EUROPEAN TELECOMMUNICATION STANDARD

DRAFT
pr **ETS 300 741**
May 1996

Source: ETSI TC-RES

Reference: DE/RES-09011

ICS: 33.060.20 33.100

Key words: EMC, paging, radio

Radio Equipment and Systems (RES); ElectroMagnetic Compatibility (EMC) standard for wide-area paging

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

*

Contents

Foreword 5

1 Scope 7

2 Normative references 7

3 Definitions 8

4 Test conditions 9
4.1 General 9
4.2 Normal test modulation 9
4.3 Arrangements for test signals at the input of the base transmitter 9
4.4 Arrangements for test signals at the output of the base transmitter 9
4.5 Arrangements for test signals at the input of the pocket receiver 10
4.6 Arrangements for test signals at the output of the pocket receiver 10
4.7 Exclusion bands 10
4.7.1 Exclusion bands for receivers. 10
4.7.2 Exclusion band for transmitters 10
4.8 Narrow band responses on receivers 11

5 Performance assessment 11
5.1 General 11
5.2 Standard paging equipment 11
5.3 Special equipment and stand alone tested ancillary equipment 11
5.4 Equipment classification 12
5.5 Conformance of ancillary equipment 12

6 Performance criteria 12
6.1 Performance criteria for Continuous phenomena applied to Transmitters (CT) 13
6.2 Performance criteria for Transient phenomena applied to Transmitters (TT) 13
6.3 Performance criteria for Continuous phenomena applied to Receivers (CR) 13
6.4 Performance criteria for Transient phenomena applied to Receivers (TR) 13

7 Applicability overview table 14
7.1 Emission 14
7.2 Immunity 14

8 Test methods and limits for emission tests 15
8.1 Test configuration 15
8.2 Enclosure 15
8.2.1 Definition 15
8.2.2 Test method 15
8.2.3 Limits 15
8.3 DC power input/output ports 15
8.3.1 Definition 15
8.3.2 Test method 16
8.3.3 Limits 16
8.4 AC mains power in/out 16
8.4.1 Definition 16
8.4.2 Test method 16
8.4.3 Limits 16

9 Test methods and levels for immunity tests 16
9.1 Test configuration 16
9.2 Radio frequency electromagnetic field (80-1 000 MHz) 17
9.2.1 Definition 17

9.2.2 Test method 17
9.2.3 Performance criteria 17
9.3 Electrostatic discharge 17
9.3.1 Definition 18
9.3.2 Test method 18
9.3.3 Performance criteria 18
9.4 Fast transients common mode 18
9.4.1 Definition 18
9.4.2 Test method 18
9.4.3 Performance criteria 18
9.5 Radio frequency common mode (current clamp injection) 19
9.5.1 Definition 19
9.5.2 Test method 19
9.5.3 Performance criteria 19
9.6 Transients and surges in vehicular environment 19
9.6.1 Definition 20
9.6.2 Test method 20
9.6.2.1 Test requirements for 12 V DC powered equipment 20
9.6.2.2 Test requirements for 24 V DC powered equipment 20
9.6.3 Performance criteria 21
9.7 Voltage dips and interruptions 21
9.7.1 Definition 21
9.7.2 Test method 21
9.7.3 Performance criteria 21
9.8 Surges common and differential mode 22
9.8.1 Definition 22
9.8.2 Test method 22
9.8.3 Performance criteria 22

History 23

Foreword

This draft European Telecommunication Standard (ETS) has been prepared by the Radio Equipment and Systems (RES) Technical Committee of the European Telecommunications Standards Institute (ETSI) and is now submitted for the Public Enquiry phase of the ETSI standards approval procedure.

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

Proposed transposition dates	
Date of latest announcement of this ETS (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

Blank page

1 Scope

This draft European Telecommunication Standard (ETS) covers the assessment of Wide-Area Paging equipment and ancillary equipment, in respect of electromagnetic compatibility (EMC). Technical specifications related to the antenna port and emissions from the enclosure port of the wide area paging equipment are not included in this ETS.

This ETS does not cover ERMES paging receiver equipment.

This ETS specifies the applicable EMC tests, the method of measurements, the limits and the minimum performance criteria for Wide-area paging equipment.

The environment classification used in this ETS refers to the environment classification used in the Generic Standards EN 50 081-1 [1], EN 50 082-1 [2].

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 wide area paging 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

For the purposes of this document, the following references apply:

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: "Electromagnetic compatibility - Generic emission standard - Part 1: Residential, commercial and light industry".

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

[3] 89/336/EEC: "Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility".

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

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

[6] IEC 1000-4-3 (1995): "Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test".

[7] IEC 1000-4-2 (1995): "Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test - Basic EMC publication".

[8] IEC 1000-4-4 (1995): "Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test - Basic EMC publication".

[9] ENV 50141 (1993): "Electromagnetic Compatibility - Basic immunity standard - Conducted disturbances induced by radio-frequency fields - Immunity test".

[10] ISO 7637 (1990): "Road vehicles - Electrical disturbance by conduction and coupling - Part 1: Passenger cars and light commercial vehicles with nominal 12 V supply voltage - Electrical transient conduction along supply lines only". and Part 2: "Commercial vehicles with nominal 24 V supply voltage - Electrical transient conduction along supply lines only".

[11] IEC 1000-4-11 (1994): "Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 11: Voltage dips, short interruptions and voltage variations immunity tests - Basic EMC publication".

[12] IEC 1000-4-5 (1995): "Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 5: Surge immunity tests".

3 Definitions

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

alignment range: For the purpose of defining the exclusion bands (subclause 4.7), the alignment range of the wide area paging equipment is defined as 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 or transmitter, is considered as an ancillary equipment (apparatus):

- if the equipment is intended for use in conjunction with a receiver or transmitter to provide additional operational and/or control features to the wide area paging equipment, (e.g. to extend control to another position or location); and

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

- if 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).

calling function: Transmission 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 responsible under the terms of the Council Directive, 89/336/EEC [3], for placing the product on the market.

mobile equipment: A pocket receiver capable of being powered by the main battery of a vehicle for intended use.

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

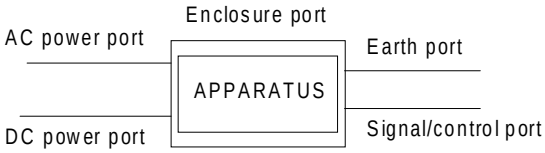

Figure 1

pocket receiver: A stand alone pocket paging receiver.

spot frequency test: A part of the radio-frequency electromagnetic field immunity test (subclause 9.2.2) which assess the ability of the wide-area paging equipment to transmit and/or receive messages in the presence of radio-frequency electromagnetic field disturbances of defined discrete frequencies.

standby mode (receiver): A mode of operation in which the receiver is capable of receiving calls.

standby mode (transmitter): A mode of operation in which the transmitter is ready to transmit, waiting for a start control signal to actual start transmitting.

wide-area paging equipment: A pocket receiver, a base transmitter or ancillary equipment.

4 Test conditions

4.1 General

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. The test conditions shall be recorded in the test report.

The test configuration and mode of operation 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 in subclauses 4.2 to 4.8 shall apply and the conditions shall be as follows:

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

- 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 immunity test (subclause 9.2) where repetitive calls shall be coupled to the input of the receiver.

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.

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 of the radiated fields within the test environment.

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

The output signal shall be delivered from the RF antenna 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.

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

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. The signal level used shall be chosen to a value significantly above the threshold sensitivity but below the overload characteristics of the receiver (the signal level should be 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 a 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 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 Exclusion bands

Exclusion bands are determined frequency bands for which the wide area paging equipment is excluded from RF immunity tests.

4.7.1 Exclusion bands for receivers.

The exclusion band for receivers is the frequency range determined by the alignment range, as declared by the manufacturer , extended as follows:

- for receivers operating in the frequency band of 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 results in the lowest frequency, and 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 results in the higher frequency;

- for receivers operating above 80 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 results in the lower frequency , and 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.

4.7.2 Exclusion band for transmitters

For transmitters operating, or intended to operate, in a channelized frequency band, the exclusion band is three times the channel separation, centred around the nominal operating frequency.

4.8 Narrow band responses on receivers

No immunity tests shall be carried out on frequencies of identified unwanted narrowband responses (spurious responses) of the receiver. These narrowband 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 narrow band 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 non acceptable (subclause 6.3), the phenomenon is considered wide band and therefore an EMC problem and the equipment fails the test.

5 Performance assessment

5.1 General

Each type of equipment shall fulfil the requirements of this standard on all frequency channels over which it is intended to operate. However, the tests shall be performed on one sample for each intended operating band.

The manufacturer shall at the time of submission of the equipment for test, supply information about ancillary equipment intended to be used with the wide area paging equipment.

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 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 including the maximum allowed length of cable connected thereto;

- the bandwidth of the IF filter immediately preceding the demodulator;

- the operating bands over which the equipment is intended to operate;

- the alignment range of the paging receiver;

- the optional features (versions) of the equipment and the actual version of the equipment that is (which are) submitted for test.

5.2 Standard paging equipment

If the equipment is wide area paging equipment of a non-specialised nature or wide area paging equipment combined with an ancillary equipment the test modulation, test arrangements etc. as specified in clause 4 shall apply.

5.3 Special equipment and stand alone tested ancillary equipment

For wide area paging equipment of a specialised 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 wide area paging equipment 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 method of test to determine the performance or the degradation of performance which is be carried out during and/or after 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

Wide area paging equipment, or combinations of equipment declared as capable of being powered for intended use by the main battery of a vehicle shall additionally be considered as a vehicular mobile equipment

Wide area paging 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 Conformance of ancillary equipment

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

- assessed separately from a receiver or transmitter against all the applicable immunity and emission clauses of this ETS;

- assessed against another appropriate notified EMC standard;

- assessed with it connected to a receiver or transmitter, in which case compliance shall be demonstrated to the appropriate clauses of this standard.

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

6 Performance criteria

The equipment shall meet the minimum performance criteria as 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 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 paging receiver at the start of the test.

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

For base transmitters:

- during the tests in standby mode, no unintentional transmission shall occur;

- during the radio frequency immunity test, no loss of functions or stored data shall occur. The transmitter output shall remain on channel and shall be unchanged from its initial power level;

- during the spot frequency test of the radio frequency immunity test, the transmitter shall be capable of transmitting calls to a (paging) receiver or 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 function or stored data.

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

The test shall be performed in standby mode, for all types of transmitters, to ensure that no unintentional transmission or loss of transmission occurs.

At the conclusion of the test the wide area paging equipment shall operate as intended with no loss of function or stored data.

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

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 function or stored data (messages)(as declared by the manufacturer, subclause 5.1);

- during the spot frequency test of the radio frequency 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.

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

For pocket receivers 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 function and/or stored data (messages) as declared by the manufacturer (subclause 5.1).

7 Applicability overview table

7.1 Emission

Table 1

Application	Equipment test requirement			Reference subclause in this ETS	Reference document
	Base station & ancillary equipment for fixed use	Mobile & ancillary equipment for vehicular use	Portable & ancillary equipment for portable use		
Enclosure	applicable to ancillary equipment	applicable to ancillary equipment	applicable to ancillary equipment	8.2	EN 55022 [4]
DC power in/out	applicable	applicable	not applicable	8.3	EN 55022 [4] CISPR.16-1 [5]
AC mains	applicable	not applicable	not applicable	8.4	EN 55022 [4]

7.2 Immunity

Table 2

Phenomena	Application	Equipment test requirement			Reference subclause in this ETS	Reference document
		Base station & ancillary equipment for fixed use	Mobile & ancillary equipment for vehicular use	Portable & ancillary equipment for portable use		
RF electromagnetic field (80-1 000 MHz)	Enclosure	applicable	applicable	applicable	9.2	IEC 1000-4-3 [6]
Electrostatic discharge	Enclosure	applicable	applicable	applicable	9.3	IEC 1000-4-2 [7]
Fast transients common mode	Signal and control ports, DC and AC power ports	applicable	not applicable	not applicable	9.4	IEC 1000-4-4 [8]
RF common mode (current clamp injection) 0,15-80 MHz	Signal and control ports, DC and AC power ports	applicable	applicable	not applicable	9.5	ENV 50141 [9]
Transient and surge	DC power input ports	not applicable	applicable	not applicable	9.6	ISO 7637 Parts 1 and 2 [10]
Voltage dips and interruption	AC mains power input ports	applicable	not applicable	not applicable	9.7	IEC 1000-4-11 [11]
Surges, common and differential mode	AC mains power input ports	applicable	not applicable	not applicable	9.8	IEC 1000-4-5 [12]

8 Test methods and limits for emission tests

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;

- an attempt shall be made to maximise 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;

- 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 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.

8.2 Enclosure

This test is applicable to ancillary equipment not incorporated in the wide area paging equipment.

8.2.1 Definition

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

8.2.2 Test method

The test method shall be in accordance with EN 55022 [4].

8.2.3 Limits

The wide area paging equipment shall meet the Class B limits according to EN 55022 [4] (10 m measuring distance) shown in table 3.

Table 3: Limits for spurious radiations

Frequency range	Limit (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. If the DC power cable of the wide area paging and/or the ancillary equipment is less than 3 m in length, and intended for direct connection to a dedicated AC/DC power supply, then the measurement shall be performed on the AC power input port of that power supply as specified in subclause 8.4. If the DC power cable may be greater than 3 m in length, then the measurement shall additionally be performed on the DC power port.

8.3.1 Definition

This test assesses the ability of transmitters, receivers and ancillary equipment to limit their 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 [4] and the Line Impedance Stabilising 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 5µH Line Impedance Stabilising Networks (LISNs), with 50 Ω characteristic measuring ports. The LISNs shall be in accordance with the requirements of clause 2 of CISPR 16-1 [5].

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 [4] subclause 9.3. 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 clause 1 of CISPR 16-1 [5].

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. 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 is unnecessary.

The wide area paging equipment shall meet the Class B limits according to EN 55022 [4], shown in table 4.

Table 4: Limits for conducted RF signals

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 the frequency in the range 0,15 MHz to 0,50 MHz.		

8.4 AC mains power in/out

This test is applicable for base station and fixed 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 [4].

8.4.3 Limits

The wide area paging equipment shall meet the Class B limits according to EN 55022 [4] shown in table 4.

9 Test methods and levels for immunity tests

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;

- 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.

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

This test is applicable for base station, mobile, pocket and ancillary equipment.

9.2.1 Definition

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

9.2.2 Test method

The test method shall be in accordance with IEC 1000-4-3 [6].

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 1 000 Hz;

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

- the test shall be performed over the frequency range 80 - 1 000 MHz with the exception of the exclusion band for transmitters (subclause 4.7.2) or with the exception of the exclusion band for receivers (subclause 4.7.1) as appropriate;

- the spot frequency test shall be performed at 80, 104, 136, 165, 200, 260, 330, 430, 560, 715 and 920 MHz $\pm$ 1 MHz, excluding those frequencies that fall within the exclusion band. The test shall additionally be performed at the edge frequencies of the exclusion band;

- responses on receivers occurring at discrete frequencies which are narrow band responses, are disregarded from the test (subclause 4.8).

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 (subclause 5.3) shall apply, unless the ancillary is tested in connection with a receiver or transmitter in which case the corresponding performance criteria above shall apply.

9.3 Electrostatic discharge

This test is applicable for base station, mobile, pocket and ancillary equipment.

9.3.1 Definition

This test assesses the ability of transmitters, receivers 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 IEC 1000-4-2 [7].

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

The test severity level for contact discharge shall be 4 kV and discharge 8kV. All other details, including intermediate test levels, are contained within IEC 1000-4-2 [7].

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 (subclause 5.3) shall apply, unless the ancillary equipment is tested in connection with a receiver or transmitter in which case the corresponding performance criteria above shall apply.

9.4 Fast transients common mode

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

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.

9.4.1 Definition

This test assesses the ability of transmitters, receivers 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 IEC 1000-4-4 [8].

For transmitters, receivers 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 0,5 kV open circuit voltage as given in clause 5 of IEC 1000-4-4 [8];

- the test level for DC power input ports shall be 0,5 kV open circuit voltage as given in clause 5 of IEC 1000-4-4 [8];

- the test level for AC mains power input ports shall be 1 kV open circuit voltage as given in clause 5 of IEC 1000-4-4 [8].

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 (subclause 5.3) shall apply, unless the ancillary is tested in connection with a receivers or transmitter 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, mobile and ancillary equipment.

This test shall be performed on signal, control and DC power ports of mobile and their ancillary equipment, which may have cables longer than 2 m.

This test shall be performed on signal, control, and DC power ports of base station and fixed ancillary equipment, which may have cables longer than 1 m.

This test shall be performed on AC mains power ports.

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 electro-magnetic immunity testing in the frequency range 150 kHz to 80 MHz.

9.5.2 Test method

The test method shall be in accordance with ENV 50141 [9].

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. Consequentially 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 1 000 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 defined in ENV 50141 [9], equivalent to 3 V RMS unmodulated;

- the test shall be performed over the frequency range 150 kHz - 80 MHz with the exception of an exclusion band for transmitters (subclause 4.7.2) or with the exception of the exclusion band for receivers (subclause 4.7.1) as appropriate;

- responses on receivers occurring at discrete frequencies which are narrow band responses, are disregarded from the test (subclause 4.8).

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 (subclause 5.3) 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 Transients and surges in vehicular environment

These tests are applicable to mobile and ancillary equipment intended for use in a vehicular environment.

These tests shall be performed on 12 V and 24 V DC power input ports of mobile and ancillary equipment, intended for vehicular use.

9.6.1 Definition

These tests assess the ability of transmitters, receivers and ancillary equipment to operate as intended in the event of transients and surges present on the DC power input ports in a vehicular environment.

9.6.2 Test method

The test method shall be in accordance with ISO 7637 Part 1 [10] for 12 V DC powered equipment and ISO 7637 Part 2 [10] for 24 V DC powered equipment.

9.6.2.1 Test requirements for 12 V DC powered equipment

Where the manufacturer in his installation documentation requires the wide area paging equipment to have a direct connection to the 12 V main vehicle battery the requirements a) shall apply.

Where the manufacturer does not require the wide area paging equipment to have a direct connection to the 12 V main vehicle battery the requirements a) and b) apply:

a) Pulse 3a and 3b, level II, with the test time reduced to 5 minutes for each;

Pulse 4, level II, 5 pulses, with the characteristics as follows:

- V_s - 5 V, V_a - 2.5 V, t_6 - 25 ms, t_8 - 5 s, t_f - 5 ms;

b) Pulse 1, level II, t_1 - 2.5 s, 10 pulses.

Pulse 2, level II, t_1 - 2.5 s, 10 pulses.

Pulse 7, level II, 5 pulses.

Where the manufacturer declares that the wide area paging equipment requires a direct connection to the vehicular battery, and therefore the tests in accordance with the requirements b) are not carried out, this shall be stated in the test report.

9.6.2.2 Test requirements for 24 V DC powered equipment

Where the manufacturer in his installation documentation requires the wide area paging equipment to have a direct connection to the 24 V main vehicle battery the requirements c) shall apply;

Where the manufacturer does not require the wide area paging equipment to have a direct connection to the 24 V main vehicle battery the requirements c) and d) apply:

c) Pulse 3a and 3b, level II, with the test time reduced to 5 minutes for each;

Pulse 4, level II, 5 pulses, with the characteristics as follows:

- V_s - 10 V, V_a - 5 V, t_6 - 25 ms, t_8 - 5 s, t_f - 5 ms.

d) Pulse 1a, level II, t1 - 2.5 s, Ri - 25 Ω 10 pulses.

Pulse 1b, level II, t1 - 2.5 s, Ri - 100 Ω 10 pulses.

Pulse 7, level II, t1 - 2,5 s, 10 pulses.

Where the manufacturer declares that the wide area paging equipment requires a direct connection to the vehicular battery, and therefore the tests in accordance with the requirements d) are not carried out, this shall be stated in the test report.

Radio and ancillary equipment designed to operate at both DC power voltageages shall be tested in both configurations.

9.6.3 Performance criteria

For transmitters pulse 3a and 3b the performance criteria CT (subclause 6.1) shall apply. For pulse 1, 1a, 1b, 2, 4 and 7 the performance criteria TT (subclause 6.2) shall apply, with the exception that a communication link need not to be maintained during exposure and may have to be re-established.

For receivers pulse 3a and 3b the performance criteria CR (subclause 6.3) shall apply. For pulse 1, 1a, 1b, 2, 4 and 7 the performance criteria TR (subclause 6.4) shall apply, with the exception that a communication link need not to be maintained during exposure and may have to be re-established.

For ancillary equipment the pass/failure criteria supplied by the manufacturer (subclause 5.3) 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.

9.7 Voltage dips and interruptions

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

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

9.7.1 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.

9.7.2 Test method

The following requirements and evaluation of test results shall apply.

The test method shall be in accordance with IEC 1000-4-11 [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.

9.7.3 Performance criteria

For a voltage dip corresponding to a reduction of the supply voltage of 30 % for 10 ms the following performance criteria 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 (subclause 5.3) shall apply, unless the ancillary equipment is tested in connection with a receiver or transmitter 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 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 (subclause 5.3) shall apply, unless the ancillary equipment is tested in connection with a receiver or transmitter 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 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) 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 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 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.

9.8 Surges common and differential mode

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

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

9.8.1 Definition

These test assesses 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.

9.8.2 Test method

The following requirements and evaluation of test results shall apply.

The test method shall be in accordance with IEC 1000-4-5 [12]:

- the test level shall be 1 kV open circuit voltage for common mode and 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) and the series resistance shall be 10 Ω.

9.8.3 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 (subclause 5.3) shall apply, unless the ancillary equipment is tested in connection with a receiver or transmitter in which case the corresponding performance criteria above shall apply.

History

Document history			
May 1996	Public Enquiry	PE 106:	1996-05-20 to 1996-09-13