TSG-RAN Working Group 4 (Radio) meeting #111R4-2410577

Fukuoka, Japan, 20th to 24th May 2024

**Source:** Ericsson

**Title:** TP for TR 38.922: Addition of technical background for 4400 to 4800 MHz in clause 4

**Agenda item:** 10.3.2

**Document for:** Approval

# Introduction

At the last RAN4 meeting (RAN4#110-bis in Changsha) the skeleton to the new technical report TR 38.922 was agreed in [1]. This new TR will capture technical background information relevant for the work to establish simulation parameters required for sharing studies in ITU-R WP 5D.

In this contribution a text proposal carrying information relevant for the frequency range 4400 to 4800 MHz have been created. Information have been captured from the WF agreed last meeting in [2]. The text proposal to TR 38.922, clause 4 is attached at the end of this contribution.

This is a revised version of R4-2408084.

# Discussion

Based on technical information agreed in WF from last meeting [2]. A text proposal to TR 38.922 clause 4 have been created to capture relevant information for the frequency range 4400 to 4800 MHz.

Based on the format used for the LS response to ITU-R WP 5D the information needs to be restructured to fit the skeleton for the technical report TR 38.922 [1].

Rather than adding references to TS 38.104 and TS 38.101-1, information relevant for 4400 to 4800 MHz have been captured from specifications into TR 38.922, clause 4.

Information in specifications not relevant for 4400 to 4800 MHz have been removed.

A text proposal for BS and UE RF characteristics and antenna characteristics have been created. The text proposal is presented for approval and is attached at the end of this contribution.

# Conclusion

A text proposal for TR 38.922, clause 4 have been created to captured information for the frequency range 4400 to 4800 MHz. The text proposal attached at the end of this contribution is presented for approval.

# References

[1] R4-2406614, “TR skeleton for the SI on IMT parameters for 4400 to 4800 MHz, 7125 to 8400 MHz and 14800 to 15350 MHz”, Ericsson

[2] R4-2406612, “WF on study of IMT parameters for 4400 to 4800 MHz frequency range”, Ericsson

TEXT PROPOSAL:

# 4 4400 - 4800 MHz frequency range

## General parameters

For the frequency range 4400 to 4800 MHz information can be extracted from requirements defined for band n79.



Figure 4.1-1: Band definition in the frequency range between 4.4 – 5.0 GHz

### Duplex mode

For this frequency range RAN4 considered TDD as the current duplexing candidate. An enhancement of TDD duplexing, via allowing the simultaneous existence of downlink and uplink sub-band at the BS side within a TDD carrier in a conventional TDD band (i.e., sub-band non-overlapping full duplex), was studied in Rel-18 [TR 38.858]. RAN4 is developing in Rel-19 the normative work for SBFD operation at the BS side within a TDD carrier [RP-240789]. The requirements and conformance aspects for Rel-19 SBFD work item can be tracked through the list of impacted specs captured in [RP-240789].

### Channel Bandwidth

A pragmatic, simple and non-ambiguous answers should be provided to ITU-R. While a number of channel bandwidth would be specified for these frequency ranges, 100 MHz has been considered as a representative channel bandwidth that will be used.

Supported channel bandwidths are listed in Table 4.1.2-1.

**Table 4.1.2-1: *BS channel bandwidths***

| **NR Band** | **SCS (kHz)** | ***BS channel bandwidth* (MHz)** |
| --- | --- | --- |
| **3** | **5** | **10** | **15** | **20** | **25** | **30** | **35** | **40** | **45** | **50** | **60** | **70** | **80** | **90** | **100** |
|  | 15 |  |  | 10 |  | 20 |  | 30 |  | 40 |  | 50 |  |  |  |  |  |
| n79 | 30 |  |  | 10 |  | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
|  | 60 |  |  | 10 |  | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |

### Signal Bandwidth

The signal bandwidth for a 100 MHz channel bandwidth signal is calculated based on the NR spectrum utilization for 30 kHz SCS:

 Signal bandwidth = NRB x SCS x 12

with NRB: Number of Resource block for 100 MHz channel bandwidth and 30kHz SCS, as specified in TS 38.104, subclause 5.3.2.

## 4.2 BS parameters

### 4.2.1 Transmitter characteristics

#### 4.2.1.1 Power dynamic range

There is no power control in downlink and fixed power per resource block is assumed in the co-existence simulation. Hence 0 dB power dynamic range was agreed for the LS reply.

#### 4.2.1.2 Spectral mask

For the frequency range 4400 to 4800 MHz the requirement limits for band n79 in TS 38.104, subclause 6.6.4 is listed in Table 4.2.1.2-1 and Table 4.2.1.2-2.

Table 4.2.1.2-1: Wide Area BS *operating band* unwanted emission limits
(NR bands above 1 GHz) for Category A

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz  |
| 5 MHz ≤ Δf <min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <min(10.05 MHz, f\_offsetmax) | -14 dBm | 100 kHz  |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax  | -13 dBm | 1 MHz  |

Table 4.2.1.2-2: Wide Area BS operating band unwanted emission limits
(NR bands above 1 GHz) for Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz  |
| 5 MHz ≤ Δf <min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <min(10.05 MHz, f\_offsetmax) | -14 dBm | 100 kHz  |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax  | -15 dBm | 1 MHz  |

#### 4.2.1.3 ACLR

From TS 38.104, subclause 6.6.3 the ACLR limit applicable for band n79 is listed in Table 4.2.1.3-1.

Table 4.2.1.3-1: Base station ACLR limit

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* of *lowest/highest carrier* transmitted BWChannel (MHz) | BS adjacent channel centre frequency offset below the lowest or above the highest carrier centre frequency transmitted | Assumed adjacent channel carrier (informative) | Filter on the adjacent channel frequency and corresponding filter bandwidth | ACLR limit |
| 100 | BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 45 dB |
|  | 2 x BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 45 dB |
| NOTE 1: BWChannel and BWConfig are the *BS channel bandwidth* and *transmission bandwidth configuration* of the *lowest/highest carrier* transmitted on the assigned channel frequency.NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig). |

#### 4.2.1.4 Spurious emissions

The spurious emission limits applicable for band n79 is listed in Table 4.2.1.4-1 and Table 4.2.1.4-2.

Table 4.2.1.4-1: General BS transmitter spurious emission limits in FR1, Category A

|  |  |  |  |
| --- | --- | --- | --- |
| Spurious frequency range | *Basic limit* | *Measurement bandwidth* | Notes |
| 9 kHz – 150 kHz |  | 1 kHz | Note 1, Note 4 |
| 150 kHz – 30 MHz |  | 10 kHz  | Note 1, Note 4 |
| 30 MHz – 1 GHz |  | 100 kHz | Note 1 |
| 1 GHz 12.75 GHz | -13 dBm | 1 MHz | Note 1, Note 2 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the DL *operating band* in GHz |  | 1 MHz | Note 1, Note 2, Note 3 |
| 12.75 GHz - 26 GHz | -13 dBm | 1 MHz | Note 1, Note 2, Note 5 |
| NOTE 1: *Measurement bandwidth*s as in ITU-R SM.329, s4.1.NOTE 2: Upper frequency as in ITU-R SM.329, s2.5 table 1.NOTE 3: Applies for Band for which the upper frequency edge of the DL *operating band* is greater than 2.55 GHz and less than or equal to 5.2 GHz.NOTE 4: This spurious frequency range applies only to *BS type 1-C* and *BS type 1-H*. NOTE 5: Applies for Band for which the upper frequency edge of the DL *operating band* is greater than 5.2 GHz. |

Table 4.2.1.4-2: General BS transmitter spurious emission limits in FR1, Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Spurious frequency range | *Basic limit* | *Measurement bandwidth* | Notes |
| 9 kHz – 150 kHz |  | 1 kHz | Note 1, Note 4 |
| 150 kHz – 30 MHz | -36 dBm | 10 kHz  | Note 1, Note 4 |
| 30 MHz – 1 GHz |  | 100 kHz | Note 1 |
| 1 GHz – 12.75 GHz |  | 1 MHz | Note 1, Note 2 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the DL *operating band* in GHz | -30 dBm | 1 MHz | Note 1, Note 2, Note 3 |
| 12.75 GHz - 26 GHz | - 30 dBm | 1 MHz | Note 1, Note 2, Note 5 |
| NOTE 1: *Measurement bandwidth*s as in ITU-R SM.329, s4.1.NOTE 2: Upper frequency as in ITU-R SM.329, s2.5 table 1.NOTE 3: Applies for Band for which the upper frequency edge of the DL *operating band* is greater than 2.55 GHz and less than or equal to 5.2 GHz.NOTE 4: This spurious frequency range applies only to *BS type 1-C* and *BS type 1-H*. NOTE 5: Applies for Band for which the upper frequency edge of the DL *operating band* is greater than 5.2 GHz. |

Additional spurious emissions requirements relevant for band n79 can be found in TS 38.104, subclause 6.6.5.2.3 and subclause 6.6.5.2.4.

#### 4.2.1.5 Maximum output power

The maximum output power will be provided in the antenna parameter table. It was agreed to be aligned with antenna characteristics.

The Total Radiated Power for two polarizations was agreed as shown in Table 4.2.1.5-1 below.

Table 4.2.1.5-1: The Total Radiated Power

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Rural | Macro Sub-urban | Macro Urban | Micro Urban |
| Total Radiated Power for two polarizations (dBm) | 46 | 46 | 46 | 37 |

#### 4.2.1.6 Average output power

It was agreed the average output power won’t be mentioned in the reply LS.

### 4.2.2 Receiver characteristics

#### 4.2.2.1 Noise figure

The BS noise figure relevant for 4400 to 4800 MHz is listed in Figure 4.2.2.1-1.

Table 4.2.2.1-1: Noise figure

|  |  |
| --- | --- |
| BS class | Noise figure (dB) |
| Wide Area | 5 |
| Medium Range | 10 |
| Local Area | 13 |

#### 4.2.2.2 Sensitivity

The BS reference sensitivity relevant for 4400 to 4800 MHz is listed in Figure 4.2.2.2-1, Figure 4.2.2.2-2 and Figure 4.2.2.2-3.

Table 4.2.2.2-1: NR Wide Area BS reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel | Reference sensitivity power level, PREFSENS (dBm) |
| 3 | 15 | G-FR1-A1-7 (Note 1) | -103.6 |
| G-FR1-A1-21 (Note 6) | -103.6 |
| 5, 10, 15  | 15 | G-FR1-A1-1 (Note 1) |  -101.7 |
|  |  | G-FR1-A1-10 (Note 3) | -101.7 (Note 2) |
| 10, 15  | 30 | G-FR1-A1-2 (Note 1) |  -101.8 |
| 10, 15 | 60 | G-FR1-A1-3 (Note 1) |  -98.9 |
| 20, 25, 30, 35, 40, 45, 50  | 15 | G-FR1-A1-4 (Note 1) |  -95.3 |
|  |  | G-FR1-A1-11 (Note 4) | -95.3 (Note 2) |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100  | 30 | G-FR1-A1-5 (Note 1) |  -95.6 |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100  | 60 | G-FR1-A1-6 (Note 1) |  -95.7 |
| NOTE 1: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*.NOTE 2: The requirements apply to BS that supports NB-IoT operation in NR in-band.NOTE 3: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-10 mapped to the 24 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-1 mapped to disjoint frequency ranges with a width of 25 resource blocks each.NOTE 4: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-11 mapped to the 105 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-4 mapped to disjoint frequency ranges with a width of 106 resource blocks each.NOTE 5: Void.NOTE 6: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-21 mapped to the 12 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-7 mapped to disjoint frequency ranges with a width of 15 resource blocks each. |

Table 4.2.2.2-2: NR Medium Range BS reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel(Note 5) | Reference sensitivity power level, PREFSENS (dBm) |
| 3 | 15 | G-FR1-A1-7 (Note 1) | -98.6 |
| G-FR1-A1-21 (Note 6) | -98.6 |
| 5, 10, 15 | 15 | G-FR1-A1-1 (Note 1) |  -96.7 |
|  |  | G-FR1-A1-10 (Note 3) | -96.7 (Note 2) |
| 10, 15  | 30 | G-FR1-A1-2 (Note 1) |  -96.8 |
| 10, 15 | 60 | G-FR1-A1-3 (Note 1) |  -93.9 |
| 20, 25, 30, 35, 40, 45, 50  | 15 | G-FR1-A1-4 (Note 1) |  -90.3 |
|  |  | G-FR1-A1-11 (Note 4) | -90.3 (Note 2) |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100  | 30 | G-FR1-A1-5 (Note 1) |  -90.6 |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100  | 60 | G-FR1-A1-6 (Note 1) |  -90.7 |
| Note 1: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*.Note 2: The requirements apply to BS that supports NB-IoT operation in NR in-band.Note 3: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-10 mapped to the 24 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-1 mapped to disjoint frequency ranges with a width of 25 resource blocks each.Note 4: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-11 mapped to the 105 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-4 mapped to disjoint frequency ranges with a width of 106 resource blocks each.Note 5: These reference measurement channels are not applied for band n46, n96 and n102.Note 6: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-21 mapped to the 12 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-7 mapped to disjoint frequency ranges with a width of 15 resource blocks each. |

Table 4.2.2.2-3: NR Local Area BS reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel(Note 5) | Reference sensitivity power level, PREFSENS (dBm) |
| 3 | 15 | G-FR1-A1-7 (Note 1) | -95.6 |
| G-FR1-A1-21 (Note 6) | -95.6 |
| 5, 10, 15 | 15 | G-FR1-A1-1 (Note 1) |  -93.7 |
|  |  | G-FR1-A1-10 (Note 3) | -93.7 (Note 2) |
| 10, 15  | 30 | G-FR1-A1-2 (Note 1) |  -93.8 |
| 10, 15 | 60 | G-FR1-A1-3 (Note 1) |  -90.9 |
| 20, 25, 30, 35, 40, 45, 50  | 15 | G-FR1-A1-4 (Note 1) |  -87.3 |
|  |  | G-FR1-A1-11 (Note 4) | -87.3 (Note 2) |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100  | 30 | G-FR1-A1-5 (Note 1) |  -87.6 |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100  | 60 | G-FR1-A1-6 (Note 1) |  -87.7 |
| Note 1: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*.Note 2: The requirements apply to BS that supports NB-IoT operation in NR in-band.Note 3: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-10 mapped to the 24 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-1 mapped to disjoint frequency ranges with a width of 25 resource blocks each.Note 4: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-11 mapped to the 105 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-4 mapped to disjoint frequency ranges with a width of 106 resource blocks each.Note 5: These reference measurement channels are not applied for band n46, n96 and n102.Note 6: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-21 mapped to the 12 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-7 mapped to disjoint frequency ranges with a width of 15 resource blocks each. |

#### 4.2.2.3 Blocking response

The BS blocking characteristics relevant for 4400 to 4800 MHz is listed in Table 4.2.2.3-1, Table 4.2.2.3-2, Table 4.2.2.3-3 and Table 4.2.2.3-4.

The in-band blocking requirement shall apply from FUL,low - ΔfOOB to FUL,high + ΔfOOB. The ΔfOOB for *BS type 1-C* and *BS type 1-H* is defined in Table 4.2.2.3-1.

Table 4.2.2.3-1: ΔfOOB offset for NR *operating bands*

|  |  |  |
| --- | --- | --- |
| BS type | *Operating band* characteristics | ΔfOOB (MHz) |
|  | FUL,high – FUL,low ≤ 200 MHz | 20 |
| *BS type 1-C* | 200 MHz < FUL,high – FUL,low ≤ 900 MHz | 60 |
|  |  |  |
|  | FUL,high – FUL,low < 100 MHz | 20 |
| *BS type 1-H* | 100 MHz ≤ FUL,high – FUL,low ≤ 900 MHz  | 60 |
|  |  |  |

Table 4.2.2.3-2: Base station general blocking requirement

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Wanted signal mean power (dBm) (Note 2) | Interfering signal mean power (dBm) | Interfering signal centre frequency minimum offset from the lower/upper *Base Station RF Bandwidth edge* or *sub-block* edge inside a *sub-block gap* (MHz) | Type of interfering signal |
| 3 | PREFSENS + x dB | Wide Area BS: -43Medium Range BS: -38Local Area BS: -35 | ±4.5 | 3 MHz DFT-s-OFDM NR signal15 kHz SCS, 15 RBs |
| 5, 10, 15, 20 | PREFSENS + x dB | Wide Area BS: -43Medium Range BS: -38Local Area BS: -35 | ±7.5 | 5 MHz DFT-s-OFDM NR signal15 kHz SCS, 25 RBs |
| 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | PREFSENS + x dB | Wide Area BS: -43Medium Range BS: -38Local Area BS: -35 | ±30 | 20 MHz DFT-s-OFDM NR signal15 kHz SCS, 100 RBs |
| NOTE 1: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in tables 7.2.2-1, 7.2.2-2 and 7.2.2-3. For band n104, PREFSENS depends on the *BS channel bandwidth* as specified in tables 7.2.2-1a, 7.2.2-2c, and 7.2.2-3c. For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2.1-5, 7.2.1-5a and 7.2.1-5c of TS 36.104 [13].NOTE 2: For a BS capable of single band operation only, "x" is equal to 6 dB. For a BS capable of multi-band operation, "x" is equal to 6 dB in case of interfering signals that are in the in-band blocking frequency range of the operating band where the wanted signal is present or in the in-band blocking frequency range of an adjacent or overlapping operating band. For other in-band blocking frequency ranges of the interfering signal for the supported operating bands, "x" is equal to 1.4 dB. |

Table 4.2.2.3-3: Base Station narrowband blocking requirement

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) |
| 3, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80,90, 100 (Note 1) | PREFSENS + 6 dB | Wide Area BS: -49Medium Range BS: -44Local Area BS: -41 |
| NOTE 1: The SCS for the *lowest/highest carrier* received is the lowest SCS supported by the BS for that *BS channel bandwidth*NOTE 2: PREFSENS depends on the *BS channel bandwidth* as specified in tables 7.2.2-1, 7.2.2-2 and 7.2.2-3. NOTE 3: 7.5 kHz shift is not applied to the wanted signal. |

Table 4.2.2.3-4: Base Station narrowband blocking interferer frequency offsets

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Interfering RB centre frequency offset to the lower/upper *Base Station RF Bandwidth edge* or *sub-block* edge inside a *sub-block gap* (kHz) (Note 2) | Type of interfering signal |
| 3 | ±(255+m\*180),m=0, 1, 2, 3, 4, 7, 10, 13 | 3 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 1 RB |
| 5 | ±(350+m\*180),m=0, 1, 2, 3, 4, 9, 14, 19, 24 | 5 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 1 RB |
| 10 | ±(355+m\*180),m=0, 1, 2, 3, 4, 9, 14, 19, 24 |  |
| 15 | ±(360+m\*180),m=0, 1, 2, 3, 4, 9, 14, 19, 24 |  |
| 20 | ±(350+m\*180),m=0, 1, 2, 3, 4, 9, 14, 19, 24 |  |
| 25 | ±(565+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 | 20 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 1 RB |
| 30 | ±(570+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 35 | ±(560+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 40 | ±(565+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 45 | ±(570+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 50 | ±(560+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 60 | ±(570+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 70 | ±(565+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 80 | ±(560+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 90 | ±(570+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 100 | ±(565+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| NOTE 1: Interfering signal consisting of one resource block positioned at the stated offset, the *channel bandwidth* of the interfering signal is located adjacently to the lower/upper *Base Station RF Bandwidth edge* or *sub-block* edge inside a *sub-block gap*. NOTE 2: The centre of the interfering RB refers to the frequency location between the two central subcarriers. |

The out-of-band blocking requirement apply from 1 MHz to FUL,low - ΔfOOB and from FUL,high + ΔfOOB up to 12750 MHz.

Table 4.2.2.3-5: Out-of-band blocking performance requirement for NR

|  |  |  |
| --- | --- | --- |
| Wanted Signal mean power (dBm) | Interfering Signal mean power (dBm) | Type of Interfering Signal |
| PREFSENS +6 dB(Note) | -15  | CW carrier  |
| NOTE 1: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in Table 7.2.2-1, 7.2.2-2, and 7.2.2-3. For band n104, PREFSENS depends on the *BS channel bandwidth* as specified in tables 7.2.2-1a, 7.2.2-2c, and 7.2.2-3c. For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2.1-5, 7.2.1-5a and 7.2.1-5c of TS 36.104 [13].NOTE 2: For NB-IoT, up to 24 exceptions are allowed for spurious response frequencies in each wanted signal frequency when measured using a 1MHz step size. For these exceptions the above throughput requirement shall be met when the blocking signal is set to a level of -40 dBm for 15 kHz subcarrier spacing and -46 dBm for 3.75 kHz subcarrier spacing. In addition, each group of exceptions shall not exceed three contiguous measurements using a 1MHz step size.NOTE 3: Void |

Table 4.2.2.3-6: Blocking performance requirement for NR BS when co-located with BS in other frequency bands.

| Frequency range of interfering signal | Wanted signal mean power (dBm) | Interfering signal mean power for WA BS (dBm) | Interfering signal mean power for MR BS (dBm) | Interfering signal mean power for LA BS (dBm) | Type of interfering signal |
| --- | --- | --- | --- | --- | --- |
| Frequency range of co-located downlink *operating band* | PREFSENS +6dB(Note 1) | +16 | +8 | x (Note 2) | CW carrier |
| NOTE 1: PREFSENS depends on the *BS channel bandwidth* as specified in Table 7.2.2-1, 7.2.2-2, and 7.2.2-3.NOTE 2: x = -7 dBm for NR BS co-located with Pico GSM850 or Pico CDMA850x = -4 dBm for NR BS co-located with Pico DCS1800 or Pico PCS1900x = -6 dBm for NR BS co-located with UTRA bands or E-UTRA bands or NR bandsNOTE 3: The requirement does not apply when the interfering signal falls within any of the supported uplink *operating band(s)* or in ΔfOOB immediately outside any of the supported uplink *operating band(s)*.NOTE 4: For unsynchronized base stations (except in band n46, n96 and n102), special co-location requirements may apply that are not covered by the 3GPP specifications. |

#### 4.2.2.4 ACS

The BS ACS relevant for 4400 to 4800 MHz is listed in Figure 4.2.2.4-1 and Figure 4.2.2.4-2.

Table 4.2.2.4-1: Base station ACS requirement

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the lowest/*highest carrier* received (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) |
| 3 | PREFSENS + 8 dB | Wide Area BS: -52Medium Range BS: -47Local Area BS: -44 |
| 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 (Note 1) | PREFSENS + 6 dB |
| NOTE 1: The SCS for the lowest/highest carrier received is the lowest SCS supported by the BS for that bandwidth.NOTE 2: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in tables 7.2.2-1, 7.2.2-2, 7.2.2-3. For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2.1-5, 7.2.1-5a and 7.2.1-5c of TS 36.104 [13]. |

Table 4.2.2.4-2: Base Station ACS interferer frequency offset values

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Interfering signal centre frequency offset from the lower/upper *Base Station RF Bandwidth edge* or *sub-block* edge inside a *sub-block gap* (MHz) | Type of interfering signal |
| 3 | ±1.5075 | 3 MHz DFT-s-OFDM NR signal15 kHz SCS, 15 RBs |
| 5 | ±2.5025 |  |
| 10 | ±2.5075 | 5 MHz DFT-s-OFDM NR signal |
| 15 | ±2.5125 | 15 kHz SCS, 25 RBs |
| 20 | ±2.5025 |  |
| 25 | ±9.4675 |  |
| 30 | ±9.4725 |  |
| 35 | ±9.4625 |  |
| 40 | ±9.4675 |  |
| 45 | ±9.4725 |  |
| 50 | ±9.4625 | 20 MHz DFT-s-OFDM NR signal |
| 60 | ±9.4725 | 15 kHz SCS, 100 RBs |
| 70 | ±9.4675 |  |
| 80 | ±9.4625 |  |
| 90 | ±9.4725 |  |
| 100 | ±9.4675 |  |

## 4.3 UE parameters

### 4.3.1 Transmitter characteristics

#### 4.3.1.1 Power dynamic range

The minimum controlled output power of the UE is defined as the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks), when the power is set to a minimum value. For existing FR1 bands, the minimum output power is -33 dBm for 100 MHz channel bandwidth. Hence, the power dynamic range is 56 dB for 100 MHz channel bandwidth.

#### 4.3.1.2 Spectral mask

The UE spectral mask is described in Table 4.3.1.2-1.

Table 4.3.1.2-1: General NR spectrum emission mask

|  |  |  |
| --- | --- | --- |
| **ΔfOOB (MHz)** | **Channel bandwidth (MHz) / Spectrum emission limit (dBm)** | **Measurement bandwidth** |
| **3** | **5** | **10, 15, 20, 25, 30, 35, 40, 45** | **50, 60, 70, 80, 90, 100** |
| ± 0-1 | -13 | -13 | -13 |  | 1 % of channel BW |
| ± 0-1 |  |  |  | -24 | 30 kHz |
| ± 1-5 | -10 | -10 | -10 | 1 MHz |
| ± 5-6 | -25 | -13 |  |
| ± 6-10 |  | -25 |  |
| ± 5-BWChannel |  |  | -13 |
| ± BWChannel-(BWChannel+5) |  |  | -25 |

#### 4.3.1.3 ACLR

The UE ACLR requirement is listed in Table 4.3.1.3-1.

Table 4.3.1.3-1: NR ACLR requirement

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Power class 1 | Power class 1.5 | Power class 2 | Power class 3 |
| NR ACLR | 37 dB | 31 dB | 31 dB | 30 dB |

#### 4.3.1.4 Spurious emissions

The UE spurious emission requirement is captured in Table 4.3.1.4-1 and Table 4.3.1.4-2.

Table 4.3.1.4-1: Boundary between NR out of band and general spurious emission domain

|  |  |
| --- | --- |
| Channel bandwidth | OOB boundary FOOB (MHz) |
| 3 | 6 |
| 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | BWChannel + 5 |

Table 4.3.1.4-2: Requirement for general spurious emissions limits

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Range | Maximum Level | Measurement bandwidth | NOTE |
| 9 kHz ≤ f < 150 kHz | -36 dBm | 1 kHz |  |
| 150 kHz ≤ f < 30 MHz | -36 dBm | 10 kHz |  |
| 30 MHz ≤ f < 1000 MHz | -36 dBm | 100 kHz |  |
| 1 GHz ≤ f < 12.75 GHz | -30 dBm | 1 MHz | 4 |
| -25 dBm | 1 MHz | 3 |
| 12.75 GHz ≤ f < 5th harmonic of the upper frequency edge of the UL operating band in GHz | -30 dBm | 1 MHz | 1 |
| 12.75 GHz < f < 26 GHz | -30 dBm | 1 MHz | 2 |
| NOTE 1: Applies for Band for which the upper frequency edge of the UL Band is greater than 2.55 GHz and less than or equal to 5.2 GHzNOTE 2: Applies for Band that the upper frequency edge of the UL Band more than 5.2 GHzNOTE 3: Applies for Band n41, CA configurations including Band n41, and EN-DC configurations that include n41 specified in clause 5.2B of TS 38.101-3 [3] when NS\_04 is signalled. NOTE 4: Does not apply for Band n41, CA configurations including Band n41, and EN-DC configurations that include n41 specified in subclause 5.2B of TS 38.101-3 [3] when NS\_04 is signalled. |

#### 4.3.1.5 Maximum output power

The UE maximum output power requirement is listed in Table 4.3.1.5-1.

Table 4.3.1.5-1: UE Power Class

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NRband | Class 1 (dBm) | Tolerance (dB) | Class 1.5 (dBm) | Tolerance (dB) | Class 2 (dBm) | Tolerance (dB) | Class 3 (dBm) | Tolerance (dB) |
| n79 |  |  | 295 | +2/-3 | 26 | +2/-3 | 23 | +2/-3 |
| NOTE 1: PPowerClass is the maximum UE power specified without taking into account the toleranceNOTE 2: Powerclass 3 is default power class unless otherwise statedNOTE 3: Refers to the transmission bandwidths confined within FUL\_low and FUL\_low + 4 MHz or FUL\_high – 4 MHz and FUL\_high, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB.NOTE 4: The maximum output power requirement is relaxed by reducing the lower tolerance limit by 0.3 dBNOTE 5: Achieved via dual TxNOTE 6: Generally, PC1 UE is not targeted for smartphone form factor.  |

#### 4.3.1.6 Average output power

It was agreed the average output power won’t be mentioned in the reply LS to WP5D.

### 4.3.2 Receiver characteristics

#### 4.3.2.1 Noise figure

The UE noise figure relevant for 4400 to 4800 MHz is 9 dB.

#### 4.3.2.2 Sensitivity

The UE sensitivity requirement is listed in Table 4.3.2.2-1.

**Table 4.3.2.2-1: Two antenna port reference sensitivity QPSK PREFSENS for TDD, SDL and FDD with variable duplex operation bands**

|  |
| --- |
| **Operating band / SCS / Channel bandwidth / REFSENS** |
| **Operating band** | **SCS****kHz** | **Channel bandwidth (MHz)** | **REFSENS (dBm)** | **Duplex Mode** |
| n79 | 15 | 10, 20, 30, 40, 50 | -95.8 + 10log10(NRB/52) | TDD |
| 30 | 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 | -96.1 + 10log10(NRB/24) |
| 60 | 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 | -96.5 + 10log10(NRB/11) |

#### 4.3.2.3 Blocking response

The UE blocking requirement is listed in Table 4.3.2.3-1, Table 4.3.2.3-2, Table 4.3.2.3-3 and Table 4.3.2.3-4.

**Table 4.3.2.3-1: In-band blocking parameters for NR bands with FDL\_low ≥ 3300 MHz and FUL\_low ≥ 3300 MHz**

|  |  |  |
| --- | --- | --- |
| **RX parameter** | **Units** | **Channel bandwidth (MHz)** |
|  |  | **10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100** |
| Power in transmission bandwidth configuration | dBm | REFSENS + 6 dB3 |
| BWinterferer | MHz | BWChannel  |
| FIoffset, case 1 | MHz | (3/2)\*BWChannel  |
| FIoffset, case 2 | MHz | (5/2)\*BWChannel  |
| NOTE 1: The transmitter shall be set to 4 dB below PCMAX\_L,f,c at the minimum UL configuration specified in Table 7.3.2-3 with PCMAX\_L,f,c defined in clause 6.2.4.NOTE 2: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 NOTE 3: For Band n104, the power in transmission bandwidth configuration is REFSENS + 9 dB |

Table 4.3.2.3-2: In-band blocking for NR bands with FDL\_low ≥ 3300 MHz and FUL\_low ≥ 3300 MHz

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR band | Parameter | Unit | Case 1 | Case 2 |
|  | Pinterferer | dBm | -56 | -44 |
| n77, n78, n79, n104 | Finterferer (offset) | MHz | -BWChannel/2 –FIoffset, case 1andBWChannel/2 +FIoffset, case 1 | ≤ -BWChannel/2 –FIoffset, case 2and≥ BWChannel/2 +FIoffset, case 2 |
|  | Finterferer |  | NOTE 2 | FDL\_low – 3\*BWChanneltoFDL\_high + 3\*BWChannel |
| NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -BWChannel/2 – FIoffset, case 1; b: BWChannel/2 + FIoffset, case 1NOTE 3: BWChannel denotes the channel bandwidth of the wanted signal |

**Table 4.3.2.3-3: Out-of-band blocking parameters for NR bands with FDL\_low ≥ 3300 MHz and FUL\_low ≥ 3300 MHz**

|  |  |  |
| --- | --- | --- |
| **RX parameter** | **Units** | **Channel bandwidth (MHz)** |
|  |  | **10** | **15** | **20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100** |
| Power in transmission bandwidth configuration | dBm | REFSENS + 6 dB | REFSENS + 7 dB | REFSENS + 9 dB |
| NOTE: The transmitter shall be set to 4 dB below PCMAX\_L,f,c at the minimum UL configuration specified in Table 7.3.2-3 with PCMAX\_L,f,c defined in clause 6.2.4. |

Table 4.3.2.3-4: Out of-band blocking for NR bands with FDL\_low ≥ 3300 MHz and FUL\_low ≥ 3300 MHz

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR band | Parameter | Unit | Range1 | Range 2 | Range 3 |
| n79 (NOTE 4) | Finterferer (CW) | MHz | N/A | -150 < f – FDL\_low ≤ -MAX(60,3\*BWChannel)orMAX(60,3\*BWChannel) ≤ f – FDL\_high < 150 | 1 ≤ f ≤ FDL\_low – MAX(150,3\*BWChannel)orFDL\_high + MAX(150,3\*BWChannel)≤ f ≤ 12750 |
| NOTE 1: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm for FInterferer > 6000 MHz.NOTE 2: BWChannel denotes the channel bandwidth of the wanted signalNOTE 3: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm, for FInterferer > 2700 MHz and FInterferer < 4800 MHz. For BWChannel > 15 MHz, the requirement for Range 1 is not applicable and Range 2 applies from the frequency offset of 3\*BWChannel from the band edge. For BWChannel larger than 60 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3\*BWChannel from the band edge.NOTE 4: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm, for FInterferer > 3650 MHz and FInterferer < 5750 MHz. For BWChannel ≥ 40 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3\*BWChannel from the band edge.NOTE 5: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm, for FInterferer > 5175 MHz. For BWChannel > 60 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3\*BWChannel from the band edge. The power level of the interferer (PInterferer) for Range 2 shall be modified to -33 dBm for the range 5925– MAX(60,3\*CBW) ≤ f < FDL\_low - MAX(60,3\*CBW). |

#### 4.3.2.4 ACS

The UE ACS requirement is listed in Table 4.3.2.4-1 and Table 4.3.2.4-2.

Table 4.3.2.4-1: Test parameters for NR bands with FDL\_low ≥ 3300 MHz and FUL\_low ≥ 3300 MHz, case 1

|  |  |  |
| --- | --- | --- |
| RX parameter | Units | Channel bandwidth (MHz) |
|  |  | 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 |
| Power in transmission bandwidth configuration | dBm | REFSENS + 14 dB |
| Pinterferer | dBm | REFSENS + 45.5 dB |
| BWinterferer | MHz | BWChannel |
| Finterferer (offset) | MHz | BWChannel/-BWChannel  |
| NOTE 1: The transmitter shall be set to 4 dB below PCMAX\_L,f,c at the minimum UL configuration specified in Table 7.3.2-3 with PCMAX\_L,f,c defined in clause 6.2.4.NOTE 2: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1. |

Table 4.3.2.4-2: Test parameters for NR bands with FDL\_low ≥ 3300 MHz and FUL\_low ≥ 3300 MHz, case 2

|  |  |  |
| --- | --- | --- |
| RX parameter | Units | Channel bandwidth (MHz) |
|  |  | 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 |
| Power in transmission bandwidth configuration | dBm | -56.5 |
| Pinterferer | dBm | -25 |
| BWinterferer | MHz | BWChannel |
| Finterferer (offset) | MHz | BWChannel/-BWChannel  |
| NOTE 1: The transmitter shall be set to 24 dB below PCMAX\_L,f,c at the minimum UL configuration specified in Table 7.3.2-3 with PCMAX\_L,f,c defined in clause 6.2.4.NOTE 2: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.  |

## 4.4 Antenna characteristics

### 4.4.1 BS antenna characteristics

#### 4.4.1.1 Antenna model

The antenna model is described in subclause 7.1.

#### 4.4.1.2 Antenna parameters

The BS antenna parameters relevant for 4400 to 4800 MHz is listed in Table 4.4.1.2-1.

**Table 4.4.1.2-1: IMT parameters relevant for 1710 to 4990 MHz**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Macro Rural** | **Macro suburban** | **Macro urban** | **Micro urban** |
| *Am* | 30 dB | 30 dB | 30 dB | 30 dB |
| *SLAv* | 30 dB | 30 dB | 30 dB | 30 dB |
| *3dB* | 90 deg. | 90 deg. | 90 deg. | 90 deg. |
| *3dB* | 65 deg. | 65 deg. | 65 deg. | 65 deg. |
| *GE,max* | 6.4 dBi | 6.4 dBi | 6.4 dBi | 6.4 dBi |
| *Msub* | 3 | 3 | 3 | N/A |
| *dv,sub* | 0.7l m | 0.7l m | 0.7l m | N/A |
| *subtilt* | 3 deg. | 3 deg. | 3 deg. | N/A |
| *M* | 4 | 4 | 4 | 8 |
| *N* | 8 | 8 | 8 | 8 |
| *dh* | 0.5l m | 0.5l m | 0.5l m | 0.5l m |
| *dv* | 2.1l m | 2.1l m | 2.1l m | 0.7l m |
| *etilt* |  deg. |  deg. |  deg. |  deg. |
| *escan* |  deg. |  deg. |  deg. |  deg. |
| *r* | 1 | 1 | 1 | 1 |
| *Ptx* | 46 dBm | 46 dBm | 46 dBm | 37 dBm |
| *mech* | 3 deg. | 6 deg. | 6 deg. | N/A |

### 4.4.2 UE antenna characteristics

For the frequency range 4400 to 4800 MHz the UE will have a conducted interface with an assumed isotropic radiation pattern antenna and no beamforming.