Draft EN 301 011 V1.1.1 (1997-11)

European Standard (Telecommunications series)

Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for Narrow-Band Direct-Printing (NBDP) NAVTEX receivers operating in the maritime mobile service

European Telecommunications Standards Institute

Reference
DEN/ERM-EMC-027 (9d000ico.PDF)
Formerly DEN/RES-09027

Keywords
EMC, maritime, NAVTEX, radio, testing

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Contents

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Foreword

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

Other standards cover radiocommunications equipment not listed in the scope.

The present document is based upon EN 60945 [11].

The present EN 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 EN, together with ETS 300 065 [10] 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 are found in the related product standard ETS 300 065 [10] 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 Narrow-Band Direct-Printing (NBDP) NAVTEX receivers operating in the maritime mobile service 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 [11].

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.

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, should be recorded in the test report.

The present document is based on the considerations and guidance as given in ETR 238 [13].

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 55022: "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 61000-4-4 (1995): "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test".

[5] EN 61000-4-5 (1995): "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 5: Surge immunity test".

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

[7] EN 61000-4-3 (1995): "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test".

[8] 89/336/EEC: "Council Directive on approximation of the laws of the Member States relating to electromagnetic compatibility".

[9] 92/31/EEC: "Council Directive amending Directive 89/336/EEC on approximation of the laws of the Member States relating to electromagnetic compatibility".

[10] ETS 300 065: "Radio Equipment and Systems (RES); Narrow-band direct-printing telegraph equipment for receiving meteorological or navigational information (NAVTEX); Technical characteristics and methods of measurement".

[11] EN 60945: "Marine navigational equipment - General requirements - Methods of testing and required test results".

[12] ETS 300 113: "Radio Equipment and Systems (RES); Land Mobile Service; Technical characteristics and test conditions for radio equipment intended for the transmission of data (and speech) and having an antenna connector".

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

3 Definitions 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: A non-radiating load of 10 Ω in series with 150 pF, non radiating..

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 Abbreviations

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

AC	Alternating Current
CER	Character Error Rate
DC	Direct Current
EMC	ElectroMagnetic Compatibility

emf	electromotive force
EUT	Equipment Under Test
IMO	International Maritime Organization
RF	Radio Frequency
rms	root mean square
SOLAS	Safety Of Life At Sea

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 normal temperature and humidity with the equipment connected to the normal power supply voltage. All tests shall be performed with the wanted signal on the operating frequency 518 kHz unless otherwise stated.

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: 20 % to 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 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, the wanted input signal, coupled to the receiver, shall be the normal test signal (subclauses 4.1.2.2 and 4.1.2.3). Before each test, the normal test signal (subclause 4.1.2.2) shall be applied to the EUT to check the correct functioning and to load the message header memory. The user memories shall be loaded with appropriate test data. During the immunity tests, the normal test signal shall be preceded by a different header.

4.1.2.2 Normal test signal

The normal test signal shall be an F1B radio-frequency signal modulated with a frequency shift of ±85 Hz centred on 518 kHz.

It shall contain signals providing the following traffic information:

1 2 3 4 5 6 7 8 9 0 A B C D E F G H I J K L M N O P Q R S T U - Carriage return - Line feed.

For tests with the normal test signal, the above information shall be transmitted at least 35 times continuously.

4.1.2.3 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 wanted signal level 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.

4.1.2.4 Receiver exclusion band

The exclusion band is the frequency range 490 kHz to 545 kHz.

4.1.2.5 Narrow band responses

Responses occurring during the test at discrete frequencies which are narrow band responses (spurious responses) are identified by the method specified in this subclause.

If an unwanted signal causes a character error rate of more than 4×10^{-2} it is necessary to establish whether the distortion is due to a narrowband response or to wideband phenomena.

Taking the initial test frequency as reference the procedure is repeated with an increase of the unwanted signal frequency by 1 kHz.

If the character error rate recovers to not more than 4×10^{-2}, then the response is considered as a narrowband response.

If the character error rate is still not more than 4×10^{-2}, the test is repeated with the frequency of the unwanted signal decreased by 1 kHz.

If the character error rate recovers to less than 4×10^{-2}, the response is considered as a narrowband response.

If the character error rate is still more than 4×10^{-2}, 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 1,25 kHz.

If the character error rate recovers to less than 4×10^{-2} the response is considered as a narrowband response. If the character error rate is still greater than 4×10^{-2}, the test is repeated with the frequency of the unwanted signal decreased by 1,25 kHz.

If the character error rate is still more than 4×10^{-2}, 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 or control. 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 the receiver 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 the receiver 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, 6.4 for the tests indicated in tables 1 and 2.

6.2 Performance criterion A for continuous phenomena

The EUT shall continue to print during the test.

After the test the print shall be examined. The Character Error Rate (CER) in the printed output shall be below 4×10^{-2}.

After the test an RF test signal shall be applied to the EUT using the same header as used preceding the test. The test signal shall not be printed.

After the test the data in the user memories shall be checked. The data shall be unchanged from that loaded preceding the test.

6.3 Performance criterion B for transient phenomena

If during the test the printing stops, one more RF test signal with the same header shall be applied to the EUT and this test signal shall be printed.

If during the test the printing does not stop, at the conclusion of the test the following shall be carried out:

- an RF test signal shall be applied to the EUT using the same header as used preceding the test. This test signal shall not be printed;
- an RF test signal shall be applied to the EUT using a new header. This test signal shall be printed.

After the test the data in the user memories shall be checked. The data shall be unchanged from that loaded preceding the test.

6.4 Performance criterion C

After the test, the EUT shall enter receive mode without operator intervention.

After the test the data in the user memories shall be checked. The data shall be unchanged from that loaded preceding the test.

6.5 Performance check

The term "performance check" is taken to mean a measurement of the receiver's character error rate with the normal test signal (subclause 4.1.2.2) applied to the receiver input using a fixed input level of 12 dBµV (emf) unless otherwise stated.

The character error rate shall be less than 4×10^{-2}.

7 Applicability overview tables

7.1 Emissions

Table 1: Emissions overview

Application	Test requirements	Reference subclause	Reference document
Radiated emissions	applicable	8.1	EN 60945 [11] CISPR 16-1 [1]
Radiated Emissions (enclosure)	applicable	8.3	ETS 300 113 [12]
DC power in/out	applicable	8.2	EN 60945 [11] CISPR 16-1 [1]
AC mains	applicable	8.2	EN 60945 [11] CISPR 16-1 [1]

7.2 Immunity

Table 2: Immunity overview

Phenomena	Application	Test requirements	Reference subclause in the present document	Reference
RF electro-magnetic field 80 MHz-1 000 MHz	Enclosure	applicable	9.1	EN 61000-4-3 [7]
Electrostatic discharge	Enclosure	applicable	9.2	EN 61000-4-2 [3]
Fast transient	AC/DC power input ports and signal and control ports	applicable cables > 3 m for DC power and signal and control ports	9.3	EN 61000-4-4 [4]
RF common mode 0,01 MHz - 80 MHz	Signal and control ports DC and AC power ports	applicable cables > 3 m for DC power and signal and control ports	9.4	EN 61000-4-6 [6]
Short term power supply variations	AC power input ports	applicable	9.5	EN 60945 [11]
Power supply failure	AC power input ports	applicable	9.6	EN 60945 [11]
Surges	AC power input ports	applicable	9.7	EN 61000-4-5 [5]
Conducted low frequency interference	AC power input ports	applicable	9.8	EN 60945 [11]

8 Methods and limits for emission measurements

The individual tests called up in table 1 shall be performed in accordance with the basic standard specified in each case. Any deviations from this principle are elaborated in the text.

The tests shall be performed on the EUT when receiving the normal test signal with a level of 40 dBµV (emf).

The applicability of tests to specific classes of equipment are elaborated in table 1.

8.1 Radiated emissions

This test is applicable to the enclosure port of the ancillary equipment, for the frequency range 30 MHz to 1 GHz.

In the frequency range 150 kHz to 30 MHz, the tests shall be performed on a representative configuration of the radio equipment or a representative configuration of the combination of the 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

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 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.

In the frequency range 150 kHz to 30 MHz for all equipment and ancillaries, tests shall be carried out according to EN 60945 [11] and CISPR 16-1 [1], at a 3 m measuring distance ,with measurement bandwidth 9 to 10 kHz and a quasi-peak detector using a magnetic loop antenna.

In the frequency range 30 MHz to 1 GHz for ancillary equipment only, tests shall be carried out according to EN 55022 [2], at a 10 m measuring distance, with measurement bandwidth 100 kHz to 120 kHz and a quasi-peak detector.

8.1.3 Limits

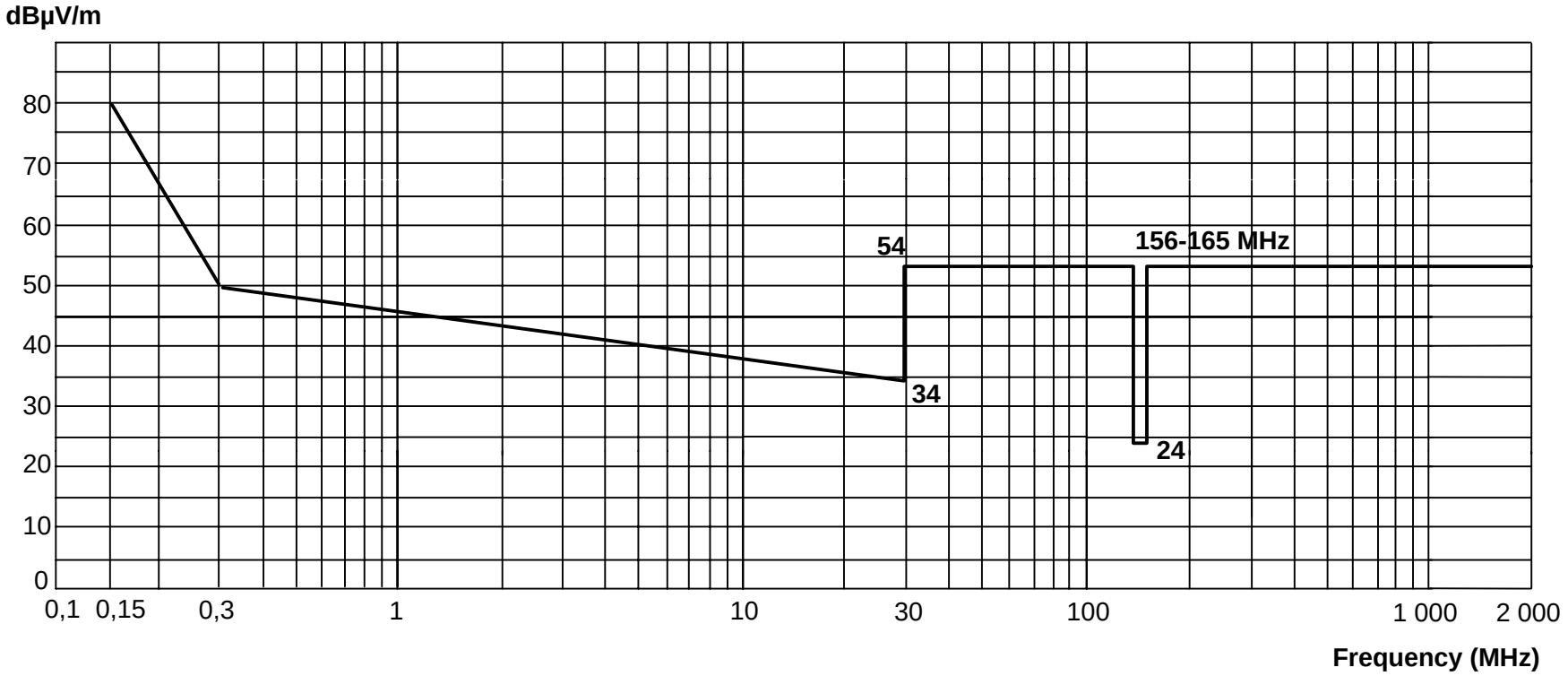
For the frequency band 150 kHz - 30 MHz the level of the field strength of any radiated spurious signals for a representative configuration of the radio equipment or a representative configuration of the combination of the radio and ancillary equipment shall not exceed the linits given in figure 1.

In the frequency range 30 MHz to 1 GHz, the level of spurious emissions shall not exceed the limits given in table 3.

More stringent emission limits in the 156 MHz to 165 MHz band are not practical to measure on an open field site, and may not be compatible with actual levels of intermodulation experienced in service in this (channelized) band. There are also considerations about emissions from cosited systems such as RADAR and harmonics from high power marine HF installations.

Table 3: Limits for unwanted emissions for ancillary equipment tested in isolation

Frequency range	Limit (quasi peak)
30 MHz - 230 MHz	30 dBuV/m
> 230 MHz - 1 000 MHz	37 dBuV/m



NOTE: In practice this graph is presented to give a basis for the comparison of measurements obtained when using different test systems. The results depend on the inductive coupling between the antenna and the EUT under near-field measurement conditions.

Figure 1: Maximum level of radiated spurious emissions (receiving condition)

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 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.

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 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.

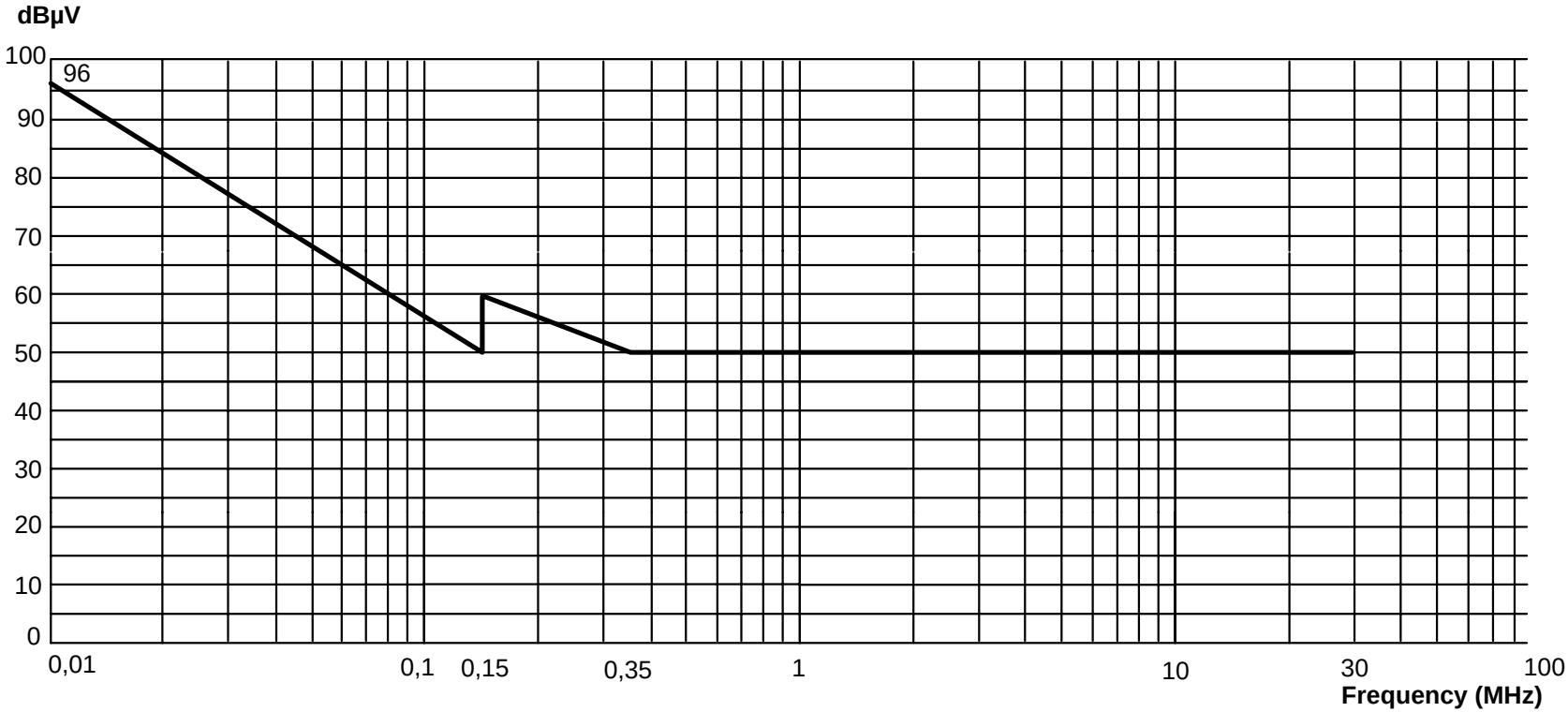


Figure 2: Maximum level of conducted spurious voltage into the mains

8.3 Radiated spurious emissions of the enclosure port of the radio equipment

8.3.1 Definition

This test assesses the ability of the EUT to limit unwanted (spurious) emissions from the enclosure of the radio equipment in the frequency range 30 MHz - 2 GHz.

8.3.2 Method of Measurement

This method applies only to equipment with an external antenna connector.

On a test site, the equipment shall be placed at the specified height on a non-conducting support and in the position closest to normal use as declared by the manufacturer.

The receiver antenna connector shall be connected to an artificial antenna.

The test antenna shall be orientated for vertical polarization and the length of the test antenna shall be chosen to correspond to the instant frequency of the measuring receiver.

The output of the test antenna shall be connected to a measuring receiver.

The receiver shall be switched on and the measuring receiver shall be tuned over the frequency range 30 MHz to 2 GHz.

At each frequency at which a spurious component is detected, the test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.

The receiver shall then be rotated through 360º in the horizontal plane until the maximum signal level is detected by the measuring receiver.

The maximum signal level detected by the measuring receiver shall be noted.

The receiver shall be replaced by a substitution antenna.

The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the spurious component detected.

The substitution antenna shall be connected to a calibrated signal generator.

The frequency of the calibrated signal generator shall be set to the frequency of the spurious component detected.

The input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver, if necessary.

The test antenna shall be raised and lowered through the specific range of height to ensure that the maximum signal is received.

The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the spurious component was measured, corrected for the change of input attenuator setting of the measuring receiver.

The input level to the substitution antenna shall be recorded as power level, corrected for the change of input attenuator setting of the measuring receiver.

The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

The measure of the effective radiated power of the spurious components is the larger of the two power levels recorded for each spurious component at the input to the substitution antenna, corrected for the gain of the antenna if necessary.

8.3.3 Limits

The power of any spurious radiation in the frequency range 30 MHz to 2 GHz shall not exceed 2 nW.

9 Test methods and levels for immunity tests

The individual tests called up in the table 2 shall be performed in accordance with the basic standard specified in each case. Any deviations from this principle are elaborated in the text.

The tests shall be performed on the EUT when receiving the normal test signal with a level of 40 dBµV (emf).

The applicability of tests to specific classes of equipment is elaborated in table 2.

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

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 %.

For narrowband responses, see subclause 4.1.2.5.

9.1.3 Performance criteria

During the test the EUT shall meet the requirements of the performance check (subclause 6.5).

Performance criterion A (subclause 6.2) shall apply.

9.2 ElectroStatic Discharge (ESD)

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 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 [3].

The test levels shall be +-2 and +-4 kV contact discharge, and +-2, +-4 and +-8 kV air discharge.

9.2.3 Performance criteria

Performance criterion B (subclause 6.3) shall apply.

After the test the EUT shall meet the requirements of the performance check (subclause 6.5).

9.3 Fast transient, differential and common mode

9.3.1 Definition

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

9.3.2 Test method

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

This test shall be performed on AC power ports.

This test shall additionally 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 [4] 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 [4] 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 [4].

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.

9.3.3 Performance criteria

Performance criterion B (subclause 6.3) shall apply.

After the test the EUT shall meet the requirements of the performance check (subclause 6.5).

9.4 Conducted disturbances induced by RF-fields in the frequency range 10 kHz - 80 MHz

This test shall be performed on the AC power input ports.

This test shall additionally 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.

The receiver frequency exclusion band shall be applied, see subclause 4.1.2.4.

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

A test generator complying with subclause 6.1 of EN 61000-4-6 [6] shall be used. Application 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 [6] and to input/output and control lines by direct injection as described in subclause 6.2.1 of EN 61000-4-6 [6].

The test level shall be 3 V (rms) and the signal shall be swept over the frequency range of 10 kHz to 80 MHz with a modulation frequency of 1 kHz.

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.

For narrowband responses, see subclause 4.1.2.5.

9.4.3 Performance criteria

During the test the EUT shall meet the requirements of the performance check (subclause 6.5).

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 [11]. The EUT shall be subject to the following power supply variations relative to nominal once per minute for the duration of 10 minutes each.

1) Voltage: nominal +20 V ± 1 %, duration 1,5 s ± 0,2 s;

   frequency: nominal +10 Hz ± 0,5 %, duration 5 s ± 0,5 s, superimposed;

2) Voltage: nominal -20 V ± 1 %, duration 1,5 s ± 0,2 s;

   frequency: nominal -10 Hz ± 0,5 %, duration 5 s ± 0,5 s, superimposed.

Voltage and frequency variation rise and decay times shall be 0,2 s ± 0,1 s (at 10 % and 90 %).

9.5.3 Performance criteria

Performance criterion B (subclause 6.3) shall apply.

After the test the EUT shall meet the requirements of the performance check (subclause 6.5).

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 or breaker dropout. This test is not applicable to an 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 3 breaks in the power supply of a duration of 60 s each.

The relevant performance check shall be performed after each break.

9.6.3 Performance criteria

Performance criterion C (subclause 6.4) shall apply.

After each break the EUT shall meet the requirements of the performance check (subclause 6.5).

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 and ancillary equipment as appropriate.

9.7.1 Definition

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

9.7.2 Test method

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

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

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

9.7.3 Performance criteria

Performance criterion B (subclause 6.3) shall apply.

After the test the EUT shall meet the requirements of the performance check (subclause 6.5).

9.8 Immunity to conducted low frequency disturbance

9.8.1 Definition

This test simulates the effects of power supply harmonics and interharmonics on AC supplies.

9.8.2 Test method

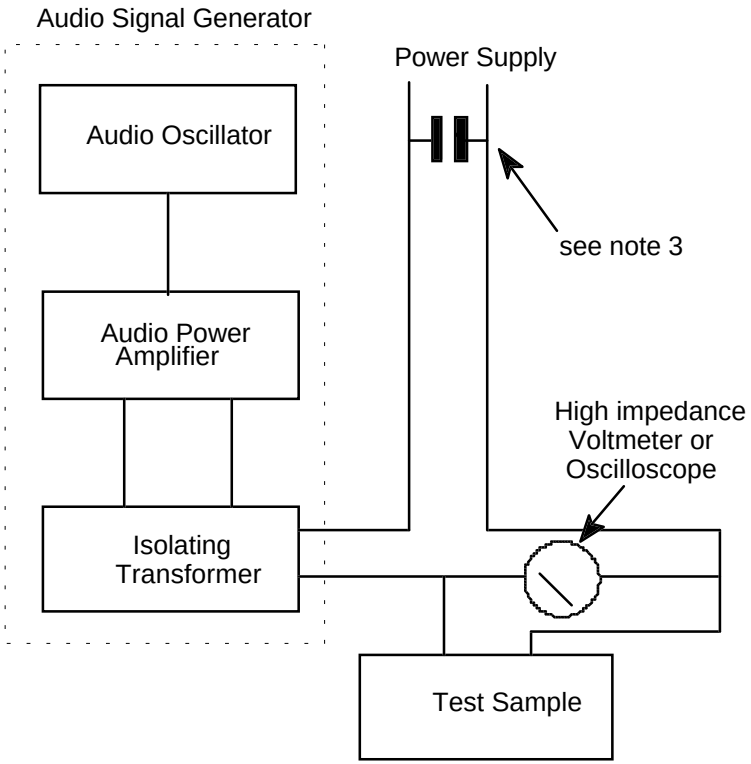
Low order supply disturbance shall be simulated by superimposing a sine wave voltage of 10 % (rms) of the nominal power supply voltage up to 900 Hz, reducing to 1 % (rms) at 3 kHz, then maintained at this level as shown in figure 3.

The appropriate signal level shall be maintained over the range 100 Hz to 10 kHz, being superimposed on the power supply lines to the equipment. The frequency shall be adjusted through the specified frequency range over a period of 15 minutes to detect any malfunction of the EUT.

A typical arrangement is shown in figure 3, where the audio signal source shall have a source impedance not exceeding 1 Ω. If an isolating transformer is used, it shall carry all currents without saturation. Where the impedance is too low to maintain the signal level, the maximum power applied to the supply lines should be limited to 2 VA.

9.8.3 Performance criteria

Performance criterion A (subclause 6.2) shall apply.


Audio Signal Generator
Audio Oscillator
Audio Power Amplifier
Isolating Transformer
Power Supply
see note 3
High impedance Voltmeter or Oscilloscope
Test Sample

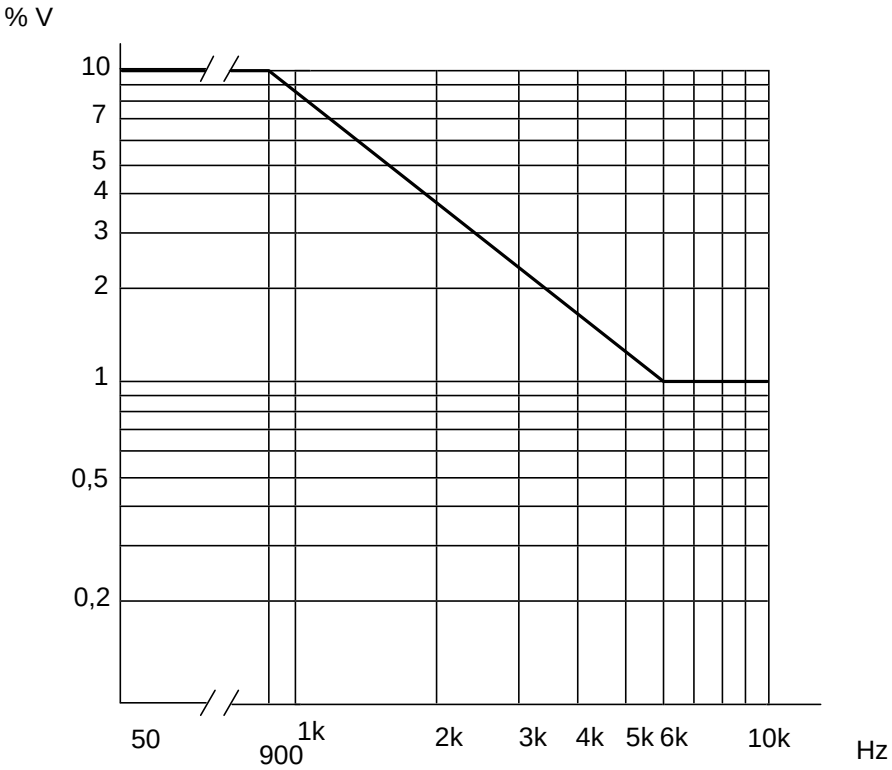

% V
10
7
5
4
3
2
1
0,5
0,2
50
900
1k
2k
3k
4k
5k
6k
10k
Hz

Figure 3

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

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

Clause/subclause and title		Corresponding article of Council Directive 89/336/EEC [8]	Qualifying remarks
8.1	Radiated emissions from the enclosure port of ancillary equipment	4(a)	
8.2	Power ports	4(a)	
8.3	Radiated emissions from the enclosure port of radio equipment	4(a)	
9.1	Radio frequency electromagnetic field (80 MHz - 1 000 MHz)	4(b)	
9.2	Electrostatic Discharge (ESD)	4(b)	
9.3	Fast transient, differential and common mode	4(b)	
9.4	Conducted disturbances induced by RF-fields in the frequency range 10 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)	
9.8	Immunity to conducted low frequency disturbance	4(b)	

History

Document history				
V1.1.1	November 1997	Public Enquiry	PE 9811:	1997-11-14 to 1998-03-13