COSPAS-SARSAT
406 MHz DISTRESS BEACONS
TYPE APPROVAL STANDARD

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COSPAS-SARSAT 406 MHz DISTRESS BEACON TYPE APPROVAL STANDARD

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1. INTRODUCTION

1.1 Scope

This document defines the Cospas-Sarsat policy on type approval of 406 MHz distress beacons and describes:

a) the procedure to apply for Cospas-Sarsat type approval of a 406 MHz distress beacon; and

b) the type approval test methods.

1.2 Reference Documents

a) Cospas-Sarsat Document C/S T.001, "Specification for Cospas-Sarsat 406 MHz Distress Beacons";

b) Cospas-Sarsat Document C/S T.008, "Cospas-Sarsat Acceptance of 406 MHz Beacon Type Approval Test Facilities";

c) Cospas-Sarsat Document C/S T.012, “Cospas-Sarsat 406 MHz Frequency Management Plan”; and

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

- END OF SECTION 1 -

2. COSPAS-SARSAT TYPE APPROVAL

2.1 Policy

The issuing of performance requirements, carriage regulations and the testing and type approval of 406 MHz distress beacons are the responsibilities of national authorities.

However, to ensure beacon compatibility with Cospas-Sarsat receiving and processing equipment, it is essential that beacons meet specified Cospas-Sarsat performance requirements. Compliance with these requirements provides assurance that the tested beacon performance is compatible with, and will not degrade, the Cospas-Sarsat system. A 406 MHz beacon with an integrated navigation system will be considered as a single integral unit for type approval testing.

Therefore, it is recommended that national authorities and search and rescue agencies require manufacturers to comply with the provisions of this document.

2.2 Testing

The Cospas-Sarsat tests described in this document are limited to ensure that:

a) beacon signals are compatible with System receiving and processing equipment;

b) beacons to be deployed do not degrade nominal System performance; and

c) beacons encoded position data is correct.

These tests will determine if beacons comply with this document, with the "Specification for Cospas-Sarsat 406 MHz Distress Beacons" (C/S T.001), and with the document “Cospas-Sarsat 406 MHz Frequency Management Plan” (C/S T.012).

Tests conducted in beacon manufacturing facilities during development of new beacon models or production unit testing must not cause harmful interference to the operational Cospas-Sarsat system. The level of 406 MHz emissions from beacon manufacturing facilities should be less than -51 dBW in an area immediately external to the manufacturers’ facility. The -51 dBW is equivalent to a power flux density of -37.4 dB (W/m^2) or a field intensity of 11.6 dB (V/m).

2.3 Type Approval Certificate

A Cospas-Sarsat Type Approval Certificate (see sample in Annex M) will be issued by the Cospas-Sarsat Secretariat, on behalf of the Cospas-Sarsat Council (CSC), to the manufacturer of each 406 MHz distress beacon model that is successfully tested at an accepted Cospas-Sarsat test facility. All manufacturers are encouraged to obtain a Cospas-Sarsat Type Approval Certificate

for each of their beacon models. The Secretariat will treat manufacturer's proprietary information in confidence.

Cospas-Sarsat TAC numbers will be issued only in the following cases:

- type approval of new beacon models,
- significant changes to an approved beacon model that has been retested at an accepted test facility, and
- the need for additional serial numbers to encode a unique identification with the Standard Location Protocol, provided that the capacity of all possible serial numbers associated with previously assigned TAC numbers was fully used.

The Cospas-Sarsat Type Approval Certificate itself does not authorize the operation or sale of 406 MHz beacons. National type acceptance and/or authorization may be required in countries where the manufacturer intends to distribute beacons.

The Certificate is subject to revocation by the Cospas-Sarsat Council should the beacon type for which it was issued cease to meet the Cospas-Sarsat specification.

- END OF SECTION 2 -

3. TESTING LABORATORIES

3.1 Testing

The tests described in this document consist of a series of laboratory technical tests and an outdoor functional test of the beacon transmitting to the satellite. Manufacturers are encouraged to conduct preliminary laboratory tests on their beacons, but are cautioned not to radiate signals to the satellite. If open air radiation of 406 MHz signals should be necessary, the manufacturer must coordinate and receive approval for the test from the appropriate national or regional MCC. Any such radiation must use the test protocol of the appropriate type and format. For example, test user-location protocol shall be used for testing of beacons intended to be encoded with user-location protocol.

All type approval tests shall be conducted by an accepted test facility unless specifically stated otherwise in this document.

3.2 Cospas-Sarsat Accepted Test Facilities

Certain test facilities are accepted by Cospas-Sarsat to perform Cospas-Sarsat type approval tests, as described in document C/S T.008. Accepted test facilities are entitled to perform tests on any 406 MHz distress beacon for the purpose of having a Cospas-Sarsat Type Approval Certificate issued by the Secretariat. A list of Cospas-Sarsat accepted test facilities is maintained by the Cospas-Sarsat Secretariat.

Following successful testing of a beacon, the technical information listed in section 5 of this document should be submitted to the Cospas-Sarsat Secretariat, so that a Cospas-Sarsat Type Approval Certificate can be issued to the beacon manufacturer.

3.3 Testing of ELT Antennas Separated from Beacons

Although the Cospas-Sarsat type approval policy is to consider only the complete beacon with its antenna (i.e. Cospas-Sarsat does not type approve specific beacon components), this policy is not strictly applicable to ELTs which can be approved for use with different aircraft antennas.

In respect of antenna testing requirements provided in Annex B to this documents, testing ELT antenna at a reputable and independent test facility specialised in antenna measurements is acceptable subject to prior agreement by Cospas-Sarsat and provided that the test facility is accredited by recognised standardisation bodies responsible for type approval of electronic and electrical equipment.

In such case, the testing application package shall also include:

a) written confirmation by the Cospas-Sarsat Representative of the country where the facility is located (see Annex J) of the independence of the antenna testing facility from the beacon manufacturer;

b) a letter from the test facility briefly describing their capability in respect of ELT antenna testing to the requirements specified in applicable Cospas-Sarsat documents; and

c) the reference of the test facility accreditation by recognised standardisation bodies responsible for type approval of electronic and electrical equipment in the facility's country.

In all cases, the testing of the aircraft antenna, as described above, shall be completed with:

i. VSWR measurement as described at Annex B;

ii. the calculated EIRP values and results of antenna polarisation test in the format provided at Tables F-B.1 and F-B.2;

iii. the calculations for EIRP minimum and maximum at beacon end of operational life ($EIRP_{minEOL}$ and $EIRP_{maxEOL}$) in the format provided at Table F-B.1; and

iv. satellite qualitative tests using a type approved ELT or the ELT submitted for type approval as described at Annex A, and reported as per Appendix A to Annex F.

- END OF SECTION 3 -

4. COSPAS-SARSAT TESTING PROCEDURE

4.1 Sequence of Events

Typical steps to obtain a Cospas-Sarsat Type Approval Certificate for a new beacon are:

a) manufacturer develops a beacon;

b) manufacturer conducts preliminary testing in his laboratory;

c) manufacturer schedules testing at a Cospas-Sarsat accepted test facility;

d) test facility conducts* type approval tests;

e) manufacturer and/or test facility (as coordinated by the manufacturer) submits to the Cospas-Sarsat Secretariat report on type approval testing, and technical data listed in section 5 of this document;

f) Secretariat and Cospas-Sarsat Parties review the test results and technical data; and

g) Cospas-Sarsat Secretariat provides results of review to the manufacturer within approximately 30 days, and if approved, a Cospas-Sarsat Type Approval Certificate is subsequently issued.

4.2 Initial Request

An initial request to a test facility might need to be made several weeks prior to the desired testing date. Since the manufacturer may wish to send a representative to witness the tests and provide assistance in operating the beacon, proper clearances should be made with the test facility well in advance. The manufacturer should be prepared to provide the test facility with:

a) one or more beacons for testing purposes; and

b) replacement batteries.

The power output of the test beacons when measured relative to 50 Ohm impedance shall have identical factory settings (aligned to 0.3 dB).

* The cost of the testing is to be borne by the manufacturer.

4.3 Test Units

If the beacon has a 121.5 MHz homer, the homer transmitters of the test beacons shall be aligned in power, and set for the maximum output power declared by the beacon manufacturer in the application form. For the test beacon subjected to antenna and satellite qualitative tests, the homer transmitter may be tuned to the frequency nearest to 121.5 MHz allowed by the national administration for type approval testing, but under no circumstances should this frequency be greater than 121.65 MHz. For position acquisition time and position accuracy test of beacon models equipped with internal navigation device, the homer-transmitter frequency shall be set in the range from 121.35 to 121.5 MHz. If such frequency offset is not possible due to national restrictions or design limitations of the beacon, the homer transmitter shall be tuned to frequency above 121.5 MHz.

One test unit 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 second beacon* shall be configured such that the antenna port can be connected to the test equipment by a coaxial cable terminated by a 50-Ohm load. All necessary signal or control devices shall be provided by the beacon manufacturer to simulate nominal operation of all ancillary devices of the beacon, such as external navigation input signals and manual control, in accordance with A.3.7, while in an environmental test chamber. The means to operate these devices in an automated and programmable way shall be also provided by the manufacturer.

Another beacon may be required to perform the RLS tests in Section A.3.8.8, or the second test beacon may be modified to permit this testing to take place on that unit.

All external ancillary devices specific to beacon operation, designed principally for use with the beacon model and forming part of nominal system configuration, such as remote control panels and switches, sound and light indicators, external navigation interface units, beacon programmers (dongles), remote activators and etc., shall be connected, powered, operated in nominal mode and placed in the same environmental conditions as beacons during all tests. If necessary, it is permissible to shield external ancillary devices from the effects of humidity and moisture during environmental tests (e.g. by enclosing them in a plastic bag).
The test units shall be coded with the test protocol of appropriate type and format and shall meet the requirements of C/S T.001. It should be noted that:

a) The test unit subjected to the Cospas-Sarsat tests remains the property of the manufacturer. All information marked as proprietary shall be treated as such;

* For type-approval testing of beacon models with detachable, remote or external antennas, it is allowed to submit a single test beacon to a type approval test facility, provided that either such beacon has a 50-Ohm antenna cable port or a robust electrically equivalent impedance matching network as described in section 5(k) and A.1.a. which can allow connection of the test equipment.

b) the organization performing the Cospas-Sarsat tests bears no responsibility for either the manufacturer's personnel or equipment;

c) the manufacturer shall certify that the units submitted for test contain no hazardous components. The testing organization may choose not to test units that it regards as hazardous; and

d) test units shall normally stay at the test facility for the full duration of type approval testing, however in situations when modification or repair of the test units is required at the manufacturer's facility, this shall be properly documented by the test facility and reflected in the test report.

If a beacon is to receive certification for several protocol types, means of changing message coding shall be provided by the beacon manufacturer. Alternatively, this can be satisfied with additional test units.

If a beacon is to receive certification for location protocols and non-location protocols, the unit used for the tests listed in section A.2 shall be coded with one of the location protocols.

RLS-capable beacons shall allow message encoding with RLS Location Test Protocol and National Location Test Protocol, with the RLS Location Test Protocol to be used only for the Satellite Qualitative Test and the Position Acquisition Time and Position Accuracy Test, and NLP Test Protocol to be used for all other on-air tests.

4.4 Test Conditions

Tests shall be conducted by test facilities accepted by Cospas-Sarsat, unless allowed otherwise herein. It is advisable that the manufacturer, or his representative, witness the tests.

The tests shall be carried out on the test beacon with its own power source and without any additional thermal shielding around the beacon that might prevent it from being exposed to the specified test temperature. However shields or deflectors inside the chamber designed to prevent the beacon from being exposed to temperatures lower or higher than the specified test temperature are permitted. In cases, when such additional shields and deflectors are used in thermal chambers, this shall be documented with photographs and reflected in the test reports.

If the ELT(DT) has an external power source that is used to power it or some parts of it when it is in the ARMED mode, as defined in section 4.5.6.1 of document C/S T.001, operation, this power source shall be set to the minimum voltage of the external power source, as specified by the beacon manufacturer during testing. For ELT(DT)s where tests refer to the beacon under test being 'off' or 'deactivated' or being 'turned on for 15 minutes prior to the start of a test', these conditions shall be taken to mean that the ELT(DT) is in its ARMED mode of operation.

Test results shall be presented on the forms shown in Annex F of this document, along with additional graphs as necessary. Test results shall demonstrate compliance with C/S T.001.

At the discretion of the test authority, the manufacturer may be required to replace the batteries between tests.

Beacons with multiple operator selectable and / or automatic modes of operation (e.g. voice transceivers, internal GNSS receivers, homers, etc.) shall undergo testing by the manufacturer to determine:

i. the mode that draws maximum battery energy; and

ii. the modes that exhibit pulse loads greater than in (i) above.

The results of the manufacturer testing shall be included in the technical data submitted to the Cospas-Sarsat Secretariat.

The mode that draws the maximum battery energy shall be tested to the full range of the test requirements by the test laboratory.

During type-approval testing, certain beacon characteristics are measured and test parameters evaluated over a period of 15 minutes by making 18 successive measurements of the 406 MHz signal during this period. The measurement interval and the number of measurements shall if necessary be extended to cover all beacon ancillary devices operating conditions (e.g. homing transmitter(s) turning on and off, GNSS receiver powered on and off, voice-transceivers in receive and transmit etc.).

Approved measurement methods are described in Annexes A, B, C, D and E of this document, although other appropriate methods may be used by the testing authority to perform the measurements. These shall be fully documented in a technical report along with the test results.

4.5 Test Configuration

The type approval tests required by Cospas-Sarsat are identical for all types of 406 MHz beacons, with the exception of the tests identified below:

a) satellite qualitative test (Annex A section A.2.5);

b) antenna characteristics (Annex A section A.2.6); and

c) position acquisition time and position accuracy (Annex A section A.3.8.2).

The test configurations for these tests are a function of the beacon type and the operational environments supported by the beacon, as declared by the manufacturer in Annex G. The applicable test configurations for the beacon antenna testing are summarised below in Figure 4.1, while the applicable test configurations for the satellite qualitative test and the position acquisition time and position accuracy test are summarised in Figure 4.2.

	Operational Environment Beacon used while	Configuration 1 (Fig: B.4) "Water" ground plane	Configuration 2 (Fig: B.3) Antenna fixed to ground plane	Configuration 3 (Fig: B.2) Beacon sitting on ground plane	Configuration 4 (Fig: B.5) Beacon above ground plane
EPIRB (*)	Floating in water, in safety raft or on deck of vessel	**X**			**X**
PLB	On ground and above ground			**X**	**X**
PLB	As above plus floating in water	**X**			**X**
ELT Survival	On ground and above ground			**X**	**X**
ELT Survival	As above plus floating in water	**X**			**X**
ELT Auto. Fixed	Fixed ELT with external antenna		**X**		
ELT(DT)	Distress Tracking ELT with aircraft external antenna		**X**		
ELT	On aircraft with external antenna		**X**		
Auto. Portable	Outside of aircraft with own antenna attached			**X**	**X**
ELT Auto. Deployable	In deployed state on ground, above ground and floating in water	**X**		**X (†)**	**X**
Other	For operational environments not defined above	To be determined by the Cospas-Sarsat Secretariat, following consultations with the beacon manufacturer, and the test facility (as appropriate)			

Figure 4.1: Antenna Test Configuration Requirements

* As configurations 1 and 4 cover the two extremes, configuration 3 is not required.

† For possible landing configuration not covered in Test Configuration 1, i.e. upside down.

	Operational Environment Bacon Used While	**Configuration 5 (see below) Water ground plane**	**Configuration 6 (see below) Antenna fixed to ground plane**	**Configuration 7 (see below) Beacon on ground plane***	**Configuration 8 (see below) Beacon above ground plane†**
EPIRB	Floating in water or on deck or in a safety raft	**X**		**X**	**X**
PLB	On ground and above ground			**X**	**X**
PLB	On ground and above ground and floating in water	**X**		**X**	**X**
ELT Survival	On ground and above ground			**X**	**X**
ELT Survival	On ground and above ground and floating in water	**X**		**X**	**X**
ELT Auto. Fixed	Fixed ELT with aircraft external antenna		**X**		
ELT(DT)	Distress Tracking ELT with aircraft external antenna		**X**		
ELT Auto. Portable	In aircraft with an external antenna		**X**		
	On ground, above ground, or in a safety raft with an integral antenna			**X**	**X**
ELT Auto. Deployable	In deployed state on ground, above ground and floating in water	**X**		**X**	**X**
Other	For operational environments not defined above	To be determined by the Cospas-Sarsat Secretariat, following consultations with the beacon manufacturer, and the test facility (as appropriate)			

Figure 4.2: Satellite Qualitative Test & Position Acquisition Time and Position Accuracy Test Configuration Requirements

* Configuration 7 is used to represent a beacon on ground, on the deck of a metal vessel and on the floor of a safety raft

† Configuration 8 is used to represent a beacon above ground (e.g. held in the hand), on the deck of a fibreglass or wooden vessel and being held in a safety raft

When performing the Satellite Qualitative Test (Annex A section A.2.5) and Position Acquisition Time and Position Accuracy test (Annex A section A.3.8.2), each of the applicable test configurations in Figure 4.2 shall be applied, even if the manufacturer states that this beacon will only be used in one configuration. PLB's used near water but not designed to be used in the water shall not be subjected to the Water Ground Plane Test. The test requirements for each configuration are as follows:

Configuration 5 – Water ground plane: The beacon shall be completely submerged in salt water (composition 5% salt solution by weight), activated while submerged, and allowed to float to the surface under its own buoyancy. The beacon shall be maintained at or near the centre of the container for the duration of the test. The container holding the salt water shall be placed on a flat surface in an area with a good all round view of the sky. The container shall be made from a non-conductive material (e.g. plastic) and there shall be at least 10cm of salt water under the base of the beacon when it is floating in the container and at least 10cm of salt water between the beacon and the sides of the container.

Configuration 6 – Antenna fixed to ground plane: The base of the antenna shall be placed in the centre of a thin 50cm ±2cm diameter conductive metal disc (made of aluminium or copper) which shall be placed directly on level dry ground (ideally cement, tarmacadam or dirt) in an area with a good all round view of the sky. The beacon itself shall either be placed in a hole under the conductive metal disc or shall be run off at least 3m (from the antenna) to one side of the disc using a coaxial cable.

Configuration 7 – Beacon on ground plane: The beacon shall be placed in the centre of a thin 27cm ±1cm diameter conductive metal disc (made of aluminium or copper) which shall be placed directly on level dry ground (ideally cement, tarmacadam or dirt) in an area with a good all round view of the sky, in the orientation described in the manufacturer's instructions.

Configuration 8 – Beacon above ground plane: The beacon shall be placed on an electrically insulating support so that its base is 0.45m ±5cm above level dry ground (ideally cement, tarmacadam or dirt) in an area with a good all round view of the sky, in the orientation described in the manufacturer's instructions. The conductive metal disc used in Configuration 7 above shall be removed for this test.

4.6 Test Procedure for Beacon with Operator Controlled Ancillary Devices

A unique test procedure may need to be defined for beacons with operator controlled ancillary devices to characterise the possible impact of these devices on the beacon performance. Such test procedure shall follow the guidelines provided at section A.3.7.2. A typical procedure for a beacon with a voice transceiver is provided at Annex E as an example of the guidelines implementation.

Unique test procedures for beacons with operator controlled ancillary device shall be:

a) coordinated between the beacon manufacturer and a Cospas-Sarsat type approval facility;

b) submitted to the Cospas-Sarsat Secretariat for review prior to type approval testing at the Cospas-Sarsat type approval facility; and

c) approved by the Cospas-Sarsat Parties as appropriate.

4.7 Test Report

Type approval test reports shall provide a summary of the beacon and antenna test results, with supporting test data, graphs and tables, as designated in Annexes A, B and F. It is recommended that the test reports be prepared in accordance with Appendix G to Annex F and contain as a minimum the following information:

a) Report management information:

   i. report reference number, issue/revision number, date of issue, report modification record with indication of the reasons for re-issue;

   ii. indication of the test facility specialist(s) in charge of the testing and contact details of the beacon manufacturer point of contact (representative) for the type approval application;

   iii. date when the test beacons have been submitted for testing; and

   iv. dates of testing start and finish;

b) Test samples details:

   i. application data and beacon design details, as per Part G.1 of ANNEX G,

   ii. indication of the test samples model name, part numbers (P/Ns) and serial numbers (S/Ns), details of the test beacon hardware, firmware and software P/Ns, battery pack details and composition, external components, manufacturer's test equipment,

   iii. photos of the test samples with antenna deployed and external ancillary devices as subjected to TA testing (if applicable),

   iv. description of physical test configuration supported with photos and/or diagrammes, providing details of a beacon and external components subjected to type approval testing;

c) Indication and description of any modifications made to the test beacons during type approval testing;

d) Statement of beacon model compliance with document C/S T.001, and indication of non-compliances observed or deviations from standard test procedures, which were allowed during type-approval testing, as per section G-2 of ANNEX G;

e) A summary of the beacon and antenna test results, with supporting test data, graphs and tables, as designated in Annexes A, B and F (if applicable).

f) Other technical information, technical data and test results, provided by the beacon manufacturer, which is referred to in the test report;

g) Photographs of beacon during radiation tests in all tested configurations (if applicable); and

h) List of measurement equipment with indication of test and calibration due date and information about the actual test facility measurement accuracies for all test parameters.

4.8 Additional Type Approval Testing Clarifications and Requirements

If the beacon fails during type approval testing or an issue of results or test method interpretation occurs at some point during the test period then the test laboratory shall inform the manufacturer and where applicable the Secretariat of the failure/problem.

For beacon failures during type approval testing the manufacturer shall investigate the issue and develop / propose corrective measures.

The manufacturer and / or test facility shall in a timely manner advise the Cospas-Sarsat Secretariat of the problem or issue, the reason for it and their proposed solution, including any necessary modifications to the beacon hardware, firmware or software. The Secretariat will in a timely manner review the information provided by the manufacturer and/or test facility and in consultation with them will provide clarifications and where necessary recommendations for additional testing.

Circumstances which will result in a need for additional or further testing include, but are not limited to:

- beacons with novel or non-standard design features or operational configurations, which are not described in the current standards and for which test procedures have not been agreed with the Secretariat prior to testing,
- any modification of the test beacon during type approval testing,
- non-compliances with C/S T.001 performance requirements,
- deviations from standard and/or agreed test procedures,
- lack and / or omission of test results or technical data,
- inadequacy of testing to cover features, modes, related functions or intended operational
- scenarios, as declared by the manufacturer,
- as a means to verify the effectiveness of undertaken corrective measures.

The scope of additional testing shall be defined and/or confirmed by the Cospas-Sarsat Secretariat following consultations with the beacon manufacturer and the test facility, as appropriate, and may range from only those tests relevant to the circumstances to a full beacon retest. In some cases, development of new test procedures may be required for beacons with non-standard or novel design and operational features.

– END OF SECTION 4 –

5. TECHNICAL DATA

Beacon manufacturers are required to provide technical data indicated below as part of their type approval application. This technical data is used to determine the appropriate test configurations and procedures. It is therefore expected that the technical data will be provided to the accepted test facility prior to type approval testing to ensure that appropriate test procedures are used.

The technical data submitted to the Cospas-Sarsat Secretariat shall include the following:

a) an application form (Annex G) for a Cospas-Sarsat Type Approval Certificate, signed by the manufacturer attesting to the technical details of the beacon as specified, and signed by the Cospas-Sarsat accepted test facility attesting that the beacon was tested in accordance with C/S T.007 and found in compliance with C/S T.001 and/or indicating the observed non-compliances and/or deviations from standard test procedures;

b) photographs of the beacon, with its antenna deployed whilst in all manufacturer declared configurations (e.g., floating in water, resting on ground, placed above ground, held by operator, etc.) and appropriate descriptions;

c) analysis and calculations from the beacon manufacturer that support the pre-test battery discharge figures required for the operating lifetime at minimum temperature test, as per Table F-E.2;

d) a list and descriptions of all automatic and manually selectable operation modes, description of beacon working cycle phases and durations, and analysis supported by results of battery current measurements, provided as per Table F-E.1, that identifies:

    i. the operating mode that draws the maximum battery energy, and

    ii. operating modes that have pulse loads greater than in i. above,

e) the beacon operating instructions and other owner manuals, if available, and a technical data sheet, describing the:

    i. beacon type and designation,

    ii. beacon specification;

    iii. typical operational scenarios and limitations with photos/drawings illustrating beacon configurations for operation with antenna(s) deployed,

    iv. system configuration, including external ancillary devices and antennas, if applicable,

    v. methods of beacon activation and beacon/antenna deployment,

    vi. self-test mode and GNSS self-test mode activation and indication,

vii. battery replacement instructions and battery replacement period;

f) beacon marketing brochure, if available;

g) the technical data sheet for the battery cells used in the beacon indicating nominal cell capacity and self-discharge rate over the declared battery replacement period, and the electric diagram of the beacon's battery pack;

h) copy of the beacon markings and labels indicating, as per C/S T.001 section 3.5.8:

i. beacon model name, beacon manufacturer and C/S TAC number,

ii. beacon 15-HEX ID,

iii. operating temperature range (e.g., -20°C to +55°C), and

iv. minimum duration of continuous operation (e.g., 24 hours);

i) the technical information on the reference oscillator, including:

i. oscillator type and specifications,

ii. technical data on long-term frequency stability and description of the beacon frequency-generation circuitry (section A.3.5),

iii. technical data sheet for any temperature-compensated oscillator (e.g., TCXO, MCXO) that may be employed, indicating maximum MTS characteristics specified for the oscillator model,

iv. report on the oscillator ageing characteristics (section A.3.5),

v. the serial number of the temperature-compensated oscillator device installed in the test beacon that was subjected to conductive testing at a test facility, and MTS characteristics from the reference oscillator manufacturer, if applicable;

j) statements and descriptions, complete with diagrams as necessary, to demonstrate that the design:

i. provides protection against continuous transmission (see section A.3.4),

ii. meets the frequency stability requirements over 5 years (see section A.3.5),

iii. provides protection from repetitive self-test mode transmissions (see section A.3.6),

iv. ensures that the self-test messages (except for GNSS self-test) have default values encoded in position fields, at all times and irrespective of the navigation data input, and

v. for location protocol beacons, provides protection against degradation in beacon 406 MHz performance due to faulty operation or failure in operation of internal or external navigation device and against invalid position encoding into the beacon message (see section 4.5.5 of C/S T.001);

k) a technical description and analysis of the matching network supplied for testing purposes per section A.1, or for cases where a matching network is not required, information shall be provided that confirms that the nominal output impedance of the beacon power amplifier is 50 Ohms and the beacon antenna VSWR measured relative to 50 Ohms is within a ratio of 1.5:1;

l) for beacon models with separated and/or remote antennas, technical data about the type of antenna cable and allowed minimum and maximum losses at 406 MHz of antenna cable assembly;

m) the beacon quality assurance plan (see Annex L);

n) for beacons with an internal GNSS receiver:

   i. description of the GNSS receiver operation cycle and its phases, including duration and average battery current measured for each phase,

   ii. technical data sheet of the internal GNSS receiver and the antenna for the internal GNSS receiver from the navigation-receiver and antenna manufacturers, and

   iii. description to demonstrate that the beacon design provides for the cold start of the internal GNSS receiver by clearing on a beacon restart the GNSS receiver internal memory, including time, data on the current (last) location determined by the GNSS receiver, the GNSS satellites almanac data, and the GNSS satellite ephemeris data;

o) for beacons capable of accepting position data from an external navigation device:

   i. specification and description of the interface to the external navigation device, and

   ii. diagrams showing electrical connections to the beacon and providing details of the external power supply, if it is required for operation of the interface to the external navigation device;

p) for beacons with external ancillary devices (e.g. external G-switch and other activation devices, remote control panel, audio- and light-indicator, S-VDR memory module etc.), and/or when an external power supply is required for beacon operation:

   i. technical data sheets, photographs and description for all the external ancillary devices, and

   ii. schematic diagrams, indicating electrical connections to the beacon and providing details of external power supply;

q) for beacon models with several variants, a comprehensive description of differences between these variants;

r) a complete check-list of technical information provided in support of the type-approval or change-notice application, as per Appendix F to Annex F;

s) a statement indicating the temperature within the declared operating temperature range, at which the shortest duration of continuous beacon operation is expected and if this is not the minimum operating temperature, a detailed description of this beacon design feature; and

t) a statement and description of any known non-compliances.

– END OF SECTION 5 –

6. COSPAS-SARSAT CERTIFICATION

6.1 Approval of Results

To receive a Cospas-Sarsat Type Approval Certificate, a beacon shall have been demonstrated to meet the requirements of C/S T.001. The technical data and test results will be reviewed by the Cospas-Sarsat Secretariat and then, if found satisfactory, submitted to the Cospas-Sarsat Parties for approval. The results of this process will be conveyed to the manufacturer within approximately 30 days.

If the unit is deemed to have passed the tests, the Secretariat will subsequently issue a Cospas-Sarsat Type Approval Certificate on behalf of the Cospas-Sarsat Council. The technical data and test results will be retained on file at the Secretariat.

6.2 Changes to Type Approved Beacons

The manufacturer must advise the Cospas-Sarsat Secretariat (see Annex H) of any changes to the design or production of the beacon or power source, which might affect beacon electrical performance. All tests for demonstrating the performance of modified beacons shall be conducted at a Cospas-Sarsat accepted test facility unless specifically stated otherwise in this document.

The manufacturer shall provide a statement clarifying whether the modification changed the beacon physical characteristics (e.g. weight, dimensions, centre of gravity, floatation characteristics, etc.). If the physical characteristics of the beacon have changed, the manufacturer shall provide photographs of the beacon in its operational configurations and submit an analysis regarding the possible impact of the change on beacon electrical performance.

For minor modifications to the beacon, factory test results provided to the Secretariat by the manufacturer can be considered on a case-by-case basis. The results of factory tests will be reviewed by the Secretariat, in consultation with the test facility which conducted the original type approval tests on the beacon, and the manufacturer will be advised if there is a need for further testing. Test results shall be submitted as described in section 4.7.

6.3 Alternative Batteries

Once a beacon incorporating a particular type of battery has been successfully tested at a Cospas-Sarsat test facility and type approved by Cospas-Sarsat, subsequent upgrades to that battery are permitted without further type approval testing at a Cospas-Sarsat test facility, provided the beacon manufacturer demonstrates that the changes do not degrade the performance of the 406 MHz beacon, as described below.

If a beacon manufacturer wishes to make changes to the type of battery after the beacon has been Cospas-Sarsat type approved, the change notice form in Annex H shall be completed and submitted to the Secretariat, together with test data, as per section 4.7, confirming that the substitute battery is at least technically equivalent to that used when the beacon was type

approved. The beacon manufacturer shall submit technical information per Section 5, items “a” (part G.1 only), “c”, “d”, “e ” (item’ vii’ only), “g”, “k”, “m” and “r”.

The Cospas-Sarsat type approval certificate will not be amended to include the alternative battery in such cases, unless the beacon was partially retested at a Cospas-Sarsat type approval test facility.

6.3.1 Batteries Not Used in Beacons Tested at an Approved Facility

The factory tests to be performed on the 406 MHz beacon with a type of battery that has not been used in previous models tested at a Cospas-Sarsat type approval facility shall include:

a) electrical tests at the three constant temperatures (maximum, minimum and ambient), excluding spurious output, VSWR and self-test (section A.2.1);

b) thermal shock test (section A.2.2);

c) operating lifetime at minimum temperature (section A.2.3);

d) re-calculations and analysis of $EIRP_{EOLmin/max}$ for all approved 406 MHz antenna models, based on results of the original type approval testing (sections B.10.3 and B.10.4) (only if beacon output power and / or $EIRP_{LOSS}$ have changed by more than 0.5 dB compared to the original type approval test results); and

e) satellite qualitative test (section A.2.5), in a single configuration only.

6.3.2 Batteries Used in Two Beacons Tested at an Approved Facility

If the alternative battery has been previously used in at least two beacon models for testing at a Cospas-Sarsat type approval test facility, the factory tests to be performed on the 406 MHz beacon with the alternative batteries shall include:

a) electrical tests at ambient temperature excluding digital message, digital message generator, modulation, spurious output, VSWR check, self-test mode (section A.2.1);

b) operating lifetime at minimum temperature (section A.2.3);

c) re-calculations and analysis of $EIRP_{EOLmin/max}$ for all approved 406 MHz antenna models, based on results of the original type approval testing (sections B.10.3 and B.10.4) (only if beacon output power and/or $EIRP_{LOSS}$ have changed by more than 0.5 dB compared to the original type approval test results); and

d) satellite qualitative test (section A.2.5), in a single configuration only.

6.4 Internal Navigation Device

6.4.1 Inclusion or Removal of an Internal Navigation Device

A type approved beacon modified to include an internal navigation device shall be completely retested at a facility accepted by Cospas-Sarsat.

In cases of a type approved beacon modified to remove an internal navigation device or new beacon models that have variants both with and without an internal navigation device, the variant with the internal navigation device shall be completely tested at a facility accepted by Cospas-Sarsat.

The variant without an internal navigation device shall undergo at a Cospas-Sarsat accepted facility the following testing:

a) electrical and functional tests at ambient temperature (section A.2.1), excluding Transmitted Frequency tests;

b) operating current measurements and analysis demonstrating that the load on the battery of beacon without the internal navigation device is not greater than the load measured for the beacon model variant with the internal navigation device;

c) beacon coding software test, which may also be performed by the beacon manufacturer; and

d) the satellite qualitative test (section A.2.5), in a single configuration only.

The beacon manufacturer shall provide detailed description of differences between variants with and without an internal navigation device.

For the variant without the internal navigation device, the beacon manufacturer shall submit technical information per Section 5, excluding items “a” (part G.2), ”n” and “o”.

6.4.2 Change to Internal Navigation Device

For changes to the internal navigation device of a type approved beacon which might affect the beacon electrical performance, the tests identified below shall be conducted at a Cospas-Sarsat accepted facility:

a) position acquisition time and position accuracy (section A.3.8.2); and

b) satellite qualitative test (section A.2.5).

In addition, the manufacturer shall provide the results and analysis of tests conducted at the manufacturer’s facilities that demonstrate that the load on the beacon battery is not greater than the load measured for the approved beacon model prior to the change of the internal navigation device.

If the change of internal navigation device results in higher battery loads, or might affect aspects of the beacon performance other than the position acquisition time and position

accuracy, the scope of testing shall be determined by Cospas-Sarsat after reviewing a description of the proposed change provided by the manufacturer.

Beacon manufacturer shall submit technical information per Section 5, excluding items "a" (part G.2), "i", "j (i-iii)", "n" and "o".

6.5 Interface to External Navigation Device

6.5.1 Modifications to Include Encoded Position Data from an External Navigation Device

A type approved beacon modified to accept position data from an external navigation device shall be tested with the test protocol of appropriate type and format at a Cospas-Sarsat type approval facility. The tests to be performed shall consist of:

a) electrical and functional tests (section A.2.1);

b) operating lifetime at minimum temperature (section A.2.3);

c) navigation system test (section A.2.7);

d) beacon coding software (section A.2.8);

e) re-calculations and analysis of $EIRP_{EOLmin/max}$ for all approved 406 MHz antenna models, based on results of the original type approval testing (sections B.10.3 and B.10.4) (only if beacon output power and / or $EIRP_{LOSS}$ have changed by more than 0.5 dB compared to the original type approval test results); and

f) satellite qualitative test (section A.2.5).

In addition, the beacon manufacturer shall also provide technical data sheets describing the navigation interface unit and technical information as per Section 5, excluding items "a" (part G.2), "h", "i", "k", "l" and "n".

6.5.2 Modifications to Interface to External Navigation Device

For a subsequent change to the beacon navigation interface unit that might affect the beacon electrical performance, the tests identified below shall be conducted at a Cospas-Sarsat accepted facility:

a) navigation system tests (section A.2.7); and

b) satellite qualitative tests (section A.2.5).

In addition, the manufacturer shall provide the results and analysis of tests conducted at the manufacturer's facilities that demonstrate that the load on the beacon battery is not greater than the load measured for the approved beacon model prior to the change of the external navigation device.

For a change to the navigation interface that might affect aspects of beacon performance beyond the processing of encoded location information from the external navigation

device, the scope of testing will be determined by Cospas-Sarsat after reviewing a description of the proposed changes provided by the manufacturer.

For the modified beacon, the beacon manufacturer shall submit technical information per Section 5, excluding items “a” (part G.2), “h”, ”i”, ”j (i-iii)”, “k”, “l”, “n”.

6.6 Changes to Frequency Generation

6.6.1 Minor Changes to Frequency Generation

In the case of oscillator replacement by an identical oscillator (on the basis of oscillator manufacturer data and written assurance) and when no other changes are required to beacon electronics or firmware, or in the case of a change of frequency of the beacon when this is achieved by modification of the oscillator (tuning or replacement of the oscillator crystal by a crystal of the same type) which does not involve significant changes to the oscillator performance, or in the case of a type approved beacon using a frequency synthesiser, the modification of the beacon can be considered as minor.

Factory tests verifying the beacon performance can be accepted after consideration by the Secretariat on a case-by-case basis.

6.6.1.1

In the case of a change of frequency, if the modification of the oscillator is limited to the replacement of the crystal by a crystal of the same type, or tuning the oscillator by the oscillator manufacturer, or reprogramming of the frequency synthesiser, the factory testing shall include:

a) measurement of absolute value of the beacon 406 MHz transmitted carrier frequency at ambient temperature; and

b) satellite qualitative test (section A.2.5).

6.6.1.2

In the case of oscillator replacement with an identical oscillator* and no other changes are required to the beacon electronics, or in the case of a change of frequency if the modification includes changes to circuits external to the frequency oscillator/synthesiser (e.g., an external trimmer), the factory tests shall include:

a) transmitted frequency (section A.3.2.1) at minimum, ambient and maximum temperature;

b) thermal shock (section A.2.2) excluding transmitted power and digital message;

* For the purpose of the Cospas-Sarsat type approval a replacement oscillator can be considered to be identical to the original oscillator if they have the same circuitry, packaging, physical dimensions and firmware (as applicable) and the replacement reference oscillator has electrical and mechanical parameters that are equal to, or better than, those of the original oscillator.

c) frequency stability with temperature gradient (section A.2.4) excluding transmitted power and digital message;

d) oscillator ageing and MTS analysis (section A.3.5); and

e) satellite qualitative test (section A.2.5).

6.6.1.3

In both cases (6.6.1.1 and 6.6.1.2 above) the technical file shall be submitted to the Secretariat including at least the following:

a) a change notice form (Annex H) specifying the details of frequency generation change;

b) the measurement results of required tests, in accordance with section 4.7; and

c) a technical data sheet describing the oscillator, including:

i. oscillator type,

ii. oscillator specifications, and

iii. assurance of oscillator manufacturer that the specification of the old and new oscillators are identical, except for the frequency, as appropriate, in the form of a detailed statement.

6.6.2 Changes to Frequency Generation which Might Affect Beacon Performance

If the alternative oscillator has different parameters, or alternative technology is used to generate the RF frequency (e.g. frequency synthesiser), or additional changes are required to the beacon electronics or firmware, the modified beacon shall be re-tested at a Cospas-Sarsat accepted facility.

The testing shall include:

a) transmitted frequency (section A.3.2.1) at minimum, ambient and maximum temperature;

b) thermal shock (section A.2.2);

c) operating lifetime at minimum temperature (section A.2.3);

d) frequency stability with temperature gradient (section A.2.4);

e) oscillator ageing and MTS analysis (section A.3.5);

f) re-calculations and analysis of $EIRP_{EOLmin/max}$ for all approved 406 MHz antenna models, based on results of the original type approval testing (sections B.10.3 and B.10.4) (only if beacon output power and / or $EIRP_{LOSS}$ have changed by more than 0.5 dB compared to the original type approval test results); and

g) satellite qualitative test (section A.2.5).

The beacon manufacturer shall submit technical data s per Section 5, indicated in items “a” (part G.1 only), “c”, “d”, “i”, j(ii),” k”,” m”, “q” and “r”.

6.7 Alternative Model Names for a Type Approved Beacon

If a beacon manufacturer wishes to have the type approved beacon designated under an alternative name (e.g., agent/distributor's name or model number), Annex H and Annex I of this document shall be completed and sent to the Secretariat.

The beacon manufacturer shall also submit technical data per Section 5, items “a” (part G.1 only), “e”, “f”, ”h”, “m” , “q” and “r”.

6.8 Beacon Hardware or Software Modifications

Any change to the beacon hardware or software which might affect the beacon electrical performance not specifically addressed above shall also be supported by a change notice form (Annex H) and test results as appropriate. The scope of the testing and the required technical data will be determined by Cospas-Sarsat Secretariat, following consultation with the manufacturer and the test facility after a review of the proposed modifications.

In the case of beacon changes that affect the software used to encode the position received from the navigation device into transmitted message, these beacons shall be updated to use the latest location protocol rules and be retested in accordance with A.3.8.

As a minimum all changes must be supported by satellite qualitative tests (A.2.5).

6.9 Change of Beacon Manufacturer

In case of a transfer of ownership / manufacturing rights for the type-approved beacon model to another organisation, or a change of beacon manufacturer’s name, an official letter shall be submitted to the Secretariat indicating:

a) nature of and date for the expected change;

b) the list of type-approved production and discontinued beacon models to be transferred (or rebranded);

c) indication of what organisation will be responsible for beacon production, maintenance of production standards, quality assurance, technical maintenance, repairs, battery replacement, customer support, and market distribution of the beacon model (not applicable for name change only);

d) whether a re-issue of type approval certificates in the name of new owner (or new company name) and changes to information published on Cospas-Sarsat website are required;

e) whether a revision of beacon manuals, marketing brochures and beacon labels is planned;

f) any new points of contact for beacon engineering, type approval and customer care.

For each beacon model concerned, the new beacon manufacturer shall also complete and submit Annex H and technical data per Section 5, items “a” (part G.1 only), “e”, “f”, ”h”, “m”, “q” and “r”.

6.10 Additional Variants and Types of Message Protocols

In cases when an additional variant of an earlier type approved type of message protocol is added, beacon manufacturer or an accepted test facility shall perform and submit results of the beacon coding software test.

In cases when an additional, not earlier approved type of message protocol is added, the modified beacon encoded with a variant of a new protocol type shall undergo at a Cospas-Sarsat accepted facility the following testing:

a) navigation system tests (section A.3.8), if applicable;

b) operating current measurements and analysis demonstrating that none of the currents recorded in Table F-E.1 are more than 1% greater than those measured prior to making the modification (which may be performed by the beacon manufacturer);

c) the operating lifetime test at minimum temperature (or a calculation demonstrating that with the increased current the beacon will still meet the lifetime requirement), if the results of the measurements and analysis in b) show an increase in current;

d) beacon coding software test, which may be performed by the beacon manufacturer; and

e) the satellite qualitative test (section A.2.5), in a single configuration only.

Beacon manufacturer shall complete and submit Annex H and technical data per section 5, items “a” (part G.1 only), “d”, “j(iv)”, “j(v)” (if applicable), “m”, “n”, “o” (if applicable), and “r” and only if there are changes to the items “e” and “n”.

6.11 Alternative Antennas

In cases of beacon modification to include an alternative antenna, such beacon shall undergo at a Cospas-Sarsat accepted facility the following testing:

a) antenna tests (Annex B) in all declared configurations;

b) transmitter power output level at ambient temperature (section A.3.2.2.1);

c) satellite qualitative test (section A.2.5).

Beacon manufacturer shall complete and submit Annex H and technical data per Section 5, items “a” (part G.1 only), “b”, “e”, “f”, “k”, “l”, “m”, “q”(if applicable), and “r”.

– END OF SECTION 6 –

ANNEXES
TO THE COSPAS-SARSAT
406 MHz DISTRESS BEACON
TYPE APPROVAL STANDARD

ANNEX A: BEACON MEASUREMENT SPECIFICATIONS

A.1 GENERAL

The tests required by Cospas-Sarsat for 406 MHz beacon type approval are described in this Annex and Annexes B, C, D and E, giving details on the parameters, defined in C/S T.001, which must be measured during the tests.

All measurements shall be performed with equipment and instrumentation which is in a known state of calibration, and with measurement traceability to National Standards. The measurement accuracy requirements for Cospas-Sarsat accepted test facilities are given in Annex A of C/S T.008. These measurement accuracies may be added to the beacon specification limits of C/S T.001 (thereby allowing a slight extra margin) when considering test results which are near the specification limit. For the Beacon Antenna Test Results (Table F-B.1 and Table F-B.3), the allowance cannot exceed a maximum 1 dB applied to no more than 4 measurement points (Table F-B.1), or 2 measurement points (Table F-B.3).

All measurement methods used by Cospas-Sarsat accepted test facilities (as defined in C/S T.007) must be approved by Cospas-Sarsat to ensure the validity and repeatability of test data.

In general, the test equipment used shall be capable of:

a) measuring the power that would be accepted by the antenna while the power is directed to a 50 Ohm load. An impedance matching network is to be provided for the test period by the beacon manufacturer. The matching network shall present a 50 Ohm impedance to the dummy load and shall present to the beacon power amplifier output the same impedance as would be present if the antenna were in place (the matching network is not required if the beacon power amplifier nominal output impedance is 50 Ohm and the beacon antenna VSWR measured relative to 50 Ohm is within the 1.5:1 ratio);

b) determining the instantaneous phase of the output signal and making amplitude and timing measurements of the phase waveform;

c) interpreting the phase modulation to determine the value of the encoded data bits;

d) measuring the frequency of the output signal;

e) producing gating signals synchronized with various features of the signal modulation;

f) maintaining the beacon under test at specified temperatures and temperature gradients while performing all other functions stated;

g) providing appropriate navigation input signals, if applicable; and

h) measuring the radiated power level, as described in Annex B.

A suggested sequence for performing the tests described herein is shown in Table F.1 of Annex F, but the tests may be performed in any other convenient sequence. However, it is highly recommended that when applicable, the tests requiring open air radiation be performed only after successful completion of conductive, non-radiation tests. The test results are to be summarized and reported as shown in Annex F, with appropriate graphs attached as indicated.

A.2 TESTS REQUIRED

A.2.1 Electrical and Functional Tests at Constant Temperature (test no. 1 to 8 in Table F.1)

The tests specified in para. A.3.1 through para. A.3.3 (except A.3.2.2.3, antenna tests) are performed after the beacon under test, while turned off (except for ELT(DT)s which shall be in the ARMED mode), has stabilized for a minimum of 2 hours at laboratory ambient temperature, at the specified minimum operating temperature, and at the maximum operating temperature. Except for testing in the self-test mode (per paragraph A.3.6), the beacon is then allowed to operate for 15 minutes before measurements are started, except for ELT(DT)s, for which measurements shall commence immediately after the ELT(DT) has been activated. The following parameters shall be measured at each of the three constant temperatures:

a) transmitter power output, per para. A.3.2.2 (except A.3.2.2.3 antenna tests);

b) digital message, per para. A.3.1.4;

c) digital message generator, per para. A.3.1, A.3.1.1, A.3.1.2 and A.3.1.3;

d) modulation, per para. A.3.2.3;

e) transmitted frequency, per para. A.3.2.1;

f) spurious output, per para. A.3.2.2.4;

g) VSWR check, per para. A.3.3; and

h) self-test mode and GNSS self-test mode (if applicable), per para. A.3.6.

A.2.2 Thermal Shock Test (test no. 9 in Table F.1)

The beacon under test, while turned off, is to stabilize at a selected temperature in its operating range. The beacon is then simultaneously placed into an environment held at 30 degrees C offset from the initial temperature and turned on. The beacon is then allowed to operate for 15 minutes before measurements are started (except for ELT(DT)s for which measurements shall commence immediately) after the beacon activation to measure the following parameters:

a) transmitted frequency, per para. A.3.2.1;

b) transmitter power output, per para. A.3.2.2.1; and

c) digital message, per para. A.3.1.4.

Frequency measurements are made continually for two hours. Stability analysis is performed for these frequency samples as in para. A.3.2.1 (except ELT(DT)s for which verification of the Medium-Term Frequency Stability characteristics is not required). The 18-sample analysis window of the stability calculations is advanced in time through the period such that each succeeding data set includes the latest frequency sample and drops the earliest one. Power output

per para. A.3.2.2.1 and digital message checks per paragraph A.3.1.4 shall also be made continually throughout the two-hour period.

A.2.3 Operating Lifetime at Minimum Temperature (test no. 10 in Table F.1)

The beacon under test is operated at its minimum operating temperature for its rated life. During this period, the following parameters are measured on each transmission:

a) transmitted frequency, per para. A.3.2.1;

b) transmitter power output, per para. A.3.2.2.1; and

c) digital message, per para. A.3.1.4.

The 18-sample analysis window of the stability calculations is advanced in time through the period such that each succeeding data set includes the latest frequency sample and drops the earliest one.

If beacon is intended to be encoded with short or long format messages, this test shall be performed with a long format message. If the beacon includes an internal GNSS receiver, this test shall be performed in an environment that ensures that the GNSS receiver draws the maximum energy from the battery (e.g. ensuring that any GNSS receiver sleep time is minimised over the test duration).

The operational lifetime test is intended to establish with reasonable confidence that the beacon will function at its minimum operating temperature for its rated life using a battery that has reached its expiration date*. To accomplish this, the lifetime test of a beacon with its circuits powered from the beacon battery prior to beacon activation shall be performed with a fresh battery pack which has been discharged to take into account:

i. the depletion in battery power resulting from normal battery loss of energy due to battery ageing over the rated life of the battery pack,

ii. the average current drain resulting from constant operation of the circuits powered from the beacon battery prior to beacon activation over the rated life of the battery pack,

iii. the number of self-tests, as recommended by the beacon manufacturer and, when the function is included, the maximum number and maximum duration of GNSS self-test transmissions, over the rated life of the battery pack (the beacon manufacturer shall substantiate the method(s) used to determine the corresponding current drain(s)),

iv. the worst case depletion in battery power due to current draw that cannot be replicated during the lifetime test, for example, to account for any difference between the actual output power setting of the test unit homer

* The beacon manufacturer shall provide data necessary to discharge a fresh battery pack at room temperature to account for current drain over the battery pack rated life time. The battery discharge figures provided by the beacon manufacturer shall be verified by the testing laboratory with current measurement results reported in the format of Table F-E.1 and pre-test battery discharge calculations reported in the format of Table F-E.2.

transmitter and the output power of the homer transmitter, as declared by the beacon manufacturer in Annex G, and

v. a correction coefficient of 1.65 applied to item (ii) and item (iii) to account for differences between battery to battery, beacon to beacon and the possibility of exceeding the battery replacement time.

After the battery pack has been appropriately discharged, the beacon is tested at its minimum operating temperature for its rated life as indicated above. Discharge of the battery may be replaced by the equivalent extension of the operating lifetime test.

Measurements shall start after soaking of beacon at minimum temperature for 2 hours, upon beacon activation, without allowing a beacon warm-up. However, compliance to medium-term frequency stability requirements (not applicable to ELT(DT)s) is applicable only for measurements taken 15 minutes after beacon activation, in accordance with C/S T.001 section 2.3.1.

If applicable, homer transmitter characteristics, including homer frequency, peak power level and transmitter duty cycle shall be measured during the lifetime test at least in the beginning and at the end of the test and the results recorded in Table F.1.

A.2.4 Frequency Stability Test with Temperature Gradient (test no. 11 in Table F.1)

The beacon under test, while turned off, is to stabilize for 2 hours at the minimum specified operating temperature. It is then turned on and subjected to temperature gradient specified in Figure A.1, during which time the following tests are performed continually on each burst:

a) transmitted frequency, per para. A.3.2.1;

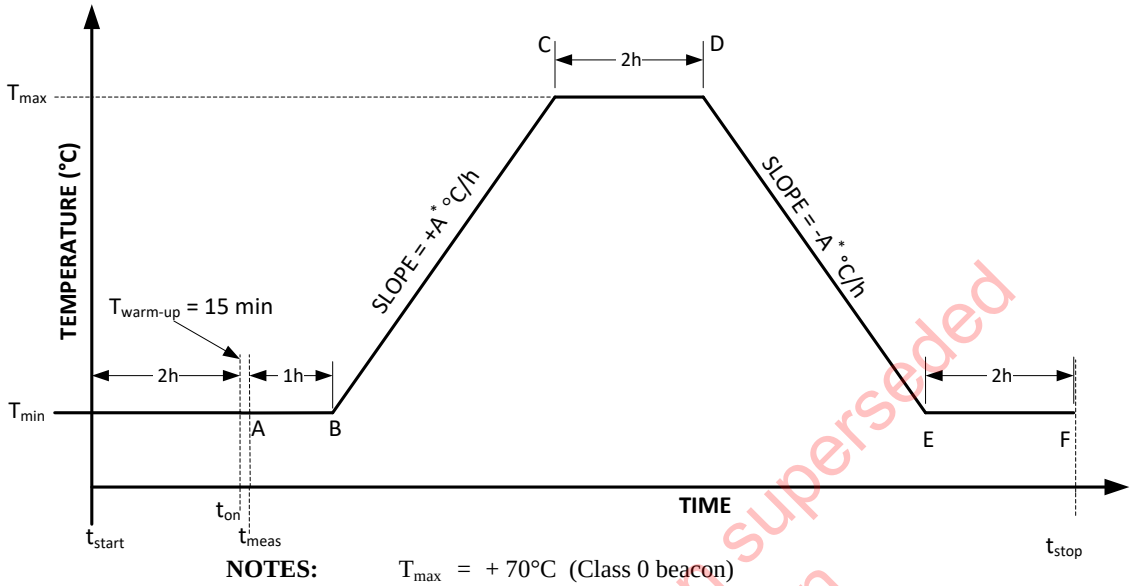
b) transmitter power output, per para. A.3.2.2.1; and

c) digital message, per para. A.3.1.4.

The 18-sample analysis window of the stability calculations is advanced in time through the period such that each succeeding data set includes the latest frequency sample and drops the earliest one. A 15-minute warm-up is allowed at the beginning of the test, after which measurements shall start, except ELT(DT)s for which measurements shall start immediately after beacon activation.

When a battery replacement is required, two separate tests shall be performed. The up-ramp test is from t_{start} to point D (see Figure A.1) and the down-ramp test is from point C to t_{stop}. Before point C of the down-ramp, the beacon under test, while turned off, is to stabilize for 2 hours at +55°C and is then turned on and allowed a 15 minute warm-up period (except ELT(DT)s).

Figure A.1: Temperature Gradient Test Profile



NOTES:

T_{max} = + 70°C (Class 0 beacon)
T_{max} = + 55°C (Class 1 & 2 beacons)

T_{min} = - 55°C (Class 0 beacon)
T_{min} = - 40°C (Class 1 beacon)
T_{min} = - 20°C (Class 2 beacon)

t_{on} = beacon turn-on time after 2 hour "cold soak"
t_{meas} = start time of frequency stability measurement (t_{on} + 15 min, except for ELT(DT)s where $t_{meas} = t_{on}$)

A^* = 7°C/hour for Class 0
A^* = 5°C/hour for Class 1 and Class 2

Table A.1: Medium-Term Frequency Stability Requirements During Temperature Gradient Test (Except for ELT(DT)s)

Points in Figure A.1	Requirements	
	Mean Slope, $x10^{-9}$/min	Residual frequency variation, $x10^{-9}$
During warm-up	**No Requirement**	**No Requirements**
A to B	-1.0 to +1.0	≤ 3.0
B to C+15 minutes	-2.0 to +2.0	
C+15 minutes to D	-1.0 to +1.0	
D to E+15 minutes	-2.0 to +2.0	
E+15 minutes to F	-1.0 to +1.0	

A.2.5 Satellite Qualitative Test (test no. 14 in Table F.1)

This test is to be performed only in coordination with the cognizant Cospas-Sarsat Mission Control Centre (MCC) and local authorities. The beacon should operate in its nominal configuration, if possible. However, if the beacon includes a homing transmitter operating on a distress frequency (e.g., 121.5 MHz or 243 MHz), this transmitter may need to be disabled or offset from the distress frequency for this test, as per the national requirements of the test facility.

This test shall be performed in environment(s) which approximate, as closely as practicable, the intended use of the beacon. Required test configurations are shown in Figure 4.2 and are dependent on the manufacturer's declaration of Operational Configurations in Annex G.

The test beacon shall have its own antenna connected and shall be coded with a test protocol of appropriate type and format (see sections 4.3 and A.3.1.4). Other parameters of the test beacon message coding including "Country Code" shall be set in coordination with the MCC.

For testing of beacons with external/remote antennas, the antenna cable assembly used in the test shall have at least the maximum declared insertion loss (see section 5 "l"). For such beacons, the antenna cable assembly may be provided by a beacon manufacturer, in which case its loss at 406 MHz shall be verified by the test facility.

The beacon shall be turned on for 15 minutes prior to the start of this test and then operated in the open for at least 5 LEOSAR satellite passes characterised by cross track angles between 1 and 21 degrees, and with bursts that bracket the satellite time of closest approach (TCA) to the beacon.

The pass/fail criteria are as follows:

a) LEOLUT solutions producing the correct beacon 15 hexadecimal identification must be provided for all satellite passes with cross track angles between 1 and 21 degrees; and

b) at least 80% of the LEOLUT Doppler locations, associated with satellite passes with cross track angles between 1 and 21 degrees and with bursts that bracket TCA, must be accurate to within 5 km.

For beacons with the RLS function, the test shall commence without a 15 minute warm up period, then within 15 minutes after activation of the beacon, the beacon shall indicate reception of the Type 1 acknowledgement as indicated in document C/S T.001, section 4.5.7.3.

For ELT(DT)s, the test shall commence without a 15-minute warm-up period after activation. Also for ELT(DT)s, the test data shall be obtained from MEOSAR satellites rather than LEOSAR. The test shall be performed at a known location 3 times for a period of between 15 to 20 minutes each time separated by a period of 5 to 7 hours between each test when there are at least 4 MEOSAR satellites in co-visibility with the ELT(DT) and MEOLUT capable of tracking the satellites in question (either L-or S-Band or a combination of these).

The pass/fail criteria for ELT(DT)s is as follows:

a) The MEOLUT shall produce an alert with a complete beacon message, including the correct beacon 15 hexadecimal identification, at least once every minute for greater than 90% of the total test time;

b) The encoded location provided by the MEOLUT for each alert in a) above shall be accurate in the horizontal plane to within 200 metres for greater than 90% of the alerts; and

c) The encoded location provided by the MEOLUT for each of the alerts in a) above shall be accurate in the vertical plane such that the altitude above sea level* is correctly reported as follows:

   i. if the actual test location altitude above sea level is within 200 metres of one of the encoded altitude band edges, then the ELT(DT) either reports the altitude band or reports the adjacent band on the side that is within 200 metres, or

   ii. alternatively if the actual test location altitude above sea level is not within 200 metres of one of the encoded altitude band edges, then the ELT(DT) reports that altitude band, and

   iii. in both cases the correct altitude band (see C/S T.001 Section A3.3.2.4) shall be reported as defined above for greater than 90% of the correctly decoded bursts.

Successful completion of this test shall be indicated by a "√" in Table F.1, and a “Satellite Qualitative Test Summary Report (Appendix A to Annex F)” shall be provided for each operational configuration tested. The “Satellite Qualitative Test Summary Reports” shall indicate all LEOSAR satellite passes with cross track angles between 1 and 21 degrees for the period of the testing, even if a solution was not produced by the LEOLUT.

For ELT(DT)s, LEOSAR passes do not apply, and instead, ELT(DT) test report shall indicate the time of the tests and tracking schedule of the MEOLUT supporting the tests (including starting and ending azimuth and elevation of each MEOSAR satellite tracked during the test).

Photos of the beacon with the antenna deployed shall be included in the report for all tested configurations.

* The test shall be performed at an altitude of less than 4000 metres above sea level.

A.2.6 Beacon Antenna Test (test no. 15 in Table F.1)

The beacon antenna test, described in section A.3.2.2.3 and Annex B, shall be performed at the ambient temperature of the test facility and a correction factor shall be applied to the data to calculate the radiated power at minimum temperature at the end of the operating lifetime. This test shall be performed using the non-modified test beacon, including the navigation antenna, if applicable. For all tested configurations, photos of the test set-up shall be included in the report.

A.2.7 Navigation System Test, if Applicable (test no. 17 in Table F.1)

For beacons incorporating the optional capability to transmit encoded position data (mandatory in ELT(DT)s), some additional tests, described in section A.3.8, are required to verify the beacon output message, including the correct position data, BCH error-correcting code(s), default values, and update rates, if applicable. With the exception of the Position Data Encoding test (A.3.8.7) the navigation input system shall be operating for the duration of all tests to ensure that it does not affect the 406 MHz signal and that the beacon can operate for the required operating lifetime. The beacon output digital message shall be monitored during all tests, as described in section A.3.1.4.

If the beacon has a homer transmitter or ancillary devices, the transmitter shall be operated and all ancillary devices shall be active for all navigation system tests.

Please note:

a) navigation tests shall be performed for one variant of each of the declared User-Location, Standard Location, National Location, ELT(DT) Location and RLS Location protocols;

b) simulators shall not be used to replicate signals from GNSS satellites, unless stated otherwise;

c) in the case of beacons that interface with external navigation devices, a simulated data stream provided in the format/protocol of the navigation interface may be used in lieu of an actual GNSS receiver;

d) when GNSS simulators are used, the peak level of a simulated navigation signal (per simulated satellite) shall be no higher than -123 dBm for all tests, except the Position Acquisition Time and Position Accuracy test, for which the peak level of a signal (per simulated satellite) shall be set to no higher than -130 dBm. For ELT(DT)s, the GNSS simulator shall also be able to simulate movement of the ELT(DT) at speeds of at least 1,000 km/h and with an altitude range from -100 m to 11,000 m; and

e) for RLS-enabled beacons, the correct activation of the RLS indicator shall be verified.

A.2.8 Beacon Coding Software (test no. 16 in Table F.1)

The digital message for each beacon message protocol supported by the beacon shall be verified at ambient temperature according to A.3.1.4. This test shall evaluate both the real and self-test modes for each beacon message protocol. For the purpose of validating specific beacon message protocols, the beacon shall be programmed in accordance with the guidance provided at Annex C.

For location protocols, verification of 2 messages with encoded position data is required, the second message shall be provided with encoded position at least 500 metres from the first position for the National, Standard, ELT(DT) and RLS location protocols, or 10 km for the User-Location protocol. The verification of the digital message does not require a change of location of the beacon.

For RLS-enabled beacons check the correct operation of the RLS Indicator for the RLS message protocol.

The content of the complete digital message for both operational and self-test transmissions (including bits 1-24) shall be included in the test report as per Appendix D to Annex F.

This test can be conducted either by the test laboratory or by the beacon manufacturer. If performed by the beacon manufacturer, the manufacturer shall provide the test laboratory with the required test results for verification and inclusion in the test report. The test laboratory shall annotate Table F.1 with a “tick”, if all beacon messages for all protocols are compliant with Cospas-Sarsat requirements.

Type approval will not be granted to beacons using the short format variants of location protocols.

A.2.9 Testing Beacons Designed to Transmit Short- or Long-Format Messages

If a beacon is designed to allow encoding with either long format or short format messages, all tests shall be performed using long format message. In addition, beacon encoded with a short format message shall be subjected to:

a) Electrical and Functional tests (as per A.2.1) at ambient temperature, excluding Transmitter Power Output, Spurious Output, VSWR check and Transmitted Frequency tests; and

b) Beacon Coding Software test.

A.3 MEASUREMENT METHODS

A.3.1 Message Format and Structure

The repetition period T_R and the duration of the unmodulated carrier T_1 are illustrated in Figure A.2. (Note: many of the following measurements can be performed on the same set of at least 18 bursts).

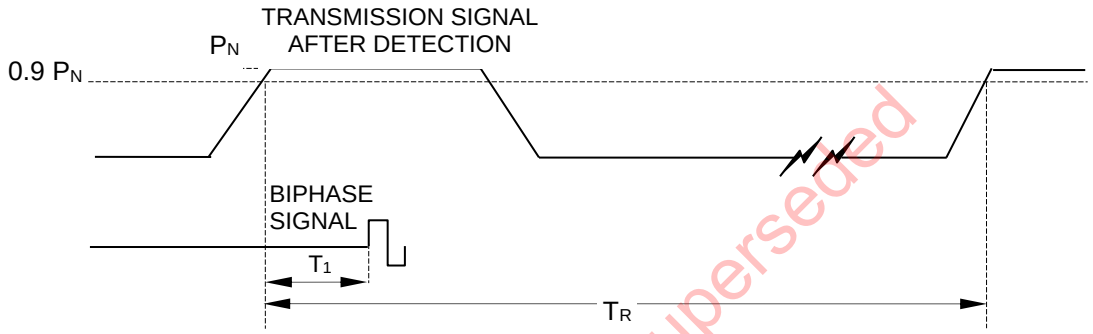


Figure A.2: Transmission Timing

A.3.1.1 First Burst Delay and Repetition Period

The first burst delay (FBD) is the time interval between the time of an action to activate beacon and the time of the beginning of the first operational burst, defined as the time when the beacon transmitter reaches 90% of the nominal transmit power P_N (see Figure A.2).

As specified in section 4.5.6 of C/S T.001, the FBD value shall not be less than 47.5 seconds for all beacon types, except for ELTs when activated automatically by G-switch / deformation and ELT(DT)s, for which the value of FBD shall not exceed:

i. for ELTs activated by G-switch/deformation 15 seconds, and*
ii. for ELT(DT)s 5 seconds

The value of measured FBD shall be recorded in Table F.1.

If there are 406 MHz self-test bursts observed prior to the first operational 406 MHz burst, these observations shall be recorded in the test report and reflected in Table F.1.

The repetition period, T_R, between the beginnings of two successive transmissions (see Figure A.2) shall be randomised over the range of 47.5 to 52.5 seconds, except for ELT(DT)s. At least 18 successive measurements shall be made and for all beacons except ELT(DT)s the difference between the maximum and minimum repetition periods shall be more than 4

* This requirement is mandatory to new beacon models submitted for type-approval testing at accepted test facilities after [1 January 2018].

seconds. The average repetition period shall be 50s ± 1.5s. The standard deviation of the 18 values of T_R shall be between 0.5 and 2.0 seconds. The minimum value of T_R observed shall be between 47.5 and 48.0 seconds, the maximum value of T_R observed shall be between 52.0 and 52.5 seconds. The standard deviation, average, maximum and minimum values of T_R shall be recorded in Table F.1.

For ELT(DT)s the repetition period, T_R, between the beginnings of two successive transmissions (see Figure A.2) shall be randomised over the range of 27.0 to 30.0 seconds after the first 30 seconds of activation. During the first 30 seconds the repetition period shall be 5.0 seconds (+0/ -0.2s) without randomisation. The results of the repetition period measurements during the first 30 seconds shall be recorded in Table F.1. At least 18 successive measurements shall be made after the first 30 seconds of activation. The average repetition period shall be 28.5 seconds ± 0.9 second. The standard deviation of at least 18 measured values of T_R shall be between 0.3 and 1.2 second. The minimum value of T_R observed shall be between 27.0 and 27.3 seconds, the maximum value of T_R observed shall be between 29.7 and 30.0 seconds. The standard deviation, average, maximum and minimum values of T_R shall be recorded in Table F.1.

In the event that the testing does not demonstrate conformance to the minimum or maximum T_R, requirements, the test may be repeated a maximum of three times. If the test is repeated, the results for each shall be recorded in Table F.1.

A.3.1.2 Duration of the Unmodulated Carrier

The unmodulated carrier duration, T_1, between the beginning of a transmission and the beginning of the data modulation (see Figure A.2) shall satisfy the following requirement, where the values are derived from at least 18 successive measurements:

$$158.4 \text{ ms} \leq T_1 \leq 161.6 \text{ ms}$$

The maximum and minimum values of T_1 are to be recorded in Table F.1.

A.3.1.3 Bit Rate and Stability

The bit rate, f_b , in bits per second (bps) which is measured over at least the first 15 bits of one transmission, shall satisfy the following requirement, where the values of f_b are provided from at least 18 successive measurements:

i. for all beacons except those below 396 bps $\leq f_b \leq$ 404 bps, and

ii. for ELT(DT)s and those with RLS Location Protocol 399.6 bps $\leq$ fb $\leq$ 400.4 bps.

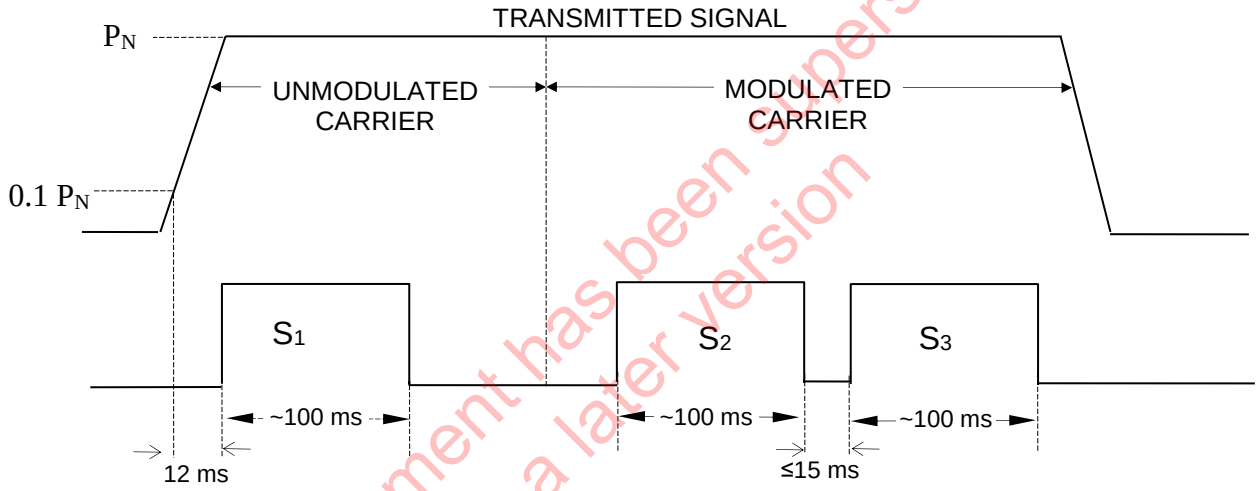
The maximum and minimum values of f_b are to be recorded in Table F.1.

A.3.1.4 Message Coding

The content of the demodulated digital message shall be checked for validity and compliance with the format for each data field, bit by bit, and the BCH error correcting code(s) shall be checked for correctness.

The content of the digital message shall be monitored during all tests. Note that protocols that support encoded location information (e.g., User-Location, Standard Location, National Location, RLS Location and ELT(DT) Location) shall only be used in beacons that are designed to accept location information from a navigation system.

A.3.2 Modulator and 406 MHz Transmitter



The S_1 pulse starts 12 ms after the beginning of the unmodulated carrier.
The S_2 pulse starts at the beginning of bit 23.
The S_3 pulse starts not later than 15 ms after the end of S_2.

Figure A.3: Definition of Measurement Intervals

A.3.2.1 Transmitted Frequency

Frequency measurements shall be made during each transmission, either directly at 406 MHz or at a stable down-converted frequency, during various intervals of approximately 100 milliseconds, as shown in Figure A.3.

The various frequency and frequency stability computations defined hereunder can all be made using data collected from the same set of at least 18 transmissions.

A.3.2.1.1 Nominal Value

The mean transmission frequency, f_0, shall be determined from 18 measurements of $f_i^{(1)}$ made during the interval S_1 during 18 successive transmissions, as follows:

$$f_0 = f^{(1)} = \frac{1}{n}\sum_{i=1}^{n} f_i^{(1)}$$

where n=18

A.3.2.1.2 Short-Term Stability

The short-term frequency stability shall be derived from measurements* of $f_i^{(2)}$ and $f_i^{(3)}$ made during the intervals S_2 and S_3 during 18 successive transmissions, as follows:

$$\sigma_{100ms} = \left\{ \frac{1}{2n}\sum_{i=1}^{n} \left(\frac{f_i^{(2)} - f_i^{(3)}}{f_i^{(2)}} \right)^2 \right\}^{1/2}$$

where n=18

The above relationship corresponds to the Allan variance. The measurement conditions used here are different (i.e. dead time between two measurements). Experience, however, has shown that the results obtained are very close to those achieved under the normal measurement conditions for the Allan variance.

* To correctly measure the short-term frequency stability, it is essential that an equal number of positive and negative phase transitions are included in the gating intervals defined as S_2 and S_3 in Figure A.3, hence these intervals are only approximately 100 ms duration.

A.3.2.1.3 Medium-Term Stability (not applicable to ELT(DT)s)

The medium-term frequency stability shall be derived from measurements of $f_i^{(2)}$ made over 18 successive transmissions at instants t_i (see Figure A.4).

For a set of n measurements*, the medium-term frequency stability is defined by the mean slope of the least-squares straight line and the residual frequency variation about that line.

The mean slope is given by:

$$A(t_n) = \frac{n\sum_{i=1}^{n} t_i f_i - \sum_{i=1}^{n} t_i \sum_{i=1}^{n} f_i}{n\sum_{i=1}^{n} t_i^{\,2} - \left(\sum_{i=1}^{n} t_i\right)^2}$$

where n=18

The ordinate at the origin of the least-squares straight line is given by:

$$B = \frac{\sum_{i=1}^{n} f_i \sum_{i=1}^{n} t_i^{\,2} - \sum_{i=1}^{n} t_i \sum_{i=1}^{n} t_i f_i}{n\sum_{i=1}^{n} t_i^{\,2} - \left(\sum_{i=1}^{n} t_i\right)^2}$$

where n=18

The residual frequency variation is given by:

$$\sigma(t_n) = \left\{ \frac{1}{n} \sum_{i=1}^{n} \left(f_i - A t_i - B \right)^2 \right\}^{1/2}$$

where n=18

* With a transmission repetition period of approximately 50 seconds, there will be 18 measurements during an approximate 15 minute period (i.e. n=18). The time reference for this group of 18 measurements is to be taken as the time of the last measurement in the group, (i.e. t_n). When reporting results of the medium-term frequency stability, the values of calculated mean slope (A) and residual frequency variation (σ) shall be divided by the value of the mean transmission frequency (f_0), defined in section A.3.2.1.1.

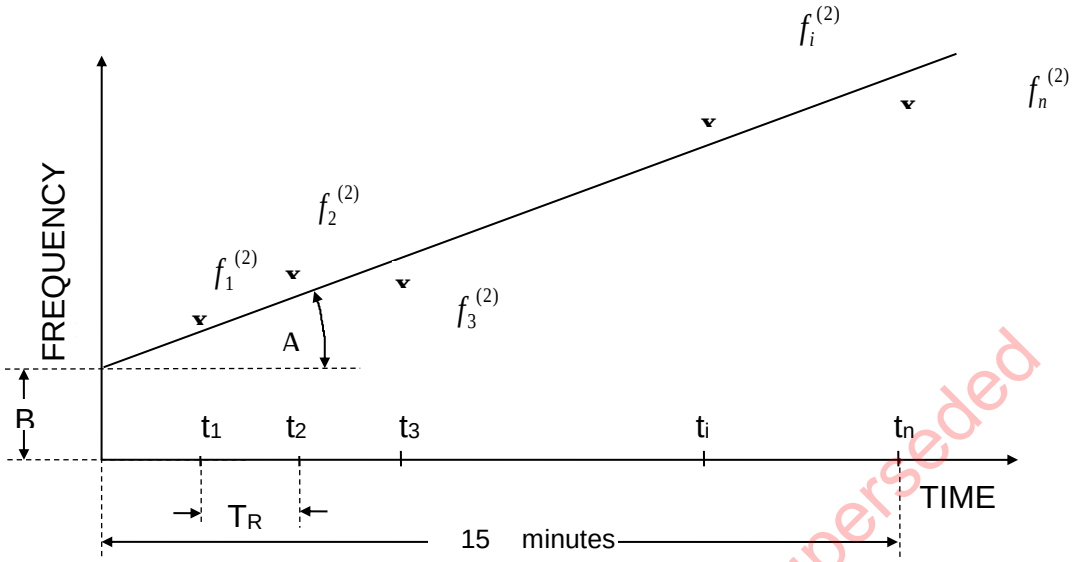


Figure A.4: Medium-Term Frequency Stability Measurement (not to scale)

A.3.2.2 Transmitter Power Output

A.3.2.2.1 Transmitter Power Output Level

The transmitter power output level shall be measured at the transmitter output. During output power measurement, the antenna shall be replaced by a dummy load that presents to the transmitter an impedance equal to that of the antenna under normal operation conditions. The RF losses of any impedance matching network which is connected to the beacon only for test purposes shall be accounted for in the power output measurement.

The minimum and maximum values of transmitter output power measured over the full test interval shall be reported in Table F.1.

A.3.2.2.2 Transmitter Power Output Rise Time and Power Level 1 ms Before Burst

The transmitter power output rise time may be determined on an oscilloscope by measuring the rise time of the burst envelope from the 10% power point to the 90% power point.

The power output level, measured 1 millisecond before the 10% power point, shall be less than -10 dBm. (Note: this can be measured using a spectrum analyzer in its "zero span" mode, with a wide resolution bandwidth (e.g., ≥3 kHz), with the beacon output signal activating the video trigger to start a sweep). To reduce possible variation of measurement results due to noise, it is recommended to repeat the test 10 times and average the results of the output power level 1 ms before the burst.

The minimum and maximum values of transmitter output power measured over the full measurements interval, the power output rise time and the power output 1 ms before burst shall be reported in Table F.1.

A.3.2.2.3 Antenna Characteristics

The antenna characteristics test procedure is given in Annex B of this document. Successful completion of these tests is sufficient to show that the beacon meets the antenna and radiated output requirements for Cospas-Sarsat Type Approval. Alternative procedures may also be used to provide equivalent information, but these procedures must be agreed by the Cospas-Sarsat Secretariat in advance.

For antennas tested separately from beacons, either the procedures of Annex B (with "Beacon Under Test" replaced by "Antenna Under Test" where appropriate), or equivalent conventional antenna range test procedures may be used to demonstrate the antenna radiation pattern. In any case, the test results for all beacons except ELT(DT)s shall demonstrate that the antenna, when receiving an input power level of 37 dBm produces an EIRP within the limits 34 dBm to 41 dBm for at least 90% of the measurement coordinates of Annex B, except for Figure B.5 configuration, in which it shall produce EIRP within the limits 32 dBm to 41 dBm for at least 80% of the measurement coordinates.

ELT(DT)s shall demonstrate that the antenna, when receiving an input power level of 37 dBm produces an EIRP within the limits 35 dBm to 43 dBm for at least 90% of the measurement coordinates for the test configuration described in Figure B.3 of Annex B.

A.3.2.2.4 Spurious Output

This measurement shall be performed with the beacon operating into 50 Ohms. The resolution bandwidth for the measurement of the spurious emission levels shall be 100 Hz or less. If this measurement is made on a spectrum analyzer, the spectrum analyzer display shall be used on a maximum hold for a period which is long enough to integrate the entire frequency spectral response. The 406 MHz beacon type approval test report shall include spectral plots showing instrumental settings of spectrum analyzer (e.g., resolution bandwidth, video bandwidth, sweep time, frequency span, etc.) and depicting the complete 406.0 MHz to 406.1 MHz band.

A.3.2.3 Modulation

The modulation sense, the modulation index, the modulation rise and fall times, and the modulation symmetry of the bi-phase demodulated signal may be checked with an oscilloscope.

The modulation rise and fall times, t_R and t_F, and the modulation symmetry are defined in C/S T.001 and are different for ELT(DT)s.

The modulation characteristics measurement* shall be performed during the first 15 bits of the modulated portion of the transmission and average values determined for the positive and negative phase deviations. It is recommended to display or monitor the complete demodulated transmission.

The minimum and maximum values of the modulation index and modulation rise and fall times, and the maximum value of modulation symmetry shall be reported in Table F.1.

A.3.3 Voltage Standing-Wave Ratio

With a matching network removed (if applicable), the transmitter shall be operated into an open circuit for a minimum period of 5 minutes, and then into a short circuit for a minimum period of 5 minutes. Afterwards, the transmitter shall be operated into a load having a VSWR of 3:1 (pure resistive load R < 50 Ohm i.e. R=17 Ohm), during which time the following parameters shall be measured:

a) transmitter nominal frequency, as per para. A.3.2.1.1;

b) digital message content, as per para. A.3.1.4; and

c) the modulation parameters, as per para. A.3.2.3.

This sequence of transmitter loads and measurements shall be performed at maximum, minimum and ambient temperatures.

A.3.4 Protection Against Continuous Transmission

If possible, the protection against continuous transmission shall be checked by inducing a continuous transmission from the beacon under test. However, if the beacon manufacturer has determined that this test is not feasible for his beacon, he must provide a technical explanation which demonstrates that his design complies with the specification.

A.3.5 Oscillator Aging

Long-term frequency stability shall be demonstrated by data (e.g. oscillator manufacturer's test data) provided by the beacon manufacturer to the test facility.

* Any overshoot observed in the modulation index (as illustrated in Figure 2.5 of C/S T.001) can be disregarded if its amplitude does not exceed 10% of the specification limit and its duration does not exceed 10% of a half-bit period. This means that the overshoot can be ignored if the absolute value of the modulation index remains within these limits. That is, the modulation index may go out of the specification limits (1.0 to 1.2 radians) momentarily following the phase transition, provided the absolute value of the modulation index remains between 0.90 radians and 1.32 radians (1.0 - 10% and 1.2 + 10%), and returns to the normal specification in less than 0.125 ms (10% of the half-bit period of 1.25 ms) after it departed from those limits. Any overshoots shall be analysed by the test laboratory and a statement regarding whether they can be disregarded shall be provided as comments to items 4 or 7 of Table F.1.

For oscillators which require compensation over the operating temperature range, measurement results and a technical analysis shall be provided to substantiate that the medium-term stability would remain within specification after five years [*, †].

A.3.6 Self-test Mode

The manufacturer shall provide a list of the parameters that are monitored in the self-test mode (see Annex G). If a GNSS self-test is also provided for, this shall be noted and any additional parameters included.

The test shall verify that the self-test mode:

a) results in a single self-test burst transmission,

b) does not cause any operational mode transmissions,

c) terminates automatically immediately after completion of the self-test cycle and indication of the self-test results; and

d) has a duration that does not exceed the maximum value declared in Annex G.

The duration of the 406 MHz burst shall be measured, the frame synchronization pattern shall be checked and, if applicable, the encoded location checked for correct default code.
The test shall verify that activation of the Self-test Mode results in distinct indications that:

a) the self-test mode has been initiated;

b) RF-power is being emitted at 406 MHz and at 121.5 MHz, if applicable;

c) the Self-test has passed successfully, or has failed; and

d) the beacon battery may not have sufficient energy to support beacon operation for the declared operating lifetime (note distinct indication of sufficient energy is not mandatory)[‡].

In addition, if a GNSS self-test mode is provided, the encoded location shall be checked against the known location to the accuracy defined in C/S T.001 paragraph 4.5.5.3 for the applicable

* The requirement can be addressed for example by measuring the medium-term stability on a batch of oscillators over a period of at least 6 months and extrapolating the results over 5 years. This can be achieved by testing a batch of at least 20 oscillators which should be measured every 4 to 6 weeks over a period of at least 6 months. The change in the medium-term slope and residual components should be calculated for each oscillator in a batch. The extrapolated results for at least 90% of the oscillators tested shall meet the performance requirements of the document C/S T.007. It is expected that any oscillator variants will be separately tested unless the manufacturer can demonstrate that they are technically equivalent to the tested oscillator.

† The test facility shall perform and report the results of the technical analysis to determine compliance of 406 MHz beacons equipped with a TCXO with Cospas-Sarsat type approval requirements, per C/S IP(TCXO).

‡ By decision of the Cospas-Sarsat Council at its Fifty-Seventh Session, this requirement will be mandatory only for new beacon models submitted for type approval testing after 1 January 2018, as a target, subject to further review and consideration.

protocols or paragraph 4.5.5.6 for ELT(DT)s. The format flag bit shall be reported. The self-test mode(s) shall be tested to verify that any transmission is limited to one self-test burst only. If a GNSS self-test is provided for, it shall be verified that inadvertent activation of this mode is precluded.

The GNSS self-test mode shall be tested at ambient temperature to verify that:

a) inadvertent activation of GNSS self-test mode is precluded;

b) it is limited in duration (all location protocol beacons) and number of GNSS self-test transmissions (beacons with internal navigation devices powered by primary battery only);

c) a distinct indication of successful completion or failure of the GNSS self-test is provided and for ELT(DT)s the beacon transmits a single self-test message with the correct encoded location; and

d) a separate distinct indication that the limited number of GNSS self-test attempts has been attained is provided immediately after GNSS self-test mode activation and without transmission of a test message or further GNSS receiver current drain.

For beacons with interface to external navigation device or for beacons that have an internal GNSS receiver that is capable for independent operation, the self-test mode test at ambient temperature shall be performed as follows. During the test, a navigation signal shall be provided and sufficient time shall be allowed for position acquisition to be obtained by an internal GNSS receiver or for position data to be acquired from the external navigation device, prior to initiating a self-test.

All beacons capable of transmitting encoded location data shall be subjected to the self-test navigation test scripts contained in Annex D.

Design data shall be provided on protection against repetitive self-test mode transmissions.

A.3.7 Ancillary Electrical Devices in the Beacon

It is recommended that all graphs and tables which make reference to beacon burst characteristics be annotated in a manner that identifies the times at which ancillary devices are in operation, or when operating modes are changed.

A.3.7.1 Automatically Controlled Ancillary Devices

Automatically controlled ancillary devices in the beacon (e.g. homing transmitter, Search and Rescue Radar Transponder (SART), strobe light, etc.) must be operating for the duration of the tests in the laboratory to ensure that they do not affect the 406 MHz signal and that the battery can operate the full load for the required operating lifetime. (Note that for beacon tests through the satellite, any homing transmitter may need to be turned off or offset from the distress frequency, as per the national requirements of the test facility.)

A.3.7.2 Operator Controlled Ancillary Devices

Type approval testing of beacons with ancillary devices under operator control shall be designed to confirm that the ancillary devices do not degrade beacon transmission characteristics, including frequency stability, timing, and modulation. This may be accomplished by causing the ancillary devices that are under operator control to be activated periodically during the measurement of these characteristics.

The timing of the periodic activation of ancillary devices shall be such that the instants of activation and deactivation occur over the full range of times relative to the beacon transmission burst, with the intent of detecting any effects of the activations or deactivations on the signal characteristics. The activation-deactivation regime shall be carried out for selected intervals spaced out over the duration of the long term tests (i.e. thermal shock, temperature gradient) to characterise the performance of the beacon over the entire range of operating conditions.

The test procedure shall include the operating life tests with the ancillary devices set in the operating mode that draws maximum battery energy. During this test the activation deactivation regime shall be carried out at suitable intervals. An example of test procedure for a beacon with an operator controlled voice transceiver function is provided at Annex E.

A.3.8 Navigation System (if applicable)

Except for the position data encoding test (section A.3.8.7), the navigation input system must be operating for the duration of all tests to ensure that it does not affect the 406 MHz signal and that the beacon can operate for the required operating lifetime. For a beacon operating with an external navigation device, navigation data input shall be provided in the same way as it would be by an operational navigation device.

All the tests specified below shall be performed at ambient temperature. A check for valid BCH code shall be performed throughout these tests, and any examples where the encoded BCH was not correct shall be specifically identified in the test report and an annotation provided at item 17 of Table F.1.

A.3.8.1 Position Data Default Values

If valid navigation data is not available in the beacon memory at the time the beacon transmits a 406 MHz message, the message shall contain default values for position data bits as specified in C/S T.001. To test this, ensure that no navigation input is present for at least 4 hours and 5 minutes (except for ELT(DT)s where no navigation signal shall be present for at least 11 minutes) (i.e., remove the appropriate navigation signal or navigation data input to the beacon), then activate and operate the test beacon for 30 minutes. Verify that the default values for position data are present in the digital message throughout this period and for ELT(DT)s that bits 113 and 114 are correctly set. Deactivate the beacon. Record the results with a pass/fail indication at item 17 of Table F.1.

A.3.8.2 Position Acquisition Time and Position Accuracy

A.3.8.2.1

At a known location, apply the appropriate navigation signal or navigation data input to the beacon. Activate the beacon and verify that the position is acquired and entered in the digital message within the specified time interval (1 min for external navigation device, 10 min for internal navigation device, 5 seconds for input from all navigation devices for ELT(DT)s). Check that the encoded data is correct within 500 metres for beacons with Standard, National or RLS Location protocols, within 200 metres in the horizontal plane (2D) and within the limits of A.2.5 c) i) and ii) in Altitude for ELT(DT)s* or 5.25 km for beacons with User-Location protocols. Deactivate the beacon.

A.3.8.2.2

Change navigation data input or the navigation signal (by using GNSS RF simulator or by moving the beacon) by more than 5 km with respect to the position of A.3.8.2.1. Activate the beacon and verify that the new position is acquired and encoded into the digital message within the specified time interval (1 min for external navigation device, 10 min for internal navigation device, 5 seconds for input from all navigation devices for ELT(DT)s). Check that the encoded data is correct within 500 metres for beacons with Standard, National or RLS Location protocols, within 200 metres in the horizontal plane (2D) and within the limits of A.2.5 c) i) and ii) in Altitude for ELT(DT)s† or 5.25 km for beacons with User-Location protocols. Deactivate the beacon.

* For ELT(DT)s this test shall be performed at a height of less than 4000 metres above sea level.
† The test shall be performed at an altitude of less than 4000 metres above sea level.

For ELT(DT)s that can accept navigation data from an external navigation device input as well as its own internal navigation device the above two tests shall be repeated with the external input method disabled.

Record the results to A.3.8.2.1 and A.3.8.2.2 with a pass/fail indication at item 17 of Table F.1, and the measured values in Table F-C.5 or Table F-C.6 as appropriate. If the test had to be repeated because initial test results failed to meet requirements, the failed tests shall also be reported and an explanation for the failure included in the report. In such circumstances the tests shall be repeated and reported at least 5 times in the configuration that failed.

In the case of beacons with internal navigation devices:

a) tests A.3.8.2.1 and A.3.8.2.2. (when moving the beacon) shall be conducted at a location where the beacon has clear visibility to the available GNSS satellites; and

b) tests A.3.8.2.1 and A.3.8.2.2 shall be conducted with the beacon in all the configurations required by Figure 4.2 as applicable per the manufacturer's declaration of Operational Configurations in Annex G.

A.3.8.3 Encoded Position Data Update Interval [*]

If the beacon is capable of updating the encoded position data, apply the appropriate navigation signal or navigation data input to the beacon which should cause the encoded position data to update and verify that the beacon does not update the digital message within 5 minutes after the time of the last update (not applicable to ELT(DT)s).

Verify that the beacon updates the digital message in accordance with the manufacturer's design, for ELT(DT)s this shall be within 2 seconds immediately prior to every 406 MHz transmission. If the beacon design does not allow encoded position data updates, verify that the encoded position data in the digital message does not change when the appropriate navigation signal, or navigation data input to the beacon, are applied.

For all beacons with an internal navigation device (except ELT(DT)s), continue changing the appropriate navigation signal once every 4 minutes and 55 seconds by a distance of at least 1 km and no more than 30 km[†] for beacons coded with Standard, National or RLS Location

[*] By decision of the Cospas-Sarsat Council at its Fifty-fourth Session, beacons submitted for type approval prior to 1 January 2017 may be tested to T.007 Issue 4 Revision 8.

[†] The maximum distance above (30 km) is suggested to prevent the GNSS Receiver cold starting when the position of the beacon is moved.

protocols, and at least 10.5 km and no more than 30 km for beacons coded with User-Location protocols until the end of the declared minimum duration of continuous operation (depending beacon type). Ensure that the encoded position data in the digital message changes in accordance with the requirements of C/S T.001 4.5.5.4 and as declared by the manufacturer in their location data update scheme.

For ELT(DT)s change the navigation signal (by using a GNSS RF simulator) at a speed of up to 1,000 km/h (277.8 m/s) in the horizontal plane and from -100m to 11,000m above sea level in altitude in accordance with Annex K. Activate the ELT(DT) and monitor the encoded 3D positions provided by the ELT(DT) while running the simulator scenario in Annex K, then deactivate the beacon. Accurately (to a resolution of better than 0.1 second) log the position provided to the beacon and the commencement of beacon transmissions vs time. For each burst from the ELT(DT) compute the 3D position provided by the signal to the beacon at the commencement of the burst ($P(t_0)$) and at the point 2 seconds before the commencement of the burst ($P(t_0-2)$). Check that in each instance the 3D encoded location transmitted by the ELT(DT) is within 200 metres in the horizontal plane and within 700 metres in altitude of at least one simulated location between the two above computed positions (i.e. ($P(t_0)$) and ($P(t_0-2)$)). Also check that bits 113 and 114 in the digital message are correctly set for location freshness.

If the ELT(DT) can accept navigation data from an external navigation device input as well as its own internal navigation device, then the above test shall be repeated with the external navigation device input disconnected. All results, except for that from the first burst, shall meet the above requirements (i.e., horizontal accuracy, vertical accuracy and location freshness).

For beacons with internal navigation devices, the tests can be performed either by changing the beacon position or with a GNSS RF simulator to emulate the GNSS satellite downlinks.

Record the first measured position data update interval at item 17 of Table F.1. For beacons with internal navigation devices record the encoded position update intervals throughout the test at item 17 of Table F.1.

This test can be conducted in a configuration determined between the beacon manufacturer and the test laboratory. Unlike A.3.8.2.1 and A.3.8.2.2 this test does not have to be repeated for each operational configuration.

A.3.8.4 Position Clearance after Deactivation

After the test A.3.8.3 deactivate and reactivate the beacon, with no navigation signal or navigation data input to the beacon, to verify that the previous position data has been cleared and that the correct default values are encoded in the message. Record the results with a pass/fail indication at item 17 of Table F.1.

A.3.8.5 Position Data Input Update Interval

If a beacon is designed to accept position data from an external navigation device prior to beacon activation, navigation data input should be provided and stored in the beacon memory

at intervals not longer than 20 minutes for EPIRBs and PLBs, or 1 minute for ELTs, except ELT(DT)s for which the interval is no longer than 2 seconds. To test this:

a) deactivate the beacon, change the initial position data, allow for the appropriate time interval (between 20 min and 30 min for EPIRBs and PLBs or between 1 min and 1.5 min for ELTs or between 2 seconds and 3 seconds for ELT(DT)s) for the changed position to be accepted. Remove the navigation data input to the beacon and allow the stored position to be kept in the beacon memory for between 19 min 50 sec and 20 minutes (for EPIRBs or PLBs), or for between 50 sec and 1 minute (for ELTs except ELT(DT)s) or for between 9 min and 50 sec and 10 minutes (for ELT(DT)s). Activate the beacon. Verify that the encoded position data is correct and corresponds to the changed position; and

b) deactivate the beacon, change the initial position data and remove the navigation data input to the beacon. Allow for the appropriate time interval (between 20 and 30 min for EPIRBs and PLBs or between 1 and 1.5 min for ELTs (except ELT(DT)s) or between 10 and 10 minutes and 15 seconds for ELT(DT)s) for the stored position to be cleared. Activate the beacon. Verify that the location fields of the message are encoded with default values.

For beacons with internal navigation devices, a GNSS RF simulator may be used to simulate the GNSS satellite downlinks. Identify in Table F.1 the applicable time intervals for this test, and record the results with a pass/fail indication at item 17 of Table F.1.

A.3.8.6 Last Valid Position

Remove the appropriate navigation signals or the navigation input and verify that the last valid position data before the loss of navigation signal is retained in the 406 MHz beacon digital message for 4 hours (± 5 min) (except for ELT(DT)s where the retention period shall be 10 minutes (+0/-10 sec) from the last valid position data input. Check that position data has been cleared and that the correct default values are encoded in the message after 4 hours (± 5 min), or after 10 minutes for ELT(DT)s. Identify in Table F.1 the duration for which the last valid position data continued to be transmitted by the beacon, and also that the correct default values were transmitted afterwards.

A.3.8.7 Position Data Encoding

This test is conducted by substituting the output of the navigation device with test scripts which replicate the location information provided in Table D.1 for the User-Location protocol, Table D.2 for the Standard Location Protocol, Table D.3 for the National Location, Tables D.4 for the ELT(DT) and the RLS Location protocols and Table D.5 for the RLS Location protocol.

For beacons supporting multiple types of data interfaces with an external navigation device, this test shall be performed for each external interface variant. Only the highest data stream baud rate shall be tested.

For beacons not capable of updating the encoded position data after beacon activation, modification shall be made to the test scripts to allow position data changes to be accepted prior to beacon activation. See Footnote 1 associated with the scripts in Tables D.1, D.2 and D.3.

This test may be conducted either by the test laboratory or the manufacturer. The results shall be provided in the formal report as per Appendix C to Annex F. The test laboratory shall annotate Table F.1 with "√" if the beacon performed as required for all the scripts tested.

A.3.8.8 RLM Reception Verification

In all the manufacturer's declared operational configurations in Annex G, activate the beacon with the RLS Location Test Protocol. Check if the beacon indicates reception of the Test RLM message as indicated in document C/S T.001 Section 4.5.7.3.

A.3.8.8.1 M_{offset} Test

Set up the beacon under test such that it is possible to monitor when the GNSS Receiver in the beacon is active and inactive (i.e. powered up and providing position and related data) and it is possible to monitor the data output from the GNSS Receiver that is providing position and related data to the rest of the beacon electronics. A specially modified beacon (test unit) may be required for this test, thus this test may be performed using either the second beacon or another beacon as defined in Section 4.3. This test may be performed by the beacon manufacturer or by the type approval test facility. This test may be carried out at any time during the testing sequence[*].

Set up the beacon under test in an area where it can send 406-MHz signals and clearly receive navigation data to fully test the RLS closed-loop functionality, e.g., in an open area with a clear view of the sky.

Set up the necessary test equipment to enable the functioning of the GNSS Receiver and its data output to be monitored. It shall be possible to either store the information received at the GNSS Receiver data output for later analysis or to decode this data in real time such that the message stream provided can be correctly decoded and interpreted.

Ensure that the beacon is correctly coded with the RLS Location Test Protocol as per C/S T.007 Annex C. Carry out a self-test and ensure that the encoded 15 Hex ID is '193BE08CBF81FE0'.

[*] Note it may be necessary to coordinate this test with both the relevant MCC and the Return Link Service Provider (RLSP) in order to ensure that test signals are correctly routed through the ground segment and the appropriate RLM is sent.

Turn the beacon on at any time between 5 minutes and 20 minutes past any natural hour (e.g. between 09:05 and 09:20, between 15:05 and 15:20 etc.) and check the following:

a) that within 5 seconds there is a visual indication of an RLS request;

b) that bits 109 to 114 in the 406 MHz transmitted message are '100001';

c) that the GNSS Receiver turns on (becomes active) within 5 seconds of the beacon transmitting its first RLS Location Protocol Test message;

d) monitor the GNSS Receiver data output and determine how long it takes after becoming active before the Receiver starts to output UTC in whichever recognised IEC 61162-1 approved sentence (e.g. GNS, ZDA etc.) the manufacturer has defined for this purpose;

e) monitor the GNSS Receiver and ensure that it remains in active mode for a period of at least 30 minutes after beacon activation after which time it may turn off, or remain on, or turn on and off one or more times;

f) during the above 30 minute period monitor the RLS indicator and note at what time it changes state to indicate receipt of an RLS request acknowledgement (i.e. receipt of an RLM);

g) monitor bits 109 to 114 in the next 406 MHz transmitted message after the RLS indicator changes state and ensure that bits 109 to 114 change to '101001';

h) monitor the GNSS Receiver and ensure that it turns on at 39 minutes +/- 5 seconds after the next natural hour (e.g. if the beacon was first activated at 10:11 check to ensure that it turns on again at 11:39 +/- 5 seconds). Note 39 minutes equates to the M_{offset} value for the encoded 15 Hex ID;

i) monitor the GNSS Receiver and ensure that it remains in active mode for a minimum period of 15 minutes after which time it may turn off, or remain on, or turn on and off one or more times;

j) monitor the GNSS Receiver for a further hour and ensure that it turns on at 39 minutes +/- 5 seconds after the next natural hour (e.g. if the beacon was first activated at 10:11 check to ensure that it turns on again this time at 12:39 +/- 5 seconds); and

k) monitor the GNSS Receiver and ensure that it remains in active mode for a minimum period of 15 minutes, after which time the test may be stopped and the beacon turned off. Leave the beacon turned off for a minimum period of 15 minutes before commencing the next test.

A.3.8.8.2 UTC Test

With the equipment and beacon test set up as in A.3.8.8.1 above

Turn the beacon on at any time between 5 minutes and 20 minutes past any natural hour (e.g. between 09:05 and 09:20, between 15:05 and 15:20 etc.) and check the following:

a) that within 5 seconds there is a visual indication of an RLS request;

b) that bits 109 to 114 in the 406 MHz transmitted message are ‘100001’;

c) that the GNSS Receiver turns on (becomes active) within 5 seconds of the beacon transmitting its first RLS Location Protocol Test message;

d) monitor the GNSS Receiver data output and determine how long it takes after becoming active before the Receiver starts to output UTC in whichever recognised IEC 61162-1 approved sentence (e.g. GNS, ZDA etc.) the manufacturer has defined for this purpose;

e) monitor the GNSS Receiver data output to check for the presence of a valid position in whichever recognised IEC 61162-1 approved sentence (e.g. GNS, RMC etc.) the manufacturer has defined for this purpose. Between 15 seconds and 45 seconds after first obtaining a position deny the beacon access to any satellite signals for the next portion of this test. Monitor the GNSS Receiver data output and ensure that no further time and / or position updates are received;

f) monitor the beacon transmitted signal and ensure that it contains the location of the beacon to within 500m accuracy and that bits 109 to 114 in the 406 MHz transmitted message are still ‘100001’;

g) monitor the GNSS Receiver and ensure that it remains in active mode for a minimum period of 30 minutes after which time it may turn off, or remain on, or turn on and off one or more times;

h) monitor the GNSS Receiver and ensure that it turns on at 39 minutes +/- 5 seconds after the next natural hour (e.g. if the beacon was first activated at 10:11 check to ensure that it turns on again at 11:39 +/- 5 seconds). Note 39 minutes equates to the M_{offset} value for the encoded 15 Hex ID, while this test ensures that the internal clock within the beacon is functioning correctly in the absence of UTC;

i) monitor the GNSS Receiver and ensure that it remains in active mode for a minimum period of 15 minutes after which time it may turn off, or remain on, or turn on and off one or more times;

j) monitor the beacon transmitted signal and ensure that it still contains the location of the beacon to within 500 m accuracy and that bits 109 to 114 in the 406 MHz transmitted message are still ‘100001’;

k) monitor the GNSS Receiver for a further hour and ensure that it turns on at 39 minutes +/- 5 seconds after the next natural hour (e.g. if the beacon was first activated at 10:11 check to ensure that it turns on again this time at 12:39 +/- 5 seconds);

l) within 10 seconds to 20 seconds of the GNSS Receiver turning back on again allow the beacon access to the satellite signals for the remaining portion of this test;

m) monitor the GNSS Receiver and ensure that it remains in active mode for a minimum period of 15 minutes;

n) during the above 15 minute period monitor the RLS indicator and note at what time it changes state to indicate receipt of an RLS request acknowledgement; and

o) monitor bits 107 to 112 in the next 406 MHz transmitted message after the RLS indicator changes state and ensure that bits 109 to 114 change to '101001', after which time the test may be stopped and the beacon turned off.

A.3.9 Method of Activation and Cancellation Message Test (ELT(DT) only)

The following tests are specific to ELT(DT)s only and are designed to check for correct activation and deactivation of the ELT(DT) coupled with the transmission of the Cancellation Message at the appropriate time, as defined in C/S T.001.

All the tests specified below shall be performed at ambient temperature. A check for valid BCH codes shall be performed throughout these tests, and any examples where the encoded BCH was not correct shall be specifically identified in the test report and an annotation provided at item 18 of Table F.1.

A.3.9.1 Activation and Deactivation Tests

The control lines into the ELT(DT) shall be activated in the sequences identified in Table A.2 and the correct indications in the beacon transmitted digital message shall be checked.

A.3.9.2 Cancellation Message Tests

When performing the tests identified in Table A.2 above the transmissions from the ELT(DT) shall be monitored. The ELT(DT) shall transmit a Cancellation Message each time that it is deactivated (i.e., at the initiation of Tests 5, 7, 11, 13, 18a, 19, 24a and 25 above). The Cancellation Message shall be checked to ensure that it meets the following:

a) transmitter nominal frequency, as per para. A.3.2.1.1;

b) transmitter power output, as per para. A.3.2.2.1;

c) digital message content, as per para. A.3.1.4 and C/S T.001 Section A3.3.8.5 and Figure A11;

d) the modulation parameters, as per para. A.3.2.3;

e) first cancellation transmitted message occurs within [5] seconds of deactivation;

f) there are 10 cancellation messages transmitted at intervals of 10 seconds +/- 0.5 seconds; and

g) After transmitting 10 cancellation messages the ELT(DT) ceases transmitting.

Test No	Control Lines*			Message Bits Status		ELT(DT) Status†
	Auto Activation by beacon	Auto Activation by external means	Manual Activation	Bit 107	Bit 108	
1	Disabled	Disabled	Disabled	N/A	N/A	ARMED
2	Disabled	Enabled	Disabled	1	0	ON
3	Disabled	Enabled	Enabled	0	0	ON
4	Disabled	Disabled	Enabled	0	0	ON
5	Disabled	Disabled	Disabled	N/A	N/A	ARMED
6	Disabled	Enabled	Disabled	1	0	ON
7	Disabled	Disabled	Disabled	N/A	N/A	ARMED
8	Disabled	Disabled	Enabled	0	0	ON
9	Disabled	Enabled	Enabled	1	0	ON
10	Disabled	Enabled	Disabled	1	0	ON
11	Disabled	Disabled	Disabled	N/A	N/A	ARMED
12	Disabled	Disabled	Enabled	0	0	ON
13	Disabled	Disabled	Disabled	N/A	N/A	ARMED
14	Enabled	Disabled	Disabled	0	1	ON
15	Enabled	Disabled	Enabled	0	0	ON
16	Enabled	Enabled	Enabled	1	0	ON
17	Enabled	Disabled	Enabled	0	0	ON
18a	Disabled ‡	Disabled	Disabled	N/A	N/A	ARMED
18b	Enabled §	Disabled	Disabled	0	1	ON
19	Disabled	Disabled	Disabled	N/A	N/A	ARMED
20	Enabled	Disabled	Disabled	0	1	ON
21	Enabled	Enabled	Disabled	1	0	ON
22	Enabled	Enabled	Enabled	0	0	ON
23	Enabled	Enabled	Disabled	1	0	ON
24a	Disabled ‡	Disabled	Disabled	N/A	N/A	ARMED
24b	Enabled §	Disabled	Disabled	0	1	ON
25	Disabled	Disabled	Disabled	N/A	N/A	ARMED

Table A.2: ELT(DT) Activation and Deactivation Tests

* The terms “Enabled” and “Disabled” as used for the ELT(DT) Control Lines are intended to be generic and apply to whatever means of ELT(DT) activation the beacon manufacturer has implemented e.g. hardwired control lines, logic levels, switches, data bits, ARINC labels etc.

† ARMED indicates that the ELT(DT) is not transmitting any 406 MHz signals. ON indicates that the ELT(DT) is transmitting 406 MHz distress signals.

‡ Manually deactivating the ELT(DT) is assumed to reset the “automatic activation by the beacon” (e.g. resetting the G-switch or means of deformation)

§ If the ELT(DT) has a separate means of resetting the “automatic activation by the beacon” then this condition applies

A.3.9.3 Reactivation Tests

The transmissions from the ELT(DT) shall again be monitored during this test. The ELT(DT) shall be activated by one of the means defined in Table A.2 above and shall then be deactivated. Approximately half way through the Cancellation Message sequence (i.e. approximately 50 seconds after deactivating the ELT(DT)) the ELT(DT) shall be reactivated by one of the means defined in Table A.2 above.

The transmissions from the ELT(DT) shall be monitored to ensure that the ELT(DT) immediately ceases transmitting the Cancellation Message as soon as it is reactivated and it then immediately reinitiates the alert sequence and transmits a valid alert message within 5 seconds after reactivation.

- END OF ANNEX A -

ANNEX B: ANTENNA CHARACTERISTICS

B.1 SCOPE

This Annex describes the measurement procedure to verify the antenna characteristics of 406 MHz distress beacons defined in document C/S T.001. Alternative procedures, including the use of a shielded anechoic room, are acceptable if they provide equivalent information and have minimal impact on Cospas-Sarsat operations.

B.2 GENERAL TEST CONFIGURATION

B.2.1

The antenna characteristics of the Beacon Under Test (BUT) shall be measured in an open field test site or a shielded anechoic room. In accordance with the guidance provided at Section 4.5, the beacon shall be tested in configuration(s) that simulate the ground conditions in which the beacon might be expected to operate.

A measuring antenna located at a horizontal distance of 3 metres from the BUT shall be used to measure the emitted field strength. In order to make measurements at all the required azimuths the BUT will have to be rotated through 360°, and to make measurements at the required elevation angles the measuring antenna will have to be moved vertically. The BUT shall be equipped with a fresh battery and the test shall be performed at ambient temperature.

B.2.2

Prior to each open field test site transmission, the appropriate national authorities responsible for Cospas-Sarsat and radio emissions shall be notified.

In order to keep the potential disturbance to the Cospas-Sarsat System to a minimum, these antenna tests shall be conducted using a beacon operating at its nominal repetition rate and coded with the test protocol of the appropriate type and format. Transmission of any continuous wave (CW) signal from a signal generator in the 406.0 - 406.1 MHz band is strictly forbidden.

B.3 TEST SITE

B.3.1

The test site shall be an area clear of any obstruction such as trees, bushes or metal fences within an elliptical boundary of dimensions shown in Figure B.1. Objects outside this

boundary may still affect the measurements and care shall be taken to choose a site as far as possible from large objects or metallic objects of any kind.

B.3.2

The terrain at an outdoor test site shall be flat. Any conducting object inside the area of the ellipse shall be limited to dimensions less than 7 cm. A metal ground plane or wire mesh enclosing at least the area of the ellipse and keeping the same major and minor axis as indicated in Figure B.1 is preferred (indicated as ground plane "A" in figures B.2 through B.5). If this is not practical then a surface of homogeneous good soil (not sand or rock) is satisfactory. All electrical wires and cables shall be run underground or under the ground plane. The antenna cable shall be extended behind the measuring antenna along the major axis of the test site for a distance of at least 1.5 metres from the dipole elements before being routed down to ground level.

B.3.3

All precautions shall be taken to ensure that reflections from surrounding structures are minimized. No personnel shall be within 6 metres of the BUT during actual measurements. Test reports shall include a detailed description of the test environment. Reports shall specifically indicate what precautions were taken to minimize reflections.

B.3.4

Weather protection enclosures may be constructed either partially or entirely over the site. Fibreglass, plastics, treated wood or fabric are suitable materials for construction of an enclosure. Alternatively, the use of an anechoic enclosure is acceptable.

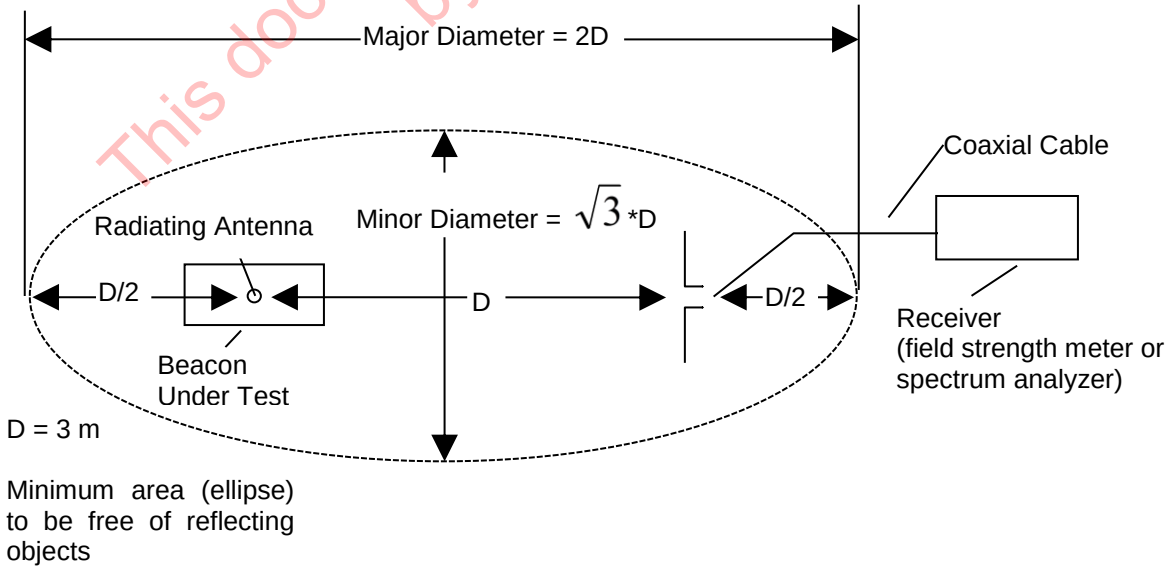


Figure B.1: Test Site Plan View

B.4 GROUND PLANE AND BEACON INSTALLATION

B.4.1

In accordance with the guidance provided at Section 4.5 the beacon shall be tested in the configurations that simulate the ground conditions in which the beacon might be expected to operate (see Figure 4.1). Descriptions of the test configurations are provided at Figures B.2 through B.5.

B.4.2

The applicable ground plane configurations, as described in Figures B.2 through B.5, will be decided by Cospas-Sarsat on the basis of technical considerations relevant to the beacon operation and information provided by the manufacturer. If there is any doubt in respect of the test configurations that must be tested, the beacon manufacturer and the type approval facility shall contact the Cospas-Sarsat Secretariat prior to the start of testing.

Figure B.2: Test Configuration for "PLB-like" Devices (e.g. PLB, survival ELT, automatic portable ELT)

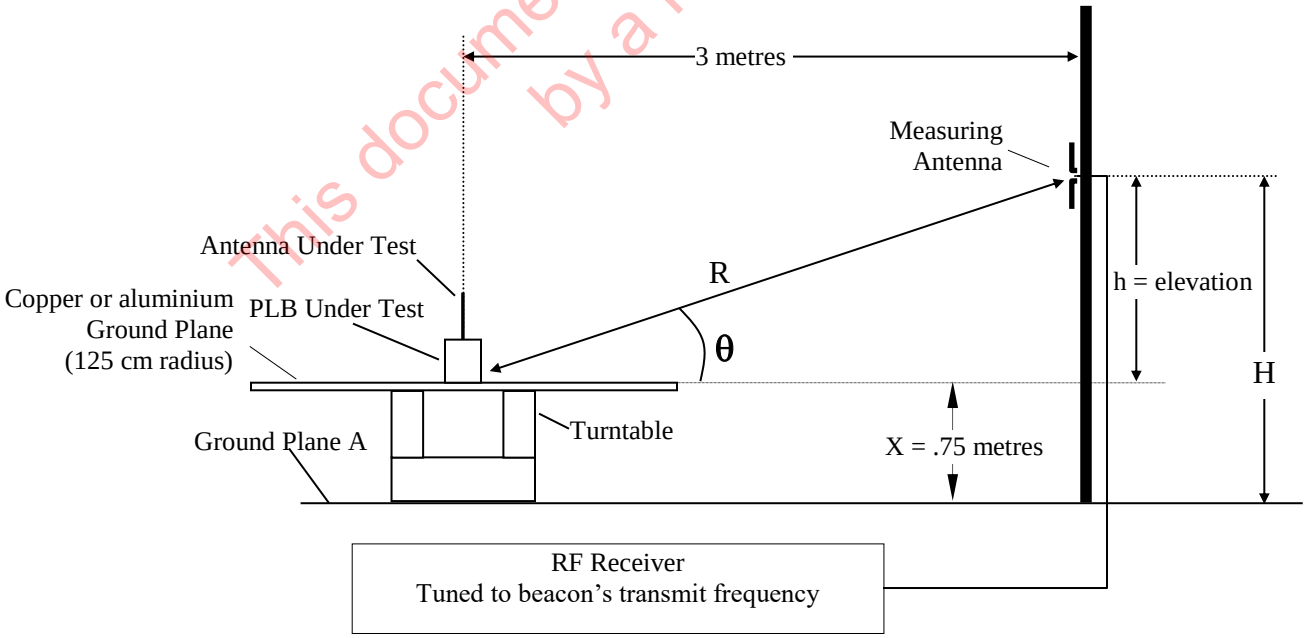


Figure B.3: Test Configuration for "Fixed ELT-like" Devices (including ELT(DT)s) (i.e., beacon with an antenna designed to be mounted on a metal surface)

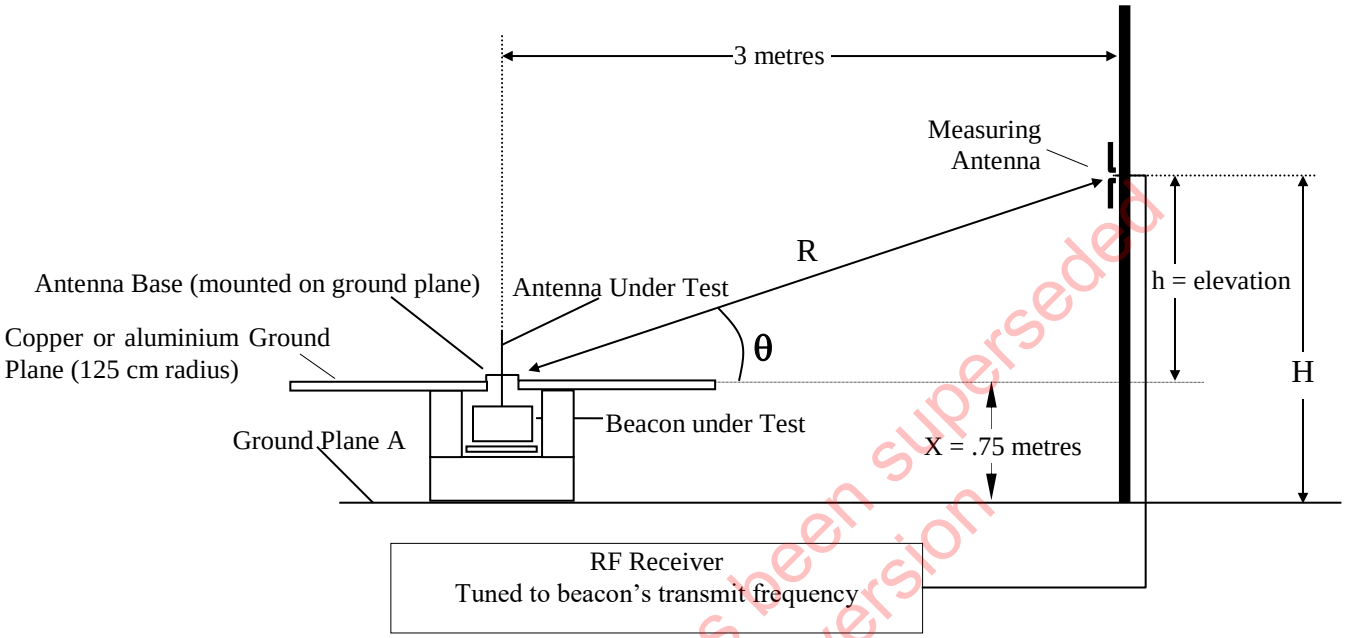


Figure B.4: Test Configuration for "EPIRB-like" Devices (i.e., beacons designed to operate while floating in water)

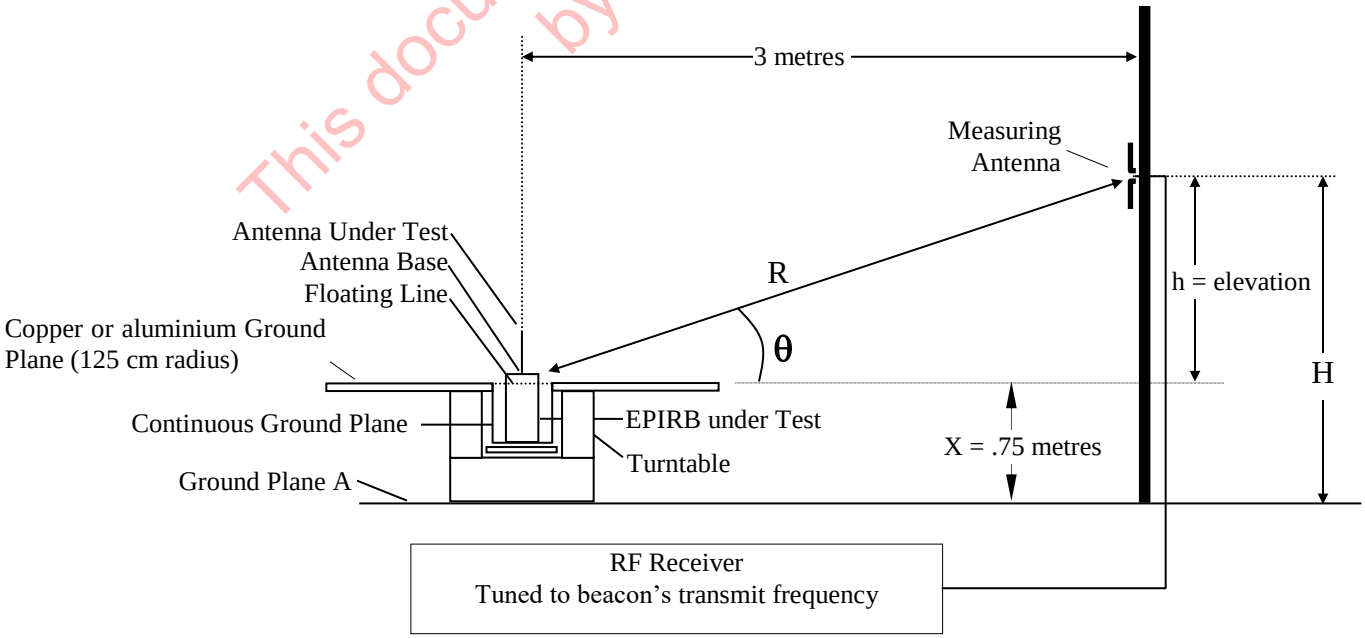


Figure B.5: Additional Test Configuration for all Devices that Might be Required to Operate Without a Ground Plane*

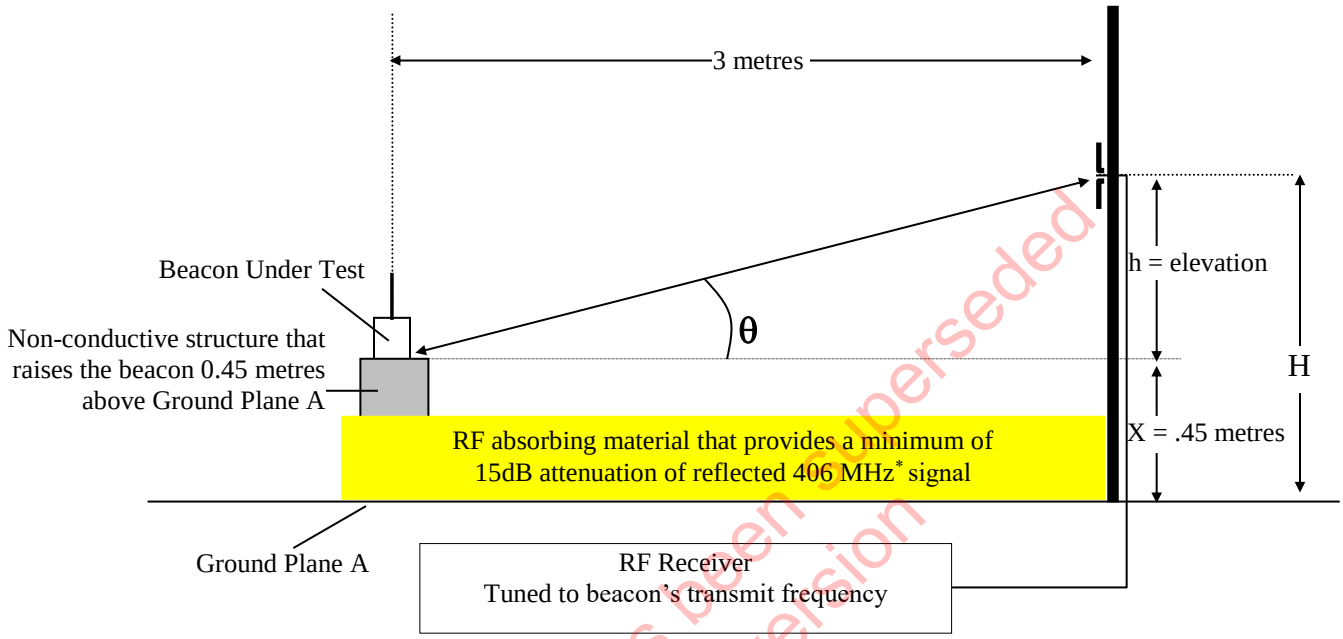
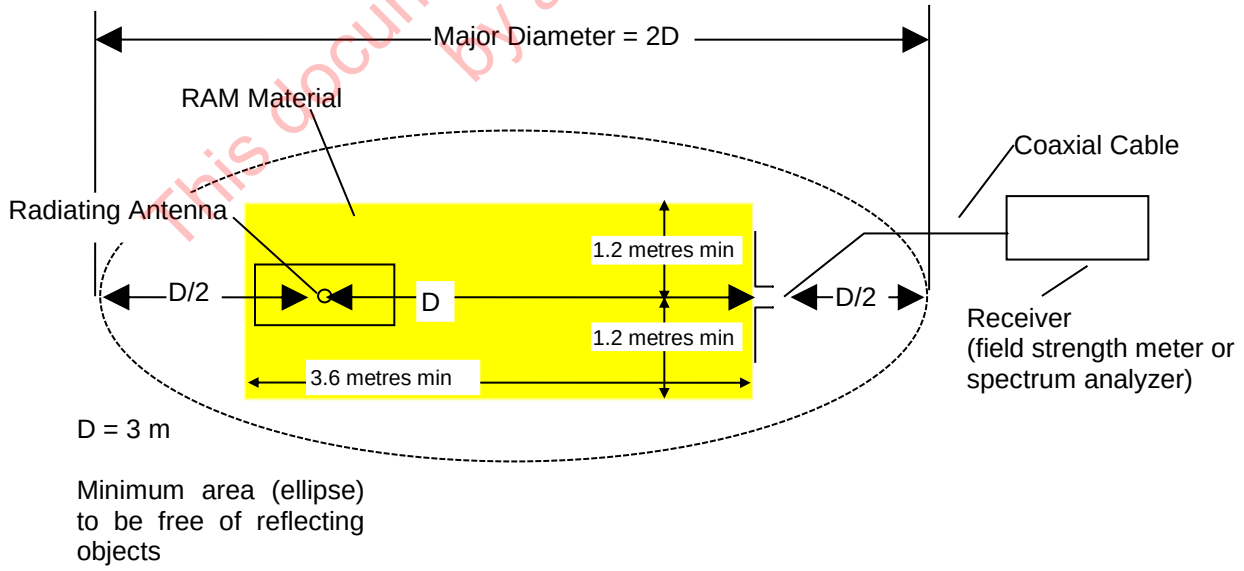


Figure B.6: Test Site Plan View with RAM Material



* The dimensions of the RF absorbing material: minimum length of 3.6 metres, minimum width of 2.4 metres and equally spaced either side of the major axis "D" (see Figures B.1 and B.6), maximum height of 0.4 metres.

B.5 MEASURING ANTENNA

B.5.1

The radiated field of the BUT antenna shall be detected and measured using a tuned dipole. This dipole antenna shall be positioned at a horizontal distance of 3 metres from the BUT antenna and mounted on a non-conducting vertical mast that permits the height of the measuring antenna to be varied sufficiently to measure the beacon EIRP at elevation angles ranging from 10 to 50 degrees.

Referring to Figures B.2 through B.5, the height at which the measuring antenna must be elevated on the supporting mast for a specific elevation angle θ is calculated as follows:

$$h = 3\ (\tan\theta) \text{ metres}$$

and

$$H = h + X$$

where,

X is the reference height
(0.45 metres or 0.75 metres depending upon the test configuration)

h* is the height of the measuring antenna relative to the reference height X,

θ is the desired angle of elevation as indicated on Figures B.2 through B.5 (at reference height X),

H is the height of the measuring antenna above the ground plane A.

B.5.2

As the measuring antenna is vertically elevated, the distance (R) between the BUT antenna and the measuring antenna increases. The distance (R) is a function of the elevation angle (θ) and it is calculated as follows:

$$R = \frac{3}{\cos\theta} \text{ metres}$$

* The centre of the measuring dipole antenna is used as the reference to determine its height.

B.5.3

The antenna factor (AF) of the measuring antenna at 406 MHz must be known. This factor is normally provided by the manufacturer of the dipole antenna or from the latest antenna calibration data. It is used to convert the induced voltage measurement into electric field strength.

B.5.4

Since the value of AF depends on the direction of propagation of the received wave relative to the orientation of the receiving antenna, the measuring dipole should be maintained perpendicular to the direction of propagation. In order to minimize errors during measurement, it is recommended to adopt this practice (Figure B.7). If the measuring antenna cannot be maintained perpendicular to the direction of propagation (Figure B.8), a correction factor must be considered due to the gain variation pattern of the measuring antenna. For a dipole, the corrected antenna factor (AF_c) is calculated as follows:

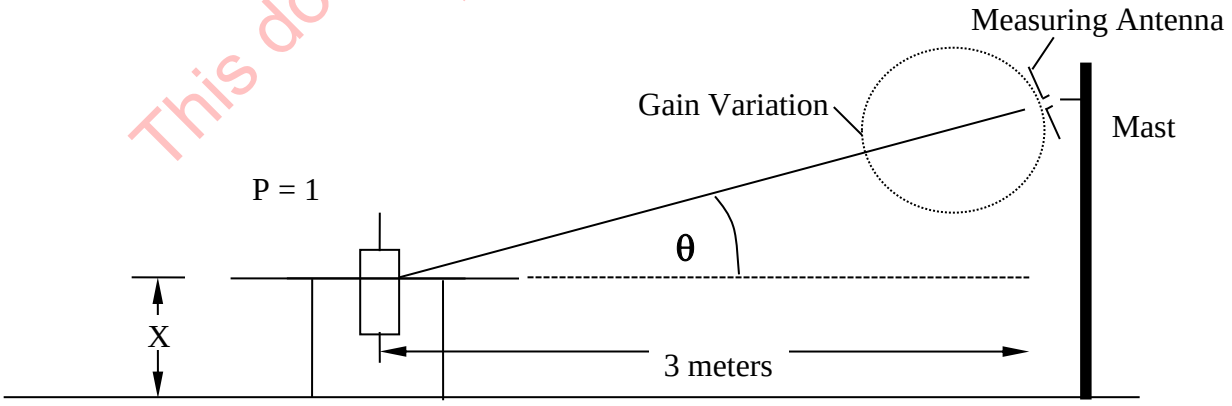
$$AF_c = \frac{AF}{P}$$

and

$$P = \frac{\cos(90 \times \sin\theta)}{\cos\theta}$$

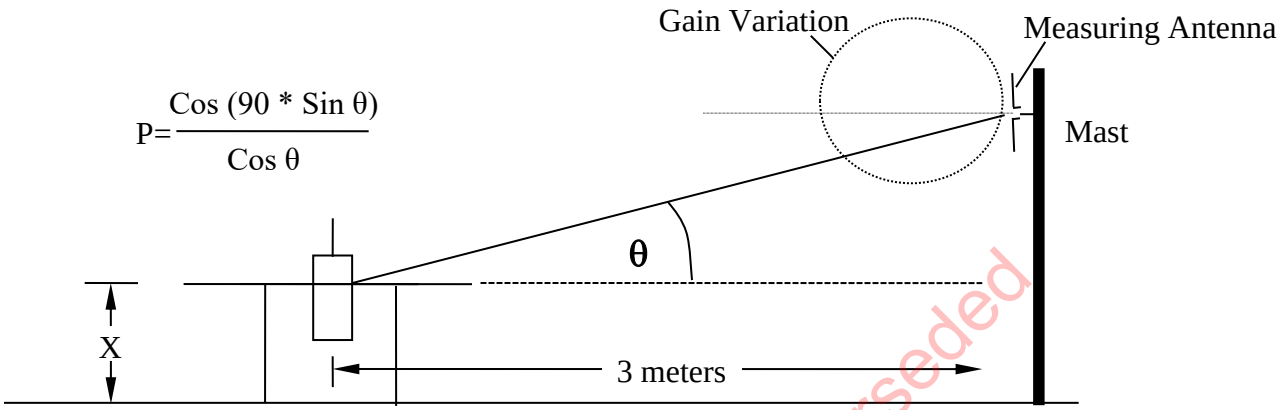
where: AF is the antenna factor from paragraph B.5.3,
θ is the elevation angle,
P^* is the correction factor for the dipole antenna pattern.

Figure B.7: Measuring Antenna Perpendicular to the Direction of Propagation



* The correction factor (P) is equal to 1 when the measuring antenna elements are maintained perpendicular to the direction of propagation. P is therefore equal to 1 when the measuring antenna is horizontally polarized at any elevation angle. The correction factor applies only to vertically polarized measurements.

Figure B.8: Measuring Antenna NOT Perpendicular to the Direction of Propagation



B.6 BEACON TRANSMITTING ANTENNA

The BUT antenna may have been designed to transmit signals in the 406.0 – 406.1 MHz frequency band, and also at 243 MHz and 121.5 MHz, and also to conduct power to a strobe light mounted above the antenna. It is possible that the radiated signal will be composed of an unknown ratio of vertically and horizontally polarized waves. For this reason, consideration shall be given to the type of antenna and its radiated field. The results shall encompass all wave polarizations. The antenna pattern and field strength measurements should provide sufficient data to evaluate the antenna characteristics.

B.7 RADIATED POWER MEASUREMENTS

B.7.1

Prior to each open field test site transmission, the appropriate national authorities responsible for Cospas-Sarsat and radio emissions shall be notified.

B.7.2

The test provides data which characterises the antenna by measuring the vertically and horizontally polarised waves.

B.7.3.1 Measurement Requirements

The BUT shall be transmitting normally with a fresh battery. The signal received by the measuring antenna shall be coupled to a spectrum analyzer or a field strength meter and the radiated power output shall be measured during the beacon transmission. An example of a power measurement made with a spectrum analyzer during the unmodulated portion of a beacon transmission is illustrated in Figure B.9. The receiver shall be calibrated according to the range of levels expected, as described in Section B.8.

Measurements* shall be made at the azimuth and elevation angles indicated in the table below.

Test Configurations	Azimuth Angle in Degrees Rotated about the Antenna Axis (± 3°)	Elevation Angle in Degrees (± 3°)
Figures B.2, B.3 and B.4	0, 30, 60, 90, 120, 150, 180, 210, 240, 270, 300 and 330	10, 20, 30, 40, 50
Figure B.5	0, 90, 180, 270	10, 20, 30, 40, 50

B.7.3.2 EIRP and Antenna Gain Calculations

The following steps shall be performed for each set of measured voltages and the results recorded:

Step 1: Calculate the total induced voltage V_{rec} in dBV using

$$V_{rec}(dBV) = 20 \log \sqrt{V_v^2 + V_h^2}$$

where:
V_v and V_h are the induced voltage measurements (in volts) when the measuring antenna is oriented in the vertical and the horizontal plane respectively.

Step 2: Calculate the field strength E in dBV/m at the measuring antenna using

$$E\ (dBV/m) = V_{rec} + 20 \log AF_c + L_c$$

* The measuring antenna should be linearly polarized and positioned twice to align with both the vertical and horizontal components of the radiated signal in order to measure the total EIRP as described in section B.7.2.2.

where:
V_{rec} is the calculated signal level from Step 1 (dBV)
AF_c is the corrected antenna factor as defined in paragraph B.5.4
L_c is the receiver system* attenuation and cable loss (dB)

Step 3: Calculate the EIRP and the G_i

Using the standard radio wave propagation equation:

$$E(\text{Volts/metre}) = \frac{\sqrt{(30 \times Pt(\text{Watts}) \times Gi)}}{R\ (\text{metres})}$$

and

$$Pt(\text{W}atts) \times Gi = EIRP$$

the EIRP for each set of angular coordinates is obtained from

$$EIRP\ (\text{Watts}) = \frac{E^2 \times R^2}{30}$$

and the antenna gain from

$$Gi = \frac{E^2 \times R^2}{30 \times Pt}$$

where:

R is the distance between the BUT and the measuring dipole antenna calculated in section B.5.2
Pt is the power transmitted into the BUT antenna
Gi is the BUT antenna numerical gain relative to an isotropic antenna
E is the field strength converted from Step 2 into volts/metre

B.8 TEST RECEIVER CALIBRATION

In order to minimize measurement errors due to frequency response, receiver linearity and cable loss, the test receiver (which may be a field strength meter or a spectrum analyzer) shall be calibrated as follows:

* The receiver system attenuation is compensated for when performing the calibration procedure (section B.8). Otherwise, it shall be calculated separately.

a) Connect the equipment as shown in Figures B.2 through B.5, as appropriate. Install the BUT as described in Section B.4.

b) Turn on the BUT for normal transmission. Set the receiver bandwidth to measure the power of the transmission. An example using a spectrum analyzer to measure the unmodulated portion of the transmission is illustrated in Figure B.9. The same receiver bandwidth shall be used during the antenna measurement process. Tune the receiver for maximum received signal. Position the measuring antenna in the plane (horizontal or vertical) that gives the greatest received signal. Rotate the BUT antenna and determine an orientation which is representative of the average radiation field strength (not a peak or a null). Record the receiver level.

c) Disconnect the measuring antenna and feed the calibrated RF source to the receiver through the measuring antenna cable. Adjust the signal source to give the same receiver level recorded in (b) above.

d) Disconnect the calibrated RF source from the measuring antenna cable and measure its RF output with a power meter.

e) Reconnect the calibrated RF source to the measuring antenna cable and adjust the gain calibration of the receiver for a reading which is equal to the power.

B.9 ANTENNA POLARIZATION MEASUREMENT

B.9.1

Provide the measured induced voltage in Table F-B.2 (for configurations described in Figures B.2 through B.4) and annotate the results as described in section B.10.2 below. An analysis of the raw data (V_v, V_h) obtained during the antenna test conducted with the beacon in configurations B.2 through B.4 should be sufficient to determine if the polarization of the BUT antenna is linear or circular. There is no requirement to evaluate the sense of polarization for Figure B.5.

B.9.2

If the induced voltage measurements V_v and V_h for at least 80% of all angular coordinates (azimuth, elevation) differ by at least 10 dB, the polarization is deemed to be linear. The polarization shall be declared as vertical or horizontal depending upon whether V_v or V_h is greater.

B.9.3

If more than 20% of the induced voltage measurements (V_v, V_h) are within 10 dB of each other, the BUT antenna is considered to be circularly polarized. Since the sense of the polarization must be right hand circular polarized (RHCP), determine the polarization using the following method and report the results.

Compare the signals received at an elevation angle of 40° for each specified azimuth angle using known right-hand circularly-polarized (RHCP) and left-hand circularly-polarized (LHCP) antennas. The circularly polarized antenna that receives the maximum signal obtained from measurements at the required azimuth angles determines the sense of polarization.

B.9.4

In the case of inclined linear beacon antennas, EIRP measurements may be performed directly using a RHCP measuring antenna with known antenna factor at 406 MHz. In this case the requirements of section B.10 shall be directly applied to the EIRP results. If the results are in accordance with C/S T.007 requirements, then the antenna should be accepted regardless of any circularly polarized component of the signal.

B.9.5

Report the measurement results in Table F-B.2.

B.10 ANALYSIS OF RESULTS

B.10.1

Enter the sense of the antenna polarization, determined per Section B.9, into Table F.1.

B.10.2

Provide the measured EIRP levels* in Table F-B.1 (for configurations described in Figures B.2 through B.4, and Table F-B.3 (for Figure B.5). Verify that the BUT produces a field equivalent to an EIRP in the ranges indicated in the table below.

Test Configurations	EIRP Required
Figures B.2, B.3, and B.4	32 dBm to 43 dBm† for at least 90% of the measurement points
Figure B.3 ELT(DT) only	34 dBm to 45 dBm‡ for at least 90% of the measurement points
Figure B.5	30 dBm to 43 dBm for at least 80% of the measurement points

* For beacons with external/remote antennas, the calculations of EIRP/Antenna Gain (Table F.E-1) and analysis of $EIRP_{min/max\ EOL}$ shall be presented separately for the minimum and maximum values of the declared antenna assembly cable loss at 406 MHz.

† The 32 dBm to 43 dBm limit is calculated from the specifications of Transmitter Power Output (37 dBm + 2 dB) and Antenna Gain characteristics (-3dBi to +4dBi).

‡ The 34 dBm to 45 dBm limit is calculated from the specifications of Transmitter Power Output (36 - 39 dBm) and Antenna Gain characteristics (-2dBi to +6dBi).

Specifically annotate Table F-B.1, F-B.2 and F-B.3:

a) with highlighted text, to indicate all the EIRP values that are not within the ranges indicated above;

b) with stricken-out text, to indicate any EIRP levels that were removed from consideration for calculating the EIRP maximum and minimum values at the end of life; and

c) with highlighted text, to indicate all induced voltage measurements that are within 10 dB of each other, and with stricken-out text to indicate the measurements that were taken out of consideration.

B.10.3

For the set of measurements identified in Section B.10.2, the overall maximum ($EIRP_{max}$) and minimum ($EIRP_{min}$) EIRP values shall be determined.

B.10.4

A power loss factor ($EIRP_{LOSS}$) shall be determined* to correct for what the power output would be after the beacon had operated at minimum temperature for its operating lifetime. The value of $EIRP_{LOSS}$ shall be entered in Table F.1 and also at Appendix B to Annex F. This value shall be subtracted from the results in Section B.10.3 and entered in Appendix B to Annex F and item 15 of Table F.1 as $EIRP_{max\ EOL}$ and $EIRP_{min\ EOL}$.

B.11 ANTENNA VSWR MEASUREMENT

This section is not applicable to beacons with integral antennas, nor for tests conducted in the configuration described at Figure B.5.

B.11.1

The antenna VSWR of the BUT shall be measured at the input of the antenna (or the matching network if applicable) using an acceptable VSWR measurement technique, to be described in the test report.

* The loss factor ($EIRP_{LOSS}$) is defined as the minimum transmitter power measured during the operating lifetime test (at minimum temperature) subtracted from the maximum transmitter power measured at ambient temperature during the transmitted power output test (i.e. $EIRP_{LOSS} = P_{t\ AMB} - P_{t\ EOL}$).

B.11.2

Numerous precautions are necessary in VSWR measurement to avoid errors due to the effect of nearby conducting objects on the antenna current distribution.

B.11.3

The VSWR measurement shall be performed with the BUT mounted in the configurations that were used for the previously described antenna test (i.e. configurations B.2 through B.4 as appropriate).

B.11.4

Report the measured results in Table F.1. The antenna VSWR at the nominal value of the transmitted frequency in the 406.0 – 406.1 MHz frequency band shall not exceed a 1.5:1 ratio.

B.11.5

If the antenna VSWR exceeds the 1.5:1 ratio but remains less than 1.8:1* at the nominal operational frequency, and if the antenna EIRP is evaluated by direct measurements† and is within the limits specified in section B.10, the beacon can still be considered as meeting the Cospas-Sarsat requirements. However, in this case, Cospas-Sarsat type approval will be deemed as valid only for the beacon-cable-antenna configuration tested (with specific cable type and length) and the antenna should not be used with any other beacon/cable‡ without further type approval testing.

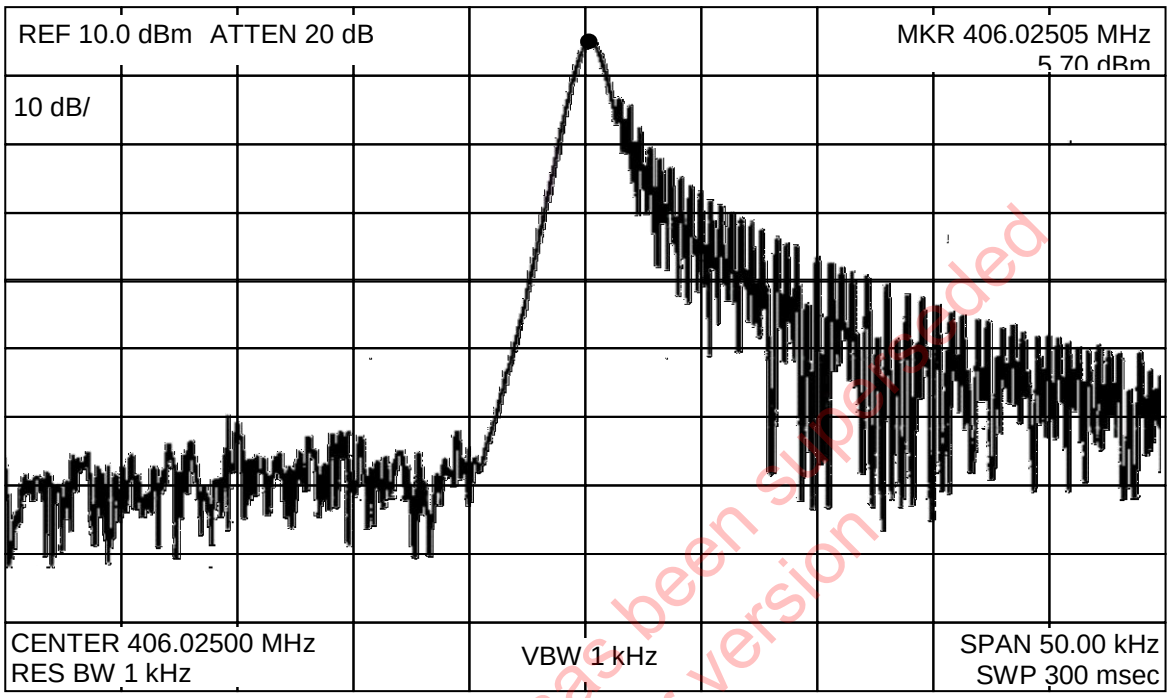
Figure B.9: RF Measurement During Preamble

* Provisions of section A.1 in respect of impedance matching network apply.

† In the case when the separated antenna was previously tested for type approval with an ELT, the direct EIRP measurement may be replaced with an analysis showing that the EIRP of the beacon-antenna combination would be within the limits specified in Section B.10.2 of Annex B. The analysis must address the actual measured beacon output power and the impedance mismatch between the beacon and the cable loaded with the ELT antenna.

‡ A special tag should be provided on the antenna cable with a warning that the length of the cable should not be changed.

- END OF ANNEX B -



ANNEX C: BEACON CODING TO BE USED FOR EVALUATING BEACON MESSAGE CODING

If the beacon is designed to operate with a protocol that requires any of the following data elements, the values programmed into the beacon for evaluating beacon message coding (Table F.1 item 16) shall be in accordance with Table C.1. Examples of each requested beacon message protocol shall be included in the test report as per Tables F-D.1, F-D.2, and F-D.3.

Table C.1: Coding Values for Beacon Message Coding Testing

Data Element	Value
Format Flag	As required by the specific protocol
Protocol Flag	As required by the specific protocol
Country Code	201
Protocol Code	As required by the specific protocol
MMSI	999999
Radio Call Sign	XPA02
Cospas-Sarsat Type Approval Certificate Number	999
Beacon Serialised Number	99
National 18 bits ID Number (binary)	011100000100011001
ELT(DT) / RLS 2 bits Beacon Type Number (binary)*	11
Any National Use Data Elements	Default values as specified in C/S T.001
Aircraft Registration Marking	C7518
Aircraft Operator Designator and a serial number	AAA500
Aircraft 24-bit Address	11472655 (Base 10 representation)
Specific Beacon	Assume only 1 beacon on vessel or aircraft
Non-Protected Data Field	Default values specified in C/S T.001
Auxiliary Radio Locating Device	As appropriate for the beacon design†
Manual / Automatic Activation	As appropriate for the beacon design†

* By decision of the Cospas-Sarsat Council at its Fifty-Seventh Session, RLS protocols will be effective as of [1 January 2018], as a target, subject to further review and consideration. The use of RLS-enabled beacons will be regulated by national administrations.

† In cases where the beacon has several variants (i.e. with and without an automatic activation capability, with and without a 121.5 MHz homer), the report shall provide examples of the coding assuming automatic activation and the 121.5 MHz homer.

- END OF ANNEX C -

ANNEX D: NAVIGATION SYSTEM TEST SCRIPTS

This test shall be conducted by inputting (e.g. in the form of NMEA sentences from a PC) the test scripts provided below* into the beacon and monitoring the beacon output digital message (ensure that the beacon position data update interval is not modified/reduced during this test in order to reduce test time). The test scenario shall be implemented in the order indicated, and the beacon shall not be turned-off until after all the scenarios have been completed. The procedure shall be completed for each location protocol type (i.e. Standard, National, RLS or User) for which type approval is being requested.

The test results shall be reported in the format provided at Tables F-C.1, F-C.2, F-C.3, F-C.4 and F-C.5.

Table D.1: User-Location Protocol Procedure

Script*	Value of Encoded Location Bits Transmitted by Beacon	BCH Correct (√)	Required Value of Encoded Location Bits†
1. Turn on beacon ensuring that navigation is not provided to the beacon. Record the value of encoded location bits.	Bits 108-132=		Bits 108-132= 0FE0FF0
2. Keeping the beacon active, apply the following navigation data to the beacon: 0° 0 min 59 sec South, 0° 0 min 57 sec West. When the beacon transmitted message changes, record the new encoded location bits and the duration of time the beacon took to update.	Bits 108 – 132= Number of seconds after providing navigation data that beacon transmitted the above encoded location information: _____		Bits 108-132= 1001000 Response time for beacon to transmit correct encoded location must be less than 62.5 sec.

* For beacon models not capable of updating the encoded position data after beacon activation, use the modified procedure for test scripts 2-10, as follows. Instead of keeping the beacon active and applying navigation data to the beacon, the test beacon shall be turned off and then, after the required navigation input is provided, the test beacon shall be turned on.

† The hexadecimal values reported in this column are calculated by converting the binary value of the data required by column two into a hexadecimal value, apart from Bit 108 which remains a binary (0 or 1) character, leading zeros must not be suppressed. For example the following bits 0 1100 0011 0000 1111 0110 1001 would be expressed as 0C30F69.

Script*	Value of Encoded Location Bits Transmitted by Beacon	BCH Correct (√)	Required Value of Encoded Location Bits†
3. Keeping the beacon active, change the navigation input to the beacon to: 0° 0 min 53 sec North, 0° 0 min 51 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 108-132=		Bits 108-132= 0000000
4. Keeping the beacon active, change the navigation input to the beacon to: 0° 11 min 10 sec North, 179° 47 min 7 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 108-132=		Bits 108-132= 0006B3C
5. Keeping the beacon active, change the navigation input to the beacon to: 0° 11 min 3 sec South, 179° 46 min 0 sec West. When the beacon transmitted message changes, record the new encoded location bits.	Bits 108-132=		Bits 108-132= 1007B3C
6. Keeping the beacon active, change the navigation input to the beacon to: 89° 15 min 8 sec South, 89° 0 min 1 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 108-132=		Bits 108-132= 1B28590
7. Keeping the beacon active, change the navigation input to the beacon to: 89° 16 min 10 sec South, 89° 0 min 1 sec West. When the beacon transmitted message changes, record the new encoded location bits.	Bits 108-132=		Bits 108-132= 1B29590
8. Keeping the beacon active, change the navigation input to the beacon to: 89° 59 min 4 sec North, 179° 59 min 54 sec West. When the beacon transmitted message changes, record the new encoded location bits.	Bits 108-132=		Bits 108-132= 0B41B40

Script*	Value of Encoded Location Bits Transmitted by Beacon	BCH Correct (√)	Required Value of Encoded Location Bits†
9. Keeping the beacon active, change the navigation input to the beacon to: 89° 57 min 59 sec North, 179° 59 min 24 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 108-132=		Bits 108-132= 0B3CB40
10. Keeping the beacon active, change the navigation input to the beacon to: 36° 30 min 0 sec South, 138° 29 min 59 sec West. When the beacon transmitted message changes, record the new encoded location bits.	Bits 108-132=		Bits 108-132= 14918A7
Self-Test Navigation Test Scripts			
11.Turn the beacon off. Ensure that navigation data is not provided to the beacon then activate the Self-Test. Record the value of encoded location bits in the self-test message.	Bits 108-132=		Bits 108-132= 0FE0FF0
12. Continuously apply the following navigation data to the beacon: 0° 0 min 59 sec South, 0° 0 min 57 sec West. Activate the Self-Test. Record the value of encoded location bits in the self-test message.	Bits 108 – 132=		Bits 108-132= 0FE0FF0

Table D.2: Standard Location Protocol Procedure

Script*	Value of Encoded Location Bits Transmitted by Beacon	BCH Correct (√)	Required Value of Encoded Location Bits†
1. Turn on beacon ensuring that navigation is not provided to the beacon. Record the value of encoded location bits.	Bits 65-85= Bits 113-132=		Bits 65-85= 0FFBFF Bits 113-132= 83E0F
2. Keeping the beacon active, apply the following navigation data to the beacon: 0° 0 min 59 sec South, 0° 0 min 57 sec West. When the beacon transmitted message changes, record the new encoded location bits and the duration of time the beacon took to update.	Bits 65-85= Bits 113-132= Number of seconds after providing navigation data that beacon transmitted the above encoded location information: _____		Bits 65-85= 100400 Bits 113-132= 8420E Response time for beacon to transmit correct encoded location must be less than 62.5 sec.
3. Keeping the beacon active, change the navigation input to the beacon to: 0° 0 min 53 sec North, 0° 0 min 51 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 65-85= Bits 113-132=		Bits 65-85= 000000 Bits 113-132= 8360D
4. Keeping the beacon active, change the navigation input to the beacon to: 0° 11 min 10 sec North, 179° 47 min 7 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 65-85= Bits 113-132=		Bits 65-85= 000ACF Bits 113-132= 0F222

* For beacon models not capable of updating the encoded position data after beacon activation, use the modified procedure for test scripts 2-11, as follows Instead of keeping the beacon active and applying navigation data to the beacon, the test beacon shall be turned off and then, after the required navigation input is provided, the test beacon shall be turned on.

† The hexadecimal values reported in this column are calculated by converting the binary values of the data required by column two into hexadecimal values, as follows: Bits 65-85 hexadecimal apart from Bit 65 which remains a binary (0 or 1) character, leading zeros must not be suppressed. For example the following bits 1 0000 0111 1110 1111 0001 would be expressed as 107EF1. Bits 113-132 all hexadecimal, leading zeros must not be suppressed. For example the following bits 0000 1000 1011 1111 0010 would be expressed as 08BF2.

Script*	Value of Encoded Location Bits Transmitted by Beacon	BCH Correct (√)	Required Value of Encoded Location Bits†
5. Keeping the beacon active, change the navigation input to the beacon to: 0° 34 min 55 sec North, 179° 35 min 59 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 65-85= Bits 113-132=		Bits 65-85= 0012CE Bits 113-132= 93A60
6. Keeping the beacon active, change the navigation input to the beacon to: 0° 11 min 3 sec South, 179° 46 min 0 sec West. When the beacon transmitted message changes, record the new encoded location bits.	Bits 65-85= Bits 113-132=		Bits 65-85= 100ECF Bits 113-132= 0FA10
7. Keeping the beacon active, change the navigation input to the beacon to: 89° 15 min 8 sec South, 89° 0 min 1 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 65-85= Bits 113-132=		Bits 65-85= 1B2964 Bits 113-132= 80A00
8. Keeping the beacon active, change the navigation input to the beacon to: 89° 16 min 10 sec South, 89° 0 min 1 sec West. When the beacon transmitted message changes, record the encoded location bits.	Bits 65-85= Bits 113-132=		Bits 65-85= 1B2D64 Bits 113-132= 84E00
9. Keeping the beacon active, change the navigation input to the beacon to: 89° 59 min 4 sec North, 179° 59 min 54 sec West. When the beacon transmitted message changes, record the new encoded location bits.	Bits 65-85= Bits 113-132=		Bits 65-85= 0B46D0 Bits 113-132= 03801
10. Keeping the beacon active, change the navigation input to the beacon to: 89° 57 min 59 sec North, 179° 59 min 24 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 65-85= Bits 113-132=		Bits 65-85= 0B42D0 Bits 113-132= 08009

Script*	Value of Encoded Location Bits Transmitted by Beacon	BCH Correct (√)	Required Value of Encoded Location Bits†
11. Keeping the beacon active, change the navigation input to the beacon to: 36° 30 min 0 sec South, 138° 29 min 59 sec West. When the beacon transmitted message changes, record the new encoded location bits.	Bits 65-85= Bits 113-132=		Bits 65-85= 14962A Bits 113-132= 80200
Self-Test Navigation Test Scripts			
12. Turn the beacon off. Ensure that navigation data is not provided to the beacon then activate the Self-Test. Record the value of encoded location bits in the self-test message.	Bits 65-85= Bits 113-132=		Bits 65-85= 0FFBFF Bits 113-132= 83E0F
13. Continuously apply the following navigation data to the beacon: 0° 0 min 59 sec South, 0° 0 min 57 sec West. Activate the Self-Test. Record the value of encoded location bits in the self-test message.	Bits 65-85= Bits 113-132=		Bits 65-85= 0FFBFF Bits 113-132= 83E0F

Table D.3: National Location Protocol Procedure

Script*	Value of Encoded Location Bits Transmitted by Beacon	BCH Correct (√)	Required Value of Encoded Location Bits†
1. Turn on beacon ensuring that navigation is not provided to the beacon. Record the value of encoded location bits.	Bits 59-85= Bits 113-126=		Bits 59-85= 3F81FE0 Bits 113-126= 27CF
2. Keeping the beacon active, apply the following navigation data to the beacon: 0° 0 min 59 sec South, 0° 0 min 57 sec West. When the beacon transmitted message changes, record the new encoded location bits and the duration of time the beacon took to update.	Bits 59-85= Bits 113-126= Number of seconds after providing navigation data that beacon transmitted the above encoded location information: _____		Bits 59-85= 4002000 Bits 113-126= 284E Response time for beacon to transmit correct encoded location must be less than 62.5 sec.
3. Keeping the beacon active, change the navigation input to the beacon to: 0° 0 min 53 sec North, 0° 0 min 51 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 59-85= Bits 113-126=		Bits 59-85= 0000000 Bits 113-126= 26CD
4. Keeping the beacon active, change the navigation input to the beacon to: 0° 11 min 10 sec North, 179° 47 min 7 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 59-85= Bits 113-126=		Bits 59-85= 0019678 Bits 113-126= 060D

* For beacon models not capable of updating the encoded position data after beacon activation, use the modified procedure for test scripts 2-11, as follows. Instead of keeping the beacon active and applying navigation data to the beacon, the test beacon shall be turned off and then, after the required navigation input is provided, the test beacon shall be turned on.

† The hexadecimal values reported in this column are calculated by converting the binary values of the data required by column two into hexadecimal values, as follows: Bits 59-85 hexadecimal apart from Bits 59, 60 and 61 which form a decimal character (0 to 7), leading zeros must not be suppressed. For example the following bits 101 1000 0000 1100 1111 0101 0000 would be expressed as 580CF50. Bits 113-126 hexadecimal apart from Bits 113 and 114 which form a decimal character (0 to 3), leading zeros must not be suppressed. For example the following bits 10 1111 0000 1100 would be expressed as 2F0C.

Script*	Value of Encoded Location Bits Transmitted by Beacon	BCH Correct (√)	Required Value of Encoded Location Bits†
5. Keeping the beacon active, change the navigation input to the beacon to: 0° 10 min 55 sec North, 179° 51 min 1 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 59-85= Bits 113-126=		Bits 59-85= 001567A Bits 113-126= 2710
6. Keeping the beacon active, change the navigation input to the beacon to: 0° 11 min 3 sec South, 179° 46 min 0 sec West. When the beacon transmitted message changes, record the new encoded location bits.	Bits 59-85= Bits 113-126=		Bits 59-85= 401B677 Bits 113-126= 0740
7. Keeping the beacon active, change the navigation input to the beacon to: 89° 15 min 8 sec South, 89° 0 min 1 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 59-85= Bits 113-126=		Bits 59-85= 6CA0B20 Bits 113-126= 06C0
8. Keeping the beacon active, change the navigation input to the beacon to: 89° 16 min 10 sec South, 89° 0 min 1 sec West. When the beacon transmitted message changes, record the new encoded location bits.	Bits 59-85= Bits 113-126=		Bits 59-85= 6CA2B20 Bits 113-126= 21C0
9. Keeping the beacon active, change the navigation input to the beacon to: 89° 59 min 4 sec North, 179° 59 min 54 sec West. When the beacon transmitted message changes, record the new encoded location bits.	Bits 59-85= Bits 113-126=		Bits 59-85= 2D03680 Bits 113-126= 0701
10. Keeping the beacon active, change the navigation input to the beacon to: 89° 57 min 59 sec North, 179° 59 min 24 sec East. When the beacon transmitted message changes, record the new encoded location bits.	Bits 59-85= Bits 113-126=		Bits 59-85= 2CF5680 Bits 113-126= 2009

Script*	Value of Encoded Location Bits Transmitted by Beacon	BCH Correct (√)	Required Value of Encoded Location Bits†
11. Keeping the beacon active, change the navigation input to the beacon to: 36° 30 min 0 sec South, 138° 29 min 59 sec West. When the beacon transmitted message changes, record the new encoded location bits.	Bits 59-85= Bits 113-126=		Bits 59-85= 523F14F Bits 113-126= 2040
Self-Test Navigation Test Scripts			
12. Turn the beacon off. Ensure that navigation data is not provided to the beacon then activate the Self-Test. Record the value of encoded location bits in the self-test message.	Bits 59-85= Bits 113-126=		Bits 59-85= 3F81FE0 Bits 113-126= 27CF
13. Continuously apply the following navigation data to the beacon: 0° 0 min 59 sec South, 0° 0 min 57 sec West. Activate the Self-Test. Record the value of encoded location bits in the self-test message.	Bits 59-85= Bits 113-126=		Bits 59-85= 3F81FE0 Bits 113-126= 27CF

Table D.4: ELT(DT) and RLS* Location Protocol Procedure

Script	Value of Encoded Location Bits Transmitted by Beacon	BCH Correct (√)	Required Value of Encoded Location Bits†
1. Turn on beacon ensuring that navigation is not provided to the beacon. Record the value of encoded location bits.	Bits 67-85= Bits 115-132= Bits 109-112=		Bits 67-85 = 3FDFF Bits 115-132 = 21F0F Bits 109-112 = F
2. Keeping the beacon active, apply the following navigation data to the beacon: 0° 0 min 59 sec South, 0° 0 min 57 sec West. Altitude = 2000m When the beacon transmitted message changes, record the new encoded location bits and the duration of time the beacon took to update.	Bits 67-85= Bits 115-132= Bits 109-112= Number of seconds after providing navigation data that beacon transmitted the above encoded location information: _____		Bits 67-85 = 40200 Bits 115-132 = 2210E Bits 109-112 = 4 Response time for beacon to transmit correct encoded location must be less than 62.5 sec.
3. Keeping the beacon active, change the navigation input to the beacon to: 0° 0 min 53 sec North, 0° 0 min 51 sec East. Altitude = 5600.4m When the beacon transmitted message changes, record the new encoded location bits.	Bits 67-85= Bits 115-132= Bits 109-112=		Bits 67-85 = 00000 Bits 115-132 = 21B0D Bits 109-112 = A

* Note that Altitude and the results for Bits 109-112 in Table D.4 above only apply to ELT(DT)s.

† The hexadecimal values reported in this column are calculated by converting the binary values of the data required by column two into hexadecimal values, as follows: Bits 67-85 hexadecimal apart from Bits 67, 68 and 69 which form a decimal character (0 to 7), leading zeros must not be suppressed. For example the following bits 010 1000 0000 1100 1111 would be expressed as 280CF. Bits 115-132 hexadecimal apart from Bits 115 and 116 which form a decimal character (0 to 3), leading zeros must not be suppressed. For example the following bits 10 1111 0000 1100 0110 1010 would be expressed as 2F0C6A.

Script	Value of Encoded Location Bits Transmitted by Beacon	BCH Correct (√)	Required Value of Encoded Location Bits†
4. Keeping the beacon active, change the navigation input to the beacon to: 0° 11 min 10 sec North, 179° 47 min 7 sec East. Altitude = 5599.6m When the beacon transmitted message changes, record the new encoded location bits.	Bits 67-85= Bits 115-132= Bits 109-112=		Bits 67-85 = 00168 Bits 115-132 = 366CD Bits 109-112 = 9
5. Keeping the beacon active, change the navigation input to the beacon to: 1° 10 min 55 sec North, 178° 51 min 1 sec East. Altitude = -100m When the beacon transmitted message changes, record the new encoded location bits.	Bits 67-85= Bits 115-132= Bits 109-112=		Bits 67-85 = 00966 Bits 115-132 = 35C90 Bits 109-112 = 0
6. Keeping the beacon active, change the navigation input to the beacon to: 0° 11 min 3 sec South, 179° 46 min 0 sec West. Altitude = 1m When the beacon transmitted message changes, record the new encoded location bits.	Bits 67-85= Bits 115-132= Bits 109-112=		Bits 67-85 = 40368 Bits 115-132 = 362E0 Bits 109-112 = 0
7. Keeping the beacon active, change the navigation input to the beacon to: 89° 15 min 8 sec South, 89° 0 min 1 sec East. Altitude = 401m When the beacon transmitted message changes, record the new encoded location bits.	Bits 67-85= Bits 115-132= Bits 109-112=		Bits 67-85 = 6CCB2 Bits 115-132 = 1DB00 Bits 109-112 = 1

Script	Value of Encoded Location Bits Transmitted by Beacon	BCH Correct (√)	Required Value of Encoded Location Bits†
8. Keeping the beacon active, change the navigation input to the beacon to: 89° 16 min 10 sec South, 89° 0 min 1 sec West. Altitude = 7000m When the beacon transmitted message changes, record the new encoded location bits.	Bits 67-85= Bits 115-132= Bits 109-112=		Bits 67-85 = 6CEB2 Bits 115-132 = 1B900 Bits 109-112 = B
9. Keeping the beacon active, change the navigation input to the beacon to: 89° 59 min 4 sec North, 179° 59 min 54 sec West. Altitude = 9999m When the beacon transmitted message changes, record the new encoded location bits.	Bits 67-85= Bits 115-132= Bits 109-112=		Bits 67-85 = 2D368 Bits 115-132 = 01C01 Bits 109-112 = D
10. Keeping the beacon active, change the navigation input to the beacon to: 89° 57 min 59 sec North, 179° 59 min 24 sec East. Altitude = 10001m When the beacon transmitted message changes, record the new encoded location bits.	Bits 67-85= Bits 115-132= Bits 109-112=		Bits 67-85 = 2D168 Bits 115-132 = 04009 Bits 109-112 = E
11. Keeping the beacon active, change the navigation input to the beacon to: 36° 30 min 0 sec South, 138° 29 min 59 sec West. Altitude = 15240m When the beacon transmitted message changes, record the new encoded location bits.	Bits 67-85= Bits 115-132= Bits 109-112=		Bits 67-85 = 52715 Bits 115-132 = 20100 Bits 109-112 = E

Script	Value of Encoded Location Bits Transmitted by Beacon	BCH Correct (√)	Required Value of Encoded Location Bits†
Self-Test Navigation Test Scripts			
12. Turn the beacon off. Ensure that navigation data is not provided to the beacon then activate the Self-Test. Record the value of encoded location bits in the self-test message.	Bits 67-85= Bits 115-132= Bits 109-112=		Bits 67-85 = 3FDFF Bits 115-132 = 21F0F Bits 109-112 = F
13. Continuously apply the following navigation data to the beacon: 0° 0 min 59 sec South, 0° 0 min 57 sec West. Altitude = 1000m Activate the Self-Test. Record the value of encoded location bits in the self-test message.	Bits 67-85= Bits 115-132= Bits 109-112=		Bits 67-85 = 3FDFF Bits 115-132 = 21F0F Bits 109-112 = F

Table D.5: RLS Location Protocol Procedure Additional Scripts

Script	Expected Result	Actual Result	Pass/Fail (√ or x)
1. Ensure that the beacon is correctly coded as per C/S T.007 Annex C. Carry out a self-test.	Ensure that the encoded 15 Hex ID is '193BFCE031BFDFF'	Hex ID =	
2. Turn the beacon on and check that it is transmitting, and what the Hex ID is, and that there is an indication of an RLS request. Decode the transmitted message and ensure that bits 127 to 132 are correctly encoded.	Transmitted 15 Hex ID is '193BFCE031BFDFF' Visual Indication of RLS request Bits 109 to 114 are '100001'.	Hex ID = Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
3. Provide an IEC 61162-1 RLM sentence as the navigation input to the beacon with the following data: 15 Hex ID = 193BFCE031BFDFF Message Type = 1 UTC Time = any valid random data Decode the next transmitted message and ensure that bits 109 to 114 are correctly encoded.	Ensure that a different indication of receipt of an RLS request acknowledgement is provided within 5 seconds of the application of the RLM sentence. Bits 109 to 114 are '101001'	Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
4. Turn the beacon off and remove the RLM sentence from the navigation input. Turn the beacon on and check that it is transmitting, and what the Hex ID is, and that there is an indication of an RLS request. Decode the transmitted message and ensure that bits 109 to 114 are correctly encoded.	Transmitted 15 Hex ID is '193BFCE031BFDFF' Visual Indication of RLS request. Bits 109 to 114 are '100001'.	Hex ID = Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	

Script	Expected Result	Actual Result	Pass/Fail (√ or x)
5. Provide an IEC 61162-1 RLM sentence as the navigation input to the beacon with the following data: 15 Hex ID = 193BFCE031BFDFF Message Type = 2 UTC Time = any valid random data Decode the transmitted message and ensure that bits 109 to 114 are correctly encoded.	Monitor the RLS Indicator for a minimum of 5 minutes and ensure that it continues to provide an indication of an RLS request. Bits 109 to 114 are '100001'.	Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
6. Turn the beacon off and remove the RLM sentence from the navigation input. Turn the beacon on and check that it is transmitting, and what the Hex ID is, and that there is an indication of an RLS request. Decode the transmitted message and ensure that bits 109 to 114 are correctly encoded.	Transmitted 15 Hex ID is '193BFCE031BFDFF' Visual Indication of RLS request Bits 109 to 114 are '100001'.	Hex ID = Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
7.* Provide an IEC 61162-1 RLM sentence as the navigation input to the beacon with the following data: 15 Hex ID = 193BFCE032BFDFF Message Type = 1 UTC Time = any valid random data Decode the transmitted message and ensure that bits 109 to 114 are correctly encoded.	Monitor the RLS Indicator for a minimum of 5 minutes and ensure that it continues to provide an indication of an RLS request. Bits 109 to 114 are '100001'.	Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	

* Test 7 is aimed at providing a valid change to the beacon serial number from 99 to 101 in the return link message and at confirming that the beacon ignores this message which is not addressed to the beacon under test.

Script	Expected Result	Actual Result	Pass/Fail (√ or x)
8. Turn the beacon off and remove the RLM sentence from the navigation input. Turn the beacon on and check that it is transmitting, and what the Hex ID is, and that there is an indication of an RLS request. Decode the transmitted message and ensure that bits 109 to 114 are correctly encoded.	Transmitted 15 Hex ID is '193BFCE031BFDFF' Visual Indication of RLS request Bits 109 to 114 are '100001'	Hex ID = Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
9.* Provide an IEC 61162-1 RLM sentence as the navigation input to the beacon with the following data: 15 Hex ID = 193BFCE031BFDFE Message Type = 1 UTC Time = any valid random data Decode the transmitted message and ensure that bits 109 to 114 are correctly encoded.	Monitor the RLS Indicator for a minimum of 5 minutes and ensure that it continues to provide an indication of an RLS request. Bits 109 to 114 are '100001'.	Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
10. Turn the beacon off and remove the RLM sentence from the navigation input. Turn the beacon on and check that it is transmitting, and what the Hex ID is, and that there is an indication of an RLS request. Decode the transmitted message and ensure that bits 109 to 114 are correctly encoded.	Transmitted 15 Hex ID is '193BFCE031BFDFF' Visual Indication of RLS request Bits 109 to 114 are '100001'.	Hex ID = Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	

* Test 9 is aimed at making an invalid change to the return link message in that it alters the default location data which should not change in a valid Hex ID. This test ensures that beacons are simply not ignoring these bits in their return link message validation of the 15 Hex ID.

Script	Expected Result	Actual Result	Pass/Fail (√ or x)
11. Provide an IEC 61162-1 RLM sentence as the navigation input to the beacon with the following data: 15 Hex ID = 183BFCE031BFDFF Message Type = 1 UTC Time = any valid random data Decode the transmitted message and ensure that bits 109 to 114 are correctly encoded.	Monitor the RLS Indicator for a minimum of 5 minutes and ensure that it continues to provide an indication of an RLS request. Bits 109 to 114 are '100001'.	Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	

- END OF ANNEX D -

ANNEX E: SAMPLE PROCEDURE FOR TYPE APPROVAL TESTING OF 406 MHZ BEACONS WITH VOICE TRANSCEIVER

The following sample procedure illustrates the guidelines provided in section C/S T.007, section A.3.7.2, concerning the testing of beacons with operator controlled ancillary devices. It is applicable to beacons with operator controlled voice transceivers but may need to be adapted for specific beacon designs. All other aspects of the testing, as documented in C/S T.007 are unchanged.

E.1 BEACON VOICE TRANSCEIVER CONFIGURATION

The following requirements pertain to the configuration of the beacon voice transceiver for the duration of all testing:

a) if the beacon has a volume control setting, the beacon loudspeaker shall be set to maximum volume and a fully modulated voice carrier from an external RF-generator shall be transmitted in the operational frequency channel;

b) if the beacon includes a manual squelch mode, this shall be selected, and it shall be set to its most sensitive level for un-squelched operating periods;

c) if the beacon includes different transmitter power levels, the highest level shall be selected; and

d) any other manual settings shall be set to the mode which creates the highest load on the beacon battery.

E.2 THERMAL SHOCK TEST (C/S T.007, SECTION A.2.2)

The beacon transceiver shall be operated as described below for the duration of the thermal shock test:

a) 5 Seconds (+/- 2.5 Seconds) before the first beacon burst to be measured, the voice transmitter shall transmit for 30 seconds, followed immediately by 30 seconds during which the beacon voice transmitter is not active; the receive mode shall be activated during the 30 seconds following the transmission cycle; this process shall be repeated for 15 minutes; and

b) thereafter, the transceiver shall be configured to repeat the following cycle, 3 times in succession, once per hour of testing:

   i. transmit for 30 seconds, and

   ii. followed by 30 seconds receiving.

E.3 OPERATING LIFETIME AT MINIMUM TEMPERATURE (C/S T.007, SECTION A.2.3)

The beacon transceiver shall be operated as described below, for the duration of this test:

a) for the first 15 minutes of this test, the transceiver shall be operated as described at paragraph E.2.a above;

b) 4 hours before the end of the test period the procedure described at paragraph E.2.a above shall be repeated for 15 minutes; and

c) for the full duration of the test except the periods specified in paragraphs (a) and (b) above, the transceiver shall be operated as follows:

i. for beacons with a means to prevent continuous transmission beyond a predetermined limit where the manufacturer has declared a transmit mode test 'on' time, the transceiver shall be operated as described below until the total time of the voice transceiver transmission reaches the declared 'on' time* commencing 6 hours after the start of the test. Note that due to the inclusion of the means to prevent continuous transmission it may be necessary to release and reactivate the PTT switch a number of times in order to achieve the declared 'on' time.

a. transmit for 30 seconds,

b. followed by 30 seconds receiving, and

ii. for beacons without a means to prevent continuous transmission beyond a predetermined limit then the transceiver shall transmit for the remaining operation for that beacon.

E.4 FREQUENCY STABILITY TEST WITH TEMPERATURE GRADIENT (C/S T.007, SECTION A.2.4)

The beacon transceiver shall be operated as described below, for the duration of this test:

a) the transceiver shall be operated as described at paragraph E.2.b above for the duration of the test period; and

b) in addition, the transceiver shall be operated as described at paragraph E.2.a above for one 15 minute period during which the temperature is rising, and for one 15 minute period during which the temperature is falling.

* Note that this test requires the beacon to transmit for a period of 15 minutes in excess of the manufacturer declared transmit mode test 'on' time as required by E.3 a. and E.3 b. This additional transmit time is to compensate for the additional current drain during the time that the receiver may be on during the operating lifetime of the beacon.

E.5 SATELLITE QUALITATIVE TESTS (C/S T.007, SECTION A.2.5)

The beacon transceiver shall be operated as described at paragraph E.2.a above for the entire duration that the beacon is in view of the satellite.

E.6 PREVENTION OF CONTINUOUS TRANSMISSION TEST

This test only applies to operator-controlled voice transceivers that include a means to prevent continuous transmission beyond a predetermined limit set by the manufacturer.

Activate the PTT switch on the beacon and keep it this way. Monitor the transmissions from the operator-controlled voice transceiver and ensure that these cease after the predetermined limit set by the manufacturer, which must not exceed 30 minutes. Continue to keep the PTT switch activated for a further period of 15 minutes after the transmissions from the operator-controlled voice transceiver cease and ensure that they do not automatically restart during this period. Release and reactivate the PTT switch and ensure that transmissions from the operator-controlled voice transceiver restart.

Report the results of the test in the Table F.1, test parameter 19.

E.7 ALL OTHER TESTS

For all other tests, the beacon transceiver shall be operated as described at paragraph E.2.b above.

- END OF ANNEX E -

ANNEX F: BEACON TYPE APPROVAL TEST RESULTS

Table F.1: Overall Summary of 406 MHz Beacon Test Results

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			T_{min} (ºC)	T_{amb} (ºC)	T_{max} (ºC)	
1. Transmitter Power Output						
- transmitter power output (min and max)						
- Except ELT(DT)	35-39	dBm				
- For ELT(DT)	36-39	dBm				
- power output rise time						
- Except ELT(DT)	< 5	ms				
- For ELT(DT)	<2	ms				
- power output 1 ms before burst	< -10 dBm	dBm				
2. Digital Message						
Bits number						
- bit sync 1-15	15 bits "1"	√*				
- frame sync 16-24	"000101111"	√				
- format flag 25	1 bit	bit value				
- protocol flag 26	1 bit	bit value				
- identification / position data 27-85	59 bit	√				
- BCH code 86-106	21 bits	√				
- emergency code / nation. use/suppl. data 107-112	6 bits	bit value				
- For RLS/ELT(DT) / suppl. data 107-114	8 bits	bit value				
- additional data /BCH (if applicable) (except for RLS/ELT(DT))	32 bits	√				
- additional data /BCH (if applicable) (for RLS/ELT(DT))	30 bits	√				

* Indicate that testing demonstrated conformance to requirements by placing the √ symbol in Table F.1.

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			T_{min} (ºC)	T_{amb} (ºC)	T_{max} (ºC)	
3a. Digital Message Generator (Except for ELT(DT))						
- repetition rate T_R:						
○ average T_R	48.5-51.5	sec				
○ min T_R	47.5≤T_R≤48.0	sec				
○ max T_R	52.0≤T_R≤52.5	sec				
○ standard deviation	0.5-2.0	sec				
- bit rate (except for RLS-capable beacons)						
○ min f_b	≥ 396	bit/sec				
○ max f_b	≤ 404	bit/sec				
- bit rate (for RLS-capable beacons)						
○ min fb	≥ 399.6	bit/sec				
○ max fb	≤ 400.4	bit/sec				
- total transmission time:						
○ short message	435.6-444.4	ms				
○ long message	514.8-525.2	ms				
- unmodulated carrier:						
○ min T_1	≥ 158.4	ms				
○ max T_1	≤ 161.6	ms				
- first burst delay:						
- all beacon types, including ELTs when manually activated	≥ 47.5	sec				
- ELTs when automatically activated by G-switch/deformation	≤ 15	sec				
3b. Digital Message Generator (for ELT(DT))						
- repetition rate (first 30 seconds)T_R:						
○ min T_R	4.8	sec				
○ max T_R	5.0	sec				
- repetition rate (after 30 seconds)T_R:						
○ average T_R	27.6-29.4	sec				
○ min T_R	27.0≤ T_R ≤27.3	sec				
○ max T_R	29.7≤ T_R ≤30.0	sec				
○ standard deviation	0.3-1.2	sec				
- bit rate:						
○ min f_b	≥ 399.6	bit/sec				
○ max f_b	≤ 400.4	bit/sec				
- total transmission time:						
○ long message	514.8-525.2	ms				
- unmodulated carrier:						

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			T_{min} (ºC)	T_{amb} (ºC)	T_{max} (ºC)	
○ min T_1	≥ 158.4	ms				
○ max T_1	≤ 161.6	ms				
- first burst delay: - ELT(DT)	≤ 5	sec				
4. Modulation						
- biphase-L		√				
- rise time except ELT(DT) (min and max)	50-250	µsec				
- fall time except ELT(DT) (min and max)	50-250	µsec				
- rise time for ELT(DT) (min and max)	50-150	µsec				
- fall time for ELT(DT) (min and max)	50-150	µsec				
- phase deviation: positive (min and max)	+(1.0 to 1.2)	radians				
- phase deviation: negative (min and max)	-(1.0 to 1.2)	radians				
- symmetry measurement	≤ 0.05					
5. 406 MHz Transmitted Frequency						
- nominal value	C/S T.001	MHz				
- short-term stability	≤ $2x10^{-9}$	/100 ms				
- medium-term stability slope (N/A for ELT(DT))	(-1 to +1)$x10^{-9}$	/min				
- medium-term stability residual frequency variation (N/A for ELT(DT))	≤ $3x10^{-9}$					
6. Spurious Emissions into 50 Ohms (406.0 – 406.1 MHz)*	C/S T.001 mask	√				
7. 406 MHz VSWR Check						
- nominal transmitted frequency	C/S T.001	MHz				
- modulation rise time except ELT(DT) (min and max)	50-250	µsec				
- modulation fall time except ELT(DT) (min and max)	50-250	µsec				
- modulation rise time for ELT(DT) (min and max)	50-150	µsec				
- modulation fall time for ELT(DT) (min and max)	50-150	µsec				
- phase deviation: positive (min and max)	+(1.0 to 1.2)	radians				
- phase deviation: negative (min and max)	-(1.0 to 1.2)	radians				
- modulation symmetry measurement	≤ 0.05					
- digital message	Correct	√				

* Include spectral plots of the 406.0-406.1 MHz band, showing the transmit signal and the emission mask as defined in document C/S T.001.

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			T_{min} (ºC)	T_{amb} (ºC)	T_{max} (ºC)	
8 (a). Self-test Mode						
- frame sync	"011010000"	√				
- format flag	1/0	bit value				
- radiated burst	≤ 440/520 (+1%)	ms				
- default position data (if applicable)	must be correct	√				
- description provided		√				
- design data provided on protection against repetitive self-test mode transmissions		√				
- single burst verification	must be one burst	√				
- provides for 15 Hex ID	must be correct	√				
- 121.5 MHz RF power (if applicable)	verify that RF power is emitted	√				
- 406 MHz RF power	verify that RF power is emitted	√				
- distinct indication of self-test start	must be provided	√				
- distinct indication of RF-power being emitted	must be provided	√				
- indication of the self-test result	must be provided	√				
- distinct indication of insufficient battery capacity*	must be provided	√				
- maximum duration of self-test mode	shall not exceed maximum duration of self-test	sec				
- automatic termination of the self-test mode upon completion of the self-test and indication of the self-test results	verify automatic termination, irrespectively of the switch position	√				

* By decision of the Cospas-Sarsat Council at its Fifty-Seventh Session, this requirement will be mandatory only for new beacon models submitted for type approval testing after 1 January 2018, as a target, subject to further review and consideration.

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			T_{min} (ºC)	T_{amb} (ºC)	T_{max} (ºC)	
8 (b). GNSS Self-Test Mode (if applicable)						
- frame sync	"011010000"	√				
- format flag	1	bit value				
- radiated burst duration	≤ 520 (+1%)	ms				
- position data except for ELT (DT) (if applicable)	must be within 500m (or 5.25km for User-Location Protocol) of the actual position	√				
- position data for ELT(DT)	must be within 200m of the actual horizontal position and 700m of the altitude	√				
- design data showing how GNSS Self-Test is limited in number of transmissions and duration	must be provided	√				
- single burst verification(if applicable)	must be one burst	√				
- 121.5 MHz RF power (if applicable)	verify that RF power is emitted	√				
- 406 MHz RF power (if applicable)	verify that RF power is emitted	√				
- Maximum duration of GNSS Self-Tests	Manufacturer to specify value	sec				
- Actual duration of GNSS Self-Test with encoded location	Less than maximum duration	sec				
- Maximum number of GNSS Self-Tests (only beacons with internal navigation devices)	Manufacturer to specify number	number				
- Distinct indication to register successful completion or failure of the GNSS self-test	must be provided	√				
- Distinct indication that a maximum number of GNSS self-tests has been attained after GNSS self-test mode activation and without transmission of a test message or further GNSS receiver current drain	must be provided	√				

Parameters to be Measured	Range of Specification	Units	Test Results	Comments
9. Thermal Shock*				
- soak temperature			T_{soak}=_____°C	
- measurement temperature			T_{meas}=_____°C	
- the following parameters are to be met within 15 minutes of beacon turn on (except for ELT(DT) for which measurements shall commence immediately after beacon activation) and maintained for 2 hours:				
- transmit frequency nominal value	C/S T.001	MHz		
- transmit frequency short-term stability	$\leq 2x10^{-9}$	/100 ms		
- transmit frequency medium-term stability slope (N/A for ELT(DT))	$(-2 \text{ to } +2)x10^{-9}$	/min		
- transmit frequency medium-term stability residual frequency variation (N/A for ELT(DT))	$\leq 3x10^{-9}$			
- transmitter power output except for ELT(DT) (min and max)	35-39	dBm		
- transmitter power output for ELT(DT) (min and max)	36-39	dBm		
- digital message	Correct	√		
10. Operating Lifetime at Minimum Temperature†				
- Duration except for ELT(DT)	> 24	hrs	_____hours at T_{min} =_____°C	
- Duration for ELT(DT)	> 20	hrs	_____hours at T_{min} =_____°C	
- transmit frequency nominal value	C/S T.001	MHz		
- transmit frequency short-term stability	$\leq 2x10^{-9}$	/100ms		
- transmit frequency medium-term stability slope (N/A for ELT(DT))	$(-1 \text{ to } +1)x10^{-9}$	/min		
- transmit frequency medium-term stability residual frequency variation (N/A for ELT(DT))	$\leq 3x10^{-9}$			
- transmitter power output (N/A for ELT(DT)) (min and max)	35-39	dBm		
- $P_{t\ EOL}$=minimum transmitter power output observed during lifetime at minimum temperature except for ELT(DT)	35-39	dBm		
- transmitter power output for ELT(DT) (min and max)	36-39	dBm		

* Attach graphs depicting the test results.
† Attach graphs depicting test results.

Parameters to be Measured	Range of Specification	Units	Test Results	Comments
- $P_{t\ EOL}$=minimum transmitter power output observed during lifetime at minimum temperature for ELT(DT)	36-39	dBm		
- digital message	Correct	√		
- homer transmitter continuous operation during the lifetime test		hours		
- homer frequency		MHz		
- homer peak power level		dBm		
- homer transmitter duty cycle		%		
11. Temperature Gradient (5°C/hour)*				
- transmit frequency nominal value	C/S T.001	MHz		
- transmit frequency short-term stability	≤ $2x10^{-9}$	/100ms		
- transmit frequency medium-term stability (N/A for ELT(DT))				
- slope (A to B, C+15 to D and E+15 to F)	(-1 to +1)$x10^{-9}$	/min		
- slope (B to C+15 and D to E+15)	(-2 to +2)$x10^{-9}$	/min		
- residual frequency variation	≤ $3x10^{-9}$			
- transmitter power output except for ELT(DT) (min and max)	35-39	dBm		
- transmitter power output for ELT(DT) (min and max)	36-39	dBm		
- digital message	Correct	√		
12. Oscillator Aging				
- 5-year carrier nominal frequency variation	C/S T.001, section 2.3.1	kHz		
- MTS analysis (if applicable)	Must demonstrate compliance	√		
13. Protection against Continuous Transmission Description Provided	< 45	sec		Provide description.

* Attach graphs depicting the test results.

Parameters to be Measured	Range of Specification	Units	Test Results	Comments
14a. Satellite Qualitative Test except for ELT(DT) (results provided)*	15 Hex ID provided by LUT and position within 5 km 80% of time RLM received within 15 minutes	√ √		For beacons with an RLS function only
14b. Satellite Qualitative Test for ELT(DT)(results provided)†	produce an alert with a complete valid beacon message at least once per minute for >90% of the time encoded location provided accurate within 200m 2D for >90% of the alerts encoded location provided by the MEOLUT as per the pass/fail criteria A.2.5 c) (i, ii, and iii) for altitude	√ √ √		
15. Antenna Characteristics - Polarization - VSWR - $EIRP_{LOSS}$ - $EIRP_{max\ EOL}$ except for ELT(DT) - $EIRP_{min\ EOL}$ except for ELT(DT) - $EIRP_{max\ EOL}$ for ELT(DT) - $EIRP_{min\ EOL}$ for ELT(DT)	 linear or RHCP ≤ 1.5 ≤ 43 ≥ 32 or ≥ 30 ≤ 45 ≥ 34	 dB dBm dBm dBm dBm		Report FF-each Antenna Configuration Tested ≥30 dBm for antenna tested in Figure B.5 configuration

* Attach a satellite qualitative test summary report (Appendix A to Annex F) for each test configuration.
† Attach a satellite qualitative test summary report (Appendix A to Annex F) for each test configuration.

Parameters to be Measured	Range of Specification	Units	Test Results	Comments
16. Beacon Coding Software*				
- sample message provided for each coding option of the applicable coding types	correct	√		Per applicable F-D.1/F-D.2/ F-D.3 Table.
- sample self-test message provided for each coding option of the applicable coding types	correct	√		Per applicable F-D.1/F-D.2/ F-D.3 Table.
17. Navigation System†				Report the results for ULP, SLP, NLP, RLSLP and ELT(DT)LP as appropriate
- position data default value	correct	√		
- position acquisition time‡	< 10 (int.nav) < 1 (ext.nav) < 3 (all ELT(DT) nav)	min min second		Results per Tables F-C.6 or F-C.7
- position accuracy§	C/S T.001	m		Results per Tables F-C.6 or F-C.7
- encoded position data update interval	> 5 (except for ELT(DT)) > every burst (for ELT(DT))	min √		
- internal navigation device update intervals (except for ELT(DT))	as per C/S T.001, section 4.5.5.4	√		Include results from 0 to 2, 2 to 6 and more than 6 hours, in a separate table
- information provided on manufacturers location data update scheme		√		
- internal navigation device update intervals (For ELT(DT))	as per C/S T.001, section 4.5.5.6	√		Results per Table F-C.8
- position clearance after deactivation	Correct	√		Test per A.3.8.4
- position data input update interval	<1.0 min (ELT) <20 min (EPIRB/PLB) <2 seconds (ELT(DT))	√ √ √		Test per A.3.8.5
- stored position cleared within interval	1.0-1.5 min (ELT) 20-30 min (EPIRB/PLB) *10-10.25 min (ELT(DT))*	√ √ √		

* Attach examples of each requested coding option as per Appendix D to Annex F.
† Attach navigation system test results as per Appendix C to Annex F.
‡ Report the results of this test for all the declared beacon configurations.
§ Report the results of this test for all the declared beacon configurations.

Parameters to be Measured	Range of Specification	Units	Test Results	Comments
- position data encoding	Correct	√		Results per Tables F-C.1 to F-C.5 as appropriate
- retained last valid position after navigation input lost (except for ELT(DT)	240(±5)	min		
- retained last valid position after navigation input lost (for ELT(DT))	9 min 50 sec to 10 min	√		
- default position data transmitted after 240 (±5) minutes without valid position data	Correct	√		Test per A.3.8.6
- default position data transmitted after 10 minutes without valid position data (for ELT(DT))	Correct	√		
- information provided on protection against erroneous position encoding into the beacon message		√		
18. Return Link Service (RLS)				
- A.3.8.8.1 M_{offset} Test				
- Self-Test for correct 15 Hex ID	193BFCE031BFDFF	N/A	Pass / Fail	
a) Visual Indication	≤ 5 seconds after activation	sec		
b) Transmitted Message Bits 109 - 114	100001	N/A	Pass / Fail	
c) GNSS Receiver turns on	≤ 5 seconds after first transmission	sec		
d) Time to output UTC	Record time since receiver activation	sec		
e) GNSS Receiver on time	≥ 30 minutes after beacon activation	min		
f) Time to indicate RLM receipt	≤ 30 minutes after beacon activation	min		
g) Transmitted Message Bits 109 to 114	101001	N/A	Pass / Fail	First transmitted burst after RLM receipt
h) GNSS Receiver reactivation time	39 minutes +/- 5 seconds past next natural hour	min		
i) GNSS Receiver on time	≥ 15 minutes after reactivation	min		
j) GNSS Receiver reactivation time	39 minutes +/- 5 seconds past next natural hour	min		
k) GNSS Receiver on time	≥ 15 minutes after reactivation	min		

Parameters to be Measured	Range of Specification	Units	Test Results	Comments
- A.3.8.8.2 UTC Test				
a) Visual Indication	≤ 5 seconds after activation	sec		
b) Transmitted Message Bits 109 to 114	100001	N/A	Pass / Fail	
c) GNSS Receiver turns on	≤ 5 seconds after first transmission	sec		
d) Time to output UTC	Record time since receiver activation	sec		
e) GNSS Receiver position output Deny Beacon further GNSS signals	Valid Lat/Long No further Receiver outputs	N/A N/A	Pass / Fail Pass / Fail	
f) Transmitted message valid location Message Bits 109 to 114	≤ 500m of actual beacon location 100001	m N/A	 Pass / Fail	
g) GNSS Receiver on time	≥ 30 minutes after beacon activation	min		
h) GNSS Receiver reactivation time	39 minutes +/- 5 seconds past next natural hour	min		
i) GNSS Receiver on time	≥ 15 minutes after reactivation	min		
j) Transmitted message valid location Message Bits 109 to 114	≤ 500m of actual beacon location 100001	m N/A	 Pass / Fail	
k) GNSS Receiver reactivation time	39 minutes +/- 5 seconds past next natural hour	min		
m) GNSS Receiver on time	≥ 15 minutes after reactivation	min		
n) Time to indicate RLM receipt	≤ 15 minutes after receiver reactivation	min		
o) Transmitted Message Bits 109 to 114	101001	N/A	Pass / Fail	First transmitted burst after RLM receipt

Parameters to be Measured	Range of Specification	Units	Test Results	Comments
19. Prevention of Continuous Transmission (for beacons with voice transceiver) Duration of continuous voice-transceiver operation in transmit mode	≤ 30 (if implemented)	min		Test per section E.6
20. Activation and Cancellation Message Tests (ELT(DT) only)				Test per section A.3.9
Activation and De-activation Tests	Message bits 107-108 comply with Table A.2	√	Pass / Fail	
Cancellation Message Tests	Comply with A.3.9.2			
- nominal transmitted frequency	C/S T.001	MHz		
- Transmitter Power Output	36-39	dBm		
- modulation rise time (min and max)	50-150	µsec		
- modulation fall time (min and max)	50-150	µsec		
- phase deviation: positive (min and max)	+(1.0 to 1.2)	radians		
- phase deviation: negative (min and max)	-(1.0 to 1.2)	radians		
- modulation symmetry measurement	≤ 0.05			
- digital message	Correct	√		
- Transmission of First Cancellation Message	Within 5 seconds of de-activation	√		
- Number of Cancellation Messages	10	√		
- Interval between Cancellation Messages	10 seconds ± 0.5 second	√		
Reactivation Test	Comply with section A.3.9.3	√		

F.1 APPENDIX A TO ANNEX F

F.1.1 APPENDIX A1 TO ANNEX F: SATELLITE QUALITATIVE TEST SUMMARY REPORT (except for ELT(DT))

Date of the Test:_____

Time of the Test:_____

Beacon Model:_____

Beacon 15-Hex ID:_____

Actual location of the test beacon: Latitude:_____; Longitude: _____

Beacon test configuration (e.g. on dry ground, floating in water, etc):_____

Satellite ID	Satellite Pass Number	Time of Closest Approach (TCA)	Cross Track Angle	15 Hex ID Provided by LUT	Doppler Location	Location Error (km)

Ratio of successful solutions = $\frac{\text{number of Doppler solutions within 5 km with 1°<CTA<21°}}{\text{number of satellite passes over test duration with 1°<CTA<21°}}$ X 100 = ____%

RLS enabled beacon provided an indication of reception of an RLM message within 15 minutes from beacon activation. Yes / No (indicate as appropriate)

Note: A separate table shall be provided for each beacon configuration tested.

Note: For beacons with an RLS function ensure that the complete Return Link Service is operational prior to commencing this test.

F.1.2 APPENDIX A2 TO ANNEX F: SATELLITE QUALITATIVE TEST SUMMARY REPORT (for ELT(DT))

Date of the Test:_____

Time of the Test:_____

Beacon Model:_____

Beacon 15-Hex ID:_____

Actual location of the test beacon: Latitude: _____
Longitude: _____
Altitude: _____

Burst number	Beacon Tx time	Complete beacon message	Encoded location reported in the MEOLUT alert			2D location error (meters)	Valid altitude band
			Latitude	Longitude	Altitude band		

Ratio of complete message with correct Hex ID = $\frac{\text{number of complete messages with correct HEX ID}}{\text{number of transmitted messages}}$ X 100 = ____%

Ratio of 2D encoded positions within 200 meters = $\frac{\text{number of alerts with 2D encoded positions within 200 meters}}{\text{number of complete message received with correct HEX ID}}$ X 100 = ____%

Ratio of valid altitude = $\frac{\text{number of alerts with valid altitude (as per A.2.5)}}{\text{number of complete message received with correct HEX ID}}$ X 100 = ____%

Note: A separate table shall be provided for each test period.

F.2 APPENDIX B TO ANNEX F: 406 MHZ BEACON ANTENNA TEST RESULTS

Table F-B.1: Equivalent Isotropically Radiated Power (dBm) / Antenna Gain (dBi)
(To be used for reporting the results of antenna testing in configurations B.2, B.3 and B.4)

Azimuth Angle (degrees)	Elevation Angle (degrees)				
	10	20	30	40	50
0	/	/	/	/	/
30	/	/	/	/	/
60	/	/	/	/	/
90	/	/	/	/	/
120	/	/	/	/	/
150	/	/	/	/	/
180	/	/	/	/	/
210	/	/	/	/	/
240	/	/	/	/	/
270	/	/	/	/	/
300	/	/	/	/	/
330	/	/	/	/	/

$EIRP_{LOSS} = Pt_{AMB} - Pt_{EOL} =$ dB

$EIRP_{max\ EOL}$ = **MAX [** $EIRP_{max}$ **,** $(EIRP_{max} - EIRP_{LOSS})$ **]** = **MAX (** _____ **,** _____ **)** = _____dBm

$EIRP_{min\ EOL}$ = **MIN [** $EIRP_{min}$ **,** $(EIRP_{min} - EIRP_{LOSS})$ **]** = **MIN (** _____ **,** _____ **)** = _____dBm

Table F-B.2: Induced Voltage Measurements V_v / V_h (dBuV)
(To be used for reporting the results of antenna testing in configurations B.2, B.3 and B.4)

Azimuth Angle (degrees)	Elevation Angle (degrees)				
	10	20	30	40	50
0	/	/	/	/	/
30	/	/	/	/	/
60	/	/	/	/	/
90	/	/	/	/	/
120	/	/	/	/	/
150	/	/	/	/	/
180	/	/	/	/	/
210	/	/	/	/	/
240	/	/	/	/	/
270	/	/	/	/	/
300	/	/	/	/	/
330	/	/	/	/	/
Min(V_v-V_h), dB					

Table F-B.3: Equivalent Isotropically Radiated Power (dBm) / Antenna Gain (dBi)
(To be used for reporting the results of antenna testing in Figure B.5 configuration)

Azimuth Angle (degrees)	Elevation Angle (degrees)				
	10	20	30	40	50
0	/	/	/	/	/
90	/	/	/	/	/
180	/	/	/	/	/
270	/	/	/	/	/

$EIRP_{LOSS}$ = Pt_{AMB} – Pt_{EOL} =_____dB

$EIRP_{max\ EOL}$ = **MAX [** $EIRP_{max}$ **,** ($EIRP_{max}$ – $EIRP_{LOSS}$) **]** = **MAX (** _____ **,** _____ **)** = _____dBm

$EIRP_{min\ EOL}$ = **MIN [** $EIRP_{min}$ **,** ($EIRP_{min}$ – $EIRP_{LOSS}$) **]** = **MIN (** _____ **,** _____ **)** = _____dBm

F.3 APPENDIX C TO ANNEX F: NAVIGATION SYSTEM TEST RESULTS

Table F-C.1: Position Data Encoding Results User-Location Protocol

Script Reference (See Table D.1)	Value of Encoded Location Bits Transmitted by Beacon	Confirmation that BCH Correct (√)
1	Bits 108-132=	
2	Bits 108 – 132= Number of seconds after providing navigation data that beacon transmitted the above encoded location information: _____	
3	Bits 108-132=	
4	Bits 108-132=	
5	Bits 108-132=	
6	Bits 108-132=	
7	Bits 108-132=	
8	Bits 108-132=	
9	Bits 108-132=	
10	Bits 108-132=	
11	Bits 108-132=	
12	Bits 108-132=	

Table F-C.2: Position Data Encoding Results Standard Location Protocol

Script Reference (See Table D.2)	Value of Encoded Location Bits Transmitted by Beacon	Confirmation that BCH Correct (√)
1	Bits 65-85= Bits 113-132=	
2	Bits 65-85= Bits 113-132= Number of seconds after providing navigation data that beacon transmitted the above encoded location information: _____	
3	Bits 65-85= Bits 113-132=	
4	Bits 65-85= Bits 113-132=	
5	Bits 65-85= Bits 113-132=	
6	Bits 65-85= Bits 113-132=	
7	Bits 65-85= Bits 113-132=	
8	Bits 65-85= Bits 113-132=	
9	Bits 65-85= Bits 113-132=	
10	Bits 65-85= Bits 113-132=	
11	Bits 65-85= Bits 113-132=	
12	Bits 65-85= Bits 113-132=	
13	Bits 65-85= Bits 113-132=	

Table F-C.3: Position Data Encoding Results National Location Protocol

Script Reference (See Table D.3)	Value of Encoded Location Bits Transmitted by Beacon	Confirmation that BCH Correct (√)
1	Bits 59-85= Bits 113-126=	
2	Bits 59-85= Bits 113-126= Number of seconds after providing navigation data that beacon transmitted the above encoded location information: _____	
3	Bits 59-85= Bits 113-126=	
4	Bits 59-85= Bits 113-126= =	
5	Bits 59-85= Bits 113-126=	
6	Bits 59-85= Bits 113-126=	
7	Bits 59-85= Bits 113-126=	
8	Bits 59-85= Bits 113-126=	
9	Bits 59-85= Bits 113-126=	
10	Bits 59-85= Bits 113-126=	
11	Bits 59-85= Bits 113-126=	
12	Bits 59-85= Bits 113-126=	
13	Bits 59-85= Bits 113-126=	

Table F-C.4: Position Data Encoding Results RLS Location Protocol

Script Reference (See Table D.4)	Value of Encoded Location Bits Transmitted by Beacon	Confirmation that BCH Correct (√)
1	Bits 67-85= Bits 115-132= Bits 109-112=	
2	Bits 67-85= Bits 115-132= Bits 109-112= Number of seconds after providing navigation data that beacon transmitted the above encoded location information: _____	
3	Bits 67-85= Bits 115-132= Bits 109-112=	
4	Bits 67-85= Bits 115-132= Bits 109-112=	
5	Bits 67-85= Bits 115-132= Bits 109-112=	
6	Bits 67-85= Bits 115-132= Bits 109-112=	
7	Bits 67-85= Bits 115-132= Bits 109-112=	
8	Bits 67-85= Bits 115-132= Bits 109-112=	
9	Bits 67-85= Bits 115-132= Bits 109-112=	
10	Bits 67-85= Bits 115-132= Bits 109-112=	
11	Bits 67-85= Bits 115-132= Bits 109-112=	
12	Bits 67-85= Bits 115-132= Bits 109-112=	

Script Reference (See Table D.4)	Value of Encoded Location Bits Transmitted by Beacon	Confirmation that BCH Correct (√)
13	Bits 67-85= Bits 115-132= Bits 109-112=	

Table F-C.5: Position Data Encoding Results RLS Location Protocol (Additional Scripts)

Script Reference (See Table D.5)	Value of Encoded Location Bits Transmitted by Beacon	Confirmation that Result Correct (√)
1	Hex ID =	
2	Hex ID = Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
3	Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
4	Hex ID = Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
5	Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
6	Hex ID = Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
7	Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
8	Hex ID = Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
9	Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
10	Hex ID = Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	
11	Confirm Indication is as per manufacturer's instructions Bits 109 to 114 =	

Table F-C.6: Position Acquisition Time and Position Accuracy (Internal Navigation Devices)

Operational Configuration	C/S T.007 Section A.3.8.2.1		C/S T.007 Section A.3.8.2.2	
	Time to Acquire Position (sec)	Location Error in metres	Time to Acquire Position (sec)	Location Error in metres
Water ground plane				
Antenna fixed to ground plane				
Antenna fixed to ground plane				
Beacon on ground plane				
Beacon above ground plane				
Other (specify)				

Table F-C.7: Position Acquisition Time and Position Accuracy (External Navigation Devices)

C/S T.007 Section A.3.8.2.1		C/S T.007 Section A.3.8.2.2	
Time to Acquire Position (sec)	Location Error in metres	Time to Acquire Position (sec)	Location Error in metres

Table F-C.8: ELT(DT) Encoded Position Update

Burst number	Beacon Tx time	Encoded location reported in the beacon message			Best-Matching simulated location between $P(t_0)$ and $P(t_0\text{-}2)$			2D location error (meters)	Altitude error (meters)
		Latitude	Longitude	Altitude band	Latitude	Longitude	Altitude		

F.4 APPENDIX D TO ANNEX F: BEACON CODING SOFTWARE RESULTS

Table F-D.1: Examples of User Protocol Beacon Messages
(Examples required for each protocol requested for inclusion on the type approval certificate)

Protocol	Operational Message (in hexadecimal including bit and frame synchronisation bits)	Self-Test Message (in hexadecimal including bit and frame synchronisation bits)
Maritime User Protocol with MMSI		
Maritime User Protocol with Radio Call Sign		
Radio Call Sign User Protocol		
Serial User: Float-Free EPIRB with Serial Number		
Serial User: Non Float-Free EPIRB with Serial Number		
Aviation User Protocol		
Serial User: ELT with Serial Number		
Serial User: ELT with Aircraft Operator Designator & Serial Number		
Serial User: ELT with Aircraft 24-bit address		
Serial User: PLB with Serial Number		
National User (Short)		
National User (Long)		
User Test		

Table F-D.2: Examples of Standard, National Location RLS and ELT(DT) Location Protocol Beacon Messages

(Examples required for each protocol requested for inclusion on the type approval certificate)

Protocol	Operational Message (in hexadecimal including bit and frame synchronisation bits)		Self-Test Message (in hexadecimal including bit and frame synchronisation bits)	GNSS Self Test Message (if applicable, in hexadecimal, including bit and frame synchronisation bits)
	Location "A"*	Location "B"*		Location "A"
Standard Location: EPIRB with MMSI				
Standard Location: EPIRB with Serial Number				
Standard Location: ELT with 24-bit Address				
Standard Location: ELT with Serial Number				
Standard Location: ELT with Aircraft Operator Designator				
Standard Location: PLB with Serial Number				
Standard Location: Test				
National Location: EPIRB				
National Location: ELT				
National Location: PLB				
National Location: Test				
RLS Location: (ELT,EPIRB or PLB)†				
RLS Location: Test				
ELT(DT) Location (24-bit Address, Aircraft Operator Designator, Serial Number)				
ELT(DT) Location: Test				

* Location "A" and location "B" must be separated by at least 500 meters for the Standard Location, National Location and RLS Location protocols.

† By decision of the Cospas-Sarsat Council at its Fifty-Seventh Session, RLS protocols will be effective as of [1 January 2018], as a target, subject to further review and consideration. The use of RLS-enabled beacons will be regulated by national administrations.

Table F-D.3: Examples of User-Location Protocol Beacon Messages
(Examples required for each protocol requested for inclusion on the type approval certificate)

Protocol	Operational Message (in hexadecimal including bit and frame synchronisation bits)		Self-Test Message (in hexadecimal including bit and frame synchronisation bits)	GNSS Self Test Message (if applicable, in hexadecimal, including bit and frame synchronisation bits)
	Location "A"*	Location "B"*		Location "A"
Maritime Protocol with MMSI				
Maritime Protocol with Radio Call Sign				
Radio Call Sign				
Serial User-Location: Float-Free EPIRB				
Serial User-Location: Non Float-Free EPIRB				
Aviation				
Serial User-Location: ELT				
Serial User-Location: ELT with Aircraft Operator Designator & Serial Number				
Serial User-Location: ELT with Aircraft 24-bit address				
Serial User-Location: PLB				
User-Location: Test				

* Location "A" and location "B" must be separated by at least 10 km for the User-Location protocol.

F.5 APPENDIX E TO ANNEX F: BEACON OPERATING CURRENT AND PRE-TEST DISCHARGE CALCULATIONS

Table F-E.1: Beacon Operating Current

Beacon Operating Modes	Mode: Manually selectable or Automatic	Measurement interval, sec	Average Current, mA	Peak Current, mA

Table F-E.2: Pre-test Battery Discharge Calculations

Characteristic	Designation	Units	Value	Comments
Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon)	T_{CS} or TCS	Years		
Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon)	T_{BR} or TBR	Years		
Battery pack electrical configuration				
Cell model and cell chemistry				
Nominal cell capacity		A-hrs		
Nominal battery pack capacity	C_{BN}	A-hrs		
Annual battery cell capacity loss (self-discharge) due to aging, as specified by cell manufacturer at ambient temperature	L_{SDC}	%		
Calculated battery pack capacity loss due to self-discharge: $L_{CBN} = C_{BN} - [C_{BN} * (1 - L_{SDC}/100)^{TBR+TCS}]$	L_{CBN}	A-hrs		
Number of self-tests per year	N_{ST}			
Average battery current during a self-test	I_{ST}	mA		
Maximum duration of a self-test	T_{ST}	sec		
Calculated battery pack capacity loss due to self-tests during battery replacement period: $L_{ST} = I_{ST}*T_{ST}*T_{BR}*N_{ST} / 3600$	L_{ST}	mA-hrs		
Maximum Number of GNSS self-tests between battery replacements	N_{GST}			
Average battery current during a GNSS self-test of maximum duration	I_{GST}	mA		
Maximum duration of a GNSS self-test	T_{GST}	sec		
Calculated battery pack capacity loss due to GNSS self-tests during battery replacement period: $L_{GST} = I_{GST}*T_{GST}*N_{GST} / 3600$	L_{GST}	mA-hrs		
Average stand-by battery pack current	I_{SB}	mA		
Other Capacity Losses	L_{OTH}	mA-hrs		See Note 1
Battery pack capacity loss due to constant operation of circuitry prior to beacon activation: $L_{ISB} = I_{SB}*T_{BR}*8760$	L_{ISB}	mA-hrs		
Calculated value of the battery pack pre-test discharge $L_{CDC} = L_{CBN} + 1.65*(L_{ST} + L_{GST} + L_{ISB})/1000 + L_{OTH}/1000$	L_{CDC}	A-hrs		

Note 1: The worst case depletion in battery power due to current drawn that cannot be replicated during the lifetime test.

F.6 APPENDIX F TO ANNEX F: CHECK-LIST OF TECHNICAL DATA PROVIDED BY BEACON MANUFACTURER

Table F-F.1: Check-List of Technical Data Provided by Beacon Manufacturer

Tick (√) to indicate submission of items	Applicable C/S T.007 requirement	Description of technical information item	File name, title of document, page, section, where the item is located
	5(a)	Application Form (Annex G)	
	6.2	Change Notice Form (Annex H)	
	5(m)	Quality Assurance Plan (Annex L)	
	5(b)	Photos of the beacon in all operational configurations	
	5(c)	Pre-test discharge data and analysis, table F-E.2	
	5(d)	List and analysis of operating modes, Table F-E.1	
	5(e)	Beacon manuals	
	5(e)	Beacon technical Data sheet	
	5(f)	Marketing brochure	
	5(g)	Battery cell technical data sheet	
	5(g)	Electrical diagramme of the battery pack	
	5(h)	Beacon labels and markings	
	5(i-i)	Reference oscillator type and specification	
	5(i-ii)	Long-term frequency stability (LTS)	
	5(i-iii)	Technical data for TCXO/MCXOs	
	5(i-iv)	Report on oscillator ageing	
	5(i-v)	Serial Number and temperature gradient results (graph, summary and Excel file)	
	5(j-i)	Design: protection against continuous transmission	
	5(j-ii)	Design: frequency 5-year frequency stability	
	5(j-iii)	Design: protection against repetitive self-test	
	5(j-iv)	Design: self-test default values	
	5(j-v)	Design: protection against GNSS receiver faulty operation	
	5(k)	Matching network	
	5(l)	Antenna cable type and maximum RF-losses	
	5(n)	GNSS receiver operating cycle and battery current	
	5(n)	Internal GNSS receiver and antenna data sheets	
	5(o)	Interface with external navigation device	
	5(p-i)	External ancillary devices: technical data sheets	
	5(p-ii)	External ancillary devices: details of electrical connections	
	5(q)	Description of differences between beacon model variants	
	5(r)	Check-list	
	5(s)	Statement on worst-case operating temperature	
	5(t)	Statement on known non-compliances	
	A.3.8.7	Position Data Encoding: Tables F-C.1, F-C.2, F-C.3	
	A.2.8	Beacon Coding Software: Tables F-D.1 , F-D.2 and F-D.3	
		Other	

_____	_____	_____	_____
(date)	(beacon model)	(beacon manufacturer's point of contact for the type approval: name, job title, e-mail address)	(signature)

F.7 APPENDIX G TO ANNEX F: TEMPLATE OF TEST REPORT

[Cospas-Sarsat Accepted Test Facility]

Report on

Cospas-Sarsat 406 MHz Emergency Beacon Testing
of the [Beacon Manufacturer][Beacon type] model "[Beacon Model]" in accordance with C/S T.007

Report Nr. [Reference Nr] – Issue [Issue Nr] [Date of Issue]

Test facility: [Test facility details, contact details, phone, email, www]
Accreditations: [List of National and International accreditations]

Report on: [Beacon type and beacon model number]

Prepared for: [Beacon manufacturer]
[Manufacturer representative (Name, Job title, Contact details)]

Prepared by: [TA specialist in charge of TA-testing: name, job title, contact details]
Approved by: [Test facility TA authority name, job title, signature]
Date of Issue: [Date of the Report Issue]

Dates of testing Submitted for testing:
Start of tests:
End of tests:

History of the report Issue/revisions:

Report Nr – Issue Nr. or Revision Nr.	Date of Issue	Reasons for re-issue

Section Contents Page

1. Scope

2. Reference Documents

3. Details of Test samples

- Model name
- S/Ns of test beacons
- P/Ns (Hardware, Firmware, Software)
- Description of the test beacon and block diagramme of equipment under test (EUT)
- List of ancillary devices: [antennas, remote switches, remote indicators, external buzzer, external navigation interface units, external activators, etc.]
- List of test equipment, provided by beacon manufacturer for TA testing
- Photos of the EUT with antennas and external ancillary devices subjected to TA-testing
- Battery Pack details (composition, cell type, battery pack P/N)
- Application details: ANNEX G – Part G.1

4. Type approval testing

- Applicable standards and compliance statement: ANNEX G – Part G.2
- Statement and details of non-compliances observed during TA testing
- Statement and list and description of deviations from standard test procedures
- EUT Modifications during TA testing:

Example:

Modification State (Mod State)	Date of Implementation	Reasons for modification	Description of modification, HW/FW P/Ns, SW version/release after modification
0	20 June 2013	-	-
1	13 July 2013	Incorrect first burst delay	FW 1.001-02 SW 1.001-x1 HW (no change)

- Modes of EUT operation during TA testing, message encoding, EUT system configuration,
- Modes of operation of external ancillary devices

5. Test Results

5.1 Test Results Summary Table

Table F.1 of ANNEX F, additionally indicating for each test parameter:

- date(s) of test,
- EUT Modification State
- Test configuration (where applicable)
- Indication of Pass/Fail result
- Indication of deviations from standard test procedures

Example:

Parameters to be Measured	**Range of Specification**	**Units**	**Test Results**			**Comments**
			T_{min} (-20°C)	T_{amb} (20°C)	T_{max} (+55°C)	
10-Aug-12, DEF-406, S/N 001, Mod State 0						FAIL
1. Transmitter Power Output						
- transmitter power output (min and max)	35-39	dBm	37.4 - 37.7	38.1 - 38.2	**38.7 - 39.6**	FAIL at Max Temp
- power output rise time	< 5	Ms	0.4	0.6	0.8	
- power output 1 ms before burst	< -10 dBm	dBm	-33.6	- 32.3	-36.3	

[…]

5.2 Electrical and Functional Tests

Date of test	
Specification	[Reference to C/S T.001
Beacon Model	
EUT Mod State	
EUT system configuration, including ancillary devices and modes of their operation	
EUT operating mode during the test	
Environmental conditions	
Deviations from standard test procedures	
Non-compliances noticed	

Test results:
[Provide test results for the following temperature conditions:]

5.2.1 Minimum Operating Temperature
5.2.2 Ambient Operating Temperature
5.2.3 Maximum Operating Temperature

[Provide test results for the following test parameters:]

- Power Output
- Digital Message
- Digital Message Generator
- Modulation
- Spurious Emission
- 406 MHz VSWR Check
- Self-test Mode
- GNSS Self-test Mode

[Provide details of test methods, message decodes, graphs, oscillograms, spectrograms, and tables of test results as appropriate]

5.3 Thermal Shock Test

Date of test	
Specification	
Beacon Model	
EUT Mod State	
EUT system configuration, including ancillary devices and modes of their operation	
EUT operating mode during the test	
Environmental conditions	
Initial/Offset temperature	
Deviations from standard test procedures	
Non-compliances noticed	

Test results:
[Provide details of test methods, message decodes, graphs, oscillograms, spectrograms, and tables of test results as appropriate]

5.4 Operating Lifetime test

Date of test	
Specification	
Beacon Model	
EUT Mod State	
EUT system configuration, including ancillary devices and modes of their operation	
EUT operating mode during the test	
Environmental conditions	
Test temperature	
Pre-test battery discharge duration	
Lifetime test duration	
Deviations from standard test procedures	
Non-compliances noticed	

5.4.1 Operating Current Measurements and Analysis

[Table F-E.1]
[Details of the EUT configuration, incl. ancillary devices and mode of their operation]
[Conclusion about the mode that exhibits the highest load]

5.4.2 Pre-test Battery Discharge

[Provide results of pre-test discharge calculations in the format of Table F-E.2]
[Describe method of battery discharge (operating current, DC/load, etc.) or equivalent test extension]
Test results:
[Provide details of test methods message decodes, oscillograms, graphs and tables of test results, as appropriate]

5.5 Temperature Gradient Test

Date of test	
Specification	
Beacon Model	
EUT Mod State	
EUT system configuration, including ancillary devices and modes of their operation	
EUT operating mode during the test	
Environmental conditions	
Temperature Range	
Deviations from standard test procedures	
Non-compliances noticed	

Test results:
[Provide details of test methods, message decodes, graphs and tables of test results, as appropriate]

5.6 Oscillator Ageing (if applicable)

Date of analysis	
Specification	
Beacon Model	
EUT Mod State	
Oscillator Manufacturer and Model (or P/N):	
Oscillator S/N	
Reference documents	
Environmental conditions:	
Deviations from standard test procedures	
Non-compliances noticed	

Record and report:
[Provide details of test methods, summary of MTS analysis and complete Table A-1, Table A-2 of Annex A to C/S IP (TCXO)]

5.7 Antenna Characteristics

Date of tests	
Specification	
Beacon Model	
EUT Mod State	
EUT system configuration, including antenna, external ancillary devices and modes of their operation	
Beacon antenna model (P/N)	
Measurement antenna type and model	
Environmental conditions	
Deviations from standard test procedures	
Non-compliances noticed	

Test results:
[Provide details of test methods, test results for each beacon-antenna and for all test configurations, as per APPENDIX B to ANNEX F. Annotate results, as appropriate]

5.8 Beacon Coding Software

Date of test	
Specification	
Beacon Model	
EUT Mod State	
Performed by	
Verified by	
Measurement Equipment, provided by beacon manufacturer	
Reference documents	
Environmental conditions:	
Deviations from standard test procedures	
Non-compliances noticed	

Record and report:
[provide details of test methods, example messages as per APPENDIX D to ANNEX F and message decodes]

5.9 Navigation System Test

[Test results shall be presented separately for each of the declared LP protocol types, for each of the declared operational configurations, where appropriate, separately for internal and external navigation device, and for each external navigation interface type]

Date of test	
Specification	
Beacon Model	
EUT Mod State	
EUT system configuration during the test, including antenna, external ancillary devices and modes of their operation	
Navigation device details (model, interface)	
Measurement Equipment, provided by beacon manufacturer, if any	
Performed by	
Verified by	
Environmental conditions	
Deviations from standard test procedures	
Non-compliances noticed	

[Provide brief description of actions, messages and decodes, time-stamps, results]

5.9.1 Position Data Default values

5.9.2 Position Acquisition Time and Position Accuracy Test (PAT-PAT)

[Provide results in the format of Table F-C.4 and Table F-C.5]
[Provide results for the actual and encoded positions, messages, decodes, time-stamps, results]
[Indicate if a GNSS simulator was used]

5.9.3 Encoded Position Data Update Interval

[Provide results for the Actual/encoded positions, messages, decodes, time-stamps, results]

5.9.4 Position Clearance After Deactivation

[Provide results for the Actual/encoded positions, messages, decodes, time-stamps, results]

5.9.5 Position Data Input Update Interval

[Provide results for the Actual/encoded positions, messages, decodes, time-stamps, results]

5.9.6 Last Valid Position

[Provide results for the Actual/encoded positions, messages, decodes, time-stamps, results]

5.9.7 Position Data Encoding

[Provide results in the format of Tables F-C.1, F-C.2 and F-C.3]

5.10 Satellite Qualitative Test

Date of test	
Specification	
Beacon Model	
EUT Mod State	
EUT system configuration, including ancillary devices and modes of their operation:	
Beacon Antenna	
Environmental conditions	
Deviations from standard test procedures	
Non-compliances noticed	

Test results:

[Provide details of test methods, results for each beacon-antenna and for all test configurations, as per APPENDIX A to ANNEX F]

6. Photographs

Include photographs of:

- EUT with antenna deployed
- External components
- EUT set for SQT (for all antennas in all test configurations)
- EUT set for PAT-PAT (for all antennas in all test configurations)
- EUT antenna set for Antenna tests (for all antennas in all test configurations)

7. Test Equipment

- List of test equipment and calibration dates
- Block diagrammes of test setup
- Measurement accuracies
- Description of measurement methods.

8. Other technical information, which is referred to in the test report

- Technical data sheets for devices and components
- Results of tests from beacon manufacturer
- Other test reports, if applicable

9. Technical data submitted by Beacon manufacturer

- Complete Check-List of Technical Data, as per Appendix F to Annex F.

- END OF ANNEX F -

ANNEX G: APPLICATION FOR A COSPAS-SARSAT 406 MHZ BEACON TYPE APPROVAL CERTIFICATE

G.1 INFORMATION PROVIDED BY THE BEACON MANUFACTURER

Beacon Manufacturer and Beacon Model

Beacon Manufacturer	
Beacon Model Name	
Additional Beacon Model Names	

Beacon Type and Operational Configurations

Beacon Type	**Beacon used while:**	**Tick where appropriate**
EPIRB Float Free	Floating in water or on deck or in a safety raft	
EPIRB Non-Float Free (automatic and manual activation)	Floating in water or on deck or in a safety raft	
EPIRB Non-Float Free (manual activation only)	Floating in water or on deck or in a safety raft	
EPIRB Float Free with VDR	Floating in water or on deck or in a safety raft	
PLB	On ground and above ground	
	On ground and above ground and floating in water	
ELT Survival	On ground and above ground	
	On ground and above ground and floating in water	
ELT Auto Fixed	Fixed ELT with aircraft external antenna	
ELT(DT)	Distress Tracking ELT with aircraft external antenna	
ELT Auto Portable	In aircraft with an external antenna	
	On ground, above ground, or in a safety raft with an integrated antenna	
ELT Auto Deployable	Deployable ELT with attached antenna	
Other (specify)		

Beacon Characteristics

Characteristic	**Specification**
Operating frequency	_____MHz
Operating temperature range	T_{min} =_____ T_{max} =_____
Temperature, at which minimum duration of continuous operation is expected	
Operating lifetime	_____hours
Beacon power supply type (internal non-rechargeable, internal re-chargeable, external, combined, other)	
External power supply parameters (AC/DC and nominal voltage)	
Is external power supply needed to energise the beacon or its ancillary devices in any of operational modes (N/A or Yes or No)	
Battery cell chemistry	
Battery cell model name, cell size, number of cells in a battery pack, and details of the battery pack electrical configuration	
Battery cell manufacturer	
Battery pack manufacturer and part number	
Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon)	_____years
Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon)	_____years
Oscillator type (e.g. OCXO, MCXO, TCXO)	
Oscillator manufacturer	
Oscillator model name/ part number	
Oscillator satisfies long-term frequency stability requirements (Yes or No)	
Antenna type: Integral or Other (e.g. External, Detachable – specify type)	
Antenna manufacturer	
Antenna part name and part number	
Antenna cable assembly min/max RF- losses at 406 MHz, if applicable	

Characteristic	Specification
Navigation device type (Internal, External or None)	
Features in beacon that prevent degradation to 406 MHz signal or beacon lifetime resulting from a failure of navigation device or failure to acquire position data (Yes, No, or N/A)	
Features in beacon that ensure erroneous position data is not encoded into the beacon message (Yes, No or N/A)	
Navigation device capable of supporting global coverage (Yes, No or N/A)	
Encoded position update capability (Yes, No, N/A) and	
Encoded position update interval value (range)	_____ min
For Internal Navigation Devices	
– Geodetic reference system (WGS 84 or GTRF)	
– GNSS receiver cold start forced at every beacon activation (Yes or No)	
– Navigation device manufacturer	
– Navigation device model name and part Number	
– Internal navigation device antenna type(integrated, internal, external, passive/active) , manufacturer and model	
– GNSS system supported (e.g. GPS, GLONASS, Galileo)	
For External Navigation Devices	
– Data protocol for GNSS receiver to beacon interface	
– Physical interface for beacon to navigation device	
– Electrical interface for beacon to navigation device	
– Part number of the external navigation interface device (if applicable)	
– Navigation device model and manufacturer (if beacon designed to use specific devices)	

Self-Test Mode Characteristics:	Self-Test Mode	Optional GNSS Self-test Mode
– Activated by a separate switch/ separate switch position (Yes or No)		
– Self-test/GNSS self-test mode switch automatically returns to normal position when released (Yes or No)		
– Self-test/ GNSS self-test activation can cause an operational mode transmission (Yes or No)		
– Results in transmission of a single self-test burst only, regardless of how long the self-test activation mechanism is applied (Yes or No)		
– Results of self-test/ GNSS self-test are indicated by (provide details, e.g. Pass / Fail indicator light, strobe light, etc.)		
– The content of the encoded position data fields of the self-test message has default values		N/A
– Performs an internal check and indicates that RF-power is being emitted at 406 MHz and 121.5 MHz, if beacon includes a 121.5 Hz homer (Yes or No)		
– Self-test results in transmission of a signal other than at 406 MHz (Yes & details or No)		
– Self-test can be activated directly at beacon (Yes or No)		
– List of Items checked by self-test		
– Self-test/ GNSS self-test 406 MHz burst duration (440 or 520 ms)		
– Self-test message length format flag in bit 25, (“0” or “1”)		
– Maximum duration of a self-test mode, sec		
– Maximum recommended number of self-tests during battery pack replacement period		N/A
– Distinct indication of self-test start (Yes or No)		
– Indication of self-test results(Yes or No)		
– Distinct indication of insufficient battery capacity (Yes or No)		
– Automatic termination of self-test mode immediately after completion of the self-test cycle (Yes or No)		

– Maximum number of GNSS Self Tests (beacons with internal navigation devices only)	N/A	
Self-Test Mode Characteristics:	Self-Test Mode	Optional GNSS Self-test Mode
– GNSS Self-test results in transmission of a single burst, irrespectively of the test result (Yes or No)	N/A	
– Maximum number of self-tests during battery pack replacement period		N/A
– Self-test/ GNSS self-test can be activated from beacon remote activation points (Yes & details or No)		
– List all methods of Self-test mode and GNSS Self-test modes activation. Provide details on a separate sheet to describe		

Message Coding Protocols:	(x)	Tick the boxes below against the intended protocol options
User Protocol (tick where appropriate)		Maritime with MMSI
		Maritime with Radio Call Sign
		EPIRB Float Free with Serial Number
		EPIRB Non Float Free with Serial Number
		Radio Call Sign
		Aviation
		ELT with Serial Number
		ELT with Aircraft Operator and Serial Number
		ELT with Aircraft 24-bit Address
		PLB with Serial Number
		National (Short Message Format)
		National (Long Message Format)
Standard Location Protocol (tick where appropriate)		EPIRB with MMSI
		EPIRB with Serial Number
		ELT with 24-bit Address
		ELT with Aircraft Operator Designator
		ELT with Serial Number
		PLB with Serial Number
National Location Protocol (tick where appropriate)		National Location: EPIRB
		National Location: ELT
		National Location: PLB
ELT(DT) Location Protocol (tick where appropriate)		ELT with Serial Number
		ELT with Aircraft Operator and Serial Number
		ELT with Aircraft 24-bit Address
		EPIRB

RLS Location Protocol (tick where appropriate) *		ELT
		PLB
User Location Protocol (tick where appropriate)		Maritime with MMSI
		Maritime with Radio Call Sign
		EPIRB Float Free with Serial Number
		EPIRB Non Float Free with Serial Number
		Radio Call Sign
		Aviation
		ELT with Serial Number
		ELT with Aircraft Operator and Serial Number
		ELT with Aircraft 24-bit Address
		PLB with Serial Number
Beacon includes a homer transmitter(s) (Yes or No) - homer transmitter(s) frequency - homer transmitter(s) power		 _____MHz _____dBm
– homer transmitter(s) duty cycle – duty cycle of homer swept tone		_____% _____%
Beacon includes a high intensity flashing light (e.g. Strobe)		Yes or No
- light intensity		_____ cd
- flash rate		_____ flashes per minute
Beacon transmission repetition period satisfies C/S T.001 requirement that two beacon's repetition periods are not synchronised closer than a few seconds over 5 minute period, and the time intervals between transmissions are randomly distributed on the interval 47.5 to 52.5 seconds (Yes or No)		
Other ancillary devices (e.g. voice transceiver, remote control, external audio and light indicators, external activation device). List details on a separate sheet if insufficient space to describe.		
Beacon includes automatic activation mechanism (Yes or No). Specify type of automatic beacon activation mechanism		

* By decision of the Cospas-Sarsat Council at its Fifty-Seventh Session, RLS protocols will be effective as of [1 January 2018], as a target, subject to further review and consideration. The use of RLS-enabled beacons will be regulated by national administrations.

Beacon includes a voice-transceiver (Yes or No) - provides prevention against continuous operation of voice transmitter (Yes or No), and if Yes specify: - maximum continuous voice-transmission duration (limit), minutes - Manufacturer-specified total duration of voice-transmitter operation during the declared rated lifetime ("On time"), (hrs)	
Beacon includes features and functions not listed above, related or non-related to 406 MHz (Yes or No) List features and use a separate sheet if insufficient space	
Beacon model hardware part number (P/N) and version	
Beacon model software/firmware P/N, version, date of issue/releases	
Beacon model printed circuit board P/N and version	
Known non-compliances with C/S T,001 requirements(Yes or No) If Yes, provide details (or use a separate sheet if insufficient space)	
Beacon Manufacturer Point of Contact (POC) for this Type Approval application:	Name and Job Title: Phone: E-mail:

Dated:..... Signed:.....
(Name, Position and Signature of Beacon Manufacturer Representative)

(Continued on Next Page)

G.2 INFORMATION PROVIDED BY THE COSPAS-SARSAT ACCEPTED TEST FACILITY

Name and Location of Beacon Test Facility: _____

_____

Date of Submission for Testing: _____

Applicable C/S Standards:

Document	Issue	Revision	Date
C/S T.001			
C/S T.007			
IP (TCXO)			
IP (LIRB)			

I hereby confirm that the 406 MHz beacon described above has been successfully tested in accordance with the Cospas-Sarsat 406 MHz Beacon Type Approval Standard (C/S T.007) and complies with the Specification for Cospas-Sarsat 406 MHz Distress Beacons (C/S T.001) as demonstrated in the attached report.*

Detail any observed non-compliances and/or deviations from standard test procedures here:

Dated:..... Signed:.....
(Name, Position and Signature of Cospas-Sarsat Accepted Test Facility Representative)

- END OF ANNEX G -

* If the test results do not indicate full compliance to the above standards, or deviations from the standard test procedures took place during type approval testing, the test laboratory shall modify this statement to identify discrepancies. A complete explanation of such discrepancies should be provided in the test report and the report references identified in this statement.

ANNEX H: CHANGE NOTICE FORM

The Manufacturer of the Cospas-Sarsat Type Approved 406 MHz Distress Beacons:

Manufacturer: _____
(name and address)

_____

406 MHz Beacon Model numbers: _____

Cospas-Sarsat Type Approval Certificate Numbers: _____

Proposed New Model Numbers Beacon: _____

hereby informs Cospas-Sarsat of the following changes to production beacons

planned date of change _____

Oscillator type: _____

Battery: _____(specify): _____

Antenna type: _____

Homing transmitter: _____

Strobe light: _____

Size or shape of beacon package: _____

Other physical characteristics: _____(specify): _____

Significant change to circuit design: _____

Internal navigation device: _____(specify): _____

Operating frequency _____(specify): _____

External navigation data interface _____(specify): _____

Message protocol _____(specify): _____

Other _____(specify): _____

and substantiates these changes with the attached technical documentation and beacon test results (if applicable). I hereby confirm that with these changes the above 406 MHz beacon models are technically equivalent to the type approved beacon and continue to meet the Cospas-Sarsat requirements.

Dated:.....Signed:.....

(Name, Position and Signature of Beacon Manufacturer Representative)

- END OF ANNEX H -

ANNEX I: DESIGNATION OF ADDITIONAL NAMES OF A COSPAS-SARSAT TYPE APPROVED 406 MHZ BEACON MODEL

The Manufacturer of the following Cospas-Sarsat Type Approved 406 MHz Distress Beacon:

Beacon Manufacturer: _____
(name and address) _____

_____

406 MHz Beacon model: _____

having Cospas-Sarsat Type Approval Certificate Number: _____

hereby informs Cospas-Sarsat that the above beacon will also be sold as:

Additional name and model number of beacon: _____

by Agent/Distributor: _____
(name and address)

telephone: _____

fax: _____

contact person/title: _____

I certify that we have an agreement with this agent/distributor to market the above-referenced 406 MHz beacon, which we will manufacture and which will be identical to the Cospas-Sarsat type approved beacon, except for labelling.

Dated:..... Signed:.....
(Name, Position and Signature of Beacon Manufacturer Representative)

- END OF ANNEX I -

ANNEX J: APPLICATION FOR TESTING SEPARATED ELT ANTENNA(S) AT AN INDEPENDENT ANTENNA TEST FACILITY

The Manufacturer of the Cospas-Sarsat Type Approved 406 MHz Distress Beacons:

Manufacturer: _____

(name and address) _____

_____

applies to test ELT antennas: _____

_____

at antenna test facility: _____

located at: _____

Dated:..... Signed:.....
(Name, Position and Signature of ELT Manufacturer Representative)

DECLARATION OF COSPAS-SARSAT REPRESENTATIVE FOR THE COUNTRY WHERE THE ANTENNA TEST FACILTY IS LOCATED:

I hereby confirm that the operation of the antenna test facility mentioned above is independent from the 406 MHz beacon manufacturer who is submitting this application.

Dated:..... Signed:.....
(Name and Signature of Cospas-Sarsat Representative)

- END OF ANNEX J -

ANNEX K: ELT(DT) ENCODED POSITION DATA UPDATE INTERVAL GNSS SIMULATOR TEST PROCEDURE

K.1 INTRODUCTION

This procedure is intended to provide additional guidance on the testing of an ELT(DT) under typical conditions that may be found on an aircraft in order to ensure the correct operation of the GNSS Receiver within the ELT(DT) using a GNSS Simulator. This procedure is intended to supplement the basic test procedure outlined in C/S T.007 Annex A.3.8.3: it provides guidance to the test facility on setting up the GNSS Simulator and running the appropriate test(s). It is intended to be used in that light and alternative test methods that provide similar results may be used by a test facility in co-ordination with the ELT(DT) manufacturer and the Cospas-Sarsat Secretariat.

K.2 TEST CONDITIONS

K.2.1 GNSS Receiver

If the GNSS Receiver in the ELT(DT) is capable of being configured by the manufacturer or other entities, such that it can function differently either under different circumstances or in different parts of the world, then each of the different modes of operation of the GNSS Receiver shall be tested. For example if the GNSS Receiver can be configured to operate solely as a GPS Receiver for use in North America or solely as a Glonass Receiver for use in Asia then both of these modes must be tested, however if the GNSS Receiver has a single fixed mode of operation pre-set by the manufacturer (regardless of what this might be) then just a single test in this mode is required. Likewise if the GNSS Receiver can handle multiple signals from one constellation (e.g. GPS L1 C/A, L2C or L5) and if these can be configured by the manufacturer or other entities under different circumstances, then each combination of signals shall be tested.

K.2.2 GNSS Constellations

The GNSS Simulator shall be configured to operate with the constellations declared by the ELT(DT) manufacturer that the GNSS Receiver is configured to accept (this could be a single constellation or multiple constellations). Each constellation shall be configured as an optimized constellation based upon the official published information on that constellation (e.g. GPS – 24 satellites in Orbital Planes A1-4, B1-4, C1-4, D1-4, E1-4 and F1-4, Glonass – 24 satellites in Orbital Planes 1 (Slots 1-8), 2 (Slots 9-16) and 3 (Slots 17-24) and Galileo – 24 satellites in Orbital Planes A (Slots 01-08), B (Slots 01-08) and C (Slots 01-08). Additional or spare satellites in any constellation shall not be included. Each constellation shall be configured to commence testing at 00:00 UTC on January 1, 2017 and the start position for each test shall be at Latitude 13.283 degrees North, Longitude 40.917 degrees East and Altitude -100 m. The simulator output shall be set such that the signal level received by the antenna of the GNSS Receiver under test is within +/- 2dB of the nominal signal level at the earth's surface for that constellation. No SBAS satellite augmentation such as WAAS or EGNOS shall be employed and no interference shall be superimposed on the GNSS signals.

K.2.3 ELT(DT)

The ELT(DT) under test, including its GNSS Receiver and related GNSS Antenna, shall be configured in a set up representative of a typical installation on board an aircraft. The GNSS Antenna shall be mounted in the centre of a superstructure of at least $1m^2$ representative of the aircraft fuselage. The cabling between the GNSS Antenna and the ELT(DT) shall be the maximum length specified by the manufacturer. If the ELT(DT) can accept navigation data from an external navigation device as well as from its own internal navigation device, then the test shall be performed twice. Firstly with the GNSS Simulator signals being fed to both inputs (over the air to the GNSS Antenna and via a cable to the ELT(DT) external input), and secondly with the ELT(DT) external input disconnected (over the air signals only). If the GNSS Receiver and/or the ELT(DT) is normally powered such that it is in the 'Armed' mode of operation prior to activation of the ELT(DT) then it shall be configured in this mode for 15 minutes immediately prior to the commencement of the following test to ensure that it has initialised and has a valid location.

K.3 GNSS SIMULATOR SCENARIO

The GNSS Simulator shall be programmed to perform a flight pattern that approximates to the following;

a) fifteen seconds of stationary (static position;

b) accelerate due North at a rate of 4.63 m/s^2 for 60 seconds in a straight line, while climbing 5,000 m;

c) apply a constant velocity of 278 m/s for 36 seconds in a straight line, while climbing a further 5,000 m;

d) level out and at a constant velocity of 278 m/s simulate a bank of 45 degrees to the left and a turn of 6 degrees per second for one minute;

e) at the same velocity remove the bank and turn and then simulate a bank of 45 degrees to the right and a turn of 6 degrees per second for one minute;

f) remove the bank and turn and then decelerate at a rate of 2.31 m/s^2 for 120 seconds, while descending 5,000 m while performing a left turn of 12 degrees per second;

g) level out, remove the turn and then accelerate at a rate of 2.31 m/s^2 for 60 seconds in a straight line, while climbing 5,000 m;

h) level out and apply a constant velocity of 157 m/s for 90 seconds, while descending 10,000 m; and

i) finally apply 60 seconds of stationary position again.

K.4 RESULTS

Ensure that the results obtained comply with C/S T.007 Annex A.3.8.3.

- END OF ANNEX K –

ANNEX L: BEACON QUALITY ASSURANCE PLAN

We, manufacturer of Cospas-Sarsat 406 MHz beacons (Manufacturer name and address)

_____

_____

confirm that ALL PRODUCTION UNITS of the following beacon model(s),

_____

(model, hardware part number, firmware part number, software version or part number)

_____

_____

will meet the Cospas-Sarsat specification and technical requirements in a similar manner to the units subjected for type approval testing. To this effect all production units will be subjected to following tests at ambient temperature:

- Digital message
- Bit rate
- Rise and fall times of the modulation waveform
- Modulation Index (positive/negative)
- Output power
- Frequency stability (short, medium) [1)]

Note 1): Beacon manufacturer shall provide technical data on the beacon frequency generation to demonstrate that the frequency stability tests at ambient temperature are sufficient for ensuring that each production beacon will exhibit frequency stability performance similar to the beacon submitted for type approval over the complete operating temperature range. If such assurance of adequate performance over the complete operating temperature range cannot be deduced from the technical data provided and the frequency stability test results at ambient temperature, a thermal gradient test shall be performed on all production units.

- Other tests:

_____
_____
_____
_____
_____

We confirm that the above tests will be performed as appropriate to ensure that the complete beacon satisfies Cospas-Sarsat requirements, as demonstrated by the test unit submitted for type approval.

We agree to keep the test result sheet of every production beacon for inspection by Cospas-Sarsat, if required, for a minimum of 10 years.

We confirm that Cospas-Sarsat representative(s) have the right to visit our premises to witness the production and testing process of the above-mentioned beacons. We understand that the cost related to the visit is to be borne by Cospas-Sarsat.

We also accept that, upon official notification of Cospas-Sarsat, we may be required to re-submit a unit of the above beacon model selected by Cospas-Sarsat for the testing of parameters chosen at Cospas-Sarsat discretion at a Cospas-Sarsat accepted test facility selected by the Cospas-Sarsat. We understand that the cost of the testing shall be borne by Cospas-Sarsat.

We understand that the Cospas-Sarsat Type Approval Certificate is subject to revocation should the beacon type for which it was issued, or its modifications, cease to meet the Cospas-Sarsat specifications, or Cospas-Sarsat has determined that this quality assurance plan is not implemented in a satisfactory manner.

Dated:..... Signed:.....
(Name, Position and Signature of Beacon Manufacturer Representative)

- END OF ANNEX L -

ANNEX M: COSPAS-SARSAT 406 MHZ BEACON TYPE APPROVAL CERTIFICATE (SAMPLE)

TYPE APPROVAL CERTIFICATE

For a 406 Megahertz Distress Beacon for use with the Cospas-Sarsat Satellite System

Certificate Number: …xxx

Manufacturer:	**The ABC Beacon Company, London, UK**
Beacon Type(s):	EPIRB
Beacon Model(s):	ABC-406
Test Laboratory:	Intespace, Toulouse, France
Date of Test:	January 2005

Details of the beacon features and battery type are provided overleaf.

The Cospas-Sarsat Council hereby certifies that the 406 MHz Distress Beacon Model identified above is compatible with the Cospas-Sarsat System as defined in documents:

C/S T.001 Specification for Cospas-Sarsat 406 MHz Distress Beacon
Issue 3 – Rev. 6, October 2004

C/S T.007 Cospas-Sarsat 406 MHz Distress Beacon Type Approval Standard
Issue 4 , November 2005

Date Originally Issued: 10 March 2005
Date(s) Amended:

_____

Head of Cospas-Sarsat Secretariat

NOTE, HOWEVER:

1. This certificate does not authorize the operation or sale of any 406 MHz distress beacon. Such authorization may require type acceptance by national administrations in countries where the beacon will be distributed, and may also be subject to national licensing requirements.

2. This certificate is intended only as a formal notification to the above identified manufacturer that the Cospas-Sarsat Council has determined, on the basis of test data of a beacon submitted by the manufacturer, that 406 MHz distress beacons of the type identified herein meet the standards for use with the Cospas-Sarsat System.

3. Although the manufacturer has formally stated that all beacons identified with the above model name(s) will meet the Cospas-Sarsat specification referenced above, this certificate is not a warranty and Cospas-Sarsat hereby expressly disclaims any and all liability arising out of or in connection with the issuance, use or misuse of the certificate.

4. This certificate is subject to revocation by the Cospas-Sarsat Council should the beacon type for which it is issued cease to meet the Cospas-Sarsat specification. A new certificate may be issued after satisfactory corrective action has been taken and correct performance demonstrated in accordance with the Cospas-Sarsat Type Approval Standard.

5. Cospas-Sarsat type approval testing requirements only address the electrical performance of the beacon at 406 MHz. Conformance of the beacon to operational and environmental requirements is the responsibility of national administrations.

Certificate Number: …xxx Dated: …xxx

Operating temperature range: -20°C to +55°C

Battery Details: xxx Battery Company, type 123 (4 D-cells)
Battery chemistry

Operating Lifetime: 48 hours*

Transmit Frequency: 406.028 MHz

Beacon Model Features:

- 121.5 MHz auxiliary radio locating device (50 mW, continuous)
- Automatic activation mechanism
- Strobe light (0.75 cd, 20 flashes/min)
- Internal navigation device (GPS): manufacturer YYY, model ZZZ
- Self-test mode: one burst of 520 ms
- Optional GNSS Self Test (limited to X times over the life of the battery)

Approved Beacon Message Protocols Beacon is approved for encoding with the message protocols indicated with "Yes" and black text below:

USER PROTOCOLS		USER-LOCATION PROTOCOLS		LOCATION PROTOCOLS	
No	Maritime with MMSI	No	Maritime with MMSI	No	Standard Location: EPIRB with MMSI
No	Maritime with Radio Call Sign	No	Maritime with Radio Call Sign	No	Standard Location: EPIRB with Serial Number
No	EPIRB Float Free with Serial Number	No	EPIRB Float Free with Serial Number	No	Standard Location: ELT with 24-bit Address
No	EPIRB Non Float Free with Serial Number	No	EPIRB Non Float Free with Serial Number	No	Standard Location: ELT with Aircraft Operator Designator
No	Radio Call Sign	No	Radio Call Sign	No	Standard Location: ELT with Serial Number
No	Aviation	No	Aviation	**Yes**	**Standard Location: PLB with Serial Number**
No	ELT with Serial Number	No	ELT with Serial Number	No	National Location: EPIRB
No	ELT with Aircraft Operator and Serial Number	No	ELT with Aircraft Operator and Serial Number	No	National Location: ELT
No	ELT with Aircraft 24-bit Address	No	ELT with Aircraft 24-bit Address	**Yes**	**National Location: PLB**
Yes	**PLB with Serial Number**	**Yes**	**PLB with Serial Number**	No	RLS Location: EPIRB
Yes	**National (Short Format Message)**			No	RLS Location: ELT
No	National (Long Format Message)			No	RLS Location: PLB
				No	ELT(DT) Location: ELT with Serial Number
				No	ELT(DT) Location: ELT with Aircraft Operator and Serial Number
				No	ELT(DT) Location: ELT with Aircraft 24-bit Address

* For beacons with an operator-controlled voice transceiver with automatic means restricting the duration of continuous voice-signal transmission the transmit mode test 'on' time shall be stated in the Operating Lifetime section of the Type Approval Certificate.

- END OF ANNEX M –

- END OF DOCUMENT –

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