**3GPP TSG-RAN WG4 Meeting #** **101-e R4-2117585**

**Electronic Meeting, 1 – 12 November, 2021**

**Source:** Ericsson

**Title:** TPs to TS on NR Repeater EMC section 1 (Scope) and section 9 (Immunity)

**Agenda item:** 8.5.4

**Document for:** Approval

# Introduction

During previous RAN4-100e meeting, it was agreed that EMC requirements for NR Repeater will be captured in a new specification. Accordingly, it was decided to split the work and that different companies will prepare different sections of the NR Repeater EMC specification [1]. In this contribution we are providing texts for the section 1 (Scope) and section 9 (Immunity).

# Discussion

Based on the above considerations, we propose the text in the Annex to be incorporated to the TS handling the EMC requirements for NR Repeaters.

# Conclusion

Based on the discussion above, we propose to approve the following:

**Proposal 1:** To approve the proposed text (in the annex) and incorporate it to the TS handling the EMC requirements for NR Repeaters.

# References

1. 3GPP TS 38.114. NR; Repeaters ElectroMagnetic Compatibility (EMC). V.0.1.0

# Annex (Text Proposals)

**--------------Start of text proposal (Section 1)-------------**

# 1 Scope

The present document covers the assessment of NR repeaters in respect of Electromagnetic Compatibility (EMC).

The present document specifies the technical characteristics, applicable test conditions, performance assessment and performance criteria for of NR Repeater and associated ancillary equipment in respect of Electromagnetic Compatibility (EMC). Technical specifications related to the antenna port are not included in the present document.

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

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.

**--------------Start of text proposal (Section 9)-------------**

## 9.2 RF electromagnetic field (80 MHz to 6000 MHz)

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

### 9.2.1 Definition

This test assesses the ability of radio equipment and *ancillary equipment* to operate as intended in the presence of a radio frequency electromagnetic field disturbance at the enclosure.

### 9.2.2 Test method and level

The test method shall be in accordance with IEC 61000‑4‑3 [x], which specified test methodology based on anechoic chamber. The use of reverberation chamber test method according to IEC 61000-4-21 [x], 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 X);

- 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 X;

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

- For the test method in accordance with IEC 61000-4-3[X], for repeater operating in FR2 the *spatial exclusion zone* can be chosen to protect the base station receiver. For the frequency arrange above 690 MHz a level of 10V/m applies on the non-radiating faces of the *repeater*.

### 9.2.3 Performance criteria

**NR Repeater:**

The performance criteria of clause X shall apply.

**Ancillary equipment:**

The performance criteria of clause X shall apply.

## 9.3 Electrostatic discharge

The 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*.

### 9.3.1 Definition

This test assesses the ability of radio equipment and *ancillary equipment* to operate as intended in the event of an electrostatic discharge.

### 9.3.2 Test method and level

The test method shall be in accordance with IEC 61000‑4‑2 [X]:

- for contact discharge, the equipment shall pass at ±4 kV;

- for air discharge shall pass at ±8 kV;

- electrostatic discharge shall be applied to all exposed surfaces of the EUT except where the user documentation specially indicates a requirement for appropriate protective measures.

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### 9.3.3 Performance criteria

**NR Repeater:**

The performance criteria of clause X shall apply.

**Ancillary equipment:**

The performance criteria of clause X shall apply.

## 9.4 Fast transients common mode

The test shall be performed on AC mains power input ports.

This test shall be performed on *signal ports*, *telecommunication ports*, *control ports* and DC power input/outputports if the cables may be longer than 3 m.

Where this test is not carried out on a port or any other ports because the manufacturer declares that it is not intended to be used with cables longer than 3 m, a list of ports which were not tested for this reason shall be included in the test report.

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

### 9.4.1 Definition

This test assesses the ability of radio equipment and *ancillary equipment* to operate as intended in the event of fast transients present on one of the input/output ports.

### 9.4.2 Test method and level

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

- The test level for *signal ports*, *telecommunication ports* and *control ports* shall be 0.5 kV open circuit voltage as given in IEC 61000‑4‑4 [X];

- The test level for DC power input/output ports shall be 0.5 kV open circuit voltage as given in IEC 61000‑4‑4 [X];

- The test level for AC mains power input ports shall be 1 kV open circuit voltage as given in IEC 61000‑4‑4 [X].

### 9.4.3 Performance criteria

**NR Repeater:**

The performance criteria of clause X shall apply.

**Ancillary equipment:**

The performance criteria of clause X shall apply.

## 9.5 RF common mode (0.15 MHz - 80 MHz)

The test shall be performed on AC mains power input/output ports.

This test shall be performed on *signal ports*, telecommunication *port*s, control and DC power input/output ports, which may have cables longer than 3 m.

Where this test is not carried out on a port or any other ports because the manufacturer declares that it is not intended to be used with cables longer than stated above, a list of ports which were not tested shall be included in the test report.

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

### 9.5.1 Definition

This test assesses the ability of radio equipment and *ancillary equipment* to operate as intended in the presence of a radio frequency electromagnetic disturbance.

### 9.5.2 Test method and level

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

- 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 [X] 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 [X];

- 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 subclause X;

- 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 X shall apply.

**Ancillary equipment:**

The performance criteria of clause X shall apply.

## 9.6 Voltage dips and interruptions

The tests shall be performed on AC mains power input ports.

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

### 9.6.1 Definition

These tests assess the ability of radio equipment and *ancillary equipment* to operate as intended in the event of voltage dips and interruptions present on the AC mains power input ports.

### 9.6.2 Test method and level

The following requirements shall apply.

The test method shall be in accordance with IEC 61000‑4‑11 [X].

The test levels shall be:

- Voltage dip: 0 % residual voltage for 0.5 cycle;

- Voltage dip: 0 % residual voltage for 1 cycle;

- Voltage dip: 70 % residual voltage for 25/30 cycles (at 50/60 Hz);

- Voltage interruption: 0 % residual voltage for 250/300 cycles (at 50/60 Hz).

### 9.6.3 Performance criteria

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

- Criteria X for NR Repeater

- Criteria X 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 X for NR Repeater

- Criteria X 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.

## 9.7 Surges, common and differential mode

The tests shall be performed on AC mains power input ports.

This test shall be additionally performed on *telecommunication port*s.

These tests shall be performed on a representative configuration of the repeater, the associated *ancillary equipment*, or representative configuration of the combination of radio and *ancillary equipment*.

### 9.7.1 Definition

These tests assess the ability of radio equipment and *ancillary equipment* to operate as intended in the event of surges being present at the AC mains power input ports and *telecommunication ports*.

### 9.7.2 Test method and level

The test method shall be in accordance with IEC 61000-4-5 [X].

The requirements and evaluation of test results given in clause 9.7.2.1 (t*elecommunication port*s, outdoor cables), clause 9.7.2.2 (*telecommunication ports*, indoor cables) and clause 9.7.2.3 (AC power ports) shall apply, but no test shall be required where normal functioning cannot be achieved, because of the impact of the CDN on the EUT.

#### 9.7.2.1 Test method for telecommunication ports directly connected to outdoor cables

The test level for t*elecommunications port*s, intended to be directly connected to the telecommunications network via outdoor cables, shall be 1 kV line to ground as given in IEC 61000-4-5 [X]. In this case the total output impedance of the surge generator shall be in accordance with the basic standard IEC 61000-4-5 [X].

The test generator shall provide the 1.2/50 μs pulse as defined in IEC 61000-4-5 [X].

#### 9.7.2.2 Test method for telecommunication ports connected to indoor cables

The test level for telecommunication *port*s, intended to be connected to indoor cables (longer than 10 m) shall be 0.5 kV line to ground. In this case the total output impedance of the surge generator shall be in accordance with the basic standard IEC 61000-4-5 [X].

The test generator shall provide the 1.2/50 μs pulse as defined in IEC 61000-4-5 [X].

#### 9.7.2.3 Test method for AC power ports

The test level for AC power input *port*s shall be 2 kV line to ground, and 1 kV line to line, with the output impedance of the surge generator as given in IEC 61000-4-5 [X].

In telecommunication centres 1 kV line to ground and 0.5 kV line to line shall be used.

The test generator shall provide the 1.2/50 μs pulse as defined in IEC 61000-4-5 [X].

### 9.7.3 Performance criteria

**NR Repeater:**

The performance criteria of clause X shall apply.

**Ancillary equipment:**

The performance criteria of clause X shall apply.

**--------------End of text proposal-------------**