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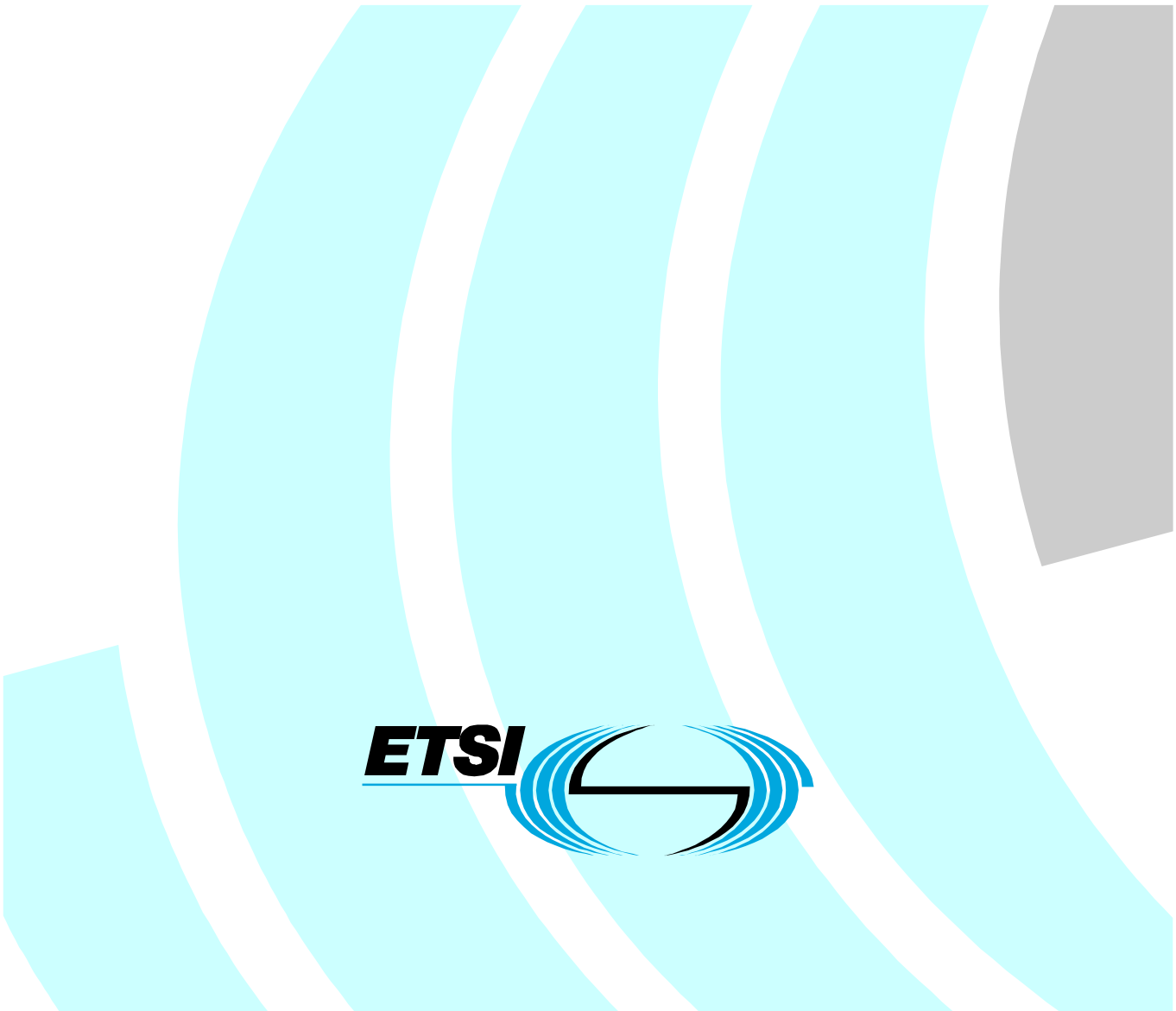
European Standard (Telecommunications series)

Electromagnetic compatibility and Radio spectrum Matters (ERM); Satellite Personal Locator Beacons (PLBs) operating in the 406,0 MHz to 406,1 MHz frequency band; Part 1: Technical characteristics and methods of measurements



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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
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Contents

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Foreword

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

The present document is part 1 of a multi-part deliverable covering Satellite Personal Locators Beacons (PLBs) operating in the 406,0 MHz to 406,1 MHz frequency band, as identified below:

Part 1: "Technical characteristics and methods of measurement";

Part 2: "Harmonized standard under article 3.2 of the R&TTE Directive".

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 sets out the minimum performance requirements and technical characteristics for satellite Personal Locator Beacon (PLB), operating in the COSPAS-SARSAT satellite system. This satellite PLB is primarily designed for use in maritime environment, however certain countries may licence them as land mobile satellite PLBs as well.

The equipment covered by the present document operates in the 406,0 MHz to 406,1 MHz frequency band and is provided with a low power 121,5 MHz homing device. The present document also covers satellite PLBs with an integrated navigation device. Satellite PLBs designed and manufactured in accordance with the present document meet the satellite PLB requirements of the COSPAS-SARSAT System as well as relevant environmental requirements.

The present document is applicable for satellite PLBs operating over the temperature ranges of:

- -40°C to +55°C (Class 1); or
- -20°C to +55°C (Class 2).

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

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

[1] C/S T.001: "Specification for COSPAS-SARSAT 406 MHz distress beacons".

NOTE: The present document may be downloaded from the COSPAS-SARSAT website: www.cospas-sarsat.org.

[2] C/S T.007: "COSPAS-SARSAT 406 MHz distress beacon type approval standard".

NOTE: The present document may be downloaded from the COSPAS-SARSAT website: www.cospas-sarsat.org.

[3] ETSI TR 100 028: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Extension of the table of maximum accumulated acceptable uncertainties in the measurement of mobile radio equipment characteristics Part 1".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

category 1: satellite PLB shall have sufficient positive buoyancy to float in fresh water

category 2: satellite PLB is not required to float

class 1: satellite PLB intended for operations over the temperature range -40°C to +55°C

class 2: satellite PLB intended for operations over the temperature range -20°C to +55°C

equipment: satellite PLB that includes a 121,5 MHz homing device, which may also be equipped with an integral GNSS receiver

homing device: 121,5 MHz beacon

satellite PLB: mobile earth station in the Mobile Satellite Service the emissions of which are intended to facilitate search and rescue operations and intended for personal use

3.2 Symbols

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

NaCl	sodium chloride

3.3 Abbreviations

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

C/S	COSPAS-SARSAT
COSPAS-SARSAT	COsmicheskaya Sistyema Poiska Avariynych Sudov - Search and Rescue Satellite-Aided Tracking
CW	Continuous Wave
e.i.r.p.	equivalent isotropically radiated power
EUT	Equipment Under Test
GNSS	Global Navigantional Satellite System
ID	Identification (according to C/S requirements for PLBs)
PLB	Personal Locator Beacon
PLL	Phase Locked Loop
ppm	parts per million
RF	Radio Frequency

4 General requirements

4.1 Introduction

The manufacturer shall declare that compliance to the requirements of clause 4 is achieved and shall provide relevant documentation.

4.2 Functional requirements

The satellite PLB shall be designed to operate satisfactorily in all kinds of weather conditions, on shore, on a ship's deck and in a survival craft. Seawater, oil or exposure to sunlight shall not unduly affect the equipment.

The satellite PLB may be equipped with a positioning device capable of global operation e.g. a GNSS receiver.

The general construction and method of operation shall provide a high degree of proof against inadvertent operation, whilst still providing a simple means of operation in an emergency.

The satellite PLB shall be manually activated only.

After manual activation, no distress signal shall be emitted until at least 47 s and at most 5 min after the satellite PLB has been activated. The satellite PLB shall be a single integral unit incorporating a primary battery and a permanently attached antenna. No part of it shall be detachable without the use of tools. The fixed portion of the distress message shall be stored in such a way that it will not be affected by removal of all power sources. Any external connection shall not inhibit the activation of the satellite PLB.

4.3 Buoyancy

Category 1 satellite PLB shall have sufficient positive buoyancy to float in fresh water.

Category 2 satellite PLB is not required to float.

4.4 Colour

The body of the satellite PLB shall be of a highly visible yellow or orange colour.

4.5 Controls

All controls shall be of sufficient size for simple and satisfactory operation.

Manual activation of the satellite PLB shall give visible indication that the unit has been activated by means of a break away part or seal which shall not be replaceable by the user and shall require two simple but independent mechanical actions neither of which, on its own, shall activate the equipment. The part or seal shall not be broken when using the test facility.

The means for manual activation shall be protected against inadvertent activation.

After activation it shall be possible to manually deactivate the satellite PLB.

4.6 Indicators

The satellite PLB shall be provided with either an audible or a visual indication that the device is activated.

4.7 Self-test mode

The satellite PLB shall be capable of being tested, without using the satellite system, to determine that the satellite PLB is capable of operating properly, i.e. the following items under a full-load condition as a minimum shall be tested:

- the battery voltage is sufficient to meet the power requirements of the satellite PLB;
- the 406 MHz Radio Frequency (RF) output stage is operational; and
- if used, the phase lock of the 406 MHz Phase Locked Loop (PLL).

When the self-test mode is activated, the satellite PLB shall emit a single burst that shall provide the beacon 15 Hex ID, the frame synchronization pattern shall be "011010000" (i.e. the last 8 bits are complemented and the burst duration shall be 440 ms or 520 ms) C/S T.001 [1]. Successful completion of the self-test shall be indicated after which the test facility shall deactivate automatically. The test mode shall be functional throughout the operating temperature range.

If the 121,5 MHz auxiliary radio-locating device signal is transmitted during the self test, the satellite PLB should include a label noting that self test should be performed only within the first 5 min of any hour and should not exceed 3 audio sweeps or 1 s, whichever is greater.

4.8 Labelling

The satellite PLB and its container, if any, shall be provided with a label or labels containing the following information, at least, in English:

- type designation, production serial number, and the type of battery specified by the manufacturer for use in the equipment;
- the date on which the battery will need to be replaced;
- adequate instruction to enable manual activation, deactivation and self-test;
- a warning to the effect that the satellite PLB shall not be operated except in an emergency;
- temperature range according to the equipment class;
- floating or non-floating category 1 or 2;
- the identity code programmed into the satellite PLB, namely hexadecimal representation of bits 26 to 85 of the digital message beacon 15 hex ID;
- safety statement relevant to the battery see clause 4.13;
- for category 2 satellite PLB, a warning that states that this satellite PLB is a non-floating unit.

The marking shall be indelible and legible.

4.9 Equipment Manual

The equipment manufacturer shall provide full instructions regarding stowage, operation and testing of the satellite PLB. This shall also include the following information:

- overview of COSPAS-SARSAT system;
- information regarding registration, registration renewal and a discussion on the importance of accurate registration;
- warning on avoidance of false alarms and instructions on reporting on inadvertent satellite PLB activation;
- instructions on battery replacement including warning to replace battery after satellite PLB is operated for any purpose other than a test;
- recommendation to operate beacon in open space rather than attempting to operate inside life raft or under any similar cover or canopy;
- manufacturer recommendation, if any, on periodic functional testing, possibly in connection with battery replacement;
- recommendations to limit self-testing to the minimum necessary to ensure confidence in the operation of the satellite PLB;
- recommendations for satellite PLBs which emit a 121,5 MHz signal during self-test, a warning to limit testing to the first five min of the hour;
- recommendations to keep original satellite PLB packaging, since it may be needed if satellite PLB must be shipped for servicing;
- for category 2 satellite PLB, a warning that states that this satellite PLB will not float;
- warranty information;
- battery disposal information.

4.10 Homing device

The satellite PLB shall be provided with a homing device operating on 121,5 MHz which shall fulfil the requirements of clause 8.2.

4.11 Coding

The satellite PLB shall be coded according to C/S T.001 [1], as applicable to satellite PLBs. The registry Administrations will advise the manufacturer or retailer which protocol is to be used.

4.12 Ancillary Devices

Where a unit of equipment provides a facility which is additional to requirements of the present document, the operation or malfunction of such additional facility shall not prevent the satellite PLB conforming fully to the requirements of the present document during normal combined operation.

4.13 Power source

4.13.1 Battery requirements

The expiry date of the battery shall be the battery manufacturing date plus no more than half the useful life of the battery.

The useful life of the battery is defined as the period of time after the date of battery manufacture that the battery will continue to meet the input power requirements of the satellite PLB.

To define the useful life of the battery, the following losses at the temperature of +20°C ± 5°C shall be included:

- self testing at a rate of once a month;
- self-discharge of the battery; and
- standby loads, if any.

4.13.2 Safety precautions

It shall not be possible to connect the battery with the polarity reversed.

The battery shall not release toxic or corrosive products inside or outside the satellite PLB:

- during or subsequent to storage at temperatures between -55°C and +75°C;
- during a full or partial discharge at any rate up to and including an external short circuit;
- during a charge or forced discharge of a cell or cells by another cell or cells within the battery;
- after a full or partial discharge.

The battery shall not be hazardous to any person handling, using or performing manufacturer approved servicing of the device or to any vehicle or equipment in which it is transported, housed or installed under any of the conditions specified in the present document.

5 Test conditions

5.1 General

The requirements of the present document shall be met after a maximum warm-up period of 15 min after satellite PLB activation.

Adequate information shall be provided to enable the equipment to be properly set up, maintained and operated during the conformance testing.

If the equipment contains any additional facilities or auxiliary devices, they shall be operational for the duration of all tests, in the mode draining maximum battery energy. During testing all audible and visual indications shall be functioning.

5.2 Performance check

For the purpose of the present document, the term "performance check" shall be taken to mean checking beacon operability in the self-test mode and decoding of the transmitted message.

5.3 Preparation of satellite PLB for testing

For the purpose of conformance testing, the satellite PLB shall be specially programmed to transmit data bursts encoded with the test protocol of the appropriate type and format (as defined in C/S T.001 [1]), when the satellite PLB is activated. All homing devices should be prepared for test transmission. Care shall be taken not to transmit distress signals on distress and safety frequencies, for example by frequency offset or test coding.

The manufacturer shall supply a satellite PLB which is configured such that the antenna port can be connected to the test equipment by a coaxial cable, terminated by a 50 Ω load. If possible this connection shall be waterproof and able to withstand all environmental conditions. The configuration of the antenna port may be prepared by the manufacturer before the relevant test.

In cases where it is not possible to fit a watertight connector to the satellite PLB due to the shape or size of the satellite PLB, the manufacturer can supply two units for testing. One unit shall be a standard production unit, the other unit shall have means to connect a coaxial cable, but may not withstand all environmental conditions. Both units shall be exposed to all environmental tests, except the tests, which include submersion into fluid, which shall only be performed on the standard production unit.

5.4 Test sequence

The tests shall be carried out in the order described in the present document, and may be combined with the tests as described in the COSPAS-SARSAT specification C/S T.001 [1] and C/S T.007 [2].

All tests shall be performed on a single unit, prepared in accordance with clause 5.3.

5.5 Test power source

All tests and performance checks shall be carried out using the internal battery.

For conformance tests, three sets of batteries shall be submitted.

5.6 Normal test conditions

Normal temperature and humidity conditions for tests shall be any convenient combination of temperature and humidity within the following ranges:

- temperature: +15°C to 35°C;
- relative humidity: 20 % to 75 %.

5.7 Extreme test conditions

For tests at extreme temperatures, measurements shall be made in accordance with the procedure specified in clause 5.8 at the following lower and upper extreme temperatures:

- for the class 1 PLB -40°C and +55°C;
- for the class 2 PLB -20°C and +55°C.

5.8 Procedure for tests at extreme temperatures

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

Before tests are carried out, the equipment shall have obtained thermal balance in the test chamber and have been switched on for a period of 15 min.

NOTE: All electrical and functional tests under extreme temperatures may be combined with the relevant tests of the COSPAS-SARSAT specification (see clause A.2.1 of C/S T.007 [2]).

5.9 Measurement uncertainties

Table 1: Absolute measurement uncertainties: maximum values

Parameter	Maximum uncertainty
Repetition time	±0,01 s
Total transmission time	±1,0 ms
CW preamble	±1,0 ms
Bit rate	±0,6 bit/s
Nominal frequency	±100 Hz
Frequency stability	$< 1x10^{-10}$
Spectrum mask	±2 dB
Carrier rise time	±0,5 ms
Modulation rise	±25 µs
Modulation symmetry	<0,01
Phase modulation	±0,04 radians
Temperature	±2°C
Antenna measurement	±3 dB
Radiated power	± 6 dB
Spurious emissions	± 6 dB

Where applicable for the test methods according to the present document the uncertainty figures are valid to a confidence level of 95 % calculated according to the methods described in TR 100 028 [3].

6 Environmental tests

6.1 General

Environmental tests in this clause shall be carried out before any other tests and shall be performed under normal test conditions unless otherwise stated. The satellite PLB shall be in operating conditions, but not transmitting unless otherwise stated.

The following tests shall be conducted in the order they appear in this clause unless otherwise stated.

6.2 Temperature tests

6.2.1 Definition

The immunity against the effects of temperature is the ability of the equipment to maintain the specified mechanical and electrical performance after the following tests have been carried out.

6.2.2 Dry heat test

6.2.2.1 Method of measurement

The equipment shall be placed in a chamber of normal room temperature. Then the temperature shall be raised to and maintained at (+70 ± 3)°C for a period of between 10 hours and 16 hours.

The maximum rate of raising or reducing the temperature of the chamber in which the equipment is being tested shall be 1°C/min.

After this period any climatic control device provided in the equipment may be switched on and the chamber cooled to (+55 ± 3)°C. The cooling of the chamber shall be completed within 30 min.

The equipment shall then be switched on and shall be kept working continuously for a period of 2 hours. The temperature of the chamber shall be maintained at (+55 ± 3)°C during the 2 hour 30 min period. The equipment shall be subjected to a performance check during the last 30 min.

At the end of the test, and with the equipment still in the chamber, the chamber shall be brought to room temperature in not less than 1 hour. The equipment shall then be exposed to normal room temperature and humidity for not less than 3 hours before the next test is carried out.

6.2.2.2 Requirement

The requirement for the performance check shall be met.

6.2.3 Low temperature test

6.2.3.1 Method of measurement

The equipment shall be placed in a chamber at normal room temperature. Then the temperature shall be reduced to, and maintained at (-40 ± 3)°C for class 1 and (-30 ± 3)°C for class 2 for a period of between 10 hours and 16 hours.

For class 2 equipment the chamber shall then be heated to (-20 ± 3)°C.

Any climatic control device provided in the equipment may be switched on. The action of the climatic control device and (for class 2 equipment) the heating of the chamber shall be completed within (25 ± 5) min.

The temperature of the chamber shall be then maintained during a period of 2 hours.

The equipment shall be subjected to a performance check during the last 30 min of the test.

At the end of the test, and with the equipment still in the chamber, the chamber shall be brought to room temperature in not less than 1 hour. The equipment shall then be exposed to normal room temperature for not less than 3 hours, or until moisture has dispersed, which ever is longer, before the next test is carried out.

Throughout the test the equipment shall be working normally.

6.2.3.2 Requirement

The requirement for the performance check shall be met.

6.3 Vibration test

6.3.1 Definition

The immunity against the effects of vibration is the ability of the equipment to maintain the specified mechanical and electrical performance when the following test is carried out.

6.3.2 Method of measurement

The equipment shall be clamped to the vibration table in its normal attitude.

Provision may be made to reduce or nullify any adverse effect on the equipment performance that could be caused by the presence of any electro-magnetic field due to the vibration unit.

Taking at least 15 min to cover each octave of frequency, the equipment shall be subjected to sinusoidal vertical vibration at all frequencies between:

- 5 Hz and 12,5 Hz with an excursion of ±1,6 mm ± 10 %;
- 12,5 Hz and 25 Hz with an excursion of ±0,38 mm ± 10 %;
- 25 Hz and 50 Hz with an excursion of ±0,10 mm ± 10 %.

The frequency sweep rate shall be slow enough to allow the detection of resonance in any part of the Equipment Under Test (EUT).

A resonance search shall be carried out during the vibration test. If any resonance of any part of any component is observed, the equipment shall be subjected to a vibration endurance test at each resonance frequency with the duration of not less than 2 hours at the vibration level specified above. The test shall be repeated with vibration in each of the mutual perpendicular direction in the horizontal plane.

A performance check at the satellite PLB shall be carried out during and after the test. At the end of the test, the equipment shall be examined for any mechanical deterioration.

6.3.3 Requirement

The satellite PLB shall not be automatically activated during the vibration test.

The requirement for the performance check shall be met. No damage or mechanical deterioration shall be visible to the naked eye.

6.4 Bump test

6.4.1 Definitions

The immunity against the effects of bumps is the ability of the equipment to maintain the specified mechanical and electrical performance after the following test has been carried out.

6.4.2 Method of measurement

The EUT should be secured to the testing equipment and subjected to the bump test according to the following profile:

- Peak Acceleration: 98 m/s^2
- Pulse duration: 16 ms
- Wave shape: Half-cycle Sine wave
- Number of Bumps: 4 000

The bump test is conducted three times; once with the EUT mounted in each of the 3-axes. Upon completion of the bump test, an exterior mechanical inspection should be performed and a performance check shall be made.

6.4.3 Requirements

The EUT should not activate during the bump test.

The requirement for the performance check shall be met. No damage or mechanical deterioration shall be visible to the naked eye.

6.5 Corrosion test

This test need not be carried out if the manufacturer is able to produce sufficient evidence that the components, materials etc. maintain their specified mechanical and electrical performance against the effects of corrosion.

6.5.1 Definition

The immunity against the effects of corrosion is the ability of the equipment to maintain the specified mechanical and electrical performance after the following test has been carried out.

6.5.2 Method of measurement

The equipment shall be turned off during the test. Before exposing the equipment to salt fog, it shall be conditioned for a duration of at least 2 hours at a temperature of (35°C ± 2)°C. After this conditioning and with the ambient temperature maintained at 35°C, salt fog should be added and maintained at the saturation point for 48 hours. The equipment shall be placed in a chamber fitted with apparatus capable of spraying in the form of fine mist, such as would be produced by a spray gun, salt solution to the formula in table 2.

Table 2: Salt solution formula

sodium chloride	26,5	g	±10 %
magnesium chloride	2,5	g	±10 %
magnesium sulphate	3,3	g	±10 %
calcium chloride	1,1	g	±10 %
potassium chloride	0,73	g	±10 %
sodium bicarbonate	0,20	g	±10 %
sodium bromide	0,28	g	±10 %
plus distilled water to make the solution up to 1 l.			

Alternatively a 5 % sodium chloride (NaCl) solution may be used. The salt used for the test shall be high quality sodium chloride (NaCl) containing, when dry, not more than 0,1 % sodium iodine and not more than 0,3 % of total impurities.

Salt solution concentration shall be (5 ± 1) % by weight. The solution shall be prepared by dissolving 5 parts ± 1 by weight of salt in 95 parts by weight of distilled or de-mineralized water.

The pH value of the solution shall be between 6,5 and 7,2 at temperature of (20 ± 2) °C. The pH value shall be maintained within this range during conditioning. For this purpose, diluted hydrochloric acid or sodium hydroxide may be used to adjust the pH value, provided that the concentration of NaCl remains within the prescribed limits. The pH value shall be measured when preparing each new batch of solution.

The spraying apparatus shall be such that the products of corrosion cannot mix with the salt solution contained within the spray reservoir.

After exposure to salt fog, the equipment shall be permitted to dry at room temperature (20 ± 5) °C for 24 hours before exposed to another period of 12 hours of salt fog exposure at 35°C. Upon completion of this exposure and after a 12 hour drying period at room temperature, the equipment shall be examined visually. The self-test of the satellite PLB (see clause 4.7) shall be carried out.

6.5.3 Requirements

There shall be no undue deterioration or corrosion of the metal parts, finishes, material, or component parts visible to the naked eye.

In the case of hermetically sealed equipment there shall be no evidence of moisture penetration.

The requirement for the performance check shall be met. No damage or mechanical deterioration shall be visible to the naked eye.

6.6 Drop test

6.6.1 Definition

The immunity against the effects of droppings is the ability of the equipment to maintain the specified mechanical and electrical performance after the following test has been carried out.

6.6.2 Method of measurement

The EUT should be OFF for this test.

The EUT should be soaked at minimum stowage temperature for 2 hours. Then soak the EUT at -40°C for 2 hours. The drop test should then be completed within five min.

The height of the lowest part of the EUT relative to the test surface at the moment of release should be (1 000 ± 10) mm. The EUT should be dropped six times onto the test surface. It should be released once with each axis of the EUT facing downwards. The antenna may be secured in its normal stowage position (if applicable) for this test. If the satellite PLB is provided with a pouch or similar package not permanently affixed, the satellite PLB should be removed before conducting the drop test.

The test surface should consist of a piece of solid hard wood with a thickness of at least 150 mm and a mass of 30 kg or more which is resting on a concrete floor.

6.6.3 Requirements

The EUT should not activate during this test.

Upon completion of the drop test, an exterior and interior mechanical inspection and performance check should be performed. The interior mechanical inspection can be deferred until the conclusion of thermal shock immersion tests (see clauses 6.7 and 6.8).

6.7 Thermal shock test

6.7.1 Definition

The immunity against the effects of thermal shock is the ability of the equipment to maintain the specified mechanical and electrical performance after the following test has been carried out.

NOTE: This test is different from the thermal shock test required by COSPAS-SARSAT Specification C/S T.007 [2].

6.7.2 Method of measurement

The equipment shall be placed in an atmosphere of (+65 ± 3) °C for 1 hour. It shall then be immersed in water at (+20 ± 3) °C to a depth of 10 cm, measured from the highest point of the equipment to the surface of the water, for a period of 1 hour.

At the end of the test the self-test of the satellite PLB (see clause 4.7) shall be carried out.

6.7.3 Requirements

The requirement for the performance check shall be met. No damage or ingress of water shall be visible to the naked eye.

6.8 Immersion test

6.8.1 Definition

The immunity against the effects of immersion in water is the ability of the equipment to maintain the specified mechanical and electrical performance after the following test has been carried out.

6.8.2 Method of measurement

A hydraulic pressure of 10 kPa, corresponding to a depth of 1 m shall be applied for a period of 5 min. At the end of the test the self-test of the satellite PLB (see clause 4.7) shall be carried out.

6.8.3 Requirements

The requirement for the performance check shall be met. No damage or ingress of water shall be visible to the naked eye.

6.9 Buoyancy test

6.9.1 Definition

This test applies only for category 1.

Buoyancy, expressed as a percentage, is its buoyant force divided by its gravity force.

6.9.2 Method of measurement

Satellite PLB shall be submerged in calm fresh water.

One of the following methods of measurement shall be used:

- the buoyant force shall be measured when the satellite PLB is totally submerged in fresh water. The buoyant force shall be then divided by the measured gravity force. The result shall be recorded; or
- the buoyancy may be calculated by dividing the volume of the unit above the waterline by the total volume of the satellite PLB. The result shall be recorded.

6.9.3 Requirements

The value of buoyancy shall be at least 5 %.

7 Technical requirements for 406 MHz transmitter

In addition to the requirements of the present document, the satellite PLB shall also meet the technical requirements of document C/S T.001 Specification for COSPAS-SARSAT 406 MHz Distress Beacon [1]. For guidance on test conditions see document C/S T.007 COSPAS-SARSAT 406 MHz Distress Beacon Type Approval Standard [2] as applicable for satellite PLB.

8 Technical requirements

8.1 Battery capacity

8.1.1 Definition

Battery capacity is the ability of the internal power source of the equipment to deliver sufficient power for an uninterrupted operation of the equipment in a specified time period.

8.1.2 Method of measurement

Using a fresh battery pack, the satellite PLB shall be activated in the normal temperature range for a period of time as stated by the manufacturer. This period of time shall cause a battery capacity loss equivalent to that occurring during the useful life of the battery pack as defined in clause 4.13. The manufacturer shall substantiate the method used to determine this time.

The satellite PLB shall be placed in a chamber of normal room temperature. Then the temperature shall be reduced to and maintained at (-40 ± 3)°C for class 1 or (-30 ± 3) °C for class 2 equipment for a period of 10 hours.

Any climatic control device provided in the equipment may be switched on, and for class 2 equipment the chamber heated to (-20 ± 3) °C, at the conclusion of the period specified above. The action of the climatic control device and for class 2 equipment, the heating of the chamber, shall be complete within 20 min.

The equipment shall be activated 30 min after this period and shall then be kept working continuously for a period of 24 hours. The temperature of the chamber shall be maintained for the whole of the 24 hours period.

This test may be combined with the relevant environmental tests of the COSPAS-SARSAT specification (see clause 4.2 of C/S T.001 [1] and clause A.2.3 of C/S T.007 [2]).

8.1.3 Limit

The satellite PLB shall comply with the following requirements of C/S T007 [2] output power, short term frequency stability, medium term frequency stability and satellite PLB coding according to C/S T.001 [1] for 24 hours.

8.2 Homing device

8.2.1 General

8.2.1.1 Class of emission

The radio frequency transmission shall be amplitude modulated with full carrier and both sidebands (A3X).

8.2.1.2 Modulation frequency

An audio signal shall sweep downward within a range of not less than 700 Hz between 1 600 Hz and 300 Hz.

8.2.1.3 Transmitter duty cycle

The transmitter shall have a continuous duty cycle except that it may be interrupted for up to a maximum of 2 s during transmission of the 406 MHz signal. The satellite PLB may also optionally transmit an identification letter in morse code. This morse code transmission should take place once immediately following each pause for the 406 MHz transmission.

8.2.1.4 Sweep repetition rate

The sweep repetition rate of the transmitter shall be 2 Hz to 4 Hz.

8.2.2 Frequency error

8.2.2.1 Definition

The frequency error is the difference between the measured carrier frequency and its nominal value.

8.2.2.2 Method of measurement

The carrier frequency shall be measured under normal and extreme test conditions with a frequency counter or a spectrum analyser.

8.2.2.3 Limit

The carrier frequency shall be 121,5 MHz ± 50 ppm.

8.2.3 Modulation duty cycle

8.2.3.1 Definition

Modulation duty cycle is the ratio of the positive modulation peak duration to the period of the instantaneous fundamental audio-modulation frequency observed at the half-amplitude points on the modulation envelope using the following formula:

$$\text{Duty cycle} = \frac{T_1}{T_2} \times 100\ \%$$

where:

- T_1 is the duration of the positive half cycle of the audio modulation measured at the half amplitude points of the modulation envelope; and
- T_2 is the period of the fundamental of the audio modulation.

8.2.3.2 Method of measurement

The transmitter output shall be connected to a storage oscilloscope. T_1 and T_2 shall be measured near the start, midpoint and end of the modulation period. The modulation duty cycle shall be calculated.

8.2.3.3 Limit

The modulation duty cycle shall be between 33 % and 55 %.

8.2.4 Modulation factor

8.2.4.1 Definition

Modulation factor is defined with respect to the maximum and minimum amplitudes of the modulation envelope by the following formula:

$$\text{Modulation factor} = \frac{A - B}{A + B}$$

where:

- A is the maximum value of the envelope curve; and
- B is the minimum value of the envelope curve.

8.2.4.2 Method of measurement

The transmitter output shall be connected to a storage oscilloscope. A and B shall be measured near the start, midpoint and end of the modulation period. The modulation factor shall be calculated.

8.2.4.3 Limit

The modulation factor shall be between 0,85 and 1,0.

8.2.5 Peak equivalent isotropic radiated power

8.2.5.1 Definition

Equivalent isotropic radiated power (e.i.r.p.) is the product of power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna. Peak e.i.r.p. indicates the power contained in the peak crest of the modulation envelope.

In the case of the satellite PLB, the radiated field shall be vertically polarized.

8.2.5.2 Method of measurement

The test site should be on level ground which has uniform electrical characteristics. The site should be clear of metal objects, overhead wires, etc, and as free as possible from undesired signals such as ignition noise or other RF carriers. The distance from the satellite PLB, or the search antenna to reflecting objects should be at least 30 m.

Measurement of the radiated signal should be made at a point 10m from the satellite PLB. At this point, a non-conductive mast, with a movable boom should be arranged so that a search antenna can be raised and lowered through elevation angles between 5° and 20°.

The search antenna shall be vertically polarized.

NOTE 1: The 10 m test distance may be reduced to a minimum of 5 m if the search mast cannot reach 20°.

NOTE 2: A screened anechoic test site may be used, provided the minimum 5 m range can be achieved.

This test is only performed at ambient (normal) temperature and should use a satellite PLB whose battery has been ON for a minimum of 20 hours. If the test exceeds 4 hours the battery may be replaced with another which has been preconditioned with at least 20 hours of ON time.

The satellite PLB should be placed on the centre of a ground plane with radius (125 ± 5) cm mounted at ground level. See annex A.

For testing outside a screened room, care shall be taken not to transmit distress signals on distress and safety frequencies, for example by using offset frequencies.

The elevation of the search antenna should be varied between elevation angles from 5° to 20° until maximum signal is found. As elevation is changed, the search antenna should be tilted to point directly at the satellite PLB. The elevation should then remain fixed for the remainder of the test.

The satellite PLB should then be rotated through 12 increments of 30° in azimuth. For each position, the peak e.i.r.p. should be measured and computed using the following equation:

$$PEIRP = Log^{-1} [(P_{rec} - G_{rec} + L_c + L_{path})/10]$$

Where

P_{rec} = Measured peak power on receiver or spectrum analyser (dBm).

G_{rec} = Search antenna gain (dB).

L_c = Receive system cable loss (dB).

L_{path} = Free space propagation loss (dB) for slant range.

8.2.5.3 Limit

The mean value of the 12 measured results shall exceed 25 mW and the maximum value recorded shall be less than 100 mW.

8.2.6 Spurious emissions

8.2.6.1 Definition

Spurious emission is emission on a frequency or frequencies, which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products, and frequency conversion products, but exclude out-of-band emissions.

8.2.6.2 Method of measurement

Spurious emissions shall be measured in the frequency bands:

- 108 MHz to 137 MHz;
- 156 MHz to 162 MHz;
- 406,0 MHz to 406,1 MHz; and
- 450 MHz to 470 MHz

at the test site described in annex A.

8.2.6.3 Limit

The power of any spurious emission component shall not exceed 25 μW on any frequency.

Annex A (normative): Antenna test site

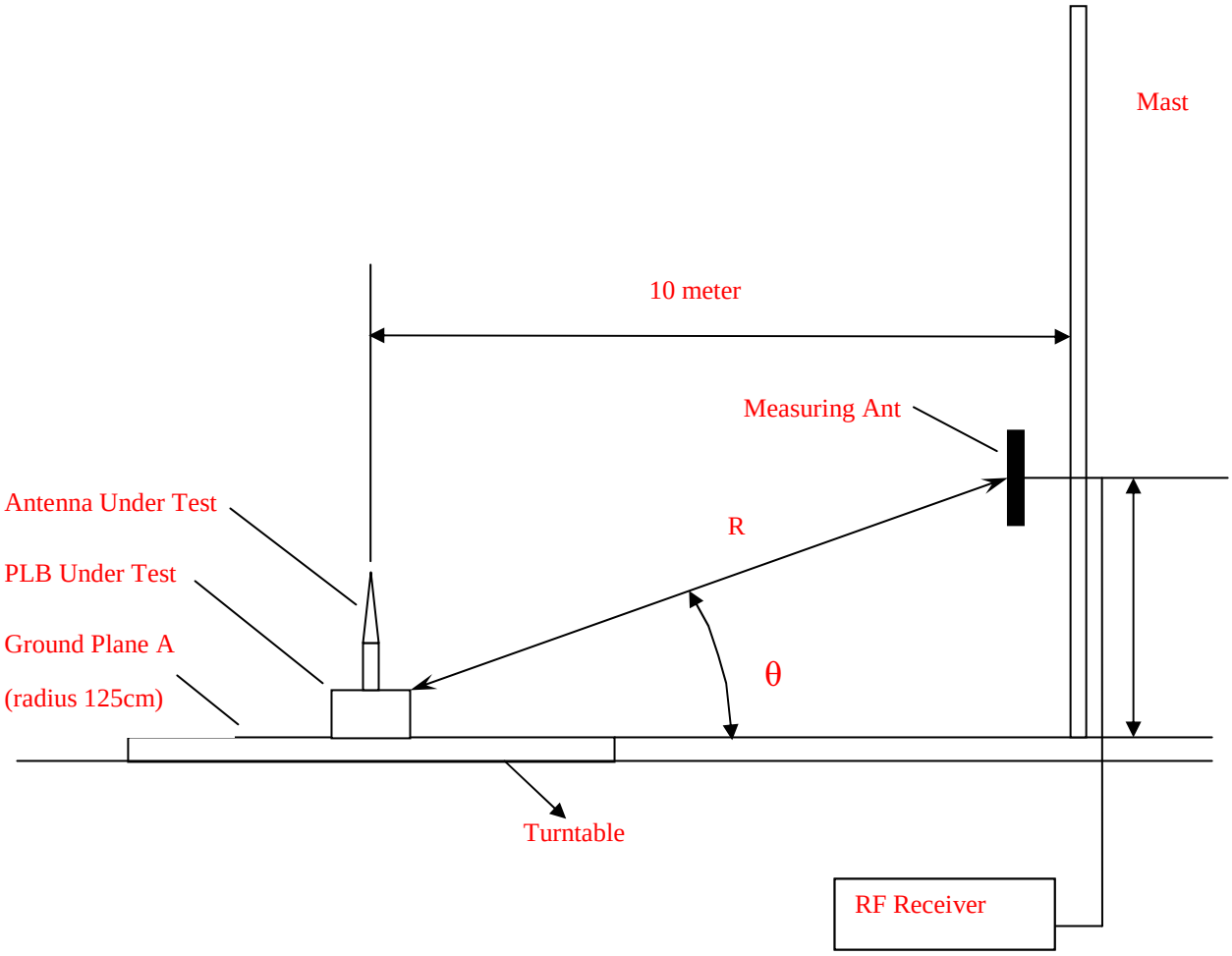

Figure A.1: Equipment Test Set-Up for Radiation Tests

Annex B (informative): Bibliography

ITU-R Recommendation M.633-2: "Transmission characteristics of a satellite emergency position-indicating radio beacon (satellite EPIRB) system operating through a low polar-orbiting satellite system in the 406 MHz band".

ITU Radio Regulations.

CENELEC EN 60945: "Maritime navigation and radio communication equipment and systems - General requirements - Methods of testing and required test results".

History

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V1.1.1	January 2003	Public Enquiry	PE 20030516: 2003-01-15 to 2003-05-16
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