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

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

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| *CR-Form-v12.2* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.106** | **CR** | **-** | **rev** | **-** | **Current version:** | **17.1.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Big CR for TS 38.106 Maintenance (Rel-17, CAT F) | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | CMCC | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_repeaters-Core | | | | |  | ***Date:*** | | | 2022-8-29 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | All the endorsed draft CRs in RAN4 #104 e-meeting are collected in this “big” CR for the complete update of TS 38.106. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Capture all following draft CRs into this big CR.   1. R4-2214767: Draft CR for 38.106: add requirements applicability for LA 1-C repeater with update of 4.3.1, CMCC 2. R4-2213713: Draft CR to TS38.106: the introduction of band n104, targeting at introducing the licensed band 6425-7125MHz into the repeater spec. ZTE Corporation 3. R4-2214766, Draft CR for 38.106: delete bracket and add declaration of location requirement for1-C LA repeater. CMCC. The main changes include    1. Add notes for LA 1-C repeaters to emphasize that co-location requirements are not required for Femto cell scenario.    2. Delete square bracket for following requirements.       1. 6.9.2 ACRR requirements       2. 6.10.2.1 transmitter transient period    3. Update the non-contiguous related requirements in 4.6    4. Replacing all the typos gap between passband by gap between passbands    5. Adding inside passband OBUE requirements 4. R4-2212310, Draft CR for 38.106: delete bracket for radiated related requirements, CMCC | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Current 38.106 17.1.0 is not complete | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.3.1, 4.6,  6.5.1, 6.5.2, 6.5.3, 6.5.4.2.2, 6.5.4.2.3, 6.7.1.1, 6.9.2, 6.10.2.1,  7.2.1, 7.5.3.1, 7.6.1, 7.6.2, 7.9.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR… CR ... | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

<Changed section>

4.3.1 Repeater class for downlink

The requirements in this specification apply to downlink Wide Area repeaters, downlink Medium Range repeaters and downlink Local Area repeaters unless otherwise stated. The associated deployment scenarios for each class are exactly the same for repeater with and without connectors.

For *repeater type 1-C* and *type 2-O*, repeater downlink classes are defined as indicated below:

- Wide Area repeaters are characterised by requirements derived from Macro Cell scenarios with a repeater to UE minimum distance along the ground equal to 35 m.

- Medium Range repeaters are characterised by requirements derived from Micro Cell scenarios with a repeater to UE minimum distance along the ground equal to 5 m.

- Local Area repeaters are characterised by requirements derived from Pico Cell scenarios with a repeater to UE minimum distance along the ground equal to 2 m or from Femto Cell scenarios.

- Note: The requirements in this specification for LA 1-C repeaters apply to 1-C repeaters with declared output power less than or equal to LA rated output power limits as in table 6.2.1-1.

<Changed section>

## 4.6 Requirements for contiguous and *non-contiguous spectrum*

A spectrum allocation where a repeater operates can either be contiguous or non-contiguous. Unless otherwise stated, the requirements in the present specification apply for repeater configured for both contiguous spectrum operation and non-contiguous spectrum operation.

For repeater operation in non-contiguous spectrum, some requirements apply at the repeater *passband* edges. For each such requirement, it is stated how the limits apply relative to the repeater *gap between passbands* and the *Inter-passband gap* respectively.

<Changed section>

## 6.5 Unwanted emissions

### 6.5.1 General

Unwanted emissions consist of out-of-band emissions and spurious emissions according to ITU definitions [5]. In ITU terminology, out of band emissions are unwanted emissions immediately outside the channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions.

The out-of-band emissions requirement for the Repeater transmitter is specified both in terms of Adjacent Channel Leakage power Ratio (ACLR) and *operating band* unwanted emissions (OBUE).

The maximum offset of the *operating band* unwanted emissions mask from the *operating band* edge is ΔfOBUE. The Operating band unwanted emissions define all unwanted emissions in each supported downlink *operating band* of *repeater type 1-C* DL and uplink *operating band* of *repeater type 1-C* UL, plus the frequency ranges ΔfOBUE above and ΔfOBUE below each band. Unwanted emissions outside of this frequency range are limited by a spurious emissions requirement.

The values of ΔfOBUE are defined in tables 6.5.1-1 and 6.5.1-2 for the NR *operating bands*.

Table 6.5.1-1: Maximum offset of OBUE outside the downlink *operating band* of *repeater type 1-C DL*

|  |  |  |
| --- | --- | --- |
| Repeater type | *Operating band* characteristics | ΔfOBUE (MHz) |
| Repeater type 1-C | FDL,high – FDL,low < 200 MHz | 10 |
|  | 200 MHz ≤ FDL,high – FDL,low ≤ 900 MHz | 40 |

Table 6.5.1-2: Maximum offset of OBUE outside the uplink *operating band* of *repeater 1-C UL*

|  |  |  |
| --- | --- | --- |
| Repeater type | *Operating band* characteristics | ΔfOBUE (MHz) |
| Repeater type 1-C | FUL,high – FUL,low < 200 MHz | 10 |
|  | 200 MHz ≤ FUL,high – FUL,low ≤ 900 MHz | 40 |

There is no co-location unwanted emission requirement for LA 1-C repeaters deployed in Femto cell scenario.

<Changed section>

6.5.2 Adjacent Channel Leakage Power Ratio

6.5.2.1 General

Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency.

The requirements shall apply outside the *repeater type 1-C passband* whatever the type of transmitter considered (single carrier or multi-carrier) and for all transmission modes foreseen by the manufacturer’s specification.

For a *repeater* operating in *non-contiguous spectrum*, the ACLR requirement in clause 6.5.2.2 shall apply in *Gaps between passbands* for the frequency ranges defined in table 6.5.2.2-3, while the CACLR requirement in clause 6.5.2.2 shall apply in *gaps between passbands* for the frequency ranges defined in table 6.5.2.2-4.

For a *multi-band connector*, the ACLR requirement in clause 6.5.2.2 shall apply in *inter-passband gaps* for the frequency ranges defined in table 6.5.2.2-3, while the CACLR requirement in clause 6.5.2.2 shall apply in *inter-passband gaps* for the frequency ranges defined in table 6.5.2.2-4.

The requirement shall apply during the *transmitter ON state*.

6.5.2.2 Minimum requirements

The ACLR is defined with a square filter of bandwidth equal to the transmission bandwidth configuration of the transmitted signal (BWConfig) centred on the assigned channel frequency and a filter centred on the adjacent channel frequency according to the tables below.

The ACLR shall be higher than the value specified in table 6.5.2.2‑1 for *repeater type 1-C* for DL and UL for Wide Area class.

For *repeater type 1-C* *nominal repeater channel bandwidth* is calculated as min(100MHz, BW*passband*).

For *repeater type 1-C* for DL and for UL for WA class, the ACLR (CACLR) absolute *minimum requirements* in table 6.5.2.2-2, 6.5.2.2-5 or the ACLR (CACLR) *limits* in table 6.5.2.2-1, 6.5.2.2-3 or 6.5.2.2-4, whichever is less stringent, shall apply for each *antenna connector*.

For Band n41 and n90 operation in Japan, absolute ACLR limits shall be applied to the sum of the absolute ACLR power over all *antenna connectors* for *repeater type 1-C*.

**Table 6.5.2.2-1: *Repeater type 1-C* ACLR limit for DL and for UL for Wide Area class**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Repeater type 1-C* nominal channel bandwidth of lowest/highest carrier transmitted BWChannel (MHz)** | ***Repeater type 1-C* 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** |
| min(100 MHz, BW*passband*) | BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 45 dB  38 dB (Note 4) |
|  | 2 x BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 45 dB  38 dB  (Note 4) |
|  | BWChannel /2 + 2.5 MHz | 5 MHz E-UTRA | Square (4.5 MHz) | 45 dB (Note 3) |
|  | BWChannel /2 + 7.5 MHz | 5 MHz E-UTRA | Square (4.5 MHz) | 45 dB (Note 3) |
| NOTE 1: BWChannel and BWConfig are the *repeater type 1-C nominal repeater bandwidth configuration* of the *lowest/highest carrier* transmitted on the assigned channel frequency.  NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig).  NOTE 3: The requirements are applicable when the band is also defined for E-UTRA or UTRA.  NOTE 4: For repeater operating in band n104, ACLR requirement 38 dB applies. For repeater operating in other bands, ACLR requirement 45 dB applies. | | | | |

The ACLR absolute *minimum requirement* is specified in table 6.5.2.2‑2.

The ACLR shall be higher than the value specified in table 6.5.2.2‑1a for *repeater type 1-C* for UL Local Area.

**Table 6.5.2.2-1a: *Repeater type 1-C* ACLR limit for UL for Local Area**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Repeater type 1-C* nominal channel bandwidth of lowest/highest carrier transmitted BWChannel (MHz)** | ***Repeater type 1-C* 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** |
| min(100 MHz, BW*passband*) | BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 31 dB |
|  | 2 x BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 31 dB |
|  | BWChannel /2 + 2.5 MHz | 5 MHz E-UTRA | Square (4.5 MHz) | 31 dB |
|  | BWChannel /2 + 7.5 MHz | 5 MHz E-UTRA | Square (4.5 MHz) | 31 dB |
| NOTE 1: BWChannel and BWConfig are the *repeater type 1-C nominal repeater bandwidth configuration* of the *lowest/highest carrier* transmitted on the assigned channel frequency.  NOTE 2: With SCS that provides nominal repeater bandwidth configuration (BWConfig).  NOTE 3: The requirements are applicable when the band is also defined for E-UTRA or UTRA. | | | | |

**Table 6.5.2.2-2: *Repeater type 1-C* ACLR absolute limit for DL and UL for WA class, for DL for MR class and for DL for LA class**

|  |  |
| --- | --- |
| **Repeater category / class** | **ACLR absolute *limit*** |
| Category A Wide Area DL and UL | -13 dBm/MHz |
| Category B Wide Area DL and UL | -15 dBm/MHz |
| Medium Range DL | -25 dBm/MHz |
| Local Area DL | -32 dBm/MHz |

For operation in non-contiguous spectrum or multiple bands, the ACLR shall be higher than the value specified in Table 6.5.2.2‑3.

**Table 6.5.2.2-3: *Repeater type 1-C* ACLR limit in non-contiguous spectrum or multiple bands**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Repeater type 1-C* nominal channel bandwidth of lowest/highest carrier transmitted BWChannel (MHz)** | **Sub-block or inter-*passband* *gap* size (Wgap) where the limit applies (MHz)** | ***Repeater type 1-C* adjacent channel centre frequency offset below or above the sub-block or *repeater type 1-C* Bandwidth edge (inside the gap)** | **Assumed adjacent channel carrier** | **Filter on the adjacent channel frequency and corresponding filter bandwidth** | **ACLR limit** |
| min(20 MHz, BW*passband*) for nominal channel bandwidth ≤ 20MHz | Wgap ≥ 15 (Note 3)  Wgap ≥ 45 (Note 4) | 2.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 45 dB  38 dB (Note 5) |
|  | Wgap ≥ 20 (Note 3)  Wgap ≥ 50 (Note 4) | 7.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 45 dB  38 dB (Note 5) |
| min(100 MHz, BW*passband*) for nominal channel bandwidth >20MHz | Wgap ≥ 60 (Note 4)  Wgap ≥ 30 (Note 3) | 10 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 45 dB  38 dB (Note 5) |
|  | Wgap ≥ 80 (Note 4)  Wgap ≥ 50 (Note 3) | 30 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 45 dB  38 dB (Note 5) |
| NOTE 1: BWConfig is the nominal repeater bandwidth configuration of the assumed adjacent channel carrier.  NOTE 2: With SCS that provides nominal repeater bandwidth configuration (BWConfig).  NOTE 3: Applicable in case the *repeater type 1-C passband* at the other edge of the gap is ≤ 20 MHz.  NOTE 4: Applicable in case the *repeater type 1-C passband* at the other edge of the gap is > 20 MHz.  NOTE 5: For repeater operating in band n104, ACLR requirement 38 dB applies. For repeater operating in other bands, ACLR requirement 45 dB applies. | | | | | |

The Cumulative Adjacent Channel Leakage power Ratio (CACLR) in a *gap between passbands* or the *inter-passband gap* is the ratio of:

a) the sum of the filtered mean power centred on the assigned channel frequencies for the two carriers adjacent to each side of the *gap between passbands* or the *inter-passband gap*, and

b) the filtered mean power centred on a frequency channel adjacent to one of the respective *sub-block* edges, *repeater type 1-C passband edges*.

The assumed filter for the adjacent channel frequency is defined in table 6.5.3.2-4 and the filters on the assigned channels are defined in table 6.5.2.2-6.

For operation in *non-contiguous spectrum* or multiple bands, the CACLR for NR carriers located on either side of the *gap between passbands* or the *inter-passband gap* shall be higher than the value specified in table 6.5.2.2-4.

**Table 6.5.2.2-4: *Repeater type 1-C* CACLR limit for DL and for UL for Wide Area class**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Repeater type 1-C* nominal channel bandwidth of lowest/highest carrier transmitted BWChannel (MHz)** | **Sub-block or inter-*passband* *gap* size (Wgap) where the limit applies (MHz)** | ***Repeater type 1-C* adjacent channel centre frequency offset below or above the sub-block or Repeater type 1-C *passband* edge (inside the gap)** | **Assumed adjacent channel carrier** | **Filter on the adjacent channel frequency and corresponding filter bandwidth** | **CACLR limit** |
| nominal repeater channel bandwidth <= 20MHz | 5 ≤Wgap< 15 (Note 3)  5 ≤Wgap< 45 (Note 4) | 2.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 45 dB  38 dB (Note 5) |
|  | 10 < Wgap< 20 (Note 3)  10 ≤Wgap< 50 (Note 4) | 7.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 45 dB  38 dB (Note 5) |
| nominal repeater channel bandwidth >20MHz | 20 ≤Wgap< 60 (Note 4)  20 ≤Wgap< 30 (Note 3) | 10 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 45 dB  38 dB (Note 5) |
|  | 40 < Wgap< 80 (Note 4)  40 ≤Wgap< 50 (Note 3) | 30 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 45 dB  38 dB (Note 5) |
| NOTE 1: BWConfig is the nominal bandwidth configuration of the assumed adjacent channel carrier.  NOTE 2: With SCS that provides nominal bandwidth configuration (BWConfig).  NOTE 3: Applicable in case the *repeater type 1-C* *passband* at the other edge of the gap is ≤ 20 MHz.  NOTE 4: Applicable in case the *repeater type 1-C passband* at the other edge of the gap is > 20MHz.  NOTE 5: For repeater operating in band n104, ACLR requirement 38 dB applies. For repeater operating in other bands, ACLR requirement 45 dB applies. | | | | | |

The CACLR shall be higher than the value specified in table 6.5.2.2-4a for *repeater type 1-C* for UL Local Area.

**Table 6.5.2.2-4a: *Repeater type 1-C C*ACLR limit for UL for Local Area**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Repeater type 1-C* nominal channel bandwidth of lowest/highest carrier transmitted BWChannel (MHz)** | **Sub-block or *inter-passband* *gap* size (Wgap) where the limit applies (MHz)** | ***Repeater type 1-C* adjacent channel centre frequency offset below or above the sub-block or *Repeater type 1-C* *passband* edge (inside the gap)** | **Assumed adjacent channel carrier** | **Filter on the adjacent channel frequency and corresponding filter bandwidth** | **CACLR limit** |
| nominal repeater channel bandwidth <= 20MHz | 5 ≤Wgap< 15 (Note 3)  5 ≤Wgap< 45 (Note 4) | 2.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 31 dB |
|  | 10 < Wgap< 20 (Note 3)  10 ≤Wgap< 50 (Note 4) | 7.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 31 dB |
| nominal repeater channel bandwidth >20MHz | 20 ≤Wgap< 60 (Note 4)  20 ≤Wgap< 30 (Note 3) | 10 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 31 dB |
|  | 40 < Wgap< 80 (Note 4)  40 ≤Wgap< 50 (Note 3) | 30 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 31 dB |
| NOTE 1: BWConfig is the nominal repeater bandwidth configuration of the assumed adjacent channel carrier.  NOTE 2: With SCS that provides nominal repeater bandwidth configuration (BWConfig).  NOTE 3: Applicable in case the *repeater type 1-C* *passband* at the other edge of the gap is ≤ 20 MHz.  NOTE 4: Applicable in case the *repeater type 1-C passband* at the other edge of the gap is > 20 MHz. | | | | | |

The CACLR absolute *minimum requirement* is specified in table 6.5.2.2‑5.

**Table 6.5.2.2-5: *Repeater type 1-C* CACLR absolute *limit* for DL and UL for WA class, for DL for MR class and for DL for LA class**

|  |  |
| --- | --- |
| ***Repeater type 1-C* category / class** | **CACLR absolute *limit*** |
| Category A Wide Area DL and UL | -13 dBm/MHz |
| Category B Wide Area DL and UL | -15 dBm/MHz |
| Medium Range DL | -25 dBm/MHz |
| Local Area DL | -32 dBm/MHz |

**Table 6.5.2.2-6: Filter parameters for the assigned channel**

|  |  |
| --- | --- |
| **RAT of the carrier adjacent to the *sub-block* or *inter-passband gap*** | **Filter on the assigned channel frequency and corresponding filter bandwidth** |
| NR | NR of same BW with SCS that provides *nominal repeater bandwidth configuration* |

<Changed section>

#### 6.5.3.1 General

Unless otherwise stated, the operating band unwanted emission (OBUE) limits for *repeater type 1-C* DL are defined from ΔfOBUE below the lowest frequency of each supported downlink *operating band* up to ΔfOBUE above the highest frequency of each supported downlink *operating band*. The values of ΔfOBUE are defined in table 6.5.1‑1 for the NR *operating bands*.

Unless otherwise stated, the operating band unwanted emission (OBUE) limits for *repeater type 1-C* UL are defined from ΔfOBUE below the lowest frequency of each supported uplink *operating band* up to ΔfOBUE above the highest frequency of each supported uplink *operating band*. The values of ΔfOBUE are defined in table 6.5.1‑2 for the NR *operating bands*.

The requirements shall apply whatever the type of transmitter considered and for all transmission modes foreseen by the manufacturer’s specification. In addition, for *repeater type 1-C* operating in *non-contiguous spectrum*, the requirements apply inside any *gap between passbands*. In addition, for a *repeater type 1-C* operating in multiple bands, the requirements apply inside any *inter-passband* *gap*.

*Limits* are specified in the tables below, where:

- Δf is the separation between the *passband edge* frequency and the nominal -3dB point of the measuring filter closest to the carrier frequency.

- f\_offset is the separation between the *passband edge* frequency and the centre of the measuring filter.

- f\_offsetmax is the offset to the frequency ΔfOBUE outside the downlink *operating band* of *repeater type 1-C* DL and uplink *operating band* of *repeater type 1-C* UL, where ΔfOBUE is defined in tables 6.5.1-1 and 6.5.1-2.

- Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.

For a *multi-band connector* inside any *inter-passband gaps* with Wgap < 2\*ΔfOBUE, a combined minimum requirement shall be applied which is the cumulative sum of the minimum requirement specified at the *repeater type 1-C passband edges* on each side of the *inter-passband gap*. The minimum requirement for *repeater type 1-C Bandwidth edge* is specified in clauses 6.5.3.2.1 to 6.5.3.2.4 below, where in this case:

- Δf is the separation between the *repeater type 1-C passband edge* frequency and the nominal -3 dB point of the measuring filter closest to the *repeater type 1-C passband edge*.

- f\_offset is the separation from the *repeater type 1-C passband edge* frequency to the centre of the measuring filter.

- f\_offsetmax is equal to the *inter-passband gap* minus half of the bandwidth of the measuring filter.

- Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.

For a *multi-band connector* of *repeater type 1-C* DL, the operating band unwanted emission limits apply also in a supported downlink *operating band* without any carrier transmitted, in the case where there are carrier(s) transmitted in another supported downlink *operating band*. In this case, no cumulative minimum requirement is applied in the *inter-band gap* between a supported downlink *operating band* with carrier(s) transmitted and a supported downlink *operating band* without any carrier transmitted and

- In case the *inter-band gap* between a supported downlink *operating band* with carrier(s) transmitted and a supported downlink *operating band* without any carrier transmitted is less than 2\*ΔfOBUE, f\_offsetmax shall be the offset to the frequency ΔfOBUE MHz outside the outermost edges of the two supported downlink *operating bands* and the operating band unwanted emission minimum requirement of the band where there are carriers transmitted, as defined in the tables of the present clause, shall apply across both downlink bands.

- In other cases, the operating band unwanted emission minimum requirement of the band where there are carriers transmitted, as defined in the tables of the present clause for the largest frequency offset (Δfmax), shall apply from ΔfOBUE MHz below the lowest frequency, up to ΔfOBUE MHz above the highest frequency of the supported downlink *operating band* without any carrier transmitted.

For a *multi-band connector* of *repeater type 1-C* UL, the operating band unwanted emission limits apply also in a supported uplink *operating band* without any carrier transmitted, in the case where there are carrier(s) transmitted in another supported uplink *operating band*. In this case, no cumulative minimum requirement is applied in the *inter-band gap* between a supported uplink *operating band* with carrier(s) transmitted and a supported uplink *operating band* without any carrier transmitted and

- In case the inter-band gap between a supported uplink operating band with carrier(s) transmitted and a supported uplink operating band without any carrier transmitted is less than 2\* ΔfOBUE, f\_offsetmax shall be the offset to the frequency ΔfOBUE MHz outside the outermost edges of the two supported uplink operating bands and the operating band unwanted emission minimum requirement of the band where there are carriers transmitted, as defined in the tables of the present clause, shall apply across both uplink bands.

- In other cases, the operating band unwanted emission minimum requirements of the band where there are carriers transmitted, as defined in the tables of the present clause for the largest frequency offset (Δfmax), shall apply from ΔfOBUE MHz below the lowest frequency, up to ΔfOBUE MHz above the highest frequency of the supported uplink operating band without any carrier transmitted.

In addition, inside any *gap between passbands* for a *single-band connector* operating in *non-contiguous spectrum*, a combined minimum requirement shall be applied which is the cumulative sum of the minimum requirementspecified for the adjacent *sub-blocks* on each side of the *gap between passbands*. The minimum requirement for each *sub-block* is specified in clauses 6.5.3.2.1 to 6.5.3.2.4 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\_offsetmax is equal to the *gap between passbands* bandwidth minus half of the bandwidth of the measuring filter.

- Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.

For Wide Area *repeater type 1-C*, the requirements of either clause 6.5.3.2.1 (Category A limits) or clause 6.5.3.2.2 (Category B limits) shall apply.

For Medium Range *repeater type 1-C*, the requirements in clause 6.5.3.2.3 shall apply (Category A and B).

For Local Area *repeater type 1-C*, the requirements of clause 6.5.3.2.4 shall apply (Category A and B).

The application of either Category A or Category B minimum requirements shall be the same as for Transmitter spurious emissions in clause 6.5.4.

For Band n41 and n90 operation in Japan, the operating band unwanted emissions limits shall be applied to the sum of the emission power over all *antenna connectors* for *repeater type 1-C*.

In addition to, for the part of passband where there is no input signal at DL input port, the requirements in Table 6.5.2.2-2 shall apply. In addition to, for the part of passband where there is no input signal at UL input port, the requirements in 6.5.3.2.6 shall apply.

#### 6.5.3.2 Minimum requirements

##### 6.5.3.2.1 Minimum requirements for Wide Area repeater type 1-C (Category A)

For repeater operating in Bands n5, n8, n12, n13, n14, n18, n26, n28, n29, n71, n85, minimum requirements are specified in table 6.5.3.2.1‑1.

Table 6.5.3.2.1-1: Wide Area *repeater type 1-C* operating band unwanted emission minimum requirements (NR bands below 1 GHz) for Category A

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Minimum requirements (Note 1, 2) | *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 | 10.05 MHz ≤ f\_offset < f\_offsetmax | -13 dBm (Note 3) | 100 kHz |
| NOTE 1: For a *repeater type 1-C* supporting *non-contiguous spectrum* operation within any *operating band*, the emission limits within *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passbands*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *gap between passbands*, where the emission limits within *gaps between passbands* shall be ‑13 dBm/1 MHz.  NOTE 2: For a *multi-band connector* with *inter-passband gap* < 2\*ΔfOBUE the emission limits within the *inter-passband gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or *passband* on each side of the *inter-passband gap*, where the contribution from the far-end *sub-block* or *passband* shall be scaled according to the *measurement bandwidth* of the near-end *sub-block* or *passband*.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

For repeater operating in Bands n1, n2, n3, n7, n24, n25, n30, n34, n38, n39, n40, n41, n48, n50, n65, n66, n70, n74, n75, n77, n78, n79, n90, n92, n94, minimum requirements are specified in table 6.5.3.2.1-2.

**Table 6.5.3.2.1-2: Wide Area *repeater type 1-C* *operating band* unwanted emission minimum requirements (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** | ***Minimum requirement* (Note 1, 2)** | ***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 (Note 3) | 1MHz |
| NOTE 1: For a *repeater type 1-C* supporting *non-contiguous spectrum* operation within any *operating band*, the emission limits within *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passbands*, 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 f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *gap between passbands*, where the emission limits within *gaps between passbands* shall be ‑13 dBm/1 MHz.  NOTE 2: For a *multi-band connector* with *inter-passband gap* < 2\*ΔfOBUE the emission limits within the *inter-passband gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or *passband* on each side of the *inter-passband gap*, where the contribution from the far-end *sub-block* or *passband* shall be scaled according to the *measurement bandwidth* of the near-end *sub-block* or *passband*.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

##### 6.5.3.2.2 Minimum requirements for Wide Area *repeater type 1-C* (Category B)

For Category B Operating band unwanted emissions, there are two options for the *minimum requirements* that may be applied regionally. Either the *minimum requirements* in clause 6.5.3.2.2.1 or clause 6.5.3.2.2.2 shall be applied.

6.5.3.2.2.1 Category B requirements (Option 1)

For *repeater type 1-C* operating in Bands n5, n8, n12, n20, n26, n28, n29, n67, n71, n85, the minimum requirements are specified in table 6.5.3.2.2.1-1:

Table 6.5.3.2.2.1-1: Wide Area *repeater type 1-C* operating band unwanted emission minimum requirements (NR bands below 1 GHz) for Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Minimum requirement (Note 1, 2) | *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 | 10.05 MHz ≤ f\_offset < f\_offsetmax | -16 dBm (Note 3) | 100 kHz |
| NOTE 1: For a *repeater type 1-C* supporting *non-contiguous spectrum* operation within any *operating band*, the emission limits within *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passbands*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *gap between passbands*, where the emission limits within *gaps between passbands* shall be ‑15 dBm/1 MHz.  NOTE 2: For a *multi-band connector* with *inter-passband gap* < 2\*ΔfOBUE the emission limits within the *inter-passband gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or *passband* on each side of the *inter-passband gap*.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

For repeater operating in Bands n1, n2, n3, n7, n25, n34, n38, n39, n40, n41, n48, n50, n65, n66, n70, n75, n77, n78, n79, n90, n92, n94, minimum requirements are specified in table 6.5.3.2.2.1-2.

Table 6.5.3.2.2.1-2: Wide Area *repeater type 1-C* operating band unwanted emission minimum requirements for Category B

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency offset of measurement filter ‑3dB point, Δf** | **Frequency offset of measurement filter centre frequency, f\_offset** | ***Minimum requirements* (Note 1, 2)** | ***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 (Note 3) | 1MHz |
| NOTE 1: For a *repeater type 1-C* supporting *non-contiguous spectrum* operation within any *operating band*, the emission limits within *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passbands*, 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 f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *gap between passbands*, where the emission limits within *gaps between passbands* shall be ‑15 dBm/1 MHz.  NOTE 2: For a *multi-band connector* with *inter-passband gap* < 2\*ΔfOBUE the emission limits within the *inter-passband gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or *passband* on each side of the *inter-passband gap*, where the contribution from the far-end *sub-block* or *passband* shall be scaled according to the *measurement bandwidth* of the near-end *sub-block* or *passband*.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

For *repeater type 1-C* operating in Band n104, thelimits are specified in tables 6.5.3.2.2.1-2a:

**Table 6.5.3.2.2.1-2a: Wide Area *repeater type 1-C* operating band unwanted emission limits for band n104 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 < 20 MHz | 0.05 MHz ≤ f\_offset < 20.05 MHz |  | 100 kHz |
| 20 MHz ≤ Δf <  min(40 MHz, Δfmax) | 20.05 MHz ≤ f\_offset <  min(40.05 MHz, f\_offsetmax) | -14 dBm | 100 kHz |
| 40 MHz ≤ Δf ≤ Δfmax | 40.5 MHz ≤ f\_offset < f\_offsetmax | -15 dBm (Note 3) | 1MHz |
| NOTE 1: For a *repeater type 1-C* supporting *non-contiguous spectrum* operation within any *operating band*, the emission limits within *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passband*, 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 f ≥ 40MHz from both adjacent *sub-blocks* on each side of the *gap between passband*, where the emission limits within *gaps between passbands* shall be ‑15 dBm/1 MHz.  NOTE 2: For a *multi-band connector* with *inter-passband gap* < 2\*ΔfOBUE the emission limits within the *inter-passband gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or *passband* on each side of the *inter-passband gap*, where the contribution from the far-end *sub-block* or *passband* shall be scaled according to the *measurement bandwidth* of the near-end *sub-block* or *passband*.  NOTE 3: The requirement is not applicable when Δfmax < 40 MHz. | | | |

6.5.3.2.2.2 Category B requirements (Option 2)

The limits in this clause are intended for Europe and may be applied regionally for *repeater type 1-C* operating in bands n1, n3, n7, n8, n38, n65.

For a *repeater type 1-C* operating in bands n1, n3, n7, n8, n38 or n65, minimum requirements are specified in Table 6.5.3.2.2.2-1:

Table 6.5.3.2.2.2-1: Regional Wide Area *repeater type 1-C* operating band unwanted emission minimum requirements for Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Minimum requirements (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.2 MHz | 0.015 MHz ≤ f\_offset < 0.215 MHz | -14 dBm | 30 kHz |
| 0.2 MHz ≤ Δf < 1 MHz | 0.215 MHz ≤ f\_offset < 1.015 MHz |  | 30 kHz |
| (Note 4) | 1.015 MHz ≤ f\_offset < 1.5 MHz | -26 dBm | 30 kHz |
| 1 MHz ≤ Δf ≤  min(10 MHz, Δfmax) | 1.5 MHz ≤ f\_offset <  min(10.5 MHz, f\_offsetmax) | -13 dBm | 1 MHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax | -15 dBm (Note 3) | 1 MHz |
| NOTE 1: For a *repeater type 1-C* supporting *non-contiguous spectrum* operation within any *operating band*, the emission limits within *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passbands*, 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 f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *gap between passbands*, where the emission limits within *gaps between passbands* shall be ‑15 dBm/1 MHz.  NOTE 2: For a *multi-band connector* with *inter-passband gap* < 2\*ΔfOBUE the emission limits within the *inter-passband gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or *passband* on each side of the *inter-passband gap*, where the contribution from the far-end *sub-block* or *passband* shall be scaled according to the *measurement bandwidth* of the near-end *sub-block* or *passband*.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz.  NOTE 4: This frequency range ensures that the range of values of f\_offset is continuous. | | | |

##### 6.5.3.2.3 Minimum requirements for Medium Range *repeater type 1-C* (Category A and B) for DL

For Medium Range *repeater type 1-C* for DL, minimum requirementsare specified in table 6.5.3.2.3-1 and table 6.5.3.2.3-2.

For the tables in this clause for *repeater type 1-C,* Prated,x = Prated,p,AC - 10\*log (ceil (BWPassband/20MHz))

Table 6.5.3.2.3-1: Medium Range *repeater type 1-C* *operating band* unwanted emission minimum requirements, 31< Prated,x ≤ 38 dBm

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency offset of measurement filter ‑3dB point, Δf** | **Frequency offset of measurement filter centre frequency, f\_offset** | ***Minimum requirements* (Note 1, 2)** | ***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) | Prated,x - 60dB | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | Min(Prated,x - 60dB, -25dBm) (Note 3) | 100 kHz |
| NOTE 1: For a *repeater type 1-C* DL supporting *non-contiguous spectrum* operation within any *operating band* the emission limits within *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passbands*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *gap between passbands*, where the emission limits within *gaps between passbands* shall be Min(Prated,x -60dB, ‑25dBm)/100kHz.  NOTE 2: For a *multi-band connector* with *inter-passband gap* < 2\*ΔfOBUE the emission limits within the *inter-passband gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or *passband* on each side of the *inter-passband gap*.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

For *repeater type 1-C* operating in Band n104, the limits are specified in Table 6.5.3.2.3-1a and Table 6.5.3.2.3-2a.

**Table 6.5.3.2.3-1a. Medium Range *repeater type 1-C* *operating band* unwanted emission limits for band n104, 31< Prated,x ≤ 38 dBm**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency offset of measurement filter ‑3dB point, Δf** | **Frequency offset of measurement filter centre frequency, f\_offset** | ***Minimum requirements* (Note 1, 2)** | ***Measurement bandwidth*** |
| 0 MHz ≤ Δf < 20 MHz | 0.05 MHz ≤ f\_offset < 20.05 MHz |  | 100 kHz |
| 20 MHz ≤ Δf <  min(40 MHz, Δfmax) | 20.05 MHz ≤ f\_offset <  min(40.05 MHz, f\_offsetmax) | Prated,x - 60dB | 100 kHz |
| 40 MHz ≤ Δf ≤ Δfmax | 40.05 MHz ≤ f\_offset < f\_offsetmax | Min(Prated,x - 60dB, -25dBm) (Note 3) | 100 kHz |
| NOTE 1: For a *repeater type 1-C* DL supporting *non-contiguous spectrum* operation within any *operating band* the emission limits within *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passband*. Exception is f ≥ 40MHz from both adjacent *sub-blocks* on each side of the *gap between passband*, where the emission limits within *gaps between passbands* shall be Min(Prated,x -60dB, ‑25dBm)/100kHz.  NOTE 2: For a *multi-band connector* with *inter-passband gap* < 2\*ΔfOBUE the emission limits within the *inter-passband gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or *passband* on each side of the *inter-passband gap*.  NOTE 3: The requirement is not applicable when Δfmax < 40 MHz. | | | | |

Table 6.5.3.2.3-2: Medium Range *repeater type 1-C* operating band unwanted emission minimum requirements, Prated,x ≤ 31 dBm

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency offset of measurement filter ‑3dB point, Δf** | **Frequency offset of measurement filter centre frequency, f\_offset** | ***Minimum requirements* (Note 1, 2)** | ***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) | -29 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -29 dBm (Note 3) | 100 kHz |
| NOTE 1: For a *repeater type 1-C* DL supporting *non-contiguous spectrum* operation within any *operating band* the emission limits within *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passbands*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *gap between passbands*, where the emission limits within *gaps between passbands* shall be -29dBm/100kHz.  NOTE 2: For a *multi-band connector* with *inter-passband gap* < 2\*ΔfOBUE the emission limits within the *inter-passband gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or *passband* on each side of the *inter-passband gap*.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

**Table 6.5.3.2.3-2a. Medium Range *repeater type 1-C* operating band unwanted emission limits for band 104, Prated,x ≤ 31 dBm**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency offset of measurement filter ‑3dB point, Δf** | **Frequency offset of measurement filter centre frequency, f\_offset** | ***Minimum requirements* (Note 1, 2)** | ***Measurement bandwidth*** |
| 0 MHz ≤ Δf < 20 MHz | 0.05 MHz ≤ f\_offset < 20.05 MHz |  | 100 kHz |
| 20 MHz ≤ Δf <  min(40 MHz, Δfmax) | 20.05 MHz ≤ f\_offset <  min(40.05 MHz, f\_offsetmax) | -29 dBm | 100 kHz |
| 40 MHz ≤ Δf ≤ Δfmax | 40.05 MHz ≤ f\_offset < f\_offsetmax | -29 dBm | 100 kHz |
| NOTE 1: For a *repeater type 1-C* DL supporting *non-contiguous spectrum* operation within any *operating band* the emission limits within *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passband*. Exception is f ≥ 40MHz from both adjacent *sub-blocks* on each side of the *gap between passband*, where the emission limits within *gaps between passbands* shall be -29dBm/100kHz.  NOTE 2: For a *multi-band connector* with *inter-passband gap* < 2\*ΔfOBUE the emission limits within the *inter-passband gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or *passband* on each side of the *inter-passband gap*.  NOTE 3: The requirement is not applicable when Δfmax < 40 MHz. | | | |

##### 6.5.3.2.4 Minimum requirements for Local Area *repeater type 1-C* (Category A and B)

For Local Area *repeater type 1-C*, *minimum requirements* are specified in table 6.5.3.2.4-1.

Table 6.5.3.2.4-1: Local Area *repeater type 1-C* operating band unwanted emission limits

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency offset of measurement filter ‑3dB point, Δf** | **Frequency offset of measurement filter centre frequency, f\_offset** | ***Minimum requirements* (Note 1, 2)** | ***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) | -37 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -37 dBm (Note 10) | 100 kHz |
| NOTE 1: For a *repeater type 1-C* supporting *non-contiguous spectrum* operation within any *operating band* the emission limits within *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passbands*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *gap between passbands*, where the emission limits within *gaps between passbands* shall be -37dBm/100kHz.  NOTE 2: For a *multi-band connector* with *inter-passband gap* < 2\*ΔfOBUE the emission limits within the *inter-passband gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or *passband* on each side of the *inter-passband gap*  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

For *repeater type 1-C* operating in Band n104, *minimum requirements* are specified in Table 6.5.3.2.4-1a.

**Table 6.5.3.2.4-1a. Local Area *repeater type 1-C* operating band unwanted emission limits for band n104**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency offset of measurement filter ‑3dB point, Δf** | **Frequency offset of measurement filter centre frequency, f\_offset** | ***Minimum requirements*(Note 1, 2)** | ***Measurement bandwidth*** |
| 0 MHz ≤ Δf < 20 MHz | 0.05 MHz ≤ f\_offset < 20.05 MHz |  | 100 kHz |
| 20 MHz ≤ Δf <  min(40 MHz, Δfmax) | 20.05 MHz ≤ f\_offset <  min(40.05 MHz, f\_offsetmax) | -37 dBm | 100 kHz |
| 40 MHz ≤ Δf ≤ Δfmax | 40.05 MHz ≤ f\_offset < f\_offsetmax | -37 dBm | 100 kHz |
| NOTE 1: For a repeater supporting *non-contiguous spectrum* operation within any *operating band* the emission limits within *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*. Exception is f ≥ 40MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the emission limits within *sub-block gaps* shall be -37dBm/100kHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the emission limits 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*  NOTE 3: The requirement is not applicable when Δfmax < 40 MHz. | | | |

6.5.3.2.5 Minimum requirements for additional requirements

6.5.3.2.5.1 Limits in FCC Title 47

In addition to the requirements in clauses 6.5.3.2.1, 6.5.3.2.2, 6.5.3.2.3 and 6.5.3.2.4, the *repeater type 1-C* may have to comply with the applicable emission limits established by FCC Title 47 [10], when deployed in regions where those limits are applied, and under the conditions declared by the manufacturer.

6.5.3.2.5.2 Protection of DTT

In certain regions the following requirement may apply for protection of DTT. For *repeater type 1-C* operating in Band n20, the level of emissions in the band 470-790 MHz, measured in an 8 MHz filter bandwidth on centre frequencies Ffilter according to table 6.5.3.2.5.2-1, a minimum requirementsPEM,N is declared by the manufacturer. This requirement applies in the frequency range 470-790 MHz even though part of the range falls in the spurious domain.

**Table 6.5.3.2.5.2-1: Declared emissions *minimum requirement* for protection of DTT**

|  |  |  |
| --- | --- | --- |
| **Filter centre frequency, Ffilter** | ***Measurement bandwidth*** | **Declared emission *minimum requirement* (dBm)** |
| Ffilter = 8\*N + 306 (MHz);  21 ≤ N ≤ 60 | 8 MHz | PEM,N |

Note: The regional requirement is defined in terms of EIRP (effective isotropic radiated power), which is dependent on both the repeater emissions at the *antenna connector* and the deployment (including antenna gain and feeder loss). The requirement defined above provides the characteristics of the repeater needed to verify compliance with the regional requirement. Compliance with the regional requirement can be determined using the method outlined in TS 36.104 [20], annex F.

6.5.3.2.6 Minimum requirements inside passband with no UL input signal

The requirement is defined as a function of frequency offset from the edge of some part of passband with non-zero input signal. The requirement is measured as the ratio of the repeater output power in a zero-input basic unit to the repeater output power in a non-zero input basic unit. Basic unit equal to 360KHz.

The average of the basic requirements over 10 sub-frames shall not exceed the values specified in Table 6.5.3.2.6-1.

Table 6.5.3.2.6-1: Minimum requirements inside passband with no UL input signal

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB |  | | Any zero-input basic unit (NOTE 2) |
| IQ Image | dB | -28 | Image frequencies when output power > 10 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -25 | Image frequencies when output power ≤ 10 dBm |  |
| Carrier leakage | dBc | -28 | Output power > 10 dBm | Carrier leakage frequency (NOTES 4, 5) |
|  |  | -25 | 0 dBm ≤ Output power ≤ 10 dBm |  |
|  |  | -20 | -30 dBm ≤ Output power < 0 dBm |  |
|  |  | -10 | -40 dBm ≤ Output power < -30 dBm |  |
| NOTE 1: requirement is evaluated in each zero-input basic unit. For each such basic unit, the minimum requirement is calculated as the higher of - 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. is defined in NOTE 10.  NOTE 2: The measurement bandwidth is one basic unit and the limit is expressed as a ratio of measured power in one zero-input basic unit to the measured average power per non-zero input basic unit, where the averaging is done across all non-zero input parts of the passband.  NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the non-zero input part of passband, based on symmetry with respect to the carrier leakage frequency, but excluding any non-zero input basic units.  NOTE 4: The measurement bandwidth is 1 basic unit and the limit is expressed as a ratio of measured power in one zero-input basic unit to the measured total power in all non-zero input basic units  NOTE 5: The applicable frequencies are those that are enclosed either in the basic unit containing the carrier leakage frequency, or in the two basic units immediately adjacent to the carrier leakage frequency but excluding any non-zero input basic units.  NOTE 6: *LCRB* is the .  NOTE 7: *NRB* is the .  NOTE 8: *EVM* is the limit specified in Table 6.6.2.2-1 for the modulation format used in the non-zero input basic units..  NOTE 9:  is the starting frequency offset between the end of nearest non-zero input basic unit and the measured zero-input basic unit (e.g. *∆RB*= 1 or *∆RB*= -1 for the first zero-input basic unit outside of the non-zero input part of passband.  NOTE 10:  is an average of the transmitted power over 10 sub-frames normalized by the number of non-zero input basic units, measured in dBm. | | | | |

<Changed section>

6.5.4.2.2 Additional spurious emissions requirements

These requirements may be applied for the protection of system operating in other frequency ranges. The limits may apply as an optional protection of such systems that are deployed in the same geographical area as the repeater-Node, or they may be set by local or regional regulation as a mandatory requirement for an NR *operating band*. It is in some cases not stated in the present document whether a requirement is mandatory or under what exact circumstances that a limit applies, since this is set by local or regional regulation. An overview of regional requirements in the present document is given in clause 4.5.

Some requirements may apply for the protection of specific equipment (UE, MS and/or BS) or equipment operating in specific systems (GSM, CDMA, UTRA, E-UTRA, NR, etc.) as listed below.

The spurious emission *minimum requirements* are provided in table 6.5.4.2.2-1 where requirements for co-existence with the system listed in the first column apply for *repeater type 1-C*. For a *multi-band connector*, the exclusions and conditions in the Note column of table 6.5.4.2.2-1 apply for each supported *operating band*.

**Table 6.5.4.2.2-1: *Repeater type 1-C* spurious emissions minimum requirements for co-existence with systems operating in other frequency bands**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **System type to co-exist with** | **Frequency range for co-existence requirement** | ***Minimum requirements*** | ***Measurement bandwidth*** | Note |
| GSM900 | 921 – 960 MHz | -57 dBm | 100 kHz | This requirement does not apply to repeater operating in band n8 |
|  | 876 – 915 MHz | -61 dBm | 100 kHz | For the frequency range 880-915 MHz, this requirement does not apply to repeater operating in band n8, since it is already covered by the requirement in clause 6.5.5.2.2. |
| DCS1800 | 1805 – 1880 MHz | -47 dBm | 100 kHz | This requirement does not apply to repeater operating in band n3. |
|  | 1710 – 1785 MHz | -61 dBm | 100 kHz | This requirement does not apply to repeater operating in band n3, since it is already covered by the requirement in clause 6.5.5.2.2. |
| PCS1900 | 1930 – 1990 MHz | -47 dBm | 100 kHz | This requirement does not apply to repeater operating in band n2, n25 or band n70. |
|  | 1850 – 1910 MHz | -61 dBm | 100 kHz | This requirement does not apply to repeater operating in band n2 or n25 since it is already covered by the requirement in clause 6.6.5.2.2. |
| GSM850 or | 869 – 894 MHz | -57 dBm | 100 kHz | This requirement does not apply to repeater operating in band n5 or n26. |
| CDMA850 | 824 – 849 MHz | -61 dBm | 100 kHz | This requirement does not apply to repeater operating in band n5 or n26, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD | 2110 – 2170 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n1 or n65 |
| Band I or  E-UTRA Band 1 or NR Band n1 | 1920 – 1980 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n1 or n65, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD | 1930 – 1990 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n2 or n70. |
| Band II or  E-UTRA Band 2 or NR Band n2 | 1850 – 1910 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n2, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD | 1805 – 1880 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n3. |
| Band III or  E-UTRA Band 3 or NR Band n3 | 1710 – 1785 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n3, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band IV or  E-UTRA Band 4 | 2110 – 2155 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66 |
|  | 1710 – 1755 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band V or  E-UTRA Band 5 or NR Band n5 | 869 – 894 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n5 or n26. |
|  | 824 – 849 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n5 or n26, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD | 860 – 890 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n18. |
| Band VI, XIX or | 815 – 830 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n18, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 6, 18, 19 or NR Band n18 | 830 – 845 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band VII or  E-UTRA Band 7 or NR Band n7 | 2620 – 2690 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n7. |
|  | 2500 – 2570 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n7, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band VIII or  E-UTRA Band 8 or NR Band n8 | 925 – 960 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n8. |
|  | 880 – 915 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n8, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band IX or  E-UTRA Band 9 | 1844.9 – 1879.9 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n3. |
|  | 1749.9 – 1784.9 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n3, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band X or  E-UTRA Band 10 | 2110 – 2170 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66 |
|  | 1710 – 1770 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band XI or XXI or  E-UTRA Band 11 or 21 | 1475.9 – 1510.9 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n50, n74, n75, n92 or n94. |
|  | 1427.9 – 1447.9 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n50, n51, n74, n75, n76, n91, n92, n93 or n94. |
|  | 1447.9 – 1462.9 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n50, n74, n75, n92 or n94. |
| UTRA FDD Band XII or  E-UTRA Band 12 or NR Band n12 | 729 – 746 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n12 or n85. |
|  | 699 – 716 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n12 or n85, since it is already covered by the requirement in clause 6.6.5.2.2.  For NR repeater operating in n29, it applies 1 MHz below the Band n29 downlink operating band (Note 5). |
| UTRA FDD Band XIII or  E-UTRA Band 13 | 746 – 756 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n13. |
|  | 777 – 787 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n13, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band XIV or  E-UTRA Band 14 or NR band n14 | 758 – 768 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n14. |
|  | 788 – 798 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n14, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 17 | 734 – 746 MHz | -52 dBm | 1 MHz |  |
|  | 704 – 716 MHz | -49 dBm | 1 MHz | For NR repeater operating in n29, it applies 1 MHz below the Band n29 downlink operating band (Note 5). |
| UTRA FDD Band XX or E-UTRA Band 20 or NR Band n20 | 791 – 821 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n20 or n28. |
|  | 832 – 862 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n20, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band XXII or E-UTRA Band 22 | 3510 – 3590 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n48, n77 or n78. |
|  | 3410 – 3490 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n77 or n78. |
| E-UTRA Band 24 | 1525 – 1559 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n24. |
|  | 1626.5 – 1660.5 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n24, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band XXV or  E-UTRA Band 25 or NR band n25 | 1930 – 1995 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n2, n25 or n70. |
|  | 1850 – 1915 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n25 since it is already covered by the requirement in clause 6.6.5.2.2. For repeater operating in Band n2, it applies for 1910 MHz to 1915 MHz, while the rest is covered in clause 6.6.5.2.2. |
| UTRA FDD Band XXVI or  E-UTRA Band 26 or NR Band n26 | 859 – 894 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n5 or n26. |
|  | 814 – 849 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n26 since it is already covered by the requirement in clause 6.6.5.2.2. For repeater operating in Band n5, it applies for 814 MHz to 824 MHz, while the rest is covered in clause 6.6.5.2.2. |
| E-UTRA Band 27 | 852 – 869 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n5. |
|  | 807 – 824 MHz | -49 dBm | 1 MHz | This requirement also applies to repeater operating in Band n28, starting 4 MHz above the Band n28 downlink operating band (Note 5). |
| E-UTRA Band 28 or NR Band n28 | 758 – 803 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n20, n67 or n28. |
|  | 703 – 748 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n28, since it is already covered by the requirement in clause 6.6.5.2.2.  For repeater operating in band n67, it applies for 703 MHz to 736 MHz. |
| E-UTRA Band 29 or NR Band n29 | 717 – 728 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n29 or n85 |
| E-UTRA Band 30 or NR Band n30 | 2350 – 2360 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n30 |
|  | 2305 – 2315 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n30, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 31 | 462.5 – 467.5 MHz | -52 dBm | 1 MHz |  |
|  | 452.5 – 457.5 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD band XXXII or E-UTRA band 32 | 1452 – 1496 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n50, n74, n75, n92 or n94. |
| UTRA TDD Band a) or E-UTRA Band 33 | 1900 – 1920 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band a) or E-UTRA Band 34 or NR band n34 | 2010 – 2025 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n34. |
| UTRA TDD Band b) or E-UTRA Band 35 | 1850 – 1910 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band b) or E-UTRA Band 36 | 1930 – 1990 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n2 or n25. |
| UTRA TDD Band c) or E-UTRA Band 37 | 1910 – 1930 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band d) or E-UTRA Band 38 or NR Band n38 | 2570 – 2620 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n38. |
| UTRA TDD Band f) or E-UTRA Band 39 or NR band n39 | 1880 – 1920MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n39. |
| UTRA TDD Band e) or E-UTRA Band 40 or NR Band n40 | 2300 – 2400MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n30 or n40. |
| E-UTRA Band 41 or NR Band n41, n90 | 2496 – 2690 MHz | -52 dBm | 1 MHz | This is not applicable to repeater operating in Band n41, n53 or [n90]. |
| E-UTRA Band 42 | 3400 – 3600 MHz | -52 dBm | 1 MHz | This is not applicable to repeater operating in Band n48, n77 or n78. |
| E-UTRA Band 43 | 3600 – 3800 MHz | -52 dBm | 1 MHz | This is not applicable to repeater operating in Band n48, n77 or n78. |
| E-UTRA Band 44 | 703 – 803 MHz | -52 dBm | 1 MHz | This is not applicable to repeater operating in Band n28. |
| E-UTRA Band 45 | 1447 – 1467 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 46 | 5150 – 5925 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 47 | 5855 – 5925 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 48 or NR Band n48 | 3550 – 3700 MHz | -52 dBm | 1 MHz | This is not applicable to repeater operating in Band n48, n77 or n78. |
| E-UTRA Band 50 or NR band n50 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n74, n75, n76, n91, n92, n93 or n94. |
| E-UTRA Band 51 or NR Band n51 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n75, n76, n91, n92, n93 or n94. |
| E-UTRA Band 53 or NR Band n53 | 2483.5 - 2495 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n41, n53 or n90. |
| E-UTRA Band 65 or NR Band n65 | 2110 – 2200 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n1 or n65. |
|  | 1920 – 2010 MHz | -49 dBm | 1 MHz | For repeater operating in Band n1, it applies for 1980 MHz to 2010 MHz, while the rest is covered in clause 6.6.5.2.2.  This requirement does not apply to repeater operating in band n65, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 66 or NR Band n66 | 2110 – 2200 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66. |
|  | 1710 – 1780 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 67 | 738 – 758 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n28 or n67. |
| E-UTRA Band 68 | 753 -783 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n28. |
|  | 698-728 MHz | -49 dBm | 1 MHz | For repeater operating in Band n28, this requirement applies between 698 MHz and 703 MHz, while the rest is covered in clause 6.6.5.2.2. |
| E-UTRA Band 69 | 2570 – 2620 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n38. |
| E-UTRA Band 70 or NR Band n70 | 1995 – 2020 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n2, n25 or n70 |
|  | 1695 – 1710 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n70, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 71 or NR Band n71 | 617 – 652 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n71 |
|  | 663 – 698 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n71, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 72 | 461 – 466 MHz | -52 dBm | 1 MHz |  |
|  | 451 – 456 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 74 or NR Band n74 | 1475 – 1518 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n50, n74, n75, n92 or n94. |
|  | 1427 – 1470 MHz | -49 dBm | 1MHz | This requirement does not apply to repeater operating in band n50, n51, n74, n75, n76, n91, n92, n93 or n94. |
| E-UTRA Band 75 or NR Band n75 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n74, n75, n76, n91, n92, n93 or n94. |
| E-UTRA Band 76 or NR Band n76 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n75, n76, n91, n92, n93 or n94. |
| NR Band n77 | 3.3 – 4.2 GHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n48, n77 or n78 |
| NR Band n78 | 3.3 – 3.8 GHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n48, n77 or n78 |
| NR Band n79 | 4.4 – 5.0 GHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n79 |
| NR Band n80 | 1710 – 1785 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n3, since it is already covered by the requirement in clause 6.6.5.2.2. |
| NR Band n81 | 880 – 915 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n8, since it is already covered by the requirement in clause 6.6.5.2.2. |
| NR Band n82 | 832 – 862 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n20, since it is already covered by the requirement in clause 6.6.5.2.2. |
| NR Band n83 | 703 – 748 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n28, since it is already covered by the requirement in clause 6.6.5.2.2.  For repeater operating in Band n67, it applies for 703 MHz to 736 MHz. |
| NR Band n84 | 1920 – 1980 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n1, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 85 | 728 – 746 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n12 or n85.  For NR repeater operating in n29, it applies 1 MHz below the Band n29 downlink operating band (Note 5). |
|  | 698 – 716 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n12 or n85, since it is already covered by the requirement in clause 6.6.5.2.2. |
| NR Band n86 | 1710 – 1780 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66, since it is already covered by the requirement in clause 6.6.5.2.2. |
| NR Band n89 | 824 – 849 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n5, since it is already covered by the requirement in clause 6.6.5.2.2. |
| NR Band n91 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n75 or n76. |
|  | 832 – 862 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n20, since it is already covered by the requirement in clause 6.6.5.5.1.2. |
| NR Band n92 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n74, n75 or n76. |
|  | 832 – 862 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n20, since it is already covered by the requirement in clause 6.6.5.5.1.2. |
| NR Band n93 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n75 or n76. |
|  | 880 – 915 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n8, since it is already covered by the requirement in clause 6.6.5.5.1.2. |
| NR Band n94 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n74, n75 or n76. |
|  | 880 – 915 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n8, since it is already covered by the requirement in clause 6.6.5.5.1.2. |
| NR Band n95 | 2010 – 2025 MHz | -52 dBm | 1 MHz |  |
| NR Band n96 | 5925 – 7125 MHz | -52 dBm | 1 MHz |  |
| NR Band n97 | 2300 – 2400MHz | -52 dBm | 1 MHz |  |
| NR Band n98 | 1880 – 1920MHz | -52 dBm | 1 MHz |  |
| NR Band n99 | 1626.5 – 1660.5 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n24, since it is already covered by the requirement in clause 6.5.5.2.2. |
| NR band n101 | 1900 – 1910 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n101. |
| NR Band n102 | 5925 – 6425 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 103 | 757 – 758 MHz | -52 dBm | 1 MHz |  |
|  | 787 – 788 MHz | -49 dBm | 1 MHz |  |
| NR Band n104 | 6425 – 7125 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n104 |

NOTE 1: As defined in the scope for spurious emissions in this clause, except for the cases where the noted requirements apply to a repeater operating in Band n28, the co-existence requirements in table 6.5.4.2.3 -1 do not apply for the ΔfOBUE frequency range immediately outside the downlink *operating band* (see table 5.2-1). Emission limits for this excluded frequency range may be covered by local or regional requirements.

NOTE 2: Table 6.5.5.2.3 -1 assumes that two *operating bands*, where the frequency ranges in table 5.2-1 would be overlapping, are not deployed in the same geographical area. For such a case of operation with overlapping frequency arrangements in the same geographical area, special co-existence requirements may apply that are not covered by the 3GPP specifications.

NOTE 3: For unsynchronized operation, special co-existence requirements may apply that are not covered by the 3GPP specifications.

NOTE 4: For NR Band n28 repeater, specific solutions may be required to fulfil the spurious emissions limits for repeater for co-existence with E-UTRA Band 27 UL *operating band*.

NOTE 5: For NR Band n29 repeater, specific solutions may be required to fulfil the spurious emissions limits for NR repeater for co-existence with UTRA Band XII, E-UTRA Band 12 or NR Band n12 UL operating band, E-UTRA Band 17 UL operating band or E-UTRA Band 85 UL or NR Band n85 UL operating band.

The following requirement may be applied for the protection of PHS. This requirement is also applicable at specified frequencies falling between ΔfOBUE below the lowest repeater transmitter frequency of the downlink *operating band* and ΔfOBUE above the highest repeater transmitter frequency of the downlink *operating band*. ΔfOBUE is defined in clause 6.5.1.

The spurious emission *minimum requirements* for this requirement are:

**Table 6.5.4.2.3-2: Repeater spurious emissions minimum requirements for repeater for co-existence with PHS for DL**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency range** | ***minimum requirements*** | ***Measurement Bandwidth*** | **Note** |
| 1884.5 – 1915.7 MHz | -41 dBm | 300 kHz | Applicable when co-existence with PHS system operating in 1884.5 – 1915.7 MHz |

In certain regions, the following requirement may apply to NR repeater operating in Band n50 and n75 within the 1432 – 1452 MHz, and in Band n51 and Band n76. The *minimum requirements are* specified in Table 6.5.4.2.3-4. This requirement is also applicable at the frequency range from ΔfOBUE below the lowest frequency of the repeater downlink *operating band* up to ΔfOBUE above the highest frequency of the repeater downlink *operating band*.

**Table 6.5.4.2.3-4: Additional operating band unwanted emission minimum requirement for NR repeater operating in Band n50 and n75 within 1432 – 1452 MHz, and in Band n51 and n76**

|  |  |  |
| --- | --- | --- |
| **Filter centre frequency, Ffilter** | ***Minimum requirements*** | ***Measurement Bandwidth*** |
| Ffilter = 1413.5 MHz | -42 dBm | 27 MHz |

In certain regions, the following requirement may apply to repeater operating in NR Band n50 and n75 within 1492-1517 MHz and in Band n74 within 1492-1518 MHz. The maximum level of emissions, measured on centre frequencies Ffilter with filter bandwidth according to Table 6.5.4.2.3-5, shall be defined according to the *minimum requirements* PEM,n50/n75,a nor PEM,n50/n75,b declared by the manufacturer.

**Table 6.5.4.2.3-5: *Operating band* n50, n74 and n75 declared emission above 1518 MHz**

|  |  |  |
| --- | --- | --- |
| **Filter centre frequency, Ffilter** | **Declared *minimum requirements* (dBm)** | ***Measurement bandwidth*** |
| 1518.5 MHz ≤ Ffilter ≤ 1519.5 MHz | PEM, n50/n75,a | 1 MHz |
| 1520.5 MHz ≤ Ffilter ≤ 1558.5 MHz | PEM,n50/n75,b | 1 MHz |

In certain regions, the following requirement shall be applied to repeater operating in Band n13 and n14 to ensure that appropriate interference protection is provided to 700 MHz public safety operations. This requirement is also applicable at the frequency range from 10 MHz below the lowest frequency of the repeater downlink operating band up to 10 MHz above the highest frequency of the repeater downlink operating band.

The power of any spurious emission shall not exceed:

**Table 6.5.4.2.3-6: Repeater spurious emissions limits for protection of 700 MHz public safety operations**

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating Band** | **Frequency range** | **Maximum Level** | ***Measurement Bandwidth*** |
| n13 | 763 - 775 MHz | -46 dBm | 6.25 kHz |
| n13 | 793 - 805 MHz | -46 dBm | 6.25 kHz |
| n14 | 769 - 775 MHz | -46 dBm | 6.25 kHz |
| n14 | 799 - 805 MHz | -46 dBm | 6.25 kHz |

In certain regions, the following requirement may apply to NR repeater operating in Band n30. This requirement is also applicable at the frequency range from 10 MHz below the lowest frequency of the repeater downlink operating band up to 10 MHz above the highest frequency of the repeater downlink operating band.

The power of any spurious emission shall not exceed:

**Table 6.5.4.2.3-7: Additional NR repeater spurious emissions minimum requirements for Band n30**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency range** | ***Minimum requirements*** | ***Measurement Bandwidth*** | **Note** |
| 2200 – 2345 MHz | -45 dBm | 1 MHz |  |
| 2362.5 – 2365 MHz | -25 dBm | 1 MHz |  |
| 2365 – 2367.5 MHz | -40 dBm | 1 MHz |  |
| 2367.5 – 2370 MHz | -42 dBm | 1 MHz |  |
| 2370 – 2395 MHz | -45 dBm | 1 MHz |  |

The following requirement may apply to repeater operating in Band n48 in certain regions. The power of any spurious emission shall not exceed:

**Table 6.5.4.2.3-8: Additional repeater spurious emissions limits for Band n48**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency range** | **Maximum Level** | ***Measurement Bandwidth* (NOTE)** | **Note** |
| 3530 MHz – 3720 MHz | -25 dBm | 1 MHz | Applicable 10 MHz from the assigned *passband edge* |
| 3100 MHz – 3530 MHz  3720 MHz – 4200 MHz | -40 dBm | 1 MHz |  |

NOTE: The resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

NOTE: The regional requirement, included in [12], is defined in terms of EIRP, which is dependent on both the repeater emissions at the *antenna connector* and the deployment (including antenna gain and feeder loss). The requirement defined above provides the characteristics of the base station needed to verify compliance with the regional requirement. The assessment of the EIRP level is described in Annex F.

The following requirement shall be applied to repeater operating in Band n26 to ensure that appropriate interference protection is provided to 800 MHz public safety operations. This requirement is also applicable at the frequency range from 10 MHz below the lowest frequency of the repeater downlink operating band up to 10 MHz above the highest frequency of the repeater downlink operating band.

The power of any spurious emission shall not exceed:

**Table 6.5.4.2.3-9: Repeater spurious emissions limits for protection of 800 MHz public safety operations**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating Band** | **Frequency range** | **Maximum Level** | **Measurement Bandwidth** | **Note** |
| n26 | 851 - 859 MHz | -13 dBm | 100 kHz | Applicable for offsets > 37.5kHz from the *passband* edge |

The following requirement may apply to Repeater for Band n41 and n90 operation in Japan. This requirement is also applicable at the frequency range from ΔfOBUE below the lowest frequency of the Repeater downlink operating band up to ΔfOBUE above the highest frequency of the Repeater downlink operating band.

The power of any spurious emission shall not exceed:

**Table 6.5.4.2.3-10: Additional repeater spurious emissions minimum requirements for Band n41 and n90**

|  |  |  |
| --- | --- | --- |
| **Frequency range** | ***Minimum requirement*** | ***Measurement Bandwidth*** |
| 2505 MHz – 2535 MHz | -42 dBm | 1 MHz |
| NOTE: This requirement applies for carriers allocated within 2545-2645 MHz. | | |

The following requirement may apply to repeater operating in 3.45-3.55 GHz in Band n77 in certain regions. Emissions shall not exceed the maximum levels specified in table 6.5.4.2.3-11.

**Table 6.5.4.2.3-11: Additional repeater spurious emissions limits for Band n77**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Channel bandwidth [MHz]** | **Frequency range [MHz]** | **Filter centre frequency, Ffilter [MHz]** | **Minimum requirement [dBm]** | ***Measurement bandwidth* [MHz]** |
| All | 3430 – 3440  3560 – 3570 | 3430.5 ≤ Ffilter < 3439.5  3560.5 ≤ Ffilter < 3569.5 | -25 | 1 |
| All | ≤ 3430  > 3570 | Ffilter < 3429.5  3570.5 ≤ Ffilter | -40 | 1 |

NOTE: The resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.5.4.2.3 Co-location with base stations and *repeater type 1-C* Nodes

These requirements may be applied for the protection of other BS, IAB-DU, IAB-MT and *repeater type 1-C* receivers when GSM900, DCS1800, PCS1900, GSM850, CDMA850, UTRA FDD, UTRA TDD, E-UTRA, NR BS, IAB-DU, IAB-MT, or *repeater type 1-C* are co-located with *repeater type 1-C*.

The requirements assume a 30 dB coupling loss between transmitter and receiver and are based on co-location with same class.

The *minimum requirements* are in table 6.5.4.2.3-1 for a *repeater type 1-C*. Requirements for co-location with a system listed in the first column apply, depending on the declared *repeater type 1-C* class. For a *multi-band connector*, the exclusions and conditions in the Note column of table 6.5.4.2.3-1 shall apply for each supported *operating band*.

**Table 6.5.4.2.3-1: *Repeater type 1-C* spurious emissions minimum requirements for co-location with BS, IAB-Node or repeater-Node**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Type of co-located BS** | **Frequency range for** | ***Minimum requirements*** | | | **Measurement** | **Note** |
|  | **co-location requirement** | **WA BS** | **MR BS** | **LA BS** | **bandwidth** |  |
| GSM900 | 876 – 915 MHz | -98 dBm | -91 dBm | -70 dBm | 100 kHz |  |
| DCS1800 | 1710 – 1785 MHz | -98 dBm | -91 dBm | -80 dBm | 100 kHz |  |
| PCS1900 | 1850 – 1910 MHz | -98 dBm | -91 dBm | -80 dBm | 100 kHz |  |
| GSM850 or CDMA850 | 824 – 849 MHz | -98 dBm | -91 dBm | -70 dBm | 100 kHz |  |
| UTRA FDD Band I or E-UTRA Band 1 or NR Band n1 | 1920 – 1980 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band II or E-UTRA Band 2 or NR Band n2 | 1850 – 1910 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band III or E-UTRA Band 3 or NR Band n3 | 1710 – 1785 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band IV or E-UTRA Band 4 | 1710 – 1755 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band V or E-UTRA Band 5 or NR Band n5 | 824 – 849 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band VI, XIX or E-UTRA Band 6, 19 | 830 – 845 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band VII or E-UTRA Band 7 or NR Band n7 | 2500 – 2570 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band VIII or E-UTRA Band 8 or NR Band n8 | 880 – 915 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band IX or E-UTRA Band 9 | 1749.9 – 1784.9 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band X or E-UTRA Band 10 | 1710 – 1770 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XI or E-UTRA Band 11 | 1427.9 –1447.9 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n50, n75, n91, n92, n93 or n94 |
| UTRA FDD Band XII or  E-UTRA Band 12 or NR Band n12 | 699 – 716 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XIII or  E-UTRA Band 13 or NR Band n13 | 777 – 787 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XIV or  E-UTRA Band 14 or NR Band n14 | 788 – 798 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 17 | 704 – 716 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 18 or NR Band n18 | 815 – 830 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XX or E-UTRA Band 20 or NR Band n20 | 832 – 862 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XXI or E-UTRA Band 21 | 1447.9 – 1462.9 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n50, n75, n92 or n94 |
| UTRA FDD Band XXII or E-UTRA Band 22 | 3410 – 3490 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n48, n77 or n78 |
| E-UTRA Band 24 or NR Band n24 | 1626.5 – 1660.5 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XXV or  E-UTRA Band 25 or NR Band n25 | 1850 – 1915 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XXVI or  E-UTRA Band 26 or NR Band n26 | 814 – 849 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 27 | 807 – 824 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 28 or NR Band n28 | 703 – 748 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 30 or NR Band n30 | 2305 – 2315 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 31 | 452.5 – 457.5 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band a) or E-UTRA Band 33 | 1900 – 1920 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band a) or E-UTRA Band 34 or NR band n34 | 2010 – 2025 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n34 |
| UTRA TDD Band b) or E-UTRA Band 35 | 1850 – 1910 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band b) or E-UTRA Band 36 | 1930 – 1990 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n2 or band n25 |
| UTRA TDD Band c) or E-UTRA Band 37 | 1910 – 1930 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band d) or E-UTRA Band 38 or NR Band n38 | 2570 – 2620 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n38. |
| UTRA TDD Band f) or E-UTRA Band 39 or NR band n39 | 1880 – 1920MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n39 |
| UTRA TDD Band e) or E-UTRA Band 40 or NR Band n40 | 2300 – 2400MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n30 or n40. |
| E-UTRA Band 41 or NR Band n41, n90 | 2496 – 2690 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n41, n53 or [n90] |
| E-UTRA Band 42 | 3400 – 3600 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n48, n77 or n78 |
| E-UTRA Band 43 | 3600 – 3800 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n48, n77 or n78 |
| E-UTRA Band 44 | 703 – 803 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n28 |
| E-UTRA Band 45 | 1447 – 1467 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 46 or NR Band n46 | 5150 – 5925 MHz | N/A | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n46 or n96 |
| E-UTRA Band 48 or NR Band n48 | 3550 – 3700 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n48, n77 or n78 |
| E-UTRA Band 50 or NR Band n50 | 1432 – 1517 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n51, n74, n75, n91, n92, n93 or n94 |
| E-UTRA Band 51 or NR Band n51 | 1427 – 1432 MHz | N/A | N/A | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n50, n74, n75, n76, n91, n92, n93 or n94 |
| E-UTRA Band 53 or NR Band n53 | 2483.5 – 2495 MHz | N/A | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n41, n53 or n90 |
| E-UTRA Band 65 or NR Band n65 | 1920 – 2010 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 66 or NR Band n66 | 1710 – 1780 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 68 | 698 – 728 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 70 or NR Band n70 | 1695 – 1710 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 71 or NR Band n71 | 663 – 698 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 72 | 451 – 456 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 74 or NR Band n74 | 1427 – 1470 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n50, n51, n91, n92, n93 or n94 |
| NR Band n77 | 3.3 – 4.2 GHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n48, n77 or n78 |
| NR Band n78 | 3.3 – 3.8 GHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to repeater operating in Band n48, n77 or n78 |
| NR Band n79 | 4.4 – 5.0 GHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n80 | 1710 – 1785 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n81 | 880 – 915 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n82 | 832 – 862 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n83 | 703 – 748 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n84 | 1920 – 1980 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 85 or NR Band 85 | 698 – 716 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n86 | 1710 – 1780 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n89 | 824 – 849 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n91 | 832 – 862 MHz | N/A | N/A | -88 dBm | 100 kHz |  |
| NR Band n92 | 832 – 862 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n93 | 880 – 915 MHz | N/A | N/A | -88 dBm | 100 kHz |  |
| NR Band n94 | 880 – 915 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n95 | 2010 – 2025 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n96 | 5925 – 7125 MHz | N/A | -90 dBm | -87 dBm | 100 kHz |  |
| NR Band n97 | 2300 – 2400MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n98 | 1880 – 1920MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n99 | 1626.5 – 1660.5 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n101 | 1900 – 1910 MHz | -96 dBm | NA | NA | 100 kHz |  |
| NR Band n102 | 5925 – 6425 MHz | N/A | -90 dBm | -87 dBm | 100 kHz |  |
| E-UTRA Band 103 | 787 – 788 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n104 | 6425 – 7125 MHz | -95 dBm | -90 dBm | -87 dBm | 100 kHz | This requirement does not apply to repeater operating in Band n104. |

NOTE 1: As defined in the scope for spurious emissions in this clause, the co-location requirements in table 6.5.4.2.4-1 do not apply for the frequency range extending ΔfOBUE immediately outside the transmit frequency range of a *repeater type 1-C*. The current state-of-the-art technology does not allow a single generic solution for co-location with other system on adjacent frequencies for 30dB antenna to antenna minimum coupling loss. However, there are certain site-engineering solutions that can be used. These techniques are addressed in TR 25.942 [3].

NOTE 2: Table 6.5.4.2.3-1 assumes that two *operating bands*, where the corresponding transmit and receive frequency ranges in table 5.2-1 would be overlapping, are not deployed in the same geographical area. For such a case of operation with overlapping frequency arrangements in the same geographical area, special co-location requirements may apply that are not covered by the 3GPP specifications.

<Changed section>

## 6.7 Input intermodulation

### 6.7.1 General requirement

#### 6.7.1.1 General

The input intermodulation is a measure of the capability of the repeater to inhibit the generation of interference in the *passband*, in the presence of interfering signals on frequencies other than the *passband*.

The following requirement applies for interfering signals depending on the repeaters *passband*.

This requirement applies to the uplink and downlink of the repeater.

There is no co-location input intermodulation requirement for LA 1-C repeaters deployed in Femto cell scenario.

<Changed section>

### 6.9.2 Minimum Requirements

For a repeater operating at *passband* below 2496 MHz, the ACRR requirements in table 6.9.2.1-1 shall apply in downlink. In normal conditions the ACRR for downlink shall be higher than the value specified in the Table 6.9.2.1-1.

Table 6.9.2.1-1: Repeater Downlink ACRR below 2496MHz

|  |  |  |  |
| --- | --- | --- | --- |
| Co-existence with other systems | Repeater Class | Channel offset from frequency edge of *passband* (MHz) | ACRR limit |
| UTRA, E-UTRA, NR | Wide Area repeater | min{100 MHz, BWpassband}/2 | 45 |
| Medium Range repeater | min{100 MHz, BWpassband}/2 | 45 |
| Local Area repeater | min{100 MHz, BWpassband}/2 | 33  (Note 1) |
| NOTE 1: This requirement does not applicable if the *passband* occupies the entire *operating band*. | | | |

For a repeater operating at *passband* above 2496 MHz, the ACRR requirements in table 6.9.2.1-1a shall apply in downlink. In normal conditions the ACRR for downlink shall be higher than the value specified in the Table 6.9.2.1-1a.

Table 6.9.2.1-1a: Repeater Downlink ACRR above 2496 MHz

|  |  |  |  |
| --- | --- | --- | --- |
| Co-existence with other systems | Repeater Class | Channel offset from frequency edge of *passband* (MHz) | ACRR limit |
| UTRA, E-UTRA, NR | Wide Area repeater | min{100 MHz, BWpassband}/2 | 33dB |
| Medium Range repeater | min{100 MHz, BWpassband}/2 | 33dB |
| Local Area repeater | min{100 MHz, BWpassband}/2 | 33dB  (Note 1) |
| NOTE 1: This requirement does not applicable if the *passband* occupies the entire *operating band*. | | | |

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### 6.10.2 Transmitter transient period

#### 6.10.2.1 General

*Transmitter transient period* requirements apply only to TDD operation of the repeater. The requirement applies to both downlink and uplink of the repeater.

The *transmitter transient state* is the time period during which the transmitter is changing from the *transmitter OFF state* to the *transmitter ON state* or vice versa. The *transmitter transient period* is illustrated in figure 6.10.2.1-1.



**Figure 6.10.2.1-1: Example of relations between transmitter ON period, transmitter OFF period and *transmitter transient period***

For *repeater type 1-C* this requirement shall be applied at the *antenna connector* supporting transmission in the *operating band*. The beginning and end point of downlink and uplink bursts are referenced to the slot timing at the input.

<Changed section>

7.2 OTA output power

7.2.1 General

*Repeater type 2-O* are declared to support one or more beams, as per manufacturer's declarations specified in TS 38.115-2 [8]. Radiated transmit power is defined as the EIRP level for a declared beam at a specific *beam peak direction*.

For each beam, the requirement is based on declaration of a beam identity, *reference beam direction pair*, beamwidth, *rated beam EIRP*, *OTA peak directions set*, the *beam direction pairs* at the maximum steering directions and their associated *rated beam EIRP* and beamwidth(s).

For a declared beam and *beam direction pair*, the *rated beam EIRP* level is the maximum power that the repeater is declared to radiate at the associated *beam peak direction*.

For each *beam peak direction* associated with a *beam direction pair* within the *OTA peak directions set*, a specific *rated beam EIRP* level may be claimed. Any claimed value shall be met within the accuracy requirement as described below. *Rated beam EIRP* is only required to be declared for the *beam direction pairs* subject to conformance testing as detailed in TS 38.115-2 [8].

NOTE 1: *OTA peak directions set* is set of *beam peak directions* for which the EIRP accuracy requirement is intended to be met. The *beam peak directions* are related to a corresponding contiguous range or discrete list of *beam centre directions* by the *beam direction pairs* included in the set.

NOTE 2: A *beam direction pair* is data set consisting of the *beam centre direction* and the related *beam peak direction.*

NOTE 3: A declared EIRP value is a value provided by the manufacturer for verification according to the conformance specification declaration requirements, whereas a claimed EIRP value is provided by the manufacturer to the equipment user for normal operation of the equipment and is not subject to formal conformance testing.

For *pass bands* where the supported *fractional bandwidth* (FBW) is larger than 6%, two rated beam EIRP may be declared by manufacturer:

- Prated,out,FBWlow for lower supported frequency range, and

- Prated,out,FBWhigh for higher supported frequency range.

For frequencies in between FFBWlow and FFBWhigh the rated beam EIRP is:

- Prated,out,FBWlow, for the output whose frequency is within frequency range FFBWlow ≤ f < (FFBWlow +FFBWhigh) / 2,

- Prated,out,FBWhigh, for the output whose frequency is within frequency range (FFBWlow +FFBWhigh) / 2 ≤ f ≤FFBWhigh.

OTA repeater output power is also declared as a TRP radiated requirement, with the output power accuracy requirement defined at the RIB. TRP does not change with beamforming settings as long as the *beam peak direction* is within the *OTA peak directions set*. Thus, the TRP accuracy requirement must be met for any beamforming setting for which the *beam peak direction* is within the *OTA peak directions set*.

There is no upper limit for the *rated TRP output power* and the *rated beam EIRP output power* of *repeater type 2-O* DL transmission.

The *repeater rated TRP output power* and the *rated beam EIRP output power* for *repeater type 2-O* UL transmissionshall be within limits as specified in table 9.2.1-1.

**Table 7.2.1-1: Repeater *rated TRP output power* limits for *repeater type 2-O* UL transmission**

|  |  |  |
| --- | --- | --- |
| **Repeater class** | **Prated,p,TRP** | **Prated,p,EIRP** |
| Wide Area | (note 1) | (note 1) |
| Local Area | ≤ + 35 + X dBm, Note 3 | ≤ + 55 + X dBm, Note 2 |
| NOTE1: There is no upper limit for the Prated,p,TRP or Prated,p,EIRP of the *repeater type 2-O* UL transmission.  NOTE2: X = 10\*log (ceil (*passband* bandwidth/100MHz)) | | |

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7.5.3.1 General

The OTA limits for operating band unwanted emissions are specified as TRP per RIB unless otherwise stated.

In addition to, for the part of passband where there is no input signal, -13dBm/MHz shall apply for all classes DL and UL.

<Changed section>

7.6.1 Downlink Error vector magnitude

7.6.1.1 General

The Error Vector Magnitude (EVM) is a measure of the difference between the symbols provided at the input of the repeater and the measured signal symbols at the output of the repeater after the equalization by the measurement equipment. This difference is called the error vector. Details about how the EVM is determined are specified in TS 38.104 Annex C for FR2. The EVM result is defined as the square root of the ratio of the mean error vector power to the mean reference power expressed in percent.

OTA modulation quality requirement is defined as a *directional requirement* at the RIB and shall be met within the *OTA coverage range* on the transmit side and the AoA of the incident wave of the received signal is in the reference direction at the receive side.

The EVM requirement is applicable when the repeater is operating with an input power level within the range from what is required to reach the rated beam EIRP output power (Prated,p,EIRP) to the minimum power levels in table 7.6.1.1-1.

**Table 7.6.1.1-1: Minimum input power for EVM**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| BS class | Minimum input power (dBm/MHz) | | | | | |
| 24.25 – 33.4 GHz | | | 37 – 52.6 GHz | | |
| Up to 16 QAM | 64QAM 1 | 256QAM 2 | Up to 16 QAM | 64QAM 1 | 256QAM 2 |
| WA, MR, LA | -77- GRX\_ANT | -73- GRX\_ANT | -66- GRX\_ANT | -75- GRX\_ANT | -71- GRX\_ANT | -64- GRX\_ANT |
| Note 1: support of 64QAM is based on the declaration  Note 2: support of 256QAM is based on the declaration | | | | | | |

Where GRX\_ANT is the gain of the receive side antennas and is based on EIRP and TRP declaration.

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7.6.2 Uplink Error vector magnitude

7.6.2.1 General

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM, the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further equalised using the channel estimates subjected to the EVM equaliser spectrum flatness requirement specified in TS 38.101-2 sub-clauses 6.4.2.4 and 6.4.2.5. For DFT-s-OFDM waveforms, the EVM result is defined after the front-end FFT and IDFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %. For CP-OFDM waveforms, the EVM result is defined after the front-end FFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %.

The basic EVM measurement interval is one slot in the time domain. The EVM measurement interval is reduced by any symbols that contains an allowable power transient in the measurement interval as defined in TS 38.101-2 clause 6.3.3.

All the parameters defined in clause 7.6.2 are defined using the measurement methodology specified in TS 38.101-2 Annex F.

OTA modulation quality requirement is defined as a *directional requirement* at the RIB and shall be met within the *OTA coverage range* on the transmit side and the AoA of the incident wave of the received signal is in the reference direction at the receive side.

The EVM requirement is applicable when the repeater is operating with an input power level within the range from what is required to reach the rated beam EIRP output power (Prated,p,EIRP) to the minimum input power levels in table 7.6.2.1-1.

**Table 7.6.2.1-1: Minimum input power for EVM**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BS class** | **Minimum input power (dBm/MHz)** | | | |
| **24.25 – 33.4 GHz** | | **37 – 52.6 GHz** | |
| Up to 16 QAM | 64QAM 1 | Up to 16 QAM | 64QAM1 |
| WA, MR, LA | -77- GRX\_ANT | -73- GRX\_ANT | -75- GRX\_ANT | -71- GRX\_ANT |
| Note 1: support of 64QAM is based on the declaration | | | | |

Where GRX\_ANT is the gain of the receive side antennas and is calculated from EIRP and TRP declaration.

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7.9.3 OTA transient period

7.9.3.1 General

The OTA *transmitter transient period* is the time period during which the transmitter is changing from the tra*nsmitter OFF state* to the *transmitter ON state* or vice versa. The *transmitter transient period* is illustrated in figure 7.9.3.1-1.

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**Figure 7.9.3.1-1: Example of relations between transmitter *ON state*, transmitter *OFF state* and *transmitter transient period***

This requirement shall be applied at each RIB supporting transmission in the *operating band*. The beginning and end point of downlink and uplink bursts are referenced to the slot timing at the input.