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Technical Report

3rd Generation Partnership Project; Technical Specification Group Radio Access Network; LTE Band 65 for NR (n65); (Release 16)



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Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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- x the first digit:
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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document is a technical report for the work item of Band 65 for New Radio.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications"
- [2] RP-181844, "New WI: Band 65 for New Radio"
- [3] 3GPP TS 45.005: "GSM/EDGE Radio transmission and reception"
- [4] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone"

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

Carrier: modulated waveform conveying the E-UTRA or UTRA physical channels

Channel bandwidth: RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell.

Channel edge: lowest or highest frequency of the NR carrier, separated by the *BS channel bandwidth*.

Contiguous spectrum: spectrum consisting of a contiguous block of spectrum with no *sub-block gap(s)*.

Inter-band gap: The frequency gap between two supported consecutive operating bands.

operating band: frequency range in which NR operates (paired or unpaired), that is defined with a specific set of technical requirements

3.2 Symbols

For the purposes of the present document, the following symbols apply:

| | |
|----------------------------|---|
| Δf | Separation between the channel edge frequency and the nominal -3dB point of the measuring filter closest to the carrier frequency |
| Δf_{\max} | The largest value of Δf used for defining the requirement |
| F_c | <i>RF reference frequency</i> on the channel raster |
| f_{offset} | Separation between the channel edge frequency and the centre of the measuring filter |
| $f_{\text{offset}_{\max}}$ | The maximum value of f_{offset} used for defining the requirement |

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

| | |
|------------|---|
| A-MPR | Additional Maximum Power Reduction |
| BC | Base Station Class |
| BS | Base Station |
| CBW | Channel Bandwidth |
| CP-OFDM | Cyclic Prefix-OFDM |
| DFT-s-OFDM | Discrete Fourier Transform-spread-OFDM |
| EDGE | Enhanced Data rates for GSM Evolution |
| GSM | Global System for Mobile Communications |
| LTE | Long Term Evolution |
| NB-IoT | Narrowband – Internet of Things |
| MPR | Maximum Power Reduction |
| MSR | Multistandard Radio |
| NR | New Radio |
| NR-ARFCN | NR Absolute Radio Frequency Channel Number |
| OFDMA | Orthogonal Frequency Division Multiple Access |
| SC-FDMA | Single Carrier FDMA |
| UE | User Equipment |
| UTRA | Universal Terrestrial Radio Access |

4 Background

NR band n65 is a LTE re-farming band from LTE Band 65. During NR Rel-15, many LTE re-farming bands were included into NR specifications as a part of the NR standardization work, without any band specific TR's. From Rel-16 onwards, a band specific WI is needed to add LTE re-farming band into NR specifications.

As the band n65 is very similar to LTE B65, with small UE aspect differences, the list of issues is pretty limited.

5 Frequency band arrangements

5.1 Adjacent 3GPP bands

The 3GPP bands nearby to band n65, when addressing co-existence aspects are bands 1 and 34 as shown in figure 5.1. Band 1 is for both Region 1 and 3, while Band 34 is region 3.

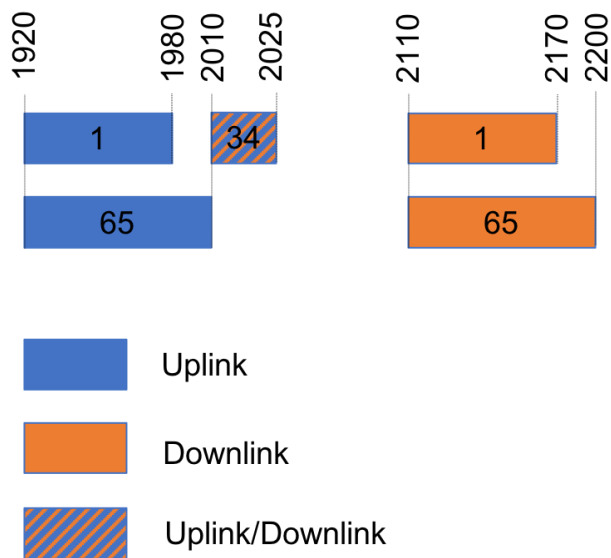


Figure 5.1: 3GPP bands nearby Band n65

6 List of band specific issues for n65

The list of band-specific issues for Band n65 are provided below.

- General issues
 - Carrier frequency and NR-ARFCN
 - Co-existence with other 3GPP bands in Region 1 and Region 3
- E-UTRA specific issues
 - UE
 - Network signalling and A-MPR
 - BS
- Co-existence with NB-IoT (MSR specification)

7 Study of E-UTRA specific issues

7.1 UE aspect issues

n65 has to protect PHS in Region 3, which is below n65 uplink. n1 same the same protection requirements, hence the same network signaling value and A-MPR are applied to n65.

n65 has to protect Band 34, which is right above n65 uplink as shown in figure 7.1-1. A-MPR study is done using applicable NR transmitter requirements. The following scenarios are simulated, shown in figure 7.1-1.

| | 1980 | 2010 | 2015 |
|---|--------|---------------|-------------|
| 5 MHz CBW: A-MPR with 5 MHz offset | | 5 MHz offset | -50 dBm/MHz |
| 10 MHz CBW: A-MPR with Fc of 1985 MHz | 10 MHz | offset | -50 dBm/MHz |
| 10 MHz CBW: A-MPR with Fc of 1995 MHz | | 10 MHz offset | -50 dBm/MHz |
| 10 MHz CBW: A-MPR with 5 MHz offset | | 10 MHz offset | -50 dBm/MHz |
| 15 MHz CBW: A-MPR with Fc of 1987.5 MHz | 15 MHz | offset | -50 dBm/MHz |
| 20 MHz CBW: A-MPR with Fc of 1990 MHz | 20MHz | offset | -50 dBm/MHz |

Figure 7.1-1: B34 protection scenarios

Simulation results were provided by Qualcomm (R4-1812118) in table 7.1-1.

Table 7.1-1: A-MPR for NS_24

| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | Region A | | | Region B | | | Region C | | |
|------------------------|-----------------------------------|------------------|-----------------|-------|------------------|-----------------|-------|------------------|-----------------|-------|
| | | Rbend*12*SCS MHz | LCRB*12*SCS MHz | A-MPR | Rbend*12*SCS MHz | LCRB*12*SCS MHz | A-MPR | Rbend*12*SCS MHz | LCRB*12*SCS MHz | A-MPR |
| 5MHz | Fc=1992.5 | | >3.24 | A7 | | | | | | |
| 5MHz | Fc=1997.5 | | >3.24 | A4 | | | | | | |
| 5MHz | Fc=2002.5 | | >2.16 | A1 | >3.78 | ≤1.98 | A2 | ≤3.6 | ≤1.98 | A3 |
| 10MHz | Fc=1985 | >5.4 | | A4 | | | | | | |
| 10MHz | Fc=1995 | | >4.5 | A1 | >7.56 | ≤4.32 | A2 | ≤7.38 | ≤4.32 | A3 |
| 10MHz | Fc=2000 | >6.84 | | A5 | <2.88 | | A5 | ≥3.06 ≤6.66 | >1.44 | A6 |
| 15MHz | Fc=1987.5 | | >7.02 | A1 | >11.52 | ≤6.84 | A2 | ≤11.34 | ≤6.84 | A3 |
| 15MHz | Fc=1997.5 | >9.36 | | A5 | <3.6 | | A5 | ≥3.78 ≤9.18 | >1.44 | A6 |
| 20MHz | Fc=1990 | >13.5 | | A5 | <4.5 | | A5 | ≥4.68 ≤13.32 | >2.16 | A6 |
| 20MHz | Fc=1995 | >12.6 | | A5 | <5.4 | | A5 | ≥5.58 ≤12.42 | >1.44 | A6 |

NOTE 1: The A-MPR values are listed in Table 7.1-2.

NOTE 2: For any undefined region, MPR applies.

Table 7.1-2: A-MPR for modulation and waveform type

| Modulation/Waveform | A1 | A2 | A3 | A4 | A5 | A6 | A7 |
|----------------------|-------------|-------------|-------------|-------|-------------|-------------|-------|
| | Outer/Inner | Outer/Inner | Outer/Inner | Outer | Outer/Inner | Outer/Inner | Outer |
| DFT-s-OFDM PI/2 BPSK | ≤ 11 | ≤ 5 | ≤ 4 | ≤ 8.5 | ≤ 18 | ≤ 10 | ≤ 3.5 |
| DFT-s-OFDM QPSK | ≤ 11 | ≤ 5 | ≤ 4 | ≤ 8.5 | ≤ 18 | ≤ 10 | ≤ 3.5 |
| DFT-s-OFDM 16 QAM | ≤ 11 | ≤ 5 | ≤ 4 | ≤ 8.5 | ≤ 18 | ≤ 10 | ≤ 3.5 |
| DFT-s-OFDM 64 QAM | ≤ 11 | ≤ 5 | ≤ 4 | ≤ 8.5 | ≤ 19 | ≤ 10 | ≤ 3.5 |
| DFT-s-OFDM 256 QAM | ≤ 11 | ≤ 5 | | ≤ 8.5 | ≤ 20 | ≤ 10 | |
| CP-OFDM QPSK | ≤ 13 | ≤ 6.5 | ≤ 4 | ≤ 8.5 | ≤ 19 | ≤ 12 | ≤ 5.5 |
| CP-OFDM 16 QAM | ≤ 13 | ≤ 6.5 | ≤ 4 | ≤ 8.5 | ≤ 19 | ≤ 12 | ≤ 5.5 |
| CP-OFDM 64 QAM | ≤ 13 | ≤ 6.5 | ≤ 4 | ≤ 8.5 | ≤ 19 | ≤ 12 | ≤ 5.5 |
| CP-OFDM 256 QAM | ≤ 13 | ≤ 6.5 | | ≤ 8.5 | ≤ 20 | ≤ 12 | |

NOTE 1: The backoff applied is max(MPR, A-MPR) where MPR is defined in Table 6.2.2-1 in TS 38.101-1 [4].
NOTE 2: Outer and inner allocations are defined in clause 6.2.2 in TS 38.101-1 [4].

Simulation results provided by Nokia (R4-1812051):

Table 7.1-3: Parameter

| CBW [MHz] | Offset from band edge [MHz] | Fc [MHz] | A-MPR |
|-----------|-----------------------------|----------|-------|
| 5 | 15 | 1992,5 | A1 |
| 5 | 10 | 1997,5 | A2 |
| 5 | 5 | 2002,5 | A3 |
| 10 | 20 | 1985 | A4 |
| 10 | 10 | 1995 | A5 |
| 10 | 5 | 2000 | A6 |
| 15 | 15 | 1987,5 | A7 |
| 20 | 10 | 1990 | A8 |

Table 7.1-4: A-MPR

| | | A1 | | A2 | | A3 | | A4 | |
|---------|-----------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | Inner | Outer | Inner | Outer | Inner | Outer | Inner | Outer |
| SC-FDMA | pi/2-BPSK | MPR | MPR | MPR | 2 | MPR | 8 | MPR | 1,5 |
| | QPSK | MPR | MPR | MPR | 3,5 | 2 | 9 | MPR | 2,5 |
| | 16QAM | MPR | MPR | MPR | 4 | 2 | 9,5 | MPR | 3 |
| | 64QAM | MPR | MPR | MPR | 4 | MPR | 10 | MPR | 3 |
| | 256QAM | MPR | MPR | MPR | 5 | 10 | 11 | MPR | MPR |
| OFDMA | QPSK | MPR | MPR | MPR | 4,5 | 4 | 11 | MPR | 4,5 |
| | 16QAM | MPR | MPR | MPR | 4,5 | 3,5 | 11 | MPR | 4,5 |
| | 64QAM | MPR | MPR | MPR | 5 | 4 | 10,5 | MPR | 4,5 |
| | 256QAM | MPR | MPR | MPR | MPR | 10 | 11,5 | MPR | MPR |
| | | A5 | | A6 | | A7 | | A8 | |
| | | Inner | Outer | Inner | Outer | Inner | Outer | Inner | Outer |
| SC-FDMA | pi/2-BPSK | MPR | 7 | 13 | 14,5 | MPR | 7 | 13 | 13 |
| | QPSK | 1,5 | 8,5 | 13,5 | 15 | 1 | 8 | 14 | 14 |
| | 16QAM | 2 | 9 | 15 | 15,5 | 1,5 | 8,5 | 15 | 14,5 |
| | 64QAM | MPR | 9 | 15,5 | 15,5 | MPR | 8,5 | 15 | 14,5 |
| | 256QAM | 5,5 | 9,5 | 16 | 16 | MPR | 9 | 16 | 15 |
| OFDMA | QPSK | 3,5 | 10,5 | 18 | 18 | 3,5 | 10 | 18 | 17 |
| | 16QAM | 3,5 | 10 | 18 | 17,5 | 3,5 | 10 | 18 | 17,5 |
| | 64QAM | MPR | 10,5 | 17,5 | 17,5 | MPR | 10 | 18,5 | 17,5 |
| | 256QAM | MPR | 10,5 | 18,5 | 18 | MPR | 10 | 18,5 | 17,5 |

8 Study of MSR specific issues

Because n65 is very similar to n1, the same requirements for cases when Standalone NB-IoT carrier is located outside the BS RF are used for n65.

8.1 Operating band unwanted emissions

Unless otherwise stated, the Operating band unwanted emission limits are defined from Δf_{OBUE} below the lowest frequency of each supported downlink operating band to the lower Base Station RF Bandwidth edge located at $F_{\text{BW RF,low}}$ and from the upper Base Station RF Bandwidth edge located at $F_{\text{BW RF,high}}$ up to Δf_{OBUE} above the highest frequency of each supported downlink operating band. The values of Δf_{OBUE} are defined in table 6.6-1 in TS 38.101-1 [4]. The requirements shall apply whatever the type of transmitter considered and for all transmission modes foreseen by the manufacturer's specification, except for any operating band with GSM/EDGE single RAT operation. The requirements in TS 45.005 [3] as defined in subclause 6.6.2.3 in TS 38.101-1 [4] apply to an MSR Base Station for any operating band with GSM/EDGE single RAT operation in Band Category 2.

For BS capable of multi-band operation where multiple bands are mapped on separate antenna connectors, the single-band requirements apply and the cumulative evaluation of the emission limit in the Inter-RF Bandwidth gap are not applicable.

8.1.1 General minimum requirement for Band Categories 1 and 3

For a Wide Area BS operating in Band Category 1 or Band Category 3 the requirement applies outside the Base Station RF Bandwidth edges. In addition, for a Wide Area BS operating in non-contiguous spectrum, it applies inside any sub-block gap. In addition, for a Wide Area BS operating in multiple bands, the requirements apply inside any Inter RF Bandwidth gap.

For a Medium Range BS operating in Band Category 1 the requirement applies outside the Base Station RF Bandwidth edges. In addition, for a Medium Range BS operating in non-contiguous spectrum, it applies inside any sub-block gap. In addition, for a Medium Range BS operating in multiple bands, the requirements apply inside any Inter RF Bandwidth gap.

For a Local Area BS operating in Band Category 1 the requirement applies outside the Base Station RF Bandwidth edges. In addition, for a Local Area BS operating in non-contiguous spectrum, it applies inside any sub-block gap. In addition, for a Local Area BS operating in multiple bands, the requirements apply inside any Inter RF Bandwidth gap.

Outside the Base Station RF Bandwidth edges, emissions shall not exceed the maximum levels specified in Tables 8.1.1-1 to 8.1.1-4 below, where:

- Δf is the separation between the Base Station RF Bandwidth edge frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency.
- f_{offset} is the separation between the Base Station RF Bandwidth edge frequency and the centre of the measuring filter.
- $f_{\text{offset}_{\text{max}}}$ is the offset to the frequency Δf_{OBUE} outside the downlink operating band.
- Δf_{max} is equal to $f_{\text{offset}_{\text{max}}}$ minus half of the bandwidth of the measuring filter.

For a BS operating in multiple bands, inside any Inter RF Bandwidth gaps with $W_{\text{gap}} < 2 \cdot \Delta f_{\text{OBUE}}$, emissions shall not exceed the cumulative sum of the minimum requirements specified at the Base Station RF Bandwidth edges on each side of the Inter-RF Bandwidth gap. The minimum requirement for Base Station RF Bandwidth edge is specified in Table 8.1.1-1 to 8.1.1-4 below, where in this case:

- Δf is the separation between the Base Station RF Bandwidth edge frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency.
- f_{offset} is the separation between the Base Station RF Bandwidth edge frequency and the centre of the measuring filter.

- $f_{\text{offset_max}}$ is equal to the inter Base Station RF Bandwidth gap minus half of the bandwidth of the measuring filter.
- Δf_{max} is equal to $f_{\text{offset_max}}$ minus half of the bandwidth of the measuring filter.

For BS capable of multi-band operation where multiple bands are mapped on the same antenna connector, the operating band unwanted emission limits apply also in a supported operating band without any carriers transmitted, in the case where there are carriers transmitted in other operating band(s). In this case where there is no carrier transmitted in an operating band, the operating band unwanted emission limit, as defined in the tables of the present subclause for the largest frequency offset (Δf_{max}), of a band where there is no carrier transmitted shall apply from Δf_{OBUE} below the lowest frequency, up to Δf_{OBUE} above the highest frequency of the supported downlink operating band without any carrier transmitted. And no cumulative limits are applied in the inter-band gap between a supported downlink band with carrier(s) transmitted and a supported downlink band without any carrier transmitted.

Inside any sub-block gap for a BS operating in non-contiguous spectrum, emissions shall not exceed the cumulative sum of the minimum requirements specified for the adjacent sub blocks on each side of the sub block gap. The minimum requirement for each sub block is specified in Tables 8.1.1-1 to 8.1.1-4 below, where in this case:

- Δf is the separation between the sub block edge frequency and the nominal -3 dB point of the measuring filter closest to the sub block edge.
- f_{offset} is the separation between the sub block edge frequency and the centre of the measuring filter.
- $f_{\text{offset_max}}$ is equal to the sub block gap bandwidth minus half of the bandwidth of the measuring filter.
- Δf_{max} is equal to $f_{\text{offset_max}}$ minus half of the bandwidth of the measuring filter.

Applicability of Wide Area operating band unwanted emission requirements in Tables 8.1.1-1, 8.1.1-1b and 8.1.1-1c is specified in Table 8.1.1-0.

Table 8.1.1-0: Applicability of operating band unwanted emission requirements for BC1 and BC3 Wide Area BS

| NR Band operation | Standalone NB-IoT carrier adjacent to the BS RF bandwidth edge | UTRA supported (NOTE 1) | Applicable requirement table |
|--|--|-------------------------|------------------------------|
| None | Y/N | Y/N | 8.1.1-1 |
| n1, n65 | Y/N | N | 8.1.1-1 |
| Any except n1 or n65 | Y | N | 8.1.1-1 |
| Any below 1GHz | N | N | 8.1.1-1b |
| Any above 1GHz except n1 or n65 | N | N | 8.1.1-1c |
| NOTE: NR operation with UTRA is not supported in this specification. | | | |

Table 8.1.1-1: Wide Area operating band unwanted emission mask (UEM) for BC1 and BC3 for BS not supporting NR (except for BS operating in Band n1 or n65) or (irrespective of NR support) BS with standalone NB-IoT at the BS RF bandwidth edge

| Frequency offset of measurement filter -3dB point, Δf | Frequency offset of measurement filter centre frequency, f_{offset} | Minimum requirement (Note 1, 2) | Measurement bandwidth (Note 7) |
|--|---|---------------------------------|--------------------------------|
| $0 \text{ MHz} \leq \Delta f < 0.2 \text{ MHz}$ | $0.015 \text{ MHz} \leq f_{\text{offset}} < 0.215 \text{ MHz}$ | -14 dBm | 30 kHz |
| $0.2 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$ | $0.215 \text{ MHz} \leq f_{\text{offset}} < 1.015 \text{ MHz}$ | (Note 4) | 30 kHz |
| (Note 6) | $1.015 \text{ MHz} \leq f_{\text{offset}} < 1.5 \text{ MHz}$ | -26 dBm (Note 4) | 30 kHz |
| $1 \text{ MHz} \leq \Delta f \leq \min(\Delta f_{\text{max}}, 10 \text{ MHz})$ | $1.5 \text{ MHz} \leq f_{\text{offset}} < \min(f_{\text{offset}_{\text{max}}}, 10.5 \text{ MHz})$ | -13 dBm (Note 4) | 1 MHz |
| $10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$ | $10.5 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$ | -15 dBm (Note 4, 8) | 1 MHz |
| <p>NOTE 1: For MSR BS supporting non-contiguous spectrum operation within any operating band the minimum requirement within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks on each side of the sub-block gap, where the contribution from the far-end sub-block shall be scaled according to the measurement bandwidth of the near-end sub-block. Exception is $\Delta f \geq 10 \text{ MHz}$ from both adjacent sub-blocks on each side of the sub-block gap, where the minimum requirement within sub-block gaps shall be -15dBm/MHz (for MSR BS supporting multi-band operation, either this limit or -16dBm/100kHz with correspondingly adjusted f_{offset} shall apply for this frequency offset range for operating bands <1GHz).</p> <p>NOTE 2: For MSR BS supporting multi-band operation with Inter RF Bandwidth gap $< 2 \times \Delta f_{\text{OBUE}}$ the minimum requirement within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap, where the contribution from the far-end sub-block or RF Bandwidth shall be scaled according to the measurement bandwidth of the near-end sub-block or RF Bandwidth.</p> <p>NOTE 3: For operation with a standalone NB-IoT carrier adjacent to the Base Station RF Bandwidth edge, the limits in Table 8.1.1-1a apply for $0 \text{ MHz} \leq \Delta f < 0.15 \text{ MHz}$.</p> <p>NOTE 4: For MSR BS supporting multi-band operation, either this limit or -16dBm/100kHz with correspondingly adjusted f_{offset}, whichever is less stringent, shall apply for operating bands <1GHz.</p> | | | |

Table 8.1.1-1a: Wide Area operating band unwanted emission limits for operation in BC1 with standalone NB-IoT carrier adjacent to the Base Station RF Bandwidth edge

| Frequency offset of measurement filter -3dB point, Δf | Frequency offset of measurement filter centre frequency, f_{offset} | Minimum requirement (Note 1, 2, 3, 4) | Measurement bandwidth (Note 7) |
|---|--|---------------------------------------|--------------------------------|
| $0 \text{ MHz} \leq \Delta f < 0.05 \text{ MHz}$ | $0.015 \text{ MHz} \leq f_{\text{offset}} < 0.065 \text{ MHz}$ | | 30 kHz |
| $0.05 \text{ MHz} \leq \Delta f < 0.15 \text{ MHz}$ | $0.065 \text{ MHz} \leq f_{\text{offset}} < 0.165 \text{ MHz}$ | | 30 kHz |
| <p>NOTE 1: The limits in this table only apply for operation with a standalone NB-IoT carrier adjacent to the Base Station RF Bandwidth edge.</p> <p>NOTE 2: For MSR BS supporting non-contiguous spectrum operation within any operating band the minimum requirement within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks on each side of the sub-block gap.</p> <p>NOTE 3: For MSR BS supporting multi-band operation with Inter RF Bandwidth gap $< 2 \times \Delta f_{\text{OBUE}}$ the minimum requirement within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap.</p> <p>NOTE 4: In case the carrier adjacent to the RF bandwidth edge is a standalone NB-IoT carrier, the value of $X = \text{PNB-IoT}_{\text{carrier}} - 43$, where $\text{PNB-IoT}_{\text{carrier}}$ is the power level of the standalone NB-IoT carrier adjacent to the RF bandwidth edge. In other cases, $X = 0$.</p> | | | |

Table 8.1.1-1b: Wide Area operating band unwanted emission mask (UEM) for BS supporting NR and neither supporting UTRA nor with a standalone NB-IoT carrier at the BS RF bandwidth edge in BC1 and BC3 bands below 1GHz

| Frequency offset of measurement filter -3dB point, Δf | Frequency offset of measurement filter centre frequency, f_{offset} | Minimum requirement (Note 1, 2) | Measurement bandwidth (Note 7) |
|---|---|---------------------------------|--------------------------------|
| $0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$ | $0.05 \text{ MHz} \leq f_{\text{offset}} < 5.05 \text{ MHz}$ | | 100 kHz |
| $5 \text{ MHz} \leq \Delta f < \min(10 \text{ MHz}, \Delta f_{\text{max}})$ | $5.05 \text{ MHz} \leq f_{\text{offset}} < \min(10.05 \text{ MHz}, f_{\text{offset}_{\text{max}}})$ | -14 dBm | 100 kHz |
| $10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$ | $10.05 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$ | -16 dBm (Note 8) | 100 kHz |
| <p>NOTE 1: For MSR BS supporting non-contiguous spectrum operation within any operating band, the minimum requirement within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap, where the contribution from the far-end sub-block or RF Bandwidth shall be scaled according to the measurement bandwidth of the near-end sub-block or RF Bandwidth. Exception is $\Delta f \geq 10\text{MHz}$ from both adjacent sub blocks on each side of the sub-block gap, where the minimum requirement within sub-block gaps shall be -16dBm/100kHz.</p> <p>NOTE 2: For MSR BS supporting multi-band operation with Inter RF Bandwidth gap $< 2 \times \Delta f_{\text{OBUE}}$ the minimum requirement within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap, where the contribution from the far-end sub-block or RF Bandwidth shall be scaled according to the measurement bandwidth of the near-end sub-block or RF Bandwidth.</p> | | | |

Table 8.1.1-1c: Wide Area operating band unwanted emission mask (UEM) for BS supporting NR (except operation in Band n1 and n65) and neither supporting UTRA nor with a standalone NB-IoT carrier at the BS RF bandwidth edge in BC1 and BC3 bands above 1GHz

| Frequency offset of measurement filter -3dB point, Δf | Frequency offset of measurement filter centre frequency, f_{offset} | Minimum requirement (Note 1, 2) | Measurement bandwidth (Note 7) |
|---|---|---------------------------------|--------------------------------|
| $0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$ | $0.05 \text{ MHz} \leq f_{\text{offset}} < 5.05 \text{ MHz}$ | | 100 kHz |
| $5 \text{ MHz} \leq \Delta f < \min(10 \text{ MHz}, \Delta f_{\text{max}})$ | $5.05 \text{ MHz} \leq f_{\text{offset}} < \min(10.05 \text{ MHz}, f_{\text{offset}_{\text{max}}})$ | -14 dBm | 100 kHz |
| $10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$ | $10.5 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$ | -15 dBm (Note 8) | 1MHz |
| <p>NOTE 1: For MSR BS supporting non-contiguous spectrum operation within any operating band, the minimum requirement within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap, where the contribution from the far-end sub-block shall be scaled according to the measurement bandwidth of the near-end sub-block. Exception is $\Delta f \geq 10\text{MHz}$ from both adjacent sub blocks on each side of the sub-block gap, where the minimum requirement within sub-block gaps shall be -15dBm/1MHz.</p> <p>NOTE 2: For MSR BS supporting multi-band operation with Inter RF Bandwidth gap $< 2 \times \Delta f_{\text{OBUE}}$ the minimum requirement within the Inter RF Bandwidth gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks or RF Bandwidth on each side of the Inter RF Bandwidth gap, where the contribution from the far-end sub-block or RF Bandwidth shall be scaled according to the measurement bandwidth of the near-end sub-block or RF Bandwidth.</p> | | | |

9 Channel numbering for NR, MSR

The NR Absolute Radio Frequency Channel Numbers (NR-ARFCNs) allocated for n65 are outlined in Table 9-1.

Table 9-1: NR channel numbers

| NR Operating Band | ΔF_{Raster} (kHz) | Uplink Range of N_{REF} (First – <Step size> – Last) | Downlink Range of N_{REF} (First – <Step size> – Last) |
|-------------------------|-------------------------------------|---|---|
| n65 | 100 | 384000 – <20> – 402000 | 422000 – <20> – 440000 |

Annex A:

Change history

| Change history | | | | | | | |
|----------------|-------------|------------|----|-----|-----|---|-------------|
| Date | Meeting | TDoc | CR | Rev | Cat | Subject/Comment | New version |
| 2018-10 | RAN4#88-Bis | R4-1812728 | | | | TR Skeleton: LTE Band 65 for NR (n65) | 0.0.1 |
| 2019-02 | RAN4#90 | R4-1900681 | | | | Approved TPs from RAN4#89 R4-1815216 TP to TR38.819: Adjacent bands R4-1815215 TP to TR38.819: Background R4-1815217 TP to TR38.819: List of band specific issues R4-1816645 TP to TR38.819: UE aspect issues R4-1815250 TP to TR38.819: MSR specific issues R4-1815252 TP to TR38.819: Channel numbering | 0.1.0 |
| 2019-06 | RAN#84 | RP-191323 | | | | V1.0.0 is submitted for 1 step approval | 1.0.0 |
| 2019-06 | RAN#84 | | | | | Approved by plenary – Rel-16 spec under change control | 16.0.0 |