**3GPP TSG-RAN WG4 Meeting # 97-e draft** **R4-2016946**

**Electronic Meeting, 2 – 13 Nov., 2020**

**Agenda item:** 4.2.1

**Source:** Hisashi Onozawa (Nokia)

**Title:** Email discussion summary for [97e][102] NR\_NewRAT\_UE\_RF\_Part\_1

**Document for:** Information

# Introduction

Rel-15 NR UE RF requirement maintenance is handled in this agenda.

Agenda Change:

R4-2014404 and its mirror CR R4-2014405 are discussed in [97e][103] NR\_NewRAT\_UE\_RF\_Part\_2.

R4-2015016 and its mirror CR R4-2015017 are discussed in [97e][104] NR\_NewRAT\_UE\_RF\_Part\_3.

R4-2016470 and its mirror CR R4-2016471 are discussed in [97e][104] NR\_NewRAT\_UE\_RF\_Part\_3.

# Topic #1: [FR1] Maintenance for 38.101-1 Transmitter characteristics

Rel-15 NR UE RF transmitter requirement maintenance is handled in Topic #1.

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2015031**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015031.zip)CR to TS 38.101-1: Correction on the Aggregated Channel Bandwidth | ZTE Corporation | Summary of change:1. Apply largest u for SCSlow, SCShigh, NRB,low, NRB,high and BWGB,Channel(k), aligned with Rel-16 spec.2. On top of 1, apply μ=1 for SCSlow, SCShigh, NRB,low, NRB,high and BWGB,Channel(k) in the case of no common μ value for both of the channel bandwidths. |
| [**R4-2016041**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016041.zip)CR Removal of Band 10 protection 38101-1 Rel15 | Skyworks Solutions Inc. | Summary of change:E-UTRA Band 10 protection: - removed from NR bands:n2,n5/n89,n7,n12,n25,n28/n83,n38,n41,n66/n86,n70 |
| [**R4-2014254**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014254.zip)CR to 38.101-1: UL MIMO EVM and emission requirements update | Qualcomm Incorporated | Summary of change:1. Introduction of wording changes for consistency with Rel-16 on emissions requirement2. Redirection clause clarification3. Tx modulation quality requirements apply on per layer basis |
| [**R4-2014256**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014256.zip)FR1 transmitter requirements for 2-layer UL | Qualcomm Incorporated | Observation 1: RAN1 design does not mandate a 1 by 1 mapping between logical antenna ports and physical antenna connectors, so the procedure implied by the RAN4 UL MIMO EVM requirement should not either.Observation 2: The 2L UL MIMO RAN4 EVM requirement in v15.11 is not valid because the test method restricts the UE’s choice to map ‘port’ to ‘connector’Proposal 1: The 2L UL MIMO RAN4 EVM requirement shall be evaluated per layer.Proposal 2: Use the linear zero-forcing 2L MIMO equalizer to define and measure the transmit EVM for multi-layer MIMO transmissionProposal 3: Change the emissions definition in Rel-15 TS 38.101-1 to reflect Rel-16 TS 38.101-1.  |
| [**R4-2014307**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014307.zip)Clarification of additional spurious emission requirements on two bands uplink Inter-band CA(R15)[**R4-2014308**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014308.zip)(Cat A CR)Moderator: Please do not upload Cat A CR before Cat F is approved! | SoftBank Corp. | Summary of change:Conditions to apply additional spurious requirements are added |
| [**R4-2014402**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014402.zip)CR for TS38.101-1 Rel-15, Correction for definition of P-MPR | CATT | Summary of change:The definitions of P-MPR are modified from “Maximum allowed UE output power reduction” to “Power Management Maximum Power Reduction”. |
| [**R4-2014718**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014718.zip)CR to TS38.101-1 on DC location correction | Samsung | Summary of change:Change “txDirectCurrentLocation IE” to “the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE” |
| [**R4-2014898**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014898.zip)Coexistence cleanup for 38.101-1 Rel15 | Apple Inc. | Summary of change:Duplicate protections with contradicting requirements are corrected for single bands n28, n83. Band 66 is protected twice with contradicting requirements. This is corrected to match Rel-16. |
| [**R4-2014905**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014905.zip)CR for TS 38.101-1: Correction to FR1 time mask for SRS antenna switching | Apple Inc. | Summary of change:Revise Figure 6.3.3.6-5 by adding a guard symbol between SRS (Ant. “y”, Ant. switch) and SRS (Ant. “x”, Ant. switch) and evenly splitting the 15s transient period between SRS (Ant. “x”, other sets) and SRS (Ant. “y”, Ant. switch). |
| [**R4-2015998**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015998.zip)Correction to spurious co-existence requirements for n28 and n83 | Keysight Technologies UK Ltd | Summary of change:Clarifying NOTE 2 applicability when protecting frequency band n66 against n28 and n83 (forcing NOTE 2 to be applicable) in spurious coexistence requirements. |
| [**R4-2016490**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016490.zip)CR for TS 38.101-1: correction of delta Tib for UE supporting multiple band combinations (R15) | Huawei, HiSilicon | Similar to Rx, make it clear that:1. When the operating band frequency range is ≤ 1 GHz, the applicable additional ∆TIB,c shall be the average value for all band combinations.2. When the operating band frequency range is > 1 GHz, the applicable additional ∆TIB,c shall be the maximum value for all band combinations |
| [**R4-2016494**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016494.zip)Update of configured transmitted power to remove ambiguity in TL,C (Rel-15)[**R4-2016495**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016495.zip)Moderator: Please do not upload Cat A CR before Cat F is approved!Coversheet shall be changed to Rel-16. | Huawei, HiSilicon | Clarifying that tolerance TL,c doesn’t consider 1.5dB relaxation when deciding T(PCMAX,f,c). |
| [**R4-2016521**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016521.zip)CR for TS 38.101-1 Pcmax | Huawei, HiSilicon | Change ‘DL-only carrier’ to PUSCH-less carrier. |
| [**R4-2016531**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016531.zip)On 5MHz AMPR for NS\_38 | Huawei, HiSilicon | ***Observation 1: UE could transmit power >15dBm in the real network on Band n74 with NS\_38 signaling, but no AMPR is defined for 5MHz CBW.******Observation 2: UE is allowed to transmit power of >15dBm, but there is no AMPR defined for 5MHz.******Observation 3: when AMPR is larger than 8dB, the Pcmax would be lower than 15dBm.******Proposal 1: Revise AMPR and ASE requirement as in Table 1 and Table 2, the corresponding CR is as in [1].*** |
| [**R4-2016534**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016534.zip)CR on correction for AMPR NS\_38,NS\_40 and NS\_41 | Huawei, HiSilicon | 1. Clarify that transmission power can be lower than 15dBm when verify NS\_38, NS\_40 and NS\_41 ASE requirement.2. Adding NS\_38 AMPR for 5MHz. |
| [**R4-2016578**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016578.zip)CR to DMRS position in UL RMC for FR1 | Qualcomm Incorporated | Updated DM-RS symbol positions in UL RMC Tables. |
| R4-2016569EVM Measurement for 2-Layer Uplink MIMOLate submission in [inbox](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_97_e/Inbox/). | Lenovo, Motorola Mobility | **Proposal 1:** For two-layer uplink MIMO, the EVM should be evaluated per layer.**Proposal 2:** The linear zero-forcing MIMO receiver should be used to define and measure the EVM for multi-layer MIMO transmissions. |

## Open issues summary

Sub topic 1-1: UL MIMO EVM: Are proposal in R4-2014256 agreeable? You can also comment directly to CR draft R4-2014254.

Sub topic 1-2: 5 MHz A-MPR to NS\_38: Are proposals in R4-2016531 agreeable? You can also comment directly to CR draft.

## Companies views’ collection for 1st round

### Open issues

Moderator: Please add your comments to sub-topic 1-1 and 1-2 here. Instead, you can directly comment to CR draft.

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| **Company** | **Comments** |
| Ericsson | Sub topic 1-1: EVM should be measured per layer, the 2-layer precoder shall be used (TPMI = 0). Antenna virtualization is not precluded by the specification (and not impossible for 2-port). Is it decided that TE will implement a ZF MIMO equalizer for Rel-15 to this end? Would this test configuration be validated for Rel-15?See also comments to the CR.Sub topic 1-2: Regarding the power limitation, we note that the WRC-15 Res. 750 does not require that the power of a mobile station should be less than 15 dBm, it states "The unwanted emission power level is to be understood here as the level measured with the mobile station transmitting at an average output power of 15 dBm." Hence this does not mean that the MOP must be verified with a P-Max limitation of 15 dBm as suggested in the NOTE 1 of the additional spurious emissions requirement. The 15 dBm average was used in coexistence studies with the victim service (among several methods).See also comments to the CR….Others: |
| NTT DOCOMO, INC | Sub topic 1-2: We would like to confirm whether “***UE is allowed to transmit power of >15dBm,***” is common understanding or not. If this is correct, we are OK to introduce A-MPR for CBW=5MHz for NS\_38.But for the A-MPR values, when n74 was introduced, we saw previous contribution of R4-1810040 and R4-1808048 which showed about 3.5dB – 5.5 dB A-MPR was needed, which was smaller than the proposed values in R4-2016531. So the values should be discussed or averaged among these contributions. |
| Nokia | Sub topic 1-1: Whether this item should be included in Rel17 NR\_RF\_FR1\_enh was discussed in RAN#89e and this item was NOT included in the WI. Thus, it would not be appropriate to discuss this. |
| Qualcomm | Sub-topic 1-2: The NR simulations were done using a 3MHz guard frequency between 1427MHz and 1430MHz. LTE simulations were done using no guard frequency. However, LTE back off applies for Fc between 1429.5MHz and 1434.5MHz, whereas NR back-off applies from Fc=1432.5MHz. So, it seems logical to give AMPR for DFT-s-OFDM waveforms based on this technicality but not for CP-OFDM waveforms. Remember only 1MHz of the IM3 emission falls in 6MHz emission region, so back-off will not be as large, and also, the power is limited to +15dBm anyway. Correction to NS\_40, NS\_41, Pcmax is okay. I propose removing AMPR for CP-OFDM. Keep your 5MHz AMPR for DFT-s-OFDM. |
| SoftBank | Sub-topic 1-2: To Ericsson’s comment: If our understanding is correct, current A-MPR is defined only for RB allocations where EESS protection is violated even if UE Tx power is at 15dBm. So if this requirement here can be interpreted only for testing where A-MPR is defined, it would be fine without the note. As you recognize, we permit to transmit 23dBm while A-MPR is small (mentioned in TR36.745), the description is to guarantee that the protection requirement is commited (for any RB allocations) as long as UE Tx is set to 15dBm.To original contribution: The same comment as the last E-meeting since the proposed modification is the same: proposed modification of the note can be understood that any power equal to or lower than 15dBm (such as 0dBm or -20dBm) can be used, while the justification is only about MPR/A-MPR. Improvement of description to limit the power unnecessary lower is required to set the valid condition. |
| Lenovo, Motorola Mobility | Sub-topic 1-1:We agree with the proposals in R4-2014256. EVM should be measured per layer. The linear zero-forcing MIMO receiver should be used to define and measure EVM for multi-layer MIMO transmissions. |
| Huawei, HiSilicon | Some clarification is needed for the changes of per layer measurement. For two layer codebook configuration, per layer measurement relies on the receiver implemented by TE. It’s not clear whether all TEs are implemented with specific ZC receiver. The spec should not mandate a certain receiver implementation, which should be left for implementation decision. On the other hand, for conductive test, the cross talk between two layers is negligible and if there is nonlinear noise existing, it cannot be eliminated by specific receiver.  |

### CRs/TPs comments collection

Moderator: Please add comments to CR drafts here.

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| **CR/TP number** | **Comments collection** |
| [**R4-2015031**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015031.zip) | Ericsson:This CR should be modified: the GB should be derived by the largest  value supported by “both of the channel bandwidths of the adjacent outer carriers at the respective low and high edge of the sub-block” or similar (except for aggregation with 5 MHz the same  value is used for all aggregated carriers).ZTE: To Ericsson. Actually such sentences were approved when RAN4 discussed the intra-band contiguous CA RF requirements.For the modifications suggested by Ericsson, there is a sentence above “The lower and upper frequency offsets depend on the transmission bandwidth configurations of the lowest and highest assigned edge component carrier and are defined as”. That’s imply the GB is based on the adjacent outer carriers at the respective low and high edge of the sub-block. We can accept Ericsson’s suggestion. Huawei: the changes should be aligned with the discussion in [101] NR\_NewRAT\_SysParameters.Skyworks: two questions for clarification:what is the reason for duplicating the following sentence in subclause 5.3A.3? “SCSlow, SCShigh, NRB,low, NRB,high, and BWGB,Channel(k) use the largest μ value among the subcarrier spacing configurations supported in the operating band for both of the channel bandwidths according to Table 5.3.5-1 and BWGB,Channel(k) is the minimum guard band for carrier k according to Table 5.3.3-1 for the said *μ* value. In case there is no common μ value for both of the channel bandwidths, SCSlow, SCShigh, NRB,low, NRB,high, and BWGB,Channel(k) use *μ*=1 according to Table 5.3.3-1 and BWGB,Channel(k) is the minimum guard band for carrier k according to Table 5.3.3-1 for the *μ*=1 value.”? Is following sentence redundant with subclause 5.4A.1 “In case there is no common μ value for both of the channel bandwidths, μ0=1 is selected and GBChannel(i) is the minimum guard band for channel bandwidth i according to Table 5.3.3-1 for μ=1 with μ as defined in TS 38.211.“ ?“In case there is no common μ value for both of the channel bandwidths, SCSlow, SCShigh, NRB,low, NRB,high, and BWGB,Channel(k) use *μ*=1 according to Table 5.3.3-1 and BWGB,Channel(k) is the minimum guard band for carrier k according to Table 5.3.3-1 for the *μ*=1 value.”ZTE: To Huawei. Here the CR is for Rel-15. We will monitor the discussion in #101. But if the outcomes in #101 is no need for the additional CR, then does it mean we can treat it in 2nd round without considering the corrections in the additional CR proposed in #101. i would like to say aggregated channel bandwidth is very important for CA , it should be resolved ASAP. To SKW: 1): These sentences are used to explain the parameters in the Foffset,low andFoffset,high equations. 2): Actually, they are the same sentence but not redundant since it used to explain the parameters in the equations. In subclause 5.41A.1, only nominal channel spacing is included. However, in subclause 5.3A.2, Foffset,low andFoffset,high are included, and this sentence is for the corner case. |
| [**R4-2016041**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016041.zip) |  |
| **R4-2014254** | Ericsson: (comments to R4-2014254)We can agree with this CR: in case antenna virtualization is not used the EVM can be still be measured per antenna connector. Good that fallback requirements are clearly specified (and aligned with Rel-16).OPPO: To 4254The EVM is defined per layer, is this applicable to Rel-15 TE? If there is no testability issue, then we are ok with this CR.Xiaomi: support the CR 4254Lenovo/Mot: we support CR 4524Huawei: Disagree with the CR. For conductive test, the impact of cross talk due to antenna isolation can be eliminated. The leakage from PCB isolation is negligible. Also the nonlinear noise cannot be compensated by MIMO receiver. And if MIMO receiver is no implemented by the TE, how can guarantee the measurement is performed per layer? |
| [**R4-2014307**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014307.zip)[**R4-2014308**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014308.zip) | Ericsson:This CR should be modified: the change is relevant but applies to all bands of the combinations that are subject to an additional requirements (NS), should be "*at least* one band of the combination". The provision should be under a new sub-clause (additional spurious emissions for inter-band CA)NTT DOCOMO, INC:We agree this CR since we think such a clarification on additional spurious emission for 2UL case proposed in R4-2014307 is needed in TS 38.101.[Nokia]Is this necessary? “the other NR band shall also protect the same band or range as specified in Table 6.5.3.2-1, with the indication of the relevant network signalling(NS) in the former band” would be covered by Table 6.5A.3.2.3-1, wouldn’t it?Qualcomm: Both bands should signal the NS. It shouldn’t be assumed if only one band signal the NS.[SoftBank] To Nokia: In NR, we had a discussion since Feb. on how to capture an additional UE co-ex requirements in CA/DC context and it was concluded to delete from the general protection table at least (and we did it). In case of PHS protection for example, CA\_1-8 should not have PHS protection in the general CA/DC table while CA\_3-8 should. Then we manage to create/propose a text to clarify how additional (NS\_signal related) requirements are applied in CA/DC context.To Qualcomm: Surely both bands can signal NS(s) but this description is intended to how to apply the requirement. The intention is, again for PHS protection for example, the requirement is applied for CA 1-8 since single band B8 is subject to PHS protection (while B1 is under additional requirement) but CA\_1-20 is not as B20 is not for the protection. Please let me know if you find a room to improve the text. (Do we need another text to clarify when both bands are subject to the same NS?)Apple: We think that a discussion is required if introducing a general rule for NS handling. There could be scenarios for inter-band CA where IMDs (created from both ULs) could violate additional spurious emissions. In these cases the UE can only keep emission requirements if additional power backoff is used for both bands. Therefore, increased A-MPR might have to be defined for certain CA combinations with NS\_X. This issue has to be checked for all CA combinations.For example, if NS\_48 is signaled for CA\_n1-n77 then IMDs could fall into protected regions. Whether MPR is sufficient has to be checked. Another problem can occur with CA\_n2\_n48 if NS\_27 is signaled for n48. The spurious emission requirement -40dBm/MHz would be applicable directly outside the channel of band 2. This requirement is not possible to be satisfied with MPR alone.The proposed rule raises further questions. Let’s consider a case where NS\_X is signaled for band A and NS\_Y is signaled for band B. What happens in the case of contradicting requirements? How are the additional spurious requirements merged if overlapping? |
| [**R4-2014402**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014402.zip) | Ericsson: This change is not really necessary. The description of the P-MPR has remained unchanged since P-MPR was introduced.OPPO: No need for the change, current definition is clear enough.Samsung: The change of the definition in Section 3 is fine for us as 38.101-2, but the same change in the main body is not so clearer and is unnecessary. |
| [**R4-2014718**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014718.zip) | Ericsson:This CR should be modified: the name of the IE containing the TX DC locations is *uplinkTxDirectCurrentBWP* in the *uplinkTxDirectCurrentList*OPPO: The intention is understood, but the name is not correct. In 38.331, there is no *UplinkTxDirectCurrent* IE, instead *UplinkTxDirectCurrentBWP* is defined.ZTE: We have a question, why RAN4 spec usually includes the IE name in RAN2? The potential risk is when the IE name is changed in RAN2 or modified by RAN2 CR, then RAN4 may not know the changes in time. We prefer to remove the IE.Qualcomm: IE name correction is ok.Samsung: thanks for all the comments. The real IE name should be *uplinkTxDirectCurrentList* as Ericsson commented. To remove the IE is also one possible way but it seems clearer to keep it. Hope that it is acceptable for companies after correcting “*UplinkTxDirectCurrent* IE” to “*uplinkTxDirectCurrentList* IE” in revised CR. |
| [**R4-2014898**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014898.zip) | [Skyworks] This correction is needed, but CR might need merging as Ericsson spotted duplication with R4-2015998. |
| [**R4-2014905**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014905.zip) | [Nokia]Would Apple share the specific reason to evenly split transient period between Ant. "x" other sets and Ant. "y" other sets? 15 us was originally shared in a way that 10 us was inside Ant. "x" other sets and 5 us was inside Ant. "y" other sets.Qualcomm: Ok with the CR. This aligns the ran4 spec with ran1.Huawei: No need to make this change. The switching time defined in the RAN4 spec reflects the implementation aspect which also depends on the RF component capability, however, the guard period is the consideration of RAN1 from performance perspective. |
| [**R4-2015998**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015998.zip) | Ericsson:Agreed but overlapping with other CRs on UE band coexistence. Perhaps merge with a joint CR collecting corrections of the coexistence table? |
| Huawei:It can be merged with R4-2014898Apple: Merging the Rel-15 modifications are not necessary as the changes from this CR are all found in R4-2014898. Merging R4-2014898 and R4-2016041 seems to be reasonable. |
| [**R4-2016490**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016490.zip) | ZTE: We feel a bit confusion for this new added sentence, maybe some examples can be further claified. In addition, why different approach are used for <=1GHz and >1 GHz?Xiaomi: support to have this clarification on ∆TIB,c when one band belongs to multiple band combinationsQualcomm: The original motivation for distinguishing between <1 GHz and >1 GHz was that the relaxation was applied to UTRA bands as well as E-UTRA. If the relaxation now is only applied to NR bands, is such distinction still needed?Huawei: to ZTE’s comments, to distinguish <=1GHz and >1 GHz is the way RAN4 used for delta Rib. To QC, the same distiction should also be applied for NR bands, as the frequency range are the same for the refarming bands. |
| [**R4-2016494**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016494.zip)[**R4-2016495**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016495.zip) | Ericsson:Not agreed, the (absolute value) of the lower tolerance can never be less than that specified by table 6.2.1-1 which is captured in the equation.ZTE: In our understanding, the current sentence "The tolerance TL,c is the absolute value of the lower tolerance for the applicable operating band as specified in Table 6.2.1-1" means the TL,c is for some operating band corresponding to the note 4 in table 6.2.1-1, which means it is independent with Note 3. For some operating bands, for example n91, both note 3 and note 4 are applied. Therefore, it is clear and no need to add such corrections.Nokia:To derive PCMAX\_L,f,c, NOTE 3 in table 6.2.1-1 is already taken into account. What ZTE mentioned would be correct.Qualcomm: **Not ok with the CR**. Admit there is room to improve the clarity of ther delta T\_C,c application but it is very late in the release to correct this now and we will need more time to check this. Propose to come back next meeting.Huawei: to above comments, the CR is not to change the applicability of T\_C,c, but to avoid the same relaxation is applied twice just because the ambiguity of the wording in the spec. |
| [**R4-2016521**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016521.zip) | Ericsson:Not agreed, what is a “PUSCH-less carrier”?OPPO: The PUSCH-less carrier is not identical to DL only carrier. In 38331 PUSCH-Less SCell is defined as “An SCell configured without PUSCH”, however, there might be carriers with SRS transmission.ZTE: Same comments as Ericsson. In addition, It is weird that huawei submit two separated CRs(16521 and 16494) for the same section although different changes in this two CRs. 16521 and 16494 should be merged.Qualcomm: DL only seems to be more appropriate than PUSCH-less since this pertains to UE architecture rather than baseband channels.Huawei: too all, in TS 38.213 subclase 11.4, SRS carrier switch signalling is defined on the carrier that "PUSCH/PUCCH transmission is not configured", while in TS 38.331, the carrier with an 3GPP terminology as PUSCH-less carrier is specified. we would like to align RAN4 spec aligned with RAN1 and RAN2 spec. for DL-only carrier, there is no such terminology in RAN1 and RAN2 spec for SRS carrier switch. |
| [**R4-2016534**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016534.zip) | Ericsson:This CR should be modified: the WRC-15 Res. 750 does not require that the UE output power is less than 15 dBm, the notes refer setting to a P-Max limitation (cap). The output power will be of the order of 15 dBm if the allowed back-off is used. No comments on the A-MPR values. |
| NTT DOCOMO, INC:We would like to confirm whether “***UE is allowed to transmit power of >15dBm,***” is common understanding or not. If this is correct, we are OK to introduce A-MPR for CBW=5MHz for NS\_38.But for the A-MPR values, when n74 was introduced, we saw previous contribution of R4-1810040 and R4-1808048 which showed about 3.5dB – 5.5 dB A-MPR was needed, which was smaller than the proposed values in R4-2016531. So the values should be discussed or averaged among these contributions.Qualcomm: The NR simulations were done using a 3MHz guard frequency between 1427MHz and 1430MHz. LTE simulations were done using no guard frequency. However, LTE back off applies for Fc between 1429.5MHz and 1434.5MHz, whereas NR back-off applies from Fc=1432.5MHz. So, it seems logical to give AMPR for DFT-s-OFDM waveforms based on this technicality but not for CP-OFDM waveforms. Remember only 1MHz of the IM3 emission falls in 6MHz emission region, so back-off will not be as large, and also, the power is limited to +15dBm anyway. Correction to NS\_40, NS\_41, Pcmax is okay. I propose removing AMPR for CP-OFDM. Keep your 5MHz AMPR for DFT-s-OFDM.[SoftBank] Improvement is required on the note.Huawei：agree with Ericsson's comments on WRC-15 res.750, it only requies on the averaged power among UEs, for each UE, it is allowed to transmit power larger than 15dBm, so AMPR is needed for 5MHz CBW. For AMPR value, we are OK to further discuss with other contribution DCM mentioned. |
| [**R4-2016578**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016578.zip) | Ericsson:Is this change correct? The duration from the first to the last OFDM symbols should be 14 with 11 OFDM symbols and 3 DMRS positions (i.e. additional positions in 7 and 11 for Type A) |
| Anritsu: We assume the changes in this CR are not necessary and the current requirements should be kept as they are. The parameter is confusing but the term “DFT-s-OFDM Symbols per slot” in Tables A.2.2.1-1 and later do not directly represent the term “*ld* in symbols” in the definitions at Table 6.4.1.1.3-3 in TS 38.211. The actual *ld* in symbols can be found as 14 in TS 38.508-1 Table 4.6.3-122. Thus the DM-RS positions *l* should be chosen from the part for *ld* = 14, i.e. 7, 11. Extract from TS 38.211 cl.6.4.1.1.3Extract from TS 36.211 cl.6.4.1.1.3 Similar to this CR, R4-2016579 is not agreeable due to the same reason. (in #103)Huawei: the current “2,7,11” DMRS position is correct, DFT-s-OFDM symbols in the table means the symbols excluding DMRS symbol. To make it clear, alternatively, we can change the symbols for the column “DFT-s-OFDM Symbols per slot” from 11 to 14.Qualcomm: Thanks all for the feedback. I think thanks to Huawei’s explanation we can tell where this misunderstanding is coming from. We have received some reports from developers/test engineers that this is incorrect due to the misunderstanding of “DFT-s-OFDM symbols per slot ” in the tables for “Reference Channels for DFT-s-OFDM”. If it is not a big deal, we want to propose adding a note clarifying what it represents somewhere in the spec or under each table so that it doesn’t create unnecessary confusion for spec readers/developers. Would moderator please allocate a new CR number to this? |

## 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 1-1: | There are supports by several companies while one company commented this was scoped out in RAN.This document (14256) is noted. The CR draft (14254) is revised for further discussion. |
| Sub topic 1-2 | Further discussion on the text of the noted and A-MPR values are needed.This document (16531) is noted. The CR draft (16534) is revised for further discussion. |

### CRs/TPs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| [**R4-2015031**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015031.zip) | Continue the second round.Unless questions and concerns has been already addressed by ZTE, please continue the discussion. |
| [**R4-2016041**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016041.zip) | Tentatively agreed. |
| **R4-2014254** | To be revised due to coversheet error and continue the second round.1 company against, 5 companies ok. |
| [**R4-2014307**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014307.zip)[**R4-2014308**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014308.zip) | Continue the second round.It appears more discussion is needed. |
| [**R4-2014402**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014402.zip) | 2 companies see the change unnecessary.Continue the second round. |
| [**R4-2014718**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014718.zip) | To be revised. |
| **[R4-2014898](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014898.zip)** | Tentatively agreed. |
| [**R4-2014905**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014905.zip) | Continue the second roundComments from Nokia and Huawei need to be sorted out. |
| [**R4-2015998**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015998.zip) | To be noted. (Coversheet error)This change is covered in R4-2014898 |
| [**R4-2016490**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016490.zip) | Continue the second round. |
| [**R4-2016494**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016494.zip)[**R4-2016495**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016495.zip) | 4 companies are against.Not pursued |
| [**R4-2016521**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016521.zip) | 4 companies are against.Not pursued |
| [**R4-2016534**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016534.zip) | To be revisedCoversheet error needs to be corrected, too. |
| [**R4-2016578**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016578.zip) | To be revised |

## Discussion on 2nd round (if applicable)

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| [**R4-2015031**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015031.zip) | ZTE: Further clarification/Reply to the comments in the 1st roundAlthough our CR is for Rel-15, some changes have been already made in Rel-16 spec. In our Rel-15 CR, not only the same changes with Rel-16, but also some other changes (i.e. for no common μ case...) are included. We have already stated it in the CR cover.In addition, according to the 1st round of Thread #101, one of the tentative agreements is “*Not enough support to the proposed changes*”, which means nothing will be changed for the nominal CA channel spacing in current RAN4 spec, instead a LS will be sent to RAN5 to clarify the situation. If there are no such changes in Rel-15, then the potantial risk is that it is unknow how to calculate the CA nominal channel spacing in Rel-15 spec (or the CA nominal channel spacing is varied), which may cause problem for those Rx requirements basing on it, also Rel-15 and Rel-16 spec will not align. Therefore, we think it needs to make up the hole ASAP due to it is crucial parameter, if companies have further comments on the spec, we can do it later. |
| **R4-2016780**(Revision of **R4-2014254)** | OPPO: Our comment in 1st round still not been answered, i..e the EVM proposed here is defined per layer, is this applicable to Rel-15 TE? If there is no testability issue, then we are ok with this CR, otherwise, how it can be applied in practice? |
| [**R4-2014307**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014307.zip)[**R4-2014308**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014308.zip) | [SoftBank0]Answer to APPLE: It seems that most of the examples raised are potential IMD against protections. But so far, in our understanding, we have been largely based on an assumption that IMD would not violate the tightest protection, -50dBm/MHz. Then, if a specific 2UL combo has a problem on protection, this should be addressed when the combo. is under study. At present, it seems we have not seen a concrete case since there is no exceptional description in Inter-band CA/DC sections (CA\_NS\_XX for inter-band).In addition, concerning contradicting protection requirements, most of the essential protections come from regulations. Then our understanding is that we need to check with the relevant regulator how contradicting requirements are applied in CA/DC context.However, this question reminds me of various exceptions: if a 2UL combo needing a NS also has a harmonic issue, we should put a note on whether relaxed requirement(-30dBm/MHz) is applied or not (it is up to the regulator also). If this is the case, we cannot live with one sentence requirement, building a table similar to general requirement instead.Nokia: To SoftBankThank you for the clarification. We think that we’ve understood the intention, but the CR may not correctly reflect what SB wants to achieve. It is difficult to understand why suddenly we need to mention Table 6.5.3.2-1 and identify what the same band or frequency range is in it. What we cares about is additional spurious emission, right? This is dual UL CA so that it does not matter one of the bands meets or the other meets protection requirement. So, why we need to mention each band protects or something like that. When noise is measured, the noise comes from both bands.*In addition, unless otherwise stated, when a network signalling(NS) specified in clauses 6.5.3.3 is indicated in at least one of the cells, the corresponding additional spurious emissions apply for inter-band carrier aggregation with the uplink assigned to two NR bands.*In any case, as far as SB’s intention is reflected, we are OK.Apple: Thanks to SoftBank for the answer and clarification.One concern is that the current descriptions and handling of NS are not well suited for CA and having a general rule will further increase confusion and hard to keep requirements if those are not resolved. For example, there are CA combinations containing band n48 with NS\_27. This NS changes spurious requirements. At the moment the NS is written for single band. The understanding on our side is that the spur requirement is -40dBm/MHz in frequency range 9kHz-3530MHz and applied directly outside the channel.With signalling the NS (and the proposal from SoftBank) any band located in this frequency range cannot transmit with MPR alone, as the requirement directly outside the band is too tight. CA/DC related to the described issue: CA\_n2-n48 / DC\_n2-n48  &  CA\_n48-n66 / DC\_n48-n66. (Not a complete list. Shall simply view that there are cases for the named issue.) If the spurious requirement should be understood differently, then we would have to change the NS description. This is one example of several potential issues. Other issues from our last comment (as stated from SoftBank) must not necessarily cause problems but should be checked. We just had a quick look through the combinations, so we believe that many more similar issues would be found by closer inspection. Therefore, we would like to propose to place the original intend on a broader scale by addressing all potential issues and adapting the spec accordingly. |
| [**R4-2014402**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014402.zip) | OPPO: No need for the change, current definition is clear enough. |
| **R4-2016781**(Revision of **R4-2014718)** |  |
| [**R4-2014905**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2014905.zip) |  |
| [**R4-2016490**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2016490.zip) |  |
| **R4-2016782**(Revision of **R4-2016534)** |  |
| **R4-2016783**Revision of **R4-2016578** | Anritsu: We agree to add notes for the clarification of the term “DFT-s-OFDM Symbols per slot”. Qualcomm: A [draft version](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_97_e/Inbox/Drafts/%5B97e%5D%5B102%5D%20NR_NewRAT_UE_RF_Part_1/%28Draft%29%20R4-2016783%20Rev%20of%20R4-2016578%20CR%20to%20DMRS%20position%20in%20UL%20RMC%20for%20FR1%20%5B102%5D.docx) is uploaded, which includes this note in NOTE 1 under all relevant Tables. To moderator, would you also help us get Tdoc/CR number for Rel-16 Cat-A CR?NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted. |

## Summary on 2nd round (if applicable)

*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**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: [FR1] Maintenance for 38.101-1 Receiver characteristics

Rel-15 NR UE RF receiver requirement maintenance is handled in Topic #2.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2015029**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015029.zip)CR to TS 38.101-1: Correction on applicability of 4Rx requirements for CA | ZTE Corporation | Apply the additional requirements for four Rx ports for carrier aggregation. |
| [**R4-2015558**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015558.zip)Discussion and reply draft LS on structure of NR CA reference sensitivity requirements in 38.101-1 | Huawei, HiSilicon | Proposal 1: It’s proposed to inform RAN5 that the requirement structure in both clause 7.3A.4 and 7.3A.6 listing only aggressor and victim will be retained in future.Proposal 2: It’s proposed to inform RAN5 that band combination specific manner will be used to specify IMD exception requirements in clause 7.3A.5.Proposal 3: It’s proposed to move the SDL requirements in 7.3A.2.4 to 7.3. The exceptions for SDL band combinations can be specified in clause 7.3A.4, 7.3A.5 and 7.3A.6. |
| [**R4-2015559**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015559.zip)CR for 38.101-1 to adjust the structure of NR CA REFSENS | Huawei, HiSilicon | 1. The SDL requirements are moved from 7.3A.2.4 to 7.3 especially for n75 and n76. For SDL bands, the reference sensitivity requirements shall be verified by inter-band CA combinations with SDL band. The contents in clause 7.3A.2.4 are voided since the requirements specified in clause 7.3A.2.3 can be reused.2. The NR CA configurations are replaced by band combination in clause 7.3A.5. The brackets are removed. |

## Open issues summary

### Sub-topic 2-1 Structure of NR CA REFSENS (R4-2015558)

Issue 2-1: Are proposals in R4-2015558 acceptable?

Issue 2-2: Is LS draft (attached in R4-2015558) acceptable?

## Companies views’ collection for 1st round

### Open issues

Moderator: Please add your comments to sub-topic 2-1 here. Be aware of LS draft attached in R4-2015558.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Sub topic 2-1: Issue 2-1: proposals acceptable (follow RAN5 guidance)Issue 2-2: the LS draft acceptable.….Others: |
| ZTE | Issue 2-1: For proposal 2, the format for ENDC, NR CA and SUL should be keep consistent in RAN4 specs, not just for NR CA. For proposal 3, we think it is more clear to keep SDL band combination table although the REFSEN are same since the SDL cannot operate alone. If the SDL band REFSENs are captured in the normal band table, then it may be interpreted any normal band can constitute of SDL band as band combinations, but actually that's not true. |
| Xiaomi | Issue 2-1: AgreeIssue 2-2: support the proposals and suggest to align between DC and CA |
| Nokia | The same as Ericsson |
| Huawei | To ZTE, For proposal 2, we can apply for a 38.101-3 CR to keep consistent in RAN4 specs following the agreement.For proposal 3, Yes, we agree the SDL cannot operate alone. If necessary, we can explicitly clarify it in the spec instead of depending on a REFSENS table format. We still have a inter band combination configuration table in the spec, so it’s impossible that we interpret that any normal band can constitute of SDL band as band combinations. In table 7.3A.2.4-1, it’s just duplicated content. |

### CRs/TPs comments collection

Moderator: Please add comments to CR drafts here.

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2015029**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015029.zip) | Ericsson: The CR should be modified: requirements for 4 RX should apply for the operating bands of band combinations for which requirements for 4RX applies. |
| ZTE: To Ericsson, actually we borrowed the sentence from TS36.101. |
| Huawei, HiSilicon: The changes are not necessary. The following paragraph under the proposed changes in the spec already clarifies which requirements will be used for CA case.ZTE: This sentence is for general diversity characteristics, if no such paragraph, how the requirement can be defined? Also, similar sentence for 2Rx case is already existed. So for 4Rx case, it indeed need to add such sentence.Apple: The introduction of this sentence is not necessary. The subsection 7.2 has already a paragraph which clearly states that the UE shall be verified with 4Rx antenna ports and skip 2 Rx antenna when the UE is equipped with 4 Rx. This is valid for Rx requirements other than single carrier REFSENS, which covers the CA case. |
| [**R4-2015559**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015559.zip) | ZTE: We think it is more clear to keep SDL band combination table although the REFSEN are same since the SDL cannot operate alone. If the SDL band REFSENs are captured in the normal band table, then it may be interpreted any normal band can constitute of SDL band as band combiantions, but actually that's not true. |
| Huawei:To ZTE, For proposal 2, we can apply for a 38.101-3 CR to keep consistent in RAN4 specs following the agreement.For proposal 3, Yes, we agree the SDL cannot operate alone. If necessary, we can explicitly clarify it in the spec instead of depending on a REFSENS table format. We still have a inter band combination configuration table in the spec, so it’s impossible that any normal band can constitute of SDL band as band combinations. In table 7.3A.2.4-1, it’s just duplicated content for configurations. |

## 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** | 4 companies are supporting and 1 company not. R4-2015558 is noted. Draft LS and CR for further discussion in the second round. |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1**R4-2016784** | Reply LS on structure of NR CA reference sensitivity requirements in 38.101-1 | Huawei |

### 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**  |
| [**R4-2015029**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015029.zip) | Continue the second round.2 companies see this unnecessary and 1 company suggests a change. |
| [**R4-2015559**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015559.zip) | Continue the second round.1 company is not supporting. |

## Discussion on 2nd round (if applicable)

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2015029**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015029.zip) |  |
| [**R4-2015559**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_97_e/Docs/R4-2015559.zip) |  |
| **R4-2016784**Reply LS on structure of NR CA reference sensitivity requirements in 38.101-1 |  |

## Summary on 2nd round (if applicable)

*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**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |