Report on the Testing of the

Jotron AS
TRON 40VDR

In accordance with RTCM 11000.4

Prepared for: Jotron AS
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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorised Signatory	Gareth Stephens	08 November 2019	
Authorised Signatory	Ryan Henley	08 November 2019	

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

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with the limited clauses tested to RTCM 11000.4

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United Kingdom

Contents

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	08 November 2019

Table 1

1.2 Introduction

Applicant	Jotron AS
Manufacturer	Jotron AS
Model Number(s)	TRON 40VDR
Manufacturer Declared Variant*	N/A
Serial Number(s)	11457
Hardware Version(s)	R1726
Software Version(s)	2.1
Number of Samples Tested	1
Test Specification/Issue/Date	RTCM 11000.4 with Amendment 1 July 17, 2016
Order Number Date	P30747 01/08/2019
Date of Receipt of EUT	11 September 2019
Start of Test	30 September 2019
Finish of Test	22 October 2019
Name of Engineer(s)	M Hardy L Bull K Stainsby K Bryant A Uminski

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with RTCM 11000.4 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
2.2	A.3	Ergonomics Tests	-	See section 2.2
2.3	A.4	Documentation	-	See section 2.3
2.4	A.5	Labelling	-	See section 2.4
2.5	A.6	Vibration	Satisfactory	
2.6	A.7	Ruggedness	Satisfactory	
2.7	A.8	Cold Thermal Shock	Satisfactory	Clause A.8.1 only
2.8	Annex D	Internal Navigation Device	Pass	

Table 2

1.4 Declaration of Build

MAIN EUT	
MANUFACTURING DESCRIPTION	COSPAS-SARSAT 406 MHz Satellite Emergency Position-Indicating RadioBeacon (EPIRB) with attached Voyager Data Recorder (VDR)
MANUFACTURER	Jotron AS
MODEL	Tron 40VDR
PART NUMBER	X-87940
HARDWARE VERSION	R1726
SOFTWARE VERSION	2.1
PSU VOLTAGE/FREQUENCY/CURRENT	7.2V / 18Ah
HIGHEST INTERNALLY GENERATED FREQUENCY	406.037 MHz
FCC ID (if applicable)	VRVTRON40VDR
INDUSTRY CANADA ID (if applicable)	-
TECHNICAL DESCRIPTION (a brief technical description of the intended use and operation)	Jotron Tron 40VDR Float Free Capsule is a combined Cospas-Sarsat and MED approved float free emergency position indicating radio beacon (EPIRB) and a float free storage medium.
COUNTRY OF ORIGIN	Lithuania
RF CHARACTERISTICS (if applicable)	
TRANSMITTER FREQUENCY OPERATING RANGE (MHz)	406.037 MHz 121.500 MHz
RECEIVER FREQUENCY OPERATING RANGE (MHz)	1575.42 MHz GPS
INTERMEDIATE FREQUENCIES	-
EMISSION DESIGNATOR(S): (i.e. G1D, GXW)	16K0G1D (406.037 MHz) 3K20A3X (121.500 MHz)
MODULATION TYPES:	406.037 MHz - Phase modulation 1.1 +/- 0.1 rad 121.500 MHz – AM Homing
OUTPUT POWER (W or dBm)	5W +/- 2 dB (406.037 MHz) 50mW +/- 3dB 121.500 MHz)

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

Name:Frank Løke
Position held: Certification Manager
Date: 05.11.2019

1.5 Product Information

1.5.1 Technical Description

The Jotron AS TRON 40VDR is an Emergency Location Transmitter with built-in 406 MHz Cospas-Sarsat and 121.5 MHz Homing transmitters. It is used to assist in the locating and recovery of individuals that are in imminent danger.

1.6 Deviations from the Standard

Ergonomics Tests, section 2.1: Male subject wore full length gloves from an immersion suit, rather than full suit. Deployment of hand free carriage only carried out by the two test subject shown in the results section, as the deployment method is single use only (two hands free carriage straps supplied).

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
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

2 Test Details

2.1 Test Location

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

Test Name	Name of Engineer(s)
Ergonomics Test	M Hardy (D Guyett-Smith, A Brander as Test Subjects)
Documentation	M Hardy
Labelling	M Hardy
Vibration	M Hardy, K Stainsby
Ruggedness	M Hardy, K Stainsby
Thermal Shock	M Hardy, K Bryant
Internal Navigation Device	A Uminski

Table 4

Office Address:

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

2.2 Ergonomics Tests

2.2.1 Specification Reference

RTCM 11000.4, Clause A.3

2.2.2 Equipment Under Test and Modification State

TRON 40VDR, S/N: 11457 – Modification State 0

2.2.3 Date of Test

03 October 2019 – 04 October 2019

2.2.4 Test Method

Actions a) to c) and e) were demonstrated and were readily and easily accomplished with a single hand by both male and female test subjects. Action d) was demonstrated with both hands kept free by the same test subjects. Action e) was demonstrated succesfully by the same test subjects.

2.2.5 Environmental Conditions

Ambient Temperature	22.0 – 22.5 °C
Relative Humidity	33.5 – 45.2 %

2.2.6 Test Results

Requirement	Succesful completion by male test subject	Succesful completion by female test subject	Comments
a) The EPIRB can be removed from it's bracket	Pass	Pass	
b) Eack individual control on the EPIRB can be activated and deactivated	Pass	Pass	
c) any hands free carriage means can be deployed/destowed, then can be fitted/attached to the person and if necessary adjusted to ensure a good fit	Pass	Pass	
d) after being prepared as in c) above, the EPIRB can be securely carried hands-free while climbing up and down a vertical ladder at least 3 meters in height	Pass	Pass	
e) the lanyard can be deployed	Pass	Pass	

2.2.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
N/A	N/A	N/A	N/A	N/A	N/A

Table 5

No Test Equipment required for test.

2.3 Documentation

2.3.1 Specification Reference

RTCM 11000.4, Clause A.4

2.3.2 Equipment Under Test and Modification State

TRON 40VDR, S/N: 11457 – Modification State 0

2.3.3 Date of Test

22 October 2019

2.3.4 Manufacturer Supplied Information

Requirements as per RTCM11000.4, clause 2.3.6	Pass/Fail	Manufacturer Manual Information
The EPIRB equipment manual shall contain the following:		
A wordless pictorial drawing(s) depicting the operation of the EPIRB. This drawing(s) should be on the inside front or inside back cover of the operator manual.	Pass	Drawing provided on page 2 of manual.
Cautions and recommendations to prevent false alarms.	Pass	Information provided in section 1.1 of the manual.
For Group 2 and Group 3 EPIRBs details of the functioning of the AIS Transmitter, how to use this capability in ana abandon ship situation (including what to expect to see on a shipborne AIS) and correct operation of the AIS test mode.	N/A	AIS functionality not supported.
Information advising the user to register both the EPIRB 15 Hex ID and the AIS Transmitter ID in the relevant registration database.	Pass	Information provided in section 1.3.4 of the manual.
For 406 MHz EPIRBs sold in the USA a NOAA EPIRB Registration Form together with instructions on how to register, clearly stating that the preferred method of registration is online at www.beaconregistration.noaa.gov.	Pass	Information provided in section 1.3.4 of the manual.
Requirements as per IEC61097-2 Ed3, clause 3.11	Pass/Fail	Manufacturer Manual Information
The EPIRB equipment manual shall contain the following:		
maintenance	Pass	Information provided on page 6 and in section 7 of the manual.
Adequate information shall be provided to enable the equipment to be properly stowed, installed, operated and tested.	Pass	Installation and stowage information provided in section 4 of the manual. Operation and testing information provided in sections 5 and 6 of the manual.
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.	Pass	x-87545_Label SOS Placard_Målsatt.pdf
an overview of the COSPAS-SARSAT system	Pass	Information provided in section 1.3 of the manual.
complete instructions for the operation and the self testing of the satellite EPIRB	Pass	Operation and testing information provided in sections 5 and 6 of the manual.
cautions and recommendations to prevent false alerts	Pass	Information provided in section 1.1 of the manual.
instructions for licensing and registration, registration renewal and a discussion on the importance of accurate registration	Pass	Information provided in section 1.3.4 of the manual.
battery information including replacement instructions, battery type, and safety information regarding battery use and disposal	Pass	Information provided in sections 2, 5 and 7 of the manual.
an instruction to replace the battery after the satellite EPIRB is operated for any purpose other than a test	Pass	Information provided in section 5 of the manual.
the minimum operating life-time and operating and stowage temperatures	Pass	Information provided in section 2 of the manual.

the purpose of the lanyard and a precaution against using it to secure the satellite EPIRB to the ship	Pass	Information provided on page 2 of the manual.
a recommendation against attempting to operate the satellite EPIRB inside a life raft or under any similar cover or canopy	Pass	Information provided on page 2 of the manual.
the servicing and/or replacement of any hydrostatic release unit and any associated components subject to ageing, such as release rods	Pass	Information provided in section 7 of the manual.
manufacturer recommendations, if any, on periodic functional testing, possibly in connection with battery replacement	Pass	Information provided in section 6 of the manual.
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	Pass	Information provided in section 9 of the manual.
instructions for the safe transportation or shipping of the satellite EPIRB or the location where such information can be obtained by the user	Pass	Information provided on page 7 of the manual.
warranty information	Pass	Information provided on page 7 of the manual.
a warning to the effect that the Satellite EPIRB shall not be operated except in an emergency	Pass	Information provided in section 1.1 of the manual.
a warning against installation near strong magnetic fields, if that might activate the satellite EPIRB	Pass	Information provided in section 4.1 of the manual.
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	*	* See manufacturer comment 1 below
a recommendation to limit self-testing to the minimum necessary to ensure confidence in the operation of the satellite EPIRB	Pass	Information provided in section 6 of the 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	Pass	Information provided in section 6 of the manual.
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	N/A	External Navigation Input not supported.
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	Pass	Information provided in section 5.1 of the manual.
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	Pass	Information provided in section 8 of the manual.

Manufacturer comment 1:
IEC recommend the user to mount the EPRIB as high as possible while COMSAR/Cir.32 § 4.10 .2 says:

“The EPRIB should be located so that it may be easily released manually and brought to the survival craft by one person. It should therefore not be located in a radar mast or other places which can only be reached by vertical ladder.”

The Tron 40VDR is also a VDR system, which is a storage medium that records data at all time. Higher up on a ship the EPIRB is closer to the radar, and more emission from the radar main lobes and side lobes can affect the VDR system, so it`s recommended to install the EPIRB/VDR system away from the radar mast.

Jotron have measured 50 times higher emission than VDR requirements on top of the wheelhouses on ships.

Therefore Jotron think the best solution is not to advice customers to mount the VDR as high as possible, but to follow the recommendations in the IMO COMSAR/CIR.32.

2.4 Labelling

2.4.1 Specification Reference

RTCM 11000.4, Clause A.5

2.4.2 Equipment Under Test and Modification State

TRON 40VDR, S/N: 11457 – Modification State 0

2.4.3 Date of Test

15 October 2019

2.4.4 Manufacturer Supplied Information

Requirements as per IEC61097, clause 3.12	Pass/Fail	Manufacturer Label Reference
The label or labels shall be placed on the satellite EPIRB itself and on its container, if any, as needed		
Brief operating instructions at least in English, to enable manual activation, deactivation and self-test	Pass	X-87555_LABEL_TRON_40VDR_OPERATION_REV-H.pdf
Warning to the effect that the satellite EPIRB shall not be operated except in an emergency	Pass	X-87555_LABEL_TRON_40VDR_OPERATION_REV-H.pdf
Type designation and class as specified by the manufacturer, type of battery and expiry date for the primary battery used - CHECK ON EPIRB AND FFCASE	Pass	X-86212_Label_Operation_Bracket_60S_REV-E.pdf X-86216_LABEL_406-121,5MHz_REV-A.pdf X-87556_LABEL_TRON-40VDR_BATTERY_EXPIRE_DATE_REV-D.pdf
The name of the ship and beacon identification data: 1) 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	Pass	X-87554_LABEL_SERIAL_NO_TRON-40VDR_REV-K.pdf
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	Pass	X-86143_LABEL_GPS_A.pdf
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	Pass	X-87555_LABEL_TRON-40VDR_OPERATION_REV-H.pdf
The float-free arrangement shall carry a label or labels indicating clearly at least in English		
The operating instructions for manual release	Pass	x-87545_Label SOS Placard_Målsatt.pdf
The type designation	Pass	X-86216_LABEL_406-121,5MHz_REV-A.pdf
The satellite EPIRB class	Pass	X-87760_LABEL_EPIRB_TYPE_REV-C.pdf
The maintenance and/or replacement date for the release mechanism, if applicable	Pass	X-87759_LABEL_BRACKET_FB-40VDR_REV-A.pdf
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		
Requirements as per RTCM11000.4, clause 2.3.7	Pass/Fail	Manufacturer Label Reference
In addition to the requirements of IEC 61097-2 Ed3.0 Paragraph 3.12 the EPIRB shall also carry the following additional labels		
Battery Labelling		
The battery shall be marked indelibly and legibly with the battery type, voltage, polarity, expiration date (month and year) and as appropriate, precautions associated with its use, handling and disposal	Pass	X-87555_LABEL_TRON-40VDR_OPERATION_REV-H.pdf X-87556_LABEL_TRON-40VDR_BATTERY_EXPIRE_DATE_REV-D.pdf

All wires to battery connectorsshould be uniquely colour coded. The wire to the most positive (+) terminal should be RED; the wire to the most negative (-)terminal should be BLACK. Colours other than black and redshould be used for wires connecting intermediate voltage levels in multi-voltage battery packs	Pass	N/A
The following additional labeling shall be applied to the interior of the EPIRB in a conspicuous place on the battery pack itself: WARNING! Regulated lifesaving device. Unauthorized battery replacement may lead to failure. For details: (insert manufacturer's telephone number or website address)	Pass	102646_LABEL_Battery Warning_REV-A.pdf
EPIRB Labelling - The following additional labelling shall be applied to the exterior of the EPIRB		
Its operating temperature range in degrees C and F	Pass	X-87554_LABEL_SERIAL_NO_TRON-40VDR_REV-K.pdf
The safe distance of the EPIRB from the magnetic compass	Pass	X-87555_LABEL_TRON_40VDR_OPERATION_REV-H.pdf
Either on the exterior of the EPIRB or permanently attached to the EPIRB, an explanation of the operation of the automatic water-immersion activation function, and how the EPIRB works in the various control positions. If permanently attached, the placard including the instruction(s) shall be conspicuously marked adjacent to the attachment point: "DO NOT REMOVE"	Pass	X-87555_LABEL_TRON_40VDR_OPERATION_REV-H.pdf
For EPIRBs registered in the USA, an outlined or otherwise identifiable space sized to accommodate the NOAA proof-of-registration decal (26mm H x 51mm W) is required on the case of the EPIRB with the text "Affix NOAA Registration Decal Here". This space shall be located so that the decal is visible without having to remove the EPIRB from its bracket. The decal may NOT cover the two spaces for name of vessel and 15 - Hex ID	Pass	X-87554_LABEL_SERIAL_NO_TRON-40VDR_REV-K.pdf
A notice stating "In the event of a false activation in the USA call toll free 855 406 USCG (855 406 8724)"	Pass	X-87555_LABEL_TRON_40VDR_OPERATION_REV-H.pdf
For Group 2 and Group 3 EPIRBs containing an AIS Transmitter the AIS User ID 974xxyyyy.	N/A	

2.5 Vibration

2.5.1 Specification Reference

RTCM 11000.4, Clause A.6

2.5.2 Equipment Under Test and Modification State

TRON 40VDR, S/N: 11457 – Modification State 0

2.5.3 Date of Test

30 September 2019 – 01 October 2019

2.5.4 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.

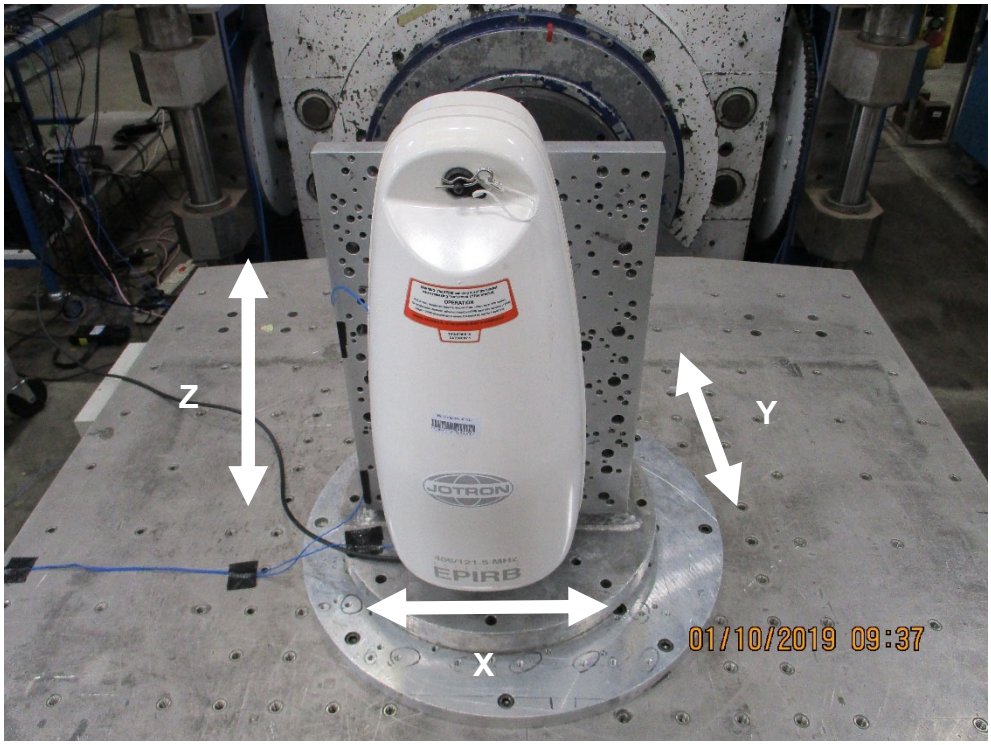
One sweep was performed at a rate of 0.5 octaves/minute.

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

Axis	Resonant Frequency (Hz)
X	86.14
Y	37.71
Z	46.54

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. The EPIRB did not activate during this test.

Test Setup



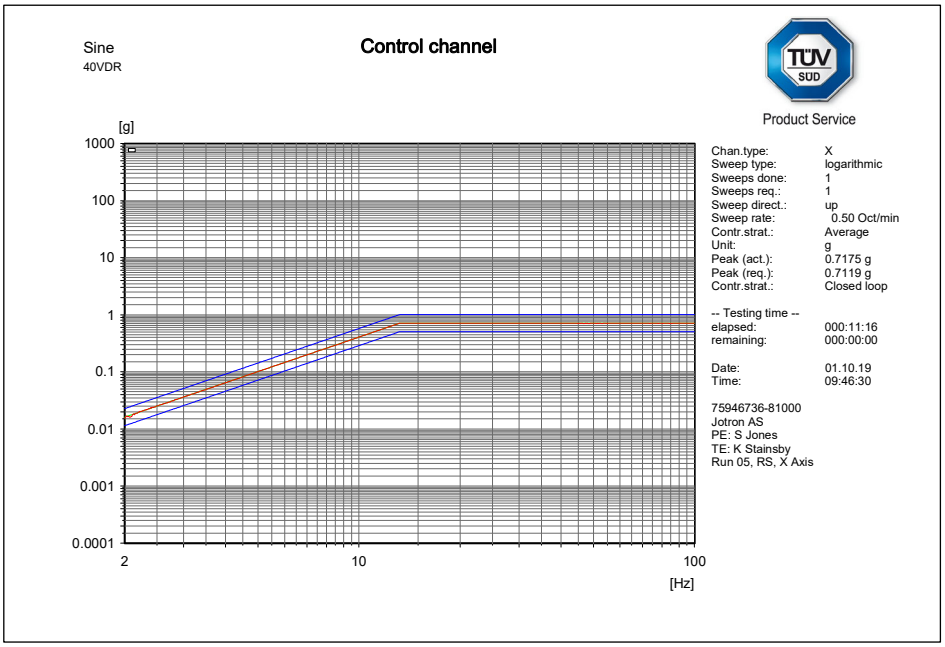
2.5.5 Environmental Conditions

Ambient Temperature	19.2 – 23.7 °C
Relative Humidity	52.0 – 62.5 %

2.5.6 Test Results

X Axis

Resonant Search



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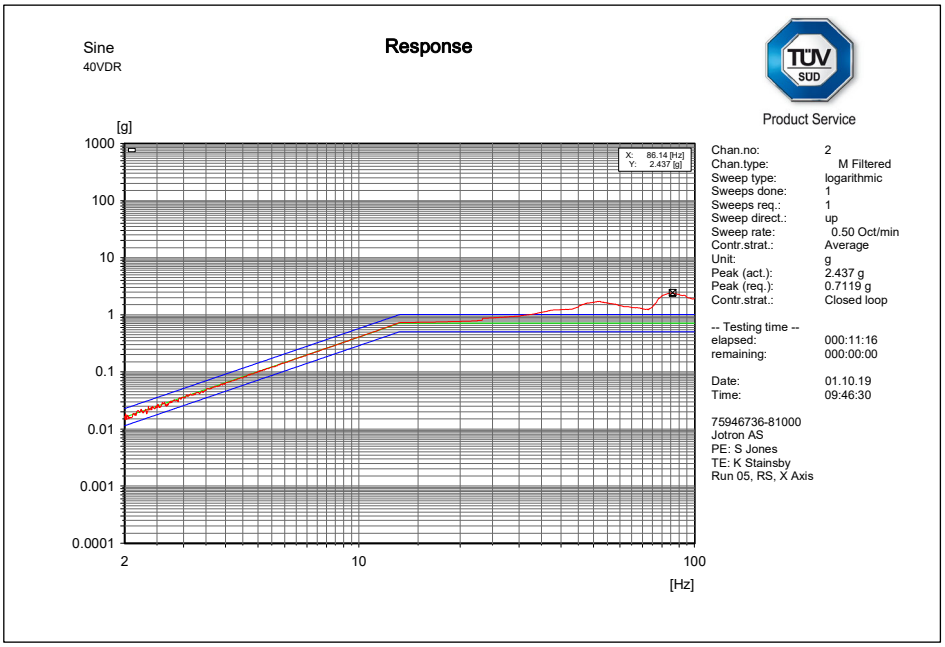

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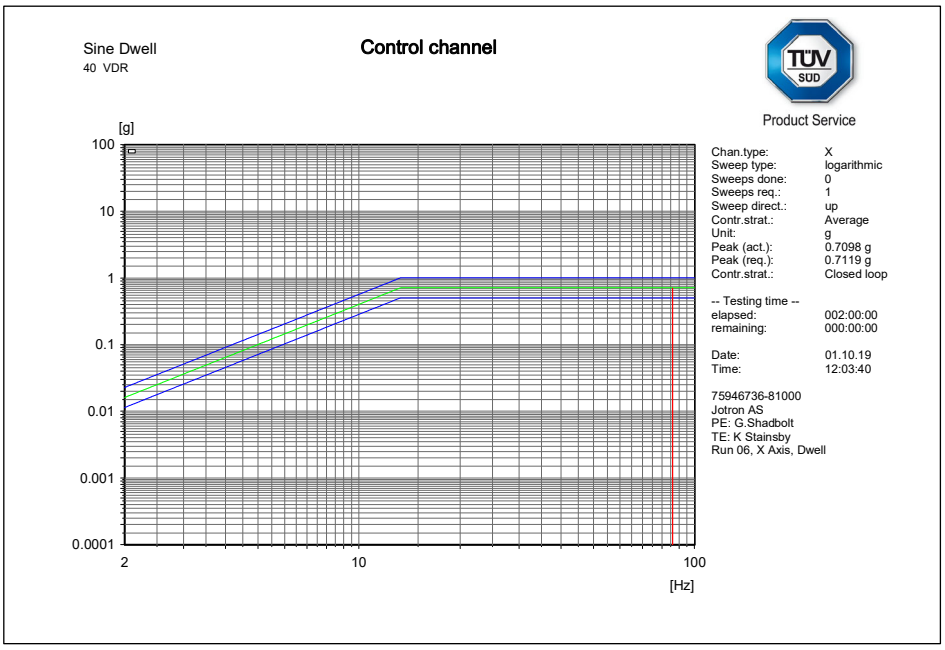
Endurance Run



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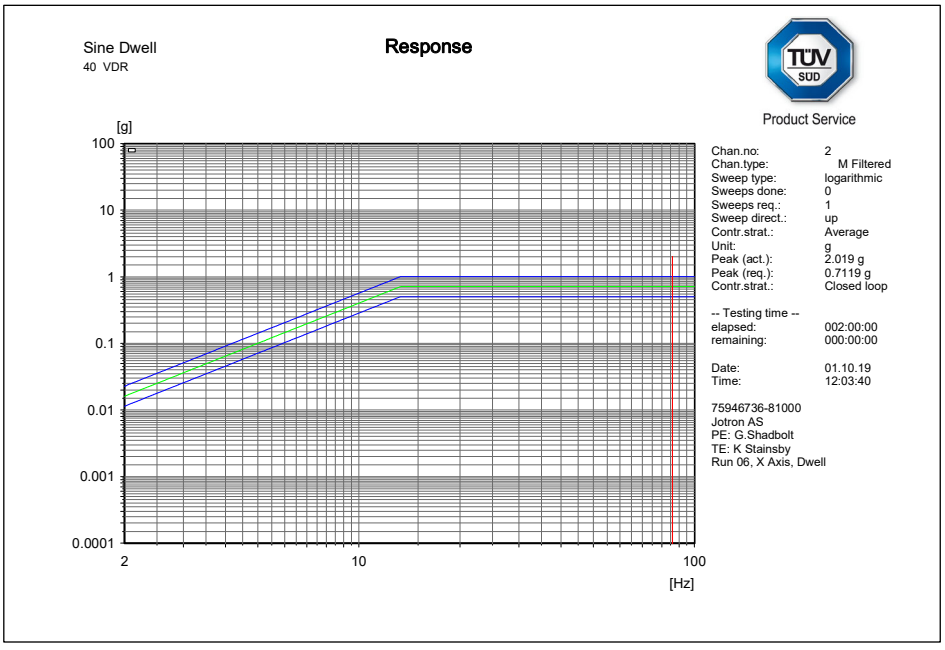

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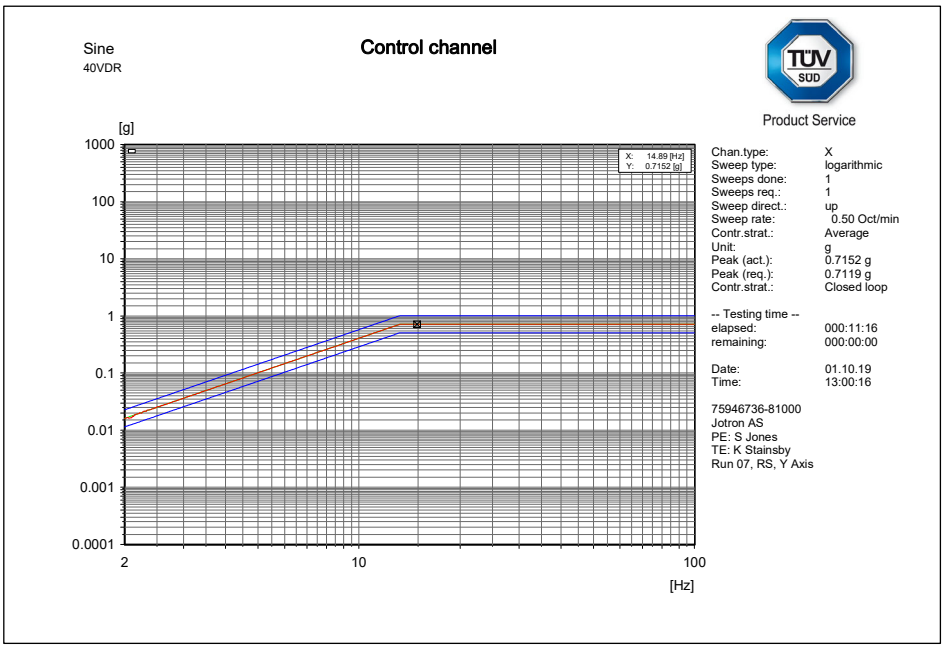
Y Axis

Resonant Search



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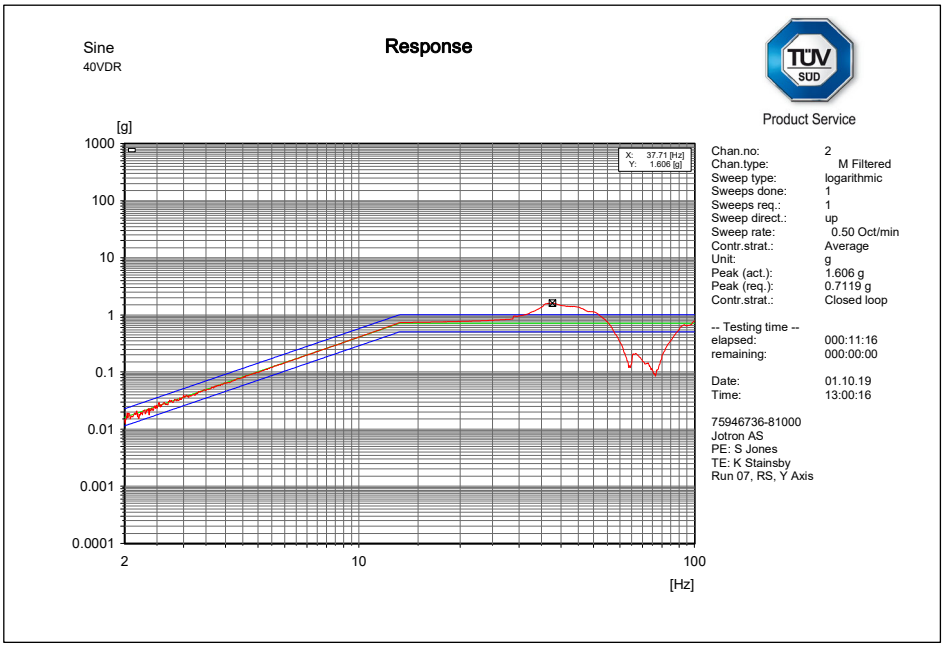

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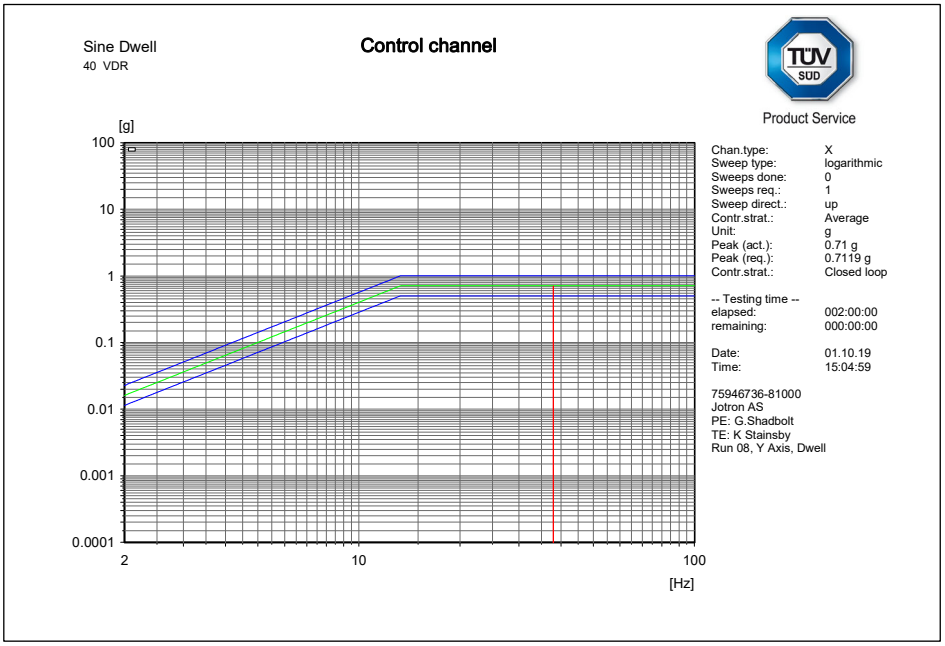

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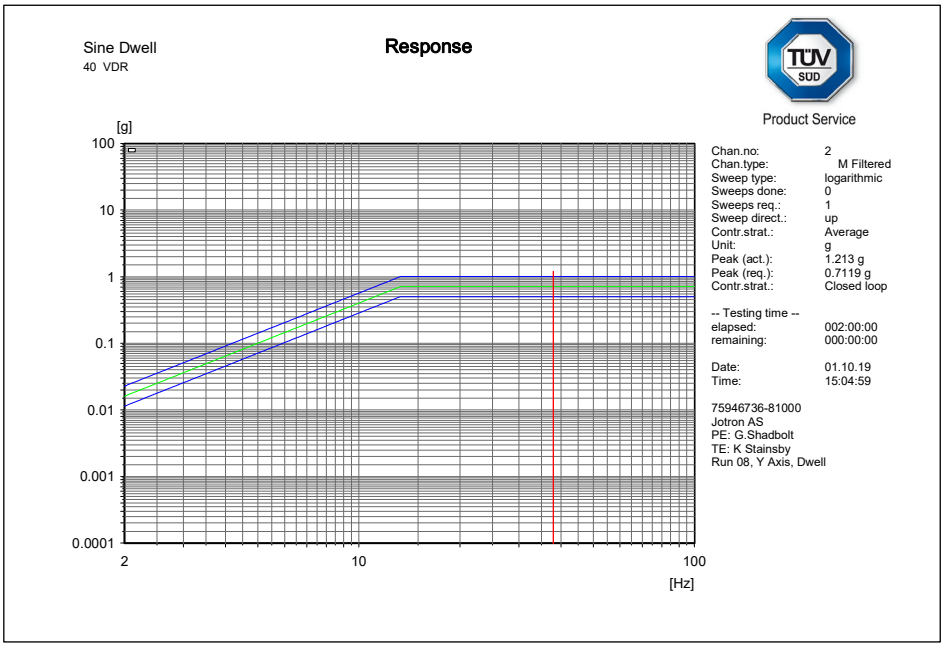

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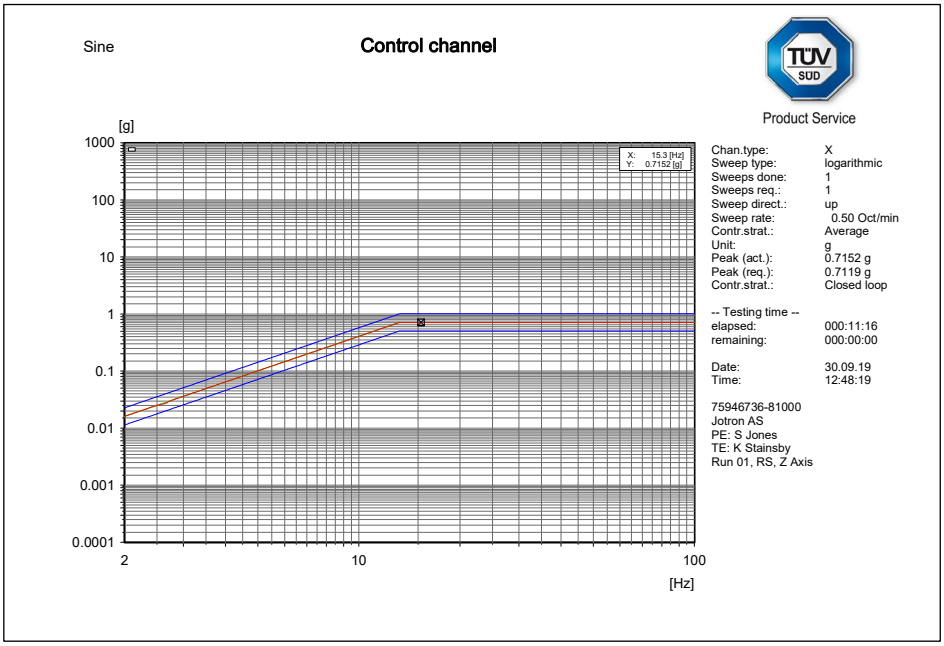
Z Axis

Resonant Search



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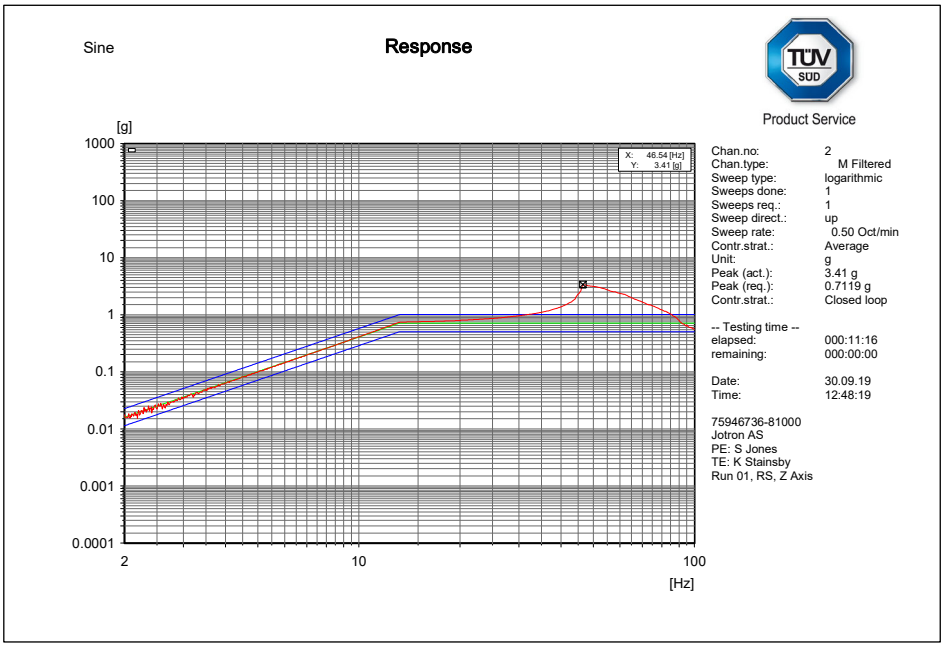

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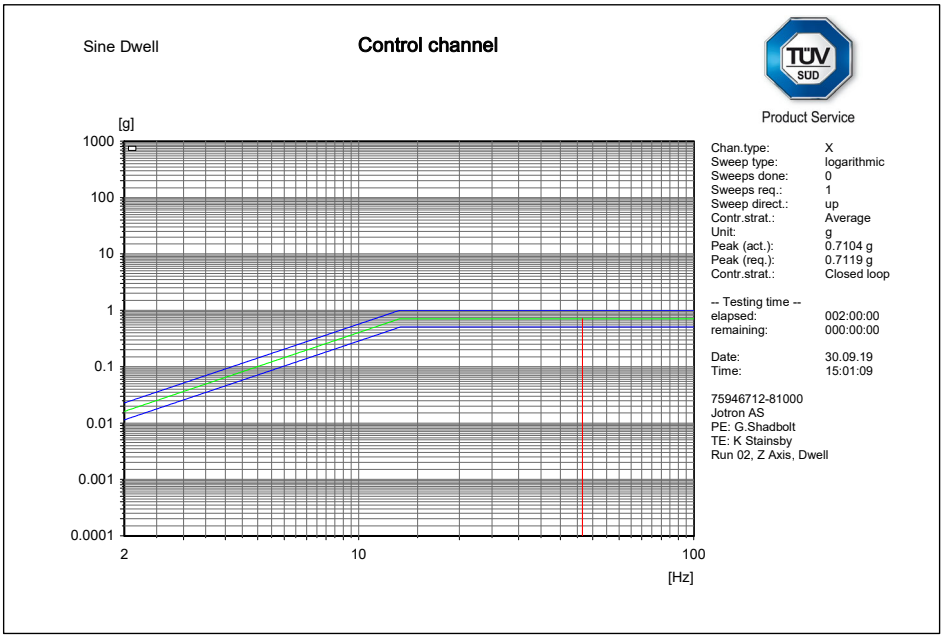
Endurance Run



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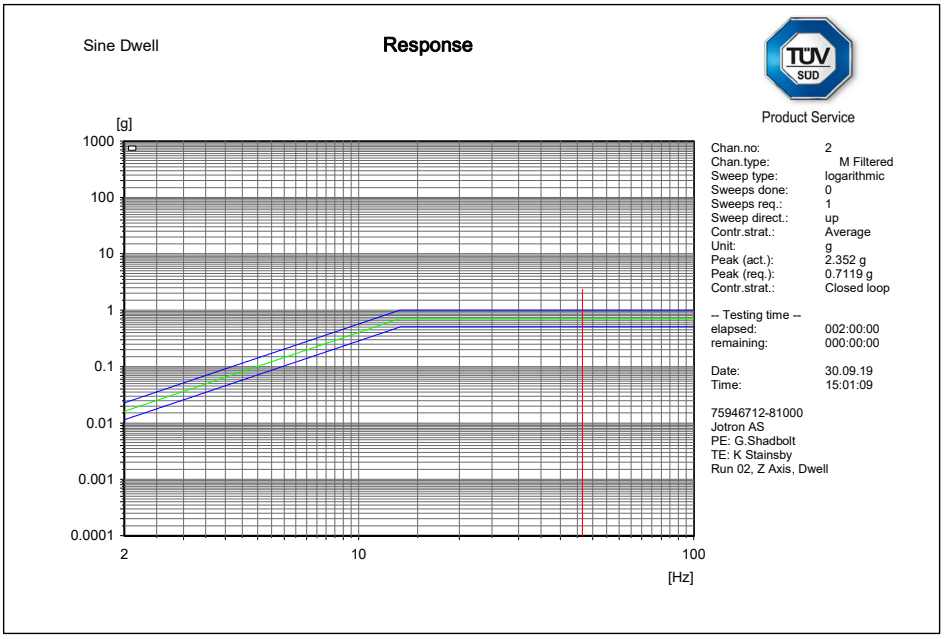

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Post Test Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED0902E2E6CC17FDFFC5714B783E0F66C
Normal Mode:	
Normal Message	FFFE2F902E2E6CC17FDFFC5714B783E0F66C
406 MHz Frequency	406.036838
121 MHz Presence	Pass

2.5.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Vibration Controller (8 Ch)	m + p International	VibPilot 8	3777	12	10-Jul-2020
Shaker	Ling Dynamic Systems	A340	4294	6	05-Mar-2020
Thermal Accelerometer	PCB Piezotronic	352C03	4364	6	23-Nov-2019
Thermal Isotron Accelerometer	PCB Piezotronic	M353B18	4568	6	11-Oct-2019
Isotron Accelerometer	PCB Piezotronic	M353B18	4583	12	10-Jan-2020
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	11-Nov-2019
1 MHz / 10 MHz reference	Quartzlock	E10-X	4973	12	26-Apr-2020

Table 6

TU – Traceability Unscheduled

2.6 Ruggedness

2.6.1 Specification Reference

RTCM 11000.4, Clause A.7

2.6.2 Equipment Under Test and Modification State

TRON 40VDR, S/N: 11457 – Modification State 0

2.6.3 Date of Test

02 October 2019

2.6.4 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/s^2 +/-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. The EPIRB did not activate during this test.

Test Setup

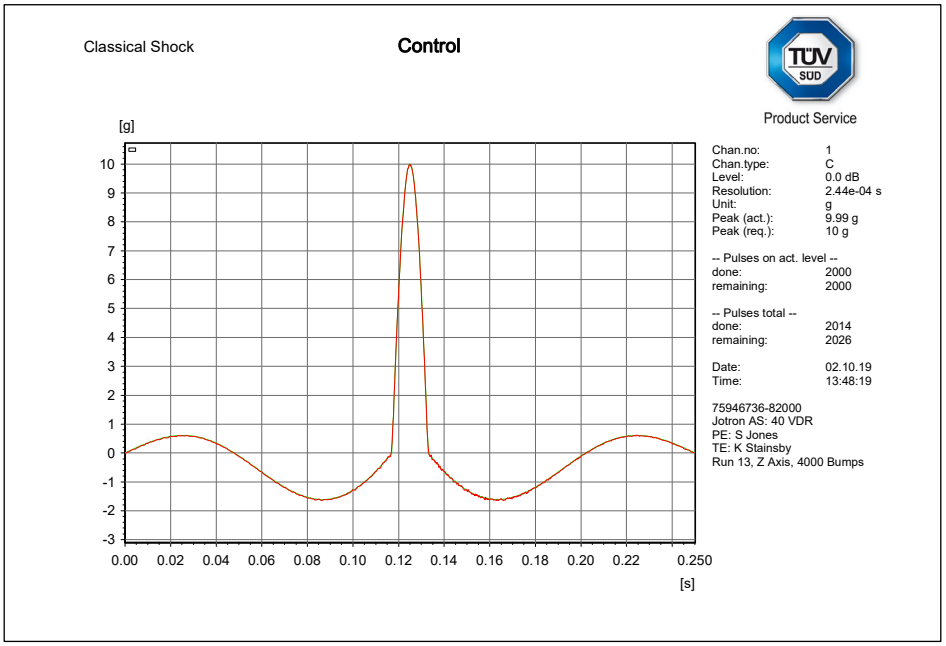
Vertical Axis, 4000 Bumps (2000 positive, 2000 negative)

2.6.5 Environmental Conditions

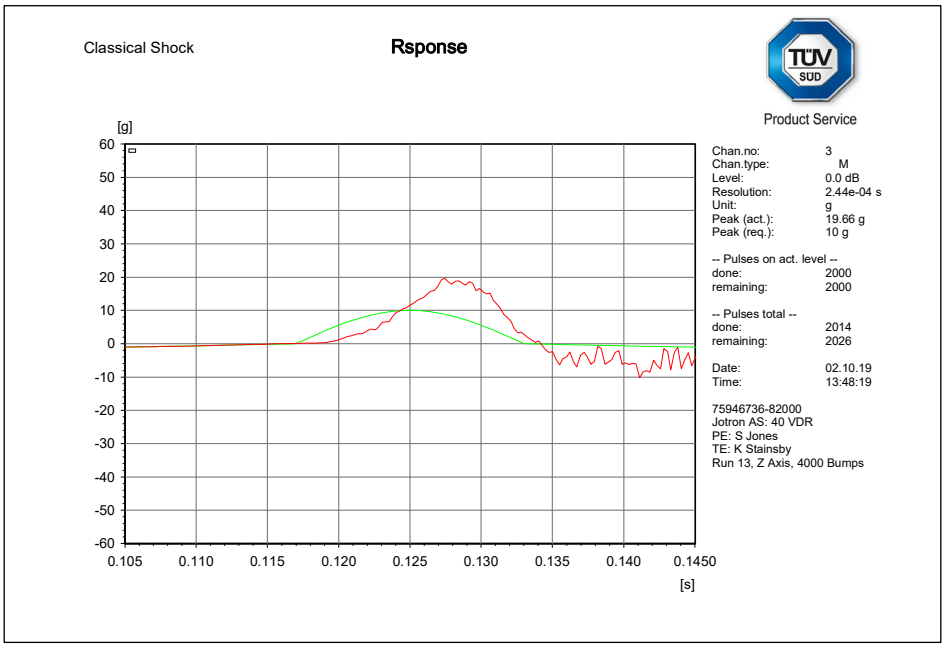
Ambient Temperature	18.3 °C
Relative Humidity	40.3 %

2.6.6 Test Results

Positive



C:\VcpNT\Daten\m+p\Jotron AS\75946736-81000\75946736-81000 4000 bump test_001.rcs



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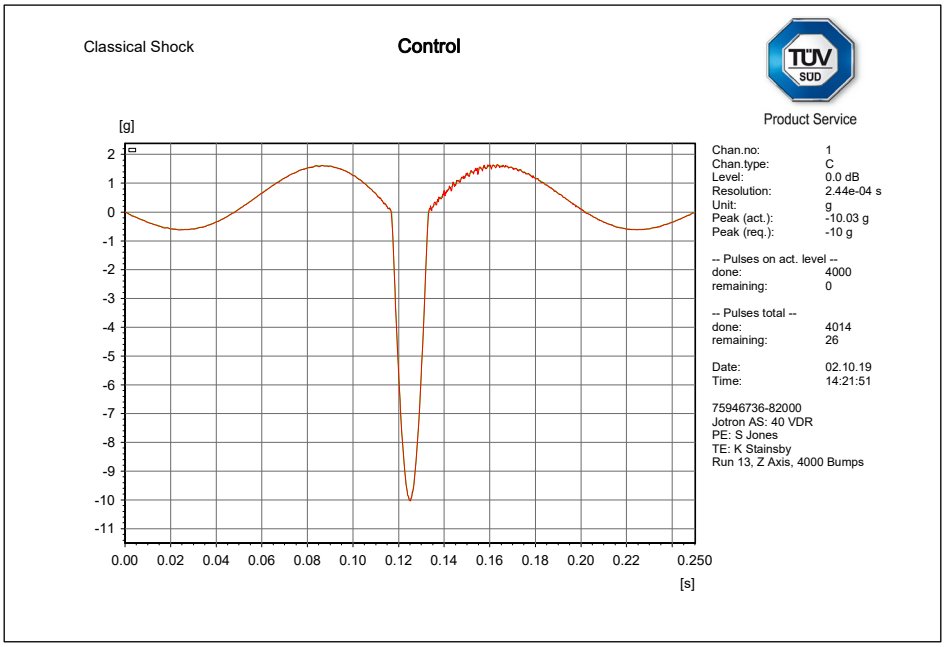
Negative



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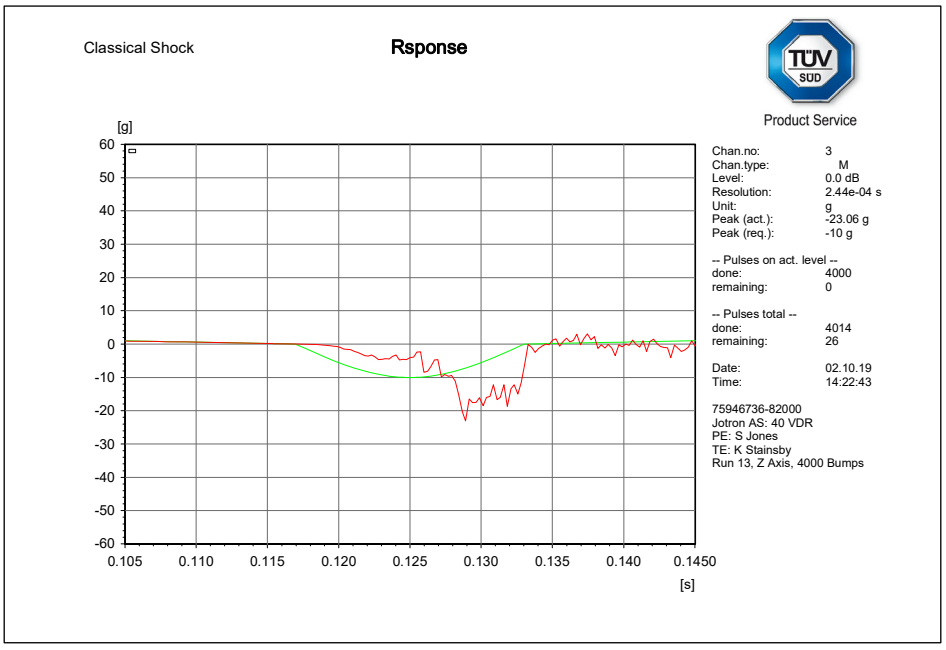


C:\VcpNT\Daten\m+p\Jotron AS\75946736-81000\75946736-81000 4000 bump test_001.rcs

Post Test Performance Check

Parameter	Result
Self-test Mode:	
Self-test Message	FFFED0902E2E6CC17FDFFC5714B783E0F66C
Normal Mode:	
Normal Message	FFFE2F902E2E6CC17FDFFC5714B783E0F66C
406 MHz Frequency	406.036838
121 MHz Presence	Pass

2.6.7 Test Location and Test Equipment Used

This test was carried out in Mechanical Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Vibration Controller (8 Ch)	m + p International	VibPilot 8	3777	12	10-Jul-2020
Shaker	Ling Dynamic Systems	A340	4294	6	05-Mar-2020
Thermal Accelerometer	PCB Piezotronic	352C03	4364	6	23-Nov-2019
Thermal Isotron Accelerometer	PCB Piezotronic	M353B18	4568	6	11-Oct-2019
Isotron Accelerometer	PCB Piezotronic	M353B18	4583	12	10-Jan-2020
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	11-Nov-2019
1 MHz / 10 MHz reference	Quartzlock	E10-X	4973	12	26-Apr-2020

Table 7

TU – Traceability Unscheduled

2.7 Thermal Shock

2.7.1 Specification Reference

RTCM 11000.4, Clause A.8

2.7.2 Equipment Under Test and Modification State

TRON 40VDR, S/N: 11457 – Modification State 0

2.7.3 Date of Test

03 and 04 October 2019

2.7.4 Test Method

The EPIRB was placed in the READY condition and thermally soaked for at least 3 hours at the minimum stowage temperature (-30 °C). The EPIRB was then totally immersed in fresh water at a temperature of 0 °C to +5 °C for 5 - 10 seconds, then floated in water that is maintained at that temperature. The EPIRB self-activated within 5 minutes.

The EPIRB was removed from the water, deactivated, made ready for automatic activation, set to the READY position and thermally soaked for at least 3 hours at the minimum stowage temperature (-30 °C). The EPIRB was then totally immersed in salt water (5% NaCl) at a temperature of -2 °C to +5 °C for 5 - 10 seconds, then floated in the water maintained at that temperature. The EPIRB self-activated within 5 minutes.

Test Setup – EUT preconditioning

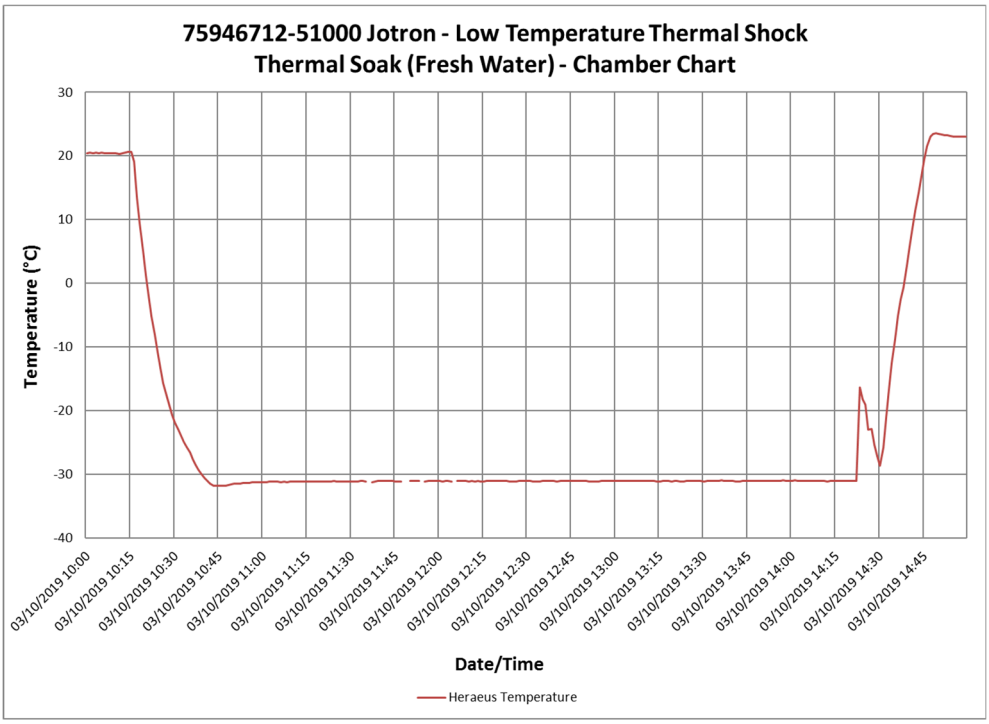
Test Setup – EUT immersed

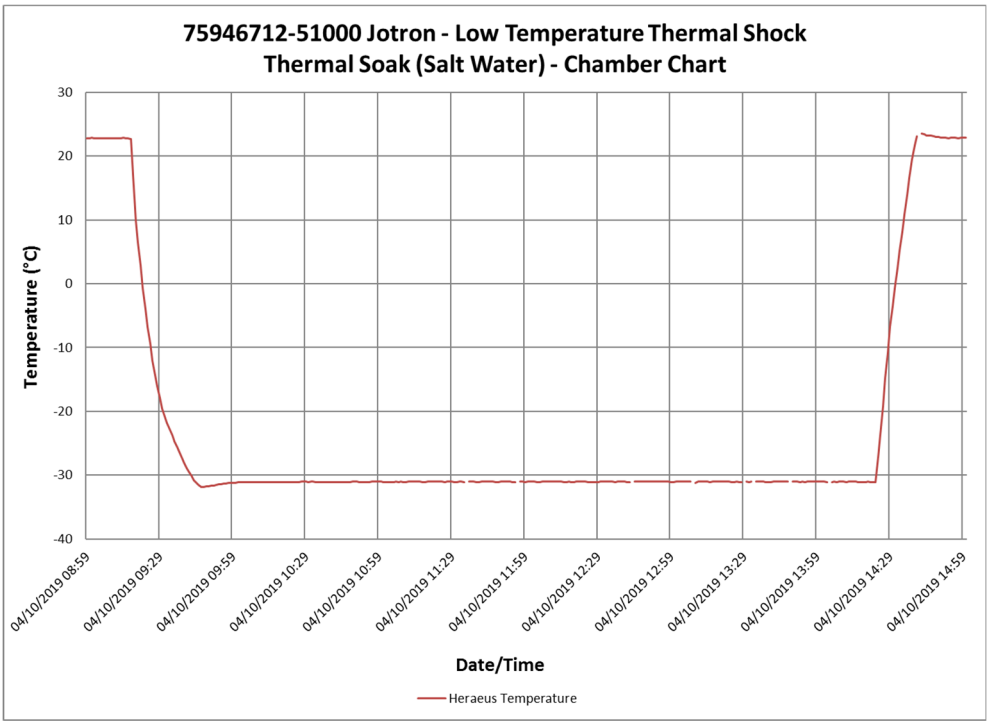
2.7.5 Environmental Conditions

Ambient Temperature	22.5 – 23.0°C
Relative Humidity	34.7 – 35.7 %

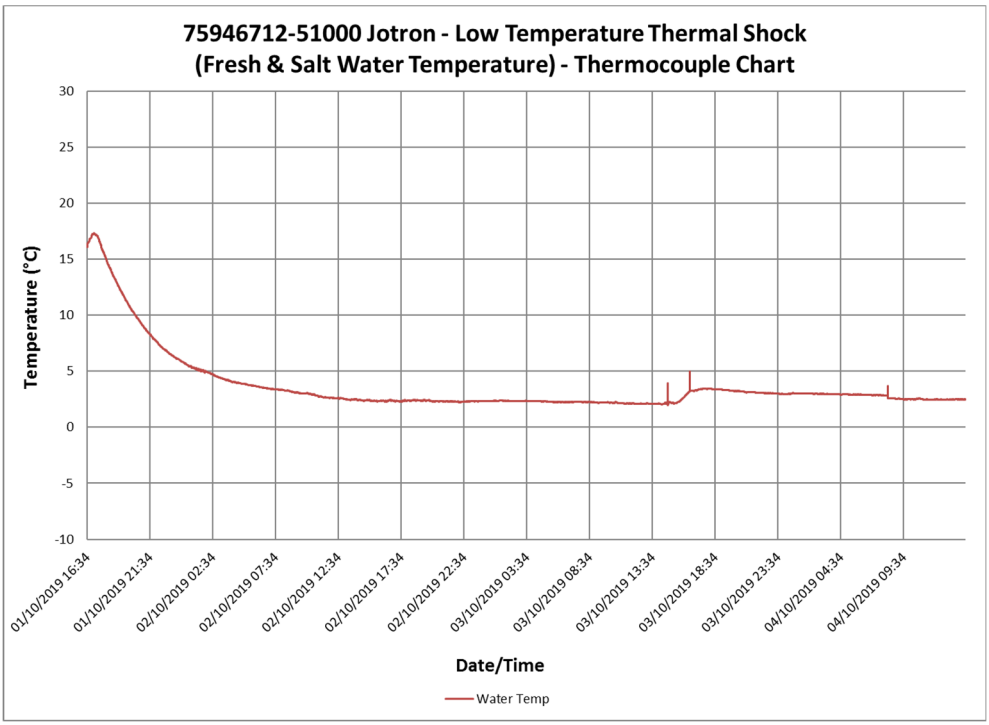
2.7.6 Test Results

Temperature Plots (Pre-conditioning)





Temperature Plot (Fresh and Salt Water)



Performance Check – Fresh Water Immersion

Parameter	Result
Automatic activation within 5 mins	Pass
Self-test Mode:	
Self-test Message	FFFED0902E2E6CC17FDFFC5714B783E0F66C*
Normal Mode:	
Normal Message	FFFE2F902E2E6CC17FDFFC5714B783E0F66C
406 MHz Frequency	406.036980
121 MHz Presence	Pass

* After activation, the EUT transmits a Self-Test message before the first normal distress message.

Table 8 – Performance Check Test Data (Thermal Shock)

Performance Check – Salt Water Immersion

Parameter	Result
Automatic activation within 5 mins	Pass
Self-test Mode:	
Self-test Message	FFFED0902E2E6CC17FDFFC5714B783E0F66C*
Normal Mode:	
Normal Message 406 MHz Frequency 121 MHz Presence	FFFE2F902E2E6CC17FDFFC5714B783E0F66C 406.036981 Pass

* After activation, the EUT transmits a Self-Test message before the first normal distress message.

Table 9 – Performance Check Test Data (Thermal Shock)

Note: The EUT was opened and inspected after the test. No ingress of water was observed.

2.7.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Beacon Tester	WS Technologies	BT 100S	87	-	TU
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	11-Nov-2019
Montford F43	Montford	4FT CUBED	2126	12	07-Jan-2020
Chamber	Heraeus	HC 4033	2174	12	05-Jul-2020
Stop Watch	Radio Spares	Model 694 (974)	4026	0	29-Oct-2019
Thermocouple Datalogger	Pico Technology Ltd	TC-08	4429	12	29-Oct-2019
Type T PFA Insulated Thermocouple	TC Limited	Type-T	4739	12	23-Jul-2020
1 MHz / 10 MHz reference	Quartzlock	E10-X	4973	12	26-Apr-2020

Table 10

TU – Traceability Unscheduled

2.8 Annex D – Internal Navigation Device

2.8.1 Specification Reference

RTCM 11000.4, Clause Annex D

2.8.2 Equipment Under Test and Modification State

TRON 40VDR, S/N: 11459 – Modification State 0

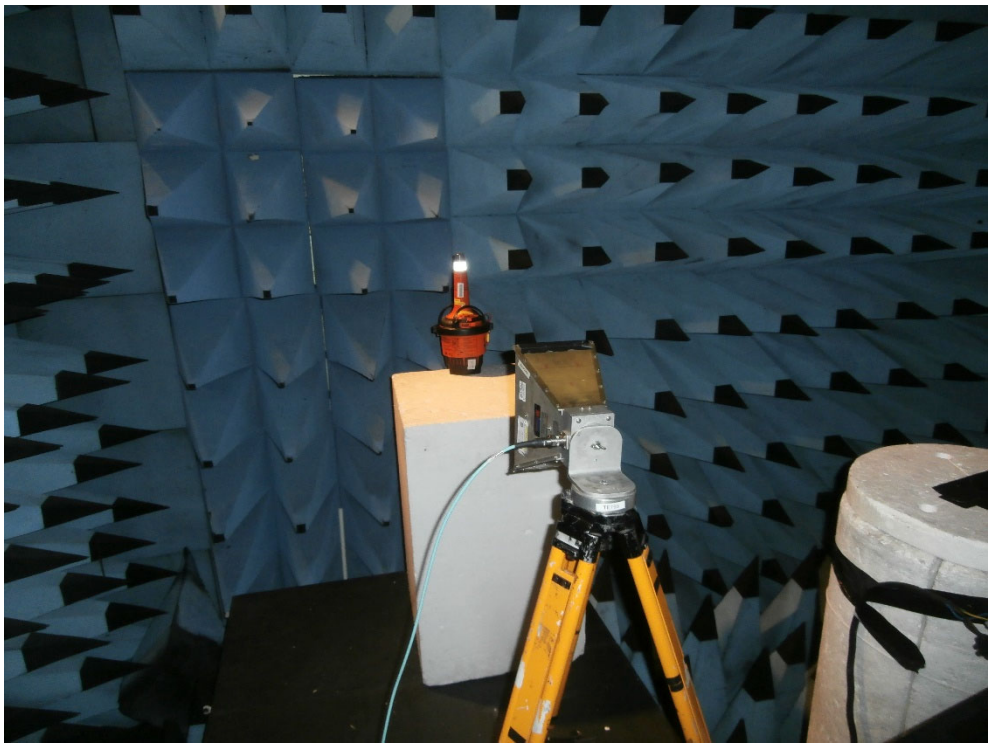
2.8.3 Date of Test

08 and 11 October 2019

2.8.4 Test Method

Each applicable scenario was run in accordance with Annex D of RTCM 11000.4 one after the other (the beacon being turned off in between scenarios to force it to 'Cold Start' each time). The Time To First Fix (TTFF) and transmitted location were recorded in each case. The results were then analyzed and an assessment of the performance of the GNSS Receiver in the EPIRB under test was made.

Test Setup



2.8.5 Environmental Conditions

Ambient Temperature	22.8 – 22.9°C
Relative Humidity	47.0 – 47.7 %

2.8.6 Test Results

Maritime Scenarios

Scenario #	TTFF (min: sec)	Simulator Location	Transmitted Location	Location Error (m)
1	00:59	0° 0' N, 0° 0' E	N 0° 0' E 0° 0'	0.00
2	01:48	0° 0' N, 0° 0' E	N 0° 0' E 0° 0'	0.00
3	N/A	0° 0' N, 0° 0' E	N/A	N/A
6	00:59	0° 0' N, 0° 0' E	N 80° 0' E 0° 0'	0.00
7	00:59	0° 0' N, 0° 0' E	N 0° 0' W 0° 0'	0.00
8	02:35	0° 0' N, 0° 0' E	S 0° 0' E 0° 0'	0.00
9	Fail	0° 0' N, 0° 0' E	No Fix	N/A
12	00:59	80° 0' N, 0° 0' E	N 80° 0' W 0° 0'	0.00
13	01:46	80° 0' N, 0° 0' E	N 80° 0' W 0° 0'	0.00
14	00:57	80° 0' N, 0° 0' E	N 80° 0' W 0° 0'	0.00
15	N/A	80° 0' N, 0° 0' E	N/A	N/A
16	01:48	80° 0' N, 0° 0' E	N 80° 0' W 0° 0'	13.65
17	02:34	80° 0' N, 0° 0' E	N 80° 0' E 0° 0'	0.00
18	Fail	80° 0' N, 0° 0' E	No Fix	N/A
19	N/A	0° 0' N, 0° 0' E	N/A	N/A
20	01:44	0° 0' N, 0° 0' E	N 0° 0' W 0° 0'	0.00
21	N/A	0° 0' N, 0° 0' E	N/A	N/A
22	02:38	0° 0' N, 0° 0' E	S 0° 0' E 0° 0'	0.00
24	00:59	0° 0' N, 0° 0' E	S 0° 0' W 0° 0'	0.00
25	N/A	0° 0' N, 0° 0' E	N/A	N/A
26	01:46	0° 0' N, 0° 0' E	S 0° 0' W 0° 0'	0.00
27	N/A	0° 0' N, 0° 0' E	N/A	N/A
28	00:58	0° 0' N, 0° 0' E	N 0° 0' W 0° 0'	0.00
30	01:51	0° 0' N, 0° 0' E	N 0° 0' W 0° 0'	0.00
32	10:55	0° 0' N, 0° 0' E	N 0° 0' E 0° 0'	0.00
33	01:52	0° 0' N, 0° 0' E	N 0° 0' W 0° 0'	0.00
34	11:00	0° 0' N, 0° 0' E	S 0° 0' W 0° 0'	0.00
35	02:36	0° 0' N, 0° 0' E	N 0° 0' E 0° 0'	0.00
36	10:08	0° 0' N, 0° 0' E	S 0° 0' W 0° 0'	0.00
37	00:57	44° 0' S, 175° 0' E	S 44° 3' E 174° 9'	0.00
38	01:46	47° 0' N, 8° 0' E	N 47° 21' W 8° 27'	0.00
39	01:01	0° 0' N, 0° 0' E	N 47° 21' W 8° 27'	5339362.24

Note: Scenarios Labelled N/A were not included in the tests

Maritime Scenarios Results Analysis (D.4):

Criteria	Limit / Condition	Result
No. of Successful Tests	TTFF ≤ 13 minutes	24
Total No. of Maritime Scenarios	26	N/A
TTFF Percentage Success Rate	(No. Successful Tests / 26) × 100	92.3
TTFF Pass / Fail Limit	≥ 70%	Pass
No of Locations with Errors	≤ 650 m	23
Total No. of Maritime Scenarios	26	N/A
Location Accuracy Percentage Pass Rate	(No Locations Errors ≤ 650 m / No Scenarios) × 100	88.4
Location Accuracy Pass / Fail Limit	≥ 70%	Pass

	EPIRB Pass / Fail
Maritime TTFF Success Rate ≥ 70%	Pass
Maritime Location Accuracy Pass Rate ≥ 70%	Pass
Both results must be a “Pass” for the EPIRB to pass, any one or more “Fails” indicated failure	

Table 11 – Maritime Scenarios Results Analysis

2.8.7 Test Location and Test Equipment Used

This test was carried out in Climatic Area.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Screened Room	Rainford	RF Chamber 8	1548	12	16-Jan-2020
Antenna (Double Ridge Guide,1GHz-18GHz)	EMCO	3115	35	12	03-Jan-2020
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	20-Dec-2019
3dB/10W Attenuator	Texscan	HFP-50N	475	12	23-Apr-2020
Directional Coupler	Narda	3022	503	-	O/P Mon
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3163	12	16-Jan-2020
Attenuator (10dB, 50W)	Aeroflex / Weinschel	47-10-34	3166	12	12-Sep-2020
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	04-Nov-2019
Multi-GNSS Simulator (GPS)	Spirent	GSS6700	4596	12	14-Aug-2020
Hygrometer	Rotronic	HP21	4740	12	17-Jan-2020
Cable (18 GHz)	Rosenberger	LU7-036-1000	5025	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-036-1000	5026	-	O/P Mon
Cable (18 GHz)	Rosenberger	LU7-036-1000	5029	-	O/P Mon
Cable (18GHz	Rosenberger	LU7-036-2000	5038	-	O/P Mon

Table 12

O/P Mon – Output Monitored using Calibrated Equipment

3 Photographs

3.1 Equipment Under Test (EUT)

Table 13