
REPORT ON

Testing of the McMurdo G5/E5 Smartfind Plus 406MHz EPIRB
in accordance with RTCM Paper 77 – 2002 / SC110-STD

COMMERCIAL-IN-CONFIDENCE

Report No RM614667/04 Issue 3

October 2006



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October 2006

PREPARED FOR

McMurdo Limited
Silverpoint
Airport Service Road
Hilsea
PO3 5PB

PREPARED BY



K W Adsetts
Project Manager

APPROVED BY



M Jenkins
Authorised Signatory

DATED

25th October 2006



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SECTION 1

REPORT SUMMARY

Testing of the McMurdo G5/E5 Smartfind Plus 406MHz EPIRB
in accordance with RCTM Paper 77 – 2002 / SC110-STD

1.1 STATUS

Name and Address of Client	McMurdo Limited Silverpoint Airport Service Road Hilsea PO3 5PB
Model Number	G5/E5 Smartfind Plus 406MHz EPIRB
Serial Number	9D1CD34D34D74D1
Test Specification/Issue/Date	RCTM Paper 77 – 2002 / SC110-STD
Number of Items Tested	One
Security Classification of EUT	Unclassified
Incoming Release Date	Application Form 1 st February 2006
Order Number Date	PC0001813 31 st August 2005
Start of Test	16 th February 2006
Finish of Test	21 st October 2006

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out to EN 50121-3-2 is shown below.

Section	RTCM Clause	Details	Result
-	-	Table of Test Results	
2.1	A1.0	Initial Aliveness test	Pass
2.2	A3.0	Dry Heat Cycle	Pass
2.3	A4.0	Damp Heat Cycle	Pass
2.4	A5.0	Vibration Test	Pass
2.5	A6.0	Bump Test	Pass
2.6	A7.0	Salt Fog Test	Pass
2.7A	A8.1	Drop Test (onto hard surface)	Pass
2.7B	A8.2	Drop Test (into water, 20 metres)	Pass
2.8	A9.0	Leakage and Immersion Tests	Pass
2.9	A10.0	Spurious Emissions Test	Pass
2.10	A11.0	Thermal Shock Test	Pass
2.11	A12.0	COSPAS-SARSAT TYPE APPROVAL TO T.007	Pass
2.12	A13.1	Operational Life Test	Pass
2.13	A13.2	Strobe Light Test	Pass
2.14	A 13.3	Self Test	Pass
2.15	A14.0	Automatic Release Mechanism Test	Pass
2.16	A15.0	Stability and Buoyancy	Pass
2.17	A16.0	Inadvertent Activation Test	Pass
2.18	A17.0	Auxiliary Radio-Locating Device Transmitter Test	Pass
2.19	A18.0	Humidity Test	N/A
2.20	A19.0	Orientation Test	Pass

1.3 APPLICATION FORM**1.3.1 Applicant Details**

Company Name McMurdo Limited

Address Silver Point
Airport Service Road
Portsmouth
Hilsea
PO3 5PB
United Kingdom

Category of Applicant ☒ Manufacturer ☐ Importer
 ☐ Distributor ☐ Agent

Contact Name Neil Jordan Telephone 02392 623934
Email neiljordan@mcmurdo.co.uk Fax 02392 623997

1.3.2 Manufacturer Details

Company Name Same as above

Address

Contact Name Telephone
Email Fax

1.3 APPLICATION FORM

1.3.3 Beacon Details

Beacon Model: G5/E5 Smartfind Plus 406MHz EPIRB

Name & Location of Test Facility: BABT, Hampshire, United Kingdom

Beacon Type: ☐ Aviation ☐ Land ☒ Maritime

Operating Temperature Range: ☐ Class 1: -40°C to +55°C ☒ Class 2: -20°C to +55°C

Specified Operating Lifetime: ☐ 24 hrs ☒ 48 hrs ☐ Other [hrs]

Beacon Battery Type:

Chemistry: Lithium Manganese Dioxide
 Manufacturer & Model No: Varta CR2/3 AH
 Size & number of cells: 3 x 3 2/3AH
 Voltage: 9V nominal 6.4V end-point

Beacon Oscillator:

Type: TCXO
 Manufacturer & Model No: CMAC E3279

Ancillary Devices & Features

	No	Yes	Details
Self Test Mode:	☐	☒	See in Self Test Characteristics below
Auxiliary Radio-Locating Device:	☐	☒	Frequency: 121.5 MHz Power: 17 dBm for 48 hours Tx. Duty Cycle: Continuous
Encoded Position Data:	☐	☒	Nav. Device: Internal Type: GPS Manufacturer: EAZIX Model: EZGPM01
Long Message (144 bits):	☐	☒	
Short Message (112 bits):	☐	☐	
Automatic Activation:	☐	☒	
Strobe Light:	☐	☒	Intensity: >0.75cd Flash Rate 21 flashes per minute
Voice Communications (PTT):	☒	☐	
Other:	☒	☐	Specify:

Protocols Supported:

User Location Protocol	☐	☒
Standard Location Protocol	☐	☒
Standard Short Location Protocol	☒	☐
National Location Protocol	☐	☒
National Short Location Protocol	☒	☐

1.3 APPLICATION FORM

1.3.3 Beacon Details

Self Test Characteristics

	Yes	No
Does self-test have a separate switch positions?	[☒]	[]
Does self-test switch automatically return to normal position when released?	[☒]	[]
If not, how long until the first 'distress' message is emitted?		
Does self-test transmit a 406MHz signal?	[☒]	[]
Unmodulated signal only?	[]	[☒]
Normal data, but with inverted frame synchronisation pattern?	[☒]	[]
1 burst only?	[☒]	[]
Does self-test transmit a 121.5MHz signal?	[☒]	[]
For less than 1 second?	[]	[☒]
Continually while self-test is activated?	[]	[☒]
☒ Other period (specify): 15		
Does self-test transmit on any other frequency (e.g. 243MHz)	[]	[☒]
Result of self test is indicated by:		
Pass fail indicator light	[☒]	[]
Strobe light flash	[☒]	[]
[] Other (specify):		
Can the self-test be performed without removing the beacon from mounting bracket?	[☒]	[]
What parameters are internally tested by the self-test?		
Battery voltage	[☒]	[]
RF power at 406MHz	[☒]	[]
RF power at 121.5MHz	[☒]	[]
Approximate RF frequency	[]	[☒]
Phase locked loop	[☒]	[]
[] Other (specify):		
Number of self tests per year	[12	]
Duration of self test	[9 seconds	]
Do the above characteristics apply for all countries where beacon sold?	[☒]	[]
If No, please specify:		
Do the above characteristics apply for all production serial numbers?	[☒]	[]
If No, please specify:		
<u>Battery Data</u>		
Battery replacement interval	[6 years	]
Battery capacity	[3.06 Ah	]
Battery self drain (i.e. when the battery is stored out of the beacon)	[1% per yr	]

1.3 APPLICATION FORM

1.3.4 Declaration of Build Status

Hardware Version: Issue C

Software Version: 1.2.186

1.3.5 Declarations

	Yes	No
Are the equipments submitted representative production models?	☒	☐
If No re the equipments pre-production models?	☐	☐
If pre-production, will final equipments be identical in ALL respects?	☒	☐
If No supply full details:		
Is the Test report to be used as part of a Cospas-Sarsat Type Approval Application?	☒	☐
If Yes, has the product, any direct engineering predecessor, or variant ever been granted Type Approval in any EEC member country?	☐	☒
If Yes, supply full details:		
Will the labeling of the equipment comply with the requirements of C/S T.007 Issue 4?	☒	☐
ITU Class of Emission: 121.5MHz = 3K20A3X 406.028MHz = 16K0G1D		

1.3.6 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: (when not emailing)
Name:


 Neil Jordan

Position Held: Electronics Engineer

Date: 1st June 2006

1.4 MODIFICATIONS

No modifications were made to the test sample during testing.

1.5 REPORT MODIFICATION RECORD

Issue 1 – First Issue

Issue 2 – Additional Testing added: Section 2.6: Salt Fog Test;
Section 2.18.7: Frequency Coherence
Test Certificate Hydrostatic Release (Annex A A.8)

Issue 3 – Section 2.18.7: Correction to Table

SECTION 2

TEST DETAILS

Testing of the McMurdo G5/E5 Smartfind Plus 406MHz EPIRB
in accordance with RCTM Paper 77 – 2002 / SC110-STD



TABLE OF TEST RESULTS

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} (-20°C)	T _{amb} (+23°C)	T _{max} (+55°C)	
1. INITIAL ALIVENESS TEST (A 1.0)						Section 2.1
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz		406.0281		
• Power Output	35 – 39	dBm		37.2		
2. DRY HEAT CYCLE (A 3.0)						Section 2.2
Aliveness test (during 2 hour period)						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz			406.0281	
• Power Output	35 – 39	dBm			36.4	
Aliveness test (at end of 2 hour period)						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz			406.0281	
• Power Output	35 – 39	dBm			36.1	
3. DAMP HEAT CYCLE (A 4.0)						Section 2.3
Aliveness test (during 2 hour period)						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz			406.0281	
• Power Output	35 – 39	dBm			36.4	
Aliveness test (at end of 2 hour period)						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz			406.0281	
• Power Output	35 – 39	dBm			36.2	



TABLE OF TEST RESULTS

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} (-20°C)	T _{amb} (+23°C)	T _{max} (+55°C)	
4. VIBRATION TEST (A 5.0)						Section 2.4
• Exterior Mechanical Inspection	No damage	✓		✓		
Aliveness test						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz		406.0281		
• Power Output	35 – 39	dBm		37.2		
• Activation	No activation during test	✓		✓		
5. BUMP TEST (A 6.0)						Section 2.5
• Exterior Mechanical Inspection	No damage	✓		✓		
Aliveness test						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz		406.0281		
• Power Output	35 – 39	dBm		37.3		
• Activation	No activation during test	✓		✓		
6. SALT FOG TEST (A 7.0)						Section 2.6
• Exterior Mechanical Inspection	No damage	✓		✓		
Aliveness test						
• Carrier Frequency (Float Free Mounting)	406.025±0.002 Or 406.028±0.001	MHz		406.0281		
• Carrier Frequency (Manual Mounting)	406.025±0.002 Or 406.028±0.001	MHz		406.0281		
• Power Output	35 – 39	dBm		N/A		EUT fitted with antenna – Power measurements not made

TABLE OF TEST RESULTS

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} (-20°C)	T _{amb} (+23°C)	T _{max} (+55°C)	
7-A. DROP TEST (A 8.1)						Section 2.7A
On Hard Surface						
• Exterior Mechanical Inspection	No damage	✓		✓		Test button cover fell off (replaced)
Aliveness test						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz		406.0282		
• Power Output	35 – 39	dBm		37.3		
• Activation	No activation during test	✓		✓		
7-B. DROP TEST (A 8.2)						Section 2.7B
In Water						
• Exterior Mechanical Inspection	No damage	✓		✓		
Aliveness test						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz		406.0281		
• Power Output	35 – 39	dBm		37.2		
• Activation	No activation during test	✓		✓		
8. LEAKAGE AND IMMERSION TEST (A 9.0)						Section 2.8
Aliveness test						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz		406.0281		
• Power Output	35 – 39	dBm		37.2		
• Interior Inspection	No water	✓		✓		



TABLE OF TEST RESULTS

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} (-20°C)	T _{amb} (+23°C)	T _{max} (+55°C)	
9. SPURIOUS EMISSIONS TEST (A 10.0)						Section 2.9
• 406 MHz	Figure 2-1	✓	✓	✓	✓	Attach graphs
• 121.5 MHz	Figure 2-6	✓	✓	✓	✓	Attach graphs
10. THERMAL SHOCK TEST (A 11.0)			(-30°C)		(+70°C)	Section 2.10
• Self-activation in water	5	Minutes	Fresh Water: 4.12 Salt Water: <0.1		Fresh Water: <0.1 Salt Water: <0.1	
Aliveness test						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz	406.0279		406.0279	
• Power Output	35 – 39	dBm	35.7		36.4	
Frequency Stability						
• Short term stability	0.002	Parts/million in 100ms	7.8 ⁻¹¹		1.01 ⁻¹⁰	
Medium term stability						
• Mean slope	0.001	Parts/million/min	-2.97 ⁻¹⁰		-6.44 ⁻¹⁰	
• Residual frequency variation	0.003	Parts/million	4.78 ⁻¹⁰		1.41 ⁻⁹	
11. COSPAS-SARSAT TYPE APPROVAL (A 12.0)	C-S Certificate					Section 2.11

TABLE OF TEST RESULTS

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} (-20°C)	T _{amb} (+23°C)	T _{max} (+55°C)	
12. OPERATIONAL LIFE, STROBE LIGHT AND SELF TESTS (A 13.0)						Section 2.12
Operational Life						
Frequency						
• Nominal Carrier	406.025± or 406.028±0.001	MHz	Max: 406.027949 Min: 406.027944			
• Short-term stability	0.002	Parts/million in 100ms	Max: 2.3525 x 10 ⁻¹⁰ Min: 5.716 x 10 ⁻¹¹			
Medium-term stability						
• Mean slope	0.001	Parts/million/min	Max: 2.469 x 10 ⁻¹⁰ Min: -2.948 x 10 ⁻¹⁰			
• Residual variation	0.003	Parts/million	Max: 1.185 x 10 ⁻⁰⁹ Min: 1.143 x 10 ⁻¹⁰			
• RF output power	35 – 39	dBm	Max: 37.43 Min: 37.19			
• Strobe flash rate	20 – 30	/min	21.2			
• Auxiliary radio-locating Peak envelope power	14 – 20	dBm	Max: 15.43 Min: 15.03			Calculated
13. STROBE LIGHT TEST (A 13.2)						Section 2.13
• Flash rate	20 – 30	/min	21.2	21.0	21.2	
• Effective intensity	0.75	Cd	1.37	1.27	1.18	
• Pulse duration	10 ⁻⁶ to 10 ⁻²	ms	10	10	10	
14. SELF TEST (A 13.3)						Section 2.14
• RF pulse duration	0.444 sec or 0.525 sec	✓	0.522	0.521	0.521	
• Frame synchronisation pattern	0 1101 0000	✓	✓	✓	✓	
• Number of RF bursts	1 – burst	✓	✓	✓	✓	

TABLE OF TEST RESULTS

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} (-20°C)	T _{amb} (+23°C)	T _{max} (+55°C)	
15. AUTOMATIC RELEASE MECHANISM TEST (A 14.1)						Section 2.15
• Normal mounted orientation	Release and float free before 4 meters: automatic activation	✓		✓		Annex A
• Rolling 90° starboard		✓		✓		Annex A
• Rolling 90° port		✓		✓		Annex A
• Rolling 90° bow down		✓		✓		Annex A
• Rolling 90° stern down		✓		✓		Annex A
• Upside down		✓		✓		Annex A
16. STABILITY AND BUOYANCY TEST (A 15.0)						Section 2.16
• Turn upright	2	S		<2		
• Reserve Buoyancy	5	%		58.7		
• Float upright; Antenna base	>4	cm		5.5		
17. INADVERTENT ACTIVATION TEST (A 16.0)						Section 2.17
• Activation / Release	EUT should not release from bracket or automatically activate	✓		✓		



TABLE OF TEST RESULTS

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min} (-20°C)	T _{amb} (+23°C)	T _{max} (+55°C)	
18. AUXILIARY RADIO-LOCATING DEVICE TRANSMITTER TEST (A 17.0)						Section 2.18
• Carrier frequency	121.5 ± 0.006	MHz	121.500081	121.500000 (ref)	121.499571	
• PERP	14 – 20	dBm		Max: 15.6 Min: 15.2		
• Duty cycle	100	%	99.08	99.05	98.91	
Modulation						
• Frequency	700Hz within range of 300 – 1600 Hz	Hz	Max: 1481 Min: 339.0	Max: 1488 Min: 339.4	Max: 1486 Min: 339.6	
• Direction	Upward	✓				
• Duty cycle	33 – 55	%	39.3	42.5	42.8	
• Factor	0.85 – 1.0	#	0.961	0.968	0.963	
• Sweep repetition rate	2 – 4	Hz	3.000	3.005	3.002	
• Frequency Coherence	±30	Hz	-3.85	-23.40	-10.42	
Antenna						
• Pattern	Omnidirectional	✓		✓		
• Polarization	Vertical	✓		✓		
• VSWR	1.5:1	✓		✓		
19. HUMIDITY TEST (A 18.0)						Section 2.19
Aliveness test						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz			N/A	
• Power Output	35 – 39	dBm			N/A	



TABLE OF TEST RESULTS

PARAMETER TO BE MEASURED	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min}	T _{amb}	T _{max}	
			(-20°C)	(+23°C)	(+55°C)	
20. ORIENTATION TEST (A 19.0)						Section 2.20
Vertical						
Aliveness test						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz		406.0281		
• Power Output	35 – 39	dBm		36.5		
Upside down						
Aliveness test						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz		406.0281		
• Power Output	35 – 39	dBm		36.3		
Horizontal						
Aliveness test						
• Carrier Frequency	406.025±0.002 Or 406.028±0.001	MHz		406.021		
• Power Output	35 – 39	dBm		36.5		



2.1 INITIAL ALIVENESS TEST

2.1.1 Specification Reference

RCTM Paper 77 (A 1.0)

Beacon Test Report 1D1C000002FFBFF

Organization:
Tested By:
Date: 16-Feb 2006, 1:03:44 PM
Tester Model/Serial No./File Name: BT100S/1025/Functional-5
Tester Cal Due Date: Nov 10, 2006
Tester Temperature: 28°C

☐ PASS ☐ FAIL INITIALS: _____

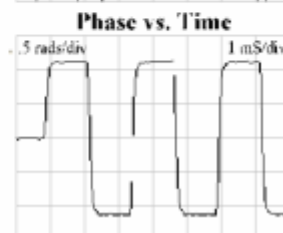
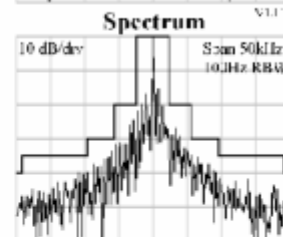
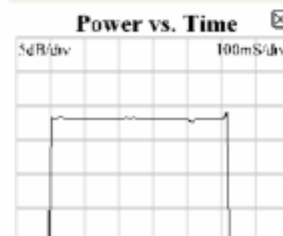
Notes: Add text comments here.

15 Hex ID: 1D1C000002FFBFF
Full Hex: FFFE2F8E8E0000017FDFFB94D53783E0F66C
Burst Mode: Normal Mode (Long)
Protocol: Standard Test Protocol
Country 232: United Kingdom
Bits 41 - 64: 1

Position Source: Internal GPS
Auxiliary Radio: 121.5 MHz
Bits 107-110: Default
Latitude: * * * * *
Longitude: * * * * *

406 MHz Measurements
406 Frequency (INT REF): 406.0281 MHz
406 Power (5 Watt): 37.2 dBm
Power Rise Time: < 5 ms
Phase Deviation: -1.11 +1.11 radians
Modulation Rise Time: 153 uS
Modulation Fall Time: 153 uS
Modulation Symmetry: 0%
Modulation Bit Rate: 400 bps
CW Preamble: 161.6 ms

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OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY
DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR
FAILURE OF THIS MEASUREMENT EQUIPMENT



Beacon Test Report - Initial Aliveness Test

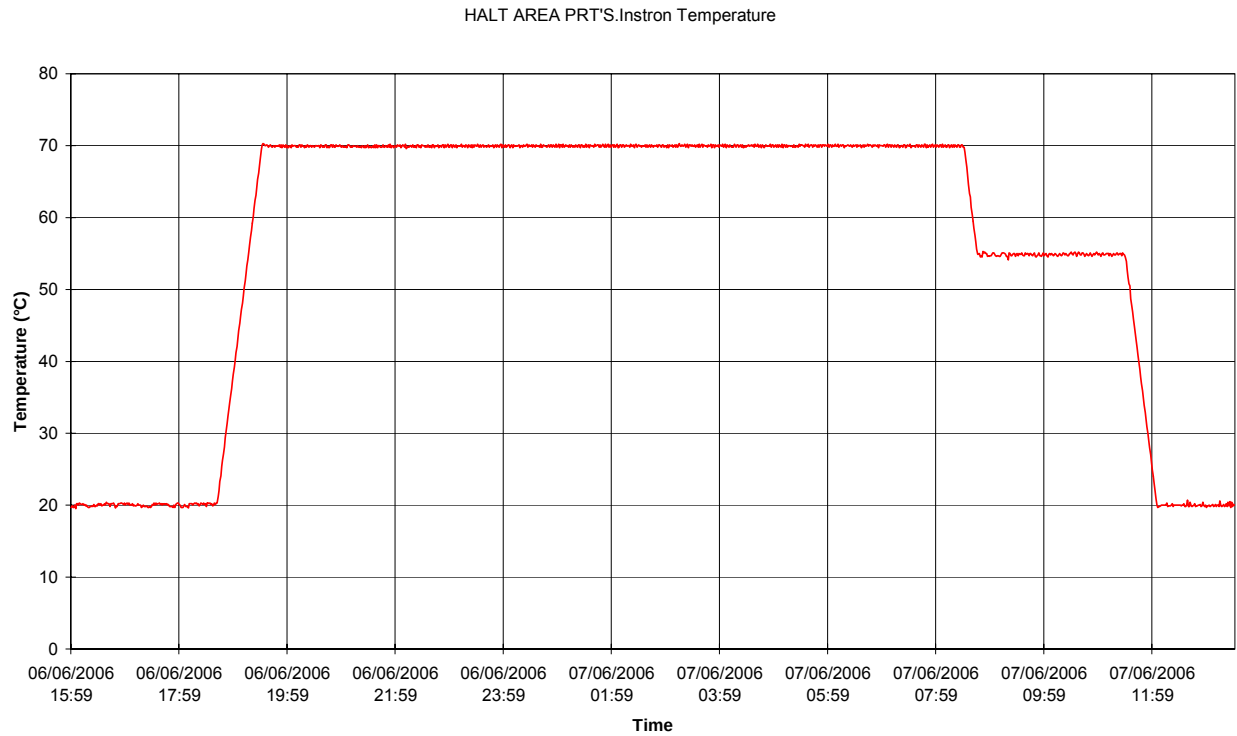


2.2 DRY HEAT CYCLE

2.2.1 Specification Reference

RCTM Paper 77 (A 3.0)

2.2.2 Temperature Plot



Plot showing temperature cycle



2.2 DRY HEAT CYCLE

2.2.3 Test Results

Beacon Test Report

1D1C000002FFBFF

Organization:

Tested By:

Date: 07-Jun-06 9:19:00 AM

Tester Model/Serial No./File Name: BT100S/1025/smarten-v-1

Tester Cal Due Date: Nov 10, 2006

Tester Temperature: 24°C

☐ PASS☐ FAIL

INITIALS: _____

Notes: Add text comments here.

15 Hex ID: 1D1C000002FFBFF

Full Hex: FFFE2F8E8E0000017FDFFB94D53783E0F66C

Burst Mode: Normal Mode (Long)

Protocol: Standard Test Protocol

Country 232: United Kingdom

Bits 41 - 64: 1

Position Source: Internal GPS

Auxiliary Radio: 121.5 MHz

Bits 107-110: Default

Latitude: *****

Longitude: *****

406 MHz Measurements

406 Frequency (INT REF): 406.0281 MHz

406 Power (5 Watt): 36.4 dBm

Power Rise Time: < 5 ms

Phase Deviation: -1.09 +1.12 radians

Modulation Rise Time: 142 uS

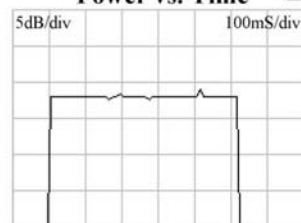
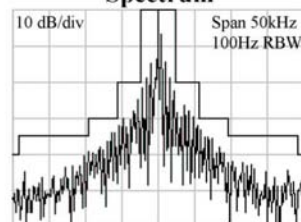
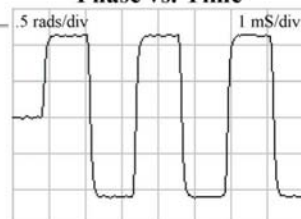
Modulation Fall Time: 153 uS

Modulation Symmetry: 0.4%

Modulation Bit Rate: 400.2 bps

CW Preamble: 161.4 ms

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Power vs. Time ☒**Spectrum****Phase vs. Time**Beacon Test Report at 55°C



2.2 DRY HEAT CYCLE

2.2.3 Test Results

Beacon Test Report

1D1C000002FFBFF

Organization:
Tested By:
Date: 07-Jun-06 11:18:49 AM
Tester Model/Serial No./File Name: BT100S/1025/smartenv-2
Tester Cal Due Date: Nov 10, 2006
Tester Temperature: 26°C

☐ **PASS**
☐ **FAIL**
INITIALS: _____

Notes: Add text comments here.

15 Hex ID: 1D1C000002FFBFF
Full Hex: FFFE2F8E8E0000017FDFFB94D53783E0F66C
Burst Mode: Normal Mode (Long)
Protocol: Standard Test Protocol
Country 232: United Kingdom
Bits 41 - 64: 1

Position Source: Internal GPS
Auxiliary Radio: 121.5 MHz
Bits 107-110: Default
Latitude: * * * * *
Longitude: * * * * *

406 MHz Measurements
406 Frequency (INT REF): 406.0281 MHz
406 Power (5 Watt): 36.1 dBm
Power Rise Time: : < 5 ms
Phase Deviation: -1.09 +1.13 radians
Modulation Rise Time: 142 uS
Modulation Fall Time: 153 uS
Modulation Symmetry: 0%
Modulation Bit Rate: 400.2 bps
CW Preamble: 161.6 ms

DISCLAIMER: IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.

Power vs. Time ☒

Spectrum ☒

Phase vs. Time

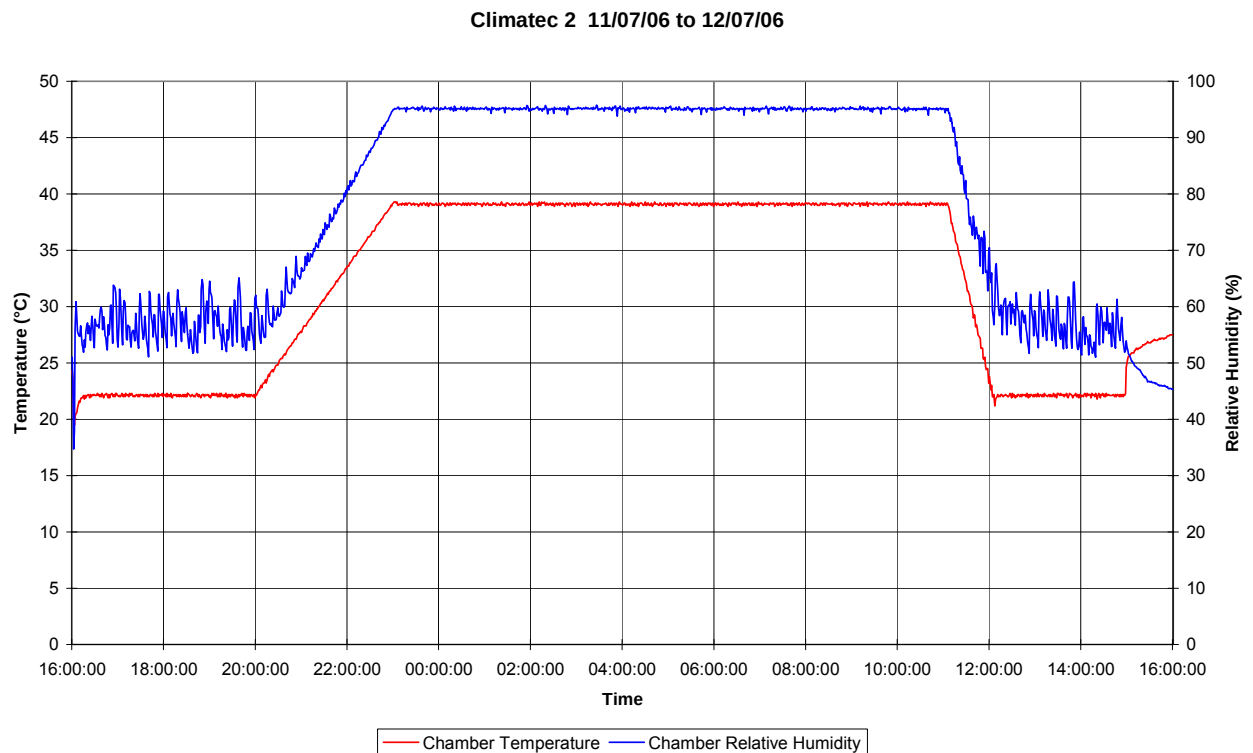
Beacon Test Report after 2 hours at 55°C

2.3 DAMP HEAT CYCLE

2.3.1 Specification Reference

RCTM Paper 77 (A 4.0)

2.3.2 Temperature/Humidity Plot



Plot showing temperature and humidity cycle



2.3 DAMP HEAT CYCLE

2.3.3 Test Results

Beacon Test Report

1D1C000002FFBFF

Organization:

Tested By:

Date: 12-Jul-06 10:45:40 AM

Tester Model/Serial No./File Name: BT100S/1025/smartfind-1

Tester Cal Due Date: Nov 10, 2006

Tester Temperature: 20°C



PASS



FAIL

INITIALS: _____

Notes: Add text comments here.

15 Hex ID: 1D1C000002FFBFF

Full Hex: FFFE2F8E8E0000017FDFFB94D53783E0F66C

Burst Mode: Normal Mode (Long)

Protocol: Standard Test Protocol

Country 232: United Kingdom

Bits 41 - 64: 1

Position Source: Internal GPS

Auxiliary Radio: 121.5 MHz

Bits 107-110: Default

Latitude: * * * * *

Longitude: * * * * *

406 MHz Measurements

406 Frequency (INT REF): 406.0281 MHz

406 Power (5 Watt): 36.4 dBm

Power Rise Time: < 5 ms

Phase Deviation: -1.1 +1.15 radians

Modulation Rise Time: 153 uS

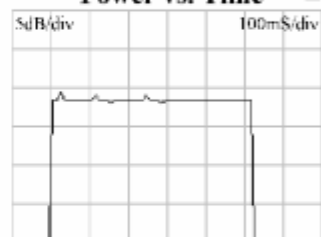
Modulation Fall Time: 153 uS

Modulation Symmetry: 0%

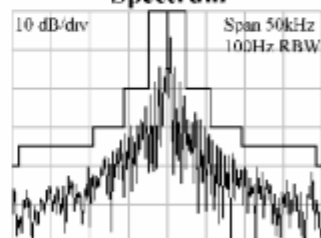
Modulation Bit Rate: 400.2 bps

CW Preamble: 161.7 ms

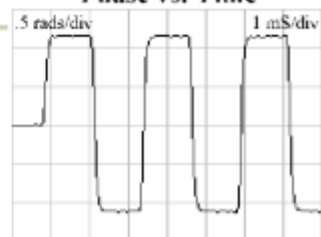
DISCLAIMER: IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.

Power vs. Time ☒

Spectrum



Phase vs. Time



Beacon Test Report during 2 hour period



2.3 DAMP HEAT CYCLE

2.3.3 Test Results

Beacon Test Report

1D1C000002FFBFF

Organization:

Tested By:

Date: 12-Jul-06 11:02:19 AM

Tester Model/Serial No./File Name: BT100S/1025/smartfind-2

Tester Cal Due Date: Nov 10, 2006

Tester Temperature: 23°C

☐ PASS

☐ FAIL

INITIALS: _____

Notes: Add text comments here.

15 Hex ID: 1D1C000002FFBFF

Full Hex: FFFE2F8E8E0000017FDFFB94D53783E0F66C

Burst Mode: Normal Mode (Long)

Protocol: Standard Test Protocol

Country 232: United Kingdom

Bits 41 - 64: 1

Position Source: Internal GPS

Auxiliary Radio: 121.5 MHz

Bits 107-110: Default

Latitude: * * * * *

Longitude: * * * * *

406 MHz Measurements

406 Frequency (INT REF): 406.0281 MHz

406 Power (5 Watt): 36.2 dBm

Power Rise Time: < 5 ms

Phase Deviation: -1.11 +1.15 radians

Modulation Rise Time: 142 uS

Modulation Fall Time: 142 uS

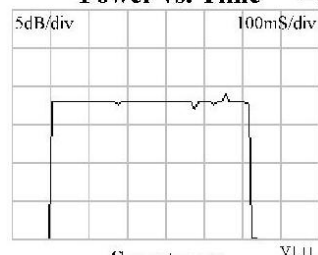
Modulation Symmetry: 0.4%

Modulation Bit Rate: 400 bps

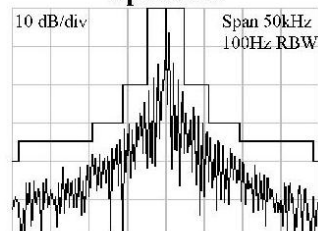
CW Preamble: 161.4 ms

DISCLAIMER: IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.

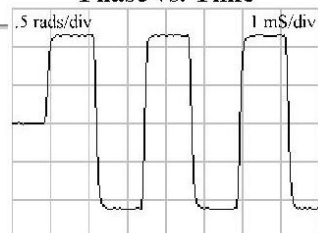
Power vs. Time ☒



Spectrum



Phase vs. Time



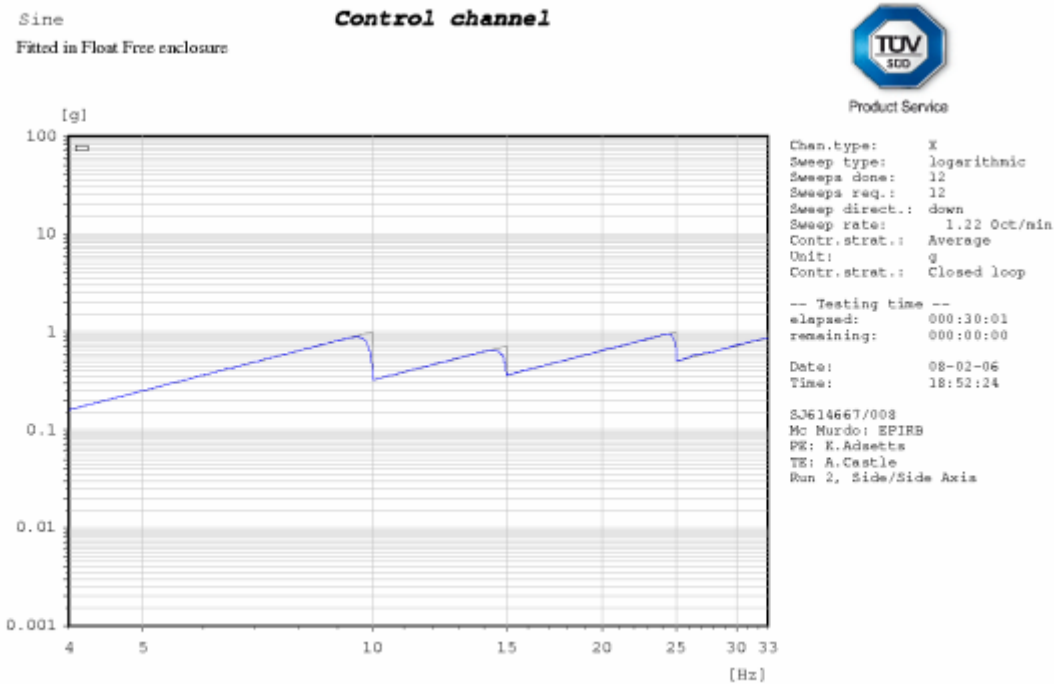
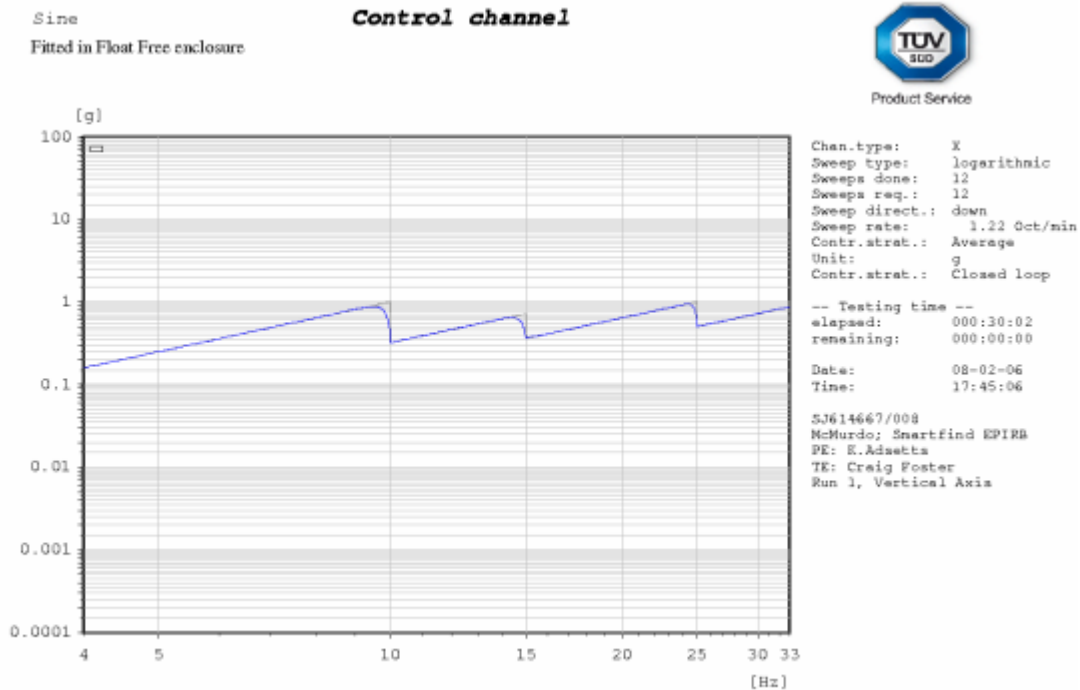
Beacon Test Report at end of 2 hour period

2.4 VIBRATION TEST

2.4.1 Specification Reference

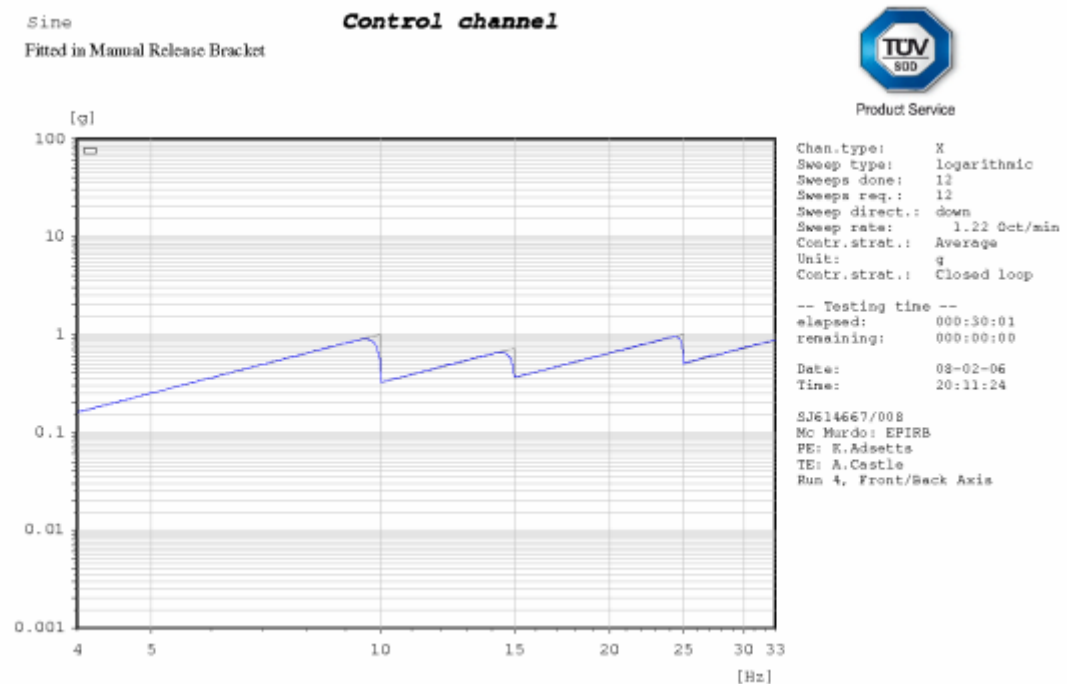
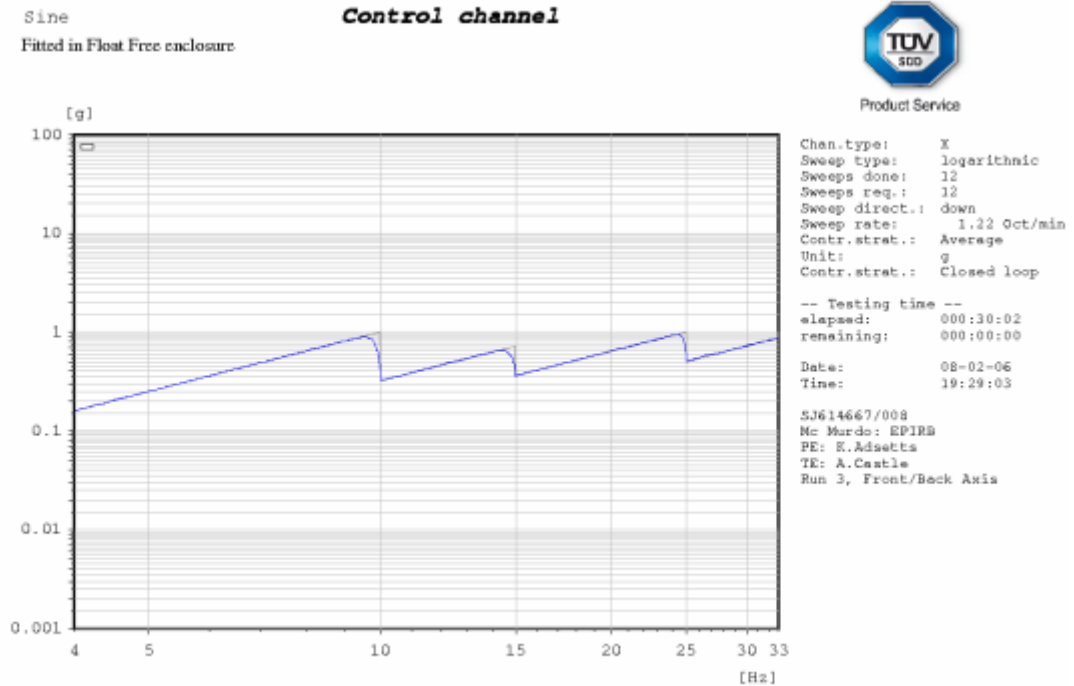
RCTM Paper 77 (A 5.0)

2.4.2 Vibration Plots



2.4 VIBRATION TEST

2.4.2 Vibration Plots





Product Service

2.4 VIBRATION TEST

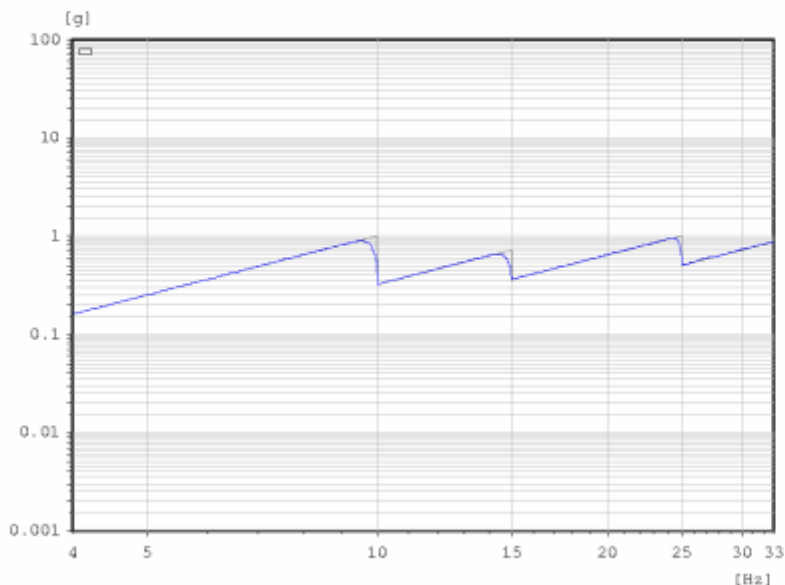
2.4.2 Vibration Plots

Sine
Fitted in Manual Release Bracket

Control channel



Product Service



Chan.type: X
Sweep type: logarithmic
Sweeps done: 12
Sweeps req.: 12
Sweep direct.: down
Sweep rate: 1.22 Oct/min
Contr.strat.: Average
Unit: g
Contr.strat.: Closed loop

-- Testing time --
elapsed: 000:30:01
remaining: 000:00:00

Date: 08-02-06
Time: 20:54:32

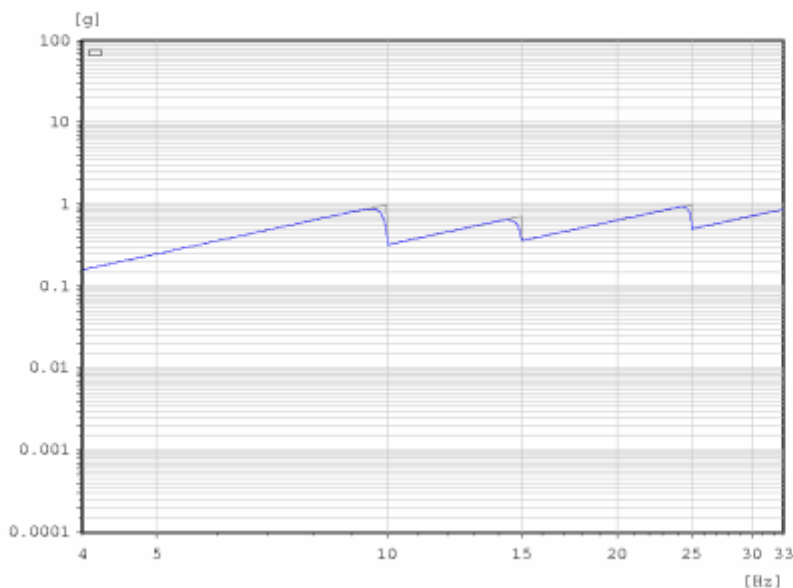
SJ614667/008
Mc Murdo: EPIRB
PE: E.Adsetts
TE: A.Castle
Run 5, Side/Side Axis

Sine
Fitted in Manual Release Bracket

Control channel



Product Service



Chan.type: X
Sweep type: logarithmic
Sweeps done: 12
Sweeps req.: 12
Sweep direct.: down
Sweep rate: 1.22 Oct/min
Contr.strat.: Average
Unit: g
Contr.strat.: Closed loop

-- Testing time --
elapsed: 000:30:02
remaining: 000:00:00

Date: 08-02-06
Time: 21:32:29

SJ614667/008
McMurdo: Smartfind EPIRB
PE: E.Adsetts
TE: Craig Foster
Run 6, Vertical Axis

2.4 VIBRATION TEST

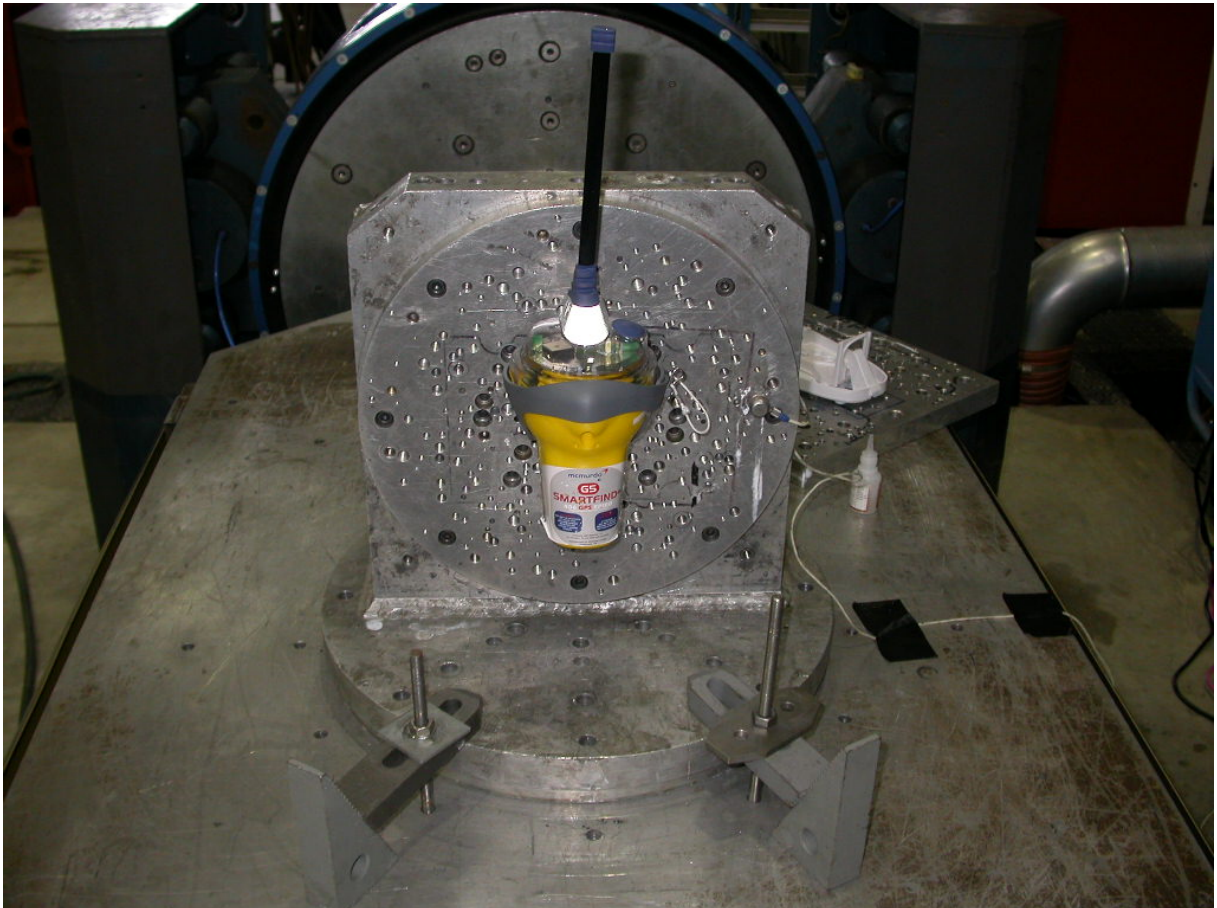
2.4.3 Set-up Photographs



Photograph showing Vibration Test Set-up in Float Free Enclosure

2.4 VIBRATION TEST

2.4.3 Set-up Photographs



Photograph showing Vibration Test Set-up in Manual Release Bracket



2.4 VIBRATION TEST

2.4.4 Test Results

Beacon Test Report

1D1C000002FFBFF

Organization:

Tested By:

Date: 03-Aug-06 9:40:11 AM

Tester Model/Serial No./File Name: BT100S/1025/mcmurdo-rtcm-1

Tester Cal Due Date: Nov 10, 2006

Tester Temperature: 24°C



PASS



FAIL

INITIALS: _____

Notes: Add text comments here.

15 Hex ID: 1D1C000002FFBFF

Full Hex: FFFE2F8E8E000017FDFB94D53783E0F66C

Burst Mode: Normal Mode (Long)

Protocol: Standard Test Protocol

Country 232: United Kingdom

Bits 41 - 64: 1

Position Source: Internal GPS

Auxiliary Radio: 121.5 MHz

Bits 107-110: Default

Latitude: * * * * *

Longitude: * * * * *

406 MHz Measurements

406 Frequency (INT REF): 406.0281 MHz

406 Power (5 Watt): 37.2 dBm

Power Rise Time: < 5 ms

Phase Deviation: -1.11 +1.11 radians

Modulation Rise Time: 153 uS

Modulation Fall Time: 165 uS

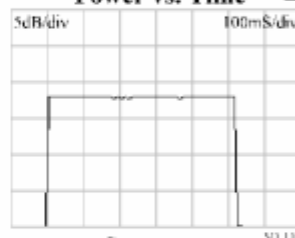
Modulation Symmetry: 0%

Modulation Bit Rate: 400 bps

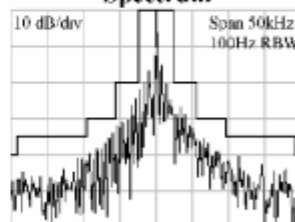
CW Preamble: 161.7 ms

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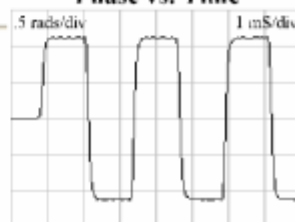
Power vs. Time



Spectrum



Phase vs. Time



Beacon Test Report following Vibration Tests

2.5 BUMP TEST

2.5.1 Specification Reference

RCTM Paper 77 (A 6.0)

2.5.2 Set-up Photographs



Photograph showing Ruggedness Test Set-up in Float Free Enclosure

2.5 BUMP TEST

2.5.2 Set-up Photographs



Photograph showing Ruggedness Test Set-up in Manual Release Bracket



2.5 BUMP TEST

2.5.3 Test Results

Beacon Test Report

1D1C000002FFBFF

Organization:

Tested By:

Date: 03-Aug-06 9:41:51 AM

Tester Model/Serial No./File Name: BT100S/1025/mcmurdo-rtcm-3

Tester Cal Due Date: Nov 10, 2006

Tester Temperature: 26°C



PASS



FAIL

INITIALS: _____

Notes: Add text comments here.

15 Hex ID: 1D1C000002FFBFF

Full Hex: FFFE2F8E8E0000017FDFFB94D53783E0F66C

Burst Mode: Normal Mode (Long)

Protocol: Standard Test Protocol

Country 232: United Kingdom

Bits 41 - 64: 1

Position Source: Internal GPS

Auxiliary Radio: 121.5 MHz

Bits 107-110: Default

Latitude: * * * * *

Longitude: * * * * *

406 MHz Measurements

406 Frequency (INT REF): 406.0281 MHz

406 Power (5 Watt): 37.3 dBm

Power Rise Time: < 5 ms

Phase Deviation: -1.1 +1.11 radians

Modulation Rise Time: 142 uS

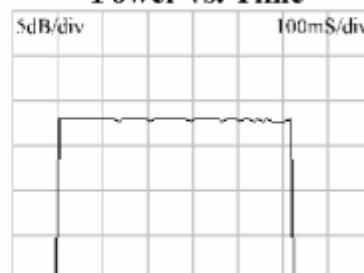
Modulation Fall Time: 153 uS

Modulation Symmetry: 0%

Modulation Bit Rate: 400 bps

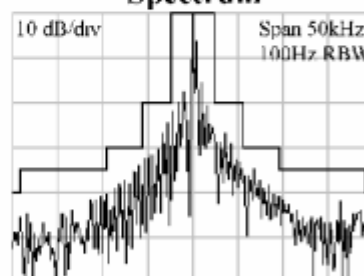
CW Preamble: 161.4 ms

Power vs. Time



Spectrum

VI.11



Phase vs. Time



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2.6 SALT FOG TEST

2.6.1 Specification Reference

RCTM Paper 77 (A 7.0)

2.6.2 Set-up Photographs



Photograph showing EUT in Float Free Mounting in Salt Fog Chamber

2.6 SALT FOG TEST

2.6.2 Set-up Photographs



Photograph showing EUT in Manual Mounting in Salt Fog Chamber



2.6 SALT FOG TEST

2.6.3 Test Results

Note: The Beacons supplied for the Salt Fog test were fitted with antennas rather than a 50 ohm termination. The Aliveness Test was performed, pre and post test, utilising radiated signals to a WS Technologies Inc BT100S Beacon Tester.

Beacon Test Report

193DF380C6FFBFF

Organization: TUV Product Service
 Tested By: BT100A S/N: 2383
 Date: 10/16/06 10:14:56 AM
 Tester Model/Serial No./File Name: BT100S/2383/smart ff-50
 Tester Cal Due Date: Sep 6, 2008
 Tester Temperature: 23°C



PASS



FAIL

INITIALS: _____

Notes: Add text comments here.

15 Hex ID: 193DF380C6FFBFF
 Full Hex: FFFED08C9EF9C0637EDFF83D15B783E0F66C
 Burst Mode: Self Test Mode (Long)
 Protocol: Standard Test Protocol
 Country 201: Albania
 Bits 41 - 64: 16367715

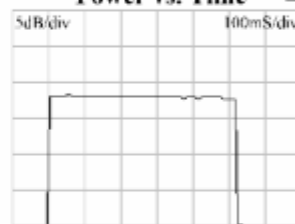
Position Source: Internal GPS
 Auxiliary Radio: 121.5 MHz
 Bits 107-110: Default
 Latitude: * * * * *
 Longitude: * * * * *

406 MHz Measurements
 406 Frequency (INT REF): 406.0281 MHz
 406 Power (INT ANT): 84%
 Power Rise Time: < 5 ms
 Phase Deviation: -1.1 +1.16 radians
 Modulation Rise Time: 153 uS
 Modulation Fall Time: 165 uS
 Modulation Symmetry: 0%
 Modulation Bit Rate: 400.5 bps
 CW Preamble: 161.1 ms

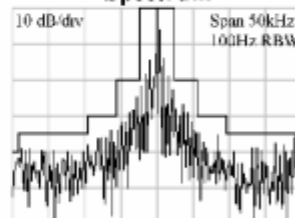
121.5 MHz Measurements
 121 Frequency (INT REF): 121.4993 MHz
 121 Power (INT ANT): 52%
 Signal was unmodulated.

DISCLAIMER: IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.

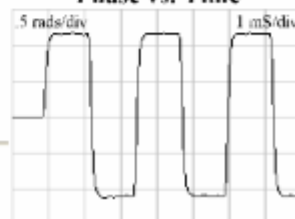
Power vs. Time ☒



Spectrum



Phase vs. Time



EUT in Float Free Mounting – Pre-test Beacon Test Report



2.6 SALT FOG TEST

2.6.3 Test Results

Beacon Test Report

193DF380C6FFBFF

Organization: TUV Product Service

Tested By: BT100A S/N: 2383

Date: 10/16/06 10:10:31 AM

Tester Model/Serial No./File Name: BT100S/2383/smart_gps-49

Tester Cal Due Date: Sep 6, 2008

Tester Temperature: 22°C

**PASS****FAIL****INITIALS:** _____

Notes: Add text comments here.

15 Hex ID: 193DF380C6FFBFF

Full Hex: FFFED08C9EF9C0637FDEF83D15B783E0F66C

Burst Mode: Self Test Mode (Long)

Protocol: Standard Test Protocol

Country 201: Albania

Bits 41 - 64: 16367715

Position Source: Internal GPS

Auxiliary Radio: 121.5 MHz

Bits 107-110: Default

Latitude: * * * * *

Longitude: * * * * *

406 MHz Measurements

406 Frequency (INT REF): 406.0279 MHz

406 Power (INT ANT): 86%

Power Rise Time: < 5 ms

Phase Deviation: -1.06 +1.08 radians

Modulation Rise Time: 153 uS

Modulation Fall Time: 153 uS

Modulation Symmetry: 0%

Modulation Bit Rate: 399.7 bps

CW Preamble: 161.8 ms

121.5 MHz Measurements

121 Frequency (INT REF): 121.5001 MHz

121 Power (INT ANT): 40%

Sweep Direction: Downwards

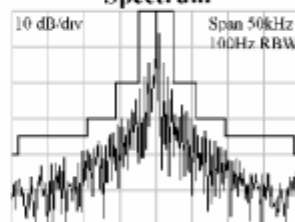
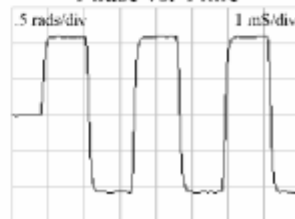
Audio Frequency: Out of Range

Sweep Range: Out of Range

Sweep rep Rate: Out of Range

Modulation Factor: 51 %

Duty Cycle: 63 %

Power vs. Time**Spectrum****Phase vs. Time**

DISCLAIMER: IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.

EUT in Manual Mounting – Pre-test Beacon Test Report



2.5 SALT FOG TEST

2.6.3 Test Results

Beacon Test Report

193DF380C6FFBFF

Organization: TUV Product Service
Tested By: BT100A S/N: 2383
Date: 10/23/06 9:26:20 AM
Tester Model/Serial No./File Name: BT100S/2383/smart ff-51
Tester Cal Due Date: Sep 6, 2008
Tester Temperature: 21°C

**PASS****FAIL****INITIALS:** _____

Notes: Add text comments here.

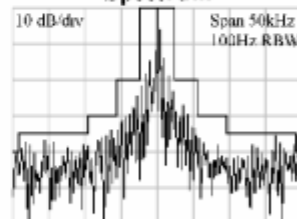
15 Hex ID: 193DF380C6FFBFF
Full Hex: FFFED08C9EF9C0637FDFF83D15B783E0F66C
Burst Mode: Self Test Mode (Long)
Protocol: Standard Test Protocol
Country 201: Albania
Bits 41 - 64: 16367715

Position Source: Internal GPS
Auxiliary Radio: 121.5 MHz
Bits 107-110: Default
Latitude: * * * * *
Longitude: * * * * *

406 MHz Measurements
406 Frequency (INT REF): 406.0281 MHz
406 Power (INT ANT): 88%
Power Rise Time: < 5 ms
Phase Deviation: -1.12 +1.16 radians
Modulation Rise Time: 153 μ S
Modulation Fall Time: 142 μ S
Modulation Symmetry: 0.8%
Modulation Bit Rate: 400.5 bps
CW Preamble: 161.5 ms

121.5 MHz Measurements
121 Frequency (INT REF): 121.4993 MHz
121 Power (INT ANT): 87%
Signal was unmodulated.

DISCLAIMER: IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.

Power vs. Time ☒**Spectrum****Phase vs. Time**EUT in Float Free Mounting – Post-test Beacon Test Report



2.6 SALT FOG TEST

2.6.3 Test Results

Beacon Test Report

193DF380C6FFBFF

Organization: TUV Product Service
Tested By: BT100A S/N: 2383
Date: 10/23/06 9:27:52 AM
Tester Model/Serial No./File Name: BT100S/2383/smart manual-52
Tester Cal Due Date: Sep 6, 2008
Tester Temperature: 22°C

**PASS****FAIL****INITIALS:** _____

Notes: Add text comments here.

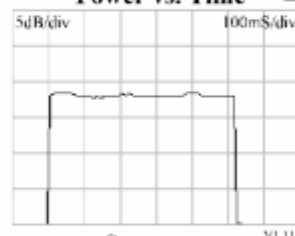
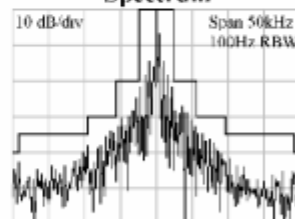
15 Hex ID: 193DF380C6FFBFF
Full Hex: FFFED08C9EF9C0637FDFF83D15B783E0F66C
Burst Mode: Self Test Mode (Long)
Protocol: Standard Test Protocol
Country 201: Albania
Bits 41 - 64: 16367715

Position Source: Internal GPS
Auxiliary Radio: 121.5 MHz
Bits 107-110: Default
Latitude: * * * * *
Longitude: * * * * *

406 MHz Measurements
406 Frequency (INT REF): 406.0279 MHz
406 Power (INT ANT): 80%
Power Rise Time: < 5 ms
Phase Deviation: -1.07 +1.1 radians
Modulation Rise Time: 165 μ S
Modulation Fall Time: 153 μ S
Modulation Symmetry: 0%
Modulation Bit Rate: 399.5 bps
CW Preamble: 161.6 ms

121.5 MHz Measurements
121 Frequency (INT REF): 121.5 MHz
121 Power (INT ANT): 68%
Signal was unmodulated.

DISCLAIMER: IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS
 DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR
 LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS
 MEASUREMENT EQUIPMENT.

Power vs. Time ☒**Spectrum****Phase vs. Time**EUT in Manual Mounting – Post-test Beacon Test Report



Product Service

2.7A DROP TEST (On Hard Surface)**2.7A.1 Specification Reference**

RCTM Paper 77 (A 8.1)

2.7A.2 Test Results**Beacon Test Report**

1D1C000002FFBFF

Organization: Tahoma

Tested By:

Date: 18-Aug-06 1:58:34 PM

Tester Model/Serial No./File Name: BT100S/1025/smartfind drop-2

Tester Cal Due Date: Nov 10, 2006

Tester Temperature: 26°C

**PASS****FAIL****INITIALS:** _____

Notes: Add text comments here.

15 Hex ID: 1D1C000002FFBFF

Full Hex: FFFE2F8E8E000017FDFFB94D53783E0F66C

Burst Mode: Normal Mode (Long)

Protocol: Standard Test Protocol

Country 232: United Kingdom

Bits 41 - 64: 1

Position Source: Internal GPS

Auxiliary Radio: 121.5 MHz

Bits 107-110: Default

Latitude: * * * * *

Longitude: * * * * *

406 MHz Measurements

406 Frequency (INT REF): 406.0282 MHz

406 Power (5 Watt): 37.3 dBm

Power Rise Time: < 5 ms

Phase Deviation: -1.09 +1.08 radians

Modulation Rise Time: 142 uS

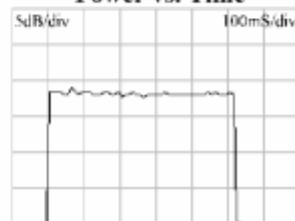
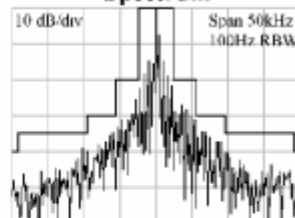
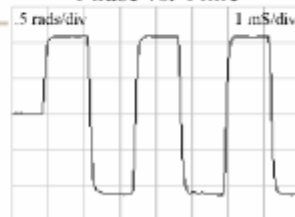
Modulation Fall Time: 142 uS

Modulation Symmetry: 0.3%

Modulation Bit Rate: 400 bps

CW Preamble: 161.5 ms

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Power vs. Time ☒**Spectrum****Phase vs. Time**Beacon Test Report following Drop test on to hard surface

2.7B DROP TEST (In Water)

2.7B.1 Specification Reference

RCTM Paper 77 (A 8.2)

2.7B.2 Test Photographs



2.7B DROP TEST (In Water)

2.7B.2 Test Photographs





2.7B DROP TEST (In Water)

2.7B.3 Test Results

Beacon Test Report

1D1C000002FFBFF

Organization:

Tested By:

Date: 22-Nov-05 2:01:42 PM

Tester Model/Serial No./File Name: BT100S/1025/Functional-5

Tester Cal Due Date: Nov 10, 2006

Tester Temperature: 28°C

☐ PASS☐ FAIL

INITIALS: _____

Notes: Add text comments here.

15 Hex ID: 1D1C000002FFBFF

Full Hex: FFFE2F8E8E0000017FDFFB94D53783E0F66C

Burst Mode: Normal Mode (Long)

Protocol: Standard Test Protocol

Country 232: United Kingdom

Bits 41 - 64: 1

Position Source: Internal GPS

Auxiliary Radio: 121.5 MHz

Bits 107-110: Default

Latitude: * * * * *

Longitude: * * * * *

406 MHz Measurements

406 Frequency (INT REF): 406.0281 MHz

406 Power (5 Watt): 37.2 dBm

Power Rise Time: < 5 ms

Phase Deviation: -1.11 +1.11 radians

Modulation Rise Time: 153 uS

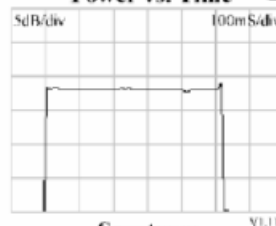
Modulation Fall Time: 153 uS

Modulation Symmetry: 0%

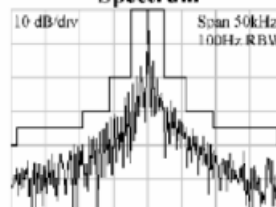
Modulation Bit Rate: 400 bps

CW Preamble: 161.6 ms

Power vs. Time



Spectrum



Phase vs. Time



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Beacon Test Report following 20 m Drop into Water



2.8 LEAKAGE AND IMMERSION TEST

2.8.1 Specification Reference

RCTM Paper 77: A7.0

2.8.2 Test Results

The EUT was installed into chamber at 65°C for minimum of 1 hour, EUT removed from the chamber at +65°C and immediately immersed into water at approx +20°C. After a period of 63 hours the EUT was submerged under water in a pressure vessel and subjected to simulated pressure of 10 metres (15psig) for a period of 5 minutes.

After the test it was observed that the red and green lights were ON. The cover was removed - no water ingress was observed. It was thought that the battery might be flat, due to 63 hour immersion. The batteries were replaced and correct function observed.

Beacon Test Report

1D1C000002FFBFF

Organization:
 Tested By:
 Date: 09-Dec-05 12:19:55 AM
 Tester Model/Serial No./File Name: BT100S/1025/Functional-6
 Tester Cal Due Date: Nov 10, 2006
 Tester Temperature: 27°C

☐ PASS ☐ FAIL INITIALS: _____

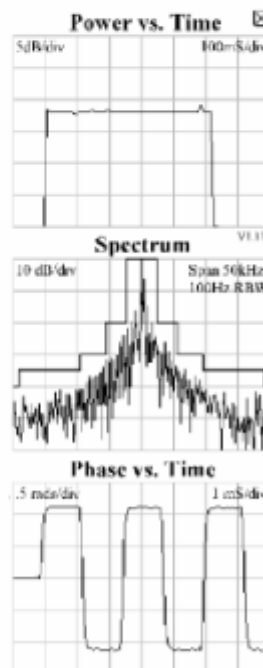
Notes: Add text comments here.

15 Hex ID: 1D1C000002FFBFF
 Full Hex: FFFE2F8E8E000017FDFFB94D53783E0F66C
 Burst Mode: Normal Mode (Long)
 Protocol: Standard Test Protocol
 Country 232: United Kingdom
 Bits 41 - 64: 1

Position Source: Internal GPS
 Auxiliary Radio: 121.5 MHz
 Bits 107-110: Default
 Latitude: *****
 Longitude: *****

406 MHz Measurements
 406 Frequency (INT REF): 406.0281 MHz
 406 Power (5 Watt): 37.2 dBm
 Power Rise Time: < 5 ms
 Phase Deviation: -1.11 +1.11 radians
 Modulation Rise Time: 142 uS
 Modulation Fall Time: 153 uS
 Modulation Symmetry: 0.3%
 Modulation Bit Rate: 400 bps
 CW Preamble: 161.3 ms

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Beacon Test Report following Leakage and Immersion Test

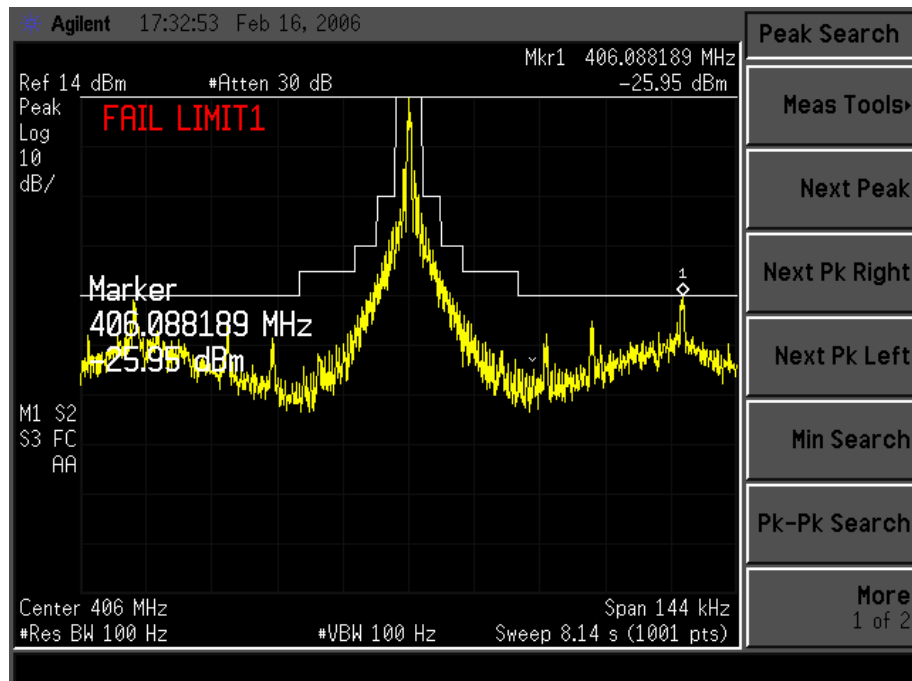


2.9 SPURIOUS EMISSIONS TEST

2.9.1 Specification Reference

RCTM Paper 77 (A 10.0)

2.9.2 Test Results (406MHz)

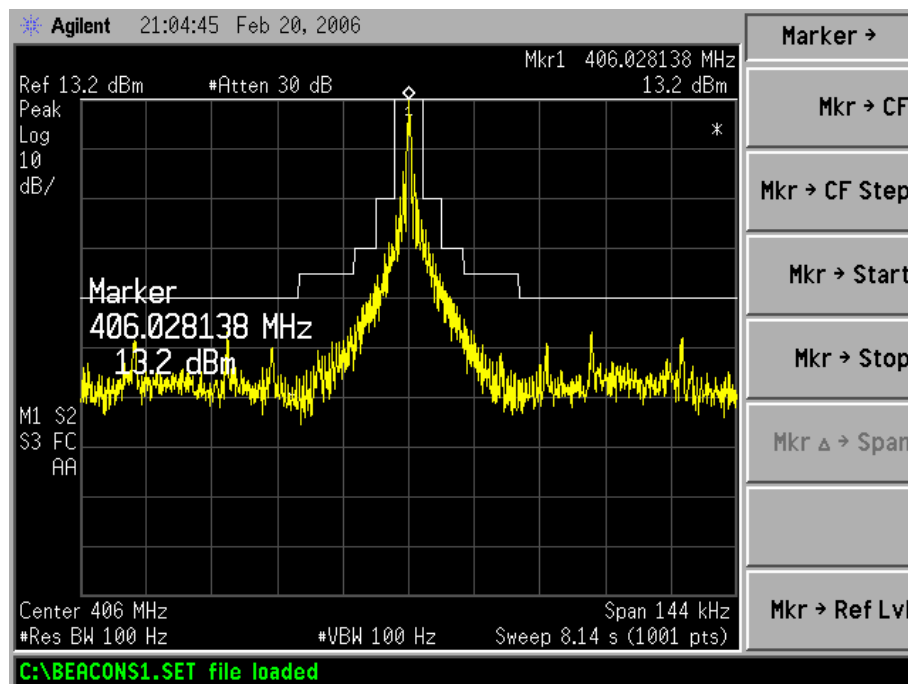


Plot showing 406MHz Spurious Emissions at Ambient Temperature

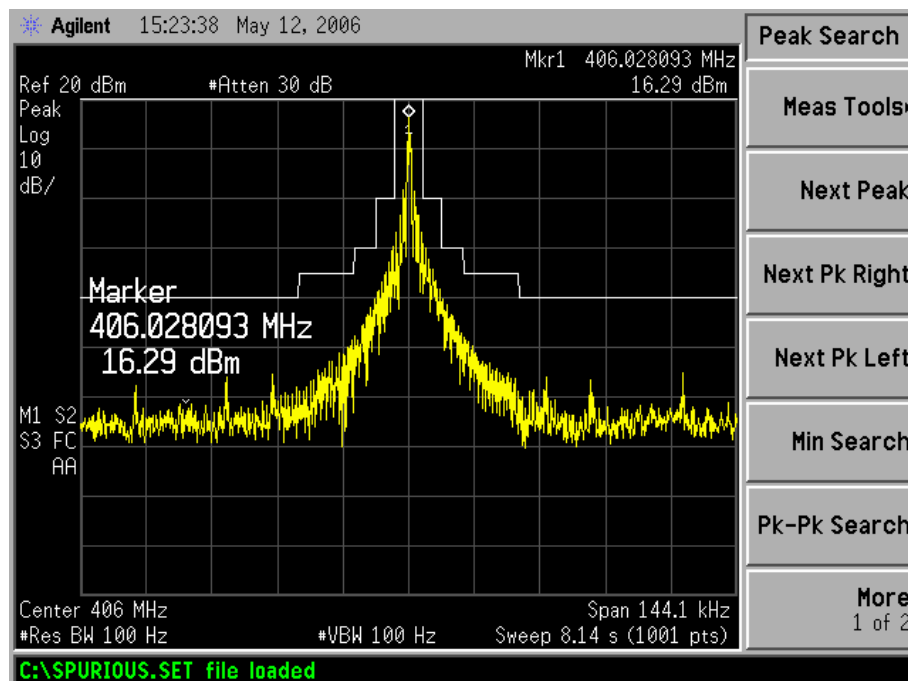
Note: From the reference level (peak power) of +14.00 dBm, the relative limit of -40.00 dBc occurring at 406.088189 MHz gives an equivalent limit of -26.00 dBm, the recorded level of -25.95 is a pass within measurement uncertainty

2.9 SPURIOUS EMISSIONS TEST

2.9.2 Test Results (406MHz)



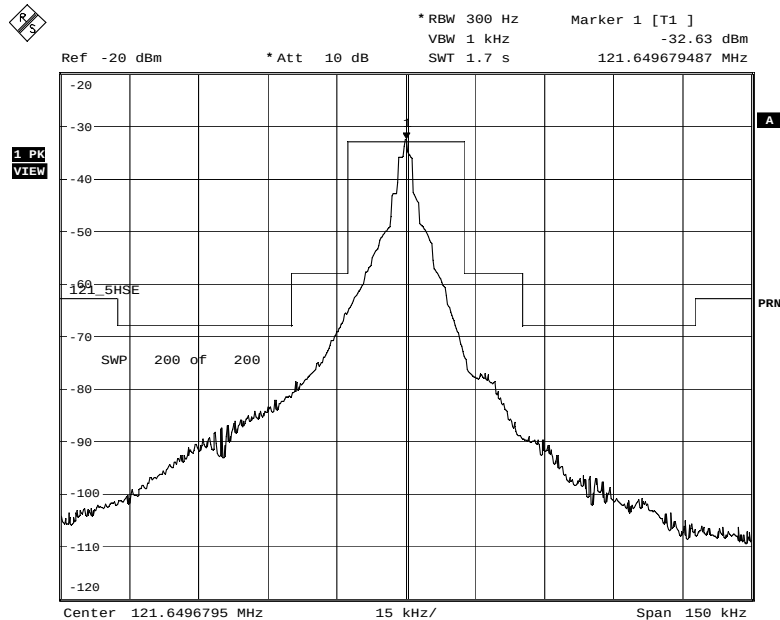
Plot showing 406MHz Spurious Emissions at High Temperature (+55°C)



Plot showing 406MHz Spurious Emissions at Low Temperature (-20°C)

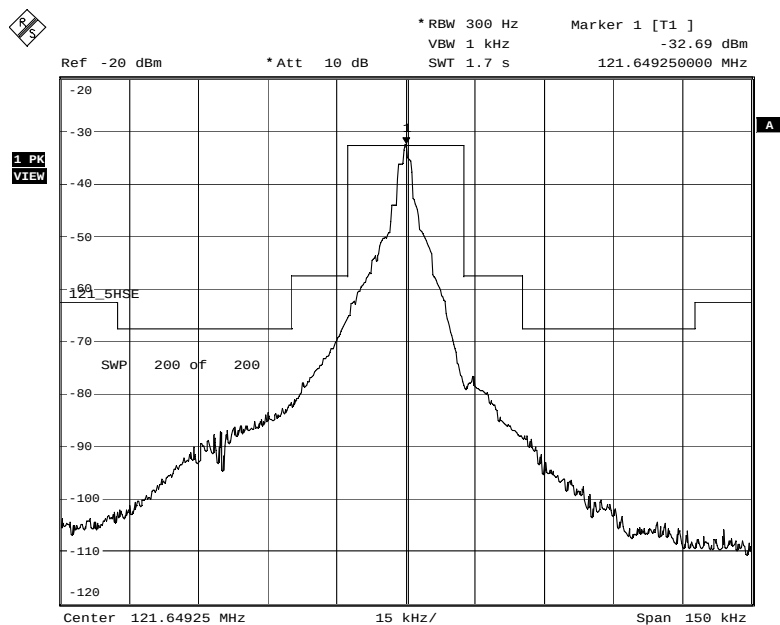
2.9 SPURIOUS EMISSIONS TEST

2.9.3 Test Results (121.5MHz)



Date: 10.MAY.2006 12:40:04

Plot showing 121.5MHz Spurious Emissions at Ambient Temperature



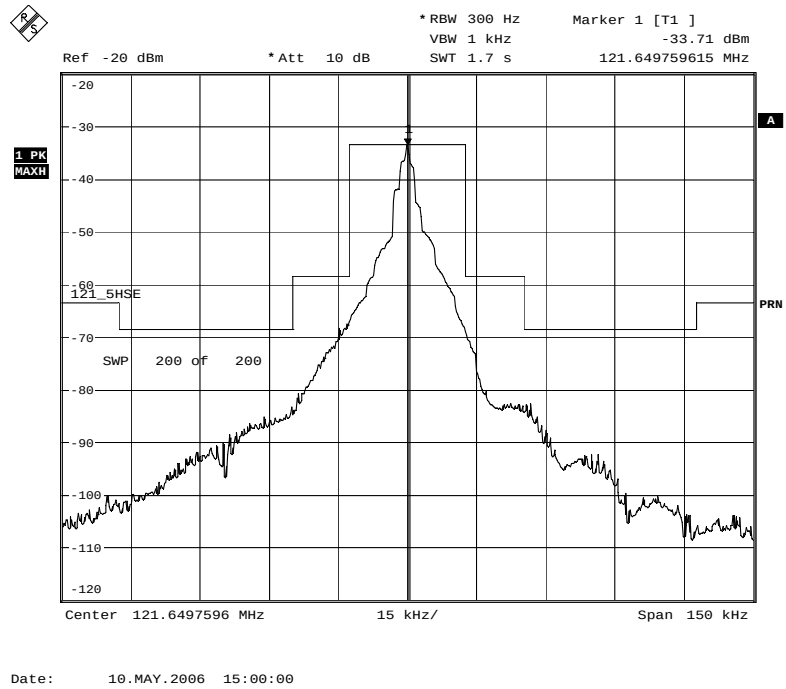
Date: 10.MAY.2006 17:14:21

Plot showing 121.5MHz Spurious Emissions at High Temperature (+55°C)



2.10 SPURIOUS EMISSIONS TEST

2.10.3 Test Results (121.5MHz)



Plot showing 121.5MHz Spurious Emissions at Low Temperature (-20°C)



2.10 THERMAL SHOCK TEST

2.10.1 Specification Reference

RCTM Paper 77 (A 11.0)

2.10.1 Test Results

Beacon Test Report

993D40018C00F9D

Organization: Tahoma

Tested By:

Date: 23-Aug-06 2:25:38 PM

Tester Model/Serial No./File Name: BT100S/1025/tshock23aug-2

Tester Cal Due Date: Nov 10, 2006

Tester Temperature: 31°C

☐ PASS

☐ FAIL

INITIALS: _____

Notes: Add text comments here.

15 Hex ID: 993D40018C00F9D

Full Hex: FFFE2F4C9EA000C6007CECEA1B50

Burst Mode: Normal Mode (Short)

Protocol: Test User Protocol

Country 201: Albania

National Use: 21990647795613

Emergency type: unspecified

Activation type: Auto

406 MHz Measurements

406 Frequency (EXT REF): 406.027933 MHz

406 Power (5 Watt): 35.7 dBm

Power Rise Time: < 5 ms

Phase Deviation: -1.1 +1.09 radians

Modulation Rise Time: 153 μ s

Modulation Fall Time: 130 μ s

Modulation Symmetry: 0%

Modulation Bit Rate: 400.4 bps

CW Preamble: 161.6 ms

Stability Measure @ 19 Bursts

Nominal Frequency: 406027934.932 Hz

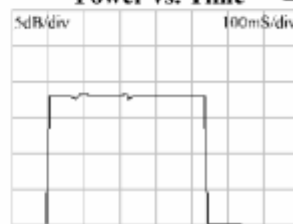
Short Term: 7.80E-11/100ms

Mean Slope: -2.97E-10/minute

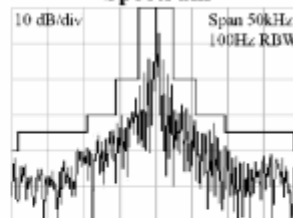
Residual: 4.78E-10

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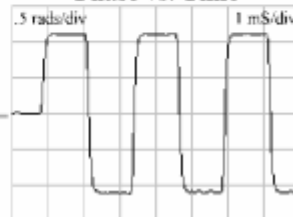
Power vs. Time ☒



Spectrum



Phase vs. Time



Beacon Test Report Cold Test Salt Water



2.10 THERMAL SHOCK TEST

2.10.1 Test Results

Beacon Test Report

993D40018C00F9D

Organization: TUV Product Service Ltd
 Tested By: Emergency Beacons Dept.
 Date: 24-Aug-06 4:25:45 PM
 Tester Model/Serial No./File Name: BT100S/1025/mcmurdo smart1-3
 Tester Cal Due Date: Nov 10, 2006
 Tester Temperature: 32°C

**PASS****FAIL****INITIALS:** _____

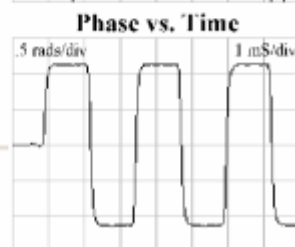
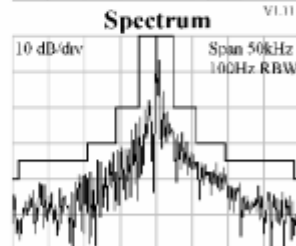
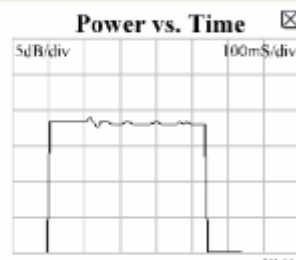
Notes: Add text comments here.

15 Hex ID: 993D40018C00F9D
 Full Hex: FFFE2F4C9EA000C6007CECEA1B50
 Burst Mode: Normal Mode (Short)
 Protocol: Test User Protocol
 Country 201: Albania
 National Use: 21990647795613

Emergency type: unspecified
 Activation type: Auto

406 MHz Measurements
 406 Frequency (EXT REF): 406.027907 MHz
 406 Power (5 Watt): 36.4 dBm
 Power Rise Time: < 5 ms
 Phase Deviation: -1.12 +1.12 radians
 Modulation Rise Time: 153 μ S
 Modulation Fall Time: 142 μ S
 Modulation Symmetry: 0%
 Modulation Bit Rate: 400.2 bps
 CW Preamble: 161.4 ms
 Stability Measure @ 19 Bursts
 Nominal Frequency: 406027909.06 Hz
 Short Term: 1.01E-10/100ms
 Mean Slope: -6.44E-10/minute
 Residual: 1.41E-09

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 MEASUREMENT EQUIPMENT.



Beacon Test Report Hot Test Salt Water

2.11 COSPAS-SARSAT TYPE APPROVAL

2.11.1 Specification Reference

RCTM Paper 77 (A 12.0)

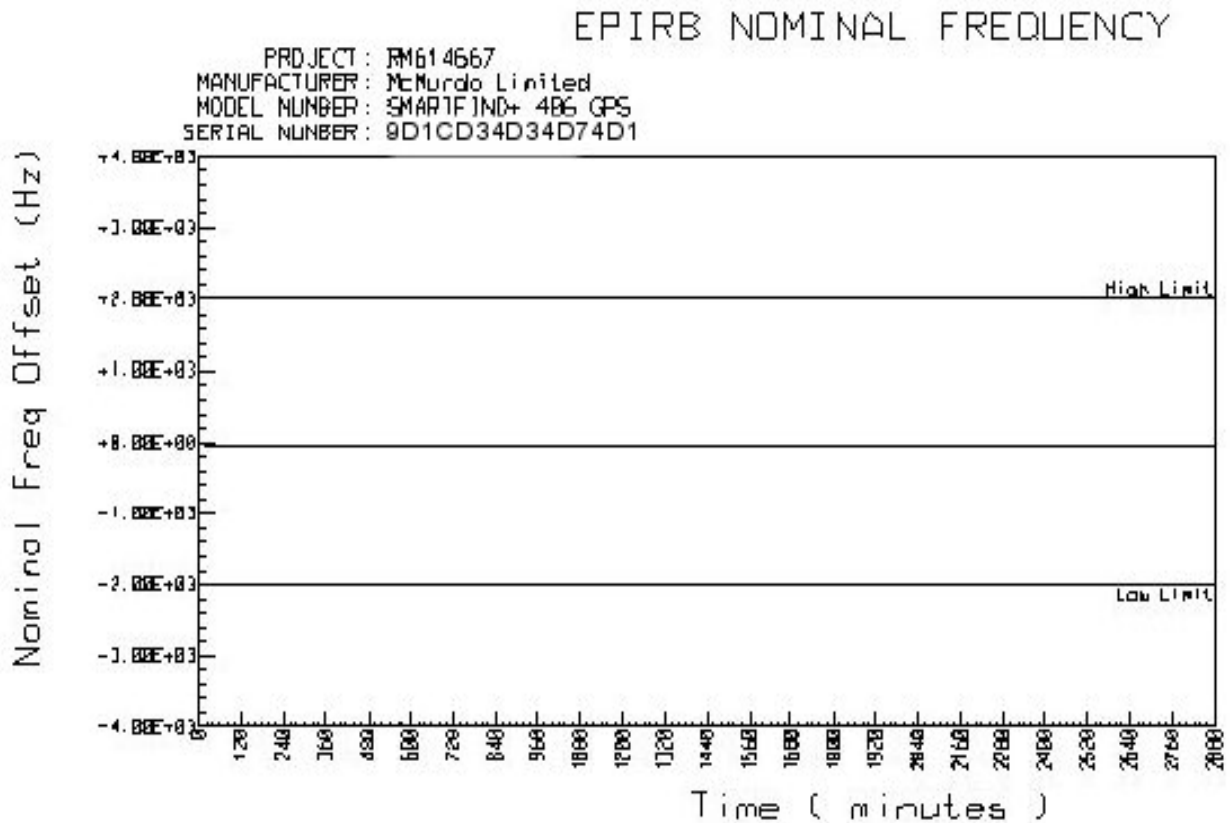
2.11.2 Refer to C/S Certificate/report

2.12 OPERATIONAL LIFE, STROBE LIGHT AND SELF TESTS

2.12.1 Specification Reference

RCTM Paper 77: A 13.0

2.12.2 Test Results



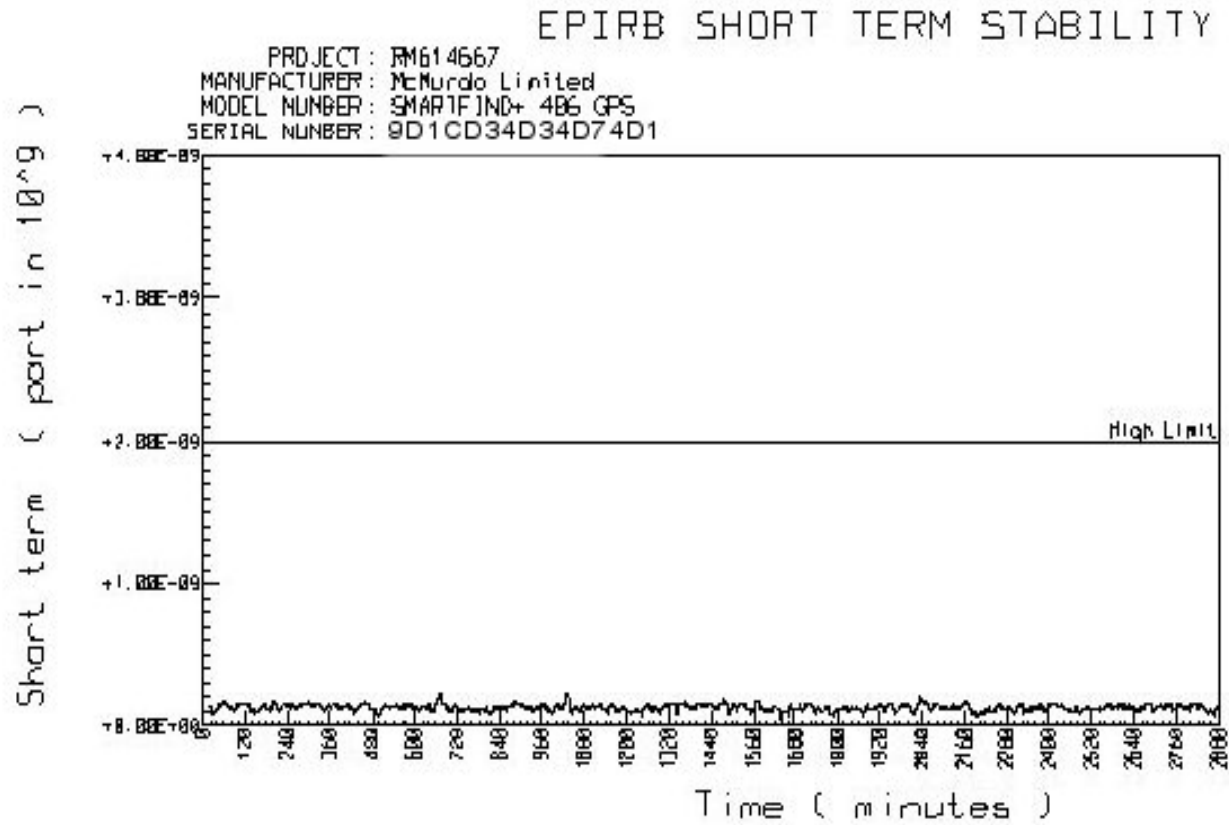
Operating Lifetime at Minimum Temperature - Nominal Frequency



Product Service

2.12 OPERATIONAL LIFE, STROBE LIGHT AND SELF TESTS

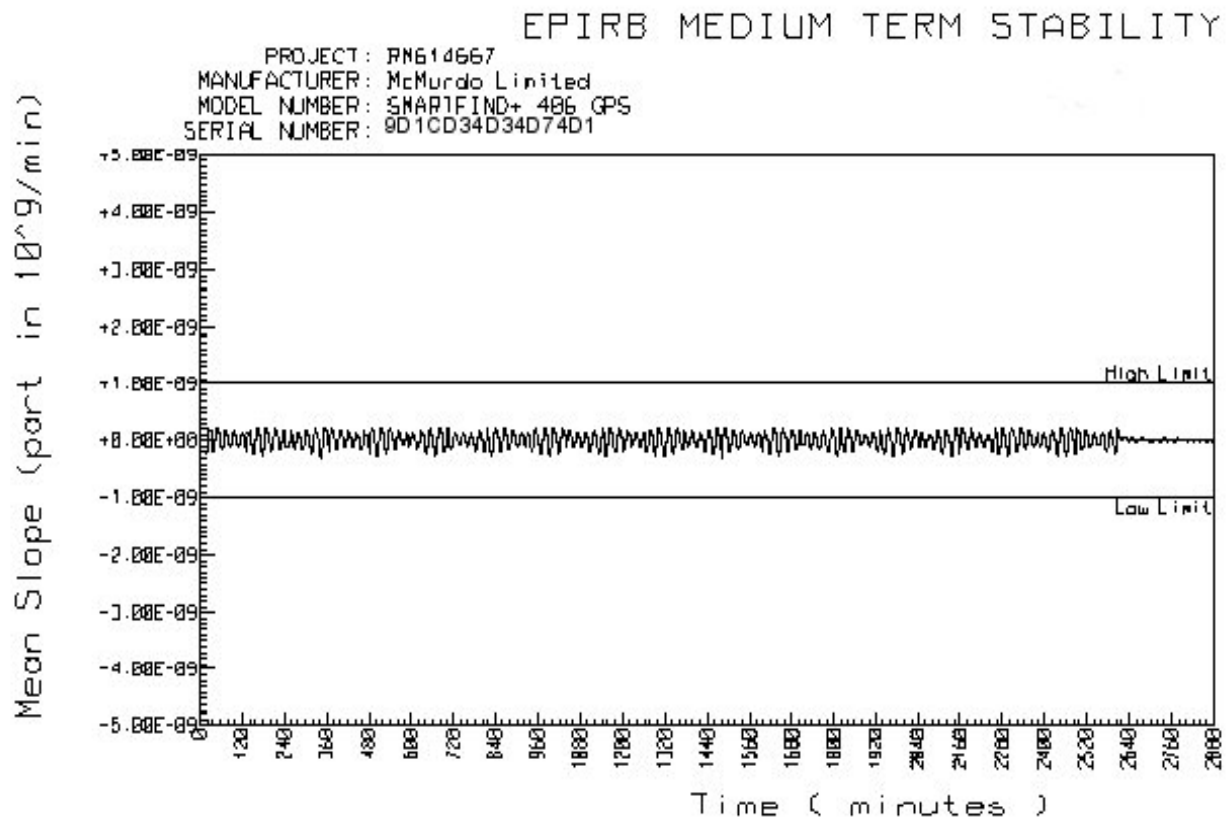
2.12.2 Test Results



Operating Lifetime at Minimum Temperature - Short Term Stability

2.12 OPERATIONAL LIFE, STROBE LIGHT AND SELF TESTS

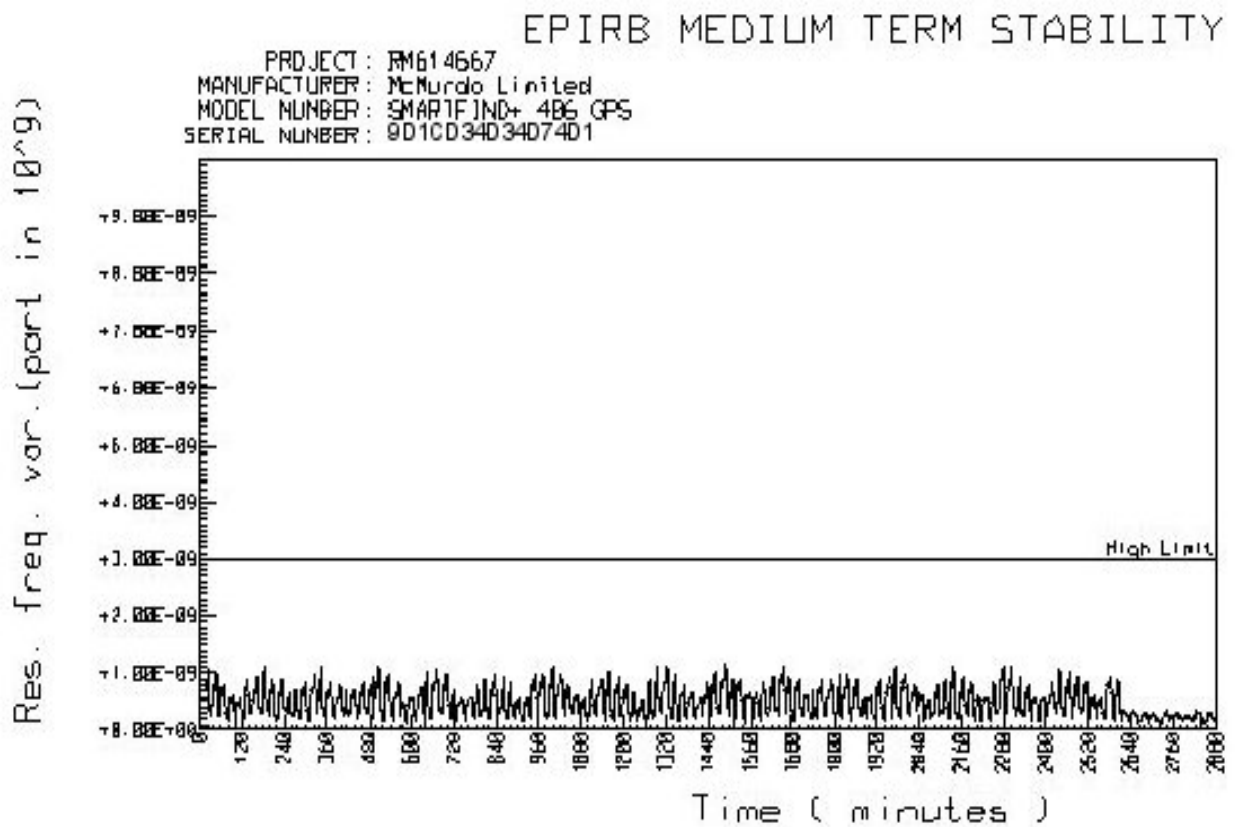
2.12.2 Test Results



Operating Lifetime at Minimum Temperature - Medium Term Stability, Mean Slope

2.12 OPERATIONAL LIFE, STROBE LIGHT AND SELF TESTS

2.12.2 Test Results



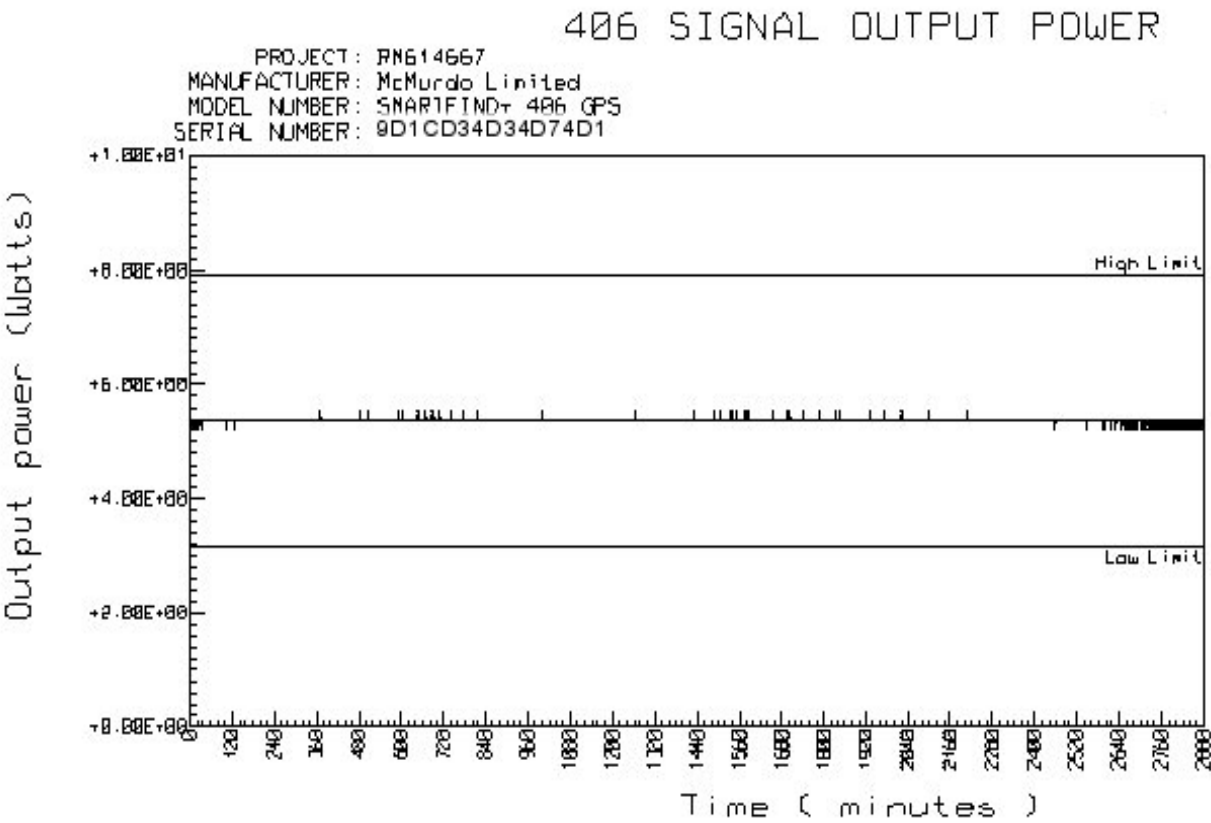
Operating Lifetime at Minimum Temperature - Medium Term Stability, Residual Frequency Variation



Product Service

2.12 OPERATIONAL LIFE, STROBE LIGHT AND SELF TESTS

2.12.2 Test Results



Operating Lifetime at Minimum Temperature - Output Power

2.12 OPERATIONAL LIFE, STROBE LIGHT AND SELF TESTS

2.12.3 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" and a GPS self-test, "GPS test Current"

Beacon activated and transmitting, "Operating Current"

The individual tests were conducted for the following durations:

Standby Current	:	30 minutes	(1799950 ms)
Self-test Current	:	15 seconds	(14990 ms)
GPS test Current	:	15 minutes	(899950 ms)
Operating Current	:	30 minutes	(1799950 ms)

Assumptions / Supplied Data

Battery Replacement Interval	:	12 years effective	(Interval, 6 years x Safety factor, 2)
Battery Capacity	:	3.06 Ah	
Battery Self Drain	:	1.00 % per year	
Self-test Interval	:	12 tests per year	
GPS Tests limited to	:	10 tests per battery	

Test Results

Mode Current	=	Accumulated Charge / Time	
Standby Current	=	39797224.5 pC / 1799950 ms	= 22.11 nA
Self-test Current	=	1153936.8 uC / 14990 ms	= 76.98 mA
GPS test Current	=	53756124.7 uC / 899950 ms	= 59.73 mA
Operating Current	=	129613345.8 uC / 1799950 ms	= 72.01 mA

Battery Preconditioning / Discharge Time Calculations

Battery Self Drain	=	Capacity - [(100% - Self Drain/Year%) ^{Replacement Interval} x Capacity]	
	=	3.06 - ((1 - 0.0100) ¹² x 3.06)	= 0.3477 Ah
Standby Drain	=	Hours per year x Battery Replacement Interval x Standby Current	
	=	365 x 24 x 12 x 22.11 x 10 ⁻⁹	= 0.0023 Ah
Self-test Drain	=	Self-tests per battery x Self-test Current x Self-test duration (in hours)	
	=	12 x 12 x 76.98 x 10 ⁻³ x (15 / 3600)	= 0.0462 Ah
GPS Test Drain	=	GPS Tests per battery x GPS test Current x GPS test duration (in hours)	
	=	10 x 59.73 x 10 ⁻³ x (15 / 60)	= 0.1493 Ah
Total Drain	=	Self Drain + Standby Drain + Self-test Drain + GPS Test Drain	
	=	0.3477 + 0.0023 + 0.0462 + 0.1493	= 0.5455 Ah

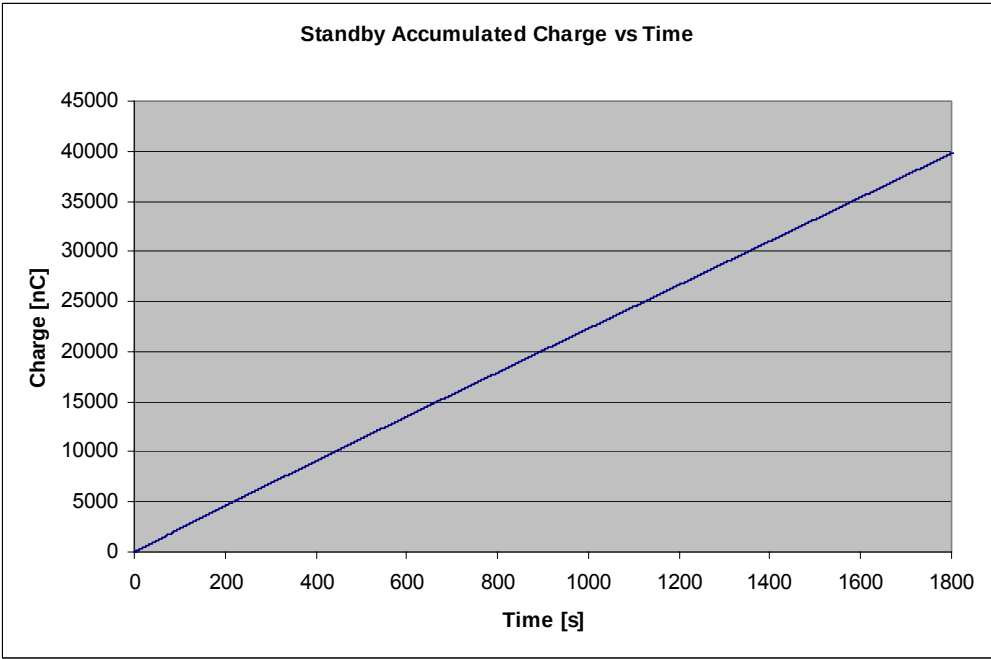
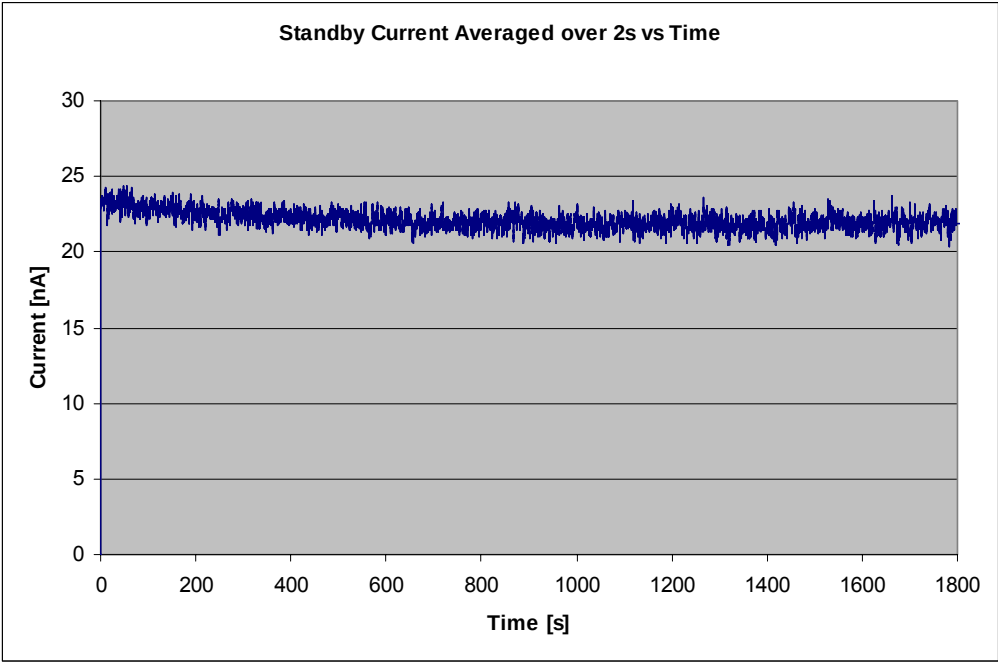
Battery Preconditioning / Discharge Time	=	Worst Case drain / Operational Current	
	=	0.5455 / (72.01 x 10 ⁻³)	
	=	<u>7.57 hours</u>	



2.12 OPERATIONAL LIFE, STROBE LIGHT AND SELF TESTS

2.12.3 Battery Current Measurement Results

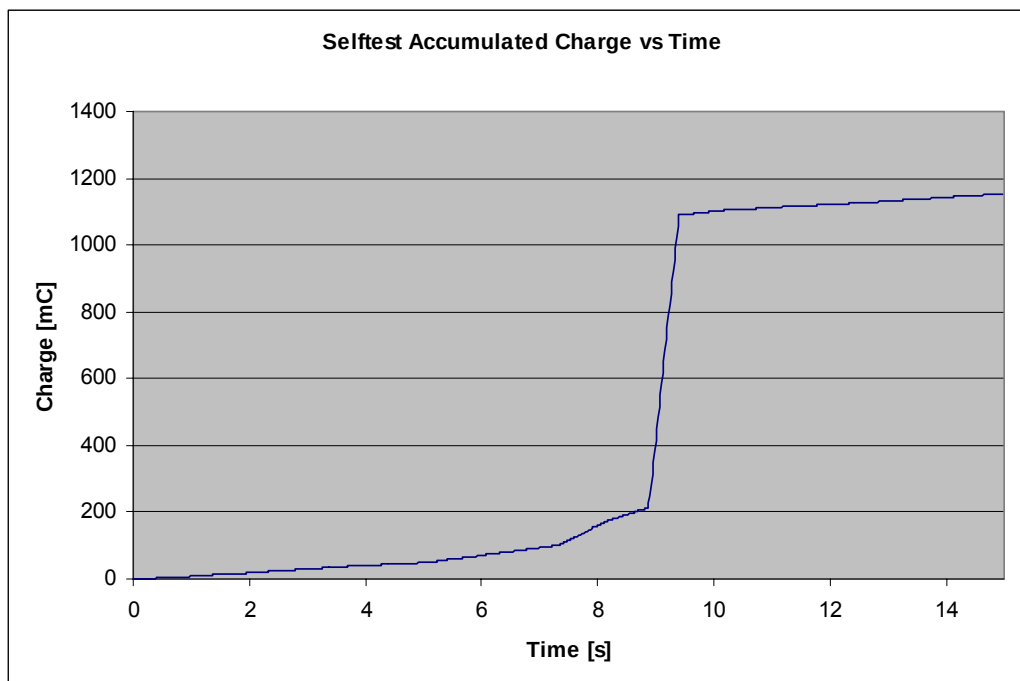
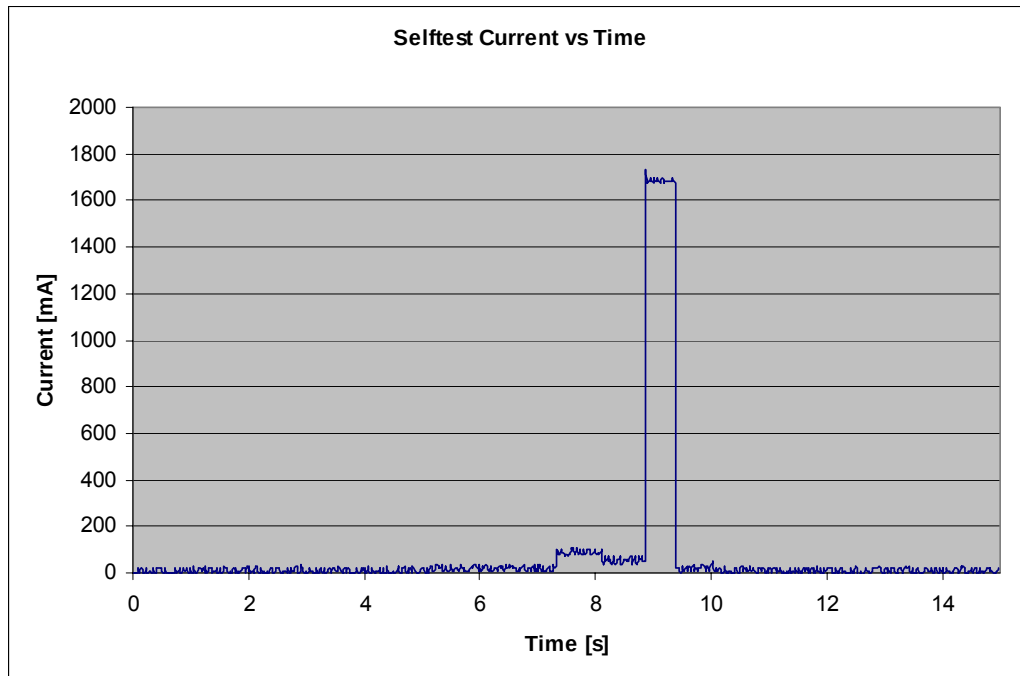
Battery Current Measurement Results (continued) - Standby Mode



2.12 OPERATIONAL LIFE, STROBE LIGHT AND SELF TESTS

2.12.3 Battery Current Measurement Results

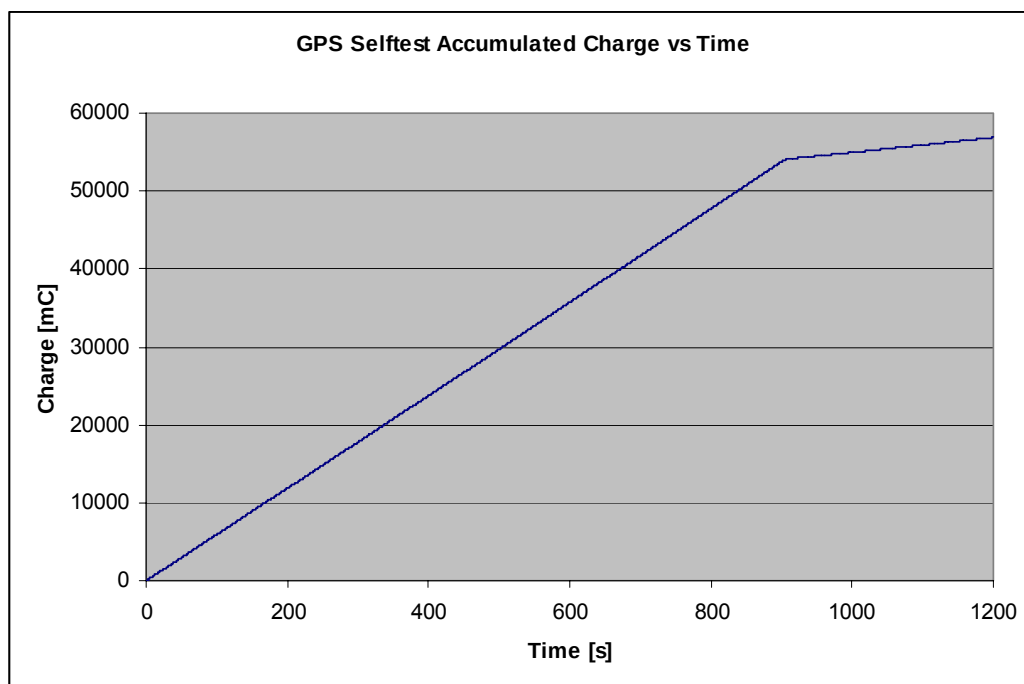
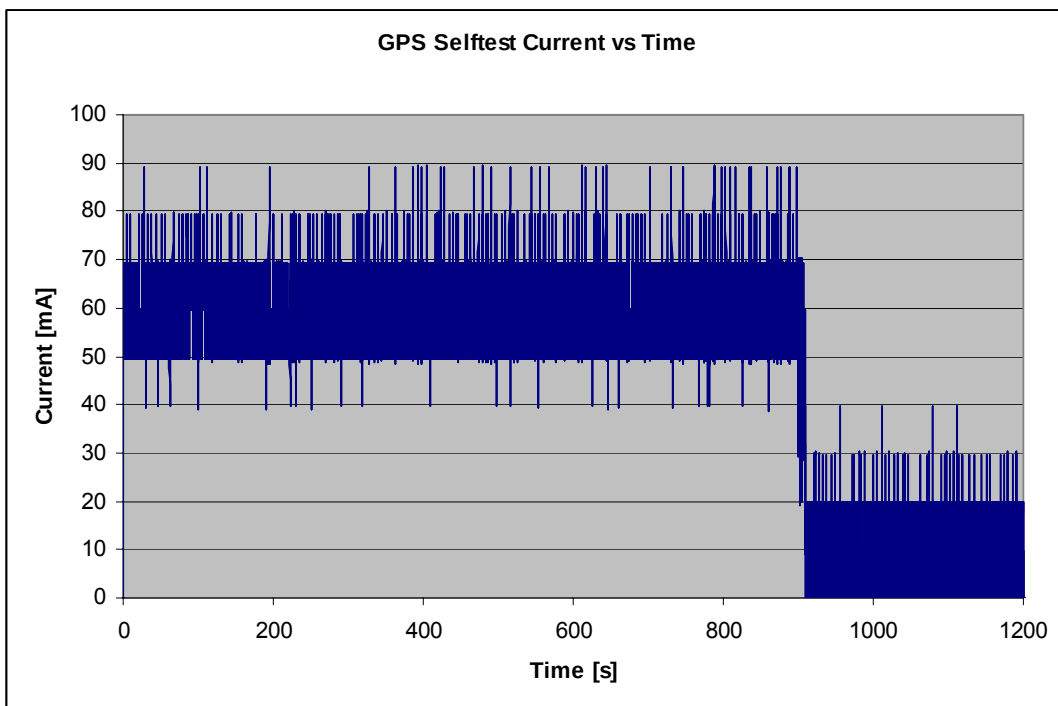
Battery Current Measurement Results (continued) - Selftest Mode



2.12 OPERATIONAL LIFE, STROBE LIGHT AND SELF TESTS

2.12.3 Battery Current Measurement Results

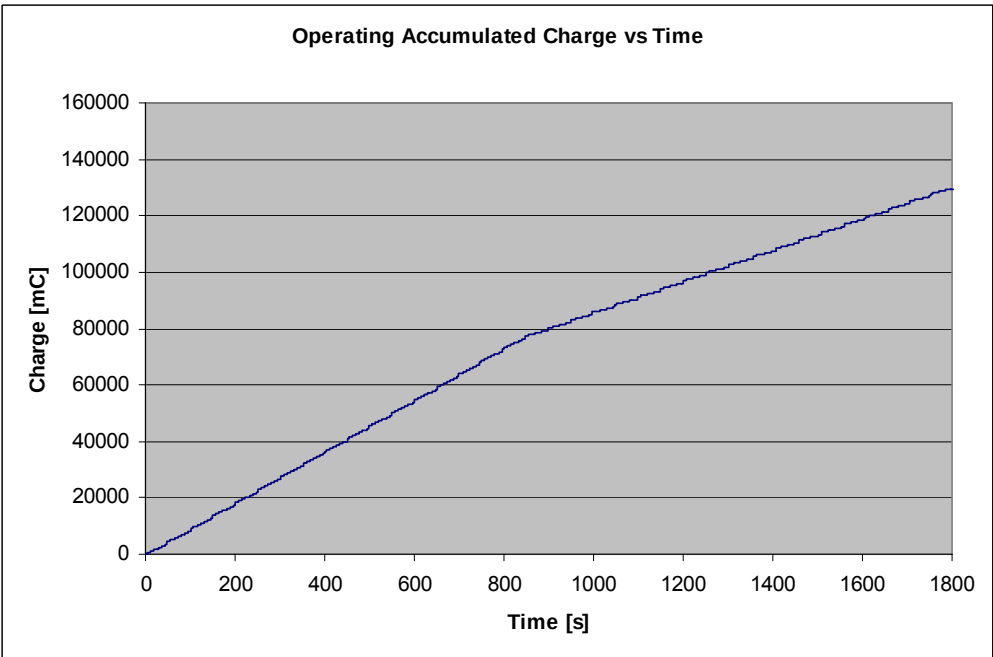
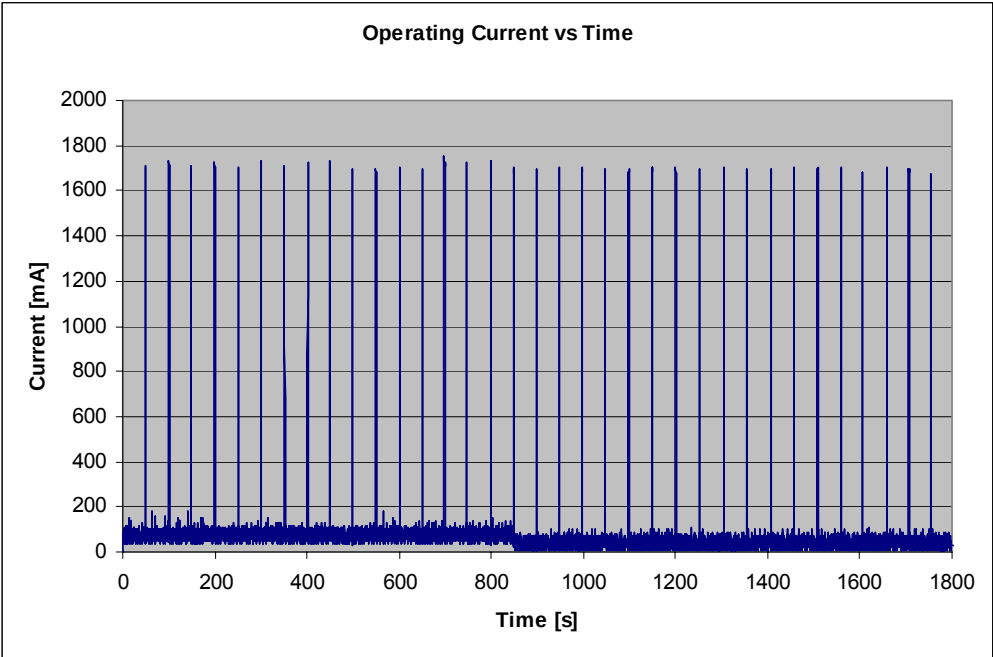
Battery Current Measurement Results (continued) – GPS Test Mode



2.6 OPERATING LIFETIME AT MINIMUM TEMPERATURE

2.6.1 Battery Current Measurement Results

Battery Current Measurement Results (continued) - Operational Mode



2.13 STROBE LIGHT TEST

2.13.1 Specification Reference

RCTM Paper 77: (A 13.2)

2.13.2 Test Results

	-20°C	Ambient	+55°C
Measured temperature (°C)	-19.2	+23.9	+54.5
Flashes per minute	21.2	21.0	21.2
Effective light output (Candela)	1.37	1.27	1.18

Note: The flash duration was recorded as 10ms.

The light was activated concurrently with the satellite EPIRB, began flashing within 10 seconds and operated for at least 48 hours (Verified during Operational Life test)



2.14 SELF TEST

2.14.1 Specification Reference

RCTM Paper 77 (A 13.3)

2.14.1 Decoded Message

BEACON ID FORMAT..... 30 HEX ID, LONG MESSAGE, BITS 25-144

15 HEX (BITS 26- 85) = 9D1CD34D34D74D1 9D1CD34D34D74D1 DEFAULT_ID

30 HEX (BITS 25-144) = CE8E69A69A6BA68E3888AFE0FF0146

	26	30	34	38	42	46	50	54	58	62	66	70	74	78	82
1	1001	1101	0001	1100	1101	0011	0100	1101	0011	0100	1101	0111	0100	1101	0001
	1100	0111	0001	0001	0001	0101	1111	1100	0001	1111	1110	0000	0010	1000	110
	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	1	USER	1
MID	27- 36	232	G BRITAIN	0011 1010 00
USER PROTOCOL	37- 39	7	TEST	111
SPARE	40- 63			0011 0100 1101 0011 0100 1101
SPARE	64- 83			0011 0101 1101 0011 0100
HOMING	84- 85	1	121.5	01
BCH ENCODED	86-106		ERRORS=0	1100 0111 0001 0001 0001 0
BCH GENERATED	86-106			1100 0111 0001 0001 0001 0
SPARE	107-126			1011 1111 1000 0011 1111
SPARE	127-144			1100 0000 0101 0001 10

2.15 AUTOMATIC RELEASE MECHANISM TEST

2.15.1 Specification Reference

RCTM Paper 77 (A 14.1)

2.15.2 REFER TO QINETIQ TEST CERTIFICATE ANNEX A

2.16 STABILITY AND BUOYANCY TEST

2.16.1 Specification Reference

RCTM Paper 77 (A 15.0)

2.16.2 Test Results

EPIRB, With the antenna deployed in its normal operating position, the G5/E5 (Smartfind) 406MHz rotated to a horizontal position about any axis and submerged in fresh water, passed through an upright position within 2 s of release.

Following release the G5/E5 (Smartfind) 406MHz EPIRB floated in an upright position with the base of the antenna a minimum of 40 mm above the water-line.

The reserve buoyancy of the G5/E5 (Smartfind) 406MHz EPIRB was determined by dividing the buoyant force by the weight of the unit:

Weight of Unit = 0.596kg

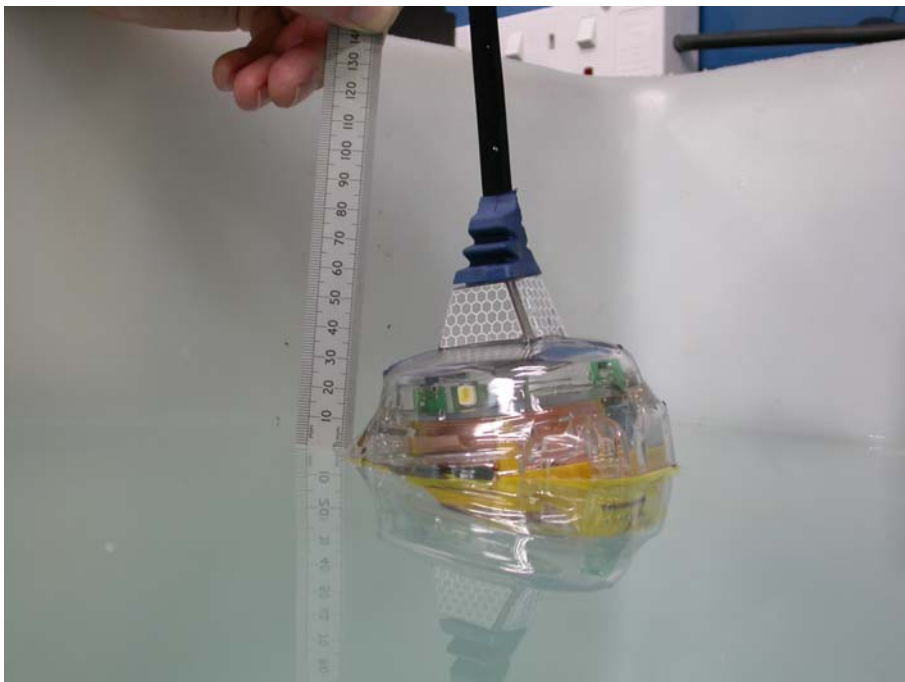
Buoyant force of submerged unit = 0.35kg

Buoyant Force/ Weight of Unit = Reserve Buoyancy

$0.350\text{kg}/0.596\text{kg} = 58.7\%$

2.16 STABILITY AND BOUYANCY

2.16.2 Test Results





2.17 INADVERTENT ACTIVATION

2.17.1 Specification Reference

RCTM Paper 77 (A 16.0)

2.17.2 Test Results

Beacon Test Report

1D1C00002FFBFF

Organization:

Tested By:

Date: 10-May-06 14:30:45 PM

Tester Model/Serial No./File Name: BT100S/1025/Functional-5

Tester Cal Due Date: Nov 10, 2006

Tester Temperature: 28°C

☐ PASS

☐ FAIL

INITIALS: _____

Notes: Add text comments here.

15 Hex ID: 1D1C00002FFBFF

Full Hex: FFFE2F8E8E000017FDFFB94D53783E0F66C

Burst Mode: Normal Mode (Long)

Protocol: Standard Test Protocol

Country 232: United Kingdom

Bits 41 - 64: 1

Position Source: Internal GPS

Auxiliary Radio: 121.5 MHz

Bits 107-110: Default

Latitude: * * * * *

Longitude: * * * * *

406 MHz Measurements

406 Frequency (INT REF): 406.0281 MHz

406 Power (5 Watt): 37.2 dBm

Power Rise Time: < 5 ms

Phase Deviation: -1.11 +1.11 radians

Modulation Rise Time: 142 uS

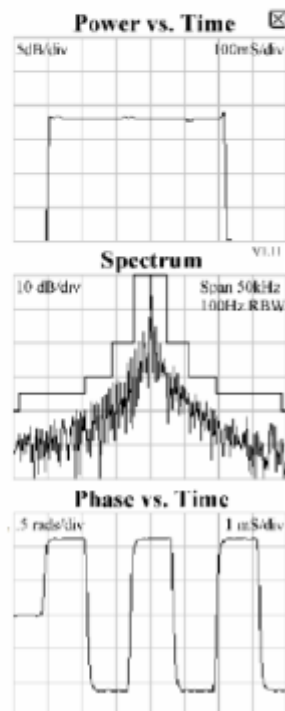
Modulation Fall Time: 153 uS

Modulation Symmetry: 0%

Modulation Bit Rate: 400 bps

CW Preamble: 161.2 ms

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OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY
DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR
FAILURE OF THIS MEASUREMENT



Beacon Test Report following Inadvertent Activation Test

2.18 AUXILIARY RADIO-LOCATING DEVICE TRANSMITTER TEST**2.18.1 Specification Reference**

RCTM Paper 77 (A 17.0)

2.18.2 CARRIER FREQUENCY (Clause A17.1)Test Date: 10th May 2006

Ambient Temperature 20°C Relative Humidity 56%

TEST CONDITIONS	FREQUENCY ERROR (kHz)		
		121.500 MHz*	
T _{nom} (+20°C)		(ref)	
T _{min} (-20°C)		+0.081	
T _{max} (55°C)		-0.429	
Maximum freq. Error (ppm)		-3.53	
Measurement uncertainty (Hz)	± 46 Hz		

Remarks

*The homing device operating frequency was offset to prevent false emergency alert.

2.18.3 TRANSMITTER DUTY CYCLE (Clause A17.2.1)Test Date: 10th May 2006

Ambient Temperature 20°C Relative Humidity 56%

TRANSMITTER DUTY CYCLE	RESULT (%)		
		121.500 MHz	
T _{nom} (+20°C)		99.05	
T _{min} (-20°C)		99.08	
T _{max} (+55°C)		98.91	
MEASUREMENT UNCERTAINTY	± 5 %		

Does the carrier transmit continuously except for a period of up to 2 seconds during the 406MHz transmission?

Yes [☒] No [☐]

2.18 AUXILIARY RADIO-LOCATING DEVICE TRANSMITTER TEST**2.18.4 MODULATION FREQUENCY AND SWEEP REPETITION RATE (Clause A17.2.2)**Test Date: 10th May 2006

Ambient Temperature 18°C

Relative Humidity 53%

TEST CONDITIONS	MODULATION PARAMETERS	
T _{nom} (+18°C)	Sweep Direction	Downward
	Minimum Audio Frequency	339.4 Hz
	Maximum Audio Frequency	1488.0 Hz
	Audio Frequency Range	1148.6 Hz
	Sweep Repetition Rate	3.005 Hz
T _{min} (-20°C)	Sweep Direction	Downward
	Minimum Audio Frequency	339.0 Hz
	Maximum Audio Frequency	1481.0 Hz
	Audio Frequency Range	1142.0 Hz
	Sweep Repetition Rate	3.000 Hz
T _{max} (+55°C)	Sweep Direction	Downward
	Minimum Audio Frequency	339.6 Hz
	Maximum Audio Frequency	1486.0 Hz
	Audio Frequency Range	1146.4 Hz
	Sweep Repetition Rate	3.002 Hz
Measurement uncertainty	Minimum Audio Frequency	± 22.4 Hz
	Maximum Audio Frequency	± 121.56 Hz
	Audio Frequency Range	± 123.6 Hz
	Sweep Repetition Rate	± 5 %

Minimum Audio Frequency	≥ 300 Hz
Maximum Audio Frequency	≥ 1600 Hz
Audio Frequency Range	≥ 700 Hz

Sweep Repetition Rate	2 to 4 Hz
-----------------------	-----------

Test Equipment Used

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

2.18 AUXILIARY RADIO-LOCATING DEVICE TRANSMITTER TEST**2.18.5 MODULATION DUTY CYCLE (Clause A17.2.3)**Test Date: 10th May 2006

Ambient Temperature 18°C Relative Humidity 53%

PARAMETER	RESULT (%)		
	121.500 MHz		
	-20°C	Ambient	+55°C
Modulation Duty Cycle	39.3	42.5	42.8
MEASUREMENT UNCERTAINTY	± 5 %		

2.18.6 MODULATION FACTOR (Clause A17.2.4)Test Date: 10th May 2006

Ambient Temperature 18°C Relative Humidity 53%

PARAMETER	RESULT (%)		
	121.500 MHz		
	-20°C	Ambient	+55°C
Modulation Factor	0.961	0.968	0.963
MEASUREMENT UNCERTAINTY	± 5 %		

2.18.7 FREQUENCY COHERENCE (Clause A17.2.5)Test Date: 12th October 2006

Ambient Temperature 21°C Relative Humidity 42%

PARAMETER	RESULT (Hz)		
	121.500 MHz		
	-20°C	Ambient	+55°C
Bandwidth Occupied by 30% of Total Power	7.85	8.65	8.65
Frequency Coherence	-3.85	-23.40	-10.42
MEASUREMENT UNCERTAINTY	± 5 %		

2.18 AUXILIARY RADIO-LOCATING DEVICE TRANSMITTER TEST

2.18.8 PEAK EFFECTIVE RADIATED POWER (PERP) (Clause A17.3)

Test Date: 31st May 2006

Ambient Temperature 21°C Relative Humidity 55%

Angle of Rotation (°)	PERP (dBm)
0	15.6
30	15.5
60	15.4
90	15.6
120	15.4
150	15.4
180	15.4
210	15.2
240	15.4
270	15.4
300	15.5
330	15.6
Measurement Uncertainty	± 5.1dB

LIMIT CLAUSE D.4.2.a)

PERP	+17dBm ± 3dB
Maximum to minimum ratio	≤ 6 dB

Remarks

The elevation angle producing the maximum gain was 10°.

2.19 HUMIDITY TEST

2.19.1 Specification Reference

RCTM Paper 77 (A 18.0)

Not applicable



2.20 ORIENTATION TEST

2.20.1 Specification Reference

RCTM Paper 77 (A 19.0

2.20.2 Test Results

Beacon Test Report	
993D40018C00F9D	
Organization: TUV Product Service Ltd Tested By: Emergency Beacons Dept. Date: 25-Aug-06 9:12:20 AM Tester Model/Serial No./File Name: BT100S/1025/mcm-smart-upright-1 Tester Cal Due Date: Nov 10, 2006 Tester Temperature: 26°C	
☐ PASS ☐ FAIL INITIALS: _____	
Notes: Add text comments here.	
15 Hex ID: 993D40018C00F9D Full Hex: FFFE2F4C9EA000C6007CECEA1B50 Burst Mode: Normal Mode (Short) Protocol: Test User Protocol Country 201: Albania National Use: 21990647795613	Power vs. Time ☒
Emergency type: unspecified Activation type: Auto	Spectrum
406 MHz Measurements 406 Frequency (INT REF): 406.0281 MHz 406 Power (5 Watt): 36.5 dBm Power Rise Time: < 5 ms Phase Deviation: -1.1 +1.11 radians Modulation Rise Time: 142 uS Modulation Fall Time: 153 uS Modulation Symmetry: 0% Modulation Bit Rate: 400.2 bps CW Preamble: 161.5 ms	Phase vs. Time
DISCLAIMER: IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.	

Beacon Test Report – Beacon Upright



2.20 ORIENTATION TEST

2.20.2 Test Results

Beacon Test Report

993D40018C00F9D

Organization: TUV Product Service Ltd

Tested By: Emergency Beacons Dept.

Date: 25-Aug-06 9:14:00 AM

Tester Model/Serial No./File Name: BT100S/1025/mcm-smart-upside-down-1

Tester Cal Due Date: Nov 10, 2006

Tester Temperature: 26°C

**PASS****FAIL****INITIALS:** _____

Notes: Add text comments here.

15 Hex ID: 993D40018C00F9D

Full Hex: FFEE2F4C9EA000C6007CECEA1B50

Burst Mode: Normal Mode (Short)

Protocol: Test User Protocol

Country 201: Albania

National Use: 21990647795613

Emergency type: unspecified

Activation type: Auto

406 MHz Measurements

406 Frequency (INT REF): 406.0281 MHz

406 Power (5 Watt): 36.3 dBm

Power Rise Time: < 5 ms

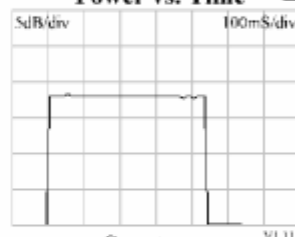
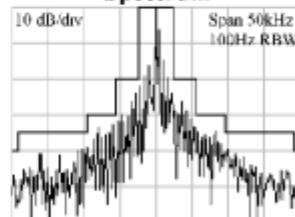
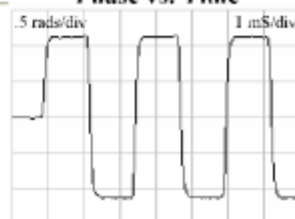
Phase Deviation: -1.11 +1.12 radians

Modulation Rise Time: 130 μ sModulation Fall Time: 142 μ s

Modulation Symmetry: 0%

Modulation Bit Rate: 400.2 bps

CW Preamble: 161.5 ms

Power vs. Time ☒**Spectrum****Phase vs. Time**

DISCLAIMER: IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.

Beacon Test Report – Beacon Upside-down



2.20 ORIENTATION TEST

2.20.2 Test Results

Beacon Test Report

993D40018C00F9D

Organization: TUV Product Service Ltd

Tested By: Emergency Beacons Dept.

Date: 25-Aug-06 9:13:12 AM

Tester Model/Serial No./File Name: BT100S/1025/mcm-smart-side-1

Tester Cal Due Date: Nov 10, 2006

Tester Temperature: 26°C

**PASS****FAIL****INITIALS:** _____

Notes: Add text comments here.

15 Hex ID: 993D40018C00F9D

Full Hex: FFFE2F4C9EA000C6007CECEA1B50

Burst Mode: Normal Mode (Short)

Protocol: Test User Protocol

Country 201: Albania

National Use: 21990647795613

Emergency type: unspecified

Activation type: Auto

406 MHz Measurements

406 Frequency (INT REF): 406.0281 MHz

406 Power (5 Watt): 36.5 dBm

Power Rise Time: < 5 ms

Phase Deviation: -1.1 +1.12 radians

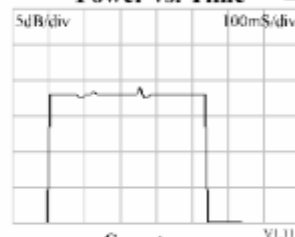
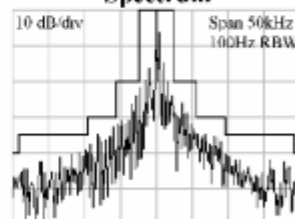
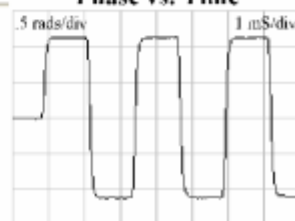
Modulation Rise Time: 142 μ SModulation Fall Time: 142 μ S

Modulation Symmetry: 0.3%

Modulation Bit Rate: 400.2 bps

CW Preamble: 161.7 ms

DISCLAIMER: IN NO EVENT SHALL WS TECHNOLOGIES INC. OR ITS DISTRIBUTORS OR AGENTS BE LIABLE FOR ANY DAMAGES OR LOSSES INCURRED AS A RESULT OF THE USE OR FAILURE OF THIS MEASUREMENT EQUIPMENT.

Power vs. Time ☒**Spectrum****Phase vs. Time**Beacon Test Report – Beacon Horizontal

SECTION 3

TEST EQUIPMENT

3.1 TEST EQUIPMENT

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

Instrument	Manufacturer	Type No	TE Number	Calibration Due
Section 2.2 Climatic - High Temperature				
Temperature Chamber	Instron	906	2128	26/12/2006
Chamber	Climatec	CLIMATEC 3	2846	29/09/2006
Section 2.3 Climatic - Humidity				
Chamber	Climatec	CLIMATEC 2	2845	23/08/2006
Section 2.4 Vibration - Sine				
Charge Amplifier	Endevco	133	2503	13/06/2006
Charge Amplifier	Endevco	133	2505	27/04/2007
Vibration Controller	Hewlett Packard	VCP9000	2508	05/12/2006
Vibration Controller	Muller & Partner	NT VX1	2509	13/03/2007
LDS 824 Vibration System	Ling	MPA16/824	2514	07/09/2006
964 Vibration System	Ling	LAS V964	2515	27/11/2006
Accelerometer	Endevco	7254A-10	2521	03/09/2006
Accelerometer	Endevco	7254A-10	2523	18/02/2007
Accelerometer	Endevco	7254A-10	2537	18/02/2007
Accelerometer	Endevco	256-10	2582	03/09/2006
Accelerometer	Endevco	256-10	2583	03/09/2006
Section 2.8 Climatic - Wet Tests				
Thermocouple	Global	T-Type	1504	27/08/2006
Over Pressure (T)	ASL (TV)	0 TO 15 PSI	2125	Class 1 (Int)
Pressure Sensor	Druck	RPT301	2345	07/10/2006
Data Logging Thermometer	Digitron	2098T	2348	14/09/2006
Tape Measure	Stanley		2363	TU
Water Jet Nozzle	Pasternack	12.5mm DIA	2453	07/07/2007
Temperature Logger	Digitron	2098T	2479	08/02/2007
Hygromer	Rotronic	A1	2677	08/12/2006
Chamber	Climatec	CLIMATEC 3	2846	29/09/2006

3.1 TEST EQUIPMENT

Section 2.12 Beacons - Operating Lifetime				
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	O/P Mon
Power Meter	Hewlett Packard	436A	47	21/06/2007
Climatic Chamber	Heraeus Votsch	VM 04/100	85	O/P Mon
Frequency -Time Analyser	Hewlett Packard	5372A	93	27/07/2006
Signal Generator	Hewlett Packard	8644A	96	17/12/2006
Time Interval Analyser	Yokogawa	TA720	181	17/11/2006
Oscilloscope	Gould	840	182	31/01/2007
Digital Temperature Indicator	Fluke	51	412	21/09/2006
Attenuator 10dB/10W)	Trilithic	HFP-50N	454	05/08/2006
Attenuator: 10dB/20W	Narda	766-10	480	21/12/2006
Attenuator (10dB)	Weinschel	47-10-34	481	21/12/2006
Signal Generator	Hewlett Packard	8663A	1172	23/08/2006
Broad Band Filter	Texscan	8BC-372-186-BB	1246	TU
Power Sensor	Hewlett Packard	8482A	1341	19/09/2006
Attenuator:10dB/10W	Trilithic	HFP-50N	1377	11/07/2006
Broadband Filter	Texscan	8BC-372-186-BB	2281	TU
Data Logger	Pico Technology Ltd	ADC-42	2395	21/09/2006
1m N(m) -N(m) Cable	Reynolds	269-0088-1000	2396	21/07/2006
3m N(m) - N(m) RF Cable	Reynolds	269-008803000	2413	21/07/2006
TERMINATION: 50ohm/15W	Radio Spares	612-192	2425	26/07/2006
Distress Beacon RF Unit	TUV		2445	TU
Logic Analyser	Hewlett Packard	1631D	2757	28/06/2006
20dB/20W Attenuator	JFW	50FHC-020-20	2774	18/02/2007
Beacon RF Unit	TUV	N/A	3066	TU
50ohm / 6W Termination	Micronde	R404613	3074	18/02/2007
3dB/2W Attenuator	Hewlett Packard	HP8491B	3075	18/02/2007
Attenuator: 3dB/2W	Hewlett Packard	HP8491B	3077	18/02/2007
1m N(m)-N(m) RF Cable	Reynolds	269-0088-1000 0201	3078	Class 1 (Int)
50ohm/ 1W Termination	Suhner		3080	18/02/2007



3dB/2W Attenuator	Hewlett Packard	HP8491B	3082	28/07/2006
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3.1 TEST EQUIPMENT

Section 2.10 Beacons - Spurious Emissions				
Attenuator (3dB,10W)	Texscan	HFP-50N	475	05/08/2006
Spectrum Analyser	Hewlett Packard	E4407B	1154	31/05/2007
20dB/20W Attenuator	JFW	50FHC-020-20	2774	18/02/2007

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

4.1 ACCREDITATION, DISCLAIMER 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).

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ANNEX A

**Additional Documents
16 pages in total**

Protection against continuous transmission

The McMurdo Smartfind EPIRB is designed to limit any inadvertent 406.028MHz transmission to a maximum of 3 seconds under the worst case conditions.

Figure 1 is an extract from the Smartfind circuit diagram 82-830C issue 1. The PA_ON line provides gate bias to the 406 PA FET Q6 via resistive network R32, R33 and R59, and also enables the PA regulator (not shown). This regulator supplies power to the drain of Q6 (Vpa). The PA_ON line also supplies voltage to the gate of Q4 via the time constant R43 and C48. If the 406 PA is on for longer than a few seconds sufficient voltage will be developed across C48 to switch Q4 on. This will result in all the PA_ON voltage being dropped across R44 and therefore removing the DC gate bias to Q6 and the shutting down the PA regulator (Vpa).

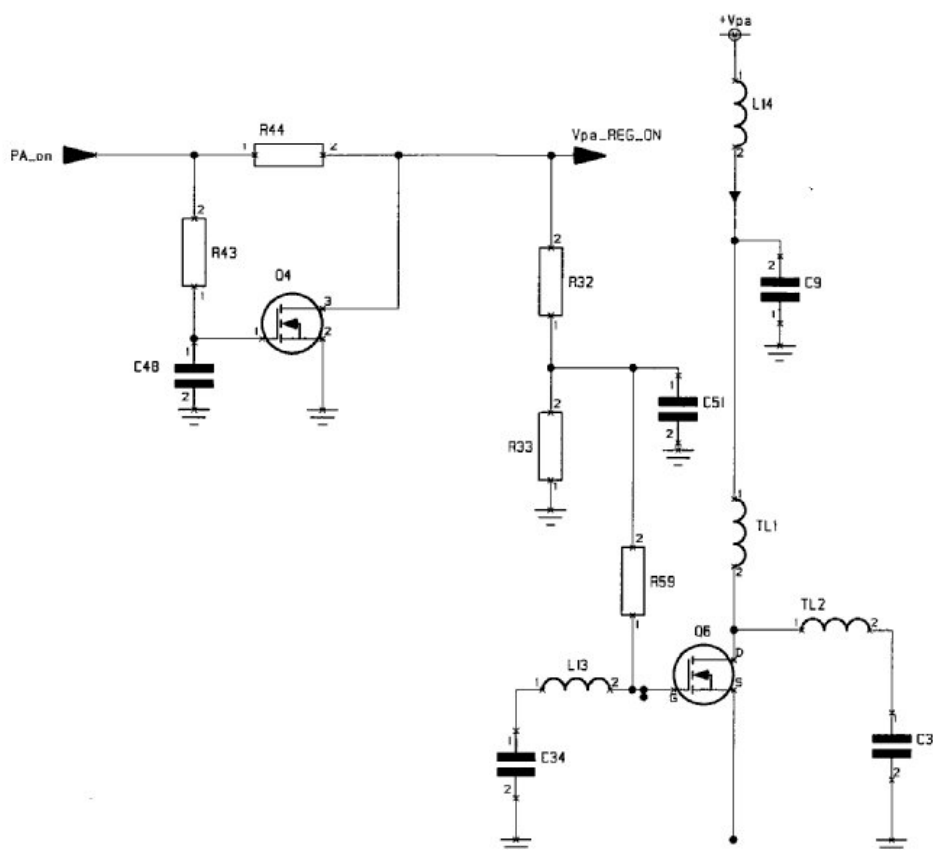


Figure 1

Neil Jordan
Electronics Engineer
8-5-06

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

The internal GPS navigation device is an EZGPM01 12-channel module made by Eazix in the Philippines.

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.

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 Eazix GPS module fails in such a way to output incorrect logic levels, this input is protected by diodes from excessive voltage on the input.

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.

Neil Jordan
Electronics Engineer
15-5-06

G5 / Smartfind+ EPIRB

Statement on self-test

Standard self-test

The G5 is a 406.028MHz EPIRB operating with the Cospas-Sarsat satellite system. The G5 has a press and release self-test facility, which operates as follows.

- a) Power up the micro-controller, the CMAC oscillator and the GPS module.
- b) Generate one short CW burst at 121.5MHz, check the antenna RF level is above threshold.
- c) Activate the 406.028MHz PLL and check that it is locked.
- d) Generate an inverted frame 406.028MHz transmission. Check the antenna RF level is above threshold. (This also confirms the battery is capable of high current loads).
- e) Confirm the GPS receiver has output normal NMEA sentences. (do not wait for a fix).

The self-test completes within 9s. If all of the above checks prove true then the sounder will sound; the LED strobe light and also the RED and GREEN LEDs will all flash simultaneously. The number of flashes actually depends on the total accumulated battery use, as follows -

Accumulated Battery Hours	Strobe / LED Flash Count Sounder Beep Count
0 to 4	3
5 to 6	2
6+	1

Additional GPS long self-test

This feature can only be accessed at the end of a successful self-test operation. If the beacon's self-test button is held down for more than 15s after the LEDs begin flashing, the GPS long self-test mode will be entered. Holding the button for such a long time deliberately makes this test hard to initiate.

If the user attempts a GPS long self-test following a failed normal self-test, the software will not initiate the long self-test. In this case the software will release the power latch and sit idling until the user releases the self-test button. The time during which the button is held down will be accumulated by the battery lifetime timer and stored in non-volatile memory.

The long GPS test takes 15 minutes to complete. When the GPS reports a valid position, the green LED will be lit and the sounder will 'beep'. The strobe LED will flash a number of times to indicate how many unused GPS long self-tests remain in the unit. For example 9 flashes indicate there are 9 more long GPS tests remaining (a maximum of 10 are allowed).

The long GPS test can be exited by holding down the test button continuously for 5s.

Battery life counter

The accumulated runtime of the beacon (both live and self-tests) is recorded by the micro-controller, thus giving an accurate indication of remaining battery life.

Repetitive self-test protection

Self tests are controlled by firmware which monitors the duration of TEST button presses, looking for firm and lengthy self test requests, thus avoiding accidental repetition of self tests.

Neil Jordan
Electronics Engineer
8-5-06

McMurdo

BS EN ISO 9001, BS9000/CECC and CAA Approved
Registered in England No. 746603
Registered Office: 1650 Parkway, Whiteley, Fareham, Hampshire PO15 7AH
VAT No. GB 421 1393 92



Certificate of Test

EPIRB Hydrostatic Release



Certificate number: QINETIQ/D&TS/SES/TC0609749
 Date of issue: 21/07/2006
 Issue: 1.0

EMC Facility
 QinetiQ Farnborough
 Ively Road, Farnborough
 Hampshire. GU14 0LX, UK
 Telephone : 01252 394009
 Facsimile : 01252 397058

Administrative Information

Customer: Sales Ref 05/347 TUV Product Services *for McMurdo Marine Ltd*
 Customer Representative: Mr R Bradbeer
 Equipment under test: EPIRB in hydrostatic housing
 Build Standard: Declared as Production units
 Test specifications: RTCM EPIRB Standard, Test A14.0
 Test Limits: Float Free at between 1 & 4 metre depth
 Test dates: 24 March 2006, 5 May 2006 & 20 July 2006
 Modes of operation: EPIRB in standby condition
 Test engineer: P J Goddard
 Location of Testing: Building A50, QinetiQ Farnborough.
 Test equipment used: Centre for Human science's Plunge Pool
 EMC's Climatic chamber, Metal tape measure
 Uncertainty of measurement: Direct depth measurement $\pm 5\text{cm}$
 Temperature $\pm 2^\circ\text{C}$

Test Item Details

Item No	Item	Type	Notes
1	McMurdo EPIRB Beacon	Smartfind G5	Also E5 (mechanically identical)
2	Hammer Hydrostatic Release	H-20	8 x disposable release

Test Summary

Test	Pre-condition Temperature	Position/Attitude of release housing during test.	Clear release and EPIRB float free?	Depth of release	Result
1	-30°C (Min Stow)	Vertical – Normal Attitude	YES	3.5m	Pass
2	Ambient	Vertical - Normal Attitude	YES	3.1m	Pass
3	Ambient	Rolling 90° to Starboard	YES	3.1m	Pass
4	Ambient	Rolling 90° to Port	YES	3.1m	Pass
5	Ambient	Horizontal.- Pitching Cover Up	Yes	3.2m	Pass
6	Ambient	Horizontal –Pitching Cover down	YES	3.2m	Pass
7	Ambient	Vertical -. Inverted (Upside down)	YES	3.0m	Pass
8	+70°C(Max Stow)	Vertical - Normal Attitude	YES	3.0m	Pass

Photographs of the EPIRB and test set-up can be found on the following pages.

IT IS CERTIFIED THAT THE TESTS DETAILED IN THIS CERTIFICATE HAVE BEEN CARRIED OUT AS SPECIFIED, WITH THE RESULTS AS SHOWN, TO THE REQUIREMENTS OF THE CONTRACT.

Signed (electronic)
 P Goddard
 EMC Business Group,
 Spectrum Solutions
 Farnborough
Photographs.

Date 25 July 2006

Certificate of Test

EPIRB Hydrostatic Release

QinetiQ

Certificate number: QINETIQ/D&TS/SES/TC0609750
Date of issue: 21/07/2006
Issue: 1.0

EMC Facility
QinetiQ Farnborough
Ively Road, Farnborough
Hampshire. GU14 0LX, UK
Telephone : 01252 394009
Facsimile : 01252 397058



EPIRB mounted on the plunge pole ready test, Rolling 90° attitude.



The release mechanism primed ready for the cover to be put on, Hammar H20 release can be seen to the left and when hydrostatically triggered will cut through the black nylon post that holds the cover on. The coiled spring under the hinged release plate will then push up and away the G5 beacon.

Certificate of Test

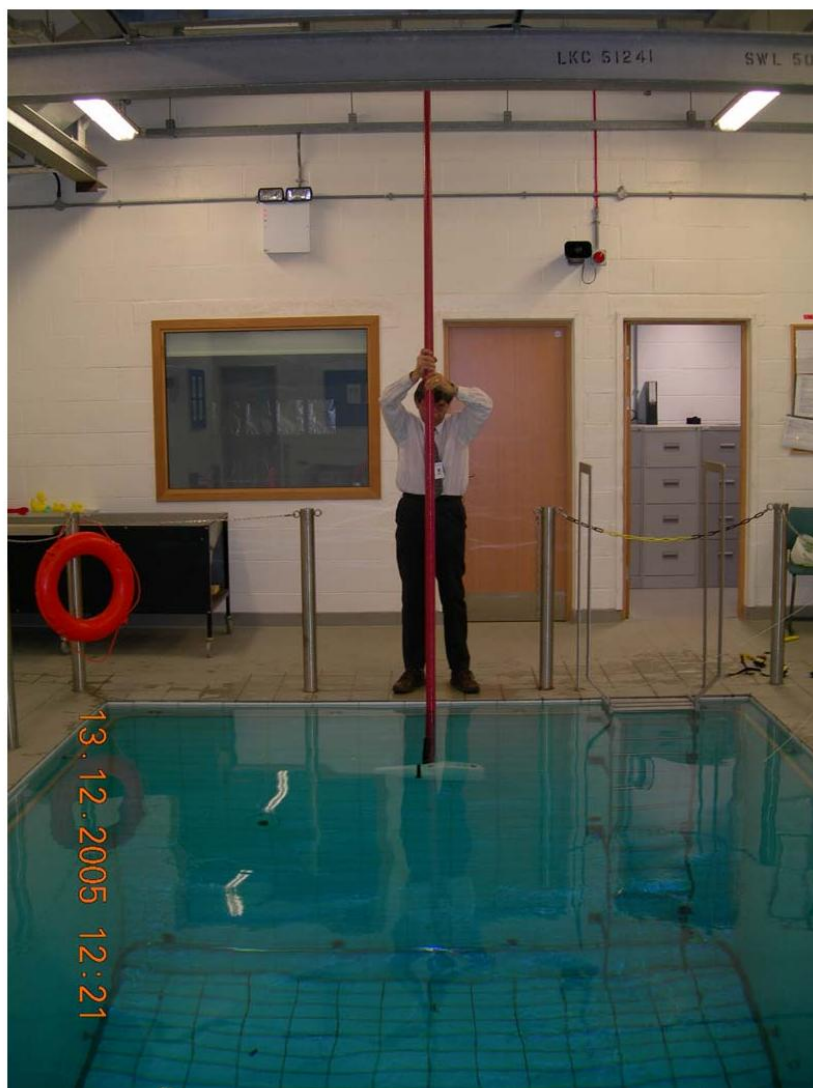
EPIRB Hydrostatic Release



Certificate number: QINETIQ/D&TS/SES/TC0609750
Date of issue: 21/07/2006
Issue: 1.0

EMC Facility
QinetiQ Farnborough
Ively Road, Farnborough
Hampshire. GU14 0LX, UK
Telephone : 01252 394009
Facsimile : 01252 397058

Photographs (Continued).



Overall view of plunge pool and typical test set-up.

Method of conduct of tests is to fix the EPIRB release housing onto the plunge pole in the required attitude, the pole would then be gently lowered into the plunge pool until release mechanism actuates and depth noted.

Certificate of Test

EPIRB Hydrostatic Release



Certificate number: QINETIQ/D&TS/SES/TC0613291
 Date of issue: 18/10/2006
 Issue: 1.1

EMC Facility
 QinetiQ Farnborough
 Ively Road, Farnborough
 Hampshire, GU14 0LX, UK
 Telephone : 01252 394009
 Facsimile : 01252 397058

Administrative Information

Customer: McMurdo Marine Ltd
 File Reference: Ref 06/189
 Equipment under test: EPIRB in hydrostatic housing
 Build Standard: Declared as Production units
 Test specifications: RTCM EPIRB Standard, Test A14.0 and BS EN 6109/-2: 2000 Clause 3.1.8 (IEC 61996-2)
 Test Limits: Float Free at between 1 & 4 metre depth
 Test dates: 4 October 2006 & 6 October 2006
 Modes of operation: EPIRB in standby condition
 Test engineer: Nigel Vickers
 Location of Testing: Building A50, QinetiQ Farnborough.
 Test equipment used: Centre for Human science's Plunge Pool. Water temperature during testing, +27 degrees.
 EMC's Climatic chamber, Metal tape measure
 Uncertainty of measurement: Direct depth measurement $\pm 5\text{cm}$ Temperature $\pm 2^\circ\text{C}$

Test Item Details

Item No	Item	Type	Notes
1	McMurdo EPIRB Beacon	Smartfind G5	Also E5 (mechanically identical)
2	McMurdo Hydrostatic Release	Breakthru HRU	8 x disposable release

Test Summary

Test	Pre-condition Temperature	Position/Attitude of release housing during test.	Clear release and EPIRB float free?	Depth of release	Result
1	+70°C(Max	Vertical - Normal Attitude	Yes	3.0 M	Pass
2	Ambient	Vertical - Normal Attitude	Yes	3.0 M	Pass
3	Ambient	Rolling 90° to Port	Yes	3.1 M	Pass
4	Ambient	Vertical - Inverted (Upside down)	Slight agitation then float free.	3.0 M	Pass
5	Ambient	Rolling 90° to Starboard	Yes	2.7 M	Pass
6	Ambient	Horizontal- Pitching Cover down	Slight agitation then float free.	3.0 M	Pass
7	Ambient	Horizontal -Pitching Cover up	Yes	3.0 M	Pass
8	-30°C(Min Stow)	Vertical - Normal Attitude	Yes	3.25 M	Pass

* BSEN 61097-2 Specifies +65°C but +70°C is acceptable as worst case.

Photographs of the EPIRB and test set-up can be found on the following pages.

IT IS CERTIFIED THAT THE TESTS DETAILED IN THIS CERTIFICATE HAVE BEEN CARRIED OUT AS SPECIFIED, WITH THE RESULTS AS SHOWN, TO THE REQUIREMENTS OF THE CONTRACT.

Signed (electronic) N.Vickers
 EMES Business Group, SES
 Farnborough

N.Vickers

Date 11th October 2006

Certificate of Test

EPIRB Hydrostatic Release



Certificate number: QINETIQ/D&TS/SES/TC0613291
Date of issue: 18/10/2006
Issue: 1.1

EMC Facility
QinetiQ Farnborough
Ively Road, Farnborough
Hampshire. GU14 0LX, UK
Telephone : 01252 394009
Facsimile : 01252 397058

Photographs.



EPIRB mounted on the plunge pole ready test, Horizontal. - Pitching Cover down.



The release mechanism primed ready for the cover to be put on, McMurdo EPIRB Breakthru HRU release can be seen to the left and when hydrostatically triggered will cut through the black nylon post that holds the cover on. The coiled spring under the hinged release plate will then push up and away the G5 beacon. Note temporary HRU label due to new production at McMurdo, Portsmouth.

Certificate of Test

EPIRB Hydrostatic Release



Certificate number: QINETIQ/D&TS/SES/TC0613291
Date of issue: 18/10/2006
Issue: 1.1

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Photographs (Continued).



Overall view of plunge pool and typical test set-up. (previous test)

Method of conduct of tests is to fix the EPIRB release housing onto the plunge pole in the required attitude, the pole would then be gently lowered into the plunge pool until release mechanism actuates and depth noted.

Smartfind E5 & G5 EPIRB Materials Declaration

As required by IEC 61097-2 & RTCM test requirements the Smartfind E5 & G5 EPIRB products are required to be tested and to meet the specific tests -

- Corrosion (Salt Mist) IEC 60945 8.12 & IEC 68-2-52
- Solar Radiation IEC 60945 8.10 & ETS 300-066.6.11
- Oil Resistance IEC 60945 8.11 & ETS 300-066.6.11

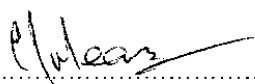
IEC 60945 stipulates that where a manufacturer can produce evidence that the components, materials and finishes employed in the equipment would satisfy the tests then the tests shall be waived.

In this instance McMurdo claim, for the one or more of the reasons listed below that these criteria are met and therefore make application that the tests be waived.

1. The materials have a proven history of service in a marine environment. Either from use in McMurdo's existing approved marine equipment range, or by implication from a long established history of exposure without effect (e.g. stainless steel).
2. The material manufacturer has conducted equivalent testing and has declared the product as being immune to these effects in the relevant data sheet.
3. McMurdo in-house testing has proven the materials to be immune to the cause of degradation (e.g. oil resistance).

McMurdo Limited hereby declares that the materials used in the construction of the Smartfind E5 & G5 EPIRB products as here-in listed are not affected by the degrading agents listed above.

Signed on behalf of McMurdo Limited.


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Date 16th June 2006

C. J. Mears
Mechanical Engineering Manager

Components and materials listed below are in contact with the marine environment

REFLECTIVE TAPE SET	RETRO REFLECTIVE TAPE TYPE 3M 3150 MS/3/70/02
MAIN SEAL 'O' RING	SILICONE RUBBER 70 SHORE
ANTENNA 'O' RING SEAL	SILICONE RUBBER 70 SHORE
SEA CONTACT 'O' RING	SILICONE RUBBER 70 SHORE
OVERMOULDED TEST BUTTON	SANTOPRENE 8211-55B100 / LEXAN 943A
OVERMOULDED ANTENNA ASSEMBLY	TALLAC AP45
BLADE ANTENNA	STAINLESS STEEL 302S25 / NYLON COATED
SWITCH SLIDER	BAYBLEND T85
FRANGIBLE TAB	SAN PDV 36
SEA CONTACT PIN	BRASS BS2874 CZ131 WITH GOLD OVER NICKEL FINISH
FLOAT FREE BASE	LURAN S OR GELOY ASA
LEVER ARM	TOYOLAC ABS 700-314
FLOAT FREE COVER	LURAN S OR GELOY ASA
ROD BREAKABLE	ACETAL COPPOLYMER
LABEL FRONT GPS	UV STABLE CLEAR POLYESTER WITH POLYPROPYLENE OVERLAY
LABEL FRONT Non GPS	UV STABLE CLEAR POLYESTER WITH POLYPROPYLENE OVERLAY
LABEL REAR	UV STABLE POLYESTER
LANYARD HOLDER	PC/ABS - PULSE A135-110 OR GE CYCOLOY C1200
LANYARD BRAID	8 PLAIT MF POLPROPYLENE (P380)
MANUAL BRACKET	LURAN S OR GELOY ASA
MANUAL BRACKET CARRY OFF	HIGHGLASS PF 062/2 20% GLASS REINFORCED POLYPROPYLENE
CLIP 'R'	STAINLESS STEEL 304
PULL TAG	TOYOLAC ABS 700-314
PLACARD UNIVERSAL	3M SCOTCHLITE FLEXIBLE GRAPHIC FILM 680-10
CLEAR MEDIA	CLEAR POLYESTER TYP222C PERMANENT ACRYLIC ADHESIVE
FLOAT MOULDING	PC/ABS, BAYBLEND T85
DOMO MOULDING	POLYCARBONATE, LEXAN 943A
PROD.DECAL AUTO HOUSING	REFLATAC PE GRADE WITH POLYPROPYLENE OVERLAY
OPERATION / LOCK LABEL AUTO HOUSING	REFLATAC PE GRADE WITH POLYPROPYLENE OVERLAY
G5 MED/BATT EXP LABEL	CLEAR POLYESTER TYP222C PERMANENT ACRYLIC ADHESIVE
MAGNET	SINTERED NdFeB.GRADE N35, COATED NiCuNi. MAGNETISED.
CLEAR MEDIA	CLEAR POLYESTER TYP222C PERMANENT ACRYLIC ADHESIVE
HYSOL 609	EPOXY ADHESIVE
M3 NYLOC NUT	STAINLESS STEEL A4/316
M3 x 8 POS PAN HD SCREW	STAINLESS STEEL A4/316
WASHER CRINKLE M4 BS4463	STAINLESS STEEL A2/304
NUT M4 NYLOC	STAINLESS STEEL A4/316
SCREW No 4 x 11mm POZI PAN SELF TAP	STAINLESS STEEL A2/304
SCREW M4x12 POSI PAN	STAINLESS STEEL A2/304
SPRING CONICAL	STAINLESS STEEL 302-026
CLIP 'E'	STAINLESS STEEL A4/316
WASHER M8	STAINLESS STEEL A4/316
HINGE PIN	STAINLESS STEEL A4/316
SINKER WEIGHT BUSH	STAINLESS STEEL A4/316
SINKER WEIGHT	STAINLESS STEEL A4/316
MOUNTING INSTRUCTION LABEL	CLEAR POLYESTER TYP222C PERMANENT ACRYLIC ADHESIVE

We hereby confirm that the products we deliver

Article: 3/CR2/3AH
P22-00096

meet the requirements of the tests according to the "Recommendations of the transport of Dangerous Goods, UN Manual of Tests and Criteria, Part III, subsection 38.3" and comply in original VARTA packaging to the following special provisions of international transport regulations:

- IATA: Special Provision A45
- ADR: Special Provision 188
- IMO/IMDG Code: Special Provision 188
- DOT / 49 CFR: Provision 173.185

VARTA Microbattery
mobility for you
VARTA Microbattery GmbH
Daimlerstr. 1
73479 Ellwangen
Germany

company stamp

i.A. Jst

signature

(Dr. Rainer Jostes)
General Manager
Quality Assurance

04 May 2006

date



G5/E5 Smartfind battery safety precautions

The Smartfind E5/G5 battery pack drawing calls up ST/SG/AC.10/11 revision 4 (United Nations recommendations on the transport of dangerous goods). Battery safety issues are covered by testing to ST/SG/AC.10/11 revision 4, this involves testing of our battery packs for the following parameters:-

Altitude Simulation
Thermal
Vibration
Shock
External Short Circuit
Impact
Forced Discharge

It is in our opinion that since McMurdo Ltd have called up ST/SG/AC.10/11 revision 4 on our drawing, it is implicit upon the battery manufacturer to comply or not accept the contract to supply.

Neil Jordan
Electronics Engineer
12-7-06

G5 GPS EPIRB Technical Specification

General

Approved to	COSPAS-SARSAT T.001 class2 RTCM SC110-STD Version 2.1 class2 IEC 61097-2 class 2
Complies with	EN 60945 Part 80 of FCC regulations
Operating temperature range	-20°C to +55°C
Storage temperature range	-30°C to +70°C
Operational life	48 hours minimum at -20°C
Battery Type	8.5V Lithium Sulphur Dioxide
Battery expiry	6 years form date of manufacture

Electrical

406.028MHz transmitter

Frequency	406.028MHz $\pm$ 1KHz
Output power	5W $\pm$ 2dB
Data encoding	Bi-phase L
Modulation	Phase modulation: 1.1 rads $\pm$ 0.1 rads
Transmission time	520ms $\pm$ 1%
Repetition period	50 secs $\pm$ 2.5 secs

121.5 MHz transmitter

Frequency	121.5MHz $\pm$ 3KHz
Output power	50mW $\pm$ 3dB PERP
Transmit duty cycle	Continuous
Modulation format	3K20A3X
Modulation frequency sweep	1480Hz to 340Hz
Modulation duty cycle	37% $\pm$ 5%
Sweep repetition	3Hz $\pm$ 1Hz
Sweep direction	Programmable UP or DOWN

GPS receiver/engine

Centre frequency	Band L1 1.57542GHz
Received signal sensitivity	-172dBW minimum
Maximum number of satellites tracked	12

Transmit Antenna

Type	Flexible, vertical whip
Characteristics	Vertically polarised, omni-directional

Receive Antenna

Type	Ceramic dielectric patch
Characteristics	Right-hand circular polarised. Nominal +3dBi.

Optical

Type	LED
Flash rate	20 to 23 flashes per minute
Light output	>0.75 candela.

External Interfaces

Programming interface	Infra-red link via USB port on a PC.
Manual activation	Slide activated switch. Protected by tamper cover.
Automatic activation	Sea water switch contacts. Activation within 3 seconds of immersion.
Self test	Sealed membrane switch. Press and Hold to activate self-test. Confirmation of successful self-test by 3 flashes of LED strobe light.

Physical characteristics

Weight	657g
Height	390mm
Width	107.5mm