**3GPP TSG-RAN WG4 Meeting #94-e R4-20xxxxx**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item: 6.5**

**Source:** Moderator (Qualcomm Incorporated)

**Title:** Email discussion summary for RAN4#94e\_#4\_NR\_NewRAT\_UE\_RF

**Document for:** Information

# Introduction

Agenda 6.5 is Rel-15 NR maintenance agenda. Most of the papers are alone with their topic and so being they are CRs. The treatment of the paper is to collect technical concerns on the proposed changes. Two topics seem to have more papers: FR1 UL MIMO PC2 where there are numerous open items in section 3.1.1 and in FR2 new requirements coming from World Radio Conference 2019 and open items are discussed in section 4.1.1.

# Topic #1: Editorial Corrections in to 38.101-1/-2/-3

## Editorial corrections on 38.101-1 Agenda 6.5.1.1

### Sub-topic #1.1.1: UL MIMO PC2 MPR reference

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000119](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000119.zip) | CR to 38.101-1 UL MIMO MPR reference table | vivo | 38.101-1 | Refer to clause 6.2.2 instead of Table 6.2.2-1 to cover MPR for all power classes |

### Sub-topic #1.1.2: Moving notes about 90 % spectral utilization

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000594](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000594.zip) | CR for TS38.101-1, Remove notes for UE channel bandwidth | CATT | 38.101-1 | Moves notes “90% spectrum utilization may not be achieved” from one table to an other |

### Sub-topic #1.1.3: maxUplinkDutyCycle

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000596](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000596.zip) | CR for TS38.101-1, Correction of IE RF-Parameters name of maxUplinkDutyCycle | CATT | 38.101-1 | Changes maxUplinkDutyCycle  to  maxUplinkDutyCycle-PC2-FR1  + some editorial corrections |

### Sub-topic #1.1.4: CBW Channel Bandwidth, which approach to choose?

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000743](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000743.zip) | CR for TS 38.101-1: Editorial addition of CBW definition in Abbreviations section | MediaTek Inc. | 38.101-1 | Adds CBW Channel Bandwidth into definitions |
| [R4-2000491](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000491.zip) | CR to TS 38.101-1: Replace CBW with symbols defined in the specification. | ZTE Corporation | 38.101-1 | Replaces CBW with BW\_Channel  From Agenda 6.5.3 |

### Sub-topic #1.1.5: offsetmax,IMD3

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2002148](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2002148.zip) | Removal of unnecessary definition of offsetmax,IMD3 from Table 6.2.3.2-1 | Motorola Mobility España SA | 38.101-1 | Removes offsetmax,IMD3 and defines offsetmax,IMD3 as BWChannel – 6 MHz. |

## Summary of Editorial corrections on 38.101-1 Agenda 6.5.1.1

### Companies views and open issues for Editorial corrections on 38.101-1

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| **Sub-topic** | **Company views** |
| 1.1.1: UL MIMO PC2 MPR reference | [ZTE].CR cover version is wrong. It should be v12.0, not v11.2. In addition, for ‘ other specs affected, the affected specs shall be added in the blank.Huawei: It seems that the proposed change is not based on the latest spec and the referred clause is not correct.Ericsson: not editorial, the applicability of MPR for different power classes needs to be explicitly specified for 23 + 23 dBm UEs, CR not agreed (see e.g. R4-2001316)  Qualcomm: Instead of referencing the sub-clause, it would be more accurate to reference the actual table. There are only two of them so it’s not too verbose. |
| 1.1.2: Moving notes about 90 % spectral utilization | Ericsson: are these (informative) notes needed?  NTT DOCOMO, INC.: For Table 5.3.2-1, it is better to have less number of NOTEs, as far as we put them into each of the relevant cells. Thus, better to have one SCS agnostic NOTE such as ”90% spectrum utilization may not be achieved”. |
| 1.1.3: maxUplinkDutyCycle |  |
| 1.1.4: CBW Channel Bandwidth, which approach to choose? | [ZTE]. Our CR([R4-2000491](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000491.zip)) is re-submission of the CR of R4-1915486, which have already been agreed in #93 meeting. The reason for the re-submission is that both R4-1915486 (Cat F for Rel-15) and [R4-1913604](D:/Program%20Files%20(x86)/zMail/app/zMail/WebContent/pcWeb/Scripts/MailControls/ReadPanelIframe/javascript:void(0);" \t "D:/Program%20Files%20(x86)/zMail/app/zMail/WebContent/pcWeb/Scripts/MailControls/ReadPanelIframe/_blank) (Cat A for rel-16) were missed to be reflected in the latest spec. According to the RAN4 secretary’s instruction, it shall be re-submitted based on the latest spec.  Since ZTE’s CR have been agreed in the last meeting, where the ‘CBW’ in the text were all replaced with symbols defined in the specification such as BWchannel or . So it is no need for MTK’s CR([R4-2000743](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000743.zip)). |
| 1.1.5: offsetmax,IMD3 |  |

### Summary of discussion in the first round on editorial corrections on 38.101-1 Agenda 6.5.1.1

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| **Sub-topic** | **Summary** |
| 1.1.1: UL MIMO PC2 MPR reference |  |
| 1.1.2: Moving notes about 90 % spectral utilization |  |
| 1.1.3: maxUplinkDutyCycle |  |
| 1.1.4: CBW Channel Bandwidth, which approach to choose? |  |
| 1.1.5: offsetmax,IMD3 |  |

## Editorial corrections 38.101-2 Agenda 6.5.1.2

### Sub topic #1.3.1: all UL CCs in MPR

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000397](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000397.zip) | CR to 38.101-2 (Rel-15) MPR for CA | Intel Corporation | 38.101-2 | “and all UL CCs use the same SCS” moved from single CC allocation clause to more general section for determining inner outer allocation.  CAT F CR! Should be treated 6.5.7 |

### Sub topic #1.3.2: Section modification for intra-contiguous and non-contiguous

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000695](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000695.zip) | CR to 38.101-2: Align Rx CA requirements structure with TS38.101-1 | Qualcomm Incorporated | 38.101-2 | Creating sections structure to accommodate intra-contiguous and non-contiguous RX requirements in separate sections |

### Sub topic #1.3.3: CABW and CBW, Align with sub-topic #1.1.4?

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000745](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000745.zip) | CR for TS 38.101-2: Editorial addition of CBW and CABW definitions in Abbreviations section | MediaTek Inc. | 38.101-2 | CABW =Cumulative Aggregated Channel Bandwidth  CBW=Channel Bandwidth  Added to definitions  Align with sub-topic #1.1.4 for FR1 treatment |

### Sub topic #1.3.4: TDD Slot in mod(i, 10) from 10 to 5

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000912](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000912.zip) | CR to TS 38.101-2 Correction on FRC table for FR2 DL 64QAM(R15) | China Telecom | 38.101-2 | Change the number of TDD Slot in mod(i, 10) from 10 to 5 in A.3.3.4 FRC for receiver requirements for 64QAM  cat F, should be treated in 6.5.8 |

## Summary of editorial corrections on 38.101-2 Agenda 6.5.1.2

### Company views and open issues for 38.101-2

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| **Sub-topic** | **Company views** |
| 1.3.1: all UL CCs in MPR | Qualcomm: “Propose” should be “purpose”. Ok to agree with a correction. |
| 1.3.2: Section modification for intra-contiguous and non-contiguous |  |
| 1.3.3: CABW and CBW. Align with sub-topic #1.1.4? | [ZTE]. it shall be aligned with topic #1.1.4. we can replace the CBW in the text with symbols in 101-2 in next meeting, like 101-1 did. |
| 1.3.4: TDD Slot in mod(i, 10) from 10 to 5 | Ericsson: OK (this is not an editorial correction). |

### Summary of open issues for 38.101-2 editorial corrections

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| **Sub-topic** | **Summary** |
| 1.2.1: all UL CCs in MPR |  |
| 1.2.2: Section modification for intra-contiguous and non-contiguous |  |
| 1.2.3: CABW and CBW. Align with sub-topic #1.1.4? |  |
| 1.2.4: TDD Slot in mod(i, 10) from 10 to 5 |  |

## Editorial corrections 38.101-3 Agenda 6.5.1.3

### Sub-topic #1.5.1: PCMAX\_L,f,c,NR

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000453](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000453.zip) | CR to TS 38.101-3: editorial corrections on Rx requirements for intra-band contiguous EN-DC | Xiaomi | 38.101-3 | PCMAX\_L,f,c is replaced by PCMAX\_L,f,c,NR  PCMAX\_L is replaced by PCMAX\_L\_E-TURA,c |

### Sub topic #1.5.2: maxUplinkDutyCycle

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000598](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000598.zip) | CR for TS38.101-3, Correction of IE RF-Parameters name of maxUplinkDutyCycle | CATT | 38.101-3 | Changes maxUplinkDutyCycle to maxUplinkDutyCycle-PC2-FR1  And numerous combinations are reorganised in Table 6.2B.1.3-1 |

### Sub topic #1.5.3: Output power dynamics with/without dual PA

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000892](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000892.zip) | CR to TS 38.101-3: editorial correction for output power dynamics for intra-band EN-DC | CHTTL | 38.101-3 | Clarification on sentence for Output power dynamics for intra-band EN-DC with/without dual PA capability |

### Sub topic #1.5.4: EN-DC table corrections

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2002098](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2002098.zip) | EN-DC configuration table corrections | Nokia | 38.101-3 | EN-DC configuration grouping is further fixed for DC\_19-42\_n77, DC\_19-42\_n78, DC\_19-42\_n79 and DC\_66\_n257.  The empty rows are removed. |

## Summary of Editorial corrections 38.101-3 Agenda 6.5.1.3

### Company views and Open issues for Editorial corrections 38.101-3 Agenda 6.5.1.3

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| **Sub-topic** | **Company views** |
| 1.5.1: PCMAX\_L,f,c,NR |  |
| 1.5.2: maxUplinkDutyCycle |  |
| 1.5.3: Output power dynamics with/without dual PA |  |
| 1.5.4: EN-DC table corrections | Huawei: there are also some configuration error in the 2 band combination table, could you revise it together with 3bands?   |  |  |  | | --- | --- | --- | | DC\_38A\_n78A7 | N/A | No |   Where UL configuration shall not be “N/A” |

### Summary for Editorial corrections 38.101-3 Agenda 6.5.1.3

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| **Sub-topic** | **Summary** |
| 1.5.1: PCMAX\_L,f,c,NR |  |
| 1.5.2: maxUplinkDutyCycle |  |
| 1.5.3: Output power dynamics with/without dual PA |  |
| 1.5.4: EN-DC table corrections |  |

# Topic #2: Band combination maintenance

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

## Maintenance for bands and band combinations for 38.101-1 Agenda 6.5.2.1

### Sub topic #2.1.1: A-MPR and spurious emission changes for NS\_04

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000413](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000413.zip) | CR for 38.101-1: n41 and n25 corrections | Sprint Corporation | 38.101-1 | Note “The A-MPR' values in this table apply for both A-MPR relative to 23 dBm for power class 3 and A-MPR relative to 26 dBm for power class 2”  Removed and  “NOTE 4:   Does not apply for Band n41, CA configurations including Band n41, and EN-DC configurations that include n41 specified in subclause 5.2B of TS 38.101-3 [3] when NS\_04 is signalled.”  added (Different tables) |

### Sub topic #2.1.2: NR CA bandwidth class B and F changes

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000525](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000525.zip) | Correction of NR CA bandwidth classe B and F | Nokia, Nokia Shanghai Bell | 38.101-1 | Class F removed and applicability for B lower limit changed from 220 to 20 MHz |

### Sub topic #2.1.3: CA fallback group 1

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2001069](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001069.zip) | CR for 38.101-1: removing the fallback group for NR CA configuration (Rel-15) | Huawei, HiSilicon | 38.101-1 | “for fallback group 1” was removed in table 5.5A.1-1. |

### Sub topic #2.1.4: Modified MPR behavior

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2001308](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001308.zip) | Introduction of the Annex modifiedMPR-Behaviour into the NR SA specification | Ericsson | 38.101-1 | Introduces modified MPR behaviour in to 38.101-1 as annex G |

## Summary of Maintenance for bands and band combinations for 38.101-1 Agenda 6.5.2.1

### Discussions issues for 38.101-1 maintenance

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| **Sub-topic** | **Company views** |
| 2.1.1: A-MPR and spurious emission changes for NS\_04 | Company: |
| 2.1.2: NR CA bandwidth class B and F changes | Huawei: Removing CA bandwidth class F has backward compatibility issue, the agreed changes in last meeting needs to be revisited. |
| 2.1.3: CA fallback group 1 |  |
| 2.1.4: Modified MPR behaviour | Huawei: there shall be a CR  NTT DOCOMO, INC.: We propose for eachTSeach of 38.101-1/2/3 to have thisthisthis  Qualcomm: Should be Annex and broadenbroadenbroadenH, not G. At the meaning of this time the modifiedMPR be included in -3 or SA spec. It was decided to put the table in -3.  [Reasons] Although we understand that remove the modifiedthe modifiedMPRbehavior is a field of the NR band capability in the supported NR band list that is part of the UE-NR-Capability IE, the MPR in or A-MPR listed in the current 38.101-3. is captured in 38.101-3. Thus, in reality-behavior table was first introduced, there was lengthy discussion about whether it is easier for readers to have this Annex in 38.101-3. On the other hand, we would have MPR or A-MPR change in the future purely related with 38.101-1 and 38.101-2 so that each of the 38.101 series should have this Annex. Finally, we also propose to broaden the meaning of this feature as proposed in R4-2000220, R4-2000221, R4-2000223 and R4-2000225. |

### Summary of discussions in 1st round for 38.101-1 maintenance

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| **Sub-topic** | **Summary** |
| 2.1.1: A-MPR and spurious emission changes for NS\_04 |  |
| 2.1.2: NR CA bandwidth class B and F changes |  |
| 2.1.3: CA fallback group 1 |  |
| 2.1.4: Modified MPR behaviour |  |

## Maintenance for bands and band combinations for 38.101-2 Agenda 6.5.2.2

### Sub topic #2.3.1: Intra-contig and non-contig CA Table re-arrangment and corretion

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000521](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000521.zip) | CR FR2 CA tables REL15 | Nokia, Nokia Shanghai Bell | 38.101-2 | Table 5.5A.2-1 and -2 changed format from listing individual CH BWs to refer to configuration |
| [R4-2000559](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000559.zip) | CR to TS 38.101-2 on corrections to intra-band contiguous CA for FR2 bands (Rel-15) | ZTE Corporation |  | Adds 50 MHz CH BWs to many configurations |

### Sub topic #2.3.2: removal of fallback clause for CA and DC

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2001310](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001310.zip) | Removal of contradicting fall-back specification for intra-band non-contigous CA/DC | Ericsson | 38.101-2 | Removes:” A terminal which supports CA or DC configurations, which include FR2 intra-band CA combinations with multiple subblocks, where at least one of the subblocks consists of a contiguous CA combination, is not required to support all possible fallback combinations but can directly fall back to a single FR2 carrier. Deactivating carriers within the CA or DC combination is still possible.”  Cover pages talks about adding this to 38.306. |

## Summary for Maintenance for bands and band combinations for 38.101-2 Agenda 6.5.2.2

### Company views and open issues for 38.101-2 band and combo maintenance

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| **Sub-topic** | **Company views** |
| 2.3.1: Intra-contig and non-contig CA Table re-arrangement and correction | Xiaomi: Thanks Nokia for the paper R4-2000521. We support this new good table format, but why so many sub blocks (14) are list in the table? Can we use 8 sub blocks in the table? In addition, one editorial correction "class A" is missing in the second revised table.  Huawei: For [R4-2000559](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000559.zip), there is no need to add 50MHz CBW to the band combination if there is no 50MHz component in the current version.  NTT DOCOMO, INC.: For R4-2000521, the proposal itself is understandable but do we need to capture columns for sub-blocks?  [ZTE]. There is note saying ‘Unless otherwise stated, BCS0 is referred in each constituent CA configuration’. How about different BCS for each sub-block in each constituent CA configuration in future?  In addition, can we use ‘sub-block configuration’ name in the table, because bandwidth class is added after the band for each sub-block. |
| 2.3.2: removal of fallback clause for CA and DC | [ZTE]. Some CA and DC configurations were added in the spec based on the approach of this sentence. If this sentention removed and add to TS38.306, then people may confuse with 101 spec if they don’t check the 38.306 spec.  Huawei: this topic is under discussion in RAN2, we would like to wait for RAN2’s decision before RAN4 make any revision. |

### Summary of 1st round of discussions 38.101-2 band and combo maintenance

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| **Sub-topic** | **Summary** |
| 2.3.1: Intra-contig and non-contig CA Table re-arrangement and correction |  |
| 2.3.2: removal of fallback clause for CA and DC |  |

## Maintenance for bands and band combinations for 38.101-3 Agenda 6.5.2.3

### Sub topic #2.5.1: Intra-EN-DC (n)41 power tolerance

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000410](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000410.zip) | CR for 38.101-3: Correction of MOP tolerance for B41/n41 EN-DC | Sprint Corporation | 38.101-3 | Intra EN-DC n41 power tolerance relaxed from +2/-2 to +2/-3. |

### Sub topic #2.5.2: Adding new BCS’s for intra EN-DC

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000854](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000854.zip) | CR to introduce new BCS of intra-band continuous EN-DC for TS 38.101-3(Rel-15) | KDDI Corporation | 38.101-3 | Adds new BCS’s DC\_(n)41AA and (n)41CA. |

### Sub topic #2.5.3: removal of fallback clause for CA and DC

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2001312](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001312.zip) | Removal of contradicting fall-back specification for intra-band non-contigous CA/DC | Ericsson | 38.101-3 | Removes:” A terminal which supports CA or DC configurations, which include FR2 intra-band CA combinations with multiple subblocks, where at least one of the subblocks consists of a contiguous CA combination, is not required to support all possible fallback combinations but can directly fall back to a single FR2 carrier. Deactivating carriers within the CA or DC combination is still possible.”  Cover page mentions conflict with 38.306 |

### Sub topic #2.5.4: removal of annex H

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2001314](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001314.zip) | Removal of the Annex modifiedMPR-Behaviour from the NSA specification | Ericsson | 38.101-3 | Removal of the Annex modifiedMPR-Behaviour Annex H |

### Sub topic #2.5.5: CA\_n78-n79 with simultaneous TX/RX

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2002118](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2002118.zip) | CR for [agreed] asynchronous operation for NR CA n78-n79 | NTT DOCOMO INC. | 38.101-3 | Adds delta TA and MSD for CA 78+79  Adds also a note:  NOTE 2: The requirements only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. The requirement does not apply for UEs supporting band n77 with a combined n77 and n78 filter.  CR has two sets on change marks |

### Sub topic #2.5.6: Mising n78 and updates on MSD testpoints

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| **[R4-2001518](ftp://ftp.3gpp.org/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001518.zip)** | Editorial corrections | Ericsson | 38.101-3 | Add missing "n78" reference in DC\_20A\_n78A in Table 7.3B.2.3.5.1-1  Correct CA -> DC for 28A\_n77A and 28A\_n78A in Table 7.3B.2.3.5.1-1  Remove DC\_12\_n5 from DC\_12\_n66 entry in spurious emission table  Correcting test frequencies for DC\_7A-28A\_n78A Table 7.3B.2.3.5.2-1 |

## Summary of Maintenance for bands and band combinations for 38.101-3 Agenda 6.5.2.3

### Company views and Open issues for 38.101-3

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| **Sub-topic** | **Company views** |
| 2.5.1: Intra-EN-DC (n)41 power tolerance | Company: |
| 2.5.2: Adding new BCS’s for intra EN-DC | KDDI: One subset is missed in current CR which is pointed out by another company. The following BCS2 of DC\_41A\_n41A need to be added to complete this feature. And we have a Cat. A CR (R4-2000857) of Rel-16 for this feature need to be moved to this agenda which has been checked with Chairman.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **DL EN-DC configuration** | **Uplink EN-DC Configuration** | **Channel bandwidth for E-UTRA carrier(MHz)** | **Channel bandwidth for NR carrier(MHz)** | **Channel bandwidth for E-UTRA carrier(MHz)** | **Maximum aggregated bandwidth(MHz)** | **Bandwidth combination set** | | DC\_41A\_n41A | DC\_41A\_n41A | 20 | 10, 20, 30, 40, 50, 60, 80,100 |  | 120 | 2 | |  | 10, 20, 30, 40, 50, 60, 80,100 | 20 | | 10 | 20, 30, 40, 50, 60, 80,100 |  | |  | 20, 30, 40, 50, 60, 80,100 | 10 |   Qualcomm: My understanding is that addition of new BCS’s requires a work item approved at RAN, rather than just adding by CR. |
| 2.5.3: removal of fallback clause for CA and DC | Huawei: this topic is under discussion in RAN2, we would like to wait for RAN2’s decision before RAN4 make any revision. |
| 2.5.4: removal of annex H | Huawei: shall be discussed together with the CR for TS 38.101-1. We think it is correct to define modified MPR in 38.101-1. NTT DOCOMO, INC.: We have the same comments for this t-doc as those for R4-2001308. |
| 2.5.5: CA\_n78-n79 with simultaneous TX/RX |  |
| 2.5.6: MisingMisingMisingMisingMisingMissing n78 and updates on MSD testpoints |  |

### Summary of 1st round of discussions for bands and band combinations for 38.101-3 Agenda 6.5.2.3

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| **Sub-topic** | **Summary** |
| 2.5.1: Intra-EN-DC (n)41 power tolerance |  |
| 2.5.2: Adding new BCS’s for intra EN-DC |  |
| 2.5.3: removal of fallback clause for CA and DC |  |
| 2.5.4: removal of annex H |  |
| 2.5.5: CA\_n78-n79 with simultaneous TX/RX |  |
| 2.5.6: MisingMisingMisingMisingMisingMissing n78 and updates on MSD testpoints |  |

# Topic #3: FR1 general requirements

## FR1 Transmitter Agenda 6.5.4 and 6.5.3

### Sub-topic #3.1.1: UL MIMO PC2 (Agenda 6.5.4.5 and 6.5.4.1)

#### Discussion papers submitted for Sub-topic #3.1.1: UL MIMO PC2

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000063](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000063.zip) | Clarification of Power Class related features | NTT DOCOMO, INC. |  | Observation 1: Supported power class information is not clear if a UE supports UL MIMO for a certain band.  Observation 2: In LTE, RAN4 does not have Tx diversity related requirements but RAN1/2 have. In NR, RAN1/2 does not have Tx diversity related requirements but RAN4 tries to have.  Observation 3: Due to lack of Tx diversity capability, even more challenging to identify supported features and relevant power classes among normal NR single, Tx diversity and UL MIMO. (e.g., A UE supporting PC2 UL MIMO may achieve normal NR single as PC2 with one single Tx chain or two Tx chains (Tx diversity) and applicable requirements are different based on which implementation is used.  Observation 4: Tx diversity may provide a better system performance while there are no specific capability signalling and requirements for NW to make maximum use of the feature.  Observation 5: Supported power class information of each of the features comprising a certain band combination is not explicitly signalled with the current RAN2 spec.  Proposal:  For Rel15, not to set a power class bundling rules such as if a UE supporting UL MIMO transmits PC2 capability, consider the UE capable of PC2 for that band in normal NR single, UL MIMO as well as Tx diversity mode etc, but rather live with the current ambiguous power class definition.  For Rel16, create a signalling mechanism to explicitly indicate supported power class when power class related features are simultaneously used as shown in Figure 2.2-1if RAN2 is possible to accommodate the request in Rel16 time-frame. |
| [R4-2001229](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001229.zip) | Further on UL MIMO PC2 fallback | OPPO |  | 23+23 and Tx diversity  Observation 1: UEs with 23+23 PA configurations to support 26dBm HPUE is 3GPP compliant.  Observation 2: Allow UE to declare whether PC2 or PC3 can be supported in basic transmission mode decouples the discussion of 23+23 UL MIMO and Tx diversity.  Observation 3: With this change, UE can use 23+23 to support 26dBm in UL MIMO and use 1 PA transmission in basic transmission mode with PC3 in Rel-15.  Observation 4: With this change, Tx diversity is not supported in Rel-15 RAN4 specification.  Proposal 1: It is proposed to agree on “*A UE supporting power class 2 and UL-MIMO configured as specified in clause 6.2D.1 in any NR band, shall meet the requirements 6.2.1 for either power class 2 or power class 3.*”  Proposal 2: Inform RAN5 that UE Tx diversity is not supported in RAN4 Rel-15 specification.  Tx emissions and SEM requirements  Observation 5: Evaluating UE with one antenna is 3dB less than regulatory.  Observation 6: MPR need to be revisited if SEM and Tx emission requirements are changed from one antenna to two antennas.  Proposal 3: MPR, SEM and Tx emissions are revisited together due to change requirements from one antenna to two antennas.  Observation 7: It has never been guaranteed that the 3GPP requirements are always consistent with regulatory requirements all over the world.  Observation 8: UE passes 3GPP tests does not necessarily mean it will pass the regulatory tests.  Observation 9: Regulation requirements can be guaranteed by regulatory certification themselves.  Observation 10: The impact to UE development and certification caused by changing Rel-15 requirements can be eased by “specification effective transient period”, i.e. new requirements will not be tested in RAN5 conformance spec for several months.  Observation 11: Re-visiting MPR, SEM and Tx emission may need several meetings which makes Rel-15 specs unstable.  Proposal 4: Change MPR, SEM and Tx emissions in Rel-16 and keep Rel-15 unchanged considering the time limitations. |
| [R4-2002037](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2002037.zip) | On UL MIMO requirements | Huawei, HiSilicon |  | Proposal: It is proposed to define the MPR requirements for PC2 UE supporting 2Tx transmission in Table 4*.* |
| [R4-2002038](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2002038.zip) | On EN-DC power class | Huawei, HiSilicon |  | Proposal: It is proposed to introduce an explicit signaling for the power class for NR side in MR-DC mode in Rel-16. |
| [R4-2000356](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000356.zip) | Correction on UL MIMO Emission requirements and alignment with RAN1 terminology | Qualcomm Incorporated |  | Observation 1: If UE supports UL MIMO, it still has to meet general requirements.  Observation 2: Usage of language “UE supporting UL MIMO” or “UE with two transmit connectors” to refer UE requirements is confusing  And to clarify the text, we made one proposal  Proposal 1: Change language in Ran4 requirement specifications from “UE supporting UL MIMO” and “UE with two transmit connectors” when referring to UL MIMO requirements to “UE configured for UL MIMO”  To understand better UL MIMO requirements, we made the following observations  Observation 3: UE output power is summed for UL MIMO  Observation 4: UE emission requirements are defined per connector  Then we looked back and found out what assumptions were made when the discrepancy between observation 3 and 4 was initially agreed and made the following observation:  Observation 5: The current specification for UL MIMO was assuming that each PA power is backed off by 3 dB from their maximum power  Observation 6: Assumptions for implementation have changed since the LTE specification for UL MIMO was created and therefore NR specification should be written in a different way  To correct the specification to reflect new assumptions, we made one proposal:  Proposal 2: Update the UL MIMO emission requirements to support implementation where PA’s operate at declared UE power class power level when configured for UL MIMO. |
| [R4-2000795](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000795.zip) | On the condition of antenna configuration for UL-MIMO in FR1 | SoftBank Corp. |  | Observation 1: In LTE, the total amount of unwanted emissions of UE supporting UL-MIMO is the same as that of UE not supporting UL-MMO considering the regulatory recommendation in ITU-R.  Observation 2: The approach of "each transmit antenna connector" can be adopted only when the average transmission power per antenna connector in UL-MIMO transmission is reduced by 3 dB comparing with that of single antenna connector transmission.  Proposal 1: In NR, the total amount of unwanted emissions of UE supporting UL-MIMO shall also be the same as that of UE not supporting UL-MMO like LTE.  Proposal 2: RAN4 confirm whether "each transmit antenna connector" approach can be adopted or not in the current UL-MIMO spec and ongoing functions for UL-MIMO. |

#### CRs submitted

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| **T-doc number** | **Title** | **Company** | **Spec** | **Changes** |
| [R4-2000117](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000117.zip) | CR to 38.101-1 clarification of MIMO power class in R15 | vivo | 38.101-1 |  |
| [R4-2001316](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001316.zip) | Correction of transmitter characteristics for UL-MIMO: powerclass 2 and fallback | Ericsson | 38.101-1 |  |
| [R4-2000354](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000354.zip) | Correction on UL MIMO Emission requirements and alignment with RAN1 terminology | Qualcomm Incorporated | 38.101-1 |  |

#### LS’s submitted

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| **T-doc number** | **Title** | **Company** | **To** | **Actions** |
| [R4-2000118](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000118.zip) | draft LS on clarification of EN-DC power class in R15 | vivo |  |  |
| [R4-2002141](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2002141.zip) | Draft LS on EN-DC power class | Huawei, HiSilicon |  |  |

#### Open issues for Sub-topic #3.1.1: UL MIMO PC2

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| **Issue #** | **Issue** | **Notes** |
| #3.1.1.1 | Power class ambiguity needs change or not | Change is prosed in [R4-2000117](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000117.zip), [R4-2001316](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001316.zip), [R4-2001229](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001229.zip), [R4-2000118](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000118.zip)  No Change is proposed: [R4-2000063](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000063.zip) |
| #3.1.1.2 | Which mode is the baseline for power class declaration, general (DCI 0\_0) or UL MIMO | Either text from [R4-2001316](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001316.zip):  For UEs indicating power class 3 in the *ue-PowerClass* field of the *UE-NR-Capability* IE, the UE shall meet the requirements 6.2D.1-1 for either power class 2 or power class 3.  or Text from R4-2000117  If above power class 2 UE is configured for transmission on single-antenna port, it shall meet the requirements for either power class 2 or power class 3 in subclause 6.2.1 |
| #3.1.1.3 | Spec language: “UE supporting UL MIMO” or “UE configured for UL MIMO” | Removal of language “UE supporting UL MIMO” proposed in [R4-2001316](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001316.zip) and [R4-2000356](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000356.zip). |
| #3.1.1.4 | Emission requirement correction for UL MIMO | Emissions summed: [R4-2001316](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001316.zip), [R4-2000063](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000063.zip), [R4-2000795](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000795.zip), [R4-2002037](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2002037.zip) (Proposal is really for new MPR table but that assumes new emission reqs).  Emissions changed in Rel-16: [R4-2001229](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001229.zip) |
| #3.1.1.5 | Power class signalling for Rel-16 | Proposed to add NR PC signalling when UE is in EN-DC [R4-2002038](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2002038.zip). |
| #3.1.1.6 | Need for new MPR requirements | If decision is to do a change in emission requirements, need for new MPR needs to be discussed. Proposed to add 2Tx MPR in: [R4-2002037](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2002037.zip), [R4-2001229](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001229.zip) |

#### Company views for Sub-topic #3.1.1: UL MIMO PC2

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| **Issue #** | **Issue** | **Companies views** |
| #3.1.1.1 | Power class ambiguity needs change or not | vivo: yes, change is needed for R15. Because current specs says “*If UE is configured for transmission on single-antenna port, the requirements in subclause 6.2.1 apply.*” (last sentence of 38.101-1 6.2D.1). And RAN4 has agreed that there will be no TxD in R15. So we need to change this sentence to implement “*not to set a power class bundling rules such as if a UE supporting UL MIMO transmits PC2 capability, consider the UE capable of PC2 for that band in normal NR single…*” which is also proposed in R4-2000063.  vivo: yes, change is needed for R15.  OPPO: Yes, actually the changes proposed in this meeting are keeping the ambiguity, e.g. UE report PC2 in UL MIMO will apply either PC2 or PC3 based on UE declaration in single antenna port.Huawei: OK with the proposed changes for single antenna port by vivo or OPPO and fine to send an LS to RAN5. In our understanding, what proposed by DOCOMO is to live with the status without explicit power class capability in Rel-15 but to introduce new signalling in Rel-16, that is ok for us.Ericsson: the power-class ambiguity should be addressed. A UE indicating PC2 shall meet PC2 requirements for all types of transmissions (e.g. also single-port transmissions like PUCCH). Exceptions can be allowed for 23 + 23 dBm when this is configured with UL-MIMO. Allowing a declaration of capability can remove ambiguity in conformance testing but not in network signaling (the main problem).  Nokia, Nokia Shanghai Bell: The specification is not broken and therefore it is not critical to change the specification. The reason for requesting to specification change has been to allow relaxation to some UE implementations, which may support 26 dBn only in some cases but not in all cases like specified by the PC2 requirements. As a compromise we can accept that some relaxations for the power class definition is allowed in Rel-15 but Rel-15 relaxation should not cause further uncertainty or relaxations in the Rel-16 specifications. If change is desired by the group, in our view the Ericsson CR in [R4-2001316](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001316.zip) should be used as basis as it also aims to corret the UE emission requirement for UL MIMO. |
| #3.1.1.2 | Which mode is the baseline for power class declaration, general (DCI 0\_0) or UL MIMO | vivo: UL MIMO power class as in R4-2000117.  There is contradiction in CR OPPO: The reported UE power class capability fundamentally can either under single antenna port mode or under UL MIMO mode, but we prefer UL MIMO mode. Usually UE has higher power capabilities under UL MIMO comparing to single antenna port mode, it is much straight forward to let UE declare the fall back power capability according to the PAs implemented. This is where this issue coming from.Huawei: It’s not clear of the proposed changes by Ericsson especially when the requirement is defined for UL MIMO mode.Ericsson: the text from R4-2001316, we propose changing the baseline for UE power-class indication (the field *ue-PowerClass* per NR band in *UE-NR-Capability*) discussed last meeting such that a UE now only indicates PC2 capability in case it supports PC2 for all transmissions, single port/connector or UL-MIMO. However, for a 23 + 23 dBm UE implementation we allow the first “mode” above when this UE is configured for two-layer transmissions: it indicates PC3 but can comply with PC2 requirements for two-layer transmissions. In fallback (single port) it shall comply with PC3 requirements according to its capability indication. Moreover, this UE that meets PC2 requirements with two-layer transmissions shall also modify the Pcmax for two-layer transmissions such that the PHR becomes correct (thus alleviating the power class ambiguity in the field). The problem with capability indication for EN-DC is eliminated for the 23 + 23 dBm UE since its capability indication is still PC3 (can always be met for all transmissions). In this way the specification accommodates the 23 + 23 dBm implementation without changing the intention of the power-class capability indication.  Nokia, Nokia Shanghai Bell: In our view the text in [R4-2001316](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001316.zip) should be used as below   * In the first paragraph of section 6.2D.1, a sentence was added as “*For UEs indicating power class 3 in the ue-PowerClass field of the UE-NR-Capability IE, the UE shall meet the requirements 6.2D.1-1 for either power class 2 or power class 3.*” * In the last paragraph of section 6.2D.1, the original sentence was changed to “*For each power class as indicated by the ue-PowerClass field of the UE-NR-Capability IE, the UE shall meet the requirements in 6.2.1 when PUSCH is scheduled for single antenna-port transmission by DCI 0\_0 or by DCI 0\_1 when the UE is configured for single port operation.*”   These two sentences are contradictory to each other i.e. the first one says that PC3 UE shall meet either PC3 or PC2. The second one says that PC3 UE shall meet PC3.  And neither of these two sentences can solve the problem of UL MIMO PC2 UE with 23+23 PAs which can only meet PC3 when configured with one port transmission without TxD as we previously agreed that no TxD requirements in R15. We have a CR in R4-2000117 to solve this problem.  baseline. |
| #3.1.1.3 | Spec language: “UE supporting UL MIMO” or “UE configured for UL MIMO” | OPPO: It is correct UE need to meet the UL MIMO requirements when UL MIMO is configured, however, RAN4 only defines requirements based on feature itself. And if UE declares it supports certain feature, the requirements will be tested no matter it is configured by NW or not. Therefore, no objecting to “UE configured for UL MIMO” but it would be better to align the wording with other features like CA, etc.Huawei: As the requirements are defined with corresponding MIMO configuration, the proposed changes may not be necessary. For each requirements, whether a change is needed should be checked case by case.  Nokia, Nokia Shanghai Bell: OK to improve the specification text as proposed |
| #3.1.1.4 | Emission requirement correction for UL MIMO | [SoftBank] As shown in our contribution (R4-2000795), there are conditions for applying “each antenna connector” approach. Considering the conditions, there is the risk to violate the regulation. It should be changed the related requirements to "sum of antenna connectors" instead of "each antenna connector" from Rel-15.OPPO: Our understanding is MPR, SEM and Tx emissions should be revisited together if from one antenna to two antennas. And if it is difficult to achieve consensus on the MPR table within this meeting, our preference is to keep Rel-15 unchanged and discuss this issue in Rel-16, considering the time limitations and also the impacts to large number of Rel-15 UEs already on the market or under development.Huawei: the emission requirements shall be changed together with MPR  Ericsson: the emission requirements should align with regulatory requirements for multi-antenna transmissions. Comment to R4-2001229: 3GPP specifications are voluntary but should reflect the binding regulatory requirements, the functionality specified should enable compliance with these.  NTT DCOOMO, INC.: Emission requirements should apply to the sum of emission from all antenna connecter from Rel-15. And a description of Minimum output power requirement should be also changed from “each” to “sum” in R4-2000354 from Qualcomm, and description of Minimum output power, Transmit OFF power, and Transmit intermodulation should be changed from “each” to “sum” in R4-2001316 from Ericsson.  Nokia, Nokia Shanghai Bell: Emission requirements should be corrected as the sum of the powers from all UE antenna connectors. In our view no further MPR relaxations should be added when correcting the emission requirements. |
| #3.1.1.5 | Power class signalling for Rel-16 | OPPO: ok with new power class introduced, but this should take #3.1.1.2 into consideration, i.e. which mode is baseline in Rel-15.Huawei: LS should be sent to RAN2 for the new signalling design  Ericsson: (draft LS in R4-2002038) unclear what RAN2 is going to do with the proposed LS, what is the expected action? An NR CA power class for an EN-DC band combination? This draft LS is not agreed.  NTT DCOOMO, INC.: The principle is OK. But we should discuss which power class for a feature should be distinguish from what. The issue may not be limited to MR-DC only. For instance, even now, Power class for UL MIMO for standalone operation is not clear even if UEs report PC2 for a certain NR band, this does not always mean the corresponding PC for UL MIMO for that band is PC2 as well.  Nokia, Nokia Shanghai Bell: No new UE capability signalling should be introduced until Rel-15 and Rel-16 requirements are agreed. The details for potential new signalling should be clear and agreed before agreeing new signalling. Otherwise, further uncertainty and increased complexity is added to the specification and system. |
| #3.1.1.6 | Need for new MPR requirements | OPPO: Our understanding is MPR, SEM and Tx emissions should be revisited together if from one antenna to two antennas.Huawei: Agree with OPPO to Change MPR, SEM and Tx emissions in Rel-16 and keep Rel-15 unchanged considering the time limitations. To comments of DCM, 2dB for BPSK inner RB is a typo, which should be 0dB.Ericsson: is the increased tolerance for UL-MIMO MOP accounted for, the tolerance is +2/-3 dB for UL-MIMO with its two connectors? Hence a 1 dB relaxation compared to a single-connector requirement. Do the results in R4-2002037 assume a 23 dBm MOP for each connector with unwanted emissions tightened by 3 dB, i.e. "measure each port and then add"? Compliance with the requirements for any requirement per connector should be clearly specified (e.g. 3 dB tighter requirement per connector subject to compliance with the total MOP for UL-MIMO).  NTT DCOOMO, INC.: For clarification, PC3 MPR and 1Tx PC2 MPR should be kept. For R4-2002037 from Huawei, we have a question why MPR of Pi/2 BPSK for inner allocation is 2 dB though that of QPSK is 0dB?  Nokia, Nokia Shanghai Bell: Emission requirements should be corrected as the sum of the powers from all UE antenna connectors. In our view no further MPR relaxations should be added when correcting the emission requirements. |

#### Summary of 1st round of discussions for Sub-topic #3.1.1: UL MIMO PC2

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| **Issue #** | **Issue** | **Summary** |
| #3.1.1.1 | Power class ambiguity needs change or not |  |
| #3.1.1.2 | Which mode is the baseline for power class declaration, general (DCI 0\_0) or UL MIMO |  |
| #3.1.1.3 | Spec language: “UE supporting UL MIMO” or “UE configured for UL MIMO” |  |
| #3.1.1.4 | Emission requirement correction for UL MIMO |  |
| #3.1.1.5 | Power class signalling for Rel-16 |  |
| #3.1.1.6 | Need for new MPR requirements |  |

### Sub-topic #3.1.2: Tx modulation quality

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2001767](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001767.zip) | CR for inter-band CA Tx requirement\_Rel-15 | Huawei, HiSilicon | 38.101-1 | Adds a limitation to tx mod quality: ”PCC with PRB allocation and SCC without PRB allocation and without CSI reporting and SRS configured.” |
| [R4-2001769](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001769.zip) | CR for inter-band ENDC Tx requirement\_Rel-15 | Huawei, HiSilicon | 38.101-3 | Adds a limitation:” applies with PRB allocation in one of the CG and the other CG unallocated” |

### Sub-topic #3.1.3: Tx EVM for UL MIMO

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000204](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000204.zip) | FR1 TX EVM test condition correction for ULMIMO | Qualcomm Incorporated |  | **Observation 1: A UE’s antenna mutual coupling dominates over conducted domain mechanisms in degrading channel quality in UL MIMO**  **Observation 2: An MMSE MIMO receiver’s throughput is much less sensitive to crosstalk than it is to uncorrelated noise**  **Observation 3: RAN4 EVM test for UL MIMO per v15.8 treats crosstalk as uncorrelated noise**  **Proposal 1: Transmit signal quality testing for UL MIMO shall employ TE with MIMO demodulation capability**  **Proposal 2: Until MIMO demod capability is available in TE, transmit signal quality testing for FR1 shall draw from v15.8 FR2 practice of configuring the UE for single layer operation with two ports.** |
| [R4-2000205](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000205.zip) | CR to 38.101-1: Revision to ULMIMO EVM spec | Qualcomm Incorporated | 38.101-1 | “The requirements apply when the UE is configured for 2-layer UL MIMO transmission as specified in Table 6.2D.1-2. The requirement may alternatively be verified in each of the single layer UL MIMO configurations as specified in Table 6.4D.2.0-1.” And table for Added for single layer TPMI’s |

### Sub-topic #3.1.4: Correction on UE co-ex tables

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000959](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000959.zip) | On correction of UE co-ex tables for Japan | SoftBank Corp., NTT docomo INC., KDDI Corporation |  | Adds notes  NOTE 43: Applicable for 5, 10 or 15MHz channel bandwidth confined between 824 - 845MHz.  NOTE 44: Applicable for 5 MHz and 15 MHz channel bandwidth confined between 900 MHz and 915 MHz and for 10 MHz channel BW confined between 905 MHz and 915 MHz.  NOTE 45: Applicable for 5, 10, 15 and 20MHz channel bandwidth.  To certain bands |

### Sub-topic #3.1.5: Avoidance of redundant power reduction for HPUE

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000227](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000227.zip) | Avoidance of redundant power reduction for HPUE | NTT DOCOMO, INC. | 38.101-1 | ***Proposal 1: ΔPPowerClass for a power class 2 capable UE shall be defined as follows for Rel15 and beyond***  ***if MAX(MAX(MPRc, A-MPRc)+ ΔTIB,c + ∆TC,c + ∆TRxSRS, P-MPRc) is less than 3 dB, ΔPPowerClass shall be 3- MAX(MAX(MPRc, A-MPRc)+ ΔTIB,c + ∆TC,c + ∆TRxSRS, P-MPRc) dB***  ***Else if ΔPPowerClass shall be 3 dB.***  ***Proposal 2: ΔPPowerClass shall be 0 dB when P-max is lower than 23 dBm for Rel15 and beyond.*** |

### Sub-topic #3.1.6: Correct the NS\_xx abbreviation to ‘network signalling’

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| [R4-2000326](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000326.zip) | CR to TS 38.101-1 on corrections to network signalling value (Rel-15) | ZTE Corporation | 38.101-1 | ***(1) Correct the NS\_xx abbreviation to ‘network signalling’ in the titles of sub-clause 6.5.2.3 and 6.5.3.3.***  ***(2) Modify the header of tables in sub-clause 6.5.2.3 for the additional requirement of network signalling values.***  ***(3) Editorial correction in Table 6.5.3.3.2-1.*** |

### Sub-topic #3.1.7: power class fallback enhancement

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| **T-doc number** | **Title** | **Company** | **Spec** | **Proposals / Observations** |
| R4-2002158 | CR for power class fallback enhancement | Huawei, HiSilicon | 38.101-1 | Changes in this CR:  Define the linear relation between ΔPPowerClass and uplink duty cycle. |

## Summary FR1 Transmitter Agenda 6.5.4 and 6.5.3

### Discussions for 1st round for FR1 transmitter

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| **Sub-topic** | **Company views** |
| 3.1.2: Tx modulation quality | Ericsson: this is not a clarification (“spec is not clear” used in the consequences if not approved), but the change aligned with the LTE requirements so could be considered. The same for EN-DC. |
| 3.1.3: Tx EVM for UL MIMO | OPPO: For clarification, in Observation 1 it says “A UE’s antenna mutual coupling dominates over conducted domain mechanisms in degrading channel quality in UL MIMO” does it mean conducted domain mutual coupling is not severe, then why this change is needed? If this can be justified, then we support the proposals.  Huawei: The UE implementation for FR1 and FR2 are quite different. We do not see the necessity to make changes for FR1 EVM test with the alternative MIMO configuration as it does not reflect the real field scenario and could degrade the system performance with a relaxed measurement result.  Ericsson: (R4-2000204) it is asserted that the test equipment (and BS in the field) can cancel the crosstalk in the device for dual-port transmissions, EVM can therefore be tested with the per-antenna precoders (one TX active at a time) or with a test equipment equipped with a MIMO receiver. However, EVM degradation is also caused by non-linear cross talk (e.g. crosstalk by coupling before the PAs and between PA outputs and inputs) that a linear MIMO receiver cannot cancel. The PAs are the main culprits of EVM degradation. The simulations make an a priori assumption of an EVM (2.5% that corresponds to 32 dB SNR) with a linear cross talk introduced after this, e.g. that occurring between the antenna ports after the PAs. This linear cross talk a MIMO receiver can cancel. EVM should be tested per connector/port with both TX chains active. The proposed test is not meaningful, the effect of non-linear cross talk on would not be verified. We do not agree the CR in R4-2000205. |
| 3.1.4: Correction on UE co-ex tables |  |
| 3.1.5: Avoidance of redundant power reduction for HPUE | Xiaomi: Thanks Docomo for the contribution R4-2000227. For clarification question, these proposals are only applied to the case that scheduling UL dutycycle excessed the signaled maxUPlinkDutycycle or whatever the UL dutycycle is?  vivo: Thank DoCoMo for the contribution in R4-2000227, we support both proposal 1 and 2. I have two questions for clarification:   1. Is it appropriate to apply the changes to both R15 and R16? (R4-2000228 and R4-2000229) Should it be R16 only?   If the proposed changes are agreed by the meeting for R16, can we conclude the R16 TEI on power class fallback? I.e. no more discussion on other solutions e.g. linear technique etc. in R16.  Ericsson: (comments to R4-2000227)Huawei: we agree with proposal 2. For Proposal 1, it depends on the relationDPpowerclass should only take fixed values, i.e. the differencerelation between (signaled) power class values, since Ppowerclass is mapped to an IE (the original intention). Notwithstanding, using the and MPR or A-adoption. Assume MPR can be misleading since these are the maximum values that can be used (set the lower limit of the configured power), not necessarily the actual values applied by the UE. In general: a "graceful" fall back from for PC2 is 2dB, then this PC2 use MPR=2dB, the PCMAX,L=24dBm. When the uplinkdutycycle exceeds UE capability, UE fallback to PC3 should be specified using another parameter. Proposal 2: if P-Max, then the UE may use MPR=0dB which is definedlessdefined for PC3, PCMAX,L=23dBm with ∆Ppowerclass=3dB. We are not sure which MPR it means in the equation of P1.  NTT DOCOMO, INC:  For Xiaomi, if PEMAX,c (P-Max) is larger than or equal to 23 dBm, the answerpower class parameteranswer is YES. If PEMAX,c (P-Max) is lower than 23 dBm, maxUplinkDutyCycle does not matter (PC3.  For vivo, we propose to change from Rel-15 since this is unnecessary power reduction and critically important for PC2 specification. We think that the R16 TEI on power class fallback is a different issue from this.  For Huawei, MPR inQualcomm: Disagree with the equation is MPR allowedproposal. The intention is that de;ta\_PPowerClass is to align the specification for the PC2 utnil the lowestUE fallbacks that falls back to PC3. Then, MPR for to be identical to a native PC3 may be used. Point is that without fixing this issue, additional ∆Ppowerclass=3dB power class). Not agreed.back off is allowed, then, UE’s PCMAX,L=21dBm regardless of the number of RBs etc. That is unnecessaryUE. |
| 3.1.6: Correct the NS\_xx abbreviation to ‘network signalling’ | Huawei: most changes are unnecessary. The last change on FOOB is acceptable. |
| 3.1.7: power class fallback enhancement | [SoftBank] The first/3rd corrections need divisions by maxUplinkDutyCycle (in logarithm) but it seems impossible since the sentences are conditioned as "UE capability of maxUplinkDutyCycle is absent". It seems that further clarification is required to avoid contradictions.  Ericsson: (comments to R4-2002158) the DPpowerclass parameter should not be used for the purpose of "graceful" fallback to PC3; the intent of this parameter is to compensate for differences between the indicated power class and the applicable power-class requirement (should only be difference between power class values if any). Use another (new) notion instead. The CR is confusing: the RRC parameter used does not exist, probably referring to the maxUplinkdutCycle-PC2-FR1 that can take values 60% and greater. Hence, 3 dB can never be reached in the fallback condition in 6.2.1 (only for the default 50%). 6.2.4: aside from the use of DPpowerclass, the compensation can be negative (results in >26 dBm) and undefined if the RRC parameter is absent. CR not agreed.  NTT DOCOMO, INC.:  Basic idea is OK but we have different ideas on how to incorporate this feature. Firstly, we need a capability for network to distinguish UEs with or without this feature. Otherwise, network cannot adjust UL scheduling for the respective UEs. Secondly, we have discussed that we cannot reuse delta Power class so that we need a new parameter. We’ve submitted an alternative CR inWe can share what the draft folder of #4\_NR\_NewRAT\_UE\_RF as “[draft] Alternative CR from docomo PC enhancement for sub topic 3.1.7.docx”.spec look like.  Qualcomm: The changes are not clear. Firstly, as pointed out by Softbank, you complete (% UL symbols/maxUplinkDutyCycle) but this is for a case where maxUplinkDutyCYcle is absent. Also, in the condition that 10log(% UL symbols / maxULDutyCycle) < 3dB, then UE should apply requirements of supported power class. Does this mean that if uplink symbols exceeds max UL Duty Cycle, the PC2 should still apply? |

### Summary after 1st round for FR1 transmitter

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| **Sub-topic** | **Summary** |
| 3.1.2: Tx modulation quality |  |
| 3.1.3: Tx EVM for UL MIMO |  |
| 3.1.4: Correction on UE co-ex tables |  |
| 3.1.5: Avoidance of redundant power reduction for HPUE |  |
| 3.1.6: Correct the NS\_xx abbreviation to ‘network signalling’ |  |
| 3.1.7: power class fallback enhancement |  |

### Discussions for 2nd round for FR1 transmitter

### Summary after 2nd round for FR1 transmitter

## FR1 Receiver Agenda 6.5.5

### Sub-topic #3.3.1: OOB TX level change due to testability issue in EN-DC

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| --- | --- | --- | --- | --- |
| Tdoc number | Title | Source | Spec | Proposals/ Observations |
| [R4-2000439](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000439.zip) | Testability issue with OoBB for FR1 EN-DC UE | Anritsu Corporation |  | ***Observation 1: Based on the current definition of the OoBB uplink signal levels, if an antenna (connector) is common between E-UTRA and NR in a UE, too much power imbalance will cause a testability issue with the FR1 EN-DC UE.***  ***Observation 2: UL level difference between E-UTRA and NR is approximately 60 dB with the current requirement.***  ***Observation 3: SS is in short of the dynamic range approximately 30 dB against the requirement and it is not possible to measure the throughput of UL signals***  ***Observation 4: Filter performance may not be provided appropriately in a case bands are aligned nearby.***  ***Proposal1: Change UL signal level settings of out-of-band blocking requirement for FR1 EN-DC UE. Choice of option and UL level are TBD.***  **Option 1: PCMAX\_L – 4 dB for both E-UTRA and NR UL**  **Option 2: PCMAX\_L – 7 dB for both E-UTRA and NR UL**  **Option 3: PCMAX\_L – 4 dB (UL for the source of IMD) and PCMAX\_L – [14] dB (UL whose DL is being tested)** |
| [R4-2000440](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000440.zip) | CR to out-of-band blocking for DC in FR1 | Anritsu Corporation | 38.101-3 | Has changes for all three candidates in the discussion paper. |

### Sub-topic #3.3.2: ACS TX level change

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| Tdoc number | Title | Source | Spec | Proposals/ Observations |
| [R4-2000449](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000449.zip) | CR to TS 38.101-1: corrections on ACS for intra-band contiguous CA | Xiaomi | 38.101-1 | Change TX from Pcmax 4 dB below max to 24 dB below max |
| [R4-2000451](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000451.zip) | CR to TS 38.101-3: corrections on ACS for intra-band contiguous EN-DC | Xiaomi | 38.101-3 | Change TX from Pcmax 4 dB below max to 24 dB below max |

### Sub-topic #3.3.3: ACS RMC change FR1 and FR2

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| --- | --- | --- | --- | --- |
| Tdoc number | Title | Source | Spec | Proposals/ Observations |
| [R4-2000747](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000747.zip) | NR UE receiver ACS test requirements | MediaTek Inc. |  | ***Proposal 1***: *Modify NR ACS test configuration by aligning the PDCCH/DCI power level to the same as PDSCH in DL reference measurement channel for both FR1 and FR2.*  ***Proposal 2****: Send an LS to inform RAN5 for RAN4’s concern on current ACS test requirements and RAN4’s agreement to modify the ACS test configuration to align the PDCCH/DCI power level to the same as PDSCH in DL reference measurement channel for both FR1 and FR2.*  ***Proposal 3****: Whether the same modification should be applied to other UE RF receiver test requirements or not is up to RAN5’s decision.* |
| [R4-2000748](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000748.zip) | LS on NR UE receiver ACS test requirements | MediaTek Inc. | 38.101-3 | ” , RAN4 has agreed to modify the NR UE ACS test configuration by aligning the PDCCH/DCI power level to the same as PDSCH in DL reference measurement channel for both FR1 and FR2” |

## Summary FR1 Receiver Agenda 6.5.5

### Discussions for 1st round for FR1 receiver

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| **Sub-topic** | **Company views** |
| 3.3.1: OOB TX level change due to testability issue in EN-DC | Company:Qualcomm: If this change is truly needed, then setting other Tx to Pcmax-14 might be the best alternative. But we should study if that impacts the requirements and whether any adjustment is needed |
| 3.3.2: ACS TX level change | Huawei: PCMAX,L-24dB is coming from LTE spec, we would like to know whether UE is allowed to lower down 24dB output power under large interference condition?Ericsson: OK, consistent with non-CA requirements. |
| 3.3.3: ACS RMC change FR1 and FR2 | Huawei: we agree that PDCCH demodulation shall not configured as the bottleneck on ACS test for PDSCH. To be more specific, there are two conditions need be clarified:   1. PSD of PDCCH and PDSCH shall be aligned. 2. The aggregation level of PDCCH can be configured as at least 8 or higher   We think the same conditions are also work for other receiver requirements.Ericsson: the CORESET is configured such that it occupies the full BW (A.3.1-1), there should be no power change between PDCCH/DCI and PUSCH. Then, presumably, the PDCCH CCE to REG for the DL transmission of the DUT interleaved (i.e. the nonInterleaved option is not used).Anritsu: Comment to R4-2000747.  We have a concern with proposals.  Aligning the output level between PDCCH and PDSCH by changing only the output power for PDCCH will make another discrepancy with the requirements described in TS38.101-1 Table C.3.1-1. (EPRE ratio between physical channels which are supposed to be aligned among them except for DMRS.)  Extract from TS38.101-1 Annex C.3.1 |

### Summary for 1st round

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| **Sub-topic** | **Summary** |
| 3.3.1: OOB TX level change due to testability issue in EN-DC | NTT DOCOMO, INC.:  We prefer option 1. We have concern about option 2. The motivation of OBB in EN-DC is to test the impact of IM caused by blocker and uplink whose down link is not being tested. If the uplink transmission power is decreased, the impact of IM is also decreased and the OBB requirement is relaxed. |
| 3.3.2: ACS TX level change |  |
| 3.3.3: ACS RMC change FR1 and FR2 |  |

### Discussion on 2nd round (if applicable)

### Summary on 2nd round (if applicable)

# Topic #4: FR2 General requirements

## FR2 Transmitter

### Sub topic #4.1.1: WRC-19 resolutions (Agenda 6.5.6.1)

#### Papers submitted for Sub-topic #4.1.1 WRC-19

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| **[R4-2000091](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000091.zip)** | On 3GPP band n258 and WRC-19 EESS unwanted emission limits | T-Mobile USA, AT&T | The proponents believe that RAN4 should revise current band n258 specifications to implement WRC-19 agreed phase-1 EESS limits only for now, and leave phase-2 limits for a future revision, when applicable. |
| **[R4-2000216](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000216.zip)** | Impact of WRC19 resolutions on FR2 | Qualcomm Incorporated | None. WRC19 resolutions analyzed, 3GPP standards impact projected |
| **[R4-2000230](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000230.zip)** | EESS protection from n257 (from 6.5.7.3) | NTT DOCOMO, INC. | Proposal 1: n257 UEs shall meet the unwanted emission limits to protect the EESS (passive) only when any portion of the UL transmission bandwidth is inside 26.5 - 27.5GHz.  Proposal 2: Specify -5 dBm/200MHz for Band n257 UEs from the beginning(No spec change from 1 to -5 dBm/200MHz in the future). |
| **[R4-2000409](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000409.zip)** | On 3GPP band n258 and WRC-19 EESS unwanted emission limits | T-Mobile USA, AT&T, U.S. Cellular | Duplicate?  The proponents believe that RAN4 should revise current band n258 specifications to implement WRC-19 agreed phase-1 EESS limits only for now, and leave phase-2 limits for a future revision, when applicable. |
| **[R4-2001775](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001775.zip)** | On FR2 EESS protection emission requirement | Huawei, HiSilicon | Observation 1: The current NS\_201 spurious emission can work well for the new ITU emission requirement.  Proposal 1: RAN4 do not change or add AMPR and spurious requirement for EESS protection in Rel-15 and Rel-16, and pay close attention on the EESS protection requirement adoption.  Proposal 2: slightly revise NS\_201 AMPR requirement as in Table 3. (*Moderator note:* *this proposal is identical to QC proposed change in [R4-2000212](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000212.zip)*) |

#### Open Issues Summary, Sub topic #4.1.1: WRC-19 resolutions

##### Additional Requirements or General Requirements?

* 4.1.1.2.1-1: Any new emissions requirements would go into general requirements
* 4.1.1.2.1-2: Any new emissions requirements would go into ‘Additional’ requirements

##### Timing of Introduction of new emissions requierments into 3GPP standard

* 4.1.1.2.2-1: Immediately
* 4.1.1.2.2-2: Wait for regulators to declare intent to change emissions limits

##### Emissions Limit for 3GPP

* 4.1.1.2.3-1: Adopt more stringent EESS protection limit (-5 dBm//200MHz)
* 4.1.1.2.3-2: Adopt emission limit that tracks regulatory requirement, not WRC-19 resolution
* 4.1.1.2.3-3: Retain emission limit from NS\_201 (-8 dBm/200MHz) as long as WRC-19 resolutions are more relaxed

#### Company Views on Open Issues Sub topic #4.1.1: WRC-19 resolutions

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| --- | --- | --- | --- |
| Open Issue | Proposal | Description | Company Views |
| 4.1.1.2.1 | -1 | Any new emissions requirements would go into general requirements | NTT DOCOMO, INC.Huawei: currently, we don’t see ECC will change the EESS -8dBm/200MHz limit, while maybe other regulation will adopt ITU requirement in the future. Then different EESS requirement may exist in different regions. We are not sure before indication from regulators. We prefer to decide on this when the EESS protection requirement is clear.Ericsson: (2) additional requirement to reflect local regulation.  NTT DOCOMO, INC. : For n257 case, strictly speaking, neither option 1 nor 2. -8dBm/200MHz was introduced without NS because this had been expected to be a benchmark which would be close to the value WRC19 selected. Now we know -5dBm/200MHz must be met in the end. This is what we have. Thus, -5dBm/200MHz must be treated as general. The other proposals such as relaxed one until Sep 1st 2027 and a value to be determined in EU would be treated as addtitional.  With respect to additing new NS, we really need a mechamism to make UEs to report which NS they can deal with to network. R4-2000214 (Qualcomm) says ”Deployed n257 UEs in the EU will remain emissions compliant because they will self-detach from the network if they receive unexpected NS\_201 and NS\_202” It is true only for Standalone operation. NSA has other issues which is elaborated in R4-2000220 (DCM).  Qualcomm: Favor -2 option  T-Mobile USA:  For n258, we support -2 option. I.e., treating WRC-19 resolution emiaaion limits as additional requirements. Meanwhile, the problem identified in DOCOMO’s paper R4-2000220 that a network not being able to distingush two types of UEs, which are subject to different emission limits and may not understand some new NS\_numbers, will result in a RRCReconfiguration failure in certain situations must be resolved. RAN4 should revise current band n258 specifications to implement WRC-19 EESS limits but not to create a new band for new emission requirements. |
| -2 | Any new emissions requirements would go into ‘Additional’ requirements |
| 4.1.1.2.2 | -1 | Introduce requirements immediately | Huawei:Option 2  Ericsson: (1) the requirements for the phase 1 and phase 2 WRC19 requirements for EESS protection should be introduced at the same time from Rel-15. There is precedence in the 3GPP specifications (Band 23/25 co-existence in 3GPP Rel-10)  NTT DCOOMO, INC.: For both n257 and n259, Favor -1 option. There are no reasons not to introduce the requirements. For EU, if they derive differnt one from that from WRC19, we newly introduce it into n257 and n259, respectively.  Qualcomm: Favor -2 option  T-Mobile USA:  For n258, we prefer to implement WRC-19 agreed phase-1 EESS limits immediately.  [SoftBank-2] We’ve got a feedback from ITU-R guys that, in general, such ITU-R resolution takes precedence over a domentic rule (because this is an international agreement made among regulators) then application of the rule should be promptly. We’d recommend that interesting parties should check with internal ITU-R relevant persons. |
| -2 | (Wait for regulators to declare intent to change emissions limits) |
| 4.1.1.2.3 | -1 | -5 dBm/200 MHz | Huawei:Option 2  Ericsson: (3) retain the existing (e.g. for use in EU) while introducing the phased additional requirements according to WRC19.  NTT DOCOMO, INC: For n257,Qualcomm: Favor -1112 option.  T-Mobile USA:  For n258, RAN4 should revise current band n258 specifications to implement +1 dBm/200 MHz immediately, and leave -5 dBm/200 MHz for a future revision, when applicable.  T-Mobile notes that the +1 dBm/200 MHz option is missing in the proposals. T-Mobile suggests it be included. |
| -2 | (Wait for indication from regulators) |
| -3 | -8 dBm/200 MHz |

#### Summary of 1st rounds of discussion on Sub topic #4.1.1: WRC-19 resolutions

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| --- | --- | --- |
| Open Issue | Description | Summary |
| 4.1.1.1 | Additional or general requirements |  |
| 4.1.1.2 | Timing of introduction of new requirements |  |
| 4.1.1.3 | Emissions Limit to adopt in 3GPP |  |

### Sub topic #4.1.2: Correction on -8 dBm / 200 MHz

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| **[R4-2000212](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000212.zip)** | CR to 38.101-2: A-MPR Corrections | Qualcomm Incorporated | Removal of -8dBm/200 MHz general requirement duplicated in error from general requirements |

### Sub topic #4.1.3: Impact of ETSI harmonised std

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| **[R4-2000214](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000214.zip)** | Impact of EN 301 908-25 on FR2 | Qualcomm Incorporated | Proposal 1: NS\_201 and NS\_202 A-MPR framework in TS38.101-2 must be modified to include n257 in a release-independent manner if the ETSI harmonized standard EN 301 908-25 includes n257 |
| **[R4-2000218](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000218.zip)** | dCR to 38.101-2: NS extension to n257 | Qualcomm Incorporated | CR according to 214 |

### Sub topic #4.1.4: PCMAX CA correction (Agenda 6.5.7.1)

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| **[R4-2000109](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000109.zip)** | Background for Pcmax correction for CA | Qualcomm Incorporated | Observation 1: PUSCH preparation time is short  Observation 2: Power control process can not be iterative  Observation 3: Section 7.1 through 7.4 conclude what are the desired powers for the channels in a transmission  Observation 4: Actual power to be transmitted is known only after scaling according to section 7.5 in TS 38.213 is performed  Observation 5: PCMAX can be calculated for each transmission occasion once based on only on grant  Observation 6: RAN4 specification is misaligned with the assumptions made in RAN1 specification  Proposal: RAN4 specification must be corrected to align with the RAN1 specification |
| [R4-2000107](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000107.zip) | Pcmax correction for CA | Qualcomm Incorporated | CR According to 109 |
| **[R4-2001765](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001765.zip)** | CR for FR2 CA Pcmax\_Rel-15 | Huawei, HiSilicon | CR seems same as Qualcomm |

### Sub topic #4.1.5: Pumax evaluation period (Agenda 6.5.7.1)

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| [R4-2000507](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000507.zip) | CR to 38.101-2 (Rel-15) Configured transmitted power for CA | Intel Corporation | Adds :” The evaluation period for PUMAX is determined by the longest slot duration among CCs. A UE expects there is no slot across the boundaries of an evaluation period. MPR and A-MPR are the largest values within the evaluation period.” to CA PCMAX  From Agenda 6.5.7.3 |

### Sub topic #4.1.6: Relative power tolerance alignement (Agenda 6.5.7.1)

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| [R4-2001387](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001387.zip) | Correction on transmission gap for FR2 relative power tolerance | Ericsson | Adds less than or equal in “transmission gap between these sub-frames is less than or equal to 20 ms” n 6.3.4.3 Relative power tolerance. Justifies alignment with FR1 |

### Sub topic #4.1.7: Beam Correspondence correction (Agenda 6.5.7.2)

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| [R4-2001763](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2001763.zip) | CR for 38.101-2 side condition for BC\_Rel15 | Huawei, HiSilicon | Adds agreed side conditions for power class 3 |

### Sub topic #4.1.8: Max duty cycle clarififcations (Agenda 6.5.7.3)

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| **[R4-2000005](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000005.zip)** | Clarification for the definition of the UL duty cycle | Apple Inc. | Proposal 1: Clarify that a UE maximum transmission power is assumed for the definition of the Rel-15 maximum UL duty cycle.  Proposal 2: Send LS to RAN WG2 asking to introduce further clarifications into the definition of maximum UL duty cycle. |
| [R4-2000084](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000084.zip) | [draft] LS on clarification for the definition of the UL duty cycle | Apple Inc. | To RAN WG2 group. ACTION: RAN WG4 asks RAN WG2 to introduce changes into the definition of maxUplinkDutyCycle-FR2 parameter. |

### Sub topic #4.1.9: UL RMC correction for undefined slots (Agenda 6.5.7.3)

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| [R4-2000003](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000003.zip) | Correction of the FR2 RMC slot patterns for MOP test cases | Apple Inc. | Correcting usage of undefined slots in Ul RMC:  mod(slot index, 40404040404040) = {36,…,39} |

### Sub topic #4.1.10: PTRS introduction to 64 QAM RMC (Agenda 6.5.7.3)

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| [R4-2000010](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000010.zip) | Correction of FR2 64QAM UL RMC | Apple Inc. | Proposes to Introduce PTRS to 64 QAM UL RMC and EVM test |

### Sub topic #4.1.11: Correction to link angles (Agenda 6.5.6)

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| [R4-2000198](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000198.zip) | CR to 38.101-2 to correct Link and Meas Angles | Keysight Technologies UK Ltd | Numerous corrections to link angle definitions and measurement grid definitions |

## Summary for FR2 transmitter

### Discussions for 1st round on FR2 transmitter

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| Sub topic | Company views: |
| 4.1.2: Correction on -8 dBm / 200 MHz | Huawei: for Refsens, it is not clear that whether both NS 201 and 202 or one of them is configured. NS 200 could be also alternatively for n258..  NTT DOCOMO, INC: We have an objection for the CR from Qualcomm. Our views are documented in R4-2000230 and R4-2000231. |
| 4.1.3: Impact of ETSI harmonised std | [SoftBank] For EESS requirements, they are limited to small range of frequencies in n257. It is straightfoward that the modification of 3GPP requirements also limit to the related frequency range in n257. It is preferable to avoid the introducion of new NS if other scheme can solve this problem since NS resources are limited.Huawei: Adding n257 to ETSI is still under reviewing process, we don’t think the EESS protection requirement is so urgent for n257, since it is relatively far from the 24GHz.Ericsson: we agree that NS\_201 and NS\_202 be added. There is also a note in the EN: “NOTE:Radio equipment in band n257 is only allowed to operate from 26 500 MHz to 27 500 MHz”. The modifiedMPRbehaviour could possibly be used to allow Rel-15 devices indicate support of the new NS values for e.g. SCG configuration by the EN-DC (gNB aware that n257 supports the new NS, should not configure SCG otherwise).  NTT DOCOMO, INC: We have an objection for the CR from Qualcomm. Our views are documented in R4-2000230 and R4-2000231. With respect to adding a new NS to an existing band, as proposed in R4-2000223, we need a mechanism to make UEs report which NS they can deal with to a network.  Nokia: Does the same A-MPR apply to n257 as n258? n257 is in much higher frequency. As an editorial concearning Table 6.2.3.2.3-1 and Table 6.2A.3.2.3-1 only one row would be sufficient to n258 A-MPR. |
| 4.1.4: PCMAX CA correction | Huawei: our CR have more discription on power scaling part cpmpared with QC.  Ericsson: (comments to R4-2000107 and R4-2001765) the intention of the deleted provision in the first paragraph was to include in PCMAX the CCs that are activated and with a transmission grant, but not deactivated but configured CCs. An iterative scaling procedure of the PCMAX is not implied. Then the PCMAX is also subject to the power class (defined in a different plane of reference) measured as PUMAX. 1) Now PCMAX is undefined. 2) The PUMAX is not scaled according to 38.213, but the power of the transmissions PUSCH/PUCCH and SRS in case PCMAX implies a PUMAX higher than the power class. 3) The PUMAX formula: there is only one frequency f per carrier c in FR2. We do not agree the CR in R4-2000107 without modifications. |
| 4.1.5: Pumax evaluation period |  |
| 4.1.6: Relative power tolerance alignment |  |
| 4.1.7: Beam Correspondence correction |  |
| 4.1.8: Max duty cycle clarifications | OPPO: maxULdutycycle capability applies to all UE powers single only one capability is reported. How to derive this duty cycle capability is up to UE implementation, there is no need to define in the spec. And with this change it will be misleading, i.e. which duty cycle should this UE appliy if this duty cycle is only defined for max power? Therefore, we suggest to keep as it is.Huawei: we would like to know the network behavior if the maxUplinkdutycycle is clarifed at only MOP.Ericsson: OK. The max duty cycle should be mapped to power class.  NTT DOCOMO, INC: We agree with the motiation. We should clarify the meaning of ”UE maximum transmission power”. Does this mean TRP or EIRP, and maximum power that each UE has or maximum power related to power class? According to 6.2.4 in the latest 38.101-2, P-MPR seems to be appried to minimum peak EIRP relate to power class. |
| 4.1.9: UL RMC correction for undefined slots | Ericsson. OK |
| 4.1.10: PTRS introduction to 64 QAM RMC | Huawei: we have a CR on PTRS configuration in previous meetings. It’s better to have a new table on PTRS configurations.Ericsson: if the exact TBS is not provided, RAN5 cannot implement this test. No point to approve in this meeting.  Qualcomm: This changes core requirement and discussion has allready once concluded not to introduce this. Not ok with the change. |
| 4.1.11: Correction to link angles | Huawei: do not need  Anritsu: In addition to the limitionsuggested changes in the CR (R4-2000198), we think two changes are needed.   1. Definition of EIS is needed with RX beam peak direction as the link angle. 2. We found that meas and link are alwaysthe link angle condition for TRP is not clear whether it is describing the initial link condition (TX beam peak direction) or the condition for during the measurement (any arbitral direction).   Suggested changes are as follows.  **Newly added**  **EIS(Link=RX beam peak direction, Meas=Link angle):** measurement of the EIS of the UE such that the measurement angle is aligned with the RX beam peak direction within an acceptable measurement error uncertainty.  **Add some clarification texts.**  **Link angle:** a DL-signal AoA from the view point of the UE, as described in Annex J. If the beam lock function is used to lock the UE beam(s), the initial link angle before the beam lock can become any arbitrary AoA once the beam lock has been activated. |

### Summary of discussions after 1st round for FR2 transmitter

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| Sub topic | Summary |
| 4.1.2: Correction on -8 dBm / 200 MHz |  |
| 4.1.3: Impact of ETSI harmonised std |  |
| 4.1.4: PCMAX CA correction |  |
| 4.1.5: Relative power tolerance alignement |  |
| 4.1.6: Beam Correspondence correction |  |
| 4.1.7: Max duty cycle clarififcations |  |
| 4.1.8: UL RMC correction for undefined slots |  |
| 4.1.9: PTRS introduction to 64 QAM RMC |  |
| 4.1.10: Correction to link angles |  |

### Discussions for 2dn round on FR2 transmitter

### Summary for 2dn round on FR2 transmitter

## FR2 Receiver (Agenda 6.5.8)

### Sub topic #4.3.1: Change on IBB blocker location

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| **[R4-2000436](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000436.zip)** | Condition of IBB blocker location in FR2 | Anritsu Corporation | Observation 1: Original motivation to place the blocker throughout the pass band is to confirm spurious responses within a UE. (e.g. Image response and Half-IF spurious response.)  Observation 2: From the current design of the mmWave UE frontend architecture, an image of the interferer does not appear in a same FR2 band of the wanted signal.  Observation 3: The half-IF spurious response also does not appear in-band or can be assumed as negligible in FR2.  Proposal 1: Modify the requirement of IBB in TS 38.101-2 to place the in-band blocker only at the first non-adjacent channel position (FIoffset = +/- 2\*Channel BW). |

### Sub topic #4.3.2: RX requirements for UL MIMO

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| **[R4-2000697](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000697.zip)** | CR to 38.101-2: Removal of Rx requirement for UE in UL MIMO | Qualcomm Incorporated | Voids sections 7.3D, 7.4D |

### Sub topic #4.3.3: Uplink level change for RX tests

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| **[R4-2000749](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_94_e/Docs/R4-2000749.zip)** | CR for TS 38.101-2: Clarifications on transmitter power for recevier requirements | MediaTek Inc. | Changes the tx level reference in max input level test to pumax, from “lower limit of pumax” and adds this condition to ACS and inband blocking |

### Sub topic #4.3.4: Change on SSB and TRS configurations

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| R4-20xxxxx | CR to TRS and SSB configurations in FR2 | Qualcomm Incorporated | SSB and TRS configurations are modified in such a way that those do not collide in the time domain, which is aligned with test configuration in TS38.101-4. |

## Summary for FR2 receiver

### Discussions for 1st round on FR2 receiver

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| Sub topic | Company views: |
| 4.3.1: Change on IBB blocker location | Huawei: We support this contribution. For the worst case with image and fIF/2, there is not possible that the interferer fall within the band on FR2. There is no need to test on all non-adjacent channel for IBB. For the other issues, the first non-adjacent test would be enough.  NTT DOCOMO, INC: We have a concern about the change of in band blocking requirements, and we need further studies since there is no out of band blocking requirent is FR2.  Qualcomm: Changes core requirement due to testability concerns. Not ok with the change. |
| 4.3.2: RX requirements for UL MIMO | OPPO: Ok with the change, but how about other Rx cases like ACS, blcoking, etc?  Huawei: UL MIMO RX requirement is not defined only for FDD band. We prefer to keep the RX requirement for UL MIMO. |
| 4.3.3: Uplink level change for RX tests | Qualcomm: Change penalises UE with higher EIRP capability. Not ok with the change  Xiaomi: Thanks MTK for the paper 2000749. Like our paper R4-2000449, we propose Changing TX from Pcmax 4 dB below PUMAX,f,c to 24 dB below PUMAX,f,c for ACS case 2 in table 7.5-3 and 7.5A-3.  ZTE: In xiaomi’s CR [449], it is ‘..4 dB below PCMAX\_L,f,c ..’, but in MTK’ CR[749], it is ‘...4 dB below the PUMAX,f,c...’. So which one is correct??  Huawei: Agree. |
| 4.3.4: Change on SSB and TRS configurations |  |

### Summary of discussions after 1st round for FR2 receiver

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| Sub topic | Summary |
| 4.3.1: Change on IBB blocker location |  |
| 4.3.2: RX requirements for UL MIMO |  |
| 4.3.3: RX requirements for UL MIMO |  |
| 4.3.4: Change on SSB and TRS configurations |  |

### Discussions for 2dn round on FR2 receiver

### Summary for 2dn round on FR2 receiver

# Topic #5: Signalling supported NS values

## Submitted contributions

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| **Tdoc** | Title | Company | **Proposals / Observations** |
| R4-2000220 | Necessity of signaling supported NS values | NTT DOCOMO, INC. | This contribution addressed to clarify the issues without means to convey supported NS values for a band by a UE to a NW. As a conclusion, we share three observations and propose the following. Companion CRs are also provided in [2-4].  **Observation 1:**  **If at least two types of UEs whose supported NS values are different for a band exist simultaneously in a NW and the NW cannot distinguish them, Standalone NW will see *RRCReconfiguration failure* during handover and Nonstandalone NW will see *RRCReconfiguration failure* during EN-DC configuration.**  **Observation 2:**  **Without solving the issues, RAN4 has to create a new band whenever RAN4 identifies a new spectrum emission requirement for the existing bands.**  **Observation 3:**  **There is no RAN2 spec impact on broadening the definition of modifiedMPR-Bhaviour.**  **Proposal:**  **Broaden a definition of “*modifiedMPR-Behaviour*” in RAN4 specifications in a way that a new bit is defined when MPR or A-MPR for the existing NS is modified or a new NS is added to an existing band from Rel15.** |
| R4-2000221 | Broadening a definition of “modifiedMPR-Behaviour” for 38.101-1 | NTT DOCOMODOCOMODOCOMODOCOMO21DOCOMODOCOMO2121DOCOMO, INC. | Adds annex H to 38.101-1 |
| R4-2000222 | Broadening a definition of “modifiedMPR-Behaviour” for 38.101-1 | NTT DOCOMO, INC. | Adds annex H to 38.101-1 |
| R4-2000223 | Broadening a definition of “modifiedMPR-Behaviour” for 38.101-2 | NTT DOCOMO, INC. | Adds annex H to 38.101-2 |
| R4-2000224 | Broadening a definition of “modifiedMPR-Behaviour” for 38.101-2 | NTT DOCOMO, INC. | Adds annex H to 38.101-2 |
| R4-2000225 | Broadening a definition of “modifiedMPR-Behaviour” for 38.101-3 | NTT DOCOMO, INC. | Adds annex H to 38.101-3 |
| R4-2000226 | Broadening a definition of “modifiedMPR-Behaviour” for 38.101-3 | NTT DOCOMO, INC. | Adds annex H to 38.101-3 |

## Open issues

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| **Issue #** | Issue | Company views |
| **#5.2.1** | Change the modified MPR behavior to define 15.8 as baseline | Ericsson: we support the idea that support of a new NS value can be indicated as a modifiedMPRbehaviour – a new NS usually implies an MPR or A-MPR modification -- to avoid RRC reconfiguration reject (this should not happen). An old problem from LTE days. However, the absence of the bitmap should mean that the UE supports features according to its indicated release and be specified in the 38.331 (behavior is not specified in RAN4 specifications), i.e. there are no modifications (in later releases) supported. For NS values absence means it supports all NS values of that indicated release. The statement "Absence of the modifiedMPR-Behaviour for a supported band means that the UE supports all of the NS values that were specified for the band in Table 6.2.3.1-1A of TS 38.101-1 version 15.8.2." cannot be used since modified behavior is not only about *new* NS values. The bits of the bitmap can be mapped to different versions of the specifications so a particular baseline version for the entire bitmap cannot be used.  Huawei: Modified MPR capability is used to indicate whether UE support the updated MPR or AMPR to a certain NS per band.  For the cell access procedure defined in RAN2 spec, the UE will check whether the current NS is supported, if it is not, UE will drop the access procedure.  In the CR, it is mentioned “Absence of the modifiedMPR-Behaviour for a supported band means that the UE supports all of the NS values that were specified for the band in Table 6.2.3.1-1A of TS 38.101-1 version 15.8.2 and Table 6.2.3.1-2 and 6.2A.3.1-2 of TS 38.101-2 version 15.8.0.”, if an UE produced for version 15.8.0 is absence with this signalling, then a later release gNB will consider this UE can support all NS defined in a later release. Then the RRCreconfiguration failure will still happen.  OPPO: Understand the intentionentire bitmapintention, and for clarification, if the “modifiedMPR-Behaviour” is not absent, how to understand this bit? Is it for modified MPR or NS signaling since these two are using same bit in RAN2. And in a later release if a new NS signaling is introduced then what is the expected behavior of legacy UE and new UE?  NTT DOCOMO, INC.:  For Huawei, with regard to a comment about *“if an UE produced for version 15.8.0 is absence with this signalling, then a later release gNB will consider this UE can support all NS defined in a later release. Then the RRCreconfiguration failure will still happen.”*  No it will not happen anymore. The gNB will consider the UE without signaling supporting at least all the NS defined until version of 15.8.0. Thus, if the gNB uses a new NS which was defined “after” v15.8.0, the gNB can avoid having RRC reconfiguration failure because the gNB know that UE cannot deal with the new NS since the UE does not report signaling.  For OPPO, [Q1]how to understand this bit? Is it for modified MPR or NS signaling since these two are using same bit in RAN2  [Ans1] Since each of the bits is listed in a table in the Annex together with the definition, NW can distinguish the meaning of each of them, i.e., if a bit is for MPR change for a band, AMPR change or a new NS (together with AMPR if necessary).  [Q2] in a later release if a new NS signaling is introduced then what is the expected behavior of legacy UE and new UE  [Ans2]  For legacy UE, a network using a new NS knows that the legacy UE does not support the new NS. In SA, the UE cannot be used. understand the NS, thus, the UE considers the cell as barred. In NSA, the UE firstly access to the network via LTE and the network can know that this UE can NOT handle the new NS. Thus, the network would not configure EN-DC with the band (with the new NS). So no failure.  For new UE, In SA, the UE can understand the NS, thus, the UE can access to the band. Also handover does work smoothly since the network knows appropriate NS for the UE and convey that information to a destined gNB during handover. In NSA, the UE firstly access to the network via LTE and the network can know that this UE can handle the new NS. Thus, the network would configure EN-DC with the band (with the new NS). Handover does work well as explained in SA. |
| **#5.2.2** | Add modified MPR to all -1, -2 and -3 specs | Ericsson; only to -1 and -2 for modifications bands in the respective frequency range. The bitmap is sent per band in the UE-NR-Capability. Introduce in -2 once there is a modification for an FR2 band. |

## Summary of Open issues

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| **Issue #** | Summary |
| **#5.2.1** |  |
| **#5.2.2** |  |