Report On

Environmental Testing of the Vesper Marine Ltd
VHF DSC Radio Transceiver, Model: Cortex M1 and Handset, Model: Cortex H1
In accordance with IEC 60945

COMMERCIAL-IN-CONFIDENCE

FCC ID: Cortex M1: YJDVESPM1 Cortex H1: YJDVESPH1
IC: Cortex M1: 9118A-M1 Cortex H1: 9118A-H1

Document 75943855 Report 10 Issue 2 **June 2020**

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REPORT ON

Environmental Testing of the
Vesper Marine Ltd, Cortex M1, Model: Cortex M1
In accordance with IEC 60945

Document 75943855 Report 10 Issue 2

June 2020

PREPARED FOR

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(Environmental Tests)	(EMC Tests)	(RF Tests)

DATED

18 June 2020	18 June 2020	18 June 2020

This report has been up-issued to Issue 2 to include the FCC and IC ID

UKAS TESTING
0141

CONTENTS

1 REPORT SUMMARY

1.1 INTRODUCTION

Applicant	Vesper Marine Ltd
Manufacturer	Vesper Marine Ltd
Equipment Under Test (EUT)	Cortex M1& Cortex H1
Model Number(s)	Cortex M1 Cortex H1
Serial Number(s)	M1.0000006B H1.0000000F
Number of Samples tested	1 of each
Product Equipment Category	Protected
Test Specification/Issue/Date	IEC 60945: 2002 C1:2008
Test Plan/Issue/Date	Test Plan: Cortex VHF_DSC_AIS RF - 20-01-2020
Order Number	13976
Date	28-08-2018
Start of Test	10 September 2019
Finish of Test	13 February 2020
Name of Engineer(s)	ENV Engineer: Colin Hedley RF Engineers: Ibrahim Bukhari, Jonathan Kenny, Daniel Bishop, Neil Rousell and Francis Kane EMC Engineer: Matthew Smart
Related Documents	IEC 60068-2-2 2007 IEC 60068-2-30 2005 IEC 60068-2-6 2007 IEC 62287:2017 IEC 62238 (2003-03).

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out is shown below.

Section	Test Description	Result	Comments
2.1	Dry Heat – Functional	Satisfactory	
2.2	Damp Heat – Functional	Satisfactory	
2.3	Low Temperature – Functional	Satisfactory	
2.4	Vibration	Satisfactory	
2.5	Compass Safe Distance	Satisfactory	

Satisfactory – No damage or detrimental effects were observed and performance assessments were reported as satisfactory.

1.3 TECHNICAL DESCRIPTION

VHF and Class B AIS transponder with integrated Wi-Fi and cellular Connectivity. VHF/DSC/AIS capable.

1.4 DEVIATIONS FROM STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.5 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
Model: Cortex M1, Serial Number: M1.0000006B			
0	As supplied by the customer	Not Applicable	Not Applicable
1	Handset Firmware updated for cold temp	Manufacturer	11-October-2019
2	R1306 100 k -> 1 M (Cold Temp Issue – Audio Codec)	Manufacturer	25-November-2019
3	Replaced component capacitor C800 value 36 pF	Manufacturer	11-February-2020
Model: Cortex H1, Serial Number: H1.0000000F			
0	As supplied by the customer	Not Applicable	Not Applicable

1.6 TEST LOCATION

TÜV SÜD conducted the following tests at our Fareham test laboratory:

Test Name	Name of Engineer(s)	Accreditation
Dry Heat	Colin Hedley	UKAS
Damp Heat Cycle	Colin Hedley	UKAS
Low Temperature	Colin Hedley	UKAS
Vibration Test	Colin Hedley	UKAS
Compass Safe Distance	Matthew Smart	UKAS

Office Address:

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

2 TEST DETAILS

2.1 DRY HEAT

2.1.1 Specification Reference

IEC 60945, Clause 8.2.2

2.1.2 Equipment Under Test and Modification State

Cortex M1, S/N: M1.000006B - Modification State 3
Cortex H1, S/N: H1.0000000F - Modification State 0

2.1.3 Date of Test

11 and 12 February 2020

2.1.4 Test Equipment Used

This test was carried out in environmental climatic test laboratory.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal Generator	Hewlett Packard	ESG4000A	61	12	17-Jul-2020
Digital Time Analyser	Marconi	2850-BS	80	-	TU
DSC Decoder/Encoder	TUV SUD	DSC TPOO1	81	-	TU
RF Power Amplifier	Amp Research	150L	578	-	TU
Modulation Analyser	Hewlett Packard	8901B	773	12	28-Jun-2020
Chamber	Heraeus	HC 4033	2174	12	5-Jul-2020
Sensor	Hewlett Packard	11722A	2787	12	21-Oct-2020
Signal Generator (250kHz to 4GHz)	Agilent Technologies	E4433B	2893	12	9-Sep-2020
DSC Pre-Emphasis Unit for VHF Modem	TUV SUD	RAB 200701	3314	12	12-Aug-2020
Multimeter	Fluke	177	3813	12	9-Oct-2020
Attenuator (30dB, 100W)	Weinschel	48-30-43	4863	12	18-Jul-2020
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
Hygrometer	Rotronic	HP21	5004	12	2-Oct-2020

TU – Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment.

2.1.5 Test Method

IEC 60945 main extract and application:

- Performance Check at normal environmental conditions as per IEC 60945 Clause 8.1 was carried out prior to testing.
- EUT placed in a chamber at normal conditions
- EUT (and climatic control devices as appropriate) switched on
- Temperature raised to and maintained at +55°C±3°C
- Soak for 10 h to 16 h at +55°C±3°C
- Chamber maintained at +55°C±3°C for:
  - Performance Test at normal power supply
  - Performance Check at Low Extreme and High Extreme power supply
- EUT returned to normal environmental conditions in not less than 1 hour.

AIS PERFORMANCE CHECK – IEC 62287-2

As per IEC 62287-2, clause 10.2.1.1 and 10.2.1.2, the transmit and received position report messages were logged on the EUT. No deterioration in message transmission/reception were observed during the performance check compared to ‘normal’ behaviour prior to the start of the test.

VHF Radiotelephone/DSC PERFORMANCE CHECK - IEC 62238

Where the term “performance check” is used, this shall be taken to mean a visual inspection of the equipment, a test of the transmitter output power and frequency error, and the receiver sensitivity to show that the equipment is functioning and that there is no visible damage or deterioration.

a) For the transmitter:
The transmitter shall be connected to the artificial antenna and tuned to channel 16. The measurements shall be made in the absence of modulation with the power switch set at maximum. The output power shall be between 6 W and 25 W, and the frequency error shall be less than ±1,5 kHz.

b) For the radiotelephone receiver:
A test signal with a level of +12 dBµV shall be applied to the receiver input. The SINAD ratio at the receiver output shall be equal to or greater than 20 dB.

c) For the DSC receiver:
A standard DSC test signal with a level of +6 dBµV shall be applied to the receiver input. The symbol error ratio in the decoder output shall be equal to or less than 10–2.

2.1.6 Test Photographs

2.1.6.1 - Test Equipment Setup outside the chamber

2.1.6.2 - EUT setup inside chamber

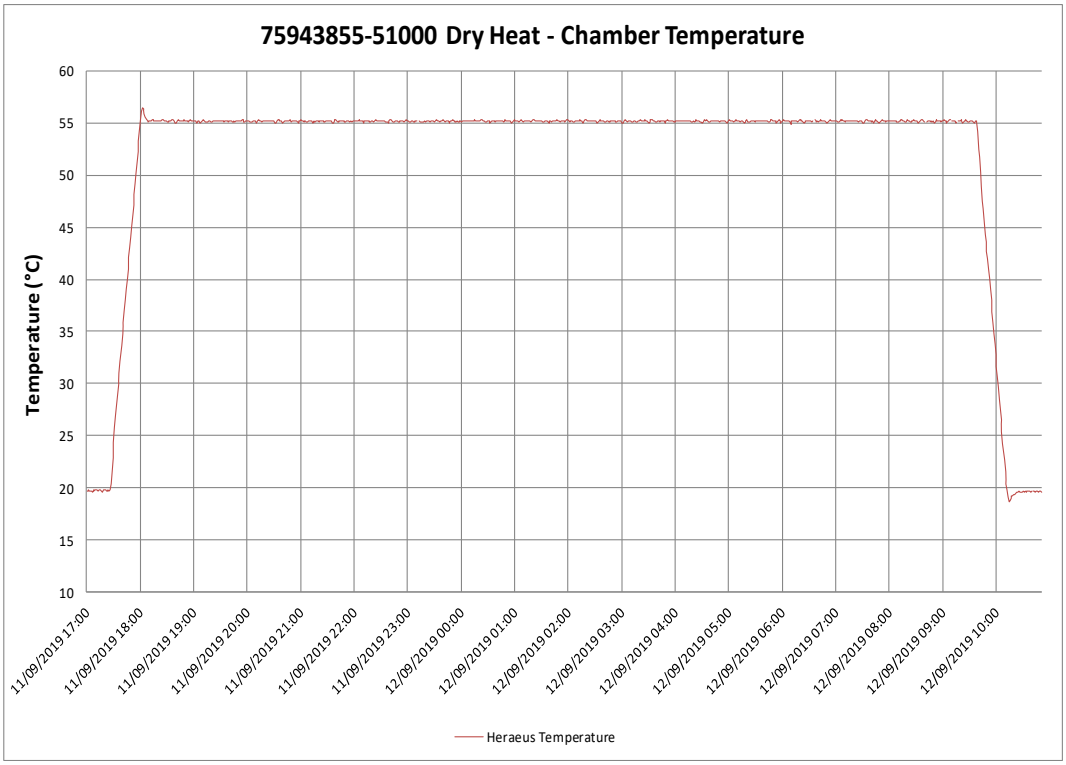
2.1.6.3 - EUT test setup

2.1.7 Test Results

The test requirements were satisfied.

No damage or deterioration was observed or reported. A visual examination and functional test carried out by the client's representative on completion of the test was reported as satisfactory.

2.1.8 Plots



2.8.1.1 – Chamber Temperature Plot

Performance Check	Frequency Error (Hz)	Carrier Power (W)	Sensitivity - SINAD (dB)	DSC Sensitivity - BER (%)
During Operational Period	-560	43.52	33.8	0

As per IEC 62287-2, clause 10.2.1.1 and 10.2.1.2, the transmit and received position report messages were logged on the EUT. No deterioration in message transmission/reception were observed during the performance check compared to 'normal' behaviour prior to the start of the test.

Remarks

It was confirmed that the temperature remained within +55 °C ± 3 °C and that the rate of change of temperature did not exceed 1 °C/min.

2.2 DAMP HEAT

2.2.1 Specification Reference

IEC 60945, Clause 8.3.1

2.2.2 Equipment Under Test

Cortex M1, S/N: M1.0000006B - Modification State 3
Cortex H1, S/N: H1.0000000F - Modification State 0

2.2.3 Date of Test

12 to 13 February 2020

2.2.4 Test Equipment Used

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

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal Generator	Hewlett Packard	ESG4000A	61	12	17-Jul-2020
Digital Time Analyser	Marconi	2850-BS	80	-	TU
DSC Decoder/Encoder	TUV SUD	DSC TPOO1	81	-	TU
RF Power Amplifier	Amp Research	150L	578	-	TU
Modulation Analyser	Hewlett Packard	8901B	773	12	28-Jun-2020
Chamber	Heraeus	HC 4033	2174	12	5-Jul-2020
Sensor	Hewlett Packard	11722A	2787	12	21-Oct-2020
Signal Generator (250kHz to 4GHz)	Agilent Technologies	E4433B	2893	12	9-Sep-2020
DSC Pre-Emphasis Unit for VHF Modem	TUV SUD	RAB 200701	3314	12	12-Aug-2020
Multimeter	Fluke	177	3813	12	9-Oct-2020
Attenuator (30dB, 100W)	Weinschel	48-30-43	4863	12	18-Jul-2020
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
Hygrometer	Rotronic	HP21	5004	12	2-Oct-2020

TU – Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment.

2.2.5 Test Method

Functional test (protected) 8.3.1.1 Purpose 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 %.

Method of test The EUT 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 EUT may be switched on at the conclusion of this period.

The EUT 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 EUT shall be subjected to a performance check as specified in the relevant equipment standard.
The temperature and relative humidity of the chamber shall be maintained as specified during the whole test period.

At the end of the test period and with the EUT still in the chamber, the chamber shall be brought to room temperature in not less than 1h.

At the end of the test the EUT shall be returned to normal environmental conditions.

AIS PERFORMANCE CHECK – IEC 62287-2

As per IEC 62287-2, clause 10.2.1.1 and 10.2.1.2, the transmit and received position report messages were logged on the EUT. No deterioration in message transmission/reception were observed during the performance check compared to ‘normal’ behaviour prior to the start of the test.

VHF Radiotelephone/DSC PERFORMANCE CHECK - IEC 62238

Where the term “performance check” is used, this shall be taken to mean a visual inspection of the equipment, a test of the transmitter output power and frequency error, and the receiver sensitivity to show that the equipment is functioning and that there is no visible damage or deterioration.

a) For the transmitter:
The transmitter shall be connected to the artificial antenna and tuned to channel 16. The measurements shall be made in the absence of modulation with the power switch set at maximum. The output power shall be between 6 W and 25 W, and the frequency error shall be less than ±1,5 kHz.

b) For the radiotelephone receiver:
A test signal with a level of +12 dBµV shall be applied to the receiver input. The SINAD ratio at the receiver output shall be equal to or greater than 20 dB.

c) For the DSC receiver:
A standard DSC test signal with a level of +6 dBµV shall be applied to the receiver input. The symbol error ratio in the decoder output shall be equal to or less than 10–2.

2.2.6 Test Photographs

2.2.6.1 - EUT setup

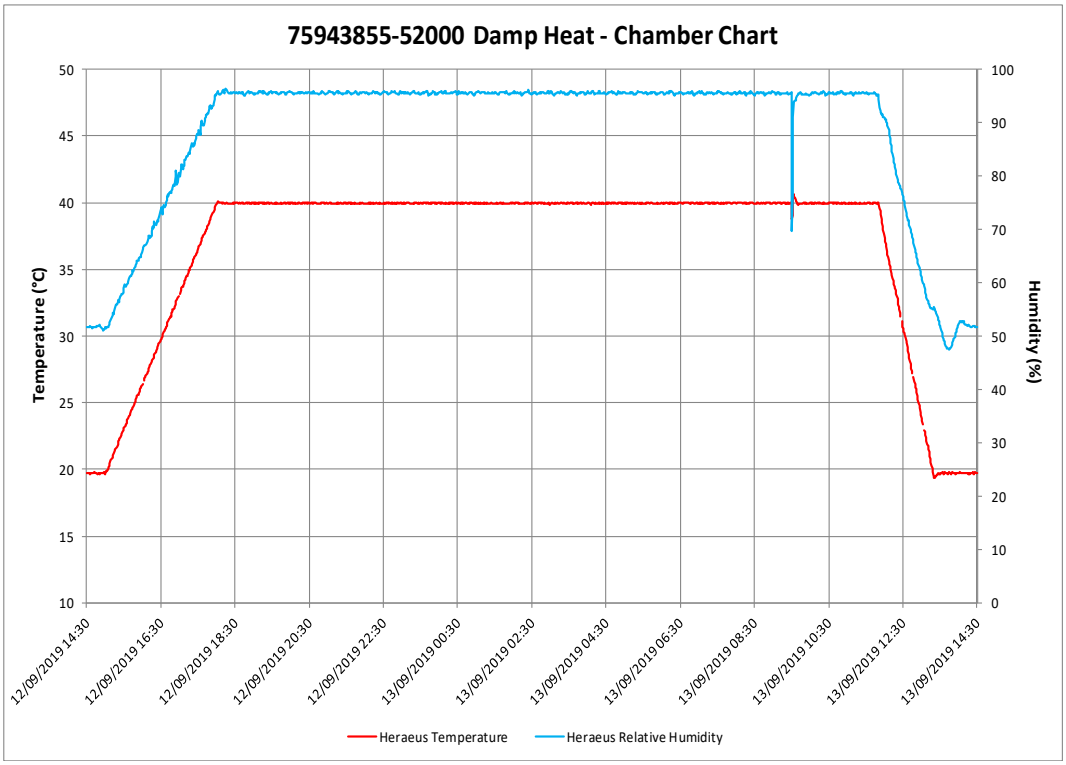
2.2.6.2 - EUT setup

2.2.7 Test Results

The test requirements were satisfied.

No damage or deterioration was observed or reported. A visual examination and functional test carried out by the client's representative on completion of the test was reported as satisfactory.

2.2.8 Plots



2.2.8.1 – Chamber Chart

Performance Check	Frequency Error (Hz)	Carrier Power (W)	Sensitivity - SINAD (dB)	DSC Sensitivity - BER (%)
During Operational Period	-440	22.59	34.01	0

As per IEC 62287-2, clause 10.2.1.1 and 10.2.1.2, the transmit and received position report messages were logged on the EUT. No deterioration in message transmission/reception were observed during the performance check compared to 'normal' behaviour prior to the start of the test.

Remarks

It was confirmed that the temperature remained within +40 °C ± 3 °C and that the rate of change of temperature did not exceed 1 °C/min. The humidity also remained within 93% ± 3% after the 3.5 h ± 0.5 h period.

2.3 LOW TEMPERATURE

2.3.1 Specification Reference

IEC 60945: 2002 Clause 8.4.2

2.3.2 Equipment Under Test and Modification State

Cortex M1, S/N: M1.0000006B - Modification State 3
Cortex H1, S/N: H1.0000000F - Modification State 0

2.3.3 Date of Test

12 to 13 February 2020

2.3.4 Test Equipment Used

This test was carried out in RF Laboratory 2

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal Generator	Hewlett Packard	ESG4000A	61	12	17-Jul-2020
Digital Time Analyser	Marconi	2850-BS	80	-	TU
DSC Decoder/Encoder	TUV SUD	DSC TPOO1	81	-	TU
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
RF Power Amplifier	Amp Research	150L	578	-	TU
Modulation Analyser	Hewlett Packard	8901B	773	12	28-Jun-2020
Digital Multimeter	Fluke	8840A	929	12	7-Oct-2020
Sensor	Hewlett Packard	11722A	2787	12	21-Oct-2020
Signal Generator (250kHz to 4GHz)	Agilent Technologies	E4433B	2893	12	9-Sep-2020
DSC Pre-Emphasis Unit for VHF Modem	TUV SUD	RAB 200701	3314	12	12-Aug-2020
Multimeter	Fluke	177	3813	12	9-Oct-2020
Attenuator (30dB, 100W)	Weinschel	48-30-43	4863	12	18-Jul-2020
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
Hygrometer	Rotronic	HP21	5004	12	

TU – Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment.

2.3.5 Test Method

The requirements of the performance test and check shall be met. See below:
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± 3 °C for a period of 10 h to 16 h. Any climatic control devices provided in the EUT may be switched on at the end of this period.

The EUT 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 EUT shall be subjected to a performance check test and check as specified in the relevant equipment standard.

The temperature of the chamber shall be maintained at –20 ± 3 °C during the whole test period

AIS PERFORMANCE CHECK - IEC 62287-2

As per IEC 62287-2, clause 10.2.1.1 and 10.2.1.2, the transmit and received position report messages were logged on the EUT. No deterioration in message transmission/reception were observed during the performance check compared to ‘normal’ behaviour prior to the start of the test.

VHF Radiotelephone/DSC PERFORMANCE CHECK - IEC 62238

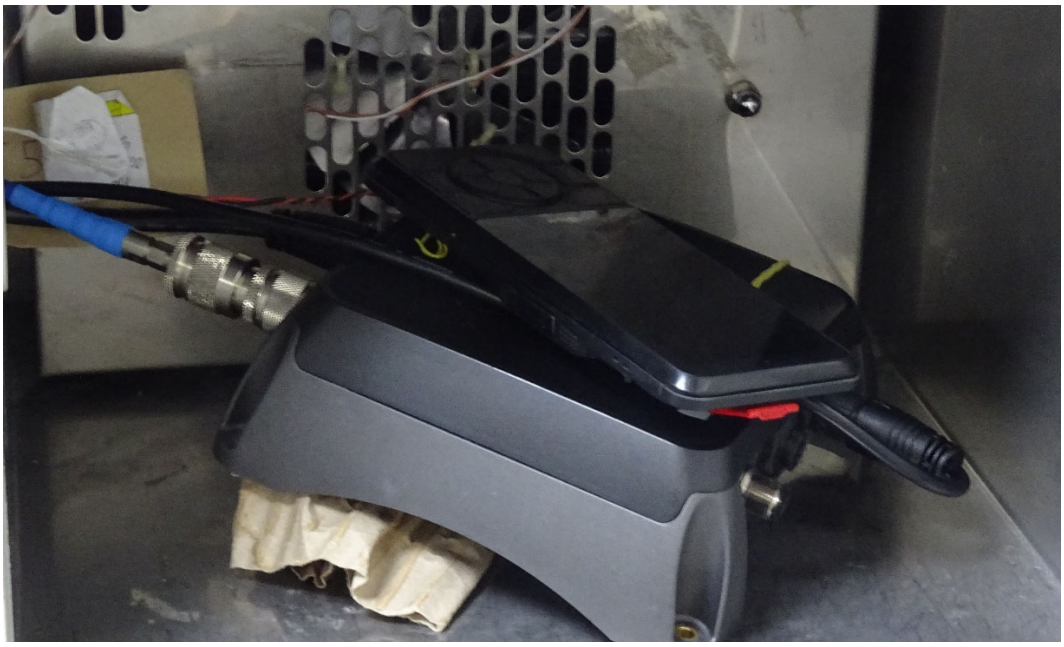
Where the term “performance check” is used, this shall be taken to mean a visual inspection of the equipment, a test of the transmitter output power and frequency error, and the receiver sensitivity to show that the equipment is functioning and that there is no visible damage or deterioration.

a) For the transmitter:
The transmitter shall be connected to the artificial antenna and tuned to channel 16. The measurements shall be made in the absence of modulation with the power switch set at maximum. The output power shall be between 6 W and 25 W, and the frequency error shall be less than ±1,5 kHz.

b) For the radiotelephone receiver:
A test signal with a level of +12 dBµV shall be applied to the receiver input. The SINAD ratio at the receiver output shall be equal to or greater than 20 dB.

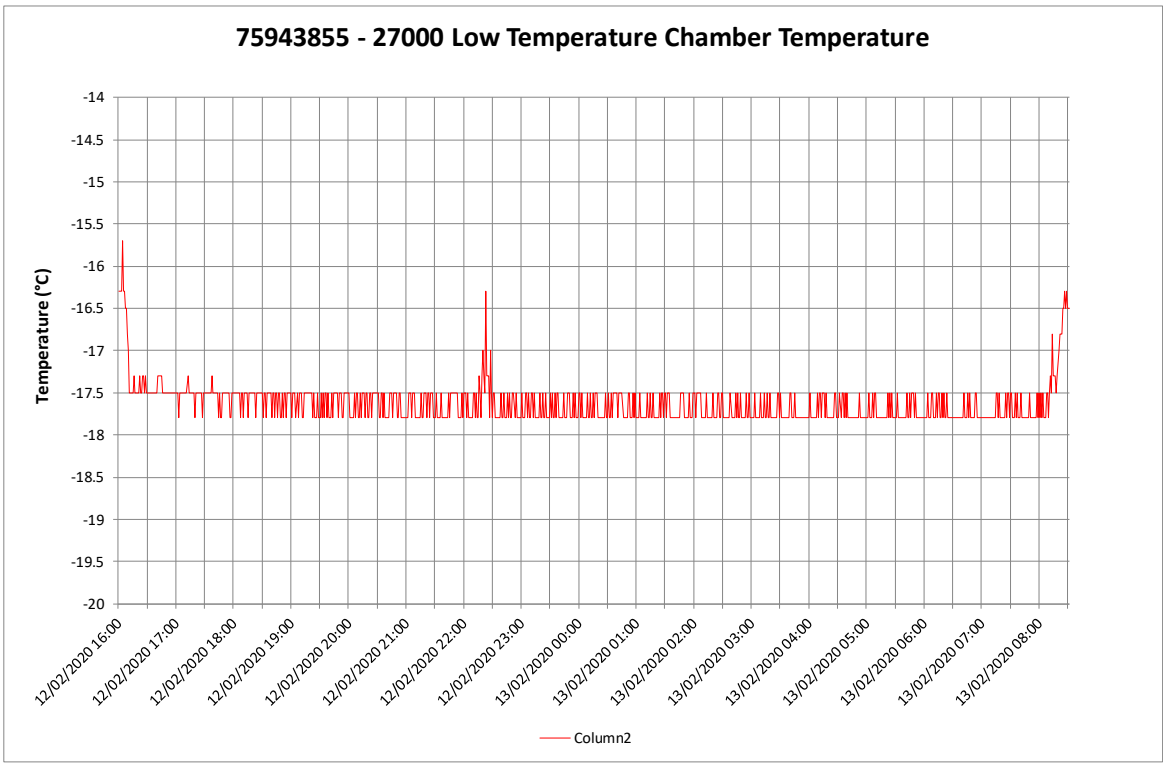
c) For the DSC receiver:
A standard DSC test signal with a level of +6 dBµV shall be applied to the receiver input. The symbol error ratio in the decoder output shall be equal to or less than 10–2.

2.3.6 Photographs



2.3.6.3 - EUT test setup (Re-test in February 2020)

2.3.7 Test Results



Temperature Versus Time

Performance Check	Frequency Error (Hz)	Carrier Power (dBm)	Sensitivity - SINAD (dB)	DSC Sensitivity - BER (%)
During Operational Period	98	43.46	35.0	0

Performance Check Results - Low Temperature Functional Test

As per IEC 62287-2, clause 10.2.1.1 and 10.2.1.2, the transmit and received position report messages were logged on the EUT. No deterioration in message transmission/reception were observed during the performance check compared to ‘normal’ behaviour prior to the start of the test.

Remarks

It was confirmed that the temperature remained within -15 °C ± 3 °C during the soak period and that the rate of change of temperature did not exceed 1 °C/min.

As per IEC 62287-2, clause 10.2.1.1 and 10.2.1.2, the transmit and received position report messages were logged on the EUT. No deterioration in message transmission/reception were observed during the performance check compared to ‘normal’ behaviour prior to the start of the test.

2.4 VIBRATION

2.4.1 Specification Reference

IEC 60945, Clause 8.7

2.4.2 Equipment Under Test and Modification State

Cortex M1, S/N: M1.0000006B – Modification State 0
Cortex H1, S/N: H1.0000000F - Modification State 0

2.4.3 Date of Test

11 September 2019

2.4.4 Test Equipment Used

This test was carried out in Envrionmental Mechanical Test Laboratory.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Signal Generator	Hewlett Packard	ESG4000A	61	12	17-Jul-2020
Digital Time Analyser	Marconi	2850-BS	80	-	TU
DSC Decoder/Encoder	TUV SUD	DSC TPOO1	81	-	TU
RF Power Amplifier	Amp Research	150L	578	-	TU
Modulation Analyser	Hewlett Packard	8901B	773	12	28-Jun-2020
Chamber	Heraeus	HC 4033	2174	12	5-Jul-2020
Charge Amp	Endevco	133	2501	12	25/11/2020
Charge Amplifier	Endevco	133	2503	12	23/05/2020
Accelerometer	Endevco	256-10	2530	6	16/04/2020
Sensor	Hewlett Packard	11722A	2787	12	21-Oct-2020
Signal Generator (250kHz to 4GHz)	Agilent Technologies	E4433B	2893	12	9-Sep-2020
DSC Pre-Emphasis Unit for VHF Modem	TUV SUD	RAB 200701	3314	12	12-Aug-2020
Vibration Controller	m + p International	Vibpilot 8	3769	12	10/07/2020
Multimeter	Fluke	177	3813	12	9-Oct-2020
Shaker	Ling Dynamic Systems	A340	4294	6	05/03/2020
Attenuator (30dB, 100W)	Weinschel	48-30-43	4863	12	18-Jul-2020
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
Hygrometer	Rotronic	HP21	5004	12	2-Oct-2020
IEPE Accelerometer	Dytran	3049E1	5089	6	06/05/2020
IEPE Accelerometer	Dytran	3049E1	5088	6	14/05/2020
IEPE Accelerometer	Dytran	3049E1	5089	6	06/05/2020
IEPE Accelerometer	Dytran	3049E1	5090	6	14/05/2020

TU – Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

2.4.5 Test Method

This test was performed in accordance with IEC 60945, clause 8.7. Details are tabled after the plots for each axis.

AIS PERFORMANCE CHECK - IEC 62287-2

As per IEC 62287-2, clause 10.2.1.1 and 10.2.1.2, the transmit and received position report messages were logged on the EUT. No deterioration in message transmission/reception were observed during the performance check compared to ‘normal’ behaviour prior to the start of the test.

VHF Radiotelephone/DSC PERFORMANCE CHECK - IEC 62238

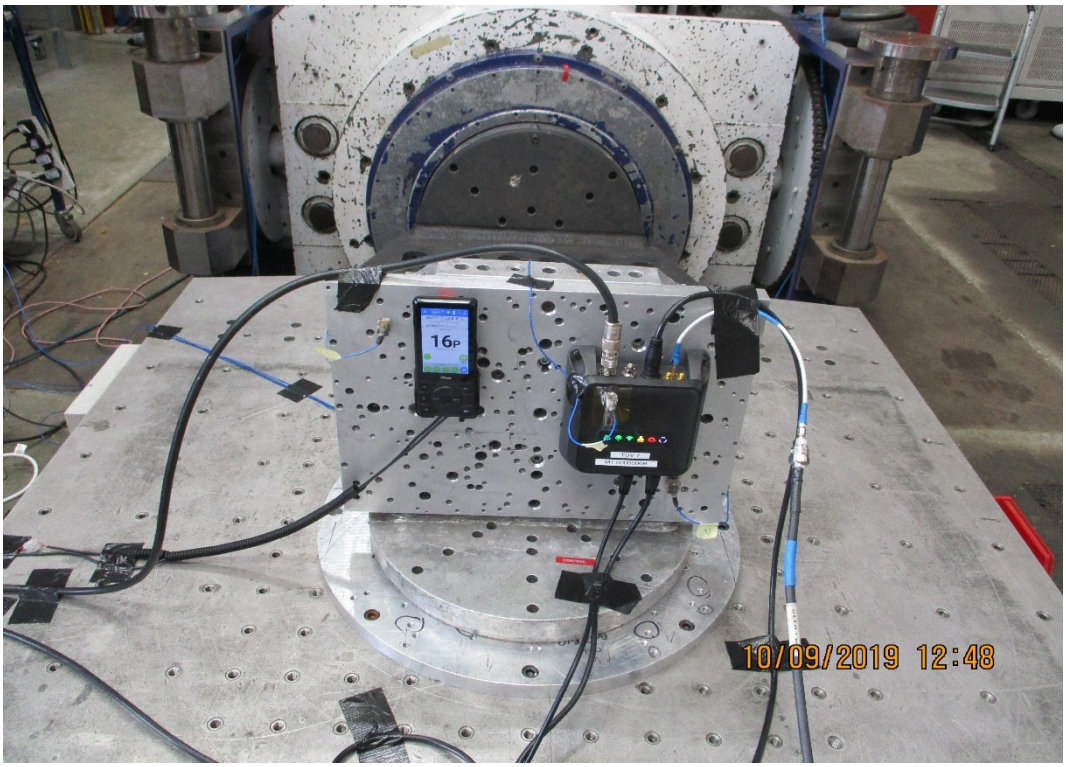
Where the term “performance check” is used, this shall be taken to mean a visual inspection of the equipment, a test of the transmitter output power and frequency error, and the receiver sensitivity to show that the equipment is functioning and that there is no visible damage or deterioration.

a) For the transmitter:
The transmitter shall be connected to the artificial antenna and tuned to channel 16. The measurements shall be made in the absence of modulation with the power switch set at maximum. The output power shall be between 6 W and 25 W, and the frequency error shall be less than ±1,5 kHz.

b) For the radiotelephone receiver:
A test signal with a level of +12 dBµV shall be applied to the receiver input. The SINAD ratio at the receiver output shall be equal to or greater than 20 dB.

c) For the DSC receiver:
A standard DSC test signal with a level of +6 dBµV shall be applied to the receiver input. The symbol error ratio in the decoder output shall be equal to or less than 10–2.

2.4.6 Test Photographs



2.4.6.1 - EUT - X Axis test set-up

2.4.6.2 EUT Y Axis test set-up

2.4.6.3 - EUT Z Axis test set-up

2.4.7 Test Results

VHF Transceiver

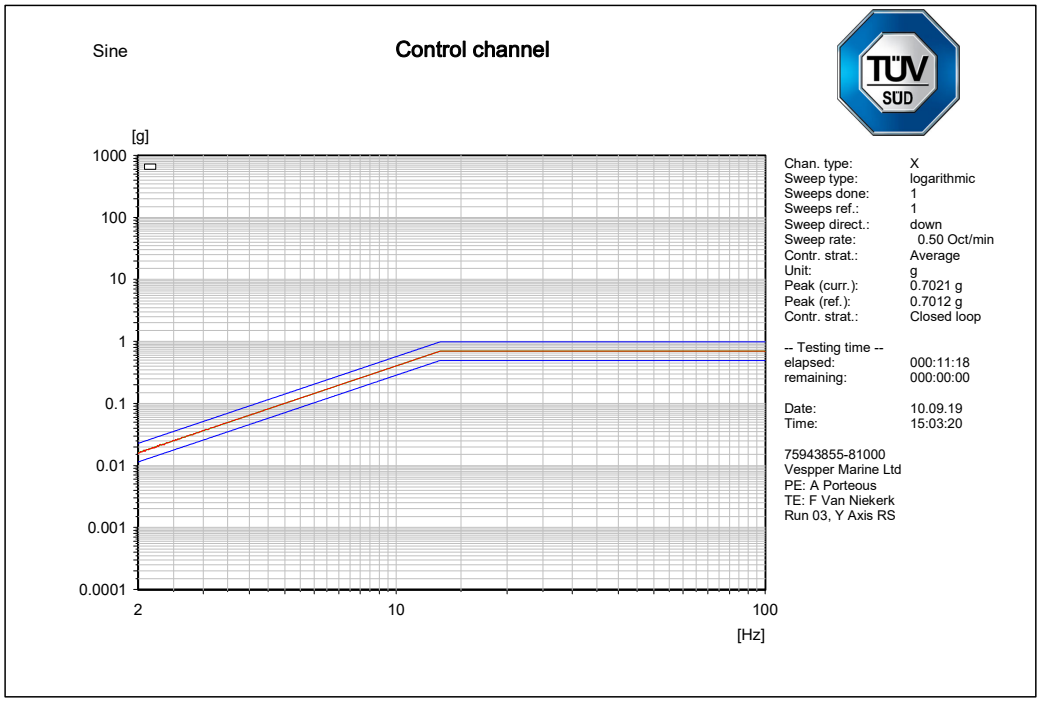
Parameter	Unit	Value
DC Power Supply Voltage	V DC	16.0

The test requirements were satisfied.

No significant resonances were observed during the resonance searches, so all dwells were conducted at 30Hz.

No damage or deterioration was observed or reported. A visual examination and functional test carried out by the client's representative on completion of the test was reported as satisfactory.

2.4.8 Plots



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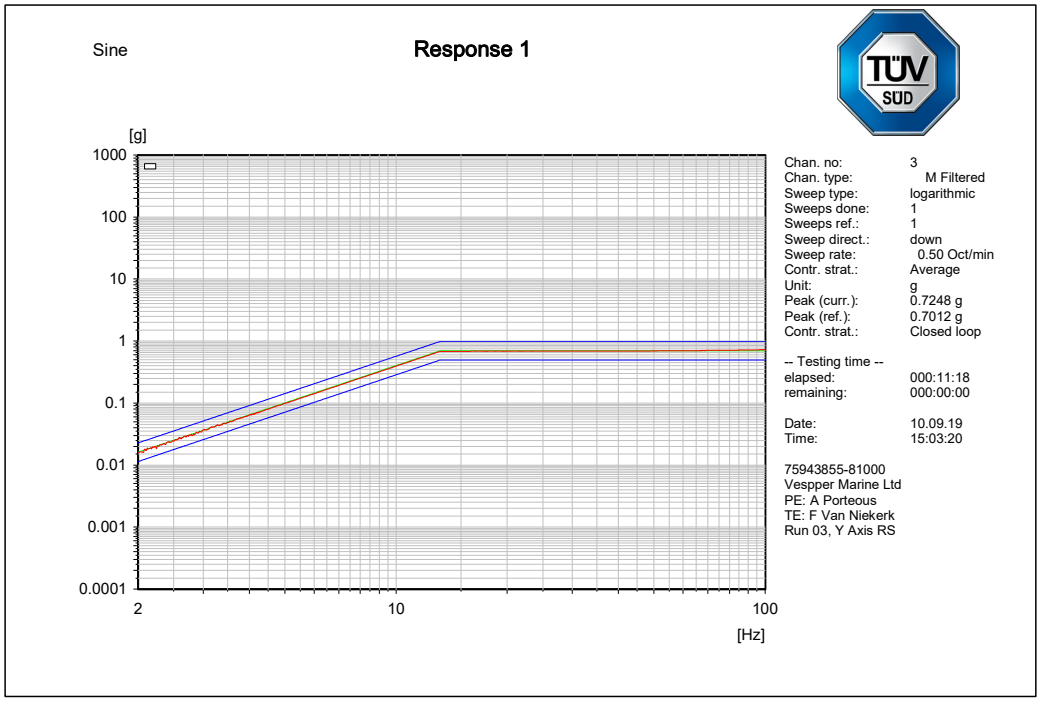
2.4.8 1 Run 03, Y Axis, Resonance Search



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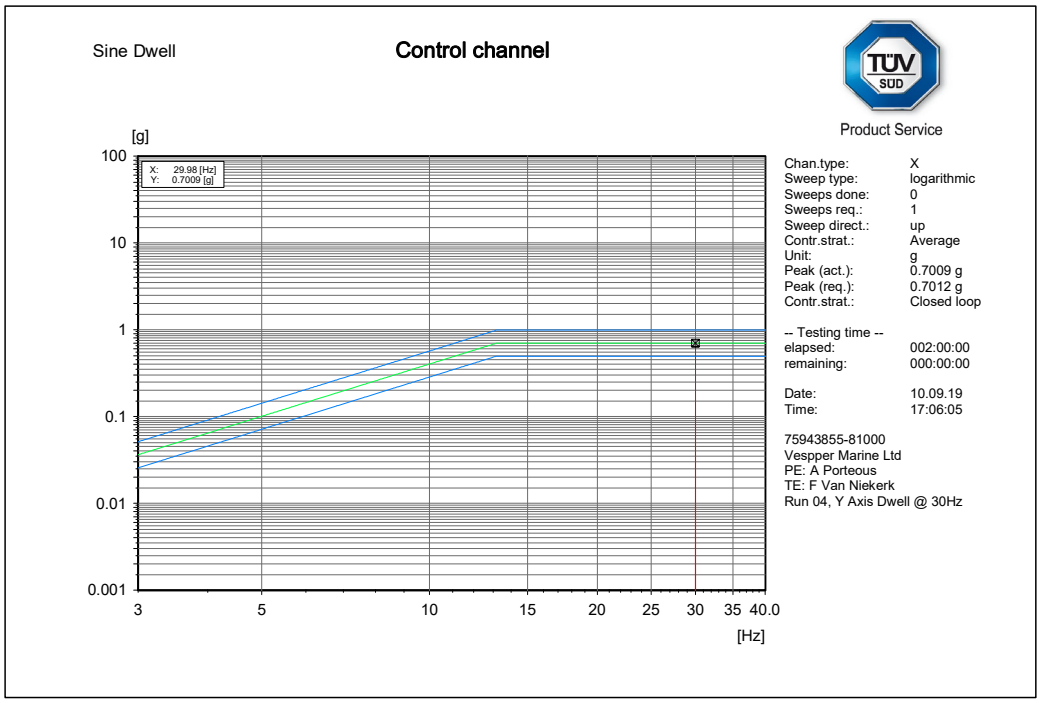
2.4.8.2 - Run 03, Y Axis, Resonance Search



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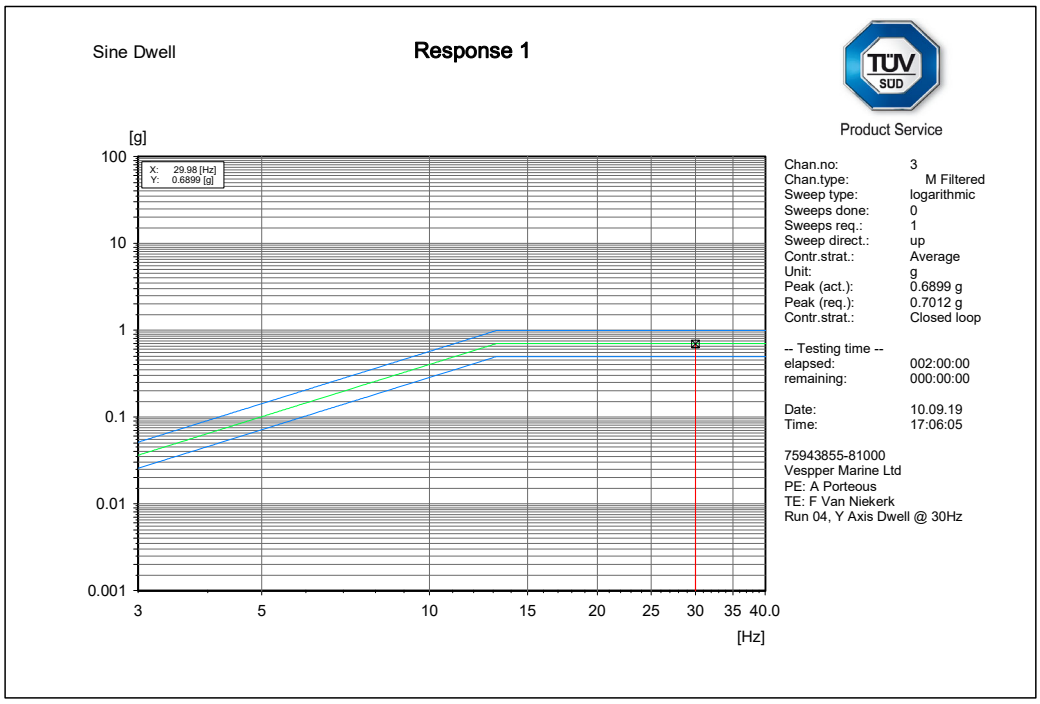
2.4.8.3 - Run 04, Y Axis, Dwell at 30 Hz



C:\VcpNT\Daten\m+p\Vesper Marine Ltd\30Hz sine dwell_007.rsd

2.4.8.4 - Run 04, Y Axis, Dwell at 30 Hz

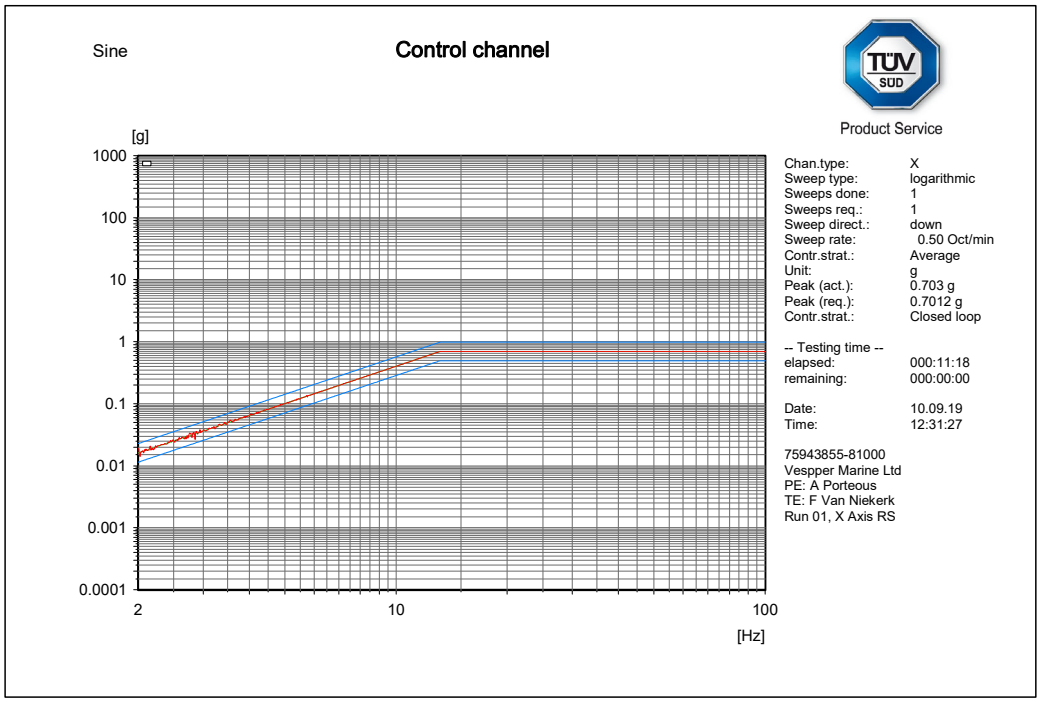
Resonance Search			Endurance Run		
Frequency (Hz)	Acceleration (g)	Magnitude	Frequency (Hz)	Duration (hours)	Applied Acceleration Set Point (g)
2 - 100	0.7	N/A	30	2	0.7

Vibration Test Data – Y Axis Resonance Search

Performance Check	Frequency Error (Hz)	Carrier Power (dBm)	Sensitivity - SINAD (dB)	DSC Sensitivity - BER (%)
During Endurance Test	-480	43.72	33.3	0
Near end of Endurance Test	-490	43.72	34.0	0

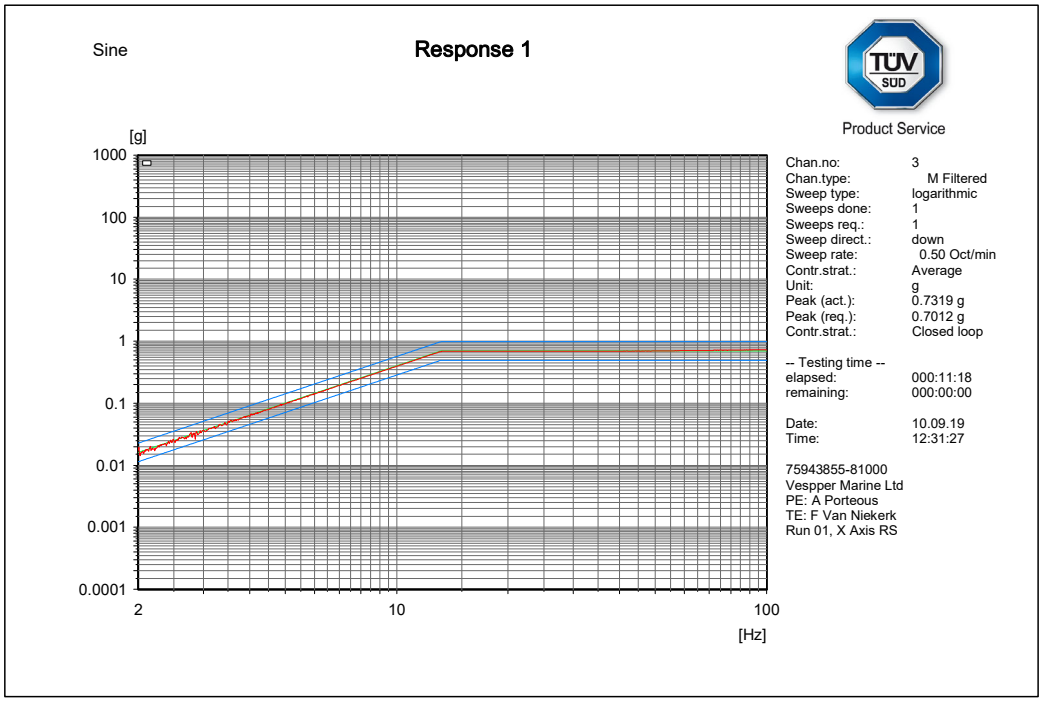
Performance Check Results – Y Axis Resonance Search

As per IEC 62287-2, clause 10.2.1.1 and 10.2.1.2, the transmit and received position report messages were logged on the EUT. No deterioration in message transmission/reception were observed during the performance check compared to ‘normal’ behaviour prior to the start of the test.



C:\VcpNT\Daten\m+p\Vesper Marine Ltd\RSX_014.rsn

2.4.8.5 - Run 01, X Axis, Resonance Search



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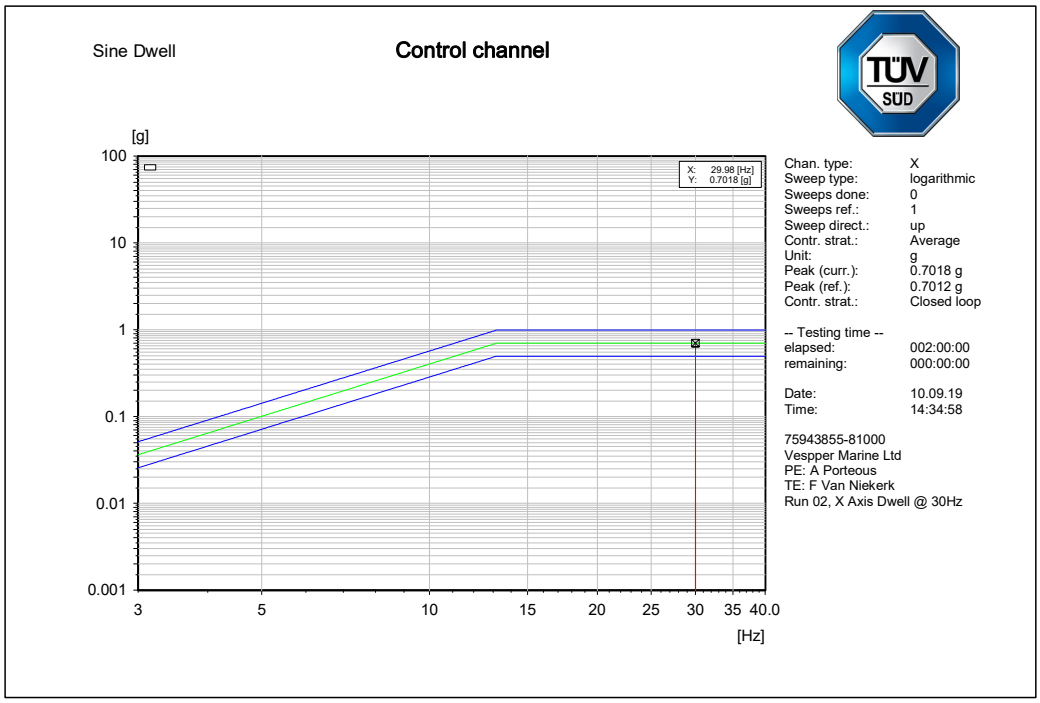
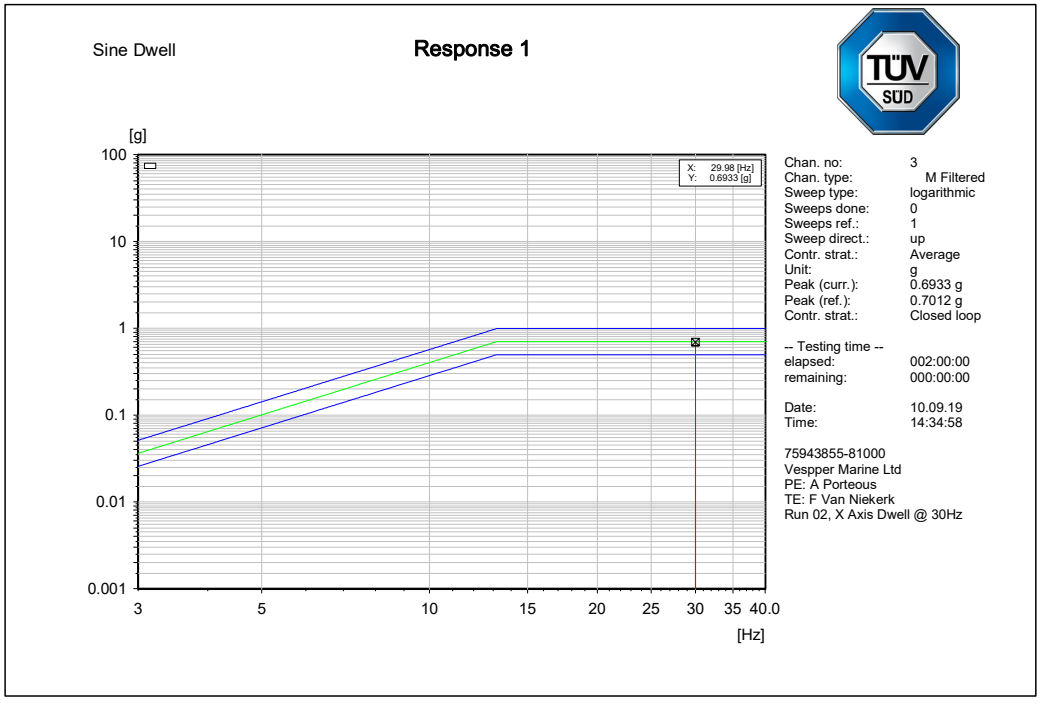
2.4.8.6 - Run 01, X Axis, Resonance Search



J:\759438xx\75943855\Non_eLOGr_Testing_Logbooks\Environmental\4 810000 - Vibration\RawData\30Hz sine dwell_005.rsd

2.4.87 - Run 02, X Axis Dwell at 30 Hz



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2.4.8.8 - Run 02, X Axis Dwell at 30 Hz

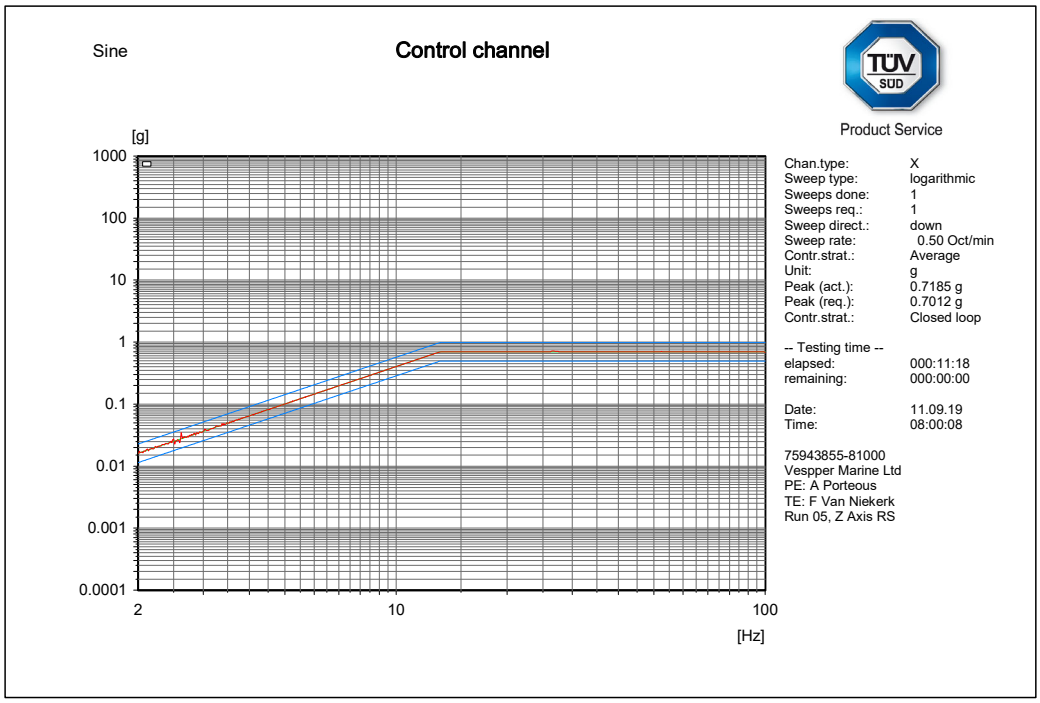
Resonance Search			Endurance Run		
Frequency (Hz)	Acceleration (g)	Magnitude	Frequency (Hz)	Duration (hours)	Applied Acceleration Set Point (g)
2 - 100	0.7	N/A	30	2	0.7

Vibration Test Data – X Axis Resonance Search

Performance Check	Frequency Error (Hz)	Carrier Power (dBm)	Sensitivity - SINAD (dB)	DSC Sensitivity - BER (%)
During Endurance Test	-500	43.90	33.8	0
Near end of Endurance Test	-470	43.71	33.3	0

Performance Check Results – X Axis Resonance Search

As per IEC 62287-2, clause 10.2.1.1 and 10.2.1.2, the transmit and received position report messages were logged on the EUT. No deterioration in message transmission/reception were observed during the performance check compared to ‘normal’ behaviour prior to the start of the test.



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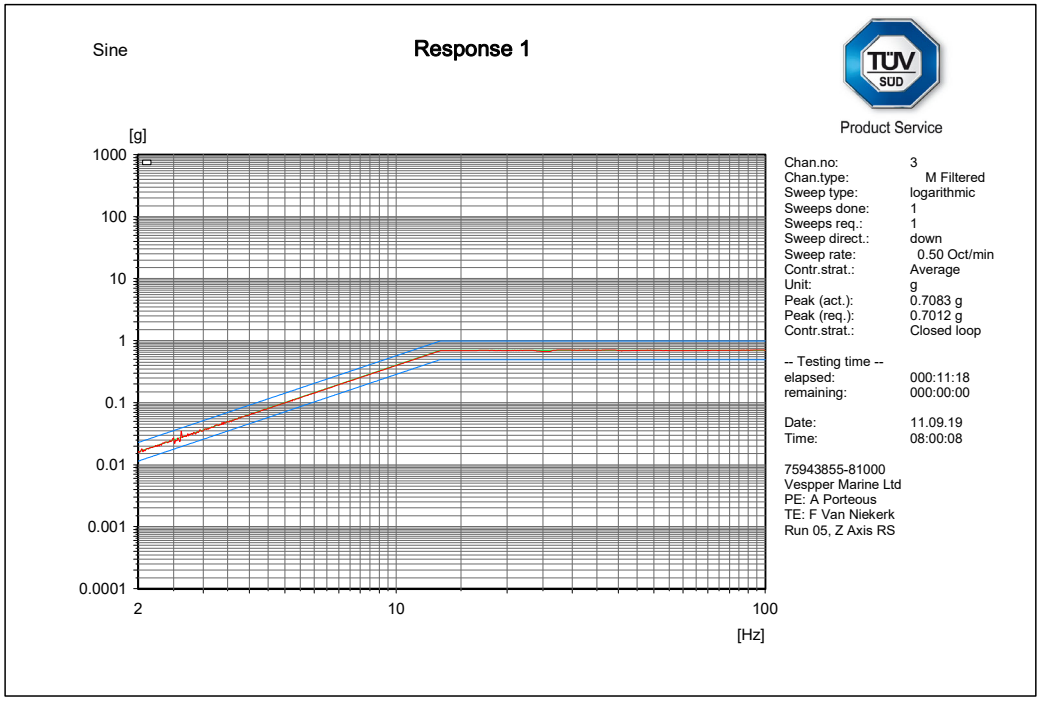
2.4.8.9 - Run 05, Z Axis, Resonance Search



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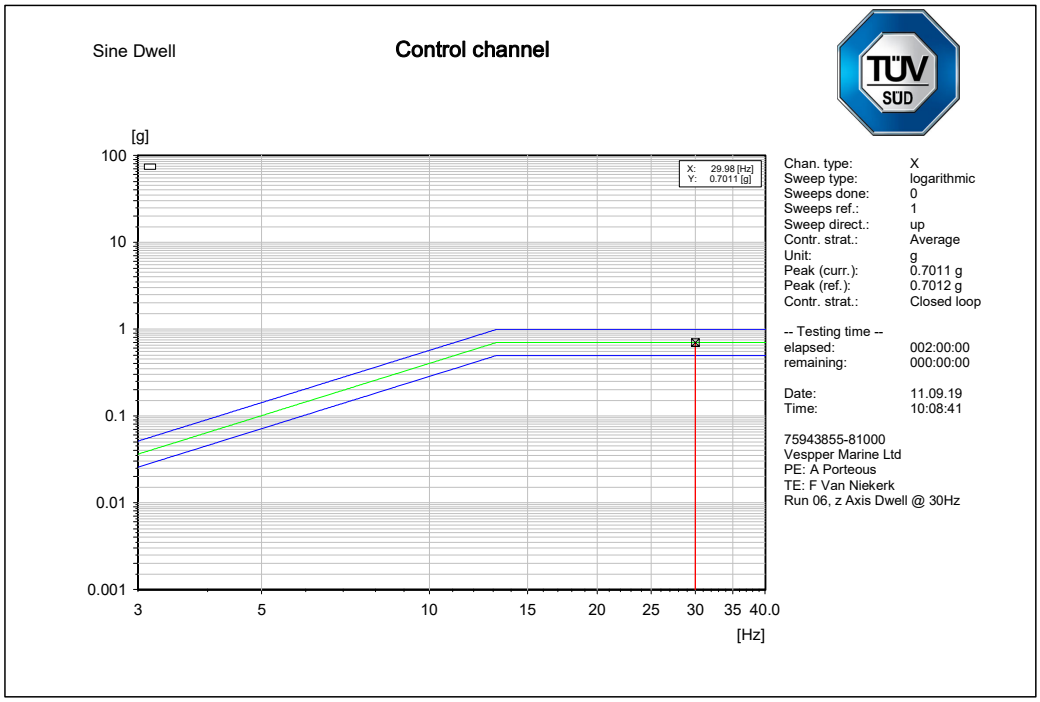
2.4.8.10 - Run 05, Z Axis, Resonance Search



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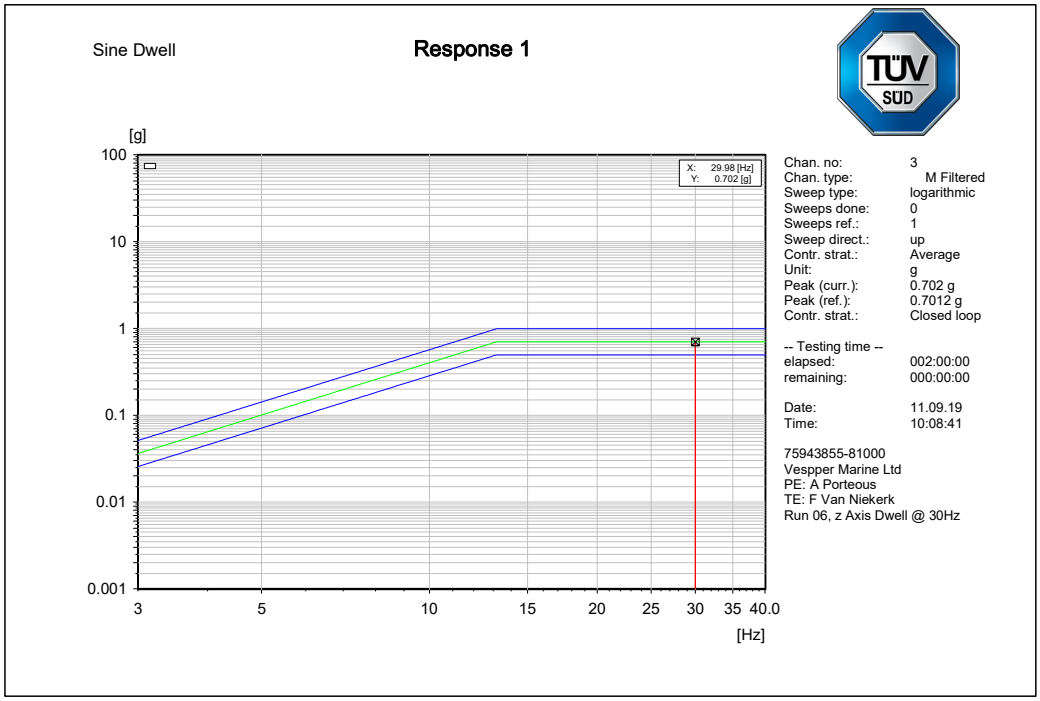
2.4.8.1 - Run 06, Z axis, Dwell @ 30 Hz



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2.4.8.12 - Run 06, Z axis, Dwell @ 30 Hz

Resonance Search			Endurance Run		
Frequency (Hz)	Acceleration (g)	Magnitude	Frequency (Hz)	Duration (hours)	Applied Acceleration Set Point (g)
2 - 100	0.7	N/A	30	2	0.7

Vibration Test Data – Z Axis Resonance Search

Performance Check	Frequency Error (Hz)	Carrier Power (dBm)	Sensitivity - SINAD (dB)	DSC Sensitivity - BER (%)
During Endurance Test	-490	43.80	34.0	0
Near end of Endurance Test	-470	43.70	33.8	0

Performance Check Results – Z Axis Resonance Search

As per IEC 62287-2, clause 10.2.1.1 and 10.2.1.2, the transmit and received position report messages were logged on the EUT. No deterioration in message transmission/reception were observed during the performance check compared to ‘normal’ behaviour prior to the start of the test.

Remarks

Following all the endurance runs the EUT was visually inspected and there was no sign of harmful deterioration visible to the naked eye.

2.5 COMPASS SAFE DISTANCE

2.5.1 Specification Reference

IEC 60945, Clause 11.2

2.5.2 Equipment Under Test and Modification State

Cortex M1, S/N M1.0000065 – Modification State 2
Cortex H1, S/N: H1.0000000F - Modification State 0

2.5.3 Date of Test

17 December 2019

2.5.4 Test Method

The EUT was setup on an East to West oriented level non-magnetic surface.
A magnetometer was used to take a horizontal magnetic flux density measurement and from this measurement, a standard and an emergency compass deflection was calculated.

A ships magnetic compass was located at the west end of the non-magnetic surface.

The compass was zeroed and the EUT was gradually moved from the east to the west end of the non-magnetic surface towards the compass centre in all 6 of its orthogonal planes and in 3 different states until the calculated compass deflection was achieved, or the EUT had reached the boundary of the ships magnetic compass.

Once all raw readings had been obtained, the worst case reading for each state was rounded up to the nearest 50 mm or 100 mm.

2.5.5 Environmental Conditions

Ambient Temperature	21.0 °C
Relative Humidity	45.0 %

2.5.6 Specification Limits

For the steering compass, the standby steering compass and the emergency compass, the permitted deviation is 18°/H, H being defined as the horizontal component of the magnetic flux density in μT's (micro-tesla's) at the location that testing takes place.

2.5.7 Test results

Performance assessment of the EUT made during this test: Satisfactory.

Detailed results are shown below.

Magnetometer Reading and Calculations

Horizontal Maximum Flux Density, Magnetic North (H)	Standard Compass Deviation Limit (5.4/H in Degrees)	Emergency Compass Deviation Limit (18/H in Degrees)
20.22	0.3	0.9

Test Results - EUT In Unpowered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Base Unit	Front	170	170
Base Unit	Top	170	170
Base Unit	Left Hand Side	170	170
Base Unit	Right Hand Side	170	170
Base Unit	Underside	170	170
Base Unit	Rear	170	170

Test Results - EUT In Normalised State

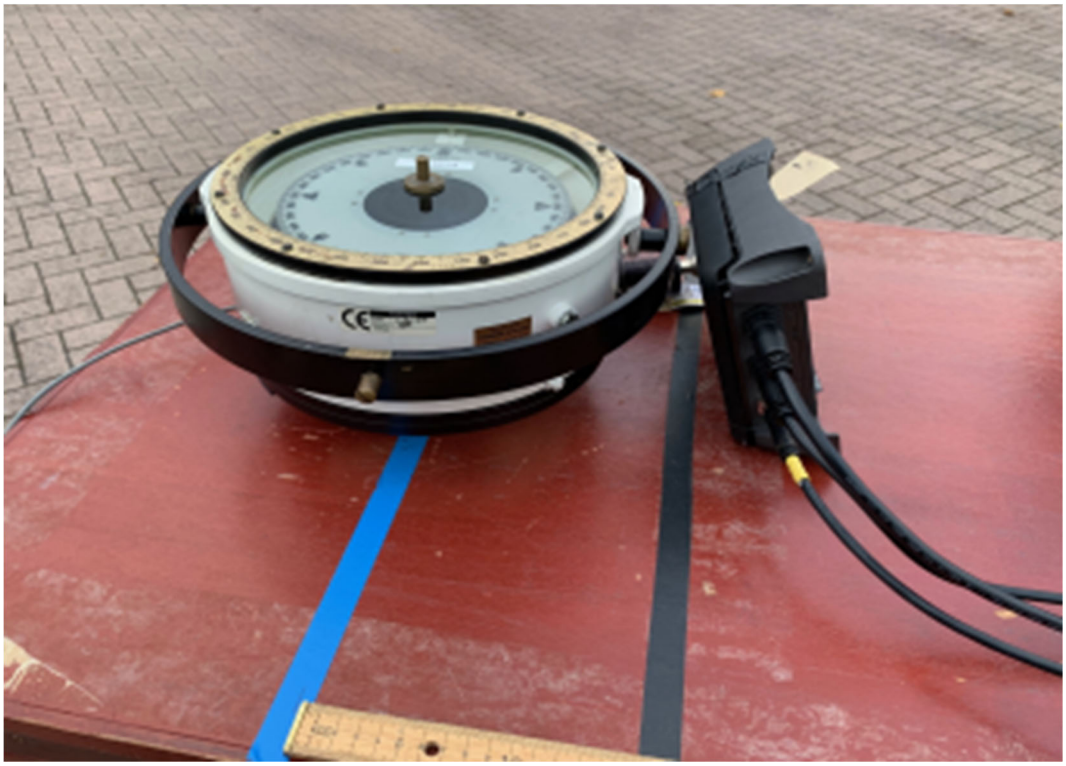
Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Base Unit	Front	170	170
Base Unit	Top	170	170
Base Unit	Left Hand Side	170	170
Base Unit	Right Hand Side	170	170
Base Unit	Underside	170	170
Base Unit	Rear	170	170

Test Results - EUT In Powered State

Unit Under Test	Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Base Unit	Front	170	170
Base Unit	Top	170	170
Base Unit	Left Hand Side	170	170
Base Unit	Right Hand Side	170	170
Base Unit	Underside	170	170
Base Unit	Rear	170	170

EUT	Distance for Standard Compass (mm)	Distance for Emergency Compass (mm)
Base Unit	200	200

2.4.8.9 - Test Setup



2.4.8.9 - Test Setup

3 MEASUREMENT UNCERTAINTY

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.

4 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).