**3GPP T****SG-RAN WG4 Meeting #112 R4-2413499**

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

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** |  | **rev** | **1** | **Current version:** |  |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | CR to TS 38.114 with updates and corrections | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia | | | | | | | | | |
| ***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 EMC specification TS 38.114. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Clause 4.1: addition of NCR  Clause 4.4: addition of NCR  Clause 4.5: addition of NCR and description updated for respective NCR types.  Clause 6.1: update of clause title  New Clause 6.1.1A added to distiguish NR repeaters and NCR-Fwd  Clause 6.2: update of clause title  New Clause 6.1.1A added to distiguish NR repeaters and NCR-Fwd | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Specification will not include NCR in some clauses. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.1, 4.4, 4.5, 6.1, new clause 6.1.1A, 6.2, new clause 6.2.1A | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 R4-2412902 | | | | | | | | |

Distiguish

<Start of changes>

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4.1 General

Requirements throughout the EMC specifications are in some cases defined separately for different frequency ranges (FR). The frequency ranges FR1 and FR2 are defined in clause 5.1 of TS 38.106 [2]. NR Repeater and NCR are designed to operate in FR1 and FR2-1.

The equipment shall be tested in normal test environment defined in the corresponding NR Repeater conformance testing specification TS 38.115-1 [3] for *NR Repeater type 1-C, NCR type 1-C* and *NCR type 1-H* or TS 38.115-2 [4] for *NR Repeater type 2-O* and *NCR type 2-O.* The test conditions shall be recorded in the test report.

For Repeater capable of multi-band operation, the requirements in the present document apply for each supported *operating band* unless otherwise stated. *Operating bands* shall be activated according to the test configuration in clause 4.5. Tests shall be performed relating to each type of port and all *operating bands* shall be assessed during the tests.

The manufacturer shall declare the supported *operating band(s)* according to the list of NR repeater and NCR *operating bands* defined in TS 38.106 [2].

NOTE 1: NR *operating bands* for *NR repeater type 1-C*, *NCR type 1-C* and *NCR type 1-H*, are declared by the manufacturer according to the declaration D.2 specified in TS 38.115-1 [3], table 4.6-1.

NOTE 2: NR *operating bands* for *NR repeater type 2-O* and *NCR type 2-O,* are declared by the manufacturer according to the declaration D.4 specified in TS 38.115-2 [4], table 4.6-1.

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4.4 Exclusion bands

The *exclusion band* for NR repeater and NCR is the frequency range over which no tests of radiated immunity are made in UL or DL.

The *exclusion band* for DL is defined as:

FDL,low – ΔfOBUE < f < FDL,high + ΔfOBUE

Where values of FDL,low and FDL,high are defined for each *operating band* in TS 38.106 [2], clause 5.2.

The *exclusion band* for UL is defined as:

FUL,low – ΔfOBUE < f < FUL,high + ΔfOBUE

Where values of FUL,low and FUL,high are defined for each *operating band* in TS 38.106 [2], clause 5.2.

For NR repeater and NCR capable of multi-band operation, the total *exclusion band* is a combination of the *exclusion bands* for each *operating band* supported by NR repeater or NCR.

The ΔfOBUE values are defined in table 4.4-1 for both DL and UL.

**Table 4.4-1: ΔfOBUE offset values**

|  |  |  |
| --- | --- | --- |
|  | ***Operating band* characteristics** | **ΔfOBUE (MHz)** |
| NCR type 1-H | FDL,high – FDL,low < 100 MHz, or  FUL,high – FUL,low < 100 MHz | 10 |
|  | 100 MHz ≤ FDL,high – FDL,low ≤ 900 MHz, or  100 MHz ≤ FUL,high – FUL,low ≤ 900 | 40 |
| Repeater type 1-C, | FDL,high – FDL,low < 200 MHz, or  FUL,high – FUL,low < 200 MHz | 10 |
| NCR type 1-C | 200 MHz ≤ FDL,high – FDL,low ≤ 900 MHz, or  200 MHz ≤ FUL,high – FUL,low ≤ 900 MHz | 40 |

NOTE: As the radiated immunity testing is defined in the frequency range 80 MHz to 6 GHz, there is no exclusion band defined for FR2.

4.5 NR repeaters and NCR test configurations

The present clause defines the NR repeaters test configurations that shall be used for demonstrating conformance. A single NR repeater carrier shall be used for testing of single-carrier capable NR repeaters.

The signal's channel bandwidth and subcarrier spacing used to build NR repeater and NCR Test Configurations shall be selected according to table 4.7.2-1 in TS 38.115-1 [3] clause 4.7 for *NR repeaters type 1-C*, *NCR type 1-C* and *NCR type 1-H* and table 4.7.2.1-1 in TS 38.115-2 [4] clause 4.7 for *NR repeaters type 2-O* and *NCR type 2-O*. The passband frequency range declared per *operating band* in TS 38.115-1 [3] clause 4.6, and TS 38.115-2 [4] clause 4.6 shall be used.

For other NR repeaters and NCR, the test configurations in tables 4.5-1, 4.5-2, 4.5-3 and 4.5.4 shall be used. The NR repeaters and NCR test configurations (RTCx) are defined in TS 38.115-1 [3], clause 4.7 for *NR repeaters type 1-C, NCR type 1-C* and *NCR type 1-H* and in TS 38.115-2 [4], clause 4.7 for *NR repeaters type 2-O, NCR type 2-O*.

**Table 4.5-1: Test configurations for *NR repeaters type 1-C***

| **Repeater test case** | **Repeater capable of single or multiple passbands in a single band** | | | **Repeater capable of multi-band operation** | |
| --- | --- | --- | --- | --- | --- |
|  | **Single passband repeater** | **Multiple passband capable repeater with identical parameters per passband** | **Multiple passband capable repeater with different parameters per passband** | **Common connector** | **Separate connectors** |
| Emission tests | RTC1 | RTC1, RTC2 | RTC1, RTC2 | RTC1/2 (Note 1), RTC4 | RTC1/2 (Note 1, 2), RTC4 (Note 2) |
| Immunity tests | RTC1 | RTC1, RTC2 | RTC1, RTC2 | RTC1/2 (Note 1), RTC4 | RTC1/2 (Note 1, 2), RTC4 (Note 2) |
| NOTE 1: RTC1 and/or RTC2 shall be applied in each supported operating band.  NOTE 2: For single-band operation test, other antenna connector(s) is (are) terminated. | | | | | |

**Table 4.5-2: Test configurations for *NR repeaters type 2-O***

| **Repeater test case** | **Repeater capable of single or multiple passbands in a single band** | | |
| --- | --- | --- | --- |
|  | **Single passband repeater** | **Multiple passband capable repeater with identical parameters per passband** | **Multiple passband capable repeater with different parameters per passband** |
| Emission tests | RTC1 | RTC1, RTC2 | RTC1, RTC2 |
| Immunity tests | RTC1 | RTC1, RTC2 | RTC1, RTC2 |

**Table 4.5-3: Test configurations for *NCR type 1-C, NCR type 1-H***

| **Repeater test case** | **Repeater capable of single or multiple passbands in a single band** | | | **Repeater capable of multi-band operation** | |
| --- | --- | --- | --- | --- | --- |
|  | **Single passband repeater** | **Multiple passband capable repeater with identical parameters per passband** | **Multiple passband capable repeater with different parameters per passband** | **Common connector** | **Separate connectors** |
| Emission tests | NCRTC1 | NCRTC1, NCRTC2 | NCRTC1, NCRTC2 | NCRTC1/2 (Note 1), NCRTC4 | NCRTC1/2 (Note 1, 3), NCRTC4 (Note 3) |
| Immunity tests | NCRTC1 | NCRTC1, NCRTC2 | NCRTC1, NCRTC2 | NCRTC1/2 (Note 1), NCRTC4 | NCRTC1/2 (Note 1, 3), NCRTC4 (Note 3) |
| Note 1: NCRTC1 and/or NCRTC2 shall be applied in each supported operating band.  Note 2: NCRTC4 may be applied for Inter passband gap only.  Note 3: For single-band operation test, other antenna connector(s) is (are) terminated. | | | | | |

**Table 4.5-4: Test configurations for *NCR type 2-O***

| **Repeater test case** | **Repeater capable of single or multiple passbands in a single band** | | |
| --- | --- | --- | --- |
|  | **Single passband repeater** | **Multiple passband capable repeater with identical parameters per passband** | **Multiple passband capable repeater with different parameters per passband** |
| Emission tests | NCRTC1 | NCRTC1, NCRTC2 | NCRTC1, NCRTC2 |
| Immunity tests | NCRTC1 | NCRTC1, NCRTC2 | NCRTC1, NCRTC2 |

<Next changes>

6 Performance criteria

6.1 Performance criteria for continuous phenomena

6.1.1A Performance criteria for continuous phenomena for NR repeaters and NCR-Fwd

The power accuracy of the EUT shall be measured throughout the period of exposure of the phenomenon.

For *repeater type 1-C*, *NCR type 1-C*, and *NCR type 1-H,* the measured output power Pmax,p,AC during the test shall not change from the rated passband output power Prated,p,AC measured before the test by more than ± 1 dB.

For repeater type 2-O and *NCR type 2-O,* the maximum passband TRP output power Pmax,p,TRP during the test shall not change from the rated passband TRP output power Prated,p,TRP measured before the test by more than ± 1 dB.

At the conclusion of the test the EUT shall operate as intended with no loss of user control functions or stored data.

6.1.1 Performance criteria for continuous phenomena for NCR-MT

The test should, where possible, be performed using a bearer with the characteristics of data rate and throughput defined in table 6.1.1-1 and table 6.1.1-2. If the test is not performed using one of these bearers (for example, none of them are supported by the NCR-MT), the characteristics of the bearer used shall be recorded in the test report.

The throughput in table 6.1.1-1 and table 6.1.1-2 is stated relative to the maximum throughput of the FRC.

The NCR-MT uplink and downlink paths shall each meet the performance criteria defined in table 6.1.1-1 and table 6.1.1-2 during the test. If the uplink and downlink paths are evaluated as a one loop then the criteria is two times the throughput reduction shown in table 6.1.1-1 for FR1 WA NCR-MT and table 6.1.1-2 for FR2 NCR-MT (i.e. throughput > 90 % instead of throughput > 95 %). After each test case NCR-MT shall operate as intended with no loss of user control function, stored data and the communication link to both UE and donor test equipment shall be maintained.

For LA NCR-MT the performance criteria shall be that the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in annex A in TS 38.101-1 [3] or TS 38.101-2 [4] for FR1 and FR2 respectively, with parameters specified in clause 7.3.2 in TS 38.101-1 [3] or TS 38.101-2 [4] during the test sequence.

**Table 6.1.1-1: FR1 performance criteria for continuous phenomena for WA NCR-MT**

|  |  |  |  |
| --- | --- | --- | --- |
| **NR channel bandwidth (MHz) as defined in TS 38.106 section 5.4.2 [2] for NCR-MT** | **Sub-carrier spacing (kHz)** | **Bearer information data rate for NCR-MT** | **Performance criteria**  **(Note 1, Note 2)** |
| 10, 15 | 30 | G-FR1-A1-22 in annex A.1 in TS 38.106 [2] | Throughput > 95 %,  no loss of service |
| 10, 15 | 60 | G-FR1-A1-23 in annex A.1 in TS 38.106 [2] |
| 20 to 100 | 30 | G-FR1-A1-25 in annex A.1 in TS 38.106 [2] |
| 20 to 100 | 60 | G-FR1-A1-26 in annex A.1 in TS 38.106 [2] |
| NOTE 1: The performance criteria, throughput > 95 %, no loss of service, applies also if a bearer with another characteristics is used in the test.  NOTE 2: The performance criteria, throughput > 90 %, no loss of service, applies instead if the uplink and downlink paths are evaluated as a one loop. | | | |

**Table 6.1.1-2: FR2-1 performance criteria for continuous phenomena for NCR-MT**

|  |  |  |  |
| --- | --- | --- | --- |
| **NR channel bandwidth (MHz)** | **Sub-carrier spacing (kHz)** | **Bearer information data rate for NCR-MT** | **Performance criteria**  **(Note 1, Note 2)** |
| 50, 100, 200 | 60 | G-FR2-A1-21 in annex A.1 in TS 38.106 [2] | Throughput > 95 %,  no loss of service |
| 50 | 120 | G-FR2-A1-22 in annex A.1 in TS 38.106 [2] |
| 100, 200, 400 | 120 | G-FR2-A1-23 in annex A.1 in TS 38.106 [2] |
| NOTE 1: The performance criteria, throughput > 95 %, no loss of service, applies also if a bearer with another characteristics is used in the test.  NOTE 2: The performance criteria, throughput > 90 %, no loss of service, applies instead if the uplink and downlink paths are evaluated as a one loop. | | | |

6.2 Performance criteria for transient phenomena

6.2.1A Performance criteria for transient phenomena for NR repeaters and NCR-Fwd

The power accuracy of the EUT shall be measured before the test and after each exposure.

For repeater type 1-C, *NCR-Fwd type 1-C* and *NCR-Fwd type 1-H,* the measured output power Pmax,p,AC after each exposure and after the total test shall not change from the rated passband output power Prated,p,AC measured before the test by more than ± 1 dB.

For repeater type 2-O and *NCR-Fwd type 2-O*, the maximum passband TRP output power Pmax,p,TRP after each exposure and after the total test shall not change from the rated passband TRP output power Prated,p,TRP measured before the test by more than ± 1 dB.

At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data.

6.2.1 Performance criteria for transient phenomena for NCR-MT

The test should, where possible, be performed using a bearer with the characteristics of data rate and throughput defined in table 6.2.1-1 and table 6.2.1-2. If the test is not performed using one of these bearers (for example, none of them are supported by the NCR-MT), the characteristics of the bearer used shall be recorded in the test report.

The NCR-MT uplink and downlink paths shall each meet the performance criteria defined in table 6.1.1-1 and table 6.1.1-2 during the test. If the uplink and downlink paths are evaluated as a one loop, then the criteria is two times the throughput reduction shown in table 6.1.1-1 for FR1 WA NCR-MT and table 6.1.1-2 for FR2 NCR-MT (i.e. throughput > 90 % instead of throughput > 95 %). After each test case NCR-MT shall operate as intended with no loss of user control function, stored data and the communication link to both UE and donor test equipments shall be maintained.

For LA NCR-MT the performance criteria shall be that the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in annex A in TS 38.101-1 [3] or TS 38.101-2 [4] for FR1 and FR2 respectively, with parameters specified in clause 7.3.2 in TS 38.101-1 [3] or TS 38.101-2 [4] during the test sequence.

<End of changes>