**3GPP TSG-RAN WG4 Meeting # 104-e *R4-221????***

**Electronic Meeting, 15 - 26 August 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.114** | **CR** | **CRnum** | **rev** | **-** | **Current version:** | **17.0.1** |  |
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| *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 38.114: Test configurations and radiation (8.1 and 8.2) | | | | | | | | | |
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| ***Source to WG:*** | Nokia, Nokia Shanghai Bell | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_repeaters-Perf | | | | |  | ***Date:*** | | | 2022-08-15 |
|  |  | | | |  | |  | | |  |
| ***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 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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
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| ***Reason for change:*** | | Test configurations and radiated emission requirements for NE repeaters are not defined in the specification. | | | | | | | | |
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| ***Summary of change:*** | | Introducing test configurations and radiated emission requirements based on agreements in RAN4 in Sections 8.1 and 8.2, respectively. | | | | | | | | |
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| ***Consequences if not approved:*** | | The specification is incomplete without test configurations and radiated emission requirements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 8.1 and 8.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 Change 1>

# 8 Emission

## 8.1 Test configurations

This clause defines the configurations for emission tests as follows:

- The equipment shall be tested under normal test conditions as specified in the functional standards;

- The test configuration shall be as close to normal intended use as possible;

- If the equipment is part of a system, or can be connected to ancillary equipment, then it shall be acceptable to test the equipment while connected to the minimum configuration of *ancillary equipment* necessary to exercise the ports;

- If the equipment has a large number of ports, then a sufficient number shall be selected to simulate actual operation conditions and to ensure that all the different types of termination are tested;

- The test conditions, test configuration and mode of operation shall be recorded in the test report;

- Ports which in normal operation are connected shall be connected to an *ancillary equipment* or to a representative piece of cable correctly terminated to simulate the input/output characteristics of the *ancillary equipment*; in case of *repeater type 1-C*, *antenna port*s shall be correctly terminated;

- For *repeater type 2-O* without *antenna ports* but intentionally radiating through the *antenna array*, the equipment shall be placed in a test setup suitable for the radiated power;

- Ports which are not connected to cables during normal operation, e.g. service connectors, programming connectors, temporary connectors etc. shall not be connected to any cables for the purpose of EMC testing. Where cables have to be connected to these ports, or interconnecting cables have to be extended in length in order to exercise the EUT, precautions shall be taken to ensure that the evaluation of the EUT is not affected by the addition or extension of these cables;

- The test arrangements for transmitter and receiver clauses of the transceiver are described separately for the sake of clarity. However, where possible the test of the transmitter clause and receiver clause of the EUT may be carried out simultaneously to reduce test time.

## 8.2 Radiated emission

### 8.2.1 Radiated emission, Repeater

This test is applicable to *repeater type 1-C*. This test shall be performed on a representative configuration of repeater.

For *repeater type 2-O*, the radiated emission is covered by radiated spurious emission requirement in TS 38.106 [x1], conforming to the test requirement in TS 38.115-2 [x2].

#### 8.2.1.1 Definition

This test assesses the ability of repeater to limit unwanted emission from the *enclosure port*.

#### 8.2.1.2 Test method

a) A test site fulfilling the requirements of ITU-R SM.329 [x3] shall be used. The repeater shall be placed on a non-conducting support and shall be operated from a power source via a RF filter to avoid radiation from the power leads. One of the following two alternative measurement methods shall be used:

1) Field strength method measurement

The test method shall be in accordance with CISPR 32 [x4]. The field strength measurements shall be performed on a test site that is validated according to the methods and requirements of CISPR 16-1-4 [x5].

Unless otherwise stated, measurements are conducted at 3 m or 10 m on an open area test site (OATS) or semi anechoic chamber (SAC) for frequencies up to 1 GHz, or at 3 m on a free space open area test site (FSOATS) or fully-anechoic room (FAR) for frequencies above 1 GHz. Unless otherwise stated, all measurements are done with RMS detector and with the -3 dB bandwidth of the measuring filter equal to the reference bandwidth in table 8.2.1.3-1.

NOTE 1: Test site validation methods for radiated emissions tests are defined in CISPR 16-1-4 [x5], clause 6 and 7. Examples of test site validation methods are listed below:

- 30 - 1000 MHz frequency range: Normalized Site Attenuation (NSA), Reference Site Method (RSM).

- 1 - 18 GHz frequency range: SVSWR standard test procedure, SVSWR reciprocal test procedure.

2) Substitution method measurement (also called a substitution method)

Mean power of any spurious components shall be detected by the test antenna and measuring receiver (e.g. a spectrum analyser). At each frequency at which a component is detected, the repeater shall be rotated and the height of the test antenna adjusted to obtain maximum response, and the effective radiated power (e.r.p.) of that component determined by a substitution measurement. The measurement shall be repeated with the test antenna in the orthogonal polarization plane. Unless otherwise stated, all measurements are done as mean power (RMS).

NOTE 2: Effective radiated power (e.r.p.) refers to the radiation of a half wave tuned dipole instead of an isotropic antenna. There is a constant difference of 2.15 dB between e.i.r.p. and e.r.p, as defined in ITU-R SM.329 annex 1 [x3].

e.r.p. (dBm)  EIRP (dBm)  2.15

b) The repeater shall transmit with maximum power declared by the manufacturer with all transmitters active. Set the repeater to transmit a signal as stated in clause 4.5.

c) The received power shall be measured over the frequency range from 30 MHz to FDL,low - ΔfOBUE and from FDL,high + ΔfOBUE up to 12750 MHz. For some *operating bands*, the upper limit is higher than 12.75 GHz in order to comply with the 5th harmonic limit of the downlink *operating band*, as specified in ITU-R SM.329 [x3]. The video bandwidth shall be approximately three times the resolution bandwidth. If this video bandwidth is not available on the measuring receiver, it shall be the maximum available and at least 1 MHz. Unless otherwise stated, all measurements are done as mean power (RMS).

#### 8.2.1.3 Limits

The frequency boundary and reference bandwidths for the detailed transitions of the limits between the requirements for out of band emissions and spurious emissions are based on ITU-R Recommendations SM.329 [x3] and SM.1539 [x6].

The *repeater type 1-C* shall meet the limits below:

Table 8.2.1.3-1: Limits for radiated emissions from Repeater

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Frequency range | e.r.p.  (dBm) | Field strength at 3 m (dBµV/m)  (NOTE 4) | Field strength at 10 m  (dBµV/m)  (NOTE 4) | Reference bandwidth | Notes |
| 30 MHz ≤ f < 1000 MHz | -36 | 65.4 (NOTE 5) | 54.9 (NOTE 5) | 100 kHz |  |
| 1 GHz ≤ f < 12.75 GHz | -30 | 67.4 | Not applicable | 1 MHz |  |
| 12.75 GHz ≤ f < 5th harmonic of the upper frequency edge of the DL operating band in GHz | -30 | 67.4 | Not applicable | 1 MHz | NOTE 1 |
| FDL,low - ΔfOBUE < f < FDL,high +ΔfOBUE | Not defined | Not defined | Not defined | Not defined | NOTE 2,3 |
| NOTE 1: This 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.  NOTE 2: For repeater capable of multi-band operation, the frequency ranges relating to the RF bandwidths of all supported *operating bands* apply.  NOTE 3: ΔfOBUE is defined in clause 6.5.3 of TS 38.106 [x1].  NOTE 4: The field strength measurements shall be conducted on OATS or SAC for frequencies up to 1 GHz, or on FSOATS or FAR for frequencies above 1 GHz.  NOTE 5: Limits for radiated emissions are translated from the e.r.p. limit of -36 dBm into the field strength limit of 61.4 dBµV/m (at 3m) or 50.9 dBµV/m (at 10m), and increased by the site gain value of 4 dB. The value of the site gain is based on ITU-R Recommendations SM.329 [x3]. | | | | | |

#### 8.2.1.4 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the radiated emission measurements described in the present document shall be as follows:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;

- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report;

- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in table 8.2.1-4-1 for repeater.

Table 8.2.1.4-1 specifies the maximum measurement uncertainty of the test system. The test system shall enable the equipment under test to be measured with an uncertainty not exceeding the specified values. All tolerances and uncertainties are absolute values, and are valid for a confidence level of 95 %, unless otherwise stated.

A confidence level of 95 % is the measurement uncertainty tolerance interval for a specific measurement that contains 95% of the performance of a population of test equipment.

Table 8.2.1.4-1: Maximum measurement uncertainty (Repeater)

|  |  |  |
| --- | --- | --- |
| Parameter | Uncertainty for EUT dimension ≤ 1 m  (NOTE 2) | Uncertainty for EUT dimension >1 m  (NOTE 2) |
| Effective radiated RF power between 30 MHz and 180 MHz | ±6 dB | ±6 dB |
| Effective radiated RF power between 180 MHz and 4 GHz | ±4 dB | ±6 dB |
| Effective radiated RF power between 4 GHz and 12,75 GHz | ±6 dB | ±9 dB (NOTE 1) |
| Effective radiated RF power between 12,75 GHz and 26 GHz | ±6 dB | ±9 dB (NOTE 1) |
| Field strength between 30 MHz and 12,75 GHz | ±6 dB | ±6 dB |
| NOTE 1: This value may be reduced to ±6 dB when further information on the potential radiation characteristic of the EUT is available.  NOTE 2: These MU values estimates and are not based on the MU budget calculations. For more background on MU derivation analyses refer to CISPR 16-4-2 [x7] and ETSI TR 100 028-1 [x8]. | | |

NOTE: If the Test System for a test is known to have a measurement uncertainty greater than that specified in table 8.2.1.4-1, this equipment can still be used, provided that an adjustment is made follows:

Any additional uncertainty in the Test System over and above that specified in table 8.2.1.4-1 is used to tighten the test requirements, i.e. making the test harder to pass.

This procedure will ensure that a test system not compliant with table 8.2.1.4-1 does not increase the probability of passing an EUT that would otherwise have failed a test if a test system compliant with table 8.2.1.4-1 had been used.

### 8.2.2 Radiated emission, ancillary equipment

This test is only applicable to *ancillary equipment* not incorporated in the radio equipment and intended to be measured on a stand-alone basis, as declared by the manufacturer. This test shall be performed on a representative configuration of the *ancillary equipment*.

This test is not applicable for *ancillary equipment* incorporated in the radio equipment, or for *ancillary equipment* intended to be measured in combination with the radio equipment. In these cases, the requirements of the relevant product standard for the effective use of the radio spectrum shall apply.

#### 8.2.2.1 Definition

This test assesses the ability of *ancillary equipment* to limit unwanted emission from the *enclosure port*.

#### 8.2.2.2 Test method

The test method shall be in accordance with CISPR 32 [x4].

#### 8.2.2.3 Limits

The *ancillary equipment* shall meet the limits according to CISPR 32 [x4] table A.4 and table A.5.

For the referred limit values, the following shall apply:

- Where the limits value varies over a given frequency range, it changes linearly with respect to the logarithm of the frequency.

- Where there is a step in the relevant limit, the lower value shall be applied at the transition frequency.

Alternatively, for *ancillary equipment* intended to be used in telecommunication centres only, the class A limits given in CISPR 32 [x4], annex A, table A.2 and table A.3 may be used.

## 8.3 Conducted emission DC power input/output port

This test is applicable to equipment which may have DC cables longer than 3 m.

If the DC power cable of the radio equipment is intended to be less than 3 m in length, and intended only for direct connection to a dedicated AC to DC power supply, then the measurement shall be performed only on the AC power input of that power supply as specified in clause 8.4.

This test shall be performed on a representative configuration of the radio equipment, the associated *ancillary equipment*, or representative configuration of the combination of radio and *ancillary equipment*.

### 8.3.1 Definition

This test assesses the ability of radio equipment and *ancillary equipment* to limit internal noise from the DC power input/output ports.

### 8.3.2 Test method

The test method shall be in accordance with CISPR 32 [5] and the Artificial Mains Network (AMN) shall be connected to a DC power source.

In the case of DC output ports, the ports shall be connected via an AMN to a load drawing the rated current of the source.

A measuring receiver shall be connected to each AMN measurement port in turn and the conducted emission recorded.

The equipment shall be installed with a ground plane as defined in CISPR 32 [5]. The reference earth point of the AMN shall be connected to the reference ground plane with a conductor as short as possible.

### 8.3.3 Limits

The equipment shall meet the limits according to CISPR 32 [5] table A.9, which are defined for average detector receiver and for quasi-peak detector receiver. If the average limit is met when using a quasi‑peak detector, the equipment shall be deemed to meet both limits and measurement with the average detector receiver is not necessary.

Where there is a step in the referred limit values, the lower value shall be applied at the transition frequency.

## 8.4 Conducted emissions, AC mains power input/output port

This test is applicable to equipment powered by the AC mains.

This test is not applicable to AC output ports which are connected directly (or via a circuit breaker) to the AC power port of the EUT.

This test shall be performed on a representative configuration of the radio equipment, the associated *ancillary equipment*, or representative configuration of the combination of radio and *ancillary equipment*.

### 8.4.1 Definition

This test assesses the ability of radio equipment and *ancillary equipment* to limit internal noise from the AC mains power input/output ports.

### 8.4.2 Test method

The test method shall be in accordance with CISPR 32 [5].

### 8.4.3 Limits

The equipment shall meet the limits according to CISPR 32 [5] table A.10, which are defined for the average detector receiver and for quasi-peak detector receiver. If the average limit is met when using a quasi‑peak detector, the equipment shall be deemed to meet both limits and measurement with the average detector receiver is not necessary.

For the referred limit values following shall apply:

Where the limits value varies over a given frequency range, it changes linearly with respect to the logarithm of the frequency.

Where there is a step in the relevant limit, the lower value shall be applied at the transition frequency.

Alternatively, for equipment intended to be used in telecommunication centres the limits given in CISPR 32 [5] table A.9 shall be used.

## 8.5 Conducted emissions, telecommunication port

This test is applicable for radio equipment and/or ancillary equipment for fixed use which have telecommunication ports.

This test shall be performed on a representative configuration of radio equipment, the associated *ancillary equipment*, or a representative configuration of the combination of radio and *ancillary equipment*.

### 8.5.1 Definition

This test assesses the EUT unwanted emission present at the *telecommunication ports*.

### 8.5.2 Test method

The test method shall be in accordance with CISPR 32 [5].

### 8.5.3 Limits

The *telecommunication po*rts shall meet the limits according to CISPR 32 [5] table A.12.

For the referred limit values, following shall apply:

Where the limits value varies over a given frequency range, it changes linearly with respect to the logarithm of the frequency.

Where there is a step in the relevant limit, the lower value shall be applied at the transition frequency.

Alternatively, for equipment intended to be used in telecommunication centres only, the limits given in CISPR 32 [5] table A.11 may be used.

## 8.6 Harmonic Current emissions (AC mains input port)

The requirements of IEC 61000‑3‑2 [8] for harmonic current emission apply for equipment covered by the scope of the present document. For equipment with an input current greater than 16 A per phase, IEC 61000-3-12 [11] applies.

## 8.7 Voltage fluctuations and flicker (AC mains input port)

The requirements of IEC 61000‑3‑3 [9] for voltage fluctuations and flicker apply for equipment covered by the scope of the present document. For equipment with an input current greater than 16 A per phase, IEC 61000-3-11 [10] applies.

<End of Change 1>