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Radio Equipment and Systems (RES); ElectroMagnetic Compatibility (EMC) standard for On-Site Paging equipment

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 4 92 94 42 00 - Fax: +33 4 93 65 47 16

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Foreword

This European Telecommunication Standard (ETS) has been produced by the European Telecommunications Standards Institute (ETSI) in response to a mandate from the European Commission issued under Council Directive 83/189/EEC (as amended) laying down a procedure for the provision of information in the field of technical standards and regulations.

This ETS is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility ("the EMC Directive") (89/336/EEC as amended).

Technical specifications relevant to the EMC Directive are given in annex A.

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

This ETS is based on EN 50081-1 [2] and EN 50082-1 [3] and other standards where appropriate.

Transposition dates	
Date of adoption:	6 June 1997
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1 Scope

This European Telecommunication Standard (ETS) covers the assessment of on-site paging equipment and ancillary equipment, used in privately owned and operated paging systems, in respect of ElectroMagnetic Compatibility (EMC). Technical specifications related to the antenna port and emissions from the enclosure port of the radio equipment are not included in this ETS. Such technical specifications are found in the radio product standard ETS 300 224 [1].

This ETS specifies the applicable EMC tests, the method of measurements, the limits and the minimum performance criteria for on-site paging equipment, as specified in ETS 300 224 [1], operating on frequencies between 9 kHz and 470 MHz and the associated ancillary equipment.

The environment classification used in this ETS refers to the environment classification used in the Generic Standards EN 50081-1 [2], EN 50082-1 [3].

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.

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 spectrum management or any requirement related to the use of the equipment (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 observation regarding the equipment 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] ETS 300 224: "Radio Equipment and Systems (RES); On-site paging service Technical and functional characteristics for on-site paging systems, including test methods".

[2] EN 50081-1: "Electromagnetic compatibility - Generic emission standard. Part 1: Residential, commercial and light industry".

[3] EN 50082-1: "Electromagnetic compatibility - Generic immunity standard. Part 1: Residential, commercial and light industry".

[4] 89/336/EEC: "Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility".

[5] EN 55022 (1994): "Limits and methods of measurement of radio disturbance characteristics of information technology equipment".

[6] CISPR 16-1 (1993): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1: Radio disturbance and immunity measuring apparatus".

[7] EN 61000-4-3: "Electromagnetic Compatibility (EMC) - Part 4: Testing and measurements techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test".

[8] EN 61000-4-2 (1995): "Electromagnetic Compatibility (EMC) - Part 4: Testing and measurements techniques - Section 2: Electrostatic discharge immunity test. Basic EMC publication".

[9] EN 61000-4-4 (1995): "Electromagnetic Compatibility (EMC); Part 4: Testing and measurements techniques - Section 4: Electrical fast transient/burst immunity test. Basic EMC publication".

[10] EN 61000-4-6 (1996): "Electromagnetic Compatibility (EMC) - Part 4: Testing and measurements techniques - Section 6: Immunity to conducted disturbances induced by radio-frequency fields".

[11] EN 61000-4-11 (1994): "Electromagnetic Compatibility (EMC); Part 4: Testing and measurements techniques - Section 11: Voltage dips, short interruptions and voltage variations immunity tests".

[12] EN 61000-4-5: "Electromagnetic Compatibility (EMC) - Part 4: Testing and measurements techniques - Section 5: Surge immunity test".

3 Definitions, abbreviations and symbols

3.1 Definitions

For the purposes of this ETS, the following definitions apply:

alignment range: The frequency range over which the receiver or transmitter can be programmed and/or re-aligned to operate without any physical change of components other than programmable read only memories or crystals.

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

- if the equipment can not be used on a stand alone basis to provide user functions independently of a receiver, transmitter or transceiver; and

- if 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).

Examples of ancillary equipment to pocket paging receivers (transceivers) are single or multiple storage racks with or without absence/presence signalling.

calling function: Transmitting of a message via the base transmitter to the pocket receiver in order to alert and/or inform the carrier of the pocket receiver.

enclosure port: The physical boundary of the apparatus through which electromagnetic fields may radiate or impinge.

manufacturer: The legal entity under the terms of Council Directive 89/336/EEC [4] for placing the product on the market.

on-site paging equipment: A pocket receiver, a pocket transmitter, a pocket transceiver, a base transmitter or a base receiver, as defined in ETS 300 224 [1], used in a privately owned and operated paging system in a restricted and predefined area. The radio type of equipment operates in the frequency range 25 MHz to 470 MHz, and the loop type of equipment operates in the frequency range 16 kHz to 146 kHz.

pocket receiver: A stand alone pocket paging receiver or a receiver being part of a pocket paging transceiver.

pocket transmitter: A stand alone pocket paging transmitter using the return channel, or a transmitter being part of a pocket paging transceiver.

port: A particular interface, of the specified equipment (apparatus), with the electromagnetic environment (see figure 1).

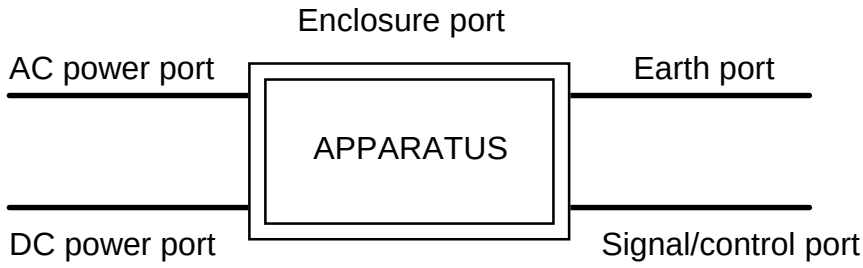

Figure 1: Examples of ports

talk-back function: Transmitting of a message from the pocket transmitter (normally combined in a transceiver) which is sent to a central receiver and further processed by the central processing unit.

3.2 Abbreviations

For the purposes of this ETS, the following abbreviations apply:

CR	Continuous phenomena applied to Receivers
CT	Continuous phenomena applied to Transmitters
EMC	ElectroMagnetic Compatibility
EUT	Equipment Under Test
LISN	Line Impedance Stabilizing Network
RF	Radio Frequency
TR	Transient phenomena applied to Receivers
TT	Transient phenomena applied to Transmitters

3.3 Symbols

For the purposes of this ETS, the following symbols apply:

AC	Alternating Current
DC	Direct Current

4 Test conditions

4.1 General

The equipment shall be tested under conditions contained in the relevant product and basic standards or in the information accompanying the equipment, which are within the manufacturers declared range of humidity, temperature and supply voltage. The test conditions shall be recorded in the test report.

The test configuration shall be as close to normal intended use as possible and shall be recorded in the test report.

For immunity tests the test modulation, test arrangements etc., as specified in this ETS, subclauses 4.2 to 4.11 shall apply and the conditions shall be as follows:

- the base transmitter shall operate in the standby mode, except for the spot frequency test of the radio frequency electromagnetic field immunity test (subclause 9.2) where the transmitter shall be operated at its maximum rated output power, modulated with normal test modulation (subclause 4.2);

- the standby mode of the base transmitter is the mode of operation in which the transmitter is ready to transmit, waiting for a start control signal to actual start transmitting;

- for pocket receivers, the message memory of the receiver memory shall be loaded with recognisable messages. The receiver shall operate in the standby mode, except for the spot frequency test of the radio frequency electromagnetic field immunity test (subclause 9.2) where repetitive calls shall be coupled to the input of the receiver;

- the standby mode of the pocket receiver is the mode of operation in which the receiver is capable of receiving calls;

- for pocket transmitters, the transmitter shall operate unmodulated (if possible) at its maximum rated output power. If unmodulated operation is not possible, the manufacturer shall specify the method of performance assessment and the acceptable degradation of performance;

- the standby mode of the pocket transmitter is the mode of operation in which the transmitter is ready to transmit waiting for a command from the press to transmit button;

- for the base receivers, the wanted Radio Frequency (RF) input signal shall be unmodulated.

The standby mode of the base receiver is the mode of operation in which the receiver is capable to receive.

4.2 Normal test modulation

The test modulation signal, to be used for the calling function, is a signal representing selective messages generated by a signal generator or encoded within the equipment. The signal generator used should be a test signal generator supplied by the manufacturer and capable of generating repetitive calls. For transmitters not having a modulation input port the internal equipment modulation shall be used, and a repetitive call possibility shall be available.

The talk-back facility shall be tested with an unmodulated carrier, if possible.

4.3 Arrangements for test signals at the input of the base transmitter

The signal generator to be used for the normal test modulation (subclause 4.2) shall be located outside the test environment and connected to the modulation input port of the transmitter. Adequate measures shall be taken to protect the measuring equipment from the effect of all the radiated fields within the test environment.

4.4 Arrangements for test signals at the output of the base transmitter

Where the transmitter incorporates an RF antenna connector, the output signal shall be delivered from that connector by a shielded transmission line, such as a coaxial cable, to the receiving/measuring equipment outside of the test environment.

Adequate measures shall be taken to avoid the effect of unwanted signals on the measuring equipment.

Where the transmitter does not incorporate an RF connector, the output signal shall be delivered from the transmitter to an antenna located within the test environment. This antenna shall be connected by a shielded transmission line, such as a coaxial cable, to the measuring equipment located outside of the test environment.

For the spot frequency test of the radio frequency electromagnetic field immunity test (subclause 9.2) the measuring equipment should be a paging receiver and repetitive calls shall be transmitted and coupled to the input of the paging receiver located outside the test environment.

4.5 Arrangements for test signals at the input of the pocket receiver

The manufacturer shall at the time of submitting the equipment for testing, supply, if necessary, a test fixture and a message generator to generate the wanted input signal.

The source of the wanted input signal, modulated with normal test modulation (subclause 4.2), shall be located outside the test environment and the signal level used shall be chosen to a value significantly above the threshold sensitivity but below the overload characteristics of the receiver (the suggested value is 60 dB above the threshold sensitivity, if possible). Adequate measures shall be taken to protect the measuring equipment from the effect of all the radiated fields within the test environment.

Where the receiver incorporates an RF antenna connector, the RF signal source shall be coupled to the input of the receiver via a shielded transmission line such as a coaxial cable.

Where the receiver does not incorporate an RF connector, the RF signal source shall be presented to the receiver from another antenna located within the test environment. This antenna shall be coupled to the RF signal source via an adjustable attenuator.

4.6 Arrangements for test signals at the output of the pocket receiver

From the performance check before and after the test it shall be possible to assess the performance of the pocket receiver from the presented messages and/or the call received alert signal(s) of the receiver.

During the spot frequency test of the radio frequency electromagnetic field immunity test (subclause 9.2) the call received alert signal output of the receiver shall be coupled to the outside of the test environment and it shall be possible to assess the performance of the equipment from the call received alert signal(s) of the receiver.

4.7 Arrangements for test signals at the output of the pocket transmitter

The measuring equipment used to monitor the output signal of the transmitter shall be located outside the test environment. Adequate measures shall be taken to protect the measuring equipment from the effect of all the radiated fields within the test environment.

Where the transmitter incorporates an RF antenna connector, the output signal of the transmitter shall be coupled to the measuring equipment via a shielded transmission line such as a coaxial cable.

Where the transmitter does not incorporate an RF connector, the output signal of the transmitter shall be coupled to an antenna located within the test environment. This antenna shall be coupled by a shielded transmission line to the measuring equipment located outside of the test environment.

4.8 Arrangements for test signals at the input of the base receiver

The source of the wanted input signal shall be located outside the test environment and the signal level used shall be chosen to be a value significantly above the threshold sensitivity but below the overload characteristics of the receiver (the suggested value is 60 dB above the threshold sensitivity, if possible). Adequate measures shall be taken to protect the measuring equipment from the effect of all the radiated fields within the test environment.

Where the receiver incorporates an RF antenna connector, the RF signal source shall be coupled to the input of the receiver via a shielded transmission line such as a coaxial cable.

Where the receiver does not incorporate an RF connector, the RF signal source shall be presented to the receiver from another antenna located within the test environment. This antenna shall be coupled to the RF signal source via an adjustable attenuator.

4.9 Arrangements for test signals at the output of the base receiver

The audio frequency output of the receiver shall be coupled to the measuring equipment, located outside the test environment. If the receiver does not have an audio frequency output, the manufacturer shall specify the method of performance assessment and the comparable degradation of performance.

4.10 Exclusion bands

Exclusion bands are determined frequency bands for which the Equipment Under Test (EUT) is excluded from RF immunity tests.

4.10.1 Exclusion bands for receivers

The exclusion band for receivers (including receivers of pocket transceivers), is the frequency range determined by the alignment range, as declared by the manufacturer, extended as follows:

- for receivers operating in the frequency band 25 MHz to 80 MHz, the lower frequency of the exclusion band is the lower frequency of the alignment range minus 10 % of the centre frequency of the alignment range or minus 5 MHz, whichever is greater. For such receivers the upper frequency of the exclusion band is the upper frequency of the alignment range plus 10 % of the centre frequency of the alignment range or plus 5 MHz, whichever is greater;

- for receivers operating in the frequency band 80 MHz to 470 MHz, the lower frequency of the exclusion band is the lower frequency of the alignment range minus 5 % of the centre frequency of the alignment range or 10 MHz, whichever is greater. For such receivers the upper frequency of the exclusion band is the upper frequency of the alignment range plus 5 % of the centre frequency of the alignment range or plus 10 MHz, whichever is greater.

4.10.2 Exclusion band for transmitters

For transmitters operating, or intended to operate, in a channelled frequency band, the exclusion band is five times the channel spacing designated to that service in the used frequency band, centred around the operating frequency.

4.11 Narrowband responses on receivers

Responses of receivers or receivers of transceivers occurring during the test at discrete frequencies which are narrow band responses (spurious responses) are identified by the following method.

If during the test the unwanted signal causes a non acceptable degradation in performance (subclause 6.3), it is necessary to establish whether this is due to a narrow band response or to a wideband phenomenon. Therefore, the unwanted signal frequency is increased by an amount equal to twice the nominal bandwidth of the receiver pre-demodulation filter, as declared by the manufacturer. The test is repeated with the frequency of the unwanted signal decreased by the same amount.

If the degradation in performance becomes acceptable again (subclause 6.3), then the response is considered to be a narrow band response.

If the degradation in performance is still not acceptable, this may be due to the fact that the offset has made the frequency of the unwanted signal correspond to the frequency of another narrowband response. Under these circumstances the procedure is repeated with the increase and decrease of the frequency of the unwanted signal adjusted two and a half times the bandwidth previously referred to. If the degradation in performance remains unacceptable (subclause 6.3), the phenomenon is considered wideband and therefore an EMC problem and the equipment fails the test.

Narrow band responses shall be disregarded.

5 Performance assessment

5.1 General

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

- the ancillary equipment to be combined with the radio paging equipment for testing;

- the method to be used to verify that a communication link is established and maintained;

- 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 AC power, DC power or signal/control;

- the bandwidth of the pre-demodulation filter immediately preceding the demodulator.

5.2 Standard paging equipment

If the equipment is radio paging equipment of a non-specialized nature or radio paging equipment combined with an ancillary equipment, the test conditions required in clause 4 shall apply.

The performance assessment of the base transmitter and pocket receiver during immunity tests is based on unintentional behaviour of the equipment, except during the spot frequency immunity test where the performance will be established by assessment of successful transfer of a paging calls.

The performance assessment of the pocket transmitter and the base receiver during immunity tests is based on the audio breakthrough level of the 400 Hz signal from the interference source, measured with an unmodulated wanted carrier.

5.3 Special equipment and stand alone tested ancillary equipment

For radio equipment of a specialized nature and/or ancillary equipment tested on a stand alone basis 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. Under these circumstances the manufacturer also shall provide the following information:

- the primary functions of the equipment to be tested during and after EMC stress;

- the intended functions of the EUT which shall be in accordance with the documentation accompanying the equipment;

- the pass/failure criteria for the equipment;

- the method of observing a degradation of performance of the equipment.

The assessment of the performance or the degradation of performance which shall be carried out during and/or at the conclusion of the tests, shall be simple, but at the same time give adequate proof that the primary functions of the equipment are operational.

5.4 Equipment classification

Pocket equipment or combinations of equipment declared as being capable of being powered for intended use by AC mains shall additionally be considered as base station equipment.

5.5 Ancillary equipment

At the manufacturer's discretion an ancillary equipment may be:

- tested separately (in isolation) from a receiver, transmitter or transceiver to all the applicable immunity and emission clauses of this ETS;

- declared compliant to an appropriate harmonized EMC standard;

- tested with it connected to a receiver, transceiver or transmitter, 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.

6 Performance criteria

The equipment shall meet the minimum performance criteria specified in subclauses 6.1, 6.2, 6.3 and 6.4.

The base transmitter and pocket receiver, for all immunity tests according to this ETS, except the spot frequency test of the radio frequency electromagnetic field immunity test (subclause 9.2), shall be assessed for:

- the transmission of recognisable messages and the storage of these messages in the memory of the receiver before the test;

- unintentional responses of the receiver or transmitter during the test;

- the maintenance of the receiver memory assessed at the conclusion of the test;

- the ability to transmit messages and to receive and store these messages at the conclusion of the test and for the spot frequency test of the radio frequency electromagnetic field immunity test (subclause 9.2) the base transmitter and pocket receiver shall be assessed for the successful transmission of a call by the resulting call received alert signal.

For the spot frequency test of the radio frequency immunity test (subclause 9.2) the base transmitter and pocket receiver shall be assessed for the successful transmission of a call by the resulting call received alert signal.

The base receiver and pocket transmitter, for all immunity tests according to this ETS, shall be assessed for:

- the establishment of a communication link at the start of the test;

- the level of the 400 Hz signal from the interference source, measured with an unmodulated wanted carrier, during the test;

- the maintained communication link after the test.

6.1 Performance criteria for Continuous phenomena applied to Transmitters (CT)

For base transmitters:

- during the tests no unintentional transmission shall occur;

- during the spot frequency test of the radio frequency immunity test, the transmitter shall be capable of transmitting calls to a (paging) receiver/measuring device with a resulting call alert acceptance ratio of 4:5 (four out of five) or better;

- at the conclusion of the test comprising the series of individual exposures the transmitter shall operate as intended with no loss of functions.

For pocket transmitters:

- a communications link shall be established before the test and during the test the modulation of the carrier caused by the 400 Hz signal from the interference source shall be less then 25 % of the system peak modulation;

- during each individual exposure in the test sequence it shall be verified by appropriate means supplied by the manufacturer that the communication link is maintained;

- at the conclusion of the test the transmitter shall operate as intended with no loss of function;

- where the EUT is a stand alone pocket transmitter, tests shall be repeated with the transmitter in standby mode to ensure that no unintentional transmission occurs.

6.2 Performance criteria for Transient phenomena applied to Transmitters (TT)

For base transmitters and pocket transmitters:

- the test shall be performed in standby mode, for all types of transmitters, to ensure that no unintentional transmission occurs;

- for pocket transmitters, a one way communication link shall be established before the test and after each individual exposure it shall be verified, by appropriate means supplied by the manufacturer, that the communication link is maintained;

- at the conclusion of the test the EUT shall operate as intended with no loss of functions;

- where the EUT is a stand alone pocket transmitter, tests shall be repeated with the transmitter in standby mode to ensure that no unintentional transmission occurs.

6.3 Performance criteria for Continuous phenomena applied to Receivers (CR)

For base receivers:

- a communications link shall be established before the test and during the test the audio output signal caused by the 400 Hz signal from the interference source shall be less then 25 % of the system peak output voltage;

- during each individual exposure in the test sequence it shall be verified by appropriate means, supplied by the manufacturer, that the communication link is maintained;

- at the conclusion of the test, the receiver shall operate with no loss of function.

For pocket receivers:

- during the test no false call shall occur;

- at the conclusion of the test comprising the series of individual exposures the receiver shall operate as intended with no loss of functions or stored data (messages), as declared by the manufacturer;

- during the spot frequency test of the radio frequency electromagnetic field immunity test (subclause 9.2) the receiver shall provide a call received alert signal acceptance ratio of 4:5 (four out of five) or better.

Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

6.4 Performance criteria for Transient phenomena applied to Receivers (TR)

- for base receivers a communication link shall be established before the test and after each individual exposure in the test sequence it shall be verified, by appropriate means, supplied by the manufacturer, that the communication link is maintained;

- for pocket receivers no false call shall occur;

- at the conclusion of the test, the receiver shall operate with no loss of function and/or stored data, as declared by the manufacturer;

- where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

7 Applicability overview tables

7.1 Emission

Table 1: Emission applicability

Application	Equipment test requirement		Reference subclause	Reference document
	Base station- & ancillary equipment for fixed use	Pocket- & ancillary equipment for portable use		
Enclosure	applicable to ancillary equipment	applicable to ancillary equipment	8.2	EN 55022 [5]
DC power in/out	applicable	not applicable	8.3	EN 55022 [5] CISPR 16-1 [6]
AC power in/out	applicable	not applicable	8.4	EN 55022 [5]

7.2 Immunity

Table 2: Immunity applicability

Phenomena	Application	Equipment test requirement		Reference subclause	Reference document
		Base station- & ancillary equipment for fixed use	Pocket- & ancillary equipment for portable use		
RF electromagnetic field 80 - 1 000 MHz	Enclosure	applicable	applicable	9.2	EN 61000-4-3 [7]
Electrostatic discharge	Enclosure	applicable	applicable	9.3	EN 61000-4-2 [8]
Fast transient common mode	Signal & control lines, DC & AC power input ports	applicable	not applicable	9.4	EN 61000-4-4 [9]
RF common mode 0,15 - 80 MHz	Signal & control lines, DC & AC power input ports	applicable	not applicable	9.5	EN 61000-4-6 [10]
Voltage dips and interruption	AC mains power input ports	applicable	not applicable	9.6	EN 61000-4-11 [11]]
Surges common & differential mode	AC mains power input ports	applicable	not applicable	9.7	EN 61000-4-5 [12]

8 Test methods for emission tests for transmitters and/or receivers and/or ancillaries

8.1 Test configuration

This subclause defines the requirements for test configurations for tests in the following subclauses and are as follows:

- measurements shall be made in the operational mode producing the largest emission in the frequency band being investigated consistent with normal applications;

- the equipment shall be configured in a manner which is representative of a nominal/typical operation, where practical;

- an attempt shall be made to maximize the detected radiated emission, e.g. by moving the cables of the equipment;

- 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 representative configuration of ancillary equipment necessary to exercise the ports;

- the configuration and mode of operation during measurements shall be precisely noted in the test report;

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

- ports which in normal operation are connected to an ancillary equipment or to a representative piece of cable terminated to simulate the impedance of the ancillary equipment. RF input/output ports shall be correctly terminated;

- the test shall be carried out at a point within the specified normal operating environmental range and at the rated supply voltage for the equipment.

8.2 Enclosure

This test is applicable to ancillary equipment not incorporated in the radio 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.

8.2.1 Definition

This test assesses the ability of ancillary equipment to limit its internal noise from being radiated from the enclosure.

8.2.2 Test method

The test method shall be in accordance with EN 55022 [5].

8.2.3 Limits

The EUT shall meet the class B limits according to EN 55022 [5] (10 m measuring distance) shown in table 3.

Table 3: Limits for spurious emission (class B)

Frequency range	Quasi-peak
30 - 230 MHz	30 dBμV/m
> 230 MHz - 1 000 MHz	37 dBμV/m

8.3 DC power input/output ports

This test is applicable for base station and ancillary equipment which may have DC cables longer than 3 m.

Where it is specified that an AC to DC power converter shall always be used to power the EUT, with interconnecting cables shorter than 3 m, emissions shall be measured at the AC port of the adapter (see subclause 8.4) and not on the DC port of the EUT. The manufacturer shall supply the power converter.

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

8.3.1 Definition

This test assesses the ability of transmitters, receivers and ancillary equipment to limit its internal noise from being present on the DC power input/output ports.

8.3.2 Test method

For equipment with a current consumption below 16 A the test method shall be in accordance with EN 55022 [5] and the Line Impedance Stabilizing Networks (LISNs) shall be connected to a DC power source.

For equipment with a current above 16 A the DC power ports shall be connected to 5 μH LISNs, with 50 Ω characteristic impedance measuring ports. The LISNs shall be in accordance with the requirements of section two of CISPR 16-1 [6].

In the case of DC-output ports the port shall be connected via a LISN to a load drawing the rated current of the source.

A measuring receiver shall be connected to each LISN measurement port in turn and the conducted emission shall be 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 [5] subclause 10.3. 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 [6].

8.3.3 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 8.3.2. 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 is unnecessary.

The EUT shall meet the class B limits according EN 55022 [5] shown in table 4.

8.4 AC mains power in/out

This test is applicable for base station and fixed 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.

8.4.1 Definition

This test assesses the ability of transmitters, receivers and ancillary equipment to limit its internal noise from being present on the AC mains power input ports.

8.4.2 Test method

The test method shall be in accordance with EN 55022 [5].

In the case of an AC output port the port shall be connected via a LISN to a load drawing the rated current of the source. In the case where the AC output port is direct connected (or via a circuit breaker) to the AC power input port of the EUT the AC power output port need not to be tested.

8.4.3 Limits

The EUT shall meet the class B limits according to EN 55022 [5], shown in table 4.

Table 4: Limits for conducted RF signals (class B)

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

9 Test methods for immunity tests for transmitters and/or receivers and/or ancillaries

9.1 Test configuration

This subclause defines the requirements for test configurations for tests in the following subclauses and are as follows:

- the measurement shall be made in operational mode as required in subclause 4.1;

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

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

- the configuration and mode of operation during measurements shall be precisely noted in the test report;

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

- ports which in normal operation are connected, shall be connected to an ancillary equipment or to a representative piece of cable terminated to simulate the impedance of the ancillary equipment. RF input/output ports shall be correctly terminated;

- the tests shall be carried out at a point within the specified normal operating environmental range and at the rated supply voltage for the equipment.

9.2 Radio frequency electromagnetic field (80 - 1 000 MHz)

This test is applicable for base station, pocket 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 presence of a radio frequency electromagnetic field disturbance.

9.2.2 Test method

The test method shall be in accordance with EN 61000-4-3 [7].

The following requirements and evaluation of test results shall apply:

- the test level shall be 3 V/m (measured unmodulated). The test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 400 Hz;

- for receivers and transmitters, the stepped frequency increments shall be 1 % of the momentary frequency;

- the spot frequency test shall be performed on the frequencies 80, 104, 136, 200, 280, 390, 500, 630, 750 and 920 MHz ± 1 MHz;

- the test shall be performed over the frequency range 80 - 1 000 MHz with the exception of the exclusion band for transmitters (subclause 4.10.2) and with the exception of the exclusion band for receivers (subclause 4.10.1);

- responses on receivers occurring at discrete frequencies which are narrow band responses, are disregarded from the test (subclause 4.11);

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

9.2.3 Performance criteria

For transmitters the performance criteria CT (subclause 6.1) shall apply.

For receivers the performance criteria CR (subclause 6.3) shall apply.

For ancillary the pass/failure 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 Electrostatic discharge

This test is applicable for base station, pocket 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.

9.3.1 Definition

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

9.3.2 Test method

The test method shall be in accordance with EN 61000-4-2 [8].

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

- the test levels shall be 4 kV contact discharge and 8 kV air discharge (EN 61000-4-2 [8]);

- electrostatic discharges shall be applied to all exposed surfaces of the EUT except where the user documentation specifically indicates a requirement for appropriate protective measures (EN 61000-4-2 [8]).

9.3.3 Performance criteria

For transmitters the performance criteria TT (subclause 6.2) shall apply.

For receivers the performance criteria TR (subclause 6.4) shall apply.

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

9.4 Fast transients common mode

This test is applicable for base station and ancillary equipment for fixed use.

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

This test shall be performed on AC mains ports.

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 event of fast transients present on one of the input/output ports.

9.4.2 Test method

The test method shall be in accordance with EN 61000-4-4 [9].

For transmitters, receivers, transceivers and ancillary equipment, which have cables longer than 3 m, or are connected to the AC mains, the following requirements and evaluation of test results shall apply:

- the test level for signal and control ports shall be severity level 3 corresponding to 1 kV open circuit voltage as given in EN 61000-4-4 [9];

- the test level for DC power input ports shall be severity level 2 corresponding to 1 kV open circuit voltage as given in EN 61000-4-4 [9];

- the test level for AC mains power input ports shall be severity level 3 corresponding to 2 kV open circuit voltage as given in EN 61000-4-4 [9];

- 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.

9.4.3 Performance criteria

For transmitters the performance criteria TT (subclause 6.2) shall apply.

For receivers the performance criteria TR (subclause 6.4) shall apply.

For ancillary the pass/failure 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 shall apply.

9.5 Radio frequency common mode (current clamp injection)

This test is applicable for base station and ancillary equipment for fixed use.

This test shall be performed on AC mains power ports.

This test shall be performed on signal, control and DC power ports of base station and ancillary equipment for fixed use, which may have 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.

9.5.1 Definition

This test assesses the ability of transmitters, receivers and ancillary equipment to operate as intended in the presence of a radio frequency electromagnetic disturbance on the input/output ports. This test substitutes radiated radio frequency electromagnetic immunity testing in the frequency range 150 kHz to 80 MHz.

9.5.2 Test method

The test method shall be in accordance with EN 61000-4-6 [10].

The following requirements and evaluation of test results shall apply:

- no intrusive or direct connection shall be made to any of the lines of any input/output port, consequently the clamp injection method shall be used;

- the test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 400 Hz;

- for receivers and transmitters 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 EN 61000-4-6 [10] corresponding to 3 V RMS (measured unmodulated);

- the test shall be performed over the frequency range 150 kHz - 80 MHz with the exception of an exclusion band for transmitters (subclause 4.10.2) and with the exception of the exclusion band for receivers (subclause 4.10.1);

- responses on receivers occurring at discrete frequencies which are narrow band responses, are disregarded from the test (subclause 4.11);

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

9.5.3 Performance criteria

For transmitters the performance criteria CT (subclause 6.1) shall apply.

For receivers the performance criteria CR (subclause 6.3) shall apply.

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

9.6 Voltage dips and interruptions

These test are applicable for base station and ancillary equipment for fixed use, powered by the AC mains.

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

These tests 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 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

The following requirements and evaluation of test results shall apply.

The test method shall be in accordance with EN 61000-4-11 [11].

The test levels shall be:

- a voltage dip corresponding to a reduction of the supply voltage of 30 % for 10 ms; and

- 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 5 000 ms.

9.6.3 Performance criteria

For a voltage dip corresponding to a reduction of the supply voltage of 30 % for 10 ms the following performance criteria shall apply:

- for transmitters the performance criteria CT (subclause 6.1);

- for receivers the performance criteria CR (subclause 6.3);

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

For a voltage dip corresponding to a reduction of the supply voltage of 60 % for 100 ms the following performance criteria shall apply:

- for transmitters the performance criteria TT (subclause 6.2);

- for receivers the performance criteria TR (subclause 6.4);

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

For a voltage interruption corresponding to a reduction of the supply voltage of > 95 % for 5 000 ms the following performance criteria shall apply:

- in the case where the equipment is fitted with or connected to a battery back-up, the performance criteria TT (subclause 6.2) or TR (subclause 6.4) shall apply as appropriate;

- 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 be maintained and lost functions shall be recoverable by user or operator;

- no unintentional responses shall occur at the end of the test.

In the event of loss of function(s) or in the event of loss of user stored data, this fact shall be recorded in the test report, the product description and the user documentation.

9.7 Surges common and differential mode

These tests are applicable for base station and ancillary equipment for fixed use.

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

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

9.7.1 Definition

These tests assess the ability of transmitters, receivers and ancillary equipment to operate as intended in the event of surges present on the AC mains power input ports.

9.7.2 Test method

The test method shall be in accordance with EN 61000-4-5 [12].

The following requirements and evaluation of test results shall apply:

- the test level shall be severity level 2 corresponding to 1 kV open circuit voltage for common mode and severity level 2 corresponding to 0,5 kV open circuit voltage for differential mode;

- 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 series resistance shall be 10 Ω.

9.7.3 Performance criteria

For transmitters the performance criteria TT (subclause 6.2) shall apply.

For receivers the performance criteria TR (subclause 6.4) shall apply.

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

Annex A (normative): Subclauses of this ETS relevant for compliance with the essential requirements of EC Council Directives

Table A.1: Subclauses of this ETS relevant for compliance with the essential requirements of EC Council Directives

Clause/subclause number and title		Corresponding article of Council Directive 89/336/EEC	Qualifying remarks
8	Test methods for emission tests for transmitters and/or receivers and/or ancillaries		
8.2	Enclosure	4 (a)	
8.3	DC power input/output ports	4 (a)	
8.4	AC mains power in/out	4 (a)	
9			
9.2	Radio frequency electromagnetic field (80 - 1 000 MHz	4 (b)	
9.3	Electrostatic discharge	4 (b)	
9.4	Fast transient common mode	4 (b)	
9.5	Radio frequency common mode (current clamp injection)	4 (b)	
9.6	Voltage dips and interruptions	4 (b)	
9.7	Surges common and differential mode	4 (b)	

History

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