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Report On

Emergency Beacons Testing of the
Astronics DME Corporation SATRO™ Model PLB-110
In accordance with RTCM Standard for PLBs

Document 75914042 Report 03 Issue 1 May 2012

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REPORT ON

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

Document 75914042 Report 03 Issue 1

May 2012

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DATED

04 May 2012	04 May 2012	26 April 2012

UKAS TESTING 0141

Product Service

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Product Service

SECTION 1

REPORT SUMMARY

Emergency Beacons Testing of the
Astronics DME Corporation
SATRO™ Model 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™ Model PLB-110 to the requirements of RTCM Standard for PLBs.

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™ Model PLB-110
Serial Number(s)	TUV#1 (S/N 100) - Radiated TUV#2 (S/N 500) - Conducted TUV#3 (S/N 200) - Radiated TUV#5 (S/N 300) - Radiated TUV#6 - Radiated TUV#7 - Radiated TUV#8 - Radiated
Number of Samples Tested	7
Test Specification/Issue/Date	RTCM Standard for PLBs RTCM 11010.2 (Excluding Annex G)
Incoming Release Date	Application Form 11 August 2011
Date of Receipt of Test Samples	11 August 2011
Order Number Date	73680 19 May 2011
Start of Test	11 August 2011
Finish of Test	23 March 2012
Name of Engineer(s)	M Hardy C Foster C Bowles R Thompson V Komka

1.2 APPLICATION FORM

Beacon Manufacturer and Beacon Model

Beacon Manufacturer	Astronics DME Corporation
Beacon Model	SATRO ™ Model 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
- 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)

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

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

Equipment Under Test

1.3.2 Physical Test Configuration

The Equipment Under Test (EUT) was operated using its own power source (internal battery). Conducted units were configured so that the antenna ports could connect to the 50Ω test system using coaxial cables.

Radiated units were supplied which are similar to the proposed production beacons equipped with its proper antenna.

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

Product Service

SECTION 2

TEST DETAILS

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

TEST RESULTS TABLE

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			(-20°C)	(+21°C)	(+55°C)	
1. PERFORMANCE CHECK						
SATRO™ Model PLB-110, TUV Ref#2, Modification State 0						**Result:** Pass
Visual Inspection	No Damage	P/F		P		
Carrier Frequency	406.037 MHz ± 0.002 MHz or Other ± 0.001 MHz	MHz		406.037040		
Digital Message	15 Hex / 30 Hex Correct	P/F		P		
121 MHz Homer **Note** Wherever a Performance Check is called for in these Test Results Tables it also includes a Visual Inspection of the PLB.	Functional	P/F		P		
SATRO™ Model PLB-110, TUV Ref#1, Modification State 0						**Result:** Pass
Visual Inspection	No Damage	P/F		P		
Carrier Frequency	406.037 MHz ± 0.002 MHz or Other ± 0.001 MHz	MHz		406.037106		
Digital Message	15 Hex / 30 Hex Correct	P/F		P		
121 MHz Homer **Note** Wherever a Performance Check is called for in these Test Results Tables it also includes a Visual Inspection of the PLB.	Functional	P/F		P		

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			(-20°C)	(+21°C)	(+55°C)	
2. DRY HEAT TEST (A.3)						
SATRO™ Model PLB-110, TUV Ref#2, Modification State 0						**Result:** Pass
Post-Storage Performance Check	Pass/Fail	P/F			P	
Post-Functional Performance Test	Pass/Fail	P/F			P	
406 Output Power	35 – 39dBm	dBm			36.93	
406 Output Power Rise Time	<5mS	P/F			P	
Digital Message	Correct	P/F			P	
Bit Rate and Stability	400bps ± 1%	Bps			398.704	
406 Modulation	Phase Deviation ± 1.1 Rad ± 0.1 Rad	Rad			1.131 -1.074	
406 Frequency	406.037 ± 0.002 or Other ± 0.001	MHz			406.0370455	
406 Spurious Output	Within Emission Mask	P/F			P	
Post-Functional Performance Check	Pass/Fail	P/F			P	

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			(-20°C)	(+21°C)	(+55°C)	
SATRO™ Model PLB-110, TUV Ref#1, Modification State 0						**Result:** Pass
Post-Storage Performance Check	Pass/Fail	P/F			P	
Post-Functional Performance Test	Pass/Fail	P/F			n/a	
406 Output Power	35 – 39dBm	dBm			n/a	
406 Output Power Rise Time	<5mS	P/F			n/a	
Digital Message	Correct	P/F			n/a	
Bit Rate and Stability	400bps ± 1%	Bps			n/a	
406 Modulation	Phase Deviation ± 1.1 Rad ± 0.1 Rad	Rad			n/a n/a	
406 Frequency	406.037 ± 0.002 or Other ± 0.001	MHz			n/a	
406 Spurious Output	Within Emission Mask	P/F			n/a	
Post-Functional Performance Check	Pass/Fail	P/F			P	
3. DAMP HEAT TEST (A.4)						
SATRO™ Model PLB-110, TUV Ref#1, Modification State 0						**Result:** Pass
Performance Check	Pass/Fail	P/F			P	
Performance Check	Pass/Fail	P/F			P	

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			(-20°C)	(+21°C)	(+55°C)	
4. LOW TEMPERATURE TEST(A.5)						
SATRO™ Model PLB-110, TUV Ref#2, Modification State 0						**Result:** Pass
Post-Storage Performance Check	Pass/Fail	P/F	P			
Post-Functional Performance Test	Pass/Fail	P/F	P			
406 Output Power	35 – 39dBm	dBm	36.42			
406 Output Power Rise Time	<5mS	P/F	P			
Digital Message	Correct	P/F	P			
Bit Rate and Stability	400bps ± 1%	Bps	398.702			
406 Modulation	Phase Deviation ± 1.1 Rad ± 0.1 Rad	Rad	1.1149 -1.084			
406 Frequency	406.037 ± 0.002 or Other ± 0.001	MHz	406.0370720			
406 Spurious Output	Within Emission Mask	P/F	P			
Post-Functional Performance Check	Pass/Fail	P/F	P			

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			(-20°C)	(+21°C)	(+55°C)	
SATRO™ Model PLB-110, TUV Ref#1, Modification State 0						**Result:** Pass
Post-Storage Performance Check	Pass/Fail	P/F	P			
Post-Functional Performance Test	Pass/Fail	P/F	n/a			
406 Output Power	35 – 39dBm	dBm	n/a			
406 Output Power Rise Time	<5mS	P/F	n/a			
Digital Message	Correct	P/F	n/a			
Bit Rate and Stability	400bps ± 1%	Bps	n/a			
406 Modulation	Phase Deviation ± 1.1 Rad ± 0.1 Rad	Rad	n/a n/a			
406 Frequency	406.037 ± 0.002 or Other ± 0.001	MHz	n/a			
406 Spurious Output	Within Emission Mask	P/F	n/a			
Post-Functional Performance Check	Pass/Fail	P/F	P			
5. VIBRATION TEST (A.6)						
SATRO™ Model PLB-110, TUV Ref#2, Modification State 0						**Result:** Pass
During Test no Activation	No activation during test	P/F		n/a		
Performance Check	Pass/Fail	P/F		P		
SATRO™ Model PLB-110, TUV Ref#1, Modification State 0						**Result:** Pass
During Test no Activation	No activation during test	P/F		P		
Performance Check	Pass/Fail	P/F		P		

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			(-20°C)	(+21°C)	(+55°C)	
6 BUMP TEST (A.7)						
SATRO™ Model PLB-110, TUV Ref#2, Modification State 0						**Result:** Pass
During Test, No Activation	No activation during test	P/F		n/a		
Performance Check	Pass/Fail	P/F		P		
SATRO™ Model PLB-110, TUV Ref#1, Modification State 0						**Result:** Pass
During Test, No Activation	No activation during test	P/F		P		
Performance Check	Pass/Fail	P/F		P		
7. CORROSION TEST (A.8)						
SATRO™ Model PLB-110, TUV Ref#8, Modification State 0						**Result:** -
No sign of corrosion, peeling paint and other signs of deterioration.	Pass/Fail	P/F		*		* See section 2.8
Performance Check	Pass/Fail	P/F		*		
8. DROP TEST (A.9)						
SATRO™ Model PLB-110, TUV Ref#1, Modification State 0						**Result:** Pass
During Test, no Activation	No activation during test	P/F	P			
Performance Check	Pass/Fail	P/F	P			
9. THERMAL SHOCK (A.10)						
SATRO™ Model PLB-110, TUV Ref#1, Modification State 0						**Result:** Pass
After test examine for signs of water ingress	No evidence of water ingress	P/F	P			
Performance Check	Pass/Fail	P/F	P			

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			(-20°C)	(+21°C)	(+55°C)	
10. IMMERSION TEST (A.11)						
Portable Equipment Immersion						
SATRO™ Model PLB-110, TUV Ref#1, Modification State 0						**Result:** Pass
After test examine for signs of water ingress	No evidence of water ingress	P/F		P		
Performance Check	Pass/Fail	P/F		P		
Portable Equipment Temporary Immersion						
SATRO™ Model PLB-110, TUV Ref#1, Modification State 0						**Result:** Pass
After test examine for signs of water ingress	No evidence of water ingress	P/F		P		
Performance Check	Pass/Fail	P/F		P		
11. SPURIOUS EMISSIONS TEST (A.12)						
SATRO™ Model PLB-110, TUV Ref#2, Modification State 0						**Result:** Pass
Close in emissions	Comply with Figures 2 and 6	P/F	P	P	P	
Aeronautical, Maritime and Satellite Band Emissions	No signal to exceed 25µW in stated bands	P/F		P		

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			(-20°C)	(+21°C)	(+55°C)	
12. OPERATIONAL LIFE AND SELF TESTS (A.13)						
SATRO™ Model PLB-110, TUV Ref#2, Modification State 0						**Result:** Pass
Operational Life	24 Hours min	P/F	P			Note: Test combined with that of C/S T.007 test campaign.
Pre-test battery discharge duration (operating)	-	hours	6.90			
Time to First Failure	-	hours	24.21			
Performance Test carried out every 6 hours	Confirm	Y/N	Y			
406 Output Power	35 – 39dBm	dBm	35.911 36.733			
406 Output Power Rise Time	<5mS	P/F	P			
Digital Message	Correct	P/F	P			Where two or more results are displayed the upper is the minimum value across 24 hours, the lower is the maximum.
Bit Rate and Stability	400bps ± 1%	Bps	398.5 398.6			
406 Modulation	Phase Deviation ± 1.1 Rad ± 0.1 Rad	Rad	1.08 1.13 -1.05 -1.10			
406 Frequency	406.037± 0.002 or Other ± 0.001	MHz	406.0370739			
406 Spurious Output	Within Emission Mask	P/F	P			
121 Peak Envelope Output Power	Pass/Fail	P/F	P			

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			(-20°C)	(+21°C)	(+55°C)	
12. OPERATIONAL LIFE AND SELF TESTS (A.13.2)						
SATRO™ Model PLB-110, TUV Ref#2, Modification State 0						**Result:** Pass
Self-test						
RF Pulse Duration	≤ 0.444 sec or ≤ 0.525 sec	mSec	440.302	440.372	440.463	
Frame synchronization pattern	0 1101 0000	P/F	P	P	P	
Number of RF bursts	1-burst	P/F	P	P	P	
Beacon 15 Hex ID	Must be provided	P/F	P	P	P	
121.5 MHz transmission	≤ 1 sec / 3 sweeps	P/F	P	P	P	
13. Cospas-Sarsat TYPE APPROVAL TESTS (A.14)						
SATRO™ Model PLB-110, TUV Ref#1, Modification State 0 and SATRO™ Model PLB-110, TUV Ref#2, Modification State 0						**Result:** Pass
Cospas-Sarsat Type Approval Tests	C-S Certificate (attach C/S test report)	Y/N	Y			C/S approval granted, TAC 225
14. BUOYANCY TEST (Category 1 PLBs only) (A.15)						
SATRO™ Model PLB-110, TUV Ref#5, Modification State 0						**Result:** Pass
A.15.1 Buoyancy	Floats	P/F		P		
A15.2 Floating Upright (PLBs designed to work floating in water only)	Self rights <2s	P/F		n/a		

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			(-20°C)	(+21°C)	(+55°C)	
15. 121.5 MHz AUXILLY RADIO-LOCATING DEVICE TRANSMITTER TEST (A.16) (TESTS REQUIRING A CONDUCTED UNIT)						
SATRO™ Model PLB-110, TUV Ref#2, Modification State 0						**Result:** Pass
Carrier Frequency	121.5 ± 0.006075	MHz	121.502615385		121.495253285	
Transmitter Duty Cycle	Continuous interrupted for up to a maximum of 2 seconds encompassing the 406 MHz burst and plus the additional time required for the Morse "P" transmission.	P/F			P	
Modulation						
Frequency	≥ 700 Hz within 300 – 1600Hz	Hz	976.69		986.06	
Duty Cycle	33 – 55	%	40.2		38.8	
Factor	0.85 – 1.0		0.91		0.90	
Sweep Repetition Rate	2 – 4	Hz	2.563		2.55	
Frequency Coherence	Pass/Fail	P/F	P		P	
Morse Letter P						
Dot Length	115 ms ± 5%	ms	114.325		114.48	
Dash Length	345 ms ± 5%	ms	345.025		345.05	
Gap	115 ms ± 5%	ms	116.375		116.35	
Mod Frequency	1000 Hz ± 50Hz	Hz	1000.0		1000.0	
15. 121.5 MHz AUXILLY RADIO-LOCATING DEVICE TRANSMITTER TEST (A.16) (TESTS REQUIRING A RADIATED UNIT)						
SATRO™ Model PLB-110, TUV Ref#5. Modification State						**Result:** Pass
PEIRP (Radiated)	Median 14 – 20 dBm (25 – 100 mW)	mW		47.85		
Max PEIRP	Value	mW		49.14		
Min PEIRP	Value	mW		46.39		
Ratio Max – Min	< 4:1 (<6dBm)	dB		0.25		
Off Ground Plane PEIRP	≥ 2 mW	mW		5.15		

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			(-20°C)	(+21°C)	(+55°C)	
16. SOLAR RADIATION TEST (A.17)						
SATRO™ Model PLB-110, TUV Ref#5, Modification State 0						**Result:** *
After Test visually inspect unit	Pass/Fail	P/F		*		See section 2.18 and annex B
Performance Check	Pass/Fail	P/F		P		
17. OIL RESISTANCE TEST (A.18)						
SATRO™ Model PLB-110, TUV Ref#7, Modification State 0						**Result:** Pass
After Test visually inspect unit	Pass/Fail	P/F		P		
Performance Check	Pass/Fail	P/F		P		
18. COMPASS SAFE DISTANCE TEST (A.19)						
SATRO™ Model PLB-110, TUV Ref#3, Modification State 0						**Result:** Pass
Standard Compass Safe Distance	Mark Distance on PLB and/or in User Manual	m		0.200		
Emergency Compass Safe Distance	Mark Distance on PLB and/or in User Manual	m		0.200		

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			(-20°C)	(+21°C)	(+55°C)	
19. MISCELLANEOUS TESTS (A.20)						
SATRO™ Model PLB-110, TUV Ref#1, Modification State 0						**Result:** Pass
A.20.1 Controls and Indicators						Note: For Section 19 of this table "Y" denotes that the particular parameter or feature was inspected and observations reported at the main section or that Information supplied by the customer is supplied at Annex C. No final decision or comment is made upon compliance.
PLB complies with 4.4.1	Inspection	Y/N		Y		
Two independent step activations	Inspection	Y/N		Y		
Means to indicate previous activation	Inspection	Y/N		Y		
Visual or Audible indication of activation	Inspection	Y/N		Y		
A.20.2 Self-Test and GNSS Self Test Function		Y/N				
Self Test automatically resets	Inspection	Y/N		Y		
Self Test has indication of activation	Inspection	Y/N		Y		
Manufacturers declaration complies with 4.4.2 a), b) and c)	Inspection	Y/N		Y		
GNSS Self Test (if applicable)		Y/N				
Distinct Means of Operation	Inspection	Y/N		Y		
Prevents Inadvertent Operation	Inspection	Y/N		Y		
Distinct Pass/Fail Indicators	Inspection	Y/N		Y		
Manufacturers declaration complies with 4.4.2 c), d), e) and f)	Inspection	Y/N		Y		
A.20.3 Battery		Y/N				
Labelling complies with 4.5.2.1	Inspection	Y/N		Y		
Manufacturer has provided evidence that Battery and Cells are either exempt from or meet UN Dangerous Goods regulations	Inspection	Y/N		Y		
A.20.4 General Construction		Y/N				
PLB complies with 4.5	Inspection	Y/N		Y		
A.20.5 Exterior Finish		Y/N				
PLB complies with 4.5.1	Inspection	Y/N		Y		

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			(-20°C)	(+21°C)	(+55°C)	
19. MISCELLANEOUS TESTS (A.20)						
A.20.6 Labelling						
Labelling complies with 4.5.2.2 to 4.5.2.2.4	Inspection	P/F		Y		
Labelling tested for Abrasion Resistance	Inspect manufacturers report	P/F		Y		
Instructions and Pictograms tested for Comprehension	Inspect manufacturers report	P/F		Y		
A.20.7 Documentation		P/F				
Manual complies with 4.5.3	Inspection	P/F		Y		
Packaging complies with 4.5.4	Inspection	P/F		Y		

2.1 GENERAL TEST CONDITIONS

2.1.1 Specification

RTCM Standard for PLBs, Clause A.1

2.1.2 Equipment Under Test and Modification State

SATRO^{TM} Model PLB-110 S/N: # 500 (TUV#2) - Modification State 0

2.1.3 Date of Test

29 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 22.6°C
Relative Humidity 34.9%

2.1.6 Test Results

Cospas-Sarsat Type Approval

The Cospas-Sarsat Type Approval process was completed as per the Cospas-Sarsat documents C/S T.001 and C/S T.007 as amended (Y/N): N

If No (N), details: Testing complete - awaiting approval

Cospas-Sarsat Document Versions Applied:

- Cospas-Sarsat T.001 Issue 3 Revision 11 October 2010
- Cospas-Sarsat T.007 Issue 4 Revision 5 October 2010

Cospas-Sarsat Type Approval Certificate(s): Issued 5th March 2012 under TAC 225. See annex A

Power Supply

Power during performance tests was supplied by batteries forming part of the Equipment Under Test (Y/N): Y

If No (N), details: n/a

The other requirements of the Power Supply clause (A.1.2) were observed throughout the test programme (Y/N): Y

If No (N), details: n/a

Warm-up Period

The maximum warm-up period allowed during testing was 15 minutes (Y/N): Y

Summary of Performance Check Results

100 (TUV#1)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F96EE3340647FDFF9CBEC7783E0F66C 406.037106 P

500 (TUV#2)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3341F47FDFF8218277
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F96EE3341F47FDFF821827783E0F66C 406.037059 P

2.2 PRE-CONDITIONING

2.2.1 Specification

RTCM Standard for PLBs, Clause A.1.13

2.2.2 Equipment Under Test and Modification State

SATRO™ Model PLB-110 S/N: # 500 (TUV#2) - Modification State 0
SATRO™ Model PLB-110 S/N: # 100 (TUV#1) - Modification State 0

2.2.3 Date of Test

11 August 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 21.0 - 22.0°C
Relative Humidity 48.0 - 54.7%

2.2.6 Test Results

Visual Inspection

Prior to the start of the testing schedule the EUT was visually inspected. No signs of damage were found.

Performance Check

A Performance Check was conducted to ensure that the EUT was functional before all upcoming tests.

Summary of Performance Check Results

500 (TUV#2)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3341F47FDFF8218277
Normal Mode:	
Normal Message	FFFE2F96EE3341F47FDFF821827783E0F66C
406 MHz Frequency	406.037040
121 MHz Presence	P

Summary of Performance Check Results

100 (TUV#1)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F96EE3340647FDFF9CBEC7783E0F66C 406.037106 P

2.3 DRY HEAT TESTS

2.3.1 Specification

RTCM Standard for PLBs, Clause A.3

2.3.2 Equipment Under Test and Modification State

SATRO™ Model PLB-110 S/N: # 500 (TUV#2) - Modification State 0
SATRO™ Model PLB-110 S/N: # 100 (TUV#1) - Modification State 0

2.3.3 Date of Test

12 August 2011 & 16 August 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 20.9 - 23.0°C
Relative Humidity 43.6 - 52.3%

2.3.6 Test Method

Storage Test

The EUT was placed in a climatic chamber with the temperature set to 70.0°C. After 16 hours, the temperature was reduced to 22.0°C for 2 hours and was subjected to a performance check during the last 30 mins.

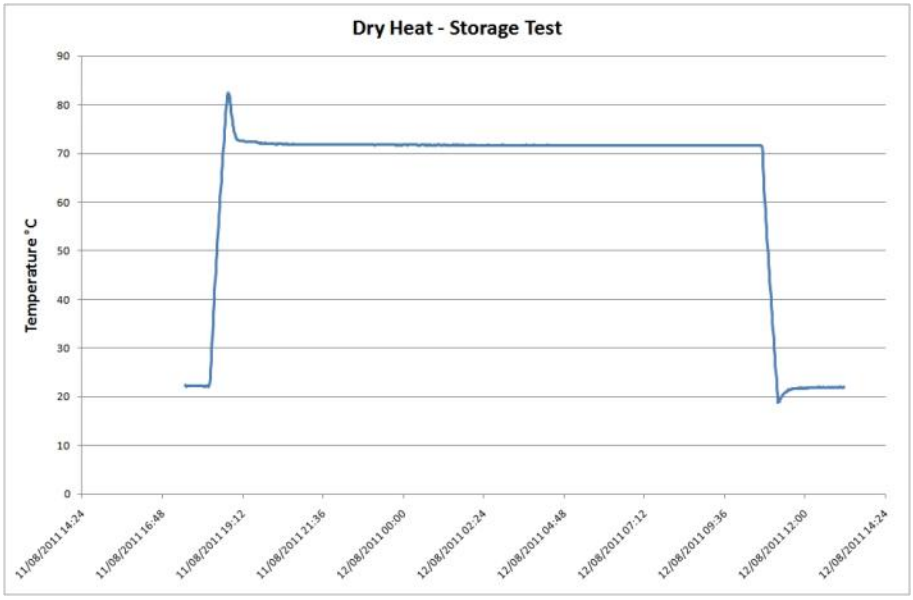
Functional Test

The EUT was placed in a climatic chamber with the temperature set to 55.0°C. After 14 hours, the EUT was subjected to a performance check and performance test.

2.3.7 Test Results

Storage Test

Temperature Plot



Post-Storage Period Performance Check

500 (TUV#2)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3341F47FDFF8218277
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F96EE3341F47FDFF821827783E0F66C 406.037058 P

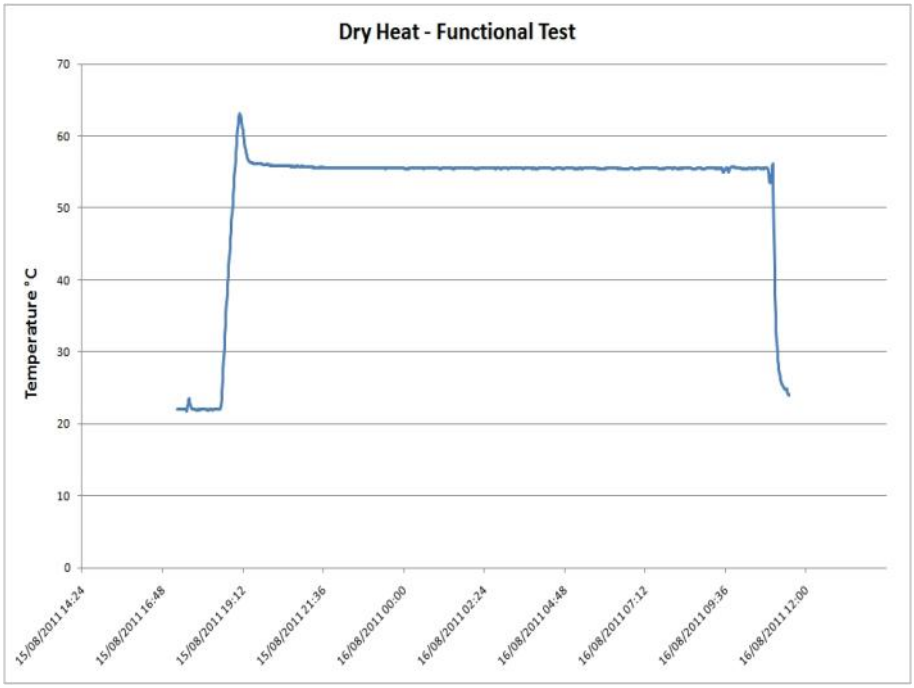
100 (TUV#1)

Post-Storage Period Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F96EE3340647FDFF9CBEC7783E0F66C 406.037116 P

Functional Test

Temperature Plot

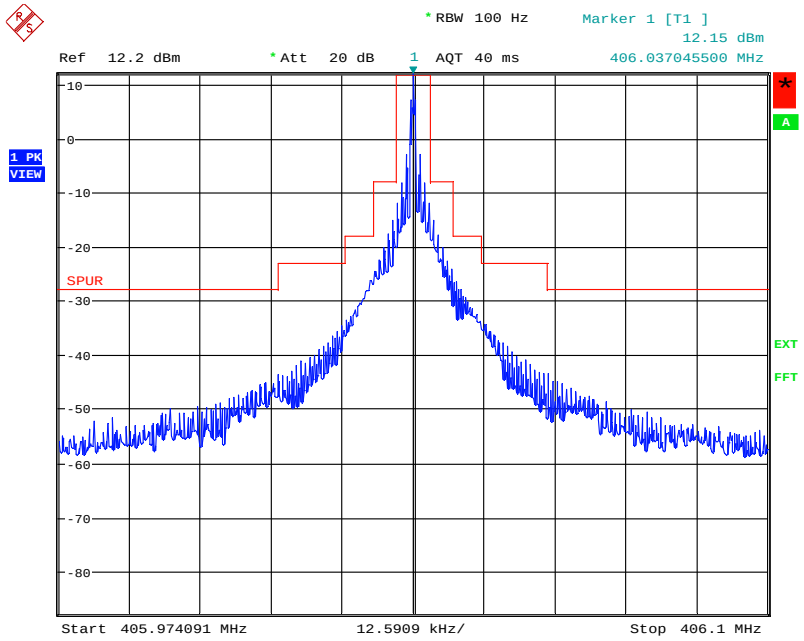


During Functional Period Performance Test

500 (TUV#2)

Parameter	Result
Output Power	36.93
Digital Message	FFFE2F96EE3341F47FDFF821827783E0F66C
Bit Rate: Average (bps)	398.704
Modulation: Rise Time (uS)	170.40
Modulation: Fall Time (uS)	170.60
Positive Deviation (rad)	1.131
Negative Deviation (rad)	-1.074
Nominal Frequency (MHz)	406.0370455
Short-term Stability (/100ms)	8.649×10^{-11}
Medium-term Stability – Slope (/minute)	9.39×10^{-11}
Medium-term Stability – Residual Frequency Stability (no units)	2.839×10^{-10}
Spurious Emissions	(see Plot)

Spurious Emissions during Functional Period



Date: 16.AUG.2011 10:46:16

Post-Functional Period Performance Check

500 (TUV#2)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3341F47FDFF8218277
Normal Mode:	
Normal Message	FFFE2F96EE3341F47FDFF821827783E0F66C
406 MHz Frequency	406.037085
121 MHz Presence	P

100 (TUV#1)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Mode:	
Normal Message	FFFE2F96EE3340647FDFF9CBEC7783E0F66C
406 MHz Frequency	406.037043
121 MHz Presence	P

2.4 DAMP HEAT TEST

2.4.1 Specification

RTCM Standard for PLBs, Clause A.4

2.4.2 Equipment Under Test and Modification State

SATRO™ Model PLB-110 S/N: # 500 (TUV#2) - Modification State 0
SATRO™ Model PLB-110 S/N: # 100 (TUV#1) - Modification State 0

2.4.3 Date of Test

18 August 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

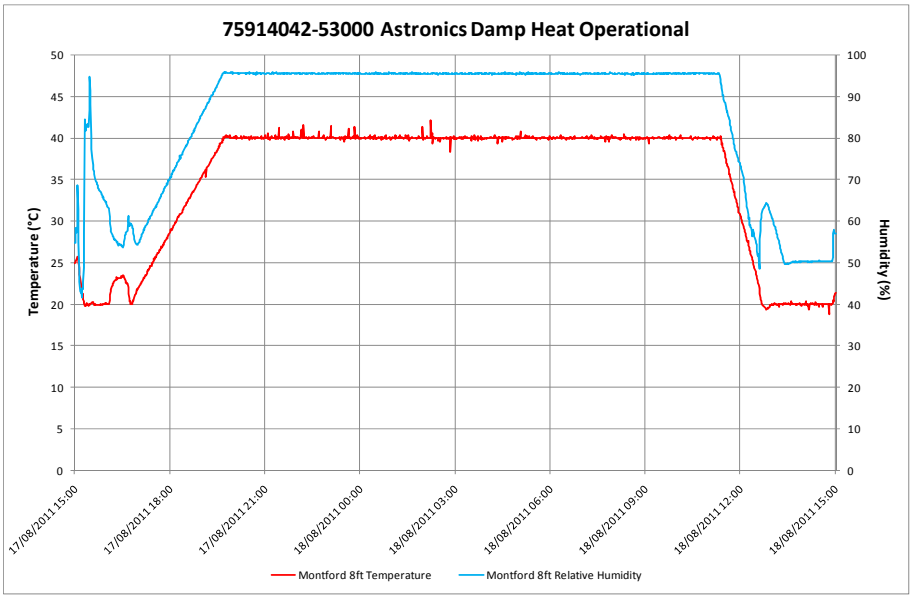
Ambient Temperature 22.7°C
Relative Humidity 48.8%

2.4.6 Test Method

The EUT was placed in a climatic chamber with the temperature increased to 40.0°C and the relative humidity increased to 95%. After 15 hours, the EUT was activated for at least 2 hours and during this period was subjected to a performance check.

2.4.7 Test Results

Temperature Plot



Summary of Performance Check Results

500 (TUV#2)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3341F47FDFF8218277
Normal Mode:	
Normal Message	FFFE2F96EE3341F47FDFF821827783E0F66C
406 MHz Frequency	406.037020
121 MHz Presence	P

100 (TUV#1)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Mode:	
Normal Message	FFFE2F96EE3340647FDFF9CBEC7783E0F66C
406 MHz Frequency	406.037078
121 MHz Presence	P

2.5 LOW TEMPERATURE TESTS

2.5.1 Specification

RTCM Standard for PLBs, Clause A.5

2.5.2 Equipment Under Test and Modification State

SATRO™ Model PLB-110 S/N: # 500 (TUV#2) - Modification State 0
SATRO™ Model PLB-110 S/N: # 100 (TUV#1) - Modification State 0

2.5.3 Date of Test

22 August 2011 & 23 August 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 23.4 - 27.1°C
Relative Humidity 24.9 - 57.0%

2.5.6 Test Method

Storage Test

The EUT was placed in a climatic chamber with the temperature reduced to -30°C. After 14.5 hours, the temperature was increased to 22°C and was subjected to a performance check.

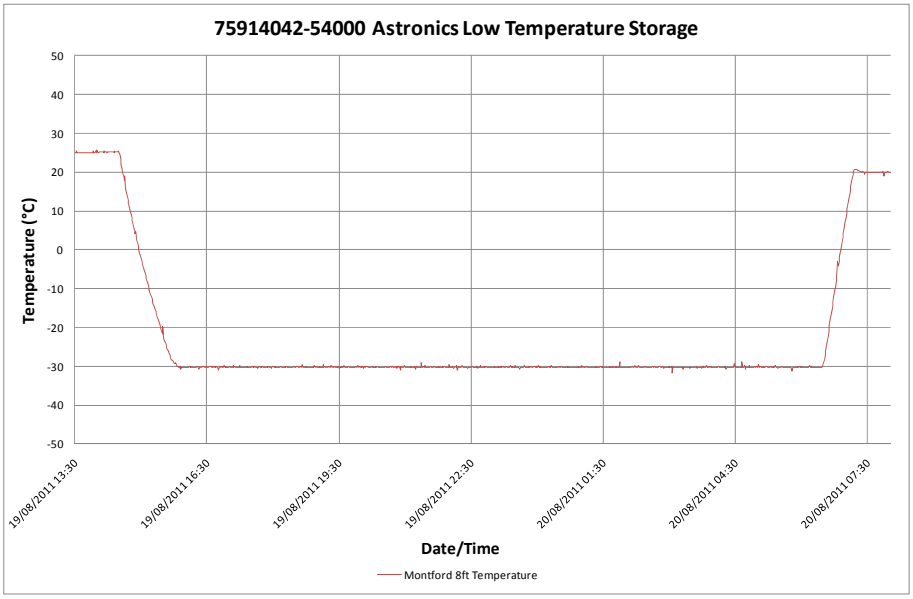
Functional Test

The EUT was placed in a climatic chamber with the temperature reduced to -20°C. After 14 hours, the EUT was activated for at least 2 hours and during this period was subjected to a performance check and performance test.

2.5.7 Test Results

Storage Test

Temperature Plot



Summary of Performance Check Results

500 (TUV#2)

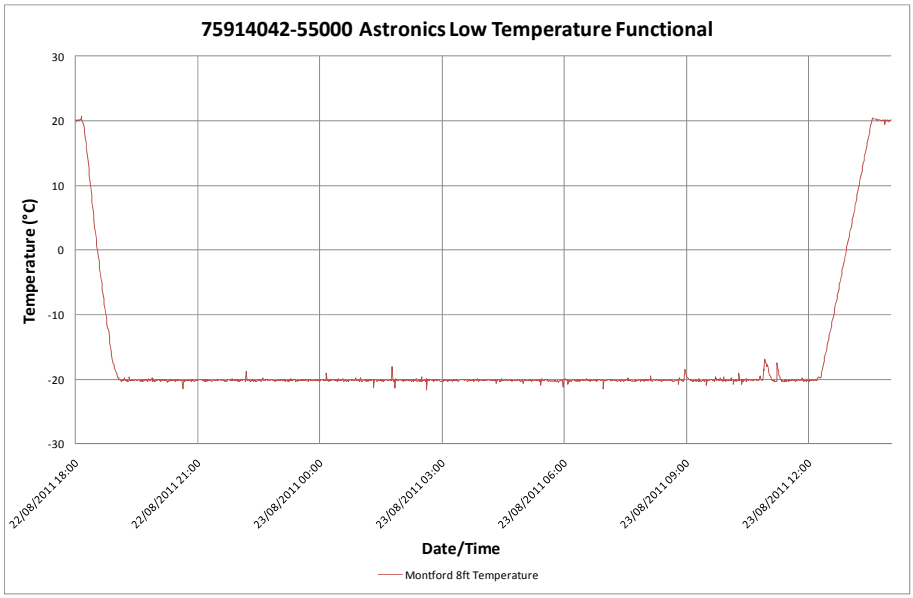
Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3341F47FDFF8218277
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F96EE3341F47FDFF821827783E0F66C 406.037050 P

100 (TUV#1)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F96EE3340647FDFF9CBEC7783E0F66C 406.037095 P

Functional Test

Temperature Plot

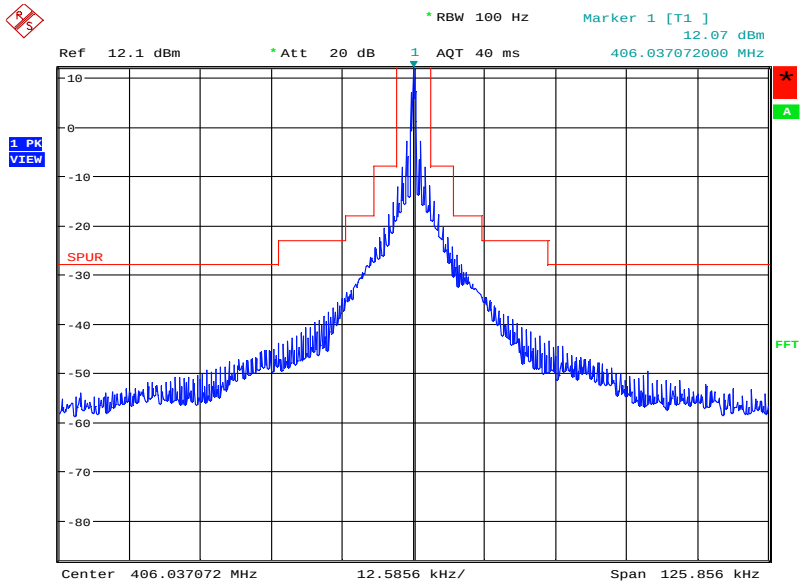


Performance Test

500 (TUV#2)

Parameter	Result
Output Power	36.42
Digital Message	FFFE2F96EE3341F47FDFF821827783E0F66C
Bit Rate: Average (bps)	398.702
Modulation: Rise Time (uS)	176.4
Modulation: Fall Time (uS)	176.6
Positive Deviation (rad)	1.1149
Negative Deviation (rad)	-1.084
Nominal Frequency (MHz)	406.0370720
Short-term Stability (/100ms)	1.155×10^{-10}
Medium-term Stability – Slope (/minute)	8.068×10^{-11}
Medium-term Stability – Residual Frequency Stability (no units)	5.600×10^{-10}
Spurious Emissions	(see Plot)

Spurious Emissions



Performance Check

500 (TUV#2)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3341F47FDFF8218277
Normal Mode:	
Normal Message	FFFE2F96EE3341F47FDFF821827783E0F66C
406 MHz Frequency	406.037078
121 MHz Presence	P

Performance Check

100 (TUV#1)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Mode:	
Normal Message	FFFE2F96EE3340647FDFF9CBEC7783E0F66C
406 MHz Frequency	406.037133
121 MHz Presence	P

Observations: It was difficult to activate the EUT at -20°C due to the on/off activation switch becoming rigid at low temperature.

2.6 VIBRATION TESTS

2.6.1 Specification

RTCM Standard for PLBs, Clause A.6

2.6.2 Equipment Under Test and Modification State

SATRO™ Model PLB-110 S/N: # 500 (TUV#2) - Modification State 0
SATRO™ Model PLB-110 S/N: # 100 (TUV#1) - Modification State 0

2.6.3 Date of Test

12 September 2011, 13 September 2011 & 14 September 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 20.3 - 23.3°C
Relative Humidity 44.2 - 60.8%

2.6.6 Test Method

The EUT was fixed to the vibration table and was subject to the following vibration profiles:

Resonance Sweep

– 5 Hz and up to 13.2 Hz with an excursion of ±1 mm (7 m/s² maximum acceleration at 13.2 Hz);
– above 13.2 Hz and up to 100 Hz with a constant maximum acceleration of 7 m/s².

One sweep was performed at a rate of 0.5 octaves / minute.

No resonances were found therefore the unit was subjected to a 2 hour endurance run at 30 Hz in each axis as required by the relevant standard.

2.6.7 Test Results

Example Setup Photo (Vertical Axis)

500 (TUV#2)

Summary of Performance Check Results

Stage/Parameter	Results
Vertical Axis	
Resonance Search	None Found
Endurance Run	30 MHz for 2 hours
Self-test Message	FFFED096EE3341F47FDFF8218277
Normal Message	FFFE2F96EE3341F47FDFF821827783E0F66C
406 MHz Frequency	406.037023
121 MHz Presence	P
Lateral Axis	
Resonance Search	None Found
Endurance Run	30 MHz for 2 hours
Self-test Message	FFFED096EE3341F47FDFF8218277
Normal Message	FFFE2F96EE3341F47FDFF821827783E0F66C
406 MHz Frequency	406.037025
121 MHz Presence	P
Longitudinal Axis	
Resonance Search	None Found
Endurance Run	30 MHz for 2 hours
Self-test Message	FFFED096EE3341F47FDFF8218277
Normal Message	FFFE2F96EE3341F47FDFF821827783E0F66C
406 MHz Frequency	406.037024
121 MHz Presence	P

Mechanical Inspection

Post test no signs of mechanical degradation could be witnessed.

Activation Monitoring

During the test this EUT was not monitored for signs of activation. It was considered a risk of damage to the conducted 50Ω ports if cables were attached during vibration.

100 (TUV#1)

Summary of Performance Check Results

Stage/Parameter	Results
Vertical Axis	
Resonance Search	None Found
Endurance Run	30MHz for 2hours
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Message	FFFE2F96EE3340647FDFF9CBEC7783E0F66C
406 MHz Frequency	406.037077
121 MHz Presence	P
Lateral Axis	
Resonance Search	None Found
Endurance Run	30MHz for 2hours
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Message	FFFE2F96EE3340647FDFF9CBEC7783E0F66C
406 MHz Frequency	406.037082
121 MHz Presence	P
Longitudinal Axis	
Resonance Search	None Found
Endurance Run	30MHz for 2hours
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Message	FFFE2F96EE3340647FDFF9CBEC7783E0F66C
406 MHz Frequency	406.037079
121 MHz Presence	P

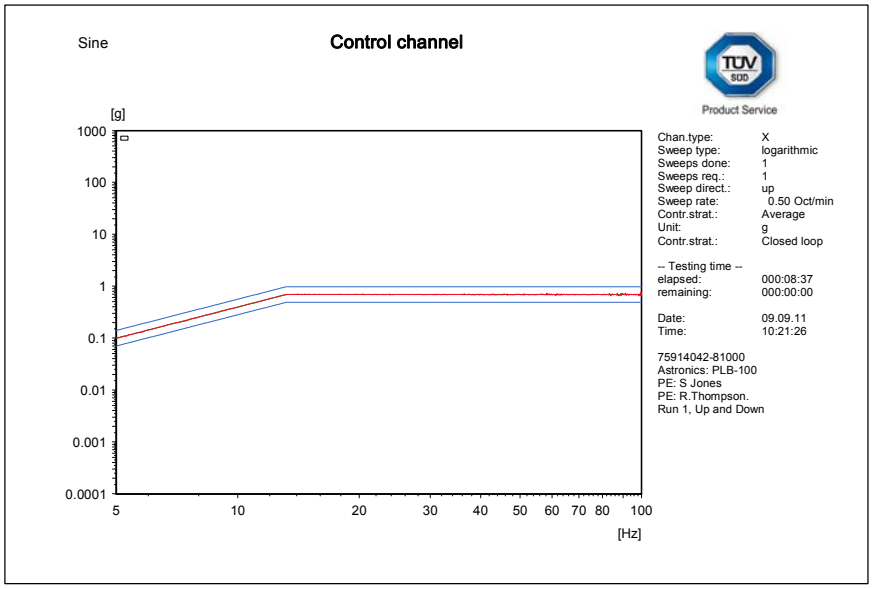
Mechanical Inspection

Post test no signs of mechanical degradation could be witnessed.

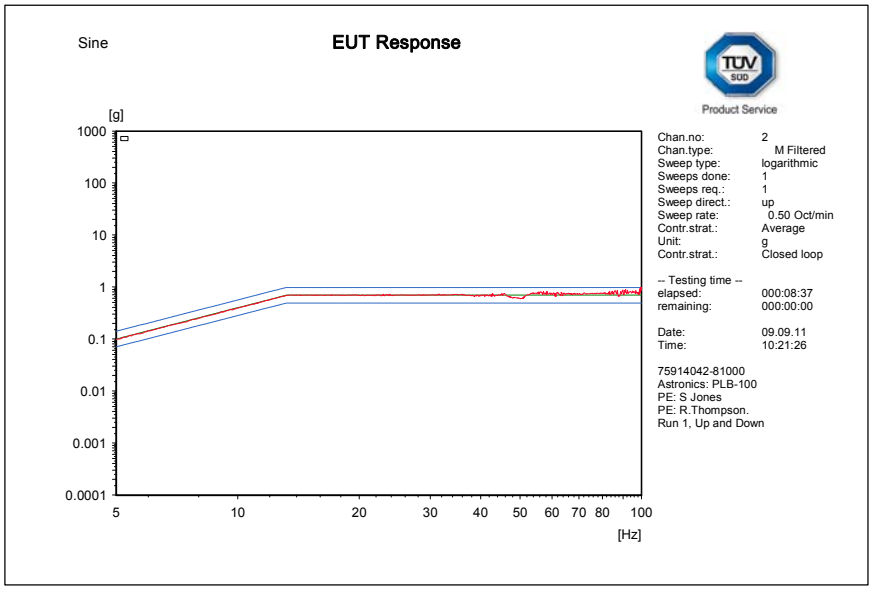
Activation Monitoring

During the test the EUT was monitored for signs of activation, none were found.

Vertical Axis



C:\VcpNT\Daten\m+p\Astronics\Resonant Survey_004.rsn



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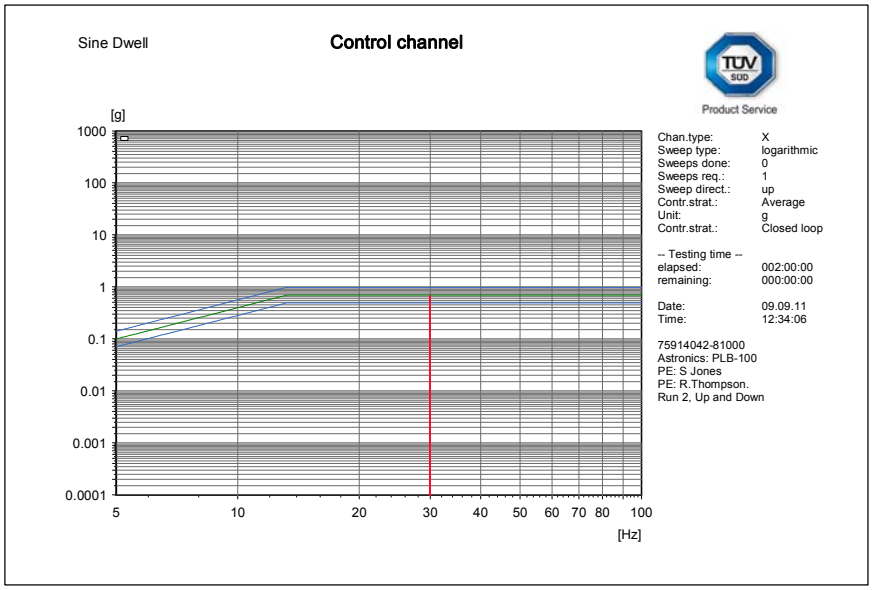
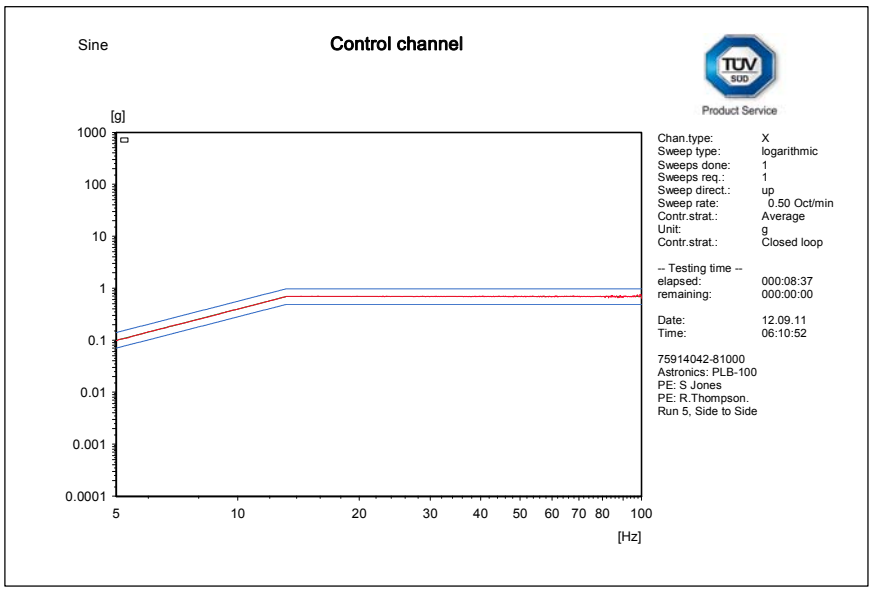
Vertical Axis - Endurance



C:\VcpNT\Daten\m+p\Astronics\30Hz Dwell_002.rsd

Lateral Axis



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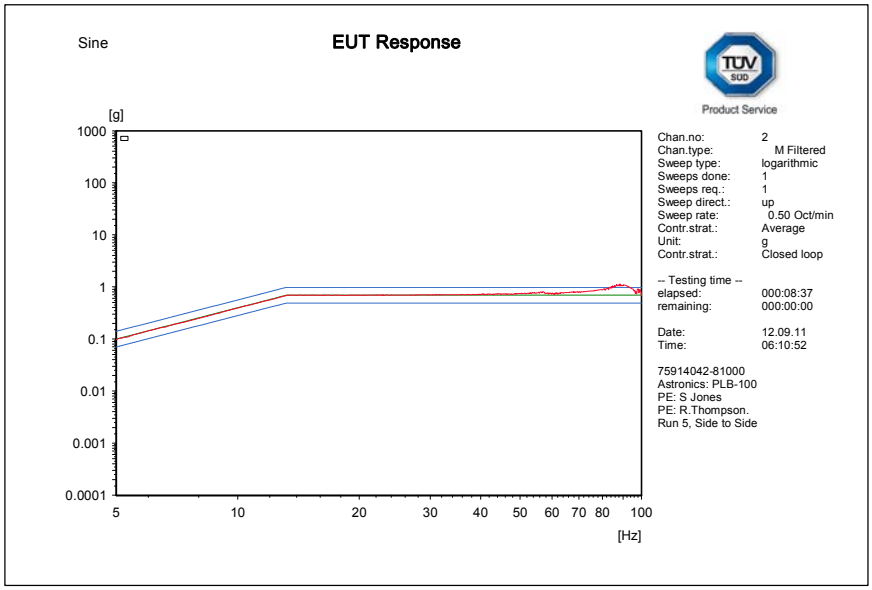

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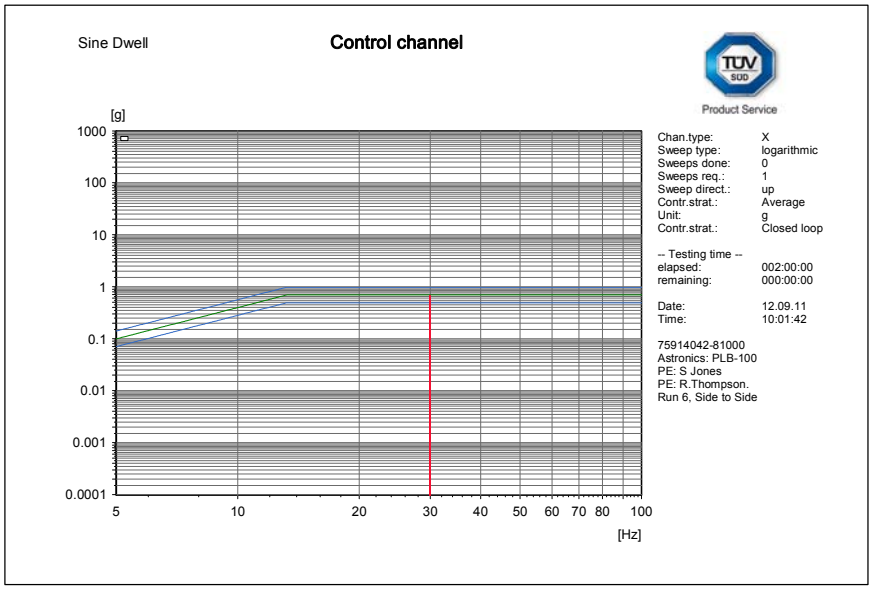
Lateral Axis Endurance



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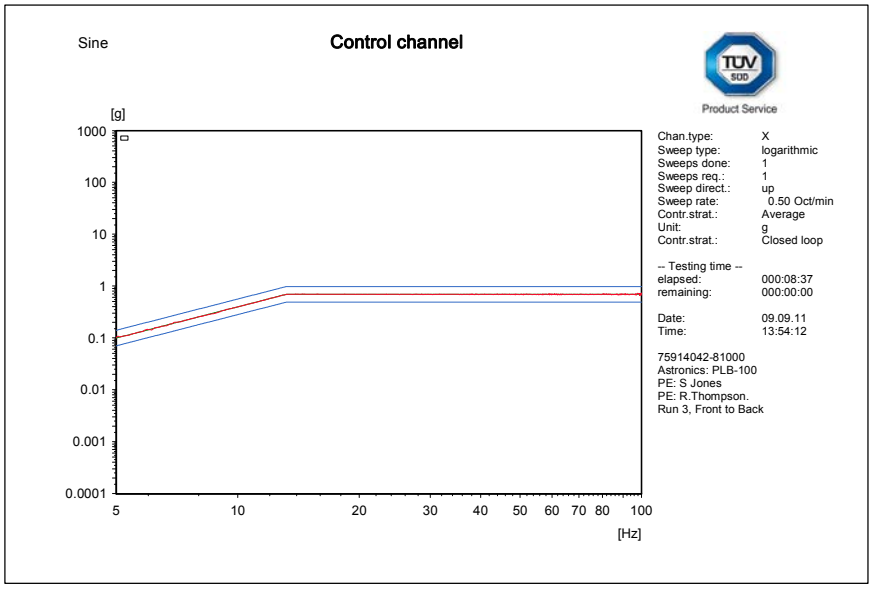
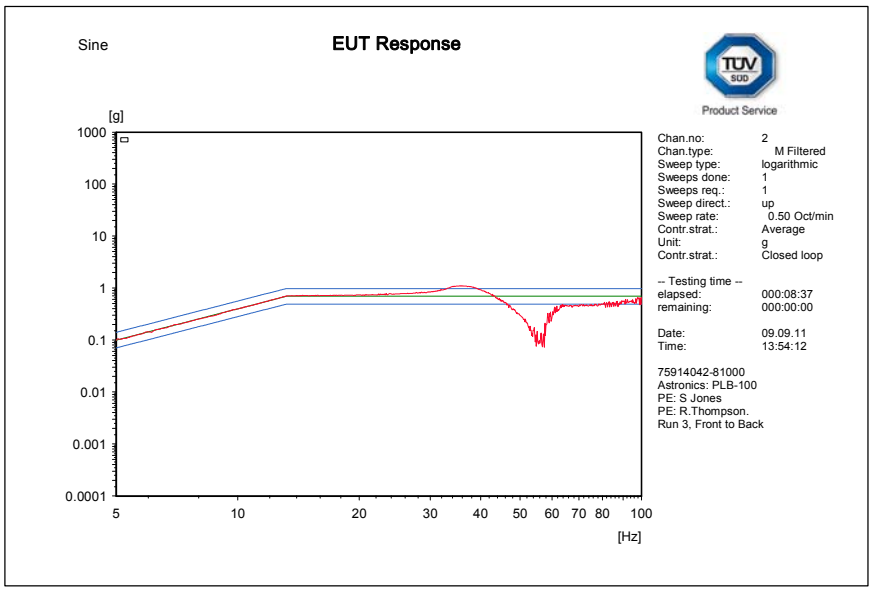
Longitudinal Axis



C:\VcpNT\Daten\m+p\Astronics\Resonant Survey_006.rsn



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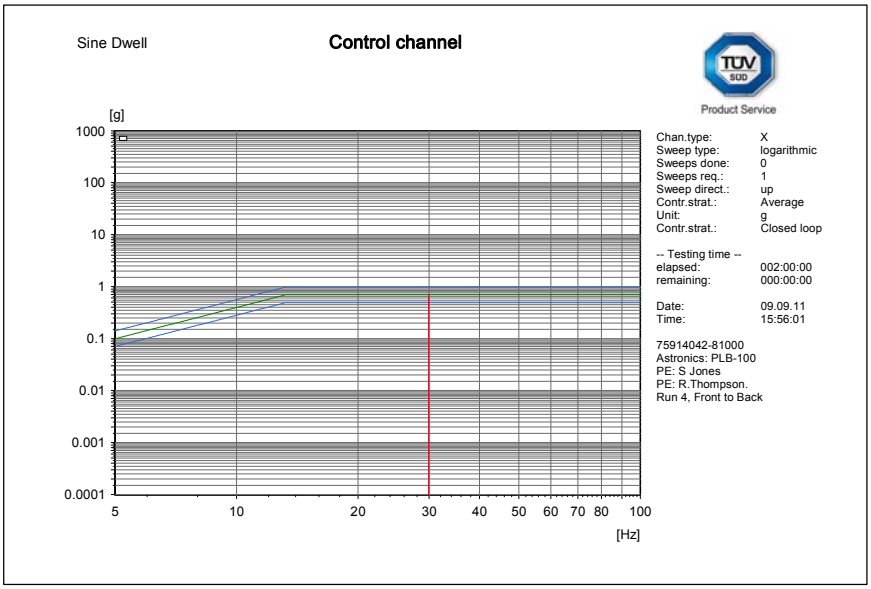
Longitudinal Axis Endurance



C:\VcpNT\Daten\m+p\Astronics\30Hz Dwell_003.rsd

2.7 BUMP TEST

2.7.1 Specification

RTCM Standard for PLBs, Clause A.7

2.7.2 Equipment Under Test and Modification State

SATRO™ Model PLB-110 S/N: # 500 (TUV#2) - Modification State 0
SATRO™ Model PLB-110 S/N: # 100 (TUV#1) - Modification State 0

2.7.3 Date of Test

14 September 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 20.5 - 20.6°C
Relative Humidity 48.8 - 49.3%

2.7.6 Test Method

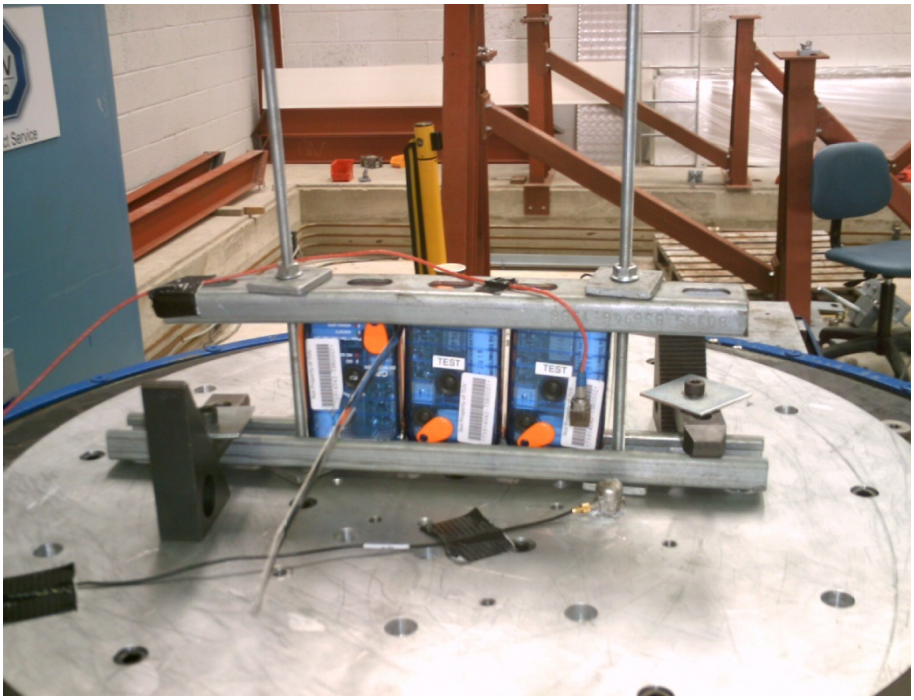
The PLB was subjected to the bump test according to the following profile:

Peak acceleration: 98 m/s_2 +/-10%
Pulse duration: 16 ms +/-10 %
Wave shape: Half-cycle sinewave
Number of bumps: 4000

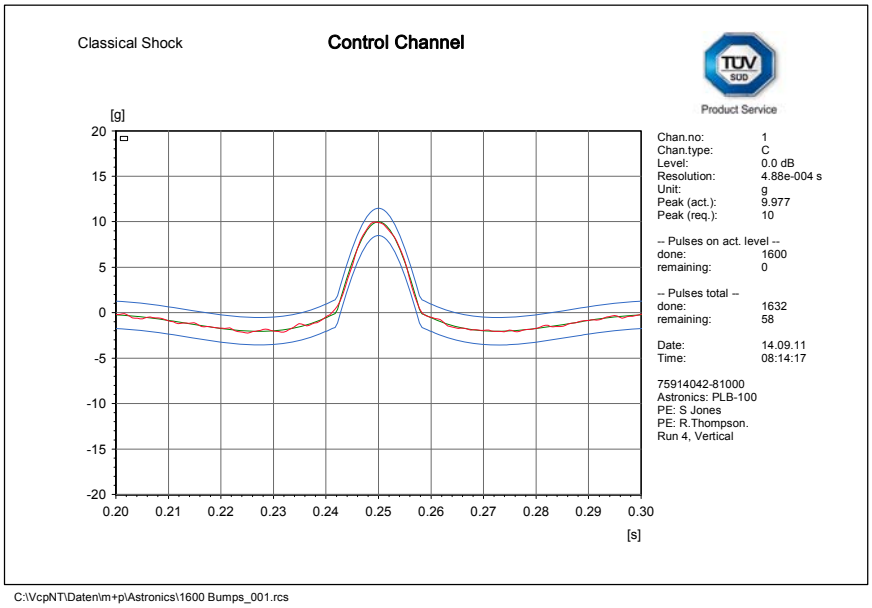
The test was carried out three times with the PLB in each of the three axes.

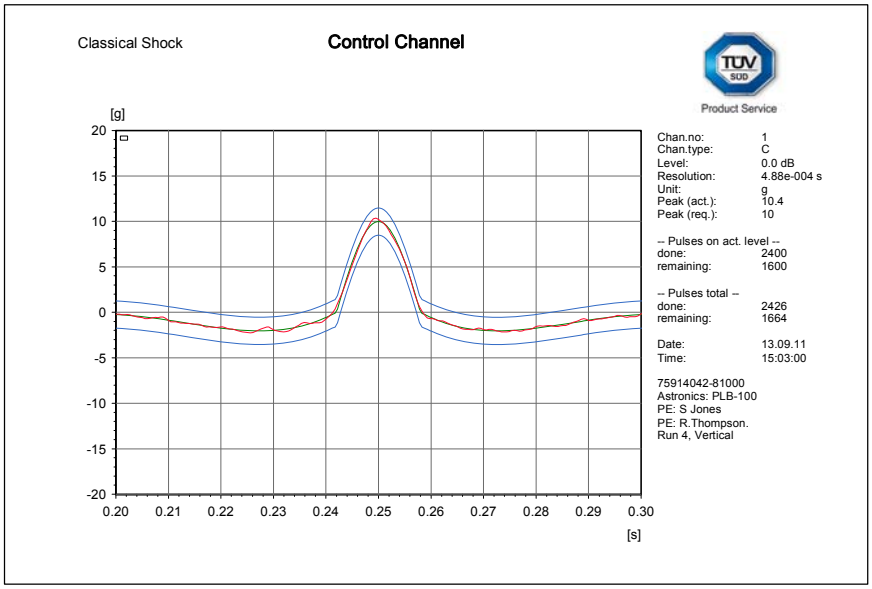
2.7.7 Test Results

Setup Photo



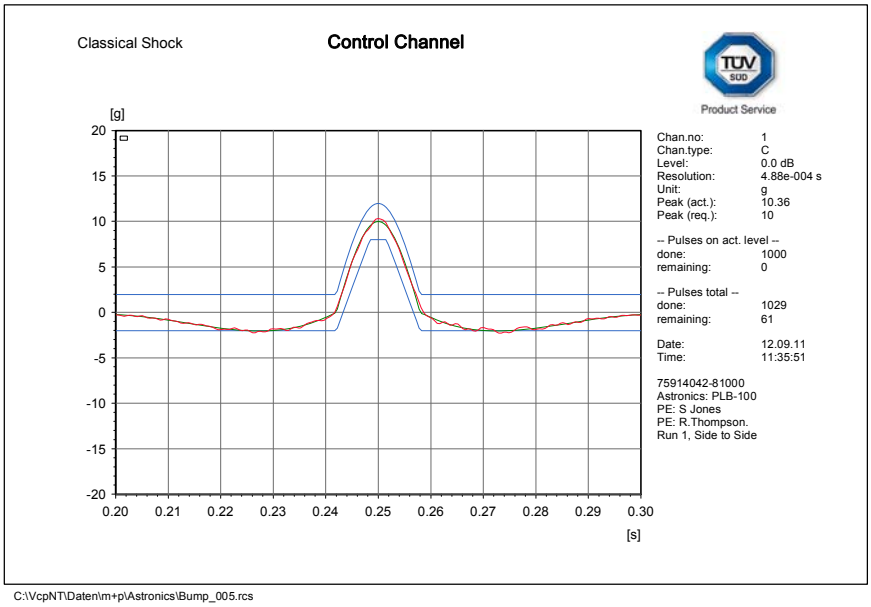
Vertical Axis, 4000 Bumps



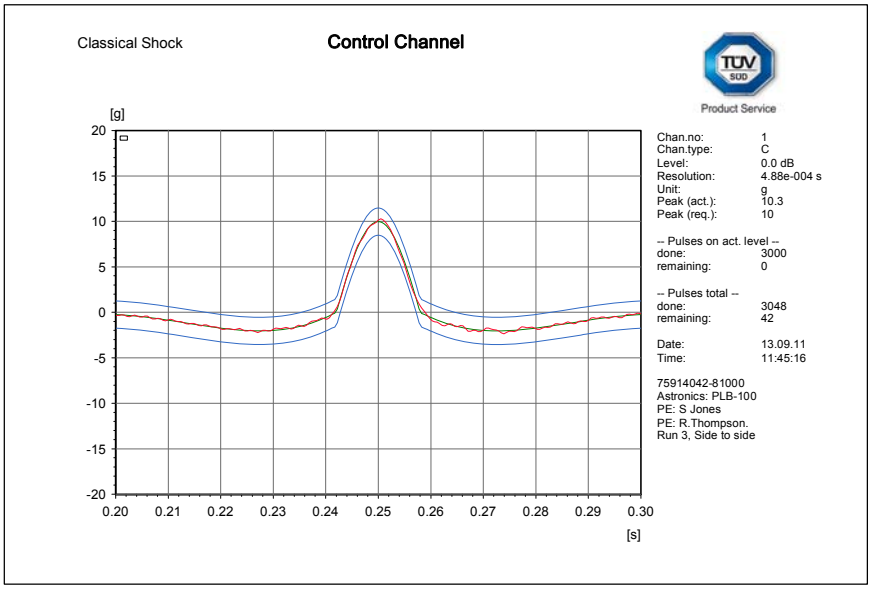


C:\VcpNT\Daten\m+p\Astronics\Bump_014.rcs

Lateral Axis, 4000 Bumps

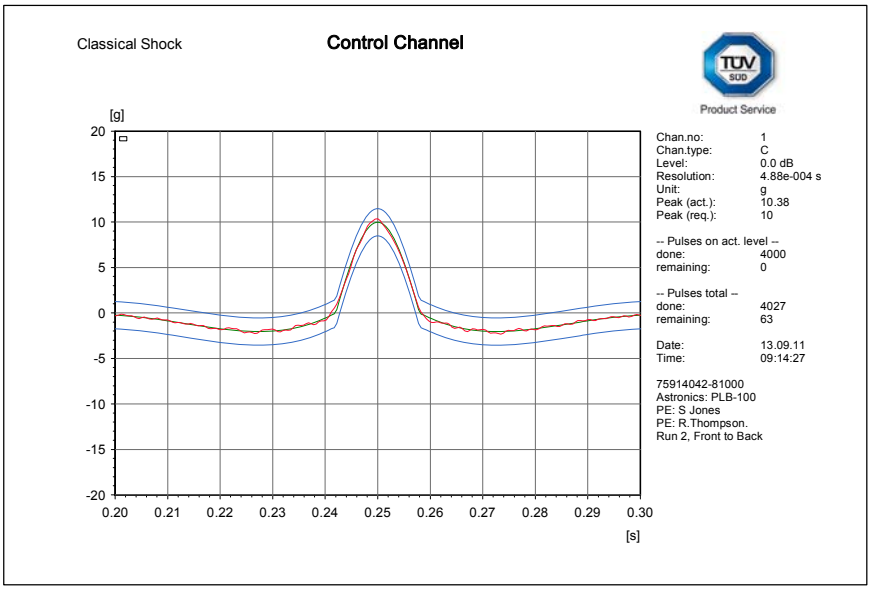


C:\VcpNT\Daten\m+p\Astronics\Bump_005.rcs



C:\VcpNT\Daten\m+p\Astronics\Bump_013.rcs

Longitudinal Axis, 4000 Bumps



C:\VcpNT\Daten\m+p\Astronics\Bump_012.rcs

Summary of Performance Check Results

500 (TUV#2)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3341F47FDFF8218277
Normal Mode:	
Normal Message	FFFE2F96EE3341F47FDFF821827783E0F66C
406 MHz Frequency	406.037035
121 MHz Presence	P

Post Test Inspection

No signs of mechanical degradation were observed.

EUT Response

During the test this EUT was not monitored for signs of activation. It was considered a risk of damage to the conducted ports if 50Ω cables were attached during vibration.

Summary of Performance Check Results

100 (TUV#1)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Mode:	
Normal Message	FFFE2F96EE3340647FDFF9CBEC7783E0F66C
406 MHz Frequency	406.037082
121 MHz Presence	P

Post Test Inspection

No signs of mechanical degradation were observed.

EUT Response

The EUT did not activate during the test.

2.8 CORROSION TEST

2.8.1 Specification

RTCM Standard for PLBs, Clause A.8

2.8.2 Equipment Under Test and Modification State

SATRO™ Model PLB-110 S/N: TUV #6 - Modification State 0
SATRO™ Model PLB-110 S/N: TUV #8 - Modification State 0

2.8.3 Date of Test

3 October 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 54.7%

2.8.6 Test Method

The EUT was placed in a chamber and sprayed with a salt solution for 2 h at normal temperature. The salt solution was prepared by dissolving (5 ± 1) parts by weight of sodium chloride (NaCl) in 95 parts by weight of distilled or demineralized water.

At the end of the spraying period, the EUT was placed in a chamber which was maintained at a temperature of 40 °C ± 2 °C, and a relative humidity between 90 % and 95 % for a period of seven days.
The EUT was subjected to a test comprising four spraying periods, each of duration 2 h, with a storage period of seven days after each.

At the conclusion of the test the EUT was inspected with the naked eye without magnification. The EUT was then subjected to a performance check.

2.8.7 Test Results

Summary of Performance Check Results/ Observations

TUV #6, failed to operate in both normal and self test modes post test. Examination of the battery revealed 6.4V (Nominal 9v). When a fresh battery was inserted into the EUT, operational checks passed.

Sample #8 which was tested to see the effects of the test on EUT labelling passed the post test performance checks. Note: the battery was disconnected during test.

Both EUT's showed signs of corrosion on the antenna surface, however this surface corrosion could be easily removed. (See photos)

Post Test Antenna Corrosion

2.9 DROP TEST

2.9.1 Specification

RTCM Standard for PLBs, Clause A.9

2.9.2 Equipment Under Test and Modification State

SATRO^{TM} Model PLB-110 S/N: # 100 (TUV#1) - Modification State 0

2.9.3 Date of Test

15 September 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 22.5 - 23.1°C
Relative Humidity 34.7 - 46.7%

2.9.6 Test Method

The test procedure below was followed to satisfy the requirements of ETSI EN 302 152 and AS/NZS 4280 and is considered as an over test to the requirements of RTCM11010:

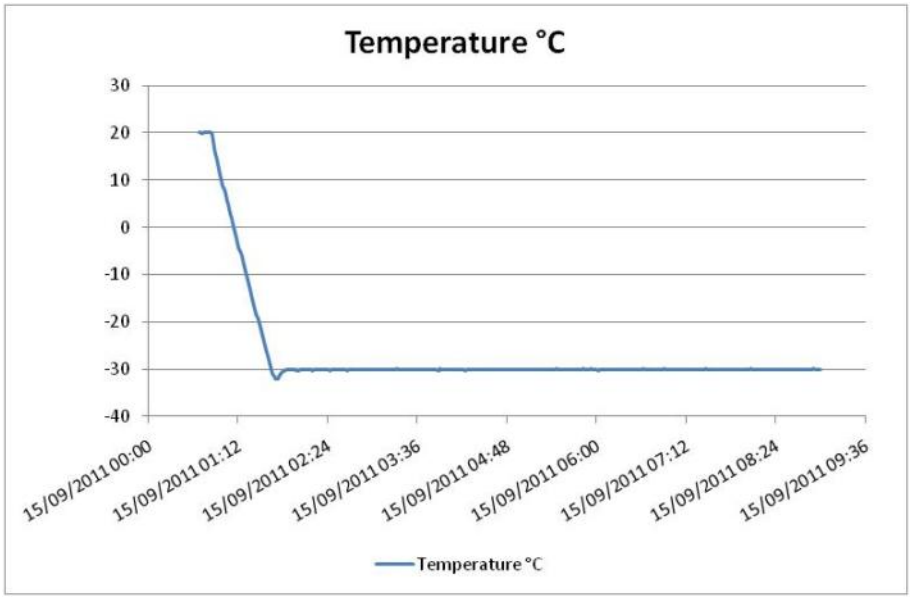
The EUT was placed in chamber and preconditioned at a temperature of -30°C for at least 7 hours. The drop test was completed within 5 minutes of removing the EUT from the preconditioning chamber.

The EUT was dropped 6 times, one on each face, from a height of 1220 mm onto the test surface.

Setup Photo

2.9.7 Test Results

Temperature Plot



The EUT was monitored and did not activate automatically during the test. The EUT was subjected to a visual inspection post-test and no signs of external damage were observed.

Summary of Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Mode:	
Normal Message	FFFE2F96EE3340647FDFF9CBEC7783E0F66C
406 MHz Frequency	406.037052
121 MHz Presence	P

2.10 THERMAL SHOCK

2.10.1 Specification

RTCM Standard for PLBs, Clause A.10

2.10.2 Equipment Under Test and Modification State

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

2.10.3 Date of Test

30 September 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 22.8 - 24.2°C
Relative Humidity 37.5 - 51.3%

2.10.6 Test Method

The EUT was placed in the pre-conditioning climatic chamber at a temperature of 70.0°C for 1 hour.

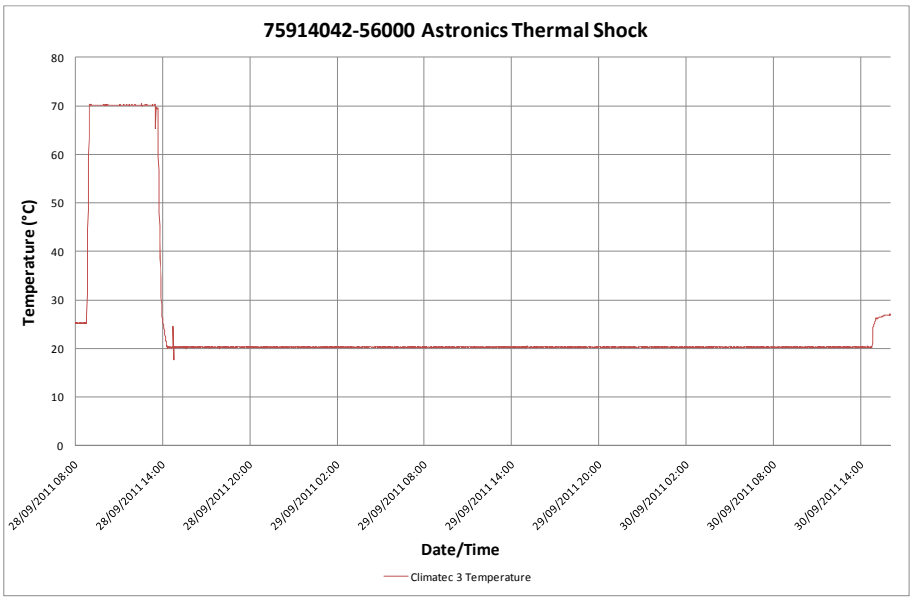
The EUT was then immersed in a water vessel at 20.2°C, at a level of 100mm below the surface of the water (measured to the highest point of the EUT).

The EUT was subjected to 48 hours of immersion.

* This temperature is a deviation from the standard to cover the requirements of ETSI EN 302 152-1 V1.1.1: 2003, and is regarded to be a more stringent test.

2.10.7 Test Results

Preconditioning Temperature Plot



Setup Photo

Summary of Performance Check Results

100 (TUV#1)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F96EE3340647FDFF9CBEC7783E0F66C 406.037055 P

2.11 IMMERSION TEST

2.11.1 Specification

RTCM Standard for PLBs, Clause A.11

2.11.2 Equipment Under Test and Modification State

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

2.11.3 Date of Test

5 October 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 25.2°C
Relative Humidity 49.6%

2.11.6 Test Method

Immersion Test

The EUT was placed in a pressure vessel as shown in the setup photograph(s). The pressure was increased to 1 bar relative to atmospheric pressure and maintained for 5 minutes.

Temporary Immersion Test

The EUT was completely submerged in a vessel of water and then positioned in an overpressure chamber and a gauge corresponding to 1 m was applied for a period of 1 hour.

2.11.7 Test Results

Summary of Performance Check Results

100 (TUV#1)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3340647FDFF9CBEC77
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F96EE3340647FDFF9CBEC7783E0F66C 406.037043 P

Inspection

On completion of the test the EUT was inspected and no sign of water ingress was found.

2.12 SPURIOUS EMISSIONS TEST

2.12.1 Specification

RTCM Standard for PLBs, Clause A.12

2.12.2 Equipment Under Test and Modification State

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

2.12.3 Date of Test

28 October 2011 & 28 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

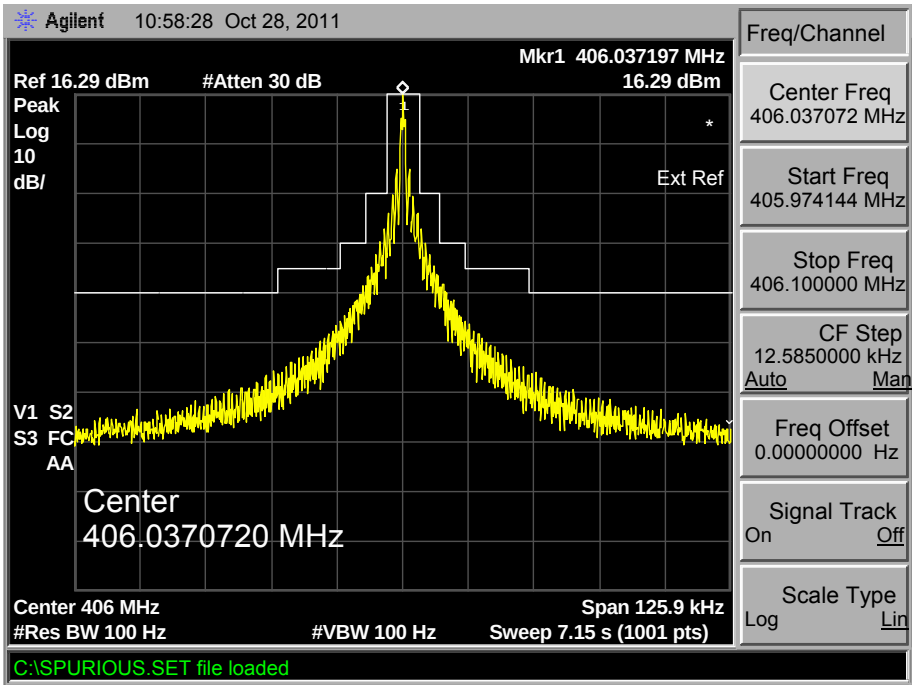
Ambient Temperature 19.5 - 23.9°C
Relative Humidity 29.7 - 40.8%

2.12.6 Test Results

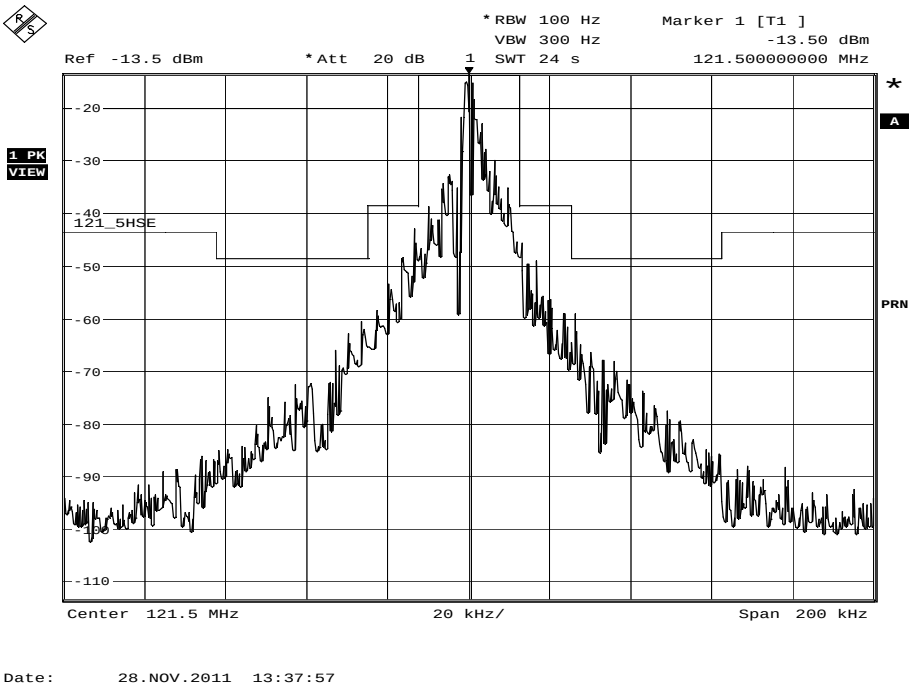
500 (TUV#2)

Close In Emissions

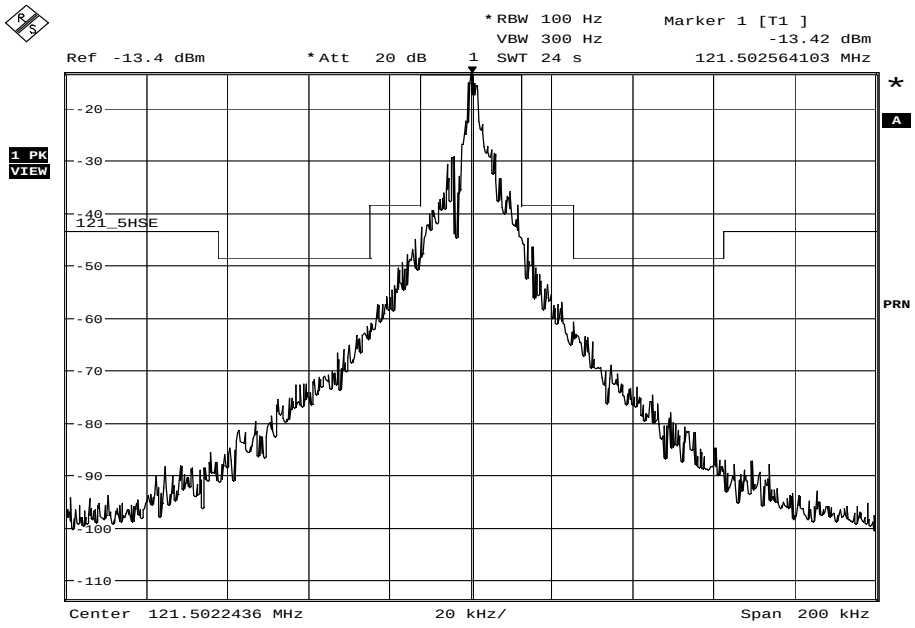
406 MHz Combined Plot Over Ambient Temperature, +55°C and -20°C



121 MHz Plot at Ambient Temperature

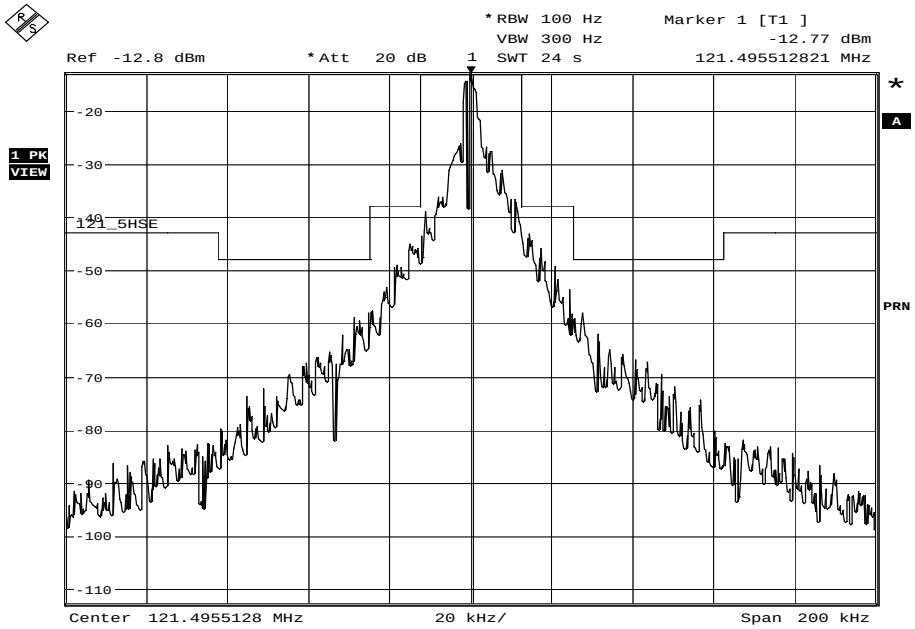


121 MHz Plot at MaximumTemperature (+55ºC)



Date: 28.NOV.2011 18:49:49

121 MHz Plot at MinimumTemperature (-20ºC)

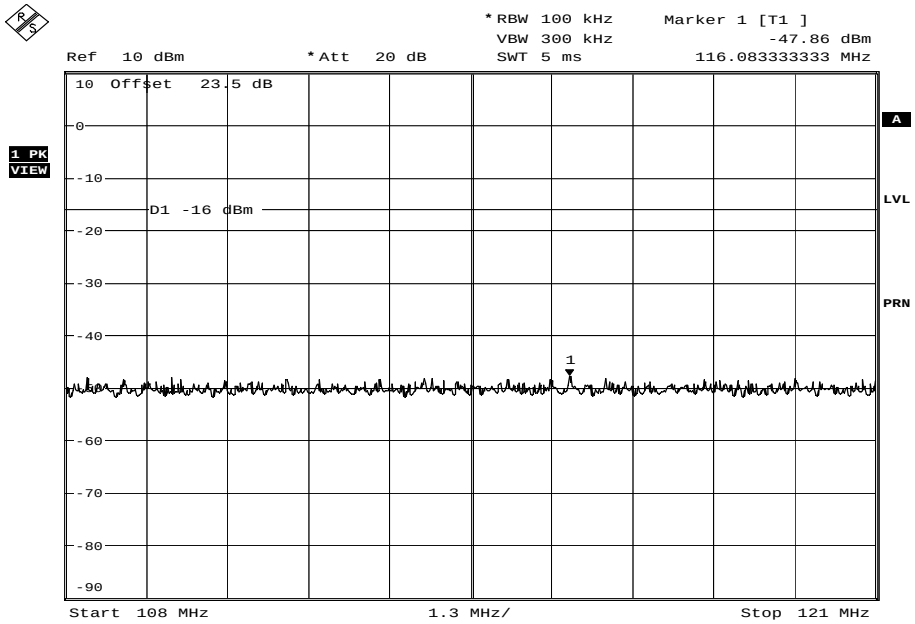


Date: 28.NOV.2011 16:11:36

Aeronautical, Maritime and Satellite Band Emissions

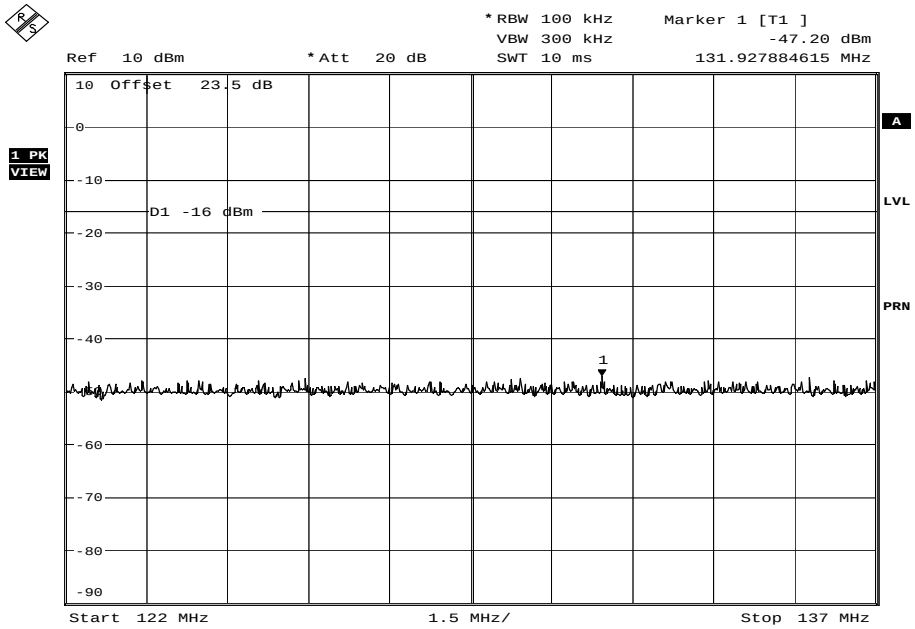
Note: Limit of 25µW (-16.0dBm) is displayed on the result plots.

108 MHz to 121 MHz



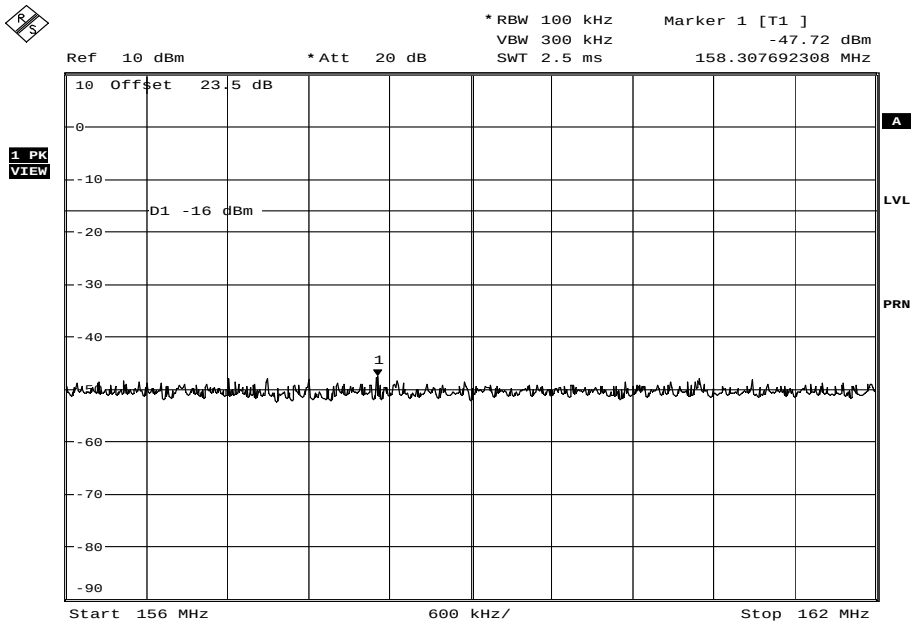
Date: 28.NOV.2011 13:51:31

122 MHz to 137 MHz



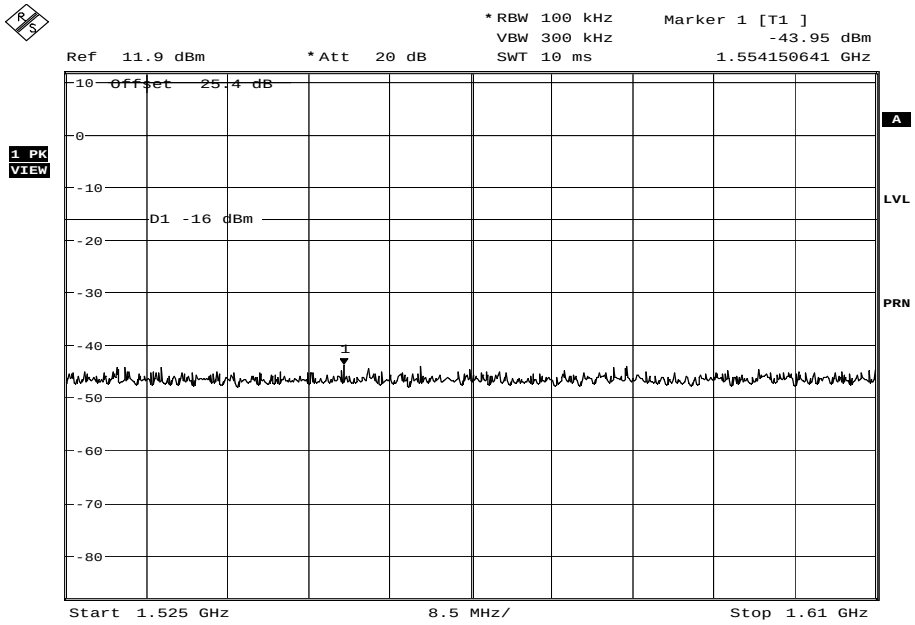
Date: 28.NOV.2011 13:54:37

156 MHz to 162 MHz



Date: 28.NOV.2011 13:57:17

1525 MHz to 1610 MHz



Date: 28.NOV.2011 14:00:04

2.13 OPERATIONAL LIFE TEST

2.13.1 Specification

RTCM Standard for PLBs, Clause A.13.1

2.13.2 Equipment Under Test and Modification State

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

2.13.3 Date of Test

18 October 2011

2.13.4 Test Equipment Used

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

2.13.5 Environmental Conditions

Ambient Temperature 22.6°C
Relative Humidity 45.7%

2.13.6 Test Results

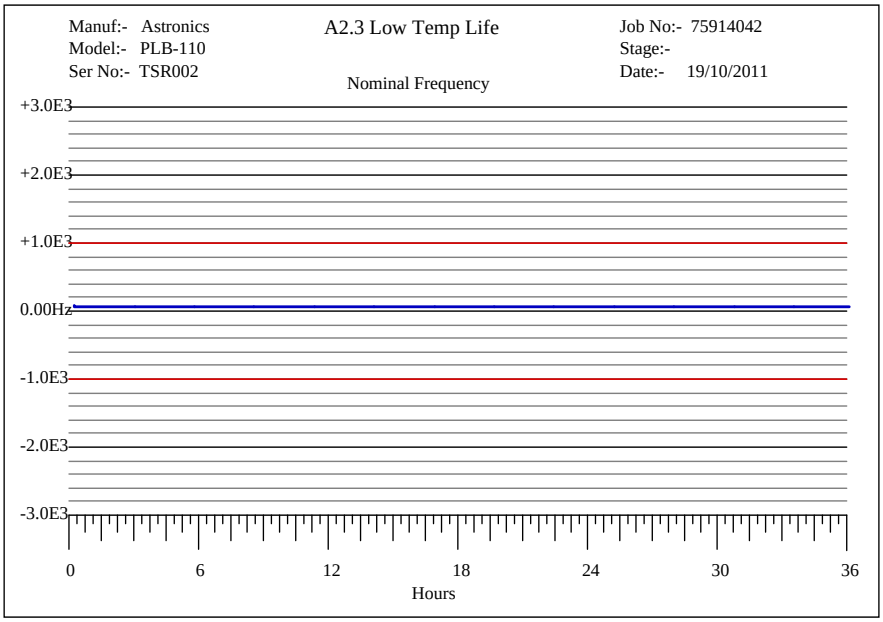
Test Method Used: 2 (Limit of 24 hours extended by extension factor (F))

Extension factor (required battery prediscahrge) = 6.90 hours

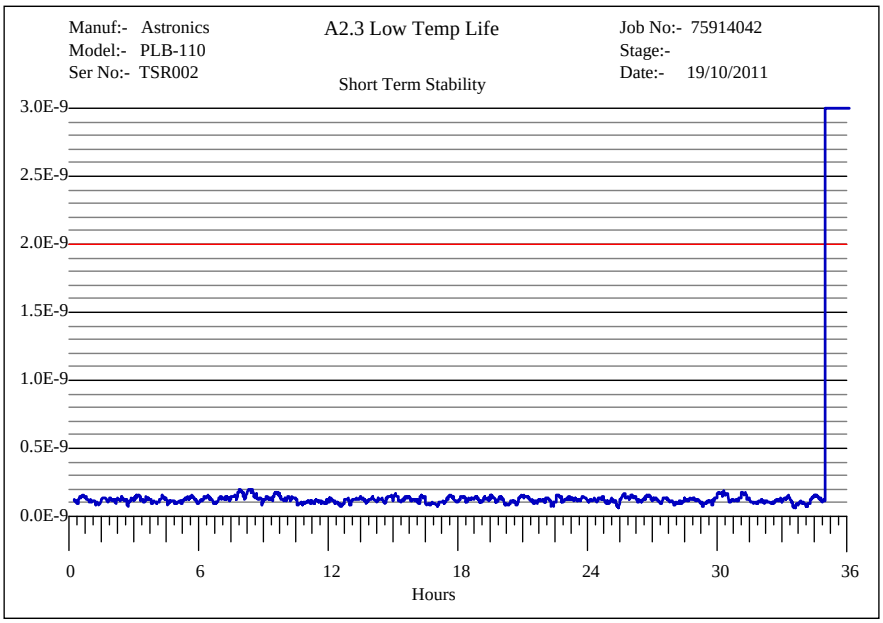
Minimum required operating time = 24 + 6.9 = 30.9 hours

Actual operating time (time to first failure) = **31.11 hours**

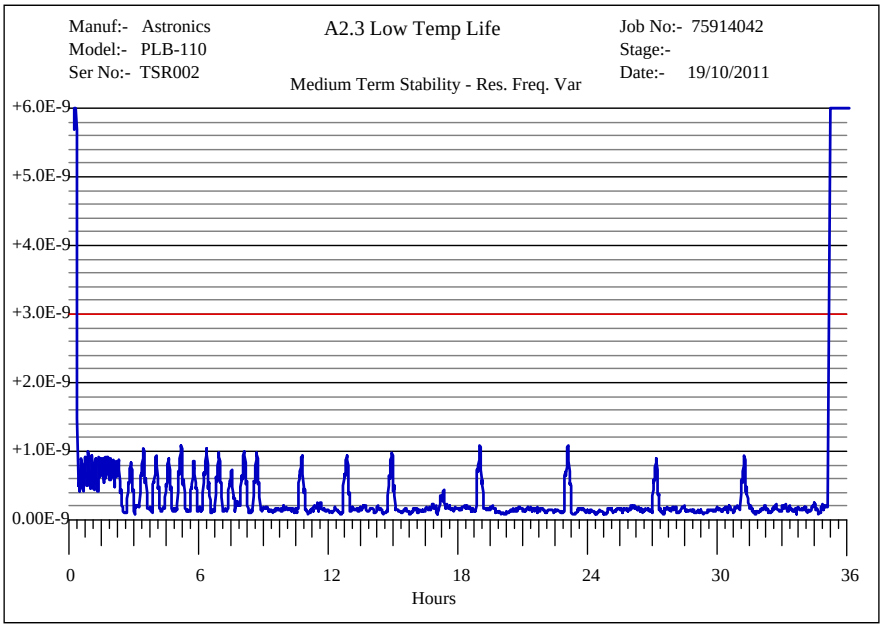
Nominal Frequency



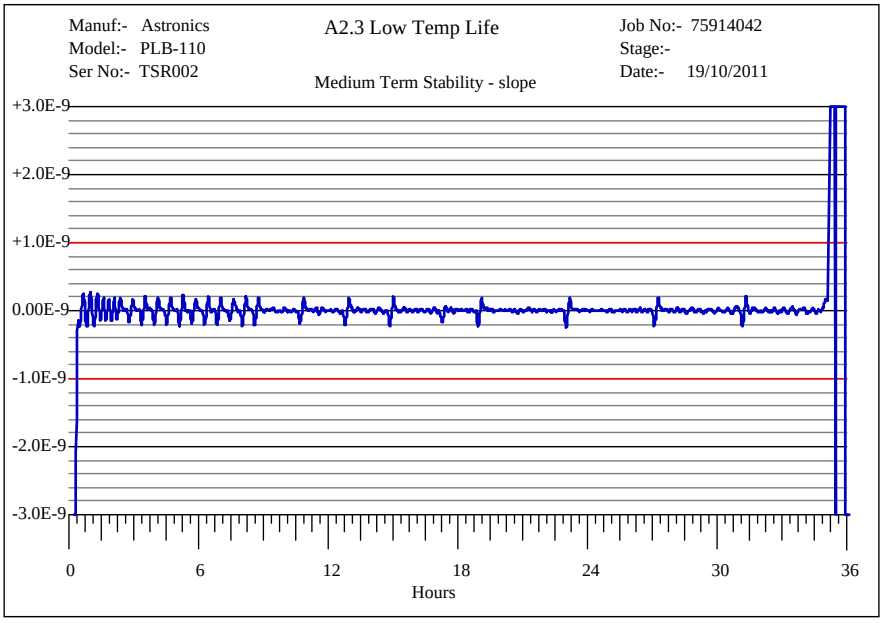
Short Term Stability



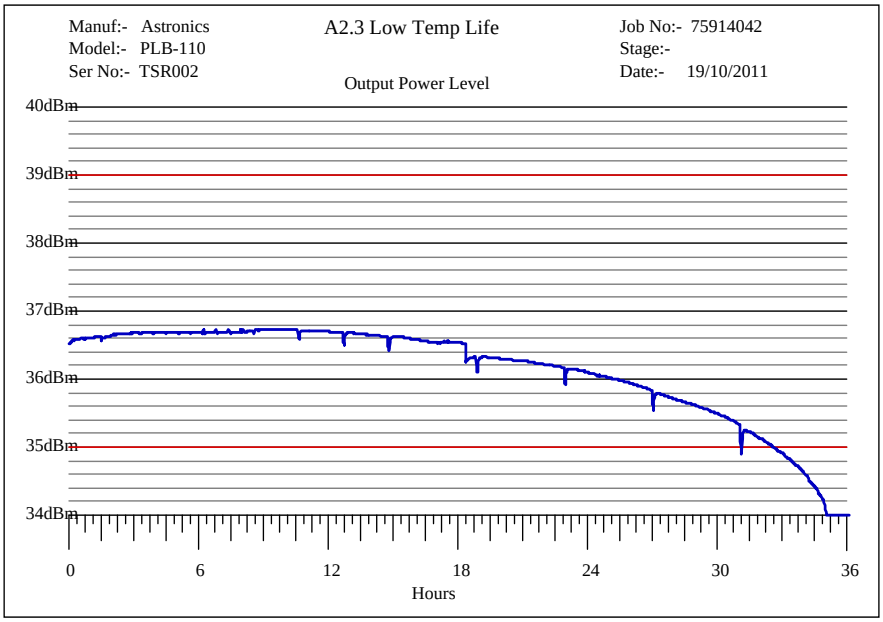
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



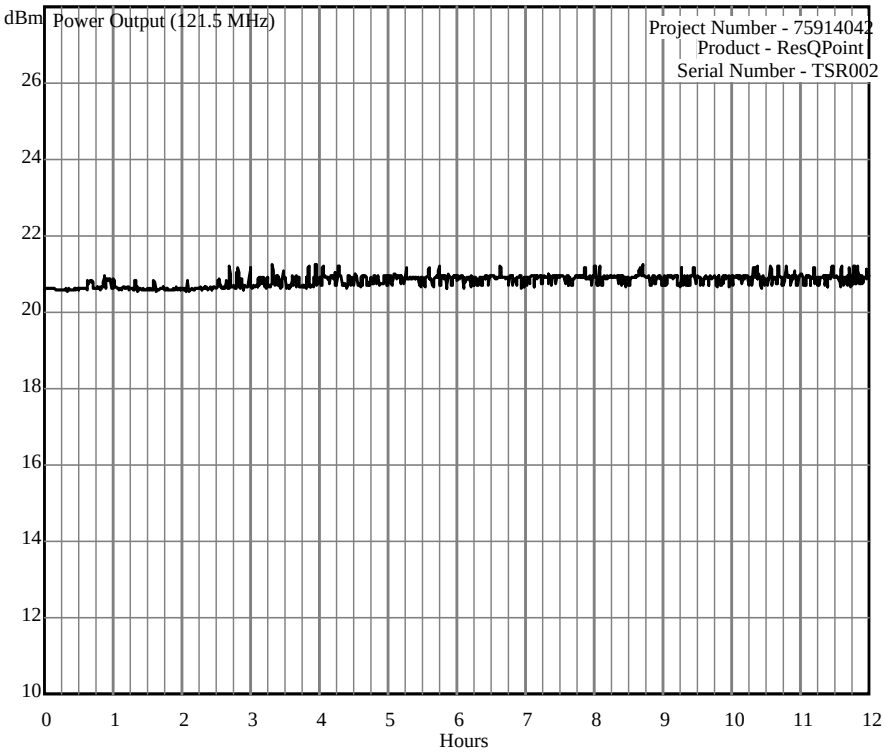
Output Power

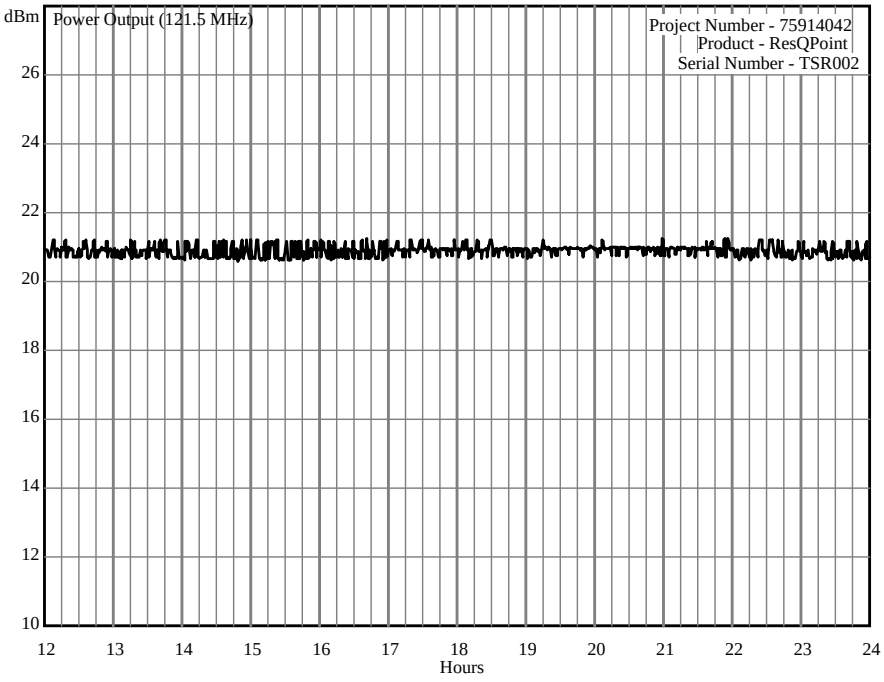


Digital Message

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

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

121 MHz Peak Envelope Power Results





Battery Current and Measurement Results

Battery Discharge Current

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

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

The individual tests were conducted for the following durations:

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

Assumptions / Supplied Data

Battery Replacement Interval	:	11.5 years	10 years + 1.5 years shelf
Battery Capacity	:	1.55 Ah	
Battery Self Drain	:	1.00 % per year	
Self-test Interval	:	10.43 tests per year	1 per month for 10 years/11.5 years
GPS Self-test Interval	:	1.04 tests per year	12 Tests (Total) in 11.5 years

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 GPS ST Current	=	3596624 uC	/	130080 ms	=	27.65	mA
Fast GPS 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)$^{11.5}$ x 1.55) = 0.1692 Ah

Standby Drain = Hours per year x Battery Replacement Interval x Standby Current

= 365 x 24 x 11.5 x 0.11 x 10^{-9} = 0.000011 Ah

Self-test Drain = Self-tests per battery x Self-test Current x Self-test duration (in hours)

= 10.43 x 11.5 x 74.56 x 10^{-3} x (8.72 / 3600) = 0.0217 Ah

Time-out GPS ST Drain = GPS STs per battery x Time-out GPS ST Current x Time-out GPS ST duration (in hours)

= 1.04 x 11.5 x 27.65 x 10^{-3} x (130.08 / 3600) = 0.0119 Ah

Fast GPS ST Drain = GPS STs per battery x Fast GPS ST Current x Fast GPS ST duration (in hours)

= 1.04 x 11.5 x 36.81 x 10^{-3} x (41.6 / 3600) = 0.0051 Ah

Total Drain = Self Drain + Standby Drain (Worst Case) + Self-test Drain (Worst Case)
+ Time-out GPS ST Current (Worst Case) + Fast GPS ST Current (Worst Case)

= 0.1692 + 0.000011 + 0.0217 + 0.0119 + 0.0051 = 0.2079 Ah

Battery Preconditioning / Discharge Time = Worst Case drain / Operational Current

= 0.2079 / (30.12 x 10^{-3})

= 6.90 hours

2.14 SELF-TEST

2.14.1 Specification

RTCM Standard for PLBs, Clause A.13.2

2.14.2 Equipment Under Test and Modification State

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

2.14.3 Date of Test

31 October 2011, 28 November 2011 & 29 November 2011

2.14.4 Test Equipment Used

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

2.14.5 Environmental Conditions

Ambient Temperature 19.0 - 22.7°C
Relative Humidity 30.0 - 43.9%

2.14.6 Test Results

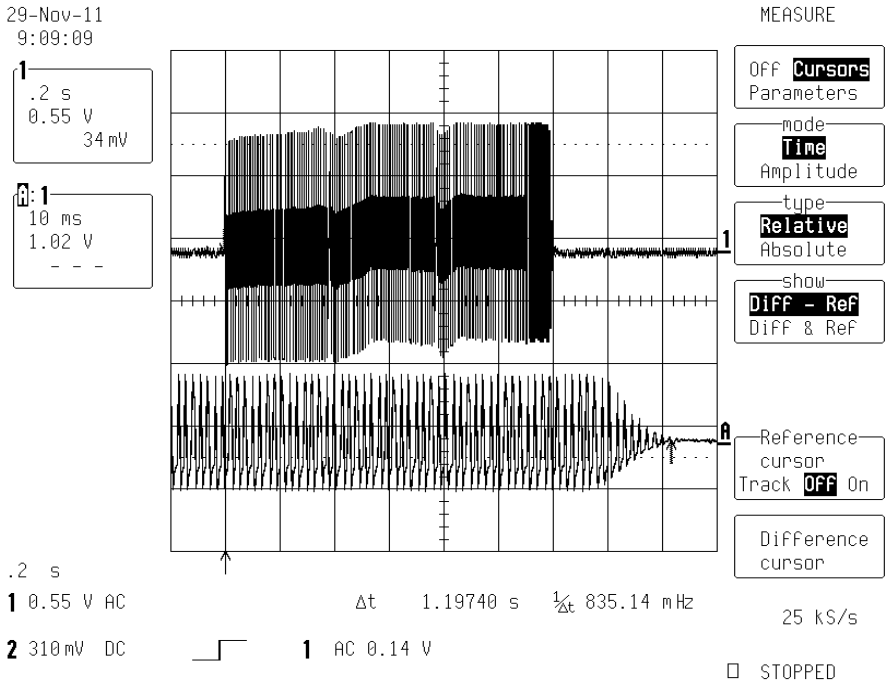
The EUT was fitted with a separate button to activate the Self Test function.

Summary of Self-test Results

Parameter	Limit/Units	Test Results		
		(-20°C)	(20°C)	(+55°C)
Self-test Indication	P/F	P	P	P
Pulse duration	≤ 444 mS	440.302	440.372	440.463
Frame sync pattern	011010000	P	P	P
Single Burst Verification	P/F	P	P	P
15 Hex ID	P/F	P	P	P
Self-test 121 MHz transmission	< 1 second or 3 sweeps	P	P	P

Ambient

121 Signal Duration

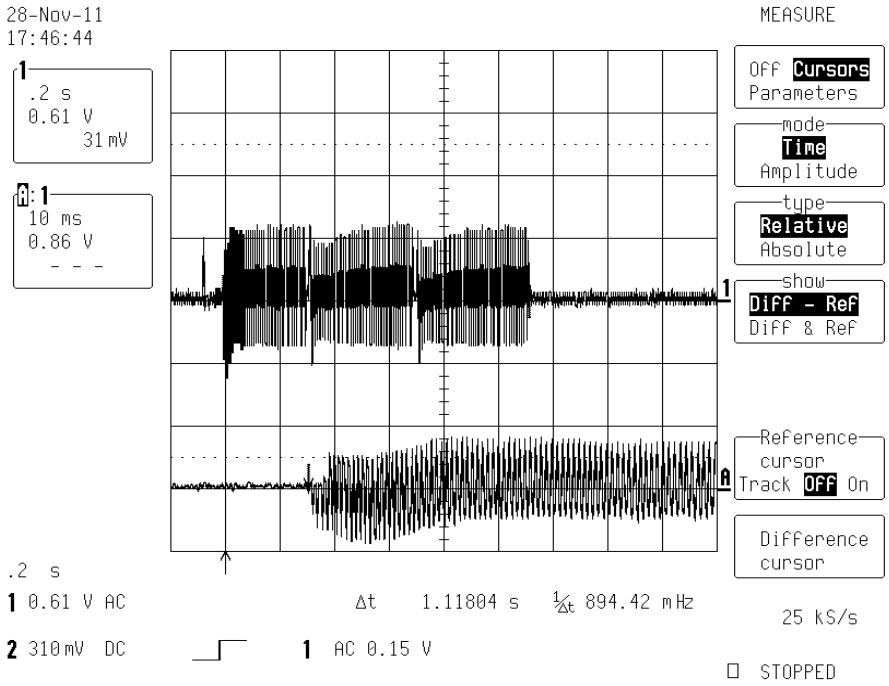


Digital Message

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

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

Maximum Temperature

121 Signal Duration

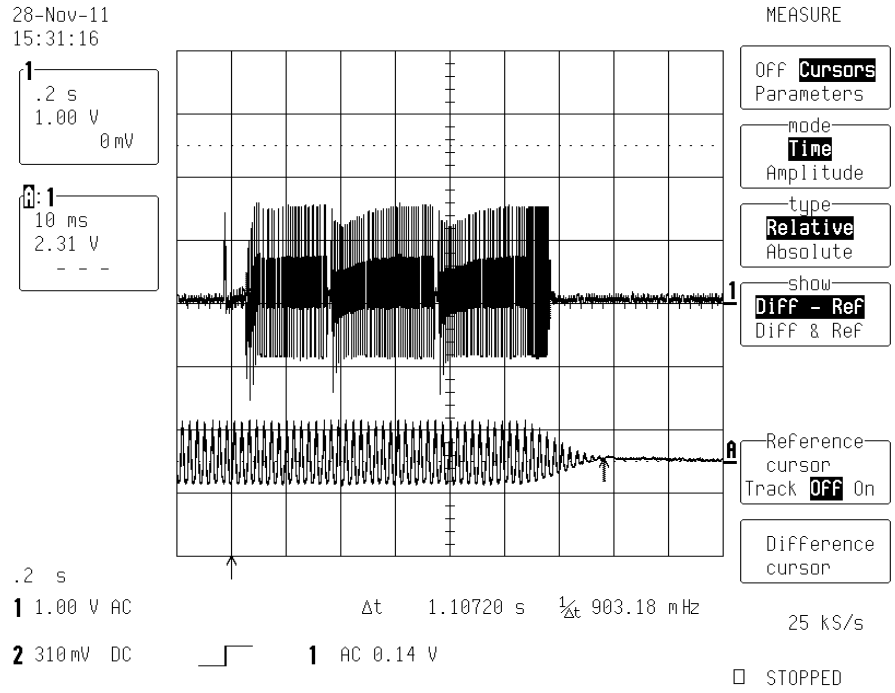


Digital Message

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

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

Minimum Temperature

121 Signal Duration



Digital Message

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

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

2.15 COSPAS-SARSAT TYPE APPROVAL TEST PROCEDURE

2.15.1 Specification

RTCM Standard for PLBs, Clause A.14

2.15.2 Test Results

EUT Tested in accordance with Cospas-Sarsat T.001 - and Cospas-Sarsat T.007 .

A copy of the Cospas-Sarsat Type Approval Certificate (TAC) can be found at Annex B.

This is intended to show compliance with the above Specification References.

2.16 BUOYANCY TEST

2.16.1 Specification

RTCM Standard for PLBs, Clause A.15

2.16.2 Equipment Under Test and Modification State

SATRO™ Model PLB-110 S/N: # 300 (TUV#5) - Modification State 0

2.16.3 Date of Test

7 October 2011

2.16.4 Test Equipment Used

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

2.16.5 Environmental Conditions

Ambient Temperature 23.0 - 25.8°C
Relative Humidity 44.5 - 57.9%

2.16.6 Test Results

Setup Photo

The EUT was completely submerged in a vessel completely filled with domestic tap water. The reserve buoyancy was calculated by dividing the displaced water (EUT volume above the waterline) by the EUT volume below the waterline:

EUT volume above the waterline = 0.01 cc
EUT volume below the waterline = 0.115 cc

$$\text{Buoyancy} = \frac{\text{above the waterline}}{\text{below the waterline}} = \frac{0.01}{0.115}$$

Buoyancy = 0.087

= 8.7 %

2.17 121.5 MHz AUXILLARY RADIO-LOCATING DEVICE TRANSMITTER TEST

2.17.1 Specification

RTCM Standard for PLBs, Clause A.16

2.17.2 Equipment Under Test and Modification State

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

2.17.3 Date of Test

2 November 2011 and 23 March 2012

2.17.4 Test Equipment Used

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

2.17.5 Environmental Conditions

Ambient Temperature 21.0 - 22.8°C
Relative Humidity 35.0 - 49.9%

2.17.6 Test Results

Carrier Frequency

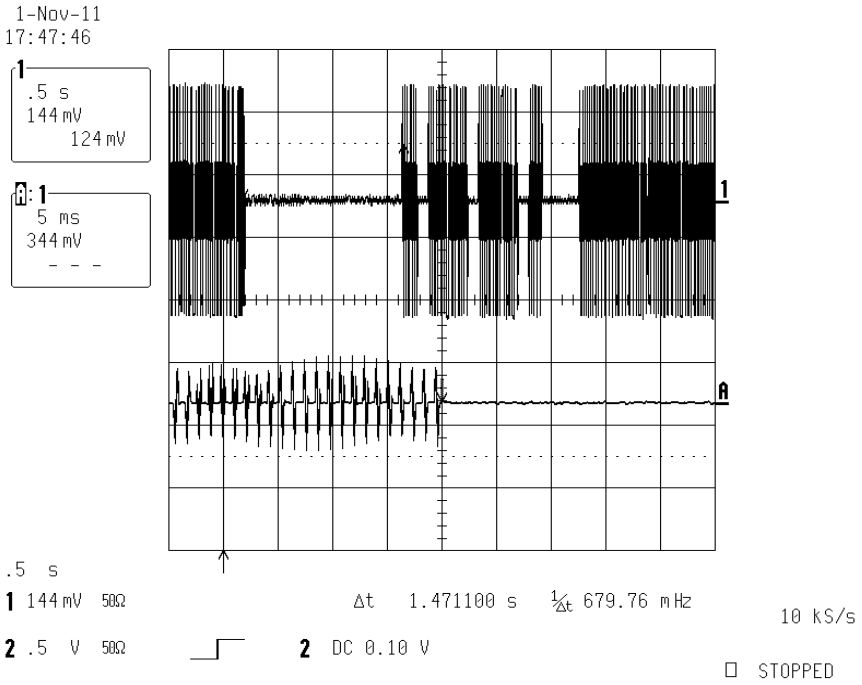
Parameter	Limit	Units	Test Results		
			T_{min} (-20°C)	T_{amb}	T_{max} (+55°C)
Carrier Frequency	121.5 ± 0.006	MHz	121.495253285	n/a	121.502615385

Transmitter Duty Cycle

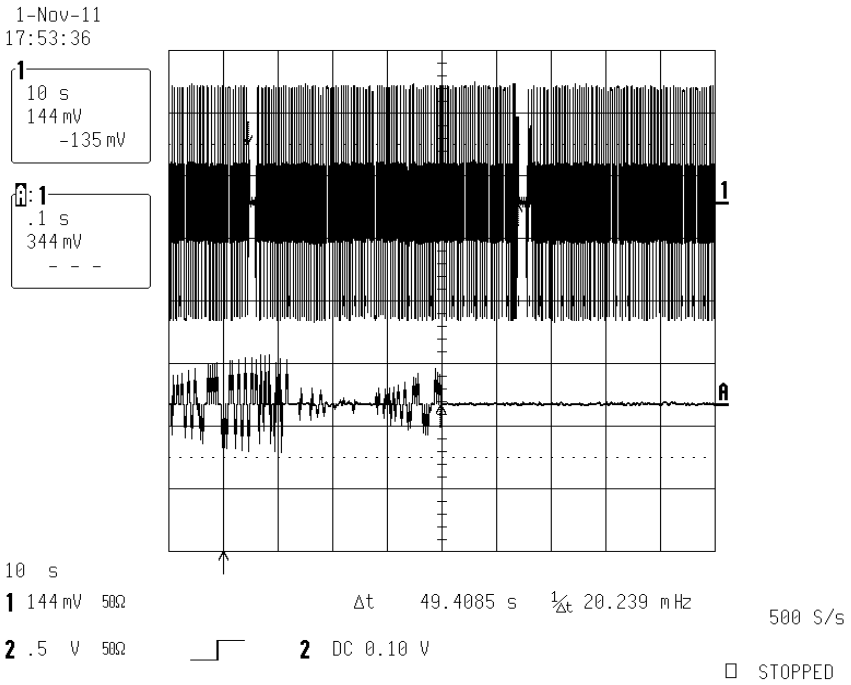
Note: Transmitter Duty Cycle = $\frac{\text{interval - duration}}{\text{interval}}$

Parameter	Units	Test Results		
		T_{min} (-20°C)	T_{amb} *	T_{max} (+55°C)
121.5 MHz transmission interruption interval	seconds	50.762	n/a	49.408
121.5 MHz transmission interruption duration	seconds	1.470	n/a	1.471
Transmitter Duty Cycle	P/F	P	n/a	P

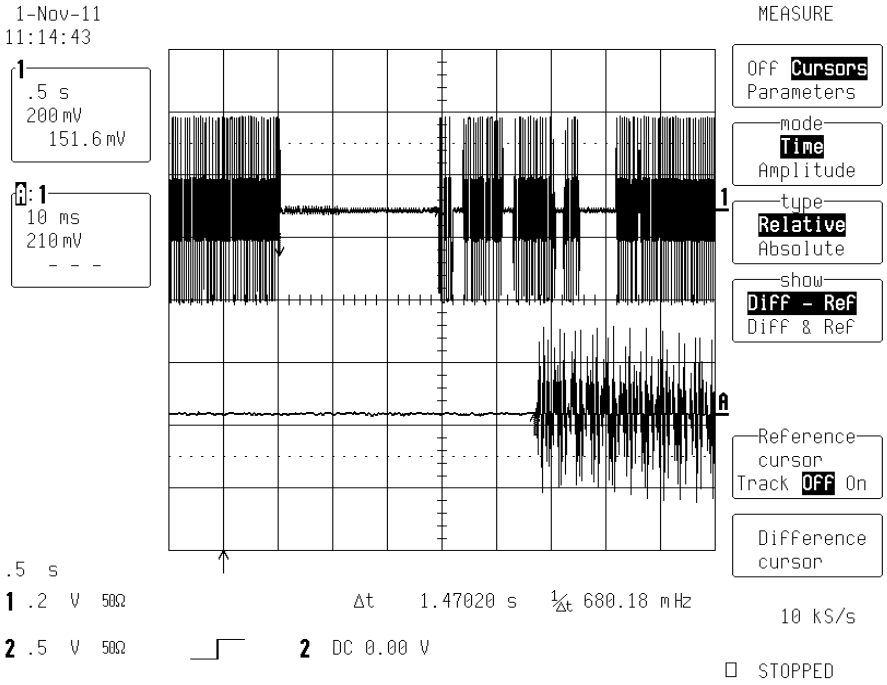
Plot showing 121.5MHz interruption duration (Maximum Temperature)



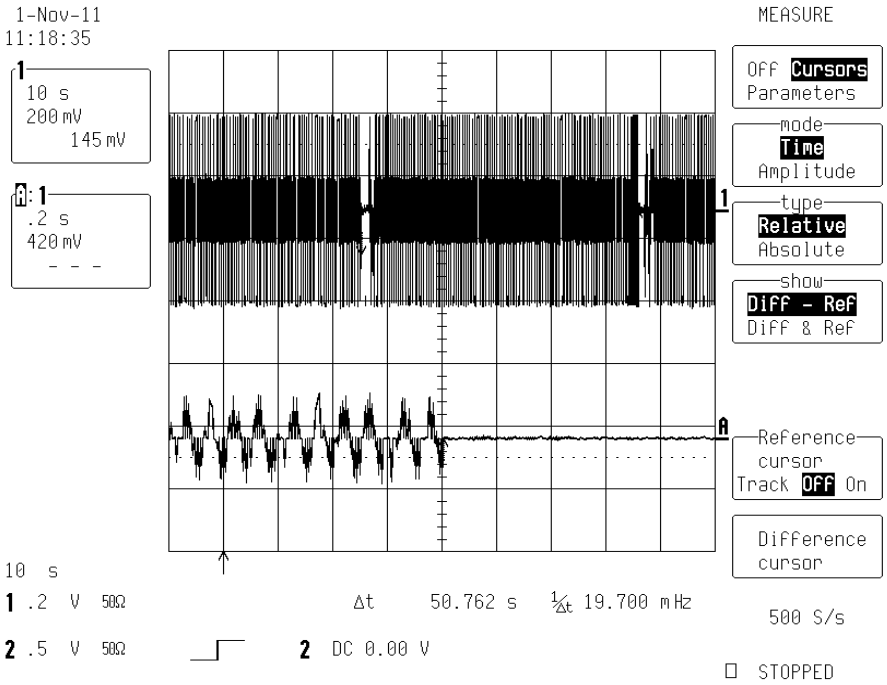
Plot showing 121.5MHz interruption interval (Maximum Temperature)



Plot showing 121.5MHz interruption duration (Minimum Temperature)



Plot showing 121.5MHz interruption interval (Minimum Temperature)



Product Service

Modulation Frequency and Sweep Repetition Rate/Modulation Duty Cycle

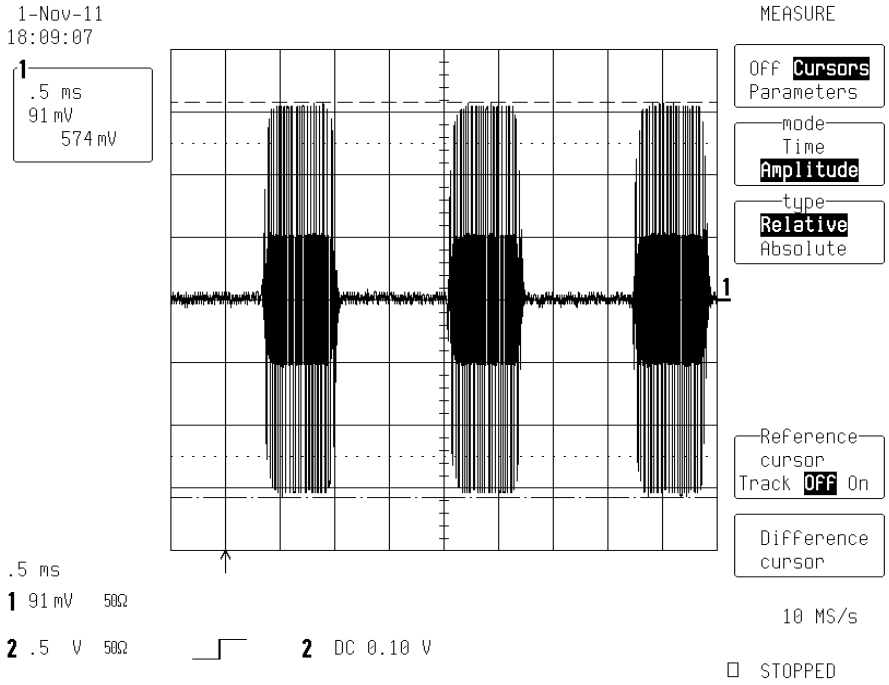
Parameter	Units	Test Results		
		T_{min} (-20°C)	T_{amb}	T_{max} (+55°C)
Frequency Range	Hz	986.06	n/a	976.69
Minimum Frequency	Hz	583.94	n/a	579.71
Maximum Frequency	Hz	1570.0	n/a	1556.4
Modulation Duty Cycle	%	38.8	n/a	40.2
Sweep repetition rate	sweeps per second	2.55	n/a	2.563

Modulation Factor

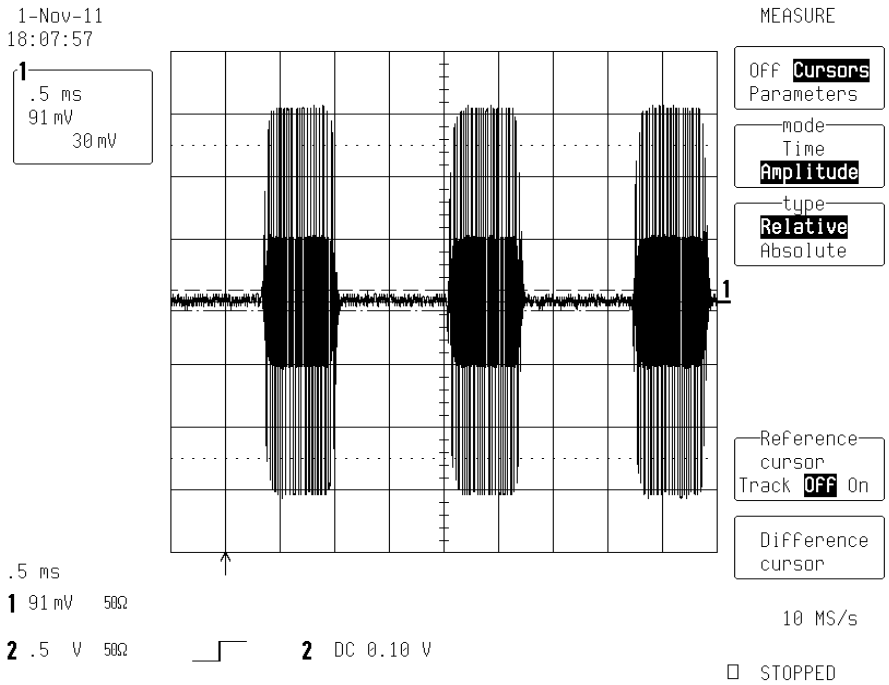
Note: Modulation Factor = (A - B) / (A + B)

Parameter	Units	Test Results		
		T_{min} (-20°C)	T_{amb} *	T_{max} (+55°C)
A	mV	641	n/a	574
B	mV	30	n/a	30
Modulation Factor	(no units)	0.91	n/a	0.90

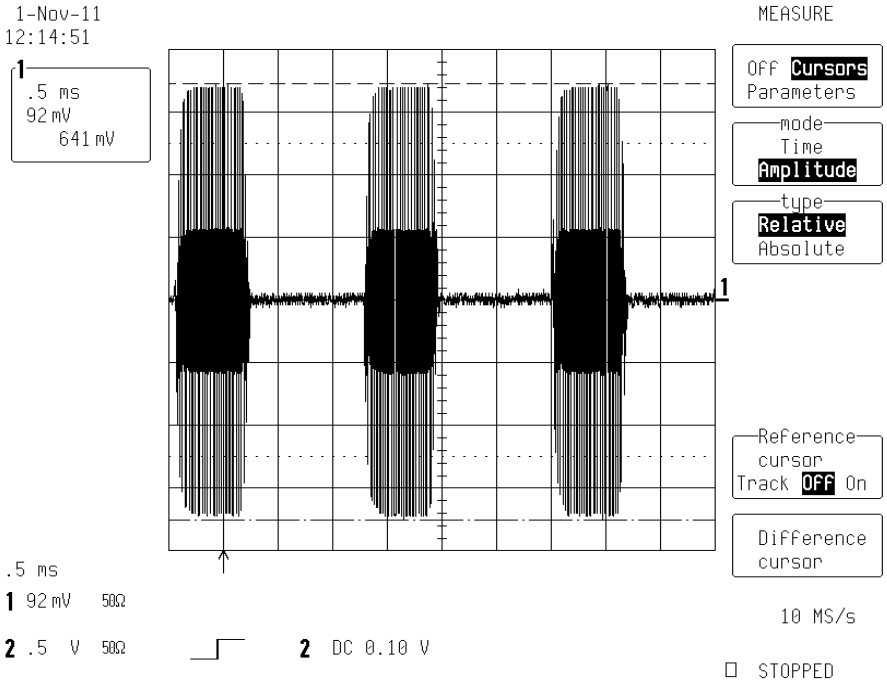
Plot showing “A” at Maximum Temperature



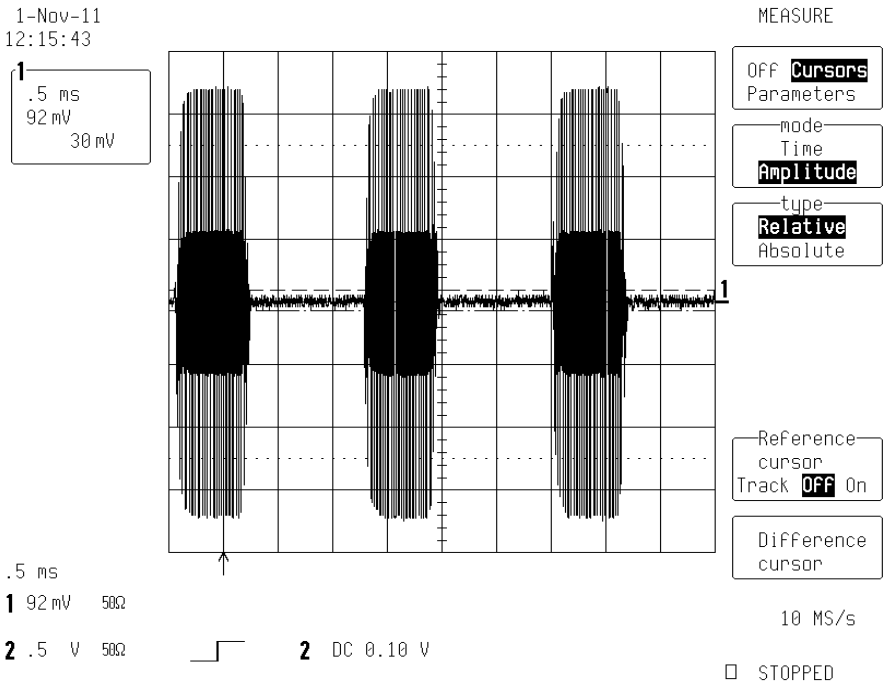
Plot Showing “B” at Maximum Temperature



Plot showing “A” (Minimum Temperature)



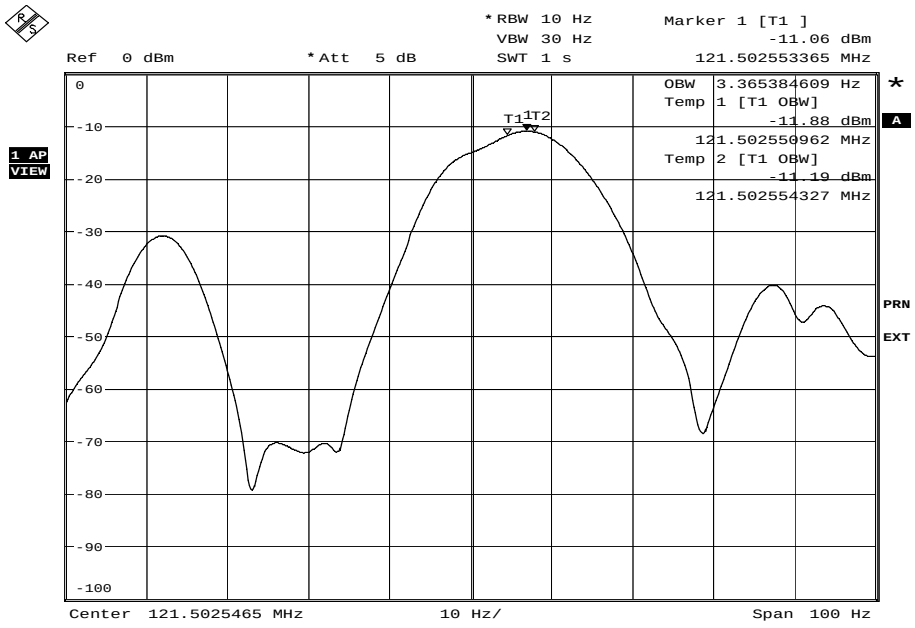
Plot Showing “B” (Minimum Temperature)



Frequency Coherence

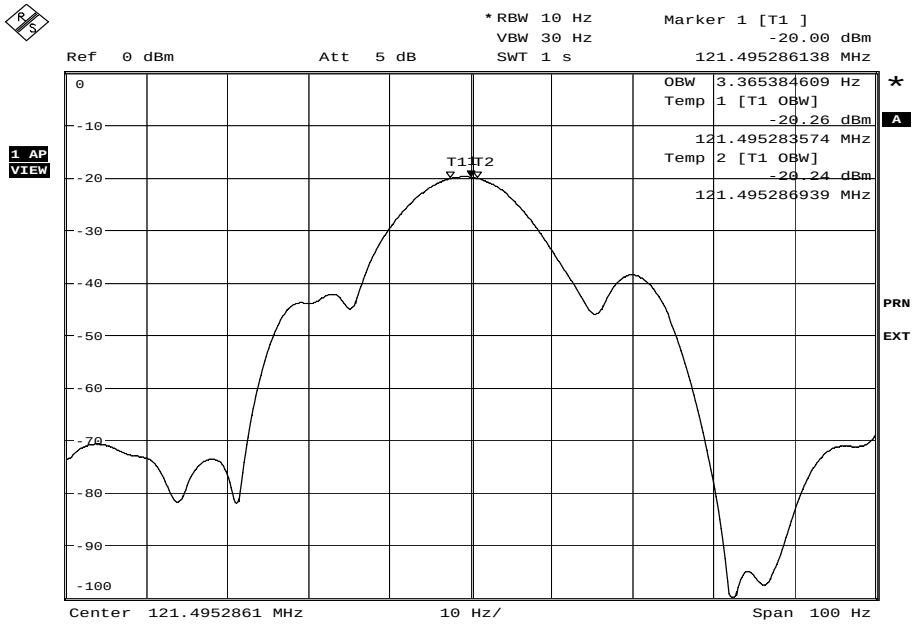
Parameter	Units	Test Results		
		T_{min} (-20°C)	T_{amb} *	T_{max} (+55°C)
Frequency Coherence:				
Occupied Bandwidth	P/F	P	n/a	P
Frequency Shift	P/F	P	n/a	P

Occupied Bandwidth Plot for Minimum Temperature (+55ºC)



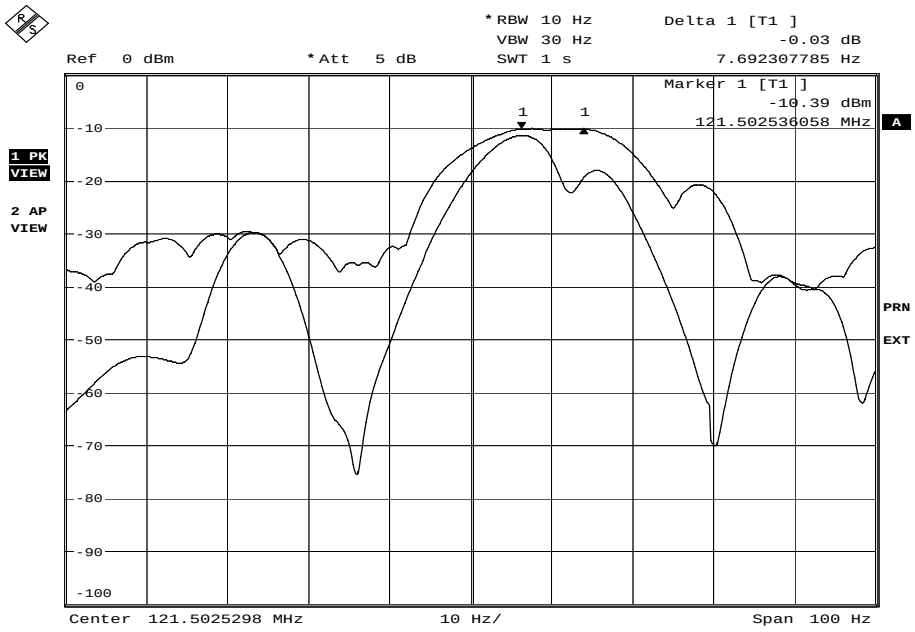
Date: 1.NOV.2011 18:29:00

Occupied Bandwidth Plot for Maximum Temperature (-20ºC)



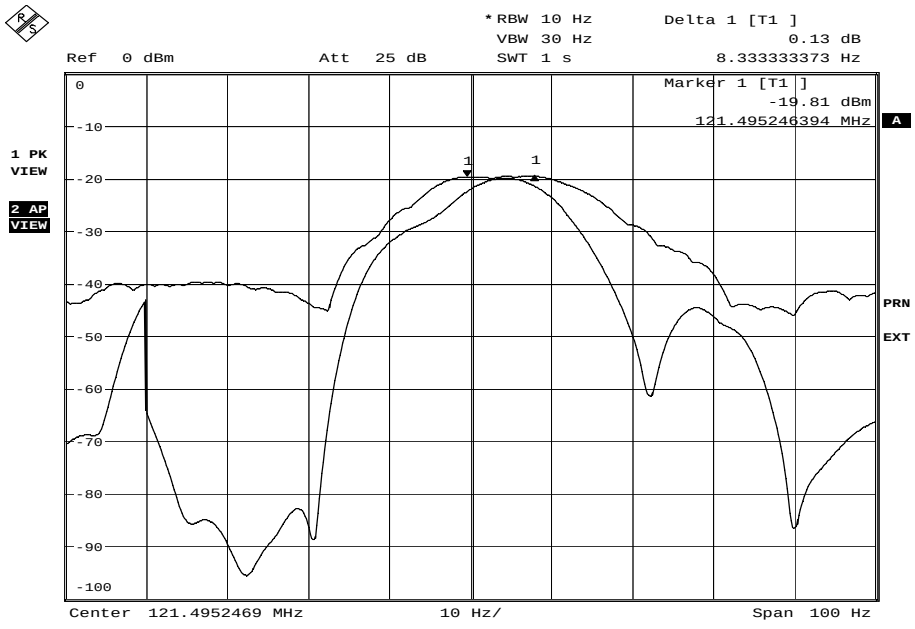
Date: 1.NOV.2011 12:43:37

Frequency Shift Plot for Maximum Temperature +55ºC



Date: 1.NOV.2011 18:43:56

Frequency Shift Plot for Minimum Temperature -20ºC



Date: 1.NOV.2011 12:53:25

Note: Trace A shown on the Frequency Shift Plots was set to Maximum Hold retaining the worst case frequency drift for the duration of the measurement.

Morse Letter P

Parameter	Limit /Units	Test Results		
		T_{min} (-20°C)	T_{amb}	T_{max} (+55°C)
Dot 1 Length	115 ± 5% ms	114.48	n/a	114.325
Gap 1 Length	115 ± 5% ms	116.35	n/a	116.375
Dash 1 Length	345 ± 5% ms	345.05	n/a	345.025
Gap 2 Length	115 ± 5% ms	116.25	n/a	116.375
Dash 2 Length	115 ± 5% ms	345.15	n/a	344.850
Gap 3 Length	345 ± 5% ms	116.30	n/a	115.550
Dot 2 Length	115 ± 5% ms	114.375	n/a	115.075
Modulation Frequency	1000 Hz ± 50 Hz	1000.0	n/a	1000.0

Peak Equivalent Isotropic Radiated Power

The results (from the vertically polarised dipole) were converted to PEIRP (mW) in the following tables:

	Azimuth											
Elevation angle at 10m	0	30	60	90	120	150	180	210	240	270	300	330
5.7	49.14	47.36	46.39	47.69	47.80	47.91	49.02	49.14	47.91	47.80	47.80	49.02

The median of the twelve values was 47.85mW

Of the 12 highest values, the max was 49.14mW and the minimum was 46.39mW, the ratio between these is 1.06 to 1 (0.25dB)

Off Ground Plane Radiated Power Test

	Azimuth			
Elevation angle at 10m	0	90	180	270
5	6.15 mW	6.02 mW	5.61 mW	5.15 mW
10	4.09 mW	-	-	-
15	2.68 mW	-	-	-
20	1.84 mW	-	-	-

The minimum of the four values was 5.15mW.

2.18 SOLAR RADIATION TEST

2.18.1 Specification

RTCM Standard for PLBs, Clause A.17

2.18.2 Equipment Under Test and Modification State

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

2.18.3 Date of Test

See attached report (Annex A)

2.18.4 Test Equipment Used

See attached report (Annex A)

2.18.5 Environmental Conditions

See attached report (Annex A)

2.18.6 Test Results

Test See attached report (Annex A)

2.19 OIL RESISTANCE TEST

2.19.1 Specification

RTCM Standard for PLBs, Clause A.18

2.19.2 Equipment Under Test and Modification State

SATRO™ Model PLB-110 S/N: TUV#7 - Modification State 0

2.19.3 Date of Test

14 December 2012

2.19.4 Test Equipment Used

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

2.19.5 Environmental Conditions

Ambient Temperature 23.4°C
Relative Humidity 25.4%

2.19.6 Test Results

On completion of the 3 hour immersion in oil the EUT was removed and inspected. There was no evidence of damage or deterioration. The EUT was subject to a satisfactory pergformance check.

Summary of Performance Check Results

TUV#7

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED096EE3343ED7FDFF9998C37
Normal Mode:	
Normal Message	FFFE2F96EE3343ED7FDFF9998C3783E0F66C
406 MHz Frequency	406.037347
121 MHz Presence	P

Inspection

On completion of the test the EUT was inspected and no sign of water ingress was found.

2.20 COMPASS SAFE DISTANCE TEST

2.20.1 Specification

RTCM Standard for PLBs, Clause A.19

2.20.2 Equipment Under Test and Modification State

SATRO™ Model PLB-110 S/N: # 200 (TUV#3) - Modification State 0

2.20.3 Date of Test

22 August 2011

2.20.4 Test Equipment Used

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

2.20.5 Environmental Conditions

Ambient Temperature 22.2°C
Relative Humidity 51.3%

2.20.6 Test Results

Standard Compass safe distance (mm)	200
Emergency Compass safe distance (mm)	200

Orientation of the EUT	Un-powered State		Normalised		Powered Up	
	Distance From Compass Centre (mm) at 0.3° deflection	Distance From Compass Centre (mm) at 0.9° deflection	Distance From Compass Centre (mm) at 0.3° deflection	Distance From Compass Centre (mm) at 0.9° deflection	Distance From Compass Centre (mm) at 0.3° deflection	Distance From Compass Centre (mm) at 0.9° deflection
Front	165 No deflection	165 No deflection	165 0.1° deflection	165 0.1° deflection	165 0.1° deflection	165 0.1° deflection
Top	165 No deflection	165 No deflection	165 No deflection	165 No deflection	165 No deflection	165 No deflection
Left Hand Side	165	165 0.3° deflection	165	165 0.3° deflection	165	165 0.3° deflection
Right Hand Side	165 0.1° deflection	165 0.1° deflection	165 0.1° deflection	165 0.1° deflection	165 0.1° deflection	165 0.1° deflection
Underside	165	165 0.3° deflection	165	165 0.3° deflection	185	165 0.3° deflection
Rear	165 0.1° deflection	165 0.1° deflection	165 No deflection	165 No deflection	165 0.1° deflection	165 0.1° deflection

Horizontal maximum flux density, Magnetic North (μT)	H=	19.555
Standard compass deviation limit (degrees)	5.4/H	0.3
Emergency compass deviation limit (degrees)	18/H	0.9

Standard Compass safe distance (mm)	200
Emergency Compass safe distance (mm)	200

2.21 MISCELLANEOUS TESTS

2.21.1 Specification

RTCM Standard for PLBs, Clause A.20

2.21.2 Equipment Under Test and Modification State

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

2.21.3 Date of Test

07 October 2011

2.21.4 Test Equipment Used

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

2.21.5 Environmental Conditions

Ambient Temperature 22.0 - 22.1°C
Relative Humidity 33.9 - 35.0%

2.21.6 Test Results

Clause 4.4.1 - Controls and Indicators

The following requirements met the standard:

- All controls are clearly and durably marked: see document Y3-03-0898 (-) in annex C.
- All controls are designed to prevent accidental activation and require at least two separate independent actions to activate the EUT.
- Activation of the EUT shall not require the use of two hands: see document Y3-02-0750 (-) in annex C.
- The PLB shall be provided with a means to indicate that it has been activated: after 1 hour of activation, the 'electronic seal' is broken, at which point the self test will signal with a red LED. See document Y3-03-0899 (-) in annex C.
- The controls are few in number (on/off and test) and require de-pressing to activate. The controls require a relative amount of force to activate. The manufacturer has advised that this is to prevent inadvertent activation. See document Y3-03-0899 (-) in annex C.
- The controls can be activated by personnel wearing gloves or mittens. (Confirmed by Manufacturer - see document Y3-02-0750 (-) in annex C.).

- As a minimum, the EUT should have integral manual controls to operate the device in the following modes:

  OFF – EUT deactivated
  ON – EUT activated
  TEST – See below

- The various modes of the PLB are apparent by positive visual observation making the user aware that the PLB is active (LED patterns and strobe light indications).

Clause 4.4.2 - Self-test function

See document Y3-03-0895 (-) in annex C.

Manufacturer's declaration verifies that the self-test function tests the following items:

- The PLB battery experiences full-load current drain during the self-test
- Each self-test pass/fail indicator correctly indentifies a fail condition when a failure in the monitored function has been induced
- Any transmission in either self-test mode is limited to one burst
- 121.5 MHz and 406 MHz RF output is verified
- 121.5 MHz signal does not exceed 3 audio sweeps or 1 second (whichever is greater)
- Phase Locked Loop (PLL) of the 406 MHz output (if used)
- That the self-test is functional throughout the operating temperature range
- The self-test message coding complies with section 4.3.1.2.

A separate switch is present for the test function. The test switch automatically returned from the test position and does not pass through the on position

Clause 4.4.2 - GNSS self-test function

See document Y3-03-0895 (-) in annex C.

Manufacturer's declaration verifies that the GNSS self-test function tests the following items:

- The GNSS self-test mode is activated by a different operation from the normal self-test mode. The GNSS self-test mode is activated by pressing the self test button for more that 5 seconds. Distinct LED patterns indicate the outcome of the GNSS self test.
- Activation results in a single burst
- Limited number of GNSS self-test bursts

- Distinct indication of either success or failure of GNSS burst
- Indication of when the maximum number of GNSS Self-tests has been reached
- Limited time duration of each GNSS burst
- If the PLB fails to encode the location into the 406 MHz message within the time limit the GNSS self-test shall cease and the PLB indicates a GNSS self-test failure and will not transmit a single self-test burst with default location data.
- If the PLB encodes the location into the 406 MHz message within the time limit, the GNSS self-test will cease at that time (before the limit is reached) and indicates a GNSS self-test pass and transmits a single self-test burst containing the valid location data.
- The GNSS self-test mode shall be verified that inadvertent activation of this mode is precluded
- Instructions for the GNSS self-test are provided within the PLB operating manual where clear warnings on the use and limitation of this function are provided.

Clause 4.4.3 - Battery

The PLB has its own battery and does not depend upon any external source of power for its operation when activated.

The battery is an integral part of the PLB.

The manufacturer has advised that the battery is not user-replaceable, however when replaced by service agents a high vacuum grease is used alongside the gasket to ensure watertight integrity.

Further battery information is provided in document Y3-03-0897 (-) in annex C.

Clause 4.4.4 - Buoyancy

See section 2.16 for buoyancy test.

Clause 4.5 - General Construction

A Sharp Edge Tester, consisting of a ‘repeatable-force arm’ and a padded ‘finger’ covered with tape, was run along the following edges:

- Antenna
- Antenna plastic swivel arm
- Antenna retaining fixture

Upon inspection of the tape covering the ‘finger’ no cuts were found.

The PLB (including antenna and battery) are an integral unit.

The design and materials used for the PLB have been subject to the various environmental tests required by the standard – refer to environmental test results sections 2.3 – 2.11, 2.16, 2.18 and 2.19.

Clause 4.5.1 - Exterior Finish

Approximately 50% of the PLB case is of a high visible orange colour. See document Y3-03-0896 (-) in annex C.

Clause 4.5.2.1 - Labelling (Battery)

The battery is marked with the battery type, voltage, expiration date and appropriate precautions associated with its use, handling and disposal. See document Y3-03-0897 (-) in annex C.

Clause 4.5.2.2 - Labelling (Resistance)

For Sunlight, seawater and Oil resistance see sections 2.18 (sunlight), 2.19 (oil resistance).

Further labelling resistance information can be found in document Y3-02-0755 (-) in annex C.

Clause 4.5.2.2 - Labelling (Legibility)

The labelling on the PLB is of a high contrast to the background (white text on orange).

The manufacturer has declared that the labelling of the PLB complies with clause 4.5.2.2.

Further labelling information can be found in documents Y3-03-0898 (-) and Y3-02-0755 (-) in annex C.

Clause 4.5.2.2.1 - Labelling on the PLB

The outside of the PLB is marked with the following:

a) Concise, unambiguous instructions for operation and testing of the PLB.

b) The warning: *WARNING Use only in situations of grave and imminent danger*

c) The warning: *NOTICE TO PUBLIC Do not remove if found. Report position to authorities.*

d) Space for 15 characters for the beacon identification code.

e) Serial number of the PLB.

f) Instructions to register the PLB with the appropriate authority.

g) Space for registration sticker.

h) Note: the battery expiration date is printed on the battery pack and can be viewed through the PLB's opaque cover.

i) Compass safe distance value (1 meter).

The following instructions and / or details are marked on the outside of the PLB in accordance with clause 4.5.2.2.2:

a) The identification of the manufacturer.

b) The PLB type number under which it was type tested (SATRO^{TM} Model PLB-110).

c) The temperature operating range in degrees Celsius and Fahrenheit of the PLB (-20°C to +55°C / -4°F to +131°F).

d) The Dangerous Goods transportation statement (no applicable date was seen).

e) The PLB antenna contains the text *Point to Sky*. The PLB body contains the text *GPS DO NOT COVER* where the GPS antenna is located.

a) The phone number to be used to report inadvertent activation.

Clause 4.5.2.2.3 – For Category 2 PLBs

The manufacturer has declared that the SATRO^{TM} Model PLB-110 is a category 1 PLB.

Clause 4.5.2.2.4 - GNSS Receiver Information

a) The PLB contains a GNSS receiver and the location of the GNSS antenna is marked on the exterior of the PLB. A warning is provided not to obstruct the antenna.

   There is no indication on the PLB cover which states that the GNSS receiver should be orient towards the sky.

b) The PLB provides a positive visual indication that the GNSS receiver has acquired a location (distinct LED patterns).

c) Other than the information provided in a) above no further instructions are included on the PLB which guide the operator towards maximizing self-locating performance.

Clause 4.5.3 - Documentation

The user manual provides the following information:

a) Complete operating instructions for the PLB

b) Cautions and recommendations to prevent false alerts

c) Warning information including the misuse of the PLB is subject to fine.

d) General battery information (replacement (5 years), type, safety information regarding use and disposal)

e) Instructions for the safe transportation or shipping of the PLB.

f) Information regarding the need to replace the battery after activation of the PLB and how to determine if the PLB has been activated or the battery needs to be replaced

g) Information relating to the requirements of preventive maintenance

h) Minimum operating lifetime and operating and stowage temperature ranges

i) Licensing and registering the PLB

j) Actions to be taken in the case of false alerts, including contact details and in the case of accidental activation of the PLB, the user should de-activate the PLB and notify the appropriate search and rescue authorities.

A different phone number is provided than that included in the standard: the manufacturer has confirmed that this is intentional and they believe it to be correct.

k) This clause is not applicable (applies to category 2 PLBs only)

l) Information that the PLB is appropriate for use in or around water and its tested depth (10 meters for 5 mins) and time rating. The PLB is buoyant (but is not designed to float) and that the PLB may not be substituted for a required EPIRB on a vessel.

m) Information to guide the operator towards maximizing self-locating performance including a warning not to obstruct the GNSS antenna's view of the sky.

n) Information noting that the self-test shall only be performed within the first 5 minutes of any hour

o) An overview of how the Cospas-Sarsat system operates

p) Beacon registration material and information

q) This clause is not applicable as the PLB does not have the capability to be connected to an external GNSS receiver.

Clause 4.5.4 – Packaging Labelling

The packaging provides the following information:

a) Category of the PLB and as per item l above (Clause 4.5.3 Documentation)

b) Temperature operation range in degrees C and degrees F

c) Expiration date of battery

d) Country Code that is coded in the 15 Hex ID

e) If the Country Code or unique national characteristics cannot be readily changed in the field at nominal cost to another Country Code due to the configuration of the PLB, a warning to that effect

Clause A20.1 – Controls and Indicators

See reference to clause 4.4.1 above.

Clause A20.3 – Battery

See reference to clause 4.4.3 above.
Please provide evidence as per the clause.

Clause A20.4 – General Construction

See reference to clause 4.4.5 above.

Clause A20.5 – Exterior Finish

See reference to clause 4.5.1 above.

Clause A20.6 – Labelling

See reference to clauses 4.5.2.2 to 4.5.2.2.4 above.

Clause A20.7 – Documentation

See reference to clauses 4.5.3 and 4.5.4 above.

Product Service

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 2.2 Beacons - Initial Aliveness Test					
Tester	WS Technologies	BT 100S	87	-	TU
Hygrometer	Rotronic	I-1000	3068	12	26-Jul-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
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 Climatic – Dry Heat					
Power Meter	Hewlett Packard	436A	47	12	11-Jul-2012
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	15-Jan-2012
Time Interval Analyser	Yokogawa	TA720	181	12	1-Mar-2012
High Resolution Oscilloscope	Gould	840	182	12	16-Mar-2012
Attenuator 10dB/10W)	Trilithic	HFP-50N	454	12	21-Jul-2012
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2012
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	21-Feb-2012
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	28-Jun-2012
Distress Beacon RF Unit	TUV	-	2445	-	TU
Hygrometer	Rotronic	I-1000	3068	12	26-Jul-2012
Termination (50ohm, 2W)	Omni-Spectra	3001-6100	3081	12	7-Mar-2012
Termination (50ohm, 0.5W)	Hewlett Packard	HP11593A	3086	-	TU
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
Power Sensor	Agilent	8482A	3290	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	3350	12	19-Apr-2012
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	20-Apr-2012
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	20-Apr-2012
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	20-Apr-2012
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	8-Mar-2012
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	23-Feb-2012
Humidity and Temperature Meter	R.S Components	1361C	3844	12	7-Feb-2012
Section 2.4 Climatic – Damp Heat					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Climatic Chamber	Climatec	Climatec 1	2124	12	22-Nov-2012
Chamber	Montford	8ft Cubed	2127	12	17-May-2012
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	6-Jun-2012
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	20-Apr-2012
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	20-Apr-2012
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	20-Apr-2012

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.5 Climatic - Low Temperature					
Power Meter	Hewlett Packard	436A	47	12	11-Jul-2012
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Signal Generator	Hewlett Packard	8644A	96	12	15-Apr-2012
Attenuator 10dB/10W)	Trilithic	HFP-50N	454	12	21-Jul-2012
Chamber	Montford	8ft Cubed	2127	12	17-May-2012
Beacon RF Unit	TUV	N/A	3066	-	TU
Termination (50ohm, 6W)	Micronde	R404613	3074	12	17-Mar-2012
Termination (50ohm, 1W)	Suhner		3080	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
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	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	3290	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	3350	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
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3355	12	20-Apr-2012
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	20-Apr-2012
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	20-Apr-2012
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	20-Apr-2012
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	8-Mar-2012
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	23-Feb-2012
Humidity and Temperature Meter	R.S Components	1361C	3844	12	7-Feb-2012
Section 2.7 Vibration - Sine					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	28-Jun-2012
Vibrator	Derritron	VP400	2286	6	2-Dec-2011
Accelerometer	Endevco	7254A-10	2521	6	21-Jan-2012
Charge Amplifier	Endevco	133	3192	12	15-Jul-2012
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	20-Apr-2012
Isotron Accelerometer	Endevco	256-10	3383	6	15-Jan-2012
Vibration Controller (8 Ch)	m + p International	VibPilot 8	3780	12	18-Apr-2012
Monopole Antenna	TUV	n/a	3984	-	TU
Section 2.7 ENV - Bump					
Transient Test Bounce machine	Savage and Parsons	SAVAGE AND PARSONS	2512	12	17-Feb-2013
Clock Timer	Radio Spares	427-590	4043	12	1-Mar-2013
10 meter Tape Measure	Stanley	Fatmax 10m/33'	4072	-	TU

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.8 Climatic - Corrosion					
Weiss Technik (T)	Weiss Technik	SALT MIST	2121	12	1-Dec-2011
Montford F43	Montford	4FT CUBED	2126	12	1-Jun-2012
Balance	Geniweigher	GM-11K	2334	12	14-Mar-2012
pH Meter	Jenway	3310	2335	-	TU
Data Logging Thermometer	Digitron	2098T	2348	12	18-Oct-2012
Temperature Logger	Digitron	2098T	2479	12	19-Oct-2012
Balance	Sartorius	HK160	2678	12	14-Mar-2012
Climatic Chamber	Climatec	Drive-In	2848	12	15-Mar-2012
Receptacle (100mm dia Nominal)	Embee	100mm	3321	-	TU
Density bottle	Technico	25mL	3322	-	TU
Thermocouple	Unknown	Type T Thermocouple	3415	24	24-Feb-2013
Section 2.9 ENV - Drop / Topple					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	28-Jun-2012
Climatic Chamber	Climatec	Climatec 1	2124	12	26-Nov-2011
Hardwood Block	Unknown	ELM	2650	-	TU
5 m tape measure	Stanley	Fatmax 5 m	3712	-	TU
Monopole Antenna	TUV	n/a	3984	-	TU
Clock Timer	Radio Spares	427-590	4043	12	1-Mar-2013
10 meter Tape Measure	Stanley	Fatmax 10m/33'	4072	-	TU
Section 2.10 Climatic - Thermal Shock					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Over Pressure (T)	ASL (TUV)	0 TO 15 PSI	2125	-	TU
Balance	Geniweigher	GM-11K	2334	12	14-Mar-2012
Thermometer	Digitron	T208	2340	12	6-Dec-2011
Digital Pressure Gauge	Druck	DPI 700	2342	12	30-Aug-2012
Climatic Chamber	Climatec	CLIMATEC 3	2846	12	8-Apr-2012
Switching Unit	Rohde & Schwarz	SSCU-GW04	3145	-	TU
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	6-Jun-2012
Monopole Antenna	TUV	n/a	3984	-	TU
Section 2.11 Climatic – Immersion					
Climatic Chamber	Climatec	Climatec 1	2124	12	22-Nov-2012
Balance	Geniweigher	GM-11K	2334	12	14-Mar-2012
Digital Thermometer	Digitron	T208	2831	12	26-Jul-2012
Thermocouple	Unknown	Type T Thermocouple	3415	24	24-Feb-2013
940 litre Tank	Unknown	940 litre	3574	-	TU
Electronic Scales	Advantest	CBK 16	3958	12	27-Jun-2012
10 meter Tape Measure	Stanley	Fatmax 10m/33'	4073	-	TU

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.12 Beacons - Spurious Emissions					
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	15-Jan-2012
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	14-Nov-2012
Dual Power Supply Unit	Thurlby	PL320	288	-	TU
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	28-Jun-2012
Pre-Amplifier	Phase One	PS04-0086	1533	12	20-Sep-2012
Mast Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	12-May-2013
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
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	29-Sep-2012
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Low Noise Amplifier	Wright Technologies	APS04-0085	3969	12	8-Jul-2012
Section 2.13 Beacons - Battery Current Measurements					
Termination (50Ω)	Diamond Antenna	DL-30N	337	12	16-Sep-2012
Hygrometer	Rotronic	I-1000	3068	12	26-Jul-2012
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3097	12	11-May-2012
Resistor (Nominal 0.25ohm)	TUV	2x RS Components 188-071 R5/100W Resistors	3343	12	21-Oct-2011
Data Logger	Pico Technology Ltd	ADC-16	3414	12	30-Jun-2012

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.13 and 2.12 Beacons - Operating Lifetime and Self Test					
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
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
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
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
Section 2.16 Climatic - Buoyancy					
Weighing Equip	Geniweigher	GM-11K	2334	12	28-Mar-2012
Section 2.17 Beacons - 121 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 2.17 Beacons – 121 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	TU
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	TU
EMI Test Receiver	Rohde & Schwarz	ESIB26	3763	12	11-Jan-2012
Section 2.17 Radio (Tx) - Occupied Bandwidth					
Attenuator: 10dB/20W	Narda	766-10	480	12	21-Jul-2012
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	18-Nov-2012
Hygrometer	Rotronic	I-1000	2891	12	3-May-2012
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	23-Jun-2012
Cable (1m, N type)	Rhophase	NPS-1601-1000-NPS	3350	12	19-Apr-2012

*In calibration at time of use.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.20 EMC - Compass Safe Distance					
Sussex Helmholtz Coil	Various	88771	327	-	TU
Magnetometer	Bartington	MAG01	671	36	3-Sep-2011
Hygrometer	Rotronic	A1	2760	12	26-Jul-2012
Compass Verification Unit	TUV	CVU	3579	-	TU
Handheld Digital Multimeter	Agilent	U1241A	3626	12	14-Sep-2011
Marine Binacle Compass with Repeater Display	Cassens & Plath	Compass: Type 11	3834	-	TU

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

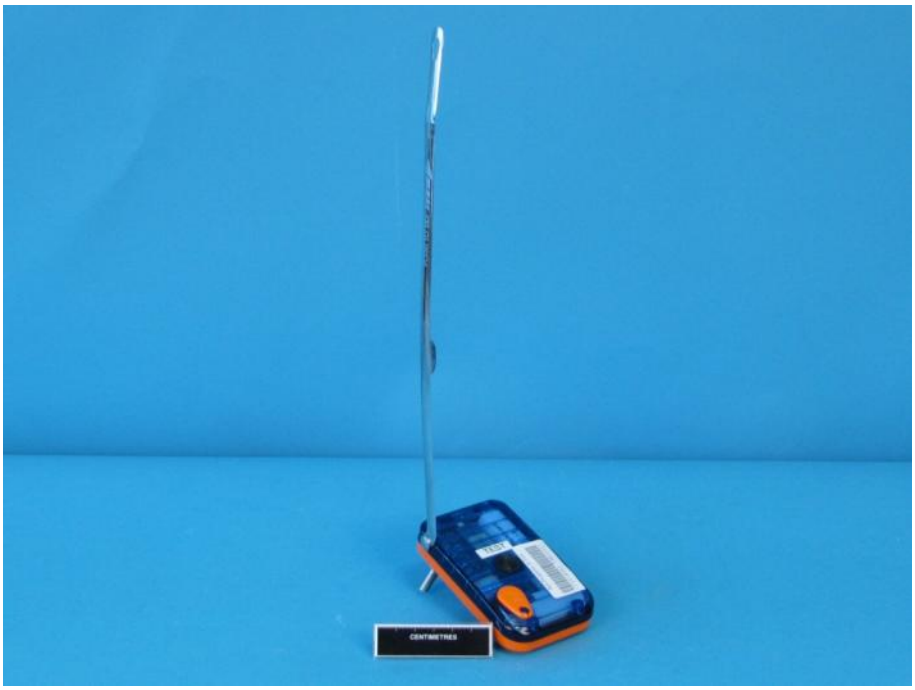
SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

Front View - Antenna Stored

Rear View - Antenna Stored



Antenna Extended

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

COSPAS-SARSAT TYPE APPROVAL CERTIFICATE

Product Service

Database ID:	225-1
TAC Number:	225
TAC Date:	05-Mar-12
TAC Rev Date:	
Beacon Model Name:	SATRO™, PLB-110
Additional Names:	
Manufacturer:	Astronics DME Corporation
Tx Frequencies:	406.037 MHz
In Production:	Yes
Class:	2
Type: **FF=Float Free**	PLB
Tested Life: (24 / 48 hrs)	24
Battery: Manufacturer (Model, No of Cells)	Lithium Manganese Dioxide, Panasonic, 3 x CR123A (2/3 A–type) cells
Protocols Tested:	NL, SL
	Protocol Notes: U=User; UL=User-Location; SL=Standard Location; NL=National Location
Self Test:	Yes
Self Test RF:	Yes
Self Test RF (Short/Long):	Short
Self Test Format Flag:	Long
Self Test Consistent with 15 Hex ID:	Yes
Homer Freq:	121.5 MHz
Homer Duty Cycle:	98%
Homer Power:	50 mW
Strobe Light:	Yes
Strobe Brightness:	Unknown
Strobe Duty Cycle:	21 flashes/min
Nav Device:	Int
Nav Device Model:	GPS receiver by GTOP, model: FGPMMOPA6B
Separable Antenna:	No
Antenna Model:	Integrated antenna
Additional Functions:	GNSS Self-test (1 message of 520 msec), non-operational buoyancy (floats in salt or fresh water)
Comments General:	PLB-110 floats in fresh or salt water, however it was not designed and not approved for operation from water, thus its buoyancy is considered to be a non-operational feature. The model "SATROTM, PLB-110" has been tested and approved for operation in PLB configurations, i.e. "on ground" and "above ground". Approved for message encoding with Standard Location Protocol for PLB with Serial Number and National ocation Protocol for PLB.
TAC Rev History:	
Database ID:	225-1

ANNEX B

SOLAR RADIATION TEST REPORT

TEST REPORT: 7191020690-CHM11-CCK

Date: 25 NOV 2011 Tel: +65 68851322 Fax: +65 67784301

Client's Ref: - Email: tai-hoe.lin@tuv-sud-psb.sg

SUBJECT

Solar Radiation Test on Personal Locator Beacon (PLB)

CLIENT

Astronics DME Corporation
6830 NW 16th Terrace
Fort Lauderdale
Florida 33309
USA

Attn : Mr Eric Hiner

SAMPLE SUBMISSION DATE

31 Oct 2011

DATE TEST CONDUCTED

04 Nov to 07 Nov 2011

DESCRIPTION OF SAMPLE

Two units of PLB were submitted by the above client.

Model : ANT 3 SN#300

TEST REPORT: 7191020690-CHM11-CCK

25 NOV 2011

PSB Singapore

METHOD OF TEST

1. IEC 60945 : 2002
   "Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results"
   Clause 8.10 : Solar radiation (portable equipment)

2. IEC 60068-2-5 : 2010
   "Environmental testing – Part 2-5 : Tests – Test Sa: Simulated solar radiation at ground level and guidance for solar radiation testing"

Chamber used	:	Atlas Solar Simulator Type SC600
Light source	:	Metal halide lamp 2,500 W
Total irradiance	:	1,120 W/m² ± 10% at 280 to 3,000 nm
Chamber temperature	:	40 ± 2°C
Black standard temperature	:	65 ± 2°C
Relative humidity	:	70 ± 5%
Test duration	:	80 hours

3. ISO 105-A02 : 1993
   "Grey scale for change in colour (including half-steps)"

   The Grey Scale (ISO 105-A02) for assessing colour change ranges from 1 to 5:
   5 : No perceived difference in colour between the exposed and unexposed areas
   1 : Greatest contrast in colour between the exposed and unexposed areas

RESULTS

Sample	Surface Tested	Visual Assessment after 80 hours of Simulated Solar Radiation Exposure (refer photographs attached)
ANT 3 SN#300	Transparent Blue Cover	– No blistering, cracking, chalking nor deformation of tested surfaces – No visible colour change to blue cover – No visible colour change to white, green and red prints – Slight fading of orange-coloured button, Grey Scale 4-5
	Orange-coloured Base	– No blistering, cracking, chalking nor deformation of tested surfaces – Slight fading of orange-coloured surface, Grey Scale 4-5

Note: Solar radiation test profiles are enclosed in Annex.

CHUA CHENG KOK
TECHNICAL EXECUTIVE

MRS WONG-LIN TAI HOE
PRODUCT MANAGER
COATINGS
CHEMICAL & MATERIALS

Before Test

After 80 hours of Solar Radiation Test

TEST REPORT: 7191020690-CHM11-CCK

25 NOV 2011

PSB Singapore

Please note that this Report is issued under the following terms:

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July 2011

ANNEX C

CUSTOMER SUPPLIED INFORMATION

Product Service

Document No. Y3-02-0750 (A

TEST REPORT
FOR
SATRO™ MODEL PLB-110 GLOVED HAND ACTIVATION

Prepared by:

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Ft. Lauderdale, Florida 33309

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Please note: document Y3-02-0750 (A) has been truncated for inclusion in this document. Annexes C to I should be referred to in the Manufacturers original document.

Y3-02-0750 (A

REVISIONS

Revision	Date	Change Description	Approval
-	1/30/12	ECO # 19487	E.HINER
A	5/1/12	ECO# 19639	H.CANTAVE

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1.0 REASON FOR TEST

This report describes the inspections and tests that were performed to demonstrate that the SATRO™ Model PLB-110 Personal Locator Beacon (PLB) meets the control requirements of RTCM Standard 11010.2, with Amendment 1, dated August 23, 2010, when controls are operated by persons wearing immersion suit gloves.

2.0 REFERENCE DOCUMENTS

Regulatory

- RTCM Standard 11010.2, with Amendment 1 - Standard for 406 MHz Satellite Personal Locator Beacons (PLBs), dated August 23, 2010.

Astronics DME Documents/Drawings

- PLB, Category 1, Class 2, PN P3-03-0060 Rev (-), refer to Appendix C.
- Assembly, Final, PLB, PN A3-06-3102 Rev (C), refer to Appendix D.
- Top Case, Overmolded, PLB, PN A1-18-2175 Rev (A), refer to Appendix E and Rev (B) refer to Appendix F.
- Case, Bottom, PLB, PN A1-18-2173 Rev (B), refer to Appendix G.
- PWA, PLB, PN A3-07-1075 Rev (C), refer to Appendix H.
- Battery Pack, PN A3-03-1025 Rev (B), refer to Appendix I.
- Y3-02-0749 - Test Procedure, PLB, Gloved Hand Activation

3.0 TEST CONDITIONS

Each test article listed in 4.0 was tested using the following test personnel:

- One male and one female, between 18 and 30 years old
- One male and one female, between 31 and 65 years old.

Each test article listed in 4.0 was tested under the following conditions:

- Ambient temperature +15 to +35° C; relative humidity not greater than 85%; and pressure 84 to 107 kPa.
- -Cold soaked at -20° C for a minimum of 1 hour.

The test equipment used is recorded on the Test Data Sheet.

Testing was accomplished at Astronics DME Corporation, 6830 NW 16th Terrace, Fort Lauderdale, Florida, 33309

4.0 DESCRIPTION OF TEST ARTICLES

Refer to Appendix B,

- 1 each, PLB, PN P3-03-0060, rev. (-) or later revision, using top case, PN A1-18-2175, revision B, (high activation force controls); bottom case, PN A1-18-2173, revision B; PWA, PN A3-07-1075-001, revision C; battery pack, PN A3-03-1025-001, revision B; and assembled per PN A3-06-3102-001, revision C. High activation force controls refer to the force required to depress the GPS & self test and ON/OFF buttons (after the cover is rotated to exposed the ON/OFF button). Activation force is nominally 6 pounds.

- 1 each, PLB, PN P3-03-0060, rev. (-) or later revision, using top case, PN A1-18-2175, revision C, (low activation force controls); bottom case, PN A1-18-2173, revision B; PWA, PN A3-07-1075-001, revision C; battery pack, PN A3-03-1025-001, revision B; and assembled per PN A3-06-3102-001, revision C. Low activation force controls refer to the force required to depress the GPS & self test and ON/OFF buttons (after the cover is rotated to expose the ON/OFF button). Activation force is nominally 4 pounds.

5.0 DISPOSITION OF TEST ARTICLES

After the conclusion of all inspections and test the test articles shall be retained in the Engineering Bond Area.

6.0 DESCRIPTION OF TEST APPARATUS

Refer to the "TEST EQUIPMENT USED" section on the Test Data Sheet in Appendix A.

7.0 TEST RESULTS

The PLB-110 PN P3-03-0060 met the requirements of Test Procedure Y3-02-0749 PLB Gloved Hand Activation. See attached Test Data Sheet in Appendix A.

All test personnel were able to perform the required actions using one gloved hand. However, test personnel did use other parts of their body to help manipulate getting the antenna into the up position or to assist in pushing the Self Test/GPS activation button.

An alternative method was used to activate the GPS & self test button for the 31-65 year old female test subject. The immersion suit arm/glove was a large size and did not fit properly on this subject (with small hands).

A section of immersion suit material was cut from the sleeve of the immersion suit arm/glove and the immersion suit section was then used to surround the test article for activation of the GPB & self test button.

Photos of test personnel performing the test procedure are shown in Figure 1, Figure 2, and Figure 3.

8.0 CONCLUSION

The SATRO™ Model PLB-110 Personal Locator Beacon (PLB) meets the control requirements of RTCM Standard 11010.2, with Amendment 1, dated August 23, 2010, when controls are operated by persons wearing immersion suit gloves or applying activation force through equivalent immersion suit material.

APPENDIX A. TEST DATA SHEETS

Y3-02-0749 (-)

APPENDIX A TEST DATA SHEET

Test Data Sheet

Unit Description: PLB-110 P/N: 13-03-0060 Serial No.: 1000 – Aus B

1007 – Aus A

Test Technician: MAGNET BRADY (F)(31-6.5) Date: 1/12/2012

Quality Assurance: [signature] Date: 1/12/12

TEST EQUIPMENT USED

Description	Model No.	DME Control No. or Serial No.	Calibration Date Last	Due
WST Beacon Tester	BT 100 AUS	5044		4/29/2013
FLUKE	87	117 2	10/5/11	7/5/12
Temp Chamber #1	Associated FK2404	553	1/28/11	1/28/12

Para.	Description	Min.	Results	Max.	Test Quality	Results P/F
	Manual Control Activation, with Immersion Suit Gloved Hands, Ambient Test					
6.2.5	Perform Self Test	N/A	✓ Check	N/A		(P) F
6.2.6	Activate PLB	N/A	✓ Check	N/A		(P) F
6.2.8	Record ambient conditions, pass/fail judgment and observations	N/A	71°F Temp ✓ Check	N/A		(P) F
	Manual Control Activation, with Immersion Suit Gloved Hands, Low Temperature Test					
6.3.6	Perform Self Test Burst 272 (Aus A)	N/A	✓ Check	N/A		(P) F
6.3.7	Perform Self Test Burst 271 (Aus B)	N/A	✓ Check	N/A		(P) F
6.3.8	Activate PLB Burst 274 (Aus A)	N/A	✓ Check	N/A		(P) F
6.3.9	Activate PLB Burst 273 (Aus B)	N/A	✓ Check	N/A		(P) F
6.3.12	Record ambient conditions, pass/fail judgment and observations	N/A	90°F Temp ✓ Check	N/A		(P) F

6.2.8 Observations: The glove was too large for the test technician – it was difficult to complete 6.2.6 ...

6.3.12 Observations: For 6.3.8 & 6.3.9 Test Tech used an alternate glove configuration – the appropriate glove size was not available ...

A-1

A-1

Y3-02-0750 (A

Y3-02-0749 (-)

APPENDIX A TEST DATA SHEET

Test Data Sheet

1000 - Rev B Low Force

Unit Description: PLB-110 P/N: P3-03-0060 Serial No.: 1007 - Rev A High Force

Test Technician: Female (18-30) Christine Gomartie Date: 1/11/12

Quality Assurance: [signature] Date: 1/11/12

TEST EQUIPMENT USED

Description	Model No.	DME Control No. or Serial No.	Calibration Date Last	Due
WST Beacon Tester	BT 100 AUS	5044		4/29/13
FLUKE	87	1179	10/5/11	7/5/12
Temp Chamber #1	Associated Ser. no. FK2169	553	1/28/11	1/28/12

Para.	Description	Min.	Results	Max.	Test Quality	Results P/F
	Manual Control Activation, with Immersion Suit Gloved Hands, Ambient Test					
6.2.5	Perform Self Test Burst 258 Rev A Burst 255 Rev B	N/A	✓ Check	N/A		(P) F
6.2.6	Activate PLB	N/A	✓ Check	N/A		(P) F
6.2.8	Record ambient conditions, pass/fail judgment and observations	N/A	71°F Temp ✓ Check	N/A		(P) F
	Manual Control Activation, with Immersion Suit Gloved Hands, Low Temperature Test					
6.3.6	Perform Self Test Rev A	N/A	✓ Check	N/A		(P) F
6.3.7	Perform Self Test Rev B Burst 262	N/A	✓ Check	N/A		(P) F
6.3.8	Activate PLB Rev A Burst 266	N/A	✓ Check	N/A		(P) F
6.3.9	Activate PLB Rev B Burst 268	N/A	✓ Check	N/A		(P) F
6.3.12	Record ambient conditions, pass/fail judgment and observations	N/A	-10°F Temp ✓ Check	N/A		(P) F

6.2.8 Observations: Completed test with some difficulty. Antenna deployment was difficult, was standing.

6.3.12 Observations: After with experience antenna A was easier to deploy - used other body parts to assist. Glove add difficulty but deployed was sealed.

A-1

A-2

Y3-02-0750 (A

Y3-02-0749 (-)

APPENDIX A TEST DATA SHEET

Test Data Sheet

Unit Description: PLB 110 P/N: P3-03-0060 Serial No.: 1007 – Rev A Upper Force; 1000 – Rev B Low Force

Test Technician: Omar Walsh (male 3145) Date: 1/11/12

Quality Assurance: [signature] Date: 1/11/12

TEST EQUIPMENT USED

Description	Model No.	DME Control No. or Serial No.	Calibration Date Last	Calibration Date Due
WST Beacon tester	BT 100 AVS	5044		4/28/13
FLUKE	87	1179	10/5/11	3/5/12
Temp Chamber #1	Associated, DW NO. FK2164	553	1/28/11	1/28/12

Para.	Description	Min.	Results	Max.	Test Quality	Results P/F
	Manual Control Activation, with Immersion Suit Gloved Hands, Ambient Test					
6.2.5	Perform Self Test Burst 254 Rev A; Burst 254 Rev B	N/A	✓ Check	N/A		(P) F
6.2.6	Activate PLB	N/A	✓ Check	N/A		(P) F
6.2.8	Record ambient conditions, pass/fail judgment and observations	N/A	71°F Temp; ✓ Check	N/A		(P) F
	Manual Control Activation, with Immersion Suit Gloved Hands, Low Temperature Test					
6.3.6	Perform Self Test Burst 264 – Rev A	N/A	✓ Check	N/A		(P) F
6.3.7	Perform Self Test Burst 263 – Rev B	N/A	✓ Check	N/A		(P) F
6.3.8	Activate PLB Burst 267 – Rev A	N/A	✓ Check	N/A		(P) F
6.3.9	Activate PLB Burst 270 – Rev B	N/A	✓ Check	N/A		(P) F
6.3.12	Record ambient conditions, pass/fail judgment and observations	N/A	90°F Temp; ✓ Check	N/A		(P) F

6.2.8 Observations: ______________________

6.3.12 Observations: Used other body parts to assist to deploy antenna. [illegible] position

A-1

A-3

TÜV SÜD
Product Service

Y3-02-0750 (A

Y3-02-0749 (-)

APPENDIX A TEST DATA SHEET

Test Data Sheet

1000 - RevB Low Force Btn.

Unit Description: PLB-110 P/N: 13-03-0060 Serial No.: 1007 - RevA High Force Btn.

Test Technician: Tristan Ewertz (male 18-30) Date: 1/10/2012

Quality Assurance: [signature] Date: 1/11/12

TEST EQUIPMENT USED

Description	Model No.	DME Control No. or Serial No.	Calibration Date Last	Calibration Date Due
WST Beacon Test	BT 100 AVS	5094		4/29/12
Fluke	87	1179	10/5/11	7/5/12
Temp Chamber #1	Associated SK 2164	553	1/28/11	1/28/12

Para.	Description	Min.	Results	Max.	Test Quality	Results P/F
	Manual Control Activation, with Immersion Suit Gloved Hands, Ambient Test					
6.2.5	Perform Self Test Burst 257 - RevA; Burst 258 RevB	N/A	✓ Check	N/A		(P) F
6.2.6	Activate PLB	N/A	✓ Check	N/A		(P) F
6.2.8	Record ambient conditions, pass/fail judgment and observations	N/A	71°F Temp; ✓ Check	N/A		(P) F
	Manual Control Activation, with Immersion Suit Gloved Hands, Low Temperature Test					
6.3.6	Perform Self Test Burst 261 - RevA	N/A	✓ Check	N/A		(P) F
6.3.7	Perform Self Test RevB	N/A	✓ Check	N/A		(P) F
6.3.8	Activate PLB Burst 265 - RevA	N/A	✓ Check	N/A		(P) F
6.3.9	Activate PLB Burst 269 - RevB	N/A	✓ Check	N/A		(P) F
6.3.12	Record ambient conditions, pass/fail judgment and observations	N/A	10°F Temp; ✓ Check	N/A		(P) F

6.2.8 Observations: USED other Body parts (nose) to assist in deploying antenna [illegible]

6.3.12 Observations: USED OTHER body parts (nose) to assist in deploying antenna. Gloves compounded added difficulty - not to [illegible] for wristband but adapted, ...

A-1

A-4

APPENDIX B PHOTOS DURING TESTING

PLB, PN P3-03-0060, rev. (-) or later revision, using top case, PN A1-18-2175, revision B, (high activation force controls); bottom case, PN A1-18-2173, revision B; PWA, PN A3-07-1075-001, revision C; battery pack, PN A3-03-1025-001, revision B; and assembled per PN A3-06-3102-001, revision C

PLB, PN P3-03-0060, rev. (-) or later revision, using top case, PN A1-18-2175, revision C, (low activation force controls); bottom case, PN A1-18-2173, revision B; PWA, PN A3-07-1075-001, revision C; battery pack, PN A3-03-1025-001, revision B; and assembled per PN A3-06-3102-001, revision C

Figure 1 PLB Systems Under Test

Y3-02-0750 (A

Alternative method used to activate the GPS & self test button. The immersion suit glove was a large size and did not fit the 31-65 year old female making it difficult to manipulate the PLB GPS & self test button. The same material used for the immersion suit was used and the test person was then able to activate the button.

Figure 2 Alternative test method for activating GPS

B-2

Y3-02-0750 (A

Figure 3 Photos of test personnel performing test

B-3

Product Service

ASTRONICS DME CORPORATION

Document No. Y3-03-0899 (-)
ECO # 19480

PLB Controls and Indicators Declaration

The Astronics DME Corporation Model PLB-110 controls and indicators are designed to comply with the requirements of Clause 4.4.1 of RTCM 11010.2 . The following requirements and/or characteristics are provided:

- All controls are clearly and durably marked (Ref. DME Corporation Engineering Abrasion Test Report Y3-02-0755).
- All controls are designed to prevent accidental activation and require at least two separate independent actions to activate the PLB. First the "on" cover must be moved, second the on/off button must be pressed for 1 second.
- Activation of the PLB does not require the use of two hands (Ref. DME Corporation Gloved Hand Test Report Y3-02-0750).
- The PLB red LED will flash every two seconds and the white strobe light will flash every three seconds to indicate that the PLB has been activated but valid GPS signals have not been acquired.
- The PCB green LED will flash every two seconds and the white strobe light will flash every three seconds to indicate that the PCB has been activated and valid GPS signals have been acquired
- If the PLB has been activated for more than 1 hour, the electronic seal will be broken and the self test will signal a failure with a red LED.
- The controls are few in number (on/off and test) and require de-pressing to activate. The controls require a relative amount of force to activate to prevent inadvertent activation.
- The controls can be activated by personnel wearing gloves or mittens (Ref. DME Corporation Gloved Hand Test Report Y3-02-0750).
- The PLB has integral manual controls to operate the device in the following modes:
  OFF – PLB deactivated.
  ON – PLB activated.
  TEST – See declaration of self test function.
- The various modes of the PLB are apparent by positive visual observation such as when the red/green LED flashes every two seconds, and the white strobe light flashes every three seconds to make the user aware that the PLB is active.

A. Haynes

Alex Haynes,
Product Assurance Director
DME Corporation

1/26/12
Date

Herve Cantave,
Engineering Director
DME Corporation

1-26-12
Date

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ASTRONICS
DME CORPORATION

Document No. Y3-03-0895 (-)
ECO # 19480

PLB GNSS Self Test Mode and Self Test Mode Declaration

The Astronics DME Corporation Model PLB-110 incorporates a GNSS self test mode and a self test mode that comply with the requirement of Clause 4.4.2 of RTCM 11010.2 and include the following features:

- The GNSS self-test mode is activated by a different operation from the normal self-test mode. The GNSS self-test mode is activated by pressing the self-test button for more than 5 seconds.
- Activation of the GNSS self test results in a single 406 MHz burst with valid GPS signal acquisitions.
- A limited number of twelve GNSS self-test bursts are allowed.
- The PLB GNSS self test has a distinct indication of either success (three seconds green LED) or failure (three seconds red LED).
- When the maximum number on GNSS Self-tests has been reached the beacon will indicate this by turning the red LED for one second followed by turning off the beacon.
- Time allowed to acquire the GPS satellite signals is limited to two minutes.
- If the PLB fails to encode the location into the 406 MHz message within the two minutes time limit the GNSS self-test will cease and the PLB indicates a GNSS self-test failure by a red LED light on up to three seconds and will not transmit a single self-test burst with default location data.
- If the PLB encodes the location into the 406 MHz message within the two minutes time limit, the GNSS self-test will cease at that time and a green LED of up to three seconds will indicate a GNSS self-test pass and transmit a single self-test burst containing the valid location data.
- Activation of the GNSS self-test mode requires depressing the self test button for a minimum of 5 seconds to preclude inadvertent activation of this mode.
- Instructions for the GNSS self-test are provided within the PLB operating manual where clear warnings on the use and limitation of this function are provided.
- The PLB battery experiences full-load current drain during the self-test (GNSS or standard self test)
- Each self-test pass/fail indicator correctly indentifies a fail condition (red LED) when a failure in the monitored function has been induced.
- Any transmission in either self-test mode is limited to one burst.
- The 121.5 MHz and 406 MHz RF outputs are verified.
- The 121.5 MHz signal does not exceed 3 audio sweeps.
- The Phase Locked Loop (PLL) of the 406 MHz output is used.
- The self-test is functional throughout the operating temperature range (-20 Deg. C to +55Deg. C).
- The self-test message coding complies with section 4.3.1.2 of RTCM 11010.2 .
- A separate switch is present for all self test functions. The test switch is a press button which automatically returns from the test position and does not pass through the on position.

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Product Service

ASTRONICS
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Documen: No. Y3-03-0895 (-)
ECO # 19480

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Product Service

ASTRONICS
DME CORPORATION

Document No. Y3-03-0897 (-)
ECO # 19480

PLB Battery and Battery Labeling Declaration

The Astronics DME Corporation Model PLB-110 Battery Design complies with the requirements of Clauses 4.4.3 and 4.5.2.1 of RTCM 11010.2 .

The Astronics DME Corporation Model PLB-110 has its own battery and does not depend upon any external source of power for its operation when activated.

The battery is an integral part of the PLB and is not user replaceable.

A high vacuum grease is used alongside the gasket to ensure watertight integrity when the battery is replaced by authorized service agents.

The battery consists of three 2/3 A size primary lithium manganese dioxide cells.

The safety features of these cells have allowed their use in consumer photo applications as demonstrated by more than 30 years and pose no hazards during partial or full discharge, shorting and/or forced discharge of the cells throughout their operating temperature (-20 Deg. C to +55 Deg. C) and the storage temperature (-55 Deg. C to +75 Deg. C).

The PLB design protects the battery from polarity reversal, shorting and the effects of self heating.

The battery useful life is in excess of 12 years, and the battery expiration date is not greater than 5.75 years after date of manufacturing of the battery.

The PLB battery is marked with battery type (Lithium Manganese Dioxide), battery voltage (9 Volts), and expiration date (5.75 years after date of manufacture).

A. Haynes

Alex Haynes,
Product Assurance Director
DME Corporation

1/26/12
Date

Herve Cantave,
Engineering Director
DME Corporation

1-26-12
Date

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Product Service

Document No. Y3-02-0755 (A)

TEST REPORT
FOR
SATRO™ MODEL PLB-110 ABRASION TESTING

Prepared by:

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Please note: document Y3-02-0755 (A) has been truncated for inclusion in this document. Annexes F to H should be referred to in the Manufacturers original document.

Product Service

Y3-02-0755 (A)

REVISIONS

Revision	Date	Change Description	Approval
-	1/26/12	ECO # 19469	H.CANTAVE
A	5/1/12	ECO # 19640	H.CANTAVE

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Y3-02-0755 (A)

1.0 REASON FOR TEST

This report documents the inspections and tests performed to demonstrate that the SATRO™ Model PLB-110 Personal Locator Beacon (PLB) meets the label/marking mechanical deterioration requirements of RTCM Standard 11010.2, with Amendment 1, dated August 23, 2010.

2.0 REFERENCE DOCUMENTS

RTCM Standard 11010.2 with Amendment 1, dated August 23, 2010 - 406 MH Satellite Personal Locator Beacons (PLBs)

ASTM Designation: F2357-10 Standard Test Method for Determining the Abrasion Resistance of Inks and Coatings on Membrane Switches Using the Norman Tool "RCA' Abrader.

Bottom Case, PLB PN A1-18-2173-001 Rev (A), refer to Appendix F.

Overmolded, PLB PN A1-18-2175-001 Rev (A), refer to Appendix G.

Pad Printing, PLB PN A1-20-0636 Rev (D), refer to Appendix H.

3.0 TEST CONDITIONS

All tests and inspections were performed at ambient conditions: temperature +23± 2°C; 50 ± 10% relative humidity.

4.0 DESCRIPTION OF TEST ARTICLES

The samples under test were the Bottom Case, PLB PN A1-18-2173-001 Rev (A) and the Top Case, Overmolded, PLB PN A1-18-2175-001 Rev (A), used on the Astronics DME PLB-110. The labeling on the cases is done by pad printing process, per Drawing, PLB PN A1-20-0636 Rev (D).

5.0 DISPOSITION OF TEST ARTICLES

After the conclusion of all inspections and test the test articles shall be retained in the Engineering Bond Area.

6.0 DESCRIPTION OF TEST APPARATUS

The Norman Tool Inc, "Master Tester" Model 7-IBB-C-C

7.0 TEST REQUIREMENT

RTCM Standard 11010.2 with Amendment 1, dated August 23, 2010 - 406 MH Satellite Personal Locator Beacons (PLBs), paragraph 4.5.2.2, all labeling on the exterior of the PLB shall be indelibly and legibly marked and resistant to deterioration by prolonged exposure to sunlight, not unduly affected by seawater or oil and abrasion resistant.

8.0 TEST PROCEDURE

The abrasion testing was performed using a Norman Tool, Inc. "Master Tester" configured to count the abrading cycles with vertical weights of 175 grams and 275 grams. The PLB

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samples and abrader set-up were prepared per ASTM Standard Test Method F-2357-10 (see Appendix E). The abrasive media was a paper strip 6.24 inch long and 0.6875 inches wide.

The vertical weight applied, number of cycles applied and number of cycles to a visible change in label legibility are reported. One cycle consists of two swipes across the specimen surface: one swipe from the start position and another swipe back to the start position.

A visual change in the specimen labeling is used to judge the abrasion resistance of the labeling.

As an alternative, hand or finger contact cycles are also used to judge the abrasion resistance of the labeling.

Hand or finger contact cycles are estimated by measuring the letter font size/letter area for letters with visual evidence of ink/material loss. The contact cycles are determined by dividing the letter area by the abrasive media area in each swipe.

9.0 TEST RESULTS

9.1 Bottom Case, PN A1-18-2173-001, Revision A

9.1.1 175 Gram Load Visual Assessment

A visual change in the pad printed labeling on the bottom case was seen in select areas after eight cycles and a 175 gram vertical load. The most significant visual change in the pad printed labeling on the bottom case was seen on letter "N" in the word WARNING after eight cycles and a 175 gram load. All text is legible.

A visual change in the permanent, self-adhesive, printed label applied to the bottom case was seen after eight cycles and a 175 gram vertical load. The label was abraded through and material was lost that contained the country code information. This label was not properly positioned when applied and the abrasion at the radius tangent appears to have resulted in a tear in the label as well as abrasive material loss. The "USA" country code letters "SA" are missing. However the country code is available from the Operation Manual and through decoding the digital message.

9.1.2 275 Gram Load Visual Assessment

A visual change in the pad printed labeling on the bottom case was seen in select areas after five and ten cycles and a 275 gram vertical load. The most significant visual change in the pad printed labeling on the bottom case was seen on letter "N" in the word WARNING after ten cycles and a 275 gram load. All text is legible.

A visual change in the permanent, self-adhesive, printed label applied to the bottom case was noted. The most significant visual change on the self adhesive label on the bottom case was seen on letter "X" in the UIN area after five cycles and a 275 gram vertical load. The complete UIN is not legible however the UIN information is available from the Operation Manual and through decoding the digital message.

9.1.3 175 Gram Load Hand/Finger Contact Assessment

The most significant visual change in the pad printed labeling on the bottom case was seen on letter "N" in the word WARNING after eight cycles and a 175 gram vertical load. The width of the letter "N" is approximately 0.065 inches. Given the 6.24 inch length of the abrasive media paper, two swipes per cycle equals 192 hand/finger contacts. Eight cycles equals 1536 hand/finger contact events at 175 gram load. The word WARNING is still legible.

The most significant visual change on the self adhesive label on the bottom case was seen on letter "X" in the UIN area after eight cycles and a 175 gram vertical load. The width of the letter "X" is approximately 0.030 inches. Given the 6.24 inch length of the abrasive media paper, two swipes per cycle equals 208 hand/finger contacts. Ten cycles equals 1040 hand/finger contact events at 175 gram load. The complete UIN is not legible however the UIN information is available from the Operation Manual and through decoding the digital message.

9.1.4 275 Gram Load Hand/Finger Contact Assessment

The most significant visual change in the pad printed on the bottom case was seen on letter "N" in the word WARNING after ten cycles and a 275 gram vertical load. The width of the letter "N" is approximately 0.065 inches. Given the 6.24 inch length of the abrasive media paper, two swipes per cycle equals 192 hand/finger contacts. Ten cycles equals 1920 hand/finger contact events at 275 gram load. The word WARNING is still legible.

The most significant visual change on the self adhesive label on the bottom case was seen on letter "X" in the UIN area after five cycles and a 275 gram vertical load. The width of the letter "X" is approximately 0.030 inches. Given the 6.24 inch length of the abrasive media paper, two swipes per cycle equals 208 hand/finger contacts. Ten cycles equals 1040 hand/finger contact events at 275 gram load. The complete UIN is not legible however the UIN information is available from the Operation Manual and through decoding the digital message.

9.2 Overmolded Top Case, PN A1-18-2175-001, Revision A

9.2.1 175 Gram Load Visual Assessment

A visual change in the pad printed labeling on the top case was seen in the logo area after ten cycles and a 175 gram vertical load. This is large font and the ink loss does not reduce legibility. All text is legible.

A visual change in the overmolded rubber button pad printed text was seen after ten cycles and a 175 gram vertical load. The ink was abraded through at the crown of the button radius. This is large font and the ink loss does not reduce legibility. All text is legible.

9.2.2 275 Gram Load Visual Assessment

A visual change in the pad printed labeling on the top case was seen in the logo area after eight cycles and a 275 gram vertical load. This is large font and the ink loss does not reduce legibility. All text is legible.

A visual change in the overmolded rubber button pad printed text was seen after eight cycles and a 275 gram vertical load. The ink was abraded through at the crown of the button radius. This is large font and the ink loss does not reduce legibility. All text is legible.

9.2.3 175 Gram Load Hand/Finger Contact Assessment

The most significant visual change in the pad printed on the top case was seen on letter "Q" in the word RESQPOINT after ten cycles and a 175 gram vertical load. The width of the letter "Q" is approximately 0.2 inches. Given the 6.24 inch length of the abrasive media paper, two swipes per cycle equals 31 hand/finger contacts. Ten cycles equals 310 hand/finger contact events at 175 gram load. All text is legible.

The most significant visual change on the overmolded rubber button text on the top case was seen on the crown of the button radius after ten cycles and a 175 gram vertical load. The width of the crown area is approximately 0.070 inches. Given the 6.24 inch length of the abrasive media paper, two swipes per cycle equals 178 hand/finger contacts. Ten cycles equals 1782 hand/finger contact events at 175 gram load. All text is legible.

9.2.4 275 Gram Load Hand/Finger Contact Assessment

There was no significant visual change in the pad printed on the top case was seen after eight cycles and a 275 gram vertical load. All text is legible.

The most significant visual change on the overmolded rubber button text on the top case was seen on the crown of the button radius after eight cycles and a 275 gram vertical load. The width of the crown area is approximately 0.070 inches. Given the 6.24 inch length of the abrasive media paper, two swipes per cycle equals 178 hand/finger contacts. Eight cycles equals 1424 hand/finger contact events at 175 gram load. All text is legible.

Photos of the Bottom Case, PLB PN A1-18-2173-001 Rev (A) and the Top Case, Overmolded, PLB PN A1-18-2175-001 Rev (A), with Pad Printing, PLB PN A1-20-0636 Rev (D) prior to the abrasion testing are shown in Appendix B.

Photos of the Bottom Case, PLB PN A1-18-2173-001 Rev (A) and the Top Case, Overmolded, PLB PN A1-18-2175-001 Rev (A), with Pad Printing, PLB PN A1-20-0636 Rev (D)] after abrasion testing are shown in Appendix C and Appendix D.

10.0 DISCUSSION

RTCM Standard 11010.2 with Amendment 1, dated August 23, 2010 - 406 MH Satellite Personal Locator Beacons (PLBs), paragraph A.20.6, Miscellaneous Test states that the manufacturer of the PLB shall present evidence that the labeling will last at least as long as the stated battery shelf life and that ideally this evidence should be in the form of test results obtained using a recognized abrasion test method. No pass/fail criteria is identified.

The selection of the ATSM Standard Test method F2357-10 was made after discussion with various test laboratories and abrasion equipment manufacturers. The ASTM F2357-10 test method does not provide any pass/fail criteria. ASTM F2357-10, paragraph 4.3 does note that the amount of abrasion resistance to a surface is dependent on numerous variables and in no way do the results provide a correlation value of the number of human finger/hand touches before coating failure.

Correlation to any specific abrasion test method to actual handling, end-use, shipment, storage and cleaning results is uneconomical to achieve for a wide variety of environments.

11.0 CONCLUSION

Based on the test requirement limitations (no correlated test result to pass/fail criteria for select substrate materials, inks and coating), test method limitations and previous acceptable test results for the same labeled bottom and overmolded top case parts after exposure to sunlight, seawater and oil exposure it is our conclusion and judgment that the labeling satisfies RTCM Standard 11010.2 with Amendment 1, dated August 23, 2010 - 406 MH Satellite Personal Locator Beacons (PLBs), paragraph A.20.6.

Appendix A Test Report from Norman Tool, Inc

NORMAN TOOL, INC

NTI 15415 OLD STATE ROAD EVANSVILLE, IN 47725 USA.

PHONE: (812) 867-3696
FAX: (812) 867-6790
E Mail: sales@normantool.com
www.normantool.com

REPORT:
November 30, 2011

Attention: / Herve Cantave

Ref: Sample parts testing report using the Norman Tool, Inc. "Master Tester".

Norman Tool, Inc. has ran several "Free" Tests for the sole purpose of evaluating this type of Abrasion Wear Testing to the sample parts we received.

The "Master Tester" did the Abrasion Tests in a timely manner without special fixtures to hold the supplied parts.

All samples were tested as Per ASTME designation # F-2357-10
All samples were tested in two weight loads; 175 Gm. and 275 Gm.
Resulting as follows;

Tests on the Blue Plastic parts;
Worldwide standard weight of 275 Gm Load, 5 to 8 cycles on various lettering and Silicone Rubber push buttons.
Worldwide standard weight of 175 Gm Load, 8 to 10 cycles on various lettering and Silicone Rubber push buttons.

Testing the Lettering on the Orange parts.
Worldwide standard weight of 275 Gm Load, 5 to 8 cycles on various lettering.
Worldwide standard weight of 175 Gm Load, 8 to 10 cycles on various lettering.

In your service;

John Norman

President, NTI. U. S. A.

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Appendix B PLB Samples - Pre-Abrasion Testing

Appendix C PLB Samples - After-Abrasion Testing

Appendix D Close Ups of Samples

D-1

Y3-02-0755 (A)

D-2

Y3-02-0755 (A)

D-3

Y3-02-0755 (A)

D-4

Y3-02-0755 (A)

D-5

Y3-02-0755 (A)

D-6

Appendix E ASTM F2357-10

Designation: F2357 – 10

Standard Test Method for Determining the Abrasion Resistance of Inks and Coatings on Membrane Switches Using the Norman Tool "RCA" Abrader[1,2]

This standard is issued under the fixed designation F2357; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method describes the procedure for subjecting inks or coatings on membrane switches to an abrasive medium at a specified force.

1.2 Within certain limitations, as described in this document, this test method is applicable for materials including, but not limited to: printed or coated polyester, polycarbonate, and silicone rubber. The samples can be either flat or contoured.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

F2112 Terminology for Membrane Switches

3. Terminology

3.1 *Definitions:*

3.1.1 *final breakthrough*—the number of cycles until complete removal of the first surface ink or coating being tested.

3.1.2 *membrane switch*—a momentary switching device in which at least one contact is on, or made of, a flexible substrate.

3.1.3 *wear limit*—*in testing membrane switches,* the number of cycles until an underlying layer of different color may be seen through the first layer (not applicable for transparent coatings).

4. Significance and Use

4.1 Membrane Switch keys are subjected to repeated actuations, usually by a human finger. They are also subjected to other conditions (for example, wiping, cleaning, rubbing) during handling, end-use, shipment, or storage that may cause abrasion damage. The result may be a significant removal of the coatings, text or decorative inks.

4.2 This test method is applicable to a wide range of materials. The main criterion is that the abrasion process produces visible wear or breakthrough in the surface being tested.

4.3 The amount of abrasion damage to a surface is dependent on numerous variables. This test method provides a way of comparing relative abrasion resistance of inks and coatings. In no way do the results provide a correlation value of the number of human finger touches before coating failure. It only provides a means to compare results of tests performed using the same equipment, abrasive materials and loading conditions.

4.4 The test method can be used for quality control purposes, as a research and development tool, to evaluate material combinations for a given application, or for the comparison of materials with relatively similar properties.

5. Interferences

5.1 Inconsistent wear can occur which will compromise the results. Caution is necessary to ensure the mounting method does not deflect the specimen, which may influence the wear characteristics.

5.2 Contoured surfaces can be tested but results may be more difficult to duplicate and some equipment is not designed to test non-flat surfaces.

5.3 Whenever possible, a smooth surface is preferred. Extra care should be taken when evaluating a non-uniform surface (that is, rough surface), and for the user to recognize potential variations between specimens.

6. Apparatus

6.1 Machine capable of providing cyclic or continuous abrasion to a test specimen under controlled loading conditions.

6.2 *Suggested Sources:*

[1] This test method is under the jurisdiction of ASTM Committee F01 on Electronics and is the direct responsibility of Subcommittee F01.18 on Membrane Switches.

Current edition approved May 1, 2010. Published June 2010. Originally approved in 2004. Last previous edition approved in 2004 as F2357 - 04. DOI: 10.1520/F2357-10.

[2] The Norman Tool "RCA" Abrader is covered by a patent. Interested parties are invited to submit information regarding the identification of an alternative(s) to this patented item to the ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

6.2.1 *Norman Tool RCA Abrader.*[4]

6.3 *Specimen Mounting Fixture or Holder*, a suitable device of sufficient strength and rigidity used to secure the specimen so that it is held rigidly and perpendicular to the load during testing.

6.4 *Abrasive Media*, commonly available from Norman Tool.

6.4.1 *0.6875 in. wide Paper*, most applications.

6.4.2 *0.25 in. wide Polyester Tape*, recommended for specimens with concave surfaces and fine graphic details.

7. Conditioning

7.1 *Abrasive Media and Specimen Conditioning*—Unless otherwise agreed upon between purchaser and seller, condition the specimens for at least 24 h at 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 10 % relative humidity.

7.2 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of 23 ± 2°C and 50 ± 10 % relative humidity.

8. Pre-Test Setup

8.1 Mount the test specimen on the mounting fixture. This holding device should firmly hold the test specimen in a fixed position, without distortion, in a perpendicular position relative to the force probe.

8.2 *Cleaning of Specimen*—Specimens shall be cleaned in such a way that the surface is free from grit, grease, fingerprints or other contaminates.

8.2.1 Use a clean lint-free piece of absorbent material and either reagent grades of *n*-heptane or isopropyl alcohol.

8.2.2 Lightly wipe the surface of the test area with a moistened piece of cleaning material.

8.2.3 Allow the surface to air dry completely (minimum two hours).

8.2.4 Inspect the test area to ensure no visual damage has been caused by the cleaning process.

8.3 Inspect for residue and quality of ink or coating in area of test.

8.4 Install specified abrasive material.

8.5 Adjust applied force to specified value.

9. Procedure

9.1 Align specimen targeted test point to the applied force probe.

9.2 Adjust force to be applied to 175 g (or otherwise specified).

9.3 Gently lower the abradant onto the specimen.

9.4 Start the abrasion process.

9.5 Subject the test specimen to abrasion for the specified number of cycles; or until sought after visual change has been detected. Wear Limit is determined when an underlying layer of different color may be seen through the first layer (not applicable for transparent coatings). In determining the extent of wear, periodically interrupt the instrument at intervals for examination of the test specimen. Final Breakthrough, not wear, on a first surface printed line constitutes a failure regardless of size.

NOTE 1—**Caution:** When the test is stopped prior to achieving final end point, it is recommended the specimen not be moved. Doing so may present problems in aligning the wear path for additional testing.

9.6 Periodically remove any loose abrading that remains on the test specimen, by light brushing or compressed air.

10. Report

10.1 Report the following information:

10.1.1 Model number and description of Abrasion Tester used,

10.1.2 Abrasive material,

10.1.3 Force applied to specimen,

10.1.4 Number of cycles to wear limit (not applicable for transparent coatings),

10.1.5 Number of cycles to final breakthrough,

10.1.6 Temperature and humidity,

10.1.7 Identity of specimen, describing the material or coating,

10.1.8 Method of cleaning, if applicable, and

10.1.9 Visual evaluation of test specimen and include photos of target test area, if possible.

11. Precision and Bias

11.1 *Precision*—It is not possible to specify the precision of the procedure in Test Method F2357 for measuring abrasion resistance because inter-laboratory studies have proven inconclusive due to insufficient participating laboratories with the appropriate equipment.

11.2 *Bias*—No information can be presented on the bias of the procedure in Test Method F2357 for measuring abrasion resistance because no standard sample is available for this industry.

12. Keywords

12.1 abrasion; breakthrough; coatings; inks; membrane switch; Norman Tool; RCA; Taber; wear

[4] Available from Norman Tool Co., 15415 Old State Road, Evansville, IN 47725.

Y3-02-0755 (A)

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Product Service

ASTRONICS
DME CORPORATION

Document No. Y3-03-0896 (-)
ECO # 19480

PLB Exterior Finish Declaration

The Astronics DME Corporation Model PLB-110 exterior case complies with the requirement of Clause 4.5.1 of RTCM 11010.2 . 52% of the exposed area is international orange.

Alex Haynes,
Product Assurance Director
DME Corporation

1/26/12
Date

Herve Cantavé,
Engineering Director
DME Corporation

1-26-12
Date

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