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# Report On

Emergency Beacons Testing of the
Ocean Signal SafeSea E101V EPIRB
In accordance with Cospas-Sarsat T.007

Document 75931777 Report 04 Issue 1 December 2015

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**REPORT ON**

Emergency Beacons Testing of the
Ocean Signal
SafeSea E101V EPIRB

Document 75931777 Report 04 Issue 1

December 2015

**PREPARED FOR**

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**DATED** 24 December 2015

UKAS TESTING 0141

Product Service

**CONTENTS**

Product Service

**SECTION 1**

**REPORT SUMMARY**

Emergency Beacons Testing of the
Ocean Signal
SafeSea E101V EPIRB

## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Emergency Beacon Testing of the Ocean Signal SafeSea E101V EPIRB to the requirements of Cospas-Sarsat T.007.

| | |
|---|---|
| Objective | To perform Emergency Beacon Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out. |
| Manufacturer | Ocean Signal |
| Model Number(s) | SafeSea E101V EPIRB |
| Beacon model hardware part number (P/N) and version | 900S-01864, issue 01.00 |
| Beacon model software/firmware P/N, version | 500S-01863, issue 01.00 |
| Beacon model printed circuit board P/N and version | 101S-01530, issue 01.00 |
| Serial Number(s) | 0800002P<br>0800003P |
| Number of Samples Tested | 2 |
| Test Specification/Issue/Date | Cospas-Sarsat T.007 Issue 4 - Rev 9 October 2014 |
| Incoming Release<br>Date | Application Form<br>14 September 2015 |
| Date of Receipt of Test Samples | 10 September 2015 |
| Order Number<br>Date | PO 01976<br>27 August 2015 |
| Start of Test | 26 September 2015 |
| Finish of Test | 21 November 2015 |
| Name of Engineer(s) | M Hardy<br>T Guy |
| Related Documents | Cospas-Sarsat T.001 Issue 3 Revision 15 October 2014<br>Cospas-Sarsat T.IP (TCXO) Issue 1 Revision 5 October 2013 |

## 1.2 APPLICATION FORM



**ANNEX G**

**APPLICATION FOR A COSPAS-SARSAT 406 MHz BEACON TYPE APPROVAL CERTIFICATE**

### G.1 Beacon Manufacturer and Beacon Model

| | |
|---|---|
| **Beacon Manufacturer** | Ocean Signal Ltd. |
| **Beacon Model** | SafeSea E101V |
| **Other Model Names** | X-VDR FF-AMI |

### 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 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 | 406.040MHz |
| Operating temperature range | $T_{min}$ = -20°C $T_{max}$ = +55°C |
| Temperature, at which minimum duration of continuous operation is expected | -20°C |
| Operating lifetime | 168 hours |
| Beacon power supply type (internal, external, combined, other) | Internal |
| External power supply parameters (AC/DC and nominal voltage) | N/A |
| Is external power supply needed to energise the beacon or its ancillary devices in any of operation modes (N/A or Yes of No) | N/A |
| Battery cell chemistry | Lithium Manganese Dioxide |
| Battery cell model name, size and number of cells in a battery pack, and details of the battery pack electrical configuration | Ultralife U10013 'D' cells, 3 cells, series connected |

| Characteristic | Specification |
|---|---|
| Battery cell manufacturer | Ultralife |
| Battery pack manufacturer and part number | Ocean Signal Ltd, 901S-01741 |
| Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon) | 2years |
| Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon) | 8years |
| Oscillator type (e.g. OCXO, MCXO, TCXO) | TCXO |
| Oscillator manufacturer | Rakon Limited |
| Oscillator part name and number | E5344LF |
| Oscillator satisfies long-term frequency stability requirements (Yes or No) | Yes |
| Antenna type: Integral or Other (e.g. External, Detachable – specify type) | Integral |
| Antenna manufacturer | Ocean Signal Ltd. |
| Antenna part name and number | Ocean Signal Ltd. |
| Antenna cable assembly min/max RF- loses at 406 MHz, if applicable | N/A |
| Navigation device type (Internal, External or None) | Internal |
| 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) | Yes |
| Features in beacon that ensures erroneous position data is not encoded into the beacon message (Yes, No or N/A) | Yes |
| Navigation device capable of supporting global coverage (Yes, No or N/A) | Yes |
| Encoded position update capability (Yes, No, N/A) | Yes |

Relating to: TÜV SÜD Report 75931777 Report 04

| | |
|---|---|
| Encoded position update interval value (range) | |
| For Internal Navigation Devices | |
| - Geodetic reference system (WGS 84 or GTRF) | WGS-84 |
| - GNSS receiver cold start forced at every beacon activation (Yes or No) | Yes |
| - Navigation device manufacturer | Quectel |
| - Navigation device model name and part Number | L70 |
| - Internal navigation device antenna type (integrated, internal, external, passive/active), manufacturer and model | Internal, AEL Crystal Ltd., DAE1575R1820A |
| - GNSS system supported (e.g. GPS, GLONASS, Galileo) | GPS |

| **Characteristic** | **Specification** | |
|---|---|---|
| For External Navigation Devices | N/A | |
| - 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 positions (Yes / No) | Yes | Yes |
| - Self-test / GNSS self-test mode switch automatically returns to normal position when released (Yes or No) | Yes | |
| - Self-test / GNSS activation can cause an operational mode transmission (Yes or No) | Yes | 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) | Yes | N/A |
| - Results of self-test /GNSS self-test indicated by (provide details, e.g Pass /Fail indicator l, strobe light, etc.) | indicator LED Strobe light | indicator LED Strobe light |
| - The content of the encoded position data fields of the self-test message has default values | Yes | N/A |
| - Performs an internal check and indicates that RF power emitted at 406 MHz and 121.5 MHz, if beacon includes a 121.5 MHz homer (Yes or No) | Yes | N/A |
| - Self-test results in transmission of a signal other than at 406 MHz (Yes & details or No) | Yes, 121.5MHz | No |
| - Self-test can be activated directly at beacon (Yes or No) | Yes | Yes |
| - List of Items checked by self-test | 406 Power, Synth, | GPS receiver |

| | | |
|---|---|---|
| | 121.5 Power Battery Status | |
| - Self-test / GNSS self-test 406 MHz burst duration (440 or 520 ms) | 520ms | N/A |
| - Self-test message length format flag in bit 25,bit ("0" or "1") | 0 | N/A |
| - Maximum duration of a self-test mode, sec | 16.5Secs | 315.5Secs |
| - Maximum recommended number of self-tests during battery pack replacement period | 72 | N/A |
| - Distinct indication of self-test start (Yes/No) | Yes | Yes |
| - Indication of self-test results (Yes/No) | Yes | Yes |
| - Distinct indication of insufficient battery capacity (Yes or No) | Yes | N/A |
| - Automatic termination of self-test mode immediately after completion of the self-test cycle (Yes or No) | Yes | Yes |
| - Maximum number of GNSS Self Tests (beacons with internal navigation devices only) | N/A | 12 |
| - GNSS Self-test results in transmission of a single burst, irrespectively of the test result (Yes or No) | N/A | No |
| - Maximum number of self-tests during battery pack replacement period | ≤280 | N/A |
| - Self-test / GNSS self-test can be activated from beacon remote activation points (Yes & details or No) | No | No |
| List all methods of self-test mode and GNSS self-test mode activation. Provide details on a separate sheet to describe. | Test key only | Test key only |

| Characteristic | Specification | |
|---|---|---|
| **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 |
| RLS Location Protocol (tick where appropriate)[1] | ☐ | EPIRB |
| | ☐ | 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 |

[1] RLS protocols will be effective as of 1 November 2015. The use of RLS-enabled beacons will be regulated by national administrations.

Relating to: TÜV SÜD Report 75931777 Report 04

| Characteristic | Specification |
|---|---|
| Beacon includes a homer transmitter(s) (Yes or No) | Yes |
| -Homer transmitter(s) frequency | 121.5MHz |
| -Homer transmit(s) power | 20dBm ±2dB |
| -Homer transmitter(s) duty cycle | 97% |
| -Duty cycle of homer swept tone | 34% |
| Beacon includes a high intensity flashing light (e.g. Strobe) | Yes |
| -light intensity | >0.5cd |
| -flash rate | 2.5Secs |
| 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) | Yes |
| 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. | None |
| Beacon includes automatic activation mechanism (Yes or No) Specify type of automatic beacon activation mechanism | Yes, Water activation |
| 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 | VDR data recorder module completely separated from EPIRB electronics and fully isolated from the EPIRB power supply |
| Beacon model hardware part number (P/N) and version | 900S-01864, issue 01.00 |
| Beacon model software/firmware P/N, version, date of issue / releases | 500S-01863, issue 01.00 |
| Beacon model printed circuit board P/N and version | 101S-01530, issue 01.00 |
| Known non-compliances with C/S T.001 requirements (Yes or No) If Yes, provide details (or use a separate sheet if insufficient space) | No |
| Beacon Manufacturer Point of Contact (POC) for this Type Approval application: | David Sheekey<br>Product and Approvals Manager<br>david.sheekey@oceansignal.com<br>+44 (0)1843 282930 |

Dated:

Signed:.....
(Simon Nolan, Chief Technical Officer)

Relating to: TÜV SÜD Report 75931777 Report 04

Information Provided by the Cospas-Sarsat Accepted Test Facility

Name and Location of Beacon Test Facility: TUV SUD Product Service, Fareham, UK

Date of Submission for Testing: 10 September 2015

Applicable Test Standards:

| Document | Issue | Revision | Date |
|---|---|---|---|
| C/S T.001 | 3 | 15 | Oct 2014 |
| C/S T.007 | 4 | 9 | Oct 2014 |
| IP (TCXO) | - | 5 | Oct 2013 |

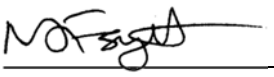
I hereby confirm that the 406 MHz beacon described above has been successfully tested in accordance with the Cospas-Sarsat Type Approval Standard (C/S T.007) and complies with the Specification for Cospas-Sarsat 406 MHz Distress Beacons (C/S T.001) as demonstrated in the attached report, with the exception of the non-compliances indicated below.

Detail any observed non-compliances and/or deviations from standard test procedures here:

Non-Compliances:

Deviations: the Operating Lifetime test was carried out in accordance with IEC61097-2 clause 5.15.1: an additional soak at -30°C was carried out prior to the requirements of T.007, clause A.2.3 at -20°C.

There were no other deviations from standard test procedures during the test program.

Signed: 

Name: Nic Forsyth

Position Held: Authorised Signatory

Date: 24 December 2015

## 1.3 PRODUCT INFORMATION

### 1.3.1 Technical Description

The Equipment Under Test (EUT) was a Ocean Signal SafeSea E101V EPIRB as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.


Equipment Under Test

The following is a list of equipment provided by the manufacturer for Type Approval Testing:

| Description | Manufacturer | Model | S/No./Version |
|---|---|---|---|
| Automatic Release Housing | Ocean Signal | ARH101 | N/A |
| EPIRB with VDR (Modified Conducted Output) | Ocean Signal | E101V | 0800002P |
| Automatic Release Housing | Ocean Signal | ARH101 | N/A |
| EPIRB with VDR | Ocean Signal | E101V | 0800003P |
| EPIRB programming cable | Ocean Signal | N/A | N/A |
| Crossover LAN Cable | RS | 405-5379 | N/A |
| 'BeaconWidget' Programming Software | Ocean Signal | N/A | V01.07 |

Physical Test Configuration

The Equipment Under Test (EUT) was operated using its own power source (internal battery). One EUT was configured so that the antenna port was connected to the 50Ω test system using a coaxial cable. The test configuration for all tests is identical with the exception of Antenna Characteristics, Satellite Qualitative and Navigation Tests.

The second EUT was a fully packaged beacon, similar to the proposed production beacons equipped with its proper antenna. This EUT was used to perform Antenna Characteristics, Satellite Qualitative and Navigation Tests. The test configuration for these tests is a function of the beacon type and the operational environments supported by the beacon, as declared by the manufacturer.

For Configuration 1 (see System Configurations below), the EUT was fitted into a manufacturer supplied Float Free Housing (see Photographs in Section 4). The EUT also incorporated a VDR module, which in accordance with the manufacturers' information, is completely electrically isolated from the main EUT. To ensure that the VDR module did not affect EUT performance in any way, the VDR input was connected to an artificial network during battery current measurements. The manufacturer has declared that the EUT should not be activated whilst in the Float Free Housing. Therefore current measurements applied to Standby and Self Test modes only.

The physical configurations for tests within this report are as follows:

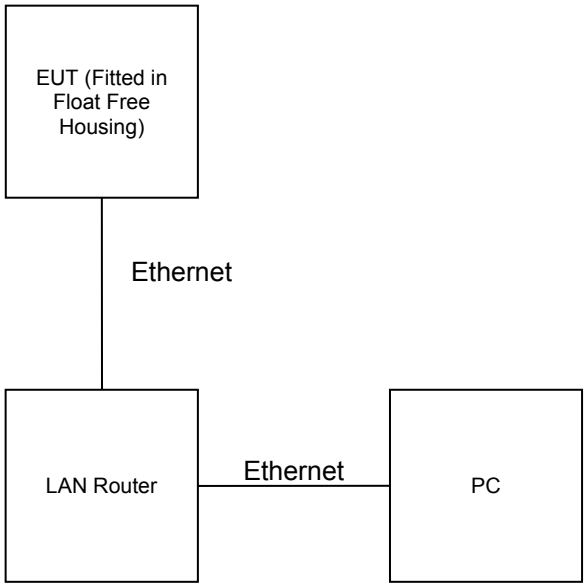
1) EUT fitted in manufacturer supplied Float Free Housing, with VDR module networked to test PC for:

    - Battery Current Measurements (Standby and Self-Test modes only)

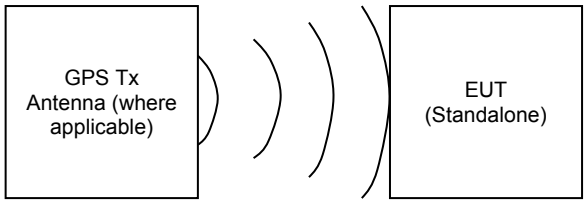
2) EUT 'standalone' – no ancillaries connected to the EUT, VDR module inactive for:

    - Electrical and Functional Tests at Constant Temperature
    - Thermal Shock
    - Operating Lifetime at Minimum Temperature
    - Frequency Stability Test with Temperature Gradient
    - Satellite Qualitative
    - Beacon Antenna Test
    - Navigation System
    - Battery Current Measurements

System Configurations




Configuration 1 (Battery Current Measurements Only)




Configuration 2 (All other tests)

### 1.3.2 Modes of Operation

Modes of operation of the EUT during testing were as follows:

Off/Standby Mode

- Main switch to “OFF” position
- No apparent activity

Self-test

- Test switch to “TEST” position for 2 seconds (approx)
- List of items checked as per Customer Supplied Information (Application Form)
- Navigation data applied at ambient temperature

GNSS Self-test

- Test switch to “TEST” position for 10 seconds (approx)
- List of items checked as per Customer Supplied Information (Application Form)
- Navigation data applied as applicable (e.g. none applied for timeout, data applied for ‘fast acquisition’)

Operating

- Main switch to “ON” position
- 121 Homer active and offset
- GPS operating in normal duty cycle for the following navigation input conditions
- No navigation data applied

All modes

All mode descriptions are applicable to all tests unless otherwise stated. Additional methods of activation include:

- Water contacts

All Navigation input descriptions are applicable to all tests unless otherwise stated.

During the first hour of operation, the manufacturers’ information states that in the absence of an external GPS signal, the EUT’s internal GPS receiver has the following duty cycle:

- ON for 5 minutes
- OFF for 5 minutes.

For the Electrical and Functional Tests at Constant Temperature, listed in section A.2.1 of T.007 (excluding spurious output and self-test modes), measurements were performed for 20 minutes (after a 15 minute warm up period). This ensured that measurements were made during periods when the internal GPS receiver of the EUT was active and inactive. Spurious output measurements were made over a 20 hour period, during which, the Climatic test chamber was set to Ambient, +55°C, and -20°C.

## 1.4 MODIFICATIONS

Modification 0 - No modifications were made to the test sample during testing.

## 1.5 REPORT MODIFICATION RECORD

Issue 1 – First Issue

**SECTION 2**

**TEST DETAILS**

Emergency Beacons Testing of the
Ocean Signal
SafeSea E101V EPIRB

## TEST RESULTS TABLE

| Parameters to be Measured | | Range of Specification | Units | Test Results | | | Comments |
|---|---|---|---|---|---|---|---|
| | | | | Tmin | Tamb | Tmax | |
| | | | | ( -20°C) | (+21°C) | (+55°C) | |
| 1. Power Output | | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800002P, TUV Ref: TSR13 and Modification State 0** | | | | | | | |
| Transmitter power output | (maximum) | 35 - 39 | dBm | 37.35 | 37.23 | 37.47 | |
| | (minimum) | | | 37.32 | 37.19 | 37.44 | |
| Power output rise time | (maximum) | < 5 | ms | 0.42 | 0.52 | 0.51 | |
| | (minimum) | | | 0.40 | 0.51 | 0.49 | |
| Power output 1ms before burst | (maximum) | < -10 | dBm | -16.60 | -18.05 | -18.71 | |
| | (minimum) | | | -17.24 | -18.78 | -19.52 | |
| 2. Digital Message Coding | | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800002P, TUV Ref: TSR13 and Modification State 0** | | | | | | | |
| Bit Sync | 1 - 15 | 15 bits “1” | P / F | P | P | P | |
| Frame sync | 16 - 24 | “000101111” | P / F | P | P | P | |
| Format flag | 25 | 1 bit | bit value | 1 | 1 | 1 | |
| Protocol flag | 26 | 1 bit | bit value | 0 | 0 | 0 | |
| Identification / position data | 27 - 85 | 59 bits | P / F | P | P | P | |
| BCH code | 86 -106 | 21 bits | P / F | P | P | P | |
| Emerg. Code/nat. use/supplem. Data | 107 - 112 | 6 bits | bit value | 110111 | 110111 | 110111 | |
| Additional data / BCH (if applicable) | 112 - 144 | 32 bits | P / F | P | P | P | |
| Position Error (if applicable) | | < 5 | km | n/a | n/a | n/a | |

| Parameters to be Measured | Range of Specification | Units | Test Results | | | Comments |
|---|---|---|---|---|---|---|
| | | | Tmin | Tamb | Tmax | |
| | | | ( -20°C) | (+21°C) | (+55°C) | |
| 3. Digital Message Generator | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800002P, TUV Ref: TSR13 and Modification State 0** | | | | | | |
| Repetition rate, $T_R$: | | | | | | |
| Average $T_R$ | 48.5 ≤ $T_{Ravg}$ ≤ 51.5 | seconds | 50.166 | 50.209 | 50.209 | |
| Minimum $T_R$ | 47.5 ≤ $T_{Rmin}$ ≤ 48.0 | seconds | 47.705 | 47.721 | 47.705 | |
| Maximum $T_R$ | 52.0 ≤ $T_{Rmax}$ ≤ 52.5 | seconds | 52.011 | 52.026 | 52.026 | |
| Standard deviation | 0.5 - 2.0 | seconds | 1.44 | 1.44 | 1.44 | |
| Bit rate | | | | | | |
| Minimum fb | ≥ 396 | bits/sec | 400.10 | 400.10 | 400.10 | |
| Maximum fb | ≤ 404 | bits/sec | 400.12 | 400.12 | 400.12 | |
| Total transmission time | | | | | | |
| Short message (maximum) | 435.6 - 444.4 | ms | n/a | n/a | n/a | |
| Short message (minimum) | | | n/a | n/a | n/a | |
| Long message (maximum) | 514.8 - 525.2 | ms | 518.92 | 518.95 | 518.98 | |
| Long message (minimum) | | | 518.87 | 518.89 | 518.91 | |
| Unmodulated carrier | | | | | | |
| Minimum T1 | ≥ 158.4 | ms | 159.97 | 159.97 | 159.97 | |
| Maximum T1 | ≤ 161.6 | ms | 160.03 | 160.03 | 160.04 | |
| First burst delay | ≥ 47.5 | seconds | 50 | 50 | 50 | |

| Parameters to be Measured | | Range of Specification | Units | Test Results | | | Comments |
|---|---|---|---|---|---|---|---|
| | | | | Tmin | Tamb | Tmax | |
| | | | | ( -20°C) | (+21°C) | (+55°C) | |
| 4. Modulation | | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800002P, TUV Ref: TSR13 and Modification State 0** | | | | | | | |
| Biphase-L | | P / F | P / F | P | P | P | |
| Rise time | (maximum) | 50 - 250 | µs | 152.4 | 153.3 | 152.4 | |
| | (minimum) | 50 - 250 | µs | 136.3 | 136.3 | 136.3 | |
| Fall time | (maximum) | 50 - 250 | µs | 166.7 | 167.6 | 163.6 | |
| | (minimum) | 50 - 250 | µs | 152.7 | 151.7 | 149.6 | |
| Phase deviation: positive | (maximum) | +(1.0 to 1.2) | radians | 1.1969 | 1.1886 | 1.1990 | |
| | (minimum) | +(1.0 to 1.2) | radians | 1.0466 | 1.0400 | 1.0674 | |
| Phase deviation: negative | (maximum) | -(1.0 to 1.2) | radians | -1.1789 | -1.1981 | -1.1770 | |
| | (minimum) | -(1.0 to 1.2) | radians | -1.0278 | -1.0545 | -1.0500 | |
| Symmetry measurement | | ≤ 0.05 | | 0.0219 | 0.0222 | 0.0230 | |
| 5. 406 MHz Transmitted Frequency | | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800002P, TUV Ref: TSR13 and Modification State 0** | | | | | | | |
| Nominal Value | (maximum) | C/S T.001 | MHz | 406.039989 | 406.0399845 | 406.039970 | |
| | (minimum) | | | 406.039989 | 406.0399845 | 406.039969 | |
| Short-term stability | (maximum) | ≤ $2x10^{-9}$ | /100ms | 87.648E-12 | 10.760E-11 | 50.145E-12 | |
| | (minimum) | | | 80.974E-12 | 85.651E-12 | 36.877E-12 | |
| Medium-term stability – Slope | (maximum) | (-1 to +1)$x10^{-9}$ | /minutes | -17.215E-12 | 35.409E-12 | 10.164E-11 | |
| | (minimum) | | | -29.585E-12 | -15.985E-12 | 71.551E-12 | |
| Medium-term stability – Residual frequency variation | (maximum) | ≤ $3x10^{-9}$ | | 25.622E-11 | 25.560E-11 | 89.679E-12 | |
| | (minimum) | | | 24.214E-11 | 11.571E-11 | 66.072E-12 | |
| 6. Spurious Emissions into 50ohms | | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800002P, TUV Ref: TSR13 and Modification State 0** | | | | | | | |
| In band (406.0 – 406.1 MHz) | | C/S T.001 mask | P / F | P | | | |

| Parameters to be Measured | | Range of Specification | Units | Test Results | | | Comments |
|---|---|---|---|---|---|---|---|
| | | | | Tmin | Tamb | Tmax | |
| | | | | ( -20°C) | (+21°C) | (+55°C) | |
| 7. 406 MHz VSWR Check | | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800002P, TUV Ref: TSR13 and Modification State 0** | | | | | | | |
| Nominal Value | (maximum) | C/S T.001 | MHz | 406.039989 | 406.0399845 | 406.039970 | |
| | (minimum) | | | 406.039989 | 406.0399843 | 406.039970 | |
| Modulation rise time | (maximum) | 50-250 | µs | 152.3 | 151.3 | 148.4 | |
| | (minimum) | 50-250 | µs | 137.3 | 136.4 | 134.4 | |
| Modulation fall time | (maximum) | 50-250 | µs | 168.6 | 165.7 | 162.6 | |
| | (minimum) | 50-250 | µs | 152.6 | 151.7 | 149.7 | |
| Modulation phase deviation: positive | (maximum) | + (1.0 to 1.2) | radians | 1.1996 | 1.1831 | 1.1846 | |
| | (minimum) | + (1.0 to 1.2) | radians | 1.0504 | 1.0400 | 1.0765 | |
| Modulation phase deviation: negative | (maximum) | - (1.0 to 1.2) | radians | -1.1846 | -1.1950 | -1.1726 | |
| | (minimum) | - (1.0 to 1.2) | radians | -1.0187 | -1.0476 | -1.0645 | |
| Modulation symmetry measurement | | ≤ 0.05 | | 0.0226 | 0.0222 | 0.0218 | |
| Digital Message | | correct | P / F | P | P | P | |

| Parameters to be Measured | Range of Specification | Units | Test Results | | | Comments |
|---|---|---|---|---|---|---|
| | | | Tmin | Tamb | Tmax | |
| | | | ( -20°C) | (+21°C) | (+55°C) | |
| 8(a). Self-test Mode | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800002P, TUV Ref: TSR13 and Modification State 0** | | | | | | |
| Frame sync | 011010000 | P / F | P | P | P | |
| Format flag | 1 / 0 | bit value | 1 | 1 | 1 | |
| Single radiated burst | ≤440 / 520 (±1%) | ms | 518.930 | 518.931 | 518.961 | |
| Default position data (if applicable) | correct | P / F | P | P | P | |
| Description | provided | Y / N | Y | | | |
| Design data on protection against repetitive self-test mode transmissions | provided | Y / N | Y | | | Applicant's data: see Annex A |
| Single burst verification | one burst | P / F | P | P | P | |
| Provides for 15 Hex ID | correct | P / F | P | P | P | |
| 121.5 MHz RF power (if applicable) | verify that RF power emitted | P / F | P | P | P | |
| 406 MHz power | verify that RF power emitted | P / F | P | P | P | |
| Distinct indication of Self-Test | provided | Y / N | Y | Y | Y | Self Test initiation is indicated by 3 red LED flashes. |
| Distinct indication of RF power being emitted | provided | Y / N | Y | Y | Y | The manufacturer's operating manual states that the strobe light indicated that RF power has been emitted |
| Indication of Self-Test result | provided | Y / N | Y | Y | Y | At Ambient, High and Low temperatures, the Self Test result returned six Amber LED flashes, indicating that the EUT had been previously activated for over 10 hours. |
| Maximum duration of Self-Test mode | ≤ maximum duration of Self-Test | sec | 13 | 13 | 13 | |
| Automatic termination of Self-Test mode upon completion of Self-Test and indication of Self-Test results | verify automatic termination | Y / N | Y | Y | Y | |

| Parameters to be Measured | Range of Specification | Units | Test Results | | | Comments |
|---|---|---|---|---|---|---|
| | | | Tmin | Tamb | Tmax | |
| | | | ( -20°C) | (+21°C) | (+55°C) | |
| 8 (b). GNSS Self-Test Mode (if applicable) | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800002P, TUV Ref: TSR13 and Modification State 0** | | | | | | |
| Frame sync | 011010000 | P / F | n/a | n/a | n/a | The EUT does not transmit a 406 burst during a GNSS Self-Test. LED indication only. |
| Format flag | 1 / 0 | bit value | n/a | n/a | n/a | |
| Single radiated burst | ≤ 520 (+1%) | ms | n/a | n/a | n/a | |
| Position data (if applicable) | must be within 500m (or 5.25km for User Location Protocol) of the actual position | P / F | n/a | n/a | n/a | |
| Design data showing how GNSS Self-test is limited in number of transmissions and duration | provided | Y / N | | Y | | Applicant's data: see Annex A |
| Single burst verification | one burst | P / F | n/a | n/a | n/a | |
| 121.5 MHz RF power (if applicable) | GNSS self-test checks RF power is emitted | Y / N | N | N | N | |
| 406 MHz power | GNSS self-test checks that RF power is emitted | Y / N | N | N | N | |
| Maximum duration of GNSS Self-test | Manufacturer to specify value | s | 300 | 300 | 300 | |
| Actual duration of Self-test with encoded location | Less than maximum duration | s | 62 | 53 | 45 | |
| Maximum number of GNSS Self-tests (only beacons with internal navigation devices) | Manufacturer to specify number | Number | | 12 | | Manufacturer specified number: 12 |
| Distinct indication to register successful completion or failure of the GNSS self-test | must be provided | Y/N | Y | Y | Y | A GNSS Self-Test is initiated by holding the test switch in the test position for 10 seconds. The EUT will display a continuously illuminated red LED, which will briefly flash green every five seconds, whilst the GNSS ST is in progress. If a GPS position is found, the strobe light will falsh, and the LED will flash green for a number indicating how many GNSS Self-Tests remain for the operator. If no GPS signal is found within 5 minutes, the strobe light will flash twice, and the LED will flash red, 12 times. |
| 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 of further GNSS receiver current drain | must be provided | Y/N | | Y | | If further GNSS Self-Tests are attempted, the Red LED will flash whilst the test button is held, to indicate no further tests are available |

| Parameters to be Measured | Range of Specification | Units | Test Results | | Comments |
|---|---|---|---|---|---|
| 9. Thermal Shock | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800002P, TUV Ref: TSR13 and Modification State 0** | | | | | |
| Soak Temperature | 30°C difference | °C | 20.0 | | |
| Measurement Temperature | | °C | -10.0 | | |
| Transmitted Frequency | | | Min | Max | |
| Nominal value | C/S T.001 | MHz | 406.0399909 | 406.0399940 | |
| Short-term stability | ≤ $2x10^{-9}$ | /100ms | 62.466E-12 | 12.219E-11 | |
| Medium-term stability – Slope | (-2 to +2)$x10^{-9}$ | /min | -41.882E-11 | 10.340E-12 | |
| Medium-term stability – Residual frequency variation | ≤ $3x10^{-9}$ | | 60.467E-12 | 22.022E-11 | |
| Transmitter power output | 35 - 39 | dBm | 37.14 | 37.39 | |
| Digital message | correct | P/F | P | | |

| Parameters to be Measured | Range of Specification | Units | Test Results | | Comments |
|---|---|---|---|---|---|
| 10. Operating Lifetime at Minimum Temperature | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800002P, TUV Ref: TSR13 and Modification State 0** | | | | | |
| Pre-test battery discharge duration (operating) required | | Hours | 11.61 | | Capacity discharge required : 0.4123Ah |
| Pre-test battery discharge duration (operating) | | Hours | 18.5 | | Capacity discharge actual : 06571Ah |
| Duration | >24 | Hours | 214.5 Hours at Tmin = -20°C | | |
| Effective Operating Lifetime duration | >24 | Hours | 214.5 Hours at Tmin = -20°C | | End of test taken as 168 hours (Manufacturer declared value) |
| Transmitted Frequency | | | Min | Max | |
| Nominal value | C/S T.001 | MHz | 406.0399941 | 406.0400086 | |
| Short-term stability | ≤ $2x10^{-9}$ | /100ms | 34.397E-12 | 43.629E-11 | |
| Medium-term stability – Slope | (-1 to +1)$x10^{-9}$ | /min | -7.13E-11 | 1.20E-10 | Results for MTS-Slope and MTS-Residual, exclude the first 30 mins of data. |
| Medium-term stability – Residual frequency variation | ≤ $3x10^{-9}$ | | 5.82E-11 | 1.99E-09 | |
| Transmitter power output | 35 - 39 | dBm | 36.42 | 37.39 | |
| Digital message | correct | P/F | P | | |
| Homer transmitter continuous operation during the lifetime test | | hours | >214.5 | | |
| | | | Start of Test | End of Test | |
| Homer frequency | | MHz | 121.499 | 121.499 | |
| Homer peak power level | | dBm | 18.756 | 19.37 | |
| Homer transmitter duty cycle | | % | 96.8 | 97.1 | |

| Parameters to be Measured | Range of Specification | Units | Test Results | | | | Comments |
|---|---|---|---|---|---|---|---|
| 11. Temperature Gradient (5°C/hr) | | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800002P, TUV Ref: TSR13 and Modification State 0** | | | | | | | |
| **Full Test** | | | | | | | |
| Transmitted Frequency | | | Min | | Max | | |
| Nominal value | C/S T.007 | MHz | 406.0399687 | | 406.0399971 | | |
| Short-term stability | ≤ $2x10^{-9}$ | /100ms | 39.496E-12 | | 24.838E-11 | | |
| Medium-term stability – Slope | (-1 to +1)$x10^{-9}$ | /min | -3.99E-11 | | 4.15E-11 | | Data for points A to B, C+15 min to D and E+15 min to F |
| | (-2 to +2)$x10^{-9}$ | /min | -1.71E-10 | | 1.71E-10 | | Data for points B to C+15 min and D to E+15 min |
| Medium-term stability – Residual frequency variation | ≤ $3x10^{-9}$ | | 36.012E-12 | | 27.957E-11 | | |
| Transmitter power output | 35 – 39 | dBm | 36.92 | | 37.43 | | |
| Digital message | correct | P/F | P | | | | |
| Interim TCXO Procedure | correct | P/F | P | | | | See test results section (2.8) for result table |
| 12. Oscillator Aging | | | | | | | |
| N/A | | | | | | | |
| Data | provided | Y / N | Y | | | | Applicant's data: see Annex A |
| 13. Protection Against Continuous Transmission | | | | | | | |
| Description | provided | Y / N | Y | | | | Applicant's data: see Annex A |
| 14. Satellite Qualitative Tests | | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800003P, TUV Ref: TSR1 and Modification State 0** | | | | | | | |
| Test Configuration | As per C/S T.007 | | Configuration | | | | |
| | | | 5 | 6 | 7 | 8 | |
| 15 Hex ID Decoded by LUT | correct | P / F | P | - | P | P | |
| Doppler Location results with error ≤ 5km | ≥ 80 | % | 100 | - | 92.86 | 86.66 | |

| Parameters to be Measured | Range of Specification | Units | Test Results | | | | Comments |
|---|---|---|---|---|---|---|---|
| 15. Antenna Characteristics | | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: , TUV Ref: TSR and Modification State** | | | | | | | |
| Test Configuration | As per C/S T.007 | | Configuration | | | | |
| | | | 1 | 2 | 3 | 4 | |
| Polarisation | linear or RHCP | | linear | - | - | linear | |
| VSWR | ≤ 1.5 | | - | - | - | - | Detachable Antennas Only |
| $EIRP_{LOSS}$ | | dB | 0.81 | - | - | 0.81 | |
| $EIRP_{maxEOL}$ | ≤ 43 | dBm | 42.8 | - | - | 41.3 | |
| $EIRP_{minEOL}$ | ≥ 32 | dBm | 32.7 | - | - | 30.6 | $EIRP_{minEOL}$ limit decreases to 30 dBm for Configuration 4 |
| 16. Beacon Coding Software | | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: , TUV Ref: TSR and Modification State** | | | | | | | |
| Sample message for each coding option of the applicable coding types | correct | P / F | P | | | | Manufacturer supplied Information – See Annex A |
| Sample self-test message for each coding option of the applicable coding types | correct | P / F | P | | | | |

| Parameters to be Measured | Range of Specification | Units | Test Results | | | Comments |
|---|---|---|---|---|---|---|
| 17. Navigation System | | | | | | **Result: Pass** |
| **Model: SafeSea E101V EPIRB, S/N: 0800003P, TUV Ref: TSR1 and Modification State 0** | | | | | | |
| Location protocol | C/S T.001 | | National | Standard | User | |
| Position data default values | correct | P / F | P | P | P | |
| **Configuration 5** | | | | | | |
| Position accuracy - A.3.8.2.1 | C/S T.001 | m | 73.2 | 73.2 | 2037.3 | |
| Position Acquisition Time - A.3.8.2.1 | <10/1 | min | 61sec | 61sec | 61sec | |
| Position accuracy - A.3.8.2.2 | C/S T.001 | m | 22.7 | 22.7 | 1565.4 | |
| Position Acquisition Time - A.3.8.2.2 | <10/1 | min | 61sec | 61sec | 61sec | |
| **Configuration 7** | | | | | | |
| Position accuracy - A.3.8.2.1 | C/S T.001 | m | 73.2 | 73.2 | 2037.3 | |
| Position Acquisition Time - A.3.8.2.1 | <10/1 | min | 51sec | 51sec | 51sec | |
| Position accuracy - A.3.8.2.2 | C/S T.001 | m | 22.7 | 22.7 | 1565.4 | |
| Position Acquisition Time - A.3.8.2.2 | <10/1 | min | 51sec | 51sec | 51sec | |
| **Configuration 8** | | | | | | |
| Position accuracy - A.3.8.2.1 | C/S T.001 | m | 73.2 | 73.2 | 2037.3 | |
| Position Acquisition Time - A.3.8.2.1 | <10/1 | min | 51sec | 51sec | 51sec | |
| Position accuracy - A.3.8.2.2 | C/S T.001 | m | 22.7 | 22.7 | 1565.4 | |
| Position Acquisition Time - A.3.8.2.2 | <10/1 | min | 51sec | 51sec | 51sec | |
| Encoded position data update interval | >20 | min | 30min 01sec | 30min 02sec | 30min 02sec | |
| Position clearance after deactivation | cleared | P / F | P | P | P | |
| Position data input update interval (as applicable) | 20/1 | Min | N/A | N/A | N/A | |
| Position data encoding | correct | P / F | P | P | P | Manufacturer supplied Information – See Annex A |
| Retained last valid position after navigation input lost | 240(±5) | min | 240.16 | 240.16 | 240.16 | |
| Default position data transmitted after 240(±5) minutes without valid position data | cleared | P / F | P | P | P | |
| Information on protection against beacon degradation due to navigation device, interface or signal failure or malfunction | provided | Y / N | Y | | | Applicant's data, see Annex A for details |

## 2.1 DIGITAL MESSAGE

### 2.1.1 Specification

Cospas-Sarsat T.007, Clause A.2.1 (b)

### 2.1.2 Equipment Under Test and Modification State

E101V S/N: 0800002P - Modification State 0

### 2.1.3 Date of Test

19 October 2015, 20 October 2015 & 22 October 2015

### 2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.1.5 Environmental Conditions

Ambient Temperature 22.4 - 23.3°C
Relative Humidity 45.6 - 49.2%

### 2.1.6 Test Results

EUT System Configuration: 2
Test Duration: 20 minutes
No. of bursts: 26

Ambient Temperature

| | |
|---|---|
| Full 36 hex message | FFFE2F8C9EF9C0637FDFF83D15B783E0F66C |

| ITEM | BITS | VALUE |
|---|---|---|
| Message format: long format | 25 | 1 |
| Protocol: Location Protocol | 26 | 0 |
| Country code: 201 - **Albania** | 27-36 | 0011001001 |
| Type of location protocol: Standard Location - Test | 37-40 | 1110 |
| Test Protocol: Test Protocol (No Decode information in bits 41 to 64) | 41-64 | 111110011100000001100011 |
| Latitude Sign: default | 65 | 0 |
| Latitude Degrees: default | 66-72 | 1111111 |
| Latitude Minutes: default | 73-74 | 11 |
| Longitude Sign: default | 75 | 0 |
| Longitude Degrees: default | 76-83 | 11111111 |
| Longitude Minutes: default | 84-85 | 11 |
| BCH 1 Encoded: | 86-106 | 00000111101000101010 |
| BCH 1 Calculated: | N/A | 00000111101000101010 |
| Fixed bits (1101): Pass | 107-110 | 1101 |
| Position Data: Encoded Position Data Source From Internal Navigation Device | 111 | 1 |
| Aux Device: 121.5 MHz homer | 112 | 1 |
| Latitude Offset Sign: default | 113 | 1 |
| Latitude Offset Minutes: default | 114-118 | 00000 |
| Latitude Offset Seconds: default | 119-122 | 1111 |
| Longitude Offset Sign: default | 123 | 1 |
| Longitude Offset Minutes: default | 124-128 | 00000 |
| Longitude Offset Seconds: default | 129-132 | 1111 |
| BCH 2 Encoded: | 133-144 | 011001101100 |
| BCH 2 Calculated: | N/A | 011001101100 |
| Composite Latitude: default | N/A | Composite Longitude: default |
| 15 Hex ID: | N/A | 193DF380C6FFBFF |

Low Temperature

| | |
|---|---|
| Full 36 hex message | FFFE2F8C9EF9C0637FDFF83D15B783E0F66C |

| ITEM | BITS | VALUE |
|---|---|---|
| Message format: long format | 25 | 1 |
| Protocol: Location Protocol | 26 | 0 |
| Country code: 201 - **Albania** | 27-36 | 0011001001 |
| Type of location protocol: Standard Location - Test | 37-40 | 1110 |
| Test Protocol: Test Protocol (No Decode information in bits 41 to 64) | 41-64 | 1111100111000000001100011 |
| Latitude Sign: default | 65 | 0 |
| Latitude Degrees: default | 66-72 | 1111111 |
| Latitude Minutes: default | 73-74 | 11 |
| Longitude Sign: default | 75 | 0 |
| Longitude Degrees: default | 76-83 | 11111111 |
| Longitude Minutes: default | 84-85 | 11 |
| BCH 1 Encoded: | 86-106 | 00000111101000101011O |
| BCH 1 Calculated: | N/A | 00000111101000101011O |
| Fixed bits (1101): Pass | 107-110 | 1101 |
| Position Data: Encoded Position Data Source From Internal Navigation Device | 111 | 1 |
| Aux Device: 121.5 MHz homer | 112 | 1 |
| Latitude Offset Sign: default | 113 | 1 |
| Latitude Offset Minutes: default | 114-118 | 00000 |
| Latitude Offset Seconds: default | 119-122 | 1111 |
| Longitude Offset Sign: default | 123 | 1 |
| Longitude Offset Minutes: default | 124-128 | 00000 |
| Longitude Offset Seconds: default | 129-132 | 1111 |
| BCH 2 Encoded: | 133-144 | 011001101100 |
| BCH 2 Calculated: | N/A | 011001101100 |
| Composite Latitude: default | N/A | Composite Longitude: default |
| 15 Hex ID: | N/A | 193DF380C6FFBFF |

High Temperature

| | |
|---|---|
| Full 36 hex message | FFFE2F8C9EF9C0637FDFF83D15B783E0F66C |

| ITEM | BITS | VALUE |
|---|---|---|
| Message format: long format | 25 | 1 |
| Protocol: Location Protocol | 26 | 0 |
| Country code: 201 - **Albania** | 27-36 | 0011001001 |
| Type of location protocol: Standard Location - Test | 37-40 | 1110 |
| Test Protocol: Test Protocol (No Decode information in bits 41 to 64) | 41-64 | 11111001110000001100011 |
| Latitude Sign: default | 65 | 0 |
| Latitude Degrees: default | 66-72 | 1111111 |
| Latitude Minutes: default | 73-74 | 11 |
| Longitude Sign: default | 75 | 0 |
| Longitude Degrees: default | 76-83 | 11111111 |
| Longitude Minutes: default | 84-85 | 11 |
| BCH 1 Encoded: | 86-106 | 00000111010001010110 |
| BCH 1 Calculated: | N/A | 00000111010001010110 |
| Fixed bits (1101): Pass | 107-110 | 1101 |
| Position Data: Encoded Position Data Source From Internal Navigation Device | 111 | 1 |
| Aux Device: 121.5 MHz homer | 112 | 1 |
| Latitude Offset Sign: default | 113 | 1 |
| Latitude Offset Minutes: default | 114-118 | 00000 |
| Latitude Offset Seconds: default | 119-122 | 1111 |
| Longitude Offset Sign: default | 123 | 1 |
| Longitude Offset Minutes: default | 124-128 | 00000 |
| Longitude Offset Seconds: default | 129-132 | 1111 |
| BCH 2 Encoded: | 133-144 | 011001101100 |
| BCH 2 Calculated: | N/A | 011001101100 |
| Composite Latitude: default | N/A | Composite Longitude: default |
| 15 Hex ID: | N/A | 193DF380C6FFBFF |

Test Summary

The results indicate compliance with Cospas-Sarsat T.007, Clause A.2.1 (b).

## 2.2 MODULATION

### 2.2.1 Specification

Cospas-Sarsat T.007, Clause A.2.1 (d)

### 2.2.2 Equipment Under Test and Modification State

E101V S/N: 0800002P - Modification State 0

### 2.2.3 Date of Test

19 October 2015, 20 October 2015 & 22 October 2015

### 2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

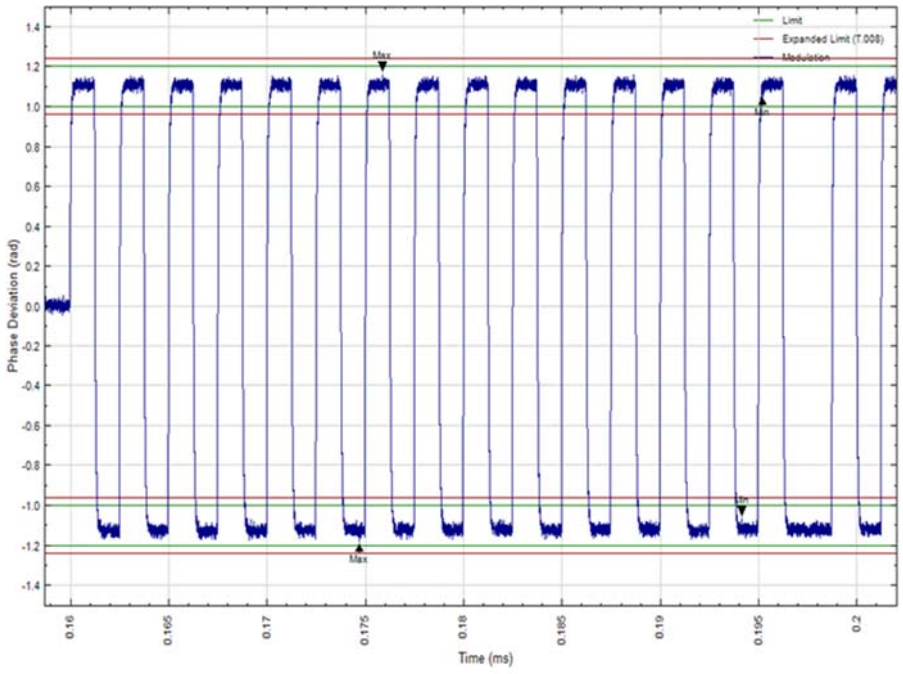
### 2.2.5 Environmental Conditions

Ambient Temperature 22.4 - 23.3°C
Relative Humidity 45.6 - 49.2%

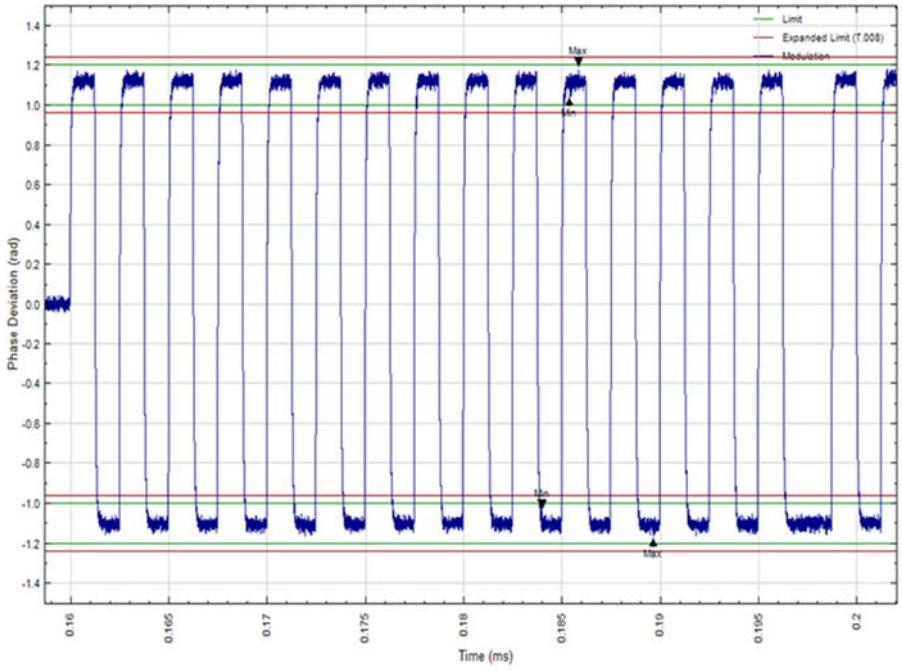
### 2.2.6 Test Results

EUT System Configuration: 2
Test Duration: 20 minutes
No. of bursts: 26

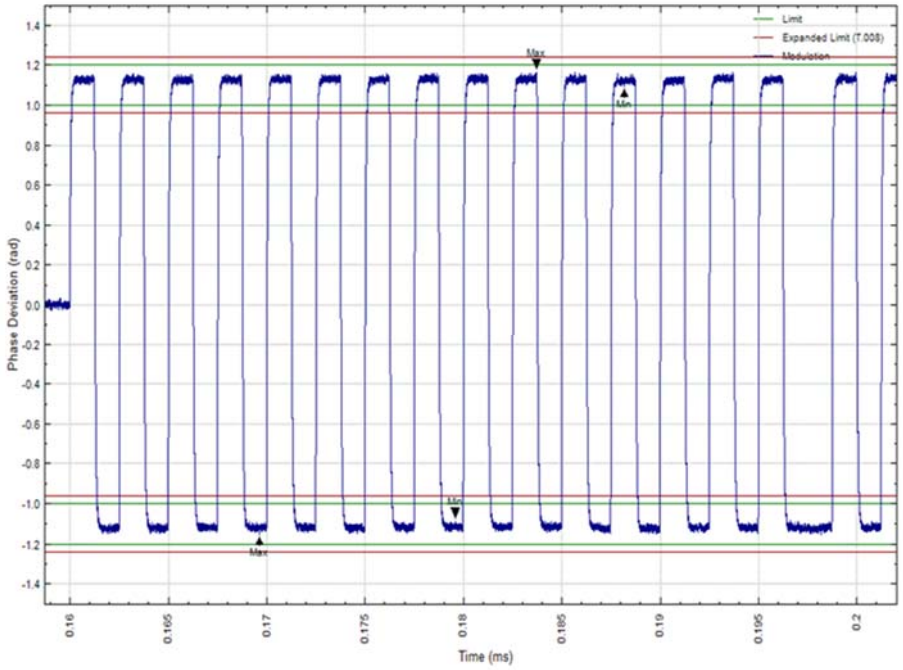
Ambient Temperature



Low Temperature




High Temperature




Test Summary

The results indicate compliance with Cospas-Sarsat T.007, Clause A.2.1 (d).

## 2.3 SPURIOUS EMISSION INTO 50 OHMS

### 2.3.1 Specification

Cospas-Sarsat T.007, Clause A.2.1 (f)

### 2.3.2 Equipment Under Test and Modification State

E101V S/N: 0800002P - Modification State 0

### 2.3.3 Date of Test

20 October 2015

### 2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.3.5 Environmental Conditions

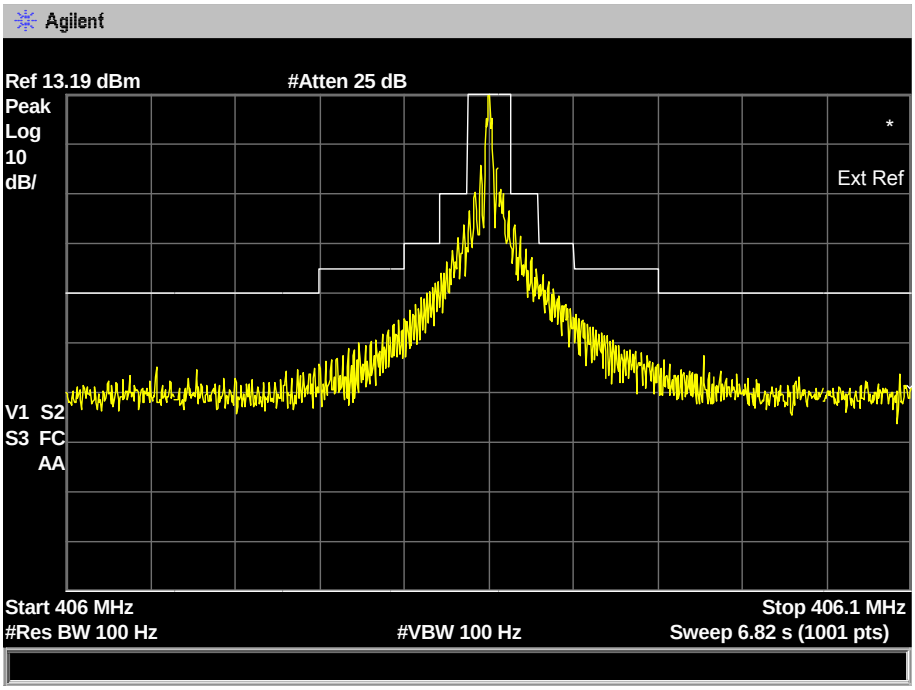
Ambient Temperature 22.1°C
Relative Humidity 44.6%

### 2.3.6 Test Results

EUT System Configuration: 2

Test Duration: 20 hours

Combined Ambient, Low and High Temperature




Test Summary

The results indicate compliance with Cospas-Sarsat T.007, Clause A.2.1 (f).

## 2.4 406 MHz VSWR CHECK

### 2.4.1 Specification

Cospas-Sarsat T.007, Clause A.2.1 (g)

### 2.4.2 Equipment Under Test and Modification State

E101V S/N: 0800002P - Modification State 0

### 2.4.3 Date of Test

19 October 2015, 21 October 2015 & 22 October 2015

### 2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.4.5 Environmental Conditions

Ambient Temperature 22.4 - 23.4°C
Relative Humidity 41.3 - 49.2%

### 2.4.6 Test Results

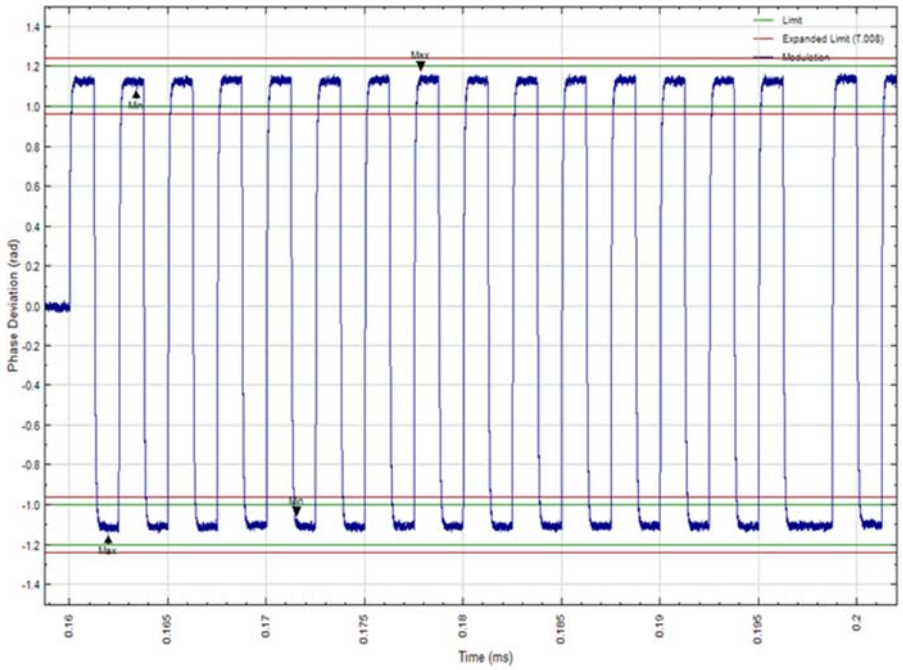
EUT System Configuration: 2
Test Duration: 20 minutes
No. of bursts: 26

Ambient Temperature

| | |
|---|---|
| Full 36 hex message | FFFE2F8C9EF9C0637FDFF83D15B783E0F66C |

| ITEM | BITS | VALUE |
|---|---|---|
| Message format: long format | 25 | 1 |
| Protocol: Location Protocol | 26 | 0 |
| Country code: 201 - **Albania** | 27-36 | 0011001001 |
| Type of location protocol: Standard Location - Test | 37-40 | 1110 |
| Test Protocol: Test Protocol (No Decode information in bits 41 to 64) | 41-64 | 111110011100000001100011 |
| Latitude Sign: default | 65 | 0 |
| Latitude Degrees: default | 66-72 | 1111111 |
| Latitude Minutes: default | 73-74 | 11 |
| Longitude Sign: default | 75 | 0 |
| Longitude Degrees: default | 76-83 | 11111111 |
| Longitude Minutes: default | 84-85 | 11 |
| BCH 1 Encoded: | 86-106 | 00000111101000101011O |
| BCH 1 Calculated: | N/A | 00000111101000101011O |
| Fixed bits (1101): Pass | 107-110 | 1101 |
| Position Data: Encoded Position Data Source From Internal Navigation Device | 111 | 1 |
| Aux Device: 121.5 MHz homer | 112 | 1 |
| Latitude Offset Sign: default | 113 | 1 |
| Latitude Offset Minutes: default | 114-118 | 00000 |
| Latitude Offset Seconds: default | 119-122 | 1111 |
| Longitude Offset Sign: default | 123 | 1 |
| Longitude Offset Minutes: default | 124-128 | 00000 |
| Longitude Offset Seconds: default | 129-132 | 1111 |
| BCH 2 Encoded: | 133-144 | 011001101100 |
| BCH 2 Calculated: | N/A | 011001101100 |
| Composite Latitude: default | N/A | Composite Longitude: default |
| 15 Hex ID: | N/A | 193DF380C6FFBFF |

Modulation Plot

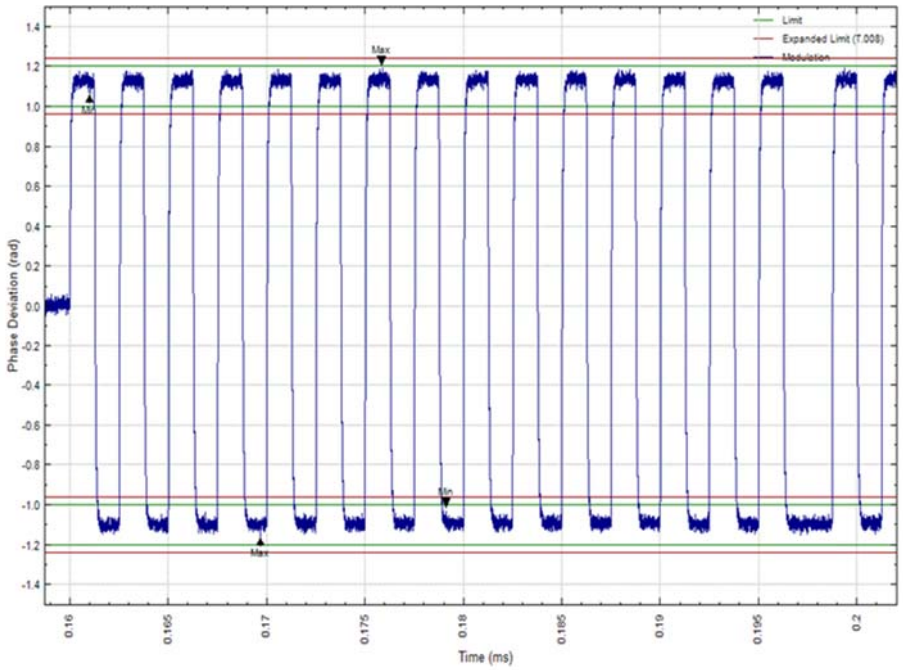


Low Temperature

| | |
|---|---|
| Full 36 hex message | FFFE2F8C9EF9C0637FDFF83D15B783E0F66C |

| ITEM | BITS | VALUE |
|---|---|---|
| Message format: long format | 25 | 1 |
| Protocol: Location Protocol | 26 | 0 |
| Country code: 201 - **Albania** | 27-36 | 0011001001 |
| Type of location protocol: Standard Location - Test | 37-40 | 1110 |
| Test Protocol: Test Protocol (No Decode information in bits 41 to 64) | 41-64 | 111110011100000001100011 |
| Latitude Sign: default | 65 | 0 |
| Latitude Degrees: default | 66-72 | 1111111 |
| Latitude Minutes: default | 73-74 | 11 |
| Longitude Sign: default | 75 | 0 |
| Longitude Degrees: default | 76-83 | 11111111 |
| Longitude Minutes: default | 84-85 | 11 |
| BCH 1 Encoded: | 86-106 | 00000111010001010110 |
| BCH 1 Calculated: | N/A | 00000111010001010110 |
| Fixed bits (1101): Pass | 107-110 | 1101 |
| Position Data: Encoded Position Data Source From Internal Navigation Device | 111 | 1 |
| Aux Device: 121.5 MHz homer | 112 | 1 |
| Latitude Offset Sign: default | 113 | 1 |
| Latitude Offset Minutes: default | 114-118 | 00000 |
| Latitude Offset Seconds: default | 119-122 | 1111 |
| Longitude Offset Sign: default | 123 | 1 |
| Longitude Offset Minutes: default | 124-128 | 00000 |
| Longitude Offset Seconds: default | 129-132 | 1111 |
| BCH 2 Encoded: | 133-144 | 011001101100 |
| BCH 2 Calculated: | N/A | 011001101100 |
| Composite Latitude: default | N/A | Composite Longitude: default |
| 15 Hex ID: | N/A | 193DF380C6FFBFF |

Modulation Plot

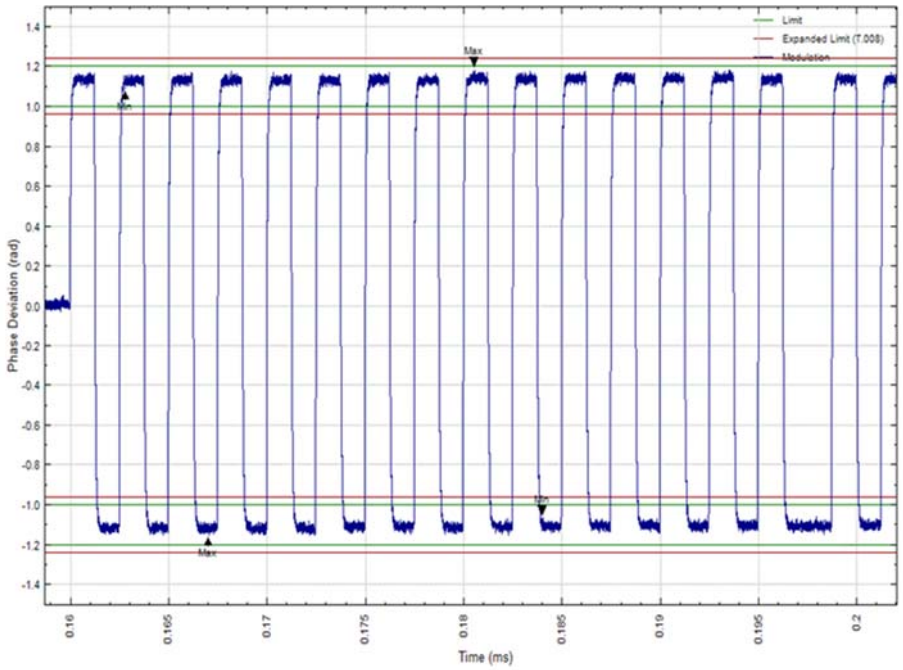


## High Temperature

| | |
|---|---|
| Full 36 hex message | FFFE2F8C9EF9C0637FDFF83D15B783E0F66C |

| ITEM | BITS | VALUE |
|---|---|---|
| Message format: long format | 25 | 1 |
| Protocol: Location Protocol | 26 | 0 |
| Country code: 201 - **Albania** | 27-36 | 0011001001 |
| Type of location protocol: Standard Location - Test | 37-40 | 1110 |
| Test Protocol: Test Protocol (No Decode information in bits 41 to 64) | 41-64 | 111110011100000001100011 |
| Latitude Sign: default | 65 | 0 |
| Latitude Degrees: default | 66-72 | 1111111 |
| Latitude Minutes: default | 73-74 | 11 |
| Longitude Sign: default | 75 | 0 |
| Longitude Degrees: default | 76-83 | 11111111 |
| Longitude Minutes: default | 84-85 | 11 |
| BCH 1 Encoded: | 86-106 | 00000111010001010110 |
| BCH 1 Calculated: | N/A | 00000111010001010110 |
| Fixed bits (1101): Pass | 107-110 | 1101 |
| Position Data: Encoded Position Data Source From Internal Navigation Device | 111 | 1 |
| Aux Device: 121.5 MHz homer | 112 | 1 |
| Latitude Offset Sign: default | 113 | 1 |
| Latitude Offset Minutes: default | 114-118 | 00000 |
| Latitude Offset Seconds: default | 119-122 | 1111 |
| Longitude Offset Sign: default | 123 | 1 |
| Longitude Offset Minutes: default | 124-128 | 00000 |
| Longitude Offset Seconds: default | 129-132 | 1111 |
| BCH 2 Encoded: | 133-144 | 011001101100 |
| BCH 2 Calculated: | N/A | 011001101100 |
| Composite Latitude: default | N/A | Composite Longitude: default |
| 15 Hex ID: | N/A | 193DF380C6FFBFF |

Modulation Plot




Test Summary

The results indicate compliance with Cospas-Sarsat T.007, Clause A.2.1 (g).

## 2.5 SELF-TEST MODES

### 2.5.1 Specification

Cospas-Sarsat T.007, Clause A.2.1 (h)

### 2.5.2 Equipment Under Test and Modification State

E101V S/N: 0800002P - Modification State 0

### 2.5.3 Date of Test

22 October 2015, 23 October 2015 & 21 November 2015

### 2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.5.5 Environmental Conditions

Ambient Temperature 23.3 - 23.6°C
Relative Humidity 34.0 - 48.3%

### 2.5.6 Test Results

EUT System Configuration: 2

Ambient Temperature

| | |
|---|---|
| Full 36 hex message | FFFED08C9EF9C0637FDFF83D15B783E0F66C |

| ITEM | BITS | VALUE |
|---|---|---|
| Message format: long format | 25 | 1 |
| Protocol: Location Protocol | 26 | 0 |
| Country code: 201 - **Albania** | 27-36 | 0011001001 |
| Type of location protocol: Standard Location - Test | 37-40 | 1110 |
| Test Protocol: Test Protocol (No Decode information in bits 41 to 64) | 41-64 | 111110011100000001100011 |
| Latitude Sign: default | 65 | 0 |
| Latitude Degrees: default | 66-72 | 1111111 |
| Latitude Minutes: default | 73-74 | 11 |
| Longitude Sign: default | 75 | 0 |
| Longitude Degrees: default | 76-83 | 11111111 |
| Longitude Minutes: default | 84-85 | 11 |
| BCH 1 Encoded: | 86-106 | 00000111101000101010 |
| BCH 1 Calculated: | N/A | 00000111101000101010 |
| Fixed bits (1101): Pass | 107-110 | 1101 |
| Position Data: Encoded Position Data Source From Internal Navigation Device | 111 | 1 |
| Aux Device: 121.5 MHz homer | 112 | 1 |
| Latitude Offset Sign: default | 113 | 1 |
| Latitude Offset Minutes: default | 114-118 | 00000 |
| Latitude Offset Seconds: default | 119-122 | 1111 |
| Longitude Offset Sign: default | 123 | 1 |
| Longitude Offset Minutes: default | 124-128 | 00000 |
| Longitude Offset Seconds: default | 129-132 | 1111 |
| BCH 2 Encoded: | 133-144 | 011001101100 |
| BCH 2 Calculated: | N/A | 011001101100 |
| Composite Latitude: default | N/A | Composite Longitude: default |
| 15 Hex ID: | N/A | 193DF380C6FFBFF |

Note: Self-test at ambient temperature was carried out with navigation data applied.

Low Temperature

| | |
|---|---|
| Full 36 hex message | FFFED08C9EF9C0637FDFF83D15B783E0F66C |

| ITEM | BITS | VALUE |
|---|---|---|
| Message format: long format | 25 | 1 |
| Protocol: Location Protocol | 26 | 0 |
| Country code: 201 - **Albania** | 27-36 | 0011001001 |
| Type of location protocol: Standard Location - Test | 37-40 | 1110 |
| Test Protocol: Test Protocol (No Decode information in bits 41 to 64) | 41-64 | 111110011100000001100011 |
| Latitude Sign: default | 65 | 0 |
| Latitude Degrees: default | 66-72 | 1111111 |
| Latitude Minutes: default | 73-74 | 11 |
| Longitude Sign: default | 75 | 0 |
| Longitude Degrees: default | 76-83 | 11111111 |
| Longitude Minutes: default | 84-85 | 11 |
| BCH 1 Encoded: | 86-106 | 00000111010001010110 |
| BCH 1 Calculated: | N/A | 00000111010001010110 |
| Fixed bits (1101): Pass | 107-110 | 1101 |
| Position Data: Encoded Position Data Source From Internal Navigation Device | 111 | 1 |
| Aux Device: 121.5 MHz homer | 112 | 1 |
| Latitude Offset Sign: default | 113 | 1 |
| Latitude Offset Minutes: default | 114-118 | 00000 |
| Latitude Offset Seconds: default | 119-122 | 1111 |
| Longitude Offset Sign: default | 123 | 1 |
| Longitude Offset Minutes: default | 124-128 | 00000 |
| Longitude Offset Seconds: default | 129-132 | 1111 |
| BCH 2 Encoded: | 133-144 | 011001101100 |
| BCH 2 Calculated: | N/A | 011001101100 |
| Composite Latitude: default | N/A | Composite Longitude: default |
| 15 Hex ID: | N/A | 193DF380C6FFBFF |

High Temperature

| | |
|---|---|
| Full 36 hex message | FFFED08C9EF9C0637FDFF83D15B783E0F66C |

| ITEM | BITS | VALUE |
|---|---|---|
| Message format: long format | 25 | 1 |
| Protocol: Location Protocol | 26 | 0 |
| Country code: 201 - **Albania** | 27-36 | 0011001001 |
| Type of location protocol: Standard Location - Test | 37-40 | 1110 |
| Test Protocol: Test Protocol (No Decode information in bits 41 to 64) | 41-64 | 111110011100000001100011 |
| Latitude Sign: default | 65 | 0 |
| Latitude Degrees: default | 66-72 | 1111111 |
| Latitude Minutes: default | 73-74 | 11 |
| Longitude Sign: default | 75 | 0 |
| Longitude Degrees: default | 76-83 | 11111111 |
| Longitude Minutes: default | 84-85 | 11 |
| BCH 1 Encoded: | 86-106 | 00000111010001010110 |
| BCH 1 Calculated: | N/A | 00000111010001010110 |
| Fixed bits (1101): Pass | 107-110 | 1101 |
| Position Data: Encoded Position Data Source From Internal Navigation Device | 111 | 1 |
| Aux Device: 121.5 MHz homer | 112 | 1 |
| Latitude Offset Sign: default | 113 | 1 |
| Latitude Offset Minutes: default | 114-118 | 00000 |
| Latitude Offset Seconds: default | 119-122 | 1111 |
| Longitude Offset Sign: default | 123 | 1 |
| Longitude Offset Minutes: default | 124-128 | 00000 |
| Longitude Offset Seconds: default | 129-132 | 1111 |
| BCH 2 Encoded: | 133-144 | 011001101100 |
| BCH 2 Calculated: | N/A | 011001101100 |
| Composite Latitude: default | N/A | Composite Longitude: default |
| 15 Hex ID: | N/A | 193DF380C6FFBFF |

Test Observations:

- Self Test initiation is indicated by 3 red LED flashes.
- The manufacturer's operating manual states that the strobe light indicated that RF power has been emitted.
- 406 and 121 RF output power were confirmed during the test.
- At Ambient, High and Low temperatures, the Self Test result returned six Amber LED flashes, indicating that the EUT had been previously activated for over 10 hours.
- The Self-Test auto terminates on completion of the Self-Test procedure.

GNSS Self-test mode

No results other than those stated in the summary table. EUT does not transmit a 406 burst during a GNSS Self-Test, regardless of the GPS input conditions. EUT provides LED indications only.

Test Observations:

- A GNSS Self-Test was initiated by holding the test switch in the test position for 10 seconds. The EUT displayed a continuously illuminated red LED, which briefly flashed green every five seconds, whilst the GNSS ST was in progress. When a GPS position was found, the strobe light flashed, and the LED flashed green for a number indicating how many GNSS Self-Tests remained for the operator. Where no GPS signal was found within 5 minutes, the strobe light flashed twice, and the LED flashed red 12 times.
- Maximum number of GNSS Self-Tests confirmed as 12.
- If further GNSS Self-Tests were attempted, the Red LED flashed whilst the test button was held, to indicate no further tests were available.

Test Summary

The results indicate compliance with Cospas-Sarsat T.007, Clause A.2.1 (h).

## 2.6 THERMAL SHOCK

### 2.6.1 Specification

Cospas-Sarsat T.007, Clause A.2.2

### 2.6.2 Equipment Under Test and Modification State

E101V S/N: 0800002P - Modification State 0

### 2.6.3 Date of Test

22 October 2015

### 2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.6.5 Environmental Conditions

Ambient Temperature 23.1°C
Relative Humidity 38.6%

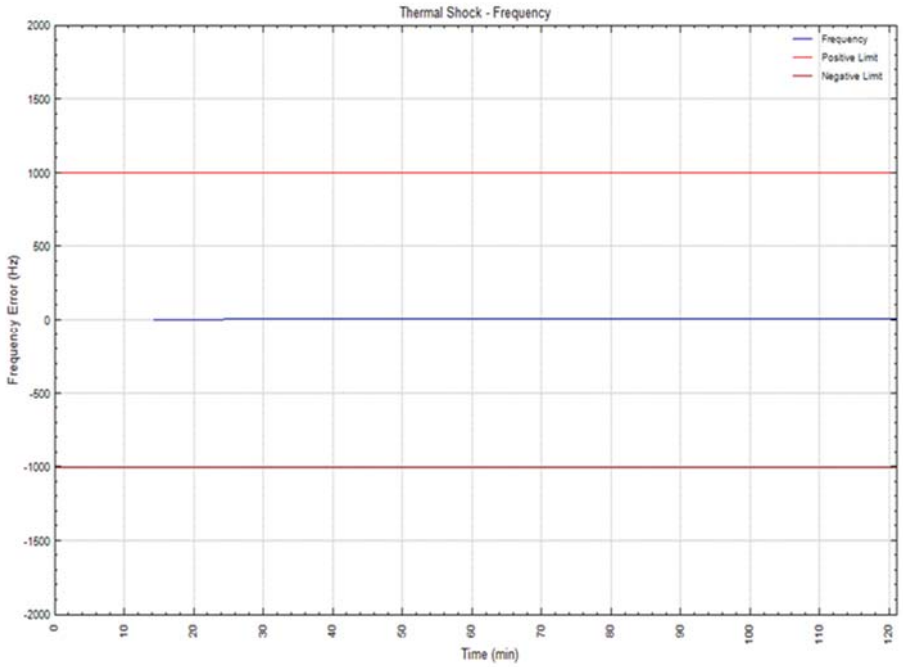
### 2.6.6 Test Results

EUT System Configuration: 2

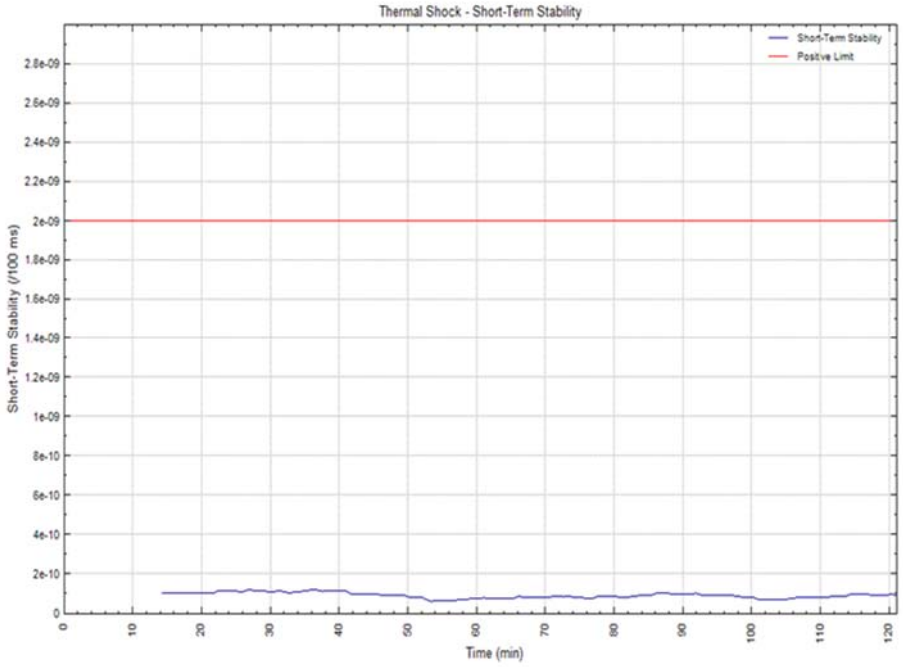
2 hour soak temperature: 20°C.

Test temperature: -10°C.

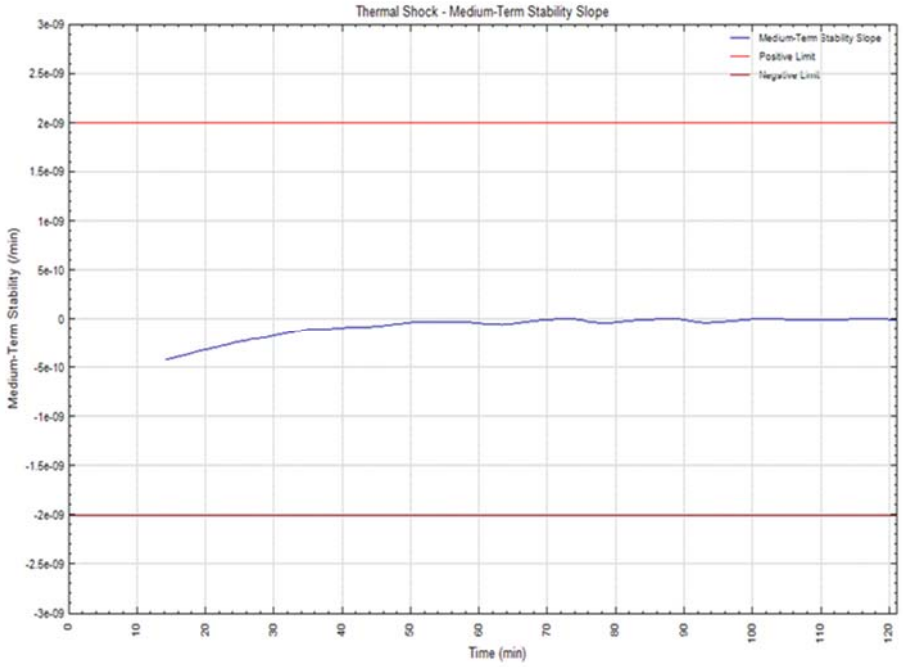
Nominal Frequency



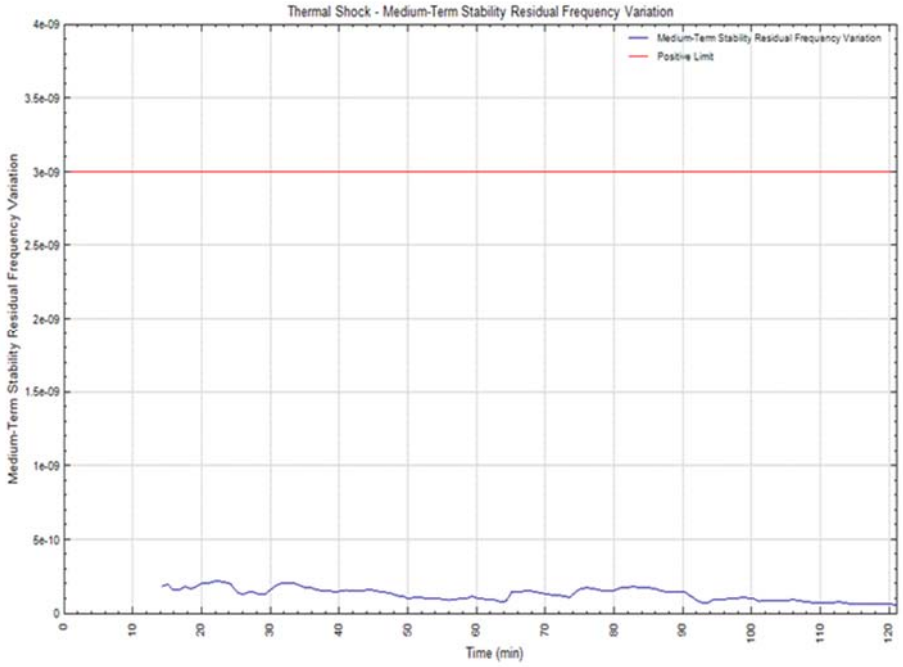
Short Term Stability



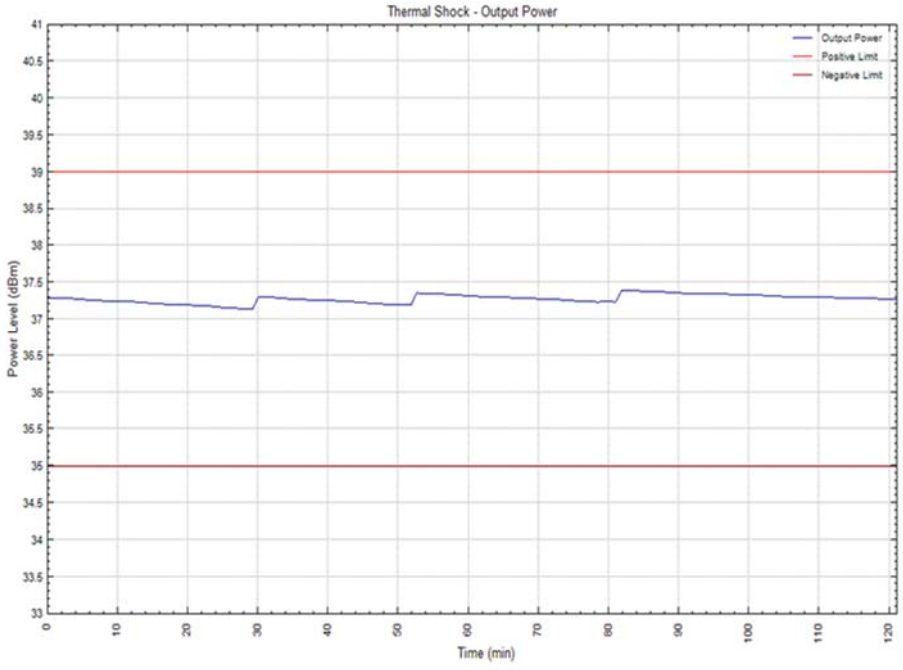

Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation




Output Power



Digital Message

| | |
|---|---|
| Full 36 hex message | FFFE2F8C9EF9C0637FDFF83D15B783E0F66C |

| ITEM | BITS | VALUE |
|---|---|---|
| Message format: long format | 25 | 1 |
| Protocol: Location Protocol | 26 | 0 |
| Country code: 201 - **Albania** | 27-36 | 0011001001 |
| Type of location protocol: Standard Location - Test | 37-40 | 1110 |
| Test Protocol: Test Protocol (No Decode information in bits 41 to 64) | 41-64 | 111110011100000001100011 |
| Latitude Sign: default | 65 | 0 |
| Latitude Degrees: default | 66-72 | 1111111 |
| Latitude Minutes: default | 73-74 | 11 |
| Longitude Sign: default | 75 | 0 |
| Longitude Degrees: default | 76-83 | 11111111 |
| Longitude Minutes: default | 84-85 | 11 |
| BCH 1 Encoded: | 86-106 | 00000111101000101010 |
| BCH 1 Calculated: | N/A | 00000111101000101010 |
| Fixed bits (1101): Pass | 107-110 | 1101 |
| Position Data: Encoded Position Data Source From Internal Navigation Device | 111 | 1 |
| Aux Device: 121.5 MHz homer | 112 | 1 |
| Latitude Offset Sign: default | 113 | 1 |
| Latitude Offset Minutes: default | 114-118 | 00000 |
| Latitude Offset Seconds: default | 119-122 | 1111 |
| Longitude Offset Sign: default | 123 | 1 |
| Longitude Offset Minutes: default | 124-128 | 00000 |
| Longitude Offset Seconds: default | 129-132 | 1111 |
| BCH 2 Encoded: | 133-144 | 011001101100 |
| BCH 2 Calculated: | N/A | 011001101100 |
| Composite Latitude: default | N/A | Composite Longitude: default |
| 15 Hex ID: | N/A | 193DF380C6FFBFF |

Test Summary

The results indicate compliance with Cospas-Sarsat T.007, Clause A.2.2.

## 2.7 OPERATING LIFETIME AT MINIMUM TEMPERATURE

### 2.7.1 Specification

Cospas-Sarsat T.007, Clause A.2.3

Note: the Operating Lifetime test was carried out in accordance with IEC61097-2 clause 5.15.1: an additional soak at -30°C was carried out prior to the requirements of T.007, clause A.2.3 at -20°C.

### 2.7.2 Equipment Under Test and Modification State

E101V S/N: 0800002P - Modification State 0

### 2.7.3 Date of Test

29 October 2015 & 30 October 2015

### 2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.7.5 Environmental Conditions

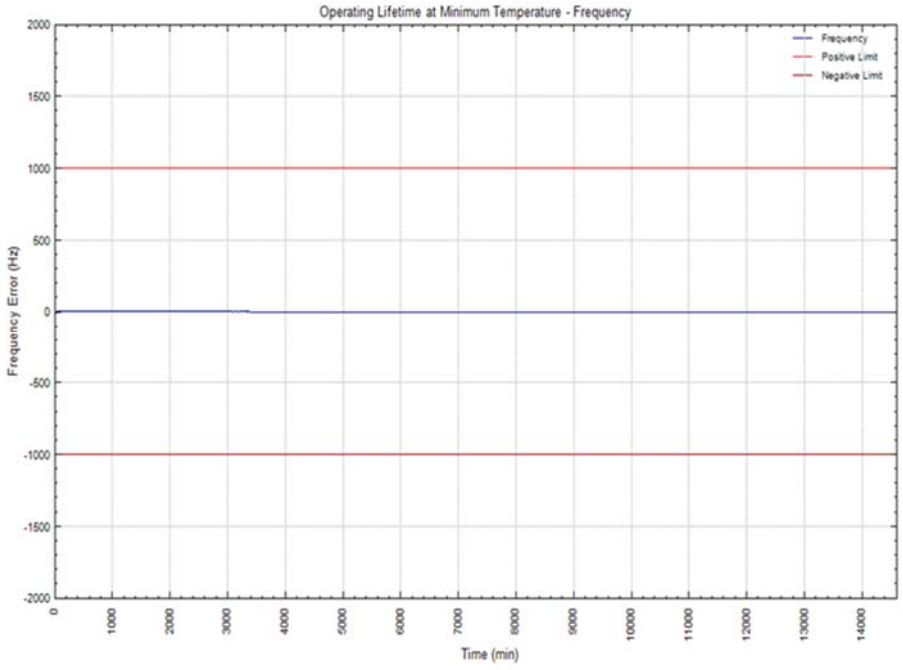
Ambient Temperature 22.3 - 22.7°C
Relative Humidity 59.1 - 64.3%

### 2.7.6 Test Results

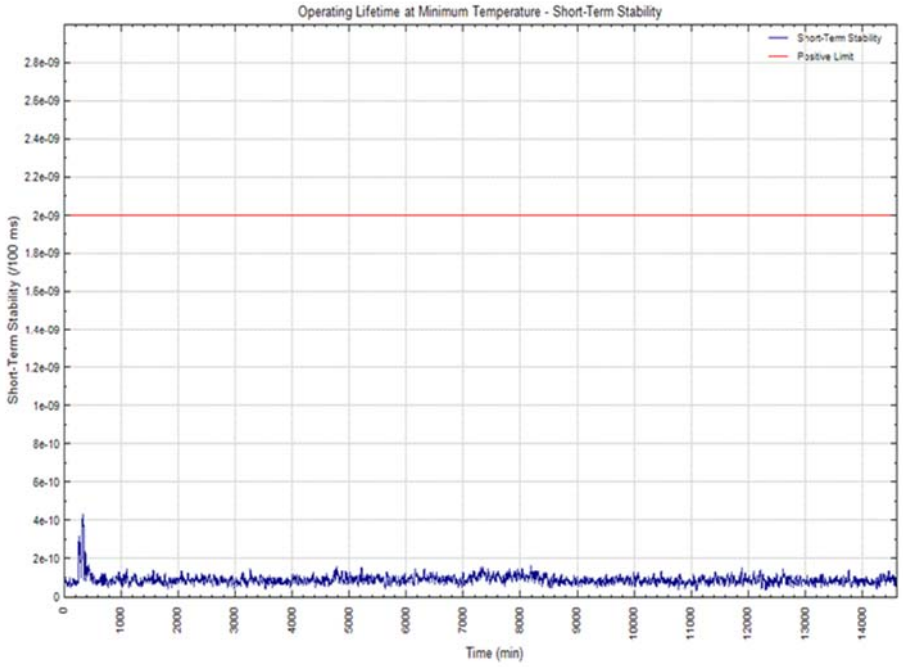
EUT System Configuration: 2

End of test taken as 168 hours (Manufacturer declared value)

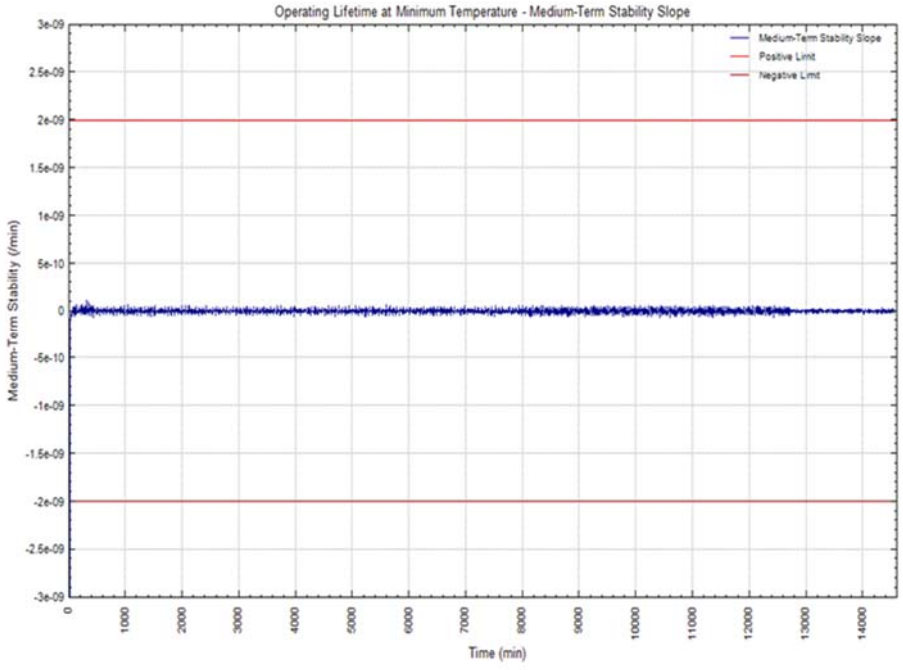
Nominal Frequency



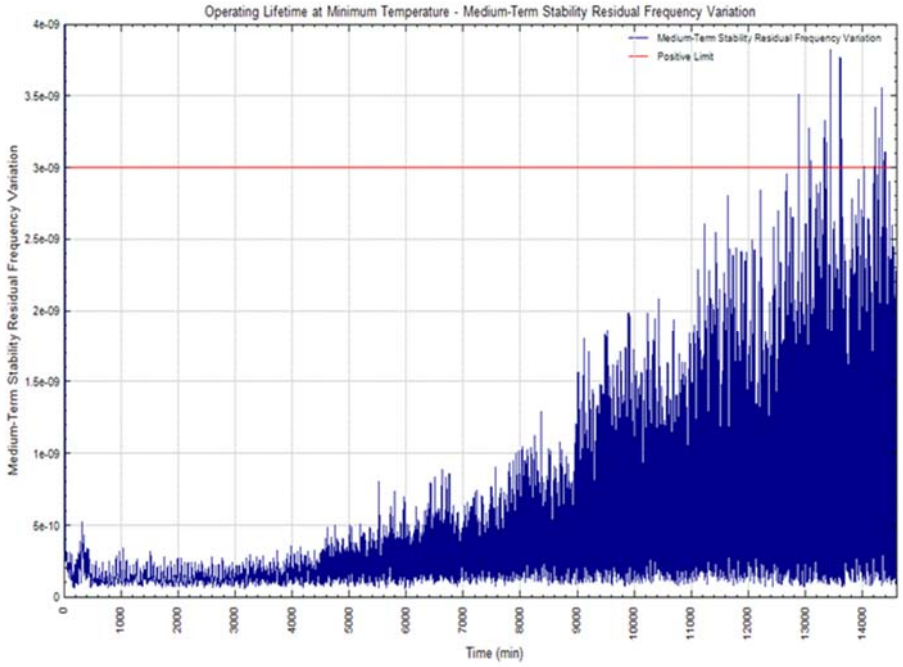
Short Term Stability



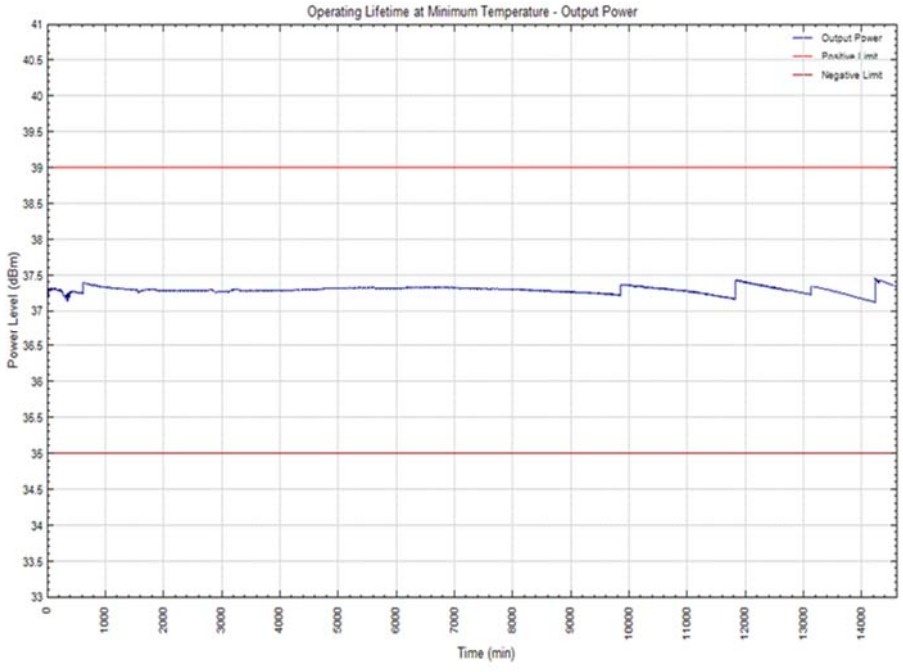

Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation




Output Power



Digital Message

| | |
|---|---|
| Full 36 hex message | FFFE2F8C9EF9C0637FDFF83D15B783E0F66C |

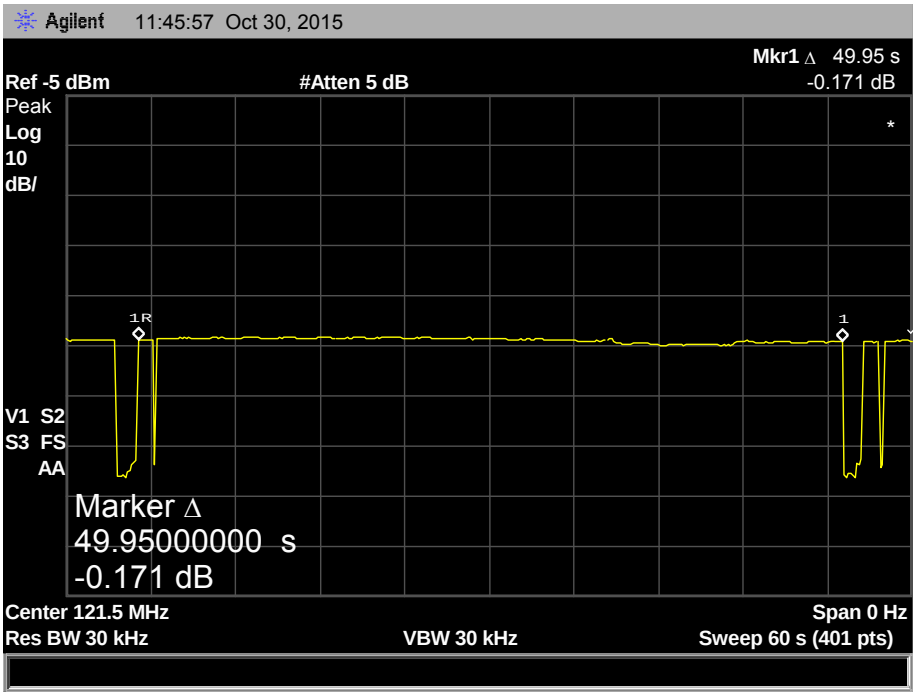
| ITEM | BITS | VALUE |
|---|---|---|
| Message format: long format | 25 | 1 |
| Protocol: Location Protocol | 26 | 0 |
| Country code: 201 - **Albania** | 27-36 | 0011001001 |
| Type of location protocol: Standard Location - Test | 37-40 | 1110 |
| Test Protocol: Test Protocol (No Decode information in bits 41 to 64) | 41-64 | 111110011100000001100011 |
| Latitude Sign: default | 65 | 0 |
| Latitude Degrees: default | 66-72 | 1111111 |
| Latitude Minutes: default | 73-74 | 11 |
| Longitude Sign: default | 75 | 0 |
| Longitude Degrees: default | 76-83 | 11111111 |
| Longitude Minutes: default | 84-85 | 11 |
| BCH 1 Encoded: | 86-106 | 00000111010001010110 |
| BCH 1 Calculated: | N/A | 00000111010001010110 |
| Fixed bits (1101): Pass | 107-110 | 1101 |
| Position Data: Encoded Position Data Source From Internal Navigation Device | 111 | 1 |
| Aux Device: 121.5 MHz homer | 112 | 1 |
| Latitude Offset Sign: default | 113 | 1 |
| Latitude Offset Minutes: default | 114-118 | 00000 |
| Latitude Offset Seconds: default | 119-122 | 1111 |
| Longitude Offset Sign: default | 123 | 1 |
| Longitude Offset Minutes: default | 124-128 | 00000 |
| Longitude Offset Seconds: default | 129-132 | 1111 |
| BCH 2 Encoded: | 133-144 | 011001101100 |
| BCH 2 Calculated: | N/A | 011001101100 |
| Composite Latitude: default | N/A | Composite Longitude: default |
| 15 Hex ID: | N/A | 193DF380C6FFBFF |

Test Data (0 min - 30 min)

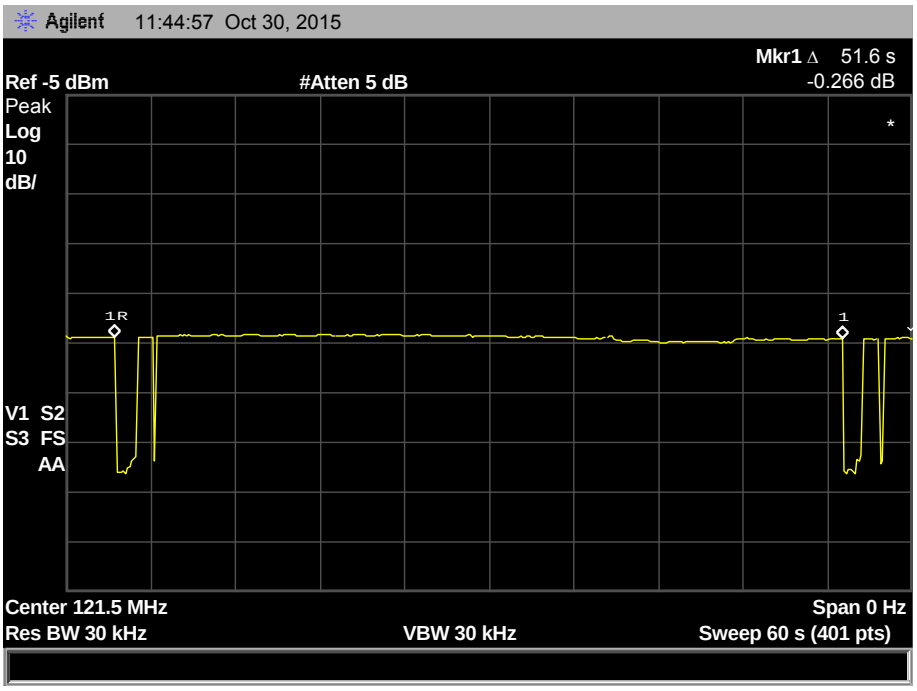
| Burst | Frequency (MHz) | STS /100ms | MTS-Slope /min | MTS-Var | Power (dBm) | Time (hours) |
|---|---|---|---|---|---|---|
| 1 | - | - | - | - | 36.42 | 0.00 |
| 2 | - | - | - | - | 37.22 | 0.01 |
| 3 | - | - | - | - | 37.31 | 0.03 |
| 4 | - | - | - | - | 37.33 | 0.04 |
| 5 | - | - | - | - | 37.35 | 0.06 |
| 6 | - | - | - | - | 37.22 | 0.07 |
| 7 | - | - | - | - | 37.22 | 0.08 |
| 8 | - | - | - | - | 37.22 | 0.10 |
| 9 | - | - | - | - | 37.21 | 0.11 |
| 10 | - | - | - | - | 37.21 | 0.13 |
| 11 | - | - | - | - | 37.21 | 0.14 |
| 12 | - | - | - | - | 37.21 | 0.15 |
| 13 | - | - | - | - | 37.2 | 0.17 |
| 14 | - | - | - | - | 37.19 | 0.18 |
| 15 | - | - | - | - | 37.19 | 0.19 |
| 16 | - | - | - | - | 37.32 | 0.21 |
| 17 | - | - | - | - | 37.32 | 0.22 |
| 18 | 406.0400086 | 8.46E-11 | -8.20E-09 | 1.38E-08 | 37.32 | 0.24 |
| 19 | 406.0400064 | 8.27E-11 | -7.33E-09 | 1.49E-08 | 37.32 | 0.25 |
| 20 | 406.0400043 | 8.21E-11 | -6.44E-09 | 1.57E-08 | 37.32 | 0.26 |
| 21 | 406.0400023 | 8.58E-11 | -5.44E-09 | 1.59E-08 | 37.31 | 0.28 |
| 22 | 406.0400005 | 8.71E-11 | -4.37E-09 | 1.54E-08 | 37.31 | 0.29 |
| 23 | 406.0399989 | 8.67E-11 | -3.28E-09 | 1.39E-08 | 37.31 | 0.31 |
| 24 | 406.0399974 | 9.11E-11 | -2.21E-09 | 1.14E-08 | 37.31 | 0.32 |
| 25 | 406.0399962 | 8.72E-11 | -1.22E-09 | 7.63E-09 | 37.31 | 0.33 |
| 26 | 406.0399953 | 7.92E-11 | -5.03E-10 | 3.60E-09 | 37.3 | 0.35 |
| 27 | 406.0399948 | 9.25E-11 | -1.51E-10 | 6.09E-10 | 37.31 | 0.36 |
| 28 | 406.0399948 | 9.27E-11 | -1.01E-10 | 2.93E-10 | 37.3 | 0.38 |
| 29 | 406.0399947 | 9.18E-11 | -9.23E-11 | 2.68E-10 | 37.3 | 0.39 |
| 30 | 406.0399947 | 9.13E-11 | -8.39E-11 | 2.49E-10 | 37.31 | 0.40 |
| 31 | 406.0399946 | 9.37E-11 | -7.26E-11 | 2.54E-10 | 37.3 | 0.42 |
| 32 | 406.0399946 | 9.26E-11 | -6.77E-11 | 2.56E-10 | 37.3 | 0.43 |
| 33 | 406.0399946 | 9.23E-11 | -6.02E-11 | 2.81E-10 | 37.3 | 0.44 |
| 34 | 406.0399946 | 9.12E-11 | -5.16E-11 | 2.96E-10 | 37.3 | 0.46 |
| 35 | 406.0399946 | 9.05E-11 | -5.46E-11 | 2.86E-10 | 37.3 | 0.47 |
| 36 | 406.0399946 | 8.96E-11 | -5.38E-11 | 2.87E-10 | 37.29 | 0.49 |
| 37 | 406.0399946 | 8.67E-11 | -5.75E-11 | 2.92E-10 | 37.29 | 0.50 |

121 Homing Transmitter - Duty Cycle (Start of Test)

On Time



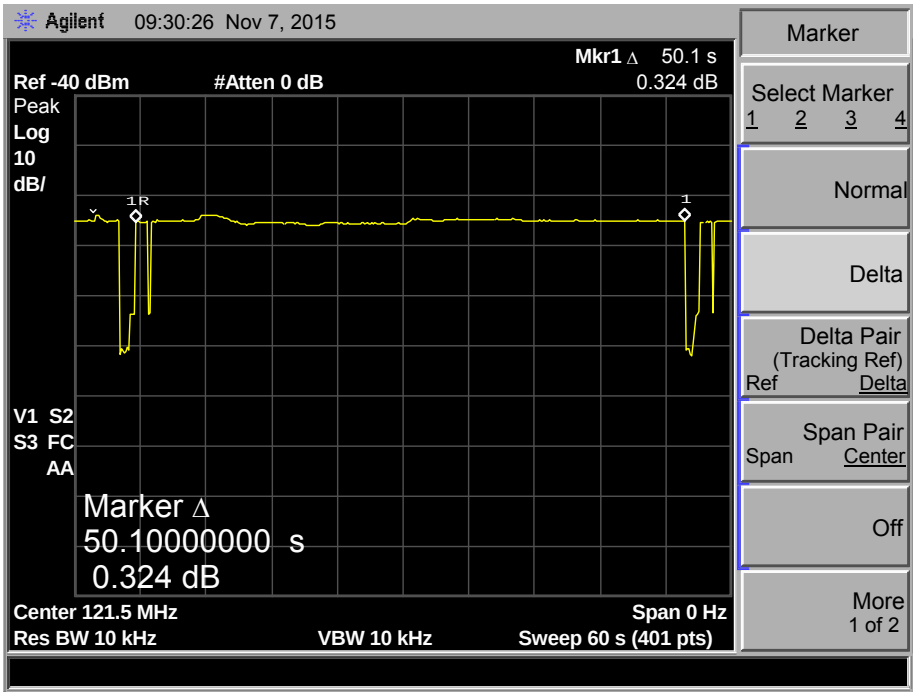

On+Off Time



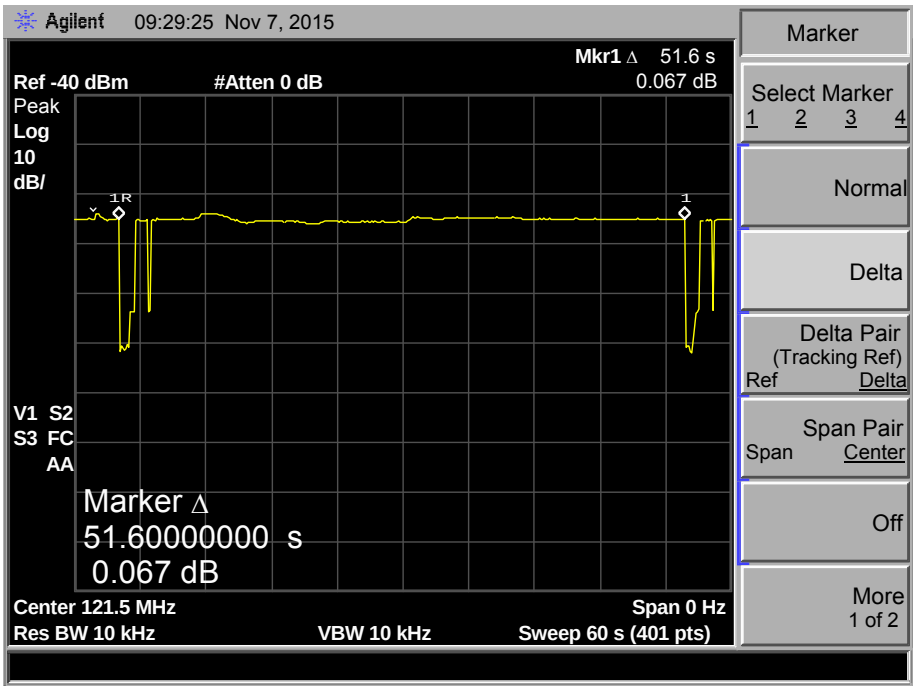

Duty Cycle = 49.95 / 51.6 = 0.968 = 96.8%

121 Homing Transmitter - Duty Cycle (End of Test)

On Time

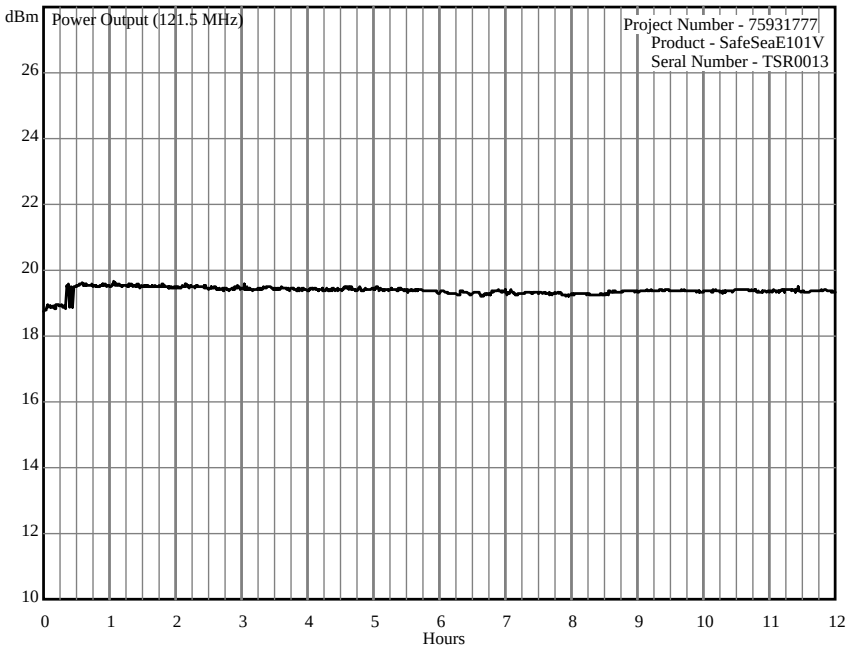


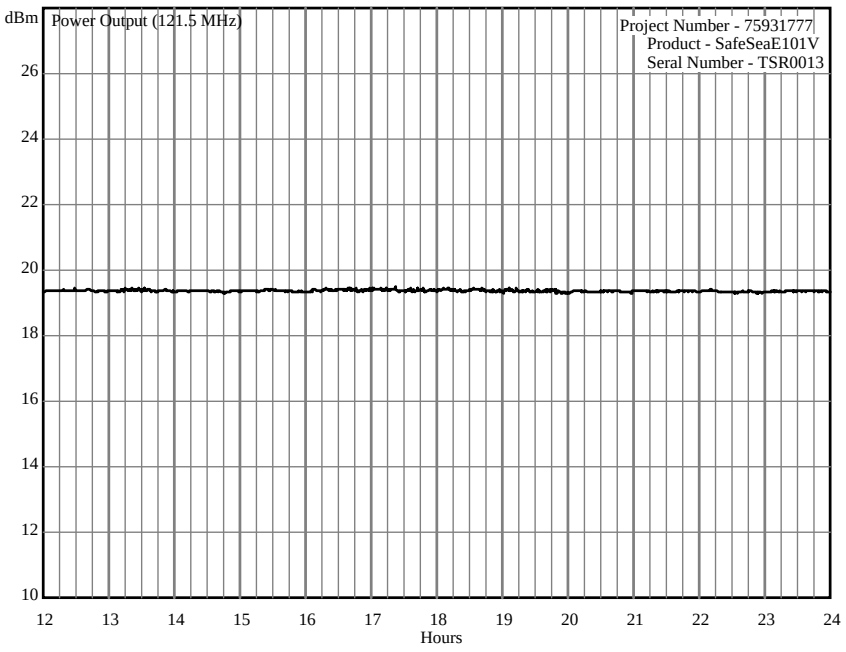

On+Off Time

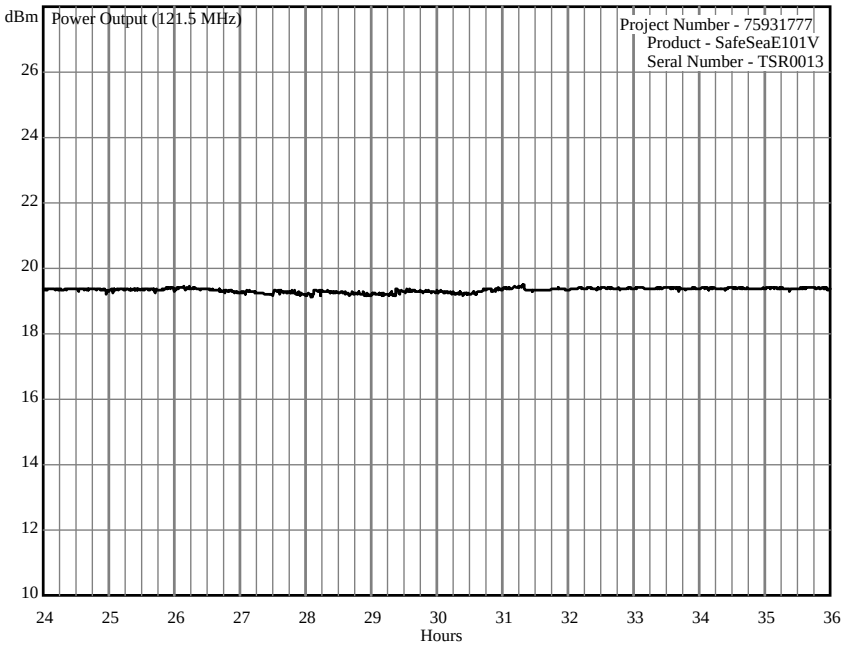


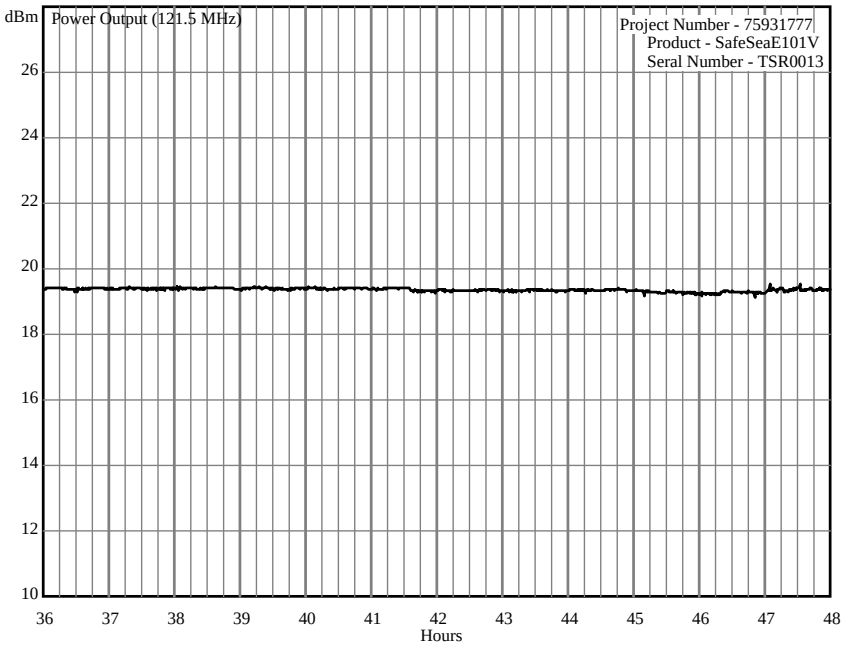

Duty Cycle = 50.1 / 51.6 = 0.971 = 97.1%

121 Homing Transmitter Power (First 48 Hours of Operation)

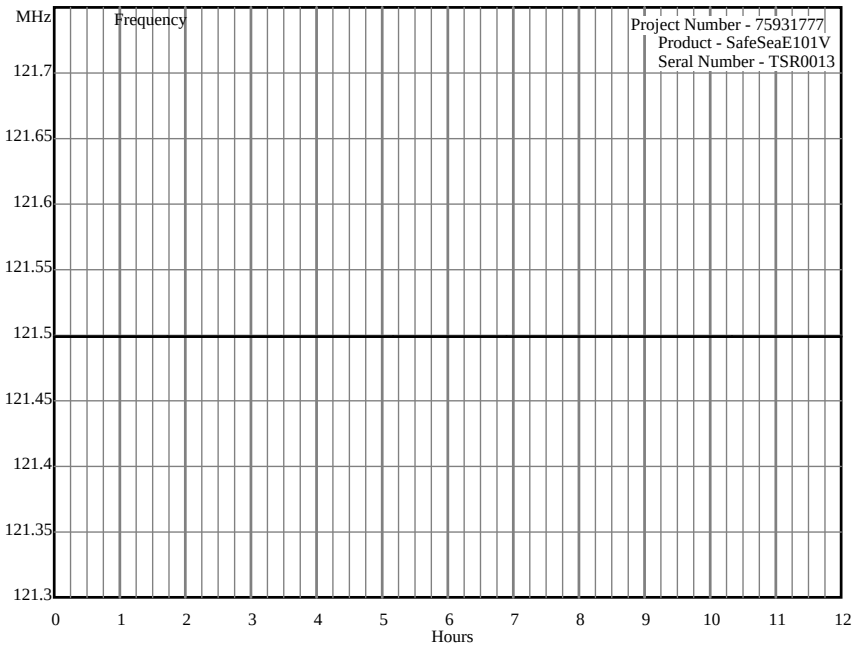


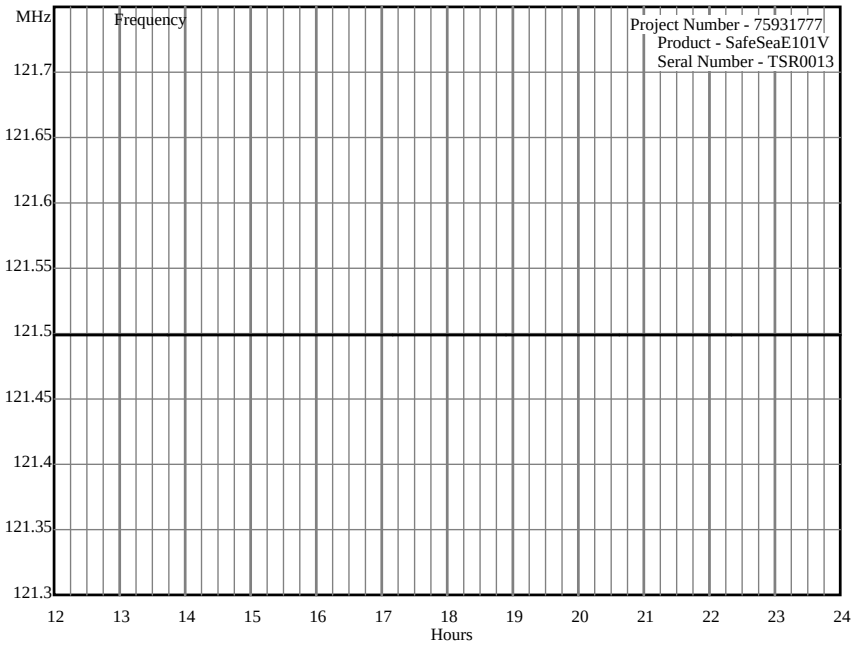



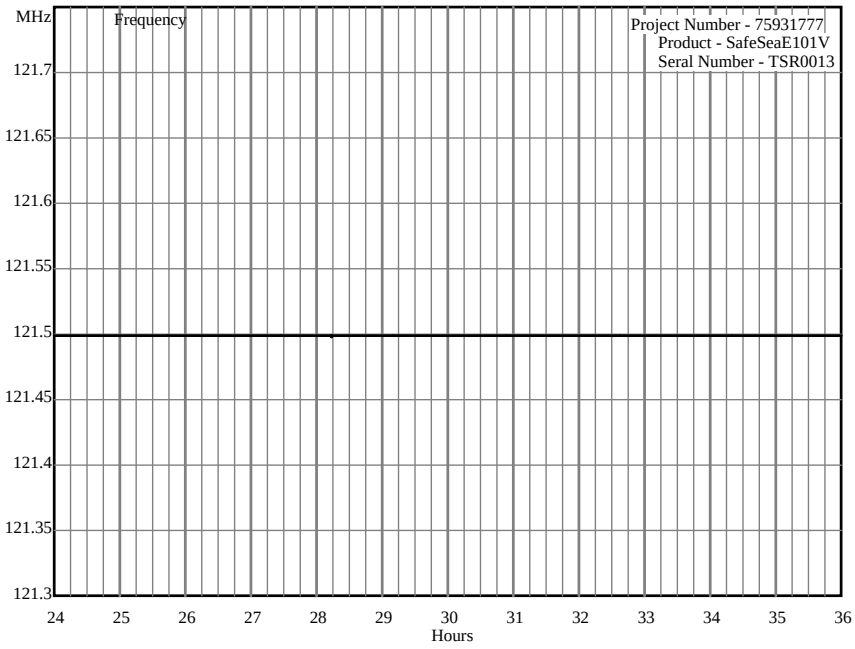

dBm
Power Output (121.5 MHz)
Project Number - 75931777
Product - SafeSeaE101V
Seral Number - TSR0013
26
24
22
20
18
16
14
12
10
24 25 26 27 28 29 30 31 32 33 34 35 36
Hours

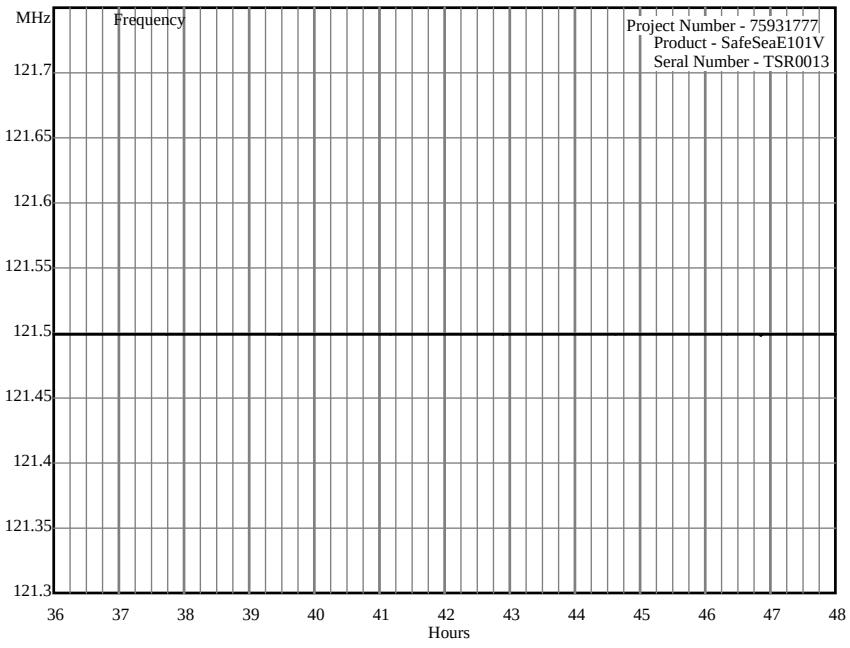

dBm
Power Output (121.5 MHz)
Project Number - 75931777
Product - SafeSeaE101V
Seral Number - TSR0013
26
24
22
20
18
16
14
12
10
36 37 38 39 40 41 42 43 44 45 46 47 48
Hours

121 Homing Transmitter Frequency (First 48 Hours of Operation)




MHz
Frequency
Project Number - 75931777
Product - SafeSeaE101V
Seral Number - TSR0013
121.7
121.65
121.6
121.55
121.5
121.45
121.4
121.35
121.3
24 25 26 27 28 29 30 31 32 33 34 35 36
Hours


MHz
Frequency
Project Number - 75931777
Product - SafeSeaE101V
Seral Number - TSR0013
121.7
121.65
121.6
121.55
121.5
121.45
121.4
121.35
121.3
36 37 38 39 40 41 42 43 44 45 46 47 48
Hours

Product Service

Beacon Operating Current

EUT System Configurations: 1 (fitted in Float Free Case) + 2 (Standalone) where applicable

As per C/S T.007 Table F-E.1:

| Beacon Operating Modes | Mode: Manually selectable or Automatic | Measurement interval, sec | Average Current, mA | Peak Current, mA |
|---|---|---|---|---|
| 1) Standalone - Standby | A | 900 | 0.0000009 | 0.000005 |
| 2) Float Free Case - Standby | A | 900 | 0.0000006 | 0.000009 |
| 3) Standalone - 406MHz + Homer + GPS searching + Strobe +(VDR off) + manual activation* | M | 48.72 | 44.75 | 1182 |
| 4) Standalone - 406MHz + Homer + GPS sleep + Strobe +(VDR off) + manual activation | M | 51.84 | 38.47 | 1173 |
| 5) Standalone - 406MHz + Homer + GPS search + Strobe +(VDR off) + water contact activation | A | 48.56 | 43.92 | 1195 |
| 6) Standalone - 406MHz + Homer + GPS sleep + Strobe +(VDR off) + water contact activation** | A | 52.00 | 35.52 | 1186 |
| 7) Standalone - Self-test Note1 | M | 13.43 | 47.88 | 1083 |
| 8) Float Free Case - Self-test | M | 13.99 | 46.90 | 1107 |
| 9) Standalone - GNSS Self-test | M | 316.6 | 12.55 | 15.77 |
| 10) Float Free Case - GNSS Self-test | M | 315.6 | 13.26 | 16.89 |

At all times the sampling interval was 80 ms nominal.

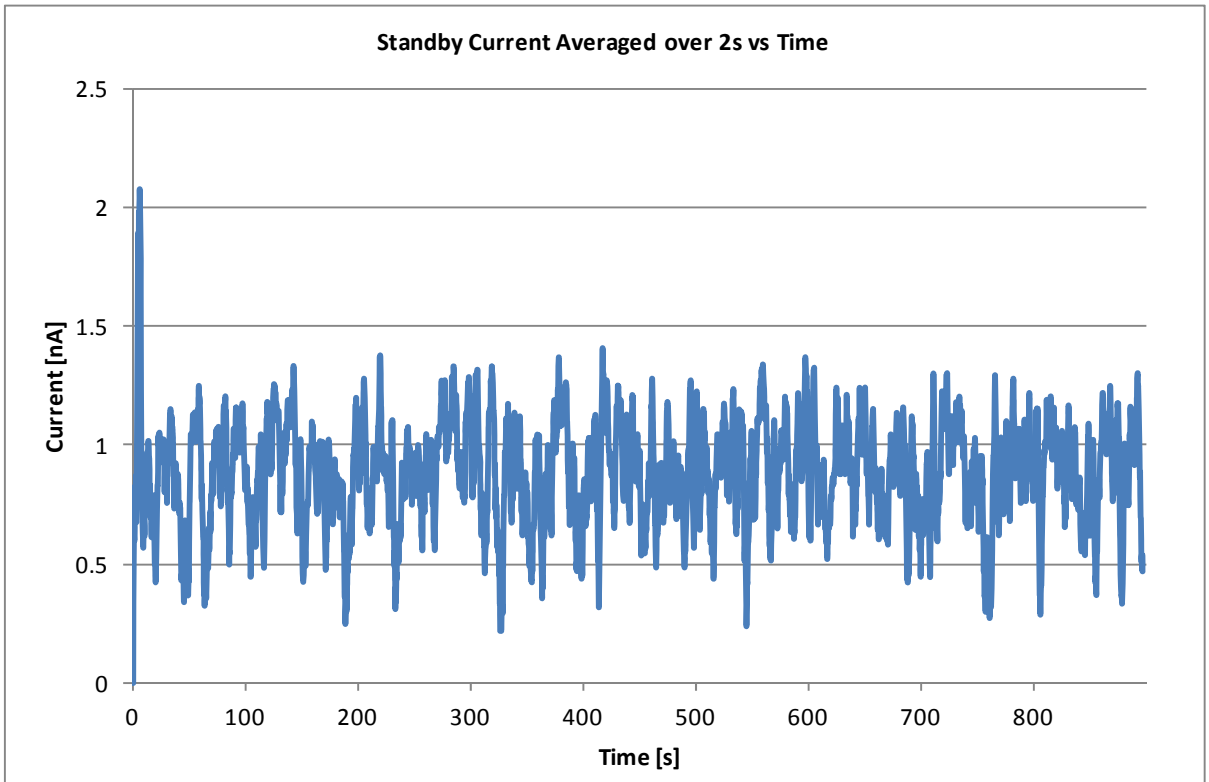
* Worst case (highest operating current) operating mode used during pre-test discharge the Operating Lifetime test.

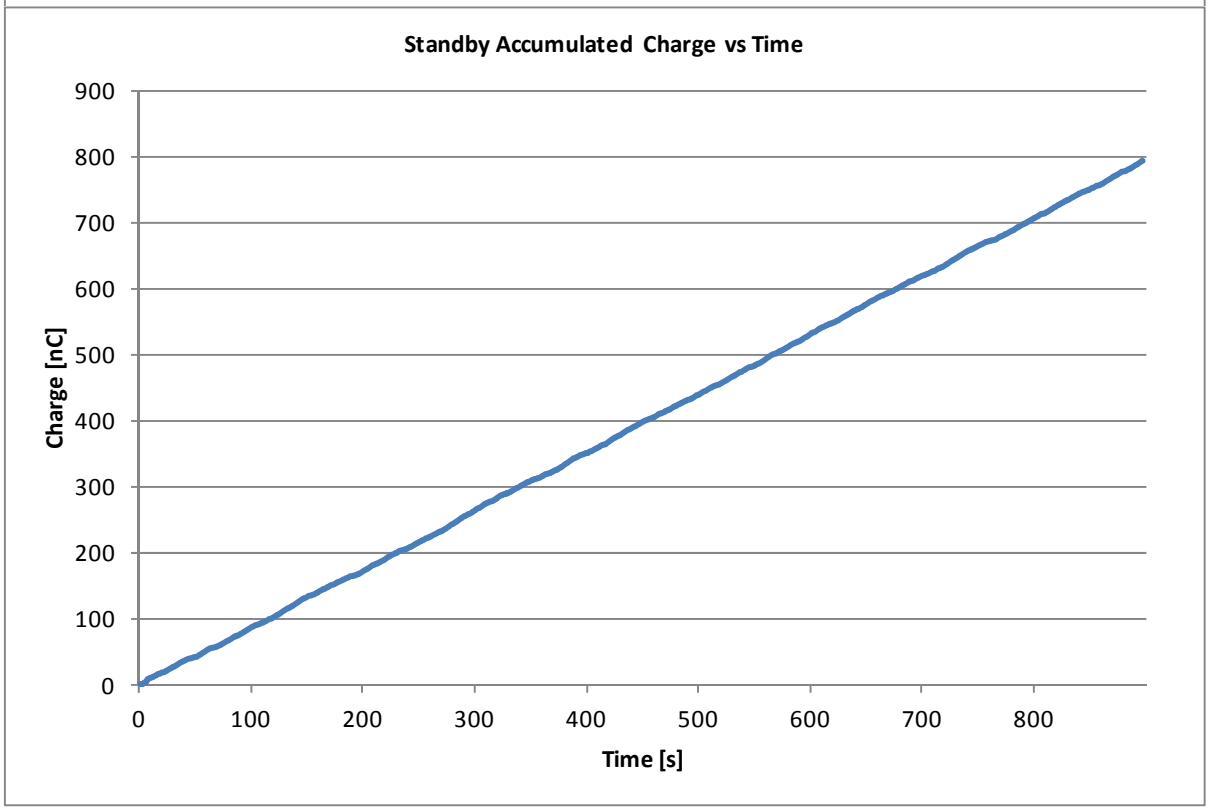
** Best case (lowest average current mode) figure used for the calculating the Operating Lifetime pre-test discharge (giving a longer discharge time). During pre-test discharge (and test itself) the average operating current was higher giving an “over-test” on the discharge.

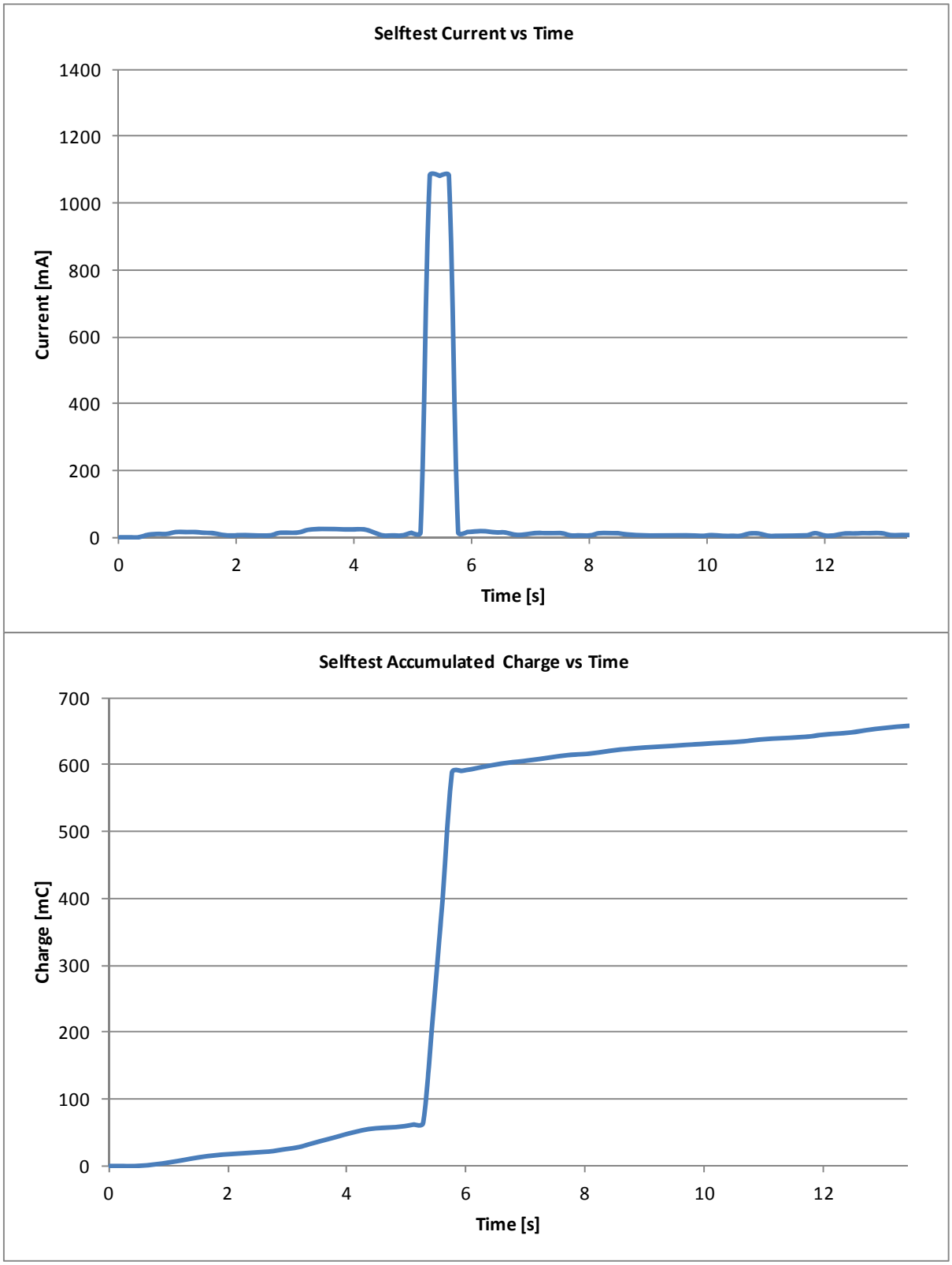
Note 1; The Self-Test result indicator (LED flashes) is variable depending on how the long the EUT has been previously activated. The maximum Self-Test duration has been used in the measurements above (6 LED flashes), which indicates that the EUT has been previously active for in excess of 10 hours.

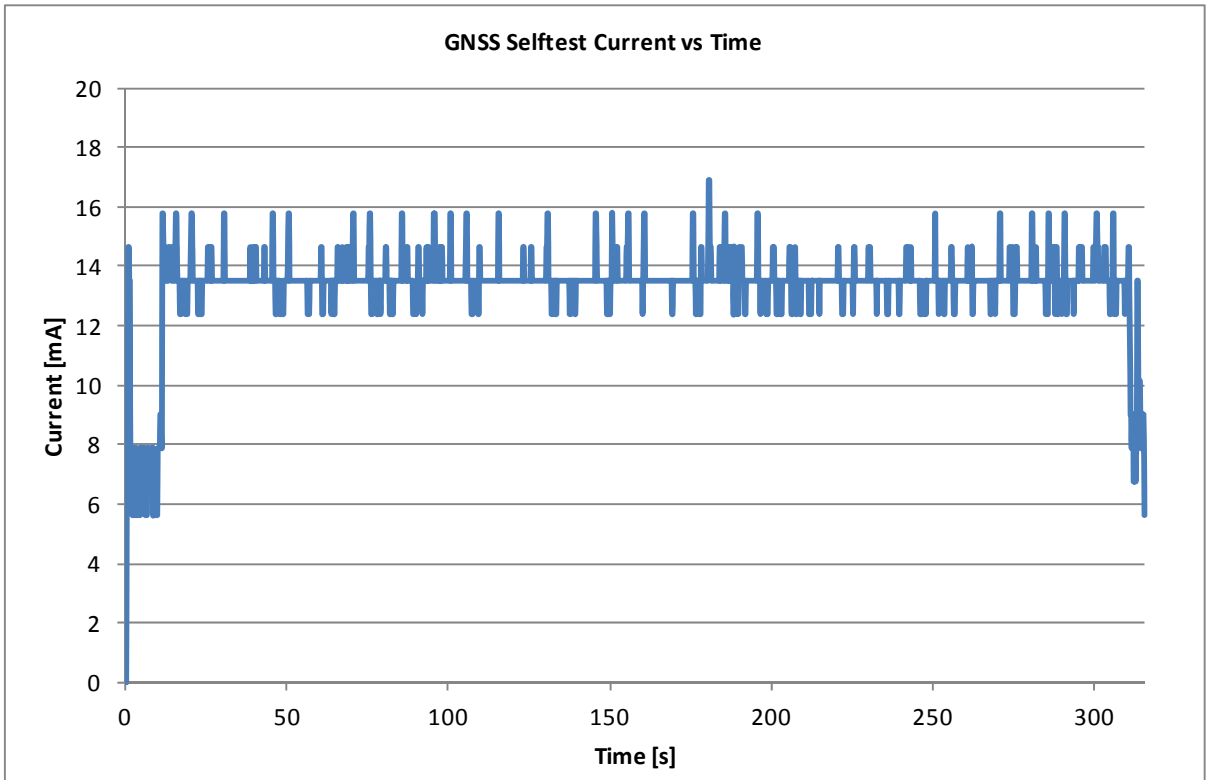
Observation – TUV measurements indicate mode 3 to be the marginally the worst case operating mode, whereas the manufacturer measured mode 5 to be marginally higher. The differences could be contributed to by the measurement uncertainty associated with the measurement made at TUV.

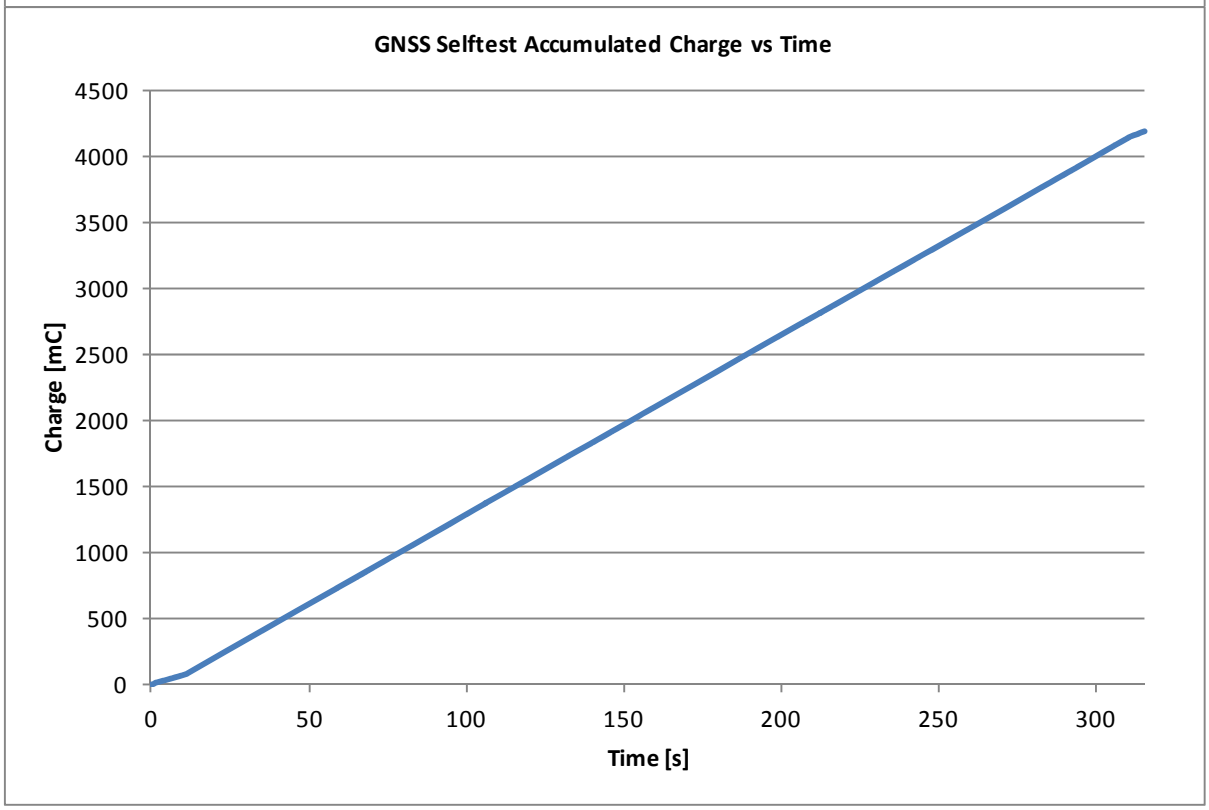
Battery Current Graphs

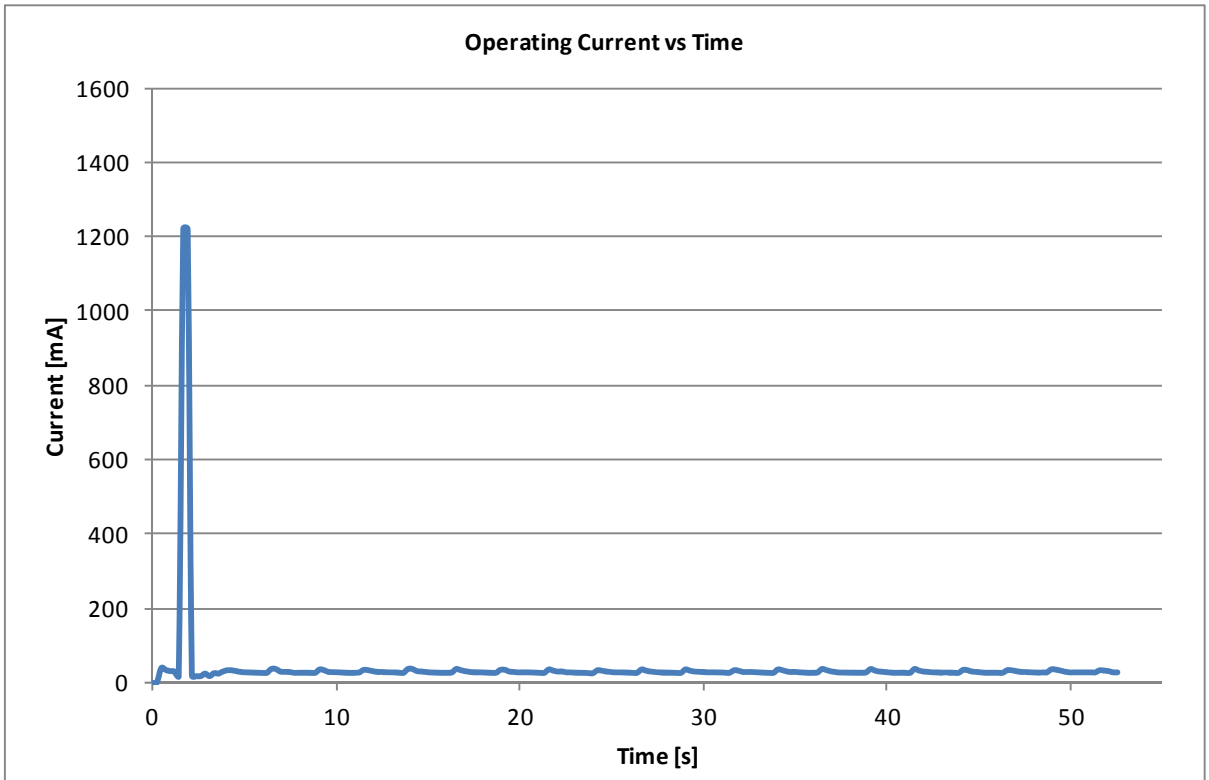


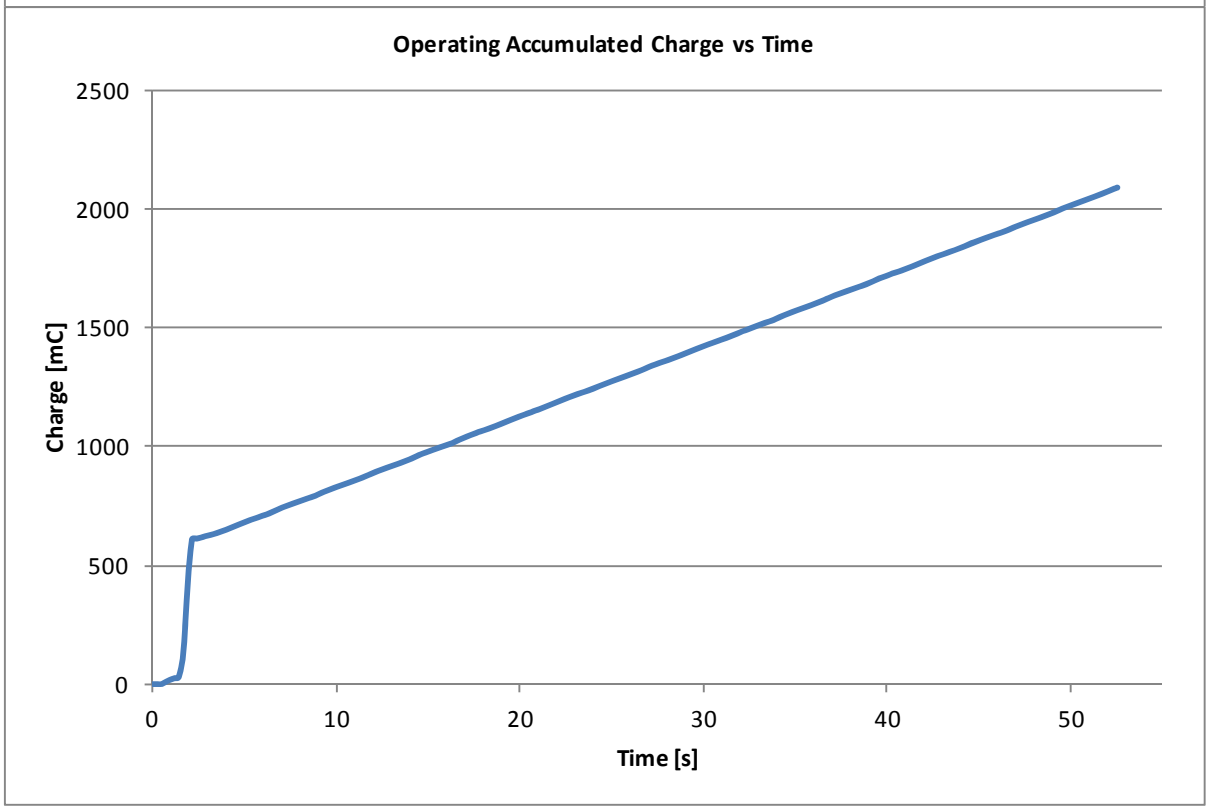




Selftest Current vs Time
Current [mA]
1400
1200
1000
800
600
400
200
0
0
2
4
6
8
10
12
Time [s]
Selftest Accumulated Charge vs Time
Charge [mC]
700
600
500
400
300
200
100
0
0
2
4
6
8
10
12
Time [s]


GNSS Selftest Current vs Time
Current [mA]
20
18
16
14
12
10
8
6
4
2
0
0
50
100
150
200
250
300
Time [s]


GNSS Selftest Accumulated Charge vs Time
Charge [mC]
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250
300
Time [s]


Operating Current vs Time
Current [mA]
1600
1400
1200
1000
800
600
400
200
0
0
10
20
30
40
50
Time [s]


Operating Accumulated Charge vs Time
Charge [mC]
2500
2000
1500
1000
500
0
0
10
20
30
40
50
Time [s]

Product Service

## Battery Current Measurement Results

Battery Discharge Current:

The discharge current for the batteries was measured for each of the following beacon states.

Beacon in the Off or Standby State, "Standby Current"
Beacon performing a Self-test, "Self-test Current"
Beacon activated and transmitting, "Operating Current"

The individual tests were conducted for the following durations:

| | | | |
|---|---|---|---|
| Standby Current | : | 15 minutes | (899932 ms) |
| Self-test Current | : | 13.4 seconds | (13432 ms) |
| GNSS ST Current | : | 316 seconds | (315600 ms) |
| Operating Current | : | 52 seconds | (51995 ms) |

Assumptions / Supplied Data:

| | |
|---|---|
| Battery Shelf-life | : 2 years |
| Battery Replacement Interval | : 8 years |
| Total Battery Life | : 10 years |
| Battery Capacity | : 11.1 Ah |
| Battery Self Drain | : 0.33 % per year |
| Self-test Interval | : 12 tests per year |
| GNSS STs per battery | : 12 |

Test Results:

| | | | | |
|---|---|---|---|---|
| Mode Current | = | Accumulated Charge / Time | | |
| Standby Current | = | 795217.92 pC / 899932 ms | = | 0.8836 nA |
| Self-test Current | = | 643073.91 uC / 13432 ms | = | 47.88 mA |
| GNSS Self-test | = | 4185947.67 uC / 315600 ms | = | 13.26 mA |
| Operating Current | = | 1846752.09 uC / 51995 ms | = | 35.52 mA |

Battery Preconditioning / Discharge Time Calculations:

Battery Self Drain = Capacity - [(100% - Self Drain/Year%)$^{\text{Replacement Interval}}$ x Capacity]
= 11.1- ((1- 0.0033) $^{10}$ x 11.1 ) = 0.3609 Ah

Standby Drain = Hours per year x Battery Replacement Interval x Standby Current
= 365 x 24 x 8 x 0.8836 x $10^{-9}$ = 0.0001 Ah
Worst Case = 1.65 x 0.0001 Ah = 0.0001 Ah

Self-test Drain = Self-tests per battery x Self-test Current x Self-test duration (in hours)
= 12 x 8 x 47.88 x $10^{-3}$ x (13 / 3600) = 0.0171 Ah
Worst Case = 1.65 x 0.0171 Ah = 0.0283 Ah

GNSS ST Drain = GNSS STs per battery x GNSS ST Current x GNSS ST duration (in hours)
= 12 x 1 x 13.26 x $10^{-3}$ x (316 / 3600) = 0.0140 Ah
Worst Case = 1.65 x 0.0140 Ah = 0.0230 Ah

Total Drain = Self discharge + Standby drain (wc) + ST drain (wc) + GNSS ST drain (wc)
= 0.3609 + 0.0001 + 0.0283 + 0.0230 = 0.4123 Ah

Battery Preconditioning / Discharge Time = Worst Case drain / Operational Current
= 0.4123 / ( 35.52 x $10^{-3}$)
= 11.61 hours

As per C/S T.007 Table F-E.2:

| Characteristic | Designation | Units | Value | Comments |
|---|---|---|---|---|
| Beacon manufacturers declare maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon) | $T_{CS}$ or TCS | Years | 2 | |
| Declared beacon battery replacement period (from date of manufacture) | $T_{BR}$ or TBR | Years | 8 | |
| Battery pack electrical configuration | Three cells in Series | | | |
| Cell model and cell chemistry | Ultralife U10013 Lithium | | | |
| Nominal cell capacity | | A-hrs | 11.1 | |
| Nominal battery pack capacity | $C_{BN}$ | A-hrs | 11.1 | |
| Annual battery cell capacity loss (self-discharge) due to aging, as specified by cell manufacturer at ambient temperature | $L_{SDC}$ | % | 0.33 | |
| 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 | 0.3609 | |
| Number of self-tests per year | $N_{ST}$ | | 12 | |
| Average battery current during a self-test | $I_{ST}$ | mA | 47.88 | |
| Maximum duration of a self-test | $T_{ST}$ | sec | 13.5 | |
| Calculated battery pack loss due to self-tests during battery replacement period: $L_{ST}= I_{ST}*T_{ST}*T_{BR}*N_{ST}/3600$ | $L_{ST}$ | mA-hrs | 17.2 | |
| Maximum number of GNSS self-tests between battery replacements | $N_{GST}$ | | 12 | |
| Average battery current during a GNSS self-test of maximum duration | $I_{GST}$ | mA | 13.26 | |
| Maximum duration of a GNSS self-test | $T_{GST}$ | sec | 316 | |
| Calculated battery pack loss due to GNSS self-tests during battery replacement period: $L_{GST}= I_{GST}*T_{GST}*N_{GST}/3600$ | $L_{GST}$ | mA-hrs | 13.96 | |
| Average battery standby current | $I_{SB}$ | mA | 0.0000009 | |
| Other Capacity Losses | $L_{OTH}$ | mA-hrs | none | |
| 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 | 0.063 | |
| 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 | 0.412 | |

Test Summary

The results indicate compliance with Cospas-Sarsat T.007, Clause A.2.3.

## 2.8 FREQUENCY STABILITY TEST WITH TEMPERATURE GRADIENT

### 2.8.1 Specification

Cospas-Sarsat T.007, Clause A.2.4

### 2.8.2 Equipment Under Test and Modification State

E101V S/N: 0800002P - Modification State 0

### 2.8.3 Date of Test

13 October 2015

### 2.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.8.5 Environmental Conditions

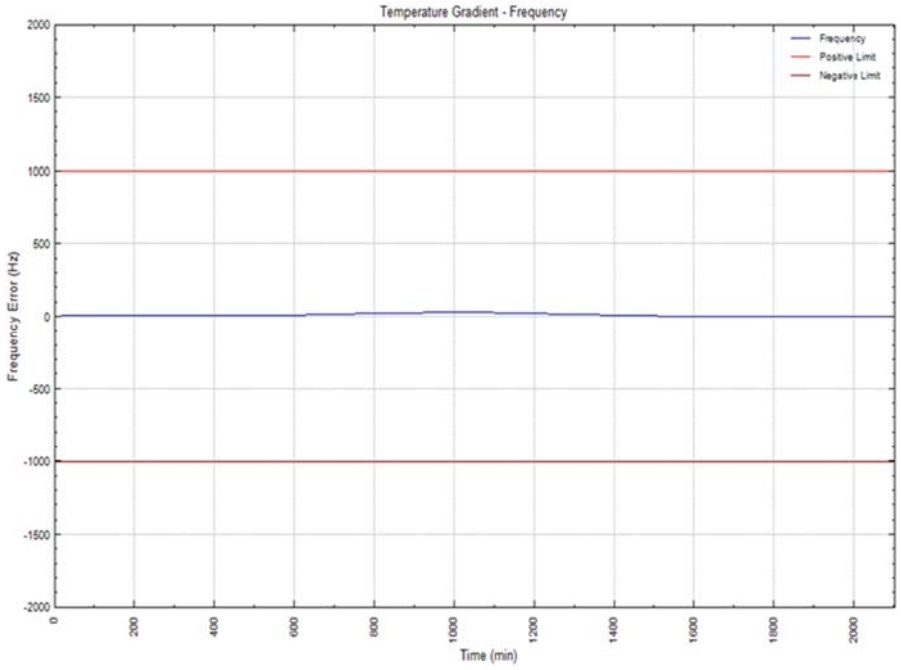
Ambient Temperature 21.4°C
Relative Humidity 41.6%

### 2.8.6 Test Results

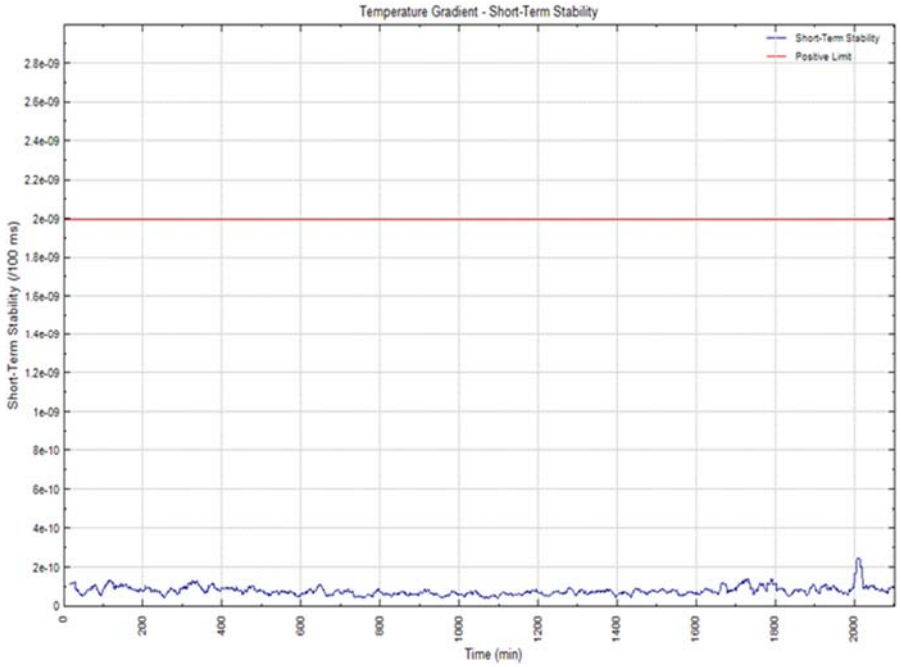
EUT System Configuration: 2

Full Test

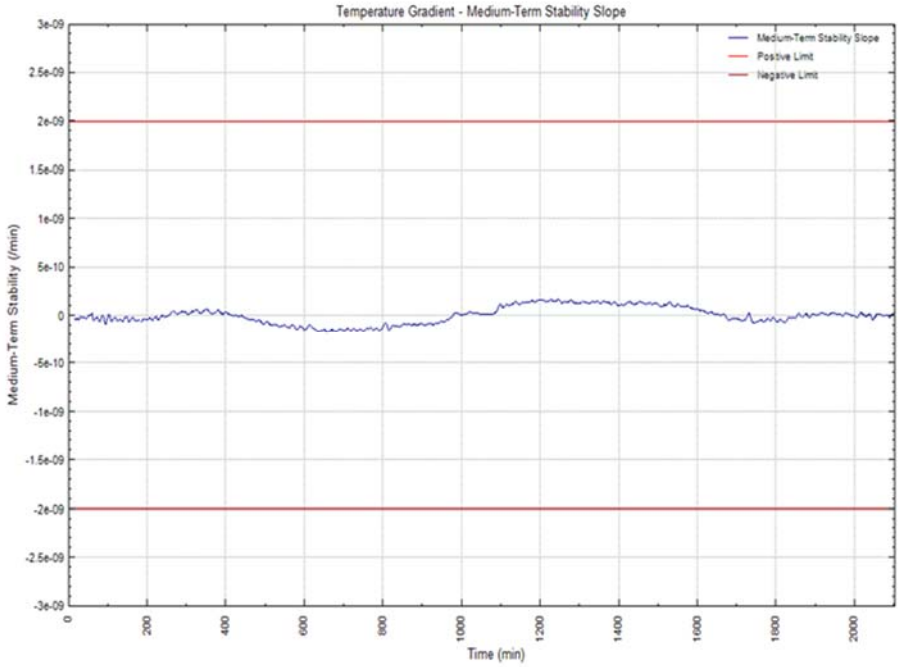
Nominal Frequency



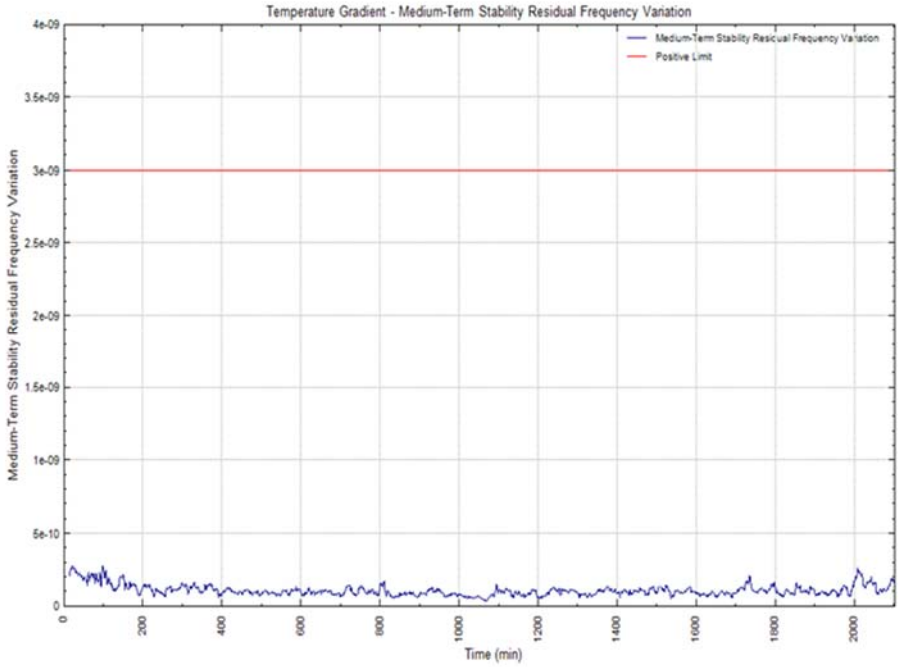
Short Term Stability



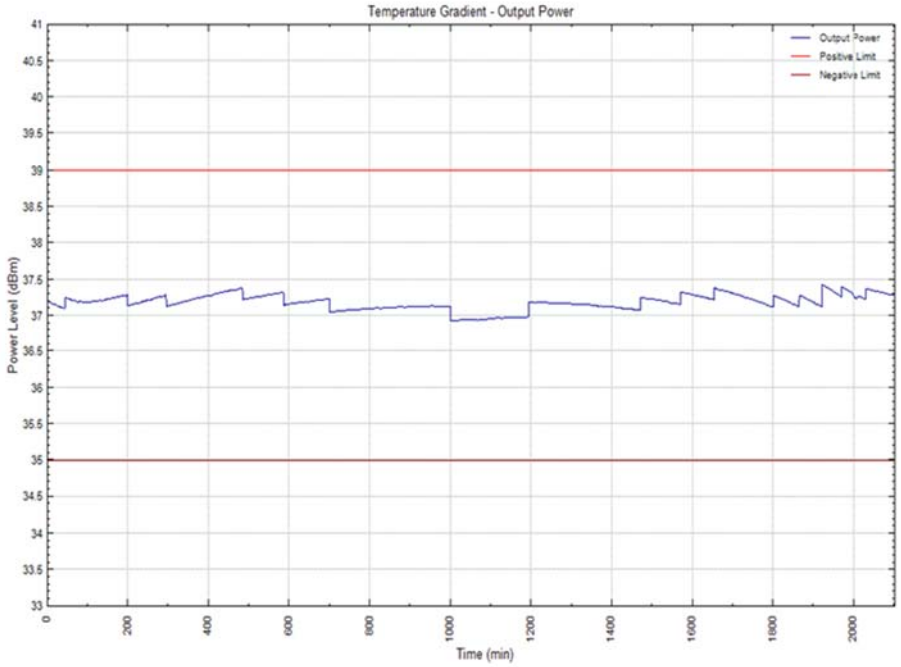

Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation




Output Power



Product Service

Digital Message

| | |
|---|---|
| Full 36 hex message | FFFE2F8C9EF9C0637FDFF83D15B783E0F66C |

| ITEM | BITS | VALUE |
|---|---|---|
| Message format: long format | 25 | 1 |
| Protocol: Location Protocol | 26 | 0 |
| Country code: 201 - **Albania** | 27-36 | 0011001001 |
| Type of location protocol: Standard Location - Test | 37-40 | 1110 |
| Test Protocol: Test Protocol (No Decode information in bits 41 to 64) | 41-64 | 111110011100000001100011 |
| Latitude Sign: default | 65 | 0 |
| Latitude Degrees: default | 66-72 | 1111111 |
| Latitude Minutes: default | 73-74 | 11 |
| Longitude Sign: default | 75 | 0 |
| Longitude Degrees: default | 76-83 | 11111111 |
| Longitude Minutes: default | 84-85 | 11 |
| BCH 1 Encoded: | 86-106 | 00000111010001010110 |
| BCH 1 Calculated: | N/A | 00000111010001010110 |
| Fixed bits (1101): Pass | 107-110 | 1101 |
| Position Data: Encoded Position Data Source From Internal Navigation Device | 111 | 1 |
| Aux Device: 121.5 MHz homer | 112 | 1 |
| Latitude Offset Sign: default | 113 | 1 |
| Latitude Offset Minutes: default | 114-118 | 00000 |
| Latitude Offset Seconds: default | 119-122 | 1111 |
| Longitude Offset Sign: default | 123 | 1 |
| Longitude Offset Minutes: default | 124-128 | 00000 |
| Longitude Offset Seconds: default | 129-132 | 1111 |
| BCH 2 Encoded: | 133-144 | 011001101100 |
| BCH 2 Calculated: | N/A | 011001101100 |
| Composite Latitude: default | N/A | Composite Longitude: default |
| 15 Hex ID: | N/A | 193DF380C6FFBFF |

Test Summary

The results indicate compliance with Cospas-Sarsat T.007, Clause A.2.4.

**Interim TCXO Procedure Summary**

**TCXO Test Sample Reference: Model E5344 S/No. MI 5758**

| MTS Characteristic | Time (h) | Temp. (°C) | tot | osc | beacon_wc | MAX-OSC | beacon_max | Ageing factor | beacon_5 year | Limit | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Residual | 1.62 | -16.8 | 2.796E-10 | 3.900E-10 | 2.796E-10 | 2.000E-09 | 2.019E-09 | 2.00E-10 | 2.219E-09 | 3.0E-09 | Pass |
| Static Positive Mean Slope | 33.51 | -20.0 | 7.20E-12 | -1.151E-10 | 1.153E-10 | 7.00E-10 | 7.094E-10 | 1.00E-10 | 8.094E-10 | 1.0E-09 | Pass |
| Static Negative Mean Slope | 16.27 | 55.0 | -4.09E-12 | 9.727E-11 | -9.735E-11 | -7.00E-10 | -7.067E-10 | -1.00E-10 | -8.067E-10 | -1.0E-09 | Pass |
| Gradient Positive Mean Slope | 7.97 | 14.8 | -5.34E-11 | -1.927E-10 | 1.852E-10 | 1.7E-09 | 1.710E-09 | 1.00E-10 | 1.810E-09 | 2.0E-09 | Pass |
| Gradient Negative Mean Slope | 14.56 | 47.5 | -9.82E-11 | 1.905E-10 | -2.143E-10 | -1.7E-09 | -1.713E-09 | -1.00E-10 | -1.813E-09 | -2.0E-09 | Pass |

Test Summary

The results indicate compliance with Cospas-Sarsat T.IP (TCXO) Issue 1, Revision 5.

## 2.9 SATELLITE QUALITATIVE TESTS

### 2.9.1 Specification

Cospas-Sarsat T.007, Clause A.2.5

### 2.9.2 Equipment Under Test and Modification State

E101V S/N: 0800003P - Modification State 0

### 2.9.3 Date of Test

30 September 2015, 1 October 2015, 2 October 2015, 3 October 2015 & 6 October 2015

### 2.9.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.9.5 Environmental Conditions

Ambient Temperature 9.8 - 18.3°C
Relative Humidity 49.1 - 77.6%

### 2.9.6 Test Results

EUT System Configuration: 2

Test Configuration 5

Test Start: 2015-10-02 17:22:58z
Test End: 2015-10-03 07:27:46z
15 Hex ID: 193DF380C6FFBFF

Actual location of the test beacon: 50.818263
(Daedalus Airfield, Lee-on-the-Solent, West) -1.197454

| Satellite ID | Satellite Pass Number | 15 Hex ID Provided by LUT | Doppler Latitude | Doppler Longitude | Mean Rx Power (dBm) | TCA | CTA (deg) | Location Error (km) |
|---|---|---|---|---|---|---|---|---|
| S12 | 34257 | 193DF 380C6 FFBFF | 50.80948 | -1.19994 | -127.25 | 01:16:01 | -17.706 | 0.991 |
| S12 | 34258 | 193DF 380C6 FFBFF | 50.82247 | -1.21563 | -125.39 | 02:57:39 | -1.691 | 1.359 |
| S12 | 34259 | 193DF 380C6 FFBFF | 50.81427 | -1.19519 | -125.66 | 04:37:50 | 12.973 | 0.471 |
| S7 | 90409 | 193DF 380C6 FFBFF | 50.80796 | -1.20845 | -126.27 | 05:04:18 | -12.148 | 1.381 |
| S10 | 53418 | 193DF 380C6 FFBFF | 50.81829 | -1.20114 | -115.18 | 05:05:37 | -10.068 | 0.259 |
| S10 | 53419 | 193DF 380C6 FFBFF | 50.80898 | -1.19589 | -126.55 | 06:46:30 | 5.515 | 1.037 |
| S7 | 90410 | 193DF 380C6 FFBFF | 50.81659 | -1.19391 | -116.88 | 06:44:30 | 3.493 | 0.311 |
| S7 | 90417 | 193DF 380C6 FFBFF | 50.83455 | -1.18688 | -125.40 | 18:10:06 | -11.839 | 1.956 |
| S10 | 53426 | 193DF 380C6 FFBFF | 50.83429 | -1.18268 | -125.93 | 18:18:55 | -15.728 | 2.061 |
| S11 | 46456 | 193DF 380C6 FFBFF | 50.82637 | -1.20851 | -127.05 | 19:01:29 | 15.580 | 1.189 |
| S13 | 15772 | 193DF 380C6 FFBFF | 50.83393 | -1.22126 | -128.42 | 19:55:46 | 8.622 | 2.413 |
| S11 | 46457 | 193DF 380C6 FFBFF | 50.82351 | -1.18953 | -126.70 | 20:40:46 | 1.439 | 0.806 |
| S13 | 15773 | 193DF 380C6 FFBFF | 50.83172 | -1.19545 | -128.61 | 21:35:46 | -6.609 | 1.502 |
| S11 | 46458 | 193DF 380C6 FFBFF | 50.82183 | -1.19459 | -125.75 | 22:21:28 | -14.366 | 0.444 |
| S12 | 34271 | 193DF 380C6 FFBFF | 50.80853 | -1.19991 | -131.05 | 01:04:31 | -19.518 | 1.095 |
| S12 | 34272 | 193DF 380C6 FFBFF | 50.81569 | -1.21629 | -126.70 | 02:46:20 | -3.461 | 1.353 |
| S12 | 34273 | 193DF 380C6 FFBFF | 50.81480 | -1.19690 | -126.26 | 04:26:41 | 11.448 | 0.387 |
| S7 | 90423 | 193DF 380C6 FFBFF | 50.80523 | -1.19970 | -126.89 | 04:39:10 | -16.132 | 1.457 |
| S10 | 53432 | 193DF 380C6 FFBFF | 50.80568 | -1.20393 | -126.68 | 04:53:58 | -11.943 | 1.470 |
| S10 | 53433 | 193DF 380C6 FFBFF | 50.81161 | -1.18759 | -127.89 | 06:35:01 | 3.790 | 1.013 |

Location Errors greater than 5 km are marked in red text.

$$\text{Ratio of Successful Solutions} = \frac{\text{number of Doppler solutions within 5 km with } 1° < CTA < 21°}{\text{number of satellite passes over test duration with } 1° < CTA < 21°}$$

$$= \frac{20}{20}$$

$$= 100\%$$

EUT System Configuration: 2

Test Configuration 7

Test Start: 2015-09-30 16:38:00z
Test End: 2015-10-01 07:02:00z
15 Hex ID: 193DF380C6FFBFF

Actual location of the test beacon: 50.818263
(Daedalus Airfield, Lee-on-the-Solent, West) -1.197454

| Satellite ID | Satellite Pass Number | 15 Hex ID Provided by LUT | Doppler Latitude | Doppler Longitude | Mean Rx Power (dBm) | TCA | CTA (deg) | Location Error (km) |
|---|---|---|---|---|---|---|---|---|
| S10 | 53397 | 193DF 380C6 FFBFF | 50.83098 | -1.19300 | -128.91 | 17:00:37 | -3.409 | 1.447 |
| S7 | 90388 | 193DF 380C6 FFBFF | 50.82867 | -1.18729 | -129.18 | 17:19:33 | -3.876 | 1.359 |
| S10 | 53398 | 193DF 380C6 FFBFF | 50.82606 | -1.18596 | -134.04 | 18:42:24 | -19.467 | 1.184 |
| S7 | 90389 | 193DF 380C6 FFBFF | 50.82383 | -1.18092 | -135.19 | 19:00:28 | -19.800 | 1.315 |
| S11 | 46428 | 193DF 380C6 FFBFF | 50.82878 | -1.20584 | -133.26 | 19:42:26 | 10.053 | 1.309 |
| S13 | 15744 | 193DF 380C6 FFBFF | 50.82124 | -1.21348 | -133.71 | 20:36:59 | 2.532 | 1.173 |
| S11 | 46429 | 193DF 380C6 FFBFF | 50.82545 | -1.19145 | -129.52 | 21:22:17 | -5.000 | 0.903 |
| S13 | 15745 | 193DF 380C6 FFBFF | 50.82746 | -1.19221 | -136.23 | 22:17:35 | -13.229 | 1.086 |
| S11 | 46430 | 193DF 380C6 FFBFF | 50.82458 | -1.19075 | -134.87 | 23:03:38 | -20.976 | 0.845 |
| S12 | 34243 | 193DF 380C6 FFBFF | 50.81510 | -1.05912 | -139.36 | 01:27:28 | -15.798 | 9.719 |
| S12 | 34245 | 193DF 380C6 FFBFF | 50.82147 | -1.19610 | -129.88 | 04:48:58 | 14.450 | 0.369 |
| S10 | 53404 | 193DF 380C6 FFBFF | 50.80850 | -1.20644 | -131.04 | 05:17:15 | -8.204 | 1.255 |
| S7 | 90395 | 193DF 380C6 FFBFF | 50.81051 | -1.20440 | -129.79 | 05:29:21 | -8.166 | 0.990 |
| S10 | 53405 | 193DF 380C6 FFBFF | 50.81063 | -1.20815 | -130.24 | 06:57:58 | 7.205 | 1.133 |

Location Errors greater than 5 km are marked in red text.

$$\text{Ratio of Successful Solutions} = \frac{\text{number of Doppler solutions within 5 km with } 1° < CTA < 21°}{\text{number of satellite passes over test duration with } 1° < CTA < 21°}$$

$$= \frac{13}{14}$$

$$= 92.86\%$$

EUT System Configuration: 2

Test Configuration 8

Test Start: 2015-10-01 17:21:01z
Test End: 2015-10-02 07:22:29z
15 Hex ID: 193DF380C6FFBFF

Actual location of the test beacon: 50.818263
(Daedalus Airfield, Lee-on-the-Solent, West) -1.197454

| Satellite ID | Satellite Pass Number | 15 Hex ID Provided by LUT | Doppler Latitude | Doppler Longitude | Mean Rx Power (dBm) | TCA | CTA (deg) | Location Error (km) |
|---|---|---|---|---|---|---|---|---|
| S7 | 90403 | 193DF 380C6 FFBFF | 50.82963 | -1.18817 | -125.61 | 18:35:14 | -15.824 | 1.421 |
| S11 | 46442 | 193DF 380C6 FFBFF | 50.82730 | -1.20716 | -125.81 | 19:21:56 | 12.885 | 1.214 |
| S13 | 15757 | 193DF 380C6 FFBFF | 50.82082 | -1.20339 | -125.56 | 18:37:27 | 18.943 | 0.504 |
| S13 | 15758 | 193DF 380C6 FFBFF | 50.82835 | -1.20794 | -126.38 | 20:16:21 | 5.618 | 1.341 |
| S13 | 15759 | 193DF 380C6 FFBFF | 50.82506 | -1.18801 | -129.59 | 21:56:38 | -9.913 | 1.005 |
| S11 | 46443 | 193DF 380C6 FFBFF | 50.75567 | -0.49030 | -115.62 | 21:01:27 | -2.167 | 50.165 |
| S10 | 53412 | 193DF 380C6 FFBFF | 50.82547 | -1.28349 | -123.79 | 18:30:39 | -17.538 | 6.093 |
| S11 | 46444 | 193DF 380C6 FFBFF | 50.81534 | -1.13018 | -117.82 | 22:42:31 | -17.722 | 4.734 |
| S12 | 34257 | 193DF 380C6 FFBFF | 50.80948 | -1.19994 | -127.25 | 01:16:01 | -17.706 | 0.991 |
| S12 | 34258 | 193DF 380C6 FFBFF | 50.82247 | -1.21563 | -125.39 | 02:57:39 | -1.691 | 1.359 |
| S12 | 34259 | 193DF 380C6 FFBFF | 50.81427 | -1.19519 | -125.66 | 04:37:50 | 12.973 | 0.471 |
| S7 | 90409 | 193DF 380C6 FFBFF | 50.80796 | -1.20845 | -126.27 | 05:04:18 | -12.148 | 1.381 |
| S10 | 53418 | 193DF 380C6 FFBFF | 50.81829 | -1.20114 | -115.18 | 05:05:37 | -10.068 | 0.259 |
| S10 | 53419 | 193DF 380C6 FFBFF | 50.80898 | -1.19589 | -126.55 | 06:46:30 | 5.515 | 1.037 |
| S7 | 90410 | 193DF 380C6 FFBFF | 50.81659 | -1.19391 | -116.88 | 06:44:30 | 3.493 | 0.311 |

Location Errors greater than 5 km are marked in red text.

$$\text{Ratio of Successful Solutions} = \frac{\text{number of Doppler solutions within 5 km with } 1°<\text{CTA}<21°}{\text{number of satellite passes over test duration with } 1°<\text{CTA}<21°}$$

$$= \frac{13}{15}$$

$$= 86.66\%$$

Test Summary

The results indicate compliance with Cospas-Sarsat T.007, Clause A.2.5.

## 2.10 BEACON ANTENNA TEST

### 2.10.1 Specification

Cospas-Sarsat T.007, Clause A.2.6

### 2.10.2 Equipment Under Test and Modification State

E101V S/N: 0800003P - Modification State 0

### 2.10.3 Date of Test

10 September 2015

### 2.10.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.10.5 Environmental Conditions

Ambient Temperature 18.8 – 20.2°C
Relative Humidity 52 - 58%

### 2.10.6 Test Results

EUT System Configuration: 2

Note: Measurements were made using a dipole antenna in a fully screened semi-anechoic chamber.

Test Configuration 1 (B.4)

| | Elevation Angle (degrees) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | | 20 | | 30 | | 40 | | 50 | |
| Azimuth Angle (Degrees) | EIRP dBm | Ant dBi | EIRP dBm | Ant dBi | EIRP dBm | Ant dBi | EIRP dBm | Ant dBi | EIRP dBm | Ant dBi |
| 0 | 38.8 | 1.5 | 41.0 | 3.8 | 42.8 | 5.6 | 39.3 | 2.1 | 33.6 | -3.6 |
| 30 | 38.7 | 1.5 | 41.0 | 3.8 | 42.7 | 5.5 | 39.0 | 1.8 | 33.5 | -3.7 |
| 60 | 38.8 | 1.6 | 40.9 | 3.7 | 42.6 | 5.4 | 39.0 | 1.8 | 33.7 | -3.5 |
| 90 | 38.9 | 1.6 | 41.1 | 3.8 | 42.8 | 5.5 | 39.0 | 1.8 | 33.6 | -3.6 |
| 120 | 38.9 | 1.6 | 40.9 | 3.7 | 42.6 | 5.4 | 39.0 | 1.8 | 33.6 | -3.7 |
| 150 | 38.8 | 1.6 | 41.0 | 3.8 | 42.8 | 5.6 | 39.0 | 1.8 | 33.8 | -3.4 |
| 180 | 38.8 | 1.6 | 41.0 | 3.8 | 42.7 | 5.4 | 39.0 | 1.8 | 33.6 | -3.6 |
| 210 | 38.8 | 1.5 | 41.0 | 3.8 | 42.7 | 5.5 | 39.2 | 2.0 | 33.5 | -3.7 |
| 240 | 38.6 | 1.3 | 41.3 | 4.0 | 42.7 | 5.5 | 39.2 | 2.0 | 33.9 | -3.3 |
| 270 | 38.8 | 1.6 | 41.1 | 3.9 | 42.6 | 5.4 | 39.3 | 2.0 | 34.2 | -3.1 |
| 300 | 38.7 | 1.5 | 41.2 | 4.0 | 42.8 | 5.6 | 39.3 | 2.1 | 33.8 | -3.4 |
| 330 | 38.7 | 1.5 | 41.1 | 3.8 | 42.7 | 5.4 | 39.3 | 2.1 | 33.9 | -3.3 |

| | Elevation Angle (degrees) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | | 20 | | 30 | | 40 | | 50 | |
| Azimuth Angle (Degrees) | Vv | Vh | Vv | Vh | Vv | Vh | Vv | Vh | Vv | Vh |
| 0 | 110.4 | 88.2 | 112.3 | 88.1 | 113.4 | 88.9 | 108.8 | 90.5 | 101.6 | 72.7 |
| 30 | 110.4 | 84.5 | 112.3 | 87.8 | 113.3 | 89.8 | 108.5 | 92.0 | 101.5 | 80.4 |
| 60 | 110.5 | 87.6 | 112.2 | 88.0 | 113.2 | 88.3 | 108.5 | 90.4 | 101.7 | 69.3 |
| 90 | 110.5 | 86.7 | 112.3 | 85.9 | 113.3 | 88.3 | 108.5 | 90.9 | 101.6 | 77.3 |
| 120 | 110.6 | 87.0 | 112.2 | 87.2 | 113.2 | 89.4 | 108.5 | 90.5 | 101.5 | 77.3 |
| 150 | 110.5 | 87.9 | 112.3 | 87.0 | 113.4 | 89.2 | 108.5 | 91.3 | 101.8 | 79.3 |
| 180 | 110.5 | 84.2 | 112.3 | 89.3 | 113.2 | 91.3 | 108.5 | 91.3 | 101.6 | 80.1 |
| 210 | 110.4 | 88.6 | 112.3 | 85.6 | 113.3 | 88.8 | 108.7 | 90.2 | 101.5 | 79.9 |
| 240 | 110.3 | 82.6 | 112.5 | 88.9 | 113.3 | 90.3 | 108.6 | 91.5 | 101.9 | 80.0 |
| 270 | 110.5 | 87.4 | 112.4 | 87.3 | 113.2 | 89.2 | 108.7 | 90.7 | 102.1 | 78.9 |
| 300 | 110.4 | 85.7 | 112.5 | 89.7 | 113.4 | 91.0 | 108.7 | 91.4 | 101.8 | 76.7 |
| 330 | 110.4 | 87.7 | 112.3 | 86.9 | 113.2 | 89.4 | 108.8 | 92.4 | 101.9 | 80.3 |
| Min (Vv-Vh) | 21.8 | | 22.8 | | 21.9 | | 16.4 | | 21.1 | |

$EIRP_{LOSS} = Pt_{ambient} - Pt_{EOL} =$ 37.23 - 36.42 = 0.81 dB

$EIRP_{maxEOL} = Max[EIRP_{max}, (EIRP_{max} - EIRP_{LOSS})] =$ Max[ 42.8, 42.0 ]= 42.8 dBm

$EIRP_{minEOL} = Min[EIRP_{min}, (EIRP_{min} - EIRP_{LOSS})] =$ Min[ 33.5, 32.7 ]= 32.7 dBm

Test Configuration 4 (B.5)

| | Elevation Angle (degrees) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | | 20 | | 30 | | 40 | | 50 | |
| Azimuth Angle (Degrees) | EIRP dBm | Ant dBi | EIRP dBm | Ant dBi | EIRP dBm | Ant dBi | EIRP dBm | Ant dBi | EIRP dBm | Ant dBi |
| 0 | 37.7 | 0.5 | 40.8 | 3.6 | 36.7 | -0.5 | 32.1 | -5.2 | 31.4 | -5.8 |
| 90 | 38.8 | 1.6 | 41.2 | 4.0 | 38.2 | 1.0 | 33.5 | -3.7 | ~~29.2~~ | -8.0 |
| 180 | 39.6 | 2.4 | 41.2 | 4.0 | 38.4 | 1.2 | 33.2 | -4.1 | ~~19.5~~ | -17.7 |
| 270 | 39.7 | 2.5 | 41.3 | 4.0 | 39.1 | 1.9 | 32.4 | -4.8 | ~~20.0~~ | -17.3 |

$EIRP_{LOSS} = Pt_{ambient} - Pt_{EOL} =$ 37.23 - 36.42 = 0.81 dB

$EIRP_{maxEOL} = Max[EIRP_{max}, (EIRP_{max} - EIRP_{LOSS})] =$ Max[ 41.3, 40.5 ]= 41.3dBm

$EIRP_{minEOL} = Min[EIRP_{min}, (EIRP_{min} - EIRP_{LOSS})] =$ Min[ 31.4, 30.6 ]= 30.6dBm

Test Summary

The results indicate compliance with Cospas-Sarsat T.007, Clause A.2.6.

## 2.11 NAVIGATION SYSTEM TEST

### 2.11.1 Specification

Cospas-Sarsat T.007, Clause A.2.7

### 2.11.2 Equipment Under Test and Modification State

E101V S/N: 0800003P - Modification State 0

### 2.11.3 Date of Test

26 September 2015, 27 September 2015, 28 September 2015 & 3 October 2015

### 2.11.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.11.5 Environmental Conditions

Ambient Temperature 9.8 - 22.6°C
Relative Humidity 42.7 - 64.5%

### 2.11.6 Test Results

EUT System Configuration: 2

National Protocol

Position Data Default Values (C/S T.007 A.3.8.1):

No position data was provided for > 4 hours before the test started. The beacon was activated and operated for 30 minutes without providing data. Message content was checked for all bursts during this period.

| 36 Hex Message | Message Count |
|---|---|
| FFFE2F8C9F00C05FC0FF06728BF79F3C0010 | 39 |

Position Acquisition Time and Position Accuracy (C/S T.007 A.3.8.2)

Locations:

| | | | |
|---|---|---|---|
| A.3.8.2.1: | N 50° 49.096' | W 001° 11.847' | ① |
| A.3.8.2.2: | N 50° 52.142' | W 001° 14.680' | ① |

The appropriate position was applied, the EUT activated and time to first message containing valid position data timed.

| Configuration as per C/S T.007 | 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 |
| Configuration 5 | 61* | 73.2 | 61* | 22.7 |
| Configuration 6 | N/A | N/A | N/A | N/A |
| Configuration 7 | 51 | 73.2 | 51 | 22.7 |
| Configuration 8 | 51 | 73.2 | 51 | 22.7 |

Positional accuracy was calculated using the Haversine Formula, The Earth's radius was taken as 6367 km.

① GPS Site Survey – Live Location
② Input from GPS simulator

* Approx 10 sec from immersion in salt water until beacon LEDs flash

Encoded Position Data Update Interval (C/S T.007 A.3.8.3):

| | | |
|---|---|---|
| Location: N 51° 22.583' W 1° 49.833' ② | | |
| Data Acquired at | 11:43:24 | FFFE2F8C9F00C04CD701CAD575F79208025B |
| Location: N 50° 48.683' W 1° 37.417' ② | | |
| Data Updated at | 12:13:25 | FFFE2F8C9F00C04CB1019F102A3794240FCD |
| Data Update Interval | 30 min 02 s | |

① GPS Site Survey – Live Location
② Input from GPS simulator

Position Clearance After Deactivation (C/S T.007 A.3.8.4)

Following the Encoded Position Data Update Interval test, the beacon was deactivated and reactivated without providing navigation data. The Digital Message output was encoded with the default position data.

Position Data Input Update Interval (C/S T.007 A.3.8.5)

EUT does not accept external position input, test is not applicable.

Last Valid Position (C/S T.007 A.3.8.6)

| | | |
|---|---|---|
| Location: N 51° 22.583' W 1° 49.833' ② | | |
| Data Acquired at | 11:02:23 | FFFE2F8C9F00C04CD701CAD575F79208025B |
| GPS Signal Navigation Data Removed | | |
| Data Updated at | 15:02:33 | FFFE2F8C9F00C05FC0FF06728BF79F3C0010 |
| Last Valid Position Held | 240min 10s | |
| Return to Default Position | ✓ | |

① GPS Site Survey – Live Location
② Input from GPS simulator

Product Service

Standard Protocol

Position Data Default Values (C/S T.007 A.3.8.1):

No position data was provided for > 4 hours before the test started. The beacon was activated and operated for 30 minutes without providing data. Message content was checked for all bursts during this period.

| 36 Hex Message | Message Count |
|---|---|
| FFFE2F8C9EF9C0637FDFF83D15B783E0F66C | 41 |

Position Acquisition Time and Position Accuracy (C/S T.007 A.3.8.2)

Locations:

| | | | |
|---|---|---|---|
| A.3.8.2.1: | N 50° 49.096' | W 001° 11.847' | ① |
| A.3.8.2.2: | N 50° 52.142' | W 001° 14.680' | ① |

The appropriate position was applied, the EUT activated and time to first message containing valid position data timed.

| Configuration as per C/S T.007 | 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 |
| Configuration 5 | 61* | 73.2 | 61* | 22.7 |
| Configuration 6 | N/A | N/A | N/A | N/A |
| Configuration 7 | 51 | 73.2 | 51 | 22.7 |
| Configuration 8 | 51 | 73.2 | 51 | 22.7 |

Positional accuracy was calculated using the Haversine Formula, The Earth's radius was taken as 6367 km.

① GPS Site Survey – Live Location
② Input from GPS simulator

* Approx 10 sec from immersion in salt water until beacon LEDs flash

Encoded Position Data Update Interval (C/S T.007 A.3.8.3):

| | | |
|---|---|---|
| Location: N 51° 22.583' W 1° 49.833' ② | | |
| Data Acquired at | 11:03:00 | FFFE2F8C9EF9C06333A03ECA66771DA4D4D0 |
| Location: N 50° 48.683' W 1° 37.417' ② | | |
| Data Updated at | 11:33:02 | FFFE2F8C9EF9C06332E0311EC7778EA76951 |
| Data Update Interval | 30 min 02 s | |

① GPS Site Survey – Live Location
② Input from GPS simulator

Position Clearance After Deactivation (C/S T.007 A.3.8.4)

Following the Encoded Position Data Update Interval test, the beacon was deactivated and reactivated without providing navigation data. The Digital Message output was encoded with the default position data.

Position Data Input Update Interval (C/S T.007 A.3.8.5)

EUT does not accept external position input, test is not applicable.

Last Valid Position (C/S T.007 A.3.8.6)

| Location: N 51° 22.583' W 1° 49.833' ① | | |
|---|---|---|
| Data Acquired at | 14:00:50 | FFFE2F8C9EF9C06333A03ECA66771DA4D4D0 |
| GPS Signal Navigation Data Removed | | |
| Data Updated at | 18:01:00 | FFFE2F8C9EF9C0637FDFF83D15B783E0F66C |
| Last Valid Position Held | 240min 10s | |
| Return to Default Position | ✓ | |

① GPS Site Survey – Live Location
② Input from GPS simulator

User Protocol

Position Data Default Values (C/S T.007 A.3.8.1):

No position data was provided for > 4 hours before the test started. The beacon was activated and operated for 30 minutes without providing data. Message content was checked for all bursts during this period.

| 36 Hex Message | Message Count |
|---|---|
| FFFE2FCC9E0A000C607CEDF5BA2FE0FF0146 | 38 |

Position Acquisition Time and Position Accuracy (C/S T.007 A.3.8.2)

Locations:

| | | | |
|---|---|---|---|
| A.3.8.2.1: | N 50° 49.096' | W 001° 11.847' | ① |
| A.3.8.2.2: | N 50° 52.142' | W 001° 14.680' | ① |

The appropriate position was applied, the EUT activated and time to first message containing valid position data timed.

| Configuration as per C/S T.007 | 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 |
| Configuration 5 | 61* | 2037.3 | 61* | 1565.4 |
| Configuration 6 | N/A | N/A | N/A | N/A |
| Configuration 7 | 51 | 2037.3 | 51 | 1565.4 |
| Configuration 8 | 51 | 2037.3 | 51 | 1565.4 |

Positional accuracy was calculated using the Haversine Formula, The Earth's radius was taken as 6367 km.

① GPS Site Survey – Live Location
② Input from GPS simulator

* Approx 10 sec from immersion in salt water until beacon LEDs flash

Encoded Position Data Update Interval (C/S T.007 A.3.8.3):

| | | |
|---|---|---|
| Location: N 51° 22.583' W 1° 49.833' ② | | |
| Data Acquired at | 12:26:37 | FFFE2FCC9E0A000C607CEDF5BA266D01C026 |
| Location: N 50° 48.683' W 1° 37.417' ② | | |
| Data Updated at | 12:56:39 | FFFE2FCC9E0A000C607CEDF5BA265901967F |
| Data Update Interval | 30 min 02 s | |

① GPS Site Survey – Live Location
② Input from GPS simulator

Position Clearance After Deactivation (C/S T.007 A.3.8.4)

Following the Encoded Position Data Update Interval test, the beacon was deactivated and reactivated without providing navigation data. The Digital Message output was encoded with the default position data.

Position Data Input Update Interval (C/S T.007 A.3.8.5)

EUT does not accept external position input, test is not applicable.

Last Valid Position (C/S T.007 A.3.8.6)

| | | |
|---|---|---|
| Location: N 51° 22.583' W 1° 49.833' ① | | |
| Data Acquired at | 09:12:28 | FFFE2FCC9E0A000C607CEDF5BA266D01C026 |
| GPS Signal Navigation Data Removed | | |
| Data Updated at | 13:12:38 | FFFE2FCC9E0A000C607CEDF5BA2FE0FF0146 |
| Last Valid Position Held | 240min 10s | |
| Return to Default Position | ✓ | |

① GPS Site Survey – Live Location
② Input from GPS simulator

Test Summary

The results indicate compliance with Cospas-Sarsat T.007, Clause A.2.7.