# Report On

Emergency Beacons Testing of the
Jotron AS
Tron SA20
In accordance with Cospas-Sarsat T.007

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| | |
|---|---|
| **REPORT ON** | Emergency Beacons Testing of the Jotron AS Tron SA20<br><br>Document 75956621 Report 08 Issue 3<br><br>October 2023 |
| **PREPARED FOR** | Jotron AS<br>Ringdalskogen 8<br>3270 Larvik<br>Norway |
| **PREPARED BY** | **Paul Adams**<br>Engineer (RF Marine) |
| **APPROVED BY** | **Martin Hardy**<br>Authorised Signatory |
| **DATED** | 17 October 2023 |

**CONTENTS**

**SECTION 1**


**REPORT SUMMARY**


Emergency Beacons Testing of the
Jotron AS
Tron SA20

## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Jotron AS Tron SA20 to the requirements of Cospas-Sarsat T.007.

The scope of testing was defined between C/S and the Manufacturer.

| | |
|---|---|
| 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 | Jotron AS |
| Model Number(s) | Tron SA20 |
| Serial Number(s) | 101<br>115<br>120<br>157 |
| Number of Samples Tested | 4 |
| Test Specification/Issue/Date | Cospas-Sarsat T.007 Issue 5 Rev 9 November 2022 |
| Date of Receipt of Test Samples | 8 December 2022 |
| Order Number<br>Date | P55347<br>16 September 2022 |
| Start of Test | 09 December 2022 |
| Finish of Test | 22 May 2023 |
| Name of Engineer(s) | P Adams<br>M Sellers<br>C Bland |
| Related Documents | Cospas-Sarsat T.001 Issue 4 Rev 10 Nov 2022<br>Cospas-Sarsat T.IP (TCXO) Issue 1 Rev 5 Oct 2013 |

## 1.2 APPLICATION FORM

### G.1 – Beacon Manufacturer and Beacon Model

| | |
|---|---|
| Beacon Manufacturer | Jotron AS |
| Beacon Manufacturer's Address | Ringdalskogen 8, 3270 Larvik |
| Beacon Model Name | Tron SA20 |
| Additional Beacon Model Names | |

### G.1 – Beacon Type and Operational Configurations

| Beacon Type | Beacon Used While | Tick Where Appropriate (X) |
|---|---|---|
| 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 | x |
| | On ground and above ground and floating in water | |
| | On ground, above ground, and on a personal floatation device* | |
| ELT Survival | On ground and above ground | |
| | On ground and above ground and floating in water | |
| ELT Auto Fixed | Fixed ELT with aircraft external antenna | |
| ELT(DT) | Distress Tracking ELT with aircraft external antenna | |
| ELT Auto Portable | In aircraft with an external antenna | |
| | On ground, above ground, or in a safety raft with an integrated antenna | |
| ELT Auto Deployable | Deployable ELT with attached antenna | |
| Other (specify) | | |

* Applicable only to PLBs with integral antennas operated while attached to personal flotation devices (e.g. lifejackets) where the PLB and its antenna are mounted on PFD in such a position, that, in the nominal mode of operation, they are kept above water.

## G.1 - Beacon Characteristics

| Characteristic | Declared Value | |
|---|---|---|
| Operating frequency (406 MHz operating channel = 406.nnn) | 406.031 MHz | |
| Operating temperature range | Tmin = -20 °C | Tmax= 55 °C |
| Temperature, at which minimum duration of continuous operation is expected (Submit C/S T.007 Section 5, part s, if applicable) | Tmin ☒ | or Other ( nn °C) |
| Manufacturer-declared Minimum Operating Lifetime* | Yes | 24 hours |
| | No | 48 hours, or |
| * this value is specified by National Administrations or International Organisations | No | 168 hours, or |
| | No | Other hours |
| | << Specify >> | Other hours, (specify) |
| Beacon power supply type (internal non-rechargeable, internal re-chargeable, external, combined, other) | Internal non-rechageable | |
| | Current (AC / DC): | << AC / DC >> |
| External power supply parameters (AC/DC, nomiminal voltage, nominal minimum and nominal maximum voltage) | Nominal Voltage (V): | << Nominal Voltage >> |
| | Nominal Minimum Voltage (V): | << Nominal Minimum Voltage >> |
| | Nominal Maximum Voltage (V): | << Nominal Maximum Voltage >> |
| Is external power supply needed to energise the beacon or its ancillary devices in any of operational modes (N/A or Yes or No) | N/A | |

| Battery cell chemistry | Lithium/Iron Disulfide (Li/FeS2) | |
|---|---|---|
| Battery cell model name, cell size, number of cells in a battery pack, and details of the battery pack electrical configuration | Cell Model Name: | L91 |
| | Cell Size: | AA size |
| | Number of Cells in Battery Pack: | 4 |
| | Details of the battery pack electrical configuration: | 4S |
| Battery cell manufacturer | Energizer | |
| Battery pack manufacturer and part number | Battery Pack Manufacturer Name: | Jotron AS |
| | Battery Pack Part Number: | 103929 |
| Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon) | 1 | years |
| Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon) | 12.5 | years |
| Oscillator type (e.g. OCXO, MCXO, TCXO) | TCXO | |
| Oscillator manufacturer | RAKON | |
| Oscillator model name/ part number | Model Name: | Pluto |
| | Part Number: | E8149LF |
| 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 | Jotron AS | |
| Antenna part name and part number (OEM, if applicable, and beacon manufacturer's) | OEM Model Name: | N/A |
| | OEM Part Number: | N/A |
| | Beacon Manufacturer's Model Name: | N/A |
| | Beacon Manufacturer's Part Number: | 103719 |
| Antenna cable assembly min/max RF- losses at 406 MHz, if applicable | Minimum loss (dB): | |
| | Maximum loss (dB): | |
| Navigation device type (Internal, External or None) | Internal | |
| Features in beacon that prevent degradation to 406 MHz signal or other beacon performances resulting from a failure of navigation device or failure to acquire position data (Yes, No, or N/A) | Yes | |

| Description | Value | |
|---|---|---|
| Features in beacon that ensure 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) and | Yes | |
| Encoded position update interval value (range) | 4:45 - 6:00 | minutes |
| 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 | µ-Blox | |
| Navigation device model name and part Number | Model Name: MAX-M10 / Part Number: MAX-M10S | |
| Internal navigation device antenna type(integrated, internal, external, passive/active) , manufacturer and model | Integrated | |
| GNSS system supported (e.g. GPS, GLONASS, Galileo) | GPS, Galileo, Glonass | |
| For External Navigation Devices | | |
| Data protocol for GNSS receiver to beacon interface | | |
| Physical interface for beacon to navigation device | | |
| Electrical interface for beacon to navigation device | | |
| Part number of the external navigation interface device (if applicable) | | |
| Navigation device model and manufacturer (if beacon designed to use specific devices) | | |
| Self-Test Mode Characteristics: | Self-Test Mode | Optional GNSS Self-test Mode |
| Activated by a separate switch/ separate switch position (Yes or No) | Yes | Yes |
| Self-test/GNSS self-test mode switch automatically returns to normal position when released (Yes or No) | Yes | Yes |
| Self-test/ GNSS self-test activation can cause an operational mode transmission (Yes or No) | No | 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 | Yes |

| | 1 Test-LED flash Green= OK Test-LED flashes RED= Fail | 1 Test-LED flash Green= OK Test-LED flashes RED= Fail |
|---|---|---|
| Results of self-test / GNSS self-test are indicated by (provide details, e.g. Pass / Fail indicator light, strobe light, etc.) | | |
| The content of the encoded position data fields of the self-test message has default values | Yes | N/A |
| Performs an internal check and indicates that RF-power is being emitted at 406 MHz and 121.5 MHz, if beacon includes a 121.5 Hz homer (Yes or No) | Yes | Yes |
| Self-test results in transmission of a signal other than at 406 MHz (Yes & details or No) | Yes, 121.5 MHz | Yes, 121.5 MHz |
| Self-test can be activated directly at beacon (Yes or No) | Yes | Yes |
| List of Items checked by self-test | RF-transmitters, Sufficient energy (PIE), GNSS functional test, Check for RLS protocol | RF-transmitters, Sufficient energy (PIE), GNSS functional test, GNSS position acquired, Check for RLS protocol, Max number of GNSS self-tests |
| Self-test/ GNSS self-test 406 MHz burst duration (440 or 520 ms) | 520 ms | 520 ms |
| Self-test message length format flag in bit 25, ("0" or "1") | "1" | "1" |
| Maximum duration of a self-test mode, sec | 9 | 150 |
| Maximum recommended number of self-tests / GNSS self-tests during battery pack replacement period (as applicable) | 150 | 60 |
| Distinct indication of self-test start (Yes or No) | Yes | Yes |
| Indication of self-test results (Yes or No) | Yes | Yes |
| Distinct indication of insufficient battery capacity (Yes or No) | Yes | Yes |
| Automatic termination of self-test mode immediately after completion of the self-test cycle (Yes or No) | Yes | Yes |
| GNSS Self-test results in transmission of a single burst, irrespectively of the test result (Yes or No) | N/A | No |
| 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 modes activation. Provide details on a separate sheet to describe | Press TEST button in 2 seconds, test-LED lights up. | Press TEST button in 7 seconds, test-LED and GNSS LED lights up |
| Repetitive Automated Interrogation of a Beacons Status (Yes & details per section 5.1, item (y), or No) | No | |

| Message Coding Protocols | Protocol Option | Tick Where Appropriate (X) |
|---|---|---|
| User Protocol | 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 | EPIRB with MMSI | X |
| | EPIRB with Serial Number | X |
| | ELT with 24-bit Address | |
| | ELT with Aircraft Operator Designator | |
| | ELT with Serial Number | |
| | PLB with Serial Number | X |
| National Location Protocol | National Location: EPIRB | |
| | National Location: ELT | |
| | National Location: PLB | X |
| ELT(DT) Location Protocol | ELT with Serial Number | |
| | ELT with Aircraft Operator and Serial Number | |
| | ELT with Aircraft 24-bit Address | |
| | ELT with Serial Number and 3LD in PDF-2 | |
| | ELT with Aircraft 24-bit Address and 3LD in PDF-2 | |
| RLS Location Protocol (TAC or NRN and Serial Number) | EPIRB | X |
| | ELT | |
| | PLB | X |
| RLS Location Protocol (MMSI) | EPIRB | X |
| | PLB | X |
| User Location Protocol | 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 |

| Other Declarations | Declared Value | | | Yes / No |
|---|---|---|---|---|
| Beacon includes a homer transmitter(s) (Yes or No) | Yes | | | |
| - homer transmitter(s) frequency and power | | Frequency | Power (dBm) | |
| | | 121.5 MHz | 17dbm±3 dB | Yes |
| | | 243.0 MHz | << Power >> | No |
| | | AIS | | No |
| | | Other (MHz) | >27 dBm | No |
| | | << frequency >> | << Power >> | << Yes / No >> |
| | | Description: | << Description >> | |
| homer transmitter(s) duty cycle | 96% DC for 121.5 MHz | | % | |
| duty cycle of homer swept tone | 35 | | % | |
| Beacon includes a high intensity flashing light (e.g. Strobe) | Yes | | | |
| - light intensity | >0.75 | | cd | |
| - flash rate | 21 | | flashes per minute | |
| Beacon transmission repetition period satisfies C/S T.001 requirement that two beacon's repetition periods are not synchronised closer than a few seconds over 5 minute period, and the time intervals between transmissions are randomly distributed on the interval 47.5 to 52.5 seconds (Yes or No) | 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. | Night vision low-duty cycle light | | | |
| Beacon includes automatic activation mechanism (Yes or No). Specify type of automatic beacon activation mechanism | Yes / No :    Description: | | | No |
| Beacon includes a voice-transceiver (Yes or No), and if Yes specify: | Yes / No : | | | No |
| Voice transmitter nominal output power | If Yes, specify: (dBm) | | | <<dBm>> |
| Voice transmitter operating frequencies | If Yes, specify: (MHz) | | | <<MHz>> |
| - provides prevention against continuous operation of voice transmitter (Yes or No), and if Yes specify: | Yes / No : | | | << Yes / No >> |
| - maximum continuous voice-transmission operation ("time-out timer") | "Time-out timer" (minutes): | | | << minutes / n/a >> |
| - maximuim cumulative transmit-mode on-time ("On time") | On time (hours : minutes): | | | << hours >> : <<minutes>> |

| 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 | Yes | |
|---|---|---|
| | Description: | NFC - Tag |
| Beacon model hardware part number (P/N) and version | P/N 103675 Rev 03 | |
| Beacon model firmware P/N, version, date of issue/releases | 104721 Rev 1.3 (30. Nov 2022) | |
| Beacon model software P/N, version, date of issue/releases | N/A | |
| Beacon model printed circuit board P/N and version | P/N 103905 - Rev 2137 | |
| Beacon model multiple programmable options, except message coding protocols (Yes/No) | No | |
| | If Yes, List all programmable options associated with this type-approval application: | |
| Known non-compliances with C/S T.001 requirements (Yes or No). If Yes, provide details (Submit C/S T.007 Section 5, part t, if applicable) | No | |
| Beacon Manufacturer Point of Contact (POC) for this Type Approval application: | | |
| Name and Job Title: | Frank Løke, Certification Manager, Jotron AS | |
| Phone: | +47 90 01 30 51 | |
| E-mail: | frank.loke@jotron.com | |

| Dated(*) 12.10.2023 | 12.10.2023 |
|---|---|
| Signed(*) _Frank Løke_ | Frank Løke |
| (Name, Position and Signature of Beacon Manufacturer Representative) | Same as above |

**Information Provided by the Cospas-Sarsat Accepted Test Facility**

Name and Location of Beacon Test Facility: <u>TÜV SÜD, United Kingdom</u>

Date of Submission for Testing: <u> 8 December 2022 </u>

**Applicable C/S Standards:**

| Document | Issue | Revision | Date |
|---|---|---|---|
| C/S T.001 | 4 | 10 | November 2022 |
| C/S T.007 | 5 | 9 | November 2022 |
| IP (TCXO) | - | 5 | October 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.

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

Non-compliances:

For MTS analysis the EUT fails to comply with the limits stated in Cospas-Sarsat IP (TCXO) – Rev.5 October 2013. However, the results fall within the MU provided in Cospas-Sarsat IP (TCXO) – Rev.5 October 2013.


Deviations:

None

Notes:

The manufacturer has provided a statement (see Annex A, Manufacturer Supplied Information) identifying a transmission loss in the BNC antenna to pin-head adapters fitted on the conducted samples provided for this approval. The transmission loss is as follows:
- 406 MHz: +0.3 dB, and
- 121.5 MHz: +0.1 dB.

The results in Test Results Table include the raw power measurement along with results which have the 406 MHz offset with applied offset in brackets next to the measured values.

Signed: _____

Name: _____Martin Hardy_____

Position Held: _____Authorised Signatory_____

Date: _____17 October 2023_____

## 1.3 PRODUCT INFORMATION

### 1.3.1 Technical Description

The Equipment Under Test (EUT) was a Jotron AS Tron SA20 as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.



Equipment Under Test

### 1.3.2 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 (S/N 101). See the note section above regarding a manufacturer declared cable loss for the conducted samples. The test configuration for all tests is identical with the exception of Antenna Characteristics and Satellite Qualitative.

Two fully packaged beacons were supplied, similar to the proposed production beacons equipped with their proper antennas (S/N 115, 157). One EUT was used to perform Antenna Characteristics (157) and the second for Satellite Qualitative (115).  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.

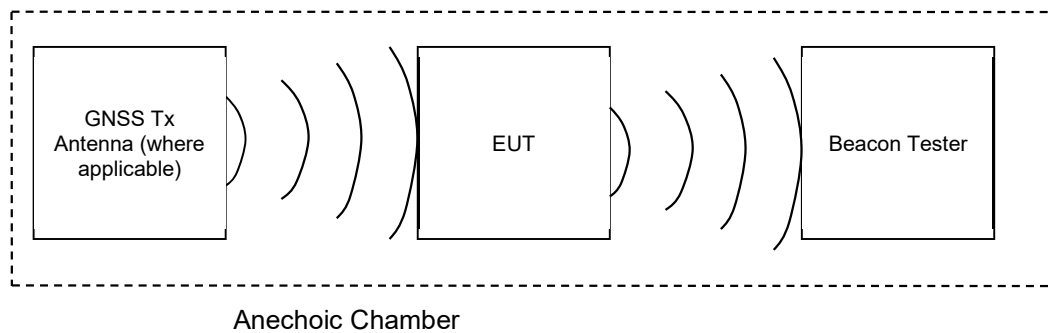The final EUT was a fully packaged beacon with an additional NMEA data output which enabled monitoring of the GNSS Receiver for the RLM Reception Verification tests (S/N 120).

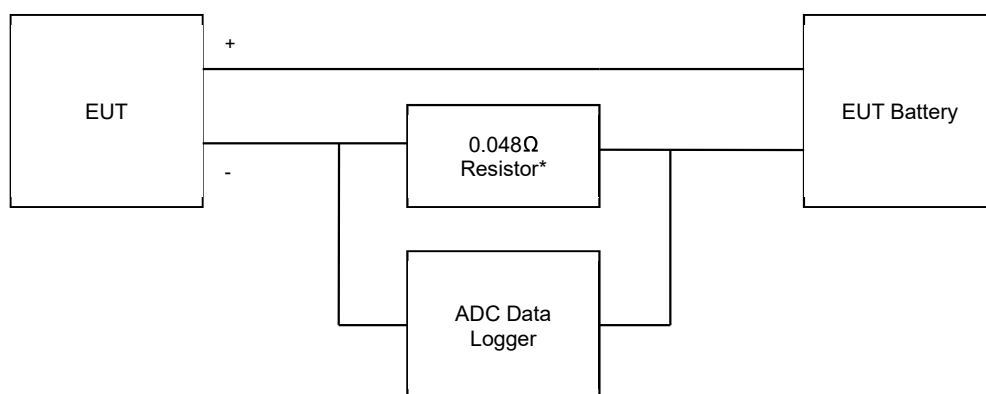System Configurations

Conducted Laboratory Tests



Climatic Chamber
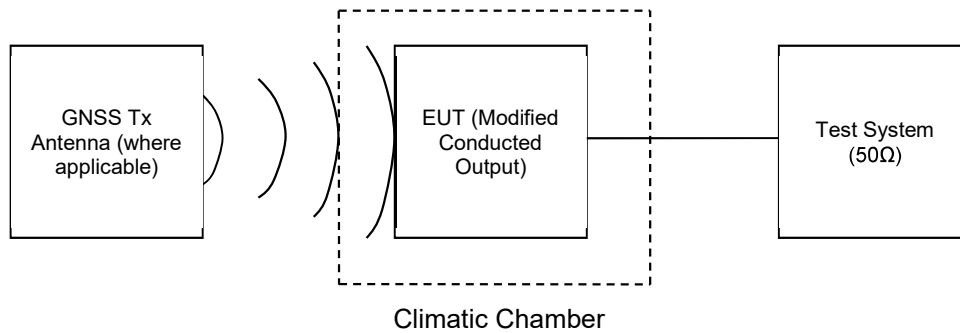
A.3.8.3 Navigation Test



Anechoic Chamber

Battery Current Measurements



Note: The resistor in series with negative line of battery

* Removed for Standby mode measurements

For other Navigation, Satellite and Antenna test configurations, see photographs in section 4 of this report.

Further Information

Battery current measurements (see 'Operating lifetime', section 2.7) concluded that the 'worst case' (highest current) operating mode of the EUT was On at EUT (A3) (GNSS Search), subject to the EUT Duty cycle (see Manufacturer document "Statements and descriptions" Rev 03 in Annex A). All tests were carried out in this mode.
The Battery conditioning was performed with a 0.07 h deficit. This was taken into account with the test results provided.

The EUT is fitted with a TCXO. The model and serial number of this oscillator used for this Type Approval is Model: E8149, S/No: VP8476.

The EUT is fitted with an internal GNSS receiver. From cold start, without GNSS signal data present, the duty cycle of the receiver is as described in the manufacturer information (see Annex A). After a 15 minute warm up, electrical and functional tests were carried out for 30 minutes to ensure that measurements were made during periods when the GNSS receiver was active and inactive.

### 1.3.3 Modes of Operation

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

Off/Standby Mode
- No apparent Activity

NFC Mode
- Interrogate the NFC device with an NFC field

Self-test
- Black "Test" Button held and released after 2 seconds.
- List of items checked as per Customer Supplied Information (Application Form)
- No Navigation data applied.

Long/GPS/GNSS Self-test
- Black "Test" Button held and released after 7s
- 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
- Slide the red cover down. Unfold and tilt the antenna into the vertical position. Press the Red "ON" Button for 2s.
- 121 Homer active and offset
- GNSS operating in normal duty cycle.
- No navigation data applied (unless otherwise stated).

All modes

All mode descriptions are applicable to all tests unless otherwise stated.

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

## 1.4 TEST LOCATIONS

Satellite Qualitative/Navigation test A.3.8.2.1: Daedalus Airfield, Lee-on-the-Solent, Hants, UK
All other tests: Octagon House Laboratory, Fareham, Hampshire, UK

## 1.5 MODIFICATIONS

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

## 1.6 REPORT MODIFICATION RECORD

Issue 1 – First Issue
Issue 2 – Update to manufacturer suppled information and Table F.E-5.
Issue 3 – Decoded messages throughout the report inspected and corrected. Digital message generator requirements updated in summary table. Beacon coding software summary table updated with full file name declared by manufacturer. Position data encoding summary table updated with full file name declared by manufacturer. Navigation test results for A.3.8.3 have been updated to reflect the correct limits and the results have been updated to reflect the testing performed. The RLS GNSS Receiver Tracking Test in the summary table has been updated to reflect the correct limits. Battery current pre-discharge calculation amended.  Annex G updated as supplied by Manufacturer.

**SECTION 2**


**TEST DETAILS**




Emergency Beacons Testing of the
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# TEST RESULTS TABLE

| Parameters to be Measured | | Range of Specification | Units | Test Results | | | Comments |
|---|---|---|---|---|---|---|---|
| | | | | Tmin (-20°C) | Tamb (+21°C) | Tmax (+55°C) | |
| **1. Power Output** | | | | | | | **Result: Pass** |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State 0** | | | | | | | |
| Transmitter power output | (maximum) | 35 – 39 | dBm | 36.40 (36.70)* | 36.35 (36.65)* | 36.36 (36.66)* | *Power offset applied |
| | (minimum) | | | 36.31 (36.61)* | 36.33 (36.63)* | 36.35 (36.65)* | |
| Power output rise time | (maximum) | < 5 | ms | 1.896 | 1.869 | 1.808 | |
| | (minimum) | | | 1.876 | 1.847 | 1.775 | |
| Power output 1ms before burst | (maximum) | <-10 | dBm | -19.98 | -21.73 | -22.03 | |
| | (minimum) | | | -33.81 | -37.04 | -34.51 | |
| **2. Digital Message Coding** | | | | | | | **Result: Pass** |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 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 | 111000 | 111000 | 111000 |
| 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 (-20°C) | Tamb (+21°C) | Tmax (+55°C) | |
| **3. Digital Message Generator** | | | | | | | **Result: Pass** |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State 0** | | | | | | | |
| Repetition rate, $T_R$: | | | | | | | |
| Average $T_R$ | | $48.5 \leq T_{Ravg} \leq 51.5$ | seconds | 49.867 | 50.125 | 50.011 | |
| Minimum $T_R$ | | $47.5 \leq T_{Rmin} \leq 48.0$ | seconds | 47.863 | 47.839 | 47.706 | |
| Maximum $T_R$ | | $52.0 \leq T_{Rmax} \leq 52.5$ | seconds | 52.301 | 52.288 | 52.32 | |
| Standard deviation | | $0.5 - 2.0$ | seconds | 1.363 | 1.568 | 1.394 | |
| Bit rate | | | | | | | |
| Minimum fb | | $\geq 399.6$ | bits/sec | 399.91 | 399.91 | 399.91 | |
| Maximum fb | | $\leq 400.4$ | bits/sec | 400.00 | 400.00 | 400.00 | |
| Total transmission time | | | | | | | |
| Short message | (maximum) | $435.6 - 444.4$ | ms | N/A | N/A | N/A | |
| | (minimum) | | | N/A | N/A | N/A | |
| Long message | (maximum) | $514.8 - 525.2$ | ms | 521.258 | 521.461 | 521.602 | |
| | (minimum) | | | 521.187 | 521.437 | 521.562 | |
| Unmodulated carrier | | | | | | | |
| Minimum T1 | | $\geq 158.4$ | ms | 159.055 | 159.180 | 159.242 | |
| Maximum T1 | | $\leq 161.6$ | ms | 159.125 | 159.211 | 159.602 | |
| First burst delay | | $\geq 47.5$ | seconds | 53.9 | 53.8 | 53.4 | |

| Parameters to be Measured | | Range of Specification | Units | Test Results | | | Comments |
|---|---|---|---|---|---|---|---|
| | | | | Tmin (-20°C) | Tamb (+21°C) | Tmax (+55°C) | |
| **4. Modulation** | | | | | | | **Result: Pass** |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State 0** | | | | | | | |
| Biphase-L | | P / F | P / F | P | P | P | |
| Rise time | (maximum) | 50 – 250 | µs | 129.5 | 138.7 | 130.5 | |
| | (minimum) | 50 – 250 | µs | 137.8 | 130.3 | 137.3 | |
| Fall time | (maximum) | 50 – 250 | µs | 137.1 | 136.0 | 135.8 | |
| | (minimum) | 50 – 250 | µs | 129.5 | 129.8 | 130.4 | |
| Phase deviation: positive | (maximum) | +(1.0 to 1.2) | radians | 1.146 | 1.126 | 1.121 | |
| | (minimum) | +(1.0 to 1.2) | radians | 1.050 | 1.053 | 1.054 | |
| Phase deviation: negative | (maximum) | -(1.0 to 1.2) | radians | -1.155 | -1.140 | -1.139 | |
| | (minimum) | -(1.0 to 1.2) | radians | -1.060 | -1.070 | -1.073 | |
| Symmetry measurement | | ≤ 0.05 | radians | 0.02932 | 0.02910 | 0.02949 | |
| **5. 406 MHz Transmitted Frequency** | | | | | | | **Result: Pass** |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State 0** | | | | | | | |
| Nominal Value | (maximum) | C/S T.001 | MHz | 406.031104983 | 406.031056712 | 406.031097565 | |
| | (minimum) | | | 406.031105171 | 406.031056908 | 406.031098744 | |
| Short-term stability | (maximum) | ≤ $2 \times 10^{-9}$ | /100ms | 2.24E-10 | 2.04E-10 | 2.03E-10 | |
| | (minimum) | | | 1.69E-10 | 1.80E-10 | 1.75E-10 | |
| Medium-term stability – Slope | (maximum) | $(-1 \text{ to } +1) \times 10^{-9}$ | /minutes | 4.59E-11 | 3.86E-11 | 3.72E-10 | |
| | (minimum) | | | -1.88E-10 | 1.88E-11 | 7.31E-11 | |
| Medium-term stability – Residual frequency variation | (maximum) | ≤ $3 \times 10^{-9}$ | | 5.05E-10 | 1.66E-10 | 3.46E-10 | |
| | (minimum) | | | 1.90E-10 | 9.57E-11 | 1.60E-10 | |
| **6. Spurious Emissions into 50ohms** | | | | | | | **Result: Pass** |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State 0** | | | | | | | |
| In band (406.0 – 406.1 MHz) | | C/S T.001 mask | P / F | P | P | P | |

| Parameters to be Measured | | Range of Specification | Units | Test Results | | | Comments |
|---|---|---|---|---|---|---|---|
| | | | | Tmin (-20°C) | Tamb (+21°C) | Tmax (+55°C) | |
| 7. 406 MHz VSWR Check | | | | | | | Result: Pass |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State 0** | | | | | | | |
| Nominal Value | (maximum) | C/S T.001 | MHz | 406.0311048 | 406.0310573 | 406.0311005 | |
| | (minimum) | | | 406.0311033 | 406.0310575 | 406.0311002 | |
| Modulation rise time | (maximum) | 50-250 | µs | 139.1 | 137.7 | 137.5 | |
| | (minimum) | 50-250 | µs | 129.7 | 130.4 | 130.1 | |
| Modulation fall time | (maximum) | 50-250 | µs | 136.8 | 136.4 | 136.3 | |
| | (minimum) | 50-250 | µs | 129.5 | 129.5 | 130.4 | |
| Modulation phase deviation: positive | (maximum) | + (1.0 to 1.2) | radians | 1.130 | 1.126 | 1.124 | |
| | (minimum) | + (1.0 to 1.2) | radians | 1.040 | 1.039 | 1.059 | |
| Modulation phase deviation: negative | (maximum) | - (1.0 to 1.2) | radians | -1.157 | -1.154 | -1.140 | |
| | (minimum) | - (1.0 to 1.2) | radians | -1.066 | -1.072 | -1.069 | |
| Modulation symmetry measurement | | ≤ 0.05 | | 0.02945 | 0.02957 | 0.02959 | |
| Digital Message | | correct | P / F | P | P | P | |

| Parameters to be Measured | Range of Specification | Units | Test Results | | | Comments |
|---|---|---|---|---|---|---|
| | | | Tmin (–20°C) | Tamb (+21°C) | Tmax (+55°C) | |
| 8(a). Self-test Mode | | | | | | Result: Pass |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 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 | 521.38 | 521.50 | 521.67 | |
| 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 | | |
| Single burst verification | one burst | P / F | P | P | P | |
| Provides for 15 Hex ID | correct | P / F | P | P | F | |
| 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 | |
| Distinct indication of RF power being emitted | provided | Y / N | Y | Y | Y | |
| Indication of Self-Test result | provided | Y / N | Y | Y | Y | |
| Distinct indication of insufficient battery capacity | provided | Y / N | | Y | | |
| Maximum duration of Self-Test mode | ≤ maximum duration of Self-Test | sec | 8 | 8 | 8 | Manufacturer specified value: 9 |
| Automatic termination of Self-Test mode upon completion of Self-Test and indication of Self-Test results | verify automatic termination, irrespective of the switch position | Y / N | Y | Y | Y | |

| Parameters to be Measured | Range of Specification | Units | Test Results | | | Comments |
|---|---|---|---|---|---|---|
| | | | Tmin (-20°C) | Tamb (+21°C) | Tmax (+55°C) | |
| 8 (b). GNSS Self-Test Mode (if applicable) | | | | | | Result: Pass |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State 0** | | | | | | |
| Frame sync | 011010000 | P / F | P | P | P | |
| Format flag | 1 / 0 | bit value | 1 | 1 | 1 | |
| Radiated burst duration | ≤ 520 (+1%) | ms | 521.38 | 521.5 | 521.5 | |
| Position data except for ELT (DT) (if applicable) | must be within 500 m (or 5.25 km for User Location Protocol) of the actual position | P / F | P | P | P | |
| Position data for ELT(DT) | must be within 200 m of the actual horizontal position and 700 m of the altitude | P / F | N/A | N/A | N/A | |
| Position data from External Navigation Input | must be within 200m (or 5.25 km for User Location Protocol) of the location data obtained from the external navigation interface | 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 | | |
| Single burst verification (if applicable) | one burst | P / F | P | P | P | |
| 121.5 MHz RF power (if applicable) | verify that RF power is emitted | Y / N | Y | Y | Y | |
| 406 MHz power (if applicable) | verify that RF power is emitted | Y / N | Y | Y | Y | |
| Maximum duration of GNSS Self-tests | Manufacturer to specify value | s | 133 | 136 | 134 | Manufacturer specified value: 150 |
| Actual duration of Self-test with encoded location | Less than maximum duration | s | 34 | 40 | 33 | |
| Maximum number of GNSS Self-tests (only beacons with internal navigation devices) | Manufacturer to specify number | Number | | 60 | | Manufacturer specified number: 60 |
| Distinct indication to register successful completion or failure of the GNSS self-test | must be provided | Y/N | Y | Y | Y | |
| Distinct indication that a maximum number of GNSS self-tests has been attained after GNSS self-test mode activation and without transmission of a test message or further GNSS receiver current drain | must be provided | Y/N | | Y | | |
| Automatic termination of the GNSS self-test mode upon completion of the GNSS self-test cycle and indication of the results | verify automatic termination of GNSS self-test mode, irrespective of the switch position | Y / N | Y | Y | Y | |

| Parameters to be Measured | Range of Specification | Units | Test Results | | Comments |
|---|---|---|---|---|---|
| **9. Thermal Shock** | | | | | **Result: Pass** |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State 0** | | | | | |
| Soak Temperature | 30°C difference | °C | 22 | | |
| Measurement Temperature | | °C | -8 | | |
| Transmitted Frequency | | | Min | Max | |
| Nominal value | C/S T.001 | MHz | 406.0310831 | 406.0310919 | |
| Short-term stability | ≤ 2x10⁻⁹ | /100ms | 1.59E-10 | 2.05E-10 | |
| Medium-term stability – Slope | (-2 to +2)x10⁻⁹ | /min | -1.19E-10 | 1.12E-09 | |
| Medium-term stability – Residual frequency variation | ≤ 3x10⁻⁹ | | 9.36E-11 | 5.30E-10 | |
| Transmitter power output | 35 – 39 | dBm | 36.27 (36.57)* | 36.33 (36.63)* | *Power offset applied |
| 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: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State 0** | | | | | |
| Pre-test battery discharge duration (operating) required | | Hours | 7.71 | | Discharged at a constant current of 50mAh. |
| Pre-test battery discharge duration (operating) | | Hours | 8.73 | | |
| Duration | >24 | Hours | 36.93 Hours at Tmin = -20°C | | Time to first failure 36:56:47 |
| Effective Operating Lifetime duration | >24 | Hours | 36.93 Hours at Tmin = -20°C | | Min/Max results are up to the manufacturer declared lifetime of 24hrs. MTS results exclude the first 30 mins of data (included in the test results section of this report). |
| Transmitted Frequency | | | Min | Max | |
| Nominal value | C/S T.001 | MHz | 406.0311019 | 406.0311217 | |
| Short-term stability | ≤ 2x10⁻⁹ | /100ms | 6.68E-11 | 3.57E-10 | |
| Medium-term stability – Slope | (-1 to +1)x10⁻⁹ | /min | -6.44E-11 | 7.06E-11 | |
| Medium-term stability – Residual frequency variation | ≤ 3x10⁻⁹ | | 6.94E-11 | 3.57E-10 | |
| Transmitter power output | 35 - 39 | dBm | 36.64 (36.94)* | 36.78 (37.08)* | *Power offset applied |
| Digital message | correct | P/F | P | | |
| Homer transmitter continuous operation during the lifetime test | | hours | 42.7 | | End of test taken as 24hrs (Manufacturer declared lifetime). |
| | | | Start of Test | End of Test | |
| Homer frequency | | MHz | 121.499498998 | 121.499498998 | |
| Homer peak power level | | dBm | 21.8 (21.9)* | 21.7 (21.8)* | *Power offset applied |
| Homer transmitter duty cycle | | % | 98.92 | 98.89 | |

| Parameters to be Measured | Range of Specification | Units | Test Results | | Comments |
|---|---|---|---|---|---|
| | | | Min | Max | |
| **11. Temperature Gradient (5°C/hr)** | | | | | **Pass** |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State 0** | | | | | |
| **Full Test** | | | | | |
| Transmitted Frequency | | | Min | Max | |
| Nominal value | C/S T.007 | MHz | 406.0310489 | 406.0311085 | |
| Short-term stability | ≤ 2x10⁻⁹ | /100ms | 1.40E-10 | 2.33E-10 | |
| Medium-term stability – Slope[1] | (-1 to +1)x10⁻⁹ | /min | -8.38E-11 | 4.46E-10 | Data for points A to B, C+15 min to D and E+15 min to F |
| | (-2 to +2)x10⁻⁹ | /min | -8.34E-10 | 7.39E-10 | Data for points B to C+15 min and D to E+15 min |
| Medium-term stability – Residual frequency variation | ≤ 3x10⁻⁹ | | 6.56E-11 | 1.44E-09 | |
| Transmitter power output | 35 – 39 | dBm | 36.01 (36.31)* | 36.23 (36.53)* | *Power offset applied |
| Digital message | correct | P/F | P | | **Result: Non-compliance** |
| **12. Oscillator Aging** | | | | | |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State** | | | | | |
| 5 year carrier nominal frequency variation | provided | Y / N | Y | | |
| MTS analysis (if applicable) | Must demonstrate compliance | P / F | F * | | * The EUT fails to comply with the limits stated in Cospas-Sarsat IP (TCXO) – Rev.5 October 2013. However, the results fall within the MU provided in Cospas-Sarsat IP (TCXO) – Rev.5 October 2013. |
| **13. Protection Against Continuous Transmission** | | | | | |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State 0** | | | | | |
| Description | provided | Y / N | Y | | Applicant's data, see Annex A for details |

| 14. Satellite Qualitative Tests | | | | | | | Result: Pass |
|---|---|---|---|---|---|---|---|

**Model: Tron SA20, S/N: 115, TUV Ref: TSR5 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 | N/A | N/A | P | P |
| Doppler Location results with error ≤ 5km | ≥ 80 | % | N/A | N/A | 100 | 94.7 |

| 15. Antenna Characteristics | | | | | | | Result: Pass |
|---|---|---|---|---|---|---|---|

**Model: Tron SA20, S/N: 157, TUV Ref: TSR4 and Modification State 0**

| Test Configuration | As per C/S T.007 | | Configuration | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | |
| Polarisation | linear or RHCP | | N/A | N/A | Linear | Linear | Detachable Antennas Only |
| VSWR | ≤ 1.5 | | N/A | N/A | N/A | N/A | |
| $EIRP_{LOSS}$ | | dB | N/A | N/A | -0.42 | -0.42 | |
| $EIRP_{maxEOL}$ | ≤ 43 | dBm | N/A | N/A | 42.70 | 41.36 | |
| $EIRP_{minEOL}$ | ≥ 32* | dBm | N/A | N/A | 34.44 | 37.06 | * $EIRP_{minEOL}$ limit decreases to 30 dBm for Configuration 4 |

| 16. Beacon Coding Software | | | | Result: Pass |
|---|---|---|---|---|

**Model: Tron SA20, S/N: (Stated in Manufacturer Supplied Report)**

| Sample message for each coding option of the applicable coding types | correct | P / F | P | Applicant's data, Refer to Manufacturer's supplied document: Tron SA20 PLB Jotron_A2.8_Beacon_coding_software_rev_C |
|---|---|---|---|---|
| Sample self-test message for each coding option of the applicable coding types | correct | P / F | P | |

N/A = Not Applicable

| Parameters to be Measured | Range of Specification | Units | Test Results | | | Comments |
|---|---|---|---|---|---|---|
| | | | National | Standard | RLS | |
| Location protocol | C/S T.001 | | | | | **Result: Pass** |
| **17. Navigation System** | | | | | | |
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State 0** | | | | | | |
| **Internal Navigation Device** | | | | | | |
| Position data default values | Correct | P / F | P | P | P | |
| **Configuration 7** | | | | | | |
| Position accuracy - A.3.8.2.1 | C/S T.001 | m | 22.82 | 22.18 | 22.19 | |
| Position Acquisition Time - A.3.8.2.1 | <10/1 | min | 0.88 | 0.87 | 0.86 | |
| Position accuracy - A.3.8.2.2 | C/S T.001 | m | 35.53 | 35.53 | 35.53 | |
| Position Acquisition Time - A.3.8.2.2 | <10/1 | min | 0.88 | 0.89 | 0.87 | |
| **Configuration 8** | | | | | | |
| Position accuracy - A.3.8.2.1 | C/S T.001 | m | 64.90 | 22.18 | 22.19 | |
| Position Acquisition Time - A.3.8.2.1 | <10/1 | min | 0.87 | 0.87 | 0.87 | |
| Position accuracy - A.3.8.2.2 | C/S T.001 | M | 35.53 | 35.53 | 35.53 | |
| Position Acquisition Time - A.3.8.2.2 | <10/1 | min | 0.95 | 0.88 | 0.95 | |
| - encoded position data update interval | | min | 4.93 | 4.98 | 4.98 | |
| - for beacons that do not allow encoded position data updates | encoded position data does not change | P / F | N/A | N/A | N/A | |
| - for beacons with internal navigation device and capable to provide the encoded position data updates (except for ELT(DT)s) for the duration of operating lifetime. | encoded position data remains unchanged for 6 to 20 bursts | P / F | P | P | P | |
| Beacon Encoded Position Update Interval (mm:ss) | | max | 05:55 | 05:55 | 05:10 | |
| | | min | 05:41 | 05:44 | 04:50 | |

| | Cleared | P / F | P | P | P | |
|---|---|---|---|---|---|---|
| Position clearance after deactivation | Cleared | P / F | P | P | P | |
| Position data encoding | Correct | P / F | P | P | P | Refer to Manufacturer's supplied document: Tron SA20 PLB A3.8.7 Position Data Encoding |
| Retained last valid position after navigation input lost | 240(±5) | min | 241.38 | 241.95 | 241.38 | |
| 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 |

| Parameters to be Measured | Range of Specification | Units | Test Results | Comments |
|---|---|---|---|---|
| 18. Return Link Service (RLS) | | | | Result: Pass |
| **Model: Tron SA20, S/N: 120, TUV Ref: TSR25 and Modification State 0** | | | | |
| A.3.8.8.1 RLM Reception Verification Test | Test RLM message received | | Pass | |
| A.3.8.8.2 Moffset Test – Config 8 Above Ground | | | | |
| Self-Test for correct 15 Hex ID | 193BF6A031BFDFF | N/A | 193BF6A031BFDFF | |
| a) RLS Indication<br><br>RLS request unique distinct indication | ≤ 5 seconds after first transmission of RLS request until a valid RLM Type 1 or Test RLM message is received | s | 1 | Test Start 08:12:02 UTC<br>RLS Request 08:12:56 UTC<br>RLS Indication 08:12:57 UTC |
| RLS indication is readily visible to the user when the beacon is operated in all declared operational configurations | Must be correct | P/F | P | |
| RLS indication is clearly visible to the user in direct sunlight, at a distance of 1 meter from the beacon. | Must be correct | P/F | P | |
| RLS indication remain inactive at all times when the beacon is encoded with any protocol other than RLS Location Protocol or RLS Location Test Protocol; | Must be correct | P/F | P | |
| Distinct indication that the RLM Type–1 or Test RLM has been received | < 5 sec, after the RLM has been received until either the beacon is deactivated or the beacon battery is expired | s | 0 | RLM Reception 08:13:44 UTC<br>RLM Indication 08:13:44 UTC |
| The beacon only provides the indication of receipt of the RLM Type 1 or Test RLM, which contain the beacon 15 Hex ID | Must be correct | | Pass | |
| b) Transmitted Message Bits 109 – 114 | 100001 | N/A | 100001 | 36 Hex message:<br>FFFE2F8C9DFB5018CCD0156FA3B84FBEA8E5 |
| c) GNSS Receiver turns on | ≤ 5 seconds after beacon activation | s | 1* | * GNSS receiver activates at beacon start up. |

| Parameters to be Measured | Range of Specification | Units | Test Results | Comments |
|---|---|---|---|---|
| d) Time to output UTC | Record time since receiver activation | s | 10 | UTC lock 08:12:12 UTC |
| e) GNSS Receiver on time | ≥ 30 minutes after beacon activation | min | N/T | RLM was received at 08:13:44 UTC, the beacon only supports Type-1 RLM therefore parts e) and h) to k) do not apply. |
| f) Time to indicate RLM receipt | ≤ 30 minutes after beacon activation | min | 1.7 | |
| g) Transmitted Message Bits 109 to 114 | 101001 | N/A | 101001 | 36 Hex message: FFFE2F8C9DFB5018CCD0156FA3BA4FBEA421 |
| h) GNSS Receiver reactivation time | Moffset minutes +/- 5 seconds past next natural hour | min | N/T | |
| i) GNSS Receiver on time | ≥ 15 minutes after reactivation | min | N/T | |
| j) GNSS Receiver reactivation time | Moffset minutes +/- 5 seconds past next natural hour | min | N/T | |
| k) GNSS Receiver on time | ≥ 15 minutes after reactivation | min | N/T | |

| Parameters to be Measured | Range of Specification | Units | Test Results | Comments |
|---|---|---|---|---|
| A.3.8.3 UTC Test - Config 8 Above Ground | | | | |
| a) Visual Indication | ≤ 5 seconds after first transmission | sec | 1 | Test Start 13:16:12 UTC<br>RLS Request 13:17:08 UTC<br>RLS Indication 13:17:09 UTC |
| b) Transmitted Message Bits 109 to 114 | 100001 | N/A | 100001 | 36 Hex message:<br>FFFE2F8C9DFB5018CCD0156FA3B84FBEA8E5 |
| c) GNSS Receiver turns on | ≤ 5 seconds after beacon activation | s | 1* | *GNSS receiver activates at beacon start up. |
| d) Time to output UTC | Record time since receiver activation | s | 9 | UTC Lock 13:16:21 |
| e) GNSS Receiver position output<br>Deny Beacon further GNSS signals | Valid Lat/Long<br>No further receiver outputs | N/A<br>N/A | Pass<br>Pass | |
| f) Transmitted message valid location<br><br>Message Bits 109 to 114 | ≤ 500m of actual beacon location<br>100001 | m<br><br>N/A | 22.69<br><br>100001 | Actual Position: N 50° 52.1423', W 1° 14.6799'<br>Encoded Position: N 50° 52' 8", W 1° 14' 40"<br>Position Error: 22.69 m<br>36 Hex message:<br>FFFE2F8C9DFE7018CCD0153323784FBEA8E5 |
| g) GNSS Receiver on time | ≥ 30 minutes after beacon activation | min | 30.2167 | GNSS Sleep 13:46:25 UTC |
| h) GNSS Receiver reactivation time (or must be already on) | Moffset minutes<br>+/- 5 seconds past next natural hour | min | 54.9667 | GNSS Reactivation 13:54:58 UTC |
| i) GNSS Receiver on time | ≥ 15 minutes after reactivation | min | 16.05 | GNSS Sleep 14:11:01 UTC |
| j) Transmitted message valid location<br><br>Message Bits 109 to 114 | ≤ 500m of actual beacon location<br>100001 | m<br><br>N/A | 22.69<br><br>100001 | Actual Position: N 50° 52.1423', W 1° 14.6799'<br>Encoded Position: N 50° 52' 8", W 1° 14' 40"<br>Position Error: 22.69 m<br>36 Hex message:<br>FFFE2F8C9DFE7018CCD0153323784FBEA8E5 |
| k) GNSS Receiver reactivation time (or must be already on) | Moffset minutes<br>+/- 5 seconds past next natural hour | min | 54.9833 | GNSS Reactivation at 14:54:59 |
| m) GNSS Receiver on time | ≥ 15 minutes after reactivation | min | N/T | 15 min period does not apply as the RLM was received at 14:57:57 UTC and beacon only accepts Type-1 RLM. Part m) is not applicable. |
| n) Time to indicate RLM receipt | ≤ 15 minutes after receiver reactivation | min | 2.9667 | RLM was received at 14:57:57 UTC |
| o) Transmitted Message Bits 109 to 114 * | 101001 | N/A | 101001 | 36 Hex message:<br>FFFE2F8C9DFB5018CCD0156FA3BA4FBEB118 |

| Parameters to be Measured | Range of Specification | Units | Test Results | Comments |
|---|---|---|---|---|
| RLS GNSS Receiver Tracking Test | | | | Pass |
| A.3.8.5 RLS GNSS Receiver Tracking Test | ≥ detection of 90% of RLS-GNSS satellites (rounded down to the nearest integer number) visible at elevation of ≥ 5 degrees at least once for each 15-minute test period | N/A | Pass | Applicant's data reviewed by TUV SUD, Refer to Manufacturer's supplied document: Tron SA20 - RLS GNSS Receiver Satellite Tracking_RevA. |

| 22. Testing Beacon Controls | | | Result: Pass |
|---|---|---|---|
| **Model: Tron SA20, S/N: 101, TUV Ref: TSR3 and Modification State 0** | | | |
| Self-test controls | Comply with A.3.10.1 (i) | P/F | P |
| GNSS self-test controls | Comply with A.3.10.1 (ii) | P/F | P |
| Operational controls | Comply with A.3.10.2 | P/F | P |

## 2.1 POWER OUTPUT

### 2.1.1 Specification

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

### 2.1.2 Equipment Under Test and Modification State

Tron SA20, S/N: 101 - Modification State 0

### 2.1.3 Date of Test

### 2.1.4 16 January 2023, 17 January 2023 and 18 January 2023

### 2.1.5 Test Equipment Used

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

### 2.1.6 Laboratory Environmental Conditions

Ambient Temperature 21.5 - 22.8°C
Relative Humidity 19.3 - 29.9%

### 2.1.7 Test Results

Ambient Temperature
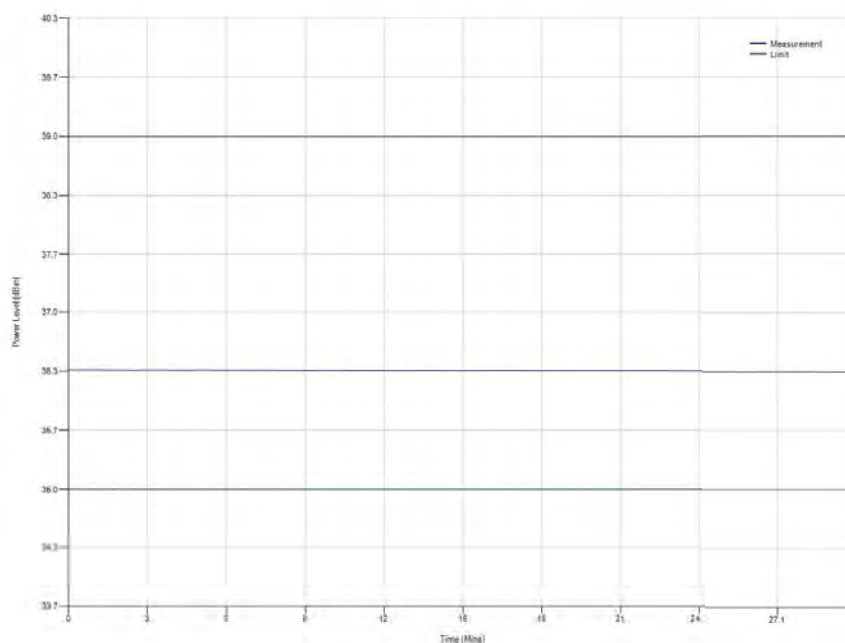
Low Temperature (-20°C)
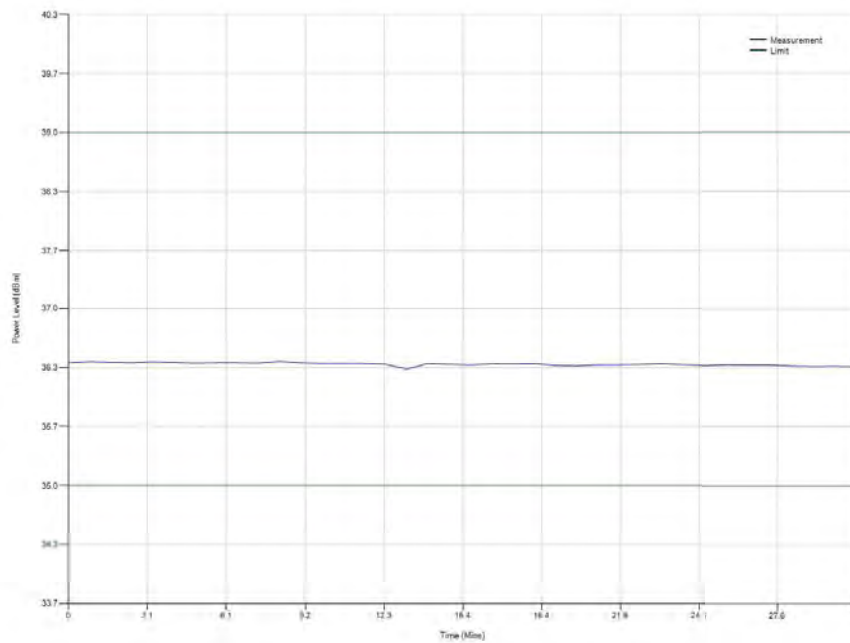


High Temperature (+55°C)



Summary

The EUT complies with clause A.3.2.2 of Cospas-Sarsat T.007.

## 2.2 DIGITAL MESSAGE

### 2.2.1 Specification

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

### 2.2.2 Equipment Under Test and Modification State

Tron SA20, S/N: 101 - Modification State 0

### 2.2.3 Date of Test

### 2.2.4 16 January 2023, 17 January 2023 and 18 January 2023

### 2.2.5 Test Equipment Used

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

### 2.2.6 Laboratory Environmental Conditions

Ambient Temperature 21.5 - 22.8°C
Relative Humidity 19.3 - 29.9%

### 2.2.7 Test Results

Test Duration: 30 minutes
No. of bursts: 37

## Decoded Beacon Message

Hexadecimal code: **FFFE2F8C9OFE7018DFEFF8129DF861F0FABE**

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 Issue 4 – Rev 5.

Unique identifier:
19OBFCE031BFDFF

| Binary Range | Binary Content | Field Name | Decoded Value |
|---|---|---|---|
| 1-15 | 111111111111111 | Bit-synchronization pattern consisting of "1"s shall occupy the first 15-bit positions. | True |
| 15-24 | 000101111 | Frame Synchronization Pattern | Normal beacon operation |
| 25 | 1 | Format Flag | Long Message |
| 26 | 0 | Protocol Flag | Location, further information provided in "Protocol Code" |
| 27-36 | 0011001001 | Country code | Albania - 201 |
| | | For associated SAR Points of Contact (SPOC) related to Albania - 201 | Search Contact list here |
| 37-40 | 1101 | Protocol Code | RLS Location Protocol |
| 41-42 | 11 | Beacon type | RLS Test Location |
| 43-46 | 1111 | Identification type | RLS protocol coded with MMSI last 6 digits |
| 47-66 | 10011100000001100011 | Last 6 digits MMSI | 639075 |
| 67-75 | 011111111 | Latitude | Default - no location (Default - no location) |
| 76-85 | 0111111111 | Longitude | Default - no location (Default - no location) |
| 86-106 | 000000100101001110111 | BCH-1 error correcting code | BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field |
| 107 | 1 | Encoded position source | Encoded position data is provided by an internal navigation device |
| 108 | 1 | 121.5 Mhz Homing Device | Included in beacon |
| 109 | 1 | Beacon capability to process and automatically generated RLM Type-1 | Capable to process an automatically generated RLM Type-1 |
| 110 | 0 | Beacon capability to process a manually generated RLM Type-1 RLM Type-2 | Not capable to process a manually generated RLM Type-2 |
| 111 | 0 | Beacon Feedback on receipt of RLM Type-1 | RLM Type-1 (automatic) not received by this beacon |
| 112 | 0 | Beacon Feedback on receipt of RLM Type-2 | RLM Type-2 (manually) not received by this beacon |
| 113-114 | 01 | RLS Provider Identification | GALILEO Return Link Service Provider |
| 115-123 | 100001111 | Latitude offset | Default value |
| 124-132 | 100001111 | Longitude offset | Default value |
| 133-144 | 101010111110 | BCH-2 error correcting code | BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field |

# Decoded Beacon Message

Hexadecimal code: **FFFE2F8C9OFE7018DFEFF8129DF861F0FABE**

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 Issue 4 - Rev 6.

Unique identifier:
19DBFCE031BFDFF

| Binary Range | Binary Content | Field Name | Decoded Value |
|---|---|---|---|
| 1-15 | 111111111111111 | Bit-synchronization pattern consisting of "1"s shall occupy the first 15-bit positions. | True |
| 15-24 | 000101111 | Frame Synchronization Pattern | Normal beacon operation |
| 25 | 1 | Format Flag | Long Message |
| 26 | 0 | Protocol Flag | Location, further information provided in "Protocol Code" |
| 27-36 | 0011001001 | Country code | Albania - 201 |
| | | For associated SAR Points of Contact (SPOC) related to Albania - 201 | Search Contact list here |
| 37-40 | 1101 | Protocol Code | RLS Location Protocol |
| 41-42 | 11 | Beacon type | RLS Test Location |
| 43-46 | 1111 | Identification type | RLS protocol coded with MMSI last 6 digits |
| 47-66 | 1001110000 0001100011 | Last 6 digits MMSI | 639075 |
| 67-75 | 011111111 | Latitude | Default - no location (Default - no location) |
| 76-85 | 0111111111 | Longitude | Default - no location (Default - no location) |
| 86-106 | 0000001001 0100111011 1 | BCH-1 error correcting code | BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field |
| 107 | 1 | Encoded position source | Encoded position data is provided by an internal navigation device |
| 108 | 1 | 121.5 Mhz Homing Device | Included in beacon |
| 109 | 1 | Beacon capability to process and automatically generated RLM Type-1 | Capable to process an automatically generated RLM Type-1 |
| 110 | 0 | Beacon capability to process a manually generated RLM Type-1 RLM Type-2 | Not capable to process a manually generated RLM Type-2 |
| 111 | 0 | Beacon Feedback on receipt of RLM Type-1 | RLM Type-1 (automatic) not received by this beacon |
| 112 | 0 | Beacon Feedback on receipt of RLM Type-2 | RLM Type-2 (manually) not received by this beacon |
| 113-114 | 01 | RLS Provider Identification | GALILEO Return Link Service Provider |
| 115-123 | 100001111 | Latitude offset | Default value |
| 124-132 | 100001111 | Longitude offset | Default value |
| 133-144 | 1010101111 10 | BCH-2 error correcting code | BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field |

High Temperature (+55°C)

## Decoded Beacon Message

Hexadecimal code: **FFFE2F8C9OFE7018DFEFF8129DF861F0FABE**

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 Issue 4 - Rev 6.

Unique Identifier:
190BFCE031BFDFF

| Binary Range | Binary Content | Field Name | Decoded Value |
|---|---|---|---|
| 1-15 | 111111111111111 | Bit-synchronization pattern consisting of "1"s shall occupy the first 15-bit positions. | True |
| 15-24 | 000101111 | Frame Synchronization Pattern | Normal beacon operation |
| 25 | 1 | Format Flag | Long Message |
| 26 | 0 | Protocol Flag | Location, further information provided in "Protocol Code" |
| 27-36 | 0011001001 | Country code | Albania - 201 |
| | | For associated SAR Points of Contact (SPOC) related to Albania - 201 | Search Contact list here |
| 37-40 | 1101 | Protocol Code | RLS Location Protocol |
| 41-42 | 11 | Beacon type | RLS Test Location |
| 43-46 | 1111 | Identification type | RLS protocol coded with MMSI last 6 digits |
| 47-66 | 10011100000001100011 | Last 6 digits MMSI | 639075 |
| 67-75 | 011111111 | Latitude | Default - no location (Default - no location) |
| 76-85 | 0111111111 | Longitude | Default - no location (Default - no location) |
| 86-106 | 000000100101001110111 | BCH-1 error correcting code | BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field |
| 107 | 1 | Encoded position source | Encoded position data is provided by an internal navigation device |
| 108 | 1 | 121.5 Mhz Homing Device | Included in beacon |
| 109 | 1 | Beacon capability to process and automatically generated RLM Type-1 | Capable to process an automatically generated RLM Type-1 |
| 110 | 0 | Beacon capability to process a manually generated RLM Type-1 RLM Type-2 | Not capable to process a manually generated RLM Type-2 |
| 111 | 0 | Beacon Feedback on receipt of RLM Type-1 | RLM Type-1 (automatic) not received by this beacon |
| 112 | 0 | Beacon Feedback on receipt of RLM Type-2 | RLM Type-2 (manually) not received by this beacon |
| 113-114 | 01 | RLS Provider Identification | GALILEO Return Link Service Provider |
| 115-123 | 100001111 | Latitude offset | Default value |
| 124-132 | 100001111 | Longitude offset | Default value |
| 133-144 | 101010111110 | BCH-2 error correcting code | BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field |

Summary

The EUT complies with clause A.3.1.4 of Cospas-Sarsat T.007.

## 2.3 MODULATION

### 2.3.1 Specification

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

### 2.3.2 Equipment Under Test and Modification State

Tron SA20, S/N: 101 - Modification State 0

### 2.3.3 Date of Test

16 January 2023, 17 January 2023 and 18 January 2023.

### 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 Laboratory Environmental Conditions

Ambient Temperature 21.5 - 22.8°C
Relative Humidity 19.3 - 29.9%

### 2.3.6 Test Results

Test Duration: 30 minutes
No. of bursts: 37

Ambient Temperature
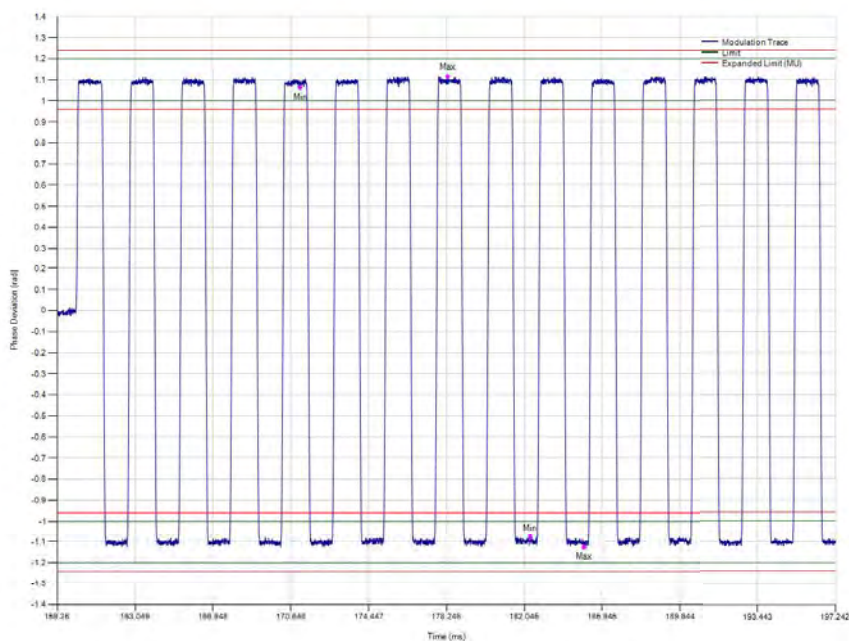
Low Temperature (-20°C)
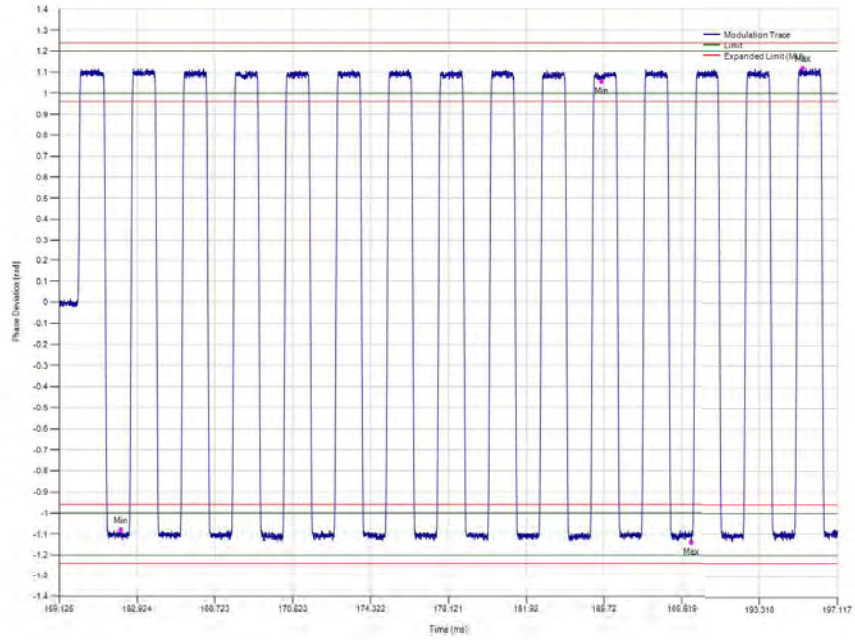
High Temperature (+55°C)
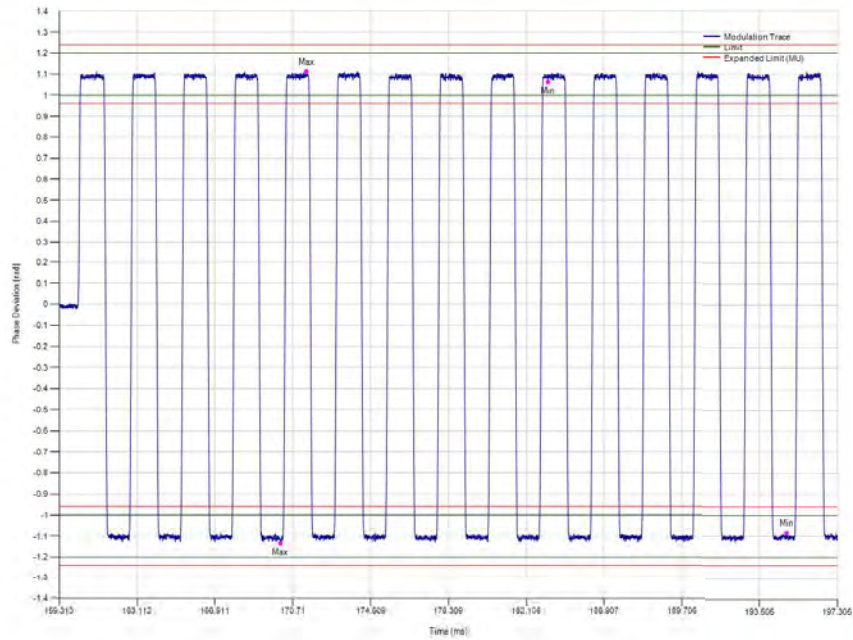


Summary

The EUT complies with clause A.3.2.5 of Cospas-Sarsat T.007.

## 2.4 406 MHZ TRANSMITTED FREQUENCY

### 2.4.1 Specification

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

### 2.4.2 Equipment Under Test and Modification State

Tron SA20, S/N: 101 - Modification State 0

### 2.4.3 Date of Test

16 January 2023, 17 January 2023 and 18 January 2023.

### 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 Laboratory Environmental Conditions

Ambient Temperature 21.5 - 22.8°C
Relative Humidity 19.3 - 29.9%

### 2.4.6 Test Results

Ambient Temperature

Nominal Frequency
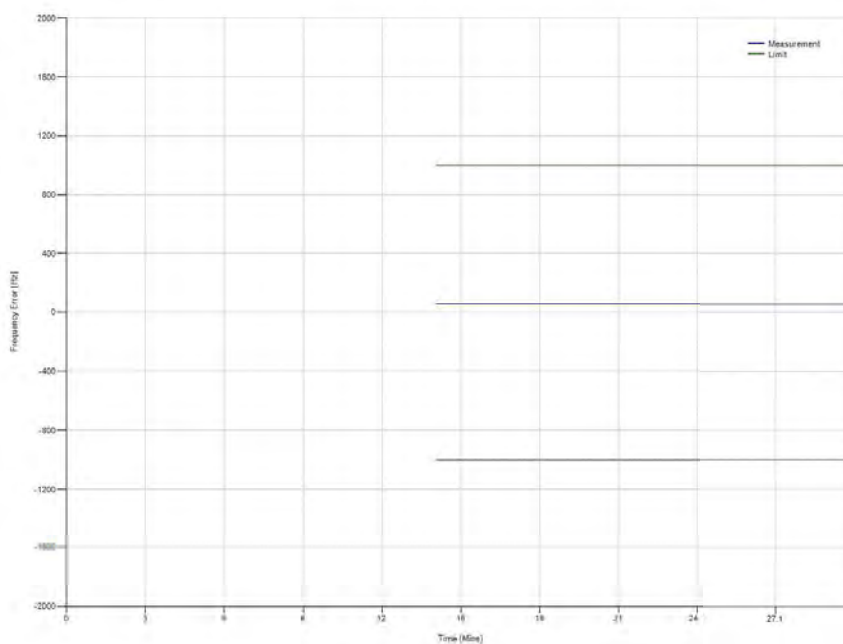
Short Term Stability
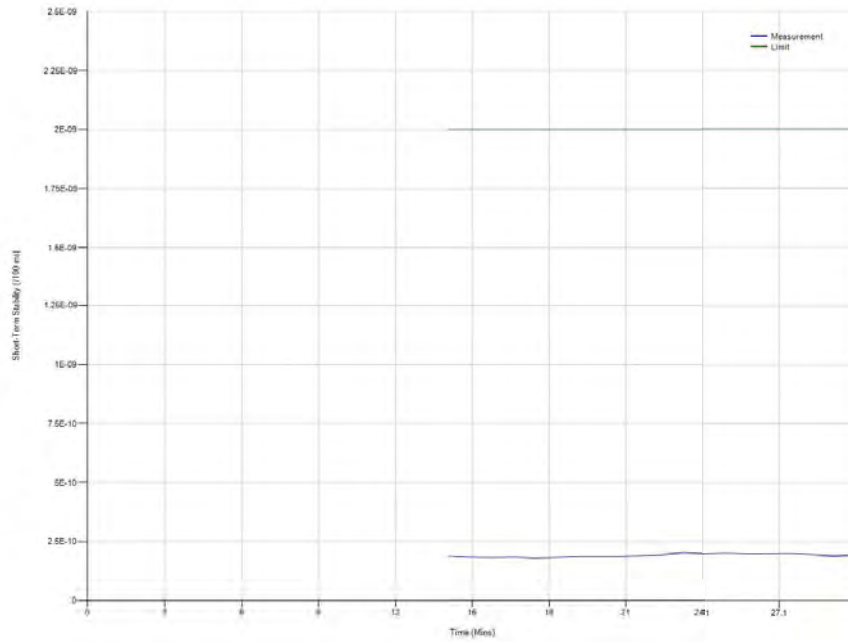


Medium Term Stability – Slope
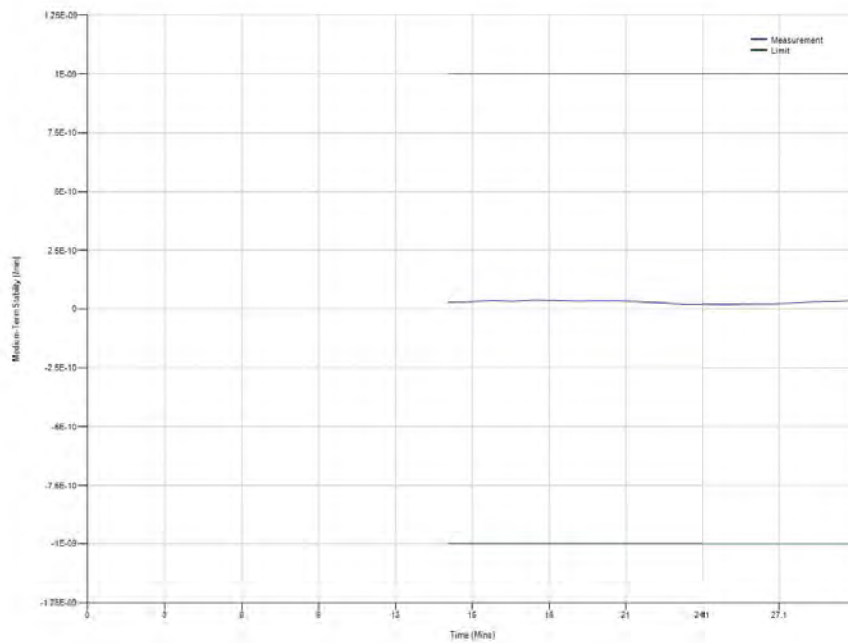
Medium Term Stability – Residual Frequency Variation
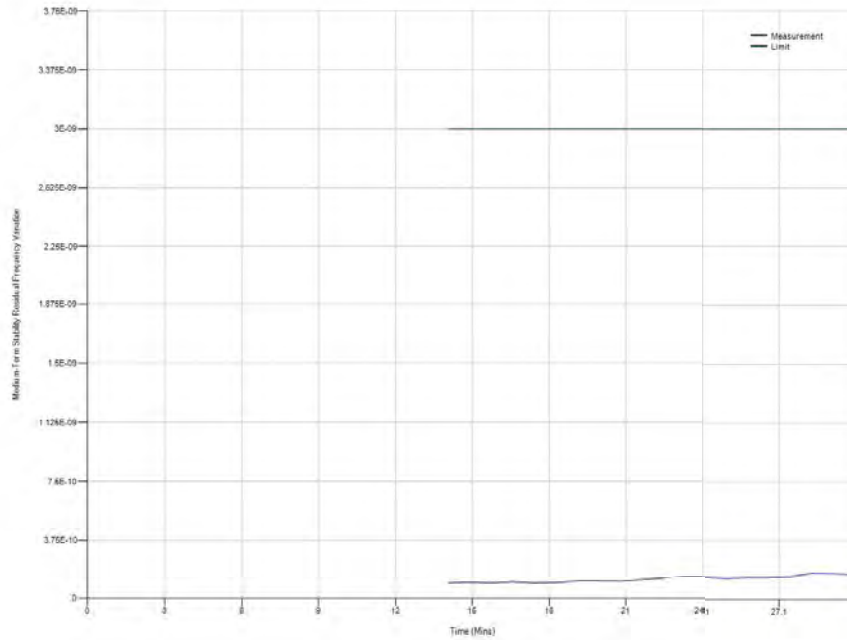
Low Temperature (-20°C)

Nominal Frequency
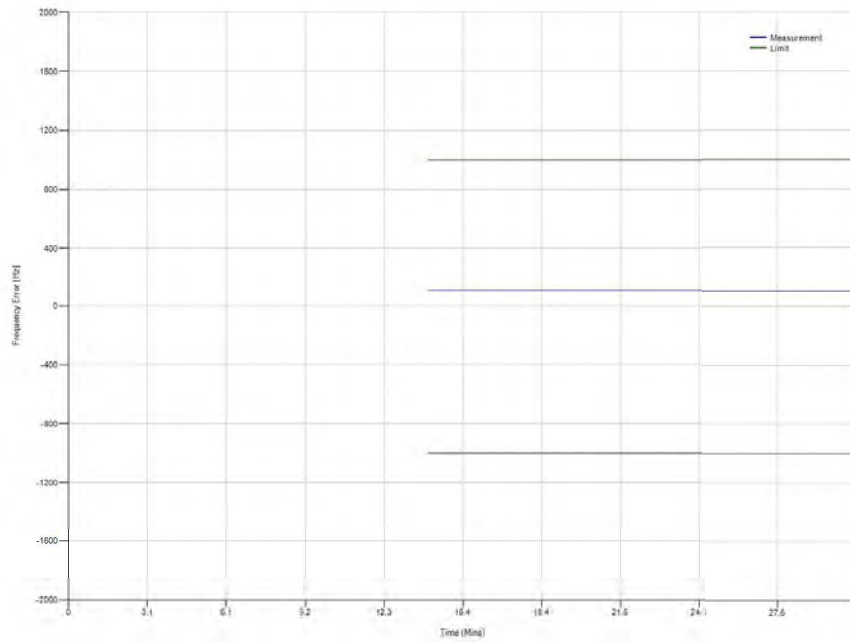


Short Term Stability
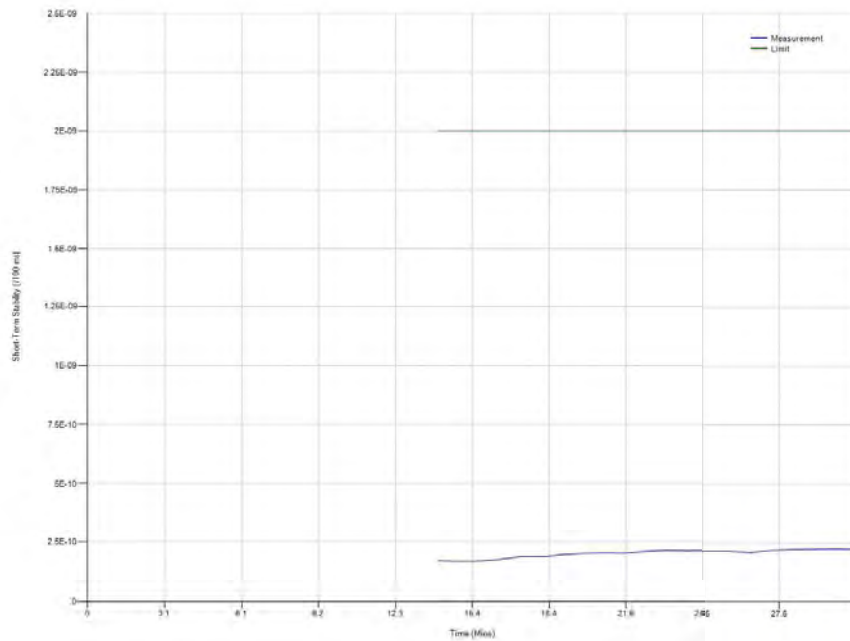
Medium Term Stability – Slope
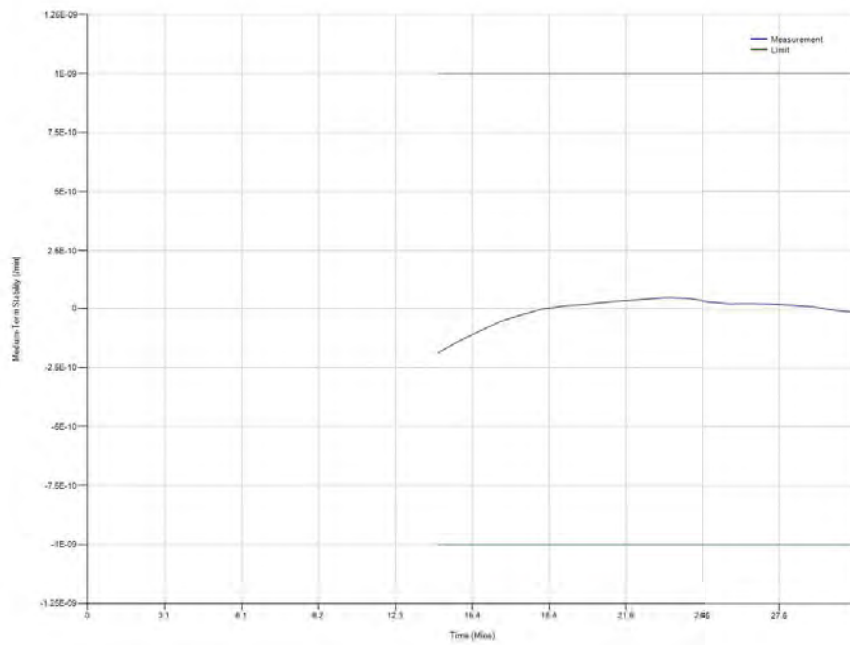


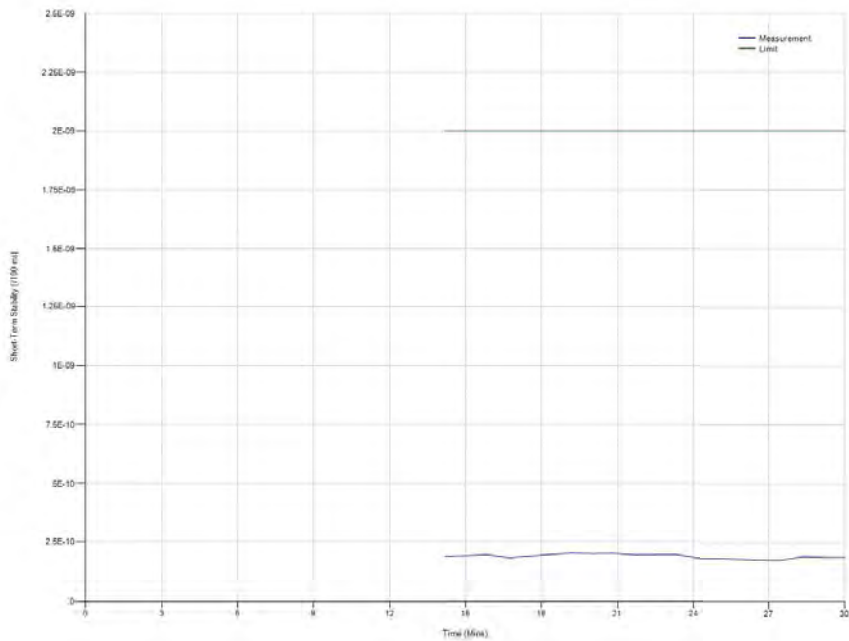Medium Term Stability – Residual Frequency Variation
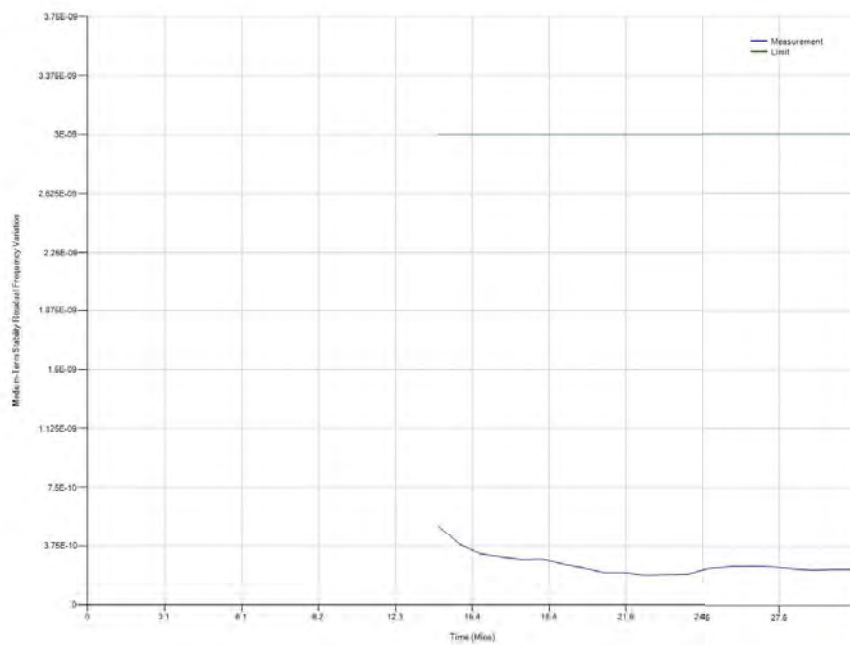
High Temperature (+55°C)

Nominal Frequency
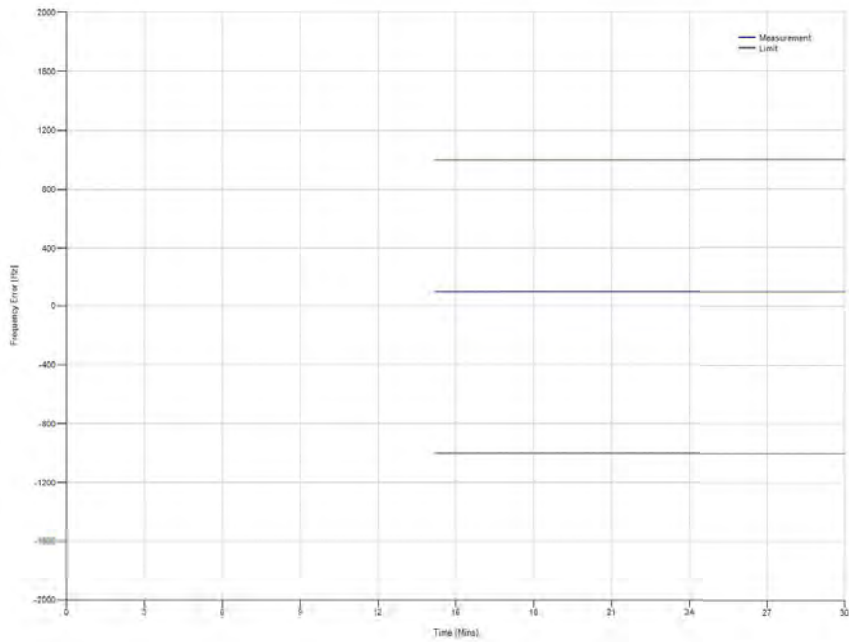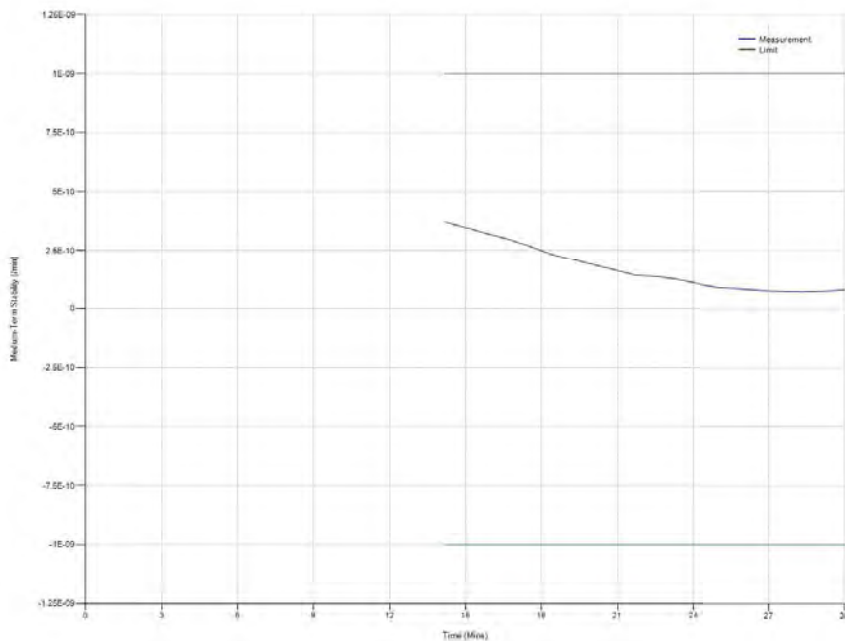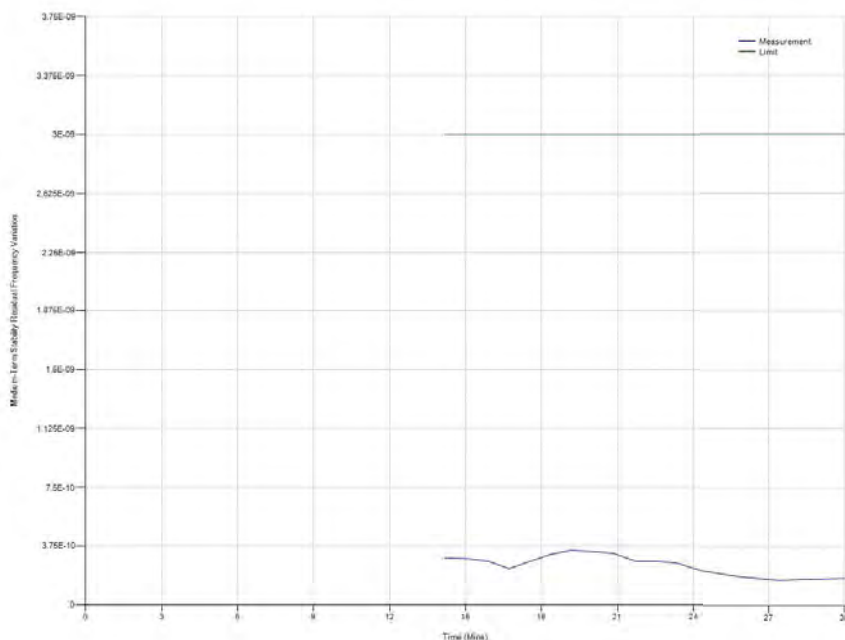


Short Term Stability

Medium Term Stability – Slope



Medium Term Stability – Residual Frequency Variation



Summary

The EUT complies with clause A.3.2.1 of Cospas-Sarsat T.007.

## 2.5    SPURIOUS EMISSIONS INTO 50 OHMS

### 2.5.1    Specification

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

### 2.5.2    Equipment Under Test and Modification State

Tron SA20, S/N: 101 - Modification State 0

### 2.5.3    Date of Test

16 January 2023, 17 January 2023, 18 January 2023

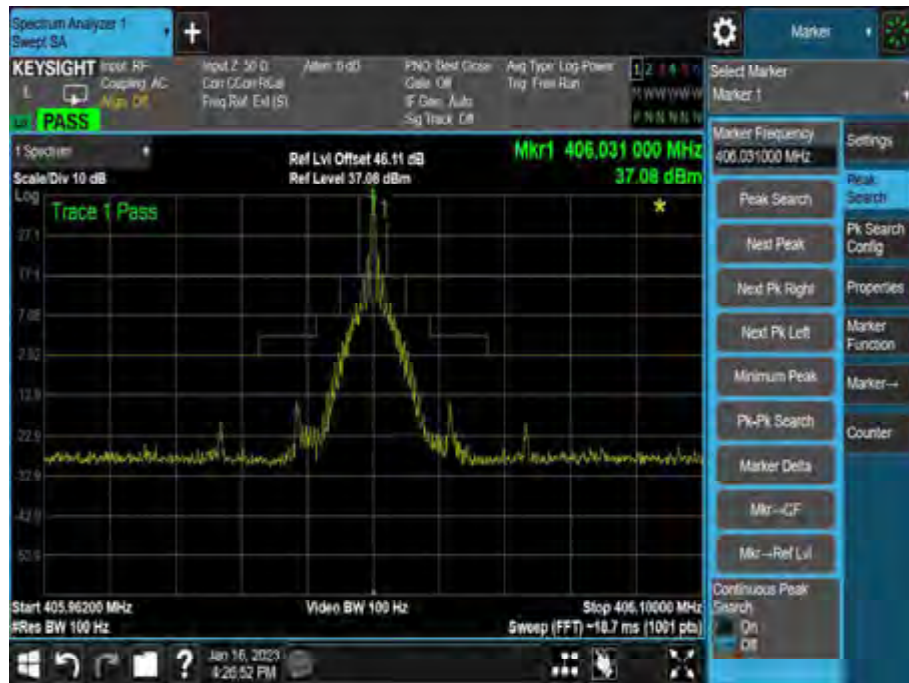### 2.5.4    Test Equipment Used

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

### 2.5.5    Laboratory Environmental Conditions

Ambient Temperature 21.5 - 22.8°C
Relative Humidity 19.3 - 29.9%

### 2.5.6    Test Results

<u>Ambient Temperature</u>



<u>Low (-20°C) Temperature</u>

High (+55°C) Temperature



Summary

The EUT complies with clause A.3.2.4 of Cospas-Sarsat T.007.

### 2.6        406 MHZ VSWR CHECK

#### 2.6.1      Specification

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

#### 2.6.2      Equipment Under Test and Modification State

Tron SA20, S/N: 101 - Modification State 0

#### 2.6.3      Date of Test

16 January 2023, 17 January 2023 and 18 January 2023

#### 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      Laboratory Environmental Conditions

Ambient Temperature 21.3 - 23.3°C
Relative Humidity 19.3 - 29.6%

#### 2.6.6      Test Results

Test Duration: 30 minutes
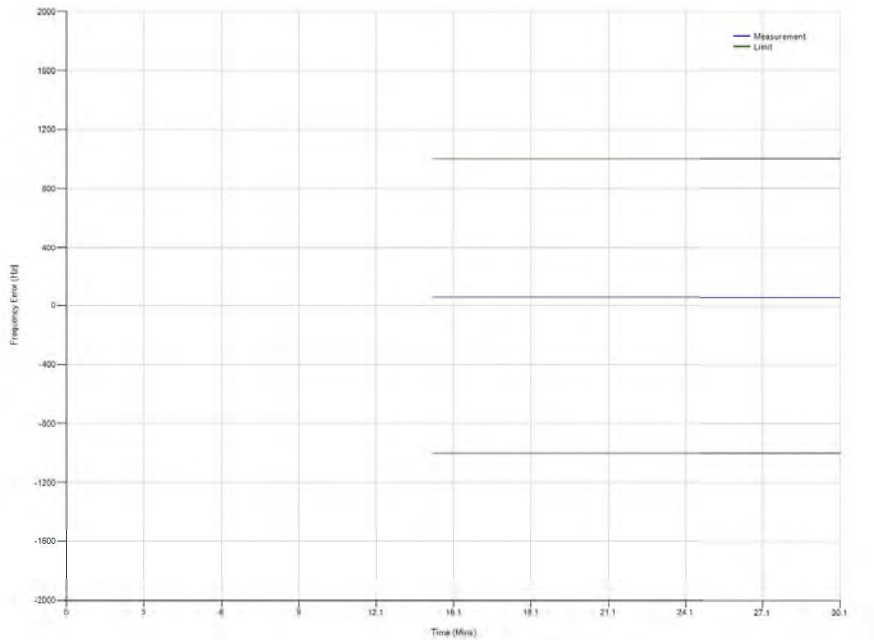No. of bursts: 37

Ambient Temperature

# Decoded Beacon Message

Hexadecimal code: FFFE2F8C9OFE7018DFEFF8129DF861F0FABE

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 Issue 4 - Rev 5
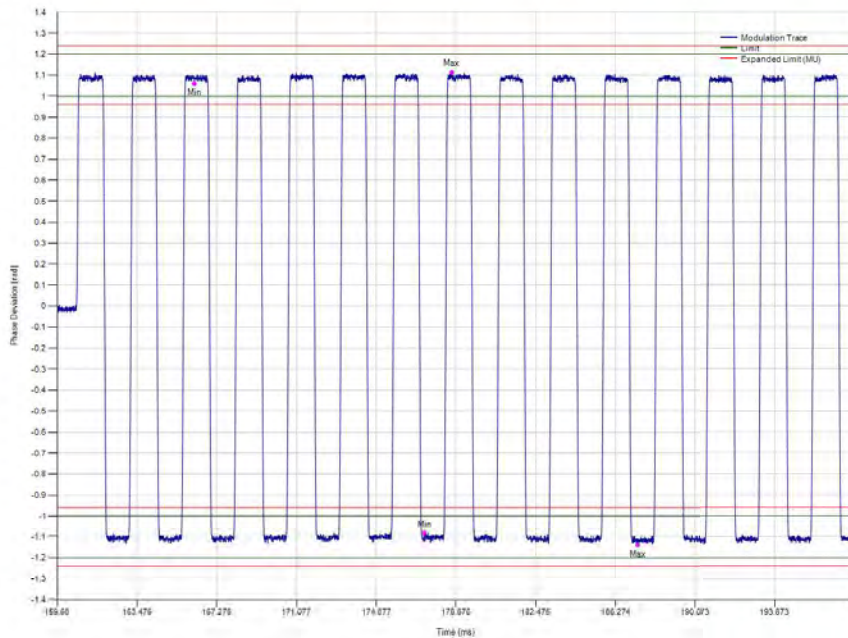
Unique identifier:
190BFCE031BFDFF

| Binary Range | Binary Content | Field Name | Decoded Value |
|---|---|---|---|
| 1-15 | 111111111111111 | Bit-synchronization pattern consisting of "1"s shall occupy the first 15-bit positions. | True |
| 15-24 | 000101111 | Frame Synchronization Pattern | Normal beacon operation |
| 25 | 1 | Format Flag | Long Message |
| 26 | 0 | Protocol Flag | Location, further information provided in "Protocol Code" |
| 27-36 | 0011001001 | Country code | Albania - 201 |
| | | For associated SAR Points of Contact (SPOC) related to Albania - 201 | Search Contact list here |
| 37-40 | 1101 | Protocol Code | RLS Location Protocol |
| 41-42 | 11 | Beacon type | RLS Test Location |
| 43-46 | 1111 | Identification type | RLS protocol coded with MMSI last 6 digits |
| 47-66 | 10011100000001100011 | Last 6 digits MMSI | 639075 |
| 67-75 | 011111111 | Latitude | Default - no location (Default - no location) |
| 76-85 | 0111111111 | Longitude | Default - no location (Default - no location) |
| 86-106 | 000000100101001110111 | BCH-1 error correcting code | BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field |
| 107 | 1 | Encoded position source | Encoded position data is provided by an internal navigation device |
| 108 | 1 | 121.5 Mhz Homing Device | Included in beacon |
| 109 | 1 | Beacon capability to process and automatically generated RLM Type-1 | Capable to process an automatically generated RLM Type-1 |
| 110 | 0 | Beacon capability to process a manually generated RLM Type-1 RLM Type-2 | Not capable to process a manually generated RLM Type-2 |
| 111 | 0 | Beacon Feedback on receipt of RLM Type-1 | RLM Type-1 (automatic) not received by this beacon |
| 112 | 0 | Beacon Feedback on receipt of RLM Type-2 | RLM Type-2 (manually) not received by this beacon |
| 113-114 | 01 | RLS Provider Identification | GALILEO Return Link Service Provider |
| 115-123 | 100001111 | Latitude offset | Default value |
| 124-132 | 100001111 | Longitude offset | Default value |
| 133-144 | 101010111110 | BCH-2 error correcting code | BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field |

Frequency Plot



Modulation Plot

Low Temperature (-20°C)

# Decoded Beacon Message

Hexadecimal code: **FFFE2F8C9OFE7018DFEFF8129DF861F0FABE**

The code consists of 36 hexadecimal characters representing a first generation beacon message with the format flag set to Long including bit and frame synchronization pattern prefix (24 bits) as defined by T.001 Issue 4 - Rev 5

Unique identifier:
190BFCE031BFDFF

| Binary Range | Binary Content | Field Name | Decoded Value |
|---|---|---|---|
| 1-15 | 111111111111111 | Bit-synchronization pattern consisting of "1"s shall occupy the first 15-bit positions. | True |
| 16-24 | 000101111 | Frame Synchronization Pattern | Normal beacon operation |
| 25 | 1 | Format Flag | Long Message |
| 26 | 0 | Protocol Flag | Location, further information provided in "Protocol Code" |
| 27-36 | 0011001001 | Country code | Albania - 201 |
| | | For associated SAR Points of Contact (SPOC) related to Albania - 201 | Search Contact list here |
| 37-40 | 1101 | Protocol Code | RLS Location Protocol |
| 41-42 | 11 | Beacon type | RLS Test Location |
| 43-46 | 1111 | Identification type | RLS protocol coded with MMSI last 6 digits |
| 47-66 | 10011100000001100011 | Last 6 digits MMSI | 639075 |
| 67-75 | 011111111 | Latitude | Default - no location (Default - no location) |
| 76-85 | 0111111111 | Longitude | Default - no location (Default - no location) |
| 86-106 | 00000010010100111011 1 | BCH-1 error correcting code | BCH-1 code in message matches the recalculated BCH-1 from the PDF-1 field |
| 107 | 1 | Encoded position source | Encoded position data is provided by an internal navigation device |
| 108 | 1 | 121.5 Mhz Homing Device | Included in beacon |
| 109 | 1 | Beacon capability to process and automatically generated RLM Type-1 | Capable to process an automatically generated RLM Type-1 |
| 110 | 0 | Beacon capability to process a manually generated RLM Type-1 RLM Type-2 | Not capable to process a manually generated RLM Type-2 |
| 111 | 0 | Beacon Feedback on receipt of RLM Type-1 | RLM Type-1 (automatic) not received by this beacon |
| 112 | 0 | Beacon Feedback on receipt of RLM Type-2 | RLM Type-2 (manually) not received by this beacon |
| 113-114 | 01 | RLS Provider Identification | GALILEO Return Link Service Provider |
| 115-123 | 100001111 | Latitude offset | Default value |
| 124-132 | 100001111 | Longitude offset | Default value |
| 133-144 | 101010111110 | BCH-2 error correcting code | BCH-2 code in message matches the recalculated BCH-2 from the PDF-2 field |