EN 300 829 V1.1.1 (1998-03)

European Standard (Telecommunications series)

Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) for Maritime Mobile Earth Stations (MMES) operating in the 1,5/1,6 GHz bands providing Low Bit Rate Data Communications (LBRDC) for the Global Maritime Distress and Safety System (GMDSS)

European Telecommunications Standards Institute

Reference
DEN/ERM-EMC-022 (7oc00ico.PDF)

Keywords
Earth station, EMC, GMDSS, LBRDC, MES,
MMSS, mobile, radio, satellite

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document has been produced by 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.

The present document, together with ETS 300 460, 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.

National transposition dates	
Date of adoption of this EN:	6 February 1998
Date of latest announcement of this EN (doa):	31 May 1998
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 November 1998
Date of withdrawal of any conflicting National Standard (dow):	30 November 1998

1 Scope

The present document covers the assessment of Inmarsat-C Global Maritime Distress and Safety System (GMDSS) and Enhanced Group Call (EGC) Ship Earth Stations, as defined by the International Maritime Organization (IMO) to be used for Low Bit Rate Data Communications (LBRDC) in the GMDSS, in respect of ElectroMagnetic Compatibility (EMC).

Technical specifications related to the antenna port and emissions for the enclosure port of the radio equipment are found in the related product standard ETS 300 460 [11] for the effective use of the radio spectrum.

The present document specifies the applicable EMC tests, the test methods, the limits and the minimum performance criteria for Ship Earth Stations for the maritime mobile service operating in the Maritime Mobile Satellite Service (MMSS) bands.

The ElectroMagnetic Environment used in the present document to develop the technical specifications encompasses the ElectroMagnetic Environment on board ships as identified in EN 60945 [13].

The EMC requirements have been selected to ensure an adequate level of compatibility for apparatus in maritime environments. The levels do not cover extreme cases which may occur in any location, but have a low probability of occurrence.

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

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

The present document is based on the consideration and guidance as given in ETR 238 [12].

2 References

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

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

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

[3] EN 61000-4-2: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test".

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

[5] EN 61000-4-4: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test".

[6] EN 61000-4-5: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 5: Surge immunity test".

[7] EN 61000-4-6: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 6: Immunity to conducted disturbances, induced by radio-frequency fields".

[8] EN 61000-4-3 (modified): "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test".

[9] 89/336/EEC: "Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility".

[10] 92/31/EEC: "Council Directive amending Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility".

[11] ETS 300 460: "Satellite Earth Stations and Systems (SES); Maritime Mobile Earth Stations (MMESs) operating in the 1,5/1,6 GHz bands providing Low Bit Rate Data Communications (LBRDC) for the Global Maritime Distress and Safety System (GMDSS); Technical characteristics and methods of measurement".

[12] ETR 238: "ETSI/CENELEC standardization programme for the development of Harmonized Standards related to Electro-Magnetic Compatibility (EMC) in the field of telecommunications".

[13] EN 60945: "Maritime navigational equipment - General requirements - Method of testing and required test results".

[14] EN 50081-1 (1992): "Electromagnetic compatibility - Generic emission standard - Part 1: Residential, commercial and light industry".

[15] EN 50082-1 (1993): "Electromagnetic compatibility - Generic immunity standard - Part 1: Residential, commercial and light industry".

3 Definitions and abbreviations

3.1 Definitions

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

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

- the equipment is intended for use in conjunction with a receiver or transceiver to provide additional operational and/or control features to the radio equipment (e.g. to extend control to another position or location); and
- the equipment cannot be used on a stand alone basis to provide user functions independently of a receiver or transceiver; and
- the receiver 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 basic functions.

artificial antenna: The antenna port(s) of the EUT shall be terminated with a power attenuator of adequate power absorption capability unless there is a requirement to apply an RF input signal to the receiver antenna port.

class 0: A stand alone EGC receiver.

class 1: A basic ship earth station providing ship-to-shore and shore-to-ship message transfer.

class 2: As for class 1 but with EGC as an alternative to shore-to-ship transfer using a shared receiver.

class 3: As for class 1 but with EGC using an independent receiver.

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

Equipment Under Test (EUT): The EUT comprises one or more units and their interconnecting cables as necessary for it to perform its intended functions.

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

ship earth station: A maritime mobile earth station operating in the GMDSS.

NOTE: The term "ship earth station" is used in the present document to align with IMO terminology.

3.2 Abbreviations

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

AC	Alternating Current
AM	Amplitude Modulation
CW	Continuous Wave
DC	Direct Current
EGC	Enhanced Group Call
EMC	ElectroMagnetic Compatibility
emf	electromotive force
EUT	Equipment Under Test
GMDSS	Global Maritime Distress and Safety System
IMO	International Maritime Organization
LBRDC	Low Bit Rate Data Communication
MMES	Maritime Mobile Earth Station
MMSS	Maritime Mobile Satellite Service
RF	Radio Frequency
rms	root mean squared
STE	Special Test Equipment

4 General test conditions

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

4.1 Test conditions and configurations

The equipment shall be tested under normal test conditions.

The normal temperature and humidity conditions shall be a combination of temperature and humidity within the following ranges:

- temperature +15°C to +35°C
- relative humidity 25 % - 75 %

The normal test voltage for equipment to be connected to the AC mains, shall be the nominal mains voltage. The frequency of the test voltage shall be 50 Hz ± 1 Hz.

The normal test voltage for equipment to be connected to a battery, shall be the nominal voltage of the battery (12 V, 24 V etc.). For operation from other power sources, the normal test voltage shall be declared by the manufacturer.

The test configuration shall be as close as possible to normal intended use.

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.

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

If the equipment has a large number of ports, then a sufficient number shall be selected to simulate actual operation conditions and to ensure that all the different types of termination are tested.

Ports which are not connected to cables during normal intended operation, e.g. service connectors, programming connectors, temporary connectors etc. shall not be connected to any cables for the purpose of EMC testing. Where cables have to be connected these ports, or interconnecting cables have to be extended in length in order to exercise the EUT, precautions shall be taken to ensure that the evaluation of the EUT is not affected by the addition or extension of these cables.

The test conditions, test configuration and mode of operation shall be recorded in the test report.

4.1.1 Emission tests

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

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

For the purpose of the emission tests, the EUT may be provided with a test facility to activate the transmitter without reception of enabling signals from the STE.

The details of the test facility shall be recorded in the test report.

4.1.2 Immunity tests

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

- the measurement shall be made in the mode of operation as required in subclause 4.1.2.1;
- for the immunity tests of ancillary equipment without separate pass/fall criteria, the receiver or transceiver coupled to the ancillary equipment shall be used to judge whether the ancillary equipment passes or fails.

4.1.2.1 Mode of operation

For the immunity tests of transmitters, the transmitter shall be operated at normal RF output power, modulated with normal modulation.

For the immunity test of receivers, the wanted input signal coupled to the receiver shall be modulated with normal modulation.

4.1.2.2 Special Test Equipment

The Special Test Equipment (STE) shall be supplied by the manufacturer or system provider. Since this test equipment will be specific for the particular system, it is not possible to provide detailed specifications in the present document. However the following requirements apply:

- STE shall simulate the satellite signal, thus enabling the ship earth station to transmit to allow measurements of transmission parameters;
- any specification of the STE which may have direct or indirect effects on any specification of the present document shall be clearly stated by the manufacturer;

- the STE shall prevent any radiation of signals, and it shall be certified by the system operator to be suitable for such purpose;
- when using the STE it shall be ensured that no transmission to the satellite occurs.

The details of the STE shall be recorded in the test report.

4.2 Narrowband responses on receivers and receivers of transceivers

Responses on 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 an unwanted signal causes the EUT to fail the performance check it is necessary to establish whether the failure is due to a narrow band response or to wide band phenomena.

Taking the initial test frequency as reference the procedure is repeated with an increase of the unwanted signal frequency by an amount equal to twice the bandwidth of the IF filter, as declared by the manufacturer. For the purpose of the present document, in the absence of a narrow IF filter bandwidth declared by the manufacturer, the IF bandwidth shall be taken as 5 kHz.

If the performance check is successful, then the response is considered to be a narrow band response.

If the performance check still fails, the test is repeated with the frequency of the unwanted signal decreased by the same amount.

If the performance check is successful, then the response is considered to be a narrow band response.

If the performance check still fails, 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.

Therefore, taking the initial test frequency as a reference the procedure is repeated with an increase of the unwanted signal frequency by two and one half times the bandwidth referred to in the third paragraph of this subclause.

If the performance check is successful, the response is considered to be a narrow band response. If the performance check still fails, the test is repeated with the frequency of the unwanted signal decreased by two and one half times the bandwidth referred to in the third paragraph of this subclause.

If the performance check still fails, the phenomenon is considered wideband and therefore an EMC problem and the equipment fails the test.

All narrow band responses shall be disregarded.

5 Performance assessment

5.1 General

The manufacturer shall supply the following information to be recorded in the test report:

- the intended functions of the radio equipment which shall be in accordance with the documentation accompanying the equipment;
- the primary functions of the radio equipment to be tested during and after the EMC testing;
- the characteristics of the signal used for testing (random bit stream, message format, etc.) and details of the necessary test equipment required to enable the assessment of the EUT;

- the method to be used to verify that a communications link is established and maintained;
- the ancillary equipment to be combined with the radio equipment for testing (where applicable);
- an exhaustive list of all ports, with the maximum cable lengths allowed, classified as either power, signal, control or antenna. Power ports shall further be classified as AC or DC power.

5.2 Ancillary equipment

At the manufacturers discretion an ancillary equipment may be:

- declared compliant separately from a receiver or transceiver to all the applicable immunity and emission clauses of the present document;
- declared compliant to another appropriate harmonized EMC standard;
- tested with it connected to a receiver or transceiver in which case compliance shall be demonstrated to the appropriate clauses of the present document.

6 Performance criteria

6.1 General

The equipment shall meet the minimum performance criteria as specified in subclauses 6.2 and 6.3 and tables 1 and 2.

6.2 Performance criteria A

The EUT shall continue to operate as intended during and after the test. No degradation of the performance or loss of function is allowed below a minimum performance level specified by the manufacturer when the apparatus is used as intended. No change of actual operating state, stored operational data or stored messages is allowed.

During the test the EUT shall be subjected to a performance check (subclause 6.4). The requirements of the performance check shall be met.

When the test is performed during transmission, it shall be ensured that the EUT is transmitting throughout the test. The minimum length of the test message shall be 300 bytes. If necessary to complete the test sequence the test message may be longer. Since the maximum message length is limited, more than one message transmission from the EUT may be necessary.

When the test is performed during reception, is shall be ensured that the EUT is receiving throughout the test. The minimum length of the test message shall be 300 bytes. If necessary to complete the test sequence the test message may be longer. Since the maximum message length is limited, more than one message transmission from the STE may be necessary.

It shall, in addition, be verified that no unintentional transmission occurs during the test.

6.3 Performance criteria B

The EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a minimum performance level specified by the manufacturer when the apparatus is used as intended. During the test, degradation or loss of function or performance which is self recoverable is allowed but no change of actual operating state, stored operational data or stored messages is allowed.

After the test the EUT shall be subjected to a performance check (subclause 6.4). The length of the test message shall be 300 bytes. The requirements of the performance check shall be met.

When the test is performed during transmission, is shall be ensured that the EUT is transmitting throughout the test. More than one message transmission from the EUT may therefore be necessary.

When the test is performed during reception, is shall be ensured that the EUT is receiving throughout the test. More than one message transmission from the STE may therefore be necessary.

It shall, in addition, be verified that no unintentional transmission occurs during the test.

6.4 Performance check

For the purposes of the present document, a performance check shall consist of the following:

- for class 0 equipment: reception of a distress priority EGC message;
- for class 1 equipment: transmission and reception of a distress message;
- for class 2 and 3 equipment: transmission of a distress message and reception of a distress priority EGC message.

For all classes of equipment, the performance check is considered to fail if retransmission of any packets is necessary to complete the message transfer.

The length of the test messages shall be as specified in subclauses 6.2 and 6.3.

6.4.1 Transmission

The transmission of a distress message is considered to be successful when:

a) the STE has received the distress message and correctly interpreted it; and

b) the acknowledgement by the STE of receipt of the transmission has been correctly indicated to the user by the EUT.

6.4.2 Reception of distress message

The reception of a distress message is considered to be successful when:

a) the EUT has correctly decoded the received distress message and indicated to the user that the transmission has been received from the STE; and

b) the STE has received the acknowledgement from the EUT of the receipt of the transmission.

6.4.3 Reception of distress priority EGC message

The reception of a distress priority EGC message is considered to be successful when:

a) the EUT has printed the message and;

b) the appropriate indications are provided to the user that a distress priority EGC message has been received.

7 Applicability overview tables

7.1 Emissions

Table 1: Emissions overview

Application	Test requirements	Reference subclause in the present document	Reference document
Enclosure port	applicable	8.1	EN 60945 [13] CISPR 16-1 [1] EN 55022 [2]
DC power in/out	applicable	8.2	EN 60945 [13] CISPR 16-1 [1]
AC mains	applicable	8.2	EN 60945 [13] CISPR 16-1 [1]

7.2 Immunity

Table 2: Immunity overview

Phenomena	Application	Test requirements	Reference subclause in the present document	Reference
RF electromagnetic field 80 MHz - 1 000 MHz	Enclosure	applicable	9.1	EN 61000-4-3 [8]
Electrostatic discharge	Enclosure	applicable	9.2	EN 61000-4-2 [3]
Fast transients, common mode	DC and AC power input ports and signal and control ports	applicable	9.3	EN 61000-4-4 [5]
RF common mode 150 kHz - 80 MHz	Signal and control ports DC and AC power ports	applicable	9.4	EN 61000-4-6 [7]
Short term power supply variations	AC power input ports	applicable	9.5	EN 60945 [13]
Surges	AC power input ports	applicable	9.6	EN 61000-4-5 [6]

8 Test methods and limits for emission tests

The individual measurements called up in this clause shall be performed in accordance with the basic standard specified in each case, using the test limits indicated. Any deviations from this principle are elaborated in the text.

The measurements shall be performed in receive and transmit modes of operation unless indicated otherwise in this clause.

The applicability of tests to specific classes of equipment are elaborated in subclause 7.1.

8.1 Radiated emissions

This test is applicable to the enclosure port of the EUT.

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

8.1.1 Definition

This test assesses the ability of the EUT to limit unwanted emissions from the enclosure.

8.1.2 Test method, general

The measuring bandwidth shall be in accordance with table 3.

Table 3: Measuring bandwidth - radiated emissions

Frequency range	Measuring bandwidth
150 kHz to 30 MHz	9 kHz to 10 kHz
30 MHz to 1 GHz	100 kHz to 120 kHz
156 MHz to 165 MHz	9 kHz to 10 kHz

The setting of controls which may affect the level of radiated interference shall be varied in order to ascertain the maximum emission level.

When the EUT consists of more than one unit the interconnecting cables shall have the maximum length as indicated by the manufacturer.

Available input and output ports shall be connected to the maximum length of cable as indicated by the manufacturer and terminated to simulate the impedance of the ancillary equipment.

These cables shall be bundled at the approximate centre of the cable with the bundles of 30 cm to 40 cm in length running in the horizontal plane from the port to which it is connected. If it is impractical to do so because of cable bulk or stiffness, the disposition of the excess cable shall be precisely noted in the test report.

The emissions shall be measured in the frequency range of 150 kHz to 1 GHz in accordance with CISPR 16-1 [1] using the measuring receiver or a comparable spectrum analyser.

During the measurements the quasi-peak detector shall be used.

8.1.2.1 Test method, frequency range 150 kHz - 30 MHz

This test is applicable to the enclosure port of radio equipment and ancillary equipment for the frequency range 150 kHz to 30 MHz.

The test shall be performed on a representative configuration of the radio equipment or a representative configuration of the combination of radio and ancillary equipment. The radio equipment shall be tested in both the transmit and receive mode of operation, if appropriate.

The test method shall be in accordance with EN 60945 [13].

The EUT shall be placed on a non-conductive support with a height of 1,5 m. The measuring distance between the centre of the test antenna and the EUT shall be 3 m. The test site as indicated in EN 60945 [13] and CISPR 16-1 [1] shall be used.

8.1.2.2 Test method, frequency range 30 MHz - 1 GHz

This test is applicable to the enclosure port of separately tested ancillary equipment, i.e. not connected to the radio equipment, for the frequency range 30 MHz - 1 GHz.

The test method applied shall be in accordance with EN 55022 [2] (see table 4).

8.1.3 Limits

The levels of field strength of any radiated spurious emission of the EUT in the frequency range 150 kHz to 1 GHz shall not exceed the values given in table 4 (see also figure 1).

Table 4: Spurious emissions limits

Frequency range	Limit (Quasi Peak)	Measuring distance
150 kHz to 300 kHz	80 dBµV/m to 50 dBµV/m (see note)	3 m
300 kHz to 30 MHz	50 dBµV/m to 34 dBµV/m (see note)	3 m
> 30 MHz to 230 MHz	30 dBµV/m	10 m
> 230 MHz to 1 GHz	37 dBµV/m	10 m
156 MHz to 165 MHz	24 dBµV/m	3 m
NOTE: The limit decreases linearly with the logarithm of frequency.		

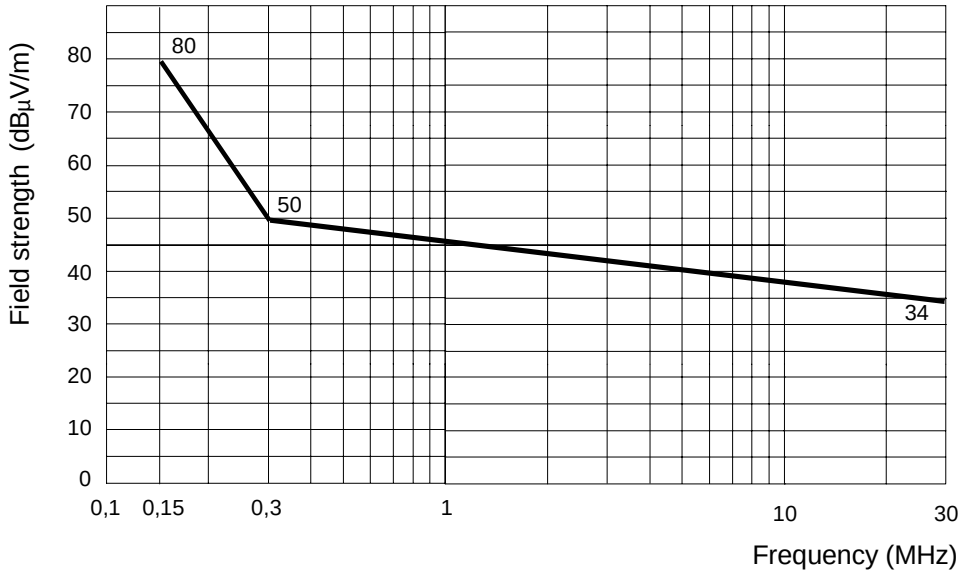

Figure 1: Maximum level of radiated spurious emissions (within the range 150 kHz to 30 MHz)

8.2 Power ports

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

8.2.1 Definition

This test assesses the ability of the EUT to limit the internal noise from the power ports.

8.2.2 Test method

The power input cable(s) between AC and/or DC input ports of the EUT and the artificial mains network shall be screened and not exceed 0,8 m in length.

If the EUT consists of more than one unit with individual AC and/or DC power input ports, power input ports of identical nominal supply voltages shall be connected to the artificial mains network in parallel.

This test shall be performed on a representative configuration of the EUT in receive and transmit mode of operation.

The measuring bandwidth in the frequency range 10 kHz to 150 kHz shall be 200 Hz. In the frequency range 150 kHz to 30 MHz the measuring bandwidth shall be 9 kHz to 10 kHz.

The emissions shall be measured in the frequency range of 10 kHz to 30 MHz by means of a measuring receiver and an artificial mains V-network (50Ω/50mH + 5Ω) in accordance with CISPR 16-1. In cases where a low voltage DC power supply is used, an alternative artificial mains V-network in accordance with CISPR 16-1 [1], may be used.

During the measurements the quasi-peak detector shall be used.

8.2.3 Limits

The level of any conducted spurious signal shall not exceed the values given in figure 2.

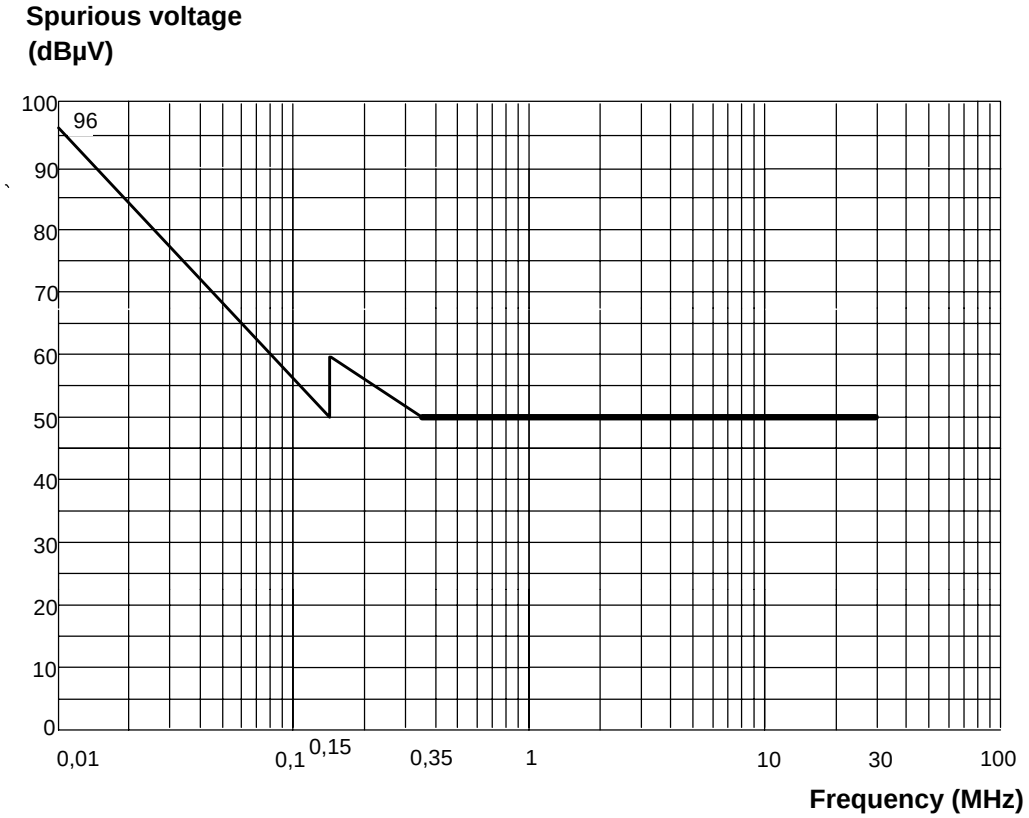

Figure 2: Maximum level of conducted spurious voltage into the mains

9 Test methods and levels for immunity tests

The individual tests called up in this clause shall be performed in accordance with the basic standard specified in each case, using the test limits indicated.

Any deviations from this principle are elaborated in the text.

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

This test shall be performed on a representative configuration of the EUT and ancillary equipment.

9.1.1 Definition

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

9.1.2 Test method

The EUT shall be subjected to the test corresponding to EN 61000-4-3 [8].

The RF-test level shall be 10 V/m swept over the frequency range 80 MHz to 1 GHz. The test signal shall be amplitude modulated with 1 kHz and a modulation depth of 80 %.

The test shall be performed with the EUT in the receive mode of operation.

For narrow band responses, see subclause 4.2.

The test shall be repeated with the EUT in the transmit mode of operation.

9.1.3 Performance criteria

The performance criterion A (subclause 6.2) shall apply.

9.2 Electrostatic discharge

This test shall be performed on a representative configuration of the EUT and ancillary equipment.

9.2.1 Definition

This test assesses the ability of the EUT to operate as intended in the event of ESDs.

9.2.2 Test method

The test generator, test set-up and test procedure shall be in accordance with EN 61000-4-2 [3].

For contact discharge, the equipment shall pass at ±2 kV and ±4 kV; for air discharge, the equipment shall pass at ±2 kV, ±4 kV and ±8 kV.

The test shall be performed with the EUT in receive mode of operation.

The test shall be repeated with the EUT in transmit mode of operation.

9.2.3 Performance criteria

The performance criterion B (subclause 6.3) shall apply.

9.3 Fast transients, common mode

9.3.1 Definition

This test assesses the ability of the EUT to operate as intended in the event of fast transients/bursts on the power, signal and control ports.

9.3.2 Test method

The EUT shall be subject to the test in accordance with EN 61000-4-4 [5].

This test shall be performed on AC power ports.

This test shall be performed on signal and control ports and DC power ports (DC common mode only) when connected to cables which may be longer than 3 m.

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

A test generator complying with subclause 6.1.1 of EN 61000-4-4 [5] shall be used. Application of the fast transient signal shall be by a coupling/decoupling network complying with subclause 6.2 of EN 61000-4-4 [5] for AC/DC power lines and a capacitive coupling clamp for signal and control lines complying with subclause 6.6.3 of EN 61000-4-4 [5].

The test level shall be 2 kV. The test voltage shall be applied as a 15 ms burst every 300 ms for the duration of 3 minutes for each positive and negative polarity of the test voltage.

The test shall be performed with the EUT in receive mode of operation.

The test shall be repeated with the EUT in transmit mode of operation.

9.3.3 Performance criteria

The performance criterion B (subclause 6.3) shall apply.

9.4 RF common mode 150 kHz to 80 MHz

It is recognized that tests down to a frequency of 10 kHz (as called for in EN 60945 [13]) are an important requirement, however at this time there are no practical test methods available, hence here the lower frequency limit is set to 150 kHz.

This test shall be performed on AC power input ports.

This test shall be performed on signal and control ports and the DC power ports of the EUT connected to cables which may be longer than 3 m.

Where this test is not carried out on any port because the manufacturer user documentation states that it is not intended to be used with cables longer than 2 m, a list of ports which were not tested for this reason shall be included in the test report.

9.4.1 Definition

This test assesses the ability of the EUT to operate as intended in the presence of radio frequency electromagnetic disturbance.

9.4.2 Test method

This test shall be performed using the intrusive or direct connection method or the clamp injection method as appropriate (see EN 61000-4-6 [7]).

The following requirements shall apply:

- the test signal level shall be 3 V rms. unmodulated. The test signal shall then be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 kHz;
- the test shall be performed over the frequency range 150 kHz - 80 MHz;
- the stepped frequency increments shall be 50 kHz in the frequency range 150 kHz - 5 MHz and 1 % frequency increment of the momentary frequency in the frequency range 5 MHz - 80 MHz;
- to enable the best test method to be used an intrusive or direct connection can be made to any of the lines of any input/output port where it is practical and the performance of the equipment is not degraded, alternatively the current clamp injection method can be used;
- the test method used shall be recorded in the test report.

Additionally a test shall be performed with a test level of 10 V emf at the following frequencies:

- 2 MHz;
- 3 MHz;
- 4 MHz;
- 6,2 MHz;
- 8,2 MHz;
- 12,2 MHz;
- 16,5 MHz;
- 18,8 MHz;
- 22 MHz; and
- 25 MHz.

The test shall be performed with the EUT in receive mode of operation.

For narrowband responses, see subclause 4.2.

The test shall be repeated with the EUT in transmit mode of operation.

9.4.3 Performance criteria

The performance criterion A (subclause 6.2) shall apply.

9.5 Power supply short term variations

9.5.1 Definition

This test assesses the ability of the EUT to operate as intended when being subjected to power supply short term variations present on the AC power input ports.

9.5.2 Test method

The test method shall be in accordance with EN 60945 [13]. The EUT shall be subject to the following power supply variations relative to the nominal value once per minute for the duration of 10 minutes each.

The nominal voltage shall be increased by 20 V ± 1 % for a duration of 1,5 s ± 0,2 s. Simultaneously the nominal AC supply frequency shall be increased by 10 Hz ± 0,5 % for a duration of 5 s ± 0,5 s.

The test shall be repeated but with the nominal voltage decreased by 20 V ± 1 % for a duration of 1,5 s ± 0,2 s. Simultaneously the nominal AC supply frequency shall be decreased by 10 Hz ± 0,5 % for a duration of 5 s ± 0,5 s.

For both the above tests the voltage and frequency variation rise and decay times shall be 0,2 ± 0,1 s (at 10 % and 90 %).

The test shall be performed with the EUT in the receive mode of operation.

The test shall be repeated with the EUT in the transmit mode of operation.

9.5.3 Performance criteria

The performance criterion B (subclause 6.3) shall apply.

9.6 Surge, common and differential mode

The test shall be performed on AC power input ports.

These tests shall be performed on a representative configuration of the EUT and ancillary equipment as appropriate.

9.6.1 Definition

These tests assesses the ability of the EUT and ancillary equipment to operate as intended in the event of surges on the AC mains power input ports.

9.6.2 Test method

The EUT shall be subject to the test corresponding to EN 61000-4-5 [6].

A combination wave (hybrid) generator complying with subclause 6.1 of EN 61000-4-5 [6] in combination with any coupling/decoupling network complying with subclause 6.3 of EN 61000-4-5 [6] shall be used:

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

The test shall be performed with the EUT in receive mode of operation.

The test shall be repeated with the EUT in transmit mode of operation.

9.6.3 Performance criteria

The performance criterion B (subclause 6.3) shall apply.

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

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

Clause/Subclause number and title		Corresponding article of Council Directive 89/336/EEC	Qualifying remarks
8.1	Radiated emissions	4(a)	
8.2	Power ports	4(a)	
9.1	Radio frequency electromagnetic field (80 MHz - 1 000 MHz)	4(b)	
9.2	Electrostatic discharge	4(b)	
9.3	Fast transients, common mode	4(b)	
9.4	RF common mode150 kHz to 80 MHz	4(b)	
9.5	Power supply short term variations	4(b)	
9.6	Surge, common and differential mode	4(b)	

Annex B (informative): Alternative performance check (under investigation)

It has been recognized that it is possible to carry out certain performance checks of Maritime Mobile Earth Stations (MMES) via satellite system, instead of the STE. At this time the operational impact of doing these performance checks are unclear and need further clarification. Therefore the contents of this annex are for information purposes only.

The performance check may be carried out without using the STE if messages are transmitted and received through the satellite system.

The optimum solution would have been to use the important and vital function - distress alert transmission - in the performance check. Using the distress alert would however cause some tests to be very difficult if not impossible to carry out because of the protocol timing and the short bursts / packets used. Instead another vital function - the distress message transmission and reception - is currently used in the performance check. If the option to transmit and receive through the satellite system were introduced, it would be necessary to protect the integrity of the operational distress communication system. The messages transmitted and received would therefore be of normal priority only. Although this is a further relaxation compared to using distress priority messages, it is found to be acceptable since the only difference between distress and normal priority messages in the Inmarsat-C system is a one bit and a two bits field in the signalling to establish and close the protocol.

If the performance check were conducted through the satellite system instead of using the STE the following requirements would apply:

a) the performance check would be as described in subclause 6.4 except that all messages would be of normal priority instead of distress priority;

b) the manufacturer would provide documentary evidence that the satellite system operator had accepted that the EUT transmits and receives messages through the satellite system;

c) when an antenna with active devices is placed outside the test premises for communication with the satellite, this antenna would be tested separately as a stand alone unit. The magnitude of the transfer function(s) of the antenna would be measured before testing. This value would be required not to change more than +/-1 dB at any time during the test.

When not using the STE it would be necessary to ensure that no distress priority transmission to the satellite occurred.

History

Document history				
Edition 1	February 1997	prETS 300 829 on Public Enquiry	PE 9726:	1997-02-28 to 1997-06-27
V1.1.1	December 1997	Vote	V 9805:	1997-12-02 to 1998-01-30
V1.1.1	March 1998	Publication		

ISBN 2-7437-0366-0
Dépôt légal : Mars 1998