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European Standard (Telecommunications series)

Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) for radiotelephone transmitters and receivers for the maritime mobile service operating in the VHF bands

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Voting phase of the ETSI standards Two-step Approval Procedure.

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 300 162, 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.

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

1 Scope

The present document covers the assessment of radiocommunication and ancillary equipment 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 300 162 [7] 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 transmitters and receivers for fixed installation on board ships operating in the maritime VHF bands in the frequency range 156 MHz - 174 MHz, and the associated ancillary equipment.

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 [8].

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, shall be recorded in the test report.

The present document is based on the considerations and guidance as given in ETR 238 [9].

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

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

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

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

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

[7] ETS 300 162 (1997): "Radio Equipment and Systems (RES); Radiotelephone transmitters and receivers for the maritime mobile service operating in the VHF bands; Technical characteristics and methods of measurement".

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

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

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

3 Definitions, symbols and abbreviations

3.1 Definitions

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

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

- the equipment is intended for use in conjunction with a receiver, transmitter or transceiver to provide additional operational and/or control features to the radio equipment (e.g. to extend control to another position or location); and
- the equipment cannot be used on a stand alone basis to provide user functions independently of a receiver, transmitter or transceiver; and
- the receiver, transmitter or transceiver to which it is connected, is capable of providing some intended operation such as transmitting and/or receiving without the ancillary equipment, i.e. it is not a sub-unit of the main equipment essential to the main equipment basic functions.

artificial antenna: The antenna port(s) of the Equipment Under Test (EUT) shall be terminated with a non-radiating 50 Ω termination unless there is a requirement to apply a Radio Frequency (RF) input signal to the receiver antenna port.

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

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.

3.2 Symbols

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

emf	electromotive force
rms	root mean square
SINAD	Signal + Noise + Distortion / Noise + Distortion

3.3 Abbreviations

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

AC	Alternating Current
AM	Amplitude Modulation
DC	Direct Current
EMC	ElectroMagnetic Compatibility
EUT	Equipment Under Test
RF	Radio Frequency

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 test shall be carried out at a point within the specified normal operating environmental range of temperature and humidity with the equipment connected to the normal power supply voltage as defined in ETS 300 162 [7].

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 to these ports, or interconnecting cables have to be extended in length in order to exercise the EUT, precautions shall be taken to ensure that the evaluation of the EUT is not affected by the addition or extension of these cables.

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

4.1.1 Emission tests

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

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

4.1.2 Immunity tests

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

- the 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/fail criteria, the receiver, transmitter or transceiver coupled to the ancillary equipment, shall be used to judge whether the ancillary equipment passes or fails.

4.1.2.1 Mode of operation

For the immunity tests of transmitters, the transmitter shall be operated at its maximum rated output power, modulated with normal test modulation (subclauses 4.1.2.2 and 4.1.2.3).

For the immunity tests of receivers, the wanted input signal, coupled to the receiver, shall be modulated with normal test modulation (subclauses 4.1.2.2 and 4.1.2.5).

4.1.2.2 Normal test modulation

The normal test modulation shall be as follows:

- the receiver wanted input signal shall be set to the nominal frequency of the receiver modulated with a sinusoidal audio frequency of 1 000 Hz and a frequency deviation of ±3 kHz;

- the transmitter shall be modulated with a sinusoidal audio frequency of 1 000 Hz and the deviation shall be ±3 kHz.

4.1.2.3 Arrangements for test signals at the input of the transmitter

The transmitter shall be modulated by a signal source capable of delivering normal test modulation.

4.1.2.4 Arrangements for test signals at the output of the transmitter

The transmitter output shall be connected to an artificial antenna. The measuring equipment for the wanted signal shall be located outside the test environment. Adequate measures shall be taken to avoid the effect of the unwanted signal on the measuring equipment.

4.1.2.5 Arrangements for test signals at the input of the receiver

Test signal sources shall be connected to the receiver input in such a way that the impedance presented to the receiver input is 50 Ω. The level of the wanted signal shall be 40 dBµV (emf) unless indicated otherwise.

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

4.1.2.6 Arrangements for test signals at the output of the receiver

The output of the receiver shall be coupled to the test equipment outside the test environment. If the equipment has an output connector/port then this port shall be used to connect the test equipment outside the test environment. Precautions shall be taken to ensure that any effect on the test is minimized.

4.1.2.7 Receiver and receivers of transceivers exclusion band

The exclusion band for receivers and receivers of transceivers is the frequency range determined by the switching range, as declared by the manufacturer, extended as follows:

- the lower frequency of the exclusion band is the lower frequency of the switching range, minus 5 % of the centre frequency of the switching range, or minus 10 MHz, whichever will result in the lowest frequency;

- the upper frequency of the exclusion band is the upper frequency of the switching range, plus 5 % of the centre frequency of the switching range, or plus 10 MHz, whichever will result in the highest frequency.

The switching range is the maximum frequency range over which the receiver can be operated without reprogramming or realignment.

4.1.2.8 Transmitter exclusion band

The exclusion band for transmitters extends ±50 kHz from the nominal operating frequency of the transmitter.

4.1.2.9 Narrow band responses of 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 method defined in this subclause.

If an unwanted signal causes a SINAD of less than 20 dB, it is necessary to establish whether the distortion is due to a narrowband response or a wideband phenomena.

Taking the initial test frequency as reference, the procedure is repeated with an increase of the unwanted signal frequency by 50 kHz.

If the SINAD recovers to not less than 20 dB, then the response is considered as a narrowband response.

If the SINAD is still less than 20 dB, the test is repeated with the frequency of the unwanted signal decreased by 50 kHz.

If the SINAD recovers to not less than 20 dB, the response is considered as a narrowband response.

If the SINAD is still less than 20 dB, 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.

Therefore, taking the initial test frequency as reference the procedure is repeated with an increase of the unwanted signal frequency by 62,5 kHz.

If the SINAD recovers to not less than 20 dB the response is considered as a narrowband response. If the SINAD is still less than 20 dB, the test is repeated with the frequency of the unwanted signal decreased by 62,5 kHz.

If the SINAD is still less than 20 dB, the phenomenon is considered wideband and therefore an EMC problem and the equipment fails the test.

All narrowband 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 ancillary equipment to be combined with the radio equipment for testing (where applicable);
- an exhaustive list of ports, with the maximum cable lengths allowed, classified as either power, signal, control or antenna. Power ports shall further be classified as Alternating Current (AC) or Direct Current (DC) power.

5.2 Ancillary equipment

At the manufacturers discretion an ancillary equipment may be:

- declared compliant separately (in isolation) from a receiver, transmitter or transceiver to all the applicable immunity and emission clauses of the present document;
- declared compliant to another appropriate Harmonized EMC Standard;
- tested with it connected to a receiver, transmitter 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, 6.3 and 6.4.

6.2 Performance criteria A for continuous phenomena

The EUT shall continue to operate as intended during and after the test. During the test sequence the EUT shall not change settings and shall not unintentionally transmit. No degradation of performance or loss of function below the level as defined in the relevant equipment standard and in the technical specification published by the manufacturer is allowed.

During the test the EUT shall be subjected to the performance check (subclause 6.5). The requirements of the performance check shall be met.

6.3 Performance criteria B for transient phenomena

During the test sequence, degradation or loss of function or performance which is self recoverable is allowed, but the EUT shall not unintentionally transmit or change actual operating state or stored data.

The EUT shall continue to operate as intended after the test. No degradation of performance or loss of function below the level as defined in the relevant equipment standard and in the technical specification published by the manufacturer is allowed.

After the test the EUT shall be subjected to the performance check (subclause 6.5). The requirements of the performance check shall be met.

6.4 Performance criteria C

Temporary degradation or loss of function or performance is allowed during the test sequence, provided the function, as defined in the relevant equipment standard and in the technical specification published by the manufacturer, is self recoverable or can be restored after the test by operation of user controls. During the test sequence the EUT shall not change settings and shall not unintentionally transmit.

After the test the EUT shall be subjected to the performance check (subclause 6.5). The requirements of the performance check shall be met.

6.5 Performance check

6.5.1 Transmitter

For the purpose of the present document, a "performance check" of the transmitter is taken to mean a measurement of:

- RF output power;
- frequency error;
- SINAD of the demodulated output signal.

The transmitter shall be connected to an artificial antenna (subclause 4.1.2.4).

The RF output signal shall be connected via an appropriate coupling device to a linear demodulator with a de-emphasis network of 6 dB/octave.

With the output power switch set at maximum:

- the RF output carrier power shall be between 6 and 25 W;
- the frequency error of the unmodulated carrier shall be within ±1,5 kHz;
- with normal test modulation (subclause 4.1.2.2), the SINAD of the demodulated output signal shall be 20 dB or better.

6.5.2 Receiver

For the purpose of the present document a "performance check" of the receiver is taken to mean a measurement of the receiver's SINAD with a test signal at a carrier frequency equal to the nominal frequency of the receiver modulated by the normal test modulation (subclause 4.1.2.2) applied to the receiver input.

An audio frequency load and measuring instrument for measuring the SINAD shall be connected to the receiver output terminal using a fixed input level of 12 dBµV (emf).

The SINAD shall be at least 20 dB with the receiver's audio frequency power control adjusted to produce 50 % of the rated output power.

7 Applicable overview tables

7.1 Emissions

Table 1: Emissions, applicability overview

Application	Test requirements	Reference subclause in the present document	Reference standard
Radiated emissions	applicable	8.1	EN 60945 [8] CISPR 16 -1 [1]
DC power in/out	applicable	8.2	EN 60945 [8] CISPR 16-1 [1]
AC mains	applicable	8.2	EN 60945 [8] CISPR 16-1 [1]

7.2 Immunity

Table 2: Immunity overview

Phenomena	Application	Test requirements	Reference subclause in the present document	Reference standard
RF electro-magnetic field 80 MHz - 1 000 MHz	Enclosure	applicable	9.1	EN 61000-4-3 [6]
Electrostatic discharge	Enclosure	applicable	9.2	EN 61000-4-2 [2]
Fast transients	AC/DC power input ports and signal and control ports	applicable	9.3	EN 61000-4-4 [3]
Conducted disturbances induced by RF fields 150 kHz - 80 MHz	Signal & control ports DC & AC power ports	applicable	9.4	EN 61000-4-6 [5]
Short term power supply variations	AC power input ports	applicable	9.5	EN 60945 [8]
Power supply failure	AC power input ports	applicable	9.6	EN 60945 [8]
Surge	AC power input ports	applicable	9.7	EN 61000-4-5 [4]

8 Test methods and limits for emission tests

The individual measurements referenced 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 [8].

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 [8] 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 [10] (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.		

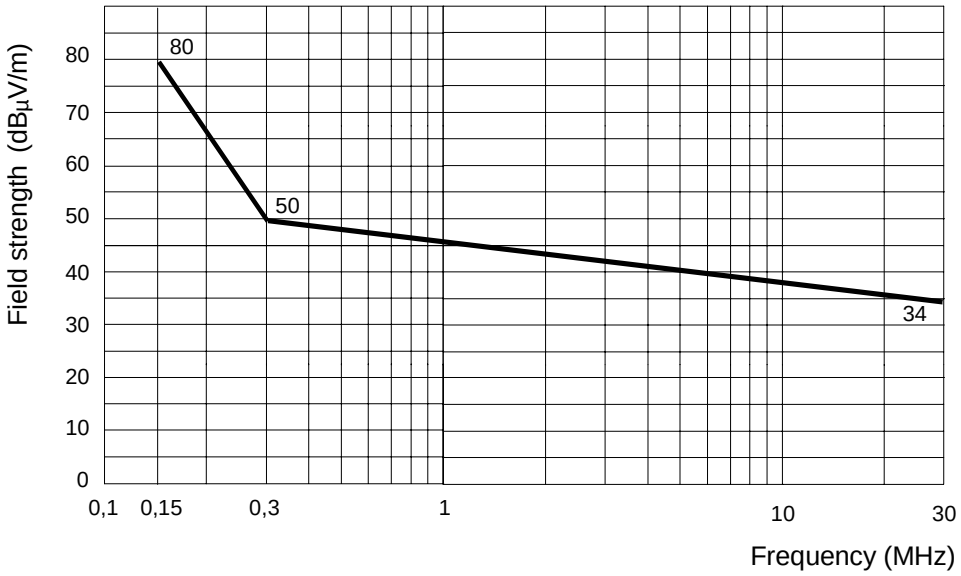

Figure 1: Maximum level of radiated spurious emissions (within the range 150 kHz to 30 MHz)

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 and ancillary equipment.

8.2.1 Definition

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

8.2.2 Test method

The test method shall be in accordance with EN 60945 [8] except where noted in this subclause.

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 in parallel to the artificial mains network.

This test shall be performed on a representative configuration of the EUT in the receive mode of operation, and also when transmitting on 156,7 MHz.

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

The measuring bandwidth in the frequency range 10 kHz to 150 kHz shall be 200 Hz and in the frequency range 150 kHz to 30 MHz 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 (50 Ω/50 μH + 5 Ω) in accordance with CISPR 16-1 [1].

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.

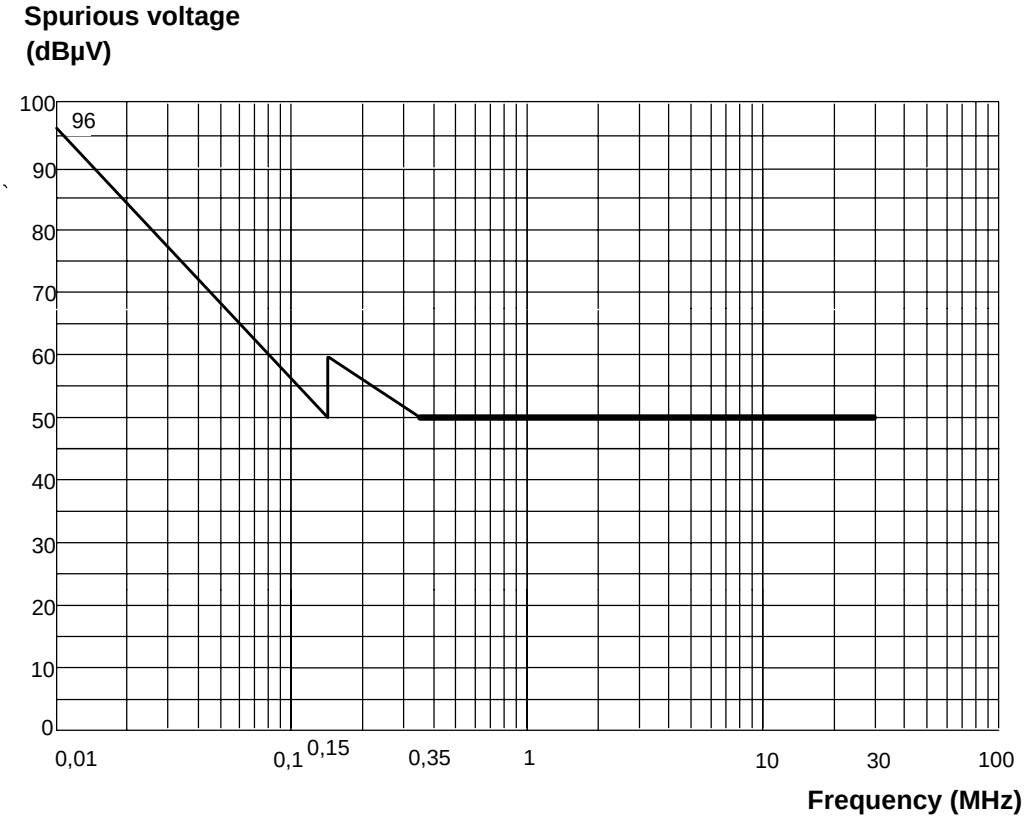

Figure 2: Maximum level of conducted spurious voltage into the mains

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 levels indicated. Any deviations from this principle are elaborated in the text.

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

Receive and transmit modes of operation, are both subject to frequency exclusion bands as in subclauses 4.1.2.8 and 4.1.2.9 when testing for RF immunity.

The applicability of tests to specific clauses of equipment is elaborated in subclause 7.2.

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

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

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 test shall be in accordance with EN 61000-4-3 [6].

The RF test level shall be 10 V/m swept over the frequency range 80 MHz to 1 GHz. The modulation shall be Amplitude Modulation (AM) at a frequency of 400 Hz to a depth of 80 %.

The test shall be performed with the EUT in the receive mode of operation (for narrowband responses, see subclause 4.1.2.9). A receiver input level of 40 dBµV shall be used during the test.

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

9.1.3 Performance criteria

Performance criterion A (subclause 6.2) shall apply.

9.2 Electrostatic discharge

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

9.2.1 Definition

This test assesses the ability of the EUT to operate as intended in the event of an electrostatic discharge.

9.2.2 Test method

The test generator, test set-up and test procedure shall be in accordance with EN 61000-4-2 [2]. The test levels shall be 6 kV contact discharge and 8 kV air discharge.

The test shall be performed with ten single discharges applied to each test point. Ten test points shall be chosen on exposed surfaces on any unit of the EUT including where appropriate, knobs and other protrusions or projecting parts accessible to the user in normal operation.

Care should be taken not to apply these discharges to conductive pins of connectors.

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

Performance criterion B (subclause 6.3) shall apply.

9.3 Fast transients

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 corresponding to EN 61000-4-4 [3].

This test shall be performed on AC power ports.

This test shall be performed on signal and control ports and DC mains 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 [3] shall be used. The induction of the interference shall be by a coupling/decoupling network complying with subclause 6.2 of EN 61000-4-4 [3] for AC/DC power lines and a capacitive coupling for signal and control lines clamp complying with subclause 6.6.3 of EN 61000-4-4 [3].

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.

RF-test signals shall be applied to the EUT as indicated in subclause 6.1 of ETS 300 162 [7].

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

Performance criterion B (subclause 6.3) shall apply.

9.4 Conducted disturbances induced by RF-fields in the frequency range 150 kHz - 80 MHz

It is recognized that tests down to a frequency of 10 kHz (as called for in EN 60945 [8]) 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 the 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 3 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 a radio frequency electromagnetic disturbance.

9.4.2 Test method

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

A test generator complying with subclause 6.1 of EN 61000-4-6 [5] shall be used. The induction of the disturbances to power supply lines shall be by a coupling/decoupling network complying with subclause 6.2.2.1 of EN 61000-4-6 [5] and to input/output and control lines by direct injection as described in subclause 6.2.1 of EN 61000-4-6 [5].

The test level shall be 3 V rms swept over the frequency range of 150 kHz to 80 MHz. The modulation shall be Amplitude Modulation (AM) at a frequency of 400 Hz to a depth of 80 %.

Additionally a test shall be performed with a test level of 10 V rms 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. A receiver input level of 40 dBµV shall be used during the test.

For narrowband responses, see subclause 4.1.2.9.

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

9.4.3 Performance criteria

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 sub-jected 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 [8]. 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:

a) test voltage = nominal voltage + (20 V ± 1 %) deviation, duration 1,5 s ± 0,2 s;

   test frequency = nominal frequency + (10 Hz ± 0,5 %) deviation, duration 5 s ± 0,5 s, superimposed;

b) test voltage = nominal voltage - (20 V ± 1 %) deviation, duration 1,5 s ± 0,2 s;

   test frequency = nominal frequency - (10 Hz ± 0,5 %) deviation, duration 5 s ± 0,5 s, superimposed.

Voltage and frequency variation raise and decay times are 0,2 s ± 0,1 s (at 10 % and 90 %).

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.

9.5.3 Performance criteria

Performance criterion B (subclause 6.3) shall apply.

9.6 Power supply failure

9.6.1 Definition

This test assesses the ability of the EUT to operate as intended after being subjected to short breaks in the power supply due to power supply change over and breaker dropout. This test is not applicable to EUT intended for operation from battery power sources only or fitted with or connected to back-up batteries. It covers the break allowed by the IMO SOLAS Convention for changeover between ships main and emergency power supplies.

9.6.2 Test method

The EUT shall be subjected to three breaks in the power supply of a duration of 60 s each.

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

Performance criterion C (subclause 6.4) shall apply.

9.7 Surge

These tests shall be performed on AC power input ports.

These test shall be performed on a representative configuration of the EUT.

9.7.1 Definition

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

9.7.2 Test method

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

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

The test voltage shall be 0,5 kV line-to-line and 1 kV line-to-ground. The test voltage shall be applied with a repetition rate of 6 pulses/minute for a duration of 3 minutes for each of the positive and negative polarity of the test voltage.

The test shall be performed with the EUT in receive mode of operation. A receiver input level of 40 dBμV shall be used during the test.

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

9.7.3 Performance criteria

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 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 transient	4(b)	
9.4	Conducted disturbances induced by RF-fields in the frequency range 150 kHz - 80 MHz	4(b)	
9.5	Power supply short term variations	4(b)	
9.6	Power supply failure	4(b)	Relates to IMO SOLAS Convention
9.7	Surge	4(b)	

History

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