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Report On

Emergency Beacons Limited Testing of the
McMurdo Limited G5 Smartfind Plus
In accordance with Cospas-Sarsat T.007 Issue 4 - Rev 4 October 2009

Document 75911555 Report 02 Issue 2 March 2011

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REPORT ON

Emergency Beacons Limited Testing of the
McMurdo Limited
G5 Smartfind Plus

Document 75911555 Report 02 Issue 2

March 2011

PREPARED FOR

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PREPARED BY

M P Hardy
Telecoms Test Engineer

APPROVED BY

M J Hardy
Authorised Signatory

DATED

10 March 2011

Product Service

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Product Service

SECTION 1

REPORT SUMMARY

Emergency Beacons Limited Testing of the
McMurdo Limited
G5 Smartfind Plus

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Emergency Beacon Limited Testing of the McMurdo Limited G5 Smartfind Plus to the requirements of Cospas-Sarsat T.007 Issue 4 - Rev 4 October 2009.

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	McMurdo Limited
Model Number(s)	G5 Smartfind Plus
Serial Number(s)	TUV Ref: TSR 0002 / Unique ID: 193DF380C6FFBFF
Number of Samples Tested	1
Test Specification/Issue/Date	Cospas-Sarsat T.007 Issue 4 - Rev 4 October 2009
Incoming Release Date	Application Form 15 November 2010
Date of Receipt of Test Samples	18 November 2010
Order Number Date	PC0004329 29 October 2010
Start of Test	17 November 2010
Finish of Test	09 March 2011
Name of Engineer(s)	M P Hardy M Russell
Related Documents	Cospas-Sarsat T.001 Issue 3 - Rev 10 October 2009

1.2 APPLICATION FORM

1.2.1 Beacon Manufacturer and Beacon Model

Beacon Manufacturer	McMurdo Ltd
Beacon Model	G5 Smartfind Plus (a) & (m)
Other Model Names	SGE406II (a) & (m), EG50:AUTO & EG50:MAN, Kannad Marine Sport+, McMurdo Smartfind A5G

1.2.2 Beacon Type and Operational Configurations

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

1.2.3 Beacon Characteristics

Characteristic	Specification
Operating frequency	406.040 MHz
Operating temperature range	Tmin = -20°C Tmax = +55 °C
Operating lifetime	48 hours
Battery chemistry	Lithium Manganese Dioxide
Battery cell model name, size and number of cells	CR 2/3AH (3x3) or CR123A (3X3)
Battery cell manufacturer	Varta/Panasonic
Battery pack manufacturer and part number	Varta/Panasonic
Battery pack replacement period	8 years

Characteristic	Specification
Oscillator type (e.g. OCXO, MCXO, TCXO)	TCXO
Oscillator manufacturer	Rakon
Oscillator part name and number	E5344LF
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	Doig/Pressco
Antenna part name and number	82-909
Navigation device type (Internal, External or None)	Internal
Features in beacon that prevent degradation to 406 MHz signal or beacon lifetime resulting from a failure of navigation device or failure to acquire position data (Yes, No, or N/A)	Yes
Features in beacon that ensures erroneous position data is not encoded into the beacon message (Yes, No or N/A)	Yes
Navigation device capable of supporting global coverage (Yes, No or N/A)	Yes
For Internal Navigation Devices	
- Geodetic reference system (WGS 84 or GTRF)	WGS 84
- GNSS receiver cold start forced at every beacon activation (Yes or No)	Yes
- Navigation device manufacturer	Ublox
- Navigation device model name and part Number	NEO-6M
- GNSS system supported (e.g. GPS, GLONASS, Galileo)	GPS, Galileo
For External Navigation Devices	
- Data protocol for GNSS receiver to beacon interface	
- Physical interface for beacon to navigation device	
- Electrical interface for beacon to navigation device	
- Part number of the external navigation interface device (if applicable)	
- Navigation device model and manufacturer (if beacon designed to use specific devices)	

Characteristic	Specification	
Self-Test Mode Characteristics	Self-Test Mode	Optional GNSS Self-Test Mode
- Self-test has separate switch position (Yes or No)	Yes	Yes
- Self-test switch automatically returns to normal position when released (Yes or No)	Yes	Yes
- Self-test activation can cause an operational mode transmission (Yes or No)	No	No
- Self-test causes a single beacon self-test message burst only regardless of how long the self-test activation mechanism applied (Yes or No)	Yes	Yes
- Results of self-test indicated by (e.g. Pass / Fail Indicator Light, Strobe Light, etc.)	Pass/Fail LED	Pass/Fail LED
- Self-test can be activated from beacon remote activation points (Yes or No)	No	No
- Self-test performs an internal check and indicates that RF power emitted at 406 MHz and 121.5 MHz if beacon includes a 121.5 MHz homer (Yes or No)	Yes	No
- Self-test transmits a signal(s) other than at 406 MHz (Yes & details or No)	Yes 121.5MHz	No
- Self-test can be activated directly at beacon (Yes or No)	Yes	Yes
- List of Items checked by self-test	406.040 MHz/121.5Mhz Power, PLL Lock, GPS module	GPS Position fix
- Self-test transmission burst duration (440 or 520 ms)	520 ms	520 ms
- Self-test format bit (“0” or “1”)	1	1
- Maximum duration of Self Test / GNSS Self-test	9	15min +/-10 seconds
- Maximum number of GNSS Self Tests (beacons with internal navigation devices only)	N/A	12
- Self-test results in transmission of a single burst, irrespectively of the test result (Yes or No)	N/A	No
- Maximum number of self-tests during battery pack replacement period	96	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)	☒	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

Characteristic	Specification
Beacon includes a homer transmitter (if yes identify frequency of transmission)	121.5 MHz
-Homer Transmit Power	17 dBm
-Homer Duty Cycle	Continuous %
-Duty Cycle of Homer Swept Tone	36 %
Beacon includes a strobe light (Yes or No)	Yes
- Strobe light intensity	>0.75cd
- Strobe light flash rate	21
Beacon transmission repetition period satisfies C/S T.001 requirement that two beacon's repetition periods are not synchronised closer than a few seconds over 5 minute period, and the time intervals between transmissions are randomly distributed on the interval 47.5 to 52.5 seconds (Yes or No)	Yes
Other ancillary devices (e.g. voice transceiver, remote control, external audio and light indicators, external activation device). List details on a separate sheet if insufficient space to describe.	N/A
Beacon includes automatic activation mechanism (Yes or No) Specify type of automatic beacon activation mechanism	Yes. Sea water switch contact
Beacon includes software or hardware features and functions not listed above and non-related to 406 MHz (Yes or No) List features and use a separate sheet if insufficient space	No

1.2.4 Information Provided by the Cospas-Sarsat Accepted Test Facility

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

Date of Submission for Testing: November 2010

Applicable C/S Standards:

Document	Issue	Revision	Date
C/S T.001	3	10	Oct-09
C/S T.007	4	4	Oct-09

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: M Hardy

Name: M J Hardy

Position Held: Authorised Signatory

Date: 10 March 2011

1.2.5 Applicant Details

Company Name	McMurdo Ltd		
Address	Silver Point Airport Service Road Portsmouth Hampshire, PO3 5PB		
Category of Applicant	☒ Manufacturer	☐ Importer	
	☐ Distributor	☐ Agent	
Contact Name	Neil Jordan	Telephone	+44(0)2392623934
Email	neiljordan@mcmurdo.co.uk	Facsimile	+44(0)2392623997

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	Issue 1
- Battery Model	Varta CR 2/3AH / Panasonic CR123A
Software Version	N/A
Firmware Version	1.3.220
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: Neil Jordan

Position Held: Engineering Manager

Date: 15th November 2010

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a McMurdo Limited G5 Smartfind Plus as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.

Equipment Under Test

1.3.2 Physical Test Configuration

The Equipment Under Test (EUT) was operated using its own power source (internal battery). The EUT was configured so that the antenna port was connected to the 50Ω test system using a coaxial cable. The test configuration for all tests is identical with the exception of Satellite Qualitative and Position Accuracy Time and Position Accuracy.

The EUT was modified to represent a fully packaged beacon, similar to the proposed production beacons equipped with its proper antenna. This EUT was used to perform 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.

1.3.3 Modes of Operation

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

Off/Standby Mode
- Main switch to “OFF/0” position
- No apparent activity

Self-test
- Separate “Test” button held for approximately 2 seconds
- List of items checked as per Customer Supplied Information (Application Form)
- No navigation data applied

Long/GPS/GNSS Self-test
- Separate “Test” button held for approximately 15 seconds
- List of items checked as per Customer Supplied Information (Application Form)
- Navigation data applied as applicable (e.g. none applied for timeout, data applied for ‘fast acquisition’)

Operating
- Switch to “ON” position
- 121 Homer active and offset
- GPS operating in normal duty cycle for the following navigation input conditions
- No navigation data applied
- Physical configuration as below

All modes

All mode descriptions are applicable to all tests unless otherwise stated. Additional method of activation includes:
- Water contacts

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

1.4 MODIFICATIONS

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

1.5 REPORT MODIFICATION RECORD

Issue 1 – First Issue
Issue 2 – Inclusion of additional test results as required by C/S.

Product Service

SECTION 2

TEST DETAILS

Emergency Beacons Limited Testing of the
McMurdo Limited
G5 Smartfind Plus

TEST RESULTS TABLE

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
5. 406 MHz Transmitted Frequency						**Result: Pass**
Test Sample: SmartFind G5 - GPS S/N: Unique ID: 193DF380C6FFBFF (TUV #2) Mod State: 0						
Nominal Value	C/S T.001	MHz	406.040070	406.0400357	406.039993	
Short-term stability	≤ $2x10^{-9}$	/100ms	$5.646x10^{-11}$	$1.048x10^{-10}$	$1.254x10^{-10}$	
Medium-term stability – Slope	(-1 to +1)$x10^{-9}$	/minutes	$7.104x10^{-10}$	$2.220x10^{-10}$	$2.232x10^{-10}$	
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$7.563x10^{-10}$	$2.505x10^{-10}$	$4.003x10^{-10}$	
8 (b). GNSS Self-Test Mode (if applicable)						**Result: Pass**
Test Sample: SmartFind G5 - GPS S/N: Unique ID: 193DF380C6FFBFF (TUV #2) Mod State: 0						
Position data (if applicable)	must be within 500m (or 5.25km for User Location Protocol) of the actual position	P / F	P	P	P	Decoded Message: Page 51
Design data showing how GNSS Self-test is limited in number of transmissions and duration	provided	Y / N	Y			Applicant's data: Page 7
Maximum number of GNSS Self-tests (only beacons with internal navigation devices)	12	Number	12	12	12	Applicant's data: Page 7

Parameters to be Measured	Range of Specification	Units	Test Results		Comments
9. Thermal Shock					**Result: Pass**
Test Sample: SmartFind G5 - GPS S/N: Unique ID: 193DF380C6FFBFF (TUV #2) Mod State: 0					
Soak Temperature	30°C difference	°C	-9		Test Data: Page 21
Measurement Temperature		°C	21		
Transmitted Frequency			Min	Max	
Nominal value	C/S T.001	MHz	406.0400159	406.0400336	
Short-term stability	≤ $2x10^{-9}$	/100ms	$5.863x10^{-11}$	$1.631x10^{-10}$	
Medium-term stability – Slope	(-2 to +2)$x10^{-9}$	/min	$-1.814x10^{-9}$	$6.706x10^{-12}$	
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$8.513x10^{-11}$	$1.313x10^{-9}$	
Transmitter power output	35 - 39	dBm	36.761	36.820	
Digital message	correct	P/F	P		

Parameters to be Measured	Range of Specification	Units	Test Results		Comments
10 Operating Lifetime at Minimum Temperature					**Result: Pass**
Test Sample: SmartFind G5 - GPS S/N: Unique ID: 193DF380C6FFBFF (TUV #2) Mod State: 0					
Pre-test battery discharge duration (operating) required		Hours	16.77		Test Data: Page 25 Operating Current Max and Average values taken when GPS receiver switched off to give worst case discharge time.
Pre-test battery discharge duration (operating)		Hours	17.00		
Duration	>24	hours	86.00 Hours at Tmin = -20°C		
Effective Operating Lifetime duration	>24	hours	86.00 Hours at Tmin = -20°C		
Transmitted Frequency			Min	Max	
Nominal value	C/S T.001	MHz	406.0400614	406.0400690	
Short-term stability	≤ $2x10^{-9}$	/100ms	$4.671x10^{-11}$	$3.347x10^{-10}$	
Medium-term stability – Slope	(-1 to +1)$x10^{-9}$	/min	$-5.781x10^{-9}$	$5.333x10^{-10}$	See detailed test data for first 2 hours
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$6.327x10^{-11}$	$1.492x10^{-8}$	See detailed test data for first 2 hours
Transmitter power output	35 - 39	dBm	36.890	37.022	
Digital message	correct	P/F	P		

Parameters to be Measured	Range of Specification	Units	Test Results				Comments
11. Temperature Gradient (5°C/hr)							**Result: Pass**
Test Sample: SmartFind G5 - GPS S/N: Unique ID: 193DF380C6FFBFF (TUV #2) Mod State: 0							
Transmitted Frequency			Min	Max			Test Data: Page 36
Nominal value	C/S T.007	MHz	406.0399947	406.0400716			
Short-term stability	≤ $2x10^{-9}$	/100ms	$4.173x10^{-11}$	$3.542x10^{-10}$			
	(-1 to +1)$x10^{-9}$	/min	$-4.46x10^{-10}$	$3.79x10^{-10}$			Data for points A to B, C+15 min to D and E+15 min to F
Medium-term stability – Slope[1]	(-2 to +2)$x10^{-9}$	/min	$-5.25x10^{-10}$	$5.93x10^{-10}$			Data for points B to C+15 min and D to E+15 min
Medium-term stability – Residual frequency variation	≤ $3x10^{-9}$		$5.163x10^{-11}$	$1.783x10^{-9}$			
Transmitter power output	35 – 39	dBm	36.926	37.429			
Digital message	correct	P/F	P				
14. Satellite Qualitative Tests							**Result: Pass**
Test Sample: SmartFind G5 - GPS S/N: Unique ID: 193DF380C6FFBFF (TUV #2) Mod State: 0							
Test Configuration	As per C/S T.007		Configuration				
			5	6	7	8	
15 Hex ID Decoded by LUT	correct	P / F	P	-	-	P	Test Data: Page 40, 41
Doppler Location results with error ≤5km	≥80	%	91.7	-	-	92.6	

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
17. Navigation System						**Result: Pass**
Test Sample: SmartFind G5 - GPS S/N: Unique ID: 193DF380C6FFBFF (TUV #2) Mod State: 0						
Location protocol	C/S T.001		National	Standard	User	
Position data default values	correct	P / F	P	P	P	Test Data: Page 43
Configuration 5						
Position accuracy - A.3.8.2.1	C/S T.001	m	31.3	31.3	1554.1	
Position Acquisition Time - A.3.8.2.1	<10/1	min	51 sec	51 sec	51sec	
Position accuracy - A.3.8.2.2	C/S T.001	m	49.2	49.8	3372.7	
Position Acquisition Time - A.3.8.2.2	<10/1	min	103 sec	103	103sec	
Configuration 6						
Position accuracy - A.3.8.2.1			-	-	-	
Position Acquisition Time - A.3.8.2.1			-	-	-	
Position accuracy - A.3.8.2.2			-	-	-	
Position Acquisition Time - A.3.8.2.2			-	-	-	
Configuration 7						
Position accuracy - A.3.8.2.1			31.3	31.3	1554.1	
Position Acquisition Time - A.3.8.2.1			51 sec	51 sec	51sec	
Position accuracy - A.3.8.2.2			49.2	49.8	3372.7	
Position Acquisition Time - A.3.8.2.2			51 sec	51 sec	51sec	
Configuration 8						
Position accuracy - A.3.8.2.1			31.3	31.3	1554.1	
Position Acquisition Time - A.3.8.2.1			51 sec	51 sec	51sec	
Position accuracy - A.3.8.2.2			49.2	49.8	3372.7	
Position Acquisition Time - A.3.8.2.2			51 sec	51 sec	103sec	
Encoded position data update interval	>20	min	20min 49sec	20min 49sec	20min 49sec	
Position clearance after deactivation	cleared	P / F	P	P	P	
Position data input update interval (as applicable)	20/1	Min	n/a	n/a	n/a	
Position data encoding	correct	P / F	n/a	n/a	n/a	
Retained last valid position after navigation input lost	240(±5)	min	239min 21sec	239min 22sec	239min 23sec	
Default position data transmitted after 240(±5) minutes without valid position data	cleared	P / F	P	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 B for details

2.1 THERMAL SHOCK

2.1.1 Equipment Under Test and Modification State

G5 Smartfind Plus 406 GPS EPIRB S/N: Unique ID: 193DF380C6FFBFF - Modification State 0

2.1.2 Date of Test

24 November and 06 December 2010

2.1.3 Test Equipment Used

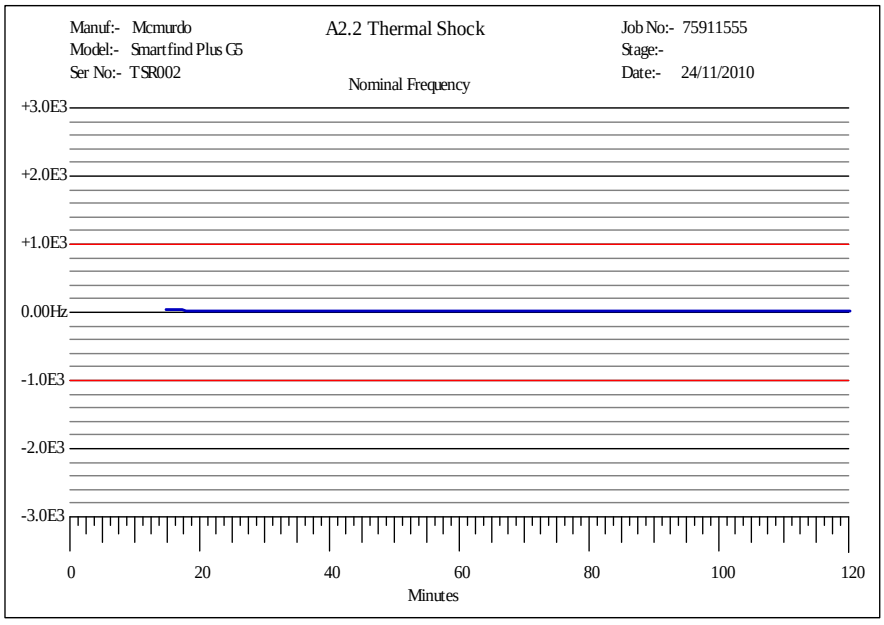
The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.4 Environmental Conditions

Ambient temperature 20 °C
Relative Humidity 25 - 32 %

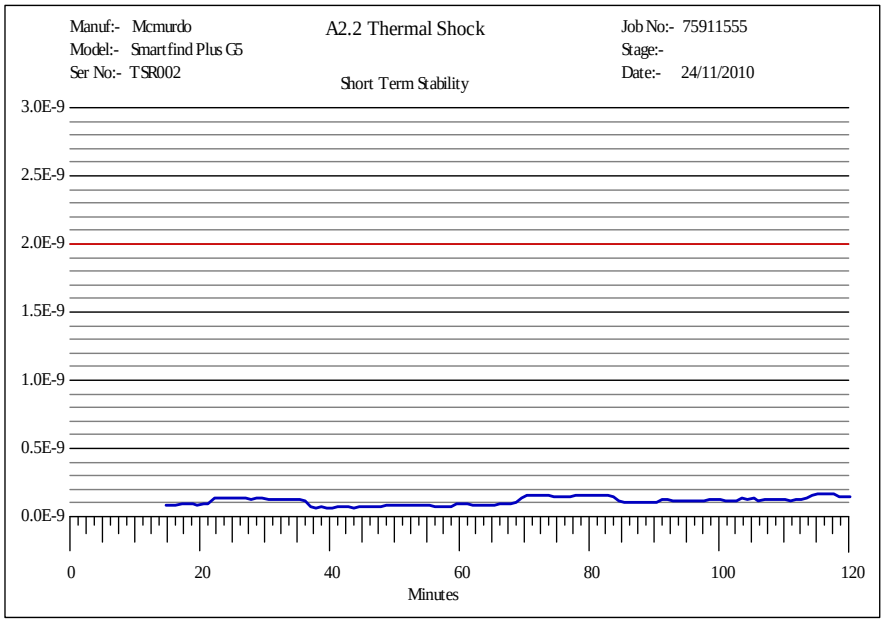
2.1.5 Test Results

Nominal Frequency

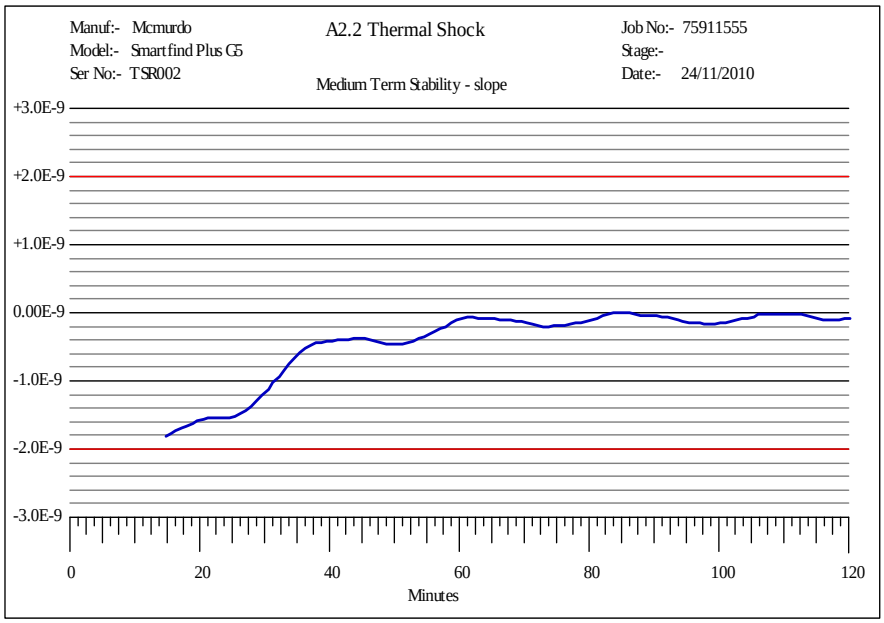


Product Service

Short Term Stability

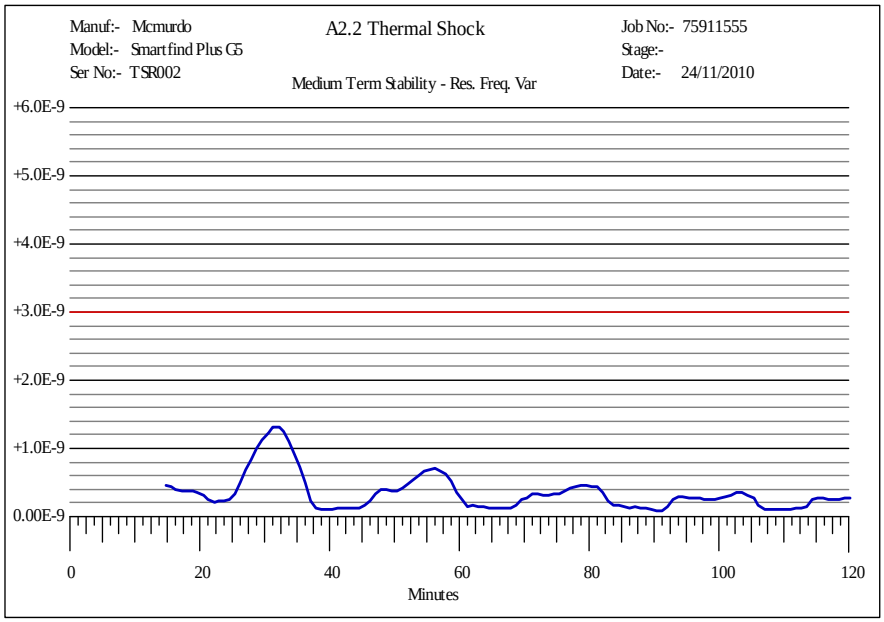


Medium Term Stability, Mean Slope

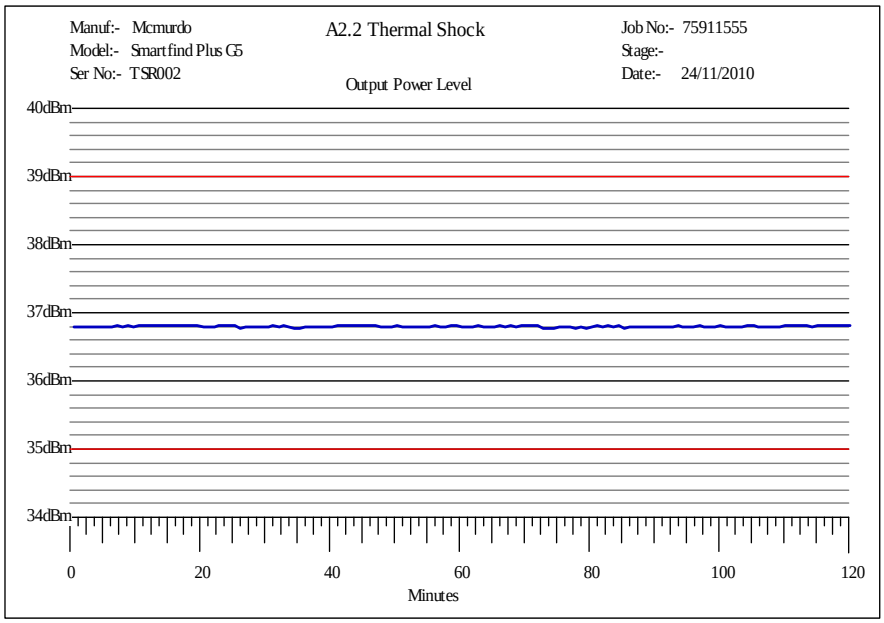


Product Service

Medium Term Stability, Residual Frequency Variation



Output Power



Digital Message

```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 193DF380C6FFBFF              193DF380C6FFBFF Default_Id
 30 Hex (Bits 25-144) = 8C9EF9C0637FDFF83D15B783E0F66C

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0001 1001 0011 1101 1111 0011 1000 0000 1100 0110 1111 1111 1011 1111 1111
   0000 0111 1010 0010 1011 0110 1111 0000 0111 1100 0001 1110 1100 1101 100
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name         Bit Pos    Value Decode                                  Bits
----------         -------    ----- ------                                  ----
Format Flag         25            1 Long Message                               1
Protocol Flag       26            0 Location NEW                               0
MID                 27- 36      201 ALBANIA                          0011 0010 01
Protocol Code       37- 40       14 Test Serial (Standard)                   1110
Spare               41- 64                          1111 1001 1100 0000 0110 0011
Coarse Position     65- 85          DEFAULT            0111 1111 1101 1111 1111 1
BCH Encoded         86-106          Errors=0           0000 0111 1010 0010 1011 0
BCH Generated       86-106                             0000 0111 1010 0010 1011 0
Long Message       107-144          Data Present
Fixed Bits         107-109                                                   110
Fixed Bit          110            1                                            1
Encode Pos Device  111            1 Internal                                   1
121.5 Homing       112            1 YES                                        1
Position Change    113-132          DEFAULT              1000 0011 1110 0000 1111
Resultant Position               --> Not Defined
BCH Encoded        133-144          Errors=0                       0110 0110 1100
BCH Generated      133-144                                         0110 0110 1100

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

2.2 OPERATING LIFETIME AT MINIMUM TEMPERATURE

2.2.1 Equipment Under Test and Modification State

G5 Smartfind Plus 406 GPS EPIRB S/N: Unique ID: 193DF380C6FFBFF - Modification State 0

2.2.2 Date of Test

09, 15 and 17 December 2010

2.2.3 Test Equipment Used

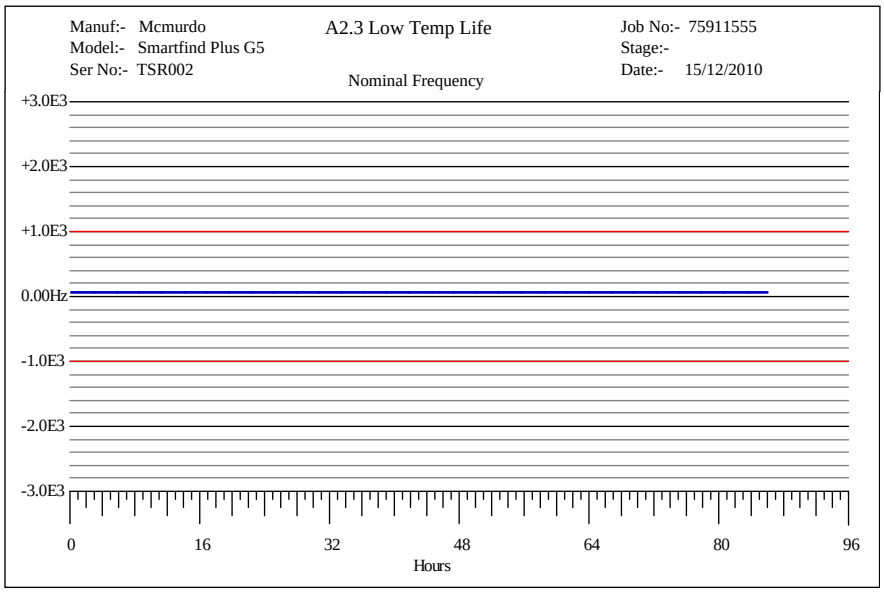
The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.4 Environmental Conditions

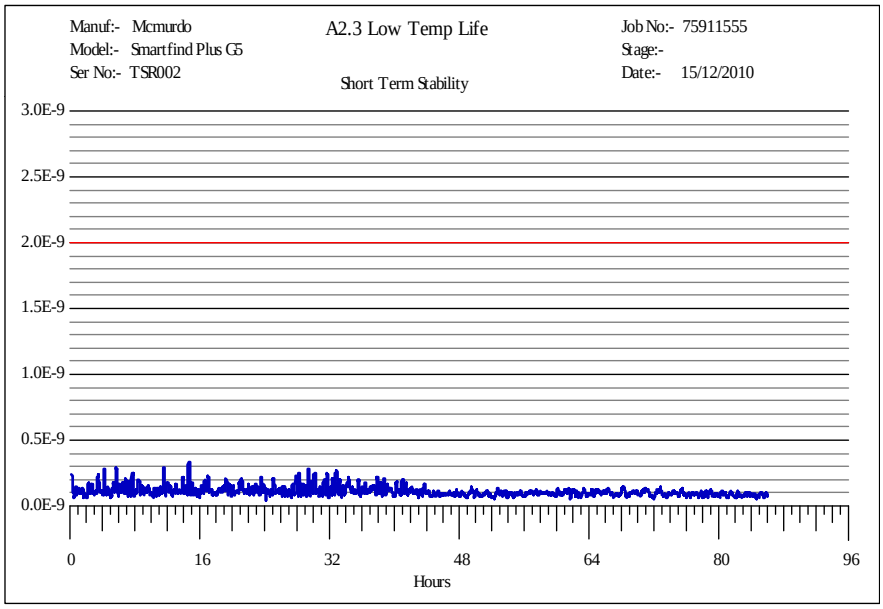
Ambient temperature 20 - 23 °C
Relative Humidity 24 - 28 %

2.2.5 Test Results

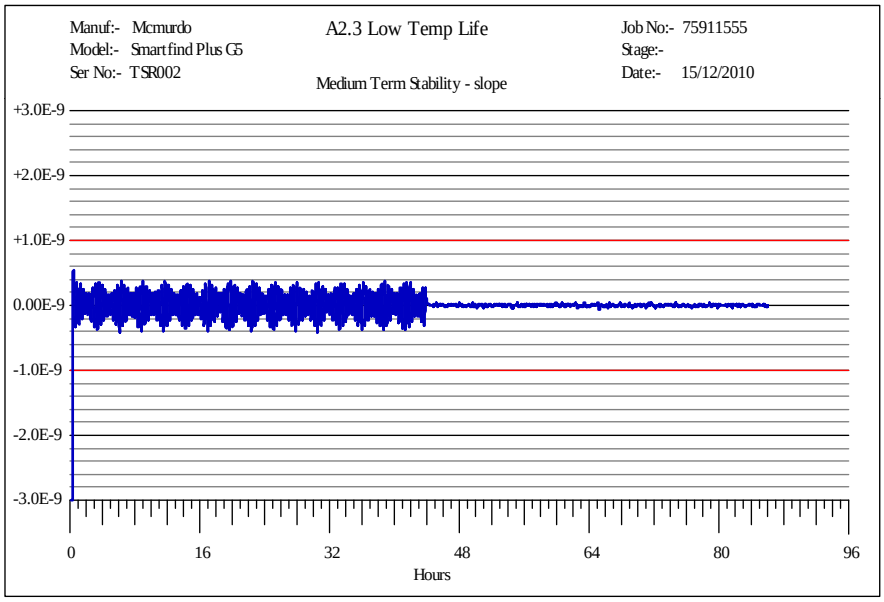
Nominal Frequency



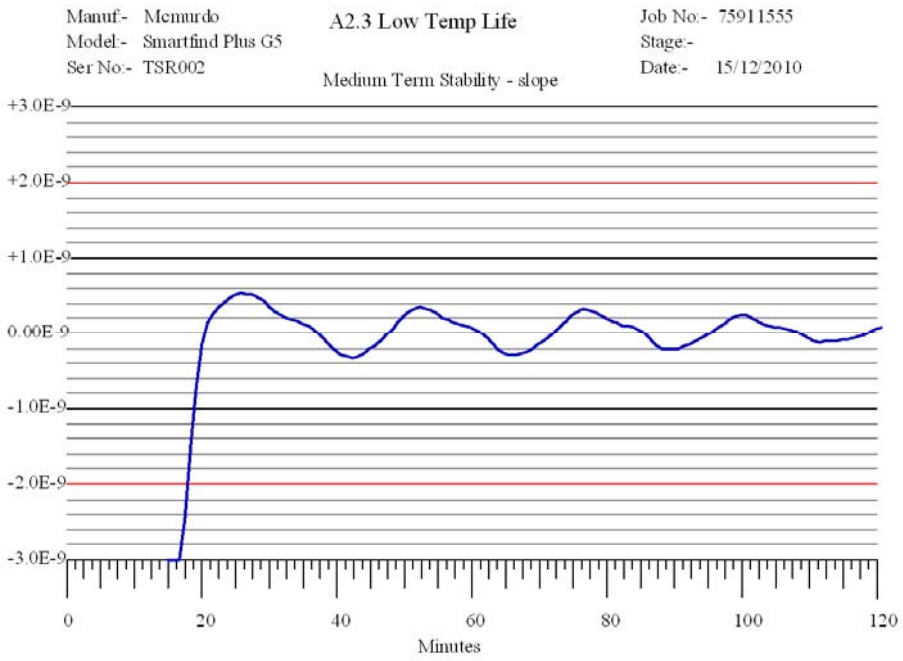
Short Term Stability



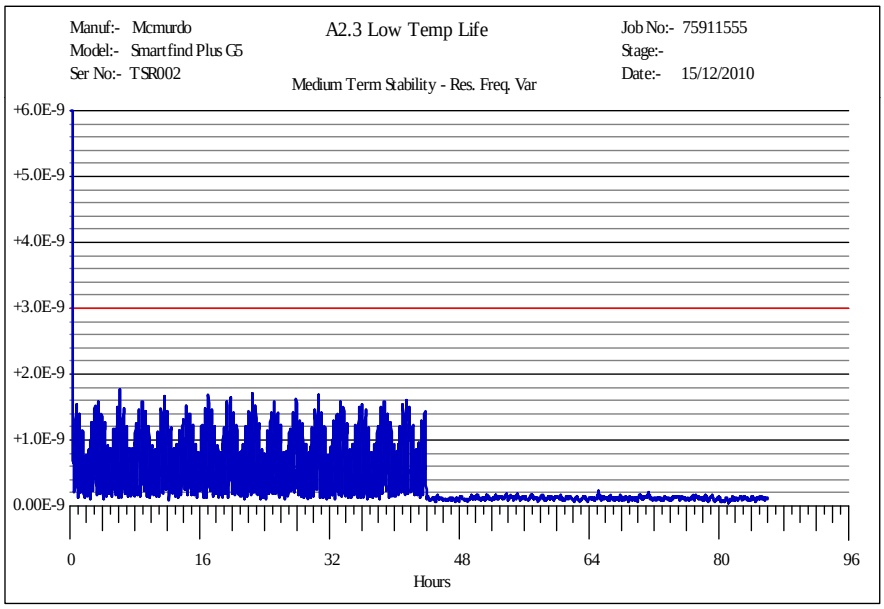
Medium Term Stability, Mean Slope



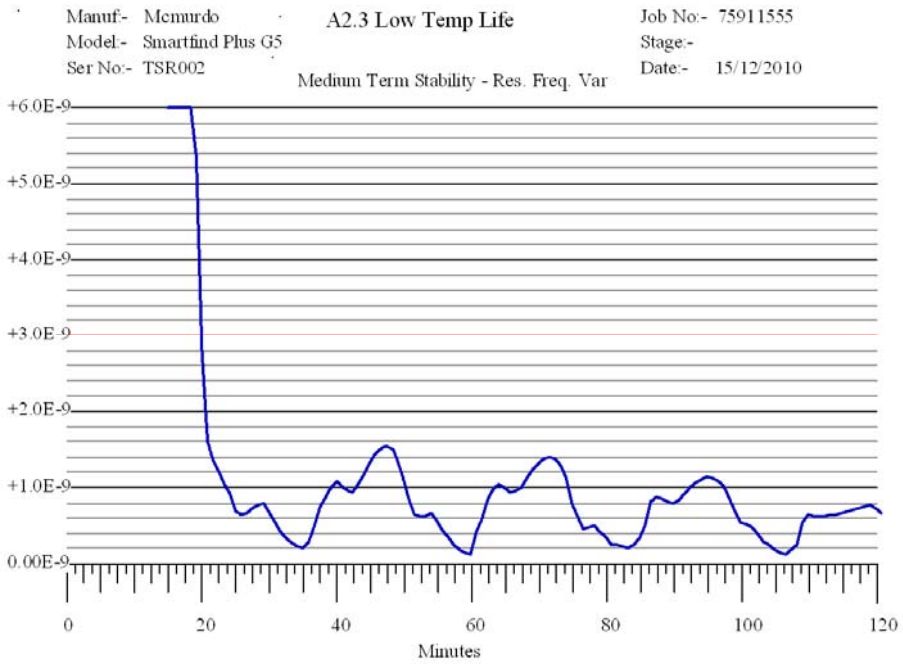
Medium Term Stability, Mean Slope (First 2 Hours)



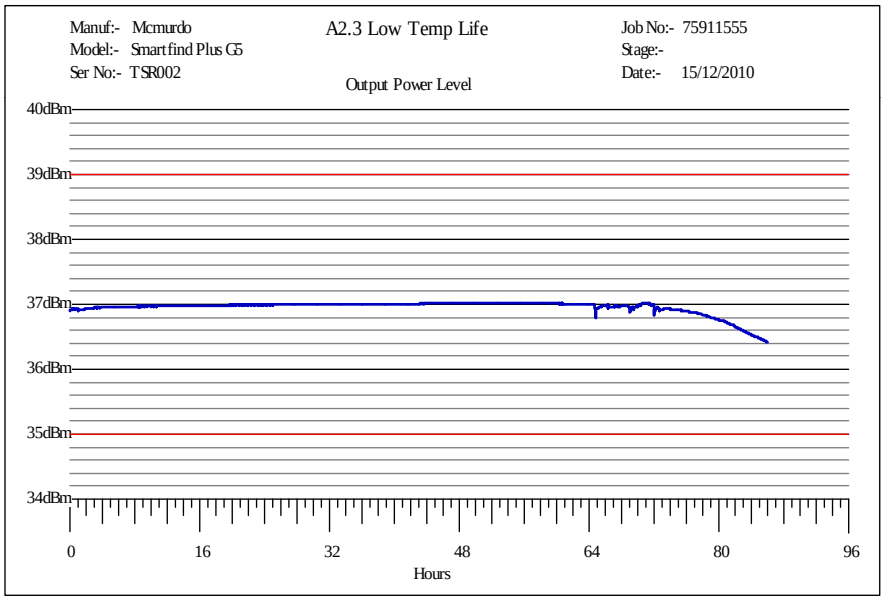
Medium Term Stability, Residual Frequency Variation



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



Output Power



Digital Message

```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 193E0031BF81FE0              193E0031BF81FE0 Default_Id
 30 Hex (Bits 25-144) = 8C9F0018DFC0FF04F9E4379F3C0010

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0001 1001 0011 1110 0000 0000 0011 0001 1011 1111 1000 0001 1111 1110 0000
   1001 1111 0011 1100 1000 0110 1111 0011 1110 0111 1000 0000 0000 0010 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                 Bits
----------        -------    ----- ------                                 ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      201 ALBANIA                        0011 0010 01
Protocol Code      37- 40       15 Test (National)                       1111
Serial Number      41- 58       99                        0000 0000 0001 1000 11
Medium Position    59- 85          DEFAULT     0111 1111 0000 0011 1111 1100 000
BCH Encoded        86-106          Errors=0           1001 1111 0011 1100 1000 0
BCH Generated      86-106                             1001 1111 0011 1100 1000 0
Long Message      107-144          Data Present
Fixed Bits        107-109                                                  110
More Data Flag    110              1 Position Data in bits 113-132            1
Encode Pos Device 111              1 Internal                                 1
121.5 Homing      112              1 YES                                      1
Position Change   113-126            DEFAULT                    1001 1111 0011 11
Resultant Position                --> Not Defined
National Use      127-132          0 Default                           0000 00
BCH Encoded       133-144            Errors=0                    0000 0001 0000
BCH Generated     133-144                                        0000 0001 0000

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

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	(1798720 ms)
Self-test Current	:	8.88 seconds	(8880 ms)
GPS Self-test Current	:	960 seconds	(959920 ms)
Operating Current	:	15 minutes	(899200 ms)

Assumptions / Supplied Data

Battery Replacement Interval	: 8 years
Battery Capacity	: 4.65 Ah
Battery Self Drain	: 1.00 % per year
Self-test Interval	: 12 tests per year
GPS Self-test Interval	: 1.50 tests per year

Test Results

Mode Current	=	Accumulated Charge	/	Time	
Standby Current	=	13108980.4 pC	/	1798720 ms	= 7.29 nA
Self-test Current	=	867400.8 uC	/	8880 ms	= 97.68 mA
GPS Self-test Current	=	39432216.5 uC	/	959920 ms	= 41.08 mA
Operating Current	=	32973874.1 uC	/	899200 ms	= 36.67 mA

Battery Preconditioning / Discharge Time Calculations

Battery Self Drain = Capacity - [(100% - Self Drain/Year%)$^{\text{Replacement Interval}}$ x Capacity]
= 4.65- ((1- 0.0100) ^{8} x 4.65) = 0.3592 Ah

Standby Drain = Hours per year x Battery Replacement Interval x Standby Current
= 365 x 24 x 8 x 7.29 x 10^{-9} = 0.0005 Ah
Worst Case = 1.65 x 0.0005 Ah = 0.0008 Ah

Self-test Drain = Self-tests per battery x Self-test Current x Self-test duration (hrs)
= 12 x 8 x 97.68 x 10^{-3} x (8.88 / 3600) = 0.0231 Ah
Worst Case = 1.65 x 0.0231 Ah = 0.0382 Ah

GPS Self-test Drain = GPS Self-tests per battery x GPS Self-test Current x GPS Self-test duration (hrs)
= 1.5 x 8 x 41.08 x 10^{-3} x (960 / 60) = 0.1314 Ah
Worst Case = 2.65 x 0.1314 Ah = 0.2169 Ah

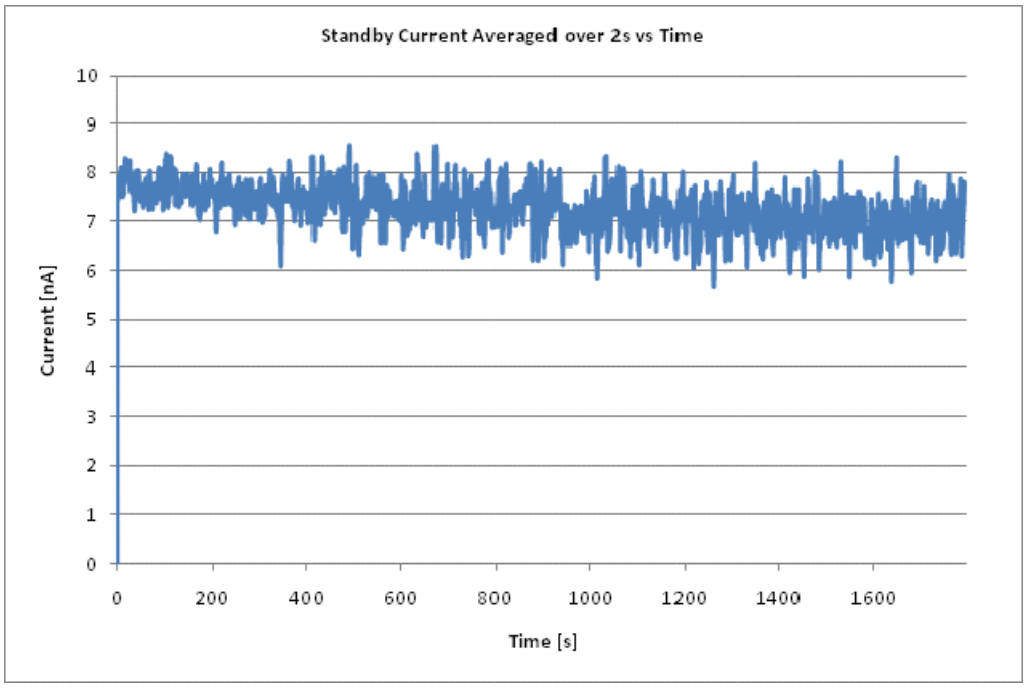
Total Drain = Self Drain + Standby Drain + Self-test Drain + GPS Self-test Drain
= 0.3592 + 0.0008 + 0.0382 + 0.2169 Ah = 0.6151 Ah

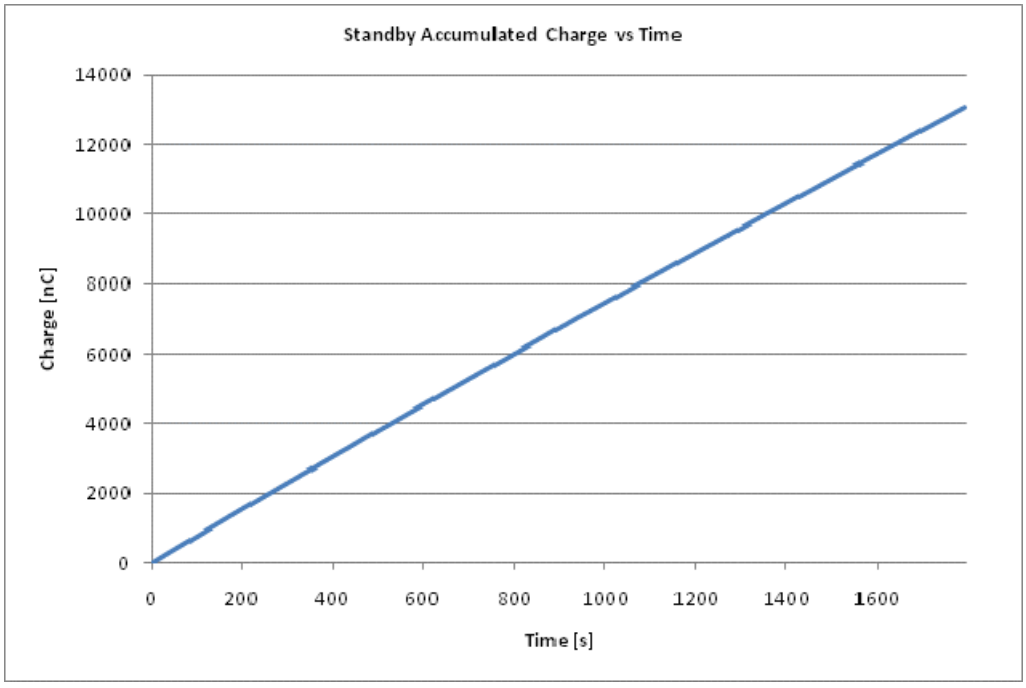
Battery Preconditioning / Discharge Time = Worst Case drain / Operational Current
= 0.6151 / (36.67 x 10^{-3})
= 16.77 hours

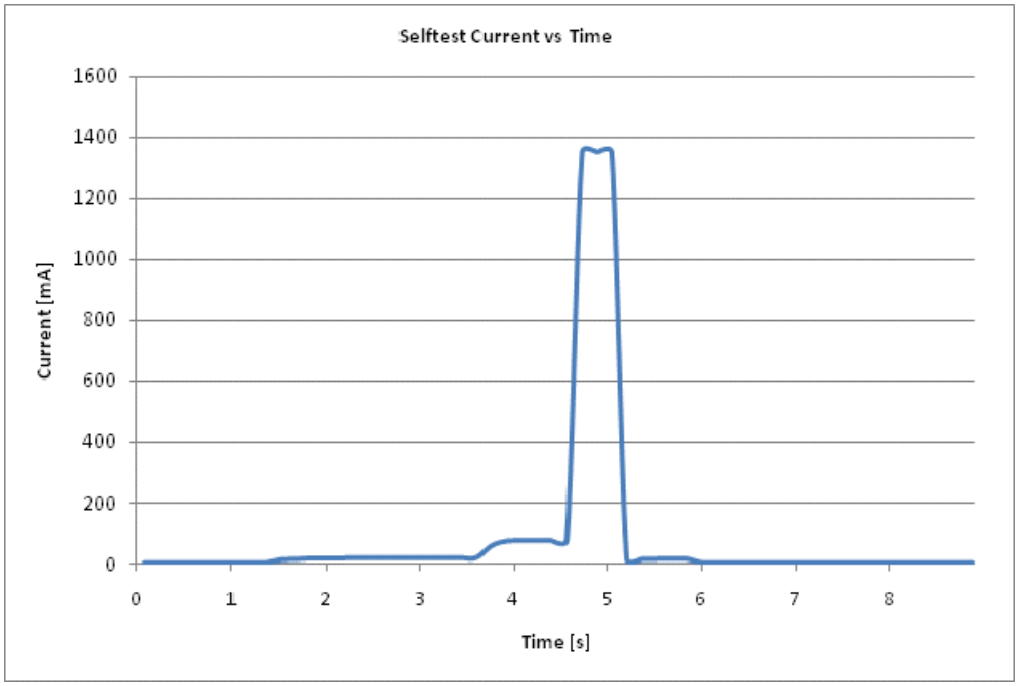
Note: Operating Current Max and Average values taken when GPS receiver switched off to give worst case discharge time.

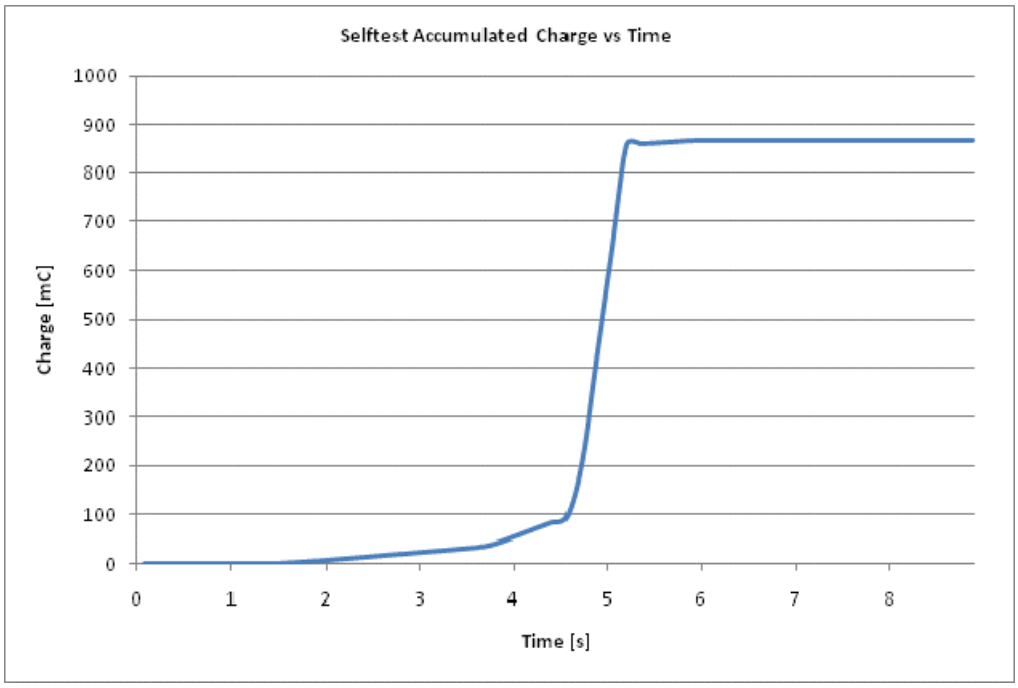
Required discharge was 16.77 hours; actual discharge performed was 17.00 (over test to give worst case result).

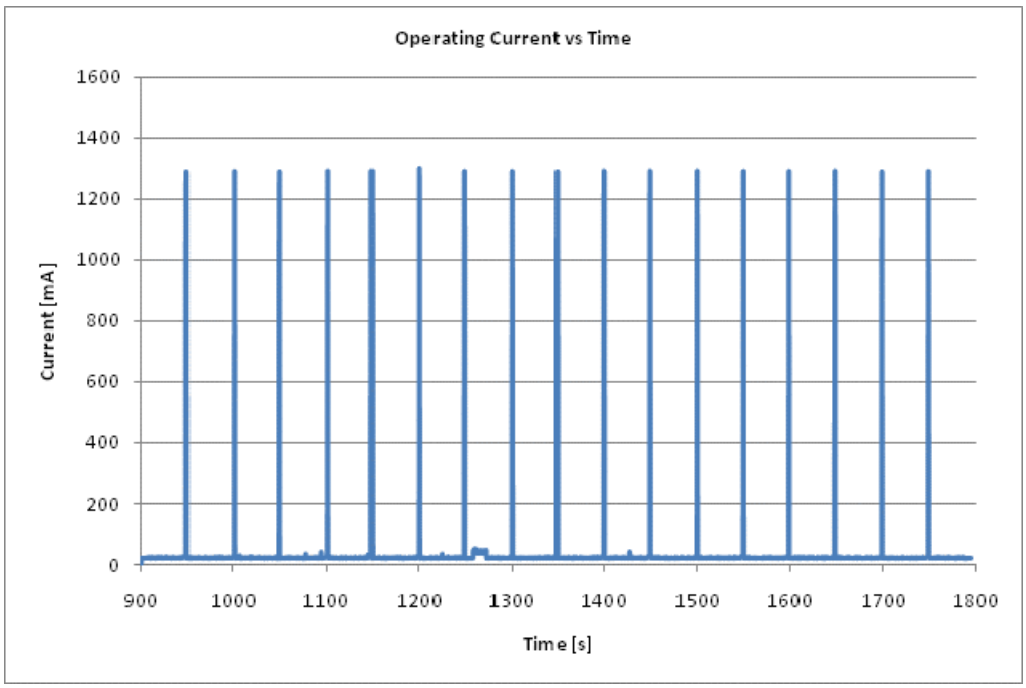
Battery Current Graphs

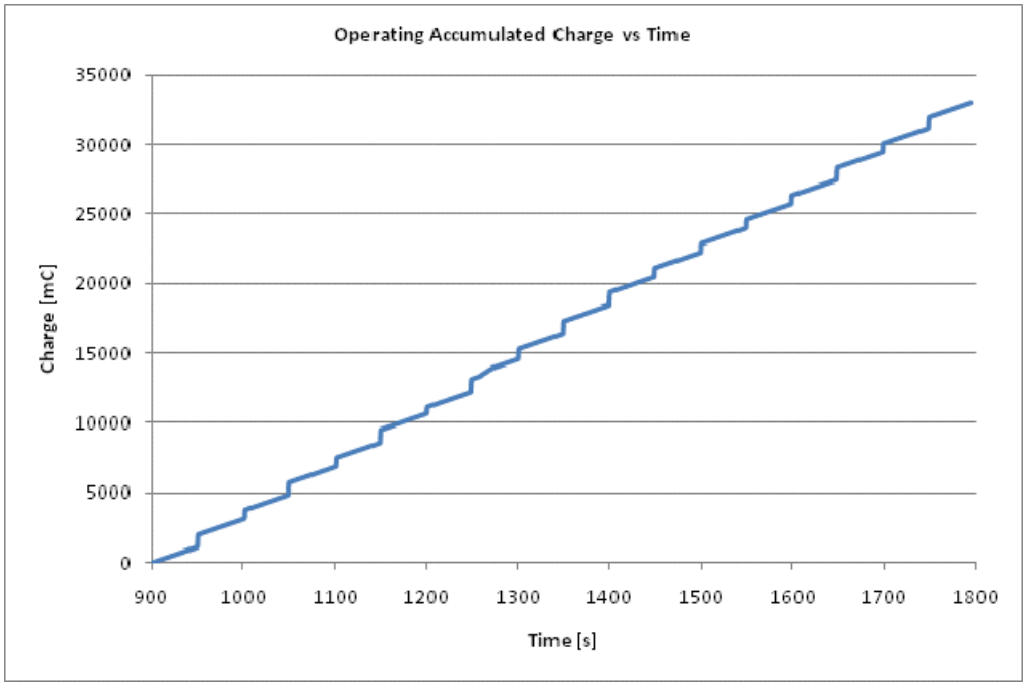





Selftest Current vs Time
Current [mA]
1600
1400
1200
1000
800
600
400
200
0
0
1
2
3
4
5
6
7
8
Time [s]


Selftest Accumulated Charge vs Time
Charge [mC]
1000
900
800
700
600
500
400
300
200
100
0
0
1
2
3
4
5
6
7
8
Time [s]


Operating Current vs Time
Current [mA]
1600
1400
1200
1000
800
600
400
200
0
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
Time [s]


Operating Accumulated Charge vs Time
Charge [mC]
35000
30000
25000
20000
15000
10000
5000
0
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
Time [s]

Beacon Operating Current

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

Beacon Operating Modes	Mode: Manually selectable or Automatic	Measurement Interval	Average Current, mA	Peak Current, mA
406/121 Transmitters Active GPS Receiver cycle (Switch Activation)*	Manual	86 hours	37.80 note 1	Not measured
406/121 Transmitters Active GPS Receiver on (Switch Activation)	Manual	15 mins	52.52	1324.93
406/121 Transmitters Active GPS Receiver off (Switch Activation)	Manual	15 mins	36.67**	1293.35
406/121 Transmitters Active GPS Receiver cycle (Water contact Activation)	Automatic	86 hours	37.20 note 1	Not measured
406/121 Transmitters Active GPS Receiver on (Water contact Activation)	Automatic	15 mins	53.41 note 2	1310.9
406/121 Transmitters Active GPS Receiver off (Water contact Activation)	Automatic	15 mins	35.96	1308.56
Self Test	Manual	9 sec	97.68	1352.99
GNSS Self Test (No GPS Signal Present)	Manual	15 mins	41.08	1678.09
GNSS Self Test (GPS Signal Present)	Manual	15 mins	37.08	1592.72
Standby	Automatic	30 mins	0.007	0.011

At all times the sampling interval was 80 ms nominal.

* Operating modes used during the Battery Discharge procedure and the Operating Lifetime test (subject to GPS Receiver Duty Cycle).

** Operating mode used to calculate battery current discharge time.

Note 1: This is an approximate calculated value over the life test of the beacon, based on customer supplied information regarding the GPS receiver duty cycle. The GPS receiver duty cycle only operates for the first 44 hours of the test (51% of 86 hours) and is only actually active for 14% of that time.

Switch Activation: (52.52mA (GPS On) x 0.14 (% Duty Cycle On)) + (36.67mA (GPS Off) x 0.86 (% Duty Cycle Off)) = 38.89mA

(38.89mA x 0.51 (51% of life duration)) + (36.67mA x 0.49 (49% of life duration)) = **37.80mA (Approximate overall average operating current)**

Water contact Activation: 53.41mA (GPS On) x 0.14 (% Duty Cycle On)) + (35.96mA (GPS Off) x 0.86 (% Duty Cycle Off)) = 38.40mA

(38.40mA x 0.51 (51% of life duration)) + (35.96mA x 0.49 (49% of life duration)) = **37.20mA (Approximate overall average operating current)**

Note 2: The average operating current of this mode appears to be slightly higher than that of the mode selected for the test. However the customer supplied information regarding the duty cycle of the GPS receiver indicates an off time of around 86%. The GPS receiver cycle is also only active for the first 44 hours of operation. For this reason the operating mode with the higher GPS off time was selected.

2.3 TEMPERATURE GRADIENT

2.3.1 Equipment Under Test and Modification State

G5 Smartfind Plus 406 GPS EPIRB S/N: Unique ID: 193DF380C6FFBFF - Modification State 0

2.3.2 Date of Test

06 December 2010

2.3.3 Test Equipment Used

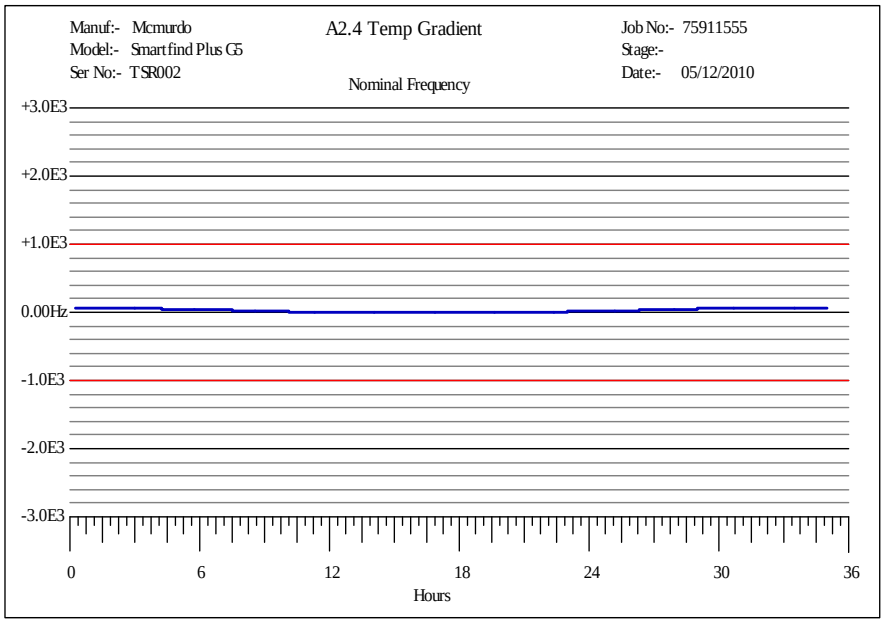
The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.4 Environmental Conditions

Ambient temperature 20 °C
Relative Humidity 25 %

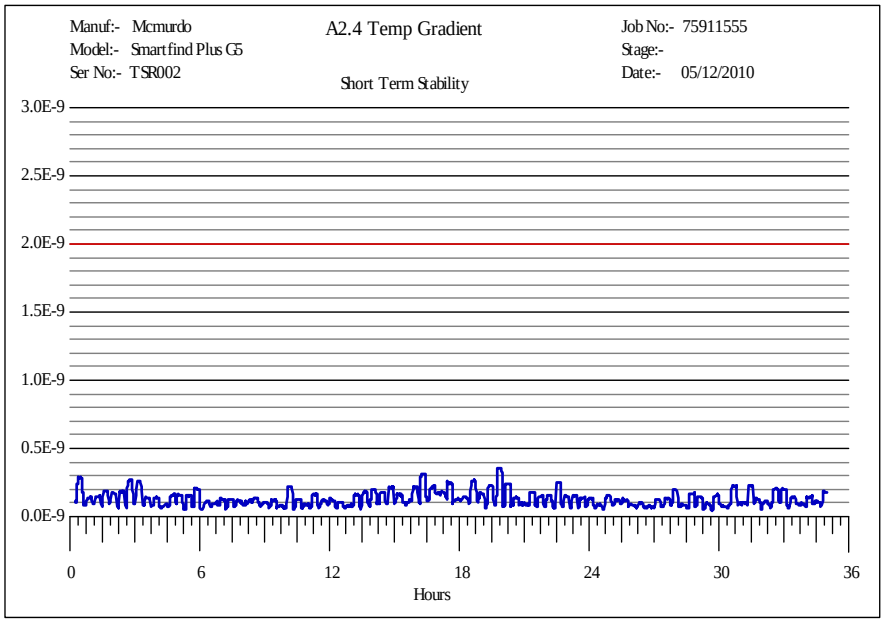
2.3.5 Test Results

Nominal Frequency

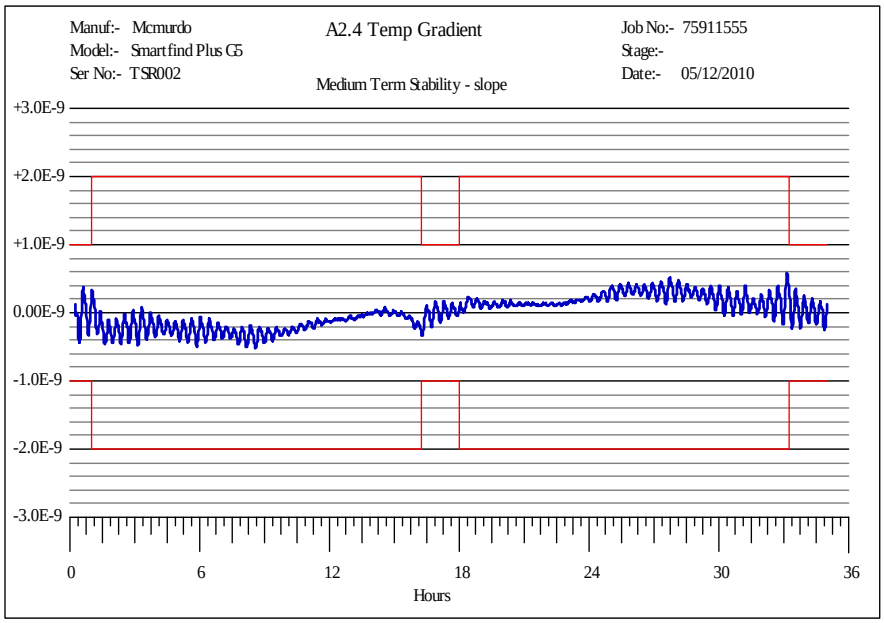


Product Service

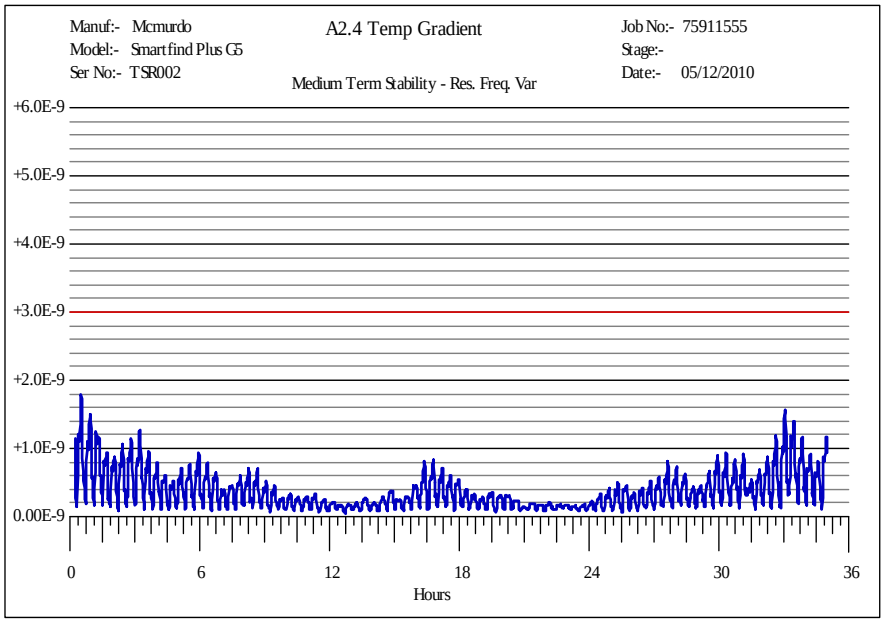
Short Term Stability



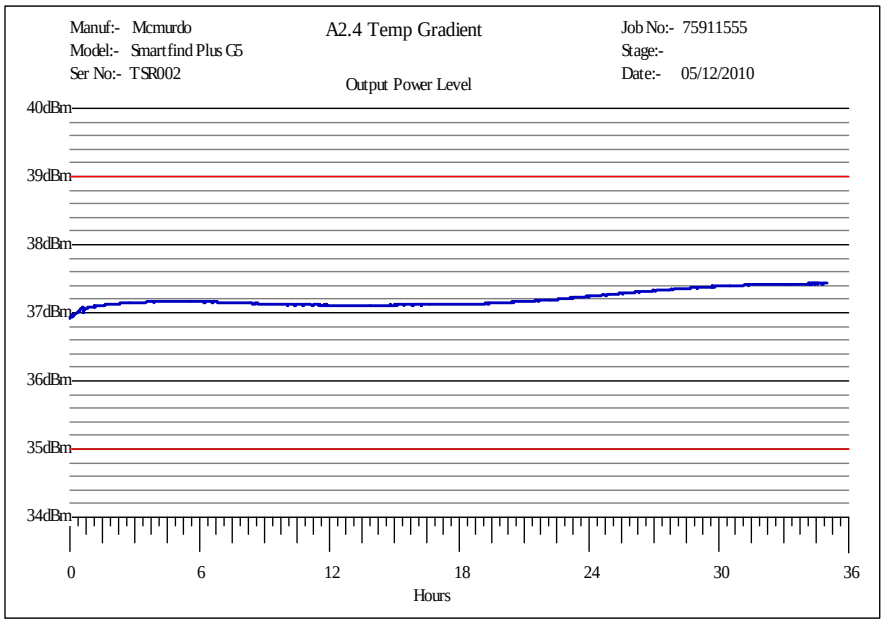
Medium Term Stability, Mean Slope



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) = 193E0031BF81FE0              193E0031BF81FE0 Default_Id
 30 Hex (Bits 25-144) = 8C9F0018DFC0FF04F9E4379F3C0010

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0001 1001 0011 1110 0000 0000 0011 0001 1011 1111 1000 0001 1111 1110 0000
   1001 1111 0011 1100 1000 0110 1111 0011 1110 0111 1000 0000 0000 0010 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      201 ALBANIA                         0011 0010 01
Protocol Code      37- 40       15 Test (National)                       1111
Serial Number      41- 58       99                          0000 0000 0001 1000 11
Medium Position    59- 85          DEFAULT     0111 1111 0000 0011 1111 1100 000
BCH Encoded        86-106          Errors=0           1001 1111 0011 1100 1000 0
BCH Generated      86-106                             1001 1111 0011 1100 1000 0
Long Message      107-144          Data Present
Fixed Bits        107-109                                                  110
More Data Flag    110              1 Position Data in bits 113-132            1
Encode Pos Device 111              1 Internal                                 1
121.5 Homing      112              1 YES                                      1
Position Change   113-126            DEFAULT                    1001 1111 0011 11
Resultant Position                --> Not Defined
National Use      127-132          0 Default                            0000 00
BCH Encoded       133-144            Errors=0                     0000 0001 0000
BCH Generated     133-144                                         0000 0001 0000

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

2.4 SATELLITE QUALITATIVE TESTS

2.4.1 Equipment Under Test and Modification State

G5 Smartfind Plus 406 GPS EPIRB S/N: Unique ID: 193DF380C6FFBFF - Modification State 0

2.4.2 Date of Test

17 and 18 November 2010

2.4.3 Test Equipment Used

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

2.4.4 Environmental Conditions

Ambient temperature 9 - 11 °C
Relative Humidity 58 - 67 %

2.4.5 Test Results

Configuration 5

Test Start: 15:03:35
Test End: 09:50:00
15 Hex ID: 193DF380C6FFBFF

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

Satellite ID	Satellite Pass Number	15 Hex ID Provided by LUT	Doppler Latitude	Doppler Longitude	Mean Rx Power (dBm)	TCA	CTA (deg)	Location Error (km)
S12	9144	193DF 380C6 FFBFF	31.56835	-110.36376	-139.08	21:16:37	-8.611	8529.659
S10	28297	193DF 380C6 FFBFF	33.24585	-102.58011	-133.88	20:46:34	-3.270	7922.753
S11	21156	193DF 380C6 FFBFF	50.81207	-1.16897	-119.26	21:28:59	-6.101	2.137
S9	43643	193DF 380C6 FFBFF	50.83073	-1.19077	-127.75	21:10:04	-11.013	1.480
S9	43642	193DF 380C6 FFBFF	50.82365	-1.19944	-118.27	19:29:49	4.595	0.618
S9	43641	193DF 380C6 FFBFF	50.82113	-1.20445	-123.95	17:50:58	18.182	0.568
S11	21155	193DF 380C6 FFBFF	50.81012	-1.20315	-120.80	19:49:02	9.084	0.971
S8	52337	193DF 380C6 FFBFF	50.83187	-1.18915	-127.69	19:23:17	-9.331	1.639
S7	65048	193DF 380C6 FFBFF	50.83266	-1.19071	-131.43	18:10:43	-20.624	1.685
S8	52336	193DF 380C6 FFBFF	50.83313	-1.20738	-127.56	17:42:29	6.187	1.791
S7	65047	193DF 380C6 FFBFF	50.83518	-1.18779	-127.16	16:29:39	-4.691	2.016
S8	52335	193DF 380C6 FFBFF	50.82961	-1.22228	-131.56	16:03:05	19.331	2.135
S11	21163	193DF 380C6 FFBFF	50.83540	-1.19579	-118.37	09:40:54	-5.514	1.919
S9	43649	193DF 380C6 FFBFF	50.81619	-1.19836	-121.55	07:39:38	-16.294	0.225
S7	65056	193DF 380C6 FFBFF	50.81694	-1.21145	-133.16	07:58:04	20.900	0.966
S8	52344	193DF 380C6 FFBFF	50.80956	-1.21813	-127.27	07:39:46	-2.288	1.717
S7	65055	193DF 380C6 FFBFF	50.80949	-1.20504	-127.36	06:19:38	8.185	1.091
S8	52343	193DF 380C6 FFBFF	50.80701	-1.19911	-133.66	05:58:08	-18.308	1.245
S7	65054	193DF 380C6 FFBFF	50.80582	-1.20526	-127.21	04:39:50	-7.058	1.469
S12	9148	193DF 380C6 FFBFF	50.79959	-1.17272	-126.57	04:30:12	17.702	2.716
S10	28301	193DF 380C6 FFBFF	50.81034	-1.20087	-127.85	04:00:47	9.992	0.897
S12	9147	193DF 380C6 FFBFF	50.80567	-1.20055	-126.90	02:50:27	3.953	1.404
S10	28300	193DF 380C6 FFBFF	50.81043	-1.20968	-128.51	02:20:15	-5.132	1.198
S12	9146	193DF 380C6 FFBFF	50.80239	-1.20472	-129.68	01:09:17	-11.814	1.820

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

$$= \frac{22}{24}$$

$$= 91.7\%$$

Product Service

Configuration 8

Test Start: 14:18:47
Test End: 09:24:16
15 Hex ID: 193DF380C6FFBFF

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

Satellite ID	Satellite Pass Number	15 Hex ID Provided by LUT	Doppler Latitude	Doppler Longitude	Mean Rx Power (dBm)	TCA	CTA (deg)	Location Error (km)
S11	21171	193DF 380C6 FFBFF	50.81472	-1.16269	-121.42	22:49:19	-18.799	2.497
S11	21170	193DF 380C6 FFBFF	50.82707	-1.18519	-126.36	21:08:12	-2.831	1.328
S9	43657	193DF 380C6 FFBFF	50.83359	-1.19596	-126.92	20:46:29	-7.293	1.717
S9	43656	193DF 380C6 FFBFF	50.82578	-1.20534	-119.70	19:06:34	8.009	0.995
S9	43655	193DF 380C6 FFBFF	50.82419	-1.21032	-125.05	17:28:02	20.842	1.102
S9	43654	193DF 380C6 FFBFF	30.76192	-106.44859	-132.10	16:10:37	1.705	8368.362
S11	21169	193DF 380C6 FFBFF	50.82515	-1.20888	-126.76	19:28:32	11.951	1.096
S8	52351	193DF 380C6 FFBFF	50.83155	-1.19484	-126.83	19:11:19	-7.411	1.500
S7	65062	193DF 380C6 FFBFF	50.82762	-1.19055	-128.11	17:46:15	-16.799	1.167
S8	52350	193DF 380C6 FFBFF	50.83412	-1.20966	-127.89	17:30:41	7.920	1.956
S7	65060	193DF 380C6 FFBFF	50.81831	-1.21017	-118.76	14:26:16	13.570	0.866
S8	52349	193DF 380C6 FFBFF	50.82460	-1.23360	-131.76	15:51:27	20.653	2.610
S8	52345	193DF 380C6 FFBFF	50.82175	-1.19839	-122.12	09:19:56	12.421	0.398
S10	28308	193DF 380C6 FFBFF	50.83101	-1.18962	-127.72	15:34:20	-20.423	1.538
S12	9154	193DF 380C6 FFBFF	50.81186	-1.19635	-115.57	14:23:10	-13.494	0.710
S11	21177	193DF 380C6 FFBFF	50.82332	-1.20994	-118.58	09:20:04	-8.814	1.024
S9	43664	193DF 380C6 FFBFF	50.80750	-1.21427	-124.98	08:56:56	-4.063	1.656
S8	52358	193DF 380C6 FFBFF	50.81142	-1.20731	-126.80	07:27:51	-4.162	1.004
S9	43663	193DF 380C6 FFBFF	50.79923	-1.18989	-133.15	07:15:51	-20.001	2.179
S7	65069	193DF 380C6 FFBFF	50.80850	-1.19816	-125.43	05:55:45	4.681	1.076
S7	65068	193DF 380C6 FFBFF	50.81779	-1.19885	-119.10	04:15:36	-10.890	0.084
S8	52357	193DF 380C6 FFBFF	50.77777	-1.14956	-132.05	05:46:02	-20.198	5.627
S12	9162	193DF 380C6 FFBFF	50.80875	-1.20439	-127.33	04:19:59	16.419	1.145
S10	28315	193DF 380C6 FFBFF	50.81053	-1.20345	-125.88	03:50:11	8.477	0.937
S12	9161	193DF 380C6 FFBFF	50.80459	-1.18694	-125.86	02:40:05	2.400	1.693
S10	28314	193DF 380C6 FFBFF	50.81034	-1.20564	-127.24	02:09:30	-6.834	1.030
S12	9160	193DF 380C6 FFBFF	50.80872	-1.20497	-128.87	00:58:45	-13.479	1.165

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

$$= \frac{25}{27}$$

$$= 92.6\%$$

2.5 NAVIGATION SYSTEM

2.5.1 Equipment Under Test and Modification State

G5 Smartfind Plus 406 GPS EPIRB S/N: Unique ID: 193DF380C6FFBFF - Modification State 0

2.5.2 Date of Test

30 November and 01 December 2010

2.5.3 Test Equipment Used

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

2.5.4 Environmental Conditions

Ambient temperature 21.9 - 23 °C
Relative Humidity 18 - 24 %

2.5.5 Test Results

National Protocol

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

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

36 Hex Message	Message Count
FFFE2F8C9F0018DFC0FF04F9E4379F3C0010	36

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

Locations:

A.3.8.2.1:	50°52.121 ' N	1° 14.685'W	①
A.3.8.2.2:	51° 22.583'N	001° 49.833'W	②

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

Configuration as per C/S T.007	C/S T.007 Section A.3.8.2.1		C/S T.007 Section A.3.8.2.2	
	Time to Acquire Position (sec)	Location Error in metres	Time to Acquire Position (sec)	Location Error in metres
Configuration 5	51	31.3	103	49.2
Configuration 7	51	31.3	51	49.2
Configuration 8	51	31.3	51	49.2

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

① GPS Site Survey – Live Location

② Input from GPS simulator

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

Location: N 50° 48.683' W 1° 37.417' ②		
Data Acquired at	10:05:29	FFFE2F8C9F0018CCB1019D9B45F794240FCD
Location: N 51° 22.583' W 1° 49.833' ②		
Data Updated at	10:26:18	FFFE2F8C9F0018CCD701C85E1A37920C0AB2
Data Update Interval	20 min 49 s	

① GPS Site Survey – Live Location

①/② Input from GPS simulator

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

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

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

Location: N 51° 22.583' W 1° 49.833' ①		
Data Acquired at	10:44:59	FFFE2F8C9F0018CCD701C85E1A37920C0AB2
GPS Signal Navigation Data Removed		
Data Updated at	14:44:20	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
Last Valid Position Held	239min 21s	
Return to Default Position	✓	

① Input from GPS simulator

Standard Protocol

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

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

36 Hex Message	Message Count
FFFE2F8C9EF9C0637FDFF83D15B783E0F66C	36

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

Locations:

A.3.8.2.1:	50° 51.121' N	001° 14.685'W	①
A.3.8.2.2:	51° 22.583'N	001° 49.833'W	②

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

Configuration as per C/S T.007	C/S T.007 Section A.3.8.2.1		C/S T.007 Section A.3.8.2.2	
	Time to Acquire Position (sec)	Location Error in metres	Time to Acquire Position (sec)	Location Error in metres
Configuration 5	51	31.3	103	49.8
Configuration 7	51	31.3	51	49.8
Configuration 8	51	31.3	51	49.8

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

① GPS Site Survey – Live Location

② Input from GPS simulator

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

Location: N 50° 48.683' W 1° 37.417'②		
Data Acquired at	09:11:42	FFFE2F8C9EF9C06332E0311EC7778EA76951
Location: N 51° 22.583' W 1° 49.833' ②		
Data Updated at	09:32:31	FFFE2F8C9EF9C06333A0377C1EB71DB3DC73
Data Update Interval	20 min 49 s	

① GPS Site Survey – Live Location

①/② Input from GPS simulator

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

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

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

Location: N 51° 22.583' W 1° 49.833' ①		
Data Acquired at	09:37:15	FFFE2F8C9EF9C06333A03ECA66771DA4D4D0
GPS Signal Navigation Data Removed		
Data Updated at	13:36:37	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
Last Valid Position Held	239min 22s	
Return to Default Position	✓	

① Input from GPS simulator

User Protocol

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

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

36 Hex Message	Message Count
FFFE2FCC9EA000C6007CEF12B86FE0FF0146	36

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

Locations:

A.3.8.2.1:	50° 52.121' N	1° 14.685'W	①
A.3.8.2.2:	51° 22.583'N	1° 49.833'W	②

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

Configuration as per C/S T.007	C/S T.007 Section A.3.8.2.1		C/S T.007 Section A.3.8.2.2	
	Time to Acquire Position (sec)	Location Error in metres	Time to Acquire Position (sec)	Location Error in metres
Configuration 5	51	1554.1	103	3372.7
Configuration 7	51	1554.1	51	3372.7
Configuration 8	51	1554.1	103	3372.7

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

① GPS Site Survey – Live Location

② Input from GPS simulator

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

Location: N 50° 48.683' W 1° 37.417' ②		
Data Acquired at	10:33:26	FFFE2FCC9EA000C6007CEF12B8665901967F
Location: N 51° 22.583' W 1° 49.833' ②		
Data Updated at	10:54:15	FFFE2FCC9EA000C6007CEF12B8666D01C026
Data Update Interval	20 min 49 s	

① GPS Site Survey – Live Location

② Input from GPS simulator

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

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

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

Location: N 51° 22.583' W 1° 49.833' ①		
Data Acquired at	10:29:11	FFFE2FCC9EA000C6007CEF12B8666D01D51F
GPS Signal Navigation Data Removed		
Data Updated at	14:28:34	FFFE2FCC9EA000C6007CEF12B86FE0FF0146
Last Valid Position Held	239min 23s	
Return to Default Position	✓	

① Input from GPS simulator

2.6 GNSS SELF-TEST MODE

2.6.1 Equipment Under Test and Modification State

G5 Smartfind Plus 406 GPS EPIRB S/N: Unique ID: 193DF380C6FFBFF - Modification State 0

2.6.2 Date of Test

09 March 2011

2.6.3 Test Equipment Used

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

2.6.4 Environmental Conditions

Ambient Temperature 22.4 - 23.4 °C
Relative Humidity 30 %

2.6.5 Test Results

Ambient Temperature

```
--> begin run time 03/01/11 15:03:58.
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 193E00319968028              193E0031BF81FE0 Default_Id
 30 Hex (Bits 25-144) = 8C9F0018CCB40141A89977000C09BD

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0001 1001 0011 1110 0000 0000 0011 0001 1001 1001 0110 1000 0000 0010 1000
   0011 0101 0001 0011 0010 1110 1110 0000 0000 0001 1000 0001 0011 0111 101
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      201 ALBANIA                          0011 0010 01
Protocol Code      37- 40       15 Test (National)                        1111
Serial Number      41- 58       99                          0000 0000 0001 1000 11
Medium Position    59- 85          Data Present
Latitude Flag      59            0 North:                                    0
Latitude Degrees   60- 66       50  50 deg                            0110 010
Lat. Minutes /2    67- 71       26  52 min                              1101 0
Longitude Flag     72            0 East:                                     0
Long. Degrees      73- 80        1   1 deg                           0000 0001
Long. Minutes /2   81- 85        8  16 min                             0100 0
BCH Encoded        86-106          Errors=0           0011 0101 0001 0011 0010 1
BCH Generated      86-106                             0011 0101 0001 0011 0010 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                 110
More Data Flag    110           1 Position Data in bits 113-132             1
Encode Pos Device 111           1 Internal                                  1
121.5 Homing      112           1 YES                                       1
Position Change   113-126         Data Present
Lat. Change Sign  113           0 Minus:                                    0
Lat. Chg. Minutes 114-115       0  0 min                                   00
Lat. Chg. Secs /4 116-119       0  0 sec                                 0000
Long Change Sign  120           0 Minus:                                    0
Long Chg. Minutes 121-122       0  0 min                                   00
Long Chg. Secs /4 123-126       3 12 sec                                 0011
Resultant Position            -->  50.86666 LAT,    1.26333 LONG
                   50 deg 52 min  0 sec N,    1 deg 15 min 48 sec E
National Use      127-132       0 Default                             0000 00
BCH Encoded       133-144         Errors=0                      1001 1011 1101
BCH Generated     133-144                                       1001 1011 1101

================================================================================

--> end run time 03/01/11 15:06:20.

Position Error = 31.5m
```

Low Temperature

```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 193E00319968028              193E0031BF81FE0 Default_Id
 30 Hex (Bits 25-144) = 8C9F0018CCB40141A89977000C09BD

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0001 1001 0011 1110 0000 0000 0011 0001 1001 1001 0110 1000 0000 0010 1000
   0011 0101 0001 0011 0010 1110 1110 0000 0000 0001 1000 0001 0011 0111 101
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            1 Long Message                              1
Protocol Flag      26            0 Location NEW                              0
MID                27- 36      201 ALBANIA                          0011 0010 01
Protocol Code      37- 40       15 Test (National)                        1111
Serial Number      41- 58       99                         0000 0000 0001 1000 11
Medium Position    59- 85          Data Present
Latitude Flag      59            0 North:                                    0
Latitude Degrees   60- 66       50  50 deg                           0110 010
Lat. Minutes /2    67- 71       26  52 min                             1101 0
Longitude Flag     72            0 East:                                     0
Long. Degrees      73- 80        1   1 deg                          0000 0001
Long. Minutes /2   81- 85        8  16 min                             0100 0
BCH Encoded        86-106          Errors=0           0011 0101 0001 0011 0010 1
BCH Generated      86-106                             0011 0101 0001 0011 0010 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                                  110
More Data Flag    110           1 Position Data in bits 113-132              1
Encode Pos Device 111           1 Internal                                   1
121.5 Homing      112           1 YES                                        1
Position Change   113-126         Data Present
Lat. Change Sign  113           0 Minus:                                    0
Lat. Chg. Minutes 114-115       0  0 min                                   00
Lat. Chg. Secs /4 116-119       0  0 sec                                 0000
Long Change Sign  120           0 Minus:                                    0
Long Chg. Minutes 121-122       0  0 min                                   00
Long Chg. Secs /4 123-126       3 12 sec                                 0011
Resultant Position            -->  50.86666 LAT,    1.26333 LONG
                   50 deg 52 min  0 sec N,    1 deg 15 min 48 sec E
National Use      127-132       0 Default                           0000 00
BCH Encoded       133-144         Errors=0                     1001 1011 1101
BCH Generated     133-144                                      1001 1011 1101

================================================================================


Position Error = 31.49m
```

High Temperature

```
================================================================================
 Beacon Id Format......... 30 Hex Id, Long Message, Bits 25-144
 15 Hex (Bits 26- 85) = 193E00319968028              193E0031BF81FE0 Default_Id
 30 Hex (Bits 25-144) = 8C9F0018CCB40141A89977000C09BD

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 1 0001 1001 0011 1110 0000 0000 0011 0001 1001 1001 0110 1000 0000 0010 1000
   0011 0101 0001 0011 0010 1110 1110 0000 0000 0001 1000 0001 0011 0111 101
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                 Bits
----------        -------    ----- ------                                 ----
Format Flag        25            1 Long Message                             1
Protocol Flag      26            0 Location NEW                             0
MID                27- 36      201 ALBANIA                        0011 0010 01
Protocol Code      37- 40       15 Test (National)                       1111
Serial Number      41- 58       99                        0000 0000 0001 1000 11
Medium Position    59- 85          Data Present
Latitude Flag      59            0 North:                                   0
Latitude Degrees   60- 66       50  50 deg                          0110 010
Lat. Minutes /2    67- 71       26  52 min                            1101 0
Longitude Flag     72            0 East:                                    0
Long. Degrees      73- 80        1   1 deg                         0000 0001
Long. Minutes /2   81- 85        8  16 min                           0100 0
BCH Encoded        86-106          Errors=0           0011 0101 0001 0011 0010 1
BCH Generated      86-106                             0011 0101 0001 0011 0010 1
Long Message      107-144          Data Present
Fixed Bits        107-109                                               110
More Data Flag    110           1 Position Data in bits 113-132             1
Encode Pos Device 111           1 Internal                                  1
121.5 Homing      112           1 YES                                       1
Position Change   113-126         Data Present
Lat. Change Sign  113           0 Minus:                                    0
Lat. Chg. Minutes 114-115       0  0 min                                   00
Lat. Chg. Secs /4 116-119       0  0 sec                                 0000
Long Change Sign  120           0 Minus:                                    0
Long Chg. Minutes 121-122       0  0 min                                   00
Long Chg. Secs /4 123-126       3 12 sec                                 0011
Resultant Position            -->  50.86666 LAT,    1.26333 LONG
                   50 deg 52 min  0 sec N,    1 deg 15 min 48 sec E
National Use      127-132       0 Default                          0000 00
BCH Encoded       133-144         Errors=0                  1001 1011 1101
BCH Generated     133-144                                   1001 1011 1101

================================================================================


Position Error = 31.49m
```

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
Beacons - Constant Temperature Tests					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Power Meter	Hewlett Packard	436A	83	12	17-Aug-2011
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	17-Feb-2011
Beacon RF Unit	TUV	N/A	3066	-	TU
Termination (50ohm, 0.5W)	Hewlett Packard	HP11593A	3086	-	TU
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	23-Jun-2011
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	13-Aug-2011
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	8-Nov-2011
ScopeCorder	Yokogawa	DL750 701210	3254	12	8-Nov-2011
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	20-Apr-2011
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3355	12	20-Apr-2011
Section 2.1 Beacons - Thermal Shock					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Power Meter	Hewlett Packard	436A	83	12	17-Aug-2011
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	17-Feb-2011
Beacon RF Unit	TUV	N/A	3066	-	TU
Termination (50ohm, 0.5W)	Hewlett Packard	HP11593A	3086	-	TU
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	23-Jun-2011
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	13-Aug-2011
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	8-Nov-2011
ScopeCorder	Yokogawa	DL750 701210	3254	12	8-Nov-2011
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	20-Apr-2011
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3355	12	20-Apr-2011

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.2 Beacons - Operating Lifetime					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Power Meter	Hewlett Packard	436A	83	12	17-Aug-2011
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	17-Feb-2011
Beacon RF Unit	TUV	N/A	3066	-	TU
Hygrometer	Rotronic	I-1000	3068	12	10-Jul-2011
Termination (50ohm, 0.5W)	Hewlett Packard	HP11593A	3086	-	TU
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	10-Jun-2011
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	23-Jun-2011
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	13-Aug-2011
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	8-Nov-2011
ScopeCorder	Yokogawa	DL750 701210	3254	12	8-Nov-2011
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3355	12	20-Apr-2011
Section 2.3 Beacons - Temperature Gradient					
Power Meter	Hewlett Packard	436A	83	12	17-Aug-2011
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	17-Feb-2011
Beacon RF Unit	TUV	N/A	3066	-	TU
Termination (50ohm, 0.5W)	Hewlett Packard	HP11593A	3086	-	TU
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	23-Jun-2011
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	13-Aug-2011
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	8-Nov-2011
ScopeCorder	Yokogawa	DL750 701210	3254	12	8-Nov-2011
Power Sensor	Agilent	8482A	3289	12	8-Dec-2011
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	20-Apr-2011
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	20-Apr-2011
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3355	12	20-Apr-2011
Section 2.5 Beacons - Navigation System					
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Hygrometer	Rotronic	I-1000	3068	12	10-Jul-2011
Beacon Tester	WS Technologies	BT100S	3263	-	TU
Timer	Radio Spares	427-590	3282	-	TU
Copper GRP	TUV	27cm Diameter	3538	-	TU

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.6 Beacons – GNSS Self Test					
Hygrometer	Rotronic	I-1000	3068	12	10-Jul-2011
Beacon Tester	WS Technologies	BT 100S	87	-	TU
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU

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

SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

Radiated Configuration – Front View

Radiated Configuration – Rear View

Conducted Configuration – Front View

Conducted Configuration – Rear View

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

INTERIM TCXO PROCEDURE

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

Two data sets, Temperature Gradient Test Data (see section 2.3) and TCXO Manufacturer Data (file reference "E5344 Date Code JG Serial Number 6188.xlsx"), were combined and 'synchronised' based on time into the Temperature Gradient profile.

Data synchronised was:

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

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

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

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

The individual data pair matching and the following calculations can be found in the supporting Document 75911555 Spreadsheet CS IP TCXO Rev 1 Spreadsheet.xlsx.

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

1. Residual Component of the Medium-Term Frequency Stability

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

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

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

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

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

Total discards for this test was 1051 (41.9%).

The maximum was chosen:

$$\text{Maximum } R_{\text{beacon}} = 1.712 \times 10^{-9}$$

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

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

$$R_{\mathrm{beacon\_max}} = \sqrt{(1.712 \times 10^{-9})^2 + (2.0 \times 10^{-9})^2}$$

$$R_{\mathrm{beacon\_max}} = \sqrt{(2.929 \times 10^{-18}) + (4.0 \times 10^{-18})}$$

$$R_{\mathrm{beacon\_max}} = \sqrt{6.929 \times 10^{-18}}$$

$$R_{\mathrm{beacon\_max}} = 2.632 \times 10^{-9}$$

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

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

$$R_{\mathrm{beacon\_5year\_max}} = 2.632 \times 10^{-9} + 0.2 \times 10^{-9}$$

$$R_{\mathrm{beacon\_5year\_max}} = 2.832 \times 10^{-9}$$

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

2. Positive and Negative Slopes

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

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

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

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

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

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

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

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

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

Method A:

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

Total discards for this method was 27 (1.1%).

Method B:

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

Total discards for this test was 993 (39.5%).

The maximum was chosen:

Method A:

$$\text{Maximum } S_{\text{beacon}} = 3.756 \times 10^{-10}$$

Method B:

$$\text{Maximum } S_{\text{beacon}} = 2.644 \times 10^{-10}$$

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

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

Method A:

$$S_{\mathrm{beacon\_max}} = \sqrt{(3.756 \times 10^{-10})^2 + (0.7 \times 10^{-9})^2}$$

$$S_{\mathrm{beacon\_max}} = \sqrt{(1.411 \times 10^{-19}) + (0.49 \times 10^{-18})}$$

$$S_{\mathrm{beacon\_max}} = \sqrt{6.311 \times 10^{-19}}$$

$$S_{\mathrm{beacon\_max}} = 7.944 \times 10^{-10}$$

Method B:

$$S_{\mathrm{beacon\_max}} = 7.490 \times 10^{-10}$$

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

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

Slope Summary Table – Method A:

All Values in min^{-1}	S_{beacon}	S_{osc_max}	S_{beacon_max}	Cospas-Sarsat performance requirement
Positive Slope Static Temp	$3.756x10^{-10}$	$+0.7x10^{-9}$	$7.944x10^{-10}$	$1.0x10^{-9}$
Positive Slope Gradient Temp	$5.445x10^{-10}$	$+1.7x10^{-9}$	$1.785x10^{-9}$	$2.0x10^{-9}$
Negative Slope Static Temp	$-[4.460x10^{-10}]$	$-0.7x10^{-9}$	$-[8.300x10^{-10}]$	$-1.0x10^{-9}$
Negative Slope Gradient Temp	$-[5.237x10^{-10}]$	$-1.7x10^{-9}$	$-[1.779x10^{-9}]$	$-2.0x10^{-9}$

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

Slope Summary Table – Method B:

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

All Values in min^{-1}	S_{beacon}	S_{osc_max}	S_{beacon_max}	Cospas-Sarsat performance requirement
Positive Slope Static Temp	$2.664x10^{-10*}$	$+0.7x10^{-9}$	$7.490x10^{-10*}$	$1.0x10^{-9}$
Positive Slope Gradient Temp	$5.445x10^{-10}$	$+1.7x10^{-9}$	$1.785x10^{-9}$	$2.0x10^{-9}$
Negative Slope Static Temp	$-[3.818x10^{-10}]$*	$-0.7x10^{-9}$	$-[7.974x10^{-10}]$*	$-1.0x10^{-9}$
Negative Slope Gradient Temp	$-[5.237x10^{-10}]$	$-1.7x10^{-9}$	$-[1.779x10^{-9}]$	$-2.0x10^{-9}$

ANNEX B

CUSTOMER SUPPLIED INFORMATION

mcmurdo
EMERGENCY LOCATION BEACONS

Statement on protection against beacon degradation due to internal navigation device failure

The internal GPS navigation device is an NEO-6M 50-channel module made by uBlox in the Switzerland.

Software protection:

The positional data is sent from the GPS module in serial NMEA format. This data is checked for validity by examining the message field quality bit and calculated HDOP (Horizontal dilution of precision) figure. The quality bit is calculated by the GPS module to determine the quality of the position fix and requires three or more satellites with good signal to noise ratios. The HDOP figure is calculated from the relative geometry of the satellites used to determine the position fix. The smaller the figure the better the positional accuracy. The software rejects position fixes with a HDOP figure greater than 20. This figure being derived from extensive trials work.

With these checks in place it is considered unlikely that false position data could be encoded in the 406MHz message.

If no valid GPS data is available, the beacon will revert to transmitting default position data.

Hardware protection:

The serial NMEA data is input to the micro-controller, this input is only connected to the GPS module. If the uBlox GPS module fails in such a way to output incorrect logic levels, this input is protected by diodes from excessive voltage on the input. A fault on the NMEA line will not inhibit normal operation of the beacon.

The GPS module is not continuously powered in order to comply with the maximum positional update rate defined in C/S T.001. Hence in any one hour, at least 64 406MHz transmissions are made with the GPS module in-active.

The GPS module is supplied by P-channel logic level FET, which is enabled or disabled by a discrete control line from the microprocessor.

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