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Maritime satellite Emergency Position Indicating Radio Beacons (EPIRBs) for non-SOLAS vessels; Technical characteristics and methods of measurement

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Reference

DEN/ERM-TGMAR-636

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Foreword

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

National transposition dates	
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Introduction

The present document details conformance tests for the ancillary functions of non-SOLAS EPIRBs, such as controls, indicators and labels; together with a GNSS receiver and ancillary transmitters operating on 121,5 MHz and AIS. The present document is set out as follows:

- Clause 4 - General operational requirements: controls, indicators, labels, etc. (normative);
- Clause 5 - Technical information to assist in understanding how the EPIRB operates (informative);
- Clause 6 - Measurement conditions (normative);
- Clause 7 - Environmental tests (normative);
- Clause 8 - Tests on 121,5 MHz homing transmitter (normative);
- Clause 9 - Tests on the AIS transmitter - for EPIRBs incorporating AIS (normative);
- Clause 10 - Radiated spurious emissions (normative);
- Clause 11 - AIS message content tests - for EPIRBs incorporating AIS (normative);
- Clause 12 - GNSS requirements (normative);
- Clause 13 - Lanyard test (normative);
- Clause 14 - Optical tests (normative).

1 Scope

The present document sets out the minimum performance requirements and technical characteristics for non-SOLAS satellite Emergency Position-Indicating Radio Beacons (EPIRBs), operating in the COSPAS-SARSAT satellite system (406,0 MHz to 406,1 MHz) and ancillary transmissions on 121,5 MHz and also AIS1 (169,975 MHz) and AIS2 (162,025 MHz).

The present document covers both first and second generation EPIRBs defined by the COSPAS-SARSAT standards C/S T.001 [1] and C/S T.018 [3]. The present document covers only category 2 EPIRBs in class 2 (-20 °C to +55 °C).

The present document only covers battery powered portable EPIRB. Category 1 (float free) EPIRBs are not covered by the present document.

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.

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

- [1] [C/S T.001](#): "Specification for COSPAS-SARSAT 406 MHz Distress Beacons".
- [2] [C/S T.007](#): "COSPAS-SARSAT 406 MHz Distress Beacons Type Approval Standard".
- [3] [C/S T.018](#): "Specification for Second-Generation COSPAS-SARSAT 406-MHz Distress Beacons".
- [4] [C/S T.021](#): "COSPAS-SARSAT Second-Generation 406-MHz Distress Beacons Type Approval Standard".
- [5] [Recommendation ITU-R M.585-9 \(05/2022\)](#): "Assignment and use of identities in the maritime mobile service".
- [6] [IEC 61108-1:2003](#): "Maritime navigation and radiocommunication equipment and systems - Global navigation satellite systems (GNSS) - Part 1: Global positioning system (GPS) - Receiver equipment - Performance standards, methods of testing and required test results".
- [7] [IEC 61108-2:1998](#): "Maritime navigation and radiocommunication equipment and systems - Global navigation satellite systems (GNSS) - Part 2: Global navigation satellite system (GLONASS) - Receiver equipment - Performance standards, methods of testing and required test results".
- [8] [IEC 61108-3:2010](#): "Maritime navigation and radiocommunication equipment and systems - Global navigation satellite systems (GNSS) - Part 3: Galileo receiver equipment - Performance requirements, methods of testing and required test results".
- [9] [IEC 61108-5:2020](#): "Maritime navigation and radiocommunication equipment and systems - Global navigation satellite systems (GNSS) - Part 5: BeiDou navigation satellite system (BDS) - Receiver equipment - Performance requirements, methods of testing and required test results".

- [10] [Recommendation ITU-R M.1371-5 \(02/2014\)](#): "Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile frequency band".
- [11] [Recommendation ITU-R M.690-3 \(03/2015\)](#): "Technical characteristics of emergency position-indicating radio beacons operating on the carrier frequencies of 121,5 MHz and 243 MHz".
- [12] [ETSI TS 103 052 \(V1.1.1\)](#): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Radiated measurement methods and general arrangements for test sites up to 100 GHz".
- [13] [IMO Resolution MSC.481\(102\) \(adopted on 9 November 2020\)](#): "Revised recommendation on the use and fitting of retro-reflective materials on life-saving appliances".
- [14] [Recommendation ITU-T O.153 \(10/1992\)](#): "Basic parameters for the measurement of error performance at bit rates below the primary rate".
- [15] [EN 55016-2-3:2017/A2:2023](#): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-3: Methods of measurement of disturbances and immunity - Radiated disturbance measurements", (produced by CEN).
- [16] [EN IEC 55016-1-1:2019](#): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus", (produced by CEN).
- [17] [ST/SG/AC.10/11/Rev.8](#): "Manual of Tests and Criteria". United Nations.
- [18] [IEC 60068-2-6:2007](#): "Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)".
- [19] [ISO 8217:2024](#): "Products from petroleum, synthetic and renewable sources — Fuels (class F) — Specifications of marine fuels".
- [20] [IMO Resolution MSC.81\(70\) \(adopted on 11 December 1998\) - MSC 70/23/Add.1](#): "Revised Recommendation on Testing of Life-Saving Appliances".

2.2 Informative 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.

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- [i.1] [Directive 2014/90/EU](#) of the European Parliament and of the Council of 23 July 2014 on marine equipment and repealing Council Directive 96/98/EC.
- [i.2] C/S T.012: "COSPAS-SARSAT 406 MHz Frequency Management Plan".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

activated: EPIRB that has been set off and is flashing and transmitting in active mode

category 1 EPIRB: EPIRB that is fitted in a housing and automatically deploys when submerged and floats free

category 2 EPIRB: EPIRB that needs to be manually deployed and activated

class 2: EPIRB intended for operation over the temperature range -20 °C to +55 °C

non-SOLAS: equipment not intended to be used under SOLAS carriage requirements nor to be covered by the Marine Equipment Directive 2014/90/EU (MED) [i.1]

switched off: neither flashing nor transmitting

3.2 Symbols

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

bps	bits per second
mW/sr	milliwatts per steradian
P_{Norm}	conducted power measured under normal conditions
P_{-20}	conducted power measured at the lower extreme temperature
P_{+55}	conducted power measured at the upper extreme temperature
pps	pulses per second

3.3 Abbreviations

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

AIS	Automatic Identification System
C/S	COSPAS-SARSAT
cd	candella
CIRM	Comité International Radio-Maritime
COG	Course Over Ground
COSPAS	Cosmicheskaya Sistema Poiska Avarynyh Sudov
CRC	Cyclical Redundancy Check
CW	Carrier Wave
DST	Down-Swept Tone
EIRP	Equivalent Isotropic Radiated Power
EIRPEP	Equivalent Isotropic Radiated Peak Envelope Power
EMI	Electro Magnetic Interference
EPIRB	Emergency Position Indicating Radio Beacon
EUT	Equipment Under Test
FGB	First Generation Beacon
FM	Frequency Modulation
GMDSS	Global Maritime Distress and Safety System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GTEM	Giga Transverse Electro Magnetic (cell)
HDOP	Horizontal Dilution Of Position
ID	Identification
IMO	International Maritime Organization
IR	Infrared
LNA	Low Noise Amplifier
LPDA	Log-Periodic Dipole Array
MDO	Marine Diesel Oil

NOTE: Also known as Distillate Marine Diesel.

MID	Maritime Identification Digits
MMSI	Maritime Mobile Station Identity
NR	Not Required
NRZ	Non Return to Zero
NRZI	Non Return to Zero Inverted
OATS	Open Area Test Site
QPSK	Quadrature Phase Shift Keying

RAIM	Receiver Autonomous Integrity Monitoring
RBW	Reference Bandwidth
RF	Radio Frequency
RLS	Return Link Service
RSS	Received Signal Strength
SAC	Semi-Anechoic Chamber
SARSAT	Search And Rescue Satellite Aided Tracking
SGB	Second Generation Beacon
SINAD	Signal In Noise And Distortion
SL	Simulated Location
SOG	Speed Over Ground
SOLAS	International Convention for Safety of Life at Sea
SOTDMA	Self-Organized Time Division Multiple Access
SV	Space Vehicle
TDMA	Time Division Multiple Access
TL	Transmitted Location

NOTE: Transmitted by the EPIRB.

TTFIT	Time To First Fix Transmission
TX	Transmit
UTC	Coordinated Universal Time

NOTE: Literally Universel Temps Coordonné.

VDL	VHF Data Link
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio

4 General Requirements

4.1 Introduction

Compliance to the requirements of clause 4 are demonstrated by inspection of the EUT and/or relevant documentation, or by simple manual tests.

4.2 General Construction

The exterior of the EUT should have no sharp edges or projections that could easily damage inflatable rafts or injure personnel so as to minimize the risk of internal and external damage during use or stowage. The EUT shall be portable and be designed as one integral unit.

The EPIRB shall derive its energy from a battery forming a part of the EUT and incorporate a permanently attached antenna. At least half of the exterior of the EUT shall be of highly visible yellow or orange colour to assist visual location.

The EPIRB shall be fitted with retro-reflective material above the waterline to aid in visual detection. The minimum area of retro-reflective material shall be at least 25 cm² with at least 5 cm² visible from every angle on the horizon. The retro-reflective material shall also meet the performance requirements of annex 2 of IMO Resolution MSC.481(102) [13].

The EPIRB shall be a single integral unit, no part of it shall be detachable without the use of tools.

4.3 Operating Conditions

4.3.1 General

The EPIRB shall be equipped with a GNSS positioning device compliant to clause 12.

The EPIRB shall be designed to operate when floating in the sea but shall also operate satisfactorily on a ship's deck and in a survival craft when manually activated. This is tested in C/S T.007 [2] for FGBs and C/S T.021 [4] for SGBs.

The EPIRB shall float in water with its antenna out of the water and upright. This is tested in clause 7.13.

The EPIRB shall be supplied with a bracket. The bracket shall protect the EPIRB from inadvertent water activation. This is tested in clause 7.14.

The EPIRB shall also transmit its current position using Automatic Identification System (AIS) transmissions conforming to clause 9.

An EPIRB conforming to the present document may also have the following additional functions:

- Return Link Service RLS receiver (via GNSS).
- Other RF transmissions.
- Other RF receptions.

4.3.2 Conditions for activation

The EPIRB shall always be able to be activated manually as described in clause 4.6.1, whether in or out of its bracket.

The EPIRB shall always be activated automatically when out of its bracket and placed in water irrespective of the settings of any control.

Table 1 shows the all the possible combinations of conditions for activation of the EPIRB. These shall be verified by simple manual testing.

Table 1: EPIRB Control Functions

Control settings	EPIRB Condition	EPIRB in its bracket	Activation status
Manually Activated	Floating in water	No	Activated and transmitting
Manually Activated	Floating in water	Yes	Activated and transmitting
Manually Activated	Dry	No	Activated and transmitting
Manually Activated	Dry	Yes	Activated and transmitting
OFF/Standby	Floating in water	No	Activated and transmitting
OFF/Standby	Floating in water	Yes	Deactivated and not transmitting
OFF/Standby	Dry	No	Deactivated and not transmitting
OFF/Standby	Dry	Yes	Deactivated and not transmitting

4.4 COSPAS-SARSAT

The EPIRB shall comply with the COSPAS-SARSAT type approval requirements set out in C/S T.001 [1] for FGBs and C/S T.018 [3] for SGBs. These requirements take precedence over the requirements of the present document where they conflict.

First generation EPIRBs shall conform to the test requirements of the current version of C/S T.007 [2].

Second generation EPIRBs shall conform to the test requirements of the current version of C/S T.021 [4].

4.5 Lanyard

The EPIRB shall be provided with a firmly attached and tidily stowed line in order that it can be tethered in use. The lanyard shall float in water. The buoyant lanyard length shall be between 5 m and 8 m long. The lanyard shall be of highly visible yellow/orange colour and shall not deteriorate in the marine environment (see clause 7).

The tethering strength of the lanyard shall comply with clause 13.

4.6 Controls

4.6.1 General

Manual activation of the EPIRB shall be by the use of two simple, but independent mechanical actions, neither of which on its own shall activate the EUT.

It should only be possible to activate the EUT after a seal or other mechanical restraint has been removed from the first mechanical action. After activation it shall be simple to de-activate the EUT and the means to deactivate the EUT shall be clearly marked. It should be possible to determine that the EUT has been previously activated, by the absence of a seal or restraint. A non-volatile electronic witness may be substituted for the seal or mechanical restraint and shall provide a clear indication for the user that the unit has been previously activated.

The switch that operates any test facility shall be so designed that it returns automatically to the off-position when released. The seal or mechanical restraint shall not be broken when operating the test facility.

It shall be possible to manually activate and deactivate the EPIRB multiple times.

4.6.2 Operation whilst wearing gloves

All controls shall be of sufficient size for simple and satisfactory operation and also be capable of being operated by a person wearing 5 mm thick neoprene gloves.

The following actions shall be possible whilst wearing 5 mm neoprene gloves:

- 1) The EPIRB can be removed from its bracket.
- 2) Each individual control on the EPIRB can be operated.
- 3) A method to carry the EPIRB shall be available that does not require the user to hold the unit in hand. For example a loop in the lanyard to wrap around the wrist so that both hands are free to climb a ladder.
- 4) Deploy the lanyard from its stowed position.

4.7 Indicators

4.7.1 General

The EPIRB shall be provided with a low duty cycle strobe light which fulfils the requirements of clause 4.7.3. The low duty light (strobe light) shall begin flashing within 10 seconds of activation.

The EUT shall be provided with visual indications to show the operation of the EPIRB as specified in clause 4.7.2.

The EUT may optionally also be provided with audible indications.

4.7.2 Operational Indicators

The visual indicator shall clearly distinguish the following states with each indicator being described in the user manual:

- i) The EPIRB has been activated.
- ii) The EPIRB is actively transmitting signals.
- iii) The EPIRB GNSS is active but does not have a position lock.
- iv) The EPIRB has GNSS position lock and is transmitting its position.
- v) The EPIRB has received an RLS message (for EPIRBs that can receive RLS).
- vi) The EPIRB is undergoing functional self-test or GNSS self-test.
- vii) The EPIRB has successfully passed functional self-test or GNSS self-test.