Report on the Testing of the

ACR Electronics Inc.
PLB-425 Personal Locating Beacon

In accordance with RTCM 11010.3

Prepared for: ACR Electronics Inc.
5757 Ravenswood Road
Ft. Lauderdale
Florida

Product Service

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Date: March 2019
Document Number: 75943183-02 Issue: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Sarah Jones	11 March 2019	
Authorised Signatory	Gareth Stephens	06 March 2019	
Authorised Signatory	Simon Bennett	11 March 2019	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with the clauses tested to RTCM 11010.3

ACCREDITATION
Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation. Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	11 March 2019

Table 1

1.2 Introduction

Applicant	ACR Electronics Inc.
Manufacturer	ACR Electronics Inc.
Model Number(s)	PLB-425
Manufacturer Declared Variant*	PLB-400
Serial Number(s)	PLB-425, S/N: #10 (TSR20) PLB-425, S/N: #1 (TSR19) PLB-400, S/N: #9 (TSR22) PLB-425, S/N: #7 (TSR23) PLB-400, S/N: #8 (TSR24)
Hardware Version(s)	PLB-425: A3-06-3138- Rev T2 PLB-400: A3-06-3138-1 Rev T2
Software Version(s)	K3-01-0145 Rev C
Number of Samples Tested	5
Test Specification/Issue/Date	RTCM 11010.3
Order Number Date	45752-00 21-June-2018
Date of Receipt of EUT	17 September 2018
Start of Test	03 October 2018
Finish of Test	18 January 2019
Name of Engineer(s)	Martin Hardy Colin Hedley Theano Papakosta Nigel Grigsby Lewis Bull Nigel Williams Adrian Uminski Matt Russell Francis Kane Nic Forsyth

*See Annex A for Manufacturer document detailing the declared variant(s).

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with RTCM 11010.3, A.2 (Compulsory Sequence of tests) is shown below.

Section	RTCM 11010.3 Reference	Test Description	EUT Sample Ref and Modification State (MS)		Result	Comments
2.1	A.3	Dry Heat*	PLB-425 S/N#10 (TSR20) PLB-425 S/N#1 (TSR19) PLB-400 S/N #9 (TSR22)	MS1 MS1 MS1	Satisfactory	
2.2	A.4	Damp Heat*	PLB-425 S/N#10 (TSR20) PLB-425 S/N#1 (TSR19) PLB-400 S/N #9 (TSR22)	MS1 MS1 MS1	Satisfactory	
2.3	A.5	Low Temperature*	PLB-425 S/N#10 (TSR20) PLB-425 S/N#1 (TSR19) PLB-400 S/N #9 (TSR22)	MS1 MS1 MS1	Satisfactory	
2.4	A.6	Vibration*	PLB-425 S/N#1 (TSR19) PLB-400 S/N #9 (TSR22)	MS1 MS1	Satisfactory	
2.5	A.7	Bump*	PLB-425 S/N#1 (TSR19) PLB-400 S/N #9 (TSR22)	MS1 MS1	Satisfactory	
2.6	A.8	Corrosion	-		Not tested	Waiver (see Annex A)
2.7	A.9	Drop*	PLB-425 S/N#1 (TSR19) PLB-400 S/N #9 (TSR22)	MS2 MS2	Satisfactory	
2.8	A.10	Thermal Shock*	PLB-425 S/N#1 (TSR19) PLB-400 S/N #9 (TSR22)	MS2 MS2	Satisfactory	
2.9	A.11	Immersion*	PLB-425 S/N#1 (TSR19) PLB-400 S/N #9 (TSR22)	MS2 MS2	Satisfactory	
2.10	A.12	Spurious Emissions*	PLB-425 S/N#10 (TSR20) PLB-425 S/N#10 (TSR20)	MS3 MS2	Satisfactory	121 Emission mask tested in Modification State 3. All other measurements made in Modification State 2
2.11	A.13	Operational Life and Self Test*	PLB-425 S/N#10 (TSR20)	MS3	Pass	
2.12	A.14	Cospas-Sarsat Type Approval*	See TUV SUD document 75943114 Report 01 (See also Amex B)			

Table 2

*Items marked thus (*) denote test clauses which fall under the compulsory sequence of tests (RTCM 11010.3 clause A.2).

A brief summary of the tests carried out in accordance with RTCM 11010.3, A.2 (Additional tests) is shown below.

2.13	A.15	Buoyancy Test	PLB-425 S/N#1 (TSR19) PLB-400 S/N #9 (TSR22)	Satisfactory	
2.14	A.16	121.5 MHz Homing Signal Tests	PLB-425 S/N#10 (TSR20) PLB-425 S/N#7 (TSR23)	Satisfactory	
2.15	A.17	Solar Radiation	-	Not tested	Waiver – See Annex A
2.16	A.18	Oil Resistance	-	Not tested	Waiver – See Annex A
2.17	A.19	Compass Safe Distance	PLB-425 S/N#7 (TSR23)	-	See section 2.17
2.18	A.20	Miscellaneous	PLB-425 S/N#7 (TSR23)	-	See section 2.18
2.19	A.20.9	Altitude	PLB-425 S/N#1 (TSR19) PLB-400 S/N #9 (TSR22)	Satisfactory	
2.20	A.21	Internal Navigation Device Tests (GPS Scenarios)	PLB-425 S/N#8 (TSR24)	Pass	

Table 3

1.4 Application Form

G.1 Beacon Manufacturer and Beacon Model

Beacon Manufacturer	ACR Electronics, Inc.
Beacon Model	PLB-400 and PLB-425
Other Model Names	For PLB-400: ResQLink For PLB-425: ResQLink View

Beacon Type and Operational Configurations

Beacon Type	**Beacon used while:**	**Tick where appropriate**
EPIRB Float Free	Floating in water or on deck or in a safety raft	☐
EPIRB Non-Float Free (automatic and manual activation)	Floating in water or on deck or in a safety raft	☐
EPIRB Non-Float Free (manual activation only)	Floating in water or on deck or in a safety raft	☐
EPIRB Float Free with VDR	Floating in water or on deck or in a safety raft	☐
PLB	On ground and above ground	☒
	On ground and above ground and floating in water	☐
ELT Survival	On ground and above ground	☐
	On ground and above ground and floating in water	☐
ELT Auto Fixed	Fixed ELT with aircraft external antenna	☐
ELT (DT)	Distress tracking ELT with aircraft external antenna	☐
ELT Auto Portable	In aircraft with an external antenna	☐
	On ground, above ground, or in a safety raft with an integrated antenna	☐
ELT Auto Deployable	Deployable ELT with attached antenna	☐
Other (specify)		☐

Beacon Characteristics

Characteristic	Specification
Operating frequency (406 MHz operating channel = 406.xxx)	406.031 MHz
Operating temperature range (T_{min}, T_{max})	Tmin = -20°C Tmax = +55°C
Temperature, at which minimum duration of continuous operation is expected (Submit C/S T.007 Section 5, part s, if applicable)	-20°C
Operating lifetime	24 hours
Beacon power supply type (internal non -rechargeable, internal re-chargeable, external, combined, other)	Internal non -rechargeable
External power supply parameters (AC/DC and nominal voltage)	N/A
Is external power supply needed to energise the beacon or its ancillary devices in any of operation modes (N/A or Yes of No)	No
Battery cell chemistry	$LiMnO_2$
Battery cell model name, size and number of cells in a battery pack, and details of the battery pack electrical configuration	CR123A, 2/3A, 3 cells in series
Battery cell manufacturer	Panasonic
Battery pack manufacturer and part number	ACR Electronics, Inc. A3-06-2703
Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon) (years)	1.0 years
Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon) (years)	5 years
Oscillator type (e.g. OCXO, MCXO, TCXO)	TCXO
Oscillator manufacturer	RAKON (Made in New Zealand)
Oscillator part name / part number	RAKON P/N E6907LF, ACR P/N A1-11-1169
Oscillator satisfies long-term frequency stability requirements (Yes or No)	Yes
Antenna type: Integral or Other (e.g. External, Detachable – specify type)	Integral
Antenna manufacturer	ACR Electronics Inc.
Antenna part name and part number (OEM, if applicable, and beacon manufacturer's)	A3-06-3136
Antenna cable assembly min / max RF- loses at 406 MHz, if applicable	N/A

Characteristic	Specification
Navigation device type (Internal, External or None)	Internal
Features in beacon that prevent degradation to 406 MHz signal or beacon lifetime resulting from a failure of navigation device or failure to acquire position data (Yes, No, or N/A)	Yes
Features in beacon that ensures erroneous position data is not encoded into the beacon message (Yes, No or N/A)	Yes
Navigation device capable of supporting global coverage (Yes, No or N/A)	Yes
Encoded position update capability (Yes, No, N/A)	Yes
Encoded position update interval value (range) (min)	>5 min, <60 min
For Internal Navigation Devices	
- Geodetic reference system (WGS 84 or GTRF)	WGS 84
- GNSS receiver cold start forced at every beacon activation (Yes or No)	Yes
- Navigation device manufacturer	uBlox
- Navigation device model name and part Number	SAM-M8Q GPS module, P/N SAM-M8Q
- Internal navigation device antenna type (integrated, internal, external, passive / active), manufacturer and model	Integral Ceramic to SAM-M8Q
- GNSS system supported (e.g. GPS, GLONASS, Galileo)	GPS
For External Navigation Devices	
- Data protocol for GNSS receiver to beacon interface	N/A
- Physical interface for beacon to navigation device	N/A
- Electrical interface for beacon to navigation device	N/A
- Part number of the external navigation interface device (if applicable)	N/A
- Navigation device model and manufacturer (if beacon designed to use specific devices)	N/A

Self-Test Mode Characteristics	Self-Test Mode	Optional GNSS Self-Test Mode
- Activated by a separate switch / separate switch positions (Yes / No)	Yes	Yes
- Self-test / GNSS self-test mode switch automatically returns to normal position when released (Yes or No)	Yes	Yes
- Self-test / GNSS activation can cause an operational mode transmission (Yes or No)	No	No
- Results in transmission of a single self-test burst only, regardless of how long the self-test activation mechanism is applied (Yes or No)	Yes	Yes
- Results of self-test / GNSS self-test indicated by (provide details, e.g Pass / Fail indicator l, strobe light, etc.)	Yes, Red Green LEDs. Additionally displayed on PLB-425	Yes, Red Green LEDs. Additionally displayed on PLB-425
- The content of the encoded position data fields of the self-test message has default values	Yes	N/A
- Performs an internal check and indicates that RF power emitted at 406 MHz and 121.5 MHz, if beacon includes a 121.5 MHz homer (Yes or No)	Yes	Yes
- Self-test results in transmission of a signal other than at 406 MHz (Yes & details or No)	Yes, 121.5 MHz	No
- Self-test can be activated directly at beacon (Yes or No)	Yes	Yes
- List of Items checked by self-test	Battery, 406 Pwr/PLL lock, 121 Pwr, Non-volatile memory Battery Witness Battery Voltage GPS Com Check	Battery, GPS ACQ, 406 Burst
- Self-test / GNSS self-test 406 MHz burst duration (440 or 520 ms)	440 ms	520 ms
- Self-test message length format flag in bit 25,bit (“0” or “1”)	1	1
- Maximum duration of a self-test mode, sec	13 Secs	110 Secs
- Maximum recommended number of self-tests / GNSS self-tests during battery pack replacement period (as applicable)	60	20
- Distinct indication of self-test start (Yes or No)	Yes	Yes
- Indication of self-test results (Yes or No)	Yes	Yes
- Distinct indication of insufficient battery capacity (Yes or No)	Yes	Yes
- Automatic termination of self-test mode immediately after completion of the self-test cycle (Yes or No)	Yes	Yes
- GNSS Self-test results in transmission of a single burst, irrespectively of the test result (Yes or No)	N/A	Yes
- Self-test / GNSS self-test can be activated from beacon remote activation points (Yes & details or No)	No	No
- List all methods of Self-test mode and GNSS Self-test modes activation. Provide details on a separate sheet to describe	Press Self-Test button 2 Sec to 5 Sec	Press Self-Test button for 5 Sec to 10 Sec

Characteristic	Specification	
Message Coding Protocols:	(x) Tick the boxes below against the intended protocol options	
User Protocol (tick where appropriate)	☐	Maritime with MMSI
	☐	Maritime with Radio Call Sign
	☐	EPIRB Float Free with Serial Number
	☐	EPIRB Non Float Free with Serial Number
	☐	Radio Call Sign
	☐	Aviation
	☐	ELT with Serial Number
	☐	ELT with Aircraft Operator and Serial Number
	☐	ELT with Aircraft 24-bit Address
	☐	PLB with Serial Number
	☐	National (Short Message Format)
	☐	National (Long Message Format)
Standard Location Protocol (tick where appropriate)	☒	EPIRB with MMSI
	☒	EPIRB with Serial Number
	☒	ELT with 24-bit Address
	☒	ELT with Aircraft Operator Designator
	☒	ELT with Serial Number
	☒	PLB with Serial Number
National Location Protocol (tick where appropriate)	☒	National Location: EPIRB
	☒	National Location: ELT
	☒	National Location: PLB
ELT (DT) Location Protocol (tick where appropriate)	☐	ELT with Serial Number
	☐	ELT with Aircraft Operator and Serial Number
	☐	ELT with Aircraft 24-bit Address
RLS Location Protocol (tick where appropriate)	☐	EPIRB
	☐	ELT
	☐	PLB
User Location Protocol (tick where appropriate)	☐	Maritime with MMSI
	☐	Maritime with Radio Call Sign
	☐	EPIRB Float Free with Serial Number
	☐	EPIRB Non Float Free with Serial Number
	☐	Radio Call Sign
	☐	Aviation
	☐	ELT with Serial Number
	☐	ELT with Aircraft Operator and Serial Number
	☐	ELT with Aircraft 24-bit Address
	☐	PLB with Serial Number

Characteristic	Specification
Beacon includes a homer transmitter(s) (Yes or No)	Yes
-Homer transmitter(s) frequency (Yes or No)	121.5 MHz
- 121.5 MHz transmit power (dBm)	17 dBm
- 243 MHz transmit power (dBm)	N/A
- AIS transmit power (dBm)	N/A
- Other	N/A
-Homer transmitter(s) duty cycle (%)	95%
-Duty cycle of homer swept tone (%)	33%
Beacon includes a high intensity flashing light (e.g. Strobe) (Yes or No)	Yes
-light intensity (cd)	36.75 cd white light
-flash rate (flashes per minute)	6 per minute
Beacon transmission repetition period satisfies C/S T.001 requirement that two beacon's repetition periods are not synchronised closer than a few seconds over 5 minute period, and the time intervals between transmissions are randomly distributed on the interval 47.5 to 52.5 seconds (Yes or No)	Yes
Other ancillary devices (e.g. voice transceiver, remote control, external audio and light indicators, external activation device). List details on a separate sheet if insufficient space to describe	N/A
Beacon includes automatic activation mechanism (Yes or No). Specify type of automatic beacon activation mechanism	No
Beacon includes a voice-transceiver (Yes or No)	No
-Provide prevention against continuous operation of voice transmitter (Yes or No), and if Yes specify:	N/A
-maximum continuous voice transmission duration (limit), minutes	N/A
-Manufacturer-specified total duration of voice-transmitter operation during the declared rated lifetime ("On time"), (hrs)	N/A
Beacon includes features and functions not listed above, related or non-related to 406 MHz (Yes or No) List features and use a separate sheet if insufficient space	No

Characteristic	Specification
Beacon model hardware part number (P/N) and version	PLB-400: A3-06-3138-1 Rev T2 PLB-425: A3-06-3138- Rev T2
Beacon model software/firmware P/N, version, date of issue / releases	K3-01-0145 Rev C
Beacon model printed circuit board P/N and version	A3-07-0469 Rev C
Known non-compliances with C/S T.001 requirements (Yes or No) If Yes, provide details (or use a separate sheet if insufficient space)	No
Beacon Manufacturer Point of Contact (POC) for this Type Approval application:	Name and Job Title: Dan Stankovic, Director of Certification and Test Phone: 954-862-2175 E-mail: Dan.stankovic@acrartex.com

Dated: 05/29/2018..... Signed:..... .....
Dan Stankovic, Director of Certification and Test

1.5 Product Information

1.5.1 Technical Description

The PLB-425 is a Personal Locator Beacon (PLB) device with built-in 406 Cospas-Sarsat transmitter and 121.5 MHz Homer. It is used to assist in the locating and recovery of people that are in imminent danger.

1.6 Deviations from the Standard

Clause A.2: Compulsory sequence of tests: Cospas-Sarsat procedure (Clause A.11) performed prior to other tests. Limited Cospas Sarsat tests at ambient temperature only carried after the conclusion of other tests. (see Annex B).

Clause A.10: Thermal Shock – The test temperature exceeds the requirements of RTCM 11010.3. The test temperature was selected to meet the requirements of ETSI 302 152-1.

Clause A.12: Spurious Emissions – Measurements frequency ranges adjusted to meet the requirements of ETSI 302 152-1. These adjustments exceed the requirements of RTCM 11010.3.

1.7 EUT Modification Record

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

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by manufacturer.	N/A	N/A
1	Update to correct Frame Sync for GNSS ST (FS incorrect when EUT transmits without GPS data for GNSS ST).	Manufacturer	25/09/2018
2	Software fix to correct GPS encoded position update interval.	Manufacturer	16/10/2018
3	121.5 MHz conducted output port repair (TSR#20 only)	Manufacturer	10/12/2018

Table 4

1.8 Test Location

TÜV SÜD Product Service conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Dry Heat	Colin Hedley Martin Hardy	UKAS
Damp Heat	Colin Hedley Martin Hardy	UKAS
Low Temperature	Colin Hedley Martin Hardy	UKAS
Vibration	Colin Hedley Martin Hardy	UKAS
Bump	Nigel Williams Martin Hardy	UKAS
Drop	Lewis Bull Martin Hardy	UKAS
Thermal Shock	Colin Hedley Martin Hardy	UKAS
Immersion	Colin Hedley Martin Hardy	UKAS
Spurious Emissions	Martin Hardy Matt Russell Adrian Uminski	UKAS
Operational Life and Self Test	Martin Hardy Adrian Uminski	UKAS
121 MHz Homing Signal Test (RF conducted tests only)	Matt Russell Adrian Uminski	UKAS
Compass Safe Distance	Francis Kane	UKAS
Miscellaneous	Nigel Grigsby	Non UKAS
Altitude	Colin Hedley	UKAS
Internal Navigation Device Tests	Theano Papakosta	UKAS

Table 5

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

TÜV SÜD Product Service conducted the following tests at EMC Hursley by a TUV SUD Product Service Engineer.

Test Name	Name of Engineer(s)	Accreditation
Peak Equivalent Isotropic Radiated Power	Theano Papakosta Nic Forsyth	None

Table 6

Office Address:

Trafalgar House
Trafalgar Cl
Chandler's Ford
Eastleigh
SO53 4BW
United Kingdom

2 Test Details

2.1 Dry Heat

2.1.1 Specification Reference

RTCM 11010.3, Clause A.3

2.1.2 Equipment Under Test and Modification State

PLB-425, S/N: #10 (TSR20) - Modification State 1
PLB-425, S/N: #1 (TSR19) - Modification State 1
PLB-400, S/N: #9 (TSR22) - Modification State 1

2.1.3 Date of Test

03 October to 04 October 2018 (Dry Heat Storage)
04 October to 05 October 2018 (Dry Heat Functional)

2.1.4 Test Method

Storage Test

The EUT's were placed in a climatic chamber where the temperature was increased from laboratory ambient temperature to +70°C. After 16 hours, the temperature was returned to ambient conditions. The EUTs were subjected to a performance check at the end of the test.

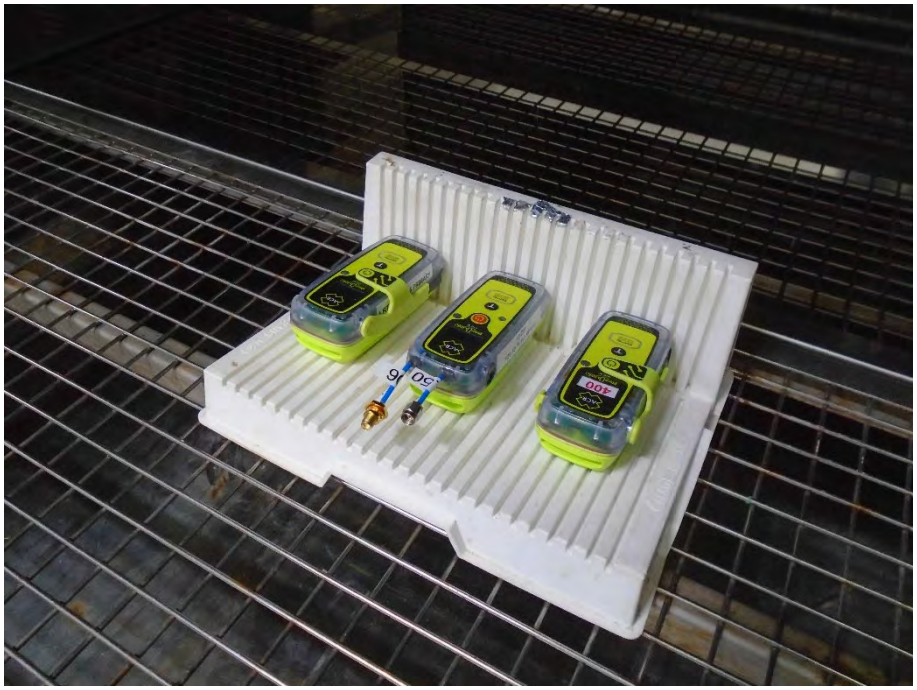
Functional Test

The EUTs were switched on, and placed in a climatic chamber where the temperature was increased from ambient temperature to +55°C. The conditions remained for a period of 10 to 16 hours. Towards the end of this period the EUTs were subjected to a performance check and performance test. At the end of the test, the temperature was returned to laboratory ambient conditions.

At the conclusion of all testing, a satisfactory Performance Check was carried on both EUTs.

Test Setup – EUTs installed in climatic chamber

Test Setup – Close up of EUTs



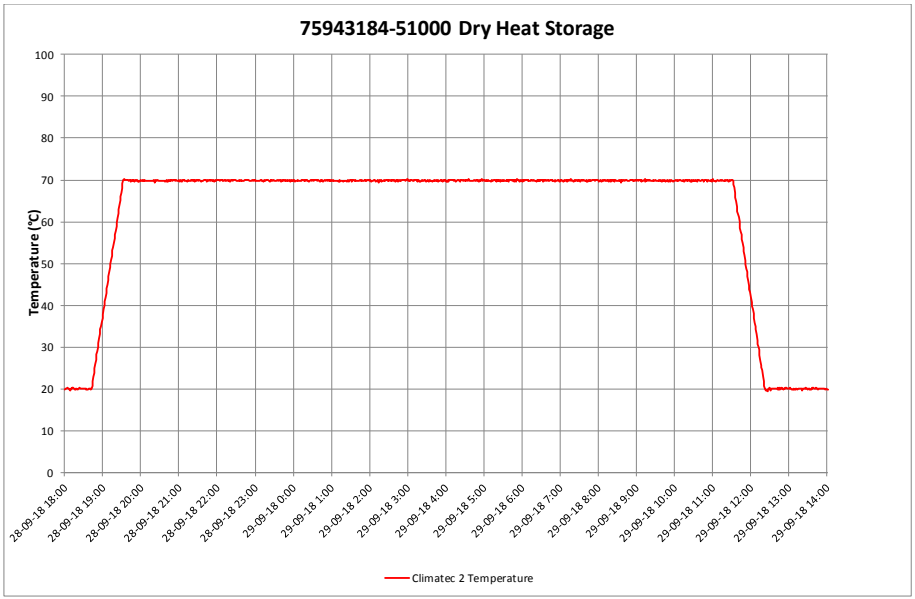
2.1.5 Environmental Conditions

Ambient Temperature	21.5 - 22.5 °C
Relative Humidity	48.4 – 55.9 %

2.1.6 Test Results

Storage Test

Temperature Plot



Performance Check

PLB-425, S/N: #10 (TSR20)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.030974
121 MHz Presence	P

Table 7

PLB-425, S/N: #1 (TSR19)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031027
121 MHz Presence	P

Table 8

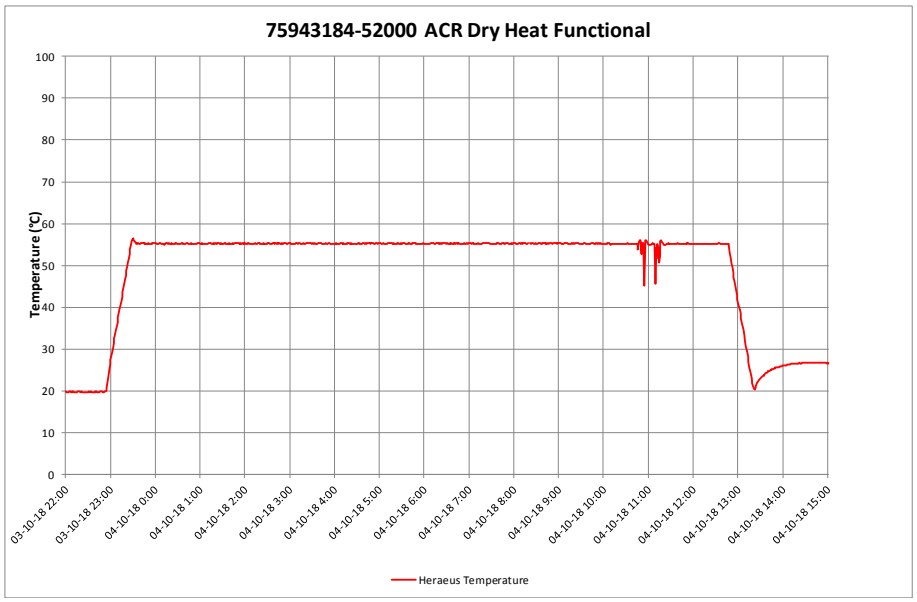
PLB-400, S/N: #9 (TSR22)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031014
121 MHz Presence	P

Table 9

Functional Test

Temperature Plot



Performance Check

PLB-425, S/N: #10 (TSR20)

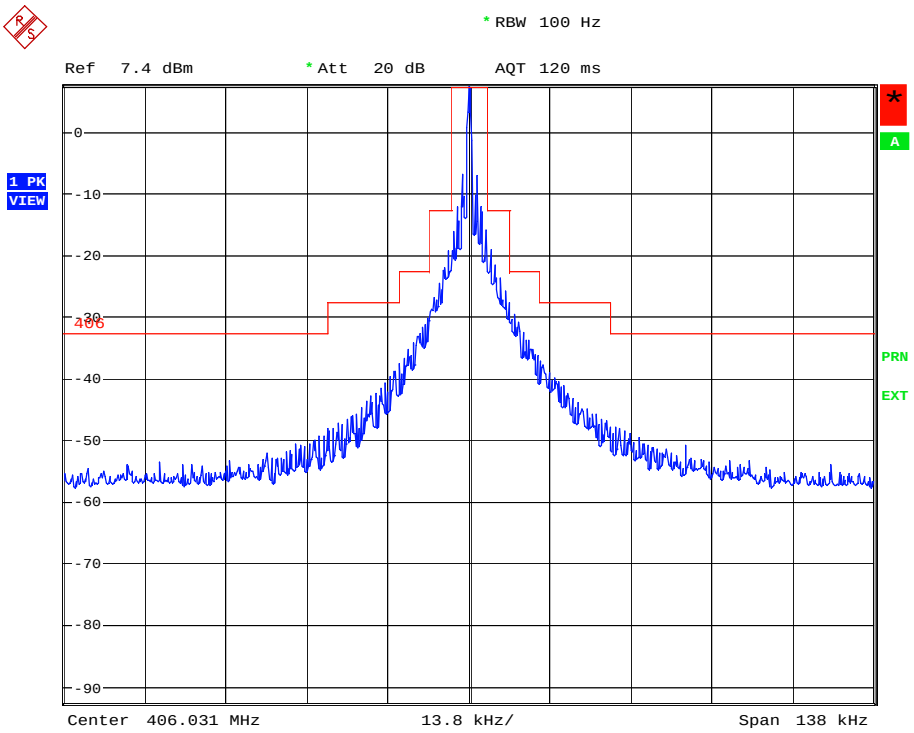
Parameter	Result (Max / Min)
Output Power	36.72 / 36.67
Digital Message	FFFE2F8C9EF9C06332E02BC44E379C8044FD*
Bit Rate	400.03 / 400.00
Modulation: Rise Time (us)	178.3 / 164.4
Modulation: Fall Time (us)	197.6 / 183.6
Positive Deviation (rad)	1.2195** / 1.1056
Negative Deviation (rad)	-1.2146** / -1.0944
Nominal Frequency (MHz)	406.0309925 / 406.0309925
Short-term Stability (/100 ms)	10.477E-11 / 88.463E-12
Medium-term Stability – Slope (/minute)	30.145E-12 / 22.686E-12
Medium-term Stability – Residual	83.598E-12 / 56.426E-12
Spurious Emissions	See plot below

Table 10

* During the test, the EUT detected live navigation data and encoded 50°52'8" N 1°14'44" W into the transmitted message. The accuracy of the encoded position was within the limits stated in Cospas Sarsat T.007.

** Measurement outside the limits stated in Cospas Sarsat T.007. However, the result is with the Test Facility Accuracy allowance stated in Cospas Sarsat T.008.

Spurious Emissions



PLB-425, S/N: #1 (TSR19)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C06332E02BC44E379C8044FD*
406 MHz Frequency	406.031006
121 MHz Presence	P

Table 11

* During the test, the EUT detected live navigation data and encoded 50°52'8" N 1°14'44" W into the transmitted message. The accuracy of the encoded position was within the limits stated in Cospas Sarsat T.007.

PLB-400, S/N: #9 (TSR22)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C06332E02BC44E379C8044FD*
406 MHz Frequency	406.030992
121 MHz Presence	P

Table 12

* During the test, the EUT detected live navigation data and encoded 50°52'8" N 1°14'44" W into the transmitted message. The accuracy of the encoded position was within the limits stated in Cospas Sarsat T.007.

2.1.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	27-Feb-2019
Beacon RF Unit	TUV SUD Product Service	N/A	97	-	TU
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	18-Dec-2018
Attenuator: 10dB/20W	Narda	766-10	480	12	18-Dec-2018
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	23-Apr-2019
Spectrum Analyser	Agilent Technologies	E7405A	1410	12	13-Sep-2019
Chamber	Heraeus	HC 4033	2174	12	20-Jun-2019
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	20-Dec-2018
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	16-Nov-2018
ScopeCorder	Yokogawa	DL750 701210	3254	12	10-Nov-2018
Bandpass Filter (1MHz)	KR Electronics	3219-SMA	4600	12	3-Sep-2019
Cable (18GHz)	Rosenberger	LU7-036-1000	5027	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5029	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-2000	5035	-	O/P Mon

Table 13

2.2 Damp Heat

2.2.1 Specification Reference

RTCM 11010.3, Clause A.4

2.2.2 Equipment Under Test and Modification State

PLB-425, S/N: #10 (TSR20) - Modification State 1
PLB-425, S/N: #1 (TSR19) - Modification State 1
PLB-400, S/N: #9 (TSR22) - Modification State 1

2.2.3 Date of Test

04 and 05 October 2018

2.2.4 Test Method

The EUT's (powered off) were placed in a climatic chamber where the conditions were increased from laboratory ambient temperature to +40°C and 93% relative humidity. After 10.5 hours (see temperature plot below), the EUTs were powered on and kept operation for a further 2 hour period. During this time, they were subjected to a performance check. After the performance check, the chamber conditions were returned to laboratory ambient.

Test Setup

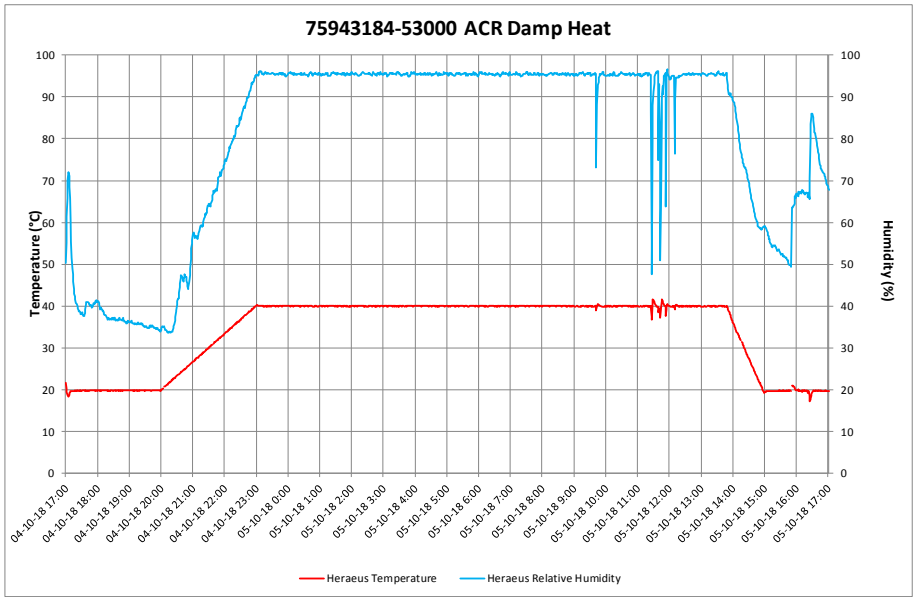
See section 2.1.4 for test setup photo.

2.2.5 Environmental Conditions

Ambient Temperature	21.7°C
Relative Humidity	54.7 %

2.2.6 Test Results

Temperature Plot



Note: the changes in relative humidity can be attributed to the environmental doors of the climatic chamber being opened in order to complete the performance checks.

Performance Check

PLB-425, S/N: #10 (TSR20)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C06332E02BC44E379C8044FD*
406 MHz Frequency	406.0309674
121 MHz Presence	P

Table 14

* During the test, the EUT detected live navigation data and encoded 50°52'8" N 1°14'44" W into the transmitted message. The accuracy of the encoded position was within the limits stated in Cospas Sarsat T.007.

PLB-425, S/N: #1 (TSR19)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031008
121 MHz Presence	P

Table 15

PLB-400, S/N: #9 (TSR22)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.030994
121 MHz Presence	P

Table 16

2.2.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	27-Feb-2019
Spectrum Analyser	Agilent Technologies	E7405A	1410	12	13-Sep-2019
Chamber	Heraeus	HC 4033	2174	12	20-Jun-2019
30dB Attenuator	Narda	766-30	4783	12	19-Dec-2018
Cable (18GHz)	Rosenberger	LU7-036-1000	5027	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5029	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-2000	5035	-	O/P Mon

Table 17

2.3 Low Temperature

2.3.1 Specification Reference

RTCM 11010.3, Clause A.5

2.3.2 Equipment Under Test and Modification State

PLB-425, S/N: #10 (TSR20) - Modification State 1
PLB-425, S/N: #1 (TSR19) - Modification State 1
PLB-400, S/N: #9 (TSR22) - Modification State 1

2.3.3 Date of Test

07 and 08 October 2018 (Storage Test)
08 and 09 October 2018 (Functional Test)

2.3.4 Test Method

Storage Test

The EUT's were placed in a climatic chamber where the temperature was decreased from laboratory ambient temperature to -30°C. After 16 hours, the temperature was returned to ambient conditions. The EUTs were subjected to a performance check at the end of the test.

Functional Test

The EUTs whilst switched off, were placed in a climatic chamber where the temperature was decreased from ambient temperature to -20°C. After 10.5 hours (see temperature plot below), the EUTs were powered on and kept operational for a further 2 hour period. During this time, they were subjected to a performance test and check. At the conclusion of the tests, the chamber conditions were returned to laboratory ambient.

At the conclusion of all testing, a satisfactory Performance Check was carried on both EUTs.

Test Setup

See section 2.1.4 for test setup photo.

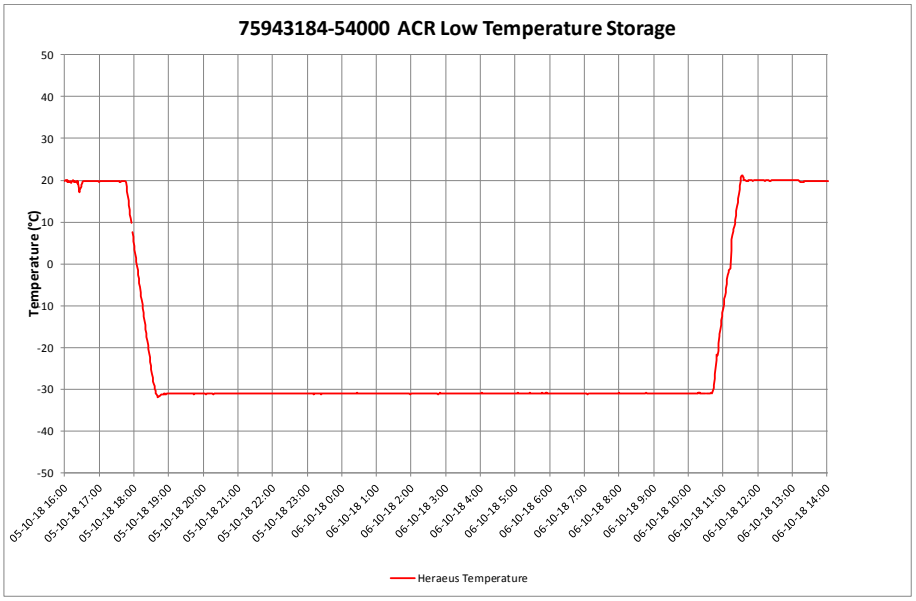
2.3.5 Environmental Conditions

Ambient Temperature	18.3 – 20.3 °C
Relative Humidity	49.3 – 49.8 %

2.3.6 Test Results

Storage Test

Temperature Plot



Performance Check

PLB-425, S/N: #10 (TSR20)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.0309707
121 MHz Presence	P

Table 18

PLB-425, S/N: #1 (TSR19)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031014
121 MHz Presence	P

Table 19

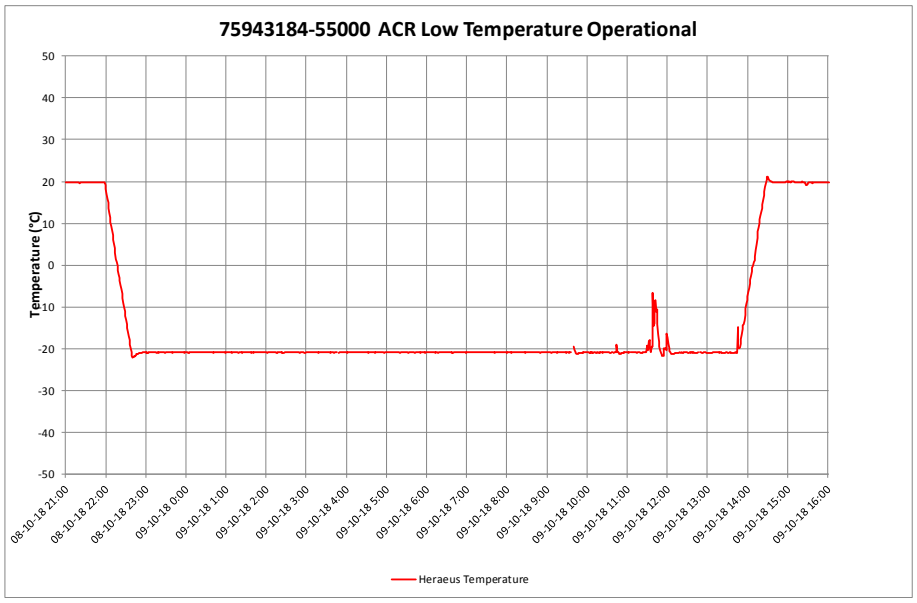
PLB-400, S/N: #9 (TSR22)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031005
121 MHz Presence	P

Table 20

Functional Test

Temperature Plot



Performance Check

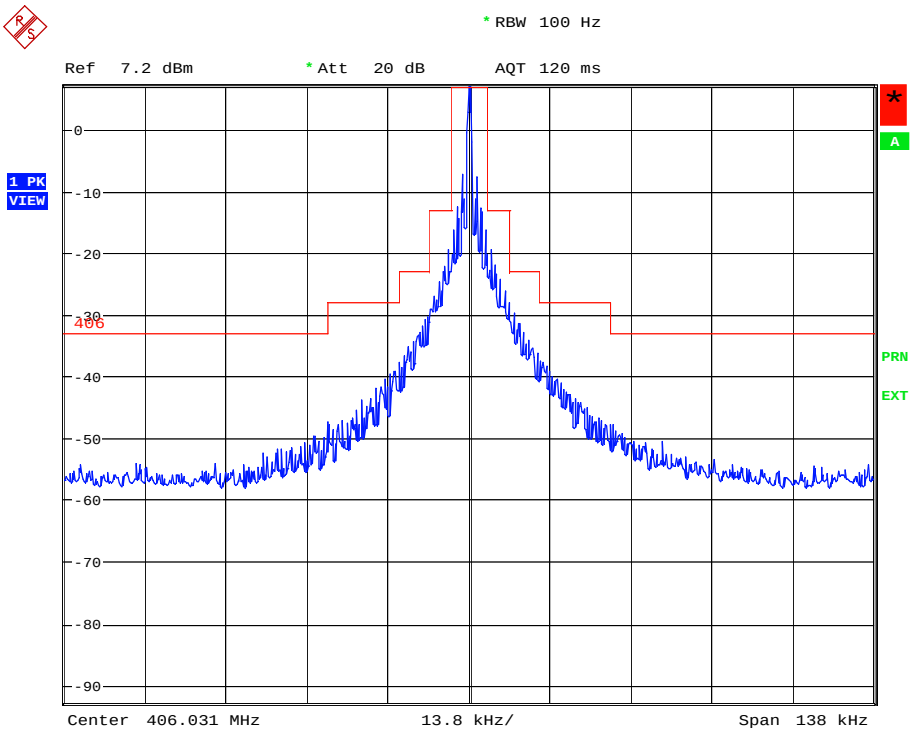
PLB-425, S/N: #10 (TSR20)

Parameter	Result (Max / Min)
Output Power	37.08 / 37.02
Digital Message	FFFE2F8C9EF9C06332E02BC44E379C8044FD*
Bit Rate	400.02 / 399.98
Modulation: Rise Time (us)	174.3 / 159.4
Modulation: Fall Time (us)	190.7 / 176.6
Positive Deviation (rad)	1.1636 / 1.0515
Negative Deviation (rad)	-1.1428 / -1.0274
Nominal Frequency (MHz)	406.0309973 / 406.0309973
Short-term Stability (/100 ms)	13.089E-11 / 11.562E-11
Medium-term Stability – Slope (/minute)	76.854E-12 / -63.689E-12
Medium-term Stability – Residual	48.347E-11 / 18.958E-11
Spurious Emissions	See plot below

Table 21

* During the test, the EUT detected live navigation data and encoded 50°52'8" N 1°14'44" W into the transmitted message. The accuracy of the encoded position was within the limits stated in Cospas Sarsat T.007.

Spurious Emissions



PLB-425, S/N: #1 (TSR19)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C06332E02BC44E379C8044FD*
406 MHz Frequency	406.031048
121 MHz Presence	P

Table 22

* During the test, the EUT detected live navigation data and encoded 50°52'8" N 1°14'44" W into the transmitted message. The accuracy of the encoded position was within the limits stated in Cospas Sarsat T.007.

PLB-400, S/N: #9 (TSR22)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C06332E02BC44E379C8051C4*
406 MHz Frequency	406.031066
121 MHz Presence	P

Table 23

* During the test, the EUT detected live navigation data and encoded 50°52'8" N 1°14'40" W into the transmitted message. The accuracy of the encoded position was within the limits stated in Cospas Sarsat T.007.

2.3.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	27-Feb-2019
Beacon RF Unit	TUV SUD Product Service	N/A	97	-	TU
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	18-Dec-2018
Attenuator: 10dB/20W	Narda	766-10	480	12	18-Dec-2018
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	23-Apr-2019
Spectrum Analyser	Agilent Technologies	E7405A	1410	12	13-Sep-2019
Chamber	Heraeus	HC 4033	2174	12	20-Jun-2019
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	20-Dec-2018
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	16-Nov-2018
ScopeCorder	Yokogawa	DL750 701210	3254	12	10-Nov-2018
Bandpass Filter (1MHz)	KR Electronics	3219-SMA	4600	12	3-Sep-2019
30dB Attenuator	Narda	766-30	4783	12	19-Dec-2018
Cable (18GHz)	Rosenberger	LU7-036-1000	5027	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5029	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-2000	5035	-	O/P Mon

Table 24

2.4 Vibration

2.4.1 Specification Reference

RTCM 11010.3, Clause A.6

2.4.2 Equipment Under Test and Modification State

PLB-425, S/N: #1 (TSR19) - Modification State 1
PLB-400, S/N: #9 (TSR22) - Modification State 1

2.4.3 Date of Test

11, 12 & 15 October 2018

2.4.4 Test Method

The EUT's were fixed to the vibration table and were subjected to the following vibration profile in each perpendicular axis:

Resonance Sweep

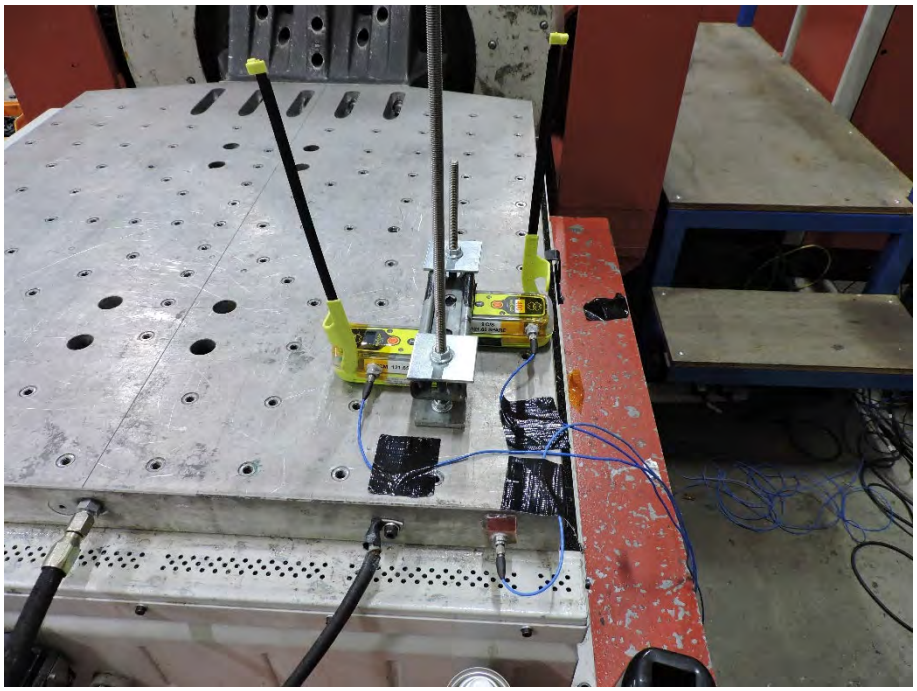
– 5 Hz and up to 13.2 Hz with an excursion of ±1 mm (7 m/s² maximum acceleration at 13.2 Hz);
– above 13.2 Hz and up to 100 Hz with a constant maximum acceleration of 7 m/s².

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

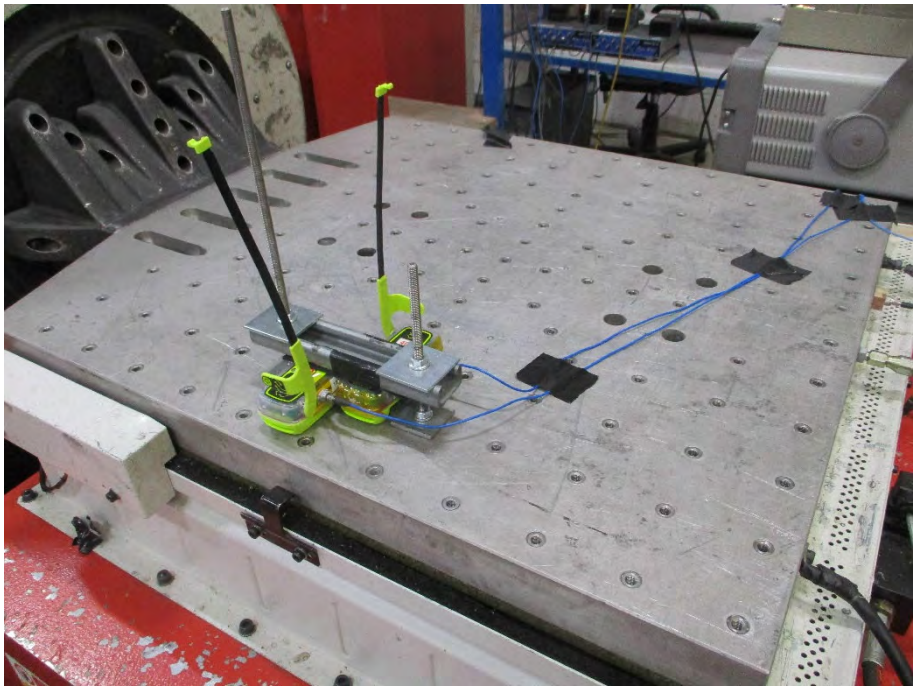
Where a resonance frequency was found the EUT was subjected to a 2 hour endurance run at that frequency. If no frequency was found the EUT endurance run was carried out at 30 Hz. During the test, the EUT's were monitored for inadvertent activation. At the end of the test, each EUT was subjected to a Performance Check.

There were no resonance frequencies detected and therefore the endurance run in each axis, was carried out at 30 Hz.

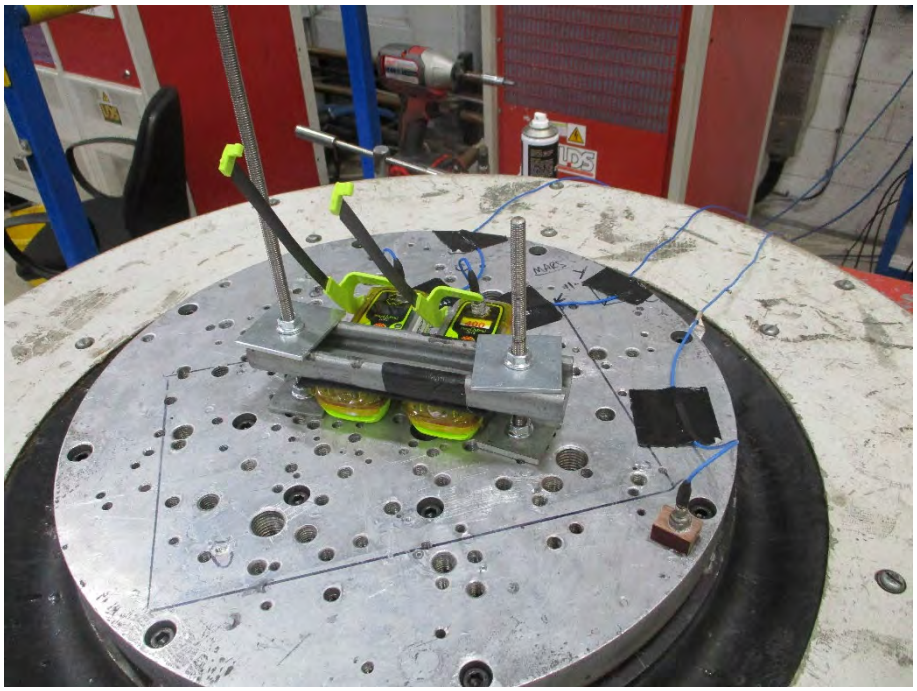
Test Setup – X Axis



Test Setup – Y Axis



Test Setup – Z Axis

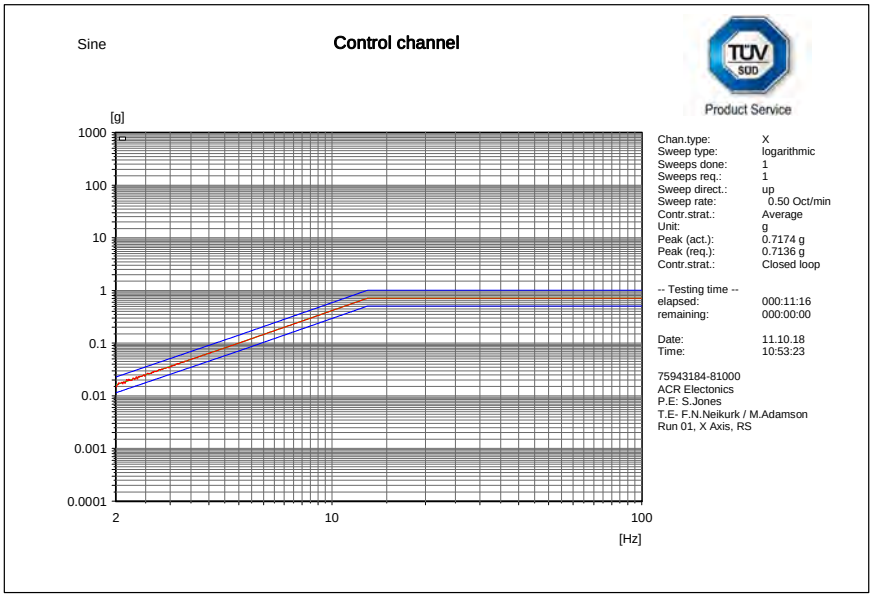


2.4.5 Environmental Conditions

Ambient Temperature	19.3 – 22.2 °C
Relative Humidity	48.8 – 56.7 %

2.4.6 Test Results

X Axis Resonance Search – Control and EUT



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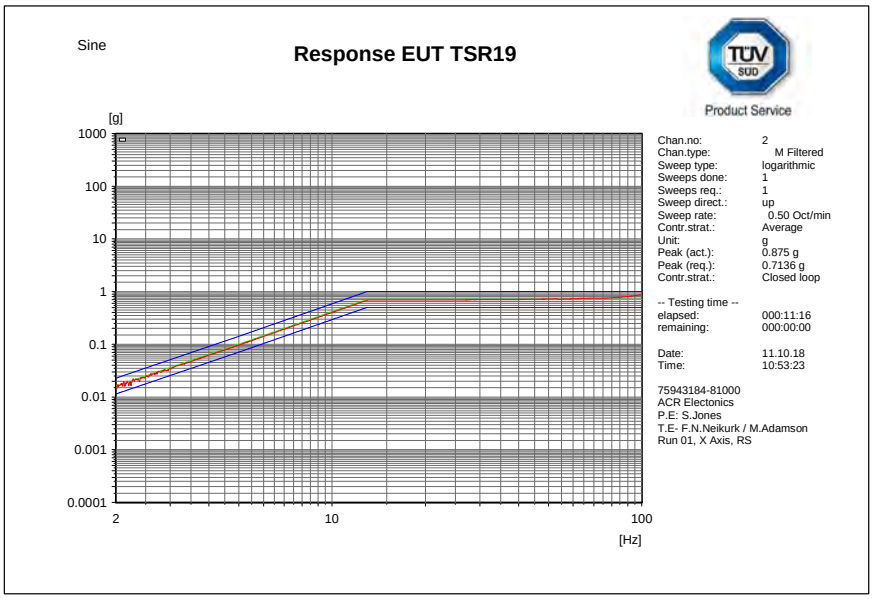

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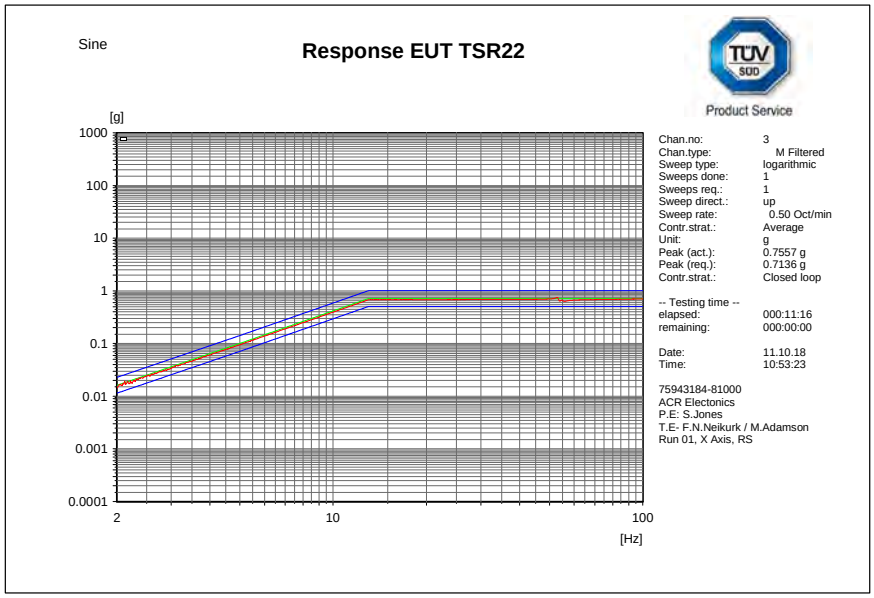

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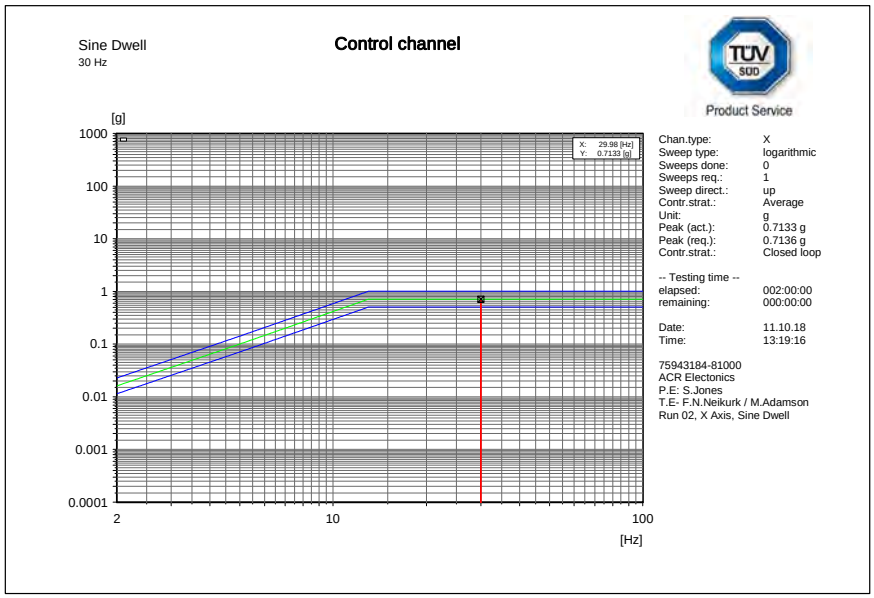
X Axis Endurance Run (30 Hz) – Control and EUT



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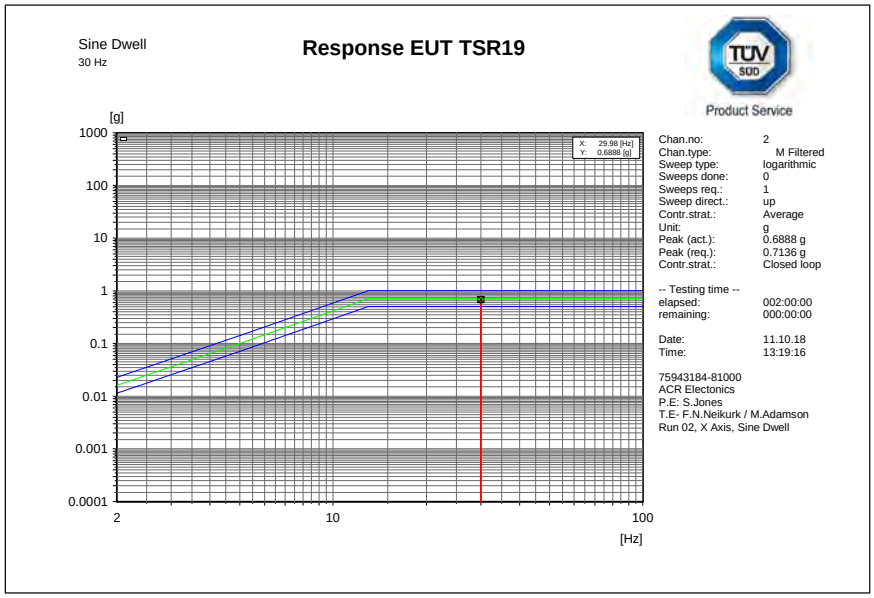

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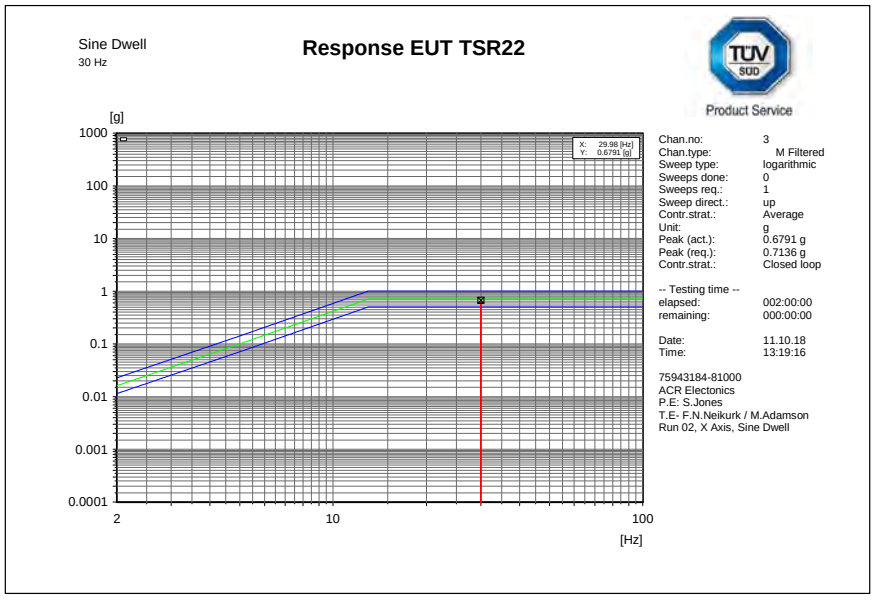

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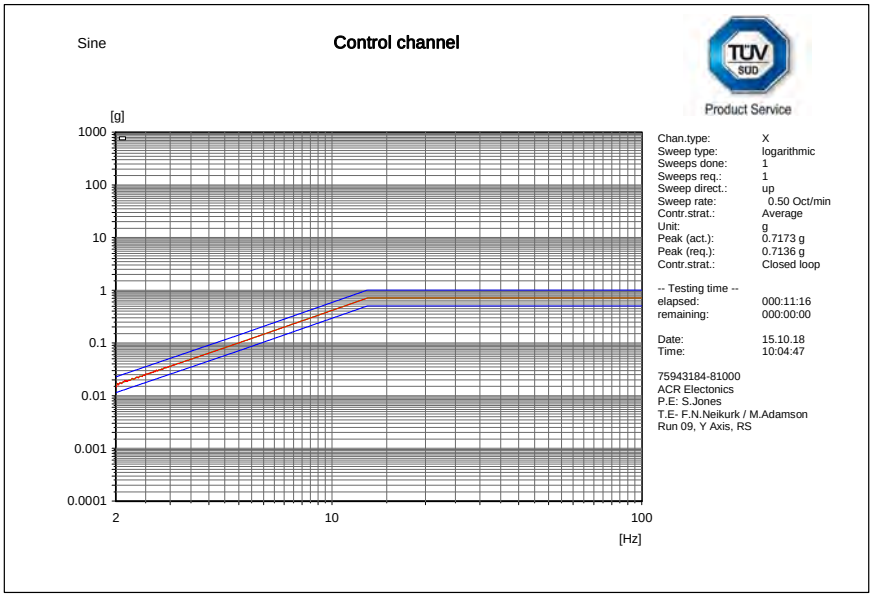
Y Axis Resonance Search – Control and EUT



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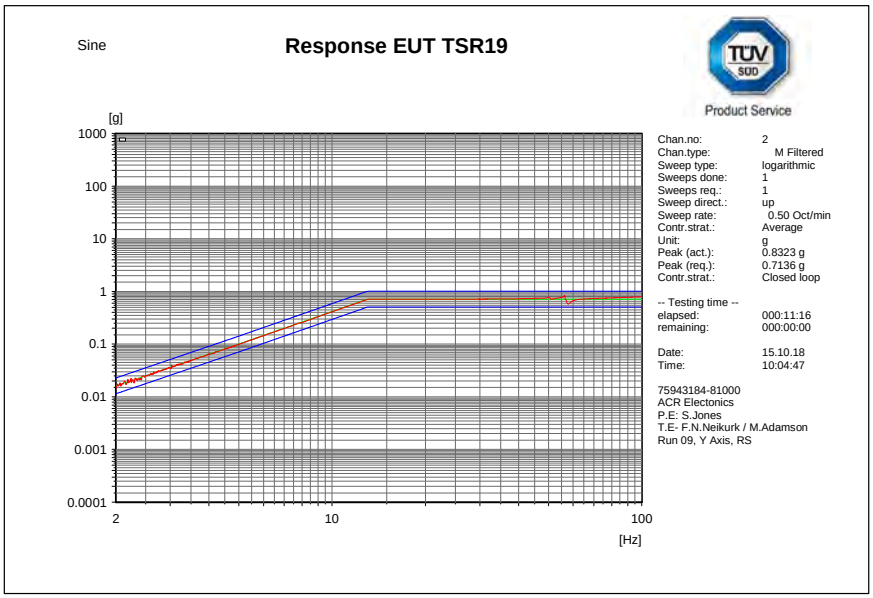

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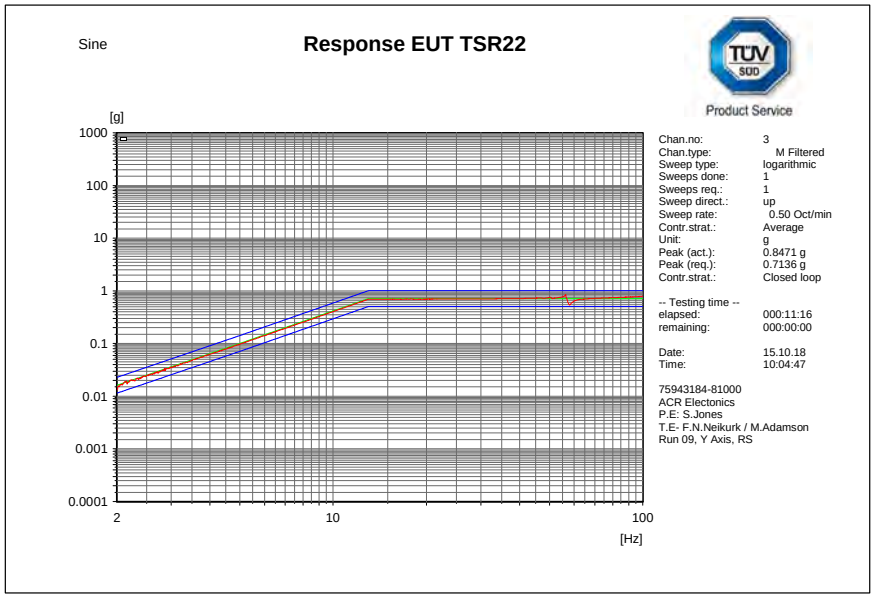

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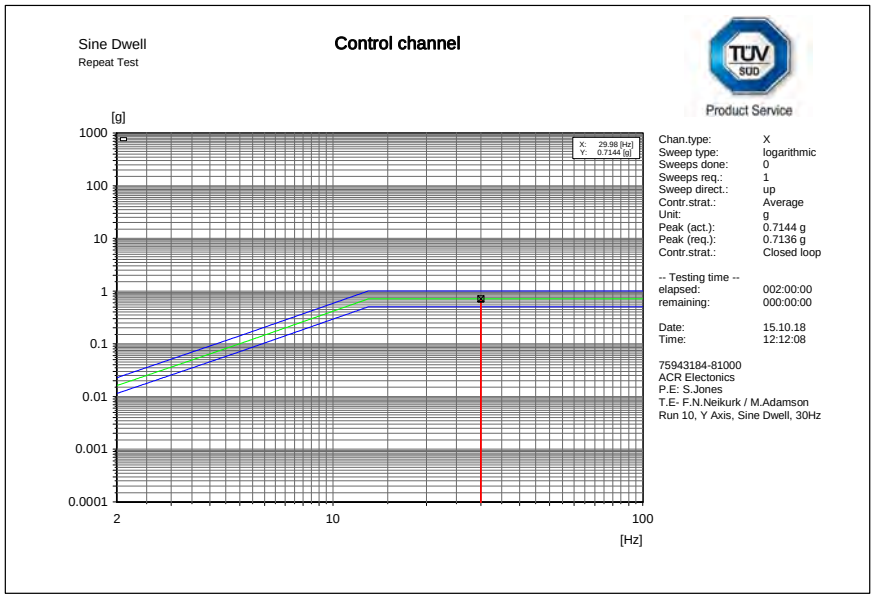
Y Axis Endurance Run (30 Hz) – Control and EUT



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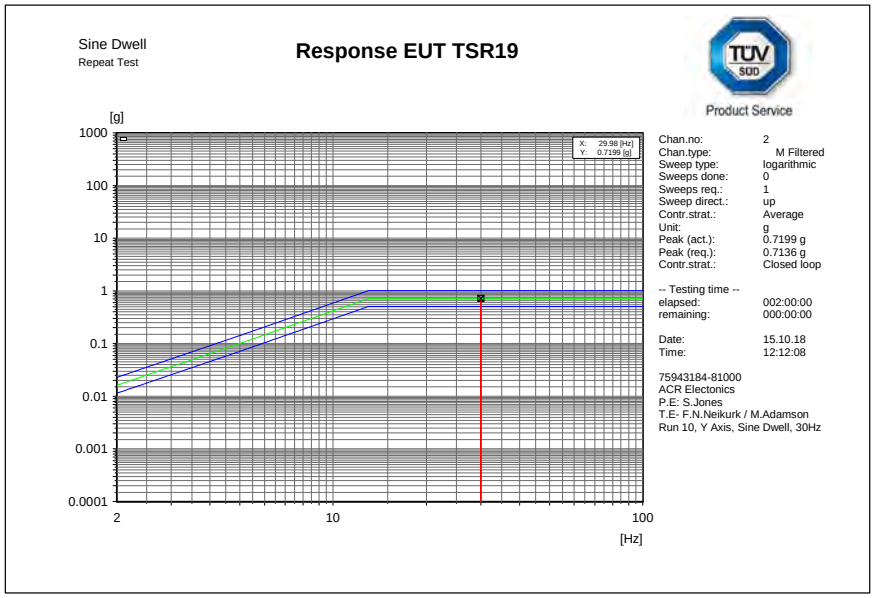

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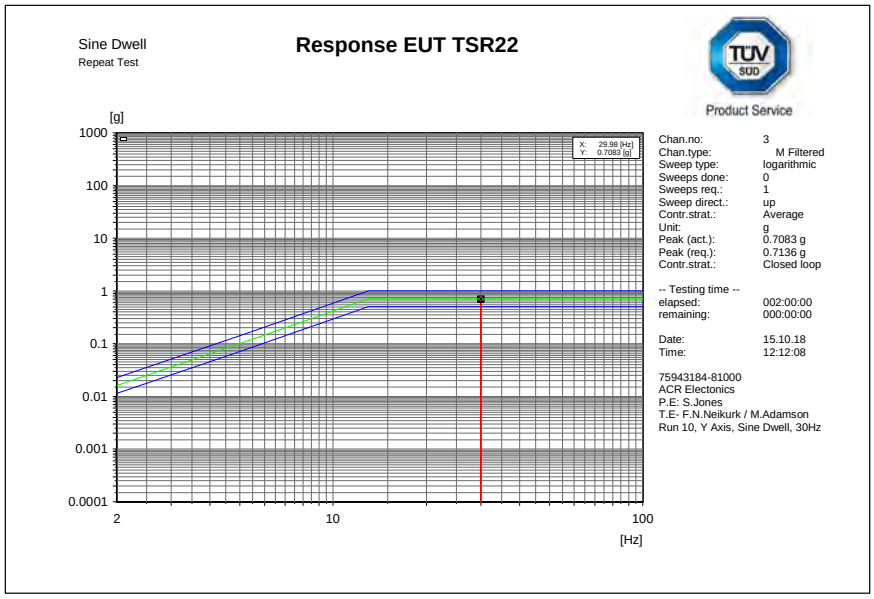

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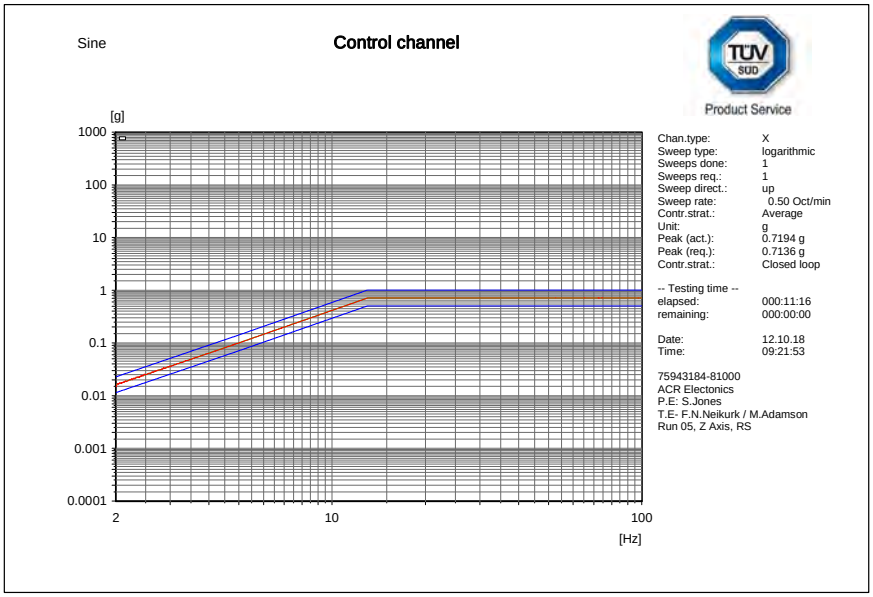
Z Axis Resonance Search – Control and EUT



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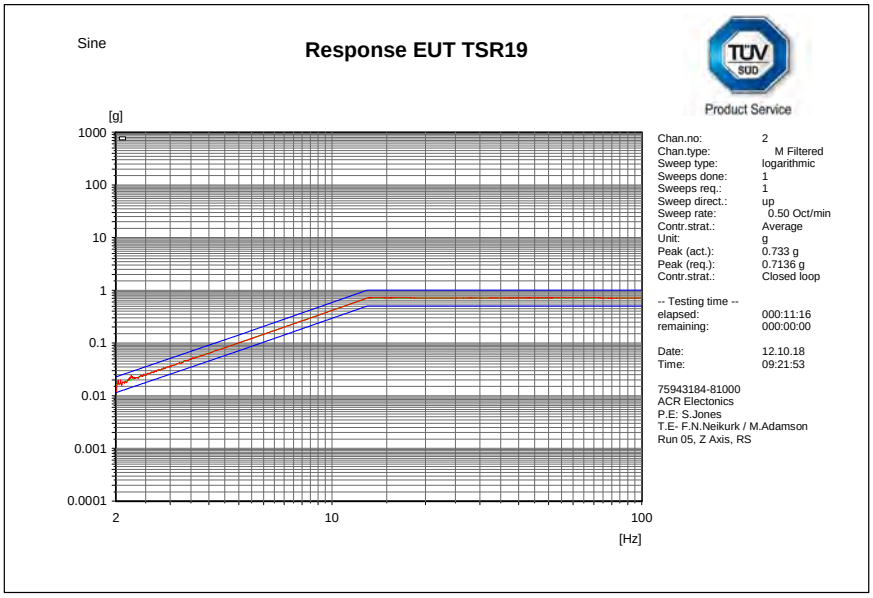

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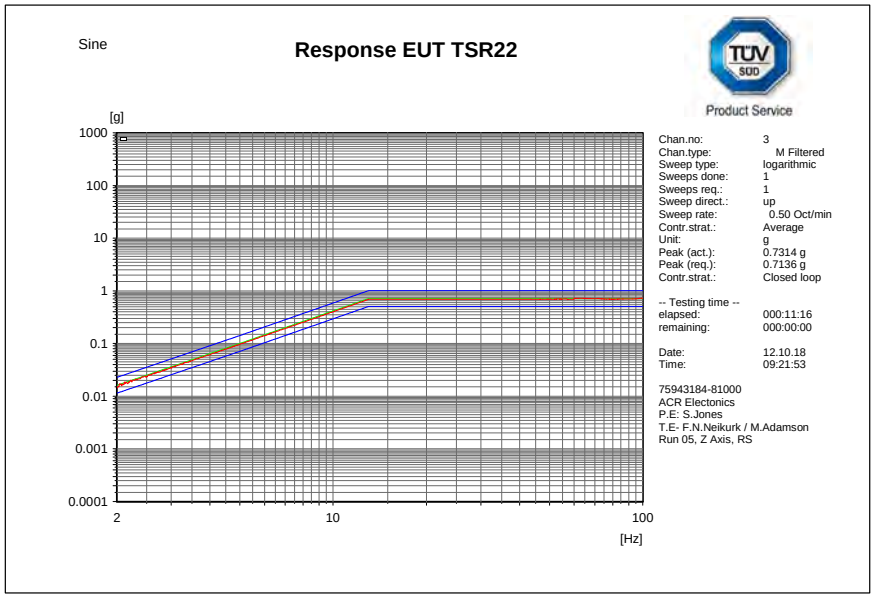

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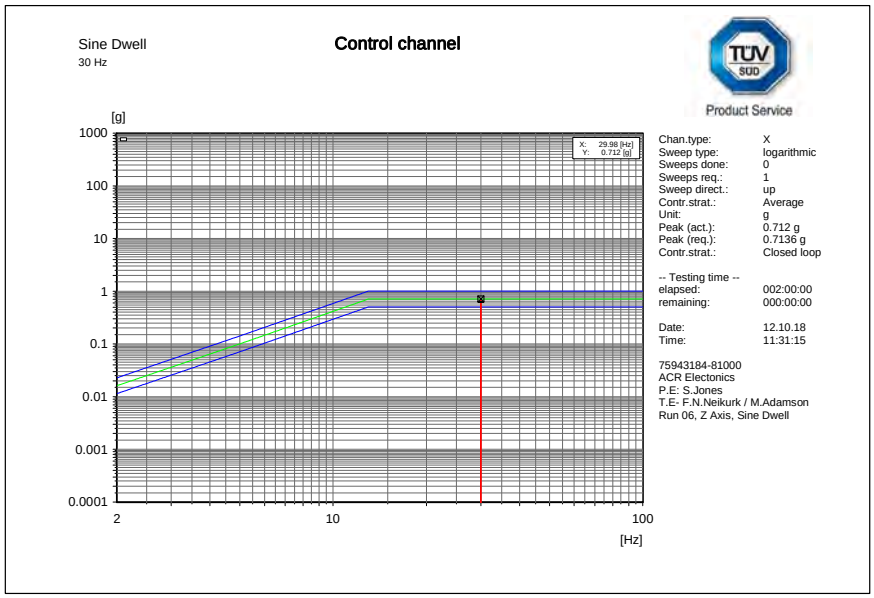
Z Axis Endurance Run (30 Hz) – Control and EUT



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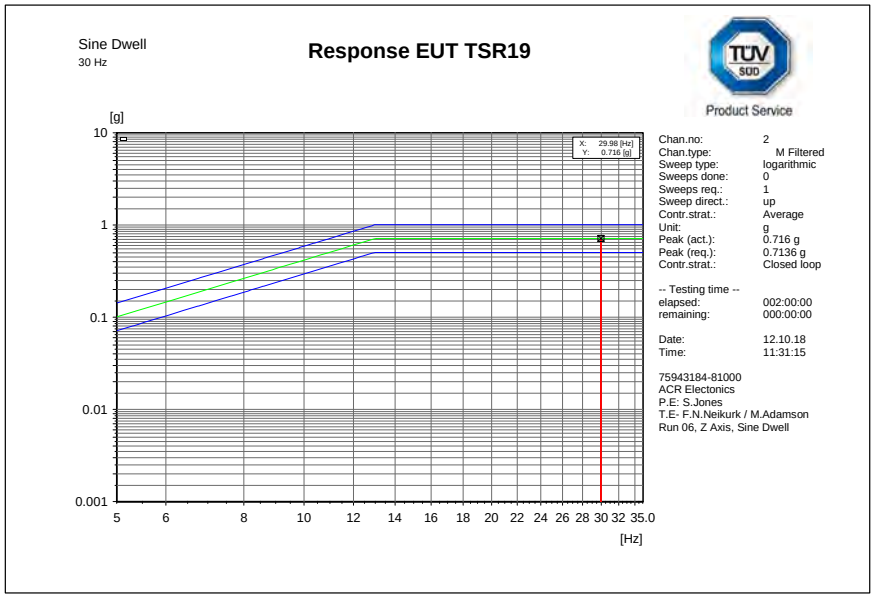

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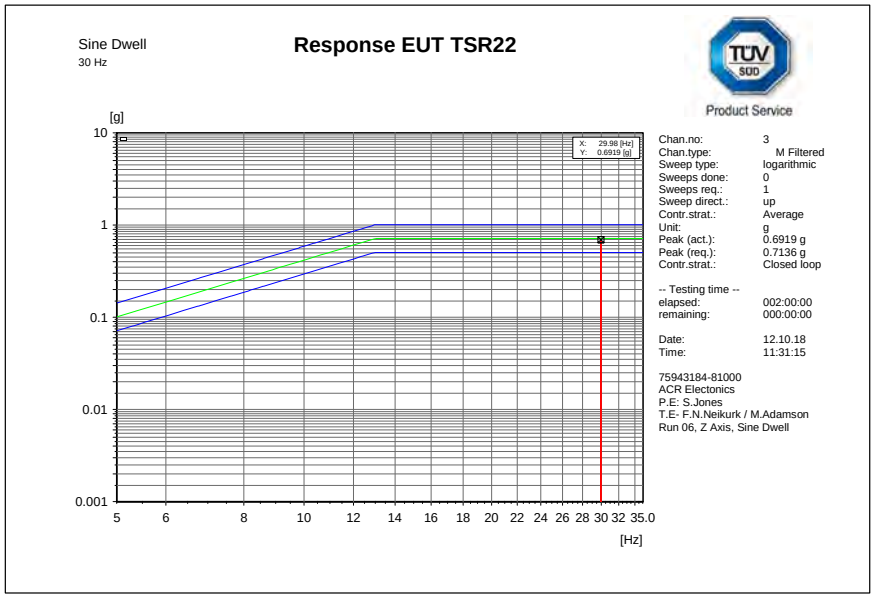


C:\VcpNT\Daten\m+p\ACR Electronics Inc\75943184-81000\Sine Dwell 30Hz_006.rsd

Performance Check

PLB-425, S/N: #1 (TSR19)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031000
121 MHz Presence	P

Table 25

PLB-400, S/N: #9 (TSR22)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.030986
121 MHz Presence	P

Table 26

2.4.7 Test Location and Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Charge Amp	Endevco	133	2501	12	22-Nov-2018
Vibration System	Ling Dynamic Systems	875	3170	6	24-Jan-2019
Accelerometer	Endevco	256-10	3435	6	19-Mar-2019
Accelerometer	Endevco	256-10	3440	6	2-Nov-2018
Vibration Controller	m + p International	Vibpilot 8	3771	12	16-Jul-2019
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	25-Sep-2019

Table 27

2.5 Bump

2.5.1 Specification Reference

RTCM 11010.3, Clause A.7

2.5.2 Equipment Under Test and Modification State

PLB-425, S/N: #1 (TSR19) - Modification State 1
PLB-400, S/N: #9 (TSR22) - Modification State 1

2.5.3 Date of Test

15 October 2018

2.5.4 Test Method

The EUT's were fixed to the vibration table and were subjected to the following profile:

Peak acceleration:	98 m/s2 +/-10 %
Pulse duration:	16 ms +/-10 %
Wave shape:	Half-cycle sinewave
Test Axis:	Vertical
Number of bumps:	4000

During the test, the EUT's were monitored for inadvertent activation. At the end of the test, each EUT was subjected to a Performance Check.

Test Setup

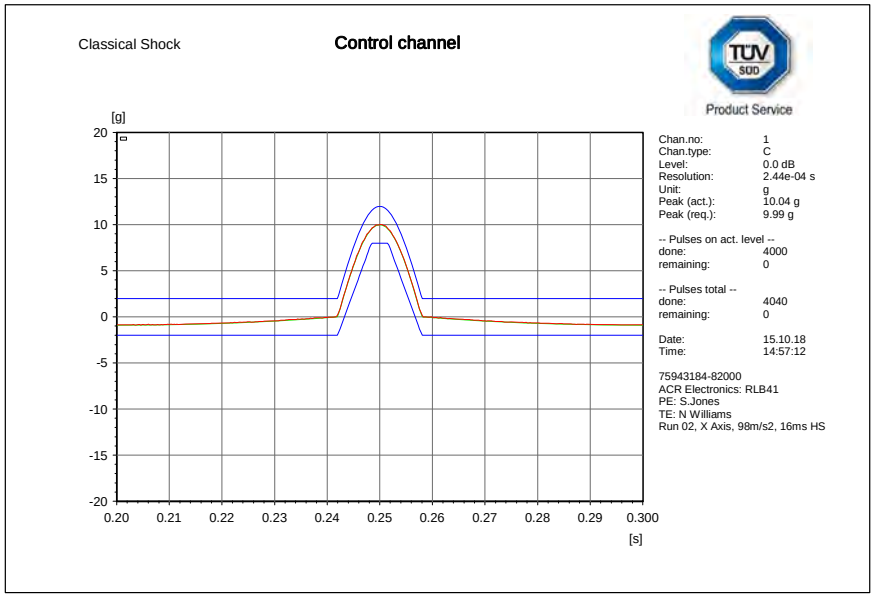
See section 2.4.4 for test setup photo.

2.5.5 Environmental Conditions

Ambient Temperature	18.9 °C
Relative Humidity	63.2 %

2.5.6 Test Results

X Axis – Control and EUT



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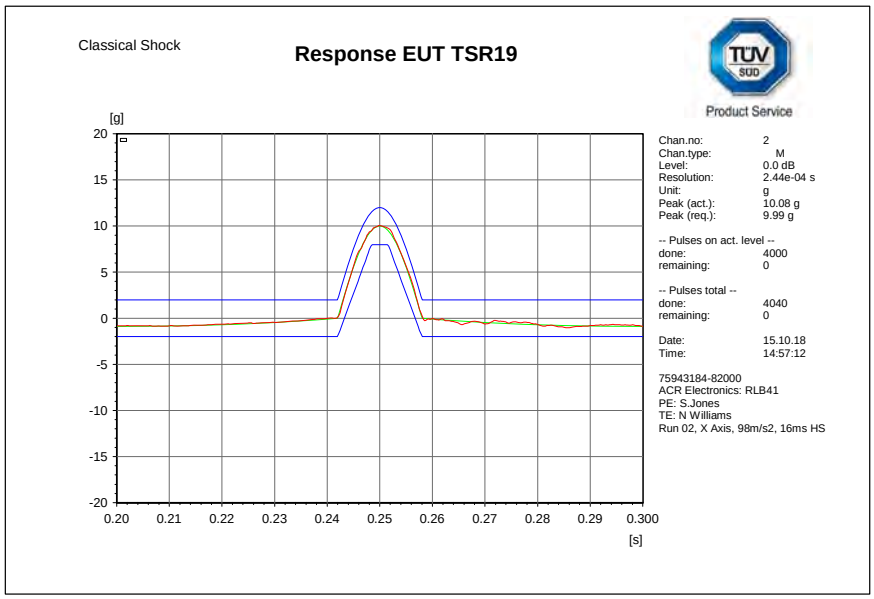

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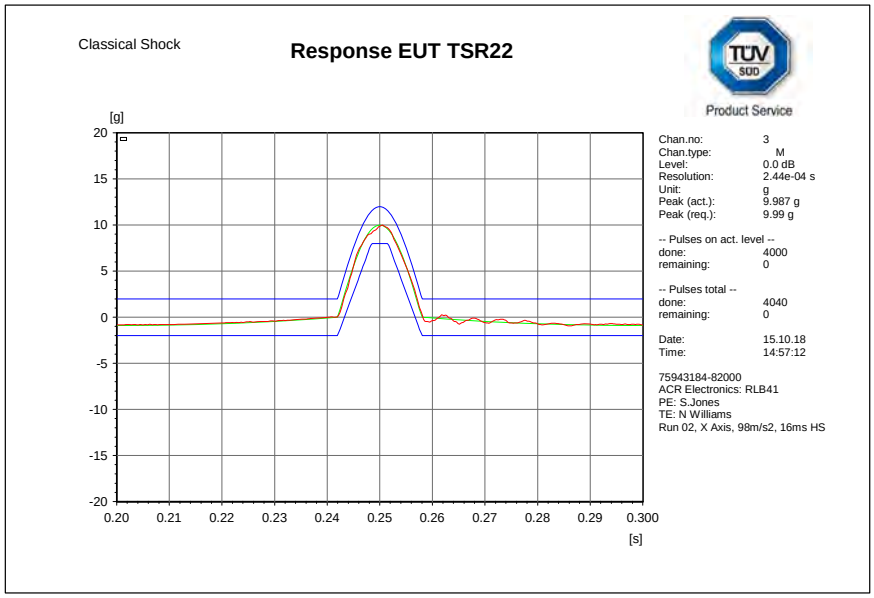

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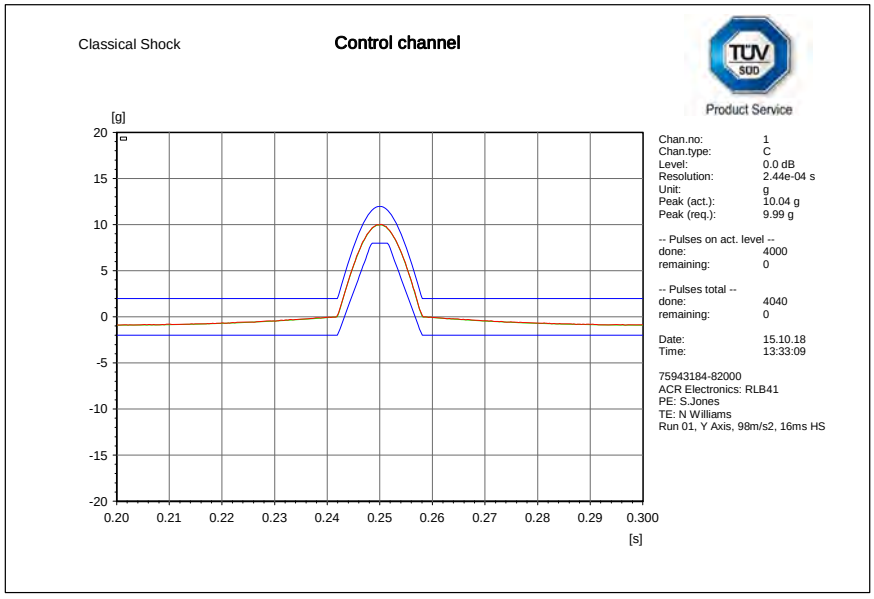
Y Axis – Control and EUT



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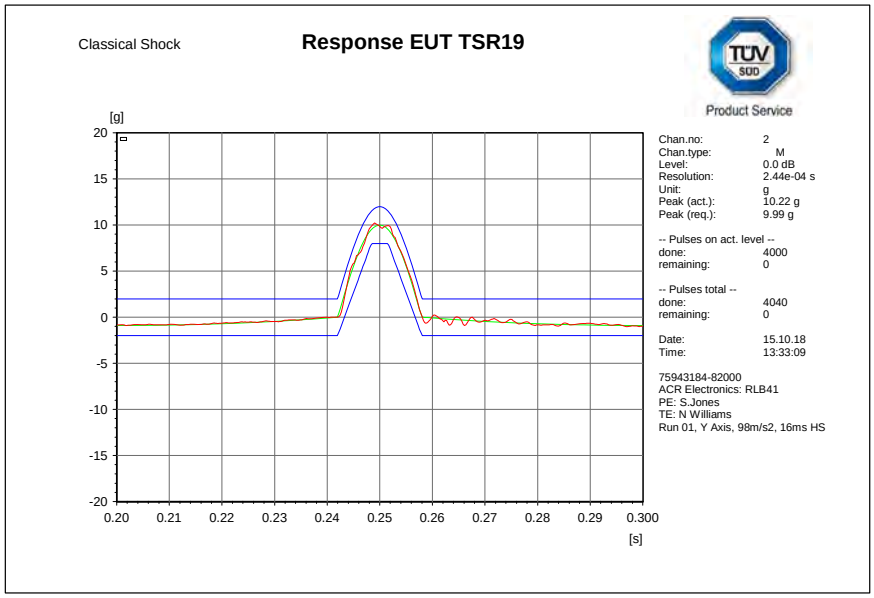

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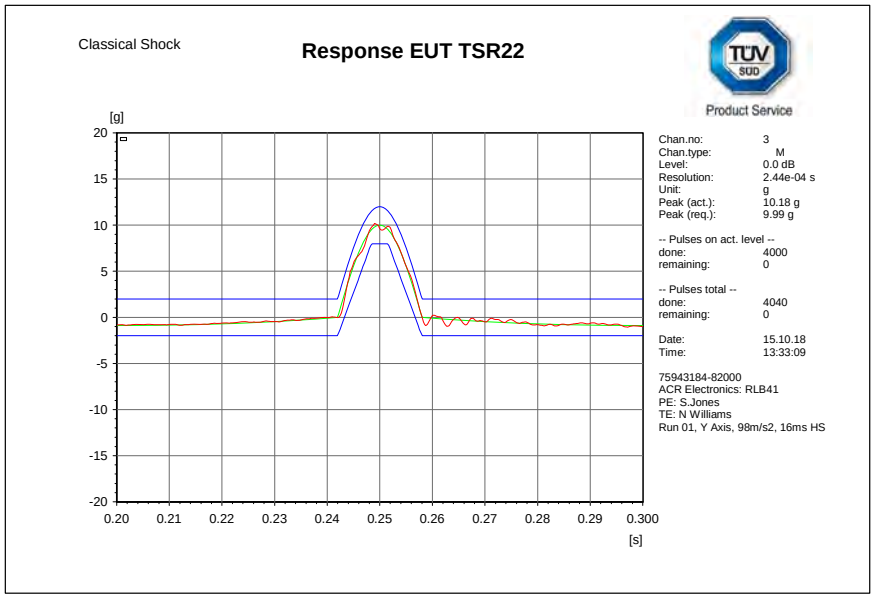

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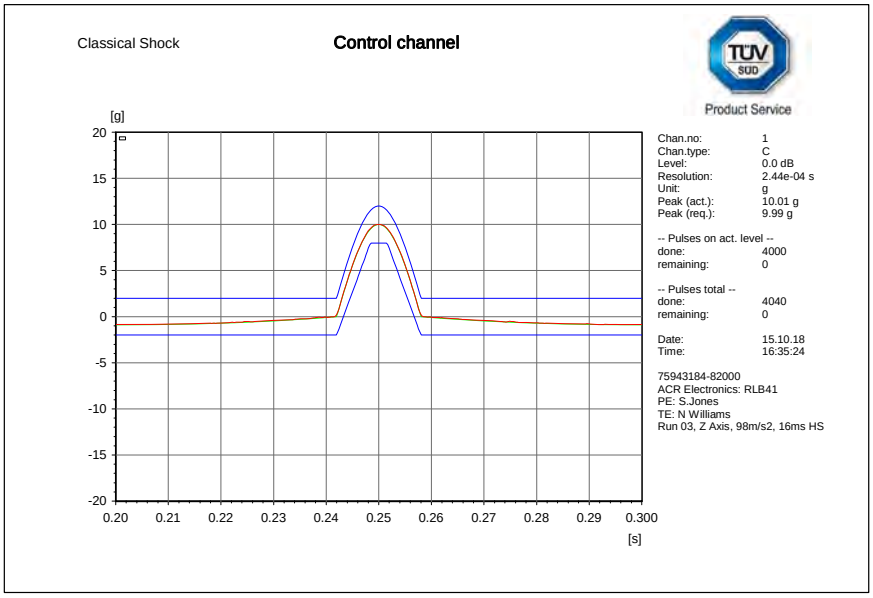
Z Axis – Control and EUT



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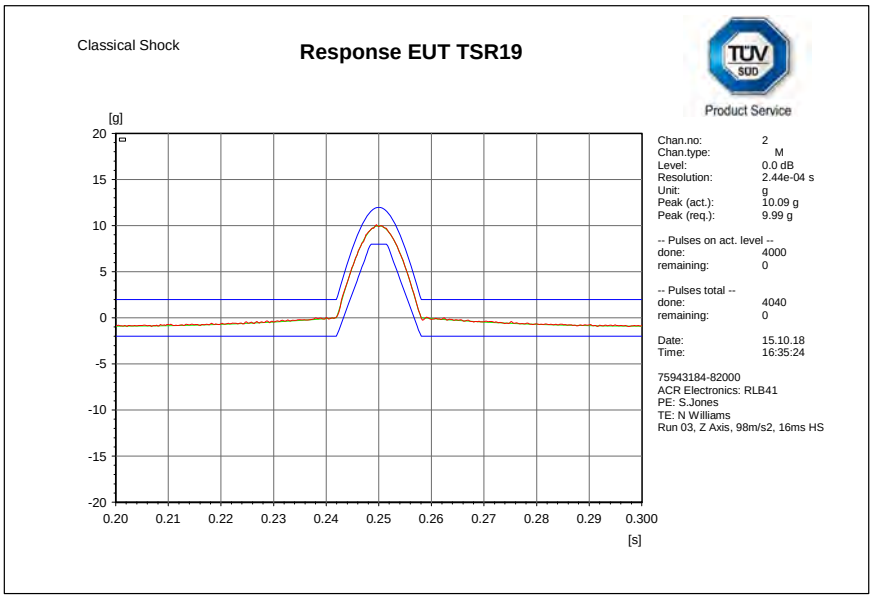

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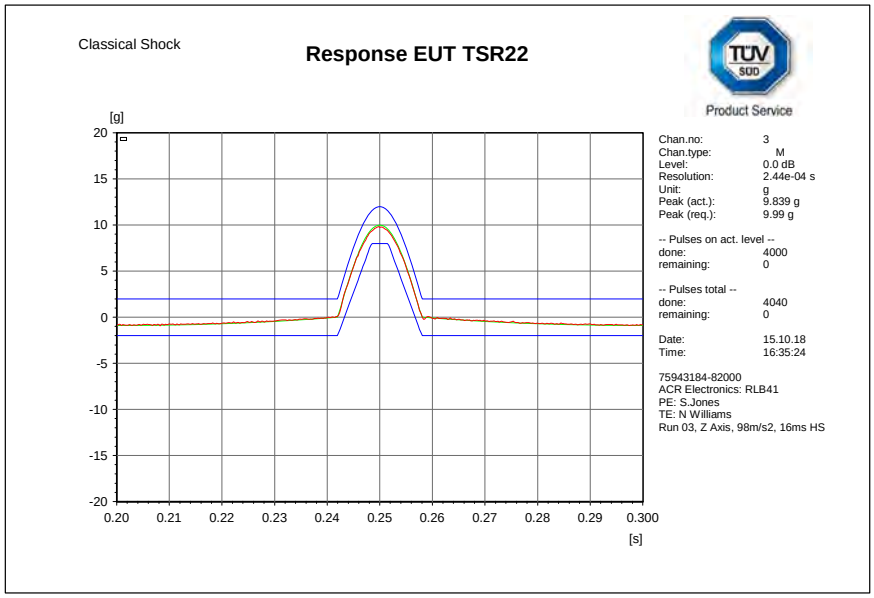


Performance Check

PLB-425, S/N: #1 (TSR19)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031000
121 MHz Presence	P

Table 28

PLB-400, S/N: #9 (TSR22)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.030990
121 MHz Presence	P

Table 29

2.5.7 Test Location and Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Beacon Tester	WS Technologies	BT 100S	87	-	TU
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	25-Sep-2019
Charge Amplifier	Endevco	133	2503	12	23-May-2019
Vibration System	Ling Dynamic Systems	875	3170	6	24-Jan-2019
Accelerometer	Endevco	256-10	3435	6	19-Mar-2019
Accelerometer	Endevco	256-10	3440	6	2-Nov-2018
Vibration Controller	m + p International	Vibpilot 8	3771	12	16-Jul-2019
Isotron Accelerometer	Endevco	256-10	3785	6	2-Nov-2018

Table 30

2.6 Corrosion

2.6.1 Specification Reference

RTCM 11010.3, Clause A.8

Manufacturer Waiver – See Annex A.

2.7 Drop Test

2.7.1 Specification Reference

RTCM 11010.3, Clause A.9

2.7.2 Equipment Under Test and Modification State

PLB-425, S/N: #1 (TSR19) - Modification State 2
PLB-400, S/N: #9 (TSR22) - Modification State 2

2.7.3 Date of Test

18 October 2018

2.7.4 Test Method

The EUT's were placed in a pre-conditioning climatic chamber at a temperature of -30°C for at least 2 hours.

Within 5 minutes of being removed from the climatic chamber, the EUT's were dropped 6 times, once on each face, from a height of 1000 mm ± 10 mm onto the test surface (solid piece of hardwood).

The EUT's were monitored throughout the test to ensure that they did not activate.
After the test, the EUT's were inspected for signs of damage, and subjected to a performance check.

Test Setup – EUT preconditioning

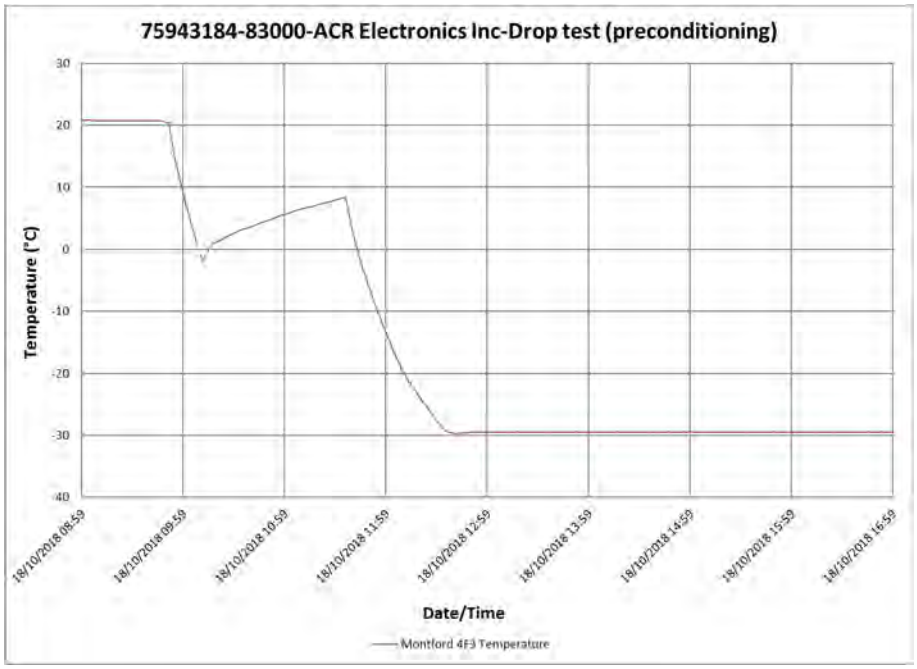
Test Setup – Drop onto Hard Surface

2.7.5 Environmental Conditions

Ambient Temperature	22.1 °C
Relative Humidity	40.5 %

2.7.6 Test Results

Temperature Plot (Pre-conditioning)



Performance Check

PLB-425, S/N: #1 (TSR19)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031007
121 MHz Presence	P

Table 31

PLB-400, S/N: #9 (TSR22)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C 406.030970 P

Table 32

2.7.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Spectrum Analyser	Agilent Technologies	E7405A	1410	12	13-Sep-2019
Montford F43	Montford	4FT CUBED	2126	12	12-Jan-2019
Lansmont	Lansmont	PDT 56E	2291	-	TU
Hardwood Block	Unknown	ELM	2650	-	TU

Table 33

2.8 Thermal Shock

2.8.1 Specification Reference

RTCM 11010.3, Clause A.10

2.8.2 Equipment Under Test and Modification State

PLB-425, S/N: #1 (TSR19) - Modification State 2
PLB-400, S/N: #9 (TSR22) - Modification State 2

2.8.3 Date of Test

23 October 2018 to 25 October 2018

2.8.4 Test Method

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

The EUT's were then immersed in a water vessel (preconditioned for greater than 24 hours) at +20°C ±3°C*, at a level of 100mm below the surface of the water (measured to the highest point of the EUT). The EUT's remained immersed for 48 hours. After this period of immersion, the EUT's were inspected and weighed for signs of water ingress and subjected to a performance check.

* This exceeds the requirements of RTCM 11010.3. The test temperature was selected to meet the requirements of ETSI 302 152-1.

Test Setup – EUT preconditioning

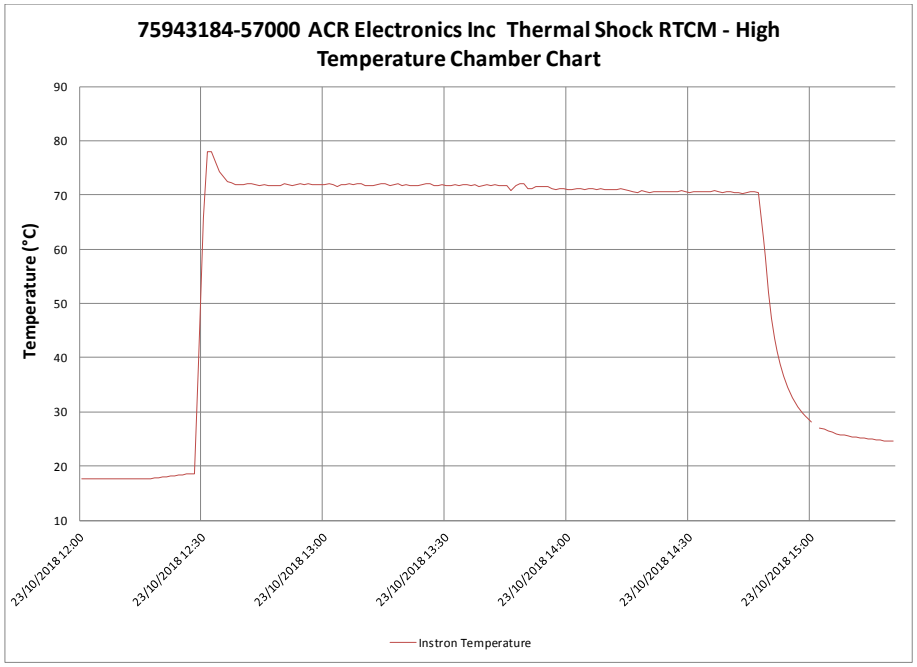
Test Setup – EUT immersed

2.8.5 Environmental Conditions

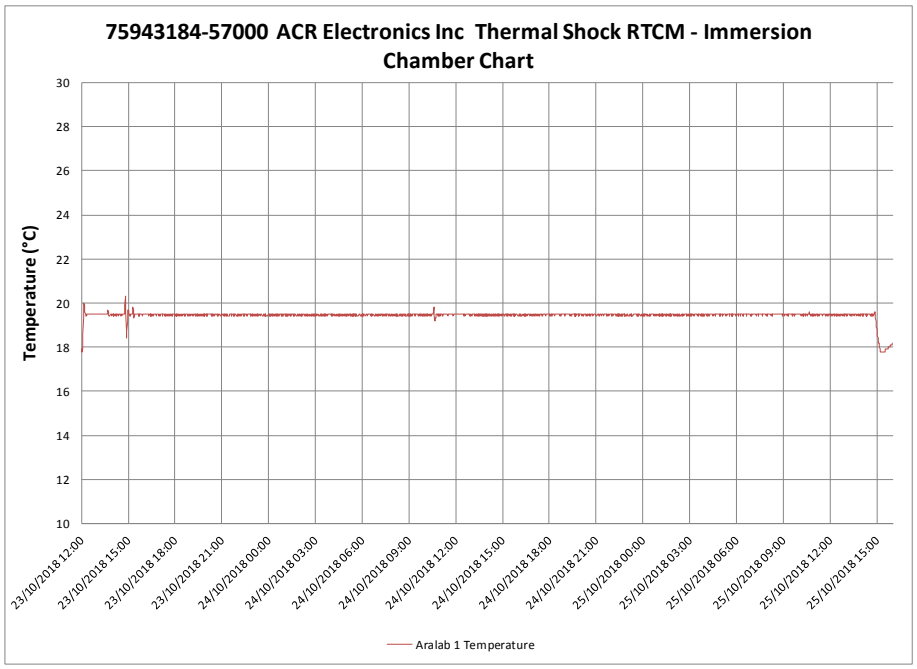
Ambient Temperature	21.5 °C
Relative Humidity	37.9 %

2.8.6 Test Results

Temperature Plot (Pre-conditioning)



Temperature Plot (Immersion)



The EUT's were weighed before and after the immersion test:

PLB-425, S/N: #1 (TSR19):
Pre-immersion weight: 147.4 g
Post-immersion weight: 147.7 g

PLB-400, S/N: #9 (TSR22)
Pre-immersion weight: 147.1 g
Post-immersion weight: 147.4 g

The difference between the pre and post-test weight can be attributed to water trapped within the recesses and external areas inaccessible to surface drying using a lint free cloth.

Performance Check

PLB-425, S/N: #1 (TSR19)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031003
121 MHz Presence	P

Table 34

PLB-400, S/N: #9 (TSR22)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C 406.030968 P

Table 35

2.8.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Spectrum Analyser	Agilent Technologies	E7405A	1410	12	13-Sep-2019
Temperature Chamber	Instron	906	2128	12	24-Jan-2019
Temperature Data Logger	Pico Technology Ltd	USB TC-08	3728	12	27-Oct-2018
Bench Scales	Kern-Sohn	CKE16K0.05	4647	12	28-Mar-2019
Climatic Chamber	Aralab	Aralab 1, 1000 ECP75	4718	12	13-Jun-2019
Type T PFA Insulated Thermocouple	TC Limited	Type-T	4739	12	31-Jul-2019

Table 36

2.9 Immersion

2.9.1 Specification Reference

RTCM 11010.3, Clause A.11

2.9.2 Equipment Under Test and Modification State

PLB-425, S/N: #1 (TSR19) - Modification State 2
PLB-400, S/N: #9 (TSR22) - Modification State 2

2.9.3 Date of Test

01 November 2018

2.9.4 Test Method

The EUT's were placed in the pre-conditioning climatic chamber at a temperature of +23°C for 2 hours.

The EUT's were then immersed in a water container (preconditioned for greater than 24 hours) at +18°C. The water container was then placed in a pressure vessel where a hydraulic pressure of 100 mbar(g), corresponding to a depth of 1 metre was applied for 1 hour. After this period of immersion, the EUT's were inspected and weighed for signs of water ingress and subjected to a performance check.

Test Setup – EUT preconditioning

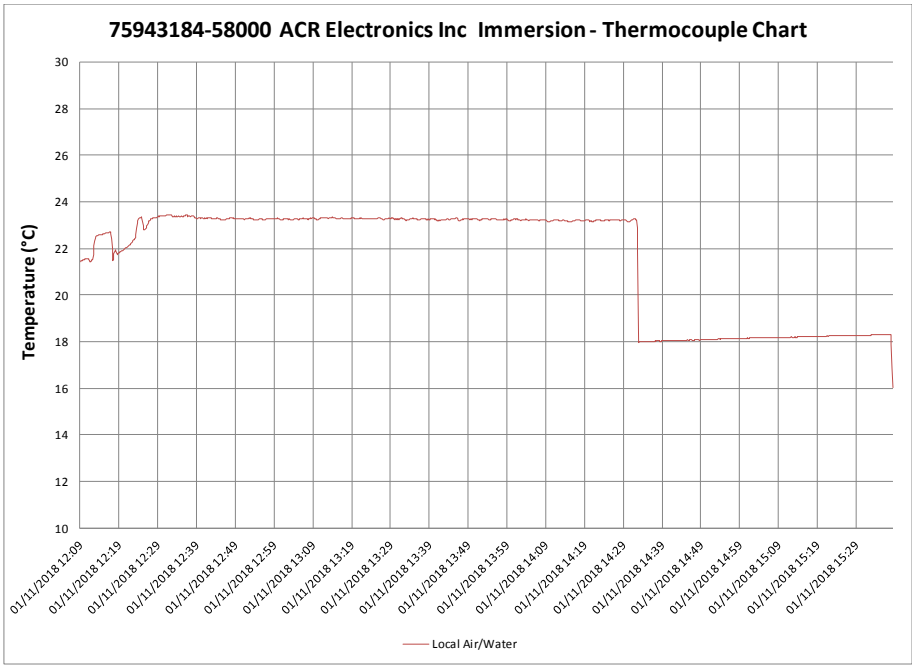
Test Setup – EUT immersed

2.9.5 Environmental Conditions

Ambient Temperature	21.0 °C
Relative Humidity	42.2 %

2.9.6 Test Results

Temperature Plot (Pre-conditioning and Immersion)



The EUT's were weighed before and after the Immersion test:

PLB-425, S/N: #1 (TSR19):
Pre-immersion weight: 147.4 g
Post-immersion weight: 147.4 g

PLB-400, S/N: #9 (TSR22)
Pre-immersion weight: 145.3 g
Post-immersion weight: 145.3 g

Performance Check

PLB-425, S/N: #1 (TSR19)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.031011
121 MHz Presence	P

Table 37

PLB-400, S/N: #9 (TSR22)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9F0018DFC0FF04F9E437
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010 406.030966 P

Table 38

2.9.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	9-Oct-2019
Over Pressure (T)	ASL (TUV)	0 TO 15 PSI	2125	-	TU
Digital Pressure Indicator	Druck	DPI 700	2351	12	3-May-2019
Climatic Chamber	Climatec	CLIMATEC 3	2846	12	20-Jul-2019
Data Logger	Pico Technology Ltd	TC-08	3265	12	14-Mar-2019
Stopwatch	R.S Components	309RS	4553	12	27-Sep-2019
Bench Scales	Kern-Sohn	CKE16K0.05	4647	12	28-Mar-2019
Type T PFA Insulated Thermocouple	TC Limited	Type-T	4739	12	31-Jul-2019

Table 39

2.10 Spurious Emissions

2.10.1 Specification Reference

RTCM 11010.3, Clause A.12

2.10.2 Equipment Under Test and Modification State

PLB-425, S/N: #10 (TSR20) - Modification State 2
PLB-425, S/N: #10 (TSR20) - Modification State 3

2.10.3 Date of Test

20 November 2018, 15 January 2019 and 16 January 2019

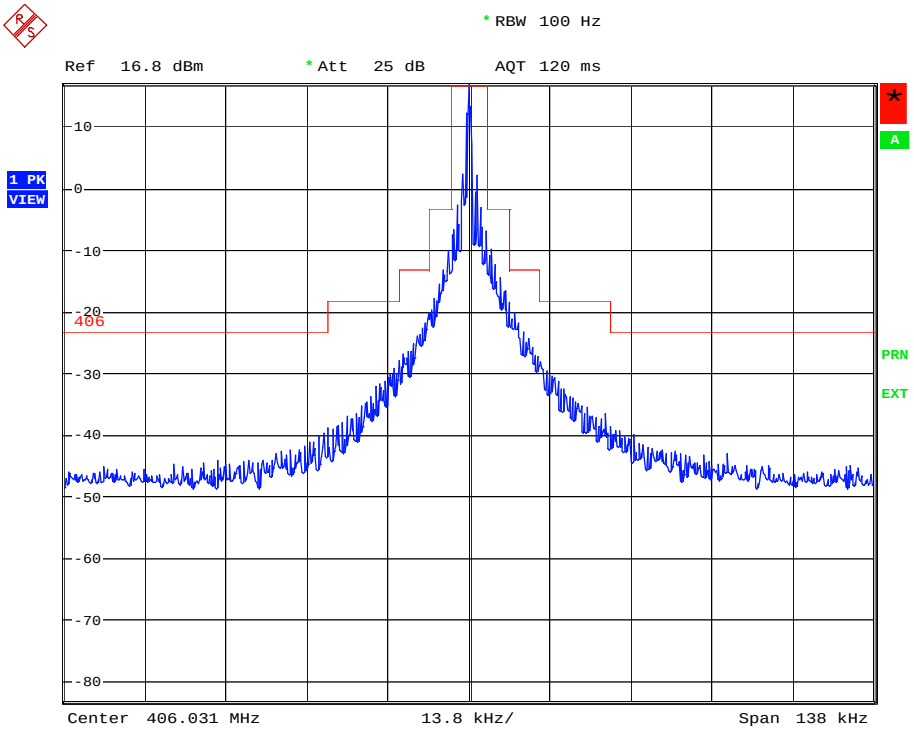
2.10.4 Test Method

This test was performed in accordance with the requirements of RTCM 11010.3 clause A.12.

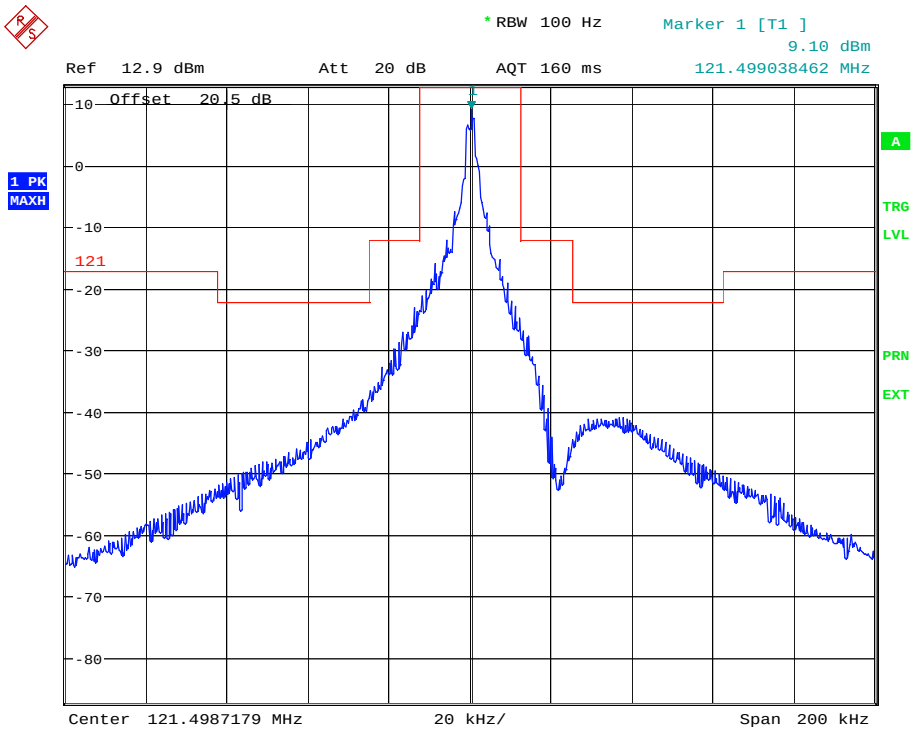
2.10.5 Test Results

Ambient Temperature

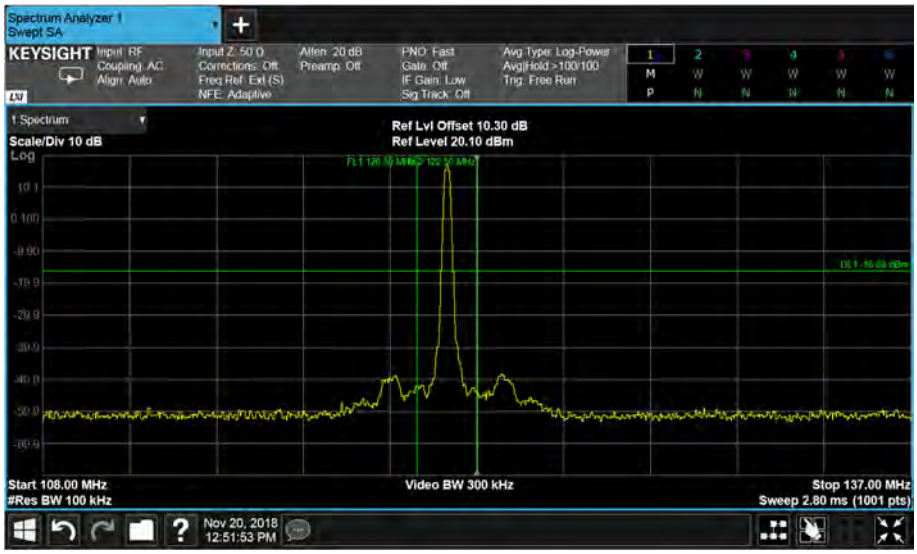
406 MHz



121.5 MHz



108 MHz to 121 MHz and 122 MHz to 137 MHz*

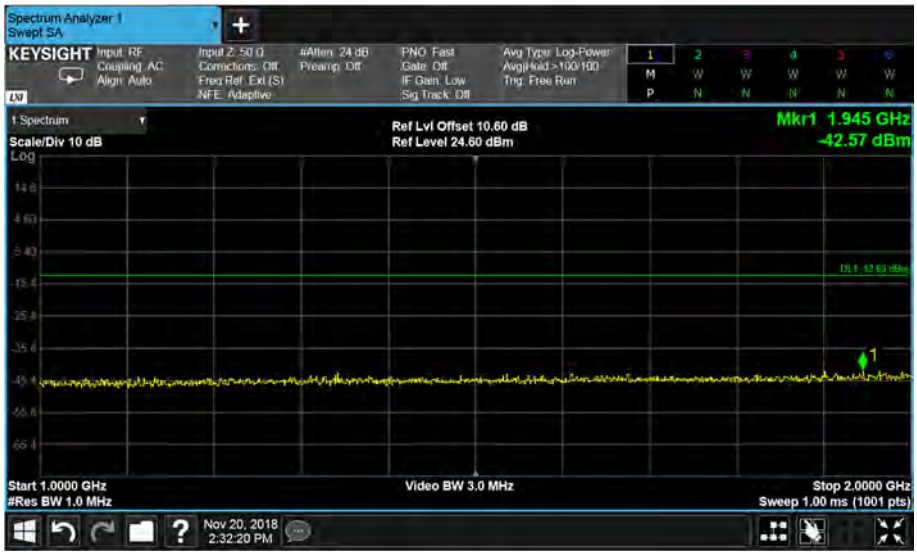


*The measurement ranges have been combined to meet the requirements of ETSI 302 152-1.

156 MHz to 162 MHz*

*The measurement range has been extended to meet the requirements of ETSI 302 152-1.

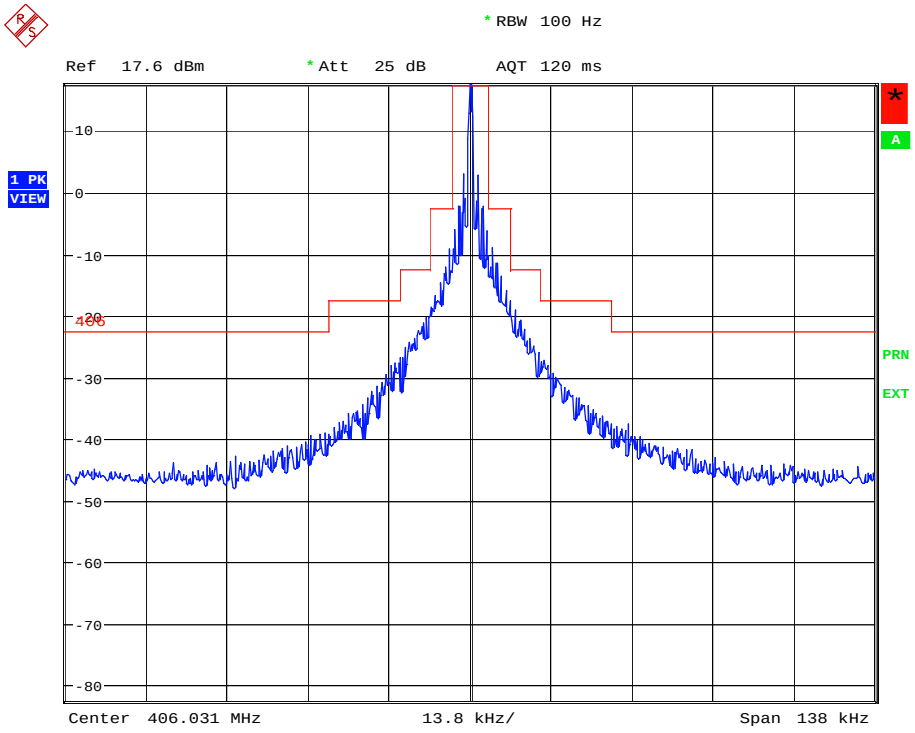
1525 MHz to 1610 MHz*



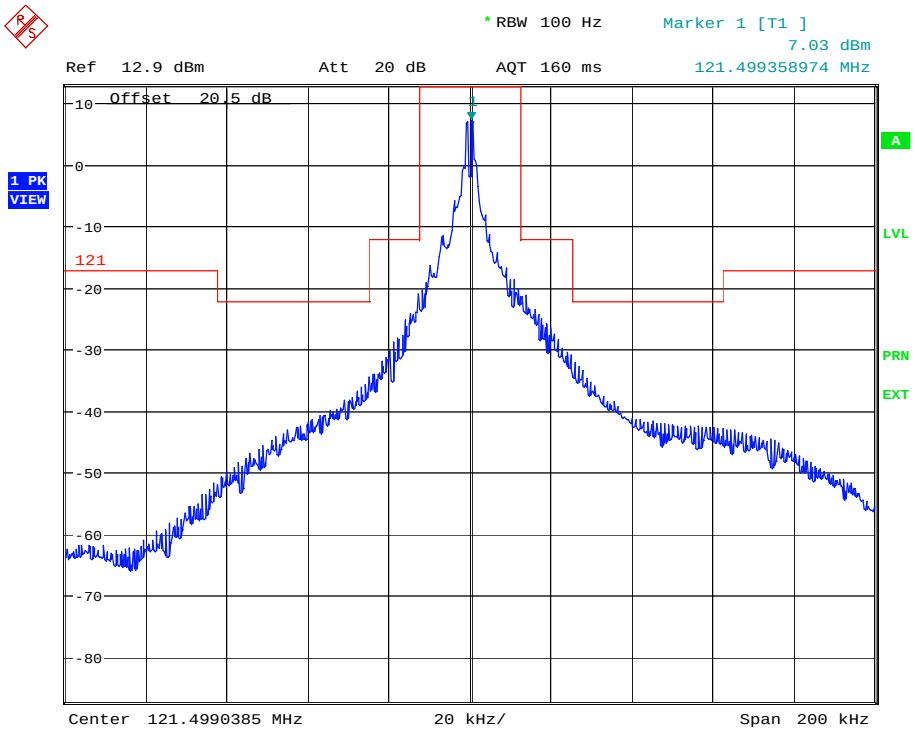
*The measurement range has been extended to meet the requirements of RSS-287. The limit line shown is also a requirement of RSS-287 and should be reduced to -16dBm (25uW) for this measurement.

Low Temperature

406 MHz

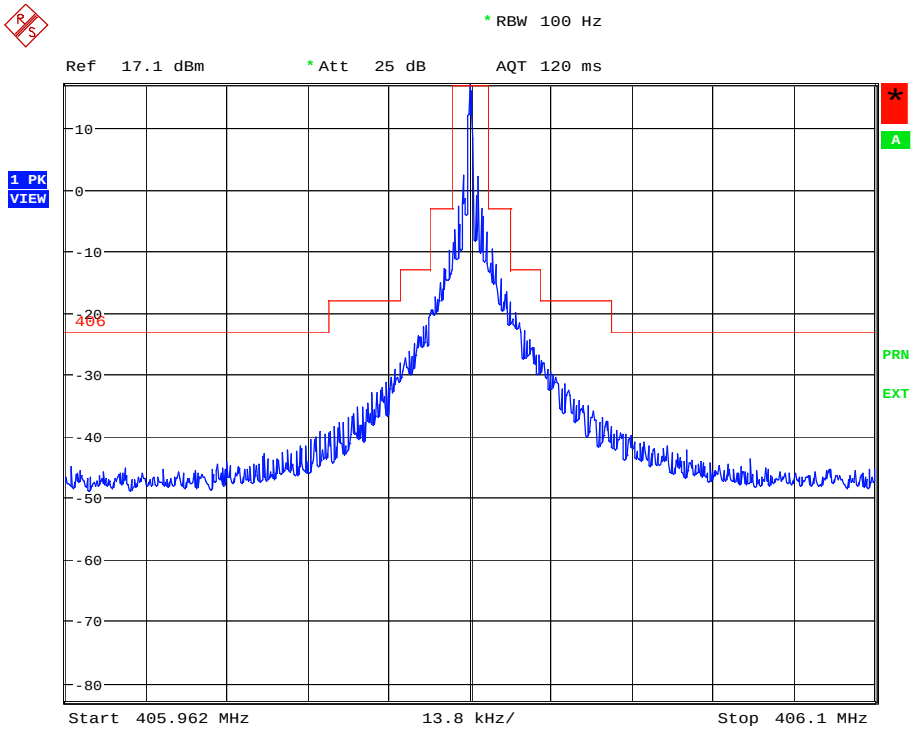


121.5 MHz

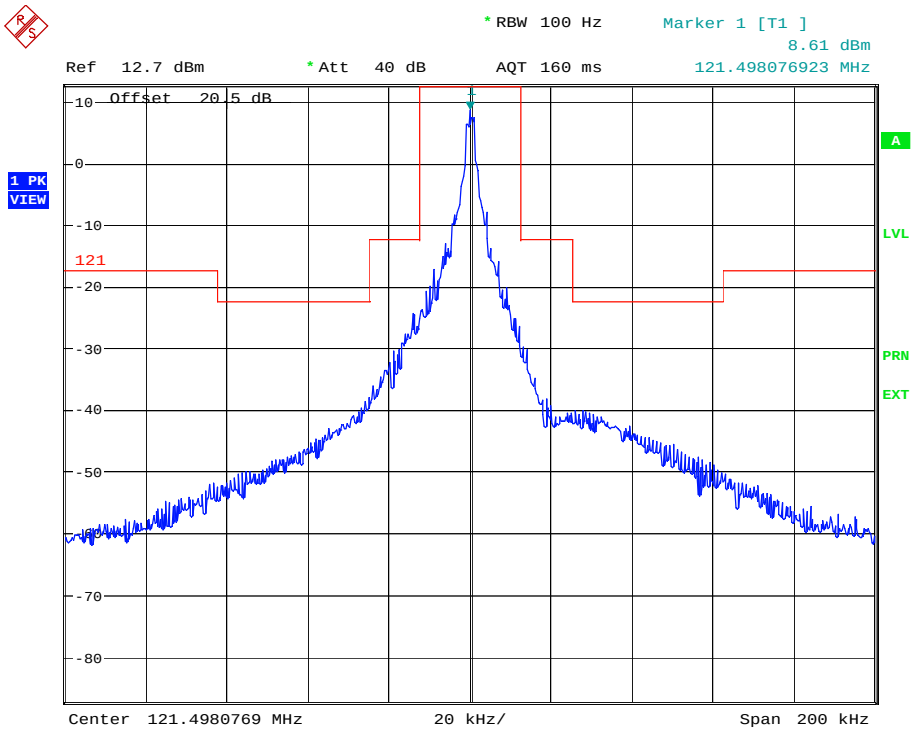


High Temperature

406 MHz



121.5 MHz



2.10.6 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1 and RF Laboratory 4.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Votsch	VT4002	161	-	TU
Attenuator (10dB)	Weinschel	47-10-34	481	12	18-Jul-2019
High Pass Filter	Mini-Circuits	NHP-300	1640	12	23-Oct-2019
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	19/02/19
Termination (50ohm, 1W)	Suhner	50ohm 1W	3080	12	18-Jul-2019
Hygrometer	Rotronic	I-1000	3220	12	13-Sep-2019
Tunable Notch Filter	Wainwright	WRCD 100.0/130.0-0.05/50-5EEK	3426	-	TU
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	17-Oct-2019
Meter & T/C	R.S Components	Meter 615-8206 & Type K T/C	3612	12	25/09/19
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	23/10/19
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	22-Oct-2019
EXA	Keysight Technologies	N9010B	4969	12	21-Dec-2018
RF Cable (18GHz)	Rosenberger	LU7-036-1000	5029	-	TU
Cable (18GHz)	Rosenberger	LU7-036-1000	5030	-	O/P Mon
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	11/05/19
Hygrometer	Rotronic	I-1000	2829	12	04/12/19
Power Meter	Hewlett Packard	436A	83	12	26/09/19
Power Sensor	Agilent Technologies	8482A	3290	12	19/04/19

2.11 Operational Life and Self-Test

2.11.1 Specification Reference

RTCM 11010.3, Clause A.13

2.11.2 Equipment Under Test and Modification State

PLB-425, S/N: #10 (TSR20) - Modification State 3

2.11.3 Date of Test

07/01/2019

2.11.4 Test Method

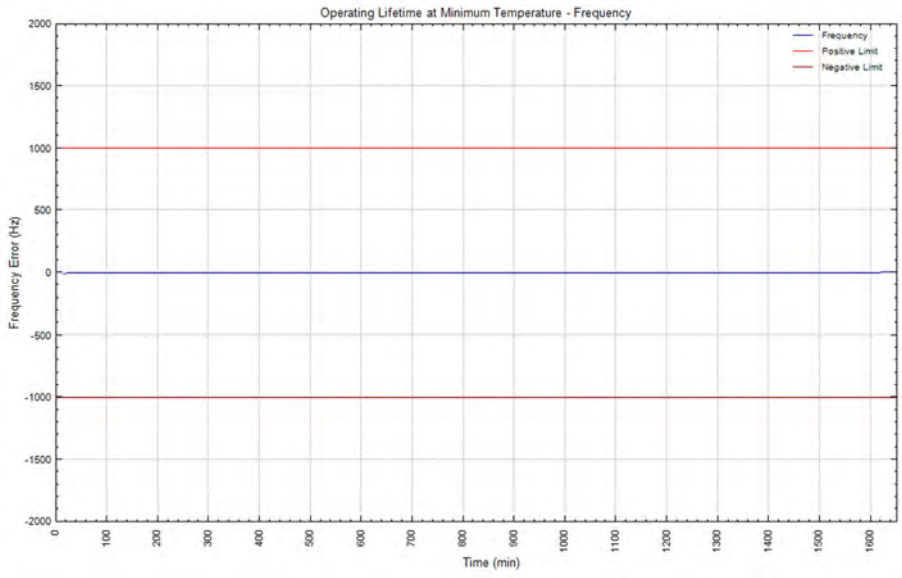
The test was carried out in accordance with the above clause.

2.11.5 Environmental Conditions

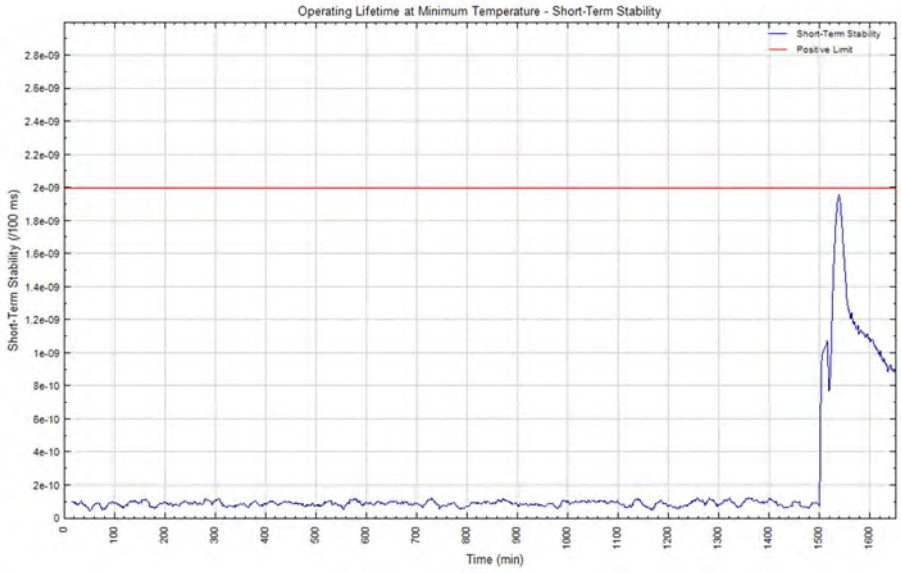
Ambient Temperature	21.5 °C
Relative Humidity	36.1 %

2.11.6 Test Results

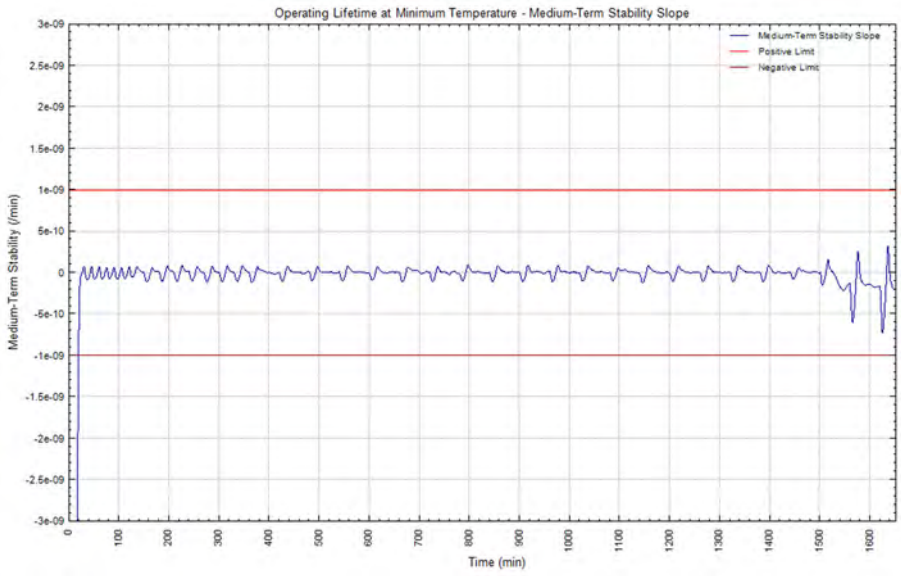
Nominal Frequency



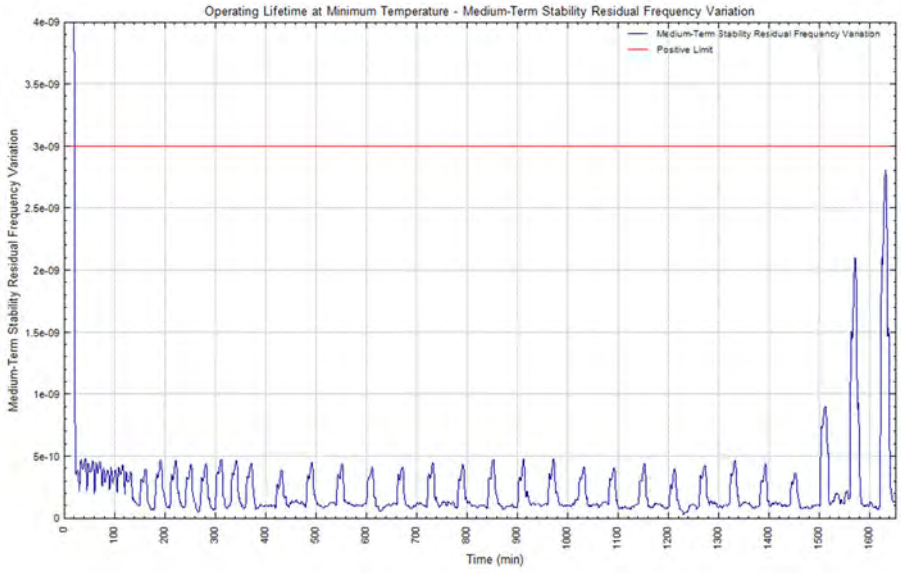
Short Term Stability



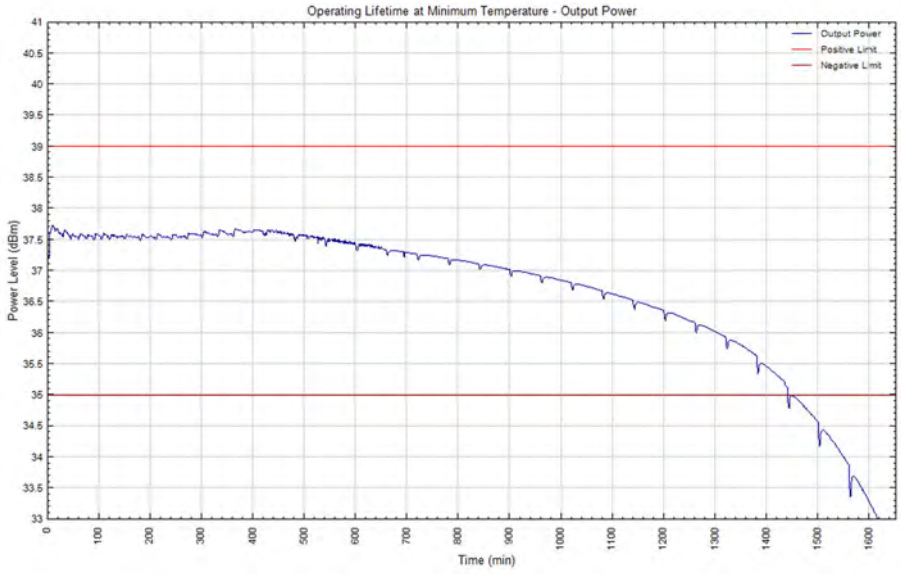
Medium term Stability – Slope



Medium Term Stability – Residual



Output Power

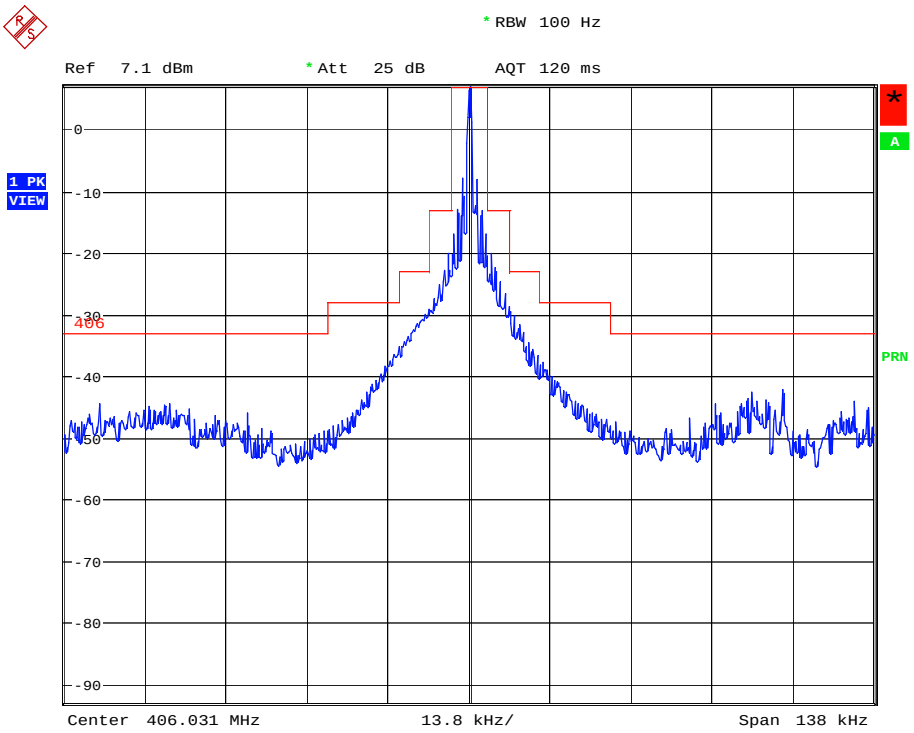


Digital Message

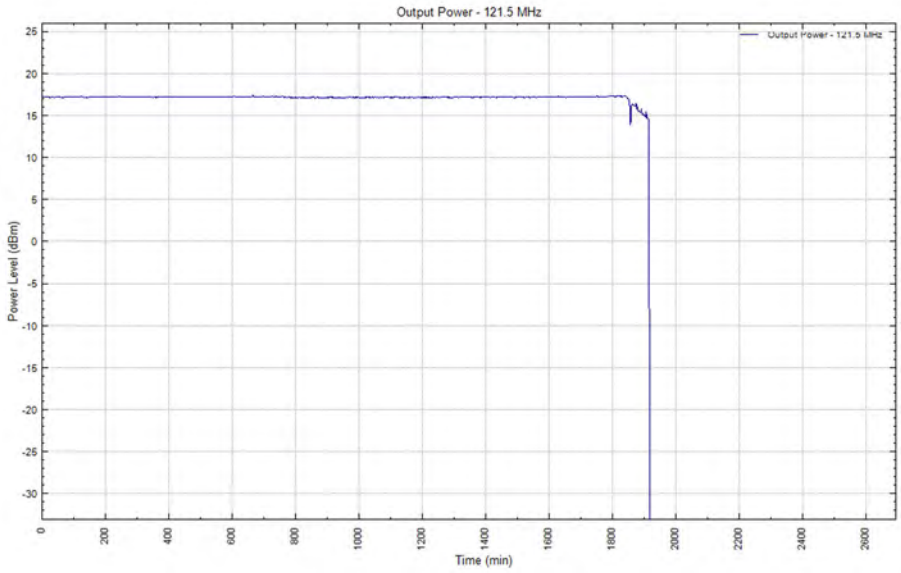
Message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C		
Hex ID	193C000000FFBFF		
Position	None - Default Values		
Parameter	Bit	Data Bits	Decoded Value
Bit synchronization	1-15	111111111111111	111111111111111
Frame synchronization	16-24	000101111	000101111
Format Flag	25	1	1
Protocol Flag	26	0	0
Country Code	27-36	0011001001	Albania (Republic of)
Protocol Code	37-40	1110	Standard Test Location Protocol
Undefined	41-64	000000000000000000000000	000000000000000000000000
N/S	65	0	Default
Latitude Degrees	66-72	1111111	Default
Latitude Minutes	73-74	11	Default
E/W	75	0	Default
Longitude Degrees	76-83	11111111	Default
Longitude Minutes	84-85	11	Default
BCH Code (21 Bit)	86-106	01001110011110110100	01001110011110110100
Calculated BCH Code (21 Bit)	-	01001110011110110100	01001110011110110100
Supplementary Data Fixed	107-110	1101	1101
Encoded Position Data Source	111	1	Internal
121.5 MHz Homing	112	1	Yes
Delta Latitude +/-	113	1	Default
Delta Latitude Minutes	114-118	00000	Default
Delta Latitude Seconds	119-122	1111	Default
Delta Longitude +/-	123	1	Default
Delta Longitude Minutes	124-128	00000	Default
Delta Longitude Seconds	129-132	1111	Default
BCH Code (12 Bit)	133-144	011001101100	011001101100
Calculated BCH Code (12 Bit)	-	011001101100	011001101100

Table 40

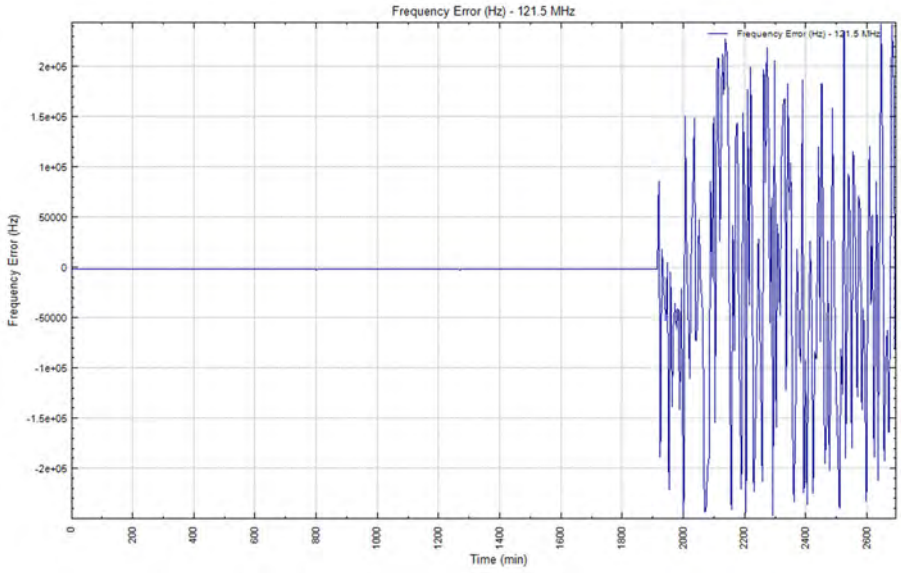
406MHz Spurious



121MHz Homing Transmitter – Output Power



121MHz Homing Transmitter – Nominal Frequency



Battery Current Measurements

System Configuration → / Operational Mode ↓	A, No Ancillaries
1, Standby	**A1**
2, ON at EUT switch (GPS Search)	**A2**
3, ON at EUT (GPS Sleep)	**A3**
4, ON at EUT (Average)	**A4**
5, Self-test	**A5**
6, GNSS Self-test	**A6**
7, Programme Mode (Test Button Held)	**A7**
8, Programme Mode (Test Button Released)	**A8**

Table 41

Beacon Operating Modes	Mode: Manually selectable or Automatic	Measurement interval, sec	Average Current, mA	Peak Current, mA
A1	A	599.9	6.509E-07	0.0000124
A2	M	221.8	46.03	1549
A3	M	221.8	33.36	1540
A4	M	443.5	39.69	1549
A5	M	13.76	74.77	1387
A6	M	106.4	26.2	1401
A7	M	30.33	19.88	21.63
A8	M	57.35	21.35	27.64

Table 42

Operating Lifetime Battery Pre-discharge Calculation

Characteristic	Designation	Units	Value	Comments
Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon)	T_{CS} or TCS	Years	1	
Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon)	T_{BR} or TBR	Years	10	
Battery pack electrical configuration	-	-		
Cell model and cell chemistry	-	-		
Nominal cell capacity	-	Ah	1.4	
Nominal battery pack capacity	C_{BN}	Ah	1.4	
Annual battery cell capacity loss (self-discharge) due to aging, as specified by cell manufacturer at ambient temperature	L_{SDC}	%	1	
Calculated battery pack capacity loss due to self-discharge: $L_{CBN} = C_{BN} - [C_{BN} * (1 - L_{SDC} /100)^{TBR+TCS}]$	L_{CBN}	Ah	0.1465	
Number of self-tests per year	N_{ST}	-	12	
Average battery current during a self-test	I_{ST}	mA	74.77	
Maximum duration of a self-test	T_{ST}	s	14	Manufacturer Declared Value
Calculated battery pack capacity loss due to self-tests during battery replacement period: $L_{ST} = I_{ST} * T_{ST} * T_{BR} * (N_{ST} / 3600)$	L_{ST}	mAh	34.89	
Maximum Number of GNSS self-tests between battery replacements	N_{GST}	-	20	
Average battery current during a GNSS self-test of maximum duration	I_{GST}	mA	26.2	
Maximum duration of a GNSS self-test	T_{GST}	s	110	Manufacturer Declared Value
Calculated battery pack capacity loss due to GNSS self-tests during battery replacement period: $L_{GST} = I_{GST} * T_{GST} * (N_{GST} / 3600)$	L_{GST}	mAh	16.011	
Average stand-by battery pack current	I_{SB}	mA	0.00000065	
Other Capacity Losses	L_{OTH}	mAh	3.4	Programming
Battery pack capacity loss due to constant operation of circuitry prior to beacon activation: $L_{ISB} = I_{SB} * T_{BR} * 8760$	L_{ISB}	mAh	0.0569	
Calculated value of the battery pack pre-test discharge $L_{CDC} = L_{CBN} + ((L_{ST} + L_{GST} + L_{ISB})/1000) + (L_{OTH}/1000)$	L_{CDC}	Ah	0.2009	
Method of discharge	-	-	Pre-test Operating Duration	A3 (worst case)
Discharge current	L_D	mA	33.36	Worst Case
Discharge duration, $T_D = L_{CDC} / (L_D * 1000)$	T_D	h	6.02	

Table 43

Self-Test

Ambient Temperature

Message	FFFED08C9E0000007FDFFA79ED37		
Hex ID	193C000000FFBFF		
Position	None - Default Values		
Parameter	Bit	Data Bits	Decoded Value
Bit synchronization	1-15	111111111111111	111111111111111
Frame synchronization	16-24	011010000	011010000
Format Flag	25	1	1
Protocol Flag	26	0	0
Country Code	27-36	0011001001	Albania (Republic of)
Protocol Code	37-40	1110	Standard Test Location Protocol
Undefined	41-64	00000000000000000000000000	00000000000000000000000000
N/S	65	0	Default
Latitude Degrees	66-72	1111111	Default
Latitude Minutes	73-74	11	Default
E/W	75	0	Default
Longitude Degrees	76-83	11111111	Default
Longitude Minutes	84-85	11	Default
BCH Code (21 Bit)	86-106	01001111001111010100	01001111001111010100
Calculated BCH Code (21 Bit)	-	01001111001111010100	01001111001111010100
Supplementary Data Fixed	107-110	1101	1101
Encoded Position Data Source	111	1	Internal
121.5 MHz Homing	112	1	Yes

Table 44

Minimum Temperature

Message	FFFED08C9E0000007FDFFA79ED37		
Hex ID	193C000000FFBFF		
Position	None - Default Values		
Parameter	Bit	Data Bits	Decoded Value
Bit synchronization	1-15	111111111111111	111111111111111
Frame synchronization	16-24	011010000	011010000
Format Flag	25	1	1
Protocol Flag	26	0	0
Country Code	27-36	0011001001	Albania (Republic of)
Protocol Code	37-40	1110	Standard Test Location Protocol
Undefined	41-64	00000000000000000000000000	00000000000000000000000000
N/S	65	0	Default
Latitude Degrees	66-72	1111111	Default
Latitude Minutes	73-74	11	Default
E/W	75	0	Default
Longitude Degrees	76-83	11111111	Default
Longitude Minutes	84-85	11	Default
BCH Code (21 Bit)	86-106	01001111001111010100	01001111001111010100
Calculated BCH Code (21 Bit)	-	01001111001111010100	01001111001111010100
Supplementary Data Fixed	107-110	1101	1101
Encoded Position Data Source	111	1	Internal
121.5 MHz Homing	112	1	Yes

Table 45

Maximum Temperature

Message	FFFED08C9E0000007FDFFA79ED37		
Hex ID	193C000000FFBFF		
Position	None - Default Values		
Parameter	Bit	Data Bits	Decoded Value
Bit synchronization	1-15	111111111111111	111111111111111
Frame synchronization	16-24	011010000	011010000
Format Flag	25	1	1
Protocol Flag	26	0	0
Country Code	27-36	0011001001	Albania (Republic of)
Protocol Code	37-40	1110	Standard Test Location Protocol
Undefined	41-64	000000000000000000000000	000000000000000000000000
N/S	65	0	Default
Latitude Degrees	66-72	1111111	Default
Latitude Minutes	73-74	11	Default
E/W	75	0	Default
Longitude Degrees	76-83	11111111	Default
Longitude Minutes	84-85	11	Default
BCH Code (21 Bit)	86-106	01001110011110110100	01001110011110110100
Calculated BCH Code (21 Bit)	-	01001110011110110100	01001110011110110100
Supplementary Data Fixed	107-110	1101	1101
Encoded Position Data Source	111	1	Internal
121.5 MHz Homing	112	1	Yes

Table 46

Parameters to be Measured	Range of Specification	Units	Test Results		
			Tmin	Tamb	Tmax
			(-20°C)	(+21°C)	(+55°C)
8(a). Self-test Mode					
Model: PLB-425, S/N: #10, TUV Ref: TSR20 and Modification State 3					
Frame sync	011010000	P / F	P	P	P
Format flag	1 / 0	bit value	1	1	1
Single radiated burst	≤440 / 520 (±1%)	ms	441.205	440.807	440.962
Default position data (if applicable)	correct	P / F	P	P	P
Single burst verification	one burst	P / F	P	P	P
Provides for 15 Hex ID	correct	P / F	P	P	P
121.5 MHz RF power (if applicable)	verify that RF power emitted	P / F	P	P	P
121.5 MHz transmission	≤ 1 sec/ 3 sweeps	P	P	P	P
406 MHz power	verify that RF power emitted	P / F	P	P	P
Distinct indication of Self-Test	provided	Y / N	Y	Y	Y
Distinct indication of RF power being emitted	provided	Y / N	Y	Y	Y
Indication of Self-Test result	provided	Y / N	Y	Y	Y
Distinct indication of insufficient battery capacity	provided	Y / N		Y	
Automatic termination of Self-Test mode upon completion of Self-Test and indication of Self-Test results	verify automatic termination	Y / N	Y	Y	Y

Table 47

2.11.7 Test Location and Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Power Meter	Hewlett Packard	436A	83	12	26-Sep-2019
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Signal Generator	Hewlett Packard	8644A	199	12	27-Apr-2019
Spectrum Analyser	Agilent Technologies	E7405A	1410	12	13-Sep-2019
Distress Beacon RF Unit	TUV SUD Product Service	-	2445	-	TU
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	19-Feb-2019
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	23-Oct-2019
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	2-Aug-2019
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	18-Jul-2019
Power Sensor	Agilent Technologies	8482A	3290	12	19-Apr-2019
Bandpass Filter	Trilithic	5BE121.55/35-3-BA	3411	12	12-Oct-2019
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	11-May-2019
Meter & T/C	R.S Components	Meter 615-8206 & Type K T/C	3612	12	25-Sep-2019
ScopeCorder	Yokogawa	DL750	4175	12	29-Jan-2019
Time Interval Analyser	Yokogawa	TA720	4550	12	14-Mar-2019
Bandpass Filter (1MHz)	KR Electronics	3219-SMA	4602	12	3-Sep-2019
Cable (18GHz)	Rosenberger	LU7-036-1000	5025	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5026	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5031	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5033	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-071-2000	5110	12	5-Oct-2019

Table 48

2.12 Cospas-Sarsat Type Approval

2.12.1 Specification Reference

RTCM 11010.3, Clause A.14

Refer to TUV SUD document 75943114 Report 01.

See also Annex B for limited Cospas-Sarsat testing.

2.13 Buoyancy test

2.13.1 Specification Reference

RTCM 11010.3, Clause A.15

2.13.2 Equipment Under Test and Modification State

PLB-425, S/N: #1 (TSR19) - Modification State 2
PLB-400, S/N: #9 (TSR22) - Modification State 2

2.13.3 Date of Test

15 January 2019 and 18 January 2019

2.13.4 Test Method

The buoyancy was calculated by dividing the volume of the unit above the waterline by the total volume of the EUT.

Buoyancy (%) = (((b) - (a)) / (b))

a) =Volume of EUT displaced when floating (ml)
b) =Volume of EUT displaced when fully submerged (ml)

The mass of the volume displaced was measured using bench top scales.

2.13.5 Environmental Conditions

Ambient Temperature	23.4 – 25.5 °C
Relative Humidity	30.5 – 26.9 %

2.13.6 Test Results

TSR 19
Displaced 151.28g (a) when floating in a cylinder.
Displaced 166.88g (b) when submerged in a cylinder.
Buoyancy = (((b) - (a)) / (b)) x 100 = 9.3%

TSR 22
Displaced 146.19g (a) when floating in a cylinder.
Displaced 161.79g (b) when submerged in a cylinder.
Buoyancy = (((b) - (a)) / (b)) x 100 = 9.6%

2.13.7 Test Location and Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Bench Scales	Kern-Sohn	CKE16K0.05	4647	12	28/03/2019

Table 49

2.14 121.5 MHz Auxiliary Radio-Locating Device Transmitter Test

2.14.1 Specification Reference

RTCM 11010.3, Clause A.16

2.14.2 Equipment Under Test and Modification State

PLB-425, S/N: #7 (TSR23) - Modification State 2
PLB-425, S/N: #10 (TSR20) - Modification State 2

2.14.3 Date of Test

13 November 2018 – 28 November 2018

2.14.4 Test Method

This test was performed in accordance with the requirements of RTCM 11010.3 clause A.16.

2.14.5 Environmental Conditions

Ambient Temperature	21.5 - 22.0 °C
Relative Humidity	29.1 - 30.6 %

2.14.6 Test Results

All tests carried out on the 121.5 MHz homing transmitter with EUT battery powered.

Carrier Frequency

Temperature	Measured Frequency (MHz)	Frequency Error (ppm)
+23.5 °C	121.49864	-11.19
-20 °C	121.49889	-9.13
+55 °C	121.49789	-17.36

Table 50

RTCM 11010.3, Clause A.16.1

The carrier frequency shall be 121.5 MHz ± 50 ppm.

Modulation Characteristics – Transmitter Duty Cycle

RTCM 11010.3, Clause A.16.2.a

The carrier is not interrupted (except for up to two seconds encompassing the transmission of the 406 MHz pulse plus the additional time required for the Morse "P" transmission).

Modulation Characteristics – Modulation Frequency and Sweep Repetition Rate

Requirement	Result			Unit
	Ambient Temperature	-20	+55	
Lower Audio Frequency	377.94	377.69	379.59	Hz
Upper Audio Frequency	1104.75	1112.63	1121.74	Hz
Range of Audio Frequency	726.81	734.94	745.15	Hz
Sweep Repetition Rate	3.68	3.68	3.69	Hz

Table 51

RTCM 11010.3, Clause A.16.2.b

The Lower and Upper Audio frequencies shall fall within 300 – 1600 Hz, and ≥700 Hz in range. The Sweep Repetition Rate shall be within 2 – 4 Hz.

Modulation Characteristics – Modulation Duty Cycle

Requirement	Result			Unit
	Ambient Temperature	-20	+55	
Modulation Duty Cycle (near start)	33.7	33.2	35.2	%
Modulation Duty Cycle (near midpoint)	35.2	36.5	34.8	%
Modulation Duty Cycle (near end)	34.6	34.6	33.8	%

Table 52

RTCM 11010.3, Clause A.16.2.c

The modulation duty cycle shall be between 33% and 55%.

Modulation Characteristics – Modulation Factor

Requirement	Result			Unit
	Ambient Temperature	-20	+55	
Modulation Factor	0.957	0.969	0.945	No Unit

Table 53

RTCM 11010.3, Clause A.16.2.d

The modulation factor shall be between 0.85 and 1.0.

Modulation Characteristics – Frequency Coherence

Parameter	Result			Unit
	Ambient Temperature	-20	+55	
Total (Wideband) Power	17.41	17.47	17.18	dBm
Power within the resolution bandwidth	13.96	14.94	14.10	dBm
Percentage of Power within resolution bandwidth	45.19	55.85	52.84	%

Table 54

Remarks

The frequency error was recorded in table 19 and did not exceed an error of 30 Hz.

RTCM 1010.2, Limit Clause A.16.2(e)

Measurements must be made to show that at least 30% of the total power emitted during any transmission cycle with or without modulation shall be contained within ± 30 Hz of the carrier frequency. Additionally, if the emission is interrupted by the transmission of the 406 MHz burst, the carrier frequency must not shift more than ± 30 Hz.

Modulation Characteristics – Morse Letter P

RTCM 11010.3, Clause A.16.2.f

Requirement	Result			Unit
	Ambient Temperature	-20	+55	
Morse Code P - Dot Length	114.96	113.76	117.80	ms
Morse Code P - Dash Length	344.19	345.83	350.00	ms
Morse Code P - Gap Length	115.80	115.88	110.04	ms
Morse Code P - Modulating Frequency	1.0028	1.0023	1.0022	kHz

Table 55

A16.3 PEIRP (On Ground Plane, Peak EIRP)

Azimuth (º)	PEIRP (mW)
	Elevation (6.5º)
0	53.0
30	54.2
60	51.8
90	51.8
120	50.6
150	49.4
180	47.2
210	47.2
240	48.3
270	51.8
300	51.8
330	51.8
Median PEIRP	51.8
Maximum to Minimum Ratio (dB)	0.6

Table 56

A16.4 Off Ground Plane Radiated Power Test

Azimuth (º)	PEIRP (mW)
	Elevation (5º)
0	5.0
90	8.9
180	3.7
270	5.8
Minimum PEIRP	3.7

Table 57

2.14.7 Test Location and Test Equipment Used

The EIRP test was carried out in OATS (EMC Hursley).
All other tests were carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Antenna, (Tuned Dipole Set)	Roberts Antenna	A-100	569	-	TU
Spectrum Analyser	Agilent Technologies	E7405A	1410	12	13-Sep-2019
Hygrometer	Rotronic	I-1000	3220	12	13-Sep-2019
Attenuator (10dB)	Weinschel	47-10-34	481	12	18-Jul-2019
Termination (50ohm, 1W)	Suhner	50ohm 1W	3080	12	18-Jul-2019
Hygrometer	Rotronic	I-1000	3220	12	13-Sep-2019
Oscilloscope	Agilent Technologies	DSO9104A	4142	12	19-Jul-2019
EXA	Keysight Technologies	N9010B	4969	12	21-Dec-2018
Cable (18GHz	Rosenberger	LU7-036-1000	5030	-	O/P Mon

Table 58

TU – Traceability Unscheduled

2.15 Solar Radiation

2.15.1 Specification Reference

RTCM 11010.3, Clause A.17

Manufacturer Waiver – See Annex A.

2.16 Oil Resistance

2.16.1 Specification Reference

RTCM 11010.3, Clause A.18

Manufacturer Waiver – See Annex A.

2.17 Compass Safe Distance

2.17.1 Specification Reference

IEC 60945, Clause 2.7 (IEC60945 Clause 11.2)

2.17.2 Equipment Under Test and Modification State

PLB-425, S/N: #7 (TSR23) - Modification State 2

2.17.3 Date of Test

16 November 2018

2.17.4 Test Method

A wooden table aligned E-W was used with a compass set in the centre, aligned to read zero. The table was marked to give a graduated scale of distance. The EUT was moved towards the compass until a deviation of 0.3° was obtained.

Each orientation of the EUT was tested in this manner with the measurement distance between the compass centre and the EUT being noted.

The test was repeated with readings taken when the compass gave a steering deviation of 0.9°.

The local area Magnetic Flux density (H) at the site of testing was 20.6 uT.

The above testing was performed three times with the EUT as follows:

a. Unpowered.
b. Normalised.
c. Power applied.

Prior to performing the tests in accordance with part b above, the EUT was normalised by placing it into Helmholtz Coil Assembly and subjecting it to a magnetic field of 79A/m.

The test was applied in accordance with the test method requirements of IEC 60945.

Test Setup

2.17.5 Environmental Conditions

Ambient Temperature	20.0 °C
Relative Humidity	35.0 %

2.17.6 Test Results

Magnetometer Reading and Calculations

Horizontal Maximum Flux Density, Magnetic North (H)	Standard Compass Deviation Limit (5.4/H in Degrees)	Emergency Compass Deviation Limit (18/H in Degrees)
20.2	0.3	0.9

Table 59

EUT In Unpowered State

EUT Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Front	170	170
Top	170	170
Left Hand Side	170	170
Right Hand Side	240	170**
Underside	170**	170**
Rear	170**	170**

Table 60

EUT In Normalised State

EUT Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Front	170**	170**
Top	210	170**
Left Hand Side	170	170**
Right Hand Side	300	170**
Underside	170**	170**
Rear	170**	170**

Table 61

** EUT reached the compass boundary without deflecting the compass by the deviation limit.

EUT In Powered State

EUT Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Front	340	170**
Top	170	170**
Left Hand Side	170	170**
Right Hand Side	400	170
Underside	170	170**
Rear	170**	170**

Table 62

** EUT reached the compass boundary without deflecting the compass by the deviation limit.

Final Results

Standard Compass Safe Distance (mm)	Emergency Compass Safe Distance (mm)
400	200

Table 63

2.17.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Magnetometer	Bartington	MAG01	671	36	5-Jun-2021
Compass Verification Unit	TUV SUD Product Service	CVU	3579	-	TU
Marine Binnacle Compass with Repeater Display	Cassens & Plath	Compass: Type 11	3834	-	TU

Table 64

2.18 Miscellaneous Test

2.18.1 Specification Reference

RTCM 11010.3, Clause A.20

2.18.2 Equipment Under Test and Modification State

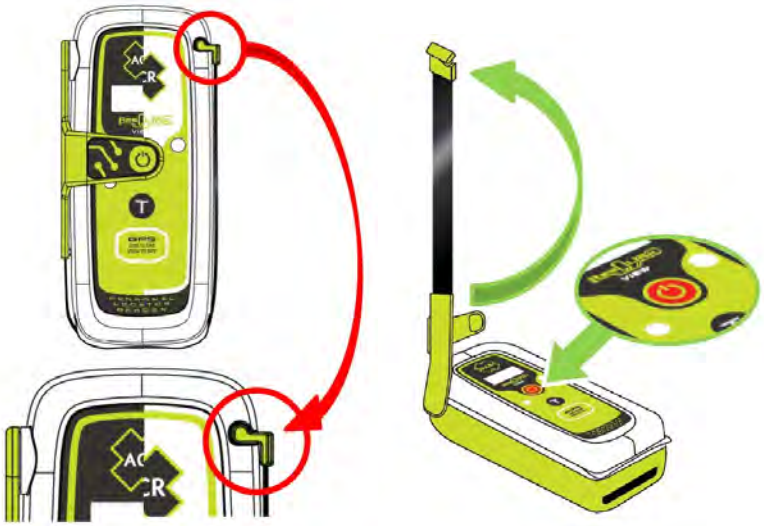
PLB-425, S/N: #7 (TSR23) - Modification State 2
Beacon manual: (Y1-03-0343 Rev. T1 - TUV Version.doc)
Beacon Labels & Markings: (A1-20-2006T4DASH.pdf, A1-20-2007T2.pdf, A1-20-2008T3DASH.pdf, A1-20-2011T2.pdf)
Battery Cell Specifications: (AAD4000PE11 Battery Cell Spec.pdf)
Label drawing: A1-20-2016ADASH (002).pdf

A later document version (Revised EUT rear label ref A1-20-2008B.pdf) was supplied 05 March 2019 and where revised labelling checks have been made a note is recorded alongside the relevant data.

2.18.3 Date of Test

7 January 2019 – 06 March 2019

2.18.4 Test Results

A.20 Miscellaneous		
Sub clause	Statement	Comment
A.20.1 Controls and Indicators		
	The PLB shall be inspected to ensure that all the requirements of paragraph 4.3.1 to 4.3.4 are met. All controls shall be operated by a person wearing gloves or mittens from an IMO SOLAS compliant immersion suit. The inspection shall ensure that if there is a tamper proof seal it is not counted as one of the two independent actions required to activate the PLB. The means to indicate that the PLB may have been previously activated shall be checked either visually or by operation of the device in accordance with the manufacturer's instructions, a clear means of visible or audible indication shall be apparent.	The EUT was operated by a TUV SUD engineer wearing an immersion suit glove. The EUT is activated by firstly unclipping the antenna clip and then rotating the antenna into a vertical position. The ON/OFF switch should then be depressed for 1 second to activate the beacon.  The EUT does not include a tamper proof seal.

A.20 (4.3.1)	Controls and Indicators	
A.20 (4.3.1)	All controls shall be clearly and durably marked. 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 and if applicable, activation cancellation of the PLB. Activation of the [the PLB] shall not require the use of two hands. The PLB shall be provided with a means to indicate when it may no longer meet the operational lifetime requirement as a part of the self-test function; see section 4.3.5.3. 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 an immersion suit mitten or glove All PLBs shall have integral manual controls to operate the device in the following modes as a minimum (note Cancellation only applies to SGB PLBs): • OFF - In the OFF mode, the PLB is deactivated. • ON - In the ON mode, the PLB is activated. • TEST - See Sections 4.2.8 and 4.3.5. • CANCELLATION - Deactivates the PLB, but also sends a specific cancellation message used in the case of a false alert / activation (if applicable) On Category 2 PLBs there shall not be a manual control to enable and disable the AIS signal. A positive visual and/or audible indication that the PLB is activated shall be provided which shall commence within 1 second of activation and shall continue at regular intervals which are easily discernible to the user all the time that the PLB is active and transmitting at least one signal. If the PLB ceases to transmit all signals, then this indication shall cease. The manufacturer may if they wish, include additional modes of indication or additional indicators to further quantify the operation of the various transmitted signals.	The EUT has two physical buttons: An ON/OFF button and a combined SELF-TEST / GNSS SELF TEST button labelled both with the following symbols.  ON/OFF  SELF-TEST / GNSS SELF-TEST The three independent actions for activation are: Unclip the antenna. Rotate the antenna. Depress the ON button (as shown in previous illustration). DESCRIBE LED / ACTIONS DURING ACTIVATION (DISPLAY). The strobe light will flash twice to let you know the beacon has been activated. The strobe light will then continue to flash once every 3 seconds for the entire time the beacon is activated. The red light will flash once every 2.5 seconds prior to the beacon acquiring your GPS coordinates. Once the beacon acquires the GPS coordinates, the green light will flash once every 2.5 seconds and red light will extinguish. When the red LED is replaced by the green LED, this is an indication that the beacon has successfully downloaded the GPS coordinates and is transmitting them along with the 406 MHz distress signal. The display gives a visual feedback of the EUT status, performance and required actions. (Model PLB 425) It is possible to activate the EUT with one hand. The physical controls relating to the 406 MHz feature of the device are few in number (as per above). The EUT was operated by a TUV SUD engineer wearing an immersion suit glove. Category 2 requirements are not applicable to this category 1 beacon.
A.20.2	Category 2 Group 3 PLB Functionality	
	Not Applicable	Not Applicable

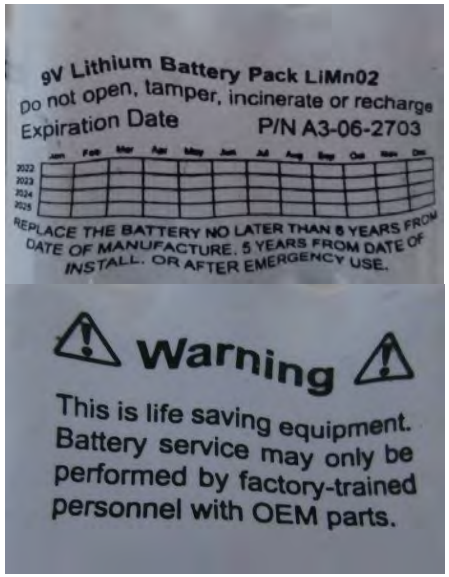
A.20.3 Self-test and GNSS Self Test Function		
	The self-test mode of the PLB shall be activated. The automatic reset of the test facility and the indication of the self-test mode shall be checked by inspection. The manufacturer's declaration as to the functioning of the self-test mode shall be checked for compliance with paragraph 4.3.5. The GNSS Self-test function as defined in paragraph 4.3.5 shall be checked by inspection to ensure that it is operated by a Distinct Operation, prevents Inadvertent Operation, is provided with Pass and Fail indications.	The EUT includes a combined 406 MHz / 121.5 MHz Self- test mode. To perform a SELF-TEST depress the "Test" button for 2 seconds and the green LED will illuminate. The green LED will then give two 1/2 second green led illuminations indicating that 406MHz and 121MHz was transmitted. A third Long green LED illumination is then followed by a strobe light. To perform a GNSS SELF-TEST depress the "Test" button for 5 seconds and the green LED will illuminate once to show the start of the GNSS test followed by 3 quick green LED illuminations. A long red LED illumination is repeated every 3 seconds until GNSS acquisition has occurred. Once valid GNSS data has been obtained, a short green illumination followed by a long green LED illumination will be observed followed by a flash of the strobe light indicating a successful GNSS self-test. If the beacon cannot acquire a GNSS fix a long red LED flash appears after 125 seconds. If the number of GNSS SELF-TEST have been exceeded the GNSS self-test function will be disabled by the beacons internal software. **Digital Display Feedback During a Passed Self-Test** ACR: The ACR logo appears indicating that the Beacon Self-Test has been initiated. SELF TEST PASS: The system performs a thorough testing of the beacon's functionality and all tests pass. **Digital Display Feedback When Battery is Low** ACR: Beacon Self-Test has been initiated, and the ACR Electronics Welcome Page appears. SELF TEST FAIL: The system checks the available hours of battery life (battery witness seal). If more than one hour of battery life has been used, this Self-Test Fail message is displayed. The system provides a low battery warning indicating that the beacon is due for a battery replacement. The battery can be replaced by ACR or an ACR Authorized Battery Replacement Center (visit www.acrartex.com and select the "Dealer Locator" option in the "Support" section of the site. **Digital Display Feedback During a Failed Self-Test** ACR: Beacon Self-Test has been initiated, and the ACR Electronics Welcome Page appears. SELF TEST FAIL: The system performs a thorough testing of the beacon's functionality and displays this message if any of the tests fail. The beacon should be returned to ACR Electronics.

A.20.3 (4.3.5)	Self-test and GNSS Self Test Function	
	A separate test switch(es) or switch position(s) is/are required for this function, such that it cannot be combined with the on 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. The GNSS self-test function shall be initiated by a distinctly different action to that required to initiate the regular self-test function. Self-test performance shall be as specified in section 4.2.8. 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.	The beacon has a dedicated self-test button.  The EUT includes a combined 406 MHz / 121.5 MHz Self- test mode.

A.20.3 (4.3.5.1)	Self-test with PLB dry	
A.20.3 (4.3.5.1)	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. b) Each self-test pass/fail indicator correctly identifies a fail condition when a failure in the monitored function has been induced. c) Any transmission in either self-test mode is limited to one burst. d) The GNSS Self-test mode shall be tested to verify that under worst case conditions (no GNSS reception or input) it is limited in duration and number as defined in section 4.2.8.2. e) It shall be verified that inadvertent activation of the GNSS self-test mode is precluded. f) The GNSS Self-test mode shall be tested to ensure the correct operation of the GNSS Self-Test pass/fail indicator(s) and the transmission of a correct and valid position in both the 406 MHz and AIS (if applicable) transmissions.	Manufacturer supplied information – see Annex A.
A.20.3 (4.3.5.2)	Self-test with PLB wet	
	The proper self-test function shall be verified by the manufacturer by carrying out a self-test in accordance with the manufacturer's instructions with the PLB initially at the maximum operating temperature and after the PLB has been immersed in a 35 parts per thousand solution of cold salt water to a depth over the PLB of at least 10 cm for a duration of at least 10 seconds. The water bath shall be at a temperature of 10 °C or cooler. Immediately after removal from the water bath the PLB shall be held (without shaking or drying) for between 5 and 10 seconds in each of 3 orthogonal orientations to allow water to drain from any recesses in the PLB case. Immediately after this, a self-test shall be successfully performed.	Manufacturer supplied information – see Annex A.

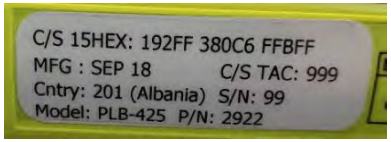
A.20.4 Battery		
	The manufacturer shall provide evidence that the primary battery used to power the PLB is not hazardous to personnel as required by paragraph 4.3.6. The manufacturer shall provide evidence that the design of the PLB includes measures to protect the batteries from reversal of polarity, shorting, self heating, cell-to-cell charging and forced discharging. The manufacturer shall declare the useful life of the battery and its expiration date and provide evidence to support these as required by paragraph 4.3.6. The battery shall be inspected to ensure that all the labelling requirements of paragraph 4.5.1 are met. The manufacturer shall provide evidence that the battery and the cells making up the battery are either exempt from testing or have been tested to the United Nations Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, Fourth Revised Edition, PART III, Section 38.3 (ST/SG/AC.10/11/Rev.4) as amended.	The Manufacturer provided document AAD4000PE11 Battery Cell Spec.pdf

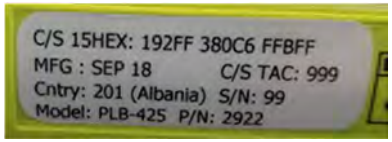
A.20.4 (4.3.6)	Battery	
A.20.4 (4.3.6)	The PLB shall have its own primary (non-rechargeable) battery and shall not depend upon any external source of power for its operation when activated. The battery shall be an integral part of the equipment. Replacement of the battery, if user-replaceable, should 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. 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. b) During a charge or forced discharge of a cell or cells by another cell or cells within the battery. c) After a full or partial discharge. 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 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 +20C ±5C): 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. 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.	The device has its own primary non-rechargeable battery source. The battery pack is an integral part of the EUT. The battery pack is not user replaceable. The batteries connectors are keyed and as such can only be connected to the EUT in the correct orientation. The Manufacturer provided document AAD4000PE11 Battery Cell Spec.pdf with respect to battery chemistry / handling etc. Manufacturer supplied information – see Annex A.

A.20.4 (4.5.1)	Battery Labelling	
A.20.4 (4.5.1)	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 battery is not user accessible.  Battery type & Voltage. Expiry / Replacement field is on the PLB label
A.20.5 General Construction		
	The PLB shall be inspected to ensure that it has no sharp edges or points, likely to cause injury to persons or damage to inflatables or similar survival equipment.	The EUT was inspected with a Sharp Edge tester. The result indicated that there were no sharp edges present.
A.20.6 Exterior Finish		
	The PLB shall be inspected to ensure that the exterior finish complies with the requirements of paragraph 4.4.1.	See below.
A.20.6 (4.4.1)	Exterior Finish	
A.20.6 (4.4.1)	The PLB case shall be predominantly a highly-visible yellow/orange colour.	The PLB is ACR-treuse™ (high visibility yellow)

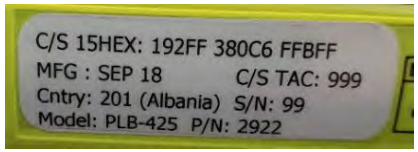
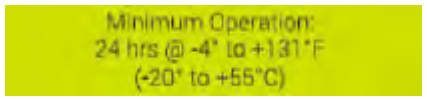
A.20.7 Labelling		
	The labelling of the exterior of the PLB and any labelling permanently attached to the PLB shall be inspected to ensure that they comply with the requirements of paragraphs 4.5.2.2 to 4.5.2.4. All labelling on the exterior of the PLB shall be tested for abrasion resistance by the manufacturer who shall present evidence of the suitability of the labelling to last for at least the stated battery shelf life of the beacon, ideally this should be in the form of test results obtained using a recognized abrasion test method.	Abrasion test - Manufacturer supplied information – refer to Annex A. Revised EUT rear label ref A1-20-2008B.pdf (supplied 05 March 2019). 

A.20.7 Labelling		
	Instructions for operating the PLB and any pictographs not already commonly in use shall be tested for comprehension in accordance with an appropriate internationally recognized testing procedure (i.e.: ISO, ANSI, ASTM) or a manufacturer may demonstrate the comprehensibility of the instruction or pictograph by the success of at least 4 out of a set of 5 randomly selected naive test subjects demonstrating compliance with or understanding of, as appropriate, the instructions.	The following operating instructions and pictographs are provided (via adhesive labels) on the EUT:  Out of the 5 test subjects 1 moved the antenna passed the required 90° angle. All other test subjects correctly followed each of the steps as pictorially described.
A.20.7 (4.5.2)	PLB Labelling	
A.20.7 (4.5.2)	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. All labelling essential to the safe and effective operation of the PLB shall be in high contras t 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. 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.)	Solar Radiation: Refer to Annex A. Corrosion: Refer to Annex A. Oil Resistance: Refer to Annex A. The operating instructions for the PLB provide a basic pictorial description on a label attached to the side of the beacon It was not possible to read all of the essential operating instructions when in a darkened room with illumination no greater than 0.3 Lux. The GPS antenna location label is located on the bottom of the face of the PLB:  The LCD display on the beacon indicates when the GNSS receiver is attempting to acquire a GNSS signal whilst also reminding the user to position the beacon so that it has a clear view of the sky. Once a GNSS fix is acquired the GNSS coordinates are displayed.

A.20.7 (4.5.2.1)	Labelling on the PLB	
A.20.7 (4.5.2.1)	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. b) The warning, or equivalent: WARNING USE ONLY IN SITUATIONS OF GRAVE AND IMMINENT DANGER c) The warning, or equivalent: NOTICE TO THE PUBLIC DO NOT MOVE IF FOUND REPORT POSITION TO AUTHORITIES 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. e) The serial number of the PLB.	The following label items / instructions were identified on the EUT a) Basic operating instructions for emergency mode activation.  b) The warning, or equivalent: WARNING USE ONLY IN SITUATIONS OF GRAVE AND IMMINENT DANGER is printed on the rear label of the EUT. Revised EUT rear label ref A1-20-2008B.pdf (supplied 05 March 2019).  c) The warning, or equivalent: NOTICE TO THE PUBLIC: IF FOUND DO NOT MOVE. REPORT POSITION TO AUTHORITIES is printed on the rear label of the EUT. Revised EUT rear label ref A1-20-2008B.pdf (supplied 05 March 2019).  d) The unique identification label shown below can be found on a label attached to the side of the EUT:  e) The serial number of the device: the serial number label of the EUT can be found on the back of the EUT, (see above).

A.20.7 (4.5.2.1)	Labelling on the PLB	
A.20.7 (4.5.2.1)	f) Instructions to register the PLB with the appropriate authority and the contact details of the authority.	f) Instructions to register the device with the appropriate authority is present on the rear label. Revised EUT rear label ref A1-20-2008B.pdf (supplied 05 March 2019). 
	g) Space for any required registration sticker.	g) Space for any required registration sticker: The registration label can be found on the back of the PLB: See f)
	h) Any additional labelling requirements required by Cospas-Sarsat within C/S T.001 and/or C/S T.018 as applicable and as required on PLBs by 47 CFR Part 95 FCC part 95.2993: (1) The owner of this 406 MHz PLB must register the identification code on this label with the National Oceanic and Atmospheric Administration (NOAA) whose address is: NOAA/SARSAT Beacon Registration, NSOF, E/SPO53, 1315 East West Hwy., Silver Spring, MD 20910–9684. (2) For PLBs with identification codes that can be changed after manufacture, the identification code shown on the plate or label must be easily replaceable using commonly available tools.	h) (1) See f). (2) The identification codes are indicated on a removable / replaceable label. 

A.20.7 (4.5.2.1)	Labelling on the PLB	
A.20.7 (4.5.2.1)	§ 2.925 Identification of equipment. (a) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following: (1) FCC Identifier consisting of the two elements in the exact order specified in § 2.926. The FCC Identifier shall be preceded by the term FCC ID in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification. i) The battery expiration date determined in accordance with section 4.3.6.	The FCC ID can be found on the rear label of the beacon. Revised EUT rear label ref A1-20-2008B.pdf (supplied 05 March 2019).  i) The battery expiration date determined in accordance with section 4.4.3: 

A.20.7 (4.5.2.2)	Attached labelling	
A.20.7 (4.5.2.2)	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” a) The identification of the manufacturer.	a) The manufacturer’s identification is shown on the front face of the beacon. The Manufactures identification is also shown on the antenna but this is not very visual. 
A.20.7 (4.5.2.2)	Attached labelling	
A.20.7 (4.5.2.2)	b) The PLB type number or model identification under which it was type tested. c) The temperature operating range in degrees Celsius and Fahrenheit of the PLB.	b) The name PLB-425 can be identified on the side of the beacon.  c) The operating temperatures can be found on the back of the beacon in both degrees Celsius and Fahrenheit. Revised EUT rear label ref A1-20-2008B.pdf (supplied 05 March 2019). 

A.20.7 (4.5.2.2)	Attached labelling	
A.20.7 (4.5.2.2)	d) 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). e) The phone number(s) to be used to report inadvertent activation negating the need for the distress alert.	d) A GPS antenna label can be found on the front face of the beacon, indicating that the area must “GIVE CLEAR VIEW TO SKY”:  e) There is a telephone number to be used to report inadvertent activation negating the need for the distress alert found on the rear of the beacon. Revised EUT rear label ref A1-20-2008B.pdf (supplied 05 March 2019). 
A.20.7 (4.5.2.3)	Attached labelling	
A.20.7 (4.5.2.3)	For Category 2 PLBs The outside of the PLB shall be marked indelibly and legibly with a warning label that states “WILL NOT FLOAT.”	Not Applicable
A.20.7 (4.5.2.4)	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.	a) A GPS antenna label can be found on the front face of the beacon, indicating that the area must “GIVE CLEAR VIEW TO SKY”: 

A.20.7 (4.5.2.4)	b) A positive visual and/or audible indication that the GNSS receiver has acquired a location. 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”	b) The LCD display on the beacon indicates when the GNSS receiver is attempting to acquire a GNSS signal whilst also reminding the user to position the beacon so that it has a clear view of the sky. Once a GNSS fix is acquired the GNSS coordinates are displayed.  c) No information is provided on the EUT labelling relating to guiding the operator towards maximizing self-locating performance., however the user manual identifies the following screen information relating to the GPS antenna: 

A.20.8 Documentation		
	The manufacturer shall supply a copy of the operation manual and this shall be inspected to ensure that it complies with the requirements of paragraph 4.6 The manufacturer shall supply a copy of the end user (consumer) packaging (or the labelling for the packaging) and this shall be inspected to ensure that it complies with the requirements of paragraph 4.7	The following documents / labels were briefly reviewed with respect to clause A.20.7 (note: the inspection was provided to confirm the presence of the required information. The accuracy of the instructions was not checked).
A.20.8 (4.6)	Documentation	
	The manufacturer shall provide an operation manual which includes the following: a) Complete instructions for operating the PLB. b) Information on the intended usage and any restrictions on usage applicable to that Category and Group of PLB. c) Cautions and recommendations to prevent false alerts. d) 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. For SGBs instructions on the use of the Cancellation Function in relation to false alerts and when and when not to use it.	The User Manual was briefly inspected as per clause 4.6 and the following was noted with respect to the applicable sub clauses (note: the inspection was provided to confirm the presence of the required information. The accuracy of the instructions was not checked): a) A pictograph activation description and further detailed 'Activating Your Beacon' operating instructions are provided (Y1-03-0343 Rev. T1 - TUV Version.docx) b) The product specifications state that the PLB is "Category 1, Buoyant" The ResQLink is a buoyant PLB but is not intended for operation in water. Intended operational environments include on ground and above ground including held in hand. The activation section also states "Make sure the antenna is pointing towards the sky, out of the water. Beacon is not intended to operate in water. While the unit is waterproof, it must be above the water's surface to function properly." c) Cautions or recommendations to prevent false alerts are provided (Y1-03-0343 Rev. T1 - TUV Version.docx) d) Instructions on actions to be taken in the case of false alerts can be found in the False alerts section of the user manual (Y1-03-0343 Rev. T1 - TUV Version.docx).

A.20.8 (4.6)	Documentation	
A.20.8 (4.6)	e) A warning paragraph with, at a minimum, the information in 4.5.2 and the fact that misuse of a PLB is subject to a fine.	e) The following conditions of 4.5.2 (and the following sub clauses) where met in the User Manual: Operating instructions Warnings (see below) Registration information Identification of the Manufacturer Device model name and name under which it was tested Operating temperature range in degrees Celsius and Fahrenheit Dangerous goods transportation information (Product contains small lithium metal batteries that comply with IATA SP 188-PI 970 Air Cargo. Always check with air carrier concerns for any additional restrictions) Antenna optimization information (clear view to sky, not to hold the device via the antenna, positioning of the device etc) Phone number to report inadvertent activation (toll / toll free status unclear). The warning: The product specifications state that the beacon is a buoyant PLB but is not intended for operation in water. Location of the GPS antenna. The user manual also includes a warning to only use in “SITUATIONS OF GRAVE AND IMMINENT DANGER”, and that “Deliberate misuse of the device could result a penalty” There is a note in the user manual, warning the public not to move if found (as per sub para 4.5.2.1 c)

A.20.8 (4.6)	Documentation	
	f) Instructions on how, when and where to carry out self-tests as recommended by the manufacturer	f) Instructions on when and where to carry out self-tests can be found in the “Testing Your Beacon” section of the user manual: Y1-03-0343 Rev. T1 - TUV Version.docx
	g) General battery information (e.g., battery replacement instructions, battery type, safety information regarding battery use and disposal).	g) General battery information is provided: Replace the battery no later than the battery expiration date specified on the beacon, or after emergency use. At each inspection, check the time remaining until replacement is required. The battery should be replaced if the beacon has been activated for any use other than the self-test/GPS test. Always refer battery replacements and other beacon service to a factory authorized Battery Replacement Centre. The battery can be replaced by ACR or an ACR Authorized Battery Replacement Centre (visit www.acrartex.com and select the “Dealer Locator” option in the “Support” section of the site. CAUTION: Contains lithium batteries. Do not incinerate, puncture, deform, short-circuit or recharge. Do not dismantle the PLB, contains no user-serviceable parts. Dispose of the used PLB with the battery removed in accordance with local waste disposal regulations.
	h) 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.	h) This beacon contains 1 lithium metal battery pack that is less than 0.8 grams. They are not classified as HAZMAT for transportation. Prior to shipping the beacon for service, alert your carriers about the batteries contained in this equipment to make sure they properly label your package. Call ACR’s Technical Service department at +1 (954) 862-2110 for proper shipping instructions or visit the ACR website for an MSDS.

A.20.8 (4.6)	Documentation	
A.20.8 (4.6)	i) 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.	i) There is a note indicating that the battery should be replaced after emergency use.: The battery should be replaced if the beacon has been activated for any use other than the self-test/GPS test. A battery replacement warning is provided (during self test) via the display for the PLB-425 and via LED indications on the PLN-400, if the beacon on time exceeds 2 hours – indicating insufficient battery power. Replace the battery no later than the battery expiration date specified on the beacon, or after emergency use. 
	j) Information related to the requirements of preventive maintenance.	j) Instructions relating to preventative maintenance are provided in the Beacon Maintenance section: Carefully inspect the beacon case for any visible cracks. Cracks may admit moisture, which could falsely activate the beacon or otherwise cause a malfunction. Any cracks observed should be immediately referred to ACR for evaluation by calling +1 (954) 862-2110. ACR Technical Support can also be reached by sending an email to: service@acrartex.com. After checking the beacon for cracks, it may be wiped down with a clean, damp cloth. Do not use any type of cleaner on your beacon. NOTE: There are no user serviceable items inside the beacon. DO NOT OPEN THE BEACON.
	k) Minimum operating lifetime and operating and stowage temperature ranges.	k) The following specification details are provided: Operating: Minimum 24 hours @ -4°F/-20°C to +131°F/+55°C Storage: -40°F/-40°C to +158°F/+70°C

A.20.8 (4.6)	Documentation	
A.20.8 (4.6)	l) Information explaining the requirement and procedure for licensing and registering PLBs, as appropriate, and encouragement to do so promptly.	l) A 406 MHz *Registration* section is provided within the “Beacon (406MHz) Registration” of the user manual: Y1-03-0343 Rev. T1 - TUV Version.docx
	m) 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.	m) This sub clause is only applicable to Category 1 PLBs.
	n) 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.	n) The User Manual notes the following: Waterproof to 16.40 ft. (5m) @ 1 hr., 33 ft. (10m) @ 10 min. Factory tested @70° F, exceeds RTCM waterproof requirements. The following statement regarding buoyancy and usage is present in the product specifications of the user manual Y1-03-0343 Rev. T1 - TUV Version.docx: The ResQLink View is a buoyant PLB but is not intended for operation in water. Intended operational environments include on ground and above ground including held in hand.

A.20.8 (4.6)	Documentation	
A.20.8 (4.6)	o) An overview and explanation of how the Cospas-Sarsat system operates. p) Beacon registration materials and information 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).	o) An overview and explanation of the how the Cospas Sarsat system works is provided in the “Anatomy of a Rescue” section of the user manual. p) The user manual does not contain any beacon registration documents, however links to the beacon registration websites (USA & All Countries), address and a fax number are provided. q) The EUT is not capable of being connected to an external GNSS receiver.

A.20.8 (4.7)	Packaging Labelling	
A.20.8 (4.7)	End user (consumer) packaging shall include the following information in a conspicuous location, readily readable and visible to the purchaser without opening the packaging: a) The Category of the PLB: If Category 2, the additional information that the PLB will not float and is not recommended for use on or in the water and that THIS PLB IS NOT AN ELT or an EPIRB and does not meet the regulatory requirements for an ELT or an EPIRB or if applicable, the additional information that the PLB will not float and is not recommended for use on or in the water unless it is fitted with the provided auxiliary flotation device, its tested depth and time rating (e.g. waterproof to x meters for x minutes/hours) and that THIS PLB IS NOT AN ELT or an EPIRB and does not meet the regulatory requirements for an ELT or an EPIRB. This PLB is buoyant when fitted with the provided auxiliary flotation device, but will not float in an upright position. Or, if applicable, the additional information that the PLB will not float and is not recommended for use on or in the water unless it is installed into the provided auxiliary flotation device, its tested depth and time rating (e.g. waterproof to x meters for x minutes/hours) and that THIS PLB IS NOT AN ELT or an EPIRB and does not meet the regulatory requirements for an ELT or an EPIRB. This PLB will float in an upright position when installed into the provided auxiliary flotation device and transmit a distress signal once manually activated.	The following documents were briefly reviewed (note: the inspection was provided to confirm the presence of the required information. The accuracy of the instructions was not checked): The following items were included with respect to each sub clause: a) The product packaging does state that the PLB is a Category 1 Beacon and is Buoyant for easy retrieval if its dropped into water. PLB is buoyant (category 1) and is appropriate for use in or around water. The packaging does show the words “THIS PLB IS NOT AN ELT or and EPIRB and does not meet the regulatory requirements for and ELT or EPIRB” The packaging shows that the beacon is Waterproof to 16.4 ft. (5m) for 1 hour / 33 ft. (10m) for 10 min and does not meet the regulatory requirements for an ELT or EPIRB. This PLB is buoyant, but is not required to float in an upright position.

A.20.8 (4.7)	Packaging Labelling	
A.20.8 (4.7)	b) The temperature operating range in degrees Celsius and Fahrenheit of the PLB. c) The expiration date of the battery. d) The Country that is coded into the 15 Hex ID e) If the Country Code or unique national characteristics cannot be readily changed in the field at nominal cost to another Country Code due to the configuration of the PLB, a warning to that effect.	b) The operating temperature range is stated in Celsius and Fahrenheit). c) A field is available for the expiry date of the battery. d) A field is available for the Country code. A Field for the HEX ID and serial number is provided. e) No note that the Country code cannot be reprogrammed in the field is provided.

A.20.9 Altitude		
	With the PLB test specimen coded using the test user protocol, activation switch in the OFF mode and under normal test conditions, place the test specimen in the altitude test chamber and reduce the chamber pressure to an altitude equivalent of 25,000 feet (7,620 meters), ± 5%. The rate of pressure change should not exceed 1.5 inches of Hg per minute (5 kPa/min). Hold the chamber at this pressure for a minimum of two hours. Increase pressure in the test chamber at a rate not to exceed 1.5 inches of Hg per minute (5 kPa/min) until the chamber pressure is equal to the ambient pressure. Carry out a self-test and verify that the self-test passes. The test specimen passes if it does not activate during the pressure changes and hold time at altitude and the self -test response is correct on completion of the test.	Refer to section 2.19 of this report.
Annex G	Internal Navigation Device	See section 2.20 of this report.

2.18.5 Test Location and Test Equipment Used

This test was carried out in Radio Lab 4.

There is no test equipment recorded for this section: inspection of documentation / labelling etc only.

2.19 Altitude

2.19.1 Specification Reference

RTCM 11010.3, Clause A.20.9

2.19.2 Equipment Under Test and Modification State

PLB-425, S/N: #1 (TSR19) - Modification State 2
PLB-400, S/N: #9 (TSR22) - Modification State 2

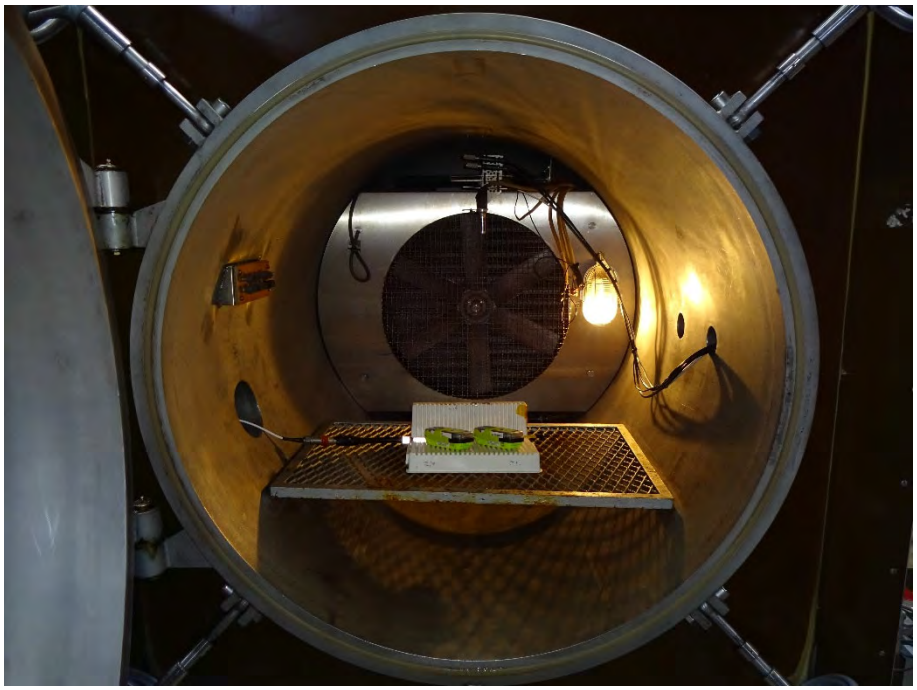
2.19.3 Date of Test

26 October 2018

2.19.4 Test Method

The EUT's (powered off) were placed in a climatic chamber where the conditions were increased from laboratory ambient atmospheric pressure to 25,000 ft (376 mbar absolute) at a rate of 35mbar / min. The conditions were maintained for 2 and a half hours. The conditions were then returned to laboratory ambient atmospheric conditions. The EUT's were then subjected to a performance check.

Test Setup

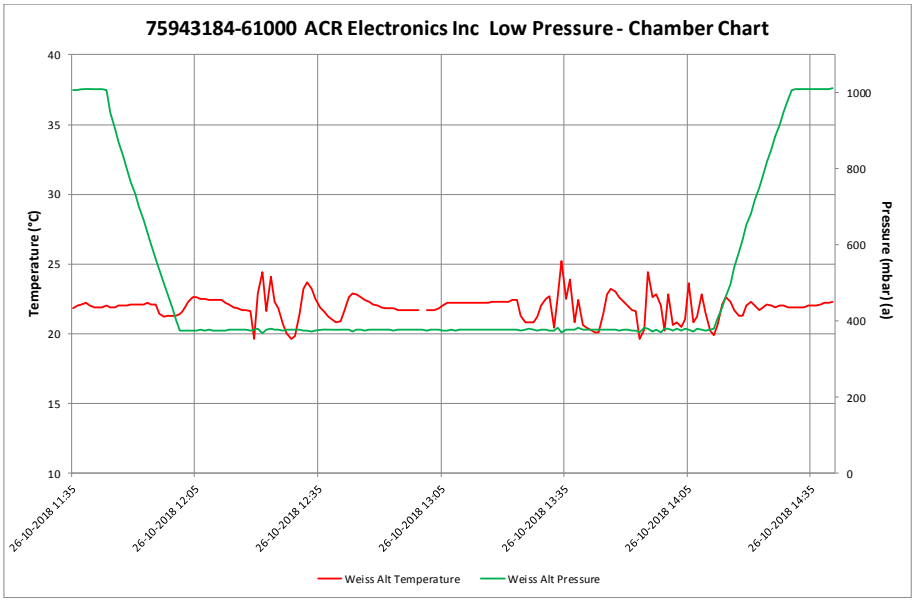


2.19.5 Environmental Conditions

Ambient Temperature	22.2°C
Relative Humidity	34.7%

2.19.6 Test Results

Temperature Plot



Performance Check

PLB-425, S/N: #1 (TSR19)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C 406.031007 P

Table 65

PLB-425, S/N: #9 (TSR22)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C 406.030967 P

Table 66

2.19.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	9-Oct-2019
Weiss Technik (T)	Weiss Technik	WEISS ALT	2133	12	2-Jan-2019
Beacon Tester	WS Technologies	BT 100S	87	-	TU

Table 67

2.20 Internal Navigation Device Tests (GPS Scenarios)

2.20.1 Specification Reference

RTCM 11010.3, Annex G

2.20.2 Equipment Under Test and Modification State

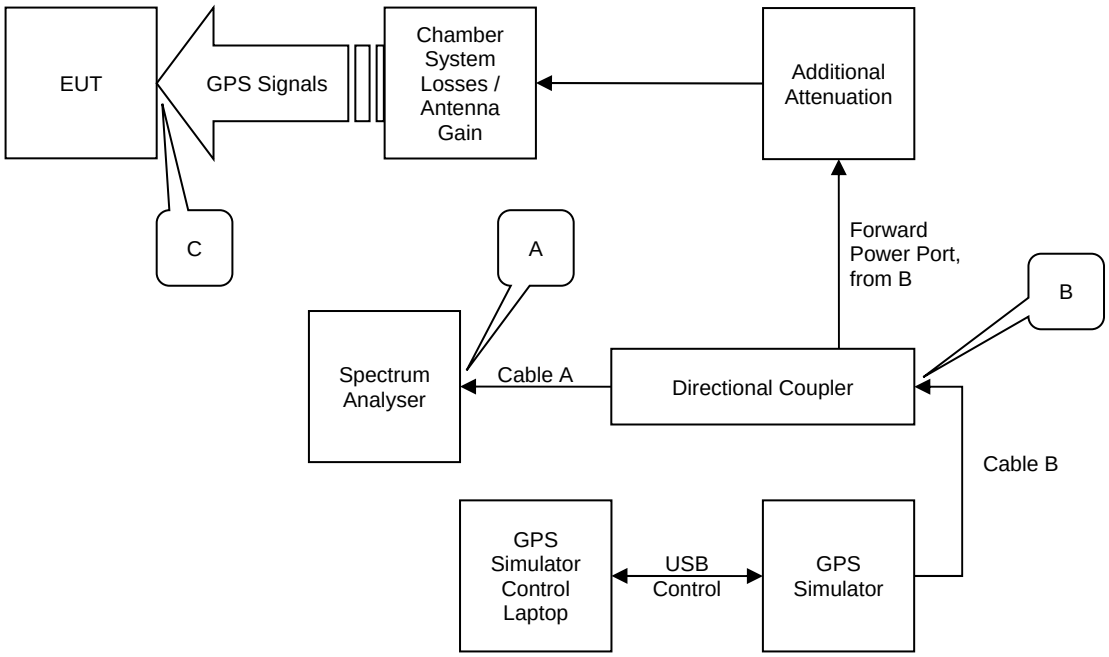
PLB-425, S/N: #8 (TSR24) - Modification State 1 (with no 121.5 MHz offset)

2.20.3 Date of Test

27 September 2018

2.20.4 Test Method

Field Calibration



Field Calibration Schematic

The basic premise of the Field Calibration procedure is that Received Signal Strength (P_{RSS}) at C equals P_{RSS} at B minus the loss from B to C (calibrated), where the P_{RSS} at B equals the power measured at A plus the loss B to A.

Resultant P_{RSS} at C is recorded for each scenario at the test results section, below.

2.20.5 Environmental Conditions

Ambient Temperature	24.3°C
Relative Humidity	43.0%

2.20.6 Test Results

Result Summary

Pass / Fail Analysis (Table G.8):

	Pass / Fail
Land TTFF Success Rate ≥ 70%	Pass
Land Location Accuracy Pass Rate ≥ 70%	Pass
Maritime TTFF Success Rate ≥ 70%	Pass
Maritime Location Accuracy Pass Rate ≥ 70%	Pass
All four results must be a “Pass” for the EUT to pass, any one or more “Fails” indicates failure	

Table 68

Land Scenarios

Scenario P_{RSS} Summary Table:

Scenario #	Number of SVs	Required RSS [dBm]	Actual RSS [dBm]
1	3	-123	-123.39
2	3	-130	-130.80
3	3	-137	-137.60
4	3	-123	-123.83
5	3	-130	-130.57
7	3	-123	-123.33
8	3	-130	-130.64
13	4	-123	-123.92
14	4	-130	-130.50
15	4	-137	-137.16
16	4	-123	-123.43
17	4	-130	-130.48
19	4	-123	-123.65
20	4	-130	-130.88
25	5	-123	-123.23
26	5	-130	-130.26
27	5	-137	-137.55
28	5	-123	-123.57
29	5	-130	-130.64
31	5	-123	-123.41
32	5	-130	-130.47
34	6	-123	-123.39
35	6	-130	-130.57
36	6	-137	-137.57
37	4	-130	-130.55
38	4	-130	-130.05
39	4	-130	-130.01
40	4	-130	-130.21
41	4	-130	-130.67
42	4	-130	-130.55

Table 69

Land Scenarios Test Results (G.4):

Scenario #	TTFF (min : sec)	Simulator Location	Transmitted Location	Location Error (m)
1	02:32	39° 36' N, 119° 35' W	N 39° 36' 13" W 119° 34' 87"	483.63
2	02:31	39° 36' N, 119° 35' W	N 39° 36' 13" W 119° 34' 87"	483.63
3	02:31	39° 36' N, 119° 35' W	N 39° 36' 13" W 119° 34' 87"	483.63
4	06:42	39° 36' N, 119° 35' W	N 39° 36' 7" W 119° 35' 0"	215.83
5	06:41	39° 36' N, 119° 35' W	N 39° 36' 7" W 119° 35' 0"	215.83
7	02:31	39° 36' N, 119° 35' W	N 39° 35' 93" W 119° 35' 0"	1017.50
8	02:29	39° 36' N, 119° 35' W	N 39° 35' 93" W 119° 35' 0"	1017.50
13	02:30	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 34' 93"	330.75
14	02:33	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 34' 93"	330.75
15	02:30	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
16	10:39	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
17	10:41	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
19	Fail	39° 36' N, 119° 35' W	N/A	N/A
20	Fail	39° 36' N, 119° 35' W	N/A	N/A
25	06:40	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
26	06:31	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
27	10:01	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
28	10:47	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
29	10:52	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
31	10:48	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
32	10:51	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
34	10:48	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
35	10:50	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
36	10:47	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
37	10:51	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00
38	06:35	23° 42.01668' S 133° 53.83336' E	S 23° 42' 0" E 133° 52' 87"	102.82
39	09:55	71° 37.56666' N 128° 52.06668' E	N 71° 37' 6" E 128° 52' 7"	199.40
40	10:47	71° 37.56666' N 128° 52.06668' E	S 23° 42' 0" E 133° 52' 87"	140.43
41	02:32	71° 37.56666' N 128° 52.06668' E	N 71° 37' 58" E 128° 52' 7"	743.79
42	05:47	39° 36' N, 119° 35' W	N 39° 36' 0" W 119° 35' 0"	0.00

Table 70

Land Scenarios Results Analysis (Table G.6):

Criteria	Limit / Condition	Result
No. of Successful Tests	TTFF ≤ 13 minutes	28
Total No. of Land Scenarios	30	N/A
TTFF Percentage Success Rate	(No. Successful Tests / 30) × 100	93.3
TTFF Pass / Fail Limit	≥ 70%	Pass
No of Locations with Errors	≤ 650 m	25
No of Scenarios with Locations	Enter result	28
Location Accuracy Percentage Pass Rate	(No Locations Errors ≤ 650 m / No Scenarios with Location) × 100	89.3%
Location Accuracy Pass / Fail Limit	≥ 70%	Pass

Table 71

Maritime Scenarios

General Note: The standard contains some contradictions, specifically regarding simulated positions. Testing was carried out in accordance with the Maritime Scenario Tables (G.11) because they are most accurate when compared to the official scenarios downloaded from the Spirent website. Where changes were made to the result templates, original values are stricken out.

Scenario P_{RSS} Summary Table:

Scenario #	Number of SVs	Required RSS [dBm]	Actual RSS [dBm]
1	7	-130	-130.48
2	7	-130	-130.61
7	7	-130	-
8	7	-130	-130.35
9	7	-130	-130.81
12	7	-130	-130.49
13	6	-130	-130.80
14	6	-130	-129.82
16	6	-130	-129.45
18	6	-130	-129.84
20	6	-130	-
22	6	-130	-130.14
26	7	-130	-129.62
30	7	-130	-130.01
32	7	-130	-
34	7	-130	-130.81
36	7	-130	-
37	7	-130	-130.52
38	7	-130	-130.25
39	7	-135	-

Table 72

Maritime Scenarios Test Results G.5):

Scenario #	TTFF (min : sec)	Simulator Location	Transmitted Location	Location Error (m)
1	01:49	0° 0’ N, 0° 0’ E	S 0° 0.0000' E 0° 0.0000'	0.00
2	01:44	0° 0’ N, 0° 0’ E	° 0.0000' ° 0.0000'	0.00
6	49:00	80° 0’ N, 0° 0’ E	S 0° 0.0000' E 0° 0.0000'	8880000.00
7	01:43	0° 0’ N, 0° 0’ E	S 0° 0.0000' E 0° 0.0000'	0.00
8	01:42	0° 0’ N, 0° 0’ E	S 0° 0.0000' E 0° 0.0000'	0.00
9	02:32	80° 0’ N, 0° 0’ E	N 80° 0.0000' E 0° 0.0000'	0.00
12	00:53	80° 0’ N, 0° 0’ E	N 80° 0.0000' W 0° 0.0000'	0.00
13	01:44	80° 0’ N, 0° 0’ E	N 80° 0.0000' W 0° 0.0000'	0.00
14	02:33	80° 0’ N, 0° 0’ E	° 0.0000' ° 0.0000'	0.00
16	01:43	80° 0’ N, 0° 0’ E	N 80° 0.0000' E 0° 0.0000'	0.00
17	03:32	0° 0’ N, 0° 0’ E	N 80° 0.0000' E 0° 0.0000'	0.00
18	03:27	0° 0’ N, 0° 0’ E	° 0.0000' ° 0.0000'	0.00
20	02:33	0° 0’ N, 0° 0’ E	° 0.0000' ° 0.0000'	0.00
22	01:39	0° 0’ N, 0° 0’ E	S 0° 0.0000' W 0° 0.0000'	0.00
24	00:50	0° 0’ N, 0° 0’ E	° 0.0000' ° 0.0000'	0.00
26	01:41	0° 0’ N, 0° 0’ E	° 0.0000' ° 0.0000'	0.00
28	01:40	0° 0’ N, 0° 0’ E	S 0° 0.0000' E 0° 0.0000'	0.00
30	02:32	44° 0’ S, 175° 0’ E	S 0° 0.0000' W 0° 0.0000'	0.00
32	01:41	47° 0’ N, 8° 0’ E	S 0° 0.0000' E 0° 0.0000'	0.00
33	00:53	0° 0’ N, 0° 0’ E	N 0° 0.0000' W 0° 0.0000'	0.00
34	00:49	0° 0’ N, 0° 0’ E	S 0° 0.0000' E 0° 0.0000'	0.00
35	00:47	0° 0’ N, 0° 0’ E	S 0° 0.0000' E 0° 0.0000'	0.00
36	00:50	80° 0’ N, 0° 0’ E	S 44° 3.0000' E 174° 9.0000'	0.00
37	00:56	0° 0’ N, 0° 0’ E	N 47° 21.0000' W 8° 27.0000'	0.00
38	01:47	0° 0’ N, 0° 0’ E	N 0° 0.0000' E 0° 0.0000'	0.00
39	01:39	0° 0’ N, 0° 0’ E	° 0.0000' ° 0.0000'	0.00

Table 73

Maritime Scenarios Results Analysis (G.7):

Criteria	Limit / Condition	Result
No. of Successful Tests	TTFF ≤ 13 minutes	25
Total No. of Maritime Scenarios	26	26
TTFF Percentage Success Rate	(No. Successful Tests / 26) × 100	96.2
TTFF Pass / Fail Limit	≥ 70%	Pass
No of Locations with Errors	≤ 650 m	25
No of Scenarios with Locations	Enter result	26
Location Accuracy Percentage Pass Rate	(No Locations Errors ≤ 650 m / No Scenarios with Location) × 100	96.2
Location Accuracy Pass / Fail Limit	≥ 70%	Pass

Table 74

2.20.7 Test Location and Test Equipment Used

This test was carried out in Chamber 8.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Directional Coupler	Narda	3022	503	-	O/P Mon
GPS/SBAS Simulator	Spirent	STR4500	3056	0	09-Oct-2018
Cable	Florida Labs	151079-001	4622	12	10-July-2019
Hygrometer	Rotronic	I-1000	2882	12	29-Nov-2018
Beacon Tester	WS Technologies	BT100S	3263	-	TU
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	25 Sep 2019
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	06-Mar-2019
Attenuator	Lucas Weinschel	AY4560	3225	12	18-July-2019

O/P Mon: Output Monitored

Table 75

3 Photographs

3.1 Equipment Under Test (EUT)

4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Frequency Error	± 11 Hz
Modulation Duty cycle	± 5%
Modulation Factor	± 5%
Peak Equivalent Isotropic Radiated Power	± 5.2 dB
Spurious Emissions	± 3.45 dB

Table 76

ANNEX A

MANUFACTUER SUPPLIED IFORMATION

Product Service

January 10th, 2019

Subject: PLB-400 and PLB-425 Material Waiver and Disclosure Information, including Waiver Statement for Label Legibility and Label Comprehensibility Tests

To Whom It May Concern:

Please be advised that the labeling on the exterior of the PLB-400 and PLB-425 is identical to PLB-375 which was previously tested for abrasion resistance, per RTCM 11010.3 (A.20.7), by ACR Electronics Inc. The same labeling process has been widely used on numerous ACR products for many years, including the previously approved PLB-375, PLB-350A/B and PLB-300 beacons, and found no degradation.

ACR Electronics, Inc. hereby declares that the labeling on the PLB-400 AND PLB-425 product fully complies with the requirements of RTCM 11010.3, section A.20.7.

As stipulated in the referenced standards, where a manufacturer can produce evidence that the components, materials and finishes employed in the equipment would satisfy the following tests then the tests shall be waived:

- Corrosion (Salt Mist) IEC 60945 (8.12) & ETSI 302-152-1 (6.5) & RTCM 11010.3 (A.8)
- Solar Radiation IEC 60945 (8.10) & RTCM 11010.3 (A.17)
- Oil Resistance IEC 60945 (8.11) & RTCM 11010.3 (A.18)

In this instance ACR Electronics, Inc. claim, for one or more of the reasons listed below that these criteria are met for the PLB-400 and PLB-425 and therefore make application that the tests be waived.

1. The materials have a proven history of service in a marine environment, either from use in ACR Electronics, Inc.'s existing approved marine equipment range, or by implication from a long established history of exposure without effect (e.g. stainless steel).

2. The material manufacturer has conducted equivalent testing and has declared the product as being immune to these effects in the relevant data sheet.

3. ACR Electronics, Inc. in-house testing has proven the materials to be immune to the cause of degradation (e.g. oil resistance).

ACR Electronics, Inc. hereby declares that the materials used in the construction of the PLB-400 and PLB-425 as here-in listed are not affected by the degrading agents listed above.

Sincerely,

Dan Stankovic
Director of Certification and Test
ACR Electronics, Inc., 5757 Ravenswood Road, Fort Lauderdale, FL 33312-6645 USA
Dan.stankovic@acrArtex.com, T: +1 (954) 981-3333 X2175, F: +1 (954) 983-5087

Product Service

ACR PLB-400 and PLB-425:
Verification of Compliance to Section 4.3.5.1 of
RTCM 11010.3 (PLB Standard)

This document provides evidence that ACR Electronics has verified that the PLB-400 and PLB-425 comply with Section 4.3.5.1 a), b), c), d), e) and f) of the RTCM Standard 11010.3 for 406 MHz Satellite Personal Locator Beacons (PLBs) dated June 25, 2018.

In particular, the following items have been verified at the minimum, ambient, and maximum operating temperatures on production units awaiting final approval for shipment.

4.3.5.1 a) The PLB battery experiences full-load current drain during the Self-test:

The current was measured during the self-test and compared to the current during a live transmission; the currents were found to be identical.

4.3.5.1 b) Each self-test pass/fail indicator correctly identifies a fail condition when a failure in the monitored function has been induced:

Each Self-Test failure condition was tested to ensure that a failure in that test would produce a Self-Test fail indication: a red LED flashed at the end of the test. The tests are briefly summarized below:

1. 406 MHz RF power – Tested by placing a wrong component in the circuit thus inducing a power mismatch in the 406 RF circuit and by disconnecting the 406 RF power input into the micro.
2. 121.5 MHz RF Power - Tested by running the test with the wrong load on the antenna and by disconnecting the 121.5 RF A to D input into the micro.
3. PLL Lock Detect – Tested by disconnecting a component in the PLL lock detect circuit so the signal oscillated and never locked.
4. Non-Volatile Memory (NVM) – Tested by writing the wrong checksum for the 406 message data into NVM.
5. GPS Module – Tested by both disconnecting the GPS module without any NMEA message injected on the GPS data line into the micro and disconnecting the GPS module and injecting the wrong NMEA message header into the micro's GPS data line.

4.3.5.1 c) Any transmission in either self-test mode is limited to one burst:

Self-test or GNSS Self-Test runs only once and transmits only one 406 message. This was confirmed by running each test and picking up the Self-Test 406 transmission with the FPR-300 data logger and confirming that only one 406 transmission was detected; the unit power was also monitored and the unit turned off as expected after both Self-Tests.

4.3.5.1 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):

For worst case condition test no GPS signal was provided and the GNSS Self-Test was limited to 2 minutes. To confirm this the time from the start of the test until the GPS ON line from the micro went low (GPS turned off) was measured as was the time to end-of-test, the GNSS Self-Test 406 transmission and the unit power were also monitored; the GPS ON line went low after 2 minutes plus the approximately 5 seconds it takes to evoke the GNSS Self-Test; the 406 transmission occurred thereafter and was picked up by the FPR-300, it had default position data and no further 406 transmissions occurred; the red LED then flashed for 3 seconds followed by the strobe LED; the unit then turned off as expected in approximately 2 minutes 8 ½ seconds.

The number of GNSS Self-Tests is limited to 12 self-tests. This was tested by first running the GNSS Self-Test 12 times, confirming that the self-test ran to completion, a 406 burst was received by the FPR-300 data logger each time, and the red or green LED and strobe LED flashed at the end of the test; on the next, thirteenth, and subsequent attempts instead of the 3 green LED flashes indicating the start of the GNSS Self-Test there were 3 red LED flashes and the unit turned off; no 406 transmissions were received by the FPRR-300 data logger and no end-of-test LED flashes occurred.

4.3.5.1 e) If a GNSS Self-Test mode is provided, it shall be verified that inadvertent activation of this mode is precluded:

The GNSS Self-Test is initiated by pressing the Self-Test button for at least 5 seconds; this precludes inadvertent activation; pressing the Self-Test button for at least ½ second and less than 5 seconds activates the regular Self-Test; continuing to press the Self-Test button for longer than 5 seconds, even past the end of the GNSS Self-Test has no additional effect, the GNSS Self-Test runs only once and then the unit turns off. All conditions were checked.

4.3.5.1 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):

As stated in d) above, if no valid fix is obtained the GNSS self-test fails, the red LED flashes at the end of test and the 406 message contains default position data; to test the pass condition a GPS signal was provided and the green LED flashed at the end of the test indicating a pass condition; the 406 message picked up using the FPR-300 data logger contained valid position data.

Product Service

Description of Differences

Per C/S T.007 5(q)

Difference between the PLB-400 and PLB-425

A3-06-3138-, named PLB-425, is identical with A3-06-3138-1, named PLB-400, in every way with the exception of having a display.

A3-06-3138-1, named PLB-400, is identical with A3-06-3138-, named PLB-425, in every way with the exception of not having a display.

The display on A3-06-3138-, named PLB-425, is an additional feature which provides the user with text messages during self-test, during GNSS self-test and during activation. The display is an additional feature, and its functionality does not affect the basic operation of the beacon. With the exclusion of the display, all other functions of the PLB-425 are identical to PLB-400 (without the display).

Major Components / Function	PLB-425	PLB-400
Display	Has a display.	Does not have a display

Table 1, Major component / function differences between PLB-400 and PLB-425

With PLB-400, the lack of the display does not affect the software routines that send messages to the display. Meaning that the messages in PLB-400 are sent to the display interface (but no display connected), in the same manner as they are sent in PLB-425 (with the display). Therefore, the presence of the display would exhibit higher battery drain in PLB-425.

Product Service

ACR PLB-400 and PLB-425:
Verification of Compliance to Section 4.3.6 of
RTCM 11010.3 (PLB Standard)

This document provides evidence that ACR Electronics has verified that the PLB-400 and PLB-425 comply with Section 4.3.5.2 of the RTCM Standard 11010.3 for 406 MHz Satellite Personal Locator Beacons (PLBs) dated June 25, 2018.

ACR Electronics verified proper self-test function by carrying out a self-test in accordance with the user manual instructions with the PLB initially at the maximum operating temperature (+55°C) and after the PLB has been immersed in a 35 parts per thousand solution of cold salt water to a depth over the PLB of at least 10 cm for a duration of at least 10 seconds. The water bath was at a temperature of 10°C. Immediately after removal from the water bath the PLB was held (without shaking or drying) for between 5 and 10 seconds in each of 3 orthogonal orientations to allow water to drain from any recesses in the PLB case. Immediately after this, a self-test was successfully performed.

Product Service

ACR PLB-400 and PLB-425:
Verification of Compliance to Section 4.3.6 of
RTCM 11010.3 (PLB Standard)

This document provides evidence that ACR Electronics has verified that the PLB-400 and PLB-425 comply with Section 4.3.6 of the RTCM Standard 11010.3 for 406 MHz Satellite Personal Locator Beacons (PLBs) dated June 25, 2018.

In particular, the following items have been verified at the minimum, ambient, and maximum operating temperatures on production units awaiting final approval for shipment.

The battery is internal to the unit and is not user replaceable. Battery replacement is to be performed by factory authorized Battery Replacement Center.

No evidence of toxic or corrosive products outside the PLB case were observed, during or subsequent to storage at temperatures between -55 degrees C and +75 degrees C with and:

a) During a full or partial discharge at any operational rate of the PLB. No external short circuit is possible as the batteries are internal to the unit.
b) PLB-400 and PLB-425 batteries can't be charged, or force discharged.
c) Partial or full discharge of the batteries.

ACR Electronics has established useful life and expiration for the battery. The label on the unit specifies the battery replacement date. Batteries were determined to meet input power requirements of the PLB. The following losses were included (at temperatures of +20 degrees C +- 5 degrees C:

a) Self-Tests, GNSS Self Tests with their frequency outlined in the user manual.
b) Self-Discharge of 1% per year.
c) Standby losses.

The battery expiration date is the date of the battery cell manufacture date plus no more than ½ of the useful life of the battery. The battery cell is not to be older than 2 years when first fitted in the PLB.

ANNEX B

LIMITED COSPAS-SARSAT TESTING

Limited Cospas Sarsat Testing

The following results present a summary of limited Cospas-Sarsat measurements which were performed after the conclusion of Environmental testing. As a deviation from the requirements of clause A.2 of RTCM 11010.3, the full Type Approval was carried out prior to environmental tests. The following limited tests are intended to indicate continued compliance with Cospas-Sarsat T.007. Limited measurements were made at ambient temperature only.

Parameters to be Measured		Range of Specification	Units	Test Results			Comments
				Tmin	Tamb	Tmax	
				(-20°C)	(+21°C)	(+55°C)	
1. Power Output							**Result: Pass**
Model: PLB-425, S/N: 3 RTCM, TUV Ref: TSR4 and Modification State 2							
Transmitter power output	(maximum)	35 - 39	dBm	NT	36.32	NT	
	(minimum)			NT	36.11	NT	
Power output rise time	(maximum)	< 5	ms	NT	0.46	NT	
	(minimum)			NT	0.43	NT	
Power output 1ms before burst	(maximum)	< -10	dBm	NT	-21.14	NT	
	(minimum)			NT	-21.36	NT	
2. Digital Message Coding							**Result: Pass**
Model: PLB-425, S/N: 3 RTCM, TUV Ref: TSR4 and Modification State 2							
Bit Sync	1 - 15	15 bits “1”	P / F	NT	P	NT	
Frame sync	16 - 24	“000101111”	P / F	NT	P	NT	
Format flag	25	1 bit	bit value	NT	1	NT	
Protocol flag	26	1 bit	bit value	NT	0	NT	
Identification / position data	27 - 85	59 bits	P / F	NT	P	NT	
BCH code	86 -106	21 bits	P / F	NT	P	NT	
Emerg. Code/nat. use/supplem. Data	107 - 112	6 bits	bit value	NT	110111	NT	
Additional data / BCH (if applicable)	112 - 144	32 bits	P / F	NT	P	NT	
Position Error (if applicable)		< 5	km	NT	P	NT	

NT = Not Tested

Parameters to be Measured		Range of Specification	Units	Test Results			Comments
				Tmin	Tamb	Tmax	
				(-20°C)	(+21°C)	(+55°C)	
3. Digital Message Generator							**Result: Pass**
Model: PLB-425, S/N: 3 RTCM, TUV Ref: TSR4 and Modification State 2							
Repetition rate, T_R:							
Average T_R		48.5 ≤ T_{Ravg} ≤ 51.5	seconds	NT	50.111	NT	
Minimum T_R		47.5 ≤ T_{Rmin} ≤ 48.0	seconds	NT	47.596	NT	
Maximum T_R		52.0 ≤ T_{Rmax} ≤ 52.5	seconds	NT	52.417	NT	
Standard deviation		0.5 - 2.0	seconds	NT			
Bit rate							
Minimum fb		≥ 396	bits/sec	NT	399.99	NT	
Maximum fb		≤ 404	bits/sec	NT	400.03	NT	
Total transmission time							
Short message	(maximum)	435.6 - 444.4	ms	NT	N/A	NT	
	(minimum)			NT	N/A	NT	
Long message	(maximum)	514.8 - 525.2	ms	NT	520.97	NT	
	(minimum)			NT	520.91	NT	
Unmodulated carrier							
Minimum T1		≥ 158.4	ms	NT	160.95	NT	
Maximum T1		≤ 161.6	ms	NT	161.01	NT	
First burst delay		≥ 47.5	seconds	NT	50	NT	

NT = Not Tested

Parameters to be Measured		Range of Specification	Units	Test Results			Comments
				Tmin	Tamb	Tmax	
				(-20°C)	(+21°C)	(+55°C)	
4. Modulation							**Result: Pass**
Model: PLB-425, S/N: 3 RTCM, TUV Ref: TSR4 and Modification State 2							
Biphase-L		P / F	P / F	NT	P	NT	
Rise time	(maximum)	50 - 250	µs	NT	179.4	NT	
	(minimum)	50 - 250	µs	NT	166.3	NT	
Fall time	(maximum)	50 - 250	µs	NT	198.6	NT	
	(minimum)	50 - 250	µs	NT	185.7	NT	
Phase deviation: positive	(maximum)	+(1.0 to 1.2)	radians	NT	1.1824	NT	
	(minimum)	+(1.0 to 1.2)	radians	NT	1.0850	NT	
Phase deviation: negative	(maximum)	-(1.0 to 1.2)	radians	NT	-1.1788	NT	
	(minimum)	-(1.0 to 1.2)	radians	NT	-1.0596	NT	
Symmetry measurement		≤ 0.05		NT	0.0369	NT	
5. 406 MHz Transmitted Frequency							**Result: Pass**
Model: PLB-425, S/N: 3 RTCM, TUV Ref: TSR4 and Modification State 2							
Nominal Value	(maximum)	C/S T.001	MHz	NT	406.0309690	NT	
	(minimum)			NT	406.0309689	NT	
Short-term stability	(maximum)	≤ $2x10^{-9}$	/100ms	NT	84.048E-12	NT	
	(minimum)			NT	64.218E-12	NT	
Medium-term stability – Slope	(maximum)	(-1 to +1)$x10^{-9}$	/minutes	NT	52.595E-12	NT	
	(minimum)			NT	-70.694E-12	NT	
Medium-term stability – Residual frequency variation	(maximum)	≤ $3x10^{-9}$		NT	36.859E-11	NT	
	(minimum)			NT	20.699E-11	NT	
6. Spurious Emissions into 50ohms							**Result: Pass**
Model: PLB-425, S/N: 3 RTCM, TUV Ref: TSR4 and Modification State 2							
In band (406.0 – 406.1 MHz)		C/S T.001 mask	P / F	NT	P	NT	

NT = Not Tested