3GPP TSG-RAN WG4 Meeting # 104-e revision\_of\_R4-2214038

Electronic Meeting, August 15 – August 26, 2022

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.114** | **CR** |  | **rev** | **1** | **Current version:** | **17.0.1** |  |
|  |
| *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:***  | Draft CR to TS 38.114: text corrections aligning with the NR repeater core RF specification |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_repeaters-Core |  | ***Date:*** | 2022-08-10 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories 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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** |  |
|  |  |
| ***Summary of change:*** | * Scope wording correction to align with the TS 38.113
* Incorporation of the NR repeater specific terminology and definitions, e.g. repeater type 1-C, repeater type 2-O
* Spatial exclusion text further detailed and aligned with TS 38.113
* Missing references and cross-references added.
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| ***Consequences if not approved:*** |  |
|  |  |
| ***Clauses affected:*** | 1, 2, 3.1, 4.3, 7.1, 9.2.2, 9.2.3, 9.3.3, 9.4.3, 9.5.2, 9.5.3, 9.6.3, 9.7.3  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  |  |
| ***affected:*** |  | **x** |  Test specifications |  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*------------------------------ Modified section ------------------------------*

# 1 Scope

The present document covers the assessment of NR repeater and ancillary equipment in respect of Electromagnetic Compatibility (EMC).

The present document specifies the applicable requirements, procedures, test conditions, performance assessment and performance criteria for NR repeater and associated ancillary equipment in the following categories:

- NR repeater equipped with antenna connectors which are possible to be terminated during EMC testing, meeting the *repeater type 1-C* RF requirements of TS 38.106 [2], with conformance demonstrated by compliance to TS 38.115-1 [3].

- NR repeater not equipped with antenna connectors, i.e. with antenna elements radiating during the EMC testing, meeting the *repeater type 2-O* RF requirements of TS 38.106 [2], with conformance demonstrated by compliance to TS 38.115-2 [4].

The environment classification used in the present document refers to the residential, commercial and light industrial environment classification used in IEC 61000‑6-1 [6] and IEC 61000-6-3 [7].

The EMC requirements have been selected to ensure an adequate level of compatibility for apparatus at residential, commercial and light industrial environments. The levels, however, do not cover extreme cases which may occur in any location but with low probability of occurrence.

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# 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. 3GPP TS 38.115-1: "NR; Repeater conformance testing - Part 1: Conducted conformance testing"
4. 3GPP TS 38.115-2: "NR; Repeater conformance testing - Part 1: Radiated conformance testing"
5. CISPR 32: "Electromagnetic compatibility of multimedia equipment - Emission requirements".
6. IEC 61000‑6-1: "Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments".
7. IEC 61000-6-3: "Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments".
8. IEC 61000-3-2: "Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)".
9. IEC 61000-3-3: "Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection".
10. IEC 61000-3-11: "Electromagnetic compatibility (EMC) - Part 3-11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in low-voltage supply systems - Equipment with rated current ≤ 75 A and subject to conditional connections".
11. IEC 61000-3-12: "Electromagnetic compatibility (EMC) - Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage system with input current >16 A and ≤ 75 A per phase".
12. IEC 61000‑4‑2: "Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test".
13. IEC 61000‑4‑3: "Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test".
14. IEC 61000‑4‑4: "Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test".
15. IEC 61000‑4‑5: "Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test".
16. IEC 61000‑4‑6: "Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio frequency fields".
17. IEC 61000‑4‑11: "Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests".
18. IEC 61000‑4‑21: "Electromagnetic compatibility (EMC) - Part 4-21: Testing and measurement techniques - Reverberation chamber test methods".
19. ITU-R SM.329: "Unwanted emissions in the spurious domain".

[20] IEC 60050-161: "International Electrotechnical Vocabulary - Chapter 161: Electromagnetic compatibility".

[21] ETSI EN 301 489-1: "Electromagnetic Compatibility (EMC) standard for radio equipment and services - Part 1: Common technical requirements - Harmonised Standard for Electromagnetic Compatibility ".

[22] ETSI EN 301 489-50: "Electromagnetic compatibility (EMC) standard for radio equipment and services; Part 50: Specific conditions for cellular communication base station (BS), repeater and ancillary equipment; Harmonised standard covering the essential requirements of article 3.1(b) of the Directive 2014/53/EU".

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# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

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

**ancillary equipment:** electrical or electronic equipment, that is intended to be used with a receiver or transmitter

NOTE: It is considered as an ancillary equipment if:

 the equipment is intended for use with a receiver or transmitter to provide additional operational and/or control features to the radio equipment, (e.g. to extend control to another position or location); and

 the equipment cannot be used on a stand alone basis to provide user functions independently of a receiver or transmitter; and

 the receiver or transmitter, to which it is connected, is capable of providing some intended operation such as transmitting and/or receiving without the ancillary equipment (i.e. it is not a sub-unit of the main equipment essential to the main equipment basic functions).

**antenna port:** for EMC purposes, port for connection of an antenna used for intentional transmission and/or reception of radiated RF energy, equivalent to an RF antenna connector.

**channel bandwidth:** the RF bandwidth supporting a single NR RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The *channel bandwidth* is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

**continuous phenomena:** electromagnetic disturbance, the effects of which on a particular device or equipment cannot be resolved into a succession of distinct effects (IEC 60050-161 [20]).

**exclusion band:** frequency range(s) not subject to test or assessment.

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

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

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

**port:** A particular interface, of the specified equipment (apparatus), with the electromagnetic environment. For example, any connection point on an equipment intended for connection of cables to or from that equipment is considered as a port (see Figure 3.1-1).



Figure 3.1-1: Examples of ports

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

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

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

**signal/control port:** portintended for the interconnection of components of an EUT, or between an EUT and associated equipment and used in accordance with relevant functional specifications (for example for the maximum length of cable connected to it).

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

**spatial exclusion zone:** range of angles where no tests of radiated immunity are made for *repeater type 2-O* (i.e. half sphere around the EUT's radiating direction).

**telecommunication port:** ports which are intended to be connected to telecommunication networks (e.g. public switched telecommunication networks, integrated services digital networks), local area networks (e.g. Ethernet, Token Ring) and similar networks.

NOTE: *Telecommunication port* is called "wired network port" in CISPR 32 [5] and ETSI EN 301 489-1 [21].

**transient phenomena:** pertaining to or designating a phenomena or a quantity which varies between two consecutive steady states during a time interval short compared with the time-scale of interest (IEC 60050-161 [20]).

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## 4.3 Narrow band responses

Responses on receivers or duplex transceivers occurring during the immunity test at discrete frequencies which are narrow band responses (spurious responses), are identified by the following method:

- if during an immunity test the quantity being monitored goes outside the specified tolerances (clause 6), it is necessary to establish whether the deviation is due to a narrow band response or to a wide band (EMC) phenomenon. Therefore, the test shall be repeated with the unwanted signal frequency increased, and then decreased by 2 x BWChannel MHz, where BWChannel is the channel bandwidth as defined in TS 38.106 [2], clause 5.3;

- if the deviation disappears in either one or both of the above MHz offset cases, then the response is considered as a narrow band response;

- if the deviation does not disappear, this may be due to the fact that the offset has made the frequency of the unwanted signal correspond to the frequency of another narrow band response. Under these circumstances the procedure is repeated with the increase and decrease of the frequency of the unwanted signal set to 2.5 x BWChannel MHz;

- if the deviation does not disappear with the increased and/or decreased frequency, the phenomenon is considered wide band and therefore an EMC problem and the equipment fails the test.

For immunity test narrow band responses are disregarded.

For EUT capable of multi-band operation, all supported *operating bands* shall be considered for narrowband responses.

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# 7 Applicability overview

## 7.1 Emission

Table 7.1-1: Emission requirements applicability

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Phenomenon | Application | Equipment test requirement | Referenceclause in the  | Referencestandard |
|  |  | NR repeater equipment | Ancillary equipment | present document |  |
| Radiated emission | Enclosure | applicable for NR *repeater type 1-C*(Note 1) | not applicable | 8.2.1 | ITU-R SM.329 [19] |
| Radiated emission | Enclosure of *ancillary equipment* | not applicable | applicable | 8.2.2 | CISPR 32 [5] |
| Conducted emission | DC power input/output port | applicable | applicable | 8.3 | CISPR 32 [5] |
| Conducted emission | AC mains input/output port | applicable | applicable | 8.4 | CISPR 32 [5] |
| Conducted emission | *Telecommunication port* | applicable | applicable | 8.5 | CISPR 32 [5] |
| Harmonic current emissions | AC mains input port | applicable | applicable | 8.6 | IEC 61000-3-2 [8] or IEC 61000-3-12 [11] (NOTE 2) |
| Voltage fluctuations and flicker | AC mains input port | applicable | applicable | 8.7 | IEC 61000-3-3 [9] or IEC 61000-3-11 [10] (NOTE 2) |
| NOTE 1: Radiated emission requirements for NR *repeater type 2-O* are described in clause 8.2.1. NOTE 2: Selection of the reference IEC specification is based on the rated input current of the EUT’s power supply. |

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### 9.2.2 Test method and level

The test method shall be in accordance with IEC 61000‑4‑3 [13], which specified test methodology based on anechoic chamber. The use of reverberation chamber test method according to IEC 61000-4-21 [18], clause 6.1 and Annex D as alternative method is allowed.

The following requirements shall apply:

- The test level shall be 3 V/m amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 kHz;

- The stepped frequency increments shall be 1 % of the momentary frequency;

- The test shall be performed over the frequency range 80 MHz - 6000 MHz; with the exception of the exclusion band for receivers (see clause 4.4.2);

- Responses in stand-alone receivers or receivers which are part of transceivers occurring at discrete frequencies which are narrow band responses, shall be disregarded, see clause 4.3;

- The frequencies selected during the test shall be recorded in the test report.

- For the test method in accordance with IEC 61000-4-3 [13], for repeater operating in FR2 the *spatial exclusion zone* can be chosen to protect the NR repeater’s receiver. For the frequency arrange above 690 MHz (according to the test method in ETSI EN 301 489-50 [22) the EMC RF electromagnetic field immunity requirement applies on the non-radiating faces of the *repeater type 2-O,* as depicted on figure 9.2.2-1..

NOTE: Depending on the BS implementation, application of the spatial exclusion to all radiating faces of the NR repeater may not allow proper execution of the RI testing. In such cases, to protect the *repeater type 2-O* receiver(s), exclusion bands shall be considered, as in table 4.4.2-2.



Figure 9.2.2-1: EMC RF electromagnetic field immunity requirement testing directions for NR *repeater type 2-O* (horizontal plane depicted) with the *spatial exclusion zone* applied

### 9.2.3 Performance criteria

**NR repeater:**

 The performance criteria of clause 6.1 shall apply.

**Ancillary equipment:**

 The performance criteria of clause 6.3 shall apply.

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### 9.3.3 Performance criteria

**NR repeater:**

 The performance criteria of clause 6.2 shall apply.

**Ancillary equipment:**

 The performance criteria of clause 6.4 shall apply.

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### 9.4.3 Performance criteria

**NR repeater:**

 The performance criteria of clause 6.2 shall apply.

**Ancillary equipment:**

 The performance criteria of clause 6.4 shall apply.

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### 9.5.2 Test method and level

The test method shall be in accordance with IEC 61000‑4‑6 [16]:

- The test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 kHz;

- The stepped frequency increments shall be 50 kHz in the frequency range 150 kHz to 5 MHz and 1% frequency increment of the momentary frequency in the frequency range 5 MHz to 80 MHz;

- The test level shall be severity level 2 as given in IEC 61000‑4‑6 [16] corresponding to 3 V rms, at a transfer impedance of 150 Ω;

- The test shall be performed over the frequency range 150 kHz - 80 MHz;

- The injection method to be used shall be selected according to the basic standard IEC 61000-4-6 [16];

- Responses of stand-alone receivers or receivers which are part of transceivers occurring at discrete frequencies which are narrow band responses, shall be disregarded, see clause 4.3;

- The frequencies of the immunity test signal selected and used during the test shall be recorded in the test report.

### 9.5.3 Performance criteria

**NR repeater:**

 The performance criteria of clause 6.1 shall apply.

**Ancillary equipment:**

 The performance criteria of clause 6.3 shall apply.

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### 9.6.3 Performance criteria

For a 0 % residual voltage dip test, the performance criteria for transient phenomena shall be applied:

- Criteria 6.2 for NR repeater

- Criteria 6.4 for *ancillary equipment*

For a 70% residual voltage dip test and for voltage interruption test, the following applies:

1. In the case where the equipment is fitted with or connected to a battery back-up, the following performance criteria shall be applied:

- Criteria 6.2 for NR repeater

- Criteria 6.4 for *ancillary equipment*

2. In the case where the equipment is powered solely from the AC mains supply (without the use of a parallel battery back-up) volatile user data may have been lost and if applicable the communication link need not to be maintained and lost functions should be recoverable by user or operator:

- No unintentional responses shall occur at the end of the test

- In the event of loss of communications link or in the event of loss of user data, this fact shall be recorded in the test report.

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### 9.7.3 Performance criteria

**NR repeater:**

 The performance criteria of clause 6.2 shall apply.

**Ancillary equipment:**

 The performance criteria of clause 6.4 shall apply.

*------------------------------ End of modified section ------------------------------*