



Product Service

**Choose certainty.
Add value.**

Report On

Emergency Beacons Testing of the
Ocean Signal SafeSea E101V
In accordance with IEC 61097-2 Ed 3 2008

Document 75931777 Report 02 Issue 1

April 2016



Product Service

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

REPORT ON

Emergency Beacons Testing of the
Ocean Signal
SafeSea E101V

Document 75931777 Report 02 Issue 1

April 2016

PREPARED FOR

Ocean Signal
Unit 4
Ocivan Way
Margate
Kent
CT9 4NN

PREPARED BY

Martin Hardy
Telecoms Test Engineer

APPROVED BY

Gareth Stephens
Authorised Signatory

Mark Jenkins
Authorised Signatory

Mary Grigbsy
Authorised Signatory

DATED

12 April 2016

13 April 2016

13 April 2016





Product Service

CONTENTS

Section	Page No
1	REPORT SUMMARY 4
1.1	Introduction 5
1.2	Brief Summary of Results 6
1.3	Application Form 8
1.4	Product Information 14
1.5	Deviations 19
1.6	Waiver Requests 19
1.7	Modifications 19
1.8	Report Modification Record 19
2	TEST DETAILS 20
2.1	Message Format and Homing Device Checks 21
2.2	Dry Heat 23
2.3	Damp Heat 29
2.4	Vibration 32
2.5	Ruggedness 41
2.6	Drop on Hard Surface 45
2.7	Drop on Hard Surface - Repeat 49
2.8	Drop Into Water (NUA) 52
2.9	Thermal Shock 55
2.10	Immersion 58
2.11	Spurious Emissions 60
2.12	Battery Capacity and Low Temperature 71
2.13	(Limited) Cospas-Sarsat Type Approval Test Procedure 84
2.14	Interference Test (Immunity to RF – Enclosure Port) 85
2.15	Interference Test (Immunity to ESD) 89
2.16	Conducted Interference (Conducted Emission – DC Power Port) 98
2.17	Conducted Interference (Immunity to Radio Frequency Common Mode – DC Power Port) .. 101
2.18	Conducted Interference (Immunity to Radio Frequency Common Mode – Signal, Control and Telecommunications Port) 102
2.19	Conducted Interference (Immunity to Fast Transient Bursts Common Mode – Signal, Control and Telecommunications Port) 103
2.20	Test of Operational Requirements (NUA) 104
2.21	Automatic Release Mechanism and Automatic Activation Test for Class 1 and Class 2 Satellite EPIRBs (Float Free Tests) 116
2.22	Automatic Release Mechanism and Automatic Activation Test for Class 1 and Class 2 Satellite EPIRBs (Float Free Tests) - repeat 119
2.23	Stability and Buoyancy 121
2.24	Float Free Activation (Salt Water Activation) 122
2.25	Safety 124
2.26	Compass Safe Distance 125
2.27	Solar Radiation 128
2.28	Oil Resistance 129
2.29	Corrosion 130
2.30	Signal Light 131
2.31	GNSS Receiver 132
2.32	121.5 MHz Homing Device 133
2.33	Test to Prevent Release when Water Washes Over the Unit (Hose Stream) (NUA) 146
3	TEST EQUIPMENT 148
3.1	Test Equipment 149
4	PHOTOGRAPHS 156



Product Service

4.1	Photographs of Equipment Under Test (EUT)	157
5	ACCREDITATION, DISCLAIMERS AND COPYRIGHT.....	163
5.1	Accreditation, Disclaimers and Copyright.....	164
ANNEX A	Limited C/S Testing (Summary of Results)	A.2
ANNEX B	Customer Supplied Information	B.2



Product Service

SECTION 1

REPORT SUMMARY

Emergency Beacons Testing of the
Ocean Signal
SafeSea E101V



Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Emergency Beacon Testing of the Ocean Signal SafeSea E101V to the requirements of IEC 61097-2.

Objective	To perform Emergency Beacon Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Ocean Signal
Model Number(s)	SafeSea E101V
Serial Number(s)	0800001P (TUV Ref TSR0005) 0800004P (TUV Ref TSR0003) 0800002P (TUV Ref TSR0013)
Number of Samples Tested	3
Test Specification/Issue/Date	IEC 61097-2 Ed 3 2008
Date of Receipt of Test Samples	10 September 2015
Order Number	PO 01976
Date	27/8/2015
Start of Test	17 September 2015
Finish of Test	17 March 2016
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 B Bennett



Product Service

1.2 BRIEF SUMMARY OF RESULTS

The information contained in this report is intended to show verification of the Emergency Beacon Testing of the Ocean Signal SafeSea E101V to the requirements of IEC 61097-2.

Section	IEC 61097-2 Spec. Clause	Test Description	Result	Comments
Configuration: SafeSea E101V (Conducted) S/N: 0800001P (TUV Ref TSR0005)				
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	-
2.11	A.1.10	Spurious Emissions	Satisfactory	-
2.13	A.1.11	Battery Capacity and Low-Temperature Test	Satisfactory	-
2.14	A.1.12	(Limited) Cospas-Sarsat Type Approval Test Procedure	Satisfactory	-
Configuration: SafeSea E101V (Radiated) S/N: 0800004P (TUV Ref TSR0003)				
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	Drop on Hard Surface	-	See section 2.6 and 2.7
2.7	A.1.6	Drop on Hard Surface	-	
2.8	A.1.7	Drop into Water (NUA)	Satisfactory	-
2.9	A.1.8	Thermal Shock	Satisfactory	-
2.10	A.1.9	Immersion	Satisfactory	-
2.11	A.1.11	Battery Capacity and Low-Temperature Test	Satisfactory	-
2.13	A.1.12	(Limited) Cospas-Sarsat Type Approval Test Procedure	Satisfactory	-
2.14	A.1.13	Interference Test (Immunity to RF)	Pass	-
2.15	A.1.13	Interference Test (Immunity to ESD)	Pass	-
2.16	A.1.14	Conducted Interference (Conducted Emissions – DC Power)	Pass	-
2.17	A.1.14	Conducted Interference (Immunity to Radio Frequency Common Mode – DC Power)	Pass	-
2.18	A.1.14	Conducted Interference (Immunity to Radio Frequency Common Mode – Signal, Control and Telecommunications Port)	Pass	-
2.19	A.1.14	Conducted Interference (Immunity to Fast Transient Bursts Common Mode – Signal, Control and Telecommunications Port)	Pass	-



Product Service

Section	IEC 61097-2 Spec. Clause	Test Description	Result	Comments
Other Tests (Non Compulsory Sequence of Tests) Configuration: SafeSea E101V (Radiated) S/N: 0800004P (TUV Ref TSR0003) and Configuration: SafeSea E101V (Conducted) S/N: 0800002P (TUV Ref TSR0013)				
2.12	A.1.11	Battery Capacity and Low-Temperature Test	Satisfactory	-
2.20	A.2.1	Test of Operational Requirements (NUA)	-	See Section 2.20
2.21	A.2.2	Automatic Release Mechanism and Automatic Activation test for Class 1 and Class 2 satellite EPIRBs	Satisfactory	-
2.22	A.2.2	Automatic Release Mechanism and Automatic Activation test for Class 1 and Class 2 satellite EPIRBs	Satisfactory	-
2.23	A.2.3	Stability and Buoyancy	Satisfactory	-
2.24	A.2.4	Float Free Activation (Salt Water Activation)	Satisfactory	-
2.25	A.2.5	Safety	-	See Section 2.25
2.26	A.2.6	Compass Safe Distance	-	See Section 2.26
2.27	A.2.7	Solar Radiation	-	See Section 2.27
2.28	A.2.8	Oil Resistance	-	See Section 2.28
2.29	A.2.9	Corrosion	-	See Section 2.29
2.30	A.2.10	Signal Light	-	See Section 2.30
2.31	A.2.11	GNSS Receiver	-	See Section 2.31
2.32	A.2.12	121.5MHz Homing Device	Pass	-
2.33	5.5.1.1	Test to Prevent Release when Water Washes Over the Unit (Hose Stream)	Satisfactory	Carried out by TUV NEL.



Product Service

1.3 APPLICATION FORM

G - 1

C/S T.007

ANNEX G

APPLICATION FOR A COSPAS-SARSAT 406 MHz BEACON TYPE APPROVAL CERTIFICATE

G.1 Beacon Manufacturer and Beacon Model

Beacon Manufacturer	Ocean Signal Ltd.
Beacon Model	SafeSea E101V
Other Model Names	X-VDR FF-AMI

Beacon Type and Operational Configurations

Beacon Type	Beacon used while:	Tick where appropriate
EPIRB Float Free	Floating in water or on deck or in a safety raft	☐
EPIRB Non-Float Free (automatic and manual activation)	Floating in water or on deck or in a safety raft	☐
EPIRB Non-Float Free (manual activation only)	Floating in water or on deck or in a safety raft	☐
EPIRB Float Free with VDR	Floating in water or on deck or in a safety raft	☒
PLB	On ground and above ground	☐
	On ground and above ground and floating in water	☐
ELT Survival	On ground and above ground	☐
	On ground and above ground and floating in water	☐
ELT Auto Fixed	Fixed ELT with aircraft external antenna	☐
ELT 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)		☐

G - 2

C/S T.007

Beacon Characteristics

Characteristic	Specification
Operating frequency	406.040MHz
Operating temperature range	$T_{min} = -20^{\circ}\text{C}$ $T_{max} = +55^{\circ}\text{C}$
Temperature, at which minimum duration of continuous operation is expected	-20°C
Operating lifetime	168 hours
Beacon power supply type (internal, 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 operation modes (N/A or Yes or No)	N/A
Battery cell chemistry	Lithium Manganese Dioxide
Battery cell model name, size and number of cells in a battery pack, and details of the battery pack electrical configuration	Ultralife U10013 'D' cells, 3 cells, series connected

Characteristic	Specification
Battery cell manufacturer	Ultralife
Battery pack manufacturer and part number	Ocean Signal Ltd, 901S-01741
Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon)	2years
Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon)	8years
Oscillator type (e.g. OCXO, MCXO, TCXO)	TCXO
Oscillator manufacturer	Rakon Limited
Oscillator part name and number	E5344LF
Oscillator satisfies long-term frequency stability requirements (Yes or No)	Yes
Antenna type: Integral or Other (e.g. External, Detachable – specify type)	Integral
Antenna manufacturer	Ocean Signal Ltd.
Antenna part name and number	Ocean Signal Ltd.
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 resulting from a failure of navigation device or failure to acquire position data (Yes, No, or N/A)	Yes
Features in beacon that ensures erroneous position data is not encoded into the beacon message (Yes, No or N/A)	Yes
Navigation device capable of supporting global coverage (Yes, No or N/A)	Yes
Encoded position update capability (Yes, No, N/A)	Yes

G - 3

C/S T.007

Encoded position update interval value (range)	
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	Quectel
- Navigation device model name and part Number	L70
- Internal navigation device antenna type (integrated, internal, external, passive/active), manufacturer and model	Internal, AEL Crystal Ltd., DAE1575R1820A
- GNSS system supported (e.g. GPS, GLONASS, Galileo)	GPS

Characteristic	Specification	
For External Navigation Devices	N/A	
- Data protocol for GNSS receiver to beacon interface		
- Physical interface for beacon to navigation device		
- Electrical interface for beacon to navigation device		
- Part number of the external navigation interface device (if applicable)		
- Navigation device model and manufacturer (if beacon designed to use specific devices)		
Self-Test Mode Characteristics	Self-Test Mode	Optional GNSS Self-Test Mode
- Activated by a separate switch / separate switch positions (Yes / No)	Yes	Yes
- Self-test / GNSS self-test mode switch automatically returns to normal position when released (Yes or No)	Yes	
- Self-test / GNSS activation can cause an operational mode transmission (Yes or No)	Yes	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	N/A
- Results of self-test /GNSS self-test indicated by (provide details, e.g Pass /Fail indicator I, strobe light, etc.)	indicator LED Strobe light	indicator LED Strobe light
- The content of the encoded position data fields of the self-test message has default values	Yes	N/A
- Performs an internal check and indicates that RF power emitted at 406 MHz and 121.5 MHz, if beacon includes a 121.5 MHz homer (Yes or No)	Yes	N/A
- Self-test results in transmission of a signal other than at 406 MHz (Yes & details or No)	Yes, 121.5MHz	No
- Self-test can be activated directly at beacon (Yes or No)	Yes	Yes
- List of Items checked by self-test	406 Power, Synth,	GPS receiver



Product Service

G - 4

C/S T.007

	121.5 Power Battery Status	
- Self-test / GNSS self-test 408 MHz burst duration (440 or 520 ms)	520ms	N/A
- Self-test message length format flag in bit 25,bit ("0" or "1")	0	N/A
- Maximum duration of a self-test mode, sec	16.5Secs	315.5Secs
- Maximum recommended number of self-tests during battery pack replacement period	72	N/A
- Distinct indication of self-test start (Yes/No)	Yes	Yes
- Indication of self-test results (Yes/No)	Yes	Yes
- Distinct indication of insufficient battery capacity (Yes or No)	Yes	N/A
- 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	12
- GNSS Self-test results in transmission of a single burst, irrespectively of the test result (Yes or No)	N/A	No
- Maximum number of self-tests during battery pack replacement period	≤280	N/A
- Self-test / GNSS self-test can be activated from beacon remote activation points (Yes & details or No)	No	No
List all methods of self-test mode and GNSS self-test mode activation. Provide details on a separate sheet to describe.	Test key only	Test key only

G - 5

C/S T.007

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

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

Characteristic	Specification
Beacon includes a homer transmitter(s) (Yes or No)	Yes
-Homer transmitter(s) frequency	121.5MHz
-Homer transmit(s) power	20dBm $\pm$ 2dB
-Homer transmitter(s) duty cycle	97%
-Duty cycle of homer swept tone	34%
Beacon includes a high intensity flashing light (e.g. Strobe)	Yes
-light intensity	>0.5cd
-flash rate	2.5Secs
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.	None
Beacon includes automatic activation mechanism (Yes or No) Specify type of automatic beacon activation mechanism	Yes, Water activation
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	VDR data recorder module completely separated from EPIRB electronics and fully isolated from the EPIRB power supply
Beacon model hardware part number (P/N) and version	90CS-01864, issue 01.00
Beacon model software/firmware P/N, version, date of issue / releases	50CS-01863, issue 01.00
Beacon model printed circuit board P/N and version	101S-01530, issue 01.00
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:	David Sheekey Product and Approvals Manager david.sheekey@oceansignal.com +44 (0)1843 282930

Dated:

Signed: 
(Simon Nolan, Chief Technical Officer)

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was an Ocean Signal SafeSea E101V 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: 0800001P (TUV Ref TSR0005) was used for tests where the specification required a Functional Check and a Functional Test.

The second EUT, S/N: 0800004P (TUV Ref TSR0003) 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 necessary.

When immersion into water was required 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 may have occurred (drop into water, leakage and immersion, high temperature thermal shock, low temperature thermal shock and salt fog). The conducted sample was also omitted from tests which could cause damage to the 50Ω connections (Vibration, Bump, Drop on to Hard Surface).

The EUT(s) were fitted in a Manufacturer supplied Float Free Housing where applicable. See test result section setup photographs for details.

Note: Both the conducted and radiated test samples were subjected to the relevant tests in parallel where possible.

An additional conducted EUT, S/N: 0800002P (TUV Ref TSR0013), was used for some of the non compulsory sequence tests.



Product Service

1.4.3 Monitoring of Performance for EMC tests

EUT Monitoring in VDR Mode

The EUT in VDR Mode was connected to a server switch which gave the EUT Power and communications link, the router was used to connect to the router and communicate with the EUT by running a VDR test program supplied by the Manufacturer. The VDR test program monitored the integrity of the data received (no errors should be seen).

EUT Monitoring in Standby Mode

The EUT was monitored throughout the test with a Beacon tester. The Beacon tester was set to record any unintentional transmissions from the EUT.

A spectrum analyser was also used to monitor any unintentional 121.375 MHz signal transmissions.

Throughout the test the EUT's LEDs rate was also observed using CCTV (radiated immunity) and directly (ESD) for any unintentional activation

EUT Monitoring in Active Mode

The EUT was provided with positional data from a GPS simulator and the 406.040 MHz messages were monitored by a Beacon tester. The 121.375 MHz homing signal was monitored with a spectrum analyser.

Throughout the test the LED flash rate was also observed using CCTV (radiated immunity) and directly (ESD). The magnitude of the 406.040 MHz signal was recorded on a signal analyser prior to the start of the test and then compared to the view trace for each burst.

1.4.4 Performance Criteria for EMC tests (Acceptable Performance Limits)

In Active mode the EUT should continue to work correctly; the beacon should continue to transmit the 406.040 MHz and 121.375 MHz signals with no degradation of amplitude.

In Standby mode there should be no transmissions.



Product Service

1.4.5 Test Conditions for EMC tests

For all EMC tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure, test laboratory or an open test area as appropriate.

The EUT was powered from the internal battery.

Where tests in the VDR mode were required, the VDR functionality was powered either over Ethernet or by a 12V DC supply as indicated in the relevant tests.

Test Results

IEC 60945, Clause 5.3 states:

The measured test results shall be compared with the corresponding acceptable performance limits and the EUT shall pass the test only if the measured performance margin is favourable and greater than the measurement uncertainty. The test report shall show, for each test measurement, the test result, its associated measurement uncertainty, the acceptable performance limits, and the acceptable performance margin, as applicable.

The tests detailed in this report met the above test requirements.



Product Service

1.4.6 Modes of Operation

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

Off/Standby Mode

- Main switch to “OFF” position
- No apparent activity

Self-test

- Test switch to “TEST” position for 2 seconds (approx)
- List of items checked as per Customer Supplied Information (Application Form)
- Navigation data applied at ambient temperature

GNSS Self-test

- Test switch to “TEST” position for 10 seconds (approx)
- 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

- Main switch to “ON” position
- 121 Homer active and offset
- GPS operating in normal duty cycle for the following navigation input conditions
- No navigation data applied

All modes

All mode descriptions are applicable to all tests unless otherwise stated. Additional methods of activation include:

- Water contacts

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

During the first hour of operation, the manufacturers’ information states that in the absence of an external GPS signal, the EUT’s internal GPS receiver has the following duty cycle:

- ON for 5 minutes
- OFF for 5 minutes.



Product Service

1.5 DEVIATIONS

Limited Cospas-Sarsat testing occurred during the compulsory sequence of tests. This was agreed with the Notified Body to allow the Cospas-Sarsat type approval to take place in parallel. The limited testing was carried out so that continuing compliance could be demonstrated.

The compulsory sequence of tests was, where possible, carried out on both the conducted and radiated sample, however, for tests requiring physical impact and / or water the EUT was not considered suitable due to the addition of the 50Ω connector conducted ports.

The operating lifetime test combined with the formal Cospas-Sarsat and IEC61097-2 requirements and was carried out on an alternative sample outside of the compulsory sequence of tests.

1.6 WAIVER REQUESTS

Waiver requests have been provided for the following clauses:

Solar Radiation
Oil Resistance
Corrosion
Signal Light Test
GNSS Receiver Requirements

1.7 MODIFICATIONS

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
SafeSea E101V S/N: 0800004P (TUV Ref TSR003)			
0	As supplied by manufacturer.	N/A	N/A
1	Reed switch change and buffers added, inductor cage added following initial drop test failure.	Ocean Signal	Returned to TUV 19 October 2015
2	Reed switch replacement, following intermittent switch failure / activation.	Ocean Signal	Returned to TUV 02 November 2015
3	EMC mod (external filter). Change to lanyard enclosure plastics and float free housing modification changes.	Ocean Signal	Returned to TUV 03 March 2016
All other samples			
0	As supplied by manufacturer.	N/A	N/A

1.8 REPORT MODIFICATION RECORD

Issue 1 – First Issue



Product Service

SECTION 2

TEST DETAILS

Emergency Beacons Testing of the
Ocean Signal
SafeSea E101V



Product Service

2.1 MESSAGE FORMAT AND HOMING DEVICE CHECKS

2.1.1 Specification Reference

IEC 61097-2, clause A.1.1

2.1.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 0

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0

2.1.3 Date of Test

17 September 2015

2.1.4 Test Equipment Used

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

2.1.5 Environmental Conditions

Ambient Temperature 22.6.0°C

Relative Humidity 44.5%

2.1.6 Test Results

Visual Inspection

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

Note: The labels fitted to the top of the EUT were lifted by the manufacturer before test, to gain access to the retaining screws.

Performance Check

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



Product Service

Summary of Performance Check Results

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039978
121 MHz Presence	P

Summary of Performance Check Results

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039907
121 MHz Presence	P



Product Service

2.2 DRY HEAT

2.2.1 Specification Reference

IEC 61097-2, clause A.1.2

2.2.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 0

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0

2.2.3 Date of Test

22 – 24 September 2015

2.2.1 Test Equipment Used

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

2.2.2 Environmental Conditions

Ambient Temperature: 21.0 – 22.2°C

Relative Humidity: 46.4 – 51.5%

2.2.4 Test Setup

Storage Test



Functional Test





Product Service

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

Functional Test

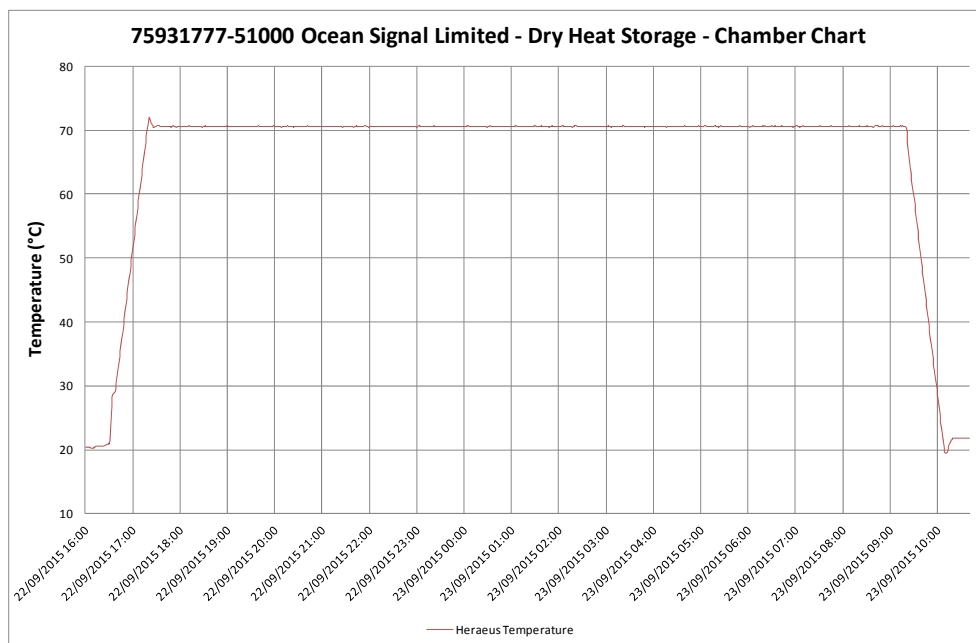
The EUTs were switched on, and placed in a climatic chamber where the temperature was increased from laboratory ambient temperature to +55°C. After 11 hours, the EUTs were subjected to a performance check and performance test. At the end of the test, the temperature was returned to laboratory ambient 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

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039967
121 MHz Presence	N (See note)

Note: It was observed during the Performance Check on the above EUT that the 121 Homing Transmitter was only present during the Self-Test function, and was disabled during normal activation. This was corrected after the Dry Heat tests in this section by reprogramming the EUT. After discussion with the Notified Body, it was agreed that repeat testing was not required, as the 121 Homing Transmitter in the conducted EUT was correctly active during the tests (results below).

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005)

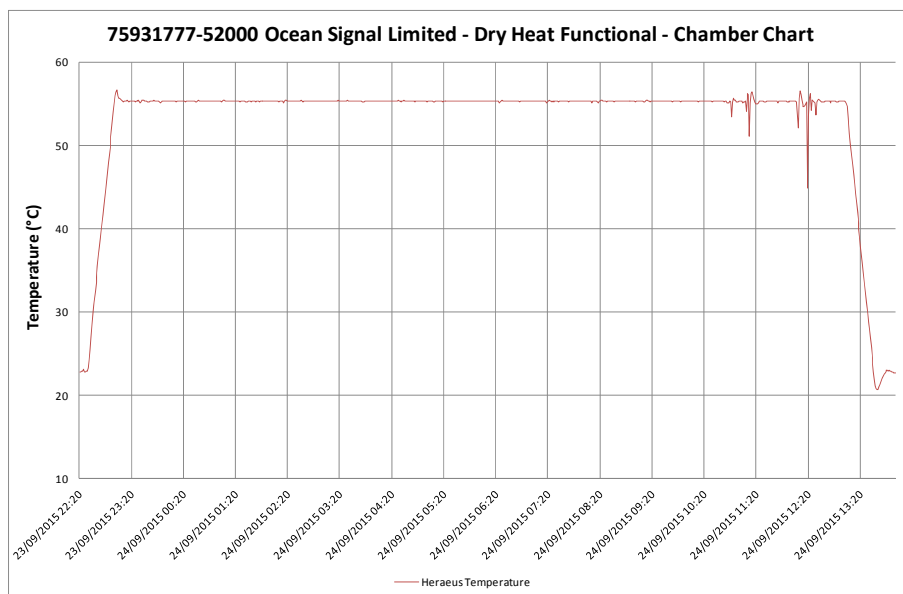
Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039931
121 MHz Presence	P



Product Service

Functional Test

Temperature Plot



Note: The variations in temperature towards the end of the plot above are due to the chamber door being opened briefly to activate/deactivate the EUT. The temperature inside the chamber was allowed to stabilise before measurements were made.

Performance Check

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003)

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.040012
121 MHz Presence	Not Activated (Self Test Only)



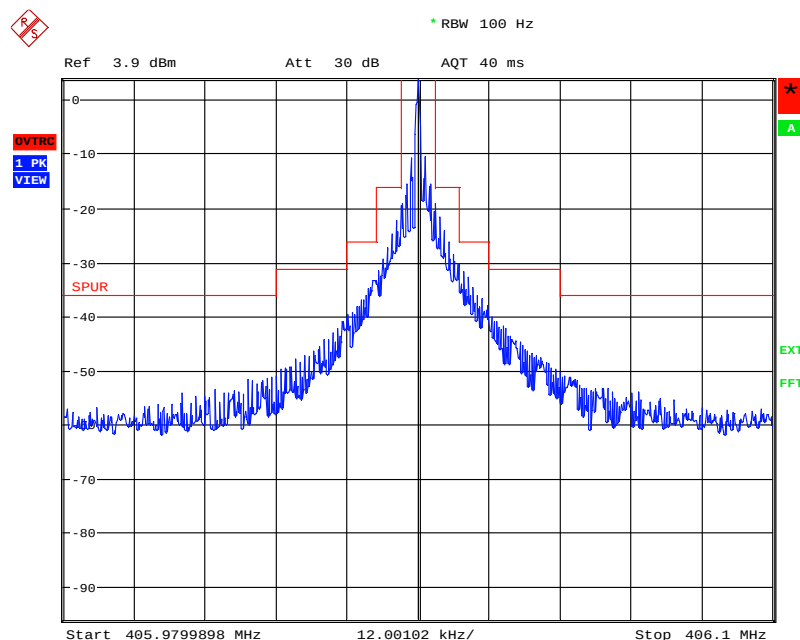
Product Service

Performance Test

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005)

Parameter	Result (Max/Min)
Output Power (dBm)	36.65 / 36.64
Digital Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
Bit Rate (bit/sec)	400.12 / 400.11
Modulation: Rise Time (uS)	149.4 / 135.3
Modulation: Fall Time (uS)	161.7 / 147.7
Positive Deviation (rad)	1.1701 / 1.0669
Negative Deviation (rad)	-1.1624 / -1.0573
Nominal Frequency (MHz)	406.0399949 / 406.0399949
Short-term Stability (/100ms)	71.813E-12 / 60.526E-12
Medium-term Stability – Slope (/minute)	23.253E-12 / -17.361E-12
Medium-term Stability – Residual	10.397E-11 / 78.830E-12
Spurious Emissions	(see Plot)
121 MHz Presence	P

Spurious Emissions



Date: 24.SEP.2015 10:33:45

2.3 DAMP HEAT

2.3.1 Specification Reference

IEC 61097-2, clause A.1.3

2.3.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 0

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0

2.3.3 Date of Test

24 – 25 September 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: 23.2 – 23.4 °C

Relative Humidity: 37.6 - 40.8 %

2.3.6 Test Setup



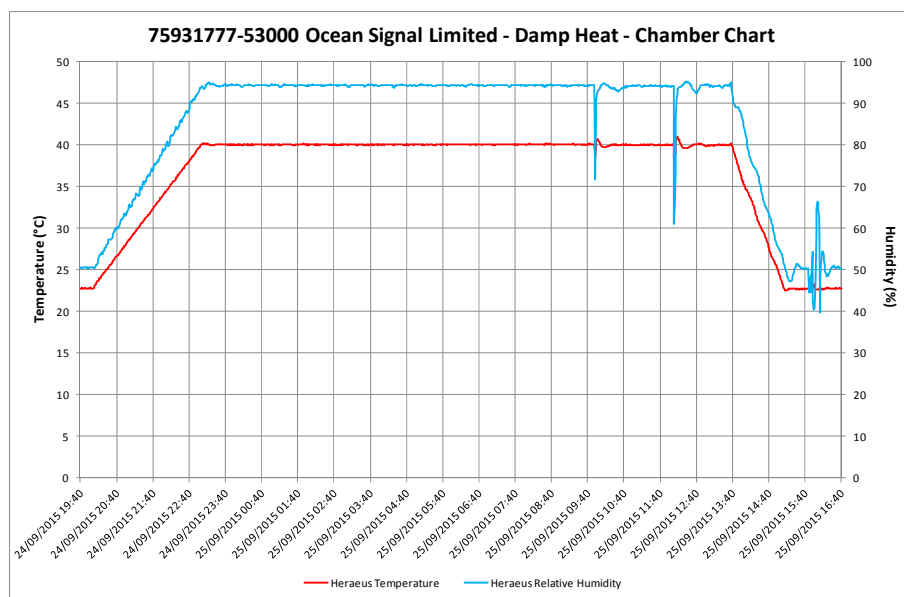
2.3.7 Test Method

The EUT's were placed in a climatic chamber where the temperature was increased from laboratory ambient to +40°C and the relative humidity increased to 95%. After 10 hours, the EUT's were activated for at least 2 hours. During this period the EUT's were subjected to a performance check.

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

2.3.8 Test Results

Temperature Plot



Note: The variations in temperature and humidity towards the end of the plot above are due to the chamber door being opened briefly to activate/deactivate the EUT. The temperature and humidity inside the chamber was allowed to stabilise before measurements were made.



Product Service

Summary of Performance Check Results

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C06332E02BC44E379C8051C4*
406 MHz Frequency	406.039951
121 MHz Presence	P

* The EUT picked up ambient GPS signals during the activation period, resulting in a non-default Hex message.

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005)

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039979
121 MHz Presence	P

2.4 VIBRATION

2.4.1 Specification Reference

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 0

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0

2.4.2 Date of Test

8 - 9 October 2015

2.4.3 Test Equipment Used

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

2.4.4 Environmental Conditions

Ambient Temperature 19.9 – 21.2°C

Relative Humidity 40.0 - 46.2%

2.4.5 Test Setup



2.4.6 Test Method

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

Resonance Sweep

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

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

The EUT was subjected to a 2 hour dwell at each of the following resonant frequencies:

Axis	Resonant Frequency (Hz)
X	62.27
Y	62.96
Z	44.45

Test Axes





Product Service

2.4.7 Test Results

Post Test Performance Check

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003)

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B783E0F66C
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039954
121 MHz Presence	P

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005)

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B783E0F66C
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039938
121 MHz Presence	P

Mechanical Inspection

Post test no signs of mechanical degradation were witnessed.

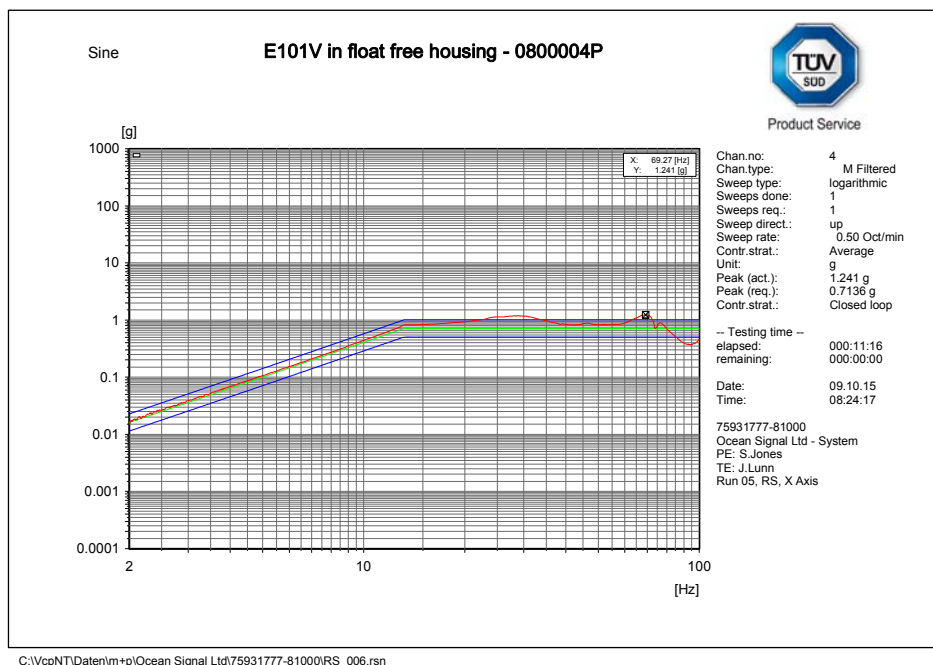
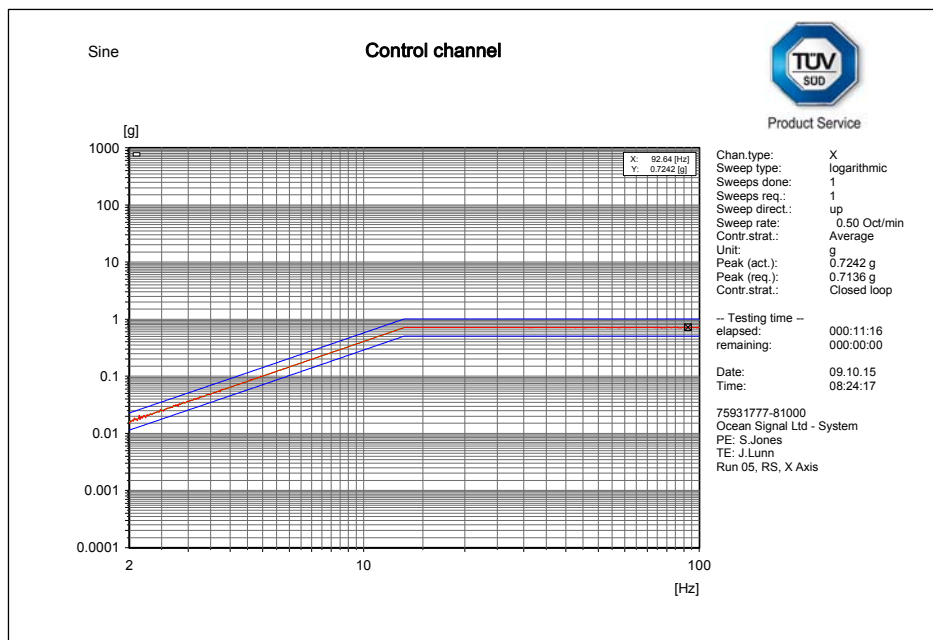
Activation Monitoring

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



Product Service

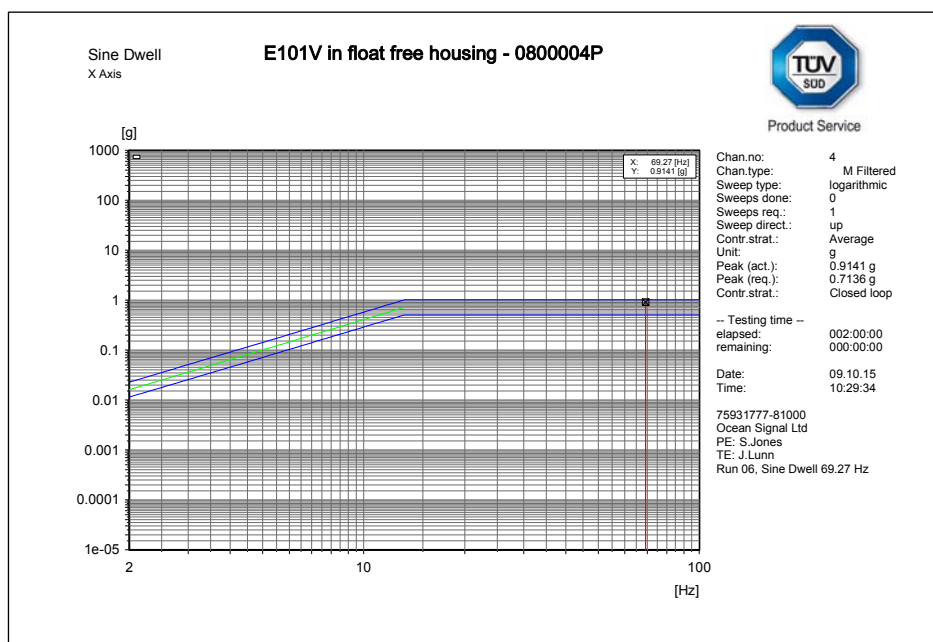
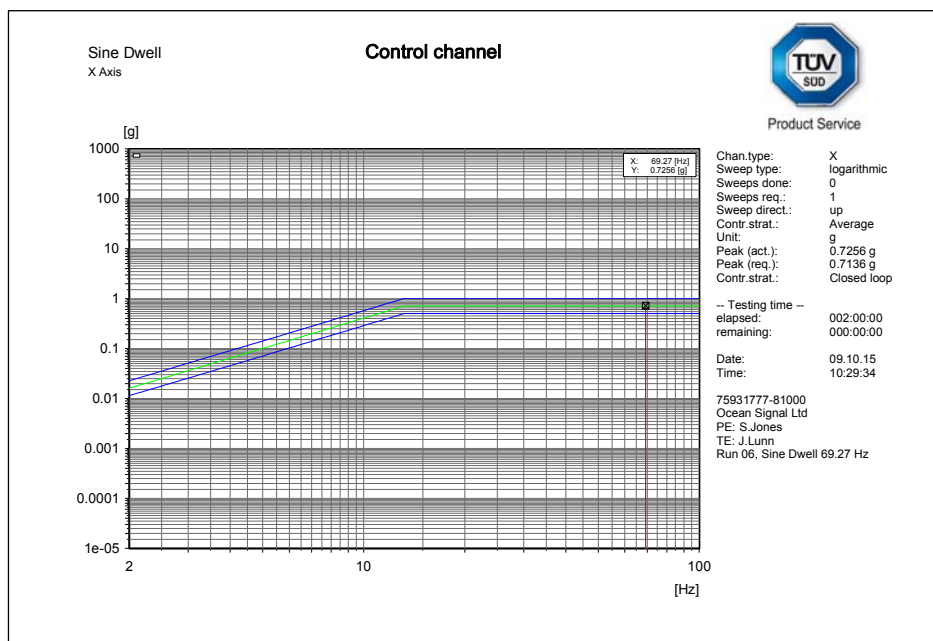
X Axis – Resonance Search





Product Service

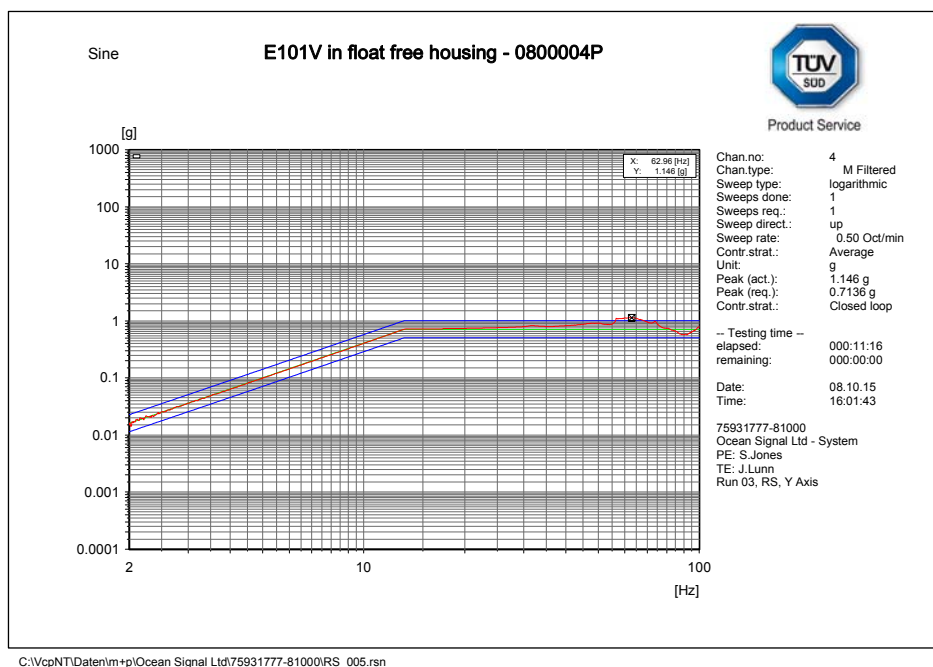
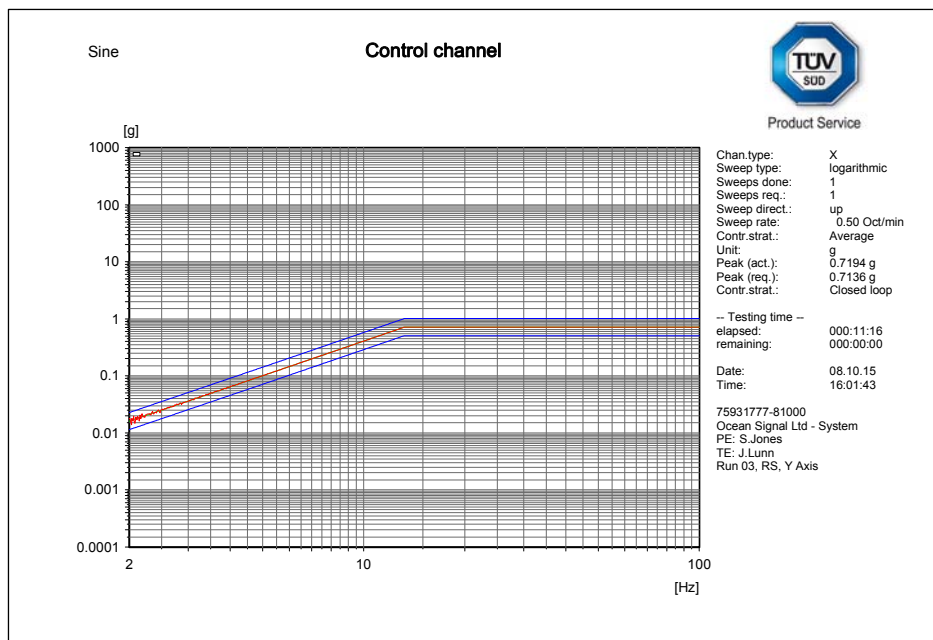
X Axis – Endurance Run





Product Service

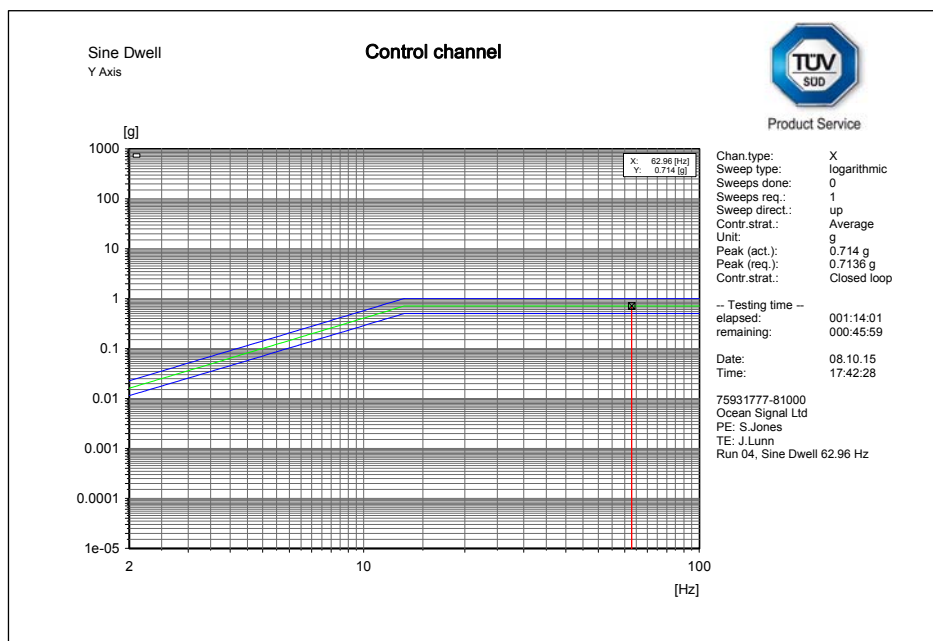
Y Axis – Resonance Search



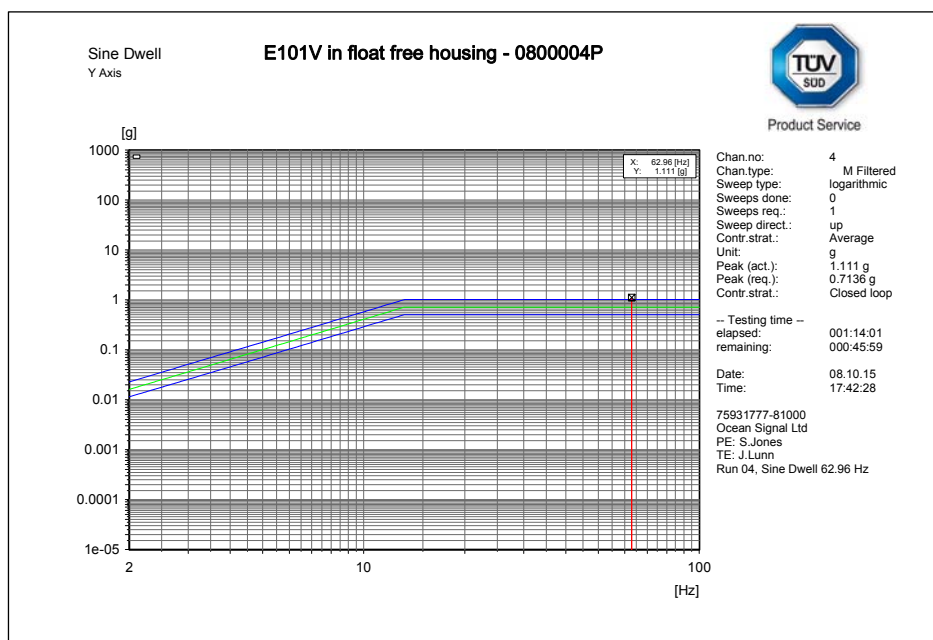


Product Service

Y Axis – Endurance Run



C:\VcpNT\Date\m+p\Ocean Signal Ltd\75931777-81000\62.96Hz_002.rsd

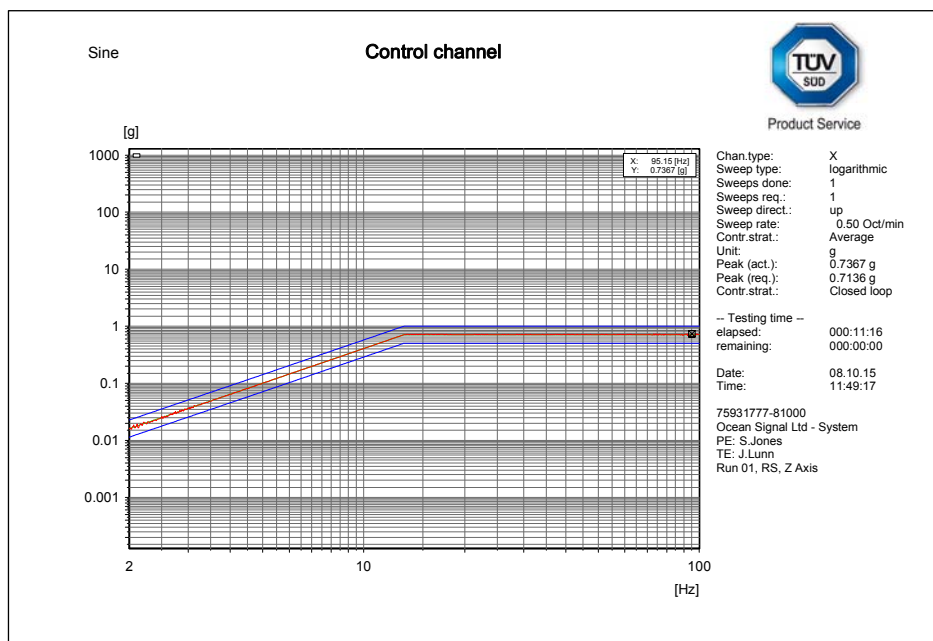


C:\VcpNT\Date\m+p\Ocean Signal Ltd\75931777-81000\62.96Hz_002.rsd

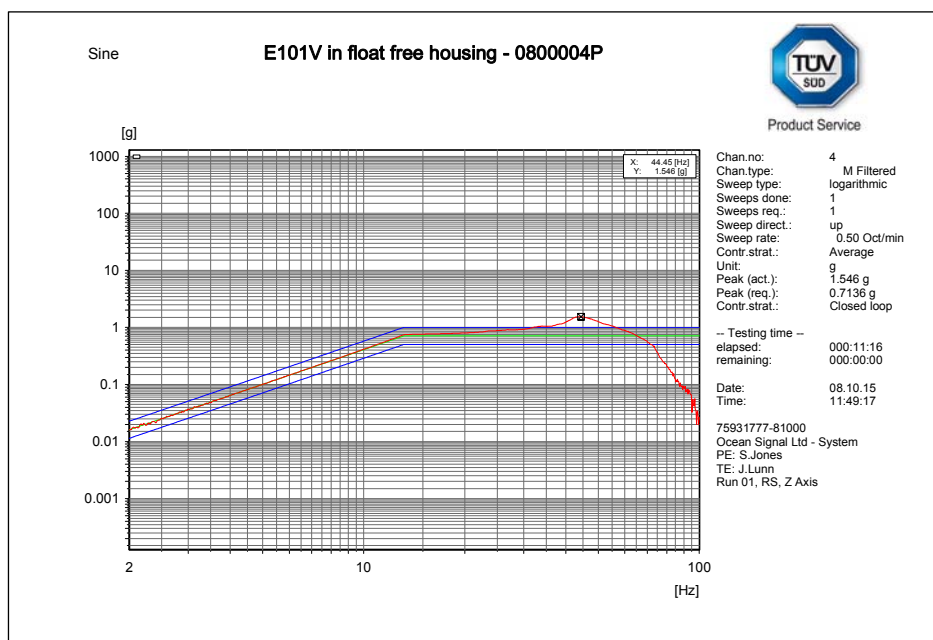


Product Service

Z Axis – Resonance Search



C:\VopNT\Date\m+p\Ocean Signal Ltd\75931777-81000\RS_002.rsn

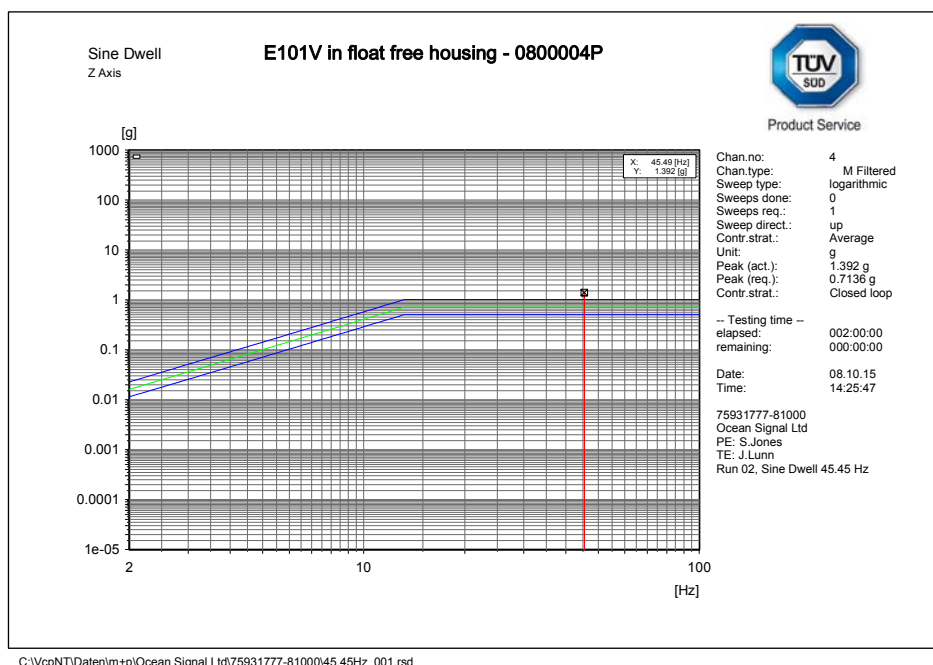
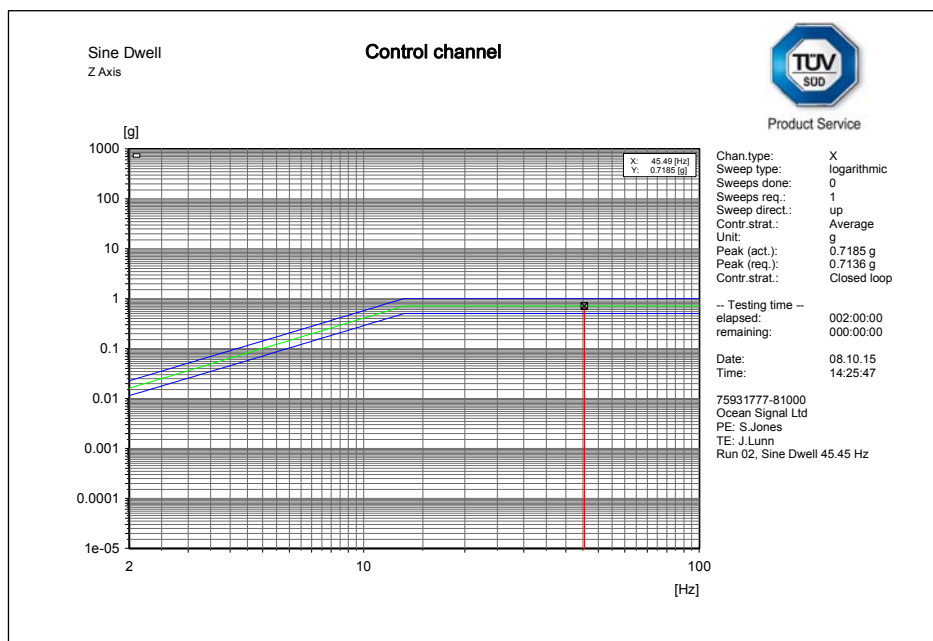


C:\VopNT\Date\m+p\Ocean Signal Ltd\75931777-81000\RS_002.rsn



Product Service

Z Axis – Endurance Run*



*The resonance identified was 44.45 Hz however the endurance run was carried out at 45.49 Hz as the peak resonance was over a span of several Hz.

2.5 RUGGEDNESS

2.5.1 Specification Reference

IEC 61097-2, clause A.1.5

2.5.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 0

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0

2.5.3 Date of Test

9 October 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 22.0 °C

Relative Humidity 37.6 %

2.5.6 Test Setup



2.5.7 Test Method

The EUT was fixed to the vibration table and subjected to the bump test according to the following profile:

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

During the test a spectrum analyser and handheld beacon tester were set to monitor the EUT output to ensure that there were no unintentional transmissions. At the conclusion of the test, The EUT was subjected to a performance check.

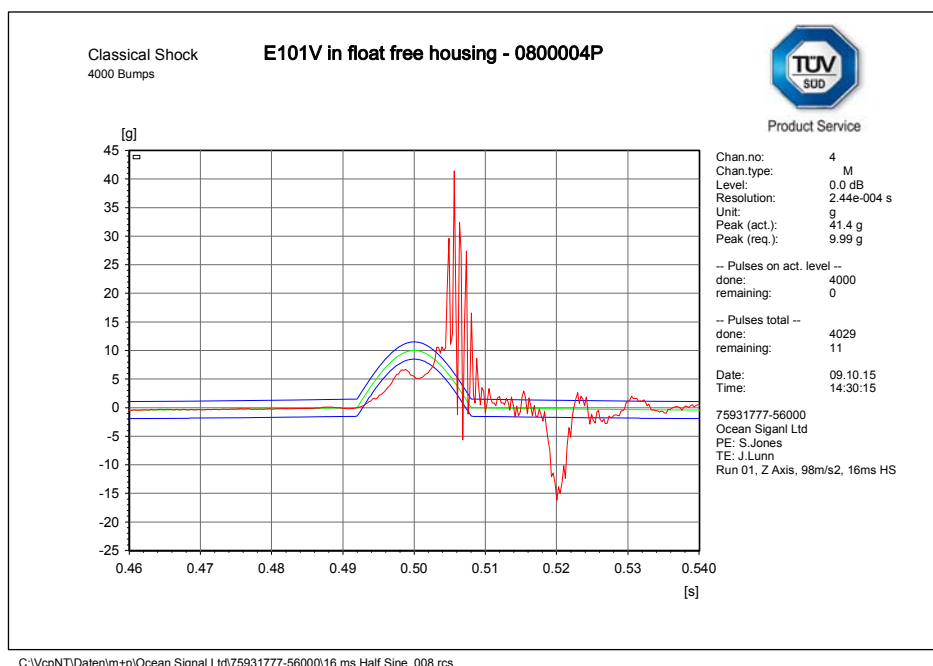
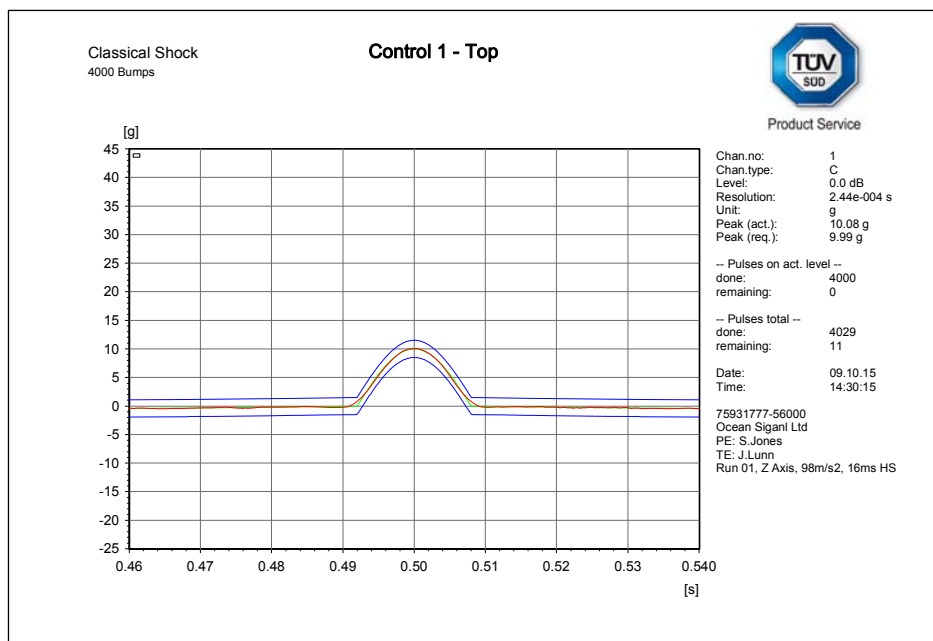
2.5.8 Test Results

Vertical Axis, 4000 Bumps





Product Service





Product Service

Post Test Performance Check

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003)

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B783E0F66C
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039956
121 MHz Presence	P

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005)

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B783E0F66C
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039931
121 MHz Presence	P

EUT Response

The EUT did not activate during the test.

Post Test Inspection

No signs of mechanical degradation were observed.



Product Service

2.6 DROP ON HARD SURFACE

2.6.1 Specification Reference

IEC 61097-2, clause A.1.6

2.6.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 1

2.6.3 Date of Test

23 October 20145

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 20.5°C
Relative Humidity 46.6%

2.6.6 Test Setup



2.6.7 Test Method

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

2.6.8 Test Results

Test Observations

The EUT was monitored and did not activate automatically during the test. The EUT was subjected to a visual inspection post-test. Distortion of the antenna was noted as shown in the photograph below and could affect functionality.* It was also noted that the main (red) activation switch did not activate the beacon at the first attempt during the post test checks, although subsequent attempts (after a Self-Test had been initiated) were successful.

* A Satellite Qualitative test was carried out during the limited Cospas-Sarsat testing, after this test and the results were found to be compliant – see section Annex A for test data.

EUT post drop test



Summary of Performance Check Results



Product Service

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039942
121 MHz Presence	P



Product Service

2.7 DROP ON HARD SURFACE - REPEAT

2.7.1 Specification Reference

IEC 61097-2, clause A.1.6

2.7.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR003) - Modification State 3

2.7.3 Date of Test

24 March 2016

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 20.4°C
Relative Humidity 33.7%

2.7.6 Test Setup



2.7.7 Test Method

The EUT was dropped 6 times, one on each face, from a height of 1000 mm onto the test surface (solid piece of hardwood). The EUT was monitored during the test to ensure that no unintentional 406 MHz or 121 MHz transmissions occur.

2.7.8 Test Results

Test Observations

The EUT was monitored and did not activate automatically during the test. The EUT was subjected to a visual inspection post-test. Distortion of the antenna was noted as shown in the photograph below. It was considered that the damage could affect the functionality of the beacon.

The Manufacturer has provided the following comment with respect to the antenna:

The Antenna is flexible and may be deformed several times without affecting performance. During the drop test the antenna deformed but did not break. The Antenna was subsequently bent back close to the original form. The Antenna also bent on an earlier drop test and successful Satellite Qualification tests were carried out after the antenna was bent back close to the original form. The results were discussed with the notified body and no further tests were requested (ref. email 09/02/2016 Michelle Hardy and Simon Nolan).

EUT post drop test



Summary of Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	FFFE08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039900
121 MHz Presence	P



Product Service

2.8 DROP INTO WATER (NUA)

2.8.1 Specification Reference

IEC 61097-2, clause A.1.7

2.8.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 1

2.8.3 Date of Test

23 October 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 18.1°C
Relative Humidity 50.9%

2.8.6 Test Setup



2.8.7 Test Method

The EUT was dropped three times from a height of 20m into water. The EUT was dropped once with the antenna vertical up, antenna vertical down, and antenna horizontal. A performance check was carried out after the test.



Product Service

2.8.8 Test Results

Test Observations

The EUT activated immediately on contact with the water after each drop. Once the EUT was removed from the water a performance check was performed.

It was noted that the EUT could not be activated manually by the main switch after the first drop. However the switch functioned correctly after the second and third drops. The EUT was returned to the manufacturer for inspection after the test.

The EUT was subjected to a visual inspection by the manufacturer post-test and no signs of external damage or water ingress were observed.

Summary of Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FF FE2F8C9EF9C06332E0227236F796A6B046*
406 MHz Frequency	406.0400
121 MHz Presence	P

* The Digital Message contained the position data N 50°50'40" W 1°6'44", which was verified as the test location.

2.9 THERMAL SHOCK

2.9.1 Specification Reference

IEC 61097-2, clause A.1.8

2.9.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 1

2.9.3 Date of Test

29 October 2015

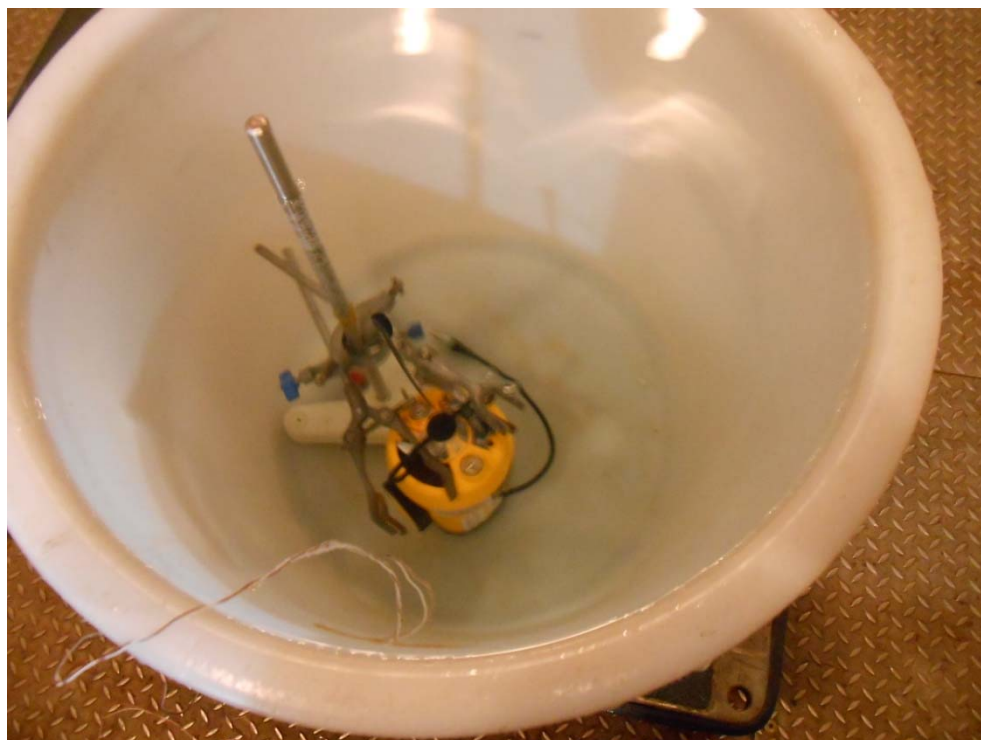
2.9.4 Test Equipment Used

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

2.9.5 Environmental Conditions

Ambient Temperature 26.1°C
Relative Humidity 43.0%

2.9.6 Test Setup





Product Service

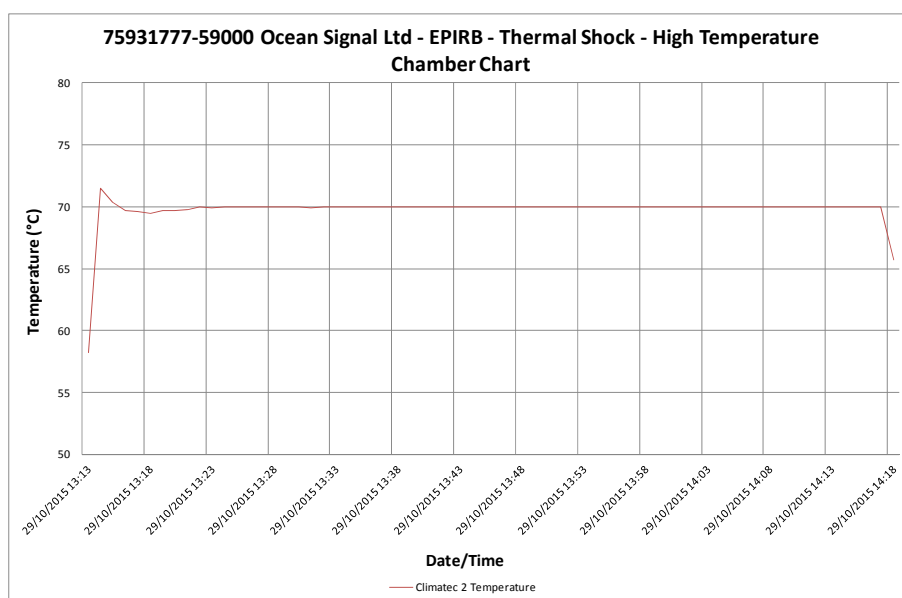
2.9.7 Test Method

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 hour) at 25°C, at a level of 100mm below the surface of the water (measured to the highest point of the EUT). The EUT activated immediately after immersion into water. A performance check and inspection were carried out at the end of the test.

2.9.8 Test Results

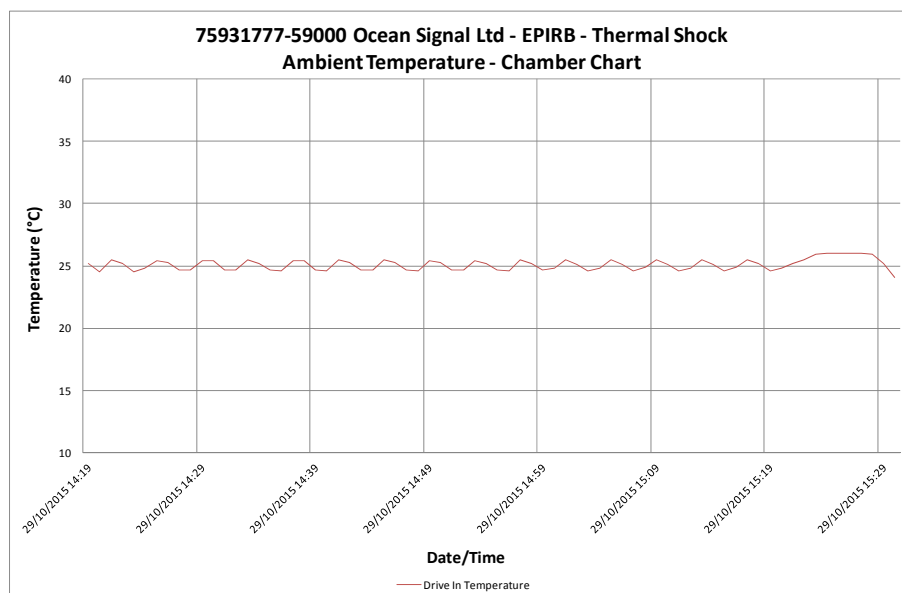
Preconditioning Temperature Plot





Product Service

Water Temperature Plot



Summary of Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	FF FED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FF FE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039944
121 MHz Presence	P

2.10 IMMERSION

2.10.1 Specification Reference

IEC 61097-2, clause A.1.9

2.10.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 1

2.10.3 Date of Test

30 October 2015

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 25.2°C
Relative Humidity 47.6%

2.10.6 Test Setup





Product Service

2.10.7 Test Method

The EUT was immersed in water and placed in a high pressure vessel. The pressure was increased to 1 bar (10 metres) for 5 minutes. At the conclusion of the test, the EUT was inspected for ingress of water, and subjected to a performance check.

2.10.8 Test Results

Inspection

On completion of the test the EUT was subjected to an inspection. No sign of water ingress was found.

Summary of Performance Check Results

Parameter	Result
Self-test Mode:	
Self-test Message	FFED08C9EF9C0637FDFF83D15B783E0F66C
Normal Mode:	
Normal Message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
406 MHz Frequency	406.039903
121 MHz Presence	P



Product Service

2.11 SPURIOUS EMISSIONS

2.11.1 Specification Reference

IEC 61097-2, clause A.1.10

2.11.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0

2.11.3 Date of Test

03 November 2015

2.11.4 Test Equipment Used

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

2.11.5 Environmental Conditions

Ambient Temperature 22.8 °C
Relative Humidity 39.8 %

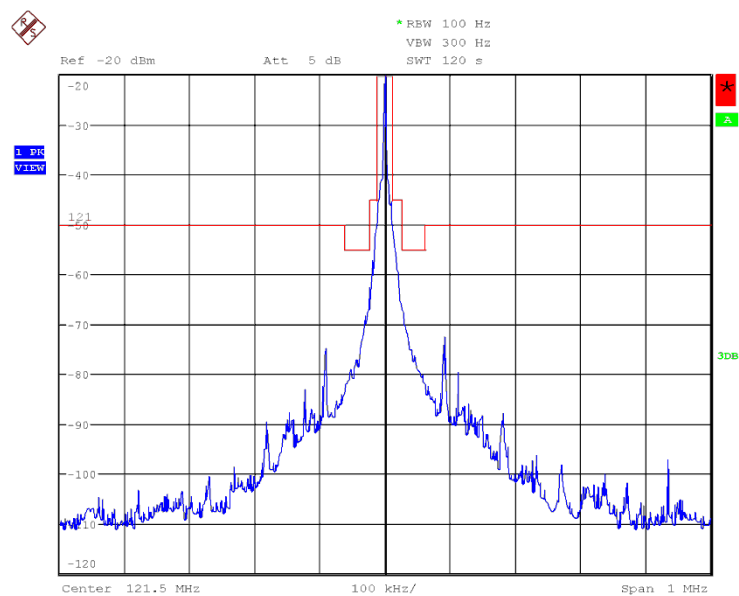
2.11.6 Test Method

Measurements were made on a spectrum analyser at both the 406MHz and 121MHz ports (where applicable) in the required ranges.

2.11.7 Test Results

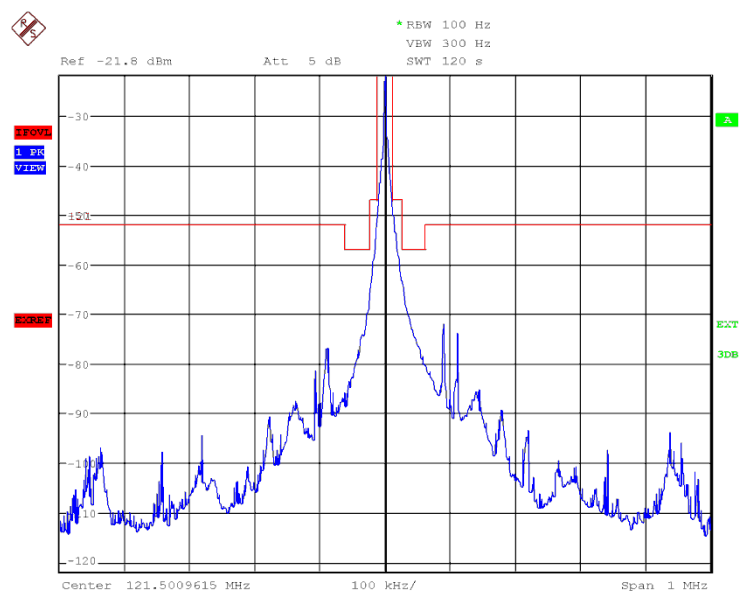
121 Homing Transmitter

Minimum Temperature



Date: 3.NOV.2015 16:05:26

Maximum Temperature



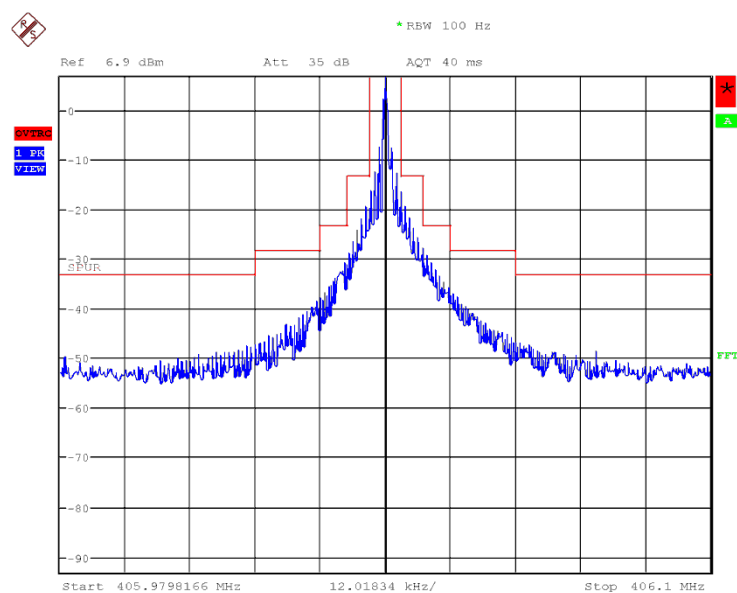
Date: 3.NOV.2015 10:07:44



Product Service

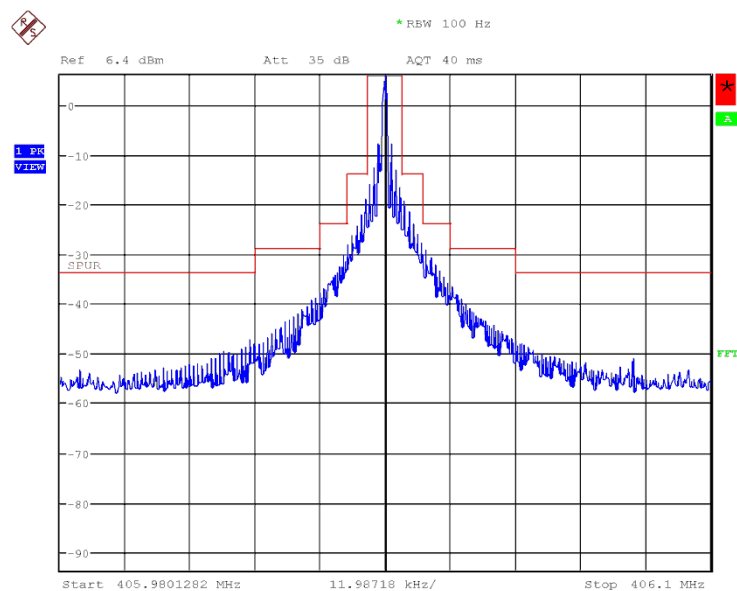
406 Transmitter

Minimum Temperature



Date: 3.NOV.2015 15:01:39

Maximum Temperature



Date: 3.NOV.2015 11:33:09

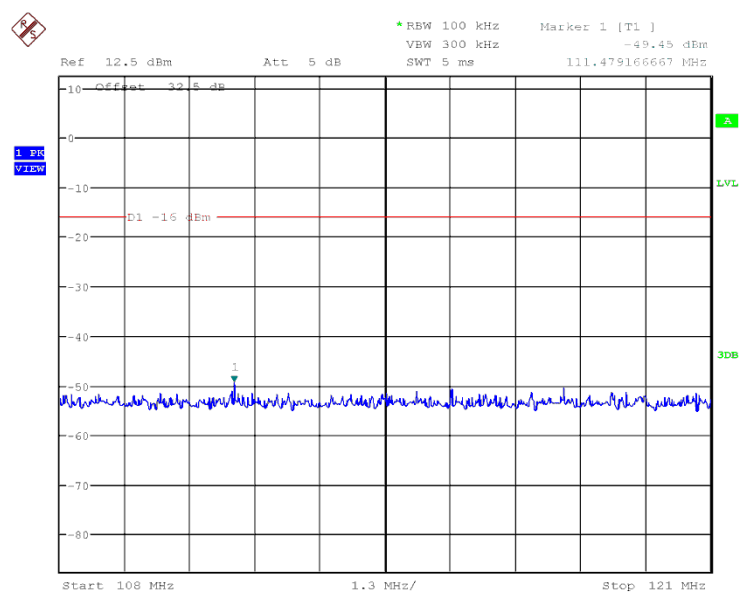


Product Service

Minimum Temperature

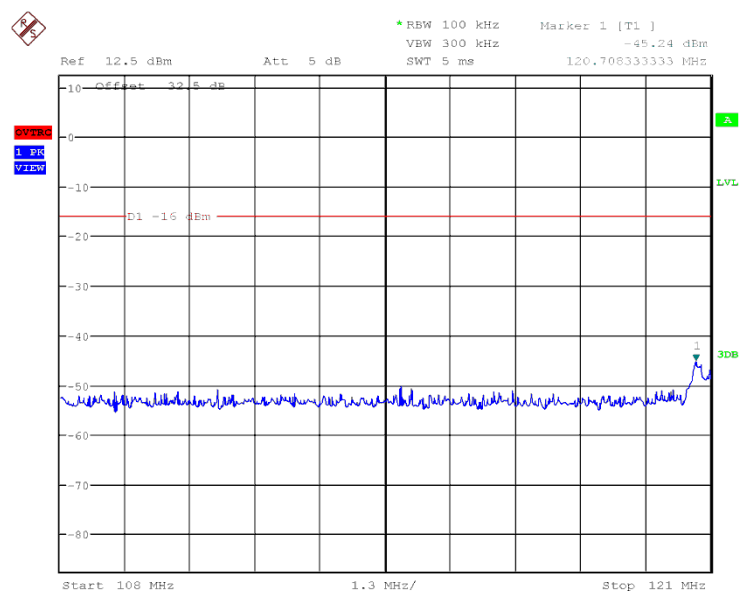
108MHz to 121MHz

406 Port



Date: 3.NOV.2015 14:33:14

121 Port



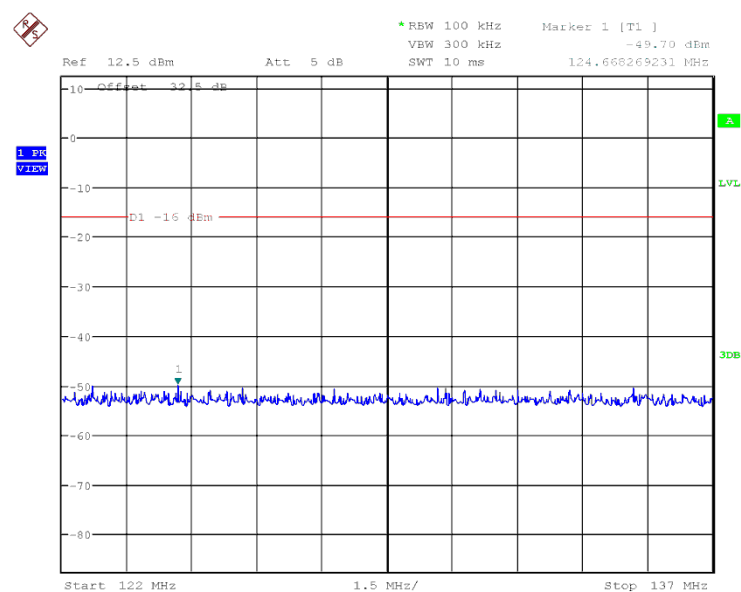
Date: 3.NOV.2015 15:31:33



Product Service

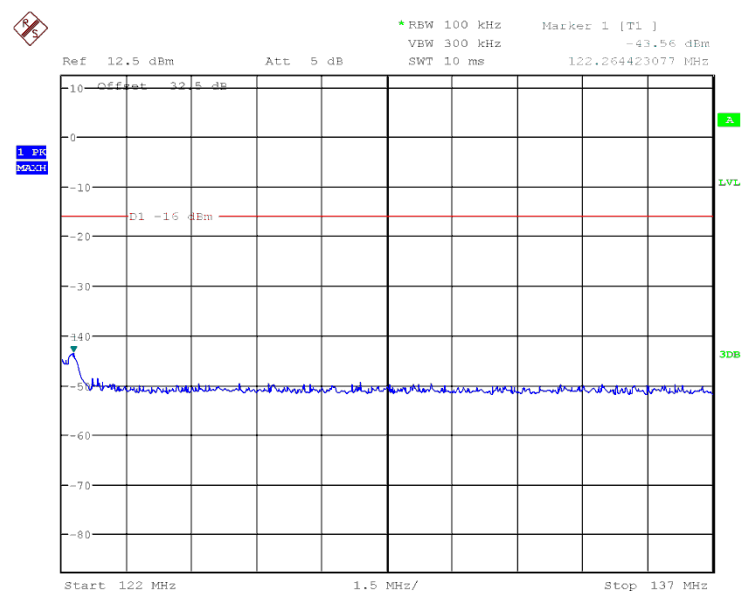
122MHz to 137MHz

406 Port



Date: 3.NOV.2015 14:32:13

121 Port



Date: 3.NOV.2015 15:42:03

406 Port



121 Port



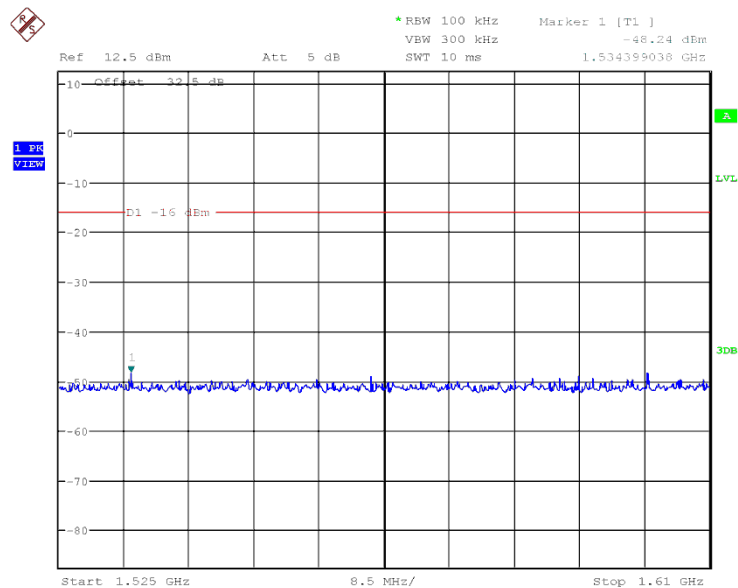
* Range extended to 174MHz to meet requirements of AS/NZS 4280.1, section 5.15



Product Service

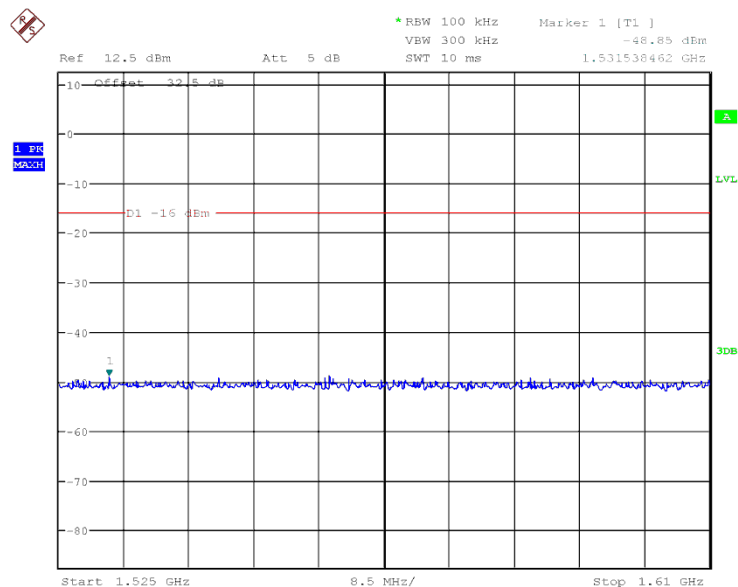
1525MHz to 1610MHz

406 Port



Date: 3.NOV.2015 14:26:47

121 Port



Date: 3.NOV.2015 15:46:09

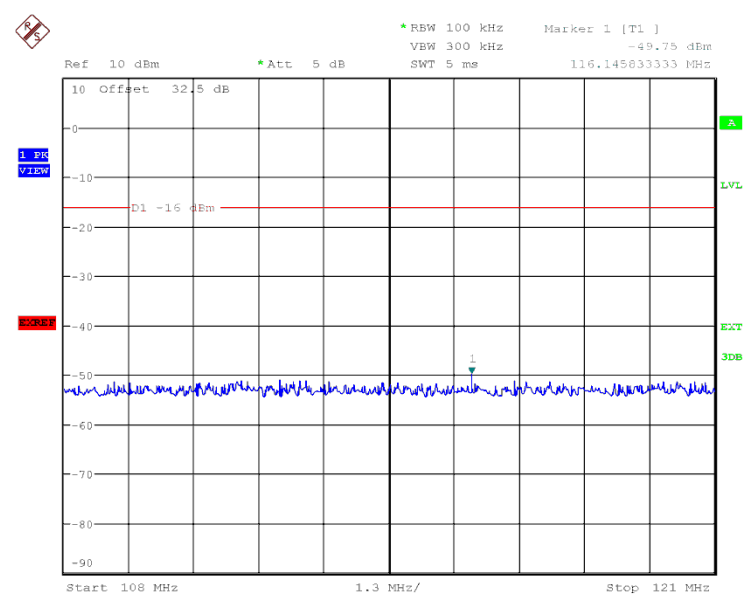


Product Service

Maximum Temperature

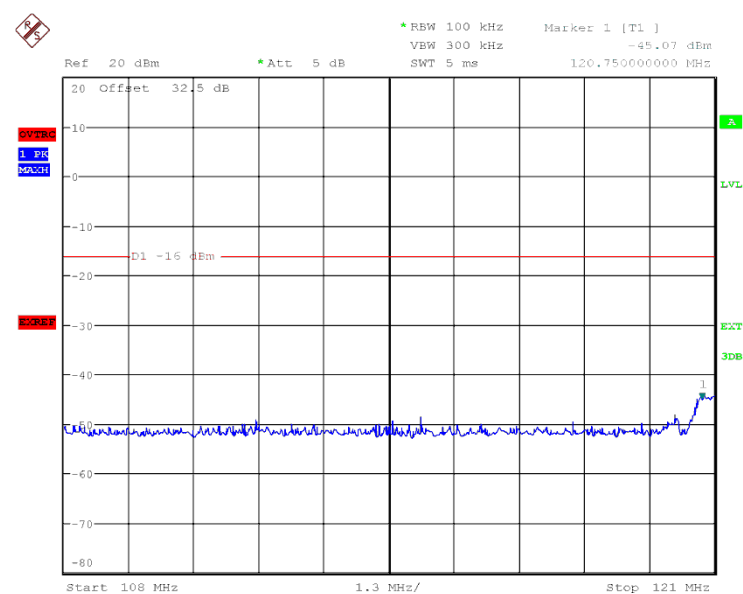
108MHz to 121MHz

406 Port



Date: 3.NOV.2015 10:54:26

121 Port



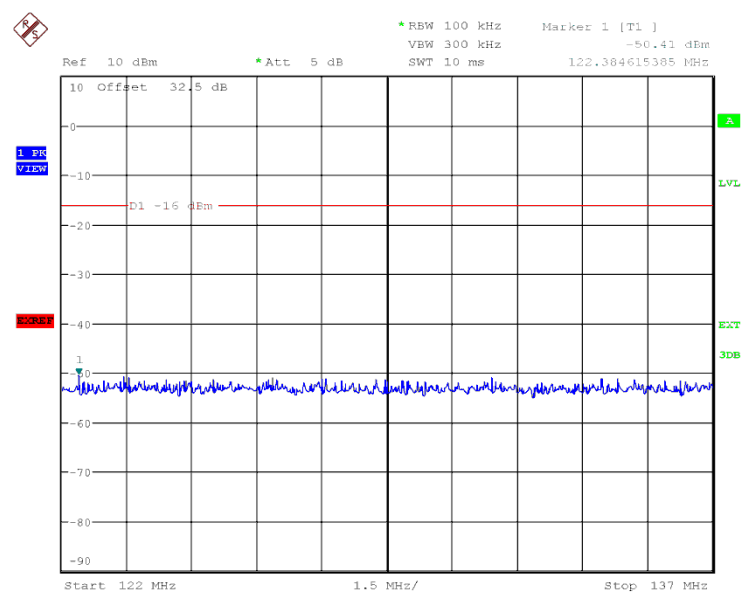
Date: 3.NOV.2015 10:23:23



Product Service

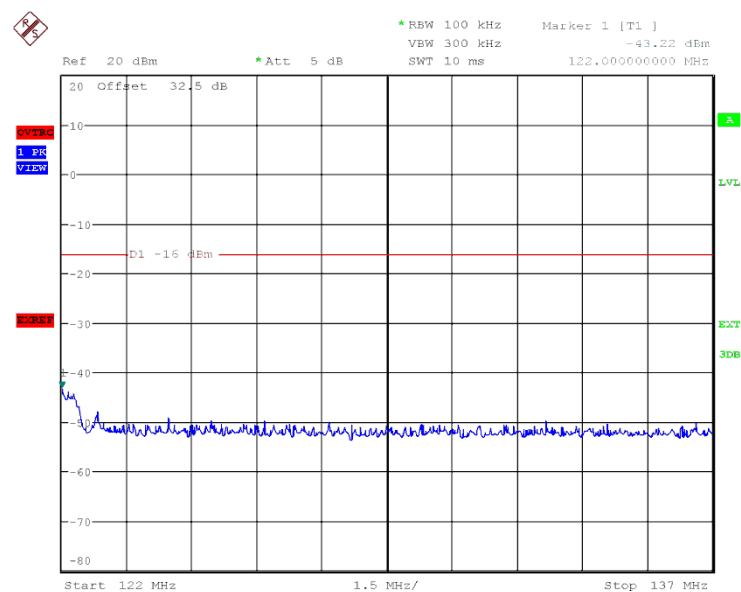
122MHz to 137MHz

406 Port



Date: 3.NOV.2015 10:52:38

121 Port



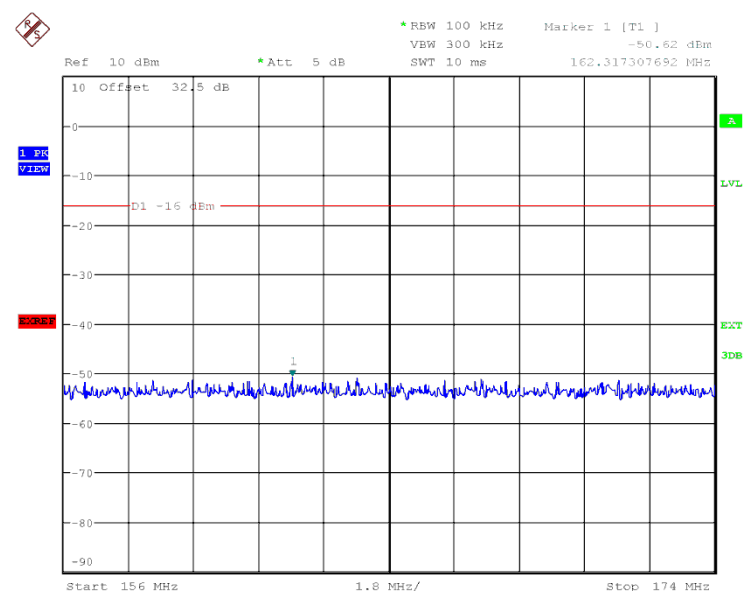
Date: 3.NOV.2015 10:24:55



Product Service

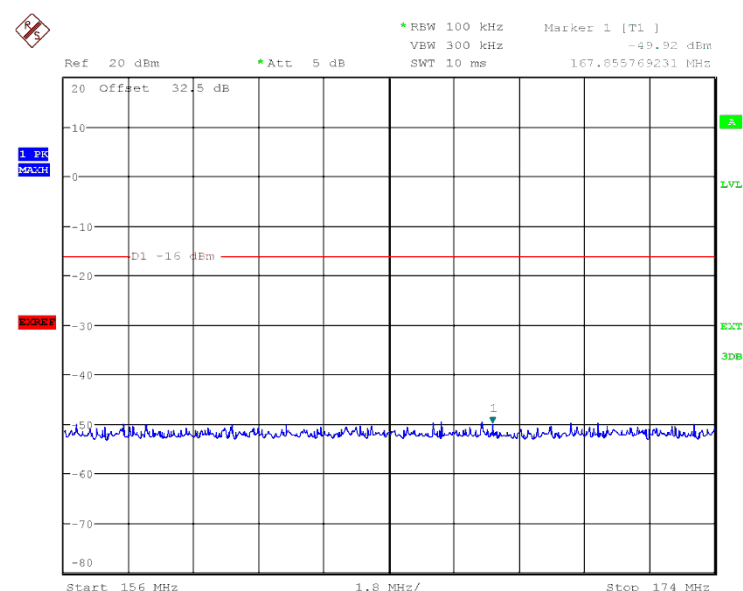
156MHz to 162MHz*

406 Port



Date: 3.NOV.2015 10:50:17

121 Port



Date: 3.NOV.2015 10:26:43

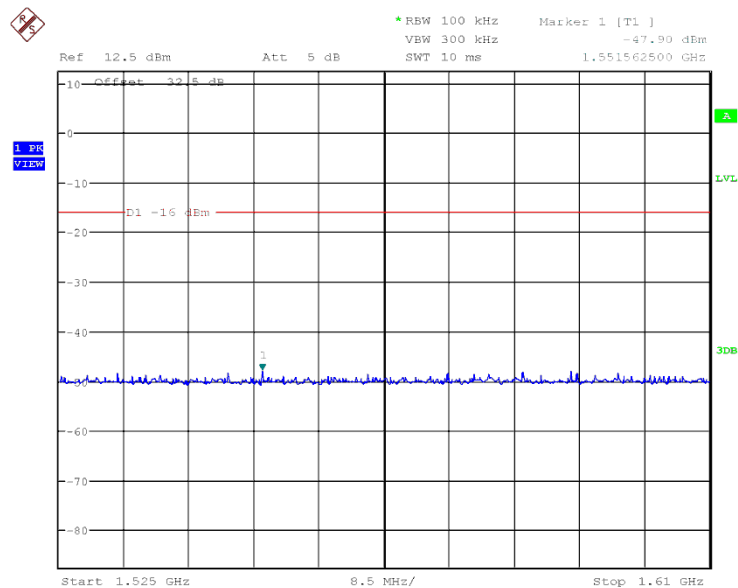
* Range extended to 174MHz to meet requirements of AS/NZS 4280.1, section 5.15



Product Service

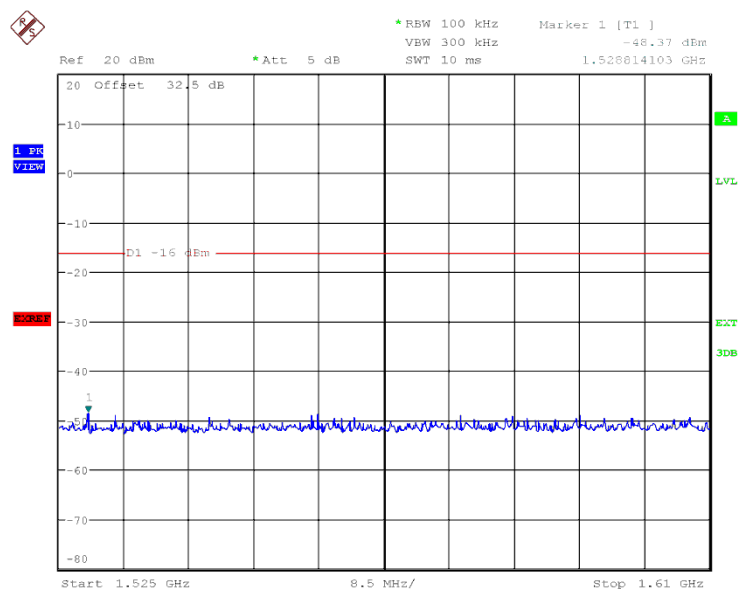
1525MHz to 1610MHz

406 Port



Date: 3.NOV.2015 11:45:02

121 Port



Date: 3.NOV.2015 10:34:31



Product Service

2.12 BATTERY CAPACITY AND LOW TEMPERATURE

2.12.1 Specification Reference

IEC 61097-2, clause A.1.11

2.12.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800002P (TUV Ref TSR0013) - Modification State 0

2.12.3 Date of Test

29 October 2015 to 6 November 2015

2.12.4 Test Equipment Used

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

2.12.5 Environmental Conditions

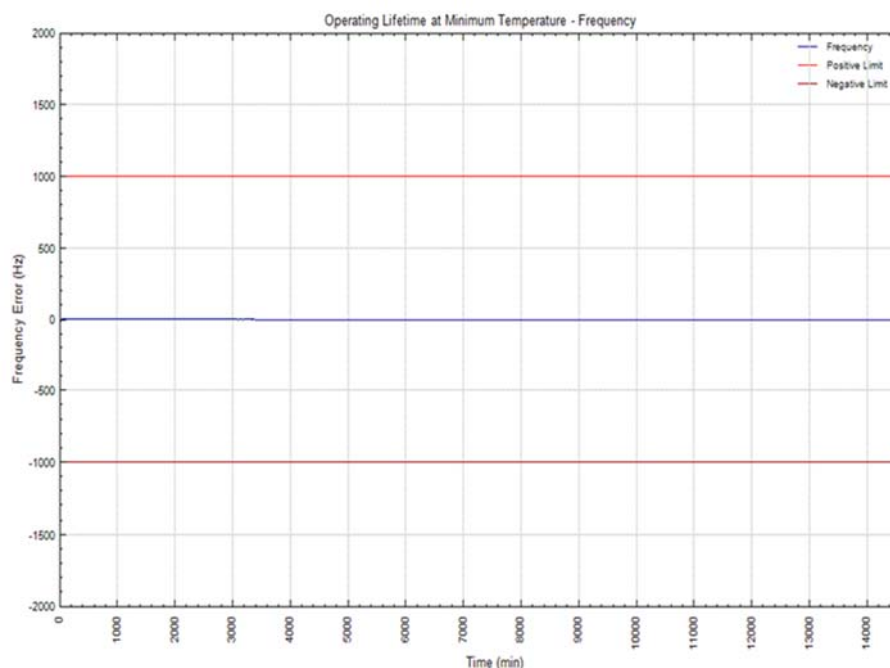
Ambient Temperature 22.3 - 22.7°C

Relative Humidity 59.1 - 64.3%

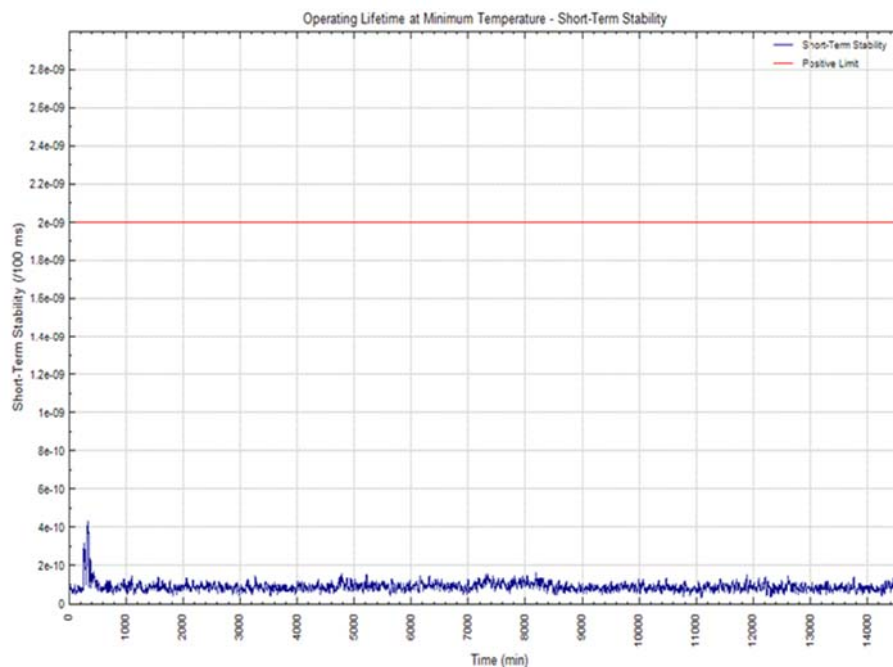
2.12.6 Test Results

End of test taken as 168 hours (Manufacturer declared value)

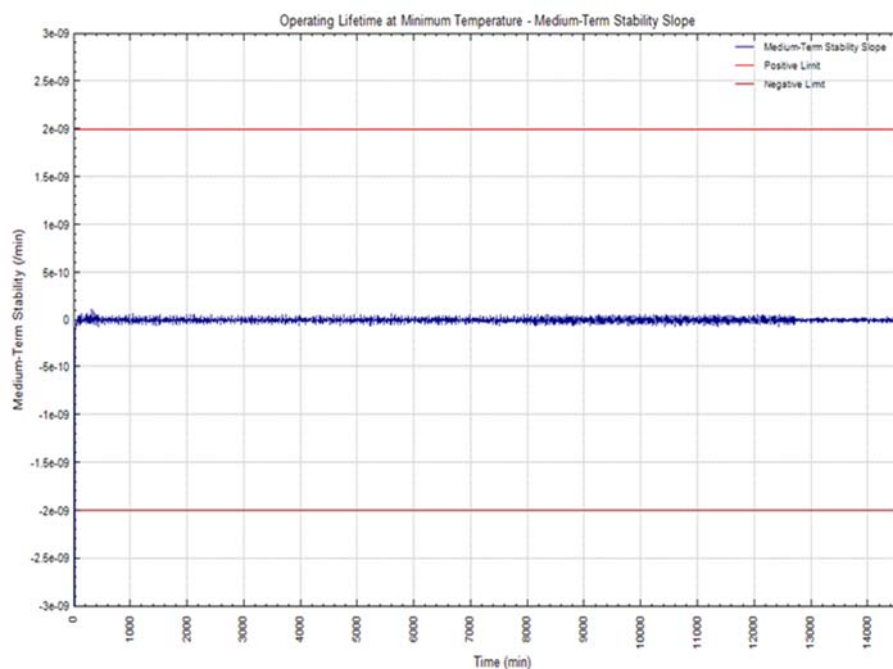
Nominal Frequency



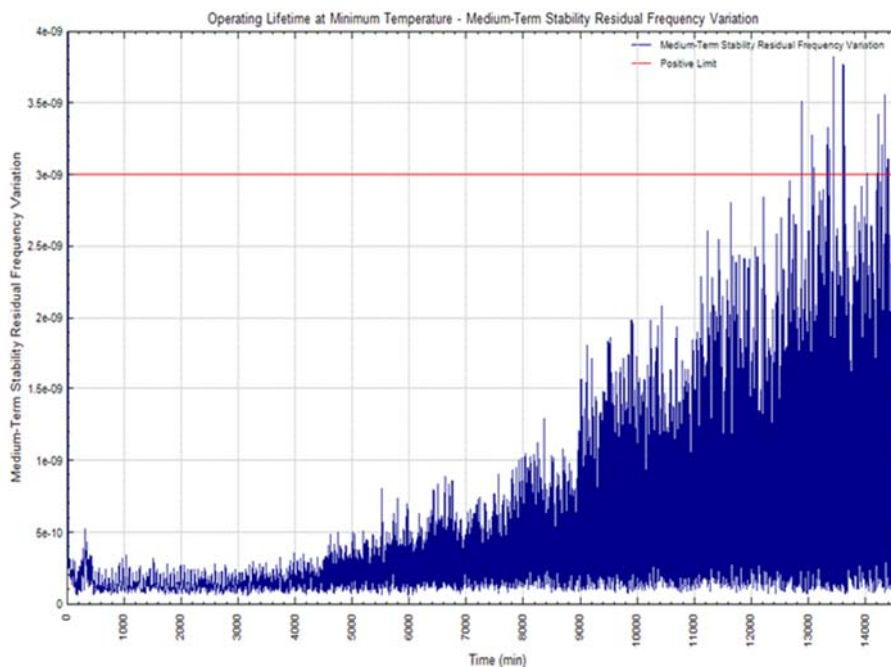
Short Term Stability



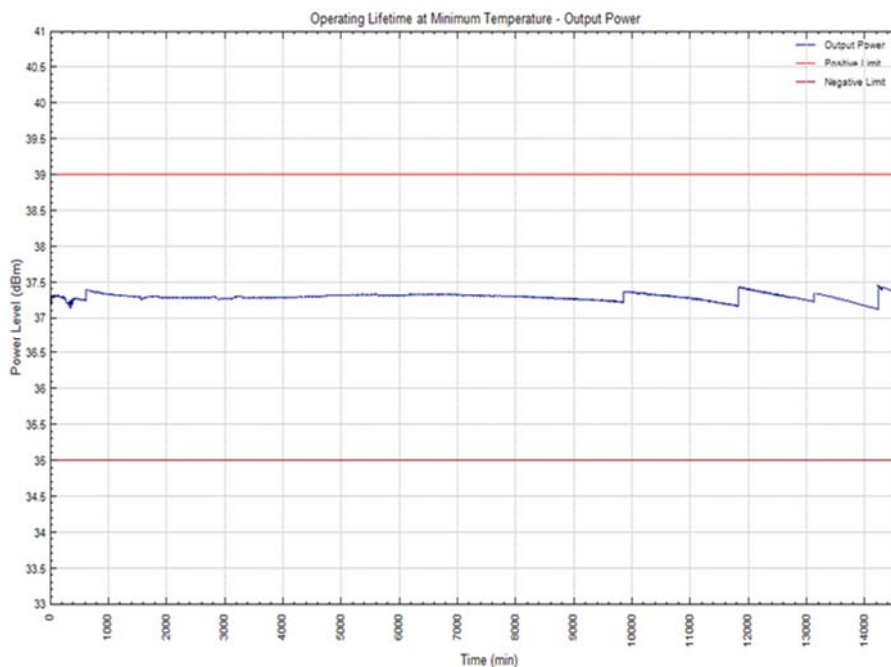
Medium Term Stability, Mean Slope



Medium Term Stability, Residual Frequency Variation



Output Power





Product Service

Digital Message

Full 36 hex message	FFFE2F8C9EF9C0637FDFF83D15B783E0F66C
---------------------	--------------------------------------

ITEM	BITS	VALUE
Message format: long format	25	1
Protocol: Location Protocol	26	0
Country code: 201 - Albania	27-36	0011001001
Type of location protocol: Standard Location - Test	37-40	1110
Test Protocol: Test Protocol (No Decode information in bits 41 to 64)	41-64	111110011100000001100011
Latitude Sign: default	65	0
Latitude Degrees: default	66-72	1111111
Latitude Minutes: default	73-74	11
Longitude Sign: default	75	0
Longitude Degrees: default	76-83	11111111
Longitude Minutes: default	84-85	11
BCH 1 Encoded:	86-106	000001111010001010110
BCH 1 Calculated:	N/A	000001111010001010110
Fixed bits (1101): Pass	107-110	1101
Position Data: Encoded Position Data Source From Internal Navigation Device	111	1
Aux Device: 121.5 MHz homer	112	1
Latitude Offset Sign: default	113	1
Latitude Offset Minutes: default	114-118	00000
Latitude Offset Seconds: default	119-122	1111
Longitude Offset Sign: default	123	1
Longitude Offset Minutes: default	124-128	00000
Longitude Offset Seconds: default	129-132	1111
BCH 2 Encoded:	133-144	011001101100
BCH 2 Calculated:	N/A	011001101100
Composite Latitude: default	N/A	Composite Longitude: default
15 Hex ID:	N/A	193DF380C6FFBFF



Product Service

Test Data (0 min - 30 min)

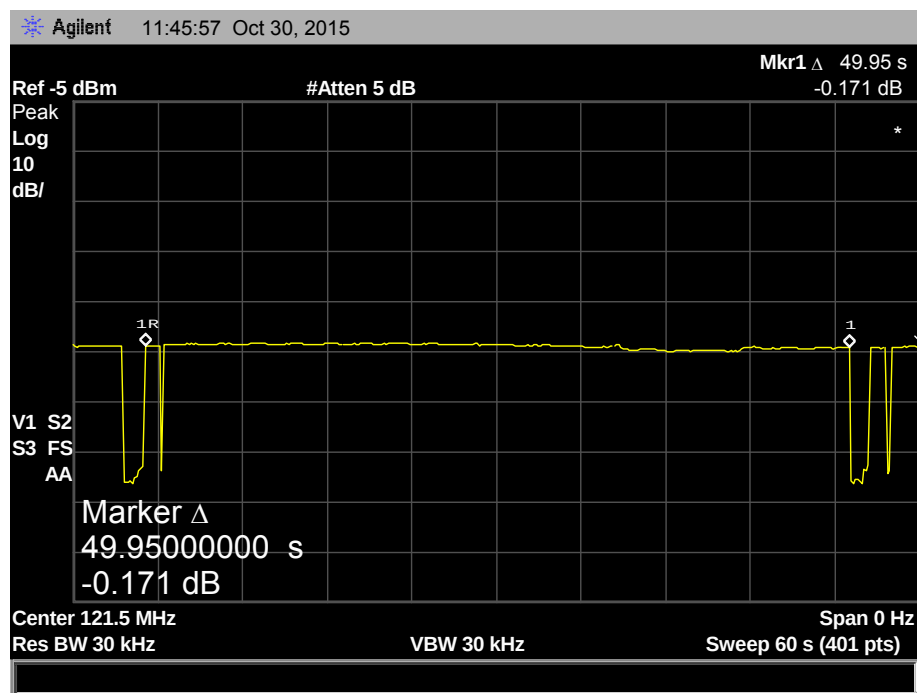
Burst	Frequency (MHz)	STS /100ms	MTS-Slope /min	MTS-Var	Power (dBm)	Time (hours)
1	-	-	-	-	36.42	0.00
2	-	-	-	-	37.22	0.01
3	-	-	-	-	37.31	0.03
4	-	-	-	-	37.33	0.04
5	-	-	-	-	37.35	0.06
6	-	-	-	-	37.22	0.07
7	-	-	-	-	37.22	0.08
8	-	-	-	-	37.22	0.10
9	-	-	-	-	37.21	0.11
10	-	-	-	-	37.21	0.13
11	-	-	-	-	37.21	0.14
12	-	-	-	-	37.21	0.15
13	-	-	-	-	37.2	0.17
14	-	-	-	-	37.19	0.18
15	-	-	-	-	37.19	0.19
16	-	-	-	-	37.32	0.21
17	-	-	-	-	37.32	0.22
18	406.0400086	8.46E-11	-8.20E-09	1.38E-08	37.32	0.24
19	406.0400064	8.27E-11	-7.33E-09	1.49E-08	37.32	0.25
20	406.0400043	8.21E-11	-6.44E-09	1.57E-08	37.32	0.26
21	406.0400023	8.58E-11	-5.44E-09	1.59E-08	37.31	0.28
22	406.0400005	8.71E-11	-4.37E-09	1.54E-08	37.31	0.29
23	406.0399989	8.67E-11	-3.28E-09	1.39E-08	37.31	0.31
24	406.0399974	9.11E-11	-2.21E-09	1.14E-08	37.31	0.32
25	406.0399962	8.72E-11	-1.22E-09	7.63E-09	37.31	0.33
26	406.0399953	7.92E-11	-5.03E-10	3.60E-09	37.3	0.35
27	406.0399948	9.25E-11	-1.51E-10	6.09E-10	37.31	0.36
28	406.0399948	9.27E-11	-1.01E-10	2.93E-10	37.3	0.38
29	406.0399947	9.18E-11	-9.23E-11	2.68E-10	37.3	0.39
30	406.0399947	9.13E-11	-8.39E-11	2.49E-10	37.31	0.40
31	406.0399946	9.37E-11	-7.26E-11	2.54E-10	37.3	0.42
32	406.0399946	9.26E-11	-6.77E-11	2.56E-10	37.3	0.43
33	406.0399946	9.23E-11	-6.02E-11	2.81E-10	37.3	0.44
34	406.0399946	9.12E-11	-5.16E-11	2.96E-10	37.3	0.46
35	406.0399946	9.05E-11	-5.46E-11	2.86E-10	37.3	0.47
36	406.0399946	8.96E-11	-5.38E-11	2.87E-10	37.29	0.49
37	406.0399946	8.67E-11	-5.75E-11	2.92E-10	37.29	0.50



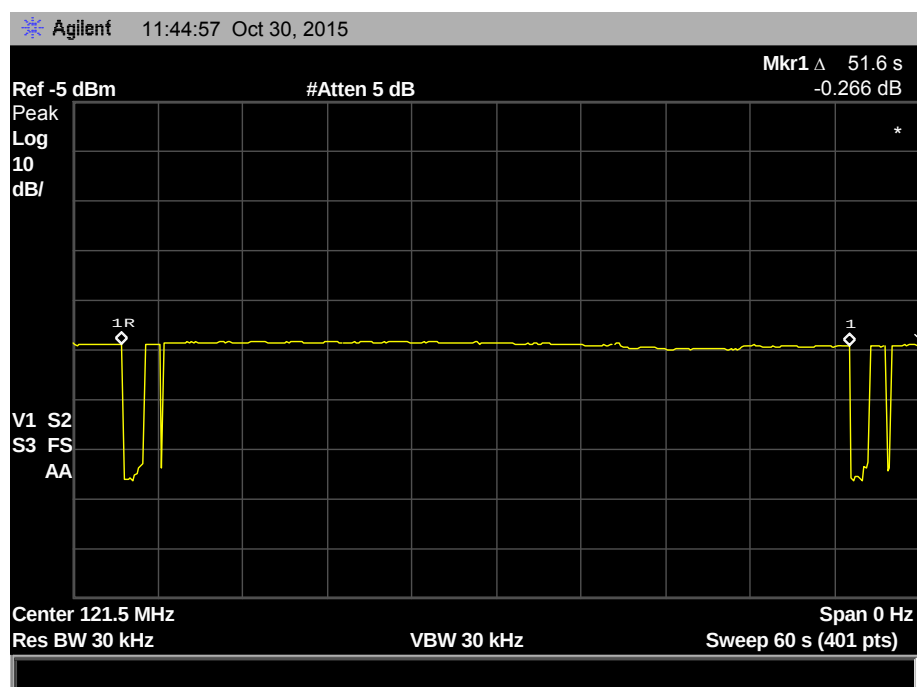
Product Service

121 Homing Transmitter - Duty Cycle (Start of Test)

On Time



On+Off Time



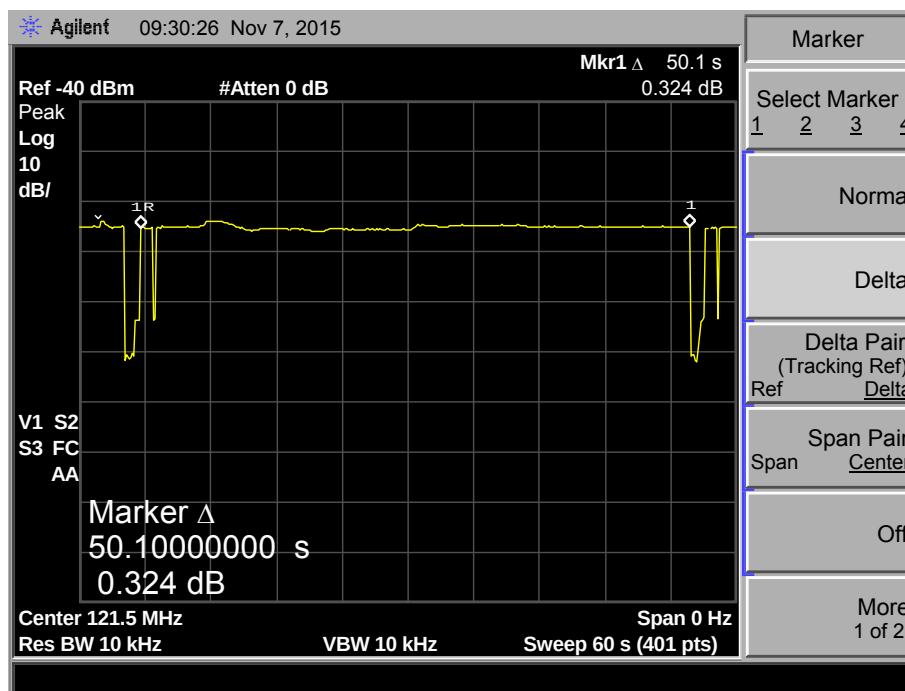
$$\text{Duty Cycle} = 49.95 / 51.6 = 0.968 = \underline{96.8\%}$$



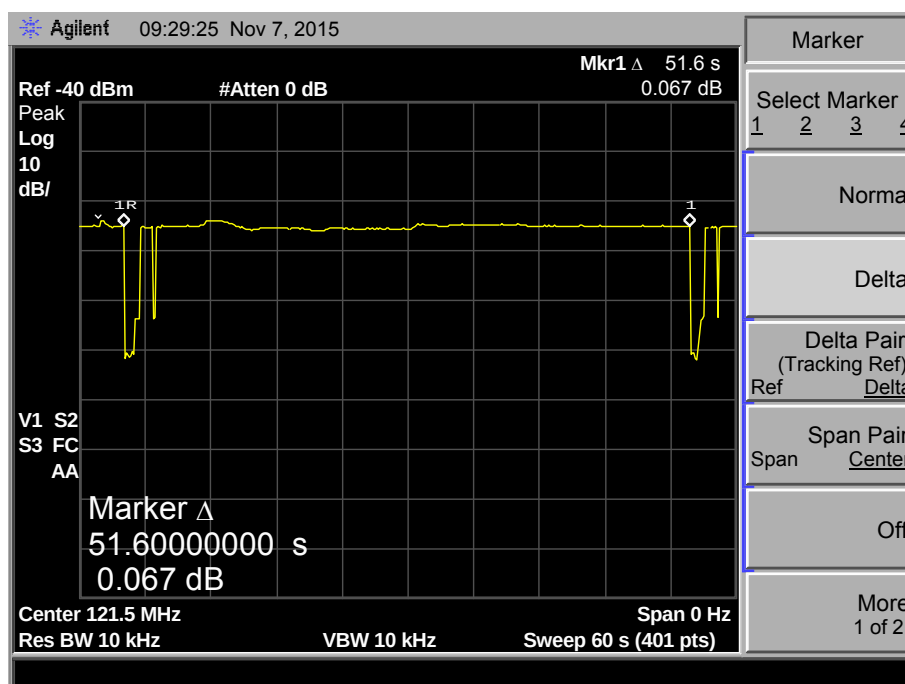
Product Service

121 Homing Transmitter - Duty Cycle (End of Test)

On Time



On+Off Time

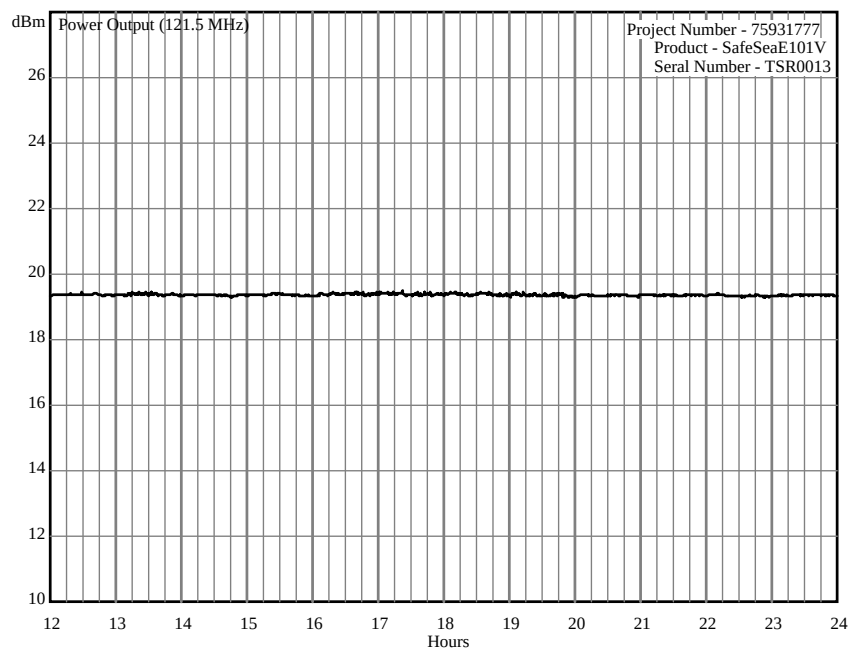
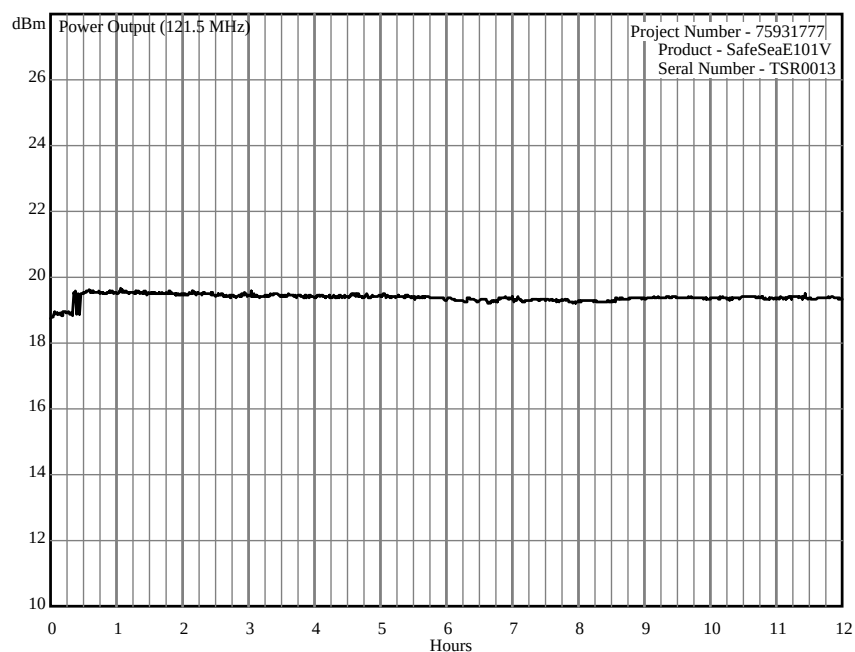


$$\text{Duty Cycle} = 50.1 / 51.6 = 0.971 = \underline{97.1\%}$$



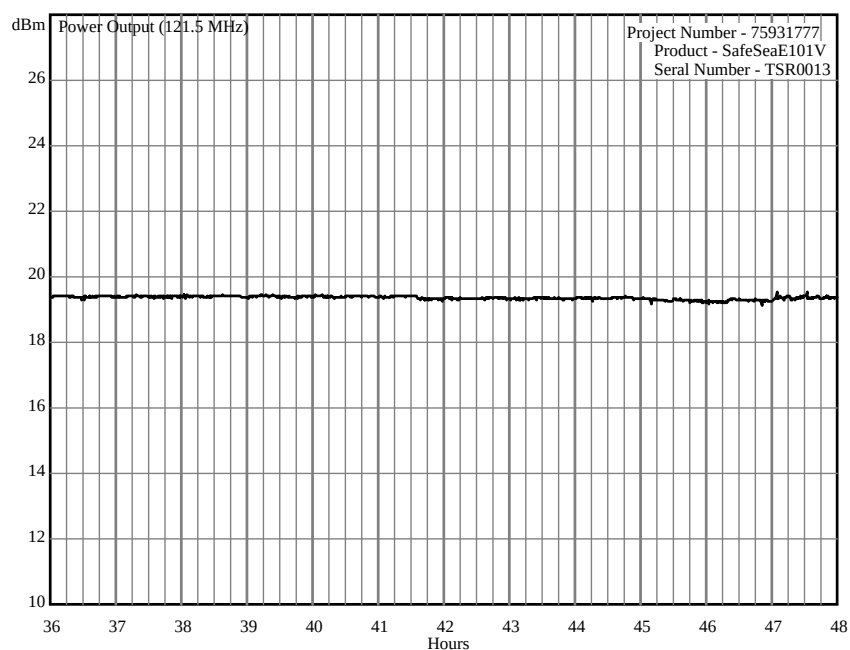
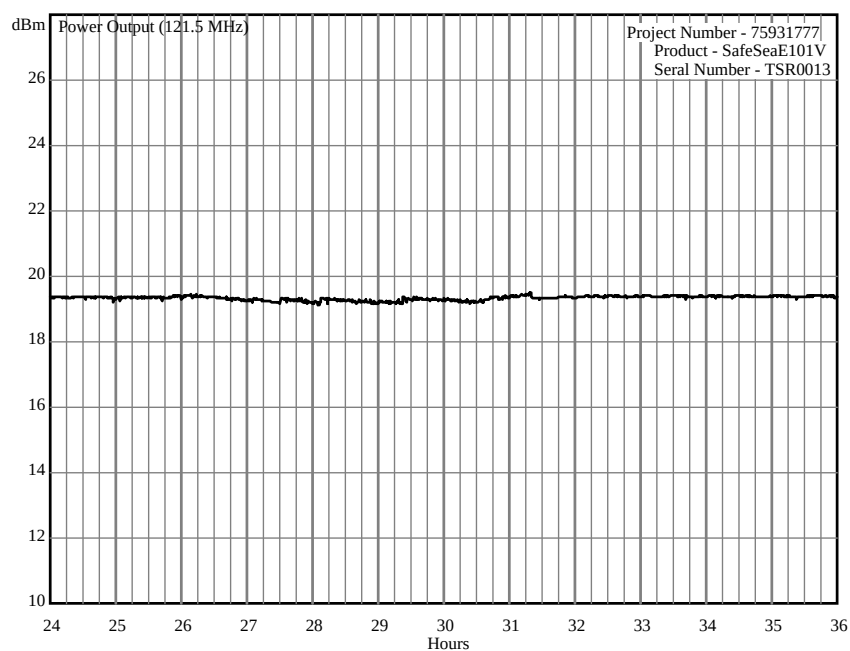
Product Service

121 Homing Transmitter Power (First 48 Hours of Operation)





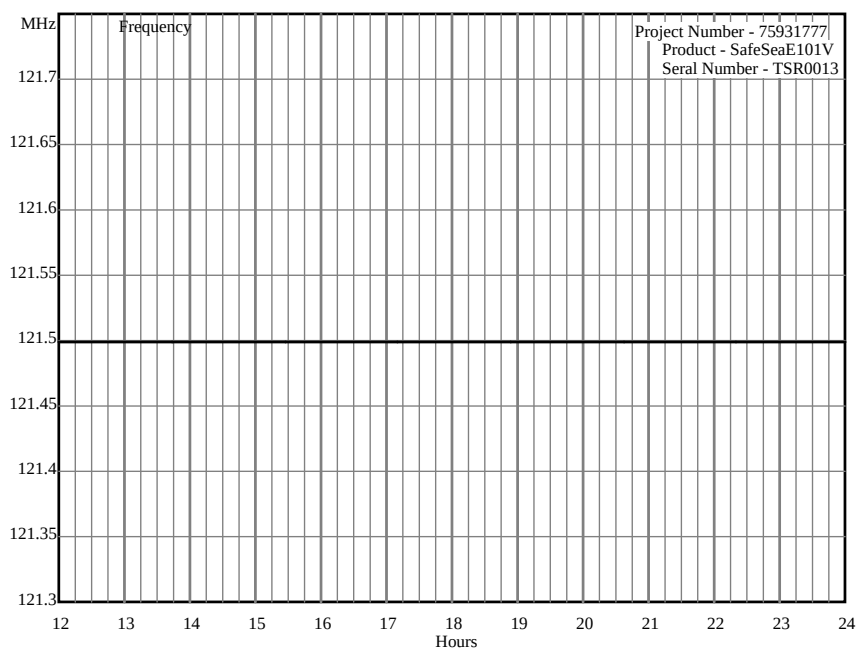
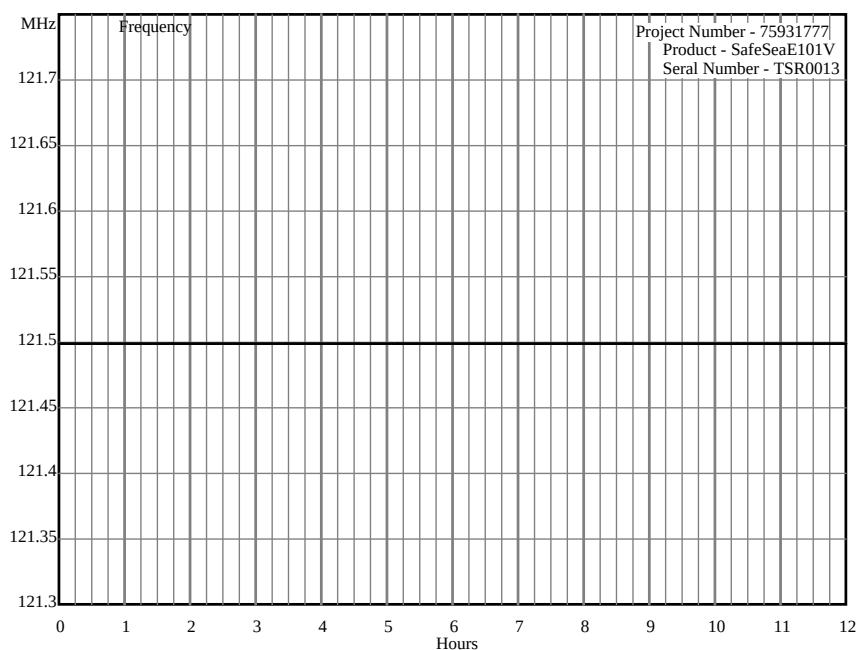
Product Service





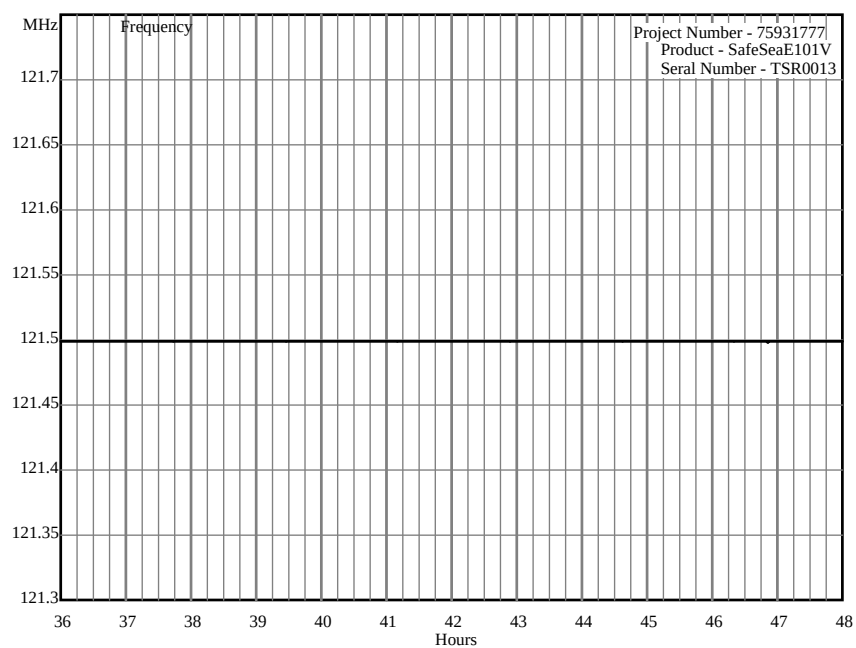
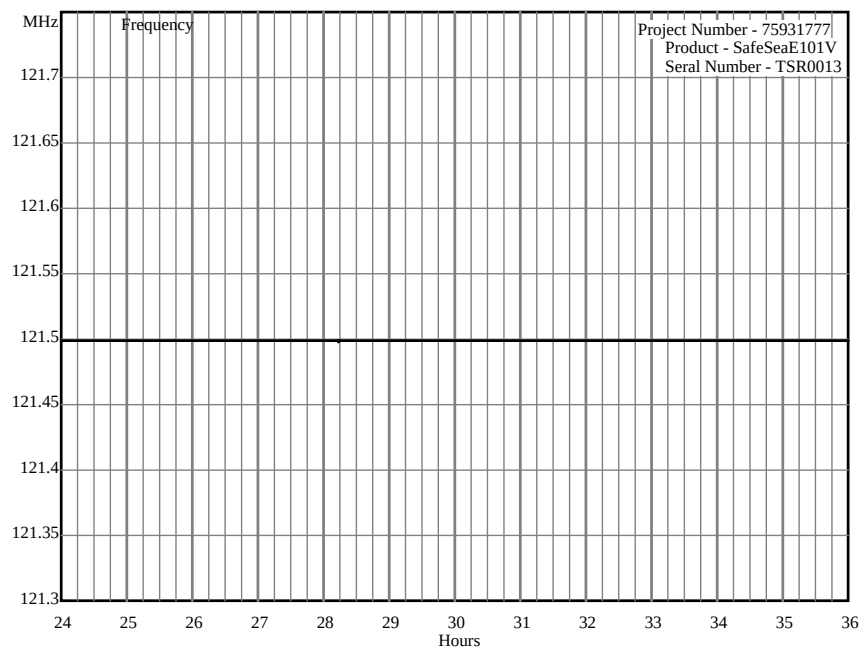
Product Service

121 Homing Transmitter Frequency (First 48 Hours of Operation)





Product Service





Product Service

Battery Discharge Current:

The discharge current for the batteries was measured for each of the following beacon states.

Beacon in the Off or Standby State, "Standby Current"

Beacon performing a Self-test, "Self-test Current"

Beacon activated and transmitting, "Operating Current"

The individual tests were conducted for the following durations:

Standby Current : 15 minutes (899932 ms)

Self-test Current : 13.4 seconds (13441 ms)

GNSS ST Current : 316 seconds (315600 ms)

Operating Current : 52 seconds (51995 ms)

Assumptions / Supplied Data:

Useful Battery Life : 16 years
 Battery Capacity : 11.1 Ah
 Battery Self Drain : 0.33 % per year
 Self-test Interval : 12 tests per year
 GNSS STs per battery : 12

Test Results:

Mode Current = Accumulated Charge / Time
 Standby Current = $795217.92 \text{ pC} / 899932 \text{ ms} = 0.8836 \text{ nA}$
 Self-test Current = $660211.84 \text{ uC} / 13441 \text{ ms} = 49.12 \text{ mA}$
 GNSS Self-test = $4185947.67 \text{ uC} / 315600 \text{ ms} = 13.26 \text{ mA}$
 Operating Current = $1846752.09 \text{ uC} / 51995 \text{ ms} = 35.52 \text{ mA}$

Battery Preconditioning / Discharge Time Calculations:

Battery Self Drain = Capacity - [(100% - Self Drain/Year%)^{Replacement Interval} x Capacity]
 = $11.1 - ((1 - 0.0033)^{16} \times 11.1) = 0.5718 \text{ Ah}$

Standby Drain = Hours per year x Battery Replacement Interval x Standby Current
 = $365 \times 24 \times 16 \times 0.8836 \times 10^{-6} = 0.0001 \text{ Ah}$

Self-test Drain = Self-tests per battery x Self-test Current x Self-test duration (in hours)
 = $12 \times 16 \times 49.12 \times 10^{-3} \times (13 / 3600) = 0.0352 \text{ Ah}$

GNSS ST Drain = GNSS STs per battery x GNSS ST Current x GNSS ST duration (in hours)
 = $12 \times 1 \times 13.26 \times 10^{-3} \times (316 / 3600) = 0.0140 \text{ Ah}$

Total Drain = Self discharge + Standby drain (wc) + ST drain (wc) + GNSS ST drain (wc)
 = $0.5718 + 0.0001 + 0.0352 + 0.0140 = 0.6211 \text{ Ah}$

Battery Preconditioning / Discharge Time = Worst Case drain / Operational Current
 = $0.6211 / (35.52 \times 10^{-3})$
 = 17.49 hours



Product Service

Battery Capacity and Low Temperature Test Summary

Parameters to be Measured	Range of Specification	Units	Test Results	Comments
Battery Capacity and Low Temperature Test				Result: Pass
Model: SafeSea E101V EPIRB, S/N: 0800002P, TUV Ref: TSR13 and Modification State 0				
Pre-test battery discharge duration (operating) required		Hours	17.49	Capacity discharge required : 0.6211Ah
Pre-test battery discharge duration (operating) Duration	>24	Hours	18.5	Capacity discharge actual : 0.6571Ah
Effective Operating Lifetime duration	>24	Hours	214.5 Hours at Tmin = <u>-20°C</u>	End of test taken as 168 hours (Manufacturer declared value)
			215.51 Hours at Tmin = <u>-20°C</u>	
Transmitted Frequency			Min	Max
Nominal value	C/S T.001	MHz	406.0399941	406.0400086
Short-term stability	$\leq 2 \times 10^{-9}$	/100ms	34.397E-12	43.629E-11
Medium-term stability – Slope	$(-1 \text{ to } +1) \times 10^{-9}$	/min	-7.13E-11	1.20E-10
Medium-term stability – Residual frequency variation	$\leq 3 \times 10^{-9}$		5.82E-11	1.99E-09
Transmitter power output	35 - 39	dBm	36.42	37.39
Digital message	correct	P/F	P	
Homer transmitter continuous operation during the lifetime test		hours	>213.56	
			Start of Test	End of Test
Homer frequency		MHz	121.499	121.499
Homer peak power level		dBm	18.756	19.37
Homer transmitter duty cycle		%	96.8	97.1



Product Service

2.13 (LIMITED) COSPAS-SARSAT TYPE APPROVAL TEST PROCEDURE

2.13.1 Specification Reference

IEC 61097-2, clause A.1.12

2.13.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 2

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0

2.13.3 Date of Test

09 November 2015 to 20 November 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 N/A

Relative Humidity N/A

2.13.6 Test Results

Full Cospas-Sarsat testing was carried out prior to the IEC 61097-2 compulsory sequence of test as requested by Ocean Signal. 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.1.12 of IEC 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 2014 and results of the full test campaign were submitted to Cospas-Sarsat Secretariat for approval.

Cospas-Sarsat Type Approval Certificate: TAC-275.

This is intended to show compliance with the above specification references.



Product Service

2.14 INTERFERENCE TEST (IMMUNITY TO RF – ENCLOSURE PORT)

2.14.1 Specification Reference

IEC 61097-2, clause A.1.13 (EN 60945, clause 10.4)

2.14.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 2

2.14.3 Date of Test

13 November 2015 and 30 November 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 17.4°C – 20.1°C
Relative Humidity 38% - 40%

2.14.6 Test Method

The test was applied in accordance with the test method requirements of IEC 61000-4-3.

The test was performed with the EUT in Standby, Operating and VDR modes.

2.14.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of EN 60945.



Product Service

EUT in VDR mode

Amplitude Modulation	Frequency	400Hz	
	Depth	80%	
Stepped Frequency Increments		1% with respect to last momentary frequency	
Dwell Time		2 Seconds 80MHz to 1000MHz 5 Seconds 1000MHz to 2000MHz	
Frequency Range (MHz)		80 – 1000 (2000 for IEC60945)	
Field Strength (V/m)		12.6 (10 + MU)	
Frequency Range (MHz)		1000 – 2000	
Field Strength (V/m)		12.6 (10 + MU)	
		Result	
Orientation of EUT		Vertical Polarisation	Horizontal Polarisation
Front		Pass	Pass
Right Side		Pass	Pass
Top		Pass	Pass



Product Service

EUT in Operating mode

Amplitude Modulation	Frequency	400Hz	
	Depth	80%	
Stepped Frequency Increments		1% with respect to last momentary frequency	
Dwell Time		2 Seconds 80MHz to 1000MHz 5 Seconds 1000MHz to 2000MHz	
Frequency Range (MHz)		80 – 1000 (2000 for IEC60945)	
Field Strength (V/m)		12.6 (10 + MU)	
Frequency Range (MHz)		1000 – 2000	
Field Strength (V/m)		12.6 (10 + MU)	
		Result	
Orientation of EUT		Vertical Polarisation	Horizontal Polarisation
Front		Pass	Pass
Right Side		Pass	Pass
Top		Pass	Pass



Product Service

EUT in Standby mode

Amplitude Modulation	Frequency	400Hz	
	Depth	80%	
Stepped Frequency Increments		1% with respect to last momentary frequency	
Dwell Time		2 Seconds 80MHz to 1000MHz 5 Seconds 1000MHz to 2000MHz	
Frequency Range (MHz)		80 – 1000 (2000 for IEC60945)	
Field Strength (V/m)		12.6 (10 + MU)	
Frequency Range (MHz)		1000 – 2000	
Field Strength (V/m)		12.6 (10 + MU)	
		Result	
Orientation of EUT		Vertical Polarisation	Horizontal Polarisation
Front		Pass	Pass
Right Side		Pass	Pass
Top		Pass	Pass



Product Service

2.15 INTERFERENCE TEST (IMMUNITY TO ESD)

2.15.1 Specification Reference

IEC 61097-2, clause A.1.13 (EN 60945, clause 10.9)

2.15.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 2

2.15.3 Date of Test

01 December 2015

2.15.4 Test Equipment Used

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

2.15.5 Environmental Conditions

Ambient Temperature 21.8°C
Relative Humidity 50.2%

2.15.6 Test Method

The test was applied in accordance with the test method requirements of IEC 61000-4-2.

The test was performed with the EUT in Standby, Operating and VDR modes.

2.15.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of IEC 60945: C1 for Immunity to Electrostatic Discharge (Enclosure Port).



Product Service

The applied test levels are shown below.

EUT in VDR Mode

		Contact Discharges (kV)								Air Discharge (kV)							
		2		4		6		8		2		4		8		15	
Test Points		+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
Horizontal Coupling Plane		✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vertical Coupling Plane		✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A	Lock Pin	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B	Lock Body	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
C	Case Seam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
D	Case Seam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
E	Screws	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
F	Cable Gland	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A

EUT in Operating Mode

		Contact Discharges (kV)								Air Discharge (kV)							
		2		4		6		8		2		4		8		15	
Test Points		+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
Horizontal Coupling Plane		✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vertical Coupling Plane		✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A	Link Cable	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
B	LED	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
C	Top Switch	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
D	Base	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
E	Activate switch	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
F	Safety switch	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
G	Antenna	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
H	Reflector	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
I	Lanyard screw	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
J	Top Screw	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
K	Ethernet connector	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
L	Strobe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A

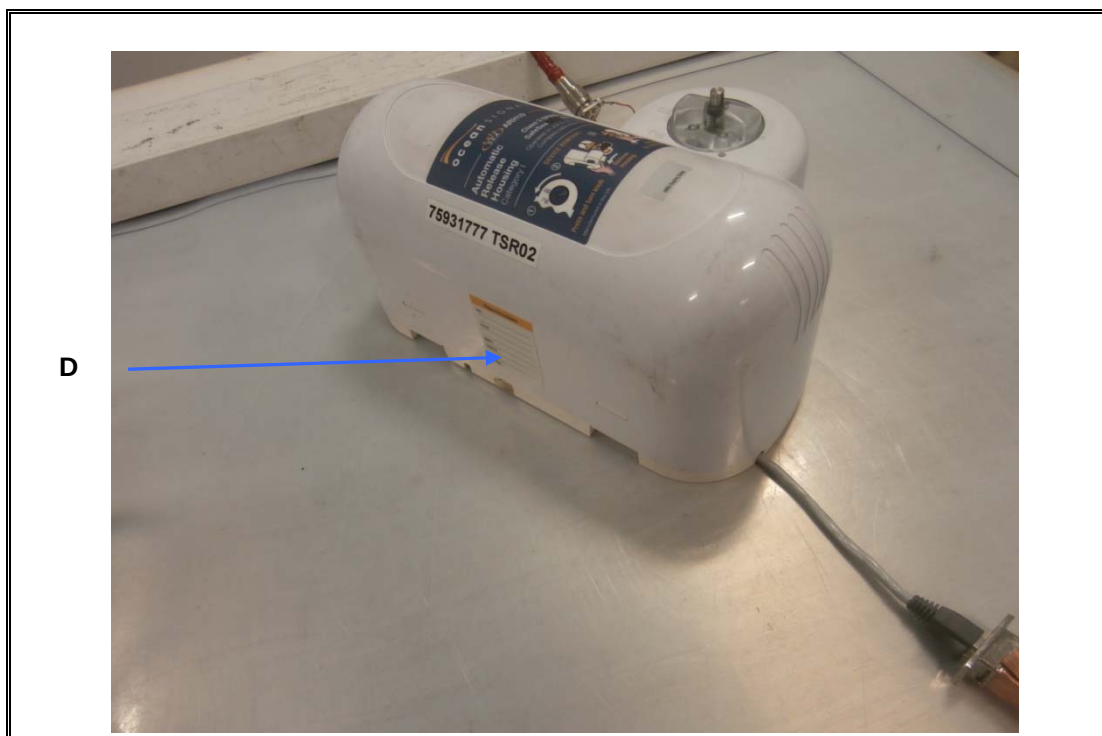
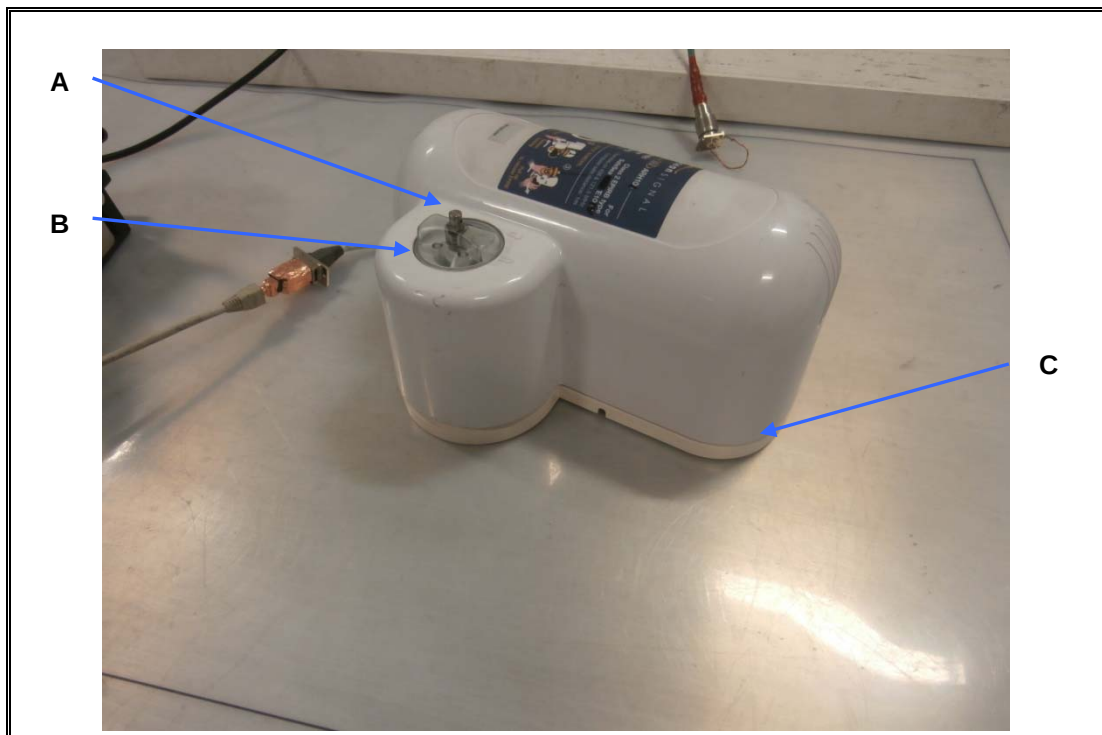


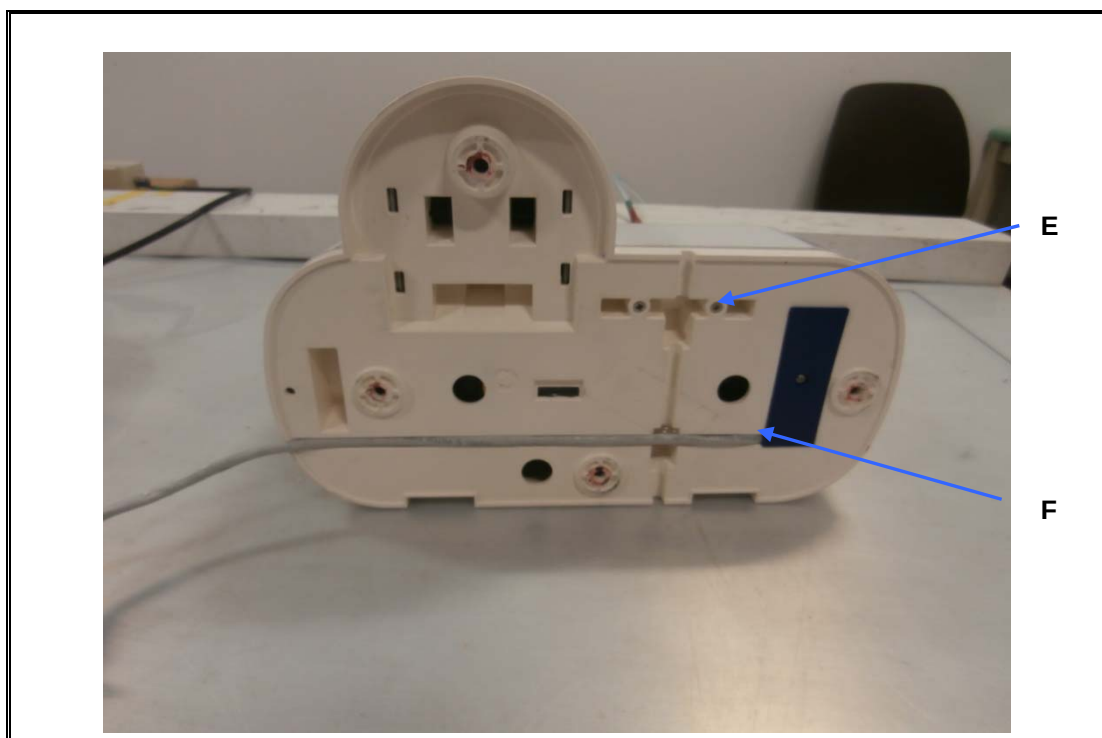
Product Service

EUT in Standby Mode

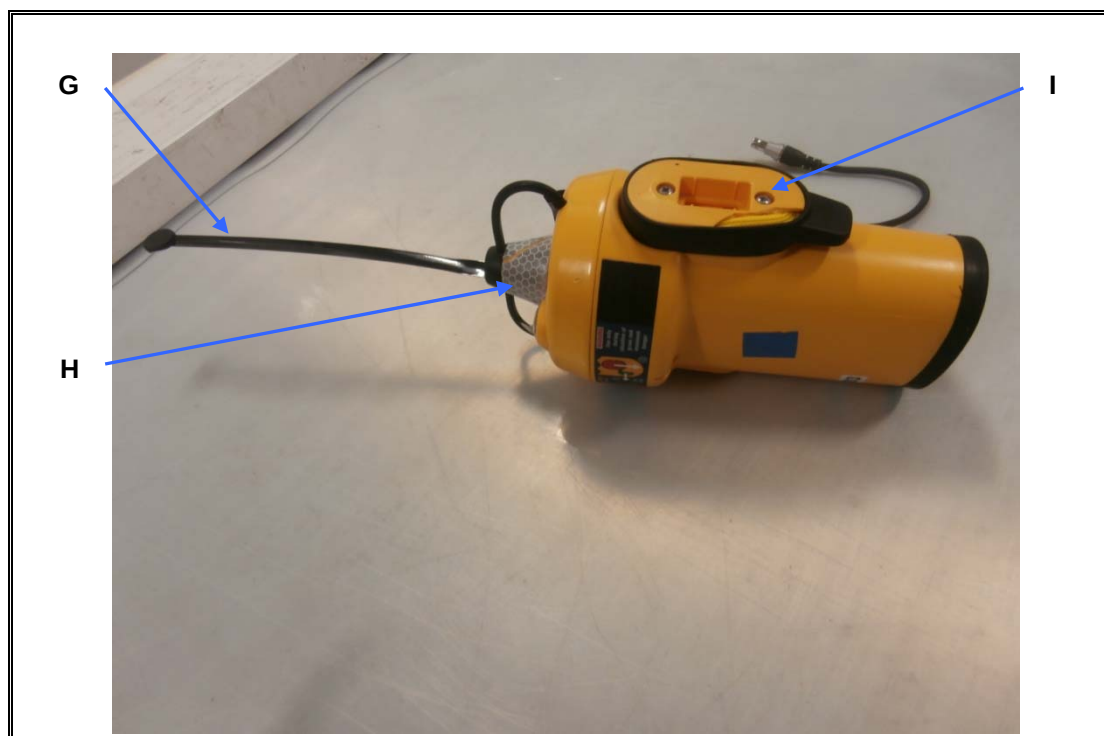
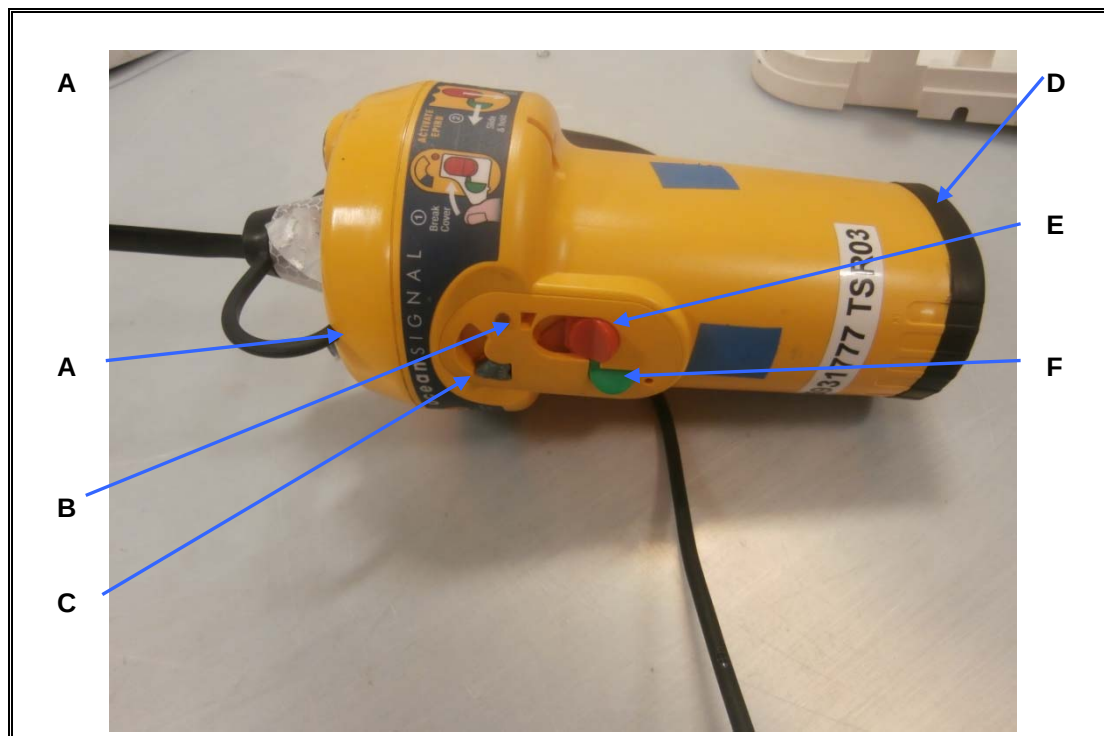
		Contact Discharges (kV)								Air Discharge (kV)							
		2		4		6		8		2		4		8		15	
Test Points		+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
Horizontal Coupling Plane		✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vertical Coupling Plane		✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A	Lanyard screws	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B	Antenna	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
C	Link Cable	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
D	Base	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
E	LED	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
F	Top switch	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
G	Activate switch	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
H	Safety switch	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
I	Reflector switch	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
J	Ethernet connector	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
K	Strobe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A

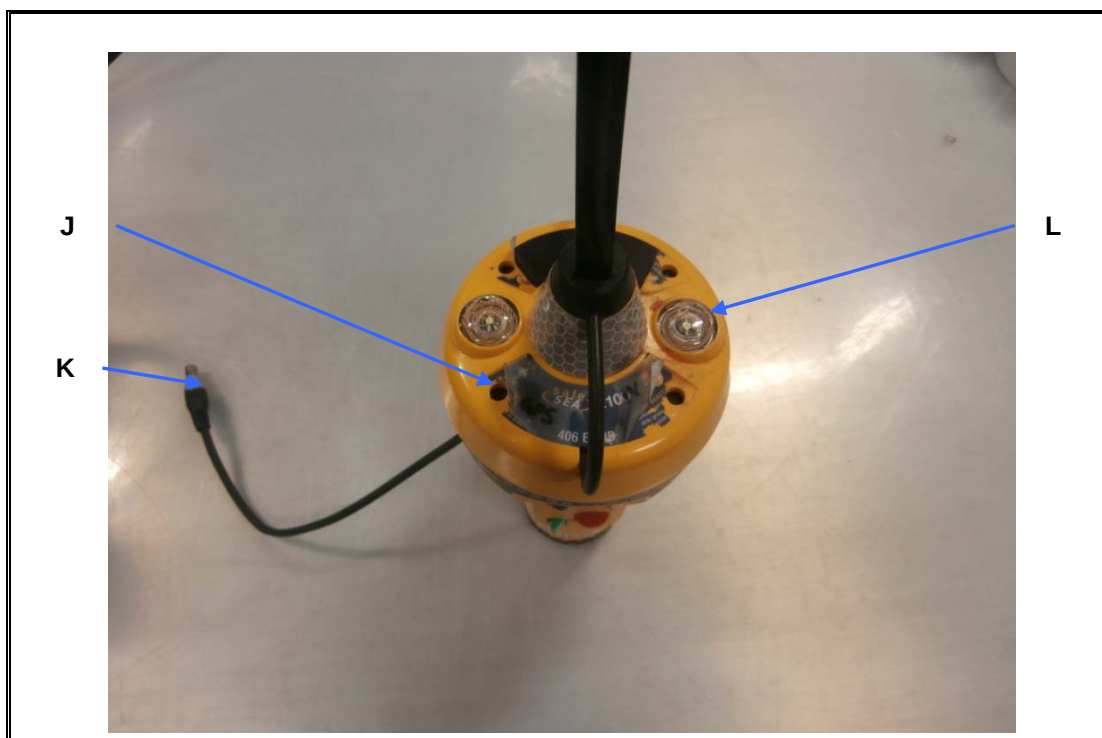
ESD TEST POINTS – EUT in VDR mode



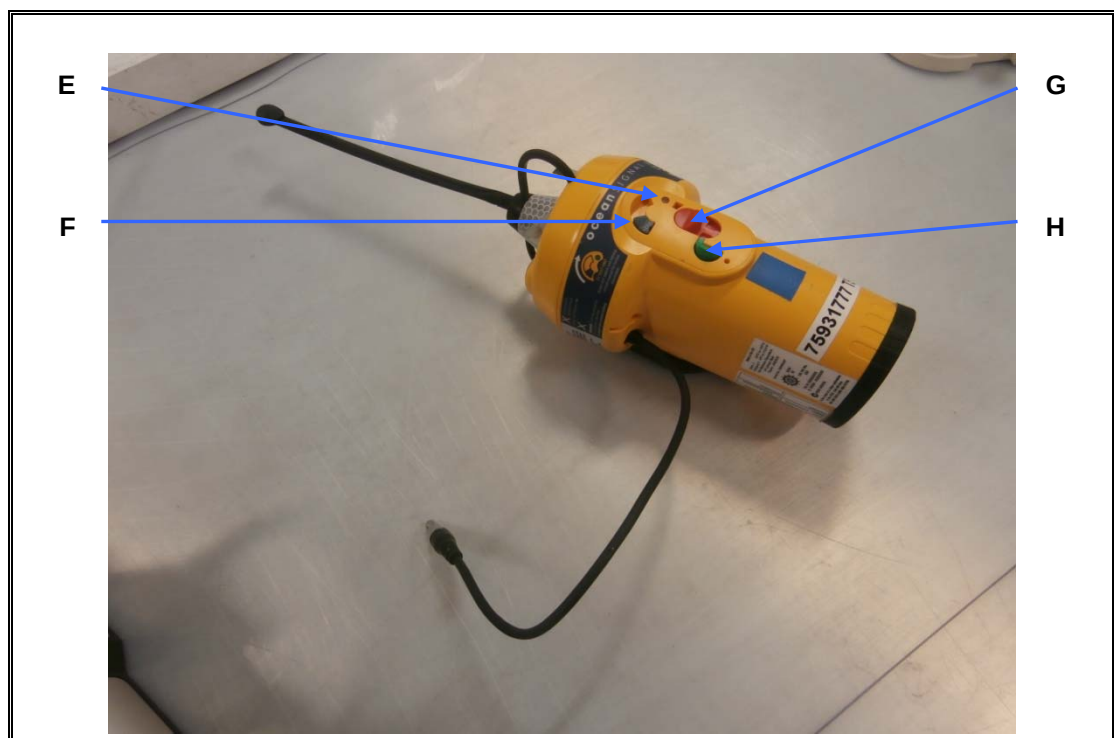
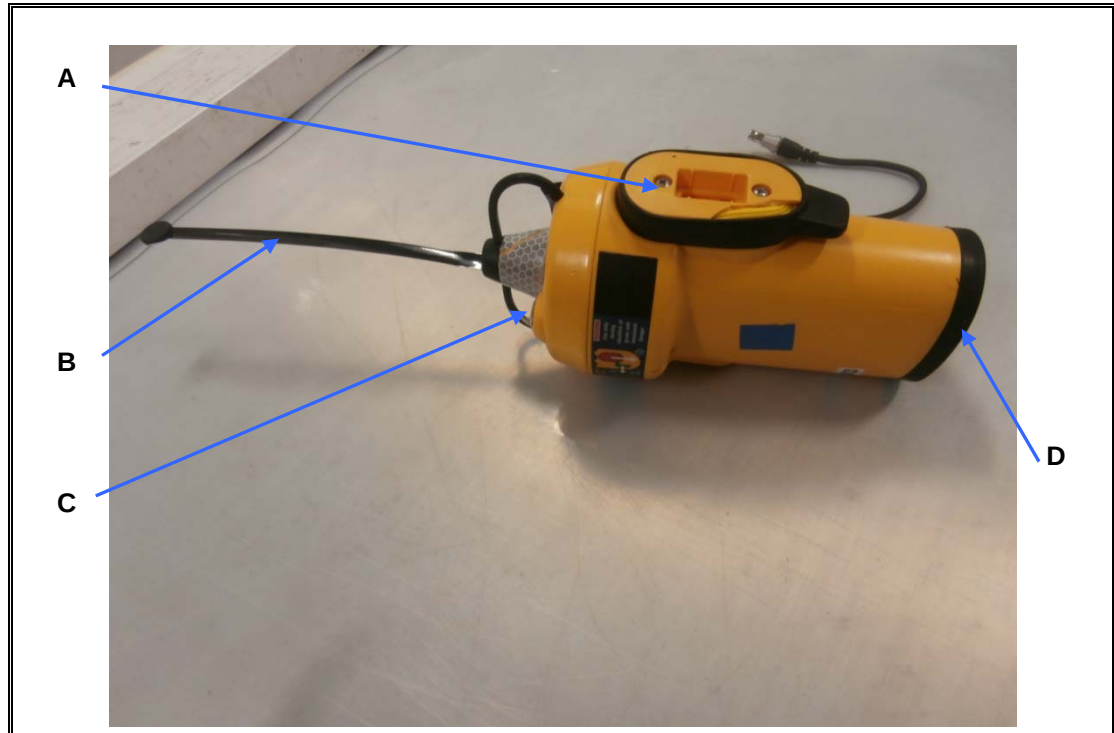


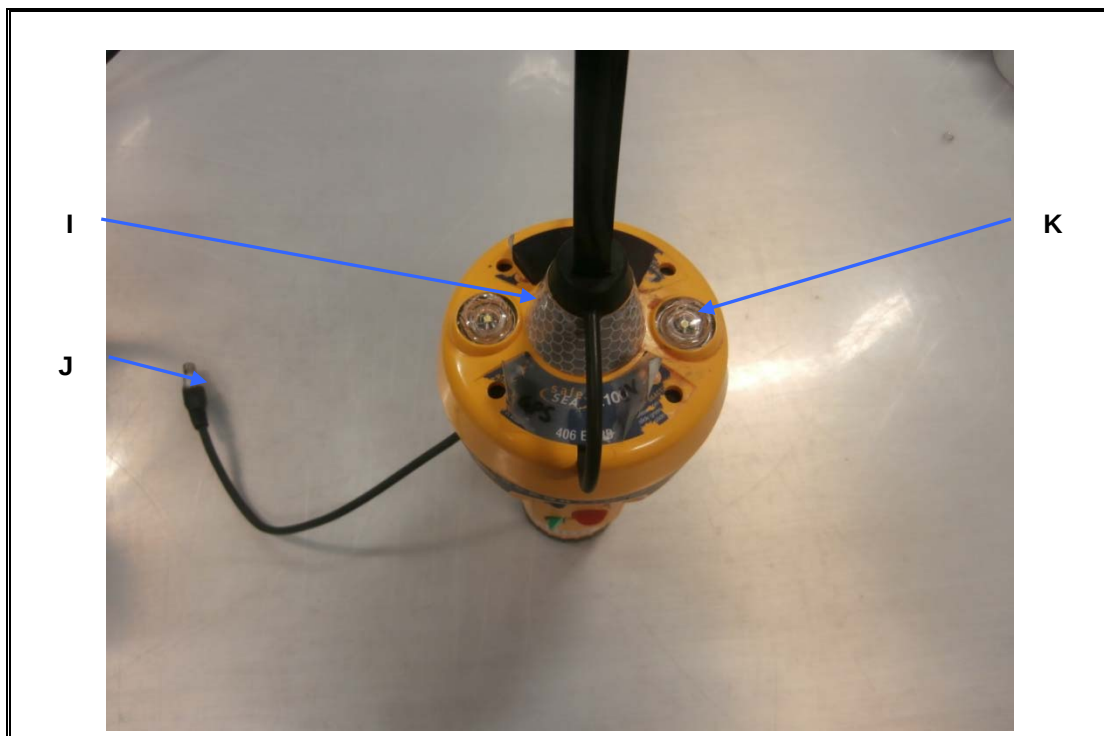
ESD TEST POINTS – CONFIGURATION 2





ESD TEST POINTS – EUT in Standby mode







Product Service

2.16 CONDUCTED INTERFERENCE (CONDUCTED EMISSION – DC POWER PORT)

2.16.1 Specification Reference

IEC 61097-2, clause 5.21 (EN 60945, Table 5, 9.2)

2.16.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 3

2.16.3 Date of Test

03 March 2016

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 Environmental Conditions

Ambient Temperature 16.1°C
Relative Humidity 41%

2.16.6 Test Method

The test was applied in accordance with the test method requirements of CISPR 16-1-2.

The test was performed with the EUT in the VDR mode.

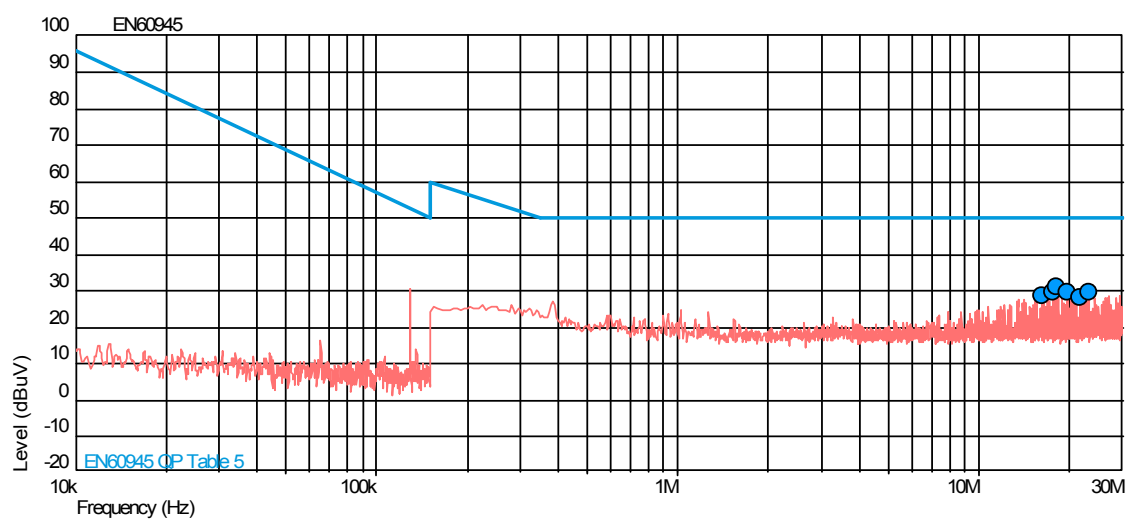
2.16.7 Test Results

For the period of test the EUT met the requirements of IEC 60945 for Conducted Emissions (DC Power Port).

The test results are shown below.

EUT in VDR Mode

+12V Line Results



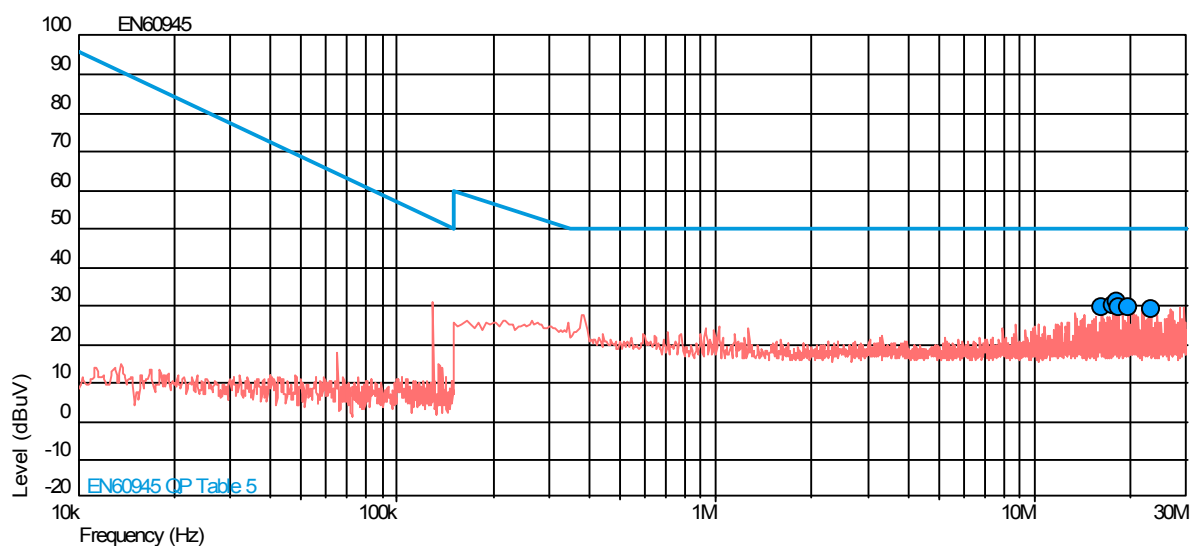
Final Result

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)
16.165	28.5	50.0	-21.5
17.691	29.7	50.0	-20.3
18.242	31.0	50.0	-19.0
19.707	29.3	50.0	-20.7
21.660	28.1	50.0	-21.9
23.127	29.6	50.0	-20.4



Product Service

0V Line Results



Final Result

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)
16.226	29.7	50.0	-20.3
17.692	29.9	50.0	-20.1
18.242	30.9	50.0	-19.1
18.303	29.5	50.0	-20.5
19.707	29.3	50.0	-20.7
23.126	29.2	50.0	-20.8



Product Service

2.17 CONDUCTED INTERFERENCE (IMMUNITY TO RADIO FREQUENCY COMMON MODE – DC POWER PORT)

2.17.1 Specification Reference

IEC 61097-2, clause 5.21 (EN 60945, Table 5, 10.3)

2.17.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 3

2.17.3 Date of Test

03 March 2016

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°C

Relative Humidity 31.6%

2.17.6 Test Method

The test was applied in accordance with the test method requirements of IEC 61000-4-6.

The test was performed with the EUT in the VDR mode.

2.17.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of IEC 60945: C1 for Immunity to Radio Frequency Common Mode (DC Power Port).

The applied test levels are shown below.

EUT in VDR Mode

Port Under Test	Test Level (Vrms)	Freq. Range	Modulation/Freq Depth	Step Size	Dwell Time	Coupling Method	Interference Return Path	Result
DC	4.8V (3V + MU)	150kHz to 80MHz	AM, 400Hz, 80%	1%	3s	EM Clamp	None	Pass
DC	15.8V (10V + MU)	Spot Frequencies	AM, 400Hz, 80%	N/A	3s	EM Clamp	None	Pass



Product Service

2.18 CONDUCTED INTERFERENCE (IMMUNITY TO RADIO FREQUENCY COMMON MODE – SIGNAL, CONTROL AND TELECOMMUNICATIONS PORT))

2.18.1 Specification Reference

IEC 61097-2, clause 5.21 (EN 60945, Table 5, 10.3)

2.18.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 2

2.18.3 Date of Test

17 November 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 20°C

Relative Humidity 48%

2.18.6 Test Method

The test was applied in accordance with the test method requirements of IEC 61000-4-6.

The test was performed with the EUT in the VDR mode.

2.18.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of IEC 60945 for Immunity to Radio Frequency Common Mode (Signal, Control and Telecommunications Port).

The applied test levels are shown below.

Port Under Test	Test Level (Vrms)	Freq. Range	Modulation/Freq Depth	Step Size	Dwell Time	Coupling Method	Interference Return Path	Result
Ethernet /power	4.8V (3V + MU)	150kHz to 80MHz	AM, 400Hz, 80%	1%	3s	EM Clamp	None	Pass
Ethernet /Power	15.8V (10V + MU)	Spot Frequencies	AM, 400Hz, 80%	N/A	3s	EM Clamp	None	Pass



Product Service

2.19 CONDUCTED INTERFERENCE (IMMUNITY TO FAST TRANSIENT BURSTS COMMON MODE – SIGNAL, CONTROL AND TELECOMMUNICATIONS PORT)

2.19.1 Specification Reference

IEC 61097-2, clause 5.21 (EN 60945, Table 5, 10.5)

2.19.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 2

2.19.3 Date of Test

30 November 2015

2.19.4 Test Equipment Used

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

2.19.5 Environmental Conditions

Ambient Temperature 22°C

Relative Humidity 35%

2.19.6 Test Method

The test was applied in accordance with the test method requirements of CISPR 16-1-2.

The test was performed with the EUT in the VDR mode.

2.19.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of IEC 60945: C1 for Immunity to Fast Transient Bursts Common Mode (Signal, Control and Telecommunications Port).

The applied test levels are shown below.

EUT in VDR Mode

Cables Under Test	Test Level (±kV)	Repetition Rate (kHz)	Test Duration (seconds)	Coupling Method	Result
Ethernet	0.5, 1.0KV	5	240 each polarity	Capacitive Clamp	Pass



Product Service

2.20 TEST OF OPERATIONAL REQUIREMENTS (NUA)

2.20.1 Specification Reference

IEC 61097-2, clause A.2.1 (subclauses detailed in table below).

2.20.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0
Label exhibit: 5(h) Beacon Labelling v1.pdf (unless noted otherwise below).
VDR user manual as supplied 09 Dec 2015 (unless noted otherwise below).

2.20.3 Date of Test

9 December 2015 – 07 April 2016

2.20.4 Test Equipment Used

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



Product Service

2.20.5 Test Results

IEC 61097-2 sub clause	Statement	Comment	Result
Clause 5.3.1 Prevention of inadvertent activation (3.3.1a – 3.3.1b)			
	a) (A.810(19)/A.2.3.1) be fitted with adequate means to prevent inadvertent activation and deactivation; b) not automatically activate when water washes over it while in its release mechanism; c) be designed to limit any inadvertent continuous 406 MHz transmission to a maximum of 45 s.	The EUT is fitted with a Break Cover. The Break Cover acts as a witness seal (one time only cover) and reveals the two part activation buttons. The Break Cover must be removed in order to activate the EPIRB. The green button must then be slid to the left to enable the red activation button to be held down. For Inadvertent activation (hose stream) test refer to section 2.29. Refer to TUV SUD document 75931777 report 04.	- Refer to TUV SUD document 75931777 report 04.
Clause 5.3.3.2 Test for repetitive manual action and deactivation (3.3.3b)			
	The satellite EPIRB shall (A.810(19)/A.2.3.4) 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.	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 Break 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 Tests for 3.3.3d to 3.3.3f			
	d) 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. e) After start of transmission of the distress signal, the operation of the low-duty cycle light should be in accordance with 3.3.3 c). f) The satellite EPIRB shall (A.810(19)/A.2.3.5) be provided with means to indicate that signals are being emitted. The low-duty cycle light operating in accordance with 3.3.3 c), is an acceptable indication.	Refer to manufacturer waiver request for Signal Light Test (Annex B).	-



Product Service

5.3.4 Self test (3.3.4)			
	The satellite EPIRB shall (A.810(19)/A.2.3.8) 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 (see C/S T.001) is activated, the satellite EPIRB shall emit a single modulated 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. The 121,5 MHz auxiliary radio-locating device signal shall also be transmitted during the self-test, but it shall not exceed 3 audio sweeps or 1 s, whichever is greater. The self-test function shall perform an internal check and indicate that RF power is being emitted at 406 MHz and at 121,5 MHz.	The EUT provides a self test function. The test switch is not protected by the Break Cover and can therefore be accessed for test as recommended by the Manufacturer. The user manual notes the following relating to the beacon test feature: the strobe light will flash once (indicating that the 406 and 121.5 MHz signal has been transmitted). The indicator LED will flash green or amber to show a pass or red to show fail status... A self test result indicator guide is provided indicating the number of hours the beacon has been activated. Codes are also provided for the red LED indicator. Once the self test is complete the EUT returns to the normal state (i.e. off and capably of being activated). Refer to TUV SUD document 75931777 report 04 for Cospas-Sarsat test results. The 121.5 MHz signal is transmitted during the self test and does not exceed 3 audio sweeps.	-



5.3.5 Colour and retro-reflecting material			
	The satellite EPIRB shall (A.810(19)/A.2.3.9) be of highly visible yellow/orange colour and be fitted with retro-reflecting material. The minimum area of retro-reflective material visible above the waterline of the satellite EPIRB shall be at least 25 cm². This shall be achieved by retro-reflective material, at least 25 mm wide, with at least 5 cm² viewable from every angle on the horizon. 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 yellow. The area of retro-reflective material above the waterline was measured as approximately 25 cm². Refer to manufacturer document Reflective Tape Technical Document and material specification (Annex B).	-
5.3.6 Lanyard (3.3.6)			
	The satellite EPIRB shall (A.810(19)/A.2.3.10) 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. 5.3.7The 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 25 kg.	The EUT is equipped with a lanyard. The lanyard is located at the rear of the EUT and is wrapped around a 'lanyard enclosure'; the lanyard is protected by a black rubber seal which forms part of the enclosure to reduce the likelihood of it become trapped when in its normal stowage condition. The lanyard was measured as being 5.28m in length. The lanyard, when affixed to the EUT was capable of lifting 25 kg; some evidence of deformation as per below. 	-



Product Service

5.3.7 Exposure to marine environment (3.3.7)			
	The satellite EPIRB shall not (A.810(19)/A.2.3.12), including the labelling, be unduly affected by sea water or oil or both; and (A.810(19)/A.2.3.13) be resistant to deterioration in prolonged exposure to sunlight.	Refer to manufacturer waiver request for Corrosion, Solar Radiation and Oil Resistance (Annex B).	–
5.3.8 Ergonomics (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). This shall include removing the EPIRB from its bracket, manual activation and deactivation of the control function and deployment of the lanyard.	When wearing an immersion suit glove it is possible to remove the EUT from the 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 Distress function (3.4)			
	(A.810(19)/A.3.1) When the satellite EPIRB is manually operated a distress alert shall be initiated only by means of a dedicated distress alert activator: The dedicated activator shall: a) (A.810(19)/A.3.2.1) be clearly identified; and b) (A.810(19)/A.3.2.2) be protected against inadvertent operation. (A.810(19)/A.3.3) 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 satellite EPIRB – breaking a seal or other means provided to comply with 3.3.9; – manual removal from the bracket; or – inversion. (A.810(19)/A.3.4) The satellite EPIRB shall not be automatically activated after being manually removed from the release mechanism (dry EPIRB condition).	The EUT has three buttons (TEST, green (slide across) and red (slide down)). The activation is initiated by moving of the green and red buttons. The EUT is fitted with Break Cover. This must be removed to gain access to the activation buttons. In order to activate the EUT the green button must be slid across to the left, and whilst in the far left position the red button must be slid down. These two actions (slide across and slid down) are the two independent means. The witness seal and removal from a bracket are other actions which may be required depending on installation. The EUT (assuming it is not immersed in water) does not automatically activate when removed from the release mechanism.	–



Product Service

5.5.1.1 Test to prevent release when sea water washes over the unit			
	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 section 2.34 for Hose Stream test.	Refer to section 2.34
5.5.1.2 Construction materials			
	By test (see 5.17.11) or by inspection of the evidence submitted by the manufacturer that the materials used, including any coloured external coating, have been previously tested and are unlikely to cause any malfunction of the unit. By test (see 5.17.9, 5.17.10 and 5.17.11) or by inspection, including the labelling, of evidence submitted by the manufacturer that the materials used have been previously tested and are unlikely to be duly affected by seawater or oil or prolonged exposure to sunlight.	Refer to manufacturer waiver request for Solar Radiation (Annex B).	-
5.5.2 External power or data connection (3.5.2)			
	(A.662(16)/3) 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.	Refer to section 2.17 for Automatic Release Mechanism and Automatic Activation Test	-
5.5.3 Ability to check the automatic release (3.5.3)			
	(A.662(16)/4) With the exception of disposable hydrostatic release 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 (as supplied 07/04/2016).	-



Product Service

5.5.4 Manual release (3.5.4)			
	(A.662(16)/5) It shall be possible to release the satellite EPIRB manually from the float-free mechanism, without tools.	It is possible to manually release to the EUT from the float free housing.	-
5.15.2 Expiry date indication			
	-	The EUT beacon labelling provides provision for the battery expiry date. (As supplied 07/04/2016).	-
5.15.3 Reverse polarity protection			
	-	Whilst the battery pack is not user replaceable, it is keyed and can only be fitted one way.	-
3.11 Equipment manual			
	Adequate information, as needed to comply with 3.9 and 3.13, shall be provided to enable the equipment to be properly stowed, installed, operated and tested. The information supplied with the satellite EPIRB shall include pictorial operating instructions on a waterproof placard, suitable for mounting on a bulkhead. Numerals may be used to indicate the order of the illustrated operations, but words should not be used as part of the instructions.	See relevant section for inspection against clause 3.9 and 3.13 (Maintenance and Installation). Maintenance is limited to periodic cleaning, if required. Installation instructions are provided. A waterproof adhesive pictorial guide is provided.	-



3.11 Equipment manual			
	The equipment manual shall also include: – an overview of the Cospas-Sarsat system; – complete instructions for the operation and the self testing of the satellite EPIRB; – cautions and recommendations to prevent false alerts; – instructions for licensing and registration, registration renewal and a discussion on the importance of accurate registration; – battery information including replacement instructions, battery type, and safety information regarding battery use and disposal; – an instruction to replace the battery after the satellite EPIRB is operated for any purpose other than a test; – the minimum operating life-time and operating and stowage temperatures; – the purpose of the lanyard and a precaution against using it to secure the satellite EPIRB to the ship; – a recommendation against attempting to operate the satellite EPIRB inside a life raft or under any similar cover or canopy; – the servicing and/or replacement of any hydrostatic release unit and any associated components subject to ageing, such as release rods; – manufacturer recommendations, if any, on periodic functional testing, possibly in connection with battery replacement; – a note to keep the original satellite EPIRB packaging, since it may be needed if the EPIRB has to be shipped for servicing. UN requirements for shipping some batteries as hazardous goods require certain packaging standards and labelling; – instructions for the safe transportation or shipping of the satellite EPIRB or the location where such information can be obtained by the user; – warranty information; – a warning to the effect that the Satellite EPIRB shall not be operated except in an emergency; – a warning against installation near strong magnetic fields, if that might activate the satellite EPIRB; – a recommendation to mounting the satellite EPIRB as high as possible, especially on small vessels. This will help ensure operation of the hydrostatic float-free release unit, in the event the vessel capsizes without sinking; – a recommendation to limit self-testing to the minimum necessary to ensure confidence in the operation of the satellite EPIRB;	The Operating manual was reviewed to confirm the following clauses were addressed. Whilst the contents of the manual were checked for inclusion the accuracy of details were not confirmed: Overview of the Cospas-Sarsat system Operating instructions Self test instructions How to prevent false alarms How to report a false alarm Beacon registration Beacon registration in the case of change of ownership Battery information (type, battery replacement instructions, disposal guidance) Battery replacement is required after use Operating and Stowage temperatures Operational lifetime Purpose of the lanyard and a precaution not to tie to the ship Recommendation to perform monthly self test. (User manual states that the Self test includes a battery capacity test) A note to keep the original packaging Transportation advice for shipping via road, sea and air Limited Warranty information Warning to use only in situations of grave and imminent danger To keep the EUT aware from strong magnetic sources To mount the EPIRB as high as possible (but still accessible) Other related comments / observations: The user manual states that the EUT may be deployed in a liferaft... preferably outside of a canopy. The user manual states that the HRU should be replaced two years after installation. Instructions are provided on how to replace the unit. (As per VDR user manual version 00.30 7/4/2016 draft).	-



Product Service

3.11 Equipment manual			
	– a warning to limit testing to the first five minutes of the hour, as the satellite EPIRB emits a 121,5 MHz signal during self-test; – if appropriate a list of approved external GNSS Receivers for those satellite EPIRBs accepting external navigation inputs together with instructions for connecting and setting up the external devices; – if appropriate for those satellite EPIRBs with an integral GNSS receiver or that can be interfaced with an external GNSS receiver, information to guide the operator towards maximizing self-locating performance including a warning not to obstruct the GNSS antenna's view of the sky. The equipment manual shall include information explaining the necessity to report satellite EPIRB false alarms by the most expedient means to the nearest search and rescue authorities. The information that should be reported includes the satellite EPIRB 15-Hex ID; date, time, duration and cause of activation; and location at time of deactivation.	The Operating manual was reviewed to confirm the following clauses were addressed. Whilst the contents of the manual were checked for inclusion the accuracy of details were not confirmed: To limit testing to the first five minutes of the hour There is no provision for external GNSS input. The GNSS location is identified with the following wording: GPS Do Not Obstruct. In the event of a false alarm the user is advised to inform the relevant body and provide the following information: Current location Time beacon was first activated 15 digit Hex code	-
3.12 Labelling			



Product Service

	The label or labels shall be placed on the satellite EPIRB itself and on its container, if any, as needed. (A.810(19)/A.4) In addition to the items specified in IMO Resolution A.694(17) 6.3 and 9 (see appropriate clauses of IEC 60945) on general requirements, the following shall be clearly indicated on the exterior of the equipment: a) (A.810(19)/A.4.1) brief operating instructions at least in English, to enable manual activation, deactivation and self-test (see 3.3.4); b) a warning to the effect that the satellite EPIRB shall not be operated except in an emergency; c) type designation and class (see Clause 1, note) as specified by the manufacturer, type of battery and (A.810(19)/A.4.2) expiry date for the primary battery used (see 4.6). Means shall be provided to change this date when the battery is replaced; d) the name of the ship and beacon identification data: 1) (A.810(19)/A.4.3) the identity code programmed into the transmitter of the satellite EPIRB (i.e. hexadecimal representation of bits 26 to 85 of the digital message, as described in C/S T.001), together with the call sign or MMSI of the ship as required by the Administration and the MID; 2) country (i.e. name of country as programmed in the MID); 3) a space for registration information (for instance Decals) as required by administrations; e) if applicable, for those satellite EPIRBs with an integral GNSS receiver or that can be interfaced with an external GNSS receiver, a statement that the device either contains a GNSS receiver or may be interfaced to one and, if necessary, brief operating instructions relevant to this feature; f) a warning to limit testing to the first five minutes of the hour, as the satellite EPIRB emits a 121,5 MHz signal during self-test.	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 the following items: • Battery expiry date. • Vessel name. • UIN • MMSI • Call Sign • C/S TAC No • Serial Number • FCC ID • IC ID • C Tick reference • MED reference • Provision for Country Instruction to not obstruct the GPS area. Warning to test in the first 5 minutes of the hour. The beacon housing includes instructions as to how to remove from the housing. The float free housing labelling includes the following information: Basic device removal instructions (pictorial). Category of EUT Class of EUT Provision for the following items: • Battery expiry date. • Vessel name. • UIN • MMSI • Call Sign	-
--	--	---	----------



Product Service

3.12 Labelling			
	3.12.2 Float-free arrangement labelling (A.662(16)/2.9) The float-free arrangement shall carry a label or labels indicating clearly at least in English: a) the operating instructions for manual release; b) the type designation; c) the satellite EPIRB class; d) the maintenance and/or replacement date for the release mechanism, if applicable. If this label or labels are not readily visible in the installed arrangement, they shall be provided in addition, for installation close to the float-free arrangement. These instructions may in addition be shown in pictorial form.	The float free housing labels include the following information: Pictorial instructions for manual release EPIRB model name EPIRB Class Provision is provided for the following: • UIN • Vessel • MMSI • Country • Call Sign • Date of installation • HRU replacement date (as supplied 07/04/2016)	-
3.9 Maintenance			
	(A.702(17)/3.2) It should be recognized that, despite the use of other methods, some reliance on shore-based maintenance to ensure the availability of the functional requirements of the GMDSS will always be necessary. As defined in 3.2 g), the satellite EPIRB is a single integral unit, which is not suited for onboard repairs. As a consequence, the equipment shall be so constructed that it is readily accessible for inspection and testing purposes only, access to the interior of the satellite EPIRB shall only be possible with the use of tools.	The EUT is a sealed unit. The screw locations which enable the EUT to be dismantled can be found underneath the labelling.	-



Product Service

3.13 Installation			
	The equipment manual shall contain instructions to ensure that the installed satellite EPIRB shall: a) (IV/7.1.6.2) be installed in an easily accessible position; b) (A.694(17)/2) be installed in such a manner that it is capable of meeting the requirements of this standard; c) (A.810(19)/A.2.6.1) have local manual activation; remote activation may also be provided from the navigating bridge, while the device is installed in the float-free mounting; d) (A.810(19)/A.2.6.3) release itself and float-free before reaching a water depth of 4 m at a list or trim of any angle; e) (A.662(16)/2.8) be mounted in such a way that, after being released, it is not obstructed by the structure of the sinking ship.	The Operating manual includes the following information: Mounting location (must be easily accessible) Advice to mount the EUT as high as possible to ensure an unobstructed deployment (as per VDR user manual version 00.30 7/4/2016 draft). Activation details are provided (manual / float free only) no remote activation facility is provided. Refer to section 2.20 for Float Free test. Not to use the lanyard to attach the EPIRB to the ship as this may result in the loss of the EPIRB if the vessel sinks.	-

2.21 AUTOMATIC RELEASE MECHANISM AND AUTOMATIC ACTIVATION TEST FOR CLASS 1 AND CLASS 2 SATELLITE EPIRBs (FLOAT FREE TESTS)

2.21.1 Specification Reference

IEC 61097-2, clause A.2.2 (5.2.1 Tests for float free arrangements)

2.21.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 2

2.21.3 Date of Test

5 November 2015 to 6 November 2015 & 9 November 2015

2.21.4 Test Equipment Used

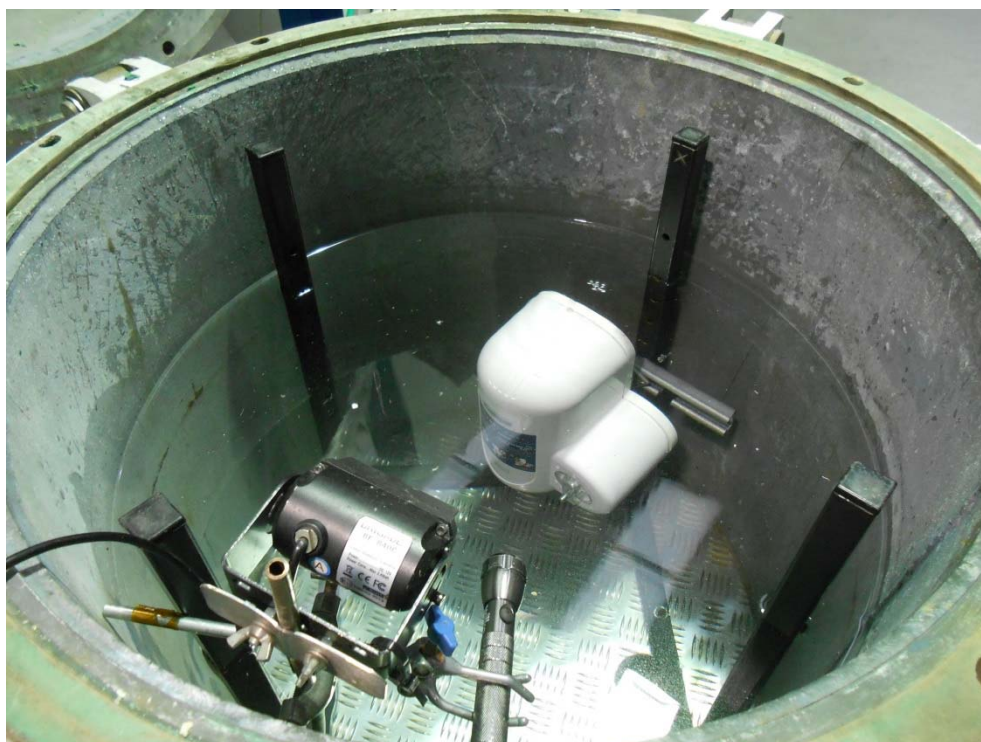
The major items of test equipment used for the above tests are identified in Section 3.1.

2.21.5 Environmental Conditions

Ambient Temperature 25.2 - 25.9°C

Relative Humidity 45.4 – 47.4%

2.21.6 Test Setup





Product Service

2.21.7 Test Method

The float free housing (with the EUT installed) was fixed to a test fixture in the normal mounting position. The test fixture was loaded into the pressure vessel and filled with water. A camera mounted inside the pressure vessel was set to monitor the release of the EPIRB from the housing.

The test was repeated with the float free housing rotated in the following orientations:

rolling 90° to starboard;
rolling 90° to port;
pitching 90° bow down;
pitching 90° stern down;
upside-down position.

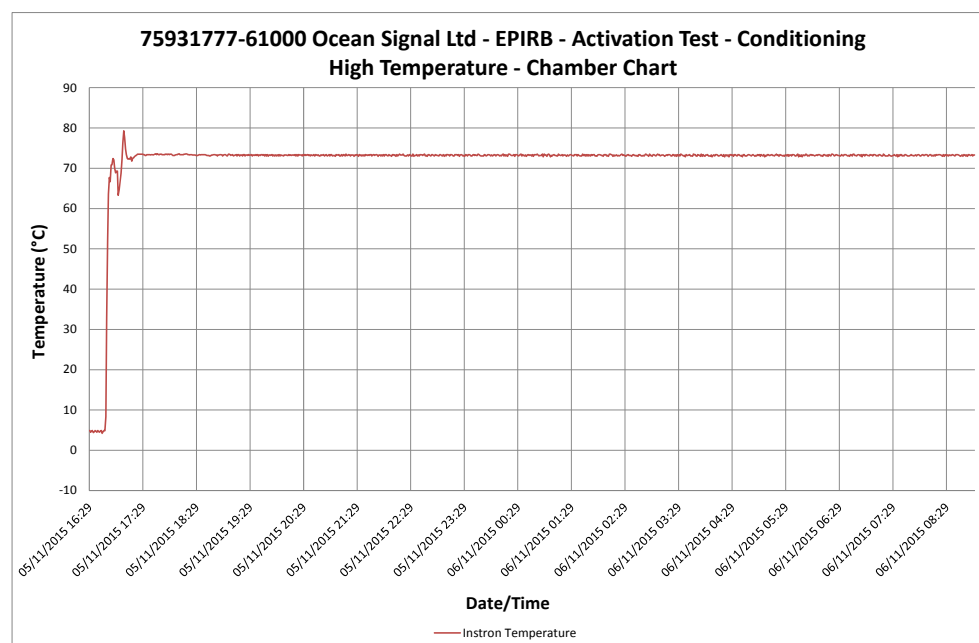
The test was repeated in the normal mounting position following an 16 hour soak at 70°C.

The test was repeated in the normal mounting position following a 4 hour soak at -30°C.

The VDR data cable disconnected during each test.

2.21.8 Test Results

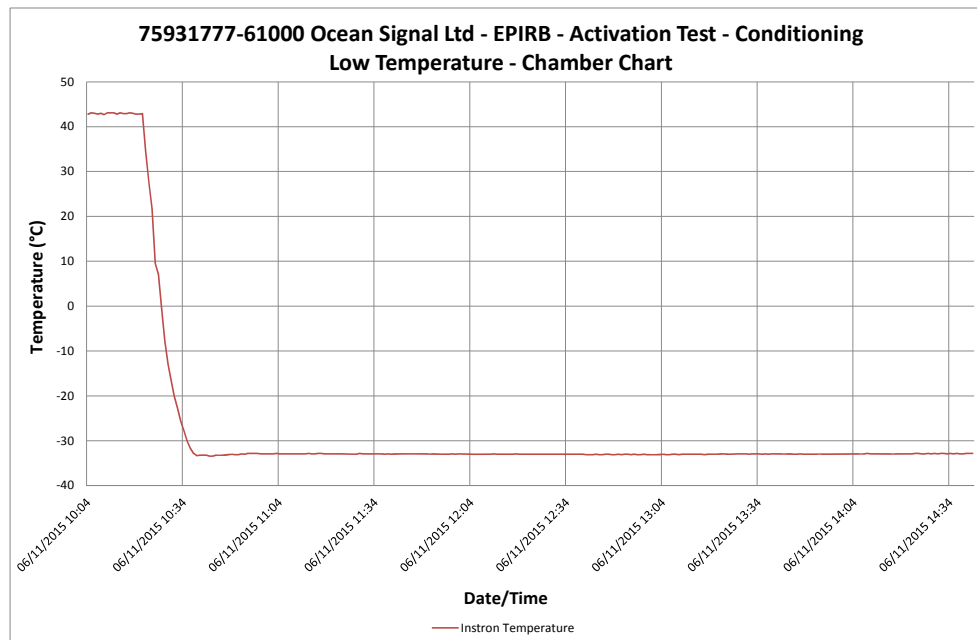
High Temperature Plot





Product Service

Low Temperature Plot



Test Results

Orientation of Float free housing	Simulated Depth of Release (m)
normal mounting position	2.13
rolling 90° to starboard	2.29
rolling 90° to port	2.14
pitching 90° bow down	2.16
pitching 90° stern down	2.24
upside-down position	2.24
Normal mounting position (+70°C)*	0.03
Normal mounting positions (-30°C)	3.8

The EUT shall be automatically released and float free of the mounting before reaching a depth of 4 m.

*It was not possible to reset the HRU following the +70°C EPIRB release test, therefore a second HRU was used for the final test at -30°C.

The EPIRB was released and activated during each release. A successful self test was carried out after each release.

2.22 AUTOMATIC RELEASE MECHANISM AND AUTOMATIC ACTIVATION TEST FOR CLASS 1 AND CLASS 2 SATELLITE EPIRBs (FLOAT FREE TESTS) - REPEAT

2.22.1 Specification Reference

IEC 61097-2, clause A.2.2 (5.2.1 Tests for float free arrangements)

2.22.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 3

2.22.3 Date of Test

16 March 2016 – 17 March 2016

2.22.4 Test Equipment Used

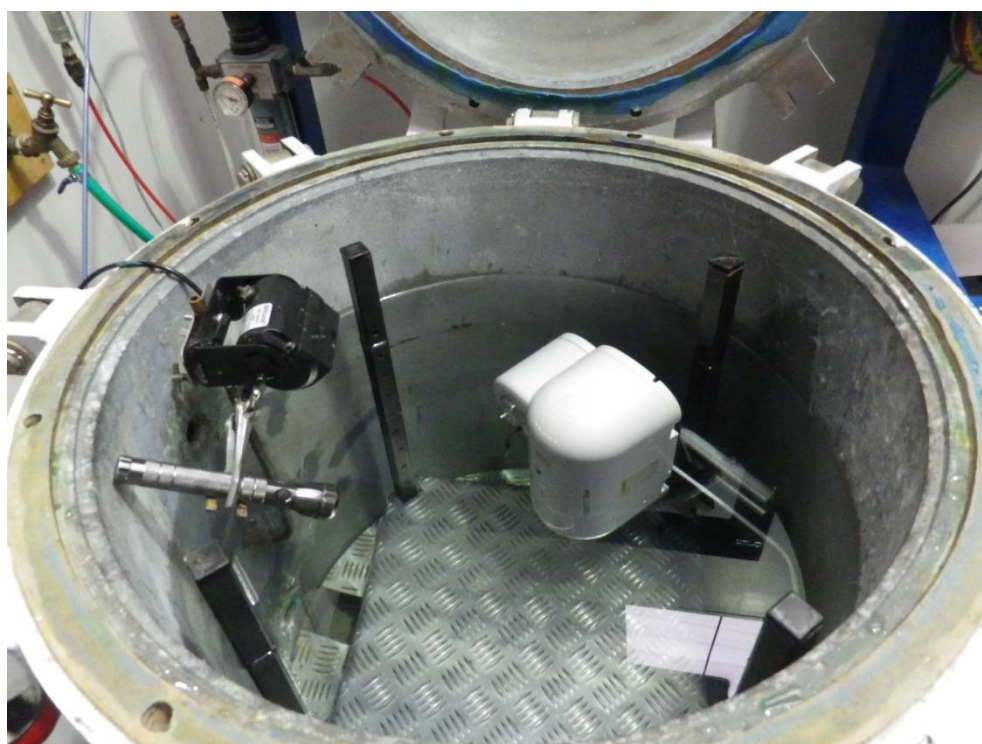
The major items of test equipment used for the above tests are identified in Section 3.1.

2.22.5 Environmental Conditions

Ambient Temperature 20°C – 23°C

Relative Humidity 32% – 23%

2.22.6 Test Setup





Product Service

2.22.7 Test Method

The float free housing (with the EUT installed) was fixed to a test fixture in the normal mounting position. The test fixture was loaded into the pressure vessel and filled with water. A camera mounted inside the pressure vessel was set to monitor the release of the EPIRB from the housing.

The test was repeated with the float free housing rotated in the following orientations:

rolling 90° to starboard;
rolling 90° to port;
pitching 90° bow down;
pitching 90° stern down;
upside-down position.

The VDR data cable disconnected during each test.

2.22.8 Test Results

The test was repeated in modification state 3 following the modifications to the float free housing. The tests were repeated at ambient only to ascertain the modifications did not impact the automatic beacon release.

Test Results

Orientation of Float free housing	Simulated Depth of Release (m)
normal mounting position	1.93
rolling 90° to starboard	2.04
rolling 90° to port	1.90
pitching 90° bow down	1.88
pitching 90° stern down	2.02
upside-down position	1.93
Normal mounting position (+70°C)	N/T
Normal mounting positions (-30°C)	N/T

The EUT shall be automatically released and float free of the mounting before reaching a depth of 4 m.



Product Service

2.23 STABILITY AND BUOYANCY

2.23.1 Specification Reference

IEC 61097-2, clause A.2.3

2.23.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 2

2.23.3 Date of Test

10 November 2015

2.23.4 Test Equipment Used

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

2.23.5 Environmental Conditions

Ambient Temperature 23.7 °C
Relative Humidity 48.8 %

2.23.6 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.

2.23.7 Test Results

The EUT passed through an upright position in 0.49 second of being released.

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

EUT Reserve Buoyancy was calculated at 15.6 %.

2.24 FLOAT FREE ACTIVATION (SALT WATER ACTIVATION)

2.24.1 Specification Reference

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

2.24.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 2

2.24.3 Date of Test

9 November 2015

2.24.4 Test Equipment Used

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

2.24.5 Environmental Conditions

Ambient Temperature 23.4°C
Relative Humidity 47.4%

2.24.6 Test Setup





Product Service

2.24.7 Test Method

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

2.24.8 Test Results

The EUT activated within 9 seconds.



Product Service

2.25 SAFETY

2.25.1 Specification Reference

IEC 61097-2, clause A.2.5

Refer to Manufacturer battery and cell data evidence report – 032015-4 UN Transport Tests OS-901S-01741.



Product Service

2.26 COMPASS SAFE DISTANCE

2.26.1 Specification Reference

IEC 61097-2, clause A.2.6

2.26.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) - Modification State 2

2.26.3 Date of Test

11 January 2016

2.26.4 Test Equipment Used

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

2.26.5 Environmental Conditions

Ambient Temperature 8.3°C
Relative Humidity 77.6%

2.26.6 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 (Standby) and active (Operating) modes.



Product Service

2.26.7 Test Results

EUT in housing

Standard Compass safe distance (mm)	350
Emergency Compass safe distance (mm)	200

Horizontal maximum flux density, Magnetic North (H)	H	19.861
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	290	185	250	190	210	170 0.7° deflection
Top	280	200	280	180	260	190
Left Hand Side	170 0.2° deflection	170 0.2° deflection	290	170 0.6° deflection	305	170 0.6° deflection
Right Hand Side	170 0.2° deflection	170 0.2° deflection	205	170 0.5° deflection	170	170 0.3° deflection
Underside	240	170 0.7° deflection	185	170 0.5° deflection	170 0.2° deflection	170 0.2° deflection
Rear	250	180	265	190	240	200



Product Service

EUT standalone

Standard Compass safe distance (mm)	450
Emergency Compass safe distance (mm)	300

Horizontal maximum flux density, Magnetic North (H)	H	19.861
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	410	240	385	230	410	290
Top	390 to tip of antenna	280 to tip of antenna	440 to tip of antenna	270 to tip of antenna	420 to tip of antenna	260 to tip of antenna
Left Hand Side	320	170 0.8° deflection	260	170 0.7° deflection	175	170 0.4° deflection
Right Hand Side	410	205	390	205	435	290
Underside	170 0.2° deflection	170 0.2° deflection	170 0.1° deflection	170 0.1° deflection	245	170 0.5° deflection
Rear	170	170 0.3° deflection	170 0.2° deflection	170 0.2° deflection	170 0.1° deflection	170 0.1° deflection



Product Service

2.27 SOLAR RADIATION

2.27.1 Specification Reference

IEC 61097-2, clause A.2.7

Refer to Manufacturer waiver request - see Annex B.



Product Service

2.28 OIL RESISTANCE

2.28.1 Specification Reference

IEC 61097-2, clause A.2.8

Refer to Manufacturer waiver request - see Annex B.



Product Service

2.29 CORROSION

2.29.1 Specification Reference

IEC 61097-2, clause A.2.9

Refer to Manufacturer waiver request - see Annex B.



Product Service

2.30 SIGNAL LIGHT

2.30.1 Specification Reference

IEC 61097-2, clause A.2.10

Refer to Manufacturer waiver request - see Annex B.



Product Service

2.31 GNSS RECEIVER

2.31.1 Specification Reference

IEC 61097-2, clause A.2.11

Refer to Manufacturer supplied data - PE TC OMEGA Test Report No. 14/509, Aug 2014



Product Service

2.32 121.5 MHz HOMING DEVICE

2.32.1 Specification Reference

IEC 61097-2, clause A.2.12

2.32.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800002P (TUV Ref TSR0013) – Modification State 0

2.32.3 Date of Test

16 November 2015 & 17 November 2015

2.32.4 Test Equipment Used

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

2.32.5 Environmental Conditions

Ambient Temperature 21.6 - 23.7°C

Relative Humidity 25.2 - 56.5%

2.32.6 Test Results

Refer also to subcontractor (Hursley EMC) report 15R418 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	121.498435	n/a	121.498710

Transmitter Duty Cycle

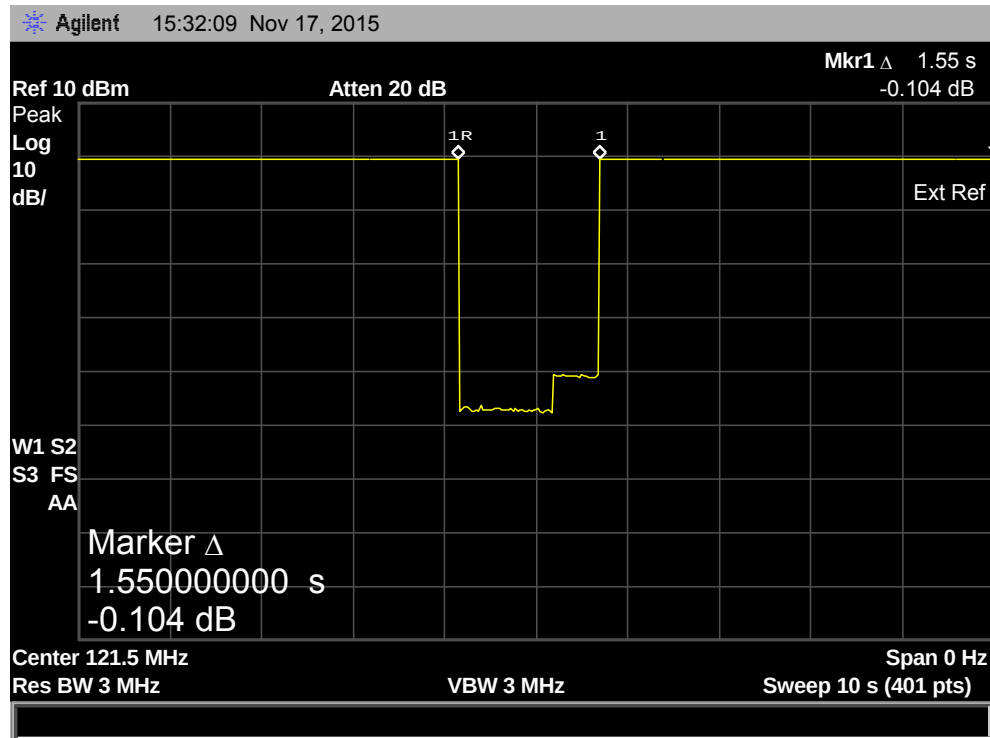
Note: Transmitter Duty Cycle = $\frac{\text{interval} - \text{duration}}{\text{interval}}$

Parameter	Units	Test Results		
		T _{min} (-20°C)	T _{amb}	T _{max} (+55°C)
121.5 MHz transmission interruption interval	seconds	51.60	n/a	51.45
121.5 MHz transmission interruption duration	seconds	1.55	n/a	1.525
Transmitter Duty Cycle	P/F	P	n/a	P

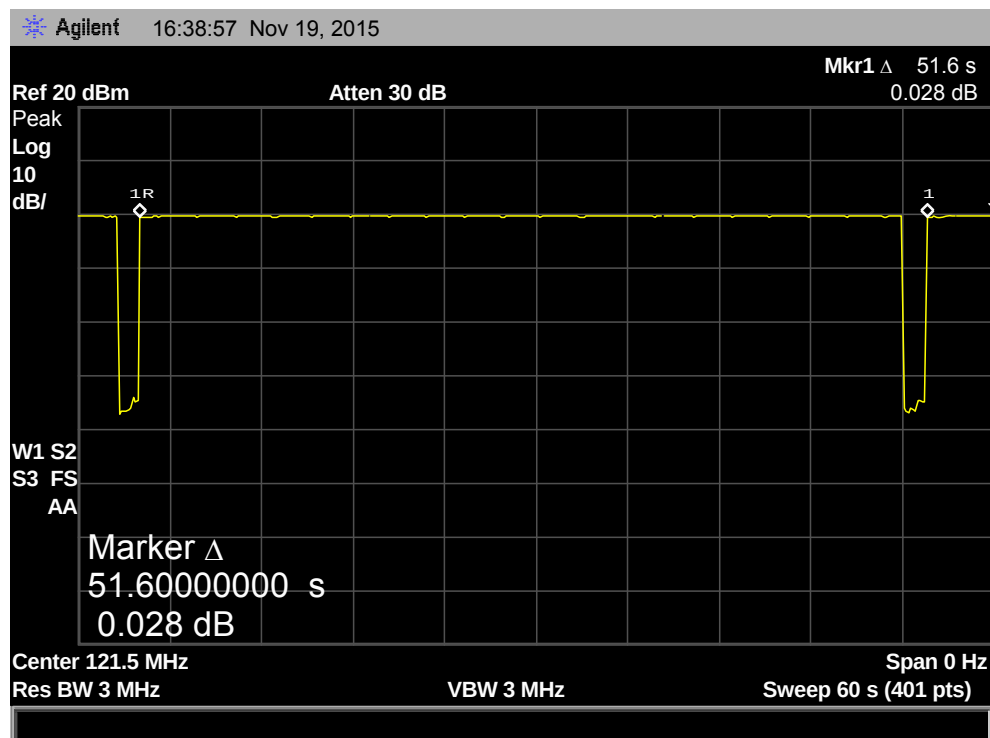


Product Service

Plot showing 121.5MHz interruption duration (Minimum Temperature)



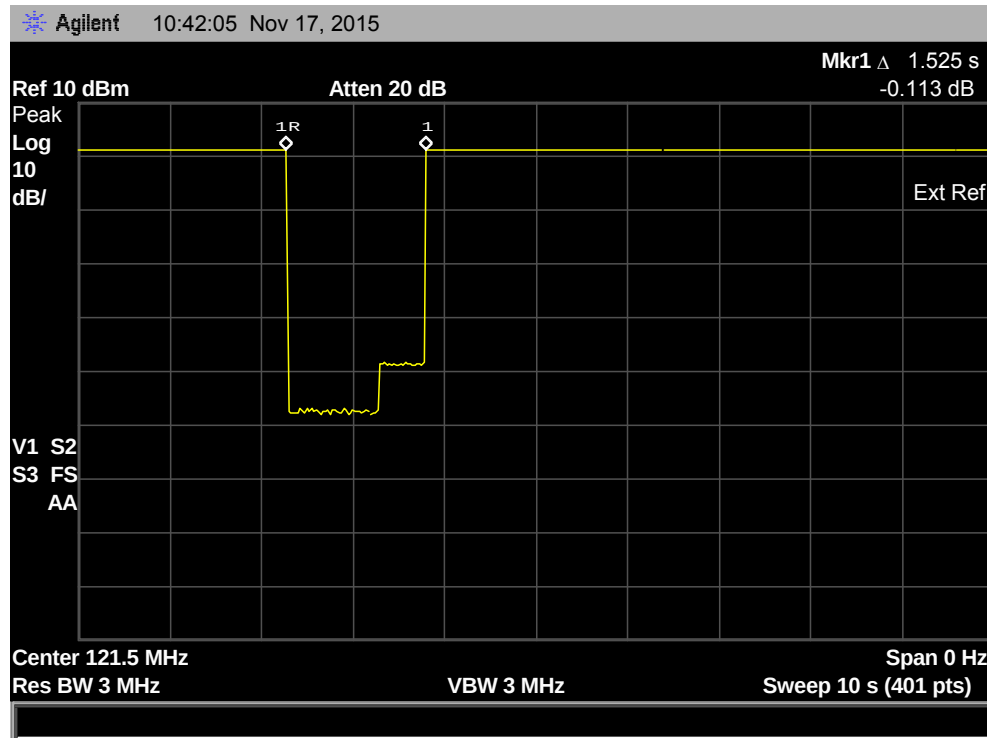
Plot showing 121.5MHz interruption interval (Minimum Temperature)



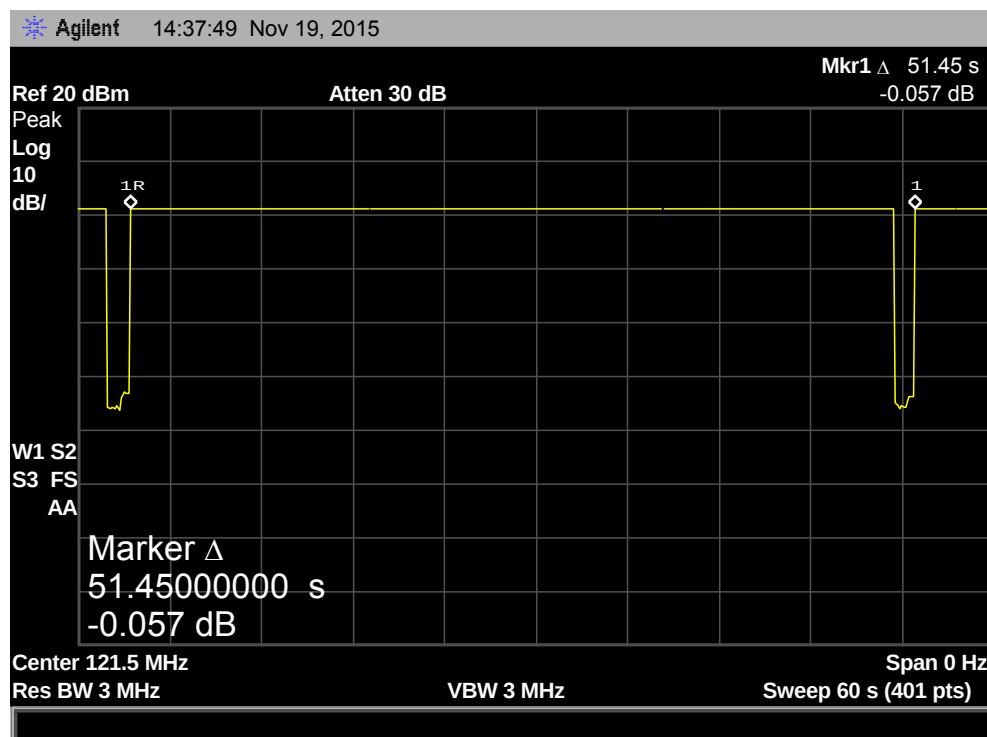


Product Service

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	733.2	n/a	762.6
Minimum Frequency	Hz	347.8	n/a	345.4
Maximum Frequency	Hz	1081	n/a	1108
Modulation Duty Cycle	%	38.4*	n/a	40.2*
Sweep repetition rate	sweeps per second	3.03	n/a	3.03

* Modulation Duty Cycle was measured near the beginning, middle and end of the audio sweep. Worst case figures shown.

Modulation Factor

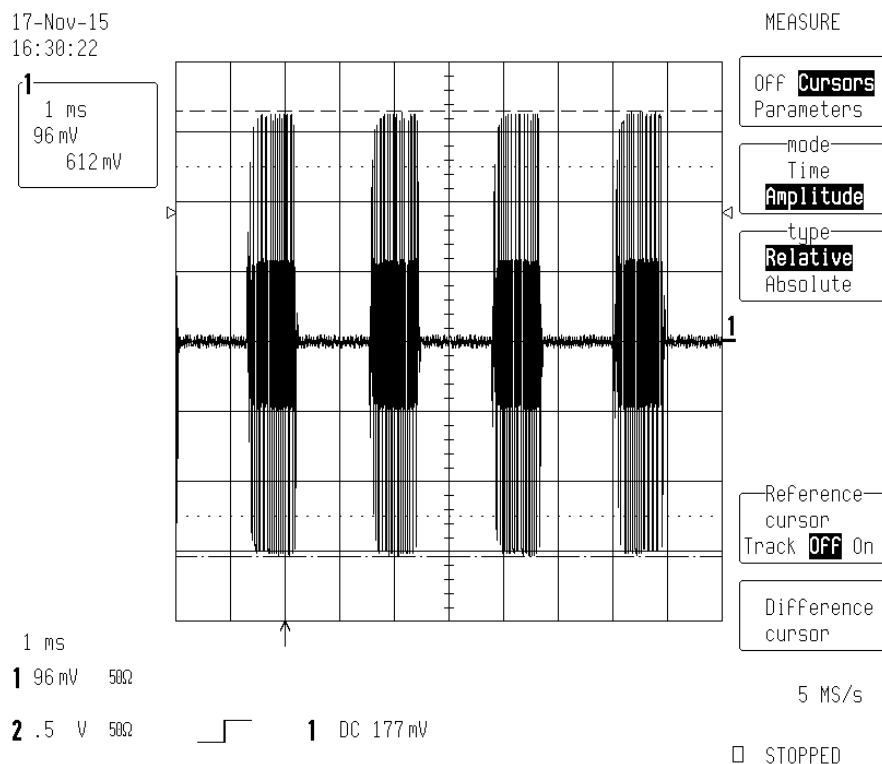
Note: Modulation Factor = (A - B) / (A + B)

Parameter	Units	Test Results		
		T _{min} (-20°C)	T _{amb}	T _{max} (+55°C)
A	mV	612	n/a	726
B	mV	21	n/a	36
Modulation Factor	(no units)	0.933	n/a	0.905

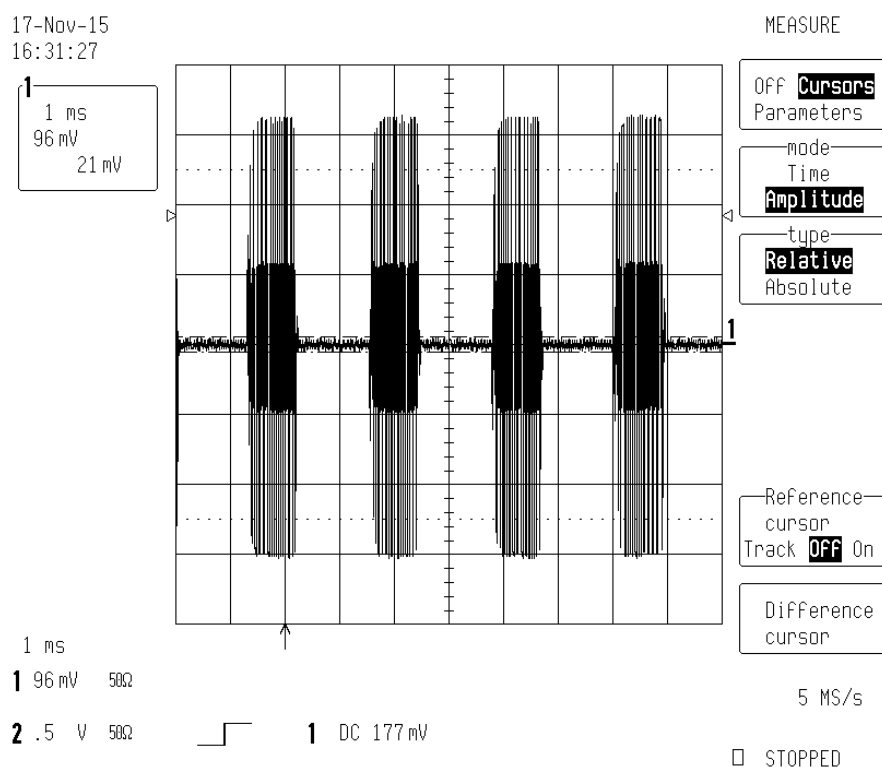


Product Service

Plot showing "A" at Minimum Temperature



Plot Showing "B" at Minimum Temperature



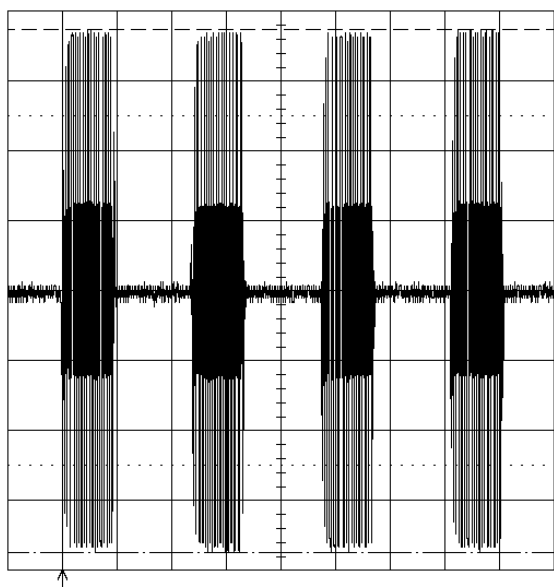


Product Service

Plot showing "A" Maximum Temperature

17-Nov-15
10:16:45

1
1 ms
97 mV
726 mV



1 ms
1 97 mV 50Ω

2 .5 V 50Ω



2 DC 0.00 V

MEASURE

OFF **Cursors**
Parameters

mode
Time
Amplitude

type
Relative
Absolute

Reference
cursor
Track **OFF** On

Difference
cursor

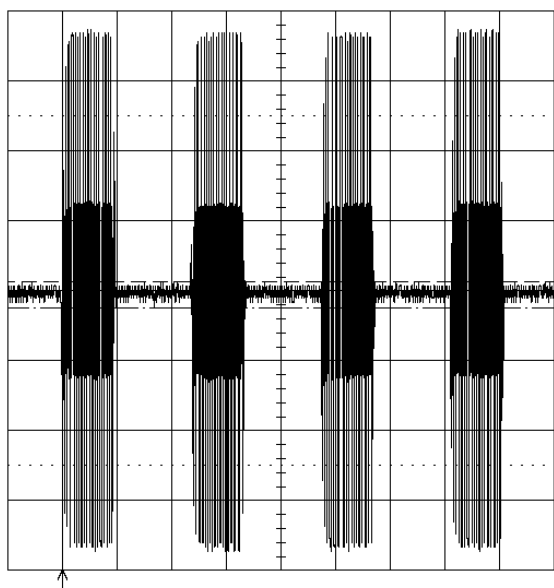
5 MS/s

□ STOPPED

Plot Showing "B" Maximum Temperature

17-Nov-15
10:17:41

1
1 ms
97 mV
36 mV



1 ms
1 97 mV 50Ω

2 .5 V 50Ω



2 DC 0.00 V

MEASURE

OFF **Cursors**
Parameters

mode
Time
Amplitude

type
Relative
Absolute

Reference
cursor
Track **OFF** On

Difference
cursor

5 MS/s

□ STOPPED

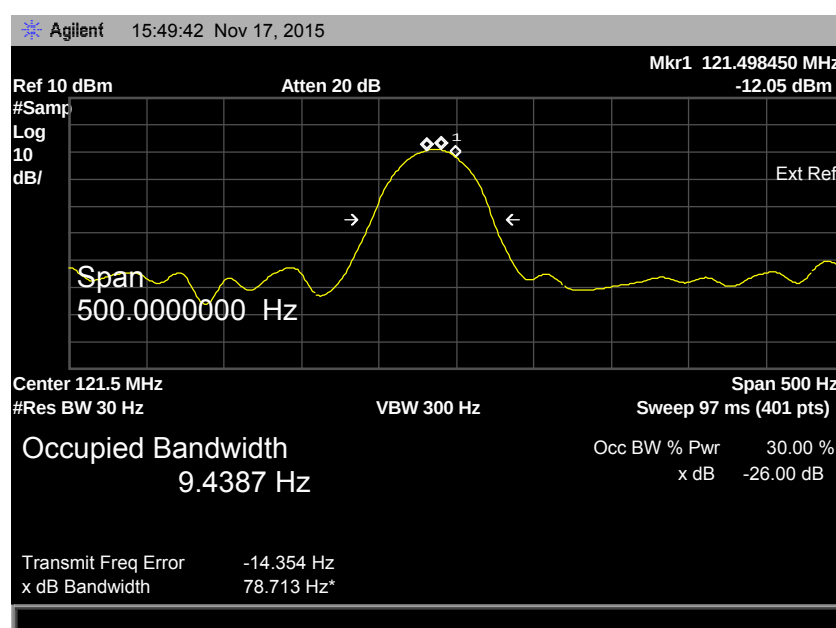


Product Service

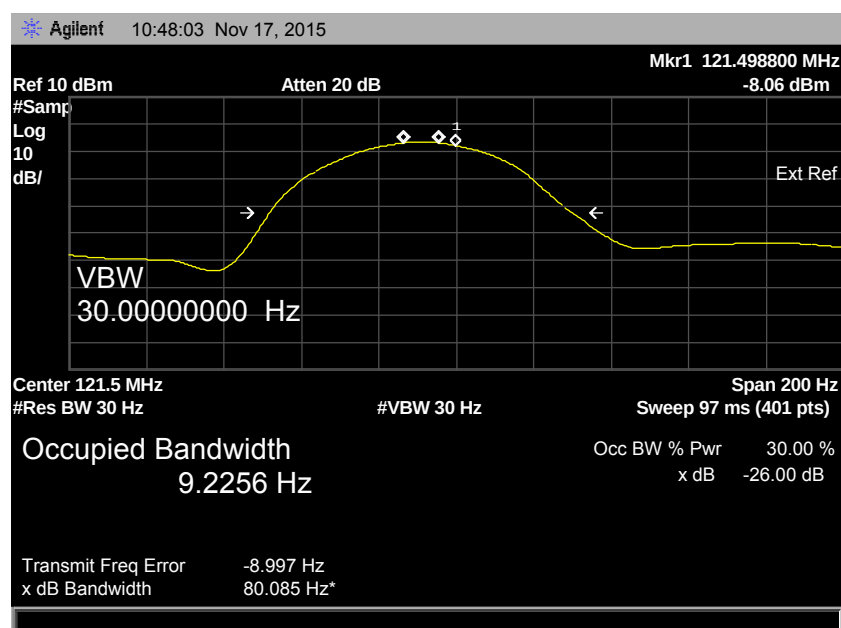
Modulation

Parameter	Limit	Units	Test Results		
			T _{min} (-20°C)	T _{amb}	T _{max} (+55°C)
30% Power Bandwidth (Hz)	±30Hz	Hz	9.43	n/a	9.22
Frequency Shift	±30Hz	Hz	2	n/a	6

30% Power Bandwidth Plot for Minimum Temperature



30% Power Bandwidth Plot for Maximum Temperature

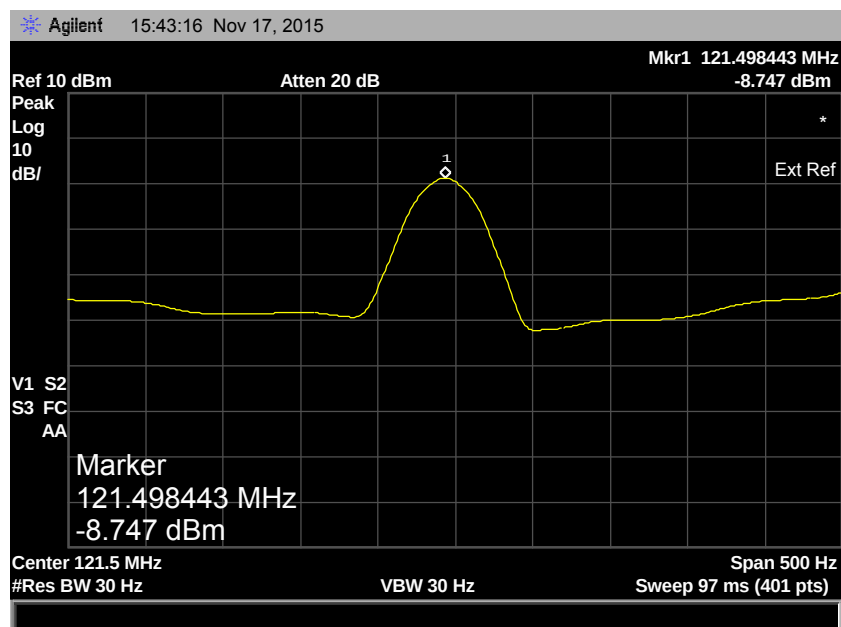




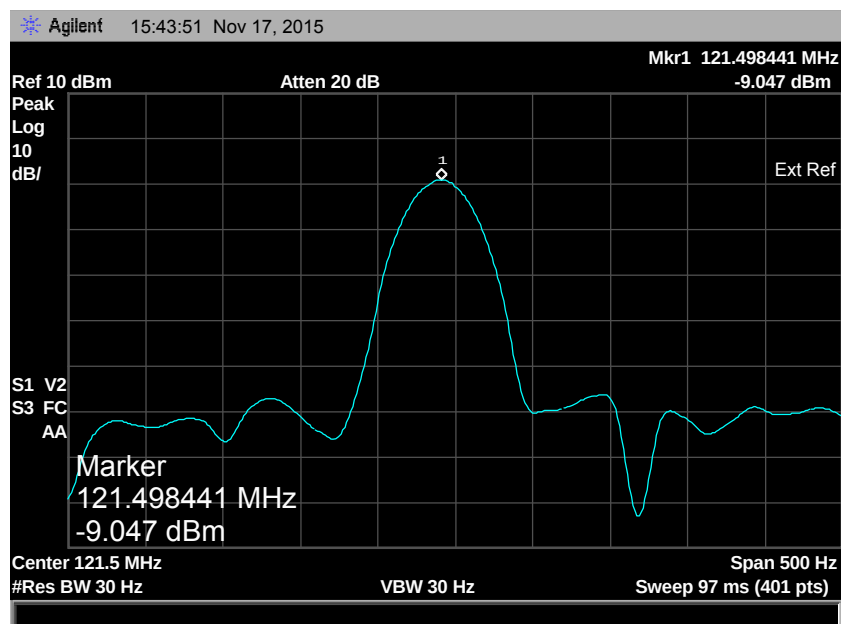
Product Service

Frequency Shift Plot for Minimum Temperature

Plot A



Plot B

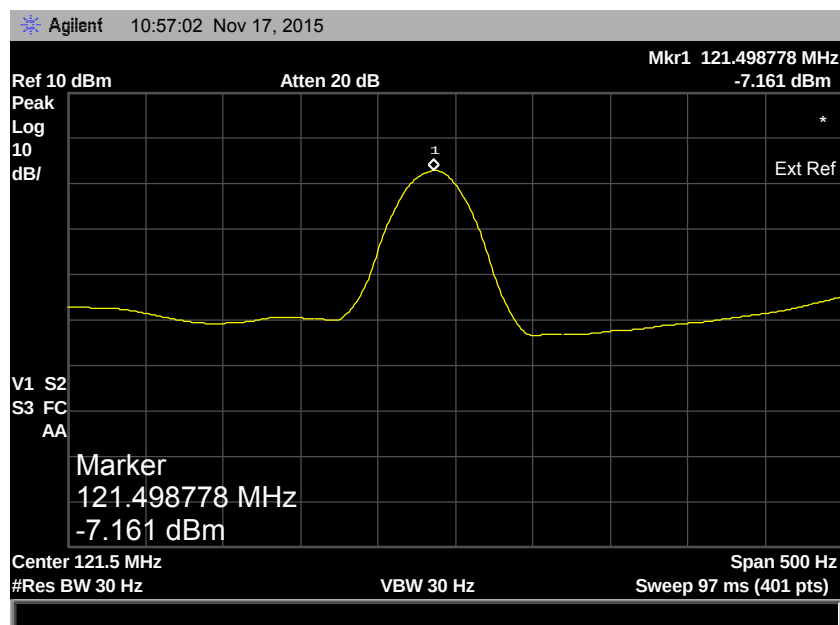




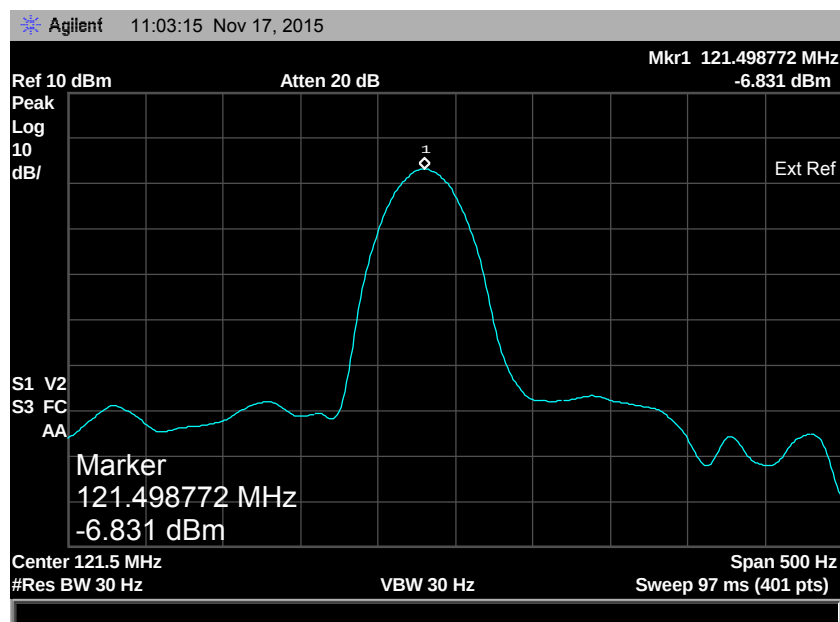
Product Service

Frequency Shift Plot for Maximum Temperature

Plot A



Plot B



Plot A above, is a Max Hold trace of the 121 transmission for approximately 40 seconds (excluding the 406 interval).

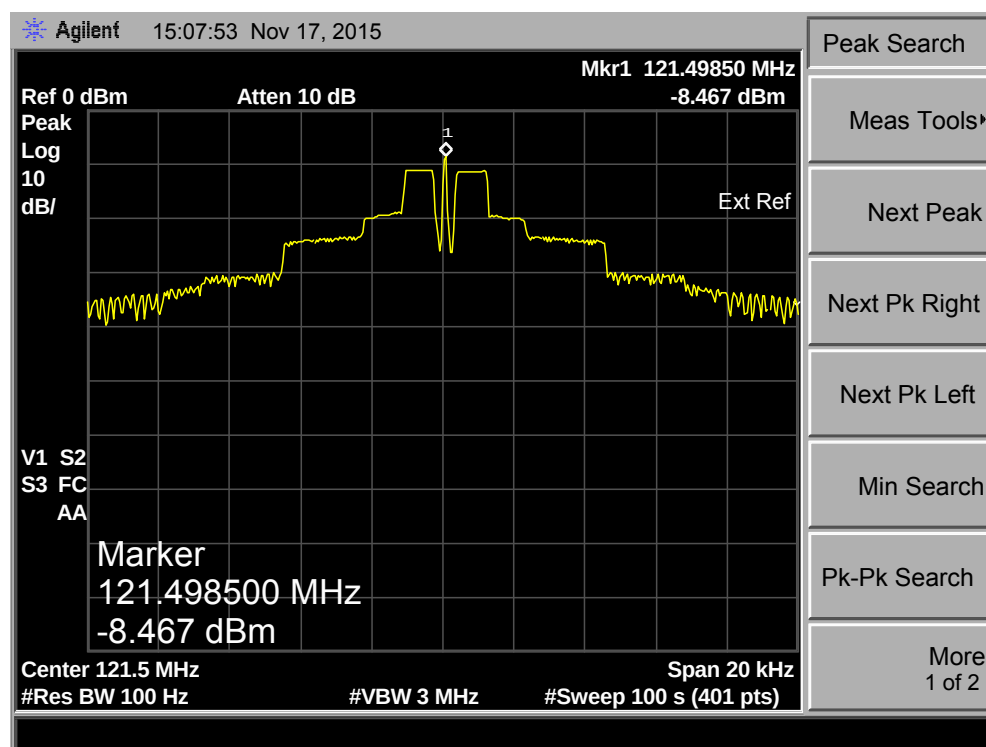
Plot B is an instantaneous measurement of the 121 transmission immediately after the 406 interval.



Product Service

Emission Characteristic

Minimum temperature



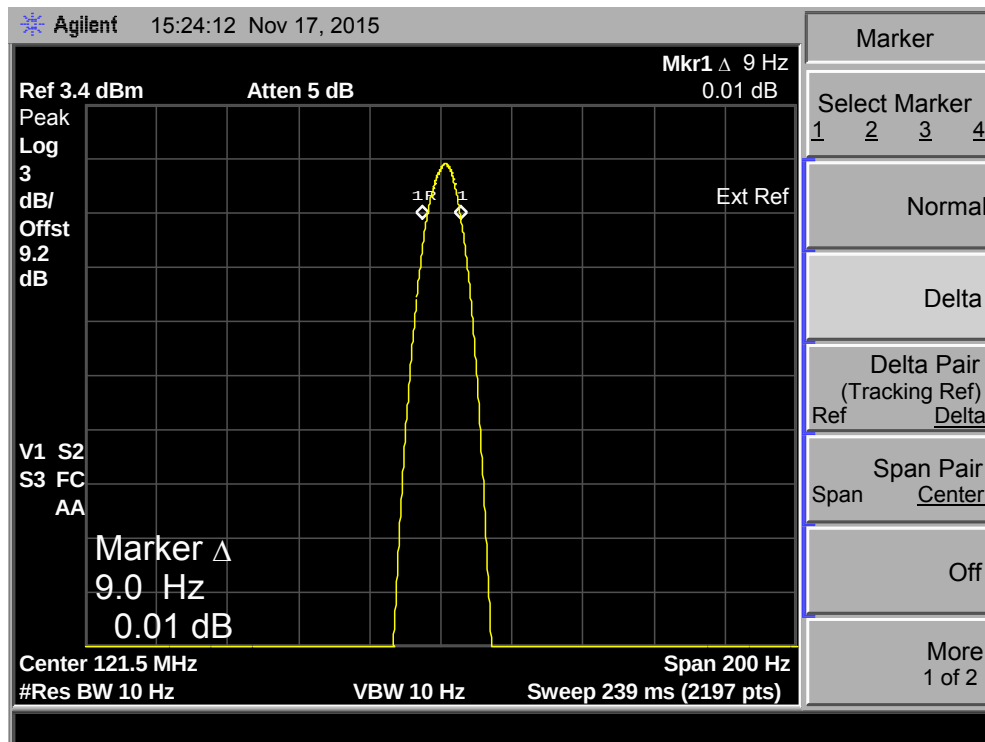
		dBm	Volts	Volts^2
Carrier	Peak	-8.467	3.773	14.233
Sideband 1	Lower	-11.1	2.786	7.762
	Upper	-11.26	2.735	7.482
Sideband 2	Lower	-19	1.122	1.259
	Upper	-19.53	1.056	1.114
Sideband 3	Lower	-23.32	0.682	0.466
	Upper	-23.36	0.679	0.461
Sideband 4	Lower	-29.99	0.317	0.100
	Upper	-30.04	0.315	0.099
Sideband 5	Lower	-32.5	0.237	0.056
	Upper	-32.4	0.240	0.058
	Result	0.430	Limit	
	Result %	43.0%	≥30%	

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

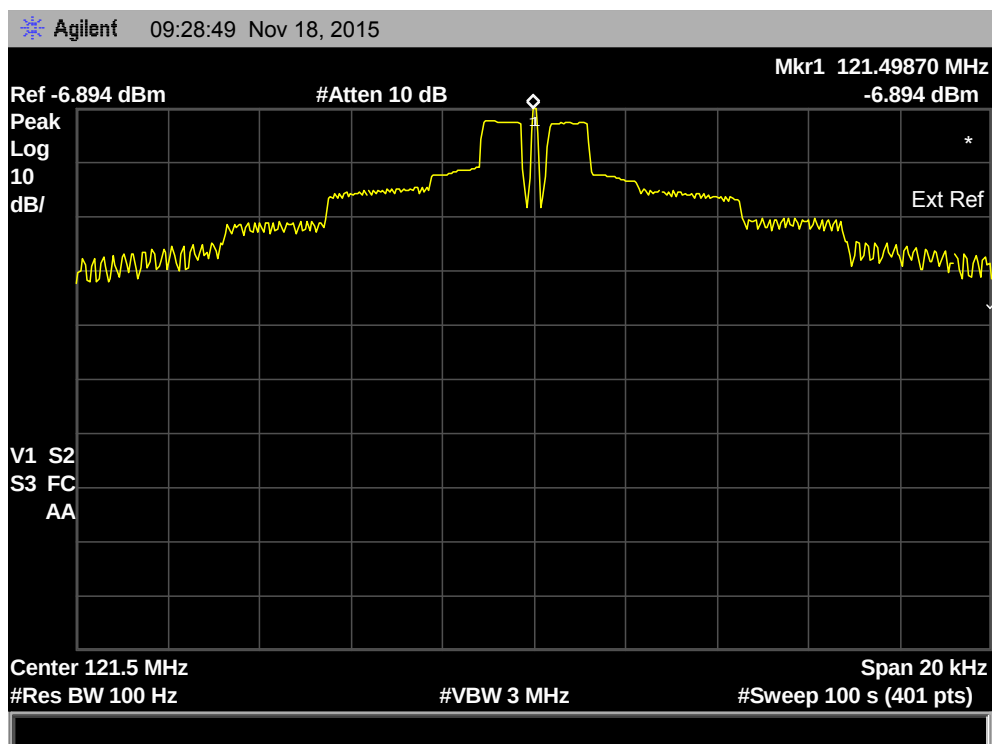


Product Service

3dB Bandwidth



Maximum Temperature



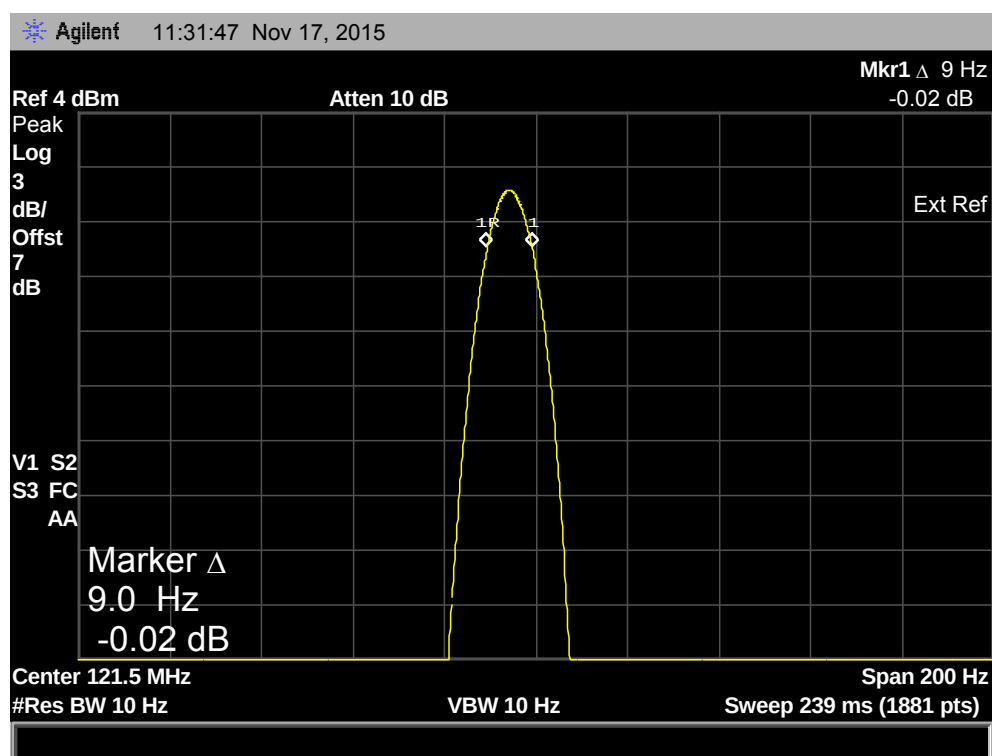


Product Service

		dBm	Volts	Volts^2
Carrier	Peak	-6.894	4.522	20.446
Sideband 1	Lower	-9.208	3.464	12.001
	Upper	-9.504	3.348	11.210
Sideband 2	Lower	-18.08	1.247	1.556
	Upper	-19.04	1.117	1.247
Sideband 3	Lower	-21.42	0.849	0.721
	Upper	-22.13	0.783	0.612
Sideband 4	Lower	-27.18	0.438	0.191
	Upper	-27.72	0.411	0.169
Sideband 5	Lower	-31.87	0.255	0.065
	Upper	-31.52	0.265	0.070
	Result	0.423	Limit	
	Result %	42.3%	≥30%	

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

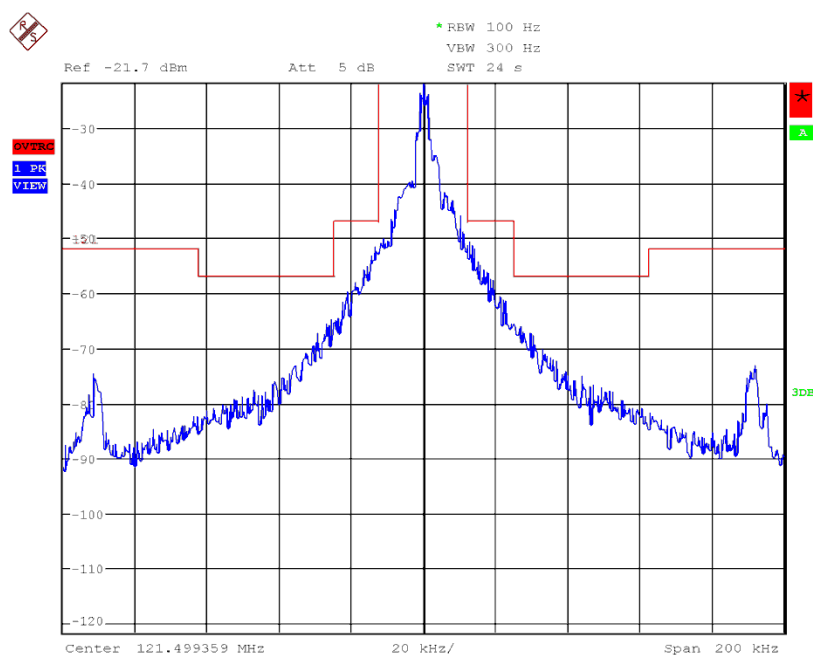
3dB Bandwidth



Spurious Emissions

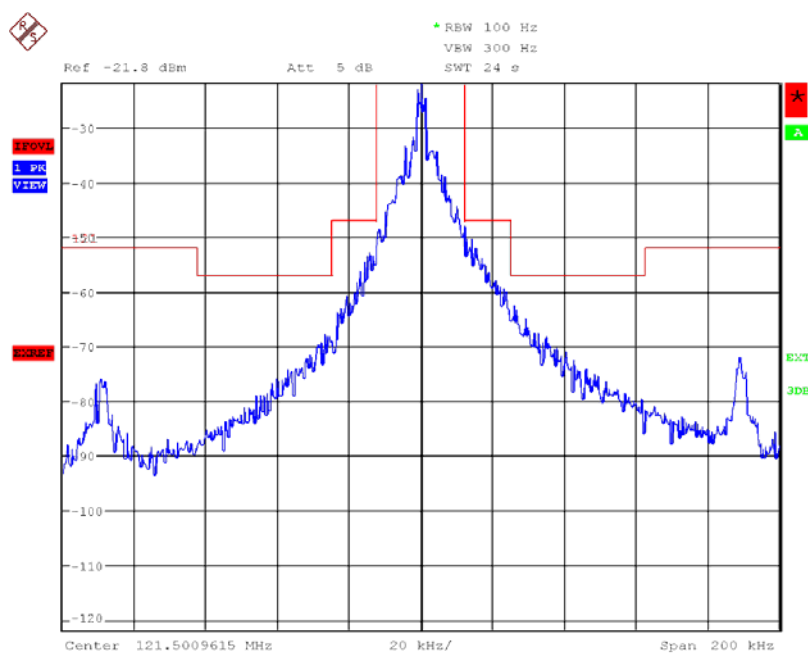
Minimum Temperature

Close-In emissions



Maximum Temperature

Close-In emissions





Product Service

2.33 TEST TO PREVENT RELEASE WHEN WATER WASHES OVER THE UNIT (HOSE STREAM) (NUA)

2.33.1 Specification Reference

IEC 61097-2, clause A.2.1 (5.5.1.1)

2.33.2 Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P (TUV Ref TSR0003) – Modification State 3

2.33.3 Date of Test

12 February 2016

2.33.4 Test Equipment Used

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

2.33.5 Test Setup



2.33.6 Test Method

The EUT was fixed via the float free housing and fixed to a test rig ready for the water test. The water spray (measured at approximately 2400 l/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

2.33.7 Test Results

Float free Housing

All faces: No visible damage to enclosure which remained closed throughout test. No visual activation of beacon.



Product Service

SECTION 3

TEST EQUIPMENT



3.1 TEST EQUIPMENT

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

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.32 Beacons - 121 Emission Characteristics					
Climatic Chamber	Heraeus Votsch	VMT 04/30	40	-	O/P Mon
Digital Temperature Indicator + T/C	Fluke	51	412	12	19-Feb-2016
Hygrometer	Rotronic	A1	2677	12	11-Jun-2016
Oscilloscope	Lecroy	9370	2832	12	27-Oct-2016
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	9-Jun-2016
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	7-Sep-2016
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4513	12	29-Jan-2016
Section 2.13 Beacons - Constant Temperature Tests					
Power Meter	Hewlett Packard	436A	83	12	7-Sep-2016
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	11-Feb-2016
Signal Generator	Hewlett Packard	8644A	96	12	23-Apr-2016
Beacon RF Unit	TUV SUD Product Service	N/A	97	-	TU
Time Interval Analyser	Yokogawa	TA720	181	12	24-Apr-2016
Termination (50ohm)	Diamond Antenna	DL-30N	219	12	3-Nov-2015
Termination (50ohm)	Diamond Antenna	DL-30N	226	12	6-Feb-2016
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	18-Nov-2015
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	9-Apr-2016
Hygrometer	Rotronic	A1	2677	12	11-Jun-2016
Hygrometer	Rotronic	I-1000	2829	12	27-Oct-2015
Beacon RF Unit	TUV SUD Product Service	N/A	3066	-	TU
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	29-Jun-2016
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	3-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	27-Oct-2016
Bandpass filter	Trilithic	5BE406/35-1-AA	3206	12	14-Sep-2016
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	12	17-Sep-2016
Short Circuit	TUV SUD Product Service	Short Circuit	3272	-	TU
Power Sensor	Agilent Technologies	8482A	3289	12	16-Jan-2016
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	7-Sep-2016
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	30-Apr-2016
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	8-Apr-2016



ScopeCorder	Yokogawa	DL750	4175	12	28-Jan-2016
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	4513	12	29-Jan-2016
Time Interval Analyser	Yokogawa	TA720	4550	12	4-Mar-2016
Oscilloscope	Yokogawa	DL750	4552	12	26-Mar-2016
Bandpass Filter (1MHz)	KR Electronics	3219-SMA	4600	12	10-Jul-2016
Section 2.13 Beacons - Operating Lifetime					
Power Meter	Hewlett Packard	436A	47	12	14-Jul-2016
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
Digital Temperature Indicator + T/C	Fluke	51	412	12	19-Feb-2016
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	9-Apr-2016
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	14-Aug-2016
Hygrometer	Rotronic	A1	2677	12	11-Jun-2016
Beacon RF Unit	TUV SUD Product Service	N/A	3066	-	TU
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
Bandpass filter	Trilithic	5BE406/35-1-AA	3206	12	14-Sep-2016
Beacon Tester	WS Technologies	BT100S	3263	-	TU
Power Sensor	Agilent Technologies	8482A	3290	12	16-Jan-2016
Bandpass Filter	Trilithic	5BE121.55/35-3-BA	3410	12	14-Sep-2016
ScopeCorder	Yokogawa	DL750	4175	12	28-Jan-2016
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4510	12	21-May-2016
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4512	12	29-Jan-2016
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4519	12	29-Jan-2016
Section 2.13 Beacons - Satellite Qualitative Test					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Copper GRP	TUV SUD Product Service	27cm Diameter	3538	-	TU
Humidity & Temperature Meter	Radio Spares	1361C	4420	12	20-May-2016
Section 2.11 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
Hygrometer	Rotronic	I-1000	2829	12	27-Oct-2015
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	3-Jun-2016
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	18-Nov-2015
Bandpass filter	Trilithic	5BE406/35-1-AA	3206	12	14-Sep-2016



ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	7-Sep-2016
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4509	12	20-May-2016
Section 2.9 Beacons - Thermal Shock					
Power Meter	Hewlett Packard	436A	83	12	7-Sep-2016
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	11-Feb-2016
Time Interval Analyser	Yokogawa	TA720	181	12	24-Apr-2016
Digital Temperature Indicator + T/C	Fluke	51	412	12	19-Feb-2016
Signal Generator (100kHz to 2.6GHz)	Hewlett Packard	8663A	1063	12	9-Apr-2016
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	14-Aug-2016
Hygrometer	Rotronic	I-1000	2829	12	27-Oct-2015
Beacon RF Unit	TUV SUD Product Service	N/A	3066	-	TU
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	3-Jun-2016
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	18-Nov-2015
Bandpass filter	Trilithic	5BE406/35-1-AA	3206	12	14-Sep-2016
Power Sensor	Agilent Technologies	8482A	3289	12	16-Jan-2016
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3354	12	30-Apr-2016
ScopeCorder	Yokogawa	DL750	4175	12	28-Jan-2016
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4509	12	20-May-2016
Section 2.2 Climatic - High Temperature (Functional)					
Power Meter	Hewlett Packard	436A	47	12	14-Jul-2016
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Signal Generator	Hewlett Packard	8644A	96	12	23-Apr-2016
Chamber	Heraeus	HC 4033	2174	12	8-Jun-2016
Distress Beacon RF Unit	TUV SUD Product Service	-	2445	-	TU
Termination (50ohm, 6W)	Micronde	R404613	3074	12	27-Mar-2016
Termination (50ohm, 2W)	Omni-Spectra	3001-6100	3081	12	27-Mar-2016
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	12	29-Jun-2016
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	9-Jun-2016
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	1-Oct-2015
Bandpass Filter	Trilithic	5BE406/35-1-AA	3205	12	1-Oct-2015
Time Interval Analyser	Yokogawa	TA720 704510	3253	12	11-Nov-2015
ScopeCorder	Yokogawa	DL750 701210	3254	12	10-Nov-2015
Power Sensor	Agilent Technologies	8482A	3290	12	16-Jan-2016
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	7-Sep-2016
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	3-Dec-2015



Product Service

Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3357	12	30-Apr-2016
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	3-Dec-2015
Rubidium Frequency Standard	Symmetricon	8040C	3490	12	8-Apr-2016
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	19-Aug-2016
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4510	12	21-May-2016
Bandpass Filter (1MHz)	KR Electronics	3219-SMA	4601	12	10-Jul-2016
2 metre N-Type Cable	Florida Labs	NMS-235SP-78.8-NMS	4622	12	12-Aug-2016
Section 2.2 Climatic - High Temperature (Storage)					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Chamber	Heraeus	HC 4033	2174	12	8-Jun-2016
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	9-Jun-2016
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	7-Sep-2016
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	3-Dec-2015
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	3-Dec-2015
Section 2.3 Climatic - Humidity					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Chamber	Heraeus	HC 4033	2174	12	8-Jun-2016
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	9-Jun-2016
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	7-Sep-2016
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3356	12	3-Dec-2015
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3358	12	3-Dec-2015
Section 2.9 Climatic - Thermal Shock					
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	11-Feb-2016
Thermometer	Digitron	T208	2340	12	22-Oct-2016
Climatic Chamber	Climatec	Climatec 2	2845	12	5-Jan-2016
Climatic Chamber	Climatec	Drive-In	2848	12	27-Jan-2016
50 Litre Container	TUV SUD Product Service	n/a	4028	-	TU
Type T PFA Insulated Thermocouple	TC Limited	Type T	4229	12	28-Jan-2016
Section 2.21 & 2.22 Climatic – Automatic Release Mechanism					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Rubidium Frequency Standard	Quartzlock	A10-B	92	12	11-Feb-2016
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	14-Aug-2016
Over Pressure (T)	ASL (TUV)	0 TO 15 PSI	2125	-	TU
Temperature Chamber	Instron	906	2128	12	17-Oct-2016
Pressure Indicator	Druck	DPI 700	2343	12	23-Dec-2015
Stop Watch	Radio Spares	Model 694 (974)	4025	0	7-Sep-2016
50 Litre Container	TUV SUD Product Service	n/a	4028	-	TU
Tape Measure	Stanley	Powerlock 33-443	4305	-	TU



Product Service

Bench Scales	Kern-Sohn	CKE16K0.05	4647	12	2-Oct-2016
Section 2.26 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 and 2.7 ENV – Drop onto Hard Surface					
Hardwood Block	Unknown	ELM	2650	-	TU
Beacon Tester	WS Technologies	BT100S	3263	-	TU
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	7-Sep-2016
10 meter Tape Measure	Stanley	Fatmax 10m/33'	4072	-	TU
Section 2.8 ENV – Drop into Water					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Hygrometer	Radio Spares	1361C	4420	12	20-May-2016
Bomb Release	MOD	-	3667	-	TU
Section 2.11 Radio - Conducted Spurious Emissions					
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Termination (50ohm)	Diamond Antenna	DL-30N	226	12	6-Feb-2016
Digital Temperature Indicator + T/C	Fluke	51	412	12	19-Feb-2016
Low Pass Filter	Mini-Circuits	NLP-300	1636	12	21-Oct-2016
Hygrometer	Rotronic	A1	2677	12	11-Jun-2016
Filter (Hi Pass)	Mini-Circuits	NHP-600	2834	12	21-Oct-2016
Rubidium Frequency Standard	Symmetricom	8040C	3490	12	8-Apr-2016
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	19-Aug-2016
DC - 8 GHz Attenuator	Lucas Weinschel	24-30-33	3963	12	29-Jun-2016
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4513	12	29-Jan-2016
2 metre SMA Cable	Florida Labs	SMS-235SP-78.8-SMS	4517	12	29-Jan-2016
Section 2.4 and 2.5 Vibration and Ruggedness					
Programmable Power Supply	Iso-tech	IPS 2010	2436	-	O/P Mon
Charge Amplifier	Endevco	133	2506	12	28-Nov-2015
Charge Amplifier	Endevco	133	2593	12	16-Feb-2016
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	9-Jun-2016
Vibration System	Ling Dynamic Systems	875	3170	6	25-Mar-2016
Beacon Tester	WS Technologies	BT100S	3263	-	TU
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	7-Sep-2016
Isotron Accelerometer	Endevco	256-10	3376	6	15-Jan-2016
Isotron Accelerometer	Endevco	256-10	3381	6	6-Jan-2016
Vibration Controller	m + p International	Vibpilot 8	3772	12	4-Sep-2016
Isotron Accelerometer	Endevco	256-10	3789	6	7-Jan-2016
Accelerometer	Meggitt Endevco	256-10	4306	6	27-Oct-2015



Section 2.4 and 2.5 Vibration and Ruggedness					
Programmable Power Supply	Iso-tech	IPS 2010	2436	-	O/P Mon
Charge Amplifier	Endevco	133	2506	12	28-Nov-2015
Charge Amplifier	Endevco	133	2593	12	16-Feb-2016
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3160	12	9-Jun-2016
Vibration System	Ling Dynamic Systems	875	3170	6	25-Mar-2016
Beacon Tester	WS Technologies	BT100S	3263	-	TU
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	7-Sep-2016
Isotron Accelerometer	Endevco	256-10	3376	6	15-Jan-2016
Isotron Accelerometer	Endevco	256-10	3381	6	6-Jan-2016
Vibration Controller	m + p International	Vibpilot 8	3772	12	4-Sep-2016
Isotron Accelerometer	Endevco	256-10	3789	6	7-Jan-2016
Accelerometer	Meggitt Endevco	256-10	4306	6	27-Oct-2015
Section 2.4 and 2.5 Vibration and Ruggedness					
Vibration System	Ling Dynamic Systems	LDS V964	2515	6	2-Dec-2015
Charge Amplifier	Endevco	133	2593	12	16-Feb-2016
Programmable Power Supply	Elgar	SW10500	3372	-	TU
Isotron Accelerometer	Endevco	256-10	3376	6	15-Jan-2016
Isotron Accelerometer	Endevco	256-10	3381	6	6-Jan-2016
Isotron Accelerometer	Endevco	256-10	3789	6	7-Jan-2016
Accelerometer	Meggitt Endevco	256-10	4306	6	27-Oct-2015
Section 2.16 EMC - Conducted Emissions					
3 phase LISN	Rohde & Schwarz	ESH2-Z5	323	12	22-Mar-2016
LISN (1 Phase)	Chase	MN 2050	336	12	1-Apr-2016
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Transient Limiter	Hewlett Packard	11947A	2378	12	1-Jul-2016
Compliance 5 Emissions	Schaffner	C5e Software V.5.00.00	3275	-	N/A - Software
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	2-Nov-2016
Section 2.17, 2.18, 2.19 EMC - Conducted Immunity					
RF Generator + Attenuator	Schaffner	NSG2070-400	222	12	20-Jan-2016
Calibration Fixture (x2)	MEB Messelektronik	KEMZ-801	229	-	TU
Termination (50ohm)	Diamond Antenna	DL-30N	341	12	23-Dec-2015
Attenuator (10dB/250W)	Weinschel	45-10-43	477	12	30-Jun-2016
Attenuator 6dB	Advance	10023-6/MF	1539	12	27-Oct-2016
EM Clamp	Teseq	KEMZ 801S	3373	-	TU
Termination (50ohm)	Weinschel	1426-4	4323	12	17-Jun-2016
Sensor Probe	Teseq	CSP 9160A	4425	12	30-Jul-2016
Section 2.15 EMC - Electrostatic Discharges					
Spectrum Analyser	Hewlett Packard	8562A	2044	12	18-Feb-2016
ESD Gun	Schloder	SESD 30000	4319	12	20-Oct-2016
Section 2.19 EMC - Fast Transient Bursts					
Immunity Test Set	Schaffner	BEST EMC V2.7	295	12	23-Feb-2016
Capacitive Coupling Clamp	Omiran	EFTC 105	298	12	20-Feb-2016



Product Service

Section 2.14 EMC - Radiated Immunity					
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Directional Coupler	Amp Research	DC6180	283	-	TU
Antenna	Schaffner	CBL6143	322	-	TU
Termination (50ohm)	Diamond Antenna	DL-30N	338	12	9-Dec-2015
Power Meter	Rohde & Schwarz	NRVD	748	-	TU
Spectrum Analyser	Hewlett Packard	8562A	1001	12	17-Nov-2015
Screened Room (2)	Rainford	Rainford	1542	-	TU
Power Supply	Farnell	H60-25	1844	-	TU
CW TWT (1-2.5GHz)	Thorn	PTC6341	2069	-	TU
Laser Powered Electric Field Sensor	Dare Development	RadiSense VI - CTR1001A	2149	12	11-Mar-2016
RF Power Amplifier	Amp Research	250W1000A	2844	-	TU
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Beacon Tester	WS Technologies	BT100S	3263	-	TU
Signal Generator, 9kHz to 6GHz	Rohde & Schwarz	SMB 100A	3499	12	2-Jun-2016
500W; CW TWT (1-2.5GHz)	TMD Technologies Ltd	PTC6440	3736	-	TU
Power Sensor: 100kHz - 6GHz/100pW - 20mW	Rohde & Schwarz	NRV-Z4	3816	-	TU
Section 2.33 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



Conducted Sample



Float Free Housing View 1



Float Free Housing View 2



Compass Safe Distance Test (EUT in housing)



Compass Safe Distance Test (EUT standalone)



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
(Not UKAS Accredited).

This report must not be reproduced, except in its entirety, without the written permission of
TÜV SÜD Product Service

© 2016 TÜV SÜD Product Service



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: SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0							
Transmitter power output	(maximum)	35 - 39	dBm	-	37.02	-	
	(minimum)			-	36.99	-	
Power output rise time	(maximum)	< 5	ms	-	0.51	-	
	(minimum)			-	0.49	-	
Power output 1ms before burst	(maximum)	< -10	dBm	-	-18.21	-	
	(minimum)			-	-18.86	-	
2. Digital Message Coding						Result: Pass	
Model: SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - 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: SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0						
Repetition rate, T _R :						
Average T _R	48.5 ≤ T _{Ravg} ≤ 51.5	seconds	-	49.648	-	
Minimum T _R	47.5 ≤ T _{Rmin} ≤ 48.0	seconds	-	47.705	-	
Maximum T _R	52.0 ≤ T _{Rmax} ≤ 52.5	seconds	-	52.214	-	
Standard deviation	0.5 - 2.0	seconds	-	1.59	-	
Bit rate						
Minimum fb	≥ 396	bits/sec	-	400.12	-	
Maximum fb	≤ 404	bits/sec	-	400.11	-	
Total transmission time						
Short message	(maximum)		-	n/a	-	
	(minimum)	435.6 - 444.4	ms	-	n/a	-
Long message	(maximum)		-	518.89	-	
	(minimum)	514.8 - 525.2	ms	-	518.81	-
Unmodulated carrier						
Minimum T1	≥ 158.4	ms	-	160.03	-	
Maximum T1	≤ 161.6	ms	-	159.95	-	
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: SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0						
Biphase-L	P / F	P / F	-	P	-	
Rise time (maximum)	50 - 250	µs	-	154.4	-	
(minimum)	50 - 250	µs	-	142.3	-	
Fall time (maximum)	50 - 250	µs	-	167.6	-	
(minimum)	50 - 250	µs	-	154.6	-	
Phase deviation: positive (maximum)	+(1.0 to 1.2)	radians	-	1.1450	-	
(minimum)	+(1.0 to 1.2)	radians	-	1.0626	-	
Phase deviation: negative (maximum)	-(1.0 to 1.2)	radians	-	-1.1599	-	
(minimum)	-(1.0 to 1.2)	radians	-	-1.0789	-	
Symmetry measurement	≤ 0.05		-	0.0222	-	
5. 406 MHz Transmitted Frequency						Result: Pass
Model: SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0						
Nominal Value (maximum)	C/S T.001	MHz	-	406.0399537	-	
(minimum)			-	406.0399532	-	
Short-term stability (maximum)	≤ 2x10 ⁻⁹	/100ms	-	80.670E-12	-	
(minimum)			-	70.624E-12	-	
Medium-term stability – Slope (maximum)	(-1 to +1)x10 ⁻⁹	/minutes	-	19.358E-11	-	
(minimum)			-	13.598E-11	-	
Medium-term stability – Residual frequency variation (maximum)	≤ 3x10 ⁻⁹		-	23.829E-11	-	
(minimum)			-	13.815E-11	-	
6. Spurious Emissions into 50ohms						Result: Pass
Model: SafeSEA E101V, 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: SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0						
Nominal transmitted frequency	C/S T.001	MHz	-	406.0399561	-	
Modulation rise time (maximum)	50-250	µs	-	154.3	-	
(minimum)	50-250	µs	-	142.4	-	
Modulation fall time (maximum)	50-250	µs	-	165.7	-	
(minimum)	50-250	µs	-	155.6	-	
Modulation phase deviation: (maximum)	+ (1.0 to 1.2)	radians	-	1.1546	-	
positive (minimum)	+ (1.0 to 1.2)	radians	-	1.0677	-	
Modulation phase deviation: (maximum)	- (1.0 to 1.2)	radians	-	-1.1536	-	
negative (minimum)	- (1.0 to 1.2)	radians	-	-1.0713	-	
Modulation symmetry measurement	≤ 0.05		-	0.0234	-	
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: SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0						
Frame sync	011010000	P / F	-	P	-	Self Test initiation is indicated by 3 red LED flashes. The manufacturer's operating manual states that the strobe light indicated that RF power has been emitted At Ambient, High and Low temperatures, the Self Test result returned six Amber LED flashes, indicating that the EUT had been previously activated for over 10 hours.
Format flag	1 / 0	bit value	-	1	-	
Single radiated burst	≤440 / 520 (±1%)	ms	-	519.002	-	
Default position data (if applicable)	correct	P / F	-	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	-	13	-	
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: SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0						
Frame sync	011010000	P / F	n/a	n/a	n/a	The EUT does not transmit a 406 burst during a GNSS Self-Test. LED indication only.
Format flag	1 / 0	bit value	n/a	n/a	n/a	
Single radiated burst	≤ 520 (+1%) must be within 500m (or 5.25km for User Location Protocol) of the actual position	ms	n/a	n/a	n/a	
Position data (if applicable)		P / F	n/a	n/a	n/a	The EUT does not transmit a 406 burst during a GNSS Self-Test. LED indication only.
Design data showing how GNSS Self-test is limited in number of transmissions and duration	provided	Y / N		Y		
Single burst verification	one burst	P / F	n/a	n/a	n/a	
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		N		
Maximum duration of GNSS Self-test	-	s	n/a	300	n/a	
Actual duration of Self-test with encoded location	Less than maximum duration	s	n/a	72	n/a	
Maximum number of GNSS Self-tests (only beacons with internal navigation devices)	-	Number		12		
Distinct indication to register successful completion or failure of the GNSS self-test	must be provided	Y/N	n/a	Y	n/a	
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		
						Manufacturer specified number: 12
						A GNSS Self-Test is initiated by holding the test switch in the test position for 10 seconds. The EUT will display a continuously illuminated red LED, which will briefly flash green every five seconds, whilst the GNSS Self-Test is in progress. If a GPS position is found, the strobe light will flash, and the LED will flash green for a number indicating how many GNSS Self-Tests remain for the operator. If no GPS signal is found within 5 minutes, the strobe light will flash twice, and the LED will flash red, 12 times.
						If further GNSS Self-Tests are attempted, the Red LED will flash whilst the test button is held, to indicate no further tests are available



Product Service

Parameters to be Measured	Range of Specification	Units	Test Results	Comments
9. Thermal Shock				Result: Pass
Model: SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - 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 correct	MHz	Min	Max
Nominal value			406.0399020	406.0399179
Short-term stability		/100ms	46.438E-12	12.010E-11
Medium-term stability – Slope		/min	14.942E-12	11.962E-10
Medium-term stability – Residual frequency variation			13.396E-11	23.285E-10
Transmitter power output		dBm	37.03	37.26
Digital message		P/F	P	

Parameters to be Measured	Range of Specification	Units	Test Results				Comments
14. Satellite Qualitative Tests							Result: Pass
Model: SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - 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

SafeSea E101V S/N: 0800001P (TUV Ref TSR0005) - Modification State 0

Date of Test

11 November 2015

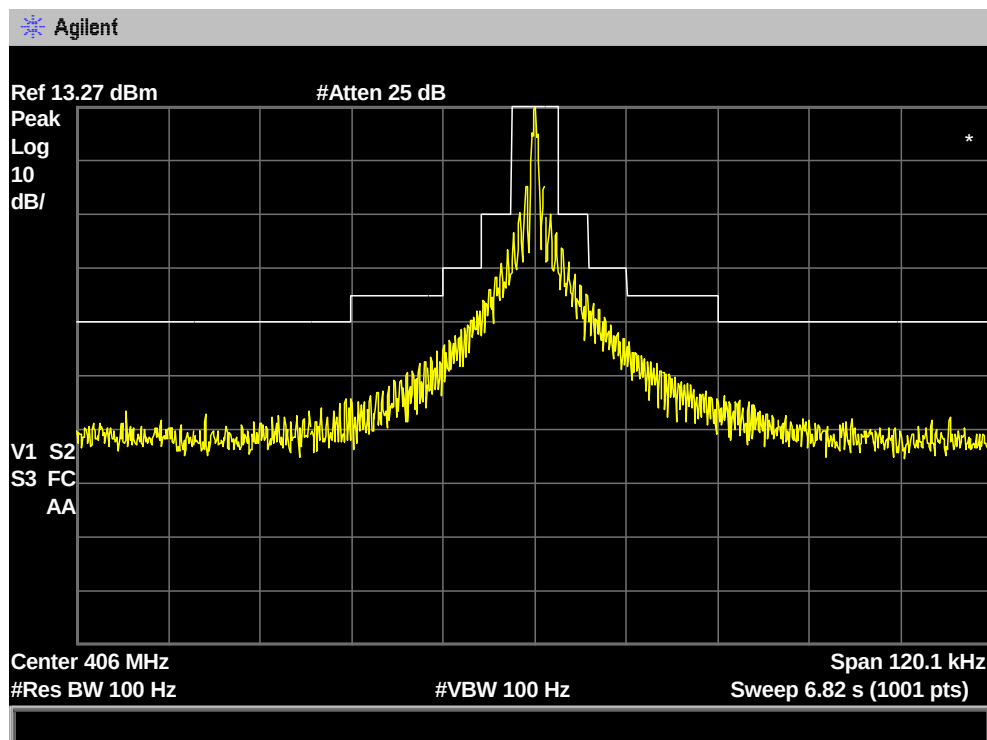
Environmental Conditions

Ambient Temperature 21.4°C

Relative Humidity 34.6%

Test Results

Combined Ambient, Low and High Temperature





Product Service

SATELLITE QUALITATIVE TEST

Specification

Cospas-Sarsat T.007, Clause A.2.5

Equipment Under Test and Modification State

SafeSea E101V S/N: 0800004P - Modification State 2

Date of Test

19 November 2015 - 20 November 2015

Environmental Conditions

Ambient Temperature 11.1°C

Relative Humidity 83.4%

Test Results

Test Configuration 8

Actual location of the test beacon: 50.814333
(Daedalus Airfield, Lee-on-the-Solent, TEMP) -1.2017389

Satellite ID	Satellite Pass Number	15 Hex ID Provided by LUT	Doppler Latitude	Doppler Longitude	Mean Rx Power (dBm)	TCA	CTA (deg)	Location Error (km)
S7	91101	193DF 380C6 FFBFF	50.82485	-1.20350	-125.11	18:16:40	-12.397	1.175
S11	47138	193DF 380C6 FFBFF	50.82303	-1.21712	-125.56	19:07:51	14.707	1.449
S13	16453	193DF 380C6 FFBFF	50.80954	-1.21735	-126.14	18:23:27	20.521	1.219
S13	16454	193DF 380C6 FFBFF	50.82333	-1.20528	-127.82	20:02:09	7.642	1.030
S13	16455	193DF 380C6 FFBFF	50.82196	-1.18703	-129.16	21:42:15	-7.697	1.336
S11	47140	193DF 380C6 FFBFF	50.82083	-1.19448	-124.91	22:28:02	-15.451	0.884
S12	34949	193DF 380C6 FFBFF	50.80941	-1.20840	-126.27	02:07:39	-10.122	0.720
S12	34950	193DF 380C6 FFBFF	50.81004	-1.19743	-124.80	03:48:35	5.491	0.565
S7	91107	193DF 380C6 FFBFF	50.79816	-1.20589	-127.50	04:45:40	-15.583	1.821
S12	34951	193DF 380C6 FFBFF	50.81915	-1.19648	-118.60	05:28:07	18.833	0.650
S10	54110	193DF 380C6 FFBFF	50.80448	-1.20928	-124.60	05:44:34	-5.150	1.216
S10	54111	193DF 380C6 FFBFF	50.80693	-1.20330	-125.81	07:25:01	9.933	0.830
S7	91109	193DF 380C6 FFBFF	50.80721	-1.20534	-125.89	08:05:17	14.511	0.831
S13	16461	193DF 380C6 FFBFF	50.81434	-1.20306	-124.36	08:12:54	-19.827	0.093

Location Errors greater than 5 km are marked in red text.



Product Service

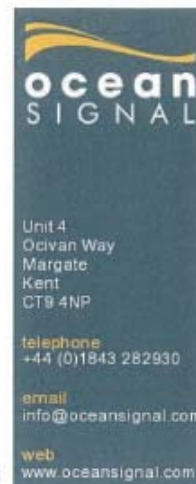
ANNEX B

CUSTOMER SUPPLIED INFORMATION



Product Service

Request for waiver of Corrosion, Solar Radiation and Oil Resistance (ARH101)



10th September 2015

Subject SafeSea ARH101 Material waiver and Disclosure Information, including Waiver Statement for Label Legibility and Comprehensibility Tests

To Whom It May Concern:

Ocean Signal Limited hereby declares that the SafeSea ARH101 automatic release housing product fully complies with the requirements of IEC61097-2. The ARH101 is a variant of the ARH100 product with an additional mechanism to connect and automatically release a connector when the EPIRB is released from the housing.

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

- Corrosion (Salt Mist) IEC 60945 (8.12) and IEC61097-2 5.17.11
- Solar Radiation IEC 60945 (8.10) and IEC61097-2 5.17.9
- Oil resistance IEC 60945 (8.11) and IEC61097-2 5.17.10

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

- 1 The materials have a proven history of service in a marine environment, either from use in Ocean Signal's existing approved product range, or by implication from a long established history of exposure without effect (e.g. Stainless steel).
- 2 The material manufacturer has conducted equivalent testing and has declared the product as being immune to these effects in the relevant data sheet.
- 3 Ocean Signal Limited, in house testing has proven the materials to be immune to the cause of degradation (e.g. oil resistance)
- 4 Ocean Signal Limited has previously had the materials tested on other approved products which demonstrated the materials conformance to the test requirements.

Registration No
6627101

Vat No
938 4374 89

Registered Office
Second Floor 26-33
Building 6000,
Langstone
Technology Park,



Product Service

Ocean Signal Limited hereby declares that the materials used in the construction of the SafeSea ARH101 as herein listed are not affected by the degrading agents listed above.

Signed on behalf of Ocean Signal Limited.

A handwritten signature in black ink, appearing to read 'Simon Nolan'.

Simon Nolan
Chief Technical Officer

The following is a list of components and materials used in the SafeSea ARH100 that are in direct contact with the marine environment.

ARH Cover	Luran
ARH main label	Polycarbonate
ARH date label	Polycarbonate
ARH vessel Label	Polycarbonate
ARH Base	Luran
ARH Spring	Stainless steel 304
EPIRB Socket	Brass, with chrome over nickel plating
HRU	Ocean Signal Approved HRU HR1E
Weight	Brass
Screw	Stainless steel
Connector holder	POM
Control rod	Stainless steel 302



Product Service

Request of waiver of Corrosion, Solar Radiation and Oil Resistance (E101V)



10th September 2015

Subject SafeSea E101V Material waiver and Disclosure Information, including Waiver Statement for Label Legibility and Comprehensibility Tests

To Whom It May Concern:

Ocean Signal Limited hereby declares that the labelling on the SafeSea E101V product fully complies with the requirements of RTCM 11000.2 Section 2.4.3.2.

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

- Corrosion (Salt Mist) IEC 60945 (8.12) and IEC61097-2 5.17.11
- Solar Radiation IEC 60945 (8.10) & IEC61097-2 5.17.9
- Oil resistance IEC 60945 (8.11) & IEC61097-2 5.17.10

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

- 1 The materials have a proven history of service in a marine environment, either from use in Ocean Signal's existing approved product range, or by implication from a long established history of exposure without effect (e.g. Stainless steel).
- 2 The material manufacturer has conducted equivalent testing and has declared the product as being immune to these effects in the relevant data sheet.
- 3 Ocean Signal Limited, in house testing has proven the materials to be immune to the cause of degradation (e.g. oil resistance)
- 4 Ocean Signal Limited has previously had the materials tested on other approved products which demonstrated the materials conformance to the test requirements.

Registration No
6627101

Vat No
938 4374 89

Registered Office
Second Floor 28-33
Building 6000,
Langstone
Technology Park,



Product Service

Ocean Signal Limited hereby declares that the materials used in the construction of the SafeSea E101V as here-in listed are not affected by the degrading agents listed above.

Signed on behalf of Ocean Signal Limited.

A handwritten signature in black ink, appearing to read 'Simon Nolan'.

Simon Nolan
Chief Technical Officer

The following is a list of components and materials used in the SafeSea E101V that are in direct contact with the marine environment.

Case Bottom	Xenoy
Case Centre	Polycarbonate
Case Top	Xenoy
Break off cover	Acrylic
Light Pipe	Acrylic
Sealing Gasket	Silicone Rubber
Switch keys	POM
SOALS Tape	Reflective Tape SOLAS approved
Antenna Moulding	Santoprene
Antenna Rubber	Neoprene
Antenna Blade	Stainless Steel 302 copper plated and nylon coated
Screw	Stainless Steel A2
Strobe Lens	PMMA
Base moulding	Neoprene
Labels	Polycarbonate
Lanyard	Polyester Cord
Lanyard Cover	Neoprene
Lanyard	Xenoy
Connector	Brass, chrome over nickel plated
Ethernet Lead	Polyurethane



Product Service

Request for waiver of Signal Light Test

TUV SUD Product Services
Octagon House
Concord Way
Segensworth North
Fareham
Hampshire PO15 5RL

10th September 2015

Subject: Request for waiver of Signal Light Test IEC61097-2 A2.10

Reference: 75931777 (your project number)

Dear Sir,

Pursuant to testing to IEC61097-2 clause A2.1, we hereby requests a waiver of the tests based upon the results of the E100 and E100G tests.

The EPIRB E100 and E100G class 2 products have the same electronic components, design and mechanical configuration as the E101V EPIRB. The EPIRB E100 and E100G has demonstrated compliance with IEC61097-2 section 5.3.3.3, the test report number 10/881.

Supporting documentation in the form of test report number 10/881 and information detailing the identical design of the signal light within the E101V EPIRB and the E100/E100G EPIRB products is enclosed with this waiver request.

Simon Nolan

A handwritten signature in blue ink, appearing to read 'Simon Nolan'.

Chief Technical Officer
Ocean Signal Limited

Enc.



Product Service

Strobe Light Technical Justification

Document Type	Document No.	
	Issue	01.00
Approved:	Date Last Amended	10/9/2015
	Last Amended by	Wayne Card
Document Title	E101V Strobe Light Technical Justification	



1: Introduction

This document has been created to produce the technical justification for a waiver upon the Strobe Light measurement testing of the Ocean Signal SafeSea E101V.

The product is a float free EPIRB incorporating a vessel data recorder module. This product has been developed using the same form and circuitry as used on the existing and approved Ocean Signal SafeSea E100/E100G EPIRB product to ensure continuation of the Ocean Signal family brand.

2: Electrical Justification

The strobe light circuitry of the E101V is identical to that of the E100/E100G.

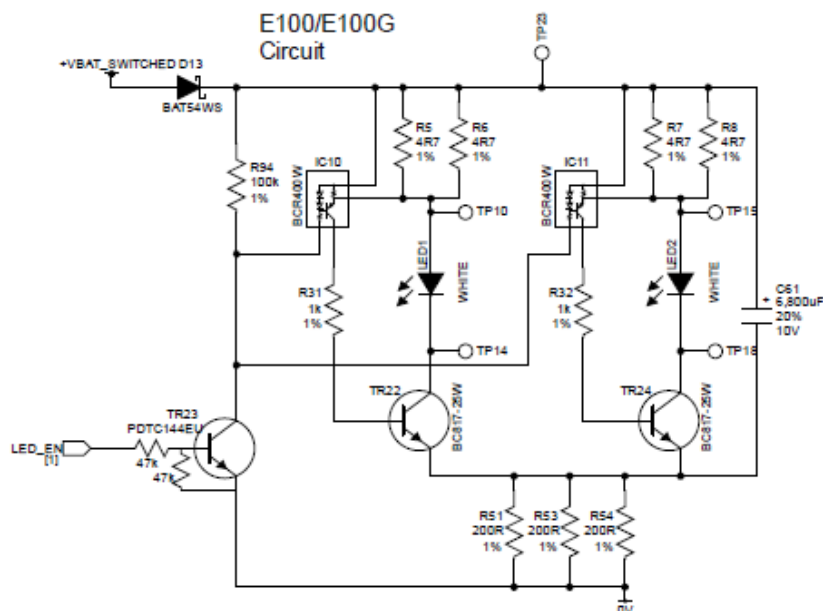


Fig. 1: E100/E100G Strobe Light Circuit

Document Type	Document No.	
	Issue	01.00
	Date Last Amended	10/9/2015
	Last Amended by	Wayne Card
Document Title	E101V Strobe Light Technical Justification	

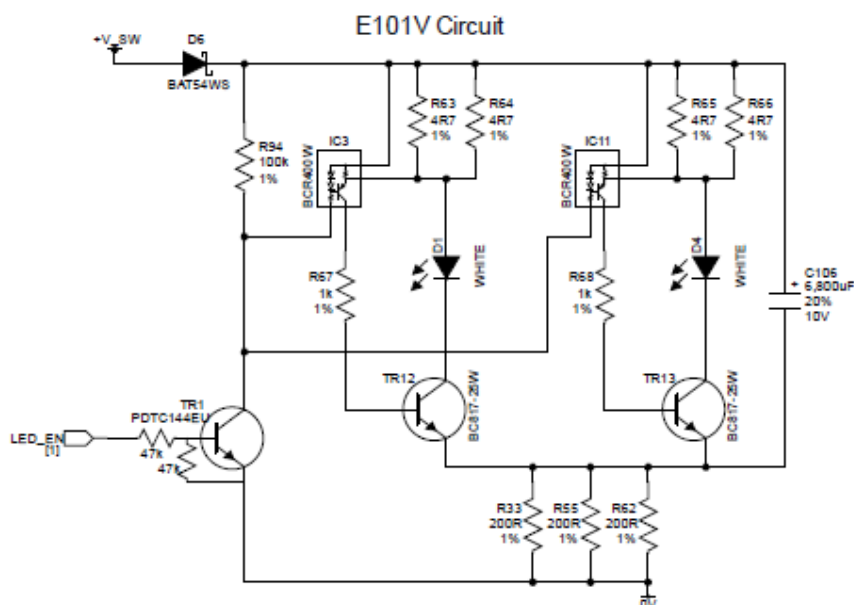


Fig. 2: E101V Strobe Light Circuit

As can be seen from Figures 1 & 2 the circuits of the two products are identical with the exception of signal names, component references and test points.

Both circuits are powered via a switched battery signal, in both cases the nominal battery voltage is 9V.

The following circuit operational description is with reference to the component references within Figure 2.

D1 & D4, the strobe LEDs, within the EPIRB products, are driven by identical circuits, this description shall involve the associated circuit of D1.

To ensure consistent light output throughout the voltage range of the battery, the current through D1 is controlled by IC3, an active bias controller. The output of which controls the LED switching transistor of TR12. TR1 is used to control the timing of the switch on period of the LEDs, this in turn is controlled directly by the product micro controller.

Each LED is configured to run at a current of 300mA, this current is set by the reference resistors of R63 & R64, calculated using the reference voltage of IC3, which is 0.7V: $I = V_{ref(IC3)} / (R63 // R64)$

Document Type	Document No.	
	Issue	01.00
	Date Last Amended	10/9/2015
	Last Amended by	Wayne Card
Document Title	E101V Strobe Light Technical Justification	



The LEDs used within this circuit are identical between the two products, this is an 8mm 0.5W White LED, part number OSAWFD87E1U, from Opto Supply, data sheet attached to this document.

3: Mechanical Justification

The external profile of the E101V has been developed to remain identical to that of the E100/E100G

The LED lenses of the E101V are in fact the same part used within the E100/E100G. These lenses are over moulded into the product top in the same position and height to ensure consistency of light intensity between products.

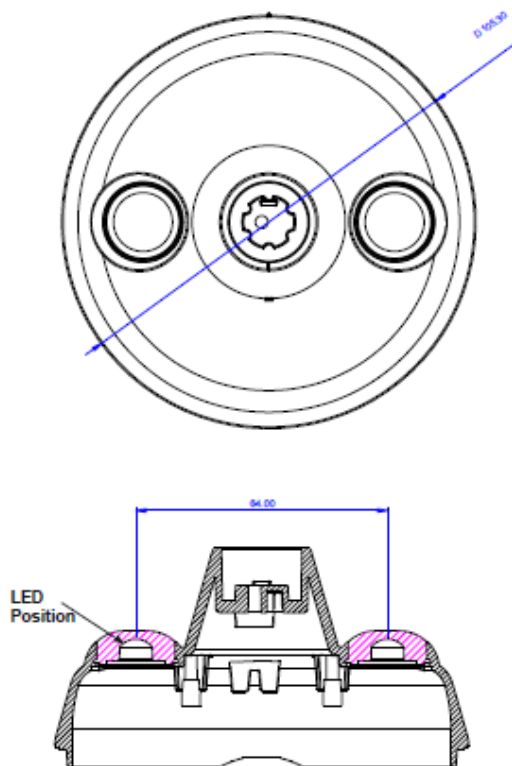


Fig. 3: Product Top Form



Product Service

Document Type	Document No.	
	Issue	01.00
	Date Last Amended	10/9/2015
	Last Amended by	Wayne Card
Document Title	E101V Strobe Light Technical Justification	

ocean
SIGNAL

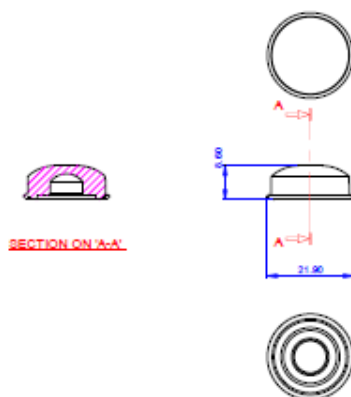


Fig. 4: LED Lens Form

Figures 3 & 4 show the forms used to develop the E101V case top.

The lens component is common between the two products, this ensures that the positional placement of the LEDs are identical.

The centre cone, of the case top, has a SOLAS reflective tape label placed around the surface; again this label is the exact same component as used on the E100/E100G

Document Type	Document No.	
	Issue	01.00
	Date Last Amended	10/9/2015
	Last Amended by	Wayne Card
Document Title	E101V Strobe Light Technical Justification	



4: LED Data Sheet



Premium 0.5 Power 8mm Straw Pure White LED

OSAWFD87E1U

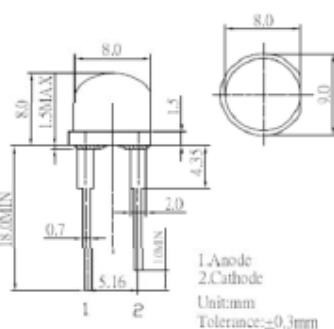
■Features

- High Luminous LEDs
- 8mm Straw Standard Directivity
- Superior Weather-resistance
- UV Resistant Epoxy
- Water Clear Type

■Applications

- Backlighting (Illuminated advertising, general lighting, etc)
- Portable (flashlight, bicycle)
- Interior and exterior automotive lighting
- Other Lighting

■Outline Dimension



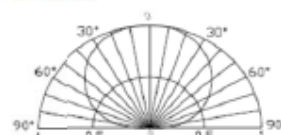
■Absolute Maximum Rating

(T_a=25°C)

Item	Symbol	Value	Unit
DC Forward Current	I _F	200	mA
Pulse Forward Current*	I _{FP}	300	mA
Reverse Voltage	V _R	5	V
Power Dissipation	P _D	720	mW
Operating Temperature	T _{OP}	-30 ~ +85	°C
Storage Temperature	T _{stg}	-40 ~ +100	°C
Lead Soldering Temperature	T _{sol}	260°C/5sec	-

*Pulse width Max 10ms, Duty ratio max 1/10

■Directivity



■Electrical -Optical Characteristics

(T_a=25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
DC Forward Voltage	V _F	I _F =150mA	2.9	3.2	3.6	V
DC Reverse Current	I _R	V _R =5V	-	-	10	μA
Luminous Flux*	Φ _v	I _F =150mA	50	55	-	lm
Color Temperature	CCT	I _F =150mA	6000	8000	12000	K
Chromaticity Coordinates*	x	I _F =150mA	-	0.29	-	-
	y	I _F =150mA	-	0.31	-	-
50% Power Angle	2θ _{1/2}	I _F =150mA	-	140	-	deg

*1 Tolerance of chromaticity coordinates is ±10%

*2 Tolerance of luminous intensity is ±15%

LED & Application Technologies





Product Service

Document Type	Document No.	
	Issue	01.00
	Date Last Amended	10/9/2015
	Last Amended by	Wayne Card
Document Title	E101V Strobe Light Technical Justification	

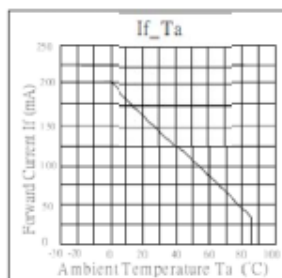
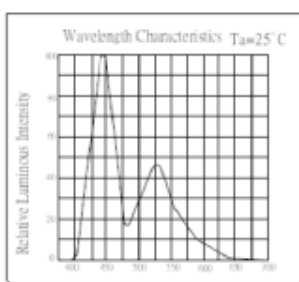
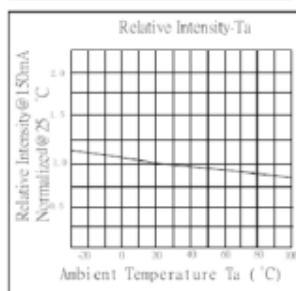
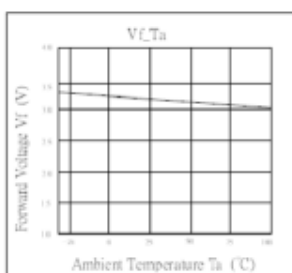
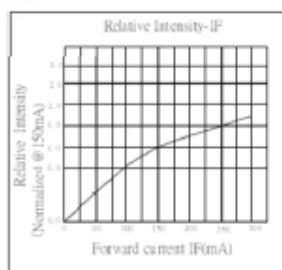
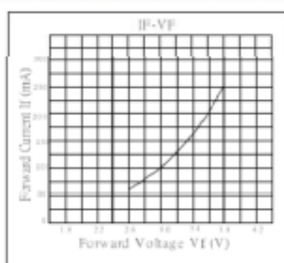


Premium 0.5 Power 8mm Straw Pure White LED

OSAWFD87E1U

InGaN LED

TYPICAL ELECTRICAL/OPTICAL CHARACTERISTIC CURVES



LED & Application Technologies





Product Service

Document Type	Document No.	
	Issue	01.00
	Date Last Amended	10/9/2015
	Last Amended by	Wayne Card
Document Title	E101V Strobe Light Technical Justification	



Premium 0.5 Power 8mm Straw Pure White LED

OSAWFD87E1U

RELIABILITY TEST REPORT

CLASSIFICATION	TEST ITEM	TEST CONDITION
ENDURANCE TEST	OPERATION LIFE	IF:150mA Ta:25±5 TEST TIME=1000HRS(-24HRS,+72HRS)
	HIGH TEMPERATURE HIGH HUMIDITY STORAGE	RH:90~95% Ta:65±5℃ TEST TIME =240HRS(+2HRS)
	HIGH TEMPERATURE STORAGE	Ta:105±5℃ TEST TIME =500HRS(-24HRS,+48HRS)
	LOW TEMPERATURE STORAGE	Ta:-55±5℃ TEST TIME =500HRS(-24HRS,+48HRS)
	TEMPERATURE CYCLING	105℃~25℃~-55℃~25℃ 60min 10min 60min 10min 20cycles
ENVIRONMENTAL TEST	THERMAL SHOCK	105℃~-55℃ 10min 10min 10cycles
	SOLDER RESISTANCE	Ta:260±5℃ TEST TIME =10±1sec
	SOLDERABILITY	Ta:230±5℃ TEST TIME =5±1sec

JUDGMENT CRITERIA OF FAILURE FOR THE RELIABILITY

MEASURING ITME	SYMBOL	CONDITIONS	FAILURE
LUMINOUS INTENSITY	IV	IF=150mA	IV<0.5*INITIAL VALUE
FORWARD VOLTAGE	VF	IF=150mA	VF>1.2*INITIAL VALUE
REVERSE CURRENT	IR	Vr=5V	IR>2*SPEC

LED & Application Technologies





Product Service

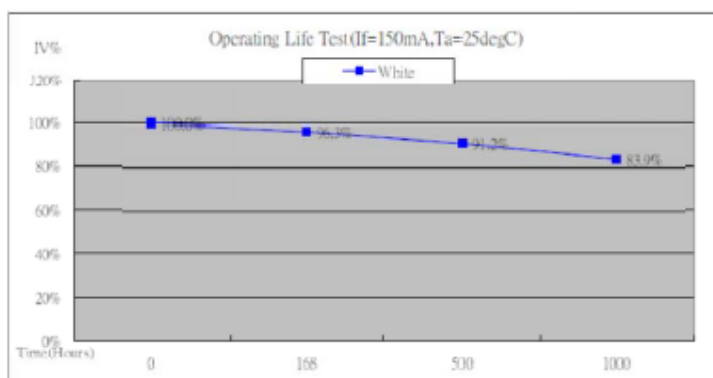
Document Type	Document No.	
	Issue	01.00
	Date Last Amended	10/9/2015
	Last Amended by	Wayne Card
Document Title	E101V Strobe Light Technical Justification	



Premium 0.5 Power 8mm Straw Pure White LED

OSAWFD87E1U
Ver.a.2

OPERATION LIFE TEST LUMINANCE RATE CURVE



*Burn-in condition: 150mA

*Projection of Statistical Average Light Output Degradation Performance for LED Technology
Extrapolated from OptoSupply QA Dept. Test Data.

*According to OptoSupply outgoing Packaged Products Specification

*MTBF: 10,000hrs, 90% Confidence (A Failure is Any LED Which is Open, shorted or fails to Emit Light)

*The Projected Data is Base on The Feature of LED Itself Under Normal Operation Conditions.

*Any Improper Circuit Design or External Factors Might Cause a Different Result.

LED & Application Technologies

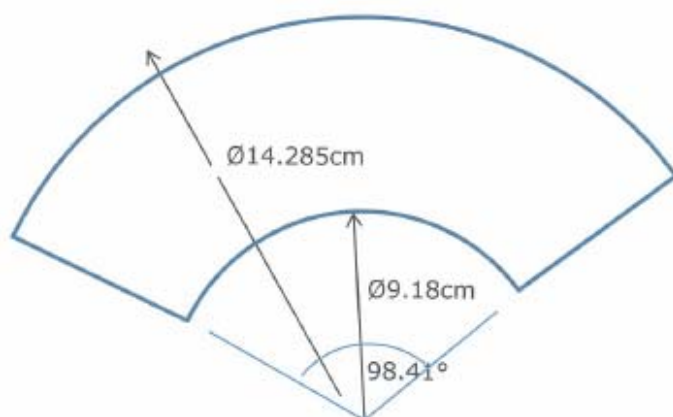


Reflective Tape Technical Document

Document Type	Document No.	
	Issue	01.00
Approved: 	Date Last Amended	S Nolan
	Last Amended by	S Nolan
Document Title	Reflective Tape used on E101V VDR EPIRB	

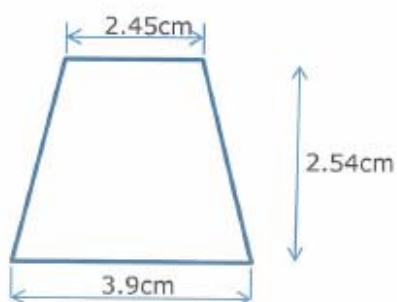


Area of Reflective Tape is given by the developed shape as follows



$$\text{Area} = \pi \cdot (14.285^2 - 9.18^2) / 4 \cdot 98.41 / 360 = 25.7\text{cm}^2$$

The Area viewed from the horizon is given by the trapezoid seen from horizon as



$$\text{Area} = 2.54 \cdot (2.45 + 3.9) / 2 = 8.06\text{cm}^2$$



Product Service

Scotchlite Reflective Material SOLAS Grade Products Technical Data Sheet

3M **Scotchlite™**
Reflective Material
SOLAS Grade Products

Technical Data Sheet

Technical Data Sheet

September 2005

Description

3M™ Scotchlite™ Reflective Material – SOLAS (Safety of Life at Sea) Grade Products are intended for life support equipment such as life vests, life rings, jackets, and rafts. These products conform to Marine Equipment Directive 96/98/EC and International Maritime Organization (IMO) Resolution A.658 (16) Annex 2. In addition, they are approved by the U.S. Coast Guard to meet 46 CFR part 164, Subpart 164.018 requirements for Type I and II retroreflective materials. Scotchlite reflective material – SOLAS grade products help enhance visibility of life-saving equipment in nighttime, or low-light conditions when illuminated by a spotlight or other light source.

3M™ Scotchlite™ Reflective Material – SOLAS Grade Series 3100 products are silver, flexible reflective materials with a 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.

All products 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.

Retroreflective Performance

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

ASTM E809 and E810 (R_{R})
CIE 54: 1982 (R')

The following table contains the minimum R_{R} 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.

Entrance Angle	Observation Angle			
	0.1	0.2	0.5	1.0
5	180	175	72	14
30	140	135	70	12
45	85	85	48	9.4

Color

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



Performance

While the use of 3M™ Scotchlite™ Reflective Material – SOLAS Grade Products enhances visibility, no reflective material can guarantee absolute visibility, particularly in adverse weather conditions. Performance will vary depending upon actual use, exposure conditions and maintenance. Users should test Scotchlite reflective material – SOLAS grade products to satisfy conformance to their own requirements.

Reduction in durability will occur when the usage requirements are particularly severe, such as work life jackets and rubber rafts that are used to maintain harbor facilities, coastal waterways and industrial equipment in the water or on decks; life-saving appliances with continuous outdoor exposure; heavy wear and tear; and chemical exposure and washing.

All current certificates issued by external organizations are available on the 3M website (<http://www.3M.com/Scotchlite>). EC MED Declaration of Conformity is available by request and requires invoice number and date information for issuance. Requests for Certifications may be submitted either through your 3M Customer Service Representative or may be faxed directly to (325) 646-3778 [USA].

Application Instructions

Whenever two or more pieces of 3M™ Scotchlite™ Reflective Material are used together on a single surface or as a set, they should be matched to ensure uniform color and reflectivity.

NOTE: Do not attach to highly elastic materials.

Applying 3M™ Scotchlite™ Reflective Material – SOLAS Grade Series 3100 products:

The application of Scotchlite reflective material – SOLAS grade series 3100 products should be carefully evaluated for adhesion by the user to assure suitability for the intended use.

3M™ Scotchlite™ Reflective Material – SOLAS Grade 3150-A is recommended on the following marine market substrates:

Smooth surfaces	Glass reinforced polyester
Rubber film	Vinyl or PVC films
Polyurethane film (varies with treatment)	Aluminum

3M™ Scotchlite™ Reflective Material – SOLAS Grade 3155 is recommended on the following marine substrates:

Rough surfaces	Glass reinforced polyester
Aluminum	Rubber coated cloth
Rubber film	Vinyl or PVC films
Polyurethane film (varies with treatment)	Polyester fabric
Nylon fabric (thicker weave)	Cotton drill

The coated fabric must be clean, dry, and substantially free of contamination. If necessary, wipe the substrate surface with a mild solvent, such as VM & P Naphtha or mineral spirits (test the solvent first on a small area of the fabric to make sure the surface is not damaged).

The minimum application temperature is 60°F (15°C). Whenever possible, remove flotation material or deflate equipment, and smooth out wrinkles.

1. Hand cut, die-cut, or guillotine the reflective material to the desired size one layer at a time. Do not cut in multi-layers. Use sharp dies or blades made of steel or magnesium.
2. Separate approximately 1" of liner paper from reflective material. Bend liner back onto itself.
3. When everything is properly aligned, press down the exposed adhesive area by using a squeegee starting from the inside and working towards end.
4. Slowly remove the rest of the liner as the squeegee application is made, keeping material away from fabric until pressure is applied. Squeegee down entire reflective area in this manner.
5. On all vinyl applications, use talcum powder around edges after material application to prevent tackiness.

It is recommended, to improve adhesion, to allow 48 hours (above 60°F) before handling, inflating, or packaging.

Note: Since plastics vary greatly in type, composition, and manufacture, a general recommendation cannot be given for their use as application surfaces.

Commercial users have made successful applications; however, many plastics contain release agents, unreacted monomers,



Application Instructions, continued

plasticizers, dyes, oils, gasses and other migrating constituents that contaminate the adhesive and result in premature failure. In addition, colorants may bleed to the surface and cause discoloration of the reflective materials. Applications should be carefully evaluated by the user to assure that they are acceptable for intended use.

The use of heat and pressure to aid in adhesion must be evaluated to ensure the material is not damaged. For silicone based fabrics use 3M™ Scotchlite™ Reflective Material – SOLAS Grade Series 6700 products.

Sewing 3M™ Scotchlite™ Reflective Material – SOLAS Grade 6755 and 3M™ Scotchlite™ Reflective Material – SOLAS Grade 6750-I:

1. Hand cut, die-cut, or guillotine reflective material to desired size. Use sharp dies or blades made of steel or magnesium. To ensure smooth edges, limit the layers of SOLAS while cutting.
2. Sew in place with 7-9 stitches per inch and not less than 5/64" from the edge of the material. Thread recommendation: #69 nylon (Quality Thread & Notions 1-800-521-4308) or other UL approved threads. Stitch: 3/16" (4.75 mm) lockstitch.

Screen Printing: Below are inks that can be used for printing on the surface of 3M™ Scotchlite™ Reflective Material – SOLAS Grade Products. All inks should be continuously tested to ensure acceptable adhesion in the event of changes occurring in the manufacturing process or composition of the ink. Prior to printing, wiping the surface with a soft cloth lightly dampened with alcohol may help ink adhesion.

Ink	Ink Type	Manufacturer
3M™ Scotchlite™ Process Color Series 990	Transparent (990-05 Black is opaque)	3M Traffic Control Materials Division 1-800-553-1380
3M™ Scotchlite™ Process Color Series 700	Transparent	3M Traffic Control Materials Division 1-800-553-1380

Care and Maintenance Instructions

Wash by hand with a sponge or soft cloth using warm water and detergent. Rinse thoroughly.

Important: Test each application according to appropriate care instructions required for the finished product. Actual life of Scotchlite reflective material – SOLAS grade products depends on cleaning methods and wear conditions.



Wash:
Do not machine wash



Dry:
Do not tumble dry



Dry-clean:
Do not dry-clean



Bleach:
Do not bleach



Iron:
Do not iron

Product Availability

Scotchlite reflective material – SOLAS grade products are available in rolls with the following standard widths and lengths:

3M™ Scotchlite™ Reflective Material				
Product Number	Roll Width Unless Noted	Width Tolerance	Splices Allowed	Standard Roll Length
3150-A, 3155, 6750-I, & 6755	13 mm < X < 150 mm	+/- 1 mm	4 per 50 m roll	50 m
3150-A, 3155, 6750-I, & 6755	150 mm ≤ X ≤ 1220 mm	+/- 2 mm	4 per 50 m roll	50 m

Order and Product Information

To order 3M™ Scotchlite™ Reflective Material, contact 3M Personal Safety Products Customer Service at 800-328-7098, Ext. 2.

Storage and Shelf Life

Store in a cool, dry area and use within one year after date of receipt. Store rolls or panels in original shipping cartons. Return partially used rolls to the carton or suspend horizontally through the core.



Product Service

Important Notice to User

LIMITED WARRANTY: In the event any 3M™ Scotchlite™ Reflective Material is found to be defective in material, workmanship, or not in conformance with any express warranty, 3M's only obligation and your exclusive remedy shall be to replace or refund the purchase price, at 3M's option, of such product upon timely notification thereof and substantiation that the product has been stored, maintained and used in accordance with 3M's written instructions.

EXCLUSIONS TO WARRANTY: THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHER WARRANTY OF QUALITY, EXCEPT OF TITLE AND AGAINST PATENT INFRINGEMENT.

LIMITATION OF LIABILITY: Except as provided above, 3M shall not be liable in contract or tort for any loss or damage, whether direct, indirect, incidental, special or consequential, (including, without limitation, lost profits, goodwill and business opportunity) arising out of the sale, use or misuse of the product, or the user's inability to use the product. **THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE.**

Because of the unlimited variety of potential applications for these products, BEFORE production use, the user (which may be a product designer, product specifier, converter or end product manufacturer or others) must determine that the Products are suitable for the intended use and are compatible with other component materials. User is solely responsible for determining the proper amount and placement of Products. While reflective products enhance visibility, no reflective product can ensure visibility or safety under all possible conditions.

3M may change the product, specifications and availability of the product as improvements are made; therefore, user should contact 3M for latest information before specifying the product.



**Personal Safety Products
3M Occupational Health and
Environmental Safety Division**

3M Center, Building 0235-02-F-06
St. Paul, MN 55144-1000
800-328-7098, Ext. 2

3M Canada
P. O. Box 5757
London, Ontario, Canada N6A 4T1
800-364-3577

Printed in USA
© 3M 2006
All rights reserved.
75-0500-6811-5