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Report On

Emergency Beacons Testing of the
ACR Electronics PLB-375

In accordance with Cospas-Sarsat T.007 Issue 4 - Rev 5 October 2010



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TÜV SÜD Product Service Ltd, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuvps.co.uk

REPORT ON

Emergency Beacons Testing of the
ACR Electronics
PLB-375

Document 75911196 Report 01 Issue 4

June 2011

PREPARED FOR

ACR Electronics
Cobham Life Support (ACR Products)
5757 Ravenswood Road
Ft. Lauderdale
USA

PREPARED BY

A handwritten signature in black ink, appearing to read 'M. P. Hardy', written over a horizontal line.

M P Hardy
Telecoms Test Engineer

APPROVED BY

A handwritten signature in black ink, appearing to read 'M. Jenkins', written over a horizontal line.

M Jenkins
Authorised Signatory

DATED

10 June 2011





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SECTION 1

REPORT SUMMARY

Emergency Beacons Testing of the
ACR Electronics
PLB-375



Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Emergency Beacon Testing of the ACR Electronics PLB-375 to the requirements of Cospas-Sarsat T.007 Issue 4 - Rev 5 October 2010.

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	ACR Electronics
Model Number(s)	PLB-375
Serial Number(s)	Unit #14 TUV Ref: TSR0003 (Conducted Test Sample) Unit #4 TUV Ref: TSR0002 (Conducted Test Sample) Unit #25 TUV Ref: TSR0004 (Radiated Test Sample) Unit #1 TUV Ref: TSR0001 (Radiated Test Sample) Unit #7 TUV Ref: TSR0036 (Conducted Test Sample) Unit #4 TUV Ref: TSR0042 (Radiated Test Sample)
Number of Samples Tested	6
Test Specification/Issue/Date	Cospas-Sarsat T.007 Issue 4 - Rev 5 October 2010
Date of Receipt of Test Samples	20 December 2010
Order Number	14488-00
Date	04 October 2010
Start of Test	10 January 2011
Finish of Test	08 June 2011
Name of Engineer(s)	M P Hardy R Hampton M Russell
Related Documents	Cospas-Sarsat T.001 Issue 3 - Rev 11 October 2010



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1.2 APPLICATION FORM

1.2.1 Beacon Manufacturer and Beacon Model

Beacon Manufacturer	ACR Electronics, Inc.
Beacon Model	PLB-375
Other Model Names	ResQLink

1.2.2 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)		☐

1.2.3 Beacon Characteristics

Characteristic	Specification
Operating frequency	406.037 MHz
Operating temperature range	Tmin = -20 °C Tmax = +55 °C
Operating lifetime	24 hours
Battery chemistry	LiMnO2
Battery cell model name, size and number of cells	CR123A, 2/3A, 3 Cells
Battery cell manufacturer	Panasonic
Battery pack manufacturer and part number	ACR, A3-06-2703
Battery pack replacement period	5 years



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Characteristic	Specification
Oscillator type (e.g. OCXO, MCXO, TCXO)	TCXO
Oscillator manufacturer	Rakon
Oscillator part name and number	A1-11-0687-2 (E4672)
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	ACR Electronics, Inc.
Antenna part name and number	A3-06-2701
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)	WGS 84
- GNSS receiver cold start forced at every beacon activation (Yes or No)	Yes
- Navigation device manufacturer	GlobalTop Tech Inc.
- Navigation device model name and part Number	A1-11-0877
- GNSS system supported (e.g. GPS, GLONASS, Galileo)	GPS
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



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Characteristic	Specification	
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	LED
- 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)	Yes, 121.5 MHz	No
- Self-test can be activated directly at beacon (Yes or No)	Yes	Yes
- List of Items checked by self-test	Battery, 406 Pwr, Lock Det, Non-Volatile Memory	Battery, 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	1
- Maximum duration of Self Test / GNSS Self-test	10 seconds	125 seconds
- 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	N/A



Product Service

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
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



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Characteristic	Specification
Beacon includes a homer transmitter (if yes identify frequency of transmission)	121.5 MHz
-Homer Transmit Power	19 dBm
-Homer Duty Cycle	97 %
-Duty Cycle of Homer Swept Tone	33.3 %
Beacon includes a strobe light (Yes or No)	Yes
- Strobe light intensity	N/A
- Strobe light flash rate	20/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	No



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1.2.4 Information Provided by the Cospas-Sarsat Accepted Test Facility

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

Date of Submission for Testing: December 2010

Applicable C/S Standards:

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

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

Signed:

A handwritten signature in black ink, appearing to be 'M Jenkins', written over a horizontal line.

Name:

M Jenkins

Position Held:

Authorised Signatory

Date:

10 June 2011



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1.2.5 Applicant Details

Company Name	ACR Electronics, Inc.		
Address	5757 Ravenswood Road Fort Lauderdale, FL 33312		
Category of Applicant	☒ Manufacturer	☐ Importer	
	☐ Distributor	☐ Agent	
Contact Name	Bryan French	Telephone	954-862-2135
Email	bryan.french@cobham.com	Facsimile	

1.2.6 Manufacturer Details

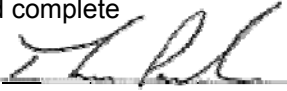
Company Name	Same as above		
Address			
Contact Name		Telephone	
Email		Facsimile	

1.2.7 Declaration of Build Status (Intended Production Build Level)

Hardware Version	Mod State 5
- PCB Revision	B
- Battery Model	A3-06-2703
Software Version	N/A
Firmware Version	T3d
Other (Specify)	

1.2.8 Applicant's Declaration

I hereby declare that I am entitled to sign on the behalf of the applicant and that the information supplied is correct and complete

Signed: 

Name: Thomas Pack

Position Held: Director - New Product Development

Date: June 10, 2011

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a ACR Electronics PLB-375 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). The EUT* was configured so that the antenna port was connected to the 50Ω test system using a coaxial cable. The test configuration for all tests is identical with the exception of Antenna Characteristics, Satellite Qualitative and Position Accuracy Time and Position Accuracy.

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

* Note: Two samples were supplied for each configuration. One programmed with National Location Protocol, the other with Standard Location Protocol.



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1.3.3 Modes of Operation

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

Off/Standby Mode

- No apparent activity

Self-test

- List of items checked as per Customer Supplied Information (Application Form)
- No navigation data applied

Long/GPS/GNSS Self-test

- 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

- 121 Homer active (offset for radiated samples)
- GPS operating in normal duty cycle for the following navigation input conditions
- 406 transmitter

All modes

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

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



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1.4 MODIFICATIONS

Mod State	Hardware Revision	Firmware Revision	Description of Modification	Modification Fitted By and Location	Modification Location	Date Modification Fitted
0	T3a	T3a	As supplied by ACR Electronics	N/A	N/A	N/A
1	T3a	T3b	Minor Firmware modification to correct self-test message length	ACR Electronics	ACR Electronics Fort Lauderdale	11-Jan-2011
2	T3a	T3c	Minor Firmware modification to correct transmitter integrated circuit sleep settings	ACR Electronics	TUV Product Service	21-Feb-2011
3	T3a	T3d	Minor Firmware modification to correct Frame Sync on GNSS Self-Test when no GPS signal is present	TUV	TUV Product Service	3-Mar-2011
4	T3b	T3d	Minor Hardware modification to eliminate possibility of rare strobe fault condition	ACR Electronics	TUV Product Service	10-Mar-2011
6	T3c	T3d	Minor Hardware modification to smooth power supply transitions and reduce spurious emissions	ACR Electronics	ACR Electronics Fort Lauderdale	18-May-2011
5	B	T3d	Minor Hardware modification to improve efficiency of 121 power transistor	ACR Electronics	ACR Electronics Fort Lauderdale	06-May-2011
Note Unless stated otherwise all units were modified at the same time to the Mod State as detailed above						

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test are recorded on the appropriate test pages.

1.5 TEST HOUSE OBSERVATIONS

Modification State 4 was implemented after the following: it was observed during testing that the EUT failed to transmit the 406 signal after being stabilised at +55°C, although the EUT LED's indicated that the EUT was in operational mode. After returning the EUT to ambient temperature, the EUT operated correctly. The EUT was then returned to +55°C, and operated correctly for the remainder of the test program. A modification was made by the manufacturer (details contained within the modification table) and retesting was carried out as directed by Cospas Sarsat to demonstrate a resolution to the problem.

During another test campaign two further problems were noted: one modification was made to the unit to the 121.5 homer power and another to reduce unwanted 406 spurious emissions noted during an extended life test. Once again Cospas Sarsat indicated the required re testing to demonstrate continual compliance. All modification details are provided in the table above.



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1.6 REPORT MODIFICATION RECORD

Issue 1 – First Issue

Issue 2 – Due to typographical errors.

Issue 3 – In response to the C/S worksheet dated 16 May 2011 (GNSS self test message samples).

Issue 4 – In response to the C/S worksheet-02 dated 03 June 2011 (Spurious emissions and satellite qualitative).



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SECTION 2

TEST DETAILS

Emergency Beacons Testing of the
ACR Electronics
PLB-375



Product Service

TEST RESULTS TABLE

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
1. Power Output						Result: Pass
Test Sample: PLB-375 S/N: Unit #14 (TUV Ref TSR0003) Mod State: 4						
Transmitter power output	35 - 39	dBm	36.73	36.17	36.24	
Power output rise time	< 5	ms	0.306	0.312	0.280	
Power output 1ms before burst	< -10	dBm	-25.97	-26.0	-27.35	
2. Digital Message Coding						Result: Pass
Test Sample: PLB-375 S/N: Unit #14 (TUV Ref TSR0003) Mod State: 4						
Bit Sync	1 - 15	15 bits "1"	P / F	P	P	Decoded Message: Page 27
Frame sync	16 - 24	"000101111"	P / F	P	P	
Format flag	25	1 bit	bit value	1	1	
Protocol flag	26	1 bit	bit value	0	0	
Identification / position data	27 - 85	59 bits	P / F	P	P	
BCH code	86 -106	21 bits	P / F	P	P	
Emerg. Code/nat. use/supplem. Data	107 - 112	6 bits	bit value	110111	110111	
Additional data / BCH (if applicable)	113 - 144	32 bits	P / F	P	P	
Position Error (if applicable)	< 5	km	n/a	n/a	n/a	



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Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
3. Digital Message Generator						Result: Pass
Test Sample: PLB-375 S/N: Unit #14 (TUV Ref TSR0003) Mod State: 4						
Repetition rate, T _R :						
Average T _R	48.5 ≤ T _{Ravg} ≤ 51.5	seconds	50.301	49.854	49.829	
Minimum T _R	47.5 ≤ T _{Rmin} ≤ 48.0	seconds	47.813	47.609	47.609	
Maximum T _R	52.0 ≤ T _{Rmax} ≤ 52.5	seconds	52.047	52.360	52.343	
Standard deviation	0.5 - 2.0	seconds	1.455	1.551	1.554	
Bit rate						
Minimum fb	≥ 396	bits/sec	400.203	400.194	400.204	
Maximum fb	≤ 404	bits/sec	400.234	400.232	400.237	
Total transmission time						
Short message	435.6 - 444.4	ms	n/a	n/a	n/a	
Long message	514.8 - 525.2	ms	519.318	519.372	519.416	
Unmodulated carrier						
Minimum T1	≥ 158.4	ms	159.277	159.572	159.627	
Maximum T1	≤ 161.6	ms	159.682	159.619	159.659	
First burst delay	≥ 47.5	seconds	100	100	100	
4. Modulation						Result: Pass
Test Sample: PLB-375 S/N: Unit #14 (TUV Ref TSR0003) Mod State: 4						
Biphase-L	P / F	P / F	P	P	P	Test Results: Page 30
Rise time	50 - 250	µs	176.30	162.30	154.30	
Fall time	50 - 250	µs	171.70	162.70	157.70	
Phase deviation: positive	+(1.0 to 1.2)	radians	1.107	1.107	1.107	
Phase deviation: negative	-(1.0 to 1.2)	radians	-1.087	-1.106	-1.099	
Symmetry measurement	≤ 0.05		0.015	0.015	0.013	



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Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
5. 406 MHz Transmitted Frequency						Result: Pass
Test Sample: PLB-375 S/N: Unit #14 (TUV Ref TSR0003) Mod State: 4						
Nominal Value	C/S T.001	MHz	406.037000	406.036997	406.036961	
Short-term stability	≤ 2x10 ⁻⁹	/100ms	1.670x10 ⁻¹⁰	1.563x10 ⁻¹⁰	1.881x10 ⁻¹⁰	
Medium-term stability – Slope	(-1 to +1)x10 ⁻⁹	/minutes	8.777x10 ⁻¹¹	-9.509x10 ⁻¹¹	2.116x10 ⁻¹⁰	
Medium-term stability – Residual frequency variation	≤ 3x10 ⁻⁹		5.139x10 ⁻¹⁰	6.042x10 ⁻¹⁰	9.463x10 ⁻¹⁰	
6. Spurious Emissions into 50ohms						Result: Pass
Test Sample: PLB-375 S/N: Unit #14 (TUV Ref TSR0003) Mod State: 4						
In band (406.0 – 406.1 MHz)	C/S T.001 mask	P / F	P			Spectrum plots: Page 32. Combined temperature plots. See Annex D for additional spurious emission check in Mod State 5 as per C/S worksheet-02.
7. 406 MHz VSWR Check						Result: Pass
Test Sample: PLB-375 S/N: Unit #14 (TUV Ref TSR0003) Mod State: 4						
Nominal transmitted frequency	C/S T.001	MHz	406.037001	406.0369979	406.036962	Decoded Message: Page 33
Modulation rise time	50-250	µs	174.30	165.30	153.30	
Modulation fall time	50-250	µs	167.70	166.70	150.70	
Modulation phase deviation: positive	+ (1.0 to 1.2)	radians	1.120	1.088	1.116	
Modulation phase deviation: negative	- (1.0 to 1.2)	radians	-1.085	-1.124	-1.094	
Modulation symmetry measurement	≤ 0.05		0.016	0.013	0.013	
Digital Message	correct	P / F	P	P	P	



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Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
8(a). Self-test Mode						Result: Pass
Test Sample: PLB-375 S/N: Unit #14 (TUV Ref TSR0003) Mod State: 4 (for additional test requested by C/S refer to main Self Test Mode results section)						
Frame sync	011010000	P / F	P	P	P	Decoded Message: Page 36 Applicant's data: Annex B
Format flag	1 / 0	bit value	1	1	1	
Single radiated burst	≤440 / 520 (±1%)	ms	439.765	439.783	439.770	
Default position data (if applicable)	correct	P / F	P	P	P	
Description	provided	Y / N	Y			
Design data on protection against repetitive self-test mode transmissions	provided	Y / N	Y			
Single burst verification	one burst	P / F	P	P	P	
Provides for 15 Hex ID	correct	P / F	P	P	P	
121.5 MHz RF power (if applicable)	verify that RF power emitted	P / F	P	P	P	
406 MHz power	verify that RF power emitted	P / F	P	P	P	



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Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
8 (b). GNSS Self-Test Mode (if applicable)						Result: Pass
Test Sample: PLB-375 S/N: Unit #14 (TUV Ref TSR0003) Mod State: 4						
Frame sync	011010000	bit value	P	P	P	Test Results: Page 40
Format flag	1 / 0		1	1	1	
Position data (if applicable)	must be within 500m (or 5.25km for User Location Protocol) of the actual position		P / F	P	P	
Design data showing how GNSS Self-test is limited in number of transmissions and duration	provided	Y / N	Y			Applicant's data: Annex B
Single burst verification	one burst	P / F	P	P	P	
121.5 MHz RF power (if applicable)	GNSS self-test checks that RF power is emitted	Y / N	-			
406 MHz power	GNSS self-test checks that RF power is emitted	Y / N	-			Applicant's data: Application Form
Maximum duration of GNSS Self-test		s	125	125	125	
Radiation burst length	≤520 (+1%)	ms	519.739	519.736	519.704	
Actual duration of Self Test with encoded location	Less than maximum duration	s	37	39	41	
Distinct indication to register successful completion or failure of GNSS Self Test	provided		Y			
Distinct indication that a maximum number of GNSS Self Tests has been attained	provided		Y			A successful GNSS Self Test is indicated by a green LED followed by the strobe light and 406 transmission containing positional data. An unsuccessful GNSS Self Test is indicated by a red LED followed by the strobe light and 406 transmission containing default data Applicant's data: Annex B Once the maximum number of GNSS Self Tests has been attained, any attempt to activate further tests receives a red flashing LED from the EUT with no further action. Applicant's data: Annex B Test performed one battery. Applicant's data: Application Form
Maximum number of GNSS Self-tests (only beacons with internal navigation devices)		Number	12			

:



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Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
8 (b) (continued) GNSS Self-Test Mode (if applicable)						Result: Pass
Test Sample: PLB-375 S/N: Unit #4 (TUV Ref TSR0002) Mod State: 4						
Frame sync	011010000	bit value	P	P	P	Test Results: Page 40
Format flag	1 / 0		1	1	1	
Position data (if applicable)	must be within 500m (or 5.25km for User Location Protocol) of the actual position		P / F	P	P	
Design data showing how GNSS Self-test is limited in number of transmissions and duration	provided	Y / N	Y			Applicant's data: Annex B
Single burst verification	one burst	P / F	P	P	P	
121.5 MHz RF power (if applicable)	GNSS self-test checks that RF power is emitted	Y / N	-			
406 MHz power	GNSS self-test checks that RF power is emitted	Y / N	-			Applicant's data: Application Form
Maximum duration of GNSS Self-test		s	125	125	125	
Radiation burst length	≤520 (+1%)	ms	519.654	519.723	519.732	
Actual duration of Self Test with encoded location	Less than maximum duration	s	51	45	55	
Distinct indication to register successful completion or failure of GNSS Self Test	provided		Y			A successful GNSS Self Test is indicated by a green LED followed by the strobe light and 406 transmission containing positional data. An unsuccessful GNSS Self Test is indicated by a red LED followed by the strobe light and 406 transmission containing default data Applicant's data: Annex B Once the maximum number of GNSS Self Tests has been attained, any attempt to activate further tests receives a red flashing LED from the EUT with no further action. Applicant's data: Annex B Test performed one battery. Applicant's data: Application Form
Distinct indication that a maximum number of GNSS Self Tests has been attained	provided		Y			
Maximum number of GNSS Self-tests (only beacons with internal navigation devices)		Number	12			



Product Service

Parameters to be Measured	Range of Specification	Units	Test Results	Comments
9. Thermal Shock				Result: Pass
Test Sample: PLB-375 S/N: Unit #14 (TUV Ref TSR0003) Mod State: 3				
Soak Temperature	30°C difference	°C	18.0	Test Data: Page 55
Measurement Temperature		°C	-12.0	
Transmitted Frequency	C/S T.001 ≤ 2x10 ⁻⁹ (-2 to +2)x10 ⁻⁹ ≤ 3x10 ⁻⁹		Min	
Nominal value		MHz	406.0370096	
Short-term stability		/100ms	1.089x10 ⁻¹⁰	
Medium-term stability – Slope		/min	-2.771x10 ⁻¹⁰	
Medium-term stability – Residual frequency variation			2.577x10 ⁻¹⁰	
Transmitter power output	35 - 39	dBm	36.505	
Digital message	correct	P/F	P	



Product Service

Parameters to be Measured	Range of Specification	Units	Test Results	Comments
10. Operating Lifetime at Minimum Temperature				Result: Pass
Test Sample: PLB-375 S/N: Unit #7 (TUV Ref TSR0036) Mod State: 5				
Pre-test battery discharge duration (operating) required		Hours	7.17	Test Data: Page 59.
Pre-test battery discharge duration (operating)		Hours	7.17	Test Data: Page 59. Discharge time calculated in accordance with RTCM 11010.2 . This is worst case as the RTCM requirement is greater than that of Cospas Sarsat. The difference between the required and actual discharge figures has been deducted from the Actual duration test time Including difference between required discharge and actual discharge
Actual duration	>24	hours	28.37Hours at Tmin = -20°C	
Effective Operating Lifetime duration	>24	hours	28.37 Hours at Tmin = -20°C	
Transmitted Frequency			MinMax	
Nominal value	C/S T.001	MHz	406.0370612406.0370683	
Short-term stability	≤ 2x10 ⁻⁹	/100ms	9.900x10 ⁻¹¹ 3.588x10 ⁻¹⁰	
Medium-term stability – Slope	(-1 to +1)x10 ⁻⁹	/min	-4.663 ⁻⁹ 1.112x10 ⁻¹⁰	
Medium-term stability – Residual frequency variation	≤ 3x10 ⁻⁹		8.692x10 ⁻¹¹ 9.804x10 ⁻⁹	
Transmitter power output	35 - 39	dBm	36.0537.22	
Digital message	correct	P/F	P	
Homer transmitter continuous operation during the lifetime test		hours	28.37	
Homer frequency		MHz	121.500	
Homer peak power level (Start of test)		dBm	18.922	
Homer peak power level (Mid point of test)		dBm	18.951	
Homer peak power level (End of test)		dBm	18.874	
Homer transmitter duty cycle (Start of test)		%	95.4	Based on the Min Repition Rate at -20°C
Homer transmitter duty cycle (End of test)		%	95.4	Based on the Min Repition Rate at -20°C



Product Service

Parameters to be Measured	Range of Specification	Units	Test Results				Comments
11. Temperature Gradient (5°C/hr)							Result: Pass
Test Sample: PLB-375 S/N: Unit #14 (TUV Ref TSR0003) Mod State: 3							
Transmitted Frequency			Min		Max		Test Data: Page 72 Data for points A to B, C+15 min to D and E+15 min to F Data for points B to C+15 min and D to E+15 min
Nominal value	C/S T.007	MHz	406.0369682		406.0370158		
Short-term stability	≤ 2x10 ⁻⁹	/100ms	8.22x10 ⁻¹¹		2.607x10 ⁻¹⁰		
	(-1 to +1)x10 ⁻⁹	/min	-1.05x10 ⁻¹⁰		1.48x10 ⁻¹⁰		
Medium-term stability – Slope ¹	(-2 to +2)x10 ⁻⁹	/min	-5.67x10 ⁻¹⁰		3.67x10 ⁻¹⁰		
Medium-term stability – Residual frequency variation	≤ 3x10 ⁻⁹		9.043x10 ⁻¹¹		1.008x10 ⁻⁹		
Transmitter power output	35 – 39	dBm	36.199		36.777		
Digital message	correct	P/F	P				
12. Oscillator Aging							
Data	provided	Y / N	Y				Applicant's data: Annex B
13. Protection Against Continuous Transmission							
Description	provided	Y / N	Y				Applicant's data: Annex B
14. Satellite Qualitative Tests							Result: Pass
Test Sample: PLB-375 S/N: See each configuration							
Test Configuration	As per C/S T.007		Configuration				*Unit #25 (TUV Ref TSR0004) Mod State 1 for Config 7 **Unit #4 (TUV Ref TSR0042) Mod State 5 for Config 8 Test Data: Page 76
			5	6	7*	8**	
15 Hex ID Decoded by LUT	correct	P / F	-	-	P	P	
Doppler Location results with error ≤5km	≥80	%	-	-	100	95	
15. Antenna Characteristics							Result: Pass
Test Sample: PLB-375 S/N: Unit #1 (TUV Ref TSR0001) Mod State: 0							
Test Configuration	As per C/S T.007		Configuration				Test Data: Page 79 Detachable Antennas Only EIRP _{minEOL} limit decreases to 30dBm for Configuration 4
			1	2	3	4	
Polarisation	linear or RHCP		-	-	Linear	Linear	
VSWR	≤1.5		-	-	n/a	n/a	
EIRP _{Loss}		dB	-	-	0.22	0.22	
EIRP _{maxEOL}	≤43	dBm	-	-	42.0	39.8	
EIRP _{minEOL}	≥32	dBm	-	-	32.9	31.4	



Product Service

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
16. Beacon Coding Software					Result: Pass	
Test Sample: PLB-375						
Sample message for each coding option of the applicable coding types	Results Checked	Y/N	Y			Testing carried out by manufacturer (see Annex C). Manufacturer has stated that the PLB was in MOD state 4.
Sample self-test message for each coding option of the applicable coding types	Results Checked	Y/N	Y			Testing carried out by manufacturer (see Annex C). Manufacturer has stated that the PLB was in MOD state 4.
17. Navigation System					Result: Pass	
Test Sample: PLB-375 S/N: Unit #14 (TUV Ref TSR0003) Mod State: 0 and Unit #4 (TUV Ref TSR0002) Mod State: 0 (see exception below for Position Data Encoding)						
Location protocol	C/S T.001	P / F	National	Standard	User	Test Data: Page 81
Position data default values	correct		P	P	N/A	
Configuration 7						
Position accuracy - A.3.8.2.1	<500	metres	49.46	50.06	N/A	
Position Acquisition Time - A.3.8.2.1	10	mins	1min 41sec	1min 41sec	N/A	
Position accuracy - A.3.8.2.2	<500	metres	32.24	32.24	N/A	
Position Acquisition Time - A.3.8.2.2	10	mins	1min 41sec	1min 40sec	N/A	
Configuration 8						
Position accuracy - A.3.8.2.1	<500	metres	50.06	50.06	N/A	
Position Acquisition Time - A.3.8.2.1	10	mins	1min 41sec	1min 41sec	N/A	
Position accuracy - A.3.8.2.2	<500	metres	32.24	32.24	N/A	
Position Acquisition Time - A.3.8.2.2	10	mins	1min 40sec	1min 40sec	N/A	
Encoded position data update interval	>20	min	29mins 18secs	29mins 56secs	N/A	
Position clearance after deactivation	cleared	P / F	P	P	N/A	
Position data input update interval (as applicable)	20/1	Min	N/A	N/A	N/A	
Position data encoding	Results Checked	Y/N	Y*	Y*	Y*	*Testing carried out by manufacturer (see Annex C). Manufacturer has stated that the PLB was in MOD state 4.
Retained last valid position after navigation input lost	240(±5)	min	239min 29s	239min 48s	N/A	
Default position data transmitted after 240(±5) minutes without valid position data	cleared	P / F	P	P	N/A	
Information on protection against beacon degradation due to navigation device, interface or signal failure or malfunction	provided	Y / N	Y			Applicant's data: Annex B



Product Service

2.1 DIGITAL MESSAGE

2.1.1 Equipment Under Test and Modification State

PLB-375 S/N: Unit #14 (TUV Ref TSR0003) - Modification State 4

2.1.2 Date of Test

28 March 2011 & 29 March 2011

2.1.3 Test Equipment Used

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

2.1.4 Environmental Conditions

Ambient Temperature 22 - 23°C

Relative Humidity 27 - 44%

2.1.5 Test Results

Ambient Temperature

```
=====
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144
15 Hex (Bits 26- 85) = 192FF380C6FFBFF 192FF380C6FFBFF Default_Id
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23783E0F66C

    26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
    |   |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0010 1111 1111 0011 1000 0000 1100 0110 1111 1111 1011 1111 1111
    |   |   |   |   |   |   |   |   |   |   |   |   |   |
  1110 0010 0011 0110 0100 0110 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      201 ALBANIA      0011 0010 01
Protocol Code     37- 40      7 PLB - Serial (Standard) 0111
CSTA Number       41- 50      999          1111 1001 11
Serial Number     51- 64      99          0000 0001 1000 11
Coarse Position   65- 85      DEFAULT      0111 1111 1101 1111 1111 1
BCH Encoded       86-106     Errors=0      1110 0010 0011 0110 0100 0
BCH Generated     86-106     1110 0010 0011 0110 0100 0
Long Message      107-144     Data Present
Fixed Bits        107-109     110
Fixed Bit         110          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
=====
```



Product Service

Low Temperature

=====															
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144															
15 Hex (Bits 26- 85) = 192FF380C6FFBFF 192FF380C6FFBFF Default_Id															
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23783E0F66C															
	26	30	34	38	42	46	50	54	58	62	66	70	74	78	82
1	0001	1001	0010	1111	1111	0011	1000	0000	1100	0110	1111	1111	1011	1111	1111
	1110	0010	0011	0110	0100	0110	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		201 ALBANIA										0011 0010 01	
Protocol Code		37- 40		7 PLB - Serial (Standard)										0111	
CSTA Number		41- 50		999										1111 1001 11	
Serial Number		51- 64		99										0000 0001 1000 11	
Coarse Position		65- 85		DEFAULT										0111 1111 1101 1111 1111 1	
BCH Encoded		86-106		Errors=0										1110 0010 0011 0110 0100 0	
BCH Generated		86-106												1110 0010 0011 0110 0100 0	
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	
=====															



Product Service

High Temperature

=====															
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144															
15 Hex (Bits 26- 85) = 192FF380C6FFBFF 192FF380C6FFBFF Default_Id															
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23783E0F66C															
	26	30	34	38	42	46	50	54	58	62	66	70	74	78	82
1	0001	1001	0010	1111	1111	0011	1000	0000	1100	0110	1111	1111	1011	1111	1111
	1110	0010	0011	0110	0100	0110	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		201 ALBANIA										0011 0010 01	
Protocol Code		37- 40		7 PLB - Serial (Standard)										0111	
CSTA Number		41- 50		999										1111 1001 11	
Serial Number		51- 64		99										0000 0001 1000 11	
Coarse Position		65- 85		DEFAULT										0111 1111 1101 1111 1111 1	
BCH Encoded		86-106		Errors=0										1110 0010 0011 0110 0100 0	
BCH Generated		86-106												1110 0010 0011 0110 0100 0	
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	
=====															



Product Service

2.2 MODULATION

2.2.1 Equipment Under Test and Modification State

PLB-375 S/N: Unit #14 (TUV Ref TSR0003) - Modification State 4

2.2.2 Date of Test

28 March 2011 & 29 March 2011

2.2.3 Test Equipment Used

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

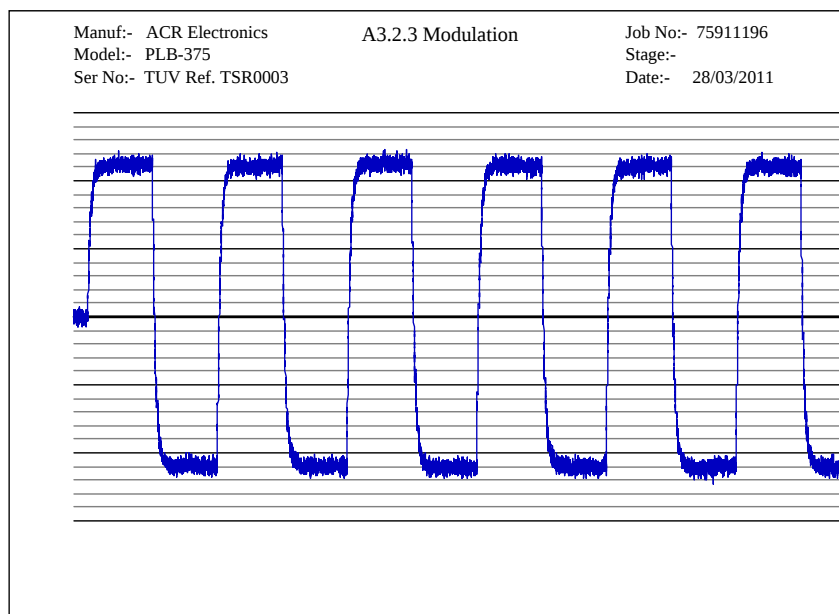
2.2.4 Environmental Conditions

Ambient Temperature 22 - 23°C

Relative Humidity 29 - 44%

2.2.5 Test Results

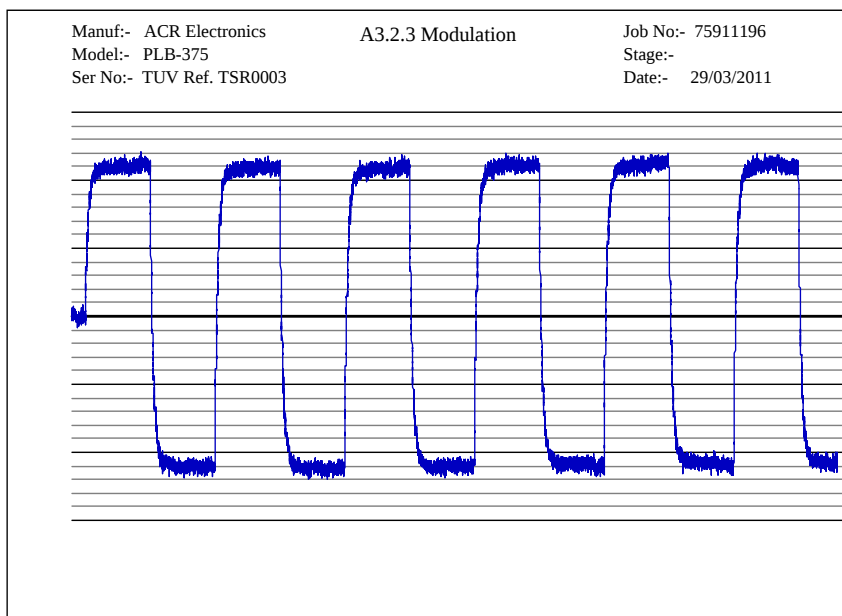
Ambient Temperature



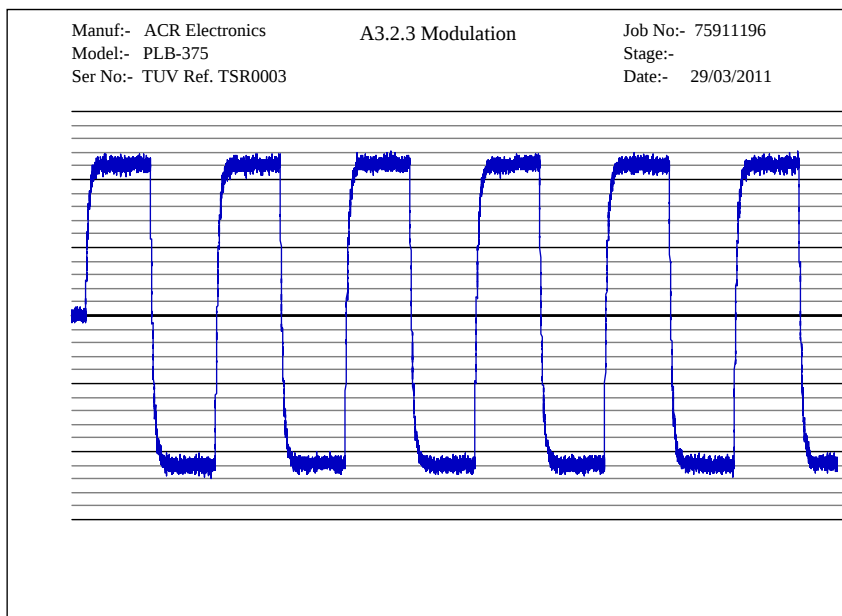


Product Service

Low Temperature



High Temperature





Product Service

2.3 SPURIOUS EMISSION INTO 50 OHMS

2.3.1 Equipment Under Test and Modification State

PLB-375 S/N: Unit #14 (TUV Ref TSR0003) - Modification State 4

2.3.2 Date of Test

22 March 2011

2.3.3 Test Equipment Used

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

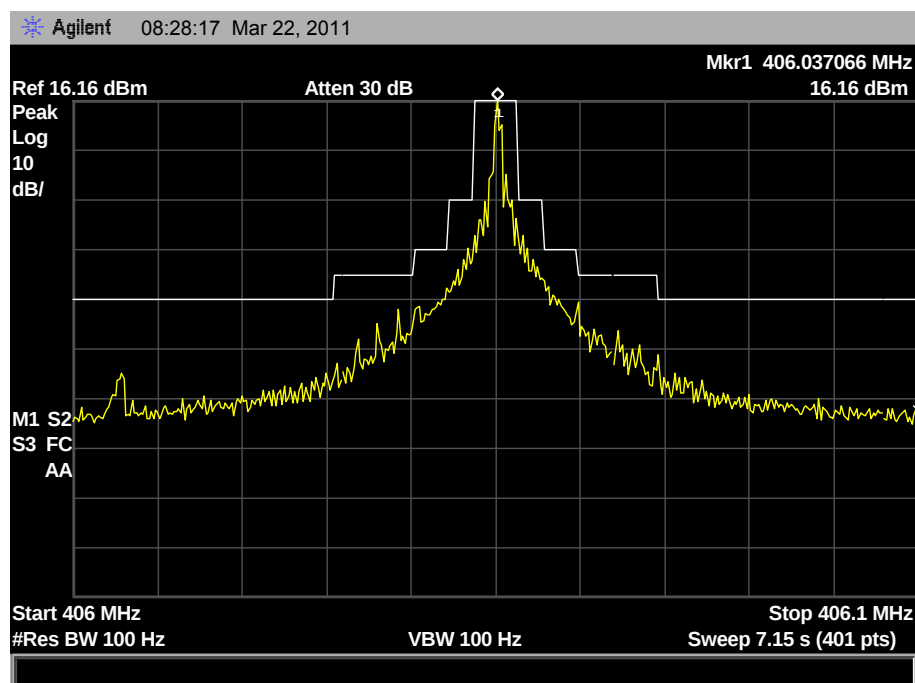
2.3.4 Environmental Conditions

Ambient Temperature 22°C

Relative Humidity 31%

2.3.5 Test Results

Combined Ambient, Low and High Temperature





Product Service

2.4 406 MHZ VSWR CHECK

2.4.1 Equipment Under Test and Modification State

PLB-375 S/N: Unit #14 (TUV Ref TSR0003) - Modification State 4

2.4.2 Date of Test

28 March 2011 & 29 March 2011

2.4.3 Test Equipment Used

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

2.4.4 Environmental Conditions

Ambient Temperature 22 - 23°C

Relative Humidity 29 - 44%

2.4.5 Test Results

Ambient Temperature

```

=====
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144
15 Hex (Bits 26- 85) = 192FF380C6FFBFF 192FF380C6FFBFF Default_Id
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23783E0F66C

    26  30  34  38  42  46  50  54  58  62  66  70  74  78  82
    |  |  |  |  |  |  |  |  |  |  |  |  |  |
1 0001 1001 0010 1111 1111 0011 1000 0000 1100 0110 1111 1111 1011 1111 1111
    |  |  |  |  |  |  |  |  |  |  |  |  |  |
1110 0010 0011 0110 0100 0110 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      201 ALBANIA      0011 0010 01
Protocol Code     37- 40      7 PLB - Serial (Standard) 0111
CSTA Number       41- 50      999          1111 1001 11
Serial Number     51- 64      99          0000 0001 1000 11
Coarse Position   65- 85      DEFAULT      0111 1111 1101 1111 1111 1
BCH Encoded       86-106     Errors=0      1110 0010 0011 0110 0100 0
BCH Generated     86-106     1110 0010 0011 0110 0100 0
Long Message     107-144     Data Present
Fixed Bits       107-109     110
Fixed Bit        110          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
=====

```



Product Service

Low Temperature

=====															
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144															
15 Hex (Bits 26- 85) = 192FF380C6FFBFF 192FF380C6FFBFF Default_Id															
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23783E0F66C															
	26	30	34	38	42	46	50	54	58	62	66	70	74	78	82
1	0001	1001	0010	1111	1111	0011	1000	0000	1100	0110	1111	1111	1011	1111	1111
	1110	0010	0011	0110	0100	0110	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		201 ALBANIA										0011 0010 01	
Protocol Code		37- 40		7 PLB - Serial (Standard)										0111	
CSTA Number		41- 50		999										1111 1001 11	
Serial Number		51- 64		99										0000 0001 1000 11	
Coarse Position		65- 85		DEFAULT										0111 1111 1101 1111 1111 1	
BCH Encoded		86-106		Errors=0										1110 0010 0011 0110 0100 0	
BCH Generated		86-106												1110 0010 0011 0110 0100 0	
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	
=====															



Product Service

High Temperature

```
=====
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144
15 Hex (Bits 26- 85) = 192FF380C6FFBFF      192FF380C6FFBFF Default_Id
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23783E0F66C

    26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
    |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0010 1111 1111 0011 1000 0000 1100 0110 1111 1111 1011 1111 1111
    |   |   |   |   |   |   |   |   |   |   |   |   |
1110 0010 0011 0110 0100 0110 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      201 ALBANIA          0011 0010 01
Protocol Code     37- 40      7 PLB - Serial (Standard) 0111
CSTA Number       41- 50      999                  1111 1001 11
Serial Number     51- 64      99                  0000 0001 1000 11
Coarse Position   65- 85      DEFAULT              0111 1111 1101 1111 1111 1
BCH Encoded       86-106      Errors=0          1110 0010 0011 0110 0100 0
BCH Generated     86-106      1110 0010 0011 0110 0100 0
Long Message      107-144      Data Present
Fixed Bits        107-109
Fixed Bit         110          1                  110
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
=====
```



Product Service

2.5 SELF-TEST MODE

2.5.1 Equipment Under Test and Modification State

PLB-375 S/N: Unit #14 (TUV Ref TSR0003) - Modification State 4 (unless otherwise stated)

2.5.2 Date of Test

28 and 29 March 2011, 28 May 2011

2.5.3 Test Equipment Used

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

2.5.4 Environmental Conditions

Ambient Temperature 22 - 23°C

Relative Humidity 27 - 44%

2.5.5 Test Results

Ambient Temperature

```

=====
Beacon Id Format..... 22 Hex Id, Short Message, Bits 25-112
15 Hex (Bits 26- 85) = 192FF380C6FFBFF 192FF380C6FFBFF Default_Id
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23700000000

    26  30  34  38  42  46  50  54  58  62  66  70  74  78  82
    |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0010 1111 1111 0011 1000 0000 1100 0110 1111 1111 1011 1111 1111
    |   |   |   |   |   |   |   |   |   |   |   |   |
1110 0010 0011 0110 0100 0110 1110 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      201 ALBANIA 0011 0010 01
Protocol Code    37- 40      7 PLB - Serial (Standard) 0111
CSTA Number      41- 50      999 1111 1001 11
Serial Number    51- 64      99 0000 0001 1000 11
Coarse Position  65- 85      DEFAULT 0111 1111 1101 1111 1111 1
BCH Encoded      86-106     Errors=0 1110 0010 0011 0110 0100 0
BCH Generated    86-106     1110 0010 0011 0110 0100 0
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
=====

```



Product Service

Self-Test in presence of GPS Signal – Ambient Temperature – Modification State 6

```
=====
Beacon Id Format..... 22 Hex Id, Short Message, Bits 25-112
15 Hex (Bits 26- 85) = 192FF380C6FFBFF          192FF380C6FFBFF Default_Id
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23700000000
```

```

      26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
      |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0010 1111 1111 0011 1000 0000 1100 0110 1111 1111 1011 1111 1111
      |   |   |   |   |   |   |   |   |   |   |   |   |
      1110 0010 0011 0110 0100 0110 1110 0000 0000 0000 0000 0000 0000 0000 0000
      |   |   |   |   |   |   |   |   |   |   |   |   |
      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	201 ALBANIA	0011 0010 01
Protocol Code	37- 40	7 PLB - Serial (Standard)	0111
CSTA Number	41- 50	999	1111 1001 11
Serial Number	51- 64	99	0000 0001 1000 11
Coarse Position	65- 85	DEFAULT	0111 1111 1101 1111 1111 1
BCH Encoded	86-106	Errors=0	1110 0010 0011 0110 0100 0
BCH Generated	86-106		1110 0010 0011 0110 0100 0
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	

The above message was captured using the following procedure:

- The EUT was switched on in the presence of a good GPS signal
- The first burst from the EUT contained positional data
- The EUT was switched off
- A Self-Test was activated immediately
- Full hex message: FFFED08C97F9C0637FDFFF11B237



Product Service

Low Temperature

```

=====
Beacon Id Format..... 22 Hex Id, Short Message, Bits 25-112
15 Hex (Bits 26- 85) = 192FF380C6FFBFF      192FF380C6FFBFF Default_Id
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23700000000

    26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
    |   |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0010 1111 1111 0011 1000 0000 1100 0110 1111 1111 1011 1111 1111
    |   |   |   |   |   |   |   |   |   |   |   |   |   |
1110 0010 0011 0110 0100 0110 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      201 ALBANIA                                0011 0010 01
Protocol Code     37- 40      7 PLB - Serial (Standard)                    0111
CSTA Number       41- 50      999                                         1111 1001 11
Serial Number     51- 64      99                                         0000 0001 1000 11
Coarse Position   65- 85      DEFAULT                                0111 1111 1101 1111 1111 1
BCH Encoded       86-106      Errors=0                                1110 0010 0011 0110 0100 0
BCH Generated     86-106      1110 0010 0011 0110 0100 0
Fixed Bits       107-109
Fixed Bit        110          1                                          1
Encode Pos Device 111          1 Internal                                1
121.5 Homing     112          1 YES                                    1
Resultant Position --> Not Defined
=====

```



Product Service

High Temperature

```
=====
Beacon Id Format..... 22 Hex Id, Short Message, Bits 25-112
15 Hex (Bits 26- 85) = 192FF380C6FFBFF      192FF380C6FFBFF Default_Id
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23700000000

    26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
    |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0010 1111 1111 0011 1000 0000 1100 0110 1111 1111 1011 1111 1111
    |   |   |   |   |   |   |   |   |   |   |   |   |
1110 0010 0011 0110 0100 0110 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      201 ALBANIA      0011 0010 01
Protocol Code    37- 40      7 PLB - Serial (Standard)      0111
CSTA Number      41- 50      999      1111 1001 11
Serial Number    51- 64      99      0000 0001 1000 11
Coarse Position  65- 85      DEFAULT      0111 1111 1101 1111 1111 1
BCH Encoded      86-106      Errors=0      1110 0010 0011 0110 0100 0
BCH Generated    86-106      1110 0010 0011 0110 0100 0
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

=====
```



Product Service

2.6 GNSS SELF-TEST MODE

2.6.1 Equipment Under Test and Modification State

PLB-375 S/Ns: Unit #14 (TUV Ref TSR0003) and #4 (TUV Ref TSR0002) - Modification 4

2.6.2 Date of Test

28 March 2011 & 29 March 2011

2.6.3 Test Equipment Used

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

2.6.4 Environmental Conditions

Ambient Temperature 21 - 22 °C

Relative Humidity 25 - 35 %

2.6.5 Test Results

Ambient Temperature – GNSS Self-test (Without Valid Position Data Input)

	Standard Location Protocol	National Location Protocol
Full HEX Code	FFFED08C97F9C0637F DFFF11B23783E0F66C	FFFED08C9B0018DF C0FF042E19779F3C0010
Frame sync verification	011010000	011010000
Format Flag (1 bit)	1	1
Single Radiated burst (ms)	519.736	519.729
Default Position data	P	P
Single burst verification	P	P
Actual duration	125s	125s

Standard Location Protocol (Without Valid Position Data Input)

Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144

15 Hex (Bits 26- 85) = 192FF380C6FFBFF 192FF380C6FFBFF Default_Id

30 Hex (Bits 25-144) = 8C97F9C0637DFFFF11B23783E0F66C

26	30	34	38	42	46	50	54	58	62	66	70	74	78	82	
1	0001	1001	0010	1111	1111	0011	1000	0000	1100	0110	1111	1111	1011	1111	1111
	1110	0010	0011	0110	0100	0110	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	201 ALBANIA	0011 0010 01
Protocol Code	37- 40	7 PLB - Serial (Standard)	0111
CSTA Number	41- 50	999	1111 1001 11
Serial Number	51- 64	99	0000 0001 1000 11
Coarse Position	65- 85	DEFAULT	0111 1111 1101 1111 1111 1
BCH Encoded	86-106	Errors=0	1110 0010 0011 0110 0100 0
BCH Generated	86-106		1110 0010 0011 0110 0100 0
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

National Location Protocol (Without Valid Position Data Input)

Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144

15 Hex (Bits 26- 85) = 19360031BF81FE0 19360031BF81FE0 Default_Id

30 Hex (Bits 25-144) = 8C9B0018DFC0FF042E19779F3C0010

26	30	34	38	42	46	50	54	58	62	66	70	74	78	82	
1	0001	1001	0011	0110	0000	0000	0011	0001	1011	1111	1000	0001	1111	1110	0000
	1000	0101	1100	0011	0010	1110	1111	0011	1110	0111	1000	0000	0000	0010	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	1
Protocol Flag	26	0 Location NEW	0
MID	27- 36	201 ALBANIA	0011 0010 01
Protocol Code	37- 40	11 PLB Serial (National)	1011
Serial Number	41- 58	99	0000 0000 0001 1000 11
Medium Position	59- 85	DEFAULT	0111 1111 0000 0011 1111 1100 000
BCH Encoded	86-106	Errors=0	1000 0101 1100 0011 0010 1
BCH Generated	86-106		1000 0101 1100 0011 0010 1
Long Message	107-144	Data Present	
Fixed Bits	107-109		110
More Data Flag	110	1 Position Data in bits 113-132	1
Encode Pos Device	111	1 Internal	1
121.5 Homing	112	1 YES	1
Position Change	113-126	DEFAULT	1001 1111 0011 11
Resultant Position		--> Not Defined	
National Use	127-132	0 Default	0000 00
BCH Encoded	133-144	Errors=0	0000 0001 0000
BCH Generated	133-144		0000 0001 0000



Product Service

Ambient Temperature – GNSS Self-test (With Valid Position Data Input)

	Standard Location Protocol	National Location Protocol
Full HEX Code	FF FED08C97F9C063 33A039E6C1F71DA4D4D0	FF FED08C9B0018CC D701C889E7779208025B
Frame sync verification	011010000	011010000
Format Flag (1 bit)	1	1
Single Radiated burst (ms)	519.744	519.723
Position data	P	P
Single burst verification	P	P
Actual duration	39s	45s
Position Input Latitude	N51° 22.583'	N51° 22.583'
Position Input Longitude	W1° 49.833'	W1° 49.833'
Position Output Latitude	N 51°22.6'	N 51°22.6'
Position Output Longitude	W 1°49.87'	W 1°49.87'
Position Error (m)	49.8m	49.8m

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



Product Service

Standard Location Protocol (With Valid Position Data Input)

```

=====
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144
15 Hex (Bits 26- 85) = 192FF380C667407          192FF380C6FFBFF Default_Id
30 Hex (Bits 25-144) = 8C97F9C06333A039E6C1F71DA4D4D0

```

```

      26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
      |   |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0010 1111 1111 0011 1000 0000 1100 0110 0110 0111 0100 0000 0111
      |   |   |   |   |   |   |   |   |   |   |   |   |   |
      0011 1100 1101 1000 0011 1110 1110 0011 1011 0100 1001 1010 1001 1010 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	1
Protocol Flag	26	0 Location NEW	0
MID	27- 36	201 ALBANIA	0011 0010 01
Protocol Code	37- 40	7 PLB - Serial (Standard)	0111
CSTA Number	41- 50	999	1111 1001 11
Serial Number	51- 64	99	0000 0001 1000 11
Coarse Position	65- 85	Data Present	
Latitude Flag	65	0 North:	0
Latitude Degrees	66- 72	51 51 deg	0110 011
Latitude Min /15	73- 74	2 30 min	10
Longitude Flag	75	1 West:	1
Longitude Degrees	76- 83	1 1 deg	0000 0001
Longitude Min /15	84- 85	3 45 min	11
BCH Encoded	86-106	Errors=0	0011 1100 1101 1000 0011 1
BCH Generated	86-106		0011 1100 1101 1000 0011 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	Data Present	
Lat. Change Sign	113	0 Minus:	0
Lat. Chg. Minutes	114-118	7 7 min	0011 1
Lat. Chg. Secs /4	119-122	6 24 sec	0110
Long Change Sign	123	1 Plus:	1
Long Chg. Minutes	124-128	4 4 min	0010 0
Long Chg. Secs /4	129-132	13 52 sec	1101
Resultant Position		--> 51.37667 LAT, -1.83111 LONG	
		51 deg 22 min 36 sec N, 1 deg 49 min 52 sec W	
BCH Encoded	133-144	Errors=0	0100 1101 0000
BCH Generated	133-144		0100 1101 0000



Product Service

National Location Protocol (With Valid Position Data Input)

```

=====
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144
15 Hex (Bits 26- 85) = 1936003199AE039          19360031BF81FE0 Default_Id
30 Hex (Bits 25-144) = 8C9B0018CCD701C889E7779208025B

    26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
    |   |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0011 0110 0000 0000 0011 0001 1001 1001 1010 1110 0000 0011 1001
    0001 0001 0011 1100 1110 1110 1111 0010 0100 0001 0000 0000 0100 1011 011
    |   |   |   |   |   |   |   |   |   |   |   |   |   |
    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    201 ALBANIA          0011 0010 01
Protocol Code    37- 40    11 PLB Serial (National) 1011
Serial Number    41- 58    99                  0000 0000 0001 1000 11
Medium Position  59- 85    Data Present
Latitude Flag    59        0 North:           0
Latitude Degrees 60- 66    51 51 deg          0110 011
Lat. Minutes /2  67- 71    11 22 min          0101 1
Longitude Flag   72        1 West:           1
Long. Degrees    73- 80    1 1 deg          0000 0001
Long. Minutes /2 81- 85    25 50 min          1100 1
BCH Encoded      86-106    Errors=0          0001 0001 0011 1100 1110 1
BCH Generated     86-106    0001 0001 0011 1100 1110 1
Long Message     107-144    Data Present
Fixed Bits       107-109
More Data Flag   110        1 Position Data in bits 113-132 1
Encode Pos Device 111        1 Internal      1
121.5 Homing     112        1 YES            1
Position Change  113-126    Data Present
Lat. Change Sign 113        1 Plus:           1
Lat. Chg. Minutes 114-115    0 0 min          00
Lat. Chg. Secs /4 116-119    9 36 sec          1001
Long Change Sign 120        0 Minus:          0
Long Chg. Minutes 121-122    0 0 min          00
Long Chg. Secs /4 123-126    2 8 sec          0010
Resultant Position --> 51.37667 LAT, -1.83111 LONG
                    51 deg 22 min 36 sec N, 1 deg 49 min 52 sec W
National Use     127-132    0 Default      0000 00
BCH Encoded      133-144    Errors=0          0010 0101 1011
BCH Generated     133-144    0010 0101 1011
=====

```

Low Temperature – GNSS Self-test (Without Valid Position Data Input)

	Standard Location Protocol	National Location Protocol
Full HEX Code	FF FED08C97F9C0637 FD FFF11B23783E0F66C	FF FED08C9B0018DFC0 FF 042E19779F3C0010
Frame sync verification	011010000	011010000
Format Flag (1 bit)	1	1
Single Radiated burst (ms)	519.746	519.716
Default Position data	P	P
Single burst verification	P	P
Actual duration	125s	125s

Standard Location Protocol (Without Valid Position Data Input)

=====

Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144

15 Hex (Bits 26- 85) = 192FF380C6FFBFF 192FF380C6FFBFF Default_Id

30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23783E0F66C

```

26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
|   |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0010 1111 1111 0011 1000 0000 1100 0110 1111 1111 1011 1111 1111
1110 0010 0011 0110 0100 0110 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	201 ALBANIA	0011 0010 01
Protocol Code	37- 40	7 PLB - Serial (Standard)	0111
CSTA Number	41- 50	999	1111 1001 11
Serial Number	51- 64	99	0000 0001 1000 11
Coarse Position	65- 85	DEFAULT	0111 1111 1101 1111 1111 1
BCH Encoded	86-106	Errors=0	1110 0010 0011 0110 0100 0
BCH Generated	86-106		1110 0010 0011 0110 0100 0
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

=====



Product Service

National Location Protocol (Without Valid Position Data Input)

=====															
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144															
15 Hex (Bits 26- 85) = 19360031BF81FE0 19360031BF81FE0 Default_Id															
30 Hex (Bits 25-144) = 8C9B0018DFC0FF042E19779F3C0010															
	26	30	34	38	42	46	50	54	58	62	66	70	74	78	82
1	0001	1001	0011	0110	0000	0000	0011	0001	1011	1111	1000	0001	1111	1110	0000
	1000	0101	1100	0011	0010	1110	1111	0011	1110	0111	1000	0000	0000	0010	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		1									
Protocol Flag	26			0 Location NEW		0									
MID	27- 36			201 ALBANIA		0011 0010 01									
Protocol Code	37- 40			11 PLB Serial (National)		1011									
Serial Number	41- 58			99		0000 0000 0001 1000 11									
Medium Position	59- 85			DEFAULT		0111 1111 0000 0011 1111 1100 000									
BCH Encoded	86-106			Errors=0		1000 0101 1100 0011 0010 1									
BCH Generated	86-106					1000 0101 1100 0011 0010 1									
Long Message	107-144			Data Present											
Fixed Bits	107-109					110									
More Data Flag	110			1 Position Data in bits 113-132		1									
Encode Pos Device	111			1 Internal		1									
121.5 Homing	112			1 YES		1									
Position Change	113-126			DEFAULT		1001 1111 0011 11									
Resultant Position				--> Not Defined											
National Use	127-132			0 Default		0000 00									
BCH Encoded	133-144			Errors=0		0000 0001 0000									
BCH Generated	133-144					0000 0001 0000									
=====															



Product Service

Low Temperature – GNSS Self-test (With Valid Position Data Input)

	Standard Location Protocol	National Location Protocol
Full HEX Code	FF FED08C97F9C063 33A039E6C1F71DA4D4D0	FF FED08C9B0018CC D701C889E777920C0AB2
Frame sync verification	P	P
Format Flag (1 bit)	1	1
Single Radiated burst (ms)	519.739	519.654
Position data	P	P
Single burst verification	P	P
Actual duration	37s	51s
Position Input Latitude	N51° 22.583'	N51° 22.583'
Position Input Longitude	W1° 49.833'	W1° 49.833'
Position Output Latitude	N 51°22.6'	N 51°22.6'
Position Output Longitude	W 1°49.87'	W 1°49.8'
Position Error (m)	49.8m	49.2m

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



Product Service

Standard Location Protocol (With Valid Position Data Input)

```

=====
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144
15 Hex (Bits 26- 85) = 192FF380C667407          192FF380C6FFBFF Default_Id
30 Hex (Bits 25-144) = 8C97F9C06333A039E6C1F71DA4D4D0

    26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
1 | 0001 | 1001 | 0010 | 1111 | 1111 | 0011 | 1000 | 0000 | 1100 | 0110 | 0110 | 0111 | 0100 | 0000 | 0111
  | 0011 | 1100 | 1101 | 1000 | 0011 | 1110 | 1110 | 0011 | 1011 | 0100 | 1001 | 1010 | 1001 | 1010 | 0000
  | 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    201 ALBANIA          0011 0010 01
Protocol Code   37- 40    7 PLB - Serial (Standard) 0111
CSTA Number     41- 50    999              1111 1001 11
Serial Number   51- 64    99              0000 0001 1000 11
Coarse Position 65- 85    Data Present
Latitude Flag   65       0 North:              0
Latitude Degrees 66- 72    51 51 deg          0110 011
Latitude Min /15 73- 74    2 30 min           10
Longitude Flag  75       1 West:              1
Longitude Degrees 76- 83    1 1 deg            0000 0001
Longitude Min /15 84- 85    3 45 min           11
BCH Encoded     86-106    Errors=0           0011 1100 1101 1000 0011 1
BCH Generated   86-106    0011 1100 1101 1000 0011 1
Long Message    107-144   Data Present
Fixed Bits      107-109
Fixed Bit       110      1
Encode Pos Device 111     1 Internal
121.5 Homing    112     1 YES
Position Change 113-132   Data Present
Lat. Change Sign 113     0 Minus:              0
Lat. Chg. Minutes 114-118 7 7 min           0011 1
Lat. Chg. Secs /4 119-122 6 24 sec          0110
Long Change Sign 123     1 Plus:              1
Long Chg. Minutes 124-128 4 4 min           0010 0
Long Chg. Secs /4 129-132 13 52 sec          1101
Resultant Position --> 51.37667 LAT, -1.83111 LONG
                    51 deg 22 min 36 sec N, 1 deg 49 min 52 sec W
BCH Encoded     133-144   Errors=0           0100 1101 0000
BCH Generated   133-144   0100 1101 0000
=====

```



Product Service

National Location Protocol (With Valid Position Data Input)

```

=====
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144
15 Hex (Bits 26- 85) = 1936003199AE039          19360031BF81FE0 Default_Id
30 Hex (Bits 25-144) = 8C9B0018CCD701C889E777920C0AB2

    26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
    |   |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0011 0110 0000 0000 0011 0001 1001 1001 1010 1110 0000 0011 1001
    0001 0001 0011 1100 1110 1110 1111 0010 0100 0001 1000 0001 0101 0110 010
    |   |   |   |   |   |   |   |   |   |   |   |   |   |
    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      201 ALBANIA          0011 0010 01
Protocol Code    37- 40      11 PLB Serial (National) 1011
Serial Number    41- 58      99          0000 0000 0001 1000 11
Medium Position  59- 85      Data Present
Latitude Flag    59          0 North:          0
Latitude Degrees 60- 66      51 51 deg          0110 011
Lat. Minutes /2  67- 71      11 22 min          0101 1
Longitude Flag   72          1 West:          1
Long. Degrees    73- 80      1 1 deg          0000 0001
Long. Minutes /2 81- 85      25 50 min          1100 1
BCH Encoded      86-106      Errors=0          0001 0001 0011 1100 1110 1
BCH Generated    86-106      0001 0001 0011 1100 1110 1
Long Message     107-144      Data Present
Fixed Bits       107-109
More Data Flag   110          1 Position Data in bits 113-132 1
Encode Pos Device 111          1 Internal      1
121.5 Homing     112          1 YES          1
Position Change  113-126      Data Present
Lat. Change Sign 113          1 Plus:          1
Lat. Chg. Minutes 114-115      0 0 min          00
Lat. Chg. Secs /4 116-119      9 36 sec          1001
Long Change Sign 120          0 Minus:          0
Long Chg. Minutes 121-122      0 0 min          00
Long Chg. Secs /4 123-126      3 12 sec          0011
Resultant Position --> 51.37667 LAT, -1.83000 LONG
                    51 deg 22 min 36 sec N, 1 deg 49 min 48 sec W
National Use     127-132      0 Default      0000 00
BCH Encoded      133-144      Errors=0          1010 1011 0010
BCH Generated    133-144      1010 1011 0010
=====

```

High Temperature – GNSS Self-test (Without Valid Position Data Input)

	Standard Location Protocol	National Location Protocol
Full HEX Code	FF FED08C97F9C0637F DFFF11B23783E0F66C	FF FED08C9B0018DFC 0FF042E19779F3C0010
Frame sync verification	P	P
Format Flag (1 bit)	1	1
Single Radiated burst (ms)	519.704	519.732
Default Position data	P	P
Single burst verification	P	P
Actual duration	125s	125s

Standard Location Protocol (Without Valid Position Data Input)

```

=====
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144
15 Hex (Bits 26- 85) = 192FF380C6FFBFF      192FF380C6FFBFF Default_Id
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23783E0F66C

      26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
      |   |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0010 1111 1111 0011 1000 0000 1100 0110 1111 1111 1011 1111 1111
      |   |   |   |   |   |   |   |   |   |   |   |   |   |
      1110 0010 0011 0110 0100 0110 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      201 ALBANIA          0011 0010 01
Protocol Code     37- 40      7 PLB - Serial (Standard) 0111
CSTA Number       41- 50      999                  1111 1001 11
Serial Number     51- 64      99                  0000 0001 1000 11
Coarse Position   65- 85      DEFAULT          0111 1111 1101 1111 1111 1
BCH Encoded       86-106      Errors=0          1110 0010 0011 0110 0100 0
BCH Generated     86-106      1110 0010 0011 0110 0100 0
Long Message     107-144      Data Present
Fixed Bits       107-109
Fixed Bit        110          1                  110
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 133-144      --> Not Defined
BCH Encoded      133-144      Errors=0          0110 0110 1100
BCH Generated    133-144      0110 0110 1100
=====

```



Product Service

National Location Protocol (Without Valid Position Data Input)

=====															
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144															
15 Hex (Bits 26- 85) = 19360031BF81FE0 19360031BF81FE0 Default_Id															
30 Hex (Bits 25-144) = 8C9B0018DFC0FF042E19779F3C0010															
	26	30	34	38	42	46	50	54	58	62	66	70	74	78	82
1															
	0001	1001	0011	0110	0000	0000	0011	0001	1011	1111	1000	0001	1111	1110	0000
	1000	0101	1100	0011	0010	1110	1111	0011	1110	0111	1000	0000	0000	0010	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		1									
Protocol Flag	26			0 Location NEW		0									
MID	27- 36			201 ALBANIA		0011 0010 01									
Protocol Code	37- 40			11 PLB Serial (National)		1011									
Serial Number	41- 58			99		0000 0000 0001 1000 11									
Medium Position	59- 85			DEFAULT		0111 1111 0000 0011 1111 1100 000									
BCH Encoded	86-106			Errors=0		1000 0101 1100 0011 0010 1									
BCH Generated	86-106					1000 0101 1100 0011 0010 1									
Long Message	107-144			Data Present											
Fixed Bits	107-109					110									
More Data Flag	110			1 Position Data in bits 113-132		1									
Encode Pos Device	111			1 Internal		1									
121.5 Homing	112			1 YES		1									
Position Change	113-126			DEFAULT		1001 1111 0011 11									
Resultant Position				--> Not Defined											
National Use	127-132			0 Default		0000 00									
BCH Encoded	133-144			Errors=0		0000 0001 0000									
BCH Generated	133-144					0000 0001 0000									
=====															



Product Service

High Temperature – GNSS Self-test (With Valid Position Data Input)

	Standard Location Protocol	National Location Protocol
Full HEX Code	FFED08C97F9C063 33A039E6C1F71DA4C1E9	FFED08C9B0018CCD 701C889E7779208025B
Frame sync verification	P	P
Format Flag (1 bit)	1	1
Single Radiated burst (ms)	519.734	519.755
Position data	P	P
Single burst verification	P	P
Actual duration	41s	55s
Position Input Latitude	N51° 22.583'	N51° 22.583'
Position Input Longitude	W1° 49.833'	W1° 49.833'
Position Output Latitude	N 51°22.6'	N 51°22.6'
Position Output Longitude	W 1°49.8'	W 1°49.87'
Position Error (m)	49.2	49.8m

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



Product Service

Standard Location Protocol (With Valid Position Data Input)

```

=====
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144
15 Hex (Bits 26- 85) = 192FF380C667407      192FF380C6FFBFF Default_Id
30 Hex (Bits 25-144) = 8C97F9C06333A039E6C1F71DA4C1E9

    26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
    |   |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 | 1001 | 0010 | 1111 | 1111 | 0011 | 1000 | 0000 | 1100 | 0110 | 0110 | 0111 | 0100 | 0000 | 0111
    0011 | 1100 | 1101 | 1000 | 0011 | 1110 | 1110 | 0011 | 1011 | 0100 | 1001 | 1000 | 0011 | 1101 | 001
    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
    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       201 ALBANIA            0011 0010 01
Protocol Code    37- 40       7 PLB - Serial (Standard) 0111
CSTA Number     41- 50       999                    1111 1001 11
Serial Number    51- 64       99                    0000 0001 1000 11
Coarse Position  65- 85       Data Present
Latitude Flag    65           0 North:           0
Latitude Degrees 66- 72       51 51 deg         0110 011
Latitude Min /15 73- 74       2 30 min          10
Longitude Flag   75           1 West:           1
Longitude Degrees 76- 83       1 1 deg           0000 0001
Longitude Min /15 84- 85       3 45 min          11
BCH Encoded      86-106      Errors=0            0011 1100 1101 1000 0011 1
BCH Generated     86-106      0011 1100 1101 1000 0011 1
Long Message     107-144     Data Present
Fixed Bits       107-109     110
Fixed Bit        110         1
Encode Pos Device 111         1 Internal       1
121.5 Homing     112         1 YES            1
Position Change  113-132     Data Present
Lat. Change Sign 113         0 Minus:         0
Lat. Chg. Minutes 114-118     7 7 min         0011 1
Lat. Chg. Secs /4 119-122     6 24 sec        0110
Long Change Sign 123         1 Plus:          1
Long Chg. Minutes 124-128     4 4 min         0010 0
Long Chg. Secs /4 129-132     12 48 sec       1100
Resultant Position --> 51.37667 LAT, -1.83000 LONG
                    51 deg 22 min 36 sec N, 1 deg 49 min 48 sec W
BCH Encoded      133-144     Errors=0            0001 1110 1001
BCH Generated     133-144     0001 1110 1001
=====

```



Product Service

National Location Protocol (With Valid Position Data Input)

```

=====
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144
15 Hex (Bits 26- 85) = 1936003199AE039          19360031BF81FE0 Default_Id
30 Hex (Bits 25-144) = 8C9B0018CCD701C889E7779208025B

    26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
    |   |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0011 0110 0000 0000 0011 0001 1001 1001 1010 1110 0000 0011 1001
    0001 0001 0011 1100 1110 1110 1111 0010 0100 0001 0000 0000 0100 1011 011
    |   |   |   |   |   |   |   |   |   |   |   |   |   |
    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      201 ALBANIA          0011 0010 01
Protocol Code    37- 40      11 PLB Serial (National) 1011
Serial Number    41- 58      99                  0000 0000 0001 1000 11
Medium Position  59- 85      Data Present
Latitude Flag    59          0 North:          0
Latitude Degrees 60- 66      51 51 deg          0110 011
Lat. Minutes /2  67- 71      11 22 min          0101 1
Longitude Flag   72          1 West:          1
Long. Degrees    73- 80      1 1 deg          0000 0001
Long. Minutes /2 81- 85      25 50 min          1100 1
BCH Encoded      86-106      Errors=0          0001 0001 0011 1100 1110 1
BCH Generated    86-106      0001 0001 0011 1100 1110 1
Long Message     107-144      Data Present
Fixed Bits       107-109
More Data Flag   110          1 Position Data in bits 113-132 110
Encode Pos Device 111          1 Internal      1
121.5 Homing     112          1 YES          1
Position Change  113-126      Data Present
Lat. Change Sign 113          1 Plus:          1
Lat. Chg. Minutes 114-115      0 0 min          00
Lat. Chg. Secs /4 116-119      9 36 sec          1001
Long Change Sign 120          0 Minus:         0
Long Chg. Minutes 121-122      0 0 min          00
Long Chg. Secs /4 123-126      2 8 sec          0010
Resultant Position --> 51.37667 LAT, -1.83111 LONG
                    51 deg 22 min 36 sec N, 1 deg 49 min 52 sec W
National Use     127-132      0 Default      0000 00
BCH Encoded      133-144      Errors=0          0010 0101 1011
BCH Generated    133-144      0010 0101 1011
=====

```



Product Service

2.7 THERMAL SHOCK

2.7.1 Equipment Under Test and Modification State

PLB-375 S/N: Unit #14 - Modification State 3 (TUV Ref TSR0003) – Modification State 3

2.7.2 Date of Test

07 March 2011

2.7.3 Test Equipment Used

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

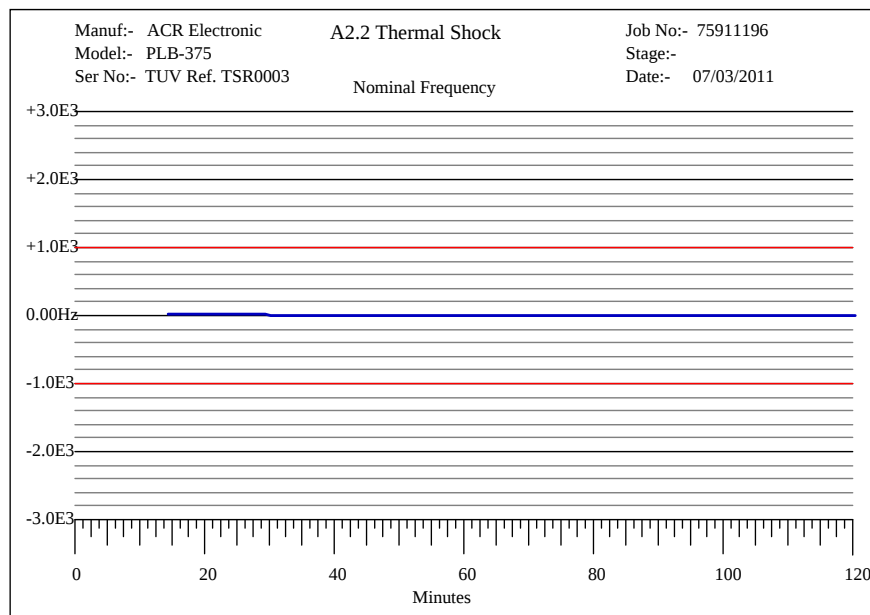
2.7.4 Environmental Conditions

Ambient Temperature 23 °C

Relative Humidity 22 %

2.7.5 Test Results

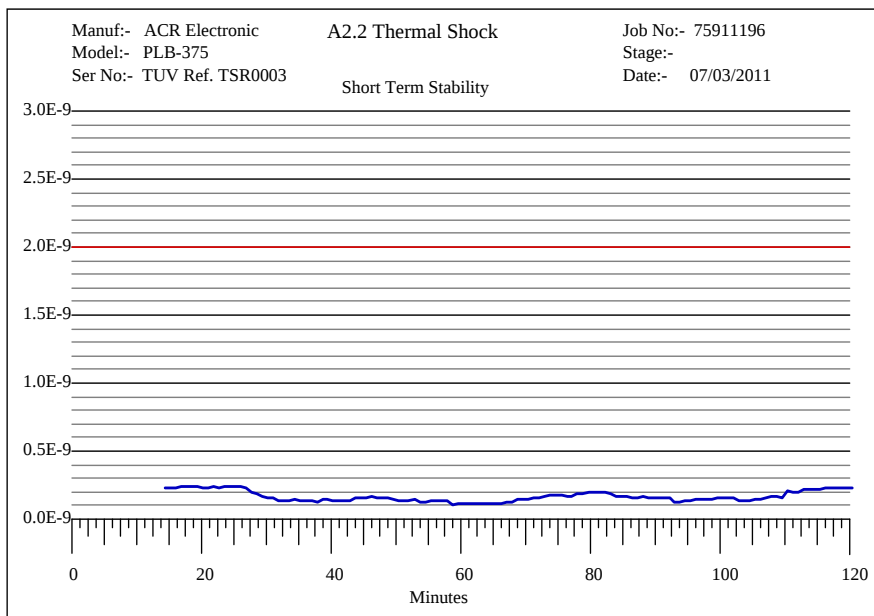
Nominal Frequency



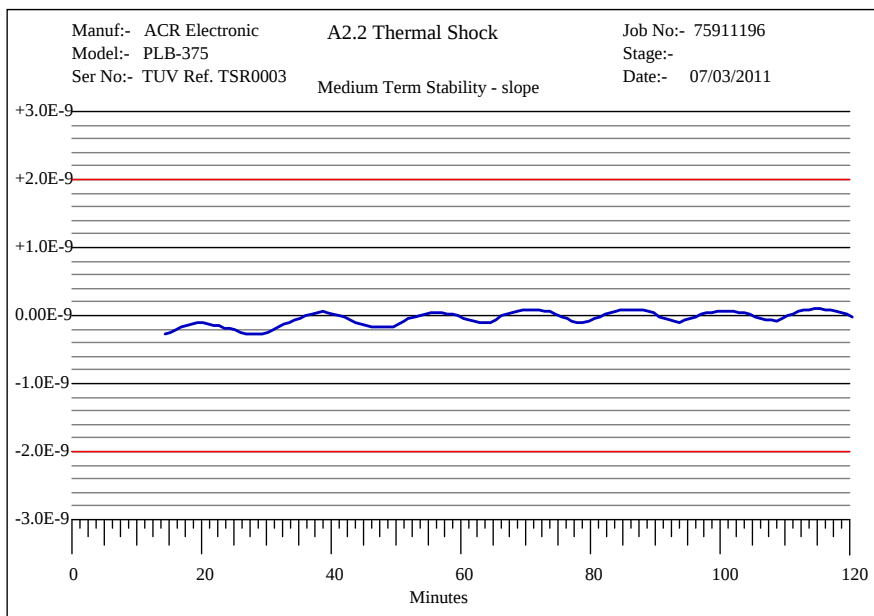


Product Service

Short Term Stability



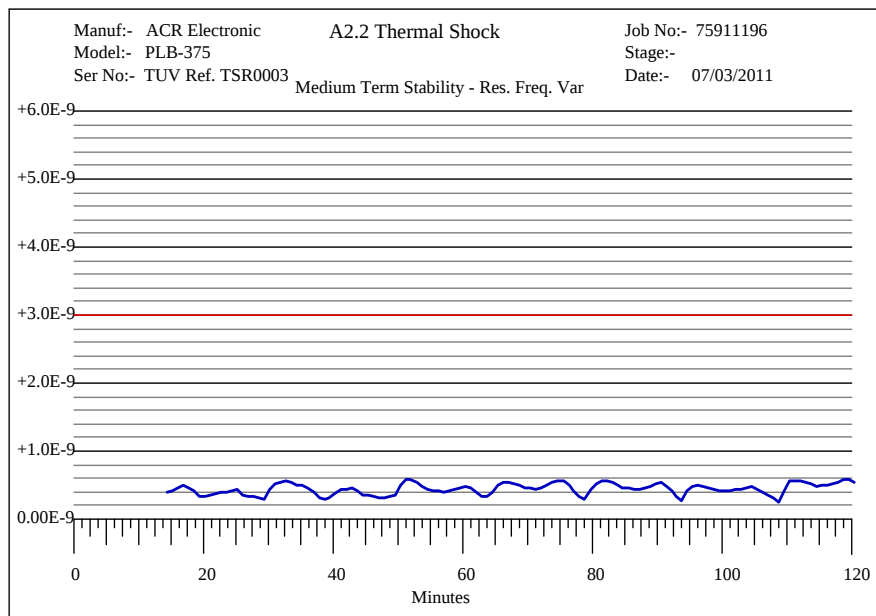
Medium Term Stability, Mean Slope



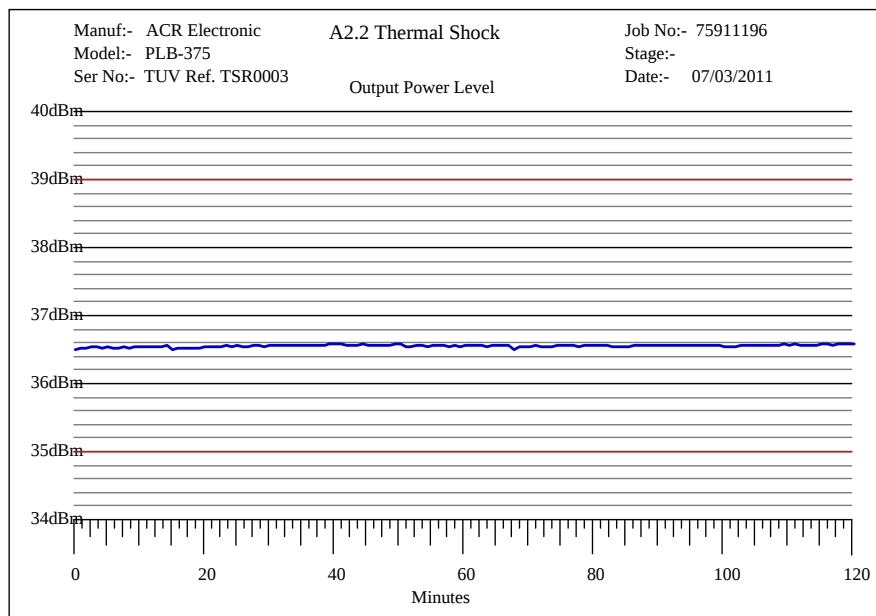


Product Service

Medium Term Stability, Residual Frequency Variation



Output Power





Product Service

Digital Message

=====															
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144															
15 Hex (Bits 26- 85) = 192FF380C6FFBFF 192FF380C6FFBFF Default_Id															
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23783E0F66C															
	26	30	34	38	42	46	50	54	58	62	66	70	74	78	82
1	0001	1001	0010	1111	1111	0011	1000	0000	1100	0110	1111	1111	1011	1111	1111
	1110	0010	0011	0110	0100	0110	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		201 ALBANIA											0011 0010 01	
Protocol Code	37- 40		7 PLB - Serial (Standard)											0111	
CSTA Number	41- 50		999											1111 1001 11	
Serial Number	51- 64		99											0000 0001 1000 11	
Coarse Position	65- 85		DEFAULT											0111 1111 1101 1111 1111 1	
BCH Encoded	86-106		Errors=0											1110 0010 0011 0110 0100 0	
BCH Generated	86-106													1110 0010 0011 0110 0100 0	
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	
=====															



Product Service

2.8 OPERATING LIFETIME AT MINIMUM TEMPERATURE

2.8.1 Equipment Under Test and Modification State

PLB-375 S/N: Unit #7 (TUV Ref TSR0036) - Modification State 5

2.8.2 Date of Test

10 May 2011 & 19 May 2011

2.8.3 Test Equipment Used

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

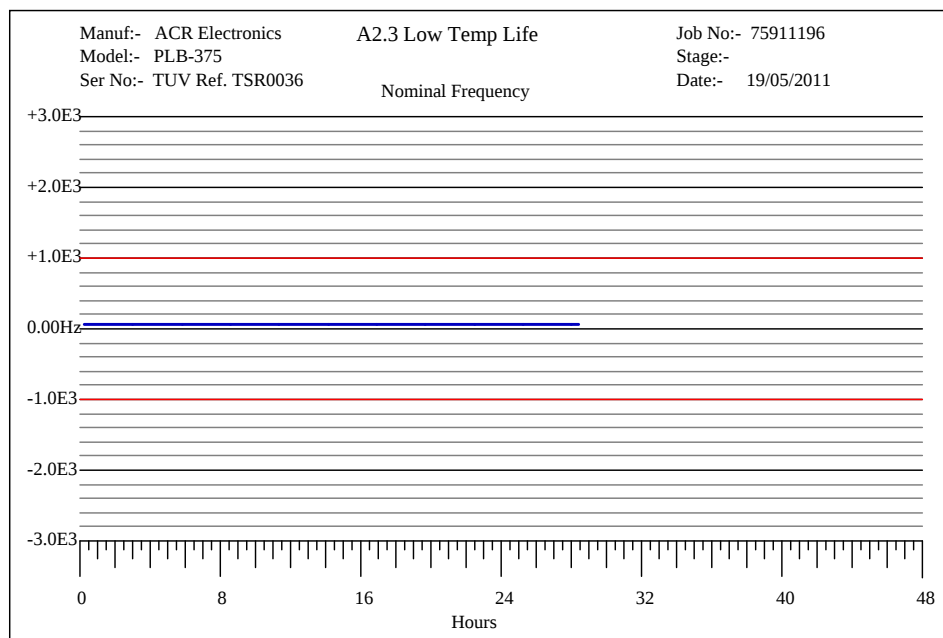
2.8.4 Environmental Conditions

Ambient Temperature 21 - 22.2 °C

Relative Humidity 32 - 37 %

2.8.5 Test Results

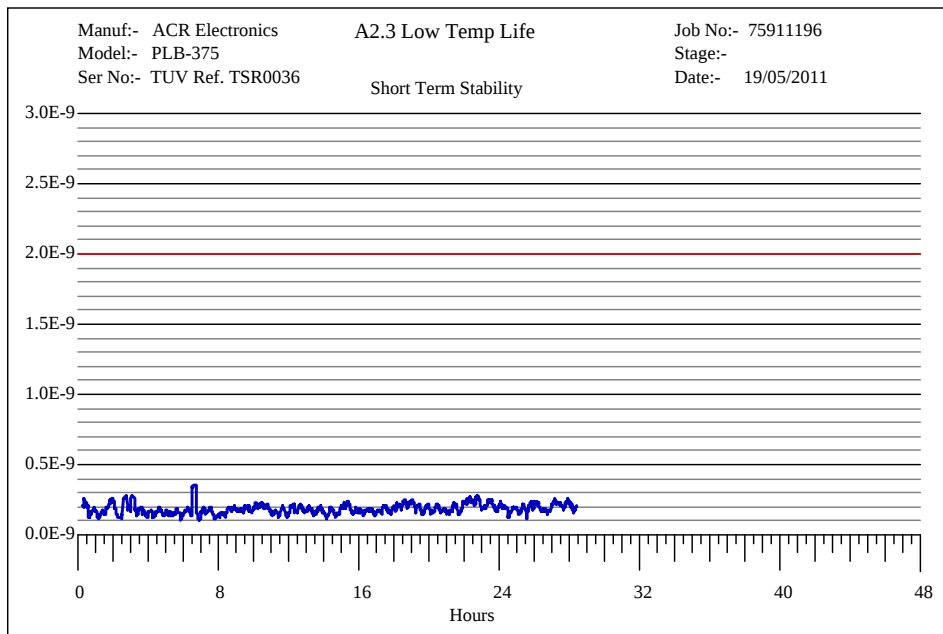
Nominal Frequency



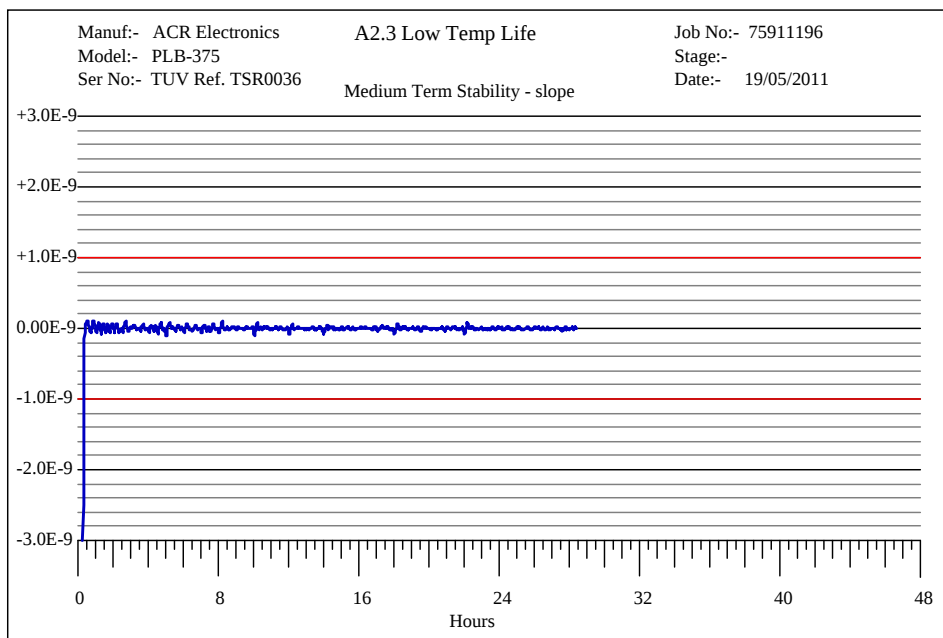


Product Service

Short Term Stability



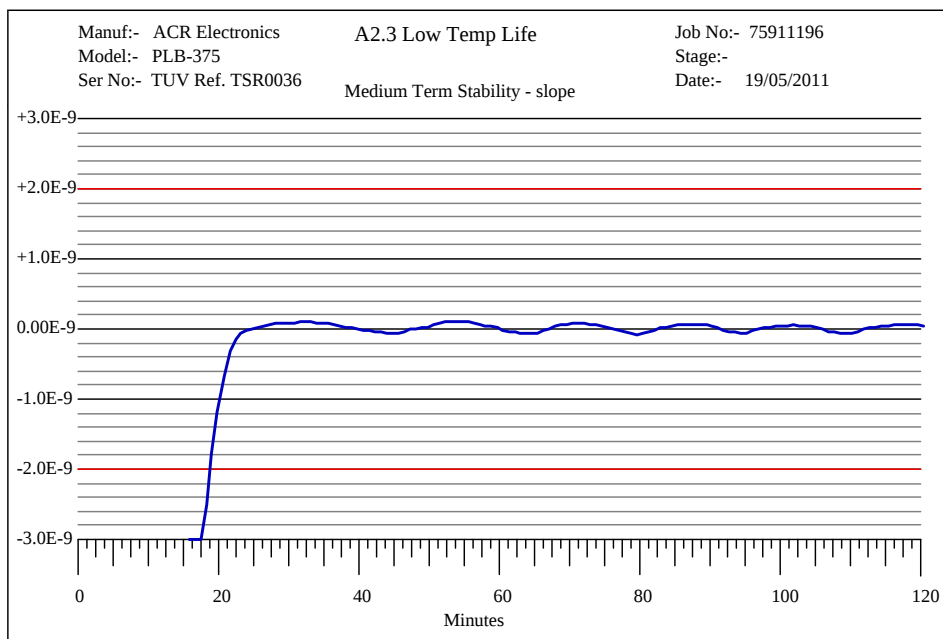
Medium Term Stability, Mean Slope



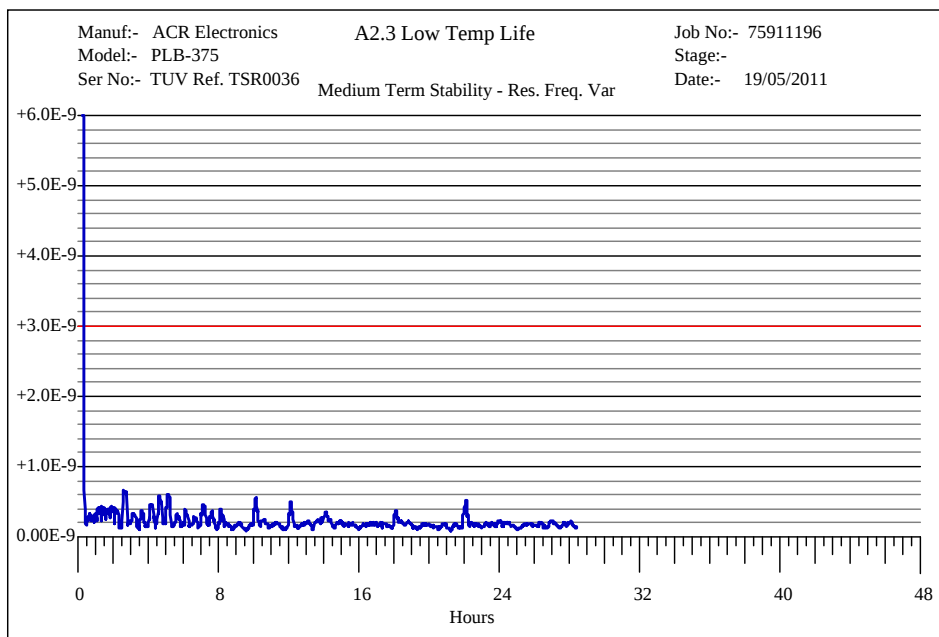


Product Service

Medium Term Stability, Mean Slope (First 2 Hours)



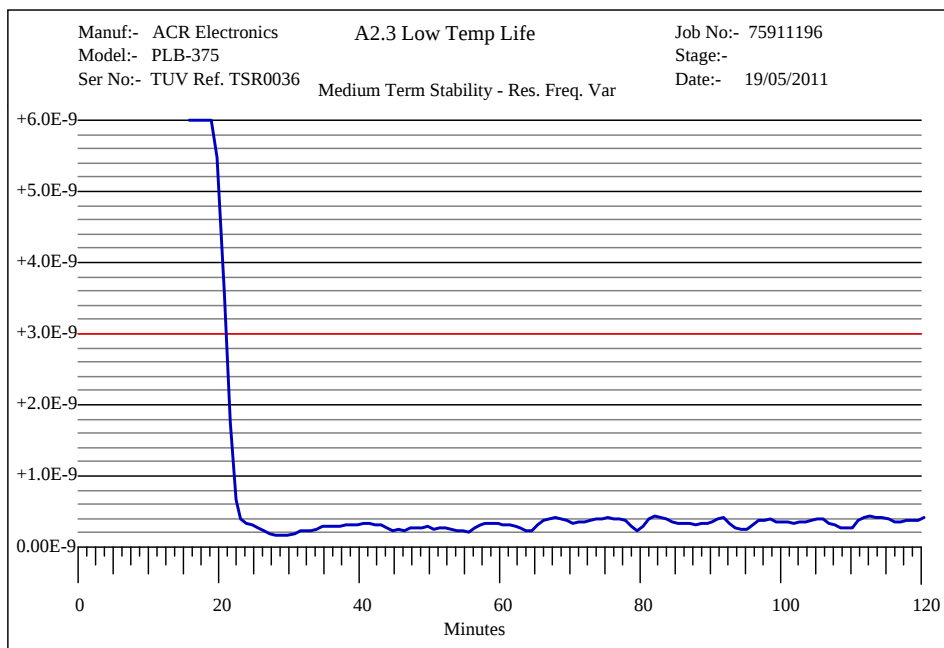
Medium Term Stability, Residual Frequency Variation



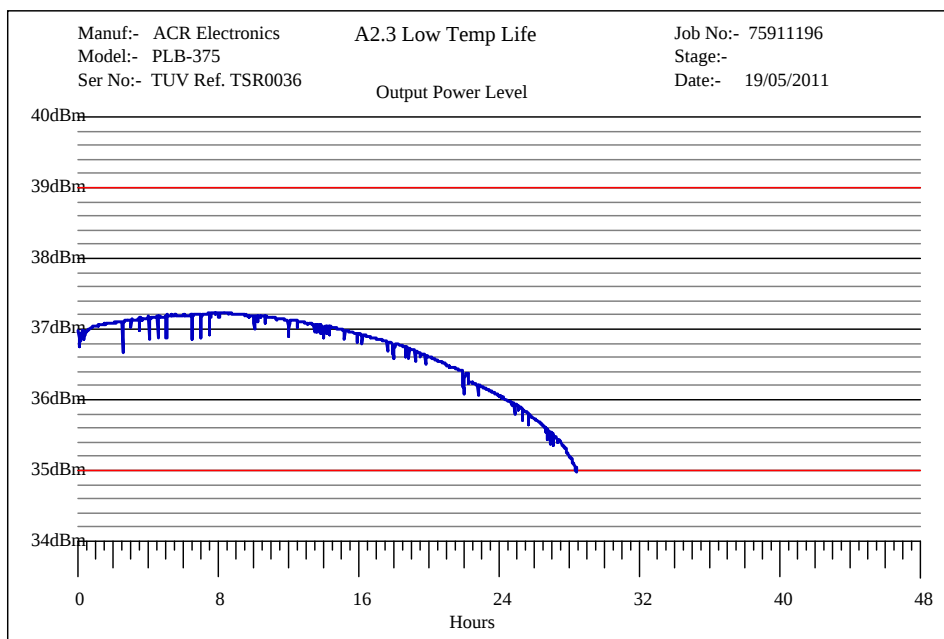


Product Service

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



Output Power





Product Service

Test Data (First 0.5hrs)

Burst No.	Nom Freq	STS	MTS-Slope	MTS_Res	Power	Time hrs
1	0	0.00E+00	0.00E+00	0.00E+00	36.979	0.027574
2	0	0.00E+00	0.00E+00	0.00E+00	36.871	0.041784
3	0	0.00E+00	0.00E+00	0.00E+00	36.853	0.055898
4	0	0.00E+00	0.00E+00	0.00E+00	36.795	0.069909
5	0	0.00E+00	0.00E+00	0.00E+00	36.759	0.083468
6	0	0.00E+00	0.00E+00	0.00E+00	36.787	0.097652
7	0	0.00E+00	0.00E+00	0.00E+00	36.816	0.111836
8	0	0.00E+00	0.00E+00	0.00E+00	36.836	0.125104
9	0	0.00E+00	0.00E+00	0.00E+00	36.852	0.139236
10	0	0.00E+00	0.00E+00	0.00E+00	36.871	0.153134
11	0	0.00E+00	0.00E+00	0.00E+00	36.884	0.166354
12	0	0.00E+00	0.00E+00	0.00E+00	36.904	0.180599
13	0	0.00E+00	0.00E+00	0.00E+00	36.92	0.194471
14	0	0.00E+00	0.00E+00	0.00E+00	36.934	0.207713
15	0	0.00E+00	0.00E+00	0.00E+00	36.94	0.221233
16	0	0.00E+00	0.00E+00	0.00E+00	36.953	0.234766
17	0	0.00E+00	0.00E+00	0.00E+00	36.961	0.24931
18	4.06E+08	2.08E-10	-4.66E-09	9.74E-09	36.97	0.262851
19	4.06E+08	2.09E-10	-3.96E-09	9.80E-09	36.973	0.276497
20	4.06E+08	2.08E-10	-3.23E-09	9.44E-09	36.958	0.290781
21	4.06E+08	2.08E-10	-2.50E-09	8.57E-09	36.977	0.304093
22	4.06E+08	2.07E-10	-1.80E-09	7.20E-09	36.983	0.317661
23	4.06E+08	2.02E-10	-1.18E-09	5.47E-09	36.845	0.331311
24	4.06E+08	2.57E-10	-6.67E-10	3.57E-09	36.869	0.345764
25	4.06E+08	2.56E-10	-3.22E-10	1.75E-09	36.894	0.359826
26	4.06E+08	2.46E-10	-1.38E-10	6.74E-10	36.903	0.373689
27	4.06E+08	2.42E-10	-6.58E-11	4.05E-10	36.916	0.386927
28	4.06E+08	2.42E-10	-2.96E-11	3.36E-10	36.928	0.400148
29	4.06E+08	2.35E-10	-4.61E-12	3.04E-10	36.935	0.413537
30	4.06E+08	2.35E-10	1.90E-11	2.79E-10	36.942	0.427526
31	4.06E+08	2.30E-10	4.34E-11	2.29E-10	36.947	0.441949
32	4.06E+08	2.16E-10	6.22E-11	1.84E-10	36.951	0.455408
33	4.06E+08	2.27E-10	7.67E-11	1.65E-10	36.957	0.469731
34	4.06E+08	2.01E-10	7.65E-11	1.66E-10	36.959	0.484154
35	4.06E+08	2.05E-10	7.42E-11	1.71E-10	36.962	0.498047



Product Service

Digital Message

```
=====
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144
15 Hex (Bits 26- 85) = 192FF380C6FFBFF      192FF380C6FFBFF Default_Id
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23783E0F66C

    26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
    |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0010 1111 1111 0011 1000 0000 1100 0110 1111 1111 1011 1111 1111
    |   |   |   |   |   |   |   |   |   |   |   |   |
    86   90   94   98  102  106  110  114  118  122  126  130  134  138  142
    |   |   |   |   |   |   |   |   |   |   |   |   |
1110 0010 0011 0110 0100 0110 1111 0000 0111 1100 0001 1110 1100 1101 100

Field Name      Bit Pos      Value Decode      Bits
-----
Format Flag      25          1 Long Message      1
Protocol Flag    26          0 Location NEW      0
MID              27- 36      201 ALBANIA          0011 0010 01
Protocol Code    37- 40      7 PLB - Serial (Standard) 0111
CSTA Number      41- 50      999                  1111 1001 11
Serial Number    51- 64      99                   0000 0001 1000 11
Coarse Position  65- 85      DEFAULT          0111 1111 1101 1111 1111 1
BCH Encoded      86-106     Errors=0          1110 0010 0011 0110 0100 0
BCH Generated    86-106     1110 0010 0011 0110 0100 0
Long Message     107-144     Data Present
Fixed Bits       107-109
Fixed Bit        110          1                  110
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
=====
```



Product Service

Battery Current Measurement Results

Battery Discharge Current

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

Beacon in the Off or Standby State, "Standby Current"

Beacon performing a Self-test, "Self-test Current"

Beacon activated and transmitting, "Operating Current"

The individual tests were conducted for the following durations:

Standby Current	: 15 minutes	(899120 ms)
Self-test Current	: 10.5 seconds	(10480 ms)
GPS ST Current	: 133 seconds	(132800 ms)
Operating Current	: 9.94 minutes	(596320 ms)

Assumptions / Supplied Data

Battery Useful Life	: 12 years	(10 years plus 2 year shelf life)
Battery Capacity	: 1.55 Ah	
Battery Self Drain	: 1.00 % per year	
Self-test Interval	: 12 tests per year	
GPS Self-test Interval	: 1 tests per year	(12 in total over 12 years)

Test Results

Mode Current	= Accumulated Charge / Time	
Standby Current	= $-455908.49 \text{ pC} / 899120 \text{ ms}$	= -0.51 nA
Self-test Current	= $950272.8 \text{ uC} / 10480 \text{ ms}$	= 90.67 mA
GPS ST Current	= $4817737.04 \text{ uC} / 132800 \text{ ms}$	= 36.28 mA
Operating Current	= $19150045.16 \text{ uC} / 596320 \text{ ms}$	= 32.11 mA

Battery Preconditioning / Discharge Time Calculations

$$\begin{aligned} \text{Battery Self Drain} &= \text{Capacity} - [(100\% - \text{Self Drain/Year}\%)^{\text{Replacement Interval}} \times \text{Capacity}] \\ &= 1.55 - ((1 - 0.0100)^{12} \times 1.55) = 0.1761 \text{ Ah} \end{aligned}$$

$$\begin{aligned} \text{Standby Drain} &= \text{Hours per year} \times \text{Battery Replacement Interval} \times \text{Standby Current} \\ &= 365 \times 24 \times 12 \times -0.51 \times 10^{-9} = -0.0001 \text{ Ah} \end{aligned}$$

$$\text{Worst Case} = 1 \times -0.0001 \text{ Ah} = -0.0001 \text{ Ah}$$

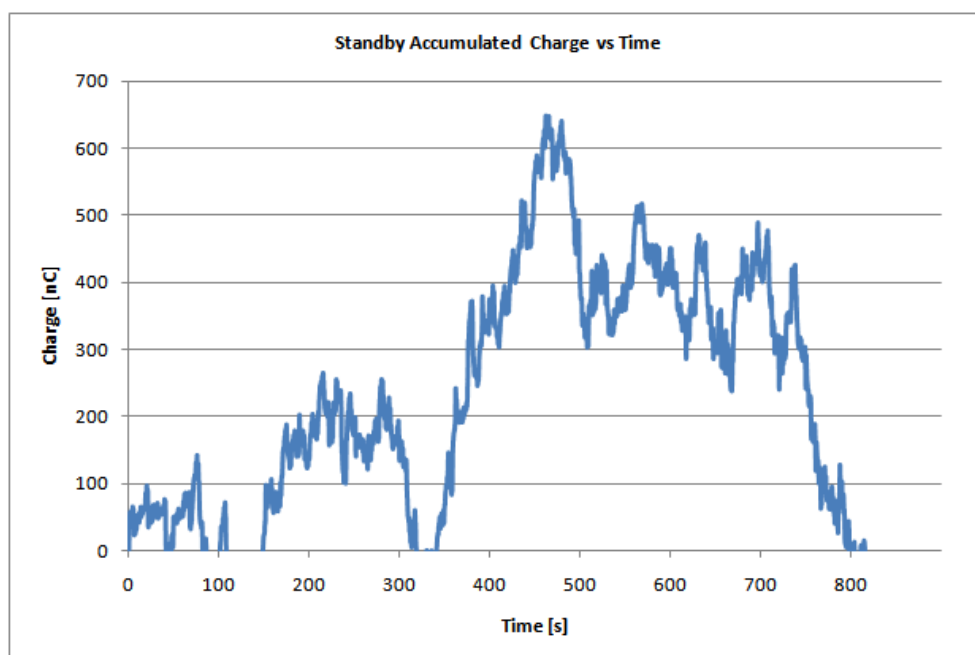
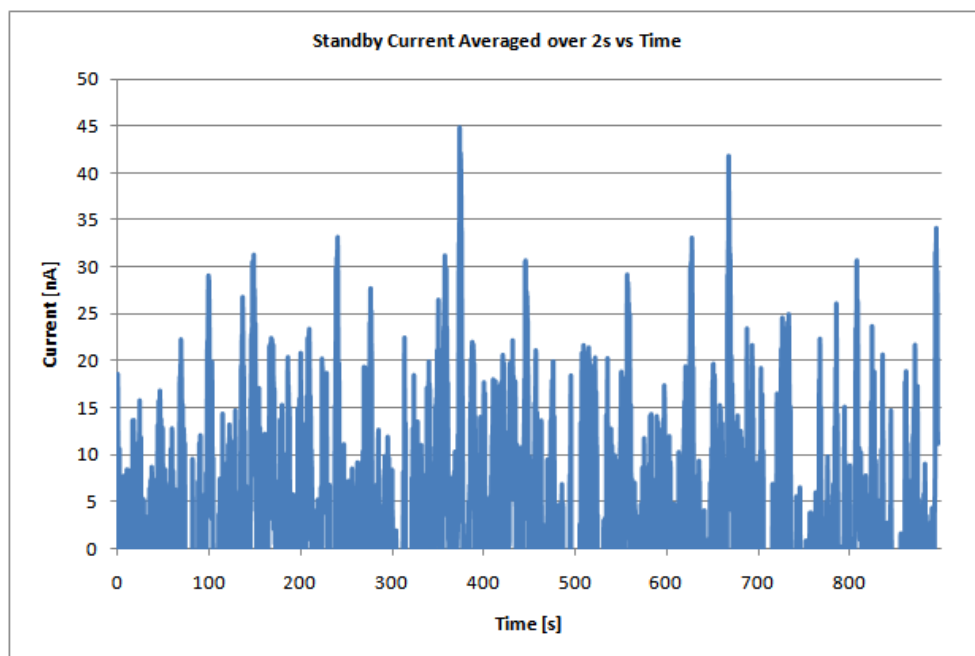
$$\begin{aligned} \text{Self-test Drain} &= \text{Self-tests per battery} \times \text{Self-test Current} \times \text{Self-test duration} \\ &= 12 \times 12 \times 90.67 \times 10^{-3} \times (10.5 / 3600) = 0.0380 \text{ Ah} \\ \text{Worst Case} &= 1 \times 0.0380 \text{ Ah} = 0.0380 \text{ Ah} \end{aligned}$$

$$\begin{aligned} \text{GPS ST Drain} &= \text{Self-tests per battery} \times \text{Self-test Current} \times \text{Self-test duration} \\ &= 1 \times 12 \times 36.28 \times 10^{-3} \times (133 / 3600) = 0.0161 \text{ Ah} \\ \text{Worst Case} &= 1 \times 0.0161 \text{ Ah} = 0.0161 \text{ Ah} \end{aligned}$$

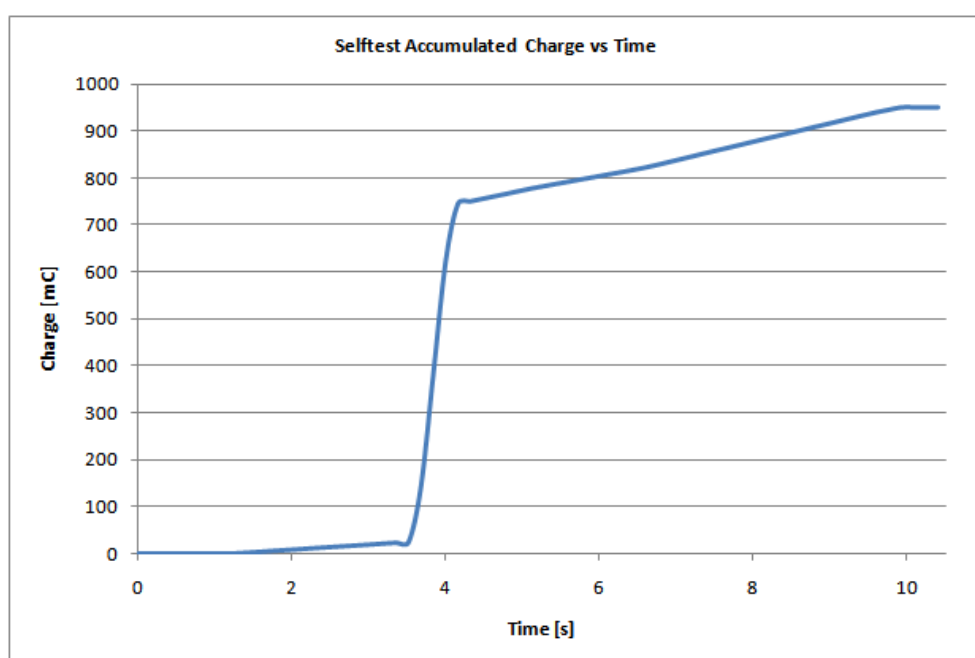
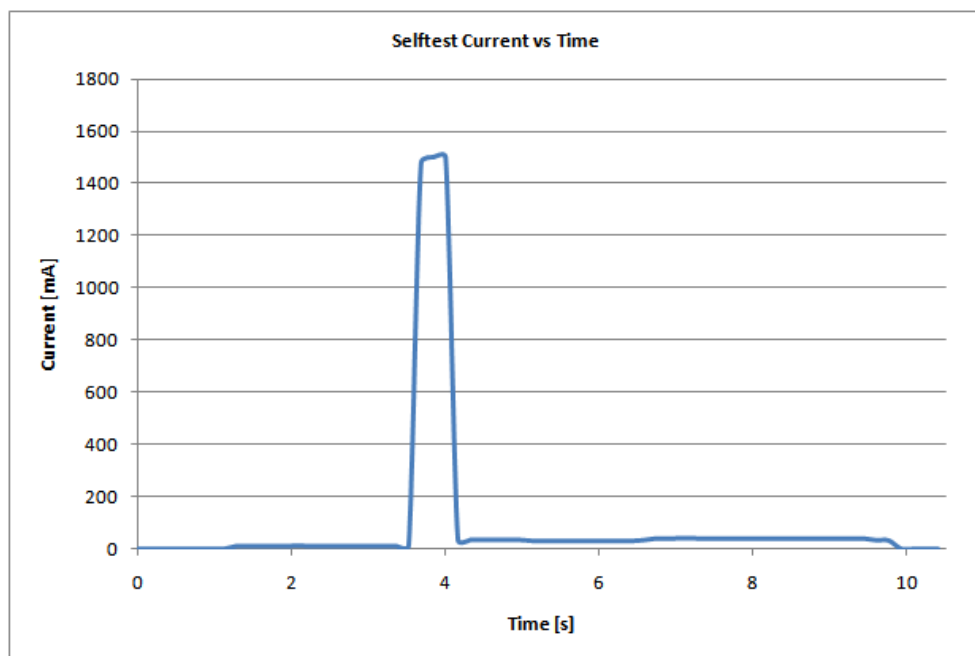
$$\begin{aligned} \text{Total Drain} &= \text{Self Drain} + \text{Standby Drain} + \text{Self-test Drain} + \text{GPS ST Drain} \\ &= 0.1761 + -0.0001 + 0.0380 + 0.0161 \text{ Ah} = 0.2301 \text{ Ah} \end{aligned}$$

$$\begin{aligned} \text{Battery Preconditioning / Discharge Time} &= \text{Worst Case drain} / \text{Operational Current} \\ &= 0.2301 / (32.11 \times 10^{-3}) \\ &= \underline{7.17 \text{ hours}} \end{aligned}$$

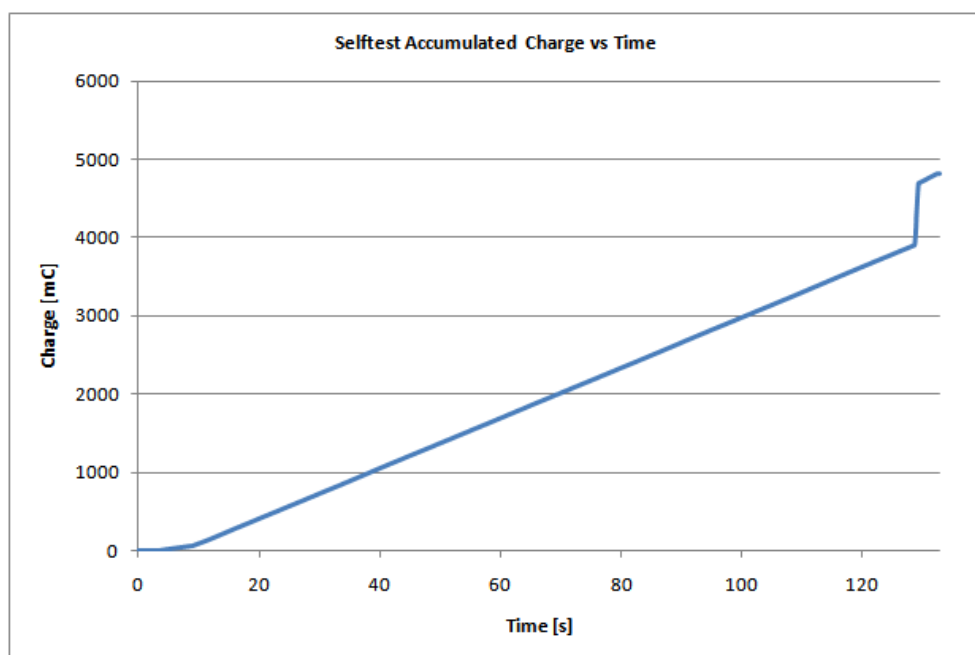
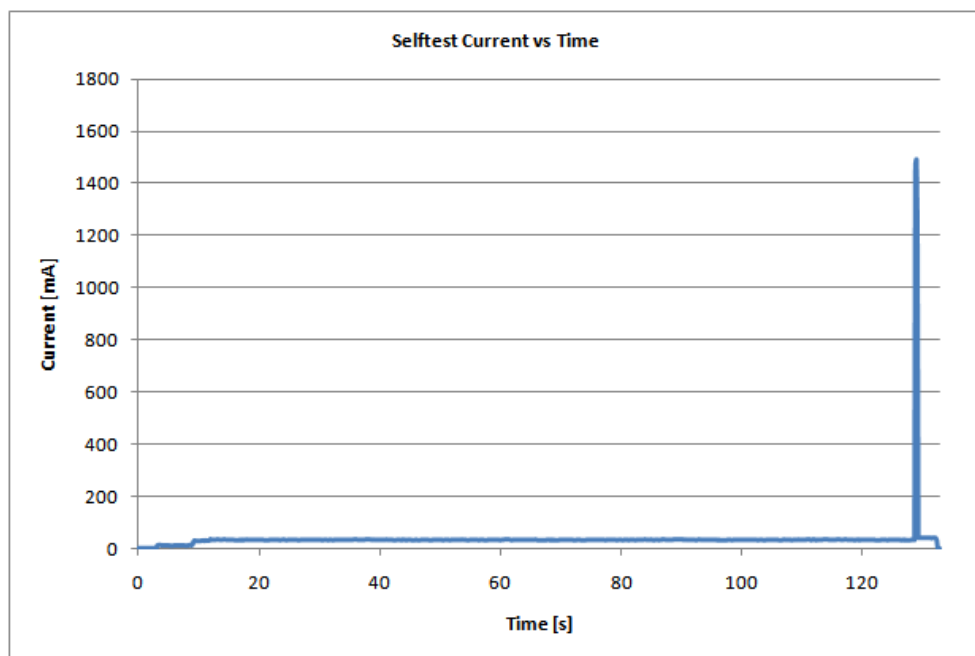
Standby Mode Plots



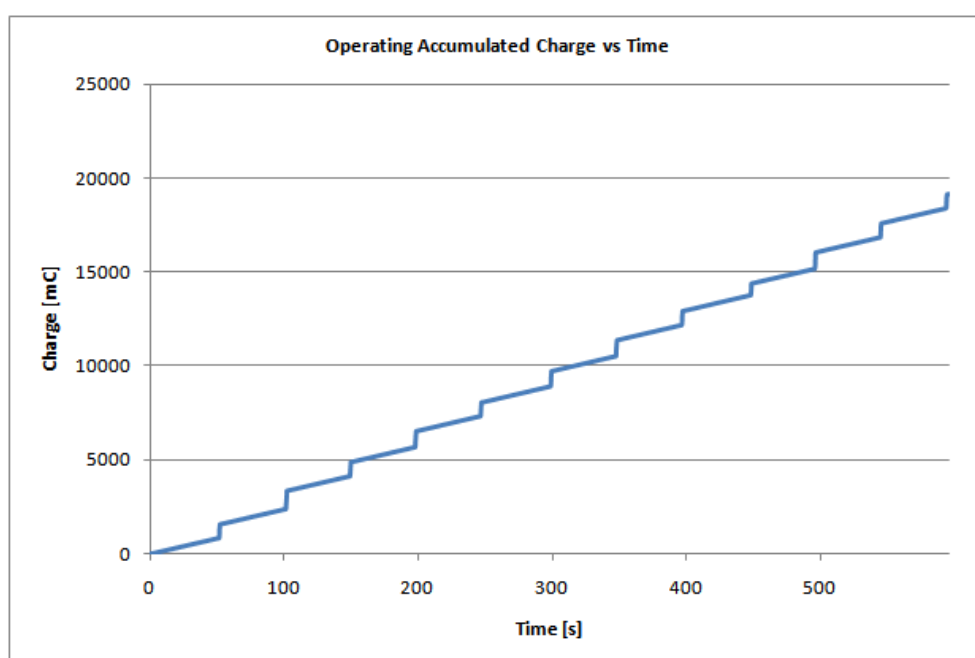
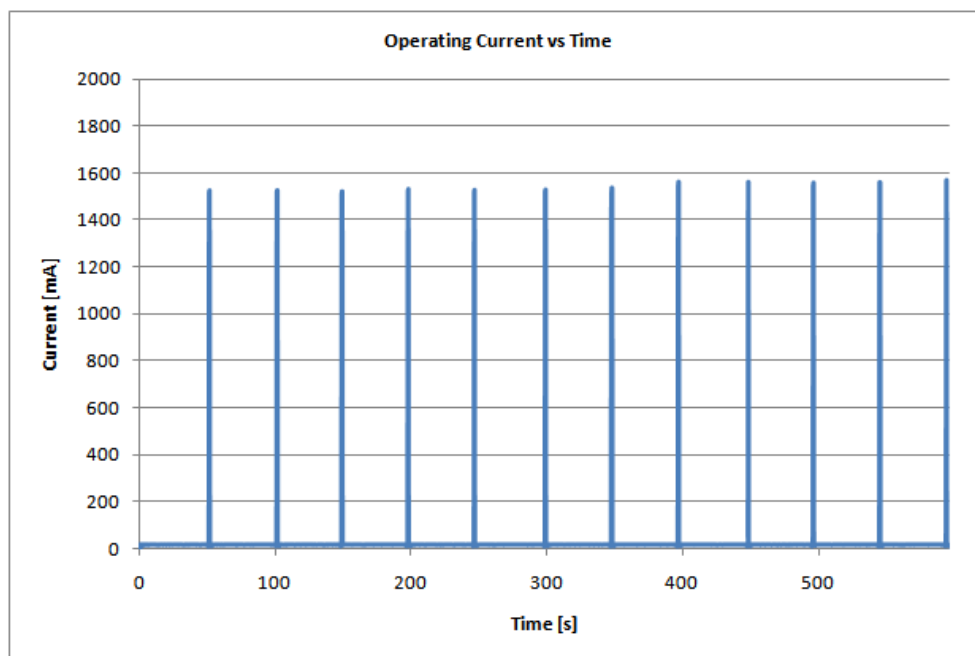
Self-test Mode Plots



GNSS Self-test Mode Plots



Operating Mode Plots





Product Service

Beacon Operating Current

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

Beacon Operating Modes	Mode: Manually selectable or Automatic	Measurement Interval, sec	Average Current, mA	Peak Current, mA
Operating Mode (GPS receiver off)*	Manual	10mins	32.11mA	1559.32 mA
SelfTest	Manual	10sec	90.67mA	1498.75mA
GNSS SelfTest	Manual	132sec	36.28mA	1494.00mA
Standby	Automatic	15mins	-0.51nA	45.12nA
Operating Mode (GPS receiver on)	Manual	10mins	50.61mA	1318.24mA

At all times the sampling interval was 80 ms nominal.

Operating Mode (GPS receiver off) is the lower average current mode; hence, this was the figure used for the calculating the Operating Lifetime pre-test Discharge (giving a longer discharge time). During pre-test discharge (and test itself) the operating mode was a combination of Operating mode with GPS Receiver On/Off (dependant on the GPS receiver duty cycle) giving an “over-test” on the discharge.



Product Service

Pre-test Battery Discharge Calculations

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

Characteristic	Designation	Units	Value	Comments
Beacon battery replacement period (from date of cell manufacture)	T_{BR} or TBR	Number of years	6	
Battery pack electrical configuration	Series			
Cell model and cell chemistry	CR123A, 2/3A, 3 Cells LiMnO2			
Nominal cell capacity		A-hrs	1.550 per Cell	
Nominal battery pack capacity	C_{BN}	A-hrs	1.550	
Annual battery cell capacity loss (self discharge) due to aging, as specified by cell manufacturer at ambient temperature	L_{SDC}	%	1	
Calculated battery pack capacity loss due to self-discharge: $L_{CBN} = C_{BN} - [C_{BN} * (1 - L_{SDC}/100)]^{T_{BR}}$	L_{CBN}	A-hrs	0.0907	
Number of self-tests per year	N_{ST}		12	
Average battery current during a self-test	I_{ST}	mA	90.67	
Maximum duration of a self-test	T_{ST}	sec	10	
Calculated battery pack capacity loss due to self-tests during battery replacement period: $L_{ST} = I_{ST} * T_{ST} * T_{BR} * N_{ST} / 3600$	L_{ST}	mA-hrs	19.0	
Maximum number of GNSS self-tests between battery replacements	N_{GST}		12	
Average battery current during a GNSS self-test of maximum duration	I_{GST}	mA	36.28	
Maximum duration of a GNSS self-test	T_{GST}	sec	132	Duration of Measurement
Calculated battery pack capacity loss due to GNSS self-tests during battery replacement period: $L_{GST} = I_{GST} * T_{GST} * N_{GST} / 3600$	L_{GST}	mA-hrs	16.1	
Average standby-by battery pack current	I_{SB}	mA	0.0000	
Battery pack capacity loss due to constant operation of circuitry prior to beacon activation: $L_{ISB} = I_{SB} * T_{BR} * 8760$	L_{ISB}	mA-hrs	0.0000	
Calculated value of the battery pack pre-test discharge $L_{CDC} = L_{CBN} + 1.65 * (L_{ST} + L_{GST} + L_{ISB}) / 1000$	L_{CDC}	A-hrs	0.1485	

Note: This calculation will differ from that on page 74. The calculation on page 74 is to meet RTCM 11010.2 requirements and can be regarded as an 'over test' with respect to Cospas Sarsat requirements.



Product Service

2.9 TEMPERATURE GRADIENT

2.9.1 Equipment Under Test and Modification State

PLB-375 S/N: Unit #14 (TUV Ref TSR0003) - Modification State 3

2.9.2 Date of Test

07 March 2011 & 09 March 2011

2.9.3 Test Equipment Used

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

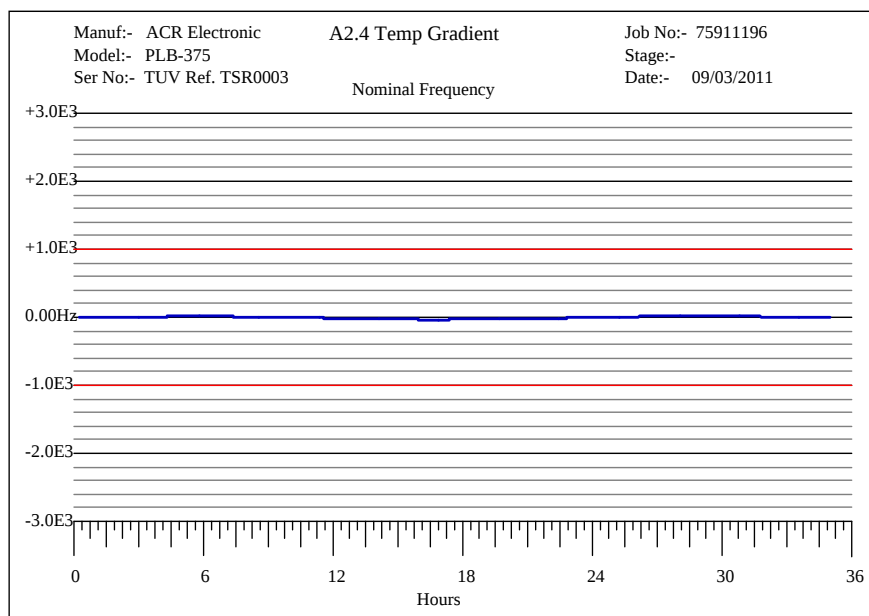
2.9.4 Environmental Conditions

Ambient Temperature 23 °C

Relative Humidity 22 - 33 %

2.9.5 Test Results

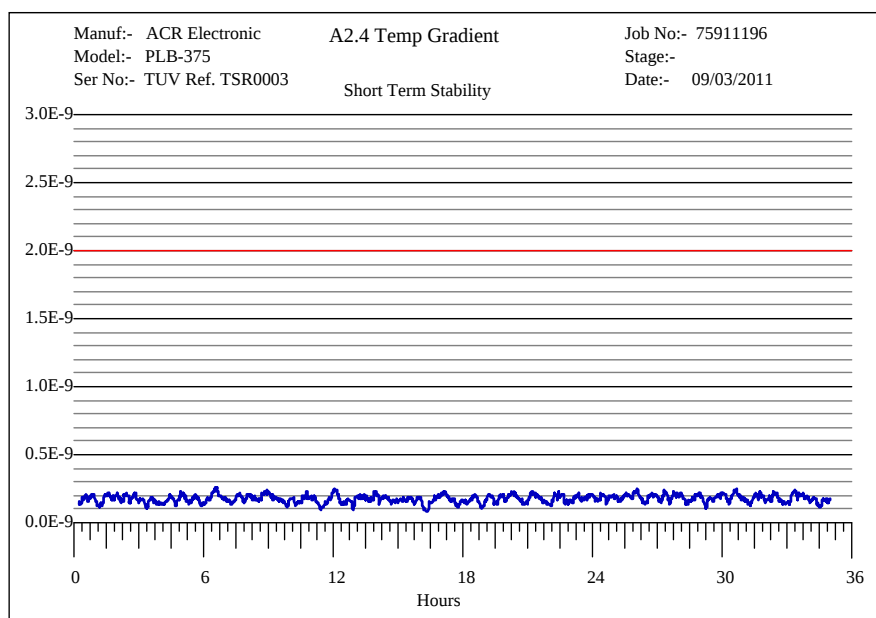
Nominal Frequency



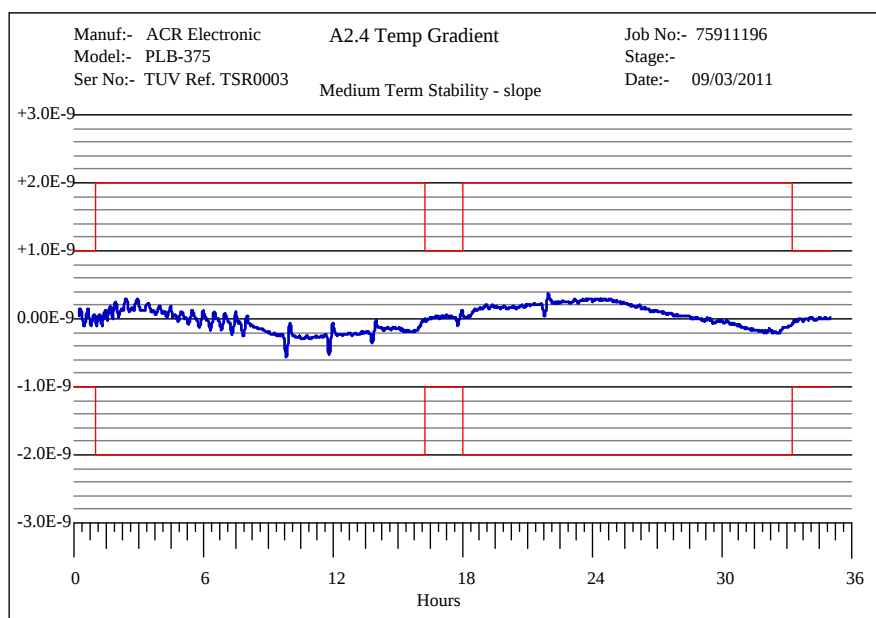


Product Service

Short Term Stability



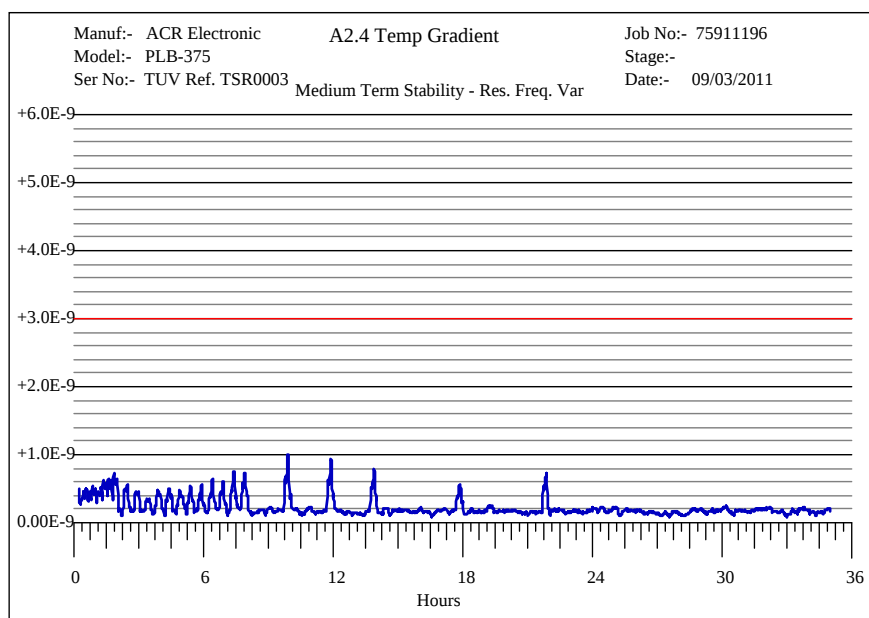
Medium Term Stability, Mean Slope



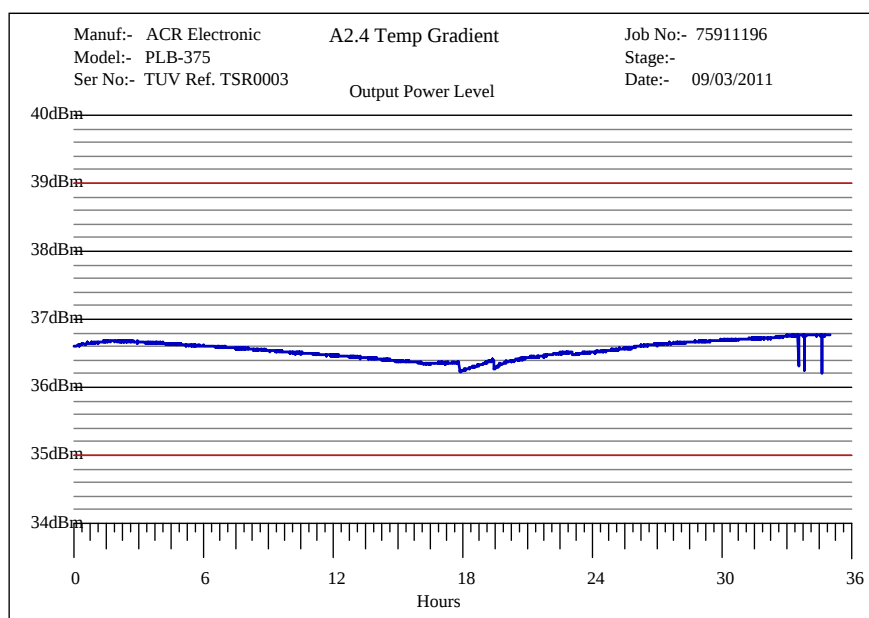


Product Service

Medium Term Stability, Residual Frequency Variation



Output Power





Product Service

Digital Message

```
=====
Beacon Id Format..... 30 Hex Id, Long Message, Bits 25-144
15 Hex (Bits 26- 85) = 192FF380C6FFBFF      192FF380C6FFBFF Default_Id
30 Hex (Bits 25-144) = 8C97F9C0637FDFFF11B23783E0F66C

    26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
    |   |   |   |   |   |   |   |   |   |   |   |   |
1 0001 1001 0010 1111 1111 0011 1000 0000 1100 0110 1111 1111 1011 1111 1111
    1110 0010 0011 0110 0100 0110 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      201 ALBANIA          0011 0010 01
Protocol Code     37- 40      7 PLB - Serial (Standard) 0111
CSTA Number       41- 50      999              1111 1001 11
Serial Number     51- 64      99              0000 0001 1000 11
Coarse Position   65- 85      DEFAULT          0111 1111 1101 1111 1111 1
BCH Encoded       86-106     Errors=0          1110 0010 0011 0110 0100 0
BCH Generated     86-106     1110 0010 0011 0110 0100 0
Long Message     107-144     Data Present
Fixed Bits       107-109
Fixed Bit        110          1              110
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
=====
```



Product Service

2.10 SATELLITE QUALITATIVE TESTS

2.10.1 Equipment Under Test and Modification State

PLB-375 S/N: Unit #25 (TUV Ref: TSR0004) – Mod State 1 (Config 7)
PLB-375 S/N: Unit #4 (TUV Ref: TSR0042) – Mod State 5 (Config 8)

2.10.2 Date of Test

31 January 2011 to 01 February 2011 & 06 June 2011 to 07 June 2011

2.10.3 Test Equipment Used

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

2.10.4 Environmental Conditions

Ambient Temperature 5.3 - 15.7 °C
Relative Humidity 51.9 - 83 %



Product Service

2.10.5 Test Results

Configuration 7

Test Start: 2011-01-31 15:30
 Test End: 2011-02-01 09:00
 15 Hex ID: 193DF380C6FFBFF

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

Satellite ID	Satellite Pass Number	15 Hex ID Provided by LUT	Doppler Latitude	Doppler Longitude	Mean Rx Power (dBm)	TCA	CTA (deg)	Location Error (km)
S11	22236	193DF 380C6 FFBFF	50.82620	-1.18951	-126.28	21:57:14	-10.465	1.065
S9	44725	193DF 380C6 FFBFF	50.82881	-1.18929	-129.26	21:31:17	-15.756	1.324
S11	22235	193DF 380C6 FFBFF	50.83124	-1.20624	-126.31	20:16:54	5.104	1.566
S11	22234	193DF 380C6 FFBFF	50.81018	-1.23438	-120.75	18:37:57	18.555	2.716
S10	29366	193DF 380C6 FFBFF	50.82659	-1.18610	-130.52	15:36:36	-20.127	1.245
S11	22242	193DF 380C6 FFBFF	50.80572	-1.20138	-129.43	08:28:04	-17.110	1.407
S9	44731	193DF 380C6 FFBFF	50.80568	-1.20104	-127.05	08:00:55	-11.529	1.408
S8	53417	193DF 380C6 FFBFF	50.80947	-1.20799	-126.97	07:42:13	-3.615	1.203
S8	53416	193DF 380C6 FFBFF	50.81914	-1.19830	-123.27	06:00:26	-19.668	0.111
S7	66138	193DF 380C6 FFBFF	50.80826	-1.21464	-129.63	07:29:41	17.647	1.615
S7	66137	193DF 380C6 FFBFF	50.81202	-1.20147	-127.10	05:50:51	4.008	0.731
S10	29374	193DF 380C6 FFBFF	50.80934	-1.22050	-131.08	05:31:45	20.898	1.870
S12	10220	193DF 380C6 FFBFF	50.83137	-1.18702	-126.60	04:44:57	19.572	1.650
S7	66136	193DF 380C6 FFBFF	50.80511	-1.20487	-128.44	04:10:38	-11.613	1.534
S10	29373	193DF 380C6 FFBFF	50.81321	-1.20338	-126.88	03:52:26	8.180	0.676
S12	10219	193DF 380C6 FFBFF	50.80487	-1.19596	-123.64	03:05:26	6.377	1.485
S10	29372	193DF 380C6 FFBFF	50.80995	-1.20444	-127.68	02:11:43	-7.162	1.026

$$\begin{aligned}
 \text{Ratio of Successful Solutions} &= \frac{\text{number of Doppler solutions within 5 km with } 1^\circ < \text{CTA} < 21^\circ}{\text{number of satellite passes over test duration with } 1^\circ < \text{CTA} < 21^\circ} \\
 &= \frac{17}{17} \\
 &= 100\%
 \end{aligned}$$



Product Service

Configuration 8

Test Start: 2011-06-07 15:00
 Test End: 2011-06-08 08:45
 15 Hex ID: 193DF380C6FFBFF

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

Satellite ID	Satellite Pass Number	15 Hex ID Provided by LUT	Doppler Latitude	Doppler Longitude	Mean Rx Power (dBm)	TCA	CTA (deg)	Location Error (km)
S12	12003	193DF 380C6 FFBFF	50.82035	-1.19167	-119.30	14:32:40	-15.488	0.495
S11	24040	193DF 380C6 FFBFF	50.82952	-1.19016	-124.63	21:29:11	-6.025	1.370
S8	55204	193DF 380C6 FFBFF	50.82999	-1.19138	-127.56	21:05:42	-20.886	1.388
S9	46532	193DF 380C6 FFBFF	50.83266	-1.18802	-126.01	20:13:26	-5.881	1.750
S11	24039	193DF 380C6 FFBFF	50.83185	-1.21091	-124.88	19:49:14	9.142	1.775
S8	55203	193DF 380C6 FFBFF	50.83344	-1.18908	-125.76	19:23:48	-4.820	1.803
S9	46531	193DF 380C6 FFBFF	50.83038	-1.21373	-126.11	18:33:39	9.289	1.756
S8	55202	193DF 380C6 FFBFF	50.83511	-1.21256	-126.44	17:43:24	10.228	2.146
S7	67938	193DF 380C6 FFBFF	50.83031	-1.18904	-125.85	16:41:15	-6.612	1.482
S7	67937	193DF 380C6 FFBFF	50.83227	-1.20489	-127.03	15:01:29	8.585	1.642
S9	46539	193DF 380C6 FFBFF	50.80730	-1.19860	-126.11	08:23:54	-5.411	1.211
S8	55210	193DF 380C6 FFBFF	50.80959	-1.20974	-125.73	07:40:14	-6.735	1.269
S7	67946	193DF 380C6 FFBFF	50.80172	-1.20625	-126.31	06:31:01	9.871	1.923
S7	67945	193DF 380C6 FFBFF	50.80780	-1.21825	-124.87	04:51:22	-5.182	1.840
S10	31165	193DF 380C6 FFBFF	50.80991	-1.20272	-126.73	04:36:56	13.230	0.981
S12	12011	193DF 380C6 FFBFF	50.79184	-1.16518	-127.45	04:29:01	17.910	3.719
S10	31164	193DF 380C6 FFBFF	50.81601	-1.23580	-126.36	02:56:44	-1.407	2.677
S10	31163	193DF 380C6 FFBFF	50.81565	-1.19751	-120.22	01:15:05	-17.406	0.282
S12	12010	193DF 380C6 FFBFF	50.77733	-1.13542	-127.57	02:49:18	4.261	6.311
S12	12009	193DF 380C6 FFBFF	50.80703	-1.20430	-127.16	01:08:10	-11.533	1.320

$$\begin{aligned}
 \text{Ratio of Successful Solutions} &= \frac{\text{number of Doppler solutions within 5 km with } 1^\circ < \text{CTA} < 21^\circ}{\text{number of satellite passes over test duration with } 1^\circ < \text{CTA} < 21^\circ} \\
 &= \frac{19}{20} \\
 &= 95\%
 \end{aligned}$$



Product Service

2.11 ANTENNA CHARACTERISTICS

2.11.1 Equipment Under Test and Modification State

PLB-375 S/N: Unit #1 (TUV Ref TSR0001) - Modification State 0

2.11.2 Date of Test

26 January 2011

2.11.3 Test Equipment Used

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

2.11.4 Environmental Conditions

Ambient Temperature 18 °C

Relative Humidity 27 %

2.11.5 Test Results

Configuration 3

	Elevation Angle (degrees)									
	10		20		30		40		50	
Azimuth Angle (Degrees)	ERP dBm	Ant dBi	ERP dBm	Ant dBi	ERP dBm	Ant dBi	ERP dBm	Ant dBi	ERP dBm	Ant dBi
0	38.8	2.15	41.2	4.48	42.0	5.33	37.4	0.69	33.4	-3.34
30	39.0	2.35	41.0	4.28	41.7	5.03	37.3	0.60	33.5	-3.24
60	39.3	2.64	41.0	4.27	41.7	5.03	37.5	0.80	33.6	-3.12
90	39.4	2.65	40.7	4.01	41.7	5.04	37.5	0.84	33.4	-3.34
120	39.2	2.45	40.7	3.98	41.7	5.03	37.7	0.96	33.2	-3.51
150	39.1	2.38	40.8	4.10	41.8	5.14	37.7	0.99	33.2	-3.54
180	39.2	2.47	40.7	3.98	41.5	4.83	37.2	0.48	33.2	-3.51
210	38.9	2.16	41.0	4.29	41.8	5.13	37.1	0.44	33.4	-3.26
240	38.9	2.25	40.7	4.00	41.6	4.94	37.0	0.32	33.4	-3.26
270	38.8	2.14	41.0	4.28	41.8	5.13	37.2	0.51	33.3	-3.39
300	38.7	2.04	41.2	4.48	41.8	5.14	37.0	0.30	33.5	-3.22
330	39.1	2.35	41.1	4.38	41.8	5.14	37.3	0.60	33.8	-2.93
Gain Variation	0.61		0.51		0.51		0.69		0.61	



Product Service

Azimuth Angle (Degrees)	Elevation Angle (degrees)									
	10		20		30		40		50	
	Vv	Vh	Vv	Vh	Vv	Vh	Vv	Vh	Vv	Vh
0	110.60	90.50	112.50	94.60	112.70	87.90	107.00	79.50	101.40	82.10
30	110.80	90.80	112.30	94.20	112.40	85.50	106.90	81.70	101.50	82.40
60	111.10	90.00	112.30	93.80	112.40	83.90	107.10	83.20	101.60	83.40
90	111.10	91.40	112.00	95.40	112.40	87.70	107.10	88.20	101.30	86.90
120	110.90	91.50	112.00	93.70	112.40	83.80	107.20	89.30	101.10	87.30
150	110.80	93.20	112.10	95.30	112.50	88.00	107.20	91.00	101.00	88.80
180	110.90	92.50	112.00	94.30	112.20	82.70	106.70	90.00	101.10	87.30
210	110.60	91.90	112.30	95.00	112.50	86.20	106.70	87.90	101.40	86.20
240	110.70	90.50	112.00	95.10	112.30	87.80	106.60	84.90	101.40	86.10
270	110.60	89.80	112.30	94.60	112.50	87.30	106.80	83.30	101.30	84.90
300	110.50	89.10	112.50	94.70	112.50	89.20	106.60	80.50	101.50	83.60
330	110.80	91.30	112.40	94.20	112.50	88.40	106.90	82.10	101.80	83.50
Min (Vv-Vh)	17.60		16.60		23.30		16.20		12.20	

$$EIRP_{LOSS} = P_{t_{ambient}} - P_{t_{EOL}} = 36.3 - 36.06 = 0.25dBm$$

$$EIRP_{maxEOL} = \text{Max}[EIRP_{max}, (EIRP_{max} - EIRP_{LOSS})] = \text{Max}[42.0, 41.8] = 42.0dBm$$

$$EIRP_{minEOL} = \text{Min}[EIRP_{max}, (EIRP_{max} - EIRP_{LOSS})] = \text{Min}[33.2, 32.9] = 32.9dBm$$

Configuration 4

Azimuth Angle (Degrees)	Elevation Angle (degrees)									
	10		20		30		40		50	
	ERP dBm	Ant dBi	ERP dBm	Ant dBi	ERP dBm	Ant dBi	ERP dBm	Ant dBi	ERP dBm	Ant dBi
0	38.9	2.24	39.3	2.62	36.5	-0.17	31.9	-4.84	29.4	-8.34
90	39.1	2.44	39.5	2.77	36.7	-0.02	31.6	-5.09	29.1	-8.63
180	39.3	2.64	39.8	3.07	37.0	0.26	33.6	-3.09	31.9	-4.76
270	39.4	2.65	39.7	2.99	37.1	0.38	33.8	-2.90	31.8	-4.86

$$EIRP_{LOSS} = P_{t_{ambient}} - P_{t_{EOL}} = 36.31 - 36.06 = 0.25dBm$$

$$EIRP_{maxEOL} = \text{Max}[EIRP_{max}, (EIRP_{max} - EIRP_{LOSS})] = \text{Max}[39.8, 39.6] = 39.8dBm$$

$$EIRP_{minEOL} = \text{Min}[EIRP_{max}, (EIRP_{max} - EIRP_{LOSS})] = \text{Min}[31.6, 31.4] = 31.4dBm$$



Product Service

2.12 NAVIGATION SYSTEM

2.12.1 Equipment Under Test and Modification State

PLB-375 S/N: Unit #1 (TUV Ref TSR0001) - Modification State 0
PLB-375 S/N: Unit #4 (TUV Ref TSR0002) - Modification State 0
PLB-375 S/N: Unit #14 (TUV Ref TSR0003) - Modification State 0
PLB-375 S/N: Unit #25 (TUV Ref TSR0004) - Modification State 0

2.12.2 Date of Test

13 January 2011, 14 January 2011, 17 January 2011, 18 January 2011 & 21 January 2011

2.12.3 Test Equipment Used

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

2.12.4 Environmental Conditions

Ambient Temperature 21.2 - 22.9 °C
Relative Humidity 32 - 52 %

2.12.5 Test Results

National Protocol

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

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

36 Hex Message	Message Count
FFFE2F8C9B0018DFC0FF042E19779F3C0010	38



Product Service

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

Locations:

A.3.8.2.1:	50° 52.131'N	001° 14.694'W	①
A.3.8.2.2:	51° 22.583'N	001° 49.833'W	②

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

Configuration as per C/S T.007	C/S T.007 Section A.3.8.2.1		C/S T.007 Section A.3.8.2.2	
	Time to Acquire Position (sec)	Location Error in metres	Time to Acquire Position (sec)	Location Error in metres
Configuration 7	101	49.46	101	32.24
Configuration 8	101	50.06	100	32.24

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

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

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

Location:	N 51° 22.583' W 1° 49.833' ①	
Data Acquired at	16:43:26	FFFE2F8C9B0018CCD701C889E7779208025B
Location:	N 50° 48.683' W 1° 37.417' ①	
Data Updated at	16:53:42	FFFE2F8C9B0018CCB1019D4CB8B796240D32
Data Update Interval	29 min 18 s	

- ① Input from GPS simulator

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

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



Product Service

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

Location: N 51° 22.583' W 1° 49.833' ①		
Data Acquired at	11:32:07	FFFE2F8C9B0018CCD701C889E7779208025B
GPS Signal Navigation Data Removed		
Data Updated at	15:31:36	FFFE2F8C9B0018DFC0FF042E19779F3C0010
Last Valid Position Held	239min 29s	
Return to Default Position	✓	

① Input from GPS simulator



Product Service

Standard Protocol

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

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

36 Hex Message	Message Count
FFFE2F8C97F9C0637FDFFF11B23783E0F66C	38

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

Locations:

A.3.8.2.1:	50° 52.131'N	001° 14.694'W	①
A.3.8.2.2:	51° 22.583'N	001° 49.833'W	②

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

Configuration as per C/S T.007	C/S T.007 Section A.3.8.2.1		C/S T.007 Section A.3.8.2.2	
	Time to Acquire Position (sec)	Location Error in metres	Time to Acquire Position (sec)	Location Error in metres
Configuration 7	101	50.06	100	32.24
Configuration 8	101	50.06	100	32.24

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

① GPS Site Survey – Live Location

② Input from GPS simulator



Product Service

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

Location:	N 51° 22.583' W 1° 49.833' ①	
Data Acquired at	15:28:29	FFFE2F8C97F9C06333A039E6C1F71DA4C1E9
Location:	N 50° 48.683' W 1° 37.417' ①	
Data Updated at	15:58:25	FFFE2F8C97F9C06332E0363260F78F276DDF
Data Update Interval	29 min 56 s	

① Input from GPS simulator

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

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

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

Location:	N 51° 22.583' W 1° 49.833' ①	
Data Acquired at	10:01:57	FFFE2F8C97F9C06333A039E6C1F71DA4D4D0
GPS Signal Navigation Data Removed		
Data Updated at	14:01:09	FFFE2F8C97F9C0637FDFFF11B23783E0F66C
Last Valid Position Held	239min 48s	
Return to Default Position	✓	

① Input from GPS simulator



Product Service

SECTION 3

TEST EQUIPMENT USED



Product Service

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
Beacons - Constant Temperature Tests					
Power Meter	Hewlett Packard	436A	47	12	9-Jul-2011
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
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
Signal Generator	Hewlett Packard	8644A	199	12	12-Aug-2011
Antenna (Bilog)	Schaffner	CBL6143	316	-	TU
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	23-Jun-2011
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2011
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jun-2011
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	11-Sep-2011
Distress Beacon RF Unit	TUV	-	2445	-	TU
Stop Clock	R.S Components	RS328 061	2674	-	TU
Hygrometer	Rotronic	I-1000	3068	12	10-Jul-2011
Termination (50ohm, 6W)	Micronde	R404613	3074	12	17-Mar-2012
Termination (50ohm, 1W)	Suhner		3080	12	7-Mar-2012
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3096	12	7-Mar-2012
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	12	7-Mar-2012
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	23-Jun-2011
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	10-Jun-2011
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	13-Aug-2011
RF Short Circuit	TUV	Short Circuit	3268	-	TU
Short Circuit	TUV	Short Circuit	3272	-	TU
Timer	Radio Spares	427-590	3282	-	TU
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
Power Sensor	Agilent	8482A	3290	12	8-Dec-2011
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3351	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	20-Apr-2011



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.6 Beacons - GNSS Self-test					
Power Meter	Hewlett Packard	436A	47	12	9-Jul-2011
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
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
Signal Generator	Hewlett Packard	8644A	199	12	12-Aug-2011
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2011
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	11-Sep-2011
Distress Beacon RF Unit	TUV	-	2445	-	TU
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Hygrometer	Rotronic	I-1000	3068	12	10-Jul-2011
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	3158	12	23-Jun-2011
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	10-Jun-2011
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	20-Apr-2011
Section 2.11 Beacons - Navigation System					
Stop Clock	R.S Components	RS328 061	2674	-	TU
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Hygrometer	Rotronic	I-1000	3068	12	10-Jul-2011
Beacon Tester	WS Technologies	BT100S	3263	-	TU
Copper GRP	TUV	27cm Diameter	3538	-	TU
Section 2.9 Beacons - Temperature Gradient					
Power Meter	Hewlett Packard	436A	47	12	9-Jul-2011
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
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	10-Mar-2011
Signal Generator	Hewlett Packard	8644A	199	12	12-Aug-2011
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2011
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	11-Sep-2011
Distress Beacon RF Unit	TUV	-	2445	-	TU
Hygrometer	Rotronic	I-1000	3068	12	10-Jul-2011
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	3158	12	23-Jun-2011
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	10-Jun-2011
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	13-Aug-2011
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	8-Nov-2011
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
Power Sensor	Agilent	8482A	3290	12	8-Dec-2011
Cable (1m, N type)	Rhophase	NPS-1601-1000-NPS	3350	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	20-Apr-2011
Cable (3m, N-type)	Rhophase	NPS-1601-3000-NPS	3361	12	20-Apr-2011



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.3 Beacons - Spurious Emissions					
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	11-Sep-2011
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	10-Jun-2011
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	2-Jun-2011
Cable (1m, N type)	Rhophase	NPS-1601-1000-NPS	3350	12	20-Apr-2011
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	20-Apr-2011
Section 2.8 Beacons - Operating Lifetime					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Power Meter	Hewlett Packard	436A	47	12	9-Jul-2011
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
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
Signal Generator	Hewlett Packard	8644A	199	12	12-Aug-2011
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2011
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	11-Sep-2011
Digital Temperature Indicator	Fluke	51	2267	12	30-Jun-2011
Distress Beacon RF Unit	TUV	-	2445	-	TU
Hygrometer	Rotronic	I-1000	3068	12	10-Jul-2011
Termination (50ohm, 6W)	Micronde	R404613	3074	12	17-Mar-2012
Termination (50ohm, 1W)	Suhner		3080	12	7-Mar-2012
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	12	7-Mar-2012
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	23-Jun-2011
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	10-Jun-2011
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	10-Jun-2011
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	13-Aug-2011
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	8-Nov-2011
8 Channel Datalogger + Terminal Board	Pico Technology Ltd	ADC-16	3287	12	17-Dec-2011
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
Power Sensor	Agilent	8482A	3290	12	8-Dec-2011
Resistor (Nominal 0.25ohm)	TUV	2x RS Components 188-071 R5/100W Resistors	3343	12	21-Oct-2011
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	2-Jun-2011
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3352	12	20-Apr-2011
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	20-Apr-2011
Cable (3m, N-type)	Rhophase	NPS-1601-3000-NPS	3361	12	20-Apr-2011
Bandpass Filter	Trilithic	5BE121.55/35-3-BA	3410	12	13-Aug-2011
Rubidium Frequency Standard	Symmetricon	8040C	3490	12	7-Mar-2012



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 Beacons – Digital Message, 2.2 - Modulation, 2.5 – Self-Test Mode					
Power Meter	Hewlett Packard	436A	47	12	9-Jul-2011
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
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
Signal Generator	Hewlett Packard	8644A	199	12	12-Aug-2011
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2011
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	11-Sep-2011
Distress Beacon RF Unit	TUV	-	2445	-	TU
Hygrometer	Rotronic	I-1000	3068	12	10-Jul-2011
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	3158	12	23-Jun-2011
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	10-Jun-2011
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	20-Apr-2011
Section 2.7 Beacons - Thermal Shock					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Power Meter	Hewlett Packard	436A	47	12	9-Jul-2011
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
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
Signal Generator	Hewlett Packard	8644A	199	12	12-Aug-2011
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2011
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	11-Sep-2011
Digital Temperature Indicator	Fluke	51	2267	12	30-Jun-2011
Distress Beacon RF Unit	TUV	-	2445	-	TU
Hygrometer	Rotronic	I-1000	3068	12	10-Jul-2011
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	3158	12	23-Jun-2011
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	10-Jun-2011
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	13-Aug-2011
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	8-Nov-2011
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
Power Sensor	Agilent	8482A	3290	12	8-Dec-2011
Cable (1m, N type)	Rhophase	NPS-1601-1000-NPS	3350	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	20-Apr-2011
Cable (3m, N-type)	Rhophase	NPS-1601-3000-NPS	3361	12	20-Apr-2011



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.4 Beacons - VSWR					
Power Meter	Hewlett Packard	436A	47	12	9-Jul-2011
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
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
Signal Generator	Hewlett Packard	8644A	199	12	12-Aug-2011
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2011
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	11-Sep-2011
Distress Beacon RF Unit	TUV	-	2445	-	TU
Hygrometer	Rotronic	I-1000	3068	12	10-Jul-2011
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	8-Nov-2011
Termination (50ohm, 6W)	Micronde	R404613	3074	12	17-Mar-2012
Termination (50ohm, 1W)	Suhner		3080	12	7-Mar-2012
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3096	12	7-Mar-2012
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	12	7-Mar-2012
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	23-Jun-2011
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	10-Jun-2011
Short Circuit	TUV	Short Circuit	3272	-	TU
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	20-Apr-2011
Section 2.11 Beacons - Antenna Characteristics					
Spectrum Analyser	Hewlett Packard	8568B	571	12	3-Mar-2011
Antenna Mast	EMCO	1050	1707	-	TU
Turntable Controller	Various	RH253	1708	-	TU
Open Area Site 2	TUV	OATS2	1850	36	11-Sep-2011
Turntable Interface	Various	RH-253.6	1855	-	TU
Antenna Tower 6M	EMCO	1050	1859	-	TU
Roberts Antenna 406MHz	Compliance Design		1860	24	30-Jun-2011

TU – Traceability Unscheduled

OP MON – Output Monitored with Calibrated Equipment



Product Service

SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



Front View (Antenna stowed)



Rear View



Side View (Antenna extended)



Test sample with 50Ω Antenna connectors



Configuration 7



Configuration 8



Configuration 3



Configuration 4



Product Service

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



Product Service

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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

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Product Service

ANNEX A

INTERIM TCXO PROCEDURE – REVISION 1



Product Service

Interim Procedure (Revision 1) for the Determination of Compliance of 406 MHz Beacons equipped with a TCXO with Cospas-Sarsat Type Approval Requirements

Two data sets, Temperature Gradient Test Data (see section 2.8) and TCXO Manufacturer Data (file reference “E4672 JJ 2540”), were combined and ‘synchronised’ based on time into the Temperature Gradient profile.

Data synchronised was:

R_{tot}	The Medium Term Stability – Residual Frequency Variation measured during the Temperature Gradient test
R_{osc}	The Medium Term Stability – Residual Frequency Variation provided for the specific oscillator in the beacon tested
S_{tot}	the Medium Term Stability – Slope measured during the Temperature Gradient test
S_{osc}	The Medium Term Stability – Slope provided for the specific oscillator in the beacon tested

The individual data pair matching and the following calculations can be found in the supporting Document 75911196 Spreadsheet “CS IP TCXO Rev 1”.

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

1. Residual Component of the Medium-Term Frequency Stability

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

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

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

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

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

Total discards for this test was 651 (26.0%).

The maximum was chosen:

$$\text{Maximum } R_{beacon} = 9.048 \times 10^{-10}$$



Product Service

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

$$\begin{aligned} R_{\text{beacon_max}} &= \sqrt{R_{\text{beacon}}^2 + R_{\text{osc_max}}^2} \\ R_{\text{beacon_max}} &= \sqrt{(9.048 \times 10^{-10})^2 + (2.0 \times 10^{-9})^2} \\ R_{\text{beacon_max}} &= \sqrt{(8.186 \times 10^{-19}) + (4.0 \times 10^{-18})} \\ R_{\text{beacon_max}} &= \sqrt{4.819 \times 10^{-18}} \\ R_{\text{beacon_max}} &= 2.195 \times 10^{-9} \end{aligned}$$

The performance after five years ($R_{\text{beacon_5year_max}}$) is estimated by adding an ageing contribution ($R_{\text{aging_contribution}}$ = 0.2 ppb).

$$\begin{aligned} R_{\text{beacon_5year_max}} &= R_{\text{beacon_max}} + R_{\text{aging_contribution}} \\ R_{\text{beacon_5year_max}} &= 2.195 \times 10^{-9} + 0.2 \times 10^{-9} \\ R_{\text{beacon_5year_max}} &= 2.395 \times 10^{-9} \end{aligned}$$

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



2. Positive and Negative Slopes

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

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

Positive Gradient: Positive S_{tot} result during the temperature change portion of the test

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

Negative Gradient: Negative S_{tot} result during the temperature change portion of the test

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

Positive Static:

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

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

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

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

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

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

Method A:

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

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

Method B:

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

Total discards for this test was 470 (18.8%).

The maximum was chosen:

Method A:

$$\text{Maximum } S_{\text{beacon}} = 1.687 \times 10^{-10}$$

Method B:

$$\text{Maximum } S_{\text{beacon}} = 1.687 \times 10^{-10}$$



Product Service

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

$$S_{\text{beacon_max}} = \sqrt{S_{\text{beacon}}^2 + S_{\text{osc_max}}^2}$$

Method A:

$$S_{\text{beacon_max}} = \sqrt{(1.687 \times 10^{-10})^2 + (0.7 \times 10^{-9})^2}$$

$$S_{\text{beacon_max}} = \sqrt{(2.846 \times 10^{-20}) + (0.49 \times 10^{-18})}$$

$$S_{\text{beacon_max}} = \sqrt{5.185 \times 10^{-19}}$$

$$S_{\text{beacon_max}} = 7.200 \times 10^{-10}$$

Method B:

$$S_{\text{beacon_max}} = 7.200 \times 10^{-10}$$

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

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



Product Service

Slope Summary Table – Method A:

All Values in min ⁻¹	S_{beacon}	$S_{\text{osc_max}}$	$S_{\text{beacon_max}}$	Cospas-Sarsat performance requirement
Positive Slope Static Temp	1.687×10^{-10}	$+0.7 \times 10^{-9}$	7.200×10^{-10}	1.0×10^{-9}
Positive Slope Gradient Temp	3.463×10^{-10}	$+1.7 \times 10^{-9}$	1.735×10^{-09}	2.0×10^{-9}
Negative Slope Static Temp	$-[1.434 \times 10^{-10}]$	-0.7×10^{-9}	$-[7.145 \times 10^{-10}]$	-1.0×10^{-9}
Negative Slope Gradient Temp	$-[5.625 \times 10^{-10}]$	-1.7×10^{-9}	$-[1.791 \times 10^{-09}]$	-2.0×10^{-9}

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

Slope Summary Table – Method B:

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

All Values in min ⁻¹	S_{beacon}	$S_{\text{osc_max}}$	$S_{\text{beacon_max}}$	Cospas-Sarsat performance requirement
Positive Slope Static Temp	1.687×10^{-10}	$+0.7 \times 10^{-9}$	7.200×10^{-10}	1.0×10^{-9}
Positive Slope Gradient Temp	3.463×10^{-10}	$+1.7 \times 10^{-9}$	1.735×10^{-09}	2.0×10^{-9}
Negative Slope Static Temp	$-[1.434 \times 10^{-10}]$	-0.7×10^{-9}	$-[7.145 \times 10^{-10}]$	-1.0×10^{-9}
Negative Slope Gradient Temp	$-[5.625 \times 10^{-10}]$	-1.7×10^{-9}	$-[1.791 \times 10^{-09}]$	-2.0×10^{-9}



Product Service

ANNEX B

CUSTOMER SUPPLIED INFORMATION



Product Service

Explanations for PLB-375 COSPAS-SARSAT Application

GNSS Self Test Description

The GPS-enabled PLB-375 provides the COSPAS-SARSAT GNSS Self Test Feature, and this feature should not be performed more than twelve times during the life of the battery pack. Once the GNSS Self Test has been performed twelve times, the feature is disabled by internal software.

GNSS Self Test Procedure:

Press the Self-Test button for greater than 5 seconds. Observe the beacon for the entire test. First, a green or yellow LED will flash; green indicates the unit has been on for a cumulative time of less than one hour, yellow indicates the cumulative on time is more than one hour. Continue to press the Self-Test button; three flashes of the green LED indicate that the GPS receiver has been turned on. The PLB will flash the red LED every three seconds and the GPS will remain on until a valid position fix has been obtained or until two minutes have elapsed. If a valid position fix has been obtained, a single 406 MHz test burst with encoded location data will be transmitted, the green LED will light for at least 3 seconds and the strobe light (bright white LED) will flash. The position fix is not saved for use. The green LED indicates that the GPS is functioning properly and that the PLB is in a location or environment where it can receive the necessary signals from the GPS satellites. If the GPS does not acquire a valid position fix, the GPS will turn off after two minutes and a 406 MHz burst with default location data will be transmitted, followed by the red LED lighting for three seconds and the strobe light (bright white LED) flashing.

The worst case current consumption scenario for the PLB-375 GNSS Self-Test feature is 12 times of the GPS on for two minutes and 12 406 MHz bursts.

Protection Against Continuous Transmission

The protection against continuous transmission of the 406 MHz signal is provided through redundant controlling hardware and software. The 406 MHz RF Power module is controlled by single circuit/switch under microprocessor control. The transmission must cease if the microprocessor control line output is not high, putting out current at 3.3 volts. If the microprocessor should fail, the voltage on this line will go low and the transmission must stop. It is fail safe. The entire synthesizer/modulator circuitry is turned on and off for each transmission. Therefore, the transmission can never be continuous.



Product Service

Protection Against Repetitive Self-Tests

The Self-Test algorithm is in-line code with no loops that execute consecutive instructions implementing self-test. It is possible to either complete one self-test, one GNSS self-test, enter the on mode, or turn the PLB off. It is not possible to repeat the instructions. If the self-test button is held down for 5 seconds, the GNSS self-test is initiated (125 seconds maximum). If it is held longer, the test does not restart. Therefore, it is not possible to generate more than one self-test.

Protection Against Beacon Degradation Due to Navigation Device, Interface or Signal Failure or Malfunction

The algorithm that accesses the GPS location information serially inputs the GPS data from the GPS module. A GPS location fix is only considered valid if all of the following are acceptable: the header information, the quality indicator, the NMEA checksum, and out-of range position data. Specifically, the predetermined header data must be verified and the GPS Quality Indicator must be GPS SPS mode, fix valid. A location fix is only considered valid and encoded into a 406 MHz message if all of the above are valid. If not, the encoded location in the 406 MHz message is left as default location. Therefore, it is not possible for 406 MHz transmissions to be degraded by a malfunctioning GPS or the failure of the GPS to acquire correct data.



Product Service



RAKON UK LTD

PRODUCT SPECIFICATION FOR: -

E4672 LF (T)

T/ 2900

Issue No. : 3

Date : 05/08/08

Originator : Jan Ooijman

Change Note : LN4661

Sheet 1 of 3

DOCUMENT CONTROL DRAWING

<u>CUSTOMER</u>	<u>SPEC</u>	<u>DATE</u>	<u>ISSUE</u>	<u>PAGES</u>	<u>DEVICE</u>
RAKON UK	T2900	09/07/08	3	2	E4672LF

DOCUMENT APPROVED BY

Originator

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Product Service



RAKON UK LTD

PRODUCT SPECIFICATION FOR: -

E4672 LF (T)

T/ 2900

Issue No. : 3

Date : 05/08/08

Originator : Jan Ooljman

Change Note : LN4661

Sheet 2 of 3

Oscillator Specification: E4672LF(T)

Issue 3, 9th July 2008, LN4661

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

Outline in mm

Pad Connections

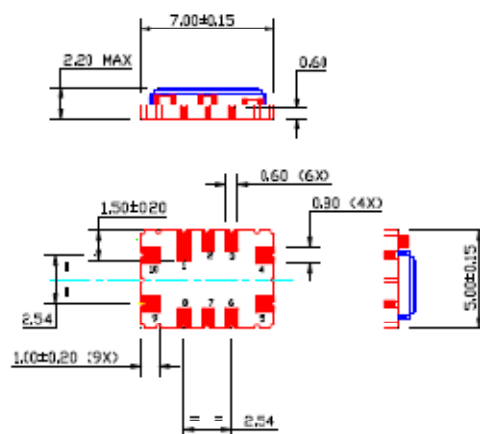
1. Do not connect
2. NC
3. Do not connect
4. GND
5. RF Output
6. NC
7. NC
8. Tri-State Control (Enable)*
9. Supply, +Vs
10. Do not connect

* leave unconnected if not required

Weight 170mg (typical)

Marking includes

R
Manufacturing identifier (X).
Crystal manufacture date
Pad 1 / Static sensitivity identifier (Δ).
Abbreviated P/N (4672),
Device date code (YW),
Serial number (nnnn).



Electrical

Nominal Frequency, F_0
Supply Voltage, V_s
Input Current
Output:
Type
Load
 V_{ol}
 V_{oh}
Duty cycle @ 50%
Rise time, 10% to 90%
Fall time, 90% to 10%
Frequency Stability
Calibration Tolerance at 25°C
Temperature, -20°C to 55°C
Supply Voltage, $\pm 10\%$
Load, ± 5 pF
Allan Variance ($\tau=100$ ms)

12.688656MHz

3.3 V $\pm 10\%$

≤ 4.0 mA

IICMOS

15 pF

$\leq 0.1 * V_s$

$\geq 0.9 * V_s$

45% to 55%

≤ 8 ns

≤ 8 ns

$\leq \pm 0.5$ ppm

$\leq \pm 0.2$ ppm reference to $(F_{max}+F_{min})/2$

$\leq \pm 0.1$ ppm reference to frequency at 3.3V

$\leq \pm 0.1$ ppm reference to frequency at 15 pF

≤ 1.0 ppb

R X YW
 Δ 4672YW0000



Product Service



RAKON UK LTD

PRODUCT SPECIFICATION FOR: -

E4672 LF (T)

T/ 2900

Issue No. : 3
 Date : 05/08/08
 Originator : Jan Ooijman
 Change Note : LN4661
 Sheet 3 of 3

Oscillator Specification: E4672LF(T)Issue 3, 9th July 2008, LN4661*Designed for use in "Cospas-Sarsat" Emergency Beacon Applications*

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

Mean Slope dF/dt

Steady state conditions $\leq \pm 0.7$ ppb/min

During and 15 minutes after variable temperature conditions

 $\leq \pm 1.7$ ppb/min (dT/dt $\leq \pm 5^\circ\text{C}/\text{ho}$)

Residual dF from slope

 $\leq \pm 2.0$ ppb (dT/dt $\leq \pm 5^\circ\text{C}/\text{hour}$)

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

Reflow soldering

 $\leq \pm 1.0$ ppm

Ageing, first year

 $\leq \pm 1.0$ ppm

Ageing, 10 years

 $\leq \pm 3.0$ ppm

Tri-State

Pad 8 open circuit or $\geq 0.6\text{V}$ s

Output Enabled

Pad 8 $< 0.2\text{V}$ s

Output High impedance

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

Phase Noise (typical values)

-90 dBc/Hz at 10 Hz

-115 dBc/Hz at 100 Hz

-127 dBc/Hz at 1 kHz

-137 dBc/Hz at 10 kHz

-143 dBc/Hz at ≥ 100 kHz**Environmental**

Operating Temperature Range

-20 to $+55^\circ\text{C}$

Storage Temperature Range

-55 to $+125^\circ\text{C}$

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

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

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

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

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

Marking Laser Marked

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

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



Product Service



Sadler Road, Lincoln
LN6 3RS, United Kingdom

Tel.: + 44 (0) 1522 883528
Fax: + 44 (0) 1522 823535
E-mail: DavidW@Rakon.co.uk

Rakon UK Ltd.

TEST SUMMARY

REPORT No.:	2008-029a
Date:	10 th July 2008
Product type:	Temperature Compensated Crystal Oscillator (TCXO)
Construction:	1) Surface Mount (7 x 5 mm) 2) "Pluto" ASIC
Generic Type:	CFPT-9000
RAKON UK Part No.:	E4672LF
Output Frequency:	12.688656 MHz
Number Tested:	20

TESTS PERFORMED

Test Performed: **5 year Stability Prediction**

Consisting of:

1) Medium Term Stability Measurements at 0, 3 and 6 months



Product Service



Sadler Road, Lincoln
LN6 3RS, United Kingdom

Tel.: + 44 (0) 1522 883528
Fax: + 44 (0) 1522 823535
E-mail: DavidW@Rakon.co.uk

Rakon UK Ltd.

SUMMARY OF TEST RESULTS			
Test Required	Pass	Fail	Remarks
5 Year Prediction Residual (ppb)	20	0	Results attached
5 Year Prediction Minimum Negative Slope (ppb/min)	20	0	Results attached
5 Year Prediction Maximum Positive Slope (ppb/min)	20	0	Results attached
5 Year Prediction Aging Mid frequency (ppm)	20	0	Results attached
TESTS CONDUCTED			
BY: <i>D Lowrie</i>		DATE December 2007 to July 2008	APPROVED: <i>D R Woodall</i>



Product Service



RAKON UK LTD
QUALIFICATION TEST RESULTS SHEET
 Qualification Test: 5Year Stability Prediction

Ref.
2008-029a

Introduction:

In order to predict the stability of the devices over a five year period, 20 off E4672LF were tested, stored for 3 months at room temperature and then re-measured, the devices were then stored for a further 3 months and re-measured, this data was then used to generate the 5 year prediction.

Results:

Device E4672LF		Residual (ppb)				
Time (Days)	3	90	180	Prediction		
Serial Number	Start	3 months	6 months	Slope	Intercept	Prediction 5 years
1353	0.50	0.56	0.22	-0.09	0.57	0.27
1354	0.47	0.03	0.24	-0.05	0.53	0.30
1355	0.71	1.34	0.38	0.01	0.79	0.83
1362	0.65	0.62	0.40	-0.10	0.72	0.38
1363	0.74	0.84	0.56	-0.05	0.79	0.63
1364	0.57	1.14	0.28	0.01	0.64	0.68
1371	0.59	0.57	0.75	0.06	0.55	0.73
1372	0.78	0.80	0.19	-0.22	0.94	0.22
1373	1.04	0.88	0.66	-0.18	1.14	0.56
1380	2.04	1.03	1.24	-0.39	2.25	0.97
1381	0.86	0.80	0.36	-0.20	0.99	0.33
1389	0.51	0.77	0.19	-0.07	0.59	0.38
1390	0.67	0.83	0.40	-0.07	0.74	0.52
1393	0.49	0.66	0.27	-0.05	0.55	0.39
1394	0.46	0.65	0.21	-0.05	0.53	0.35
1402	0.68	0.94	0.23	-0.12	0.80	0.42
1403	1.19	0.99	0.72	-0.22	1.32	0.59
1412	1.01	0.78	1.21	0.03	0.96	1.05
1420	0.80	0.75	0.29	-0.21	0.94	0.26
1421	0.63	0.89	0.27	-0.08	0.72	0.46
Average	0.77	0.85	0.45	-0.10	0.85	0.52



Product Service



RAKON UK

QUALIFICATION TEST RESULTS SHEET

Qualification Test: 5Year Stability Prediction

Ref. 2008-029a

Device E4672LF		Min Negative Slope (ppb/min)				
Time (Days)	3	90	180	Prediction		
Serial Number	Start	3 months	6 months	Slope	Intercept	Prediction 5 years
1353	-0.26	-0.22	-0.22	0.02	-0.27	-0.19
1354	-0.26	-0.22	-0.31	-0.01	-0.25	-0.28
1355	-0.35	-0.44	-0.39	-0.03	-0.34	-0.45
1362	-0.40	-0.45	-0.42	-0.02	-0.39	-0.45
1363	-0.47	-0.47	-0.48	0.00	-0.47	-0.48
1364	-0.31	-0.35	-0.35	-0.02	-0.30	-0.38
1371	-0.53	-0.40	-0.40	0.03	-0.54	-0.45
1372	-0.20	-0.21	-0.25	-0.02	-0.19	-0.26
1373	-0.79	-0.86	-0.84	-0.03	-0.78	-0.89
1380	-1.64	-1.60	-1.54	0.05	-1.67	-1.51
1381	-0.40	-0.46	-0.36	0.00	-0.41	-0.40
1389	-0.27	-0.30	-0.21	0.02	-0.29	-0.23
1390	-0.42	-0.40	-0.39	0.02	-0.43	-0.30
1393	-0.45	-0.48	-0.49	-0.02	-0.44	-0.51
1394	-0.24	-0.24	-0.26	-0.01	-0.23	-0.26
1402	-0.24	-0.27	-0.23	0.00	-0.24	-0.25
1403	-0.90	-0.77	-0.72	0.10	-0.95	-0.63
1412	-0.92	-0.76	-0.96	0.02	-0.91	-0.85
1420	-0.20	-0.27	-0.37	-0.03	-0.26	-0.36
1421	-0.24	-0.30	-0.26	-0.02	-0.23	-0.30
Average	-0.48	-0.48	-0.48	0.00	-0.48	-0.48



Product Service



RAKON UK

QUALIFICATION TEST RESULTS SHEET

Qualification Test: 5Year Stability Prediction

Ref. 2008-029a

Device E4672LF		Max Positive Slope (ppb/min)			Prediction	
Time (Days)	3	90	180			
Serial Number	Start	3 months	6 months	Slope	Intercept	prediction 5 years
1353	0.23	0.21	0.20	-0.02	0.24	0.19
1354	0.18	0.16	0.41	0.08	0.12	0.39
1355	0.44	0.54	0.48	0.04	0.43	0.55
1362	0.40	0.41	0.45	0.02	0.39	0.46
1363	0.29	0.33	0.27	0.00	0.30	0.30
1364	0.26	0.31	0.28	0.02	0.25	0.31
1371	0.43	0.47	0.46	0.02	0.42	0.49
1372	0.23	0.23	0.26	0.01	0.22	0.26
1373	0.89	0.84	0.79	-0.05	0.92	0.76
1380	1.86	1.76	1.64	-0.11	1.92	1.57
1381	0.37	0.38	0.37	0.00	0.37	0.38
1389	0.21	0.20	0.17	-0.02	0.22	0.16
1390	0.55	0.50	0.54	-0.01	0.55	0.51
1393	0.47	0.48	0.55	0.03	0.45	0.56
1394	0.20	0.22	0.25	0.02	0.19	0.26
1402	0.26	0.26	0.23	-0.01	0.27	0.23
1403	0.44	0.50	0.47	0.02	0.43	0.51
1412	0.71	0.74	1.13	0.17	0.60	1.14
1420	0.29	0.23	0.36	0.01	0.27	0.32
1421	0.32	0.34	0.31	0.00	0.32	0.32
Average	0.45	0.46	0.48	0.01	0.44	0.48



Product Service



RAKON UK LTD
 QUALIFICATION TEST RESULTS SHEET
 Qualification Test: 5Year Stability Prediction Ref. 2008-029a

Device E4672LF Aging Mid Frequency ppm						
Time (Days)	3	90	180	Prediction		
Serial Number	Start	3 months	6 months	Slope	Intercept	prediction 5 years
1353	-0.09	-0.10	-0.13	-0.02	-0.08	-0.14
1354	-0.08	-0.16	-0.34	-0.12	-0.01	-0.39
1355	-0.08	-0.14	-0.21	-0.06	-0.05	-0.25
1362	-0.09	-0.14	-0.17	-0.04	-0.07	-0.20
1363	-0.08	-0.10	-0.13	-0.02	-0.07	-0.14
1364	-0.07	-0.14	-0.20	-0.06	-0.04	-0.25
1371	-0.01	-0.10	-0.16	-0.08	0.03	-0.22
1372	-0.13	-0.22	-0.25	-0.07	-0.10	-0.31
1373	-0.08	-0.12	-0.17	-0.04	-0.06	-0.20
1380	-0.13	-0.16	-0.17	-0.02	-0.12	-0.19
1381	-0.05	-0.10	-0.15	-0.05	-0.02	-0.18
1389	-0.05	-0.09	-0.11	-0.03	-0.03	-0.14
1390	-0.10	-0.15	-0.19	-0.05	-0.08	-0.22
1393	-0.10	-0.15	-0.21	-0.05	-0.07	-0.24
1394	-0.07	-0.09	-0.14	-0.03	-0.05	-0.15
1402	-0.10	-0.14	-0.10	-0.04	-0.00	-0.21
1403	-0.16	-0.20	-0.24	-0.04	-0.14	-0.27
1412	-0.03	-0.06	-0.19	-0.07	0.01	-0.21
1420	-0.05	-0.12	-0.25	-0.09	0.00	-0.30
1421	-0.14	-0.21	-0.24	-0.05	-0.11	-0.29
Average	-0.08	-0.13	-0.19	-0.05	-0.06	-0.22



Product Service

ANNEX C

CUSTOMER SUPPLIED TEST RESULTS



Product Service

APPENDIX C TO ANNEX F

NAVIGATION SYSTEM TEST RESULTS

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

Script Reference (Table D.2 C/S T.007 - Issue 4 - Revision 4 October 2009)	Value of Encoded Location Bits Transmitted by Beacon	Confirmation that BCH is Correct (✓)
1	Bits 65 - 85 = 0FFBFF Bits 113 - 132 = 83E0F	✓
2	Bits 65 - 85 = 100400 Bits 113 - 132 = 8420E Number of seconds after providing navigation data that beacon transmitted the above encoded location information: 41.72 seconds	✓
3	Bits 65 - 85 = 000000 Bits 113 - 132 = 8360D	✓
4	Bits 65 - 85 = 000ACF Bits 113 - 132 = 0F222	✓
5	Bits 65 - 85 = 0012CE Bits 113 - 132 = 93A60	✓
6	Bits 65 - 85 = 100ECF Bits 113 - 132 = 0FA10	✓
7	Bits 65 - 85 = 1B2964 Bits 113 - 132 = 80A00	✓
8	Bits 65 - 85 = 1B2D64 Bits 113 - 132 = 84E00	✓
9	Bits 65 - 85 = 0B46D0 Bits 113 - 132 = 03801	✓
10	Bits 65 - 85 = 0B42D0 Bits 113 - 132 = 08009	✓
11	Bits 65 - 85 = 14962A Bits 113 - 132 = 80200	✓



Product Service

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

Script Reference (See Table D.3 C/S T.007 - Issue 4 - Revision 4 October 2009)	Value of Encoded Location Bits Transmitted by Beacon	Confirmation that BCH is Correct (√)
1	Bits 59 - 85 = 3F81FE0 Bits 113 - 126 = 27CF	√
2	Bits 59 - 85 = 4002000 Bits 113 - 126 = 284E Number of seconds after providing navigation data that beacon transmitted the above encoded location information: 39.57 seconds	√
3	Bits 59 - 85 = 0000000 Bits 113 - 126 = 26CD	√
4	Bits 59 - 85 = 0019678 Bits 113 - 126 = 060D	√
5	Bits 59 - 85 = 001567A Bits 113 - 126 = 2710	√
6	Bits 59 - 85 = 401B677 Bits 113 - 126 = 0740	√
7	Bits 59 - 85 = 6CA0B20 Bits 113 - 126 = 06C0	√
8	Bits 59 - 85 = 6CA2B20 Bits 113 - 126 = 21C0	√
9	Bits 59 - 85 = 2D03680 Bits 113 - 126 = 0701	√
10	Bits 59 - 85 = 2CF5680 Bits 113 - 126 = 2009	√
11	Bits 59 - 85 = 523F14F Bits 113 - 126 = 2040	√



Product Service

APPENDIX D TO ANNEX F

BEACON CODING SOFTWARE RESULTS

Table F-D.2: Examples of Location Protocol Beacon Messages

Protocol	Operational message		Self-Test Message	GNSS Self-Test Message
	Location "A"	Location "B"		Location "A"
	Lat: 26° 3' 4" N Lon: 80° 10' 8" W	Lat: 26° 13' 35" N Lon: 80° 11' 20" W		Lat: 26° 3' 4" N Lon: 80° 10' 8" W
Standard Location: PLB with Serial Number	FFFE2F8C97F9C0631A2A 0FBB8EF78C44DA11	FFFE2F8C97F9C0631A6 A0E5B1C370583A49B	FFFED08C97F9C0 637FDFFF11B237	FFFED08C97F9C0631A2A0 FBB8EF78C44DA11
National Location: PLB	FFFE2F8C9B0018C68550 2B6CA4F71D080674	FFFE2F8C9B0018C68F5 03715F1370C2809C3	FFFED08C9B0018 DFC0FF042E1977	FFFED08C9B0018C685502 B6CA4F71D080674

ANNEX D

ADDITIONAL TESTS REQUIRED BY C/S WORKSHEET-02

D.1.0 SPURIOUS EMISSIONS

D.1.1.1 Equipment Under Test and Modification State

PLB-375 S/N: Unit #7 TUV TSR0036 – Mod State 5

D.1.1.2 Date of Test

07 June 2011

D.1.1.3 Test Equipment Used

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

D.1.1.4 Environmental Conditions

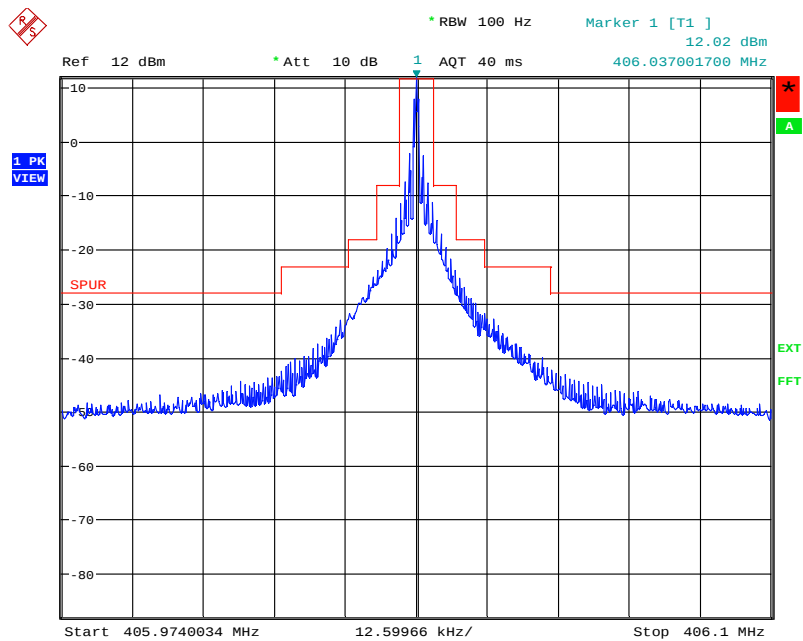
Ambient Temperature 22 °C
Relative Humidity 33%

D.1.1.5 Test Results

In response to Cospas Sarsat worksheet-02, section 21, the spurious emissions test was repeated in accordance with the procedure detailed below:

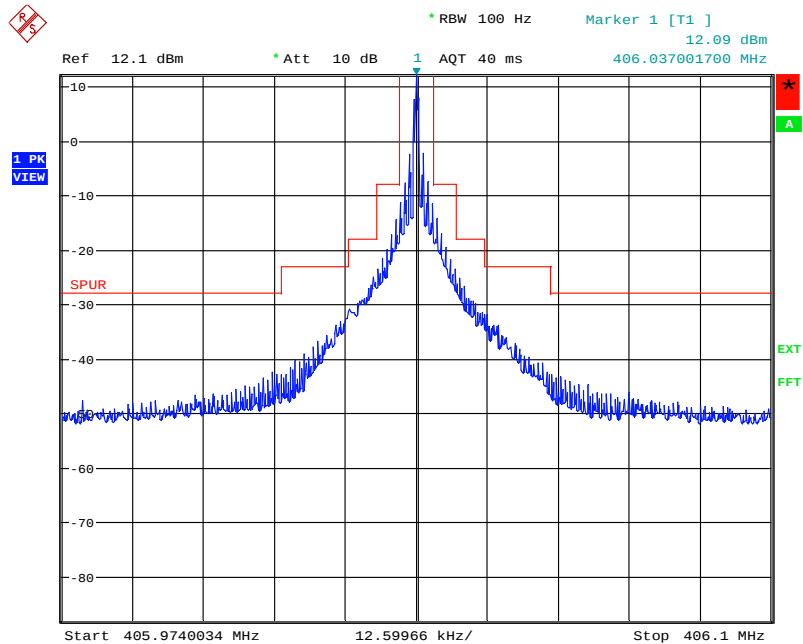
- Test carried out on sample ref: TSR0036, modification state 5.
- Battery ref: TSR0039 used for testing.
- Battery used for previous Battery Discharge at ambient temperature for 7.14 hours and Operating Lifetime test at -20°C in excess of 28.3 hours. The same battery was used for all three measurements.
- Total previous battery usage 35.5hrs.
- Spurious emissions test carried out at ambient, +55°C and -20°C. The beacon was allowed to stabilize at each temperature for at least 2 hours before the measurements were taken.
- Measurements made for 30mins at each temperature.
- Spectrum Analyser set to BW filter type FFT (40mS acquisition time).

Ambient Temperature



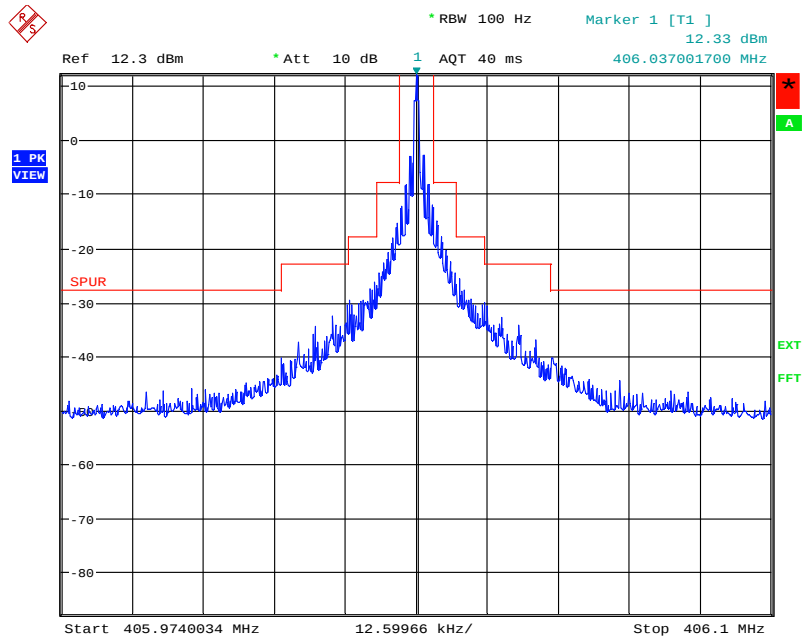
Date: 6.JUN.2011 16:25:30

Extreme Temperature: +55°C



Date: 7.JUN.2011 09:26:48

Extreme Temperature: -20°C



Date: 7. JUN. 2011 14:17:13