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Report On

Emergency Beacons Testing of the
Astronics DME Corporation SATRO ™, PLB-110
In accordance with Cospas-Sarsat T.007

Document 75914042 Report 01 Issue 4 February 2012

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REPORT ON

Emergency Beacons Testing of the
Astronics DME Corporation
SATRO ™, PLB-110

Document 75914042 Report 01 Issue 4

February 2012

PREPARED FOR

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Mark Jenkins
Authorised Signatory

DATED

20 February 2012

UKAS TESTING 0141

Product Service

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SECTION 1

REPORT SUMMARY

Emergency Beacons Testing of the
Astronics DME Corporation
SATRO ™, PLB-110

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Emergency Beacon Testing of the Astronics DME Corporation SATRO ™, PLB-110 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	Astronics DME Corporation
Model Number(s)	SATRO ™, PLB-110
Serial Number(s)	# 100 (TUV#1) # 500 (TUV#2) # 200 (TUV#3) # 600 (TUV#4)
Number of Samples Tested	4
Test Specification/Issue/Date	Cospas-Sarsat T.007 Issue 4 - Rev 5 October 2010
Date of Receipt of Test Samples	11 August 2011
Order Number Date	73680 19 May 2011
Start of Test	7 October 2011
Finish of Test	22 November 2011
Name of Engineer(s)	M Hardy
Related Documents	Cospas-Sarsat T.001 Issue 3 - Rev 11 October 2010

1.2 APPLICATION FORM

Beacon Manufacturer and Beacon Model

Beacon Manufacturer	Astronics DME Corporation
Beacon Model	SATRO ™, PLB-110
Other Model Names	

Beacon Type and Operational Configurations

Beacon Type	**Beacon used while:**	**Tick where appropriate**
EPIRB	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	406.037 MHz distress frequency 121.5 MHz homing frequency
Operating temperature range	Tmin = -20°C Tmax = +55°C
Operating lifetime	24 hours
Beacon power supply type (internal, external, combined, other)	Internal, 9.0 VDC
External power supply parameters (AC/DC and nominal voltages)	N/A
Is external power supply needed to energise the beacon or its ancillary devices in any of operation modes (Y/N or Yes of No)	No

Characteristic	Specification
Battery chemistry	LiMnO2
Battery cell model name, size and number of cells	Model: CR123A, Size: 2/3A, # of cells: 3 each
Battery cell manufacturer	Panasonic, CR123A
Battery pack manufacturer and part number	A3-03-1025-001 Astronics
Battery pack replacement period	5 Years
Oscillator type (e.g. OCXO, MCXO, TCXO)	TCXO
Oscillator manufacturer	RAKON/C-MAC (E4672LF)
Oscillator part name and number	A1-24-0015-001 (E4672LF)
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	Astronics DME Corporation
Antenna part name and number	Antenna, A1-04-0225-001
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
For Internal Navigation Devices	
- Geodetic reference system (WGS 84 or GTRF)	WGS84
- GNSS receiver cold start forced at every beacon activation (Yes or No)	Yes
- Navigation device manufacturer	GTOP
- Navigation device model name and part Number	FGPMMOPA6B
- Internal navigation device antenna type (integrated, internal, external, passive/active), manufacturer and model	Integrated patch (FGPMMOPA6B)
- GNSS system supported (e.g. GPS, GLONASS, Galileo)	GPS

Characteristic	Specification	
For External Navigation Devices		
- Data protocol for GNSS receiver to beacon interface	N/A	
- Physical interface for beacon to navigation device	N/A	
- Electrical interface for beacon to navigation device	N/A	
- Part number of the external navigation interface device (if applicable)	N/A	
- Navigation device model and manufacturer (if beacon designed to use specific devices)	N/A	
Self-Test Mode Characteristics	Self-Test Mode	Optional GNSS Self-Test Mode
- Self-test has separate switch position (Yes or No)	Yes	Yes
- Self-test switch automatically returns to normal position when released (Yes or No)	Yes	Yes
- Self-test activation can cause an operational mode transmission (Yes or No)	No	No
- Self-test causes a single beacon self-test message burst only regardless of how long the self-test activation mechanism applied (Yes or No)	Yes	Yes
- Results of self-test indicated by (e.g. Pass / Fail Indicator Light, Strobe Light, etc.)	LED display	LED display
- The content of the encoded position data fields of the self-test message has default values	Yes	N/A
- Self-test can be activated from beacon remote activation points (Yes or No)	No	No
- Self-test 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)	No	No
- Self-test transmits a signal(s) other than at 406 MHz (Yes & details or No)	No	No
- Self-test can be activated directly at beacon (Yes or No)	Yes	Yes
- List of Items checked by self-test	Battery, Lock detect, 406 PWR	GPS ACQ. 406 burst
- Self-test transmission burst duration (440 or 520 ms)	440 ms	520 ms
- Self-test format bit (“0” or “1”)	1	
- Maximum duration of Self Test	8 seconds	2 minutes

Characteristic	Specification	
- Maximum number of GNSS Self Tests (beacons with internal navigation devices only)	N/A	12
- Self-test results in transmission of a single burst, irrespectively of the test result (Yes or No)	N/A	Yes
- Maximum number of self-tests during battery pack replacement period	60	12

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)	☐	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

Characteristic	Specification
Beacon includes a homer transmitter (if yes identify frequency of transmission)	121.5MHz
-Homer Transmit Power	17dBm
-Homer Transmitter Duty Cycle	98%
-Duty Cycle of Homer Swept Tone	37.5%
Beacon includes a strobe light (Yes or No)	Yes
- Strobe light intensity	N/A
- Strobe light flash rate	21/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.	N/A
Beacon includes automatic activation mechanism (Yes or No) Specify type of automatic beacon activation mechanism	No
Beacon includes software or hardware features and functions not listed above and non-related to 406 MHz (Yes or No) List features and use a separate sheet if insufficient space	Yes, LED Strobe Light is used as secondary indicators besides LED indicators, buoyant, Morse code letter "P" in homer signal, GPS receiver automatic.
Beacon model hardware part number (P/N) and version	P3-03-0060, rev (A)
Beacon model software/firmware P/N and version	S2-03-0061, rev. (-)
Beacon model printed circuit board P/N and version	A1-07-1062-001, rev, (B)

Dated:17 February 2012 Signed

Hervé Cantave, Director of Engineering
(Name, Position and Signature of Beacon Manufacturer Representative)

1.2.1 Information Provided by the Cospas-Sarsat Accepted Test Facility

Name and Location of Beacon Test Facility: TÜV SÜD Product Service Ltd, United Kingdom

Date of Submission for Testing: 11 August 2011

Applicable C/S Standards:

Document	Issue	Revision	Date
C/S T.001	3	11	Oct-10
C/S T.007	4	5	Oct-10

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.

Signed: 

Name: Mark Jenkins

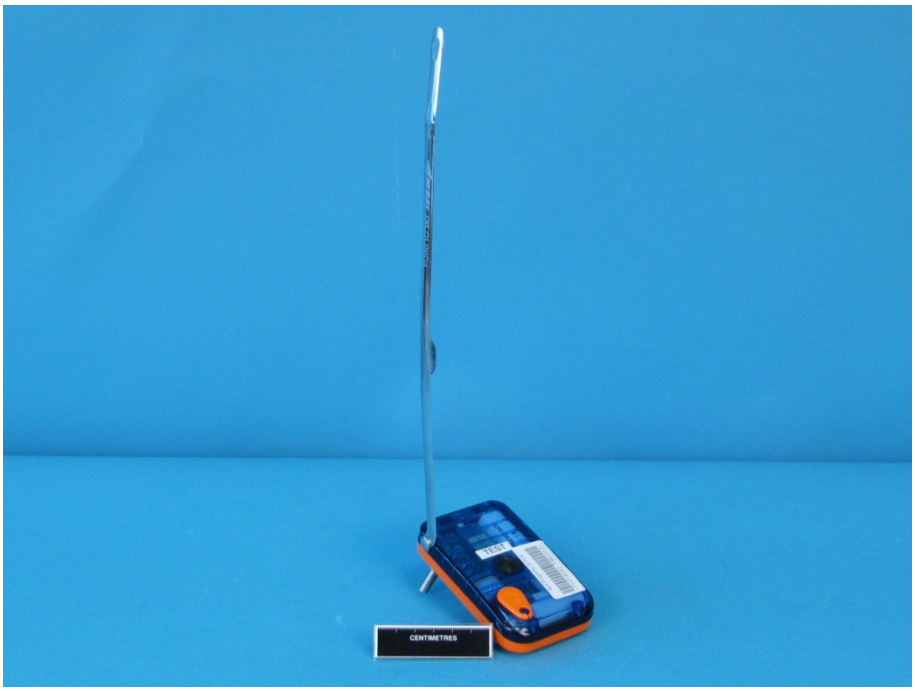
Position Held: Authorised Signatory

Date: 20 February 2012

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Astronics DME Corporation SATRO ™, PLB-110 as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.



Equipment Under Test with 50Ω antenna ports

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 ports were connected to the 50Ω test system using coaxial cables. The test configuration for all tests is identical with the exception of Antenna Characteristics, Satellite Qualitative and Position Accuracy Time and Position Accuracy.

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 Position Acquisition Time and Position Accuracy. 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.

* Please note that the manufacturer supplied two samples in each physical test configuration. Test samples TUV#1 and TUV#2 were programmed (by the manufacturer) with Standard Location Test protocol, and TUV#3 and TUV#4 were programmed with National Location Test protocol.

Customer supplied Programming Software

Beacon Infra Red Programmer (BIRP) version: *Software, PLB Digital Message, IR Programming, USA, Morse Code P; PN P3-03-0063-001*, rev. (-).

This software was used to reprogram the EUT for Beacon Coding software and as a method to reset the total GNSS Self Test counter.

1.3.3 Modes of Operation

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

Off Mode

- No apparent activity

Self-test

- Press ‘Test’ button for 2 seconds
- List of items checked as per Customer Supplied Information (Application Form)
- Navigation data applied where stated

Long/GPS/GNSS Self-test

- Press and hold ‘Test’ button for 5 seconds
- 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

- Remove protective cover, press for 1 second to activate/5 seconds to deactivate
- 121 Homer active and offset (for radiated test samples only)
- GPS operating in normal duty cycle for the following navigation input conditions
- No navigation data applied, unless otherwise stated

1.4 MODIFICATIONS

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

1.5 REPORT MODIFICATION RECORD

Issue 1 – First Issue
Issue 2 – Removal of comment.
Issue 3 – Clarification note added re repetition rate failures in summary table. Battery Current discharge calculation corrected. Clarification notes/comments added to Battery Current discharge regarding GNSS Self Test 'Timeout' and 'Fast' terminology. Acquisition times for navigation results corrected in summary table. Revised application form as supplied by manufacturer.
Issue 4 – Revised application form as supplied by manufacturer (to correct transmit frequency and number of battery cell information).

Product Service

SECTION 2

TEST DETAILS

Emergency Beacons Testing of the
Astronics DME Corporation
SATRO ™, PLB-110

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**
SATRO ™, PLB-110, TUV Ref#2, Modification State 0							
Transmitter power output		35 - 39	dBm	36.52	36.50	36.20	
Power output rise time		< 5	ms	0.478	0.466	0.436	
Power output 1ms before burst		< -10	dBm	-30.68	-28.69	-32.18	
2. Digital Message Coding							**Result: Pass**
SATRO ™, PLB-110, TUV Ref#2, 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°C)	(+21°C)	(+55°C)	
3. Digital Message Generator						**Result: Pass**
SATRO ™, PLB-110, TUV Ref#2, Modification State 0						
Repetition rate, T_R:						Repetition rate allowed a 15min warm up. (Max and Min) tested 3 times @ -20 and +55 before all parameters were within specification limits.
Average T_R	$48.5 \le T_{Ravg} \le 51.5$	seconds	50.164	50.177	50.163	
Minimum T_R	$47.5 \le T_{Rmin} \le 48.0$	seconds	48.203	n/a	48.172	Min Rep Rate result out of spec.
Minimum T_R	$47.5 \le T_{Rmin} \le 48.0$	seconds	48.328	n/a	48.313	Min Rep Rate results out of spec.
Minimum T_R	$47.5 \le T_{Rmin} \le 48.0$	seconds	47.782	47.828	47.766	
Maximum T_R	$52.0 \le T_{Rmax} \le 52.5$	seconds	51.969	n/a	51.984	Max Rep Rate result out of spec.
Maximum T_R	$52.0 \le T_{Rmax} \le 52.5$	seconds	52.079	n/a	51.984	Max Rep Rate result out of spec at +55°C.
Maximum T_R	$52.0 \le T_{Rmax} \le 52.5$	seconds	52.172	52.328	52.188	
Standard deviation	0.5 - 2.0	seconds	1.412	1.379	1.408	
Bit rate						
Minimum fb	≥ 396	bits/sec	398.702	398.697	398.700	
Maximum fb	≤ 404	bits/sec	398.720	398.718	398.716	
Total transmission time						
Short message	435.6 - 444.4	ms	n/a	n/a	n/a	
Long message	514.8 - 525.2	ms	519.720	520.035	520.127	
Unmodulated carrier						
Minimum T1	≥ 158.4	ms	158.460	158.766	158.842	
Maximum T1	≤ 161.6	ms	158.538	158.809	158.901	
First burst delay	≥ 47.5	seconds	100	100	100	
4. Modulation						**Result: Pass**
SATRO ™, PLB-110, TUV Ref#2, Modification State 0						
Biphase-L	P / F	P / F	P	P	P	
Rise time	50 - 250	µs	177.40	169.30	169.30	
Fall time	50 - 250	µs	182.60	169.70	169.70	
Phase deviation: positive	+(1.0 to 1.2)	radians	1.097	1.121	1.106	
Phase deviation: negative	-(1.0 to 1.2)	radians	-1.101	-1.091	-1.103	
Symmetry measurement	≤ 0.05		0.0155	0.0155	0.0150	

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
5. 406 MHz Transmitted Frequency						**Result: Pass**
SATRO ™, PLB-110, TUV Ref#2, Modification State 0						
Nominal Value	C/S T.001	MHz	406.0370661	406.0370362	406.0370393	
Short-term stability	≤ $2x10^{-9}$	/100ms	$1.219x10^{-10}$	$9.925x10^{-11}$	$5.595x10^{-11}$	
Medium-term stability – Slope	(-1 to +1)$x10^{-9}$	/minutes	$1.860x10^{-10}$	$5.97x10^{-11}$	$1.065x10^{-10}$	
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$4.641x10^{-10}$	$9.052x10^{-11}$	$4.155x10^{-10}$	
6. Spurious Emissions into 50ohms						**Result: Pass**
SATRO ™, PLB-110, TUV Ref#2, Modification State 0						
In band (406.0 – 406.1 MHz)	C/S T.001 mask	P / F	P			Combined temperature plots.
7. 406 MHz VSWR Check						**Result: Pass**
SATRO ™, PLB-110, TUV Ref#2, Modification State 0						
Nominal transmitted frequency	C/S T.001	MHz	406.0370618	406.0370363	406.0370393	
Modulation rise time	50-250	µs	177.30	172.30	171.30	
Modulation fall time	50-250	µs	184.70	171.70	167.70	
Modulation phase deviation: positive	+ (1.0 to 1.2)	radians	1.106	1.128	1.109	
Modulation phase deviation: negative	- (1.0 to 1.2)	radians	-1.094	-1.091	-1.100	
Modulation symmetry measurement	≤ 0.05		0.0146	0.0166	0.0151	
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**
SATRO ™, PLB-110, TUV Ref#2, 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	440.3024	440.3722	440.4632	
Default position data (if applicable)	correct	P / F	P	P	P	With and without GPS data present
Description	provided	Y / N	-			
Design data on protection against repetitive self-test mode transmissions	provided	Y / N	-			Applicant's statement : 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	

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**
SATRO ™, PLB-110, TUV Ref#2, Modification State 0						
Frame sync	011010000		P	P	P	
Format flag	1 / 0	bit value	1	1	1	
Single radiated burst	≤ 520 (+1%)	ms	520.529	520.643	520.690	Maximum values – further details in results section
Position data (if applicable)	must be within 500m (or 5.25km for User Location Protocol) of the actual position	P / F	P	P	P	
Design data showing how GNSS Self-test is limited in number of transmissions and duration	provided	Y / N	Y			Applicant's statement : See Annex A
Single burst verification	one burst	P / F	P	P	P	
121.5 MHz RF power (if applicable)	GNSS self-test checks that RF power is emitted	Y / N	n/a			
406 MHz power	GNSS self-test checks that RF power is emitted	Y / N	Y			
Maximum duration of GNSS Self-test	-	s	120	120	120	See Application Form
Actual duration of Self-test with encoded location	Less than maximum duration	s	38	36	40	Maximum values – further details in results section
Maximum number of GNSS Self-tests (only beacons with internal navigation devices)	-	Number	12	12	12	See Application Form

Parameters to be Measured	Range of Specification	Units	Test Results		Comments
9. Thermal Shock					**Result: Pass**
SATRO ™, PLB-110, TUV Ref#2, 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	406.0370615	406.0370628	
Short-term stability	≤ $2x10^{-9}$	/100ms	$6.29x10^{-11}$	$1.919x10^{-10}$	
Medium-term stability – Slope	(-2 to +2)$x10^{-9}$	/min	$-8.756x10^{-11}$	$1.337x10^{-10}$	
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$1.952x10^{-10}$	$5.334x10^{-10}$	
Transmitter power output	35 - 39	dBm	36.509	36.605	
Digital message	correct	P/F	P		
10 Operating Lifetime at Minimum Temperature					**Result: Pass**
SATRO ™, PLB-110, TUV Ref#2, Modification State 0					
Pre-test battery discharge duration (operating) required		Hours	4.42		
Pre-test battery discharge duration (operating)		Hours	0.0		
Duration	>24	Hours	31.11 Hours at Tmin = -20°C		
Effective Operating Lifetime duration	>24	Hours	26.69 Hours at Tmin = -20°C		
Transmitted Frequency			Min	Max	
Nominal value	C/S T.001	MHz	406.0370649	406.0370739	
Short-term stability	≤ $2x10^{-9}$	/100ms	$7.585x10^{-11}$	$2.03x10^{-10}$	
Medium-term stability – Slope	(-1 to +1)$x10^{-9}$	/min	$-7.93x10^{-10}$	$2.61x10^{-10}$	
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$7.58x10^{-11}$	$2.53x10^{-9}$	
Transmitter power output	35 - 39	dBm	35.911	36.733	
Digital message	correct	P/F	P		
Homer transmitter continuous operation during the lifetime test		hours	n/a		
			Start of Test	End of Test	
Homer frequency		MHz	121.495	121.496	
Homer peak power level		dBm	20.638	20.693	
Homer transmitter duty cycle		%	97.1	97.0	

Parameters to be Measured	Range of Specification	Units	Test Results		Comments
11. Temperature Gradient (5°C/hr)					**Result: Pass**
SATRO ™, PLB-110, TUV Ref#2, Modification State 0					
Up Ramp					
Transmitted Frequency			Min	Max	
Nominal value	C/S T.007	MHz	406.0370275	406.0370655	
Short-term stability	≤ $2x10^{-9}$	/100ms	$4.423x10^{-11}$	$1.819x10^{-10}$	
Medium-term stability – Slope	(-1 to +1)$x10^{-9}$	/min	$-2.77x10^{-10}$	$2.618x10^{-10}$	Data for points A to B and C+15 to D
	(-2 to +2)$x10^{-9}$	/min	$-4.16x10^{-10}$	$2.38x10^{-10}$	Data for points B to C+15 min
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$5.339x10^{-11}$	$1.06x10^{-9}$	
Transmitter power output	35 – 39	dBm	36.686	36.940	
Digital message	correct	P/F	P		
Down Ramp					
Transmitted Frequency			Min	Max	
Nominal value	C/S T.007	MHz	406.0370331	406.0370697	
Short-term stability	≤ $2x10^{-9}$	/100ms	$5.284x10^{-11}$	$1.63x10^{-10}$	
Medium-term stability – Slope	(-1 to +1)$x10^{-9}$	/min	$-1.978x10^{-10}$	$1.71x10^{-10}$	Data for points C to D, E + 15 min to F
	(-2 to +2)$x10^{-9}$	/min	$-7.03x10^{-11}$	$2.323x10^{-10}$	Data for points D to E+15 min
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$6.266x10^{-11}$	$8.516x10^{-10}$	
Transmitter power output	35 – 39	dBm	36.423	37.527	
Digital message	correct	P/F	P		
12. Oscillator Aging					
SATRO ™, PLB-110, TUV Ref#2, Modification State 0					
Data	provided	Y / N	Y		Applicant's data : See Annex A
13. Protection Against Continuous Transmission					
SATRO ™, PLB-110, TUV Ref#2, Modification State 0					
Description	provided	Y / N	Y		Applicant's statement : See Annex A

Parameters to be Measured	Range of Specification	Units	Test Results				Comments
14. Satellite Qualitative Tests							**Result: Pass**
SATRO ™, PLB-110, TUV Ref#1, 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	
Doppler Location results with error ≤5km	≥80	%	-	-	95.5	100	
15. Antenna Characteristics							**Result: Pass**
SATRO ™, PLB-110, TUV Ref#1, Modification State 0							
Test Configuration	As per C/S T.007		Configuration				
			1	2	3	4	
Polarisation	linear or RHCP		-	-	Linear	Linear	
VSWR	≤1.5		-	-	n/a	n/a	Detachable Antennas Only
$EIRP_{LOSS}$		dB	-	-	0.59	0.59	
$EIRP_{maxEOL}$	≤43	dBm	-	-	42.6	40.5	
$EIRP_{minEOL}$	≥32	dBm	-	-	32.1	30.9	$EIRP_{minEOL}$ limit decreases to 30dBm for Configuration 4
16. Beacon Coding Software							**Result: Pass**
SATRO ™, PLB-110, TUV Refs#2 and #4, Modification State 0							
Sample message for each coding option of the applicable coding types	correct	P / F	P				Test Samples TUVRef#2 (SLP) and #4 (NLP)
Sample self-test message for each coding option of the applicable coding types	correct	P / F	P				Test Samples TUVRef#2 (SLP) and #4 (NLP)

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
17. Navigation System						**Result: Pass**
SATRO ™, PLB-110, TUV Refs#1, #2, #3 and #4, Modification State 0						
Location protocol	C/S T.001		National	Standard	User	
Position data default values	correct	P / F	P	P	n/a	Test SamplesTUV Ref#2 and #4
Configuration 7						
Position accuracy - A.3.8.2.1	C/S T.001	m	68.8	55.6	n/a	Test SamplesTUV Ref#1 and #3
Position Acquisition Time - A.3.8.2.1	<10/1	min	1min 40sec	1min 40sec	n/a	Test SamplesTUV Ref#1 and #3
Position accuracy - A.3.8.2.2	C/S T.001	m	49.8	49.8	n/a	Test SamplesTUV Ref#1 and #3
Position Acquisition Time - A.3.8.2.2	<10/1	min	1min 40sec	1min 40sec	n/a	Test SamplesTUV Ref#1 and #3
Configuration 8						
Position accuracy - A.3.8.2.1	C/S T.001	m	55.6	55.6	n/a	Test SamplesTUV Ref#1 and #3
Position Acquisition Time - A.3.8.2.1	<10/1	min	2min 31sec	1min 40sec	n/a	Test SamplesTUV Ref#1 and #3
Position accuracy - A.3.8.2.2	C/S T.001	m	49.8	49.8	n/a	Test SamplesTUV Ref#1 and #3
Position Acquisition Time - A.3.8.2.2	<10/1	min	1min 40sec	2min 31sec	n/a	Test SamplesTUV Ref#1 and #3
Encoded position data update interval	>5	min	10 min 51sec	10min 51sec	n/a	Test SamplesTUV Ref#2 and #4
Position clearance after deactivation	cleared	P / F	P	P	n/a	Test SamplesTUV Ref#2 and #4
Position data input update interval (as applicable)	20/1	Min	n/a	n/a	n/a	
Position data encoding	correct	P / F	*	*	*	*Test carried out by manufacturer. See Annex C for results
Retained last valid position after navigation input lost	240(±5)	min	240min 40sec	240min 40sec	n/a	Test SamplesTUV Ref#2 and #4
Default position data transmitted after 240(±5) minutes without valid position data	cleared	P / F	P	P	n/a	Test SamplesTUV Ref#2 and #4
Information on protection against beacon degradation due to navigation device, interface or signal failure or malfunction	provided	Y / N	Y			Applicant's statement : See Annex A

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

SATRO ™, PLB-110 S/N: # 500 (TUV#2) - Modification State 0

2.1.3 Date of Test

31 October 2011 & 2 November 2011

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 21.2 - 23.3°C
Relative Humidity 32.9 - 49.7%

2.1.6 Test Results

Ambient Temperature

```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF             2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                 Bits
----------        -------    ----- ------                                 ----
Format Flag        25            1 Long Message                             1
Protocol Flag      26            0 Location NEW                             0
MID                27- 36      366 USA                           0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                1110
Spare              41- 64                         0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT           0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0          0000 0100 0011 0000 0100 1
BCH Generated      86-106                            0000 0100 0011 0000 0100 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                 110
Fixed Bit         110              1                                        1
Encode Pos Device 111              1 Internal                               1
121.5 Homing      112              1 YES                                    1
Position Change   113-132          DEFAULT             1000 0011 1110 0000 1111
Resultant Position                --> Not Defined
BCH Encoded       133-144          Errors=0                      0110 0110 1100
BCH Generated     133-144                                        0110 0110 1100

================================================================================
```

Low Temperature

```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF             2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                          0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           0000 0100 0011 0000 0100 1
BCH Generated      86-106                             0000 0100 0011 0000 0100 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                  110
Fixed Bit         110              1                                         1
Encode Pos Device 111              1 Internal                                1
121.5 Homing      112              1 YES                                     1
Position Change   113-132          DEFAULT              1000 0011 1110 0000 1111
Resultant Position                --> Not Defined
BCH Encoded       133-144          Errors=0                       0110 0110 1100
BCH Generated     133-144                                         0110 0110 1100

================================================================================
```

High Temperature

```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF             2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                          0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           0000 0100 0011 0000 0100 1
BCH Generated      86-106                             0000 0100 0011 0000 0100 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                  110
Fixed Bit         110            1                                           1
Encode Pos Device 111            1 Internal                                  1
121.5 Homing      112            1 YES                                       1
Position Change   113-132          DEFAULT              1000 0011 1110 0000 1111
Resultant Position              --> Not Defined
BCH Encoded       133-144          Errors=0                        0110 0110 1100
BCH Generated     133-144                                          0110 0110 1100

================================================================================
```

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

SATRO ™, PLB-110 S/N: # 500 (TUV#2) - Modification State 0

2.2.3 Date of Test

31 October 2011 & 2 November 2011

2.2.4 Test Equipment Used

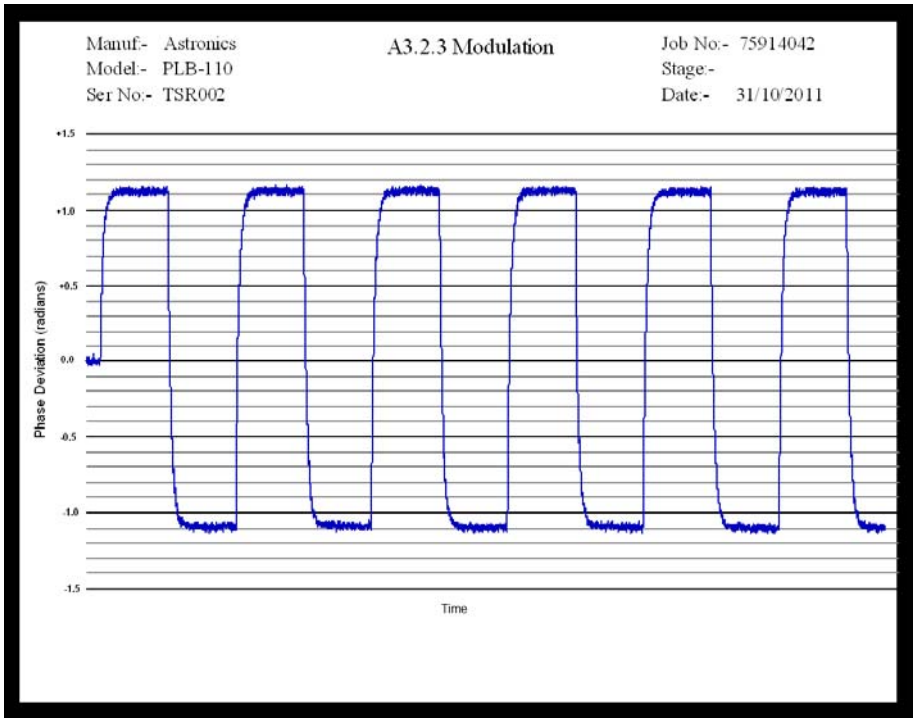
The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Environmental Conditions

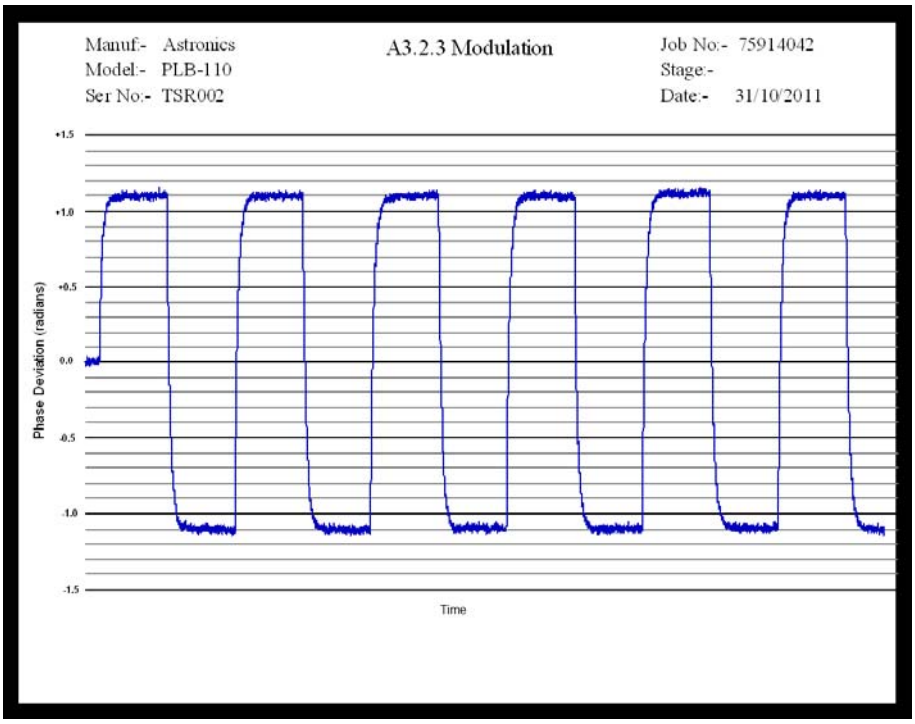
Ambient Temperature 21.2 - 23.5°C
Relative Humidity 33.1 - 45.0%

2.2.6 Test Results

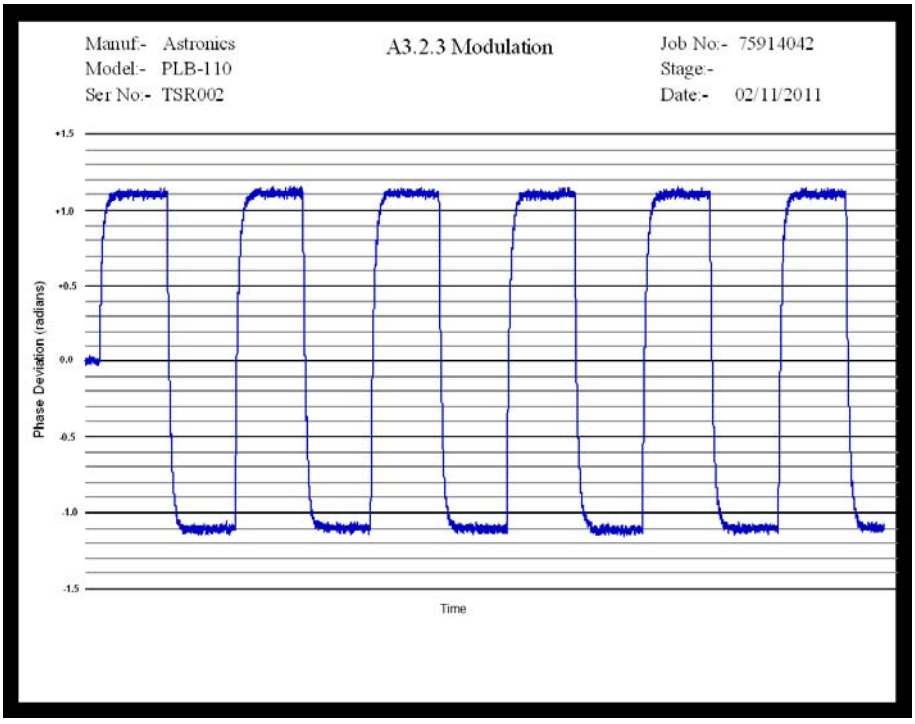
Ambient Temperature



Low Temperature



High Temperature



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

SATRO ™, PLB-110 S/N: # 500 (TUV#2) - Modification State 0

2.3.3 Date of Test

28 October 2011

2.3.4 Test Equipment Used

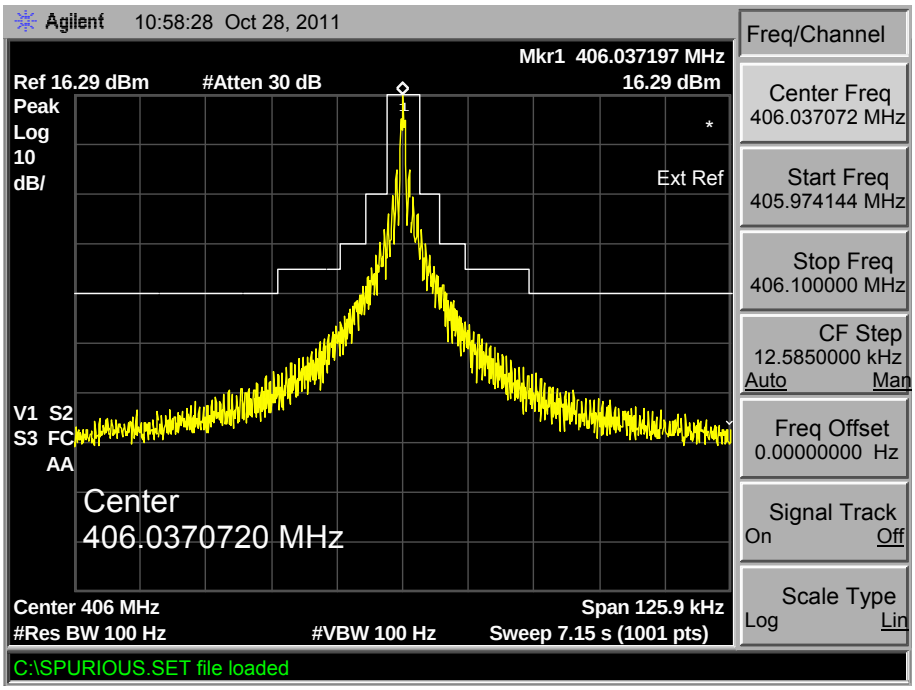
The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Environmental Conditions

Ambient Temperature 23.8°C
Relative Humidity 29.8%

2.3.6 Test Results

Combined Ambient, Low and High Temperature



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

SATRO ™, PLB-110 S/N: # 500 (TUV#2) - Modification State 0

2.4.3 Date of Test

31 October 2011 & 2 November 2011

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 20.7 - 23.7°C
Relative Humidity 33.4 - 46.4%

2.4.6 Test Results

Ambient Temperature

```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF             2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                          0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           0000 0100 0011 0000 0100 1
BCH Generated      86-106                             0000 0100 0011 0000 0100 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                  110
Fixed Bit         110              1                                         1
Encode Pos Device 111              1 Internal                                1
121.5 Homing      112              1 YES                                     1
Position Change   113-132          DEFAULT              1000 0011 1110 0000 1111
Resultant Position                --> Not Defined
BCH Encoded       133-144          Errors=0                       0110 0110 1100
BCH Generated     133-144                                         0110 0110 1100

================================================================================
```

Low Temperature

```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF             2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                          0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           0000 0100 0011 0000 0100 1
BCH Generated      86-106                             0000 0100 0011 0000 0100 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                  110
Fixed Bit         110              1                                         1
Encode Pos Device 111              1 Internal                                1
121.5 Homing      112              1 YES                                     1
Position Change   113-132          DEFAULT              1000 0011 1110 0000 1111
Resultant Position                --> Not Defined
BCH Encoded       133-144          Errors=0                       0110 0110 1100
BCH Generated     133-144                                         0110 0110 1100

================================================================================
```

High Temperature

```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF             2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                          0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           0000 0100 0011 0000 0100 1
BCH Generated      86-106                             0000 0100 0011 0000 0100 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                  110
Fixed Bit         110               1                                        1
Encode Pos Device 111               1 Internal                               1
121.5 Homing      112               1 YES                                    1
Position Change   113-132           DEFAULT              1000 0011 1110 0000 1111
Resultant Position                --> Not Defined
BCH Encoded       133-144           Errors=0                       0110 0110 1100
BCH Generated     133-144                                          0110 0110 1100

================================================================================
```

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

SATRO ™, PLB-110 S/N: # 500 (TUV#2) - Modification State 0

2.5.3 Date of Test

31 October 2011 & 2 November 2011

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 20.8 - 23.8°C
Relative Humidity 33.0 - 44.8%

2.5.6 Test Results

Self Test Mode

Ambient Temperature

No GPS data present

```
================================================================================
 Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF              2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827700000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1110 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message: bcn entered Short Non-Spec    1
Protocol Flag      26            0 Location NEW                                0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                          0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           0000 0100 0011 0000 0100 1
BCH Generated      86-106                             0000 0100 0011 0000 0100 1
Fixed Bits        107-109                                                   110
Fixed Bit         110              1                                          1
Encode Pos Device 111              1 Internal                                 1
121.5 Homing      112              1 YES                                      1
Resultant Position                --> Not Defined

================================================================================
```

GPS data present

```
================================================================================
 Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF              2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827700000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1110 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message: bcn entered Short Non-Spec    1
Protocol Flag      26            0 Location NEW                                0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                          0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           0000 0100 0011 0000 0100 1
BCH Generated      86-106                             0000 0100 0011 0000 0100 1
Fixed Bits        107-109                                                   110
Fixed Bit         110              1                                          1
Encode Pos Device 111              1 Internal                                 1
121.5 Homing      112              1 YES                                      1
Resultant Position                --> Not Defined

================================================================================
```

Low Temperature

No GPS data present

```
================================================================================
 Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF              2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827700000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1110 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message: bcn entered Short Non-Spec    1
Protocol Flag      26            0 Location NEW                                0
MID                27- 36      366 USA                                 0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                    1110
Spare              41- 64                          0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           0000 0100 0011 0000 0100 1
BCH Generated      86-106                             0000 0100 0011 0000 0100 1
Fixed Bits        107-109                                                   110
Fixed Bit         110             1                                           1
Encode Pos Device 111             1 Internal                                  1
121.5 Homing      112             1 YES                                       1
Resultant Position               --> Not Defined

================================================================================
```

GPS data present

```
================================================================================
 Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF              2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827700000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1110 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message: bcn entered Short Non-Spec    1
Protocol Flag      26            0 Location NEW                                0
MID                27- 36      366 USA                                 0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                    1110
Spare              41- 64                          0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           0000 0100 0011 0000 0100 1
BCH Generated      86-106                             0000 0100 0011 0000 0100 1
Fixed Bits        107-109                                                   110
Fixed Bit         110             1                                           1
Encode Pos Device 111             1 Internal                                  1
121.5 Homing      112             1 YES                                       1
Resultant Position               --> Not Defined

================================================================================
```

High Temperature

No GPS data present

```
================================================================================
 Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF              2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827700000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1110 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message: bcn entered Short Non-Spec    1
Protocol Flag      26            0 Location NEW                                0
MID                27- 36      366 USA                                 0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                    1110
Spare              41- 64                          0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           0000 0100 0011 0000 0100 1
BCH Generated      86-106                             0000 0100 0011 0000 0100 1
Fixed Bits        107-109                                                   110
Fixed Bit         110             1                                           1
Encode Pos Device 111             1 Internal                                  1
121.5 Homing      112             1 YES                                       1
Resultant Position               --> Not Defined

================================================================================
```

GPS data present

```
================================================================================
 Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF              2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827700000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1110 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message: bcn entered Short Non-Spec    1
Protocol Flag      26            0 Location NEW                                0
MID                27- 36      366 USA                                 0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                    1110
Spare              41- 64                          0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           0000 0100 0011 0000 0100 1
BCH Generated      86-106                             0000 0100 0011 0000 0100 1
Fixed Bits        107-109                                                   110
Fixed Bit         110             1                                           1
Encode Pos Device 111             1 Internal                                  1
121.5 Homing      112             1 YES                                       1
Resultant Position               --> Not Defined

================================================================================
```

GNSS Self-test mode

List of parameters monitored during the GNSS Self-test: See Application Form (Section 1.2)

GNSS Self-test activation method: - Press and Hold ‘Test’ Button for 5 seconds

Does the activation method preclude inadvertent activation? (Y/N): - Y (see above)

Method used to count number of GNSS Self-tests (Customer Supplied Information): - Internal Software

Method used during testing to reset the above “counter”: - Customer supplied software

With Valid GPS Input

	Standard Location Protocol			National Location Protocol		
	-20°C	+22°C	+55°C	-20°C	+22°C	+55°C
Frame sync verification	011010000	011010000	011010000	011010000	011010000	011010000
Format Flag (1 bit)	1	1	1	1	1	1
Single Radiated burst (ms)	520.509	520.643	520.690	520.529	520.594	520.650
Position data	P	P	P	P	P	P
Single burst verification	P	P	P	P	P	P
Actual duration (sec)	38	34	37	38	36	40
Position Input Latitude	N51° 22.583'			N51° 22.583'		
Position Input Longitude	W1° 49.833'			W1° 49.833'		
Position Output Latitude*	N51°22'36”	N51°22'36”	N51°22'36”	N51°22'36”	N51°22'36”	N51°22'36”
Position Output Longitude*	W1°49'52”	W1°49'52”	W1°49'52”	W1°49'52”	W1°49'52”	W1°49'52”
Position Error (m)	49.8	49.8	49.8	49.8	49.8	49.8

Without Valid GPS Input

	Standard Location Protocol			National Location Protocol		
	-20°C	+22°C	+55°C	-20°C	+22°C	+55°C
Frame sync verification	n/a	n/a	n/a	n/a	n/a	n/a
Format Flag (1 bit)	n/a	n/a	n/a	n/a	n/a	n/a
Single Radiated burst (ms)	n/a	n/a	n/a	n/a	n/a	n/a
Default Position data	n/a	n/a	n/a	n/a	n/a	n/a
Single burst verification	n/a	n/a	n/a	n/a	n/a	n/a
Actual duration (min)*	2	2	2	2	2	2

* As the EUT does not transmit a 406 burst if no valid GPS data is present, the measured duration was taken from when the Self-Test button was activated to when EUT activity appeared to terminate.

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

SATRO ™, PLB-110 S/N: # 500 (TUV#2) - Modification State 0

2.6.3 Date of Test

4 November 2011

2.6.4 Test Equipment Used

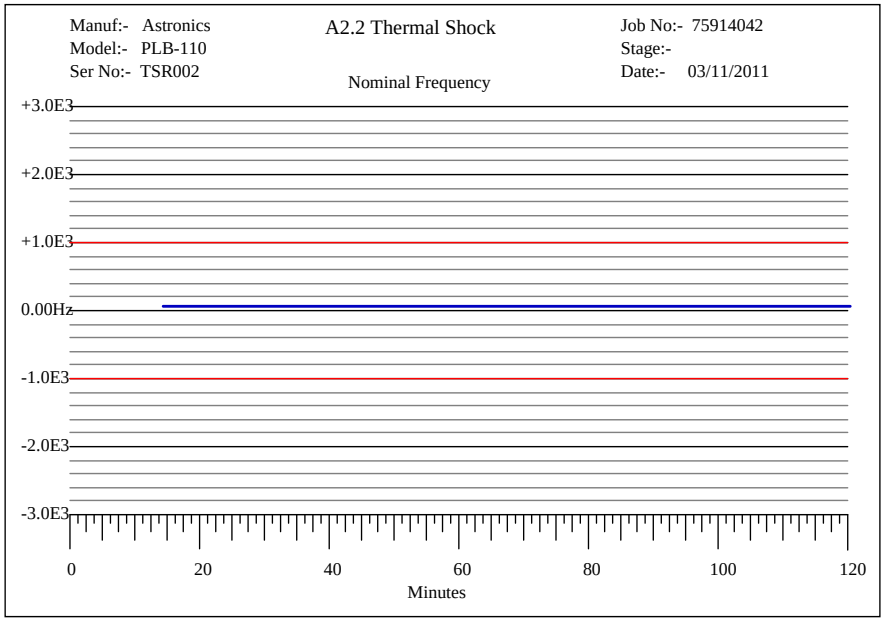
The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Environmental Conditions

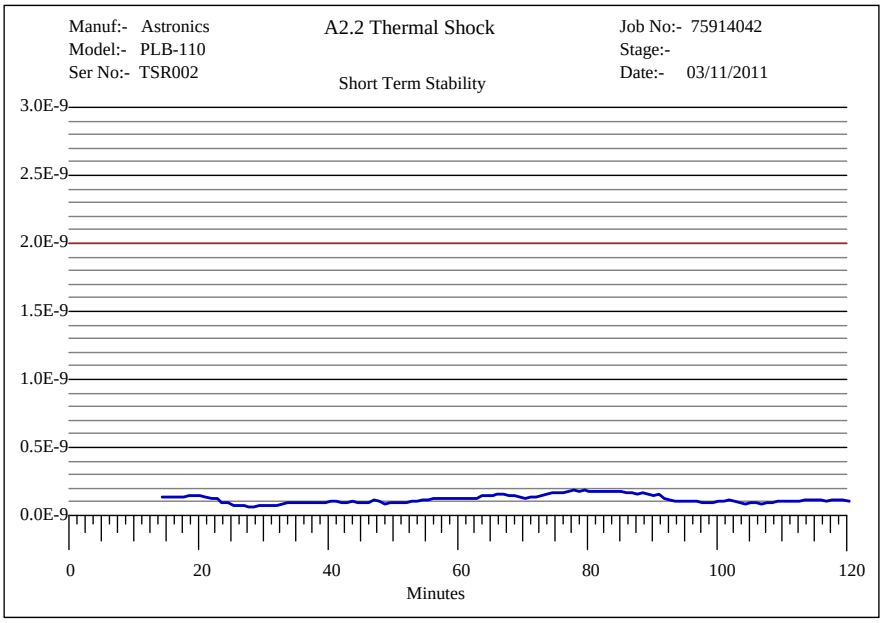
Ambient Temperature 22.8°C
Relative Humidity 48.2%

2.6.6 Test Results

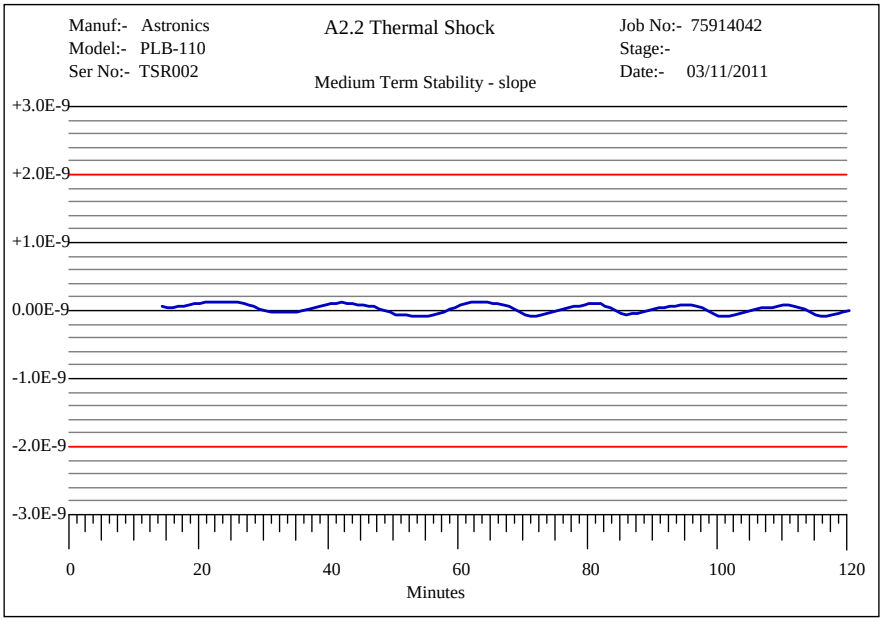
Nominal Frequency



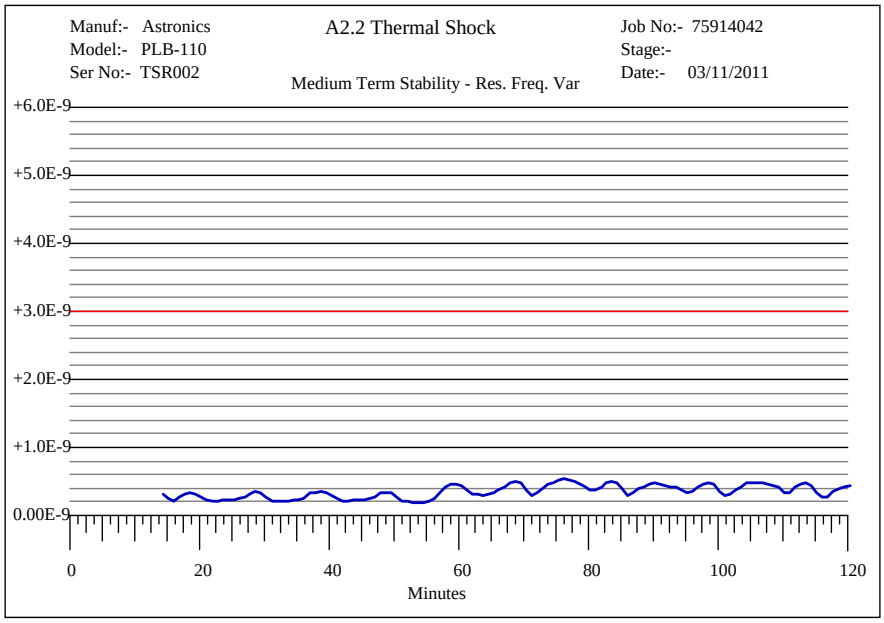
Short Term Stability



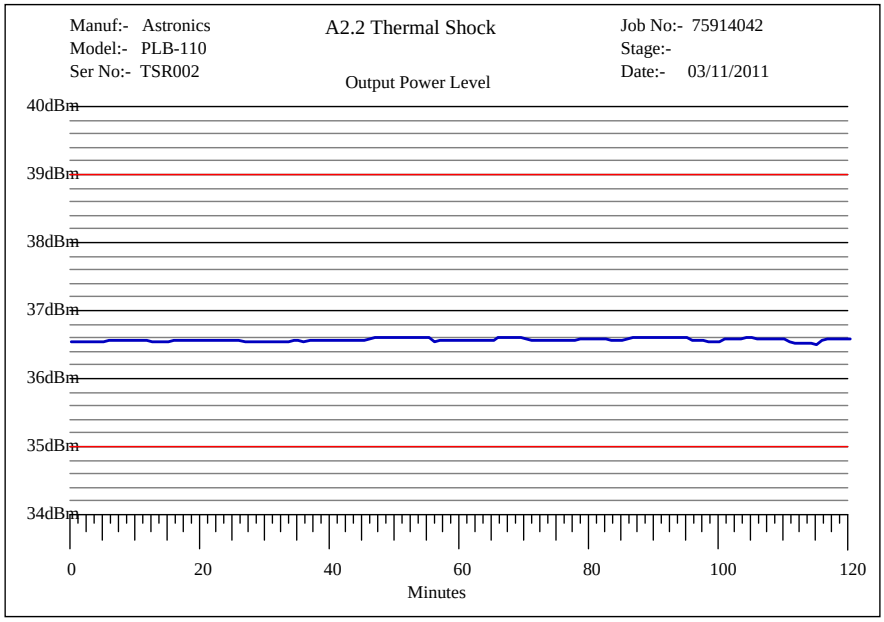
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



Output Power



Digital Message

```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF             2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                          0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           0000 0100 0011 0000 0100 1
BCH Generated      86-106                             0000 0100 0011 0000 0100 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                  110
Fixed Bit         110              1                                         1
Encode Pos Device 111              1 Internal                                1
121.5 Homing      112              1 YES                                     1
Position Change   113-132          DEFAULT              1000 0011 1110 0000 1111
Resultant Position                --> Not Defined
BCH Encoded       133-144          Errors=0                       0110 0110 1100
BCH Generated     133-144                                         0110 0110 1100

================================================================================
```

2.7 OPERATING LIFETIME AT MINIMUM TEMPERATURE

2.7.1 Specification

Cospas-Sarsat T.007, Clause A.2.3

2.7.2 Equipment Under Test and Modification State

SATRO ™, PLB-110 S/N: # 500 (TUV#2) - Modification State 0

2.7.3 Date of Test

7 October 2011 & 19 October 2011

2.7.4 Test Equipment Used

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

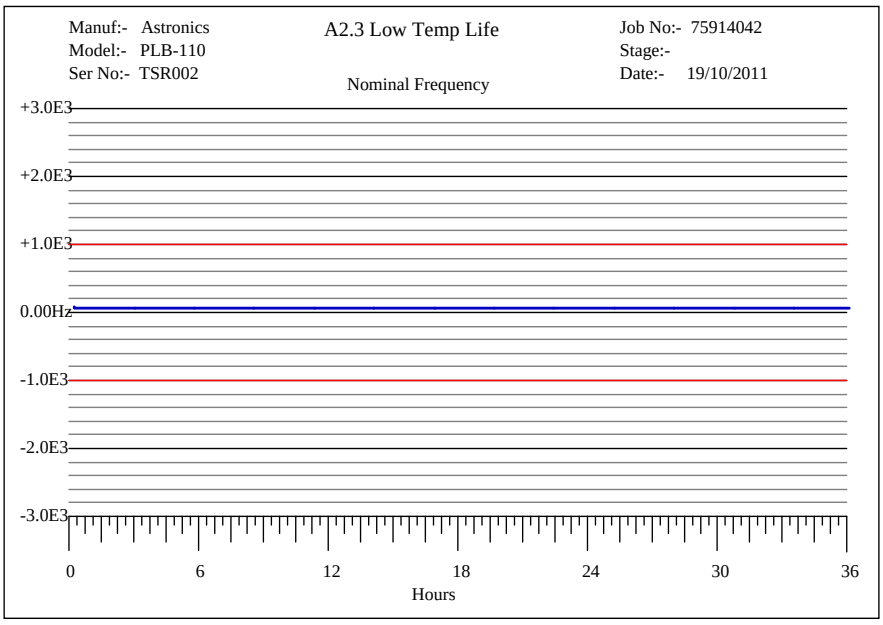
2.7.5 Environmental Conditions

Ambient Temperature 21.9 - 22.9°C
Relative Humidity 33.9 - 53.7%

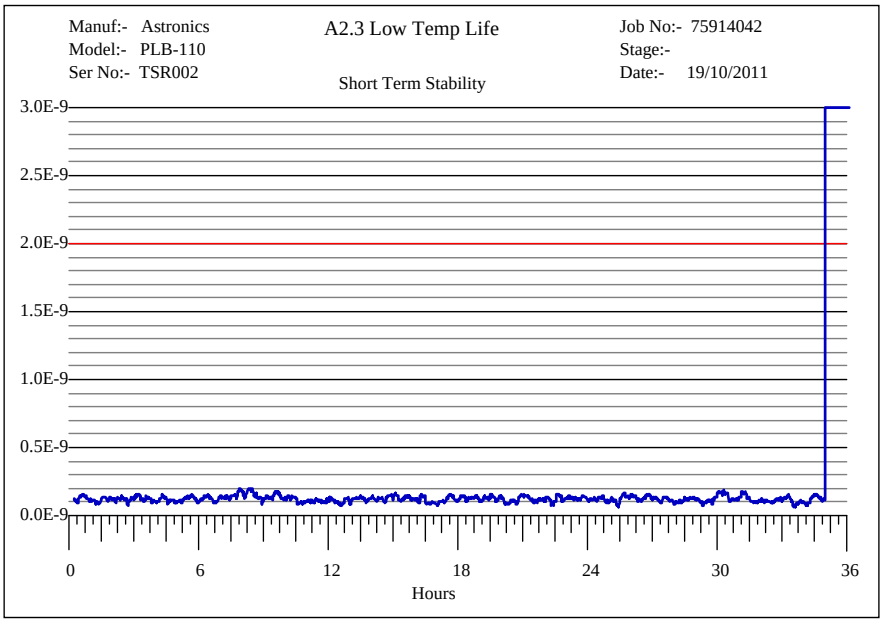
2.7.6 Test Results

NOTE: The results contained in the graphs below do not include a battery pre-discharge of 4.42 hours.

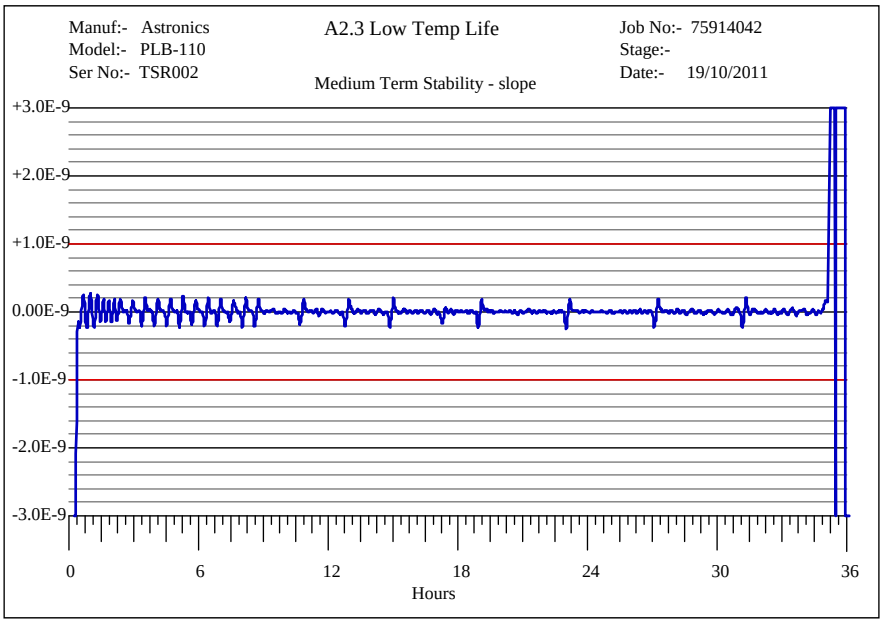
Nominal Frequency



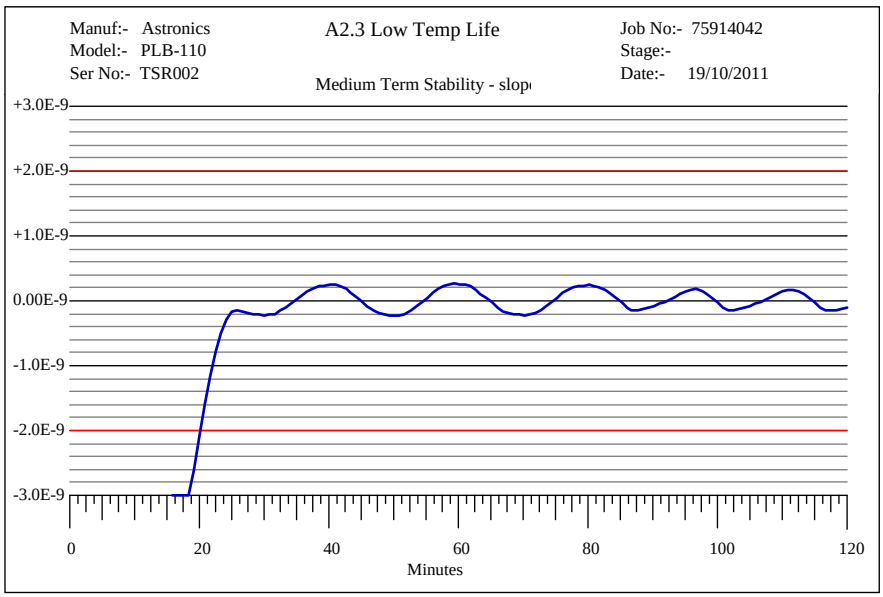
Short Term Stability



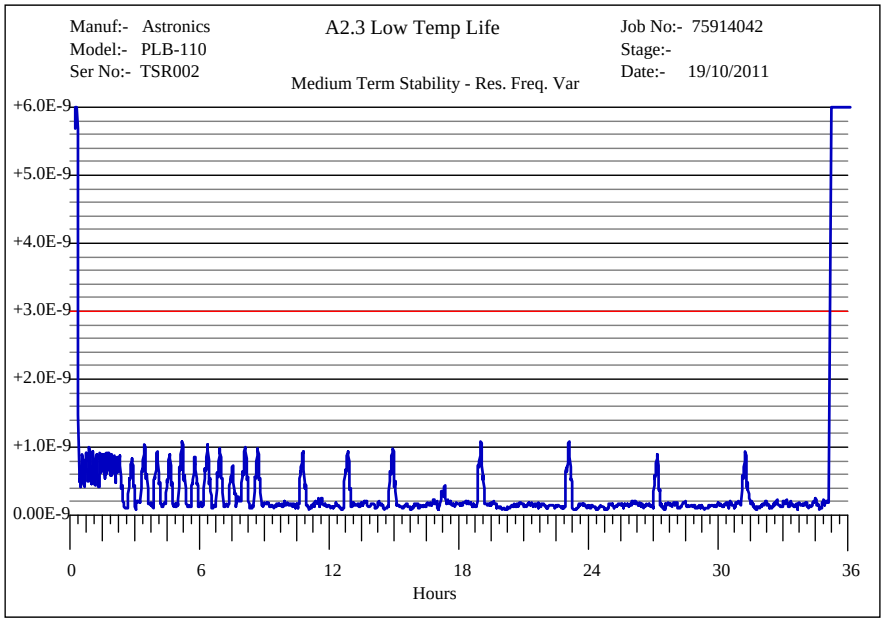
Medium Term Stability, Mean Slope



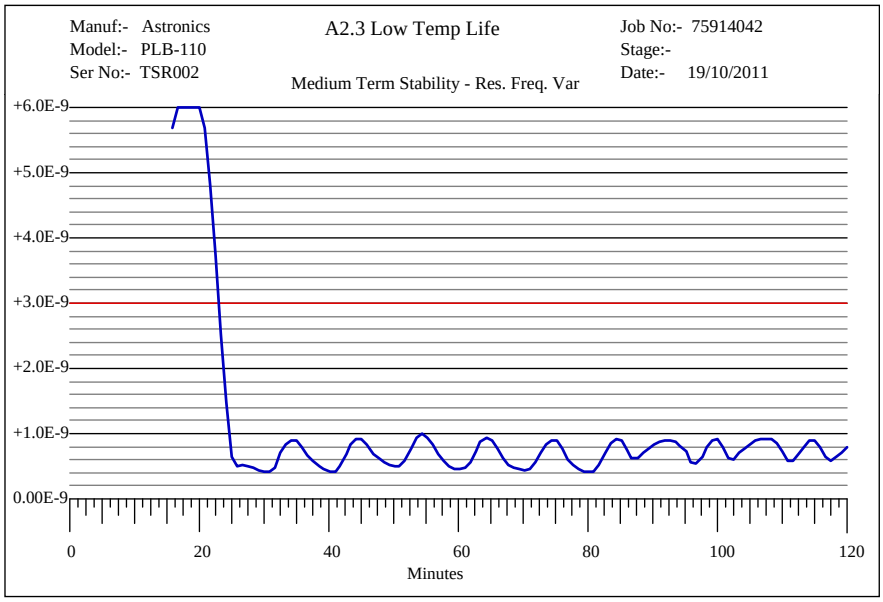
Medium Term Stability, Mean Slope (First 2 hours)



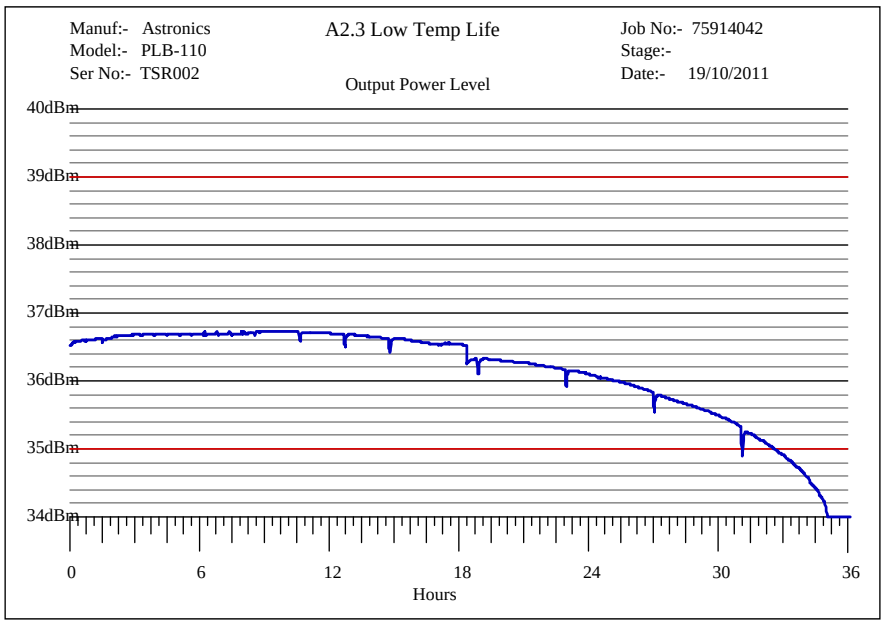
Medium Term Stability, Residual Frequency Variation



Medium Term Stability, Residual Frequency Variation (First 2 Hours)



Output Power



Digital Message

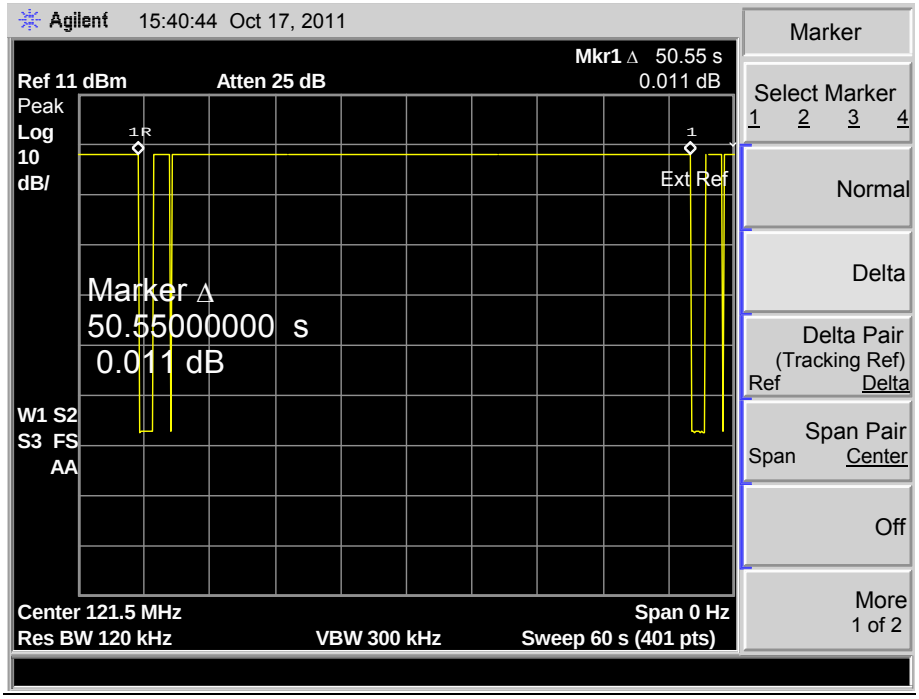
```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF             2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                 Bits
----------        -------    ----- ------                                 ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                           0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                1110
Spare              41- 64                        0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT          0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0         0000 0100 0011 0000 0100 1
BCH Generated      86-106                           0000 0100 0011 0000 0100 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                 110
Fixed Bit         110            1                                          1
Encode Pos Device 111            1 Internal                                 1
121.5 Homing      112            1 YES                                      1
Position Change   113-132          DEFAULT             1000 0011 1110 0000 1111
Resultant Position              --> Not Defined
BCH Encoded       133-144          Errors=0                      0110 0110 1100
BCH Generated     133-144                                        0110 0110 1100

================================================================================
```

Test Data (0 min - 30 min)

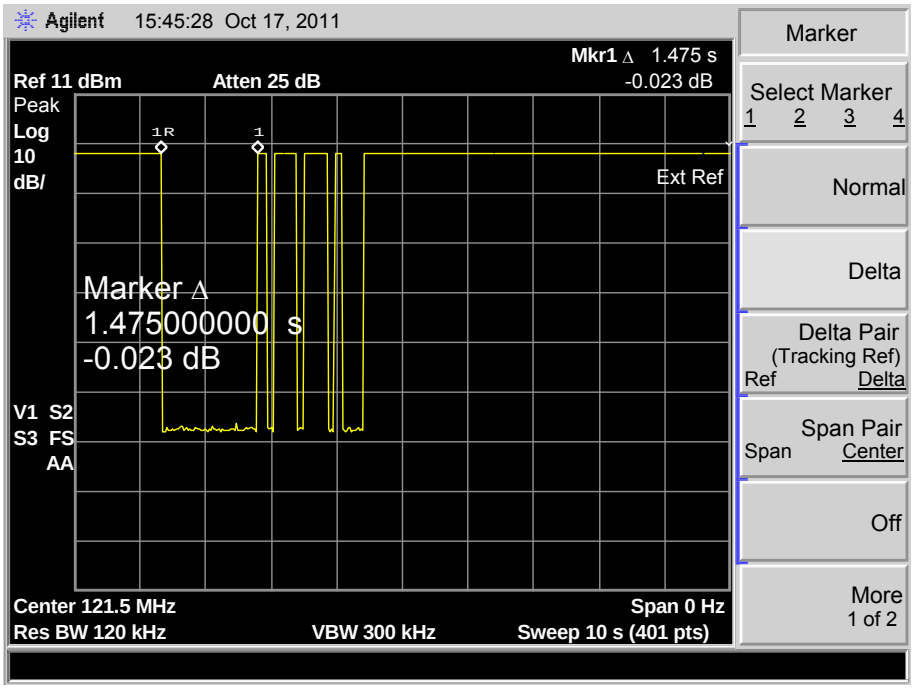
Burst No.	Nom Freq	STS	MTS - Slope	MTS - Res	Power	Time (hrs)
1	0	0.00E+00	0.00E+00	0.00E+00	36.524	0.028294
2	0	0.00E+00	0.00E+00	0.00E+00	36.516	0.042227
3	0	0.00E+00	0.00E+00	0.00E+00	36.524	0.056016
4	0	0.00E+00	0.00E+00	0.00E+00	36.533	0.070048
5	0	0.00E+00	0.00E+00	0.00E+00	36.533	0.083724
6	0	0.00E+00	0.00E+00	0.00E+00	36.537	0.097869
7	0	0.00E+00	0.00E+00	0.00E+00	36.538	0.111454
8	0	0.00E+00	0.00E+00	0.00E+00	36.543	0.125699
9	0	0.00E+00	0.00E+00	0.00E+00	36.545	0.139175
10	0	0.00E+00	0.00E+00	0.00E+00	36.557	0.153516
11	0	0.00E+00	0.00E+00	0.00E+00	36.561	0.166892
12	0	0.00E+00	0.00E+00	0.00E+00	36.562	0.181328
13	0	0.00E+00	0.00E+00	0.00E+00	36.567	0.194618
14	0	0.00E+00	0.00E+00	0.00E+00	36.573	0.209149
15	0	0.00E+00	0.00E+00	0.00E+00	36.571	0.223038
16	0	0.00E+00	0.00E+00	0.00E+00	36.584	0.236975
17	0	0.00E+00	0.00E+00	0.00E+00	36.587	0.250759
18	406037073.9	1.20E-10	-4.64E-09	5.69E-09	36.588	0.264805
19	406037072.6	1.15E-10	-4.15E-09	6.28E-09	36.587	0.278489
20	406037071.4	1.15E-10	-3.66E-09	6.71E-09	36.589	0.292617
21	406037070.2	1.13E-10	-3.13E-09	6.82E-09	36.587	0.306198
22	406037069.2	1.15E-10	-2.61E-09	6.68E-09	36.588	0.320438
23	406037068.3	1.01E-10	-2.09E-09	6.30E-09	36.59	0.333924
24	406037067.6	1.02E-10	-1.60E-09	5.68E-09	36.591	0.348259
25	406037066.9	9.97E-11	-1.16E-09	4.82E-09	36.585	0.361645
26	406037066.4	1.15E-10	-7.93E-10	3.73E-09	36.585	0.376085
27	406037065.9	1.15E-10	-4.97E-10	2.53E-09	36.581	0.389375
28	406037065.6	9.80E-11	-2.91E-10	1.47E-09	36.58	0.403911
29	406037065.4	9.67E-11	-1.72E-10	6.48E-10	36.581	0.417782
30	406037065.3	9.80E-11	-1.46E-10	5.09E-10	36.581	0.431728
31	406037065.2	1.00E-10	-1.64E-10	5.23E-10	36.582	0.445512
32	406037065.2	1.23E-10	-1.88E-10	5.09E-10	36.582	0.459553
33	406037065.1	1.40E-10	-1.99E-10	4.73E-10	36.583	0.473229
34	406037065.1	1.35E-10	-2.12E-10	4.39E-10	36.578	0.487366
35	406037065	1.37E-10	-2.21E-10	4.13E-10	36.58	0.500959

121 Homing Transmitter - Duty Cycle (Start of Test)

On Time



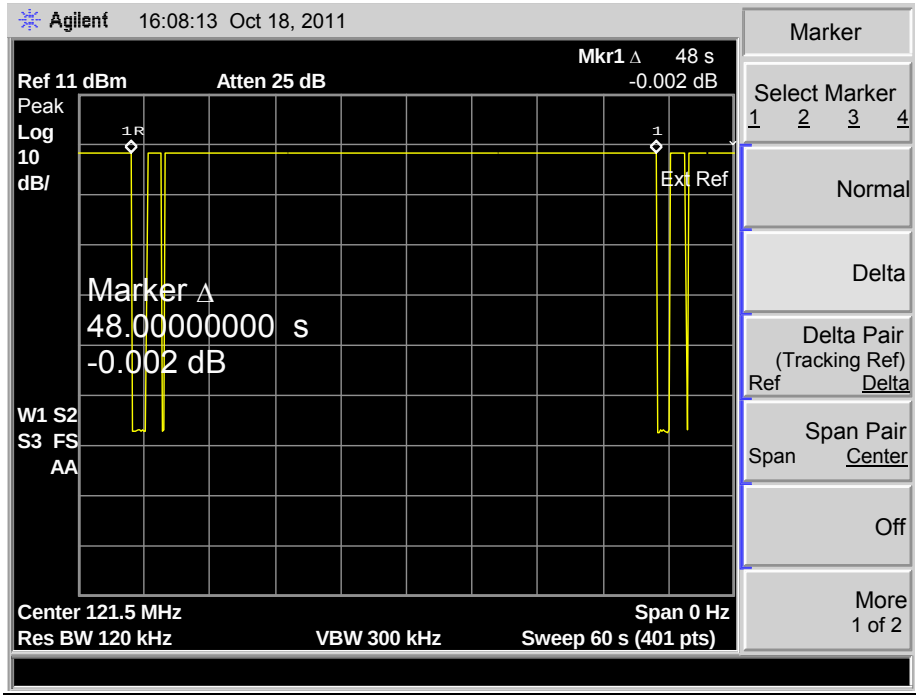
Off Time



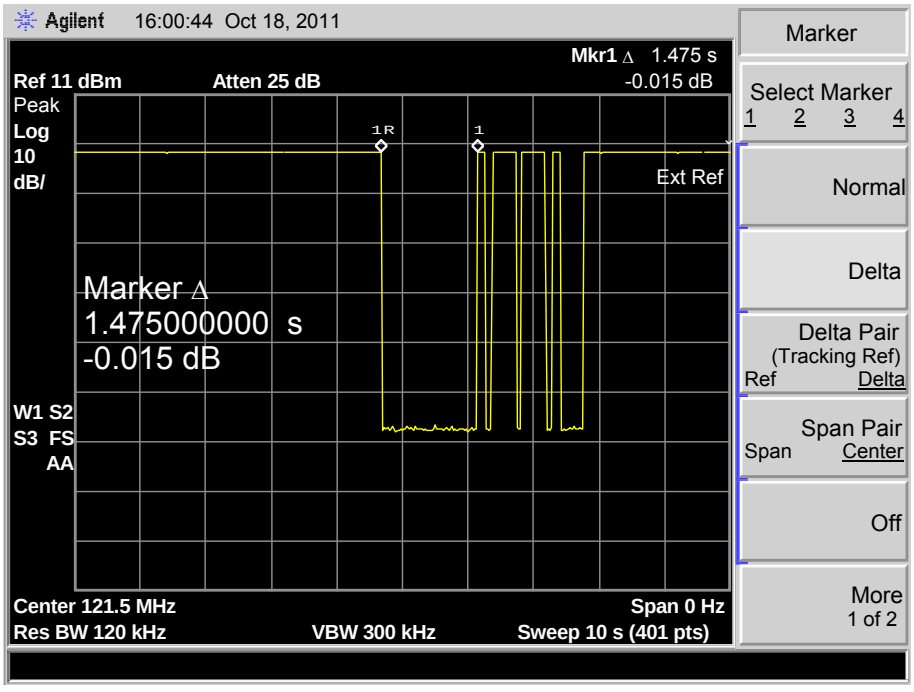
Duty Cycle = 50.55 / (50.55+1.475) = 0.971 = 97.1%

121 Homing Transmitter - Duty Cycle (End of Test)

On Time

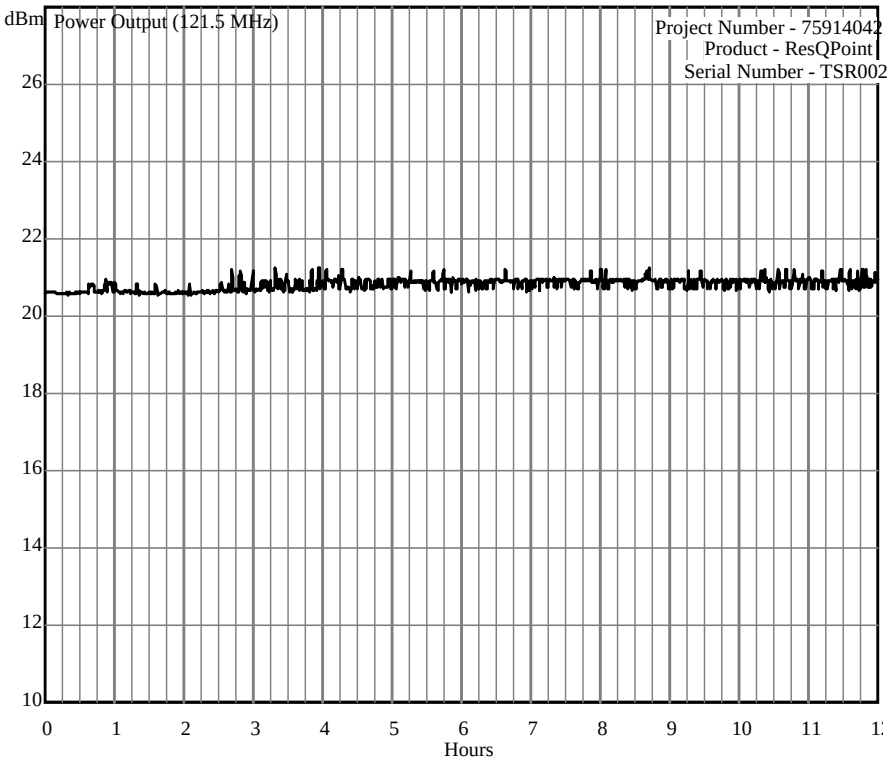


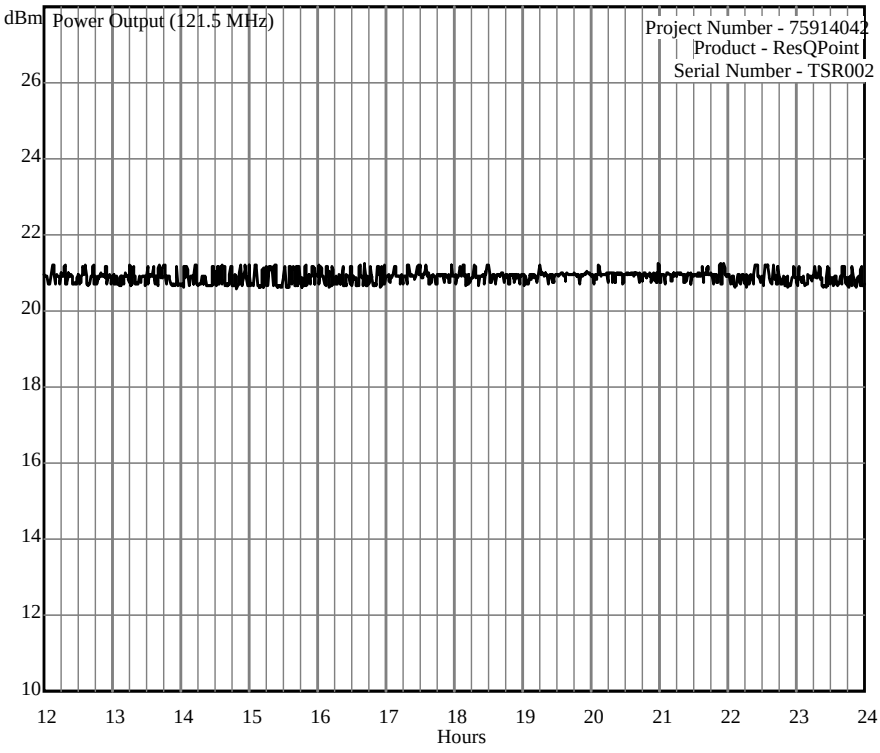
Off Time



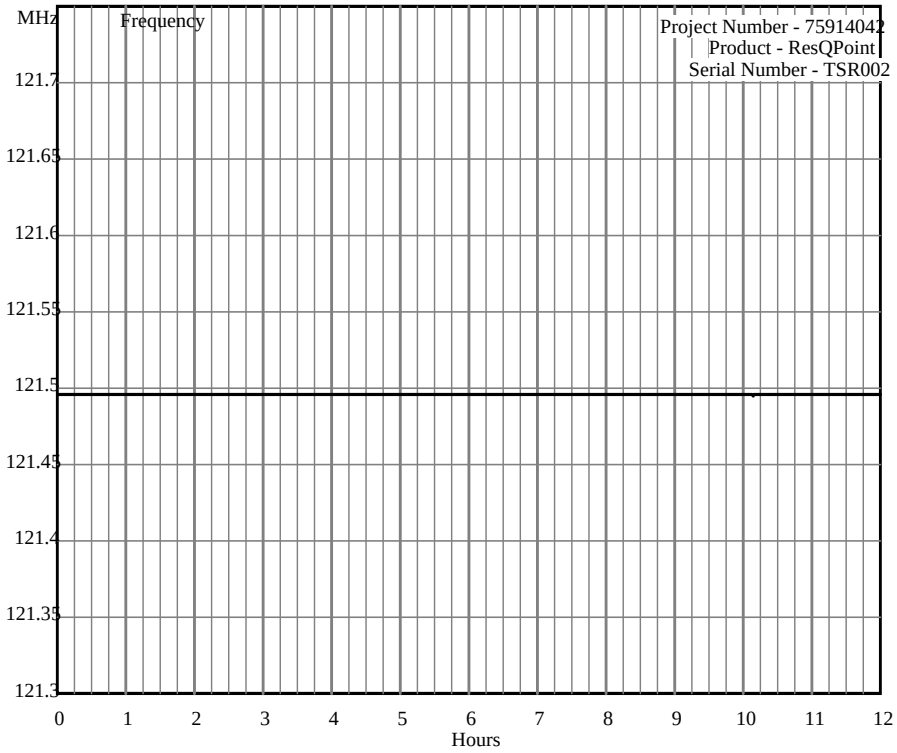
Duty Cycle = 48.00 / (48.0+1.475) = 0.970 = 97.0%

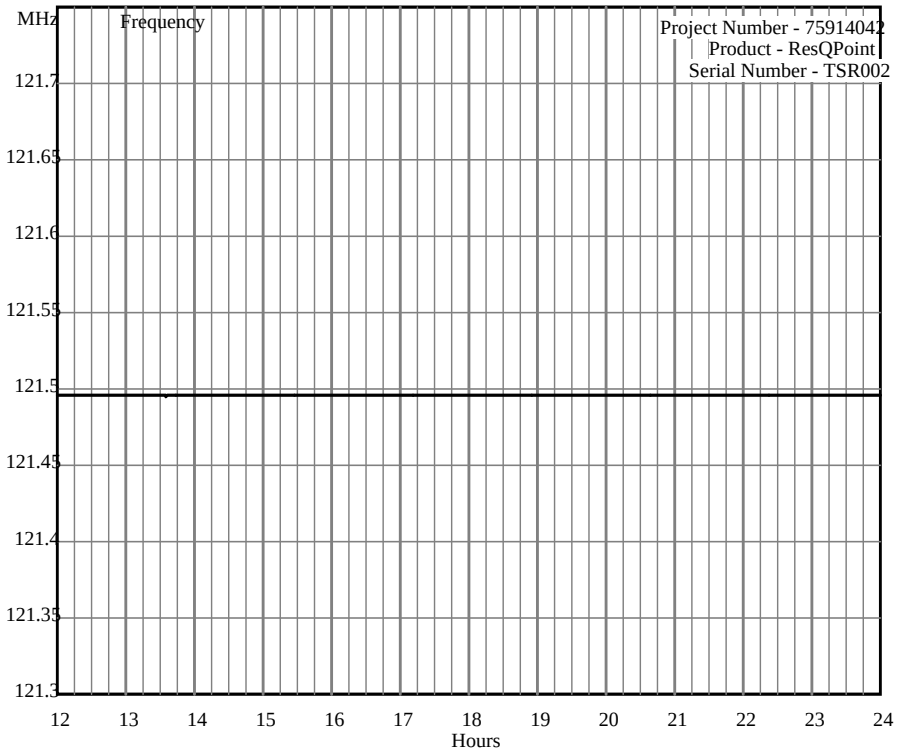
121 Homing Transmitter Power (First 24 Hours of Operation)





121 Homing Transmitter Frequency (First 24 Hours of Operation)





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"
- Beacon performing a GNSS Self-test without GPS Data present, "Time-out GNSS ST Current"
- Beacon performing a GNSS Self-test with GPS Data present, "Fast GNSS ST Current"

The individual tests were conducted for the following durations:

Standby Current	: 15.0067 minutes		(900400 ms)
Self-test Current	: 8.72 seconds		(8720 ms)
Time-out GNSS ST Current	: 130.08 seconds		(130080 ms)
Fast GNSS ST Current	: 41.6 seconds		(41600 ms)
Operating Current	: 10.0053 minutes		(600320 ms)

Assumptions / Supplied Data

Battery Replacement Interval	: 5.75 years
Battery Capacity	: 1.55 Ah
Battery Self Drain	: 1.00 % per year
Self-test Interval	: 10.43 tests per year
GNSS Self-test Interval	: 2.08 tests per year

Test Results

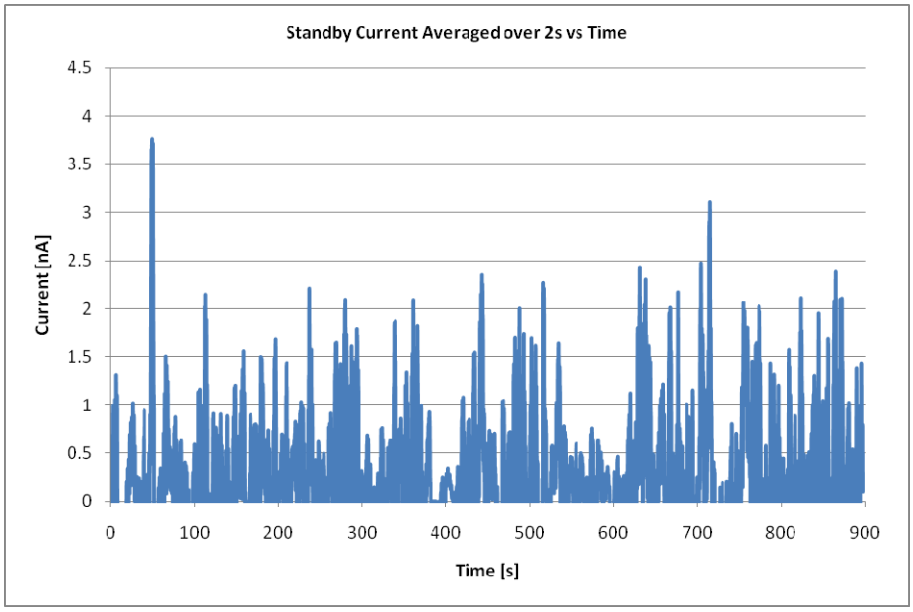
Mode Current	=	Accumulated Charge	/	Time		
Standby Current	=	102177.3 pC	/	900400 ms	=	0.11 nA
Self-test Current	=	650140 uC	/	8720 ms	=	74.56 mA
Time-out GNSS ST Current	=	3596624 uC	/	130080 ms	=	27.65 mA
Fast GNSS ST Current	=	1531228.8 uC	/	41600 ms	=	36.81 mA
Operating Current	=	18081671.38 uC	/	600320 ms	=	30.12 mA

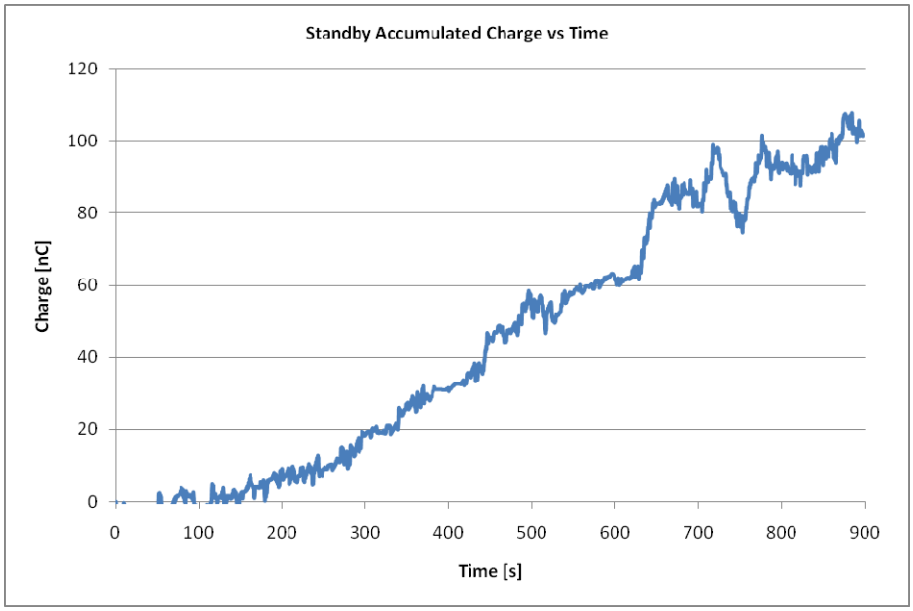
Battery Preconditioning / Discharge Time Calculations

Battery Self Drain	=	Capacity - [(100% - Self Drain/Year%)$^{\text{Replacement Interval}}$ x Capacity]
	=	1.55- ((1- 0.0100) $^{5.75}$ x 1.55) = 0.0870 Ah
Standby Drain	=	Hours per year x Battery Replacement Interval x Standby Current
	=	365 x 24 x 5.75 x 0.11 x 10^{-9} = 0.000006 Ah
Worst Case	=	1.65 x 0.0000 Ah = 0.000009 Ah
Self-test Drain	=	Self-tests per battery x Self-test Current x Self-test duration (in hours)
	=	10.43 x 6 x 74.56 x 10^{-3} x (8.72 / 3600) = 0.0108 Ah
Worst Case	=	1.65 x 0.0108 Ah = 0.0179 Ah
Time-out GNSS ST Drain	=	GNSS STs per battery x Time-out GNSS ST Current x Time-out GNSS ST duration (hours)
	=	2.08 x 6 x 27.65 x 10^{-3} x (130.08 / 3600) = 0.0119 Ah
Worst Case	=	1.65 x 0.0119 Ah = 0.0197 Ah
Fast GNSS ST Drain	=	GNSS STs per battery x Fast GNSS ST Current x Fast GNSS ST duration (hours)
	=	2.08 x 6 x 36.81 x 10^{-3} x (41.6 / 3600) = 0.0051 Ah
Worst Case	=	1.65 x 0.0051 Ah = 0.0084 Ah
Total Drain	=	Self Drain + Standby Drain (Worst Case) + Self-test Drain (Worst Case)
		+ Time-out GNSS ST Current (Worst Case) + Fast GNSS ST Current (Worst Case)
	=	0.0870 + 0.000009 + 0.0179 + 0.0197 + 0.0084 = 0.1330 Ah

Battery Preconditioning / Discharge Time	=	Worst Case drain / Operational Current
	=	0.1330 / (30.12 x 10^{-3})
	=	4.42 hours

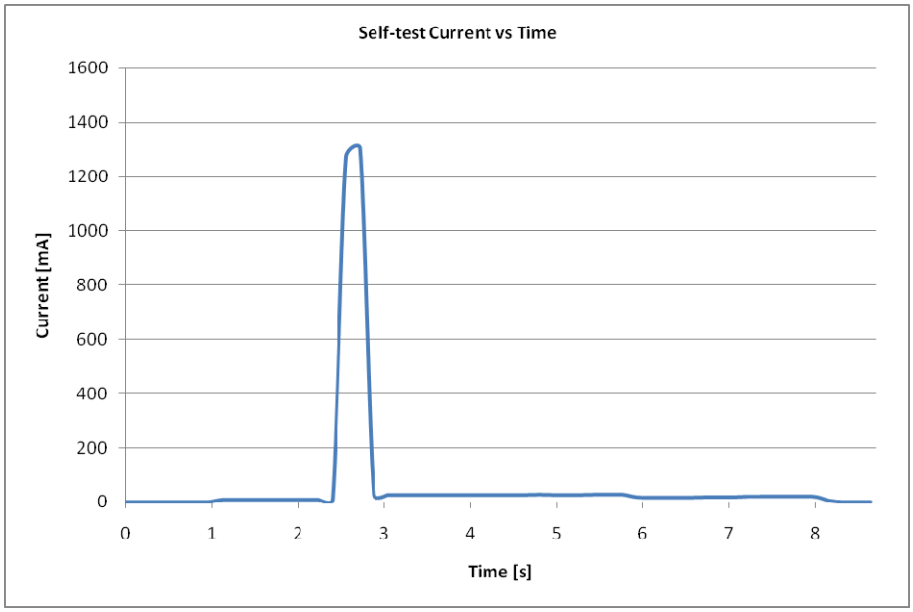
Standby Mode Plots

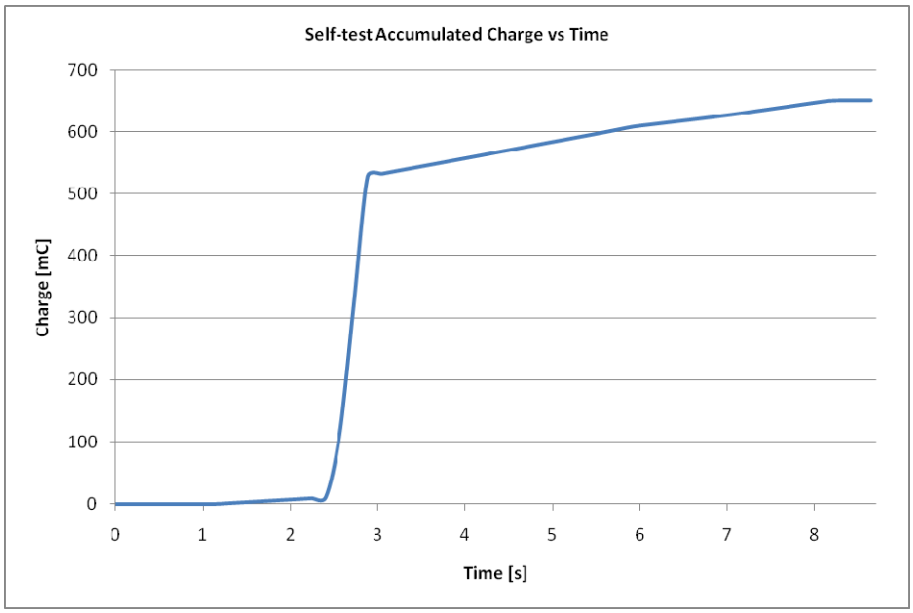




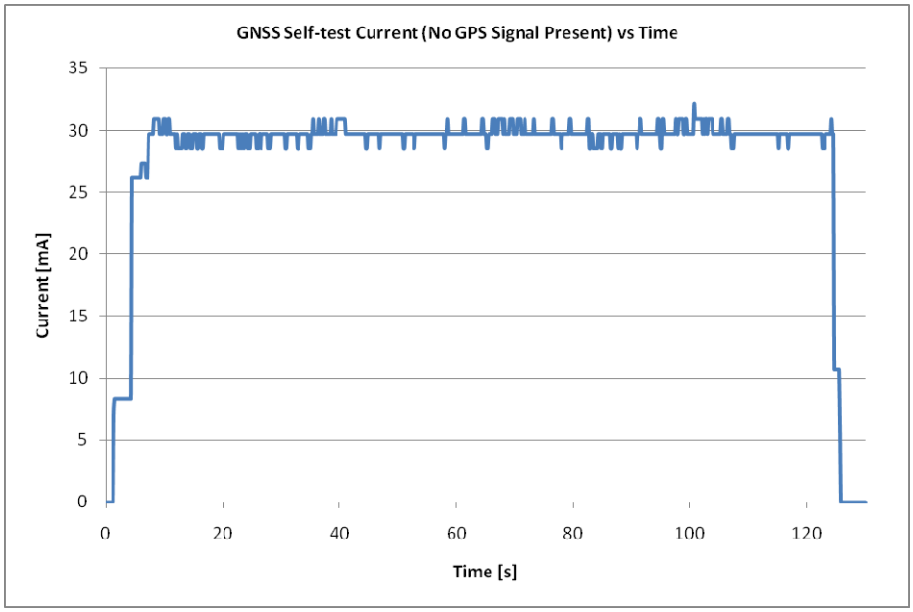
Product Service

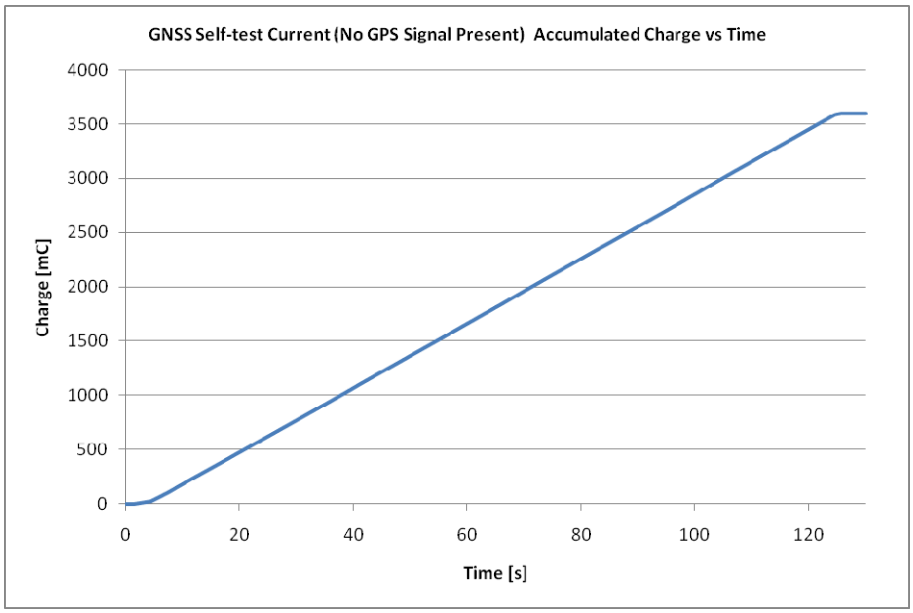
Self-test Mode Plots



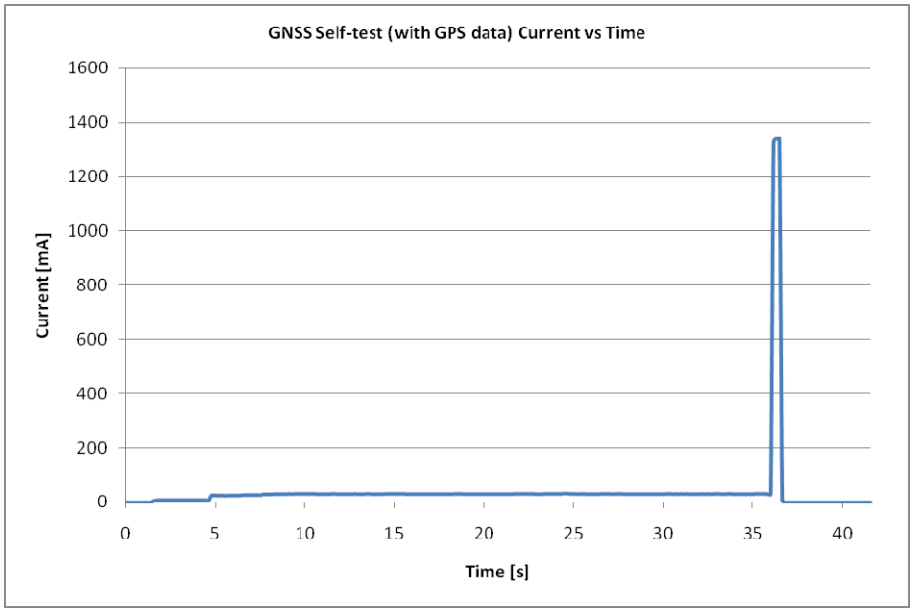


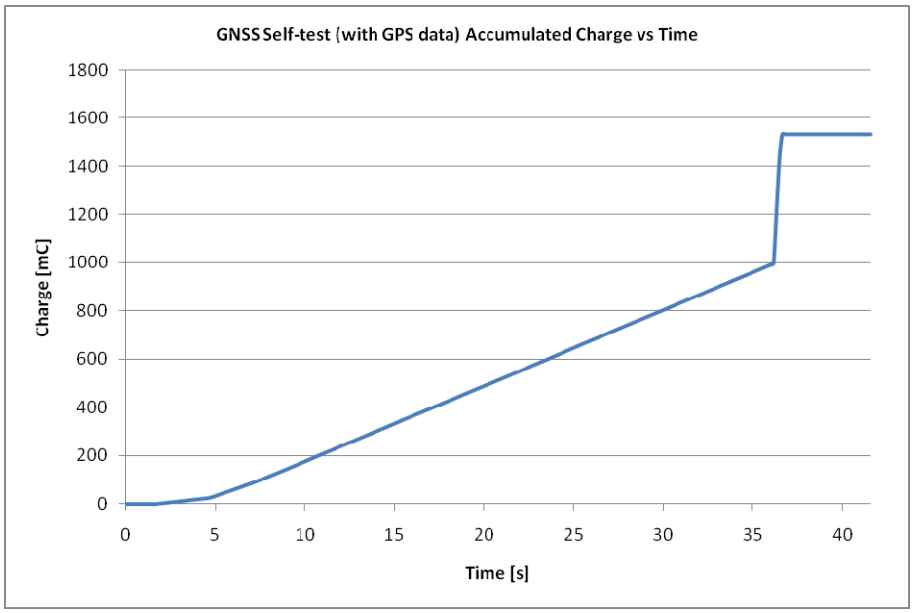
GNSS Self-test (Timeout) Mode Plots



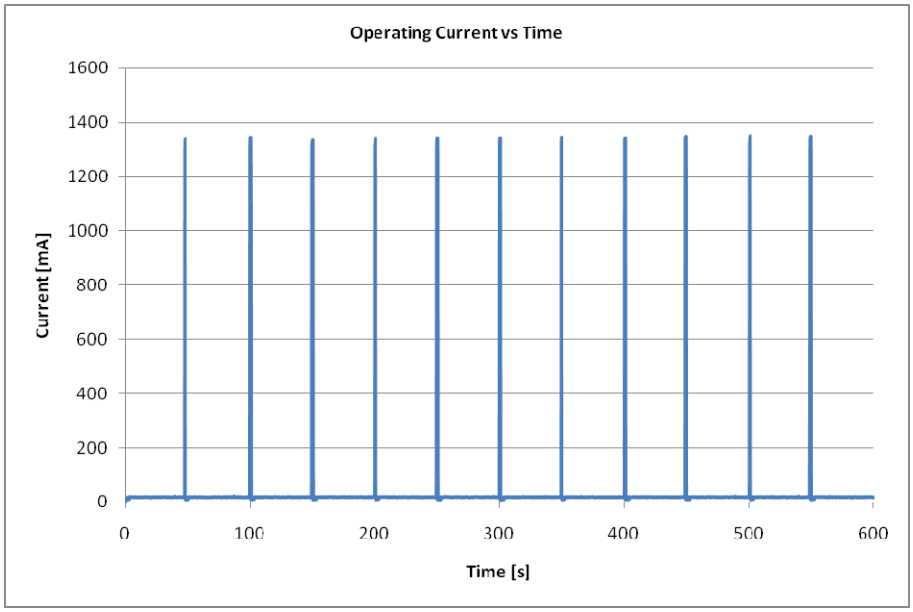


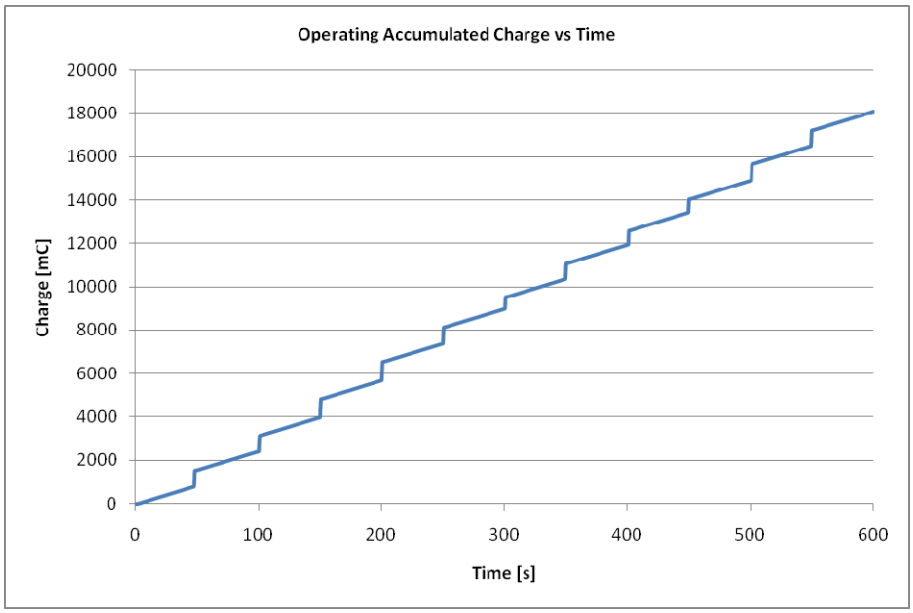
GNSS Self-test (Fast Acquire) Mode Plots





Operating Mode Plots





Beacon Operating Current

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

Beacon Operating Modes	Mode: Manually selectable or Automatic	Measurement Interval	Average Current	Peak Current
Standby (Off)	A	15 min	0.11nA	9.7nA
Self Test	M	8.7 sec	74.56mA	1302.8mA
GNSS Self Test (Timeout)[1]	M	130 sec	27.65mA	32mA
GNSS Self Test (Position Acquire)[1]	M	41.6 sec	36.81mA	1339.6mA
*Operating Current GPS Rxr Off[2]	M	10 min	30.12mA	1351.4mA
Operating Current GPS Rxr On[2]	M	9 min	51.89mA	1459.5mA

At all times the sampling interval was 80 ms nominal.

* This is the lower average current mode; hence, this was the figure used for the calculating the Operating Lifetime pre-test Discharge (giving a longer discharge time).

[1] 'Timeout GNSS Self Test' is conducted with no GPS data present. 'Fast GNSS Self Test is conducted with GPS data present. As a worst case scenario, both sets of measurement data are used in the battery pre discharge calculation.

[2] A combination of these modes (subject to the internal GPS receiver duty cycle) was used during pre-test discharge (and test itself) giving an "over-test" on the discharge.

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

SATRO ™, PLB-110 S/N: # 500 (TUV#2) - Modification State 0

2.8.3 Date of Test

8 November 2011

2.8.4 Test Equipment Used

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

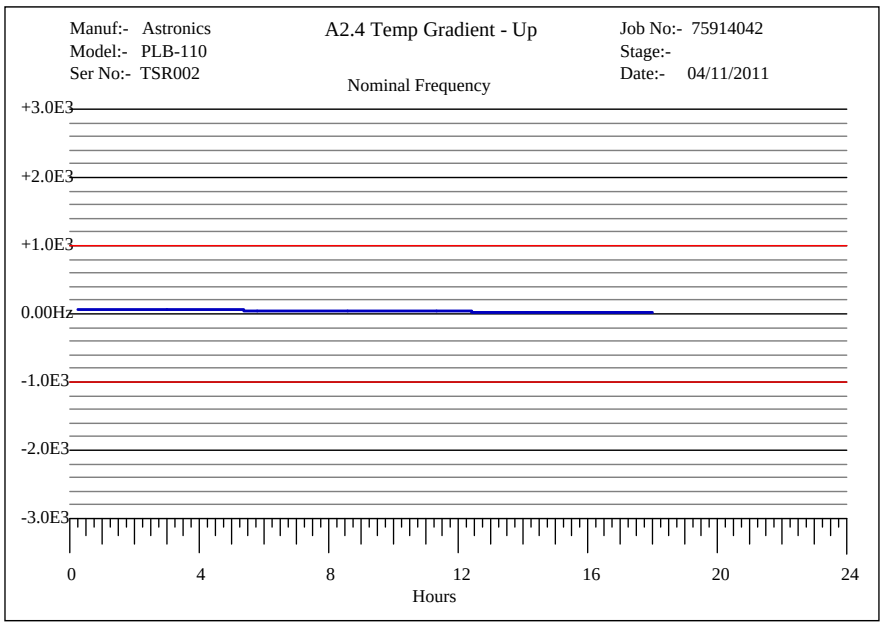
2.8.5 Environmental Conditions

Ambient Temperature 23.4°C
Relative Humidity 45.5%

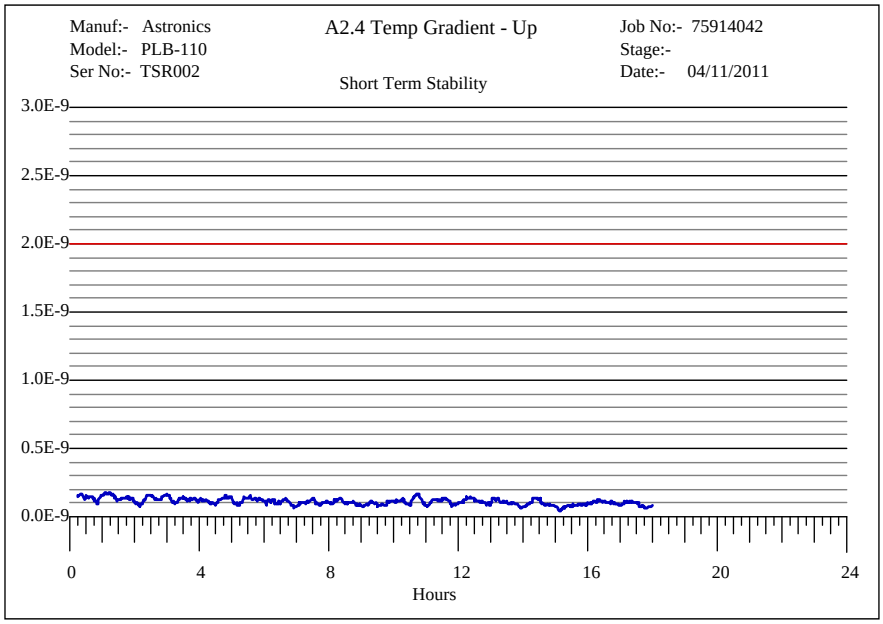
2.8.6 Test Results

Up Ramp

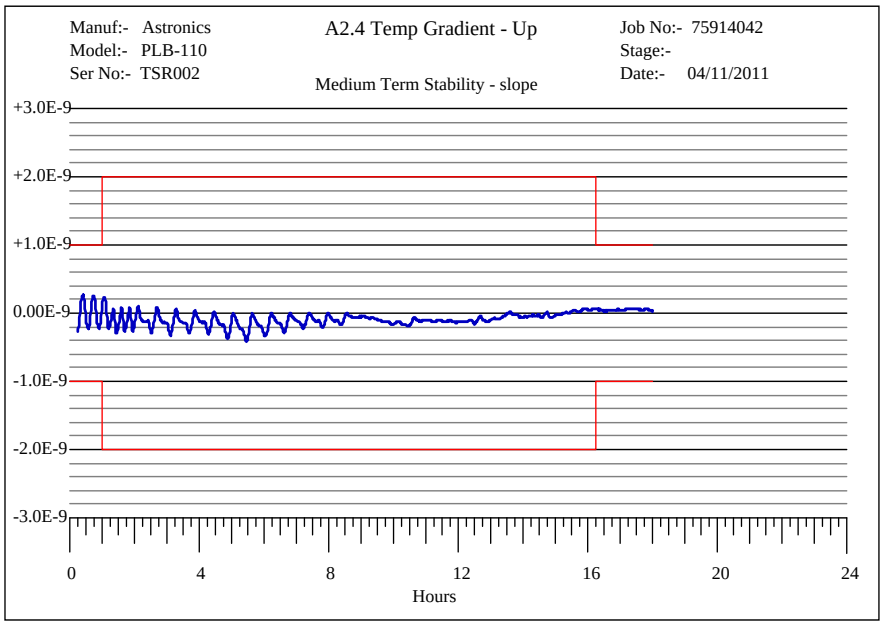
Nominal Frequency



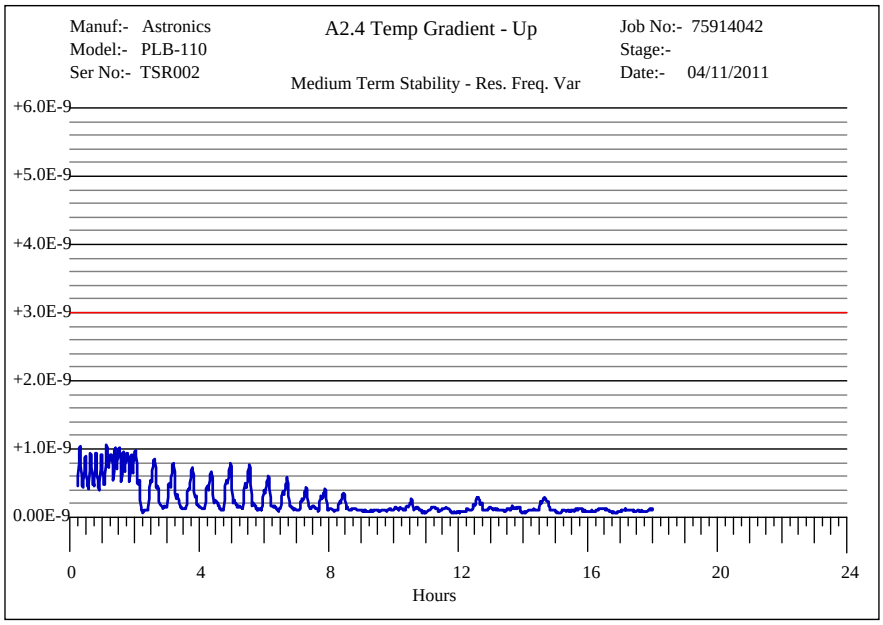
Short Term Stability



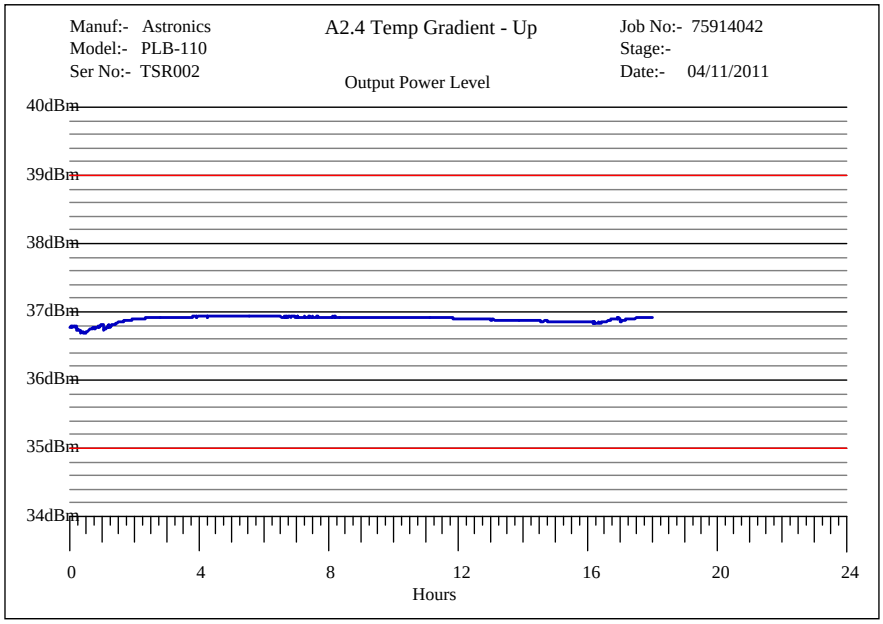
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



Output Power

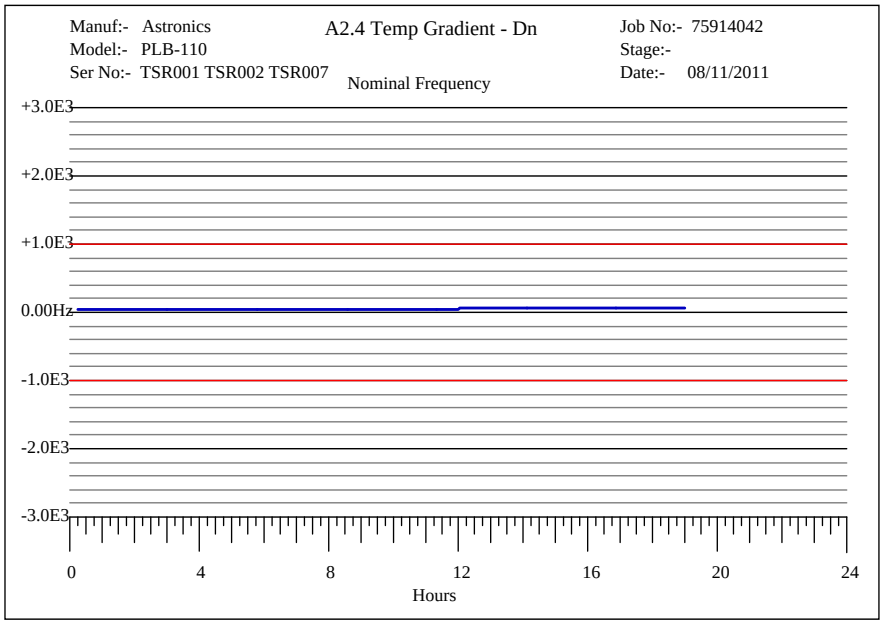


Digital Message

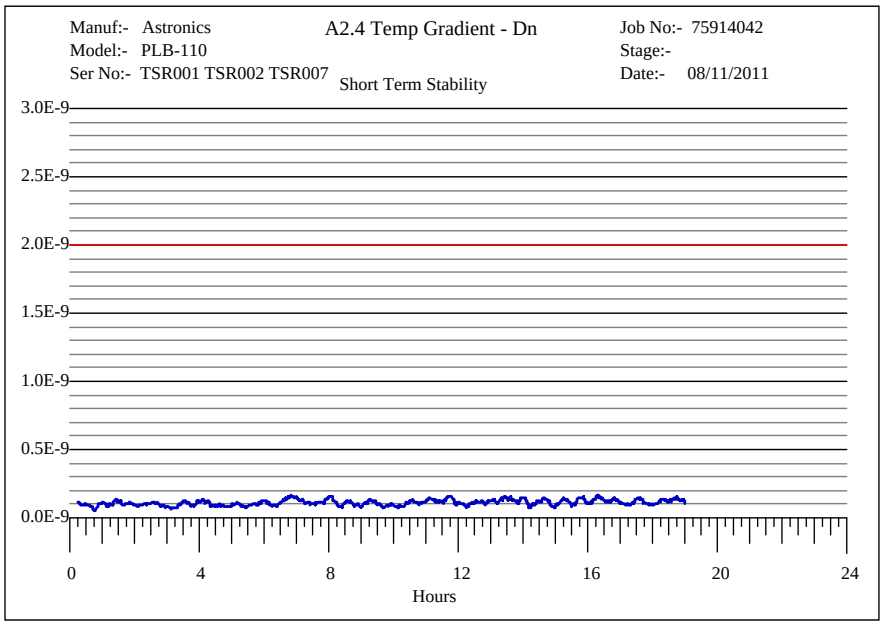
```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF              2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                               0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                  1110
Spare              41- 64                          0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           0000 0100 0011 0000 0100 1
BCH Generated      86-106                             0000 0100 0011 0000 0100 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                  110
Fixed Bit         110              1                                         1
Encode Pos Device 111              1 Internal                                1
121.5 Homing      112              1 YES                                     1
Position Change   113-132          DEFAULT              1000 0011 1110 0000 1111
Resultant Position               --> Not Defined
BCH Encoded       133-144          Errors=0                      0110 0110 1100
BCH Generated     133-144                                        0110 0110 1100

================================================================================
```

Down Ramp

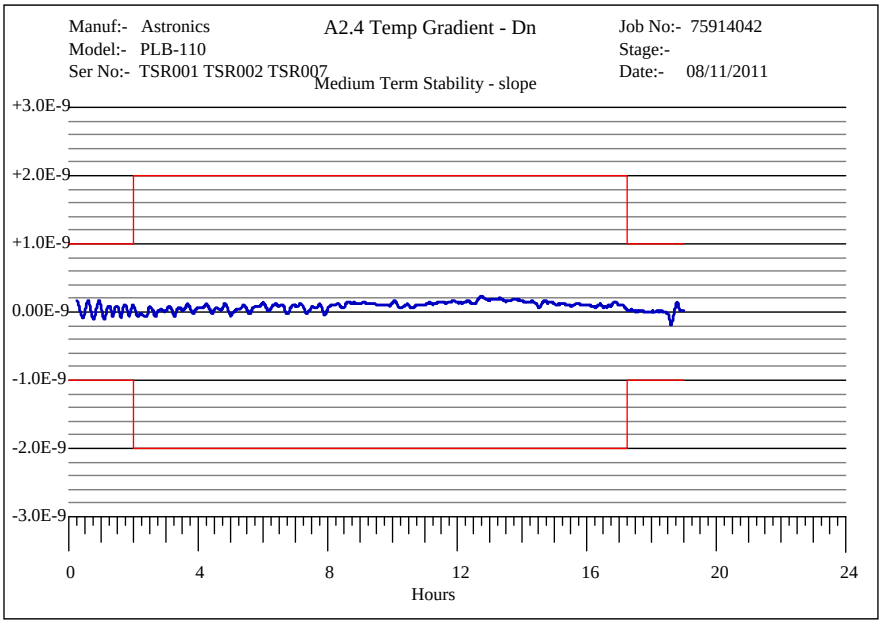
Nominal Frequency



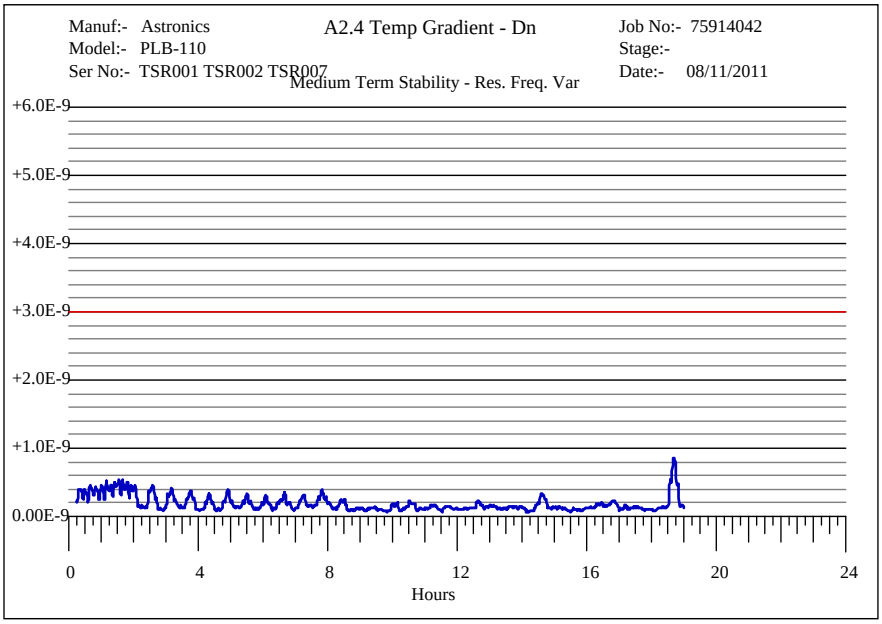
Short Term Stability



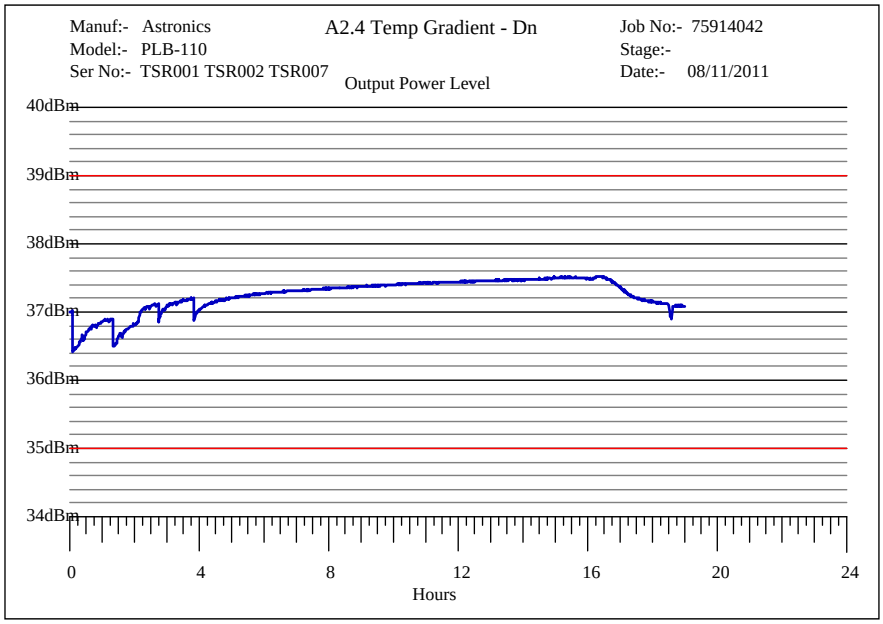
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



Output Power



Digital Message

```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC6683E8FFBFF            2DDC6683E8FFBFF Default_Id
 30 Hex (Bits 25-144) = 96EE3341F47FDFF821827783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0110 0110 1000 0011 1110 1000 1111 1111 1011 1111 1111
   0000 0100 0011 0000 0100 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                          0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                        0011 0011 0100 0001 1111 0100
Coarse Position    65- 85          DEFAULT          0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0         0000 0100 0011 0000 0100 1
BCH Generated      86-106                           0000 0100 0011 0000 0100 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                  110
Fixed Bit         110              1                                         1
Encode Pos Device 111              1 Internal                                1
121.5 Homing      112              1 YES                                     1
Position Change   113-132          DEFAULT             1000 0011 1110 0000 1111
Resultant Position               --> Not Defined
BCH Encoded       133-144          Errors=0                     0110 0110 1100
BCH Generated     133-144                                       0110 0110 1100

================================================================================
```

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

SATRO ™, PLB-110 S/N: # 100 (TUV#1) - Modification State 0

2.9.3 Date of Test

8 November 2011 & 10 November 2011

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 10.2 - 10.4°C
Relative Humidity 43.7 - 56.9%

2.9.6 Test Results

Product Service

Configuration 7

Test Start: 08/11/11 15:20
Test End: 09/11/11 08:30
15 Hex ID: 2DDC6 680C8 FFBFF

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)
S11	26228	2DDC6 680C8 FFBFF	50.82875	-1.19225	-125.43	21:43:20	-8.301	1.238
S8	57378	2DDC6 680C8 FFBFF	50.83013	-1.19136	-126.91	20:38:32	-13.305	1.403
S11	26227	2DDC6 680C8 FFBFF	50.88937	-1.13212	-125.26	20:03:12	7.016	9.156
S11	26226	2DDC6 680C8 FFBFF	50.82016	-1.20523	-119.80	18:24:26	20.068	0.564
S9	48724	2DDC6 680C8 FFBFF	50.83165	-1.19266	-126.71	19:55:20	-6.151	1.540
S8	57377	2DDC6 680C8 FFBFF	50.83178	-1.21133	-126.61	18:57:22	2.514	1.783
S9	48723	2DDC6 680C8 FFBFF	50.83527	-1.20825	-127.31	18:15:32	9.041	2.035
S7	70132	2DDC6 680C8 FFBFF	50.82616	-1.18834	-128.16	18:05:00	-19.712	1.109
S8	57376	2DDC6 680C8 FFBFF	50.82948	-1.22473	-128.49	17:17:37	16.434	2.267
S7	70131	2DDC6 680C8 FFBFF	50.83279	-1.19234	-125.49	16:24:02	-3.782	1.668
S10	33330	2DDC6 680C8 FFBFF	50.83020	-1.18432	-127.36	15:29:06	-16.008	1.638
S9	48731	2DDC6 680C8 FFBFF	50.80796	-1.20436	-126.88	08:05:43	-5.131	1.225
S7	70140	2DDC6 680C8 FFBFF	50.82632	-1.18626	-125.95	07:52:30	20.213	1.216
S8	57384	2DDC6 680C8 FFBFF	50.80600	-1.20266	-128.73	07:13:25	-14.286	1.396
S7	70139	2DDC6 680C8 FFBFF	50.82396	-1.19341	-117.44	06:14:00	7.288	0.713
S10	33338	2DDC6 680C8 FFBFF	50.80589	-1.20972	-129.32	05:25:07	17.951	1.601
S7	70138	2DDC6 680C8 FFBFF	50.80913	-1.18244	-126.98	04:34:06	-8.029	1.477
S12	14183	2DDC6 680C8 FFBFF	50.81242	-1.20628	-128.60	04:25:32	17.584	0.873
S10	33337	2DDC6 680C8 FFBFF	50.80882	-1.19857	-127.12	03:45:28	4.363	1.042
S12	14182	2DDC6 680C8 FFBFF	50.81009	-1.19773	-127.09	02:45:48	3.851	0.899
S10	33336	2DDC6 680C8 FFBFF	50.80683	-1.20623	-127.59	02:04:23	-11.347	1.393
S12	14181	2DDC6 680C8 FFBFF	50.80866	-1.20362	-128.18	01:04:38	-11.917	1.134

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

$= \dfrac{21}{22}$

$= 95.5\%$

Product Service

Configuration 8

Test Start: 09/11/11 14:30
Test End: 10/11/11 09:30
15 Hex ID: 2DDC6 680C8 FFBFF

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)
S11	26243	2DDC6 680C8 FFBFF	50.82389	-1.18875	-126.76	23:03:51	-20.991	0.899
S11	26242	2DDC6 680C8 FFBFF	50.82236	-1.18126	-126.32	21:22:31	-5.019	1.253
S9	48739	2DDC6 680C8 FFBFF	50.82984	-1.20321	-127.66	21:12:39	-18.381	1.349
S8	57392	2DDC6 680C8 FFBFF	50.83170	-1.19024	-126.04	20:26:25	-11.366	1.594
S11	26241	2DDC6 680C8 FFBFF	50.82485	-1.20393	-125.99	19:42:39	10.032	0.856
S9	48738	2DDC6 680C8 FFBFF	50.83080	-1.19463	-124.94	19:31:43	-2.464	1.420
S8	57391	2DDC6 680C8 FFBFF	50.83461	-1.21361	-125.64	18:45:26	4.323	2.135
S9	48737	2DDC6 680C8 FFBFF	50.82641	-1.21354	-127.56	17:52:15	12.301	1.432
S7	70146	2DDC6 680C8 FFBFF	50.82133	-1.18611	-125.72	17:40:27	-15.859	0.894
S8	57390	2DDC6 680C8 FFBFF	50.83091	-1.22190	-127.76	17:05:52	17.882	2.203
S7	70140	2DDC6 680C8 FFBFF	50.82597	-1.18953	-126.89	07:52:30	20.211	1.043
S10	33344	2DDC6 680C8 FFBFF	50.83083	-1.18412	-126.18	15:18:06	-14.257	1.703
S9	48746	2DDC6 680C8 FFBFF	50.81352	-1.19019	-125.84	09:22:05	6.602	0.746
S9	48745	2DDC6 680C8 FFBFF	50.80753	-1.20362	-125.85	07:42:03	-8.850	1.252
S7	70154	2DDC6 680C8 FFBFF	50.82706	-1.18645	-119.65	07:28:49	17.415	1.270
S8	57398	2DDC6 680C8 FFBFF	50.80625	-1.19846	-128.94	07:01:17	-16.223	1.327
S7	70153	2DDC6 680C8 FFBFF	50.82540	-1.18869	-116.94	05:49:59	3.732	1.027
S7	70152	2DDC6 680C8 FFBFF	50.82315	-1.19748	-116.70	04:09:45	-11.904	0.553
S10	33352	2DDC6 680C8 FFBFF	50.80725	-1.21002	-127.40	05:14:28	16.639	1.486
S12	14197	2DDC6 680C8 FFBFF	50.80751	-1.20583	-126.69	04:15:11	16.306	1.312
S10	33351	2DDC6 680C8 FFBFF	50.80641	-1.19219	-125.95	03:34:39	2.734	1.367
S12	14196	2DDC6 680C8 FFBFF	50.80558	-1.18605	-125.56	02:35:18	2.275	1.627
S10	33350	2DDC6 680C8 FFBFF	50.80561	-1.20273	-127.27	01:53:25	-13.097	1.439
S12	14195	2DDC6 680C8 FFBFF	50.80678	-1.20330	-127.41	00:53:58	-13.606	1.324

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

$= \dfrac{24}{24}$

$= 100\%$

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

SATRO ™, PLB-110 S/N: # 100 (TUV#1) - Modification State 0

2.10.3 Date of Test

12 October 2011

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 19.6°C
Relative Humidity 59.0%

2.10.6 Test Results

Configuration 3

	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	39.1	2.63	40.9	4.42	42.6	6.15	37.5	0.98	~~32.4~~	-4.07
30	39.1	2.62	40.9	4.41	42.5	6.05	37.5	0.95	~~32.5~~	-4.04
60	38.9	2.41	40.6	4.08	42.4	5.94	38.1	1.57	~~32.4~~	-4.13
90	38.7	2.25	40.8	4.33	42.3	5.84	38.1	1.64	32.7	-3.77
120	38.7	2.23	40.6	4.10	42.1	5.63	38.3	1.78	32.8	-3.73
150	38.6	2.15	40.9	4.41	42.3	5.83	38.5	1.98	32.9	-3.60
180	38.3	1.85	40.8	4.30	42.3	5.83	38.2	1.69	32.8	-3.73
210	38.4	1.92	40.8	4.29	42.4	5.93	38.2	1.69	32.8	-3.73
240	38.8	2.32	41.0	4.49	42.3	5.83	37.8	1.27	33.4	-3.11
270	38.9	2.42	40.6	4.11	42.2	5.74	37.7	1.24	33.2	-3.30
300	39.0	2.52	40.7	4.20	42.5	6.04	37.6	1.06	32.8	-3.70
330	39.4	2.92	40.7	4.21	42.4	5.94	37.2	0.68	32.8	-3.69
Gain Variation	1.07		0.40		0.52		1.31		1.03	

$EIRP_{LOSS} = Pt_{ambient} - Pt_{EOL} =$ 36.5 - 35.91 = 0.59dBm

$EIRP_{maxEOL} = Max[EIRP_{max}, (EIRP_{max} - EIRP_{LOSS})] =$ Max[42.6, 42.0]= 42.6 dBm

$EIRP_{minEOL} = Min[EIRP_{min}, (EIRP_{min} - EIRP_{LOSS})] =$ Min[32.7, 32.1]= 32.1 dBm

Configuration 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	39.1	2.61	40.2	3.65	38.9	2.35	35.9	-0.60	31.5	-5.03
90	39.4	2.89	40.2	3.67	39.0	2.50	36.1	-0.42	34.7	-1.82
180	39.5	2.97	40.5	4.01	39.5	3.04	37.0	0.54	34.0	-2.54
270	39.3	2.77	40.2	3.75	39.6	3.13	37.4	0.90	34.5	-1.98

$EIRP_{LOSS} = Pt_{ambient} - Pt_{EOL} =$ 36.5- 35.91 = 0.59dBm

$EIRP_{maxEOL} = Max[EIRP_{max}, (EIRP_{max} - EIRP_{LOSS})] =$ Max[40.5, 39.9]= 40.5dBm

$EIRP_{minEOL} = Min[EIRP_{min}, (EIRP_{min} - EIRP_{LOSS})] =$ Min[31.5, 30.9]= 30.9dBm

2.11 BEACON CODING SOFTWARE

2.11.1 Specification

Cospas-Sarsat T.007, Clause A.2.8

2.11.2 Equipment Under Test and Modification State

SATRO ™, PLB-110 S/N: # 500 (TUV#2) and #600 (TUV#4) - Modification State 0

2.11.3 Date of Test

22 November 2011

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 23.5°C
Relative Humidity 39.4%

2.11.6 Test Results

Protocol	Operational Message		Self-Test Message	GNSS Self Test Message
	Location A	Location B		Location A
Standard Location: PLB with Serial Number	FFFE2F8C9733406333A0381EB2371DA4D4D0	FFFE2F8C9733406332E037CA13378EA76951	FFFED08C973340637FDFFEE9C1F7	FFFED08C9733406333A0381EB2371DA4D4D0
National Location: PLB	FFFE2F8C9B0018CCD701C889E777920C0AB2	FFFE2F8C9B0018CCB1019D4CB8B794240FCD	FFFED08C9B0018DFC0FF042E1977	FFFED08C9B0018CCD701C889E777920C0AB2

Note: The only parameters that were programmable via the customer supplied software were Country code and Beacon Serial Number. All other parameters were set automatically.

2.12 NAVIGATION SYSTEM TEST

2.12.1 Specification

Cospas-Sarsat T.007, Clause A.2.7

2.12.2 Equipment Under Test and Modification State

SATRO ™, PLB-110 S/N: # 100 (TUV#1) - Modification State 0
SATRO ™, PLB-110 S/N: # 500 (TUV#2) - Modification State 0
SATRO ™, PLB-110 S/N: # 200 (TUV#3) - Modification State 0
SATRO ™, PLB-110 S/N: # 600 (TUV#4) - Modification State 0

2.12.3 Date of Test

11 November 2011, 15 November 2011 & 16 November 2011

2.12.4 Test Equipment Used

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

2.12.5 Environmental Conditions

Ambient Temperature 21.4 - 22.3°C
Relative Humidity 35.9 - 56.9%

2.12.6 Test Results

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
FFFE2F96EF00961FC0FF037302779F3C0010	35

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

Locations:

A.3.8.2.1:	50° 52.163' N	1° 14.607'W	①
A.3.8.2.2:	51° 22.583'N	1° 49.833'W	②

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 7	100	68.8	100	49.8
Configuration 8	151	55.6	100	49.8

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

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

Location: N 51° 22.583' W 1° 49.833' ①		
Data Acquired at	09:44:12	FFFE2F96EF00960CD701CFD4FC779208025B
Location: N 50° 48.683' W 1° 37.417' ①		
Data Updated at	09:55:03	FFFE2F96EF00960CB1019A11A3B794240FCD
Data Update Interval	10 min 51 s	

① 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.

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

Location: N 50° 52.135' W 1° 14.701' ①		
Data Acquired at	12:30:44	FFFE2F96EF00960CB50139A6E0B7852C0204
GPS Signal Navigation Data Removed		
Data Updated at	16:31:24	FFFE2F96EF00961FC0FF037302779F3C0010
Last Valid Position Held	240min 40s	
Return to Default Position	✓	

① Input from GPS simulator

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
FFFE2F96EE3341F47FDFF821827783E0F66C	35

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

Locations:

A.3.8.2.1:	50° 52.163' N	1° 14.607'W	①
A.3.8.2.2:	51° 22.583'N	1° 49.833'W	②

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 7	100	55.6	100	49.8
Configuration 8	100	55.6	151	49.8

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

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

Location: N 51° 22.583' W 1° 49.833' ①		
Data Acquired at	09:44:34	FFFE2F96EE3341F433A03ED6F1B71DA4D4D0
Location: N 50° 48.683' W 1° 37.417' ①		
Data Updated at	09:55:25	FFFE2F96EE3341F432E0310250B78EA76951
Data Update Interval	10 min 51 s	

① 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.

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

Location: N 50° 52.135' W 1° 14.701'①		
Data Acquired at	12:31:12	FFFE2F96EE3341F432E02BD8D9F79C8044FD
GPS Signal Navigation Data Removed		
Data Updated at	16:31:52	FFFE2F96EE3341F47FDFF821827783E0F66C
Last Valid Position Held	240min 40s	
Return to Default Position	✓	

① Input from GPS simulator

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1, 2.4 and 2.5 - Constant Temperature Tests					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Power Meter	Hewlett Packard	436A	47	12	11-Jul-2012
Signal Generator	Hewlett Packard	8644A	96	12	15-Apr-2012
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Beacon RF Unit	TUV	N/A	3066	-	TU
Hygrometer	Rotronic	I-1000	3068	12	26-Jul-2012
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3096	12	7-Mar-2012
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	12	7-Mar-2012
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	10-Jun-2012
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3161	12	10-Jun-2012
Thermocouple Thermometer	Fluke	51	3174	12	6-Sep-2012
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	15-Aug-2012
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	8-Nov-2011
ScopeCorder	Yokogawa	DL750 701210	3254	12	8-Nov-2011
Short Circuit	TUV	Short Cicuit	3272	-	TU
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	6-Jun-2012
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	19-Apr-2012
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	19-Apr-2012
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	8-Mar-2012
Section 2.2 - Modulation Characteristics					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2012
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	12-Nov-2011
Oscilloscope	Lecroy	9370	2832	12	25-Oct-2012
Hygrometer	Rotronic	I-1000	3068	12	26-Jul-2012
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	23-Jun-2012
Thermocouple Thermometer	Fluke	51	3174	12	6-Sep-2012
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	6-Jun-2012
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	20-Apr-2012
Section 2.3 - Spurious Emissions					
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	15-Jan-2012
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	28-Jun-2012
Hygrometer	Rotronic	I-1000	3068	12	26-Jul-2012
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	10-Jun-2012
Thermocouple Thermometer	Fluke	51	3174	12	6-Sep-2012
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3352	12	19-Apr-2012

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.6 - Thermal Shock					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Power Meter	Hewlett Packard	436A	47	12	11-Jul-2012
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Signal Generator	Hewlett Packard	8644A	96	12	15-Apr-2012
Beacon RF Unit	TUV	N/A	3066	-	TU
Hygrometer	Rotronic	I-1000	3068	12	26-Jul-2012
Termination (50ohm, 6W)	Micronde	R404613	3074	12	17-Mar-2012
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	10-Jun-2012
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3161	12	10-Jun-2012
Thermocouple Thermometer	Fluke	51	3174	12	6-Sep-2012
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	15-Aug-2012
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	8-Nov-2011
ScopeCorder	Yokogawa	DL750 701210	3254	12	8-Nov-2011
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	19-Apr-2012
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	19-Apr-2012
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	8-Mar-2012
Section 2.7 - Operating Lifetime					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Power Meter	Hewlett Packard	436A	47	12	11-Jul-2012
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	15-Jan-2012
Signal Generator	Hewlett Packard	8644A	96	12	15-Apr-2012
Termination (50Ω)	Diamond Antenna	DL-30N	337	12	16-Sep-2012
Spectrum Analyser	Agilent	E7405A	1410	12	22-Jul-2012
Beacon RF Unit	TUV	N/A	3066	-	TU
Hygrometer	Rotronic	I-1000	3068	12	26-Jul-2012
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3097	12	11-May-2012
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	23-Jun-2012
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	10-Jun-2012
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3161	12	10-Jun-2012
Thermocouple Thermometer	Fluke	51	3174	12	6-Sep-2012
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	15-Aug-2012
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	8-Nov-2011
ScopeCorder	Yokogawa	DL750 701210	3254	12	8-Nov-2011
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
Resistor (Nominal 0.25ohm)	TUV	2x RS Components 188-071 R5/100W Resistors	3343	12	21-Oct-2011
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	6-Jun-2012
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3351	12	19-Apr-2012
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3352	12	19-Apr-2012
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	19-Apr-2012
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	19-Apr-2012
Bandpass Filter	Trilithic	5BE121.55/35-3-BA	3410	12	15-Aug-2012
Data Logger	Pico Technology Ltd	ADC-16	3414	12	30-Jun-2012

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.8 - Frequency Stability Test with Temperature Gradient					
Power Meter	Hewlett Packard	436A	47	12	11-Jul-2012
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Signal Generator	Hewlett Packard	8644A	96	12	15-Apr-2012
Beacon RF Unit	TUV	N/A	3066	-	TU
Hygrometer	Rotronic	I-1000	3068	12	26-Jul-2012
Termination (50ohm, 6W)	Micronde	R404613	3074	12	17-Mar-2012
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	10-Jun-2012
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3161	12	10-Jun-2012
Thermocouple Thermometer	Fluke	51	3174	12	6-Sep-2012
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	15-Aug-2012
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	8-Nov-2011
ScopeCorder	Yokogawa	DL750 701210	3254	12	8-Nov-2011
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	19-Apr-2012
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	19-Apr-2012
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	8-Mar-2012
Section 2.9 - Satellite Qualitative Test					
Beacon Tester	WS Technologies	BT100S	3263	-	TU
Copper GRP	TUV	27cm Diameter	3538	-	TU
Humidity and Temperature Meter	R.S Components	1361C	3844	12	7-Feb-2012
Section 2.10 - Antenna Characteristics					
Antenna, (Tuned Dipole Set)	Roberts Antenna	A-100	569	-	TU
Spectrum Analyser	Hewlett Packard	8568B	571	12	7-Mar-2012
Antenna Mast	EMCO	1050	1707	-	TU
Turntable Controller	Various	RH253	1708	-	TU
Open Area Site 2	TUV	OATS2	1850	36	01-Jun-2012
Turntable Interface	Various	RH-253.6	1855	-	TU
Bilog Antenna	Schaffner	CBL6143	1858	24	9-Aug-2012
Antenna Tower 6M	EMCO	1050	1859	-	TU
Roberts Antenna 406MHz	Compliance Design		1860	24	30-Oct-2011
EMI Test Receiver	Rohde & Schwarz	ESIB26	3763	12	11-Jan-2012
Section 2.11 - Beacon Coding Software					
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Hygrometer	Rotronic	I-1000	3068	12	26-Jul-2012
Beacon Tester	WS Technologies	BT100S	3263	-	TU
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	19-Apr-2012
Section 2.12 - Navigation System					
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Beacon Tester	WS Technologies	BT100S	3263	-	TU
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	19-Apr-2012
Copper GRP	TUV	27cm Diameter	3538	-	TU

TU – Traceability Unscheduled
OP MON – Output Monitored with Calibrated Equipment

SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

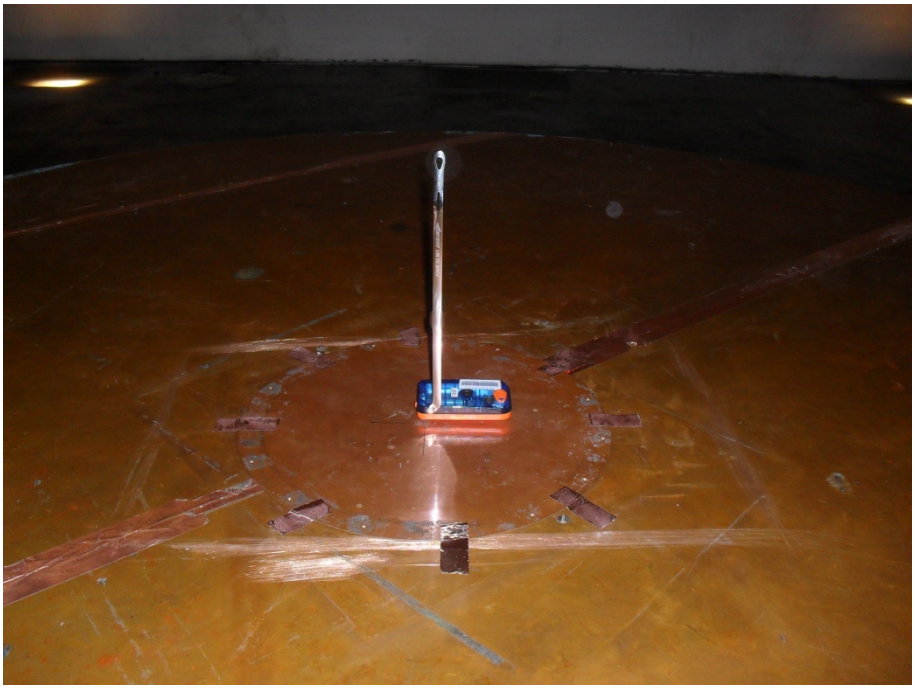
Front View - Antenna Stored

Rear View - Antenna Stored

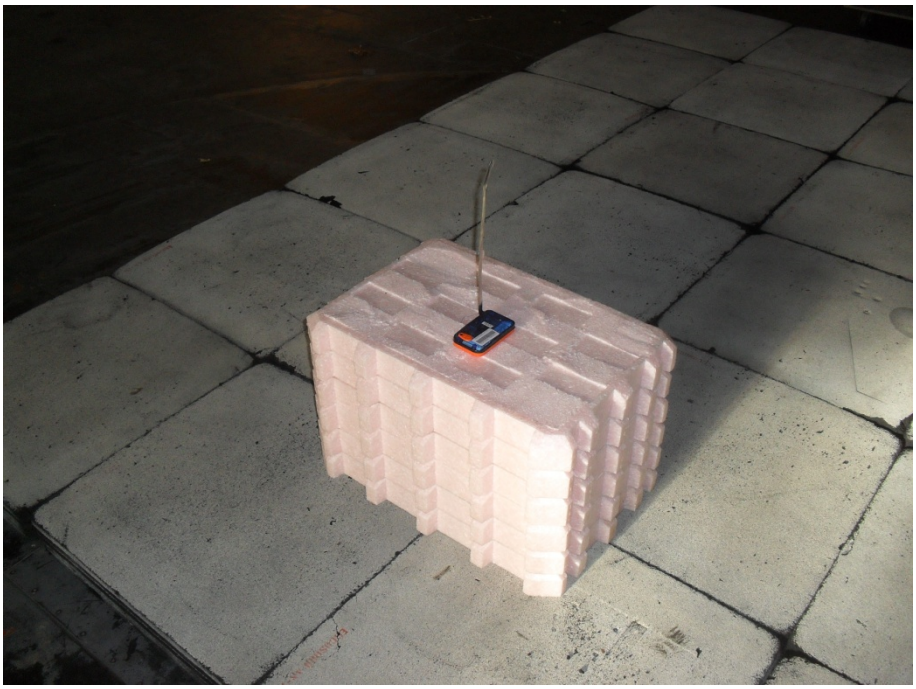
Antenna Extended

Configuration 7 - Satellite Qualitative and Position Acquisition and Accuracy

Configuration 8 - Satellite Qualitative and Position Acquisition and Accuracy



Configuration 3 – Antenna Test



Configuration 4 – Antenna Test

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

Product Service

ANNEX A

CUSTOMER SUPPLIED INFORMATION

ASTRONICS
DME CORPORATION

Document No. Y3-03-0880 (-)
ECO # 19252

Protection Against Continuous Transmission

Continuous transmission of the 406 MHz signal cannot occur in the Astronics DME Corporation Model PLB-110 because:

1) The entire 406 MHz transmitter is turned ON and OFF by both software code programmed in the microcontroller, and hardware RF circuitries that have switches. The protection is safe and redundant.

2) When the microcontroller Output pin outputs a logic HI to the 406 Tx line, it will send out a 406 burst, and when the output pin outputs a logic LO to the 406 Tx, it will stop. Therefore, if the microcontroller fails, it will fail safely without transmitting.

3) The microcontroller used in the Model PLB-110 also has a built in function that periodically resets the microprocessor unless it is cleared during operation. When the microprocessor is reset, the control for the 406 MHz RF power is turned off. This provides additional protection should the software ever get to an unknown state or stop completely.

Fred Pribyl,
Engineering Manager
Astronics DME Corporation

8-12-11
Date

Oscillator Specification: E4672LF(T)

Issue 3, 9th July 2008, LN4661

Designed for use in "Cospas-Sarsat" Emergency Beacon Applications

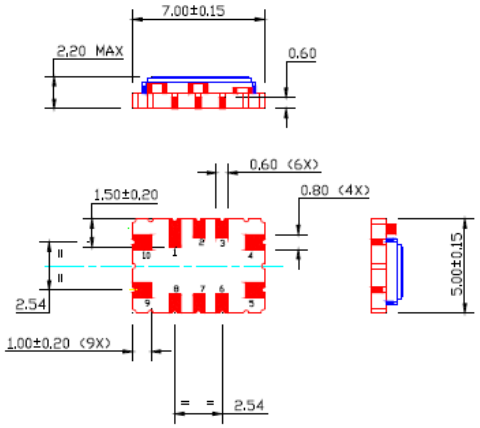
Outline in mm

Pad Connections

1. Do not connect
2. NC
3. Do not connect
4. GND
5. RF Output
6. NC
7. NC
8. Tri-State Control (Enable)*
9. Supply, +Vs
10. Do not connect

* leave unconnected if not required

Weight 170mg (typical)



Marking includes

R

Manufacturing identifier (X).

Crystal manufacture date.

Pad 1 / Static sensitivity identifier (Δ),

Abbreviated P/N (4672),

Device date code (YW),

Serial number (nnnn).

R X YW

Δ 4672YW0000

Electrical

Nominal Frequency, Fo	12.688656MHz
Supply Voltage, Vs	3.3 V ± 10%
Input Current	≤ 4.0 mA
Output:	
Type	HCMOS
Load	15 pF
Vol	≤ 0.1 * Vs
Voh	≥ 0.9 * Vs
Duty cycle @ 50%	45% to 55%
Rise time, 10% to 90%	≤ 8 ns
Fall time, 90% to 10%	≤ 8 ns
Frequency Stability	
Calibration Tolerance at 25°C	≤ ± 0.5 ppm
Temperature, -20°C to 55°C	≤ ± 0.2 ppm reference to $(F_{max}+F_{min})/2$
Supply Voltage, ± 10%	≤ ± 0.1 ppm reference to frequency at 3.3V
Load, ± 5pF	≤ ± 0.1 ppm reference to frequency at 15 pF
Allan Variance (tau=100ms)	≤ 1.0 ppb

Oscillator Specification: E4672LF(T)

Issue 3, 9th July 2008, LN4661

Designed for use in "Cospas-Sarsat" Emergency Beacon Applications

Medium term stability specified and measured according to C/S T.001 & T.007* (averaged over 18 measurements in 15 minute period, and following 15 minute power up period)

Mean Slope dF/dt

Steady state conditions ≤ ± 0.7 ppb/min

During and 15 minutes after variable temperature conditions ≤ ± 1.7 ppb/min (dT/dt ≤ ± 5°C / ho

Residual dF from slope ≤ ± 2.0 ppb (dT/dt ≤ ± 5°C / hour)

Test results shipped with each device, identified by date and serial number, retained for 10 years.

Reflow soldering ≤ ± 1.0 ppm

Ageing, first year < ± 1.0 ppm

Ageing, 10 years ≤ ± 3.0 ppm

Tri-State

Pad 8 open circuit or ≥ 0.6Vs Output Enabled

Pad 8 ≤ 0.2Vs Output High impedance

In Tri-state mode, the output stage is disabled but the oscillator and compensation circuit are still active (Current consumption 1mA typ.).

Phase Noise (typical values)

-90 dBc/Hz at 10 Hz
-115 dBc/Hz at 100 Hz
127 dBc/Hz at 1 kHz
-137 dBc/Hz at 10 kHz
-143 dBc/Hz at ≥ 100 kHz

Environmental

Operating Temperature Range	-20 to +55°C
Storage Temperature Range	-55 to +125°C

Vibration IEC 60068-2-6 Test Fc, 10-60Hz 1.5mm displacement, at 98.1 ms^{-2},30 minutes in each of three mutually perpendicular axes at 1 octave per minute

Shock IEC 60068-2-27 Test Ea, 980ms^{-2} acceleration for 6ms duration, 3 shocks in each direction along three mutually perpendicular axes

Soldering SMD product suitable for Convection Reflow soldering. Peak temperature 260°C. Maximum time above 220°C, 60 secs.

Solderability MIL-STD-202, Method 208, Category 3

RoHS Parts are fully compliant with the European Union directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment. Note these RoHS compliant parts are suitable for assembly using both Lead-free solders and Tin/Lead solders.

Marking Laser Marked

Packaging Parts ordered with suffix 'T' are supplied on Tape-and-Reel.

* COSPAS SARSAT 406MHz distress beacons specification C/S T.001 (Issue 3, Revision 8, NOV 2007) and C/S T.007 (Issue 4, Revision 2, NOV 2007)

Product Service

ASTRONICS DME CORPORATION

Document No. Y3-03-0881 (-)
ECO # 19252

Self-Test Repetition Protection Description

The Astronics DME Corporation Model PLD-110 self-test software has no loops that can perform repetitive self-tests. It can either complete one self-test, one GNSS test, or enter the ON mode, or turn off mode. It cannot repeat the instructions since there are no loops in the code.

Fred Pribyl,
Engineering Manager
Astronics DME Corporation

8-12-11
Date

ASTRONICS
DME CORPORATION

Document No. Y3-03-0877 (A)
ECO # 19252
ECO # 19426

GNSS Self Test Description

The Astronics DME Corporation Model PLB-110 model employs a GPS receiver and provides a GNSS self test feature. GNSS self test is only allowed a maximum number of 12 times to protect over-draining the batteries. Once this feature reaches 12 times, the feature will be disabled by internal software. The worst case current consumption scenario for the Model PLB-110 GNSS self test feature is 12 times of 2 minutes and 12 406 MHz bursts.

GNSS Self Test Procedure:

Press the self-test button for greater than 5 seconds. Observe the beacon for the entire GPS test. A red LED will indicate that the GPS has been turned ON. The beacon will flash a red LED every 3 seconds and the GPS will remain ON until LAT/LON coordinates have been obtained or until 2 minutes have elapsed. If good LAT/LON data has been obtained, a single 406MHz test burst will be sent out with location data and the GPS will be turned OFF and the white strobe light will flash once. This LAT/LON data is not saved for use. The white strobe flash indicates that the GPS is functioning properly and that the beacon is in a location or environment where it can receive the necessary signals from GPS satellites. If the GPS does not acquire good location data, the GPS will turn OFF after 2 minutes, followed with a RED LED light up for 3 seconds, and no 406MHz burst sent out.

Herve Cantave,
Director of Engineering
Astronics DME Corporation

12/06/11
Date

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Product Service

ASTRONICS
DME CORPORATION

Document No. Y3-03-0882 (-)
ECO #19252

Erroneous Position Encoding Protection

The Astronics DME Corporation Model PLB-110 software is uses a serial NMEA interface format to access the GPS receiver information data, and only valid position data from the GPS receiver will be used to send through the 406 burst. Valid data need to pass all criteria:

- Correct header of NMEA information
- The location from the GPS
- The GPS quality indicator from the GPS
- Valid fix from GPS

If one of the above criteria is not verified, the DEFAULT location will be sent out with the 406 burst.

Hence, there is no 406 burst degradation due to faulty GPS.

Fred Pribyl,
Engineering Manager
Astronics DME Corporation

5-12-11
Date

Product Service

ANNEX B

INTERIM TCXO PROCEDURE

Interim Procedure for the Determination of Compliance of 406 MHz Beacons equipped with a TCXO with Cospas-Sarsat Type Approval Requirements

Two data sets, Temperature Gradient Test Data (see section 2.8) and TCXO Manufacturer Data (file reference "E4672 KC1816.xlsx"), were combined and 'synchronised' based on time into the Temperature Gradient profile.

Data synchronised was:

R_{tot} The Medium Term Stability – Residual Frequency Variation measured during the Temperature Gradient test

R_{osc} The Medium Term Stability – Residual Frequency Variation provided for the specific oscillator in the beacon tested

S_{tot} the Medium Term Stability – Slope measured during the Temperature Gradient test

S_{osc} The Medium Term Stability – Slope provided for the specific oscillator in the beacon tested

The individual data pair matching and the following calculations can be found in the supporting Documents 75914042 Spreadsheet CS IP TCXO Rev 1 Spreadsheet_upramp.xlsm and CS IP TCXO Rev 1 Spreadsheet_downramp.xlsm.

NB: The values shown in the calculation steps herein are displayed rounded to 3 decimal places. For the actual calculation the **unrounded** value is used, using the rounded figure may provide different values.

1. Residual Component of the Medium-Term Frequency Stability

The contribution of the beacon design (R_{beacon}) was calculated for each matched data pair as per the following equation:

$$R_{\text{beacon}} = \sqrt{R_{\text{tot}}{}^2 - R_{\text{osc}}{}^2}$$

If R_{osc} was greater than R_{tot}, then allowance was made for measurement inaccuracies by adding/subtracting the measurement uncertainty contained within document C/S T.008 from R_{tot} /R_{osc} (MU = 0.1 ppb).

NB: If R_{osc} – MU was greater than R_{tot} + MU, i.e. the error was persistent, the data pair was discarded.

NB: If R_{osc} was less than MU (which would result in a negative adjusted R_{osc}) then R_{osc} was set to zero (0), i.e. $R_{beacon} = R_{tot}$.

Total discards for this test was 1348 (51.2%).

The maximum was chosen:

$$\text{Maximum } R_{\text{beacon}} = 9.034 \times 10^{-10}$$

The worst-case beacon residual component performance (R_{beacon_max}) is then recalculated by adding the maximum oscillator contribution (R_{osc_max} = i.e. 2.0 ppb) as follows:

$$R_{\text{beacon\_max}} = \sqrt{R_{\text{beacon}}{}^2 + R_{\text{osc\_max}}{}^2}$$

$$R_{\text{beacon\_max}} = \sqrt{(9.034 \times 10^{-10})^2 + (2.0 \times 10^{-9})^2}$$

$$R_{\text{beacon\_max}} = \sqrt{(8.161 \times 10^{-19}) + (4.0 \times 10^{-18})}$$

$$R_{\text{beacon\_max}} = \sqrt{4.816 \times 10^{-18}}$$

$$R_{\text{beacon\_max}} = 2.195 \times 10^{-9}$$

The performance after five years ($R_{beacon\_5year\_max}$) is estimated by adding an ageing contribution ($R_{aging\_contribution}$ = 0.2 ppb).

$$R_{\text{beacon\_5year\_max}} = R_{\text{beacon\_max}} + R_{\text{aging\_contribution}}$$

$$R_{\text{beacon\_5year\_max}} = 2.195 \times 10^{-9} + 0.2 \times 10^{-9}$$

$$R_{\text{beacon\_5year\_max}} = 2.395 \times 10^{-9}$$

The final value obtained shall be less than the Cospas-Sarsat requirement for the medium-term frequency stability residual, 3.0 ppb:

2. Positive and Negative Slopes

A similar procedure is used for the evaluation of the Medium Term Stability – Slope beacon design contribution (S_{beacon}) except that results were divided amongst four categories:

Positive Static: Positive S_{tot} result during the steady state temperature portion of the test
Positive Gradient: Positive S_{tot} result during the temperature change portion of the test
Negative Static: Negative S_{tot} result during the steady state temperature portion of the test
Negative Gradient: Negative S_{tot} result during the temperature change portion of the test

Note: Only the first calculation is broken down, step-by-step to show the method. All calculation results are then shown in the summary table along with the corresponding limits.

Positive Static:
The contribution of the beacon design (R_{beacon}) was calculated for each matched data pair as per the following equation:

$$S_{\text{beacon}} = \sqrt{{S_{\text{tot}}}^2 - {S_{\text{osc}}}^2}$$

If $|S_{osc}|$ was greater than $|S_{tot}|$ then allowance was made for measurement inaccuracies by adding/subtracting the measurement uncertainty contained within document C/S T.008 from S_{tot} /S_{osc} (MU = 0.1 ppb).

NB: If $|S_{osc}|$ – MU was greater than $|S_{tot}|$ + MU, i.e. the error was persistent, then the data pair was discarded.

NB: If $|S_{osc}|$ was less than MU (which would result in a negative adjusted S_{osc}) then S_{osc} was set to zero (0), i.e. $S_{beacon} = S_{tot}$.

NB: For a proportion of data pairs the slope direction (sense) did not match, e.g. a positive S_{tot} matched to a negative S_{osc}, this was termed a "sense mismatch". In the absence of guidance in C/S IP TCXO, two methods were pursued:

Method A:
No action taken in case of sense mismatch. (The above MU allowances were still performed and persistent errors still discarded.)

Total discards for this method was 0 (0%).

Method B:
If either of S_{tot} and S_{osc} was positive and the other negative (i.e. sense mismatch) the data pair was discarded. (The above MU allowances were still performed and persistent errors still discarded.)

Total discards for this test was 876 (33.2%).

The maximum was chosen:

Method A:
$$\text{Maximum } S_{\text{beacon}} = 2.620 \times 10^{-10}$$

Method B:
$$\text{Maximum } S_{\text{beacon}} = 2.620 \times 10^{-10}$$

The worst case beacon positive slope component performance (S_{beacon_max}) is then recalculated by adding the maximum oscillator contribution (S_{osc_max} = i.e. 0.7 ppb) as follows:

$$S_{\text{beacon\_max}} = \sqrt{S_{\text{beacon}}{}^2 + S_{\text{osc\_max}}{}^2}$$

Method A:

$$S_{\text{beacon\_max}} = \sqrt{(2.620 \times 10^{-10})^2 + (0.7 \times 10^{-9})^2}$$

$$S_{\text{beacon\_max}} = \sqrt{(6.864 \times 10^{-20}) + (0.49 \times 10^{-18})}$$

$$S_{\text{beacon\_max}} = \sqrt{5.586 \times 10^{-19}}$$

$$S_{\text{beacon\_max}} = 7.474 \times 10^{-10}$$

Method B:

$$S_{\text{beacon\_max}} = 7.474 \times 10^{-10}$$

The Cospas-Sarsat performance requirement is 1.0 ppb /min.

No ageing factors were applied for the calculations of the negative and positive slope.

Product Service

Slope Summary Table – Method A:

All Values in min^{-1}	S_{beacon}	S_{osc_max}	S_{beacon_max}	Cospas-Sarsat performance requirement
Positive Slope Static Temp	$2.620x10^{-10}$	$+0.7x10^{-9}$	$7.474x10^{-10}$	$1.0x10^{-9}$
Positive Slope Gradient Temp	$2.295x10^{-10}$	$+1.7x10^{-9}$	$1.715x10^{-9}$	$2.0x10^{-9}$
Negative Slope Static Temp	$-[2.765x10^{-10}]$	$-0.7x10^{-9}$	$-[7.526x10^{-10}]$	$-1.0x10^{-9}$
Negative Slope Gradient Temp	$-[4.158x10^{-10}]$	$-1.7x10^{-9}$	$-[1.750x10^{-9}]$	$-2.0x10^{-9}$

Values in square brackets (e.g. "$[1.234x10^{-9}]$") are from equations giving positive results, but as the Root-mean-square method strips the positive or negative sense of numbers, they are reverted to a negative number to restore their sense.

Slope Summary Table – Method B:

Values differing from Method A are asterisked and highlighted in red (e.g.*).

All Values in min^{-1}	S_{beacon}	S_{osc_max}	S_{beacon_max}	Cospas-Sarsat performance requirement
Positive Slope Static Temp	$2.620x10^{-10}$	$+0.7x10^{-9}$	$7.474x10^{-10}$	$1.0x10^{-9}$
Positive Slope Gradient Temp	$2.295x10^{-10}$	$+1.7x10^{-9}$	$1.715x10^{-9}$	$2.0x10^{-9}$
Negative Slope Static Temp	$-[2.765x10^{-10}]$	$-0.7x10^{-9}$	$-[7.526x10^{-10}]$	$-1.0x10^{-9}$
Negative Slope Gradient Temp	$-[3.198x10^{-10}]$	$-1.7x10^{-9}$	$-[1.730x10^{-9}]$	$-2.0x10^{-9}$

Product Service

ANNEX C

NAVIGATION SYSTEM TEST REPORT

Product Service

Document No. Y3-02-0752 (A)

TEST REPORT
FOR
PLB-110 NAVIGATION SYSTEM

Prepared by:

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Product Service

Y3-02-0752 (A)

REVISIONS

Revision	Date	Change Description	Approval
-	11/22/11	ECO # 19413	H.CANTAVE
A	11/29/11	ECO # 19419	H.CANTAVE

TABLE OF CONTENTS

Y3-02-0752 (A)

1.0 PURPOSE

This test report documents the results of navigation system tests conducted by inputting standard location and national location test scripts into the SATRO™ Model PLB-110 Personal Locator Beacon (PLB), PN P3-03-0060, revision (-).

2.0 LIMITATIONS

None

3.0 REFERENCE DOCUMENTS

3.1 Regulatory

Cospas-Sarsat Standard T.007, 406 MHz Distress Beacon Type Approval Standard, Issue 4, Revision 5.

4.0 TEST REQUIREMENT

4.1 Navigation System Test

These tests shall be conducted per Annex D of CS T.007 and results reported in the format defined in Annex D.

5.0 TEST RESULTS

5.1 Standard Location Protocol Results

Table F-C.2

Script Reference (See Table D.2 of C/S T.007-Issue 4 Oct. 2009)	Value of Encoded Location Bits Transmitted by Beacon (HEX)	Confirmation that BCH Correct (X)
1	Bits 65-85=0FFBFF Bits 113-132=83E0F	X
2	Bits 65-85=100400 Bits 113-132=8420E Number of seconds after providing navigation data that beacon transmitted the above encoded location information: 50 sec	X
3	Bits 65-85=000000 Bits 113-132=8360D	X
4	Bits 65-85=000ACF Bits 113-132=0F222	X
5	Bits 65-85= 0012CE Bits 113-132=93A60	X
6	Bits 65-85=100ECF Bits 113-132=0FA10	X
7	Bits 65-85= 1B2964 Bits 113-132=80A00	X
8	Bits 65-85=1B2D64 Bits 113-132=84E00	X
9	Bits 65-85=0B46D0 Bits 113-132=03801	X
10	Bits 65-85= 0B42D0 Bits 113-132= 08009	X
11	Bits 65-85= 14962A Bits 113-132= 80200	X

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Y3-02-0752 (A)

5.2 National Location Protocol Results

Table F-C.3

Script Reference (See Table D.2 of C/S T.007-Issue 4 Oct. 2009)	Value of Encoded Location Bits Transmitted by Beacon (HEX)	Confirmation that BCH Correct (X)
1	Bits 59-85=3F81FE0 Bits 113-126=27CF	X
2	Bits 59-85=4002000 Bits 113-126=284E Number of seconds after providing navigation data that beacon transmitted the above encoded location information: 49 sec	X
3	Bits 59-85=0000000 Bits 113-126=26CD	X
4	Bits 59-85=0019678 Bits 113-126=060D	X
5	Bits 59-85= 001567A Bits 113-126=2710	X
6	Bits 59-85=401B677 Bits 113-126=0740	X
7	Bits 59-85= 6CA0B20 Bits 113-126=06C0	X
8	Bits 59-85=6CA2B20 Bits 113-126=21C0	X
9	Bits 59-85=2D03680 Bits 113-126=0701	X
10	Bits 59-85= 2CF5680 Bits 113-126= 2009	X
11	Bits 59-85= 523F14F Bits 113-126= 2040	X

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6.0 EXAMPLES OF LOCATION PROTOCOL BEACON MESSAGES

Table F-D.2 of C/S T.007

Protocol	Operational Message (in hexadecimal including bit and frame synchronization bits)		Self-Test Message (in hexadecimal including bit and frame synchronization bits)	GNSS Self Test Message (if applicable, in hexadecimal, including bit and frame synchronization bits)
	Location "A"	Location "B"		Location "A"
Standard Location: EPIRB with MMSI	FFFE2F8C92F423F01A6A0A615E37924293F1	FFFE2F8C92F423F09352C7DBD2F709A2D5EE	FFFED08C92F423F07FDFFB2BF037	FFFED08C92F423F01A6A0A615E37924293F1
Standard Location: EPIRB with Serial Number	FFFE2F8C96F9C0631A6A08D84137924293F1	FFFE2F8C96F9C0639352C562CDF709A2D5EE	FFFED08C96F9C0637FDFF992EF37	FFFED08C96F9C0631A6A08D84137924293F1
Standard Location: ELT with 24-bit Address	FFFE2F8C93AF0F0F1A6A0963C477924293F1	FFFE2F8C93AF0F0F9352C4D948B709A2D5EE	FFFED08C93AF0F0F7FDFF8296A77	FFFED08C93AF0F0F1A6A0963C477924293F1
Standard Location: ELT with Serial Number	FFFE2F8C94F9C0631A6A0C6883F7924293F1	FFFE2F8C94F9C0639352C1D20F3709A2D5EE	FFFED08C94F9C0637FDFFD222DF7	FFFED08C94F9C0631A6A0C6883F7924293F1
Standard Location: ELT with Aircraft Operator Designator	FFFE2F8C95C631F41A6A083741F7924293F1	FFFE2F8C95C631F49352C58DCD3709A2D5EE	FFFED08C95C631F47FDFF97DEFF7	FFFED08C95C631F41A6A083741F7924293F1
Standard Location: PLB with Serial Number	FFFE2F8C97F9C0631A6A0E5B1C37924293F1	FFFE2F8C97F9C0639352C3E190F709A2D5EE	FFFED08C97F9C0637FDFFF11B237	FFFED08C97F9C0631A6A0E5B1C37924293F1
National Location: EPIRB	FFFE2F8C9A0018C69550371714370D180D63	FFFE2F8C9A0018E4CC9608272FF793340AF9	FFFED08C9A0018DFC0FF02AD4477	FFFED08C9A0018C69550371714370D180D63
National Location: ELT	FFFE2F8C980018C6955033A7D6F70D180D63	FFFE2F8C980018E4CC960C97ED3793340AF9	FFFED08C980018DFC0FF061D86B7	FFFED08C980018C6955033A7D6F70D180D63
National Location: PLB	FFFE2F8C9B0018C69550319449370D180D63	FFFE2F8C9B0018E4CC960EA472F793340AF9	FFFED08C9B0018DFC0FF042E1977	FFFED08C9B0018C69550319449370D180D63

Location "A" represents latitude N 26 19' 36" and Longitude W 80 12' 24".
Location "B" represents latitude S 19 12' 36" and Longitude E 150 2' 52".