**3GPP T****SG-RAN WG4 Meeting #113 rev of R4-2419466**

**Orlando, US, November 18 – 22, 2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **.106** | **CR** |  | **rev** | **1** | **Current version:** |  |  |
|  | | | | | | | | |
| *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:*** | CR to TS 38.106 with terminology alignment for Rel-18 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_netcon\_repeater-Core | | | | |  | ***Date:*** | | | 2024-11-08 |
|  |  | | | |  | |  | | |  |
| ***Category:*** |  |  | | | | | ***Release:*** | | | Rel-18 |
|  | *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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This is CR to TS 38.106 Rel-17 with terminology aligment for repeaters discussed during RAN4#112 meeting and agreed in R4-2413502.   * Agreement from R4-2413502 * Following terminology should be used to align repeater Rel-17 and Rel-18 specifications:  |  |  | | --- | --- | | **Term** | **Repeater type** | | RF repeater (Rel-17) | RF Repeater type 1-C (RFR type 1-C)  RF Repeater type 2-O (RFR type 2-O) | | NCR (Rel-18) | NCR type 1-C  NCR type 1-H  NCR type 2-O | | Repeater | **Includes all repeaters in Rel-18:**  RF Repeater type 1-C (RFR type 1-C)  RF Repeater type 2-O (RFR type 2-O)  NCR type 1-C  NCR type 1-H  NCR type 2-O | | NR repeater | Term to be removed and not used as a name of any type of repeater. | | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Updates of terminology in afftect claueses listed below. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Specification will include terminology which is not align. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 1, 3.1, 3.3, 4.2, 4.3, 4.5, 5.2, 6.2, 6.5.5, 6.7.2, 6.7.3, 7.2.2, 7.3.2, 7.3.3, 7.4.2, 7.5.2, 7.5.3, 7.4.2, 7.5.2, 7.5.3, 7.5.4, 7.5.5, 7.7, 7.8.2, 7.9 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | | This is revision of R4-2419466. | | | | | | | | |

<Start of changes>

1 Scope

The present document establishes the minimum RF characteristics of RF repeater and network controlled repeater. For network controlled repeater (NCR), requirements for NCR-Fwd and NCR-MT apply. In this version of the specification mixed type NCR are not considered.

<Next change>

3 Definitions of terms, symbols and abbreviations

3.1 Terms

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

**Antenna connector:** connector at the conducted interface of the *repeater type 1-C*

**Beam:** beam (of the antenna) is the main lobe of the radiation pattern of an *antenna array*

**Beam centre direction:** direction equal to the geometric centre of the half-power contour of the beam

**Beam direction pair:** data set consisting of the *beam centre direction* and the related *beam peak direction*

**Beam peak direction:** direction where the maximum EIRP is found

**Beamwidth:** beam which has a half-power contour that is essentially elliptical, the half-power beamwidths in the two pattern cuts that respectively contain the major and minor axis of the ellipse

**directional requirement:** requirement which is applied in a specific direction within the *OTA coverage range*.

**Equivalent isotropic radiated power:** equivalent power radiated from an isotropic directivity device producing the same field intensity at a point of observation as the field intensity radiated in the direction of the same point of observation by the discussed device

**Fractional bandwidth:** *fractional bandwidth* FBW is defined as

**gap between passbands:** frequency gap between two consecutive passbands that belong to the same *operating band*, where the RF requirements in the gap are based on co-existence for un-coordinated operation

**Inter-passband gap**: The frequency gap between two supported consecutive *passbands* that belong to different operating bands.

**Maximum passband output power:** mean power level measured per *passband* at the *antenna connector*, during the *transmitter ON state* in a specified reference condition

**Maximum passband TRP output power:** mean power level measured perpassband during the *transmitter ON state* in a specified reference condition and corresponding to the declared *rated passband TRP output* power (Prated,p,,TRP)

**Measurement bandwidth**: RF bandwidth in which an emission level is specified

**multi-band connector**: *Antenna Connector* for a *Multi-band repeater*.

**Multi-band repeater:** *Repeater Type 1-C* whose *antenna connector* is associated with a transmitter and/or receiver that is characterized by the ability to process two or more *passband(s)* in common active RF components simultaneously, where at least one *passband* is configured at a different operating band than the other *passband(s)* and where this different operating band is not a sub-band or superseding-band of another supported operating band

**NCR type 1-C:** NCR-MT or NCR-Fwd at FR1 with a *requirement set* consisting only of conducted requirements defined at individual antenna connectors.

**NCR type 1-H:** NCR-MT or NCR-Fwd operating at FR1 with a *requirement set* consisting of conducted requirements defined at individual TAB connectors and OTA requirements defined at RIB.

**NCR type 2-O:** NCR-MT or NCR-Fwd operating at FR2 with a *requirement set* consisting only of OTA requirements defined at the RIB.

**Nominal channel bandwidth:** Bandwidth calculated as min(100MHz, BWpassband) in FR1 or min(400MHz, BWpassband) in FR2. If this bandwidth is not defined for BS channel bandwidth for the operating band, *nominal channel bandwidth* shall be defined as the widest BS channel bandwidth for the operating band which is narrower than BWpassband.

**Non-contiguous spectrum**: spectrum consisting of two or more *passbands* separated by *inter-passband gap*(s).

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

**OTA coverage range**: a common range of directions within which OTA requirements that are neither specified in the *OTA peak directions sets* nor as *TRP requirement* are intended to be met

**OTA peak directions set:** set(s) of *beam peak directions* within which certain OTA requirements are intended to be met, where all *OTA peak directions set(s)* are subsets of the *OTA coverage range*

**Passband:** The frequency range in which the repeater operates in with operational configuration, this frequency range can correspond to one or several consecutive nominal channels, if they are not consecutive each subset of channels shall be considered as an individual *passband*, a repeater can have one or several *passbands*, all channels within the *passband(s)* shall belong to a single operator or collaborating operators.

**passband edge***:* Frequency at the edge of the passband

**Radiated interface boundary**: *operating band* specific radiated requirements reference where the radiated requirements apply

**Rated beam EIRP:** 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* during the *transmitter ON state*

**Rated passband output power**: mean power level associated with a *passband* the manufacturer has declared to be available at the *antenna connector*, during the *transmitter ON state* in a specified reference condition

**Rated passband TRP output power**: mean power level declared by the manufacturer per passband, that the manufacturer has declared to be available at the RIB during the *transmitter ON state*

**Rated total output power**: mean power level associated with a particular *operating band* the manufacturer has declared to be available at the *antenna connector*, during the *transmitter ON state* in a specified reference condition

**Rated total TRP output power**: mean power level associated with a particular *operating band*, that the manufacturer has declared to be available at the RIB during the *transmitter ON state* in a specified reference condition

**Reference beam direction pair:** Beam direction pair in the reference direction declared by the manufacturer.

**RF repeater type 1-C (RFR type 1-C)**: Repeater operating at FR1 with a requirement set consisting only of conducted requirements defined at individual *antenna connectors*.

**RF repeater type 2-O (RFR type 2-O):** Repeater operating at FR2 with a requirement set consisting only of OTA requirements defined at the RIB

**Requirement set**: one of the NR requirements set as defined for  *repeater*

**single-band connector:** *Repeater type 1-C* *antenna connector* supporting operation either in a single *operating band* only, or in multiple *operating bands* but does not meet the conditions for a *multi-band connector*.

**Sub-band**: A *sub-band* of an operating band contains a part of the uplink and downlink frequency range of the operating band.

**sub-block:** one contiguous allocated block of spectrum for transmission and reception by the repeater.

**Superseding-band**: A *superseding-band* of an operating band includes the whole of the uplink and downlink frequency range of the operating band.

**Total radiated power:** is the total power radiated by the antenna

NOTE: The *total radiated power* is the power radiating in all direction for two orthogonal polarizations. *Total radiated power* is defined in both the near-field region and the far-field region

**Transmitter OFF state:** Time period during which the repeater downlink or uplink is not allowed to transmit in the corresponding direction.

**Transmitter ON state:** Time period during which the repeater is transmitting downlink or uplink signals in the corresponding direction.

**Transmitter transient period:** Time period during which the repeater is changing from the OFF state to the ON state or vice versa.

<Next change>

3.3 Abbreviations

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

ACLR Adjacent Channel Leakage Ratio

AoA Angle of Arrival

BFD Beam Failure Detection

BW Bandwidth

BWP Bandwidth Part

CACLR Cumulative ACLR

CBD Candidate Beam Detection

CP-OFDM Cyclic Prefix-OFDM

CSI-RS Channel State Information - Reference Signal

DFT-s-OFDM Discrete Fourier Transform-spread-OFDM

DL Downlink

DMRS Demodulation Reference Signal

EIRP Effective Isotropic Radiated Power

EVM Error Vector Magnitude

FBW Fractional Bandwidth

FR Frequency Range

ITU‑R Radiocommunication Sector of the International Telecommunication Union

LA Local Area

MR Medium Range

NCR Network Controlled Repeater

NCR-MT NCR Mobile Termination

NCR-Fwd NCR Forward

NR New Radio

OBUE Operating Band Unwanted Emissions

OOB Out-of-band

OTA Over-The-Air

QAM Quadrature Amplitude Modulation

QCL Quasi Co-Location

RF Radio Frequency

RFR RF repeater

RIB Radiated Interface Boundary

RLM Radio Link Monitoring

RLM-RS Reference Signal for RLM

RMSI Remaining Minimum System Information

RSRP Reference Signal Received Power

RX Receiver

SA Standalone operation mode

SCS Sub-Carrier Spacing

SMTC SSB-based Measurement Timing configurationSS-RSRP Synchronization Signal based Reference Signal Received Power

SSB Synchronization Signal Block

SSS Secondary Synchronization Signal

TCI Transmission Configuration Indicator

TRS Tracking Reference Signal

TX Transmitter

TRP Total Radiated Power

UL Uplink

WA Wide Area

<Next change>

4.2 Conducted and radiated requirement reference points

4.2.1 *RF repeater type 1-C*

For *RF* *Repeater type 1-C*, the requirements are applied at the repeater *antenna connector* (BS-side connector or UE-side connector) for downlink or uplink for the configuration in normal operating conditions.

Downlink

Uplink

UE-side connector

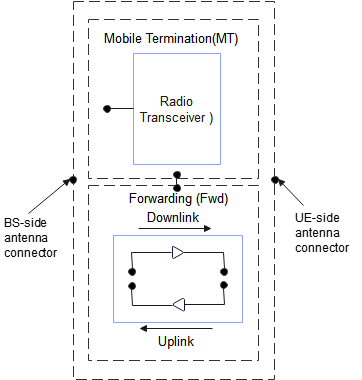
BS-side connector

**Figure 4.2.1-1: *RF repeater type 1-C* downlink and uplink interface**

4.2.1A NCR type 1-C

For *NCR type 1-C*, the NCR-Fwd RF requirements are applied at the NCR *antenna connector* (BS-side connector or UE-side connector) for downlink or uplink for the configuration in normal operating conditions.

For *NCR type 1-C*, the NCR-MT RF requirements are applied at the NCR *antenna connector* (BS-side connector) for the configuration in normal operating conditions.

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**Figure 4.2.1-1A: Network controlled *Repeater type 1-C* downlink and uplink interface**

NOTE 1: the NCR-MT and NCR-Fwd may have the same or separate antenna connectors.

<Next change>

4.2.2 *Repeater type 2-O*

For *RF* *repeater type 2-O*, the radiated characteristics are defined over the air (OTA), where the operating band specific radiated interface is referred to as the Radiated Interface Boundary (RIB). Radiated requirements are also referred to as OTA requirements. The (spatial) characteristics in which the OTA requirements apply are detailed for each requirement.

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**Figure 4.2.2-1: Radiated reference points for *RF* *repeater type 2-O***

<Next change>

4.3 Repeater classes

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 *RF* *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.

4.3.2 Repeater class for uplink

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

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

- Wide Area repeaters are characterised by requirements derived from Macro Cell and/or Micro Cell scenarios.

- Local Area repeaters are characterised by requirements derived from Pico Cell and/or Micro Cell scenarios.

<Next change>

4.5 Applicability of requirements

In Table 4.5-1, the requirement applicability for each requirement set is defined. For each requirement, the applicable requirement clause in the specification is identified. Requirements not included in a requirement set is marked not applicable (NA).

**Table 4.5-1: *Requirement set* applicability**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Requirement** | **Requirement set** | | | | | |
|  | ***RFR***  ***type 1-C,***  ***NCR-Fwd***  ***type 1-C*** | ***NCR-Fwd***  ***type 1-H*** | ***NCR-MT type 1-C*** | ***NCR-MT type 1-H*** | ***-RFR type 2-O, NCR-Fwd type 2-O*** | ***NCR-MT type 2-O*** |
| Repeater output power | 6.2 | 6.2 |  |  |  |  |
| Frequency stability | 6.3 | 6.3 |  |  |  |  |
| Out of band gain | 6.4 | 6.4 |  |  |  |  |
| Unwanted emissions | 6.5 | 6.5 |  |  |  |  |
| Repeater Error Vector Magnitude | 6.6 | 6.6 | NA | NA | NA |  |
| Input intermodulation | 6.7 | 6.7 |  |  |  |  |
| Output intermodulation | 6.8 | 6.8 |  |  |  |  |
| Adjacent Channel Rejection Ratio (ACRR) | 6.9 | 6.9 |  |  |  |  |
| Transmit ON/OFF power | 6.10 | 6.10 |  |  |  |  |
| Repeater output power for NCR-MT |  |  | 6.2.3.2 | 6.2.3.2 |  |  |
| Output power dynamics for NCR-MT |  |  | 6.11 | 6.11 |  |  |
| Transmit signal quality for NCR-MT |  |  | 6.12 | 6.12 |  |  |
| Unwanted emissions for NCR-MT |  |  | 6.5 | 6.5 |  | NA |
| Transmit intermodulation for NCR-MT |  | NA | 6.13 | 6.13 |  |  |
| Diversity characteristics for NCR-MT |  |  | 6.15 | 6.15 |  |  |
| Reference sensitivity for NCR-MT |  |  | 6.16 | 6.16 |  |  |
| Maximum input level for NCR-MT |  |  | 6.17 | 6.17 |  |  |
| Adjacent channel selectivity for NCR-MT |  |  | 6.18 | 6.18 |  |  |
| Blocking characteristics for NCR-MT |  |  | 6.19 | 6.19 |  |  |
| Spurious response for NCR-MT |  |  | 6.20 | 6.20 |  |  |
| Receiver intermodulation characteristics for NCR-MT |  |  | 6.21 | 6.21 |  |  |
| Receiver spurious emissions for NCR-MT |  |  | 6.22 | 6.22 |  |  |
| Performance requirements for NCR-MT |  |  | 8 | 8 |  |  |
| OTA Repeater output power |  | 7.2 |  |  | 7.2 |  |
| OTA frequency stability |  |  |  |  | 7.3 |  |
| OTA out of band gain |  |  |  |  | 7.4 |  |
| OTA unwanted emissions |  |  |  |  | 7.5 |  |
| OTA Repeater Error Vector Magnitude | NA |  |  | NA | 7.6 |  |
| OTA input intermodulation |  |  |  |  | 7.7 |  |
| OTA Adjacent Channel Rejection Ratio (ACRR) |  |  |  |  | 7.8 |  |
| OTA transmit ON/OFF power |  |  |  |  | 7.9 |  |
| OTA repeater output power for NCR-MT |  | NA | NA | 7.2 |  | 7.2 |
| OTA output power dynamics for NCR-MT |  |  |  |  |  | 7.10 |
| OTA transmit signal quality for NCR-MT |  |  |  |  |  | 7.11 |
| OTA unwanted emissions for NCR-MT |  |  |  |  |  | 7.5 |
| OTA diversity characteristics for NCR-MT |  |  |  |  |  | 7.12 |
| OTA reference sensitivity for NCR-MT |  |  |  | NA | NA | 7.13 |
| OTA maximum input level for NCR-MT |  |  |  |  |  | 7.14 |
| OTA adjacent channel selectivity for NCR-MT |  |  |  |  |  | 7.15 |
| OTA blocking characteristics for NCR-MT |  |  |  |  |  | 7.16 |
| OTA receiver spurious emissions for NCR-MT |  |  |  |  |  | 7.17 |
| Radiated performance requirements for NCR-MT |  |  |  |  |  | 9 |

**Table 4.5-1a: *Void***

**Table 4.5-1b: *Void***

<Next change>

5.2 Operating bands

Repeater is designed to operate in the *operating bands* in FR1 and FR2-1 defined in TS 38.104 [2] except the operating bands n46, n96 and n102.

<Next change>

6.2 Repeater output power

6.2.1 General

The repeater conducted output power requirement is at the *antenna connector*.

The *rated passband output power* of the *RF* *repeater type 1-C* and *NCR-Fwd type 1-C* shall be as specified in table 6.2.1-1 and table 6.2.1-2.

**Table 6.2.1-1: *RF* *repeater type 1-C* and *NCR-FWD type 1-C* DL transmission classes rated output power limits for repeater classes**

|  |  |
| --- | --- |
| **Repeater class** | **Prated,p,AC** |
| Wide Area repeater | Note 1 |
| Medium Range repeater | ≤ 38 dBm + X, Note 2 |
| Local Area repeater | ≤ 24 dBm + X, Note 2 |
| NOTE 1: There is no upper limit for the Prated,p,AC *rated passband output power* of the Wide Area repeater  NOTE 2: X = 10\*log (ceil (*passband* bandwidth/20MHz)) | |

**Table 6.2.1-2: *RF* *repeater type 1-C* and *NCR-Fwd type 1-C* UL transmission classes rated output power limits for repeater classes**

|  |  |
| --- | --- |
| **Repeater class** | **Prated,p,AC** |
| Wide Area repeater | Note 1 |
| Local Area repeater | ≤ 24 dBm+ X, Note 2 |
| NOTE 1: There is no upper limit for the Prated,p,AC *rated passband output power* of the Wide Area repeater.  NOTE 2: X = 10\*log (ceil (*passband* bandwidth/20MHz)) | |

The rated passband output power of the *NCR-Fwd 1-H* shall be as specified in table 6.2.1-3 and table 6.2.1-4.

**Table 6.2.1-3: *NCR-Fwd 1-H* DL rated output power limits for NCR classes**

| **Repeater class** | **Prated,c,sys** | **Prated,c,TABC** |
| --- | --- | --- |
| Wide Area NCR | (Note 1) | (Note 1) |
| Medium Range NCR | ≤ 38 dBm +10log(NTXU,counted) + X (NOTE 2) | ≤ 38 dBm+ X (NOTE 2) |
| Local Area NCR | ≤ 24 dBm +10log(NTXU,counted) + X (NOTE 2) | ≤ 24 dBm+ X (NOTE 2) |
| NOTE 1: There is no upper limit for the Prated,c,sys or Prated,c,TABC of the Wide Area NCR-Fwd.  NOTE 2: X = 10\*log (ceil (*passband* bandwidth/20MHz)) | | |

**Table 6.2.1-4: *NCR-Fwd 1-H* UL rated output power limits for NCR classes**

| **Repeater class** | **Prated,c,sys** | **Prated,c,TABC** |
| --- | --- | --- |
| Wide Area NCR | (Note 1) | (Note 1) |
| Local Area NCR | ≤ 24 dBm +10log(NTXU,counted) + X (NOTE 2, 3) | ≤ 24 dBm+ X (NOTE 2) |
| NOTE 1: There is no upper limit for the Prated,c,sys or Prated,c,TABC of the Wide Area NCR.  NOTE 2: X = 10\*log (ceil (*passband* bandwidth/20MHz))  NOTE 3: For joint transmission of NCR-Fwd and NCR-MT, Prated,c,sys shall apply to the total power of NCR-Fwd and NCR-MT. | | |

<Next change>

6.5.4.2.2 Additional spurious emissions *basic limits*

These *basic limits* 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 *basic limits* 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 basic limits for co-existence with systems operating in other frequency bands**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **System type to co-exist with** | **Frequency range for co-existence requirement** | ***basic limits*** | ***Measurement bandwidth*** | **Note** |
| GSM900 | 921 – 960 MHz | -57 dBm | 100 kHz | This basic limit does not apply to repeater operating in band n8 |
|  | 876 – 915 MHz | -61 dBm | 100 kHz | For the frequency range 880-915 MHz, this basic limit does not apply to repeater operating in band n8, since it is already covered by the basic limit in clause 6.5.5.2.2. |
| DCS1800 | 1805 – 1880 MHz | -47 dBm | 100 kHz | This basic limit does not apply to repeater operating in band n3. |
|  | 1710 – 1785 MHz | -61 dBm | 100 kHz | This basic limit does not apply to repeater operating in band n3, since it is already covered by the basic limit in clause 6.5.5.2.2. |
| PCS1900 | 1930 – 1990 MHz | -47 dBm | 100 kHz | This basic limit does not apply to repeater operating in band n2, n25 or band n70. |
|  | 1850 – 1910 MHz | -61 dBm | 100 kHz | This basic limit does not apply to repeater operating in band n2 or n25 since it is already covered by the basic limit in clause 6.6.5.2.2. |
| GSM850 or | 869 – 894 MHz | -57 dBm | 100 kHz | This basic limit does not apply to repeater operating in band n5 or n26. |
| CDMA850 | 824 – 849 MHz | -61 dBm | 100 kHz | This basic limit does not apply to repeater operating in band n5 or n26, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| UTRA FDD | 2110 – 2170 MHz | -52 dBm | 1 MHz | This basic limit 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 basic limit does not apply to repeater operating in band n1 or n65, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| UTRA FDD | 1930 – 1990 MHz | -52 dBm | 1 MHz | This basic limit 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 basic limit does not apply to repeater operating in band n2, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| UTRA FDD | 1805 – 1880 MHz | -52 dBm | 1 MHz | This basic limit 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 basic limit does not apply to repeater operating in band n3, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| UTRA FDD Band IV or  E-UTRA Band 4 | 2110 – 2155 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n66 |
|  | 1710 – 1755 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n66, since it is already covered by the basic limit 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 basic limit does not apply to repeater operating in band n5 or n26. |
|  | 824 – 849 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n5 or n26, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| UTRA FDD | 860 – 890 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n18. |
| Band VI, XIX or | 815 – 830 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n18, since it is already covered by the basic limit 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 basic limit does not apply to repeater operating in band n7. |
|  | 2500 – 2570 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n7, since it is already covered by the basic limit 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 basic limit does not apply to repeater operating in band n8. |
|  | 880 – 915 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n8, since it is already covered by the basic limit 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 basic limit does not apply to repeater operating in band n3. |
|  | 1749.9 – 1784.9 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n3, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| UTRA FDD Band X or  E-UTRA Band 10 | 2110 – 2170 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n66 |
|  | 1710 – 1770 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n66, since it is already covered by the basic limit 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 basic limit does not apply to repeater operating in band n50, n74, n75, n92, n94 or n109. |
|  | 1427.9 – 1447.9 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n50, n51, n74, n75, n76, n91, n92, n93, n94 or n109. |
|  | 1447.9 – 1462.9 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n50, n74, n75, n92, n94 or n109. |
| UTRA FDD Band XII or  E-UTRA Band 12 or NR Band n12 | 729 – 746 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n12 or n85. |
|  | 699 – 716 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n12 or n85, since it is already covered by the basic limit in clause 6.6.5.2.2.  For 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 basic limit does not apply to repeater operating in band n13. |
|  | 777 – 787 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n13, since it is already covered by the basic limit 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 basic limit does not apply to repeater operating in band n14. |
|  | 788 – 798 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n14, since it is already covered by the basic limit 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 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 basic limit does not apply to repeater operating in band n20 or n28. |
|  | 832 – 862 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n20, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| UTRA FDD Band XXII or E-UTRA Band 22 | 3510 – 3590 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n48, n77 or n78. |
|  | 3410 – 3490 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n77 or n78. |
| E-UTRA Band 24 | 1525 – 1559 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n24. |
|  | 1626.5 – 1660.5 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n24, since it is already covered by the basic limit 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 basic limit does not apply to repeater operating in band n2, n25 or n70. |
|  | 1850 – 1915 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n25 since it is already covered by the basic limit 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 basic limit does not apply to repeater operating in band n5 or n26. |
|  | 814 – 849 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n26 since it is already covered by the basic limit 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 basic limit does not apply to repeater operating in Band n5. |
|  | 807 – 824 MHz | -49 dBm | 1 MHz | This basic limit 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 basic limit does not apply to repeater operating in band n20, n67 or n28. |
|  | 703 – 748 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n28, since it is already covered by the basic limit 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 basic limit 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 basic limit does not apply to repeater operating in band n30 |
|  | 2305 – 2315 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n30, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| E-UTRA Band 31 or NR Band n31 | 462.5 – 467.5 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n31 or n72. |
|  | 452.5 – 457.5 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n31, since it is already covered by the basic limit in clause 6.6.5.2.2. This basic limit does not apply to repeater operating in band n72. |
| UTRA FDD band XXXII or E-UTRA band 32 | 1452 – 1496 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n50, n74, n75, n92, n94 or n109. |
| 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 basic limit 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 basic limit 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 basic limit 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 basic limit 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 basic limit 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 basic limit does not apply to repeater operating in Band n50, n51, n74, n75, n76, n91, n92, n93, n94 or n109. |
| E-UTRA Band 51 or NR Band n51 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in Band n50, n51, n75, n76, n91, n92, n93, n94 or n109. |
| E-UTRA Band 53 or NR Band n53 | 2483.5 - 2495 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in Band n41, n53 or n90. |
| E-UTRA Band 54 or NR Band n54 | 1670 – 1675 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in Band n54 |
| E-UTRA Band 65 or NR Band n65 | 2110 – 2200 MHz | -52 dBm | 1 MHz | This basic limit 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 basic limit does not apply to repeater operating in band n65, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| E-UTRA Band 66 or NR Band n66 | 2110 – 2200 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n66. |
|  | 1710 – 1780 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n66, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| E-UTRA Band 67 | 738 – 758 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in Band n28 or n67. |
| E-UTRA Band 68 | 753 -783 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n28. |
|  | 698-728 MHz | -49 dBm | 1 MHz | For repeater operating in Band n28, this basic limit 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 basic limit 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 basic limit does not apply to repeater operating in band n2, n25 or n70 |
|  | 1695 – 1710 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n70, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| E-UTRA Band 71 or NR Band n71 | 617 – 652 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n71 or n105 |
|  | 663 – 698 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n71 or n105, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| E-UTRA Band 72 or NR Band n72 | 461 – 466 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n31 or n72. |
|  | 451 – 456 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n72, since it is already covered by the basic limit in clause 6.6.5.2.2. This basic limit does not apply to repeater operating in band n31. |
| E-UTRA Band 74 or NR Band n74 | 1475 – 1518 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n50, n74, n75, n92, n94 or n109. |
|  | 1427 – 1470 MHz | -49 dBm | 1MHz | This basic limit does not apply to repeater operating in band n50, n51, n74, n75, n76, n91, n92, n93, n94 or n109. |
| E-UTRA Band 75 or NR Band n75 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in Band n50, n51, n74, n75, n76, n91, n92, n93, n94 or n109. |
| E-UTRA Band 76 or NR Band n76 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in Band n50, n51, n75, n76, n91, n92, n93, n94 or n109. |
| NR Band n77 | 3.3 – 4.2 GHz | -52 dBm | 1 MHz | This basic limit 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 basic limit 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 basic limit does not apply to repeater operating in Band n79 |
| NR Band n80 | 1710 – 1785 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n3, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| NR Band n81 | 880 – 915 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n8, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| NR Band n82 | 832 – 862 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n20, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| NR Band n83 | 703 – 748 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n28, since it is already covered by the basic limit 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 basic limit does not apply to repeater operating in band n1, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| E-UTRA Band 85 and NR Band n85 | 728 – 746 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n12 or n85.  For 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 basic limit does not apply to repeater operating in band n12 or n85, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| NR Band n86 | 1710 – 1780 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n66, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| NR Band n89 | 824 – 849 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n5, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| NR Band n91 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in Band n50, n51, n75, n76 or n109. |
|  | 832 – 862 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n20, since it is already covered by the basic limit in clause 6.6.5.5.1.2. |
| NR Band n92 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in Band n50, n51, n74, n75, n76 or n109. |
|  | 832 – 862 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n20, since it is already covered by the basic limit in clause 6.6.5.5.1.2. |
| NR Band n93 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in Band n50, n51, n75, n76 or n109. |
|  | 880 – 915 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n8, since it is already covered by the basic limit in clause 6.6.5.5.1.2. |
| NR Band n94 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in Band n50, n51, n74, n75, n76 or n109. |
|  | 880 – 915 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n8, since it is already covered by the basic limit 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 basic limit does not apply to repeater operating in band n24, since it is already covered by the basic limit in clause 6.5.5.2.2. |
| NR band n101 | 1900 – 1910 MHz | -52 dBm | 1 MHz | This basic limit 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 basic limit does not apply to repeater operating in Band n104 |
| NR band n105 | 612 – 652 MHz | -52 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n71 or n105 |
|  | 663 – 703 MHz | -49 dBm | 1 MHz | This basic limit does not apply to repeater operating in band n105, since it is already covered by the basic limit in clause 6.6.5.2.2. |
| E-UTRA Band 106 | 935 - 940 MHz | -52 dBm | 1 MHz |  |
|  | 896 – 901 MHz | -49 dBm | 1 MHz |  |
| NR band n109 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This basic limit does not apply to BS operating in Band n50, n51, n74, n75, n76, n91, n92, n93, n94 or n109 |
|  | 703 – 733 MHz | -49 dBm | 1 MHz | This basic limit does not apply to BS operating in band n109, since it is already covered by the basic limit in clause 6.6.6.5.2.4. |

NOTE 1: As defined in the scope for spurious emissions in this clause, except for the cases where the noted basic limits 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 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 *basic limit* for this requirement are:

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency range** | ***basic limit*** | ***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 repeater operating in Band n50 and n75 within the 1432 – 1452 MHz, and in Band n51 and Band n76. The *basic limit 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 basic limit for repeater operating in Band n50 and n75 within 1432 – 1452 MHz, and in Band n51 and n76**

|  |  |  |
| --- | --- | --- |
| **Filter centre frequency, Ffilter** | ***basic limit*** | ***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 *basic limits* 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 *basic limits* (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 basic limits for protection of 700 MHz public safety operations**

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating Band** | **Frequency range** | ***Basic limit*** | ***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 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 repeater spurious emissions basic limits for Band n30**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency range** | ***basic limits*** | ***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 basic limits for Band n48**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency range** | ***Basic limits*** | ***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 basic limits for protection of 800 MHz public safety operations**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating Band** | **Frequency range** | ***Basic limit*** | **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 basic limit for Band n41 and n90**

|  |  |  |
| --- | --- | --- |
| **Frequency range** | ***Basic limit*** | ***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. Basic limits are specified in table 6.5.4.2.3-11.

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Channel bandwidth [MHz]** | **Frequency range [MHz]** | **Filter centre frequency, Ffilter [MHz]** | ***Basic limit* [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.

The following requirement may also apply to repeater operating in Band n54 in certain regions. The level of emissions in the 1541 – 1650 MHz band, measured in measurement bandwidth according to Table 6.5.4.2.3-12 shall not exceed the maximum emission levels PEM,n54,a, PEM,n54,b, PEM,n54,c, PEM,n54,d, PEM,n54,e and PEM,n54,f declared by the manufacturer.

**Table 6.5.4.2.3-12: Declared Band n54 emissions basic limits for protection of the 1541-1650 MHz band**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating Band** | **Frequency range** | **Declared emission level (dBW)**  **(Measurement bandwidth = 1 MHz)** | **Declared emission level (dBW) of discrete emissions of less than 700 Hz bandwidth**  **(Measurement bandwidth = 1 kHz)** | **Declared emission level (dBW) of discrete emissions of less than 2 kHz bandwidth**  **(Measurement bandwidth = 1 kHz)** |
| n54 | 1541 - 1559 MHz | PEM,n54,a |  | PEM,n54,f |
|  | 1559 - 1610 MHz | PEM,n54,b | PEM,n54,d |  |
|  | 1610 - 1650 MHz | PEM,n54,c | PEM,n54,e |  |

Note: The regional requirements specified in attachment to the FCC reference document, 0007135419 are 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 EIRP level is calculated using: PEIRP = PE + Gant where PE denotes the repeater unwanted emission level at the antenna connector, Gant equals the repeater antenna gain minus feeder loss. The requirement defined above provides the characteristics of the base station needed to verify compliance with the regional requirement.

<Next change>

6.5.5 Receiver spurious emissions

6.5.5.1 General

The receiver spurious emissions power is the power of emissions generated or amplified in a receiver unit that appear at the *antenna connector*. The requirements only apply to *repeater type 1-C* for TDD operation.

For each a*ntenna connectors* on BS-side and UE-side supporting both RX and TX in TDD, the requirements apply during the *transmitter OFF state*. For *antenna connectors* both BS-side and UE-side in FDD, the RX spurious emissions requirements are superseded by the TX spurious emissions requirements, as specified in clause 6.5.4.

For *multi-band* *connectors* that both transmit and receive in *operating band* supporting TDD, RX spurious emissions requirements are applicable during the *TX OFF state*, and are subject to exclusion zones in each supported *operating band*.

For Band n41 and n90 operation in Japan, the sum of receiver spurious emissions requirements over all *antenna connectors* for *repeater type 1-C* shall not exceed *minimum requirements* defined in clause 6.5.5.2.

6.5.5.2 Basic limits

The receiver spurious emissions requirements*, basic limits* are provided in table 6.5.5.2-1.

**Table 6.5.5.2-1: *Repeater* receiver spurious emissions *basic limits***

| **Spurious frequency range** | ***Basic limits*** | ***Measurement bandwidth*** | **Note** |
| --- | --- | --- | --- |
| 30 MHz – 1 GHz | -57 dBm | 100 kHz | Note 1 |
| 1 GHz – 12.75 GHz | -47 dBm | 1 MHz | Note 1, Note 2 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the UL *operating band* in GHz | -47 dBm | 1 MHz | Note 1, Note 2, Note 3, Note 5 |
| 12.75 GHz ‑ 26 GHz | -47 dBm | 1 MHz | Note 1, Note 2, Note 6 |
| NOTE 1: *Measurement bandwidth*s as in ITU-R SM.329 [5], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [5], s2.5 table 1.  NOTE 3: This spurious frequency range applies only for *operating bands* for which the 5th harmonic of the upper frequency edge of the UL *operating band* is reaching beyond 12.75 GHz.  NOTE 4: The frequency range from ΔfOBUE below the lowest frequency of the repeater transmitter *operating band* to ΔfOBUE above the highest frequency of the repeater transmitter *operating band* may be excluded from the requirement. ΔfOBUE is defined in clause 6.5.1. For *multi-band* *connectors*, the exclusion applies for all supported *operating bands*.  NOTE 5: Does not apply for band n104.  NOTE 6: Applies only for band n104. | | | |

<Next change>

6.7.2 Co-location with BS/repeater in other systems

6.7.2.1 General

This additional input intermodulation requirement may be applied for the protection of repeater receivers when GSM, CDMA, UTRA, E-UTRA, NR BS or repeater operating in a different frequency band are co-located with a repeater.

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

This requirement applies to the uplink and downlink of the repeater. If the BS side is declared to meet co-location requirements, then it should meet input intermodulation co-location requirements for the downlink. If the UE side is declared to meet co-location requirements, then it should meet input intermodulation co-location requirements for the uplink.

6.7.2.2 Minimum requirement for *RF repeater*

For the parameters specified in table 6.7.2.2-1 for DL and 6.7.2.2-2 for UL, the power in the *passband* shall not increase with more than 10 dB at the output of the repeater as measured with 1MHz measurement bandwidth, compared to the level obtained without interfering signals applied.

The core requirement is applicable for all frequency separation possibilities between the two interfering signals that cause the 3rd order intermodulation product to fall into the *passband*.

**Table 6.7.2.2-1: input intermodulation requirement for RF repeater DL when co-located with BS/repeater in other frequency bands.**

| **Frequency range of interfering signal** | **Interfering signal mean power for repeater with WA UE side (dBm)** | **Interfering signal mean power for repeater with MR UE side(dBm)** | **Interfering signal mean power for repeater with LA UE side(dBm)** | **Type of interfering signals** |
| --- | --- | --- | --- | --- |
| Frequency range of co-located BS’s downlink operating band or located repeater’s *passband* | +16 | +8 | x (Note 1) | 2 CW carriers |
| NOTE 1: x = -7 dBm for RF repeater co-located with Pico GSM850 or Pico CDMA850  x = -4 dBm for RF repeater co-located with Pico DCS1800 or Pico PCS1900  x = -6 dBm for RF repeater co-located with UTRA bands or E-UTRA bands or NR bands  NOTE 2: The requirement does not apply when the interfering signal falls within the *passband*.  NOTE 3: For unsynchronized base stations (except in band n46, n96, and n102) or repeaters, special co-location requirements may apply that are not covered by the 3GPP specifications. | | | | |

**Table 6.7.2.2-2: input intermodulation requirement for RF Repeater UL when co-located with BS/repeater in other frequency bands.**

| **Frequency range of interfering signal** | **Interfering signal mean power for repeater with WA BS side(dBm)** | **Interfering signal mean power for repeater with LA BS side(dBm)** | **Type of interfering signals** |
| --- | --- | --- | --- |
| Frequency range of co-located BS’s downlink operating band or located repeater’s *passband* | +16 | Prated,p,AC -30 | 2 CW carriers |
| NOTE 1: The requirement does not apply when the interfering signal falls within the *passband*.  NOTE 2: For unsynchronized base stations (except in band n46, n96, and n102) or repeaters, special co-location requirements may apply that are not covered by the 3GPP specifications. | | | |

<Next change>

6.7.3 Co-existence with other systems

6.7.3.1 General

This input intermodulation existence requirement may be applied for the protection of RF repeater receivers when GSM, CDMA, UTRA, E-UTRA, NR BS or repeater operating in another frequency band co-exist with a RF repeater.

6.7.3.2 Minimum requirement for *RF repeater*

For the parameters specified in table 6.7.3.2-1, the power in the *passband* shall not increase with more than 10 dB at the output of the repeater as measured with 1MHz measurement bandwidth, compared to the level obtained without interfering signals applied.

The core requirement is applicable for all frequency separation possibilities between the two interfering signals that cause the 3rd order intermodulation product to fall into the *passband*.

**Table 6.7.3.2-1: input intermodulation requirement for RF repeater when co-exist with BS/repeater in other non-overlapping frequency bands**

| **Frequency range of interfering signal** | **Interfering signal mean power (dBm)** | **Type of interfering signals** | **Measurement bandwidth** |
| --- | --- | --- | --- |
| Frequency range of co-existence system operating band | -15 | 2 CW carriers | 1MHz |
| NOTE 1: All the interfering signals should be limited into the frequency ranges that are either X MHz higher than FUL,high or X MHz lower than FUL,low, where X equals to 20MHz when FUL,high - FUL,low is not larger than 200MHz, otherwise X equals to 60MHz | | | |

<Next change>

7.2.2 Minimum requirement for RF repeater

The AoA of the input signal shall be the same as the reference direction for the *OTA peak directions set* when operating in the opposite DL/UL direction.

The requirements shall apply with NR signals in the *passband* of the repeater at:

The lowest input power (Pp,in,EIRP) that produces the *rated passband TRP output power* (Prated,p,TRP)

Up to:

The lowest input power (Pp,in,EIRP) that produces the *rated passband TRP output power* (Prated,p,TRP), plus 10dB

In normal conditions, the measured output power, Pmax,p,EIRP shall remain within +3.4 dB and -3.4 dB of the *rated beam EIRP output power* Prated,p,EIRP, declared by the manufacturer.

In extreme conditions, the measured output power, Pmax,p,,EIRP shall remain within +4.5 dB and -4.5 dB of the *rated beam EIRP output power* Prated,p,EIRP, declared by the manufacturer.

In normal conditions, the *repeater type 2-O* *maximum passband TRP output power*, Pmax,p,TRP measured at the RIB shall remain within ±3 dB of the *rated passband TRP output power* Prated,p,TRP, as declared by the manufacturer.

<Next change>

7.3.2 Minimum requirement for RF repeater

The frequency deviation of the output signal with respect to the input signal shall be no more than ±0,01 PPM.

7.3.3 Minimum requirement for NCR

7.3.3.1 Minimum requirement for NCR-Fwd

7.3.3.1.1 Minimum requirement for NCR-Fwd type 2-O

The frequency deviation of the output signal with respect to the input signal shall be no more than ±0,01 PPM.

<Next change>

7.4.2 Minimum requirement for RF repeater

The gain outside the *passband* shall not exceed the maximum level specified in table 7.4.2-1, where:

- f\_offset\_CW is the offset between the outer channel edge frequency of the outer channel in the *passband* and a CW signal.

**Table 7.4.2-1: Out of band gain limits 1**

|  |  |
| --- | --- |
| **Frequency offset, f\_offset\_CW** | **Maximum gain** |
| 0.1\*Minimum {400MHz, *passband* BW}  f\_offset\_CW < 150 MHz | 68 dB |
| 150 MHz  f\_offset\_CW < 400 MHz | 55 dB |
| 400 MHz  f\_offset\_CW < f\_offset\_max | 35 dB |

<Next change>

7.5.2 OTA Adjacent Channel Leakage Power Ratio (ACLR)

7.5.2.1 General

OTA 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 measured power is TRP.

The requirement shall be applied per RIB during the *transmitter ON state*.

7.5.2.2 Minimum requirement for *RF repeater*

The OTA ACLR limit is specified in table 7.5.2.2-1 for DL and UL for Wide Area class and DL for Local Area class.

The OTA ACLR limit is specified in table 7.5.2.2-1a for UL for Local Area class.

The OTA ACLR absolute limit is specified in table 7.5.2.2-2.

Either the OTA ACLR (CACLR) absolute limit in table 7.5.2.2-2 or 7.5.2.2-5 or the relevant ACLR (CACLR) limit in table 7.5.2.2-1, 7.5.2.2-1a, 7.5.2.2-3, 7.5.5.2-3a, 7.5.2.2-4 or 7.5.2.2-4a, whichever is less stringent, shall apply.

For a RIB operating in *non-contiguous spectrum*, the OTA ACLR requirement in table 7.5.2.2-3 shall apply in *gaps between passbands* for the frequency ranges defined in the table, while the OTA CACLR requirement in table 7.5.2.2-4 shall apply in *gaps between passbands* for the frequency ranges defined in the table.

The CACLR in a *gap between passbands* 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*, and

b) the filtered mean power centred on a frequency channel adjacent to one of the respective *passband* edges.

The assumed filter for the adjacent channel frequency is defined in table 7.5.2.2-4 and the filters on the assigned channels are defined in table 7.5.2.2-6.

For operation in *non-contiguous spectrum*, the CACLR for NR carriers located on either side of the *gap between passbands* shall be higher than the value specified in table 7.5.2.2-4.

<Next change>

7.5.3 OTA operating band unwanted emissions

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.

7.5.3.2 Minimum requirement for RF repeater

7.5.3.2.1 General

The requirements of either clause 7.5.3.2.2 (Category A limits) or clause 7.5.3.2.3 (Category B limits) shall apply. The application of either Category A or Category B limits shall be the same as for General OTA transmitter spurious emissions requirements (*repeater type 2-O*) in clause 7.5.3.3.2. In addition, the limits in clause 7.5.3.2.4 may also apply.

Out-of-band emissions in FR2 are limited by OTA operating band unwanted emission limits.

For *repeater type 2-O*, unless otherwise stated, the OTA operating band unwanted emission limits in FR2 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 7.5.1-1 and 7.5.1-2 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. For a *RIB* operating in contiguous CA, the requirements apply to the frequencies (ΔfOBUE) starting from the edge of the *passband.* In addition, for a *RIB* operating in *non-contiguous spectrum*, the requirements apply inside any *gap between passbands*.

Emissions shall not exceed the maximum levels 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 *passband* edge.

- 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 thedownlink *operating band*, where ΔfOBUE is defined in table 7.5.1-1 and 7.5.1-2..

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

In addition, inside any *gap between passbands* for a *RIB* operating in *non-contiguous spectrum*, emissions shall not exceed the cumulative sum of the limits specified for the adjacent *sub-blocks* on each side of the *gap between passbands*. The limit for each *sub-block* is specified in clauses 7.5.3.2.2 and 7.5.3.2.3 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.

<Next change>

7.5.4 OTA transmitter spurious emissions

7.5.4.1 General

Unless otherwise stated, all requirements are measured as mean power.

The OTA spurious emissions limits are specified as TRP per RIB unless otherwise stated.

7.5.4.2 Minimum requirement for *RF repeater*

7.5.4.2.1 General

For *repeater type 2-O*, the OTA transmitter spurious emission limits apply from 30 MHz to 2nd harmonic of the upper frequency edge of the downlink *operating band*, excluding the frequency range from ΔfOBUE below the lowest frequency of the downlink *operating band*, up to ΔfOBUE above the highest frequency of the downlink *operating band*, where the ΔfOBUE is defined in table 7.5.1-1 and 7.5.1-2.

<Next change>

7.5.5 OTA receiver spurious emissions

7.5.5.1 General

The OTA RX spurious emission is the power of the emissions radiated from the antenna array from a receiver unit.

The metric used to capture OTA receiver spurious emissions is *total radiated power* (TRP), with the requirement defined at the RIB.

For a RIB operating in FDD, OTA RX spurious emissions requirement do not apply as they are superseded by the OTA TX spurious emissions requirement. This is due to the fact that TX and RX spurious emissions cannot be distinguished in OTA domain.

For a RIB operating in TDD, the OTA RX spurious emissions requirement shall apply during the *transmitter OFF state* only.

For *multi-band RIB*, the OTA RX spurious emissions requirements are subject to exclusion zones in each supported *operating band*.

7.5.5.2 Minimum requirement for *RF repeater*

For the *Repeater type 2-O*, the power of any RX spurious emission shall not exceed the limits in table 7.5.5.2-1.

**7.5.5.2-1: OTA receiver spurious emission limits for *Repeater type 2-O***

|  |  |  |  |
| --- | --- | --- | --- |
| **Spurious  frequency range  (Note 4)** | **Limit (Note 5)** | **Measurement Bandwidth** | **Note** |
| 30 MHz ↔ 1 GHz | -36 dBm | 100 kHz | Note 1 |
| 1 GHz ↔ 18 GHz | -30 dBm | 1 MHz | Note 1 |
| 18 GHz ↔ Fstep,1 | -20 dBm | 10 MHz | Note 2 |
| Fstep,1  ↔ Fstep,2 | -15 dBm | 10 MHz | Note 2 |
| Fstep,2 ↔ Fstep,3 | -10 dBm | 10 MHz | Note 2 |
| Fstep,4  ↔ Fstep,5 | -10 dBm | 10 MHz | Note 2 |
| Fstep,5  ↔ Fstep,6 | -15 dBm | 10 MHz | Note 2 |
| Fstep,6 ↔ 2nd harmonic of the upper frequency edge of the UL *operating band* | -20 dBm | 10 MHz | Note 2, Note 3 |
| NOTE 1: Bandwidth as in ITU-R SM.329 [5], s4.1.  NOTE 2: Limit and bandwidth as in ERC Recommendation 74-01 [9], Annex 2.  NOTE 3: Upper frequency as in ITU-R SM.329 [5], s2.5 table 1.  NOTE 4: The step frequencies Fstep,X are defined in table 7.5.5.3-2.  NOTE 5: Additional limits may apply regionally. | | | |

**Table 7.5.5.2-2: Step frequencies for defining** **the OTA receiver spurious emission limits for *Repeater type 2-O***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Operating band** | **Fstep,1 (GHz)** | **Fstep,2 (GHz)** | **Fstep,3 (GHz)** | **Fstep,4 (GHz)** | **Fstep,5 (GHz)** | **Fstep,6 (GHz)** |
| n257 | 18 | 23.5 | 25 | 31 | 32.5 | 41.5 |
| n258 | 18 | 21 | 22.75 | 29 | 30.75 | 40.5 |
| n259 | 23.5 | 35.5 | 38 | 45 | 47.5 | 59.5 |
| n260 | 25 | 34 | 35.5 | 41.5 | 43 | 52 |
| n261 | 18 | 25.5 | 26.0 | 29.85 | 30.35 | 38.35 |
| n262 | 37.2 | 45.2 | 45.7 | 49.7 | 50.2 | 58.2 |
| n263 | 18 | 43 | 53.5 | 74.5 | 85 | 127 |

In addition to the requirements in Table 7.5.5.2-1, the requirement for protection of EESS for *RF repeater* operating in frequency range 24.25 – 27.5 GHz in clause 7.5.4.2.3.1 may be applied.

<Next change>

7.6.1.2 Minimum requirement for repeater

The repeater EVM levels for different modulation schemes outlined in table 7.6.1.2-1 shall be met using the frame structure described in clause 7.6.1.3.

**Table 7.6.1.2-1: Repeater EVM requirements**

|  |  |
| --- | --- |
| **Parameter** | **Required repeater EVM** |
| Up to 16QAM | 12.5% |
| 64QAM | 8 % 1 |
| 256QAM | 3.5 % 2 |
| Note 1: support of 64QAM is based on the declaration  Note 2: support of 256QAM is based on the declaration. | |

<Next change>

7.6.2.2 Minimum requirement for RF repeater

The RMS average of the basic repeater EVM measurements over 10 subframes for the average repeater EVM case, for the different modulation schemes shall not exceed the values specified in Table 7.6.2.2-1.

**Table 7.6.2.2-1: Minimum requirements for repeater error vector magnitude**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Average repeater EVM level** |
| Up to 16 QAM | % | 12.5 |
| 64 QAM | % | 8 1 |
| Note 1: support of 64QAM is based on the declaration | | |

7.6.2.3 Minimum requirement for NCR

7.6.2.3.1 Minimum requirement for NCR-Fwd

7.6.2.3.1.1 Minimum requirement for *NCR-Fwd type 2-O*

The requirements in clause 7.6.2.2 apply for *NCR-Fwd type 2-O*.

<Next change>

7.7 OTA input intermodulation

7.7.1 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 requirement is defined as a directional requirement.

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction:

The interfering signals apply to each supported polarization, under the assumption of polarization match.

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

This requirement applies to the uplink and downlink of the repeater during the *transmitter ON state*.

When GSM, CDMA, UTRA, E-UTRA, NR BS or repeater operating in a different frequency band are co-located with a NCR, additional input intermodulation co-location requirement may be applied for the protection of RF repeater or NCR receivers. This requirement applies to the uplink and downlink of the repeater. If the BS side is declared to meet co-location requirements, then it should meet input intermodulation co-location requirements for the downlink. If the UE side is declared to meet co-location requirements, then it should meet input intermodulation co-location requirements for the uplink.

When GSM, CDMA, UTRA, E-UTRA, NR BS or repeater operating in another frequency band co-exist with a NCR, additional input intermodulation co-existence requirement may be applied for the protection of NR repeater or NCR receivers.

7.7.2 Minimum requirement for RF repeater

For the parameters specified in table 7.7.2-1, the power in the *passband* shall not increase with more than 10 dB at the output of the repeater as measured with 1 MHz measurement bandwidth, compared to the level obtained without interfering signals applied.

The core requirement is applicable for all frequency separation possibilities between the two interfering signals that cause the 3rd order intermodulation product to fall into the whole *passband*.

Table 7.7.2-1 specifies the parameters for two interfering signals, where:

- f1 offset is the offset from the channel edge frequency of the first or last channel in the *passband* of the closer carrier.

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

**Table 7.7.2-1: Input intermodulation requirement**

|  |  |  |  |
| --- | --- | --- | --- |
| **f1 offset** | **Interfering Signal Levels** | **Type of signals** | **Measurement bandwidth** |
| 1 MHz | -53dBm – G\_RX\_ANT | 2 CW carriers | 1 MHz |

<Next change>

7.8.2 Minimum Requirements for RF repeater

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal in the *passband* and a received signal on an adjacent channel outside repeater *passband* is from the same direction and are the same as the TX reference direction for the opposite DL/UL setting*.*

For a repeater operating at *passband* operating in FR2, the ACRR requirements in table 7.8.2-1 shall apply in downlink. ACRR for downlink shall be higher than the value specified in the Table 7.8.2-1.

**Table 7.8.2-1: Repeater Downlink ACRR**

|  |  |  |  |
| --- | --- | --- | --- |
| **Co-existence with other systems** | **Repeater Class** | **Channel offset from frequency edge of *passband* (MHz)** | **ACRR limit (dB)** |
| NR | Wide Area repeater | BWNominal/2 | 28 (Note 2)  26 (Note 3) |
| Medium Range repeater | BWNominal/2 | 28 (Note 2)  26 (Note 3) |
| Local Area repeater | BWNominal/2 | 28 (Notes 1, 2)  26 (Note 1, 3) |
| NOTE 1: This requirement does not applicable if the *passband* occupies the entire *operating band*.  NOTE 2: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz.  NOTE 3: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz | | | |

For a repeater operating at *passband* operating in FR2, the ACRR requirements in table 7.8.2-2 shall apply in uplink. ACRR for uplink shall be higher than the value specified in the Table 7.8.2-2.

**Table 7.8.2-2: Repeater Uplink ACRR**

|  |  |  |  |
| --- | --- | --- | --- |
| **Co-existence with other systems** | **Repeater Class** | **Channel offset from frequency edge of *passband* (MHz)** | **ACRR limit (dB)** |
| NR | Wide Area repeater | BWNominal/2 | 28 (Note 2)  26 (Note 3) |
| Local Area repeater | BWNominal/2 | 17 (Note 1, 2)  16 (Note 1, 3) |
| NOTE 1: This requirement does not applicable if the *passband* occupies the entire *operating band*.  NOTE 2: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz.  NOTE 3: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz | | | |

<Next change>

7.9 OTA transmit ON/OFF power

7.9.1 General

OTA transmit ON/OFF power requirements apply only to TDD operation of repeater. The requirements apply to both downlink and uplink of the repeater.

7.9.2 OTA transmitter OFF power

7.9.2.1 General

OTA transmitter OFF power is defined as the mean power measured over 70/N µs filtered with a square filter of bandwidth equal to the *passband bandwidth* of the repeater (BWpassband ) centred on the assigned channel frequency during the *transmitter OFF state*. N = SCS/15, where SCS is Sub Carrier Spacing in kHz of the input signal. For *repeater type 2-O* and *NCR-Fwd type 2-O*, the OTA transmitter OFF power is defined as TRP.

7.9.2.2 Minimum requirement for RF repeater

The OTA transmitter OFF TRP spectral density for *repeater type 2-O* shall be less than ‑36 dBm/MHz.

7.9.2.3 Minimum requirement for NCR

7.9.2.3.1 Minimum requirement for NCR-Fwd

7.9.2.3.1.1 Minimum requirement for NCR-Fwd *type 2-O*

The requirements in clause 7.9.2.2 apply for NCR-Fwd type 2-O.

7.9.2.3.2 Minimum requirement for NCR-MT

7.9.2.3.2.1 Minimum requirement for NCR-MT type 2-O

For Wide Area NCR-MT type 2-O, the OTA transmitter OFF TRP spectral density for shall be less than ‑36 dBm/MHz.For Local Area *NCR-MT type 2-O,* the transmit OFF power shall not exceed the values specified in Tables 7.9.2.3.2.1-1 for each operating band supported. The requirement is verified with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

**Table7.9.2.3.2.1-1: Transmit OFF power for FR2-1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth** | | | |
|  | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** |
| n257, n258, n259, n260, n261, n262 | -35 | -35 | -35 | -35 |
|  | 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |

<Next change>

7.9.3.2 Minimum requirement for RF repeater

For *repeater type 2-O*, the OTA *transmitter transient period* shall be shorter than the values listed in the minimum requirement table 7.9.3.2-1.

**Table 7.9.3.2-1: Minimum requirement for the OTA *transmitter transient period* for *repeater type 2-O***

|  |  |
| --- | --- |
| **Transition** | **Transient period length (µs)** |
| OFF to ON | 3 |
| ON to OFF | 3 |

<End of changes>