**3GPP T****SG-RAN WG4 Meeting #112 R4-2413500**

**Maastricht, Netherlands, August 19 – 23, 2024**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** | **0045** | **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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | CR to TS 38.115-1 with updates and corrections | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_netcon\_repeater-Perf | | | | |  | ***Date:*** | | | 2024-08-09 |
|  |  | | | |  | |  | | |  |
| ***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 repeater conducted test conformance specification TS 38.115-1 with corrections. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Clause 6.5.4.5.1 – missing NCR types are added to spurious emission requirements.  Clause 6.14.4.2 - NCR MT details are added to the procedure.  Clause 6.15.1 - NCR MT details are added. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Specification will not include NCR in some requirements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.5.4.5.1, 6.14.4.2, 6.15.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 R4-2412903 | | | | | | | | |

<Start of changes>

6.5.4.5 Test requirements for RF repeater

6.5.4.5.1 General transmitter spurious emissions requirements

The *minimum requirements* of either table 6.5.4.5.1-1, table 6.5.4.5.1-2 (Category A limits) or table 6.5.4.5.1-3 (Category B limits) shall apply. The application of either Category A or Category B limits shall be the same as for operating band unwanted emissions in clause 6.5.3.

**Table 6.5.4.5.1-1: General *repeater type 1-C, NCR type 1-C and NCR type 1-H* transmitter spurious emission minimum requirements for DL in FR1, Category A**

|  |  |  |  |
| --- | --- | --- | --- |
| **Spurious frequency range** | **Minimum requirements** | ***Measurement bandwidth*** | **Notes** |
| 9 kHz – 150 kHz | -13 dBm | 1 kHz | Note 1 |
| 150 kHz – 30 MHz |  | 10 kHz | Note 1 |
| 30 MHz – 1 GHz |  | 100 kHz | Note 1 |
| 1 GHz – 12.75 GHz |  | 1 MHz | Note 1, Note 2 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the DL *operating band* in GHz |  | 1 MHz | Note 1, Note 2, Note 3 |
| NOTE 1: *Measurement bandwidth*s as in ITU-R SM.329 [4], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [4], s2.5 table 1.  NOTE 3: For *repeater type 1-C,* *NCR type 1-C and NCR type 1-H* in DL, this spurious frequency range applies only for *operating bands* for which the 5th harmonic of the upper frequency edge of the DL *operating band* is reaching beyond 12.75 GHz. | | | |

**Table 6.5.4.5.1-2: General *repeater type 1-C, NCR type 1-C and NCR type 1-H* transmitter spurious emission minimum requirements for UL in FR1, Category A**

|  |  |  |  |
| --- | --- | --- | --- |
| **Spurious frequency range** | ***Minimum requirements*** | ***Measurement bandwidth*** | **Notes** |
| 9 kHz – 150 kHz | -36 dBm | 1 kHz | Note 1 |
| 150 kHz – 30 MHz |  | 10 kHz | Note 1 |
| 30 MHz – 1 GHz |  | 100 kHz | Note 1 |
| 1 GHz – 12.75 GHz | -30 dBm | 1 MHz | Note 1, Note 2 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the UL *operating band* in GHz |  | 1 MHz | Note 1, Note 2, Note 3 |
| NOTE 1: *Measurement bandwidth*s as in ITU-R SM.329 [4], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [4], s2.5 table 1.  NOTE 3: For *repeater type 1-C NCR type 1-C and NCR type 1-H in* UL, 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. | | | |

**Table 6.5.4.5.1-3: General *repeater type 1-C, NCR type 1-C and NCR type 1-H* transmitter spurious emission minimum requirements in FR1, Category B**

|  |  |  |  |
| --- | --- | --- | --- |
| **Spurious frequency range** | ***minimum requirements*** | ***Measurement bandwidth*** | **Notes** |
| 9 kHz – 150 kHz | -36 dBm | 1 kHz | Note 1 |
| 150 kHz – 30 MHz |  | 10 kHz | Note 1 |
| 30 MHz – 1 GHz |  | 100 kHz | Note 1 |
| 1 GHz – 12.75 GHz | -30 dBm | 1 MHz | Note 1, Note 2 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the *operating band* in GHz |  | 1 MHz | Note 1, Note 2, Note 3 |
| NOTE 1: *Measurement bandwidth*s as in ITU-R SM.329 [4], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [4], s2.5 table 1.  NOTE 3: For *repeater type 1-C, NCR type 1-C and NCR type 1-H* DL, this spurious frequency range applies only for *operating bands* for which the 5th harmonic of the upper frequency edge of the DL *operating band* is reaching beyond 12.75 GHz. For *repeater type 1-C, NCR type 1-C and NCR type 1-H* UL, 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. | | | |

6.5.4.5.2 Additional spurious emissions requirements

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

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

The spurious emission *minimum requirements* are provided in table 6.5.4.5.2-1 where requirements for co-existence with the system listed in the first column apply for *repeater type 1-C, NCR type 1-C and NCR type 1-H*. For a *multi-band connector*, the exclusions and conditions in the Note column of table 6.5.4.5.2-1 apply for each supported *operating band*.

**Table 6.5.4.5.2-1: *Repeater type 1-C, NCR type 1-C and NCR type 1-H* spurious emissions minimum requirements for co-existence with systems operating in other frequency bands**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **System type to co-exist with** | **Frequency range for co-existence requirement** | ***Minimum requirements*** | ***Measurement bandwidth*** | **Note** |
| GSM900 | 921 – 960 MHz | -57 dBm | 100 kHz | This requirement does not apply to repeater operating in band n8 |
|  | 876 – 915 MHz | -61 dBm | 100 kHz | For the frequency range 880-915 MHz, this requirement does not apply to repeater operating in band n8. |
| DCS1800 | 1805 – 1880 MHz | -47 dBm | 100 kHz | This requirement does not apply to repeater operating in band n3. |
|  | 1710 – 1785 MHz | -61 dBm | 100 kHz | This requirement does not apply to repeater operating in band n3. |
| PCS1900 | 1930 – 1990 MHz | -47 dBm | 100 kHz | This requirement does not apply to repeater operating in band n2, n25 or band n70. |
|  | 1850 – 1910 MHz | -61 dBm | 100 kHz | This requirement does not apply to repeater operating in band n2 or n25. |
| GSM850 or | 869 – 894 MHz | -57 dBm | 100 kHz | This requirement does not apply to repeater operating in band n5 or n26. |
| CDMA850 | 824 – 849 MHz | -61 dBm | 100 kHz | This requirement does not apply to repeater operating in band n5 or n26. |
| UTRA FDD | 2110 – 2170 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n1 or n65 |
| Band I or  E-UTRA Band 1 or NR Band n1 | 1920 – 1980 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n1 or n65. |
| UTRA FDD | 1930 – 1990 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n2 or n70. |
| Band II or  E-UTRA Band 2 or NR Band n2 | 1850 – 1910 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n2. |
| UTRA FDD | 1805 – 1880 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n3. |
| Band III or  E-UTRA Band 3 or NR Band n3 | 1710 – 1785 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n3. |
| UTRA FDD Band IV or  E-UTRA Band 4 | 2110 – 2155 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66 |
|  | 1710 – 1755 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66. |
| UTRA FDD Band V or  E-UTRA Band 5 or NR Band n5 | 869 – 894 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n5 or n26. |
|  | 824 – 849 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n5 or n26. |
| UTRA FDD | 860 – 890 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n18. |
| Band VI, XIX or | 815 – 830 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n18. |
| E-UTRA Band 6, 18, 19 or NR Band n18 | 830 – 845 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band VII or  E-UTRA Band 7 or NR Band n7 | 2620 – 2690 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n7. |
|  | 2500 – 2570 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n7. |
| UTRA FDD Band VIII or  E-UTRA Band 8 or NR Band n8 | 925 – 960 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n8. |
|  | 880 – 915 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n8. |
| UTRA FDD Band IX or  E-UTRA Band 9 | 1844.9 – 1879.9 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n3. |
|  | 1749.9 – 1784.9 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n3. |
| UTRA FDD Band X or  E-UTRA Band 10 | 2110 – 2170 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66 |
|  | 1710 – 1770 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66. |
| UTRA FDD Band XI or XXI or  E-UTRA Band 11 or 21 | 1475.9 – 1510.9 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n50, n74, n75, n92 or n94. |
|  | 1427.9 – 1447.9 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n50, n51, n74, n75, n76, n91, n92, n93 or n94. |
|  | 1447.9 – 1462.9 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n50, n74, n75, n92 or n94. |
| UTRA FDD Band XII or  E-UTRA Band 12 or NR Band n12 | 729 – 746 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n12 or n85. |
|  | 699 – 716 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n12 or n85.  For NR repeater operating in n29, it applies 1 MHz below the Band n29 downlink operating band (Note 5). |
| UTRA FDD Band XIII or  E-UTRA Band 13 | 746 – 756 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n13. |
|  | 777 – 787 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n13. |
| UTRA FDD Band XIV or  E-UTRA Band 14 or NR band n14 | 758 – 768 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n14. |
|  | 788 – 798 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n14. |
| E-UTRA Band 17 | 734 – 746 MHz | -52 dBm | 1 MHz |  |
|  | 704 – 716 MHz | -49 dBm | 1 MHz | For NR repeater operating in n29, it applies 1 MHz below the Band n29 downlink operating band (Note 5). |
| UTRA FDD Band XX or E-UTRA Band 20 or NR Band n20 | 791 – 821 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n20 or n28. |
|  | 832 – 862 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n20. |
| UTRA FDD Band XXII or E-UTRA Band 22 | 3510 – 3590 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n48, n77 or n78. |
|  | 3410 – 3490 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n77 or n78. |
| E-UTRA Band 24 | 1525 – 1559 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n24. |
|  | 1626.5 – 1660.5 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n24. |
| UTRA FDD Band XXV or  E-UTRA Band 25 or NR band n25 | 1930 – 1995 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n2, n25 or n70. |
|  | 1850 – 1915 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n25 since it is already covered by the requirement in clause 6.5.4.5.2. For repeater operating in Band n2, it applies for 1910 MHz to 1915 MHz, while the rest is covered in clause 6.5.4.5.2. |
| UTRA FDD Band XXVI or  E-UTRA Band 26 or NR Band n26 | 859 – 894 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n5 or n26. |
|  | 814 – 849 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n26 since it is already covered by the requirement in clause 6.5.4.5.2. For repeater operating in Band n5, it applies for 814 MHz to 824 MHz, while the rest is covered in clause 6.5.4.5.2. |
| E-UTRA Band 27 | 852 – 869 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n5. |
|  | 807 – 824 MHz | -49 dBm | 1 MHz | This requirement also applies to repeater operating in Band n28, starting 4 MHz above the Band n28 downlink operating band (Note 5). |
| E-UTRA Band 28 or NR Band n28 | 758 – 803 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n20, n67 or n28. |
|  | 703 – 748 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n28..  For repeater operating in band n67, it applies for 703 MHz to 736 MHz. |
| E-UTRA Band 29 or NR Band n29 | 717 – 728 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n29 or n85 |
| E-UTRA Band 30 or NR Band n30 | 2350 – 2360 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n30 |
|  | 2305 – 2315 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n30. |
| E-UTRA Band 31 or NR Band n31 | 462.5 – 467.5 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n31 or n72. |
|  | 452.5 – 457.5 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n31, since it is already covered by the requirement in clause 6.5.4.5.2. This requirement 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 requirement does not apply to repeater operating in band n50, n74, n75, n92 or n94. |
| UTRA TDD Band a) or E-UTRA Band 33 | 1900 – 1920 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band a) or E-UTRA Band 34 or NR band n34 | 2010 – 2025 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n34. |
| UTRA TDD Band b) or E-UTRA Band 35 | 1850 – 1910 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band b) or E-UTRA Band 36 | 1930 – 1990 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n2 or n25. |
| UTRA TDD Band c) or E-UTRA Band 37 | 1910 – 1930 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band d) or E-UTRA Band 38 or NR Band n38 | 2570 – 2620 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n38. |
| UTRA TDD Band f) or E-UTRA Band 39 or NR band n39 | 1880 – 1920MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n39. |
| UTRA TDD Band e) or E-UTRA Band 40 or NR Band n40 | 2300 – 2400MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n30 or n40. |
| E-UTRA Band 41 or NR Band n41, n90 | 2496 – 2690 MHz | -52 dBm | 1 MHz | This is not applicable to repeater operating in Band n41, n53 or [n90]. |
| E-UTRA Band 42 | 3400 – 3600 MHz | -52 dBm | 1 MHz | This is not applicable to repeater operating in Band n48, n77 or n78. |
| E-UTRA Band 43 | 3600 – 3800 MHz | -52 dBm | 1 MHz | This is not applicable to repeater operating in Band n48, n77 or n78. |
| E-UTRA Band 44 | 703 – 803 MHz | -52 dBm | 1 MHz | This is not applicable to repeater operating in Band n28. |
| E-UTRA Band 45 | 1447 – 1467 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 46 | 5150 – 5925 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 47 | 5855 – 5925 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 48 or NR Band n48 | 3550 – 3700 MHz | -52 dBm | 1 MHz | This is not applicable to repeater operating in Band n48, n77 or n78. |
| E-UTRA Band 50 or NR band n50 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n74, n75, n76, n91, n92, n93, n94 or n109. |
| E-UTRA Band 51 or NR Band n51 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n75, n76, n91, n92, n93, n94 or n109. |
| E-UTRA Band 53 or NR Band n53 | 2483.5 - 2495 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n41, n53 or n90. |
| E-UTRA Band 54 or NR Band n54 | 1670 – 1675 MHz | -52 dBm | 1 MHz | This requirement 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 requirement does not apply to repeater operating in band n1 or n65. |
|  | 1920 – 2010 MHz | -49 dBm | 1 MHz | For repeater operating in Band n1, it applies for 1980 MHz to 2010 MHz, while the rest is covered in clause 6.5.4.5.2.  This requirement does not apply to repeater operating in band n65. |
| E-UTRA Band 66 or NR Band n66 | 2110 – 2200 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66. |
|  | 1710 – 1780 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66. |
| E-UTRA Band 67 or NR Band n67 | 738 – 758 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n28 or n67. |
| E-UTRA Band 68 | 753 -783 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n28. |
|  | 698-728 MHz | -49 dBm | 1 MHz | For repeater operating in Band n28, this requirement applies between 698 MHz and 703 MHz, while the rest is covered in clause 6.5.4.5.2. |
| E-UTRA Band 69 | 2570 – 2620 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n38. |
| E-UTRA Band 70 or NR Band n70 | 1995 – 2020 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n2, n25 or n70 |
|  | 1695 – 1710 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n70.. |
| E-UTRA Band 71 or NR Band n71 | 617 – 652 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n71 or n105. |
|  | 663 – 698 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n71 or n105. |
| E-UTRA Band 72 or NR Band n72 | 461 – 466 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n31 or n72. |
|  | 451 – 456 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n72, since it is already covered by the requirement in clause 6.5.4.5.2. This requirement does not apply to BS operating in band n31. |
| E-UTRA Band 74 or NR Band n74 | 1475 – 1518 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n50, n74, n75, n92, n94 or n109. |
|  | 1427 – 1470 MHz | -49 dBm | 1MHz | This requirement 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 requirement 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 requirement 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 requirement does not apply to repeater operating in Band n48, n77 or n78 |
| NR Band n78 | 3.3 – 3.8 GHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n48, n77 or n78 |
| NR Band n79 | 4.4 – 5.0 GHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n79 |
| NR Band n80 | 1710 – 1785 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n3. |
| NR Band n81 | 880 – 915 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n8. |
| NR Band n82 | 832 – 862 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n20. |
| NR Band n83 | 703 – 748 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n28.  For repeater operating in Band n67, it applies for 703 MHz to 736 MHz. |
| NR Band n84 | 1920 – 1980 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n1. |
| E-UTRA Band 85 or NR Band n85 | 728 – 746 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n12 or n85.  For NR repeater operating in n29, it applies 1 MHz below the Band n29 downlink operating band (Note 5). |
|  | 698 – 716 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n12 or n85. |
| NR Band n86 | 1710 – 1780 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n66. |
| NR Band n89 | 824 – 849 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n5. |
| NR Band n91 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n75, n76 or n109. |
|  | 832 – 862 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n20, since it is already covered by the requirement in clause 6.5.4.5.2. |
| NR Band n92 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n74, n75, n76 or n109. |
|  | 832 – 862 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n20, since it is already covered by the requirement in clause 6.5.4.5.2. |
| NR Band n93 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n75, n76 or n109. |
|  | 880 – 915 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n8, since it is already covered by the requirement in clause 6.5.4.5.2. |
| NR Band n94 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n50, n51, n74, n75, n76 or n109. |
|  | 880 – 915 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n8, since it is already covered by the requirement in clause 6.5.4.5.2. |
| NR Band n95 | 2010 – 2025 MHz | -52 dBm | 1 MHz |  |
| NR Band n96 | 5925 – 7125 MHz | -52 dBm | 1 MHz |  |
| NR Band n97 | 2300 – 2400MHz | -52 dBm | 1 MHz |  |
| NR Band n98 | 1880 – 1920MHz | -52 dBm | 1 MHz |  |
| NR Band n99 | 1626.5 – 1660.5 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n24. |
| NR Band n100 | 919.4 – 925 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n8 or n100. |
|  | 874.4 – 880 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n100. |
| NR band n101 | 1900 – 1910 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n101. |
| NR Band n102 | 5925 – 6425 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 103 | 757 – 758 MHz | -52 dBm | 1 MHz |  |
| 787 – 788 MHz | -49 dBm | 1 MHz |  |
| NR Band n104 | 6425 – 7125 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in Band n104 |
| NR band n105 | 612 – 652 MHz | -52 dBm | 1 MHz | This requirement does not apply to repeater operating in band n71 or n105. |
|  | 663 – 703 MHz | -49 dBm | 1 MHz | This requirement does not apply to repeater operating in band n105, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 106 or NR band n106 | 935 - 940 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n106. |
|  | 896 – 901 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n106, since it is already covered by the requirement in clause 6.6.5.2.2.  This requirement does not apply to BS operating in band n5 or n26. |
| NR band n109 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This requirement 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 requirement does not apply to BS operating in band n109, since it is already covered by the requirement 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 requirements apply to a repeater operating in Band n28, the co-existence requirements in table 6.5.4.5.2 -1 do not apply for the ΔfOBUE frequency range immediately outside the downlink *operating band*. Emission limits for this excluded frequency range may be covered by local or regional requirements.

NOTE 2: Table 6.5.4.5.2 -1 assumes that two *operating bands*, where the frequency ranges would be overlapping, are not deployed in the same geographical area. For such a case of operation with overlapping frequency arrangements in the same geographical area, special co-existence requirements may apply that are not covered by the 3GPP specifications.

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

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

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

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

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

**Table 6.5.4.5.2-2: Repeater spurious emissions minimum requirements for repeater for co-existence with PHS for DL**

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

In certain regions, the following requirement may apply to NR repeater or NCR operating in Band n50 and n75 within the 1432 – 1452 MHz, and in Band n51 and Band n76. The *minimum requirements are* specified in Table 6.5.4.5.2-3. 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 6.5.4.5.2-3: Additional operating band unwanted emission minimum requirement for NR repeater operating in Band n50 and n75 within 1432 – 1452 MHz, and in Band n51 and n76**

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

In certain regions, the following requirement may apply to repeater operating in NR Band n50 and n75 within 1492-1517 MHz and in Band n74 within 1492-1518 MHz. The maximum level of emissions, measured on centre frequencies Ffilter with filter bandwidth according to Table 6.5.4.5.2-4, shall be defined according to the *minimum requirements* PEM,n50/n75,a nor PEM,n50/n75,b declared by the manufacturer.

**Table 6.5.4.5.2-4: *Operating band* n50, n74 and n75 declared emission above 1518 MHz**

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

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

The power of any spurious emission shall not exceed:

**Table 6.5.4.5.2-5: Repeater spurious emissions limits for protection of 700 MHz public safety operations**

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

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

The power of any spurious emission shall not exceed:

**Table 6.5.4.5.2-6: Additional NR repeater spurious emissions minimum requirements for Band n30**

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

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

**Table 6.5.4.5.2-7: Additional repeater spurious emissions limits for Band n48**

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

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

NOTE: The regional requirement, included in [14], 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 6.5.4.5.2-8: Repeater spurious emissions limits for protection of 800 MHz public safety operations**

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

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

The power of any spurious emission shall not exceed:

**Table 6.5.4.5.2-9: Additional repeater spurious emissions minimum requirements for Band n41 and n90**

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

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

**Table 6.5.4.5.2-10: Additional repeater spurious emissions limits for Band n77**

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

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

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 6.5.4.5.2-11 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 6.5.4.5.2-11: Declared Band n54 emissions levels 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 changes>

6.14.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For NCR-MT type 1-H the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested; see clause 7.1.

1) Connect the connector under test to measurement equipment as shown in annex D.2.1 for NCR-MT type 1-C and in annex D.4.1 for NCR-MT type 1-H.

2) Start the signal generator for the wanted signal to transmit the Fixed Reference Channels for reference sensitivity in clause 6.14.5 and according to annex A.1.

3) Set the signal generator for the wanted signal power as specified in clause 6.14.5.

4) Measure the throughput according to annex A.1.

In addition, for a *multi-band connector*, the following steps shall apply:

5) For *multi-band connector* 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.

6.14.5 Test requirements for NCR-MT

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in annex A.1 with parameters specified in table 6.14.5-1 for Wide Area NCR-MT.

**Table 6.14.5-1: Wide Area NCR-MT reference sensitivity levels**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NCR-MT channel bandwidth (MHz)** | **Sub-carrier spacing (kHz)** | **Reference measurement channel** | **Reference sensitivity power level, PREFSENS**  **(dBm)** | | |
| **f ≤ 3.0 GHz** | **3.0 GHz < f ≤ 4.2 GHz** | **4.2 GHz < f ≤ 6.0 GHz** |
| 10, 15 | 30 | G-FR1-A1-22 (Note 1) | -101.3 | -101 | -100.8 |
| 10, 15 | 60 | G-FR1-A1-23 (Note 1) | -98.3 | -98 | -97.8 |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-25 (Note 1) | -94.7 | -94.4 | -94.2 |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-26 (Note 1) | -94.9 | -94.6 | -94.4 |
| NOTE 1: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *passband.*. | | | | | |

For Local Area NCR-MT reference sensitivity levels are defined in TS 38.101-1 [x] in clause 7.3.2 plus measurement uncertainty.

**Table 6.14.5-2: measurement uncertainty for reference sensitivity levels**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **The applicable frequency range** | | |
| f ≤ 3 GHz | 3 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6 GHz |
| REFSENS | ±0.7 dB | ±1.0 dB | ±1.2 dB |

6.15 Conducted maximum input level

6.15.1 Definition and applicability

Maximum input level is defined as the maximum mean power received at the Local Area *NCR-MT type 1-C* antenna port or *NCR-MT type 1-H* TAB connectors, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel.

6.15.2 Minimum requirement

For Local Area NCR-MT, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in 38.101-1 [13] Annex A.3.2 and Annex A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) with parameters specified in TS 38.101-1 [13] in Table 7.4-1.

6.15.3 Test purpose

Maximum input level tests the NCR-MT ability to receive data with a given average throughput for a specified reference measurement channel, under conditions of high signal level, ideal propagation and no added noise.

6.15.4 Method of test

Test description for NCR-MT conducted maximum input level is s specified in TS 38.521-1 clause 7.4.4.

6.15.4.1 Initial conditions

Test environment: Normal; see annex B.2.

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

6.15.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For NCR-MT *type 1-H* the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect the connector under test to measurement equipment.

2) Set the signal generator for the wanted signal to transmit as specified in Table 6.15.5-1 in clause 6.15.5.

3) Measure the throughput.

<End of changes>