

Report on the Environmental Testing of:

Ocean Signal Limited

AIS Class B transponder. Model: ATB1

In accordance with IEC 60945

Prepared for: Ocean Signal Limited
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CT9 4NN
United Kingdom



Product Service

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Project Management	Sarah Jones	12 October 2018	
Authorised Signatory	Gareth Stephens	12 October 2018	

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

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with IEC 60945: 2002 for the clauses listed within this document



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Contents

1 Report Summary2

1.1 Report Modification Record.....2

1.2 Introduction.....2

1.3 Brief Summary of Results3

1.4 Application Form4

1.5 Product Information7

1.6 Deviations from the Standard.....7

1.7 EUT Modification Record8

1.8 Test Location.....9

2 Test Details10

2.1 Dry Heat Storage.....10

2.2 Dry Heat Functional.....13

2.3 Damp Heat15

2.4 Low Temperature Storage17

2.5 Low Temperature Functional19

2.6 Vibration21

2.7 Maintenance, Equipment Manuals and Marking and Identification (NUA)28

3 Photographs33

3.1 Equipment Under Test (EUT).....33



1 Report Summary

1.1 Report Modification Record

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

Issue	Description of Change	Date of Issue
1	First Issue	12 October 2018

Table 1

1.2 Introduction

Applicant	Ocean Signal Limited
Manufacturer	Ocean Signal Limited
Model Number(s)	ATB1
Serial Number(s)	TA001 (TUV Ref TSR0012)
Hardware Version(s)	Mod State 0: 0B.00 Mod State 1: 0B.01 Mod State 2: 0B.02 Mod State 3: 0B.03 Final Build Version: 01.00 (same as 0B.03)
Firmware Version(s)	0.1.03 0.1.14 01.00.00 (Final Version)
Number of Samples Tested	1
IEC 60945 Equipment Category (Manufacture declared)	ATB1: Protected GPS Antenna*: Exposed
Test Specification/Issue/Date	IEC 60945: 2002
Order Number	3122-00 reprint 03/1
Date	03-November-2016
Date of Receipt of EUT	13-February-2018
Start of Test	22 August-2018
Finish of Test	08 October-2018
Name of Engineer(s)	G Porter N Forsyth K Bryant A Castle S Jones
Related Document(s)	IEC 62287-2: Edition 2 (2017)

*The GPS antenna was connected to the EUT but was not subjected to the additional tests required for exposed devices as this was covered by Manufacturer supplied report HH40002A/2017 .pdf .



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with IEC 60945 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: DC Powered - AIS - SOTDMA				
2.1	8.2	Dry Heat Storage	Satisfactory	
2.2	8.2.2	Dry Heat Functional	Satisfactory	
2.3	8.3	Damp Heat	Satisfactory	
2.4	8.4	Low Temperature Storage	Satisfactory	
2.5	8.4.2.4	Low Temperature	Satisfactory	
2.7	13, 14, 15	Maintenance, Equipment Manuals and Marking and Identification	-	See section 2.7

Table 2

A brief summary of the tests carried out in accordance with IEC 62287-2 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: DC Powered - AIS - SOTDMA				
2.6		Vibration	Satisfactory	Testing in accordance with the product specific standard IEC 62287-2.

Table 3



1.4 Application Form

EQUIPMENT DESCRIPTION	
Model Name/Number	ATB1
Part Number	760S-02700
Hardware Version	01.00
Software Version	01.00.00
Technical Description (Please provide a brief description of the intended use of the equipment)	Class B AIS transponder

EXTREME TEMPERATURE RANGE (over which equipment is to be type tested)	
☐ Not Applicable (no extreme temperature testing required)	
☒ Category I (General)	
☐ Category II (Portable equipments)	
☐ Other (please specify):	

TYPE OF EQUIPMENT			
☐ Fixed Station	☐ Transmitter	☐ Simplex	☐ Integral Antenna
	☐ Receiver	☐ Duplex	☒ Single Antenna
☒ Mobile Station	☒ Transceiver		☐ Two Antenna Connector
			☐ Multiple Antenna Connectors No.
☐ Portable Station	☐		
☐ Transponder (Tag)	☒ Active	☐ Passive	

TRANSMITTER TECHNICAL CHARACTERISTICS		
FREQUENCY CHARACTERISTICS		
Transmitter frequency alignment range	to	MHz
Transmitter channel switching frequency range	156.025 to 162.025	MHz



TRANSMITTER RF POWER CHARACTERISTICS			
Maximum rated transmitter output power as stated by manufacturer (if applicable)			
5	W	At transmitter permanent external 50 Ω RF output connector	
and/or		W Effective radiated power (for equipment with integral antenna)	
Minimum rated transmitter output power as stated by manufacturer (if applicable)			
W		At transmitter permanent external 50 Ω RF output connector	
and/or		W Effective radiated power (for equipment with integral antenna)	
Is transmitter intended for :			
Continuous duty		☐ Yes	☒ No
Intermittent duty only		☒ Yes	☐ No
If intermittent duty state DUTY CYCLE			
Transmitter ON	0.026	Seconds	Transmitter OFF
		Seconds	

TRANSMITTER - MODULATION			
Amplitude	☐	Other	☒
Frequency	☐	Details :	GMSK
Phase	☐	Channel Spacing	25kHz
Can the transmitter be operated without modulation? * See definition below			☐ Yes ☒ No

RECEIVER TECHNICAL CHARACTERISTICS	
FREQUENCY CHARACTERISTICS	
Receiver frequency alignment range	to
Receiver channel switching frequency range	156.025 to 162.025
Channel Separation (if applicable)	25kHz
State the maximum number of channels over which the equipment can operate:	



POWER SOURCE			
☐ AC mains State voltage AC supply frequency (Hz) VAC Max Current Hz 			
☐ Single phase		☐ Three phase	
And / Or			
☒ External DC supply			
Nominal voltage		Max Current	
V		6 A	
Extreme upper voltage		31.2 V	
Extreme lower voltage		10.8 V	
Battery			
☐ Nickel Cadmium		☐ Lead acid (Vehicle regulated)	
☐ Alkaline		☐ Leclanche	
☐ Lithium		☐ Other Details :	
Volts nominal.			
End point voltage as quoted by equipment manufacturer 10.8 V			

AUTOMATIC EQUIPMENT SWITCH OFF	
If the equipment is designed to automatically switch off at a predetermined voltage level which is higher or lower in value than the battery minimum and minimum calculated values this shall be clearly stated.	
☐ Applies V cut-off voltage	
☒ Does not apply	

CHANNEL IDENTIFICATION			
Each equipment, whether one or more submitted for tests shall carry clear identification (such as a serial number), together with the frequencies associated with the channel identification displayed on the equipment.			
Equipment Identification eg Serial Number	Channel No.	Transmit Nominal Freq MHz	Receive Nominal Freq MHz

I hereby declare that that the information supplied is correct and complete.

Name: David Sheekey

Position held:

Type Approval Manager

Date: 28/3/2018



1.5 Product Information

1.5.1 Technical Description

Class B AIS Transponder.

1.5.2 Test Power Source

The equipment is designed to operate from a 12 V or 24 V DC supply. Unless otherwise stated, all tests made under nominal voltage conditions were performed at 12 V DC.

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing. The vibration test however was carried out in accordance with the product specific standard (IEC 62287-2). For all other environmental tests documented within the present document, IEC 62287-2 refers to IEC 60945.



1.7 EUT Modification Record

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

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Hardware			
0	As supplied by the Manufacturer	Not Applicable	Not Applicable
1	Add 22pf decoupling capacitor from IC 42 Pin 42 to 0V - SPI data line (Signal RF_MOSI). Add 22pf decoupling capacitor from IC 42 Pin 43 to 0V - SPI data line (Signal RF_MISO). Change C299 from 1nF to 4n7 – TX Power control loop BW reduction.	Manufacturer	15 May 2018
2	Add M95512 non -volatile memory IC to SPI Bus (IC50).	Manufacturer	12 June 2018
3	Add 4A SM Fuse "F2" to Supply +V between J1 and D2 (TA001 only). Not applicable to this document.	Manufacturer	17 September 2018
Firmware: all testing was carried out with firmware 0.1.12 unless indicated otherwise.			
0.1.12	Fixed GNNS no fix speed threshold. Fixed message 23 so as to override long range messages. Fixed issues in message 16. Improved reporting rate system watch dog.	Manufacturer	20 August 2018
0.1.16	Firmware 1.16 Adjusted BITT LED flash sequences. Changes to DSC processing. Changes to message 23 and message 16 processing.	T Nicholson	9 September 2018
Manufacturer notes the following: Further firmware revisions were applied to the EUT within the test dates. This was to maintain all of the supplied test samples at the same firmware revision. The revisions made were to resolve non-compliances identified during network testing and had no effect on the EUT transceiver performance or the operation of the serial data ports.			

Table 4



1.8 Test Location

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

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: DC Powered - AIS		
Dry Heat Storage	K Bryant G Porter N Forsyth	UKAS
Dry Heat Functional	K Bryant G Porter N Forsyth	UKAS
Damp Heat	K Bryant G Porter N Forsyth	UKAS
Low Temperature Storage	K Bryant G Porter N Forsyth	UKAS
Low Temperature Functional	K Bryant G Porter N Forsyth	UKAS
Vibration	A Castle G Porter N Forsyth	UKAS

Table 5

Office Address:

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

2 Test Details

2.1 Dry Heat Storage

2.1.1 Specification Reference

IEC 60945, Clause 8.2

2.1.2 Equipment Under Test and Modification State

ATB 1, S/N: TA 001 - Modification State 2

2.1.3 Date of Test

22-August-2018 to 23-August-2018

2.1.4 Test Method

The EUT (powered off) was placed in a climatic chamber where the temperature was increased from laboratory ambient temperature to +70°C. After 12 hours (see temperature plot below), the temperature was reduced laboratory ambient. The EUT was then powered on and subjected to a performance check.

Test Setup

The EUT along with its GPS antenna was installed in the climatic chamber. An external Class A AIS device was used to monitor the transmit and receive transmissions of the EUT. The GPS antenna, along with a GPS simulator antenna were both installed inside the climatic chamber, alongside the EUT. An example of the test setup can be seen below (note: more than one chamber was used for testing but the setup remained the same).



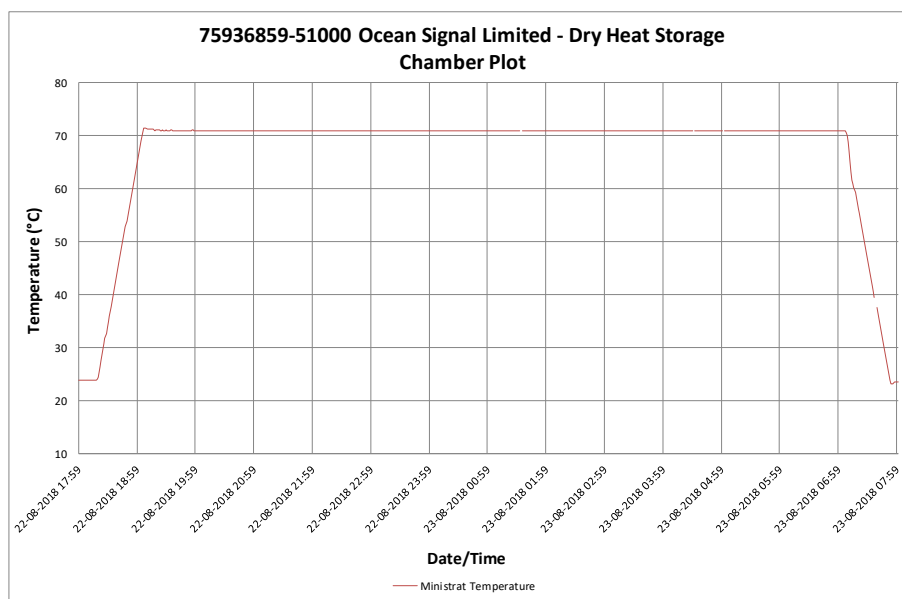


2.1.5 Environmental Conditions

Ambient Temperature 24.2°C
Relative Humidity 56.2 %

2.1.6 Test Results

Temperature Plot



Performance Check

The EUT continued to transmit Messages 18 and 24 part A and B, following the autonomous continuous schedules, alternating between channels A and B.

The EUT continuously received messages from a Class A AIS device.



Product Service

2.1.7 Test Location and Test Equipment Used

This test was carried out in the Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Unitemp	Ministrat	2129	12	6-Feb-2019

Table 6



2.2 Dry Heat Functional

2.2.1 Specification Reference

IEC 62287-2, Clause 11.1.2

2.2.2 Equipment Under Test and Modification State

ATB 1, S/N: TA 001 - Modification State 2

ATB 1, S/N: TA 001 - Modification State 2 with firmware 0.1.16 (test at extreme upper voltage)

2.2.3 Date of Test

23-August-2018 to 24-August-2018

2.2.4 Test Method

The EUT (powered on) was placed in a climatic chamber where the temperature was increased from laboratory ambient temperature to +55°C. After approximately 15 hours the EUT was subject to a performance check whilst remaining at the elevated temperature and remained operation for 2 hours. On conclusion of the performance check the climatic chamber was reduced to laboratory ambient (see temperature plot below).

See section 2.1.4 for test setup.

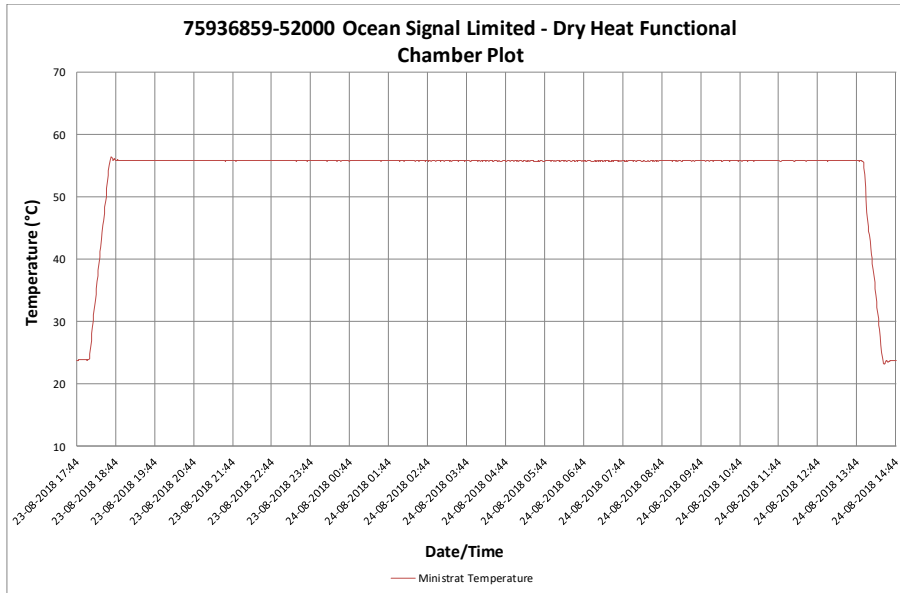
2.2.5 Environmental Conditions

Ambient Temperature 25.6°C

Relative Humidity 52.3%

2.2.6 Test Results

Temperature Plot



Performance Check

The EUT continued to transmit Messages 18 and 24 part A and B following the autonomous continuous schedules, alternating between channels A and B.

The EUT continuously received messages from a Class A AIS device.

An additional Performance Check was carried out with the upper extreme voltage (31.2 V DC). The EUT continued to operate as intended.

2.2.7 Test Location and Test Equipment Used

This test was carried out in the Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Unitemp	Ministrat	2129	12	6-Feb-2019

Table 7

2.3 Damp Heat

2.3.1 Specification Reference

IEC 62287-2, Clause 11.1.3

2.3.2 Equipment Under Test and Modification State

ATB 1, S/N: TA 001 - Modification State 2

2.3.3 Date of Test

30-August-2018 to 31-August-2018

2.3.4 Test Method

The EUT (powered off) was placed in a climatic chamber where the temperature was increased from laboratory ambient temperature to +40°C and 93% relative humidity. After 13.5 hours (see temperature plot below), the EUT was powered on and subjected to the performance check and remained operational for at least 2 hours. The EUT was then powered off and the climatic chamber returned to laboratory ambient conditions.

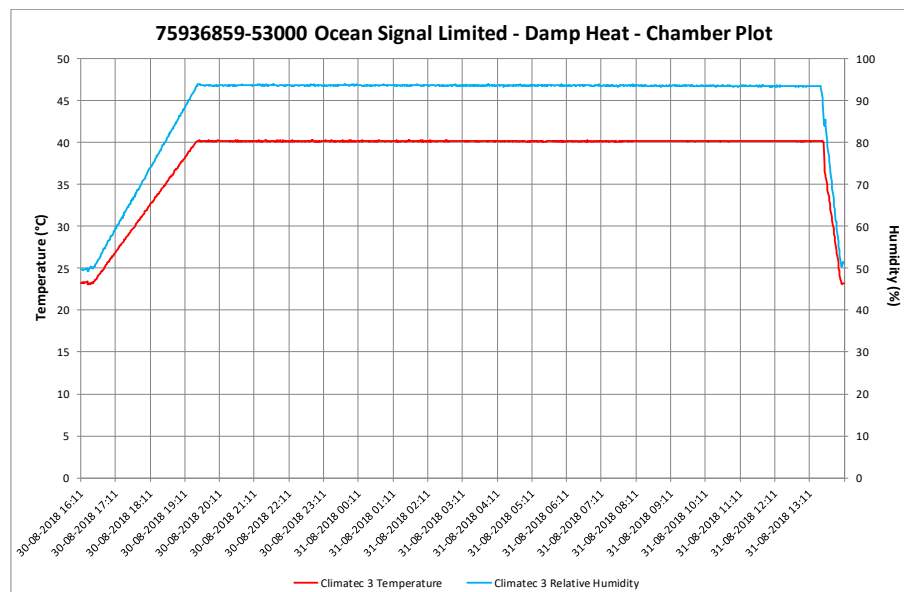
See section 2.1.4 for test setup.

2.3.5 Environmental Conditions

Ambient Temperature 21.7°C
Relative Humidity 54.2%

2.3.6 Test Results

Temperature Plot





Performance Check

The EUT continued to transmit Messages 18 and 24 part A and B following the autonomous continuous schedules, alternating between channels A and B.

The EUT continuously received messages from a Class A AIS device.

2.3.7 Test Location and Test Equipment Used

This test was carried out in the Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Climatec	CLIMATEC 3	2846	12	20-July-2019

Table 8



2.4 Low Temperature Storage

2.4.1 Specification Reference

IEC 60945, Clause 8.4.1

2.4.2 Equipment Under Test and Modification State

ATB 1, S/N: TA 001 - Modification State 2

2.4.3 Date of Test

02-September-2018 to 03-September-2018

2.4.4 Test Method

The EUT (powered off) was placed in a climatic chamber where the temperature was decreased from laboratory ambient temperature to -30°C. After 14 hours (see temperature plot below), the temperature was returned to laboratory ambient. The EUT was then powered on and subjected to a performance check.

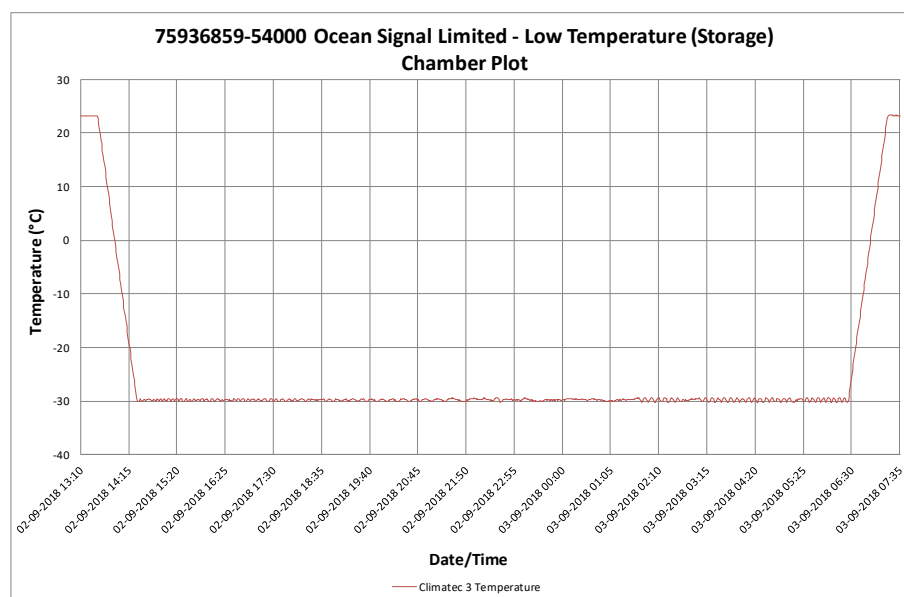
See section 2.1.4 for test setup.

2.4.5 Environmental Conditions

Ambient Temperature 23.0°C
Relative Humidity 44.9%

2.4.6 Test Results

Temperature Plot





Performance Check

The EUT continued to transmit Messages 18 and 24 part A and B following the autonomous continuous schedules, alternating between channels A and B.

The EUT continuously received messages from a Class A AIS device.

2.4.7 Test Location and Test Equipment Used

This test was carried out in the Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Climatec	Climatec 3	2846	12	20-Jul-2019

Table 9



2.5 Low Temperature Functional

2.5.1 Specification Reference

IEC 60945, Clause 8.4.2.4

2.5.2 Equipment Under Test and Modification State

ATB 1, S/N: TA 001 - Modification State 2

ATB 1, S/N: TA 001 - Modification State 2 with firmware 0.1.16 (test at extreme upper voltage)

2.5.3 Date of Test

29-August-2018 to 30-August-2018

2.5.4 Test Method

The EUT (powered off) was placed in a climatic chamber where the temperature was decreased from laboratory ambient temperature to -15°C. After 12.5 hours (see temperature plot below), the EUT was powered, kept operational for at least 2 hours and subject to the performance check. The climatic chamber conditions were then returned to laboratory ambient.

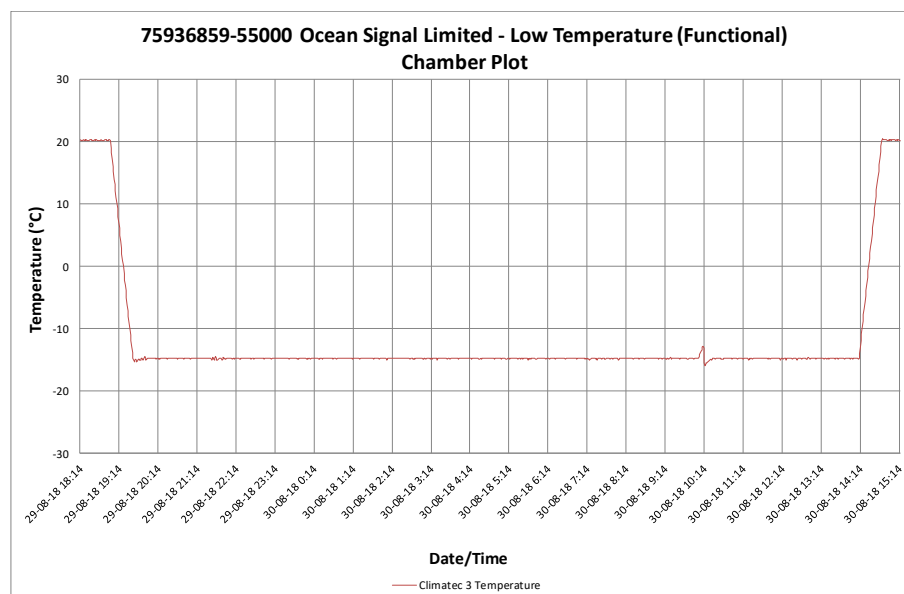
See section 2.1.4 for test setup.

2.5.5 Environmental Conditions

Ambient Temperature 20.0°C
Relative Humidity 49.6%

2.5.6 Test Results

Temperature Plot





Performance Check

The EUT continued to transmit Messages 18 and 24 part A and B following the autonomous continuous schedules, alternating between channels A and B.

The EUT continuously received messages from a Class A AIS device.

An additional Performance Check was carried out with the lower extreme voltage (10.8 V DC). The EUT continued to operate as intended.

2.5.7 Test Location and Test Equipment Used

This test was carried out in the Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Climatic Chamber	Climatec	CLIMATEC 3	2846	12	20-Jul-2019

Table 10



2.6 Vibration

2.6.1 Specification Reference

IEC 62287-2, Clause 9.2

2.6.2 Equipment Under Test and Modification State

ATB 1, S/N: TA 001 - Modification State 2

2.6.3 Date of Test

03-September-2018

2.6.4 Test Method

Fixed to the vibration table (see Test Setup below), the EUT (powered on) was subject to the following vibration profile in each axis:

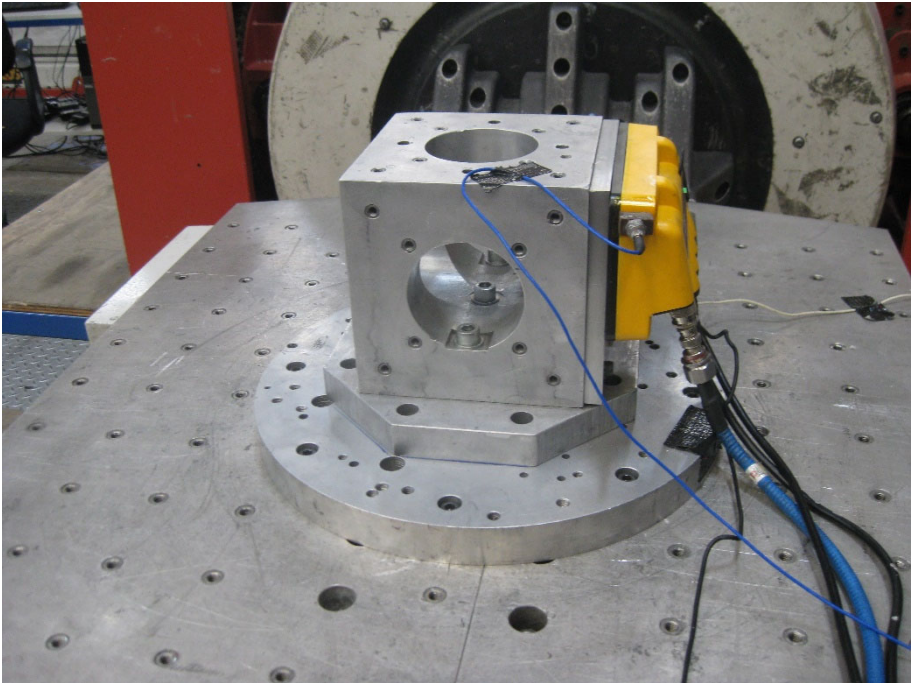
Amplitude: 2 Hz to 5 Hz and up to 13,2 Hz with an excursion of $\pm 1 \text{ mm} \pm 10 \%$ (7 m/s^2 maximum acceleration at 13,2 Hz);
above 13,2 Hz and up to 100 Hz with a constant maximum acceleration of 7 m/s^2 .
Sweep rate: 0.2 octave / minutes.

One sweep up (2 Hz to 100 Hz) followed by one sweep down (100 Hz to 2 Hz).

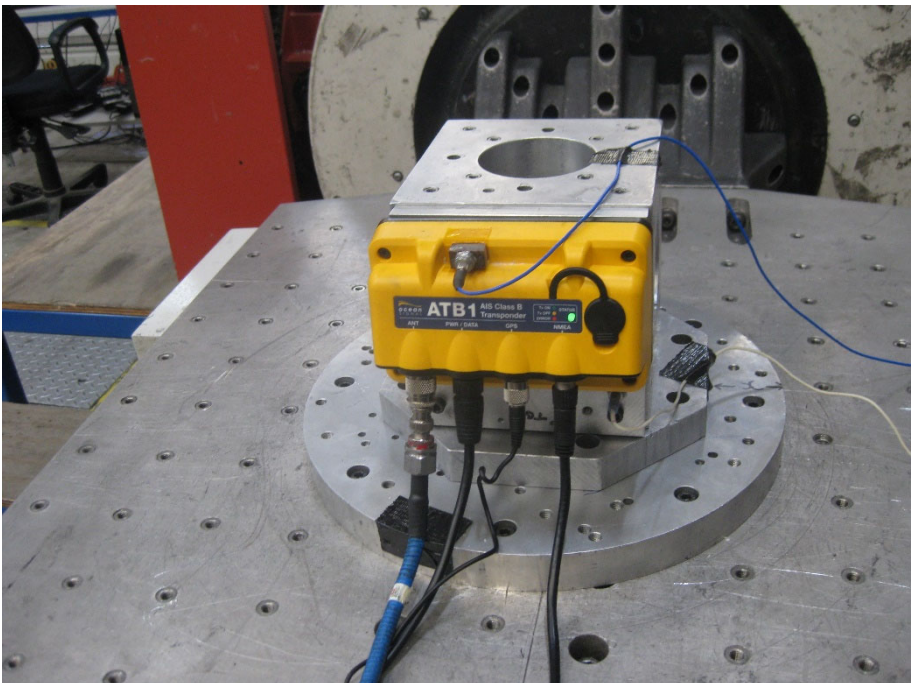
The EUT was kept operational throughout the test and was subject to the performance check on completion of the test.



Test Setup – X Axis



Test Setup – Y Axis





Test Setup – Z Axis



2.6.5 Environmental Conditions

Ambient Temperature	23.4°C
Relative Humidity	44.7%

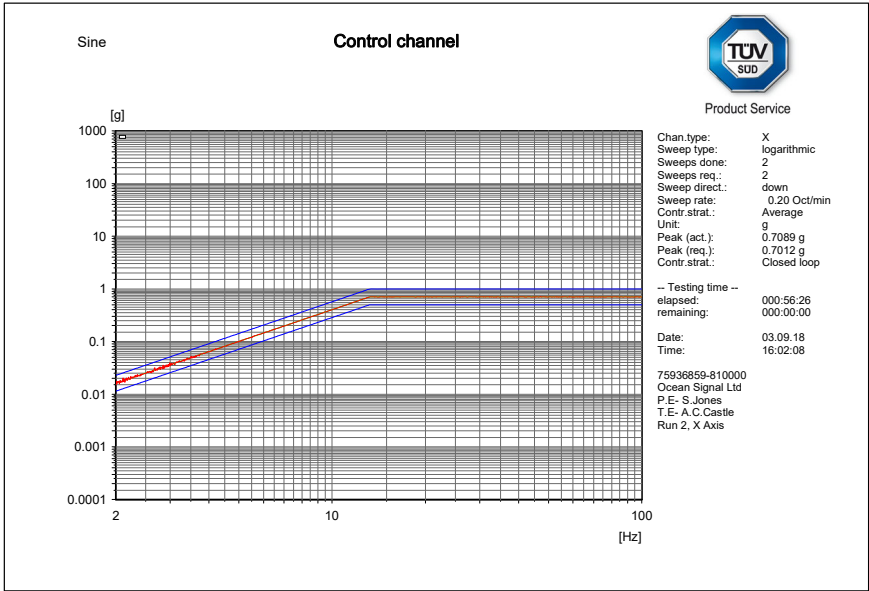


Product Service

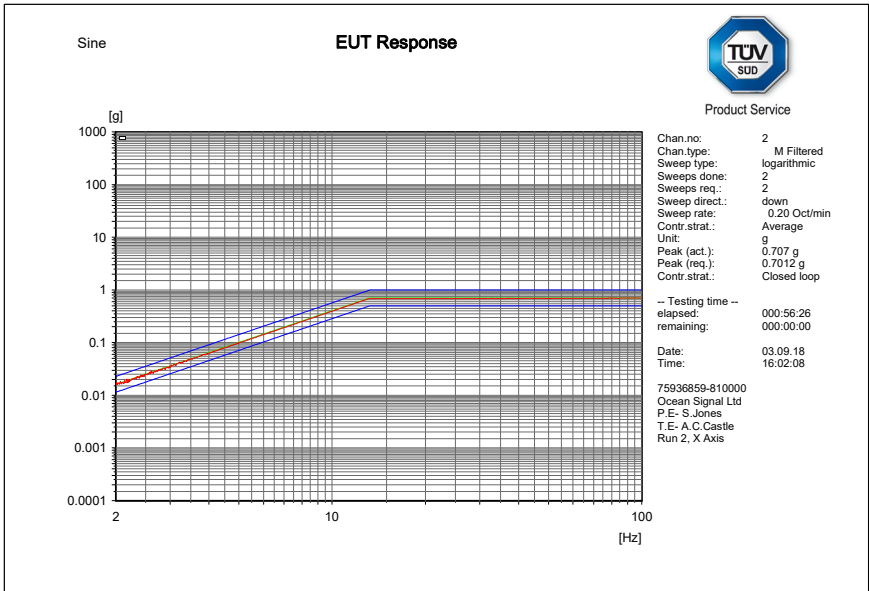
2.6.6 Test Results

Vibration Plots

X Axis (Control)



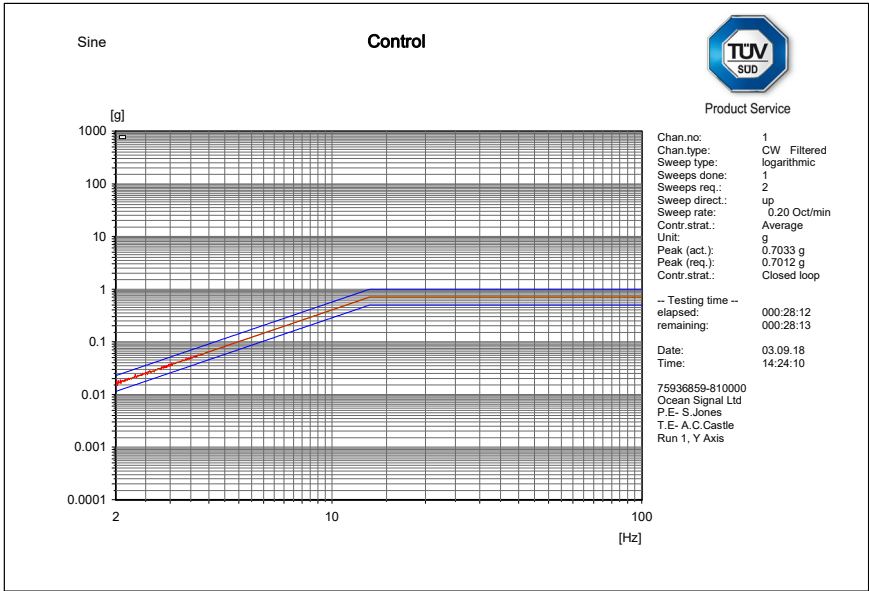
X Axis (EUT)



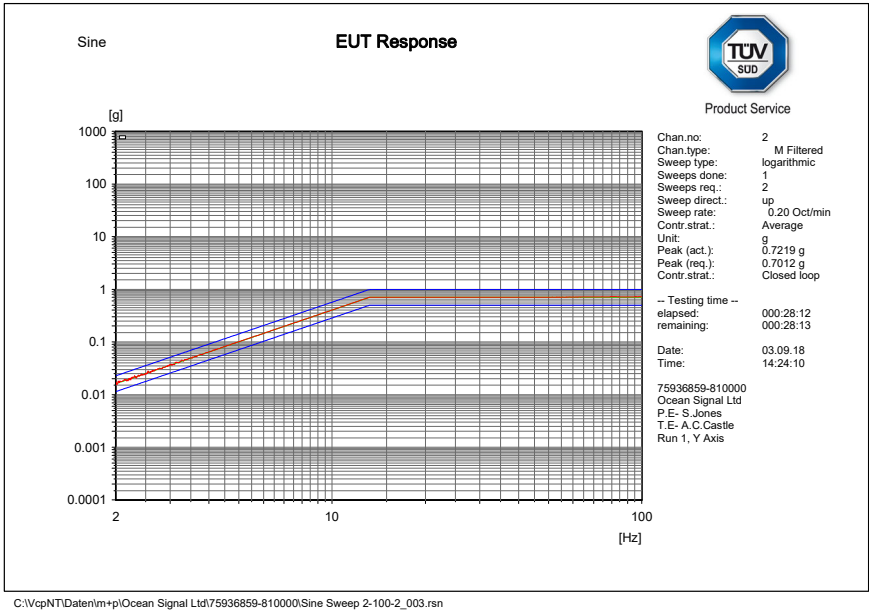


Product Service

Y Axis (Control)



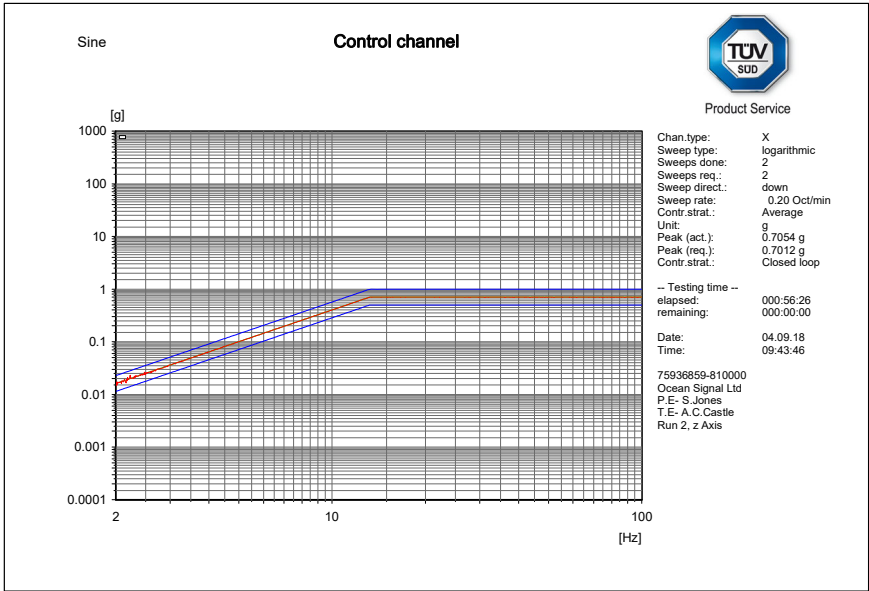
Y Axis (EUT)



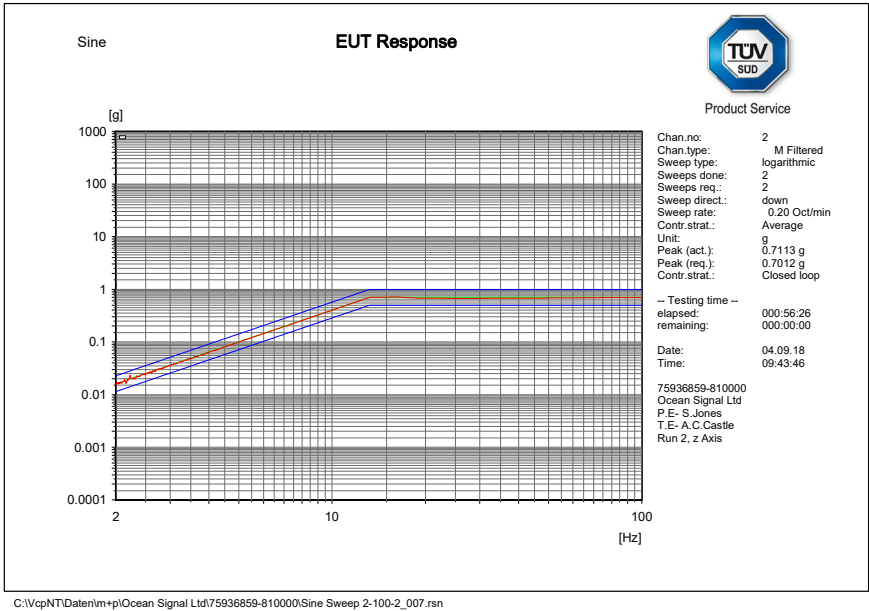


Product Service

Z Axis (Control)



Z Axis (EUT)



Performance Check

The EUT continued to transmit Messages 18 and 24 part A and B following the autonomous continuous schedules, alternating between channels A and B.

The EUT continuously received messages from a Class A AIS device.



Product Service

2.6.7 Test Location and Test Equipment Used

This test was carried out in the Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Charge Amplifier	Endevco	133	2503	12	23-May-2019
Vibration System	Ling Dynamic Systems	875	3170	6	24-Jan-2019
Isotron Accelerometer	Endevco	256-10	3383	6	15-Sep-2018
Accelerometer	Endevco	256-10	3440	6	02-Nov-2018
Vibration Controller	m + p International	Vibpilot 8	3771	12	16-Jul-2019

Table 11



Product Service

2.7 Maintenance, Equipment Manuals and Marking and Identification (NUA)

2.7.1 Specification Reference

IEC 60945, Clause 13, 14 and 15

2.7.2 Equipment Under Test and Modification State

ATB 1, S/N: TA 001 - Modification State 2

User Manual: ATB1 User Manual 912S-02692 Issue 00.13.pdf (unless indicated otherwise)

Labelling: 163S-03141 LABEL ATB1 Approvals

2.7.3 Date of Test

29-September-2018



2.7.4 Test Method

The supplied documentation as indicated above was inspected for compliance with the above clauses. The findings are noted below: the inspection was provided to confirm the presence of the required information. The accuracy of the instructions was not checked:

Specification Clause	Clause Details		Inspection Comments
13	Maintenance	The EUT shall be checked for conformity with the requirements of 4.7, paying due regards to any restriction likely to be imposed by the installation spatial environment. 4.7.1 Maintenance of hardware: EUT designed to be replaced readily without elaborate recalibration or readjustment	Whilst the contents of the User Guide were checked for inclusion the accuracy of details were not confirmed. The user manual indicated that the EUT should not be installed in a flammable atmosphere or in a location subject to excessive solar heat. Installation instructions are provided with guidance to ensure it is located such that the indicator LED can be seen and to allow access to the EUT controls and ports.
13	Maintenance	4.7.1 Maintenance of hardware: EUT constructed and installed to be readily accessible for inspection and maintenance	Installation instructions are provided for the GPS antenna. Indicating that the antenna should be given a clear and unobstructed view of the sky. Further guidance is provided to not mount the antenna on the mast so as to avoid the swing and thus potentially reduce of the accuracy. Additional instructions are provided to not position the GPS antenna in the path of a radar transmitter. The user manual indicates that the EUT contains no user-serviceable part, and that all maintenance work should be carried out by trained person authorised by Manufacturer. The Manufacturer advises that no maintenance of the EUT is required, and hence there are no maintenance instructions within the user guide.



Specification Clause		Clause Details	Inspection Comments
13	Maintenance	4.7.2 Maintenance of software:	Not applicable.
14	Equipment manuals	Equipment manuals compliant with 4.8 4.8 Adequate information provided to enable proper operation and maintenance by suitably qualified persons 4.8 a) Operating and servicing manuals written in English 4.8 b) Operating and servicing manuals identify category of EUT as per 4.4 4.8 c) Where EUT so designed, operating and servicing manuals facilitate fault diagnosis and repair to component level, are practicable and provide full circuit diagrams, component layouts and a component parts list 4.8 d) Where EUT so designed, operating and servicing manuals facilitate location, identification and replacement of defective complex modules 4.8 Adequate information provided to allow operation per requirements of relevant equipment standard Examples of typical operational and equipment set up procedures easy-to-use and effective Examples of typical fault-finding routines easy-to-use and effective under simulated fault conditions Installation procedures	The user 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: Operating Instructions, detailing the operating modes and guidance for the LED indications. There is no separate Service Manual. The user is advised that there are no user-serviceable parts. The user manual states that the EUT is classed as Protected (GPS antenna exposed). (Confirmed in ATB1 User Manual 912S-02692 Iss 00.14.pdf.) The user manual indicates that there are no user-serviceable parts. There are no maintenance instructions provided. Details of supported data sentence for NMEA0183 are provided. Details of supported NMEA2000 PGNs are provided. Installation instructions to allow operation, including: mounting, setup diagram, connections diagrams and recommendations, port settings, initial configuration requirements (MMSI, Vessel name, Vessel call sign, Vessel dimensions and AIS GPS antenna location and Vessel type), and using WiFi. The user guide was written in English.



Specification Clause		Clause Details	Inspection Comments
15	Marking and identification	EUT compliant with 4.9 4.9 Each unit marked externally, clearly and visible in normal installed position (where practicable) with: 1) manufacturer 2) equipment type number or model identification 3) serial number Alternatively, marking presented on a display at equipment start-up	The EUT labelling includes: 1. The Manufacturer details 2. Model number 3. Serial number
15	Marking and identification	4.9 EUT marked before delivery or on installation	The Manufacturer confirmed that the labelling is affixed to the EUT prior to shipping.
15	Marking and identification	4.9 Title and version of each software element marked or displayed on command	Not applicable – EUT does not have a display. The Manufacturer confirmed that the user can identify the firmware version installed by sending an NMEA command. Additionally the Manufacturer advised that the firmware version will be available via the android/IOS configuration applications.
15	Marking and identification	4.9 When marking, title and version only displayed on display, such information also included in equipment manual	As above.
15	Marking and identification	4.9 Compass safe distance marking compliant with 4.5.3 4.5.3 Each unit clearly marked with minimum safe distance Alternatively, minimum safe distance for fixed (non-portable) equipment given in equipment manual	The compass safe distance value can be found on the EUT labelling. The compass safe distance value for the GPS antenna is provided in the user manual.



Product Service

2.7.5 Test Location and Test Equipment Used

The inspection was carried out at Octagon House.

There is no test equipment required for this section (documentation review only).

3 Photographs

3.1 Equipment Under Test (EUT)



EUT and GPS Antenna