**3GPP TSG-RAN WG4 Meeting #104-bis-e R4-22xxxxx**

**Online Meeting, 10 – 21 October 2022**

**Third Generation Partnership Project (3GPP™)**

**DRAFT Meeting Report  
for  
TSG RAN WG4  
meeting: 104-e**

**Electronic Meeting, Online, 15/08/2022 to 26/08/2022**

Report generated on Thursday, 2022-08-11 04:07 UTC

## 1 Opening of the E-meeting

## 2 Approval of the agenda

**R4-2211500 RAN4#103-e Meeting Report**

*Type: report For: Approval  
 Source: ETSI MCC*

**Decision: Approved.**

**R4-2211501 Agenda for RAN4#104-e**

*Type: agenda For: Approval  
 Source: RAN4 Chair (Huawei)*

**Decision: Approved.**

**R4-2211502 RAN4#104-e E-Meeting Arrangements and Guidelines**

*Type: other For: Approval  
 Source: RAN4 Chair (Huawei)*

**Decision: Approved.**

**R4-2214006 RAN4#103-e Meeting Report**

*Type: report For: Approval  
 Source: ETSI MCC*

(Replaces R4-2211500)

**Decision: Approved.**

## 3 Incoming LS and meeting report

### 3.2 Session chair notes

Main session email thread list

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Email title** | **WI** | **Topic areas** | **AI covered in the email thread** | **Moderator & Summary agenda** |
| [104-e][100] Main Session | N.A | N.A | N.A | Xizeng Dai AI 3.2 |
| [104-e][101] R15\_R16\_Maintenance | NR\_newRAT-Core | 4.1 NR UE RF requirements | 4.1 | Jinqiang Xing AI 4.8 |
| [104-e][102] R17\_Maintenance\_part1 | Closed Rel-17 spectrum and non-spectrum related WI | [May need update]: 5.1.1 introduction of operation in full unlicensed band 5925-7125MHz for NR 5.1.2 High power UE (power class 2) for NR FDD band 5.1.3 Adding channel bandwidth support to existing NR bands 5.1.4 BCS4 5.1.5 Increasing UE power high limit for CA and DC 5.1.6 Simultaneous Rx/Tx 5.1.7 Additional LTE bands for UE category M1/M2 and NB1/NB2 5.1.8 others | 5.1.1 5.1.2 5.1.3 5.1.4 5.1.5 5.1.6 5.1.7 5.1.8 | Dominique Evereare AI 5.3 |
| [104-e][103] R17\_Maintenance\_part2 | Closed Rel-17 spectrum and non-spectrum related WI | 5.2.1 UE RF for TxD 5.2.4.2 UE RF requirements (for other WIs) 5.2.4.5 Rel-17 TEI for specific UE RF topics | 5.2.1 5.2.4.2 5.2.4.5 | Peng Zhang AI 5.3 |
| [104-e][104] NR\_6 GHz\_licensed | NR\_6 GHz | 8.1 Introduction of 6GHz NR licensed bands | 8.1 | Liehai Liu AI 8.1.3 |
| [104-e][105] NR\_RF\_FR1\_enh\_maintenance | NR\_RF\_FR1\_enh-Core | 9.3.1 R17 RF requirements enhancement for NR frequency range 1 (FR1) | 9.3.1 | Ye Liu AI 9.3.3 |
| [104-e][106] NR\_RF\_FR2\_enh2\_Part\_1 | NR\_RF\_FR2\_req\_enh2 | 9.4.1 R17 NR RF requirement enhancements for frequency range 2 (FR2) | 9.4.1 | Petri Vasenkari AI 9.4.7 |
| [104-e][107] NR\_RF\_FR2\_enh2\_Part\_2 | NR\_RF\_FR2\_req\_enh2 | 9.4.2 UL gaps for self-calibration and monitoring 9.4.5 UL gaps RRM (part of papers in 9.4.5) 9.4.6.2 UL gap RRM perf | 9.4.2 9.4.5 9.4.6.2 | Yang Tang AI 9.4.7 |
| [104-e][108] NR\_RF\_FR2\_enh2\_Part\_3 | NR\_RF\_FR2\_req\_enh2 | 9.4.3 DC location 9.4.4 CA BW classes | 9.4.3 9.4.4 | Sanjun Feng AI 9.4.7 |
| [104-e][109] NRSL\_enh\_maintenance | NR\_SL\_enh-Core | 9.13.1 R17 NR SL enh UE RF maintenance 9.13.2 con-current and high power maintenance | 9.13.1 9.13.2 | Su Hwan Lim AI 9.13.5 |
| [104-e][110] NR\_ext\_to\_71GHz\_Part\_1 | Extending current NR operation to 71GHz | 9.14.1, 9.14.2, R17 up to 71GHz: general, band, system parameters 9.14.3.3 FR1+FR2-2 DC/CA | 9.14.1, 9.14.2 9.14.3.3 | Aida L Vera Lopez AI 9.14.9 |
| [104-e][111] NR\_ext\_to\_71GHz\_Part\_2 | Extending current NR operation to 71GHz | 9.14.3.1 Tx requirements for R17 up to 71GHz 9.14.3.2 Rx requirements for R17 up to 71GHz | 9.14.3,1 9.14.3.2 | Phil Coan AI 9.14.9 |
| [104-e][112] NR\_cov\_enh\_maintenance | NR\_cov\_enh-Core | 9.16.1 UE RF for R17 NR coverage enhancements | 9.16.1 | Shan Yang AI 9.16.3 |
| [104-e][114] NR\_RedCap | NR\_redcap-Core | 9.18.1, 9.18.2 R17 NR RedCap | 9.18.1 9.18.2 | Chunhui Zhang AI 9.18.6 |
| [104-e][115] NR\_Baskets\_Part\_1 | NR basket WIs: selected topics: | 10.1 Issues arising from basket WIs but not subject to block approval | 10.1 | Dominique Brunel AI 10.1.2 |
| [104-e][116] NR\_Baskets\_Part\_2 | MR-DC Basket WIs: DC\_R18\_1BLTE\_1BNR\_2DL2UL DC\_R18\_2BLTE\_1BNR\_3DL2UL DC\_R18\_xBLTE\_1BNR\_yDL2UL DC\_R18\_xBLTE\_2BNR\_yDL2UL DC\_R18\_xBLTE\_yBNR\_zDL2UL DC\_R18\_xBLTE\_yBNR\_zDL3UL | R18 MR-DC basket WIs 10.3~10.8 | AIs for basket WIs 10.3 10.4 10.5 10.6 10.7 10.8 | Iwo Angelow AI 10.2 |
| [104-e][117] NR\_Baskets\_Part\_3 | NR CA/DC Basket WIs: NR\_CA\_R18\_intra NR\_SUL\_combos\_R18-Core | R18 NR-CA/DC basket Wis 10.9, 10.13 | AIs for basket WIs 10.9 10.13 | Per Lindell AI 10.2 |
| [104-e][118] NR\_Baskets\_Part\_4 | NR CA/DC Basket WIs: NR\_CADC\_R18\_2BDL\_xBUL NR\_CADC\_R18\_3BDL\_xBUL NR\_CADC\_R18\_yBDL\_xBUL | R18 NR-CA/DC basket Wis 10.10, 10.11, 10.12 | AIs for basket WIs 10.10 10.11 10.12 | Johannes Hejselbaek  AI 10.2 |
| [104-e][119] LTE\_Baskets | LTE Basket WIs:  LTE\_CA\_R17\_2BDL\_1BUL | 12.1 LTE\_CA\_R18\_xBDL\_yBUL | Rel-17 basket WIs: 12.1 | Mohammad Abdi Abyaneh AI 12.1.4 |
| [104-e][120] NR\_LTE\_V2X\_PC5\_combos | NR\_LTE\_V2X\_PC5\_combos\_R18 | 10.14 Band combinations for Uu and V2X con-current operation | 10.14 | Qiuge Guo AI 10.14.3 |
| [104-e][121] LTE\_NR\_HPUE\_FWVM | LTE\_NR\_HPUE\_FWVM\_REL18 | 10.15 HPUE fixed-wireless/vehicle-mounted use cases | 10.15 | Man Hung Ng  AI 10.15.4 |
| [104-e][122] Railway\_HPUE\_n100-n101 | RAIL\_HPUE\_n100\_n101 | 10.16 CAB-radio - High Power UE support for band n100 and n101 for Rail Mobile Radio (RMR) in Europe | 10.16 | Ingo Wendler AI 10.16.3 |
| [104-e][123] LTE\_NR\_Other\_WI | DL\_intrpt\_combos\_TxSW\_R18 NR\_bands\_UL\_MIMO NB\_IOTenh4\_LTE\_eMTC6 | 10.17 Rel-18 downlink interruption for NR and EN-DC band combinations at dynamic Tx switching 10.18 Additional NR bands for UL-MIMO in Rel-18 9.24.1 UE RF R17 Additional enhancements for NB-IoT and LTE-MTC | 10.17 10.18 9.24.1 | Jin Wang AI 10.17.3 |
| [104-e][124] NR\_600MHz\_APT | NR\_600MHz\_APT | 10.19 APT 600 MHz NR band | 10.19 | Christian Bergljung AI 10.19.6 |
| [104-e][125] NR\_unlic\_enh | NR\_unlic\_enh | 10.20 Introduction of evolved shared spectrum bands | 10.20. | Daniel Poop AI 10.20.5 |
| [104-e][126] LTE\_intraBandCA\_n8 | LTE\_intra\_band\_CA\_n8 | 12.2 LTE intra-band contiguous CA for band 8 | 12.2 | Chunxia Guo AI 12.2.3 |
| [104-e][127] R18\_LTE\_TDD\_1.6GHz | LTE\_TDD\_1670\_1675MHz | 12.3 Introduction of LTE TDD band in 1670-1675 MHz | 12.3 | Ojas Choksi AI 12.3.4 |
| [104-e][128] LTE\_terr\_bcast\_bands\_UERF | LTE\_terr\_bcast\_bands\_part2 | 12.4 New bands and BW allocation for 5G terrestrial broadcast - part 2 | 12.4 12.4.1 12.4.2 12.4.3 | Gene Fong AI 12.4.5 |
| [104-e][129] FS\_NR\_eff\_BW\_util | FS\_NR\_eff\_BW\_util | 11.1 R18 SI irregular CBW | 11.1 | Esther Sienkiewicz AI 11.1.3 |
| [104-e][130] FS\_NR\_700800900 | FS\_NR\_700800900\_combo\_enh | 11.2 Study on enhancement for 700/800/900MHz band combinations for NR | 11.2 | Huiping Shan AI 11.2.4 |
| [104-e][131] FS\_SimBC | FS\_SimBC | 11.3 Study on simplification of band combination specification for NR and LTE | 11.3 | Zhifeng Ma AI 11.3.4 |
| [104-e][132] FR1\_enh2 | NR\_ENDC\_ RF\_FR1\_enh2 | 11.6 Further RF requirements enhancement for NR and EN-DC in FR1 | 11.6 | Ye Liu AI 11.6.5 |
| [104-e][133] FR2\_enh\_req\_Ph3 | NR\_RF\_FR2\_req\_Ph3 | 11.7 NR RF requirements enhancement for FR2, Phase 3 | 11.7 | Petri Vasenkari AI 11.7.4 |
| [104-e][134] FR2\_multiRx\_UERF | NR\_FR2\_multiRX\_DL | 11.8.1, 11.8.2 Requirement for NR FR2 multi-Rx chain DL reception | 11.8.1, 11.8.2 | Sumant Iyer AI 11.8.4 |
| [104-e][135] NonCol\_intraB | NonCol\_intraB\_ENDC\_NR\_CA | 11.11 Support of intra-band non-collocated EN-DC/NR-CA deployment | 11.11 | Suzuki Yasuki AI 11.11.3 |
| [104-e][136] NR\_ATG\_UERF | NR\_ATG | 11.12.1, 11.12.2, 11.12.3 (UE part ony) Air-to-ground network for NR | 11.12.1, 11.12.2, 11.12.3 | Zhe Shao AI 11.12.5 |
| [104-e][137] FS\_NR\_pos\_UERF | FS\_NR\_pos\_enh2 | 11.14 Study on expanded and improved NR positioning | 11.14 | Aida L Vera Lopez AI 11.14.4 |
| [104-e][138] NR\_MC\_enh | NR\_MC\_enh | 11.15 Multi-carrier enhancements for NR | 11.15 | Shan Yang AI 11.15.3 |
| [104-e][139] LTE\_NBeMTC\_NTN\_UERF | LTE\_NBIOT\_eMTC\_NTN\_req | 12.5.1 General 12.5.4 UE RF requirements | 12.5.1 12.5.4 | Tim Frost AI 12.5.6 |
| [104-e][140] NR\_reply\_LS\_UE\_RF |  | 13.1.2 UE power limitation for STxMP in FR2 (R1-2205639) 13.1.3 UE antenna gain for NR NTN coverage enhancement (R1-2205623) 13.3.1 FR2 requirement applicability over ETC 13.3.2 Lower humidity limit in normal temperature test environment (R5-221604) 13.3.3 Power control for NR-DC (R1-2205448) | 13 | Steven Chen AI 13.4 |
| [104-e][141] R17\_feature\_list | All Rel-17 WIs | 7 Rel-17 feature list | 7 | Xiaoran Zhang AI 7.2 |
| [104-e][142] R18\_HUPE\_basket\_WI | R18 HPUE basket | 14.1 Discussions on R18 high power UE basket work items | 14.1 | Xizeng Dai AI 14.1 |

## 4 Up to Rel-16 maintenance for LTE and NR

### 4.8 Moderator summary and conclusions

**[104-e][101] R15\_R16\_Maintenance, AI 4.1 – Jingqiang Xing**

**R4-2214079 Email Discussion Summary for [104-e][101] R15\_R16\_Maintenance**

*Type: other For: Information  
 Source: Moderator (OPPO)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214219 (from R4-2214079).**

**R4-2214219 Email Discussion Summary for [104-e][101] R15\_R16\_Maintenance**

*Type: other For: Information  
 Source: Moderator (OPPO)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at <https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Tdoclist>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214408 | WF on 30MHz reconfiguration failure when accessing 40MHz network of n28 | CMCC |  |
| R4-2214409 | WF on clarification of the NS mapping from RAN2 to RAN4 | Qualcomm |  |
| R4-2214410 | WF on EIRP-based test metric for FR2 SEM | Apple |  |
| R4-2214411 | LS on intrabandENDC-Support | Huawei | To: RAN2 |
| R4-2215110 | Draft CR to 38101-1-fi0 for n41 relevant MSD test frequencies | MediaTek Inc. |  |
| R4-2215111 | Draft CR to 38101-1-gc1 for n41 relevant MSD test frequencies | MediaTek Inc. |  |
| R4-2215112 | Draft CR to 38101-3-fi0 for n41 relevant MSD test frequencies | MediaTek Inc. |  |
| R4-2215113 | Draft CR to 38101-3-fi0 for n41 relevant MSD test frequencies | MediaTek Inc. |  |
| R4-2215114 | Draft CR to 38101-3-h60 for n41 relevant MSD test frequencies | MediaTek Inc. |  |

**Existing tdocs**

**38.101-1**

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| --- | --- | --- | --- | --- | --- |
| **T-doc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2211552 |  | AdditionalSpectrumEmission in NR CA for n77 in the USA | Nokia | Return to |  |
| R4-2212769  R4-2212770 (CAT-A) |  | Amendments to requirements for n77 operations in the US | Ericsson | Return to |  |
| R4-2211575  R4-2211576 (CAT-A)  R4-2211577  (CAT-A) | R4-2214881 | Update of UL MIMO transmit quality definitions | Rohde & Schwarz | Revise |  |
| R4-2212022  R4-2212023 (CAT-A)  R4-2212024 (CAT-A) |  | Cat F Rel-15 Draft CR to 38.101-1 update of simultaneous RxTx capability for band combinations | Samsung | Return to |  |
| R4-2212222  R4-2212249 (CAT-A) | R4-2214946 | Draft CR to 38101-1-gc1 for n41 relevant MSD test frequencies | MediaTek | R4-2212222 not pursued, 4946 withdrawn |  |
| R4-2212361 |  | Draft CR for TS 38.101-1 Rel-15: Corrections on band combinations for UE co-existence | Apple | Endorsed | Status changed on Aug-22 |
| R4-2212362 |  | Draft CR for TS 38.101-1 Rel-16: Corrections on band combinations for UE co-existence | Apple | Endorsed | Status changed on Aug-22 |
| R4-2212363 | R4-2214583 | CR for TS 38.101-1 Rel-17: Corrections on band combinations for UE co-existence | Apple | Revise | Moderator note: This is a formal CR |
| R4-2212536  R4-2212537 (CAT-A) | R4-2214966 | Correction to EVM measurement point for DFTs-OFDM DM-RS Type 2 | Anritsu | Revise |  |
| R4-2212709 | R4-2214973 | draft CR to TS38.101-1: 4Rx for inter-band NR CA | ZTE | Revise |  |
| R4-2212710 | R4-2214974 | draft CR to TS38.101-1: 4Rx for inter-band NR CA | ZTE | Revise |  |
| R4-2212711 | R4-2214975 | draft CR to TS38.101-1: 4Rx for inter-band NR CA | ZTE | Revise |  |
| R4-2212733  R4-2212734 (CAT-A) |  | Draft CR to TS38.101-1: Correction on terms for NR DC Pcmax | ZTE | Return to |  |
| R4-2213134  R4-2213135 (CAT-A)  R4-2213136  (CAT-A) | R4-2215024  R4-2215025  R4-2215026 | Draft CR for 38.101-1 to improve the wording for simultaneousRxTx clarification(R15) |  | Revise | 3134 -> 5024  3135 -> 5025  3136 -> 5026 |
| R4-2213319 |  | R16 Draft CR on power class of each band in inter-band UL CA | OPPO | Return to |  |
| R4-2213732  R4-2213733 (CAT-A) |  | draft CR for TS 38.101-1: correction on intra-band UL CA contiguous CA requirement (Rel-16) | Huawei | Return to |  |
| R4-2213993  R4-2213994 (CAT-A)  R4-2213995 (CAT-A) | R4-2215101 | Correction to NS\_05 frequency range | Qualcomm | Revise |  |

**38.101-2**

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| **T-doc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2211922  R4-2211923  (CAT-A)  R4-2211924 (CAT-A) | R4-2211924 revised to  R4-2214569 | Modification on maiximum ouput power related terminology | Apple | R4-2211922 is agreeable  R4-2211924 is revised | Moderator notes:  Rel-15 formal CR;  R4-2211924 is Rel-16 CAT-A CR but already uploaded before meeting. |
| R4-2211919  R4-2211919r1  R4-2211920 (CAT-A) | R4-2214195 | On Beam correspondence requirement in R15 | Apple | Revise | Moderator notes: Revision is made before the meeting starts. |
| R4-2211921  R4-2211921r1 | R4-2214196 | On Beam correspondence requirement in R17 | Apple | Revise | Moderator notes: Revision is made before the meeting starts. |
| R4-2212730 |  | draft CR to TS38.101-2[R15] Introduce symbols of delta RIBC and delta RIBNC for intra-band CA | ZTE | Return to |  |
| R4-2213324 |  | R16 Draft CR on clarification of FR2 CA DC location reporting | OPPO | Return to |  |
| R4-2213734  R4-2213735 (CAT-A)  R4-2213736 (CAT-A) |  | draft CR for 38.101-2 revison on MIMO receiver characteristics (Rel-15) | Huawei | Return to |  |

**38.101-3**

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| **T-doc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2211579  R4-2211580 (CAT-A)  R4-2211581 (CAT-A) | R4-2214882 | Addition of missing Additional Spurious Emissions Clause | Rohde & Schwarz | Revise |  |
| R4-2212012  R4-2212013 (CAT-A) | R4-2214923 | Cat F Rel-16 Draft CR to 38.101-3 to correct the requirement of Type2 non-collocated ENDC deployement | Samsung | Revise |  |
| R4-2212026  R4-2212027 (CAT-A)  R4-2212028 (CAT-A) |  | Cat F Rel-15 Draft CR to 38.101-3 update of simultaneous RxTx capability for band combinations | Samsung | Return to |  |
| R4-2212582  R4-2212583 (CAT-A) | R4-2214967 | Draft CR for 38.101-3 Rel-16 to correct band combination for intra-band ENDC | Xiaomi | Revise |  |
| R4-2212728  R4-2212729 (CAT-A) | R4-2214977 | draft CR to TS38.101-3[R16] Clarification on REFSEN for inter-band CA | ZTE | Revise |  |
| R4-2213137 R4-2213138 (CAT-A)  R4-2213139 (CAT-A) | R4-2215027 | Draft CR for 38.101-3 to improve the wording for simultaneousRxTx clarification(R15) | Huawei | Revise |  |
| R4-2213140  R4-2213141 (CAT-A) | R4-2215028 | Draft CR for 38.101-3 To remove the frequency restriction for DC\_28\_n5 (R16) | Huawei | Revise |  |

## 5 Rel-17 maintenance for LTE and NR

### 5.3 Moderator summary and conclusions

**[104-e][102] R17\_Maintenance\_part1, AI 5.1.1~5.1.8 – Dominique Evereare**

**R4-2214080 Email Discussion Summary for** **[104-e][102] R17\_Maintenance\_part1**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214220 (from R4-2214080).**

**R4-2214220 Email Discussion Summary for [104-e][102] R17\_Maintenance\_part1**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| **AI 5.1.1** | | | | | |
| R4-2212191 |  | CR on NR-U A-MPR for PC5 VLP | LG Electronics | To return to |  |
| R4-2213992 |  | CR to R17 TS38.101-1 on corrections to NRU 100MHz MPR | Skyworks Solutions Inc. | To return to |  |
| **AI 5.1.2** | | | | | |
| R4-2213365 |  | Clarification of duty cycle not applying to FDD bands | Huawei, HiSilicon | To return to |  |
| R4-2213997 |  | A-MPR for PC2 Tx Diversity UE | Qualcomm Incorporated | To return to |  |
| **AI 5.1.3** | | | | | |
| R4-2214012 | R4-2214652 | CR for 38.101-1: Addition of 5 MHz channel BW for n41 | T-Mobile USA | To be revised |  |
| R4-2214051 | R4-2214654 | CR for 38.104: Add 5 MHz channel BW for n41 | T-Mobile USA | To be revised |  |
| **AI 5.1.4** | | | | | |
| R4-2213152 |  | CR for 38.101-1 to introduce the missing MSD due to cross band isolation | Huawei, HiSilicon | To return to |  |
| R4-2213153 | R4-2214616 | CR for 38.101-1 to clarify the ambiguity of BCS4 and BCS5 | Huawei, HiSilicon | To be revised |  |
| R4-2213154 | R4-2214617 | CR for 38.101-3 to clarify the ambiguity of BCS4 and BCS5 | Huawei, HiSilicon | To be revised |  |
| **AI 5.1.5** | | | | | |
| R4-2213318 | R4-2215043 | R17 Draft CR on per band per BC power class changes | OPPO | To be revised |  |
| **AI 5.1.6** | | | | | |
| R4-2211792 | R4-2214199 | Draft CR for updating the note of mandatory simultaneous Rx/Tx capability for FR1 NR-CA combinations | KDDI Corporation, Samsung, Nokia, Nokia Shanghai Bell | To be revised |  |
| R4-2211794 | R4-2214201 | Draft CR for updating the note of mandatory simultaneous Rx/Tx capability for FR1 and FR2 EN-DC combinations | KDDI Corporation, Samsung, Nokia, Nokia Shanghai Bell | To be revised |  |
| R4-2212025 |  | Cat F Rel-17 Draft CR to 38.101-1 update of simultaneous RxTx capability for DC | Samsung, KDDI, Huawei, Hisilicon, CHTTL | To return to |  |
| R4-2212029 |  | Cat F Rel-17 Draft CR to 38.101-3 to remove the duplicated content of Simultaneous RxTx | Samsung | To return to |  |
| **AI 5.1.8** | | | | | |
| R4-2212250 | R4-2214578 | CR to 38101-1-h60 for n41 relevant MSD test frequencies | MediaTek Inc. | To be revised |  |
| R4-2212345 | R4-2214581 | CR 38.101-1: Rel-17 Adding missing fallback combinations and bug fixes | Apple | To be revised |  |
| R4-2212347 | R4-2214582 | CR 38.101-3: Rel-17 Adding missing fallback combinations and bug fixes | Apple | To be revised |  |
| R4-2212700 | R4-2214596 | CR to 38.101-1 Maintenance for HPUE CA with 2 bands downlink and x bands uplink (x =1,2) | China Telecom | To be revised |  |
| R4-2213114 | R4-2214613 | CR 38.101-1 for editorial corrections to band combination tables | Ericsson | To be revised |  |
| R4-2213131 | R4-2214614 | CR for 38.101-3 to remove the band combinations in which band n7/7 and n38/38 are not Scell (R17) | Huawei, HiSilicon | To be revised |  |
| R4-2213223 |  | CR to 38.101-1 Correction of CA\_n40-n41 synchronous RX\_TX | Nokia | To return to |  |
| R4-2213229 | R4-2214618 | Corrections to CA\_n18A-n28A and CA\_n28A-n78A | Nokia | To be revised |  |
| R4-2213756 | R4-2214643 | CR correction to n100 and n101 UE to UE coexsistence tables | Nokia | To be revised |  |
| R4-2213999 |  | Per-cell P-MPR for intra-band UL CA | Qualcomm Incorporated | To return to |  |
| R4-2214009 | R4-2214650 | CR for 38.101-1: Missing combinations for NR-CA | T-Mobile USA | To be revised |  |
| R4-2214010 | R4-2214651 | CR for 38.101-3: Corrections | T-Mobile USA | To be revised |  |

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**[104-e][103] R17\_Maintenance\_part2, AI 5.2.1, 5.2.4.2, 5.2.4.5 – Henry(Peng) Zhang**

**R4-2214081 Email Discussion Summary for [104-e][103] R17\_Maintenance\_part2**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214221 (from R4-2214081).**

**R4-2214221 Email Discussion Summary for [104-e][103] R17\_Maintenance\_part2**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214413 | WF on PC2 MPR and PC1.5 fallback MPR | T-Mobile USA | To cover sub-topic 1-1 based on the 1st round discussion. |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2211578 |  | Update of TxD inband emissions | Rohde & Schwarz | Return to |  |
| R4-2212773 |  | Definition of PC1.5 and applicability of extensions of power-class parameters (RRC) | Ericsson | Return to |  |
| R4-2213382 | R4-2214624 | CR on TS 38.101-1 for transmitter power for Tx Diversity | ZTE Wistron Telecom AB | To be Revised |  |
| R4-2214008 | R4-2214649 | CR for 38.101-1: Corrections for PC2 MPR and PC1.5 fallback to PC2 MPR | T-Mobile USA | To be Revised |  |
| R4-2211554 |  | AdditionalSpectrumEmission in NR CA for n77 in Canada | Nokia, Nokia Shanghai Bell | Return to |  |
| R4-2212565 |  | Draft CR to TS38.101-1[R17] Corrections on Output power dynamics | ZTE Corporation | Return to. |  |
| R4-2212566 |  | CR to TS38.101-1[R17] Inter-band NR CADC Tx requirements including combinations of NR-U bands intra-band and inter-band CA UL configuration | ZTE Corporation | Return to. |  |
| R4-2212605 | R4-2214592 | CR to 38.101-1: Corrections on Pcmax for intra-band contiguous CA with UL MIMO | Xiaomi | To be revised |  |
| R4-2213323 |  | R17 Draft CR on modifiedMPRbehavior for FR2 | OPPO | Return to. |  |
| R4-2213329 |  | R17 FR1 Draft CR on clarification of DC location with 3300 and 3301 in TSQ requirement | OPPO | Return to. |  |
| R4-2213330 |  | R17 FR2 Draft CR on clarification of DC location with 3300 and 3301 in TSQ requirement | OPPO | Return to. |  |
| R4-2213598 | R4-2215121 | CR for TS 38.101-3 on corrections to MOP band edge relaxation for intra-band contiguous and non-contiguous EN-DC band combinations | ZTE Corporation | Revised |  |
| R4-2212774 |  | Amendments to requirements for n77 operations in Canada | Ericsson | Return to |  |

## 6 LS response to ITU

## 7 Rel-17 feature list

### 7.2 Moderator summary and conclusions

**[104-e][141] R17\_feature\_list, AI 7 – Xiaoran Zhang**

**R4-2214119 Email Discussion Summary for [104-e][141] R17\_feature\_list**

*Type: other For: Information  
 Source: Moderator (CMCC)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214252 (from R4-2214119).**

**R4-2214252 Email Discussion Summary for [104-e][141] R17\_feature\_list**

*Type: other For: Information  
 Source: Moderator (CMCC)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214216 | Rel-17 RAN4 UE feature list for NR | CMCC | Approved |
| R4-2214217 | LS on Rel-17 RAN4 UE feature list for NR | CMCC | Approved |

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
|  | Rel-17 RAN4 UE feature list for NR | CMCC |  |
|  | LS on Rel-17 RAN4 UE feature list for NR | CMCC |  |

**GTW on Aug-19**

**UE feature list was discussed during GTW.**

**The outcome is as follows:**

* For NR\_ext\_to\_71Ghz WI, remove the feature group of 15-x [Improved ON-ON transient period]
* For NR\_RF\_FR1\_enh WI, add the note of [it is applicable to uplink inter-band CA] for the feature group of 16-8 UE power class per band per band combination.
* For NR\_RF\_FR2\_req\_enh2 WI,
  + Remove the feature group of 17-3 “Support of UL gap for coherent UL MIMO”.
  + Add R2~R12 and [] on R, S, T, U and remove [] on 17-6.
  + Remove the feature group [17-7].
* For NR\_PC2\_UE\_FDD WI, remove the feature groups of [21-1] and [21-2].
* For NR\_NTN\_solutions WI, add the feature group of 25-7.

## 8 Rel-17 spectrum related WIs for NR

### 8.1 Introduction of 6GHz NR licensed bands

#### 8.1.3 Moderator summary and conclusions

**[104-e][104] NR\_6 GHz\_licensed, AI 8.1 – Liehai Liu**

**R4-2214082 Email Discussion Summary for [104-e][104] NR\_6 GHz\_licensed**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214222 (from R4-2214082).**

**R4-2214222 Email Discussion Summary for [104-e][104] NR\_6 GHz\_licensed**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214414 | WF on measurement uncertainty for 6 to 7.125GHz | Huawei |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| [R4-2211748](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211748.zip) | R4-2214566 | Introducing 6GHz licensed operation into TS 38.141-1 (Rel-17) | CATT | Revised |  |
| [R4-2212654](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212654.zip) | R4-2214593 | CR to TS 38.141-2 - Introduction of licensed 6GHz band n104 | Ericsson | Revised |  |
| [R4-2213705](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213705.zip) |  | Draft CR to TS38.104: further clarity on the applicability of band n104 | ZTE Corporation | Return to |  |
| [R4-2213706](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213706.zip) |  | Draft CR to TS38.101-1: further clarity on the applicability of band n104 | ZTE Corporation | Return to |  |

## 9 Rel-17 non-spectrum related work items for NR and LTE

### 9.3 RF requirements enhancement for NR frequency range 1 (FR1)

#### 9.3.3 Moderator summary and conclusions

**[104-e][105] NR\_RF\_FR1\_enh\_maintenance, AI 9.3.1 – Leo(Ye) Liu**

**R4-2214083 Email Discussion Summary for [104-e][105] NR\_RF\_FR1\_enh\_maintenance**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214223 (from R4-2214083).**

**R4-2214223 Email Discussion Summary for [104-e][105] NR\_RF\_FR1\_enh\_maintenance**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214415 | Reply LS to RAN2 on clarification of dualPA-Architecture capability | Samsung |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| [R4-2212016](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212016.zip) | R4-2214924 | Reply LS to RAN2 on clarification of dualPA-Architecture capability | Samsung | Revised |  |
| R4-2213364 | R4-2215116 | Correction to RF requirements of NR\_RF\_FR1\_enh | Huawei, HiSilicon | Revised |  |

### 9.4 NR RF requirement enhancements for frequency range 2 (FR2)

#### 9.4.7 Moderator summary and conclusions

**[104-e][106] NR\_RF\_FR2\_enh2\_Part\_1, AI 9.4.1 – Petri Vasenkari**

**R4-2214084 Email Discussion Summary for** **[104-e][106] NR\_RF\_FR2\_enh2\_Part\_1**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214224 (from R4-2214084).**

**R4-2214224 Email Discussion Summary for [104-e][106] NR\_RF\_FR2\_enh2\_Part\_1**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214416 | WF on in-gap exemption for inter-band DL CA | vivo |  |
| R4-2214417 | WF on FR2 ULCA for PC3 | NTT Docomo |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2213334 | R4-2215120 | R17 FR2 Draft CR on separate REFSENS tables for different power classes | OPPO | Return to | Revised on 24 August |
| R4-2211777 |  | CR to TS38.101-2 PC3 TIB for inter-band UL CA | NTT DOCOMO, INC. | Return to |  |
| R4-2213755 |  | CR to 38.101-2: Correction to modified MPR information | Nokia, Qualcomm Inc, Skyworks Inc | Return to |  |

**GTW on Aug-16**

**Sub-topic 2-1 PC3 requirement for FR2 inter-band UL CA**

**Issue 2-1-1: FR2 UL CA for PC3**

* Discussion
  + PC3 was lower prioritized due to possible power and thermal issues. Should PC3 be supported in Rel-17?

**Discussion:**

Oppo: Rel-17 WI was closed. How can we handle PC3 for FR2 in case that we have paper submitted?

NTT DOCOMO: PC3 is not excluded from Rel-17 WI. PC3 device is the high priority. We would like to discuss it in Rel-17 maitnenance.

Vivo: It is hard to reach consensus on any relaxation value before knowing the complexity.

Apple: it might be good to consider it in Rel-18.

Qualcomm: considering the work that has been done in Rel-17, the proponent chose the relaxed requirements, i.e., conservative values for requirements.

Huawei: we have similar views as Vivo and OPPO. If it was agreed as TEI, it can be further discussed. We need better understand what the requirements should be defined.

Samsung: why PC3 is de-prioritized is the controversial view on the total power concept. If companies can accept the total power concept, we are OK.

Sony: we have similar understanding as Samsung.

LGE: have similar view as Samsung. PC3 requires many meeting cycles. We prefer not to include PC3 in Rel-17. We need focus on Rel-18 from now.

Ericsson: we would like to recall 3dB relaxation. We should be carefully to specify very large relaxation considering the coverage is very constrain.

Qualcomm: not set the requirements but remove some section not to preclude power class 3.

Apple: how do we make sure the hand set UE do not support it?

Qualcomm: intra-band contiguous CA can be supported. If UE does not support it, UE can report capability.

Sony: Qualcomm proposal is a good compromise.

OPPO: what is the meaning to introduce the feature without requirements?

Qualcomm: that is a fair question. There is no requirement for such feature.

Huawei: we have concern on the proposal to have no requirements for a feature.

Samsung: share the similar view.

**Chair =>** further discuss if PC3 can be introduced in Rel-17 together with issue 2-1-2 ~ 2-1-5.

**Issue 2-1-2: ΔTIB relaxation factor (Observation 1)**

* Discussion
  + Is the relaxation breakdown proposed in observation 1 agreeable? Are all necessary factors included? Is there any alternative split of relaxation factors?

**Issue 2-1-3: Factor for thermal issue (Observation 4)**

* Discussion
  + Is the relaxation for thermal issue 3.5 dB agreeable?

**Issue 2-1-4: Total relaxation (Proposal 1)**

* Discussion
  + Is the total relaxation values (5.0/6.0dB for peak/spherical) in Proposal 1 agreeable?

**Issue 2-1-5: Intra-band contiguous case (Proposal 2)**

* Discussion
  + Is proposal 2 option1 ~~option 2~~ agreeable for intraband CA to avoid double-counting of relaxation? Is there any alternative?

**Sub-topic 2-2 Reply LS to RAN5 LS on ModifiedMPR-Behaviour clarification for different power classes**

**Issue 2-2: LS reply text**

* Discussion
  + Is each proposed answer agreeable?
* If not please provide your comment.

**Chair =>** Discuss the Nokia contribution in email thread [140].

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**[104-e][107] NR\_RF\_FR2\_enh2\_Part\_2, AI 9.4.2, 9.4.5, 9.4.6.2 – Yang Tang**

**R4-2214085 Email Discussion Summary for [104-e][107] NR\_RF\_FR2\_enh2\_Part\_2**

*Type: other For: Information  
 Source: Moderator (Apple)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214225 (from R4-2214085).**

**R4-2214225 Email Discussion Summary for [104-e][107] NR\_RF\_FR2\_enh2\_Part\_2**

*Type: other For: Information  
 Source: Moderator (Apple)*

**Abstract:**

* + This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| [R4-2212775](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212775.zip) | R4-2215122 | Amendment of the requirement on TX power management | Ericsson, Sony | Revised |  |
| [R4-2211886](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211886.zip) | R4-2214911 | DraftCR on UL gaps for BPS | Apple | Revised |  |

**GTW on Aug-16**

**Sub-topic 1-1: on step 3 test procedure**

Related agreement in RAN#103e

* *Agreement: Step 3 discussion is decoupled with UL gap.*
* *Agreement: When UL gap is not configured/activated and PHR is configured during the test, P bit in PHR shall be 1 during the UL gap test.*

**Open issues and candidate options before e-meeting:**

* **R4-2213641(Sony, Ericsson)**
  + Proposal 1: step 3 of the proposed test procedure (of the WF in R4-2206604) shall be specified; the Ppeak\_EIRP shall be attained a duty cycle lower than [10]% or for a duty cycle lower than the capability maxUplinkDutyCycle-FR2. No P-MPR shall be applied for this case.
  + Proposal 2: It is proposed to revise the text in 38.101-2 as below:
  + For UE support UL gap, when UL gap for Tx power management is not configured and activated or the configured uplink duty cycle is lower than the maxUplinkDutyCycle-FR2 (or UL duty cycle = [10] % if UE does not report the maxUplinkDutyCycle-FR2), UE shall set the P bit in PHR to 1 in the test when PHR is configured.
* **Proposal:**
  + Option 1: revisit step 3 agreement in RAN4#103 to specify step 3 in UL gap related tests
    - If Yes to option 1, please provide your comments on R4-2213641
  + Option 2: keep the agreement in RAN4#103 unchanged
    - Option 2.1: discuss step 3 in this email thread independently from UL gap
      * If Yes to option 2.1, please provide your comments on R4-2211884
    - Option 2.2: stop step 3 related discussion in this email thread and seek for the guidance from chairman on how to proceed

**Discussions:**

OPPO: we did not expect the discussion in this meeting. In last meeting, step 3 is de-coupled from UL gap. Step 3 is out of scope of this WI. We should not proceed this discussion.

Vivo: we prefer Option 2.2. It is not reasonable to discuss this under FR2 WI.

Sony: For step3, it was decoupled but there was no agreement to stop discussion in this agenda. There is a lack of clarification of UE behavior here. We think it is meaningful test to be verified.

Ericsson: We agree with Sony. This is part of uplink power management. From network, it would be most useful to ensure UE behavior. It is useful for MPE is averaged. It is the general behavior to be tested. This is related to gap behavior. You can reuse the data for measurement. It is most useful addition to the UL gap.

Samsung: in general option 2.2 is aligned with the previous agreement. It is better to discuss the technique issue. Most companies may think step 3 is necessary. Step 3 is for all the UE or not? From Sony CR, it is for all the UEs. For UE who does not support UL gap, why do we need this? We do not see the necessity to introduce this.

Apple: Technically Ericsson is correct. When the reported duty cycle is lower than threshold, UE needs to report p=0. Why should it be limited to UE who supports the UL gap? All the FR2 UE is supposed to meet that requirement. Proposal 2 is not very consistent with the previous agreement.

Sony: Proposal 2 has nothing to do with step 3.

Apple: the content is covered by step 3. Do we think we have the requirements to require FR2 UE to follow Proposal 2? Do we need to repeat what we have in other session for UE to support UL gap?

Sony: Step 3 should be kind of test for all kinds of UE. We are still open to how to organize the specification.

Chair => Further discuss this issue under TEI agenda in future meeting with the understanding that TEI items should be closed within one quarter.

**Proposal after 1st discussions:**

* For UE support UL gap, when UL gap for Tx power management is not configured and de-activated ~~or~~ and the configured uplink duty cycle is ~~lower~~ higher than the maxUplinkDutyCycle-FR2 ~~(or UL duty cycle = [10] % if UE does not report the maxUplinkDutyCycle-FR2)~~, UE shall set the P bit in PHR to 1 in the test when PHR is configured.

**Discussions:**

Moderator: this is the step 3. We should understand whether we should discuss it under this agenda. Sony proposal requires to revisit the existing requirement. It is not completely to follow the agreement in the last meeting. The group needs to decide where and how to proceed the step 3.

OPPO: for proposal 2, the update is OK.

**Sub-topic 2-1: time period between UL gap and CSI report colliding and MAC CE for SCell activation**

Related agreements in RAN4#103e

* *The valid CSI report and/or valid L1-RSRP report during SCell activation procedure, where the valid CSI report is valid CQI with non-zero CQI index defined in clause 5.2.2.1, TS 38.214 and the valid L1-RSRP report is non lowest L1-RSRP defined in clause 10.1.6.*
  + *The UE need not apply UL gap prioritization rules specified above for SCell activation procedure if the time period between UL gap colliding with CSI report of non-zero CQI or L1-RSRP and the slot where the SCell activation MAC CE or CSI report activation command is received is less than [X ms].*
* **Proposals**
  + Remove the bracket and define X=10ms

**Agreement:**

* Remove the bracket and define X=10ms

**Sub-topic 2-2: Test on prioritized procedure over UL gap**

**Sub-topic description**

Open issues and candidate options before e-meeting:

* **Proposal 1: No need to define test cases for UL signal prioritization of RACH, CG-PUSCH, PUCCH for SR and LRR over UL gap.**
* **Proposal 2: If prioritization rule for valid CQI report during Scell activation procedure is to be tested, use FR2 intra-cell Scell activation test case as baseline, with additional specification of UL gap configuration offset fully overlapping with the periodic CQI report.**

**Discussion:**

Moderator: based on RAN1 design, all those are UE behaviour which is hard to be tested. We do not want to define the requirements. Let us focus on the prioritization rule for the test.

Samsung: For proposal 1 we can support. For proposal 2 we need more clarification. Is there any agreement that the prioritization should be tested? For the priotization rule, in RAN1 spec, there are many prioritization rules which there are no test cases for.

Apple: this is restrict for UE behaviour. We are open to discuss whether we need test such behaviour. We just want to make sure the test case is deterministic. We do not have agreement to test it.

Qualcomm: we can agree on proposal 1 first, because it is up to UE implementation. We provide our comments to Apple paper on how the test should be designed.

**Agreement:**

* No need to define test cases for UL signal prioritization of RACH, CG-PUSCH, PUCCH for SR and LRR over UL gap.
* Further discuss proposal 2.

**Sub-topic 2-3: On other prioritized procedure over UL gap**

**Sub-topic description**

Open issues and candidate options before e-meeting:

* **Proposal 1: Similar situation as RACH procedure, in order to finish some RRM procedures in which CSI report is involved in, CSI report can be prioritized over UL gap.**

**Discussions:**

Moderator: consider this as new proposal in the meeting. It is a bit late. Unless we identify some critical, we do not need to discuss. What procedure are you talking about?

ZTE: need further discussion via email

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**[104-e][108] NR\_RF\_FR2\_enh2\_Part\_3, AI 9.4.3, 9.4.4 – Sanjun Feng**

**R4-2214086 Email Discussion Summary for [104-e][108] NR\_RF\_FR2\_enh2\_Part\_3**

*Type: other For: Information  
 Source: Moderator (Vivo)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214226 (from R4-2214086).**

**R4-2214226 Email Discussion Summary for [104-e][108] NR\_RF\_FR2\_enh2\_Part\_3**

*Type: other For: Information  
 Source: Moderator (Vivo)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214418 | WF on DC location signaling applicability | Qualcomm |  |
| R4-2214419 | LS on intra-band UL CA DC default location clarification | Apple | To: RAN2  Note: it is required to change it to WF. Chair proposed to capture the agreements in chair note. |
| R4-2214420 | LS on new contiguous BW classes for legacy networks | Qualcomm | To: RAN2 |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| [R4-2213332](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213332.zip) | R4-2215044 | R17 Draft CR on introduction of FR1 CA DC location reporting | OPPO | Revised | See if an update is needed. |
| [R4-2213333](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213333.zip) | R4-2215045 | R17 Draft CR on introduction of FR2 CA DC location reporting | OPPO | Revised | See if an update is needed. |
| [R4-2212777](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212777.zip) |  | Removal of the CA bandwidth classes R-U | Ericsson | Returned to | Waiting for the discussion decision. |

**GTW on Aug-16**

**Sub-topic 2-1 non-FBG5 issue**

**Issue 2-1-1: Introduce a new CA BW class V for aggregated BW 1200 MHz < BWChannel\_CA ≤ 1600 MHz with 4CCs in FBG#1. (ZTE R4-2213593)**

|  |  |  |  |
| --- | --- | --- | --- |
| NR CA bandwidth class | Aggregated channel bandwidth | Number of contiguous CC | Fallback group |
| A | BWChannel ≤ 400 MHz | 1 | 1,2,3,4 |
| B | 400 MHz < BWChannel\_CA ≤ 800 MHz | 2 | 1 |
| C | 800 MHz < BWChannel\_CA ≤ 1200 MHz | 3 |  |
| V | 1200 MHz < BWChannel\_CA ≤ 1600 MHz | 4 |  |

* **Proposals**
  + Option 1: Yes
  + Option 2: No.
  + Option 3: Others.
* **Recommended WF**
  + TBA

**Discussion:**

Ericsson: we propose not to introduce it from this point of time.

Verizon: we do not prefer to introduce the new bandwidth class.

Xiaomi: we prefer to introduce the new class, which was agreed in previous RAN4 meeting considering the backward compatibility.

Samsung: we agree with Ericsson and Verizon. We should introduce the new bandwidth class based on real demand.

Apple: In general, we do not object this new class according to demand from operators and vendors. It is better to introduce this in later release.

ZTE: We support to introduce 400MHz. We want to keep all the bandwidth class to have their own roadmap. This is the previous RAN4 agreement, like what Xiaomi commented.

Moderator: to Xiaomi, we check the previous document. We have agreement to introduce such 400MHz as the agreement. But with discussion continuing, companies have different understanding.

Huawei: have similar understanding as Xiaomi and ZTE. Keeping 400MHz is still valid.

Samsung: Could Xiaomi clarify the agreement? I did not see the agreement.

Xiaomi: captured in R4-2107859.

OPPO: in future, we can ask companies to update to clearly capture the agreement.

**Agreement:**

* Further discuss the bandwidth class V in the future release depending on the demand from operators.

**Issue 2-1-2: Remove R S T U for now and can be added back when there are industry needs**

* **Proposals**
  + Option 1: Yes
  + Option 2: No.
  + Option 3: Others.
* **Recommended WF**
  + [Option 1]

**Discussion:**

Xiaomi: we disagree with it. FBG2 we should keep them considering the backward compatibility. FBG5 also covers FBG3. Does it mean FBG3 is obsolete?

Huawei: It is not necessary to remove RSTU from now. The development of RSTU and FBG5 are not contradictive.

Ericsson: we would like to understand why there is backward computability issue for the bandwidth class which is not introduced yet. From deployment, R~U have been covered by R5~R8 and they are redundant. The other capability covers them. The FBG3 may be obsolete but UE still need to report to network that does not understand the new FBG. There is no need to introduce the class which has been covered by RAN2 signaling.

Verizon: we fully agree with Ericsson comment. We do not understand why we should discuss something does not exist.

ZTE: we disagree with removing RSTU. FBG2 is not obsolete. FBG2 has been introduced from Rel-15. If we think FBG5 can include all the requirements, how to handle CC with 400MHz? Should we define the new hybrid groups?

Samsung: we support moderator proposal. The background to introduce RSTU is that at that time we just discuss fallback group 1,2,3 but later we agree on fallback group 5 and then fall back group 2 is obsolete. In the future we are open to introduce this.

Qualcomm: It is good for proponent to come up with the concrete proposal where RSTU is useful. It would not be useful for legacy network. FBG5 can work. FBG5 is constructive and can support the future demand.

Ericsson: Agree with Qualcomm. It is beneficial to get clear clarification on the problem of backward compatibility.

Apple: FBG5 has issue on the signalling compatibility. It may need complicated feature set. RSTU can provide the advantage to indicate UE capability of number of 200MHz carriers.

Verizon: There is no legacy issue for this particular bandwidth class. The discussion here is mainly focusing on what we are going to deploy in the system. In the future, we have no clear view. At the current stage, we do not think these requirements are needed.

Xiaomi: have similar view as Apple. It seems FBG 5 covers FBG2. FBG5 have differences for legacy bandwidth class. RAN2 needs further check if UE report its support R12 with limited 1600MHz, the network cannot configure 8 carriers with 200MHz bandwidth.

Qualcomm: I do not believe FBG5 brings any new fall back rules.

Samsung: to Apple, FBG5, RSTU can be helpful for capability. We wonder if UE reports for FBG5 and FBG2 simulatenously.

Ericsson: FBG5 indeed follows the fall back rule. The introduction of new information is to reduce the signalling of capability.

Apple: I have different understanding. CA bandwidth class definition is mixed with configuration of network. UE does not know what the network configuration is when reporting capability. UE needs to indicate the different bandwidth class with different fall back group.

Moderator: in case that we cannot reach agreement, we can also keep them in the spec.

**Chair =>** Encourage experts to further discuss if there is fall-back issue. If there is no fall back issue, it is suggested to further discuss RSTU in the future release depending on the operator demands.

**Sub-topic 2-2 FBG5 related issue**

**Issue 2-2-1: How to enable the blue-but-not-red region in following figure?**

Chart, line chart

Description automatically generated

* **Proposals**
  + Option 1: Use additional FeatureSets
  + Option 2: Introduce MaxAggregatedBW only.
  + Option 3: Introduce MaxAggregatedBW and signal corresponding FBG2 class to indicate the number of individual CC that can support 200MHz. (Apple R4-2212344, Alt3)
* **Recommended WF**
  + TBA

**Discussion:**

Moderator: Most companies support to introduce the MaxAggregatedBW.

Huawei: We do not need to introduce this IE. For the next issue, whether it is per BC or per FS needs further discussion.

Qualcomm: we have example where the signaling can help. We have side by side comparison. This aggregated BW is the baseband capability. It has to be per FS.

Ericsson: The concern from UE vendors is that they can only support a certain aggregated bandwidth. To avoid the heavy signaling load, we introduce this to allow UE to report the maximum aggregated BW. Whether it is per band or per FS is up to RAN2. It could be beneficial to reduce the signaling by introduce this capability. That should be done for FBG5 at least. In the field, the issues were identified. Last time around, there is no fall-back issue for FBG5 but the signaling load is the concern. We can ask RAN2 what is possible. RAN2 can tell signaling design rather than RAN4.

Xiaomi: according to current fall-back rule, if UE report to support higher class, UE needs to support lower class. UE will report the highest bandwidth class. UE does not need to indicate all the lower order classes.

Verizon: we agree to introduce the new IE to avoid the signaling overload. That is useful.

Huawei: This capability has pre-condition. Baseband capability should be the same. Baseband is limited by this new IE. We only see the applicability for intra-band contiguous CA. We wonder how the new IE is applied for intra-band NC CA. To Ericsson, we can list the problem and options in LS to ask RAN2 opinion. RAN4 cannot conclude on the introduction of IE from now.

Qualcomm: We agree that RAN2 can decide the signaling. We agree with Huawei. This is limited to intra-band contiguous. It is applied to intra-band contiguous CA. To comment that the IE is not useful enough since it does not cover the situation where baseband capability is different, this comment would be true…. To Xiaomi, picture of blue is purely FBG5.

Apple: we support the new IE. Many companies have commented. In order to support 2400MHz deployment, it has used 12 CC. But there will be some limitation, that UE cannot support 12 by 200MHz. This number should be supported by R12, 11 and 10. Without it, UE need to indicate multiple feature sets, which is really complicated and even complicated for FR1+FR2. We see the merit of this IE.

Ericsson: Our position is IE should be applicable to FBG5. It may be difficult to introduce for other group.

Samsung: this issue should not totally reply on RAN2. RAN2 may not have RAN4 knowledge. RAN4 needs to have consensus on introduction of such signaling.

ZTE: The current RAN2 signaling design work when we introduce the new fallback group. We can see the potential reduction of signaling load. We cannot judge how much signaling load can be saved. We can leave the judgement to RAN2. They can decide how much we can save. Introduction of such signaling will break the rule of RAN2.

Qualcomm: We should first align on the view. We can add and delete to the framework in our LS proposal.

**Chair =>** Work on the LS provided by Qualcomm, and further discuss the Issue 2-2-1~2-2-4 together.

**Issue 2-2-2: If introduced, the new IE MaxAggregatedBW is applicable for all FBG or only FBG5?**

* **Proposals**
  + Option 1: FBG5 only.
  + Option 2: All FBG
  + Option 3: Others.
* **Recommended WF**
  + [Option 1]

**Issue 2-2-3: If introduced, the new IE is per-band or** **per-FS?**

* **Proposals**
  + Option 1: per-band (Apple R4-2212344, Alt2)
  + Option 2: per-FS. (Qualcomm R4-2212329)
  + Option 3: Others.
* **Recommended WF**
  + TBA

**Issue 2-2-4: If introduced, whether the new IE and FBG5 can be release independent from R15?**

* **Proposals**
  + Option 1: Yes
  + Option 2: No.
  + Option 3: Others.
* **Recommended WF**
  + TBA

**Sub-topic 1-1** **”Edge” Clarification**

**Issue 1-1-1: Whether and how to clarify which of the following definitions is intended for “edge” frequency of the edge component carriers?**

* **Proposals**
  + Option 1: Edge sub-carrier frequency
  + Option 2: Edge sub-carrier boundary frequency
  + Option 3: Not need to clarify
* **Recommended WF**
  + TBA

**Discussions:**

OPPO: in the previous LS to RAN2 the definition of DC location is clear. Lower edge is the lowest frequency of all the component CC. It should be option 2.

ZTE: I have different proposal. For this issue, the definition of upper and lower edge for mixed SCS. We can reuse the existing spec definition in section 5.3A.2. Regarding the necessity to send LS to RAN2, there seems no need.

Qualcomm: if we use the same on the both edges, it means calculation is based on the center. Does it really matter.

Apple: From our side, either option 1 or option 2 are OK. UE definition needs be aligned with network understanding. UE needs this definition to align the LO. If all the CCs have the same SCS, different definition makes no difference. If the SCS is different, we need clarify. The common understanding is needed. We slightly prefer Option 1.

Nokia: we also think either Option works. If we send LS to RAN2 or not depends on the definition of center is written in RAN2 or RAN4. If it was written in RAN4, we do not need to send LS to RAN2.

OPPO: when the SCS is the same, the option 1 = option 2. When SCS is mixed, option 2 gives the fixed location. We think option 2 is proper way.

Vivo: we support Nokia comment for LS. For options, we prefer option 1.

**Issue 1-1-2: Whether send an LS to RAN2 to clarify the definition of “edge” frequency of the edge component carriers for default UL DC location calculation?**

* **Proposals**
  + Option 1: Yes
  + Option 2: No.
* **Recommended WF**
  + TBA

**Chair =>** follow Nokia comment “If it was written in RAN4, we do not need to send LS to RAN2.”

**Sub-topic 1-2 Applicability**

**Issue 1-2-1: Discuss which feature variants which method for DC location signalling is applicable.**

* Proposals
  + Option 1: Tentative proposal from R4-2214039:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Feature/Reporting method | | R15 | R16 | R17 |
| Single CC |  | Yes | Yes | Yes |
| DL CA, single UL CC | UL DC on UL CC | Yes | Yes | Yes |
| UL DC on DL CC | No | No | Yes |
| Contiguous UL CA up to 2 UL CCs | Single LO on UL CC | Yes, but one DC per UL CC | Yes | Yes |
| Single LO outside UL CC | No | No | Yes |
| Dual LO on UL CC | Yes, one DC per UL CC | Yes | Yes |
| Dual LO on DL CC  (N/A in RAN4 specs) | Yes | No | Yes |
| Contiguous UL CA > 2 UL CCs | Single LO, all cases | Yes, one DC per UL CC | No | Yes |
| Non-contiguous UL CA | Single LO on UL CC | Yes, but one per CC | Yes | Yes |
| Single LO outside UL CC | No | No | Yes |
| Dual LO on UL CC | Yes, one per CC | No | Yes |
| Dual LO, at least one outside UL CC | No | No | Yes |

* + Option 2: Others
* **Recommended WF**
  + TBA

**Discussion:**

Qualcomm: we need update RAN4 spec. We need discuss whether we should apply the Rel-17 approach to all the cases?

**Issue 1-2-2: Whether change RAN4 specifications to allow exceptions for carrier leakage and IQ image only if UE declares support for an appropriate method for signalling the DC location?**

* **Proposals**
  + Option 1: Yes.
  + Option 2: No.
  + Option 3: Others
* **Recommended WF**
  + [Option 1]

**Discussion**:

Apple: before reaching agreement, we would like to clarify this exception is only for carrier without RB allocated or including carrier with RB allocated.

OPPO: for issue 1-2-2, does it mean carrier leakage and LO image allowed for UE when DC location is reported. If yes, we are fine.

Nokia: we have similar comment. There is an exception for mask for FR2 only. There is difference between FR1 and FR2. What exception does Qualcomm mention?

Qualcomm: Our intention is that we have such exception. There is unclear part for this exception. Our proposal is exception is applied where UE reports.

### 9.13 NR Sidelink enhancement

#### 9.13.5 Moderator summary and conclusions

**[104-e][109] NRSL\_enh\_maintenance, AI 9.13.1, 9.13.2 – Su Hwan Lim**

**R4-2214087 Email Discussion Summary for [104-e][109] NRSL\_enh\_maintenance**

*Type: other For: Information  
 Source: Moderator (Facebook)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214227 (from R4-2214087).**

**R4-2214227 Email Discussion Summary for [104-e][109] NRSL\_enh\_maintenance**

*Type: other For: Information  
 Source: Moderator (Facebook)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214412 | CR for TS 38.101-1, Correction of configured transmitted power for V2X | Xiaomi | Rel-16 CR (mirror CR of LGE) |
| R4-2214421 | LS on Pemax,c of S-SSB transmission or PSFCH transmission when multiple resource pool is configured in a carrier | vivo | LS to RAN1/RAN2 |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2211816 | R4-2214567 | SL to Uu same carrier and same bandwidth switching | Qualcomm Incorporated | Revised |  |
| R4-2211817 | R4-2214568 | V2X corrections | Qualcomm Incorporated | Revised |  |
| R4-2212005 | R4-2214575 | CR for TS 38.101-1, Correction of configured transmitted power for V2X | LG Electronics, CATT | Revised | Rel-17 CR |
| R4-2213577 | R4-2214641 | CR TS 38.101-1: Correction on NR V2X requirements in TS 38.101-1 | Facebook Japan K.K. | Revised |  |
| R4-2212114 | R4-2215115 | NR Band n14 PC1 MPR for NR Sidelink Operation | AT&T | Revised | Revised on 24 August |

### 9.14 Extending current NR operation to 71GHz

#### 9.14.9 Moderator summary and conclusions

**[104-e][110] NR\_ext\_to\_71GHz\_Part\_1, AI 9.14.1, 9.14.2, 9.14.3.3 – Aida L Vera Lopez**

**R4-2214088 Email Discussion Summary for [104-e][110] NR\_ext\_to\_71GHz\_Part\_1**

*Type: other For: Information  
 Source: Moderator (Intel)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214228 (from R4-2214088).**

**R4-2214228 Email Discussion Summary for [104-e][110] NR\_ext\_to\_71GHz\_Part\_1**

*Type: other For: Information  
 Source: Moderator (Intel)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214422 | WF on system parameters for FR2-2 | Intel Corporation |  |
| R4-2214430 | Draft CR for TS 38.101-2 on system parameter updates for FR2-2 | Nokia, Nokia Shanghai Bell | CR to capture latest system parameter agreements |
| R4-2214480 | Draft CR for TS 38.104 on system parameter updates for FR2-2 | Nokia, Nokia Shanghai Bell | CR to capture latest system parameter agreements |
| R4-2214431 | Draft CR for TS 38.101-3 to add new NR\_CADC 2BDL\_xBUL combinations containing FR1 + FR2-2 | Charter Comm Inc. | CR to introduce FR1+FR2-2 DC/CA band combination |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2211697 | R4-2214890 | Reply LS for the minimum guard period between two SRS resources for antenna switching | CATT | Revised |  |

**GTW on Aug-18**

**Sub-topic 1-2: LS reply to RAN1**

RAN4 received an LS from RAN1 with the following question (R1-2200796):

**Question to RAN4**: How many symbol(s) is/are needed to accommodate the required minimum guard time for SRS antenna switching for 480 and 960 kHz respectively, in FR2-2?

For reference, the following was specified in Rel-15 (38.214 Section 6.2.1.2) for subcarrier spacing up to 120 kHz:

**Table 6.2.1.2-1: The minimum guard period between two SRS resources of an SRS resource set for antenna switching**

|  |  |  |
| --- | --- | --- |
|  |  | ***Y* [symbol]** |
| 0 | 15 | 1 |
| 1 | 30 | 1 |
| 2 | 60 | 1 |
| 3 | 120 | 2 |

**Issue 1-2: LS reply to RAN1**

* Proposals
  + Option 1: CATT, R4-2211697
    - **Answer from RAN4:** The absolute switching time for FR2-2 is the same as the capability evaluated in R15, i.e., the antenna switching time is 15 µsec. The detail evaluation results for every possible switching scenario are included in the R15 reply LS R4-1710048 [1]. The decision on the symbol(s) needed to accommodate the required minimum guard time for SRS antenna switching for 480 and 960 kHz SCS is up to RAN1 discussion based on the absolute switching time in R4-1710048.
  + Option 2: Huawei, R4-2213370
    - **Answer to RAN1:** The SRS antenna switching time is 15us for both 480 and 960 kHz in FR2-2. The minimum guard time needed to accommodate the required antenna switching time could be calculated as 7.2 symbols for 480kHz SCS and 14.4 symbols for 960kHz SCS, which are rounded up in below table. RAN1 could further discuss and determine on the final values.
* Recommended WF
  + Companies are encouraged to provide comments on the specific wording and content of the LS reply. Draft LS reply R4-2211697 can be taken as baseline and updated based on feedback received.

**Discussions:**

CATT: the situation does not change. We should target approving LS in this meeting.

Ericsson: Did you analyze the consequence of 15us? The implementation perspective, does it requires UE to support other optional features specified in Rel-16 and Rel-17? RAN1 asks for another number which can be used in future. These values requires UE to support some new feature groups to get SRS antenna switching to work.

CATT: In my understanding, for RF discussion, we only discussed the hardware complexity. RAN1 features are not scope of RAN4.

**Sub-topic 2-1: FR2 band for unlicensed operation**

**Issue 2-1: Note on unlicensed operation**

* Proposal (Apple, R4-2211873)
  + RAN4 to agree on either Alt. 1 or Alt. 2 for Table 5.2-1.
    - Alt. 1: NOTE 1: This band is for unlicensed operation
    - Alt. 2: NOTE 1: This band is for unlicensed operation and subject to regional and/or country specific regulations
* Recommended WF
  + Companies are encouraged to provide feedback on the two alternatives listed to capture the unlicensed operation of band n263

**Discussions:**

Intel: NOTE XX: This band is restricted to operation with shared spectrum channel access as defined in TS 37.213 [reference for 37.213].

Nokia: we prefer alt2.

Apple: it is indeed unlicensed band. As Nokia mentioned, there is different understanding. Alt2 is the best one.

Ericsson: same understanding as Intel. We do not discuss the unlicensed operation in 3GPP.

**Sub-topic 2-2: Operating bands and channel arrangement for CA**

**Issue 2-2a: Operating bands for CA**

* Proposal (Nokia, R4-2212845)
  + Add NR CA band CA\_n263 to table 5-2A.1-1 in TS 38.101-2 together with a note clarifying that only contiguous CA is applicable for this band.

|  |  |
| --- | --- |
| **NR CA Band** | **NR Band**  **(Table 5.2-1)** |
| CA\_n257 | n257 |
| CA\_n258 | n258 |
| CA\_n259 | n259 |
| CA\_n260 | n260 |
| CA\_n261 | n261 |
| CA\_n263 (Note) | n263 |
| NOTE: Only contiguous CA is applicable for this operating band. | |

* Recommended WF
  + Companies should share their views on the proposal and note wording. Agreement will be captured in a CR for TS 38.101-2.

**Discussions:**

Nokia: the requirement can be introduced as package.

**Agreement:**

* If all the UE CA requirements are finalized,
  + Add NR CA band CA\_n263 to table 5-2A.1-1 in TS 38.101-2 together with a note clarifying that only contiguous CA is applicable for this band.

|  |  |
| --- | --- |
| **NR CA Band** | **NR Band**  **(Table 5.2-1)** |
| CA\_n257 | n257 |
| CA\_n258 | n258 |
| CA\_n259 | n259 |
| CA\_n260 | n260 |
| CA\_n261 | n261 |
| CA\_n263 (Note) | n263 |
| NOTE: in the current release, only contiguous CA is applicable for this operating band. | |

**Issue 2-2b: NR CA bandwidth class**

* Proposals (Nokia, R4-2212845)
  + Proposal 1: In Rel-17 only support for n\*100 MHz and m\*400 MHz contiguous CA is specified.
  + Proposal 2: No new bandwidth classes are specified for n\*100 MHz
  + Proposal 3: Two new bandwidth classes are specified and placed within fallback group 1 to cover 4\*400 MHz and 5\*400 MHz. These new bandwidth classes are applicable only for FR2-2.

|  |  |  |  |
| --- | --- | --- | --- |
| **NR CA BW class** | **Aggregated channel bandwidth** | **# cont. CC** | **Fallback group** |
| A | BWChannel ≤ 400 MHz | 1 | 1,2,3,4,5 |
| B | 400 MHz < BWChannel\_CA ≤ 800 MHz | 2 | 1 |
| C | 800 MHz < BWChannel\_CA ≤ 1200 MHz | 3 |
| V (Note 4) | 1200 MHz < BWChannel\_CA ≤ 1600 MHz | 4 |
| W (Note 4) | 1600 MHz < BWChannel\_CA ≤ 2000 MHz | 5 |
| NOTE 3: In this release of the specification, the minimum requirements for intra-band contiguous CA configurations apply for aggregated channel bandwidths up to 1600 MHz for FR2-1 (this note is not relevant for UE capability parsing by the network).  NOTE 4: In this release of the specification, this bandwidth class is applicable only for operating bands within FR2-2. | | | |

* Recommended WF
  + Companies should share their views on the three proposals listed, including how the proposed CA bandwidth classes are captured in the above table.

**Discussions:**

Huawei: further check #1. No big deal. We can proceed with #2. For #3, the note can be modified. It creates impress that we are willing to modify them in future.

Nokia: The new BW class is applied to FR2-2.

Apple: even though it looks quite straightforward, the discussion in FR2-1 is quite involved about the fall back and how to signal. We proposed to consider it addition to FR2-1. For urgency, there is still some time for RAN4 to consider. There is no rush.

Nokia: it is fine to limit. To Apple, how to proceed?

Apple: currently FR2-1 discussion take place in email [108]. Let us wait for the discussion there as maintenance. We are open to any other suggestion. Our main concern is that not to treat as trivial.

Nokia: we can treat them as maintenance.

**Agreement:**

* No new bandwidth classes are specified for n\*100 MHz
* The discussion on the new channel bandwidth classes for FR2-2 is allowed in the maintenance of this WI.

**Issue 2-2c: Channel spacing for CA**

* Proposals
  + Proposal 1: For NR operating bands in FR2-2, nominal channel spacing is when the center frequencies of two closest channels are multiple of 100.8MHz or multiple of 100.8MHz plus 50.4MHz and the two channels do not overlap. Note CA of 2000MHz CBW with another CBW is not considered. (Apple, R4-2211873)
  + Proposal 2: Specify channel spacing for adjacent NR carriers and channel spacing for CA using the following rules: (Nokia, R4-2212845)
    - Channel centers are integer multiple of 100.8 MHz apart and
    - Channels are centered at closest available RF raster point with no overlap between carriers
  + Proposal 3: Align channel spacing for CA for FR2-2 between TS 38.104 and TS 38.101-2. (Nokia, R4-2212845)
* Recommended WF
  + Companies are encouraged to provide feedback on the three proposals listed
  + Note that this issue can be sub-divided into two parts: channel spacing for adjacent carriers and the definition of contiguous CA
    - Proposal 1 and Proposal 2 are aligned on channel spacing for adjacent carriers
    - For contiguous CA definition, revisions may be needed

**Discussions:**

Nokia: Intel formulation is good. One thing need to be clarified is that we do not enable any cases.

Intel: some bandwidth combination may exceed the nominal spacing. Do you have case that it does not work?

Nokia: need re-checking.

Apple: In general, Intel formulation can work.

**Chair** => check Intel’s concreate proposal:

*Nominal channel spacing*

Adjacent channel spacing can be expressed in compact form below for FR2-2 operating bands:

Nominal Channel spacing = ceil((BWChannel(1) + BWChannel(2))/100.8 MHz) \* (100.8/2) [MHz]

*Channel spacing for CA*

Since contiguous CA is intended for CA between adjacent carriers, we can simply re-use the nominal channel spacing for adjacent carrier captured above.

**Issue 2-2d: Configurations for intra-band contiguous CA**

* Proposals (Nokia, R4-2212845)
  + Proposal 1: Include CA configurations up to 5\*400 MHz and 8\*100 MHz.
  + Proposal 2: Include a note in CA configuration table to clarify that only multiples of the same channel bandwidth are allowed for FR2-2.

| **NR CA configuration / Bandwidth combination set / Fallback group** | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configs.** | **Uplink CA configs.** | **BWChannel (MHz)** | **BWChannel (MHz)** | **BWChannel (MHz)** | **BWChannel (MHz)** | **BWChannel (MHz)** | **BWChannel (MHz)** | **BWChannel (MHz)** | **BWChannel (MHz)** | **Max aggregated**  **BW (MHz)** | **BCS** | **Fallback group** |
| CA\_n263B | CA\_n263A | 400 | 400 |  |  |  |  |  |  | 800 | 0 | 1 |
| CA\_n263C | CA\_n263A | 400 | 400 | 400 |  |  |  |  |  | 1200 | 0 | 1 |
| CA\_n263V | CA\_n263A | 400 | 400 | 400 | 400 |  |  |  |  | 1600 | 0 | 1 |
| CA\_n263W | CA\_n263A | 400 | 400 | 400 | 400 | 400 |  |  |  | 2000 | 0 | 1 |
| CA\_n263G | CA\_n263A | 100 | 100 |  |  |  |  |  |  | 200 | 0 | 3 |
| CA\_n263H | CA\_n263A | 100 | 100 | 100 |  |  |  |  |  | 300 | 0 | 3 |
| CA\_n263I | CA\_n263A | 100 | 100 | 100 | 100 |  |  |  |  | 400 | 0 | 3 |
| CA\_n263J | CA\_n263A | 100 | 100 | 100 | 100 | 100 |  |  |  | 500 | 0 | 3 |
| CA\_n263K | CA\_n263A | 100 | 100 | 100 | 100 | 100 | 100 |  |  | 600 | 0 | 3 |
| CA\_n263L | CA\_n263A | 100 | 100 | 100 | 100 | 100 | 100 | 100 |  | 700 | 0 | 3 |
| CA\_n263M | CA\_n263A | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 800 | 0 | 3 |
| NOTE 1: Void  NOTE 2: For the NR CA configuration with more than two component carries, the bandwidths in a BCS which may introduce combinations more than requested unintentionally should be listed in a row separately.  NOTE 3: In this release of the specification, contiguous DL CA configurations within FR2-2 may only contain multiples of the same channel bandwidth. | | | | | | | | | | | | |

* Recommended WF
  + Companies should share their views on the proposed configurations captured in the above table

**Discussions:**

Nokia: we do not have CR to introduce CA if we can have agreement in place.

Intel: that is may intention. We are going to have two separate CRs allocated.

**Sub-topic 3-1: Defining a band combination for FR1 + FR2-2 DC/CA**

At least one band combination for the case of FR2-2 DC/CA with an anchor in FR1 needs to be included to complete the work item. Alignment on an approach to take is encouraged.

**Issue 3-1: Approach to introduce an FR2-2 DC/CA with an anchor in FR1 combination**

* Option (Intel, R4-2212118)
  + RAN4 targets completing one example band combination FR2-2 DC/CA with an anchor in FR1 within the maintenance phase of the WI
  + Additional band combinations can be added in a release-independent manner as part of a Release 18 basket WI
  + To specify the example band combination FR2-2 DC/CA with an anchor in FR1, RAN4 could take a corresponding FR2-1 DC/CA combination with anchor in FR1 as a baseline in this meeting, with square brackets around the requirements, and aim to remove the brackets in the maintenance phase
* Recommended WF
  + Please share your views on the suggested approach, and any modifications or recommendations to introduce band combinations
  + Based on operator interest, companies are asked to consider n48 + n263 as a potential FR2-2 DC/CA + FR1 band combination to be completed within this work item

**Discussions:**

Nokia: is there no additional band combination added? In WI we consider three combinations.

CHTTL: how many configurations will be under this combination n48+n263? The list of configurations is long.

**Chair=>** further check if all the configurations can be finalized in this WI.

**Agreement:**

* Specify n48 + n263 within this work item and if n48 + n263 is completed, then the WI is viewed as completed.

**Agreement:**

* RAN4 targets completing one example band combination FR2-2 DC/CA with an anchor in FR1 within the maintenance phase of the WI
* Additional band combinations can be added in a release-independent manner as part of a Release 18 basket WI
* To specify the example band combination FR2-2 DC/CA with an anchor in FR1, RAN4 could take a corresponding FR2-1 DC/CA combination with anchor in FR1 as a baseline in this meeting, with square brackets around the requirements, and aim to remove the brackets in the maintenance phase

-------------------------------------------------------------------------------------------------------------------------------

**[104-e][111] NR\_ext\_to\_71GHz\_Part\_2, AI 9.14.3.1, 9.14.3.2 – Phil Coan**

**R4-2214089 Email Discussion Summary for [104-e][111] NR\_ext\_to\_71GHz\_Part\_2**

*Type: other For: Information  
 Source: Moderator (Qualcomm)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214229 (from R4-2214089).**

**R4-2214229 Email Discussion Summary for [104-e][111] NR\_ext\_to\_71GHz\_Part\_2**

*Type: other For: Information  
 Source: Moderator (Qualcomm)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| [R4-2211626](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211626.zip) | R4-2214883 | Draft CR to 38.101-2 on band n263 Tx aspects | Qualcomm Inc | Revised | This will be the basis for draft CR on TX |
| [R4-2211627](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211627.zip) | R4-2214884 | Draft CR to 38.101-2 on band n263 Rx aspects | Qualcomm Inc | Revised |  |
| [R4-2213368](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213368.zip) |  | Draft CR for n263 RMC | Huawei, HiSilicon | Return to |  |

**GTW on Aug-18**

**Topic #0: Unwanted emissions and signal quality**

**Issue 0.1.1 EVM PTRS processing**

*Important to decide as it affects the MPR for 16QAM and 64QAM*

* Proposals

Proposal 10: The DMRS based channel estimate shall utilize CPE-corrected DMRS symbols

Proposal 11: The PTRS extraction and correction stage is used as the final refinement of the received signal.

Proposal 12: For CP-OFDM, all non-DMRS symbols in a slot must be equipped with PTRS, and frequency density of PTRS tones maximized.

Proposal 13a: For DFT-s-OFDM, PTRS is specified with 4 symbols per group, and the groups are configured in a ‘head and tail’ configuration.

Proposal 13b: For DFT-s-OFDM, the number of PTRS groups is maximised so the ratio of PUSCH symbols to PTRS symbols stays at 1 or higher.

* Recommended WF
  + Agree with all the proposals

**Agreement:**

* The DMRS based channel estimate shall utilize CPE-corrected DMRS symbols
* The PTRS extraction and correction stage is used as the final refinement of the received signal.
* For CP-OFDM, all non-DMRS symbols in a slot must be equipped with PTRS, and frequency density of PTRS tones maximized.
* For DFT-s-OFDM, PTRS is specified with 4 symbols per group, and the groups are configured in a ‘head and tail’ configuration.
* For DFT-s-OFDM, the number of PTRS groups is maximised so the ratio of PUSCH symbols to PTRS symbols stays at 1 or higher.

**FFS on PTRS configuration:**

* PTRS configuration during the test will be based on UE declaration.

**Discussion:**

Oppo: it causes the RAN5 test problem.

Apple: we are open. But we are not sure about the benefit. We should evaluate.

**Issue 0.1.2 EVM compliance power levels**

power range over which the EVM requirement applies

**CCBW = 100 MHz Power class 1 and 2**

* Proposals

Proposal 1: EVM compliance levels for FR2-2 CBW=100MHz in PC2 and PC1 are the same as FR2-1

****

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1.

**CCBW = 100 MHz Power class 3**

* Proposals

**Proposal 1: EVM compliance levels for FR2-2 CBW=100MHz in PC3 is the same as FR2-1**

**PC3 FR2-2 proposal**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **100 MHz** |
| UE EIRP | dBm | [≥ -13] |
| UE EIRP for UL 16 QAM | dBm | [≥ -10] |
| UE EIRP for UL 64 QAM | dBm | [≥ -6] |

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**CCBW >= 400 MHz Power class 3**

* Proposals

Proposals in R4-2111628 and R4-2212372 differ by 3 dB



* Recommended WF
  + Discuss between the two proposals

**Discussions:**

Moderator: wonder where 3dB difference comes from in Apple paper.

Apple: the intention is to correct the values. We start with FR2-1 range.

**CCBW >= 400 MHz, Power class 1 and 2**

Proposal in R4-2111628



* Recommended WF
  + Agree the proposal for PC1 and PC2 for CBW >= 400 MHz

**Discussions:**

LGE: These numbers are aligned with ours.

**Agreement:**

* The numbers in the table of the proposal are agreeable, but further checking is needed.

**Issue 0.1.3 Phase noise mask assumption for EVM**

Companies may choose to align on PN mask assumption as a means to arrive at MPR, however MPR values between companies are pretty close so in the end agreement on PN mask may not be necessary

* Proposals

**Proposal 1: RAN4 uses the proposed PN mask for development of EVM requirements. (R4-2211628)**

* Recommended WF
  + Agree proposal 1

**Issue 0.1.4 Carrier leakage for PC1 and PC3**

*Carrier leakage values*

* Proposal 1: PC1 carrier leakage for n263 as shown in the table:

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > 13.4 dBm | -25 |
| 0.4 dBm ≤ EIRP ≤ 13.4 dBm | -20 |

* Proposal 2: PC3 carrier leakage for n263 as shown in the table:

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > -1.9 dBm | -25 |
| -14.9dBm ≤ EIRP ≤ -1.9 dBm | -20 |

* Recommended WF
  + Agree with the proposals

**Agreement:**

* Agree proposal 1 and proposal 2.

**Issue 0.1.5 Inband emissions for PC1, PC2, and PC3**

* Proposals
  + Proposal 1: Use the PC1 and PC3 inband emissions as in the tables. (R4-2211628)

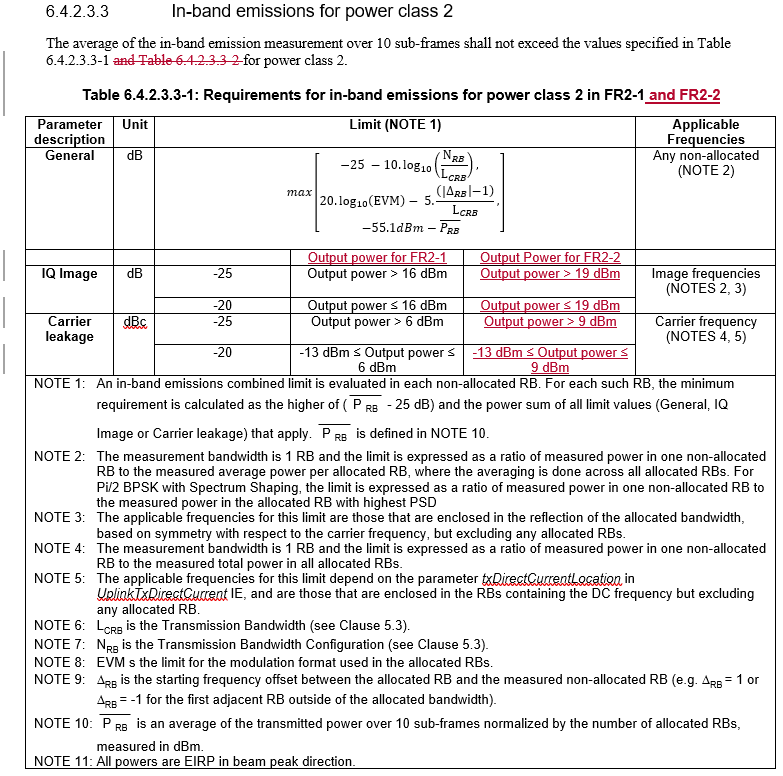
**Table 6.4.2.3.2-1: Requirements for in-band emissions for power class 1**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | | **Applicable Frequencies** |
| **General** | dB |  | | | Any non-allocated (NOTE 2) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| **IQ Image** | dB | -25 | > 27 dBm | > 23.4 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | ≤ 27 dBm | ≤ 23.4 dBm |  |
| **Carrier leakage** | dBc | -25 | > 17 dBm | > 13.4 dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | 4 dBm ≤ Output power ≤ 17 dBm | 0.4 dBm ≤ Output power ≤ 13.4 dBm |  |

**Table 6.4.2.3.4-1: Requirements for in-band emissions for power class 3**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | | **Applicable Frequencies** |
| **General** | dB |  | | | Any non-allocated (NOTE 2) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| **IQ Image** | dB | -25 | > 10 dBm | > 8.1 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | ≤ 10 dBm | ≤ 8.1 dBm |  |
| **Carrier leakage** | dBc | -25 | > 0 dBm | > -1.9dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | -13 dBm ≤ Output power ≤ 0 dBm | -14.9 dBm ≤ Output power ≤ -1.9 dBm |  |

* + Proposal 2 on formatting of PC2 agreed inband emissions (from LGE comment in thread)



* Recommended WF
  + WF #1 Agree with the proposal 1
  + WF #2 Agree with proposal 2 using modified table title with the “in FR2-1 and FR2-2” removed

**Agreement:**

* Agree with the proposal 1
* Agree with proposal 2 using modified table title with the “in FR2-1 and FR2-2” removed

**Topic #1: MPR and A-MPR**

Open issues summary

Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.

**Issue 1.1.1 MPR**

MPR for power class 1 and power class 3 all SCS and CBW

**Power class 1**

* Proposals
  + Proposal 1: RAN4 adopt the PC1 MPRWT values in the tables and use the same MPRNARROW definition and values as FR2-1. (R4-2211628). The numbers for 16 and 64QAM assume the PTRS proposal in R4-

**Table 6.2.2.1-3 MPRWT for power class 1, BWchannel = 100 MHz in FR2-2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Modulation** | | **MPRWT (dB), BWchannel = 100 MHz** | | |
|  | | **Outer RB allocations** | **Inner RB allocations** | |
|  | |  | **Region 1** | **Region 2** |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.5 | 0.0 | ≤ 3.5 |
|  | QPSK | ≤ 6.5 | 0.0 | ≤ 3.5 |
|  | 16 QAM | ≤ 7.0 | ≤ 2.5 | ≤ 2.5 |
|  | 64 QAM | ≤ 8.0 | ≤ 8.0 | ≤ 8.0 |
| CP-OFDM | QPSK | ≤ 8.0 | ≤ 1.5 | ≤ 3.5 |
|  | 16 QAM | ≤ 8.0 | ≤ 3.5 | ≤ 4.0 |
|  | 64 QAM | ≤ 9.5 | ≤ 9.5 | ≤ 9.5 |

**Table 6.2.2.1-4 MPRWT for power class 1, BWchannel >= 400 MHz in FR2-2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Modulation** | | **MPRWT (dB), BWchannel = 400, 800, 1600, 2000 MHz** | | |
|  | | **Outer RB allocations** | **Inner RB allocations** | |
|  | |  | **Region 1** | **Region 2** |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 6.0 | ≤ 1.0 | ≤ 3.5 |
|  | QPSK | ≤ 6.0 | ≤ 1.0 | ≤ 4.0 |
|  | 16 QAM | ≤ 4.5 | ≤ 3.0 | ≤ 3.0 |
|  | 64 QAM | ≤ 8.0 | ≤ 8.0 | ≤ 8.0 |
| CP-OFDM | QPSK | ≤ 6.0 | ≤ 1.5 | ≤ 3.5 |
|  | 16 QAM | ≤ 6.0 | ≤ 4.0 | ≤ 5.5 |
|  | 64 QAM | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 |

* Recommended WF
  + Agree proposal 1. Note the 16QAM and 64QAM values are valid only if PTRS proposal is agreed as the values will change without PTRS.

**Discussions:**

Huawei: need further checking.

Nokia: there is significant jump of 64QAM over other modulations.

Qualcomm: to Nokia, 64QAM values that Qualcomm provided are not based on phase noise achievable and we base on the simulation. The phase noise mask is even cleaner. PTRS compensation is conducted to improve the MPR and achievable phase noise.

Ericsson: to look at the implementation of values. We looks at one example of proposal 3 of 16QAM DFT. In practice UE may be better. We recognize the difficulty but we need consider the usefulness of these numbers. We provided the comments and encouraged companies to check.

**Chair=>** discuss further together with the following MPR proposals for power classe 3

**Power class 3 100 MHz**

* Proposal 1: Numbers in the “PROP #1” column assuming QCOM PTRS processing is agreed
* Proposal 2: PROP2 column

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Modulation | | PC3 MPRWT, BWchannel = 100 MHz | | | |
| **Inner RB allocations,**  Region 1 | | **Edge RB allocations** | |
| ***PROP #1*** | ***PROP #2*** | ***PROP #1*** | ***PROP #2*** |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | 0 | ≤ 0.5 | 2 |
|  | QPSK | 0.0 | 0 | ≤ 0.5 | 2 |
|  | 16 QAM | ≤ 3.0 | 3 | ≤ 2.5 | 3.5 |
|  | 64 QAM | ≤ 8.5 | 5 | ≤ 8.5 | 5.5 |
| CP-OFDM | QPSK | ≤ 1.5 | 3.5 | ≤ 1.5 | 4 |
|  | 16 QAM | ≤ 4.0 | 5 | ≤ 4.0 | 5 |
|  | 64 QAM | ≤ 10.0 | 7.5 | ≤ 10.0 | 7.5 |

* Recommended WF
  + Discuss proposal 1 and proposal 2

**Power class 3 > 100 MHz**

* Proposal 1 option A: MPR is the same for 400, 800, 1600, and 200 MHz and uses the PROP#1 numbers
* Proposal 1 option B: MPR is the same for 400, 800, 1600, and 200 MHz and uses the PROP#2 numbers

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Modulation | | PC3 MPRWT, BWchannel >= 400 MHz | | | |
| **Inner RB allocations,**  Region 1 | | **Edge RB allocations** | |
| ***PROP #1*** | ***PROP #2*** | ***PROP #1*** | ***PROP #2*** |
| DFT-s-OFDM | Pi/2 BPSK | 1.0 | 0 | ≤ 1.0 | 3 |
|  | QPSK | 1.0 | 0 | ≤ 1.0 | 3 |
|  | 16 QAM | ≤ 3.5 | 4.5 | ≤ 3.0 | 4.5 |
|  | 64 QAM | ≤ 9.5 | 6.5 | ≤ 9.0 | 6.5 |
| CP-OFDM | QPSK | ≤ 2.0 | 5 | ≤ 2.0 | 5 |
|  | 16 QAM | ≤ 4.0 | 6.5 | ≤ 4.0 | 6.5 |
|  | 64 QAM | ≤ 10.0 | 9 | ≤ 10.0 | 9 |

* Proposal 3: Consider the following MPR delta for CBW of 800MHz, 1600MHz and 200MHz
  + X1 = 1.0, Y1 = 1.0 for 800MHz
  + X2 = 2.0, Y2 = 2.5 for 1600MHz
  + X3 = 2.0, Y3 = 2.5 for 2000MHz

**Table 6.2.2.3-3 MPRWT for power class 3, BWchannel = 800 MHz, FR2-2**

|  |  |  |  |
| --- | --- | --- | --- |
| **Modulation** | | **MPRWT, BWchannel = 800 MHz** | |
|  | | **Inner RB allocations,**  **Region 1** | **Edge RB allocations** |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ 4.0 |
|  | QPSK | 0.0 | ≤ 4.0 |
|  | 16 QAM | ≤ 5.5 | ≤ 5.5 |
|  | 64 QAM | ≤ 7.5 | ≤ 7.5 |
| CP-OFDM | QPSK | ≤ 6.0 | ≤ 6.0 |
|  | 16 QAM | ≤ 7.5 | ≤ 7.5 |
|  | 64 QAM | ≤ 10.0 | ≤ 10.0 |

**Table 6.2.2.3-4 MPRWT for power class 3, BWchannel = 1600 and 2000 MHz, FR2-2**

|  |  |  |  |
| --- | --- | --- | --- |
| **Modulation** | | **MPRWT, BWchannel = 1600 MHz** | |
|  | | **Inner RB allocations,**  **Region 1** | **Edge RB allocations** |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ 5.0 |
|  | QPSK | 0.0 | ≤ 5.0 |
|  | 16 QAM | ≤ 7.0 | ≤ 7.0 |
|  | 64 QAM | ≤ 9.0 | ≤ 9.0 |
| CP-OFDM | QPSK | ≤ 7.5 | ≤ 7.5 |
|  | 16 QAM | ≤ 9.0 | ≤ 9.0 |
|  | 64 QAM | ≤ 11.5 | ≤ 11.5 |

* Proposal 4: Same as proposal 3 except the 800 MHz table is slightly different.
  + X1=[1.0], X2=[2.0], X3=[2.0] dB, Y1=[1.5], Y2=[2.5] and Y3=[2.5] dB.

**Table 6.2.2.3-3 MPRWT for power class 3, BWchannel = 800 MHz, FR2-2**

|  |  |  |  |
| --- | --- | --- | --- |
| **Modulation** | | **MPRWT, BWchannel = 800 MHz** | |
|  | | **Inner RB allocations,**  **Region 1** | **Edge RB allocations** |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ 4.0 |
|  | QPSK | 0.0 | ≤ 4.0 |
|  | 16 QAM | ≤ 6.0 | ≤ 6.0 |
|  | 64 QAM | ≤ 8.0 | ≤ 8.0 |
| CP-OFDM | QPSK | ≤ 6.5 | ≤ 6.5 |
|  | 16 QAM | ≤ 8.0 | ≤ 8.0 |
|  | 64 QAM | ≤ 10.5 | ≤ 10..5 |

* Recommended WF
  + For PC3 > 100 MHz Discuss between proposal 1, 2, and 3

**Issue 1.1.2 A-MPR for EN 303753**

Emissions mask in EN 303753

* Proposals
  + Proposal 1: No A-MPR requirement needed for the EN 303753 emissions mask.
* Recommended WF
  + No A-MPR needed for EN 303753

**Agreement:**

* No A-MPR requirement needed for the EN 303753 emissions mask.

**Topic #2: Other TX power related issues**

**Issue 2.1.1 PC3 max TRP**

* Proposals
  + Observation 1: The 27 dBm value listed for band n263 in Table 6.2.1.3-2 is a conducted limit that can be verified by max TRP ≤ 27dBm when suitable methods to measure maximum power level at antenna port or ports are not available. Therefore, we should consider whether a clarifying note is needed in the table:

****

* Recommended WF
  + Discuss in round 1

**Chair=>** this issues is missed during GTW.

**Issue 2.1.2 UL gap for TX power management**

* Proposals
  + Proposal 1: The UL gap for Tx power measurement doesn’t apply to FR2-2 in Rel-17.
* Recommended WF
  + Discuss in round 1

**Discussions:**

Huawei: uplink gap for power measurement is based on FR2-1. We do not think the requirements can be applied for FR2-2.

Apple: We believe that UL gap helps UE handles MPE. I think the basic feature should be equally applicable to FR2-2.

Huawei: we does not object it but we want to check the requirements.

Apple: What do you mean by saying any particular action?

Huawei: the whole discussion of UL gap for requirement is based on the assumption of FR2-1. For example the measurement period and duty cycle. We have not discussed the details for FR2-2.

Apple: FR2-2 is introduce the new band. UL gap is a general feature.

**Issue 2.1.3 Multi-band relaxation**

* Proposals
  + Proposal 1: Remove the brackets on the multi-band relaxation factors (∆MBP,n and ∆MBS,n) of band n263 and confirm both values are 1.0 dB.

****

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1.

**Issue 2.1.4 Pmin**

* Proposal 1: PC1 Pmin to be 4 dBm. PC2 and PC3 Pmin to be -13 dBm as shown in the tables
* Recommended WF
  + PC1 Pmin to be 4 dBm. PC2 and PC3 Pmin to be -13 dBm

**Agreement:**

* PC1 Pmin to be 4 dBm. PC2 and PC3 Pmin to be -13 dBm

**Issue 2.1.5 TX OFF power**

* Proposals
  + Proposal 1: Reuse FR2-1 requirements for minimum output power and OFF power, specifically remove the [] from this table

****

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1.

**Topic #3: CA unwanted emissions and signal quality**

**Issue 3.1.1 Carrier leakage for power classes 1 and 3 in CA**

* Proposals
  + Proposal 1: For CA carrier leakage use the PC1 and PC3 values in the tables.
  + Proposal 2: For n263 PC2 use the same value as in FR2-1 since the min peak EIRP values are nearly the same.

**PC1 carrier leakage for n263 as shown in the table:**

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > 13.4 dBm | -25 |
| 0.4 dBm ≤ EIRP ≤ 13.4 dBm | -20 |

**PC3 carrier leakage for n263 as shown in the table:**

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > -1.9 dBm | -25 |
| -14.9dBm ≤ EIRP ≤ -1.9 dBm | -20 |

* Recommended WF
  + Agree proposal 1 and proposal 2

**Agreement:**

* Agree proposal 1 and proposal 2.

**Issue 3.1.2 Inband emissions for power classes 1 and 3 in CA**

* Proposals
  + Proposal 1: Re-use the FR2-1 CA inband emissions method for PC1 and PC3 CA with the same output power values we are proposing for FR2-2 single carrier. (R4-2211628)
* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1.

**Issue 3.1.3 SEM for CA**

* Proposals
  + Proposal 1: Re-use the FR2-1 CA SEM requirements for FR2-2.
* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**Issue 3.1.4 ACLR for CA**

* Proposals
  + Proposal 1: Use the FR2-2 single carrier 15 dB ACLR value for CA
* Recommended WF
  + Agree proposal 1

**Discussions:**

Huawei: in previous RAN4 agreement, OBW is more stringent than ACLR. Should we send RAN5 to indicate the RAN4 agreement?

Nokia: We agree with moderator. This is RAN5 discussion. To Huawei, we do not believe it is necessary. Huawei can raised it in RAN5.

**Agreement:**

* Agree proposal 1
* The common understanding in RAN4 is that OBW requirement is more stringent than ACLR for FR2-2.

**Issue 3.1.5 OBW for CA**

* Proposals
  + Proposal 1: Re-use the FR2-2 single carrier 99% OBW for CA
* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**Topic #4: CA output power, MPR, and A-MPR**

**Issue 4.1.1 Maximum output power for CA**

* Proposals
  + Proposal 1: FR2-2 PC1 and PC3 power classes for CA are the same as for FR2-2 single carrier. Note this is the same approach as in FR2-1.
* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1.

**Issue 4.1.2 MPR for CA**

* Proposals
  + Proposal 1: Adopt the CA MPR tables for PC1 and PC3. (R4-2211628)

**Table TBD Maximum power reduction (MPRWT\_C\_CA) for FR2-2 UE power class 1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Waveform Type** | **Cumulative aggregated channel bandwidth** | | | |
| **< 400 MHz** | **≥ 400 MHz and < 800 MHz** | **≥ 800 MHz and ≤ 1400 MHz** | **> 1400 MHz and ≤ 2000 MHz** |
| Pi/2 BPSK | ≤ 7.0 | ≤ 5.0 | ≤ 2.0 | ≤ 2.0 |
| QPSK | ≤ 8.0 | ≤ 6.0 | ≤ 3.0 | ≤ 3.0 |
| 16 QAM | ≤ 8.0 | ≤ 6.0 | ≤ 4.0 | ≤ 4.0 |
| 64 QAM | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 |

**Table TBD Maximum power reduction (MPRWT\_C\_CA) for FR2-2 UE power class 3**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Waveform Type** | **Cumulative aggregated channel bandwidth** | | | |
| **< 400 MHz** | **≥ 400 MHz and < 800 MHz** | **≥ 800 MHz and ≤ 1400 MHz** | **> 1400 MHz and ≤ 2000 MHz** |
| Pi/2 BPSK | ≤ 1.0 | ≤ 1.0 | ≤ 1.0 | ≤ 1.0 |
| QPSK | ≤ 2.0 | ≤ 2.0 | ≤ 2.0 | ≤ 2.0 |
| 16 QAM | ≤ 4.0 | ≤ 4.0 | ≤ 4.0 | ≤ 4.0 |
| 64 QAM | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 |

* Recommended WF
  + Agree proposal 1

**Chair=>** need futher discusions.

**Issue 4.1.3 A-MPR for CA**

*Sub-topic description*

* Proposals
  + Proposal 1: No CA A-MPR needed for the EN 303753 emissions mask.
* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**Topic #5: Other TX or general Issues**

**Issue 5.1.1 Minimum guard band (Table 5.3.3-1)**

* Proposals
  + Proposal 1: Agree TP#1 above to 38.101-2 removing the square brackets in Table 5.3.3-1

**Table 5.3.3-1: Minimum guardband for each UE channel bandwidth and SCS (kHz)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **SCS (kHz)** | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **800 MHz** | **1600 MHz** | **2000 MHz** |
| 60 | 1210 | 2450 | 4930 | N/A | N/A | N/A | N/A |
| 120 | 1900 | 2420 | 4900 | 9860 | N/A | N/A | N/A |
| 480 | N/A | N/A | N/A | 9680 | 42640 | 85520 | N/A |
| 960 | N/A | N/A | N/A | 9440 | 42400 | 85280 | 147040 |

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**Issue 5.1.2 PRACH time mask**

* Proposals
  + Proposal 1: PRACH ON power measurement period table should be updated for 480 and 960 SCS as shown. (R4-2211628)

**Table 6.3.3.4-1: PRACH ON power measurement period**

|  |  |  |  |
| --- | --- | --- | --- |
| **Format** | **SCS** | **Measurement period** | **Note** |
| A1 | 60 kHz | 0.035677 ms |  |
|  | 120 kHz | 0.017839 ms |  |
|  | 480 kHz | 0.004460 ms |  |
|  | 960 kHz | 0.002230 ms |  |
| A2 | 60 kHz | 0.071354 ms |  |
|  | 120 kHz | 0.035677 ms |  |
|  | 480 kHz | 0.008919 ms |  |
|  | 960 kHz | 0.004460 ms |  |
| A3 | 60 kHz | 0.107031 ms |  |
|  | 120 kHz | 0.053516 ms |  |
|  | 480 kHz | 0.013379 ms |  |
|  | 960 kHz | 0.006690 ms |  |
| B1 | 60 kHz | 0.035091 ms |  |
|  | 120 kHz | 0.0175455 ms |  |
|  | 480 kHz | 0.004386 ms |  |
|  | 960 kHz | 0.002193 ms |  |
| B4 | 60 kHz | 0.207617 ms |  |
|  | 120 kHz | 0.103809 ms |  |
|  | 480 kHz | 0.025952 ms |  |
|  | 960 kHz | 0.012976 ms |  |
| A1/B1 | 60 kHz | 0.035677 ms for front X1 occasion 0.035091 ms for last occasion  X | X1 = [2,5] |
|  | 120 kHz | 0.017839 ms for front X1occasion 0.017546 ms for last occasion  X |
|  | 480 kHz | 0.004460 ms for front X1 occasion  0.004387 ms for last occasion |
|  | 960 kHz | 0.017839 ms for front X1occasion 0.017546 ms for last occasion |
| A2/B2 | 60 kHz | 0.071354 ms for front X2 occasion 0.069596 ms for last occasion  X | X2 = [1,2] |
|  | 120 kHz | 0.035677 ms for front X2 occasion 0.034798 ms for last occasion  X |
|  | 480 kHz | 0.008919 ms for front X2 occasion 0.008700 ms for last occasion |
|  | 960 kHz | 0.004460 ms for front X2 occasion 0.004350 ms for last occasion |
| A3/B3 | 60 kHz | 0.107031 ms for first occasion 0.104101 ms for second occasion |  |
|  | 120 kHz | 0.053515 ms for first occasion 0.052050 ms for second occasion |  |
|  | 480 kHz | 0.013379 ms for first occasion 0.013013 ms for second occasion |  |
|  | 960 kHz | 0.006689 ms for first occasion 0.006506 ms for second occasion |  |
| C0 | 60 kHz | 0.026758 ms |  |
|  | 120 kHz | 0.013379 ms |  |
|  | 480 kHz | 0.003345 ms |  |
|  | 960 kHz | 0.001672 ms |  |
| C2 | 60 kHz | 0.083333 ms |  |
|  | 120 kHz | 0.0416667 ms |  |
|  | 480 kHz | 0.010417 ms |  |
|  | 960 kHz | 0.005208 ms |  |
| NOTE: For PRACH on PRACH occasion start from begin of 0ms or 0.5 ms boundary, the measurement period will plus 0.032552 μs | | | |

* Recommended WF
  + Agree proposal 1

**Discussions:**

Huawei: I have no concern on the values. The maximum period is only 2us. The off power mask in RAN5. I do not know if 2us is feasible or not for measurement from test perspective.

Qualcomm: we can have discussion with TE vendor.

**Issue 5.1.3 Beam correspondence**

* Proposals
  + Proposal 1: All FR2-2 UEs shall support beamCorrespondenceWithoutUL-BeamSweeping.
  + Proposal 2: RAN4 shall apply the minimum SSB and minimum CSI-RS as provided in Table 1 and Table 2 for band n263. (re: 38.101-2 6.6.4.3.1)

**Table 1: Conditions for SSB based L1-RSRP measurements for beam correspondence**

|  |  |
| --- | --- |
| **Band** | **Minimum SSB (dBm/SCSSBB)** |
| n257 | -96.2 |
| n258 | -96.2 |
| n259 | -90.7 |
| n260 | -91.9 |
| n261 | -96.2 |
| n262 | -88.5 |
| n263 | -88.2 |

**Table 2: Conditions for CSI-RS based L1-RSRP measurements for beam correspondence**

|  |  |
| --- | --- |
| **Band** | **Minimum CSI-RS (dBm/SCSSBB)** |
| n257 | -96.2 |
| n258 | -96.2 |
| n259 | -90.7 |
| n260 | -91.9 |
| n261 | -96.2 |
| n262 | -88.5 |
| n263 | -88.2 |

* Recommended WF
  + Discuss during round 1

**Discussions:**

Qualcomm: prefer proposal 1.

Huawei: I do think we can agree on proposal 2 without proposal 1. Regarding proposal 1, for FR2-2, people have different design for the antenna the frequency range is different from FR2-1. We can keep the capability optional.

Qualcomm: for table 2, it is said CSI-RS based …

Nokia: we prefer option 1. The UL sweeping is agreed in Rel-15. In Rel-17 it is not needed. Proposal 2 needs further discussions.

OPPO: regarding proposal 1, we slightly prefer not to mandate without beam sweeping. In market no device can support 71. The propagation condition would be different from below 71Ghz. And the antenna is different. We would like to be conservative.

Sony: for proposal 1 we echo Qualcomm and Nokia. From antenna, even if we is moving up to higher frequency, there is no fundamental difference.

**Issue 5.1.4 ON/ON transient periods**

* Options
  + Option 1: The transient period from FR2-1 is based on the capability of the UE to configure the transmitter and receiver. The same capability will exist in FR2-2. Use the same 5usec for FR2-2.
  + Option 2: Introduce 2 µS improved ON/ON transient period as optional UE capabilities for 480 and 960 kHz SCS.
* Recommended WF
  + Discuss during round 1

**Discussions:**

OPPO: we prefer Option 1. For option 2, where is 2us coming from?

Intel: we had it a few meetings ago. We presented the benefit. If companies want to discuss the exact numbers, we are open to discussion. But we want to have it as optional feature.

AT&T: it was discussed for many meetings. The views are diverse. We agreed the benefit and optional features. We would like to introduce it in Rel-17. We would like to consider it in Rel-18 if needed and if we get the alignment in RAN4 to add it into FR2 enhancement.

Nokia: we support AT&T. We should consider it for Rel-18.

**Chair=>** align companies’ view if it needs be discussed in Rel-18.

**Issue 5.1.5 Beam direction only switching time**

* Proposals
  + Proposal 1: Use a UE beam direction switching time of 59 ns.
* Recommended WF
  + Discuss during round 1

**Discussions:**

Ericsson: 200us requirement is not feasible. It is longer than CP. I wonder if we could consider the compromised value 100ns at least for 480KHz SCS.

Nokia: from many meetings, we know 200us is longer than CP which does not work.

Qualcomm: the UE architecture of FR2-2 is similar as FR2-1. From feasibility perspective, it does not work. We think 200ns is needed for FR2-2.

Huawei: we agree with Qualcom’s view. 200ns is generated based on practical design. 59ns is not feasible.

**Topic #6: RX issues**

**Issue 6.1.1 REFSENS**

* Proposals
  + Proposal 1: Implement the agreed PC1 REFSENS in the specification. (-79 dBm/400 MHz)
  + Proposal 2: Specify the uplink configuration for band n263 as in Table 2.6-1. (R4-2213369)

**Table 2.6-1**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Operating band** | **NR Band / Channel bandwidth / NRB / SCS / Duplex mode** | | | | | | | | |
|  | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **800 MHz** | **1600 MHz** | **2000 MHz** | **SCS** | **Duplex Mode** |
| n257 | 32 | 64 | 128 | 256 | N.A | N.A | N.A | 120 kHz | TDD |
| n258 | 32 | 64 | 128 | 256 | N.A | N.A | N.A | 120 kHz | TDD |
| n260 | 32 | 64 | 128 | 256 | N.A | N.A | N.A | 120 kHz | TDD |
| n261 | 32 | 64 | 128 | 256 | N.A | N.A | N.A | 120 kHz | TDD |
| n262 | 32 | 64 | 128 | 256 | N.A | N.A | N.A | 120 kHz | TDD |
| n263 | N.A | 64 | N.A | 256 | N.A | N.A | N.A | 120 kHz | TDD |
| N.A | N.A | N.A | N.A | 120 | 243 | N.A | 480 kHz | TDD |
| N.A | N.A | N.A | N.A | N.A | N.A | 144 | 960 kHz | TDD |

* + Proposal 3: vivo in thread

The NRB number for uplink configuration for band n263 is not the same with what we agreed for.

The numbers for 400M with 480/960k and 800M/1600M with 960k are missing.

**Table 5.3.2-1: Maximum transmission bandwidth configuration NRB**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **SCS (kHz)** | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **800 MHz** | **1600 MHz** | **2000 MHz** |
|  | **NRB** | **NRB** | **NRB** | **NRB** | **NRB** | **NRB** | **NRB** |
| 60 | 66 | 132 | 264 | N/A | N/A | N/A | N/A |
| 120 | 32 | 66 | 132 | 264 | N/A | N/A | N/A |
| 4801 | N/A | N/A | N/A | 66 | [124] | [248] | N/A |
| 9601 | N/A | N/A | N/A | 33 | [62] | [124] | 148 |
| Note 1: This SCS is optional in this release of the specification. | | | | | | | |

* Recommended WF
  + WF #1 Agree proposal 1
  + WF #2 - discuss the discrepancy between proposals 2 and 3

**Discussions:**

Huawei: Proposal 2 comes from Huawei. The uplink configuration is not targeting to provide all the combinations of channel bandwidth and SCS. When the REFSEN test is conducted for one SCS, we do not need to do it for other SCS. We are not sure if UE can support 480KHz all the time. So we should add 800 and 1600MHz for 960KHz to ensure all the bandwidths combination can be tested.

**Agreement:**

* Agree proposal 1.

**Issue 6.1.2 EIS relaxation for intraband contiguous CA**

* Proposals
  + Proposal 1: Use the same values as in FR2-1. For 1600-2000 MHz FR2-2 EIS relaxation dB value as [1.5]

**Table 7.3A.2.1-1: EIS Relaxation for CA operation by aggregated channel bandwidth**

|  |  |
| --- | --- |
| **Aggregated Channel BW 'BWChannel\_CA' (MHz)** | **(dB)** |
| BWChannel\_CA ≤ 800 | 0 |
| 800 < BWChannel\_CA ≤ 1200 | 0.5 |
| 1200 < BWChannel\_CA ≤ 1600 | 1.0 |
| 1600 < BWChannel\_CA ≤ 2000 | [1.5] |

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1.

**Issue 6.1.3 In-band blocking**

* Proposals
  + Proposal 1: Agree the IBB values as shown in the table (R4-2213221 and identical proposal in R4-2211629)

**Table 7.6.2-1: In band blocking requirements**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Rx parameter** | **Units** | **Channel bandwidth** | | | | | | | | | |
|  |  | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | | **800 MHz** | | **1600 MHz** | | **2000 MHz** | |
| Power in Transmission Bandwidth Configuration | dBm | REFSENS + 14 dB | | | |  | |  | |  | |
| BWInterferer | MHz | 50 | 100 | 200 | 400 | | 800 | | 1600 | | 2000 | |
| PInterferer  for bands n257, n258, n261 | dBm | REFSENS + 35.5 dB | REFSENS + 35.5 dB | REFSENS + 35.5 dB | REFSENS + 35.5 dB | | N.A. | | N.A. | | N.A. | |
| PInterferer  for bands n259, n260, n262 | dBm | REFSENS + 34.5 dB | REFSENS + 34.5 dB | REFSENS + 34.5 dB | REFSENS + 34.5 dB | | N.A. | | N.A. | | N.A. | |
| PInterferer  for band n263 | dBm | N.A. | REFSENS + 33.5 dB | N.A. | REFSENS + 33.5 dB | | REFSENS + 33.5 dB | | REFSENS + 33.5 dB | | REFSENS + 33.5 dB | |
| FIoffset | MHz | ≤ -100 & ≥ 100  NOTE 5 | ≤ -200 & ≥ 200  NOTE 5 | ≤ -400 & ≥ 400  NOTE 5 | ≤ -800 & ≥ 800  NOTE 5 | | ≤ -1600 & ≥ 1600  NOTE 5 | | ≤ -3200 & ≥ 3200 | | ≤ -4000 & ≥ 4000 | |
| FInterferer | MHz | FDL\_low + 25  to  FDL\_high - 25 | FDL\_low + 50  to  FDL\_high - 50 | FDL\_low + 100  to  FDL\_high - 100 | FDL\_low + 200  to  FDL\_high - 200 | | FDL\_low + 400  to  FDL\_high - 400 | | FDL\_low + 800  to  FDL\_high - 800 | | FDL\_low + 1600  to  FDL\_high - 1600 | |

* Recommended WF
  + Agree proposal 1

**Discussions:**

Huawei: to the format, we have similar changes with different format to introduce the requirements in the separate tables.

**Agreement:**

* Agree the IBB values as shown in the table in proposal 1
  + FFS whether to use one table or separate tables to capture the requriements.

**Issue 6.1.4 CA In-band blocking**

* Proposals
  + Proposal 1: Agree CA IBB requirements as given in TP#3 and TP#4. (R4-2213221 and identical proposal6 in R4-2211629 )

**Table 7.6A.2.1-1: In band blocking minimum requirements for intra-band contiguous CA**

|  |  |  |
| --- | --- | --- |
| **Rx Parameter** | **Units** | **All CA bandwidth classes** |
| Power in Transmission Bandwidth Configuration, per CC |  | REFSENS + 14 dB |
| Pinterferer for band n257, n258, n261 | dBm | Aggregated power + 21.5 |
| Pinterferer for band n260, n262 | dBm | Aggregated power + 20.5 |
| Pinterferer for band n263 | dBm | Aggregated power + 19.5 |

* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**Issue 6.1.5 Maximum input level for** **Intra-band contiguous CA**

* Proposals
  + Proposal 1: Use the FR2-1 max input for intra-band contiguous requirement for FR2-2.
* Recommended WF
  + Agree proposal 1

**Agreement:**

* Agree proposal 1

**Issue 6.1.6 Adjacent channel selectivity**

* Proposals
  + The tables below with:
    - Option 1: using 21 dB for the ACS for all CCBWs.
    - Option 2: using 21 dB for CCBW <= 400 MHz and 20 dB for > 400 MHz.

**Table 7.5-1: Adjacent channel selectivity**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Operating band** | **Units** | **Adjacent channel selectivity / Channel bandwidth** | | | | | | |
|  |  | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **800 MHz** | **1600 MHz** | **2000 MHz** |
| n257, n258, n261 | dB | 23 | 23 | 23 | 23 | N.A. | N.A. | N.A. |
| n259, n260, n262 | dB | 22 | 22 | 22 | 22 | N.A. | N.A. | N.A. |
| n263 | dB | N.A. | 21 | N.A. | 21 | 21 or 20 | 21 or 20 | 21 or 20 |

**Table 7.5-2: Adjacent channel selectivity test parameters, Case 1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Rx Parameter** | **Units** | **Channel bandwidth** | | | | | | |
|  |  | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **800 MHz** | **1600 MHz** | **2000 MHz** |
| Power in Transmission Bandwidth Configuration | dBm | REFSENS + 14 dB | | | | | | |
| PInterferer for band n257, n258, n261 | dBm | REFSENS  + 35.5 dB | REFSENS +35.5 dB | REFSENS  +35.5 dB | REFSENS  +35.5 dB | N.A. | N.A. | N.A. |
| PInterferer for band n259, n260, n262 | dBm | REFSENS  + 34.5 dB | REFSENS +34.5 dB | REFSENS  +34.5 dB | REFSENS  +34.5 dB | N.A. | N.A. | N.A. |
| PInterferer for band n263 | dBm | N.A. | REFSENS +33.5 dB | N.A. | REFSENS  +33.5 dB | REFSENS  +33.5 dB or 32.5 | REFSENS  +33.5 dB or 32.5 | REFSENS  +33.5 dB  or 32.5 |
| BWInterferer | MHz | 50 | 100 | 200 | 400 | 800 | 1600 | 2000 |
| FInterferer (offset) | MHz | 50  /  -50  NOTE 3 | 100  /  -100  NOTE 3 | 200  /  -200  NOTE 3 | 400  /  -400  NOTE 3 | 800  /  -800  NOTE 3 | 1600  /  -1600  NOTE 3 | 2000  /  -2000  NOTE 3 |

**Table 7.5-3: Adjacent channel selectivity test parameters, Case 2**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Rx Parameter** | **Units** | **Channel bandwidth** | | | | | | |
|  |  | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **800 MHz** | **1600 MHz** | **2000 MHz** |
| Ptxbc for bands n257, n258, n261 | dBm | -46.5 | -46.5 | -46.5 | -46.5 | -N.A. | -N.A. | -N.A. |
| Ptxbc for bands n259, n260, n262 | dBm | -45.5 | -45.5 | -45.5 | -45.5 | -N.A. | -N.A. | -N.A. |
| Ptxbc for band n263 | dBm | -N.A. | -44.5 | -N.A. | -44.5 | -44.5 or -43.5 | -44.5  or -43.5 | -44.5 or -43.5 |
| PInterferer | dBm | -25 | | | | | | |
| BWInterferer | MHz | 50 | 100 | 200 | 400 | 800 | 1600 | 2000 |
| FInterferer (offset) | MHz | 50  /  -50  NOTE 2 | 100  /  -100  NOTE 2 | 200  /  -200  NOTE 2 | 400  /  -400  NOTE 2 | 800  /  -800  NOTE 2 | 1600  /  -1600  NOTE 2 | 2000  /  -2000  NOTE 2 |
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern TDD as described in Annex A and set-up according to Annex C.  NOTE 2: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have same SCS.  NOTE 3: The transmitter shall be set to 4 dB below the PUMAX,f,c as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.1-2.  NOTE 4: Ptxbc is the power in the transmission bandwidth configuration | | | | | | | | |

* Recommended WF
  + Discuss between options 1 and 2

**Discussions:**

Apple: 1dB relaxation is needed.

**Agreement:**

* Option 2: using 21 dB for CCBW <= 400 MHz and 20 dB for > 400 MHz.

**Issue 6.1.7 Adjacent channel selectivity for Intra-band contiguous CA**

* Proposals
  + Proposal1: For CA Agree ACS the tables below based on 21 dB ACS. This proposal may need modification based on the single carrier ACS discussion above as 20 dB is being proposed for BW > 400 MHz.

**Table 7.5A.1-1: Adjacent channel selectivity for intra-band contiguous CA**

|  |  |  |
| --- | --- | --- |
| **Operating band** | **Units** | **Adjacent channel selectivity / CA bandwidth class** |
|  |  | **All CA bandwidth class** |
| n257, n258, n261 | dB | 23 |
| n259, n260, n262 | dB | 22 |
| n263 | dB | 21 |

**Table 7.5A.1-2: Adjacent channel selectivity test parameters for intra-band contiguous CA, Case 1**

|  |  |  |
| --- | --- | --- |
| **Rx Parameter** | **Units** | **All CA bandwidth Classes** |
| Pw in Transmission Bandwidth Configuration, per CC |  | REFSENS + 14 dB |
| PInterferer for band n257, n258, n261 | dBm | Aggregated power + 21.5 |
| PInterferer for band n259, n260, n262 | dBm | Aggregated power + 20.5 |
| PInterferer for band n263 | dBm | Aggregated power + 19.5 |
| BWInterferer | MHz | BWChannel\_CA |
| FInterferer (offset) | MHz | + BWchannel CA  /  - BWchannel CA  NOTE 3 |
|
|
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern as described in Annex A and set-up according to Annex C.  NOTE 2: The Finterferer (offset) is the frequency separation between the center of the aggregated CA bandwidth and the center frequency of the Interferer signal  NOTE 3: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interfering signal has the same SCS as that of the closest carrier.  NOTE 4: The transmitter shall be set to 4 dB below the PUMAX,f,c as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.1-2. | | |

**Table 7.5A.1-3: Adjacent channel selectivity test parameters for intra-band contiguous CA, Case 2**

|  |  |  |
| --- | --- | --- |
| **Rx Parameter** | **Units** | **All CA bandwidth classes** |
| Pw in Transmission Bandwidth Configuration, aggregated power for band n257, n258, n261 | dBm | - 46.5 |
| Pw in Transmission Bandwidth Configuration, aggregated power for band n259, n260, n262 | dBm | - 45.5 |
| Pw in Transmission Bandwidth Configuration, aggregated power for band n263 | dBm | - 44.5 |
| Pinterferer | dBm | - 25 |
| BWInterferer | MHz | BWChannel\_CA |
| FInterferer (offset) | MHz | + BWchannel CA  /  - BWchannel CA  NOTE 3 |
|
|
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3.2 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 and set-up according to Annex C.  NOTE 2: The Finterferer (offset) is the frequency separation between the center of the aggregated CA bandwidth and the center frequency of the Interferer signal  NOTE 3: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interfering signal has the same SCS as that of the closest carrier.  NOTE 4: The transmitter shall be set to 4 dB below the PUMAX,f,c as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.1-2. | | |

* Recommended WF
  + Agree proposal 1. If 20 dB ACS is decided for BW> 400 MHz there would need to be modification.

**Discussions:**

Moderator: need further discussion considering the format of table.

### 9.16 NR coverage enhancements

#### 9.16.3 Moderator summary and conclusions

**[104-e][112] NR\_cov\_enh\_maintenance, AI 9.16.1 – Shan Yang**

**R4-2214090 Email Discussion Summary for [104-e][112] NR\_cov\_enh\_maintenance**

*Type: other For: Information  
 Source: Moderator (China Telecom)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214230 (from R4-2214090).**

**R4-2214230 Email Discussion Summary for [104-e][112] NR\_cov\_enh\_maintenance**

*Type: other For: Information  
 Source: Moderator (China Telecom)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214423 | WF on DMRS bundling | China Telecom |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2211623 | R4-2214562 | CR: Maintenance of phase continuity requirements for DMRS bundling in FR1 | China Telecom | Revised | To capture R&S comments |
| R4-2213249 | R4-2214619 | CR on DMRS bundling support for CA in FR1\_FR2 | Ericsson | Revised | A revision tdoc number is requested in case any update is needed |
| R4-2213375 | R4-2214623 | CR on DMRS bundling support for CA in FR1 | Ericsson | Revised | A revision tdoc number is requested in case any update is needed |
| R4-2213738 |  | CR for TS 38.101-1: clarification on DMRS bundling RF requirements for SUL | Huawei, HiSilicon, China Telecom, CMCC | Return to |  |
| R4-2214041 | R4-2214653 | CR 38.101-1 DMRS DL CA | Qualcomm Incorporated, China Telecom | Revised | A revision tdoc number is requested in case any update is needed |

**GTW on Aug-16**

**Issue 1-3: CA capability for DMRS bundling**

* **Background:** Updated RAN1 UE feature list in LS [R4-2211513](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211513.zip)/R1-2205609
  + Per band granularity was agreed for FG30-4
  + The granularities for FG30-4a/b/…./h are still in []

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Type** |
| 30. NR\_cov\_enh | 30-4 | The maximum duration for DM-RS bundling | The maximum duration during which UE is able to maintain power consisitency and phase continuity to support DM-RS bundling for PUSCH/PUCCH | Per band |
| 30. NR\_cov\_enh | 30-4a | DM-RS bundling for PUSCH repetition type A | Support DM-RS bundling for PUSCH repetition type A | [Per UE] |
| 30. NR\_cov\_enh | 30-4b | DM-RS bundling for PUSCH repetition type B | Support DM-RS bundling for PUSCH repetition type B | [Per UE] |
| 30. NR\_cov\_enh | 30-4c | DM-RS bundling for TB processing over multi-slot PUSCH | Support DM-RS bundling for TB processing over multi-slot PUSCH | [Per UE] |
| 30. NR\_cov\_enh | 30-4d | DMRS bunding for PUCCH repetitions | Support DM-RS bundling for PUCCH repetitions for PUCCH formats 1/3/4 | [Per UE] |
| 30. NR\_cov\_enh | 30-4e | Enhanced inter-slot frequency hopping with inter-slot bundling for PUSCH | Support enhanced inter-slot frequency hopping with inter-slot bundling for PUSCH | [Per UE] |
| 30. NR\_cov\_enh | 30-4f | Enhanced inter-slot frequency hopping for PUCCH repetitions with DMRS bundling | Enhanced inter-slot frequency hopping for PUCCH repetitions with DMRS bundling | [Per UE] |
| 30. NR\_cov\_enh | 30-4g | [Restart DM-RS bundling after the events that violate power consistency and phase continuity] | [Support restarting DM-RS bundling after the events that violate power consistency and phase continuity] | [Per UE] |
| 30. NR\_cov\_enh | 30-4h | DM-RS bundling for non-back-to-back transmission | Support DM-RS bundling for [non-back-to-back transmission for consecutive slots] for PUSCH and PUCCH only for [corresponding supported back-to-back transmission FGs (30-4a, 30-4b, 30-4c, or 30-4d)] | [Per UE] |

* **Proposals**
  + Option 1: DMRS bundling capabilities are per band per band combination. (QC)
* **Recommended WF**
  + Discuss in GTW

**Discussion:**

Huawei: granularity should be decided by RAN1. From 30-4x, they are RAN1 capability.

ZTE: tend to agree with Huawei. Some capability comes from RAN1. If we have the agreement in RAN4, we can send them to RAN1. We see the intention to leave more flexibility for UE to implement.

Qualcomm: we recognize the capability is initiated by RAN1. If RAN4 identifies some difficulty to implement, RAN4 can give the feedback. There is implementation and challenge.

Apple: question to Qualcomm to clarify the motivation. Is the intention to enable DL CA or UL&DL CA?

China Telecom: to Qualcomm, is the proposal for 30-4 or 30-4a/b/c? We cannot reach any agreement for 30-4a/b/c. When RAN1 starts their work, they can take our input. To Apple, this proposal can be applied to DL CA or DL&UL CA.

Mediatek: we need be careful not to confuse RAN1. We should not send LS based on the LS sent in the last meeting. We should wait for RAN1 decision.

Qualcomm: LS does not say RAN4 has concluded. It is open item. To CTC, our view, 30-4 and 30-4a/b/d should be per band per band combination. To Apple it is for future release.

Samsung: we agree with Huawei and Mediatek.

**Issue 1-2: Pcmax reference time**

* **Background:**
  + In TS 38.214 v17.1.0 section 6.1.7 it states that “The UE shall maintain power consistency and phase continuity within an actual TDW…”.
* **Proposals**
  + Option 1: Define Pcmax reference time as “Actual TDW” for DMRS bundling. (QC)
    - QC: TS 38.214 and TS 38.101-1 are not aligned for the power control timing parts.
* **Recommended WF**
  + Discuss in GTW

**Discussion:**

Huawei: we would like to better understand the intention for the change. It is clearly defined in RAN1 and RAN4 during actual TDW as long as the feature is activated UE needs to maintain the phase continuity. No need to clarify.

Apple: 38.213 has already defined what transmission occasion is.

Mediatek: last meeting we asked the question about the ambiguity. We should wait for RAN1 response and discussion.

Qualcomm: To Huawei, we do not agree on the actual spec. Physical channel length last for a number of OFDM symbols. If 38.214 is not aligned with TS38.101-1, 214 says that UE needs to maintain in the whole bundling. To Apple, why is there LS to ask the alignment if transmission occasion is well defined? Maybe the 38.101-1 is misaligned with UE behaviour. To MTK, we do not think RAN1 will discuss. We can wait for the next meeting.

Ericsson: our view is that in the test we only test UE capability which is the maximum time for UE to keep to consistent. That is not specified from power perspective. We do not see the need to update the Pcmax. If the actual TDW really needs be updated, we need further discuss how we should reflect this.

Qualcomm: It just means removing the whole Pcmax section.

**Issue 1-1: FR1 inter-band CA and SUL with DMRS bundling**

* **Background: RAN4 LS to RAN1 in R4-2211225**

*RAN4 discussed whether applying DMRS bundle to FR1 inter-band UL CA would have any RAN1 spec impacts, and would appreciate RAN1 feedback before making further decision:*

|  |
| --- |
| *Considering DL CA with “additional” UL carrier configured with SRS only (i.e. no PUCCH/PUSCH configured) with the following conditions:*   * *For carrier switching back and forth between UL carrier and SRS carrier, if the switching happens within the DMRS bundling duration, then the phase continuity is not maintained by the UE.*   *Considering FR1 inter-band UL CA with DMRS bundling with following conditions:*   * *UE shall only have ongoing transmissions on a single uplink carrier at the same time. If overlapping transmissions of PUSCH, PUCCH, and/or SRS are erroneously scheduled/configured by the gNB on more than one carrier, then the phase continuity of DMRS bundling will be broken.* * *Only configuration of a single TAG is supported.* * *If there is any carrier switching back and forth between two carriers and the switching happens within the DMRS bundling duration, then the phase continuity is not maintained by the UE.* * *Can only one band can be configured with DMRS bundling at a time?* |

*RAN4 also discussed whether applying DMRS bundle to SUL would have any RAN1 spec impacts, and would appreciate RAN1 feedback before making further decision:*

|  |
| --- |
| *Considering SUL with DMRS bundling with following conditions:*   * *Can only one band can be configured with DMRS bundling at a time?* * *If there is any carrier switching back and forth between SUL and NUL carriers and the switching happens within the bundling duration, then the phase continuity is not maintained by the UE.* |

* **Proposals** 
  + Proposal 1: Ran4 to define DMRS bundling requirement applicability to cover FR1 inter-band UL CA with the restriction that UE is not schedule to transmit simultaneously on two bands (Qualcomm)
  + Proposal 2: Ran4 to define DMRS bundling requirement applicability to cover SUL band (Huawei)
* **Moderator’s Recommendation**
  + From RAN4 perspective, it is feasible to define DMRS bundling requirement applicability to cover the following 3 scenarios:
    - FR1 inter-band UL CA with the restriction that UE is not schedule to transmit simultaneously on two bands
    - SUL band
    - DL CA with “additional” UL carrier configured with SRS only
  + RAN4 CRs on DMRS bundling requirements applicability for the above 3 scenarios can be agreed ONLY if:
    - it is also confirmed as feasible from RAN1 perspective, and,
    - based on the conditions stated in the RAN4 LS to RAN1 in R4-2211225 as well as other conditions (if any) introduced in RAN1

**Discussions:**

Apple: our view is quite clear that we do not consider UL CA and SUL. They are not the scope of physical layer design. It is premature. We do see the benefit for UL-CA scenario. This work is definitely worthy to see in Rel-18. Strongly urge proponents to propose them for Rel-18.

Ericsson: it seems like inter-band UL CA has already been agreed in the latest spec. There are something that need be clarified here. For the detailed analysis, we need wait for RAN1.

ZTE: for inter-band UL CA, it should be supported. The consistence can be maintained in one carrier.

Huawei: in last meeting, we agreed that we should wait for RAN1 decision.

China Telecom: firstly, we support the scenarios here. The use of SUL is to extend the coverage. SUL+DMRS bundling would be beneficial. We would like to clarify RAN1 meeting starts next week. We are OK to postpone the discussion. Regarding Ericsson discussion on the UL-CA, actually the CR for UL-CA has been agreed in the merged final.

Mediatek: we should wait for RAN1. Last meeting we agree the DL CA with one uplink configured. We should wait.

Qualcomm: to Apple, how feasible to propose them for Rel-18. Can Apple comment? Is there any activity in RAN1?

Apple: In Rel-17 RAN1 will discuss the LS we sent. From our side, we think the physical layer design cannot be adapted to UL-CA.

**Issue 1-1A: RAN4 specfication for FR1 CA DMRS bundling**

* **Background:**
  + *The CR in R4-2207659 (content shown below) was marked as agreed in the RAN4 #103e final EOM report and already implemented in v17.6.0 of TS 38.101-1.*

|  |
| --- |
| 6.4A.2.3 Transmit modulation quality for inter-band CA For inter-band carrier aggregation with one uplink carrier assigned to one NR band, the transmit modulation quality requirements in subclause 6.4.2 apply including phase continuity requirements for DMRS bundling [IE name].  For inter-band carrier aggregation with two contiguous carriers assigned to one NR band, the transmit modulation quality requirements in subclause 6.4A.2.1 apply for those carriers.  For inter-band carrier aggregation with two uplink non-contiguous carrier assigned to one NR band, the transmit modulation quality requirements in subclause 6.4A.2.2 apply for those carriers.  For inter-band carrier aggregation with uplink assigned to two NR bands, the transmit modulation quality requirements shall apply on each component carrier as defined in clause 6.4.2 with all component carriers active: PCC with PRB allocation and SCC without PRB allocation and without CSI reporting and SRS configured. For DMRS bundling [ IE name], requirements for phase continuity in clause 6.4.2.5 apply for PCC when SCC has no UL allocation for the duration of the bundle on PCC.  For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per operating band), the transmit modulation quality requirements specified in subclause 6.4.2 apply for the NR band supporting one component carrier, and for the NR band supporting two contiguous component carriers the requirements specified in subclause 6.4A.2.1 apply. |

* **Recommended WF**
  + Discuss in GTW

**Discussions:**

China Telecom: it seems that the CR was mistakenly marked as agreed and implemented.

Apple/Mediatek: in last meeting, only DL CA with one uplink carrier configured was agreed.

**Chair=>** Double check with MCC. If there was a mistake, consider email to RAN1 chair or session chair to avoid confusion. Ask for help from rapporteur company to check if there is a big confusion in RAN1.

### 9.17 Further enhancements on MIMO for NR

#### 9.17.5 Moderator summary and conclusions

**[104-e][113] NR\_feMIMO\_maintenance, AI 9.17.1 – Taekhoon Kim**

**R4-2214091 Email Discussion Summary for [104-e][113] NR\_feMIMO\_maintenance**

*Type: other For: Information  
 Source: Moderator (Samsung)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Withdrawn.**

### 9.18 Support of reduced capability NR devices

#### 9.18.6 Moderator summary and conclusions

**[104-e][114] NR\_RedCap, AI 9.18.1, 9.18.2 – Chunhui Zhang**

**R4-2214092 Email Discussion Summary for [104-e][114] NR\_RedCap**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214231 (from R4-2214092).**

**R4-2214231 Email Discussion Summary for [104-e][114] NR\_RedCap**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| [R4-2213150](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213150.zip) | R4-2214615 | CR for 38.101-1 to correct the errors for FR1 RedCap UE | Huawei, HiSilicon | Revised |  |
| [R4-2213250](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213250.zip) | R4-2214620 | CR on RedCap RF to add section 6.1I | Ericsson, Huawei, Qualcomm Incorporated | Revised |  |

### 9.24 Additional enhancements for NB-IoT and LTE-MTC

#### 9.24.7 Moderator summary and conclusions

**[104-e][123] LTE\_NR\_Other\_WI, AI 10.17, 10.18, 9.24.1 – Jin Wang**

## 10 Rel-18 spectrum related WIs for NR

### 10.1 Issues arising from basket WIs but not subject to block approval

#### 10.1.2 Moderator summary and conclusions

**[104-e][115] NR\_Baskets\_Part\_1, AI 10.1 – Dominique Brunel**

**R4-2214093 Email Discussion Summary for [104-e][115] NR\_Baskets\_Part\_1**

*Type: other For: Information  
 Source: Moderator (Skyworks)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214232 (from R4-2214093).**

**R4-2214232 Email Discussion Summary for [104-e][115] NR\_Baskets\_Part\_1**

*Type: other For: Information  
 Source: Moderator (Skyworks)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214425 | WF on band combinations request and fallback rules | Apple, Huawei, Nokia, Samsung |  |
| R4-2214426 | WF on triple beat MSD of UL DC\_3C\_n28A | Huawei, HiSilicon |  |
| R4-2214427 | [duplicated tdoc number] |  | withdrawn |
| R4-2214428 | [duplicated tdoc number] |  | withdrawn |
| R4-2214429 | [duplicated tdoc number] |  | withdrawn |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| [R4-2213102](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213102.zip) | R4-2215017 | TP for TR 38.818-02-01 to include CA\_n3-n26 | Ericsson, Telstra | To be revised | Moved from basket to add harmonic mixing MSD |
| [R4-2213103](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213103.zip) | R4-2215018 | TP for TR 38.818-02-01 to include CA\_n7-n26 | Ericsson, Telstra | To be revised | Moved from basket to add harmonic mixing MSD |
| [R4-2213108](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213108.zip) |  | TP for TR 38.818-03-01 to include CA\_n1-n7-n26 | Ericsson, Telstra | Return to | Pending lower order BC in R4-2213103 |
| [R4-2213110](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213110.zip) |  | TP for TR 38.818-03-01 to include CA\_n3-n7-n26 | Ericsson, Telstra | Return to | Pending lower order BC in R4-2213103 |
| [R4-2213112](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213112.zip) |  | TP for TR 38.818-03-01 to include CA\_n7-n26-n78 | Ericsson, Telstra | Return to | Pending lower order BC in R4-2213103 |
| [R4-2213113](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213113.zip) |  | draft CR 38.101-1 to add new NR CA combinations | Ericsson, Telstra | Return to | Pending lower order BC in R4-2213103 |
| [R4-2213126](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213126.zip) | R4-2215023 | TP for 38.718-02-01 CA\_n3A-n41C with UL\_n41C | Huawei, HiSilicon | To be revised | Clarify IMD9 intra ULCA MSD and request |

### 10.2 Moderator summary and conclusions (for basket WI AI 10.3 to AI 10.13)

**[104-e][116] NR\_Baskets\_Part\_2, AI 10.3~10.8 – Iwo Angelow**

**R4-2214094 Email Discussion Summary for** **[104-e][116] NR\_Baskets\_Part\_2**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions**

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**[104-e][117] NR\_Baskets\_Part\_3, AI 10.9, 10.13 – Per Lindell**

**R4-2214095 Email Discussion Summary for [104-e][117] NR\_Baskets\_Part\_3**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions**

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**[104-e][118] NR\_Baskets\_Part\_4, AI 10.10~10.12 – Johannes Hejselbaek**

**R4-2214096 Email Discussion Summary for** **[104-e][118] NR\_Baskets\_Part\_4**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions**

### 10.14 Rel-18 band combinations for concurrent operation of NR/LTE Uu bands/band combinations and one NR/LTE V2X PC5 band

#### 10.14.3 Moderator summary and conclusions

**[104-e][120] NR\_LTE\_V2X\_PC5\_combos\_R18, AI 10.14 – Qiuge Guo**

**R4-2214098 Email Discussion Summary for [104-e][120] NR\_LTE\_V2X\_PC5\_combos\_R18**

*Type: other For: Information  
 Source: Moderator (CATT)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214233 (from R4-2214098).**

**R4-2214233 Email Discussion Summary for [104-e][120] NR\_LTE\_V2X\_PC5\_combos\_R18**

*Type: other For: Information  
 Source: Moderator (CATT)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2211744 | R4-2214902 | Draft TR 37.xxx v0.0.1 TR skeleton for R18 Uu+V2X band combinations | CATT | Revised |  |
| R4-2213168 |  | Draft CR for TS 38.101-1, Introduce new band combination of V2X\_n3A-n47A | CATT | Return to |  |
| R4-2213169 |  | Draft CR for TS 38.101-3, Introduce new band combinations of V2X\_n3A\_47A | CATT | Return to |  |
| R4-2213170 |  | TP on coexistence study of V2X\_n3A-n47A and V2X\_n3A\_47A | CATT | Return to |  |

### 10.15 High-power UE operation for fixed-wireless/vehicle-mounted use cases in LTE bands and NR bands

#### 10.15.4 Moderator summary and conclusions

**[104-e][121] LTE\_NR\_HPUE\_FWVM, AI 10.15 – Man Hung Ng**

**R4-2214099 Email Discussion Summary for [104-e][121] LTE\_NR\_HPUE\_FWVM**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214234 (from R4-2214099).**

**R4-2214234 Email Discussion Summary for [104-e][121] LTE\_NR\_HPUE\_FWVM**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214432 | TP to TR 37.829: PC1 A-MPR and MPR for bands n71 and n85 | Nokia, Skyworks |  |

### 10.16 CAB-radio - High Power UE support for band n100 and n101 for Rail Mobile Radio (RMR) in Europe

#### 10.16.3 Moderator summary and conclusions

**[104-e][122] Railway\_HPUE\_n100-n101, AI 10.16 – Ingo Wendler**

**R4-2214100 Email Discussion Summary for** **[104-e][122] Railway\_HPUE\_n100-n101**

*Type: other For: Information  
 Source: Moderator (UIC)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Noted.**

**Conclusions after 1st round**

The email thread [122] was closed after the 1st round.

### 10.17 Rel-18 downlink interruption for NR and EN-DC band combinations at dynamic Tx switching

#### 10.17.3 Moderator summary and conclusions

**[104-e][123] LTE\_NR\_Other\_WI, AI 10.17, 10.18, 9.24.1 – Jin Wang**

**R4-2214101 Email Discussion Summary for [104-e][123] LTE\_NR\_Other\_WI**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Noted.**

**Conclusions after 1st round**

Email thread of [123] was closed after 1st round.

### 10.18 Additional NR bands for UL-MIMO in Rel-18

#### 10.18.3 Moderator summary and conclusions

**[104-e][123] LTE\_NR\_Other\_WI, AI 10.17, 10.18, 9.24.1 – Jin Wang**

### 10.19 APT 600 MHz NR band

#### 10.19.6 Moderator summary and conclusions

**[104-e][124] NR\_600MHz\_APT, AI 10.19 – Christian Bergljung**

**R4-2214102 Email Discussion Summary for** **[104-e][124] NR\_600MHz\_APT**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214235 (from R4-2214102).**

**R4-2214235 Email Discussion Summary for [104-e][124] NR\_600MHz\_APT**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214433 | WF on system parameters for APT 600 MHz. | Huawei, HiSilicon |  |
| R4-2214434 | WF on BS requirements for APT 600 MHz. | Nokia, Nokia Shanghai Bell |  |
| R4-2214435 | WF on UE requirements for APT 600 MHz. | Skyworks Solutions Inc |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2211529 | R4-2214878 | Workplan for Introduction of APT 600 MHz band | Spark NZ Ltd, Nokia | To be revised |  |
| R4-2211530 | R4-2214879 | Skeleton TR for APT 600MHz NR band | Spark NZ | To be revised |  |
| R4-2211532 | R4-2214880 | Text Proposals for TR 38.xxx for APT 600MHz NR band | Spark NZ Ltd | To be revised |  |
| R4-2213681 | R4-2215090 | draft CR to TS38.104 the introduction of APT600MHz | ZTE Corporation | To be revised |  |
| R4-2214001 | R4-2215102 | Introduction of APT 600 MHz band | Qualcomm Incorporated | To be revised |  |

**GTW on Aug-17**

**Sub-topic 2-2 channel bandwidth**

Sub-topic description: channel bandwidth and possible support of asymmetric bandwidths

Open issues and candidate options before e-meeting:

**Issue 2-2-1: supported channel bandwidth**

* Proposals
  + Option 1: follow the WID (see e.g. R4-2214001)
  + Option 2: other
* Recommended WF
  + TBA

**Issue 2-2-2: asymmetric channel bandwidths**

* Proposals
  + Option 1: shall be supported like for n71 with a mandatory set
  + Option 2: asymmetric BCS shall not be mandated
  + Option 3: to be considered further (R4-2213679)
  + Option 4: not specified in this WI
* Recommended WF
  + TBA

**Discussions:**

Moderator: the asymmetric bandwidth has been in the WID.

Skyworks: The uplink bandwidth is limited to 20MHz. The question is whether we supports the same asymmetric bandwidth as n71. We prefer to support bandwidth above 20MHz.

ZTE: We support option 3. FDD band is pending on operators’ demand.

Qualcomm: we have similar view as ZTE. We are OK to have asymmetric bandwidth especially for larger bandwidth. That is operator driven. Skyworks comment makes sense.

Telstra: we share the same view as Qualcomm and skyworks that for bandwidth < 20Mhz we can have symmetric bandwidth.

Ericsson: We needs address the Tx-Rx separation.

Moderator: Option 3 seems OK.

Nokia: we should minimize the numbers of combination set. We can only define one set.

**Agreement:**

* As per WID, to support DL bandwidth larger than 20MHz, specify the asymmetric DL and UL channel bandwidth.
* For bandwidth less than or equal to 20MHz, follow Option 3.

**Sub-topic 2-3 TX/RX frequency separation**

Sub-topic description: TX/RX spacing and compatibility with n71 system parameters (e.g. use of MFBI)

Open issues and candidate options before e-meeting:

**Issue 2-3-1: UE TX/RX separation**

* Proposals
  + Option 1: Specify a RX-TX separation of -46MHz for DL/UL frequency pairs within the frequency range 617-652MHz (DL) and 663-698MHz (UL), other separations between -51 and -86MHz are used if one or both channels are not within this frequency range. (R4-2212353)
  + Option 2: -51 MHz (R4-2214001)
  + Option 3: other, state what
* Recommended WF
  + TBA

**Discussions:**

Apple: the proposal intends for inter-operation capability for existing UE in the market to support n71.

Qualcomm: 51 Tx-Rx separation fits the band. 2x40 can fully utilize the spectrum. This is not good way to use the spectrum. This is different band. 51 is better.

Skyworks: We need to support variable duplex. There needs flexibility.

Spark: we share the same view as Qualcomm, which is requested. Option 2 is more compliant.

Apple: the flexible frequency duplex can allow the use case.

Qualcomm: checking with Indian colleagues, one operator BSNL has been given 10MHz …/663-673. I am not against flexible idea. At least we would like to include -51MHz.

Apple: it is exactly possible to use flexible separation.

Skyworks: for asymmetric, should we only keep -51MHz.

Mediatek: we should only take -51MHz. For n71, Tx-Rx separate is only -46MHz.

Apple: if we fix it to 51MHz, then we cannot have existing n71 operating in this frequency range. If we do not use -46, the legacy device cannot be used.

Mediatek: 46MHz is for n71 cooperation only? If yes, there is MFBI approach. For this new band, we can only consider 51.

Apple: MFBI works only when 46 is defined.

Qualcomm: there is no requirement that n71 device should work on this new band.

Apple: it would be highly desirable to reuse n71. If we fix the separation to -51, it preclude reusing n71 device.

Spark: We agree with the compromise solution. For n71, in our region, the device does not support n71 usually.

**Agreement:**

* At least -51 Rx-Tx separation will be specified.
* FFS on the other separation and/or variable frequency separation.

**Issue 2-3-2: MFBI and duplex spacing**

* Proposals
  + Option 1: The network should use -46MHz duplex spacing and signal MBFS for n71, if the frequencies used are within the n71 frequency range to enable. (R4-2212353)
  + Option 2: other, state what
* Recommended WF
  + TBA

**Discussions:**

Apple: MFBI works only when 46 is defined.

**Sub-topic 2-4 blocking requirements, coexistence with broadcast**

Sub-topic description: discuss the need of a blocking requirement for protection from broadcast services below the band, e.g. similar to the in-band requirement for n71

Open issues and candidate options before e-meeting:

**Issue 2-4-1: protection from interference from broadcast**

* Proposals
  + Option 1: specify a requirement similar to that for n71
  + Option 2: as proposed in R4-2214001 (-15 dBm at 605 MHz with restrictions on range 3 interferer power)
* Recommended WF
  + TBA

**Discussions:**

Qualcomm: we support option 2. For option 1, the n71 requirement is derived based on TV regulation in US, i.e., 1 watts transmission power for TV. The situation in Asian pacific region is different, i.e., 200 kwatts. There are restriction depending on the offset.

Skyworks: agree with Qualcomm about the difference. However, we always discussed APT 600 implementation could work to support n71. If we do not define the same requirement, when UE implements APT 600, UE supporting n71 needs pass n71 requirements. We should make sure the implementation to support both bands.

Apple: we should not agree any option. Both specify -15 dBm. We should lower -15dBm by 7dB. We should consider UE can fulfil the blocking on both bands.

Qualcomm: it seems to suggest that device should support new band and n71. To comment not including blocking requirement, we disagree with it.

Spark: we support that most device will comply with n71 anyway.

Skyworks: we are not saying every device shall. We should make sure APT requirements allow UE to support n71.

Apple: to -15dBm, it should be -22.

Qualcomm/Mediatek: OK with -22.

Skyworks: offset should be the same?

Qualcomm: For the lowest channel, I propose to relax the value.

**Agreement:**

* Specify [-22] dBm blocking requirements for coexistence with broadcast
  + FFS whether the relaxation of -22dB for lowest channel with smaller offset

**Sub-topic 3-2 Reference sensitivity**

Sub-topic description

Open issues and candidate options before e-meeting:

**Issue 3-2: Reference sensitivity**

* Proposals
  + Option 1: as proposed in R4-2212097

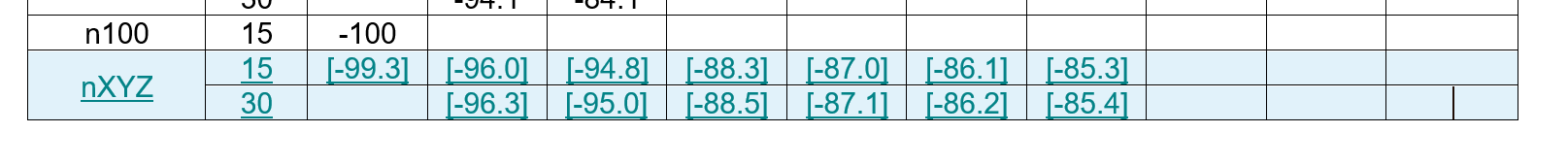
**Table 4a: REFSENS level for APT600 band**

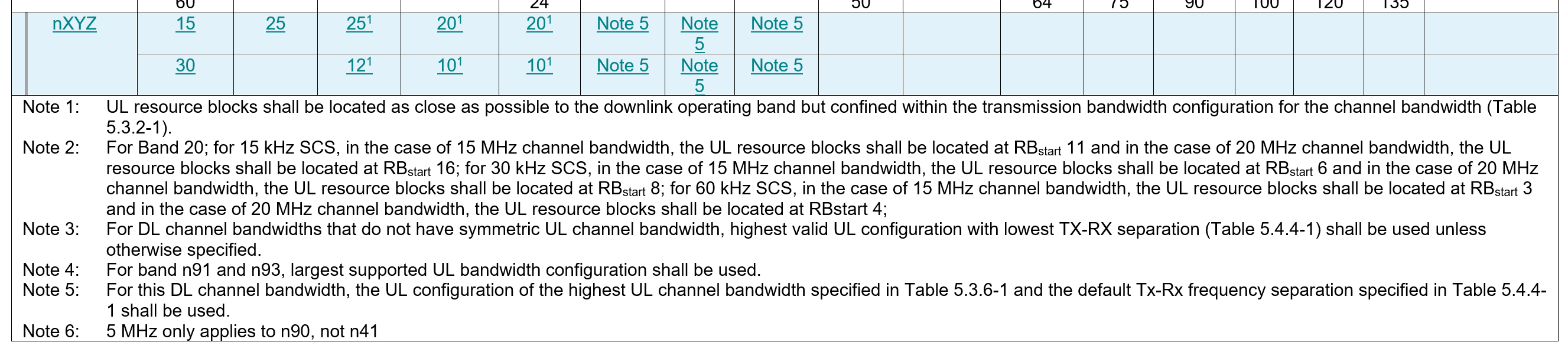
| **Operating band / SCS / Channel bandwidth** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Operating Band** | **SCS kHz** | **5**  **MHz (dBm)** | **10**  **MHz (dBm)** | **15**  **MHz (dBm)** | **20**  **MHz (dBm)** | **25**  **MHz (dBm)** | **30 MHz (dBm)** | **35 MHz (dBm)** |
| APT600  (n10X?) | 15 | -97.2X | -94.0Y | -91.6Y | -86.0Y | -84.1Y | -82.5Y | -80.7Y |
| 30 |  | -94.3Y | -91.9Y | -87.4Y | -84.2Y | -82.6Y | -80.8Y |
| Note X: 5MHz channels overlapping the 612-617MHz range are allowed [1]dB REFSENS degradation  Note Y: >5MHz channels overlapping the 612-617MHz range are allowed [0.5]dB REFSENS degradation | | | | | | | | | |

**Table 4b: UL configuration for REFSENS**

| **Operating band / SCS (kHz) / Channel bandwidth (MHz) / Duplex mode** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Operating Band** | **SCS** | **5** | **10** | **15** | **20** | **25** | **30** | **35** | **Duplex Mode** |
| APT600 | 15 | 25 | 251 | 201 | 201 | Note 5 | Note 5 | Note 5 | FDD |
| (n10X?) | 30 |  | 121 | 101 | 101 | Note 5 | Note 5 | Note 5 |  |
| Note 1: UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.3.2-1).  Note 5: For this DL channel bandwidth, the UL configuration of the highest UL channel bandwidth specified in Table 5.3.6-1 and the default Tx-Rx frequency separation specified in Table 5.4.4-1 shall be used. | | | | | | | | | |

* + Option 2: as proposed in R4-2214001





* + Option 3: other
* Recommended WF
  + TBA

**Discussions:**

Apple: comparing two values, option 2 tightens 2dB, which is not correct.

Qualcomm: the reason for tightening is that we think refsens of n71 is too relaxed. Based on our analysis, we think the reference sensitivity we proposed is the proper one.

Skyworks: Values that we proposed for n71 was better than the agreed value. Considering the larger distance, we think using current technology can maintain the same refsens. N71 requirement can be used as baseline.

Mediatek: share the same view as Skyworks. We can start with n71. For bandwidth smaller than 20MHz, we put relaxation based on TR.

Xiaomi: sensitivity for n71 can be used as the starting point. APT band has more 5MHz separation which could not bring 2dB tightening. We need more study on how to tighten.

Skyworks: at least for 5, 10 15Mhz, they are not impacted by UL transmission noise. They can be used as the starting point. We are open to discuss whether we can improve for higher bandwidth.

**Agreement:**

* For 5MHz, 10MHz, 15MHz, use the requirements of n71 as the starting point, and further discuss whether to add 0.5dB relaxation or to tighten the requirement of n71.
* For larger channel bandwidth, FFS on the improvement of reference sensitivity compared to n71.

### 10.20 Introduction of evolved shared spectrum bands

#### 10.20.5 Moderator summary and conclusions

**[104-e][125] NR\_unlic\_enh, AI 10.20 – Daniel Poop**

**R4-2214103 Email Discussion Summary for** **[104-e][125] NR\_unlic\_enh**

*Type: other For: Information  
 Source: Moderator (Apple)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214236 (from R4-2214103).**

**R4-2214236 Email Discussion Summary for [104-e][125] NR\_unlic\_enh**

*Type: other For: Information  
 Source: Moderator (Apple)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214436 | WF on NS harmonization and A-MPR for VLP | Apple |  |
| R4-2214437 | WF on NR-U PC3 requirements | Charter |  |
| R4-2214438 | WF on NR-U MPR/A-MPR | Skyworks |  |
| R4-2214439 | WF on channel raster extension for NR-U 6GHz bands | Apple |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2212337 | R4-2214952 | Work plan for enhancing operation in unlicensed bands for NR | Apple | revised | Work plan and work split requires adjustment according to first round comments |
| R4-2212339 | R4-2214953 | LS on extending the maximum range for NS values | Apple | revised | LS to RAN2 requesting extension of additionalSpectrumEmission IE to cover the additional need for unlicensed bands |

**GTW on Aug-17**

**Sub-topic 2-3 (Expanding range for NS values)**

With the large amount of new network signaling values the limit for the available NS values is at least hit for band n96. It is expected that more values are required in the future. The existing additionalSpectrumEmission IE is encoded as a 3-bit value thus allowing 8 different values.

**Issue 2-3: Expanding range for NS values**

* Proposals
  + Option 1: Send LS to RAN WG2 asking to extend the existing range of NS values up to 32.
  + Option 2: Other (please specify)
* Recommended WF
  + TBA

**Discussions:**

Qualcomm: I have a concern. I wonder if the traditional approach is better solution. We want to step back to consider if there is a better way to do this.

Charter: if we go with Option 1, we support it. Otherwise, people to fight the limited values.

Skyworks: Agree with thinking about whether we should consider the better idea. We probably need more. One option is to use one value for different modes. For example for Korean, we can use one NS value for two modes.

LGE: our preference is option 1, because we need acquire NS value and at the same time we can discuss the better solution. On one hand we can ask for extension of values. On the other hand, we can discuss the better solution in RAN4.

Mediatek: our preference is Option 1. The five bit extension is enough. Better solution is not precluded.

Ericsson: one other option is to use different band number within the same range. There is enough available number for bands.

T-Mobile USA: we can use mobile country codes.

**Agreement:**

* Send LS to RAN WG2 asking to extend the existing range of NS values up to 32.
  + The extension is applicable for unlicensed band
* Further discuss the better solution to address the issue of running out the NS values.

**Issue 3-1: PC3 ACLR requirement**

* Proposals
  + Option 1: Remove ACLR requirement for both PC5 and PC3
  + Option 2: Same 27dB ACLR requirement for PC5 and PC3
  + Option 3: Same 30dB ACLR requirement for PC3
  + Option 4: Other (please specify)
* Recommended WF
  + TBA

**Discussions:**

Skyworks: if looking at the competition tech, it has no such requirement. If we use 30dB ACLR for PC3, in the case we use 2Tx (two PC5) there would be no power gain.

Huawei: we consider the co-existence when deciding the ACLR.

Skyworks: we had some results for it.

Nokia: we have the same understanding. For NR-U, we have relative mask.

Huawei: in our understanding, when deciding ACLR, we do the co-existence study. In this case, if we would like to take 27 ACLR, we should have more analysis on this aspects

**Agreement**

* Evaluate ACLR for 27 and 30dB to be able to make an informed decision
  + Co-existence study is needed for evaluation of 27dB ACLR

**Sub-topic 5-1 (Channel at band edge)**

3GPP bands n96 and n102 both start at 5925MHz. However, no channel raster points were defined that would allow utilizing first 20MHz chunk of spectrum, i.e. 5925-5945MHz. This sub-topic discusses the introduction of additional channel raster points enabling true edge channel support for the named bands.

**Issue 5-1-1: New channels at band edge**

* Proposals
  + Option 1: Additional channels should map to the current A-MPR values or to the in-band PSD limited A-MPR as proposed in R4-2211606. Additional channels validity should be clarified per NS.
  + Option 2: Channel at band edge which have larger A-MPR than current edge channels shall be downlink only
  + Option 3: As a baseline, enable first 20MHz for band n96 and n102 only for NR-U DL channels.

First 20MHz can be considered for NR-U UL channels later (depending on the progress of the technical work).

* + Option 4: Do not define the additional channel raster points
  + Option 5: Other (please specify)
* Recommended WF
  + TBA

**Discussions:**

LGE: it depends on the country region. The starting point can be different depending on country. In Korea, 20MHz is not available. Option 4 works.

Skyworks: similar to LGE. There are bands where these additional channel are not feasible or it will require higher MPR than the existing. If we introduces the new channel bandwidth, they need be optional for some bands. One way is to enable additional channels as optional using the existing NS values.

Charter: we have same view. Pending on the region, the higher A-MPR is needed. We support option 4.

Apple: we prefer not to define. Option 2 and 4 would be way forward.

Qualcomm: same comment. We can assume DL only and base station can meet the emission requirement.

Skyworks: we agree that if we use DL only the BS can decide whether to implement the channel or not depending on local regulation. For country there is no out-of-band requirements, what should we do? Are we open to see the UL?

Qualcomm: either option 4. We just do DL only and sacrifis the UL.

Skyworks: there are cases. Only sub-band is used. The channel space is not always ideal and there is no out-of-band requirements.

**Agreement:**

* Down-select to Option 2 and Option 4.

## 11 Rel-18 non-spectrum related work items and study items for NR

### 11.1 Study on Efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths

#### 11.1.3 Moderator summary and conclusions

**[104-e][129] FS\_NR\_eff\_BW\_util, AI 11.1 – Esther Sienkiewicz**

**R4-2214107 Email Discussion Summary for** **[104-e][129] FS\_NR\_eff\_BW\_util**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214240 (from R4-2214107).**

**R4-2214240 Email Discussion Summary for [104-e][129] FS\_NR\_eff\_BW\_util**

*Type: other For: Information  
 Source: Moderator (Ericsson)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2212779 |  | Clarification of carrier grid and channel bandwidth mapping to the channel raster (TS 38.104) | Ericsson | Return to in 2nd round | Depending on outcome of Issue 2-1 |
| R4-2212782 |  | Carrier resource grid mapping to channel raster and use of UE-specific bandwidth (TS 38.101-1) | Ericsson | Return to in 2nd round | Depending on outcome of Issue 2-1 |
| R4-2212785 |  | Carrier resource grid mapping to channel raster and use of UE-specific bandwidth (TS 38.101-1) | Ericsson | Return to in 2nd round | Depending on outcome of Issue 2-1 |

**GTW on Aug-19**

**Sub-topic 2-1**

Sub-topic description: In order to avoid any misinterpretation of the details described in company contributions, the proposals have been copied/pasted exactly from the contributions. If proponent companies believe their proposal can be merged with other proposals (i.e. there is duplicates) to help narrow down options please indicate this in the comments.

**Issue 2-1: UE interpretation of CBW in SIB1**

* Please indicate which proposals would be acceptable:
  + Proposal 1: For the case that the channel bandwidth smaller than the actual BS channel bandwidth is indicated in SIB1, it should be supported that UEs supporting wider bandwidth could be reconfigured with a UE-specific channel bandwidth wider than the one indicated in SIB1, if needed. [China Telecom, Qualcomm]
  + Proposal 2: The carrierBandwidth in SIB1 should correspond to the maximum transmission bandwidth configuration NRB defined in TS 38.101-1/2, so that UE can map it unambiguously to a regular UE channel bandwidth. [China Telecom]
  + Proposal 3: To change the last bullet for agreement to: SIB1->servingCellConfigCommon is used to determine the initial channel bandwidth and location setting for UEs in a cell. servingCellConfig may be further signalled to change the channel bandwidth for a dedicated UE. [Intel]
  + Proposal 4: Unless the network configures a UE with a dedicated channel BW, the network has no knowledge of the channel bandwidth employed by the UE. [Qualcomm]
  + Proposal 5: The carrier bandwidth signalled either in SIB1 or the dedicated signalling must correspond to one of the existing carrier bandwidths as defined in TS 38.101-1. [Apple]
  + Proposal 6: the carrierBandwidth in SIB1 (and in dedicated signaling of common parameters) is the size of the resource grid of the downlink or uplink carrier used for transmitting to or receiving from UEs connected to the BS [Ericsson]Proposal 10: SIB1 broadcast bandwidth provides an upper limit on the UE specific channel bandwidth which a UE chooses for the initial access to the cell, and does not need to be the BS channel bandwidth, and can be configured with any value no more than the maximum value. [ZTE]
  + Proposal 7: make clear in the Rel-15 versions of 38.101-1, 38.101-2 and 38.104 that the carrierBandwidth in SIB1 (and in dedicated signaling of common parameters) is the size of the resource grid of the downlink or uplink carrier used for transmitting to or receiving from UEs connected to the BS [Ericsson]
* Recommended WF
  + TBA

**Discussions:**

ZTE: we could align the understanding whether the SIB1 carrierBandwidth corresponds to BS channel bandwidth.

Apple: Whether we mandate the SIB1 carrierBandwidth to BS channel bandwidth is the key question.

Ericsson: In our view the SIB1 carrierBandwidth is the BS transmission bandwidth configuration. It is the carrier grid size. One carrier per Cell. It has no relation to the maximum value specified for BS and it has not exact to be the same such specified value in 38.104. For conformance test it is the same as the specified value in 38.104, say corresponding to the maximum value specified BS. It is one bandwidth per cell per numerology. Initially there is no only one grid and UE bandwidth is added later. The reason for change when UE specific bandwidth is introduced is that UE needs determine how to access for initial access. Please refer to RP-182896 in RAN plenary in December 2018

China Telecom: SIB1 carrierBandwidth can be any number.

CMCC: Companies view are aligned.

Intel: agree with ZTE proposal. For Apple and Ericsson, we agree but need more discussions.

Huawei: Agree with CMCC that there is no need to restrict the size of SIB1 bandwidth. The question is whether the UE can be configured with dedicated channel bandwidth that is wider than the carrierBandwidth in the SIB1. Whether the capability is needed is still FFS.

Nokia: what we are more interested is whether UE can support bandwidth beyond the SIB1 channel bandwidth.

T-Mobile USA: we agree with Nokia. We agree with Huawei view. RAN2 thought there is no problem in RAN2 but cannot guarantee the legacy UE. There may be new signaling and new UE capability to address legacy UE case.

Ericsson: we should not change the intended behaviour just because the implementation does not follow the initial intention.

Apple: if we broadcasts something that UE cannot support, there would be problem.

Intel: From Nokia and Chinatelecom, I do not see the initial BWP should be wider than the BWP supported by UE.

CMCC: for UE behaviour, if UE supports the smaller or equal to the bandwidth in the initial access BWP, UE should access that the cell. We do not see the restriction that dedicated BWP should be smaller than SIB1 carrierBandwidth.

Intel: we want to clarify the definition of carrier resource grid. The initial bandwidth part is set in the grid but the dedicated signalling can change it.

China Telecom: it may be related to Rel-15 specification. We propose to reflect the agreement in Rel-15 spec.

Ericsson: carrier resource grid has the starting point and ending point. SIB1 is the fixed number. The relation of sync GSCN raster and SIB1 cannot be changed on fly.

**Agreement:**

* RAN4 common understanding are
  + In the current specification
    - SIB1 carrierBandwidth corresponds to BS transmit bandwidth configurations, which is not mandated to be the maximum BS transmission bandwidth configuration specified in TS38.104 and can be any values in MHz.
    - The dedicated channel BWP has to be configured within resource grid (refer to Clause 4.4 and Clause 4 in 38.211).
      * FFS whether the resource grid can be changed by signalling such that it is different from the SIB1 carrierBandwidth
    - Check how UE selects the channel bandwidth for the case when SIB carrierBandwidth is not supported by UE.
      * Check it for the initial access and connected mode separately.
  + In Rel-18, a new UE capability may be needed to indicate that a UE can be configured with a channel BW wider than the carrier Bandwidth in SIB1.

**Issue 2-3: 100 kHz channel raster**

* Proposals
  + Option 1: neither CBW in SIB1 nor UE dedicated CBW need to be aligned with 100 kHz channel raster [ CMCC, Apple]
  + Option 2: For Rel-18, it is possible to consider further enhancements that the FR1 low-frequency bands can be also SCS aligned [Apple]
  + Option 3: Unknown UE behaviour whether UEs will work with channels that are not configured on the defined channel raster [Qualcomm]
  + Option 4: global raster of 5 kHz could be applied [China Telecom]
    - Option 4a: UE vendors to confirm with legacy UEs can support Option 4. [Huawei]
  + Option 5: The channel raster signaling granularity/flexibility has no relationship with the valid channel raster positions. [Qualcomm]
  + Option 6: the carrier resource grid (SIB1) shall be on the channel raster for at least one numerology UE specific bandwidth need not be on the raster; a restriction that the UE specific bandwidth be located on the 100 kHz channel raster would imply that is it impossible to locate any UE channel bandwidth with an odd/even-sized maximum transmission bandwidth configuration within a wider carrier resource grid with an even/odd-sized carrierBandwidth (SIB1) for SCS = 15k, while a channel bandwidth with an even/odd-sized maximum transmission bandwidth configuration can only be located with 5 PRB granularity within this resource grid. [Ericsson]
  + Proposal 7: at least allow some exceptions that channel raster could not be aligned with SIB1 CBW nor UE dedicated CBW especially when UE dedicated CBW is not aligned with CBW in SIB1. [CMCC]
* Recommended WF
  + TBA

**Discussions:**

Moderator: the key issue is whether the dedicated channel bandwidth should be located at 100KHz raster.

Ericsson: UE specific bandwidth has not to be located at 100KHz raseter. SIB1 has to be on the 100KHz raster.

ZTE: This issue is originated from the fact that in RAN1 and RAN4 we use the different reference points. UE specific channel bandwidth should be on the 100KHz raster. SIB1 is not predefined channel bandwidth in RAN4 specification. SIB1 is part of BS bandwidth which may be unknown to UE.

CMCC: during our test, both SIB1 and UE specific bandwidth do not need be aligned with 100KHz raster.

Huawei: this is related to legacy UE. We would like to check with UE vendors. Whether the legacy UE can support the channel raster other than 100KHz. I do not think it is related to SIB1 raster.

Ericsson: From RAN1 specification, it does not have to be aligned with channel raster. But 100KHz raster is chosen for legacy spectrum, which has to be aligned with LTE to support EN-DC on the same carrier. There is no limitation in the configuration in RAN1. But there is RAN4 specification related to channel grid that SIB1 should be on the raster. It is different from SCS based bands. Resource grid advertised by SIB1 should be on 100KHz.

Qualcomm: tend to agree with Ericsson. RAN4 specification assumes that UE should be on the channel raster of 100KHz. If not the UE performance cannot be guaranteed.

China Telecom: based on our understanding and field test, UE specific channel bandwidth has not to be on the 100KHz raster. For SA deployment, there should be possible. For LTE-NR co-existence there would be issue.

CMCC: 100KHz is due to co-existence with LTE. But not always we need co-exist with LTE. If there are LTE and NR, we should configure on 100KHz raster. To ZTE, if SIB1 should be, UE specific does not need to be on 100KHz, how does UE can work in idle mode?

Apple: SIB1 Carrier is a real carrier. UE can know the channel bandwidth from SIB1. UE may not know BS maximum transmission bandwidth. RF center frequency mapping table is used to help UE set the DC frequency to make sure UE to fulfil the regulatory requirements. UE dedicated channel bandwidth does not need to be aligned with 100KHz. UE should follow BS. SIB1 has not to be located on 100KHz for some case.

**FFS on the following bullet:**

* For the current RAN4 specification, UE dedicated channel bandwidths and BWPs do not have to be aligned with the 100 kHz raster.

### 11.2 Study on enhancement for 700/800/900MHz band combinations for NR

#### 11.2.4 Moderator summary and conclusions

**[104-e][130] FS\_NR\_700800900, AI 11.2 – Huiping Shan**

**R4-2214108 Email Discussion Summary for [104-e][130] FS\_NR\_700800900**

*Type: other For: Information  
 Source: Moderator (CATT)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214241 (from R4-2214108).**

**R4-2214241 Email Discussion Summary for [104-e][130] FS\_NR\_700800900**

*Type: other For: Information  
 Source: Moderator (CATT)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214445 | WF on study on FS\_NR\_700800900 | CATT |  |

**GTW on Aug-23**

**CA\_n5-n8**

**2.2.1 Spectrum restriction assumption for the analysis**

The following spectrum restriction can be used as the assumption for further CA\_n5-n8 UE RF analysis:

|  |  |  |
| --- | --- | --- |
|  | UL | DL |
| Frequency 1 (800MHz) | 824MHz - 835MHz | 869MHz - 880MHz |
| Frequency 2 (900MHz) | 904MHz - 915MHz | 949MHz - 960MHz |

*Comments from companies:*

Apple: Despite the above frequency restriction may be applicable to a specific operator, it should not be used as a baseline for front-end filter implementation feasibility study as the filter design should cover the full band ranges in order to support the single-band operation in different regions.

ZTE: Dedicated filter may need to be studied.

OPPO: Our understanding on the above restriction means that RAN4 only support this frequency ranges in this band combination. And UE need to consider how to implement such band combination. But meanwhile, we share similar view as Apple, the RF component study should be common for future cases.

Samsung: Share similar view with Apple.

China Unicom: As there is frequency overlapping between n5 DL and n8 UL, spectrum restriction would be needed for the study of CA feasibility. This table is proposed as example bands as part of the study.

China Telecom: In our understanding, the feasibility study shall be based on the standard filter which cover the full band ranges, but can be better adapted for the CA\_n5-n8 with the frequency restriction, also to see if the requirements are acceptable or additional requirements need to be defined.

Qualcomm: In our view making spectrum restrictions give RAN4 still two alternatives for further studies in upcoming meetings; to assume full n5/n8 RF filters (baseline) or to assume restriction-specific RF filters. This was also captured in SI description notes 1 and 2. The implications of these two alternatives are of course completely different in magnitude.

Huawei: We can start to work based on the frequency restriction as listed above. In addition, we are open to hear other operators’ inputs about the frequency restriction to enlarge the eco-system as soon as possible. To Qualcomm, the baseline implementation has been specified in this SI, but I don’t think the frequency restriction-specific RF filters are excluded.

Skyworks: we are fine to assume that filters should cover the full band but then it implies for a 2 antenna case that there is non simultaneous Tx/Rx for n8UL with n5DL at least for one of the DL path (ie n5DL could operate as 1Rx while transmission in n5 with the related MSD for the proposed range. I suggest that both 2 and 3 antenna architecture are studied, in the case of a third antenna there may still be options for an optimized filter.

Vivo: What is the impact of this frequency restriction on RF architecture? Whether Full Range RF components or Partial Range RF components can be used as baseline?

**Discussions:**

Skyworks: what is the UE architecture for full band or adapting to part of bandwidth. All the options should be kept.

Nokia: about the restriction it would be OK. We need study if it is possible to realize the spectrum with supporting of full range of spectrum. It is only for CA mode, which is understandable. But if UE is only configured with one band, such UE cannot deal with the full range due to support CA and have restriction. Then UE should not report to support the band.

Apple: share the similar view as Skeyworks and Nokia. Such restriction should not be used as baseline for filter feasibility study. The filter will be also used for single band operation.

Skyworks: UE basically supports band n8 and it should support the full frequency range. UE needs to be equipped with full band duplexer and also should support the dedicated architecture to adapt.

Huawei: To Nokia, UE can still support n8 and n5 for full frequency range when network configures the full range. This restriction is only used for CA mode. We have two options: 1) resue the current RF component 2) new tri-plexer of Qua-plexer. When UE support the single band, UE will use the legacy filter.

Verizon: this work is for specific band combination or general requirements for other frequency. If it is generic requirement, I share the view from Apple. 700 and 900 have additional restriction in our region. We do have 700 and 800 which is even worse than 800 and 900.

OPPO: the whole band is designed for global use. In the future, if we define the requirement based on the restriction, then it means that the band combination is for this specific frequency range, which should be specified.

Qualcomm: Even we agree with the restriction. It does not mean that filter is restricted for this frequency range.

China Telecom: the frequency range proposed by China Telecom and China Unicom. We have the same allocation in such frequency. We are OK with both options. We prefer Option 1 to define the requirements based on the exisiting filter. For option 2, we can agree to switch to single band filter when the single band is configured.

ZTE: in the uplink CA, two DL and one UL for n5+n8 is feasible, since there is only single band uplink. The problem exists for uplink CA. We should keep open for two options.

Xiaomi: we supports this frequency restriction and apply it to CA mode. We have concern on whether UE needs to support two filters.

Nokia: as pre-condition, there is no restriction for single band operation.

Qualcomm: how can it be managed if no new band is specified.

Skyworks: we need do beyond the diplexer. Maybe we need the specific di-plexer.

Verizon: we should work out the generic solution.

T-Mobile: we should make the signaling is clear since the frequency range is different in other regions.

**Agreement:**

* UE should support the full range of spectrum for single band operation on both n5 and n8
* Use the follow frequency ranges for further discussion for spectrum restriction to support uplink CA\_n5-n8.

|  |  |  |
| --- | --- | --- |
|  | UL | DL |
| Frequency 1 (800MHz) | 824MHz - 835MHz | 869MHz - 880MHz |
| Frequency 2 (900MHz) | 904MHz - 915MHz | 949MHz - 960MHz |

**2.3 CA\_n5-n28**

**2.3.2 CBW assumption**

* n5: 5, 10, 15, 20
* n28: 5, 10, 15, 20, 25, 30

Comments from companies:

Company A:

OPPO: For clarification, is there CBW location restriction in this band combination?

Huawei: To OPPO, I don’t think we have CBW location restriction in this band combination.

Skyworks: If all n5 and n28 CBW are to be supported in the BCS:

• n5UL is 21MHz away from n28DL => ACLR2 interference for 15 and 20MHz UL ~ IMD5 issue

• n5DL is 121MHz away from n28UL => ACLR4 interference for 30MHz UL ~ IMD9 issue should be OK

• n28 dual duplexer should be studied.

Vivo: No need to restrict CBW location.

**Discussions:**

Apple: Is there frequency restriction for n28?

Moderator: the full range should be supported. In the SID, the full range should be supported.

Huawei: we focus DL+UL CA for n5+n28.

ZTE: the supported bandwidth should be requested by operator. We have comments for all the band combinations. SI is for inter-band operation. There is no any BCS information, which should be included in the SI.

Skyworks: Echo Apple comment. In Australia and New Zeland, operators have n5 and n28 and they use the full frequency range.

**Chair => further check with operators for the required bandwidth combinations.**

### 11.3 Study on simplification of band combination specification for NR and LTE

#### 11.3.4 Moderator summary and conclusions

**[104-e][131] FS\_SimBC, AI 11.3 – Zhifeng Ma**

**R4-2214109 Email Discussion Summary for [104-e][131] FS\_SimBC**

*Type: other For: Information  
 Source: Moderator (ZTE)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214242 (from R4-2214109).**

**R4-2214242 Email Discussion Summary for [104-e][131] FS\_SimBC**

*Type: other For: Information  
 Source: Moderator (ZTE)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214446 | Revised SID for Study on simplification of band combination specification for NR and LTE | vivo, ZTE |  |
| R4-2214447 | Way forward on test burden reduction for band combination | Huawei |  |
| R4-2214448 | Way forward on FR1 2UL inter-band CA coexistence requirements | Apple |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2213595 | R4-2215080 | TR 38.846 v0.0.1\_Study on simplification of band combination specification for NR and LTE | ZTE Corporation | Revised |  |
| R4-2212736 | R4-2214978 | EXCEL template for R18 PC3 ENDC NRCA SUL V2X band combinations | ZTE Corporation | Revised |  |

**GTW on Aug-23**

**Sub-topic #2-2 (2nd round)   Working procedure for BC basket WI**

Note: There is also a parallel discussion in Thread#115. Maybe the related issues in #115 could also be taken into considerations.

**Issue 2-2A: When is the appropriate submission deadline for a new band combination request?**

* Option 1: One week prior to the RAN4 submission deadline.
* Option 2: Same deadline as RAN4 Tdoc submission.
* Option 3: 3 weeks prior to the RAN4 submission deadline (From Thread#115)

**Discusions:**

CHTTL: we strongly suggest to go with Option 2. We have set the deadline as the RAN4 tdoc submission from long time. The deadline of RAN4 tdoc submission is carefully selected.

Softbank: Option 2 is preferable considering the internal checking.

Nokia: we prefer Option 1 and live with Option 2.

Samsung: with clarification from CHTTL, we can go with Option 2.

Skyworks: If we have already made the exception to allow the late request, we should force tdoc deadline to allow the exception if the fallback mode is forgotten.

Apple: we should do it one week before. If we do it at the same time, we have contribution concerning this band combination.

KDDI: Option 2. We need time to check internally.

Skyworks: it should be hard deadline by going with Option 2.

T-Mobile: Support Option 1.

ZTE: we do not have strong opinion. We should consider the time interval between two meetings is too close. If the deadline is too close, maybe the exception should be needed. Option 2 will be suitable.

CHTTL: regarding Skyworks comment, the request and contribution cannot be submitted in the same meeting.

Apple: the short time between meetings does not account since the meeting schedule is published months ago.

**Agreement:**

* Same deadline as RAN4 Tdoc submission.
  + No request of adding new band combinations into basket WIs will be handled for bis-meeting and ad hoc meeting.
  + No new band combination is allowed to be requested after the deadline
* It is allowed to only correct the missing fallback and add more supporting companies for the proposed band combinations.

**Issue 2-2D: Can the working procedure agreed in normal CA/DC basket WIs also be applied to V2X basket WI?**

* Option 1: Yes
  + Samsung, CHTTL, Xiaomi, ZTE, Ericsson, QC
* Option 2: No

**Agreement**

* The working procedure agreed in normal CA/DC basket WIs also be applied to V2X basket WI

**Issue 2-2E: How to ensure the higher order combination not earlier than the lower order combinations in the spec?**

* Option 1: The proponent should clarify the fallback status in the TPs / draftCRs and if lower order combinations are not finished in the same meeting, the higher order combinations should be put on hold.
* Option 2: Others.

**Discussions:**

Samsung: I feel it is good chance to circulate the rule. It should be clear to state in the draft rule captured in 102 that the fallback mode should be carefully checked. The proponent should be first responsible person to make sure that the fallback modes should be included.

T-Mobile USA: we should document what the fallback means. There should be guidance for what the fallback mode is.

Apple: The numbers of fall modes should always match the number of carriers. The completed combination is only in CR or specification itself rather than TP. We really should ensure that when we do the CR for higher order combiations all the lower order combinations in the CR already.

Skyworks: it is really tricky considering band combinations with proper BCS. Checking if the fall back mode is complete is not easy. What does it mean that all the fall back should be included.

T-Mobile USA: Agree with Skyworks.

Charter: Agree with T-Mobile and Skyworks. It would be difficult to decide the fallback mode if there is clear guidance.

ZTE: If the higher order combination and lower order combination are finished in the same meeting, maybe someone checks the status after the meeting should be allowed.

CHTTL: in RAN2 spec, there is already fallback definition. Regarding option 1, this rule was agreed before and captured in the TR. Option 1 is OK. In practical people may not check if there is finished condition.

Apple: To ZTE, it is not correct to do the checking after the meeing before the CR is agreed. I do not think it can work.

Ericsson: To Apple, we should first complete TP. We should complete the combination with TP. If the 3 combiation is agreed in TP, then 4 DL combination should be allowed finished. I disagree TP is not allowed.

Apple: I do not forbit writing TPs. If the lower order combination is just in the TP, then the higher order combination should be captured in the big CR in the next meeting.

Ericsson: it is mis-understanding. Big CRs should be at the same meeting.

**Agreement:**

* Document the definition of fall back modes and the rules related to fall back mode in RAN4 TR
* The big CRs for higher and lower order band combiations should be agreed in the same meeting.
* The rapporteurs do not have blank rows in the WID spreadsheets to facilitate the readers to sort out the interested band combiantions.

**Issue 2-2F: Can the rapporteur of basket WI refuse to add any combinations to the big CR before the proponent has done the work to prove that all fallbacks have been added?**

* Option 1: Yes.
* Option 2: No.

**Discussions:**

CHTTL: it is difficult for rapporteur to check the fallback.

Skyworks: it is difficult to ask rapporteur to make it police.

Nokia: from moderator perspective, some combinations may be postponed due to lack of fall back.

Huawei: Rapporteurs cannot check all the fall backs. Postponing it or asking proponents to complete.

Charter: following agreement would be OK.

### 11.6 Further RF requirements enhancement for NR and EN-DC in FR1

#### 11.6.5 Moderator summary and conclusions

**[104-e][132] FR1\_enh2, AI 11.6 – Leo(Ye) Liu**

**R4-2214110 Email Discussion Summary for [104-e][132] FR1\_enh2**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214243 (from R4-2214110).**

**R4-2214243 Email Discussion Summary for [104-e][132] FR1\_enh2**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214449 | WF for assumptions on CPE/FWA/vehicle/industrial devices | SoftBank Corp. |  |
| R4-2214450 | WF on FR1 4Tx UE RF requirements | vivo |  |
| R4-2214451 | WF on FR1 8Rx UE RF requirements | NTT DOCOMO, INC |  |
| R4-2214452 | WF on study for lower MSD | Huawei, HiSilicon |  |

**GTW on Aug-23**

**Draft WF for assumptions on CPE/FWA/vehicle/industrial devices SoftBank Corp.**

**Agreement: (**WF for assumptions on CPE/FWA/vehicle/industrial devices can be approved)

Companies are encouraged to provide inputs on the following aspects in the next meeting to seek for convergence.

It is also likely to indicate which UE type is considered (and which is not) for each input, as these 4 types of UEs could not always share the same characteristics.

**2.1 RF parts/performance**

Different views are expressed: reusing handheld parts or considering better parts. Further inputs are expected such as:

* Possible convergence or different sets of requirements?
* Common to 4 types of UEs or specific to a certain type?

In addition, some RF requirements can be revisited because of larger form factor, i.e., better isolation or longer PCB trace/feeder for example. Opinions are also invited on this aspect.

RF component assumptions can be further considered during discussion for 4Tx and 8Rx RF requirements.

**2.2 SAR compliance**

As a general view, SAR or duty cycle scheme can be removed/relaxed. Further views are expected on the degree of modifications and the other aspects mentioned such as MPE for FWA.

SAR/MPE compliance issue can be further considered during discussion for 4Tx RF requirements.

**2.3 International operation**

For CPE, possibility of operation in a country other than its home is still diversified. Further inputs are expected, including views on the other type of devices.

It is suggested to identify whether there are requirements impact due to international operation/roaming in next meeting.

**Draft WF on FR1 4Tx UE RF requirements vivo**

**Prioritized Scope**

*Summary of 1st round discussion:*

*Majority companies support the proposed scope which is based on the first priority scope to be prioritized. The scope need further clarification on ULFPTx and its fallback mode for 4x4 UL-MIMO. Some companies express concerns on start next phase work after the completion of the prioritized scope, and one company thinks FDD for UL-MIMO is also needed.*

*Recommendations for 2nd round:*

*Discuss whether and what ULFPTx Modes and its fallback mode for UL-MIMO can be considered in the first stage. Confirm whether the tentative agreements are agreeable.*

* *Tentative agreements in 1st round discussion:*

*The following scope is prioritized and started in the first stage:*

* *Bands n41, n77/n78*
* *4x4 UL MIMO, including: 4 layers; [ULFPTx Modes and its fallback mode]*
* *UE power class: PC1.5*
* *PA configuration: 4x23dBm*

*Others would still be considered, but after the requirements are complete for prioritized scope.*

Moderator’s note: Companies are encouraged to further discuss the part with square brackets, what ULFPTx Modes and/or its fallback mode would be considered. In addition, confirmation is also needed on “consider other requirements only after complete requirements of prioritized scope”.

**Discussions:**

Moderator: whether ULFPTx modes should be included or not needs more discussions.

Qualcomm: is it PC1.5? The PA is 4x23. It is combined power class.

OPPO: we would like to understand that the [ ] is kept here. What does [] mean? It is quite complex currently. When we consider the fall back mode, we see the complexity. This is quite complex situation. We prefer to remove this or only consider mode 1 and not consider fall back.

Huawei: to Qualcomm, it is for PC1.5. Currently we are discussing the first PA configuration. For ULFPTx mode, we share the same understanding as OPPO. We prefer to consider mode 1 with other modes in the second stage.

Skyworks: UE power class is related to power sent over antenna. If 4x23dB, we only consider mode 1 supported.

Nokia: we have similar view with Skyworks. We are OK to uplink full power mode with fallbacks. But we are OK to focus on mode1.

LGE: with 4x23dBm, we have same view. Fallback mode should be considered together. Agree with Huawei.

Qualcomm: the power class should be defined per single antenna port. There will impact on two difference for power class in the previous release.

Meta: initially we just focus on mode 1 and fallback modes can be considered.

Apple: in terms of fall back mode, are we talking about the mimo layer or power.

Huawei: to Apple, firstly we are considering the power fallback and for layer fall back we can align with RAN1 for full power transmission mode.

Skyworks/Nokia: the power class is defined as the sum of power of antenna connector.

Meta: do not understand the concern on PC1.5. Power class is per band or per band combination.

OPPO: Qualcomm question is included in the WID. This is one study point in the WID.

Qualcomm: to Meta, the power class is per single antenna port and not per band combination and sum of the antenna port.

**Agreement:**

* RAN4 agree to include ULFPTx mode 1 applied to 4x23dBm in the first stage and include its fall back modes in the second stage.

*The following scope is prioritized and started in the first stage:*

* *Bands n41, n77/n78*
* *4x4 UL MIMO, including: 4 layers; [ULFPTx Modes and its fallback mode]*
* *UE power class: PC1.5*
* *PA configuration: 4x23dBm*

*Others would still be considered, but after the requirements are complete for prioritized scope.*

* Further clarify the definition of PC1.5 for 4Tx case

**Scope clarification-3layers**

* Original question: Will 4 TX operation encompass 3-layer operation where one Tx is turned OFF?

*Summary of 1st round discussion:*

*Some companies believe 3 layers was not supported by RAN1, one company point out this has been dropped during scope discussion. Some companies think related discussion should be deprioritized after the 1st phase. No company intend to start this work in the 1st phase.*

* Tentative agreements in 1st round discussion:
  + Do not consider 3-layer in this WI as it has RAN1 impact.

**Discussions:**

OPPO: we do not have big concern to preclude 3-layer. But 3-layer is supported in RAN1 already.

CHTTL: we share the similar view as OPPO. 4Tx can support 3-layer. 1Tx is not turned off to support 3-layer in our understanding.

Moderator: we do have 3-layer but we have four port transmission.

**Agreement:**

* Do not consider 3-layer in this WI.

**MPR requirements framework**

* Proposal: 4Tx MPR need to be re-visited compared to 2Tx.

*Summary of 1st round discussion:*

*All the companies agree that 4Tx MPR need to be studied further before any conclusion can be made. However, currently there is still no detailed framework proposals yet.*

*Recommendations for 2nd round:*

*MPR requirements framework can be raised int the 2nd round, and should be an important topic in the next meeting.*

Moderator’s note: It is proposed that tentative further frame work be raised at least for information.

**Discussions:**

Moderator: use 2Tx PC1.5 MPR as starting point.

Skyworks: it is not MPR. It is using the additional note that higher antenna isolation is assumed.

LGE: for high antenna isolation what values are assumed?

Skyworks: 16dB?

Huawei: change the as for 2Tx PC1.5 FWA to “compared to handheld UE”.

Meta: Skyworks proposal considers two PA architecture. It is only for refesen?

Skyworks: suggesting reuse the higher antenna isolation assumption only. 20dB isolation is assumed for large FWA form factor.

**Agreement:**

* For 4Tx MPR requirement, the high antenna isolation compared to handheld UE is assumed for CPE and FWA device.
* For 4Tx MPR requirement, the same antenna isolation as for handheld UE is assumed for vehicular UE.

**Draft WF on FR1 8Rx UE RF requirements NTT DOCOMO, INC**

**1.2 How to determine the ΔTRxSRS for 1T8R/2T8R AS-SRS?**

**<Way forward >**: Open issue needs further discussion

*Summary of round 1 discussion*

< Candidate options >

* Option 1: Reuse 3dB for 8Rx (R4-2212561).
* Option 2: Need more analysis/evaluation (R4-2212804/R4-2213193/R4-2213727).
* Option 3: Adopt the following table for additional ILs for different SRS transmission capabilities (R4-2213312).

|  |  |  |
| --- | --- | --- |
| UE capability | Additional IL @ .5GHz | Additional IL @ 4.9GHz |
| t1r8 | 4 dB | 5 dB |
| t2r8 | 3 dB | 3.5 dB |
| t2r8 and t1r8 | 5 dB | 6 dB |

<Companies’ views on each option>

* Option 1:
* Option 2: Qualcomm, Xiaomi, Skyworks. Nokia, Huawei, DOCOMO, Meta, AT&T, T-Mobile USA, Sony, Ericsson.
* Option 3: OPPO, (Huawei)

Majority views support option 2. Need more analysis and evaluation. During 1st round, as impacted factors, Ils, form factor and the number of antennas are suggested. There are comments that CPE/FWA specific assumption should be further studied, and that the study of the impact of larger SRS IL on the NW performance is needed. Question on the assumption (zero delta is applied for the transmission power calculation for the first SRS resource (or even PUSCH)) is also raised.

* Recommended WF
  + Further study ΔTRxSRS for 1T8R/2T8R AS-SRS considering the following aspects:
    - Ils, form factor and the number of Rx/Tx antennas as impacted factors
    - CPE/FWA/vehicle/industrial devices specific assumption
    - The impact of larger SRS IL on the NW performance
  + [Clarify if the assumption that zero delta is applied for the transmission power calculation for the first SRS resource ] still valid]
  + ΔTRxSRS for 4T8R AS-SRS will be discussed after 4Tx requirement is completed.

**Discussions:**

Skyworks: we are fine with the last bullet.

Nokia: to NTT DCOMO and Huawei, did Huawei provide the specific alternative?

Huawei: according to our proposal, we would like to refine the second bullet to “clarify to further study and remove PUSCH

OPPO: is it for the next issue?

Huawei: we are focusing on the different parameter.

Qualcomm: how the zero delta is applied? What does “further study” means?

Huawei: according to our understanding, for NR it is different from LTE. The new architecture. What could be potential issue for SRS transmission power? What could we do with the potential issue?

**Agreement:**

* Further study ΔTRxSRS for 1T8R/2T8R AS-SRS considering the following aspects:
  + Ils, form factor and the number of Rx/Tx antennas as impacted factors
  + CPE/FWA/vehicle/industrial devices specific assumption
  + The impact of larger SRS IL on the NW performance
* [Further study if the assumption that zero delta is applied for the transmission power calculation for the first SRS resource still valid]
* ΔTRxSRS for 4T8R AS-SRS will be discussed after 4Tx requirement is completed.

**1.3 Methods to improve the SRS output power given the large delta SRS value**

**<Way forward >**: Open issue needs further discussion

Summary of round 1 discussion

< Candidate options >

* Option 1: For a UE indicating the support of TxD and 1T8R AS-SRS, the ΔPPowerClass applied for PCMAX\_H,f,c should be reviewed (R4-2213727).
* Option 2: Others

<Companies’ views on each option>

* Option 1:
* Option 2 Qualcomm, Skyworks, Nokia (Need more analysis), OPPO (different view), AT&T, T-Mobile USA,

Need more discussion. There is a question for clarification, and proponent answer that this proposes to study a way to improve the SRS output power, e.g., by not applying ΔPPowerClass for PCMAX\_H,f,c, while considering the severe power imbalance foreseen for the routing implementation with 8Rx, and possibility of supporting more complex front end architecture for 8R AS-SRS. On the other hands, there is a comment thatΔPPowerClass should be applied to both Pcmax,L and Pcmax,H.

* Recommended WF
  + For a UE that supports 2Tx and 1T8R SRS AS, further study whether 3dB power back off at main antenna defined for TxD (ΔPPowerClass) is applied for PCMAX\_H,f,c or not
  + For a UE that supports 4Tx and 1T8R and/or 2T8R SRS AS, further study after 4Tx requirement is completed.

**Discussions:**

Qualcomm: why is not related to 1T4R?

NTT DOCOMO: this is the discussion point. This is WI for 8Rx. We also agree if the enhancement can be applied. It is better to discuss it in maintenance phase. Is there other companies who want to enhance it?

Huawei: To Qualcomm, the discussion regarding TxD for 4Rx has been done months ago. We may find out that such limitation for higher PcmaxH could be further studied for 8Rx. For 4Rx, such limitation has been introduced for 1T4R. We would like to further study. We would like to remove the second bullet. We are open for 4Tx case.

Nokia: we are OK with the first bullet. We just would like to know what is expected as outcome. 2Tx means TxD? We further study the possibility not to allow 3dB power back off. Is it what Huawei wants to study.

Huawei: the limitation for lower bound is enough. The limit for higher power is not necessary.

**Agreement:**

* For a UE that supports 2Tx and 1T8R SRS AS, further study whether 3dB power back off at main antenna defined for TxD (ΔPPowerClass) is applied for PCMAX\_H,f,c or not.

**Draft WF on study for lower MSD Huawei, HiSilicon**

**Example band combinations for MSD analysis**

Candidate example band combinations

**<Way forward >**: Open issue needs further discussion

*Summary of round 1 discussion*

* Option 1: Nokia
  + CA\_n1-n3-n77 and relevant fallbacks. IMD2, IMD4, 2nd harmonic mixing for (UL, DL)=(n3-n77, n3-n77) and IMD falling into 3rd band, Cross band isolation, IMD3 for (UL, DL)=(n1-n3, n1-n3-n77)
    - QC, DCM, AT&T, CUC, ZTE
  + CA\_n2-n5-n77 covers all the MSD types except for certain order of MSD types
    - QC, CHTTL, ZTE
* Option 2: Samsung
  + CA\_n3-n78 as candidate to evaluate harmonic, IMD to own DL (Both PC3 and PC2 are supported for this combo)
    - QC, OPPO, vivo, CHTTL, ZTE, CUC, HW, AT&T (also for other combos)
  + CA\_n41-n77 as candidate to evaluate cross band isolation and harmonic mixing (Both PC2 and PC3 are supported for this combo)
  + CA\_n2-n5-n77 as candidate to evaluate IMD of dual UL falls into the third DL (UL\_n2-n5 supports PC3, UL\_n5-n77 and UL\_n2-n77 support Both PC2 and PC3)
    - QC, CHTTL, ZTE
* Option 3: CMCC
  + CA\_n8-n41 is suggested for 3rd harmonic with max 13dB MSD for PC3 CA
  + CA\_n28-n40 is suggested for 3rd harmonic mixing with max 37.8dB MSD for PC3 CA
  + CA\_n3-n41 is suggested for IMD4 with max 18.4dB MSD for PC2 CA

The band combination proposed by Nokia and Samsung can cover more combinations proposed by companies during the 1st round discussion. Example band combinations mainly based on the two proposals could be further discussed.

* Recommended WF
  + Use the following example band combinations to study the feasibility of MSD improvement for different MSD types:
    - CA\_n3-n78 (IMD2, IMD4, 2nd harmonic)
    - CA\_n28-n40 (harmonic mixing)
    - CA\_n41-n77 (cross band isolation)
    - CA\_n2-n5-n77 (IMD falling into 3rd band)
  + Note 1: All supported power classes for the above example band combinations can be analyzed
  + Note 2: Band combinations with two bands are in the first priority

**Discussions:**

Moderator: we need to choose one 3-band band combination.

CHTTL: we also hope NR-DC and MR-DC are included for the same band combination.

Nokia: at least we would like to remove the restriction on MSD types for each band combination. CA\_n3-n78 also has harmonic mixing. We would like to study if IMD2 also impacts the harmonic and harmonic mix. We would like to add more band, but as compromise we can remove the limitation of restriction.

Qualcomm: why do we need 3-band band combination?

Huawei: the analysis can be extended to others. Removing the MSD types for 2 –band is OK. For 3-band, we would like to keep. For 3-band combination, there are difference like IMD for the 3rd band.

ZTE: we see different proposals from different companies. We should agree on the criterion first. 3 band not including fallback and also including the impact on the 3rd band.

Vivo: if we want to remove one more, CA\_n28-n40 can be removed.

NTT DOCOMO: agree with Nokia and Samsung. We think it is better to study the core relation between different types. If we can identify the relation, we can justify the single capability.

Meta: the example bands is proposed in the RAN plenary. It is the reason to propose MSD with different impacts. We would like to keep the recommend proposal.

Nokia: add CA\_n1-n3-n78 (IMD on the 3rd band).

Skyworks: CA\_n41-n77 is not necessary. We can use CA\_n1-n3 for cross band isolation.

CMCC: support the original recommend proposal. We keep CA\_n28-n40.

ZTE: for CA\_n41-n77, the cross band isolation is smaller. CA\_n18-n28 has largest isolation in the table.

Huawei: we are OK to use CA\_n1-n3. For cross band isolation, we have already had CA\_n1-n3-n78.

Nokia: we agree with Skyworks and Huawei.

AT&T: Is PC2 included for CA\_n1-n3-n78?

Skyworks: if we can improve PC3 then we can improve PC2.

Apple: for cross band isolation, do we consider multiple configurations?

Xiaomi: Share the similar view as Apple. For CA\_n1-n3, the cross isolation impact is 3dB.

Qualcomm: to Skyworks, we have two band combination with cross-band.

Huawei: PC2 is defined for CA\_n1-n3-n78. PC2 and PC3 specified for fall-back mode.

Skyworks: lower MSD for CA\_n1-n3. Increasing bandwidth introduces the higher cross band isolation.

NTT DOCOMO: for cross band isolation for CA\_n1-n3, this meeting we observed >20dB MSD.

Samsung: we would also study all the fall back. We can remove CA\_n3-n78.

**Agreement:**

* Use the following example band combinations to study the feasibility of MSD improvement for different MSD types:
  + CA\_n28-n40 (harmonic mixing)
  + CA\_n41-n77 (cross band isolation)
  + CA\_n1-n3-n78 and fallback combinations (IMD on the 3rd band, cross band isolation on CA\_n1-n3 using 50MHz channel bandwidth, IMD2/4 and 2nd harmonic and harmonic mixing on CA\_n3-n78)
* Note 1: All supported power classes for the above example band combinations can be analyzed
* Note 2: Band combinations with two bands are in the first priority

### 11.7 NR RF requirements enhancement for FR2, Phase 3

#### 11.7.4 Moderator summary and conclusions

**[104-e][133] FR2\_enh\_req\_Ph3, AI 11.7 – Petri Vasenkari**

**R4-2214111 Email Discussion Summary for** **[104-e][133] FR2\_enh\_req\_Ph3**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214244 (from R4-2214111).**

**R4-2214244 Email Discussion Summary for [104-e][133] FR2\_enh\_req\_Ph3**

*Type: other For: Information  
 Source: Moderator (Nokia)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214453 | WF on UL 256QAM | Xiaomi |  |
| R4-2214454 | WF on BC in RRC\_INACTIVE and initial access | Nokia |  |
| R4-2214455 | WF on beam refinement assumptions in RRC\_INACTIVE and initial access | Nokia |  |
| R4-2214456 | WF on testability aspect of BC in RRC\_INACTIVE and initial access | Nokia |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| [R4-2212590](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212590.zip) |  | TR skeleton | Xiaomi, Nokia | Return to | See if an update is needed. |

**GTW on Aug-25**

**WF on UL 256QAM Xiaomi**

**Issue 1-1-1: Link level simulation assumption**

In first round discussion, most of companies agree the simulation assumption, at the same time some modifications are proposed.

* 1. Consider 48GHz(n262), 5 companies agree(vivo, Xiaomi, Sony, AT&T, LG), Nokia prefer to focus on 29GHz first;
* 2. PTRS configuration: for DFT-s-OFDM waveform, the mapping parameter (,)could be choose from the group (2,2) (2,4) (4,2) (4,4) (8,4), two companies prefer to use (4,4) as baseline;
* 3. Other more parameters need consider refer to R4-2212591.
* 4. Further align the MIMO channel for 2x2 AWGN, whether just use the diagonal matrix.

**Agreement:**

* Modified simulation assumption: (new added as yellow highlight part)

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Carrier frequency | 29 GHz (n257), 39 GHz (n260) and 48GHz (n262) |
| CBW | 50 MHz, 100MHz |
| SCS | 120 kHz |
| Allocated RBs | Full allocation |
| Propagation | TDL-A 30ns delay spread, 35Hz Doppler frequency  TDL-D 30ns delay spread, 35Hz Doppler frequency  Static (AWGN) |
| MCS | 64QAM:  CP-OFDM: MCS 23, 24 in TS 38.214 Table 5.1.3.1-1, other MCSs are not precluded.  DFT-s-OFDM: MCS 22, 23 in TS 38.214 Table 6.1.4.1-1, other MCSs are not precluded.  256QAM:  CP-OFDM/DFT-s-OFDM: MCS 21, 23 in TS 38.214 Table 5.1.3.1-2, other MCSs are not precluded.  Baseline: fixed MCSs |
| Symbol type | CP-OFDM; DFT-s-OFDM |
| HARQ | 8, None |
| Antenna configuration | Fading channel: 2x2 for Rank1 and Rank2, Low correlation  Static channel: 1x2 for Rank1, 2x2 for Rank2 (using the diagonal matrix) |
| Channel estimation | Practical |
| Receiver type | MMSE |
| PUSCH configuration | Type A mapping, Start symbol 0, Duration 14 |
| DMRS configuration | Type 1, Single symbol, 1 additional DMRS |
| PTRS configuration | CP-OFDM: KPTRS : 2 (every 2 RBs), LPTRS : 1 (every 1 symbol)  DFT-s-OFDM: (,)=(4, 4), LPTRS : 1 (every 1 symbol) |
| Phase noise compensation | Practical based on PTRS |
| Phase noise model | TR 38.803 model (in section 6.1.10 and section 6.1.11)  modelled Phase noise for TX and RX  Option a): example1 (UE)  + example1(BS)  Option b): example2 (UE) + example2(BS)  Option d): example1 (UE) + example2(BS) |
| txEVM + rxEVM excluding phase noise for 256QAM | txEVM: 2%, 3%, 3.5%, 4%, rxEVM: 2%, 3%, 3.5%, 4%  Option 1: txEVM >= rxEVM; |
| Other parameters | follow assumptions in TS38.104 Section 11.2.2 . |

**Issue 1-1-2: Supporting power classes**

**Agreement:**

* First focus on PC1, PC2, PC5.
  + Discussion on PC3 is not precluded and handled as second priority.

**Issue 1-1-3: EVM test**

**Agreement:**

* Option 1: Configuring PTRS for 256QAM EVM testing to compensate CPE.
  + The DMRS based channel estimate in the PTRS-ready EVM calculator shall utilize CPE-corrected DMRS symbols.
  + The PTRS extraction and correction stage in the PTRS-ready EVM calculator is the final refinement of the received signal.
* FFS on the compensation for Inter Carrier Interference (ICI).

**Issue 1-1-4: PTRS configuration**

* Options:
  + Option 1: PTRS configuration shall be aligned with the UE’s recommended PTRS configuration.
  + Option 2: Use a fixed PTRS configuration for all devices

**Discussion:**

Moderator: keep two options for further discussion. Try to align on option 1. We can decided whether to send LS to RAN5 based on the discussion in the next meeting.

Qualcomm: Option 2 is added from testability consideration.

R&S: we are fine to keep both options. We want to check what the impact of option 1 is

Oppo: we share the similar view as R&S. There would be testability issue in RAN5. When we define the requirement, we should think about how to test it.

Apple: we also think option 1 and option 2 should be left for further discussions. It is benefit of option 1 over option 2. If the benefit is identified, we can determine it.

Qualcomm: we have delegate of TE in RAN4. Do we need LS to RAN5?

OPPO: it is better to check with RAN5. Some time it is not only TE issue but also verification issue.

**Agreement:**

* Option 1: PTRS configuration shall be aligned with the UE’s recommended PTRS configuration.
* Option 2: Use a fixed PTRS configuration for all devices

**Issue 1-2-1: MPR simulation assumption**

The following MPR simulation parameters can be used as the start point, the detail values for the parameters are FFS.

* Transceiver noise
* Modulator I/Q imbalance
* Modulator CIM3
* Carrier suppression
* Phase noise

**Discussions:**

Nokia: this is not starting point. We would like to keep the values. Otherwise, people use different values in the simulation. We suggest to keep them and if the problem is found we can fix it.

Apple: I see the issue discussed by Nokia. FR1 parameters is quite harsh.

Huawei: the parameters come from FR1 which is not suitable for FR2.

Qualcomm: we want to further discuss the phase noise.

**Chair=> further discuss those parameters in the future meeting.**

**Issue 1-2-2: EVM budget in MPR simulation**

**Agreement:**

* Option 3: Discuss it after EVM is defined.

**Issue 1-3: minimum EIRP**

**Agreement:**

* Option 3: Discuss it after EVM and operating SNR are defined.

**WF on BC in RRC\_INACTIVE and initial access**

**Sub-topic 1: Rel-16 RRC\_Connected Beam Correspondence applicability to Rel-18 RRC\_INACTIVE/IA Beam Correspondence**

**Way forward proposals:**

* There is no UL beam sweep for IA BC requirements
* At least Msg1 will be tested.
* A new requirement is needed for Msg1 for all UEs regardless of Rel-16 BC IEs.

**Discussions:**

CMCC clarify what the new req is? spherical requirement? minimum peak EIRP or tolerance requirements?

Nokia: at least our intention is requirement for Msg1. We could remove new.

Qualcomm: Nokia comment is OK.

CMCC: removing new is oK for us. Do we consider the tolerance requirement? I did not see any description about the tolerance.

Ericssson: we would like to add at least Msg 1 it does not preclude the combinations with other metrics like RAR performance. Check the correlation between Rx and Tx beams.

Qualcomm: beam correspondence tolerance is associated with UE bit-0 to do beam sweeping. The requirement on the delta is not relevant there. There is not beam sweeping requirement here, i.e., tolerance.

Samsung: we just say beam correspondence is relative.

Huawei: share the same view as Qualcomm and Samsung. BC requirement is OK for me. For RAR requirement, currently companies agree with requirement of Msg1.

OPPO: regarding this bullet, it said requirement is needed regardless of Rel-16 BC IEs. In the later stage we will discuss the test reduction. We do not want to preclude Rel-16 BC.

CMCC: for UE to reporting supporting BC without beam sweeping, it means that we totally trust UE and no requirement.

Ericsson: we disagree with Huawei that RAR is FFS. We should not preclude it. The spherical coverage requirement would be relaxed and cannot guarantee the performance of BC.

Apple: Similar question as Ericsson. For connected mode, we have no additional step measurement similarity of Rx and Tx. Why do we need to do it for initial stage. We are OK to keep the door open. Currently stage we not sure.

ZTE: Missing part is whether there is BC in the initial access. We need to consider other metric.

Sony: to CMCC, for initial access, network cannot configure UE to do beam sweeping. All the UE should support BC without sweeping. We support not to preclude RAR. Whether to check RAR depends on how to set requirement.

Huawei: FFS does not preclude the RAR. We have already check UL and DL beam similarity.

Ericsson: does any spherical coverage requirement guarantee the beam correspondence?

Qualcomm: BC we have to talk about what is meaning of BC. It means that enough EIRP should be gotten. If checking the spatial filter, UL and DL may be different.

Samsung: the similarity was discussed. After discussion we only keep EIRP. We need to stick to previous. We just use EIRP metric. At the current stage, we do not think RAR metric and similarity is reasonable.

Apple: similar view as Samsung. The EIRP based requirement is sufficient. If Ericson believe the current requirement is not sufficient, it may be beyond the scope of WI.

Vivo: we are not ready to accept to take EIRP as the only values in this meeting. We do not know how UE generate the rough beam.

* If UEs support both IEs beamCorrespondenceWithoutUL-BeamSweeping and beamCorrespondenceSSB-based-r16, and performs IA with 4-step RACH then no new requirement is needed for Msg3

**Discussions:**

OPPO against

OPPO: for the Msg 3 it is premature to say whether it is needed or not. There is no consensus on it.

Apple: Share the similar view as OPPO. We think the sentence is misleading.

Qualcomm: the concern from companies are not automatically true.

Samsung: it is a slightly misleading.

* Use PC3 as baseline for testing and requirements and handle specific values for other PC afterwards and based on the same method
* At least spherical coverage requirements will be tested for RRC\_Inactive Beam correspondence for Msg1

**Discussions:**

Huawei/Xiaomi proposes RRC\_IDLE instead of RRC\_Inactive

Huawei: there is related discussion on whether the requirement should be specified for both. Majority view is that RRC\_idle is OK. We can only list idle.

Xiaomi: there is FFS on STD test and inactive mode test. The spherical need be test is unreasonable.

Nokia: this WI name is using RRC\_idle and initial access. We should align the terms.

OPPO: Echo Huawei and Xiaomi.

* Define a specific EIRP value at N% of the distribution of radiated power

**Discussions:**

QC/Samsung/Sony/ZTE not agree. Existing ones reused. vivo against the existing metric. Huawei to move this to FFS.

* Discuss the value of N, e.g. N=[X]% for PC3

**Discussions:**

QC/Samsung/Sony/ZTE not agree. Existing value X=50% reused. vivo against the existing metric. Huawei to move this to FFS.

* BC is defined at maximum output power. [Samsung, Sony]

**Agreement:**

* There is no UL beam sweep for IA BC requirements
* At least Msg1 will be tested.
* Use PC3 as baseline for testing and requirements and handle specific values for other PC afterwards and based on the same method
* BC is defined at maximum output power

**WF on beam refinement assumptions in RRC\_INACTIVE and initial access**

**Sub-topic 1: UE beam type and DRX implications in Rel-18 Inactive Beam Correspondence**

**Way forward proposals:**

* The UE need not indicate support of BC without UL beam sweeping in inactive and IA. The usability of this capability is not clear at this point [Initial proposed text]

A few companies are not sure about keeping the 2nd sentence.

Alternative texts

* The UE need not indicate support of BC without UL beam sweeping in inactive and IA. [ZTE]
* The network presumes UE does not depend on UL beam sweeping functionality for beam correspondence in inactive or idle mode [Qualcomm, Verizon]
* It is assumed UE does not depend on UL beam sweeping functionality for beam correspondence in inactive or idle mode. [OPPO]
* All UE should support beam correspondence without UL beam sweeping in inactive and IA, therefore there is no need for UE to indicate the support of BC without UL beam sweeping. [Sony, CMCC]

**Proposal for compromise:**

* The UE need not indicate support of BC without UL beam sweeping in inactive and IA. [ZTE]

**Discussion:**

Qualcomm: what is the agreement here?

ZTE: the original proposal is to make sure at network it does not relay on the capability reported. “Usability of this capability” is not clear

OPPO: this way forward is discussing the assumption and pre-condition.

Apple: not sure if it is needed since there is no requirement.

Samsung: we agreed that all the UE needs support the BC. The new agreement is dulplicated.

Sony: agree with Samsung. It is duplicated to the agreement in the other way forward. Capability is not clear.

**Way forward proposals:**

* FFS: How beam refinement may work in RRC\_INACTIVE (RA-SDT and CG-SDT) and initial access
* FFS: Discuss the impact of fine beam vs rough beam for UE UL Tx beam on the test(s)
* FFS: Discuss if the refinement is the same as Rel-16 SSB only case
* FFS: Whether the peak EIRP the same as Rel-16 SSB only case achieved.
* FFS: Discuss DRX implications on UE beam refinement and on BC accuracy

**Agreement:**

* FFS: How beam refinement may work in RRC\_INACTIVE (RA-SDT and CG-SDT) and initial access
* FFS: Discuss the impact of fine beam vs rough beam for UE UL Tx beam on the test(s)
* FFS: Discuss if the refinement is the same as Rel-16 SSB only case
* FFS: Whether the peak EIRP the same as Rel-16 SSB only case achieved.
* FFS: Discuss DRX implications on UE beam refinement and on BC accuracy

**WF on testability aspect of BC in RRC\_INACTIVE and initial access**

**Sub-topic 1: Rel-18 Beam Correspondence Test Issues**

* Overall comment: it may be premature to discuss testability [Ericsson]

**Way forward proposal:**

* BC test for RRC\_INACTIVE (if applicable) and IA is at UE maximum output power
  + what is RRC\_INACTIVE and initial access? [Xiaomi]
* BEAM\_LOCK is not available in RRC\_INACTIVE and IA mode

**Discussions:**

Xiaomi: we have concern on the wording. It is related RRC\_inactive mode. RRC\_inactive mode means STD.

Qualcomm: why do we need “if applicable”?

Huawei: similar reason as the previous agreement. RRC\_inactive needs further discussion. Maybe RRC idle and RRC inactive tests are the same. We cannot say RRC inactive is really needed and defined now.

ZTE: to Xiaomi, inactive mode is not equivalent to STD.

OPPO: for RRC inactive, it is premature to say to test as MOP. For how to test and what it looks like .. we are open.

Samsung: it is little complicated. For RRC\_inactive, BC requirement we have no consensus yet. There are discussions on test reduction and test time. The bullet does not exactly reflect the discussion.

ZTE: for testability for RRC inactive mode, RAN5 agreed the simple solution by using loop mode B and other new timer.

**Agreement:**

* BC test for RRC\_INACTIVE (if applicable) and RRC\_Idle is at UE maximum output power

### 11.8 Requirement for NR FR2 multi-Rx chain DL reception

#### 11.8.4 Moderator summary and conclusions

**[104-e][134] FR2\_multiRx\_UERF, AI 11.8.1, 11.8.2 – Sumant Iyer**

**R4-2214112 Email Discussion Summary for [104-e][134] FR2\_multiRx\_UERF**

*Type: other For: Information  
 Source: Moderator (Qualcomm)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214245 (from R4-2214112).**

**R4-2214245 Email Discussion Summary for [104-e][134] FR2\_multiRx\_UERF**

*Type: other For: Information  
 Source: Moderator (Qualcomm)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214457 | WF on multi-Rx chain DL reception | Sony |  |

**GTW on Aug-25**

**Work Plan**

* Proposal: Revised work plan for UE RF:

**Agreement:**

* The work plan below is agreed.

|  |  |  |  |
| --- | --- | --- | --- |
| **RAN 4 meeting** | **Date** | **Discussion** | **Work progress goal** |
| **RAN4#104** | Aug. 2022 | Discussion on system assumptions, UE assumptions | Agree on system assumptions |
| **RAN4#104-Bis** | Oct. 2022 | UE implementation assumptions and Requirement concept |  |
| **RAN4#105** | Nov. 2022 | UE implementation assumptions and Requirement concept | Agree on UE assumptions |
| **RAN4#106** | Feb. 2023 | Requirement concept and Simulation discussion | Agree on details pertaining to simulation effort |
| **RAN4#106-Bis** | Apr. 2023 | Simulation results discussion | Draft CR? |
| **RAN4#107** | May 2023 | Requirement Parameter details | Draft CR |
| **RAN4#108** | Aug. 2023 | Requirement Parameter details | Feature CR |

**UE RF**

**System assumptions**

**General deployment assumption for DL split between TRPs to enable 4L reception**

**Agreement:**

* Proposal: To support 4L DL MIMO reception at the UE when configured with 2 active TCI states, polarization multiplex (2 layers/direction) + spatial multiplex (2 directions) is assumed at the UE.
  + Note: This proposal is for general deployment assumption, not aimed at UE RF assumption

**Scope definition for UE RF requirements**

**Agreement:**

* UE RF requirements for simultaneous reception from different directions shall be based on single-layer reception for each DL direction with dual TCI configuration, i.e., total 2 layers for both directions.

**DCI scheme when UE is configured for 2 active TCI states for UE RF requirements**

**Agreement:**

* For setting the UE RF requirement when the UE is configured with 2 active TCI states, single DCI scheme is adopted as a baseline.

**UE assumptions**

**UE architecture assumption**

* Proposal: The concept of panel should not be explicitly used in core requirements and test configurations

**Discussions:**

Lenovo: we understand there is a lot of reluctance to refer to. It would be beneficial to extract the information from single panel. We would like to leave it open for now.

Verizon: We suggest leaving it FFS. Otherwise, we may miss the important feature in Rel-15 and Rel-18. We need better understand the difference.

Apple: Back in Rel-15 when we specify the requirement, we do not mention the panel. In the testing I am not sure. The bottom line panel concept was not well defined. If we introduced the concept, we would need the good definition to ensure no ambiguity. To Lenovo, if you think one panel can receive two AoA, then one panel can be considered as two panels.

Vivo: we have same understanding as Apple. Even if it is named as mult-Rx chains in RAN1, we do not have common understanding on the panel. It is difficult to define the test.

Samsung: agree with Apple and Vivo. Panel is not official definition in 3GPP. In the initial stage for approval of WI, we call it panel but after WID is approved, we correct the terminology. We do not need use nick name in the spec.

Sony: we also agree with Apple, vivo and Samsung. In RAN1 discussion panel is virtual. We can add one sentence to say that the revisit is allowed if issue identified.

**Agreement:**

* FFS whether the concept of panel should not be explicitly used in core requirements and test configurations.
* FFS whether the single panel should be excluded.

**UE architecture assumption**

* Proposal: FFS UE implementations to set the RF requirements, with consideration (but not limited to) the following aspects:
  + FFS if single mmWave module can receive all 4 layer.

**Discussions:**

Apple: Try to understand the sub-bullet. What does it mean?

Sony: we never assume the single panel can have two beams simultaneously.

Apple: can we merge this issue with the previous issue.

Intel: agree that two issues are related. If we capture and list the assumption and what exactly the UE implementation is, it would be helpful.

Huawei: Some specific implementation should be proposed. This proposal is not needed.

Nokia: We do not consider the single panel in this case. But this is to try to see whether we can preclude the single case to receive two direction and four layers.

Samsung: Single panel should not be explicitly precluded. Here we discuss the scenario. We do not think it is necessary to explicitly mention single panel here.

Apple: since we do not have agreement for previous issue, we should do something. I doubt if we have clear definition of single mmWave module. Without clear definition, how can we address the issue in future meeting? Panel could have multiple sub-panels. Do not know how to address the definition.

**Principle for determining UE requirements**

* Proponents are encouraged to suggest wording for agreeable proposals based on the input below:
  + RAN4 must consider in this work item how to specify the DL spherical coverage requirement of the FR2-1 multi-Rx chain UE to ensure satisfactory real-life performance of the FR2-1 multi-Rx chain UE for two AoAs simultaneous reception in terms of both spherical coverage percentage and sensitivity.
  + The new RF requirements should be specified with the aim to minimize RF impact on legacy UEs/RF designs.
  + All existing implementation shall be carefully considered when the general RF requirements will be defined for simultaneous DL reception with two different QCL Type-D RSs on single component carrier.

Based on the discussion in the WF issue 2.2.2 so far (CET 22:30 08-23), the following options are proposed:

* Option1 (Huawei):

Agree on the following principles for the derivation of the RF requirement for two AoAs simultaneous reception in FR2-1:

* + Both spherical coverage percentage and sensitivity shall be ensured.
  + The new RF requirements should be specified with the aim to minimize RF impact on legacy UEs/RF designs.
  + All existing implementation shall be carefully considered.
* Option2 (Apple):
  + The new EIS spherical requirement should be set in an implementation-agnostic manner and ensure real-life performance of FR2-1 multi-Rx chain UE for two AoAs simultaneous reception
* Option 3: No need to capture this in the WF.

**Discussions:**

Apple: when we discuss the principle, many companies think we do not need specific proposal to capture the principle. The high level understanding is OK. If this is the business as usual to consider performance…in the study and it is the common understanding we are OK not to capture any concrete proposal..

Nokia: it is related to previous discussion. We worry the requirement will be unnecessarily relaxed. We suggest to exclude this from consideration for requirements. We should not consider the single panel to define the too relaxed requirement.

Huawei: we would like to discuss between option 1 and 2. It is no harm to discuss the principle before discussing the RF requirement definition. We can try option 2 adding “all existing implementation shall be carefully considered”.

Qualcomm: as Apple comment, it is significant enhancement to UE capability. We need jointly discuss the requirement on what is the mean to UE. What is the business usual, we just balance the requests from companies. It is pre-mature until we discuss the requirements and how to impact UE.

Samsung: Generally the input is reasonable from some sense. It is not implementable for the feasibility perspective. For UE detailed assumption, it is better to reuse the existing hardware. For this new feature, we are not sure if the existing hardware can work well.

Intel: we aims to consider all the implementation as much as possible. We try to align some assumptions.

Vivo: we also think it is better to discuss the detailed requirements and we can have clear attitude for compromise solution. Implementation agnostic is reasonable one.

Nokia: we do not mind implementation agnostic. Is there any objection to precluded single panel? If we can preclude single panel, we are OK with implementation agnostic.

Sony: we have similar concern as Qualcomm especially it is optional feature in previous release. Companies can come up with specific proposal for implementation.

Qualcomm: to Nokia, we understand the intend of your proposal. But there are many UE like CPE and FWA, which will be beneficial from this feature and they are single panel.

Intel: similar comment. There are other power classes. We can discuss all the parameters.

Samsung: to Nokia, about the agnostic manner, it does not mean the UE requirement is based on single panel. If the single panel can meet the requirement, it is still allowed.

Verizon: Nokia had point. We care about the requirement without any relaxation. To Qualcomm, for CPE and FWA, we have different spherical coverage, We understand Qualcomm comment. We need understanding what is the general picture and what is the general requirements.

Apple: since anyway we will discuss the implementation in future meetings, it is OK to take option3.

Ericsson: Won’t it make sense to have assumption on the architecture for individual power class? We should make sure it will present the improvement. We will be able to set requirement for improvement.

Intel: to Ericsson, it makes sense. This is what we have done previously.

**Agreement:**

* Option 3. No need to capture this in the WF. The section (2.2.2) will be removed in the final WF but discussion will be captured in the 2nd round email discussion.

**Test setups**

**How the network/TE configures the UE for mTRP connection**

* Background: The following sequence was originally proposed to establish common understanding that the UE is able to refine its Rx beams that can coexist towards each TRP after it is configured for 2 active TCI states.
  + starting condition: basic connection between the UE and a single TRP
  + network configures UE for joint reporting with other TRPs visible to the UE
  + network requests CSF based on RS pairs reported by the UE with ‘joint reporting’
  + network configures second active TCI state based on CSF
  + network continues to provide resources to refine the UE beams for a 2-active TCI state condition in the form of continuously transmitted BMRS (such as CSI-RS or SSB)
  + (UE is ready to be evaluated).
* Proposal: FFS beam refinement by the UE when configured with 2 active TCI states’

**Discussion:**

Huawei: have concern on FFS for beam refinement at this stage.

Apple: why do we need to have this proposal? UE will use fine beam to receive.

Samsung: According to the work plan, for the first meetings we should focus on the assumptions. For this issue, we had good background information is valuable. But the details are not ready for agreement now. For the related beam refinement, it is not critical issue and it is like previous release.

Sony: the intention is to create the common understanding how to refine the beam. We are fine to remove it from way forward and capture the information in the summary.

Qualcomm: we want to avoid only rough beam available in the end.

**Agreement:**

* Remove 2.3.1 and proposal from the way forward and capture the background information in the summary.

**How to determine candidate AoA pairs for setting the UE RF requirement**

**Agreement:**

* Further discuss on the on the candidate AoA pairs for setting the UE RF requirement
  + One Fixed AoA1 (e.g. Peak) + Full set AoA2.
  + Multiple AoA1 + Full set AoA2.
  + Fixed offset between the two AoAs, both probes swept simultaneously.
  + Full set AoA1 + Full set AoA2

Other solutions are not precluded. Companies are also encouraged to bring the analysis on how to quantify the Refsens value when receiving multiple signals.

### 11.11 Support of intra-band non-collocated EN-DC/NR-CA deployment

#### 11.11.3 Moderator summary and conclusions

**[104-e][135] NonCol\_intraB, AI 11.11 – Suzuki Yasuki**

**R4-2214113 Email Discussion Summary for** **[104-e][135] NonCol\_intraB**

*Type: other For: Information  
 Source: Moderator (KDDI)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214246 (from R4-2214113).**

**R4-2214246 Email Discussion Summary for [104-e][135] NonCol\_intraB**

*Type: other For: Information  
 Source: Moderator (KDDI)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214458 | WF on NonCol\_intraB\_ENDC\_NR\_CA | KDDI |  |

**GTW on Aug-22**

**Sub-topic 2-4 : Guidelines for RRM requirements**

**Issue 2-4-1: Guidelines for RRM requirements on MRTD**

* Discuss candidate scenarios on NR-CA.
* Proposals
  + Scenario 1: async NR-CA *[FFS]*
  + Scenario 2: sync NR-CA
* MRTD will be discussed in RRM session based on the scenarios(s) from RAN4#105.

**Discussions:**

Softbank: we are fine with moderator proposal. Supporting both scenarios of async and sync NR-CA are desirable. But we are not sure if for n78/77 async case is valid. But in the future we may need consider async.

NTT DOCOMO: we are fine with the proposal. We need more time to check is all the options should be considered. Intra-band EN-DC type 2 assumes 30us for async. We need more discussion for values.

Skyworks: One of assumption is there is no simultaneous Tx-Rx for overlapped TDD bands. Can we agree with it?

Apple: Echo Skyworks. For TDD bands, the sync operation should be assumed to make deployment simpler.

Ericsson: There will be no simultaneous Tx-Rx. But the deployement can be non-collocated with guard. MRTD can also be 30us.

Samsung: agree MRTD should be discussed in RRM session. Whether sync NR-CA is necessary should be decided in main session. Sync operation is assumed for all the CA. Async is not necessary to be supported for NR CA.

Moderator: for simulatenous Rx-Tx, it is discussed in issue 2-1-1b to preclude Tx-Rx simulatenous operation in the 2nd round.

Huawei: About Tx-Rx simultaneous operation, all the companies agree to prohibit it.

Skyworks: We can discuss it later in other issue. The major aspect architecture assume non-simultaneous operation for CA.

**Agreement:**

* Agree to consider sync NR-CA scenario.
  + No Tx-Rx simultaneous operation is assumed to be supported for sync NR-CA scenario.
* FFS async NR-CA scenario.

**Sub-topic 2-2 : UE RF architecture baseline**

Issue 2-2-1 is split into sub-issues ‘2-2-1 (a)’ and ‘2-2-1 (b)’ as follows.

**Issue 2-2-1 (a): UE RF architecture**

* For further clarification, add the wording “total 4 Rx Chain” to Option 1 of 1st round as follows:
* Proposal
  + Reuse UE RF architecture of inter-band non-contiguous DC\_42\_n77/78 EN-DC Type-2 (i.e. 2 layer/2 Rx Chain per CC, total 4 Rx Chain)

**Discussions:**

Skyworks: agree with proposal as long as 4Rx chain is for RF aspect and there may be more CC in one RF chain.

Samsung: Similar view as Skyworks. 2Rx chain per CC is separate chain. Antenna and RFIC are separate. Not sure if baseband should be separate. We just need to assume that BB is separate.

Vivo: we should clarify RF chain means Antenna. BB can be shared.

Apple: Architecure for EN-DC may be a good start point. But it is not clear from companies’ view which of RF or BB should be separate or shared. We can just use EN-DC architecture as starting point.

ZTE: share the similar view as skyworks. RF chain is only for RF aspect. We need further discuss the meaning of RF chain. We should preclude BB part from RF chain.

Samsung: now it is clear the antenna and RF chain are separated and only whether BB is separate or shared is unclear. RF chain is separated means separate LNA but LNA would share the AGC setting. Should we study one AGC setting for type II?

Skyworks: only four antenna and RF chains is assumed. LNA should be shared as input at least. Whether and how the antenna path can be shared, or BB be shared need further discussions.

Samsung: we agree with Skyworks. The antenna assumption is 4. Not sure if Skyworks is talking about the Type-3.

Skyworks: we can further discuss if LNA output can be shared or separate.

Huawei: it is better not to preclude separate LNA.

Skyworks: how can you have separate LNA going to the same antenna from the input of LNA?

Huawei: we do not say to only apply on separate LNA but just keep the option open.

Samsung: agree with Skyworks. If companies have concern, we can change the total 4Rx.

Apple: Based on the discussion, there is no consensus whether LNA is shared or separate. Type-2 means two LNA will be used for one CC and two LNA used for other ones. We would like to keep the type-2 as baseline.

Samsung: we cannot see the LNA can be separate. LNA cannot be shared. We do not know whether we need it as the baseline.

Skyworks: the minimum capability can be supported by using this architecture for UE to support collocated scenario. It does not prevent the discussion for other scnearios with more CCs or Rx being supported.

**Agreement:**

* Total four RF antenna is assumed.
* Reuse UE RF architecture of inter-band non-contiguous DC\_42\_n77/78 EN-DC Type-2 (i.e. 2 layer/2 Rx Chain per CC, total 4 Rx Chain) as the baseline.

**Issue 2-2-2: CA bandwidth class**

* Proposal
  + 1 CC on each sub-block. This means to be a total of 2 CC, i.e. n78(2A)/n77(2A) for CA as baseline, but 3 CC, i.e. n77(3A)/n78(3A) is not precluded.

Discussions:

Skyworks: we need sort out the architecture first for the prioritized case. Then we have clear view whether to intra…

Samsung: 1CC on each sub-block and total of 2CC should be prioritized. But we do not preclude 3CC case.

KDDI: two CC is prioritized and currently we do not preclude 3 CC case.

Apple: Similar view. 3CC case should not start before 2 CC.

Huawei: agree with 2CC being prioritized.

Apple: does 3CC means all 3CCs are not collocated? We need further discussion.

Samsung: we means 3CC non-collocated since 3CC collocated is specified.

Skyworks: the assumptions is no matter how many CC two BSs are used. 2CC from one BS and 1CC from another one.

Ericsson: Agree with skyworks. We are talking about two non-collocated sub-blocks.

**Agreement:**

* 1 CC on each sub-block. This means to be a total of 2 CC, i.e. n78(2A)/n77(2A) for CA as baseline
  + 3 CC, i.e. n77(3A)/n78(3A), is not precluded. The work on 3CC should be done after work for 2CC is finalized and it is clear how many non-collocated base stations are assumed.

**Sub-topic 2-3 : RF requirements**

**Issue 2-3-1: Power Imbalance and in-band blocking**

* Proposal
  + 25dB power imbalance, 1dB REFSENS relaxation. RAN4 may revisit if there is technical concern.

**Discussions:**

Samsung: we have concern on “revisit”. What does “revisit” mean? Does it mean that RAN4 will have multiple requirements for different power imbalance values or to reduce the value. The latter one is not acceptable.

Skyworks: For type-2, there is independent AGC for each CC. For other case, we may need to revist the power imbalance is applicable. For type-2 there is no reason to revisit.

Huawei: In some cases with high densitiy and NLOS, 25dB will shrink the cell. I want to know how operator operate the shrunk cell scenario?

ZTE: the issue needs clarified. Whether it is for type II only or other types need be considered. If it is former one, we agree with Samsung. For other type, the value depends on the UE architecture.

Vivo: We share the similar view as Samsung for RESFEN is discussed for Rel-16. We do not need to revist the requirement of REFSENS.

Apple: Agree that 25dB has been discussed extensively for EN-DC case. It is better to keep discussion being open. We need further check if it is applicable for CA case.

Huawei: if operator said with lower REFENS they can fully operation cell. Then we do not see any issue of reduction for 25dB.

KDDI: from operator point of view, if migrating from EN-DC for CA, 25dB should be kept. If there is different values, then operator will occur problem in migration.

Apple: for EN-DC case, we can assume non-ideal backhaul. But for CA we assume ideal backhaul. We are not sure if the same assumption will be kept.

Samsung: 25dB is reused from EN-DC case which is derived based on RF architecture. If CA share the same architecture, we see no reason.

**Agreement:**

* 25dB power imbalance, 1dB REFSENS relaxation. RAN4 may revisit if there is technical concern.

### 11.12 Air-to-ground network for NR

#### 11.12.5 Moderator summary and conclusions

**[104-e][136] NR\_ATG\_UERF, AI 11.12.1~11.12.3 – Zhe Shao**

**R4-2214114 Email Discussion Summary for** **[104-e][136] NR\_ATG\_UERF**

*Type: other For: Information  
 Source: Moderator (CMCC)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214247 (from R4-2214114).**

**R4-2214247 Email Discussion Summary for [104-e][136] NR\_ATG\_UERF**

*Type: other For: Information  
 Source: Moderator (CMCC)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214459 | WF on co-existence evaluation for ATG | Huawei |  |
| R4-2214460 | WF on UE requirements for ATG | Apple |  |
| R4-2214461 | WF on BS requirements for ATG | ZTE |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| [R4-2211952](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211952.zip) | R4-2214912 | TR 38.876 ATG v0.0.1 skeleton | CMCC | To be revised  (only Cover page logo issue) |  |
| [R4-2211953](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211953.zip) |  | Work plan on Rel-18 ATG | CMCC | Return to |  |

**GTW on Aug-25**

**WF on co-existence evaluation for ATG**

**<Way forward 2>: Discuss whether ATG BS can be co-located with TN BS**

**Agreement:**

* That the scenario of ATG BS non-co-located with TN BS is included. Whether the scenario of ATG BS co-located with synchronized TN BS should be included will be decided in the next meeting.
  + Note: working group can clarify if “the TN BS with ATG BS are synchronized then co-location” is a valid scenario.

**<Way forward 5>: For commercial aircraft flight, what is the range of UE altitude?**

* The following upper and lower boundary can be considered.
  + UE altitude (upper boundary): range: 10~15km
  + UE altitude (lower boundary): range: 3~7km

**Discussions:**

Huawei: we can choose one value for lower and upper boundary separately.

Qualcomm: for UE altitude, we prefer to use one value for each simulation. We do not want to use random value. We can just select higher bound and lower bound.

ZTE: for lower boundary, choose 7km. In that altitude there is no additional service.

Huawei: We have concern on the simulation workload. We just drop aircraft into range.

China Telecom: for specific number, we should check worst case. (3 for lower and 10 for upper)

Apple: to lower boundary, I wonder if 7 km is too high. We need consider helicopter.

Ericsson: for values, we would like prefer to 3km. This is co-existence simulation. We should make sure it is robust.

CMCC: we also support to use lower value to evaluate the worst case, 3 and 10.

ZTE: during the aircraft taking-off and landing the UE needs be turned off. We believe 3km is not the use case.

LGE: we have similar view as CTC and CMCC.

ZTE: what is the link budget for 3 km?

China Telecom: service can be provided at 3km.

Ericsson: regarding 3 or 7km, it is not obvious what regulation is used. Aircraft may not land at 3km. For link budget, if it does not work, we

**Agreement:**

**For UE altitude of commercial aircraft flight,**

* The following upper and lower boundary can be considered.
  + UE altitude (upper boundary): range: 10km
  + UE altitude (lower boundary): range: 3~7km
* Choose one fixed value for one simulation.

**<Way forward 8>: Is the co-existence scenario adjacent channel only or both adjacent channel and co-channel?**

* Only adjacent channel co-existence scenario is considered by RAN4.

**Discussions:**

China Telecom: we think it is true that co-channel simulation is not done by RAN4. It is better to have co-channel simulation to decide the power class.

ZTE: Power class is just parameters to do the simulation. RAN4 just defines the requirement for adjacent channel. RAN decision for other similar issue is do the simulation for adjacent channel in RAN4.

Apple: we share the similar view as ZTE.

Huawei: it is more relevant to RAN1 to do the co-channel study.

Qualcomm: share the similar view as ZTE and Apple. `

**Agreement:**

* Focus on adjacent channel co-existence scenario in RAN4.

**<Way forward 9>: Co-existence simulation scenario**

**Proposed sceanrios:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Combination | Aggressor | | Victim | | Simulation frequency | Notes | Study Phase |
| deployment scenario  UL/DL | CBW  duplex mode | deployment scenario  UL/DL | CBW  duplex mode |
| 1 | TN with ATG | ATG DL | 100MHz  TDD | TN rural DL | 100MHz  /TDD | 3.5 GHz |  | Phase 1 |
| 2 | TN with ATG | ATG UL | 100MHz  TDD | TN rural UL | 100MHz  TDD | 3.5GHz |  | Phase 1 |
| 3 | TN with ATG | TN rural DL | 100MHz  TDD | ATG DL | 100MHz  TDD | 3.5GHz |  | Phase 1 |
| 4 | TN with ATG | TN rural UL | 100MHz  TDD | ATG UL | 100MHz  TDD | 3.5GHz |  | Phase 1 |
| 5 | TN with ATG | ATG DL | 100MHz  TDD | TN rural UL | 100MHz  /TDD | 3.5GHz |  | FFS |
| 6 | TN with ATG | ATG UL | 100MHz  TDD | TN rural DL | 100MHz  TDD | 3.5GHz |  | FFS |
| 7 | TN with ATG | TN rural DL | 100MHz  TDD | ATG UL | 100MHz  TDD | 3.5GHz |  | FFS |
| 8 | TN with ATG | TN rural UL | 100MHz  TDD | ATG DL | 100MHz  TDD | 3.5GHz |  | FFS |
| 9 | TN with ATG | ATG DL | 20MHz FDD | TN rural DL | 20MHz FDD | 2 GHz |  | Phase 1 |
| 10 | TN with ATG | ATG UL | 20MHz FDD | TN rural UL | 20MHz FDD | 2 GHz |  | Phase 1 |
| 11 | TN with ATG | TN rural DL | 20MHz FDD | ATG DL | 20MHz FDD | 2 GHz |  | Phase 1 |
| 12 | TN with ATG | TN rural UL | 20MHz FDD | ATG UL | 20MHz FDD | 2 GHz |  | Phase 1 |
| 13 | TN with ATG | ATG UL | 20MHz FDD | TN rural DL | 20MHz TDD | 2 GHz | n1/n39 | FFS |
| 14 | TN with ATG | TN rural DL | 20MHz TDD | ATG UL | 20MHz FDD | 2 GHz | n39/n1 | FFS |
| 15 | ATG with ATG | ATG DL | 100/20M  TDD/FDD | ATG DL | 100/20M  TDD/FDD | 3.5/2 GHz |  | FFS |
| 16 | ATG with ATG | ATG UL | 100/20M  TDD/FDD | ATG UL | 100/20M  TDD/FDD | 3.5/2 GHz |  | FFS |

**Discussions:**

Huawei: remove 15 and 16.

ZTE: support to remove 15 and 16. In NTN we do not consider interference bwt NTN. 7 and 8 are deprioritized.

CMCC: OK to remove 15 and 16. Regarding 7 and 8, for example band we also have n79. For n79 we will have different CP length.

ZTE: 7 corresponds gNB-gNB interference.

**Agreement:**

* The following scenarios can be assumed as starting point.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Combination | Aggressor | | Victim | | Simulation frequency | Notes | Study Phase |
| deployment scenario  UL/DL | CBW  duplex mode | deployment scenario  UL/DL | CBW  duplex mode |
| 1 | TN with ATG | ATG DL | 100MHz  TDD | TN rural DL | 100MHz  /TDD | 3.5 GHz |  | Phase 1 |
| 2 | TN with ATG | ATG UL | 100MHz  TDD | TN rural UL | 100MHz  TDD | 3.5GHz |  | Phase 1 |
| 3 | TN with ATG | TN rural DL | 100MHz  TDD | ATG DL | 100MHz  TDD | 3.5GHz |  | Phase 1 |
| 4 | TN with ATG | TN rural UL | 100MHz  TDD | ATG UL | 100MHz  TDD | 3.5GHz |  | Phase 1 |
| 5 | TN with ATG | ATG DL | 100MHz  TDD | TN rural UL | 100MHz  /TDD | 3.5GHz |  | FFS |
| 6 | TN with ATG | ATG UL | 100MHz  TDD | TN rural DL | 100MHz  TDD | 3.5GHz |  | FFS |
| 7 | TN with ATG | TN rural DL | 100MHz  TDD | ATG UL | 100MHz  TDD | 3.5GHz |  | FFS |
| 8 | TN with ATG | TN rural UL | 100MHz  TDD | ATG DL | 100MHz  TDD | 3.5GHz |  | FFS |
| 9 | TN with ATG | ATG DL | 20MHz FDD | TN rural DL | 20MHz FDD | 2 GHz |  | Phase 1 |
| 10 | TN with ATG | ATG UL | 20MHz FDD | TN rural UL | 20MHz FDD | 2 GHz |  | Phase 1 |
| 11 | TN with ATG | TN rural DL | 20MHz FDD | ATG DL | 20MHz FDD | 2 GHz |  | Phase 1 |
| 12 | TN with ATG | TN rural UL | 20MHz FDD | ATG UL | 20MHz FDD | 2 GHz |  | Phase 1 |
| 13 | TN with ATG | ATG UL | 20MHz FDD | TN rural DL | 20MHz TDD | 2 GHz | n1/n39 | FFS |
| 14 | TN with ATG | TN rural DL | 20MHz TDD | ATG UL | 20MHz FDD | 2 GHz | n39/n1 | FFS |

**<Way forward 10>: Potential assumption for network layout of ATG.**

* Option 1: ATG network can be deployed on the airline routes.
* Option 2: ATG network can be deployed in larger area

**Discussions:**

Huawei: how many ATG sites should be put in simulation?

ZTE: most company to support option 1. ATG BS is equipped with three sectors to serve the large area.

Ericsson: Option 1 is for aircraft directly. The aircraft goes in different directions as observed in Radar24. We should not assume all the aircraft go in one direction. ZTE comment is part of simulation assumption discussion.

ZTE: single ATC can provide the service for large area.

Verizon: it is better to have regulation study on this one. If you touch countries, we should have some regulation study.

Huawei: if we just put single ATG, option 1 and 2 have no difference.

China Telecom: agree with ZTE.

Ericsson: 1) do we expect all the aircrafts flights in the same difference; 2) antenna; 3) ISD. Discuss those things separately.

**WF on ATG BS RF requirements**

**Topic #3 ATG BS RF requirements**

**Issue 3-2-1: ATG BS class**

4 companies support the following option 1 and one company say this need the coexistence study and WA BS might be reused, since the majority of view are fine with option 1, it’s proposed to agree on option 1 as baseline and further discuss the altitude value in 2nd round.

**Proposed Agreements:**

* Option1: to follow the HAPS approach
  + ATG Base Stations are characterized by requirements derived from ATG scenarios with a ground BS to air UE with typical vertical altitude range [TBD km].
  + Further discuss the typical vertical altitude range

**Agreement:**

* follow the HAPS approach

**Issue 3-2-2: ATG BS type**

2 companies clearly support the option 2 and one company support the option 1 and one company slight prefer option 1. It’s proposed to agree on BS type 1-H and BS type 1-O firstly and then further discuss BS type 1-C.

**Proposed Agreements:**

* Agree to support the BS type 1-H and BS type 1-O, FFS for BS type 1-C

**Discussions:**

Huawei: based on the current BS spec, the baseline is 1-C, 1-O and 1-C.

ZTE: 1-C cannot have beam capability to serve the service in the air.

Ericsson: similar understanding is as 1-C. BS should use the beam rather than fixed antenna.

**Agreement:**

* Use BS type 1-H, 1-O as baseline. FFS for BS type I-C.

**Issue 3-2-3: ATG BS RF requirements**

Discussion on ATG BS RF requirement is a bit high level, since this is first meeting. For ACLR, unwanted emission mask/ACS requirement, this should depend on the coexistence study outcome and it’s premature to agree on option 2 at current stage.

The following RF requirements highlighted in yellow, these requirements need more discussions in 2nd round.

Potential Agreements for other RF requirements except for ACLR/ACS:

|  |  |
| --- | --- |
| **Tx requirements** | **Proposal** |
| **gNB output power** | define a new BS-class which adopts the properties from the Wide area BS, similar to what have been done for HAPS and its maximum output power should be left up to the declaration. |
| **Output power dynamics** |  |
| **RE power control dynamic range** | To reuse the existing requirement defined in TS 38.104 |
| **Total power dynamic range** | To reuse the total power dynamic range of TS 38.104 |
| **Transmit ON/OFF power** | To reuse the existing requirement defined in TS 38.104 |
| **Transmitted signal quality** |  |
| **Frequency error** | To reuse the same requirement defined in TS 38.104 |
| **Modulation quality** | To reuse the same requirement defined in TS 38.104  FFS:256QAM |
| **Time alignment error** | This is not applicable for ATG BS |
| **Unwanted emissions** |  |
| **Occupied bandwidth** | To reuse the same requirement defined in TS38.104 which is following ITU-R Recommendation SM.328 |
| **Adjacent Channel Leakage Power Ratio** | *Agreements for ACLR,unwanted emission mask and ACS:*  for ACLR, UEM/ACS requirement, this should depend on the coexistence study outcome . |
| **Operating band unwanted emissions** | *Agreements for ACLR and ACS:*  for ACLR, UEM/ACS requirement, this should depend on the coexistence study outcome .. |
| **Transmitter spurious emissions** | To reuse the same spurious emission requirement defined in TS 38.104 |
| **Transmitter intermodulation** | Not applicable  since it’s supposed to have no surrounding interfering gNB next to gNB |
| **Rx requirement** |  |
| **Reference sensitivity level** | To reuse the same reference requirements for Wide Area BS defined in TS 38.104 |
| **Dynamic range** | Since IoT of ATG BS is supposed to quite low compared with IoT level of the legacy TN BS, it’s sufficient to reuse the existing requirement for Wide Area BS defined in TS 38.104. |
| **ACS** | *Agreements for ACLR and ACS:*  for ACLR, UEM/ACS requirement, this should depend on the coexistence study outcome . |
| **In-band blocking** | This depends on the outcome of coexistence study. |
| **Out of band blocking** | To reuse OOBB power level as -15dBm for ATG BS which should be sufficient enough. |
| **Receiver spurious emission** | To reuse the requirements defined in TS 38.104 |
| **Receiver intermodulation** | Similar as transmitter intermodulation requirements, not applicable since it’s supposed to have no surrounding interfering gNB next to gNB |
| **In-channel selectivity** | Similar as dynamic range requirements, the IoT of ATG BS is supposed to quite low compared with IoT level of the legacy TN BS, it’s sufficient to reuse the existing requirement for Wide Area BS defined in TS 38.104. |

**Agreement:**

* For gNB output power
  + define a new BS-class which adopts the properties from the Wide area BS, similar to what have been done for HAPS and its maximum output power should be left up to the declaration.
* For modulation quality
  + FFS:256QAM

**WF on UE requirements for ATG**

**Issue 3-1-2: GNSS assumption**

**Agreement:**

* It is proposed that ATG UE in R18 is GNSS capable.

**Issue 3-1-2a: Doppler/timing pre-compensation assumption**

* Option 1: NTN functionality is re-used together with GNSS. Revisit if any issue is found.

**Discussions:**

Qualcomm: How can NTN functionality be reused?

Huawei: Doppler pre-compensation is difficult to be done

ZTE: NTN signalling can be reused. Pre-compensation can be done.

Ericsson: for the satellite, UE is still and satellite is moving. For ATG, both are moving. UE needs to review the position of BS. We should double check.

**Issue 3-1-3: subclause to capture ATG UE requirement**

**Agreement:**

* Companies are encouraged to discuss the following options in the next meeting.
  + Option1: It is proposed to define UE requirement for ATG UE in separate subclause with suffix J in 38.101-1.
  + Option2: other considerations are not precluded.

**Issue 3-1-4: Power class for ATG UE**

**Agreement:**

* Companies are encouraged to discuss the following options in the next meeting:
  + Option1: A separate UE power class is defined for ATG UE
  + Option2: Consider further whether to set a power level in the requirement, or set a requirement on power accuracy with a declared power (subject to a maximum limit)
  + Option3: not to define the power class for ATG UE similar as IAB-MT

**Issue 3-1-7: power control accuracy**

**Agreement:**

* Companies are encouraged to input on the following options in the next meeting:
  + Power control accuracy should be investigated, e.g. whether it can be tightened to reduce the interference.
  + Option 2: reuse the current requirement

**Others**

**Agreement:**

* FFS on whether the requirement like in-band blocking, maximum input level could be relaxed.

### 11.14 Study on expanded and improved NR positioning

#### 11.14.4 Moderator summary and conclusions

**[104-e][137] FS\_NR\_pos\_UERF, AI 11.14 – Aida L Vera Lopez**

**R4-2214115 Email Discussion Summary for** **[104-e][137] FS\_NR\_pos\_UERF**

*Type: other For: Information  
 Source: Moderator (Intel)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214248 (from R4-2214115).**

**R4-2214248 Email Discussion Summary for [104-e][137] FS\_NR\_pos\_UERF**

*Type: other For: Information  
 Source: Moderator (Intel)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214462 | WF on expanded and improved NR positioning study | Intel Corporation |  |

**GTW on Aug-22**

**Intra-band CA scenario**

**[Tentative] Agreement:**

* Intra-band contiguous CA scenario will be prioritized in study

**Discussions:**

ZTE: want not to preclude NC CA.

Huawei/Ericsson/Apple: do not need sub-bullet for NC CA scenario.

ZTE: is that possible that companies show the evidence that TAE is very large… for non-contiguous CA.

Huawei: TAE requirement is very large to evaluate positioning performance. The TAE for NC CA is even larger.

Apple: At least we see 3us misalignment, which means 10km distance, which is too large.

ZTE: intra-band NC CA is 3us for FR1 and 200ns for FR2. It is not for the positioning. More infra vendors to do calibration such that much better requirement can be met.

**Agreement:**

* Intra-band contiguous CA scenario will be prioritized in study.

**Scope of study based on PRS/SRS bandwidth aggregation**

*Further discuss the following:*

* *RF architecture – can we agree to focus on a single RF architecture (i.e., single Tx/Rx chain)*
* *Studying RF impairment model (timing/group delay/frequency/phase) first to assess performance and accuracy gain with realistic impairments*
* *Studying achievable accuracy gain when TAE is within specified requirement for intra-band contiguous CA*
* *Deprioritizing power imbalance discussion*
* *Notifying RAN1 of the UE transmit power limitation due to potential prioritization*

**Discussions:**

ZTE: for the 3rd bullet, I believe “when TAE…” can be removed. For last bullet, it can be further discussed. There is no discussion. For the first one, we do not need to agree on single RF chain.

Huawei: Agree with most of bullets. For second bullet, it mention that we should study impairment model. The main of impairment is the group delay. We do not see big difference for two factors frequency error and phase error.

Ericsson: agree with most of bullets. On 3rd bullet, on timing alignment should be the same for transmission and positioning for intra-band contiguous CA.

Apple: we are also fine with most proposals. TAE should consider the UE architecture. I we prioritize the intra-band CA. it makes the work easier. The single RF architecture does not only intra-band CA can be supported. Some NC CA can also be supported. For TAE, from UE perspective, MRTD is related to TAE. I should link it to assumption of single FFT.

Qualcomm: for bullets #4 is fine. #2 and #3 are related to #1 what kind of architecture we are talking about. Not sure if companies agree with #1. Which impairment should be focus on. The group delay is more valid one if focusing on single RF.

ZTE: the purpose of TAE requirement is different from that for positioning. Using the existing TAE for positioning, then the positioning may not work. If only single RF chain, timing/group delay are related. We cannot use current TAE requirement as baseline. For uplink FR2-1, if we want to apply it for 200 or 400MHz, then it is better for us not to assume the single RF chain.

Apple: when we are talking about the positioning, why should we discuss TAE? TAE is just part of timing misalignment. I wonder if MRTD is the right metric.

Qualcomm: If we really need to down-scope to single RF architecture needs more discussion. We may can agree to prioritize intra-band contiguous CA case.

ZTE: to Qualcomm, for FR1 for intra-band contiguous CA, single RF chain is feasible. I am not sure if for FR2 it is OK, e.g., 400MHz not feasible.

**Agreement:**

* Deprioritizing power imbalance discussion

**Baseline assumptions**

*Discuss whether the assumption in the proposal below is truly needed in our study, and if it is better suited for RAN1 discussion.*

* *Proposal: RAN4 assumes that the legacy FFT processing strategy of legacy RXs, that is one FFT processing per CC with standard FFT size, must be baseline. Processing with extended FFT-size specifically for high accuracy positioning measurement is not assumed as baseline.*

**Discussions:**

Qualcomm: we do not think this assumption is needed. We fail to see how it is valid for this assumption.

ZTE: we share the similar view. Most important is related to FFT assumption.

Huawei: support the proposal. FFT size is the basic assumption from Rel-15.

**Initial conclusion on feasibility**

**[Tentative] Agreement:**

* PRS/SRS bandwidth aggregation for intra-band contiguous carrier is feasible for single chain Tx/Rx architectures

**Agreement:**

* PRS/SRS bandwidth aggregation for intra-band contiguous carrier is feasible for single chain Tx/Rx architectures

### 11.15 Multi-carrier enhancements for NR

#### 11.15.3 Moderator summary and conclusions

**[104-e][138] NR\_MC\_enh, AI 11.15 – Shan Yang**

**R4-2214116 Email Discussion Summary for [104-e][138] NR\_MC\_enh**

*Type: other For: Information  
 Source: Moderator (China Telecom)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214249 (from R4-2214116).**

**R4-2214249 Email Discussion Summary for [104-e][138] NR\_MC\_enh**

*Type: other For: Information  
 Source: Moderator (China Telecom)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New Tdoc**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214463 | WF on UL Tx switching across 3/4 bands with single TAG | China Telecom |  |
| R4-2214464 | Reply LS on UL Tx switching across 3 or 4 bands | China Telecom |  |
| R4-2214465 | WF on UL Tx switching with multiple TAGs | Ericsson |  |
| R4-2214466 | LS on UL Tx switching with multiple TAGs | Ericsson |  |

**GTW on Aug-22**

**Topic #2: Tx switching across 3/4 bands with single TAG**

**Discussions on the draft Reply LS on UL Tx switching across 3 or 4 bands**

The following answers highlighted by green were agreed.

**RAN1 Question #1:**

RAN WG1 would like to respectfully ask RAN WG4 to provide their feedback on potential increase of switching period and UE’s complexity in case of UL Tx switching across 3 or 4 bands in comparison to 2 bands.

**Agreement:**

**---------------------- RAN4 Answer to RAN1 Question #1 -----------------------------------**

On the length of switching period:

* For UL switching period with Tx switching across 3 or 4 bands, RAN4 agreed to reuse the same set of values as in Rel-16/17, i.e., {35 us, 140 us, 210 us} for UL CA and SUL.
* The length of switching period is applied per band pair for each band combination.
* For each band pair, the switching period can be the same or different for 1Tx-2Tx switching and 2Tx-2Tx switching based on UE reporting, which is similar as in Rel-17.
  + Note: For UE reporting different periods for 1Tx-2Tx switching and 2Tx-2Tx switching for a band pair, similar to Rel-17, it is RAN4 understanding that the 2Tx-2Tx switching period is applied when 2Tx-2Tx switching mode is configured.
* For the same band pair, RAN4 has not concluded on whether the same or a different value can be reported for the specific band pair supporting Tx switching across 3 or 4 bands in Rel-18 compared to Tx switching across 2 bands specified in Rel-16/17.

On the UE complexity:

* RAN4 has not identified any technical difficulty for UE to prevent realizing Tx switching across 3 or 4 bands.
* RAN4 would like to recommend the UE memory sharing issue to be further discussed in RAN1 if necessary.

**---------------------- RAN4 Answer to RAN1 Question #1 -----------------------------------**

The additional agreement to be captured in the way forward:

**Agreement:**

* The capture the following sentence in the other way forward document.
  + The complexity related aspects would be discussed in RAN4 in future meetings.

**RAN1 Question #2:**

RAN WG1 would like to respectfully ask RAN WG4 to provide their feedback on whether following assumption can be considered as baseline UE assumption/behavior even in case of the UL Tx switching across 3 or 4 bands.

* “When one of the two Tx chains is triggered to switch from one band to another band, another Tx chain which is in any of bands is also not expected to be used for transmission during the switching period.”

**Agreement:**

**---------------------- RAN4 Answer to RAN1 Question #2 -----------------------------------**

**RAN4 Answer:**

RAN4 has discussed the UE assumption/behavior considering two cases:

* Case 1: One of the two Tx chains is triggered to switch from one band (named “band A”) to another band (name “band B”), and the other Tx chain is maintained on either band A or band B.
  + For Case 1, RAN4 agreed that neither of Tx chains is expected to be used for transmission during the switching period.
* Case 2: One of the two Tx chains is triggered to switch from one band (named “band A”) to another band (name “band B”), and the other Tx chain is maintained on a different band (named “band C”).
  + For Case 2, RAN4 agreed that, as baseline UE assumption, neither of Tx chains is expected to be used for transmission on band C during the switching period.

**---------------------- RAN4 Answer to RAN1 Question #2 -----------------------------------**

The additional agreement to be captured in the way forward:

**Agreement:**

* Capture the following bullet in the way forward
  + RAN4 will further discuss optional advanced features to allow the other Tx chain can be expected to be used for transmission on band C during the switching period as advanced/optional UE assumption.

**For concurrent UL transmission on 2 bands:**

**Agreement:**

* For UL Tx switching across 3 and 4 bands, the support of concurrent UL transmission on 2 (out of 3 or 4) bands at least requires UL CA support on the corresponding band pair(s) by the UE.

**For the number of bands supporting 2Tx:**

From RAN4 perspective, it was recommended that at least 1 band out of 3 or 4 bands can support 2Tx. In RAN4 understanding, the final decision on the minimum and maximum numbers of bands that a UE shall support 2Tx across the bands is up to RAN1.

**FFS:**

* Add the action in the LS to ask RAN1 to inform the progress related to the number of bands supporting 2Tx.

**Topic #3: Tx switching with multiple TAGs**

**Issue 3-1-1: UL switching time**

*Summary of round 1 discussion*

* Option 2: The switching time is the same for single TAG and 2 TAGs (China Telecom, HW, Samsung, OPPO, ZTE, Xiaomi, Nokia, vivo, MTK, E///)
  + China Telecom, Samsung, OPPO, ZTE, vivo, E///: the difference is on UL outage time, or alternatively, TA can be considered separately
  + MTK: On top of UE reported Tx switching time, network need to handle delta MTTD as described in R4-2212220.
  + QC question: how to reflect the difference on the UL outage time in RAN4 specification. so the ran4 specifcation should then say “network is not expected to the schedule transmission for the outage time…” instead of referring to switching time?
* Option 3: Agree that the switching time should not include timing difference. But switching time for one given band combination can be different when UE supports TX switching on a band pair with single TAG and multiple TAGs. (QC)

*Tentative agreement:*

* The UL Tx switching time does not include the timing difference.

*Recommendation for round 2:*

* Further discuss the two options:
  + Option A: The UL switching time is the same for single TAG and 2 TAGs.
  + Option B: The switching time for one band pair can be different for single TAG and 2 TAGs, while the candidate switching time values are still in the set of {35us, 140us, 210us}.

**Discussion:**

Ericsson: prefer Option A.

Apple: we need more time to discuss on the preparation time for two TAGs. We are not ready to agree on Option A or B.

Qualcomm: Ericsson comment is that we can reuse the same values. UE should report the highest number for supported band combination. How does the network know the different number will be used?

ZTE: By definition the switching period is nothing to do with TA.

China Telecom: the values that UE reported for single TAG and two TAGs can be different. But we agree with ZTE that the implementation of UE is the same.

Ericsson: to Qualcomm, the UE can indicate that it can support Two TAGs. Number of TAG can be reported. If we can report supporting two TAGs and numbers of switching, it means UE can support this number for two TAGs. The gNB should make sure if UE cannot transmit anything during this period.

Mediatek: we share the same views with companies. For multi-TAGs, we know there is timing difference.

**Agreement:**

* RAN4 further discuss if the UL switching time is the same for single TAG and 2 TAGs
* UL switching time should not include timing difference up to MTTD between two TAGs.

**FFS:**

* UE may omit the uplink transmissions corresponding to any TAG during the UE switching time.

## 12 Rel-18 Work Items for LTE

### 12.1 Rel-18 LTE-Advanced Carrier Aggregation for x bands (2<=x<= 6) DL with y bands (y=1, 2) UL

#### 12.1.4 Moderator summary and conclusions

**[104-e][119] LTE\_Baskets, AI 12.1 – Mohammad Abdi Abyaneh**

**R4-2214097 Email Discussion Summary for** **[104-e][119] LTE\_Baskets**

*Type: other For: Information  
 Source: Moderator (Huawei)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions**

### 12.2 LTE intra-band contiguous CA for band 8

#### 12.2.3 Moderator summary and conclusions

**[104-e][126] LTE\_intraBandCA\_n8, AI 12.2 – Chunxia Guo**

**R4-2214104 Email Discussion Summary for [104-e][126] LTE\_intraBandCA\_n8**

*Type: other For: Information  
 Source: Moderator (CMCC)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214237 (from R4-2214104).**

**R4-2214237 Email Discussion Summary for [104-e][126] LTE\_intraBandCA\_n8**

*Type: other For: Information  
 Source: Moderator (CMCC)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| [R4-2212304](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212304.zip) | R4-2214950 | Draft CR for 36.101: UE RF requirements for band 8 intra-band contiguous CA | CMCC | Revised |  |

### 12.3 Introduction of LTE TDD band in 1670-1675 MHz

#### 12.3.4 Moderator summary and conclusions

**[104-e][127] R18\_LTE\_TDD\_1.6GHz, AI 12.3 – Ojas Choksi**

**R4-2214105 Email Discussion Summary for** **[104-e][127] R18\_LTE\_TDD\_1.6GHz**

*Type: other For: Information  
 Source: Moderator (Ligado)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214238 (from R4-2214105).**

**R4-2214238 Email Discussion Summary for [104-e][127] R18\_LTE\_TDD\_1.6GHz**

*Type: other For: Information  
 Source: Moderator (Ligado)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214440 | WF on Introduction of LTE TDD band in 1670 – 1675 MHz | Ligado Networks (Moderator) | The agreements from Round 1 to be captured for approval. |

**GTW on Aug-17**

**Sub-topic 1-1: Band Numbering and Operating Band Parameters**

Sub-topic description: In RAN4 #103-e, it was agreed to assign number 105 to the new LTE TDD Band in 1670 – 1675 MHz. There are proposals to assign instead the number 54 given that TDD band numbers between 0 – 63 have not yet been exhausted

Open issues and candidate options before e-meeting:

**Issue 1-1-1: Band number allocation for the new band**

There is a proposal to assign #54 to the new band instead of #105 that was agreed to in RAN4#103-e

* Proposals
  + Option 1: Change the assigned band number to 54 for the new band and draft CR to add the highlighted text below to clause 5.5 of TS 36.101 (Table 5.5-1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E‑UTRA Operating Band** | **Uplink (UL) operating band BS receive UE transmit** | | | **Downlink (DL) operating band BS transmit  UE receive** | | | **Duplex Mode** |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| 54 | 1670 MHz | – | 1675 MHz | 1670 MHz | – | 1675 MHz | TDD |

* + Option 2: Keep Band number 105 for the new band and draft CR to add the highlighted text below to clause 5.5 of TS 36.101 (Table 5.5-1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E‑UTRA Operating Band** | **Uplink (UL) operating band BS receive UE transmit** | | | **Downlink (DL) operating band BS transmit  UE receive** | | | **Duplex Mode** |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| 105 | 1670 MHz | – | 1675 MHz | 1670 MHz | – | 1675 MHz | TDD |

* Recommended WF
  + Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Agreement:**

* Option 1.

**Sub-topic 2-1: A-MPR assessment for the new band**

Sub-topic description: Assessing whether A-MPR needs to be specified or not for the new band to be included in the draft CR for the TS 36.101 at this meeting. R4-2212090 presents PAout measurements and filter data for the proposed new band to facilitate the assessment.

Open issues and candidate options before e-meeting:

**Issue 2-1-1:** UE transmission in 1670 – 1675 MHz is required to meet certain OOBE limits in the 1541 – 1625 MHz frequency range. The frequency range 1541 – 1625 MHz falls in the spurious region and the general spurious emission limits specified in Clause 6.5.3.1 of TS 36.101 will not be adequate to meet the required OOBE limits. It was agreed in RAN4#103-e meeting to evaluate if A-MPR will be required to meet these additional requirements.

* Proposals
  + Option 1: No A-MPR needs to be specified for the new band in 1670 – 1675 MHz to meet the additional spurious emissions associated with the new band.
  + Option 2: TBA
* Recommended WF
  + Companies are encouraged to review the data presented and the proposal for any issues/concerns. Companies should also review Issue 2-3-1 to assess if A-MPR may be required to meet the spurious emission co-existence requirement for protecting the DL of legacy E-UTRA/NR bands. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Discussions:**

Skyworks: we do have an issue. The evaluation is done by doing average. It would be good to cross check the worst case.

Ligado: we provide the analysis for worst case. There are enough margin.

Skyworks: I would like to cross check. One unclear part is how the PA is calibrated 30dB ACLR.

Ligado: Yes.

**Sub-topic 2-3: Spurious emission limits for band UE co-existence**

Sub-topic description: Assessing the spurious emission limits for UE co-existence for the new band as well as legacy US bands. The E-UTRA/NR bands with either DL or UL operations in proximity of the new band are depicted below in blue:

Table

Description automatically generated

Open issues and candidate options before e-meeting:

**Issue 2-3-1: UE spurious emission co-existence limit for the new band to protect DL of legacy E-UTRA/NR bands in the US.**

* Proposals
  + Option 1: Given the distance to US legacy DL bands and the fact that H2 falls outside the n77 US range, -50dBm/MHz protection can be granted for all US bands. Draft CR forTS 36.101 be prepared accordingly.
  + Option 2: TBA
* Recommended WF
  + Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Agreement:**

* Option 1: Given the distance to US legacy DL bands and the fact that H2 falls outside the n77 US range, -50dBm/MHz protection can be granted for all US bands. Draft CR forTS 36.101 be prepared accordingly.

**Issue 2-3-2: UE spurious emission co-existence limit for nearby legacy US E-UTRA/NR bands, B24/n24/n99, B66/n66, B70/n70 and n255 to protect the DL of the new band**

Proposals

* Option 1:
  + -50dBm/MHz protection level by band n24/n99, n70 and n66 is not specified
  + Relaxed protection can be specified but must account for legacy devices:
* Band n24 UL filter is focussed on the critical protection of the GNSS bands on the lower frequency side which is regulatory and thus provides only a small rejection at the new band frequencies at the higher frequency side
* Band n70 and n66 UL use a consolidated UL filter, which only provides moderate rejection at the new band frequencies
* The relaxation could be limited to UL BW above a given value and/or at a given position
* For some cases, it may be feasible to provide the -50dBm/MHz protection level but only up to a given channel bandwidth, while not specifying protection for a higher CBW (for n66 for example)
* Option 2:
  + Collect additional B24 duplexer rejection data as well measurements to finalize exception/relaxation, if any, for the UE coexistence spurious emission limit for protection of the new band by B24/n24 at the next meeting.
  + Collect additional B70 duplexer data as well measurements to finalize exception/relaxation, if any, for the UE coexistence spurious emission limit for protection of the new band by B70/n70 at the next meeting.
* Option 3:
  + Collect duplexer rejection data as well as measurements for different channel bandwidths for legacy bands B24/n24/n99, B66/n66, B70/n70 and n255 and finalize exception/relaxation for the UE coexistence spurious emission limits for these legacy bands for protection of the new band at the next meeting.
* Recommended WF
  + Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Discussions:**

Skyworks: For collecting data, we have the devices, which do not look into this protection. We may have issue for legacy. If we collect data, we should consider the existing devices.

Qualcomm: we agree with Skyworks. The bands are closed. In addition to that for band 66, the range is extended over the entire spectrum. More work is needed on it. Making the emission requirement based on filter rejection is some kind of frustructing

**Chair =>** when collecting data, take the comments from Skyworks and Qualcomm into account.

**Agreement:**

* Option 3

**Issue 2-3-3: UE spurious emission co-existence limit for other legacy US E-UTRA/NR bands to protect the DL of the new band**

Moderator Proposal

* Option 1:
  + -50dBm/MHz protection level can be specified for other legacy US bands (B2/n2, B5/n5/n89, B12/n12, B13/n13, B14/n14, B17, B25/n25, B26/n26, B29/n29, B30/n30, B41/n41, B48/n48, B53/n53, B71/n71, B77/n77, B85/n85, n86) to protect the new band. Draft CR for TSs 36.101, 38.101-1 and 38.101-5 be prepared accordingly.
* Option 2:
  + TBA
* Recommended WF
  + Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Discussions:**

Verizon: for n5, should we consider both 5 and n5?

Skyworks: n255.

T-mobile USA: why n66 and B66 not included?

Ligado: n66 is with larger channel bandwidth. The first ACLR falls. There may be more work.

Skyworks: when 35Mhz CBW is used for n66, filter does not help too much. It is not feasible to guarantee -50dBm.

**Agreement:**

* -50dBm/MHz protection level can be specified for other legacy US bands (B2/n2, B5/n5/n89, B12/n12, B13/n13, B14/n14, B17, B25/n25, B26/n26, B29/n29, B30/n30, B41/n41, B48/n48, B53/n53, B71/n71, B77/n77, B85/n85, n86) to protect the new band. Draft CR for TSs 36.101, 38.101-1 and 38.101-5 be prepared accordingly.

**Sub-topic 3-1: Rx reference sensitivity power level for the new band**

Sub-topic description: Expected changes to key band specific Rx requirements to be included in the draft CR for the TS 36.101.

Open issues and candidate options before e-meeting:

**Issue 3-1-1: The highlighted text is proposed to be introduced for Rx reference sensitivity power level requirement in the Draft CR for TS 36.101, Clause 7.3, Table 7.3.1-1. The band number to be populated will be based on agreement reached for Issue 1.1.1.**

* Proposals
  + Option 1: The following reference sensitivity table for the new band Clause is proposed

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA Band** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **Duplex**  **Mode** |
| **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** |
| 54 or 105 | -106.2 | -102.2 | -100 |  |  |  | TDD |

* + Option 2: TBA
* Recommended WF
  + Companies are encouraged to review the proposal for any issues/concerns. While expressing a view, it is suggested that each company provide a brief summary/reason for the expressed view.

**Discussions:**

Huawei: refsens should be based on the whole noise figure rather than only insertion loss.

Mediatek: we agree with Huawei comment.

**Agreement:**

* Option 1: The following reference sensitivity table for the new band Clause is proposed

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA Band** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **Duplex**  **Mode** |
| **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** | **(dBm)** |
| 54 | -106.2 | -102.2 | -100 |  |  |  | TDD |

### 12.4 New bands and BW allocation for 5G terrestrial broadcast - part 2

#### 12.4.5 Moderator summary and conclusions

**[104-e][128] New\_Bands\_BW\_5G\_broadcast, AI 12.4, 12.4.1~12.4.3 – Gene Fong**

**R4-2214106 Email Discussion Summary for [104-e][128] New\_Bands\_BW\_5G\_broadcast**

*Type: other For: Information  
 Source: Moderator (Qualcomm)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214239 (from R4-2214106).**

**R4-2214239 Email Discussion Summary for [104-e][128] New\_Bands\_BW\_5G\_broadcast**

*Type: other For: Information  
 Source: Moderator (Qualcomm)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214441 | WF on the scope of a coexistence study for HPHT 5G broadcast | Ericsson |  |
| R4-2214442 | WF on band definition for 5G broadcast in UHF | Nokia |  |
| R4-2214443 | WF on UE RF requirements for 5G broadcast | SWR |  |
| R4-2214444 | WF on system parameters for 5G broadcast | Qualcomm Incorporated |  |

**GTW on Aug-17**

**Topic #1: System parameters**

**Sub-topic 1-1 Coexistence**

Aspects related to system parameters was discussed in a number of papers. It was recognized by all companies that the WID indicates coordination between systems operating in the same geography is expected

The operation and planning of transmitters in these bands is different from cellular. In most cases, coordination mechanisms are in place so that when a new transmitter is proposed to be deployed in a given region, appropriate measures are taken (e.g. in terms of specific requirements for that transmitter, or usage of guard channels) to ensure coexistence with other systems in the same geography.

Nonetheless, Nokia in R4-2212071 proposes that the HPHT deployment was not the scenario studied in 3GPP when the general coexistence parameters were derived and when MBMS was specified. Therefore, before applying the general coexistence parameters (ACLR, ACS, etc), some study should first be conducted. On the other hand, ZTE in R4-2213699 (treated in thread 316) agrees that currently TN BS is not applicable for HPHT scenario. However, for how to protect the DTT service, there were some discussions in the past e.g., Band 20 or Band n71 (9 MHz guard band) and its coexistence requirement were also captured in BS spec. ZTE suggest to follow the legacy regulatory requirement instead of further do the evaluation study again.

**Issue 1-1: Coexistence**

* Is a coexistence study for HPHT deployment needed?
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + Discuss in the first round.

**Discussions:**

SWR: we support Option 2. We did operate as the existing one. There is no need for further study.

Nokia: we are not sure how the existing requirements of ACLR.. can be reused. We are not sure if we can skip the study.

Ericsson: We would like to see the study since HPHT is not considered in 3GPP before.

Qualcomm: I have concern on the open-ended co-existence study. The HPHT deployment has been there for long time.

T-Mobile: we often have requirements on top of regulation requirements. We support the idea to study here.

Verizon: study is needed. We need align on the regulation requirements.

**Agreement:**

* A coexistence study for HPHT deployment is needed

**Sub-topic 1-2 New band type**

It was recognized that the existing band types FDD, TDD, SDL are not well suited for the 5G broadcast band(s) and that a new type should be created. It was also suggested that a new suffix could be used to capture the specific requirements related to these downlink-only bands.

If there is a new band type created, is there any impact to other specifications in other working groups?

**Issue 1-2: New band type**

* Is a new band type needed?
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + If the answer is Yes, then please also comment whether there is impact to other WG’s
  + If the answer is No, then please comment on how existing band types could be used

**Discussions:**

SWR: we are in favor of Option 1.

Nokia: we only have FDD/TDD in RAN1 and RAN2. We can introduce the new band type in RAN4 but do not have impact on other WGs.

Ericsson: we are OK to define the new band type.

ZTE: this broadcast is different from SDL or other band.

T-mobile USA: do we need LS to other WG.

Qualcomm: something has already been included in other WGs.

ZTE: Feature has been captured in other WGs. Maybe we can send LS to RAN1/2 to check. The impact should be marginal.

Huawei: share the similar view as Qualcomm. In RAN1 the receiving only mode. For this mode UE has no need to report capability. We do not send LS.

Nokia: Agree with Qualcomm and Huawei.

**Agreement:**

* A new band type is needed.

**Sub-topic 1-3 Channel bandwidths**

The bandwidths allocated for broadcast in the UHF band are 6, 7, and 8 MHz depending on the region. However, LTE specifications only define bandwidths of 1.4, 3, 5, 10, 15, and 20 MHz. One option is to explicitly define new 6, 7, and 8 MHz channels (recognizing on the UE side that new filters should not necessarily be assumed). The other option is to reuse the existing bandwidths, perhaps taking into account some of the ideas explored in the NR study item on efficient use of non-standard bandwidths.

**Issue 1-3: Channel bandwidths**

* How should the channel bandwidths be handled?
  + Option 1: New channel bandwidths 6, 7, and 8 MHz are defined in both BS and UE specifications, applicable only to the 5G broadcast bands. It is recognized that the UE will not necessarily incorporate a new filter, rather only the existing 10 MHz filter should be assumed.
  + Option 2: The existing LTE bandwidths are used to cover the 5G broadcast channels.
  + Option 3: Other solutions?
* Recommended WF
  + Based on the contributions submitted, companies seem to recommend option 1 but all options can be discussed in the first round.

**Discussions:**

SWR: go with Option 1.

ZTE: prefer to Option 1 since the band is dedicated.

T-Mobile USA: we have concern on defining the new UE channel bandwidths. Some mobile operators requires supporting of 6, 8 bandwidths. We got a lot of push-back from vendors. They do not want to support the bands. We discussed it for years. Why we should go ahead for broadcast spectrum but not for IMT spectrum?

Qualcomm: I have the similar view as T-Mobile. It seems quick significant change. It is possible to accommodate the broadcast in the existing requirements, like 10MHz filter. We want to see if the existing implementation before agreeing on defining the requirements.

Apple: agree with T-Mobile USA and Qualcomm.

Mediatek: regarding new channel bandwidths or irregular channel bandwidth, it is feasible from base station side. For UE, more discussion is needed.

Nokia: for irregular channel bandwidth, we have many issue (ACS or blocking) not being addressed. We need study more before going for option 2.

Huawei: I think we reach any agreement. It should have no impact on the NR on-going SI for irregular channel bandwidth. We do not have strong view to define 6,7,8Mhz. But we need the whole picture on whether the new bandwidth for BS or UE.

Qualcomm: in WID, we assume 10MHz filter. Nokia concern cannot be addressed anyway.

Ericsson: it makes sense to introduce new bandwidths on BS side. For UE we need more discussion.

ZTE: agree with Ericsson. For UE side, 10MHz filter is assumed. But how it can protect DTT system. Probably the degradation is expected.

Nokia: we have already had study, which is captured in the TR. There is quite large degradation.

**Agreement:**

* For BS, define new channel bandwidths 6, 7, and 8 MHz.
* FFS for UE

**Sub-topic 1-4 Channel spacing and channel raster**

The conventional channel raster resolution for LTE is 100 kHz. However, the broadcast channelization for the UHF band is fixed for 6, 7, or 8 MHz channels.

**Issue 1-4: Channel spacing and channel raster**

* How should the channel spacing and channel raster be handled?
  + Option 1: Maintain the 100 kHz channel raster for generality. Some channel raster points may not be used.
  + Option 2: Downsample the channel raster to 3 sets of possibilities, for 6, 7, and 8 MHz channelizations.
* Recommended WF
  + Decide between the two options for channelization stating the reason for your preference

**Discussions:**

ZTE: Option 2. Fixed raster can make initial access easier.

SWR: Option 1 is flexible one.

Qualcomm: We favour option 1. Some country may off set the channel allocation. 100KHz would address that problem. We support flexibility.

Ericsson: Option 1.

ZTE: We are fine with Option 1 if no concern on the initial access complexity. If the offset 5 and 15khz, how to manage that?

Qualcomm: need further discussion.

**Agreement:**

* Option 1: Maintain the 100 kHz channel raster for generality. Some channel raster points may not be used.

**Sub-topic 1-5 Spectrum utilization**

**Table 2.3.1-1: Maximum transmission bandwidth configurations for MBMS**

|  |  |  |  |
| --- | --- | --- | --- |
| **Bandwidth** | **6 MHz** | **7 MHz** | **8 MHz** |
| **NRB** | 30 | 35 | 40 |

**Issue 1-5: Spectrum utilization**

* Any concerns with the above? Any other aspect that needs consideration?

**Discussions:**

SWR: this was already agreed. This is less efficient. If there is any solution for improvement we are happy.

**Topic #2: Band definition**

**Sub-topic 2-1 Number of bands**

Sub-topic description:

Open issues and candidate options before e-meeting:

**Issue 2-1: Number of bands**

* Proposals
  + Option 1: Single global band from 470 – XXX MHz defined for 6, 7, and 8 MHz bandwidths
  + Option 2: Three bands from 470 – XXX MHz with one band for 6 MHz bandwidth, one band for 7 MHz bandwidth, and one band for 8 MHz bandwidth. Each of these bands would be intended for deployment in regions compatible with the defined channel bandwidth.
  + Option 3: Other
* Recommended WF
  + Discuss options in the first round

**Discussions:**

Qualcomm: most companies are interested in global band. We do have concern about the feasibility. The relative bandwidth is very large. Using the existing filter technology, we do not think such wide band can be supported. We should use multiple bands. Do operators will use the whole spectrum? More interested part is the higher part of the band. There are some overlapping IMT band (71, APT). The hardware of n71 and APT can be used for this broadcast band. Our preference is to consider smaller band rather than massive global band.

SWR: a single band is very appealing. Higher part of band is more favourable since smaller antenna. There is another choise. To filter there is existing DTT receiver which can cover the whole band. Thus the single band can be supported.

Ericsson: We share the similar view as Qualcomm.

ZTE: In general, a global band is better. When taking about the DTT to support the whole band, it is for smart phone or other device?

SWR: we intend to have smart phone and tablet.

Qualcomm: I am not familiar with DTT. I concern the case in US. 71 is used for IMT. If there is no filter, the system will be hammered by band 71. We should consider the regional.

### 12.5 NB-IoT/eMTC core & perf. requirements for NTN

#### 12.5.6 Moderator summary and conclusions

**[104-e][139] LTE\_NBeMTC\_NTN\_UERF, AI 12.5.1, 12.5.4 – Tim Frost**

**R4-2214117 Email Discussion Summary for [104-e][139] LTE\_NBeMTC\_NTN\_UERF**

*Type: other For: Information  
 Source: Moderator (Mediatek)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214250 (from R4-2214117).**

**R4-2214250 Email Discussion Summary for [104-e][139] LTE\_NBeMTC\_NTN\_UERF**

*Type: other For: Information  
 Source: Moderator (Mediatek)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Status** |
| R4-2214467 | WF on NB-IoT/eMTC NTN agenda items 12.5.1 and 12.5.4 | MediaTek | For Approval, 12.5 |
| R4-2214468 | TP for Information on clause 6 and 7 of TS36.102 | MediaTek | For information, 12.5.4 |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2211799 | R4-2215117 | Work Plan for NB-IoT/eMTC NTN | MediaTek (Rapporteur) |  | Revised on 24 August |
| R4-2211778 | R4-2215118 | Draft spec for TS 36.102 | MediaTek |  | Revised on 24 August |
| R4-2213694 | R4-2215119 | Draft spec for TS 36.108 | ZTE |  | Revised on 24 August |

**GTW on Aug-19**

**Topic#1: Work Plan and Scope**

**Sub-topic #1-2**

**Issue 1-2-1: Deployment scenario (standalone vs other operating modes)**

**Moderator Proposal:** Agree to focus the WI requirements work on the standalone deployment scenario for NB-IoT and cat-M1 operation.

**Discussions:**

ZTE: We are fine with moderator proposals. I think for eMTC part different companies had different understanding. For UE only 1.4MHz is supported while for BS all the bandwidths can be supported.

**Agreement:**

* Agree to focus the WI requirements work on the standalone deployment scenario for NB-IoT and cat-M1 operation.

**Topic#2: Specification drafting general aspects**

**Sub-topic#2-1**

**Issue 2-1-3: UE spec structure**

A slight majority view to follow Option 1 (Suffix approach). Some support for a non-suffix approach.

**Moderator Proposal:** Suggest moving forward with Option 1 for now. As we become more familiar with the spec contents it should be very straightforward to adapt to a non-suffix approach if the opinion of the group changes. Do not include general and additional requirements in clause 4 text for these UE categories.

**Agreement:**

* For UE spec structure, follow suffix approach and do not include general and additional requirements in clause 4 text.

**Sub-topic#2-2**

**Issue 2-2-2: Create a 37 series SAN spec to replace the already agreed 36 series SAN specification**

**Moderator proposal**: No consensus was reached, and further discussion needed. If a 37 series spec was adopted, the scope of work should be limited to single RAT E-UTRA requirements to align with current WI scope.

**Discussions:**

Huawei: the whole 36 series there are not OTA requirements. Those are only 1-C. For SAN, it does not make sense to have 1-C. We need 1-H or 1-O following the AAS architecture. If including SAN in 36 series, it would break the rule for the 36 series spec where no AAS is included. It is just spec number change and need Ran decision. 37 series is multi-RAT. 37 series include other shared spectrum not only MSR.

ZTE: Huawei comments are correct. 37 series is about the multi-RAT. If we use 37 series, it is wiered. We need check with MCC which series need be used. We do not have strong view.

Mediatek: the WI scope is written including 36 which is single RAT. There is no intention to specify the multi-standard. It will impact the schedule.

Huawei: To ZTE, you are right. 37 like AAS includes the single RAT. To Mediatek, it is not our intention to modify the scope and impact the timeline.

Thales: understand the concerns. Remind 38.108 includes 1-H and 1-O.

**Topic#3: UE RF requirements**

**Moderator proposal:** items in the table with a single option are proposed to be agreed. Items in red require further contribution or discussion. Items highlighted in yellow require specific attention in GTW.

|  |  |
| --- | --- |
| **Requirement clause** | **Moderator Proposal for each item (items highlighted suggested for specific attention in GTW)** |
| Clause 6: Transmitter Characteristics |  |
| 6.1: General | **Agreement:**   * Reuse TN (cat-M1 and NB1/2 relevant aspects) |
| 6.2.1: Tx power | Option 2: Power class 3 and 5 as defined for TN for **all** categories  **Discussion:**  Ligado: there are different requirements tolerance.  **Agreement:**   * Power class 3 and 5 as defined for **all** categories   + FFS on the tolerance |
| 6.2.2: MPR | Option 1: Depends on outcome of SEM/ACLR discussion |
| 6.2.3: A-MPR | Further discussion needed. Options for all categories were:  **For b255**   * Option 1: Depends on outcome of SEM/ACLR discussion and spurious emission for UE coexistence. * Option 2: Reuse n255 and n256 requirements from NR NTN * Option 3: Already clear that A-MPR is not needed.   **Discussions:**  Huawei: in NR NTN, there is no addition backoff allowed. Do we still need the additional requirement in the spectrum emission requirement? When we say we use NR NTN, the treatment of A-MPR for NR and LTE are different. For LTE the A-MPR is on top of MRP.  Ericsson: it depends on further discussion. We need also specify the sub-PRB A-MPR and we can discuss whether or not we should follow NR NTN. This is specific to Cat-M1 device, which was not discussed before. For NB-IOT the legacy has not A-MPR, for which it should be OK.  Qualcomm: before getting agreement, can we assume SEM and ACLR can be reused? Can we reuse the regulatory requirement? We should have some conclusion above two points. Regarding NB-IoT, no A-MPR is needed.  Ligado: Qualcomm is correct. There are different regulatory, which is captured in different NS values for TN and NTN. Agree with Ericsson, we are looking at 10, 20, rather than looking at 1.4MHz. We can go with no A-MPR for NB1 and NB2 and  Huawei: I wonder if there is any evaluation done for NB-IoT for band 24.  Ligado: the evaluation is done for different regulatory requirements. We cannot take the evaluation for TN. The evaluation is done for 5Mhz with NTN regulatory requirements where no backoff is needed.  Huawei: it is not clear for me that no A-MPR is needed for Cat NB1 and NB2 since the smaller bandwidth will be used.  **For b256**   * Option 1: Depends on outcome of SEM/ACLR discussion and spurious emission for UE coexistence. * Option 2: Reuse n255 and n256 requirements from NR NTN * Option 3: Already clear that A-MPR is not needed. |
| 6.2.4: Configured Tx power | Option 1: Reuse TN requirements for **all** categories  **Agreement:**   * Reuse TN requirements for **all** categories |
| 6.3: Output Power Dynamics |  |
| 6.3.1 Minimum output power | Option 1: Reuse TN requirements for **all** categories  **Agreement:**   * Reuse TN requirements for **all** categories |
| 6.3.2 OFF power | **All categories:** Option 1: Reuse TN requirements  **Agreement:**   * Reuse TN requirements for **all** categories |
| 6.3.3 Transmit ON/OFF mask | **Cat-M1:** Options for further discussion:  Option 1: Reuse TN requirements, and sTTI is applicable  Option 2: Reuse TN requirements, but sTTI not applicable  **Discussions:**  Ericsson: We just reuse the sTTI from legacy. We did not discuss whether or not sTTI should be applied to Cat M1. We do not need touch it, say, explicitly remove sTTI from IoT-NTN.  **Agreement:**   * Do not explicitly preclude sTTI from IoT-NTN. |
| **NB1/2:** Option 1: Reuse TN requirements  **Agreement:**   * Reuse TN requirements for NB1/2 |
| 6.3.4 Power control | Option 1: Reuse TN requirements for **all** categories  **Agreement:**   * Reuse TN requirements for **all** categories |
| 6.4: Transmit signal quality |  |
| 6.4.1: Frequency error | Expected to use same requirement values for all categories, but NR NTN approach to frequency error needs to stabilize. Further contribution invited.  **Agreement:**   * Reuse 0.1 and 0.2 ppm requirements of frequency error and further discuss the condition where the requirements are applied. |
| 6.4.2: Transmit modulation quality | **Cat-M1:** Option 1: Reuse TN, but clarity on modulation orders needed.  **Discussion:**  Moderator: the modulation orders need be clarified. Is 64QAM supported for Cat M1? If we copy 36.101, basically we need copy all the modulation orders requirements.  **Further check the following bullet:**   * Follow the modulation orders supported by Cat M1 for TN in Rel-16 when specifying the requirements for IoT-NTN. |
| **NB1/2:** Option 1: Reuse TN (not beyond Rel-16 modulation schemes in line with WID)  **Agreement:**   * Reuse TN (not beyond Rel-16 modulation schemes in line with WID) for NB1/2 |
| 6.5: Output RF spectrum emissions |  |
| 6.5.1: Occupied bandwidth | **All categories:** Option 1: Reuse TN  **Agreement:**   * Reuse TN requirements for all categories |
| 6.5.2: Out of band emission |  |
| 6.5.2.1: SEM | **All categories:** Option 1: Assume TN as baseline, and reconfirm after coexistence verification |
| 6.5.2.2: Additional SEM | Option 1: For **all** categories and bands, this is not applicable.  **Agreement:**   * For **all** categories and bands, this is not applicable. |
| 6.5.2.3: ACLR | Option 1: For **all** categories, wait for coexistence verification outcome |
| 6.5.3: Spurious emission |  |
| 6.5.3.1: Minimum requirements | Option 1: Reuse TN for **all** categories  **Agreement:**   * Reuse TN requirements for **all** categories |
| 6.5.3.2: For UE co-existence | Option 1: Further contribution needed but consider NR NTN and existing E-UTRA TN as baselines. |
| 6.5.3.3 Additional spurious emissions |  |
| 6.6: Transmit intermodulation | **Cat-M1:** Further discuss between:   * Option 1: Requirement needs to be defined for 1.4MHz channel bandwidth * Option2: Not applicable for cat-M1   **Discussion:**  ZTE: Option 2 is also fine since there is no requirement before. Otherwise there would be mis-alignement between TN and NTN UE.  Ericsson: Same as ZTE.  Sony: Same comment.  **Agreement:**   * Agree Option 2. |
| **NB1/2:** Option 1: Reuse TN  **Agreement:**   * Reuse TN for **NB1/2** |
| 7.1: General | Option 1: Reuse TN  **Agreement:**   * Reuse TN requirements for all categories. |
| 7.2: Diversity characteristics | Option 1: Reuse aspects applicable for Cat-M1 and NB1/2 In TN  **Agreement:**   * Reuse aspects applicable for Cat-M1 and NB1/2 In TN |
| 7.3: Reference sensitivity | **Cat-M1 (1.4MHz):**  Different proposals discussed including reference to equivalent existing TN bands such as b24 and b65, to referring to a bandwidth-scaled version of n255 and n256.  More structured input needed here. |
| **NB1/2:** Option 1:Reuse TN (-108.2dBm for both bands)  **Agreement:**   * Reuse TN (-108.2dBm for both bands) for NB1/2 |
| 7.4: Maximum input level | Option 1: Same relative relaxation (15dB) as for NR NTN for **all** categories  Needs to be confirmed by further analysis. |
| 7.5: ACS | Option 1: Depends on outcome of coexistence verification for **all** categories |
| 7.6: Blocking characteristics |  |
| 7.6.1: In-band blocking | **All categories:** Option 1: Reuse TN  **Agreement:**   * Reuse TN for all the cateogries. |
| 7.6.2: Out-of-band blocking | **Cat-M1**:  For b255: Option 1: reuse TN (some ambiguity in the responses here)  Discussion:  Mediatek: Hardware of 24 can be applied for b255. It is feasible to reuse.  ZTE: Same understanding.  **Agreement:**   * For b255, agree Option 1.   For b256: Option 2: wait for NR NTN outcome in RAN4#104-e. |
| **NB1/2**:  For b255: Option 1: reuse TN (some ambiguity in the responses here)  **Agreement:**   * For b255, agree Option 1.   For b256: Option 2: wait for NR NTN outcome in RAN4#104-e. |
| 7.6.3: Narrow band | **Cat-M1:** Option 1: Reuse TN  **Agreement:**   * Reuse TN requirements for Cat-M1. |
| **NB1/2:** Option 1: Not applicable (as for TN)  **Agreement:**   * Not applicable (as for TN) for NB1/2. |
| 7.7: Spurious response | **All categories:** Option 1: Reuse TN  **Agreement:**   * Reuse TN for all categories |
| 7.8: Intermodulation | **All categories:** Option 1: Reuse TN  **Agreement:**   * Reuse TN for all categories |
| 7.9: Spurious emissions | Option 1: Reuse TN for **all** categories  **Agreement:**   * Reuse TN for all categories. |

## 13 Liaison and output to other groups

### 13.1 R18 related

### 13.4 Moderator summary and conclusions

**[104-e][140] NR\_reply\_LS\_UE\_RF, AI 13 – Steven Chen**

**R4-2214118 Email Discussion Summary for [104-e][140] NR\_reply\_LS\_UE\_RF**

*Type: other For: Information  
 Source: Moderator (Apple)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214251 (from R4-2214118).**

**R4-2214251 Email Discussion Summary for [104-e][140] NR\_reply\_LS\_UE\_RF**

*Type: other For: Information  
 Source: Moderator (Apple)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 1st round**

Based on the recommendation the status of existing tdoc and the new tdoc allocation can be found in the latest version of tdoc list at

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Inbox/Drafts/%5B104-e%5D%5B100%5D%20Main%20Session/TDoc_List_Meeting_RAN4%23104-e_220819_PM_Main-Session_RRM-206207214-227_v2.xlsx>

<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_104-e/Docs/TDoc_List_Meeting_RAN4%23104-e.xlsx>

**Conclusions after 2nd round**

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Status** | **Comments** |
| R4-2213618 | R4-2215081 | Draft Reply LS on lower humidity limit in normal temperature test environment | ZTE |  | revised |
| R4-2213729 | R4-2215091 | draft reply LS on ModifiedMPRbehaviour clarification for different power classes | Huawei, HiSilicon |  | Revised |
| R4-2212821 | R4-2214979 | On reply to RAN5 on FR2 ETC | vivo |  | revised |
| R4-2212327 | R4-2214951 | Reply LS on UE power limitation for STxMP in FR2 (R1-2205639) | Qualcomm |  | Revised |
| R4-2212656 | R4-2214968 | LS Reply to RAN1 on UE antenna gain | Ericsson |  | Revised |

## 14 Revision of the Work Plan

### 14.1 Discussions on R18 high power UE basket work items

**[104-e][142] R18\_HUPE\_basket\_WI, AI 14.1 – RAN4 Chair**

**R4-2214120 Email Discussion Summary for [104-e][142] R18\_HUPE\_basket\_WI**

*Type: other For: Information  
 Source: Moderator (RAN4 Chair)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Revised to R4-2214253 (from R4-2214120).**

**R4-2214253 Email Discussion Summary for [104-e][142] R18\_HUPE\_basket\_WI**

*Type: other For: Information  
 Source: Moderator (RAN4 Chair)*

**Abstract:**

This contribution provides the summary of email discussion and recommended summary.

**Decision: Return to.**

**Conclusions after 2nd round**

### 14.2 Other R18 item proposals

## 15 Any other business

## 16 Close of the E-meeting

Report prepared by: MCC