



**Maritime Location Systems;
Radio transmitters and receivers for radio links
in maritime radio location systems
operating in the 9 GHz frequency band (X band)**

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Foreword

This final draft European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Vote phase of the ETSI standards EN Approval Procedure.

Proposed national transposition dates

Date of latest announcement of this EN (doa):	7 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

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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Introduction

The present document applies to systems utilizing radio links between platforms and vessels for dynamic positioning of vessels engaged in coordinated maritime activities.

1 Scope

The present document specifies technical characteristics and methods of measurements for radiolocation equipment with the following characteristics:

- intended to operate in maritime dynamic positioning systems functioning with full duplex links having a duplex separation of 30 MHz;
- operating in the 9 GHz frequency band;
- with an integral antenna.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference/>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] Recommendation ITU-T E.161 (02-2001): "Arrangement of digits, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network".
- [2] ISO 25862:2019: "Ships and marine technology -- Marine magnetic compasses, binnacles and azimuth reading devices".
- [3] ETSI TS 103 052 (V1.1.1) (03-2011): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Radiated measurement methods and general arrangements for test sites up to 100 GHz".
- [4] ERC Recommendation 74-01 (2019): "Unwanted emissions in the spurious domain".
- [5] ISO 7010:2019: "Graphical symbols - Safety colours and safety signs - Registered safety signs".

2.2 Informative references

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

Not applicable.

3 Definition of terms, symbols and abbreviations

3.1 Terms

Void.

3.2 Symbols

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

B	Bandwidth
dBm	Level (dB) relative to 1 mW
dBpp	Level (dB) below peak power
dB μ V	Level (dB) relative to 1 μ V/m
f	Frequency
m	Metre
ppm	Parts per million (10^{-6})
Q	Q factor is a resonance parameter
s	Second
V	Volt
W	Watt
Ω	Ohm

3.3 Abbreviations

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

ac	alternating current	ETSI EN 303 746 V1.1.1 (2021-02)
dc	direct current	
EIRP	Equivalent Isotropically Radiated Power	https://standards.iteh.ai/catalog/standards/sist/4789d69b-bf81-4727-89d7-21b7d376276c/etsi-en-303-746-v1-1-1-2021-02
EN	European Norm	
ERC	European Radiocommunication Committee	
EUT	Equipment Under Test	
FM	Frequency Modulation	
IPR	Intellectual Property Right	
ISO	International Organization for Standardization	
ITU-T	International Telecommunication Union - Telecommunication standardization sector	
PEP	Peak Envelope Power	
pp	peak power	
RF	Radio Frequency	
Rx	Receiver	
SR	Special Report	
TS	Technical Specification	
Tx	Transmitter	
VSWR	Voltage Standing Wave Ratio	

4 Technical requirements

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the manufacturer, but as a minimum, shall be that specified in the test conditions contained in the present document.

4.2 Construction

The mechanical and electrical construction and finish of the equipment shall conform in all respects to good engineering practice, and the equipment shall be suitable for use on board ships.

All controls shall be of sufficient size to enable the usual control functions to be easily performed and the number of controls should be the minimum necessary for simple and satisfactory operation.

For the purpose of conformance testing, relevant technical documentation shall be supplied with the equipment.

The equipment shall be capable of operating on two full duplex channels.

It shall not be possible to transmit while any frequency synthesizer used within the transmitter is out of lock.

4.3 Controls and indicators

The equipment shall have a frequency selector and shall indicate the operating frequency at which the installation is set and this shall be legible irrespective of the external lighting conditions.

Where an input panel on the equipment for entering digit 0 to digit 9 is provided, this shall conform to Recommendation ITU-T E.161 [1].

The equipment shall have the following additional controls and indicators:

- a means for reducing the brightness of the equipment illumination to almost zero;
- an on/off switch for the entire installation with a visual indication that the installation is in operation;
- a visual indication that the equipment is transmitting.

The equipment shall also meet the following requirements:

- the user shall not have access to any control which, if wrongly set, might impair the technical characteristics of the equipment.

4.4 Safety precautions

Measures shall be taken to protect the equipment against the effects of overcurrent or overvoltage.

Measures shall be taken to prevent damage to the equipment if the electrical power source produces transient voltage variations and to prevent any damage that might arise from an accidental reversal of polarity of the electrical power source.

Means shall be provided for earthing exposed metallic parts of the equipment.

All components and wiring in which the dc or ac voltage (other than radio-frequency voltage) are generated, separately or in combination, peak voltages in excess of 50 V shall be protected against any accidental access and shall be automatically isolated from all electrical power sources if the protective covers are removed. Alternatively, the equipment shall be constructed in such a way as to prevent access to components operating at such voltages unless an appropriate tool is used such as a nut-spanner or screwdriver. Conspicuous warning labels in accordance with ISO 7010 [5] shall be affixed both inside the equipment and on the protective covers.

The information in any volatile memory device shall be protected from interruptions in the power supply of up to 60 s duration.

4.5 Labelling

All controls, instruments, indicators and ports shall be clearly labelled.

Details of the power supply from which the equipment is intended to operate shall be clearly indicated on the equipment.

The compass safe distance as defined in ISO 25862 [2] (Method B) shall be stated on the equipment or in the technical manual.

4.6 Frequencies

The frequency pairs used by the equipment shall be clearly marked. An example of such pairs is given in Table 1.

Table 1: Example of operating frequencies

Pair number	Tx [MHz]	Rx [MHz]
1	9 200	9 230
1(reverse)	9 230	9 200
2	9 270	9 300
2(reverse)	9 300	9 270

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4.7 Polarization (standards.iteh.ai)

The equipment shall operate with vertical linear polarization.

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4.8 Transceiver data interface 4789d69b-bf81-4727-89d7-443434343434/etsi-en-303-746-v1-1-1-2021-02

Equipment shall provide a digital connection such as Ethernet or other suitable interfaces for access to the equipment.

Variation in the level of the input signals, within the specified limits for that interface, shall have no measurable influence on the characteristics of the signals on the radio path.

Appropriate means and documentation of the implemented interface(s) allowing for the equipment to be tested are expected to be provided in view of the measurements.

5 General conditions of measurements

5.1 Test site and general arrangements for measurements

Measurements of all equipment shall be done by radiated measurements.

Descriptions of the anechoic chamber and radiated measurement arrangements are included in ETSI TS 103 052 [3].

5.2 General

Tests shall be carried out on all of the frequency pairs available in the equipment.

5.3 Impedance

In the present document the term "50 Ω " is used for a 50 Ω non-reactive impedance. Non-reactive impedance is taken to mean a VSWR of 1,2 or better over the frequency range of interest.

5.4 Tests of equipment with a notch filter

A notch filter may be required to obtain the required dynamic range for measurement of the transmitter.

If a notch filter is used, it shall be centred on the transmitter carrier frequency and attenuating this signal by at least 30 dB.

If a notch filter is used, the measured results shall be corrected for the insertion loss of the notch filter.

5.5 Facilities for access

5.5.1 Coupling arrangements

Equipment to be connected to the Equipment Under Test (EUT) shall be connected by a method which shall not affect the radiated field.

5.6 Modes of operation of the transmitter

For the purpose of the measurements according to the present document, the transmitter shall be able to generate the necessary test signals described in Clause 6.2.

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6 Test conditions

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6.1 General

All the tests shall be performed in both normal and extreme test conditions unless otherwise specified.

6.2 Test signals

Test signal 1 is an unmodulated carrier.

Test signal 2 is an FM signal with a modulation index of 2,3 being modulated with a sinusoidal wave of the frequency 140 kHz. The test signal is repeatedly switched on for 124 μ s and switched off for 1 μ s.

Test signal 3 is an FM modulated signal with a modulation index of 2,3 and sinusoidal modulating wave with the frequency of 75 kHz.

6.3 Normal test conditions

6.3.1 Normal temperature and humidity

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

- temperature: +15 $^{\circ}$ C to +35 $^{\circ}$ C;
- relative humidity: not exceeding 75 %.

6.3.2 Normal power source

6.3.2.1 Mains voltage and frequency

The normal test voltage shall be the nominal ac mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage or any of the declared voltages for which the equipment is indicated as having been designed. The frequency of the test voltage shall be 50 Hz \pm 1 Hz.

6.3.2.2 Battery power source

Where the equipment is designed to operate from a battery, the normal test voltage shall be the nominal voltage of the battery (12 V, 24 V, etc.).

6.3.2.3 Other power sources

For operation from other power sources the normal test voltage shall be that declared by the equipment manufacturer.

6.4 Extreme test conditions

6.4.1 General requirements

Unless otherwise stated the extreme test conditions means that the Equipment Under Test (EUT) shall be tested at the upper temperature and at the upper limit of the supply voltage applied simultaneously, and at the low temperature and the lower limit of the supply voltage applied simultaneously.

6.4.2 Extreme temperatures

For tests at extreme temperatures, measurements shall be made in accordance with clause 6.4.4, at a lower temperature of -15 °C and an upper temperature of +55 °C.

6.4.3 Extreme values of test power source

6.4.3.1 Mains voltage and frequency

The extreme test voltages shall be the nominal ac mains voltage \pm 10 %. The frequency of the test voltage shall be 50 Hz \pm 1 Hz.

6.4.3.2 Battery power source

Where the equipment is designed to operate from a battery, the extreme test voltages shall be 1,3 and 0,9 times the nominal voltage of the battery (12 V, 24 V, etc.).

6.4.3.3 Other power sources

For operation from other power sources the extreme test voltages shall be declared by the equipment manufacturer.

6.4.4 Procedure for tests at extreme temperatures

The equipment shall be switched off during the temperature stabilizing periods.

Before conducting tests at the upper temperature, the equipment consisting of a transmitter and associated receiver, shall be placed in the test chamber and left until thermal equilibrium is reached. The equipment shall then be switched on for half an hour in normal transmit mode in the high power transmit condition at the normal voltage and the equipment shall meet the requirement of the present document.

For tests at the lower temperature, the equipment shall be left in the test chamber until thermal equilibrium is reached and shall then be switched on, after which the equipment shall meet the requirements of the present document.