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Test Report

No: U142199E1

Designation of equipment under test: Sea Angel SA14

Test Laboratory

for

"Safety of Electrical Equipment and Industrial Low-Voltage Devices as well as Environmental Tests"

accredited by
DAkkS Deutsche Akkreditierungsstelle GmbH
in compliance with DIN EN ISO/IEC 17025
under
Reg. No. D-PL-17186-01-03

Testing body:	PHOENIX TESTLAB GmbH Königswinkel 10 D-32825 Blomberg
Applicant:	FT-TEC GmbH Werner von Siemens Straße 5 A-7343 Neutal
Order number:	14-112199
Type of test:	Environmental test: - Vibration, sinusoidal - Dry Heat - Cold - Damp Hea - Battery Capacity Test
Test base:	IEC 60945

Equipment under test: Sea Angel SA14

DUT-No. PTL	Typ	Note
142199_148243	148243	Climatic Test
142199_148233	148233	Thermal Shock
142199_148246	148246	Vibration
142199_148233	148233	IP X7
142199_148243 142199_148244	148243 148244	Battery Capacity Test

Manufacturer: See applicant

Date equipment was received: 28 July 20014

Test specifications: IEC 60945

Customer represented during the test by the following person(s): ---

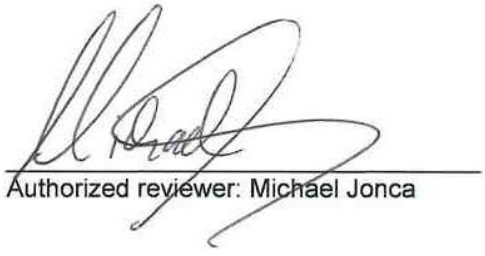
Place of testing: PHOENIX TESTLAB GmbH, Blomberg

Date of testing: 30 July 2014 to 22 August 2014

Test result:	Test requirements and conditions are present in the following chapters. The requirements made in the test documents were not fulfilled by the equipment under test.

Blomberg, 10 October 2014

Test Engineer: Jörg Jacob



Authorized reviewer: Michael Jonca

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1 Test specifications and test conditions

1.1 Vibration

This test determines the ability of equipment to withstand vibration without resulting in mechanical weakness or degradation in performance. The test simulates the effect of vibration induced in a ship's hull by its propeller and machinery. This is generally at frequencies of up to 13 Hz and predominantly vertical. The tests at higher frequencies simulate the effect of slamming which occurs in irregular stormy seas, and is predominantly horizontal. The test does not simulate the effect of regular seas giving the translational components of surging, swaying and heaving, and the corresponding rotational components of rolling, pitching and yawing which generally produce accelerations too small to be of consequence to electronic equipment.

The DUT, complete with any shock and vibration absorbers with which it is provided, shall be fastened to the vibration table by its normal means of support and in its normal attitude. The DUT may be resiliently suspended to compensate for weight not capable of being withstood by the vibration table. Provision may be made to reduce or nullify any adverse effect on EUT performance which might be caused by the presence of an electromagnetic field due to the vibration unit.

The DUT shall be subjected to sinusoidal vertical vibration at all frequencies between:

Frequency range	5 Hz to 100 Hz
Cross-over frequency	13.2 Hz
Displacement amplitude below the cross-over frequency	1 mm
Acceleration amplitude above the cross-over frequency	7 m/s^2
Sweep rate	0.5 octaves/min
Axis	X, Y, Z

The frequency sweep rate shall be 0,5 octaves/min in order to allow the detection of resonances in any part of the DUT as mounted.

A resonance search shall be carried out throughout the test. During the resonance search the DUT shall be externally observed, by unaided visual and aural means, for obvious signs of any resonances of components or sub-assemblies, that may affect the integrity of the DUT.

Such observations shall be recorded in the test report. If any resonance, as measured by a sensor fixed to the outside of the DUT at the location where obvious signs of resonance have been observed, has a magnitude ratio ≥5 measured relative to the surface where the DUT is fastened, the DUT shall be subjected to a vibration endurance test at each resonant frequency at the vibration level specified in the test with a duration of 2 h. When resonant frequencies with magnitude ratios ≥ 5 are harmonically related, only the fundamental frequency shall be tested. If no resonance with a magnitude ratio ≥ 5 occurs, the endurance test shall be carried out at one single observed frequency. If no resonance occurred, the endurance test shall be carried out at a frequency of 30 Hz. Performance check(s) shall be carried out at least once during each endurance test period, and once before the end of each endurance test period. The procedure shall be repeated with vibration in each of two mutually perpendicular directions in the horizontal plane. Further information is given in IEC 60068-2-6.

1.2 Dry heat, Storage

To simulate the effects of temperature stress on equipment in the non-operating (un-powered) mode. A temperature of +70 °C is the maximum likely to be encountered in enclosed spaces on ships and in equipment exposed to the full effects of solar radiation in ports.

The temperature shall then be raised to and maintained at +70 °C ± 3 °C, for a period of 10 h to 16 h. At the end of the test, the DUT shall be returned to normal environmental conditions and then subjected to a performance check as specified in the relevant equipment standard. Further information is given in IEC 60068-2-2 and IEC 60068-2-48

1.2.1 Dry heat, Functional Test

This test determines the ability of equipment to be operated at high ambient temperatures and to operate through temperature changes. The reasonable maximum air temperature likely to be encountered over the sea is +32 °C and the maximum solar gain at sea is +23 °C giving +55 °C as the maximum temperature likely to be encountered by ships at sea.

The DUT shall be placed in a chamber at normal room temperature and relative humidity. The DUT and, if appropriate, any climatic control devices with which it is provided shall then be switched on. The temperature shall then be raised to and maintained at +55 °C ± 3 °C. At the end of a soak period of 10 h to 16 h at +55 °C ± 3 °C, the DUT shall be subjected to a performance test and check as specified in the relevant equipment standard. The temperature of the chamber shall be maintained at +55 °C ± 3 °C during the whole performance test period. At the end of the test, the DUT shall be returned to normal environmental conditions. Further information is given in IEC 60068-2-2.

1.3 Damp heat, Functional test

This test determines the ability of equipment to be operated under conditions of high humidity. A single cycle is used with an upper temperature limit of +40 °C which is the maximum that occurs in the earth's surface atmosphere with a relative humidity of 95 %

The DUT shall be placed in a chamber at normal room temperature and relative humidity. The temperature shall then be raised to +40 °C ± 2 °C, and the relative humidity raised to 93 % ± 3 % over a period of 3 h ± 0,5 h. These conditions shall be maintained for a period of 10 h to 16 h. Any climatic control devices provided in the DUT may be switched on at the conclusion of this period. The DUT shall be switched on 30 min later, or after such period as agreed by the manufacturer, and shall be kept operational for at least 2 h during which period the DUT shall be subjected to a performance check as specified in the relevant equipment standard.

1.4 Low Temperature storage test

This test simulates the effects of temperature stress on equipment in the non-operating (un-powered) mode. It is applied to the portable equipment because of the importance that emergency equipment functions correctly after prolonged non-operation. The DUT shall be placed in a chamber at normal room temperature and relative humidity. The temperature shall then be lowered to and maintained at – 30 °C ± 3 °C, for a period of 10 h to 16 h. At the end of the test period, the DUT shall be returned to normal environmental conditions and then subjected to a performance check as specified in the relevant equipment standard. Further information is given in IEC 60068-2-48

1.4.1 Low Temperature Functional Test

The EUT shall be placed in a chamber at normal room temperature and relative humidity. The temperature shall then be reduced to, and maintained at – 20 °C ± 3 °C, for a period of 10 h to 16 h. Any climatic control devices provided in the DUT may be switched on at the conclusion of this period. The DUT shall be switched on 30 min later, or after such period as agreed by the manufacturer, and shall be kept operational for at least 2 h during which period the DUT shall be subjected to a performance check test and check as specified in the relevant equipment standard.

1.4.2 Thermal Shock

To determines the ability of portable equipment to function correctly after sudden immersion in water from storage at high temperature.

in water at + 25 °C ± 3 °C to a depth of 100 mm ± 5 mm, measured from the highest point of the DUT to the surface of the water, for a period of 1 h. At the end of the test the DUT shall be subjected to a performance check, and shall then be examined for damage and for unwanted ingress of water. Following examination, the DUT shall be resealed in accordance with the manufacturer's instructions. Alternatively, if there are no external signs of unwanted ingress of water, an internal examination of the EUT, which involves disturbance to seals, may be carried out after all environmental tests have been completed.

The requirements of the performance check shall be met. There shall be no damage to the DUT or ingress of water. The findings shall be noted in the test report.

1.4.3 Battery Capacity Test

Using a fresh battery pack, the AIS-SART shall be activated (at the ambient temperature) for a period of time as stated by the manufacturer to be equivalent to the loss of battery capacity due to self-testing, stand-by loads as well as battery-pack self-discharge during the useful life of the battery pack. The manufacturer shall substantiate the method used to determine this time. Alternatively, at the manufacturer's discretion the pre-discharge of the battery (as outlined above) may be replaced by the equivalent extension beyond 96 h of the following battery capacity and low-temperature test. If using this test method the AIS-SART manufacturer shall apply a compensation figure to allow for the fact that the extension period due to loss in battery capacity is being carried out at the minimum operating temperature rather than at ambient temperature. This compensation figure shall be substantiated by the manufacturer.

The AIS-SART shall be placed in a chamber at normal room temperature. Then the temperature shall be reduced to and maintained at – 20 °C ± 3 °C for a period of 10 h to 16 h. Any climatic control device provided in the equipment may be switched on at the conclusion of this period. The equipment shall be activated in its mode of maximum current draw (for example EPFS drawing maximum current) 30 min after the end of the period and shall then be kept working continuously for a period of 96 h. The temperature of the chamber shall be maintained as specified above for the whole of the period of 96 h. The operation of the AIS-SART during the test shall be verified.

2 Test performance and test results

2.1 Test performance

The tests are carried out as follows:

No.	DUT	Test	Axis
1	142199_148243	Dry Heat Storage	---
2		Dry Heat, Functional Test	---
3		Damp Heat, Functional Test	---
4		Low Temperature Storage	---
6		Low Temperature, Functional Test	---
7	142199_148233	Thermal Shock	---
8	142199_148243 142199_148244	Battery Capacity Test	---
0	142199_148246	Resonance search 5 Hz to 100 Hz	Vertical
11		Vibration Dwell 30 Hz for 2 h	
13		Resonance search 5 Hz to 100 Hz	Horizontal 1
14		Vibration Dwell 30 Hz for 2 h	
15		Resonance search 5 Hz to 100 Hz	Horizontal 2
16		Vibration Dwell 30 Hz for 2 h	

Note: The final evaluation of the DUTs will be carried out by the applicant and not by the testing body, PHOENIX TESTLAB GmbH

2.2 Test results

2.2.1 Resonance search

DUT	Test	Axis	Requirements fulfilled
142199_148246	Resonance search 5 Hz to 100 Hz	Vertical	see Diagrams
	Resonance search 5 Hz to 100 Hz	Horizontal 1	
	Resonance search 5 Hz to 100 Hz	Horizontal 2	

Note: The final evaluation of the DUTs will be carried out by the applicant and not by the testing body, PHOENIX TESTLAB GmbH

2.2.2 Vibration

DUT	Test	Axis	Performance check all the time during the test	Requirements fulfilled
142199_14846	Vibration Dwell 30 Hz for 2 h	Vertical	OK	Yes
	Vibration Dwell 30 Hz for 2 h	Horizontal 1	OK	Yes
	Vibration Dwell 30 Hz for 2 h	Horizontal 2	OK	Yes

Note: The final evaluation of the EUTs will be carried out by the applicant and not by the testing body, PHOENIX TESTLAB GmbH

2.2.3 Dry heat Storage and Functional Test

DUT	Temp.	Test duration	Visual damages	Performance check during the test	Requirements fulfilled
142199_148243	+ 70 °C	16 h	No	No	Yes
	+ 55 °C	16 h	No	Yes	Yes

Note: The final evaluation of the EUTs will be carried out by the applicant and not by the testing body, PHOENIX TESTLAB GmbH

2.2.4 Damp heat

DUT	Temp.	Test duration	Visual damages	Performance check during the test	Requirements fulfilled
142199_148243	+ 40 °C 93 % rel	16 h	No	No	Yes

Note: The final evaluation of the EUTs will be carried out by the applicant and not by the testing body, PHOENIX TESTLAB GmbH

2.2.5 Low Temperature storage test and Functional Test

DUT	Temp.	Test duration	Visual damages	Performance check during the test	Requirements fulfilled
142199_148243	- 30 °C	16 h	No	None	Yes
	- 20 °C	16 h	No	Yes	Yes

Note: The final evaluation of the EUTs will be carried out by the applicant and not by the testing body, PHOENIX TESTLAB GmbH

2.2.6 Thermal Shock

DUT	Temp.	Test duration	Visual damages	Performance check during the test	Requirements fulfilled
142199_148243	+ 70 °C	1 h	No	No	Yes
	+ 25°C water	1 h	Yes[1)]	Yes[1)]	No[1)]

Note: The final evaluation of the EUTs will be carried out by the applicant and not by the testing body, PHOENIX TESTLAB GmbH
[1)] At the end of the test water was inside the housing

2.2.7 Battery Capacity Test

DUT	Temp.	Test duration	Visual damages	Performance check during the test	Requirements fulfilled
142199_148243 142199_148244	-20°C	96 h	No	Yes	Yes

Note: The final evaluation of the EUTs will be carried out by the applicant and not by the testing body, PHOENIX TESTLAB GmbH

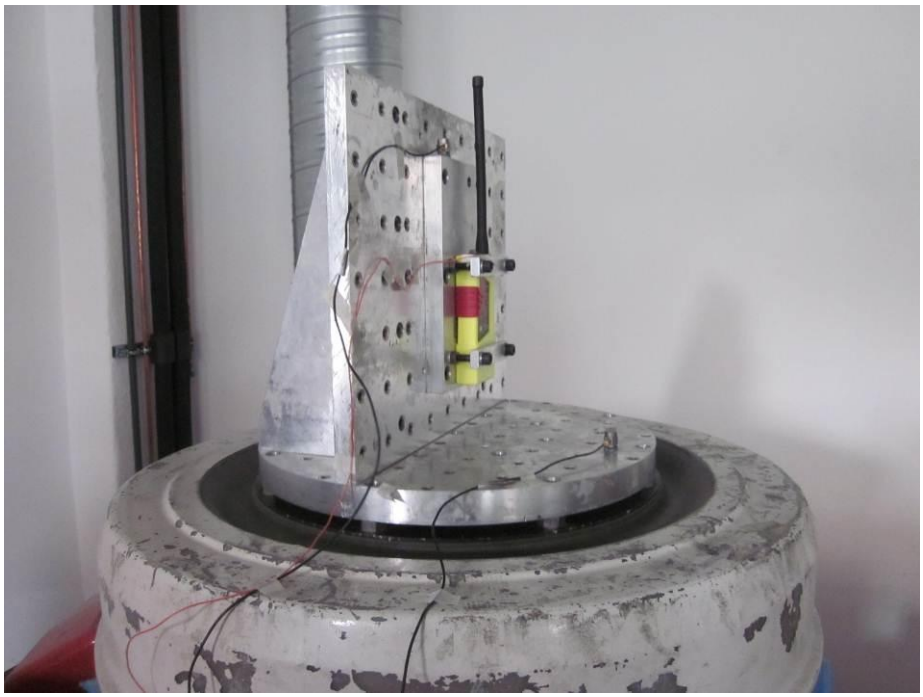
3 List of measurement equipment

Measurement equipment	PM Nr.
Shaker LDS V850-440 LPT 600	490082
Accelerometer	481337
Accelerometer	481208
AIS protocol tester MK II	481422
Temperature Chamber RS M58	480619
GPS SOURS	481520

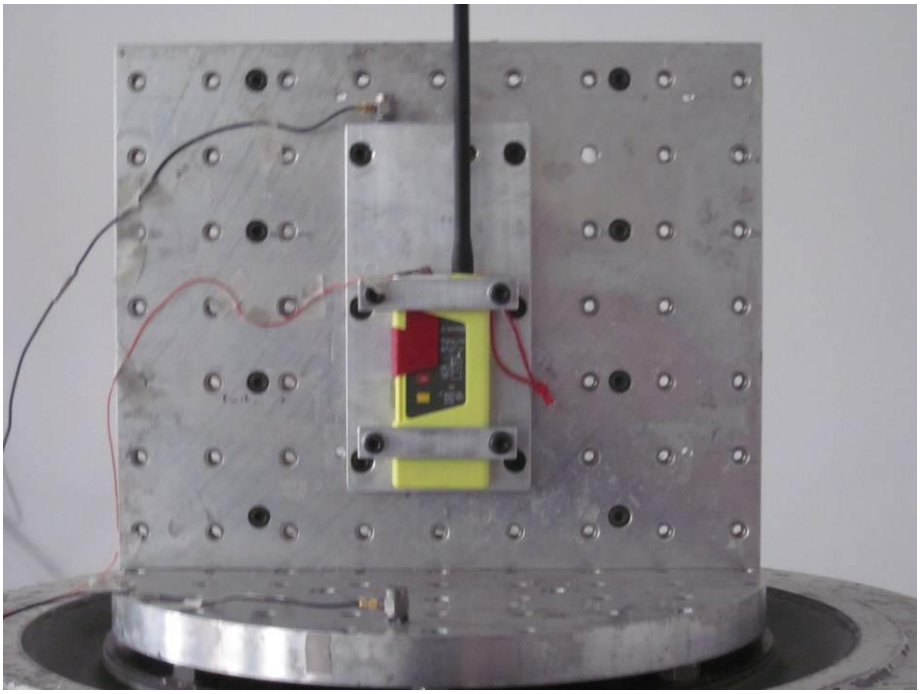
Note: The QM-Manual of PHOENIX TESTLAB regulates the calibration of the measuring equipment. All listed measuring equipment is traceable calibrated according to national or international standards. Measurement uncertainty is calculated according to GUM.

4 Pictures

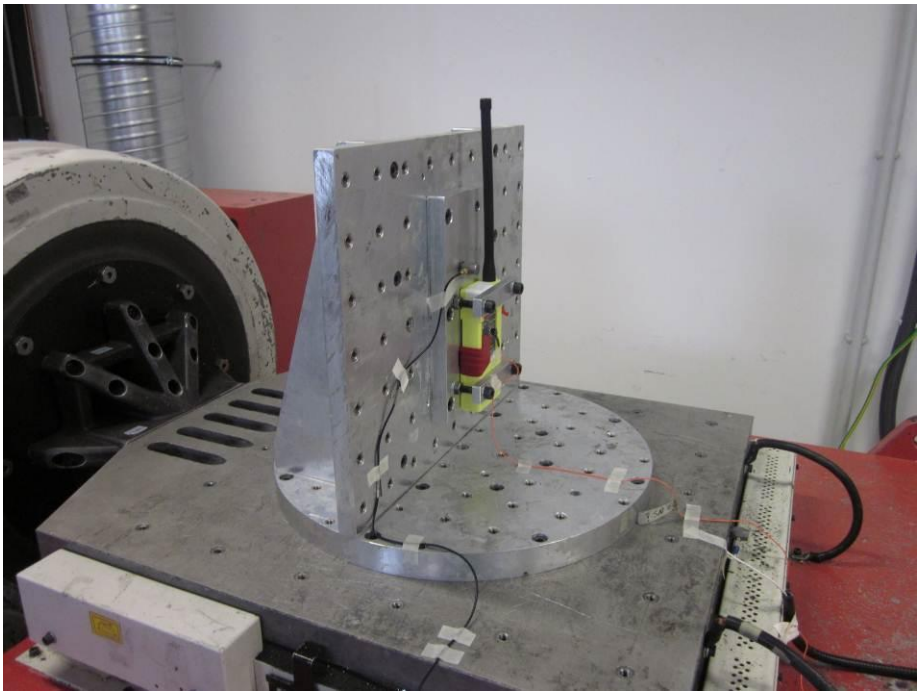
Picture 1: Test set-up vibration vertical



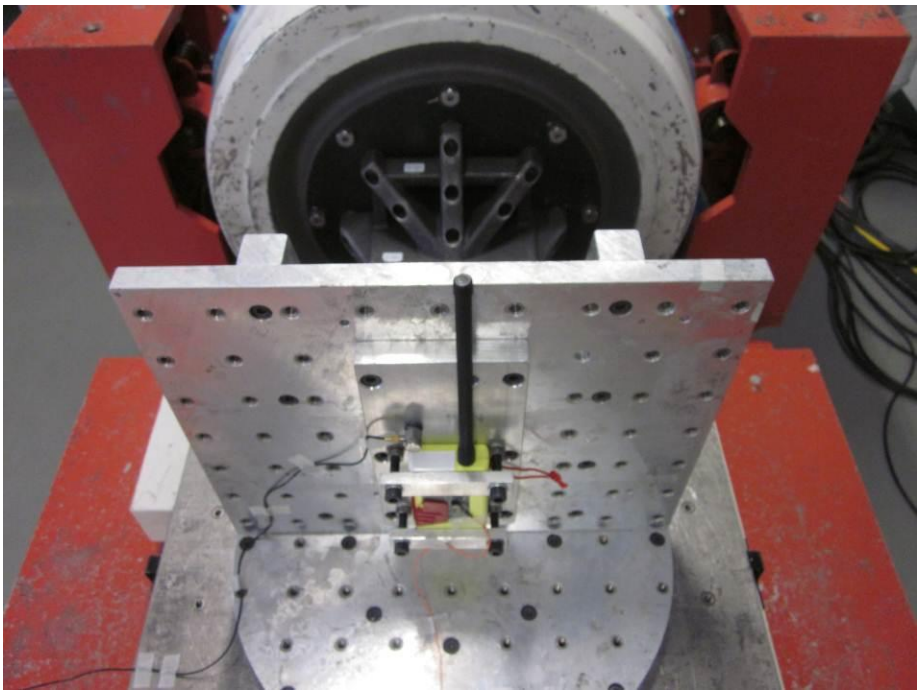
Picture 2: Test set-up vibration vertical



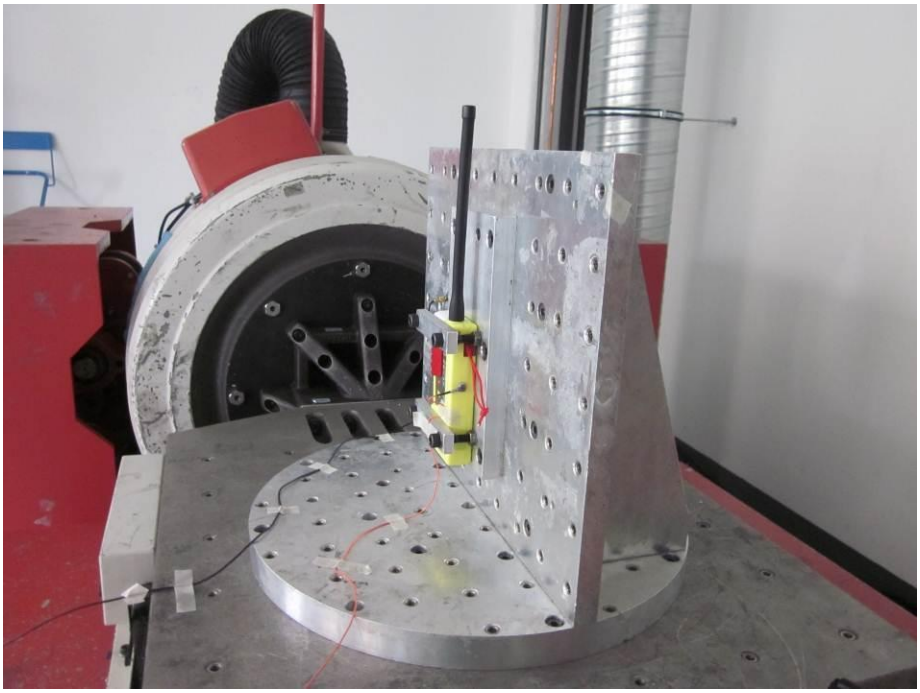
Picture 3: Test set-up vibration horizontal 1



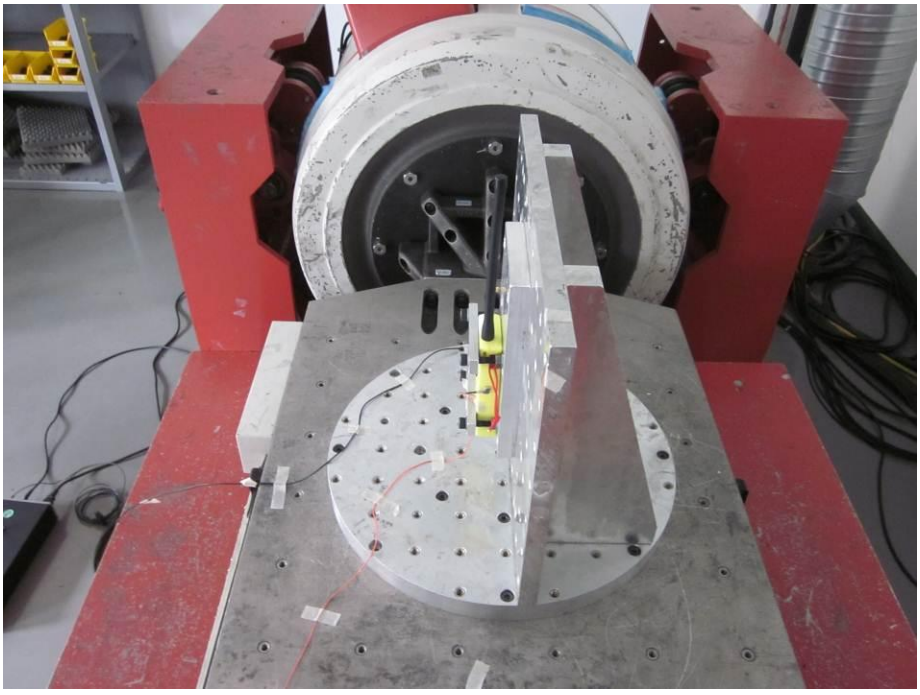
Picture 4: Test set-up vibration horizontal 1



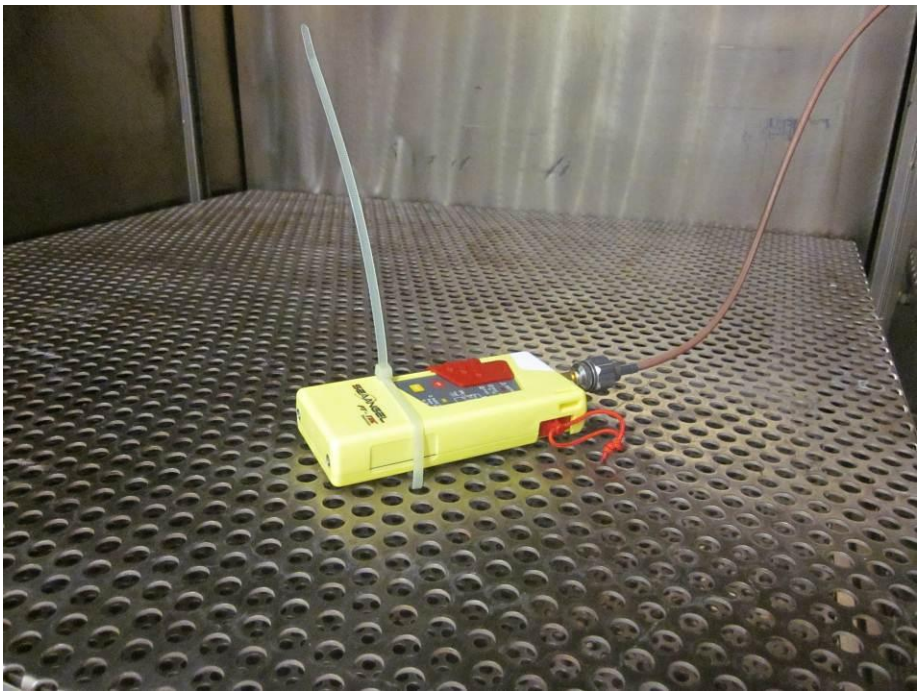
Picture 5: Test set-up vibration horizontal 2



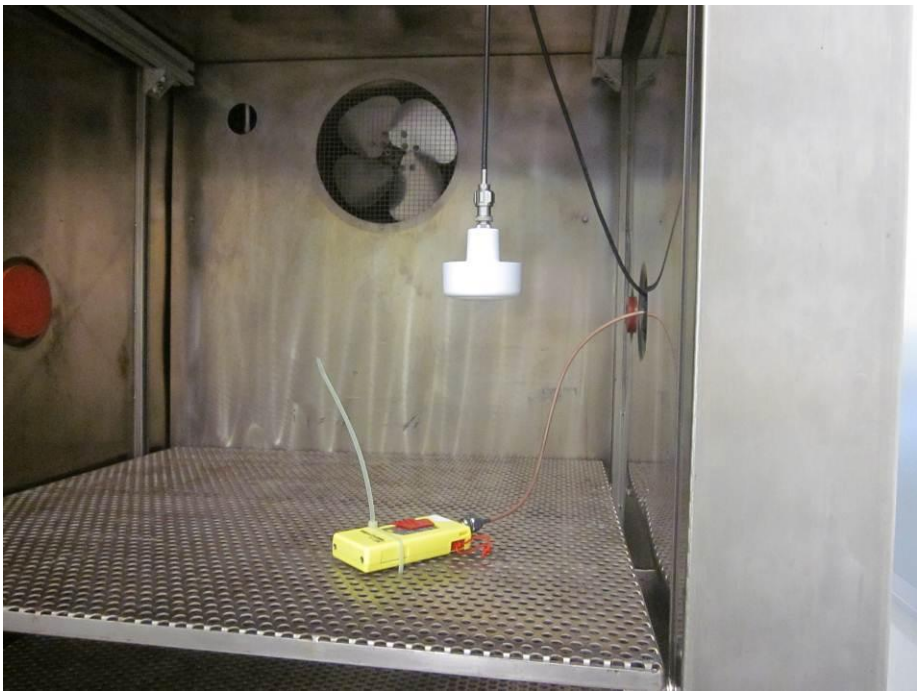
Picture 6: Test set-up vibration horizontal 2



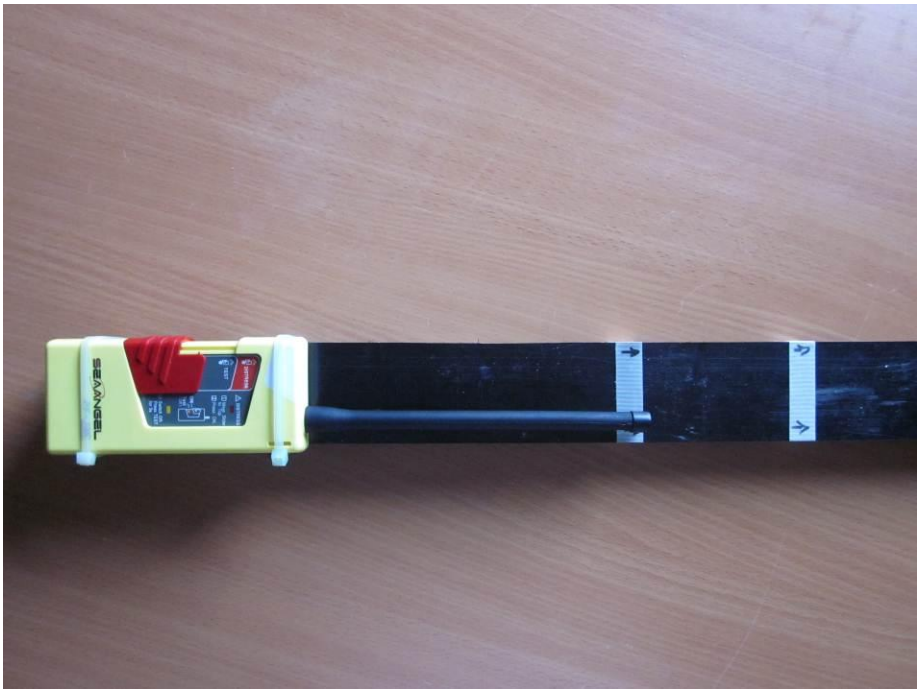
Picture 7: Dry-, Damp Heat-, Low Temperature Storage , Functional-Test



Picture 8: Dry-, Damp Heat-, Low Temperature Storage , Functional-Test



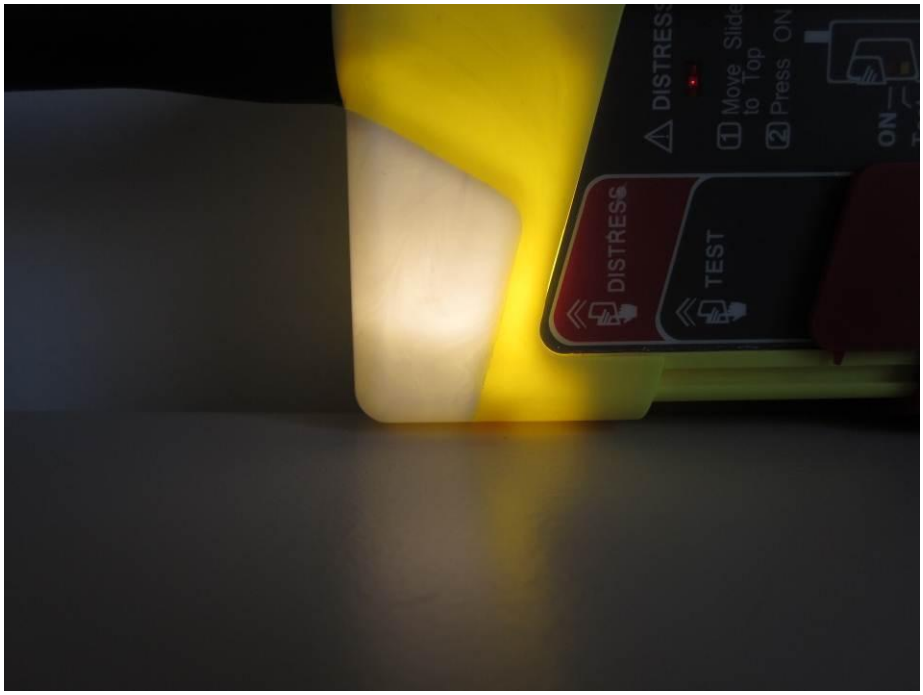
Picture 9: Thermal Shock



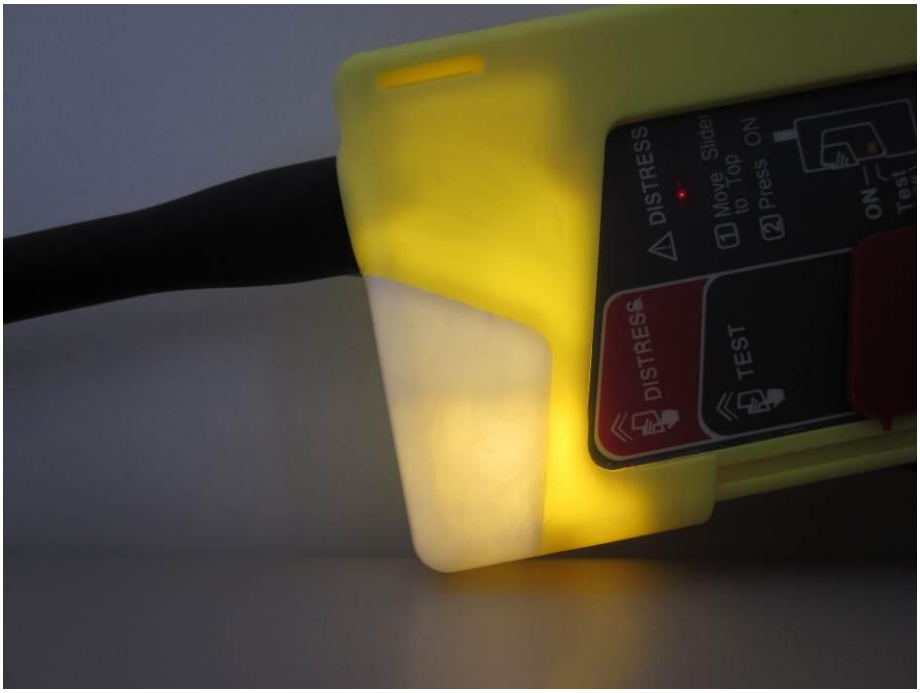
Picture 10: Thermal Shock

Picture 11 Thermal Shock

Picture 12: Thermal Shock



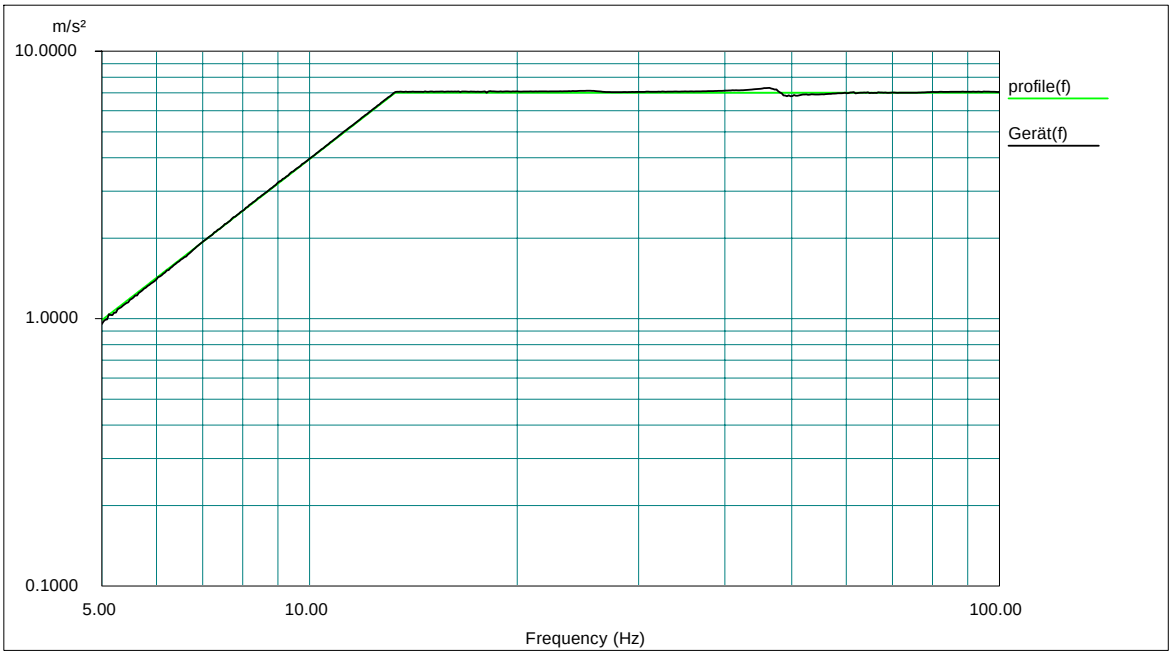
Picture 13 Thermal Shock



Picture 14 Thermal Shock

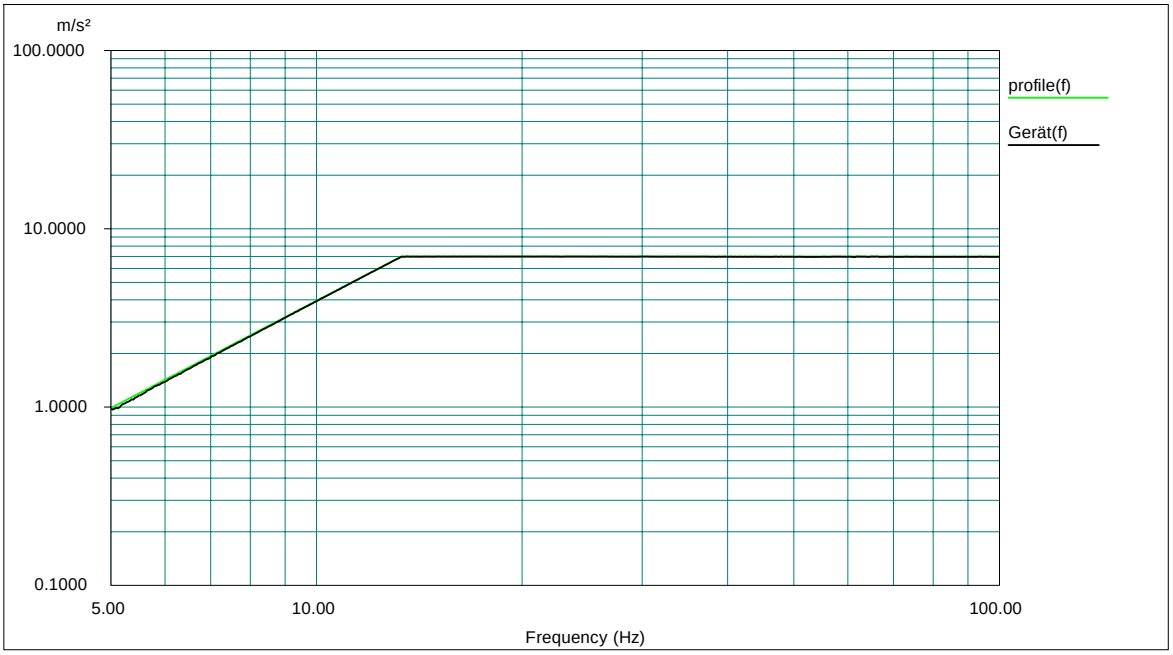
5 Diagram

Diagram 1 Vibration vertical



Level: 100 % Full Level Time: 00:08:40 Sweep Type: Loga-rithmic
Frequency: 99.986885 Hz Time Remaining:00:00:00 Sweep Rate: 0.5 Oct/Min

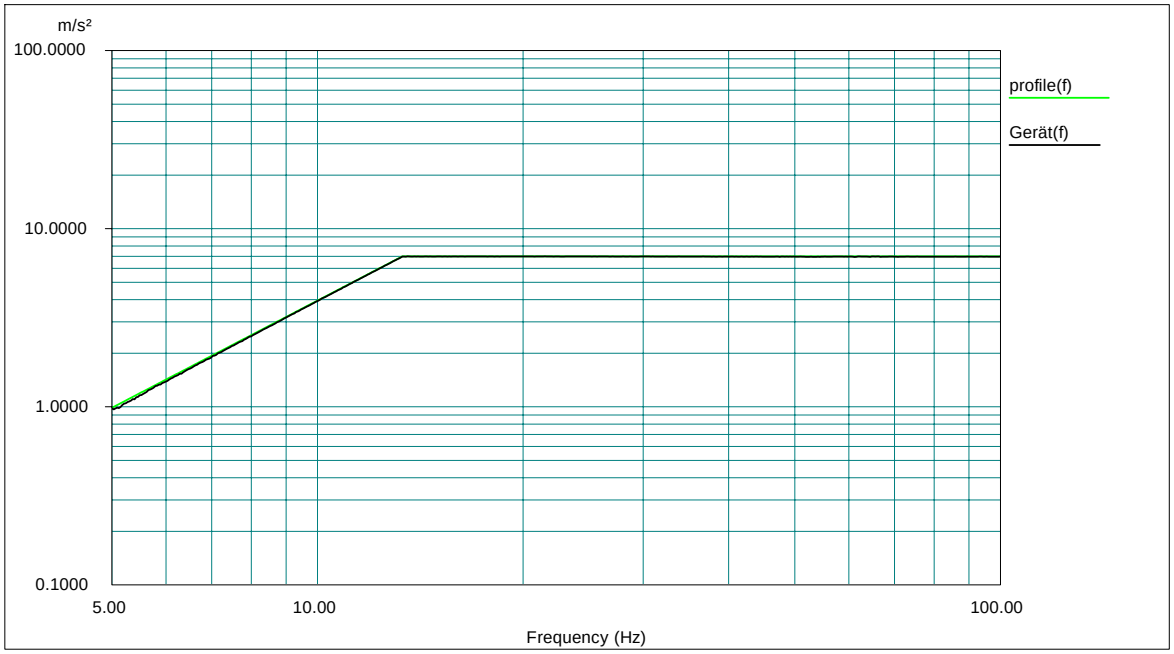
Diagram 2 Vibration horizontal 1



Level: 100 % Full Level Time: 00:08:45 Sweep Type: Loga-rithmic

Frequency: 99.974586 Hz Time Remaining:00:00:00 Sweep Rate: 0.5 Oct/Min

Diagram 3 Vibration horizontal 2



Level: 100 % Full Level Time: 00:08:40 Sweep Type: Logarithmic
Frequency: 99.974586 Hz Time Remaining: 00:00:00 Sweep Rate: 0.5 Oct/Min

6 List of pictures

7 List of Diagram