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Report On

Emergency Beacons Testing of the
ACR Electronics, Inc.
PLB-350A (Non-GPS)

Document 75905359 Report 02 Issue 3 June 2009

TUV 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

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ACR Electronics, Inc.
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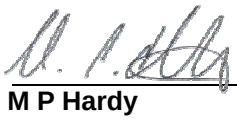
Document 75905359 Report 02 Issue 3

June 2009

PREPARED FOR

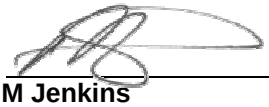
ACR Electronics, Inc.
5757 Ravenswood Road
Fort Lauderdale
USA

PREPARED BY



M P Hardy
Test Engineer

APPROVED BY



M Jenkins
Authorised Signatory

DATED 05 June 2009

Product Service

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ANNEX A Customer Supplied Information A.2

SECTION 1

REPORT SUMMARY

Emergency Beacons Testing of the
ACR Electronics, Inc.
PLB-350A (Non-GPS)

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Emergency Beacon Testing of the ACR Electronics, Inc. PLB-350A (Non-GPS) to the requirements of T.007 Issue 4 – Rev 2 November 2007.

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, Inc.	
Model Number(s)	PLB-350A (Non-GPS)	
TUV Reference Number(s), Model(s) and Serial Number(s)	75905359_003 75905359_005 75905359_009	PLB-350A Floatation, S/N: #20 PLB-350A Floatation (50Ω), S/N: #7 PLB-350A Slim, S/N: #18
Number of Samples Tested	Three	
Test Specification/Issue/Date	Cospas-Sarsat T.007 Issue 4 – Rev 2 November 2007	
Incoming Release Date	Application Form 16 January 2009	
Date of Receipt of Test Samples	23 January 2009	
Order Number Date	95233_001 10 January 2009	
Start of Test	02 February 2009	
Finish of Test	06 March 2009	
Name of Engineer(s)	M P Hardy R Henley	

1.2 APPLICATION FORM

1.2.1 Beacon Manufacturer and Beacon Model

Beacon Manufacturer	ACR Electronics, Inc
Beacon Model	PLB-350A (non-GPS)
Other Model Names	PLB-350A Slim, PLB-350A Float

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 temperature range	Tmin = -20°C Tmax = +55°C
Operating lifetime	24 hours
Battery chemistry	LiMnO2
Battery cell size and number of cells	2/3A size, two connected-in-series Packs (2 series cells per pack)
Battery cell manufacturer	Sanyo, CR123A
Battery pack manufacturer and part number	ACR, A3-06-2613
Oscillator type (e.g. OCXO, MCXO, TCXO)	TCXO
Oscillator manufacturer	Rakon/C-MAC
Oscillator part name and number	A1-11-0687-2 (E4672)
Oscillator satisfies long-term frequency stability requirements (Yes or No)	Yes

Characteristic	Specification
Antenna type: Integral or Other (e.g. External, Detachable – specify type)	Integrated
Antenna manufacturer	ACR Electronics, Inc.
Antenna part name and number	A3-06-2493
Navigation device type (Internal, External or None)	None
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)	N/A
Features in beacon that ensures erroneous position data is not encoded into the beacon message (Yes, No or N/A)	N/A
Navigation device capable of supporting global coverage (Yes, No or N/A)	N/A
For Internal Navigation Devices	
- Geodetic reference system (WGS 84 or GTRF)	
- GNSS receiver cold start forced at every beacon activation (Yes or No)	
- Navigation device manufacturer	
- Navigation device model name and part Number	
- GNSS system supported (e.g. GPS, GLONASS, Galileo)	
For External Navigation Devices	
- Data protocol for GNSS receiver to beacon interface	na
- Physical interface for beacon to navigation device	na
- Electrical interface for beacon to navigation device	na
- Navigation device model and manufacturer (if beacon designed to use specific devices)	na

Characteristic	Specification	
Self-Test Mode Characteristics	Self-Test Mode	Optional GNSS Self-Test Mode
- Self-test has separate switch position (Yes or No)	Yes	
- Self-test switch automatically returns to normal position when released (Yes or No)	Yes	
- Self-test activation can cause an operational mode transmission (Yes or 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	
- Results of self-test indicated by (e.g. Pass / Fail Indicator Light, Strobe Light, etc.)	4 beeps/LED	
- Self-test can be activated from beacon remote activation points (Yes or 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	
- Self-test transmits a signal(s) other than at 406 MHz (Yes & details or No)	no	
- Self-test can be activated directly at beacon (Yes or No)	Yes	
- List of Items checked by self-test	Battery,406PWR,Lock Det	
- Self-test transmission burst duration (440 or 520 ms)	440 ms	
- Self-test format bit (“0” or “1”)	1	
- Maximum duration of GNSS Self Test	N/A	
- Maximum number of GNSS Self Tests (beacons with internal navigation devices only)	N/A	
Beacon includes a homer transmitter (if yes identify frequency of transmission)	121.5MHz	
-Homer Transmit Power	17dBm	
-Homer Duty Cycle	98%	
-Duty Cycle of Homer Swept Tone	37.5%	

Characteristic	Specification
Beacon includes a strobe light (Yes or No)	No
- Strobe light intensity	
- Strobe light flash rate	
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). List details on a separate sheet if insufficient space to describe.	na
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

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

1.2.4 Information Provided by the Cospas-Sarsat Accepted Test Facility

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

Date of Submission for Testing: 23 January 2009

Applicable C/S Standards:

Document	Issue	Revision	Date
C/S T.001	3	7	Nov-05
C/S T.007	4	1	Oct-06
C/S T.007	4	2	Nov-07

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

Signed: 

Name: M Jenkins

Position Held: Authorised Signatory

Date: 05 June 2009

1.2.5 Applicant Details

Company Name	ACR Electronics, Inc.		
Address	5757 Ravenswood Road Fort Lauderdale, Florida 33312-6645 USA		
Category of Applicant	☒ Manufacturer	☐ Importer	
	☐ Distributor	☐ Agent	
Contact Name	Chung Tong	Telephone	954-981-3333, ext.2186
Email	ctong@acrelectronics.com	Facsimile	954-983-5087

1.2.6 Manufacturer Details

Company Name	Same as above		
Address			
Contact Name		Telephone	
Email		Facsimile	

1.2.7 Declaration of Build Status

Hardware Version	
- PCB Revision	Rev.A (same as T2)
- Battery Model	A3-06-2613
Software Version	N/A
Firmware Version	Rev.A (same as T2)
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: Chung Tong

Name: Chung Tong

Position Held: Principal electrical Engineer

Date: 06/02/2009

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a ACR Electronics, Inc. PLB-350A (Non-GPS) as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.

Equipment Under Test (75905359_004)

1.3.2 Physical Test Configuration

The Equipment Under Test (EUT) was operated using its own power source (internal battery).

The Main "50Ω" EUT Sample was configured for direct connection to the 50Ω test system using a coaxial cable (sample 75905359_005). These samples were used for all tests except Antenna Characteristics and Satellite Qualitative.

The two other EUT samples were fully packaged beacons, similar to the proposed production beacons equipped with their proper antennas. These EUT samples were used to perform Antenna Characteristics and Satellite Qualitative. 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.

1.3.3 Modes of Operation

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

Standby Mode:
- No apparent EUT activity
- No ancillary devices were declared

Self-test:
- “TEST” button depressed until green LED light indicated Self-test operation
- List of features tested as per Application Form

Operating:
- 121 MHz homer active and offset to 121.65 MHz
- 243 MHz homer not declared
- Physical configuration as above

1.4 MODIFICATIONS

No modifications were made to the test sample during testing.

1.5 REPORT MODIFICATION RECORD

Issue 1 – First Issue
Issue 2 – Customer requested corrections made
Issue 2 – Cospas-Sarsat Worksheet 1: Actions include (but are not limited to):
- New Application Forms (Separated Float and Slim variants)
- Amended Battery Discharge Calculations and corresponding reduction to Operating Lifetime at Minimum Temperature results
- Additional photographs included
- Numerous omissions and typographical errors corrected

SECTION 2

TEST DETAILS

Emergency Beacons Testing of the
ACR Electronics, Inc.
PLB-350A (Non-GPS)

TEST RESULTS TABLE

Parameter		Limits	Units	Test Results			Comments
				Tmin	Tamb	Tmax	
				(-20°C)	(20°C)	(+55°C)	
2. Digital Message Coding		Bit Numbers					Test Sample: 75905359_05 Mod State: 0 **Result: Pass**
Bit Sync	1 - 15	15 bits "1"	P / F	P	P	P	Decoded Message: Page 19
Frame sync	16 - 24	"000101111"	P / F	P	P	P	
Format flag	25	1 bit	bit value	0	0	0	
Protocol flag	26	1 bit	bit value	1	1	1	
Identification / position data	27 - 85	59 bits	P / F	P	P	P	
BCH code	86 -106	21 bits	P / F	P	P	P	
Emerg. Code/nat. use/supplem. Data	107 - 112	6 bits	bit value	000000	000000	000000	
Additional data / BCH (if applicable)	112 - 144	32 bits	P / F	N/A	N/A	N/A	
Position Error (if applicable)		< 5	km	N/A	N/A	N/A	
3. Digital Message Generator							Test Sample: 75905359_05 Mod State: 0 **Result: Pass**
Repetition rate, T_R:							
Average T_R		$48.5 \leq T_{Ravg} \leq 51.5$	seconds	49.958	49.968	49.967	
Minimum T_R		$47.5 \leq T_{Rmin} \leq 48.0$	seconds	47.563	47.703	47.766	
Maximum T_R		$52.0 \leq T_{Rmax} \leq 52.5$	seconds	52.266	52.109	52.359	
Standard deviation		0.5 - 2.0	seconds	1.563	1.633	1.190	
Bit rate							
Minimum fb		≥ 396	bits/sec	400.011	400.000	399.989	
Maximum fb		≤ 404	bits/sec	400.045	400.028	400.019	
Total transmission time							
Short message		435.6 - 444.4	ms	440.439	440.451	440.458	
Long message		514.8 - 525.2	ms	N/A	N/A	N/A	
Unmodulated carrier							
Minimum T1		≥ 158.4	ms	160.546	160.549	160.545	
Maximum T1		≤ 161.6	ms	160.564	160.563	160.561	
First burst delay		≥ 47.5	seconds	100	100	100	

Parameter	Limits	Units	Test Results			Comments
			T_{min} (-20°C)	T_{amb} (20°C)	T_{max} (+55°C)	
6. Spurious Emissions into 50ohms						Test Sample: 75905359_05 Mod State: 0 **Result: Pass**
In band (406.0 – 406.1 MHz)	C/S T.001 mask	P / F	P	P	P	Spectrum plots: Page 22
8. Self-test Mode						Test Sample: 75905359_05 Mod State: 0 **Result: Pass**
Frame sync	011010000	P / F	P	P	P	Decoded Message: Page 23
Format flag	1 / 0	bit value	0	0	0	
Single radiated burst	≤440 / 520 (±1%)	ms	440.295	440.422	439.973	
Default position data (if applicable)	correct	P / F	N/A	N/A	N/A	
Description	provided	Y / N		Y		
Design data on protection against repetitive self-test mode transmissions	provided	Y / N		Y		Applicants Data, see Annex A.
Single burst verification	one burst	P / F	P	P	P	
Provides for 15 Hex ID	correct	P / F	P	P	P	
121.5 MHz RF power (if applicable)	self-test checks that RF power emitted	Y / N		N/A*		* See Self-test Mode Description under Applicants Data, Annex A.
406 MHz power	self-test checks that RF power emitted	Y / N		N/A*		

Parameter	Limits	Units	Test Results		Comments
			T_{min} (-20°C)	T_{max} (+55°C)	
10 Operating Lifetime at Minimum Temperature					Test Sample: 75905359_05 Mod State: 0 **Result: Pass**
Pre-test battery discharge duration (operating)		hours	4.16		Test Data: Page 24
Duration	>24	hours	40.90 Hours at Tmin = -20 °C		The Pre-test battery discharge of 3.63 was performed prior to the start of the Operating Lifetime at Minimum Temperature;hence 0.53 hours is deducted to provide the Effective Operating Lifetime Duration.
Effective Operating Lifetime Duration	>24	Hours	40.37 Hours at Tmin = -20 °C		
Transmitted Frequency			Min	Max	
Nominal value	C/S T.001	MHz	406.0366797	406.0366807	Maximum and minimum values are taken up to 24 hours. The first failure was a measurement of Output Power.
Short-term stability	≤ $2x10^{-9}$	/100ms	$6.972 x10^{-11}$	$1.97 x10^{-10}$	
Medium-term stability – Slope	(-1 to +1)$x10^{-9}$	/min	$-2.478 x10^{-11}$	$2.647 x10^{-11}$	
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$5.62 x10^{-11}$	$1.925 x10^{-10}$	
Transmitter power output	35 - 39	dBm	36.857	37.189	
Digital message	correct	P/F	P		Decoded Message: Page 29

Parameter	Limits	Units	Test Results				Comments
12. Oscillator Aging							
Data	provided	Y / N	Y				Applicants Data, see Annex A.
13. Protection Against Continuous Transmission							
Description	provided	Y / N	Y				Applicants Data, see Annex A.
14. Satellite Qualitative Tests							Test Sample: 75905359_03/09 Mod State: 0 **Result: Pass**
Test Configuration	As per C/S T.007		Configuration 7		Configuration 8		
	TUV Reference		003	009	003	009	
15 Hex ID Decoded by LUT	correct	P / F	P	P	P	P	Test Data: Page 34
Doppler Location results with error ≤5km	≥80	%	100	93.8	100	100	
15. Antenna Characteristics							Test Sample: 75905359_03 Mod State: 0 **Result: Pass(MU)**
Test Configuration	C/S T.007	Figure	B.2		B.5		
Polarisation	linear or RHCP		Linear		N/A		Test Data: Page 38
VSWR	≤1.5		N/A		N/A		Detachable Antennas Only
$EIRP_{LOSS}$		dB	-0.22		-0.22		
$EIRP_{maxEOL}$	≤43	dBm	43.3		41.5		MU Pass
$EIRP_{minEOL}$	≥32	dBm	32.3		34.7		
Azimuth gain variation at 40° elevation angle	≤3	dB	1.3		N/A		
16. Beacon Coding Software							
Sample message for each coding option of the applicable coding types	correct	P / F	N/A *				* Applicants Data, see Annex A.
Sample self-test message for each coding option of the applicable coding types	correct	P / F	N/A *				

2.1 DIGITAL MESSAGE

2.1.1 Equipment Under Test

PLB-350A, Serial Number #7 (TUV Reference 75905359_005)

2.1.2 Date of Test and Modification State

02 and 03 February 2009 - Modification State 0

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 Test Results

Ambient Temperature

```
Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = 993D400004001AD              993D400004001AD Default_Id
 30 Hex (Bits 25-144) = 4C9EA00002000D6A77978000000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 0 1001 1001 0011 1101 0100 0000 0000 0000 0000 0100 0000 0000 0001 1010 1101
   0100 1110 1111 0010 1111 0000 0000 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            0 Short Message                              0
Protocol Flag      26            1 User                                       1
MID                27- 36      201 ALBANIA                          0011 0010 01
User Protocol      37- 39        7 Test                                    111
Spare              40- 63                          0101 0000 0000 0000 0000 0001
Spare              64- 83                               0000 0000 0000 0110 1011
Homing             84- 85        1 121.5                                    01
BCH Encoded        86-106          Errors=0             0100 1110 1111 0010 1111 0
BCH Generated      86-106                               0100 1110 1111 0010 1111 0
Emergency Cd Flag 107            0 National Use                               0
Beacon Activation 108            0 Manual only                                0
National Use      109-112                                                  0000
```

Minimum Temperature

```
Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = 993D400004001AD              993D400004001AD Default_Id
 30 Hex (Bits 25-144) = 4C9EA00002000D6A77978000000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 0 1001 1001 0011 1101 0100 0000 0000 0000 0000 0100 0000 0000 0001 1010 1101
   0100 1110 1111 0010 1111 0000 0000 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	0	Short Message	0
Protocol Flag	26	1	User	1
MID	27- 36	201	ALBANIA	0011 0010 01
User Protocol	37- 39	7	Test	111
Spare	40- 63			0101 0000 0000 0000 0000 0001
Spare	64- 83			0000 0000 0000 0110 1011
Homing	84- 85	1	121.5	01
BCH Encoded	86-106		Errors=0	0100 1110 1111 0010 1111 0
BCH Generated	86-106			0100 1110 1111 0010 1111 0
Emergency Cd Flag	107	0	National Use	0
Beacon Activation	108	0	Manual only	0
National Use	109-112			0000

Maximum Temperature

```
Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = 993D400004001AD              993D400004001AD Default_Id
 30 Hex (Bits 25-144) = 4C9EA00002000D6A77978000000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 0 1001 1001 0011 1101 0100 0000 0000 0000 0000 0100 0000 0000 0001 1010 1101
   0100 1110 1111 0010 1111 0000 0000 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	0	Short Message	0
Protocol Flag	26	1	User	1
MID	27- 36	201	ALBANIA	0011 0010 01
User Protocol	37- 39	7	Test	111
Spare	40- 63			0101 0000 0000 0000 0000 0001
Spare	64- 83			0000 0000 0000 0110 1011
Homing	84- 85	1	121.5	01
BCH Encoded	86-106		Errors=0	0100 1110 1111 0010 1111 0
BCH Generated	86-106			0100 1110 1111 0010 1111 0
Emergency Cd Flag	107	0	National Use	0
Beacon Activation	108	0	Manual only	0
National Use	109-112			0000

2.2 SPURIOUS EMISSIONS

2.2.1 Equipment Under Test

PLB-350A, Serial Number #7 (TUV Reference 75905359_005)

2.2.2 Date of Test and Modification State

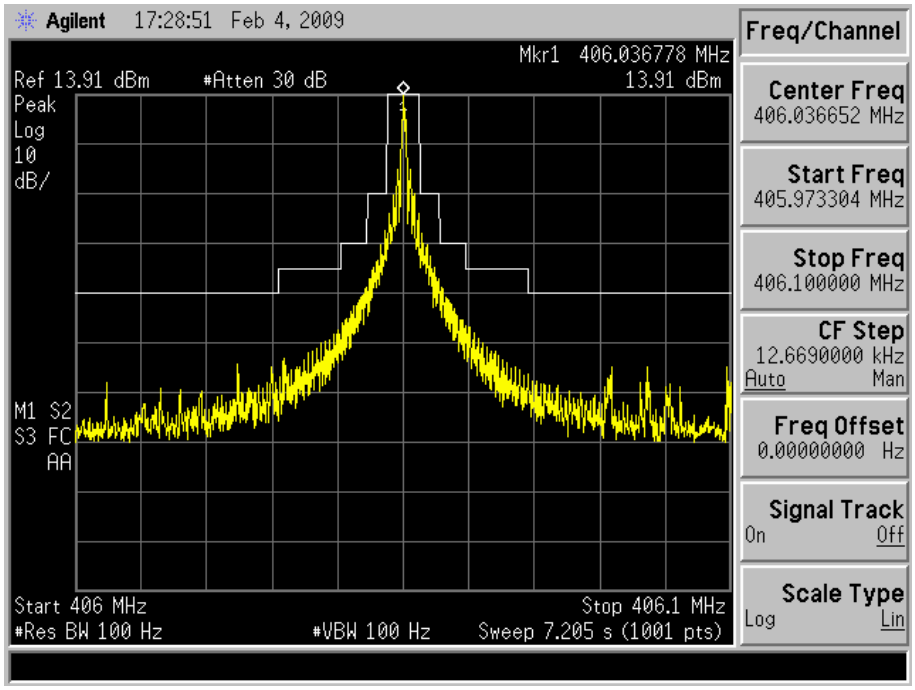
04 February 2009 - Modification State 0

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 Test Results

Combined Plot at Ambient, -20°C and +55°C



2.3 SELF-TEST MODE – DECODED MESSAGE

2.3.1 Equipment Under Test

PLB-350A, Serial Number #7 (TUV Reference 75905359_005)

2.3.2 Date of Test and Modification State

02 and 03 February, 17 March 2009 - Modification State 0

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 Test Results

Digital Message

Note: The digital message for Self-test was identical for all 3 test temperatures.

```
Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = 993D400004001AD              993D400004001AD Default_Id
 30 Hex (Bits 25-144) = 4C9EA00002000D6A77978000000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 0 1001 1001 0011 1101 0100 0000 0000 0000 0000 0100 0000 0000 0001 1010 1101
   0100 1110 1111 0010 1111 0000 0000 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            0 Short Message                              0
Protocol Flag      26            1 User                                       1
MID                27- 36      201 ALBANIA                          0011 0010 01
User Protocol      37- 39        7 Test                                    111
Spare              40- 63                          0101 0000 0000 0000 0000 0001
Spare              64- 83                               0000 0000 0000 0110 1011
Homing             84- 85        1 121.5                                     01
BCH Encoded        86-106          Errors=0             0100 1110 1111 0010 1111 0
BCH Generated      86-106                               0100 1110 1111 0010 1111 0
Emergency Cd Flag 107            0 National Use                               0
Beacon Activation 108            0 Manual only                                0
National Use      109-112                                                  0000
```

2.4 OPERATING LIFETIME AT MINIMUM TEMPERATURE

2.4.1 Equipment Under Test

PLB-350A, Serial Number #7 (TUV Reference 75905359_005)

2.4.2 Date of Test and Modification State

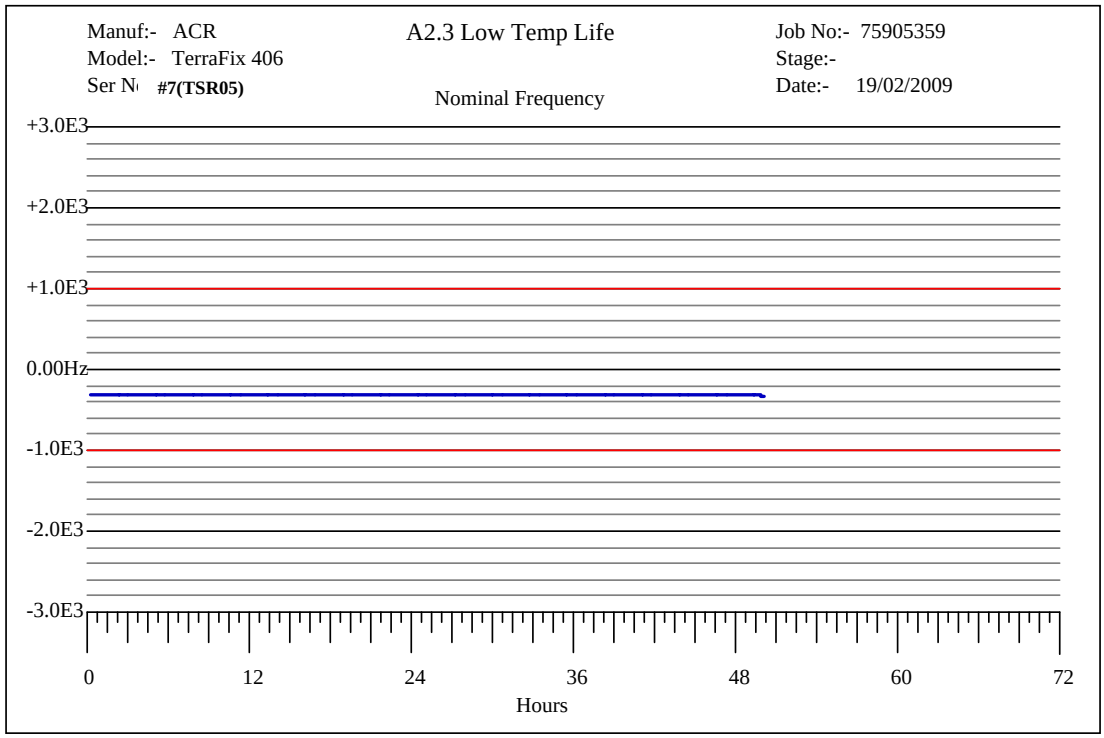
16 to 19 February 2009 - Modification State 0

2.4.3 Test Equipment Used

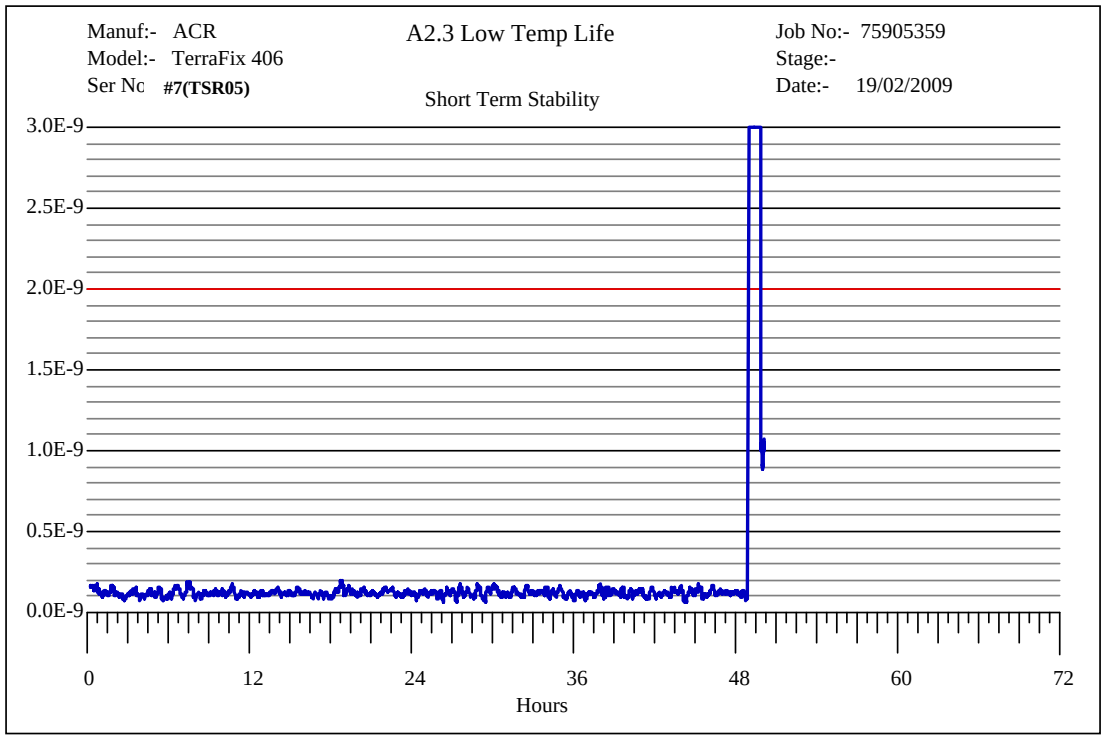
The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.4 Test Results

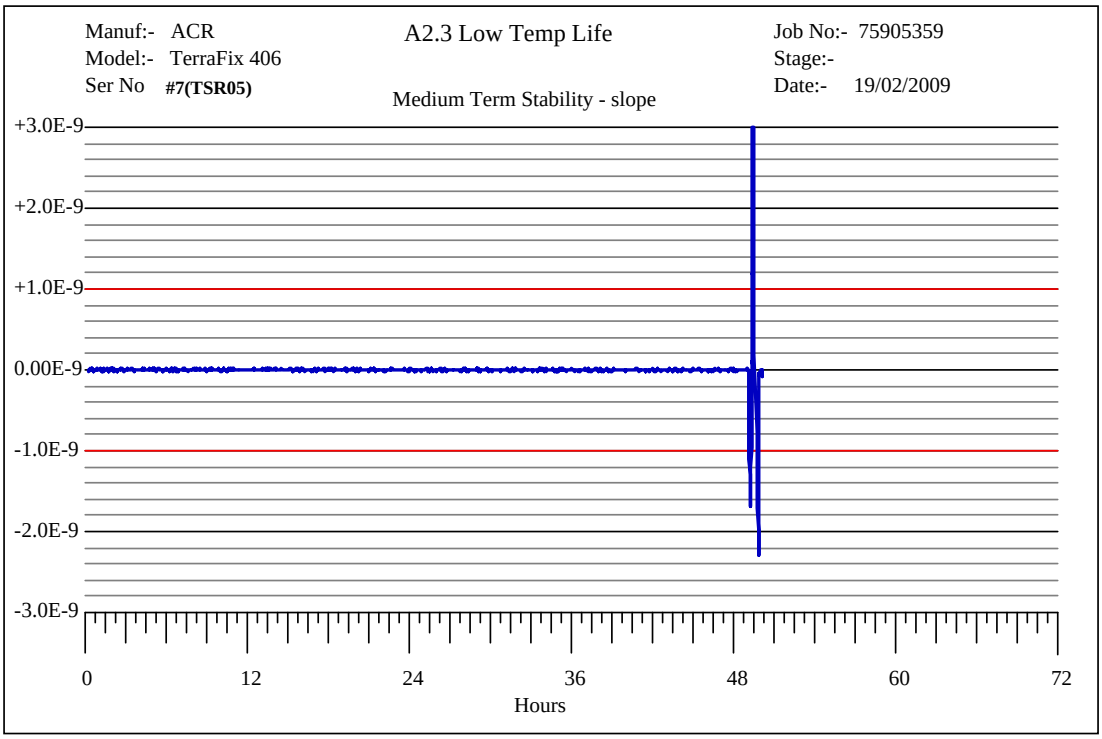
Nominal Frequency



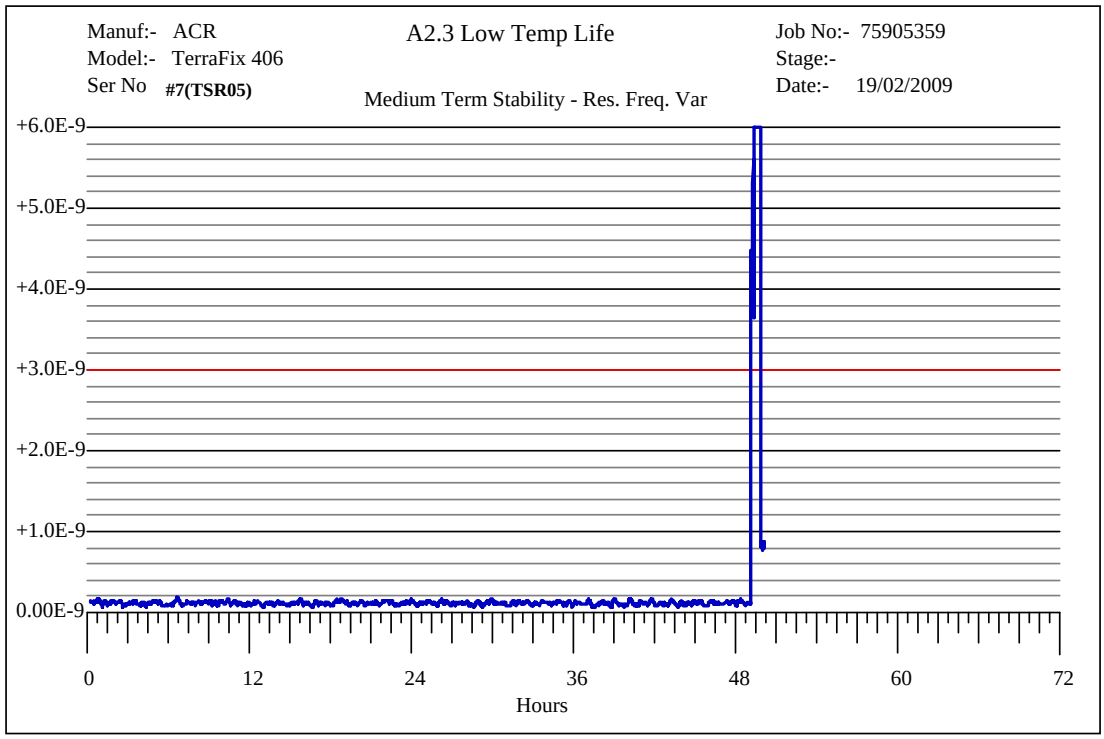
Short Term Stability



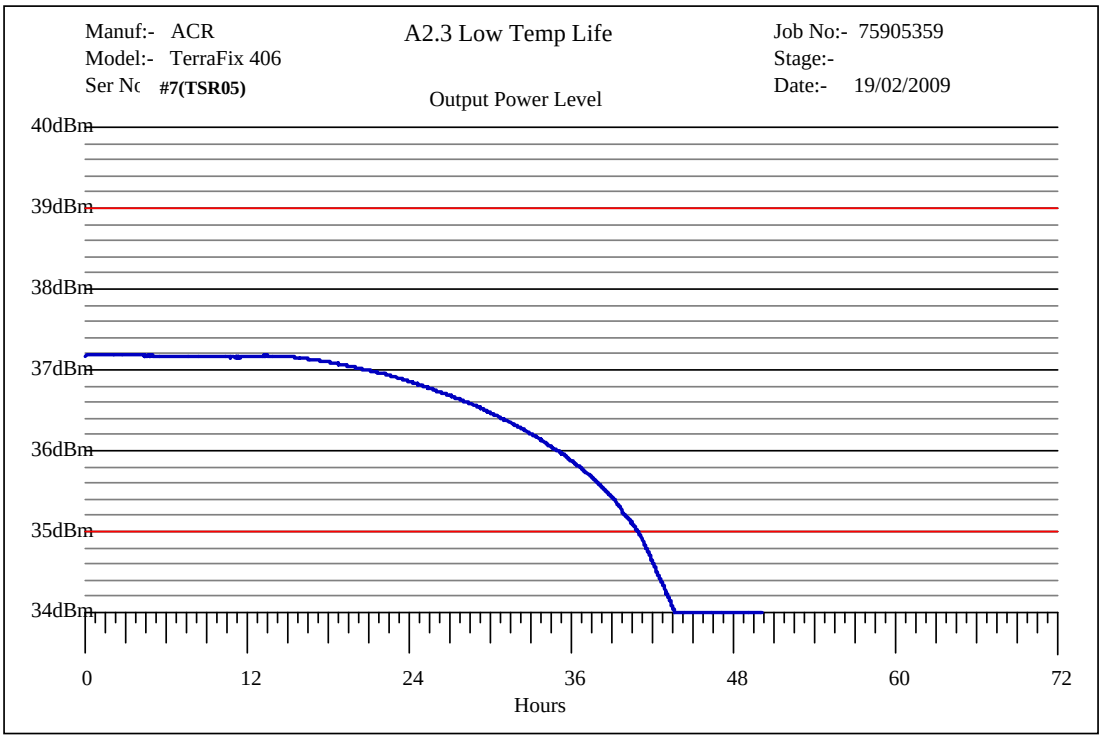
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



Output Power



Digital Message

```
 Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = 993D400004001AD              993D400004001AD Default_Id
 30 Hex (Bits 25-144) = 4C9EA00002000D6A77978000000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 0 1001 1001 0011 1101 0100 0000 0000 0000 0000 0100 0000 0000 0001 1010 1101
   0100 1110 1111 0010 1111 0000 0000 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            0 Short Message                              0
Protocol Flag      26            1 User                                       1
MID                27- 36      201 ALBANIA                          0011 0010 01
User Protocol      37- 39        7 Test                                    111
Spare              40- 63                          0101 0000 0000 0000 0000 0001
Spare              64- 83                               0000 0000 0000 0110 1011
Homing             84- 85        1 121.5                                    01
BCH Encoded        86-106          Errors=0             0100 1110 1111 0010 1111 0
BCH Generated      86-106                               0100 1110 1111 0010 1111 0
Emergency Cd Flag 107            0 National Use                               0
Beacon Activation 108            0 Manual only                                0
National Use      109-112                                                  0000
```

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	:	30 minutes	(1799840 ms)
Self-test Current	:	4.88 seconds	(4880 ms)
Operating Current	:	30 minutes	(1799920 ms)

Assumptions / Supplied Data

Battery Replacement Interval	: 5.75 years
Battery Capacity	: 1.4 Ah
Battery Self Drain	: 1.00 % per year
Self-test Interval	: 12 tests per year

Test Results

Mode Current = Accumulated Charge / Time

Standby Current	=	80469.31 pC / 1799840 ms	=	0.04	nA
Self-test Current	=	532797.6 uC / 4880 ms	=	109.18	mA
Operating Current	=	41276298 uC / 1799920 ms	=	22.93	mA

Battery Preconditioning / Discharge Time Calculations

Battery Self Drain = Capacity - [(100% - Self Drain/Year%)$^{\text{Replacement Interval}}$ x Capacity]
= 1.4- ((1- 0.0100) ^{6} x 1.4) = 0.0786 Ah

Standby Drain = Hours per year x Battery Replacement Interval x Standby Current
= 365 x 24 x 6 x 0.04 x 10^{-9} = 0.0000 Ah
Worst Case = 1.65 x 0.0000 Ah = 0.0000 Ah

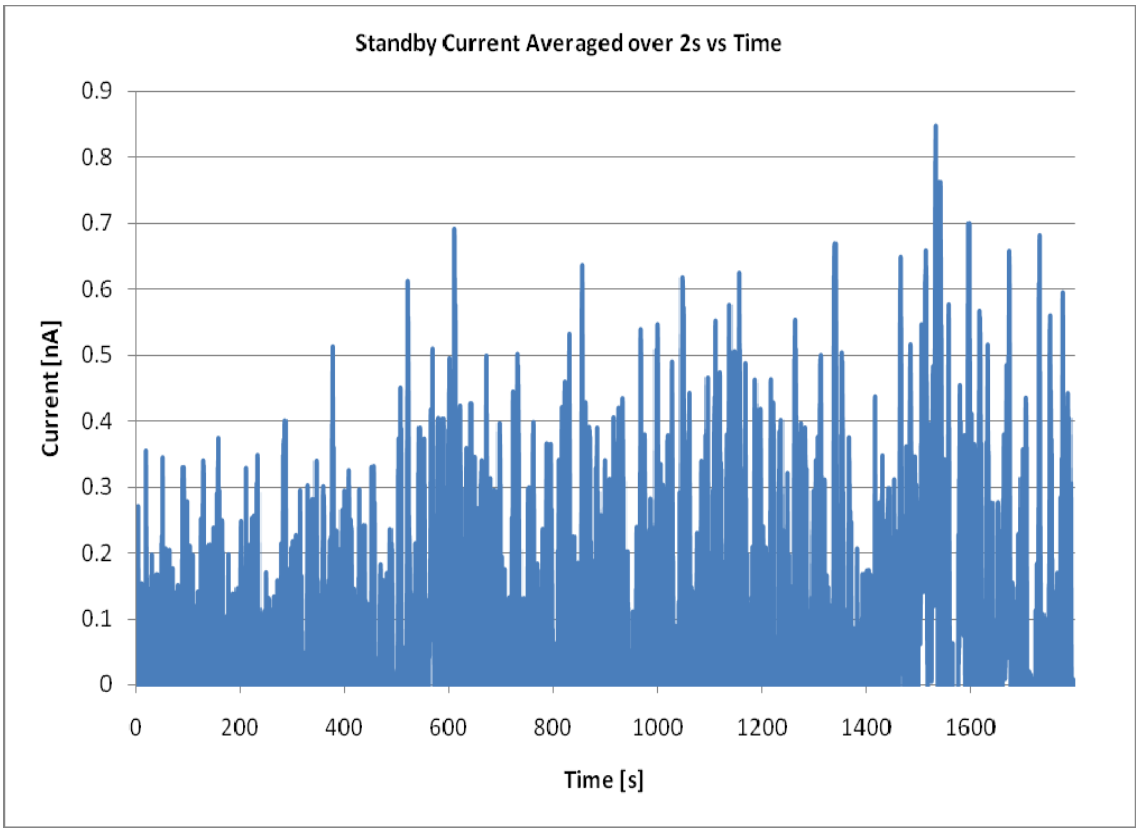
Self-test Drain = Self-tests per battery x Self-test Current x Self-test duration (in hours)
= 12 x 6 x 109.18 x 10^{-3} x (4.9 / 3600) = 0.0102 Ah
Worst Case = 1.65 x 0.0102 Ah = 0.0168 Ah

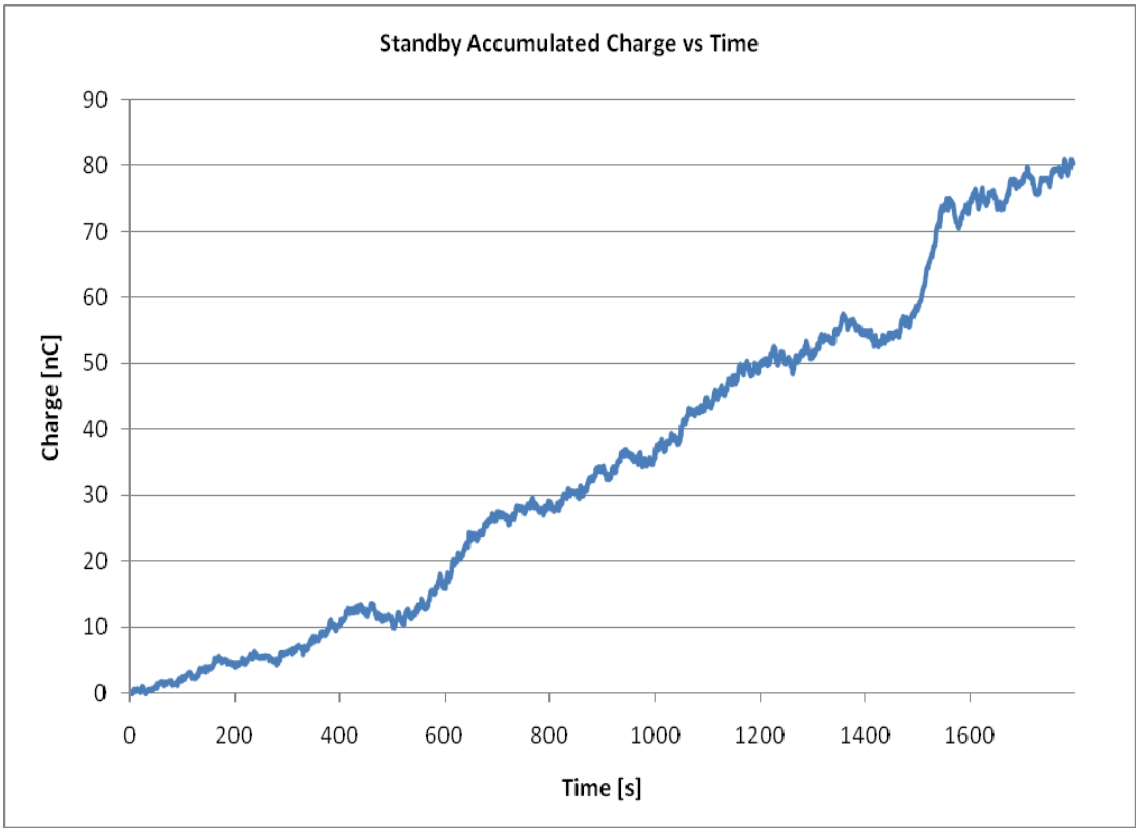
Total Drain = Self Drain + Standby Drain (Worst Case) + Self-test Drain (Worst Case)
= 0.0786 + 0.0000 + 0.0168 = 0.0955 Ah

Battery Preconditioning / Discharge Time = Worst Case drain / Operational Current
= 0.0955 / (22.93 x 10^{-3})
= 4.16 hours

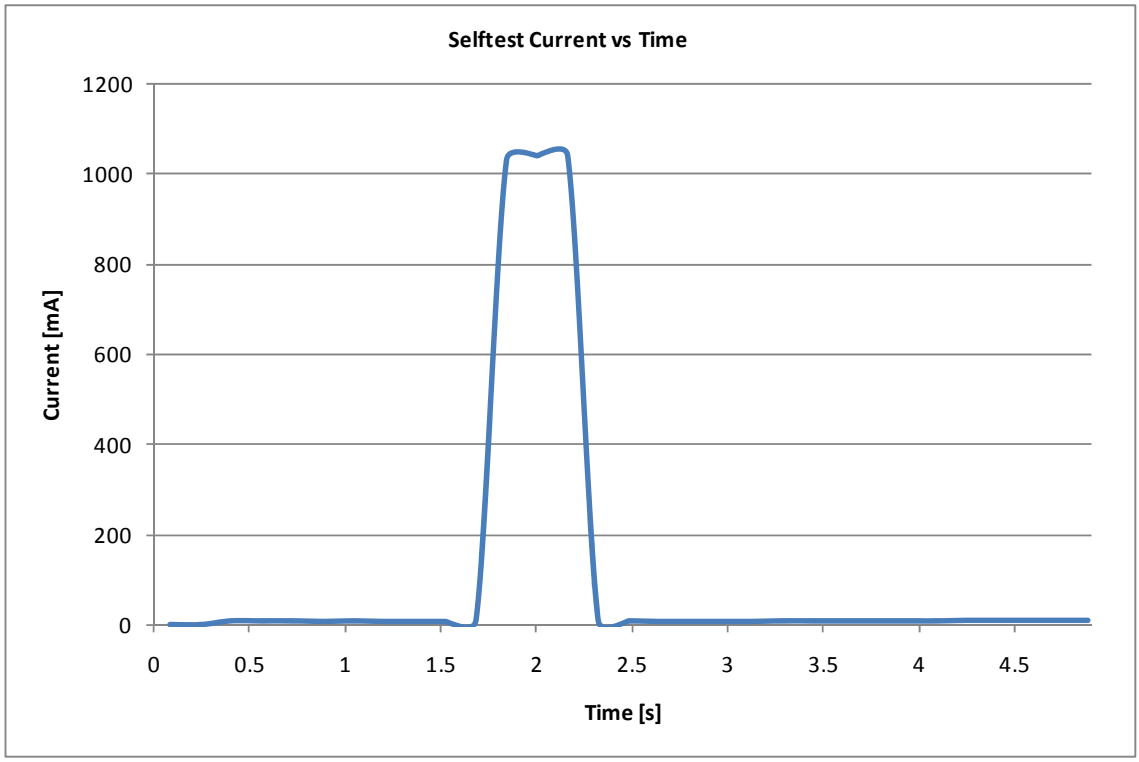
4.16 hours = 4 hours 10 minutes, a fresh battery was discharged by operating the beacon in the same configuration as the Operating Current was measured above for 3.63 hours; hence 0.53 hours must be deducted from the final Operating Lifetime Duration to provide an 'Effective Operating Lifetime Duration'. This can be found in the Test Results Table.

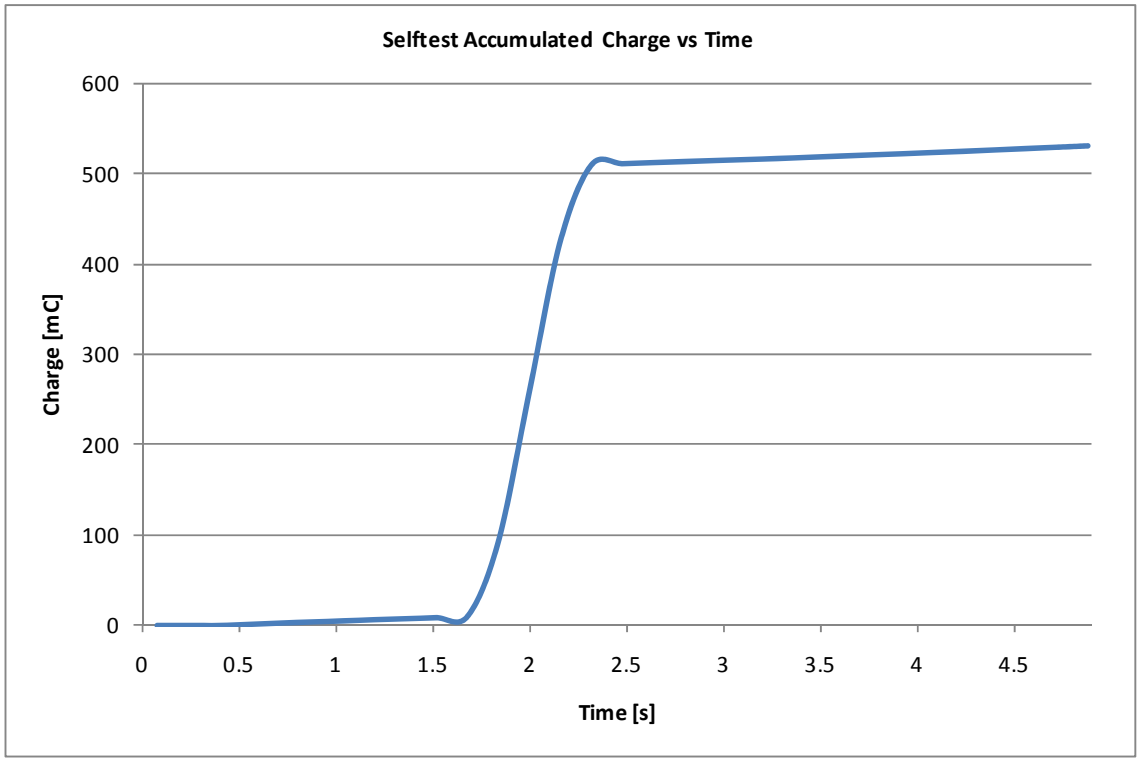
Standby Mode Plots



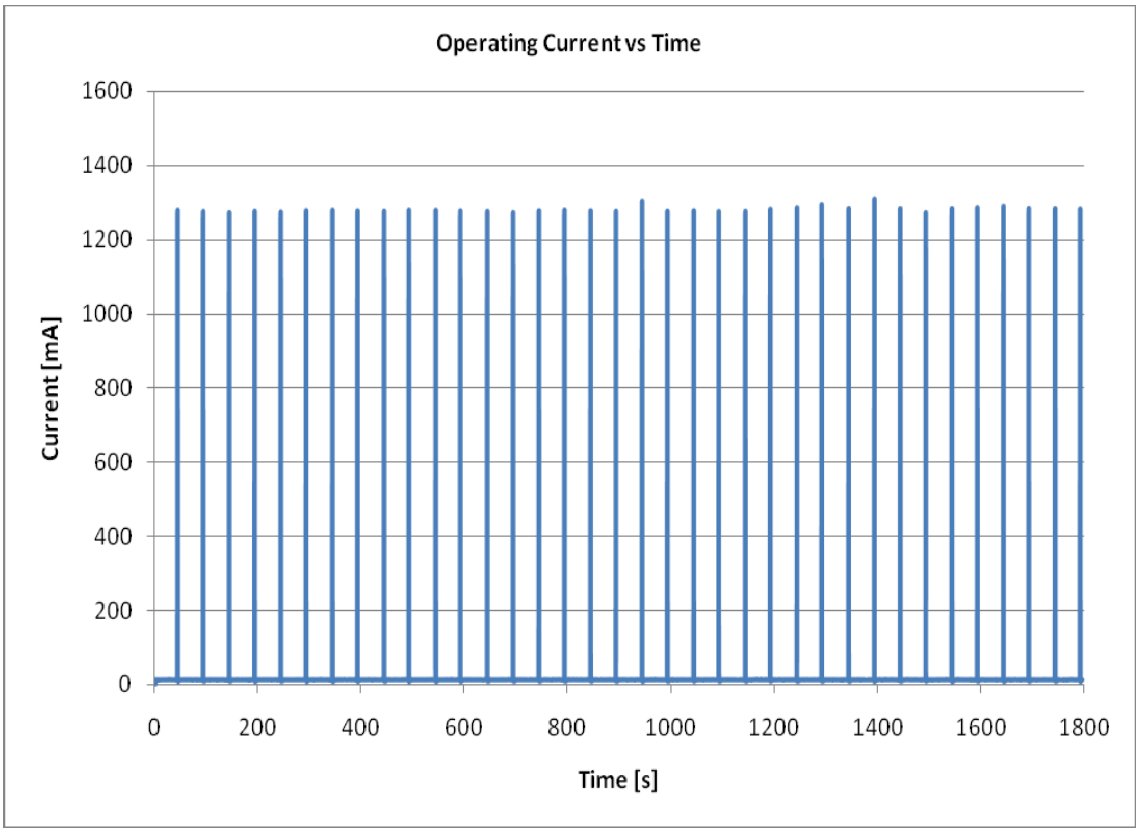


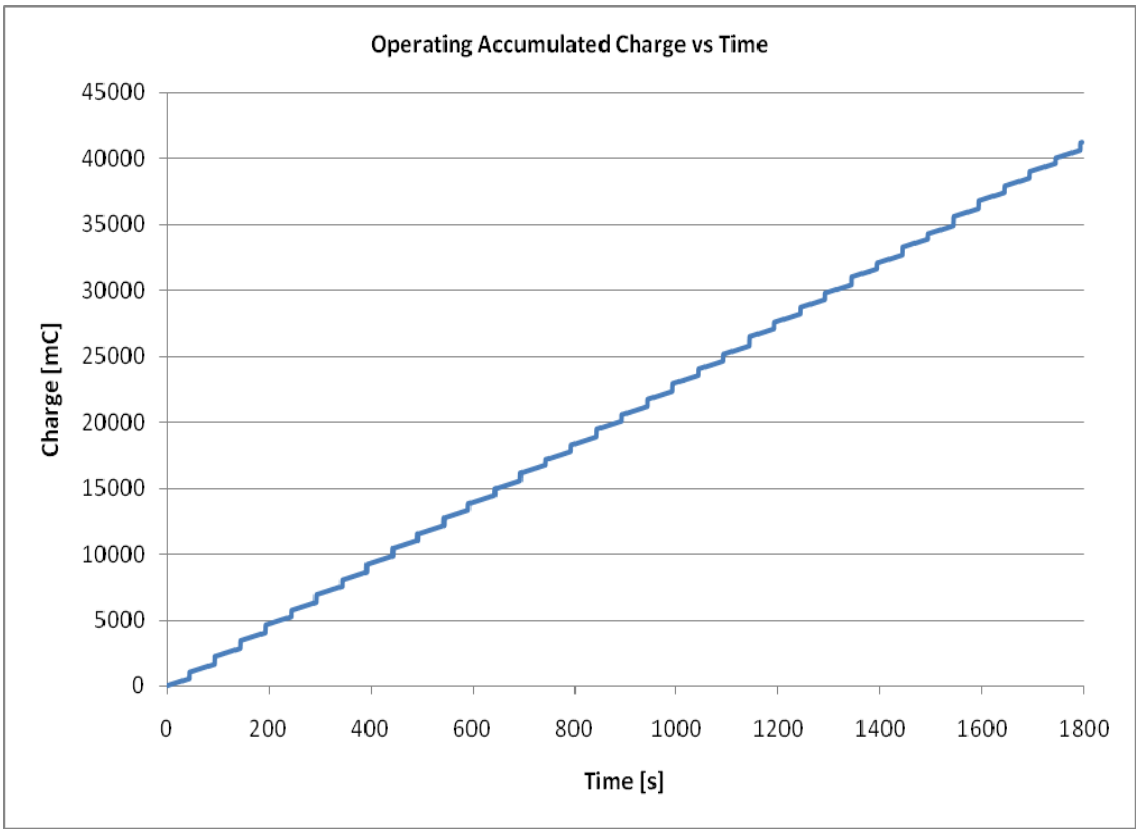
Self-test Plots





Operating Mode Plots





2.5 SATELLITE QUALITATIVE TESTS

2.5.1 Equipment Under Test

Runs 1 & 4 – PLB-350A, Serial Number #18 (TUV Reference 75905359_009)
Runs 2 & 3 – PLB-350A, Serial Number #20 (TUV Reference 75905359_003)

2.5.2 Date of Test and Modification State

Run 1 – 23 and 24 February 2009	17:18 to 08:09 - Modification State 0
Run 2 – 24 and 25 February 2009	18:01 to 08:20 - Modification State 0
Run 3 – 03 and 04 March 2009	17:26 to 08:15 - Modification State 0
Run 4 – 06 March 2009	08:58 to 17:54 - Modification State 0

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 Test Results

Run 1, Configuration 7, Serial Number #18 (75905359_009)

Beacon 15 Hex ID: 993D40000C001AD
Actual location of the test beacon: Latitude: 052° 14.447'N
Longitude: 001° 43.970'W

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)
S8	43436	993D4 0000C 001AD	52.24072	-1.72034	-128.30	08:01:46	13.743	0.850
S7	56070	993D4 0000C 001AD	52.24168	-1.72344	-126.66	06:59:52	11.012	0.647
S7	56069	993D4 0000C 001AD	52.23911	-1.72641	-124.81	05:20:21	-3.329	0.475
S10	19401	993D4 0000C 001AD	52.23933	-1.72379	-132.45	04:47:23	17.884	0.636
S8	43434	993D4 0000C 001AD	52.24363	-1.75019	-128.27	04:40:20	-15.587	1.223
S7	56068	993D4 0000C 001AD	52.23802	-1.72605	-133.00	03:39:23	-18.771	0.554
S10	19400	993D4 0000C 001AD	52.24126	-1.72383	-124.46	03:07:44	4.934	0.615
S10	19399	993D4 0000C 001AD	52.23910	-1.71956	-128.55	01:26:41	-10.220	0.922
S9	34663	993D4 0000C 001AD	52.24000	-1.71864	-130.77	23:01:16	-18.761	0.970
S11	12192	993D4 0000C 001AD	52.24630	-1.71943	-124.90	22:28:23	-14.541	1.099
S9	34662	993D4 0000C 001AD	52.24469	-1.71793	-124.51	21:20:15	-3.311	1.103
S9	34661	993D4 0000C 001AD	52.24710	-1.72813	-127.11	19:40:40	11.050	0.771
S11	12190	993D4 0000C 001AD	52.24980	-1.72725	-128.77	19:08:16	14.523	1.072
S11	12186	993D4 00008 001AD	52.27759	-1.85620	-129.27	12:38:40	18.033	9.335
S8	43428	993D4 0000C 001AD	52.24719	-1.71133	-127.19	18:06:12	-12.085	1.627
S7	56062	993D4 0000C 001AD	52.24672	-1.71633	-124.27	17:10:58	-8.777	1.302

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

= $\frac{15}{16}$ = 93.8%

Run 2, Configuration 7, Serial Number #20 (75905359_003)

Beacon 15 Hex ID: 993D400008001AD
Actual location of the test beacon: Latitude: 052° 14.447'N
Longitude: 001° 43.970'W

Satellite ID	Satellite Pass Number	15 Hex ID Provided by LUT	Doppler Latitude	Doppler Longitude	Mean Rx Power (dBm)	TCA	CTA (deg)	Location Error (km)
S7	56085	993D4 00008 001AD	52.24335	-1.72589	-134.26	08:14:41	20.042	0.552
S8	43450	993D4 00008 001AD	52.24192	-1.72137	-127.29	07:50:07	12.241	0.790
S7	56084	993D4 00008 001AD	52.24192	-1.72411	-123.29	06:36:10	7.780	0.607
S8	43449	993D4 00008 001AD	52.23961	-1.72262	-125.05	06:09:56	-1.902	0.707
S7	56083	993D4 00008 001AD	52.23938	-1.72475	-125.68	04:56:19	-6.984	0.572
S10	19415	993D4 00008 001AD	52.24058	-1.72305	-130.16	04:37:02	16.689	0.666
S8	43448	993D4 00008 001AD	52.23321	-1.72807	-133.90	04:28:20	-17.431	0.902
S10	19414	993D4 00008 001AD	52.24145	-1.72724	-125.00	02:57:14	3.415	0.388
S10	19413	993D4 00008 001AD	52.23775	-1.72369	-130.19	01:16:02	-11.862	0.708
S9	34677	993D4 00008 001AD	52.24222	-1.71876	-127.65	22:37:39	-15.179	0.971
S11	12206	993D4 00008 001AD	52.24947	-1.71939	-122.59	22:07:25	-11.322	1.330
S11	12205	993D4 00008 001AD	52.25134	-1.71584	-123.89	20:26:57	3.828	1.647
S9	34675	993D4 00008 001AD	52.24786	-1.72934	-129.83	19:17:43	14.026	0.822
S11	12204	993D4 00008 001AD	52.24819	-1.74145	-129.67	18:47:52	16.993	1.011
S7	56077	993D4 00008 001AD	52.24542	-1.71558	-135.28	18:28:02	-20.550	1.282
S8	43442	993D4 00008 001AD	52.24623	-1.71818	-124.61	17:54:16	-10.224	1.166

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

= $\frac{16}{16}$ = 100%

Run 3, Configuration 8, Serial Number #20 (75905359_003)

Beacon 15 Hex ID: 993D400008001AD
Actual location of the test beacon: Latitude: 052° 14.447'N
Longitude: 001° 43.970'W

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)
S8	43549	993D4 00008 001AD	52.23894	-1.72394	-128.18	08:07:54	14.351	0.639
S7	56184	993D4 00008 001AD	52.24000	-1.72264	-123.71	07:08:16	12.157	0.699
S7	56183	993D4 00008 001AD	52.23876	-1.72640	-124.29	05:28:51	-2.003	0.492
S7	56182	993D4 00008 001AD	52.23449	-1.72136	-125.09	03:48:02	-17.418	1.048
S10	19514	993D4 00008 001AD	52.23889	-1.72621	-132.44	05:03:36	19.640	0.497
S8	43547	993D4 00008 001AD	52.23505	-1.72404	-127.51	04:46:37	-14.799	0.874
S10	19513	993D4 00008 001AD	52.23970	-1.72252	-122.42	03:24:10	7.237	0.712
S10	19512	993D4 00008 001AD	52.23968	-1.71862	-125.17	01:43:21	-7.687	0.975
S11	12306	993D4 00008 001AD	52.24649	-1.72209	-128.20	23:03:29	-19.874	0.968
S11	12305	993D4 00008 001AD	52.24544	-1.71984	-117.77	21:22:12	-4.392	1.024
S9	34776	993D4 00008 001AD	52.24707	-1.72157	-124.10	21:34:25	-5.553	1.037
S9	34775	993D4 00008 001AD	52.24807	-1.73072	-124.47	19:54:37	9.081	0.822
S11	12304	993D4 00008 001AD	52.24933	-1.73368	-124.09	19:42:22	10.098	0.952
S8	43541	993D4 00008 001AD	52.24625	-1.71943	-124.02	18:12:28	-12.858	1.096
S7	56176	993D4 00008 001AD	52.24453	-1.71743	-123.98	17:19:31	-10.133	1.128

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

$$= \frac{15}{15} = 100\%$$

Run 4, Configuration 8, Serial Number #18 (75905359_009)

Beacon 15 Hex ID: 993D40000C001AD
Actual location of the test beacon: Latitude: 052° 14.447'N
Longitude: 001° 43.970'W

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)
S8	43582	993D4 0000C 001AD	52.24553	-1.72695	-122.66	15:56:03	7.542	0.662
S7	56217	993D4 0000C 001AD	52.24715	-1.72707	-122.52	14:28:17	14.517	0.809
S8	43581	993D4 0000C 001AD	52.24819	-1.74489	-128.38	14:16:45	19.779	1.162
S10	19548	993D4 0000C 001AD	52.24166	-1.71775	-127.72	14:36:43	-14.520	1.031
S11	12342	993D4 0000C 001AD	52.24276	-1.72169	-124.83	12:11:28	14.901	0.789
S11	12341	993D4 0000C 001AD	52.24243	-1.71857	-116.15	10:32:09	1.261	0.988
S10	19546	993D4 0000C 001AD	52.24888	-1.72815	-126.79	11:15:15	14.664	0.955
S9	34812	993D4 0000C 001AD	52.24271	-1.72359	-125.03	10:37:47	1.757	0.664
S9	34811	993D4 0000C 001AD	52.23894	-1.71871	-126.91	08:57:16	-13.521	0.983
S11	12340	993D4 0000C 001AD	52.24212	-1.72442	-125.86	08:51:26	-14.063	0.591

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

$$= \frac{10}{10} = 100\%$$

2.6 ANTENNA CHARACTERISTICS

2.6.1 Equipment Under Test

PLB-350A, Serial Number #20 (TUV Reference 75905359_003)

2.6.2 Date of Test and Modification State

24 February 2009 - Modification State 0

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 Test Results

Antenna Model: A3-06-2493, Configuration: C/S T.007 Figure B.5

	Elevation Angle (degrees)									
	10		20		30		40		50	
Azimuth Angle (degrees)	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi
0	40.0	3.37	40.6	3.99	38.9	2.31	36.3	-0.31	34.8	-1.80
90	40.2	3.58	40.5	3.87	39.1	2.50	36.4	-0.26	35.8	-0.80
180	40.4	3.80	41.2	4.59	39.5	2.91	36.6	0.00	35.5	-1.11
270	40.7	4.03	41.3	4.63	39.6	2.92	36.6	-0.05	34.7	-1.94

$EIRP_{LOSS}$ = Pt_{amb} - Pt_{EOL} = (36.64 – 36.86) = -0.22dB

$EIRP_{maxEOL}$ = MAX [$EIRP_{max}$, ($EIRP_{max}$ - $EIRP_{LOSS}$)] = MAX [41.27 ,(41.49)] = 41.49dBm

$EIRP_{minEOL}$ = MIN [$EIRP_{min}$, ($EIRP_{min}$ - $EIRP_{LOSS}$)] = MIN [34.70, (34.92) = 34.70dBm

Pt_{amb} is the power at ambient from the summary table
Pt_{EOL} is the power at the end of Operating Life at Minimum Temperature
$EIRP_{max}$ is the maximum EIRP from the antenna characteristics spreadsheet
$EIRP_{min}$ is the minimum EIRP from the antenna characteristics spreadsheet

Antenna Model: A3-06-2493, Configuration: C/S T.007 Figure B.2

	Elevation Angle (degrees)									
	10		20		30		40		50	
Azimuth Angle (degrees)	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi
0	39.6	2.98	42.4	5.77	~~43.2~~	6.51	36.3	-0.29	33.0	-3.59
30	39.6	2.98	42.3	5.68	43.1	6.41	36.7	0.08	33.3	-3.29
60	39.4	2.77	42.0	5.37	42.9	6.22	37.2	0.56	33.0	-3.69
90	39.4	2.78	41.9	5.29	42.8	6.14	37.6	0.96	32.7	-3.95
120	39.5	2.88	42.0	5.38	42.6	5.95	37.3	0.65	32.6	-4.03
150	39.2	2.60	42.0	5.39	42.9	6.26	37.4	0.77	32.3	-4.31
180	39.0	2.39	41.8	5.21	42.8	6.16	37.1	0.50	~~31.8~~	-4.80
210	39.5	2.89	42.0	5.39	42.7	6.04	37.1	0.47	~~31.4~~	-5.24
240	39.8	3.17	42.0	5.39	42.8	6.15	36.8	0.17	~~30.8~~	-5.88
270	40.0	3.38	41.8	5.18	42.7	6.03	36.5	-0.15	~~30.9~~	-5.73
300	39.8	3.17	42.1	5.48	43.1	6.43	36.3	-0.33	~~30.9~~	-5.73
330	39.8	3.20	42.0	5.38	43.0	6.32	36.3	-0.38	32.5	-4.17
Gain Variation	0.99		0.59		0.56		1.34		2.58	

	Elevation Angle (degrees)									
	10		20		30		40		50	
Azimuth Angle (degrees)	Vv	Vh	Vv	Vh	Vv	Vh	Vv	Vh	Vv	Vh
0	111.50	86.30	113.90	80.60	113.90	92.30	106.00	87.60	100.90	90.00
30	111.50	87.20	113.80	84.50	113.80	92.60	106.40	85.90	101.40	86.50
60	111.30	83.50	113.50	82.00	113.60	93.00	106.90	80.90	101.00	86.20
90	111.30	86.00	113.40	89.30	113.50	95.00	107.30	82.50	100.80	83.60
120	111.40	87.70	113.50	88.40	113.30	95.20	107.00	77.60	100.60	87.40
150	111.10	89.70	113.50	90.60	113.60	96.30	107.10	85.20	100.20	89.00
180	110.90	88.10	113.30	92.50	113.50	96.30	106.80	87.40	99.60	89.80
210	111.40	89.00	113.50	90.20	113.40	95.10	106.80	84.30	99.00	90.60
240	111.70	83.20	113.50	90.40	113.50	95.30	106.50	84.50	98.60	87.90
270	111.90	86.00	113.30	85.50	113.40	93.90	106.20	69.40	98.50	90.20
300	111.70	84.60	113.60	86.80	113.80	94.10	106.00	83.80	98.50	90.20
330	111.70	90.50	113.50	85.30	113.70	93.40	105.90	88.10	100.20	90.70
Min (Vv-Vhh	21.20		20.80		17.20		17.80		8.30	

$EIRP_{LOSS}$ = Pt_{amb} - Pt_{EOL} = (36.6 – 36.86) = -0.22dB

$EIRP_{maxEOL}$ = MAX [$EIRP_{max}$, ($EIRP_{max}$ - $EIRP_{LOSS}$)] = MAX (43.1, 43.3) = 43.3dBm

$EIRP_{minEOL}$ = MIN [$EIRP_{min}$, ($EIRP_{min}$ - $EIRP_{LOSS}$)] = MIN (32.3, 32.5) = 32.3dBm

Pt_{amb} is the power at ambient from the summary table
Pt_{EOL} is the power at the end of Operating Life at Minimum Temperature
$EIRP_{max}$ is the maximum EIRP from the antenna characteristics spreadsheet
$EIRP_{min}$ is the minimum EIRP from the antenna characteristics spreadsheet

2.7 BEACON CODING SOFTWARE

2.7.1 Test Results

Test was conducted by the customer as permitted by C/S T.007 clause A.2.8; see Customer Supplied Information at Annex A

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT

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

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.6 Beacons - Antenna Characteristics					
Antenna, (Tuned Dipole Set)	Roberts Antenna	A-100	569	-	TU
Spectrum Analyser	Hewlett Packard	8568B	571	12	11-Feb-2010
Test Receiver	Rohde & Schwarz	ESVP	1669	12	7-Nov-2009
Antenna Mast	EMCO	1050	1707	-	TU
Turntable Controller	Various	RH253	1708	-	TU
Spectrum Analyser	Rohde & Schwarz	EZM	1823	-	TU
Open Area Site 2	TUV	OATS2	1850	36	11-Sep-2011
Floppy Disc Station	Rohde & Schwarz	LAS-Z11	1854	-	TU
Turntable Interface	Various	RH-253.6	1855	-	TU
Antenna Tower 6M	EMCO	1050	1859	-	TU
Roberts Antenna 406MHz	Compliance Design	-	1861	24	7-Sep-2009
Antenna (Bilog, 20MHz-2GHz)	York Electronics	CBL6111B	1868	24	20-Aug-2010
Signal Generator, 9kHz to 6GHz	Rohde & Schwarz	SMB 100A	3501	12	19-May-2009
Section 2.4 Beacons - Battery Current Measurements					
Load (50ohm)	Diamond	DL-30N	392	12	1-Sep-2009
Hygrometer	Rotronic	I-1000	3068	12	26-Jun-2009
8 Channel Datalogger + Terminal Board	Pico Technology Ltd	ADC-16	3287	12	17-Dec-2009
Resistor (Nominal 0.25ohm)	TUV	2x RS Components 188-071 R5/100W Resistors	3343	-	TU

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1, 2.2, 2.3 plus 2, 3, 6, 8 in Test Results Table - Beacons - Constant Temperature Tests					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Power Meter	Hewlett Packard	436A	83	12	13-Aug-2009
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	12-Jan-2010
Signal Generator	Hewlett Packard	8644A	96	12	17-Apr-2009
Time Interval Analyser	Yokogawa	TA720	181	12	27-Feb-2009
High Resolution Oscilloscope	Gould	840	182	12	6-Mar-2009
Load (50ohm, 15W)	Diamond Antenna	DL-30N	337	12	1-Sep-2009
Load (50ohm)	Diamond	DL-30N	392	12	1-Sep-2009
Attenuator 10dB 25W	Weinschel	46-10-43	400	12	6-May-2009
Attenuator 10dB/10W)	Trilithic	HFP-50N	454	12	22-Jul-2009
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	13-Feb-2009
Distress Beacon RF Unit	TUV	-	2445	-	TU
Beacon RF Unit	TUV	N/A	3066	-	TU
Hygrometer	Rotronic	I-1000	3068	12	26-Jun-2009
Termination (50ohm, 2W)	Omni-Spectra	3001-6100	3081	12	15-Mar-2009
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3097	12	15-Mar-2009
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	12	15-Mar-2009
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	2-Jun-2009
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3161	12	2-Jun-2009
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3163	12	2-Jun-2009
Thermocouple Thermometer	Fluke	51	3172	12	3-Jul-2009
Thermocouple Thermometer	Fluke	51	3173	12	3-Jul-2009
Bandpass filter	Trilithic	5BE406/35-1-AA	3206	12	1-Aug-2009
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	1-Aug-2009
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	4-Nov-2009
ScopeCorder	Yokogawa	DL750 701210	3254	12	5-Nov-2009
Short Circuit	TUV	Short Cicuit	3272	-	TU
Power Sensor	Agilent	8482A	3289	12	1-Dec-2009
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3352	12	22-Apr-2009
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	22-Apr-2009
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	22-Apr-2009
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	22-Apr-2009
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3359	12	22-Apr-2009
Cable (3m, N-type)	Rhophase	NPS-1601-3000-NPS	3361	12	22-Apr-2009
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	21-Feb-2009

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.4 Beacons - Operating Lifetime					
Power Meter	Hewlett Packard	436A	47	12	8-Jul-2009
Power Meter	Hewlett Packard	436A	83	12	13-Aug-2009
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	12-Jan-2010
Signal Generator	Hewlett Packard	8644A	96	12	17-Apr-2009
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	9-Jun-2009
Beacon RF Unit	TUV	N/A	3066	-	TU
Hygrometer	Rotronic	I-1000	3068	12	26-Jun-2009
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	2-Jun-2009
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	2-Jun-2009
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3163	12	2-Jun-2009
Thermocouple Thermometer	Fluke	51	3173	12	3-Jul-2009
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	1-Aug-2009
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	4-Nov-2009
ScopeCorder	Yokogawa	DL750 701210	3254	12	5-Nov-2009
Power Sensor	Agilent	8482A	3289	12	1-Dec-2009
Power Sensor	Agilent	8482A	3290	12	1-Dec-2009
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	21-Apr-2009
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	22-Apr-2009
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	22-Apr-2009
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	22-Apr-2009
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3359	12	22-Apr-2009
Bandpass Filter	Trilithic	5BE121.55/35-3-BA	3410	12	4-Aug-2009

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

SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

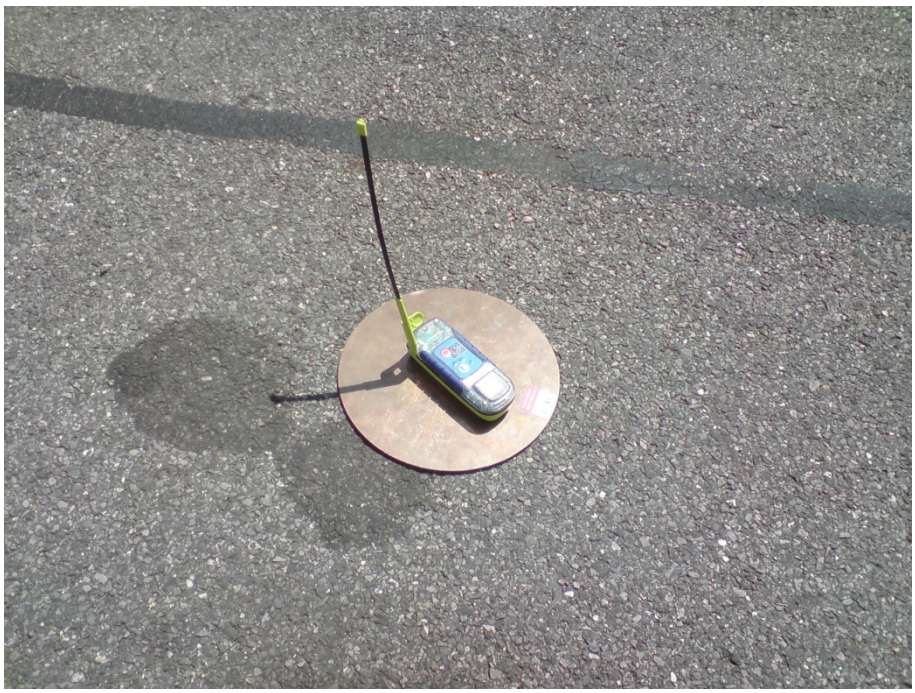
Front View

Rear View

Side View

Configuration 3

Configuration 4



Configuration 7

Configuration 8

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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

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

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

ANNEX A

CUSTOMER SUPPLIED INFORMATION

01/22/2009

PROTECTION AGAINST REPETITIVE SELF-TEST MODE TRANSMISSIONS, PLB-350A

The self-test algorithm is in-line code with no loops that execute consecutive instructions implementing self-test with checks interspersed to monitor the switch positions. It is possible to either complete one self-test, enter the ON mode, or turn off. It is not possible to repeat the instructions. The self-test algorithm causes the software to continuously monitor the hardware during self-test. If the switch is left in self-test for an extended time, the stuck mode is entered for a maximum time of 50 seconds. This mode alternately flashes the red LED, the green LED, and sounds the buzzer, then times out after 50 seconds. Nothing else can be generated when in this mode. Therefore, if the switch is left in the self-test position, it is not possible to generate more than one self-test.

Oscillator Aging (Document 1)

RAKON

CERTIFICATE OF COMPLIANCE: COSPAS-SARSAT

Rakon UK Limited
Dowsett House
Sadler Road
Lincoln
LN6 3RS
United Kingdom

Tel.: +44-1522-883500

This is to certify that the following crystal oscillator:

Item	Rakon Part No.	Description
1	E4672LF	TCXO, 12.688656 MHz, Class II, SM 7x5 mm

is fully compliant with the short-term and medium-term transmitted frequency stability requirements of the Cospas-Sarsat system beacons including the oscillator aging requirements in paragraph A.3.5 Oscillator Aging of document C/S T.007, Issue 4, Revision 3 (dated: October 2008).

The type of compensation used to correct the frequency of the oscillator for temperature changes within the TCXO remains constant with the individual characterization set in non-volatile memory. No adjustment is required, or available , to correct for aging for the life of the device, so this characterization is not perturbed. There is no mechanism to suggest any change or aging affect to the medium or short-term stability exists.

Signature: ..... Date: January 22nd, 2008
(authorized representative of Rakon UK Limited)

Name: ...David R Woodall ..... Telephone: +44 (0)1522 883528

Title: ... Quality Manager - FCP..... e-mail: DavidW@rakon.co.uk

Oscillator Aging (Document 2)

RAKON
Rakon UK Ltd.

Sadler Road, Lincoln
LN6 3RS, United Kingdom

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

PRODUCT EVALUATION REPORT

REPORT No.:	2006-016C
Date:	26th November 2007
Product type:	Temperature Compensated, Voltage Controlled Crystal Oscillator (TC/VCXO)
Construction:	1) Surface Mount (7 x 5 mm) 2) "Pluto" ASIC
Generic Type:	"Cospas Sarsat" Beacon Oscillator
Parts Tested:	Batch 1 - p/no. E3357 (12.551630 MHz) Batch 2 - p/no. E3233 (12.688375 MHz)

Applicable to:

This report is applicable to the following part numbers all of which are identical to the parts tested with respect to materials used, including the same crystal, construction, manufacture and test. And are to the same or a looser internal specification.

12.551630 MHz - E3356 & E3357
12.688281 MHz - E3403
12.688375 MHz - E3233, E3261, E3279, E3328, E3476, E3499, E4150, E4218, E4281, E4472, E4478, E4495
12.688656 MHz - E4520, E4574 & E4672

Long Term Performance Verification

This document sets out the steps taken by RAKON UK to address the requirements for long term assurance of performance with respect to short and medium term stability. Specifically with respect to the short and medium term stability addressed in the second paragraph of the specification requirement:

Cospas-Sarsat type approval standard T.007 Issue 4 Nov 2005.
Section A.3.5 Oscillator Aging:

Long-term frequency stability shall be demonstrated by data (e.g. oscillator manufacturer's test data) provided by the beacon manufacturer to the test facility.

For oscillators which require compensation over the operating temperature range, measurement results and a technical analysis shall also be provided to substantiate that short and medium-term stability would remain within specification after five years.

Product Service

The long-term frequency stability or oscillator aging requirement is industry standard and has established procedures both company specific and as laid out by international standards, for example as referenced in MIL-PRF-55310 section 4.8.35. However the long term verification of the short and in particular the medium term stability requirements has no directly established procedure. The 100ms short term stability is not associated with the temperature compensation part of the oscillator and so should not be degraded by the use of a TCXO as opposed to an OCXO type oscillator. The short term stability also forms part of the medium term stability in respect of the residual error requirements, and so it should only be necessary to study the medium term stability to cover both of these requirements.

For oscillators which include a frequency adjustment or trim component for either initial calibration in the beacon or for correction of aging during lifetime then there is a recognised degradation process called trim effect. This is where the compensation can be degraded when the oscillator is tuned away from its nominal or compensated condition. This effect can be tested for by measurement of the frequency temperature characteristics at the frequency adjustment limits as well as the nominal condition during for example production verification. Whether the oscillator is adjustable or not should be clearly stated in any beacon qualification so this point can be addressed.

This however is not the case for the oscillators addressed in this document as they have no frequency adjustment available after manufacture. As such we have usually stated in respect of the above requirement:

' For RAKON UK TCXO's the type of compensation used to correct the frequency of the oscillator for temperature changes within the TCXO remains constant with the individual characterisation set in non-volatile memory. No adjustment is required, or available, to correct for aging for the life of the device, so this characterisation is not perturbed. There is no known mechanism to suggest any change or ageing effect to the Medium or Short term stability exists.'

The medium term stability requirements for the beacon are difficult to achieve with temperature compensation techniques and were until recently not achievable. Therefore the long term verification of performance to this required level was not specifically available, although no degradation was expected from either extrapolation of less precise data on comparable oscillators or from analysis of any possible aging mechanism.

With aging verification it is standard practice to use data from accelerated aging conditions, ie aging at high temperature. Data taken during this time is then fitted and extrapolated with established procedures, for example as MIL-PRF-55310. Also standard acceleration factors are often applied for example "30 days at 85C is roughly equivalent to 1 year at room". For the medium term stability requirement, no established procedures or acceleration factors exist and continuous or periodic measurement is not possible. Therefore real data over a reasonable period of time with significant numbers of oscillators was studied.

Two studies are presented. One batch of devices were measured before and after a 8 month period (measurements in August 2005 and April 2006) and a second set of devices was measured after a period of approximately 1 year.

Batch 1 results:
The histograms show the results for August 2005 in red and April 2006 in blue

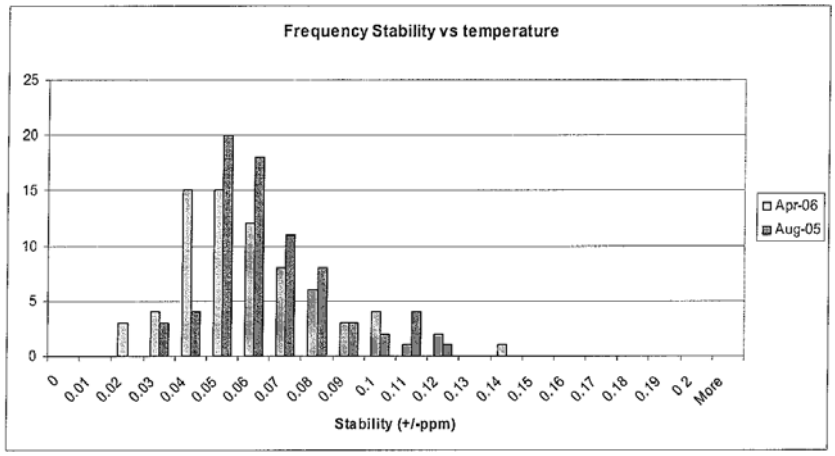


Figure 1 Frequency Stability vs. Temperature

The average change for frequency stability vs. temperature over the batch is -0.0007 ppm, effectively zero or a extremely small improvement.

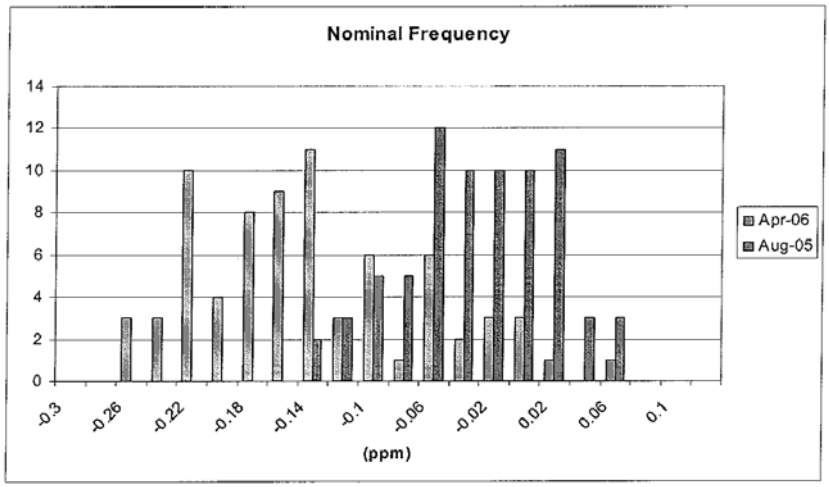


Figure 2 Nominal frequency

The average change for nominal frequency over the batch is -0.10 ppm, considerably inside the aging requirements for nominal frequency.

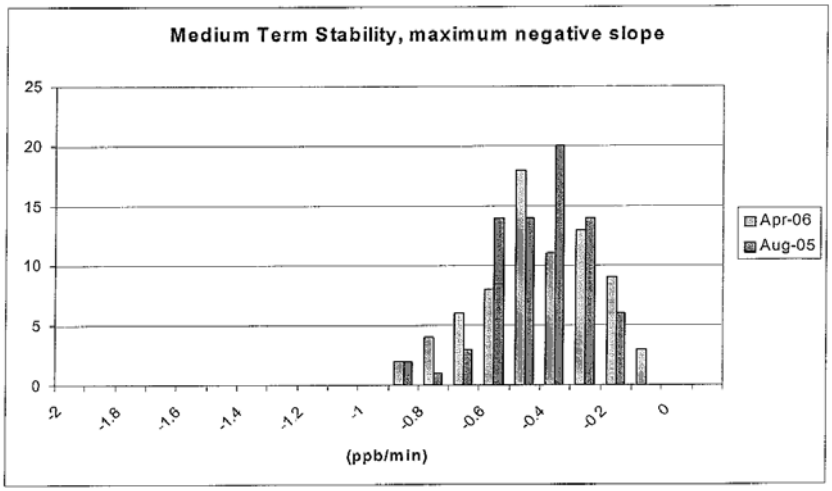


Figure 3 Medium term stability, Slope

The average change over the batch for maximum negative slope for 8 months is +0.004ppb/min and for the maximum positive slope -0.0011ppb/min. This again effectively shows no change or very small improvement within the measurement uncertainties involved.

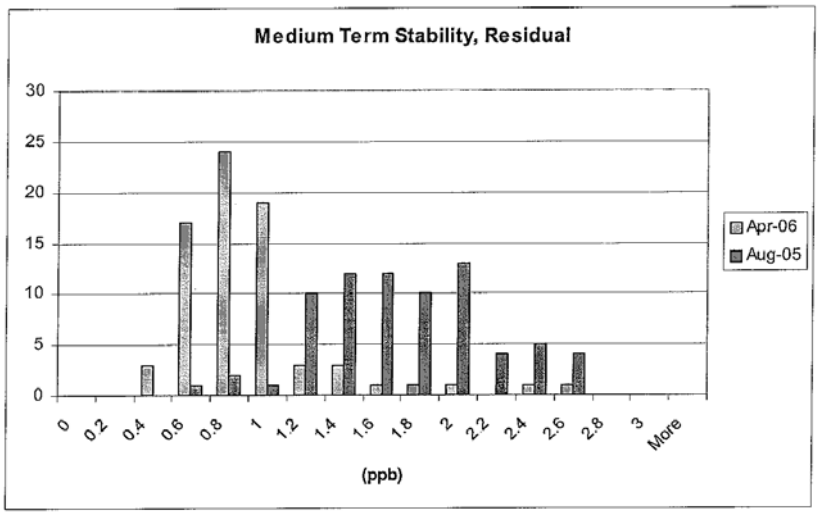
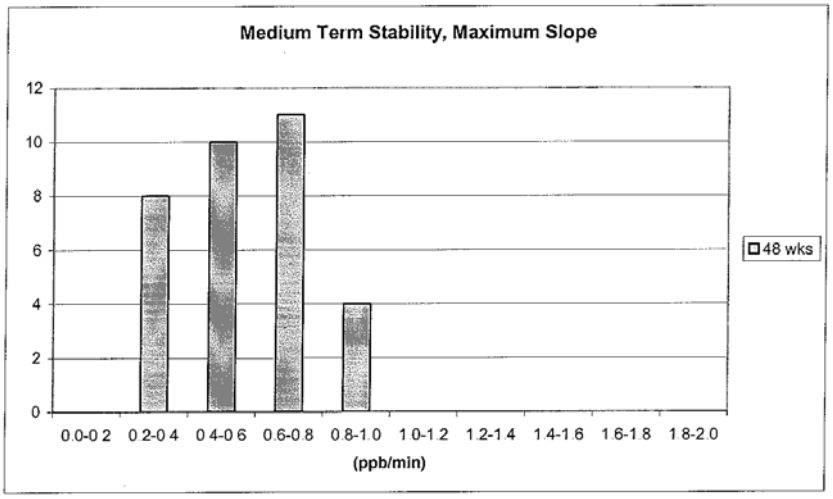


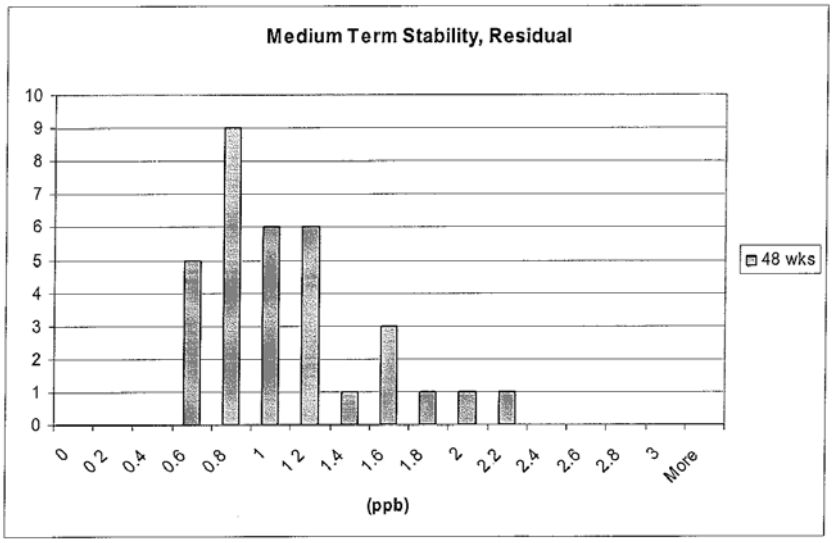
Figure 4 Medium term stability, Residual

The average change over the batch for medium term stability residual error shows an apparent improvement of -0.78 ppb. However this improvement is due in the main part to improvements in the measurement system noise floor and not to any improvement in the oscillator performance over this period.

Batch 2 results:

These devices were re-measured after a period of between 44 and 52 weeks after manufacture and initial testing. Results after an average of 48 wks are shown below.





Product Service

Conclusion:

In conclusion, no noticeable degradation in temperature compensation performance was observed and all devices stayed with specification. Therefore, we conclude the requirement to provide measurement and technical analysis for long-term conformance has been demonstrated for these oscillators.

Dr Nigel D Hardy
Principal Design Engineer
For and on behalf of
RAKON UK Ltd
Antell House, Windsor Place
Harlow, Essex. CM20 2GQ
England

16 May 2006

01/22/2009

PROTECTION AGAINST CONTINUOUS TRANSMISSION for PLB-350A and PLB-350B

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 a 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. Therefore, if the microprocessor should fail 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.

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

Therefore, continuous transmission of the 406 MHz signal cannot occur.

APPENDIX D TO ANNEX F

BEACON CODING SOFTWARE RESULTS

Table F-D.1: Examples of User Protocol Beacon Messages
(Examples required for each protocol requested for inclusion on the type approval certificate)

Protocol	Operational Message (in hexadecimal including bit and frame synchronization bits)	Self-Test Message (in hexadecimal including bit and frame synchronization bits)
Maritime User Protocol with MMSI	FFFE2F4C9418618618668A26F180	FFFED04C9418618618668A26F180
Maritime User Protocol with Radio Call Sign	FFFE2F4C9526F6F06B268C679100	FFFED04C9526F6F06B268C679100
Radio Call Sign User Protocol	FFFE2F4C9DBDBC1A55468D215500	FFFED04C9DBDBC1A55468D215500
Serial User: Float-Free EPIRB with Serial Number	FFFE2F4C96A000C6007CED45E1C0	FFFED04C96A000C6007CED45E1C0
Serial User: Non Float-Free EPIRB with Serial Number	FFFE2F4C972000C6007CE8871240	FFFED04C972000C6007CE8871240
Aviation User Protocol	FFFE2F4C932497380BA60F475D40	FFFED04C932497380BA60F475D40
Serial User: ELT with Serial Number	FFFE2F4C962000C6007CEE044F40	FFFED04C962000C6007CEE044F40
Serial User: ELT with Aircraft Operator Designator & Serial Number	FFFE2F4C967C71C0FA7CEE731C00	FFFED04C967C71C0FA7CEE731C00
Serial User: ELT with Aircraft 24-bit address	FFFE2F4C96F5E1E1E07CE9F59D40	FFFED04C96F5E1E1E07CE9F59D40
Serial User: PLB with Serial Number	FFFE2F4C97A000C6007CEBC6BCC0	FFFED04C97A000C6007CEBC6BCC0
National User (Short)	FFFE2F4C98000000000000526140	FFFED04C98000000000000526140
National User (Long)	N/A	N/A

Beacon Coding Software

Sample Messages for the PLB350A

1. PLB-350A Model

2. Introduction

2.1 Purpose

This document contains the printouts of sample messages as generated by the beacon coding software for each coding protocol applicable to beacon model PLB-350A to satisfy the technical data requirements as stated in Annex C, Table C.1, and Table F.1, item 16. [C/S T.007 – Issue 4 – November 2005].

Each message includes beacon identification and location data, and each protocol has at least two messages showing locations at least 500 meters apart. [C/S T.007 – Issue 4 – November 2005, Section 4.3, Paragraph A.2.8)].

Sample messages generated by the beacon coding software for each coding option applicable to the beacon models as per Appendix D to Annex F. [C/S T.007 – Issue 4 – November 2005, Section 5, Paragraph b, iv)].

2. 2 Document Organization and Information

Sections 3, 4, and 5, contain the coding options for Standard Location Protocol, National Location Protocol, and Test Location Protocol, respectively. Under each of these main headings are sections for each coding option. Each of these subsections includes the beacon's 15 Hex ID, what information was encoded for each message and a list of the printouts associated with the coding option for that specific model.

3. Maritime User Protocol with MMSI

3.1 Hex Messages for PLB350A
3.1.1 15 Hex ID: 992830C30C30CD1

3.1.2 Encoded Data

- Country code: 201
- Maritime MMSI (6 digits): 999999
- Specific beacon number: 0
- Aux radio device: 121.5 MHz

3.2 Sample Hex Messages

Msg	Hex Message	Comment
1-1	**FFFE2F4C9418618618668A26F180**	Operational Message
1-2	**FFFED04C9418618618668A26F180**	Self test Message

4. Maritime User Protocol with Radio Call Sign

4.1 Hex Messages for PLB350A
4.1.1 15 Hex ID: 992A4DEDE0D64D1

4.1.2 Encoded Data

- Country code: 201
- Radio Call Sign (6 digits): XPA02
- Specific bcn: 0
- Aux radio device: 121.5 MHz 121.5 MHz

4.2 Sample Hex Messages

Msg	Hex Message	Comment
2-1	**FFFE2F4C9526F6F06B268C679100**	Operational Message
2-2	**FFFED04C9526F6F06B268C679100**	Self test Message

5. Radio Call Sign User Protocol

5.1 Hex Messages for PLB350A
5.1.2 15 Hex ID: 993B7B7834AA8D1

5.1.2 Encoded Data

- Country code: 201
- Radio Call Sign Identification: XPA02
- Specific beacon Number: 0
- Aux radio device: 121.5 MHz

5.2 Sample Hex Messages

Msg	Hex Message	Comment
3-1	FFFE2F4C9DBDBC1A55468D215500	Operational Message
3-2	FFFED04C9DBDBC1A55468D215500	Self test Message

6. Serial User: Float-Free EPIRB with Serial Number

6.1 Hex Messages for PLB350A
6.1.1 Hex ID: 992D40018C00F9D

6.1.2 Encoded Data

- Country code: 201
- Cospas-Sarsat Certificate Number in bits 74-83: Yes
- Serial Number: 99
- C/S Number or National Use (bit 43 refers): 999
- Aux radio device: 121.5 MHz

6.2 Sample Hex Messages

Msg	Hex Message	Comment
4-1	FFFE2F4C96A000C6007CED45E1C0	Operational Message
4-2	FFFED04C96A000C6007CED45E1C0	Self test Message

7. Serial User: Non Float-Free EPIRB with Serial Number

7.1 Hex Messages for PLB350A

7.1.1 15 Hex ID: 992E40018C00F9D

7.1.2 Encoded Data

- Country code: 201
- Cospas-Sarsat Certificate Number in bits 74-83: Yes
- Serial Number: 99
- C/S Number or National Use (bit 43 refers): 999
- Aux radio device: 121.5 MHz

15 Hex ID:	992E40018C00F9D
Country code: 201	201
Cospas-Sarsat Certificate Number in bits 74-83:	Yes
Serial Number: 99	99
C/S Number or National Use (bit 43 refers):	999
Aux radio device: 121.5 MHz	121.5MHZ

7.2 Sample Hex Messages

Msg	Hex Message	Comment
5-1	**FFFE2F4C972000C6007CE8871240**	Operational Message
5-2	**FFFED04C972000C6007CE8871240**	Self test Message

8. Aviation User Protocol

8.1 Hex Messages for PLB350A

8.1.1 15 Hex ID: 9926492E70174C1

8.1.2 Encoded Data

- Country code: 201 201
- Aircraft Identification C7518
- Aux radio device: 121.5 MHz 121.5MHZ

8.2 Sample Hex Messages

Msg	Hex Message	Comment
6-1	**FFFE2F4C932497380BA60F475D40**	Operational Message
6-2	**FFFED04C932497380BA60F475D40**	Self test Message

9. Serial User: ELT with Serial Number

9.1 Hex Messages for PLB350A
9.1.1 15 Hex ID: 992C40018C00F9D

9.1.2 Encoded Data

- Country code: 201
- Cospas-Sarsat Certificate Number in bits 74-83: Yes
- Serial Number: 99
- C/S Number or National Use (bit 43 refers): 999
- Aux radio device: 121.5 MHz

9.2 Sample Hex Messages

Msg	Hex Message	Comment
7-1	**FFFE2F4C962000C6007CEE044F40**	Operational Message
7-2	**FFFED04C962000C6007CEE044F40**	Self test Message

10. Serial User: ELT with Aircraft Operator Designator & Serial Number

10.1 Hex Messages for PLB350A
10.1.1 15 Hex ID: 992CF8E381F4F9D

10.1.2 Encoded Data

- Country code: 201 201
- Cospas-Sarsat Certificate Number in bits 74-83: Yes
- Three letter designator: AAA
- Serial Number: 500
- C/S Number or National Use (bit 43 refers): 999
- Aux radio device: 121.5 MHz 121.5MHZ

10.2 Sample Hex Messages

Msg	Hex Message	Comment
8-1	**FFFE2F4C967C71C0FA7CEE731C00**	Operational Message
8-2	**FFFED04C967C71C0FA7CEE731C00**	Self test Message

11. Serial User: ELT with Aircraft 24-bit address

11.1 Hex Messages for PLB350A
11.1.1 15 Hex ID: 992DEBC3C3C0F9D

11.1.2 Encoded Data

- Country code: 201
- Cospas-Sarsat Certificate Number in bits 74-83: Yes
- Serial Type: ELT with Aircraft 24-bit Address 11472655
- Number of Additional ELTs 0
- C/S Number or National Use (bit 43 refers): 999
- Aux radio device: 121.5 MHz 121.5MHZ

11.2 Sample Hex Messages

Msg	Hex Message	Comment
9-1	**FFFE2F4C96F5E1E1E07CE9F59D40**	Operational Message
9-2	**FFFED04C96F5E1E1E07CE9F59D40**	Self test Message

12. Serial User: PLB with Serial Number

12.1 Hex Messages for PLB350A
12.1.1 Hex ID: 992F40018C00F9D

12.1.2 Encoded Data

- Country code: 201
- Cospas-Sarsat Certificate Number in bits 74-83 : Yes
- Serial Number: 99
- C/S Number or National Use (bit 43 refers): 999
- Aux radio device: 121.5 MHz

12.2 Sample Hex Messages

Msg	Hex Message	Comment
10-1	**FFFE2F4C97A000C6007CEBC6BCC0**	Operational Message
10-2	**FFFED04C97A000C6007CEBC6BCC0**	Self test Message

13. National User (Short)

13.1 Hex Messages for PLB350A
13.1.1 15 Hex ID: 993000000000000

13.1.2 Encoded Data

- Country code: 201
- National Use: 0
- Aux radio device: 121.5MHZ

13.2 Sample Hex Messages

Msg	Hex Message	Comment
11-1	**FFFE2F4C98000000000000526140**	Operational Message
11-2	**FFFED04C98000000000000526140**	Self test Message