**3GPP TSG-RAN WG4 Meeting # 112 R4-2412715**

**Maastricht , NL, 19th – 23th Aug, 2024**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | **38.115-2** | **CR** | **0023** | **rev** | **1** | **Current version:** | **18.1.0** |  |
|  |
| *For* ***[HE](http://www.3gpp.org/3G_Specs/CRs.htm%22%20%5Cl%20%22_blank)******[LP](http://www.3gpp.org/3G_Specs/CRs.htm%22%20%5Cl%20%22_blank)*** *on using this form: comprehensive instructions can be found at <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:***  | Maintenance CR of NCR to TS 38.115-2 |
|  |  |
| ***Source to WG:*** | ZTE Corporation |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_netcon\_repeater-Perf |  | ***Date:*** | 2024-8-08 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | *Release 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 canbe 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:*** | 1. Some declarations are missing;
2. There are lots of editorial typos or missing reference.
3. Sub-clause number is not consistent with the other sub-clause.
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|  |  |
| ***Summary of change:*** | 1. Add the missing declaration in clause 4.6
2. Add the declaration in clause 6.1
3. Update the sub-clause level in clause 6.2
4. Correct the clause number of reference spec in clause 6.3
5. There are two duplicated sub-clause 6.5.3.4 and have some updates on it.
6. Add the missing index of reference specification for it in clause 6.10.
7. Clause number 6.6.3.4.3 in clause 6.11 is not consistent with the previous clause and void this clause and add the new sub-clause for .
8. Have some editorial update to align the format with other minimum requirement and some editorial updates in clause 6.12.
9. Clause number 6.17.4.1/2/4 in clause 6.15 is not consistent with the previous clause and void this clause and add the new sub-clause for it.
10. Clause number 7.7.4.2 in clause 6.16 is not consistent with the previous clause and void this clause and add the new sub-clause for it.
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|  |  |
| ***Consequences if not approved:*** | The specification is not correctly specified.  |
|  |  |
| ***Clauses affected:*** | 1, 2, 4.6, 6.1, 6.2, 6.3, 6.5, 6.10, 6.11, 6.12, 6.15, 6.16 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*<Start of the change>*

# 1 Scope

The present document specifies the Radio Frequency (RF) test methods and conformance requirements for RF *Repeater* *type 2-O* and *network controlled repeater* (*NCR*) *type 1-H* and *2-O*. These have been derived from, and are consistent with the radiated requirements for *Repeater type 2-O* and *network controlled repeater* (*NCR*) *type 1-H* and *2-O* in Repeater specification defined in TS 38.106 [2].

RF *Repeater type 1-C* and *NCR type 1-C*  only have conducted requirements so they does not require compliance to this specification.

*NCR type 1- H* has both conducted and radiated requirements so it requires compliance to this specification and TS 38.115-1 [23].

*RF Repeater type 2-O* and *NCR type 2-O* have only radiated requirements so they require compliance to this specification only.

*<next of the change>*

# 2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications"

[2] 3GPP TS 38.106: "NR repeater radio transmission and reception"

[3] Recommendation ITU-R M.1545: "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000"

[4] ITU-R Recommendation SM.329: "Unwanted emissions in the spurious domain"

[5] 3GPP TS 38.104: "NR Base Station (BS) radio transmission and reception"

[6] 3GPP TS 38.141-2: "NR; Base Station (BS) conformance testing; Part 2: Radiated conformance testing"

[7] IEC 60 721-3-3: "Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use at weather protected locations"

[8] IEC 60 721-3-4: "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Clause 4: Stationary use at non-weather protected locations"

[9] IEC 60 721: "Classification of environmental conditions"

[10] IEC 60 068-2-1 (2007): "Environmental testing - Part 2: Tests. Tests A: Cold"

[11] IEC 60 068-2-2: (2007): "Environmental testing - Part 2: Tests. Tests B: Dry heat"

[12] IEC 60 068-2-6: (2007): "Environmental testing - Part 2: Tests - Test Fc: Vibration (sinusoidal)"

[13] 3GPP TR 37.941: "Radio Frequency (RF) conformance testing background for radiated Base Station (BS) requirements"

[14] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[15] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[16] 3GPP TS 38.101-4: “NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone”

[17] 3GPP TR 38.901: "Study on channel model for frequencies from 0.5 to 100 GHz"

[18] 3GPP TS 38.211: "NR; Physical channels and modulation[19] 3GPP TR 38.174: "NR; Integrated Access and Backhaul (IAB) radio transmission and reception"

[20] 3GPP TS 38.521-2: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Range 2 standalone"

[21] 3GPP TS 38.176-2: "NR; Integrated Access and Backhaul (IAB) conformance testing; Part 2: Radiated conformance testing"

[22] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification"

[23] 3GPP TS 38.115-1: "NR; Repeater conformance testing, Part 1: Conducted conformance testing"

*<next of the change>*

## 4.6 Manufacturer's declarations

The following repeater manufacturer's declarations listed in table 4.6-1, when applicable to the repeater under test, are required to be provided by the manufacturer for radiated requirements testing for *repeater type 2-O*. Declarations can be made independently for UL and DL.

Table 4.6-1: Manufacturers declarations for *repeater type 2-O* radiated test requirements

| Declaration identifier | Declaration | Description |
| --- | --- | --- |
| D.1 | Coordinate system reference point | Location of coordinated system reference point in reference to an identifiable physical feature of the repeater enclosure. |
| D.2 | Coordinate system orientation | Orientation of the coordinate system in reference to an identifiable physical feature of the repeater enclosure. |
| D.3 | Beam identifier | A unique title to identify a beam, e.g. a, b, c or 1, 2, 3. The vendor may declare any number of beams with unique identifiers. The minimum set to declare for conformance, corresponds to the beams at the reference beam direction with the highest intended EIRP, and covering the properties listed below:1) A beam with the narrowest intended BeWθ and narrowest intended BeWϕ possible when narrowest intended BeWθ is used.2) A beam with the narrowest intended BeWϕ and narrowest intended BeWθ possible when narrowest intended BeWϕ is used.3) A beam with the widest intended BeWθ and widest intended BeWϕ possible when widest intended BeWθ is used.4) A beam with the widest intended BeWϕ and widest intended BeWθ possible when widest intended BeWϕ is used.5) A beam which provides the highest intended EIRP of all possible beams.When selecting the above five beam widths for declaration, all beams that the repeater is intended to produce shall be considered, including beams that during operation may be identified by any kind of cell or UE specific reference signals, with the exception of any type of beam that is created from a group of transmitters that are not all phase synchronised.(Note 1) |
| D.4 | *Operating bands* and passband frequency ranges | List of NR *operating band(s)* supported by the repeater and passband frequency range(s) within the *operating band(s)* that the repeater can operate in. Supported bands declared for every beam (D.3). (Note 2) |
| D.5 | Repeater class | Declared as Wide Area repeater, Medium Range repeater, or Local Area repeater. |
| D.6 | *OTA peak directions set* reference beam direction pair | The beam direction pair, describing the reference beam peak direction and the reference beam centre direction. Declared for every beam (D.3). |
| D.7 | OTA peak directions set | The OTA peak directions set for each beam. Declared for every beam (D.3). |
| D.8 | *OTA peak directions set* maximum steering direction(s) | The *beam direction pair(s)* corresponding to the following points:1) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the positive Φ direction, while the θ value being the closest possible to the reference beam centre direction.2) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the negative *Φ* direction, while the *θ value being the closest possible to the* reference beam centre direction*.*3) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the positive *θ* direction, while the *Φ value being the closest possible to the* reference beam centre direction.4) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the negative *θ* direction, while the *Φ value being the closest possible to the* reference beam centre direction*.*The maximum steering direction(s) may coincide with *the reference beam centre direction*.Declared for every beam (D.3). |
| D.9 | Rated beam EIRP | The rated EIRP level per passband (Prated,p,EIRP) at the *beam peak direction* associated with a particular *beam direction pair* for each of the declared maximum steering directions (D.8), as well as the reference *beam direction pair* (D.8). Declared for every beam (D.3).(Note 5, 6, 7) |
| D.10 | Beamwidth | The *beamwidth* for the reference *beam direction pair* and the four maximum steering directions. Declared for every beam (D.3). |
| D.11 | Equivalent beams | List of beams which are declared to be equivalent.Equivalent beams imply that the beams are expected to have identical *OTA peak directions sets* and intended to have identical spatial properties at all steering directions within the *OTA peak directions set* when presented with identical signals. All declarations (D.4 – D.10) made for the beams are identical and the transmitter unit*,* RDN and antenna array responsible for generating the beam are of identical design. |
| D.12 | Parallel beams | List of beams which have been declared equivalent (D.11) and can be generated in parallel using independent RF power resources.Independent power resources mean that the beams are transmitted from mutually exclusive transmitter units. |
| D.13 | OTA coverage range | Declared as a single range of directions within which selected TX OTA requirements are intended to be met.(Note 3) |
| D.14 | *OTA coverage range* reference direction | The direction describing the reference direction of the *OTA coverage range* (D.13).(Note 4) |
| D.15 | OTA coverage range maximum directions | The directions corresponding to the following points:1) The direction determined by the maximum φ value achievable inside the *OTA coverage range*, while θ value being the closest possible to the *OTA coverage range* reference direction.2) The direction determined by the minimum φ value achievable inside the *OTA coverage range*, while θ value being the closest possible to the *OTA coverage range* reference direction.3) The direction determined by the maximum θ value achievable inside the *OTA coverage range*, while φ value being the closest possible to the *OTA coverage range* reference direction.4) The direction determined by the minimum θ value achievable inside the OTA coverage range, while φ value being the closest possible to the OTA coverage range reference direction. |
| D.16 | The rated passband OTA repeater power, Prated,p,TRP | Prated,p,TRP is declared as TRP OTA power per passband, declared per supported operating band.(Note 5, 7) |
| D.17 | Rated transmitter TRP, Prated,t,TRP | Rated total radiated output power*.*Declared per supported *operating band*.(Note 5, 7) |
| D.18 | Spurious emission category | Declare the repeater spurious emission category as either category A or B with respect to the limits for spurious emissions, as defined in Recommendation ITU-R SM.329 [4]. |
| D.19 | Additional operating band unwanted emissions | The manufacturer shall declare whether the repeater under test is intended to operate in geographic areas where the additional operating band unwanted emission limits defined in clause 6.7.4 apply. |
| D.20 | Co-existence with other systems | The manufacturer shall declare whether the repeater under test is intended to operate in geographic areas where one or more of the systems GSM850, GSM900, DCS1800, PCS1900, UTRA FDD, UTRA TDD, E-UTRA and/or PHS operating in another operating band are deployed. |
| D.21 | Supported frequency range of the NR *operating band* | List of supported frequency ranges representing *fractional bandwidths* (FBW) of *operating bands* with FBW larger than 6%. |
| D.22 | Rated beam EIRP at lower end of the *fractional bandwidth* (Prated,out,FBWlow) | The rated EIRP level per passband at lower frequency range of the *fractional bandwidth* (Prated,out,FBWlow), at the *beam peak direction* associated with a particular *beam direction pair* for each of the declared maximum steering directions (D.10), as well as the reference *beam direction pair* (D.6).Declared per beam for all supported frequency ranges (D.21).(Note 5, 6, 7) |
| D.23 | Rated beam EIRP at higher frequency range of the *fractional bandwidth* (Prated,out,FBWhigh) | The rated EIRP level per passband at higher frequency range of the *fractional bandwidth* (Prated,out,FBWhigh), at the *beam peak direction* associated with a particular *beam direction pair* for each of the declared maximum steering directions (D.10), as well as the reference *beam direction pair* (D.6).Declared per beam for all supported frequency ranges in (D.21).(Note 5, 6, 7)] |
| D.24 | Long delay repeater | Declared only if the repeater internal delay between the input and output for this repeater does not fit within the TDD transient time. The repeater is intended for situations in which it will not cause interference to other nodes. This is achieved by RF isolation or by reservation of longer guard periods, which degrades frame utilization. The length of repeaters internal delay is declared using this declaration. |
| D.25 | Input signal EIRP for maximum output power | Declaration of input signal EIRP required to reach maximum output power. Declared per passband. |
| D.26 | Repeater radiating direction | Declaration on whether the repeater is intended to radiate in DL, UL or both. Testing shall be performed only for the direction(s) in which the repeater radiates. |
| D.27 | Maximum repeater RF Bandwidth | Maximum *repeater RF Bandwidth* in the *operating band* for single-band operation. Declared per supported *operating band.* (Note 8) |
|  |  |  |
| NOTE 1: Depending on the capability of the system some of these beams may be the same. For those same beams, testing is not repeated.NOTE 2: These *operating bands* are related to their respective single‑band RIBs.NOTE 3: *OTA coverage range* is used for conformance testing of such TX OTA requirements as frequency error or EVM.NOTE 4: The *OTA coverage range* reference direction may be the same as the Reference beam direction pair (D.8) but does not have to be.NOTE 5: If a *Repeater type 2-O* is capable of 64QAM operation but not capable of 256QAM operation, then up to two rated output power declarations may be made. One declaration is applicable when configured for 64QAM operation and the other declaration is applicable when not configured for 64QAM operation.NOTE 6: If D.22 and D.23 are declared for certain frequency range (D.21), there shall be no "Rated beam EIRP" declaration (D.9) for the *operating band* containing that particular frequency range.NOTE 7: If a repeater type 2-O is capable of 256QAM operation, then up to three rated output power declarations may be made. One declaration is applicable when configured for 256QAM operation, a different declaration is applicable when configured for 64QAM operation and the other declaration is applicable when not configured neither for 256QAM nor 64QAM operation.NOTE 8: Parameters for contiguous or non-contiguous spectrum operation in the operating band are assumed to be the same unless they are separately declared. When separately declared, they shall still use the same declaration identifier. |

The following NCR manufacturer's declarations listed in table 4.6-2, when applicable to the NCR under test, are required to be provided by the manufacturer for radiated requirements testing for *NCR type 2-O*. Declarations can be made independently for UL and DL.

**Table 4.6-2: Manufacturers declarations for *NCR type 2-O* radiated test requirements**

| Declaration identifier | Declaration | Description |  **Applicability** |
| --- | --- | --- | --- |
| **NCR-Fwd** | **NCR-MT** |
| D.1 | Coordinate system reference point | Location of coordinated system reference point in reference to an identifiable physical feature of the NCR enclosure. | x | x |
| D.2 | Coordinate system orientation | Orientation of the coordinate system in reference to an identifiable physical feature of the NCR enclosure. | x | x |
| D.3 | Beam identifier | A unique title to identify a beam, e.g. a, b, c or 1, 2, 3. The vendor may declare any number of beams with unique identifiers. The minimum set to declare for conformance, corresponds to the beams at the reference beam direction with the highest intended EIRP, and covering the properties listed below:1) A beam with the narrowest intended BeWθ and narrowest intended BeWϕ possible when narrowest intended BeWθ is used.2) A beam with the narrowest intended BeWϕ and narrowest intended BeWθ possible when narrowest intended BeWϕ is used.3) A beam with the widest intended BeWθ and widest intended BeWϕ possible when widest intended BeWθ is used.4) A beam with the widest intended BeWϕ and widest intended BeWθ possible when widest intended BeWϕ is used.5) A beam which provides the highest intended EIRP of all possible beams.When selecting the above five beam widths for declaration, all beams that the NCR is intended to produce shall be considered, including beams that during operation may be identified by any kind of cell or UE specific reference signals, with the exception of any type of beam that is created from a group of transmitters that are not all phase synchronised.(Note 1) | x | x |
| D.4 | *Operating bands* and passband frequency ranges | List of NR *operating band(s)* supported by the NCR and passband frequency range(s) within the *operating band(s)* that the NCR can operate in. Supported bands declared for every beam (D.3). (Note 2) | x | x |
| D.5 | NCR class | Declared as Wide Area NCR, Medium Range NCR, or Local Area NCR. | x | x |
| D.6 | *OTA peak directions set* reference beam direction pair | The beam direction pair, describing the reference beam peak direction and the reference beam centre direction. Declared for every beam (D.3). | x | x |
| D.7 | OTA peak directions set | The OTA peak directions set for each beam. Declared for every beam (D.3). | x | x |
| D.8 | *OTA peak directions set* maximum steering direction(s) | The *beam direction pair(s)* corresponding to the following points:1) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the positive Φ direction, while the θ value being the closest possible to the reference beam centre direction.2) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the negative *Φ* direction, while the *θ value being the closest possible to the* reference beam centre direction*.*3) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the positive *θ* direction, while the *Φ value being the closest possible to the* reference beam centre direction.4) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the negative *θ* direction, while the *Φ value being the closest possible to the* reference beam centre direction*.*The maximum steering direction(s) may coincide with *the reference beam centre direction*.Declared for every beam (D.3). | x | x |
| D.9 | Rated beam EIRP | The rated EIRP level per passband (Prated,p,EIRP) at the *beam peak direction* associated with a particular *beam direction pair* for each of the declared maximum steering directions (D.8), as well as the reference *beam direction pair* (D.8). Declared for every beam (D.3).(Note 5, 6, 7) | x | x |
| D.10 | Beamwidth | The *beamwidth* for the reference *beam direction pair* and the four maximum steering directions. Declared for every beam (D.3). | x | x |
| D.11 | Equivalent beams | List of beams which are declared to be equivalent.Equivalent beams imply that the beams are expected to have identical *OTA peak directions sets* and intended to have identical spatial properties at all steering directions within the *OTA peak directions set* when presented with identical signals. All declarations (D.4 – D.10) made for the beams are identical and the transmitter unit*,* RDN and antenna array responsible for generating the beam are of identical design. | x | x |
| D.12 | Parallel beams | List of beams which have been declared equivalent (D.11) and can be generated in parallel using independent RF power resources.Independent power resources mean that the beams are transmitted from mutually exclusive transmitter units. | x | x |
| D.13 | OTA coverage range | Declared as a single range of directions within which selected TX OTA requirements are intended to be met.(Note 3) | x | x |
| D.14 | *OTA coverage range* reference direction | The direction describing the reference direction of the *OTA coverage range* (D.13).(Note 4) | x | x |
| D.15 | OTA coverage range maximum directions | The directions corresponding to the following points:1) The direction determined by the maximum φ value achievable inside the *OTA coverage range*, while θ value being the closest possible to the *OTA coverage range* reference direction.2) The direction determined by the minimum φ value achievable inside the *OTA coverage range*, while θ value being the closest possible to the *OTA coverage range* reference direction.3) The direction determined by the maximum θ value achievable inside the *OTA coverage range*, while φ value being the closest possible to the *OTA coverage range* reference direction.4) The direction determined by the minimum θ value achievable inside the OTA coverage range, while φ value being the closest possible to the OTA coverage range reference direction. | x | x |
| D.16 | The rated passband OTA NCR power, Prated,p,TRP | Prated,p,TRP is declared as TRP OTA power per passband, declared per supported operating band.(Note 5, 7) | x | x |
| D.17 | Rated transmitter TRP, Prated,t,TRP | Rated total radiated output power*.*Declared per supported *operating band*.(Note 5, 7) | x | x |
| D.18 | Spurious emission category | Declare the NCR spurious emission category as either category A or B with respect to the limits for spurious emissions, as defined in Recommendation ITU-R SM.329 [4]. | x | x |
| D.19 | Additional operating band unwanted emissions | The manufacturer shall declare whether the NCR under test is intended to operate in geographic areas where the additional operating band unwanted emission limits defined in clause 6.7.4 apply. | x | x |
| D.20 | Co-existence with other systems | The manufacturer shall declare whether the NCR under test is intended to operate in geographic areas where one or more of the systems GSM850, GSM900, DCS1800, PCS1900, UTRA FDD, UTRA TDD, E-UTRA and/or PHS operating in another operating band are deployed. | x | x |
| D.21 | Supported frequency range of the NR *operating band* | List of supported frequency ranges representing *fractional bandwidths* (FBW) of *operating bands* with FBW larger than 6%. | x | x |
| D.22 | Rated beam EIRP at lower end of the *fractional bandwidth* (Prated,out,FBWlow) | The rated EIRP level per passband at lower frequency range of the *fractional bandwidth* (Prated,out,FBWlow), at the *beam peak direction* associated with a particular *beam direction pair* for each of the declared maximum steering directions (D.10), as well as the reference *beam direction pair* (D.6).Declared per beam for all supported frequency ranges (D.21).(Note 5, 6, 7) | x | x |
| D.23 | Rated beam EIRP at higher frequency range of the *fractional bandwidth* (Prated,out,FBWhigh) | The rated EIRP level per passband at higher frequency range of the *fractional bandwidth* (Prated,out,FBWhigh), at the *beam peak direction* associated with a particular *beam direction pair* for each of the declared maximum steering directions (D.10), as well as the reference *beam direction pair* (D.6).Declared per beam for all supported frequency ranges in (D.21).(Note 5, 6, 7)] | x | x |
| D.24 | Long delay NCR | Declared only if the NCR internal delay between the input and output for this NCR does not fit within the TDD transient time. The NCR is intended for situations in which it will not cause interference to other nodes. This is achieved by RF isolation or by reservation of longer guard periods, which degrades frame utilization. The length of NCRs internal delay is declared using this declaration. | x |  |
| D.25 | Input signal EIRP for maximum output power | Declaration of input signal EIRP required to reach maximum output power. Declared per passband. | x |  |
| D.26 | NCR radiating direction | Declaration on whether the NCR is intended to radiate in DL, UL or both. Testing shall be performed only for the direction(s) in which the NCR radiates. | x |  |
| D.27 | Maximum NCR RF Bandwidth | Maximum *NCR RF Bandwidth* in the *operating band* for single-band operation. Declared per supported *operating band.* (Note 8) | x |  |
| D.28 | Support of simultaneous Tx of NCR-Fwd and NCR-MT  | Declaration on whether the NCR support the simultaneous Tx of NCR-Fwd and NCR-MT | x | x |
| D.29 | OTA REFSENS RoAoA | Range of angles of arrival associated with the OTA REFSENS.  | N/A | x |
| D.30 | OTA REFSENS receiver target reference direction | Reference direction inside the OTA REFSENS RoAoA (D.29). | N/A | x |
| D.31 | OTA REFSENS conformance test directions | The following four OTA REFSENS conformance test directions shall be declared:1) The direction determined by the maximum φ value achievable inside the OTA REFSENS RoAoA, while θ value being the closest possible to the OTA REFSENS receiver target reference direction.2) The direction determined by the minimum φ value achievable inside the OTA REFSENS RoAoA, while θ value being the closest possible to the OTA REFSENS receiver target reference direction.3) The direction determined by the maximum θ value achievable inside the OTA REFSENS RoAoA, while φ value being the closest possible to the OTA REFSENS receiver target reference direction.4) The direction determined by the minimum θ value achievable inside the OTA REFSENS RoAoA, while φ value being the closest possible to the OTA REFSENS receiver target reference direction. | N/A | x |
| D.32 | Single-band RIB or multi-band RIB | Declaration whether it is single band RIB or multi-band RIB. | x | x |
| NOTE 1: Depending on the capability of the system some of these beams may be the same. For those same beams, testing is not repeated.NOTE 2: These *operating bands* are related to their respective single‑band RIBs.NOTE 3: *OTA coverage range* is used for conformance testing of such TX OTA requirements as frequency error or EVM.NOTE 4: The *OTA coverage range* reference direction may be the same as the Reference beam direction pair (D.8) but does not have to be.NOTE 5: If a *NCR type 2-O* is capable of 64QAM operation but not capable of 256QAM operation, then up to two rated output power declarations may be made. One declaration is applicable when configured for 64QAM operation and the other declaration is applicable when not configured for 64QAM operation.NOTE 6: If D.22 and D.23 are declared for certain frequency range (D.21), there shall be no "Rated beam EIRP" declaration (D.9) for the *operating band* containing that particular frequency range.NOTE 7: If a NCR type 2-O is capable of 256QAM operation, then up to three rated output power declarations may be made. One declaration is applicable when configured for 256QAM operation, a different declaration is applicable when configured for 64QAM operation and the other declaration is applicable when not configured neither for 256QAM nor 64QAM operation.NOTE 8: Parameters for contiguous or non-contiguous spectrum operation in the operating band are assumed to be the same unless they are separately declared. When separately declared, they shall still use the same declaration identifier. |

*<Next of the change>*

### 6.2.1 General

OTA output power include both OTA output EIRP power and OTA output TRP.

# 6 Radiated characteristics

## 6.1 General

Unless otherwise stated, the radiated characteristics are specified at RIBfor *repeater type 2-O* configuration in normal operating conditions.

Requirements apply in both DL and UL unless otherwise stated, or declared.

- For the DL the BS-side RIB is the input and the UE-side RIB is the output.

- For the UL the UE-side RIB is the input and the BS-side RIB is the output.

General test conditions for radiated tests of the *repeater type 2-O* are given in clause 4, including interpretation of measurement results and configurations for testing. Repeater configurations for the tests are defined in clause 4.5.

If a number of *single-band RIB* have been declared equivalent (D.32), only a representative one is necessary to be tested to demonstrate conformance.

*<Next of the change>*

## 6.2 OTA output power

### 6.2.2 OTA output power (EIRP)

#### 6.2.2.1 Definition and applicability

Radiated transmit power is defined as the EIRP level for a declared beam at a specific *beam peak direction*.

For each declared beam, the requirement is based on declarations captured in clause 4.6 for a beam identifier (D.3), *reference beam direction pair* (D.6), *rated beam EIRP* (D.9) at the beam's reference direction pair, *OTA peak directions set* (D.7), the *beam direction pairs* at the maximum steering directions (D.8) and their associated *rated beam EIRP* and *beamwidth(s)* for reference *beam direction pair* and maximum steering directions(D.10).

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 clause 6.2.4.

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 *passbands* 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.

The repeater radiated transmit power requirements are specified at *single-band RIB*.

If beams have been declared equivalent and parallel (D.11, D.12), only a representative beam is necessary to be tested to demonstrate conformance.

The *repeater rated beam EIRP output power* for *repeater type 2-O* UL transmissionshall be within limits as specified in table 6.2.2.1-1.

Table 6.2.2.1-1: Repeater *rated beam EIRP output power* limits for *repeater type 2-O and NCR type 2-O* UL transmission

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

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

The *rated TRP output power* and the *rated beam EIRP output power* for *NCR-Fwd type 2-O* UL transmissionshall be within limits as specified in table 6.2.2.1-2.

Table 6.2.2.1-2: *Rated TRP output power* limits and *rated beam EIRP output power* limits for *NCR- type 2-O for MT* UL transmission

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

#### 6.2.2.2 Minimum requirement

The minimum requirement applies per *single-band RIB* supporting transmission in the *operating band*.

The minimum requirement for *repeater type 2-O* is defined for normal and extreme conditions in TS 38.106 [2], clause 7.2.2.

The minimum requirement for *NCR type 2-O* is defined for normal and extreme conditions in TS 38.106 [2], clause 7.2.3.

#### 6.2.2.3 Test purpose

The test purpose is to verify the ability to accurately generate and direct radiated power per beam, across the frequency range, for all declared beams.

#### 6.2.2.4 Method of test

##### 6.2.2.4.1 Initial conditions

Test environment:

- Normal, see annex A.2,

- Extreme, see annexes A.3 and A.5.

A measurement system set-up is shown in annex E.

RF channels to be tested for single carrier: B, M and T; see clause 4.9.1.

RF channels positions to be tested for multi-carrier and/or CA:

- BRFBW, MRFBW and TRFBW for *single-band RIB*, see clause 4.9.1.

Under extreme test environment, it is sufficient to test on one NR-ARFCN or one RF bandwidth position, and with one applicable test configuration defined in clauses 4.7 and 4.8. Testing shall be performed under extreme power supply conditions, as defined in annex B.5.

NOTE: Tests under extreme power supply conditions also test extreme temperatures.

Directions to be tested:

- OTA peak directions set reference beam direction pair (D.6), and

- OTA peak directions set maximum steering directions (D.8).

Beams to be tested: Declared beam with the highest intended EIRP for the narrowest intended beam corresponding to the smallest BeWθ, or for the narrowest intended beam corresponding to the smallest BeWϕ (D.3, D.9).

Power levels to be tested:

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

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

##### 6.2.2.4.2 Procedure

For normal test environment conditions in OTA domain, the test procedure is as follows:

1) Place the DUT at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the DUT with the test system.

3) For repeater type 2-O, Orient the positioner (and repeater and test signal generator) in order that the direction to be tested aligns with the test antenna and the correct angle of arrival for the input signal is achieved.

For NCR-Fwd, orient the positioner (and repeater and test signal generator) in order that the direction to be tested aligns with the test antenna and the correct angle of arrival for the input signal is achieved; for NCR-MT, configure the NCR-MT such that the beam peak direction(s) applied during the power measurement step 7.

4) Configure the *beam peak direction* of the DUT according to the declared *beam direction pair* if necessary.

5) Set the test signal generator power at the RIB as shown in annex E with a power equivalent to the power level to be tested, according to the applicable test configuration in clause 4.8 using the corresponding test model(s) in clause 4.9.2,in the correct direction in respect to the repeater.

6) Measure EIRP for any two orthogonal polarizations (denoted p1 and p2) and calculate total radiated transmit power for particular *beam direction pair* as EIRP = EIRPp1 + EIRPp2.

7) Test steps 3 to 6 are repeated for all declared beams (D.7) and their reference *beam direction pairs* and *maximum steering directions* (D.6 and D.8), and for all applicable power levels.

For extreme conditions tests the methods in TS 38.141-2 [6], annex B.7 may be used.

#### 6.2.2.5 Test requirement for RF repeater type 2-O and NCR-Fwd type 2-O

For each *single-band RIB* under test, the power measured in clause 6.2.2.4.2 in step 6 shall remain within the values provided in table 6.2.2.5-1 for normal and extreme test environments, relative to the manufacturer's declared Prated,p,EIRP (D.9) for *repeater type 2-O*:

Table 6.2.2.5-1: Test requirements for radiated transmit power accuracy

|  |  |
| --- | --- |
| Normal test environment | Extreme test environment |
| 24.25 GHz < f ≤ 29.5 GHz: ± 5.1 dB | 24.25 GHz < f ≤ 29.5 GHz: ± 7.6 dB |
| 37 GHz < f ≤ 43.5 GHz: ± 5.4 dB | 37 GHz < f ≤ 43.5 GHz: ± 7.8 dB  |
| 43.5 GHz < f ≤ 48.2 GHz: ± 5.6 dB | 43.5 GHz < f ≤ 48.2 GHz: ± 8.0 dB |

#### 6.2.2.6 Test requirement for NCR

##### 6.2.2.6.1 Test requirement for NCR-MT

###### 6.2.2.6.1.1 Test requirement for NCR-MT type 1-H

For NCR-MT type 1-H, the IAB requirement specified in clause 9.2.2 in TS 38.174 [19] apply.

For each declared conformance *beam direction pair*, the EIRP measurement results in clause 6.2.4.2 shall remain within the values provided in table 6.2.2.6.1.1-1, relative to the manufacturer's declared rated beam EIRP (D.11) value:

Table 6.2.2.6.1.1-1: Test requirement for radiated transmit power for NCR-MT

|  |  |  |
| --- | --- | --- |
|  | **Normal test environment** |  |
| *NCR-MT type 1-H* | f ≤ 3 GHz: ± 3.3 dB |  |
|  | 3 GHz < f ≤ 6 GHz: ± 3.5 dB |  |

###### 6.2.2.6.1.2 Test requirement for NCR-MT type 2-O

For each declared conformance *beam direction pair*, the EIRP measurement results in clause 6.2.2.4.3 shall remain within the values provided in table 6.2.2.6.1.2-1, relative to the manufacturer's declared rated beam EIRP (D.11) value:

Table 6.2.2.6.1.2-1: Test requirement for radiated transmit power for NCR-MT

|  |  |  |
| --- | --- | --- |
| **NCR type** | **Normal test environment** | **Extreme test environment** |
| *NCR-MT type 2-O* | 24.15 GHz < f ≤ 29.5 GHz: ± 6 dB37 GHz < f ≤ 43.5 GHz: ± 6 dB43.5 GHz < f ≤ 48.2 GHz: ± 6 dB | 24.15 GHz < f ≤ 29.5 GHz: ± [7.1] dB37 GHz < f ≤ 43.5 GHz: ± [7.1] dB43.5 GHz < f ≤ 48.2 GHz: ± [7.1] dB |

### 6.2.3 OTA repeater output power (TRP)

#### 6.2.3.1 Definition and applicability

OTA repeater output power is declared as rated carrier TRP, with the output power accuracy requirement defined at the RIB.

The repeater *rated TRP output power* for *repeater type 2-O* UL transmissionshall be within limits as specified in table 6.2.3.1-1.

Table 6.2.3.1-1: Repeater *rated TRP output power* limits for *repeater type 2-O* UL transmission

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

The output power limit for the respective repeater classes in table 6.2.3.1-1 shall be compared to the rated output power and the declared repeater class. It is not subject to testing.

#### 6.2.3.2 Minimum requirement

The minimum requirement applies per *single-band RIB* supporting transmission in the *operating band*.

The minimum requirement for *repeater type 2-O* is defined for normal conditions in TS 38.106 [2], clause 7.2.2.

The minimum requirement for *NCR type 2-O* is defined for normal conditions in TS 38.106 [2], clause 7.2.3.

#### 6.2.3.3 Test purpose

The test purpose is to verify the accuracy of the *maximum passband TRP output power* (Pmax,p,TRP) across the frequency range for all *RIBs*.

#### 6.2.3.4 Method of test

##### 6.2.3.4.1 Initial conditions

Test environment: Normal, see annex A.2.

A measurement system set-up is shown in annex E.

RF channels to be tested for single carrier: B, M, T; see clause 4.9.1.

*Base Station RF Bandwidth* positions to be tested for multi-carrier and/or CA:

- BRFBW, MRFBW and TRFBW in single band operation; see clause 4.9.1.

Beams to be tested: As the requirement is TRP the beam pattern(s) may be set up to optimise the TRP measurement procedure (see annex G) as long as the required TRP level is achieved.

Power levels to be tested:

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

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

##### 6.2.3.4.2 Procedure

The following procedure for measuring TRP is based on the directional power measurements as described in annex G. An alternative method to measure TRP is to use a characterized and calibrated reverberation chamber if so follow steps 1, 3, 5, and 7.

1) Place the DUT at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the DUT with the test system.

3) For repeater type 2-O, orient the positioner (and repeater and test signal generator) in order that the direction to be tested aligns with the test antenna and the correct angle of arrival for the input signal is achieved.

For NCR-Fwd, orient the positioner (and repeater and test signal generator) in order that the direction to be tested aligns with the test antenna and the correct angle of arrival for the input signal is achieved; for NCR-MT, configure the NCR-MT such that the beam peak direction(s) applied during the power measurement step 7 are consistent with the grid and measurement approach for the TRP test.

4) Configure the DUT such that the beam peak direction(s) applied during the power measurement step 6 are consistent with the grid and measurement approach for the TRP test.

5) Set the test signal generator power at the RIB as shown in annex G with a power equivalent to the tested input power level, transmit according to the applicable test configuration in clause 4.8 using the corresponding test model(s) in clause 4.9.2, in the correct direction in respect to the repeater.

6) For repeater type 2-O, orient the positioner (and DUT) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex G) whilst maintaining the correct direction of arrival for the test signal.

For NCR-Fwd, orient the positioner (and DUT) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex G) whilst maintaining the correct direction of arrival for the test signal; for NCR-MT, orient the positioner (NCR) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex I).

7) Measure the radiated power for any two orthogonal polarizations (denoted p1 and p2) and calculate total radiated transmit power for particular beam direction pair as EIRP = EIRPp1 + EIRPp2.

8) Repeat step 6-7 for all directions in the appropriated TRP measurement grid needed for full TRP estimation (see annex G).

9) Calculate TRP using the EIRP measurements.

#### 6.2.3.5 Test requirement

The final TRP measurement result in clause 6.2.3.4.2 shall remain:

- within +5.1 dB and -5.1 dB of the manufacturer's declared *rated TRP output power* Prated,p,TRP for carrier frequency 24.25 GHz < f ≤ 29.5 GHz.

- within +5.4 dB and –5.4 dB of the manufacturer's declared *rated TRP output power* Prated,p,TRP for carrier frequency 37 GHz < f ≤ 43.5 GHz.

- within +5.6 dB and –5.6 dB of the manufacturer's declared *rated TRP output power* Prated,p,TRP for carrier frequency 43.5 GHz < f ≤ 48.2 GHz.

#### 6.2.3.6 Test requirement for NCR

###### 6.2.3.6.2.1 Test requirement for NCR-Fwd type 2-O

The final TRP measurement result in clause 6.2.3.4.3 shall remain:

- within +5.1 dB and -5.1 dB of the manufacturer's declared *rated TRP output power* Prated,p,TRP for carrier frequency 24.25 GHz < f ≤ 29.5 GHz.

- within +5.4 dB and –5.4 dB of the manufacturer's declared *rated TRP output power* Prated,p,TRP for carrier frequency 37 GHz < f ≤ 43.5 GHz.

- within +5.6 dB and –5.6 dB of the manufacturer's declared *rated TRP output power* Prated,p,TRP for carrier frequency 43.5 GHz < f ≤ 48.2 GHz.

*<Next of the change>*

##### 6.2.3.6.1 Test requirement for NCR-MT

###### 6.2.3.6.1.1 Test requirement for NCR-MT type 2-O

The final TRP measurement result in clause 6.3.4.2 shall remain:

- within +5.1 dB and -5.1 dB of the manufacturer's declared *rated carrier TRP* Prated,c,TRP carrier frequency 24.25 GHz < f ≤ 29.5 GHz.

- within +5.4 dB and –5.4 dB of the manufacturer's declared *rated carrier TRP* Prated,c,TRP for carrier frequency 37 GHz < f ≤ 43.5 GHz.

- within +5.6 dB and –5.6 dB of the manufacturer's declared *rated TRP output power* Prated,p,TRP for carrier frequency 43.5 GHz < f ≤ 48.2 GHz.

##### 6.2.3.6.2 Test requirement for NCR-Fwd

## 6.3 OTA frequency stability

### 6.3.1 Definition and applicability

Frequency stability is the ability to maintain the same frequency on the output signal with respect to the input signal.

### 6.3.2 Minimum Requirement

The minimum requirement for repeater type 2-O is in TS 38.106 [2], clause 7.3.2.

The minimum requirement for NCR type 2-O is in TS 38.106 [2], clause 7.3.3.

### 6.3.3 Test purpose

The test purpose is to verify that frequency stability is within the limit specified by the minimum requirement.

### 6.3.4 Method of test

Requirement is tested together with modulation quality test, as described in clause 6.6.

### 6.3.5 Test Requirements for RF repeater and NCR

The frequency deviation of the output signal with respect to the input signal shall be accurate to within ±(0.01 ppm + 12 Hz) observed over 1 ms.

*<Next of the change>*

### 6.5.3 OTA operating band unwanted emissions

#### 6.5.3.1 Definition and applicability

The requirements of either clause 6.5.3.4.1 (Category A limits) or clause 6.5.3.4.2 (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* and *NCR-Fwd type 2-O*) in clause 6.5.4. In addition, the limits in clause 6.5.3.4.3 may also apply.

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

For *repeater type 2-O* and *NCR-Fwd 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 6.5.1-1 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 6.5.1-1.

- 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 6.5.3.4.1 and 6.5.3.4.2 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.

#### 6.5.3.2 Minimum requirement

The minimum requirement for *repeater type 2-O* is defined in TS 38.106 [2], clause 7.5.3.2.

The minimum requirement for *NCR-Fwd type 2-O* is defined in TS 38.106 [2], clause 7.5.3.3.1.1.

For Wide Area *NCR-MT type 2-O*, the BS OBUE requirements specified in clause 9.7.4.3 in TS 38.104 [5] apply.

For Local Area *NCR-MT type 2-O*, the UE SEM requirements specified in clause 6.5.2.1 in TS 38.101-2 [14] apply.

#### 6.5.3.3 Test purpose

This test measures the emissions close to the assigned channel bandwidth of the wanted signal, while the transmitter is in operation.

#### 6.5.3.4 Method of test

##### 6.5.3.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier: B, M and T; see clause 4.9.1.

##### 6.5.3.4.2 Procedure

The following procedure for measuring TRP is based on the directional power measurements as described in annex I.

1) Place the RF repeater or NCR at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the repeater with the test system.

3) The measurement devices characteristics shall be:

- detection mode: true RMS.

- As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity, efficiency and avoiding e.g. carrier leakage, 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.

4a) For RF repeater, set the input signal at the RIB according to the applicable test configuration and direction in clause 4.8 using the corresponding test models RDL-FR2-TM1.1and RUL-FR2-TM1.1 in clause 4.9.2 at the input power intended to produce the maximum rated output power, Pin,p,EIRP + 10dB.

for NCR-Fwd, set the input signal at the RIB according to the applicable test configuration and direction in clause 4.8 using the corresponding test models RDL-FR2-TM1.1 and RUL-FR2-TM1.1 in clause 4.9.2 at the input power intended to produce the maximum rated output power, Pin,p,EIRP + 10dB.

For NCR-MT, set the NCR-MT with the declared maximum output power according to the applicable test configuration and direction in clause 4.8 using the corresponding test models RUL-FR2-TM1.1 in clause 4.9.2.

4b) Verify measurement impact from feeding test signal by generating a signal for repeater input with repeater to be turned off. Verify measured result is enough below requirement limit.

5) Orient the positioner (and repeater and test signal source) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex G) whilst maintaining the correct direction of arrival for the test signal.

6) Step the centre frequency of the measurement filter in contiguous steps and measure the emission within the specified frequency ranges with the specified measurement bandwidth. For connector under test declared to operate in non-contiguous spectrum, the emission within the *sub-block gap* shall be measured using the specified measurement bandwidth from the closest sub block edge.

7) Repeat step 5-6 for all directions in the appropriated TRP measurement grid needed for TRPEstimate (see annex G).

8) Calculate TRPEstimate using the measurements made in Step 7.

#### 6.5.3.4 Void

##### 6.5.3.4.1 Void

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##### 6.5.3.4.2 Void

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##### 6.5.3.4.3 Void

##### 6.5.3.4.3.1 Void

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#### 6.5.3.5 Test requirements

##### 6.5.3.5.1 OTA operating band unwanted emission limits (Category A)

*Repeater type 2-O* and *NCR-Fwd type 2-O* unwanted emissions shall not exceed the maximum levels specified in table 6.5.3.5.1‑1 or 6.5.3.5.1-2 or 6.5.3.5.1-3.

Table 6.5.3.5.1-1: OBUE limits applicable in the frequency range 24.25 – 33.4 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3B point, Δf  | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-2.3 dBm, Max(Prated,t,TRP – 32.3 dB, -9.3 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < Δfmax | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < f\_ offsetmax | Min(-13 dBm, Max(Prated,t,TRP – 43 dB, -20 dBm)) | 1 MHz |
| NOTE 1: For *non-contiguous spectrum* operation within any *operating band* the limitwithin *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passbands*.  |

Table 6.5.3.5.1-2: OBUE limits applicable in the frequency range 37 – 43.5 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3B point, Δf  | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-2.3 dBm, Max(Prated,t,TRP – 30.3 dB, -9.3 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < Δfmax | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < f\_ offsetmax | Min(-13 dBm, Max(Prated,t,TRP – 41 dB, -20 dBm)) | 1 MHz |
| NOTE 1: For *non-contiguous spectrum* operation within any *operating band* the limitwithin *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passbands*. |

Table 6.5.3.5.1-3: OBUE limits applicable in the frequency range 43.5 – 48.2 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3B point, Δf  | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-2.1 dBm, Max(Prated,t,TRP – 30.1 dB, -9.1 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < Δfmax | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < f\_ offsetmax | Min(-13 dBm, Max(Prated,t,TRP – 41 dB, -20 dBm)) | 1 MHz |
| NOTE 1: For *non-contiguous spectrum* operation within any *operating band* the limitwithin *gaps between passbands* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *gap between passbands*. |

For OTA OBUE requirement of Wide area NCR-MT, the test requirement defined in clause 6.7.4.5.2.2 of TS 38.141-2 [6] is applicable.

For OTA OBUE requirement for Local area NCR-MT, the test requirement is defined as UE OBUE requirements specified in clause 6.5.2.1 in TS 38.101-2 [14] plus measurement uncertainty as specified in the following table 6.5.3.4.1-4.

Table 6.5.3.5.1-4: measurement uncertainty for OBUE for FR2-1

|  |  |
| --- | --- |
|  | **The applicable frequency range** |
| 24.25 – 29.5 GHz | 37 – 43.5 GHz | 43.5 GHz < f ≤ 48.2 GHz |
| OBUE: | ±2.7 dB  | ±2.7 dB | ±2.9 dB |

##### 6.5.3.5.2 OTA operating band unwanted emission limits (Category B)

*Repeater type 2-O* and *NCR-Fwd type 2-O* unwanted emissions shall not exceed the maximum levels specified in table 6.5.3.5.2‑1 or 6.5.3.5.2-2 or 6.5.3.5.2-3.

Table 6.5.3.5.2-1: OBUE limits applicable in the frequency range 24.25 – 33.4 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3 dB point, Δf  | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-2.3 dBm, Max(Prated,t,TRP – 32.3 dB, -9.3 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < ΔfB | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < ΔfB +0.5 MHz | Min(-13 dBm, Max(Prated,t,TRP – 43 dB, -20 dBm)) | 1 MHz |
| ΔfB ≤ Δf < Δfmax | ΔfB +5 MHz ≤ f\_offset < f\_ offsetmax | Min(-5 dBm, Max(Prated,t,TRP – 33 dB, -10 dBm)) | 10 MHz |
| NOTE 1: For non-contiguous spectrum operation within any *operating band* the limitwithin gaps between *passbands* is calculated as a cumulative sum of contributions from adjacent sub-blocks on each side of the gap between *passbands*. NOTE 2: ΔfB = 2\*BWcontiguous when BWcontiguous ≤ 500 MHz, otherwise ΔfB = BWcontiguous + 500 MHz. |

Table 6.5.3.5.2-2: OBUE limits applicable in the frequency range 37 – 43.5 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3 dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-2.3 dBm, Max(Prated,t,TRP – 30.3 dB, -9.3 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < ΔfB | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < ΔfB +0.5 MHz | Min(-13 dBm, Max(Prated,t,TRP – 41 dB, -20 dBm)) | 1 MHz |
| ΔfB ≤ Δf < Δfmax | ΔfB +5 MHz ≤ f\_offset < f\_ offsetmax | Min(-5 dBm, Max(Prated,t,TRP – 31 dB, -10 dBm)) | 10 MHz |
| NOTE 1: For non-contiguous spectrum operation within any *operating band* the limitwithin gaps between *passbands* is calculated as a cumulative sum of contributions from adjacent sub-blocks on each side of the gap between *passbands*. NOTE 2: ΔfB = 2\*BWcontiguous when BWcontiguous ≤ 500 MHz, otherwise ΔfB = BWcontiguous + 500 MHz. |

For OTA OBUE requirement of Wide area NCR-MT, the test requirement defined in clause 6.7.4.5.2.3 of TS 38.141-2 [6] is applicable.

Table 6.5.3.5.2-2: OBUE limits applicable in the frequency range 43.5 - 48.2 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3 dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-2.3 dBm, Max(Prated,t,TRP – 30.3 dB, -9.3 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < ΔfB | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < ΔfB +0.5 MHz | Min(-13 dBm, Max(Prated,t,TRP – 41 dB, -20 dBm)) | 1 MHz |
| ΔfB ≤ Δf < Δfmax | ΔfB +5 MHz ≤ f\_offset < f\_ offsetmax | Min(-5 dBm, Max(Prated,t,TRP – 31 dB, -10 dBm)) | 10 MHz |
| NOTE 1: For non-contiguous spectrum operation within any *operating band* the limitwithin gaps between *passbands* is calculated as a cumulative sum of contributions from adjacent sub-blocks on each side of the gap between *passbands*. NOTE 2: ΔfB = 2\*BWcontiguous when BWcontiguous ≤ 500 MHz, otherwise ΔfB = BWcontiguous + 500 MHz. |

##### 6.5.3.5.3 Additional OTA operating band unwanted emission requirements

##### 6.5.3.5.3.1 Protection of Earth Exploration Satellite Service

For repeater operating in the frequency range 24.25 – 27.5 GHz, the power of unwanted emission shall not exceed the limits in table 6.5.3.5.3.1-1 for DL and in table 6.5.3.5.3.1-2 for UL.

Table 6.5.3.5.3.1-1: OBUE limits for protection of Earth Exploration Satellite Service for DL

|  |  |  |
| --- | --- | --- |
| Frequency range  | Limit | *Measurement Bandwidth* |
| 23.6 – 24 GHz | -3 dBm (Note 1) | 200 MHz |
| 23.6 – 24 GHz | -9 dBm (Note 2) | 200 MHz |
| NOTE 1: This limit applies to repeater brought into use on or before 1 September 2027.NOTE 2: This limit applies to repeater brought into use after 1 September 2027. |

Table 6.5.3.5.3.1-2: OBUE limits for protection of Earth Exploration Satellite Service for UL

|  |  |  |
| --- | --- | --- |
| Frequency range  | Limit | *Measurement Bandwidth* |
| 23.6 – 24 GHz | 1 dBm | 200 MHz |

*<Next of the change>*

6.10 OTA output power dynamics

6.10.1 Definition and applicability

OTA output power dynamic for NCR-MT consist of three requirements, transmit OFF power, transmit ON-OFF transition period requirement and power control requirements. The transmit OFF power and transition period requirement is specified in clause 6.9. For power control requirement for NCR-MT, it is the difference between the maximum and the minimum controlled transmit power in the channel bandwidth for a specified reference condition. The maximum and minimum output powers are defined as the mean power in at least one sub-frame 1ms

This requirement shall apply at each RIB supporting transmission in the *operating band*.

6.10.2 Minimum requirement

For WA NCR-MT type 2-O, the IAB-MT requirements specified in clause 9.4.2.1.3 output dynamic range requirement in TS 38.174 [19] applies.

For LA NCR-MT type 2-O, the UE requirements specified in clause 6.3.4.3 of relative power tolerance and clause 6.3.4.4 of aggregate power tolerance in TS 38.102-2 [14] applies

6.10.3 Test purpose

The test purpose is to verify that the NCR-MT OTA total power dynamic range is within the limits specified by the minimum requirement.

6.10.4 Method of test

6.10.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier:

- M; see clause 4.9.1.

Beams to be tested:

- Declared beam with the highest intended EIRP for the narrowest intended beam corresponding to the smallest BeWθ, or for the narrowest intended beam corresponding to the smallest BeWϕ (D.3, D.11).

Directions to be tested:

- The OTA peak directions set reference beam direction pair (D.8).

6.10.4.2 Procedure

1) Place the NCR-MT at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the NCR-MT with the test system.

3) Orient the positioner (and NCR-MT) in order that the direction to be tested aligns with the test antenna.

4) Configure the beam peak direction of the NCR-MT according to the declared beam direction pair.

5) For *NCR type 2-O*, set the NCR-MT to transmit a signal according to the applicable test configuration in clause 4.8 using the corresponding test model:

- NCRUL-FR2-TM3.1;

6) Measure the power by measuring the EIRP for any two orthogonal polarizations (denoted p1 and p2) over 1ms and calculate total EIRP for particular *beam direction pair* as EIRP = EIRPp1 + EIRPp2.

7) For NCR *type 2-O*, set the NCR-MT to transmit a signal according to the applicable test configuration in clause 4.8 using the corresponding test models:

- NCRUL-FR2-TM3.1;

8) Measure the power by measuring the EIRP for any two orthogonal polarizations (denoted p1 and p2) over 1ms and calculate total EIRP for particular *beam direction pair* as EIRP = EIRPp1 + EIRPp2..

In addition, for *multi-band RIB(s)*, the following steps shall apply:

9) For *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

6.10.5 Test requirements

For Wide area NCR-MT the ΔP between the power measured in step 6 and step 8 of clause 6.10.5-1 shall be:

Table 6.10.5-1: NCR-MT type 2-O Output power dynamics test requirements.

|  |  |  |
| --- | --- | --- |
| NCR-MT Type | NCR-MT channel bandwidth | Requirement |
| Wide area | ≤40MHz | 10 log(Maximum RB) -1.2 < ΔP ≤ 10 log(Maximum RB) + 11.2 |
| 40MHz < BW ≤ 100MHz | 10 log(Maximum RB) -1.5 < ΔP ≤ 10 log(Maximum RB) + 11.5 |
| Local area | ≤40MHz | 10 log(Maximum RB) + 3.8 < ΔP ≤ 10 log(Maximum RB) + 15.2 |
| 40MHz < BW ≤ 100MHz | 10 log(Maximum RB) + 3.5 < ΔP ≤ 10 log(Maximum RB) + 16.5 |

For Local area NCR-MT, the test requirement for power control in clause 6.3.4 in TS 38.521-2 [20] is applicable.

*<Next of the change>*

6.11 OTA transmit signal quality

6.11.1 Definition and applicability

Transmit signal quality is specified in terms of: frequency error and transmit modulation quality requirements.

6.11.2 Minimum requirement

#### 6.11.2.1 Frequency error requirements for NCR-MT

##### 6.11.2.1.1 Minimum requirement for NCR-MT type 2-O

For NCR-MT type 2-O, the requirements specified in clause 9.6.1.2.3 in TS 38.174 [19] applies.

#### 6.11.2.2 Transmit modulation quality

##### 6.11.2.2.1 Minimum requirement for NCR-MT type 2-O

For NCR-MT type 2-O, the requirements specified in clause 9.6.2.2.3 in TS 38.174 [19] applies.

6.11.3 Test purpose

The test purpose is to verify that OTA transmit signal quality is within the limit specified by the minimum requirement.

6.11.4 Method of test

#### 6.11.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier:

- B and T; see clause 4.9.1.

*Passband bandwidth* positions to be tested for multi-carrier:

- BRFBW and TRFBW in single-band operation, see clause 4.9.1;

- BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation, see clause 4.9.1.

Directions to be tested:

- The OTA coverage range reference direction (D.14).

- The OTA coverage range maximum directions (D.15).

Polarizations to be tested: For dual polarized systems the requirement shall be tested and met for both polarizations.

6.6.3.4.3 Void

#### 6.11.4.2 Initial conditions

1) Place the NCR-MT at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the NCR-MT with the test system.

3) Orient the positioner (and NCR-MT) in order that the direction to be tested aligns with the test antenna.

4) Configure the beamforming settings of the NCR-MT according to the direction to be tested.

5) Set the NCR-MT to output according to the applicable test configuration in clause 4.8 using the corresponding test models or set of physical channels in clause 4.9.2.

 For *NCR-MT type 2-O* declared to be capable of single carrier operation only, set the NCR-MT to transmit a signal according to the applicable test signal configuration and corresponding power setting specified in clause 4.7.2 and 4.8 using the corresponding test models on all carriers configured:

- NCRUL-FR2-TM3.1 with 64QAM signal if 64QAM is supported by NCR-MT without power back off, or

- NCRUL-FR2-TM 3.1 with highest modulation order without power back off if 64QAM is not supported by NCR-MT, or

- if 64 QAM is supported by NCR-MT with power back off, NCRUL-FR2-TM 3.1 with 64QAM at manufacturer's declared rated output power (Prated,p,EIRP) and NCRUL-FR2-TM3.1 with highest modulation order supported at maximum power.

 For *NCR-MT type 2-O* declared to be capable of multi-carrier operation, set the NCR-MT to transmit according to:

- NCRUL-FR2-TM3.1 with 64QAM signal if 64QAM is supported by NCR-MT without power back off, or

- NCRUL-FR2-TM3.1 with highest modulation order supported without power back off if 64QAM is not supported by NCR-MT, or

- if 64QAM is supported by NCR-MT with power back off, NCRUL-FR2-TM3.1 with 64QAM signal at manufacturer's declared rated output power (Prated,p,EIRP) and NCRUL-FR2-TM3.1 with highest supported modulation order at maximum power

 For NCRUL-FR1-TM 3.1a and NCRUL-FR2-TM 3.1, power back-off shall be applied if it is declared.

6) For each carrier, measure the EVM and frequency error as defined in annex L.

7) Repeat steps 5 and 6 for NCRUL-FR2-TM2 if 256QAM is not supported by *NCR-MT type 2-O* or for NCRUL-MT-FR2-TM2a if 256QAM is supported by *NCR-MT type 2-O*. For NCRUL-FR2-TM2 and NCRUL-FR1-TM2a the OFDM symbol power (in the conformance direction) shall be at the lower limit of the dynamic range according to the test procedure in clause 6.10.4.2.

6.11.5 Test requirements

For *NCR-MT type 2-O*, the EVM of each NR carrier for different modulation schemes on PUSCH shall be less than the limits in table 6.11.5-1.

**Table 6.11.5-1: EVM requirements for *NCR-MT type 2-O***

|  |  |
| --- | --- |
| **Modulation scheme for PUSCH** | **Required EVM (%)** |
| QPSK | 18.5  |
| 16QAM | 13.5  |
| 64QAM | 9  |
| 256QAM | 4.5 |
| NOTE: 256QAM is not supported by FR2-1 NCR-MT PUSCH |

EVM requirements shall apply for each NR carrier over all allocated resource blocks and uplink slots for NCR-MT. PT-RS should be configured for localized setting for every fourth symbol for every second RB for NCR-MT. Different modulation schemes listed in table 6.11.5-1 shall be considered for rank 1.

For all bandwidths, the EVM measurement shall be performed for each NR carrier over all allocated resource blocks and uplink slots for NCR-MT within 10 ms measurement periods. The boundaries of the EVM measurement periods need not be aligned with radio frame boundaries.

Tables 6.11.5-2 and 6.11.5-3 below specify the EVM window length (*W*) for normal CP for *NCR-MT type 2-O*.

**Table 6.11.5-2: EVM window length for normal CP, FR2-1, 60 kHz SCS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Channel bandwidth (MHz)** | **FFT size** | **Cyclic prefix lengthen FFT samples** | **EVM window length *W*** | **Ratio of *W* to total CP length (Note)****(%)** |
| 50 | 1024 | 72 | 36 | 50 |
| 100 | 2048 | 144 | 72 | 50 |
| 200 | 4096 | 288 | 144 | 50 |
| NOTE: These percentages are informative and apply to all OFDM symbols within subframe except for symbol 0 of slot 0 and slot 2. Symbol 0 of slot 0 and slot 2 may have a longer CP and therefore a lower percentage. |

**Table 6.11.5-3: EVM window length for normal CP, FR2-1, 120 kHz SCS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Channel bandwidth (MHz)** | **FFT size** | **Cyclic prefix length in FFT samples** | **EVM window length *W*** | **Ratio of *W* to total CP length (Note)****(%)** |
| 50 | 512 | 36 | 18 | 50 |
| 100 | 1024 | 72 | 36 | 50 |
| 200 | 2048 | 144 | 72 | 50 |
| 400 | 4096 | 288 | 144 | 50 |
| NOTE: These percentages are informative and apply to all OFDM symbols within subframe except for symbol 0 of slot 0 and slot 4. Symbol 0 of slot 0 and slot 4 may have a longer CP and therefore a lower percentage. |

*<Next of the change>*

6.12 OTA reference sensitivity

6.12.1 Definition and applicability

The reference sensitivity power level REFSENS is defined as the EIS level at the centre of the quiet zone in the RX beam peak direction, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

6.12.2 Minimum requirement for NCR-MT type 2-O

For *NCR type 2-O* of WA class, the reference sensitivity requirement is specified the same as Wide Area IAB-MT reference sensitivity power level in TS 38.174 [19], clause 10.3.3.3.

For *NCR type 2-O* of LA class, the reference sensitivity requirement is specified the same as reference sensitivity power level for power class 3 in TS 38.101-2 [14], clause 7.3.2.3.

6.12.3 Test purpose

The test purpose is to verify that the NCR-MT can meet the throughput requirement for a specified measurement channel at the EISREFSENS level and the range of angles of arrival within the *OTA REFSENS RoAoA*.

6.12.4 Methd of test

#### 6.12.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier:

- B, M and T; see clause 4.9A.1.

Directions to be tested:

- OTA REFSENS receiver target reference direction (D.30),

- OTA REFSENS conformance test directions (D.31).

#### 6.12.4.2 Procedure

1) Place the NCR with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system

2) Align the manufacturer declared coordinate system orientation of the NCR with the test system.

3) Align the NCR with the test antenna in the declared direction to be tested.

4) Ensure the polarization is accounted for such that all the power from the test antenna is captured by the NCR under test.

5) Start the signal generator for the wanted signal to transmit:

- The test signal as specified in clause 6.12.5.

6) Set the test signal mean power so the calibrated radiated power at the BS Antenna Array coordinate system reference point is as specified in clause 6.12.5.

7) Measure the throughput.

8) Repeat steps 3 to 9 for all OTA REFSENS conformance test directions of the NCR (D.31), and supported polarizations.

6.12.5 Test requirements

For *NCR type 2-O* of WA class, the test requirement for OTA reference sensitivity requirement is defined in TS 38.176-2 [21], clause 7.3.5.

For *NCR type 2-O* of LA class, the test requirement for OTA reference sensitivity requirement is defined in TS 38.521-2 [20], clause 7.3.2.5.

This test requirement applies at MT RIB only.

*<Next of the change>*

## 6.15 OTA blocking characteristics

### 6.15.1 Definition and applicability

The blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those at which a spurious response occurs.

This requirement applies at MT RIB only.

### 6.15.2 Minimum requirement

For WA class *NCR type 2-O*, the OTA blocking requirement is specified in TS 38.174 [19], clause 10.5.2.4.

For LA class *NCR type 2-O*, the OTA blocking requirement is specified in TS 38.101-2 [14], clause 7.6.

### 6.15.3 Test purpose

In-band blocking is defined for an unwanted interfering signal falling into the receive band or into the spectrum equivalent to twice the channel bandwidth below or above the receive band at which the relative throughput shall meet or exceed the minimum requirement for the specified measurement channels.

### 6.15.4 Method of test

#### 6.17.4.1 Void

#### 6.17.4.2 Void

#### 6.17.4.4 Void

#### 6.15.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier:

- M; see clause 4.9A.1.

*NCR RF Bandwidth* edge position to be tested for multi-carrier:

- MRFBW in single-band operation, see clause 4.9A.1;

Directions to be tested:

- For NCR *type 2-O*, OTA REFSENS receiver target reference direction (D.30).

#### 6.15.4.2 Procedure for general blocking

1) Place the NCR with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system.

2) Align the manufacturer declared coordinate system orientation of the NCR with the test system.

3) Align the NCR with the test antenna in the declared direction to be tested.

4) Align the NCR so that the wanted signal and interferer signal is *polarization matched* with the test antenna(s).

5) Configure the beam peak direction for the transmitter according to the declared reference beam direction pair for the appropriate beam identifier.

6) Set the test signal mean power so that the calibrated radiated power at the NCR Antenna Array coordinate system reference point is as follows:

a)

For NCR*-MT* *type 2-O,* set the signal generator for the wanted signal to transmit as specified in clause 6.15.5.

b)

For NCR*-MT* *type 2-O*, set the signal generator for the interfering signal at the in-band blocking frequency of the wanted signal to transmit as specified in clause 6.15.5.

7) Measure throughput according to annex A.1 for each supported polarization, for multi-carrier and/or CA operation the throughput shall be measured for relevant carriers specified by the test configuration specified in clauses 4.7.2 and 4.8.

#### 6.15.4.3 Procedure for out of band blocking

1) Place the NCR with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system.

2) Align the manufacturer declared coordinate system orientation of the NCR with the test system.

3) Align the NCR with the test antenna in the declared direction to be tested.

4) Align the NCR so that the wanted signal and interferer signal is *polarization matched* with the test antenna(s).

5) Configure the beam peak direction for the transmitter according to the declared reference beam direction pair for the appropriate beam identifier.

6) Set the test signal mean power so that the calibrated radiated power at the NCR Antenna Array coordinate system reference point is as follows:

a)

For NCR*-MT* *type 2-O,* set the signal generator for the wanted signal to transmit as specified in clause 6.15.5.

b)

For NCR*-MT* *type 2-O*, set the signal generator for the interfering signal at the out of band blocking frequency of the wanted signal to transmit as specified in clause 6.15.5. The interfering signal shall be swept within the frequency range specified in clause 6.15.5 with the step size specified in table 6.15.4.3-1.

Table 6.15.4.3-1: Interferer signal step size

|  |  |  |
| --- | --- | --- |
| Frequency range(MHz) | Minimum supported *NCR-MT channel bandwidth* (MHz) | Measurementstep size(MHz) |
| 30 to 6000 | 50, 100, 200, 400 | 1 |
| 6000 to 60000 | 50 | 15 |
|  | 100  | 30 |
|  | 200 | 60 |
|  | 400  | 60 |

7) Measure throughput according to annex A.1 for each supported polarization, for multi-carrier and/or CA operation the throughput shall be measured for relevant carriers specified by the test configuration specified in clauses 4.7.2 and 4.8.

### 6.15.5 Test requirements

For *NCR type 2-O* of WA class, the test requirement for OTA blocking is defined in TS 38.176-2 [21], clause 7.5.2.5.3.

For *NCR type 2-O* of LA class, the test requirement for OTA blocking is defined in TS 38.521-2 [20], clause 7.6.2.5.

This test requirement applies at MT RIB only.

## 6.16 OTA receiver spurious emissions

### 6.16.1 Definition and applicability

The receiver spurious emissions power is the power of emissions generated or amplified in a receiver. The receiver spurious emissions power level is measured as TRP.

This requirement applies at MT RIB only.

### 6.16.2 Minimum requirement

For *NCR type 2-O* of WA class, the OTA receiver spurious emission requirement is specified in TS 38.174 [19], clause 10.7.3.2.

For *NCR type 2-O* of LA class, the OTA receiver spurious emission requirement is specified in TS 38.101-2 [14], clause 7.9.

### 6.16.3 Test purpose

Test verifies whether receiver spurious emissions meet the requirements described in clause 6.16.5. Excess receiver spurious emissions increase the interference to other systems.

### 6.16.4 Method of test

#### 6.16.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier, see clause 4.9A.1:

- For FR2:

- B when testing from 30 MHz to FDL\_low - ΔfOBUE

- T when testing from FDL\_high + ΔfOBUE to 2nd harmonic (or to 60 GHz)

RF bandwidth positions to be tested in single-band operation, see clause 4.9A.1:

- For FR2:

- BRFBW when testing from 30 MHz to FDL\_low - ΔfOBUE

- TRFBW when testing from FDL\_high + ΔfOBUE to 2nd harmonic (or to 60 GHz)

Directions to be tested: As the requirement is TRP the beam pattern(s) may be set up to optimise the TRP measurement procedure (see annex I) as long as the required TRP level is achieved.

#### 7.7.4.2 Void

#### 6.16.4.2 Procedure

The following procedure for measuring TRP is based on the directional power measurements as described in annex I. An alternative method to measure TRP is to use a characterized and calibrated reverberation chamber if so follow steps 1, 3, 4, 5, 7 and 10.

1) Place the NCR with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system.

2) Align the manufacturer declared coordinate system orientation of the NCR with the test system.

3) Align the NCR with the test antenna in the declared direction to be tested.

4) Measurements shall use a measurement bandwidth in accordance to the conditions in clause 6.16.5.

5) The measurement device characteristics shall be:

- Detection mode: True RMS.

6) Set the TDD NCR to receive only.

7) Orient the positioner (and NCR) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex I).

8) Measure the emission at the specified frequencies with specified measurement bandwidth

9) Repeat step 7-10 for all directions in the appropriated TRP measurement grid needed for full TRP estimation (see annex I).

NOTE 1: The TRP measurement grid may not be the same for all measurement frequencies.

NOTE 2: The frequency sweep or the TRP measurement grid sweep may be done in any order

10) Calculate TRP at each specified frequency using the directional measurements.

### 6.16.5 Test requirements

For *NCR type 2-O* of WA class, the test requirement for OTA receiver spurious emission is defined in TS 38.176-2 [21], clause 7.7.5.

For *NCR type 2-O* of LA class, the test requirement for OTA receiver spurious emission is defined in TS 38.521-2 [20], clause 7.9.5.

This test requirement applies at MT RIB only.

*<End of the change>*