Product Service

Choose certainty.
Add value.

Report On

Emergency Beacons Testing of the
Breitling SA
EMERGENCY
In accordance with RTCM 11010.2

Document 75924879 Report 01 Issue 1 July 2014

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

REPORT ON

Emergency Beacons Testing of the
Breitling SA
EMERGENCY

Document 75924879 Report 01 Issue 1

July 2014

PREPARED FOR

Breitling SA
Schlachthausstrasse 2
2540 GRENCHEN
Switzerland

PREPARED BY

Martin Hardy
Engineer

APPROVED BY

Jensen Adams
Authorised
Signatory

Robert Hampton
Authorised
Signatory

Gareth Stephens
Authorised
Signatory

DATED

22 July 2014

UKAS TESTING
0141

Product Service

CONTENTS

Product Service

SECTION 1

REPORT SUMMARY

Emergency Beacons Testing of the
Breitling SA
EMERGENCY

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Emergency Beacon Testing of the Breitling SA EMERGENCY to the requirements of RTCM 11010.2.

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	Breitling SA
Model Number(s)	EMERGENCY
Serial Number(s)	1555969 1555585
Number of Samples Tested	2
Test Specification/Issue/Date	RTCM 11010.2 2012
Date of Receipt of Test Samples	January 2014
Order Number Date	Email 21/11/2013 JPG 21 November 2013
Start of Test	11 April 2013
Finish of Test	16 June 2014
Name of Engineer(s)	M Hardy R Hampton S Jones

1.2 APPLICATION FORM

APPLICANT'S DETAILS

COMPANY NAME :	BREITLING SA
ADDRESS :	Schlachthausstrasse 2 CH-2540 GRENCHEN Switzerland
NAME FOR CONTACT PURPOSES :	Jean-Paul Girardin
TELEPHONE NO: +41 32 654 54 54	FAX NO: +41 32 654 54 00 E-MAIL: jean-paul.girardin@breitling.com

EQUIPMENT INFORMATION

Model name/number	EMERGENCY	Identification/Part number	76325
Hardware Version	Spin5-PCB -Emergency-Watch-II	Software Version	P/N breitling_7.15, ver. 7.15
Manufacturer	Breitling	Country of Origin	Switzerland
FCC ID	OPFX763	Industry Canada ID	11807A

Technical description (a brief description of the intended use and operation)

Wrist-worn dual frequency PLB which shares casing with an analog-digital watch chronograph

Supply Voltage:

[ ]	AC mains	State AC voltage V	and AC frequency ..... Hz
[ ]	DC (external)	State DC voltage V	and DC current ..... A
[X]	DC (internal)	State DC voltage 4.2 V	and Battery type Lithium-ion LIRB NMC/Si

Frequency characteristics:

Transmitter Frequency range	121.5 MHz and 406.04 MHz	Channel spacing ..... (if channelized)
Receiver Frequency range (if different)	not applicable	Channel spacing..... (if channelized)

Designated test frequencies:

Bottom: ..... MHz Middle: ..... MHz Top: ..... MHz

Intermediate Frequencies : ..... MHz

Highest Internally Generated Frequency : ..... MHz

Power characteristics:

Maximum transmitter power 5 W — Minimum transmitter power (if variable) 0.03 W

[ ]	Continuous transmission	
[X]	Intermittent transmission	State duty cycle dependent on temperature 33% for 121.5 MHz, 2% for 406.04 MHz

If intermittent, can transmitter be set to continuous transmit test mode? ~~Y~~/N

Antenna characteristics:

[ ]	Antenna connector	State impedance ..... ohm
[ ]	Temporary antenna connector	State impedance ..... ohm
[X]	Integral antenna Type "406-121.5MHz" P/N 109.024	State gain -3 dBi
[ ]	External Antenna Type	State gain ..... dBi

Modulation characteristics:

[ ]	Amplitude	[ ] Other
[ ]	Frequency	Details: .....
[ ]	Phase	(GMSK, QSPK etc)

Can the transmitter operate un-modulated? ~~Y~~/N

ITU Class of emission: 121.5 MHz: 3K20A3X + 2K00A2A (morse code P); 406 MHz: 16K0G1D

Battery/Power Supply

Model name/number	Lithium-ion LIRB	Identification/Part number	INP63438
Manufacturer	Prollion	Country of Origin	France

Ancillaries (if applicable)

Model name/number	NONE	Identification/Part number	
Manufacturer		Country of Origin	

Extreme conditions:

Maximum temperature	+55 °C	Minimum temperature	-20 °C
Maximum supply voltage	4.2 V	Minimum supply voltage	2.5 V

Product Service

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

Signature : 

Name : Jean-Paul Girardin

Position held : Vice-President

Date : June 10, 2014

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Breitling SA EMERGENCY 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

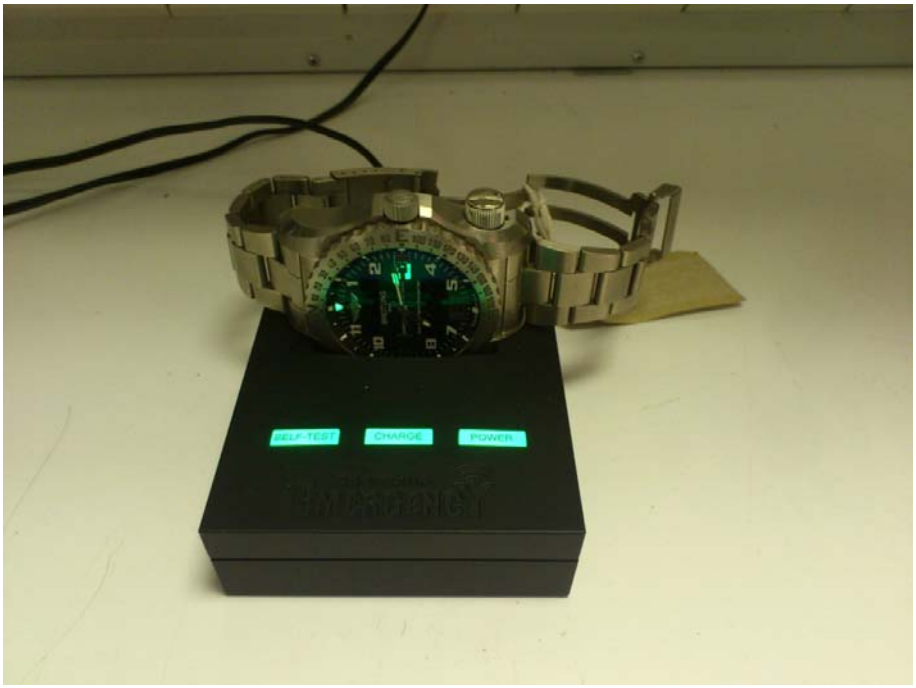
The Equipment Under Test (EUT) was operated using its own power source (internal battery). One EUT was configured so that the antenna port was connected to the 50Ω test system using a coaxial cable. This EUT was used for all conducted measurement tests (emissions, 121 parameters, etc.) and whenever a performance test and check was required by the standard. Due to the EUT physical configuration with a modified conducted output, it was not suitable for any tests requiring immersion into water, vibration, bump or drop tests.

A second EUT was a fully packaged beacon, similar to the proposed production beacons equipped with its proper antenna. 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. This EUT was subjected to all environmental tests where it was subjected to a post test performance check (defined below). It was also used for radiated PEIRP measurements.

Performance Test and Check

For the purpose of this report, a performance test was only performed on the modified conducted sample. This EUT was fitted with an additional on/off switch to allow repeated activations/deactivations. The fully packaged EUT is intended as a single use item only (i.e. once deployed, cannot be deactivated by the user).

A performance check was performed on both samples when requested in the standard. For the fully packaged beacon, performance check was performed by placing the EUT into the customer supplied charging fixture. The fixture confirmed a satisfactory internal self-test by displaying green illuminated LEDs as shown below:



Performance Check – Fully Packaged EUT (Radiated Sample)

1.3.3 Modes of Operation

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

Off/Standby Mode

- LED – inactive, unless the internal battery level drops below a threshold level. (See notes below).

Self-test

- EUT placed in battery charger,
- List of items checked as per Customer Supplied Information (Application Form),
- Charger and EUT LED's indicate Self-test Pass or Fail.

Operating

- 406 and 121 antennae deployed,
- 121 Homer active (Note: The 121 homer is only active when the temperature is above a predetermined threshold level. Once the temperature falls below this level, the 121 homer deactivates to conserve battery power).

Notes

In Standby mode a red flashing LED will alert the end user that the EUT battery requires recharging if:

- the battery level drop below a safety threshold,
- OR the TBRC (Time Between Recommended Charges) time has expired.

The manufacturer has stated that the operating manual will clearly state that, should the user not recharge the battery when recommended, the operating lifetime performance of the EUT will be compromised.

To carry out a self-test, the EUT is placed in the supplied battery charger. When charging is complete, the charger and EUT LED's will indicate a successful self-test (green LED) or a self-test failure (red LED). Should a failure occur, the user will be advised to return the EUT to the manufacturer for servicing.

1.4 MODIFICATIONS

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

1.5 REPORT MODIFICATION RECORD

Issue 1 – First Issue

SECTION 2

TEST DETAILS

Emergency Beacons Testing of the
Breitling SA
EMERGENCY

TEST RESULTS TABLE

Parameter to be Measured	Range of Specification	Units	Test Results			Comments
			(-20 °C)	(+21 °C)	(+55 °C)	
1. PRE-CONDITIONING PERFORMANCE CHECK (A.1.13)						
Model: EMERGENCY, S/N: 1555969, TUV Ref: TSR2 and Modification State 0 & S/N: 1555585, TUV Ref: TSR12 and Modification State 0						**Result:** Pass
Visual Inspection	No Damage	P/F		P		
Carrier Frequency	406.025 MHz ± 0.002 MHz or Other ± 0.001 MHz	MHz		406.040048		
Digital Message	15 Hex / 30 Hex Correct	P/F		P		
121 MHz Homer **Note** Wherever a Performance Check is called for in these Test Results Tables it also includes a Visual Inspection of the PLB.	Functional	P/F		P		

Parameter to be Measured	Range of Specification	Units	Test Results			Comments
			(-20 °C)	(+21 °C)	(+55 °C)	
2. DRY HEAT TEST (A.3)						
Model: EMERGENCY, S/N: 1555969, TUV Ref: TSR2 and Modification State 0 & S/N: 1555585, TUV Ref: TSR12 and Modification State 0						**Result:** Pass
Post-Storage Performance Check	Pass/Fail	P/F			P	
Post-Functional Performance Test	Pass/Fail	P/F			P	
406 Output Power	35 – 39	dBm			34.85	Outside specification limits but within limits expanded by Test Facility Accuracy requirements in Cospas-Sarsat T.008
406 Output Power Rise Time	< 5 ms	P/F			P	
Digital Message	Correct	P/F			P	
Bit Rate and Stability (max/min)	400 bps ± 1%	bps			400.47/399.03	
406 Modulation (max/min)	Positive Deviation +1.0 to +1.2 Negative Deviation -1.0 to -1.2	rad			1.1953/0.9716 -1.2222/-0.9941	Outside specification limits but within limits expanded by Test Facility Accuracy requirements in Cospas-Sarsat T.008
406 Frequency	406.025 ± 0.002 or Other ± 0.001	MHz			406.0400291	
406 Spurious Output	Within Emission Mask	P/F			P	
Post-Functional Performance Check	Pass/Fail	P/F			P	
3. DAMP HEAT TEST (A.4)						
Model: EMERGENCY, S/N: 1555969, TUV Ref: TSR2 and Modification State 0 & S/N: 1555585, TUV Ref: TSR12 and Modification State 0						**Result:** Pass
Performance Check	Pass/Fail	P/F			P	

Parameter to be Measured	Range of Specification	Units	Test Results			Comments
			(-20 °C)	(+21 °C)	(+55 °C)	
4. LOW TEMPERATURE TEST(A.5)						
Model: EMERGENCY, S/N: 1555969, TUV Ref: TSR2 and Modification State 0 & S/N: 1555585, TUV Ref: TSR12 and Modification State 0						**Result:** Pass
Post-Storage Performance Check	Pass/Fail	P/F	P			
Post-Functional Performance Test	Pass/Fail	P/F	P			
406 Output Power	35 – 39	dBm	34.66			
406 Output Power Rise Time	< 5 ms	P/F	P			
Digital Message	Correct	P/F	P			
Bit Rate and Stability (max/min)	400 bps ± 1%	bps	400.295/399.138			
406 Modulation (max/min)	Positive Deviation +1.0 to +1.2 Negative Deviation -1.0 to -1.2	rad	1.220/0.962 -1.240/-0.978			Outside specification limits but within limits expanded by Test Facility Accuracy requirements in Cospas-Sarsat T.008
406 Frequency	406.025 ± 0.002 or Other ± 0.001	MHz	406.0400409			
406 Spurious Output	Within Emission Mask	P/F	P			
Post-Functional Performance Check	Pass/Fail	P/F	P			
5. VIBRATION TEST (A.6)						
Model: EMERGENCY, S/N: 1555585, TUV Ref: TSR12 and Modification State 0						**Result:** Pass
During Test no Activation	No activation during test	P/F		P		
Performance Check	Pass/Fail	P/F		P		
6 BUMP TEST (A.7)						
Model: EMERGENCY, S/N: 1555585, TUV Ref: TSR12 and Modification State 0						**Result:** Pass
During Test, No Activation	No activation during test	P/F		P		
Performance Check	Pass/Fail	P/F		P		

Parameter to be Measured	Range of Specification	Units	Test Results			Comments
			(-20 °C)	(+21 °C)	(+55 °C)	
7. CORROSION TEST (A.8)						
N/A						**Result:** Waiver
No sign of corrosion, peeling paint and other signs of deterioration.	Pass/Fail	P/F		-		* Test waivered, see Annex A for details.
Performance Check	Pass/Fail	P/F		-		
8. DROP TEST (A.9)						
Model: EMERGENCY, S/N: 1555585, TUV Ref: TSR12 and Modification State 0						**Result:** Pass
During Test, no Activation	No activation during test	P/F	P			
Performance Check	Pass/Fail	P/F	P			
9. THERMAL SHOCK (A.10)						
Model: EMERGENCY, S/N: 1555585, TUV Ref: TSR12 and Modification State 0						**Result:** Pass
After test examine for signs of water ingress	No evidence of water ingress	P/F	P			
Performance Check	Pass/Fail	P/F	P			
10. IMMERSION TEST (A.11)						
Portable Equipment Temporary Immersion						
Model: EMERGENCY, S/N: 1555585, TUV Ref: TSR12 and Modification State 0						**Result:** Pass
After test examine for signs of water ingress	No evidence of water ingress	P/F		P		
Performance Check	Pass/Fail	P/F		P		

Parameter to be Measured	Range of Specification	Units	Test Results			Comments
			(-20 °C)	(+21 °C)	(+55 °C)	
11. SPURIOUS EMISSIONS TEST (A.12)						
Model: EMERGENCY, S/N: 1555969, TUV Ref: TSR2 and Modification State 0						**Result:** Pass
Close in emissions	Comply with Figures 2 and 6	P/F	P	P	P	
Harmonic Emissions	< - 30 dBc	P/F	P	P	P	
Aeronautical, Maritime and Satellite Band Emissions	No signal to exceed 25 µW in stated bands	P/F		P		

Parameter to be Measured	Range of Specification	Units	Test Results			Comments
			(-20 °C)	(0 °C)	(+55 °C)	
12. OPERATIONAL LIFE AND SELF TESTS (A.13) Tested at 0 °C (121 Homing Transmitter enabled) and -20 °C (121 Homing Transmitter disabled)						
Model: EMERGENCY, S/N: 1555969, TUV Ref: TSR2 and Modification State 0						**Result:** See Section 2.12
Operational Life	24 Hours min	P/F	-	-		See Section 2.12
Pre-test battery discharge required	-	hours	9.46	9.46		See Annex A. To be deducted from Time to first failure
Time to First Failure	-	hours	36.82	34.16		Effective duration at 0 °C (34.16 - 9.46) = 24.7 hours Effective duration at -20 °C (36.82 - 9.46) = 27.36 hours
Performance Test carried out every 6 hours	Confirm	Y/N	Y	Y		
406 Output Power (max/min)	35 – 39	dBm	35.11 34.88	35.47 35.04		
406 Output Power Rise Time	< 5 ms	P/F	P	P		
Digital Message	Correct	P/F	P	P		
Bit Rate and Stability (max/min)	400 bps ± 1%	bps	399.0 400.2	399.5 399.0		Up to 24 hours of operation
406 Modulation (max/min)	Phase Deviation ± 1.1 Rad ± 0.1 Rad	rad	+1.09 / +1.08 -1.10 / -1.09	+1.10 / +1.09 -1.10 / -1.08		
406 Frequency (max/min)	406.025 ± 0.002 or Other ± 0.001	MHz	406.0400460 406.0400352	406.0400354 406.0400331		
406 Spurious Output	Within Emission Mask	P/F	P	P		
121 Peak Envelope Output Power	Pass/Fail	P/F	N/A	P		

Parameter to be Measured	Range of Specification	Units	Test Results			Comments
			(-20 °C)	(+21 °C)	(+55 °C)	
13. Cospas-Sarsat TYPE APPROVAL TESTS (A.14)						
Model: EMERGENCY, S/N:See TUV report 75924041 Report 01						**Result:** Pass *
Cospas-Sarsat Type Approval Tests	-	Y/N	N/A			See Annex A for C/S type approval Letter of Compatibility. * Tests completed out-of-sequence

14. BUOYANCY TEST (A.14) – Category 1 PLBs only				
N/A				**Result:** N/A
Buoyancy	Floats	P/F	N/A	The EUT is a Category 2 PLB and is therefore not required to float.
Floating Upright (PLBs designed to work floating in water only)	Self Rights	< 2 s	N/A	

Parameter to be Measured	Range of Specification	Units	Test Results			Comments
			(0 °C) *	(+21 °C)	(+55 °C)	
15. 121.5 MHz AUXILIARY RADIO-LOCATING DEVICE TRANSMITTER TEST (A.16)						
Model: EMERGENCY, S/N: 1555969, TUV Ref: TSR2 and Modification State 0 & S/N: 1555585, TUV Ref: TSR12 and Modification State 0						**Result:** Fail**
Carrier Frequency	121.5 ± 0.006075	MHz	121.50025		121.50042636	* The minimum temperature for the 121.5 MHz auxiliary radio locating device transmitter tests was 0 °C. The 121.5 homing transmitter is only operational at temperatures of 0 °C and above. See Waiver (Annex A) for further details.
Transmitter Duty Cycle	Continuous interrupted for up to a maximum of 2 seconds encompassing the 406 MHz burst and plus the additional time required for the Morse "P" transmission.	P/F	F ** 34%		F ** 34%	
Modulation						
Frequency	≥ 700 within 300 – 1600	Hz	920		842	
Duty Cycle	33 – 55	%	35.5 (worst case)		36.8 (worst case)	
Factor	0.85 – 1.0		0.92		0.87	
Sweep Repetition Rate	2 – 4	Hz	2.62		2.64	
Frequency Coherence	Pass/Fail	P/F	P		P	** Non compliance noted for Transmitted Duty Cycle: see Waiver (Annex A) for further details.
Morse Letter P						
Dot Length	115 ms ± 5%	ms	115.8		115.4	
Dash Length	345 ms ± 5%	ms	349.65		348.8	
Gap	115 ms ± 5%	ms	115.0		114.3	
Mod Frequency	1000 Hz ± 50 Hz	Hz	1000.0		1000.0	
PEIRP (Radiated)	Median 14 – 20 dBm (25 – 100 mW)	dBm		14.99		
Max PEIRP	Value	dBm		15.13		
Min PEIRP	Value	dBm		14.83		
Ratio Max – Min	< 4:1 (< 6 dBm)	dB		0.30		
Off Ground Plane PEIRP	≥ 2 mW	mW		24.15		

Parameter to be Measured	Range of Specification	Units	Test Results			Comments
			(-20 °C)	(+21 °C)	(+55 °C)	
16. SOLAR RADIATION TEST (A.17)						
N/A						**Result:** Waiver
After Test visually inspect unit	Pass/Fail	P/F	N/A			
Performance Check	Pass/Fail	P/F	N/A			* Test waivered, see Annex A for details.
17. OIL RESISTANCE TEST (A.18)						
N/A						**Result:** Waiver
After Test visually inspect unit	Pass/Fail	P/F	N/A			
Performance Check	Pass/Fail	P/F	N/A			* Test waivered, see Annex A for details.
18. COMPASS SAFE DISTANCE TEST (A.19)						
Model: EMERGENCY, S/N: 1555585, TUV Ref: TSR12 and Modification State 0						**Result:** Pass
Standard Compass Safe Distance	Mark Distance on PLB and/or in User Manual	m		0.16		
Emergency Compass Safe Distance	Mark Distance on PLB and/or in User Manual	m		0.16		

Parameter to be Measured	Range of Specification	Units	Test Results			Comments
			(-20 °C)	(+21 °C)	(+55 °C)	
19. MISCELLANEOUS TESTS (A.20)						
Model: EMERGENCY, S/N: 1555585, TUV Ref: TSR12 and Modification State 0						**Result:** -
A.20.1 Controls and Indicators						Note: For Section 19 of this table "Y" denotes that the particular parameter or feature was inspected only and any observations are reported in the main section of the report. Where applicable it is noted if further Information is supplied by the Manufacturer. No final decision or comment is made upon compliance.
PLB complies with 4.4.1	Inspection	Y/N		Y		
Two independent step activations	Inspection	Y/N		Y		
Visual or Audible indication of activation	Inspection	Y/N		Y		
A.20.2 Self-test and GNSS Self-test Function		Y/N				
Self-test automatically resets	Inspection	Y/N		Y		
Self-test has indication of activation	Inspection	Y/N		Y		
Manufacturers declaration complies with 4.4.2 a), b) and c)	Inspection	Y/N		Y		
GNSS Self-test (if applicable)		Y/N				
Distinct Means of Operation	Inspection	Y/N		N/A		
Prevents Inadvertent Operation	Inspection	Y/N		N/A		
Distinct Pass/Fail Indicators	Inspection	Y/N		N/A		
Manufacturers declaration complies with 4.4.2 c), d), e) and f)	Inspection	Y/N		N/A		
A.20.3 Battery		Y/N		-		
Labelling complies with 4.5.2.1	Inspection	Y/N		-		
Manufacturer has provided evidence that Battery and Cells are either exempt from or meet UN Dangerous Goods regulations	Inspection	Y/N		-		
A.20.4 General Construction		Y/N		-		
PLB complies with 4.5	Inspection	Y/N		-		
A.20.5 Exterior Finish		Y/N		-		
PLB complies with 4.5.1	Inspection	Y/N		-		

Parameter to be Measured	Range of Specification	Units	Test Results			Comments
			(-20 °C)	(+21 °C)	(+55 °C)	
19. MISCELLANEOUS TESTS (A.20)						
A.20.6 Labelling						Note: For Section 19 of this table "Y" denotes that the particular parameter or feature was inspected only and any observations are reported in the main section of the report. Where applicable it is noted if further Information is supplied by the Manufacturer. No final decision or comment is made upon compliance.
Labelling complies with 4.5.2.2 to 4.5.2.2.4	Inspection	P/F		-		
Labelling tested for Abrasion Resistance	Inspect manufacturers report	P/F		-		
Instructions and Pictograms tested for Comprehension	Inspect manufacturers report	P/F		-		
A.20.7 Documentation		P/F		-		
Manual complies with 4.5.3	Inspection	P/F		-		
Packaging complies with 4.5.4	Inspection	P/F		-		

2.1 PRE-CONDITIONING

2.1.1 Specification

RTCM 11010.2, Clause A.1.13

2.1.2 Equipment Under Test and Modification State

Emergency S/N: 1555969 - Modification State 0
Emergency S/N: 1555585 - Modification State 0

2.1.3 Date of Test

7 April 2014 & 8 April 2014

2.1.4 Test Equipment Used

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

2.1.5 Environmental Conditions

Ambient Temperature 21.9 – 22.4 °C
Relative Humidity 30.1 – 34.8 %

2.1.6 Test Results

Visual Inspection

Prior to the start of the testing schedule the EUT was visually inspected. No signs of damage were found.

Performance Check

A Performance Check was conducted to ensure that the EUT was functional before all upcoming tests.

Summary of Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	Pass
Normal Mode:	
Normal Message	FFFE2F50DFA002F600578A007F80
406 MHz Frequency	406.040048
121 MHz Presence	P

2.2 DRY HEAT TESTS

2.2.1 Specification

RTCM 11010.2, Clause A.3

2.2.2 Equipment Under Test and Modification State

Emergency S/N: 1555969 - Modification State 0
Emergency S/N: 1555585 - Modification State 0

2.2.3 Date of Test

8 April 2014 & 9 April 2014

2.2.4 Test Equipment Used

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

2.2.5 Environmental Conditions

Ambient Temperature 21.9 – 24.5 °C
Relative Humidity 30.1 – 39.6 %

2.2.6 Test Method

Storage Test

The EUT was placed in a climatic chamber with the temperature set to 70.0 °C. After 16 hours, the temperature was reduced to 22.0 °C and the EUT was subjected to a performance check.

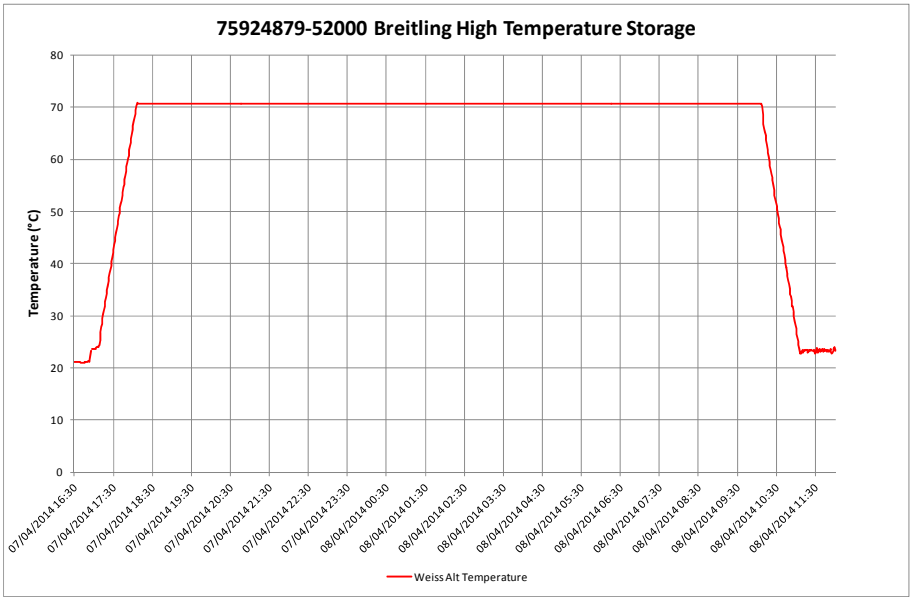
Functional Test

The EUT was placed in a climatic chamber with the temperature set to 55.0 °C. After 14 hours, the EUT was subjected to a performance check and performance test.

2.2.7 Test Results

Storage Test

Temperature Plot

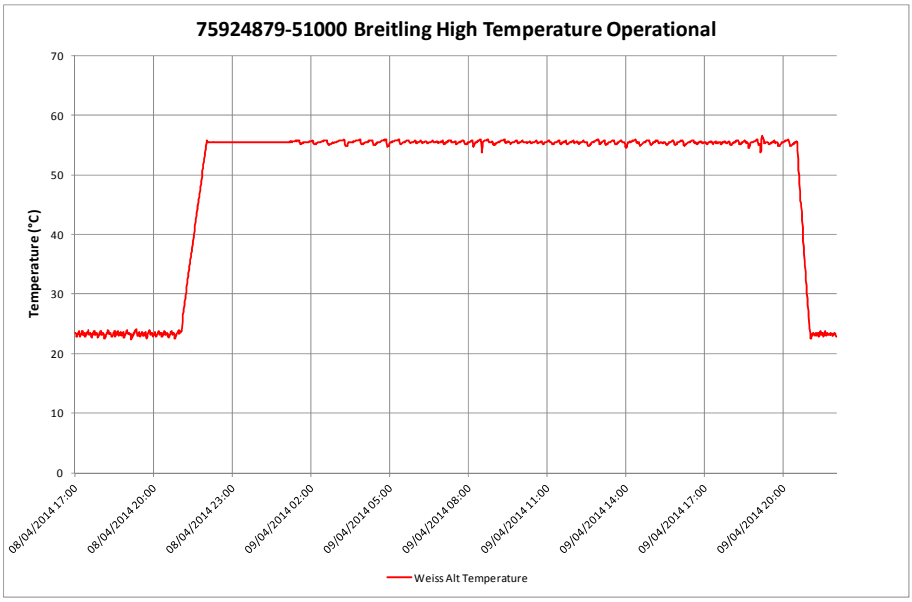


Post-Storage Period Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	Pass
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F50DFA002F600578A007F80 406.040044 P

Function Test

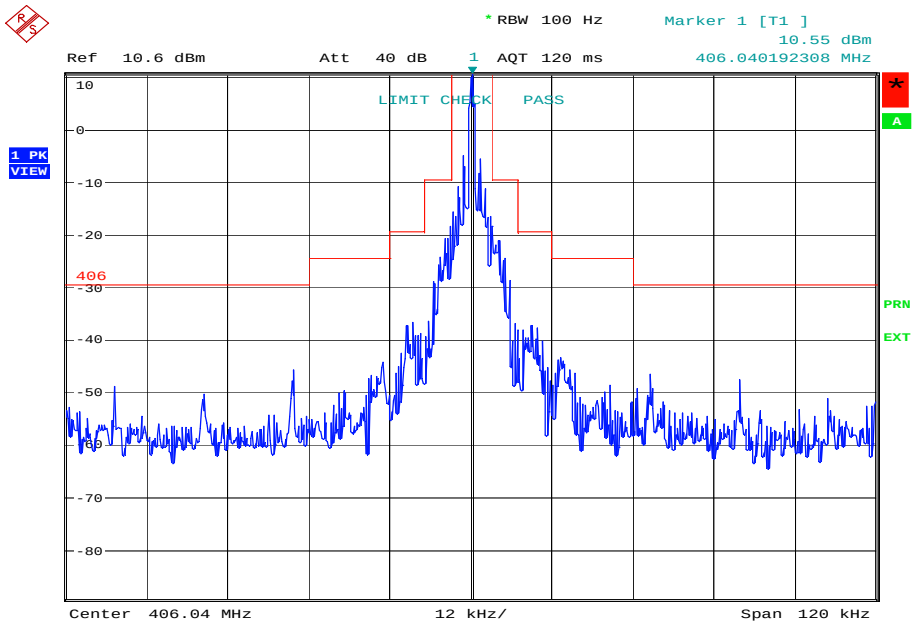
Temperature Plot



During Functional Period Performance Test

Parameter	Result
406 Output Power	34.85 (Within MU stated in Cospas-Sarsat T.008)
Digital Message	FFFE2F50DFA002F600578A007F80
Bit Rate: Average (bps) max/min	400.47/399.03
Modulation: Rise Time (uS) max/min	190.4/167.3
Modulation: Fall Time (uS) max/min	190.6/175.7
406 Modulation Positive Deviation (rad) max/min	1.1953/0.9716
406 Modulation Negative Deviation (rad) max/min	-1.2222/-0.9941
406 Frequency (MHz)	406.0400291
Short-term Stability (/100 ms)	1.318×10^{-10}
Medium-term Stability – Slope (/minute)	5.222×10^{-11}
Medium-term Stability – Residual Frequency Stability (no units)	7.590×10^{-10}
Spurious Emissions	(see Plot)

Spurious Emissions during Functional Period



Date: 9.APR.2014 20:01:24

Post-Functional Period Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	P
Normal Mode:	
Normal Message	FFFE2F50DFA002F600578A007F80
406 MHz Frequency	406.040044
121 MHz Presence	P

2.3 DAMP HEAT TEST

2.3.1 Specification

RTCM 11010.2, Clause A.4

2.3.2 Equipment Under Test and Modification State

Emergency S/N: 1555969 - Modification State 0
Emergency S/N: 1555585 - Modification State 0

2.3.3 Date of Test

10 April 2013 & 11 April 2014

2.3.4 Test Equipment Used

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

2.3.5 Environmental Conditions

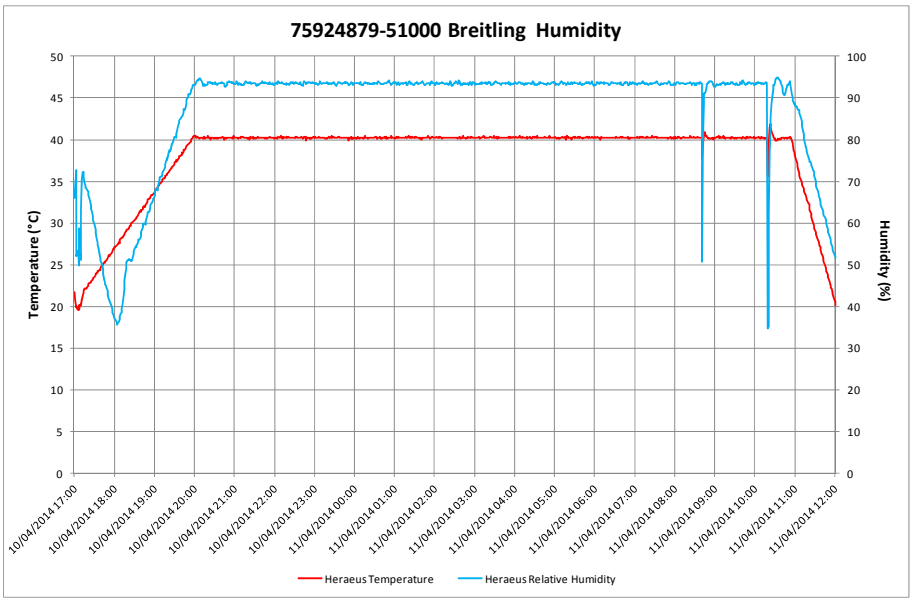
Ambient Temperature 22.2 – 22.3 °C
Relative Humidity 31.0 – 33.7 %

2.3.6 Test Method

The EUT was placed in a climatic chamber with the temperature increased to 40.0 °C and the relative humidity increased to 95%. After 15 hours, the EUT was activated for at least 2 hours and during this period a performance check was performed.

2.3.7 Test Results

Temperature Plot



Summary of Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	Pass
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F50DFA002F600578A007F80 406.040035 P

2.4 LOW TEMPERATURE TESTS

2.4.1 Specification

RTCM 11010.2, Clause A.5

2.4.2 Equipment Under Test and Modification State

Emergency S/N: 1555969 - Modification State 0
Emergency S/N: 1555585 - Modification State 0

2.4.3 Date of Test

23 April 2014 & 24 April 2014

2.4.4 Test Equipment Used

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

2.4.5 Environmental Conditions

Ambient Temperature 22.7 – 23.8 °C
Relative Humidity 34.2 – 45.3%

2.4.6 Test Method

Storage Test

The EUT was placed in a climatic chamber with the temperature reduced to -30 °C. After 14.5 hours, the temperature was increased to 22 °C after which the EUT was subjected to a performance check.

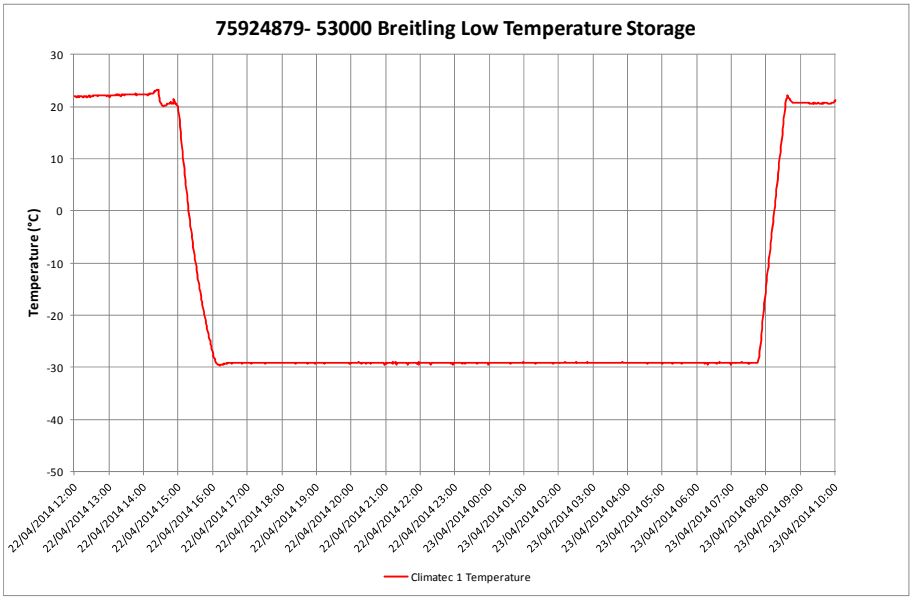
Functional Test

The EUT was placed in a climatic chamber with the temperature reduced to -20 °C. After 14 hours, the EUT was activated for at least 2 hours and during this period was subjected to a performance check and performance test.

2.4.7 Test Results

Storage Test

Temperature Plot



Summary of Performance Check Results

Performance Check

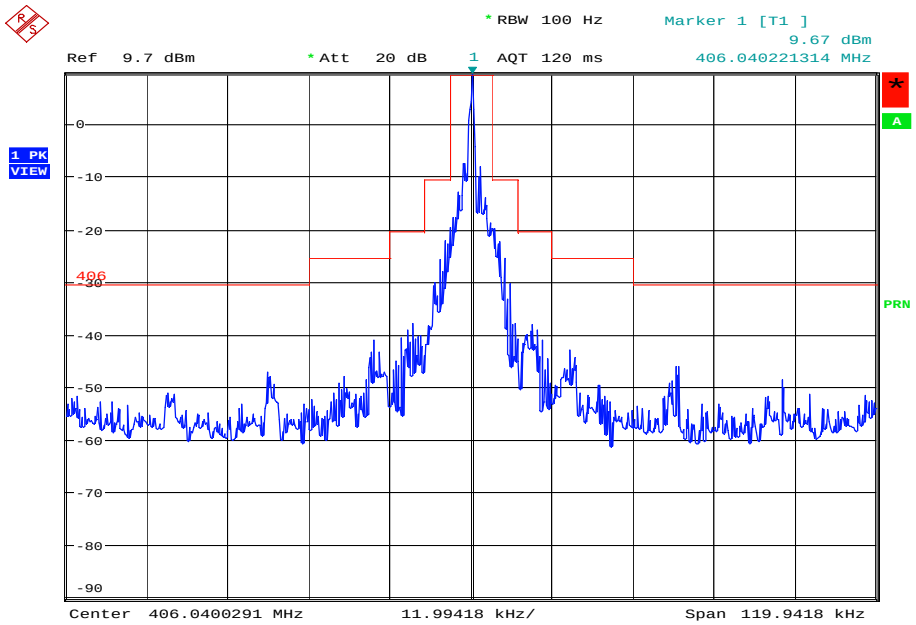
Parameter	Result
Self-test Mode:	
Self-test Message	Pass
Normal Mode:	
Normal Message	FFFE2F50DFA002F600578A007F80
406 MHz Frequency	406.040051
121 MHz Presence	P

Functional Test

Performance Test

Parameter	Result
406 Output Power	34.66 (Within MU stated in Cospas-Sarsat T.008)
Digital Message	FFFE2F50DFA002F600578A007F80
Bit Rate and Stability (Bps) max/min	400.295/399.138
Modulation: Rise Time (uS) max/min	190.4/165.3
Modulation: Fall Time (uS) max/min	190.6/164.6
406 Modulation Positive Deviation (rad) max/min	1.220/0.962
406 Modulation Negative Deviation (rad) max/min	-1.240/-0.978
406 Frequency (MHz)	406.0400409
Short-term Stability (/100 ms)	1.261×10^{-9}
Medium-term Stability – Slope (/minute)	-1.280×10^{-10}
Medium-term Stability – Residual Frequency Stability (no units)	6.090×10^{-10}
Spurious Emissions	(see Plot)

Spurious Emissions



Date: 24.APR.2014 09:23:33

Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	Pass
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F50DFA002F600578A007F80 406.040027 P

2.5 VIBRATION TESTS

2.5.1 Specification

RTCM 11010.2, Clause A.6

2.5.2 Equipment Under Test and Modification State

Emergency S/N: 1555585 - Modification State 0

2.5.3 Date of Test

6 May 2014

2.5.4 Test Equipment Used

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

2.5.5 Environmental Conditions

Ambient Temperature 22.7 – 23.9 °C
Relative Humidity 34.8 – 45.9 %

2.5.6 Test Method

The EUT was fixed to the vibration table and was subject to the following vibration profiles:

Resonance Sweep

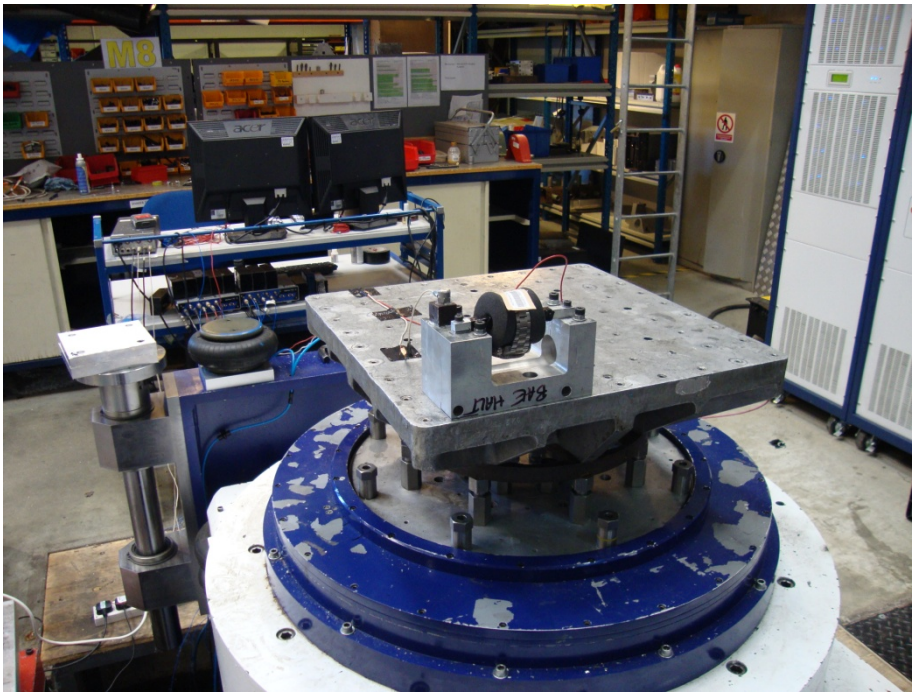
– 5 Hz and up to 13.2 Hz with an excursion of ±1 mm (7 m/s² maximum acceleration at 13.2 Hz);
– above 13.2 Hz and up to 100 Hz with a constant maximum acceleration of 7 m/s².

One sweep was performed at a rate of 0.5 octaves / minute.

The EUT was subjected to a 2 hour endurance run at any observed resonances in each axis as required by the relevant standard.

2.5.7 Test Results

Setup Photo



Summary of Performance Check Results

Stage/Parameter	Results
Vertical Axis	
Resonance Search	36.72 Hz
Endurance Run	36.72 Hz
Self-test Message	Pass
Normal Message	N/A
406 MHz Frequency	N/A
121 MHz Presence	N/A
Lateral Axis	
Resonance Search	25.73 Hz
Endurance Run	25.73 Hz
Self-test Message	Pass
Normal Message	N/A
406 MHz Frequency	N/A
121 MHz Presence	N/A
Longitudinal Axis	
Resonance Search	13.23 Hz
Endurance Run	13.23 Hz
Self-test Message	Pass
Normal Message	N/A
406 MHz Frequency	N/A
121 MHz Presence	N/A

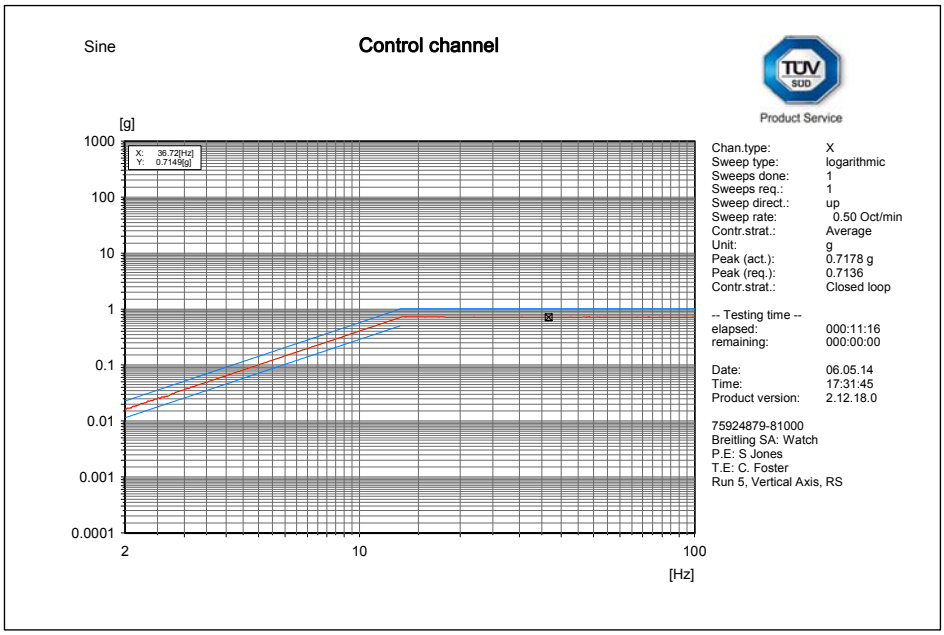
Mechanical Inspection

No degradation was observed

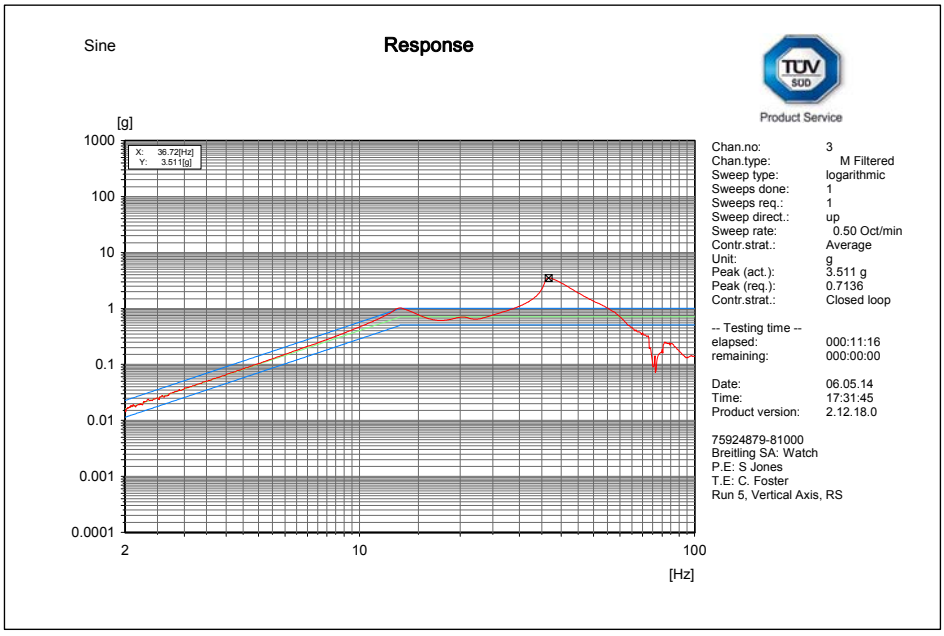
Activation Monitoring

No unintentional transmissions were detected

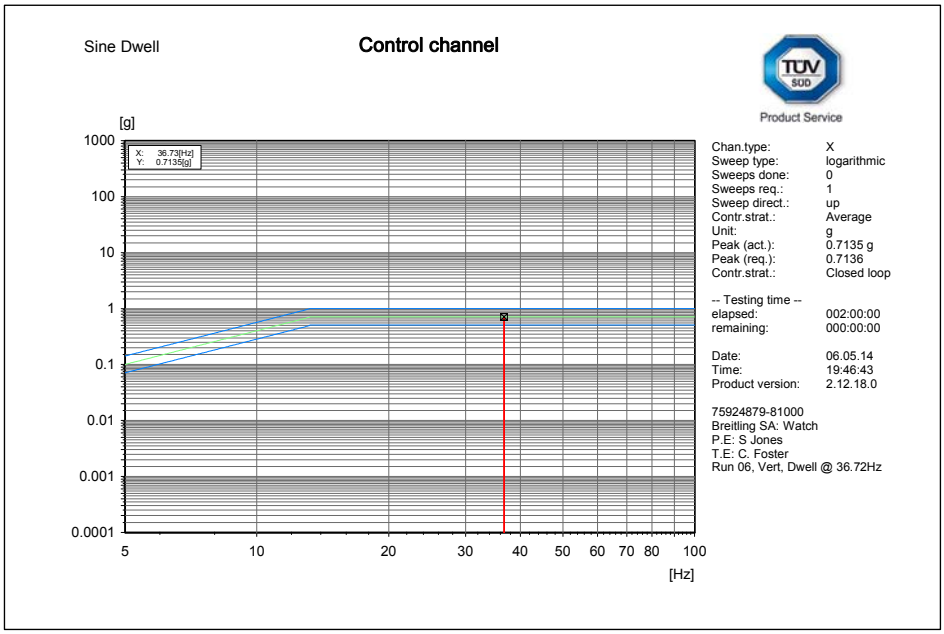
Vertical Axis



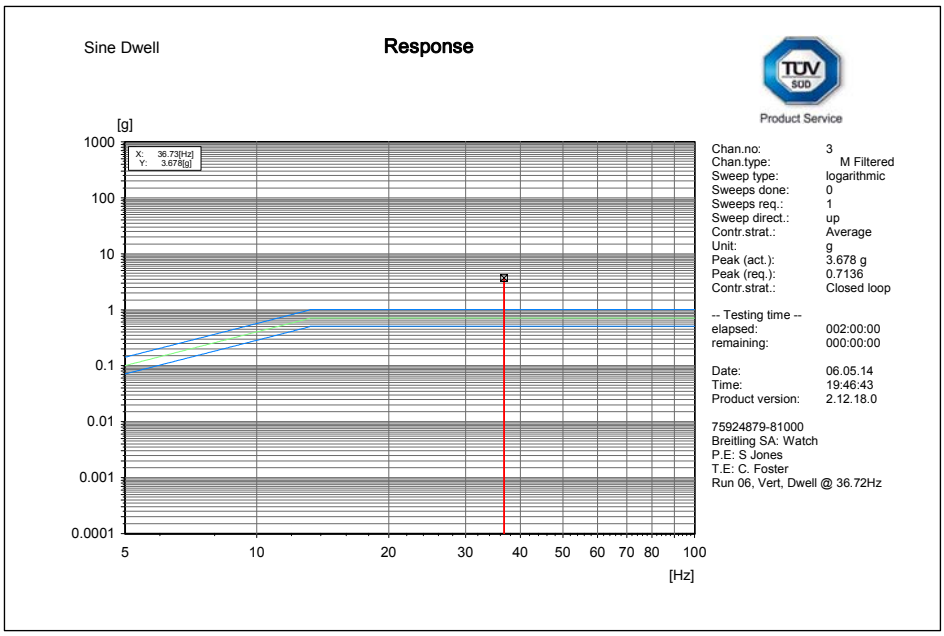
C:\VcpNT\Daten\m+p\Breitling\Sine RS_006.rsn



C:\VcpNT\Daten\m+p\Breitling\Sine RS_006.rsn

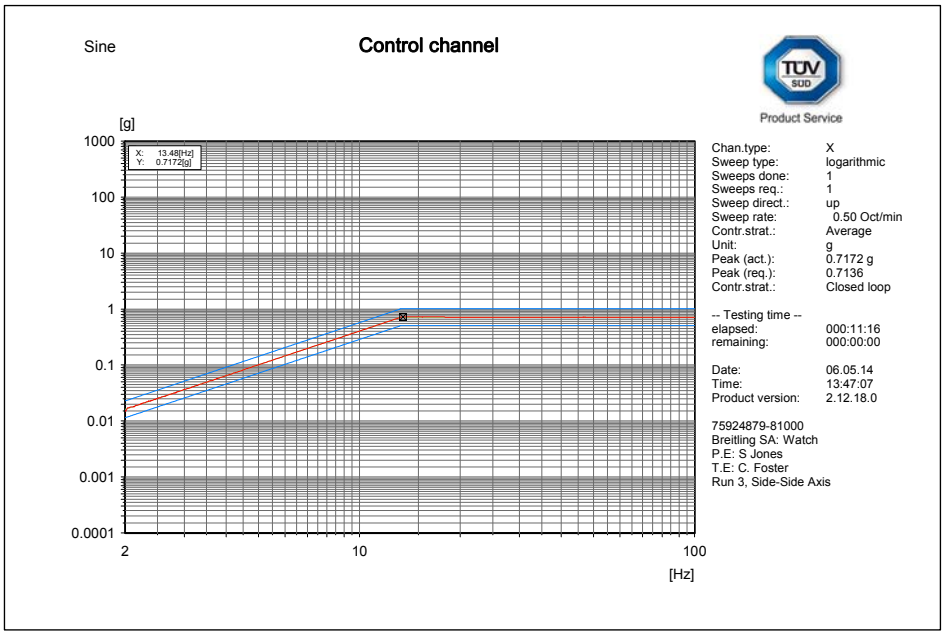


C:\VcpNT\Daten\m+p\Breitling\Sine Dwell 36.72Hz_001.rsd

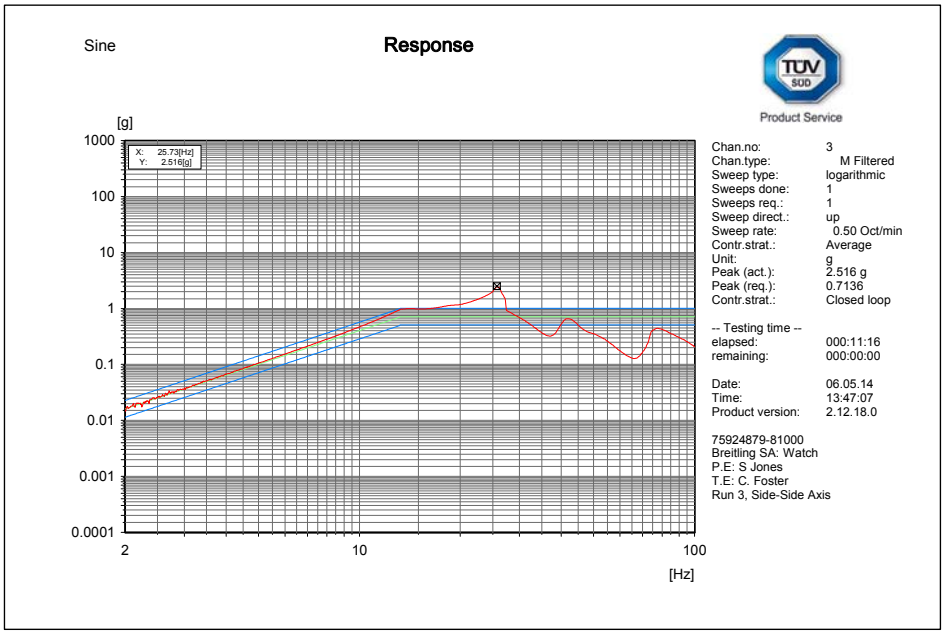


C:\VcpNT\Daten\m+p\Breitling\Sine Dwell 36.72Hz_001.rsd

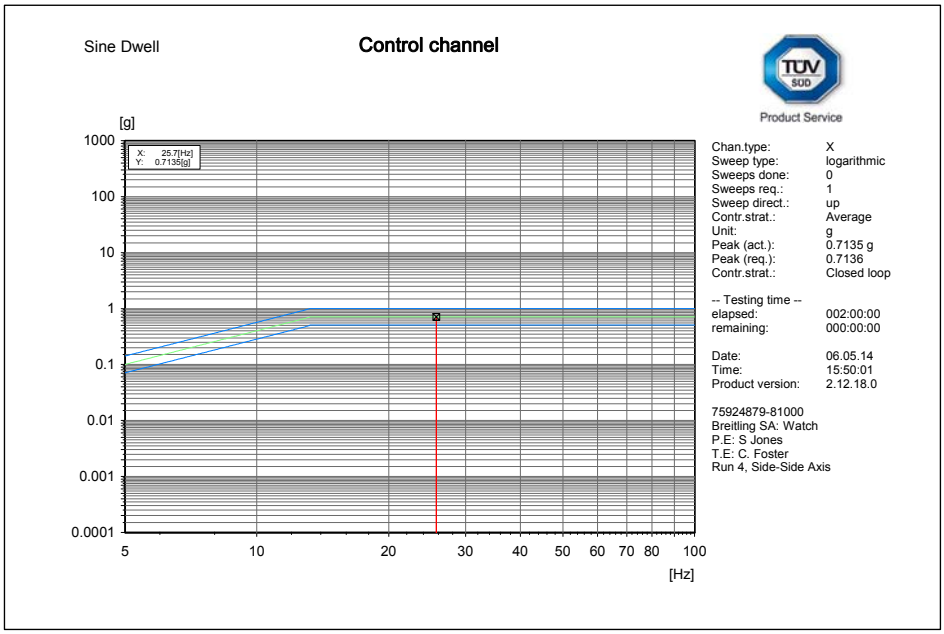
Lateral Axis



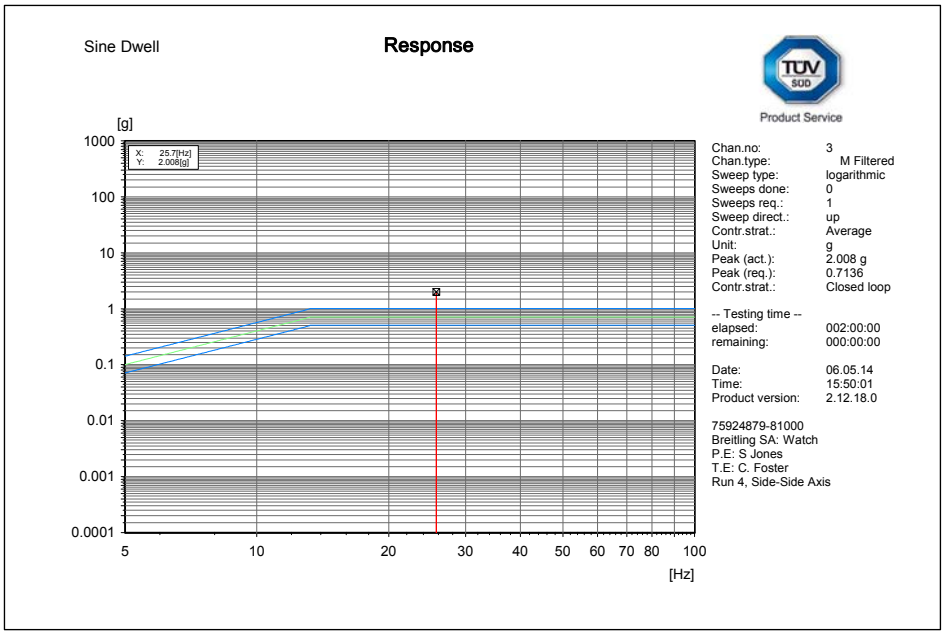
C:\VcpNT\Daten\m+p\Breitling\Sine RS_004.rsn



C:\VcpNT\Daten\m+p\Breitling\Sine RS_004.rsn



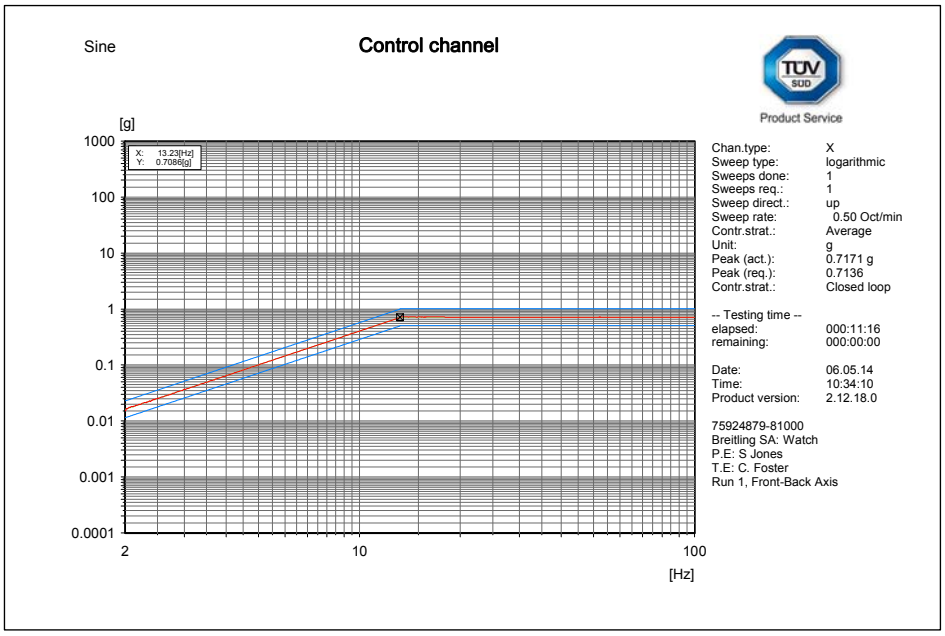
C:\VcpNT\Daten\m+p\Breitling\Sine Dwell_002.rsd



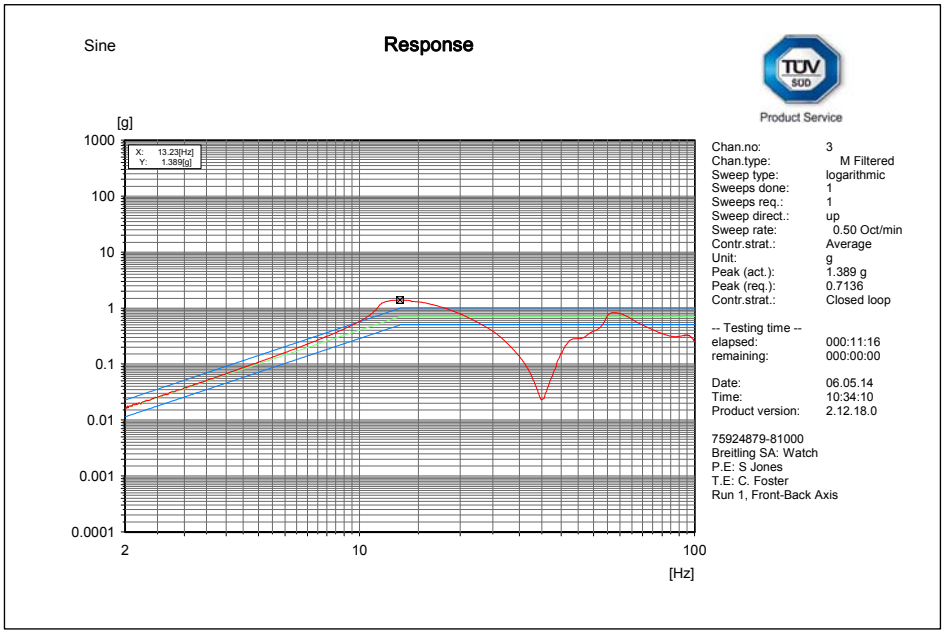
C:\VcpNT\Daten\m+p\Breitling\Sine Dwell_002.rsd

Product Service

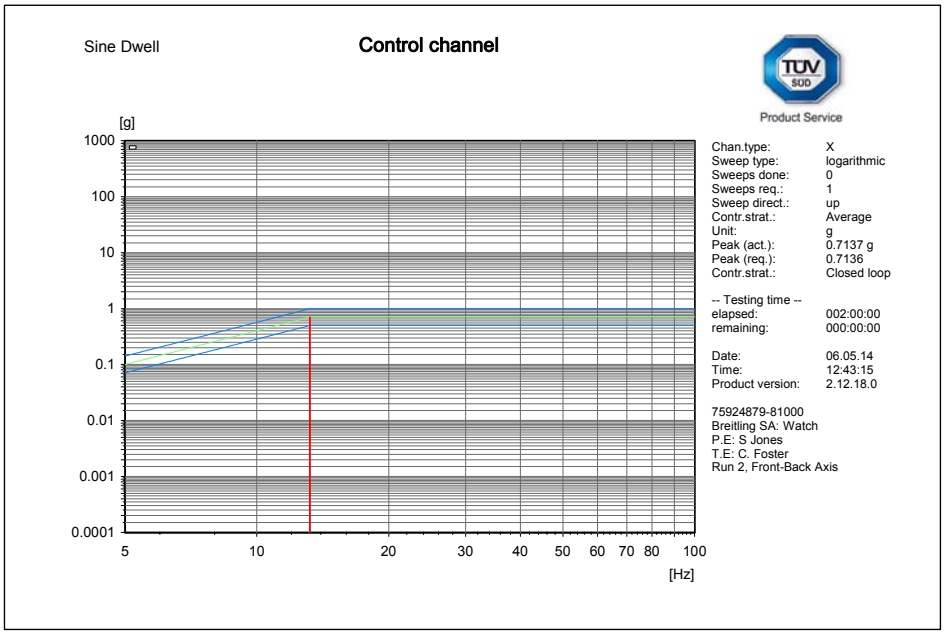
Longitudinal Axis



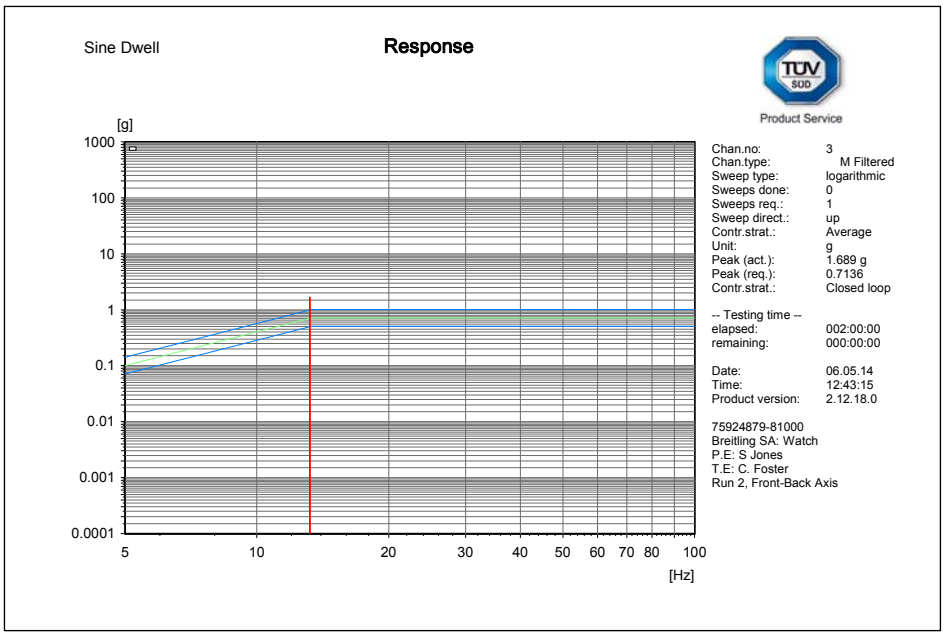
C:\VcpNT\Daten\m+p\Breitling\Sine RS_002.rsn



C:\VcpNT\Daten\m+p\Breitling\Sine RS_002.rsn



C:\VcpNT\Daten\m+p\Breitling\Sine Dwell_001.rsd



C:\VcpNT\Daten\m+p\Breitling\Sine Dwell_001.rsd

2.6 BUMP TEST

2.6.1 Specification

RTCM 11010.2, Clause A.7

2.6.2 Equipment Under Test and Modification State

Emergency S/N: 1555585 - Modification State 0

2.6.3 Date of Test

7 May 2014

2.6.4 Test Equipment Used

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

2.6.5 Environmental Conditions

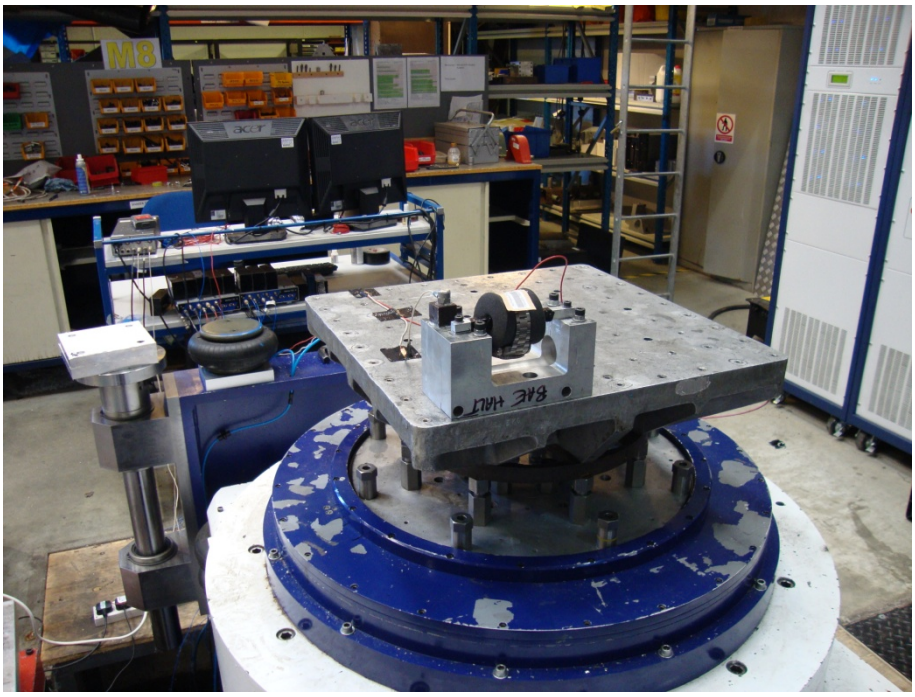
Ambient Temperature 21.8 – 23.6 °C
Relative Humidity 34.2 – 36.9 %

2.6.6 Test Results

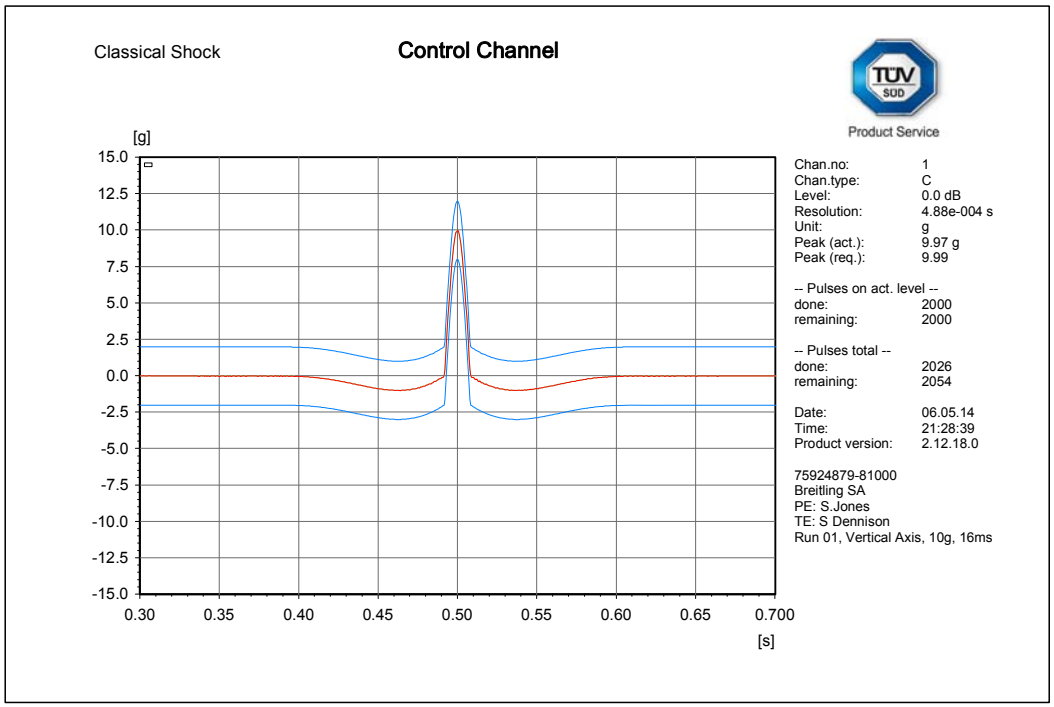
The PLB was subjected to the bump test according to the following profile:
Peak acceleration: 98 m/s^2 +/-10%
Pulse duration: 16 ms +/-10 %
Wave shape: Half Sine
Number of bumps: 4000 (2000 in each sense)

The bump test was conducted three times, once with the PLB mounted in each of the 3-axes.

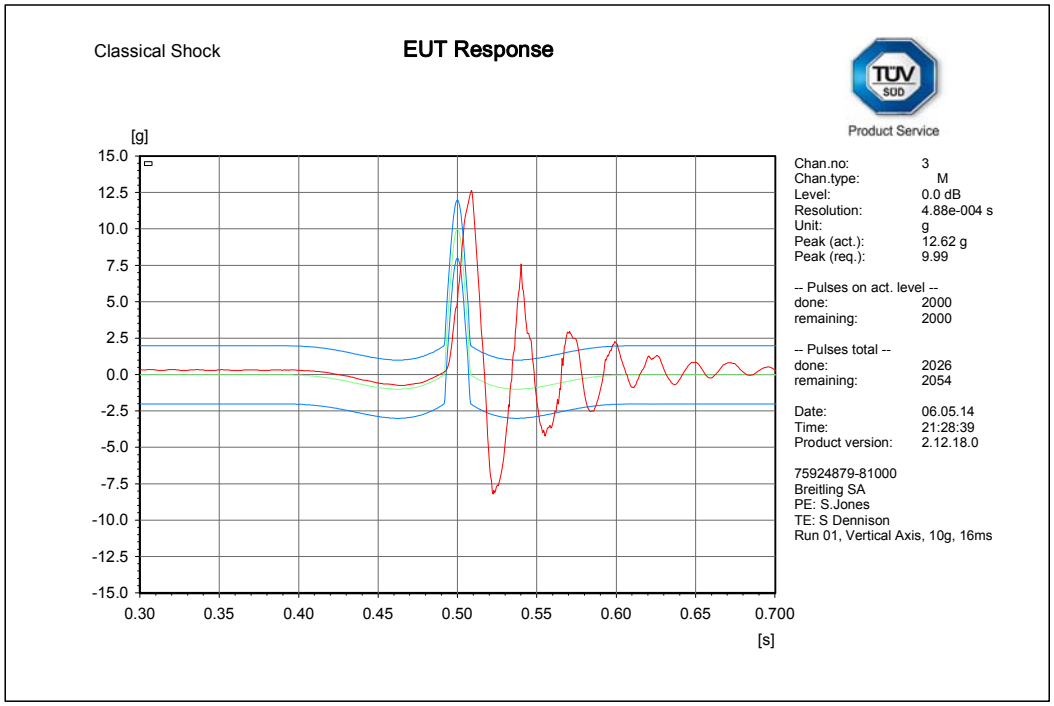
Setup Photo



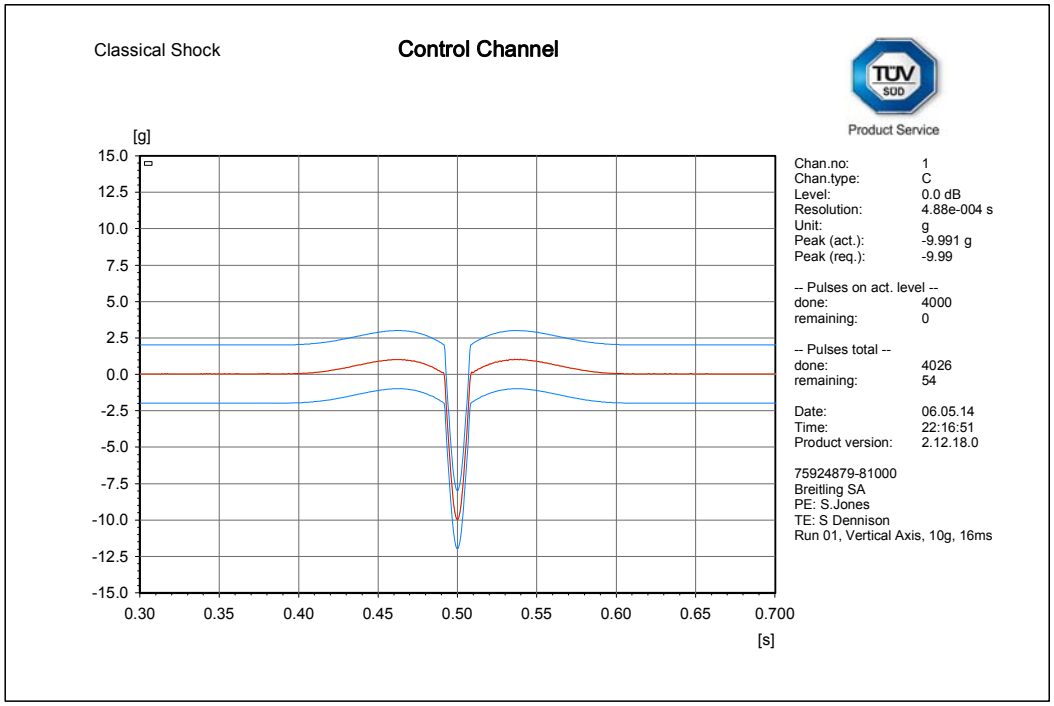
Vertical Axis, 4000 Bumps



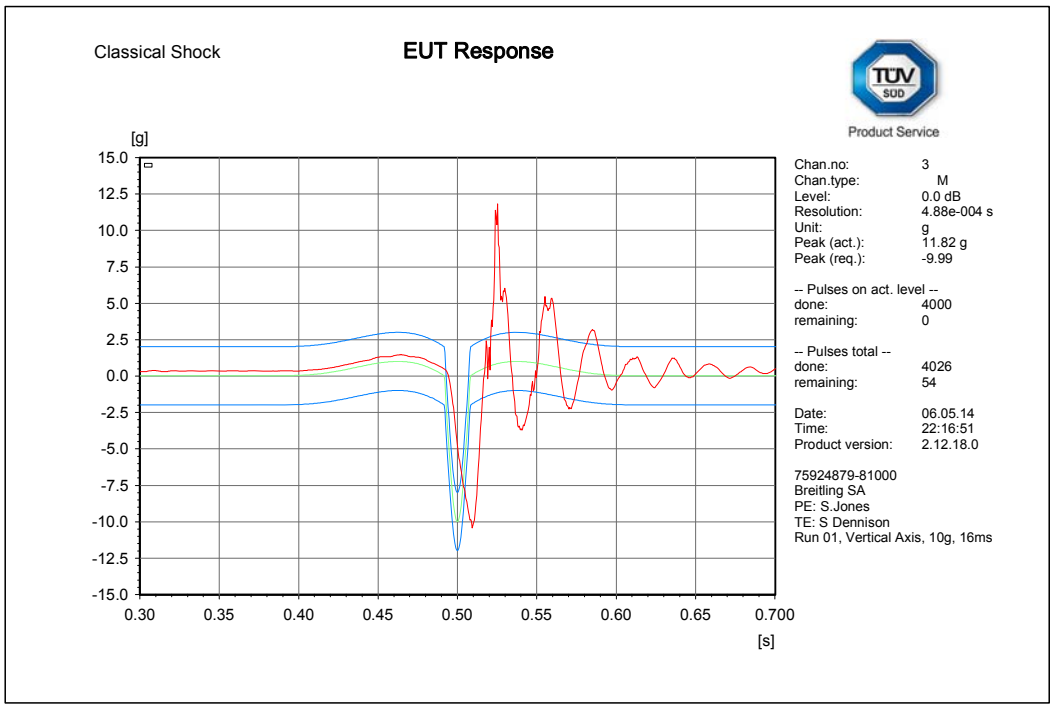
C:\VcpNT\Daten\m+p\Breitling\New Folder\10g 16ms_003.rcs



C:\VcpNT\Daten\m+p\Breitling\New Folder\10g 16ms_003.rcs

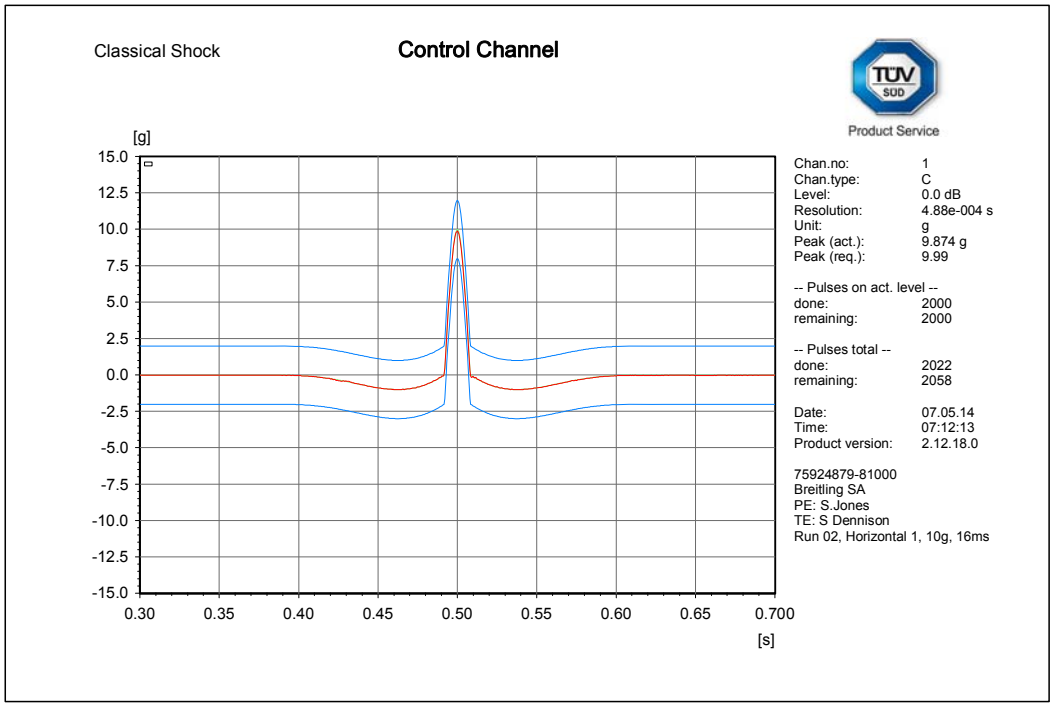


C:\VcpNT\Daten\m+p\Breitling\New Folder\10g 16ms_003.rcs

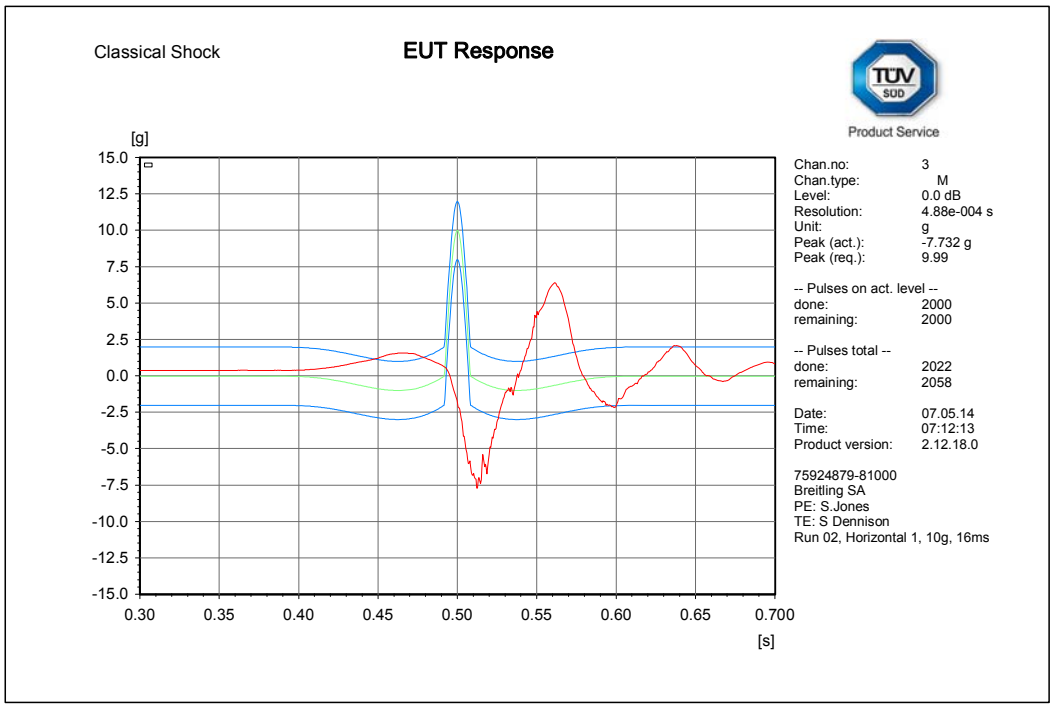


C:\VcpNT\Daten\m+p\Breitling\New Folder\10g 16ms_003.rcs

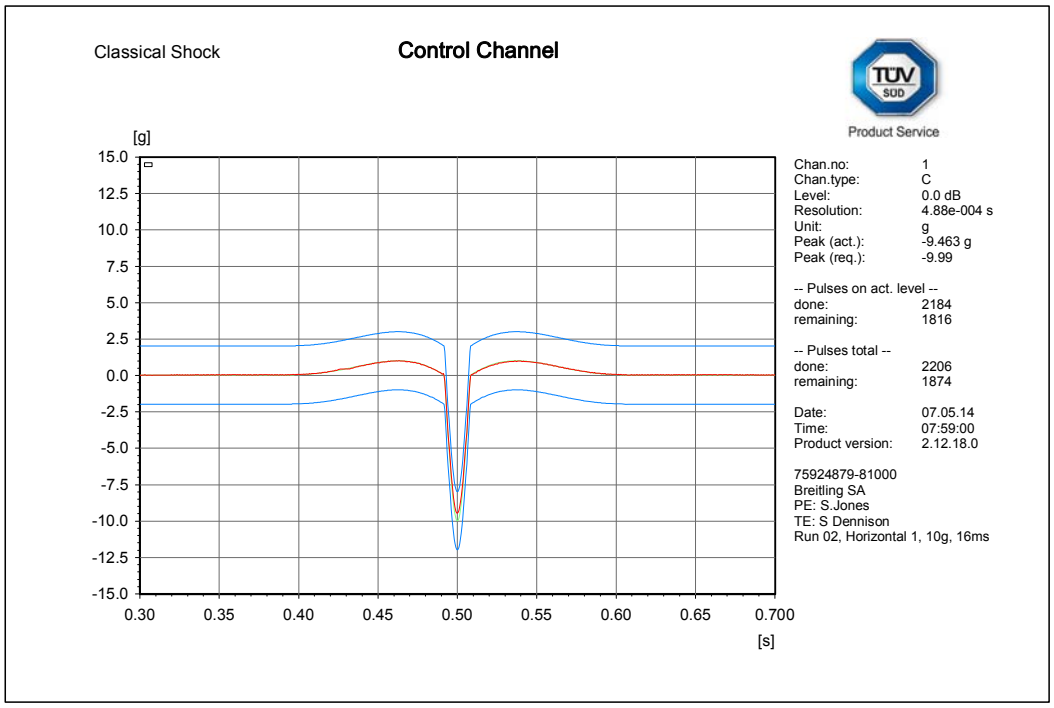
Horizontal Axis, 4000 Bumps



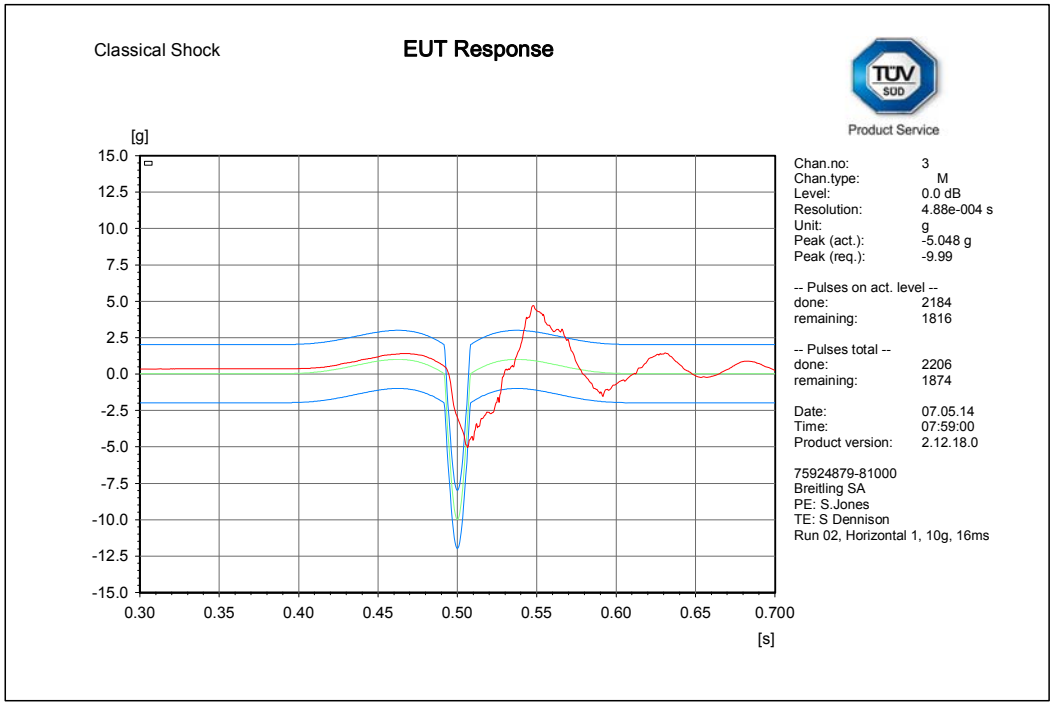
C:\VcpNT\Daten\m+p\Breitling\New Folder\10g 16ms_005.rcs



C:\VcpNT\Daten\m+p\Breitling\New Folder\10g 16ms_005.rcs

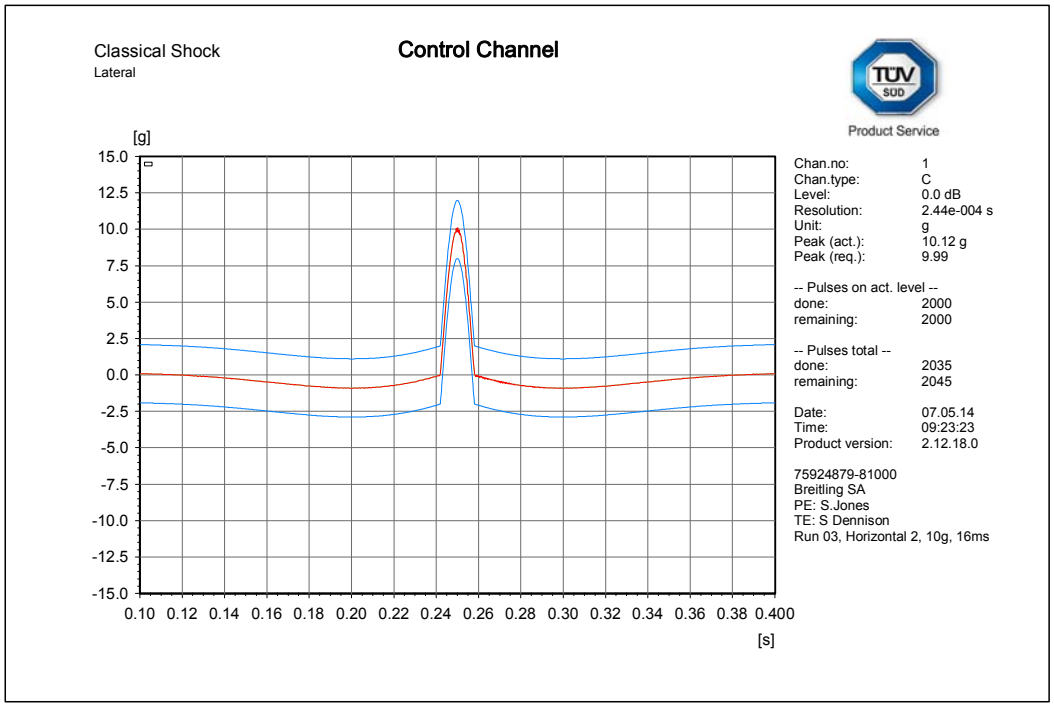


C:\VcpNT\Daten\m+p\Breitling\New Folder\10g 16ms_005.rcs

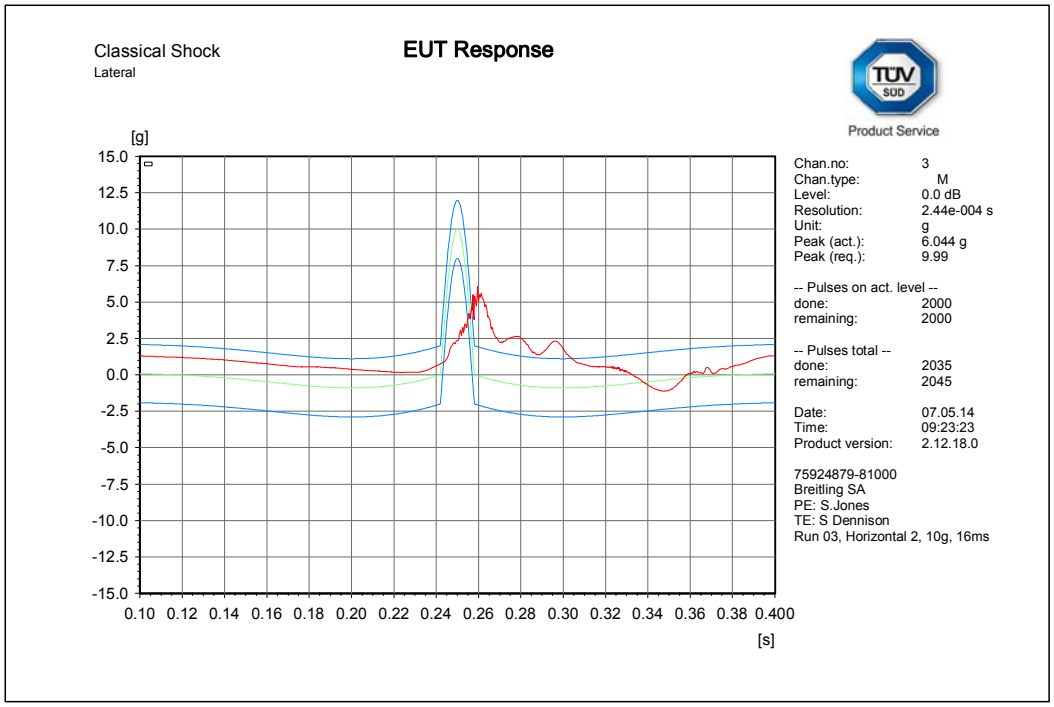


C:\VcpNT\Daten\m+p\Breitling\New Folder\10g 16ms_005.rcs

Lateral Axis, 4000 Bumps



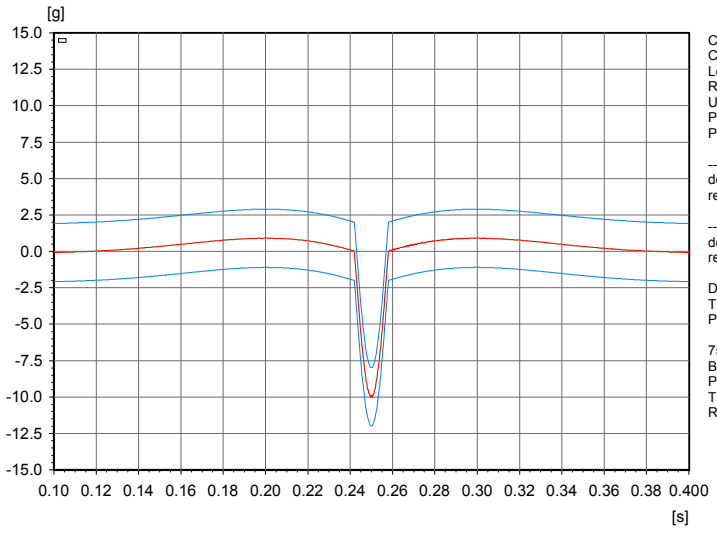
C:\VcpNT\Daten\m+p\Breitling\New Folder\10g 16ms Reduced pre pulse_001.rcs



C:\VcpNT\Daten\m+p\Breitling\New Folder\10g 16ms Reduced pre pulse_001.rcs

Classical Shock
Lateral

Control Channel



Product Service

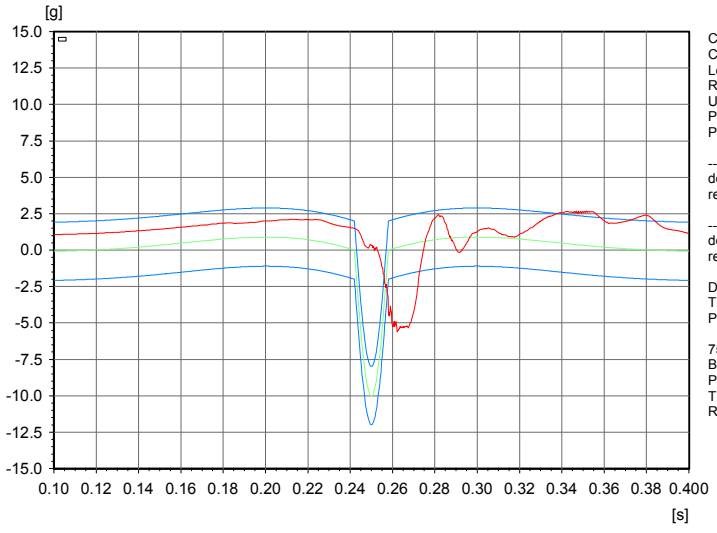
Chan.no:	1
Chan.type:	C
Level:	0.0 dB
Resolution:	2.44e-004 s
Unit:	g
Peak (act.):	-10.02 g
Peak (req.):	-9.99
-- Pulses on act. level --	
done:	4000
remaining:	0
-- Pulses total --	
done:	4035
remaining:	45
Date:	07.05.14
Time:	09:56:48
Product version:	2.12.18.0

75924879-81000
Breitling SA
PE: S.Jones
TE: S Dennison
Run 03, Horizontal 2, 10g, 16ms

C:\VcpNT\Daten\m+p\Breitling\New Folder\10g 16ms Reduced pre pulse_001.rcs

Classical Shock
Lateral

EUT Response



Product Service

Chan.no:	3
Chan.type:	M
Level:	0.0 dB
Resolution:	2.44e-004 s
Unit:	g
Peak (act.):	-5.605 g
Peak (req.):	-9.99
-- Pulses on act. level --	
done:	4000
remaining:	0
-- Pulses total --	
done:	4035
remaining:	45
Date:	07.05.14
Time:	09:56:48
Product version:	2.12.18.0

75924879-81000
Breitling SA
PE: S.Jones
TE: S Dennison
Run 03, Horizontal 2, 10g, 16ms

C:\VcpNT\Daten\m+p\Breitling\New Folder\10g 16ms Reduced pre pulse_001.rcs

Post Test Inspection

No degradation was observed

EUT Response

No unintentional transmissions were detected

Summary of Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	Pass
Normal Mode:	
Normal Message	N/A
406 MHz Frequency	N/A
121 MHz Presence	N/A

2.7 CORROSION TEST

2.7.1 Specification

RTCM 11010.2, Clause A.8

Corrosion test was waived in accordance with the following specification references:

IEC 60945, Clause 8.12.1 Waiver:
"*The corrosion test shall be waived where the manufacturer is able to produce evidence that the components, materials and finishes employed in the equipment would satisfy the test.*"

Refer to Manufacturer documentation.

2.8 DROP TEST

2.8.1 Specification

RTCM 11010.2, Clause A.9

2.8.2 Equipment Under Test and Modification State

Emergency S/N: 1555585 - Modification State 0

2.8.3 Date of Test

7 May 2014

2.8.4 Test Equipment Used

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

2.8.5 Environmental Conditions

Ambient Temperature 21.8 – 23.1 °C
Relative Humidity 36.8 – 42.9 %

2.8.6 Test Results

The EUT was placed in chamber and preconditioned at a temperature of -30 °C for at least 2 hours. The drop test was completed within 5 minutes of removing the EUT from the preconditioning chamber.

The EUT was dropped 6 times, one on each face, from a height of 1000 mm onto the test surface.

Setup Photo

Test Observations

The EUT did not unintentionally activate during the test. No mechanical degradation was observed. After the test, the EUT Self-test check passed satisfactorily.

Summary of Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	Pass
Normal Mode:	
Normal Message	N/A
406 MHz Frequency	N/A
121 MHz Presence	N/A

2.9 THERMAL SHOCK

2.9.1 Specification

RTCM 11010.2, Clause A.10

2.9.2 Equipment Under Test and Modification State

Emergency S/N: 1555585 - Modification State 0

2.9.3 Date of Test

8 May 2014

2.9.4 Test Equipment Used

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

2.9.5 Environmental Conditions

Ambient Temperature 23.6 °C
Relative Humidity 45.8 %

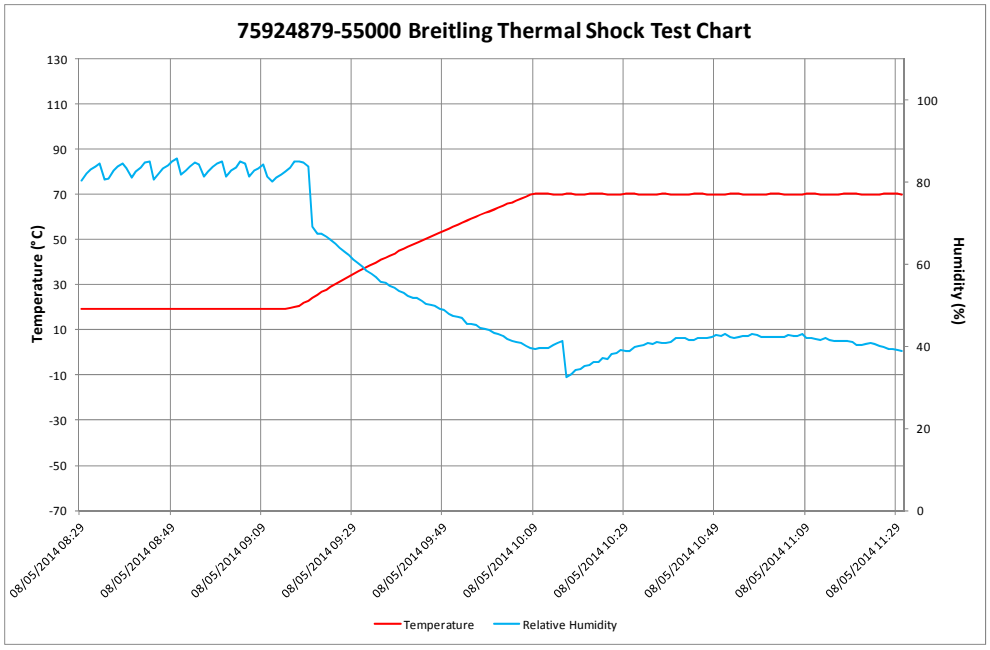
2.9.6 Test Results

The EUT was placed in the pre-conditioning climatic chamber at a temperature of 70 °C for 1 hour.

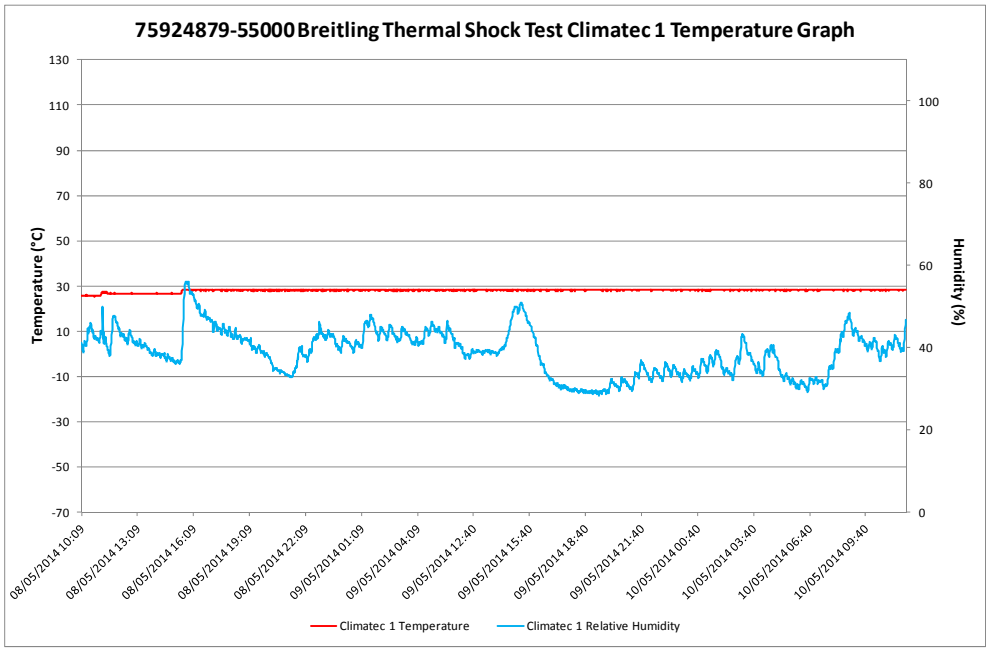
The EUT was then immersed in a water vessel (preconditioned for approximately 2 hours) at 25 °C, at a level of 100 mm below the surface of the water (measured to the highest point of the EUT).

The EUT was subjected to 48 hours of immersion.

Preconditioning Temperature Plot



Water Temperature Plot*



* The plot above shows the temperature of the test chamber that was required to maintain the water temperature at 25 °C (Monitored on a handheld thermometer).

Setup Photos

Summary of Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	Pass
Normal Mode:	
Normal Message	N/A
406 MHz Frequency	N/A
121 MHz Presence	N/A

2.10 IMMERSION TEST

2.10.1 Specification

RTCM 11010.2, Clause A.11

2.10.2 Equipment Under Test and Modification State

Emergency S/N: 1555585 - Modification State 0

2.10.3 Date of Test

12 May 2014

2.10.4 Test Equipment Used

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

2.10.5 Environmental Conditions

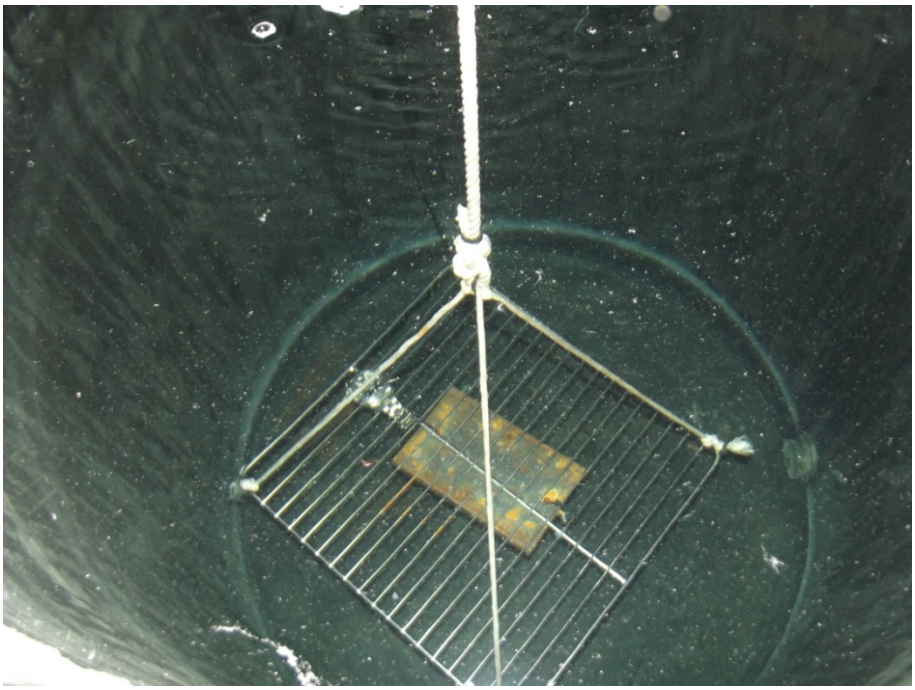
Ambient Temperature 23.5 °C
Relative Humidity 45.9 %

2.10.6 Test Results

Temporary Immersion Test

The EUT was completely submerged in a vessel of water and then positioned in an overpressure chamber and a gauge corresponding to 1 m was applied for a period of 1 hour.

Setup Photo



Inspection

The EUT was weighed before and after the test to indicate if any ingress occurred.

Weight Before (Kg)	0.201
Weight After (Kg)	0.201

The weight after the test was the same as before the test, indicating no measurable ingress occurred.

Summary of Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	Pass
Normal Mode:	
Normal Message	N/A
406 MHz Frequency	N/A
121 MHz Presence	N/A

2.11 SPURIOUS EMISSIONS TEST

2.11.1 Specification

RTCM 11010.2, Clause A.12

2.11.2 Equipment Under Test and Modification State

Emergency S/N: 1555969 - Modification State 0

2.11.3 Date of Test

28 April 2014

2.11.4 Test Equipment Used

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

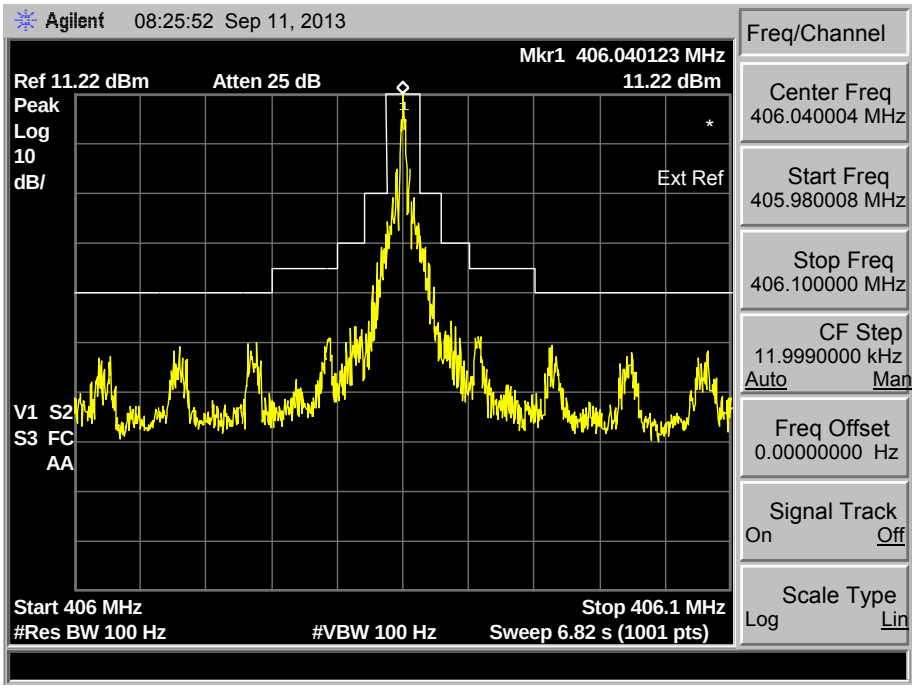
2.11.5 Environmental Conditions

Ambient Temperature 21.2 – 22.1 °C
Relative Humidity 34.2 – 44.6 %

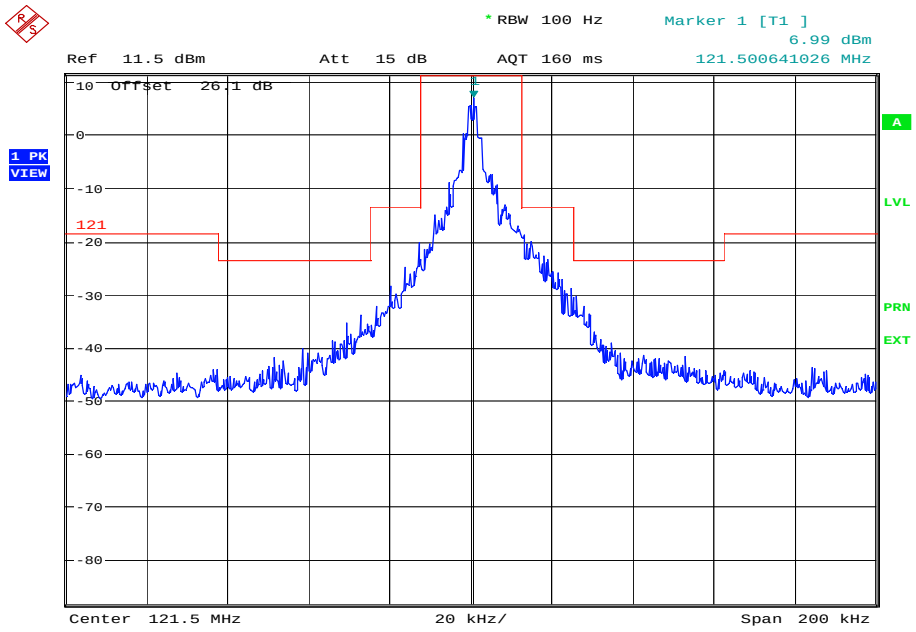
2.11.6 Test Results

Close In Emissions

406 MHz Combined Plot (Ambient, +55 °C and -20 °C)

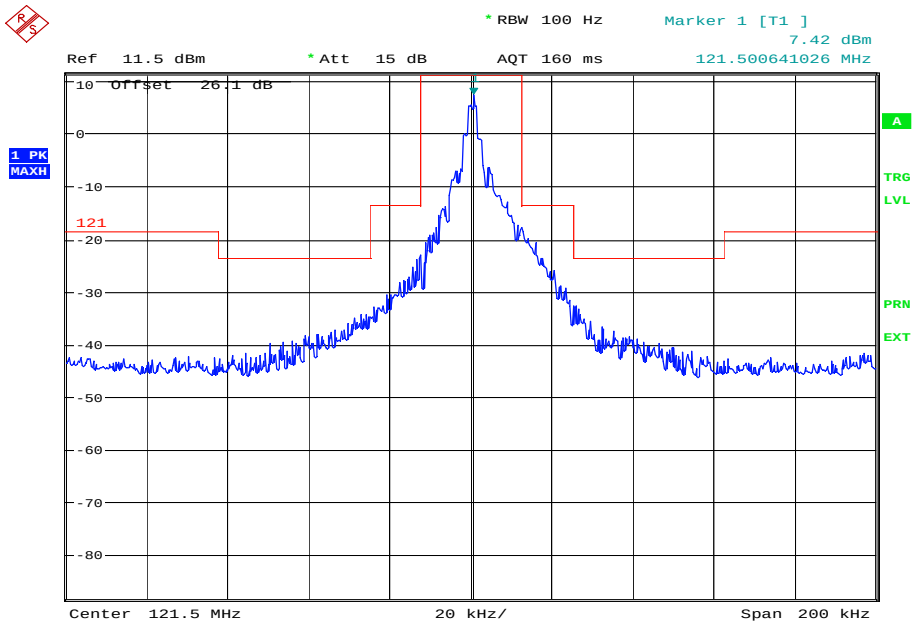


121 MHz Plot at Ambient Temperature



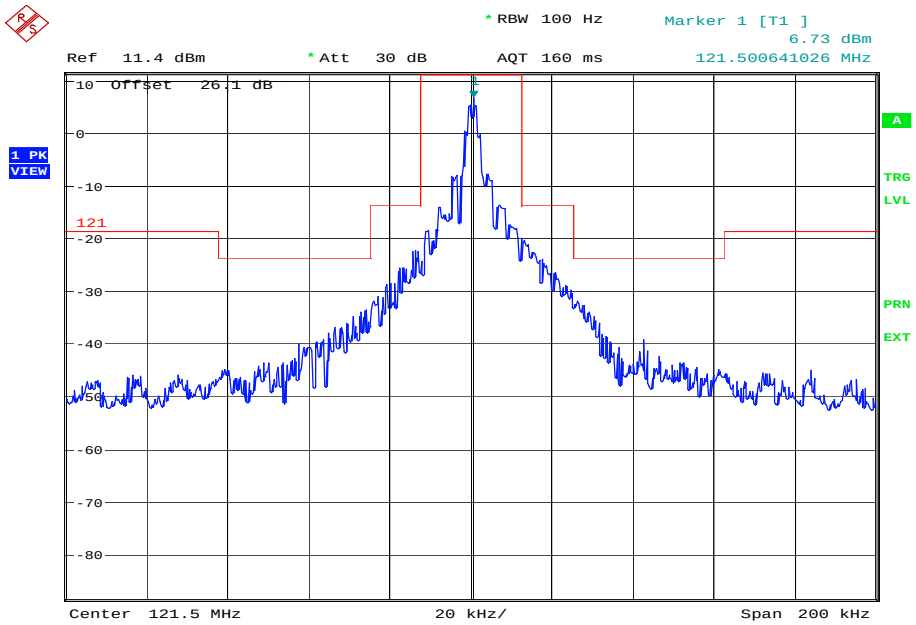
Date: 25.APR.2014 13:00:26

121 MHz Plot at MaximumTemperature (+55ºC)



Date: 28.APR.2014 11:40:37

121 MHz Plot at MinimumTemperature (0ºC)



Date: 25.APR.2014 15:31:42

Harmonic Emissions

121.5 MHz

Harmonic	Low Temperature (dBc) (0 °C)	Ambient Temperature (dBc)	High Temperature (dBc)
2nd	-49.8	-54.9	-52.2
3rd	-63.4	-67.4	-64.7
4th	-52.0	-53.9	-50.7
5th	-32.9	-37.4	-40.5
6th	-57.4	-61.2	-62.5
7th	-59.9	-64.3	-65.3
8th	-64.2	-68.0	-68.8
9th	-62.9	-66.2	-69.2
10th	-74.5	-86.4	-83.7

406 MHz

Harmonic	Low Temperature (dBc) (-20 °C)	Ambient Temperature (dBc)	High Temperature (dBc)
2nd	-60.0	-64.5	-59.9
3rd	-37.5	-35.9	-33.5
4th	-64.6	-75.1	-72.3
5th	-83.9	-82.1	-82.6
6th	-82.2	-83.6	-81.6
7th	-79.3	-85.4	-84.8
8th	-81.2	-82.0	-88.2
9th	-86.6	-90.2	-91.5
10th	-83.4	-89.3	-90.9

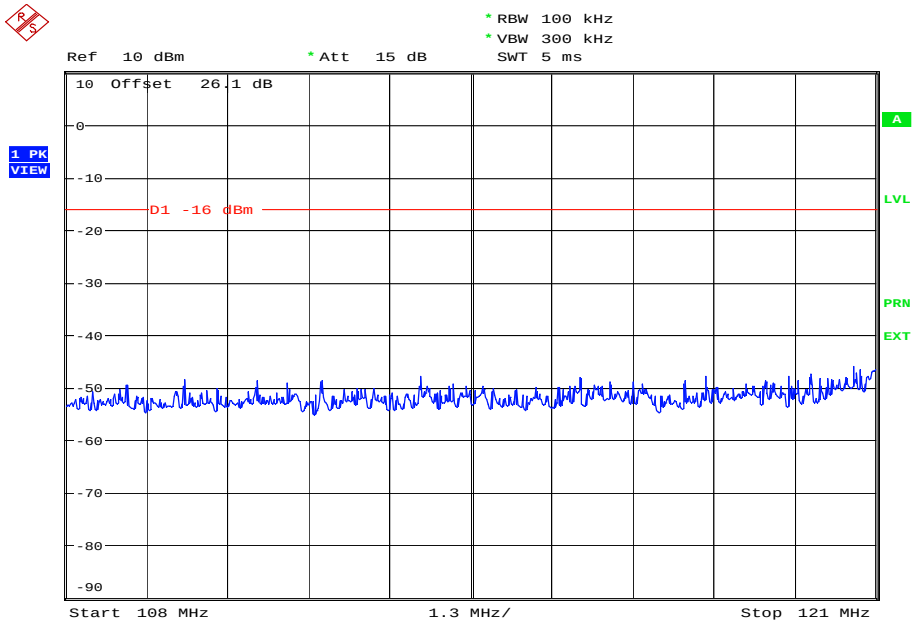
Limit

Harmonic Emissions	≤ -30 dBc

Aeronautical, Maritime and Satellite Band Emissions

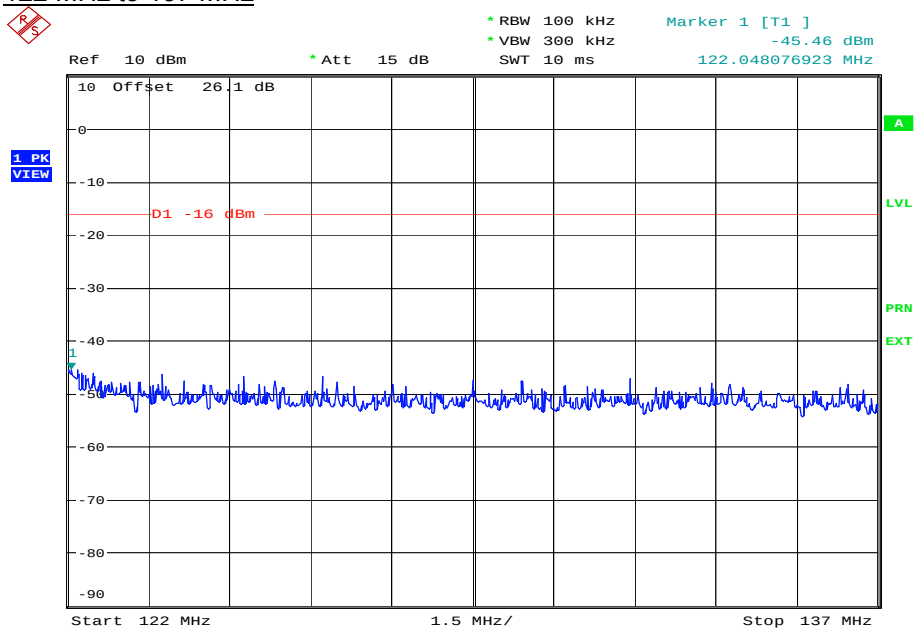
Note: Limit of 25 µW (-16.0 dBm) is displayed on the result plots.

108 MHz to 121 MHz



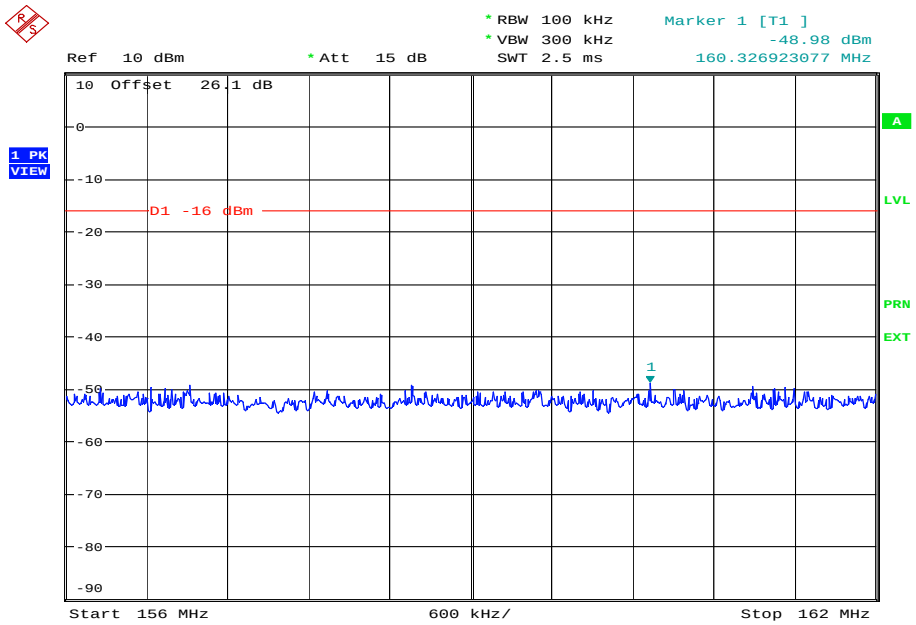
Date: 25.APR.2014 13:42:58

122 MHz to 137 MHz



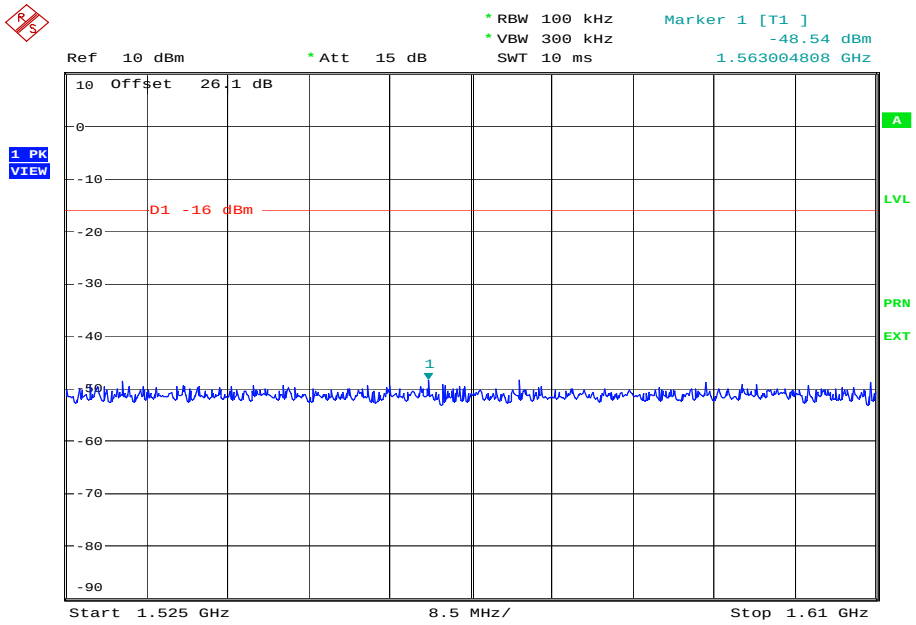
Date: 25.APR.2014 13:43:53

156 MHz to 162 MHz



Date: 25.APR.2014 13:44:50

1525 MHz to 1610 MHz



Date: 25.APR.2014 13:45:36

For 406 spurious emissions, see TUV report 75924041 Report 01

2.12 OPERATIONAL LIFE TEST

2.12.1 Specification

RTCM 11010.2, Clause A.13.1

2.12.2 Equipment Under Test and Modification State

Emergency S/N: 1555969 - Modification State 0

2.12.3 Date of Test

15 May 2014 and 16 June 2014

2.12.4 Test Equipment Used

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

2.12.5 Environmental Conditions

Ambient Temperature 23.1 °C
Relative Humidity 45.3 %

2.12.6 Test Results

Test Method Used: 2 (Extension Factor deducted after test)

Note: Due to a feature of the EUT where the homing transmitter is disabled below 0 °C, the Operating Lifetime Test was performed twice, once at the minimum operating temperature of -20 °C, and once at 0 °C.

At 0 °C, the first failure occurred at 34.16 hours. After deducting the predischarge (Extension Factor) of 9.46 hours, the final operating lifetime = 24.7 hours.

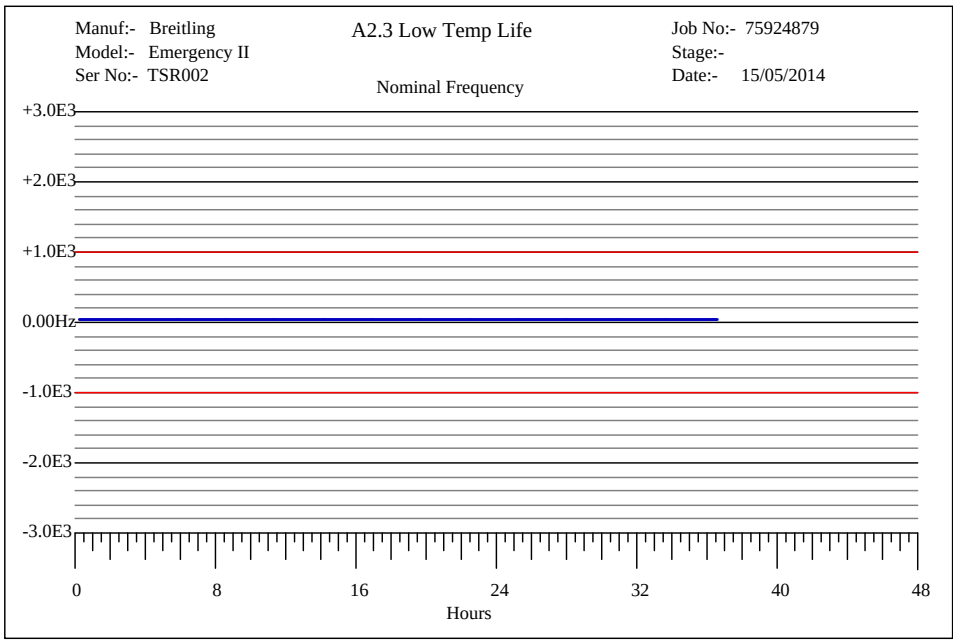
At -20 °C, the first failure occurred at 36.82 hours. After deducting the predischarge (Extension Factor) of 9.46 hours, the final operating lifetime = 27.36 hours.

Battery Current and Measurement Results

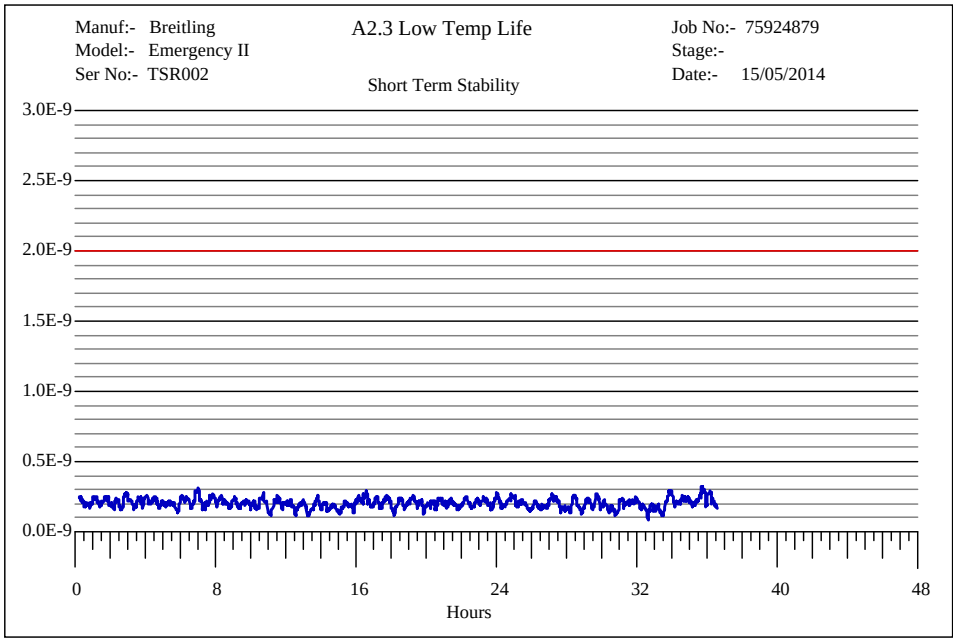
See customer supplied information in Annex A

Results at 0 °C

Nominal Frequency

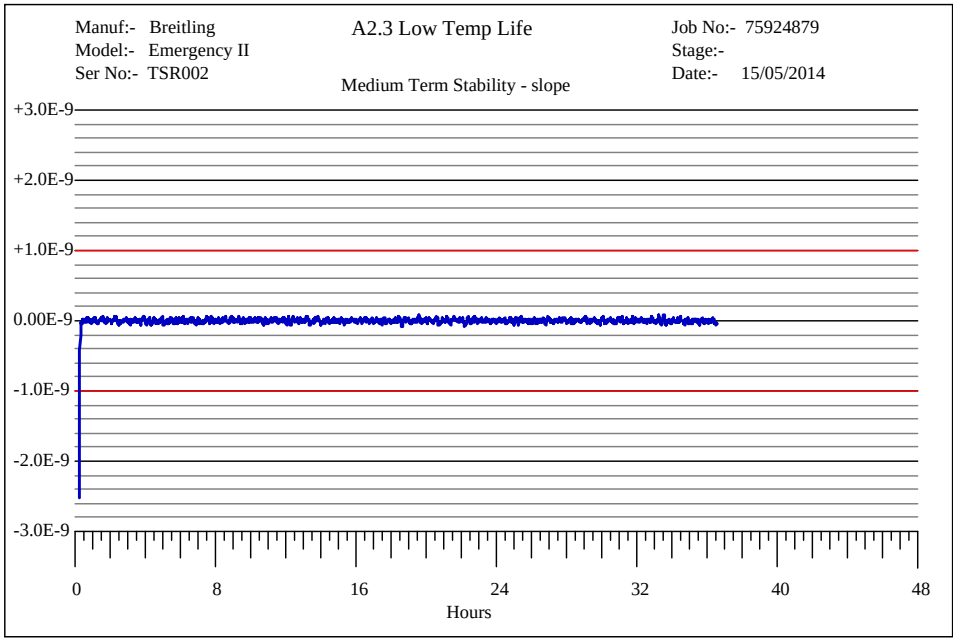


Short Term Stability

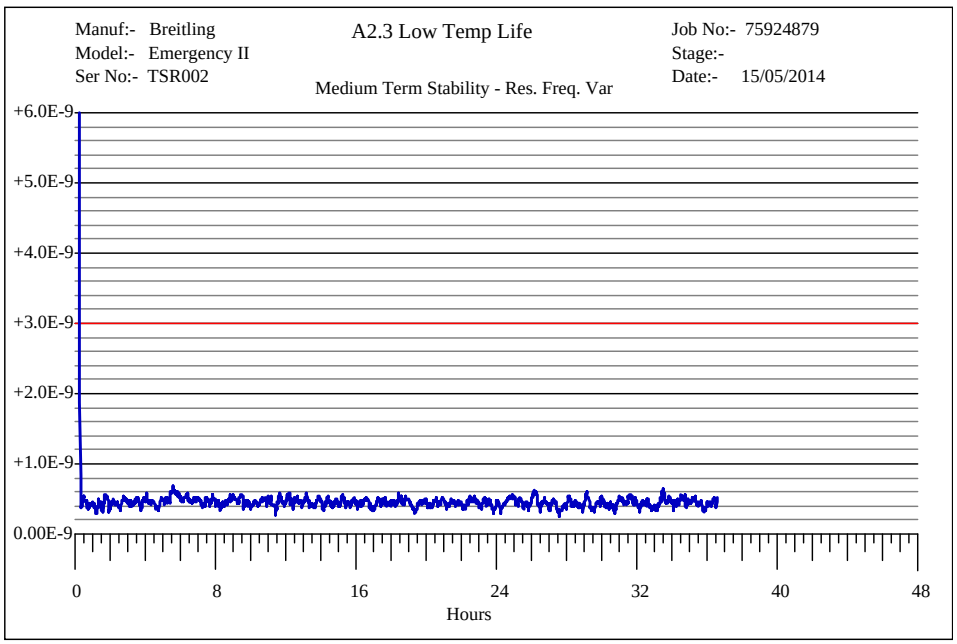


Product Service

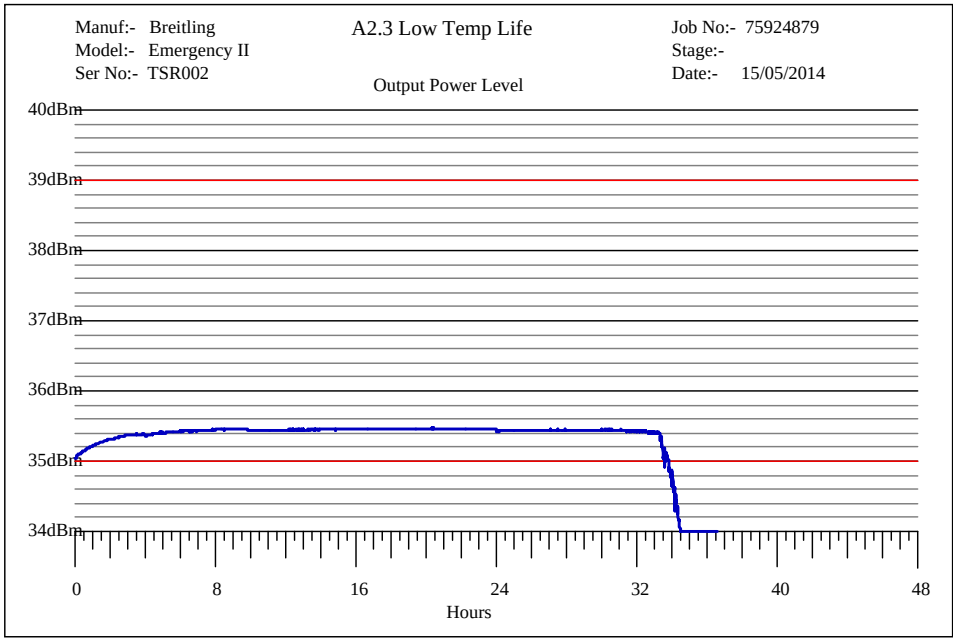
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



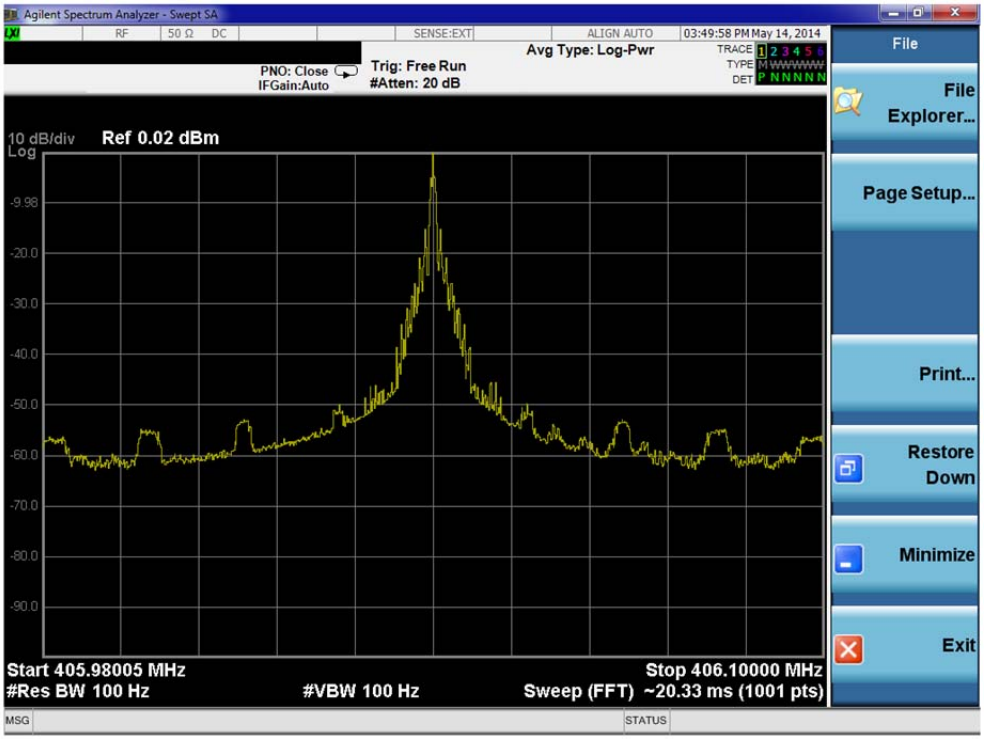
Output Power



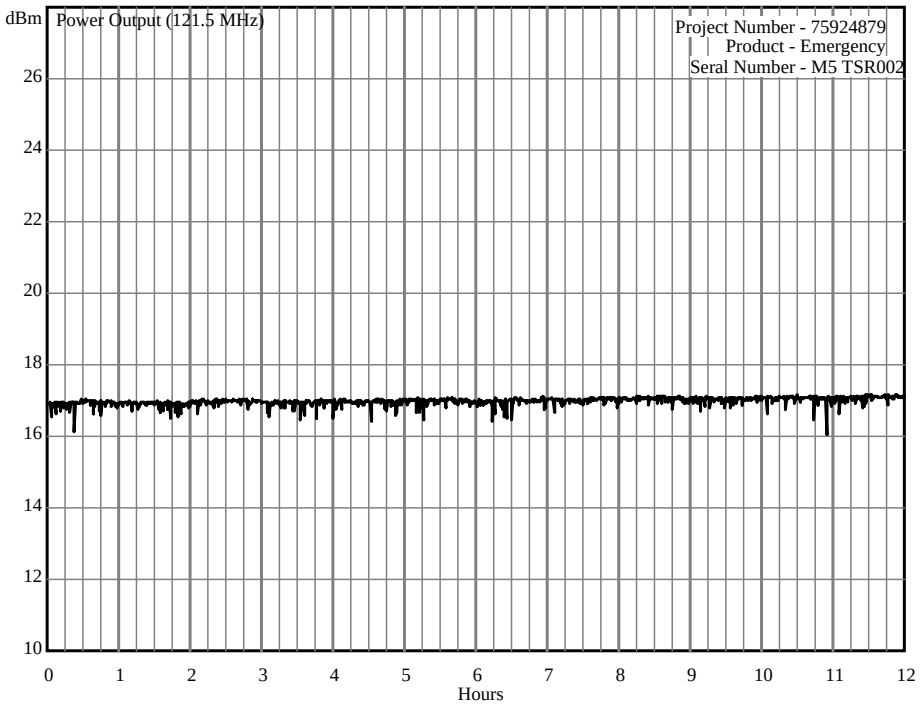
Digital Message

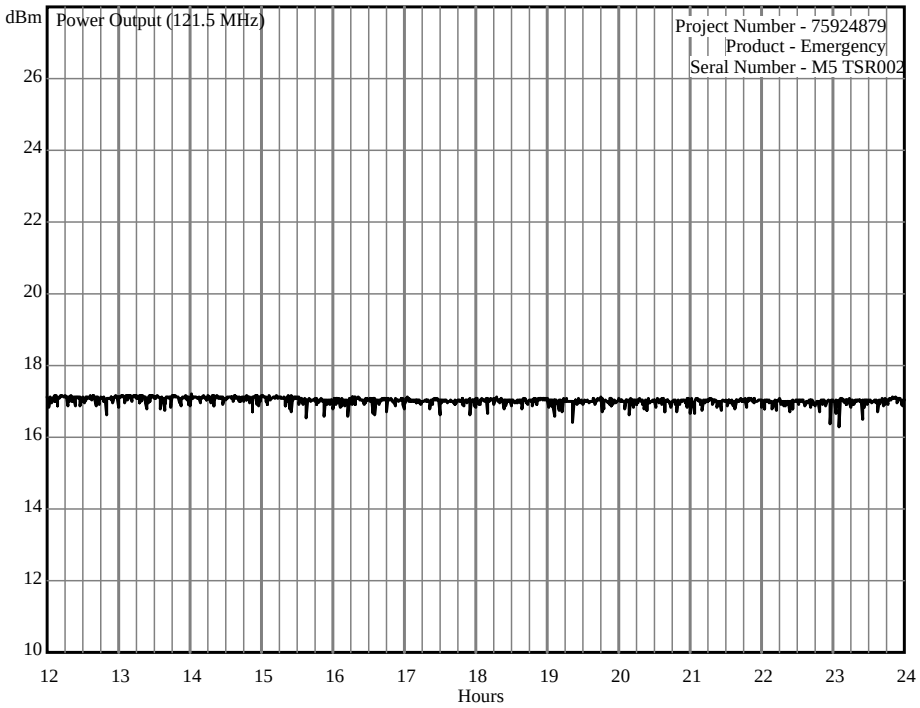
```
================================================================================
 Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = A1BF4005EC00AF1              A1BF4005EC00AF1 Default_Id
 30 Hex (Bits 25-144) = 50DFA002F600578A007F8000000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 0 1010 0001 1011 1111 0100 0000 0000 0101 1110 1100 0000 0000 1010 1111 0001
   0100 0000 0000 1111 1111 0000 0000 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                 Bits
----------        -------    ----- ------                                 ----
Format Flag        25            0 Short Message                             0
Protocol Flag      26            1 User                                      1
MID                27- 36      269 SWISS                          0100 0011 01
User Protocol      37- 39        7 Test                                   111
Spare              40- 63                              1101 0000 0000 0001 0111 1011
Spare              64- 83                                   0000 0000 0010 1011 1100
Homing             84- 85        1 121.5                                    01
BCH Encoded        86-106          Errors=0            0100 0000 0000 1111 1111 0
BCH Generated      86-106                              0100 0000 0000 1111 1111 0
Emergency Cd Flag 107            0 National Use                              0
Beacon Activation 108            0 Manual only                               0
National Use      109-112                                                 0000

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

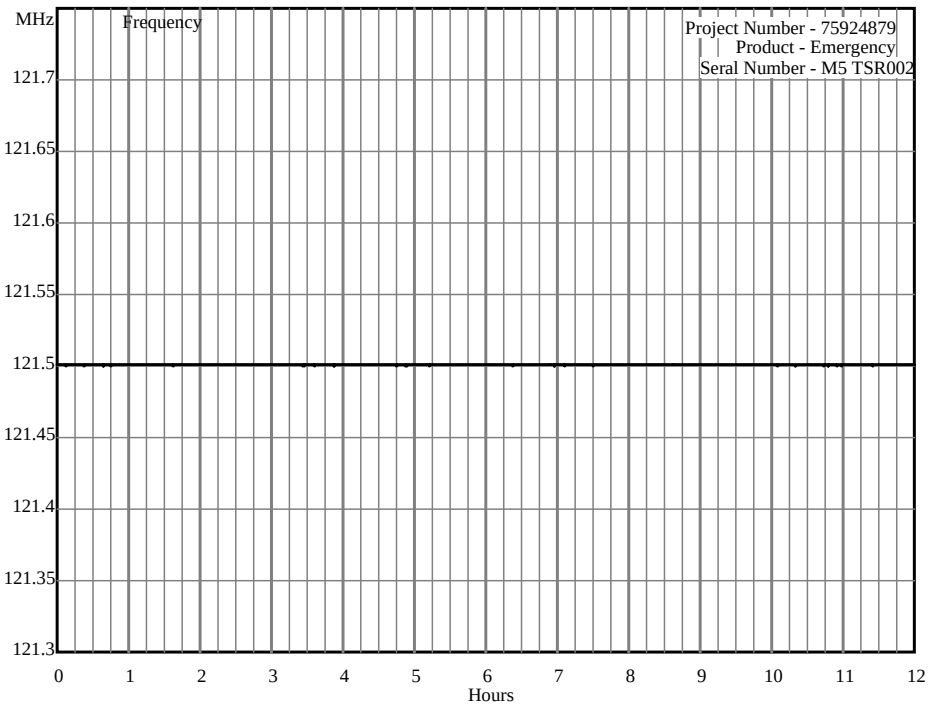
406 Spurious monitored during Life test

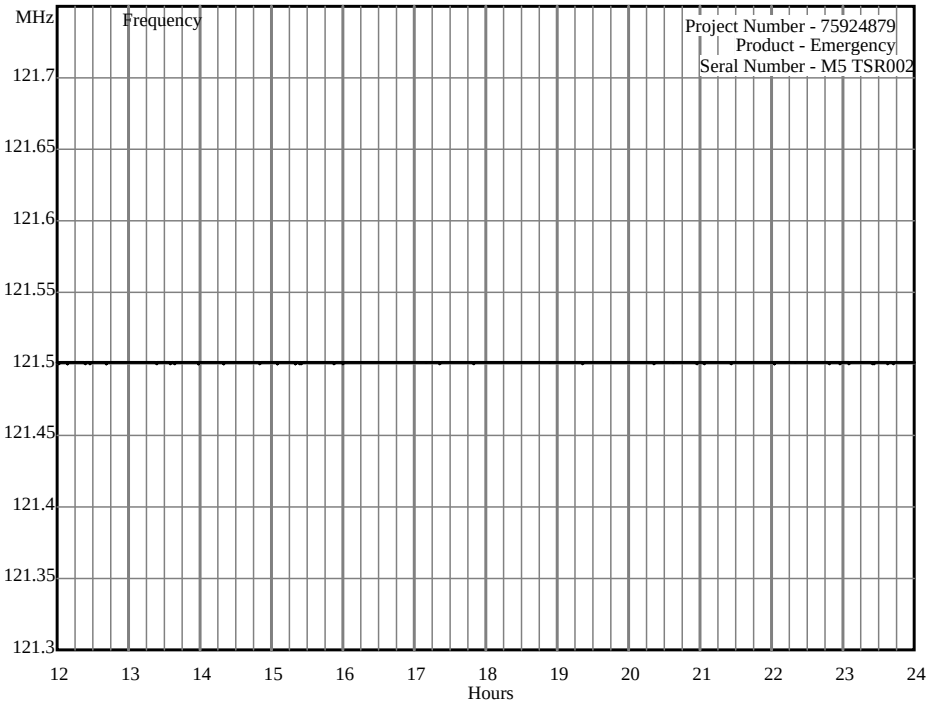


121 Power and Frequency (Up to 24 Hours)



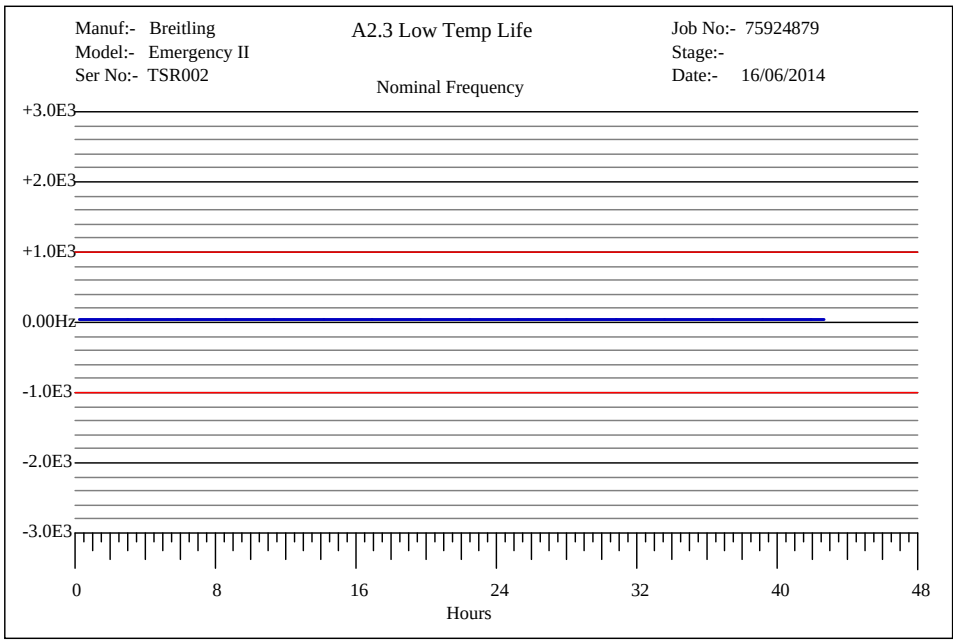



MHz
Frequency
Project Number - 75924879
Product - Emergency
Seral Number - M5 TSR002
121.7
121.65
121.6
121.55
121.5
121.45
121.4
121.35
121.3
0 1 2 3 4 5 6 7 8 9 10 11 12
Hours

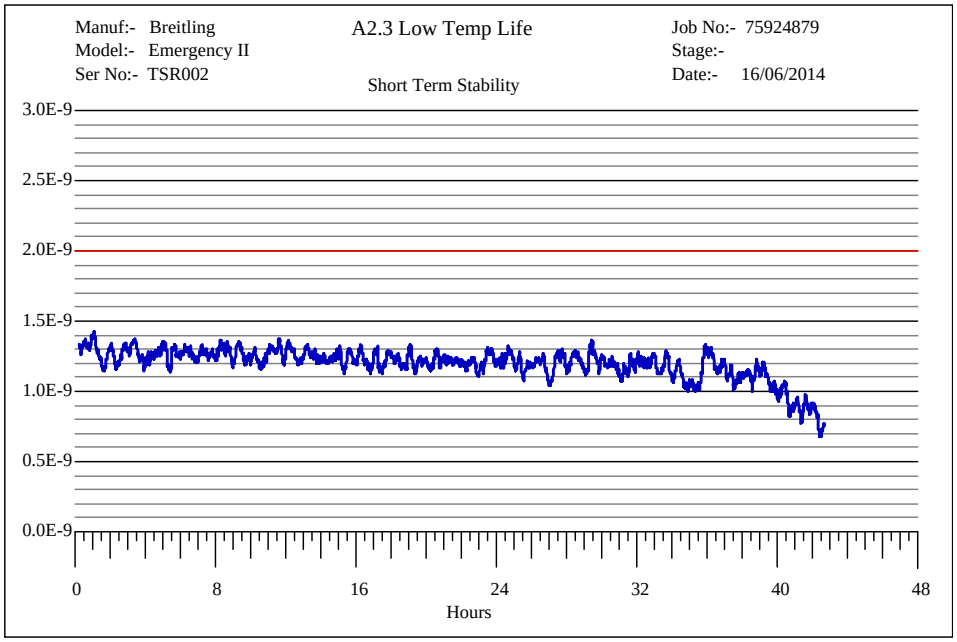

MHz
Frequency
Project Number - 75924879
Product - Emergency
Seral Number - M5 TSR002
121.7
121.65
121.6
121.55
121.5
121.45
121.4
121.35
121.3
12 13 14 15 16 17 18 19 20 21 22 23 24
Hours

Results at -20 °C

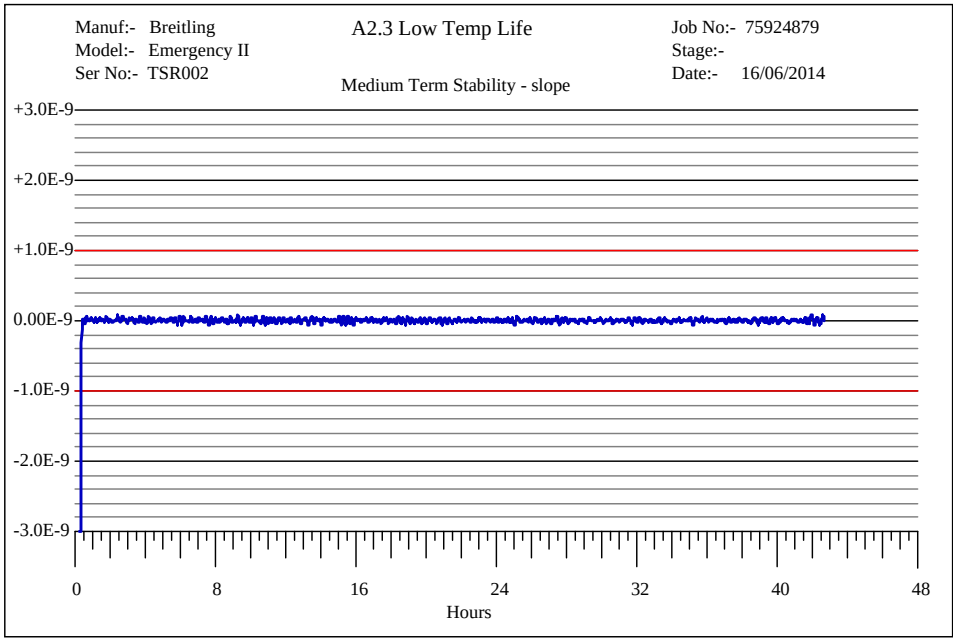
Nominal Frequency



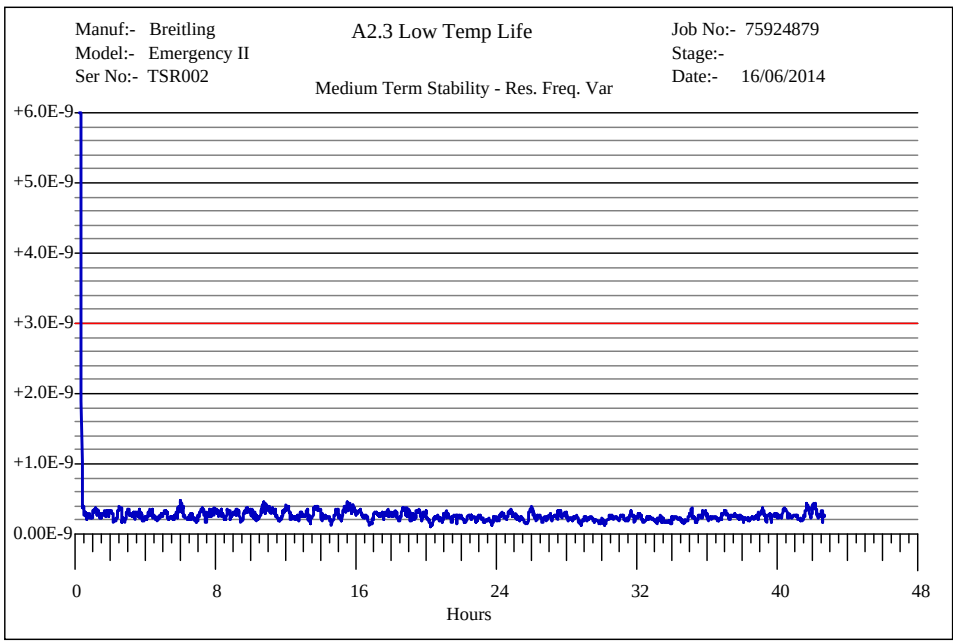
Short Term Stability



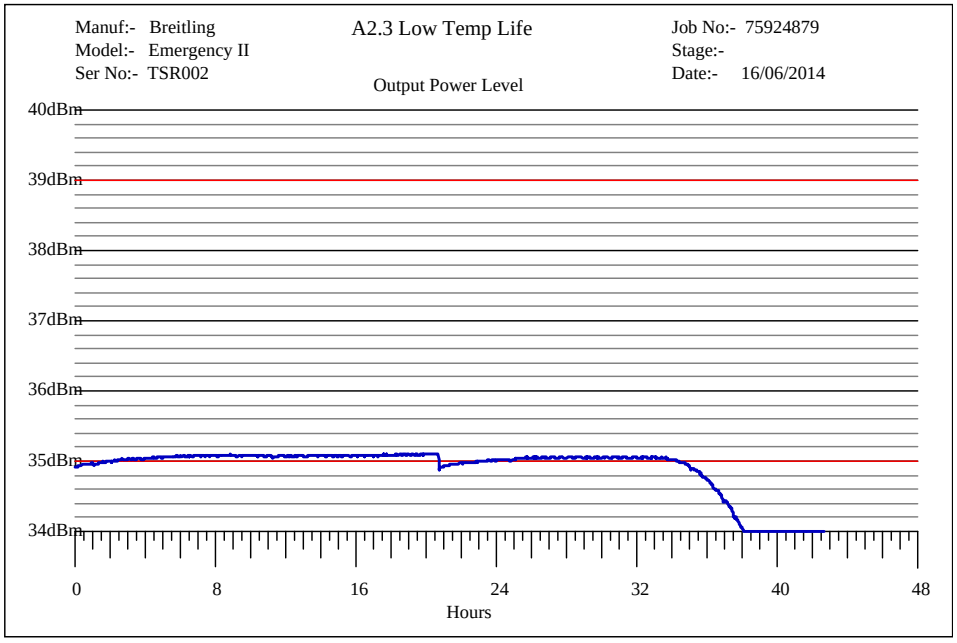
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



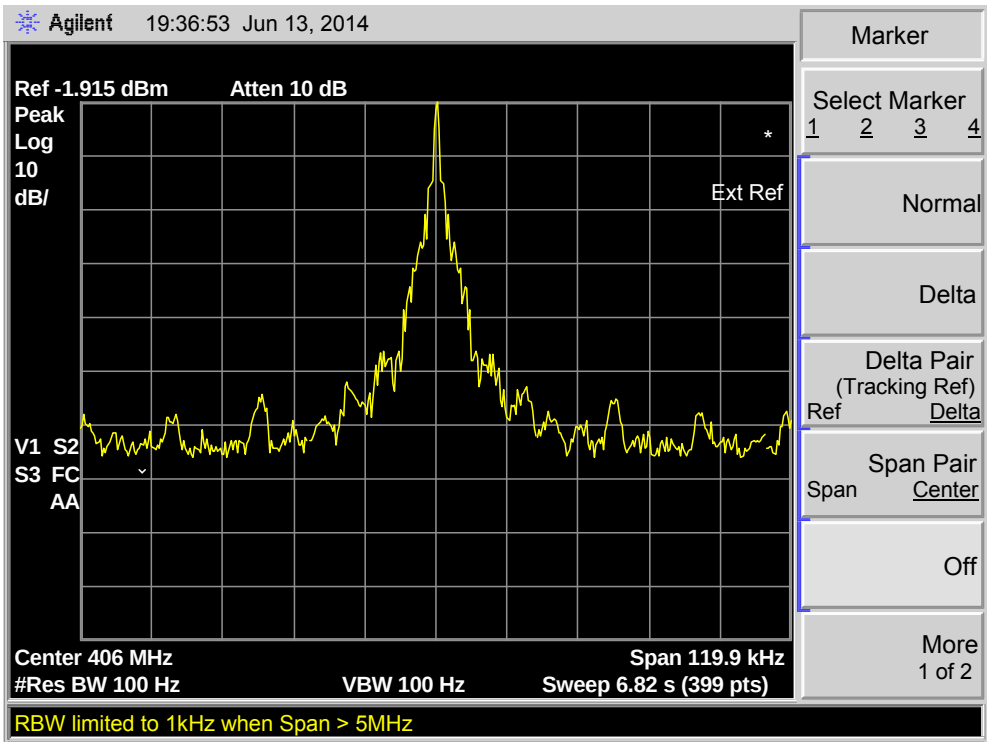
Output Power



Digital Message

```
================================================================================
 Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = A1BF4005EC00AF1              A1BF4005EC00AF1 Default_Id
 30 Hex (Bits 25-144) = 50DFA002F600578A007F8000000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 0 1010 0001 1011 1111 0100 0000 0000 0101 1110 1100 0000 0000 1010 1111 0001
   0100 0000 0000 1111 1111 0000 0000 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            0 Short Message                              0
Protocol Flag      26            1 User                                       1
MID                27- 36      269 SWISS                          0100 0011 01
User Protocol      37- 39        7 Test                                    111
Spare              40- 63                          1101 0000 0000 0001 0111 1011
Spare              64- 83                               0000 0000 0010 1011 1100
Homing             84- 85        1 121.5                                     01
BCH Encoded        86-106          Errors=0            0100 0000 0000 1111 1111 0
BCH Generated      86-106                              0100 0000 0000 1111 1111 0
Emergency Cd Flag 107            0 National Use                               0
Beacon Activation 108            0 Manual only                                0
National Use      109-112                                                  0000

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

406 Spurious monitored during Life test



2.13 COSPAS-SARSAT TYPE APPROVAL TEST PROCEDURE

2.13.1 Specification

RTCM 11010.2, Clause A.14

2.13.2 Equipment Under Test and Modification State

Emergency S/N: 1555585 - Modification State 0

2.13.3 Date of Test

19 May 2014

2.13.4 Test Equipment Used

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

2.13.5 Environmental Conditions

Ambient Temperature 22.0 °C
Relative Humidity 34.0 %

2.13.6 Test Results

Full Cospas-Sarsat testing was carried out prior to the RTCM 11010.2 sequence of test as requested by the customer. I.e. tests were completed out-of-sequence and not as per RTCM 11010.2 Clause A.2, Sequence of Tests.

The EUT was tested in accordance with Cospas-Sarsat T.001 Issue 3 - Revision 14 and Cospas-Sarsat T.007 001 Issue 4 - Revision 8. Results of the full test campaign were submitted to Cospas-Sarsat Secretariat for approval.

A Cospas-Sarsat Type Approval LoC was issued by the Secretariat: See – Annex A

This is intended to show compliance with the above Specification References.

2.14 BUOYANCY TEST

2.14.1 Specification

RTCM 11010.2, Clause A.15

Test not applicable – Category 1 PLBs only

2.15 121.5 MHz AUXILLARY RADIO-LOCATING DEVICE TRANSMITTER TEST

2.15.1 Specification

RTCM 11010.2, Clause A.16

2.15.2 Equipment Under Test and Modification State

Emergency S/N: 1555969 - Modification State 0
Emergency S/N: 1555585 - Modification State 0

2.15.3 Date of Test

20 May 2014, 22 May 2014 & 23 May 2014

2.15.4 Test Equipment Used

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

2.15.5 Environmental Conditions

Ambient Temperature 14.5 – 22.9 °C
Relative Humidity 44.9 – 76.6 %

2.15.6 Test Results

Carrier Frequency

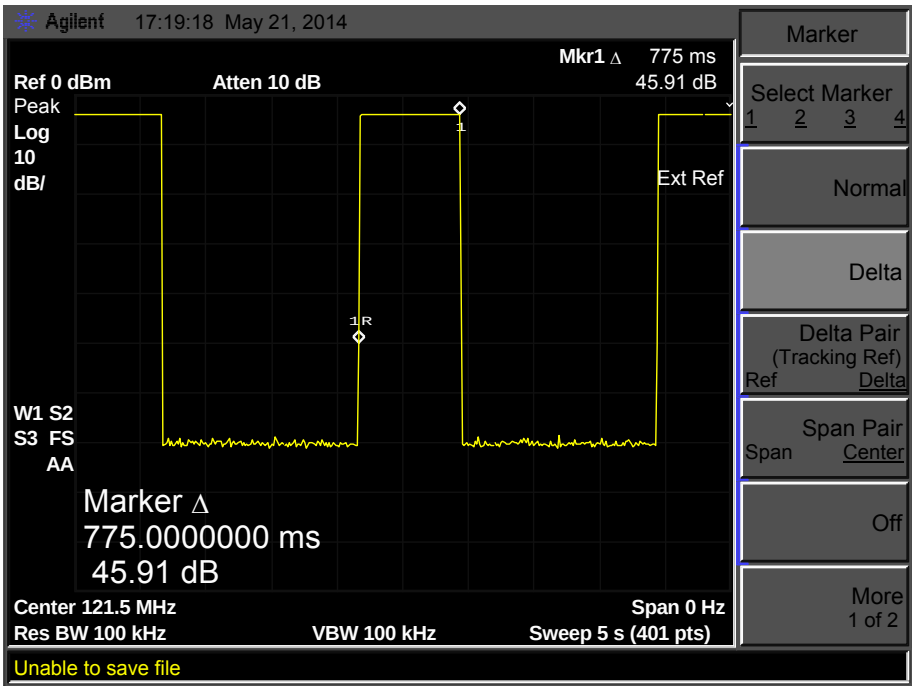
Parameter	Limit	Units	Test Results	
			T_{min} (0 °C)	T_{max} (+55 °C)
Carrier Frequency	121.5 ± 0.006	MHz	121.50025	121.50042636

Transmitter Duty Cycle

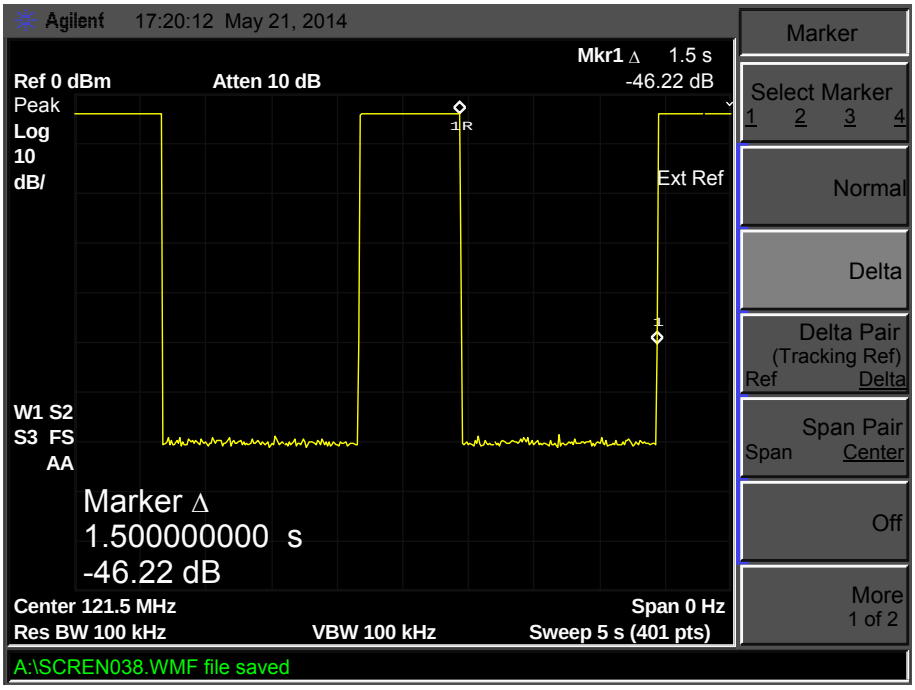
Note: Transmitter Duty Cycle = $\frac{\text{interval - duration}}{\text{interval}}$

Parameter	Units	Test Results	
		T_{min} (0 °C)	T_{max} (+55 °C)
121.5 MHz transmission interruption interval	seconds	1.5 (Off Time)	1.5 (Off time)
121.5 MHz transmission interruption duration	seconds	0.775 (On Time)	0.775 (On time)
Transmitter Duty Cycle	P/F	F (34%)	F (34%)

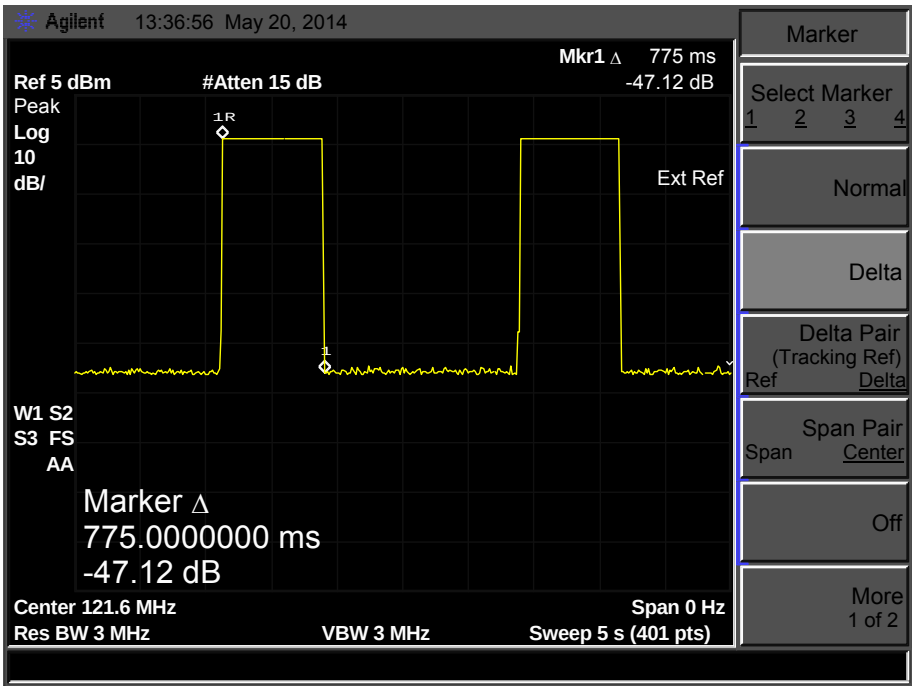
Plot showing 121.5 MHz 'On' time (0 °C)



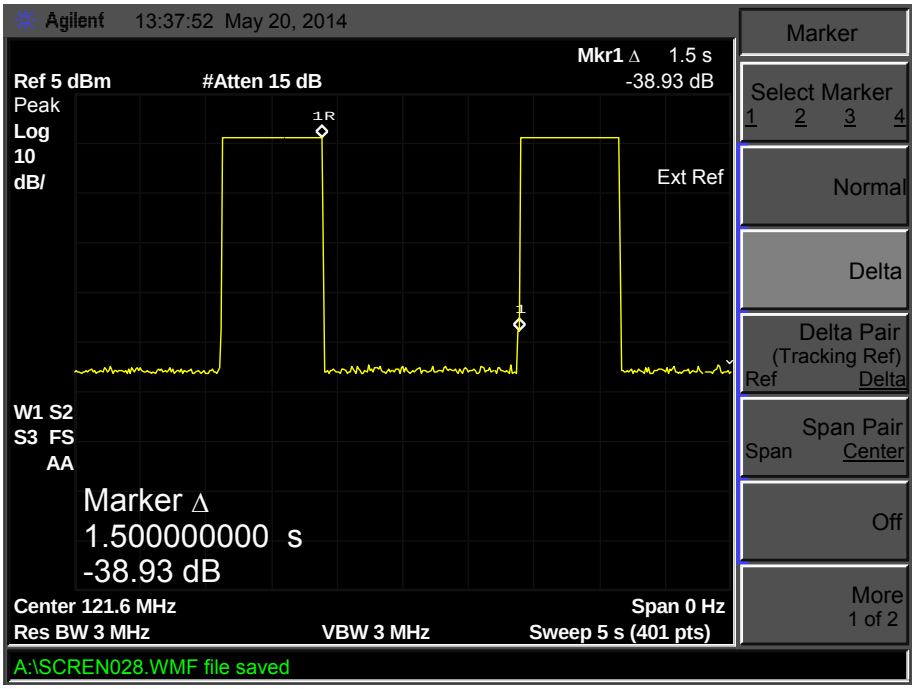
Plot showing 121.5 MHz 'Off' time (0 °C)



Plot showing 121.5 MHz 'On' time (Maximum Temperature)



Plot showing 121.5 MHz 'Off' time (Maximum Temperature)



Modulation Frequency and Sweep Repetition Rate/Modulation Duty Cycle

Parameter	Units	Test Results	
		T_{min} (0 °C)	T_{max} (+55 °C)
Frequency Range	Hz	920	842
Minimum Frequency	Hz	1320	400
Maximum Frequency	Hz	400	1242
Modulation Duty Cycle*	%	35.5 (worst case)	36.8 (worst case)
Sweep repetition rate	sweeps per second	2.62	2.64

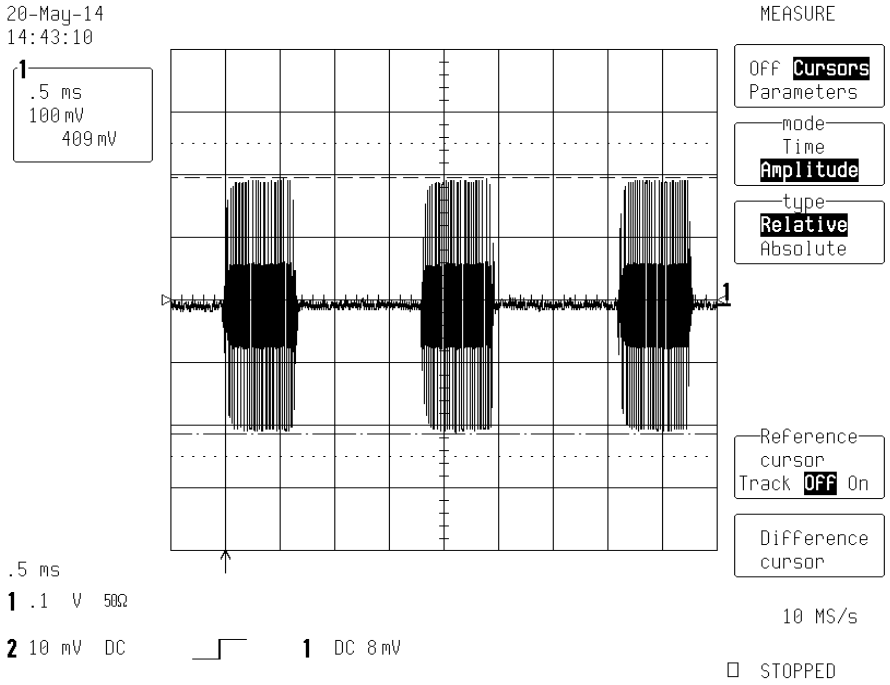
* Modulation Duty Cycle was measured near the beginning, middle and end of the audio sweep. The result closest to the limit (worst case) is shown.

Modulation Factor

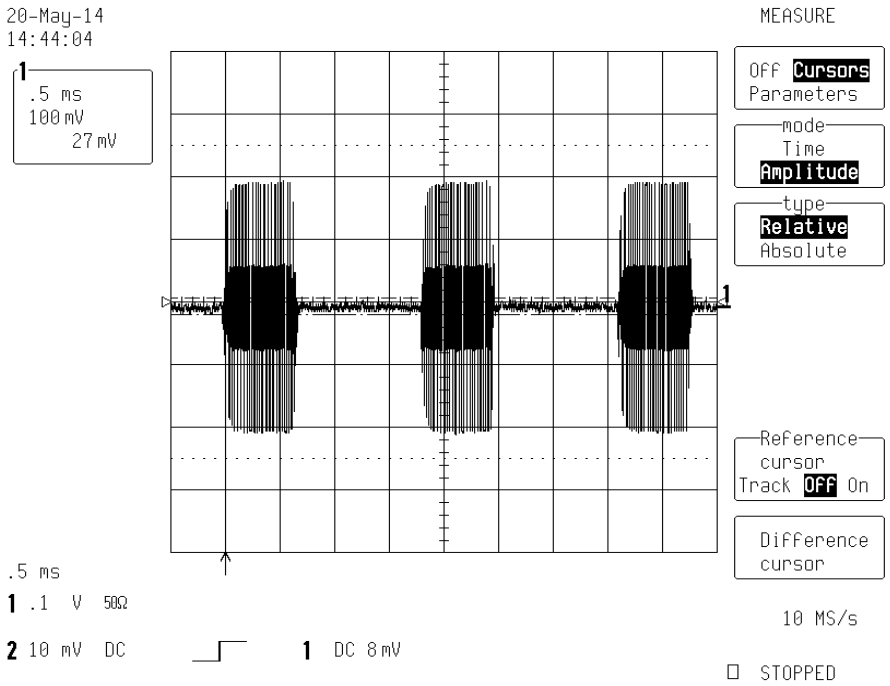
Note: Modulation Factor = (A - B) / (A + B)

Parameter	Units	Test Results	
		T_{min} (0 °C)	T_{max} (+55 °C)
A	mV	395	409
B	mV	16	27
Modulation Factor	(no units)	0.92	0.87

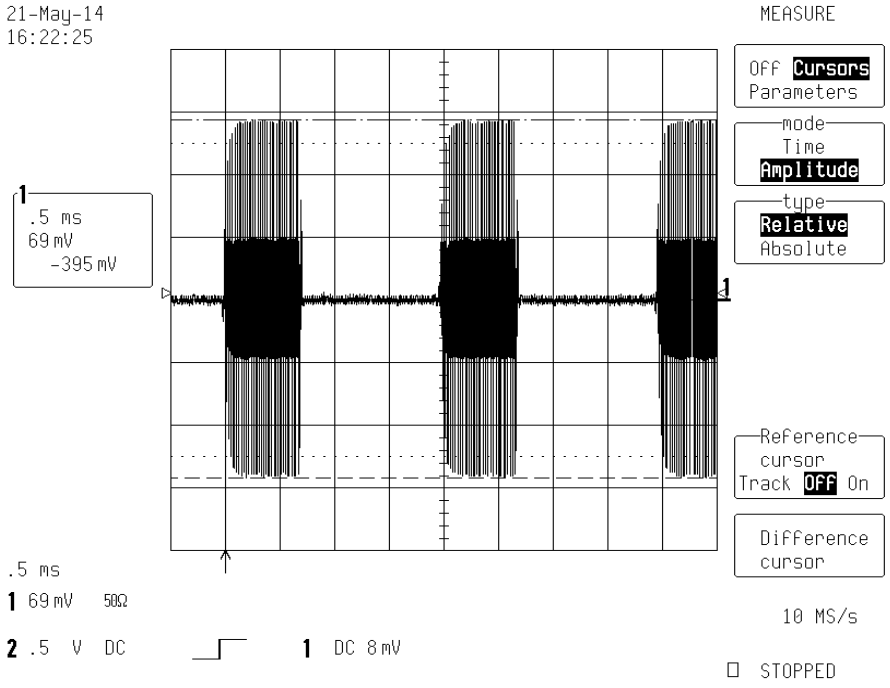
Plot showing “A” at Maximum Temperature



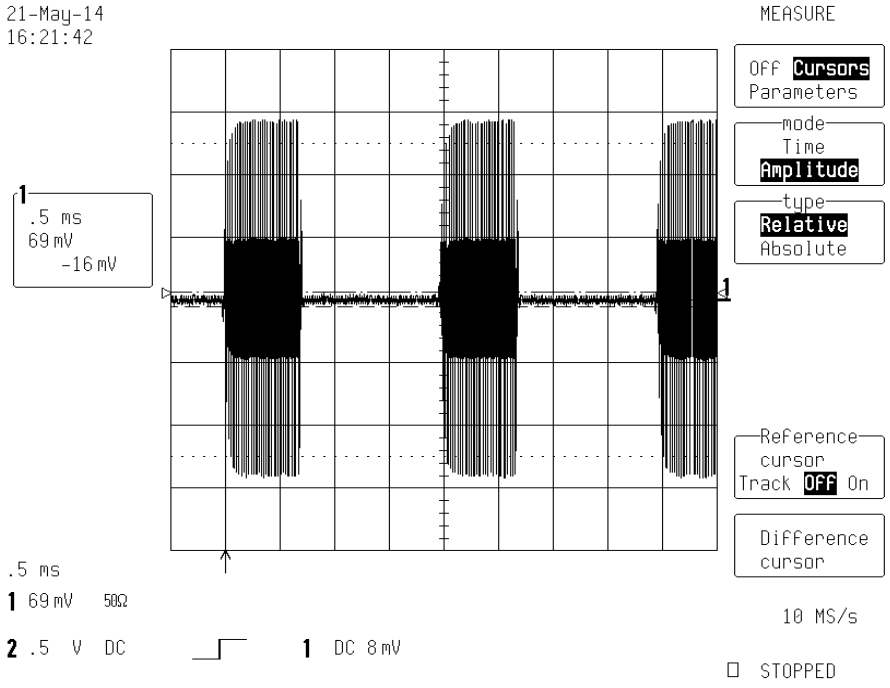
Plot Showing “B” at Maximum Temperature



Plot showing “A” (0 °C)



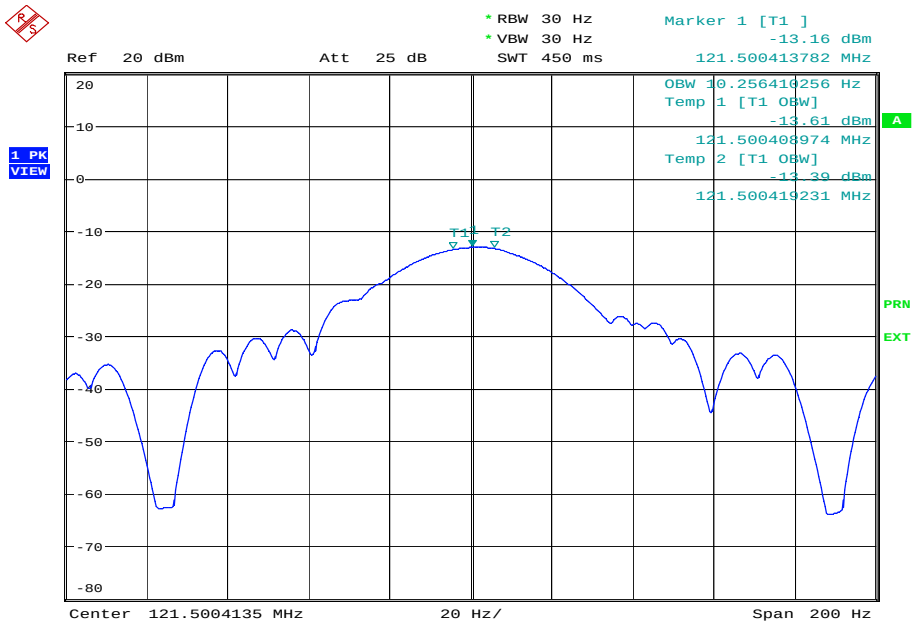
Plot Showing “B” (0 °C)



Frequency Coherence

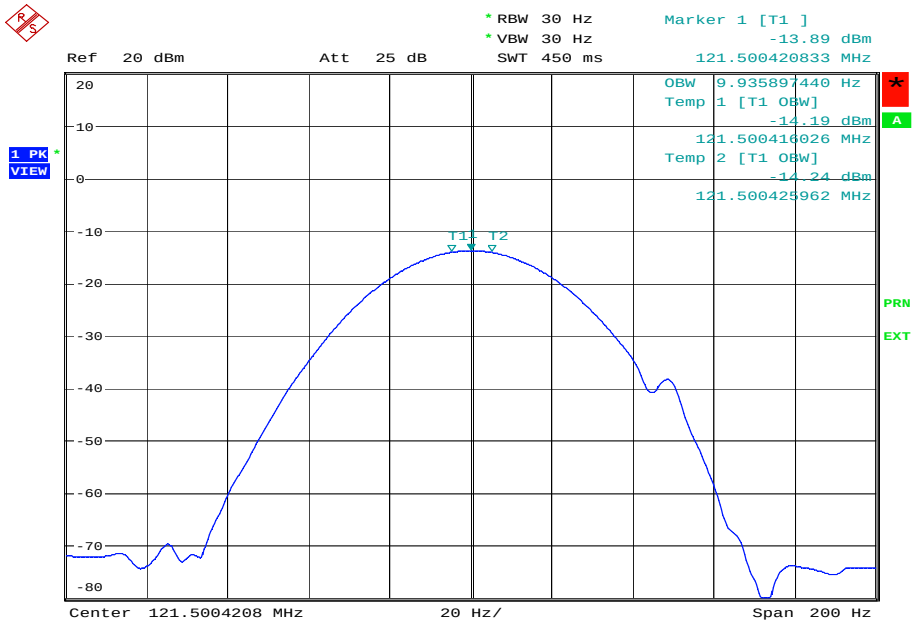
Parameter	Units	Test Results	
		T_{min} (0 °C)	T_{max} (+55 °C)
Frequency Coherence:			
Occupied Bandwidth	P/F	P	P
Frequency Shift	P/F	P	P

Occupied Bandwidth Plot for Maximum Temperature (+55 °C)



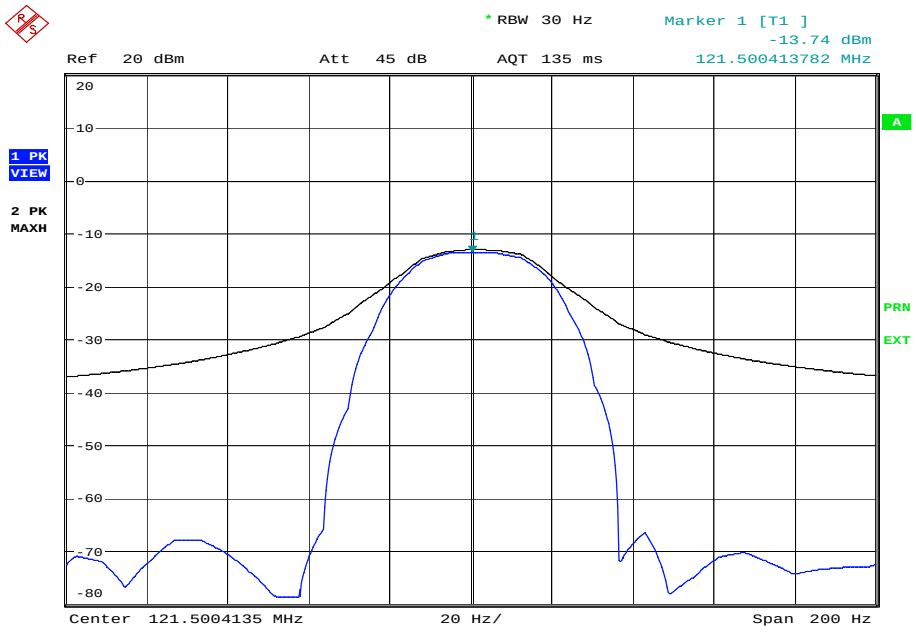
Date: 20.MAY.2014 17:22:06

Occupied Bandwidth Plot for Minimum Temperature (0 °C)



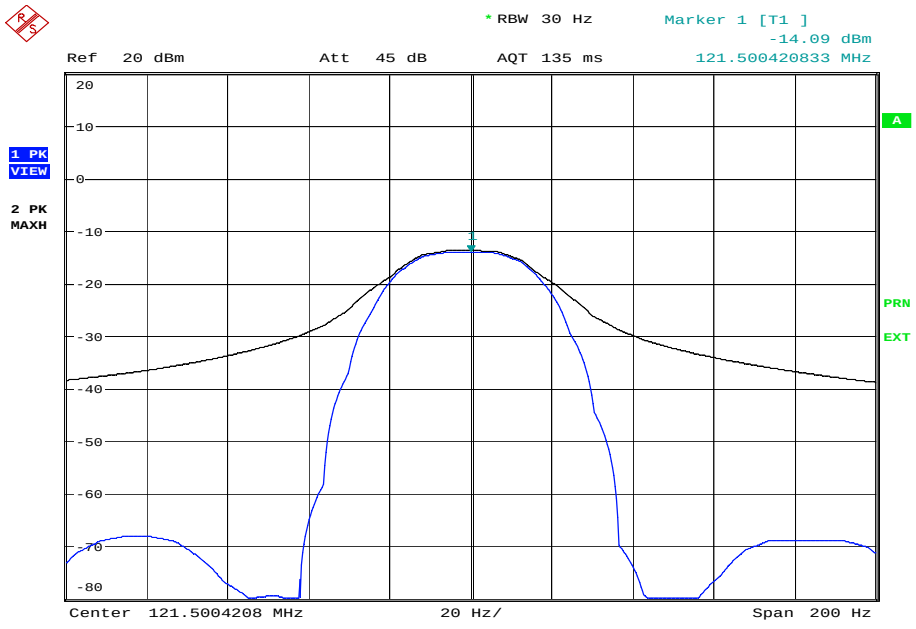
Date: 21.MAY.2014 11:26:57

Frequency Shift Plot for Maximum Temperature +55 °C



Date: 20.MAY.2014 17:10:04

Frequency Shift Plot for Minimum Temperature 0 °C



Date: 21.MAY.2014 11:31:36

Note: Trace A shown on the Frequency Shift Plots was set to Maximum Hold retaining the worst case frequency drift for the duration of the measurement.

Morse P

Parameter	Limit /Units	Test Results	
		T_{min} (0 °C)	T_{max} (+55 °C)
Dot 1 Length	115 ± 5% ms	115.8	115.4
Gap 1 Length	115 ± 5% ms	115.0	114.3
Dash 1 Length	345 ± 5% ms	349.65	348.8
Gap 2 Length	115 ± 5% ms	112.75	113.25
Dash 2 Length	345 ± 5% ms	348.5	350.0
Gap 3 Length	115 ± 5% ms	113.75	112.50
Dot 2 Length	115 ± 5% ms	117.25	118.25
Modulation Frequency	1000 Hz ± 50 Hz	1000.0	1000.0

Peak Equivalent Isotropic Radiated Power

The results (from the vertically polarised dipole) were converted to PEIRP (mW) in the following tables:

Azimuth Angle (Degrees)	Elevation (Degrees)							
	5		10		15		20	
	PEIRP (dBm)	PEIRP (mW)	PEIRP (dBm)	PEIRP (mW)	PEIRP (dBm)	PEIRP (mW)	PEIRP (dBm)	PEIRP (mW)
0	12.19	16.57	14.15	25.99	13.16	20.70	14.91	30.97
30	-	-	-	-	-	-	15.03	31.84
60	-	-	-	-	-	-	14.92	31.04
90	-	-	-	-	-	-	14.91	30.97
120	-	-	-	-	-	-	14.83	30.41
150	-	-	-	-	-	-	14.99	31.55
180	-	-	-	-	-	-	14.97	31.40
210	-	-	-	-	-	-	14.99	31.55
240	-	-	-	-	-	-	15.10	32.36
270	-	-	-	-	-	-	15.13	32.58
300	-	-	-	-	-	-	15.09	32.28
330	-	-	-	-	-	-	15.13	32.58

The median of the twelve values was 31.55 mW, or 14.99 dBm.

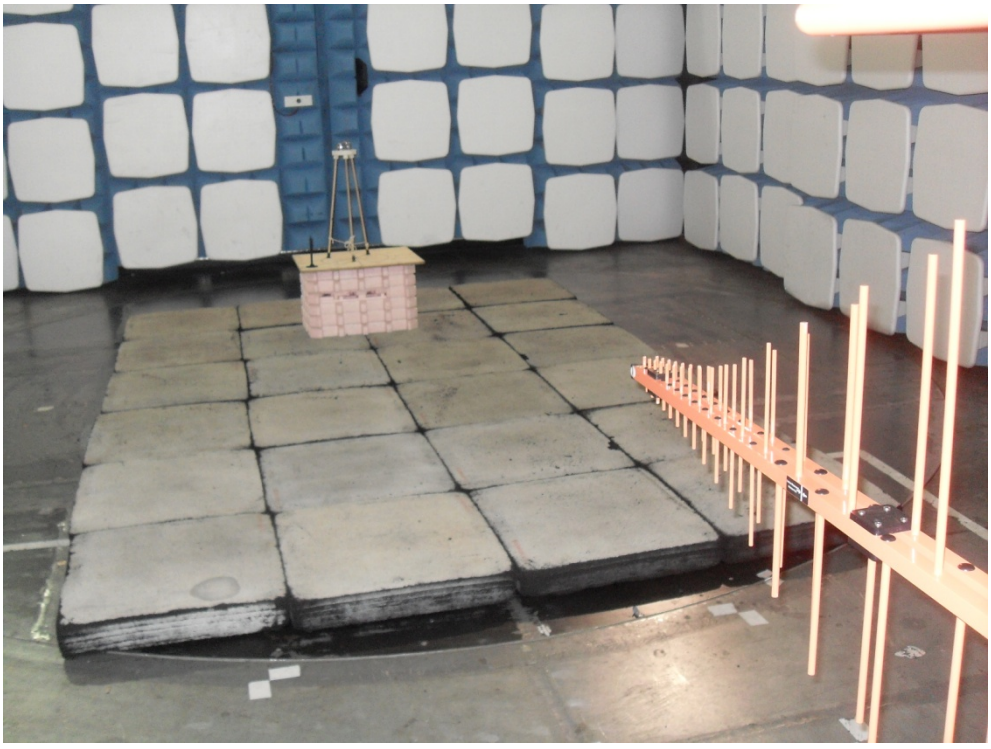
Of the 11 highest values, the max was 32.58 mW and the minimum was 30.41 mW, the ratio between these is 1.07 to 1 (0.30 dB)

Test Configuration

Off Ground Plane Radiated Power Test

Azimuth Angle (Degrees)	Elevation (Degrees)							
	5		10		15		20	
	PEIRP (dBm)	PEIRP (mW)	PEIRP (dBm)	PEIRP (mW)	PEIRP (dBm)	PEIRP (mW)	PEIRP (dBm)	PEIRP (mW)
0	14.01	25.16	12.16	16.46	9.53	8.97	5.11	3.24
90	13.83	24.14	-	-	-	-	-	-
180	14.08	25.57	-	-	-	-	-	-
270	14.17	26.11	-	-	-	-	-	-

The minimum of the four values was 24.15 mW, or 13.83 dBm.



Test Configuration

2.16 SOLAR RADIATION TEST

2.16.1 Specification

RTCM 11010.2, Clause A.17

Solar Radiation was waived in accordance with the above specification reference which states: "*The solar radiation test shall be waived where the manufacturer is able to produce evidence that the components, materials and finishes employed in the equipment and its labels would satisfy the test.*"

Customer supplied information (see Annex A) intends to show that the waiver is justified.

See Manufacturer Waiver request document "Breitling Waiver Request March 2014."

2.17 OIL RESISTANCE TEST

2.17.1 Specification

RTCM 11010.2, Clause A.18

Oil Resistance was waived in accordance with the above specification reference which states: "*The oil resistance test shall be waived where the manufacturer is able to produce evidence that the components, materials and finishes employed in the equipment would satisfy the test.*"

Customer supplied information (see Annex A) intends to show that the waiver is justified.

See Manufacturer Waiver request document "Breitling Waiver Request March 2014."

2.18 COMPASS SAFE DISTANCE TEST

2.18.1 Specification

RTCM 11010.2, Clause A.19

2.18.2 Equipment Under Test and Modification State

Emergency S/N: 1555585 - Modification State 0

2.18.3 Date of Test

19 May 2014

2.18.4 Test Equipment Used

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

2.18.5 Environmental Conditions

Ambient Temperature 23.0 °C
Relative Humidity 31.6 %

2.18.6 Test Results

Horizontal maximum flux density, Magnetic North (H)	H	21.32
Standard compass deviation limit (degrees)	5.4/H = A	A = 0.3
Emergency compass deviation limit (degrees)	18/H = B	B = 0.8

Orientation of the EUT	Un-powered State (Mode 1 - Watch mode)		Normalised		Powered Up (Mode 2 - Distress mode)	
	Distance From Compass Centre (mm) at A° deflection	Distance From Compass Centre (mm) at B° deflection	Distance From Compass Centre (mm) at A° deflection	Distance From Compass Centre (mm) at B° deflection	Distance From Compass Centre (mm) at A° deflection	Distance From Compass Centre (mm) at B° deflection
Front	160	160	N/T	N/T	160	160
Top	160	160	N/T	N/T	160	160
Left Hand Side	160	160	N/T	N/T	160	160
Right Hand Side	160	160	N/T	N/T	160	160
Underside	160	160	N/T	N/T	160	160
Rear	160	160	N/T	N/T	160	160

Standard Compass safe distance (m)	0.16
Emergency Compass safe distance (m)	0.16

2.19 MISCELLANEOUS TESTS (NUA)

2.19.1 Specification

RTCM 11010.2, Clause A.20

2.19.2 Equipment Under Test and Modification State

Emergency S/N: 1555585 - Modification State 0

2.19.3 Date of Test

23 May 2014

2.19.4 Test Equipment Used

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

2.19.5 Environmental Conditions

Ambient Temperature 22.3 °C
Relative Humidity 48.0 %

2.19.6 Test Results

	Operational Requirements RTCM Paper 11010.2		
	All Categories of Satellite PLBs		
	Clause 4.4		
	Controls and indicators		
Sub clause	Statement	Comment	Result
4.4.1	All controls shall be clearly and durably marked.	The instructions provided on the EUT are engraved in the metal parts of the device.	✓
	They shall be designed to prevent inadvertent activation and shall require the use of not less than two simple, independent mechanical actions for manual activation of the PLB.	The EUT is worn on the wrist and intended to be operated whilst in this position. In order to activate the EUT the user must unscrew the antenna dial and deploy the antennas. The Manufacturer advises that the EUT is not intended to be operated whilst on the wrist. It can be activated on the wrist (or other), but after activation it should be placed according to the recommendations in the user manual (pages 13 – 15).	✓
	Activation of the PLB shall not require the use of two hands.	The EUT is worn on the wrist and therefore only one hand is required to active the device.	✓
	The PLB shall be provided with a means to indicate that it has been activated.	Once the EUT has been activated the antennas cannot be restored unless the device is returned to the manufacturer. The EUT is a onetime only operation. A green flashing LED indicates the EUT has been successfully activated.	✓
	The controls should be few in number and the function of each control shall be kept simple to permit ease of operation of the PLB. All controls shall be so designed that they can be used by personnel wearing gloves or mittens.	Only one dial, and subsequent deployment of the antennas, is required to activate the device. It would be necessary to remove thick gloves in order to activate the beacon.	-
	PLBs shall have, as a minimum, integral manual controls to operate the device in the following modes: **OFF** In the **OFF** mode, the PLB is deactivated. **ON** In the **ON** mode, the PLB is activated. **TEST** See paragraph 4.4.2.	Waiver request due to product design constraints regarding one time operation and switch off – refer to Manufacturer documentation. OFF mode; in order to reduce the 406 MHz and 121.5 MHz transmission power the antennas must be cut or wrapped around the body of the EUT. On mode: Unscrew the cap and pull the main antenna, then pull the secondary antenna. The TEST function is only possible when the device is installed in the battery charger. An internal check is made (but no transmission) and the status of the check is indicated on LEDs on the charger.	-

	The various modes of the PLB shall be readily apparent by visual observation. A positive visual and/or audible indication that the PLB is activated shall be provided.	An LED is present on the watch face of the EUT: The flashing green LED indicates that the 406 MHz and 121.5 MHz beacon function is active – distress mode. The flashing red LED indicates a low battery state. A constant red LED indicates an internal error. The constant red LED is also active when the watch is on the charger and the charge is in progress.	
4.4.2	The PLB shall include a functional Self-test designed to test the following items under a full-load condition as a minimum: battery, 121.5 MHz and 406 MHz RF outputs, and, if used, phase lock of the 406 MHz phase locked loop (PLL). The Self-test shall be functional throughout the operating temperature range.	The self-test function is possible when the EUT is installed in the charger. The following items are checked: battery level, 121.5 and 406. The Manufacturer declared that the EUT complies with this clause. See also waiver request due to product design constraints regarding Self-test function – refer to Manufacturer documentation.	-
	During the Self-test function, the PLB shall transmit the first 112 bits of the digital message. The frame synchronization of this Self-test message shall be bits 16-24 = 0 1101 0000.	The Manufacturer declared that the EUT complies with this clause.	-
	The 121.5 MHz auxiliary radio-locating device signal shall not exceed 3 audio sweeps or 1 second, whichever is greater.	The Manufacturer declared that the EUT complies with this clause.	-
	A separate test switch or switch position is required for this test function. The test switch (or similar control) shall automatically return (e.g., spring-loaded switch) from the test position and shall not pass through the ON position.	Waiver request due to product design constraints regarding Self-test function – refer to Manufacturer documentation.	-
	Self-test message coding shall be as specified in section 4.3.1.2	Refer to Manufacturer documentation. See also C/S T.007 LoC and TUV SUD document 75924041 Report 1.	-
	Additionally, location protocol beacons should also provide for the transmission of a self-test encoded GNSS derived location. Location protocol beacons which provide for a test of the reception and / or encoding of a GNSS derived location in a self-test message shall:	Not applicable: EUT does not support the coding of the location protocol.	-
4.4.2 cont	• Activate the GNSS self-test mode via a distinct operation from the normal self-test mode, but the GNSS self-test mode may be activated via the same self-test switch(es) or operation provided that, it shall require a separate, deliberate action by the user that would limit the likelihood of inadvertent activation, nor shall it result in more than a single self-test burst; Provide for, in the case of internal GNSS receivers powered by the primary beacon battery, the number of GNSS self-tests shall be limited to prevent inadvertent battery depletion;	Not applicable: EUT does not support GNSS.	-

	• Provide a distinct indication to register successful completion or failure of the GNSS self-test and a separate distinct indication shall be provided, when appropriate, to indicate that the limited number of GNSS self-test opportunities have been attained; • Ensure that the duration of the GNSS self-test is limited to a maximum time duration set by the manufacturer.	Not applicable: EUT does not support GNSS.	-
	In the case where the PLB fails to encode the location into the 406 MHz message within this time limit, the GNSS self-test shall cease and the PLB shall indicate a GNSS self-test failure and may transmit a single self-test burst with default location data. In the case where the PLB encodes the location into the 406 MHz message within this time limit, the GNSS self-test shall cease at that time (before the time limit is reached) and shall indicate a GNSS self-test pass and may transmit a single self-test burst containing the valid location data.	Not applicable: EUT does not support GNSS.	-
	The manufacturer shall include instructions for the GNSS self-test in the PLB Operating Manual which shall include a clear warning on the use and limitations of this function. Instructions for the GNSS self-test shall not be included on the beacon itself.	Not applicable: EUT does not support GNSS.	-
	The following items shall be verified by the manufacturer at the minimum, ambient, and maximum operating temperatures: a) The PLB battery experiences full-load current drain during the Self-test.	Refer to Manufacturer documentation. The Manufacturer has further advised that: as the self-test is performed only when the battery is fully charged, and still on charge, we can assume that the full load current drain during the self-test has no impact on the beacon performance.	-
	b) Each self-test pass/fail indicator correctly identifies a fail condition when a failure in the monitored function has been induced.	Refer to Manufacturer documentation. The Manufacturer has further advised that: in a fail condition, a red LED is illuminated on the dial of the beacon and remains on, even if the watch is removed from the charger.	-
	c) Any transmission in either self-test mode is limited to one burst.	Refer to Manufacturer documentation. See also C/S T.007 LoC and TUV SUD document 75924041 Report 1.	-
	d) If a GNSS Self-test mode is provided it shall be tested to verify that under worst case conditions (no GNSS reception or input) it is limited in duration (all location protocol beacons) and number (beacons with internal navigation devices only)	Not applicable: EUT does not support GNSS.	-
	e) If a GNSS Self-test mode is provided, it shall be verified that inadvertent activation of this mode is precluded.	Not applicable: EUT does not support GNSS.	-
	f) If a GNSS Self-test mode is provided, it shall be tested to ensure the correct operation of the GNSS Self-test pass/fail indicator(s) NOTE The manufacturer shall provide test results to document the above tests. This sub-clause will not be tested during the tests specified in Annex A.	Not applicable: EUT does not support GNSS.	-

4.4.3	The PLB shall have its own primary (non-rechargeable) battery and shall not depend upon any external source of power for its operation when activated. The battery shall be an integral part of the equipment. Replacement of the battery, if user-replaceable, should be possible with relative ease, and any interface connections required shall be such as to prevent reversed polarity or incorrect installation. Provision shall be made to ensure watertight integrity upon replacement of the battery.	Waiver request due to product design regarding the use of the lithium rechargeable battery – refer to Manufacturer documentation.	-
	The PLB shall not be hazardous to personnel handling it, operating it, or performing manufacturer-approved servicing of it nor shall it release toxic or corrosive products outside the PLB case during or subsequent to storage at temperatures between -55° and +75° C and: a) During a full or partial discharge at any rate up to and including an external short circuit.	Refer to Manufacturer documentation. The Manufacturer also advises that: the watch is sealed, so no release of any products outside of the watch is possible. The battery has an internal protection circuit against short circuit. Due to the materials of the case, there is no problem due to storage temperatures between -55 °C and 75 °C.	-
	b) During a charge or forced discharge of a cell or cells by another cell or cells within the battery.	Refer to Manufacturer documentation.	-
	c) After a full or partial discharge.	Refer to Manufacturer documentation. The Manufacturer further advises that: the battery passed the CB test certificate. Ref certify Nr : FR647887A	-
	All PLBs shall include measures to protect the batteries from reversal of polarity, shorting and the effects of self-heating, cell-to-cell charging, and forced discharging.	The battery is installed by the Manufacturer only and can only be installed in one orientation. The device can only be installed in one orientation in the battery charger.	✓
	The PLB manufacturer shall establish a useful life and an expiration date for batteries. The useful life is defined as the period of time after the date of battery manufacture that the battery will continue to meet the input power requirements of the PLB. The following losses must be included (at a temperature of +20° C ±5° C): a) Testing, as recommended by the manufacturer, including GNSS Self Tests if applicable, or as required by the regulatory authority, whichever is the more demanding.	Waiver request due to product design regarding the use of the lithium rechargeable battery – refer to Manufacturer documentation.	-
	b) Self-discharge of the battery pack.		
	c) Standby loads.		
	The battery expiration date shall be the date of battery cell manufacture plus no more than 1/2 of the useful life of the battery.		
	The battery cells shall be no older than 2 years when first fitted in the PLB.		
4.4.4	Category 1 PLBs shall have sufficient positive buoyancy to float in fresh water.	The EUT is not classified as a Category 1 PLB. The EUT does not float.	-

4.5	The external design of the PLB shall avoid sharp edges or points to prevent injury or damage to equipment or personnel.	The sharp edge test was carried out using a Sharp Edge Tester: whilst some areas of the EUT have a define point, no permanent indentations or perforations were left on the Sharp Edge Tester surface.	✓
	The PLB (including antenna and battery) shall be an integral unit.	The EUT including the antenna is an integral unit.	✓
	The design and materials used for the PLB and any mounting devices, and other auxiliary components shall be suitable to ensure reliable operation in harsh environments.	The Manufacturer advises that the EUT is made of Titanium Grade 2 and sapphire crystal. The Manufacturer has advised that *titanium is a lightweight, hard wearing material with high tensile strength; it is a corrosion resistant material and able to withstand extreme temperatures*. The Manufacturer also advised that the *sapphire crystal offers scratch – resistance, high friction resistance to abrasion and has very stable physicochemical properties*.	-
	The PLB shall be resistant to deterioration by prolonged exposure to sunlight and shall not be unduly affected by seawater or oil.	Waiver request for Solar Radiation, Corrosion and Oil Resistance - Refer to Manufacturer documentation.	-
	The electronic components shall be protected to prevent malfunction under prolonged conditions of high humidity, including condensation inside the body of the PLB.	Refer to Manufacturer documentation. The Manufacturer also advises that: *based on the experience of our company in producing watches with internal corrosion sensitive materials, we can confirm that there is no humidity problem inside the watch. The water resistance is checked on dedicated devices for each beacon before leaving the factory and after each battery replacement.*	-
4.5.1	The PLB case shall be predominantly a highly-visible yellow/orange colour.	Waiver request due to product design constrains regarding the outward appearance of the device – refer to Manufacturer documentation.	-
4.5.2	Battery Labelling The battery shall be marked indelibly and legibly with the battery type (chemical composition), voltage, expiration date (month and year) and as appropriate, precautions associated with its use, handling and disposal.	The replacement date of the battery can be seen from a 'window' in the back case of the EUT. The battery type and voltage are presented on the battery. The Manufacturer has advised that the *Replace battery by MMM YYYY* label identification is equivalent to the expiration date.	-
	All labelling on the exterior of the PLB shall be resistant to deterioration by prolonged exposure to sunlight, not unduly affected by seawater or oil, and abrasion resistant.	The instructions provided on the EUT are engraved in the metal parts of the device.	✓
	All labelling essential to the safe and effective operation of the PLB shall be in high contrast to the background of the text or pictograph. Labelling and Pictograph instructions essential to the safe and effective operation of the PLB shall be sized such that they are readable by persons having 20/20 normal vision at a minimum viewing distance of 150 mm with illumination no greater than 0.3 lux.	Waiver request due to product design constraints regarding the applicability and suitability of all labelling requirements – refer to Manufacturer documentation.	-

	Items a) through h) in 4.5.2.2.1 below and any other information required for the safe and effective operation of the PLB shall be visible on the PLB, or their location identified and accessible by a single simple action on the part of the operator (e.g. lifting or removing a protective cover over the control panel). Such information shall not be hidden by any permanent or semi-permanent accessory or ancillary devices normally attached to or installed on or around the body of the PLB. (A separate storage case from which the PLB can be easily removed with one hand for activation is not included in this requirement.)	Waiver request due to product design constraints regarding the applicability and suitability of all labelling requirements – refer to Manufacturer documentation.	-
	The outside of the PLB shall be marked indelibly and legibly with the following: a) Concise, unambiguous instructions for operating and testing of the PLB that shall be understandable by untrained personnel.	Waiver request due to product design constraints regarding the applicability and suitability of all labelling requirements – refer to Manufacturer documentation.	-
	b) The warning, or equivalent: WARNING USE ONLY IN SITUATIONS OF GRAVE AND IMMINENT DANGER	On the underside of the EUT the following is engraved: *Warning use only in case of real emergency.*	✓
	c) The warning, or equivalent: NOTICE TO THE PUBLIC DO NOT MOVE IF FOUND REPORT POSITION TO AUTHORITIES	Waiver request due to product design constraints regarding the applicability and suitability of all labelling requirements – refer to Manufacturer documentation.	-
	d) Space for 15 characters shall be provided on a label with text identifying this as the “Beacon Identification Code.” This is the hexadecimal representation of bits 26 through 85 of the digital message. This unique identifier number, the 15 Hex ID, shall be inserted on the label when the PLB is programmed.	The HEX ID is engraved on the back of the EUT.	✓
	e) The serial number of the PLB	The unique serial number is engraved on the back of the EUT.	✓
	f) Instructions to register the PLB with the appropriate authority and the contact details of the authority.	Waiver request due to product design constraints regarding the applicability and suitability of all labelling requirements – refer to Manufacturer documentation.	-
	g) Space for any required registration sticker.	Waiver request due to product design constraints regarding the applicability and suitability of all labelling requirements – refer to Manufacturer documentation.	-
	h) The battery expiration date determined in accordance with section 4.4.3.	The replacement date of the battery can be seen from a ‘window’ in the back case of the EUT.	-
4.5.2.2.2	The following instructions shall be marked indelibly and legibly on the outside of the PLB or permanently attached to the PLB. If permanently attached, the placard including the instructions(s) shall be conspicuously marked adjacent to the attachment point: “DO NOT REMOVE”	Waiver request due to product design constraints regarding the applicability and suitability of all labelling requirements – refer to Manufacturer documentation.	-
	a) The identification of the manufacturer.	The Manufacturer is identified on the device.	✓

	b) The PLB type number or model identification under which it was type tested.	The model number Emergency is identified on the device.	✓
	c) The temperature operating range in degrees Celsius and Fahrenheit of the PLB.	The operating temperature range in C and F is identified on the device.	✓
	d) An appropriate Dangerous Goods transportation statement together with the applicable date.	The Manufacturer has advised that: no Dangerous Goods transportation statement is required.	-
	e) If there exists a condition or operating circumstance which has been identified by the manufacturer or regulating authorities that could substantially affect the alerting or self-locating performance of the PLB, then information appropriate to prevent this occurring shall appear in a conspicuous location appropriate to the prevention or remediation by the operator of said condition or operating circumstance (e.g. the necessity to orient the antenna vertically upward if orientation of the antenna is adjustable).	Transmission of the 121.5 MHz homing transmitter is only possible above 0 degrees. The antennas of the EUT require careful deployment and positioning. Details are clearly provided in the user manual and product movie.	-
	f) The phone number(s) to be used to report inadvertent activation negating the need for the distress alert.	Waiver request due to product design constraints regarding the applicability and suitability of all labelling requirements – refer to Manufacturer documentation.	-
4.5.2.2.3	For Category 2 PLBs The outside of the PLB shall be marked indelibly and legibly with a warning label that states “WILL NOT FLOAT.”	The statement WILL NOT FLOAT is included on the back of the EUT.	✓
4.5.2.2.4	For PLBs with an integral GNSS Receiver a) The location of the GNSS antenna shall be marked on the exterior of the PLB in a manner and location that shall be clearly viewable to the operator activating the beacon together with concise, unambiguous instructions to orient the GNSS antenna towards the sky and a warning not to obstruct the antenna.	The device does not support an integral GNSS receiver device.	-
	b) A positive visual and/or audible indication that the GNSS receiver has acquired a location.	The device does not support an integral GNSS receiver device.	-
	c) Instructions on or permanently attached to the PLB shall guide the operator towards maximizing self-locating performance. If permanently attached, the placard including the instructions(s) shall be conspicuously marked adjacent to the attachment point: “DO NOT REMOVE”	The device does not support an integral GNSS receiver device.	-
4.5.3	The manufacturer shall provide an operation manual which includes the following: a) Complete instructions for operating the PLB.	Instructions for operation are provided in the user manual (pages 10 -15). Details relating to limitations of use (i.e. no 121.5 MHz transmission) are included. Special instructions of use (i.e. careful positioning of deployed antennas, including during windy conditions) are included.	✓

	b) Cautions and recommendations to prevent false alerts.	Cautions relating to false alerts are provided on page 2, 8 and 9. It is worth noting that it is only possible to activate the EUT ONCE – extending the antenna automatically activates the beacon: it is only possible to stop this transmission by cutting the antennas and/or on battery discharge. After activation the EUT is required to be returned to the Manufacturer so that it can be rendered operational again.	✓
	c) A warning paragraph with, at a minimum, the information in 4.5.2.2 and the fact that misuse of a PLB is subject to a fine.	Details of a potential fine are included within the user manual (pages 2 and 8).	✓
	d) General battery information (e.g., battery replacement instructions, battery type, safety information regarding battery use and disposal).	Cautions relating to the battery composition can be found in the manual (page 2). The manual states that the battery must be recharged at least once every two months and ideally before each mission / expedition (page 16). Chapter 6 details day to day operation and provides information relating to the EUT and the battery use, including the charging requirements and LED indications relating to the battery. If the indicator on the watch dial blinks red, the beacon's battery requires recharging. The charger/tester is designed for indoor use only (since it is not water-resistant) and plugged into an external power source.	✓
	e) Instructions for the safe transportation or shipping of the PLB or the location where such information can be obtained on the Internet or by mail by the consumer.	The Manufacturer advises that no specific instructions are needed for transportation or shipping.	✓
	f) Information regarding the need to replace the battery after activation of the PLB and how to determine if the PLB has been activated or the battery needs to be replaced.	It is only possible to activate the EUT once – extending the antenna automatically activates the beacon. After activation the EUT is required to be returned to the Manufacturer so that it can be rendered operational again. If the battery is discharged the indicator on the watch dial blinks. The blink codes are detailed in the user manual (chapter 16) Battery end of life indicator details are also provided on page 30.	✓
	g) Information related to the requirements of preventive maintenance.	The user manual details the correct procedure for battery recharging. The user manual recommends that the EUT is returned to a service centre once every two years for Manufacturer prescribed checks. This should be once a year if used intensively in water. General details of the periodic maintenance are detailed on page 32.	✓

	h) Minimum operating lifetime and operating and stowage temperature ranges.	The user manual indicated the operating temperature of the EUT for both the 406 MHz and 121.5 MHz transmissions (i.e. 121.5 MHz is at temperatures greater than 0 °C only). The 406 MHz is operational at -20 degrees to + 55 degrees C. This information can be found on page 20.	✓
	i) Information explaining the requirement and procedure for licensing and registering.	Information relating to a license can be found on page 2 of the user manual. Registration details can also be found here and on page 8.	✓
	j) Instructions on actions to be taken in the case of false alerts, including toll and toll-free phone numbers for contacts and including instructions that in the case of accidental activation of the PLB, the user should de-activate the PLB and notify the appropriate search and rescue authorities at the earliest possible time, and encouragement to do so promptly.	Details of the actions to be taken in the event of a false alert can be found on page 16: the user is instructed how to reduce the distress signal transmission. In addition the Manufacturer has advised: a dedicated registration instruction paper is edited for each country and will contain toll and toll-free phone numbers for contacts and instructions that in the case of accidental activation of the PLB, the user should de-activate the PLB and notify the appropriate search and rescue authorities at the earliest possible time.	-
	k) For Category 2 PLB, a warning that states “THIS PLB WILL NOT FLOAT" and, if applicable, the information that when used around water it must be installed in a provided auxiliary flotation device, its tested depth and time rating (e.g. waterproof to x meters for x minutes/hours) and that the PLB is not designed to float and transmit a distress signal and that the PLB may not be substituted for a required EPIRB on a vessel.	The user manual states that the EUT “does not float and should not be used in water” (page 2).	-
	l) For Category 1 PLB, information that the PLB is appropriate for use in or around water and, its tested depth and time rating (e.g. waterproof to x meters for x minutes/hours) and as appropriate, either: The PLB is buoyant (but is not designed to float in an upright position and transmit a distress signal) and that the PLB may not be substituted for a required EPIRB on a vessel. or The PLB will float without support in an upright position and transmit a distress signal and that the PLB may not be substituted for a required EPIRB on a vessel.	The EUT is not classified as a Category 1 PLB.	-
	m) For PLBs with an integral GNSS receiver or that can be interfaced with an external GNSS receiver, information to guide the operator towards maximizing self-locating performance including a warning not to obstruct the GNSS antenna's view of the sky and to ensure the GNSS antenna is not submersed in water.	The device does not support an integral GNSS receiver device.	-
	n) If the 121.5 MHz signal is transmitted during the Self-test, information noting that the Self-test shall be performed only within the first 5 minutes of any hour.	Self-test signal is not transmitted during self-test check.	-
	o) An overview and explanation of how the Cospas-Sarsat system operates.	An overview of the Cospas-Sarsat system is provided on pages 4 – 7 of the user manual.	✓

	p) Beacon registration materials and information 15	The Manufacturer has advised: a dedicated registration instruction paper is edited for each country and will contain toll and toll-free phone numbers for contacts and instructions that in the case of accidental activation of the PLB, the user should de-activate the PLB and notify the appropriate search and rescue authorities at the earliest possible time.	-
	q) For PLBs with the capability to be connected to an external GNSS receiver the manufacturer shall provide instructions for connecting and setting up the external GNSS receiver in the equipment manual. This information shall include: 1) A list of all the GNSS receivers that have been tested with the PLB to ensure correct operation of the interface; 2) Details of the electrical and/or data connections to the PLB; 3) The specification of the interface (e.g. IEC 61162-1); 4) Details of the communications protocol to be used (e.g. Baud Rate, Data Bits, Parity Bits etc.); 5) A list of the NMEA messages that the PLB can handle (e.g. GGA, GLL, RMC etc.) and; 6) Instructions on the key settings and parameters of the GNSS Receiver (e.g. Map Datum (WGS84/GTRF), I/O Formats, Mode of Operation etc.).	The device does not support an integral GNSS receiver device.	-

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT

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

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.2 – Dry Heat (Storage)					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	13-Aug-2014
Weiss Technik (T)	Weiss Technik	WEISS ALT	2133	12	7-Jan-2015
2 Metre SMA Type Cable	Rhophase	3PS-1801A-2000-3PS	4111	12	5-Nov-2014
DC - 8 GHz Attenuator	Lucas Weinschel	24-30-33	3963	12	27-Jun-2014
Section 2.2 - Dry Heat (Functional)					
Power Meter	Hewlett Packard	436A	83	12	30-Aug-2014
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	30-Jan-2015
Signal Generator	Hewlett Packard	8644A	96	12	18-Apr-2014
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	9-Oct-2014
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	13-Aug-2014
Weiss Technik (T)	Weiss Technik	WEISS ALT	2133	12	7-Jan-2015
Distress Beacon RF Unit	TUV SUD Product Service	-	2445	-	TU
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	15-Nov-2014
Termination (50ohm, 6W)	Micronde	R404613	3074	12	27-Mar-2015
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	12-Sep-2014
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	21-Aug-2014
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	19-Nov-2014
Power Sensor	Agilent Technologies	8482A	3289	12	14-Jan-2015
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	19-Apr-2014
DC - 8 GHz Attenuator	Lucas Weinschel	24-30-33	3963	12	27-Jun-2014
50 ohm 0.5 W DC-1 GHz termination	Unknown	RS 456-251	4044	12	30-Oct-2014
ScopeCorder	Yokogawa	DL750	4175	12	29-Jan-2015
Section 2.3 - Damp Heat					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	13-Aug-2014
Chamber	Heraeus	HC 4033	2174	12	14-May-2014
DC - 8 GHz Attenuator	Lucas Weinschel	24-30-33	3963	12	27-Jun-2014
1803-A 4.0M PCNm PCNm	Rosenberger	NPS-1803A-4000-NPS	4357	12	5-Sep-2014
Section 2.4 - Low Temperature (Functional)					
Power Meter	Hewlett Packard	436A	83	12	30-Aug-2014
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	30-Jan-2015
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	9-Oct-2014
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	8-Apr-2015
Climatic Chamber	Climatec	Climatec 1	2124	12	22-Nov-2014
Distress Beacon RF Unit	TUV SUD Product	-	2445	-	TU

	Service				
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	15-Nov-2014
Termination (50ohm, 6W)	Micronde	R404613	3074	12	27-Mar-2015
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	12-Sep-2014
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	21-Aug-2014
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	19-Nov-2014
Power Sensor	Agilent Technologies	8482A	3289	12	14-Jan-2015
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	13-Jun-2014
Termination (50ohm)	Meca	405-1	3518	12	30-Oct-2014
1 Metre SMA Cable	Rhophase	3PS-1801A-1000-3PS	4099	12	5-Nov-2014
ScopeCorder	Yokogawa	DL750	4175	12	29-Jan-2015
1803-A 4.0M PCNm PCNm	Rosenberger	NPS-1803A-4000-NPS	4357	12	5-Sep-2014
Section 2.4 - Low Temperature (Storage)					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	13-Aug-2014
2 Metre SMA Type Cable	Rhophase	3PS-1801A-2000-3PS	4111	12	5-Nov-2014
Climatic Chamber	Climatec	Climatec 1	2124	12	22-Nov-2014
DC - 8 GHz Attenuator	Lucas Weinschel	24-30-33	3963	12	27-Jun-2014
1803-A 4.0M PCNm PCNm	Rosenberger	NPS-1803A-4000-NPS	4357	12	5-Sep-2014
Section 2.5 - Vibration Test					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	13-Jun-2014
Shaker	TUV SUD Product Service	A340	4294	6	8-Oct-2014
Section 2.6 - Bump Test					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	13-Jun-2014
Shaker	TUV SUD Product Service	A340	4294	6	8-Oct-2014
Section 2.8 - Drop Test					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Montford F43	Montford	4FT CUBED	2126	12	18-Jul-2014
Hardwood Block	Unknown	ELM	2650	-	TU
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	13-Jun-2014
Section 2.9 - Thermal Shock					
Climatic Chamber	Climatec	Climatec 1	2124	12	22-Nov-2014
Montford F43	Montford	4FT CUBED	2126	12	18-Jul-2014
Balance	Geniweigher	GM-11K	2334	12	11-Mar-2015
Digital Thermometer	Digitron	T208	2831	12	25-Jul-2014
Section 2.10 – Immersion Test					
Montford F43	Montford	4FT CUBED	2126	12	18-Jul-2014
Balance	Geniweigher	GM-11K	2334	12	11-Mar-2015
940 litre Tank	Unknown	940 litre	3574	-	TU
5 m tape measure	Stanley	Fatmax 5 m	3712	-	TU
Type T PFA Insulated Thermocouple	TC Limited	Type T	4229	12	24-Feb-2015
K Type Thermocouples (x46)	Universal Thermosensors	449931	4279	24	2-Apr-2015

Section 2.11 - Spurious Emissions					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	30-Jan-2015
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Attenuator 10dB/10W)	Trilithic	HFP-50N	454	12	7-Aug-2014
Broadband Resistive Power Divider	Weinschel	1506A	605	12	11-Oct-2014
Power Splitter	Weinschel	1506A	606	12	14-Jan-2015
Crystal Detector	Hewlett Packard	8470B	1320	12	3-Jun-2014
High Pass Filter	Mini-Circuits	NHP-300	1640	12	21-Aug-2014
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	15-Nov-2014
Hygrometer	Rotronic	I-1000	3068	12	10-Apr-2015
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	27-Jun-2014
Thermocouple Thermometer	Fluke	51	3172	12	21-Aug-2014
Attenuator (30dB, 150W)	Narda	769-30	3369	12	29-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
1 Metre SMA Cable	Rhophase	3PS-1801A-1000-3PS	4099	12	5-Nov-2014
1 Metre K Type Cable	Rhophase	KPS-1501A-1000-KPS	4105	12	5-Nov-2014
DC to TTL Converter	TUV SUD Product Service	N/A	4377	-	TU
DC to TTL Converter	TUV SUD Product Service	N/A	4378	-	TU
Section 2.12 - Beacons - Operating Lifetime					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Power Meter	Hewlett Packard	436A	47	12	12-Jul-2014
Power Meter	Hewlett Packard	436A	83	12	30-Aug-2014
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	30-Jan-2015
Time Interval Analyser	Yokogawa	TA720	181	12	25-Apr-2015
Signal Generator	Hewlett Packard	8644A	199	12	14-Apr-2015
Attenuator 10dB/10W)	Trilithic	HFP-50N	454	12	7-Aug-2014
Attenuator: 6dB/10W	Trilithic	HFP-50N	476	12	7-Aug-2014
Broadband Resistive Power Divider	Weinschel	1506A	601	12	21-Mar-2015
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	8-Apr-2015
Attenuator (10dB, 10W)	Trilithic	HFP-50N	1377	12	17-Oct-2014
Distress Beacon RF Unit	TUV SUD Product Service	-	2445	-	TU
Beacon RF Unit	TUV SUD Product Service	N/A	3066	-	TU
Hygrometer	Rotronic	I-1000	3068	12	10-Apr-2015
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	27-Jun-2014
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	9-Oct-2014
Thermocouple Thermometer	Fluke	51	3172	12	21-Aug-2014
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	21-Aug-2014
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	21-Aug-2014
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	19-Nov-2014
ScopeCorder	Yokogawa	DL750 701210	3254	12	18-Nov-2014
Power Sensor	Agilent	8482A	3289	12	14-Jan-2015

	Technologies				
Power Sensor	Agilent Technologies	8482A	3290	12	14-Jan-2015
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	13-Jun-2014
Cable (1m, N type)	Rhophase	NPS-1601-1000-NPS	3350	12	29-Apr-2015
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3351	12	29-Apr-2015
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3352	12	29-Apr-2015
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	29-Apr-2015
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	29-Apr-2015
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	29-Apr-2015
Bandpass Filter	Trilithic	5BE121.55/35-3-BA	3410	12	12-Sep-2014
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	31-Mar-2015
ScopeCorder	Yokogawa	DL750	4175	12	29-Jan-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
Section 2.15 - 121 MHz Auxillary Radio-Locating Device Transmitter Test					
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Counter	Hewlett Packard	53181A	159	12	28-May-2014
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	27-Jun-2014
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	9-Oct-2014
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	15-Nov-2014
Oscilloscope	Lecroy	9370	2832	12	24-Oct-2014
Hygrometer	Rotronic	I-1000	3068	12	10-Apr-2015
Thermocouple Thermometer	Fluke	51	3172	12	21-Aug-2014
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	13-Jun-2014
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3353	12	29-Apr-2015
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	29-Apr-2015
Test Receiver	Rohde & Schwarz	ESIB26	242	12	9-Jun-2014
Bilog Antenna	Schaffner	CBL6143	1858	24	5-Sep-2014
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	8-Nov-2014
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	10-Jun-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Bandpass Filter	Trilithic	5BE121.55/35-3-BA	3410	12	12-Sep-2014
Section 2.15 Wireless Group - Radiated Emissions					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	8-Nov-2014
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	10-Jun-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU

Section 2.18 - Compass Safe Distance					
Magnetometer	Bartington	MAG01	671	36	14-Nov-2014
Compass Verification Unit	TUV SUD Product Service	CVU	3579	-	TU
Handheld Digital Multimeter	Agilent Technologies	U1241A	3625	12	24-Sep-2014
Marine Binacle Compass with Repeater Display	Cassens & Plath	Compass: Type 11	3834	-	TU

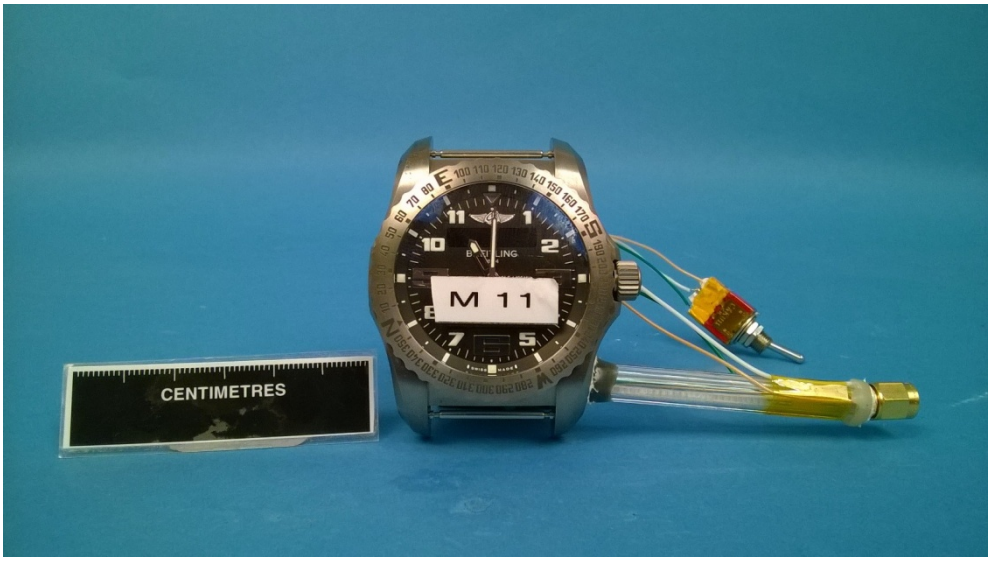
TU – Traceability Unscheduled
OP MON – Output Monitored with Calibrated Equipment

SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

Radiated Sample (antennae deployed)



Conducted Sample

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

MANUFACTURER SUPPLIED INFORMATION

Product Service

BREITLING
1884

BREITLING EMERGENCY

Waiver Request RTCM STANDARD 11010.2

Product : Breitling Emergency PLB

Breitling requests a waiver for the following tests:

- Solar radiation according to 8.10.1
- Oil Resistance according to 8.11.1
- Corrosion according to 8.12.1

Breitling Emergency PLB description

The Breitling Emergency PLB case is made of the following materials.

- Titanium (Grade 2) for the case, the back and the crown
- 316L stainless steel (DIN 1.4435) for the two caps of the antenna and the back screws.
- Sapphire crystal glass
- Glass gasket is made of PA12 (Polyamide 12)
- All the other gaskets are made of NBR (Nitrile butadiene rubber)

Solar radiation, RTCM 11010.2 A17 (IEC 60945 8.10)

Due to the material used for the realization of the case, there is no effect of the solar radiation on the performance of the PLB. All the NBR gaskets are not exposed to the solar light.

The PLB has been tested in an accredited laboratory according to IEC 60945 8.10 Solar radiation (portable equipment). This test was successful. The report of the laboratory is included. It is in French. English translation is available on request.

Corrosion resistance IEC 60945 8.12

Titanium metal is generally considered to be the ultimate in corrosion resistance, particularly in salt laden atmosphere.

P.O. BOX 1132 · 2540 GRENCHEN · SWITZERLAND · TEL +41-32 654 54 54 · FAX +41-32 654 54 08

The steel used for the two caps of the antenna is a DIN1.4435 steel, which is the higher available quality in the 316L family. Corrosion resistance of this steel is one of the best behaviors available with a stainless steel.

The PLB has been tested in an accredited laboratory, according to IEC 60945 8.12 Corrosion (salt mist). This test was successful. The report of the laboratory is included. It is in French. English translation is available on request.

Oil resistance RTCM 11010.2 A18 (IEC 60945 8.11)

A.18 Oil resistance test says: "The oil test shall be waived where the manufacturer is able to produce evidence that the components, material and finishes employed in the equipment would satisfy the test."

Due to the material used for the realization of the case, there is no effect of mineral oils for the test on the performance of the PLB.

Apart from Titanium, Sapphire glass and stainless steel, the only parts which are in contact with the oil are the gaskets. As explained above, they are two different materials, NBR and PA12.

NBR has excellent resistance to mineral oils (see table, source: The Harboro Rubber Co Ltd), and PA12 has excellent resistance to all the oils (see hereafter, source: Palle Knudsen (DK)

Common Name	**Nitrile**
Chemical Name	Nitrile Butadiene Rubber
Nomenclature	NBR
Cost Factor	2
Hardness Range	40-100°
Colours	Limited Range
Heat Resistance (°c) Maximum Continuous Maximum Intermittent	 100°c 130°c
Low Temperature Resistance	-20°c
Resistances Oxidation Ozone & Weathering	 Good Fair
Oil Resistance *ASTM Oil No. 1 @ 20°c @ 100°c *ASTM Oil No. 3 @ 20°c @ 100°c	 Excellent Good Excellent Good

Chemical resistance
PA 12 is resistant to:
- oil products, petrol, fatty substances, lubricants and solvents such as alcohol, ketones, esters and ether

PA 12 is not resistant to:
- many acids, strong bases and oxidizing agents
- chlorine based products

For this point "Oil resistance", Breitling has not performed any specific tests, as it is clearly obvious that the behavior of the PLB is not affected by immersion in mineral oil.

Product Service

3

Conclusion

Based on these facts, Breitling asks for a waiver for these three tests.

Grenchen, March 10, 2014

BREITLING SA

Jean-Paul Girardin
Vice-President

P.O. BOX 1132 · 2540 GRENCHEN · SWITZERLAND · TEL +41-32 654 54 54 · FAX +41-32 654 54 04

METALLO TESTS SA

LABORATOIRE D'ANALYSES CHIMIQUES
CARACTERISATION DES MATERIAUX
TESTS DE VIEILLISSEMENT MECANIQUE ET CLIMATIQUE
CONSULTING, CONTRÔLES, HOMOLOGATION

Breitling SA
A l'att. de M. von Allmen
P.O. Box 1132
2540 Grenchen

RAPPORT N° 14-39879-i1
V / Réf. BL n°31
Réception 25.11.2013
Annexe Pièces en retour

La Chaux-de-Fonds, le 21 janvier 2014

DESCRIPTION ECHANTILLON

- Composant analysé: 1 tête de montre Emergency E76325

ESSAIS EFFECTUES

		APPRECIATIONS
- Essai n°1	Rayonnement solaire	conforme
- Essai n°2	Brouillard salin	conforme
- Essai n°3	Chaleur / Humidité	conforme

RESULTATS

[X] conforme [ ] remarques

- Résultats détaillés et observations : voir pages suivantes

CONCLUSIONS

La pièce testée est conforme aux critères fiabilités appliqués selon la norme, car l'on n'observe pas d'altération visible au niveau de cette dernière après vieillissement.

METALLO-TESTS SA

P. Girardin
Directeur

Product Service

RAYONNEMENT SOLAIRE

PIECE TESTEE 1 tête de montre Emergency E76325

TESTS / PARAMÈTRES

[x] Rayonnement solaire

Méthode	:	Selon CEI 60945 : 2002
Source	:	Lampe Xénon
Spectre principal	:	300 à 400 nm
Intensité du rayonnement	:	5 à 8.3 mW / cm²
Température sur échantillon	:	noir : < 60 °C
Humidité	:	Non-contrôlée
Indice de décoloration	:	selon norme ISO 105 A03
Accréditation	:	Non-accrédité

DOSE APPLIQUEE **

(**) La durée du test est adaptée en fonction du rayonnement mesuré.

[x] **80h à 6 mW/cm²**

RÉSULTATS ET OBSERVATIONS

Pas d'altération visible.

CORROSION BROUILLARD SALIN

- Méthode	MON-E.101 selon ISO 9227
- Equipement	Chambre de pulvérisation Telectric TK 125B
- Accréditation	Test accrédité selon ISO 17025 (STS 535)

PIECE TESTEE

1 tête de montre Emergency E76325

TESTS / PARAMÈTRES

Pulvérisation	:	15 min / h
Température	:	35 ± 2 °C
Humidité relative	:	90 à 100 %

DUREE DU TEST

4 CYCLES DE 2 HEURES

RÉSULTATS ET OBSERVATIONS

Pas d'altération visible

CORROSION CHALEUR HUMIDITE

- Méthode	MON-E.105 Selon EN 60068-2-67
- Equipement	Enceinte climatique Vötsch VTRK 150
- Accréditation	Test accrédité selon ISO 17025 (STS 535)

PIECE TESTEE

1 tête de montre Emergency E76325

TESTS / PARAMÈTRES

Température	:	40 °C ± 1 °C
Humidité relative	:	90 % ± 5 %

DUREE DU TEST

7 JOURS

RÉSULTATS ET OBSERVATIONS

Après 1 cycle BS+CH
1 tête de montre : Pas d'altération visible.

Après 2 cycles BS+CH :
1 tête de montre : Pas d'altération visible.

Après 3 cycles BS+CH :
1 tête de montre : Pas d'altération visible.

Après 4 cycles BS+CH :
1 tête de montre : Pas d'altération visible.

Product Service

BREITLING
1884

OLT – Emergency

OLT measurement based on RTCM Standard 11010.2 (4.4.3)

According to RTCM standards, the following values are assumed

- **Useful life.** 5 years
- **Expiration date.** 3 years
- **Storage duration.** According to Breitling standards and procedures, the storage duration of the battery is no more than 1 year.
- Therefore, the **battery replacement period** is 2 years.

Average current Measurements Results at ambient temperature

Stand-by..... 0.0089mA
Self-test..... 442.63 mA (measurement interval 2.4 sec.)
Emission 25.79mA

Assumptions / Supplied Data

Breitling has demonstrated that the irreversible capacity loss after 2 years is 7%. As it has been also demonstrated that the rate of the irreversible capacity loss is decreasing with the time, it is a worst estimation to assume a value of 14% (2x7%) for 4 years.

Useful life..... 5 years (4 years useful life + 1 year storage)
Battery capacity..... 1.15 Ah
Irreversible losses in storage 1 year 3.5%
Irreversible losses stand-by mode 4 years 14%
Reversible losses during TBRC (2 months)..... 1.11%
Current drain of protection circuit (2 months) 17 mAh

Battery Preconditioning / Discharge Time Calculations

	Losses [%]	Losses [mAh]	Calculation
Battery irreversible capacity loss over 4 years	14	161	1150*.14
Battery irreversible capacity loss 1 year	3.5	40.25	1150*.035

P.O. BOX 1132 · 2540 GRENCHEN · SWITZERLAND · TEL +41-32 654 54 54 · FAX +41-32 654 54 08

2

storage			
Battery self-drain during 2 months	1.11	12.77	1150*.0111
Standby drain during 2 months		12.81	0.0089*24*60
Self-test		0.29	442.63*2.4/3600
Current drain, battery protection circuit		17	2 months
Total losses		244.12	

Battery Preconditioning / Discharge Time = Worst case drain / Operational current
= 244.12 / 25.79
= 9.46 hours

TAC Report Nr. 717-1

TAC Number	717	**TAC Date**	18-APR-2014	**TAC Rev. date**	
Beacon Model Name	EMERGENCY				
Additionnal Names	---				
Manufacturer	Breitling SA				
Tx Frequencies	406.040 MHz				
In Production	in production			**Class**	2
Type	PLB			**Tested Life (hours)**	18 hours
Battery	Lithium-Ion LIRB, Li-Ion NMC/Si, PROLLION INP63438 rechargeable battery, manufacturer: Prollion, France				
	Battery Legend: Battery cell manufacturer, Cell chemistry, Cell model, No. of cells, Cell size.				
Protocols tested	U - User.				
Self Test	yes	**Self Test RF**	yes	**Self Test RF (Short/Long)**	short
Self Test Format Flag	short			**Self Test Consistent with 15 Hex ID**	yes
Homer Freq	121.5 MHz			**Homer Duty Cycle**	33%
Homer Power	15 dBm				
Strobe Light	no	**Strobe Brightness**	---	**Strobe Duty Cycle**	---
Nav Device	No	**Nav Device Model**	---		
Separable Antenna	no	**Antenna Model**	---		
Additionnal functions	battery charger				
General comments	EMERGENCY is a wrist-worn 406/121.5 MHz emergency PLB which shares casing with a Breitling analog-digital chronograph. The chronograph and the emergency beacon are fully independent. 121.5 MHz homer operates only at temperatures above 0°C, homer is automatically disabled at temperatures below 0°C. Designed for operation only above ground. Not designed to operate while in water or when the watch is still worn on the wrist. The Li-Ion rechargeable battery shall be fully charged, the battery recharging shall be performed at regular, not exceeding 2 months intervals. Minimum duration of operation is 18 hrs. Approved for message encoding with the User protocol variant for PLBs with Serial Number. Designated for use of qualified and properly instructed customers.				
TAC rev history	---				

1 / 1

Product Service

BREITLING
1884

BREITLING EMERGENCY

Waiver Request RTCM STANDARD 11010.2

Product : Breitling Emergency PLB

The Breitling Emergency PLB is worn on the wrist. So it is permanently accessible to the user and thus guarantees that it can be activated in any circumstances.

Due to the miniaturisation of the components of the beacon (i.e. battery, electronic circuit, antenna), it has not been possible to satisfy to all the requirements of the RTCM Standard 11010.2.

The Breitling Emergency PLB got a letter of compatibility from Cospas-Sarsat and received the TAC Number 717.

The present document lists the different points where a waiver is requested by Breitling.

From our point of view, the two main points where the Breitling Emergency PLB does not fulfil the RTCM requirements are the fact that the battery is a rechargeable Li-Ion battery, and that the 121.5 is disabled for temperature under 0°C.

Waiver request for the use of a "Rechargeable Li-Ion battery"

Cospas-Sarsat has introduced an "INTERIM PROCEDURE FOR TYPE APPROVAL OF 406 MHz BEACONS EQUIPPED WITH LI-ION RECHARGEABLE BATTERIES C/S IP (LIRB)".

Breitling has successfully passed the requirements of that procedure. We believe that that technology and its application in this specific product are reliable. Furthermore, each recharge of the battery with the dedicated charger concludes by a self-test which ensures the beacon is permanently operational.

Waiver request for the 121.5MHz cut off under 0°C

So as to guarantee the minimum operating lifetime of 18 hours if the battery is at its end of life and the temperature at -20°C it has been necessary to make a choice to save energy.

As the LEOSAR system allows a localization of the beacon by Doppler Effect, and the fact that the SAR teams are now often equipped with 406MHz homing devices,

P.O. BOX 1132 · 2540 GRENCHEN · SWITZERLAND · TEL +41-32 654 54 54 · FAX +41-32 654 54 08

2

Breitling has decided to save energy in cutting off the 121.5MHz emission if the internal temperature of the beacon is under 0°C.

P.O. BOX 1132 · 2540 GRENCHEN · SWITZERLAND · TEL +41-32 654 54 54 · FAX +41-32 654 54 04

3

Waiver request for the other points of the RTCM Standard 11010.2

15. 121.5 MHz AUXILARY RADIO-LOCATING DEVICE TRANSMITTER TEST (A.16)

The requirement is that 121.5MHz transmitter be continuous apart from up to 2 s for the 406 MHz burst plus the additional time required for the Morse "P" transmission.

Due to successful use of Eurocae recommendation (*) during live trials and actual rescue events (more than 20 people found with the first Breitling Emergency 121.5 only) a waiver is requested to transmit 121.5 homing signal 750ms every 2.25ms.

And, as already above mentioned, 121.5 is more and more replaced by 406 as homing signal.

(*) ELT spec from EUROCAE, ED-62A:2009 Clause 3.1.3.1 has a note that states: *"It has been shown that an ON period of 0.75 seconds followed by an OFF period of 1.5 seconds gives satisfactory results"*.

Sub clause	Statement	Comment
4.4.1	PLBs shall have, as a minimum, integral manual controls to operate the device in the following modes: **OFF** In the **OFF** mode, the PLB is deactivated. **ON** In the **ON** mode, the PLB is activated. **TEST** See paragraph 4.4.2.	Waiver request due to product design constraints regarding one time operation and switch off. OFF mode: After activation, in order to reduce the 406MHz and 121.5MHz transmission power the antennas must be cut or wrapped around the body of the EUT. On mode: Activated when extracting the antenna. The TEST function is only possible when the device is installed in the battery charger. An internal check is made (but no transmission) and the status of the check is indicated on LEDs on the charger.

4

Sub clause	Statement	Comment
4.4.2	A separate test switch or switch position is required for this test function. The test switch (or similar control) shall automatically return (e.g., spring-loaded switch) from the test position and shall not pass through the ON position.	Waiver request due to product design constraints regarding self-test function. The use of a separate charger which launches the self-test can be considered as a "separate test switch"
4.4.3	The PLB shall have its own primary (non-rechargeable) battery and shall not depend upon any external source of power for its operation when activated. The battery shall be an integral part of the equipment. Replacement of the battery, if user-replaceable, should be possible with relative ease, and any interface connections required shall be such as to prevent reversed polarity or incorrect installation. Provision shall be made to ensure watertight integrity upon replacement of the battery.	Waiver request due to product design regarding the use of the lithium rechargeable battery. Refer to the chapter "Waiver request for the use of a Rechargeable Li-Ion battery" at the beginning of the document.
4.4.3	The PLB manufacturer shall establish a useful life and an expiration date for batteries. The useful life is defined as the period of time after the date of battery manufacture that the battery will continue to meet the input power requirements of the PLB.	Waiver request due to product design regarding the use of the lithium rechargeable battery. Refer to the document "OLT measurement based on RTCM Standard 11010.2 (4.4.3)" which is enclosed in the Annex A of the TUV Report.
4.5.1	The PLB case shall be predominantly a highly-visible yellow/orange color.	Waiver request due to product design constraints regarding the outward appearance and the material of the device. As the beacon is permanently worn on the wrist, the need of a highly-visible color is less important as the user has not to search for the beacon in case of emergency.

P.O. BOX 1132 · 2540 GRENCHEN · SWITZERLAND · TEL +41-32 654 54 54 · FAX +41-32 654 54 04

Sub clause	Statement	Comment
4.5.2.2	All labelling essential to the safe and effective operation of the PLB shall be in high contrast to the background of the text or pictograph. Labelling and Pictograph instructions essential to the safe and effective operation of the PLB shall be sized such that they are readable by persons having 20/20 normal vision at a minimum viewing distance of 150 mm with illumination no greater than 0.3 lux8. Items a) through h) in 4.5.2.2.1 below and any other information required for the safe and effective operation of the PLB shall be visible on the PLB, or their location identified and accessible by a single simple action on the part of the operator (e.g. lifting or removing a protective cover over the control panel). Such information shall not be hidden by any permanent or semi-permanent accessory or ancillary devices normally attached to or installed on or around the body of the PLB. (A separate storage case from which the PLB can be easily removed with one hand for activation is not included in this requirement.)	Waiver request due to product design constraints regarding the applicability and suitability of all labelling requirements. The Emergency PLB is a personal beacon. All the buyers, who are also the users, will be instructed about the activation of the PLB. However, the activation process is very simple: Unscrew and pull the two antennas !
4.5.2.2.1	The outside of the PLB shall be marked indelibly and legibly with the following: a) Concise, unambiguous instructions for operating and testing of the PLB that shall be understandable by untrained personnel.	The three steps necessary to activate the beacon are engraved on the watch. All the buyers of the Breitling Emergency PLB will be instructed about the activation of the PLB. A USB key with an explanation movie is also delivered with the beacon.
4.5.2.2.1	c) The warning, or equivalent: NOTICE TO THE PUBLIC DO NOT MOVE IF FOUND REPORT POSITION TO AUTHORITIES	Waiver request due to product design constraints regarding the applicability. There is not enough space to engrave such text.

P.O. BOX 1132 · 2540 GRENCHEN · SWITZERLAND · TEL +41-32 654 54 54 · FAX +41-32 654 54 04

6

Sub clause	Statement	Comment
4.5.2.2.1	f) Instructions to register the PLB with the appropriate authority and the contact details of the authority.	Waiver request due to product design constraints regarding the applicability and suitability. Customers will be instructed by a trained vendor and make aware of necessity to register. A separate sheet dedicated to the registration process is enclosed with the beacon. See at the end of this document.
4.5.2.2.1	g) Space for any required registration sticker	Waiver request due to product design constraints regarding the applicability and suitability of all labelling requirements. There is not enough space for a decal.
4.5.2.2.2	e) If there exists a condition or operating circumstance which has been identified by the manufacturer or regulating authorities that could substantially affect the alerting or self-locating performance of the PLB, then information appropriate to prevent this occurring shall appear in a conspicuous location appropriate to the prevention or remediation by the operator of said condition or operating circumstance (e.g. the necessity to orient the antenna vertically upward if orientation of the antenna is adjustable).	There is no possibility to permanently attach special instructions to the PLB. There is a mention of two important points in the manual. *1) Once activated, the beacon will broadcast at least during 18 hours For special situations when the beacon is at temperatures below 0°C/32°F, the 121.5 MHz signal is automatically switched off in order to guarantee the broadcast duration for the 406 MHz signal* *2) The two antenna sections must be kept vertical, with the short section IN ALL CIRCUMSTANCES pointing upwards and the long section pointing downwards at a sufficient height to avoid the antenna touching ground (the far end of the long section must be 5-10 cm/2-4 in off the ground). The Emergency is not designed to be worn on the wrist when the beacon is activated*

P.O. BOX 1132 · 2540 GRENCHEN · SWITZERLAND · TEL +41-32 654 54 54 · FAX +41-32 654 54 04

Product Service

7

Sub clause	Statement	Comment
4.5.2.2.2	f) The phone number(s) to be used to report inadvertent activation negating the need for the distress alert.	Waiver request due to product design constraints regarding the applicability and suitability of all labelling requirements. A separate sheet enclosed with the beacon mentions the phone number for USA. See at the end of this document.

Grenchen, July 4, 2014

BREITLING SA

Jean-Paul Girardin
Vice-President

P.O. BOX 1132 · 2540 GRENCHEN · SWITZERLAND · TEL +41-32 654 54 54 · FAX +41-32 654 54 04

8

Annex 1: Registering instruction enclosed in the beacon package for US beacons

IMPORTANT: the Emergency must be registered at the time of purchase in accordance with the national procedures in force. The beacon must be registered in the owner's country of residence.

PLB registration in the U.S.A.

Cospas-Sarsat TAC Number for the Emergency: 717

1) Online registration directly on: www.beaconregistration.noaa.gov

2) Registration by filling in the enclosed paper form, and then sending it to the competent authority as follows:
   - By post:
     NOAA/SARSAT
     NSOF, E/SP3
     4231 Suitland Road
     Suitland, MD 20746
   - By fax: 301-817-4565

Further information can be found on www.sarsat.noaa.gov
Or call: 1-888-212-SAVE (7283) or 301-817-4515

N.B.: In the event of a false alert, call the US Air Force RCC at 1-800-851-3051

P.O. BOX 1132 · 2540 GRENCHEN · SWITZERLAND · TEL +41-32 654 54 54 · FAX +41-32 654 54 04