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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 (LBRDCs) for the Global Maritime Distress and Safety System (GMDSS); Technical characteristics and methods of measurement

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Foreword

This European Telecommunication Standard (ETS) has been produced by the Satellite Earth Stations and Systems (SES) Technical Committee of the European Telecommunications Standards Institute (ETSI).

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Every ETS prepared by ETSI is a voluntary standard. This ETS may contain text concerning conformance testing of the equipment to which it relates. This text should be considered as guidance only and does not make this ETS mandatory.

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1 Scope

This European Telecommunication Standard (ETS) sets out the minimum performance requirements and technical characteristics for ship earth stations capable of transmitting and receiving direct-printing communications, and for Enhanced Group Call (EGC) equipment, as required by regulations IV/7, IV/8, IV/9 and IV/10 of the 1974 International Convention for Safety of Life at Sea (SOLAS) [5] as amended, concerning radio communications for the Global Maritime Distress and Safety System (GMDSS). Minimum performance requirements for the Network Control Facility (NCF) are contained in ETS 300 459 [3].

NOTE: The only satellite system accepted by the SOLAS convention to provide LBRDC in the GMDSS is INMARSAT-C at the date of publication.

For the purpose of this ETS the term "ship earth station" is used in order to align this ETS to ITU terminology. It is defined as a Maritime Mobile Earth Station (MMES) operating in the GMDSS.

This ETS is applicable to the following classes of equipment:

- Class 0:
  - a stand alone EGC receiver;
- Class 1:
  - a basic ship earth station providing shore-to-ship and ship-to-shore message transfer only;
- 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.

This ETS covers equipment construction and performance testing. GMDSS requirements and tests are included where they are supplementary to those contained in the equipment certification required in subclause 5.1.

Frequency bands allocated by the Radio Regulations [1] to the Maritime Mobile Satellite Service (MMSS) are as follows:

	MMSS
Transmit frequencies	1 626,5 to 1 645,5 MHz
Receive frequencies	1 525,0 to 1 545,0 MHz

Requirements are specified in order to ensure the requirements of the GMDSS are met, to protect other users of the frequency spectrum from unacceptable interference, for the purposes of general safety and for the provision of protection of the ship earth station against electromagnetic interference from other systems.

2 Normative references

This ETS incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] International Telecommunication Union, Radio Regulations, (WARC 1992).

[2] IEC 510-2-1 (1978): "Methods of measurement for radio equipment used in satellite earth stations, Part 2: Measurement for sub-systems".

[3] ETS 300 459: "Satellite Earth Stations and Systems (SES); Network Control Facilities (NCF) for Maritime Mobile Earth Stations (MMESs) operating in the 1,5/1,6 GHz and 11/12/14 GHz bands providing Low Bit Rate Data Communications (LBRDCs)".

[4] CISPR 16-1 (First edition 1993-08): "Specification for radio disturbance and immunity measuring apparatus methods. Part 1: Radio disturbance and immunity measuring apparatus".

[5] Regulations IV/7, IV/8, IV/9 and IV/10 of the 1988 Amendments to the 1974 SOLAS convention as amended.

[6] NMEA 0183, version 2.01: "Standards for Interfacing Marine Electronic Devices".

[7] IMO Resolution A.663(16): "Performance Standards for INMARSAT Standard-C Ship Earth Stations Capable of Transmitting and Receiving Direct-Printing Communications".

[8] IMO Resolution A.664(16): "Performance Standards for Enhanced Group Call Equipment".

[9] IMO Resolution A.694(17): "General Requirements for Ship borne Radio Equipment forming part of the Global Maritime Distress and Safety System (GMDSS) and for Electronic Navigational Aids".

[10] ISO/R694 (1968): "Recommendations for the positioning of compasses, Method B".

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

3 Definitions and abbreviations

3.1 Definitions

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

ship earth station: A MMES on board a ship, (see clause 1).

nominated bandwidth: The nominated bandwidth encompasses all spectral elements of the transmission which have a level greater than the specified spurious levels. The nominated bandwidth is wide enough to take account of the transmit carrier frequency stability. The nominated bandwidth is within the MMSS transmit frequency band within which the ship earth station operates. The bandwidth of the ship earth station radio frequency transmission is nominated by the manufacturer and included in the data sheet of the test report.

unwanted emissions: For the purpose of this ETS unwanted emissions are those falling outside the nominated bandwidth.

performance check: A performance check consists of the following:

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

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

- the Special Test Equipment (STE) has received the distress message and correctly interpreted it; and
- the Equipment Under Test (EUT) has correctly indicated to the user, the acknowledgement of receipt of the transmission from the STE.

The reception of a distress priority EGC message is considered to be successful when the EUT has printed the message and the appropriate indications are provided to the user that a distress priority EGC message has been received.

Special Test Equipment (STE): Specific equipment which enables the tests specified in this ETS to be carried out.

Equipment Under Test (EUT): For the purposes of this ETS the EUT includes all units necessary for intended operation.

This includes:

- the Externally Mounted Equipment (EME);
- the Internally Mounted Equipment (IME) including the data terminal equipment such as keyboard, Visual Display Unit (VDU), printer, etc.;
- all interconnecting cables and power supply leads.

3.2 Abbreviations

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

CMF	Control and Monitoring Function
EGC	Enhanced Group Call
EIRP	Equivalent Isotropically Radiated Power
EMC	Electro-Magnetic Compatibility
EME	Externally Mounted Equipment
EUT	Equipment Under Test
FARI	Forward And Return Identity
GMDSS	Global Maritime Distress and Safety System
IME	Internally Mounted Equipment
IMO	International Maritime Organisation
MMSS	Maritime Mobile Satellite Service
NCF	Network Control Facility
MMSI	Maritime Mobile Service Identity
RF	Radio Frequency
SOLAS	Safety Of Life At Sea
STE	Special Test Equipment
VDU	Visual Display Unit

4 Tests

4.1 Special Test Equipment (STE)

The 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 this ETS. However, the following baseline is provided:

- special test arrangements are required to simulate the satellite signal, thus enabling the ship earth station to transmit, to allow measurement of transmission parameters;

- any specification of these special test arrangements which may have direct or indirect effects on any specification of this ETS 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 STE it shall be ensured that no transmission to the satellite occurs.

4.2 Test report

The test report shall contain:

- the value of the nominated bandwidth declared by the manufacturer;

- the results of the test;

- all parameters and operational conditions.

5 Environmental tests

Purpose:

To ensure that the equipment is capable of continuous operation under conditions of various sea states, vibration, humidity and temperature likely to be experienced in ships.

Specification:

Elements of the equipment shall be divided into two categories as follows, marked to indicate the class for which it is intended:

- **IME:** equipment or units designed to be protected from the weather;
- **EME:** equipment or units intended to be exposed to the weather.

The equipment shall be subjected to the tests specified in annex A. These tests shall be carried out before any other test specified in this ETS.

The manufacturer shall declare to which category each of the elements of the equipment belongs.

Verification:

The equipment shall successfully complete the performance checks under the conditions, defined in annex A.

6 General requirements

6.1 Equipment certification

Purpose:

To ensure that the ship earth station has obtained certification for operating in the satellite system to be used for communications in the GMDSS.

Specification:

The ship earth station shall have obtained certification for operating in the satellite system to be used for communications in the GMDSS as required by IMO Resolution A.663(16) [7], section 2 or IMO Resolution A.664(16) [8], section 2.

Verification:

By documentary evidence.

6.2 Power supply

6.2.1 Power supply reversal

Purpose:

To ensure that the equipment is protected from the effects of reversal of the power supply polarity.

Specification:

Means shall be incorporated for the protection of equipment from reversal of the power supply polarity.

Verification:

The ship earth station shall be connected to a power supply of reversed polarity at nominal voltage.

If a protection fuse blows during this test it shall be replaced.

Normal power supply polarity shall then be restored and a performance check carried out successfully.

6.2.2 Power supply interruption

Purpose:

To ensure satisfactory operation after power supply interruption.

Specification:

Any interruption of the power supply of up to 60 seconds duration shall not require the equipment to be manually re-initialised and shall not result in change or loss of stored operational parameters or in loss of stored messages.

Verification:

With the equipment in the stand-by mode, and with a message stored, the power shall be removed for a period of 60 seconds, and then restored.

The ship earth station shall automatically return to the stand-by mode. The stored operational parameters and the stored message shall be retained unaltered.

The test shall be repeated with the power supply interruption being effected first during transmission and then reception. For Class 0 equipment the test shall be effected only during reception.

6.3 Mechanical construction

Purpose:

Protection of persons and goods from insecure or unsafe equipment.

Specification:

The equipment shall, as far as practicable, be constructed of non-flammable materials and shall have adequate strength to ensure safety.

Equipment shall be mechanically designed to minimise the possibility of injury to persons, for example, from sharp edges or protruding corners.

Verification:

Verification shall be by visual inspection.

6.4 Electrical safety

Purpose:

To ensure the protection and safety of persons against accidental access to dangerous voltages.

Specification:

Accidental access to dangerous voltages shall be prevented. All parts and wiring in which the direct or alternating voltages or both, other than radio frequency voltages, combine to give a peak voltage greater than 50 volts shall be protected against accidental access and shall be isolated automatically from all sources of electrical energy when the protective covers are removed. Alternatively, the equipment shall be so constructed that access to such voltages may only be gained after having used a tool for the purpose, such as a spanner or screwdriver, and warning labels shall be prominently displayed both within the equipment and on protective covers.

Means shall be provided for earthing exposed metallic parts of the equipment. This shall not cause any terminal of the source of electrical energy to be earthed.

Verification:

Conformance to the electrical safety requirements shall be checked by visual inspection of the units.

6.5 Radio frequency radiation protection (classes 1, 2 and 3 only)

Purpose:

To ensure the protection of persons from potentially dangerous RF power densities.

Specification:

The radiating part of the equipment (which includes the exterior of any radome or other antenna enclosure where fitted) shall be labelled with a warning notice which shall be clearly visible when the equipment is in its normal operating configuration. This notice shall indicate the closest distance to the radiating part within which a person may approach the equipment without experiencing radio frequency power density levels in excess of 8 W/m^2, when under worst case conditions (e.g. maximum power, maximum on/off ratio), averaged over a 6 minutes period. This notice shall also state that before approaching the radiating part within any distance closer than that indicated, the ship earth station equipment shall be switched-off or otherwise disabled so that it shall not transmit.

Where the radiating part is mounted in a position where it is not normally visible, further warning notices shall be provided to be attached to the ship so as to be clearly visible to anyone attempting to reach the radiating part of the equipment.

In the case where the antenna is enclosed in a radome, or other antenna enclosure, and when no RF power density greater than 8 W/m^2, when under worst case conditions (e.g. maximum power, maximum on/off ratio), averaged over a 6 minutes period, is produced outside of this radome, or antenna enclosure, then it is not necessary to label the radiating part. Instead, the external surface of the radome or antenna enclosure shall be clearly labelled with a warning that the ship earth station equipment shall be switched-off, or otherwise disabled, so that it shall not transmit while any work requiring the removal of the radome or antenna enclosure takes place.

Verification:

Verification of the distance below which RF power densities exist in excess of 8 W/m^2, when under worst case conditions (e.g. maximum power, maximum on/off ratio) averaged over a 6 minutes period, shall be by documentary evidence. The manufacturer shall quantify the worst case conditions.

Conformance with the labelling requirements of this subclause shall be demonstrated by visual inspection of the external surface of the radome or antenna enclosure and, if relevant, an examination of the notices provided by the manufacturer.

6.6 Additional facilities

Purpose:

To ensure that the provision of facilities additional to those required for normal operation does not inhibit normal operation.

Specification:

Where a facility is provided which is additional to the minimum requirements of this ETS, the operation or malfunction of such a facility shall not degrade the performance of the equipment below these minimum requirements.

Verification:

By documentary evidence or demonstration.

6.7 Integrity of GMDSS equipment

Purpose:

To protect the integrity of GMDSS operation.

Specification:

Any ancillary device which is part of the GMDSS equipment, such as VDU, keyboard and printer, shall be provided with fixing arrangements to prevent unauthorised or unintended removal or disconnection.

These ancillaries shall, if available for use with non-GMDSS systems, revert immediately and automatically or on a single prominently indicated and easily performed command, to service GMDSS functional requirements.

Verification:

By demonstration and inspection.

6.8 Operating controls

Purpose:

Equipment shall be so constructed that it is capable of being operated properly and readily by a suitably qualified member of a ship's staff.

Specification:

The number of operational controls, their design and manner of functions, location, arrangement and size shall provide for simple, quick and effective operation. The controls shall be arranged in a manner which minimises the chance of inadvertent operation.

All operational controls shall permit normal adjustments to be easily performed and shall be easy to identify from the position at which the equipment is normally operated. Controls not required for normal operations shall not be readily accessible.

The controls intended for initiating distress alerts, shall be clearly marked, dedicated to the function and protected against inadvertent activation by at least two independent mechanical actions, e.g. lifting or breaking a protective cover and pressing a button. Such controls shall not be a standard key of an ITU-T digital input panel or of the keyboard provided with the equipment.

When a distress alert transmission has been initiated, the equipment shall indicate the status of this transmission.

It shall be possible to interrupt and initiate distress alerts at any time.

Adequate adjustable illumination may be provided in the equipment to enable identification of controls and facilitate reading of indicators under low levels of ambient lighting. Means shall be provided for dimming to extinction any equipment light source which is capable of interfering with navigation. If adequate illumination is not provided this shall be stated in the test report.

The design of the equipment shall be such that misuse of the controls shall not cause damage to the equipment or injury to persons.

Verification:

By documentary evidence and, where applicable, by inspection or demonstration.

6.9 User documentation

Purpose:

To ensure that adequate information is provided to enable the equipment to be properly installed, operated and maintained.

Specification:

Operating handbooks shall be written at least in English and contain sufficient information to enable the equipment to be properly installed and operated. If the equipment is so designed that fault diagnosis and repair at component level is practicable, full circuit diagrams, component layouts and a component parts list shall be provided. If the equipment contains complex modules where fault diagnosis and repair at component level is not practicable, sufficient information shall be provided to enable location, identification and replacement of the defective module.

Documentation shall state the compass safe distance, as determined in accordance with the standards specified in ISO/R694: 1968 [10], Method B, for all units of the equipment.

Verification:

By examination of the manufacturers documentation.

6.10 Equipment labelling

Purpose:

To ensure that equipment may be readily identified.

Specification:

Each unit of the equipment shall be clearly marked externally with the following information which, where practicable, shall be clearly visible in the normal installation position:

- identification of the manufacturer;
- unit type number or model identification under which it was type tested;
- serial number of the unit.

Verification:

By visual examination.

6.11 Ship earth station identities

Purpose:

To prevent the alteration, inadvertently or otherwise, of the ship earth station identities.

Specification:

No control accessible to the operator shall be available for alteration of the ship earth station identities, Maritime Mobile Service Identity (MMSI) and Forward And Return Identity (FARI).

Verification:

By documentary evidence.

6.12 Storage of software

Purpose:

To ensure that all software necessary for normal operation is stored in a non-corruptible form.

Specification:

Any programming material or software that forms part of the ship earth station and which is necessary for meeting the GMDSS requirements shall be permanently installed in the ship earth station. Any software needed to fulfil any distress and safety requirements of the GMDSS shall be stored in non-volatile memory and be protected against unauthorised access, modification or corruption.

Verification:

By documentary evidence and inspection.

6.13 Equipment maintenance

Purpose:

To ensure that on-board maintenance of the equipment, where practicable, can be done without specialised procedures or test equipment.

Specification:

The equipment shall be so designed that replacement of main units does not require elaborate recalibration or readjustment.

Verification:

By documentary evidence.

7 Operational requirements

7.1 Printing of Enhanced Group Call (EGC) messages (classes 0, 2 and 3 only)

Purpose:

To ensure that all vital EGC messages received by the equipment are printed.

Specification:

The equipment shall be capable of producing a printed copy of received information. Received EGC messages may be stored, with indication that the message has been received, for later printing, except for the following messages which shall be printed upon receipt: distress or urgency calls or calls having distress categories, relevant navigational warnings, meteorological warnings, search and rescue information and any special warnings directed to the geographical area in which the ship is operating (service codes 04, 14, 24, 31, 34, 44 and all messages with B2 = A, B or D under service code 13 and priority codes 3, 2). The maximum number or the maximum volume of data able to be received and stored before printing shall be declared by the manufacturer and recorded on the data sheet of the test report.

Verification:

An EGC message of each of the combinations of all available service codes and the priority codes 3 and 2 shall be initiated from the STE. It shall be verified that the EUT produces a printed copy of each message and that the messages are printed immediately upon receipt. Following that, an EGC message of each of the combinations of service codes 04, 14, 24, 31 and 44 and all messages with B2 = A, B or D under service code 13 and the priority codes 1 and 0 shall be initiated from the STE. It shall again be verified that the EUT produces a printed copy of each message and that the messages are printed immediately upon reception.

7.2 Service codes (classes 0, 2 and 3 only)

Purpose:

To prevent inadvertent rejection of relevant safety warnings transmitted via the EGC system.

Specification:

Acceptance or rejection of service codes shall be under the operator's control except that equipment shall be unable to reject relevant messages regarding distress and safety, navigational warnings, meteorological warnings, search and rescue information and certain special warnings, which are directed to a geographical area in which the ship is operating (service codes 04, 14, 24, 31, 34, 44 and all messages with B2 = A, B or D under service code 13 and priority codes 3, 2).

The equipment shall be able to select more than one service code.

Verification:

By inspection of the user documentation and the operating controls of the EUT.

If necessary, tests or demonstrations shall be carried out to verify that it is not possible to reject the relevant service codes.

7.3 Navigational interface

Purpose:

To ensure that both manual and automatic means are available to update the ship earth station's position information and the time at which the position was determined, and to ensure that the navigational interface complies with a recognised standard.

Specification:

The ship earth station shall provide means for entering the ship's position, and the time at which the position was determined manually.

It shall also provide means for entering this information automatically via a navigational interface.

The navigational interface shall comply with NMEA 0183, ver. 2.01 [6].

Verification:

By manufacturers declaration and demonstration.

7.4 Provision for initiating distress alerts from two positions (classes 1, 2 and 3 only)

Purpose:

To ensure distress alerts may be initiated from at least two positions, when installed on board ship.

Specification:

Provision shall be made for initiating distress alerts from at least two different positions. For that purpose the equipment shall provide for two independent methods of initiating distress alerts.

Verification:

The two independent methods of alerting shall be tested by initiating a distress alert from each one. The transmission of a distress alert is considered to be successful when:

- the STE has received the distress alert and correctly interpreted it; and

- the EUT has correctly indicated to the user the acknowledgement from the STE of receipt of the distress alert.

8 Unwanted emissions

8.1 General

In this clause, whenever a change of limit between adjacent frequency bands occurs, the lower of the two limits shall apply at the transition frequency.

8.2 Unwanted emissions outside the band 1 626,5 to 1 645,5 MHz

Purpose:

Protection of terrestrial and satellite services from emissions caused by ship earth stations outside the band 1 626,5 to 1 645,5 MHz and to facilitate the effective use of the spectrum.

Specification:

For unwanted emissions below 1 GHz, the ship earth station shall meet the requirements of EN 55022, Class B [11].

The unwanted emissions of Equivalent Isotropically Radiated Power (EIRP) shall not exceed the limits in table 1 in any direction.

Table 1

Frequency range (MHz)	Carrier on (classes 1, 2 and 3 only)		Carrier off (all classes)(4)	
	EIRP limit (dBpW)	Measurement bandwidth (kHz)	EIRP limit (dBpW)	Measurement bandwidth (kHz)
1 000 to 1 525	49	100	48	100
1 525 to 1 559	49	100	17	3
1 559 to 1 600	49	100	48	100
1 600 to 1 623,5	74	100	48	100
1 623,5 to 1 626,0	74 (note 1)	100 (note 1)	48	100
1 626,0 to 1 626,5	84	3	48	100
1 645,5 to 1 645,6	104	3	57	3
1 645,6 to 1 646,1	84	3	57	3
1 646,1 to 1 661,0	74	3	57	3
1 661,0 to 1 663,5	74 (note 1)	100 (note 1)	48	100
1 663,5 to 1 690.0	74	100	48	100
1 690,0 to 3 400,0	49 (note 2)	100	48	100
3 400 to 10 700	55 (note 3)	100	48	100
10 700 to 21 200	61	100	54	100
21 200 to 40 000	67	100	60	100

NOTE 1: These figures shall be 74 dBpW/3 kHz prior to 1 January 1996.
NOTE 2: In the band 3 253,0 to 3 291,0 MHz the maximum EIRP in one, and only one, 100 kHz measurement bandwidth shall not exceed 82 dBpW. Prior to 1 January 1996 this figure shall be 92 dBpW. Elsewhere in this band the power limit in this table shall be applied.
NOTE 3: In each of the bands 4 879,5 to 4 936,5 MHz, 6 506,0 to 6 582,0 MHz and 8 132,5 to 8 227,5 MHz the maximum EIRP in one, and only one, 100 kHz measurement bandwidth shall not exceed 72 dBpW. Prior to 1 January 1996 this figure shall be 82 dBpW. Elsewhere in these bands the power limit in table 2 shall be applied. In the band 9 759,0 to 9 873,0 MHz the maximum power in one, and only one, 100 kHz measurement bandwidth shall not exceed 61 dBpW. Prior to 1 January 1996 this figure shall be 71 dBpW. Elsewhere in this band the power limit in this table shall be applied.
NOTE 4: For class 0 equipment the measurements shall only be made up to 21 200 MHz.

Verification:

By measurement of unwanted emissions generated by an operating ship earth station.

All RF tests in this subclause shall be carried out at ambient environmental conditions and for a nominal power supply voltage.

All tests with carrier on shall be undertaken with the transmitter operating at full power and with the maximum transmit burst rate where applicable.

The full system shall be tested according to the test procedure given in annex B.

The upper frequency to which tests shall be performed shall be at least the 10th. harmonic of the highest frequency conversion oscillator or ten times the highest operational frequency, whichever is greater.

Two ship earth station transmit frequencies shall be used for this test; the frequencies shall be selected to be as close as possible to the upper and lower limits of the transmit frequency band intended for operational use by the ship earth station. These frequency limits shall be declared by the manufacturer and entered in the test report. The upper and lower extremes of the tuning range shall be declared by the manufacturer and entered in the test report.

8.3 Unwanted emissions within the 1 626,5 to 1 645,5 MHz band (classes 1, 2 and 3 only)

Purpose:

Protection of satellite and terrestrial services operating in the above frequency band.

Specification:

The unwanted emissions of EIRP in any 3 kHz band within the 1 626,5 to 1 645,5 MHz band in which the ship earth station is designed to transmit, but outside the nominated bandwidth, shall not exceed the following limits:

- when the carrier is off: 57 dBpW;
- when the carrier is on as follows in table 2:

Table 2

Offset from the edge of the band of the nominated bandwidth (kHz)	Maximum EIRP (dBpW)
0	117
100	104
200	84
greater than 700	74

Verification:

Conformance shall be determined by direct measurement.

The conditions (e.g. environment, power etc.) set out in the verification section of subclause 8.2 of this ETS shall apply.

The measurement shall be performed by either of the two following methods:

a) in the first method, the full system shall be tested according to the test procedure presented in annex B;

b) in the second method, the power of the unwanted emissions at the interface point between the antenna and the remaining EME shall be measured according to the alternative measurement method in annex B. The antenna on-axis gain shall be measured according to the measurement methods in IEC 510-2-1 [2]. The EIRP of the unwanted radiation shall be calculated from the above two measurements.

9 Ship earth station Control and Monitoring Functions (CMF)

9.1 General

This clause defines a minimum set of Control and Monitoring Functions (CMF) which shall be implemented on ship earth stations in order to minimise the probability that they originate unwanted transmissions that may give rise to harmful interference.

9.2 Processor monitoring (classes 1, 2 and 3 only)

Purpose:

To ensure that the ship earth station can suppress transmissions in the event of a processor sub-system failure.

Specification:

An ship earth station shall incorporate a processor monitoring function for each of its processors involved in the manipulation of traffic and in control and monitoring functions.

The processor monitoring function shall detect any failure of the processor hardware and software.

No later than 1 second after any fault condition occurs, the transmissions shall be suppressed until the processor monitoring function has determined that the fault condition has been cleared.

Verification:

Compliance shall be verified by certification by the network operator, or

by documentary evidence and demonstration.

The demonstration, if relevant, shall show that all transmissions are suppressed within 1 second following a controllable processor induced fault (e.g. processor board disconnected).

The manufacturer shall provide the test house with a test procedure to demonstrate this transmission shutdown.

9.3 Transmit frequency sub-system (classes 1, 2 and 3 only)

Purpose:

To verify the correct operation of the transmit frequency generation sub-system and to inhibit transmissions should the sub-system fail.

Specification:

A ship earth station shall monitor the operation of its transmit frequency generation sub-system.

The failure of the transmit frequency generation sub-system for a period longer than 5 seconds shall result in transmissions being suppressed until the fault condition has been cleared.

Verification:

Compliance shall be verified by certification by the network operator, or

by documentary evidence and demonstration.

The demonstration, if relevant, shall show that all transmissions are suppressed within 6 seconds following a controllable transmit frequency generation sub-system fault (e.g. replacement of frequency reference).

The manufacturer shall provide the test house with a test procedure to demonstrate this transmission shutdown.

9.4 Initial burst rate transmission (classes 1, 2 and 3 only)

Purpose:

To limit disturbance duration and period to other services.

Specification:

Transmission of initial bursts shall not exceed 1 % on the time.

Each burst shall not last more than 1 second.

This specification shall not apply to initial bursts indicating distress priority.

Verification:

By documentary evidence and demonstration.

9.5 Network control authorisation (classes 1, 2 and 3 only)

Purpose:

To ensure that the ship earth station cannot transmit messages unless it receives an appropriate indication.

Specification:

a) Without reception of an appropriate enable signal to the ship earth station via an authorised control channel it shall not be possible to initiate message transmission.

b) Transmissions shall not continue for longer than 15 minutes unless further enables are received.

Verification:

By documentary evidence and demonstration.

It shall be demonstrated that a transmitting ship earth station suppresses message transmissions when it has not received a suitable enable for a period of time longer than 15 minutes and the ship earth station message transmissions shall remain suppressed until a further enable is received.

It shall be demonstrated that after POWER ON/RESET of the ship earth station, it is not possible to initiate message transmission until an appropriate enable signal is received by the ship earth station.

9.6 Network control reception (classes 1, 2 and 3 only)

Purpose:

These requirements ensure that the ship earth station shall be capable of:

- receiving and implementing commands from the Network Control Facility (NCF) through its correct reception of the appropriate control channel(s);

- transmitting the ship earth station identity upon reception of an appropriate request.

Specification:

The ship earth station shall be enabled or disabled through control channels. The disabling function shall however not apply to distress messages and distress alerts.

Failure to receive an authorised control channel (either a command or a signal) for a period longer than 15 minutes shall inhibit message transmission.

The ship earth station shall be capable of receiving and acting upon the control messages that are addressed to it which contain transmitter enabling and disabling information. The ship earth station shall be capable of transmitting its identity upon reception of an appropriate control message addressed to the ship earth station.

Verification:

The requirements shall be verified by documentary evidence and demonstration showing that the ship earth station is capable of receiving appropriate signals from the NCF to implement enables, disables and identification functions and it shall be verified by documentary evidence and demonstration that the disabling function does not prevent the transmission of distress messages and distress alerts.

The manufacturer shall provide the test house with a test procedure to demonstrate the implementation of enables, disables and identification functions.

Annex A (normative): Environmental tests

A.1 Ambient temperature

The equipment or units shall be tested to the following procedures, according to the category, IME or EME.

Dry heat - test specification

IME Place the equipment in a chamber at room temperature. Raise temperature to + 55° C ± 3° C, and maintain it for a period of 10 hours. Thirty minutes after this period, the equipment shall be switched on and operated continuously for a period of 2 hours. During this period the equipment shall be subjected to the performance check.

EME Place the equipment in a chamber at room temperature. Raise temperature to + 70° C ± 3° C, and maintain it for a period of 10 hours. At the end of this period, the temperature shall be cooled to + 55° C ± 3° C over a period of 30 minutes. The equipment shall then be switched on and operated continuously for a period of 2 hours. During this period the equipment shall be subjected to the performance check.

IME and EME The equipment shall be allowed to cool at normal room temperature for a period of 3 hours before continuing with the next test.

Low temperature cycle - test specification

IME Place the equipment in a chamber at room temperature. Lower the temperature to - 15° C ± 3° C, and maintain it for a period of 10 hours. Thirty minutes after this period, and with the temperature maintained, the equipment shall be switched on and operated continuously for a period of 2 hours. During this period the equipment shall be subjected to the performance check.

EME Place the equipment in a chamber at room temperature. Lower the temperature to - 25° C ± 3° C, and maintain it for a period of 10 hours. Thirty minutes after this period, and with the temperature maintained, the equipment shall be switched on and operated continuously for a period of 2 hours. During this period the equipment shall be subjected to the performance check.

IME and EME The equipment shall be allowed to warm to normal room temperature during a period of not less than 1 hour. The equipment shall be exposed to normal temperature and humidity for at least 3 hours before continuing with further tests.

A.2 Relative humidity

The equipment or units shall be tested to the following procedure, according to the category, IME or EME.

Damp heat - test specification

IME and EME Place the equipment in a chamber at room temperature and humidity. Raise temperature to + 40° C ± 3° C over a period of 3 hours and bring the humidity to 93 % ± 2 % and maintain these conditions for a period of 10 hours. Thirty minutes after this period, and maintaining the conditions, the equipment shall be switched on and operated continuously for a period of 2 hours. During this period the equipment shall be subjected to the performance check.

At the conclusion of this test, the chamber shall be brought to room temperature in not less than 1 hour. The equipment shall be exposed to normal temperature and humidity for not less than 3 hours before conducting further tests.

A.3 Vibration

The equipment or units shall be tested to the following procedure, according to the category, IME or EME.

Vibration - test specification

IME and EME

Attach the equipment to a vibration table by its normal means of support, and in its normal attitude. The equipment shall be subjected to sinusoidal vertical vibration at all frequencies between:

- 5 Hz to 12,5 Hz, amplitude ± 1,6 mm ± 10 %;
- 12,5 Hz to 25 Hz, amplitude ± 0,38 mm ± 10 %;
- 25 Hz to 50 Hz, amplitude ± 0,1 mm ± 10 %;

taking at least 15 minutes for each octave increase.

During this test the equipment shall be subjected to the performance check.

The following limits may be used as an alternative to those specified above:

- 5 Hz to 12,5 Hz, amplitude ± 1,6 mm ± 10 %;
- 12,5 Hz to 50 Hz, constant acceleration of 10 m/s^2 ± 10 %;

taking at least 15 minutes for each octave increase.

During this test the equipment shall be subjected to the performance check.

A resonance search shall be carried out during testing, and any excessive frequency component shall be identified and the tests repeated for at least 2 hours at each of the identified frequencies.

Annex B (normative): Unwanted emissions above 1 GHz - test procedure

B.1 Introduction

This annex describes the measurement procedure of unwanted emissions from 1 GHz to 40 GHz generated by a ship earth station terminal under operating conditions (as specified in subclauses 8.2 and 8.3).

B.2 Measuring apparatus

In order to carry out the test, the following elements are required, as a minimum:

- a set of calibrated reference antennas covering the frequency range of interest;

- the necessary post reference antenna pre-amplification and amplification devices;

- spectrum analyzer(s) with sweep/store capability covering the frequency range of interest.

For the apparatus utilized, it shall be verified that:

- the response of the apparatus, including any antenna and associated amplification system, to a constant amplitude sine wave signal remains within ± 1 dB of calibration across the frequency range of interest;

- the screening performance of the measuring apparatus shall be such that when the measuring antenna/post-antenna equipment is removed, and the input to the measuring apparatus is screened, the measured power density shall fall to a value at least 60 dB below the measured value (see CISPR 16-1, section 2.8 [4]).

B.3 Test set-up

The tests shall be carried out at ambient environmental conditions and for a nominal power supply voltage.

The EME and IME shall be installed with a separation of about 0,5 m. Between the two equipments, the maximum length connection cable specified by the manufacturer shall be installed. The height of the cable shall be between 0,5 m and 1 m. The cable shall be maintained in that position by non-metallic means. The EME shall be set, in its normal operating configuration on a non-metallic table at a height between 0,5 m and 1 m. The IME shall be set on a non-metallic table at a height between 0,5 m and 1 m. Any associated equipment, e.g. portable computer or data terminal if required for operation of the ship earth station, shall be placed next to, and at the same height as the IME.

The measuring antenna shall be installed in the horizontal plane of the radiating part of the ship earth station. Each antenna shall be positioned to be outside the near field of the other antenna.

In addition, it shall be verified that the test site shall be suitable with respect to ambient noise which shall be at least 6 dB lower than the lowest specification value being measured.

B.4 Measuring procedure

The EUT shall be switched on and the STE (if used) activated. The measuring equipment shall be set to the appropriate measuring bandwidths and the measured EIRP given in the nominated bandwidth. Where an unwanted emission is detected that is near to the specification limits a measuring bandwidth not exceeding (e.g. twice) the nominated bandwidth shall be used.

The measuring antenna shall be placed at a fixed height and an appropriate distance from the EUT. Measurements shall be carried out with the measuring antenna and the EUT antenna so oriented that the values of measured unwanted emissions are maximised.

Testing should first be performed in angular steps of 90^{o} while varying the height of the measuring antenna between 1 m and 4 m. For those directions and frequencies, or frequency bands, where

unwanted emissions are detected that are near to the specified limits, additional tests shall be performed for each detected emission by varying the height of the measuring antenna between 1 m and 4 m and rotating the EUT through 360^{o} to maximise the unwanted emission value.

These measurements shall be carried out with the measuring antenna in both planes (vertical and horizontal) of polarisation to ensure that the values of the measured unwanted emissions obtained are maximised.

The received power density shall be measured over the entire frequency range of interest in measurement ranges appropriate to the test equipment being used. The precise knowledge of the distance between the EUT and the reference antenna, the reference antenna gain and the amplification/attenuation characteristics of the post reference antenna network allow the determination of the unwanted EIRP density radiated by the EUT.

B.5 Alternative measurement procedure

For the case in which it is desired to measure the power of the emissions from the ship earth station by direct coupling at the interface point between the antenna and the rest of the ship earth station, the method set out in this annex shall apply except that the test set-up will need to be modified to allow direct coupling of the measuring equipment to the antenna feed, and references to the positioning of the measuring antenna shall be ignored. The ship earth station maximum antenna gain at the measurement frequency shall be taken into account.

For this test set-up it may also be necessary to arrange for the coupling of signals form the STE to the ship earth station in order to put the ship earth station into its normal mode.

Annex C (informative): Manufacturers declaration

The following is a list of subclauses in this ETS, where the manufacturer is obliged to provide documentation or declarations:

- documentary evidence:
    - subclauses 6.5, 6.6, 6.8, 6.11, 6.12, 7.2, 9.2, 9.3, 9.4, 9.5 and 9.6;
- documentation:
    - subclause 6.9;
- manufacturers declaration:
    - subclauses 7.3, 5, 8.2 and 8.3;
- certification by the network operator:
    - subclause 6.1, (optional 9.2 and 9.3).

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