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**Radio Equipment and Systems (RES);
ElectroMagnetic Compatibility (EMC) standard
for digital fixed radio links and ancillary equipment
with data rates at around 2 Mbit/s and above**

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE

Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE

X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

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Foreword

This European Telecommunication Standard (ETS) has been prepared by the Radio Equipment and Systems (RES) Technical Committee of the European Telecommunications Standards Institute (ETSI).

Other ETSs cover radio communications equipment not listed in the scope.

This ETS is based upon the Generic Standards EN 50081-1 [1] and EN 50082-1 [2] and other standards where appropriate, to meet the essential requirements of the Council Directive 89/336/EEC "Council Directive of 3 May 1989 on the approximation of the laws of the Member States relating to Electromagnetic Compatibility" (Official Journal L139 of 23/5/89).

Transposition dates	
Date of adoption of this ETS:	14 February 1996
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Date of withdrawal of any conflicting National Standard (dow):	30 November 1996

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1 Scope

This ETS covers the assessment of Digital Fixed Radio Links and ancillary equipment in respect of ElectroMagnetic Compatibility (EMC). Technical specifications related to the antenna port of the radio equipment are found in the related product standards for the effective use of the radio spectrum.

This ETS specifies the applicable EMC tests, the test methods, the limits and the minimum performance criteria for Digital Fixed Radio Links, operating as fixed point to point systems, with data rates at around 2 Mbit/s and above, in the frequency range 1 - 60 GHz, and the associated ancillary equipment.

The processing and protection switch, (de)modulator, transmitter, receiver, RF filters, branching networks, feeders are covered by this ETS. The multiplexing and/or de-multiplexing elements are covered if they form part of the transmitter, receiver and/or transceiver.

The environmental classification used in this ETS refers to the environment classification used in the Generic Standards EN 50081-1 [1], EN 50082-1 [2] or the telecommunications centre environment ETS 300 386-1 [14].

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

This ETS may not cover those cases where a potential source of interference which is producing individually repeated transient phenomena or a continuous phenomena is permanently present, e.g. a radar or broadcast site in the near vicinity. In such a case it may be necessary to use special protection applied to either the source of interference or the interfered part or both.

Compliance of radio equipment to the requirements of this ETS does not signify compliance to any requirements related to the use of the equipment (i.e. licensing requirements).

Compliance to this ETS does not signify compliance to any safety requirements. However, it is the responsibility of the assessor of the equipment that any observations regarding apparatus becoming dangerous or unsafe as a result of the application of the tests of this ETS, should be recorded in the test report.

2 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] EN 50081-1 (1992): "Electromagnetic compatibility - Generic emission standard - Part 1: Residential, commercial and light industry".
- [2] EN 50082-1 (1992): "Electromagnetic compatibility - Generic immunity standard - Part 1: Residential, commercial and light industry".
- [3] EN 55022 (1994): "Limits and methods of measurement of radio interference characteristics of information technology equipment".
- [4] CISPR 16-1: "Specification for radio disturbance and immunity measuring apparatus and methods; Part 1: Radio disturbance and immunity measuring apparatus".
- [5] ENV 50140: "Electromagnetic compatibility - Basic immunity standard - Radiated, radio frequency electromagnetic field; Immunity test".
- [6] EN 60801-2 (1993): "Electromagnetic compatibility for industrial-process measurement and control equipment - Part 2: Electrostatic discharge requirements".

- [7] IEC 801-4 (1988): "Electromagnetic compatibility for industrial-process measurement and control equipment - Part 4: Electrical fast transient / burst requirements".
- [8] ENV 50141: " Electromagnetic compatibility - Basic immunity standard - Conducted disturbances induced by radio-frequency fields".
- [9] EN 61000-4-11: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 11: Voltage dips, short interruptions and voltage variations immunity tests".
- [10] ENV 50142: "Electromagnetic compatibility - Basic immunity standard - Surge immunity test".
- [11] ITU-T Recommendation G.821: " Error performance of an international digital connection forming part of an integrated services digital network".
- [12] ITU-T Recommendation. G.826: " Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate ".
- [13] IEC 50 (161): "International Electrotechnical Vocabulary - Chapter 161 Electromagnetic compatibility".
- [14] ETS 300 386-1: " Equipment Engineering (EE); Public telecommunication network equipment Electro-Magnetic Compatibility (EMC) requirements; Part 1: Product family overview, compliance criteria and test levels".

3. Definitions

ancillary equipment: Equipment (apparatus), used in connection with a receiver, transmitter or transceiver is considered as an ancillary equipment (apparatus) if:

- the equipment is intended for use in conjunction with a receiver, transmitter or transceiver 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, transmitter or transceiver; and
- the receiver, transmitter or transceiver 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).

continuous phenomena (continuous disturbance): Electromagnetic disturbance, the effects of which on a particular device or equipment cannot be resolved into a succession of distinct effects IEC 50 (161) [13].

port: A particular interface of the specified equipment (apparatus) with the external electromagnetic environment.

enclosure port: The physical boundary of the apparatus onto which an electromagnetic field may radiate or impinge.

radio communications equipment: An apparatus that includes one or more transmitters and/or receivers and/or parts thereof. This type of equipment (apparatus) is used in a fixed application but may be used as transportable equipment (semi fixed) to provide for provisional links.

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 50 (161) [13].

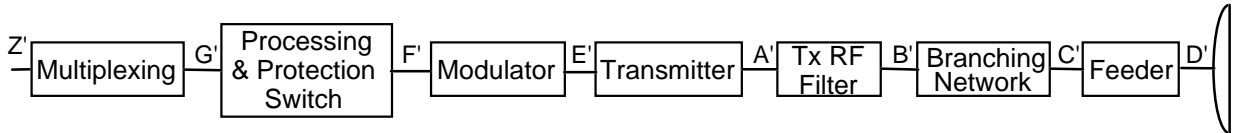
4 General test conditions

This clause defines the general test configuration and is relevant to clauses 8 and 9.

4.1 Test conditions and configurations

This subclause defines the test conditions and configurations for the emission and immunity tests as follows:

- a transmitter shall, as a minimum, comprise the element between E' and A' of figure 1. Additionally the transmitter may comprise any of the other elements from the transmitter chain shown in figure 1. If these additional elements are part of the transmitter or system they shall also meet the requirements of this ETS;

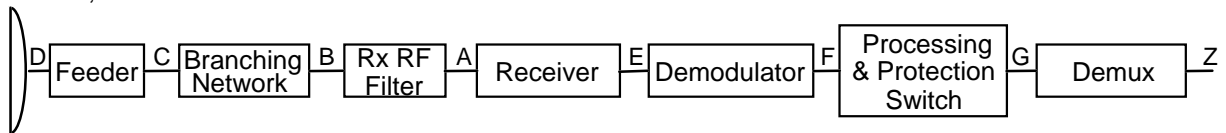


NOTE 1: For the purposes of defining the measurement points, the branching network (B' to C') does not include a hybrid.

NOTE 2: Points B' and C' may coincide, dependent on the equipment configuration.

Figure 1: Elements of a transmitter

- a receiver shall, as a minimum, comprise the element between A and E of figure 2. Additionally the receiver may comprise any of the other elements from the receiver chain shown in figure 2. If these additional elements are part of the receiver or system they shall also meet the requirements of this ETS;



NOTE 1: For the purposes of defining the measurement points, the branching network (B to C) does not include a hybrid.

NOTE 2: Points B and C may coincide, dependent on the equipment configuration.

Figure 2: Elements of a receiver

- a transceiver shall comprise as a minimum the elements E' to A' and A to E shown in figures 1 and 2, and additionally it may comprise any combinations of the other elements. If these additional elements are part of the transceiver they shall also meet the requirements of this ETS;
- the equipment shall be tested under conditions which are within the manufacturer's declared range of humidity, temperature and supply voltage;
- 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;
- 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 impedance of the ancillary equipment, RF input/output ports shall be correctly terminated;

- 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;
- ports which are not connected to cables during normal intended 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 conditions, test configuration and mode of operation shall be recorded in the test report.

4.1.1 Emission tests

This subclause defines the test conditions and configurations for the emission tests as follows:

- the measurement shall be made in the operation mode producing the largest emission in the frequency band being investigated consistent with normal applications;
- an attempt shall be made to maximise the detected radiated emission for example by moving the cables of the equipment.

4.1.2 Immunity tests

This subclause defines the test conditions and configurations for the immunity tests as follows:

- the test configuration shall for transmitters be in accordance with the principle of one of the figures 3, 5 or 6 and for receivers it shall be in accordance with the principle of one of the figures 4, 5 or 6.
- the measuring equipment shall be located outside the test environment. Adequate measures shall be taken to avoid any effects of the unwanted signals on the measuring equipment.

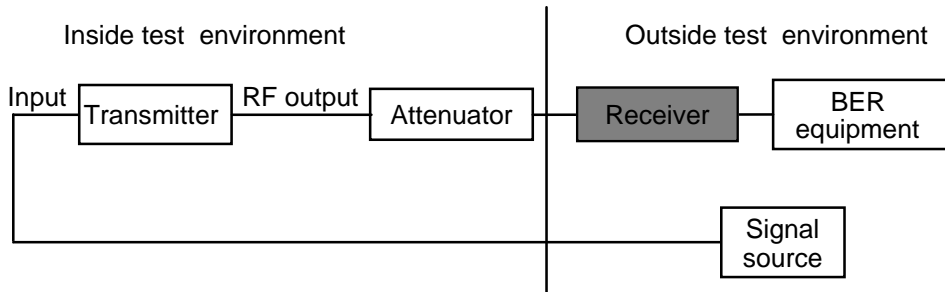


Figure 3: Test configuration for transmitters

During immunity tests the transmitter shall be operated at its rated output power. The input to the transmitter shall be in accordance with subclause 4.1.2.1 (see figure 3). A communication link shall be established at the start of the test and be maintained during the test.

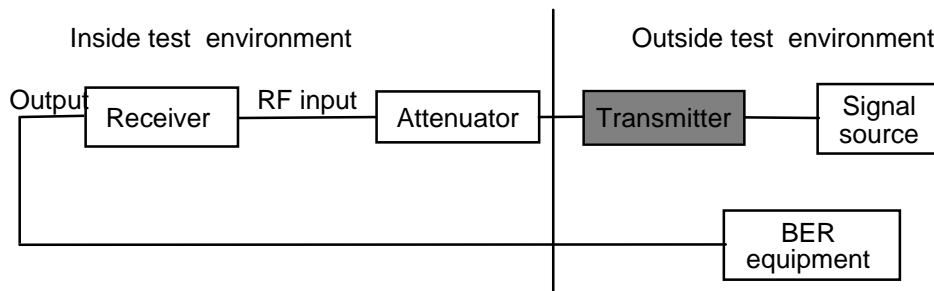


Figure 4: Test configuration for receivers.

During immunity tests for receivers, the wanted RF input signal, coupled to the receiver, shall be in accordance with subclause 4.1.2.3 (see figure 4). A communication link shall be established at the start of the test and be maintained during the test.

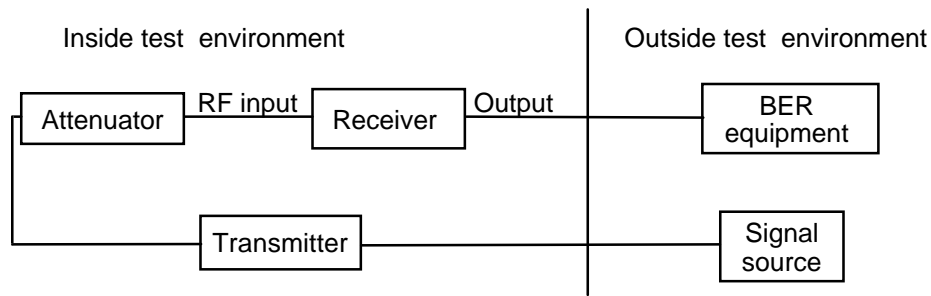


Figure. 5: Test configuration of transceiver, operating on the same Rx and Tx frequency

If the transmitter and receiver in the equipment under test can operate on the same radio frequency, the transmitter with an input as in subclause 4.1.2.1 with its RF output suitably attenuated may be used to constitute the wanted RF input signal to the receiver (see figure 5). A communication link shall be established at the start of the test and be maintained during the test.

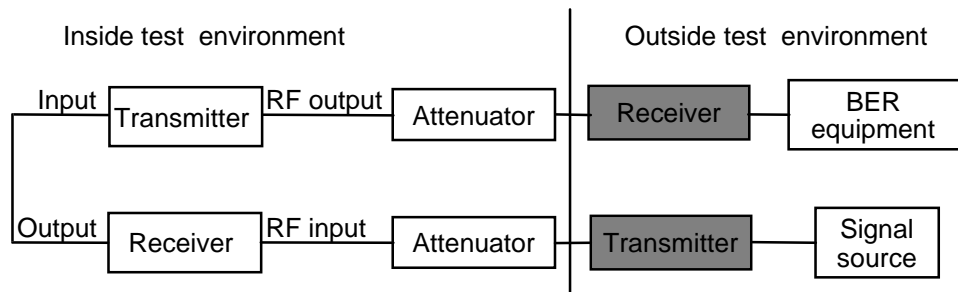


Figure. 6. : Test configuration of transceiver, operating on different RX and TX frequencies

In the case of duplex transceivers where the transmitter and receiver cannot operate at the same radio frequency, the wanted input signal, coupled to the receiver, shall be in accordance subclause 4.1.2.1. The transmitter shall be operated at its rated output power, and with its input coupled to the output of the receiver (repeater mode) (see figure 6). A communication link shall be established at the start of the test and be maintained during the test.

The measurement shall be made in the mode of operation as required in this subclause.

For the immunity tests of ancillary equipment without a separate pass/fail criteria, the receiver, transmitter or transceiver coupled to the ancillary equipment, shall be used to judge whether the ancillary equipment passes or fails.

4.1.2.1 Arrangements for test signals at the input of the transmitter

The input of the transmitter shall be coupled via the normal input connector to the signal source shown in figures 3 to 6.

The wanted signal(s) shall be (a) representative baseband input signal(s) corresponding to normal operation.

4.1.2.2 Arrangements for test signals at the output of the transmitter

To establish a communication link the wanted output signal shall be delivered from the transmitter RF output via suitable attenuation through a coaxial cable or wave guide. Adequate measures shall be taken to minimise the effects of unwanted currents on the external conductor of the coaxial cable or wave guide at the point of entry to the EUT. Mismatch errors may be avoided by placing the attenuators close to the EUT.

If the transmitter RF output cannot be recovered via connection another antenna of the same type may be used to retrieve the wanted output signal from the transmitter.

4.1.2.3 Arrangements for test signals at the input of the receiver

The wanted signal shall be a representative modulated RF input signal corresponding to normal operation.

To establish a communication link the wanted input signal shall be applied to the RF input of the receiver via a coaxial cable or wave guide. Adequate measures shall be taken to minimise the effects of unwanted currents on the external conductor of the coaxial cable or wave guide at the point of entry to the EUT. Mismatch errors may be avoided by placing the attenuators close to the EUT.

If the receiver RF input cannot be applied via connection another antenna of the same type may be used to apply the wanted input signal to the receiver.

The source of the wanted input signal shall be located outside of the test environment and shall be at a nominal value of 30 dB above the receiver input level for a BER of 1×10^{-5} . This level is close to normal operation and sufficient to avoid the broad band noise from the power amplifiers, which generate the disturbing EM phenomena, from influencing the measurement.

4.1.2.4 Arrangements for test signals at the output of the receiver

The output of the receiver shall be coupled via the normal output connectors. The test equipment for evaluating the performance of the equipment shall be located outside the test environment.

5 Performance assessment

5.1 General

The manufacturer shall at the time of submission of the equipment for test, supply the following information to be recorded in the test report:

- the primary functions of the radio equipment to be tested during and after the EMC testing;
- the intended functions of the radio equipment which shall be in accordance with the documentation accompanying the equipment;
- the ancillary equipment to be combined with the radio equipment for testing (where applicable);
- the user control functions and stored data that are required for normal operation and the method to be used to assess whether these have been lost after EMC stress;
- an exhaustive list of ports, classified as either power or signal/control. Power ports shall further be classified as ac or dc power;
- the environment(s) in which the equipment is intended to be used This declaration shall be as indicated in the user instructions.

5.2 Equipment which can provide a communications link

The test arrangement and signals given in clause 4 apply to radio equipment or a combination of a radio equipment and ancillary equipment which permits the establishment of a communications link.

5.3 Equipment which does not provide a communications link

If the equipment is of a specialised nature (see clause 6) which does not permit a communications link to be established, such as protection switching equipment, or ancillary equipment tested in isolation, (i.e. not connected to radio equipment), the manufacturer shall define the method of test to determine the acceptable level of performance or degradation of performance during and/or after the test. The manufacturer shall provide the method of observing the degradation of performance of the equipment.

The performance assessment carried out shall be simple, but at the same time give adequate proof that the primary functions of the equipment are operational.

5.4 Ancillary equipment

At the manufacturers discretion an ancillary equipment may be:

- declared compliant separately (in isolation) from a receiver, transmitter or transceiver to all the applicable immunity and emission clauses of this ETS;
- declared compliant to another appropriate harmonised EMC standard;
- tested with it connected to a receiver, transmitter or transceiver in which case compliance shall be demonstrated to the appropriate clauses of this ETS.

In each case, compliance enables the ancillary equipment to be used with different receivers, transmitters or transceivers.

5.5 Equipment classification

The equipment are classified into the following two grades and for both grades the requirements provided represent "the minimum entry to the market requirement":

- grade A of digital fixed radio link equipment for which no harmonised grade of service is specified;
- grade B of digital fixed radio link equipment for which a harmonised grade of service is specified as in ITU-T Recommendations G.821 [11] and G.826 [12].

6 Performance criteria

The equipment shall meet the minimum performance criteria as specified in table 1 below.

The establishment of the communication link at the start of the test, its maintenance and the assessment of the recovered signal are used as the performance criteria for the evaluation of the essential functions of the equipment during and after the test.

If an equipment is of a specialised nature and the performance criteria specified in the table are not appropriate the manufacturer shall declare a substituted specification for an acceptable performance level or performance degradation as required by this ETS. The performance specification shall be included in the test report and the product description and documentation.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in table 1.

Table 1: Performance criteria (note 1)

Bit rate	Grade A BER (note 3)	Grade B Error rate (note 2)	Loss of function self recovery Grade A only
2 Mbit/s	$<1 \times 10^{-6}$	0	N (note 4)
8 Mbit/s	$<1 \times 10^{-6}$	0	N (note 4)
34 Mbit/s	$<1 \times 10^{-6}$	0	N (note 4)
140 Mbit/s	$<1 \times 10^{-6}$	0	N (note 4)
155 Mbit/s	$<1 \times 10^{-6}$	0	N (note 4)
622 Mbit/s	$<1 \times 10^{-6}$	0	N (note 4)

NOTE 1: Definition of performance levels:
Continuous tests: bit errors/second (calculated and measured over one second).
Transient tests: bit errors/second/transient (one electrical fast transient burst is regarded as one single transient), (calculated and measured over one second).

NOTE 2: To allow for background errors which may occur at any time, the test can be repeated up to three times to determine any correlation between eventual errors and the EMC phenomena. The equipment will pass the test if:

- first test - no errors; or
- first test - errors, second test - no errors; or
- first test - errors, second test - errors, third test - no errors.

NOTE 3: The performance level given in the table shall be met except for equipment which, according to the manufacturer, has a background bit error rate greater than 1×10^{-7} in which case the criterion shall be an increase of the background bit error rate by a factor of 10.

NOTE 4: N: No requirement during the test. Normal operation after the test.

7 Applicability overview tables

7.1 Emission

Table 2

Application	Equipment test requirement	Reference subclause in this ETS	Reference document
	Fixed links & ancillary for fixed use		
Enclosure	applicable	8.1	EN 55022 [3]
DC power input/output port	applicable	8.2	EN 55022 [3] CISPR 16-1 [4]
AC mains power input/output port	applicable	8.3	EN 55022 [3]

7.2 Immunity

Table 3

Phenomena	Application	Equipment test requirement	Reference clause in this ETS	Reference document
		Fixed links & ancillary for fixed use		
RF electromagnetic field 80-1000 MHz	Enclosure	applicable	9.1	ENV 50140 [5]
Electrostatic discharge	Enclosure	applicable	9.2	EN 60801-2 [6]
Fast transients common mode	Signal & control ports, dc & ac power input ports	applicable	9.3	IEC 801-4 [7]
RF common mode 0,15-80 MHz	Signal & control ports, dc & ac power input ports	applicable	9.4	ENV 50141 [8]
Voltage dips and interruptions	AC mains power input ports	applicable	9.5	EN 61000-4-11 [9]
Surges common and differential. mode	AC mains power input ports	applicable	9.6	ENV 50142 [10]

8 Test methods and limits for emission tests

8.1 Enclosure

This test is applicable to radio equipment and ancillary equipment.

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

8.1.1 Definition

This test assesses the ability of transmitters, receivers, transceivers and ancillary equipment to limit spurious emissions from the enclosure.

8.1.2 Test method

The test method for spurious emissions from the enclosure shall be in accordance with EN 55022 [3].

8.1.3 Limits

The value of the limits from EN 55022 [3] (see table 4) shall be used for both grade A and grade B equipment (subclause 5.5). However, the limits in table 5 may be used for equipment in telecommunications centres, ETS 300 386-1 [14], annex B).

Table 4: Limits for unwanted emissions at a measuring distance of 10m

Frequency range	Limit (quasi-peak)
30 - 230 MHz	30 dB μ V/m
> 230 - 1000 MHz	37 dB μ V/m

Table 5: Limits for unwanted emissions at a measuring distance of 10m applied in telecommunication centres

Frequency range	Limit (quasi-peak)
30 - 230 MHz	40 dB μ V/m
> 230 - 1000 MHz	47 dB μ V/m

8.2 DC power input/output port

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

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

8.2.1 Definition

This test assesses the ability of transmitters, receivers, transceivers and ancillary equipment to limit their internal noise from the dc power input/output ports.

8.2.2 Test method

For equipment with a current consumption below 16 A the test method shall be in accordance with EN 55022 [3] and the Line Impedance Stabilising Networks (LISNs) shall be connected to a dc power source.

For equipment with a current consumption above 16 A the dc power ports shall be connected to 5 μ H (LISNs), with 50 Ω measurement ports. The LISNs shall be in accordance with the requirements of section two of CISPR 16-1 [4].

A measuring receiver shall be connected to each LISN measurement port in turn and the conducted emission recorded. The LISN measurement ports not being used for measurement shall be terminated with a 50 Ω load.

The equipment shall be installed with a ground plane as defined in EN 55022 [3], subclause 9.1.1. The reference earth point of the LISNs shall be connected to the reference ground plane with a conductor as short as possible.

The measurement receiver shall be in accordance with the requirements of section one of CISPR 16-1 [4].

8.2.3 Limits

The equipment shall meet the limits below (including the average limit and the quasi-peak limit) when using, respectively, an average detector receiver and a quasi-peak detector receiver and measured in accordance with the method described in subclause 8.2.2 above. 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 unnecessary.

The following limits shall apply:

Table 6: limits of conducted emissions

Frequency range	Quasi-peak	Average
>0,15-0,5 MHz	79 dB μ V	66 dB μ V
> 0,5-30 MHz	73 dB μ V	60 dB μ V

Additionally the limits in table 7 shall apply for telecommunication centres (ETS 300 386-1 [14] annex B).

Table 7: limit of conducted emissions for telecommunication centres

Frequency range	Average
0,02- 0,15 MHz	79 dB μ V

8.3 AC mains power input/output port

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

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

8.3.1 Definition

This test assesses the ability of transmitters, receivers, transceivers and ancillary equipment to limit internal noise from the ac mains power input/output ports.

8.3.2 Test method

The test method shall be in accordance with EN 55022 [3].

8.3.3 Limits

The value of the limits from EN 55022 [3] (see table 8) shall be used for both grade A and grade B equipment (subclause 5.5). However, the limits in table 9 may be used for equipment in telecommunication centres (ETS 300 386-1 [14], annex B).

Table 8: Limits of conducted emission

Frequency range	Quasi-peak	Average
0,15-0,5 MHz	66-56 dB μ V	56-46 dB μ V
0,5-5 MHz	56 dB μ V	46 dB μ V
5-30 MHz	60 dB μ V	50 dB μ V
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

Table 9: Limits of conducted emission applied in telecommunication centres

Frequency range	Quasi-peak	Average
0,15-0,5 MHz	79 dB μ V	66 dB μ V
> 0,5-30 MHz	73 dB μ V	60 dB μ V

9 Test methods and levels for immunity tests

9.1 Radio frequency electromagnetic field (80-1000 MHz)

This test is applicable to radio communications equipment and ancillary equipment.

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

9.1.1 Definition

This test assesses the ability of transmitters, receivers, transceivers and ancillary equipment to operate as intended in the presence of a radio frequency electromagnetic field disturbance.

9.1.2 Test method and level

The test method shall be in accordance with ENV 50140 [5] except that the following requirements and evaluation of test results shall apply:

- the test level shall be 3 V/m unmodulated. The test signal shall then be amplitude modulated to a depth of 80 % by a sinusoidal audio signal at 1 kHz;
- the stepped frequency increments shall be 1 % of the momentary frequency;
- the test shall be performed over the frequency range 80 - 1000 MHz;
- the test shall be carried out on one surface. The surface selected to face the source of the interference signal shall be the one anticipated by the test house to be the most susceptible;
- the frequencies selected during the test shall be recorded in the test report.

9.1.3 Performance criteria

The performance criteria for grade A equipment and for grade B equipment as given in table 1, clause 6, shall apply.

For ancillary equipment the pass/fail criteria supplied by the manufacturer shall apply, unless the ancillary is tested in connection with receivers, transmitters or transceivers in which case the corresponding performance criteria above shall apply.

9.2 Electrostatic discharge

This test is applicable to radio communications equipment and ancillary equipment.

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

9.2.1 Definition

This test assesses the ability of transmitters, receivers, transceivers and ancillary equipment to operate as intended in the event of an electrostatic discharge.

9.2.2 Test method and level

The test method shall be in accordance with EN 60801-2 [6].

For transmitters, receivers, transceivers and ancillary equipment the following requirements and evaluation of test results shall apply:

- for contact discharge, the equipment shall be tested at ± 2 kV and ± 4 kV; for air discharge, the equipment shall be tested at ± 2 kV, ± 4 kV and ± 8 kV (EN 60801-2 [6] clause 5).
- electrostatic discharges shall be applied to all exposed surfaces of the equipment except where the user documentation specifically indicates a requirement for appropriate protective measures (EN 60801-2 [6] subclause 8.3.1).

9.2.3 Performance criteria

The performance criteria for grade A equipment and for grade B equipment as given in table 1, clause 6, shall apply.

For ancillary equipment the pass/fail criteria supplied by the manufacturer shall apply, unless the ancillary is tested in connection with receivers, transmitters or transceivers in which case the corresponding performance criteria above shall apply.

9.3 Fast transients common mode

This test is applicable to radio communications equipment and ancillary equipment.

This test shall be performed on ac mains power input ports.

This test shall be performed on signal ports, control ports and dc power input ports if the cables may be longer than 3 m.

Where this test is not carried out on any port 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 or a representative configuration of the combination of radio and ancillary equipment.

9.3.1 Definition

This test assesses the ability of transmitters, receivers, transceivers and ancillary equipment to operate as intended in the event of fast transients on one of the input/output ports.

9.3.2 Test method and level

For transmitters, receivers, transceivers and ancillary equipment, which may have longer cables than 3 m, or are connected to the ac mains, the test method shall be in accordance with IEC 801-4 [7] except that the following requirements and evaluation of test results shall apply:

- the test level for signal and control ports shall be 1 kV open circuit voltage as given in IEC 801-4 [7] clause 5.
- the test level for dc power input ports shall be 1 kV open circuit voltage as given in IEC 801-4 [7] clause 5.
- the test level for ac mains power input ports shall be 2 kV open circuit voltage as given in the table of IEC 801-4 [7] clause 5.

For ac and dc power input ports the transients shall be applied (in parallel) to all the wires in the cable with reference to the cabinet reference ground (true common mode) the source impedance shall be 50 Ω .

9.3.3 Performance criteria

The performance criteria for grade A equipment and for grade B equipment as given in table 1 (clause 6) shall apply.

For ancillary equipment the pass/fail criteria supplied by the manufacturer shall apply, unless the ancillary is tested in connection with receivers, transmitters or transceivers in which case the corresponding performance criteria above shall apply.

9.4 RF common mode, 0,15 MHz - 80 MHz (current clamp injection)

This test is applicable to radio communications equipment and ancillary equipment.

This test shall be performed on signal, control, dc power and ac mains power input ports of the equipment and ancillary equipment, which may have cables longer than 1 m.

Where this test is not carried out on any port because the manufacturer declares that it is not intended to be used with cables longer than 1 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 or a representative configuration of the combination of radio and ancillary equipment.

9.4.1 Definition

This test assesses the ability of transmitters, receivers, transceivers and ancillary equipment to operate as intended in the presence of a radio frequency electromagnetic disturbance on the input/output ports.

9.4.2 Test method and level

The test method shall be the current clamp injection method in accordance with ENV 50141 [8], except that the following requirements and evaluation of test results shall apply:

- the test shall be performed over the frequency range 150 kHz - 80 MHz;
- the stepped frequency increments shall be 50 kHz in the frequency range 150 kHz - 5 MHz and 1 % frequency increment of the momentary frequency in the frequency range 5 MHz - 80 MHz;
- the test level shall be severity level 2 as given in ENV 50141 [8] corresponding to 3 V rms;
- no intrusive or direct connection shall be made to any of the lines of any input/output port, therefore the current clamp injection method shall be used;
- the frequencies selected during the test shall be recorded in the test report.

9.4.3 Performance criteria

The performance criteria for grade A equipment and for grade B equipment as given in clause 6, table 1 shall apply.

For ancillary equipment the pass/fail criteria supplied by the manufacturer shall apply, unless the ancillary is tested in connection with receivers, transmitters or transceivers in which case the corresponding performance criteria above shall apply.

9.5 Voltage dips and interruptions

These tests are applicable to radio communications equipment and ancillary equipment.

These tests shall be performed on ac mains power input ports.

These test shall be performed on a representative configuration of the equipment or a representative configuration of the combination of radio and ancillary equipment.

9.5.1 Definition

These tests assesses the ability of transmitters, receivers, transceivers and ancillary equipment to operate as intended in the event of voltage dips and interruptions on the ac mains power input ports.

9.5.2 Test method and level

The test method shall be in accordance with EN 61000-4-11 [9] except that the following requirements and evaluation of test results shall apply.

The test levels shall be:

- a voltage dip corresponding to a reduction of the supply voltage of 60 % for 100 ms; and
- a voltage interruption corresponding to a reduction of the supply voltage of > 95 % for 5 s.

9.5.3 Performance criteria

The performance criteria for grade A equipment and for grade B equipment as given in clause 6, table 1 shall apply for a voltage dip corresponding to a reduction of the supply voltage of 60 % for 100 ms.

For ancillary equipment the pass/fail criteria supplied by the manufacturer shall apply, unless the ancillary is tested in connection with receivers, transmitters or transceivers in which case the corresponding performance criteria above shall apply.

The following performance criteria shall apply for a voltage interruption corresponding to a reduction of the supply voltage of > 95 % for 5 s:

- for grade A equipment and for grade B equipment the performance criteria as given in clause 6, table 1 shall apply where the equipment is fitted with or connected to a battery back-up;
- where the equipment is powered solely from the ac mains supply (without parallel battery back-up) the communications link need not be maintained and may have to be re-established. For grade A equipment volatile user data may have been lost, grade B equipment shall recover without intervention and without the loss of user data.

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

9.6 Surges common and differential mode

These tests are applicable to radio communications equipment and ancillary equipment.

These tests shall be performed on ac mains power input ports and signal ports intended to be connected to extensive telecommunications networks.

These test shall be performed on a representative configuration of the equipment or a representative configuration of the combination of radio and ancillary equipment.

9.6.1 Definition

These tests assess the ability of transmitters, receivers, transceivers and ancillary equipment to operate as intended in the event of surges on the ac mains power input ports and, where applicable, signal ports.

9.6.2 Test method and level

The test method shall be in accordance with ENV 50142 [10] except that the following requirements and evaluation of test results shall apply:

- the test level shall be 1 kV open circuit voltage for common mode and 0,5 kV open circuit voltage for differential mode;
- the surges shall be applied (in parallel) to all the wires in the cable with reference to the cabinet reference ground, (true common mode), the series resistance shall be 10 Ω .

9.6.3 Performance criteria

The performance criteria for grade A equipment and for grade B equipment as given in clause 6, table 1 shall apply.

For ancillary equipment the pass/fail criteria supplied by the manufacturer shall apply, unless the ancillary is tested in connection with receivers, transmitters or transceivers in which case the corresponding performance criteria above shall apply.

History

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