**3GPP TSG-RAN WG4 Meeting # 104-e**

**Electronic Meeting, 15 – 26 August 2022**

**Agenda item:** 9.14.9

**Source:** Moderator (Qualcomm Inc)

**Title:** Email discussion summary for [104-e][111]

# Topic: Unwanted emissions and signal quality

### 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

### 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

**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

**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

**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

### 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

### 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

### Inband emissions for PC1, PC2, and PC3

* Proposals

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

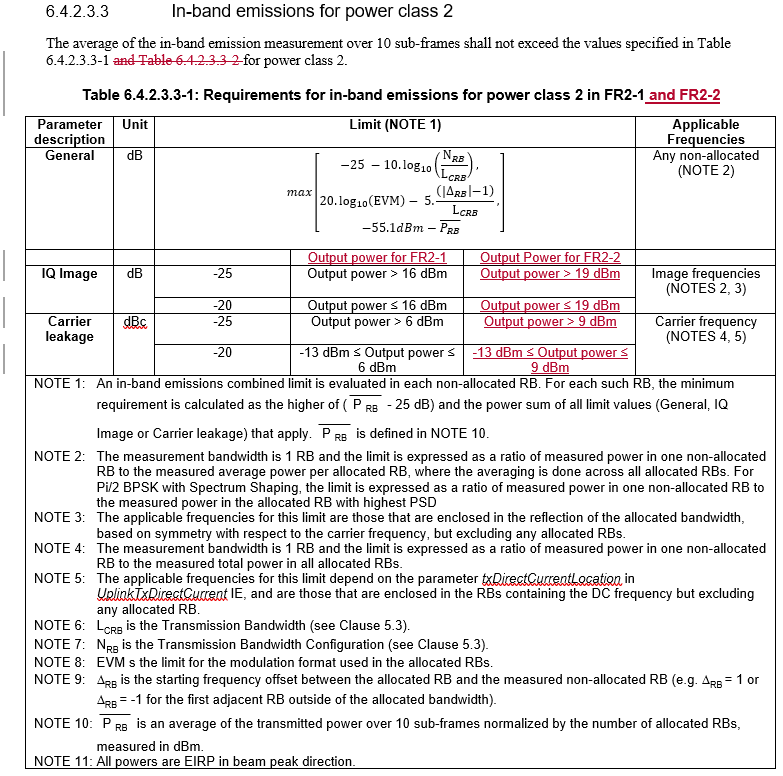
Table 6.4.2.3.2-1: Requirements for in-band emissions for power class 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 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

# Topic : MPR and A-MPR

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

## Open issues summary

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

### 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.

**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

### 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

# Topic : Other TX power related issues

### PC3 max TRP

*Sub-topic description*

**Issue**

* 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

### UL gap for TX power management

*Sub-topic description*

* 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

### Multi-band relaxation

*Sub-topic description*

* 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

### Pmin

*Sub-topic description*

**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

### TX OFF power

*Transmit 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

# Topic : CA unwanted emissions and signal quality

### Carrier leakage for power classes 1 and 3 in CA

*Sub-topic description*

* 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

### Inband emissions for power classes 1 and 3 in CA

*Sub-topic description*

* 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

### SEM for CA

*Sub-topic description*

* Proposals

**Proposal 1: Re-use the FR2-1 CA SEM requirements for FR2-2.**

* Recommended WF
  + Agree proposal 1

### ACLR for CA

*Sub-topic description*

* Proposals

**Proposal 1: Use the FR2-2 single carrier 15 dB ACLR value for CA**

* Recommended WF
  + Agree proposal 1

### OBW for CA

*Sub-topic description*

* Proposals

**Proposal 1: Re-use the FR2-2 single carrier 99% OBW for CA**

* Recommended WF
  + Agree proposal 1

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

### Maximum output power for CA

*Sub-topic description:*

* 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

### MPR for CA

*Sub-topic description*

* 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

### 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

# Topic: Other TX or general Issues

### Minimum guard band (Table 5.3.3-1)

*Sub-topic description*

* 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

### PRACH time mask

*Sub-topic description*

* 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 | X1 = [2,5] |
|  | 120 kHz | 0.017839 ms for front X1occasion 0.017546 ms for last occasion |
|  | 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 | X2 = [1,2] |
|  | 120 kHz | 0.035677 ms for front X2 occasion 0.034798 ms for last occasion |
|  | 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

### Beam correspondence

*Sub-topic description:*

* 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

### ON/ON transient periods

*Sub-topic description*

* 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

### Beam direction only switching time

*Sub-topic description*

* Proposals

**Proposal 1: Use a UE beam direction switching time of 59 ns.**

* Recommended WF
  + Discuss during round 1

# Topic: RX issues

### REFSENS

*Sub-topic description:*

* 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

### EIS relaxation for intraband contiguous CA

*Sub-topic description:*

* 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

### In-band blocking

*Sub-topic description*

* 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

### CA In-band blocking

*Sub-topic description*

* 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

### Maximum input level for Intra-band contiguous CA

*Sub-topic description*

* Proposals

**Proposal 1: Use the FR2-1 max input for intra-band contiguous requirement for FR2-2.**

* Recommended WF
  + Agree proposal 1

### Adjacent channel selectivity

*Sub-topic description*

* 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

### Adjacent channel selectivity for Intra-band contiguous CA

*Sub-topic description*

* 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.

# Tdocs

**Existing tdocs**

|  |  |  |
| --- | --- | --- |
| **Tdoc number** | **Title** | **Source** |
| [**R4-2211626**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211626.zip) | Draft CR to 38.101-2 on band n263 Tx aspects | Qualcomm Inc |
| [**R4-2211628**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211628.zip) | 60GHz UE TX | Qualcomm Inc |
| [**R4-2211950**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211950.zip) | Multi-band relaxation for FR2-2 handheld UE | Murata Manufacturing Co Ltd. |
| [**R4-2212119**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212119.zip) | Open issues for UE Tx requirements in FR2-2 | Intel Corporation |
| [**R4-2212278**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212278.zip) | Draft CR to 38.101-2 on minimum peak EIRP for PC3 band n263 | Murata Manufacturing Co Ltd. |
| [**R4-2212372**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212372.zip) | Discussion on minimum UE EIRP scaling for FR2-2 | Apple |
| [**R4-2212373**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212373.zip) | CR for TS 38.101-2: Correcting oversight with UE EIRP CBW scaling for FR2-2 | Apple |
| [**R4-2213220**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213220.zip) | On UE Tx RF aspects for FR2-2 | Nokia, Nokia Shanghai Bell |
| [**R4-2213232**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213232.zip) | SSB side conditions for band n263 | Apple |
| [**R4-2213366**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213366.zip) | Draft CR for n263 RF Tx requirements | Huawei, HiSilicon |
| [**R4-2213369**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213369.zip) | On remaining RF requirements on n263 | Huawei, HiSilicon |
| [**R4-2213466**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213466.zip) | CR on FR2-2 PC3 MPR | LG Electronics Finland |
| [**R4-2213573**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213573.zip) | Discussion on MPR values for FR2-2 PC3 | LG Electronics Finland |
| [**R4-2213744**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213744.zip) | UE Tx requirements for band n263 | Apple |
| [**R4-2211627**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211627.zip) | Draft CR to 38.101-2 on band n263 Rx aspects | Qualcomm Inc |
| [**R4-2211629**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211629.zip) | 60GHz UE RX | Qualcomm Inc |
| [**R4-2213203**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213203.zip) | draftCR on the UE RX requirement for band n263 | Xiaomi |
| [**R4-2213221**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213221.zip) | On UE Rx RF aspects for FR2-2 | Nokia, Nokia Shanghai Bell |
| [**R4-2213231**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213231.zip) | UE Rx requirements for band n263 | Apple |
| [**R4-2213367**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213367.zip) | Draft CR for n263 RF Rx requirements | Huawei, HiSilicon |
| [**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 |