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Report On

Emergency Beacons Testing of the
ACR Electronics, Inc
RLB-36

Document 75902695 Report 01 Issue 3 June 2008

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REPORT ON

Emergency Beacons Testing of the
ACR Electronics, Inc
RLB-36

Document 75902695 Report 01 Issue 3

June 2008

PREPARED FOR

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PREPARED BY

R Hampton
Test Engineer

APPROVED BY

M Jenkins
Authorised Signatory

DATED 17 June 2008

Product Service

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Product Service

SECTION 1

REPORT SUMMARY

Emergency Beacons Testing of the
ACR Electronics, Inc
RLB-36

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Emergency Beacon Testing of the ACR Electronics, Inc RLB-36 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)	RLB-36	
Serial Number(s)	75902695_57	RLB-36, S/N: 007 (Standard Location Protocol, Modified 50Ω output)
	75902695_46	RLB-36, "Unit #4" (National Location Protocol, Modified 50Ω output)
	75902695_49	RLB-36, "Unit #3" (Standard Location Protocol, Production unit with following antenna)
	75902695_51	Antenna, A3-06-2554 (Not serialised)
	75902695_50	RLB-36, "Unit #10" (Standard Location Protocol, Production unit (build state 0) with following antenna)
	75902695_52	Antenna, A3-06-2554 (Not serialised)
	75902695_58	RLB-36, "Unit #9" (National Location Protocol, Production unit with following antenna)
	75902695_59	Antenna, A3-06-2554 (Not serialised)
Number of Samples Tested	Five	
Test Specification/Issue/Date	Cospas-Sarsat T.007 Issue 4 – Rev 2 November 2007	
Date of Receipt of Test Samples	18 February 2008	
Order Number Date	90763-00 12 April 2007	
Start of Test	06 March 2008	
Finish of Test	12 June 2008	
Name of Engineer(s)	R Henley R Hampton M P Hardy R Bennett	

1.2 APPLICATION FORM

1.2.1 Beacon Manufacturer and Beacon Model

Beacon Manufacturer	ACR Electronics, Inc.
Beacon Model	RLB-36
Other Model Names	

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	48 hours
Battery chemistry	LiMnO2
Battery cell size and number of cells	2/3A size, 3 battery packs, 3 cells each
Battery cell manufacturer	Sanyo, CR123A
Battery pack manufacturer and part number	ACR, A3-06-2449

Characteristic	Specification
Oscillator type (e.g. OCXO, MCXO, TCXO)	TCXO
Oscillator manufacturer	C-MAC / RAKON (E4520)
Oscillator part name and number	A1-11-0786-1
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	A3-06-2554
Navigation device type (Internal, External or None)	Both Internal and External
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	Wonde Proud
- Navigation device model name and part Number	A1-11-0688
- GNSS system supported (e.g. GPS, GLONASS, Galileo)	GPS
For External Navigation Devices	
- Data protocol for GNSS receiver to beacon interface	NMEA 0183
- Physical interface for beacon to navigation device	A plug to a keyed GPS bezel
- Electrical interface for beacon to navigation device	GPS Optical Interface
- Navigation device model and manufacturer (if beacon designed to use specific devices)	Any Nav. devices with NMEA 0183 protocol; ie, Garmin GPS handheld

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.)	5 beeps and green light	
- 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, Lock detect, 406 PWR, Strobe light	
- 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%	

Note: Though a GNSS test mode exists it does not incorporate a 406MHz transmission, hence is not mentioned here.

Characteristic	Specification
Beacon includes a strobe light (Yes or No)	Yes
- Strobe light intensity	> 0.75 cd
- Strobe light flash rate	21/minute
Beacon transmission repetition period satisfies C/S T.001 requirement that two beacon's repetition periods are not synchronised closer than a few seconds over 5 minute period, and the time intervals between transmissions are randomly distributed on the interval 47.5 to 52.5 seconds (Yes or No)	Yes
Other ancillary devices (e.g. voice transceiver). 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	Yes, ACR Hydrostatic release unit, part # A3-06-2429
Beacon includes software or hardware features and functions not listed above and non-related to 406 MHz (Yes or No) List features and use a separate sheet if insufficient space	Yes, OLED display is used as secondary indicators besides beep/LED indicators

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: 18 February 2008

Applicable C/S Standards:

Document	Issue	Revision	Date
C/S T.001	3	8	Nov-07
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: 17 June 2008

1.2.5 Applicant Details

Company Name	ACR Electronics, Inc.		
Address	5757 Ravenswood Road Fort Lauderdale, FL.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

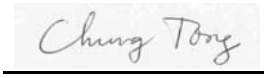
Company Name	Same as above		
Address			
Contact Name		Telephone	
Email		Facsimile	

1.2.7 Declaration of Build Status

Hardware Version	
- PCB Revision	Rev A (same as T2)
- Battery Model	A3-06-2449
Software Version	
Firmware Version	Rev A (same as SW version T3)
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: Chung Tong

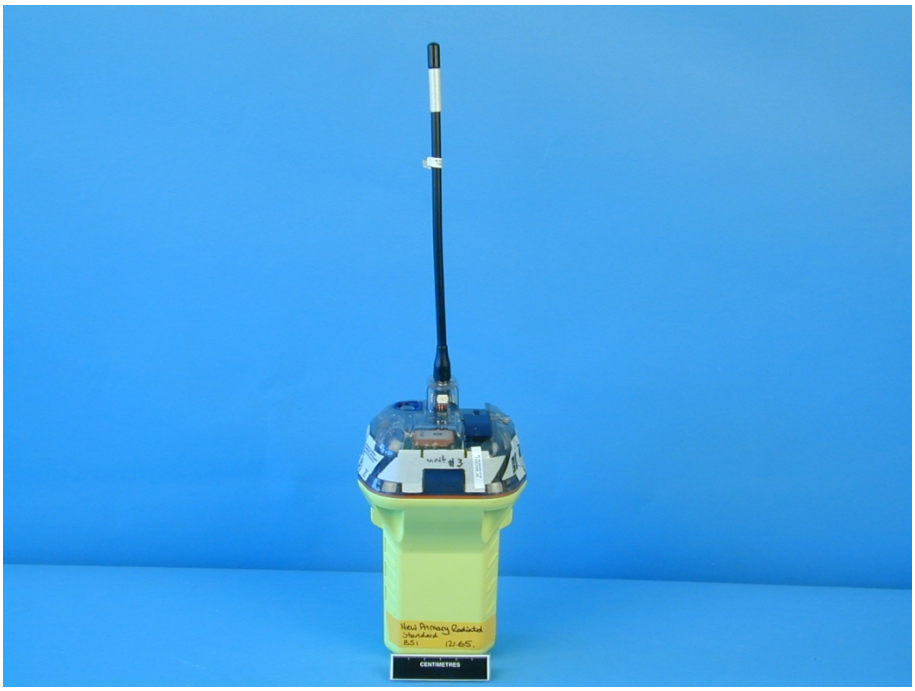
Position Held: Principal Electrical Engineer

Date: 01/16/2008

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a ACR Electronics, Inc RLB-36 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). Some EUT were configured so that the antenna port was connected to the 50Ω test system using a coaxial cable, these are identified in section 1.1 as "Modified 50Ω output". The EUT configuration for all tests is identical with the exception of Antenna Characteristics, Satellite Qualitative and Position Accuracy Time and Position Accuracy. Supporting equipment varied during some tests – see below.

The other EUT were fully packaged beacons, similar to the proposed production beacons equipped with their proper antennas. These EUT were 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.

For "Internal GPS" tests (applicable to all tests unless otherwise stated) there was no supporting equipment. No remote panels or data storage systems were declared by the manufacturer. Supporting equipment in the case of "External GPS" tests (stated where appropriate) comprised of a data cable connected at one end to the beacon via an infrared link and at the other to a generic GPS receiver compatible with the NMEA 0183 protocol. The specific receiver used was a Garmin GPSmap 60C powered by its internal batteries or an external power supply for the Operational Lifetime at Minimum Temperature Test (to avoid battery failure).

1.3.3 Modes of Operation

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

Standby Mode:

- No ancillary devices attached
- No apparent activity in EUT, (e.g. LED activity)

Self-test:

- Activated by raising the main switch to the upright position for approximately 1 second, releasing and allowing the switch to return, by itself, to the normal (off) position
- List of items tested/active features can be found in the application form at section 1.2

(Long/GPS Self-test):

- Activated by raising the main switch to the upright position for approximately 11 seconds or more, releasing and allowing the switch to return, by itself, to the normal (off) position
- List of items tested/active features can be found in the application form at section 1.2

Operating:

- 406 transmitter active
- 121 transmitter active
- 243 transmitter not present
- Navigation Device
    - GPS in “Search Mode”, i.e. no GPS data supplied – customer declared worst case current drain; or
    - GPS off, position derived from external input to infrared port (stated where appropriate)

1.4 MODIFICATIONS

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

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer All samples were originally supplied in this state. However, the test programme was aborted after encountering message errors. The issue was resolved through modification and the test programme was restarted. One sample remained in the original modification state as it was already involved in a simultaneous testing programme for another approval. Note: This modification state applies only to the sample: Unit #10.	N/A	N/A
1	As supplied by the customer This modification state applies to the all other samples for the entire duration of the test programme.	ACR Electronics Inc.	N/A (See Description of Mod State 0)

Note: Details of the message errors present in modification state 0 can be found at Annex A: Customer Supplied Information. The customer declared that the modification would have no impact upon the results of the tests undertaken by the Modification State 0 sample – namely Antenna Characteristics and Position Acquisition and Accuracy (Internal GPS, Standard Location Protocol).

1.5 REPORT MODIFICATION RECORD

Issue 1 – First Issue
Issue 2 – Revised application form (original also included in Annex). Administrative errors corrected as per C/S worksheet 1. Navigation system tests for modification state 1 revised for both external and internal GPS units.
Issue 3 – Addition of hex messages on pages 30 and 58. Inclusion of signatures in annex on application form.

SECTION 2

TEST DETAILS

Emergency Beacons Testing of the
ACR Electronics, Inc
RLB-36

TEST RESULTS TABLE

Parameter		Limits	Units	Test Results			Comments
				Tmin	Tamb	Tmax	
				(-20°C)	(23.4°C)	(+55°C)	
1. Power Output							Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Transmitter power output		35 - 39	dBm	38.56	38.41	38.22	
Power output rise time		< 5	ms	0.108	0.136	0.138	
Power output 1ms before burst		< -10	dBm	-38.84	-35.35	-37.02	
2. Digital Message Coding		Bit Numbers					Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Bit Sync	1 - 15	15 bits "1"	P / F	P	P	P	Decoded Message: Page 26
Frame sync	16 - 24	"000101111"	P / F	P	P	P	
Format flag	25	1 bit	bit value	1	1	1	
Protocol flag	26	1 bit	bit value	0	0	0	
Identification / position data	27 - 85	59 bits	P / F	P	P	P	
BCH code	86 -106	21 bits	P / F	P	P	P	
Emerg. Code/nat. use/supplem. Data	107 - 112	6 bits	bit value	110111	110111	110111	
Additional data / BCH (if applicable)	112 - 144	32 bits	P / F	P	P	P	
Position Error (if applicable)		< 5	km	N/A	N/A	N/A	
3. Digital Message Generator							Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Repetition rate, T_R:							
Average T_R		48.5 ≤ T_{Ravg} ≤ 51.5	seconds	50.010	50.220	49.875	
Minimum T_R		47.5 ≤ T_{Rmin} ≤ 48.0	seconds	47.922	47.688	47.781	
Maximum T_R		52.0 ≤ T_{Rmax} ≤ 52.5	seconds	52.125	52.328	52.172	
Standard deviation		0.5 - 2.0	seconds	1.329	1.489	1.441	
Bit rate							
Minimum fb		≥ 396	bits/sec	400.008	400.007	400.004	
Maximum fb		≤ 404	bits/sec	400.026	400.028	400.026	
Total transmission time							
Short message		435.6 - 444.4	ms	N/A	N/A	N/A	
Long message		514.8 - 525.2	ms	519.804	519.754	519.762	
Unmodulated carrier							
Minimum T1		≥ 158.4	ms	159.881	159.823	159.826	
Maximum T1		≤ 161.6	ms	159.898	159.844	159.848	
First burst delay		≥ 47.5	seconds	101	100	101	

Parameter	Limits	Units	Test Results			Comments
			T_{min} (-20°C)	T_{amb} (23.4°C)	T_{max} (+55°C)	
4. Modulation						Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Biphase-L	P / F	P / F	P	P	P	
Rise time	50 - 250	µs	166.26	165.09	167.37	
Fall time	50 - 250	µs	168.93	165.50	165.57	
Phase deviation: positive	+(1.0 to 1.2)	radians	1.112	1.1094	1.0984	
Phase deviation: negative	-(1.0 to 1.2)	radians	-1.093	-1.1022	-1.1087	
Symmetry measurement	≤ 0.05		0.0021	0.0018	0.0021	
5. 406 MHz Transmitted Frequency						Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Nominal Value	C/S T.001	MHz	406.036708	406.036697	406.036673	
Short-term stability	≤ $2x10^{-9}$	/100ms	$1.502 x10^{-10}$	$1.051x10^{-10}$	$1.230x10^{-10}$	
Medium-term stability – Slope	$(-1 to +1)x10^{-9}$	/minutes	$8.970 x10^{-12}$	$2.853x10^{-11}$	$2.748x10^{-11}$	
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$4.285 x10^{-10}$	$4.604x10^{-10}$	$1.912x10^{-10}$	
6. Spurious Emissions into 50ohms						Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
In band (406.0 – 406.1 MHz)	C/S T.001 mask	P / F	P	P	P	Spectrum plot(s): Page 31
7. 406 MHz VSWR Check						Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Nominal transmitted frequency	C/S T.001	MHz	406.036712	406.036696	406.036675	
Modulation						
Rise time	50-250	µs	206.3	165.30	173.12	
Fall time	50-250	µs	162.03	166.83	164.49	
Phase deviation: positive	+ (1.0 to 1.2)	radians	1.0469	1.1077	1.0838	
Phase deviation: negative	- (1.0 to 1.2)	radians	-1.1611	-1.1026	-1.129	
Symmetry measurement	≤ 0.05		0.0055	0.0019	0.0043	
Digital Message	correct	P / F	P	P	P	Decoded Message: Page 32

Parameter	Limits	Units	Test Results			Comments
			T_{min} (-20°C)	T_{amb} (23.4°C)	T_{max} (+55°C)	
8. Self-test Mode						Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Frame sync	011010000	P / F	P	P	P	Decoded Message: Page 33
Format flag	1 / 0	bit value	1	1	1	
Single radiated burst	≤440 / 520 (±1%)	ms	439.90	439.91	439.91	
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		Applicant's 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		Y		
406 MHz power	self-test checks that RF power emitted	Y / N		Y		Applicant's data: See Application Form

Parameter	Limits	Units	Test Results		Comments
9. Thermal Shock					Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Soak Temperature	30°C difference	°C	23.4		
Measurement Temperature		°C	-6.6		Test Data: Page 35
Transmitted Frequency			Min	Max	
Nominal value	C/S T.001	MHz	406.036710	406.036712	
Short-term stability	≤ $2x10^{-9}$	/100ms	$1.028x10^{-10}$	$1.592x10^{-10}$	
Medium-term stability – Slope	(-2 to +2)$x10^{-9}$	/min	$-1.043x10^{-10}$	$1.43x10^{-10}$	
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$1.151x10^{-10}$	$4.847x10^{-10}$	
Transmitter power output	35 - 39	dBm	38.60	38.64	
Digital message	correct	P/F	P		Decoded Message: Page 40
10 Operating Lifetime at Minimum Temperature					Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Pre-test battery discharge duration (operating)		Hours	17.45		Test Data: Page 41
duration	>24	hours	72.35 Hours at Tmin = -20 °C		The battery was discharged prior to the start of the test by operating the EUT at Ambient Temperature.
Transmitted Frequency			Min	Max	
Nominal value	C/S T.001	MHz	406.0367078	406.0367113	
Short-term stability	≤ $2x10^{-9}$	/100ms	$6.151x10^{-11}$	$2.11x10^{-10}$	Max/min values shown are to 48 hours – the customer stated operational lifetime duration
Medium-term stability – Slope	(-1 to +1)$x10^{-9}$	/min	$-1.058x10^{-10}$	$1.542x10^{-10}$	
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$5.589x10^{-11}$	$5.483x10^{-10}$	
Transmitter power output	35 - 39	dBm	37.82	38.60	First failure occurred at 72.35 hours on power output
Digital message	correct	P/F	P		Decoded Message: Page 46
11. Temperature Gradient (5°C/hr)					Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Transmitted Frequency			Min	Max	Test Data: Page 60
Nominal value	C/S T.007	MHz	406.036670	406.036715	
Short-term stability	≤ $2x10^{-9}$	/100ms	$6.053x10^{-11}$	$2.035x10^{-10}$	
Medium-term stability – Slope[1]	(-1 to +1)$x10^{-9}$	/min	$-3.821x10^{-10}$	$2.929x10^{-10}$	Limits between points B to C+15 minutes and D to E+15 minutes as per C/S T.007 are (-2 to +2)$x10^{-9}$
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$8.348x10^{-11}$	$7.238x10^{-10}$	
Transmitter power output	35 – 39	dBm	38.22	38.78	
Digital message	correct	P/F	P		Decoded Message: Page 65

Parameter	Limits	Units	Test Results			Comments
12. Oscillator Aging						
Data	provided	Y / N	Y			Applicant's data: See Annex A
13. Protection Against Continuous Transmission						
Description	provided	Y / N	Y			Applicant's data: See Annex A
14. Satellite Qualitative Tests						Test Sample: 75902695_49 Mod State: 1 **Result: Pass**
Test Configuration	As per C/S T.007		Config 5	Config 7	Config 8	
15 Hex ID Decoded by LUT	correct	P / F	P	P	P	Test Data: Page 66
Doppler Location results with error ≤5km	≥80	%	100	81.3	100	
15. Antenna Characteristics						Test Sample: 75902695_50 **Result: Pass (MU)** Mod State: 0
Test Configuration	C/S T.007	Figure	B.4		B.5	
Polarisation	linear or RHCP		Linear			Test Data: Page 71
VSWR	≤1.5		N/A			Detachable Antennas Only Note: Though the antenna is removable it is not intended to be interchangeable and no other antenna is intended for use with the beacon, hence this test was omitted.
$EIRP_{LOSS}$		dB	0.59			
$EIRP_{maxEOL}$	≤43	dBm	43.7 ①		42.8	① Pass within Measurement Uncertainty
$EIRP_{minEOL}$	≥32	dBm	34.0		31.7②	② ≥30dBm limit for antenna tested in Figure B.5 configuration
16. Beacon Coding Software						
Sample message for each coding option of the applicable coding types	correct	P / F	N/T *			* N/T (Not Tested) Customer Supplied Information. See Annex A
Sample self-test message for each coding option of the applicable coding types	correct	P / F	N/T *			

Parameter	Limits	Units	Test Results		Comments
17. Navigation System					Test Samples: **Result: Pass** 75902695_57 Mod State: 1 75902695_49 Mod State: 1 75902695_46 Mod State: 1 75902695_ 58 Mod State: 1
Location protocol	C/S T.001		National	Standard	
Position data default values	correct	P / F	P	P	Test Data: Page 74
Position acquisition time	<10/1	min	1.67	1.67	See tables in accordance with C/S T.007 F-C.4
Position accuracy	C/S T.001	P / F	P	P	
Position accuracy - A3.8.2.1, C/S T.007: Conf 5	C/S T.001	m	31.5	40.1	
Position accuracy - A3.8.2.1, C/S T.007: Conf 7	C/S T.001	m	311.1	40.1	
Position accuracy - A3.8.2.1, C/S T.007: Conf 8	C/S T.001	m	68.8	40.1	
Encoded position data update interval	>20	min	23	23	
Position clearance after deactivation	cleared	P / F	P	P	
Position data input update interval (as applicable)	20/1	Min	N/A	N/A	Covered in the External GPS Test Results Table, below.
Position data encoding	correct	P / F	P	P	See tables in accordance with C/S T.007 F-C.2 & F-C.3
Retained last valid position after navigation input lost	240(±5)	min	241	241	
Default position data transmitted after 240(±5) minutes without valid position data	cleared	P / F	P	P	
Information on protection against beacon degradation due to navigation device, interface or signal failure or malfunction	provided	Y / N	Y		Applicant's data: See Annex A

TEST RESULTS TABLE – EXTERNAL GPS

Parameter		Limits	Units	Test Results Tmin (-20°C)	Test Results Tamb (22°C)	Test Results Tmax (+55°C)	Comments
1. Power Output							Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Transmitter power output		35 - 39	dBm	N/R	38.39	38.17	N/R = Not Required; Tests completed in External GPS mode were agreed in advance between the customer and the Cospas-Sarsat Secretariat
Power output rise time		< 5	ms	N/R	0.136	0.138	
Power output 1ms before burst		< -10	dBm	N/R	-34.84	-38.87	
2. Digital Message Coding		Bit Numbers					Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Bit Sync	1 - 15	15 bits "1"	P / F	N/R	P	P	Decoded Message: Page 29
Frame sync	16 - 24	"000101111"	P / F	N/R	P	P	
Format flag	25	1 bit	bit value	N/R	1	1	
Protocol flag	26	1 bit	bit value	N/R	0	0	
Identification / position data	27 - 85	59 bits	P / F	N/R	P	P	
BCH code	86 -106	21 bits	P / F	N/R	P	P	
Emerg. Code/nat. use/supplem. Data	107 - 112	6 bits	bit value	N/R	110101	110101	
Additional data / BCH (if applicable)	112 - 144	32 bits	P / F	N/R	P	P	
Position Error (if applicable)		< 5	km	N/R	0.0495	0.0495	
3. Digital Message Generator							Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Repetition rate, T_R:							
Average T_R		48.5 ≤ T_{Ravg} ≤ 51.5	seconds	N/R	50.058	50.087	
Minimum T_R		47.5 ≤ T_{Rmin} ≤ 48.0	seconds	N/R	47.703	47.844	
Maximum T_R		52.0 ≤ T_{Rmax} ≤ 52.5	seconds	N/R	52.312	52.344	
Standard deviation		0.5 - 2.0	seconds	N/R	1.553	1.495	
Bit rate							
Minimum fb		≥ 396	bits/sec	N/R	400.005	400.007	
Maximum fb		≤ 404	bits/sec	N/R	400.025	400.025	
Total transmission time							
Short message		435.6 - 444.4	ms	N/R	N/A	N/A	
Long message		514.8 - 525.2	ms	N/R	519.756	519.755	
Unmodulated carrier							
Minimum T1		≥ 158.4	ms	N/R	159.821	159.820	
Maximum T1		≤ 161.6	ms	N/R	159.848	159.835	
First burst delay		≥ 47.5	seconds	N/R	100	100	

Parameter	Limits	Units	Test Results			Comments
			T_{min} (-20°C)	T_{amb} (22.2°C)	T_{max} (+55°C)	
5. 406 MHz Transmitted Frequency						Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Nominal Value	C/S T.001	MHz	N/R	406.036695	406.036676	
Short-term stability	≤ $2x10^{-9}$	/100ms	N/R	$1.170x10^{-10}$	$1.010x10^{-10}$	
Medium-term stability – Slope	(-1 to +1)$x10^{-9}$	/minutes	N/R	$-1.639x10^{-11}$	$2.574x10^{-11}$	
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		N/R	$2.648x10^{-10}$	$1.362x10^{-10}$	
8. Self-test Mode						Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Frame sync	011010000	P / F	N/R	P	P	Decoded Message: Page 33
Format flag	1 / 0	bit value	N/R	1	1	
Single radiated burst	≤440 / 520 (±1%)	ms	N/R	439.896	439.914	
Default position data (if applicable)	correct	P / F	N/R	N/A	N/A	All messages contain a position – without said position the EUT would revert to “Internal GPS”, default position coding is therefore covered by the previous tests.
Description provided		Y / N		N/A		
Design data on protection against repetitive self-test mode transmissions	provided	Y / N		N/A		Covered by Internal GPS data
Single burst verification	one burst	P / F	N/R	P	P	
Provides for 15 Hex ID	correct	P / F	N/R	P	P	
121.5 MHz RF power (if applicable)	self-test checks that RF power emitted	Y / N		N/A		
406 MHz power	self-test checks that RF power emitted	Y / N		N/A		Covered by Internal GPS data

Parameter	Limits	Units	Test Results		Comments
10 Operating Lifetime at Minimum Temperature					Test Sample: 75902695_57 Mod State: 1 **Result: Pass**
Pre-test battery discharge duration (operating)		Hours	17.45		Test Data: Page 41
duration	>24	hours	>61.5 Hours at Tmin = -20 °C		The battery was discharged prior to the start of the test by operating the EUT at Ambient Temperature.
Transmitted Frequency			Min	Max	**NB: Test was stopped at 61.5 hours, no failure was encountered**
Nominal value	C/S T.001	MHz	406.0367017	406.0366988	
Short-term stability	≤ $2x10^{-9}$	/100ms	$6.71x10^{-11}$	$1.92x10^{-10}$	Max/min values shown are to the full test duration of 61.5 hours
Medium-term stability – Slope	(-1 to +1)$x10^{-9}$	/min	$-1.61x10^{-10}$	$4.38x10^{-11}$	
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$7.76x10^{-11}$	$4.15x10^{-10}$	
Transmitter power output	35 - 39	dBm	36.818	38.413	
Digital message	correct	P/F	P		Decoded Message: Page 46
14. Satellite Qualitative Tests					Test Sample: 75902695_49 Mod State: 1 **Result: Pass**
Test Configuration	As per C/S T.007		Configuration 7	Configuration 8	
15 Hex ID Decoded by LUT	correct	P / F	P	P	Test Data: Page 66
Doppler Location results with error ≤5km	≥80	%	88.9	87.5	Note: Configuration 5 declared invalid by customer after consultation with Cospas-Sarsat Secretariat.
16. Beacon Coding Software					
Sample message for each coding option of the applicable coding types	correct	P / F	N/T *		* N/T (Not Tested) Customer Supplied Information. See Annex A
Sample self-test message for each coding option of the applicable coding types	correct	P / F	N/T *		

Parameter	Limits	Units	Test Results		Comments
17. Navigation System					Test Samples: **Result: Pass** 75902695_57 Mod State: 1 75902695_49 Mod State: 1 75902695_46 Mod State: 1 75902695_ 58 Mod State: 1
Location protocol	C/S T.001		National	Standard	Test Data: Page 80
Position data default values	correct	P / F	N/A	N/A	Without position data the EUT reverts to “Internal GPS”, default position coding is therefore covered by the previous tests.
Position acquisition time	<10/1	min	<1	<1	
Position accuracy	C/S T.001	P / F	P	P	Note: Configuration 5 declared invalid by customer after consultation with Cospas-Sarsat Secretariat.
Position accuracy - A3.8.2.1, C/S T.007: Conf 7	C/S T.001	m	68.8	49.8	
Position accuracy - A3.8.2.1, C/S T.007: Conf 8	C/S T.001	m	68.8	49.8	
Encoded position data update interval	>20	min	22.4	22.5	
Position clearance after deactivation	cleared	P / F	P	P	
Position data input update interval (as applicable)	20/1	Min	23	23	
Position data encoding	correct	P / F	P	P	
Retained last valid position after navigation input lost	240(±5)	min	241	240	
Default position data transmitted after 240(±5) minutes without valid position data	cleared	P / F	P	P	
Information on protection against beacon degradation due to navigation device, interface or signal failure or malfunction	provided	Y / N	N/A		Covered by Internal GPS data

2.1 DIGITAL MESSAGE CODING

2.1.1 Equipment Under Test

RLB-36, Serial Number: 007

2.1.2 Date of Test and Modification State

06, 10 and 11 March 2008 - Modification State 1

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......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC4407D4FFBFF              2DDC4407D4FFBFF Default_Id
 36 Hex (Bits 25-144) = FFFE2F96EE2203EA7FDFFCE287F783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0100 0100 0000 0111 1101 0100 1111 1111 1011 1111 1111
   1001 1100 0101 0000 1111 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                         0010 0010 0000 0011 1110 1010
Coarse Position    65- 85          DEFAULT           0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0          1001 1100 0101 0000 1111 1
BCH Generated      86-106                            1001 1100 0101 0000 1111 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                  110
Fixed Bit         110               1                                        1
Encode Pos Device 111               1 Internal                               1
121.5 Homing      112               1 YES                                    1
Position Change   113-132           DEFAULT             1000 0011 1110 0000 1111
Resultant Position                --> Not Defined
BCH Encoded       133-144           Errors=0                       0110 0110 1100
BCH Generated     133-144                                          0110 0110 1100
```

Minimum Temperature

```
Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC4407D4FFBFF             2DDC4407D4FFBFF Default_Id
 36 Hex (Bits 25-144) = FFFE2F96EE2203EA7FDFFCE287F783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0100 0100 0000 0111 1101 0100 1111 1111 1011 1111 1111
   1001 1100 0101 0000 1111 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                               1
Protocol Flag      26            0 Location NEW                               0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                  1110
Spare              41- 64                          0010 0010 0000 0011 1110 1010
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           1001 1100 0101 0000 1111 1
BCH Generated      86-106                             1001 1100 0101 0000 1111 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                   110
Fixed Bit         110               1                                         1
Encode Pos Device 111               1 Internal                                1
121.5 Homing      112               1 YES                                     1
Position Change   113-132           DEFAULT              1000 0011 1110 0000 1111
Resultant Position                 --> Not Defined
BCH Encoded       133-144          Errors=0                        0110 0110 1100
BCH Generated     133-144                                          0110 0110 1100
```

Maximum Temperature

```
Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC4407D4FFBFF             2DDC4407D4FFBFF Default_Id
 36 Hex (Bits 25-144) = FFFE2F96EE2203EA7FDFFCE287F783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0100 0100 0000 0111 1101 0100 1111 1111 1011 1111 1111
   1001 1100 0101 0000 1111 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                               1
Protocol Flag      26            0 Location NEW                               0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                          0010 0010 0000 0011 1110 1010
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           1001 1100 0101 0000 1111 1
BCH Generated      86-106                             1001 1100 0101 0000 1111 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                   110
Fixed Bit         110               1                                         1
Encode Pos Device 111               1 Internal                                1
121.5 Homing      112               1 YES                                     1
Position Change   113-132           DEFAULT              1000 0011 1110 0000 1111
Resultant Position                 --> Not Defined
BCH Encoded       133-144          Errors=0                        0110 0110 1100
BCH Generated     133-144                                          0110 0110 1100
```

2.2 DIGITAL MESSAGE CODING (EXTERNAL GPS)

2.2.1 Equipment Under Test

RLB-36, Serial Number: 007

2.2.2 Date of Test and Modification State

06, 10 and 11 March 2008 - Modification State 1

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

Note: All messages contain a position – without said position the EUT would revert to “Internal GPS”, default position coding is therefore covered by the previous tests.

Ambient Temperature

```
Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC4407D467407              2DDC4407D4FFBFF Default_Id
 36 Hex (Bits 25-144) = FFFE2F96EE2203EA33A03A15F4351DA4D814

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0100 0100 0000 0111 1101 0100 0110 0111 0100 0000 0111
   0100 0010 1011 1110 1000 0110 1010 0011 1011 0100 1001 1011 0000 0010 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                          0010 0010 0000 0011 1110 1010
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           0100 0010 1011 1110 1000 0
BCH Generated      86-106                             0100 0010 1011 1110 1000 0
Long Message      107-144          Data Present
Fixed Bits        107-109                                               110
Fixed Bit         110              1                                      1
Encode Pos Device 111              0 External                             0
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                  1000 0001 0100
BCH Generated     133-144                                    1000 0001 0100
```

Maximum Temperature

```
Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC4407D467407             2DDC4407D4FFBFF Default_Id
 36 Hex (Bits 25-144) = FFFE2F96EE2203EA33A03A15F4351DA4D814

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0100 0100 0000 0111 1101 0100 0110 0111 0100 0000 0111
   0100 0010 1011 1110 1000 0110 1010 0011 1011 0100 1001 1011 0000 0010 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                    Bits
----------        -------    ----- ------                                    ----
Format Flag        25            1 Long Message                                1
Protocol Flag      26            0 Location NEW                                0
MID                27- 36      366 USA                                0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                   1110
Spare              41- 64                          0010 0010 0000 0011 1110 1010
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           0100 0010 1011 1110 1000 0
BCH Generated      86-106                             0100 0010 1011 1110 1000 0
Long Message      107-144          Data Present
Fixed Bits        107-109                                                   110
Fixed Bit         110            1                                            1
Encode Pos Device 111            0 External                                   0
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                       1000 0001 0100
BCH Generated     133-144                                         1000 0001 0100
```

Position Error Calculations

Applied Position:	N 51° 22' 35"	W 001° 49' 50"
Encoded position(s):	N 51° 22’ 36”	W 001° 49’ 52”
Position Error:	49.5m	

2.3 SPURIOUS EMISSIONS

2.3.1 Equipment Under Test

RLB-36, Serial Number: 007

2.3.2 Date of Test and Modification State

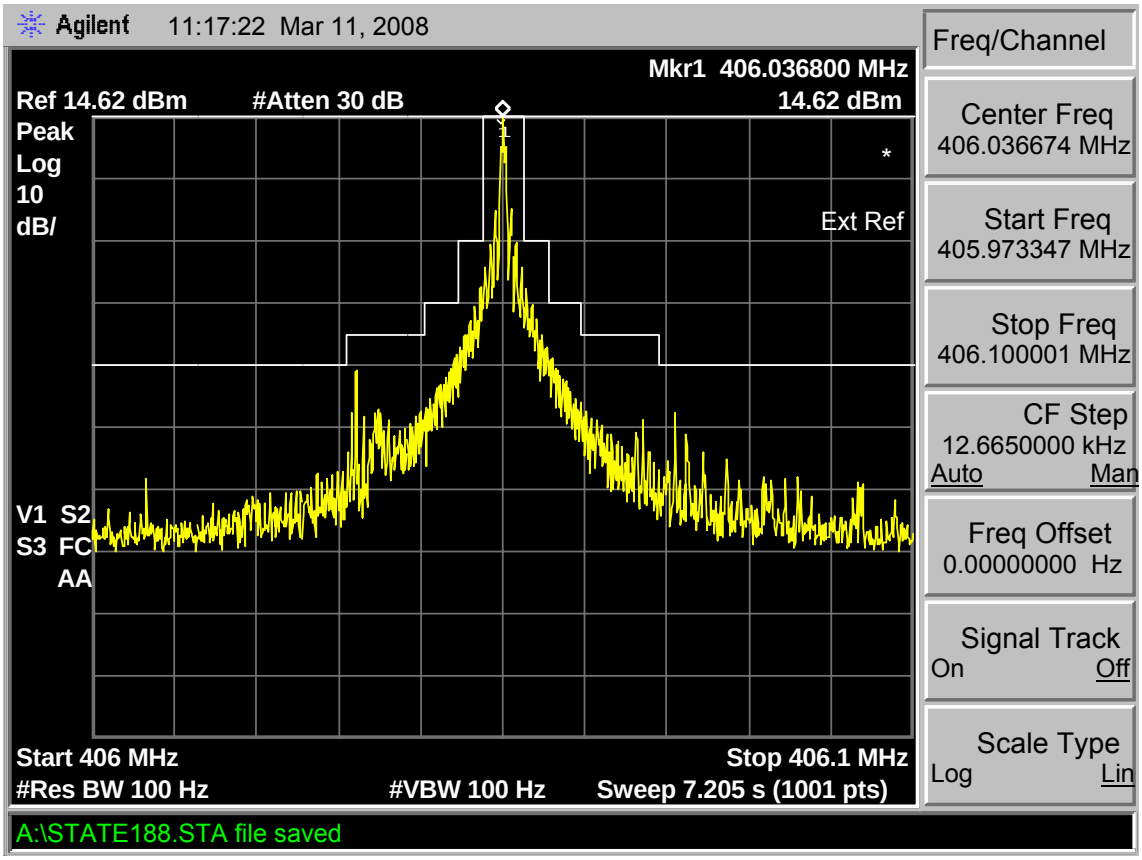
10 and 11 March 2008 - Modification State 1

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

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



2.4 406 MHZ VSWR CHECK – DECODED MESSAGE

2.4.1 Equipment Under Test

RLB-36, Serial Number: 007

2.4.2 Date of Test and Modification State

06 March 2008 - Modification State 1

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

Digital Message at all temperatures

```
Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC4407D4FFBFF              2DDC4407D4FFBFF Default_Id
 36 Hex (Bits 25-144) = FFFE2F96EE2203EA7FDFFCE287F783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0100 0100 0000 0111 1101 0100 1111 1111 1011 1111 1111
   1001 1100 0101 0000 1111 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                          0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                        0010 0010 0000 0011 1110 1010
Coarse Position    65- 85          DEFAULT          0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0         1001 1100 0101 0000 1111 1
BCH Generated      86-106                           1001 1100 0101 0000 1111 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                  110
Fixed Bit         110               1                                        1
Encode Pos Device 111               1 Internal                               1
121.5 Homing      112               1 YES                                    1
Position Change   113-132           DEFAULT             1000 0011 1110 0000 1111
Resultant Position                 --> Not Defined
BCH Encoded       133-144          Errors=0                      0110 0110 1100
BCH Generated     133-144                                        0110 0110 1100
```

2.5 SELF-TEST MODE – DECODED MESSAGE

2.5.1 Equipment Under Test

RLB-36, Serial Number: 007

2.5.2 Date of Test and Modification State

06 March 2008 - Modification State 1

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

Digital Message at all temperatures

```
Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = 2DDC4407D4FFBFF              2DDC4407D4FFBFF Default_Id
 36 Hex (Bits 25-144) = FFFED096EE2203EA7FDFFCE287F700000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0100 0100 0000 0111 1101 0100 1111 1111 1011 1111 1111
   1001 1100 0101 0000 1111 1110 1110 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message: bcn entered Short Non-Spec    1
Protocol Flag      26            0 Location NEW                                0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                         0010 0010 0000 0011 1110 1010
Coarse Position    65- 85          DEFAULT           0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0          1001 1100 0101 0000 1111 1
BCH Generated      86-106                            1001 1100 0101 0000 1111 1
Fixed Bits        107-109                                                   110
Fixed Bit         110             1                                           1
Encode Pos Device 111             1 Internal                                  1
121.5 Homing      112             1 YES                                       1
Resultant Position               --> Not Defined
```

2.6 SELF-TEST MODE (EXTERNAL GPS) – DECODED MESSAGE

2.6.1 Equipment Under Test

RLB-36, Serial Number: 007

2.6.2 Date of Test and Modification State

02 and 04 April 2008 - Modification State 1

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

Digital Message at Ambient and Maximum Temperatures

```
Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = 2DDC4407D4FFBFF              2DDC4407D4FFBFF Default_Id
 36 Hex (Bits 25-144) = FFFED096EE2203EA7FDFFCE287F700000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0100 0100 0000 0111 1101 0100 1111 1111 1011 1111 1111
   1001 1100 0101 0000 1111 1110 1110 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message: bcn entered Short Non-Spec    1
Protocol Flag      26            0 Location NEW                                0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                         0010 0010 0000 0011 1110 1010
Coarse Position    65- 85          DEFAULT           0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0          1001 1100 0101 0000 1111 1
BCH Generated      86-106                            1001 1100 0101 0000 1111 1
Fixed Bits        107-109                                                   110
Fixed Bit         110              1                                          1
Encode Pos Device 111              1 Internal                                 1
121.5 Homing      112              1 YES                                      1
Resultant Position                --> Not Defined
```

2.7 THERMAL SHOCK

2.7.1 Equipment Under Test

RLB-36, Serial Number: 007

2.7.2 Date of Test and Modification State

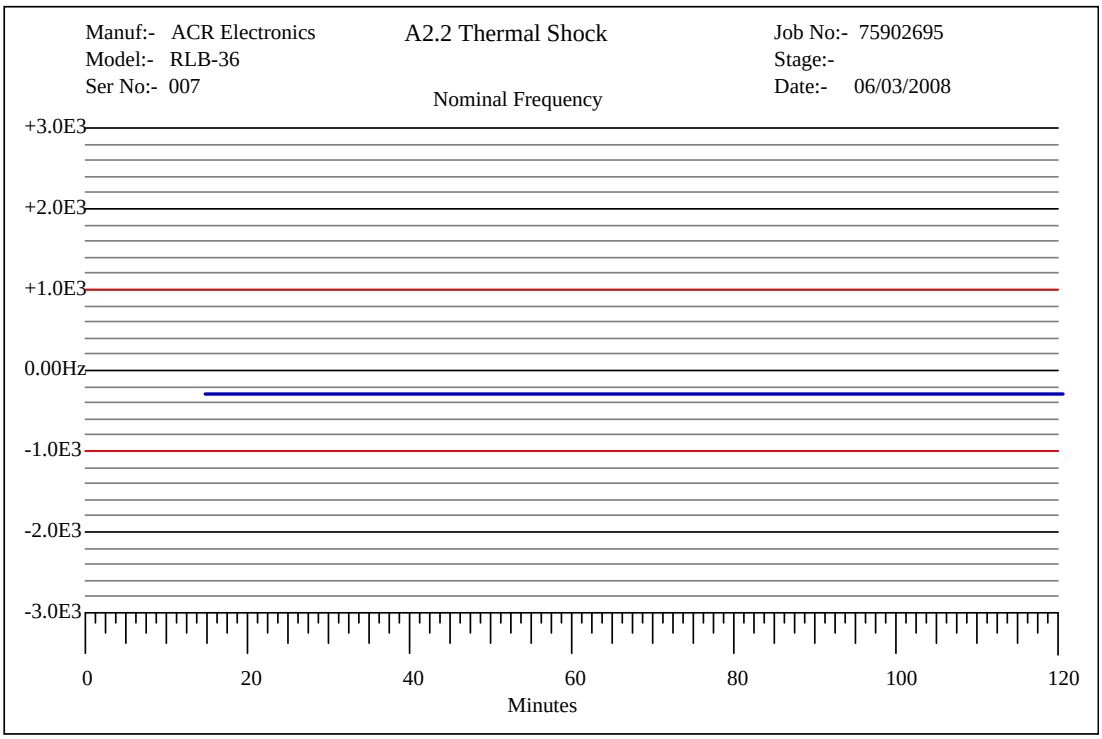
06 March 2008 - Modification State 1

2.7.3 Test Equipment Used

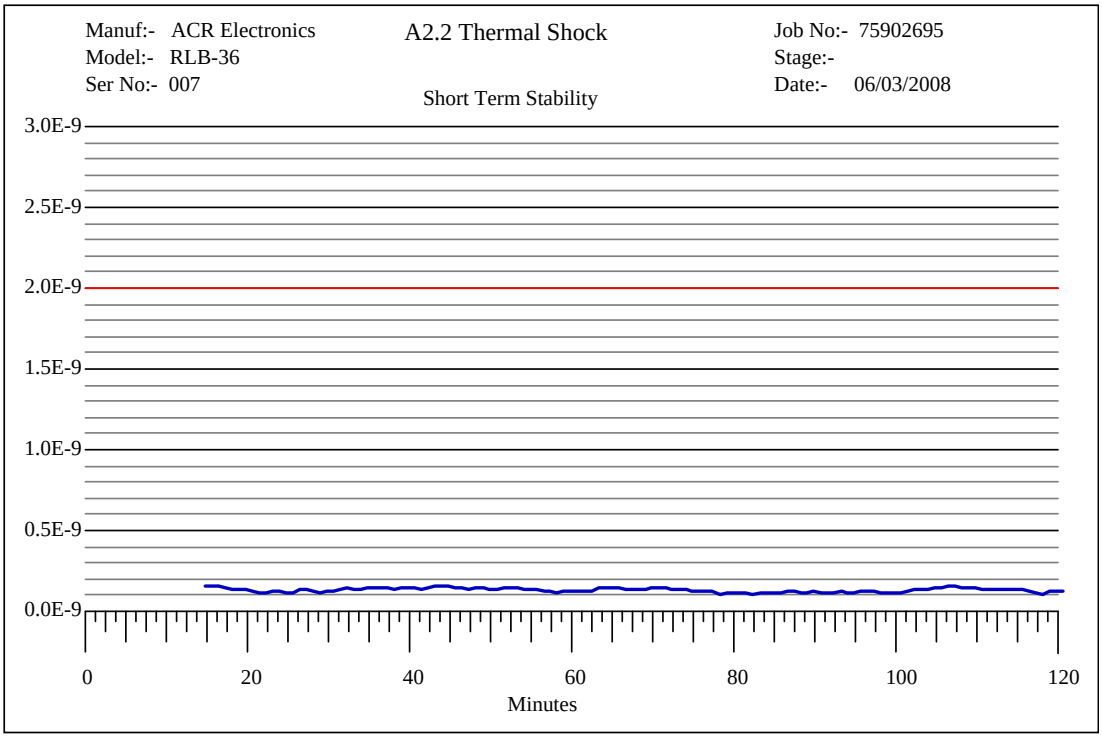
The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.4 Test Results

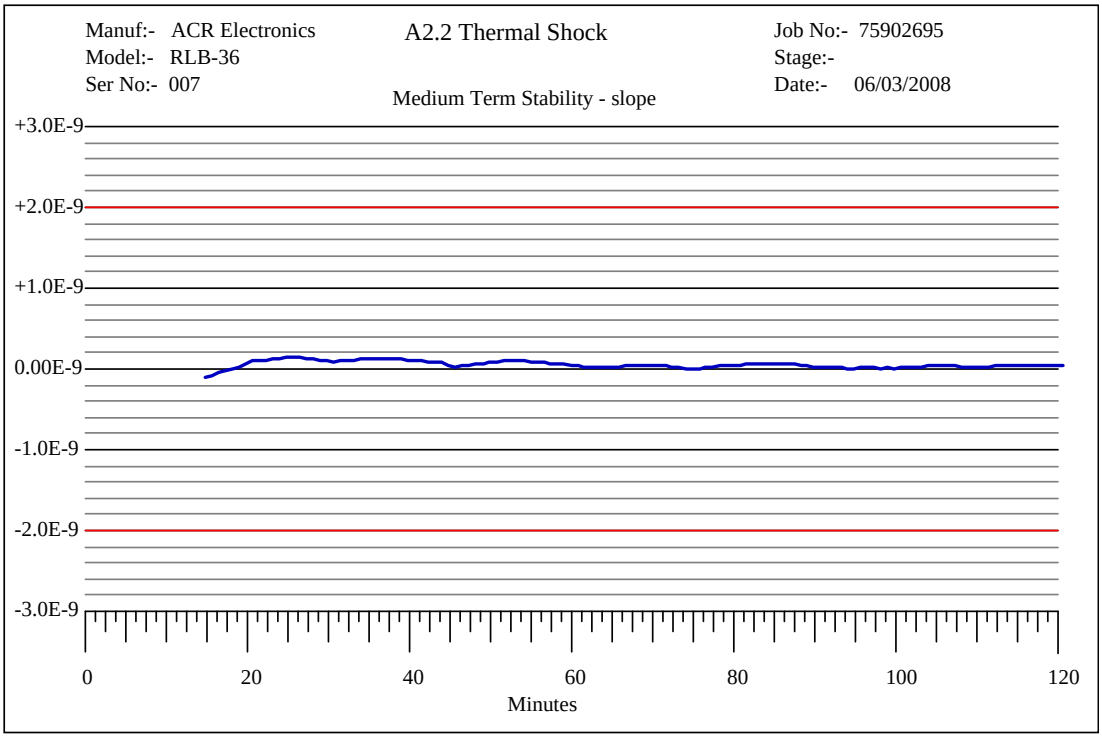
Nominal Frequency



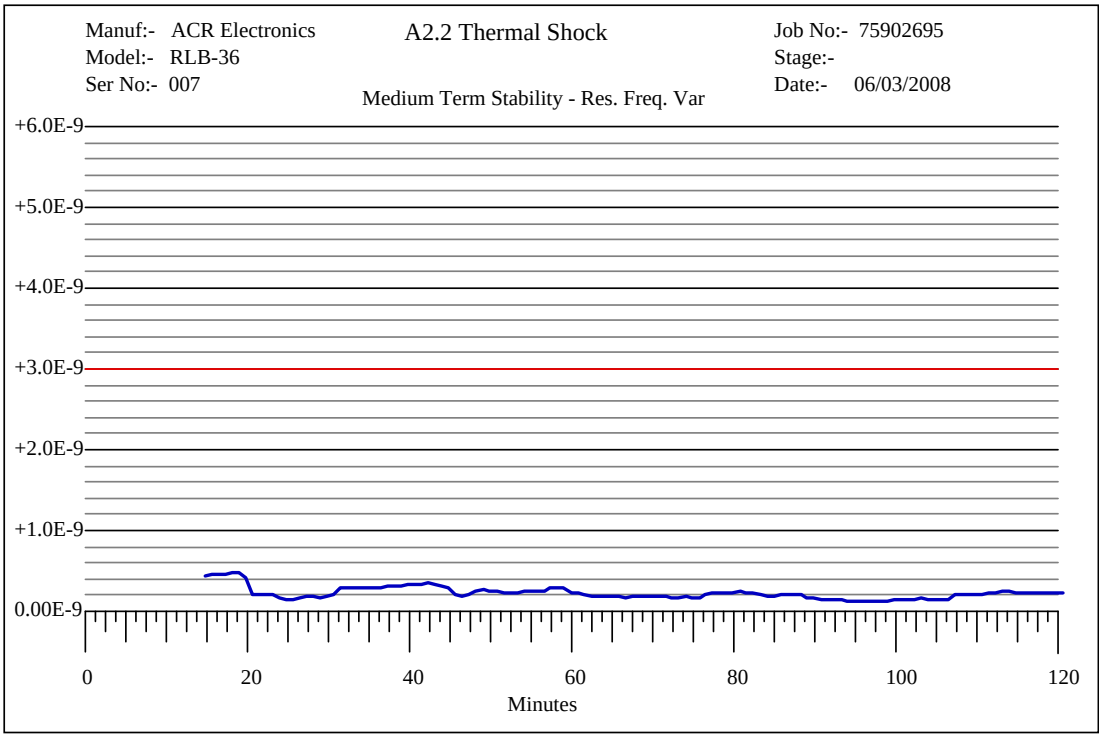
Short Term Stability



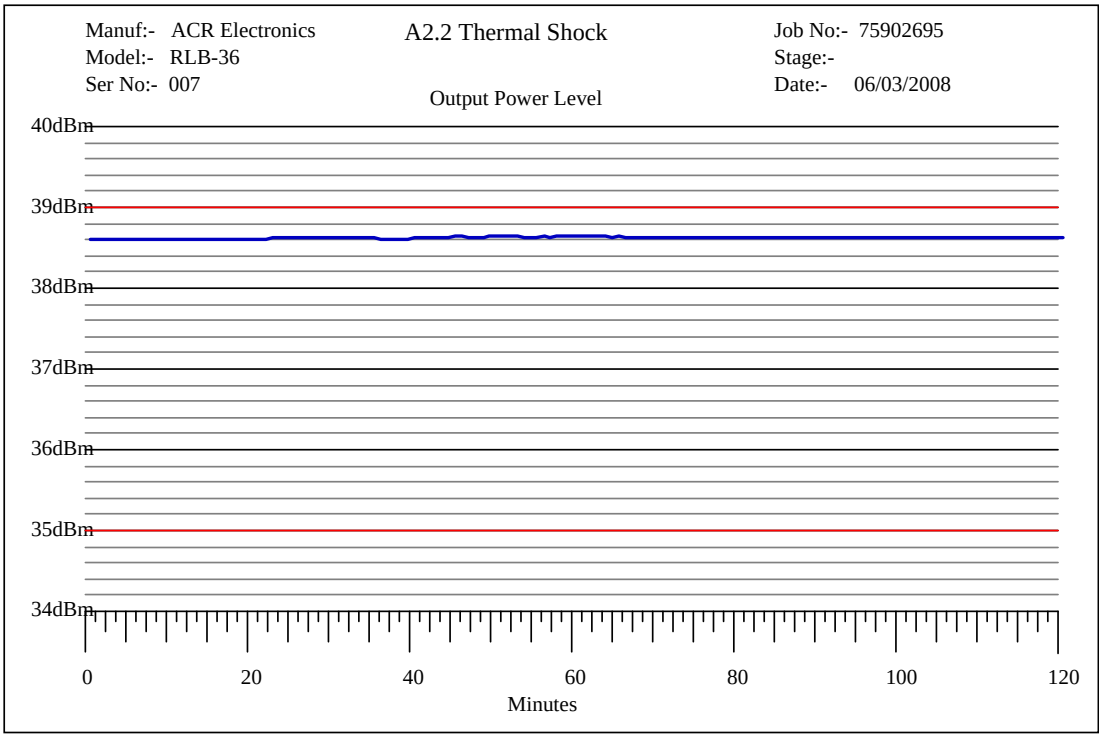
Mean Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



Output Power



Digital Message

```
Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC4407D4FFBFF              2DDC4407D4FFBFF Default_Id
 36 Hex (Bits 25-144) = FFFE2F96EE2203EA7FDFFCE287F783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0100 0100 0000 0111 1101 0100 1111 1111 1011 1111 1111
   1001 1100 0101 0000 1111 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                               1
Protocol Flag      26            0 Location NEW                               0
MID                27- 36      366 USA                              0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                  1110
Spare              41- 64                          0010 0010 0000 0011 1110 1010
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           1001 1100 0101 0000 1111 1
BCH Generated      86-106                             1001 1100 0101 0000 1111 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                   110
Fixed Bit         110              1                                          1
Encode Pos Device 111              1 Internal                                 1
121.5 Homing      112              1 YES                                      1
Position Change   113-132          DEFAULT              1000 0011 1110 0000 1111
Resultant Position               --> Not Defined
BCH Encoded       133-144          Errors=0                        0110 0110 1100
BCH Generated     133-144                                          0110 0110 1100
```

2.8 OPERATING LIFETIME AT MINIMUM TEMPERATURE

2.8.1 Equipment Under Test

RLB-36, Serial Number: 007

2.8.2 Date of Test and Modification State

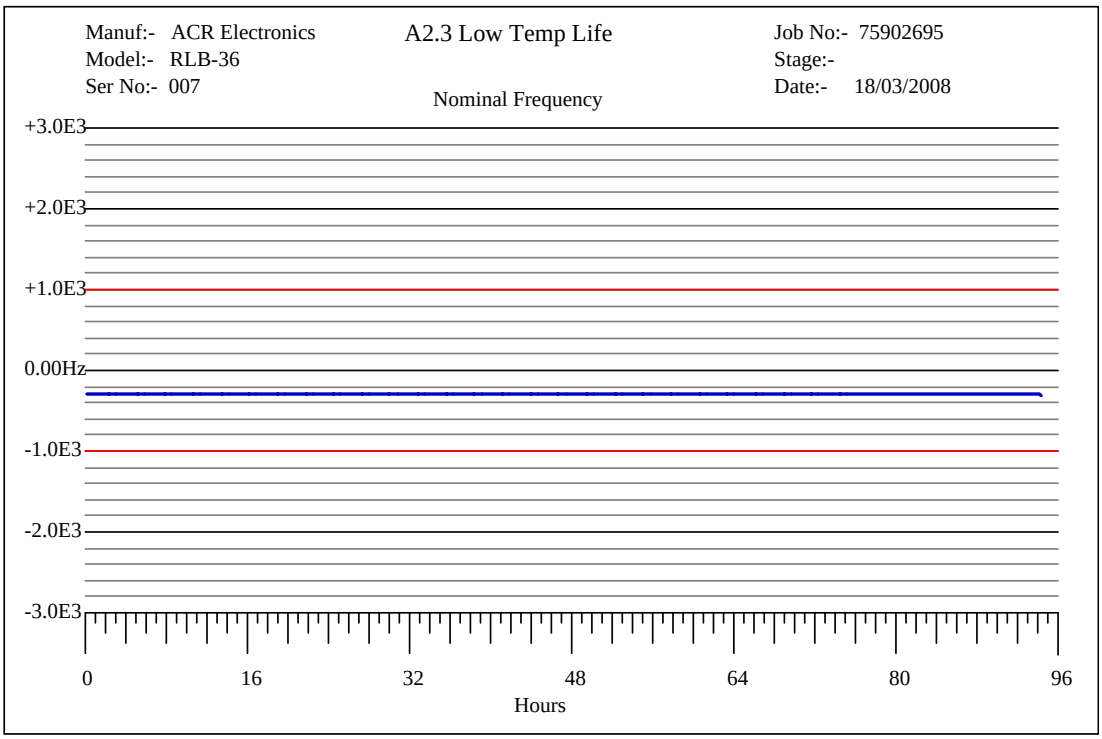
18 March 2008 - Modification State 1

2.8.3 Test Equipment Used

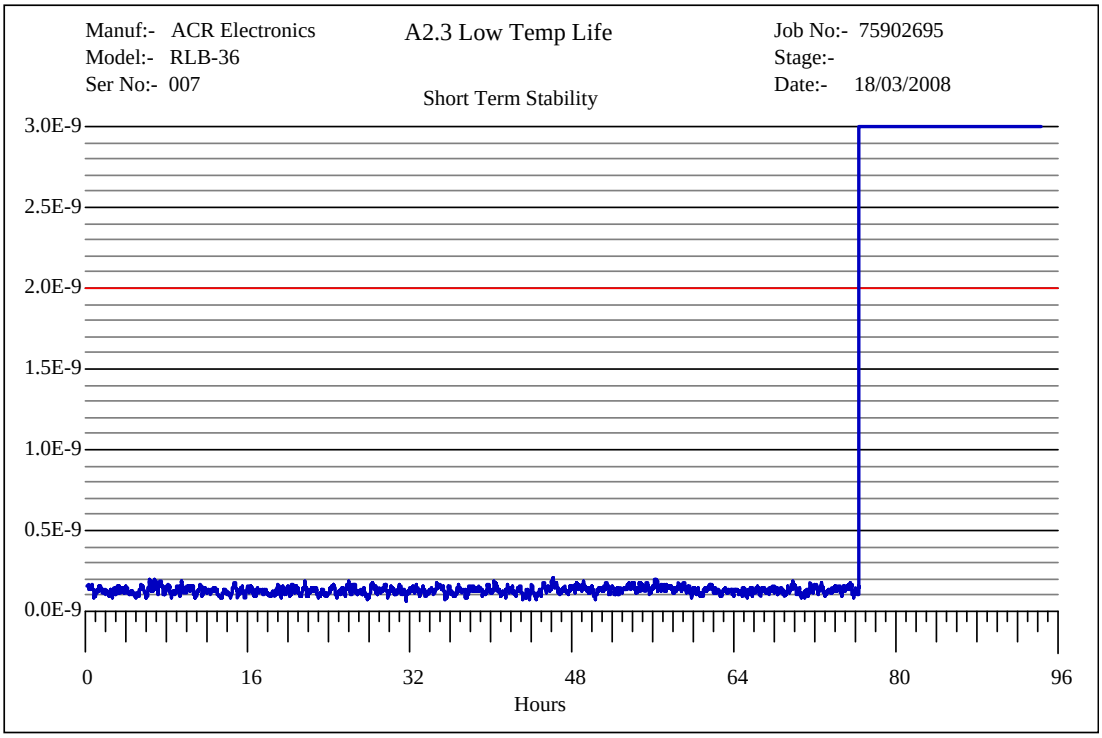
The major items of test equipment used for the above tests are identified in Section 3.1.

2.8.4 Test Results

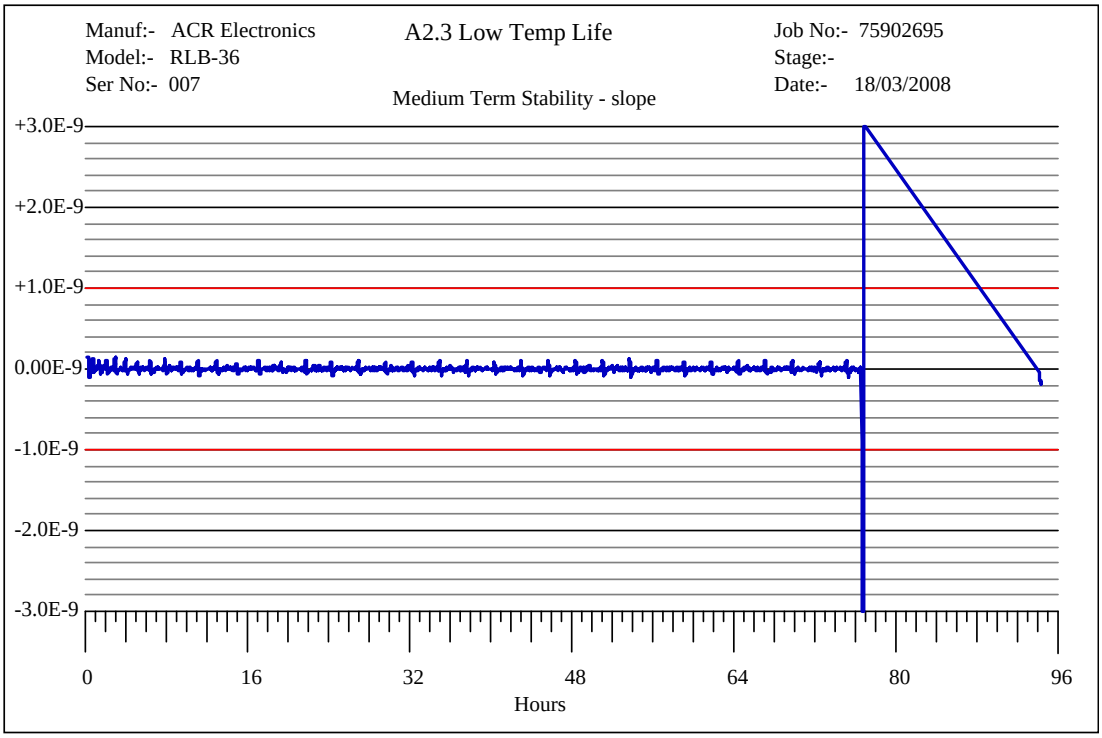
Nominal Frequency



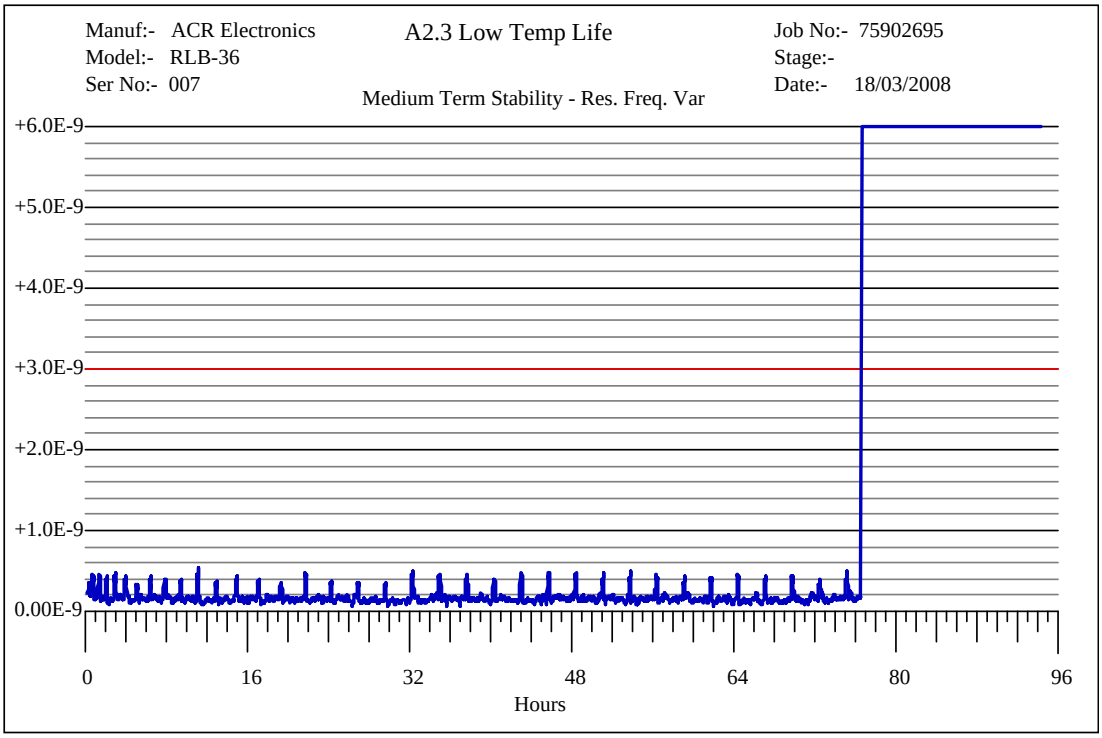
Short Term Stability



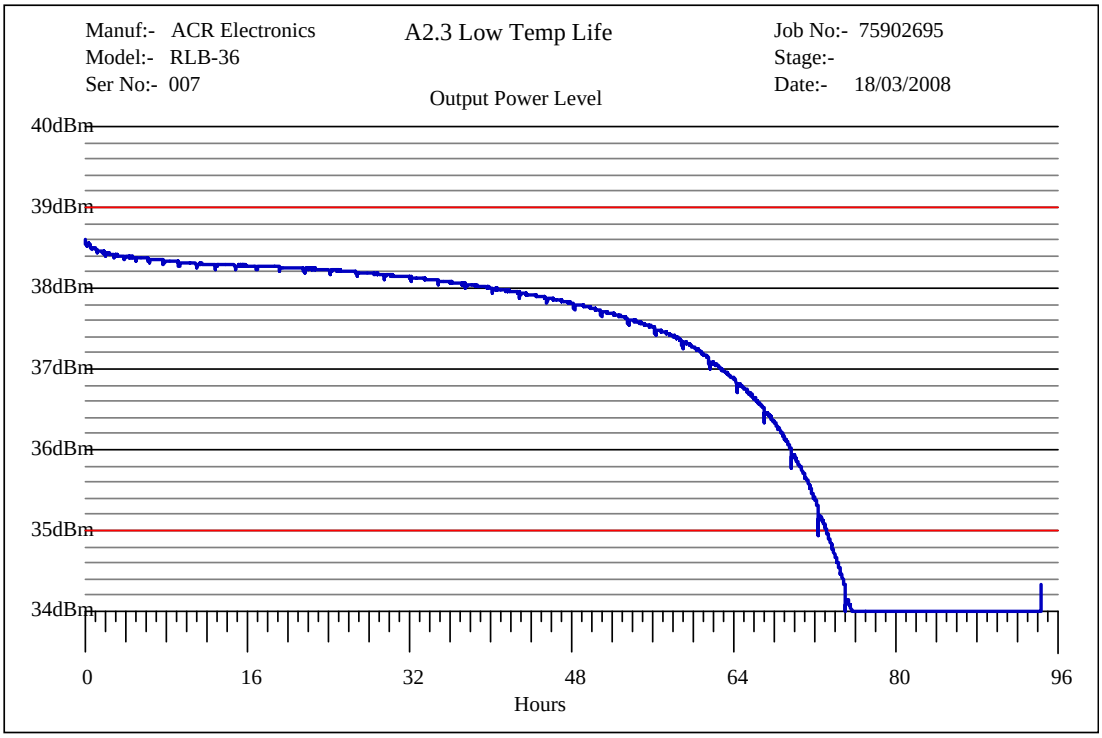
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



Output Power



Digital Message

```
Message Content
     Expected Message       FFFE2F96EE2203EA7FDFFCE287F783E0F66C
     Actual Message         FFFE2F96EE2203EA7FDFFCE287F783E0F66C
     Message Error Count    0


Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC4407D4FFBFF              2DDC4407D4FFBFF Default_Id
 36 Hex (Bits 25-144) = FFFE2F96EE2203EA7FDFFCE287F783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0100 0100 0000 0111 1101 0100 1111 1111 1011 1111 1111
   1001 1100 0101 0000 1111 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                           0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                1110
Spare              41- 64                          0010 0010 0000 0011 1110 1010
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           1001 1100 0101 0000 1111 1
BCH Generated      86-106                             1001 1100 0101 0000 1111 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                   110
Fixed Bit         110               1                                         1
Encode Pos Device 111               1 Internal                                1
121.5 Homing      112               1 YES                                     1
Position Change   113-132           DEFAULT              1000 0011 1110 0000 1111
Resultant Position                 --> Not Defined
BCH Encoded       133-144          Errors=0                       0110 0110 1100
BCH Generated     133-144                                         0110 0110 1100
```

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	(1799920 ms)
Self-test Current	:	12 seconds	(11920 ms)
GPS test Current	:	11.6 minutes	(698000 ms)
Operating Current	:	12.37 minutes	(741920 ms)

Assumptions / Supplied Data

Battery Replacement Interval	: 5 years	
Battery Capacity	: 4.2 Ah	(3 parallel packs of 1.4Ah each)
Battery Self Drain	: 1.02 % per year	(5% per 5 years, customer stated max.)
Self-test Interval	: 12 tests per year	
GPS-test Interval	: 0.2 tests per year	(1 test every 5 years (once per beacon))

Test Results

Mode Current	= Accumulated Charge	/ Time		
Standby Current	= 8286522887 pC	/ 1799920 ms	=	4604 nA
Self-test Current	= 895823.04 uC	/ 11920 ms	=	75.15 mA
GPS-test Current	= 16730748.4 uC	/ 698000 ms	=	23.97 mA
Operating Current	= 24308483.1 uC	/ 741920 ms	=	32.76 mA

Battery Preconditioning / Discharge Time Calculations

Battery Self Drain = Capacity - [(100% - Self Drain/Year%)$^{\text{Replacement Interval}}$ x Capacity]
= 4.2- ((1- 0.0102)^{5} x 4.2) = 0.2099 Ah

Standby Drain = Hours per year x Battery Replacement Interval x Standby Current
= 365 x 24 x 5 x 4604 x 10^{-9} = 0.2016 Ah
Worst Case = 1.65 x 0.2016 Ah = 0.3327 Ah

Self-test Drain = Self-tests per battery x Self-test Current x Self-test duration (in hours)
= 12 x 5 x 75.15 x 10^{-3} x (11.9 / 3600) = 0.0149 Ah
Worst Case = 1.65 x 0.0149 Ah = 0.0246 Ah

GPS-test Drain = GPS-tests per battery x GPS-test Current x GPS-test duration (in hours)
= 0.2 x 5 x 23.97 x 10^{-3} x (11.6 / 60) = 0.0046 Ah
Worst Case = 1.65 x 0.0046 Ah = 0.0077 Ah

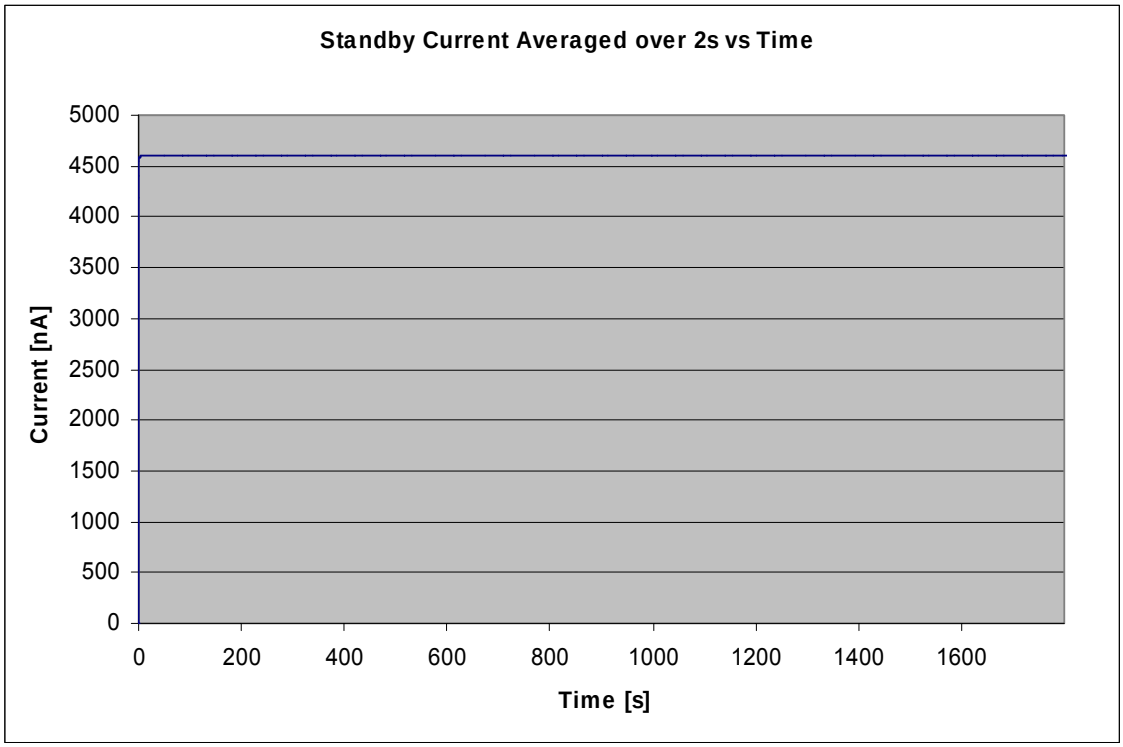
Total Drain = Self Drain + Standby Drain* + Self-test Drain* + GPS-test Drain
= 0.2099 + 0.3327 + 0.0246 + 0.0077 = 0.5719 Ah

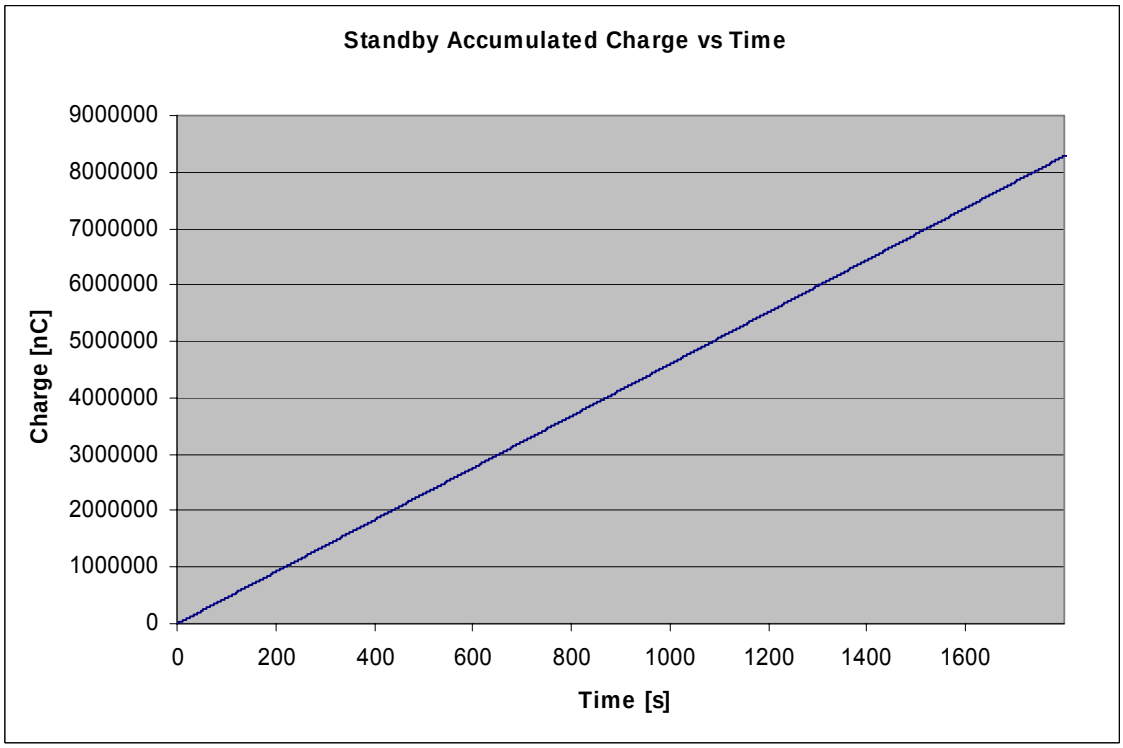
* Worst case

Battery Preconditioning / Discharge Time = Worst Case drain / Operational Current
= 0.5719 / (32.76 x 10^{-3})
= 17.45 hours

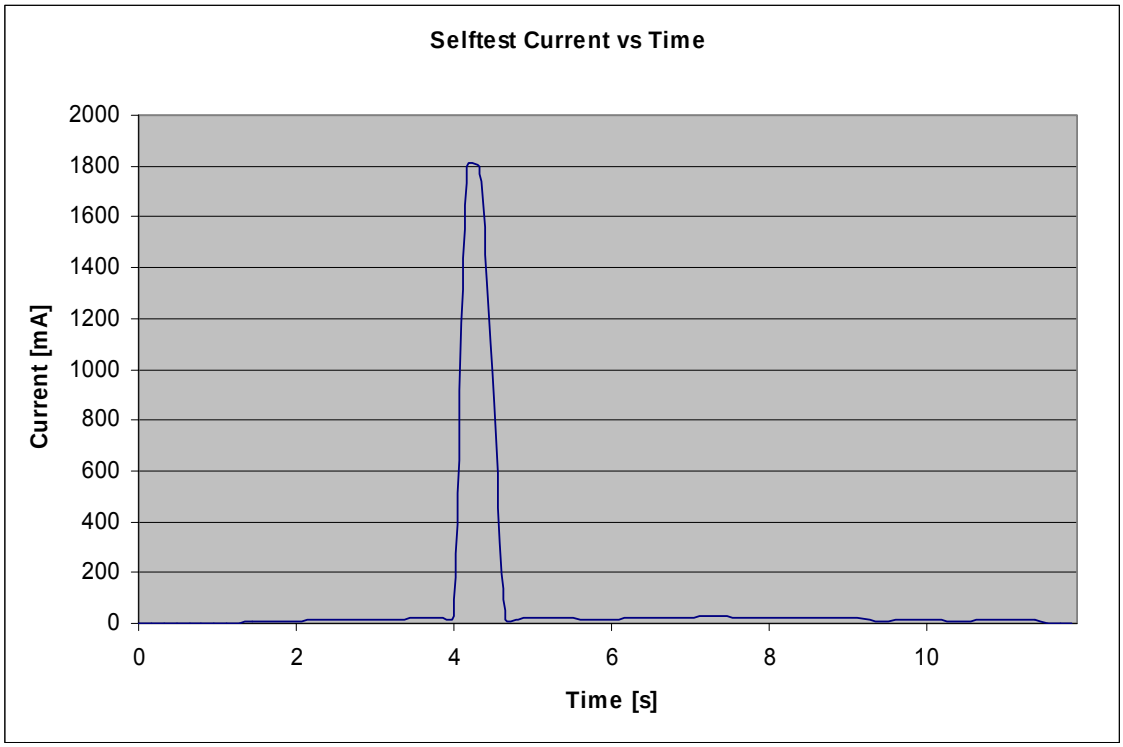
EUT was discharged by being placed in operational mode at ambient temperature for 17 hours and 28 minutes

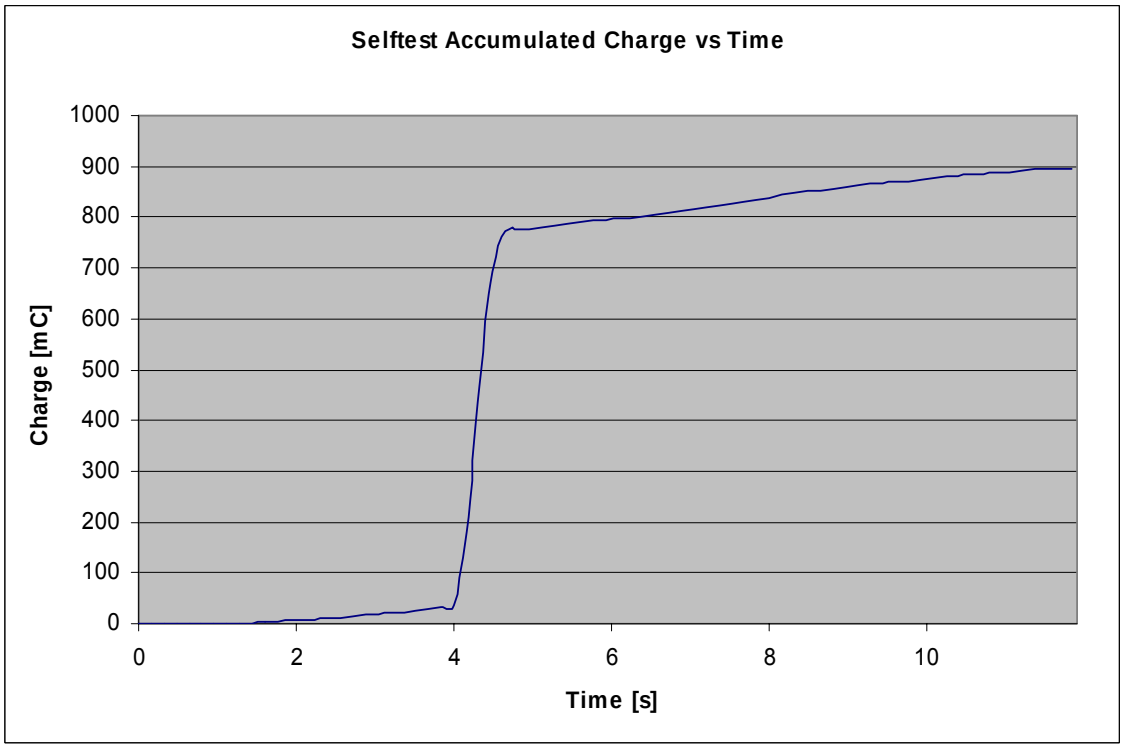
Battery Current Measurement Results (continued) - Standby Mode



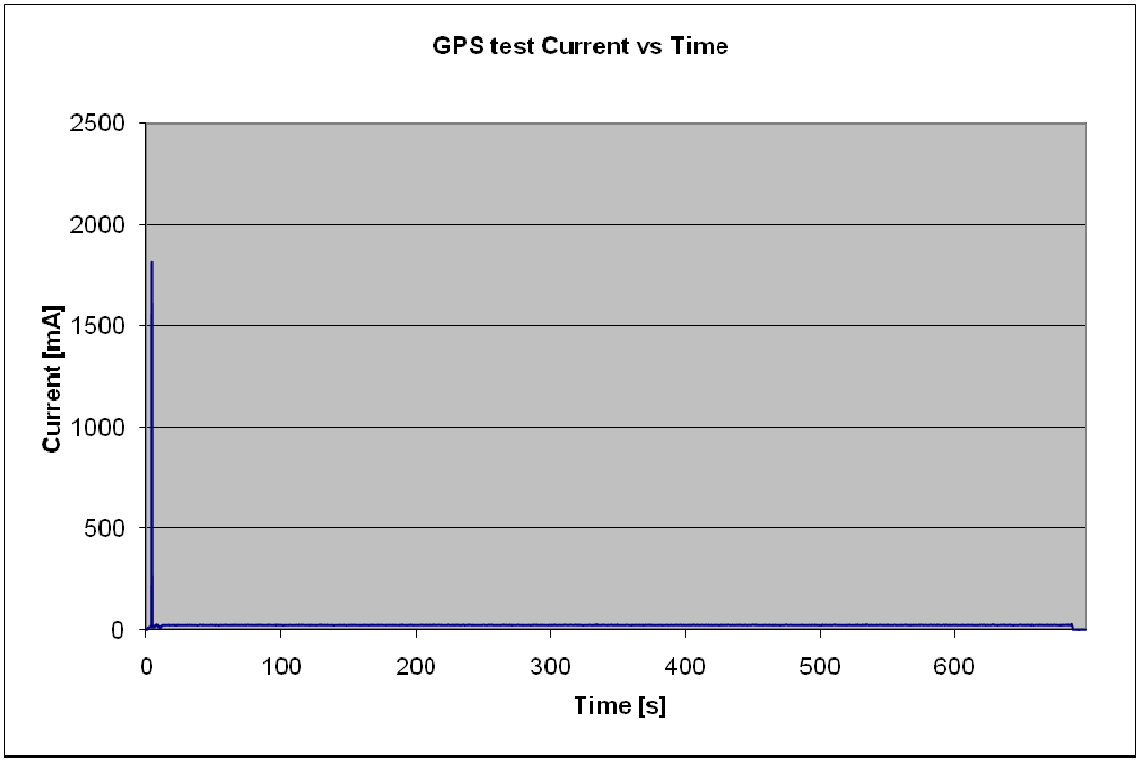


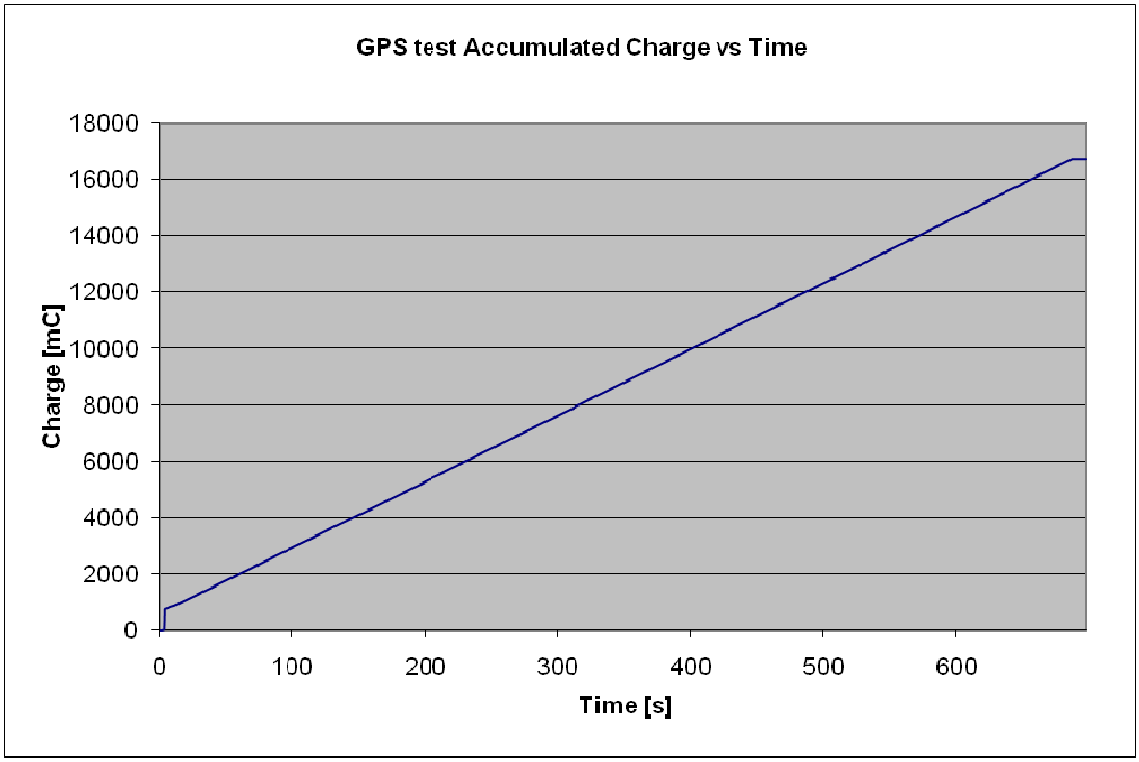
Battery Current Measurement Results (continued) - Self-test Mode



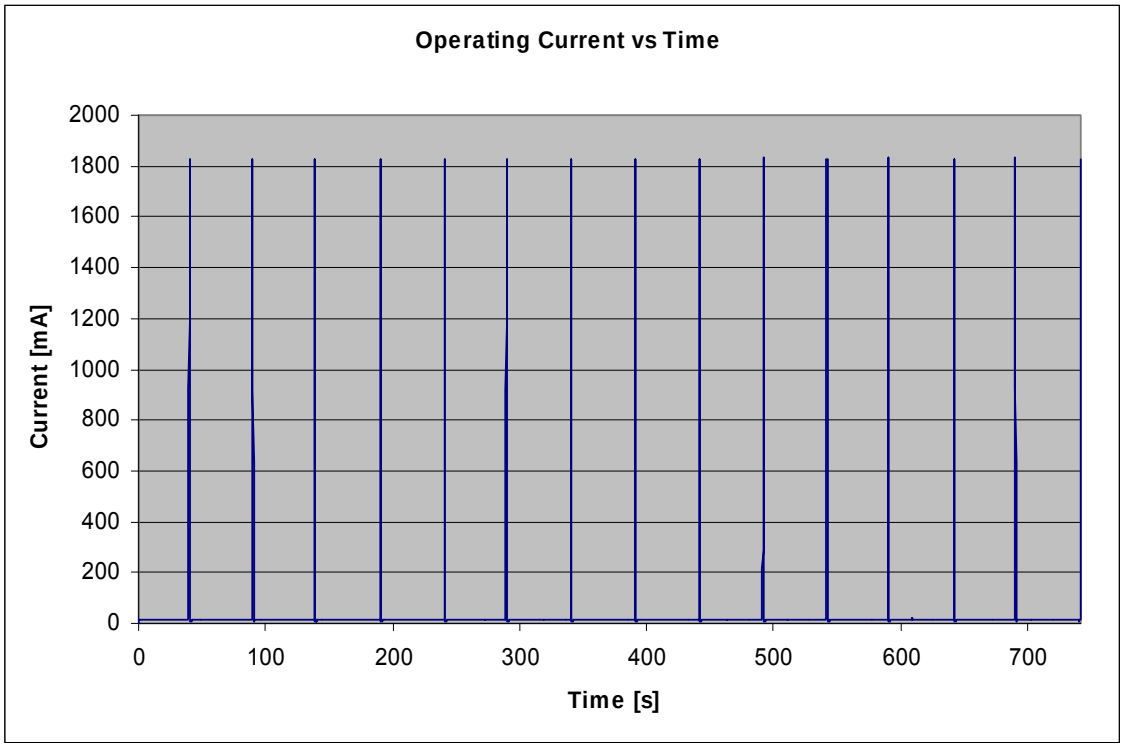


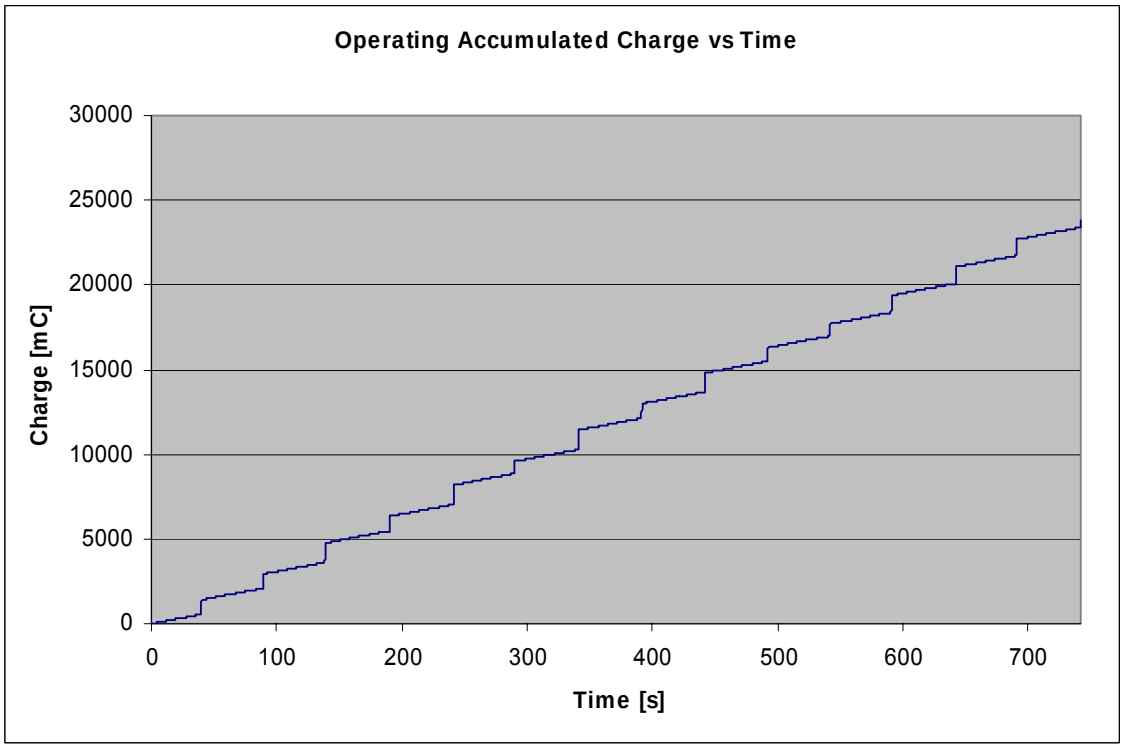
Battery Current Measurement Results (continued) - GNSS-test Mode





Battery Current Measurement Results (continued) - Operational Mode





2.9 OPERATING LIFETIME AT MINIMUM TEMPERATURE (EXTERNAL GPS)

2.9.1 Equipment Under Test

RLB-36, Serial Number: 007

2.9.2 Date of Test and Modification State

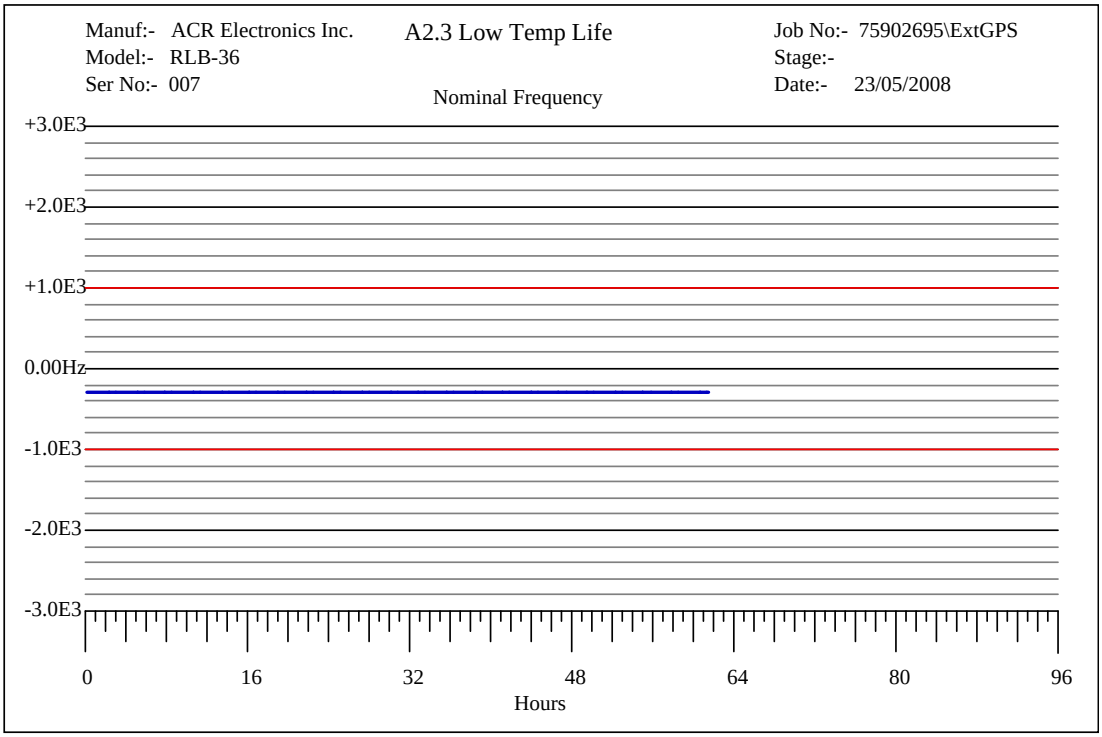
20 to 23 May 2008 - Modification State 1

2.9.3 Test Equipment Used

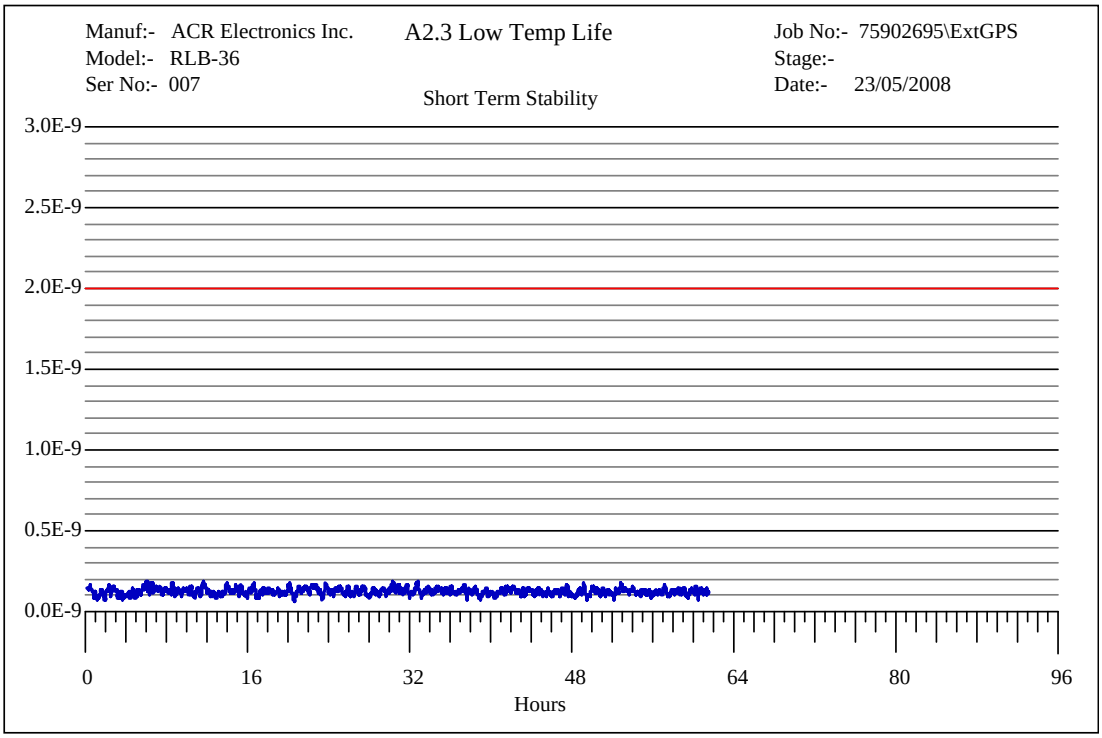
The major items of test equipment used for the above tests are identified in Section 3.1.

2.9.4 Test Results

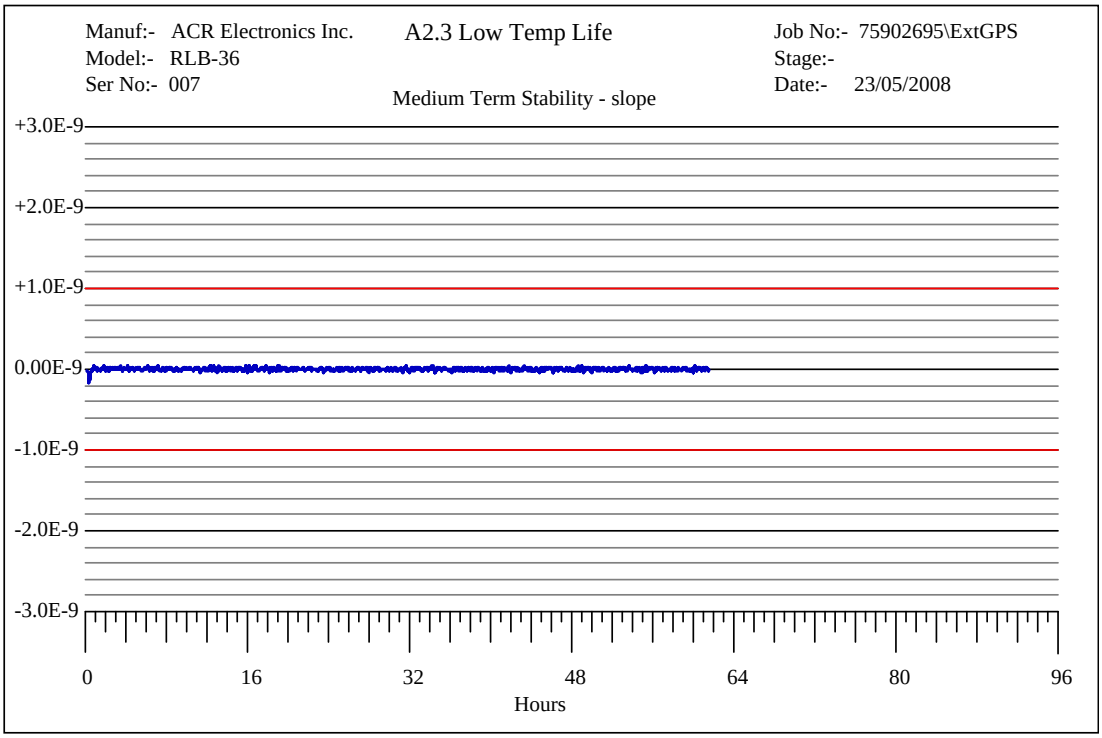
Nominal Frequency



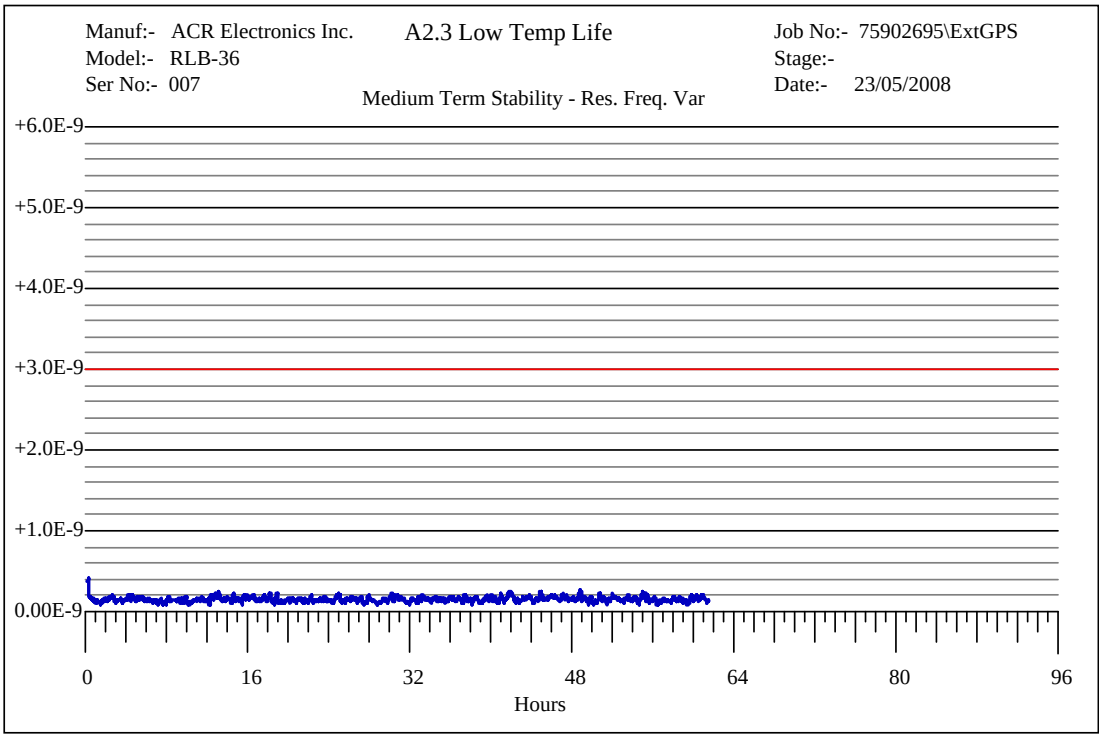
Short Term Stability



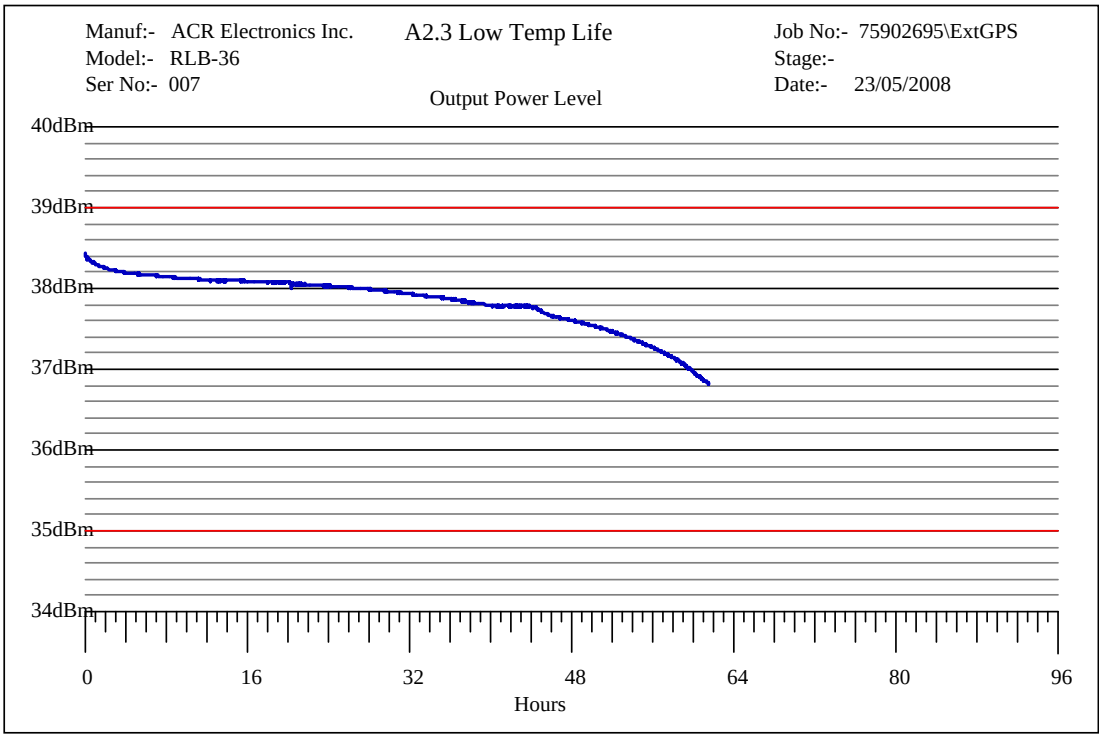
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



Output Power



Digital Message

```
Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC4407D465805             2DDC4407D4FFBFF Default_Id
 36 Hex (Bits 25-144) = FFFE2F96EE2203EA32C02B30A9759C20C27B

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0100 0100 0000 0111 1101 0100 0110 0101 1000 0000 0101
   0110 0110 0001 0101 0010 1110 1011 0011 1000 0100 0001 1000 0100 1111 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      366 USA                                0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                   1110
Spare              41- 64                          0010 0010 0000 0011 1110 1010
Coarse Position    65- 85          Data Present
Latitude Flag      65            0 North:                                      0
Latitude Degrees   66- 72       50  50 deg                              0110 010
Latitude Min /15   73- 74        3  45 min                                   11
Longitude Flag     75            0 East:                                       0
Longitude Degrees  76- 83        1   1 deg                              0000 0001
Longitude Min /15  84- 85        1  15 min                                   01
BCH Encoded        86-106          Errors=0           0110 0110 0001 0101 0010 1
BCH Generated      86-106                             0110 0110 0001 0101 0010 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                   110
Fixed Bit         110              1                                          1
Encode Pos Device 111              0 External                                 0
121.5 Homing      112              1 YES                                      1
Position Change   113-132          Data Present
Lat. Change Sign  113              1 Plus:                                    1
Lat. Chg. Minutes 114-118          7   7 min                             0011 1
Lat. Chg. Secs /4 119-122          0   0 sec                               0000
Long Change Sign  123              1 Plus:                                    1
Long Chg. Minutes 124-128          0   0 min                             0000 0
Long Chg. Secs /4 129-132         12  48 sec                               1100
Resultant Position               -->  50.86666 LAT,    1.26333 LONG
                   50 deg 52 min  0 sec N,    1 deg 15 min 48 sec E
BCH Encoded       133-144          Errors=0                       0010 0111 1011
BCH Generated     133-144                                         0010 0111 1011
```

Position Error Calculations

Applied Position:	N 50° 51’ 59"	E 001° 15’ 48”
Encoded position(s):	N 50° 52’ 00”	E 001° 15’ 48”
Position Error:	30.9m	

Battery Current Measurement Results

EUT was discharged by being placed in operational mode (Internal GPS) at ambient temperature for 17 hours and 28 minutes

Note: Whether the beacon operates from its internal GPS or an external navigation input the battery discharge due to self-testing, standby current and battery self-discharge remains the same. For the External GPS Operating Lifetime At Minimum Temperature test the pre-test discharge was done in the same mode in which the current measurements were made for the original Internal GPS test. Hence, no further calculations are required.

2.10 FREQUENCY STABILITY WITH TEMPERATURE GRADIENT

2.10.1 Equipment Under Test

RLB-36, Serial Number: 007

2.10.2 Date of Test and Modification State

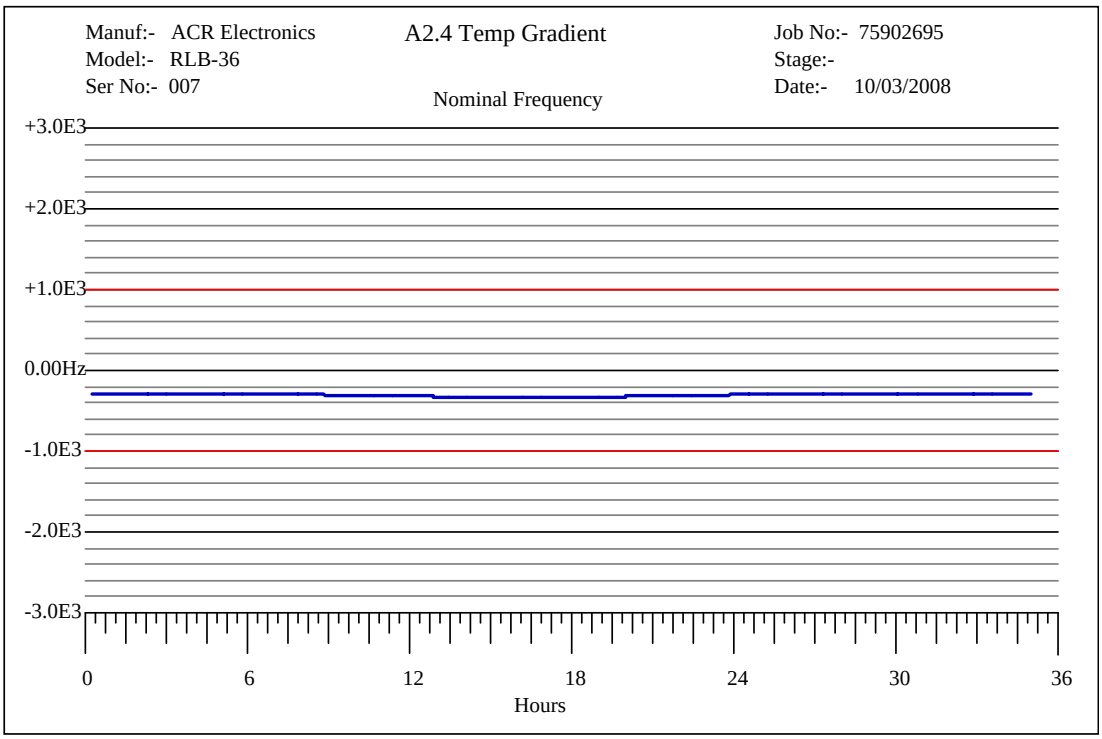
08 to 10 March 2008 - Modification State 1

2.10.3 Test Equipment Used

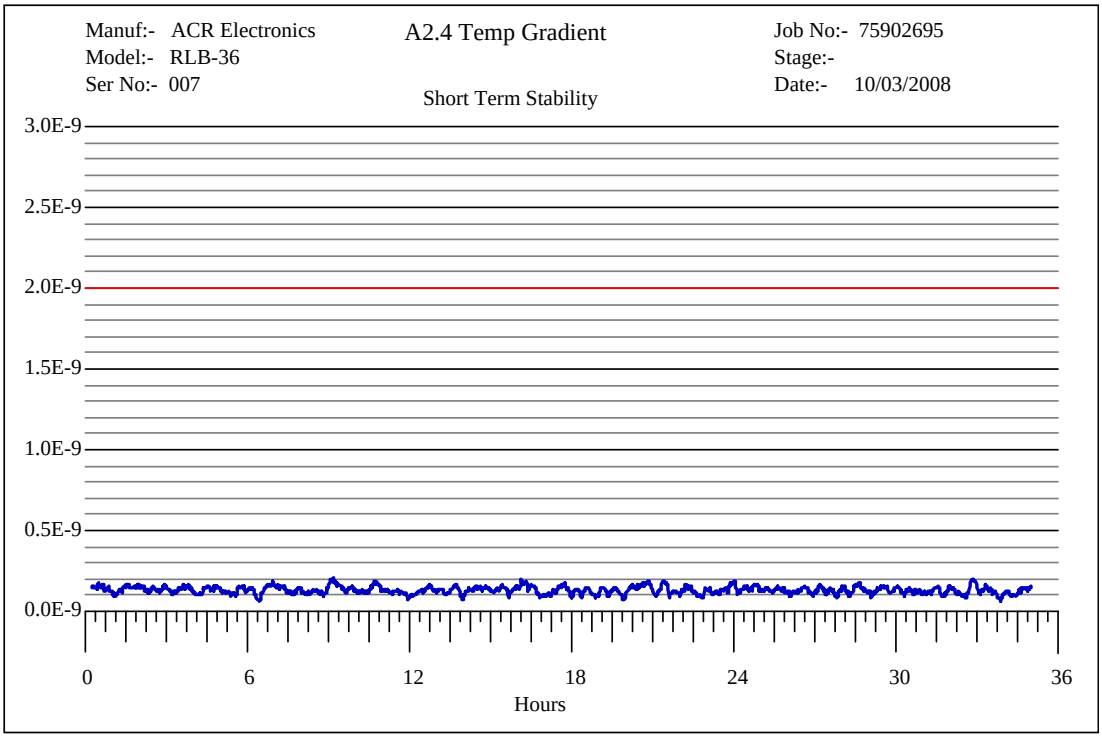
The major items of test equipment used for the above tests are identified in Section 3.1.

2.10.4 Test Results

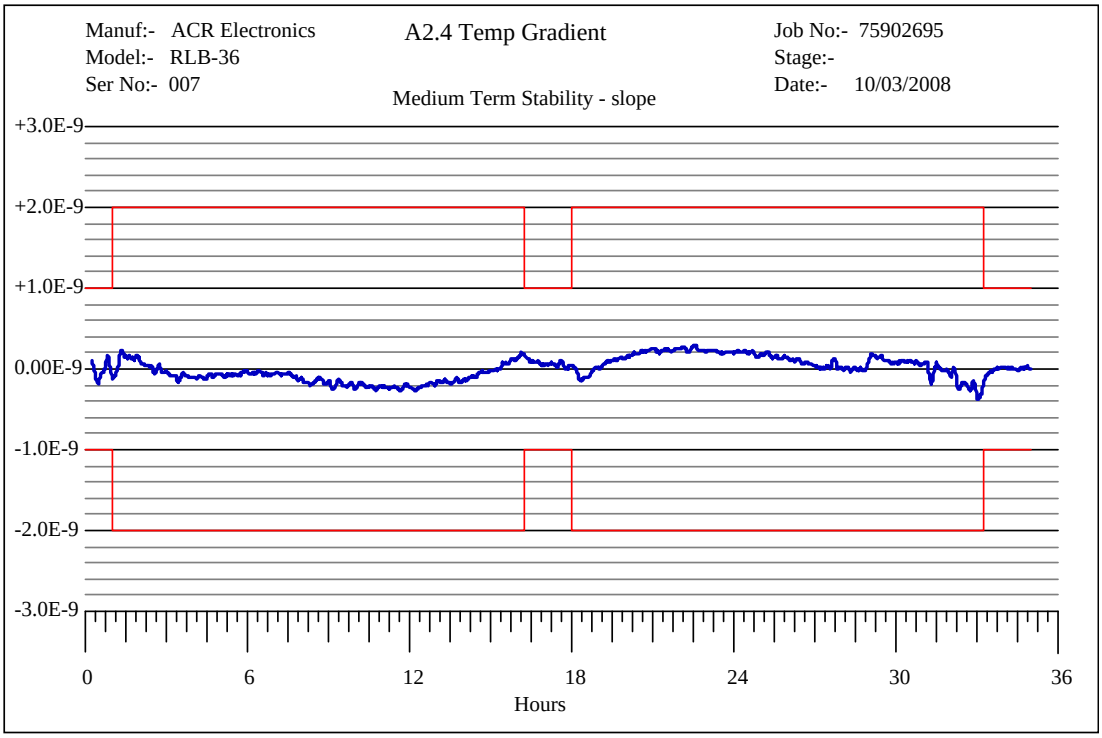
Nominal Frequency



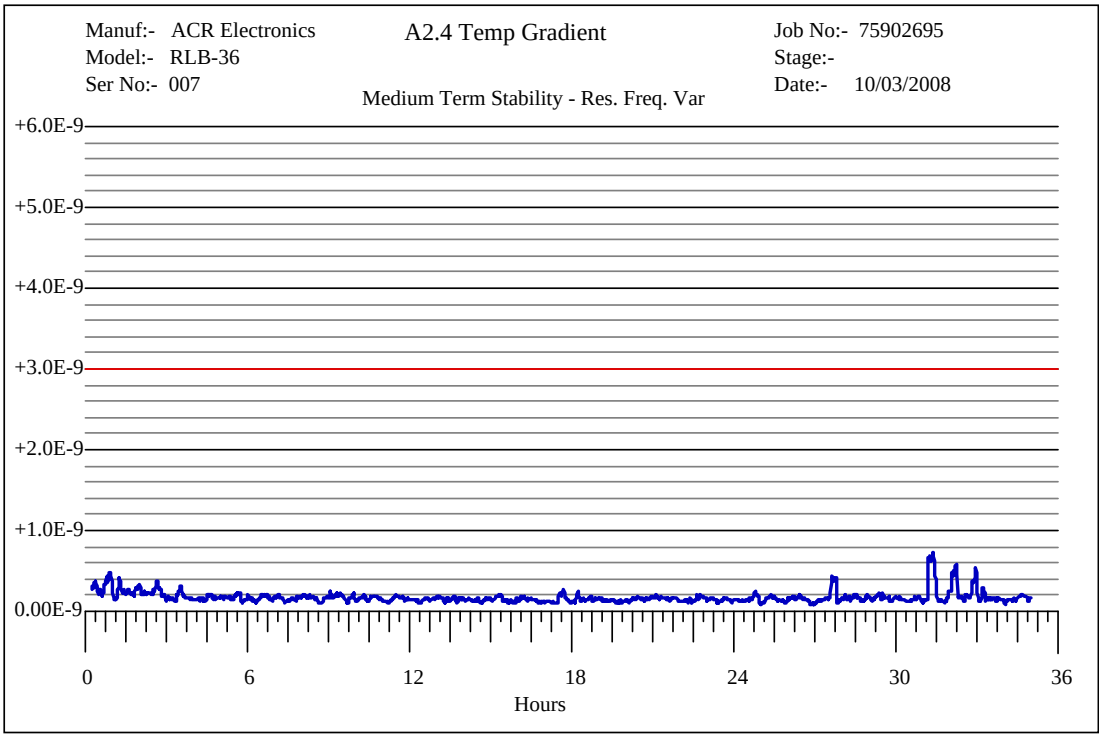
Short Term Stability



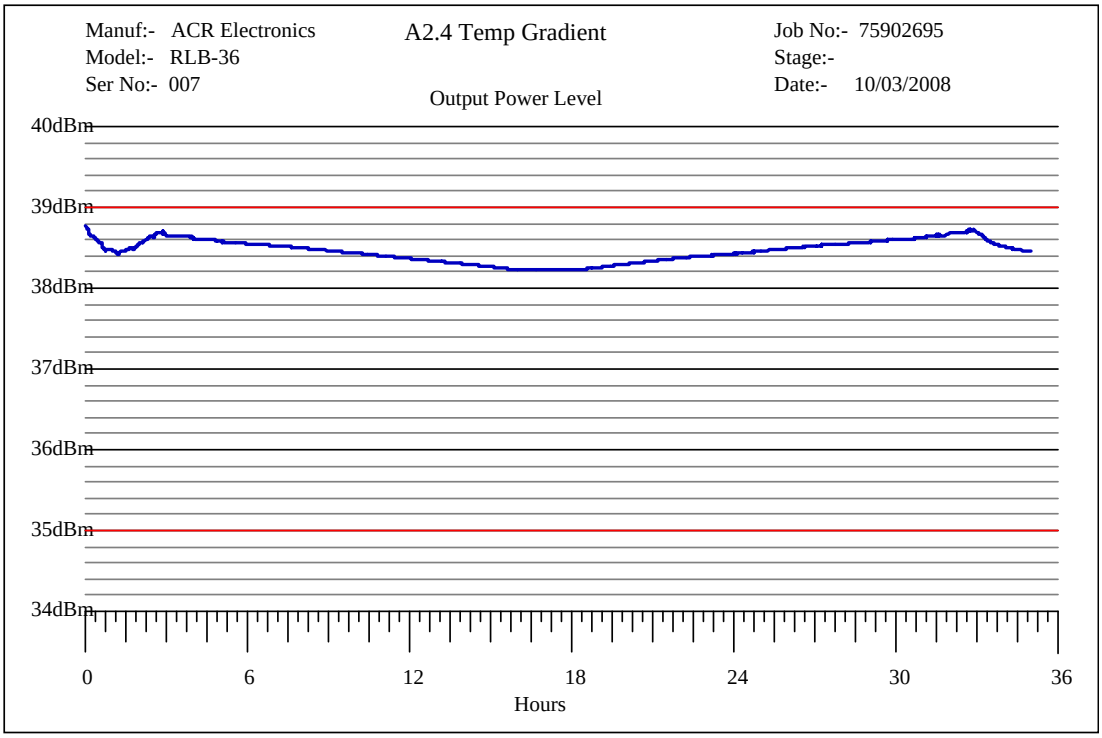
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



Output Power



Digital Message

```
Message Content
     Expected Message       FFFE2F96EE2203EA7FDFFCE287F783E0F66C
     Actual Message         FFFE2F96EE2203EA7FDFFCE287F783E0F66C
     Message Error Count    0


Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 2DDC4407D4FFBFF              2DDC4407D4FFBFF Default_Id
 36 Hex (Bits 25-144) = FFFE2F96EE2203EA7FDFFCE287F783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0010 1101 1101 1100 0100 0100 0000 0111 1101 0100 1111 1111 1011 1111 1111
   1001 1100 0101 0000 1111 1110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      366 USA                          0101 1011 10
Protocol Code      37- 40       14 Test Serial (Standard)                 1110
Spare              41- 64                          0010 0010 0000 0011 1110 1010
Coarse Position    65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded        86-106          Errors=0           1001 1100 0101 0000 1111 1
BCH Generated      86-106                             1001 1100 0101 0000 1111 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                   110
Fixed Bit         110               1                                         1
Encode Pos Device 111               1 Internal                                1
121.5 Homing      112               1 YES                                     1
Position Change   113-132           DEFAULT              1000 0011 1110 0000 1111
Resultant Position                --> Not Defined
BCH Encoded       133-144           Errors=0                       0110 0110 1100
BCH Generated     133-144                                          0110 0110 1100
```

2.11 SATELLITE QUALITATIVE TESTS

2.11.1 Equipment Under Test

RLB-36, Serial Number: Unit #3

2.11.2 Date of Test and Modification State

Configuration 5 – 29 April 2008, 1800 to 30 April 2008, 0900 – Modification State 1
Configuration 7 – 24 April 2008, 0800 to 2330 – Modification State 1
Configuration 8 – 24 April 2008, 2330 to 25 April 2008, 0900 – Modification State 1
Configuration 7 (Ext GPS) – 13 May 2008, 2300 to 14 May 2008, 0900 – Modification State 1
Configuration 8 (Ext GPS) – 19 May 2008, 2100 to 20 May 2008 0900 – Modification State 1

Note: All dates/times are GMT.

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 Test Results

Configuration 5

Beacon 15 Hex ID: 2DDC4 407D2 FFBFF
Actual location of the test beacon: Latitude: 050° 49.091'N
Longitude: 001° 11.870'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)
S9	30392	2DDC4 407D2 FFBFF	50.82332	-1.19959	-116.31	20:38:58	5.822	0.584
S11	7928	2DDC4 407D2 FFBFF	50.82485	-1.20365	-114.52	19:12:28	14.235	0.846
S9	30392	2DDC4 407D2 FFBFF	50.82768	-1.20230	-120.50	20:38:58	5.823	1.101
S9	30391	2DDC4 407D2 FFBFF	50.82167	-1.20402	-121.95	19:00:15	19.123	0.582
S11	7928	2DDC4 407D2 FFBFF	50.82474	-1.20763	-121.45	19:12:28	14.237	1.002
S9	30391	2DDC4 407D2 FFBFF	50.82440	-1.21066	-125.92	19:00:15	19.124	1.135
S7	51791	2DDC4 407D2 FFBFF	50.83000	-1.19554	-125.43	18:26:00	-18.940	1.323

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

$$= \frac{7}{7} = 100\%$$

Product Service

Configuration 7

Beacon 15 Hex ID: 2DDC4 407D2 FFBFF
Actual location of the test beacon: Latitude: 050° 49.091'N
Longitude: 001° 11.870'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)
S9	30322	2DDC4 407D2 FFBFF	50.82177	-1.18994	-125.34	22:35:02	-12.157	0.683
S9	30321	2DDC4 407D2 FFBFF	50.82398	-1.19767	-120.36	20:54:41	3.516	0.644
S11	7857	2DDC4 407D2 FFBFF	50.82522	-1.20657	-114.46	19:15:48	13.790	0.994
S9	30320	2DDC4 407D2 FFBFF	50.82184	-1.20295	-123.17	19:15:45	17.284	0.542
S8	39122	2DDC4 407D2 FFBFF	50.82149	-1.18642	-127.04	17:38:53	-15.242	0.881
S7	51719	2DDC4 407D2 FFBFF	50.82771	-1.19496	-123.41	17:04:34	-6.042	1.078
S7	51718	2DDC4 407D2 FFBFF	50.83691	-1.19684	-123.51	15:24:50	9.101	2.082
S10	15091	2DDC4 407D2 FFBFF	50.82191	-1.19189	-126.45	14:26:35	-13.965	0.588
S8	39120	2DDC4 407D2 FFBFF	50.82276	-1.20144	-120.72	14:17:37	14.921	0.568
S9	30316	2DDC4 407D2 FFBFF	51.40830	-1.33908	-125.70	12:47:22	17.237	66.313
S11	7853	2DDC4 407D2 FFBFF	51.46990	-1.30387	-123.41	12:46:36	19.952	72.798
S10	15090	2DDC4 407D2 FFBFF	50.82296	-1.20265	-122.81	12:45:13	1.927	0.629
S11	7852	2DDC4 407D2 FFBFF	52.26600	-1.86289	-115.39	11:07:41	6.611	167.324
S10	15089	2DDC4 407D2 FFBFF	50.82228	-1.20307	-122.21	11:05:17	16.022	0.585
S9	30314	2DDC4 407D2 FFBFF	50.81742	-1.19361	-120.19	09:28:17	-11.608	0.308
S11	7851	2DDC4 407D2 FFBFF	50.81996	-1.19781	-122.96	09:27:54	-7.709	0.197

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

$$= \frac{13}{16} = 81.3\%$$

Configuration 8

Beacon 15 Hex ID: 2DDC4 407D2 FFBFF
Actual location of the test beacon: Latitude: 050° 49.091'N
Longitude: 001° 11.870'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	39130	2DDC4 407D2 FFBFF	50.82096	-1.20103	-122.60	07:34:35	17.110	0.382
S7	51727	2DDC4 407D2 FFBFF	50.82410	-1.19112	-120.46	06:54:33	9.546	0.809
S8	39129	2DDC4 407D2 FFBFF	50.81930	-1.19048	-121.42	05:54:55	3.371	0.531
S7	51726	2DDC4 407D2 FFBFF	50.81816	-1.19450	-119.76	05:14:51	-5.550	0.234
S10	15099	2DDC4 407D2 FFBFF	50.82244	-1.19677	-120.97	04:23:12	16.666	0.479
S8	39128	2DDC4 407D2 FFBFF	50.81830	-1.19747	-114.90	04:13:50	-12.385	0.029
S10	15098	2DDC4 407D2 FFBFF	50.81735	-1.18937	-116.56	02:43:20	2.721	0.601
S10	15097	2DDC4 407D2 FFBFF	50.81727	-1.19560	-115.50	01:02:03	-13.122	0.187

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

$$= \frac{8}{8} = 100\%$$

Configuration 7 (External GPS)

Beacon 15 Hex ID: 2DDC4 407D2 FFBFF
Actual location of the test beacon: Latitude: 050° 49.091'N
Longitude: 001° 11.870'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	51998	2DDC4 407D2 FFBFF	50.83586	-1.16499	-127.84	07:40:01	15.830	3.029
S7	51997	2DDC4 407D2 FFBFF	50.81735	-1.19001	-122.19	06:00:58	1.751	0.557
S8	39398	2DDC4 407D2 FFBFF	50.81946	-1.19465	-128.23	07:12:36	13.980	0.265
S7	51997	2DDC4 407D2 FFBFF	50.82025	-1.23647	-127.41	06:00:58	1.722	2.722
S7	51996	2DDC4 407D2 FFBFF	50.81691	-1.19452	-122.83	04:20:30	-14.019	0.272
S7	51996	2DDC4 407D2 FFBFF	50.86880	-1.19543	-129.81	04:20:29	-14.019	5.627
S8	39396	2DDC4 407D2 FFBFF	50.81554	-1.19688	-130.65	03:51:07	-16.414	0.301
S10	15366	2DDC4 407D2 FFBFF	50.81720	-1.19096	-126.20	02:46:13	3.133	0.495
S10	15365	2DDC4 407D2 FFBFF	50.81599	-1.19816	-127.41	01:04:58	-12.683	0.245

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

$$= \frac{8}{9} = 88.9\%$$

Configuration 8 (External GPS)

Beacon 15 Hex ID: 2DDC4 407D2 FFBFF
Actual location of the test beacon: Latitude: 050° 49.091'N
Longitude: 001° 11.870'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	39483	2DDC4 407D2 FFBFF	50.81500	-1.18982	-122.85	07:42:10	17.602	0.665
S7	52083	2DDC4 407D2 FFBFF	50.81471	-1.19543	-120.25	06:57:14	10.087	0.421
S7	52082	2DDC4 407D2 FFBFF	50.81596	-1.20008	-114.75	05:17:35	-4.945	0.293
S8	39482	2DDC4 407D2 FFBFF	50.81706	-1.19313	-121.36	06:02:33	3.974	0.353
S8	39481	2DDC4 407D2 FFBFF	50.81697	-1.19536	-115.58	04:21:31	-11.735	0.220
S7	52081	2DDC4 407D2 FFBFF	50.89738	-1.21954	-123.61	03:36:26	-20.890	8.932
S10	15451	2DDC4 407D2 FFBFF	50.82074	-1.19352	-121.91	03:24:02	8.688	0.415
S10	15450	2DDC4 407D2 FFBFF	50.81718	-1.19856	-114.29	01:43:20	-6.614	0.123

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

$$= \frac{7}{8} = 87.5\%$$

2.12 ANTENNA CHARACTERISTICS

2.12.1 Equipment Under Test

RLB-36, 75902695_50 with antenna 75902695_52

2.12.2 Date of Test and Modification State

17 April 2008 - Modification State 0

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 Test Results

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	42.3	3.92	~~43.1~~	4.71	41.2	2.77	36.7	-1.72	34.0	-4.39
90	42.4	4.01	42.8	4.42	40.8	2.36	35.7	-2.68	32.3	-6.14
180	42.2	3.80	42.8	4.40	40.6	2.22	35.8	-2.59	32.9	-5.54
270	42.1	3.71	~~43.0~~	4.61	40.9	2.52	36.5	-1.88	34.6	-3.80

$EIRP_{LOSS}$ = Pt_{amb} - Pt_{EOL} = (38.41 – 37.82) = 0.59dB

$EIRP_{maxEOL}$ = MAX [$EIRP_{max}$, ($EIRP_{max}$ - $EIRP_{LOSS}$)] = MAX (42.8, 42.2) = 42.8dBm

$EIRP_{minEOL}$ = MIN [$EIRP_{min}$, ($EIRP_{min}$ - $EIRP_{LOSS}$)] = MIN (32.3, 31.7) = 31.7dBm

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

Configuration: C/S T.007 Figure B.4

	Elevation Angle (degrees)									
	10		20		30		40		50	
Azimuth Angle (degrees)	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi	EIRP dBm	Ant dBi
0	39.8	1.42	42.9	4.54	~~43.7~~	5.25	37.8	-0.63	36.3	-2.11
30	40.0	1.62	42.8	4.35	43.6	5.16	38.4	-0.05	35.4	-3.06
60	39.8	1.42	42.5	4.14	43.6	5.24	38.3	-0.16	35.9	-2.50
90	39.4	1.02	42.6	4.14	43.7	5.25	38.6	0.21	34.8	-3.61
120	39.3	0.84	42.5	4.11	43.6	5.15	38.7	0.25	34.7	-3.75
150	39.2	0.76	42.5	4.11	~~43.7~~	5.27	38.7	0.33	34.6	-3.80
180	39.0	0.54	42.7	4.31	43.6	5.19	38.4	0.00	34.9	-3.53
210	39.4	0.95	42.7	4.30	~~43.7~~	5.28	38.5	0.04	35.3	-3.12
240	39.4	1.03	42.8	4.41	~~43.7~~	5.29	38.2	-0.21	36.0	-2.43
270	39.5	1.05	42.7	4.30	43.6	5.16	37.7	-0.69	36.3	-2.07
300	39.7	1.32	43.0	4.63	~~43.9~~	5.46	37.3	-1.10	36.6	-1.81
330	39.7	1.32	42.6	4.23	~~43.9~~	5.45	37.5	-0.88	36.2	-2.18
Gain Variation	1.07		0.52		0.30		1.43		1.99	

	Elevation Angle (degrees)									
	10		20		30		40		50	
Azimuth Angle (degrees)	Vv	Vh	Vv	Vh	Vv	Vh	Vv	Vh	Vv	Vh
0	111.50	90.00	114.20	93.20	114.20	94.20	107.20	90.50	103.70	95.30
30	111.70	88.90	114.00	94.60	114.10	94.40	107.80	90.00	102.60	95.30
60	111.50	88.60	113.80	93.20	114.20	92.00	107.70	89.60	103.30	95.00
90	111.10	89.40	113.80	93.50	114.20	94.10	108.10	87.30	102.40	92.10
120	110.90	91.40	113.80	88.00	114.10	94.10	108.10	90.30	102.40	90.20
150	110.80	92.50	113.80	87.30	114.20	95.90	108.10	93.80	102.50	86.30
180	110.60	91.20	114.00	83.20	114.10	96.80	107.70	95.00	102.80	84.90
210	111.00	92.20	114.00	70.00	114.20	96.10	107.70	95.70	103.20	86.00
240	111.10	90.30	114.10	87.30	114.20	96.90	107.50	94.60	103.90	86.20
270	111.10	92.30	114.00	80.30	114.10	95.00	107.10	92.00	104.20	89.00
300	111.40	89.40	114.30	91.90	114.40	94.70	106.80	84.20	104.40	91.00
330	111.40	89.50	113.90	92.50	114.40	93.70	107.00	86.80	103.80	93.90
Min (Vv-Vhh	18.30		19.40		17.30		12.00		7.30	

$EIRP_{LOSS}$ = Pt_{amb} - Pt_{EOL} = (38.41 – 37.82) = 0.59dB

$EIRP_{maxEOL}$ = MAX [$EIRP_{max}$, ($EIRP_{max}$ - $EIRP_{LOSS}$)] = MAX (43.7, 43.1) = 43.7dBm

$EIRP_{minEOL}$ = MIN [$EIRP_{min}$, ($EIRP_{min}$ - $EIRP_{LOSS}$)] = MIN (34.6, 34.0) = 34.0dBm

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

2.13 BEACON CODING SOFTWARE

2.13.1 Test Results

Not Tested, Customer Supplied Information. See Annex A for supplied details.

2.14 NAVIGATION SYSTEM – STANDARD LOCATION PROTOCOL

2.14.1 Equipment Under Test

RLB-36, Serial Numbers: 007 and #3

2.14.2 Date of Test and Modification State

18, 19 and 25 March and 12 June 2008 - Modification State 1

2.14.3 Test Equipment Used

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

2.14.4 Test Results

Position Data Default Values

The beacon was activated without providing data and operated for 30 minutes. Message content was checked for all bursts during this period.

30 Hex Message	Message Count
96EE2203EA7FDFFCE287F783E0F66C	37

Position Acquisition Time and Position Accuracy

A3.8.2.1: N 50° 52.163' W 1° 14.605' ①
A3.8.2.2 : N 51° 22.583' W 1° 49.833' ②

Configuration as per C/S T.007 Figure 4.2	C/S T.007 Section A3.8.2.1		C/S T.007 Section A3.8.2.2	
	Time to Acquire Position (sec)	Location Error in metres	Time to Acquire Position (sec)	Location Error in metres
5: Water ground plane	100	40.1	100	50.1
7: Beacon on ground plane	101	40.1	101	49.5
8: Beacon above ground plane	101	40.1	101	50.1

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

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

Encoded Position Data Update Interval

Location: N 50° 48' 40'' W 1° 37' 24'' ②		
Time from activation to 1st message	100s	
First Message Acquired at	11:46:16	FFFE2F96EE2203EA32E035C155378EA76951
Data Acquired at	11:46:16	FFFE2F96EE2203EA32E035C155378EA76951
Location: N 51° 22' 36'' W 1° 49' 52'' ②		
First Message Acquired at	11:47:10	FFFE2F96EE2203EA32E035C155378EA76951
Data Updated at	12:09:23	FFFE2F96EE2203EA33A033A38CF71DB3DC73
Data Update Interval	23min 07s	

Position Clearance After Deactivation

Following the Encoded Position Data Update Interval test, the beacon was deactivated and reactivated without providing navigation data.

Deactivated at	12:09:30	
Time from re-activation to 1st message	100s	
Default data present	12:26:54	FFFE2F96EE2203EA7FDFFCE287F783E0F66C

Last Valid Position

Location: N 51° 22' 35" W 1° 49' 50" ②		
Time from activation to 1st message	101s	
First Message Acquired at	11:34:24	FFFE2F96EE2203EA7FDFFCE287F783E0F66C
Data Acquired at	11:35:14	FFFE2F96EE2203EA33A03A15F4371DA4C1E9
GPS Signal Navigation Data Removed	11:35:14	
Last Message with Positional Data	15:36:06	FFFE2F96EE2203EA33A03A15F4371DA4C1E9
First Message with Default Data	15:36:57	FFFE2F96EE2203EA7FDFFCE287F783E0F66C
Last Valid Position Held	241min	

② Input from GPS simulator.

Coarse Position and Delta Offset

Script Reference (See table D.2 of C/S T.007 – Issue 4 November 2005)	Value of Encoded Location Bits Transmitted by Beacon (Hexadecimal)	Confirmation that BCH Correct (✓)
1	Bits 65-85 = FFBFF Bits 113-132 = 83E0F	✓
2	Bits 65-85 =2404 Bits 113-132 = 8E227 Number of seconds after providing navigation data that beacon transmitted the above encoded location information: 40	✓
3	Bits 65-85 =2404 Bits 113-132 =F8227	✓
4	Bits 65-85 =3404 Bits 113-132 =88227	✓
5	Bits 65-85 =3404 Bits 113-132 =74627	✓
6	Bits 65-85 =2404 Bits 113-132 =8227	✓
7	Bits 65-85 =2404 Bits 113-132 =83D7	✓
8	Bits 65-85 =2406 Bits 113-132 =8227	✓
9	Bits 65-85 =2406 Bits 113-132 =81B8	✓
10	Bits 65-85 =2402 Bits 113-132 =8206	✓

Note: "Number of seconds after providing navigation data that beacon transmitted the above encoded location information" derived from timing the application of position to the green "Position Acquired" LED being lit on the EUT.

Test Scripts from GPS simulator.

2.15 NAVIGATION SYSTEM – NATIONAL LOCATION PROTOCOL

2.15.1 Equipment Under Test

RLB-36, Serial Numbers 004 and 009

2.15.2 Date of Test and Modification State

25, 26, 27 March, 01 and 02 April 2008 - Modification State 1

2.15.3 Test Equipment Used

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

2.15.4 Test Results

Position Data Default Values

The beacon was activated without receiving GPS signals/without providing data and operated for 30 minutes. Message content was checked for all bursts during this period.

30 Hex Message	Message Count
96EF00FADFC0FF05DF72F79F3C0010	37

Position Acquisition Time and Position Accuracy

A3.8.2.1: Location 50° 52.163'N, 1° 14.607'W ① used for Configurations 7 and 8
A3.8.2.1: Location 50° 52.121'N, 1° 14.685'W ① used for Configuration 5
A3.8.2.2 : Location 25° 3.067'N, 179° 58.600'W ②

Operation Configuration	C/S T.007 Section A3.8.2.1		C/S T.007 Section A3.8.2.2	
	Time to Acquire Position (sec)	Location Error in metres	Time to Acquire Position (sec)	Location Error in metres
Water ground plane	100	31.5	151	0.9
Beacon on ground plane	100	311.1	150	0.8
Beacon above ground plane	100	68.8	100	0.8

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

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

Encoded Position Data Update Interval

Location: N 51°22'36"	W 1°49'52"②	
Time from activation to 1st message	100s	
First Message Acquired at	09:41:12	FFFE2F96EF00FADFC0FF05DF72F79F3C0010
Data Acquired at	09:42:02	FFFE2F96EF00FACCD701C9788CF79208025B
Location: N 50°48'40"	W 1°38'12"②	
First Message Acquired at	09:42:52	FFFE2F96EF00FACCD701C9788CF79208025B
Data Updated at	10:05:25	FFFE2F96EF00FACCB1019CBDD337950C0650
Data Update Interval	23min 23s	

Position Clearance After Deactivation

Following the Encoded Position Data Update Interval test, the beacon was deactivated and reactivated without providing navigation data.

Deactivated at	10:05:45	
Time from re-activation to 1st message	100s	
Default data present	10:07:49	FFFE2F96EF00FADFC0FF05DF72F79F3C0010

Last Valid Position

Location: N 27°2'36" W 6°3'24"②		
Time from activation to 1st message	100s	
First Message Acquired at	12:30:46	FFFE2F96EF00FAC6C30615291337922408CC
Data Acquired at	12:30:46	FFFE2F96EF00FAC6C30615291337922408CC
GPS Signal Navigation Data Removed	12:30:56	
Last Message with Positional Data	16:30:40	FFFE2F96EF00FAC6C30615291337922408CC
First Message with Default Data	16:31:32	FFFE2F96EF00FADFC0FF05DF72F79F3C0010
Last Valid Position Held	241min	

②Input from GPS simulator.

Coarse Position and Delta Offset

Script Reference (See table D.3 of C/S T.007 – Issue 4 November 2005)	Value of Encoded Location Bits Transmitted by Beacon (Hexadecimal)	Confirmation that BCH Correct (✓)
1	Bits 59-85 =3F81FE0 Bits 113-126 = 27CF	✓
2	Bits 59-85 =A8A0C2 Bits 113-126 =2489 Number of seconds after providing navigation data that beacon transmitted the above encoded location information: 36	✓
3	Bits 59-85 = A8A0C2 Bits 113-126 = 3F09	✓
4	Bits 59-85 = D8A0C2 Bits 113-126 = 2189	✓
5	Bits 59-85 =D8A0C2 Bits 113-126 =B09	✓
6	Bits 59-85 =C8B67D Bits 113-126 =749	✓
7	Bits 59-85 =C8B67D Bits 113-126 =77E	✓
8	Bits 59-85 = C8967C Bits 113-126 = 702	✓
9	Bits 59-85 = C8967C Bits 113-126 = 77E	✓
10	Bits 59-85 = C8B67D Bits 113-126 = 749	✓

Note: “Number of seconds after providing navigation data that beacon transmitted the above encoded location information” derived from timing the application of position to the green “Position Acquired” LED being lit on the EUT.

Test Scripts from GPS simulator.

2.16 NAVIGATION SYSTEM (EXTERNAL GPS) – STANDARD LOCATION PROTOCOL

2.16.1 Equipment Under Test

RLB-36, Serial Numbers: 007, #10 and #3

2.16.2 Date of Test and Modification State

19 March, 04, 08 and 09 April , 06 June 2008 - Modification State 1

2.16.3 Test Equipment Used

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

2.16.4 Test Results

Position Data Default Values

Without a position input the EUT reverts to “Internal GPS”, default position coding is therefore covered by the previous tests.

Position Acquisition Time and Position Accuracy

A3.8.2.1: N 50° 52.163’ W 1° 14.605' ①
A3.8.2.2 : N 25° 3.067’ W 179° 59.933’ ②

Configuration as per C/S T.007 Figure 4.2	C/S T.007 Section A3.8.2.1		C/S T.007 Section A3.8.2.2	
	Time to Acquire Position (sec)	Location Error in metres	Time to Acquire Position (sec)	Location Error in metres
5: Water ground plane	N/A	N/A	N/A	N/A
7: Beacon on ground plane	10	49.8	10	0.8
8: Beacon above ground plane	10	49.8	10	0.8

Positional accuracy was estimated using the Haversine Formula, Earth’s radius taken as 6367km.

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

Encoded Position Data Update Interval

Location: N 51°22'36" W 1°49'52"①		
Time from activation to 1st message	100s	
First Message Acquired at	10:27:16	FFFE2F96EE2203EA33A03A15F4351DA4D814
Data Acquired at	10:27:16	FFFE2F96EE2203EA33A03A15F4351DA4D814
Location: N 50°48'36" W 1°38'12"①		
First Message Acquired at	10:30:35	FFFE2F96EE2203EA33A03A15F4351DA4D814
Data Updated at	10:49:48	FFFE2F96EE2203EA32E03C772DF58E46CFFB
Data Update Interval	22min 32s	

Position Clearance After Deactivation

Following the Encoded Position Data Update Interval test, the beacon was deactivated and reactivated without providing navigation data.

Note: Note, after power on, without a position input the EUT default location is used and “internal GPS” source is coded. Once the EUT acquired a location the source bit will be set accordingly. The source bit will be kept as long as the beacon is on till the point the current source stop providing location and the other source start providing location. However this test was conducted as the intent is to show the EUT does indeed revert to its default (although “Internally sourced”) position.

Deactivated at	10:50:00	
Time from re-activation to 1st message	100s	
Default data present	11:13:53	FFFE2F96EE2203EA7FDFFCE287F783E0F66C

Position Data Input Update Interval

The beacon was activated and a position acquired. The beacon was deactivated, position changed and after the appropriate time interval the navigation input was removed and the beacon was activated.

Location: N 51°22'35" W 1°49'50" ①		
Time from activation to 1st message	100s	
First message acquired at	16:17:53	FFFE2F96EE2203EA33A03A15F4351DA4D814
Beacon deactivated	within 47 seconds	
Location: N 50° 48' 37" W 1° 38' 13" ①	(Applied for 60 seconds)	
Location: None (Data input to beacon deactivated)		
Beacon reactivated at	16:44:05	
First message acquired at	16:45:45	FFFE2F96EE2203EA32E03C772DF58E46CFFB

① Input from GPS simulator.

Last Valid Position

Location: N 51° 22.583' W 1° 49.833' ②		
Time from activation to 1st message	100s	
First Message Acquired at	10:15:11	FFFE2F96EE2203EA33A03A15F4351DA4D814
Data Acquired at	10:15:11	FFFE2F96EE2203EA33A03A15F4351DA4D814
Last Message with Positional Data	14:15:03	FFFE2F96EE2203EA33A03A15F4351DA4D814
First Message with Default Data	14:15:52	FFFE2F96EE2203EA7FDFFCE287F583E0FAA8
Last Valid Position Held	240min	

② Input from GPS simulator.

Coarse Position and Delta Offset

Script Reference (See table D.2 of C/S T.007 – Issue 4 November 2005)	Value of Encoded Location Bits Transmitted by Beacon (Hexadecimal)	Confirmation that BCH Correct (✓)
1	Bits 65-85 = FFBFF Bits 113-132 = 83E0F	✓
2	Bits 65-85 =2404 Bits 113-132 = 8E227 Number of seconds after providing navigation data that beacon transmitted the above encoded location information: 15	✓
3	Bits 65-85 =2404 Bits 113-132 =F8227	✓
4	Bits 65-85 =3404 Bits 113-132 =88227	✓
5	Bits 65-85 =3404 Bits 113-132 =74627	✓
6	Bits 65-85 =2404 Bits 113-132 =8227	✓
7	Bits 65-85 =2404 Bits 113-132 =83D7	✓
8	Bits 65-85 =2406 Bits 113-132 =8227	✓
9	Bits 65-85 =2406 Bits 113-132 =81B8	✓
10	Bits 65-85 =2402 Bits 113-132 =8206	✓

Note: "Number of seconds after providing navigation data that beacon transmitted the above encoded location information" derived from timing the application of position to the green "Position Acquired" LED being lit on the EUT.

Test Scripts from GPS simulator.

2.17 NAVIGATION SYSTEM (EXTERNAL GPS) – NATIONAL LOCATION PROTOCOL

2.17.1 Equipment Under Test

RLB-36, Serial Numbers #4 and #9

2.17.2 Date of Test and Modification State

19 March, 04, 07, 08 and 09 April 2008 - Modification State 1

2.17.3 Test Equipment Used

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

2.17.4 Test Results

Position Data Default Values

Without a position input the EUT reverts to “Internal GPS”, default position coding is therefore covered by the previous tests.

Position Acquisition Time and Position Accuracy

A3.8.2.1: Location 50° 52.163’N, 1° 14.607’W ①
A3.8.2.2: Location 25° 3.067’N, 179° 58.067’E ①

Operation Configuration	C/S T.007 Section A3.8.2.1		C/S T.007 Section A3.8.2.2	
	Time to Acquire Position (sec)	Location Error in metres	Time to Acquire Position (sec)	Location Error in metres
5: Water ground plane	N/A	N/A	N/A	N/A
7: Beacon on ground plane	10	68.8	10	1.6
8: Beacon above ground plane	10	68.8	10	1.6

Positional accuracy was estimated using the Haversine Formula, Earth’s radius taken as 6367km.

① Measured using hand held GPS receiver
② Input from GPS simulator.

Encoded Position Data Update Interval

Location: N 51° 22'36'' W 1° 49'52'' ①		
Time from activation to 1st message	100s	
First Message Acquired at	15:49:23	FFFE2F96EF00FACCD701C9788CF592080E9F
Data Acquired at	15:49:23	FFFE2F96EF00FACCD701C9788CF592080E9F
Location: N 27° 2'36'' W 6° 3'24'' ①		
First Message Acquired at	15:50:13	FFFE2F96EF00FACCD701C9788CF592080E9F
Data Updated at	16:11:55	FFFE2F96EF00FAC6C3061529133592240408
Data Update Interval	22min 22s	

Position Clearance After Deactivation

Following the Encoded Position Data Update Interval test, the beacon was deactivated and reactivated without providing navigation data.

Deactivated at	16:12:15	
Time from re-activation to 1st message	100s	
Default data present	16:30:26	FFFE2F96EF00FADFC0FF05DF72F79F3C0010

Position Data Input Update Interval

The beacon was activated and a position acquired. The beacon was deactivated, position changed and after the appropriate time interval the navigation input was removed and the beacon was activated.

Location: N 50° 48' 37" W 1° 38' 13" ①		
Time from activation to 1st message	100s	
First message acquired at	11:50:25	FFFE2F96EF00FACCB1019CBDD337930C0151
Beacon deactivated	within 47 seconds	
Location: N 51°22'35" W 1°49'50" ①	(Applied for 60 seconds)	
Location: None (Data input to beacon deactivated)		
Beacon reactivated at	12:16:49	
First message acquired at	12:18:29	FFFE2F96EF00FACCD701C9788CF592080E9F

① Input from GPS simulator.

Last Valid Position

Location: N 27° 2‘36’’ W 6° 3’24’’ ①		
Time from activation to 1st message	100s	
First Message Acquired at	10:00:12	FFFE2F96EF00FAC6C3061529133592240408
Data Acquired at	10:00:12	FFFE2F96EF00FAC6C3061529133592240408
GPS Signal Navigation Data Removed	10:00:30	
Last Message with Positional Data	14:00:12	FFFE2F96EF00FAC6C3061529133592240408
First Message with Default Data	14:01:03	FFFE2F96EF00FADFC0FF05DF72F79F3C0010
Last Valid Position Held	241min	

① Input from GPS simulator.

Coarse Position and Delta Offset

Script Reference (See table D.3 of C/S T.007 – Issue 4 November 2005)	Value of Encoded Location Bits Transmitted by Beacon (Hexadecimal)	Confirmation that BCH Correct (✓)
1	Bits 59-85 = 3F81FE0 Bits 113-126 = 27CF	✓
2	Bits 59-85 = A8A0C2 Bits 113-126 = 2489 Number of seconds after providing navigation data that beacon transmitted the above encoded location information: 12	✓
3	Bits 59-85 = A8A0C2 Bits 113-126 = 3F09	✓
4	Bits 59-85 = D8A0C2 Bits 113-126 = 2189	✓
5	Bits 59-85 = D8A0C2 Bits 113-126 = B09	✓
6	Bits 59-85 = C8B67D Bits 113-126 = 749	✓
7	Bits 59-85 = C8B67D Bits 113-126 = 77E	✓
8	Bits 59-85 = C8967C Bits 113-126 = 702	✓
9	Bits 59-85 = C8967C Bits 113-126 = 77E	✓
10	Bits 59-85 = C8B67D Bits 113-126 = 749	✓

Note: “Number of seconds after providing navigation data that beacon transmitted the above encoded location information” derived from timing the application of position to the green “Position Acquired” LED being lit on the EUT.

Test Scripts from GPS simulator.

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT

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

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Sections 2.8 and 2.9 Beacons - Battery Current Measurements					
PICO ADC-16 High Resoulution Data Logger	Pico Technology Ltd	ADC-16	2264	12	6-Jan-2009
Termination (50ohm, 15W)	Radio Spares	612-192	2416	12	5-Sep-2008
Hygrometer	Rotronic	I-1000	3068	12	25-Apr-2008
Resistor (Nominal 0.25ohm)	TUV	2x RS Components 188-071, R5/100W Resistors	3343	-	TU
Section 2.11 Beacons - Satellite Qualitative Test					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Copper GRP	TUV	27cm Diameter	3538	-	TU
Section 2.3 Beacons - Spurious Emissions					
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	2-Jan-2009
Hygrometer	Rotronic	I-1000	3068	12	25-Apr-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3162	12	19-Jun-2008
Thermocouple Thermometer	Fluke	51	3172	12	18-Jun-2008
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	18-Sep-2008
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	16-Apr-2008
Cable (1m, N type)	Rhophase	NPS-1601-1000-NPS	3350	12	18-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	18-Apr-2008
Cable (3m, N-type)	Rhophase	NPS-1601-3000-NPS	3361	12	18-Apr-2008
Section 2.14, 2.15, 2.16 and 2.17 Beacons - Navigation System					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Termination (50ohm, 15W)	Radio Spares	612-192	2416	12	5-Sep-2008
Stop Clock	R.S Components	RS328 061	2674	-	TU
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Hygrometer	Rotronic	I-1000	3068	12	25-Apr-2008
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3097	12	15-Mar-2009
EPIRB Tester	Arg Electro Design	5412	3270	-	TU
Cable (1m, N type)	Rhophase	NPS-1601-1000-NPS	3350	12	18-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3352	12	18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	18-Apr-2008
Copper GRP	TUV	27cm Diameter	3538	-	TU

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Sections 2.1, 2.2, 2.5 and 2.6 Beacons - Constant Temperature Tests					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Power Meter	Hewlett Packard	436A	47	12	9-Jul-2008
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	2-Jan-2009
Time Interval Analyser	Yokogawa	TA720	181	12	27-Feb-2009
High Resolution Oscilloscope	Gould	840	182	12	1-Mar-2008
Colour TV Monitor	Panasonic	WV-CP220-B	320	-	TU
Load (50ohm)	Diamond	DL-30N	392	12	28-Aug-2008
Signal Generator	Hewlett Packard	8663A	1063	12	13-Feb-2009
Signal Generator	Hewlett Packard	3336C	1189	12	19-Jul-2008
Power Sensor	Hewlett Packard	8482A	1341	12	15-Oct-2008
Termination (50ohm, 15W)	Radio Spares	612-192	2416	12	5-Sep-2008
Termination (50ohm, 15W)	Radio Spares	612-192	2425	12	5-Sep-2008
Distress Beacon RF Unit	TUV	-	2445	-	TU
Beacon RF Unit	TUV	N/A	3066	-	TU
Hygrometer	Rotronic	I-1000	3068	12	25-Apr-2008
Termination (50ohm, 1W)	Suhner	-	3080	12	24-Feb-2008
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3097	12	16-Mar-2008
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	12	16-Mar-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	30-May-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3161	12	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3162	12	19-Jun-2008
Thermocouple Thermometer	Fluke	51	3172	12	18-Jun-2008
Thermocouple Thermometer	Fluke	51	3174	12	18-Jun-2008
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	28-Jul-2008
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	18-Sep-2008
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	6-Nov-2008
ScopeCorder	Yokogawa	DL750 701210	3254	12	6-Nov-2008
Timer	Radio Spares	427-590	3282	-	TU
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	16-Apr-2008
Cable (1m, N type)	Rhophase	NPS-1601-1000-NPS	3350	12	18-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	18-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354		18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3355	12	18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	18-Apr-2008

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.8 and 2.9 Beacons - Operating Lifetime					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Power Supply Unit	Farnell	LT-30-2	41	-	O/P Mon
Power Meter	Hewlett Packard	436A	47	12	9-Jul-2008
Power Meter	Hewlett Packard	436A	83	12	11-Aug-2008
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	2-Jan-2009
Time Interval Analyser	Yokogawa	TA720	181	12	27-Feb-2009
High Resolution Oscilloscope	Gould	840	182	12	6-Mar-2009
Load (50ohm)	Diamond	DL-30N	392	12	28-Aug-2008
Attenuator 10dB/10W)	Trilithic	HFP-50N	454	0	19-Jul-2008
Signal Generator	Hewlett Packard	8663A	765	12	10-Jan-2009
Load (50ohm, 15W)	Diamond Antenna	DL-30N	822	12	5-Sep-2008
Signal Generator	Hewlett Packard	8663A	1063	12	13-Feb-2009
Power Sensor	Hewlett Packard	8482A	1341	12	15-Oct-2008
Cable (1m N(m) - N(m))	Reynolds	269-0088-1000	2397	12	18-Sep-2008
Termination (50ohm, 15W)	Radio Spares	612-192	2416	12	5-Sep-2008
Multimeter	Iso-tech	Iso Tech IDM101	2421	12	13-Aug-2008
Termination (50ohm, 15W)	Radio Spares	612-192	2425	12	5-Sep-2008
Distress Beacon RF Unit	TUV	-	2445	-	TU
Stop Clock	R.S Components	RS328 061	2674	-	TU
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Beacon RF Unit	TUV	N/A	3066	-	TU
Hygrometer	Rotronic	I-1000	3068	12	25-Apr-2008
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	12	15-Mar-2009
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	30-May-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	30-May-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3161	12	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3162	12	19-Jun-2008
Thermocouple Thermometer	Fluke	51	3172	12	18-Jun-2008
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	28-Jul-2008
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	18-Sep-2008
Cable (2m, SMA Type)	Reynolds	262-0248-2000	3222	12	17-Sep-2008
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	6-Nov-2008
ScopeCorder	Yokogawa	DL750 701210	3254	12	6-Nov-2008
Timer	Radio Spares	427-590	3282	-	TU
Power Sensor	Agilent	8482A	3290	12	26-Nov-2008
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	16-Apr-2008

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.8 and 2.9 Beacons - Operating Lifetime (continued…)					
Cable (1m, N type)	Rhophase	NPS-1601-1000-NPS	3350	12	18-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3351	12	18-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354		22-Apr-2009
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3355	12	22-Apr-2009
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	21-Feb-2009
Section 2.4 Beacons - VSWR					
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Time Interval Analyser	Yokogawa	TA720	181	12	21-Feb-2008
High Resolution Oscilloscope	Gould	840	182	12	1-Mar-2008
Load (50ohm, 15W)	Diamond Antenna	DL-30N	337	12	28-Aug-2008
Load (50ohm)	Diamond	DL-30N	392	12	28-Aug-2008
Signal Generator	Hewlett Packard	8663A	1063	12	13-Feb-2009
Signal Generator	Hewlett Packard	3336C	1189	12	19-Jul-2008
Termination (50ohm, 15W)	Radio Spares	612-192	2425	12	5-Sep-2008
Distress Beacon RF Unit	TUV	-	2445	-	TU
Hygrometer	Rotronic	I-1000	3068	12	25-Apr-2008
Termination (50ohm, 1W)	Suhner	-	3080	12	24-Feb-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3161	12	30-May-2008
Thermocouple Thermometer	Fluke	51	3172	12	18-Jun-2008
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	28-Jul-2008
RF Short Circuit	TUV	Short Circuit	3268	-	TU
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354		18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	18-Apr-2008
Cable (3m, N-type)	Rhophase	NPS-1601-3000-NPS	3361	12	18-Apr-2008

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.10 Beacons - Temperature Gradient					
Power Meter	Hewlett Packard	436A	47	12	9-Jul-2008
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	2-Jan-2009
High Resolution Oscilloscope	Gould	840	182	12	1-Mar-2008
Signal Generator	Hewlett Packard	8663A	1063	12	13-Feb-2009
Power Sensor	Hewlett Packard	8482A	1341	12	15-Oct-2008
Termination (50ohm, 15W)	Radio Spares	612-192	2425	12	5-Sep-2008
Distress Beacon RF Unit	TUV	-	2445	-	TU
Beacon RF Unit	TUV	N/A	3066	-	TU
Hygrometer	Rotronic	I-1000	3068	12	25-Apr-2008
Termination (50ohm, 1W)	Suhner	-	3080	12	24-Feb-2008
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3097	12	16-Mar-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	30-May-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3161	12	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3162	12	19-Jun-2008
Thermocouple Thermometer	Fluke	51	3172	12	18-Jun-2008
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	28-Jul-2008
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	18-Sep-2008
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	6-Nov-2008
ScopeCorder	Yokogawa	DL750 701210	3254	12	6-Nov-2008
Timer	Radio Spares	427-590	3282	-	TU
Cable (1m, N type)	Rhophase	NPS-1601-1000-NPS	3350	12	18-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	18-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354		18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3355	12	18-Apr-2008
Cable (3m, N-type)	Rhophase	NPS-1601-3000-NPS	3361	12	18-Apr-2008
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	Class 1 (Int)

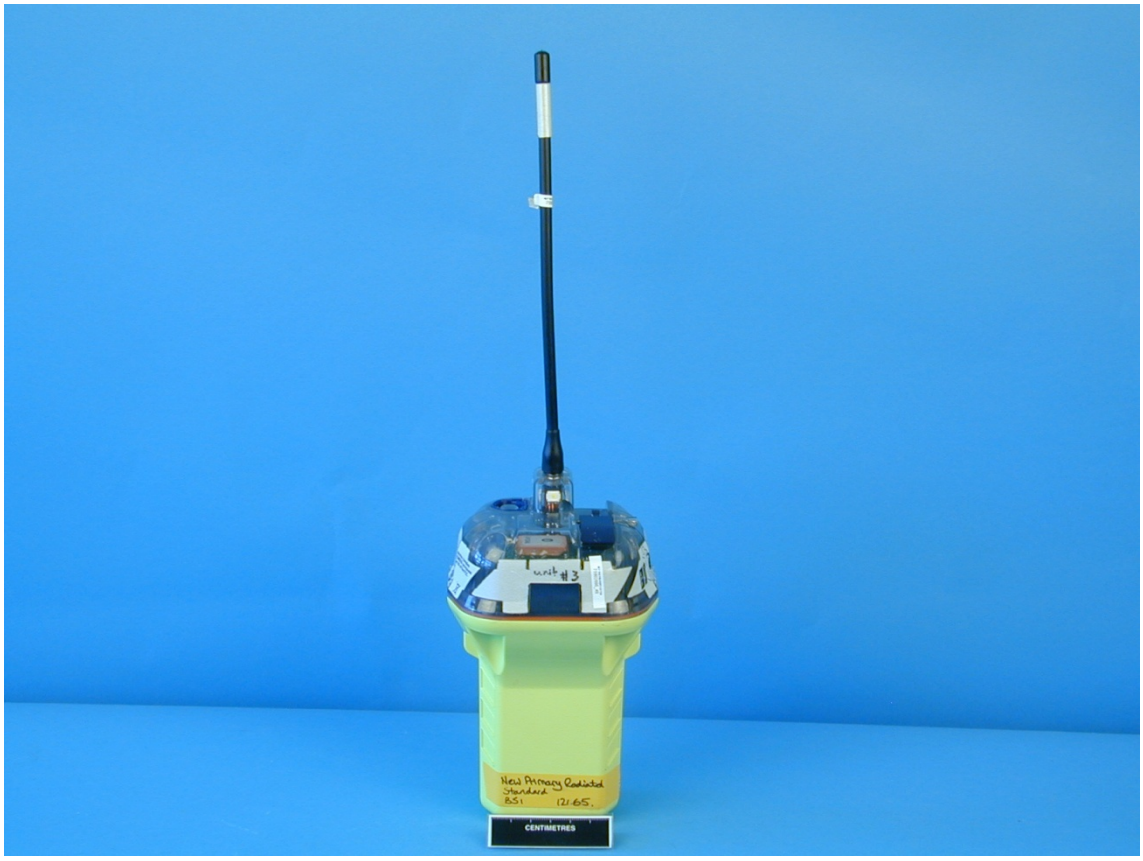
Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.7 Beacons - Thermal Shock					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Power Meter	Hewlett Packard	436A	47	12	9-Jul-2008
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	2-Jan-2009
Time Interval Analyser	Yokogawa	TA720	181	12	27-Feb-2009
High Resolution Oscilloscope	Gould	840	182	12	1-Mar-2008
Signal Generator	Hewlett Packard	8663A	1063	12	13-Feb-2009
Signal Generator	Hewlett Packard	3336C	1189	12	19-Jul-2008
Power Sensor	Hewlett Packard	8482A	1341	12	15-Oct-2008
Termination (50ohm, 15W)	Radio Spares	612-192	2425	12	5-Sep-2008
Distress Beacon RF Unit	TUV	-	2445	-	TU
Beacon RF Unit	TUV	N/A	3066	-	TU
Hygrometer	Rotronic	I-1000	3068	12	25-Apr-2008
Termination (50ohm, 1W)	Suhner	-	3080	12	24-Feb-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3161	12	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3162	12	19-Jun-2008
Thermocouple Thermometer	Fluke	51	3172	12	18-Jun-2008
Thermocouple Thermometer	Fluke	51	3174	12	18-Jun-2008
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	28-Jul-2008
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	18-Sep-2008
ScopeCorder	Yokogawa	DL750 701210	3254	12	6-Nov-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	18-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354		18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3355	12	18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	18-Apr-2008

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

SECTION 4

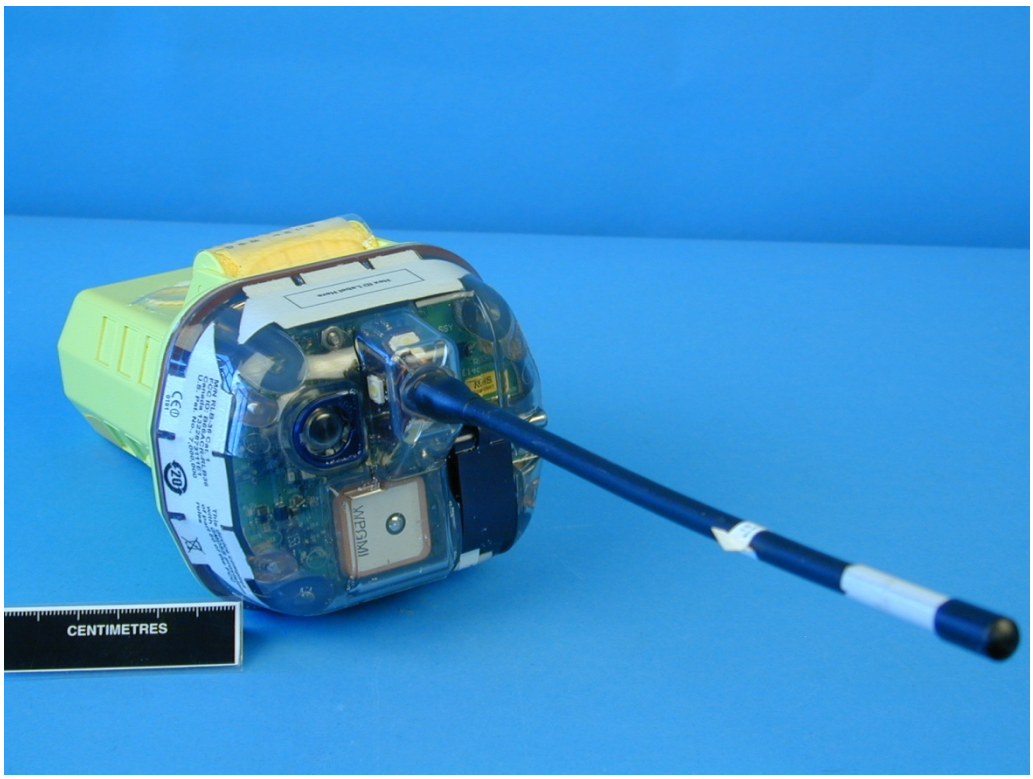
PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



EUT Front View

EUT Rear View



EUT Top View

Satellite Qualitative – Configuration 5

Satellite Qualitative – Configuration 7

Satellite Qualitative – 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

Customer Supplied Description of Modification and Impact on Testing

"***Explanation of Digital Message Error in Modification State 0***

The microcontroller used in the RLB-36 is the Microchip PIC18F4525. The PIC18F4525 RevA Silicon has an Interrupt bug, which caused the Digital Message Error. The work around is to change the C compiler option to disable the Fast Return and use Standard Return instead, as suggested by Microchip.

The conducted units were tested with reprogrammed SW that fixed the interrupt issue in chip vendor silicon by re-compiling the C code with the Standard Return option (Modification State 1), instead of the Fast Return option.

The environmental/radiated unit was tested as originally provided (Modification State 0) without any modifications. The reason we did not re-program this unit is this vendor silicon issue does not affect the test data/results, and also the test was in progress for over a week on this unit.

This modification will have no effect on Antenna Characteristic and Position Acquisition and Accuracy tests."

Product Service

Self-test mode (Description)

Self testing the beacon

The full functional self-test is initiated by momentarily lifting the thumb switch to a vertical position and holding it in this position for at least one second and at most 4 seconds. A beep indicates the initiation of the test, and the self test will attempt 5 functional test sequence as described in Figure 7. The first red/green LED flash indicates if the electronic witness is broken. Then if all tests pass, the buzzer will beep an additional five times as the green LED lights simultaneously. The last green LED flash and the smiley faces shown on the display indicates a successful test. However, if the test fails at any step, there will be no beep and the red LED will flash with the "x" shown on the display. The self-test will stop at that step. During the self-test, an actual satellite message is transmitted while certain key performance parameters are measured and recorded. The self-test message is modified to prevent the satellite from forwarding an alert message during self-test.

01/17/2008

PROTECTION AGAINST REPETITIVE SELF-TEST MODE TRANSMISSIONS, RLB-36

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, one long GPS test, enter the ON mode, enter the stuck 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 during and after the long GPS test is generated, the stuck mode is entered for a maximum time of 10 minutes. This mode alternately flashes the red LED, the green LED, and sounds the buzzer. 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 Data

Rakon UK Limited

CERTIFICATE OF COMPLIANCE - COSPAS-SARSAT

Rakon UK Limited
Sadler Road
Lincoln
LN6 3RS
United Kingdom
+44-(0)1522-883528

This is to certify that any the following Crystal oscillators:

Item	Rakon Part No.	Description
1	E4520LF	TCXO, 12.688656 MHz, SMD (7x5mm)

is fully compliant with 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 1 (dated October 2006).

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: 22th January 2008
(authorized representative of Rakon (UK) Limited)

RAKON UK 1

Name: David R Woodall Phone: +44-(0)1522-883528

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

RAKON

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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

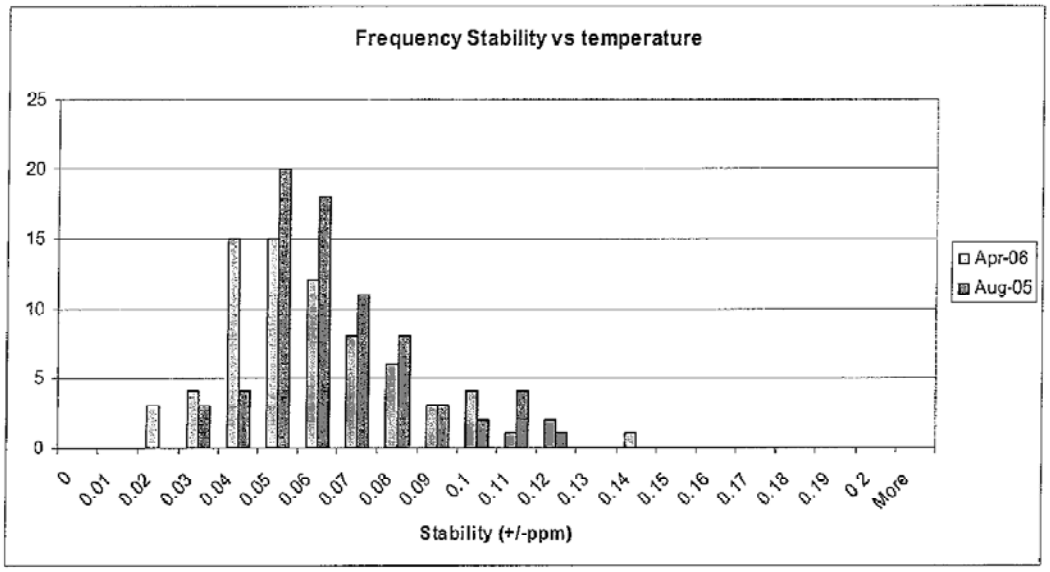


Figure 1 Frequency Stability vs. Temperature

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

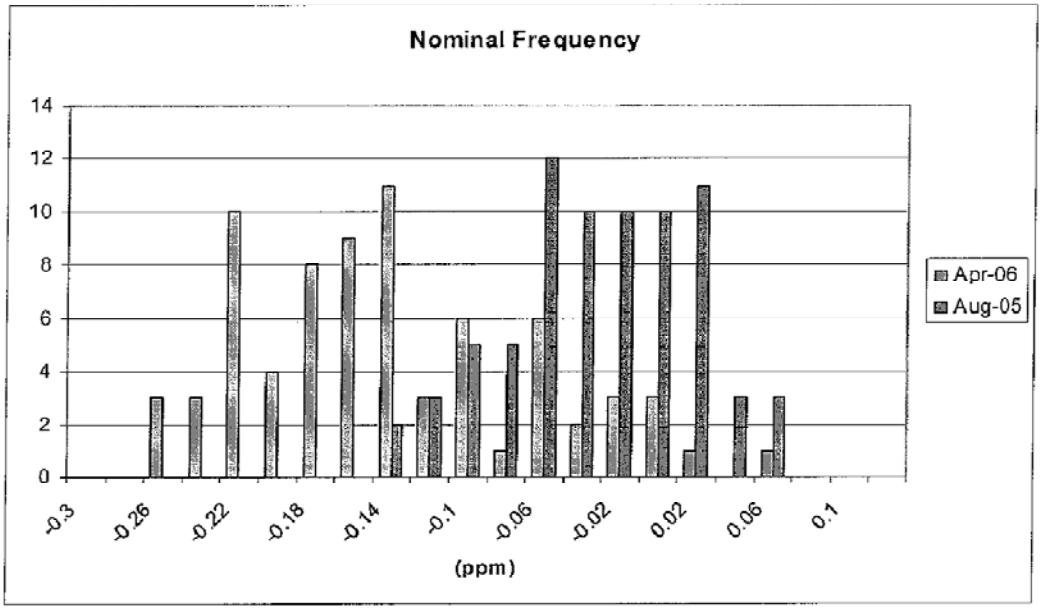


Figure 2 Nominal frequency

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

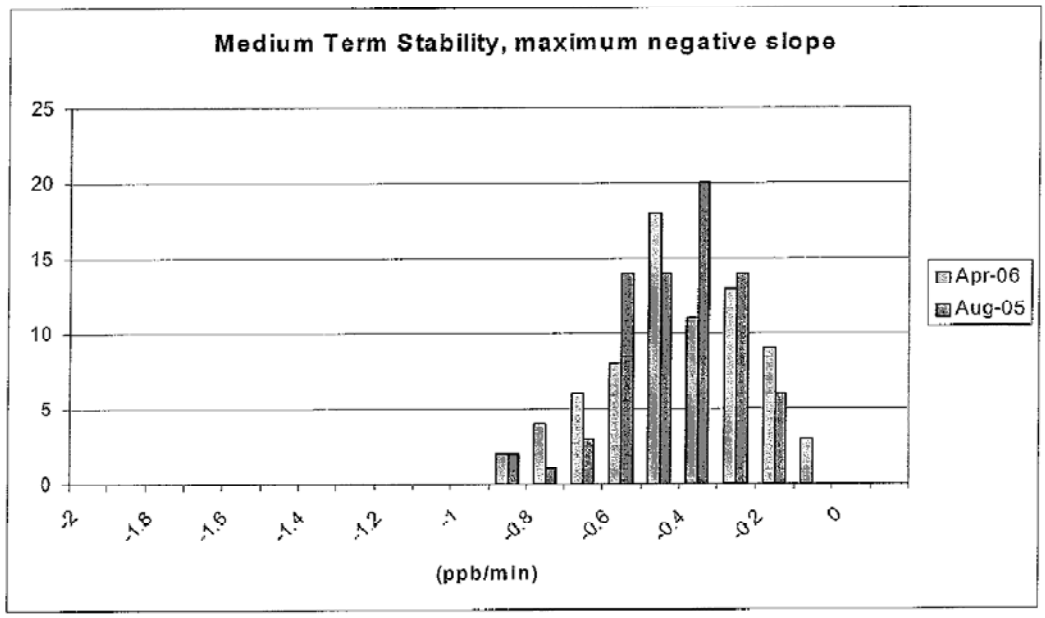


Figure 3 Medium term stability, Slope

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.

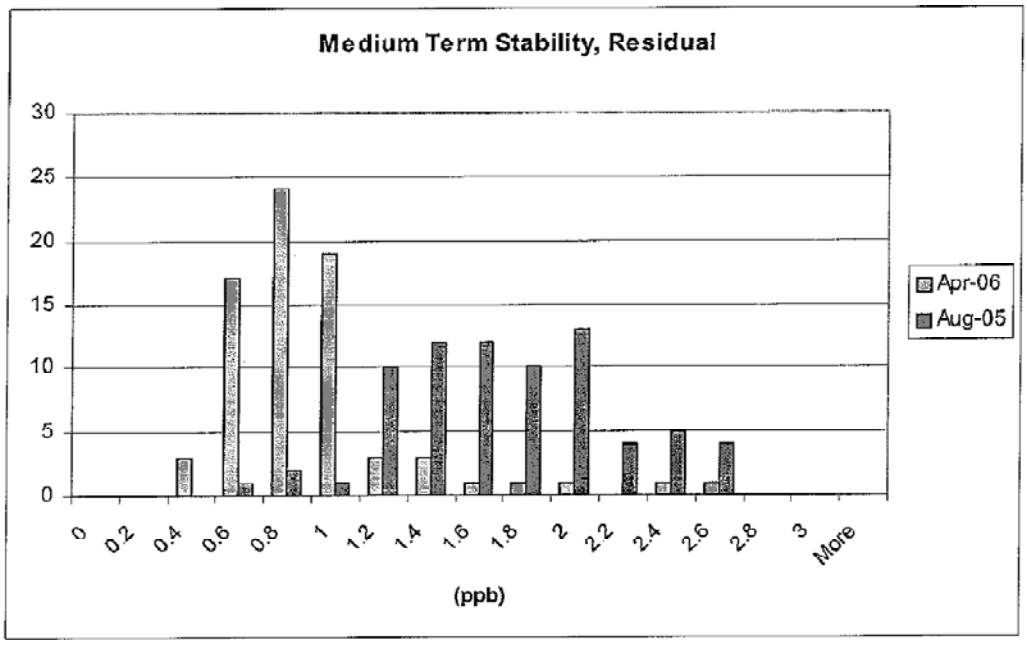
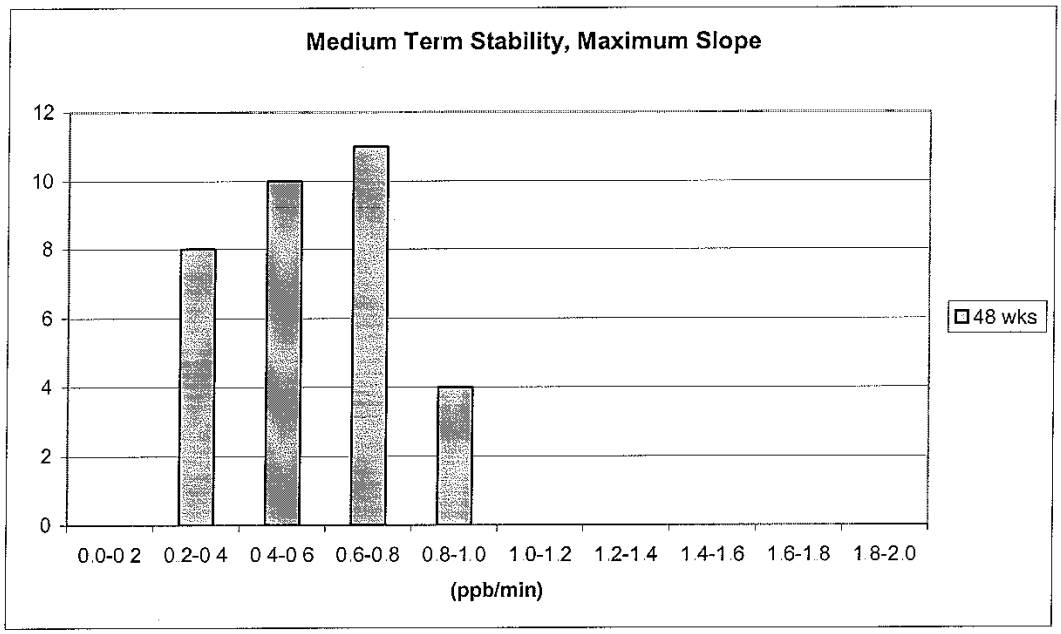


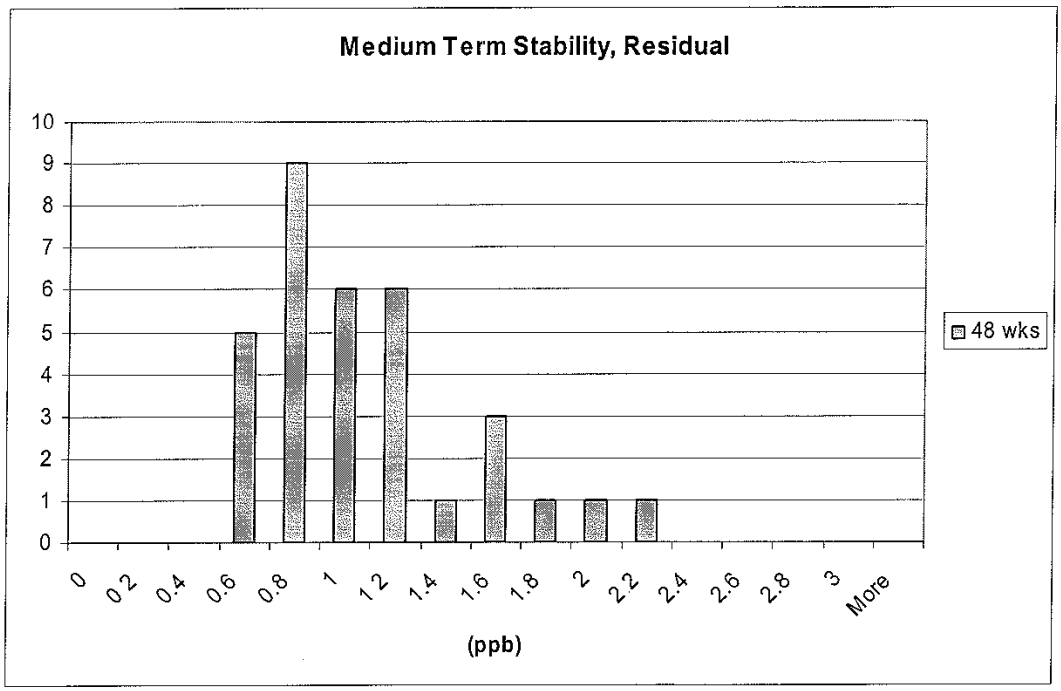
Figure 4 Medium term stability, Residual

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

01/17/2008

PROTECTION AGAINST CONTINUOUS TRANSMISSION for RLB-36

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.

Table F-D.2 of C/S T.007
Examples of Location Protocol Beacon Messages

Protocol		Operational Message (in hexadecimal including bit and frame synchronization bits)		Self-test Message (in hexadecimal including bit and frame synchronization bits)
		Location "A"	Location "B"	
Standard Location: EPIRB with MMSI	Int. GPS	FFFE2F8C92F4 23F01A2A0B81 CCF78C44DA11	FFFE2F8C92F4 23F01AAA1B2C 18F783A0EE7F	FFFED08C92F4 23F07FDFFB2B F037
	Ext. GPS	FFFE2F8C92F4 23F01A2A0B81 CCF58C44D6D5	FFFE2F8C92F4 23F01AAA1B2C 18F583A0E2BB	
Standard Location: EPIRB with Serial Number	Int. GPS	FFFE2F8C96F9 C0631A2A0938 D3F78C44DA11	FFFE2F8C96F9 C0631AAA1995 07F783A0EE7F	FFFED08C96F9 C0637FDFF992 EF37
	Ext. GPS	FFFE2F8C96F9 C0631A2A0938 D3F58C44D6D5	FFFE2F8C96F9 C0631AAA1995 07F583A0E2BB	
National Location: EPIRB	Int. GPS	FFFE2F8C9A00 18C685502DEF F9F71D080674	FFFE2F8C9A00 18C69F50B9BF B5379C0402A4	FFFED08C9A00 18DFC0FF02AD 4477
	Ext. GPS	FFFE2F8C9A00 18C685502DEF F9F51D080AB0	FFFE2F8C9A00 18C69F50B9BF B5359C040E60	
Standard Location Test: EPIRB with Serial Number	Int. GPS	FFFE2F8C9EF9 C0631A2A0897 29778C44DA11	FFFE2F8C9EF9 C0631AAA183A FD7783A0EE7F	FFFED08C9EF9 C0637FDFF83D 15B7
	Ext. GPS	FFFE2F8C9EF9 C0631A2A0897 29758C44D6D5	FFFE2F8C9EF9 C0631AAA183A FD7583A0E2BB	
National Location Test: EPIRB	Int. GPS	FFFE2F8C9F00 18C685502BBB 59B71D080674	FFFE2F8C9F00 18C69F50BFEB 15779C0402A4	FFFED08C9F00 18DFC0FF04F9 E437
	Ext. GPS	FFFE2F8C9F00 18C685502BBB 59B51D080AB0	FFFE2F8C9F00 18C69F50BFEB 15759C040E60	

Beacon Coding Software
Sample Messages for the RLB-36

1. **RLB-36 Model**

   The RLB-36 has both internal and external GPS.

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 RLB-36 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. Position data for all messages were generated by GPS simulators.

3. Standard Location Protocols

3.1 EPIRB – MMSI / Location Protocol

3.1.1 Hex Messages For RLB-36

3.1.1.1 15 Hex ID: 1925E847E0FFBFF

3.1.1.2 Encoded Data
Country Code: 201
MMSI: 999999
Specific Beacon Number: 0
GPS Data Source: Internal GPS

3.1.1.3 Sample Hex Messages: Standard Location – EPIRB – MMSI

Msg	Hex Message	Comment	GPS Latitude	GPS Longitude
1-1	FFFE2F8C92F423F01A2A0B81CCF78C44DA11	Int. GPS position	N 26° 3' 4"	W 80° 10' 8"
1-2	FFFE2F8C92F423F01A2A0B81CCF58C44D6D5	Ext. GPS position	N 26° 3' 4"	W 80° 10' 8"
1-3	FFFED08C92F423F07FDFFB2BF037	Selftest	Default	Default

3.1.2 Hex Messages For RLB-36

3.1.2.1 15 Hex ID: 1925E847E0FFBFF

3.1.2.2 Encoded Data
Country Code: 201
MMSI: 999999
Specific Beacon Number: 0
GPS Data Source: Internal GPS

3.1.2.3 Sample Hex Messages: Standard Location – EPIRB – MMSI

Msg	Hex Message	Comment	GPS Latitude	GPS Longitude
2-1	FFFE2F8C92F423F01AAA1B2C18F783A0EE7F	Int. GPS position	N 26° 30' 56"	W 80° 45' 56"
2-2	FFFE2F8C92F423F01AAA1B2C18F583A0E2BB	Ext. GPS position	N 26° 30' 56"	W 80° 45' 56"
2-3	FFFED08C92F423F07FDFFB2BF037	Selftest	Default	Default

3.2 EPIRB – Serial

3.2.1 Hex Messages For RLB-36

Beacon Coding Software – Sample Messages – Continued

3.2.1.1 15 Hex ID: 192DF380C6FFBFF

3.2.1.2 Encoded Data
Country Code: 201
C/S Number: 999
Serial Number: 99
GPS Data Source: Internal GPS

3.2.1.3 Sample Hex Messages: Standard Location – EPIRB – Serial

Msg	Hex Message	Comment	GPS Latitude	GPS Longitude
3-1	FFFE2F8C96F9C0631A2A0933D3F78C44DA11	Int. GPS position	N 26° 3' 4"	W 80° 10' 8"
3-2	FFFE2F8C96F9C0631A2A0933D3F58C44D6D5	Ext. GPS position	N 26° 3' 4"	W 80° 10' 8"
3-3	FFFED08C96F9C0637FDFF992EF37	Selftest	Default	Default

3.2.2 Hex Messages For RLB-36

3.2.2.1 15 Hex ID: 192DF380C6FFBFF

3.2.2.2 Encoded Data
Country Code: 201
C/S Number: 999
Serial Number: 99
GPS Data Source: Internal GPS

3.2.2.3 Sample Hex Messages: Standard Location – EPIRB – Serial

Msg	Hex Message	Comment	GPS Latitude	GPS Longitude
4-1	FFFE2F8C96F9C0631AAA195507F783A0EE7F	Int. GPS position	N 26° 30' 56"	W 80° 45' 56"
4-2	FFFE2F8C96F9C0631AAA195507F583A0E2BB	Ext. GPS position	N 26° 30' 56"	W 80° 45' 56"
4-3	FFFED08C96F9C0637FDFF992EF37	Selftest	Default	Default

4. National Location Protocols

4.1 EPIRB

4.1.1 Hex Messages For RLB-36

4.1.1.1 15 Hex ID: 19340031BF81FE0

4.1.1.2 Encoded Data
Country Code: 201
Serial Number: 99
GPS Data Source: Internal GPS

4.1.1.3 Sample Hex Messages: National Location – EPIRB

Msg	Hex Message	Comment	GPS Latitude	GPS Longitude
5-1	FFFE2F8C9A0018C685502DEFF9F71D080674	Int. GPS position	N 26° 3' 4"	W 80° 10' 8"
5-2	FFFE2F8C9A0018C685502DEFF9F51D080AB0	Ext. GPS position	N 26° 3' 4"	W 80° 10' 8"
5-3	FFFED08C9A0018DFC0FF02AD4477	Selftest	Default	Default

4.1.2 Hex Messages For RLB-36

4.1.2.1 15 Hex ID: 19340031BF81FE0

4.1.2.2 3Encoded Data
Country Code: 201
Serial Number: 99
GPS Data Source: Internal GPS

4.1.2.3 Sample Hex Messages: National Location – EPIRB

Msg	Hex Message	Comment	GPS Latitude	GPS Longitude
6-1	FFFE2F8C9A0018C69F50E9BFB5379C0402A4	Int. GPS position	N 26° 30' 56"	W 80° 45' 56"
6-2	FFFE2F8C9A0018C69F50E9BFB5359C040E60	Ext. GPS position	N 26° 30' 56"	W 80° 45' 56"
6-3	FFFED08C9A0018DFC0FF02AD4477	Selftest	Default	Default

5. Test Location Protocols

5.1 Standard Test Location

5.1.1 Hex Messages For RLB-36

5.1.1.1 15 Hex ID: 193DF380C5FFBFF

5.1.1.2 Encoded Data
Country Code: 201
C/S Number: 999
Serial Number: 99
GPS Data Source: Internal GPS

5.1.1.3 Sample Hex Messages: Standard Test Location

Msg	Hex Message	Comment	GPS Latitude	GPS Longitude
7-1	FFFE2F8C9EF9C0631A2A089729778C44DA11	Int. GPS position	N 26° 3' 4"	W 80° 10' 8"
7-2	FFFE2F8C9EF9C0631A2A089729758C44D6D5	Ext. GPS position	N 26° 3' 4"	W 80° 10' 8"
7-3	FFFED08C9EF9C0637FDFF83D15B7	Selftest	Default	Default

5.1.2 Hex Messages For RLB-36

5.1.2.1 15 Hex ID: 193DF380C5FFBFF

5.1.2.2 Encoded Data
Country Code: 201
C/S Number: 999
Serial Number: 99
GPS Data Source: Internal GPS

5.1.2.3 Sample Hex Messages: Standard Test Location

Msg	Hex Message	Comment	GPS Latitude	GPS Longitude
8-1	FFFE2F8C9EF9C0631AAA183AFD7783A0EE7F	Int. GPS position	N 26° 30' 56"	W 80° 45' 56"
8-2	FFFE2F8C9EF9C0631AAA183AFD7583A0E2BB	Ext. GPS position	N 26° 30' 56"	W 80° 45' 56"
8-3	FFFED08C9EF9C0637FDFF83D15B7	Selftest	Default	Default

5.2 National Test Location

5.2.1 Hex Messages For RLB-36

5.2.1.1 15 Hex ID: 193E0031BF81FE0

5.2.1.2 Encoded Data
Country Code: 201
Serial Number: 99
GPS Data Source: Internal GPS

5.2.1.3 Sample Hex Messages: National Test Location

Msg	Hex Message	Comment	GPS Latitude	GPS Longitude
9-1	FFFE2F8C9F0018C685502BBB59B71D080674	Int. GPS position	N 26° 3' 4"	W 80° 10' 8"

Beacon Coding Software – Sample Messages – Continued

9-2	FFFE2F8C9F0018C685502BBB59B51D080AB0	Ext. GPS position	N 26° 3' 4"	W 80° 10' 8"
9-2	FFFED08C9F0018DFC0FF04F9E437	Selftest	Default	Default

5.2.2 Hex Messages For RLB-36

5.2.2.1 15 Hex ID: 193E0031BF81FE0

5.2.2.2 Encoded Data
Country Code: 201
Serial Number: 99
GPS Data Source: Internal GPS

5.2.2.3 Sample Hex Messages: National Test Location

Msg	Hex Message	Comment	GPS Latitude	GPS Longitude
10-1	FFFE2F8C9F0018C69F50BFEB15779C0402A4	Int. GPS position	N 26° 30' 56"	W 80° 45' 56"
10-2	FFFE2F8C9F0018C69F50BFEB15759C040E60	Ext. GPS position	N 26° 30' 56"	W 80° 45' 56"
10-3	FFFED08C9F0018DFC0FF04F9E437	Selftest	Default	Default

ANNEX G
APPLICATION FOR A COSPAS-SARSAT 406 MHz BEACON
TYPE APPROVAL CERTIFICATE

G.1 INFORMATION PROVIDED BY THE BEACON MANUFACTURE

Beacon Manufacture and Beacon Model

Beacon Manufacturer	ACR Electronics, Inc.
Beacon Model	RLB-36
Other Model Names	

Beacon Type and Operational Configurations

Beacon Type	**Beacon used while:**	**Tick where appropriate**
EPIRB	Floating in water or on deck or in a safety raft	X
PLB	On ground and above ground	☐
	On ground and above ground and floating in water	☐
ELT Survival	On ground and above ground	☐
	On ground and above ground and floating in water	☐
ELT Auto Fixed	Fixed ELT with aircraft external antenna	☐
ELT Auto Portable	In aircraft with an external antenna	☐
	On ground, above ground, or in a safety raft with an integrated antenna	☐
ELT Auto Deployable	Deployable ELT with attached antenna	☐
Other (specify)		☐

Beacon Characteristics

Characteristic	**Specification**
Operating temperature range	Tmin = -20°C Tmax = +55°C
Operating lifetime	48 hours
Battery chemistry	LiMnO2

Characteristic	Specification
Battery cell size and number of cells	2/3A size, 3 battery packs, 3 cells each
Battery cell manufacturer	Sanyo, CR123A
Battery pack manufacturer and part number	ACR, A3-06-2449
Oscillator type (e.g. OCXO, MCXO, TCXO)	TCXO
Oscillator manufacturer	C-MAC / RAKON (E4520)
Oscillator part name and number	A1-11-0786-1
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	A3-06-2554
Navigation device type (Internal, External or None)	Both Internal and External
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	Wonde Proud
- Navigation device model name and part Number	A1-11-0688
- GNSS system supported (e.g. GPS, GLONASS, Galileo)	GPS

Characteristic	Specification	
For External Navigation Devices		
- Data protocol for GNSS receiver to beacon interface	NMEA 0183	
- Physical interface for beacon to navigation device	A plug to a keyed GPS bezel	
- Electrical interface for beacon to navigation device	GPS Optical Interface	
- Navigation device model and manufacturer (if beacon designed to use specific devices)	Any Nav. devices with NMEA 0183 protocol; ie, Garmin GPS handheld	
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.)	5 beeps and green light	
- 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, Lock detect, 406 PWR, Strobe light	
- 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	

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)	X	EPIRB with MMSI
	X	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)	X	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
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)	Yes
- Strobe light intensity	> 0.75 cd
- Strobe light flash rate	21/minute
Beacon transmission repetition period satisfies C/S T.001 requirement that two beacon's repetition periods are not synchronised closer than a few seconds over 5 minute period, and the time intervals between transmissions are randomly distributed on the interval 47.5 to 52.5 seconds (Yes or No)	Yes
Other ancillary devices (e.g. voice transceiver). 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	Yes, ACR Hydrostatic release unit, part # A3-06-2429
Beacon includes software or hardware features and functions not listed above and non-related to 406 MHz (Yes or No) List features and use a separate sheet if insufficient space	Yes, OLED display is used as secondary indicators besides beep/LED indicators

Date: June 12th, 2008

Signed: Chung Tong

Chung Tong
Principal Electrical Engineer
ACR Electronics, Inc.

G.2 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: 18 February 2008

Applicable C/S Standards:

Document	Issue	Revision	Date
C/S T.001	3	8	Nov-07
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.

Date: 23 May 2008 Signed: 

M. Jenkins , Authorised Signatory

- **END OF ANNEX G** -