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Report On

Emergency Beacons Testing of the
ACR Electronics, Inc. RLB-41

In accordance with AS/NZS 4280.1 Inc Amendments 1, 2, 3 and 4



Product Service

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REPORT ON

Emergency Beacons Testing of the
ACR Electronics, Inc.
RLB-41

Document 75927040 Report 05 Issue 1

October 2015

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26 October 2015





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SECTION 1

REPORT SUMMARY

Emergency Beacons Testing of the
ACR Electronics, Inc.
RLB-41



Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Emergency Beacon Testing of the ACR Electronics, Inc. RLB-41 to the requirements of AS/NZS 4280.1.

Objective	To perform Emergency Beacon Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	ACR Electronics, Inc.
Model Number(s)	RLB-41
Serial Number(s)	S/N: #6 (TUV Ref TSR0066) S/N: #7 (TUV Ref TSR0067) S/N: #8 (TUV Ref TSR0068) S/N: #9 (TUV Ref TSR0064) S/N: #15 (TUV Ref TSR0058) S/N: #26 (TUV Ref TSR0051)
Number of Samples Tested	6
Test Specification/Issue/Date	AS/NZS 4280.1: 2002 + A1, A2, A3 and A4
Date of Receipt of Test Samples	9 March 2015
Order Number	31575
Date	6 June 2014
Start of Test	17 November 2014
Finish of Test	25 September 2015
Name of Engineer(s)	R Hampton M Hardy J Tuckwell S Mooney M Cox J Lunn I Bromley A Guy F Van Niekerk C Bowles



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1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results in accordance with AS/NZS4280.1

Section	Spec. Clause	Test Description	Result	Comments
Configuration: RLB-41 (Conducted) S/N: #15 (TUV Ref TSR0058)				
2.1	A.1.1	Message Format and Homing Device Checks	Pass	-
2.2	A.1.2	Dry Heat	Satisfactory	-
2.3	A.1.3	Damp Heat	Satisfactory	-
2.4	A.1.4	Vibration	Satisfactory	-
2.5	A.1.5	Ruggedness	Satisfactory	-
Configuration: RLB-41 (Radiated) S/N: #9 (TUV Ref TSR0064)				
2.1	A.1.1	Message Format and Homing Device Checks	Pass	-
2.2	A.1.2	Dry Heat	Satisfactory	-
2.3	A.1.3	Damp Heat	Satisfactory	-
2.4	A.1.4	Vibration	Satisfactory	-
2.5	A.1.5	Ruggedness	Satisfactory	-
2.6	A.1.6	Corrosion	Satisfactory	-
2.7	A.1.7	Drop into Water (NUA)	Satisfactory	-
2.8	A.1.8	Thermal Shock	Satisfactory	-
2.9	A.1.9	Immersion	Satisfactory	-
2.10	A.1.10	Spurious Emissions	Satisfactory	-
2.11	A.1.11	Conducted Interference	-	N/A
2.12	A.1.12	Signal Light Test	-	See Opti Consulting Limited report OC-0522-01
2.13	A.1.13	Battery capacity and low-temperature test	Satisfactory	-
2.14	A.1.14	(Limited) Cospas-Sarsat Type Approval Test Procedure	Satisfactory	-
Other Tests (Non Compulsory Sequence of Tests)				
Configuration: RLB-42 S/N #6, #8, #7, #26, #9 (TUV Ref TSR0066, 0068, 0067, 0051, 0064)				
2.15		Test of Operational Requirements (NUA)	-	See Section 2.15
2.16		Automatic Release Mechanism and Automatic Activation test for Class 1 and Class 2 satellite EPIRBs	Satisfactory	-
2.17		Stability and Buoyancy	Satisfactory	-
2.18		Float Free Activation (Salt Water Activation)	Satisfactory	-
2.19		Safety Precautions	-	See Annex B
2.20		Compass Safe Distance	-	See Section 2.20
2.21		Test to Prevent Release when Water Washes Over the Unit (Hose Stream)	Satisfactory	Carried out by TUV NEL.
2.22		121.5MHz Homing Device	Pass	-



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1.3 APPLICATION FORM

Beacon Manufacturer and Beacon Model

Beacon Manufacturer	ACR Electronics, Inc.
Beacon Model Name	RLB-41
Additional Beacon Model Names	GlobalFix™ V4

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	X
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 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)		



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Beacon Characteristics

Characteristic	Specification
Operating frequency	406.040 MHz 121.5 MHz
Operating temperature range	T _{min} = -20 °C T _{max} = 55 °C
Temperature, at which minimum duration of continuous operation is expected	-20 °C
Operating lifetime	48 hours for 121.5 MHz and 406 MHz
Beacon power supply type (internal non-rechargeable, internal re-chargeable, external, combined, other)	Internal
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 operational modes (N/A or Yes or No)	No
Battery cell chemistry	LiMnO ₂
Battery cell model name, cell size, number of cells in a battery pack, and details of the battery pack electrical configuration	CR-123A, 2/3A size, 3 battery packs, 3 cells each
Battery cell manufacturer	Panasonic
Battery pack manufacturer and part number	ACR pack P/N: A3-06-2865 ACR cell P/N: A1-13-0118 Panasonic cell P/N: CR-123A
Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon)	0.25 years
Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon)	10 years
Oscillator type (e.g. OCXO, MCXO, TCXO)	TCXO
Oscillator manufacturer	RAKON Ltd, (Made in New Zealand)
Oscillator model name/ part number	RAKON P/N 5344LF, ACR P/N A1-11-0940
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	Antenna Assy RLB's, P/N A3-06-2554
Antenna cable assembly min/max RF- losses at 406 MHz, if applicable	N/A
Navigation device type (Internal, External or None)	Internal
Features in beacon that prevent degradation to 406 MHz signal or beacon lifetime	Yes

Characteristic	Specification
resulting from a failure of navigation device or failure to acquire position data (Yes, No, or N/A)	Yes
Features in beacon that ensure 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) and	Yes
Encoded position update interval value (range)	20 min to 4 hours
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	GlobalTop Tech Inc.
– Navigation device model name and part Number	ACR P/N: A1-11-0877-1 GlobalTop P/N: gms-lpr
– Internal navigation device antenna type(integrated, internal, external, passive/active) , manufacturer and model	Integrated in A1-11-0877-1
– 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 position (Yes or 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 self-test 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 are indicated by (provide details, e.g. Pass / Fail indicator light, strobe light, etc.)	Refer to Operating Manual	Refer to Operating Manual
- The content of the encoded position data fields of the self-test message has default values	Yes	Yes if NO GNSS found. No if GNSS found
☐ Performs an internal check and indicates that RF-power is being emitted at 406 MHz and 121.5 MHz, if beacon includes a 121.5 Hz homer (Yes or No)	Yes	No
☐ 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	See Note 1	See Note 1
- 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, ("0" or "1")	1	1
- Maximum duration of a self-test mode, sec	11 Seconds	132 Seconds
- Maximum recommended number of self-tests during battery pack replacement period	120	84
- 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	No
- Automatic termination of self-test mode immediately after completion of the self-test cycle (Yes or No)	Yes	Yes
- Maximum number of GNSS Self Tests (beacons with internal navigation devices only)	N/A	84

Self-Test Mode Characteristics:	Self-Test Mode	Optional GNSS Self-test Mode
– GNSS Self-test results in transmission of a single burst, irrespectively of the test result (Yes or No)	N/A	Yes
– Maximum number of self-tests during battery pack replacement period	120	84
– Self-test/ GNSS self-test can be activated from beacon remote activation points (Yes & details or No)	N/A	N/A
– List all methods of Self-test mode and GNSS Self-test modes activation. Provide details on a separate sheet to describe	Switch at EPIRB Activated less than 2 s	Switch at EPIRB Activated more than 5 s

NOTE 1:

First pass/fail indication:

- Beacon will check Battery Capacity monitor.
- Beacon will check for previous emergency activations.

Second pass/fail indication:

- Beacon will test that the PLL locks.
- Beacon will test that 406 MHz RF power is present during a 406 MHz transmission.
- Beacon will test battery voltage during a 406 MHz transmission.
- Beacon will test that 121.5 MHz RF power is present during a 121.5 MHz transmission.

Third pass/fail indication:

- Beacon will check the code checksum.
- Beacon will check the serialization of the current (ACR or POS) 406 message checksum.
- Beacon will check for GPS module communication.



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

RLS Location Protocol (tick where appropriate) ¹	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	
Beacon includes a homer transmitter(s) (Yes or No)	Yes
- homer transmitter(s) frequency	121.5 MHz
- homer transmitter(s) power	17 - 22 dBm EIRP
☐ homer transmitter(s) duty cycle	96 %
☐ duty cycle of homer swept tone	33 %
Beacon includes a high intensity flashing light (e.g. Strobe)	Yes
- light intensity	>0.75 cd
- flash rate	20 flashes 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	Yes. Automatic activation occurs when water makes contact across water sensors when not in bracket
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

¹ RLS protocols will be effective as of 1 November 2015. The use of RLS-enabled beacons will be regulated by national administrations.



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Beacon model hardware part number (P/N) and version	A3-06-2862, Rev B
Beacon model software/firmware P/N, version, date of issue/releases	K3-01-0122, Version B, Release 10/15/2014
Beacon model printed circuit board P/N and version	A3-07-0413 Rev G
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: Mr. Dan Stankovic, Director of Certification and Test. Phone: 954-981-3333 X 2175 E-mail: dan.stankovic@acrartex.com

Dated: 07/10/2015..... Signed: Dan Stankovic, Director of Certification and Test

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was an ACR Electronics, Inc. RLB-41 as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.



Equipment Under Test



Product Service

1.4.2 Physical Test Configuration

The Equipment Under Test (EUT) was operated using its own power source (internal battery). One EUT was configured so that the antenna port was connected to the 50Ω test system using a coaxial cable. This EUT, S/N: #15 (TUV Ref TSR0058) was used for tests where the specification required a Functional Check and a Functional Test.

A second EUT, S/N: #9 (TUV Ref TSR0064) was a fully packaged beacon, similar to the proposed production beacons equipped with its proper antenna. This EUT was used for all tests required within the specification but was only subjected to a Functional Check, where required.

A third EUT, S/N: #26 (TUV Ref TSR0051) was a fully packaged beacon, similar to the proposed production beacons equipped with its proper antenna. This EUT was used for the Compass Safe Distance test.

A fourth EUT, S/N: #20 (TUV Ref TSR0036) was a fully packaged beacon, similar to the proposed production beacons equipped with its proper antenna. This EUT was used for the Corrosion test.



Product Service

1.4.3 Modes of Operation

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

Off/Standby Mode

- Main activation button to “OFF” position

Self-test

- Depress Self-test activation button for 2 seconds
- List of items checked as per Customer Supplied Information (Application Form)

Long/GPS/GNSS Self-test

- Depress Self-test activation button for 6 seconds
- List of items checked as per Customer Supplied Information (Application Form)
- Navigation data applied as applicable (e.g. none applied for timeout, data applied for ‘fast acquisition’)

Operating

- Depress Main activation button
- 121 Homer active and offset
- GPS operating in normal duty cycle for the following navigation input conditions ^{Note1}
- No navigation data applied

Note 1: The manufacturer has declared that the GPS receiver operates as follows:

GPS On/Off Cycle:

The following schedule is followed until an initial valid GPS location is encoded into the beacon message:

- For the first 60 minutes, the GPS is turned on for 10 minutes once every 20 minutes.
- For the next 60 minutes, the GPS is turned on for 5 minutes once every 15 minutes.

If a valid location fix is obtained during either of the above GPS on times, the GPS is turned off immediately. The GPS is then turned on no less than 25 minutes and no more than 30 minutes from the time the GPS was previously turned on, then the GPS is then turned on and off according to the schedule below. If no valid fix was obtained during the above schedule, the schedule below is followed.

- For the next 6 hours the GPS is turned on once every 30 minutes and is on for a period of 5 minutes or until a valid location fix is obtained.
- For the next 18 hours the GPS is turned on once every 2 hours and is on for a period of 5 minutes or until a valid location fix is obtained.
- Until the battery end-of-life, the GPS is turned on once every 4 hours and is on for a period of 5 minutes or until a valid location fix is obtained.



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1.5 DEVIATIONS

Where immersion into water was required or a physical impact to be applied the radiated sample was the only EUT which was subjected to the test. The 50Ω connector (conducted) sample was not watertight and was therefore not subject to any test where water immersion or impact may have occurred (drop into water, drop onto hard surface, leakage and immersion, thermal shock and corrosion).

The Corrosion test (section 2.6) was carried out of sequence and on an alternate sample. This was carried out at the request of the Manufacturer with the understanding that it is possible to waive the test.

The Signal Light test was carried out of sequence and on an alternate sample. This was carried out at the request of the Manufacturer in order to maintain the compulsory sequence as required by IEC 61097-2 standard. The compulsory sequence detailed in the AS/NZS 4280.1 Standard differs from the IEC 61097-2 standard.

1.6 WAIVER REQUESTS

None

1.7 MODIFICATIONS

No modifications were made to the samples under test during the test programme.

1.8 REPORT MODIFICATION RECORD

Issue 1 – First Issue



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SECTION 2

TEST DETAILS

Emergency Beacons Testing of the
ACR Electronics, Inc.
RLB-41



Product Service

2.1 MESSAGE FORMAT AND HOMING DEVICES

2.1.1 Equipment Under Test and Modification State

RLB-41 S/N: #15 (TUV Ref TSR0058) - Modification State 0

RLB-41 S/N: #9 (TUV Ref TSR0064) - Modification State 0

2.1.2 Date of Test

30 March 2015

2.1.3 Test Equipment Used

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

2.1.4 Environmental Conditions

Ambient Temperature 22.4.0°C

Relative Humidity 48.1.0%

2.1.5 Test Results

Visual Inspection

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

Performance Check

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

Summary of Performance Check Results

RLB-41 S/N: #15 (TUV Ref TSR0058)

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.0400
121 MHz Presence	P



Product Service

Summary of Performance Check Results

RLB-41 S/N: #9 (TUV Ref TSR0064)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.0400
121 MHz Presence	P

2.2 DRY HEAT TEST

2.2.1 Specification Reference

AS/NZS 4280.1, clause A.1.2 (5.13.1)

2.2.2 Equipment Under Test and Modification State

RLB-41 S/N: #15 (TUV Ref TSR0058) - Modification State 0

RLB-41 S/N: #9 (TUV Ref TSR0064) - Modification State 0

2.2.1 Date of Test

30 March 2015, 31 March 2015, 07 April 2015 and 08 April 2015

2.2.2 Test Equipment Used

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

2.2.3 Environmental Conditions

Ambient Temperature: 20.5 - 23.2 °C

Relative Humidity: 23.4 - 31.3 %

2.2.4 Test Setup





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2.2.5 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 approximately 12 hours, the temperature was returned to ambient conditions. The EUTs were subjected to a performance check at the end of the test.

Functional Test

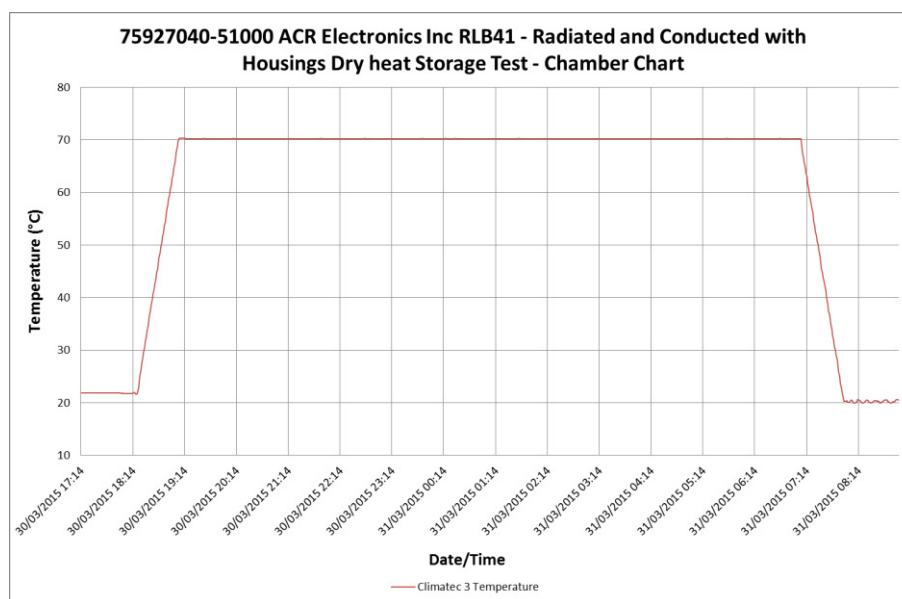
The EUTs were switched on, and placed in a climatic chamber where the temperature was increased from ambient temperature to +55°C. The conditions remained for a period of approximately 17 hours. Towards the end of this period the EUTs were subjected to a performance check and performance test. At the 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.

2.2.6 Test Results

Storage Test

Temperature Plot





Product Service

Post-Storage Period Performance Check

RLB-41 S/N: #15 (TUV Ref TSR0058)

Parameter	Result
Self-test Mode:	
Self-test Message	FFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039988
121 MHz Presence	P

RLB-41 S/N: #9 (TUV Ref TSR0064)

Parameter	Result
Self-test Mode:	
Self-test Message	FFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039983
121 MHz Presence	P

Observation: it was noted after the 12 hour storage period there was some damage to the labels including cracking, lifting and bobbling as indicated below:



Cracking and lifting

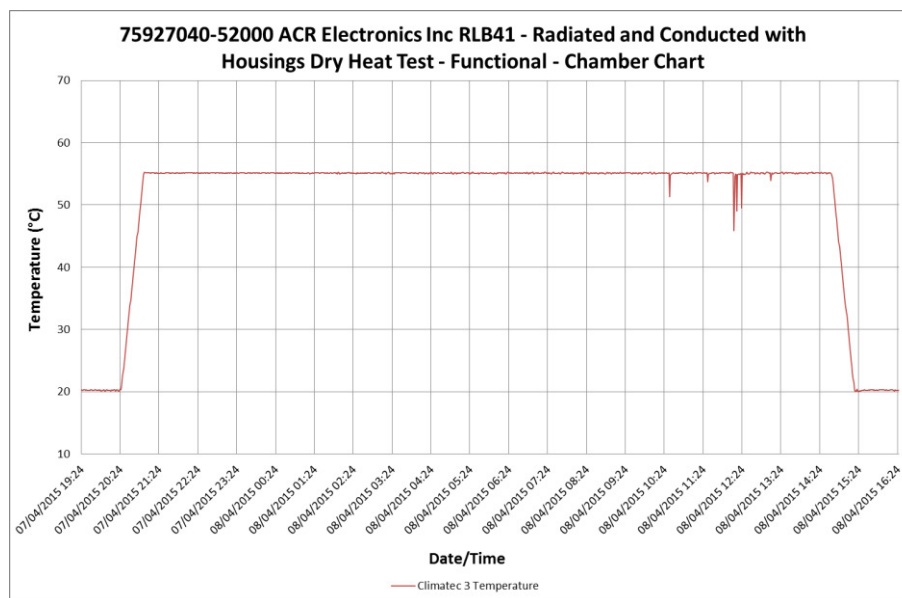
Bobbling



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Functional Test

Temperature Plot



During Functional Period Performance Test

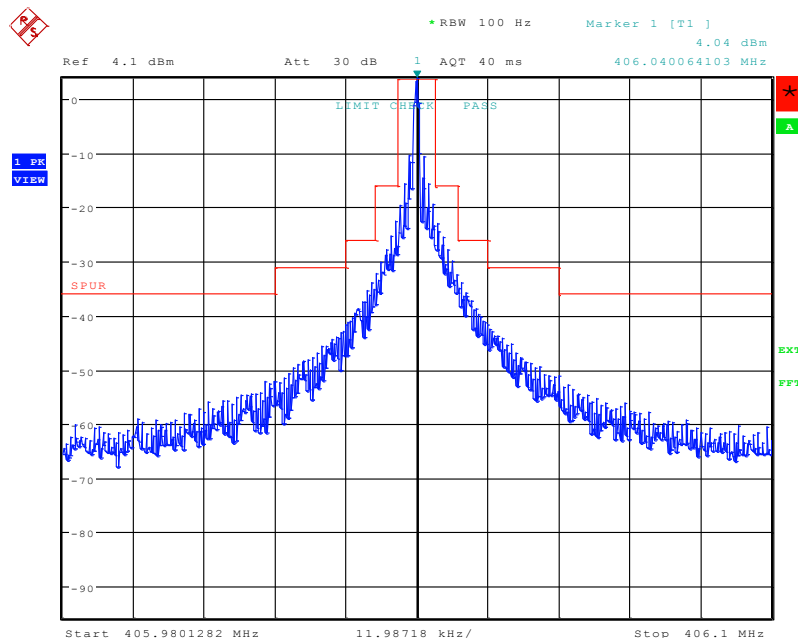
RLB-41 S/N: #15 (TUV Ref TSR0058)

Parameter	Result (Max / Min)
Output Power	37.67 / 37.66
Digital Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
Bit Rate	399.93 / 399.91
Modulation: Rise Time (uS)	190.3 / 166.3
Modulation: Fall Time (uS)	191.7 / 163.6
Positive Deviation (rad)	1.1848 / 1.0136
Negative Deviation (rad)	-1.1860 / -1.0253
Nominal Frequency (MHz)	406.0399700 / 406.0399699
Short-term Stability (/100 ms)	12.465E-11 / 10.024E-11
Medium-term Stability – Slope (/minute)	25.992E-12 / 53.624E-13
Medium-term Stability – Residual	10.359E-11 / 81.644E-12
Spurious Emissions	See plot below



Product Service

Spurious Emissions



Date: 8.APR.2015 11:31:08

RLB-41 S/N: #15 (TUV Ref TSR0058)

Post-Functional Period Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.0401
121 MHz Presence	P

Post-test Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039974
121 MHz Presence	P



Product Service

RLB-41 S/N: #9 (TUV Ref TSR0064)

Post-Functional Period Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.0400
121 MHz Presence	P

Post-test Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039981
121 MHz Presence	P

2.3 DAMP HEAT TEST

2.3.1 Specification Reference

AS/NZS 4280.1, clause A.1.3 (5.13.2)

2.3.2 Equipment Under Test and Modification State

RLB-41 S/N: #15 (TUV Ref TSR0058) - Modification State 0

RLB-41 S/N: #9 (TUV Ref TSR0064) - Modification State 0

2.3.3 Date of Test

08 April 2015 and 09 April 2015

2.3.4 Test Equipment Used

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

2.3.5 Environmental Conditions

Ambient Temperature: 18.1 - 24.4 °C

Relative Humidity: 25.2 - 38.8 %

2.3.6 Test Setup





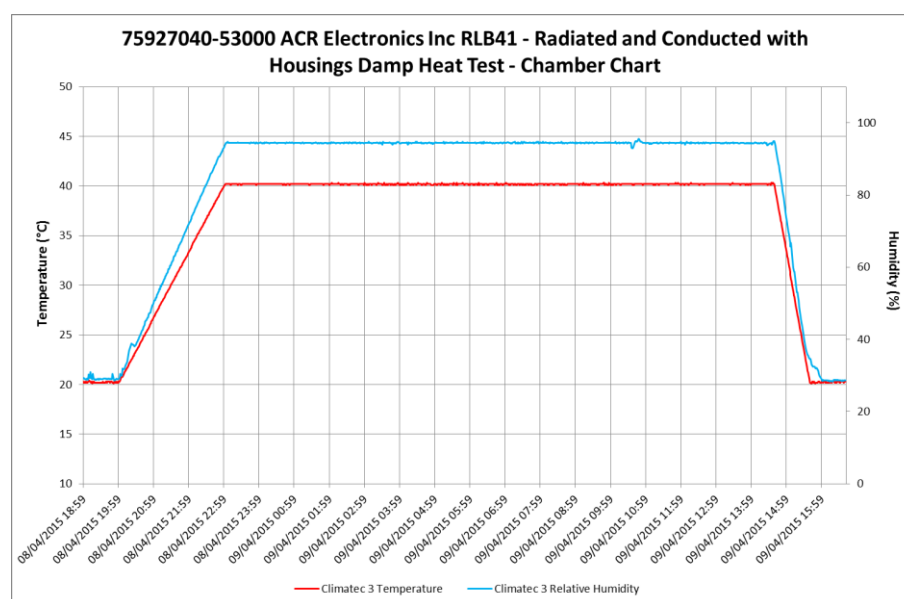
Product Service

2.3.7 Test Method

The EUT was placed in a climatic chamber with the temperature increased to 40 °C and the relative humidity increased to 93 %. After 12 hours, the EUT was activated for at least 2 hours, during this period was subjected to a performance check.

2.3.8 Test Results

Temperature Plot



RLB-41 S/N: #15 (TUV Ref TSR0058)

Post-storage Period Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039962
121 MHz Presence	P



Product Service

Post-test Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039968
121 MHz Presence	P

RLB-41 S/N: #9 (TUV Ref TSR0064)

Post-storage Period Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039964
121 MHz Presence	P

Post-test Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039982
121 MHz Presence	P

2.4 VIBRATION TESTS

2.4.1 Specification Reference

AS/NZS 4280.1, clause A.1.4 (5.13.6)

2.4.2 Equipment Under Test and Modification State

RLB-41 S/N: #15 (TUV Ref TSR0058) - Modification State 0

RLB-41 S/N: #9 (TUV Ref TSR0064) - Modification State 0

2.4.3 Date of Test 00

21 April 2015, 29 April 2015 and 23 September 2015

2.4.4 Test Equipment Used

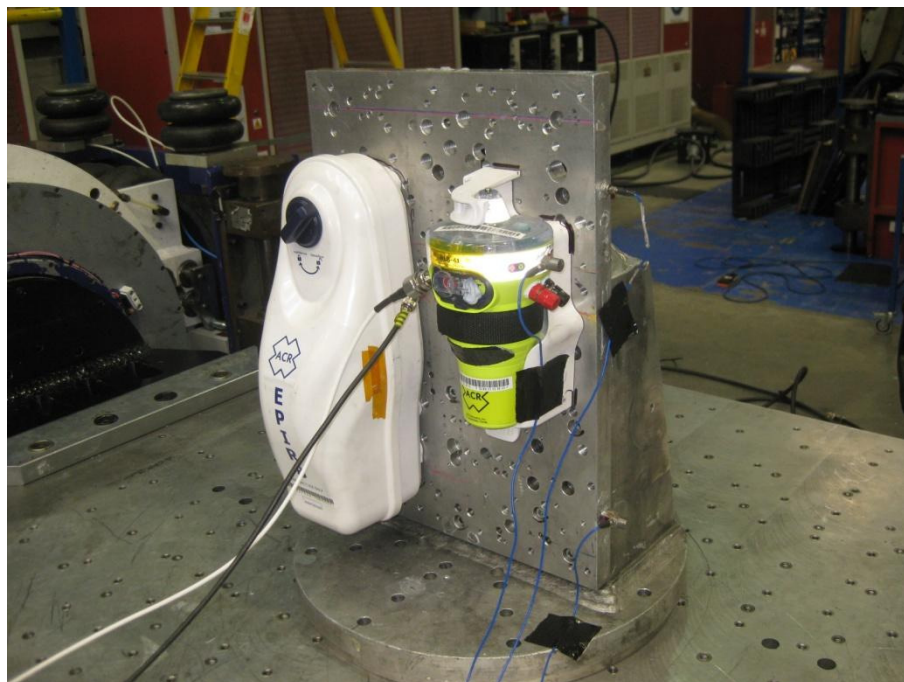
The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Environmental Conditions

Ambient Temperature 18.4 - 19.0°C

Relative Humidity 45.9 – 57.9%

2.4.6 Test Setup





Product Service

2.4.7 Test Method

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

Resonance Sweep

- 5 Hz and up to 13.2 Hz with an excursion of ± 1 mm (7 m/s^2 maximum acceleration at 13.2 Hz);
- above 13.2 Hz and up to 100 Hz with a constant maximum acceleration of 7 m/s^2 .

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

The following resonant frequencies were found

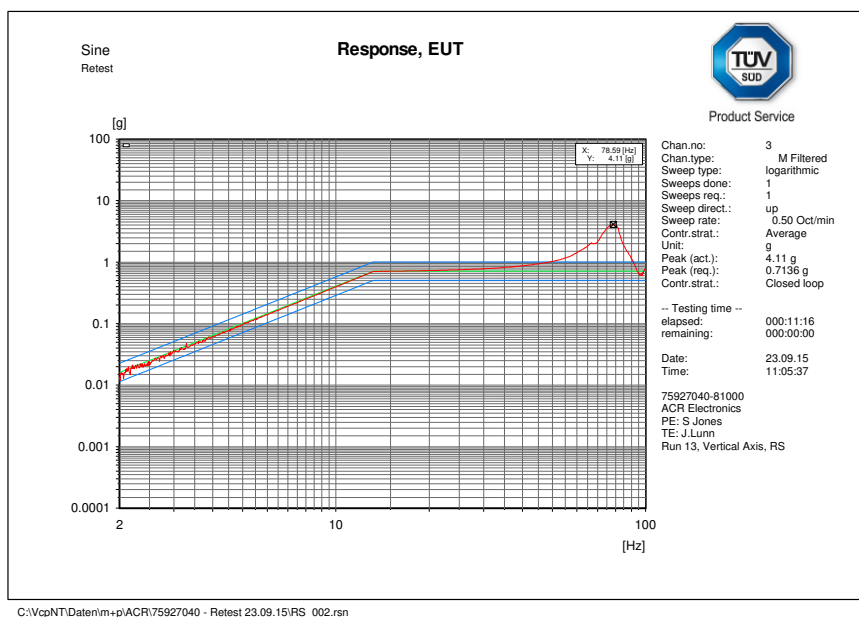
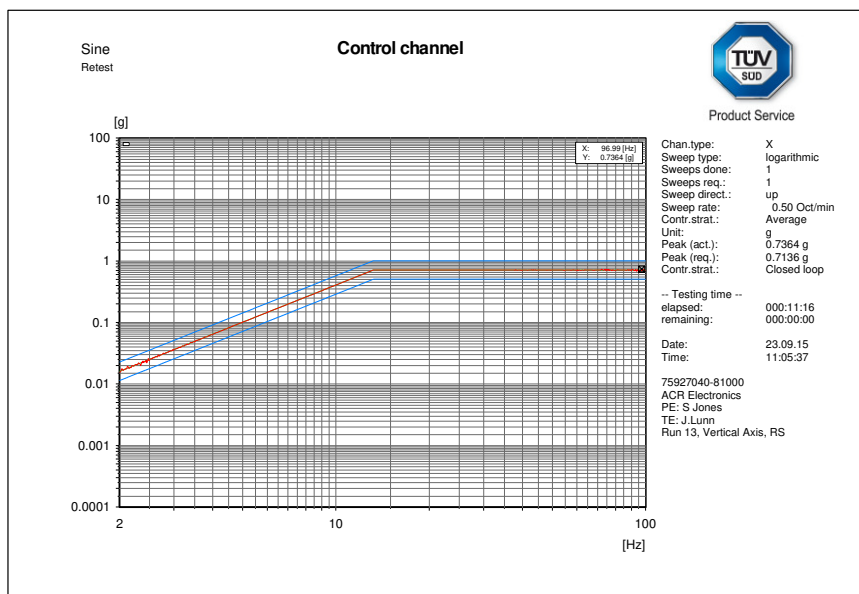
Up and Down EUT in float free housing: 78.59 Hz
Side to Side EUT in float free housing: 81.97 Hz
Front and Back EUT in float free housing: 81.03 Hz
Up and Down EUT in manual release bracket: 48.37 Hz
Side to Side EUT in manual release bracket: 26.0 Hz
Front and Back EUT in manual release bracket: 39.33 Hz

Where a resonance frequency was found the EUT was subject to the 2 hour endurance run at that frequency. If not frequency was found the EUT endurance run was carried out at 30 Hz. At the end of the test, each EUT was subjected to a Performance Check.



Product Service

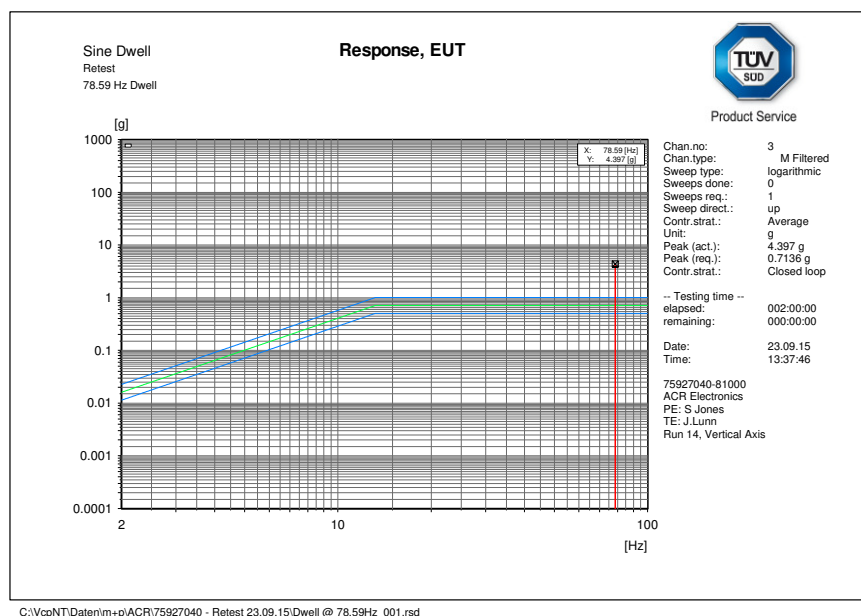
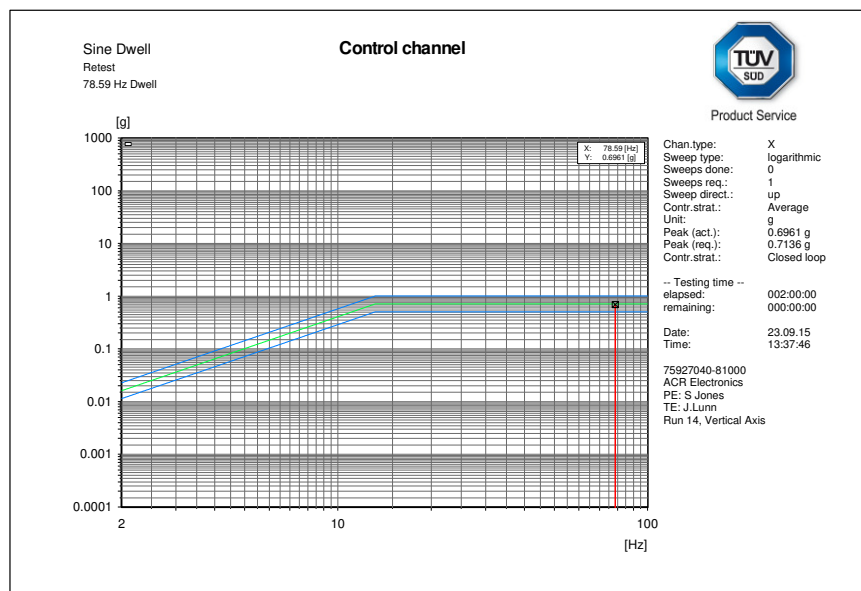
Up and Down (Float Free Housing) Res Search – Control and EUT





Product Service

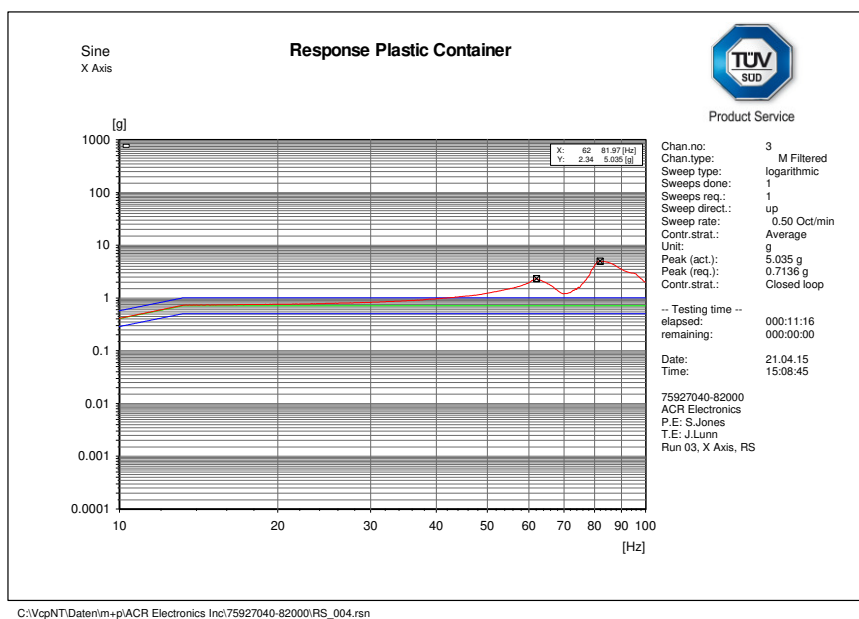
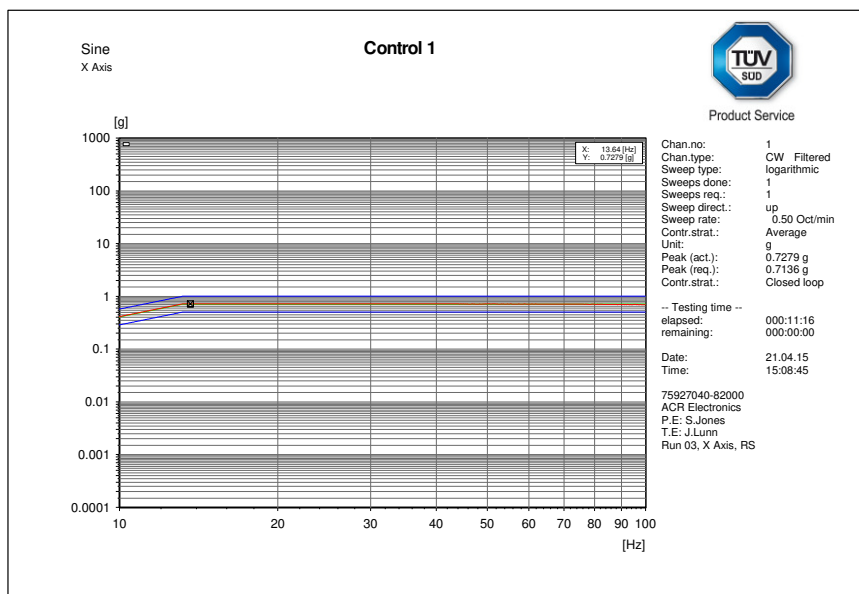
Up and Down (Float Free Housing) Endurance Run (78.59 Hz) – Control and EUT





Product Service

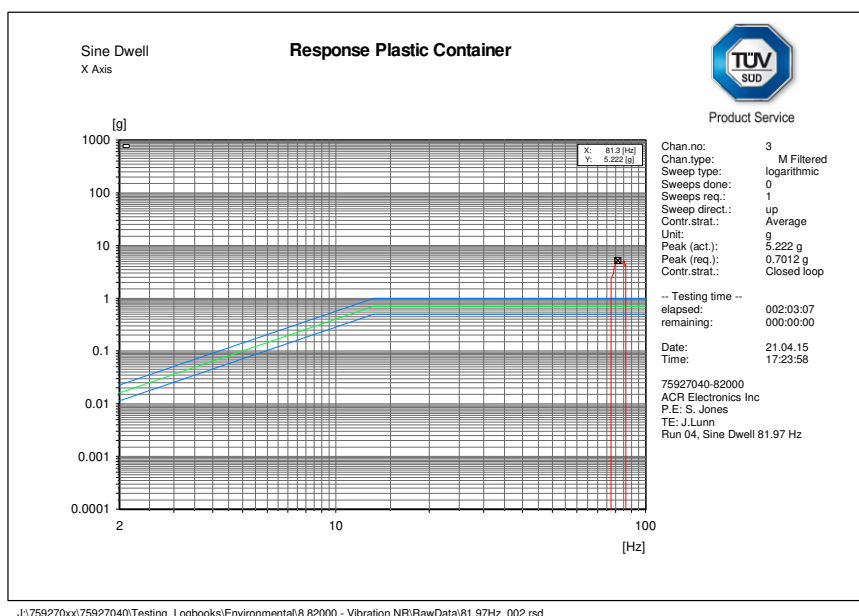
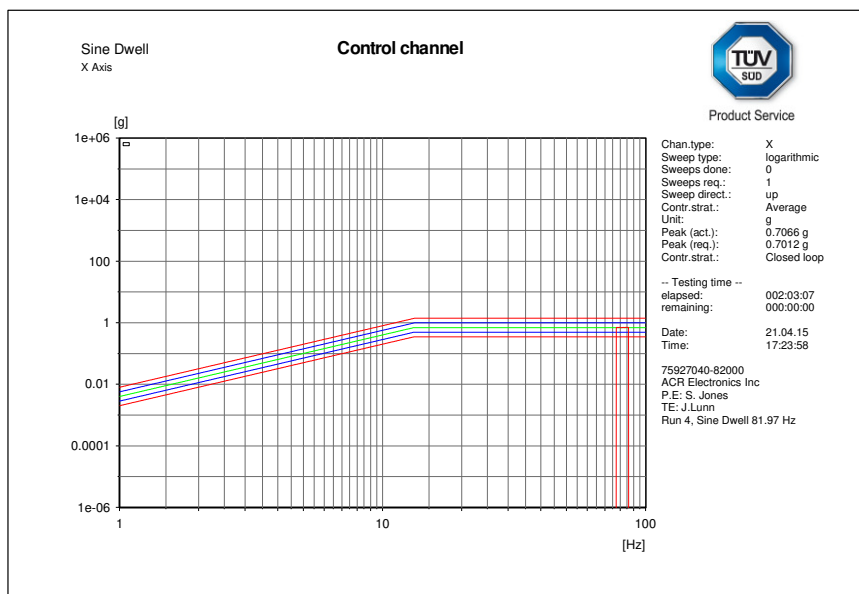
Side to Side (Float Free Housing) Res Search – Control and EUT





Product Service

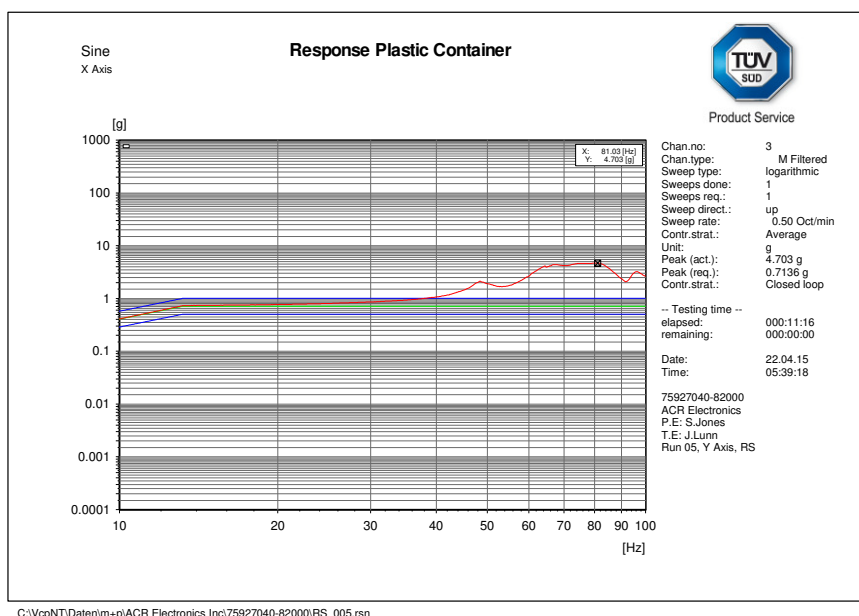
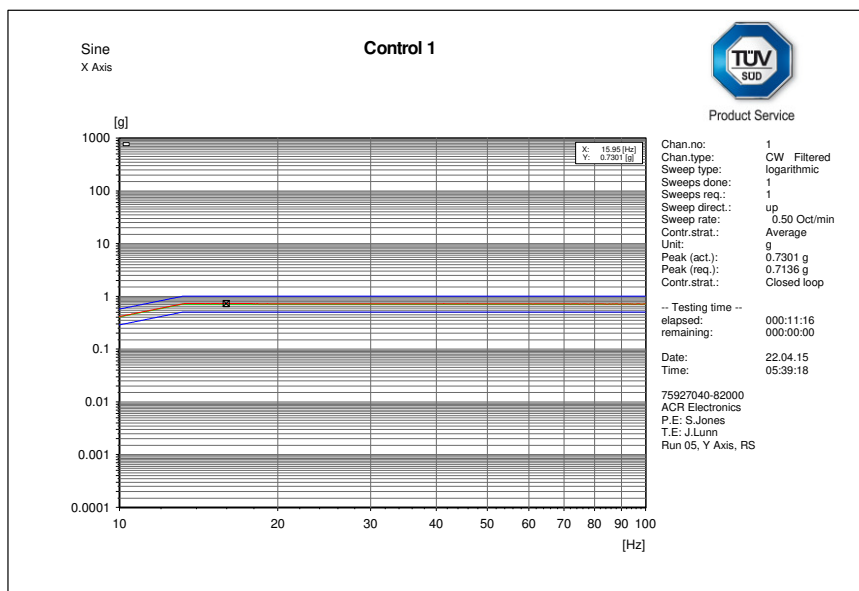
Side to Side (Float Free Housing) Endurance Run (81.97 Hz) – Control and EUT





Product Service

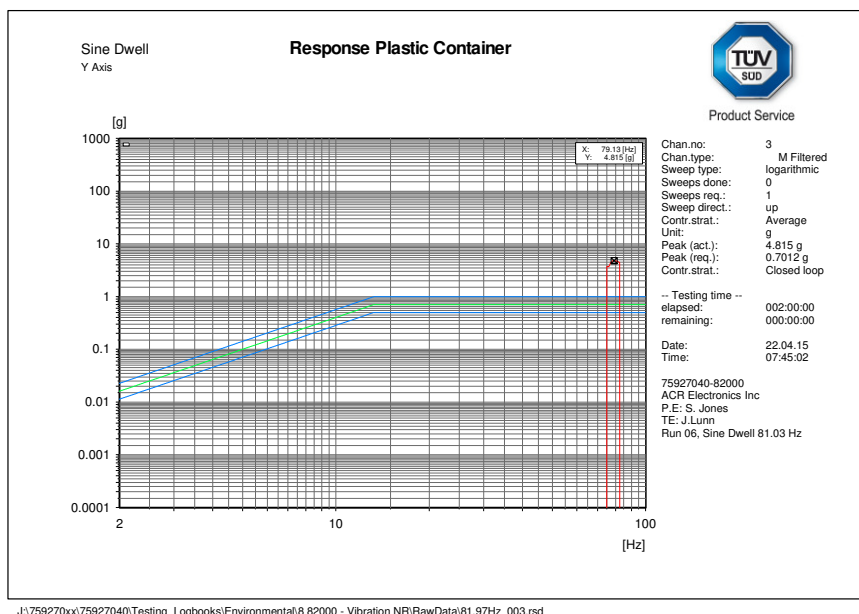
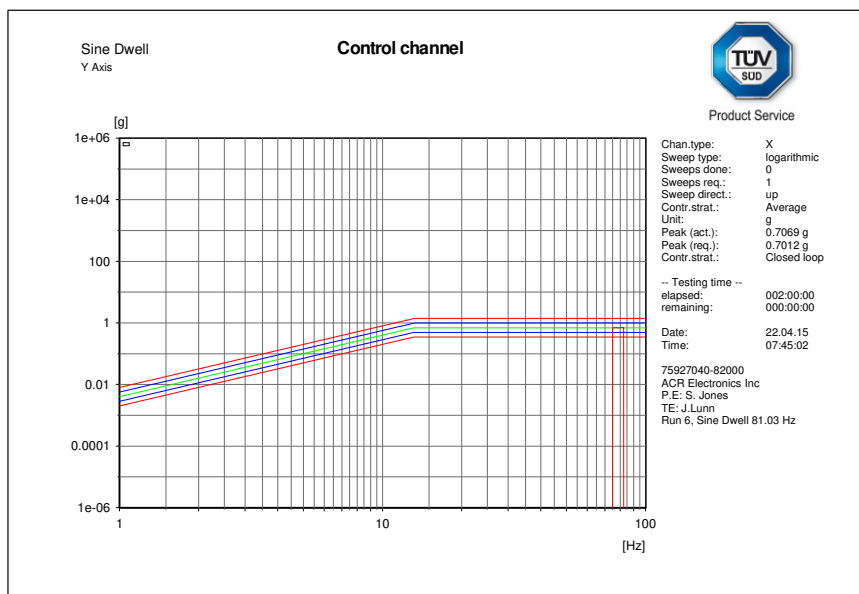
Front and Back (Float Free Housing) Res Search – Control and EUT





Product Service

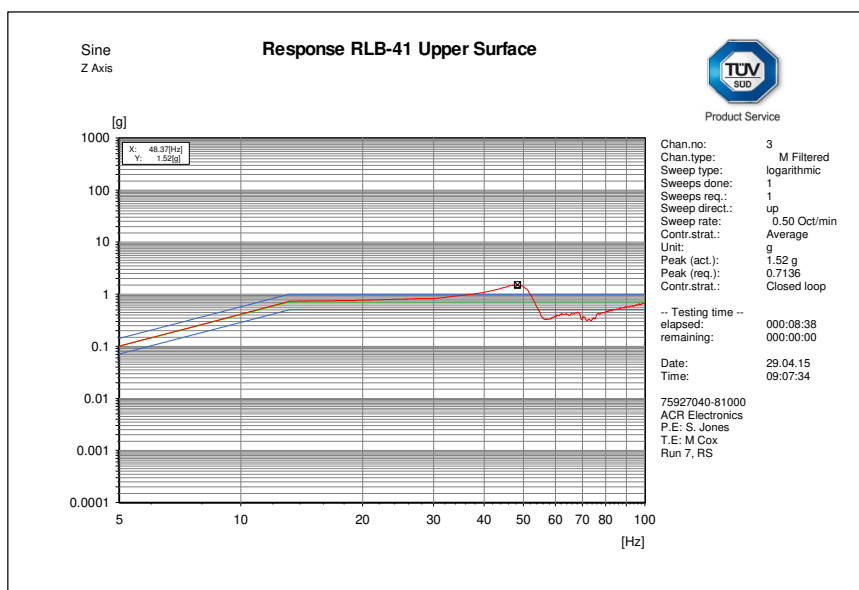
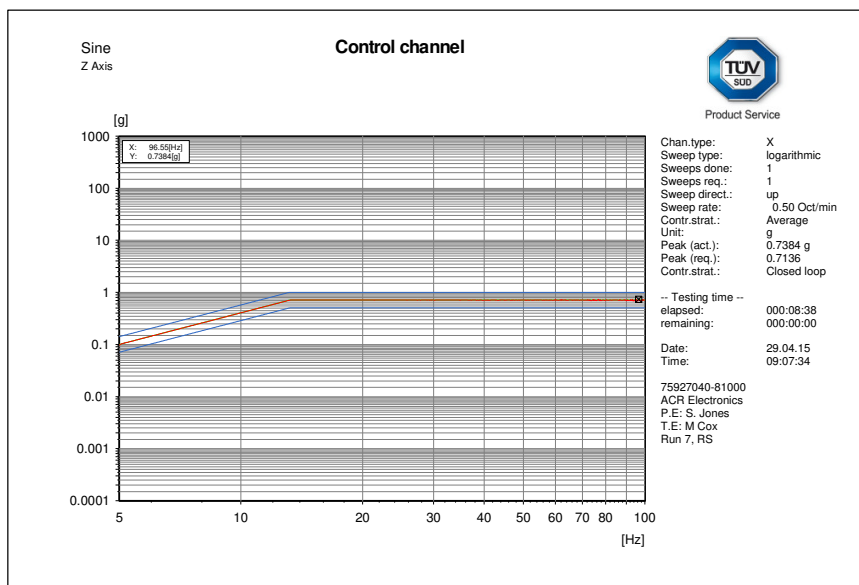
Front and Back (Float Free Housing) Endurance Run (81.03 Hz) – Control and EUT





Product Service

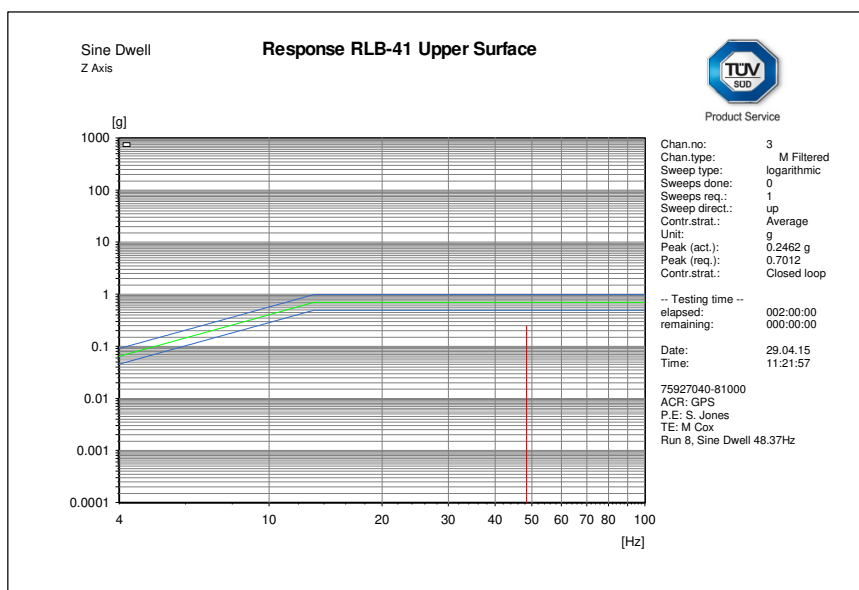
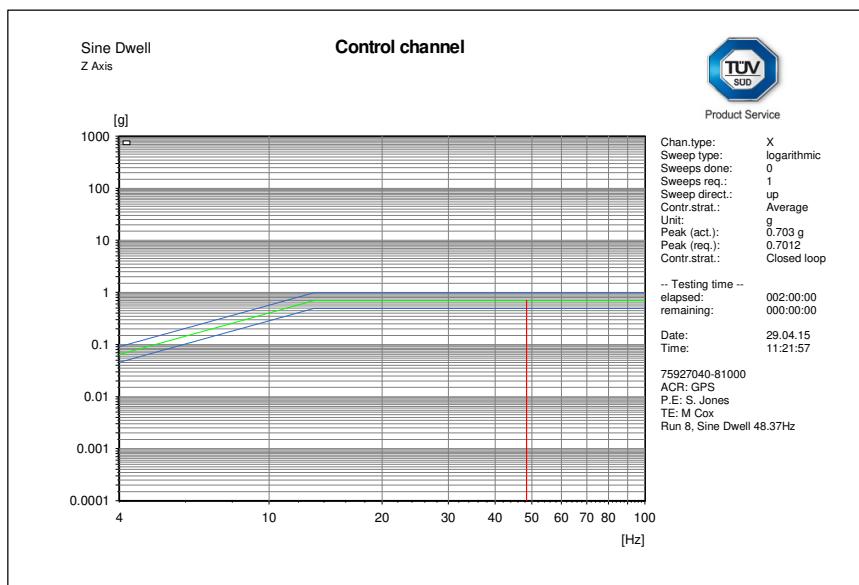
Up and Down (Manual Bracket) Res Search – Control and EUT





Product Service

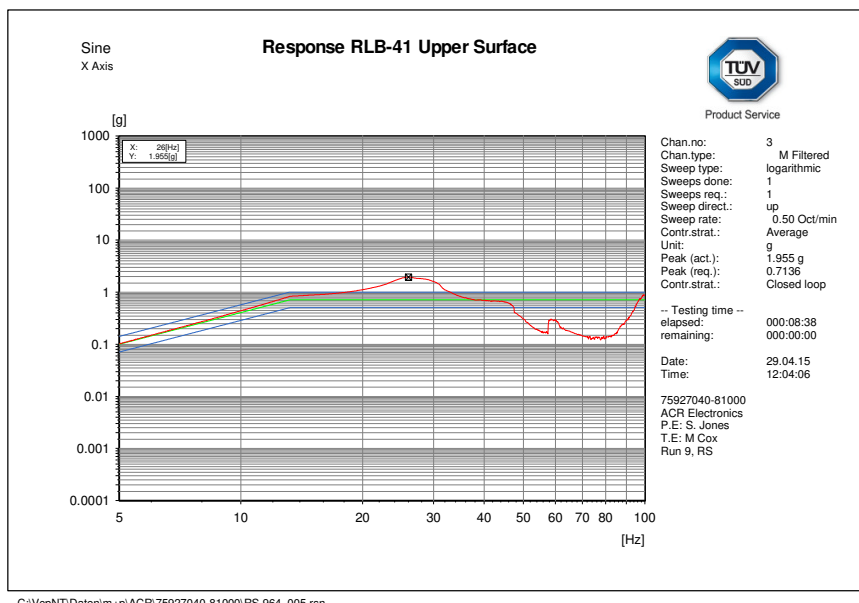
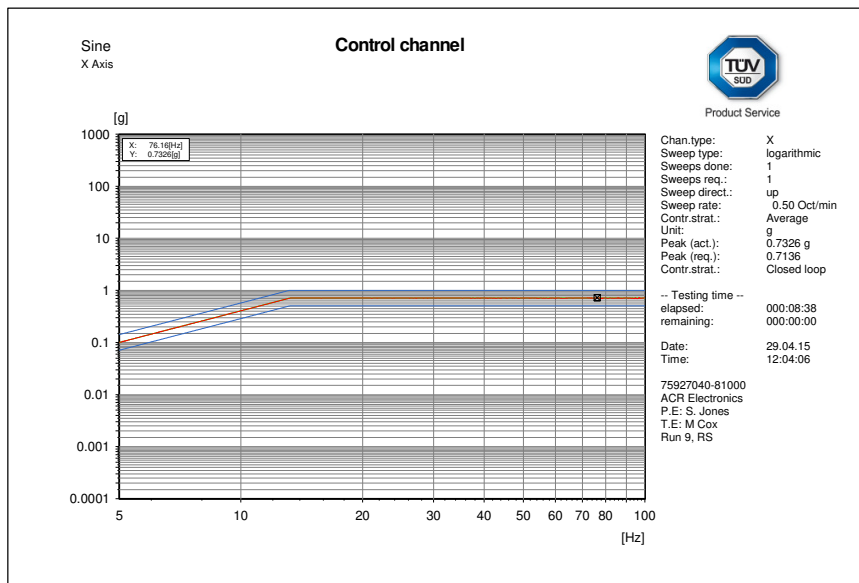
Up and Down (Manual Bracket) Endurance Run (48.37 Hz) – Control and EUT





Product Service

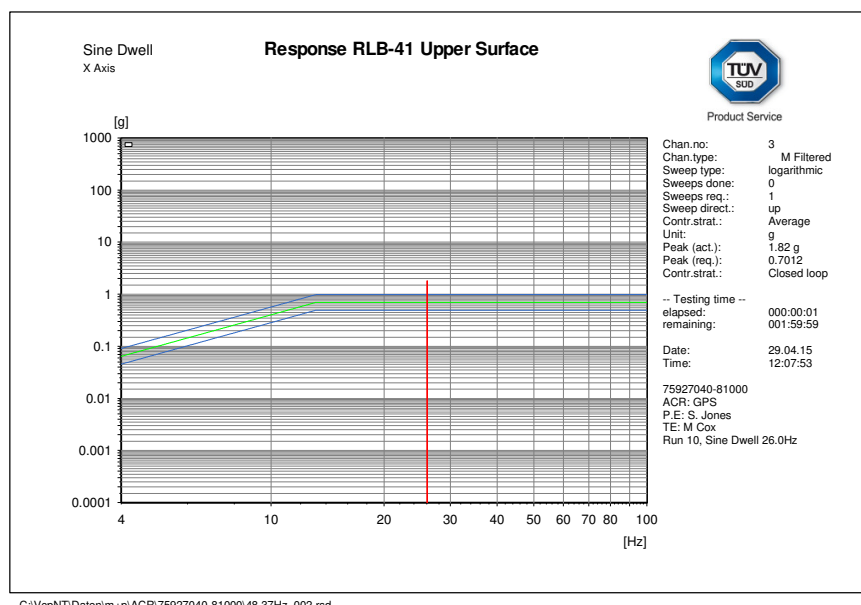
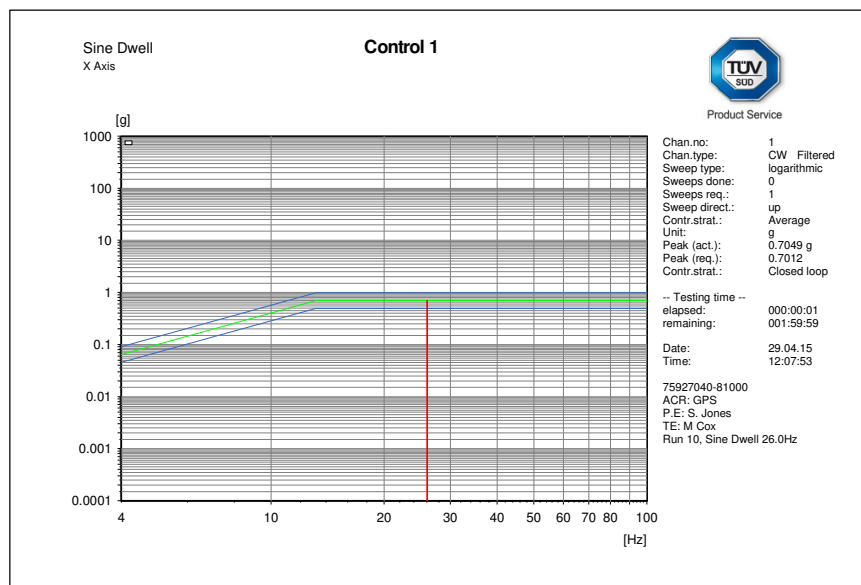
Side to Side (Manual Bracket) Res Search – Control and EUT





Product Service

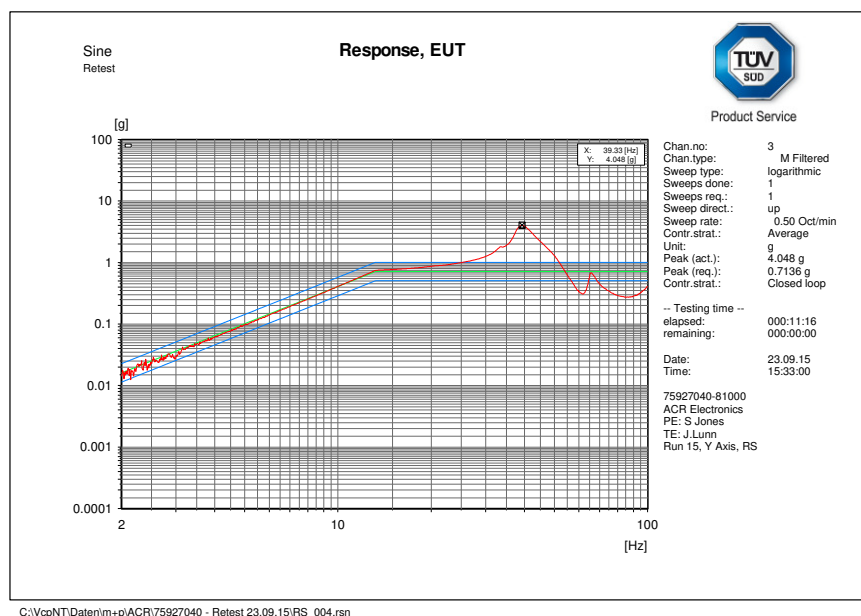
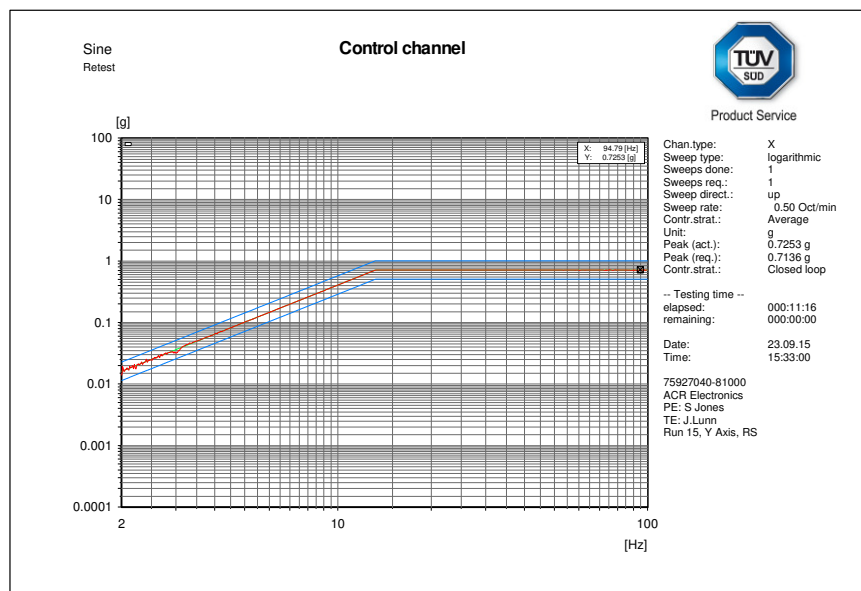
Side to Side (Manual Bracket) Endurance Run (26.0 Hz) – Control and EUT





Product Service

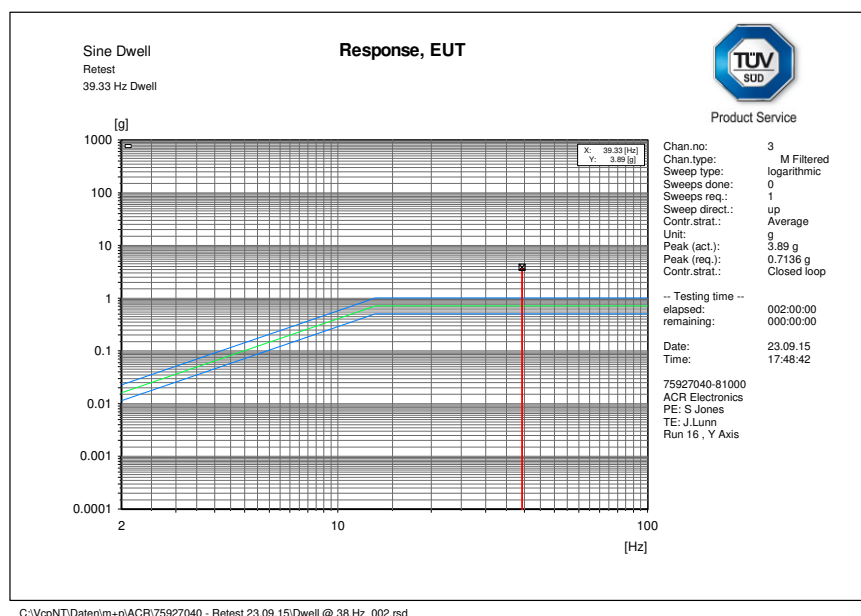
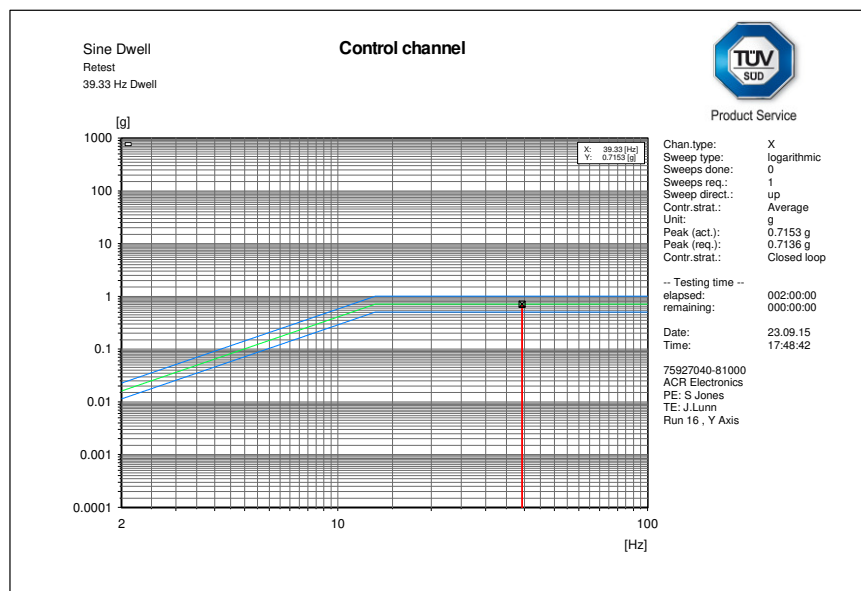
Front and Back (Manual Bracket) Res Search – Control and EUT





Product Service

Front and Back (Manual Bracket) Endurance Run (39.33 Hz) – Control and EUT





Product Service

2.4.8 Test Results

Performance Check Results

RLB-41 S/N: #9 (TUV Ref TSR0064)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039965
121 MHz Presence	P

RLB-41 S/N: #15 (TUV Ref TSR0058)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.0400
121 MHz Presence	P

Mechanical Inspection

Post test no signs of mechanical degradation were witnessed.

Activation Monitoring

During the test the EUT was monitored for signs of activation, none were found.

2.5 RUGGEDNESS TEST

2.5.1 Specification Reference

AS/NZS 4280.1, clause A.1.5 (5.13.7)

2.5.2 Equipment Under Test and Modification State

RLB-41 S/N: #15 (TUV Ref TSR0058) - Modification State 0

RLB-41 S/N: #9 (TUV Ref TSR0064) - Modification State 0

2.5.3 Date of Test

24 April 2015

2.5.4 Test Equipment Used

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

2.5.5 Environmental Conditions

Ambient Temperature 18.2 °C

Relative Humidity 47.9 %

2.5.6 Test Setup





Product Service

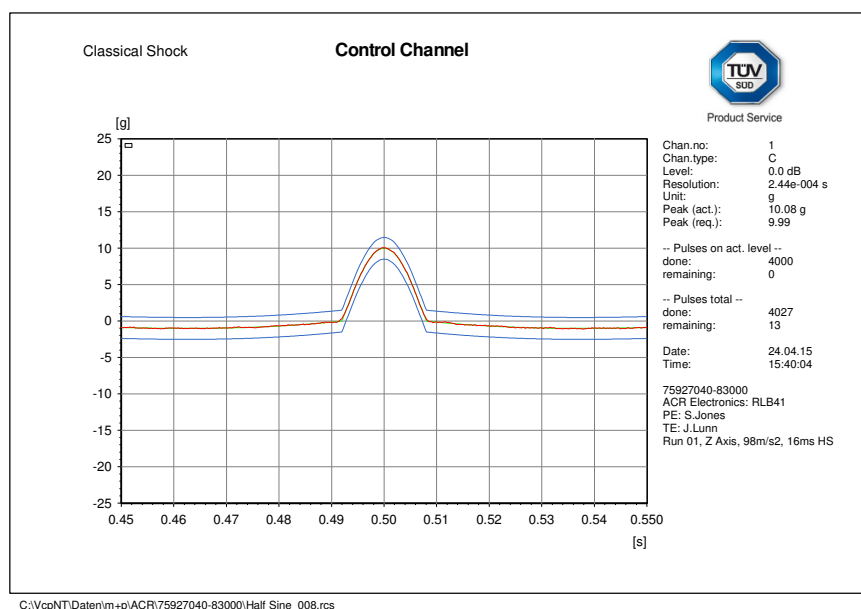
2.5.7 Test Method

The PLB was subjected to the bump test according to the following profile:

Peak acceleration: $98 \text{ m/s}^2 \pm 10\%$
Pulse duration: $16 \text{ ms} \pm 10\%$
Wave shape: Half-cycle sinewave
Test Axis: Vertical
Number of bumps: 4000

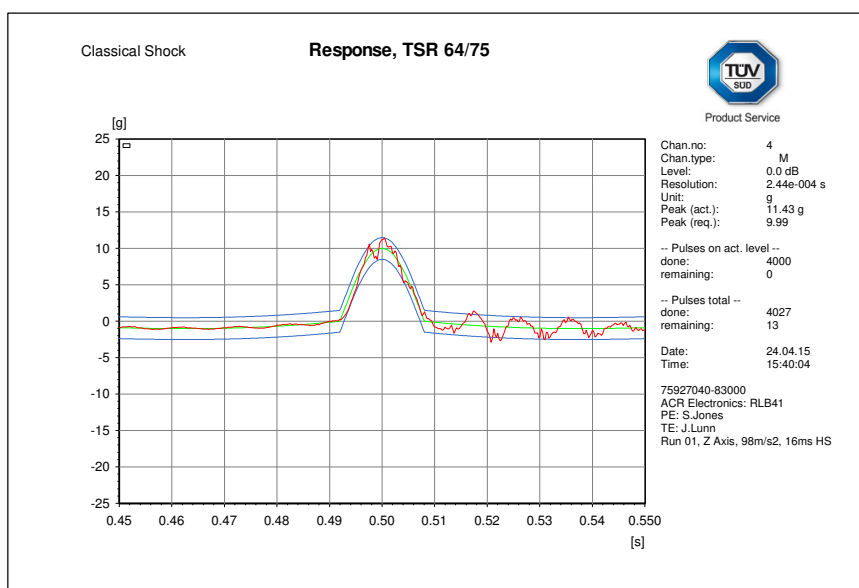
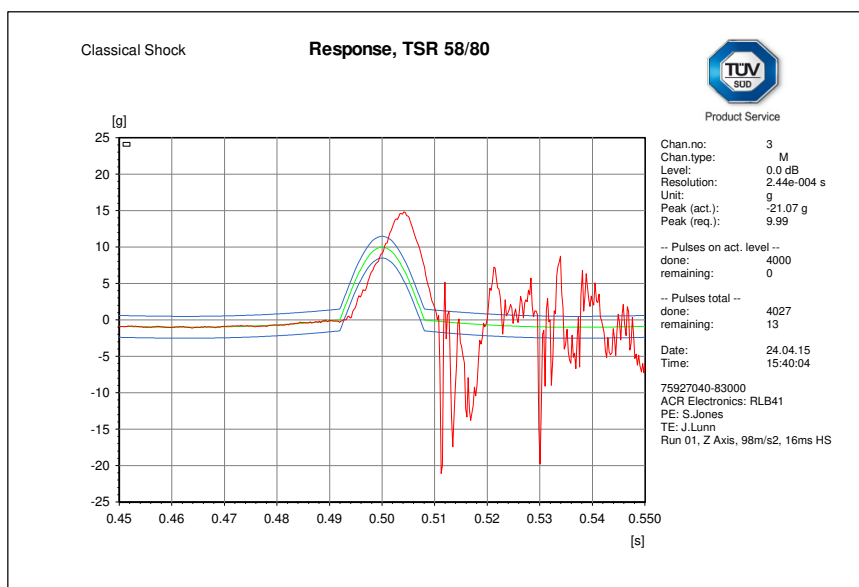
2.5.8 Test Results

Vertical Axis, 4000 Bumps





Product Service



Post Test Inspection

No signs of mechanical degradation were observed.

EUT Response

The EUT did not activate during the test.



Product Service

Summary of Performance Check Results

S/N: #15 (TUV Ref TSR0058) – Conducted EUT in Manual Release Bracket

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039962
121 MHz Presence	P

S/N: #9 (TUV Ref TSR0064) – Radiated EUT in Float Free Case

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039974
121 MHz Presence	P

2.6 CORROSION TEST

2.6.1 Specification Reference

AS/NZS 4280.1, clause A.1.6 (5.13.9)

2.6.2 Equipment Under Test and Modification State

RLB-41 S/N: #20 (TUV Ref TSR0036) - Modification State 0

2.6.3 Date of Test

17 November to 17 December 2014

2.6.4 Test Equipment Used

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

2.6.5 Environmental Conditions

Ambient Temperature 22.2 – 23.7°C

Relative Humidity 28.8 - 45.7%

2.6.6 Test Setup





2.6.7 Test Method

The EUT was placed in a chamber and sprayed with a salt solution for 2 h at normal temperature. The salt solution was prepared by dissolving (5 ± 1) parts by weight of sodium chloride (NaCl) in 95 parts by weight of distilled or demineralised water.

At the end of the spraying period, the EUT was placed in a chamber which was maintained at a temperature of $40\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, and a relative humidity between 90 % and 95 % for a period of seven days.

The EUT was subjected to a test comprising four spraying periods, each of duration 2 h, with a storage period of seven days after each.

At the conclusion of the test the EUT was inspected with the naked eye without magnification. The EUT was then subjected to a performance check.

2.6.8 Test Results

Inspection

On completion of the test the EUT was subjected to an inspection. No sign of water ingress was found. There were signs of some corrosion around water activation contacts, as shown below:



Product Service



Corrosion on
water
contacts

Summary of Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039951
121 MHz Presence	P



Product Service

2.7 DROP INTO WATER (NUA)

2.7.1 Specification Reference

AS/NZS 4280.1, clause A.1.7 (5.13.5)

2.7.2 Equipment Under Test and Modification State

RLB-41 S/N: #9 (TUV Ref TSR0064) - Modification State 0

2.7.3 Date of Test

30 April 2015

2.7.4 Test Equipment Used

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

2.7.5 Environmental Conditions

Ambient Temperature 19.4 °C
Relative Humidity 34.9 %

2.7.6 Test Method

The EUT was dropped three times from a height of 20 m into water. The EUT was orientated once with the antenna vertically up, once vertically down, and once horizontally.

2.7.7 Test Results

Setup Photo



EUT Response

The EUT activated after each drop, when contact with the water was made and deactivated shortly after being removed from the water.

Examination

The EUT was subjected to an external visual inspection post-test and no signs of ingress or external damage were observed.



Product Service

Summary of Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FFFE2F8C9EF9C06332E0227236F796A6B046
406 MHz Frequency	406.039961
121 MHz Presence	P

Message content indicates that a position was acquired. The Performance Check was conducted outdoors, therefore ambient signals were likely detected by the EUT.

2.8 THERMAL SHOCK

2.8.1 Specification Reference

AS/NZS 4280.1, clause A.1.8 (5.13.4)

2.8.2 Equipment Under Test and Modification State

RLB-41 S/N: #9 (TUV Ref TSR0064) - Modification State 0

2.8.3 Date of Test

11 May 2015

2.8.4 Test Equipment Used

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

2.8.5 Environmental Conditions

Ambient Temperature 23.2 °C
Relative Humidity 46.6 %

2.8.6 Test Setup





Product Service

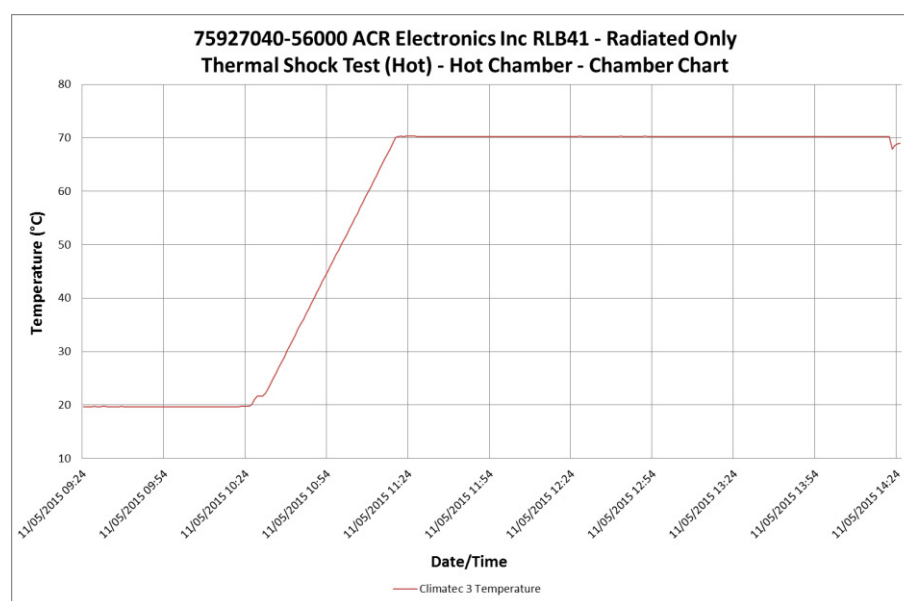
2.8.7 Test Method

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

The EUT was then immersed in a water vessel (preconditioned for approximately 1 hours) at 25°C, at a level of 100mm below the surface of the water (measured to the highest point of the EUT).

2.8.8 Test Results

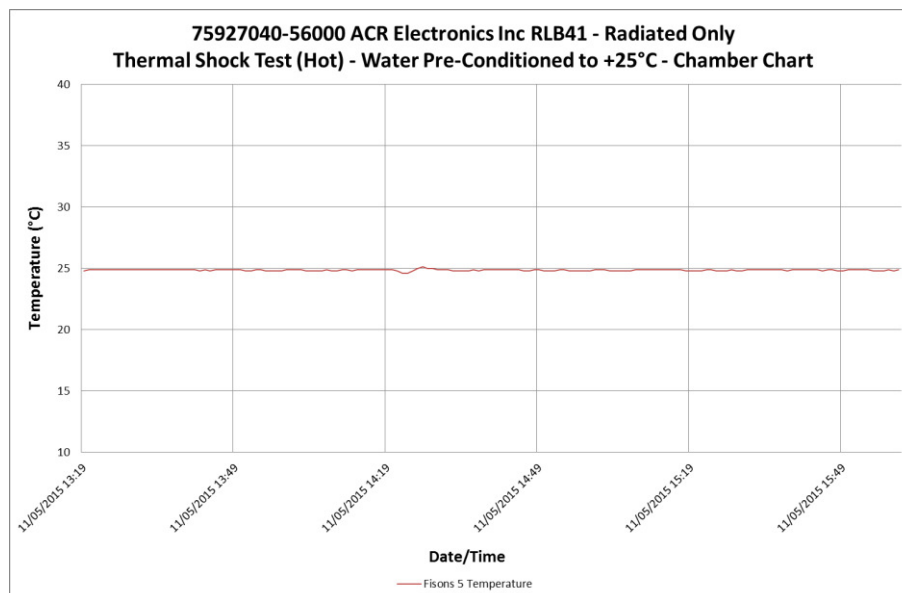
Preconditioning Temperature Plot





Product Service

Water Temperature Plot



Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.0400
121 MHz Presence	P



Product Service

2.9 IMMERSION TEST

2.9.1 Specification Reference

AS/NZS 4280.1, clause A.1.9 (5.13.8)

2.9.2 Equipment Under Test and Modification State

RLB-41 S/N: #9 (TUV Ref TSR0064) - Modification State 0

2.9.3 Date of Test

11 May 2015

2.9.4 Test Equipment Used

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

2.9.5 Environmental Conditions

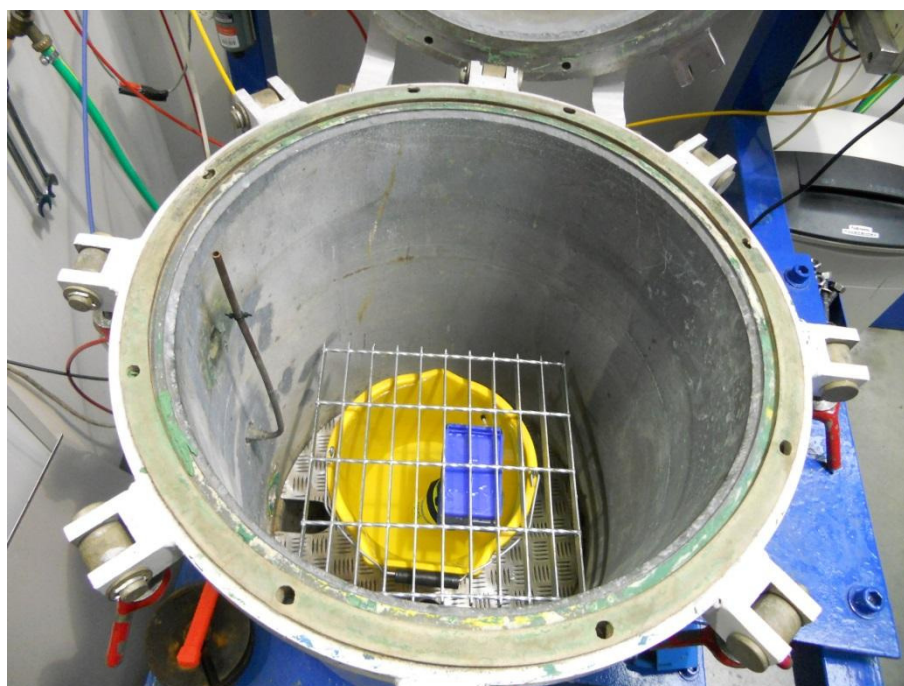
Ambient Temperature 23.4 °C
Relative Humidity 46.6 %

2.9.6 Test Method

The EUT was completely submerged in a vessel of water and then positioned in an overpressure chamber. A gauge pressure corresponding to a 10 m head of water was applied for a period of 5 minutes.

2.9.7 Test Results

Setup Photo



Examination

On completion of the test the EUT was inspected. No signs of water ingress were found.

Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B7
Normal Mode:	
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039965
121 MHz Presence	P

Observation: the EUT failed to switch off after the immersion test. The Manufacturer advised that this was most likely caused by pressure differential between the inside and outside of the EPIRB, thus causing the membrane On/Off switch to remain in the depressed state. The EUT was switched off manually by TUV SUD engineers.



Product Service

2.10 SPURIOUS EMISSIONS TEST

2.10.1 Specification Reference

AS/NZS 4280.1, clause A.1.10 (5.15)

2.10.2 Equipment Under Test and Modification State

RLB-41 S/N: Unit #56 (TUV Ref TSR0002) - Modification State 0

2.10.3 Date of Test

18 May 2015, 8 June 2015, 12 June 2015 and 15 June 2105

2.10.4 Test Equipment Used

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

2.10.5 Environmental Conditions

Ambient Temperature 22.5 - 23.2 °C

Relative Humidity 29.1 - 30.3 %

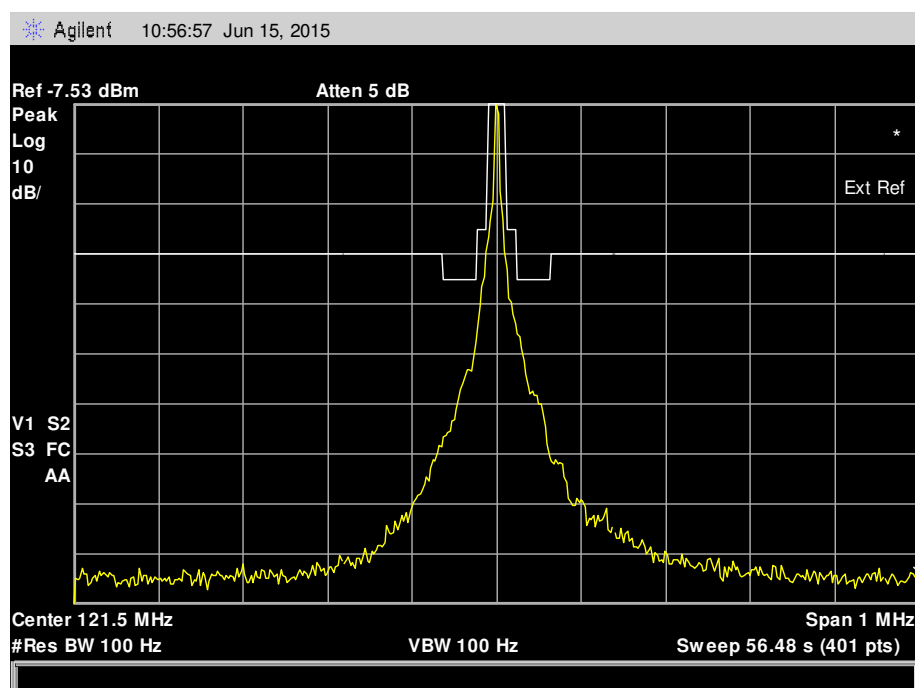


Product Service

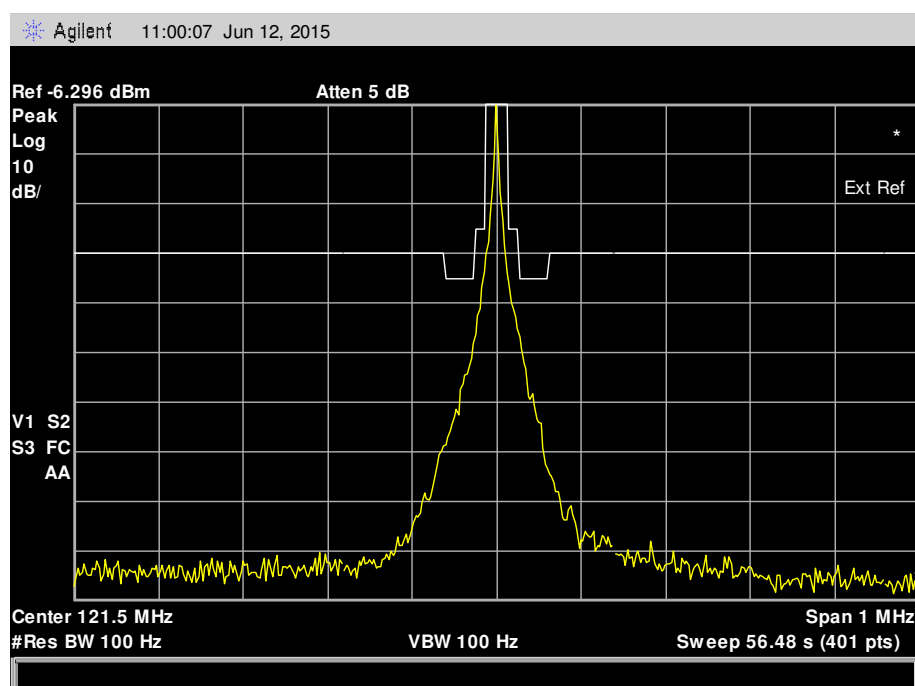
2.10.6 Test Results

121 Homing Transmitter

Minimum Temperature



Maximum Temperature

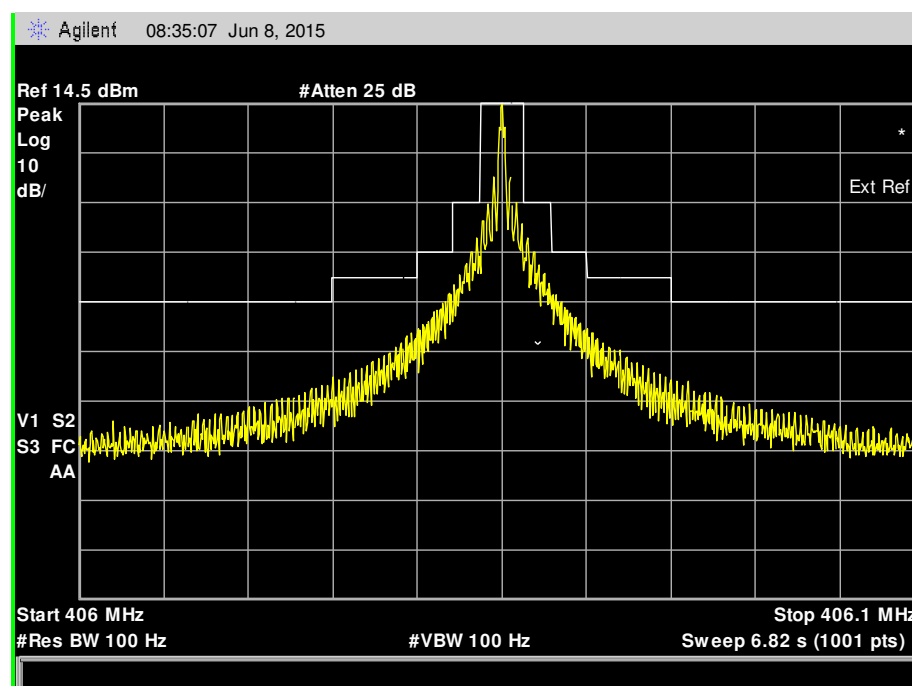




Product Service

406 Transmitter

Combined Plot over Ambient, Minimum and Maximum Temperatures



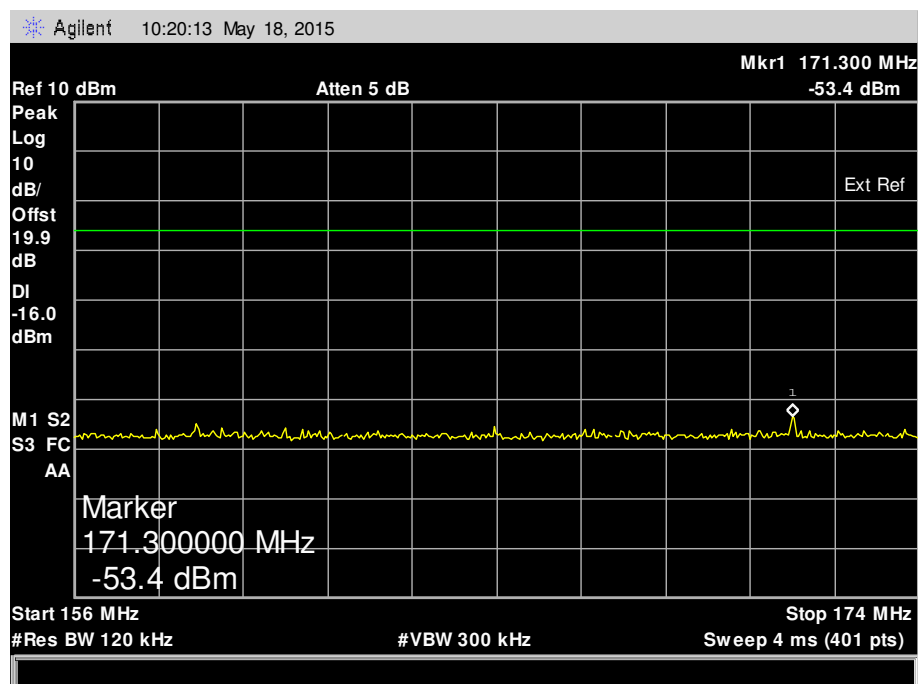
Note: Plot taken during Limited Cospas Sarsat measurements made at the end of the Environmental Test programme



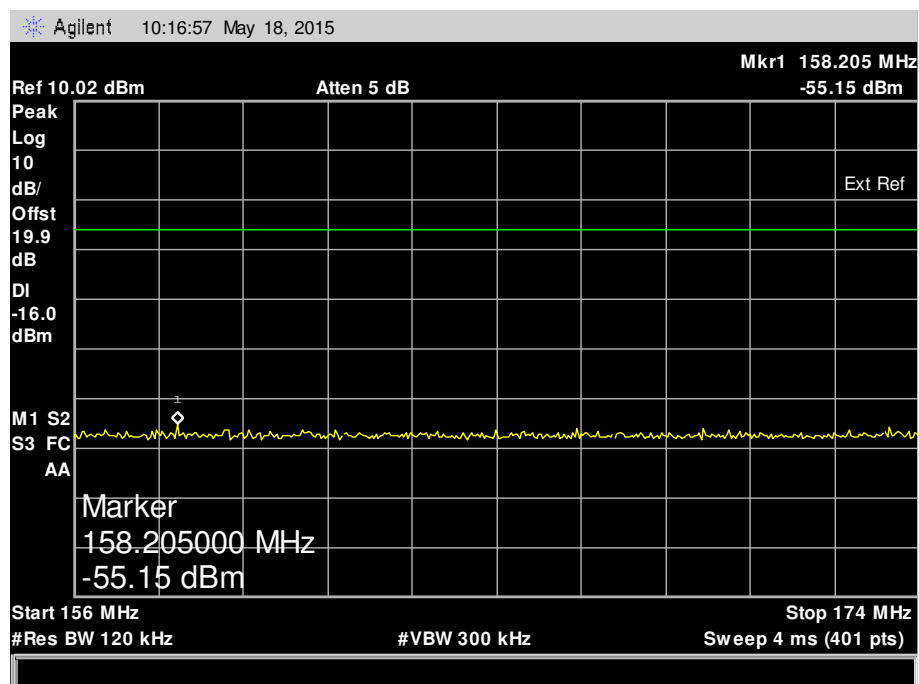
Product Service

156MHz to 174MHz

406 Port



121 Port

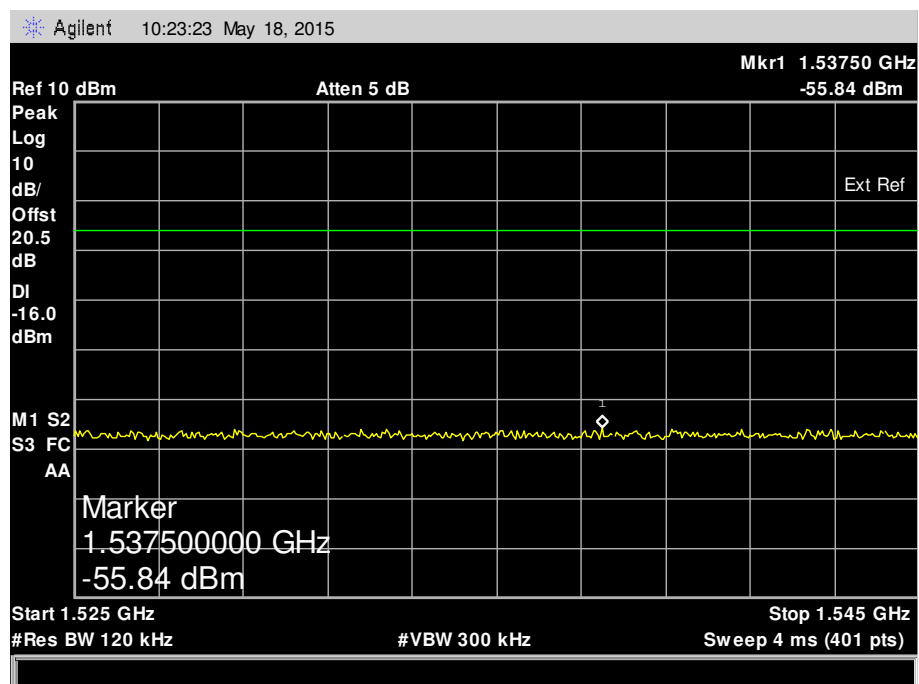




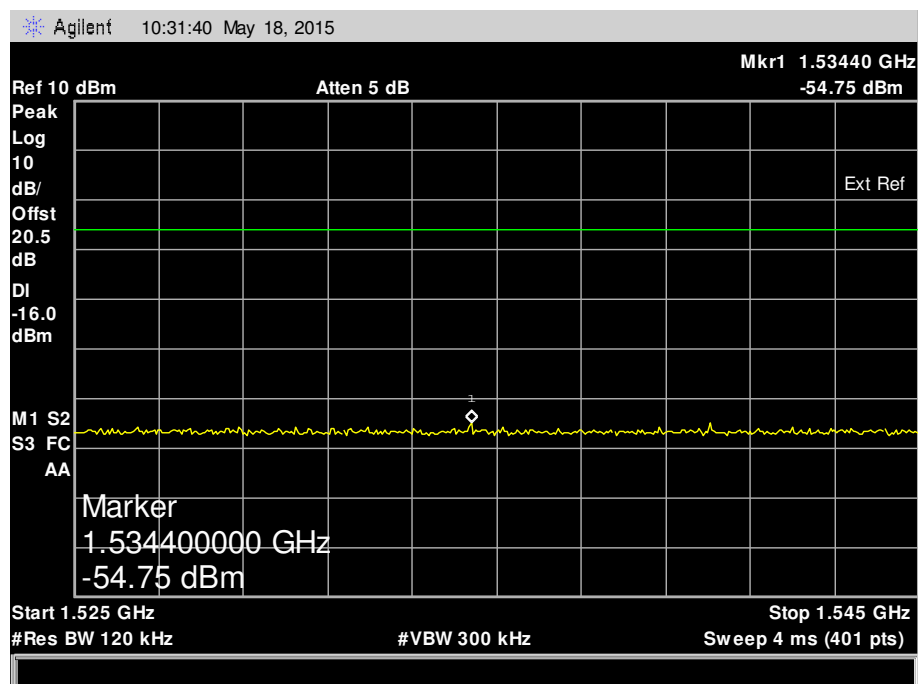
Product Service

1525MHz to 1545MHz

406 Port



121 Port





Product Service

2.11 CONDUCTED INTERFERENCE TEST

2.11.1 Specification Reference

AS/NZS 4280.1, clause A.1.11 (5.17)

There are no connections between the ship's power system and the EPIRB or its release mechanism therefore this test is not applicable.



Product Service

2.12 SIGNAL LIGHT TEST

2.12.1 Specification Reference

AS/NZS 4280.1, clause A.1.12

Refer to subcontractor (Opti Consulting Limited) report OC-0522-01.



Product Service

2.13 BATTERY CAPACITY AND LOW TEMPERATURE TEST

2.13.1 Specification Reference

AS/NZS 4280.1, clause A.1.13 (5.12.1)

2.13.2 Equipment Under Test and Modification State

RLB-41 S/N: #15 (TUV Ref TSR0058) - Modification State 0

2.13.3 Date of Test

31 May, 01 June and 02 June 2015

2.13.4 Test Equipment Used

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

2.13.5 Environmental Conditions

Ambient Temperature 21.1 °C

Relative Humidity 31.7 %

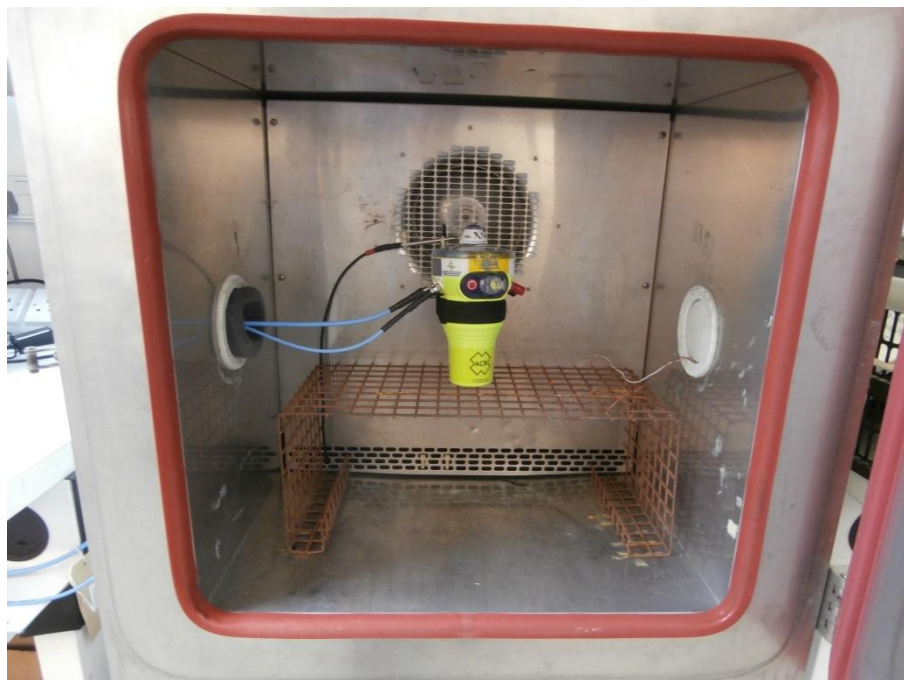
2.13.6 Test Method

The EUT was placed in a chamber; the temperature was reduced to -30 °C at ≥ 1 °C/min and held for 10 hours. The chamber temperature was increased to -20 °C over a period of 10 minutes and maintained at that temperature until the end of the test. The EUT was activated 30 minutes after the end of the 10 hour period and the Operating lifetime at minimum temperature test from C/S T.007 was performed. After 48 hours a Performance Check was performed.

2.13.7 Test Results

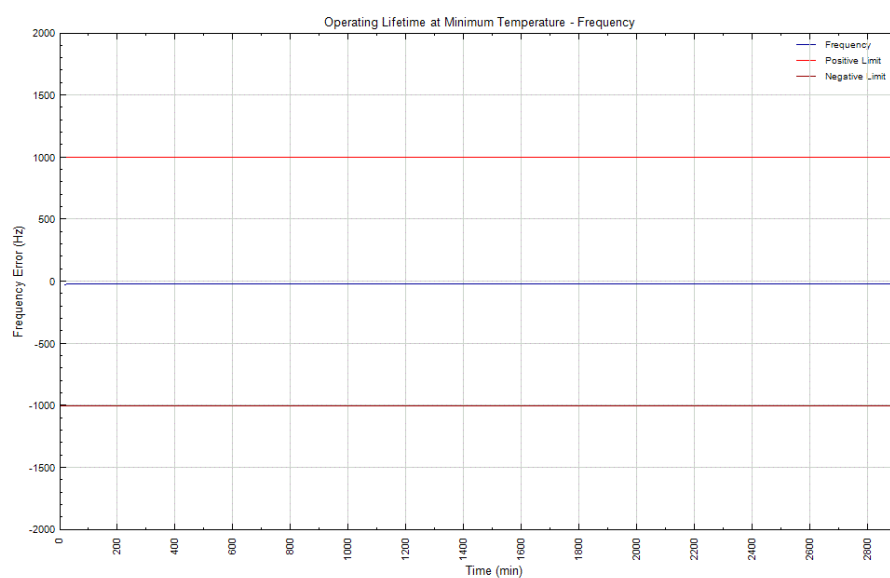
The test was performed with a fresh battery pack that had been discharged by operating for 38.4 hours. This figure was substantiated by the manufacturer.

Test Setup



Operating Lifetime Test Results

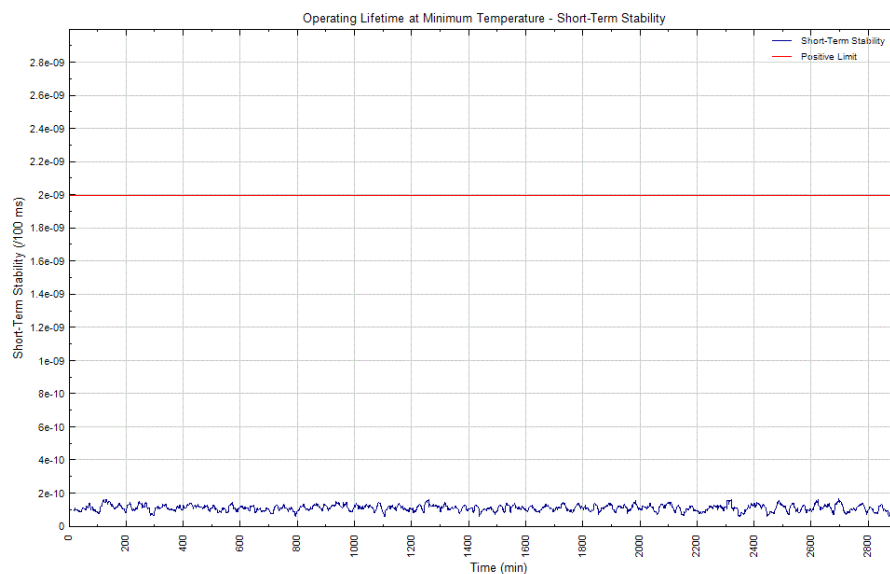
Nominal Frequency



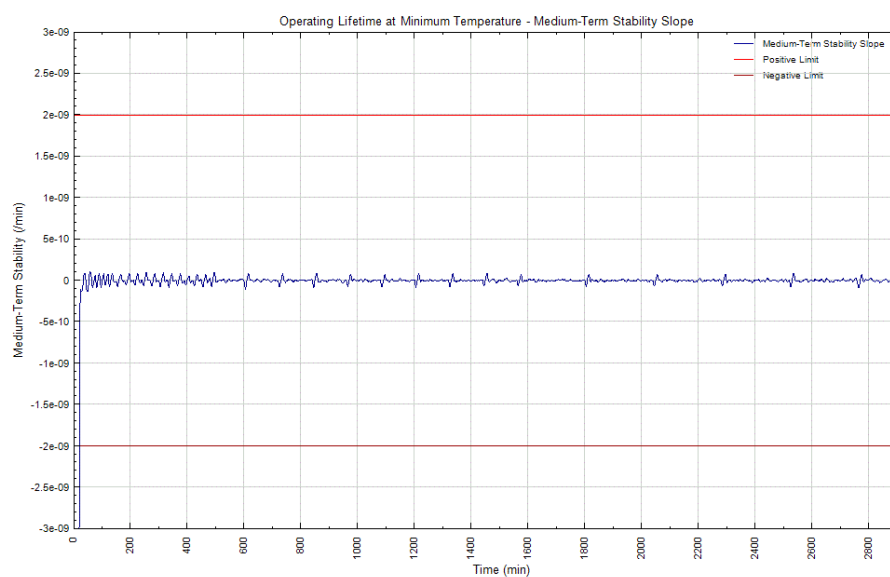


Product Service

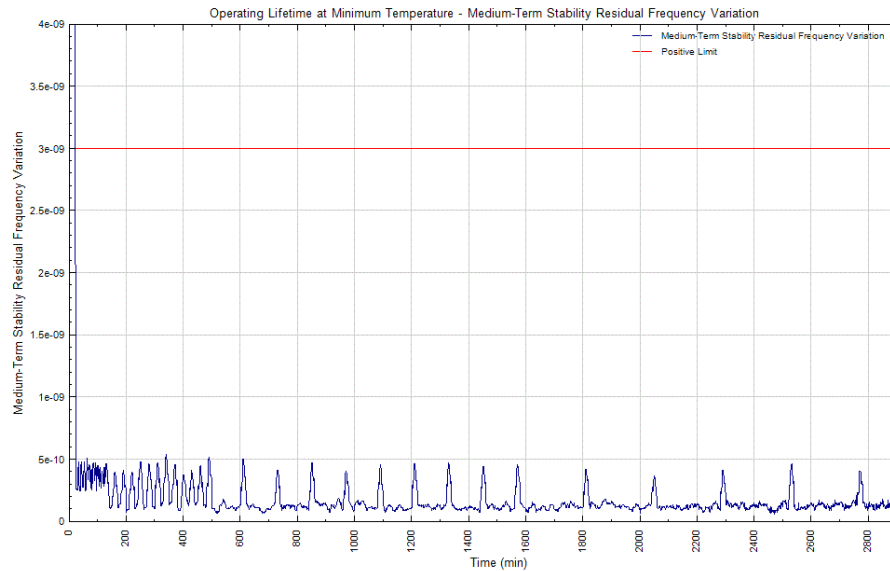
Short Term Stability



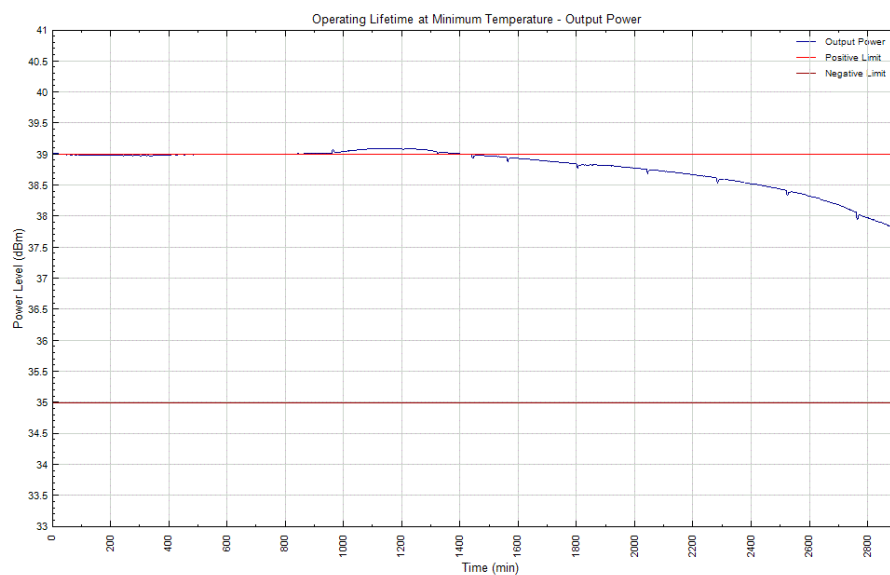
Medium Term Stability – Mean Slope



Medium Term Stability – Residual Frequency Variation



Output Power



Note: Whilst multiple output power measurements were above the upper limit, they were accepted as satisfactory per C/S T.007 Clause A.1 which states that “measurement accuracies may be added to the beacon specification limits [...] allowing a slight extra margin” and that “measurement accuracy requirements [...] are given in Annex A of C/S T.008”. The C/S T.008 measurement accuracy requirement for output power is 0.5 dB.



Product Service

Digital Message

Message: FFFE2F8C9EF9C0637FDFF83D15B783E0F66C

Hex ID: 193DF380C6FFBFF

Parameter	Bit	Data Bits	Decoded Value
Bit synchronization	1	1111111111111111	1111111111111111
Frame synchronization	16	000101111	000101111
Format Flag	25	1	1
Protocol Flag	26	0	0
Country Code	27	0011001001	Albania (Republic of)
Protocol Code	37	1110	Standard Test Location Protocol
Undefined	41	111110011100000001100011	-
N/S	65	0	Default
Latitude Degrees	66	111111111	Default
E/W	75	0	Default
Longitude Degrees	76	111111111	Default
BCH Code (21 Bit)	86	000001111010001010110	Correct
Supplementary Data Fixed	107	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	00000	Default
Delta Latitude Seconds	119	1111	Default
Delta Longitude +/-	123	1	Default
Delta Longitude Minutes	124	00000	Default
Delta Longitude Seconds	129	1111	Default
BCH Code (12 Bit)	133	011001101100	Correct



Product Service

Pre-test Discharge Calculation

The calculated pre-test discharge figure of 38.35 hours was determined as per the table below; values were manufacturer-declared unless otherwise specified.

Parameter	Unit	Value	Comments
Battery capacity	mAh	4200	3 packs at 1400 mAh per pack
Self-test current	mA	79.3	
Self-test duration	s	11	
Self-tests per year	-	12	
Self-test drain / year, Q_{ST}	mAh	2.91	= Current $\times$ duration $\times$ tests per year
GNSS Self-test current	mA	25.14	
GNSS Self-test duration	s	131.68	Measured during Cospas-Sarsat Type Approval Test Procedure (see Section 2.12)
GNSS Self-tests per year	-	8.4	
GNSS Self-test drain / year, Q_G	mAh	7.72	= Current $\times$ duration $\times$ tests per year
Standby current	nA	77.46	Measured during Cospas-Sarsat Type Approval Test Procedure (see Section 2.12)
Standby drain / year, Q_S	mAh	0.68	= Standby current $\times$ hours per year
Battery self-discharge / year	% / year	1%	
Battery self-discharge / year, Q_B	mAh	42	= self-discharge $\times$ battery capacity
Useful life, t_{UL}	years	20	
Capacity loss over useful life, Q_{UL}	mAh	1066.20	= $t_{UL} \times (Q_{ST} + Q_G + Q_S + Q_B)$
Operating current at ambient temp, I_{AMB}	mA	27.8	
Pre-test discharge	h	38.35	= $Q_{UL} \div I_{AMB}$



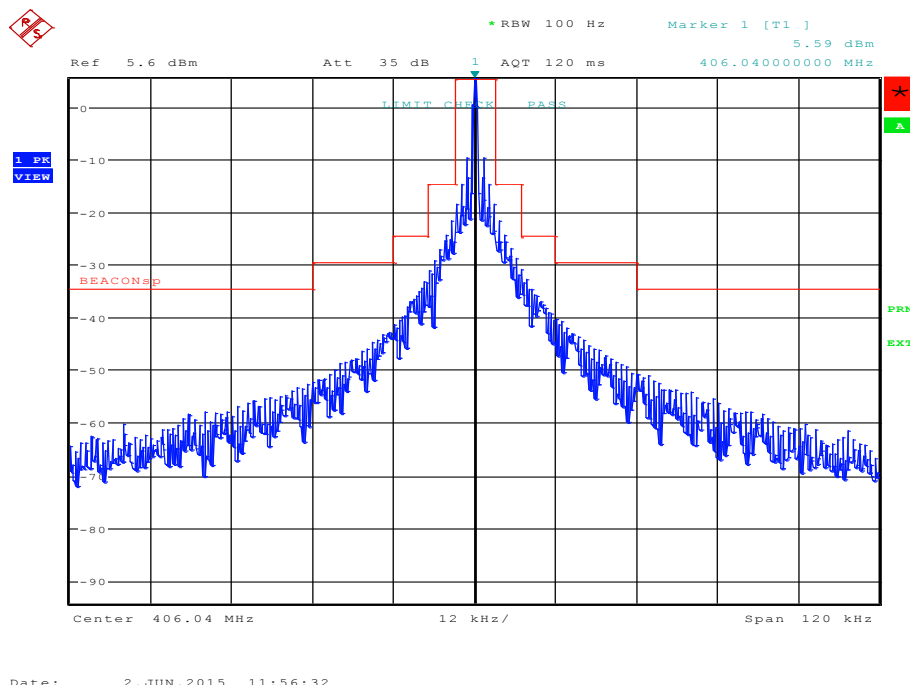
Product Service

Performance Test

RLB-41 S/N: #15 (TUV Ref TSR0058)

Parameter	Result (Max / Min)
Output Power	37.75 / 37.71
Digital Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
Bit Rate	399.93 / 399.91
Modulation: Rise Time (uS)	199.3 / 170.3
Modulation: Fall Time (uS)	187.7 / 163.6
Positive Deviation (rad)	1.1774 / 1.0170
Negative Deviation (rad)	-1.1966 / -1.0440
Nominal Frequency (MHz)	406.0400216 / 406.0400216
Short-term Stability (/100 ms)	11.562E-11 / 11.478E-11
Medium-term Stability – Slope (/minute)	-71.225E-13 / -16.950E-12
Medium-term Stability – Residual	13.080E-11 / 12.042E-11
Spurious Emissions	See plot below

Spurious Emissions





Product Service

2.14 COSPAS-SARSAT TYPE APPROVAL

2.14.1 Specification Reference

AS/NZS 4280.1, clause A.1.14

2.14.2 Equipment Under Test and Modification State

RLB-41 S/N: #15 (TUV Ref TSR0058) - Modification State 0
RLB-41 S/N: #9 (TUV Ref TSR0064) - Modification State 0

2.14.3 Date of Test

4 June 2015 to 17 June 2015

2.14.4 Test Equipment Used

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

2.14.5 Environmental Conditions

Ambient Temperature N/A
Relative Humidity N/A

2.14.6 Test Results

Full Cospas-Sarsat testing was carried out prior to the compulsory sequence of test as requested by ACR Electronics, Inc. A limited number of Cospas-Sarsat tests were repeated in order to demonstrate continuing compliance. The summary of results of the limited test campaign which was carried out as required by the sequence of tests (A.1 of 61097-2) can be found in annex A.

EUT tested in accordance with Cospas-Sarsat T.001 Issue 3 Revision 15 October 2014 and Cospas-Sarsat T.007 Issue 4 Revision 9 October 2015 and results of the full test campaign were submitted to Cospas-Sarsat Secretariat for approval.

Cospas-Sarsat Type Approval Certificate: Pending.

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



Product Service

2.15 TEST OF OPERATIONAL REQUIREMENTS (NUA)

2.15.1 Specification Reference

AS/NZS 4280.1, clause A.2.1 (various clauses – see table below)

2.15.2 Equipment Under Test and Modification State

RLB-41 S/N: #6 (TUV Ref TSR0066) - Modification State 0
Y1-03-0280 (Rev T4 unless indicated otherwise below)

Labels: A1-20-1007JDASH
A1-20-1759D
A1-20-1760C
A1-20-1804A
A3-06-2862B
A3-06-2932ADASH
A1-20-1869A
A1-20-1448A
A1-20-1454A
A1-20-1771A
A1-20-0947K

2.15.3 Date of Test

23 October 2015

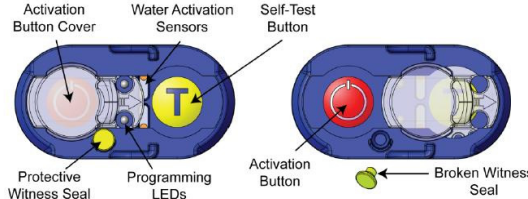
2.15.4 Test Equipment Used

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

Operational Requirements				
All Categories of Satellite EPIRBs				
Clause A.2.1				
Test of Operational Requirements: 5.3.1, 5.3.3.2, 5.3.3.4, 5.3.4, 5.3.5, 5.3.6, 5.3.7, 5.3.8, 5.4, 5.5.1.1, 5.5.1.2, 5.5.2, 5.5.3, 5.5.4, 5.12.2, 5.12.3				
Sub clause	Point	Statement	Observation	Comment
5.3.1	3.3.1 a	The satellite EPIRB shall be fitted with adequate means to prevent inadvertent activation and deactivation, for instance, manual activation shall require two simple but independent movements, neither of which on its own shall activate the satellite EPIRB.	The EUT is fitted with Activation Button Cover. This must be slid over to the self test button thus breaking the witness seal and uncovering the Activation button For Inadvertent activation (hose stream) test refer to section 2.21. Refer to TUV SUD document 75927040 report 01.	-
	3.3.1 b	The satellite EPIRB shall not automatically activate when water washes over it while in its release mechanism.	For Inadvertent activation (hose stream) test refer to section 2.21.	See section 2.21
	3.3.1 c	The satellite EPIRB shall be designed to limit any inadvertent continuous 406 MHz transmission to a maximum of 45 s.	For self test mode details refer to COSPAS SARSAT TAC and TUV SUD document 75927040 report 1.	✓ TUV SUD document 75927040 report 01
5.3.3.2	3.3.3 b	The satellite EPIRB shall be capable of repetitive manual activation and manual deactivation. Manual deactivation shall not prevent automatic activation of the satellite EPIRB when automatically released from its release mechanism or when floating in the water. (Does not apply to Class 3 EPIRBs).	The EUT can be manually switched on and off as required. After the initial manual activation the EUT witness seal will be broken (thus indicating that the Activation Button Cover has been moved). When placed in water the EUT will automatically activate. Once the water contacts are dried the EUT should deactivate.	-
5.3.3.4	3.3.3 d, e and f	When the satellite EPIRB is manually activated, the low-duty cycle light (see 3.3.3 c)) shall begin flashing within 2 s, in any lighting condition, and no distress signal shall be emitted until at least 47 s and at most 5 min after the satellite EPIRB has been manually activated. After start of transmission of the distress signal, the operation of low-duty cycle light should be in accordance with 3.3.3 c). The satellite EPIRB shall be provided with means to indicate that signals are being emitted. If a low-duty cycle light operating in accordance with 3.3.3 c), is not active during daylight, alternative indication during this time shall be provided.	The EPIRB includes a low duty cycle light. Refer to subcontractor (Opti Consulting Limited) report OC-0522-01.	- See report OC-0522-01

	3.3.3 g	The satellite EPIRB shall be provided with a 121.5 MHz beacon primarily for homing by aircraft.	The EPIRB transmits a 121.5MHz homing signal. Refer to section 2.22.	See section 2.22
5.3.4		The self-test mode of the satellite EPIRB shall be activated. The digital message generated shall be in accordance with the requirements of 3.3.4 (self-test frame synchronization). The automatic reset of the test facility and the indication of the self-test mode shall be checked by inspection.	For self test mode details refer to COSPAS SARSAT TAC and TUV SUD document 75927040 report 01. On completion of the self test function the EPIRB is reset.	- TUV SUD document 75927040 report 01.
	3.3.4	The satellite EPIRB shall be capable of being tested, without using the satellite system, to determine that the satellite EPIRB is capable of operating properly. When the self-test mode (C/S T.001) is activated, the satellite EPIRB shall emit a single burst which shall always provide the beacon 15 Hex ID. The frame synchronization pattern shall be "011010000" (i.e. the last eight bits are complemented so that this test burst will not be processed by the satellite equipment and the burst duration shall be 440 ms or 520 ms). For location protocol beacons, the content of the encoded position data field of the self-test message should be the default values specified in (C/S T.001). Successful completion of the test shall be indicated. Activation of the test facility shall reset automatically. Any transmission in the self-test mode shall be limited to one burst. If the 121,5 MHz auxiliary radio-locating device signal is transmitted during the self-test, it should not exceed 3 audio sweeps or 1 second, whichever is greater.	A self test facility is provided with the EPIRB which checks the 406MHz and 121.5 MHz circuits, GPS, and board circuits. Successful completion of the self-test is indicated by a long green LED flash and a long beep. Any self-test failures for the individual checks will result in 4 beeps and a red LED flash. An explanation of the self-test LED sequences is provided in the user guide. The self test emits a single burst that includes the 15 Hex ID and frame synchronisation pattern as required. Once the self test is complete the EPIRB is off and self test facility reset. The 121.5 MHz signal is transmitted during the self test and does not exceed 3 audio sweeps.	-
5.3.5	(3.3.5)	By inspection of the fitting and of evidence of compliance with IMO Resolution A.658(16) for the performance requirements of the retro-reflecting material. The satellite EPIRB shall be of highly visible yellow/orange colour and be fitted with retro-reflecting material. A band of retro-reflective material, at least 25 mm wide, encircling that part of the satellite EPIRB's body which is normally protruding above the water-line, shall be acceptable. The retro-reflective material shall also meet the performance requirements of IMO Resolution A.658(16) annex 2.	The main body of the EUT is the standard ACR equipment colour (ACR Artreuse). The area of retro-reflective material above the waterline was measured as approximately 15 cm ² . In some parts of this 15cm ² retro-reflective material additional detail (writing / diagrams etc) is printed on top. There are two additional retro reflective bands which are included on the top and bottom of the antenna (approximately 14.5 cm ²). There is additional retro-reflective material below the waterline (at least another 15cm ²), also including additional detail on top. The manufacturer advises that the following documents provide additional information relating to the retro reflective material A2-05-0180 A A3-06-2858 C 3 M Scotchlite Reflective materials SOLAS Grade Products Technical Data Sheet Sept 07 (page 1 included in Annex B).	-

5.3.6	3.3.6	By inspection of evidence submitted by the manufacturer that the lanyard meets the specified requirements. The satellite EPIRB shall be equipped with a buoyant lanyard, firmly attached to it, suitable for use as a tether for survivors or from a survival craft in the water. It shall be so arranged as to prevent its being trapped in the ship's structure when floating free. The buoyant lanyard shall have a length of 5 m to 8 m. The breaking strength of the lanyard and its attachment to the satellite EPIRB shall be at least five times the weight of the satellite EPIRB or 245N whichever is the greater.	The EUT is equipped with a lanyard. The lanyard is wrapped around the beacon body and can be found under the Velcro wrist strap. When shipped from the manufacturer the lanyard has an additional plastic wrap, which is easily removed, together with the location of the lanyard and the Velcro cover the likelihood of being trapped is reduced when in its normal stowage condition. The lanyard was measured as being 6.8m in length. The lanyard, when affixed to the EUT via the mounting point and around the beacon body was capable of lifting 25 kg. The lanyard is yellow in colour. Refer to Annex B for lanyard material specification data sheet / Manufacturer declaration regarding material suitability to marine environment. The manufacturer advises that the following documents provide additional information relating to the lanyard: A2-05-0140 A1 A3-06-2857 B	-
5.3.7		By inspection of the evidence submitted by the manufacturer that the materials used, including any coloured external coating, are unlikely to be affected adversely by seawater or oil or prolonged exposure to sunlight.	See Manufacturer information – Annex B. See section 2.6	See Annex B. See section 2.6
	3.3.7	The satellite EPIRB shall not, including the labelling, be unduly affected by sea water or oil or both; and be resistant to deterioration in prolonged exposure to sunlight.	See Manufacturer information – Annex B. See section 2.6	See Annex B. See section 2.6
5.3.8	3.3.8	The satellite EPIRB shall have all controls of sufficient size for simple and satisfactory operation and also be capable of being operated by a person wearing an immersion suit as defined in the IMO Lifesaving Appliance Code (Resolution MSC.48(66)), section 2.3.	When wearing an immersion suit glove it is possible to remove the EUT from the manual housing bracket and float free housing and activate the EUT. It is also possible to deactivate the EUT and deploy the lanyard when wearing an immersion suit glove.	-
5.4		The requirements of clause 3.4 shall be verified as follows: By inspection and by checking that the items listed in 3.4 as those items not counted as one of the two independent actions required to activate the EPIRB, do not cause activation on their own and that two independent actions are required to activate the EPIRB. If appropriate remove the EPIRB from the bracket and ensure that it is not activated by this action.	The EUT has two buttons, these are identified as the Activation and Self test buttons. The Activation button uses a familiar power button symbol and is red in colour:	-

	3.4	When the satellite EPIRB is manually operated a distress alert shall be initiated only by means of a dedicated distress alert activator. See table 1. For Class 3 EPIRBs see clause 3.2f). The dedicated activator shall: a) be clearly identified; and b) be protected against inadvertent operation. Manual distress alert initiation shall require at least two independent actions neither of which on its own shall activate the satellite EPIRB. The following actions shall not be counted as one of the two independent actions required to activate the EPIRB – breaking a seal provided to comply with 3.3.9; – manual removal from the bracket; or – inversion. The satellite EPIRB shall not be automatically activated after being manually removed from the release mechanism. (Dry EPIRB condition.)	 The EUT is fitted with Activation Button Cover. This must be slid over to the self test button in order to gain access to the Activation button. The Activation button must then be depressed for 5 seconds in order to activate the EUT. These two actions (slide and press) are the two independent means. The witness seal and removal from a bracket are other actions which may be required depending on installation. The EU (assuming it is not immersed in water) does not automatically activate when removed from the release mechanism.	-
5.5.1.1		The unit consisting of the satellite EPIRB and its release mechanism installed in its bracket, if any, shall be mounted, on a suitable test fixture, successively in each method intended for mounting on a ship, as described in the equipment manual. A stream from a hose shall be directed at the unit for a period of 5 min. The nozzle of the hose shall have a nominal diameter of 63,5 mm and a water-delivery rate of approximately 2 300 l of water per minute. The end of the nozzle shall be 3,50 m away from the satellite EPIRB and 1,50 m above the base of the antenna. The nozzle or the unit shall be moved during the test, so that water strikes the satellite EPIRB in an arc of at least 180° perpendicular to the normal mounting position of the unit. The satellite EPIRB shall not release from its bracket nor shall it automatically activate as a result of the water from the hose stream.	Refer to Hose Stream test	See section 2.21
	3.5.1 b	The float free arrangement shall be constructed to prevent release when seas wash over the unit.	Refer to Hose Stream test	See section 2.21
	3.5.1 c	The float free arrangement shall have its release mechanism fitted with adequate means to prevent its inadvertent activation.	Refer to Hose Stream test	See section 2.21
	3.3.1 b	The satellite EPIRB shall not automatically activate when water washes over it while in its release mechanism.	Refer to Hose Stream test	See section 2.21

5.5.1.2		By inspection of the evidence submitted by the manufacturer that the materials used, including any coloured external coating, are unlikely to cause any malfunction of the unit. By inspection, including the labelling, of evidence submitted by the manufacturer that the materials used are unlikely to be duly affected by seawater or oil or prolonged exposure to sunlight.	See Manufacturer information – Annex B. See section 2.6	See Annex B. See section 2.6
	3.5.1 d	The float-free arrangement shall be constructed of non-corrosive compatible materials, so as to prevent deterioration which may cause any malfunction of the unit. Galvanizing or other forms of metallic coating on parts of the float-free release mechanism shall not be accepted.	See Manufacturer information – Annex B. See section 2.6	See Annex B. See section 2.6
	3.4.1 e	The float-free arrangement shall including the labelling, not be unduly affected by seawater or oil or prolonged exposure to sunlight.	See Manufacturer information – Annex B. See section 2.6	See Annex B. See section 2.6
5.5.2	3.5.2	For the satellite EPIRB requiring external power or data connection, or both, the means of connection shall not inhibit the release from the release mechanism or activation of the satellite EPIRB.	There are no external power connections to the EPIRB.	-
5.5.3	3.5.3	With the exception of single-use hydrostatic units, it shall be possible to assess the proper functioning of the automatic release mechanism by a simple method without activation of the satellite EPIRB.	The float free case can be manually opened; this does not cause the EUT to activate. Pictorial instructions are supplied for placement alongside the housing.	-
5.5.4		It shall be possible to release the satellite EPIRB manually from the float-free mechanism, without tools.	It is possible to remove the EUT manually from the float free housing.	-
5.12.2		Expiry date indication	The EUT labels include the following information: Basic operating instructions (including activation, deactivation and self test). Warning to only use in situations of grave and imminent danger. Category of EUT Class of EUT Provision for battery expiry date. Provision for vessel name. Provision for UIN Country code Recommendation to give a clear view to the sky (relating to GPS) Warning to test in the first 5 minutes of the hour If a battery pack is changed the new battery pack will be provided with a new label.	-
5.12.3		Reverse polarity protection	It is possible for the user to replace the EUT battery pack. The battery pack is a sealed unit and the connections are keyed.	-

2.16 AUTOMATIC RELEASE MECHANISM AND AUTOMATIC ACTIVATION TESTS FOR CLASS 1 AND CLASS 2 SATELLITE EPIRBs

2.16.1 Specification Reference

AS/NZS 4280.1, clause A.2.2 (5.2.1)

2.16.2 Equipment Under Test and Modification State

RLB-41 S/N: #8 (TUV Ref TSR0068) - Modification State 0

2.16.3 Date of Test

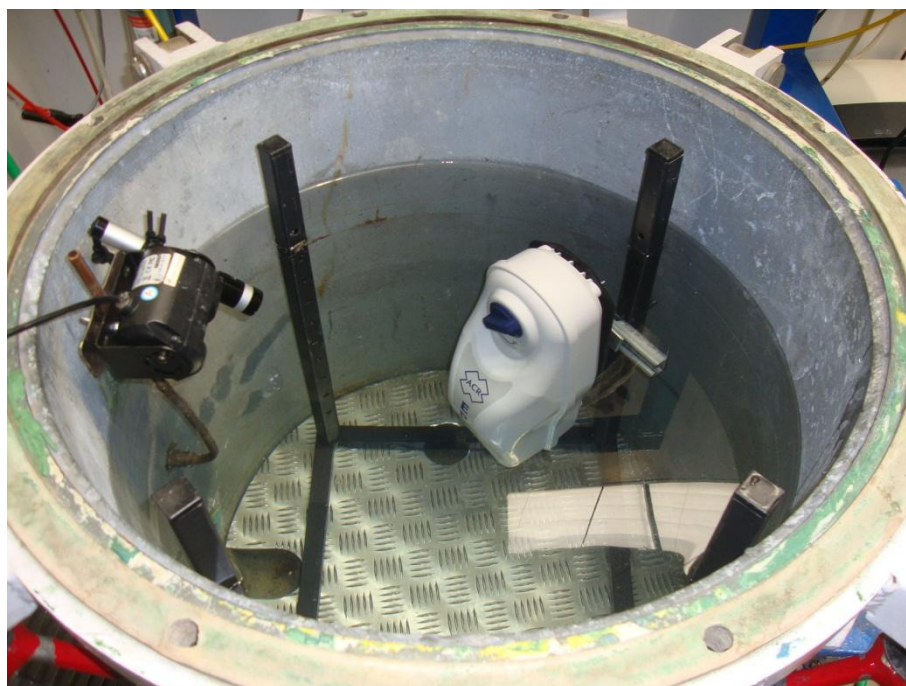
18 June 2015 to 23 June 2015

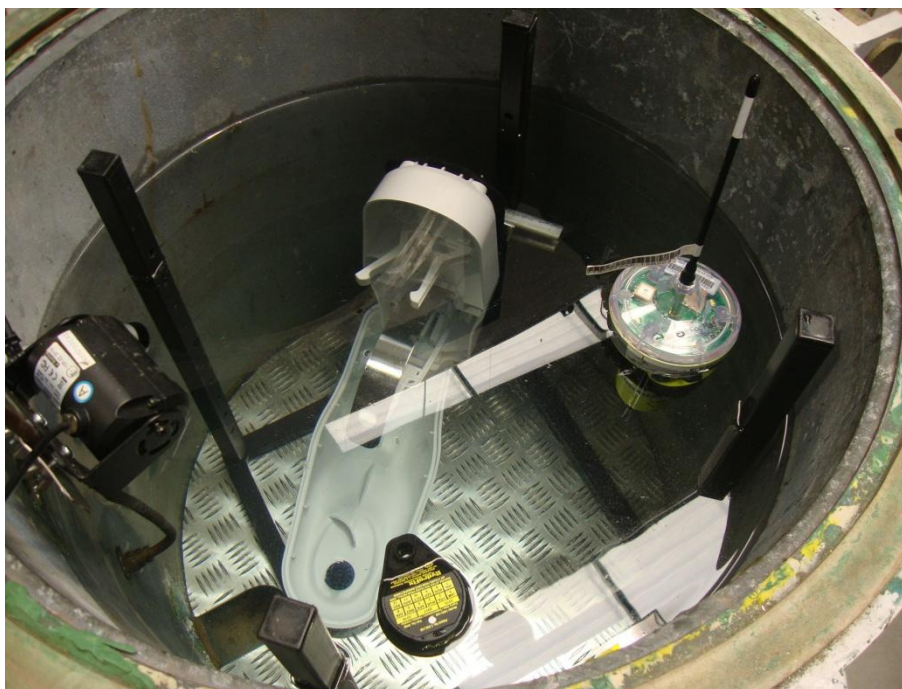
2.16.4 Test Equipment Used

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

2.16.5 Test Method

Test Setup Photographs





The EUT (fitted inside the Float-Free Housing) was submerged in water inside a sealed variable pressure vessel. The pressure inside the vessel was gradually increased until the EUT was released from the housing via the automatic release mechanism. The pressure at this point was recorded and converted to an equivalent depth. The above procedure was repeated for the orientations and extreme temperatures shown in the summary table below:

2.16.6 Test Results

Orientation	Pressure on Automatic Release (bar)	Equivalent Depth (m)	Performance Check
normal mounting position	0.234	2.20	satisfactory
rolling 90° starboard	0.263	2.49	satisfactory
rolling 90° port	0.234	2.20	satisfactory
pitching 90° bow down	0.236	2.22	satisfactory
pitching 90° stern down	0.227	2.13	satisfactory
upside down position	0.231	2.17	satisfactory
normal mounting position EUT preconditioned at +65°C	0.231	2.17	satisfactory
normal mounting position EUT preconditioned at -30°C	0.231	2.17	satisfactory



Product Service

2.17 STABILITY AND BUOYANCY TEST

2.17.1 Specification Reference

AS/NZS 4280.1, clause A.2.3

2.17.2 Equipment Under Test and Modification State

RLB-41 S/N: #7 (TUV Ref TSR0067) - Modification State 0

2.17.3 Date of Test

03 September 2015

2.17.4 Test Equipment Used

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

2.17.5 Environmental Conditions

Ambient Temperature 21.6 °C

Relative Humidity 38.2 %

2.17.6 Test Method

The EUT was floated in fresh water. The EUT was rotated to a horizontal position and released.

The distance between the antenna base and the waterline was measured.

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

2.17.7 Test Results

The EUT passed through an upright position within one second of being released.

The distance between the antenna base and the waterline exceeded 40mm.

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

EUT volume (below) waterline	= 764 mm ³
EUT volume (total)	= 992 mm ³
EUT volume above waterline (total – below)	= 228 mm ³

Buoyancy	= $\frac{228}{764}$
----------	---------------------

Reserve Buoyancy	= 0.298
	= 29.84 %



Product Service

2.18 FLOAT FREE ACTIVATION (TEST FOR SALT WATER ACTIVATION)

2.18.1 Specification Reference

IEC 61097-2, clause A.2.4 (5.3.3.1)

2.18.2 Equipment Under Test and Modification State

RLB-41 S/N: #7 (TUV Ref TSR0067) - Modification State 0

2.18.3 Date of Test

4 September 2015

2.18.4 Test Equipment Used

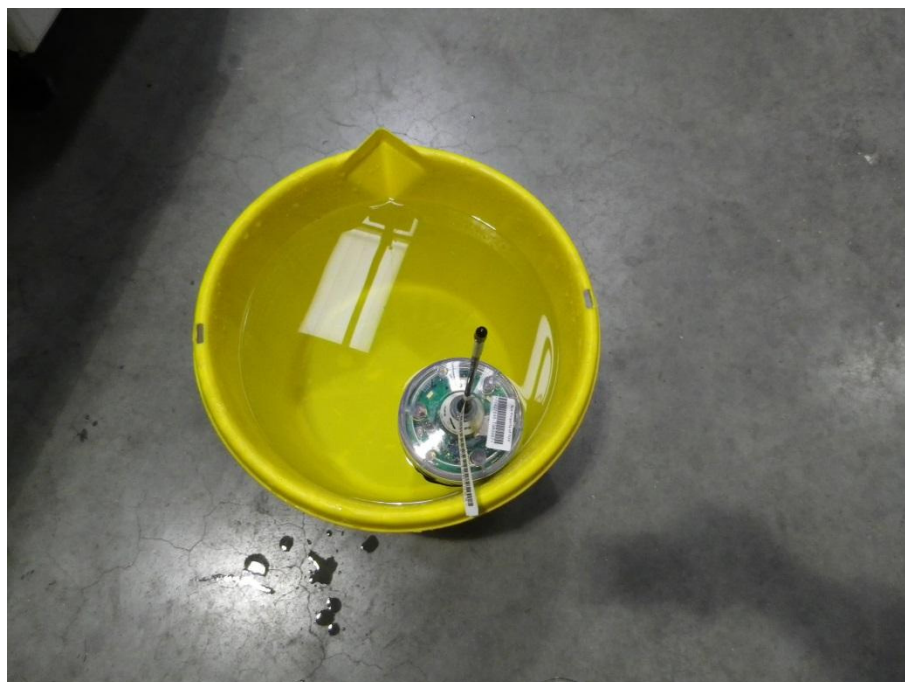
The major items of test equipment used for the above tests are identified in Section 3.1.

2.18.5 Environmental Conditions

Ambient Temperature 23.7°C

Relative Humidity 39.8%

2.18.6 Test Setup





Product Service

2.18.7 Test Method

The EUT was placed in a bucket of salt water (0.1%).

2.18.8 Test Results

The EUT activated within 7 seconds.



Product Service

2.19 SAFETY PRECAUTIONS

2.19.1 Specification Reference

AS/NZS 4280.1, clause A.2.5 (3.10)

The EUT has no parts or wiring in which the direct or alternating voltages or both combined to give a peak voltage greater than 50 V. Therefore clause 12.1 (Protection against accidental access to dangerous voltages) is not applicable.

The following clauses are also not applicable to the RLB-41:

- 12.2 Electromagnetic radio frequency radiation
- 12.3 Emission from VDU
- 12.4 X radiation.

The Manufacturer has advised the following documents support clause 3.10:

Refer to Manufacturer battery and cell data evidence:

A1-13-0118 E

A3-06-2860 B

A3-06-2865 A

AAD4000PE11 (Panasonic Lithium Handbook)



Product Service

2.20 COMPASS SAFE DISTANCE

2.20.1 Specification Reference

AS/NZS 4280.1, clause A.2.6 (5.16)

2.20.2 Equipment Under Test and Modification State

RLB-41 S/N: #26 (TUV Ref TSR0051) - Modification State 0

2.20.3 Date of Test

05 March 2015

2.20.4 Test Equipment Used

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

2.20.5 Environmental Conditions

Ambient Temperature 15.5°C

Relative Humidity 39.4%

2.20.6 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 standard 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 19.91uT.

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 61097-2.

The test was performed with the EUT in both idle and active modes.



Product Service

2.20.7 Test Results

Standard Compass safe distance (mm)	600
Emergency Compass safe distance (mm)	400

Horizontal maximum flux density, Magnetic North (H)	H	19.448
Standard compass deviation limit (degrees)	$5.4/H = A$	$A = 0.3$
Emergency compass deviation limit (degrees)	$18/H = B$	$B = 0.9$

Orientation of the EUT	Un-powered State		Normalised		Powered Up	
	Distance From Compass Centre (mm) at A° deflection	Distance From Compass Centre (mm) at B° deflection	Distance From Compass Centre (mm) at A° deflection	Distance From Compass Centre (mm) at B° deflection	Distance From Compass Centre (mm) at A° deflection	Distance From Compass Centre (mm) at B° deflection
Front	370	270	430	300	420	300
Top	470 to tip of antenna	340 to tip of antenna	520 to tip of antenna	360 to tip of antenna	590 to tip of antenna	370 to tip of antenna
Left Hand Side	360	270	430	300	430	300
Right Hand Side	430	305	430	315	440	320
Underside	170, No deflection	170, No deflection	170, 0.2° deflection	170, 0.2° deflection	170, 0.2° deflection	170, 0.2° deflection
Rear	410	310	435	300	445	310



Product Service

2.21 TEST TO PREVENT RELEASE WHEN SEA WATER WASHES OVER THE UNIT (NUA)

2.21.1 Specification Reference

AS/NZS 4280.1, clause 5.5.1.1

2.21.2 Equipment Under Test and Modification State

RLB-41 S/N: #9 (TUV Ref TSR0064) - Modification State 0

2.21.3 Date of Test

9 September 2015

2.21.4 Test Equipment Used

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

2.21.5 Test Setup

Setup Photo (manual bracket and float free housing)



2.21.6 Test Method

The EUT was fixed via the supplied manual mounting bracket and float free housing and fixed to a test rig ready for the water test. The water spray (measured at approximately 2400l / min) was directed at 5 faces of the EUT for 1 min in each face. The five faces were:

Face on
45 degrees to the left
45 degree to the right
90 degrees to the left
90 degree to the right

2.21.7 Test Results

Manual Housing

Face on: During test the security tab securing the button cover on the RLB-41 beacon was sheared enabling the gate to move right exposing the activation button. However no activation of the beacon was visible post test and the beacon remained within the mounting bracket throughout.

45 degree left and 90 degree left: Button cover pushed right by water stream but no activation of the beacon visible. Beacon remained securely in the mounting bracket.

45 degree right and 90 degree right: Button cover remained over the activation button with no activation of the beacon visible. Beacon remained securely in its mounting bracket throughout.



Product Service

Float free Housing

Face on: No visible damage to enclosure which remained closed throughout test. No visual activation of beacon. EPIRB label washed off during test.

45 degree left, right and 90 degree left and right: No visible damage to enclosure which remained closed throughout test. No visual activation of beacon.



Product Service

2.22 121.5 MHz HOMING DEVICE TESTS

2.22.1 Specification Reference

AS/NZS 4280.1 2003, Annex D

2.22.2 Equipment Under Test and Modification State

RLB-41 S/N #15 (TUV Ref TSR0058) - Modification State 0

2.22.3 Date of Test

12 June 2015 and 15 June 2015

2.22.4 Test Equipment Used

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

2.22.5 Environmental Conditions

Ambient Temperature 19.7 - 23.7 °C

Relative Humidity 41.5 – 58.6 %

2.22.6 Test Results

Refer also to subcontractor (Hursley EMC) report 15R146 ER for the 121.5 MHz radiated measurements.

Carrier Frequency

Parameter	Limit	Units	Test Results		
			T _{min} (-20°C)	T _{amb}	T _{max} (+55°C)
Carrier Frequency	121.5 ± 0.006	MHz	121.499005	n/a	121.498585

Transmitter Duty Cycle

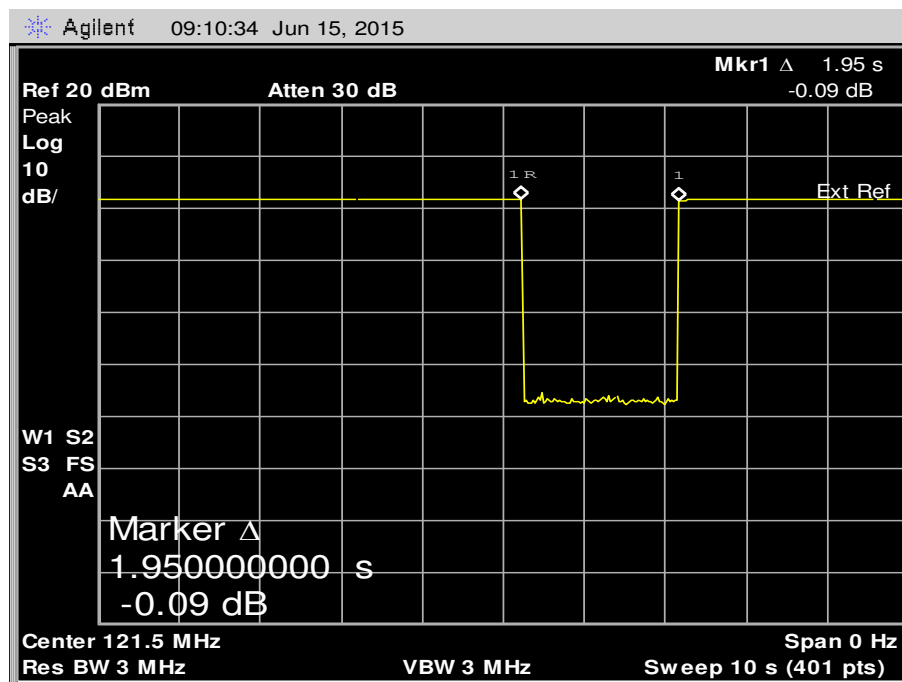
Note: Transmitter Duty Cycle = $\frac{\text{interval} - \text{duration}}{\text{interval}}$

Parameter	Units	Test Results		
		T _{min} (-20°C)	T _{amb}	T _{max} (+55°C)
121.5 MHz transmission interruption interval	seconds	51.00	n/a	51.75
121.5 MHz transmission interruption duration	seconds	1.95	n/a	1.925
Transmitter Duty Cycle	P/F	P	n/a	P

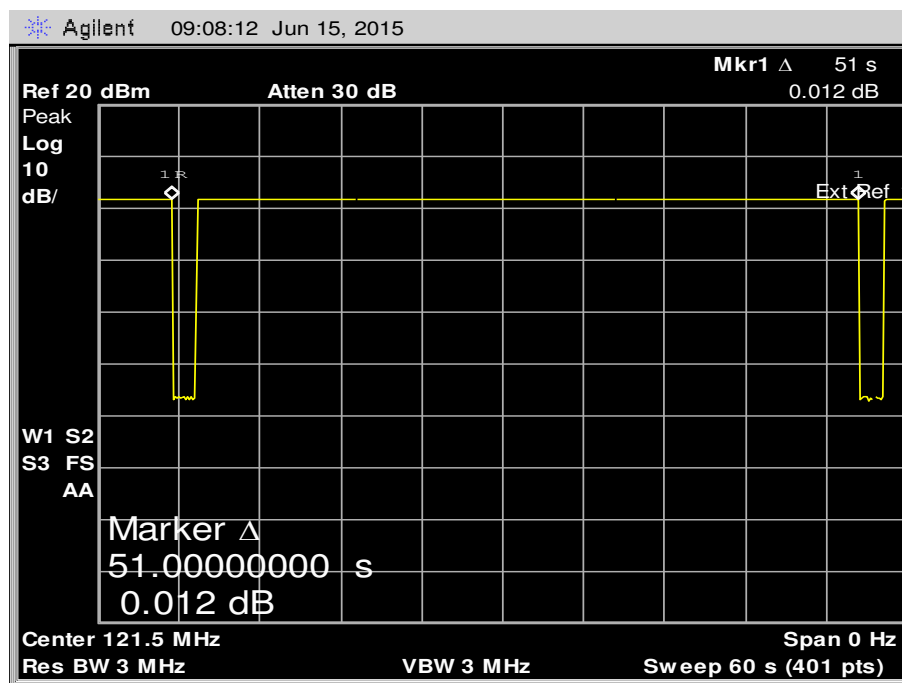


Product Service

Plot showing 121.5MHz interruption duration (Minimum Temperature)



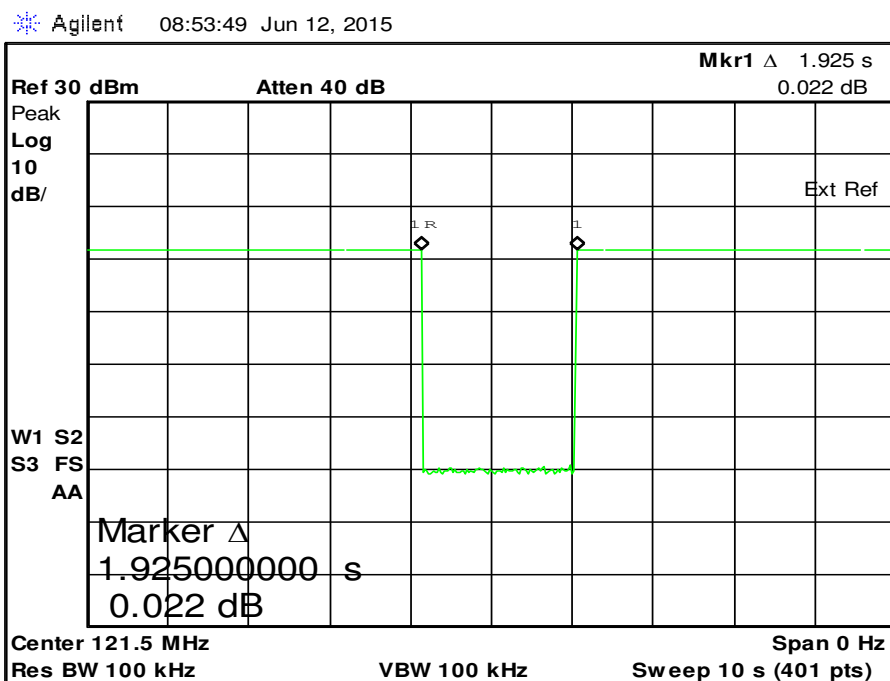
Plot showing 121.5MHz interruption interval (Minimum Temperature)



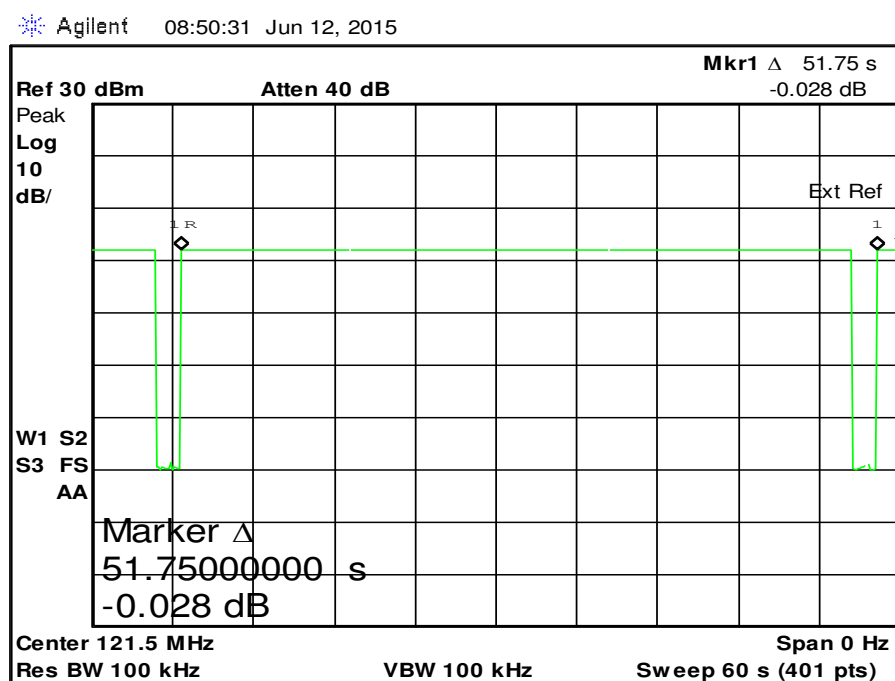


Product Service

Plot showing 121.5MHz interruption duration (Maximum Temperature)



Plot showing 121.5MHz interruption interval (Maximum Temperature)





Product Service

Modulation Frequency and Sweep Repetition Rate/Modulation Duty Cycle

Parameter	Units	Test Results		
		T _{min} (-20°C)	T _{amb}	T _{max} (+55°C)
Frequency Range	Hz	905.8	n/a	883.7
Minimum Frequency	Hz	548.7	n/a	544.9
Maximum Frequency	Hz	1454.5	n/a	1428.6
Modulation Duty Cycle*	%	37.6	n/a	38.2
Sweep repetition rate	sweeps per second	2.652	n/a	2.652

* measurements made near the start, middle and end of the modulation cycle. Worst case result shown.

Modulation Factor

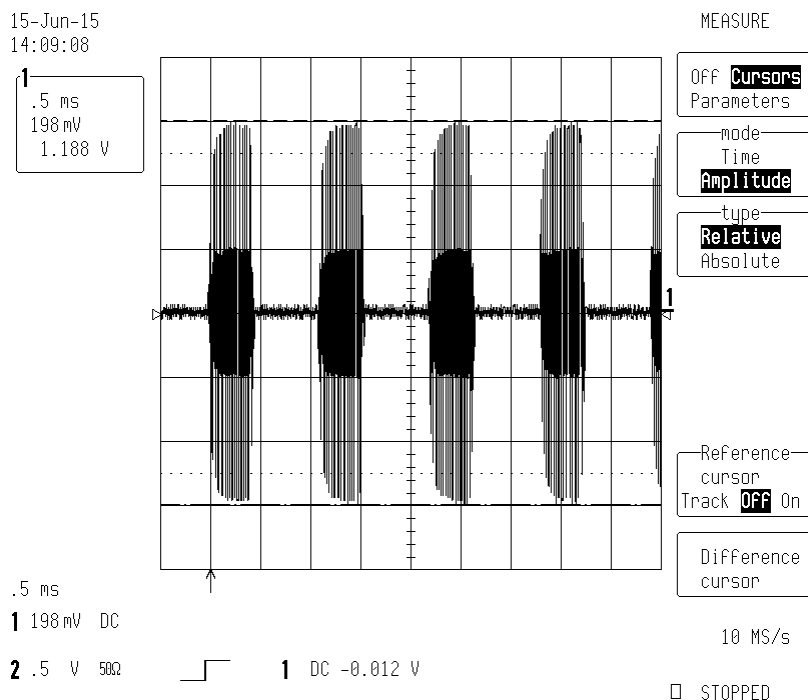
Note: Modulation Factor = (A - B) / (A + B)

Parameter	Units	Test Results		
		T _{min} (-20°C)	T _{amb}	T _{max} (+55°C)
A	mV	1188	n/a	1187
B	mV	56	n/a	35
Modulation Factor	(no units)	0.909	n/a	0.942

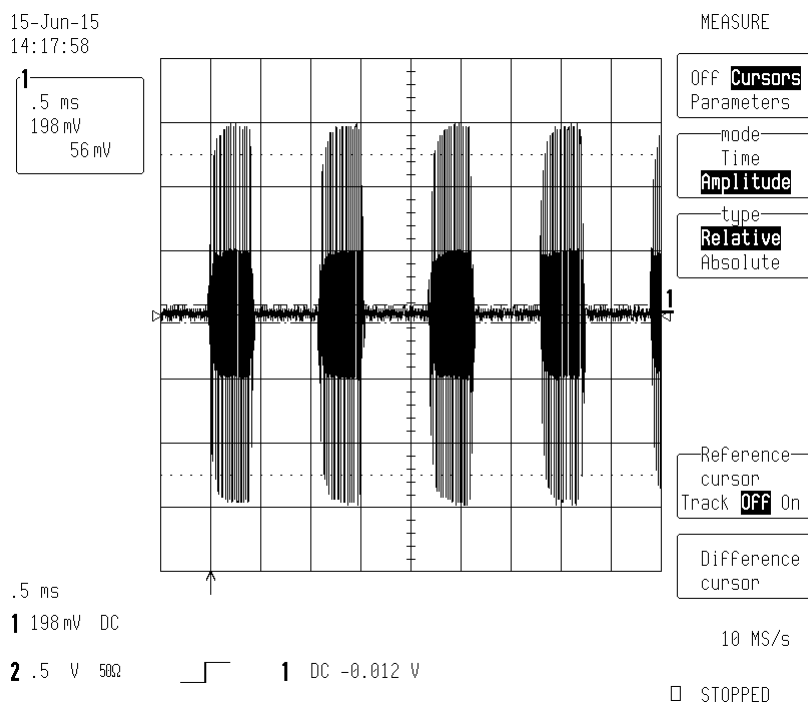


Product Service

Plot showing "A" at Minimum Temperature



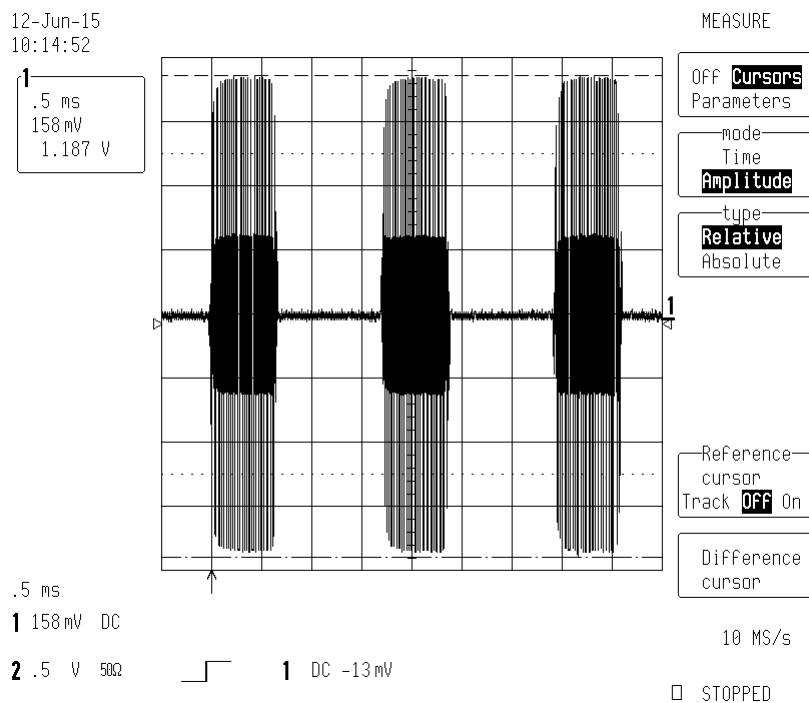
Plot Showing "B" at Minimum Temperature



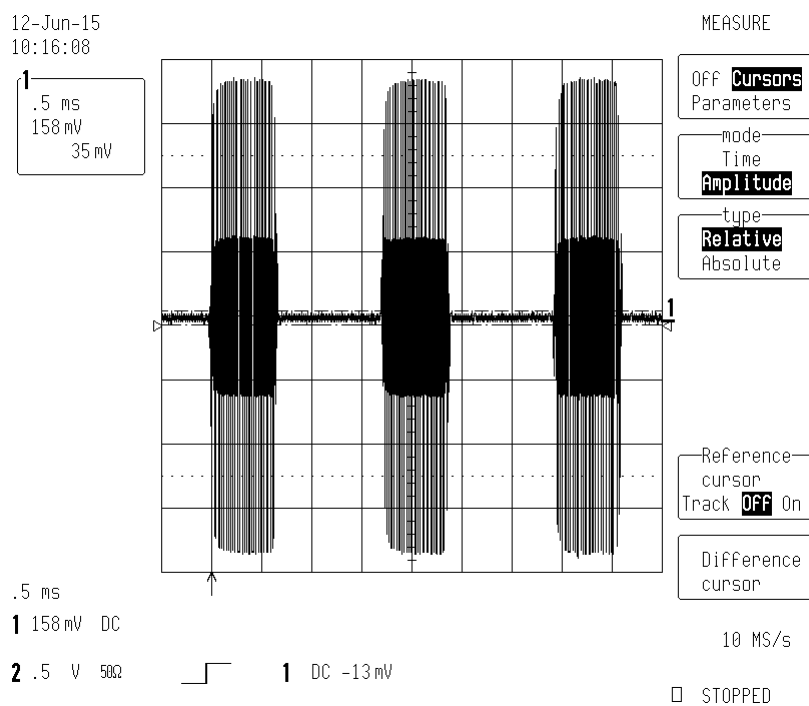


Product Service

Plot showing "A" Maximum Temperature



Plot Showing "B" Maximum Temperature



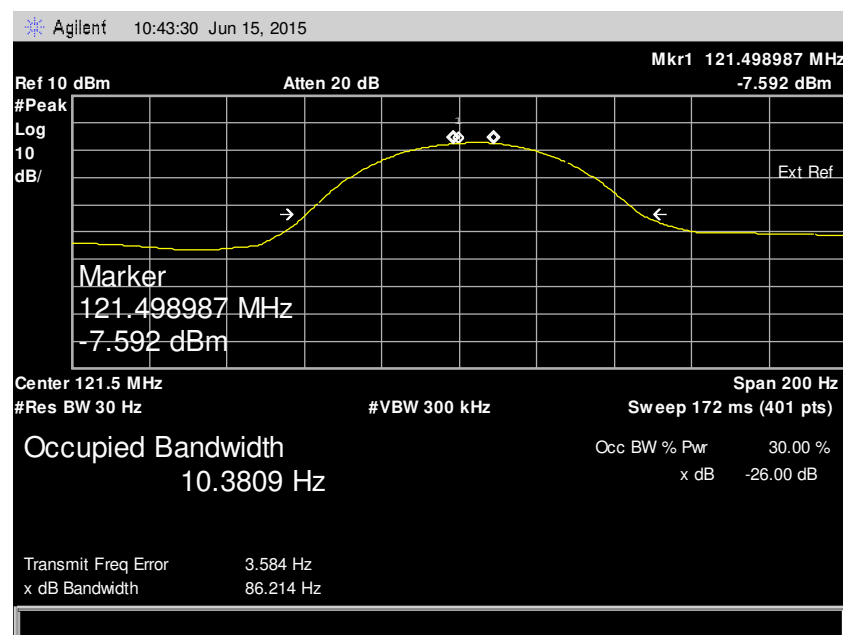


Product Service

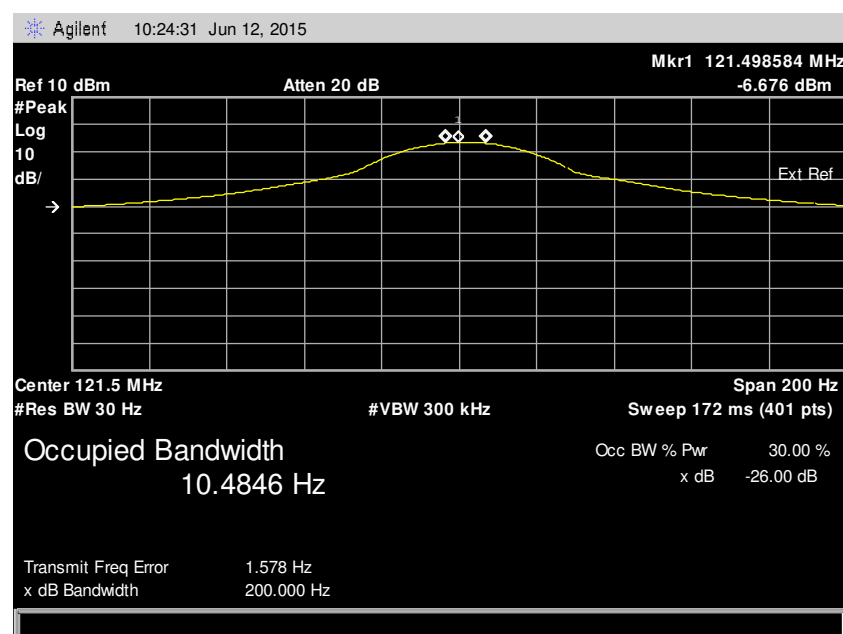
Frequency Coherence

Parameter	Units/Limit	Test Results		
		T _{min} (-20°C)	T _{amb}	T _{max} (+55°C)
30% Power Bandwidth (Hz)	±30Hz	10.38	n/a	10.48
Frequency Shift	Hz	1	n/a	1

30% Power Bandwidth Plot for Minimum Temperature



30% Power Bandwidth Plot for Maximum Temperature

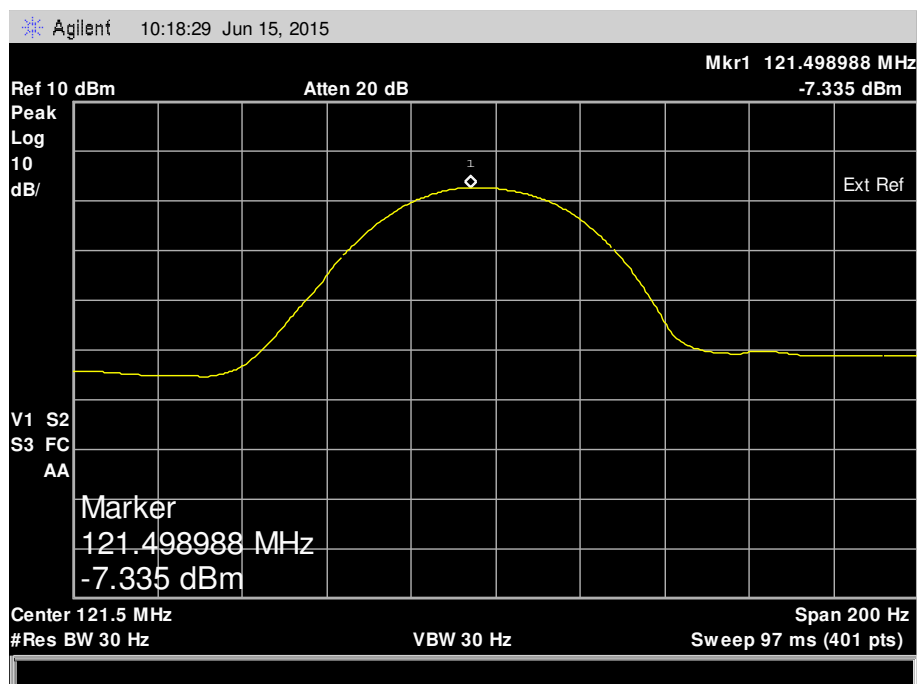




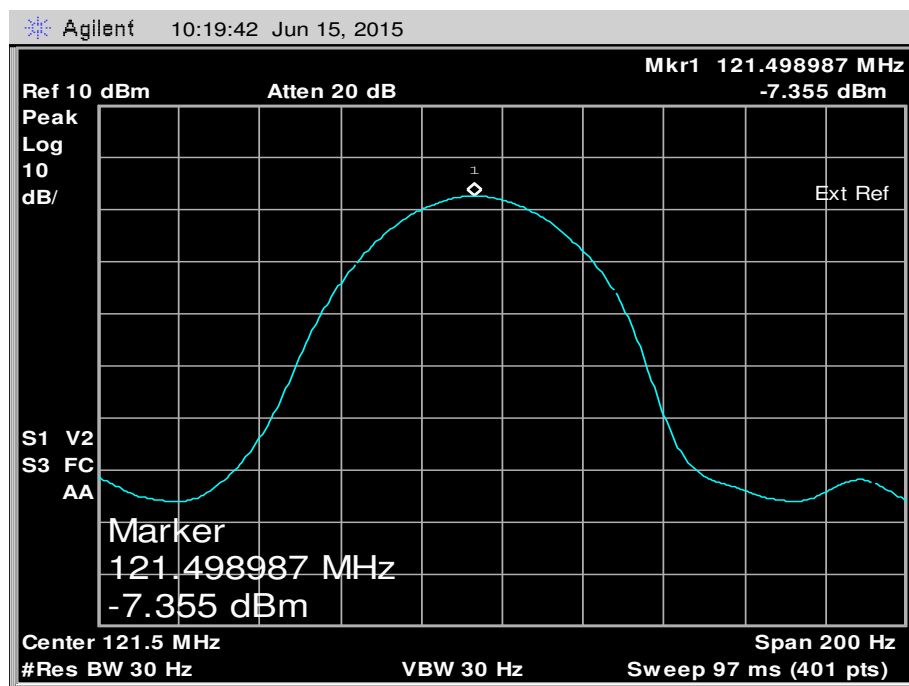
Product Service

Frequency Shift Plot for Minimum Temperature

Plot A



Plot B

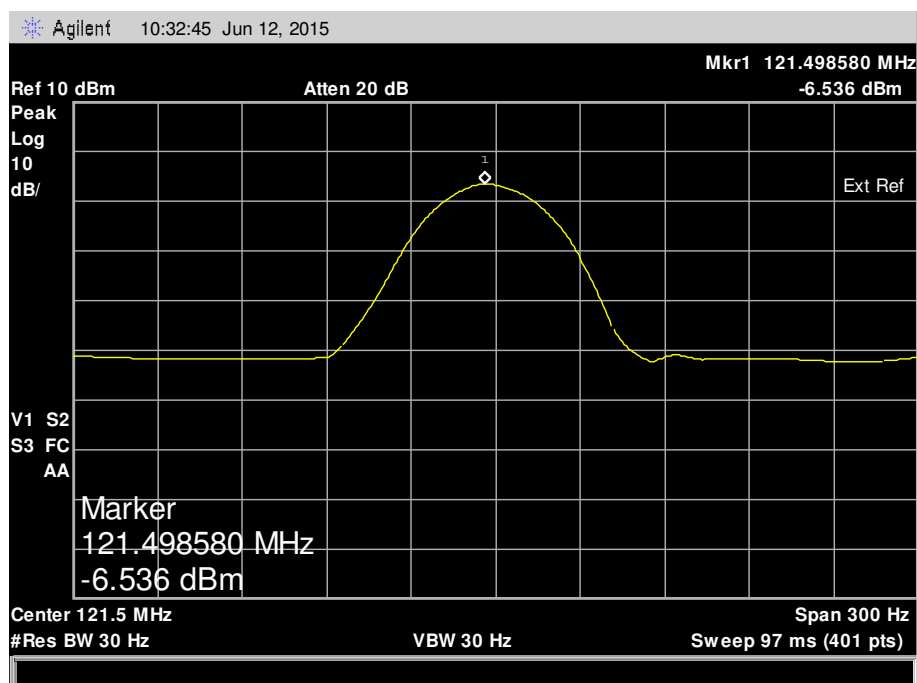


Frequency Shift Plot for Maximum Temperature

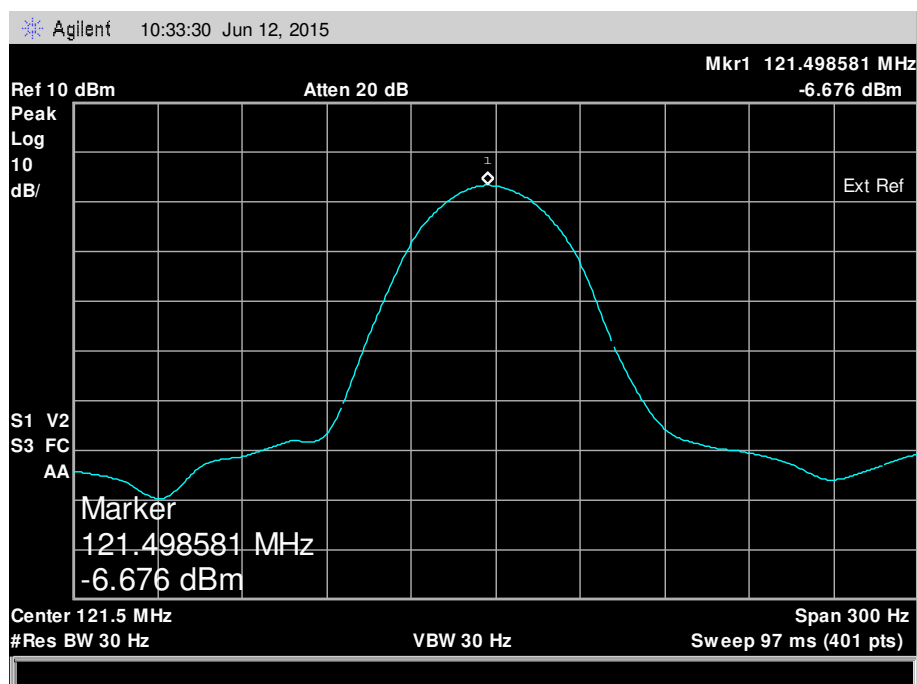


Product Service

Plot A



Plot B



Plot A above, is a Max Hold trace of the 121 transmission for >60 seconds (including the 2 second interval).

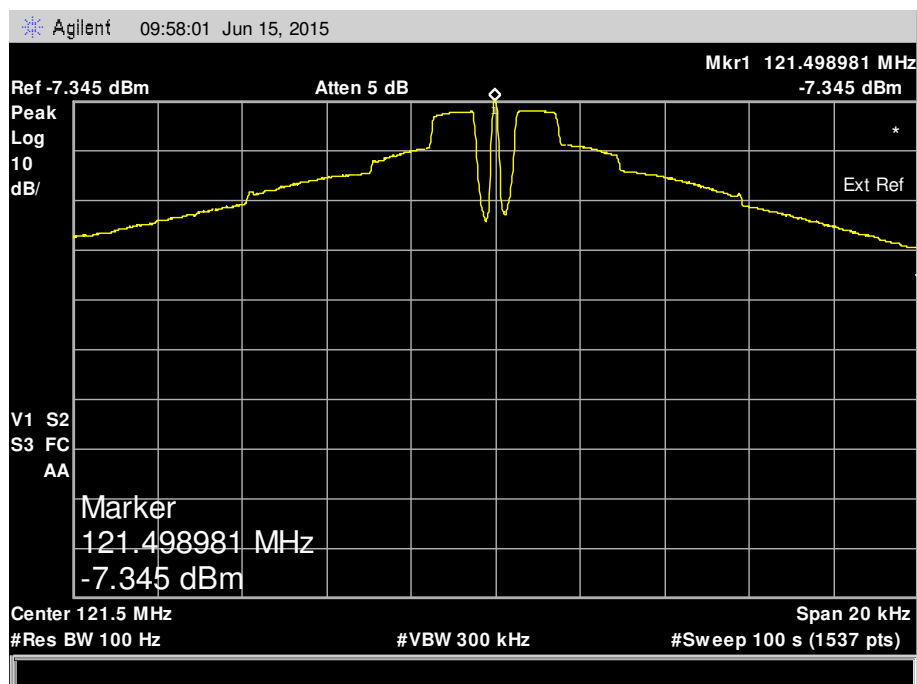
Plot B is an instantaneous measurement of the 121 transmission before the 2 second interval



Product Service

Emission Characteristic

Minimum temperature



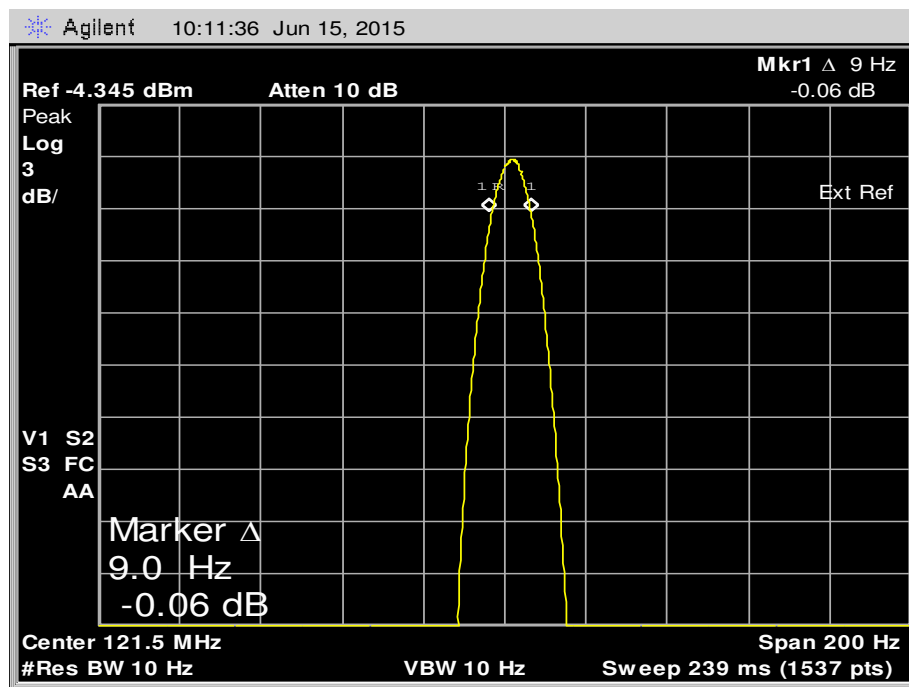
		dBm	Volts	Volts^2
Carrier	Peak	-7.345	4.293	18.429
Sideband 1	Lower	-9.316	3.421	11.706
	Upper	-9.255	3.445	11.871
Sideband 2	Lower	-16.9	1.429	2.042
	Upper	-16.33	1.526	2.328
Sideband 3	Lower	-21.93	0.801	0.641
	Upper	-21.55	0.837	0.700
Sideband 4	Lower	-28.26	0.386	0.149
	Upper	-28.47	0.377	0.142
	Result	0.384		
	Result %	38.4%		

* Final results calculated using the formulas stated in section D.4.4.4 of the standard.

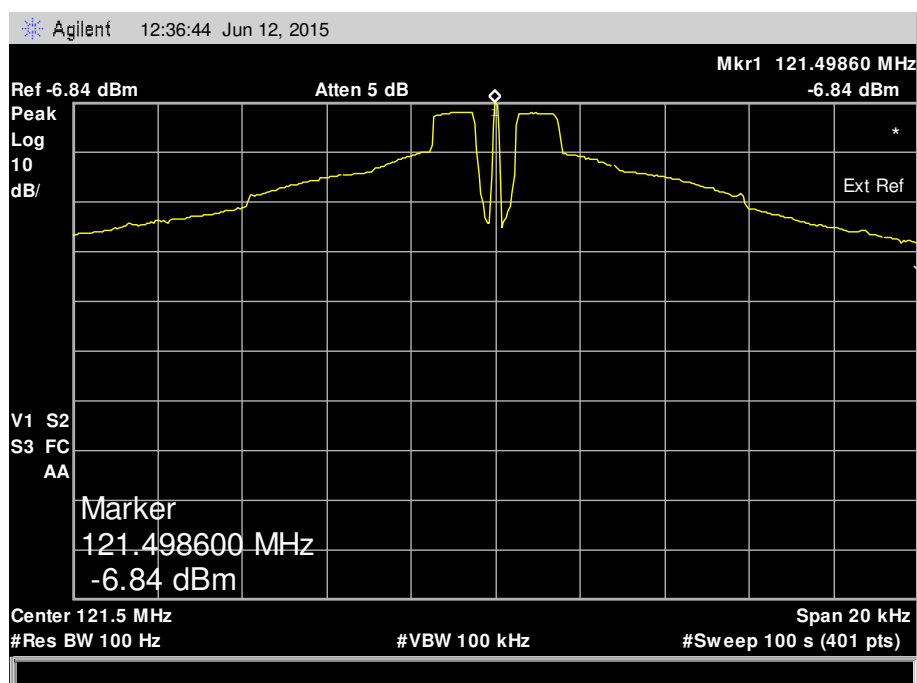


Product Service

3dB Bandwidth



Maximum Temperature



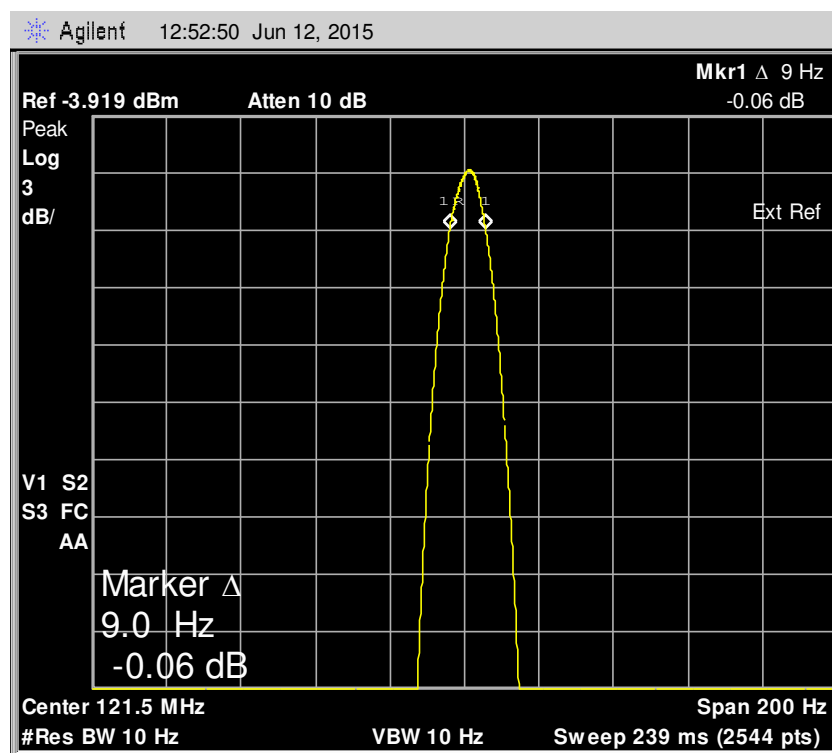


Product Service

		dBm	Volts	Volts^2
Carrier	Peak	-6.84	4.550	20.701
Sideband 1	Lower	-8.88	3.597	12.942
	Upper	-8.96	3.565	12.706
Sideband 2	Lower	-16.88	1.432	2.051
	Upper	-17.36	1.355	1.837
Sideband 3	Lower	-21.01	0.890	0.793
	Upper	-20.68	0.925	0.855
Sideband 4	Lower	-28.26	0.386	0.149
	Upper	-29.59	0.332	0.110
	Result	0.397		
	Result %*	39.7%		

* Final results calculated using the formulas stated in section D.4.4.4 of the standard.

3dB Bandwidth



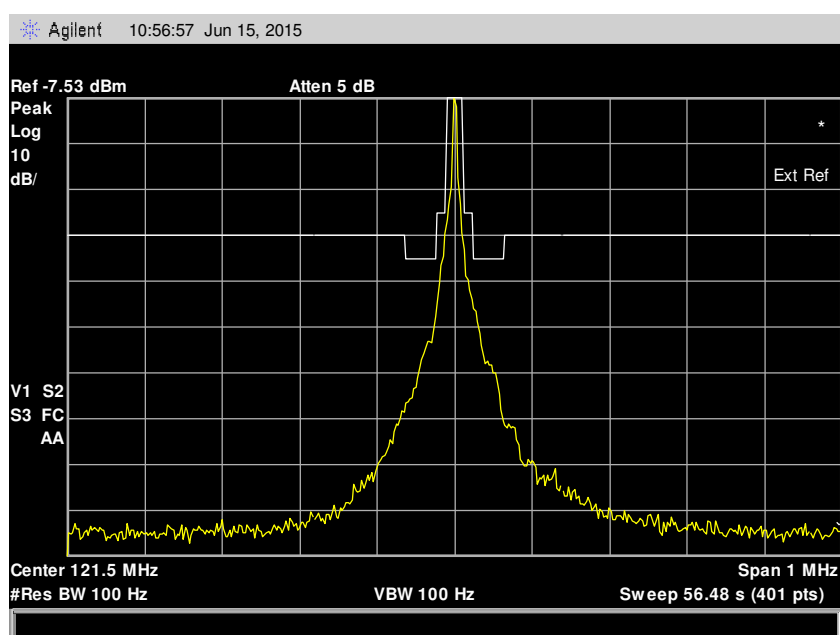


Product Service

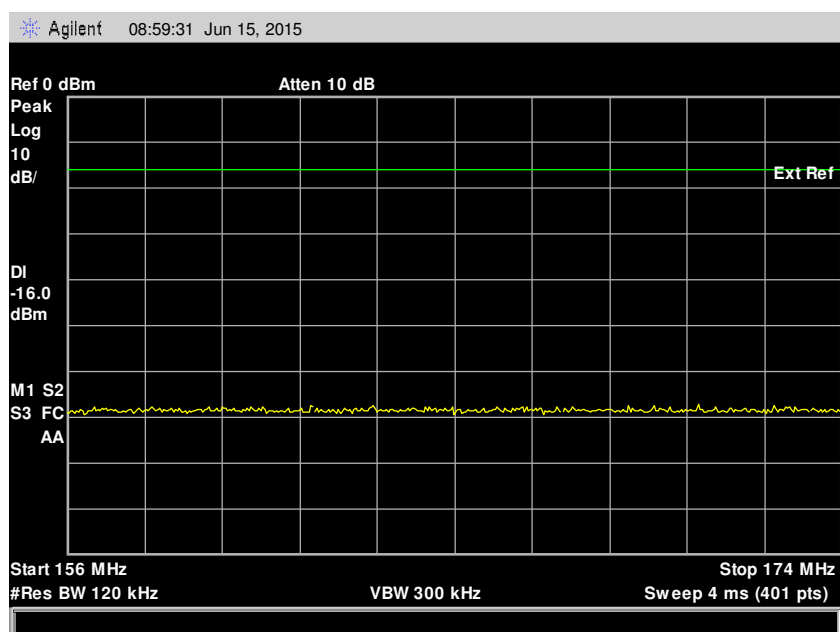
Spurious Emissions

Minimum Temperature

Close-In emissions



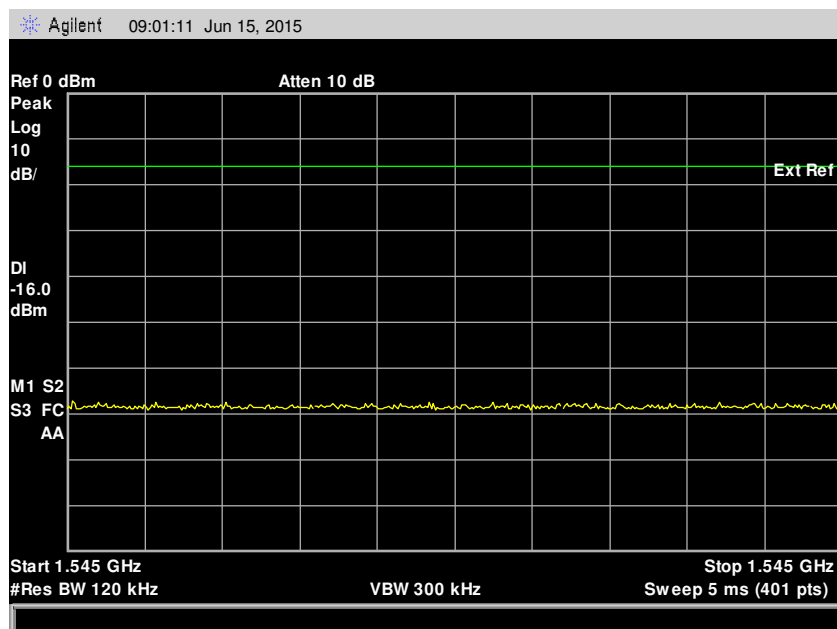
156 to 174MHz





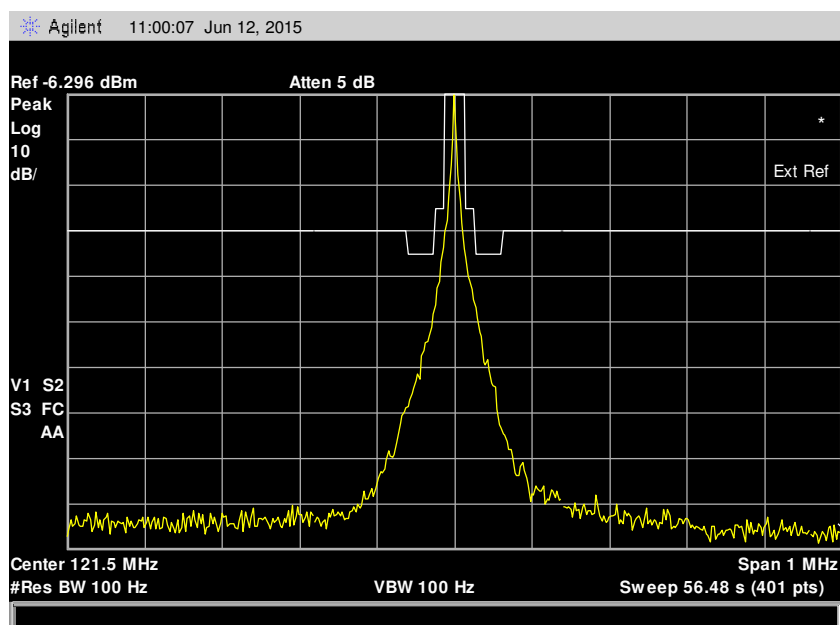
Product Service

1525 to 1545MHz



Maximum Temperature

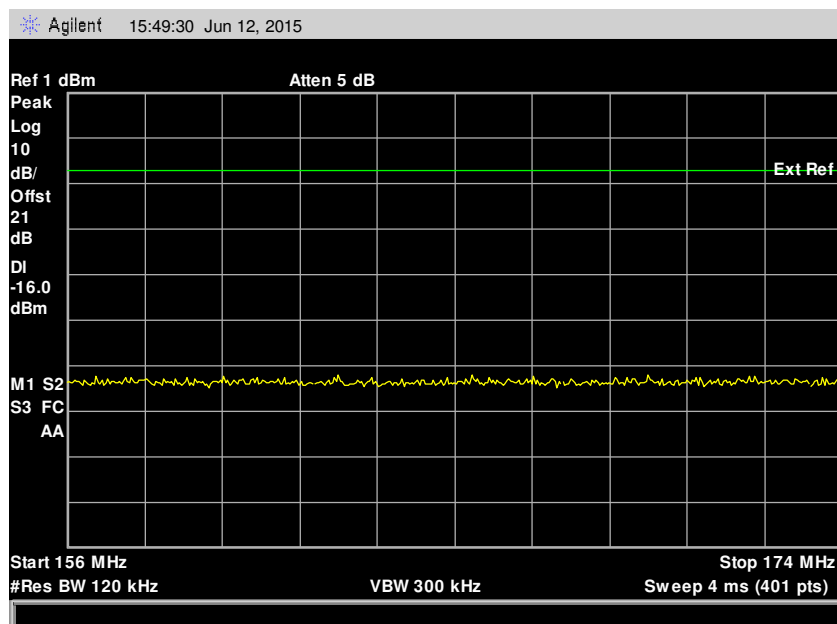
Close-In emissions



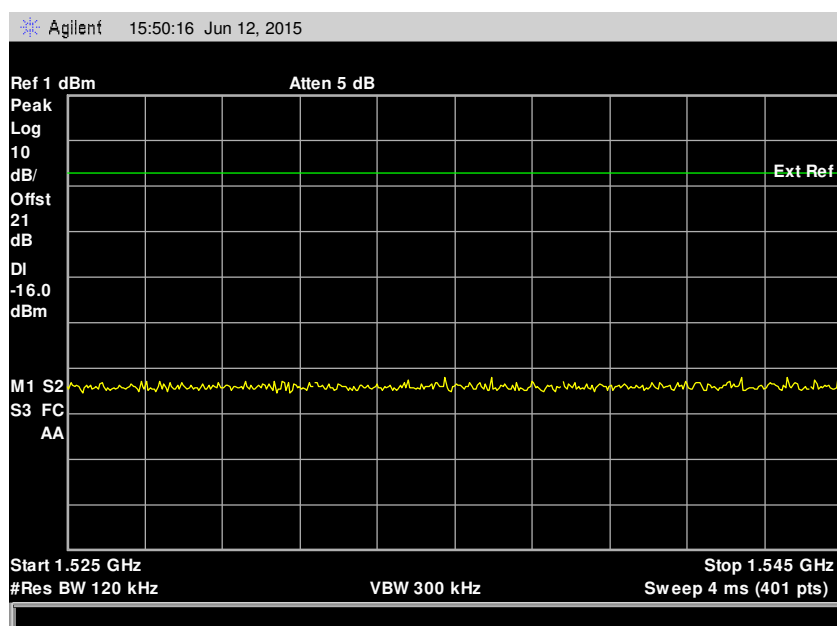


Product Service

156 to 174MHz



1525 to 1545MHz





Product Service

SECTION 3

TEST EQUIPMENT USED



Product Service

3.1 TEST EQUIPMENT

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 Beacons – Message Format and Homing Device Checks					
Power Meter	Hewlett Packard	436A	83	12	29-Aug-2015
Signal Generator	Hewlett Packard	8644A	96	12	23-Apr-2015
RF Shielded Enclosure	Rittal	AE1380	162	-	TU
Termination (50ohm)	Diamond Antenna	DL-30N	226	12	6-Feb-2016
Termination (50ohm)	Diamond Antenna	DL-30N	337	12	8-Oct-2015
Distress Beacon RF Unit	TUV SUD Product Service	-	2445	-	TU
Stop Clock	R.S Components	RS328 061	2674	12	30-Jun-2015
Hygrometer	Rotronic	I-1000	2829	12	27-Oct-2015
Termination (50ohm, 6W)	Micronde	R404613	3074	12	27-Mar-2016
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	4-Jun-2015
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	4-Jun-2015
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	16-Sep-2015
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	17-Sep-2015
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	11-Nov-2015
ScopeCorder	Yokogawa	DL750 701210	3254	12	10-Nov-2015
Beacon Tester	WS Technologies	BT100S	3263	-	TU
RF Short Circuit	TUV SUD Product Service	Short Circuit	3268	-	TU
Short Circuit	TUV SUD Product Service	Short Circuit	3272	-	TU
Power Sensor	Agilent Technologies	8482A	3290	12	16-Jan-2016
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	5-Sep-2015
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3352	12	29-Apr-2015
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	29-Apr-2015



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.2 Climatic - High Temperature (Functional)					
Power Meter	Hewlett Packard	436A	83	12	29-Aug-2015
Signal Generator	Hewlett Packard	8644A	96	12	23-Apr-2015
Termination (50ohm)	Diamond Antenna	DL-30N	337	12	8-Oct-2015
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	23-Jun-2015
Signal Generator	Hewlett Packard	8663A	765	12	4-Nov-2015
Attenuator (10dB, 10W)	Trilithic	HFP-50N	1377	12	22-Oct-2015
Chamber	Heraeus	HC 4033	2174	12	20-May-2015
Distress Beacon RF Unit	TUV SUD Product Service	-	2445	-	TU
Climatic Chamber	Climatec	CLIMATEC 3	2846	12	2-Jun-2015
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3096	12	4-Mar-2016
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	4-Jun-2015
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	18-Nov-2015
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	17-Sep-2015
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	11-Nov-2015
ScopeCorder	Yokogawa	DL750 701210	3254	12	10-Nov-2015
Beacon Tester	WS Technologies	BT100S	3263	-	TU
RF Short Circuit	TUV SUD Product Service	Short Circuit	3268	-	TU
Short Circuit	TUV SUD Product Service	Short Circuit	3272	-	TU
Power Sensor	Agilent Technologies	8482A	3290	12	16-Jan-2016
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	5-Sep-2015
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3355	12	3-Dec-2015
Cable (3m, N-type)	Rhophase	NPS-1601-3000-NPS	3361	12	24-Jul-2015
2 metre SMA Cable	Florida Labs	SMS-235SP-78.8-SMS	4517	12	29-Jan-2016
Section 2.3 Climatic - Humidity					
Climatic Chamber	Climatec	CLIMATEC 3	2846	12	1-Jun-2016
Section 2.4 Vibration - Sine					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Charge Amplifier	Endevco	133	2499	12	2-Dec-2015
Charge Amplifier	Endevco	133	2506	12	28-Nov-2015
Vibration System	Ling Dynamic Systems	LDS V964	2515	6	2-Dec-2015
Isotron Accelerometer	Endevco	256-10	3112	-	17-Jun-2015
Isotron Accelerometer	Endevco	256-10	3113	6	9-Jan-2016
Vibration System	Ling Dynamic Systems	875	3170	6	30-Sep-2015
Charge Amplifier	Endevco	133	3189	12	20-Jul-2016
Beacon Tester	WS Technologies	BT100S	3263	-	TU
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	5-Sep-2015
Cable (3m, N-type)	Rhophase	NPS-1601-3000-NPS	3361	12	24-Jul-2015
Vibration Controller	m + p International	Vibpilot 8	3768	12	13-May-2016
Vibration Controller	m + p International	Vibpilot 8	3769	12	12-May-2016
Vibration Controller (8 Ch)	m + p International	VibPilot 8	3777	12	23-Jun-2016
Isotron Accelerometer	Endevco	256-10	3806	6	9-Jul-2015
Accelerometer	Endevco	256-10	3987	6	28-Oct-2015
Accelerometer	Meggitt	256-10	4222	6	9-Jan-2016
Accelerometer	Meggitt Endevco	256-10	4272	6	15-Nov-2015
Accelerometer	Meggitt Endevco	256-10	4306	6	26-Apr-2016
Accelerometer	PCB Piezotronic	352C03	4338	6	1-Jan-2016
Accelerometer	PCB Piezotronic	352C03	4475	6	1-Jan-2016
Isotron Accelerometer	PCB Piezotronic	M353B18	4568	12	26-May-2016



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.4 Vibration - Sine on Random					
Accelerometer	Endevco	7254A-10	2537	6	14-Jan-2016
Accelerometer	Endevco	7254-A-10	2543	6	15-Jan-2016
Vibration System	Ling Dynamic Systems	875	3170	6	30-Sep-2015
Charge Amplifier	Endevco	133	3189	12	20-Jul-2016
Charge Amplifier	Endevco	133	3192	12	1-Dec-2015
Vibration Controller (8 Ch)	m + p International	VibPilot 8	3779	12	13-Jul-2016
Accelerometer	Meggitt Endevco	256-10	4306	6	26-Apr-2016
Section 2.5 Ruggedness					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Charge Amplifier	Endevco	133	2499	12	2-Dec-2015
Charge Amp	Endevco	133	2500	12	27-Nov-2015
Vibration System	Ling Dynamic Systems	LDS V964	2515	6	12-Jun-2015
Isotron Accelerometer	Endevco	256-10	3112	-	17-Jun-2015
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	30-Jun-2015
Beacon Tester	WS Technologies	BT100S	3263	-	TU
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	5-Sep-2015
Vibration Controller	m + p International	Vibpilot 8	3768	12	12-May-2015
Accelerometer	Endevco	256-10	3992	6	8-May-2015
Accelerometer	PCB Piezotronic	352C03	4337	6	8-May-2015
Section 2.7 Beacons - Drop Into Water					
Beacon Tester	WS Technologies	BT100S	3263	-	TU
Humidity & Temperature Meter	Radio Spares	1361C	4420	12	1-May-2015
Section 2.8 Climatic - Thermal Shock					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Climatic Chamber	Fisons	Fisons 5	2123	12	10-Dec-2015
Balance	Geniweigher	GM-11K	2334	12	12-Mar-2016
Climatic Chamber	Climatec	CLIMATEC 3	2846	12	2-Jun-2015
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	5-Sep-2015
Section 2.9 Climatic - Immersion					
Over Pressure (T)	ASL (TUV)	0 TO 15 PSI	2125	-	TU
Pressure Indicator	Druck	DPI 700	2343	12	23-Dec-2015
Section 2.10 and 2.14 Beacons - Spurious Emissions					
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	11-Feb-2016
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	23-Jun-2015
3dB/10W Attenuator	Texscan	HFP-50N	475	12	1-Apr-2016
Attenuator (10dB, 10W)	Trilithic	HFP-50N	1377	12	22-Oct-2015
Hygrometer	Rotronic	I-1000	2829	12	27-Oct-2015
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	30-Jun-2015
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	9-Jun-2016
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	16-Sep-2015
Thermocouple Thermometer	Fluke	51	3172	12	24-Sep-2015
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	17-Sep-2015
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	5-Sep-2015
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	8-Apr-2016
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4512	12	29-Jan-2016
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4513	12	29-Jan-2016



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.14 Beacons - Constant Temperature Tests					
Power Meter	Hewlett Packard	436A	47	12	11-Jul-2015
Power Meter	Hewlett Packard	436A	83	12	29-Aug-2015
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	11-Feb-2016
Time Interval Analyser	Yokogawa	TA720	181	12	24-Apr-2016
Termination (50ohm)	Diamond Antenna	DL-30N	226	12	6-Feb-2016
Termination (50ohm)	Diamond Antenna	DL-30N	337	12	8-Oct-2015
Attenuator (10dB, 10W)	Texscan	HFP-50N	468	12	23-Jun-2015
3dB/10W Attenuator	Texscan	HFP-50N	475	12	28-Mar-2015
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	9-Apr-2016
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	21-Aug-2015
Attenuator (10dB, 10W)	Trilithic	HFP-50N	1377	12	22-Oct-2015
Stop Clock	R.S Components	RS328 061	2674	12	30-Jun-2015
Hygrometer	Rotronic	I-1000	2829	12	27-Oct-2015
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Beacon RF Unit	TUV SUD Product Service	N/A	3066	-	TU
Termination (50ohm, 0.5W)	Hewlett Packard	HP11593A	3086	-	TU
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3096	12	4-Mar-2016
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	12	27-Mar-2016
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	30-Jun-2015
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	3-Jun-2016
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	9-Jun-2016
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	18-Nov-2015
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	16-Sep-2015
Thermocouple Thermometer	Fluke	51	3172	12	24-Sep-2015
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	17-Sep-2015
RF Short Circuit	TUV SUD Product Service	Short Circuit	3268	-	TU
Power Sensor	Agilent Technologies	8482A	3289	12	16-Jan-2016
Power Sensor	Agilent Technologies	8482A	3290	12	14-Jan-2015
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	5-Sep-2015
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3351	12	30-Apr-2016
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3352	12	30-Apr-2016
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	3-Dec-2014
Cable (3m, N-type)	Rhophase	NPS-1601-3000-NPS	3361	12	24-Jul-2015
ScopeCorder	Yokogawa	DL750	4175	12	28-Jan-2016
GPS Antenna	SRT Marine Technology Ltd	260-0002	4225	-	TU
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4509	12	20-May-2016
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4512	12	29-Jan-2016
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4513	12	29-Jan-2016



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.18 Automatic Release Mechanism and Automatic Activation					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Over Pressure (T)	ASL (TUV)	0 TO 15 PSI	2125	-	TU
Balance	Geniweigher	GM-11K	2334	12	12-Mar-2016
Pressure Indicator	Druck	DPI 700	2343	12	23-Dec-2015
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	5-Sep-2015
Stopwatch	R.S Components	309RS	4553	12	18-Mar-2016
Section 2.20 EMC - Compass Safe Distance					
Sussex Helmholtz Coil	Various	88771	327	-	TU
Magnetometer	Bartington	MAG01	671	36	24-Feb-2018
Multimeter	Iso-tech	IDM101	2422	12	22-Jan-2016
Compass Verification Unit	TUV SUD Product Service	CVU	3579	-	TU
Marine Binacle Compass with Repeater Display	Cassens & Plath	Compass: Type 11	3834	-	TU
Section 2.6 Climatic - Corrosion					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	21-Aug-2015
Section 2.22 Beacons - 121 Emission Characteristics					
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	11-Feb-2016
1GHz Digital Oscilloscope	Lecroy	9370M	612	12	23-Oct-2015
Hygrometer	Rotronic	I-1000	2829	12	27-Oct-2015
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	3-Jun-2016
Thermocouple Thermometer	Fluke	51	3172	12	24-Sep-2015
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	5-Sep-2015
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4509	12	20-May-2016
Section 2.22 Beacons - 121 Modulation Characteristics					
Test Receiver	Rohde & Schwarz	ESIB26	2085	0	4-Mar-2016
Oscilloscope	Lecroy	9370	2832	12	24-Oct-2015
Section 2.21 TUV NEL - Hose Stream					
Ultrasonic Flowmeter	Flexim	CDQ1N27	NEL 15401	-	TU

TU – Traceability Unscheduled

O/P MON – Output Monitored with Calibrated Equipment



Product Service

SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



Radiated sample



Product Service



Conducted Sample



Float Free Case View 1



Product Service



Float Free Case View 2



Product Service



Non-Float Free Bracket 1



Product Service

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



Product Service

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA
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Product Service

ANNEX A

LIMITED C/S TESTING (SUMMARY OF RESULTS)



Product Service

TEST RESULTS TABLE

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: RLB-41, S/N: #15, TUV Ref: TSR0058 and Modification State 0							
Transmitter power output	(maximum)	35 - 39	dBm	-	38.88	-	
	(minimum)			-	38.87	-	
Power output rise time	(maximum)	< 5	ms	-	0.29	-	
	(minimum)			-	0.28	-	
Power output 1ms before burst	(maximum)	< -10	dBm	-	-35.90	-	
	(minimum)			-	-39.86	-	
2. Digital Message Coding						Result: Pass	
Model: RLB-41, S/N: #15, TUV Ref: TSR0058 and Modification State 0							
Bit Sync	1 - 15	15 bits “1”	P / F	-	P	-	
Frame sync	16 - 24	“000101111”	P / F	-	P	-	
Format flag	25	1 bit	bit value	-	1	-	
Protocol flag	26	1 bit	bit value	-	0	-	
Identification / position data	27 - 85	59 bits	P / F	-	P	-	
BCH code	86 -106	21 bits	P / F	-	P	-	
Emerg. Code/nat. use/supplem. Data	107 - 112	6 bits	bit value	-	110111	-	
Additional data / BCH (if applicable)	112 - 144	32 bits	P / F	-	P	-	
Position Error (if applicable)		< 5	km	-	n/a	-	



Product Service

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: RLB-41, S/N: #15, TUV Ref: TSR0058 and Modification State 0						
Repetition rate, T _R :						
Average T _R	48.5 ≤ T _{Ravg} ≤ 51.5	seconds	-	50.018	-	
Minimum T _R	47.5 ≤ T _{Rmin} ≤ 48.0	seconds	-	47.845	-	
Maximum T _R	52.0 ≤ T _{Rmax} ≤ 52.5	seconds	-	52.401	-	
Standard deviation	0.5 - 2.0	seconds	-	1.34	-	
Bit rate						
Minimum fb	≥ 396	bits/sec	-	399.91	-	
Maximum fb	≤ 404	bits/sec	-	399.93	-	
Total transmission time						
Short message	(maximum)		-	n/a	-	
	(minimum)	435.6 - 444.4	ms	-	n/a	-
Long message	(maximum)		-	520.04	-	
	(minimum)	514.8 - 525.2	ms	-	519.99	-
Unmodulated carrier						
Minimum T1	≥ 158.4	ms	-	159.98	-	
Maximum T1	≤ 161.6	ms	-	160.04	-	
First burst delay	≥ 47.5	seconds	-	50	-	



Product Service

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: RLB-41, S/N: #15, TUV Ref: TSR0058 and Modification State 0						
Biphase-L	P / F	P / F	-	P	-	
Rise time (maximum)	50 - 250	µs	-	194.4	-	
(minimum)	50 - 250	µs	-	171.3	-	
Fall time (maximum)	50 - 250	µs	-	188.7	-	
(minimum)	50 - 250	µs	-	167.6	-	
Phase deviation: positive (maximum)	+(1.0 to 1.2)	radians	-	1.1911	-	
(minimum)	+(1.0 to 1.2)	radians	-	1.0182	-	
Phase deviation: negative (maximum)	-(1.0 to 1.2)	radians	-	-1.1913	-	
(minimum)	-(1.0 to 1.2)	radians	-	-1.0276	-	
Symmetry measurement	≤ 0.05		-	0.0202	-	
5. 406 MHz Transmitted Frequency						Result: Pass
Model: RLB-41, S/N: #15, TUV Ref: TSR0058 and Modification State 0						
Nominal Value (maximum)	C/S T.001	MHz	-	406.0399677	-	
(minimum)			-	406.0399675	-	
Short-term stability (maximum)	≤ 2x10 ⁻⁹	/100ms	-	13.541E-11	-	
(minimum)			-	94.438E-12	-	
Medium-term stability – Slope (maximum)	(-1 to +1)x10 ⁻⁹	/minutes	-	90.061E-12	-	
(minimum)			-	-11.172E-11	-	
Medium-term stability – Residual frequency variation (maximum)	≤ 3x10 ⁻⁹		-	35.185E-11	-	
(minimum)			-	15.974E-11	-	
6. Spurious Emissions into 50ohms						Result: Pass
Model: RLB-41, S/N: #15, TUV Ref: TSR0058 and Modification State 0						
In band (406.0 – 406.1 MHz)	C/S T.001 mask	P / F	P			



Product Service

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
7. 406 MHz VSWR Check						Result: Pass
Model: RLB-41, S/N: #15, TUV Ref: TSR0058 and Modification State 0						
Nominal transmitted frequency	C/S T.001	MHz	-	406.0399680	-	
Modulation rise time (maximum)	50-250	µs	-	195.3	-	
Modulation rise time (minimum)	50-250	µs	-	169.3	-	
Modulation fall time (maximum)	50-250	µs	-	196.7	-	
Modulation fall time (minimum)	50-250	µs	-	170.6	-	
Modulation phase deviation: positive (maximum)	+ (1.0 to 1.2)	radians	-	1.1877	-	
Modulation phase deviation: positive (minimum)	+ (1.0 to 1.2)	radians	-	1.0134	-	
Modulation phase deviation: negative (maximum)	- (1.0 to 1.2)	radians	-	-1.1936	-	
Modulation phase deviation: negative (minimum)	- (1.0 to 1.2)	radians	-	-1.0198	-	
Modulation symmetry measurement	≤ 0.05		-	0.0198	-	
Digital Message	correct	P / F	-	P	-	



Product Service

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
8(a). Self-test Mode						Result: Pass
Model: RLB-41, S/N: #15, TUV Ref: TSR0058 and Modification State 0						
Frame sync	011010000	P / F	-	P	P	On activation of the Self Test the following items are checked: Battery On Time RF Test Board Test. Various LED indications are provided which correlate to the pass / fail status of the above parameter checks. In accordance with the Operator Manual, if the third LED indicator is green, 406 MHz and 121 MHz power has been emitted. See also Annex B for further details.
Format flag	1 / 0	bit value	-	1	1	
Single radiated burst	≤440 / 520 (±1%)	ms	-	439.978	439.977	
Default position data (if applicable)	correct	P / F	-	P	P	
Description	provided	Y / N	Y			
Design data on protection against repetitive self-test mode transmissions	provided	Y / N	Y			
Single burst verification	one burst	P / F	-	P	-	
Provides for 15 Hex ID	correct	P / F	-	P	-	
121.5 MHz RF power (if applicable)	verify that RF power emitted	P / F	-	P	-	
406 MHz power	verify that RF power emitted	P / F	-	P	-	
Distinct indication of Self-Test	provided	Y / N	-	Y	-	
Distinct indication of RF power being emitted	provided	Y / N	-	Y	-	
Indication of Self-Test result	provided	Y / N	-	Y	-	
Maximum duration of Self-Test mode	≤ maximum duration of Self-Test	sec	-	10	-	
Automatic termination of Self-Test mode upon completion of Self-Test and indication of Self-Test results	verify automatic termination	Y / N	-	Y	-	



Product Service

Parameters to be Measured	Range of Specification	Units	Test Results			Comments
			Tmin	Tamb	Tmax	
			(-20°C)	(+21°C)	(+55°C)	
8 (b). GNSS Self-Test Mode (if applicable)						Result: Pass
Model: RLB-41, S/N: #15, TUV Ref: TSR0058 and Modification State 0						
Frame sync	011010000	P / F	-	P	-	Applicants Data – Annex B
Format flag	1 / 0	bit value	-	1	-	
Single radiated burst	≤ 520 (+1%)	ms	-	520.020	-	
Position data (if applicable)	must be within 500m (or 5.25km for User Location Protocol) of the actual position	P / F	-	P	-	
Design data showing how GNSS Self-test is limited in number of transmissions and duration	provided	Y / N		-		
Single burst verification	one burst	P / F	-	P	-	
121.5 MHz RF power (if applicable)	GNSS self-test checks that RF power is emitted	Y / N		N		
406 MHz power	GNSS self-test checks that RF power is emitted	Y / N		Y		
Maximum duration of GNSS Self-test	-	s	-	132	-	
Actual duration of Self-test with encoded location	Less than maximum duration	s	-	45	-	
Maximum number of GNSS Self-tests (only beacons with internal navigation devices)	-	Number		-		Applicant's data: See Application Form
Distinct indication to register successful completion or failure of the GNSS self-test	must be provided	Y/N	-	Y	-	See comments in Test Results section
Distinct indication that a maximum number of GNSS self-tests has been attained after GNSS self-test mode activation and without transmission of a test message of further GNSS receiver current drain	must be provided	Y/N	-	Y	-	Applicants Data – Annex B



Product Service

Parameters to be Measured	Range of Specification	Units	Test Results	Comments
9. Thermal Shock				Result: Pass
Model: RLB-41, S/N: #15, TUV Ref: TSR0058 and Modification State 0				
Soak Temperature	30°C difference	°C	20	
Measurement Temperature		°C	-10	
Transmitted Frequency	C/S T.001 ≤ 2x10 ⁻⁹ (-2 to +2)x10 ⁻⁹ ≤ 3x10 ⁻⁹ 35 - 39	MHz	Min	Max
Nominal value			406.0400027	406.0400093
Short-term stability		/100ms	57.334E-12	13.726E-11
Medium-term stability – Slope		/min	-65.211E-12	96.163E-11
Medium-term stability – Residual frequency variation			17.069E-11	92.930E-11
Transmitter power output	correct	dBm	38.02	38.10
Digital message		P/F	P	

Parameters to be Measured	Range of Specification	Units	Test Results				Comments
14. Satellite Qualitative Tests							Result: Pass
Model: RLB-41, S/N: #9, TUV Ref: TSR0064 and Modification State 0							
Test Configuration	As per C/S T.007	P / F %	Configuration				
			5	6	7	8	
	15 Hex ID Decoded by LUT		correct	-	-	-	
Doppler Location results with error ≤ 5km	≥ 80		-	-	-	100	



Product Service

SPURIOUS EMISSION INTO 50 OHMS

Specification

Cospas-Sarsat T.007, Clause A.2.1 (f)

Equipment Under Test and Modification State

RLB-41 S/N: #15 (TUV Ref TSR0058) - Modification State 0

Date of Test

08 June 2015

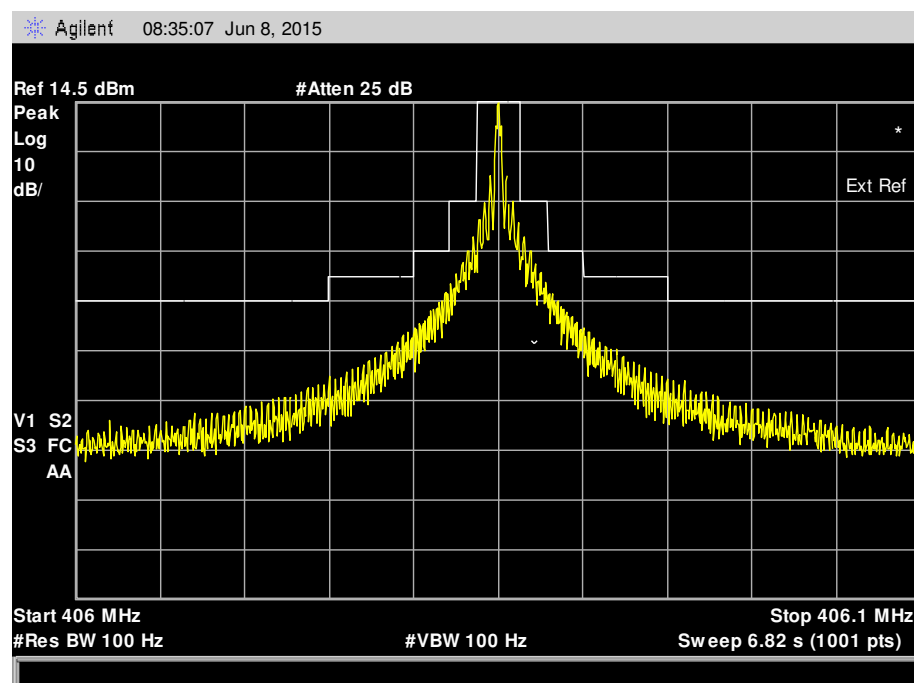
Environmental Conditions

Ambient Temperature 22.6°C

Relative Humidity 30.8%

Test Results

Combined Ambient, Low and High Temperature





Product Service

ANNEX B

CUSTOMER SUPPLIED INFORMATION



Product Service



October 19, 2015

Subject: ACR RLB-41 EPIRB Waiver Information

To Whom It May Concern:

ACR Electronics, Inc. hereby declares that all components and materials (including the labeling) on the exterior of the RLB-41 are of identical material used on the RLB-36, which has been fully tested and type approved, and has been in production for years. The only changes between the currently approved RLB-36 and the RLB-41 are in shape and internal to the EPIRB housing.

Based on the above information, ACR Electronics, Inc. requests that the following tests be waived:

TEST	IEC 61097-2: 2008	ETSI EN 300 066: 2001	AS/NZS 4280.1: 2003
Solar Radiation	A.2.7 (5.17.9)	6.11	5.5.1.2
Oil Resistance	A.2.8 (5.17.10)	6.12	5.5.1.2

Please feel free to contact me if additional information is required.

Signed on behalf of ACR Electronics, Inc.

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Product Service



3M™ Scotchlite™ Reflective Material SOLAS Grade Products

Description

3M™ Scotchlite™ Reflective Material – SOLAS (Safety of Life at Sea) Grade Products are intended for reflectorizing SOLAS life support equipment such as life vests, jackets, and rafts. It conforms to Marine Equipment Directive 96/98/EC and International Maritime Organization (IMO) Resolution A.658(16) Annex 2. It is approved by the U.S. Coast Guard to meet 46 CFR part 164, Subpart 164.018 for Type I and II retroreflective material used to enhance visibility of life-saving equipment in nighttime, or low-light conditions.

3M™ Scotchlite™ Reflective Material – SOLAS Grade Series 3100 products are silver, flexible reflective material with an aggressive pressure sensitive adhesive. 3M™ Scotchlite™ Reflective Material – SOLAS Grade 6755 is a silver, flexible reflective material with a sewable fabric backing while 3M™ Scotchlite™ Reflective Material – SOLAS Grade 6750-I has a sewable 4 mil polyester film backing.

These materials utilize the principle of retroreflection and are comprised of an encapsulated lens optical design that provides high reflectivity over a wide range of entrance angles, whether dry or wet. Scotchlite reflective material – SOLAS grade products have a European mark of conformance. All products are silver in color under daytime viewing conditions and reflect a bright white when illuminated by a light source.

Retroreflective Performance

The coefficient of retroreflection (R_A , in cd/lux/m^2) is measured by methods traceable to either of the following retroreflective intensity testing procedures:

ASTM E809 and E810 (R_A)

CIE 54.2:2001 (R')

The following table contains the minimum R_A values as measured at the listed specific entrances and observations angles. Based on tests performed by 3M in accordance with IMO procedures and verified by an outside third party, Scotchlite reflective material – SOLAS grade products meet or exceed these values.

3M™ Scotchlite™ Reflective Material					
Entrance Angle	Observation Angle				
	0.1	0.2	0.5	1.0	2.0
5	180	175	72	14	2.5
30	140	135	70	12	2.0
45	85	85	48	9.4	1.0

Color

3M™ Scotchlite™ Reflective Material		
Product Number	Daytime Color	Reflected Color
3150-A, 3155, 6750-I, 6755	Silver	White

