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Contents

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

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 [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.

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 ".

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.

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

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).

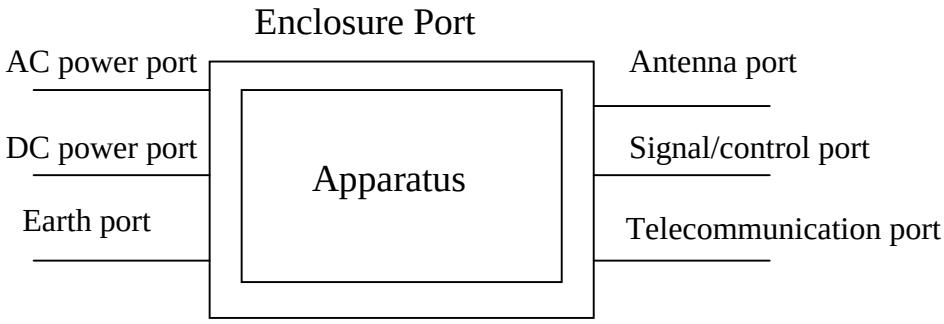

Figure 3.1-1: Examples of ports

repeater: A device that receives, amplifies and transmits the radiated or conducted RF carrier both in the down-link direction (from the base station to the mobile area) and in the up-link direction (from the mobile to the base station). In operating bands specified with only down-link or up-link, only the up-link or down-link as specified for the operating band is repeated.

signal/control port: port intended 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).

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]).

3.2 Symbols

For the purposes of the present document, the following symbols apply:

$BW_{Channel}$ Channel bandwidth

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

AC	Alternating Current
AMN	Artificial Mains Network
CDN	Coupling/Decoupling Network
DC	Direct Current
EMC	Electromagnetic Compatibility
EUT	Equipment Under Test
FR	Frequency Range
NR	New Radio
RF	Radio Frequency
rms	root mean square

4 Test conditions

4.1 General

Texts will be added.

4.2 Arrangements for test signals for NR repeaters

Texts will be added.

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 $BW_{Channel}$ MHz, where $BW_{Channel}$ is the channel bandwidth as defined in TS 38.106 [2], clause x;
- 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 $BW_{Channel}$ 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.

4.4 Exclusion bands

Texts will be added.

4.5 NR repeaters test configurations

Texts will be added.

5 Performance assessment

5.1 General

Texts will be added.

5.2 NR repeaters

Texts will be added.

5.3 Ancillary equipment

At the manufacturer's discretion the test may be performed on the *ancillary equipment* separately or on a representative configuration of the combination of radio and *ancillary equipment*. In each case EUT is tested against all applicable immunity and emission clauses of the present document and in each case, compliance enables the *ancillary equipment* to be used with different radio equipment.

6 Performance criteria

6.1 Performance criteria for continuous phenomena for NR repeaters

Texts will be added.

6.2 Performance criteria for transient phenomena for NR repeaters

Texts will be added.

6.3 Performance criteria for continuous phenomena for Ancillary equipment

The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below the performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible performance loss. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

6.4 Performance criteria for transient phenomena for Ancillary equipment

The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below the performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible performance loss. During the test, degradation of performance is however allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

7 Applicability overview

7.1 Emission

Table 7.1-1: Emission requirements applicability

Phenomenon	Application	Equipment test requirement		Reference clause in the present document	Reference standard
		NR repeater equipment	Ancillary equipment		
Radiated emission	Enclosure	applicable for [repeater TBD] (Note)	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 [repeater TBD] are described in subclause 8.2.1. NOTE 2: Selection of the reference IEC specification is based on the rated input current of the EUT's power supply.					

7.2 Immunity

Table 7.2-1: Immunity requirements applicability

Phenomenon	Application	Equipment test requirement		Reference clause in the present document	Reference standard
		NR repeater equipment	Ancillary equipment		
RF electromagnetic field (80 – 6000 MHz)	Enclosure	applicable	applicable	9.2	IEC 61000-4-3 [13]
Electrostatic discharge	Enclosure	applicable	applicable	9.3	IEC 61000-4-2 [12]
Fast transients common mode	Signal, telecommunications and control ports, DC and AC power input ports	applicable	applicable	9.4	IEC 61000-4-4 [14]
RF common mode 0.15 - 80 MHz	Signal, telecommunications and control ports, DC and AC power input ports	applicable	applicable	9.5	IEC 61000-4-6 [16]
Voltage dips and interruptions	AC mains power input *port*s	applicable	applicable	9.6	IEC 61000-4-11 [17]
Surges, common and differential mode	AC power input *port*s and *telecommunications port*	applicable	applicable	9.7	IEC 61000-4-5 [15]

8 Emission

8.1 Test configurations

Texts will be added.

8.2 Radiated emission

Texts will be added.

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.

9 Immunity

9.1 Test configurations

Texts will be added.

9.2 RF electromagnetic field (80 MHz - 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 [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 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[13], 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 [12]:

- 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.

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/output ports 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 [14]:

- 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 [14];
- The test level for DC power input/output ports shall be 0.5 kV open circuit voltage as given in IEC 61000-4-4 [14];

- The test level for AC mains power input ports shall be 1 kV open circuit voltage as given in IEC 61000-4-4 [14].

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 [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 subclause 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 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 [17].

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 [15].

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 [15]. In this case the total output impedance of the surge generator shall be in accordance with the basic standard IEC 61000-4-5 [15].

The test generator shall provide the 1.2/50 μs pulse as defined in IEC 61000-4-5 [15].

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 [15].

The test generator shall provide the 1.2/50 μs pulse as defined in IEC 61000-4-5 [15].

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 [15].

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 [15].

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.

Annex A (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2021-05	RAN4#99-e	R4-2109916				TS skeleton	0.0.1
2021-11	RAN4#101-e	R4-2118228				Updating TS38.114 to capture RAN4#101 agreements: R4-2118064, TP to TS38.114: Emission, ZTE Corporation R4-2120637, TPs to TS 38.114 on RF Repeater EMC section 1 (Scope) and section 9 (Immunity), Ericsson LM R4-2120638, TP to TS 38.114 for sections 4.3, 5.3, 6.3, 6.4, Huawei R4-2120639, TP to TS 38.114 – applicability overview, Nokia, Nokia Shanghai Bell	0.1.0
2022-01	RAN4#101-bis-e	R4-2200730				Updating TS38.114 to capture RAN4#101-bis agreements: R4-2202986, TP to TS 38.114: References, ZTE Corporation	0.2.0
2022-03	RAN4#102-e	R4-2204494				Updating TS38.114 to capture RAN4#102 agreements: R4-2204358, TP to TS38.114:Definitions, symbols and abbreviations, ZTE Corporation	0.3.0
2022-03	RAN#95-e	RP-220549				Draft version for approval to the RAN Plenary	1.0.0

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2022-03	RAN#95					Approved by plenary – Rel-17 spec under change control	17.0.0
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History

Document history		
V17.0.1	April 2022	Publication