

AS/NZS 4280.2:2023



Australian/New Zealand Standard™

Global maritime distress and safety system (GMDSS)

Part 2: 406 MHz Satellite Personal Locator Beacons (PLBs)



AS/NZS 4280.2:2023

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- Boating Industry Association
- Civil Aviation Safety Authority
- Consumer Electronics Suppliers Association
- Electromagnetic Technical Evaluation Committee
- Maritime New Zealand
- NZ Ministry of Business, Innovation and Employment (MBIE)
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Part 2: 406 MHz Satellite Personal Locator Beacons (PLBs)

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Preface

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee RC-004 Radiocommunications Equipment - Maritime and Safety of Life, to supersede AS/NZS 4280.2:2017, *406 MHz satellite distress beacons, Part 2: Personal locator beacons (PLBs)*.

The objective of this document is to provide manufacturers, suppliers and testing facilities with minimum requirements for the functional and technical performance of Personal Locator Beacons (PLBs) operating in the 406.0 to 406.1 MHz band through polar-orbiting, medium earth orbiting and geostationary satellite systems. A 406 MHz PLB designed and manufactured to the standards contained in this document meets the PLB portion of the Cospas-Sarsat System developed and implemented by the Cospas-Sarsat Partners (the Russian Federation, Canada, France and the United States) as well as the environmental requirements considered necessary for the PLB use.

This document is an adoption with national modifications, and has been reproduced from, RTCM Standard 11010.4, *406 MHz Satellite Personal Locator Beacons (PLBs)*. The modifications set out in [Appendices ZZ](#), [ZA](#) and [ZB](#) are additional requirements, which have been added at the end of the source text.

[Appendix ZZ](#) lists the modifications to RTCM Standard 11010.4 for the application of this document in Australia and New Zealand. These modifications include the following:

- (a) Contact details for the national registration authorities for Australia and New Zealand have been included.
- (b) Contact details for the national search and rescue authorities for Australia and New Zealand have been included.
- (c) Category 2 PLBs are not permitted in Australia or New Zealand hence reference to Category 2 has been deleted from this revision.
- (d) Morse Code “P” in the 121.5 MHz homing signal is optional for Australian and New Zealand coded PLBs.
- (e) Automatic Identification System (AIS) transmitter is optional for Australian and New Zealand coded PLBs, except for a Group 3 PLB.
- (f) Labelling on the PLB is to include search and rescue authority phone numbers and national registration details for Australian and New Zealand coded PLBs.
- (g) The PLB includes an internal GNSS navigation device which—
 - (i) Includes the requirements for Second Generation Beacons (SGB); and
 - (ii) Includes the requirements for the Return Link Service (RLS) when included in design.

[Appendix ZA](#) specifies NOAA calculations of checksums for 15 and 23 character hexadecimal ID (UIN) codes.

[Appendix ZB](#) provides sample beacon registration cards for Australia and New Zealand.

As this document has been reproduced from an International document, a full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

National Foreword

Category 1 PLB positive buoyancy status may be achieved by permanently attaching a flotation device to a non-Category 1 PLB. It is acceptable for the tests detailed in Annexes to be carried out on the non-floating version of a beacon.

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RADIO TECHNICAL COMMISSION FOR MARITIME SERVICES

**RTCM STANDARD 11010.4 FOR
PERSONAL LOCATOR BEACONS (PLBs)****1 Scope****1.1 Personal Locator Beacons**

This document contains minimum requirements for the functional and technical performance of Personal Locator Beacons (PLBs) operating in the 406.0 to 406.1 MHz band through polar-orbiting, medium earth orbiting and geostationary satellite systems. A 406 MHz PLB designed and manufactured to the standards contained in this document meets the PLB portion of the Cospas-Sarsat ¹ System developed and implemented by the Cospas-Sarsat Partners (the Russian Federation, Canada, France, and the United States) as well as the environmental requirements considered necessary for PLB use.

1.2 System overview

Cospas-Sarsat is an international system that uses low altitude, near-polar orbiting, medium earth orbiting and geostationary satellites that assist in detecting and locating activated 406 MHz satellite beacons. The Russian Federation provides COSPAS payloads aboard Russian navigation spacecraft. In addition to weather and environmental sensors, SARSAT payloads, provided by Canada and France, are carried aboard the United States National Oceanic and Atmospheric Administration National Environmental Satellite Data and Information Service (NOAA, NESDIS) environmental satellites. 406 MHz repeater payloads are now also being deployed on Global Navigation Satellite Systems (GNSS) such as Galileo, Glonass and GPS in medium earth orbits. The COSPAS, SARSAT and GNSS Systems are fully interoperable.

Satellite receiver/processors receive distress signals from PLBs transmitting in the 406.0 – 406.1 MHz frequency band. The use of the band is limited by the International Telecommunications Union (ITU) Radio Regulations, Article 5 (Table of Allocations) to low-power satellite EPIRBs ², which include those that are being used with the COSPAS and SARSAT satellite receiver/processors. The Cospas-Sarsat 406 MHz PLB signal consists of a transmission of unmodulated carrier followed by a digital message format that provides identification data, nationality, and (optionally) encoded position data.

Because many of the search and rescue forces presently are not equipped to home on the 406 MHz PLB signal, homing must be accomplished at another frequency. This standard provides for the inclusion of an auxiliary radio-locating device operating at 121.5 MHz or an auxiliary radio-locating device operating at 121.5 MHz and an Automatic Identification System (AIS) transmitter operating in the maritime VHF frequency band.

¹ COSPAS - COsmicheskaya Sistyema Poiska Avariynykh Sudov (Space System for Search of Distressed Vessels) (Russian Federation).
SARSAT - Search and Rescue Satellite-Aided Tracking (Canada, France, and United States).

² An emergency position-indicating radiobeacon (EPIRB) is defined by the ITU Radio Regulation No. 1.93 as a station in the mobile service the emissions of which are intended to facilitate search and rescue (SAR) operations. A satellite EPIRB is also defined by the ITU Radio Regulations No. 1.94 as an earth station in the mobile-satellite service the emissions of which are intended to facilitate SAR operations. For the purposes of the ITU Radio Regulations a PLB is understood to be a type of EPIRB.

Local User Terminals (LUTs) process the 406 MHz signal and determine the location of the PLB; the LUT then relays the position of the distress to a Mission Control Center (MCC) where the distress alert and location information is immediately forwarded to an appropriate Search and rescue Point Of Contact (SPOC). The SPOC dispatches Search And Rescue (SAR) forces.

1.3 Purpose and intended use

The PLBs are intended to provide individuals in remote areas a means to alert others of an emergency situation and to aid search and rescue personnel locate those in distress. The purpose of the PLB is to alert authorities to a distress situation and the location of the alerting beacon. The PLB consists of a transmitter, an internal GNSS receiver and a battery power source, all contained in an impact resistant watertight case. PLBs are envisioned to be used in two general environments, areas with water (e.g. rivers, lakes, oceans, seas, flooding) and areas without significant water (e.g. deserts, mountains). Therefore, this recommended standard includes two categories of PLBs, Category 1 which must float and Category 2 which is not required to float.

1.4 Precedence

In case of any conflicts between this standard and any other document or standard referenced in this standard, this standard takes precedence.

1.5 Types of PLB

406 MHz PLBs are divided into two generations, two categories, three classes and three groups as defined below.

1.5.1 Generations

There are two generations of 406 MHz PLBs:

- First Generation Beacons (FGBs) that are designed to comply with C/S T.001 and are tested and approved to C/S T.007; and
- Second Generation Beacons (SGBs) that are designed to comply with C/S T.018 and are tested and approved to C/S T.021.

1.5.2 Categories

There are two categories of PLBs:

- Category 1 PLBs are designed for use in and around water (but in some circumstances can also be used on land) and must float³; and
- Category 2 PLBs are designed principally for use on land (but in some circumstances can also be used in and around water) and are not required to float.

1.5.3 Classes

There are three classes of PLBs:

- Class 0 PLBs are designed for use in extreme climatic conditions and must operate over the temperature range of -55°C to + 70 °C;
- Class 1 PLBs are designed for use in arduous climatic conditions and must operate over the temperature range of -40°C to + 55 °C; and

³ Floating can be achieved by either inherent buoyancy or by a permanently attached flotation device (i.e. cannot be disconnected without the use of tools). A flotation aid such as a pouch, bag or floating key fob does not count unless it is permanently attached to the PLB. Category 1 PLBs can either be designed to operate while floating in water or when attached to items of personal LSA, further details are provided in A.1.10

- Class 2 PLBs are designed for use in less arduous climatic conditions and must operate over the temperature range of -20°C to + 55°C.

1.5.4 Groups

There are three groups of PLBs:

- Group 1 PLBs shall include a 121.5 MHz homing transmitter
- Group 2 PLBs – reserved for future use
- Group 3 PLBs shall include a 121.5 MHz homing transmitter and an AIS transmitter

1.5.5 GNSS Navigation Devices

All types of PLBs designed to meet this standard shall include beacon position data, obtained from a GNSS navigation device internal to the PLB and shall comply with the requirements of Annex G (Internal Navigation Device Test Methods).

1.5.6 Combinations of PLB Generations, Categories, Classes and Groups

Any combination of Generation, Category, Class and Group is permitted by this standard.

Every PLB must comply with the requirements of at least one Generation, one Category, one Class and one Group as defined above.

A PLB cannot be both a Category 1 and Category 2 device, either it floats or it doesn't.

A PLB is only ever approved to one Class, by definition a Class 0 PLB also meets the requirements for a Class 1 and Class 2 PLB and a Class 1 PLB also meets the requirements for a Class 2 PLB.

A PLB can currently only be a Group 1 or Group 3 PLB, a Group 3 PLB may potentially also meet the requirements of a Group 1 PLB.

Any PLB can also include Return Link Service (RLS) capability.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Cospas-Sarsat C/S T.001, as amended, *Specification for Cospas-Sarsat 406 MHz Distress Beacons*

Cospas-Sarsat C/S T.007, as amended, *Cospas-Sarsat 406 MHz Distress Beacon Type Approval Standard*

Cospas-Sarsat C/S T.012, as amended, *COSPAS-SARSAT 406 MHz Frequency Management Plan*

Cospas-Sarsat C/S T.018, as amended, *Specification for Second Generation Cospas-Sarsat 406 MHz Distress Beacons*

Cospas-Sarsat C/S T.021, as amended, *Cospas-Sarsat Second Generation 406 MHz Distress Beacon Type Approval Standard*

IEC 60945, as amended, *Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results*

IEC 61162-1, as amended, *Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 1: Single talker and multiple listeners*

IEC 61108-1, as amended, *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*

IEC 61108-2, as amended, *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*

IEC 61108-3, as amended, *Maritime navigation and radiocommunication equipment and systems – Global Navigation Satellite Systems (GNSS) – Part 3: Galileo receiver equipment – Performance standards, methods of testing and required test results*

IEC 61108-5, as amended, *Maritime navigation and radiocommunication equipment and systems – Global Navigation Satellite Systems (GNSS) – Part 5: BeiDou navigation satellite system (BDS) – Performance requirements, methods of testing and required test results*

Recommendation ITU-R M.633-4, as amended, *Transmission characteristics of a satellite emergency position-indicating radio beacon (satellite EPIRB) system operating through a satellite system in the 406 MHz band*

Recommendation ITU-R M.690-3, as amended, *Technical characteristics of emergency position-indicating radio beacons operating on the carrier frequencies of 121.5 MHz and 243 MHz*

Recommendation ITU-R M.1371-5, as amended, *Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile frequency band*

United Nations Recommendations on the Transport of Dangerous Goods, *Manual of Tests and Criteria, Sixth Revised Edition*, PART III, Section 38.3 (ST/SG/AC.10/11/Rev.7) as amended.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ACTIVATION

Activation is defined as the point in time when any distress, homing or locating signals are initiated in the PLB, excluding self-test transmissions

AIS

Automatic Identification System

BCH

Bose-Chaudhuri-Hocquenghem – an error-correcting coding system

BDS (BeiDou)

BeiDou Navigation Satellite System (BDS) a Chinese GNSS system

Cospas-Sarsat (C/S)

COSPAS - COsmicheskaya Sistyema Poiska Avariynykh Sudov (Space System for Search of Distressed Vessels) (Russian Federation).

SARSAT - Search and Rescue Satellite-Aided Tracking (Canada, France, and United States).

Cospas-Sarsat is a satellite system designed to provide distress alert and location data to assist Search and Rescue (SAR) operations, using spacecraft and ground facilities to detect and locate the signals of distress beacons operating on 406 Megahertz (MHz).

CRC

Cyclic Redundancy Check

EPIRB

Emergency Positioning Indicating Radio Beacon

EUT

Equipment Under Test

FCC

Federal Communications Commission

FGB

First Generation Beacon (that is compliant with C/S T.001)

Galileo

European GNSS system

Global

means worldwide including all land, maritime and polar regions

GLONASS

GLobalnaya NAVigatsionnaya Sputnikovaya Sistema

GNSS

Global Navigation Satellite System – a generic term used to indicate one or more global satellite-radionavigation systems that are recognized by the International Maritime Organization (IMO) and for which the International Electrotechnical Committee (IEC) has defined performance requirements, methods of testing and required test results.

GPS

Global Positioning System

IEC

International Electrotechnical Commission

IMO

International Maritime Organization

IR

Infrared

ITU

International Telecommunications Union

LSA

Lifesaving Appliances (in this context means devices designed to keep people afloat or to keep them out of the water in an emergency to which a PLB may be attached)

NRZI

Non-Return to Zero Inverted

PEIRP

Peak Equivalent Isotropic Radiated Power

PEP

Peak Envelope Power

PERP

Peak Effective Radiated Power

PLB

Personal Locator Beacon, comprising all the functions and features of the device in question

RAIM

Receiver Autonomous Integrity Monitoring

RAM

Radiation Absorbent Material

RLS

Return Link Service (as defined by Cospas-Sarsat in either C/S T.001 or C/S T.018)

RMS

Root Mean Square

RTCM

Radio Technical Commission for Maritime Services

SGB

Second Generation Beacon (that is compliant with C/S T.018)

Shall

describes attributes which RTCM considers necessary to meet the standard. However, the use of the term "shall" is not intended to limit the possibility of amending the standard through the language of a regulation or contract which incorporates this standard by reference. If an PLB is produced to such an amended standard, any claim of compliance with this standard on the PLB or in its documentation, shall also describe the modification.

Should

describes attributes recommended by RTCM, but not mandatory to claim compliance with this standard.

SOLAS

International Convention for the Safety of Life at Sea

SOTDMA

Self-Organizing Time Division Multiple Access

TTF

Time To First Fix

UUT

Unit Under Test

4 Design characteristics

4.1 Summary of technical characteristics

Operating Temperature Range

Class 0	-55°C to + 70°C
Class 1	-40°C to + 55°C
Class 2	-20°C to + 55°C

Stowage Temperature Range

Class 0	-55°C to + 70°C
Class 1	-55° C to +70° C
Class 2	-30° C to +70° C

The technical characteristics of the 406 MHz transmitter shall comply with the requirements in C/S T.001 and C/S T.012 for FGBs and in C/S T.018 for SGBs, reference should also be made to Recommendation ITU-R M.633-4 (as amended).

The technical characteristics of the 121.5 MHz homing transmitter shall comply with Table 1 below and with Recommendation ITU-R M.690-3 (as amended).

The technical characteristics of the AIS transmitter shall comply with the requirements in Recommendation ITU-R M.1371-5 Annex 9 and Annex D of this specification. The AIS Message 1 and 14 content and the user ID shall comply with Recommendation ITU-R M.1371-5 Annex 1 Section 2.1.7 Man overboard-automatic identification system.

Table 1 – Summary of Technical Characteristics of 121.5 MHz Homing Signal

PARAMETER	VALUE
RF Signal	
Carrier Frequency	121.5 MHz
Frequency Tolerance	50 parts/million
Peak Equivalent Isotropic Radiated Power ¹	25 mW, -0 dB, +6 dB
Transmitter Duty Cycle	Duty Cycle between 33% and 100% as further defined in Section 4.2.7 below, except that it shall be interrupted for up to a maximum of 2 seconds encompassing the 406 MHz burst transmission and if applicable for up to 50 ms to facilitate the transmission of an AIS signal The transmitter shall be on for a period of not less than 0.75 seconds and then off for not more than 1.5 seconds.
Modulation ²	Amplitude modulated (3K20A3X) except that a Morse "P" (2K00A2A) shall be inserted immediately following the (2 s maximum) interruption of the homer signal as indicated in the Figure 1 with a dot length (one unit) equal to 115 ms ± 5%

Modulation Frequency	An audio signal swept upward or downward by not less than 700 Hz within the range 300 to 1600 Hz except that during the dot and dash intervals of the Morse "P" the signal shall be modulated at 1000 ± 50 Hz
Modulation Duty Cycle	33% - 55%
Modulation Factor	Between 0.85 and 1.0
Sweep Repetition Rate	2 Hz - 4 Hz
Spurious Emissions	See Figure 4
Antenna	
Pattern	Omnidirectional in horizontal plane, ± 3 dB
Polarization	Vertical

¹ Peak Equivalent Isotropic Radiated Power (PEIRP) is the power supplied to the antenna by the transmitter (measured at the highest crest of the modulation envelope) multiplied by the gain of the antenna

² The A3X emission must have a clearly defined carrier frequency distinct from the modulation sideband components. At least 30% of the total power emitted during any transmission cycle with or without modulation shall be contained within ± 30 Hz of the carrier frequency. Additionally, when the emission is interrupted by the transmission of a 406 MHz burst or an AIS burst, the carrier frequency must not shift more than ± 30 Hz

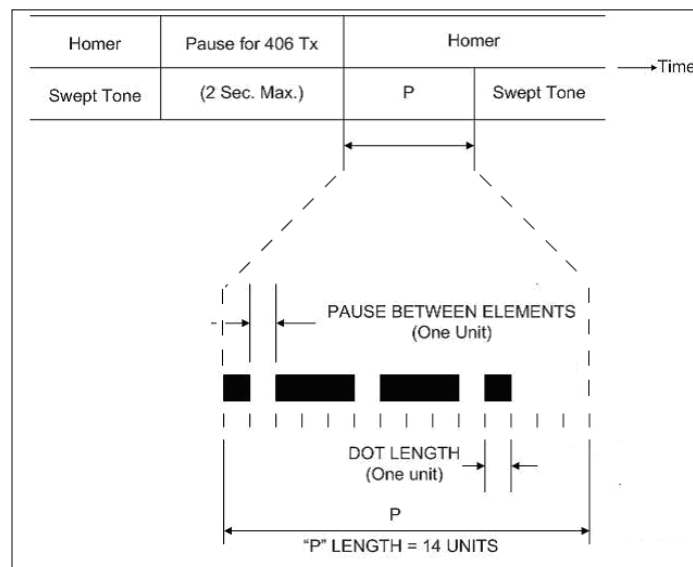


Figure 1 – Format of Morse Code “P” In 121.5 MHz homing signal

4.2 Electrical performance details

4.2.1 406 MHz Signal

The 406 MHz signal shall comply with either C/S T.001 and / or C/S T.018 as appropriate.

PLB coding methods for both FGBs and SGBs are defined in Annex F of this standard.

The unique identity of an FGB PLB is provided in its 15 Hex ID in accordance with C/S T.001 and shall be marked on the exterior of the beacon. The unique identity of an SGB PLB is provided in its 23 Hex ID in accordance with C/S T.018 and shall be marked on the exterior of the beacon

4.2.2 406 MHz emission limitations

4.2.2.1 FGB PLBs

The FGB transmitter power output spectrum shall remain within the limits of the emission mask shown in Figure 2.

NOTE This mask is compatible with the mask in C/S T.001 Fig. 2.4 it simply extends the frequency coverage beyond that of C/S to meet US FCC requirements.

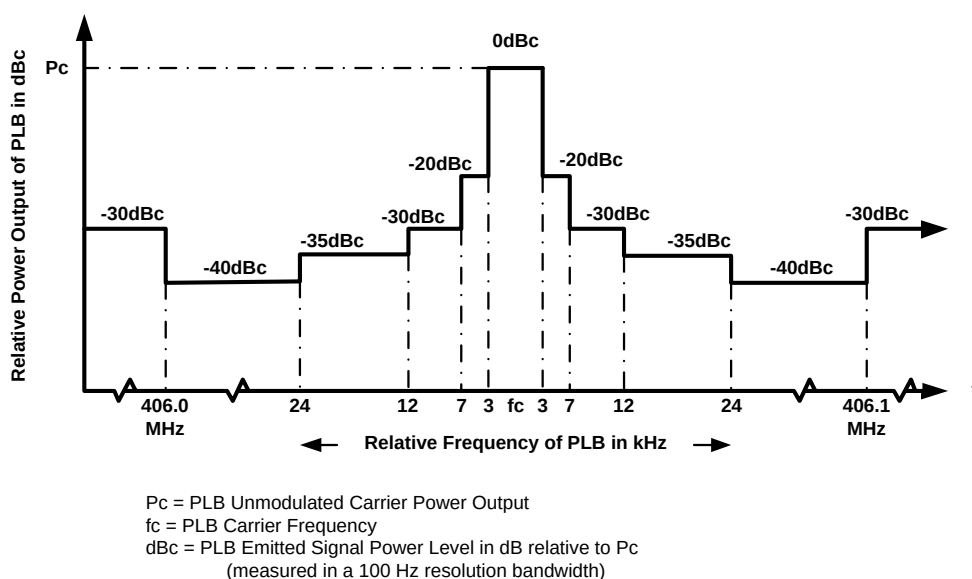


Figure 2 – Emission Mask for FGB 406 MHz⁴ PLBs

4.2.2.2 SGB PLBs

The SGB transmitter power output spectrum shall remain within the limits of the emission mask shown in Figure 3.

NOTE This mask is compatible with the mask in C/S T.018 Fig. 2-5 it simply extends the frequency coverage beyond that of C/S to meet US FCC requirements.

⁴ This emission mask also complies with US FCC 47 CFR Part 80.211(e)

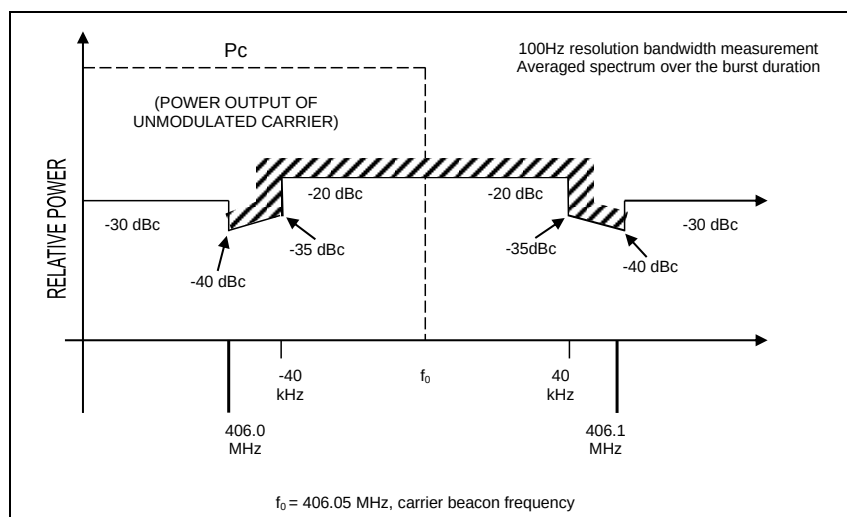


Figure 3 – Emission Mask for SGB 406 MHz⁵ PLBs

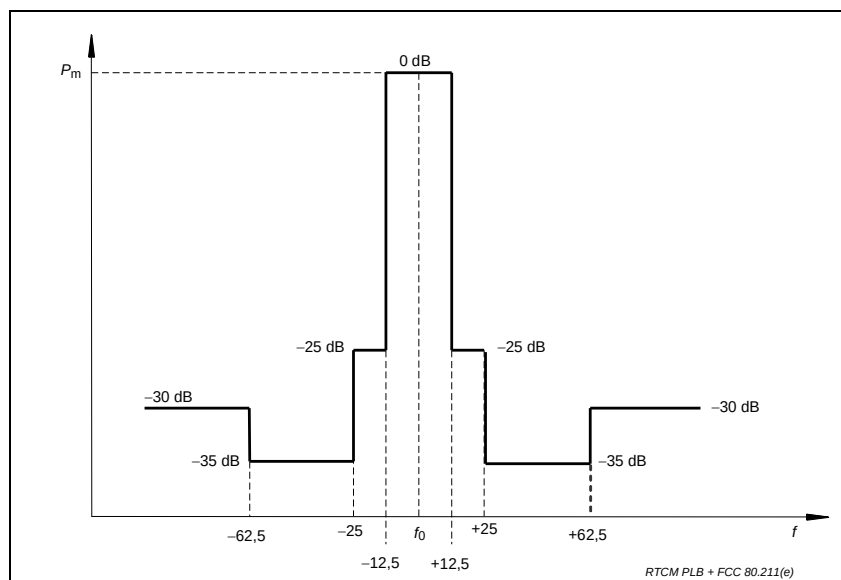
4.2.3 121.5 MHz Signal

The 121.5 MHz signal shall comply with the requirements in Table 1 above and Section 4.2.7. The Morse letter P shall always be transmitted after every 406 MHz burst, once 121.5 MHz transmissions have commenced.

⁵ This emission mask also complies with US FCC 47 CFR Part 80.211(e)

4.2.4 121.5 MHz emission limitations

The transmitter power output spectrum shall remain within the limits of the emission mask shown in Figure 4.



Relative frequencies to 121,5 MHz homing device in kHz
 P_m = mean power
 $P_m = D(\text{PERP})$ power output of 121,5 MHz homing device
 D = Modulation Duty Cycle
 PERP = Peak effective radiated power
 Measurement Resolution Bandwidth 100 Hz

Figure 4 – Emission Mask for 121.5 MHz Signal ⁶

4.2.5 AIS Signal

The AIS signal shall comply with Annex D.

The AIS transmitter shall have its own identifier (User ID) which is different to the PLB 15 or 23 Hex ID. The AIS transmitter shall transmit the PLB 15 Hex ID as a Message 14 Safety Related Broadcast Message as defined in Annex D. For SGBs the PLB shall transmit the SGB truncated 15 Hex ID as defined in C/S T.018 Section 3.6 Note 2.

The User ID for a PLB AIS transmitter is 972xyyyy⁷, where xx = manufacturer ID 01 to 99⁸; yyyy = the sequence number 0000 to 9999.

The manufacturer ID xx = 00 is reserved for test purposes. The identifier used for the purposes of type approval to this standard shall be in the format 97200yyyy.

⁶ This emission mask also complies with US FCC 47 CFR Part 80.211(e)

⁷ The format of the AIS transmitter User ID is defined in ITU-R M.585.

⁸ The manufacturers ID is allocated by CIRM, see <https://cirm.org/services/manufacturer-ids.html> for details.

After being programmed by the manufacturer, the identifier shall be stored in the PLB and it shall not be possible for the user to change the identifier of the PLB AIS transmitter.

The configuration method for the AIS identifier shall be as defined by the manufacturer.

4.2.6 406 MHz PLB Transmissions

After activation, FGB PLBs shall not transmit any 406 MHz signals until at least one 406 MHz repetition period has elapsed, however the first 406 MHz burst (with or without encoded location) shall commence within no more than 5 minutes⁹ of beacon activation.

After activation SGB PLBs shall commence 406 MHz transmissions in accordance with C/S T.018.

4.2.7 Homing Signals

The PLB shall contain one or more homing signals in accordance with the requirements of either Group 1 or Group 3, as defined below.

4.2.7.1 Group 1 – 121.5 MHz homing signal

121.5 MHz transmissions shall not start for at least 30 seconds or before completion of the first 406 MHz transmission has occurred, whichever is the longer, but within 5 minutes of beacon activation.

The 121.5 MHz transmissions shall have a minimum duty cycle of 33% (but which can be greater at the manufacturer's discretion). For the 33% duty cycle case the transmitter shall be on for a period of not less than 0.75 seconds and then off for not more than 1.5 seconds. For duty cycles between 33% and 100% the on time shall be increased beyond 0.75 seconds and the off time may if desired be reduced to less than 1.5 seconds. In addition to interruptions in the 121.5 MHz homing signal due to duty cycles of less than 100% the 121.5 MHz homing transmissions may also be interrupted for up to a maximum of 2 seconds to encompass each 406 MHz satellite signal transmission. The transmission of the Morse 'P' is considered to be part of the homing signal.

4.2.7.2 Group 2 – Reserved for future use

Reserved for future use.

4.2.7.3 Group 3 – Combined 121.5 MHz and AIS transmissions

If the PLB is equipped with a 121.5 MHz transmitter and an AIS transmitter then the 121.5 MHz transmitter shall comply with Sections 4.2.3 and 4.2.4 of this standard and the AIS transmitter shall comply with Section 4.2.5 of this standard. In addition both transmitters shall comply with the following additional requirements:

AIS transmissions shall commence no sooner than 15 seconds after beacon activation or as specified by Cospas-Sarsat in C/S T.018 for SGBs if this is longer and within 1 minute, followed by 121.5 MHz transmissions no sooner than 35 seconds after beacon activation or before completion of the first 406 MHz transmission has occurred, whichever is the longer, but within 5 minutes of beacon activation, as defined below.

AIS and 121.5 MHz homing signal transmissions shall be interleaved. AIS transmissions shall take precedence over 121.5 MHz homing transmissions, which shall have a minimum duty cycle of 33%, when not interrupted by AIS or 406 MHz transmissions (but which can be greater at the manufacturer's

⁹ Note for beacons with an External Navigation Device Input if valid navigation data is present at the input then the first 406 MHz burst with encoded location shall commence within 1 minute of beacon activation.

discretion). For the 33% duty cycle case the transmitter shall be on for a period of not less than 0.75 seconds and then off for not more than 1.5 seconds. For duty cycles between 33% and 100% the on time shall be increased beyond 0.75 seconds and the off time may if desired be reduced to less than 1.5 seconds.

The 121.5 MHz homing signal shall transmit asynchronously to AIS, with AIS taking precedence over 121.5 MHz homing transmissions. Individual AIS transmissions may interrupt homer audible sweeps, causing limited disturbance to the sweep pattern or Morse letter P transmissions or may occur in the natural gaps between 121.5 MHz transmissions when the duty cycle is less than 100%. Gaps in the 121.5 MHz homing transmission (other than those due to duty cycles of less than 100%) caused by individual AIS transmissions interrupting 121.5 MHz transmissions shall last no longer than 50 ms. Once homer transmission resumes, the sweep profile or the Morse letter P shall continue as if the AIS transmission had not happened as illustrated in Figure 5. In addition to interruptions in the 121.5 MHz homing signal due to duty cycles of less than 100% the 121.5 MHz homing transmissions may also be interrupted for up to a maximum of 2 seconds to encompass each 406 MHz satellite signal transmission. The transmission of the Morse 'P' is considered to be part of the homing signal.

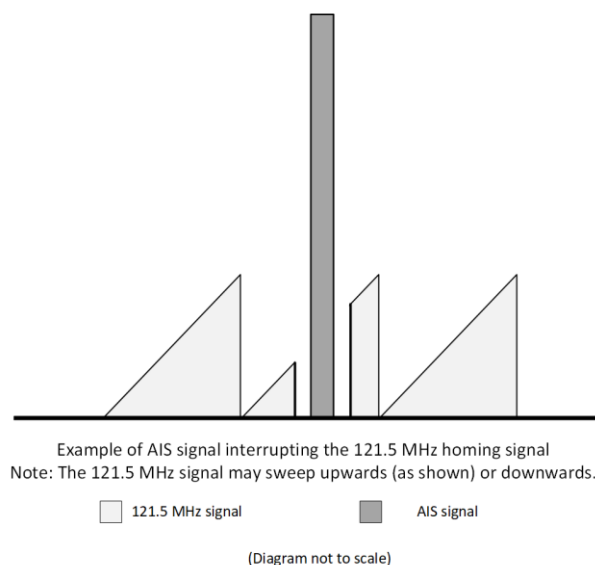


Figure 5 – Example of AIS Signal Interrupting the 121.5 MHz Homing Signal

4.2.8 Beacon Self-Test

The PLB shall have two self-test modes as defined below. Both self-test modes shall comply with C/S T.001 and / or C/S T.018 as applicable and the requirements within this section and section 4.3.5. A clear indication of self-test pass/fail shall be provided.

All self-test RF transmissions shall occur in a defined sequence as follows, any auxiliary homing frequency in ascending frequency order, lastly followed by the 406 transmission.

4.2.8.1 Regular Self-Test

The PLB shall include a functional Self-test designed to test the following items under a full-load condition as a minimum: battery, GNSS Receiver, 121.5 MHz, AIS and 406 MHz RF outputs (as applicable), and, if used, phase lock of the 406 MHz phase locked loop (PLL). The Self-test shall

be functional throughout the operating temperature range. Additionally, the Self-test shall be functional with the PLB dry as well as after being immersed in salt water.

The 121.5 MHz auxiliary radio-locating device in the PLB shall transmit a self-test signal which shall not exceed 3 audio sweeps or 1 second, whichever is greater.

If the PLB includes an AIS transmitter then it shall transmit a VHF RF pulse lasting no more than 26.6ms, on either AIS1 or AIS2 or both AIS1 and AIS2. The pulse may consist of either an unmodulated carrier or an AIS message 1 containing default location data. Valid AIS slot timing is not required for this test. The test transmission shall occur on channel AIS1 and then on channel AIS2 if separate transmitter circuits are employed for AIS2.

The PLB shall transmit a single 406 MHz self-test burst. The number of self-tests shall not be limited, however the manufacturer shall indicate the recommended frequency of self-tests over the life of the battery and this figure shall be used to calculate the self-test current consumption for the PLB Operating Lifetime test.

4.2.8.2 GNSS Self-Test

The PLB shall include a GNSS self-test designed to ensure the correct functioning of the internal GNSS Receiver in the PLB and the correct encoding of the location of the PLB in the AIS (if applicable) and 406 MHz signals.

The PLB is not required to transmit a 121.5 MHz signal during this test (although it may transmit for a maximum of 1 second at the manufacturer's discretion), however it is required to transmit a 406 MHz signal and an AIS signal (if applicable), if a GNSS location is obtained within the GNSS self-test time limit. If a GNSS location is not obtained within the GNSS self-test time limit then the PLB shall not transmit a 406 MHz or AIS signal.

The PLB shall provide for a minimum of at least one GNSS self-test for each year of the declared useful life of the PLB. The PLB shall limit the maximum number of GNSS self-tests to prevent inadvertent battery depletion.

The duration of the GNSS receiver search time during the self-test shall be a minimum of 90 seconds, unless a GNSS location is obtained before this, and shall be limited to a maximum time duration of 5 minutes.

If a GNSS location is obtained prior to the completion of the GNSS self-test, then before the 406 MHz test transmission, the PLB shall provide an AIS test mode transmission as defined in Annex D.2.6.2.

4.2.9 Encoded Position Data

All PLBs shall include an internal GNSS receiver designed to provide encoded location in the PLB transmitted messages. Group 3 PLBs shall also provide encoded location in the AIS transmitted messages. PLBs may also optionally provide an input to accept encoded location data from a navigation device external to the beacon.

PLBs shall comply with the Encoded Position Data requirements in C/S T.001 and / or C/S T.018 as appropriate.

In addition, Group 3 PLBs shall comply with the following requirements. The PLB shall attempt to determine its position at least every 5 minutes and for FGB PLBs only no more frequently than every 4 minutes and 25 seconds for the operating life of the PLB as defined in Section 4.3.7.

4.2.9.1 Internal navigation device performance

An internal navigation device shall be capable of global operation and shall employ one or more satellite-radionavigation systems that are recognized by the International Maritime Organization

(IMO) and for which the International Electrotechnical Committee (IEC) has defined performance requirements, methods of testing and required test results.

The GNSS receiver shall comply with the relevant sections of either IEC 61108-1 or IEC 61108-2 or IEC 61108-3 or IEC 61108-5 as defined in Annex G. If the PLB includes RLS capability, then the standard selected shall be the one related to that of the RLS service provider. If the PLB does not include RLS capability, then the manufacturer should select the latest dated relevant standard that the GNSS receiver within the PLB is programmed to receive and which is used to encode position into its digital message. This shall include the following requirements:

- accuracy (static accuracy, angular movement of the antenna and dynamic accuracy);
- acquisition;
- protection (antenna and input/output connections – if applicable);
- sensitivity and dynamic range (acquisition and tracking);
- interference protection from other shipborne transmitters (L band interference from Inmarsat terminals and S band interference from marine radars);
- position update (slow speed and high speed)

4.2.9.1.1 External navigation device input

Beacons which are designed to accept data from an external navigation device shall be compatible with an applicable international standard, such as the IEC Standard on Digital Interfaces (IEC 61162-1).

The manufacturer shall provide evidence that any malfunction of the navigation interface (e.g. a short circuit) does not damage, degrade or prevent the PLB from operating correctly while the malfunction is present.

4.2.10 Return Link Service (RLS)

Any PLB may optionally include a Return Link Service capability; if it does then this shall comply with all the RLS requirements in either C/S T.001 or C/S T.018 as applicable.

4.3 Operational requirements

4.3.1 Controls and indicators

All controls shall be clearly and durably marked, see section 4.5.2. They shall be designed to prevent inadvertent activation and shall require the use of not less than two simple, independent mechanical actions for manual activation and if applicable activation cancellation of the PLB.

Activation of the PLB shall not require the use of two hands.

The controls should be few in number and the function of each control shall be kept simple to permit ease of operation of the PLB. All controls shall be so designed that they can be used by personnel wearing an immersion suit mitten or glove (complying with the IMO Life-Saving Appliance Code Resolution MSC.48 (66), section 2.3). The Cancellation mode shall not be combined with the Off mode.

All PLBs shall have integral manual controls to operate the device in the following modes as a minimum (note Cancellation only applies to SGB PLBs):

- **OFF** In the **OFF** mode, the PLB is deactivated.
- **ON** In the **ON** mode, the PLB is activated.

- **TEST** See Sections 4.2.8 and 4.3.5.
- **CANCELLATION** Deactivates the PLB, but also sends a specific cancellation message used in the case of a false alert / activation (if applicable)

On Category 2 PLBs there shall not be a manual control to enable and disable the AIS signal.

The various modes of the PLB shall be readily apparent by visual observation.

A positive visual and/or audible indication that the PLB is activated shall be provided which shall commence within 1 second of activation and shall continue at regular intervals which are easily discernible to the user all the time that the PLB is active and transmitting at least one signal. If the PLB ceases to transmit all signals, then this indication shall cease.

The PLB may include a flashing light to assist searcher detection. If it does include a flashing light then it should include a near IR component with a dominant wavelength at 770-890 nm. If such a light is provided it shall not be possible to confuse this with any of the other required indicators apart from the indication that the PLB is active and transmitting, where it may also fulfill this function.

The PLB shall indicate when 406 MHz transmissions are occurring.

The PLB shall indicate whether it has a valid location provided by the GNSS receiver or whether it is trying / waiting to obtain a location. A valid location is a position that complies with Cospas-Sarsat Internal Navigation Device Encoded Position Data requirements.

The PLB shall provide self-test indications as required by Sections 4.2.8 and 4.3.5.

The manufacturer may if they wish include additional modes of indication or additional indicators to further quantify the operation of the various transmitted signals.

4.3.2 Category 1 PLB Operation

Category 1 PLBs are designed for use in and around water (but in some circumstances can also be used on land) and must float.

Usage of Category 1 PLBs is further clarified in Table 2.

Table 2 – Category 1 (Buoyant) PLBs Usage

PLB Group	Homing Signal	Use on Water	Use on Land	Comments
Group 1	121.5 MHz	Designed Use	Designed Use	
Group 3	121.5 MHz + AIS	Designed Use	AIS Restricted use, only allowed in conjunction with a 406.0 to 406.1 MHz distress transmission	See Sections 4.6 and 4.7

4.3.3 Category 2 PLB Operation

Category 2 PLBs are designed principally for use on land, but may also be used in and around water, if designed to be integrated with a Personal Lifesaving Appliance, and are not required to float.

Usage of Category 2 PLBs is further clarified in Table 3.

Table 3 – Category 2 (Non-Buoyant) PLBs Usage

PLB Group	Homing Signal	Use on Water	Use on Land	Comments
Group 1	121.5 MHz	Designed Use	Designed Use	
Group 3	121.5 MHz + AIS	Designed Use attached to personal LSA	AIS Restricted use, only allowed in conjunction with a 406.0 to 406.1 MHz distress transmission	See Sections 4.6 and 4.7

4.3.4 Cancellation Control (only applicable to SGB PLBs)

When activated the cancellation control transmits a series of cancellation messages as defined in C/S T.018 before deactivating the PLB. In addition, activation of the cancellation control within 180 seconds of a previously activated PLB having been turned off shall also initiate transmission of a series of cancellation messages.

4.3.5 Regular Self-test and GNSS Self-test function

A separate test switch(es) or switch position(s) is/are required for this function, such that it cannot be combined with the on function. The test switch (or similar control) shall automatically return (e.g., spring-loaded switch) from the test position and shall not pass through the ON position. The GNSS self-test function shall be initiated by a distinctly different action to that required to initiate the regular self-test function.

Self-test performance shall be as specified in section 4.2.8.

The manufacturer shall include instructions for the GNSS self-test in the PLB Operating Manual which shall include a clear warning on the use and limitations of this function.

4.3.5.1 Self-test with PLB dry

The following items shall be verified by the manufacturer at the minimum, ambient, and maximum operating temperatures:

- The PLB battery experiences full-load current drain during the Self-test.
- Each self-test pass/fail indicator correctly identifies a fail condition when a failure in the monitored function has been induced.
- Any transmission in either self-test mode is limited to one burst.
- The GNSS Self-test mode shall be tested to verify that under worst case conditions (no GNSS reception or input) it is limited in duration and number as defined in section 4.2.8.2.
- It shall be verified that inadvertent activation of the GNSS self-test mode is precluded.
- The GNSS Self-test mode shall be tested to ensure the correct operation of the GNSS Self-Test pass/fail indicator(s) and the transmission of a correct and valid position in both the 406 MHz and AIS (if applicable) transmissions.

4.3.5.2 Self-test with PLB wet

The proper self-test function shall be verified by the manufacturer by carrying out a self-test in accordance with the manufacturer's instructions with the PLB initially at the maximum operating temperature and after the PLB has been immersed in a 35 parts per thousand solution of cold salt water to a depth over the PLB of at least 10 cm for a duration of at least 10 seconds. The water bath shall be at a temperature of 10 °C or cooler. Immediately after removal from the water bath the PLB shall be held (without shaking or drying) for between 5 and 10 seconds in each of 3 orthogonal orientations to allow water to drain from any recesses in the PLB case. Immediately after this, a self-test shall be successfully performed.

NOTE The manufacturer shall provide test results to document the above tests. This sub-clause will not be tested during the tests specified in Annex A.

4.3.5.3 Self-test indication of insufficient battery energy

The PLB shall provide an indication to the user during the self-test when it is unlikely to meet the PLB minimum duration of continuous operation in Table 4 (section 4.3.7), or as declared by the manufacturer if greater than this, as specified in C/S T.001 or C/S T.018 as applicable.

4.3.6 Battery

The PLB shall have its own primary (non-rechargeable) battery and shall not depend upon any external source of power for its operation when activated. The battery shall be an integral part of the equipment. Replacement of the battery, if user-replaceable, should be possible with relative ease, and any interface connections required shall be such as to prevent reversed polarity or incorrect installation. If the battery is user-replaceable, provision shall be made to ensure watertight integrity during and upon replacement of the battery.

The PLB battery shall comply with the United Nations Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, 7th Revised Edition, PART III, Section 38.3 (ST/SG/AC.10/11/Rev.7 as amended).

The PLB manufacturer shall establish a useful life and an expiration date for the battery. The useful life 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 PLB. The following losses must be included (at a temperature of +20° C ±5° C):

- a) Testing, as recommended by the manufacturer, including GNSS Self Tests, or as required by the regulatory authority, whichever is the more demanding.
- b) Self-discharge of the battery pack.
- c) Standby loads.

The battery expiration date shall be the date of battery cell manufacture plus no more than 1/2 of the useful life of the battery. The battery cells shall be no older than 2 years when first fitted in the PLB.

4.3.7 PLB Operating Lifetime

At the end of the PLBs useful life as defined in section 4.3.6 the PLB shall continue to function at any temperature throughout the specified operating temperature range (i.e. Class 0, 1 or 2 as applicable) with all features and functions of the PLB operating under worst case conditions for the minimum periods of time indicated below:

Table 4 – PLB Minimum Operating Lifetimes

PLB Group	Transmissions			GNSS Receiver
	406 MHz	121.5 MHz	AIS	
1	24 Hours	24 Hours	N/A	24 Hours
3	24 Hours	24 Hours	24 Hours	24 Hours

4.3.8 Buoyancy

Category 1 PLBs shall have sufficient positive buoyancy to float in fresh water, with a minimum of 5% reserve buoyancy.

4.3.9 Inadvertent Activation at altitude

The PLB shall not be affected by changes in altitude from sea level to an altitude equivalent of 30,000 feet (9,144 meters), $\pm 5\%$. When tested, the rate of pressure change should not exceed 1.5 inches of Hg per minute (5 kPa/min).

4.4 General construction and Safety Requirements

The external design of the PLB shall avoid sharp edges or points to prevent injury or damage to equipment or personnel.

The PLB shall not be hazardous to personnel handling it, operating it, or performing manufacturer-approved servicing of it nor shall it release toxic or corrosive products outside the PLB case during storage or use.

The PLB shall comply with relevant Specific Absorption Radiation (SAR) requirements dependent upon the intended use of the product¹⁰.

The PLB (including antenna and battery) shall be an integral unit¹¹.

The design and materials used for the PLB and any mounting devices, and other auxiliary components shall be suitable to ensure reliable operation in harsh environments.

The PLB shall be resistant to deterioration by prolonged exposure to sunlight and shall not be unduly affected by seawater or oil.

The electronic components shall be protected to prevent malfunction under prolonged conditions of high humidity, including condensation inside the body of the PLB.

¹⁰ In the USA radio frequency radiation exposure (SAR) requirements are specified in 47 CFR Parts 1.1307(b), 1.1310, 2.1091 and 2.1093 as appropriate.

¹¹ An integral unit is one in which either all the parts are contained within a single enclosure or one in which the parts may be in two or more enclosures provided that these are permanently connected to each other and cannot be disconnected without the use of tools.

4.4.1 Exterior Finish

The PLB case shall be predominantly a highly-visible yellow/orange color.

4.5 Labeling and Marking

4.5.1 Battery Labeling

The battery shall be marked indelibly and legibly with the battery type (chemical composition), voltage, expiration date (month and year) and as appropriate, precautions associated with its use, handling and disposal.

4.5.2 PLB Labeling and Marking

Labeling / marking for operation controls and indicators should, as far as possible, be understood through graphical images and symbols without the need for text. The symbols provided in Annex H are recommended for this purpose. Text may be used in addition to symbols if required.

All labeling on the exterior of the PLB shall be resistant to deterioration by prolonged exposure to sunlight, not unduly affected by seawater or oil, and abrasion resistant.

All labeling essential to the safe and effective operation of the PLB shall be in high contrast to the background of the text or pictograph. Labeling and Pictograph instructions essential to the safe and effective operation of the PLB shall be sized such that they are readable by persons having 20/20 normal vision at a minimum viewing distance of 150 mm with illumination no greater than 0.3 lux.¹²

Items a) through h) in 4.5.2.1 below and any other information required for the safe and effective operation of the PLB shall be visible on the PLB, or their location identified and accessible by a single simple action on the part of the operator (e.g. lifting or removing a protective cover over the control panel). Such information shall not be hidden by any permanent or semi-permanent accessory or ancillary devices normally attached to or installed on or around the body of the PLB. (A separate storage case from which the PLB can be easily removed with one hand for activation is not included in this requirement.) If the PLB is designed to be attached to a belt clip, lifejacket mounting clip or similar and items 4.5.2.1 a) through c) below will be obscured by that clip, then this information shall be repeated on the exterior surface of the clip.

4.5.2.1 Labeling on the PLB

The outside of the PLB shall be marked legibly with the following:

- a) Concise, unambiguous instructions for operating and testing of the PLB that shall be understandable by untrained personnel, including correct orientation of the PLB transmitting and GNSS antennas.
- b) The warning, or equivalent:
EMERGENCY USE ONLY
- c) Space for either 27 or 35 characters (the words 15 (or 23) Hex ID and 15 (or 23) characters, as applicable, plus the 5 character checksum) shall be provided on a label with text identifying this,

¹² An example of how to achieve this is to use a dimmer on the light(s) in a darkened room and to adjust the light level until 0.3 lux is observed on a light meter held next to the instructions. A group of 5 or more naïve people (people with no prior knowledge of the instructions) are then positioned at least 150 mm away from the instructions and are asked to read them. If at least 80% succeed then the instructions are acceptable.

for example “15 Hex ID followed by 15 characters a space and 5 characters”.¹³ This unique Hex ID identifier shall be inserted on the label when the PLB is programmed and shall include the checksum.

- d) The serial number of the PLB ¹⁴
- e) Instructions to register the PLB with the appropriate authority ¹⁵ and the contact details of the authority
- f) Space for any required registration sticker ¹⁶
- g) Any additional labeling requirements required by Cospas-Sarsat within C/S T.001 and/or C/S T.018 as applicable and as required on PLBs by 47 CFR Part 95 for USA approved devices
- h) The battery expiration date determined in accordance with section 4.3.6

4.5.2.2 Attached labeling

The following instructions shall be marked indelibly and legibly on the outside of the PLB or permanently attached to the PLB. If permanently attached, the placard including the instructions(s) shall be conspicuously marked adjacent to the attachment point: “DO NOT REMOVE”

- a) The identification of the manufacturer.
- b) The PLB type number or model identification under which it was type tested.
- c) The temperature operating range in degrees Celsius and Fahrenheit of the PLB.
- d) If there exists a condition or operating circumstance which has been identified by the manufacturer or regulating authorities that could substantially affect the alerting or self-locating performance of the PLB, then information appropriate to prevent this occurring shall appear in a conspicuous location appropriate to the prevention or remediation by the operator of said condition or operating circumstance (e.g. the necessity to orient the antenna vertically upward if orientation of the antenna is adjustable).

4.5.2.3 For Category 2 PLBs

The outside of the PLB should be marked indelibly and legibly with a warning label that states “WILL NOT FLOAT.”

4.6 Documentation

The manufacturer shall provide an operation manual which includes the following:

¹³ Font type Consolas for the Unique Hex ID identifier and checksum is highly recommended with a font size not less than 10 point.

¹⁴ In the United States, the 15 or 23 character hexadecimal Beacon Identification Code (15 or 23 Hex ID) may be used for this purpose and thus this item maybe omitted for PLBs authorized in the U.S.

¹⁵ In the U.S. it is mandatory to register the PLB with NOAA and as a minimum NOAA's beacon registration website and the following language must be included on the PLB. The label must contain the following statement “The owner of this PLB must register it with the relevant national authority. In the US the owner must register the ID code on this label at www.beaconregistration.noaa.gov.”

¹⁶ In the U.S. an outlined or otherwise identifiable space sized to accommodate the NOAA registration decal (50mm x 25mm) with the text “Affix NOAA Registration Decal Here” which should not interfere with nor cover the beacon manufacturers label. The NOAA Registration Decal also provides the contact number to call in case of a false alert.

- a) Complete instructions for operating the PLB including guidance on how to maximize self-locating performance of the PLB including antenna orientation and siting (for both the main PLB antenna and the GNSS antenna) together with any appropriate warnings (such as don't obstruct the antennas, provide a clear view of the sky, do not submerge the antennas etc).
- b) Information on the intended usage and any restrictions on usage applicable to that Category and Group of PLB. This shall include guidance as to where that PLB is intended to be used and the restrictions on use as defined in Tables 2 and 3 as applicable.
- c) Cautions and recommendations to prevent inadvertent activations which result in false alerts.
- d) Instructions on actions to be taken in the case of false alerts, including toll and toll-free phone numbers for contacts and including instructions that in the case of accidental activation of the PLB, the user should de-activate the PLB and notify the appropriate search and rescue authorities¹⁷ at the earliest possible time. For SGBs instructions on the use of the Cancellation Function in relation to false alerts and when and when not to use it.
- e) A warning paragraph with, at a minimum, the information in 4.5.2 and the fact that misuse of a PLB may be subject to a fine.
- f) Instructions on how, when and where to carry out self-tests as recommended by the manufacturer (including both the Regular Self-Test and the GNSS Self-Test), together with any appropriate warnings.
- g) General battery information (e.g., battery replacement instructions, battery type, safety information regarding battery use and disposal).
- h) Instructions for the safe transportation or shipping of the PLB or the location where such information can be obtained on the Internet or by mail by the consumer.
- i) Information regarding the need to replace the battery after activation of the PLB and how to determine if the PLB has been activated or the battery needs to be replaced.
- j) Information related to the requirements of preventive maintenance.
- k) Minimum operating lifetime and operating and stowage temperature ranges.
- l) Information explaining the requirement and procedure for licensing and registering PLBs, as appropriate, and encouragement to do so promptly. These instructions shall include language directing any subsequent owner to update these registration details.
- m) For Category 2 PLBs, a warning that states "THIS PLB WILL NOT FLOAT" and, if applicable, the information that when used around water it should be installed in or attached to an auxiliary flotation device, its tested depth and time rating (e.g. waterproof to x meters for x minutes/hours) and that the PLB is not designed to float and transmit a distress signal and that the PLB may not be substituted for a required EPIRB on a vessel.
- n) For Category 1 PLB, information that the PLB is appropriate for use in or around water and, its tested depth and time rating (e.g. waterproof to x meters for x minutes/hours) and as appropriate, either:

¹⁷ e.g., in the U.S. for Group 1 PLBs telephone 1-800-851-3051 and for Group 3 PLBs telephone 1-855-406-8724, in the U.K. the Coastguard

The PLB is buoyant (but is not designed to float in an upright position and transmit a distress signal) and that the PLB may not be substituted for a required EPIRB on a vessel.

or

The PLB will float without support in an upright position and transmit a distress signal and that the PLB may not be substituted for a required EPIRB on a vessel.

- o) An overview and explanation of how the Cospas-Sarsat system operates.
- p) Beacon registration materials and information ¹⁸
- q) For PLBs with the capability to be connected to an external GNSS receiver the manufacturer shall provide instructions for connecting and setting up the external GNSS receiver in the equipment manual. This information shall include:
 - 1) A list of all the GNSS receivers that have been tested with the PLB to ensure correct operation of the interface;
 - 2) Details of the electrical and/or data connections to the PLB;
 - 3) The specification of the interface (e.g. IEC 61162-1);
 - 4) Details of the communications protocol to be used (e.g. Baud Rate, Data Bits, Parity Bits etc);
 - 5) A list of the NMEA messages that the PLB can handle (e.g. GGA, GLL, RMC etc) and;
 - 6) Instructions on the key settings and parameters of the GNSS Receiver (e.g. Map Datum (WGS84/GTRF), I/O Formats, Mode of Operation etc).
- r) If the PLB is RLS capable functional and operational details as required by Cospas-Sarsat.

4.7 Packaging Labeling

End user (consumer) packaging shall include the following information in a conspicuous location, readily readable and visible to the purchaser without opening the packaging:

- a) The Category of the PLB:
 - If Category 1 information that the PLB will float.
 - If Category 2, information that the PLB will not float.
- b) A note to the effect that; THIS PLB IS NOT AN ELT or an EPIRB and does not meet the regulatory requirements for an ELT or an EPIRB.
- c) The temperature operating range in degrees Celsius and Fahrenheit of the PLB.
- d) The expiration date of the battery.

¹⁸ Manufacturers may obtain registration procedures and a sample registration card for USA PLBs from:

NOAA SARTSAT Beacon Registration
 NSOF, E/SP3
 4231 Suitland Road
 Suitland MD 20746
 or
www.beaconregistration.noaa.gov

NOAA maintains a registration database at the USMCC for PLBs encoded with USA country codes.

- e) The Country that is coded into the 15 / 23 Hex ID
- f) If the beacon Country Code / identity cannot be readily changed in the field at nominal cost to another Country Code / identity due to the configuration of the PLB, a warning to that effect.

4.8 406 MHz and AIS registration details

Registration Forms and related paperwork (e.g. Warranty Cards) supplied by the manufacturer shall contain provision for the Beacon 15 Hex ID / or 23 Hex ID (as applicable) and the AIS Transmitter User ID (if applicable).

Annex A (normative)

Environmental and Operational Performance Test Procedures for Approval of 406 MHz PLBs

A.1 GENERAL TEST CONDITIONS

A.1.1 COSPAS-SARSAT Type Approval

The requirements of this Appendix are in addition to the COSPAS-SARSAT requirements for type approval, as per COSPAS-SARSAT documents C/S T.001 and T.007 for FGBs and T.018 and T.021 for SGBs, as amended. Tests shall be normally carried out at test sites accepted by the type approval authority. The manufacturer shall, unless otherwise agreed, set up the equipment and ensure it is operating normally before testing commences. If the test site accepted by the type approval authority is also an accepted COSPAS-SARSAT test facility, both series of tests may be combined.

A.1.2 Power Supply

Electrical power shall be supplied during performance tests normally by the batteries which form a part of the equipment. For type-approval tests, a minimum of three sets of batteries shall be submitted. A log of battery on-time shall be maintained for the PLB under test. Batteries shall not be replaced unless it is probable that the battery on-time will exceed the prescribed operating life time of the PLB before the test is complete. In any case batteries shall not be replaced during a test. If the batteries fail during a test new batteries shall be fitted and the test repeated from the beginning.

A.1.3 Warm-up Period

The requirements of C/S T.001 shall be met after a maximum warm-up period of 15 min. The requirements of C/S T.018 shall be met without a warm up period.

A.1.4 Instructions

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

A.1.5 Additional Facilities / Supplemental Devices

If the equipment contains any additional facilities or supplemental devices, such as an interface to an external GNSS Receiver, they shall be operational for the duration of all tests, except if specified otherwise. Additional testing may be required if additional facilities and/or supplemental devices are incorporated within the PLB. If not specifically addressed within this standard or within the COSPAS-SARSAT standards additional testing requirements shall be addressed on a case-by-case basis to COSPAS-SARSAT and to the appropriate national authorities before the commencement of any tests.

A.1.6 Audible and Visual Indications

During testing, all audible and visual indications including any alarms, indicators, displays and audio outputs (if fitted) shall be operational.

A.1.7 Preparation of PLB for type-approval testing

A minimum of two PLBs shall be provided by the manufacturer for testing purposes, together with the batteries required by A.1.2.

For the purpose of performance testing, all PLBs shall be specially programmed to transmit data bursts encoded using a test protocol of appropriate type and format (see C/S T.007 and / or C/S T.021 as applicable for details).

The first PLB shall be a fully packaged beacon, similar to the proposed production beacons, operating on its normal power source and equipped with its proper antenna. The manufacturer shall document any changes or variations from the planned production beacon.

The second PLB shall be configured so that the antenna port can be connected to the test equipment by a coaxial cable terminated by a 50Ω load. The configuration of the antenna port shall be prepared by the manufacturer before the first test. The manufacturer under the supervision of the test facility or the test facility itself shall be able to connect the RF output of the PLB to either the antenna or the 50Ω port with the minimum possible amount of disturbance to the PLB internal components and circuitry. If the 50Ω port is present for the Thermal Shock and Immersion tests it must be waterproof. All tests shall be performed with the RF output connected into a 50Ω load. The COSPAS-SARSAT tests shall be performed with the beacon operating into the antenna or 50Ω load as defined in C/S T.007 and / or C/S T.021.

All homing devices shall be prepared for test transmission as required by the national authority. Care shall be taken not to transmit distress signals on distress and safety frequencies, for example, by frequency offset to a maximum frequency of 121.65 MHz.

Either the first or the second PLB shall be subjected to all the Compulsory tests defined in section A.2. If it is not practical to apply all the Compulsory tests including the Performance Tests to either the first or the second PLB then both PLBs shall be subjected to as many tests as is practical at the same time and just one sample shall be subjected to those tests where it is impractical to test the other PLB. Details of which PLB was subjected to which tests shall be documented in the test report.

Additional PLBs may, at the manufacturer's discretion, be provided for completing the Additional tests defined in section A.2.

No adjustments are permitted to the PLBs under test throughout the complete test program. Except as specifically specified by the test procedures, or in order to replace the batteries or change the antenna connection, the PLBs shall not be opened during the test program.

Evidence of compliance with all the requirements of this sub-clause shall be submitted by the manufacturer before testing commences.

A.1.8 Measurements and Observations

The values of all parameters of the PLB under test shall be measured or observed during each of the tests prescribed in this appendix and shall be duly recorded and submitted to the appropriate national authority as part of the required type approval testing data set. Any failures or repeated tests shall be recorded. The measurement accuracy of each value (or set of values) shall also be reported in the test data. A complete summary of the test results (see Annex E) shall also be submitted to the appropriate national authority.

A.1.9 Test Conditions

Tests shall be carried out under normal test conditions, unless otherwise stated.

A.1.9.1 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%

A.1.9.2 Extreme temperature test conditions

For tests at extreme temperatures, measurements shall be made in accordance with the procedure specified in IEC 60945 as modified herein.

Applicable operational temperature ranges for PLBs are based upon the Class of the PLB as follows:

For class 0: –55°C to +70°C

For class 1: –40°C to +55°C

For class 2: –20°C to +55°C

A.1.10 Equipment Category and Group Test Requirements

In addition to declaring the class of the PLB (as defined in paragraph A.1.9.2) the manufacturer shall also declare the category and group of the PLB.

Category 1 PLBs Must float in compliance with A.15

Category 2 PLBs Not required to comply with A.15

Also for Category 1 devices the manufacturer shall declare if the PLB is intended to be used floating in water, in which case it must also comply with A.15.2 the Floating Upright Test.

The applicable antenna test configurations for each type of PLB in accordance with C/S T.007 Figure 4.1 are as follows:

Type of PLB	T.007 Figure 4.1 Test Configurations
Category 1 – Floats and is declared by the manufacturer as being suitable to operate floating in water	Test Configurations 1 and 4
Category 1 – Floats but is not intended to operate floating in water, but is intended to operate when attached to personal LSA	Test Configurations 3 and 4
Category 2 – Not required to comply with A.15	Test Configurations 3 and 4

The applicable antenna test configurations for each type of PLB in accordance with C/S T.021 Table B.11-2 are as follows:

Type of PLB	T.021 Table B.11-2 Test Configurations
Category 1 – Floats and is declared by the	Test Configurations AG and GP-IN

manufacturer as being suitable to operate floating in water	Plus if applicable GP-LP (see below)
Category 1 – Floats but is not intended to operate floating in water, but is intended to operate when attached to personal LSA	Test Configurations AG, GP-ON and GP-LP
Category 2 – Not required to comply with A.15	Test Configurations AG and GP-ON Plus if applicable GP-LP (see below)

NOTE – If the manufacturer declares that an SGB PLB is also designed to be attached to items of LSA then in addition to any other required antenna test configurations said PLB shall also be testing in the GP-LP configuration.

The declared PLB Group defines the additional Homing Signal tests that the PLB shall be subjected to in accordance with the Additional tests defined in section A.2.

For the purposes of IEC 60945 the equipment category is defined as Portable.

A.1.11 Performance Check

For the purposes of IEC 60945 and this standard a performance check consists of measuring the following parameters using suitable test equipment (e.g., a handheld Beacon Tester) as defined in C/S T.007 and / or C/S T.021 as applicable:

- a) 406 MHz transmitted frequency (single burst only);
- b) 406 MHz digital message (check of 15 and / or 23 Hex ID and full 144 message bits and / or 250 message bits as appropriate); and
- c) the presence of Homing transmissions (either by an audio tone or display of key parameters (e.g. homing frequency)) as applicable to the PLB Group 1 or 3 being tested.

A.1.12 Performance Test

For the purposes of IEC 60945 and this standard a performance test consists of measuring the following parameters as defined in C/S T.007 Annex A.2.1 and / or C/S T.021 Annex A.2.1 as applicable:

- a) 406 MHz transmitter power output (T.007 and T.021);
- b) 406 MHz digital message (T.007 and T.021);
- c) 406 MHz digital message generator (T.007 Bit Rate and Stability only);
- d) 406 MHz modulation (T.007);
- e) EVM (T.021);
- f) 406 MHz transmitted frequency (T.007);
- g) Carrier frequency stability (T.021)
- h) 406 MHz spurious output (T.007 and T.021); and
- i) 121.5 MHz and / or AIS Homing Signal Peak Envelope Power output as applicable to the Group of PLB under test

Details on making measurements a) to h) above can be found in C/S T.007 Annex A and / or C/S T.021 Annex B and this Annex as applicable.

A.1.13 Pre-conditioning and Post Examination for Environmental Tests

Prior to testing, the PLB shall be visually inspected for any signs of damage and a performance check shall be made. No other preconditioning is required unless specifically detailed within each environmental test herein.

After each environmental test, the equipment shall be inspected for any mechanical deterioration and/or for water penetration and a performance check shall be made.

A.2 SEQUENCE OF TESTS

The following environmental and operational tests shall be conducted in the sequence as stated here below. All tests shall be performed on test samples as defined in A.1.7.

Tests marked "x" may be performed in the indicated sequence or moved in the sequence and combined with the related COSPAS-SARSAT tests.

Compulsory sequence of tests

- | | | |
|---|----|--|
| | 1 | Dry heat tests (see A.3) |
| | 2 | Damp heat test (see A.4) |
| | 3 | Low temperature tests (see A.5) |
| | 4 | Vibration tests (see A.6) |
| | 5 | Bump test (see A.7) |
| | 6 | Drop test (see A.9) |
| | 7 | Thermal shock test (see A.10) |
| | 8 | Immersion test (see A.11) |
| x | 9 | Spurious emission (see A.12) |
| | 10 | Operational Life (Battery capacity) and Self-test (see A.13) |
| | 11 | COSPAS-SARSAT type-approval tests (see A.14) or Limited COSPAS-SARSAT type-approval tests (see below) provided that the full tests are carried out as Additional Tests (see item 20 below) |

A subset of the Cospas-Sarsat tests shall be repeated on the radiated test sample at the end of the test sequence as follows:

FGBs – C/S T.007 Test A.2.1 (except transmitter power output and VSWR) at ambient temperature, Tests A.2.5 and A.3.8.2 in Configuration 5 only.

SGBs – C/S T.021 Test A.2.1 (except transmitter power output and VSWR) at ambient temperature, Tests A.2.5 and B.14.2.4 in Configuration SN-ON only.

NOTE The manufacturer shall agree a method of performing the limited C/S tests on the radiated test sample with the relevant approval authorities and the test facility prior to commencing the tests.

Additional tests

The following tests may be run in any sequence and / or may be performed on separate test units:

- | | | |
|--|----|---|
| | 12 | Buoyancy Test (Category 1 PLBs only) (see A.15) |
| | 13 | Homing Signal Tests as applicable (see A.16 and / or Annex D) |
| | 14 | Solar Radiation (see A.17) |
| | 15 | Oil Resistance (see A.18) |
| | 16 | Corrosion (salt mist) test (see A.8) |

- 17 Compass Safe Distance (see A.19)
- 18 Miscellaneous tests including Altitude (see A.20)
- 19 Internal Navigation Device tests (see A.21)
- 20 COSPAS-SARSAT type-approval test procedure (see A.14)
- 21 Additional USA Approval Requirements (see below)

USA Approval Requirements

In the United States PLBs must be Certified by the Federal Communications Commission (FCC). As well as meeting this standard PLBs must comply with 47 CFR Part 95 Subpart K of the rules, the PLB must also obtain Equipment Authorization, specifically a Grant of Certification, as required by 47 CFR Part 2 Subpart J of the rules. This includes submitting the data required by Parts 2.1046 to 2.1057 inclusive. The Radiofrequency Radiation Exposure requirements of Parts 2.1091 and 2.1093 also apply to PLBs.

Other tests contained in IEC 60945 but not listed above are not required to be carried out.

A.3 DRY HEAT TESTS

The dry heat storage test defined in IEC 60945 shall be performed on all Classes of PLB. The storage temperature shall be 70°C for all Classes, after the completion of the test a performance check shall be made.

The dry heat functional test defined in IEC 60945 shall be performed, during the operational period at elevated temperature a performance test shall be made. After completion a performance check shall be made.

A.4 DAMP HEAT TEST

The damp heat functional test defined in IEC 60945 shall be performed. During the operational period at elevated temperature and humidity a performance check shall be made.

A.5 LOW TEMPERATURE TESTS

The low temperature storage test as defined in IEC 60945 shall be performed on Class 2 PLBs. Class 0 and Class 1 PLBs shall be subjected to the same IEC 60945 test except that the storage temperature shall be reduced to -55°C. After the completion of the test a performance check shall be made.

The low temperature functional test for portable equipment defined in IEC 60945 shall be performed on Class 2 PLBs. Class 0 PLBs shall be subjected to the same IEC 60945 test, except that the operational temperature shall be reduced to -55°C. Class 1 PLBs shall be subjected to the same IEC 60945 test, except that the operational temperature shall be reduced to -40°C. During the operational period at reduced temperature a performance test shall be made. After completion a performance check shall be made.

NOTE: The low temperature functional test may be combined with the Operational Life test in A.13.1.

A.6 VIBRATION TESTS

The vibration test defined in IEC 60945 shall be performed, after the completion of the test a performance check shall be made. The PLB shall not activate during the vibration tests.

A.7 BUMP TEST

The PLB shall be secured to the testing equipment through its normal attachments or mounting intended for use in service conditions and mounted in the normal operating position(s). Additional straps or other holding means shall not be used.

The PLB shall be subjected to the bump test according to the following profile:

Peak acceleration:	98 m/s ² +/-10%
Pulse duration:	16 ms +/-10 %
Wave shape:	Half-cycle sinewave
Number of bumps:	4 000

The bump test is conducted three times, once with the PLB mounted in each of the 3-axes. After the completion of the tests a visual inspection shall be performed and the PLB shall be subjected to the performance check. The PLB shall not activate during the bump tests.

A.8 CORROSION TEST

This test shall be performed on a complete PLB assembly with all necessary labeling attached, any storage case that is not a permanent part of the PLB shall be removed before testing, any cover over a control panel or similar shall be raised (open) during the test.

The corrosion test shall be waived where the manufacturer is able to produce evidence that the components, materials and finishes employed in the equipment would satisfy the test.

The corrosion test as defined in IEC 60945 shall be performed, at the conclusion of the test the PLB shall be inspected with the naked eye without magnification for signs of corrosion, peeling paint and other signs of deterioration. The unit shall then be subjected to a performance check. Salt deposits and water stains may be washed off with clean warm water not exceeding a temperature of 38°C.

A.9 DROP TEST

The PLB shall be tested in its normal stowage condition. If applicable the antenna shall also be secured in its normal stowage position for this test. If the PLB is provided with a pouch or similar package not permanently affixed to the PLB, it shall be removed before conducting the drop tests.

The PLB shall be pre-conditioned before the drop tests as appropriate by soaking it at the following temperatures for at least two hours:

Class 0 PLBs	-55°C
Class 1 PLBs	-40°C
Class 2 PLBs	-30°C

The drop test shall then be completed within 5 minutes of removing the PLB from preconditioning.

The PLB shall be dropped onto a hard surface as defined in IEC 60945.

The PLB shall not activate during the test. Upon completion of the tests the exterior of the device shall be examined for signs of damage and a performance check shall be made.

A.10 THERMAL SHOCK

The thermal shock test for portable equipment defined in IEC 60945 shall be performed, except that the period of time that the PLB remains under water shall be increased to 4 hours. After the completion of the test the device shall be examined for signs of any ingress of water and a performance check shall be made. Subject to a satisfactory performance check, the opening of the PLB to check for water ingress may be delayed until the completion of all tests.

NOTE: This test is different to the thermal shock test required by C/S T.007 and / or C/S T.021.

A.11 IMMERSION TEST

The PLB shall be subjected to one or both of the following portable equipment immersion tests depending on its declared Category of operation.

Category 1 PLBs	IEC 60945 Portable Equipment Immersion; and IEC 60945 Portable Equipment Temporary Immersion
Category 2 PLBs	IEC 60945 Portable Equipment Temporary Immersion

However the duration of the Temporary Immersion test only shall be extended to one hour.

After the completion of these tests a performance check shall be made and then the device shall be opened and examined for signs of any ingress of water.

If the PLB is equipped with a battery compartment, which allows for user replacement of the battery, the test shall be repeated with the battery compartment open to ensure that there is no water ingress into the PLB electronics.

NOTE: This test may be combined with the thermal shock test in A10.0.

A.12 SPURIOUS EMISSIONS TEST

The following spurious emissions tests may, where relevant and practical, be combined together.

A.12.1 Close in Emissions

The spurious and harmonic emissions measurements for the 406 MHz and 121.5 MHz signals shall be performed with the device at the minimum, maximum, and ambient operating temperatures for the relevant class of PLB. These emissions shall not exceed the limits given in Figures 2 and 6, respectively, when measured in a nominal 100 Hz resolution bandwidth. Measurement of the 121.5 MHz signal may be performed during testing of the 121.5 MHz Auxiliary Radio-Locating Device Transmitter Tests (clause A.16).

The measurements shall be made at the transmitter output at 50 Ω using a receiver or a spectrum analyzer.

The AIS modulation and transient sidebands (if applicable) shall comply with the requirements of Annex D and may be tested during the rest of the Annex D tests.

This test may be combined with the Spurious Output test required by C/S T.007, Annex A.3.2.2.4, or C/S T.021, as appropriate.

A.12.2 Aeronautical, Maritime and Satellite Band Emissions

The measurement shall be performed only between bursts and only at the ambient operating temperature. The measurements shall be made at the transmitter output at 50 Ω using a