Report No. E13261.06

Test Report

Product	EPIRB with attached Voyage Data Recorder
Name and address of the applicant	Jotron AS Østbyveien 1, Postboks 54, N-3280 Tjodalyng, Norway
Name and address of the manufacturer	Jotron AS Østbyveien 1, Postboks 54, N-3280 Tjodalyng, Norway
Model	Tron 40VDR
Rating	External power: 24/48V DC PoE: 48V DC Battery EPIRB: 7.2V 18Ah
Trademark	JOTRON
Serial number	00075
Additional information	COSPAS-SARSAT 406 MHz Satellite Emergency Position-Indicating RadioBeacon (EPIRB) with attached Voyager Data Recorder (VDR)
Tested according to	IEC 61097-2 (2008) IEC 60945 (2002) Ed.4 IEC 61996-1 (2013) RTCM Paper 77-2002/SC1100-STD
Order number	245988
Tested in period	2013-11-15 to 2014-06-01
Issue date	2015-03-03
Name and address of the testing laboratory	**Nemko Group** Nemko AS Gaustadalléen 30, P.O.Box 73 Blindern, 0314 Oslo, Norway Telephone (+47) 22 96 03 30 Fax (+47) 22 96 05 50

ilac-MRA NORWEGIAN ACCREDITATION TEST 033

An accredited technical test executed under the Norwegian accreditation scheme

Prepared by [Jan Gunnar Eriksen] Approved by [Roger Berget]

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REVISIONS

Revision #	Date	Order #	Description
00	2014-01-29	245988	-
01	2014-05-07	245988	Added result for Oil Resistance Test
02	2014-05-22	245988	Clarified the interference tests described in IEC 61097-2 in the summary table
03	2014-06-12	245988	Corrected the software version for the EPIRB Added Clause number for the IEC 60945 tests Added a calculation for the IEC 60945 Cl 12.2 Corrected misprint in Leakage and Immersion Added test results for IP2x Added solar radiation report from SP as an appendix
04	2014-06-26	245988	Added sections for: Excessive conditions, Marking, Bit Error Rate, Data Integrity under float free operation, Aids to location, Means to facilitate grappling Updated table of witnessed tests Added table of customer supplied information Updated references to tested standards for witnessed tests Updated witnessed tests
05	2014-11-26	245988	Added result for Thermal Shock Test.
06	2015-03-03	245988	Added missing detailed test log and conclusion to Recording Integrity test.

GENERAL REMARKS

This report applies only to the sample(s) tested. It is the manufacturer's responsibility to assure the additional production units of this product are manufactured with identical electrical and mechanical components. The manufacturer is responsible to the Competent Authorities in Europe for any modifications made to the product, which result in non-compliance to the relevant regulations.

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Opinions expressed within this report regarding general assessments and qualifications for PASS or FAIL to the standards limits and requirements, are not part of the current accreditation. Neither is opinions expressed regarding model variants covered by the testing of this report.

CALIBRATION

All instruments used in the tests given in this test report are calibrated and traceable to national or international standards. Between calibrations all test set-ups are controlled and verified on a regular basis by periodic checks to ensure, with 95% confidence that the instruments remain within the calibrated levels.

MEASUREMENT UNCERTAINTY

Measurement uncertainties are calculated or considered for all instruments and instrument set-ups used during these tests.

EMC emission measurement uncertainty calculations have been made according to CISPR 16-4-1.

EMC test uncertainties for transient immunity are kept within the requirements of the relevant basic standard. Periodic calibrations and internal controls ensure that the instruments remain within the calibrated levels.

Uncertainty figures are found in an appendix to this report.

Further information about measurement uncertainties is provided on request.

If not explicitly stated otherwise in the standard, the test is passed if the measurement value is equal to or below the limit line, regardless of the uncertainty of the measurement. If the measurement value is above the limit line, the test is not passed - ref. IECEE/CTL (Sec) 056/94 (CTL = Committee of Testing Laboratories) and CISPR 16-4-1. The instrumentation accuracy and measurement uncertainties are within limits specified by CISPR 16-4-1.

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DESCRIPTION OF TESTED DEVICE (EUT)

PRODUCT DESCRIPTION

The EUT is a COSPAS-SARSAT Float Free 406 MHz Satellite Emergency Position-Indicating Radio Beacon (EPIRB) with an attached Voyage Data Recorder (VDR), which continuously receives the most important data concerning position, speed, heading from the ships computer and transmit this information if an emergency state is activated (manually or automatically).

Hardware identity and/or version:

Bracket:

VDR Docking Module	87922 – R1320

Storage Module:

Digital Board	87912 – R1320
Interface	87914 – R1326

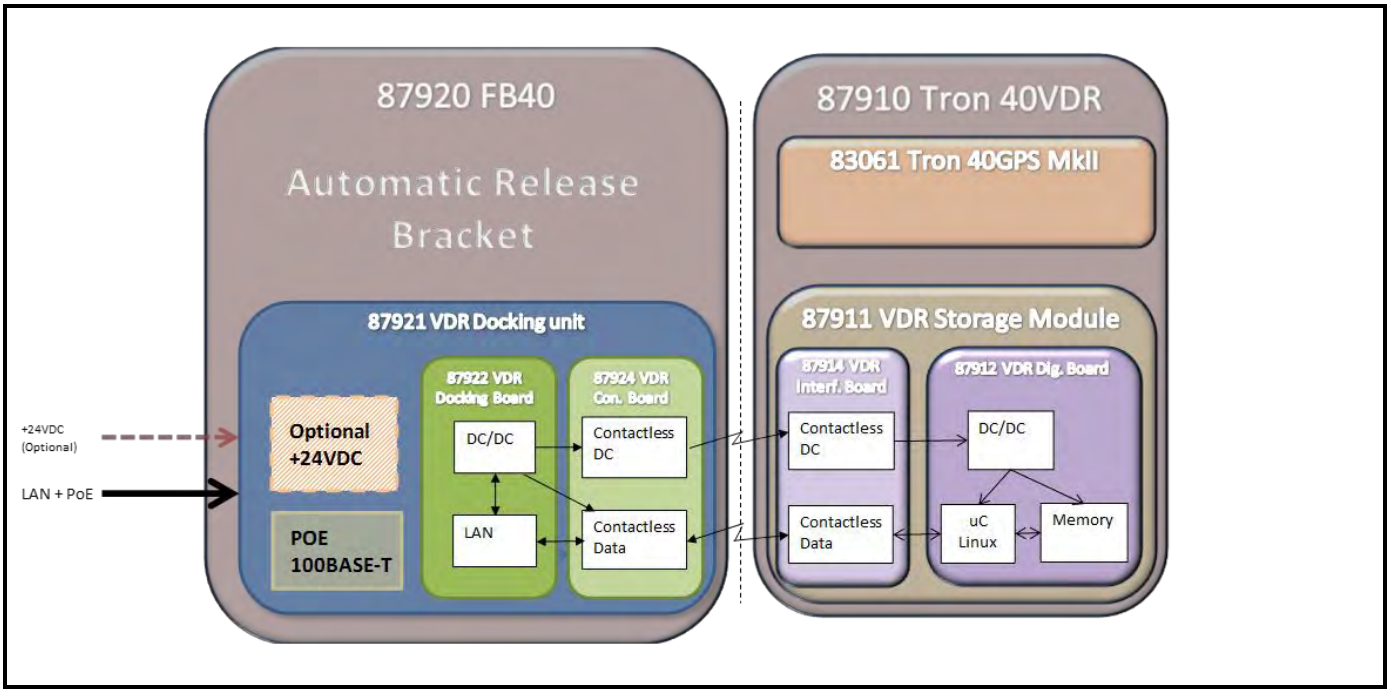
EPIRB:

Main Board	87454 – R1341
Antenna	83052 – R0815

Software identity and/or version:

EPIRB:	87934 – v2.0
Boot Loader:	87812 – v1.0
Root File System:	87890 – v1.0

PRINCIPLE DIAGRAM



AVAILABLE PORTS

This equipment is fitted with the following electrical ports.

PO no.	Port Name	Port Type	Count	Comment
1	LAN+PoE	Ethernet Port	1	10BASE-T/100BASE-T 36-48VDC
2	+24V DC	DC Input Port	1	Nominal + 24-48VDC

CONFIGURATION OF CABLES (INCLUDING INTERCONNECTING ONES)

This equipment has been tested with the following cable types and cable configurations. Any changes to these parameters when installed may influence on the EMC properties of this equipment.

CA no.	Connection	Shielded	Leads	Length (m)
1	LAN+PoE to Ethernet	YES	4	2 1)
3	+24V DC to external DC source	YES	2	2 1)

NOTE: 1) can be 0.5m from specimen to connection box.

CLOCK FREQUENCIES AND DISTRIBUTIONS

This equipment utilizes the following crystal oscillators and clocking schemes as described below:

XF no.	Frequency	Type	Purpose
1	25MHz	Xtal	Hub LAN Bracket
2	25MHz	Xtal	Hub LAN Storage Module
3	100MHz	Xtal	SATA Controller Storage Module
4	24MHz	Xtal	Possessor

AVAILABLE OPERATING MODES

The following functional operating modes are provided by the appliance and are applicable during intended use.

FU no.	Operating modes	Description	Investigated
1	Standby mode	64 Gb storage of data. Read/Write	Yes
2	Emergency mode	Unit is transmitting emergency signals on 121,5 and 406 MHz	No

EQUIPMENT MODIFICATIONS

No modifications applied.

ADDITIONAL INFORMATION RELATED TO TESTING

Some of the tests required by the reference standard are not standard tests, and requires practical real-life conditions. For that reason some of the tests have been perfomed at the customer premises or at sites outside Nemko's premises. In these tests Nemko has performed supervision and witnessing of the tests. These tests have been separated in this report, and are described in the last annex of the report. Summary of the results from all tests are listed in pages 10, 11 and 12.

GENERAL TEST CONDITIONS

TEST LABORATORY

The following Nemko test sites have been utilized for the tests documented in this report:

	Site	
X	**GAUSTAD**	(Gaustadalleen 30, N-0314 Oslo, Norway)
X	**KJELLER**	(Instituttveien 6, N-2007 Kjeller, Norway)
X	**SKAR**	(Maridalsveien 621, N-0890 Oslo, Norway)

OTHER TEST SITES USED DURING WITNESSED TESTS

Witnessed tests have been performed at the following sites:

- Jotron's premises at Skoppum
- Sandefjord Public Swimming Hall
- Sandefjord Quay Area
- Sandefjord Fire Station

LABORATORY ACCREDITATIONS

NORWEGIAN ACCREDITATION TEST 033

Norsk Akkreditering – TEST 033
P06 – Electromagnetic Compatibility

VCCI – Membership No. 3220

POWER SUPPLIED TO EUT

Filtered electrical power was available for operation of EUT in all the test sites.

Voltage type: 24V DC
Grounding: Grounded through grounding strap.

AMBIENT CONDITIONS

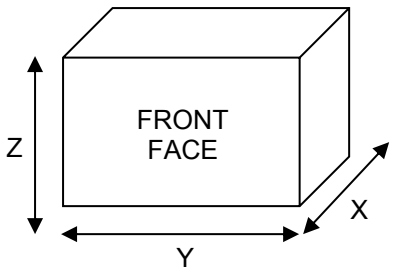
All EMC tests and measurements were performed in a shielded enclosure or in a controlled environment suitable for the tests conducted.

Normal ambient test conditions:

Ambient temperature:	20 - 23°C
Relative humidity:	40 - 50%RH
Atmospheric pressure:	98 - 102kPa

Note: The climatic conditions in the test areas are automatically controlled and recorded continuously.

DEFINITION OF AXIS CONVENTIONS



EVALUATION OF PERFORMANCE

FUNCTIONAL TESTS AND CHECKS

In order to verify acceptable performance by the EUT during and after the applied tests, the following functions were monitored:

Performance checks: A short functional test carried out during or after a technical test to confirm that the equipment operates:	**Performance tests:** A measurement or a group of measurements carried out during or after a technical test to confirm that the equipment complies with selected parameters as defined in the equipment standard:	**Monitoring methods:** Which functions were monitored and how:
Description: During immunity tests the communication link between EUT and an external PC was checked constantly. During ESD test, in addition to checking the communication between EUT and PC, it was checked that data files written to the EUT remained at the EUT and was possible to read back to the external PC.	**Description:** During immunity tests the communication link between EUT and an external PC was checked constantly.	**Description:** Manual monitoring method was used.

PERFORMANCE CRITERIA

In order to pass each test, the EUT shall meet the following criteria:

Performance criterion A: The device shall continue to operate as intended both during and after the test. No degradation of performance or loss of function is allowed below the expected performance level of the device	**Performance criterion B:** The device shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below the expected performance level of the device	**Performance criterion C:** Temporary loss of function during test is allowed, provided the function is self-recoverable or can be restored by the operation of the controls
Modified by the manufacturer: Not modified	**Modified by the manufacturer:** Not modified	**Modified by the manufacturer:** Not modified

SUMMARY OF TESTING

APPLIED STANDARDS

» **EN 60945 (2002)**	*Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results*
» **IEC 61097-2 (2008)**	*Global maritime distress and safety system (GMDSS)* *Part 2: COSPAS-SARSAT EPIRB* *Satellite emergency position indicating radio beacon operating on 406 MHz. Operational and performance requirements, methods of testing and required test results*
» **IEC 61996-1 (2013)**	*Maritime navigation and radiocommunication equipment and systems –Shipborne voyage data recorder (VDR) –* *Part 1: Performance requirements, methods of testing and required test results*
» **RTCM Paper 77-2002/SC1100-STD**	*RTCM Standard 11000.2* *406 MHz Satellite Emergency Position-Indicating RadioBeacons (EPIRBs).*

APPLIED TESTS

Test items	Test methods	Result
Conducted Emissions	EN 60945 (2002)	PASS
Radiated Emissions (150kHz-30MHz)	EN 60945 (2002)	PASS
Radiated Emissions (30MHz-1000MHz)	EN 60945 (2002)	PASS
Interference Testing (see Note 1 below)	IEC 61097-2 (2008) Clause A.1.13	PASS
Conducted Interference Testing (see Note 2 below)	IEC 61097-2 (2008) Clause A.1.14	PASS
Electrostatic Discharges Immunity	EN 60945 (2002) EN 61000-4-2 (2009), Ed.2.0	PASS
Radiated RF Disturbance Immunity	EN 60945 (2002) EN 61000-4-3 (2008), Ed.3.1	PASS
Electric Fast Transients Immunity	EN 60945 (2002) EN 61000-4-4 (2010), Ed.2.1	PASS
Surge Immunity	EN 60945 (2002) EN 61000-4-5 (2006), Ed.2.0	PASS
Conducted RF Disturbance Immunity	EN 60945 (2002) EN 61000-4-6 (2009), Ed.3.0	PASS
Dips and Interruptions Immunity	EN 60945 (2002) EN 61000-4-11 (2004), Ed.2.0	PASS
Voltage and Frequency Variations Immunity	EN 60945 (2002) EN 61000-4-11 (2004), Ed.2.0	PASS
Thermal Shock Test	RTCM Paper 77-2002/SC110-STD	PASS
Low Temperature (storage)	EN 60945 (2002) IEC 61097-2 (2008)	PASS
Low Temperature (operational)	EN 60945 (2002) IEC 61097-2 (2008)	PASS
Dry Heat (storage)	EN 60945 (2002) RTCM Paper 77-2002/SC110-STD IEC 61097-2 (2008)	PASS
Dry Heat (operational)	EN 60945 (2002) RTCM Paper 77-2002/SC110-STD IEC 61097-2 (2008)	PASS
Damp Heat	EN 60945 (2002) RTCM Paper 77-2002/SC110-STD IEC 61097-2 (2008)	PASS
Oil Resistance	EN 60945 (2002) IEC 61097-2 (2008)	PASS*
Salt Mist/Corrosion	EN 60945 (2002) IEC 61097-2 (2008) EN 60068-2-52 (1996), Ed.2.0	PASS
Salt Mist/Corrosion (RTCM requirements)	RTCM Paper 77-2002/SC110-STD EN 60068-2-52 (1996), Ed.2.0	PASS
Stability and Buoyancy test	RTCM Paper 77-2002/SC110-STD IEC 61097-2 (2008)	PASS*
Sinusoidal Vibration	EN 60945 (2002)	PASS
Sinusoidal Vibration (RTCM requirements)	RTCM Paper 77-2002/SC110-STD	PASS

Test items	Test methods	Result
Mechanical Shock	RTCM Paper 77-2002/SC110-STD IEC 61097-2 (2008)	PASS
Drop On Hard Surface	EN 60945 (2002) RTCM Paper 77-2002/SC110-STD IEC 61097-2 (2008)	PASS*
Ingress Protection (IP)	EN 60945 (2002) IEC 60529 (2001), Ed.2.1	PASS
Leakage and Immersion tests	RTCM Paper 77-2002/SC110-STD IEC 61097-2 (2008)	PASS*
Compass Safe Distance	EN 60945 (2002) IEC 61097-2 (2008) EN ISO 694 (2001)	PASS
Extreme Power Supply Conditions	EN 60945 (2002) IEC 60092-101 (1994)	N/A
Acoustic Noise and Signals	EN 60945 (2002)	N/A
Excessive Conditions	EN 60945 (2002)	PASS
Solar Radiation	EN 60945 (2002)	PASS*

PASS : Tested and complied with the requirements
FAIL : Tested and failed the requirements
N/A : Test not relevant to this specimen (evaluated by the test laboratory)
– : Test not performed (instructed by the applicant)
* : An asterisk (*) placed after the verdict in the Result column indicates test items that are not within Nemko's scope of accreditation
# : A grid (#) placed after the verdict in the Result column indicates test items that are only partly covered by Nemko's scope of accreditation. Further information is detailed in the test section

Note 1. The Interference Testing referenced in IEC 61097-2 Clause A.1.13 is covered by the EN 60945 Radiated RF Disturbance Immunity and the Electrostatic Discharges Immunity tests.

Note 2. The Conducted Interference Testing referenced in IEC 61097-2 Clause A.1.14 is covered by the EN 60945 Conducted RF Disturbance Immunity and the Electric Fast Transients Immunity tests.

DEVIATIONS AND EVALUATIONS

Product standards with dated references to basic standards may be modified by Nemko AS to test according to the newest edition of the basic standard. This may impact the compliance criteria or technical performance of the test, still this is considered to be adequate as long as the test is expected to confirm compliance to the intention of the product standard. The tables above list the edition of the basic standards used during testing.

WITNESSED TESTS

Test items	Test methods	Result
Marking	IEC 61996-1 (2013)	PASS*
Excessive conditions	IEC 60945 (2002)	PASS
Automatic release and activation test	IEC 61097-2 (2008)	PASS*
Drop into water	IEC 61097-2 (2008)	PASS*
Test to prevent release when water washes over the unit	IEC 61097-2 (2008)	PASS*
Means to facilitate grappling and recovery	IEC 61996-1 (2013)	PASS*
Resistance to tampering	IEC 61996-1 (2013)	PASS*
Information for use by an investigation authority	IEC 61996-1 (2013)	PASS*
Write and verify tests	IEC 61996-1 (2013)	PASS*
Data integrity under float-free conditions	IEC 61996-1 (2013)	PASS*
Recording integrity – bit error rate	IEC 61996-1 (2013)	PASS*

PASS : Tested and complied with the requirements
FAIL : Tested and failed the requirements
N/A : Test not relevant to this specimen (evaluated by the test laboratory)
– : Test not performed (instructed by the applicant)
* : An asterisk (*) placed after the verdict in the Result column indicates test items that are not within Nemko's scope of accreditation
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CUSTOMER SUPPLIED INFORMATION

Test items	Test methods	Document reference	Result
Light	IEC 61996-1 (2013)	10062014_Jotron_Light_measurement, see page 101-110	PASS*
Locating transmitter	IEC 61996-1 (2013)	75924802 Report 01 Issue 3.pdf (TÜV), see page 111	PASS
Float-free capsule	IEC 61996-1 (2013)	Particular design requirements, see page 111-114	PASS*

PASS : Tested and complied with the requirements
FAIL : Tested and failed the requirements
N/A : Test not relevant to this specimen (evaluated by the test laboratory)
– : Test not performed (instructed by the applicant)
* : An asterisk (*) placed after the verdict in the Result column indicates test items that are not within Nemko's scope of accreditation
# : A grid (#) placed after the verdict in the Result column indicates test items that are only partly covered by Nemko's scope of accreditation. Further information is detailed in the test section

Test Results

CONDUCTED EMISSIONS

TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Reference
IEC 60945 (2002) Ed. 4 Clause 9.2 Conducted emissions

Set-up
The measurements are performed in a shielded enclosure with filtered mains supply.
EUT is mounted directly on, and bonded to, the reference ground plane.
EUT is connected to an Artificial Mains Network (AMN) by an 80cm long screened power cable.

Procedure
A screening test is first performed to decide the most disturbing operating mode of the EUT, maximizing the cable layout and deciding the proper dwell time for the measurements.

Then measurements are run between each of the current carrying wires of the power cord, and ground.

The frequency is swept in the range specified under Severity.

A comparison of the results obtained from the different wires is then performed to find the highest level at each frequency. This worst-case sweep with peak detector is presented below.

At the frequencies where the peak level of the emission is exceeding the applicable [limit - offset], the emission is also measured with the quasi-peak detector.

Instruments used during measurement

Instrument list:	Test Receiver: R&S / ESHS (N-3528) (07/2013) AMN: R&S / ESH3-Z5 (N-4097) (11/2013)

Comments
No recorded comments.

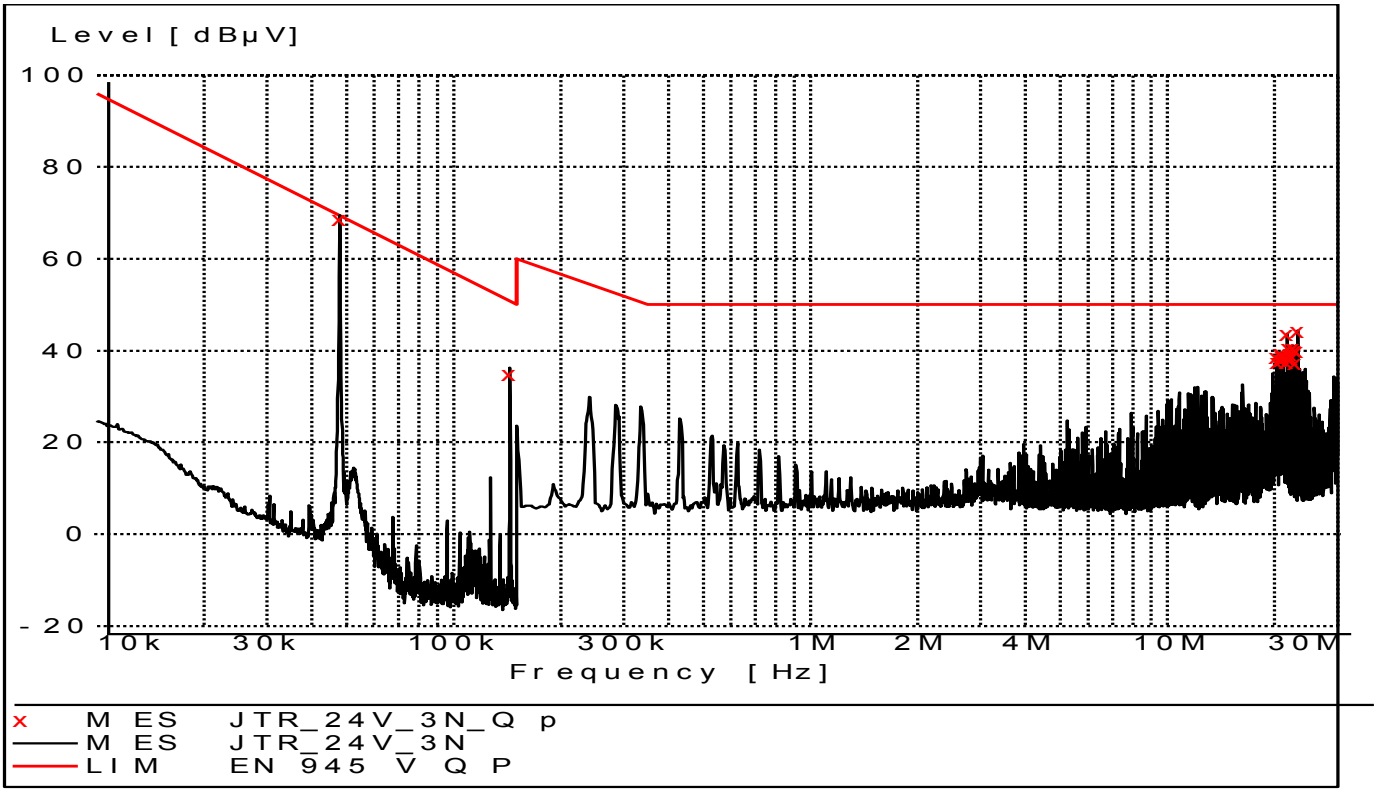
Severity

Port:	DC Input Port: +24V
Frequency range:	0.01 – 30 MHz
Frequency step:	100 Hz / 5 kHz
Dwell time:	50 mSec / 20 mSec
Bandwidth:	200 Hz / 10 kHz

Conformity

Verdict:	PASS
Test engineer:	Jan G Eriksen

EMISSION SPECTRUM



QUASI PEAK DETECTOR DATA

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.048000	68.70	10.20	69.40	0.70	QP	L1	Pass
0.144000	34.90	10.10	50.70	15.80	QP	N	Pass
20.260000	38.60	11.30	50.00	11.40	QP	N	Pass
20.380000	37.40	11.30	50.00	12.60	QP	N	Pass
20.810000	39.30	11.30	50.00	10.70	QP	N	Pass
20.870000	37.90	11.30	50.00	12.10	QP	N	Pass
20.990000	38.10	11.30	50.00	11.90	QP	N	Pass
21.055000	38.70	11.30	50.00	11.30	QP	N	Pass
21.115000	38.90	11.30	50.00	11.10	QP	N	Pass
21.175000	38.60	11.30	50.00	11.40	QP	N	Pass
21.665000	43.60	11.30	50.00	6.40	QP	N	Pass
21.725000	37.40	11.30	50.00	12.60	QP	N	Pass
21.910000	40.60	11.30	50.00	9.40	QP	N	Pass
22.030000	38.10	11.30	50.00	11.90	QP	N	Pass
22.215000	39.20	11.30	50.00	10.80	QP	N	Pass
22.395000	38.30	11.30	50.00	11.70	QP	N	Pass
22.455000	40.60	11.30	50.00	9.40	QP	N	Pass
22.580000	40.60	11.30	50.00	9.40	QP	N	Pass
22.825000	37.30	11.30	50.00	12.70	QP	N	Pass
22.885000	40.10	11.30	50.00	9.90	QP	N	Pass
23.070000	39.90	11.30	50.00	10.10	QP	N	Pass
23.130000	44.30	11.30	50.00	5.70	QP	N	Pass

RADIATED EMISSIONS (150KHZ-30MHZ)

TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Reference
IEC 60945 (2002) Ed. 4 Clause 9.3 Radiated emissions

Set-up
The measurements are performed in a semi-anechoic chamber (SAC) with filtered mains supply.
EUT is placed on a wooden table 80 cm above the ground plane, in the centre of the turntable. The measuring antenna is located 3 meters from EUT and 100cm above the ground plane. Antenna is oriented both longitudinal and transverse to the EUT.

Procedure
A screening test was first performed to decide the most disturbing operating mode of the EUT, maximizing the cable layout and deciding the proper dwell time for the measurements.

A set of preliminary measurements are then performed with a peak detector across the frequency range. Frequency scans are performed at individual turntable azimuths; 0°, 90°, 180° and 270°. The frequency is scanned in the range specified under Severity.

A comparison of the levels measured at each measurement positions is then performed, and the highest level at each frequency is stored. This "Worst Case" scan with peak detector is presented in the report.

At the frequencies where the peak values of the emission are exceeding the applicable [limit - offset], the emission is also measured with the quasi-peak detector: Cables connected to EUT are altered to cause maximum emission, and a maximum emitting point is identified by finetuning the turntable azimuth.

The quasi-peak detector measurement is performed at the maximum emitting point and compared to the limit. The emission level is calculated in the following matter: Elevel = Ereading + Eantenna + Ecable.

Instruments used during measurement

Instrument list: Test Receiver R&S / ESU40 (LR-1638) (09/2014)
Loop Antenna R&S / HFH2-Z2 (LR-285) (10/2013)

Comments
No recorded comments.

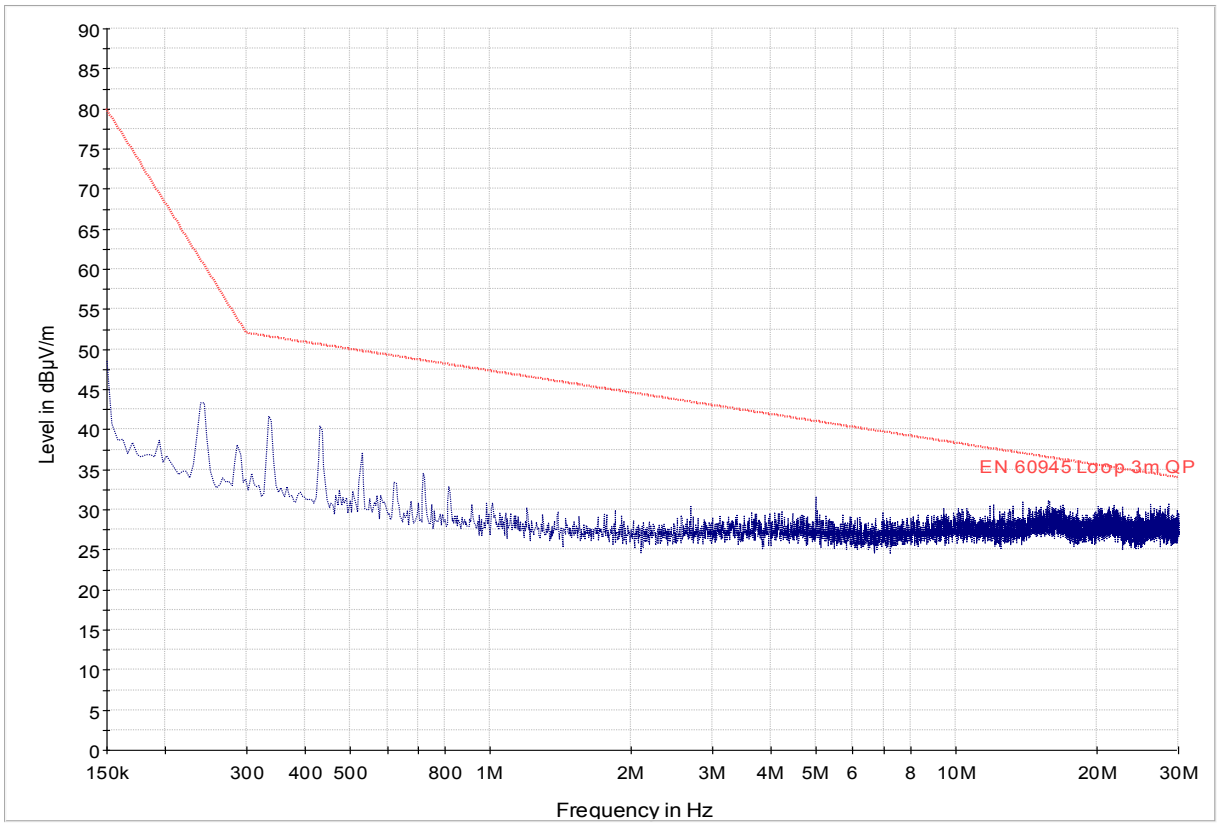
Severity

Port:	Enclosure Port
Frequency range:	150 kHz – 30 MHz
Frequency step:	5 kHz
Dwell time:	20 msec
Bandwidth:	10 kHz
Meas. distance:	3 m

Conformity

Verdict:	PASS
Test engineer:	Jan G Eriksen

EMISSION SPECTRUM



Note: This preview is a merged result of all peak detector measurements carried out on this product. This preview includes measurements for all pre-sets, but shows only the worst level at each frequency. Any quasi-peak detector measurements are carried out at the "worst case" position. (red pointers indicate quasi-peak measurement frequencies and levels. Measurement data are presented below)

QUASI PEAK DETECTOR DATA

Frequency [MHz]	QP Level [dBuV]	Margin [dB]	Limit [dBuV]	Azimuth [deg]	Verdict [Pass/Fail]
0.240	40.6	20.4	61.0	135	Pass
0.338	39.1	12.4	51.5	135	Pass
0.433	38.7	11.9	50.6	135	Pass

RADIATED EMISSIONS (30MHZ-2000MHZ)

TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Reference
IEC 60945 (2002) Ed. 4 Clause 9.3 Radiated emissions

Set-up
The measurements are performed in a semi-anechoic chamber (SAC) with filtered mains supply.
EUT is placed on a wooden table 80 cm above the ground plane, in the centre of the turntable. The measuring antenna is located 3 meters from EUT.

Procedure
A screening test is first performed to decide the most disturbing operating mode of the EUT, maximizing the cable layout and deciding the proper dwell time for the measurements.

A set of preliminary measurements are then performed with a peak detector across the frequency range. Frequency sweeps are running continuously while the turntable azimuth is turned from 0° to 360°. Individual sweeps are performed for horizontal and vertical polarizations of the antenna, and for three individual antenna heights. The frequency is swept in the range specified under Severity.

A comparison of the levels measured at each measurement positions is then performed, and the highest level at each frequency is stored. This "Worst Case" sweep with peak detector is presented in the report.

At the frequencies where the peak values of the emission are exceeding the applicable [limit - offset], the emission is also re-measured with the quasi-peak detector. Cables connected to EUT are altered to cause maximum emission, and a maximum emitting point is identified by first finetuning the turntable azimuth and then finetuning the antenna height between 100 cm and 400 cm above the ground plane.

The quasi-peak detector measurement is performed at the maximum emitting point and compared to the limit. The emission level is calculated in the following matter: Elevel = Ereading + Eantenna + Ecable - Epreamp.

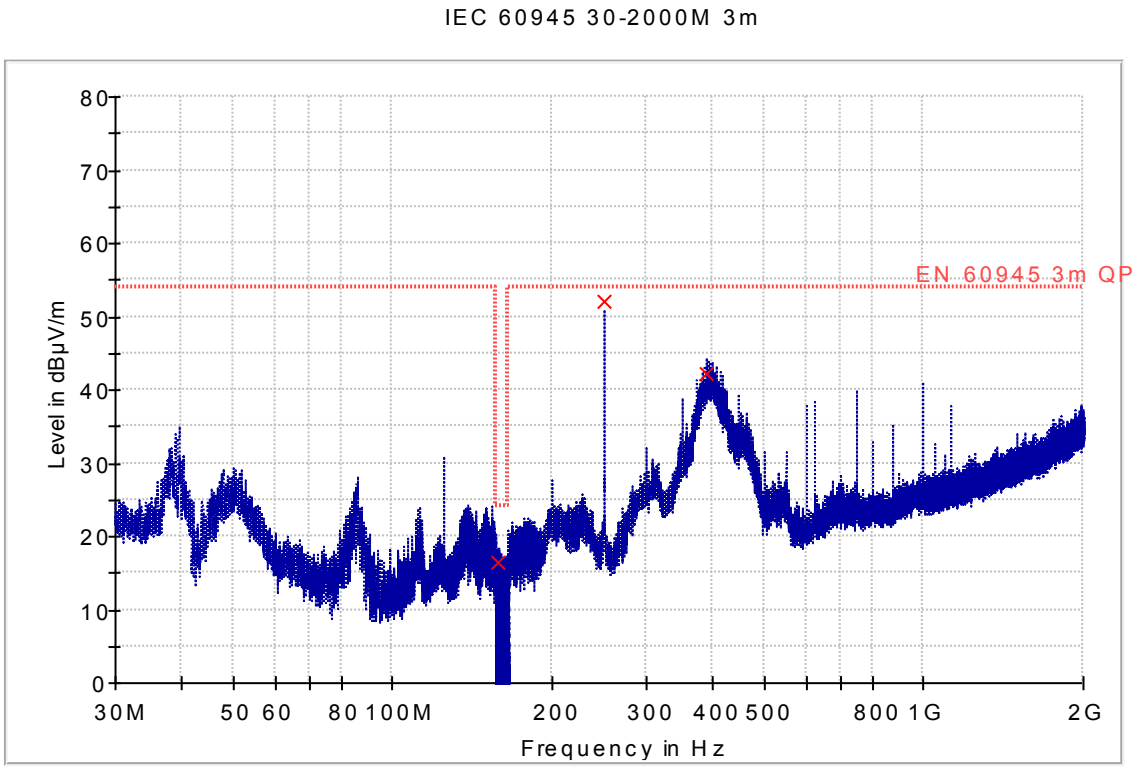
Instruments used during measurement

Instrument list:
Test Receiver: R&S / ESU40 (LR-1638) (09/2014)
Antenna: Sunol Sciences / JB3 (N-4525) (11/2013)
Preamplifier: Teseq / LNA 6900 (LR-1593) (11/2013)

Comments
No recorded comments.

Severity		Conformity	
Port:	Enclosure Port	Verdict:	PASS
Frequency range:	30 MHz – 2000 MHz	Test engineer:	Jan G Eriksen
Sweep time:	20 mSec		
RBW:	120 kHz (9 kHz within 156-165MHz)	VBW:	1 MHz
Meas. distance:	3 m	Meas. height:	100-400 cm

EMISSION SPECTRUM



Note: This preview is a merged result of all peak detector measurements carried out on this product. This preview includes measurements for all pre-sets, but shows only the worst level at each frequency. Any quasi-peak detector measurements are carried out at the "worst case" position. (red pointers indicate quasi-peak measurement frequencies and levels. Measurement data are presented below)

QUASI PEAK DETECTOR DATA

Frequency [MHz]	QP Level [dBuV/m]	Margin [dB]	Limit [dBuV/m]	Height [cm]	Pol [H/V]	Azimuth [deg]	Verdict [Pass/Fail]
158.543758	16.5	7.5	24.0	172.0	H	283.0	Pass
250.009543	52.0	2.0	54.0	133.0	H	254.0	Pass
390.355205	42.1	11.9	54.0	100.0	H	42.0	Pass

ELECTROSTATIC DISCHARGES IMMUNITY

TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Reference
IEC 60945 (2002) Ed. 4 Clause 10.9 Immunity to electrostatic discharge

Set-up
A ground reference plane is located on the floor, and connected to earth via a low impedance connection. The return cable of the ESD generator is connected to the reference plane.

EUT is placed on a wooden table 10 cm (floor standing) / 80 cm (tabletop) above the reference plane, and all cables attached to the EUT is isolated the same way.

A vertical coupling plane (VCP) of 50x50 cm is placed 10 cm from the EUT's exterior. This VCP is connected to the reference plane via a cable with two 470kΩ resistors located one in each end of the cable.

In case of tabletop equipment, a horizontal coupling plane (HCP) of 160x80 cm is located on the table, and connected to the reference plane the same way as the VCP. EUT is separated from the HCP by a 0.5mm insulating support.

Procedure
Direct contact and air discharges are applied to the EUT enclosure. Indirect contact discharges are applied to the mid edge of the HCP and VCP.

In accordance with IEC 61097-2 discharge was also performed directly to the EPIRB.

Contact discharges are applied to various selected test points of the EUT at conductive surfaces, and to the HCP and VCP. Air discharges are applied to various selected test points of the EUT at non-conductive surfaces.

Discharges are applied at increasing levels to each test point.

Instruments used during measurement
Instrument list: ESD generator: Schaffner / NSG 435 (LR-1281) (06/2014)

Comments
Both Enclosure Port of EPIRB with protecting dome and Enclosure Port of EPIRB itself, including metallic flange at its lower part have been tested.

Severity		Conformity	
Port:	Enclosure Port	Verdict:	PASS
		Test engineer:	Jan G Eriksen

DESCRIPTION OF TEST POINTS

Enclosure dome on

Enclosure dome off

★ = Contact discharge points
★ = Air discharge points

DETAILED TEST LOG

Note: The choice of test levels could differ from the procedure, based on the nature of EUT.
Note: An asterisk (*) indicates tests not within the scope of accreditation.
Note: Possible test case performances: <space> = Not tested, or letters indicating level of performance.
Note: ND = No Discharge, indicates discharge attempts, which have given no actual observable discharge.

Test Point	Applied Level [kV]	Discharge Type	Discharges per test level	Required Criteria	Complied Criteria	Result
Enclosure Dome	±4, ±8	Air	10	B	A	PASS
Diode area of EPIRB	±4, ±8	Air	10	B	B	PASS
PVC-parts of EPIRB	±4, ±8	Air	10	B	A	PASS
Metallic flange on EPIRB	±2, ±6	Contact	10	B	B	PASS
HCP	±2, ±6	Contact	10	B	B	PASS
VCP	±2, ±6	Contact	10	B	B	PASS

CONCLUSION

No operation errors were detected during or after the applied test(s).

RADIATED RF DISTURBANCE IMMUNITY

TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Reference
IEC 60945 (2002) Ed. 4 Clause 10.4 Immunity to radiated radiofrequencies

Set-up
The tests are performed at 3 meter antenna distance in an anechoic chamber. EUT is placed on a wooden table 10 cm (floor standing) / 80 cm (tabletop) above the floor.
The EUT is placed within the calibrated volume, and the cables connected to EUT is arranged so that 100 cm of each cable is exposed to the electromagnetic field.
Interconnecting cables specified ≤ 300 cm whose length exceeded 100 cm are bundled to achieve 100 cm length.
Interconnecting cables specified > 300 cm and other cables connected to the EUT are exposed for 100 cm, and the remaining cable length is decoupled with the use of ferrites.

Procedure
The EUT is exposed to a RF electromagnetic field generated by one or more antennas. The field is applied with the antennas facing each of the four faces of the EUT (0°, 90°, 180°, 270°). The polarization of the field requires testing each side of the EUT twice, once with the antenna horizontally and again with the antenna vertically. The antenna height during test is 150 cm.

A field level and type as specified below is applied in the defined frequency range. The frequency is swept through the range with a step width and a dwell time per frequency as specified below.

Optional conditions if the testing has been performed in a GTEM cell or in a Stripline (see Severity):
For physically small, uncomplicated equipment, this test may have been done in a GTEM cell. In a GTEM cell the EUT is placed on a wooden table in the centre between the floor ground reference plane and the septum transmitter plane. The EUT is tested in all three orthogonal axis (X, Y and Z). The septum height in the test volume is 140 cm.

Instruments used during measurement

Instrument list:
RF Generator:: R&S / SMB100A (LR-1603) (04/2014)
Power Meter: R&S / NRVD (LR-1347) (04/2014)
Power Probe: R&S / NRV-Z5 (LR-1372) (04/2014)
Antenna: R&S / HL023-A1 (LR-282) (N/A)
Antenna: EMCO / 3115 (N-3452) (N/A)
Field Probe: AR / FP4080 (LR-1424) (04/2014)

Comments
No recorded comments.

Severity		Conformity	
Port:	Enclosure Port	Verdict:	PASS
Frequency range:	80 – 2000 MHz	Test engineer:	Jan G Eriksen
Step size:	1 %		
Dwell time:	5 seconds		
Modulation:	80% AM, 400 Hz		
Field generation:	Testing has been performed in an anechoic chamber using antennas to apply the field		

DETAILED TEST LOG

Note: The choice of test levels could differ from the procedure, based on the nature of EUT.
Note: An asterisk (*) indicates tests not within the scope of accreditation.
Note: Possible test case performances: <space> = Not tested, or letters indicating level of performance.

Frequency range [MHz]	Field strength [V/m]	Azimuth [deg]	Polarization	Required Criteria	Complied Criteria	Result
80 - 2000	10	0°	HOR	A	A	PASS
80 - 2000	10	180°	HOR	A	A	PASS
80 - 2000	10	0°	VER	A	A	PASS
80 - 2000	10	180°	VER	A	A	PASS

CONCLUSION

No operation errors were detected during or after the applied test(s).

ELECTRIC FAST TRANSIENTS IMMUNITY

TEST DESCRIPTION

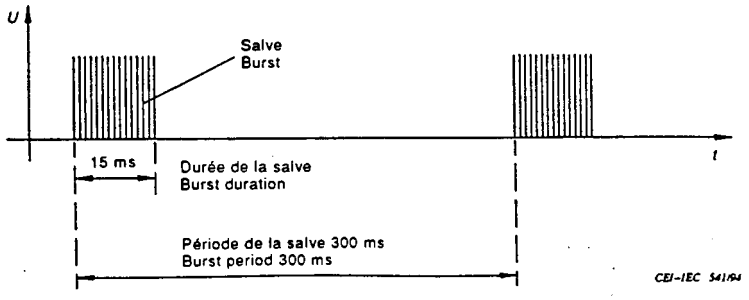
Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Reference
IEC 60945 (2002) Ed. 4 Clause 10.5 Immunity to fast transients

Set-up
A ground reference plane is located on the floor, and connected to earth via a low impedance connection. The EFT/B generator's reference ground is connected to the reference plane.

EUT is placed on a wooden table 10 cm above the reference plane, and all cables attached to the EUT are isolated the same way.

Procedure
Transients are applied at increasing levels to each single line of the AC or DC mains port using a coupling network (both one and one line separately, and then all lines at once), and other remaining ports using a capacitive coupling clamp.



Instruments used during measurement

Instrument list: Generator EMTEST UCS 500N (LR-1608) (06-2013)
Transient Coupling Clamp IP4A-93 Haefely (LR-1301) (06-2013)

Comments
No recorded comments.

Severity		Conformity	
Port:	DC Input Port; Signal Port	Verdict:	PASS
Duration:	3 mins each polarisation	Test engineer:	Jan G Eriksen

DETAILED TEST LOG

Note: The choice of test levels could differ from the procedure, based on the nature of EUT.
Note: An asterisk (*) indicates tests not within the scope of accreditation.
Note: Possible test case performances: <space> = Not tested, or letters indicating level of performance.

Port	Applied Level [kV]	Injection Method	Required Criteria	Complied Criteria	Result
Signal Port (LAN+PoE)	±2.0	CLAMP	B	A	PASS
DC Input Port (+24V DC)	±2.0	CLAMP	B	A	PASS

CONCLUSION
No operation errors were detected during or after the applied test(s).

CONDUCTED RF DISTURBANCE IMMUNITY

TEST DESCRIPTION

Method
The reference method for this test is listed in the table under clause APPLIED TESTS.

Reference
IEC 60945 (2002) Ed. 4 Clause 10.3 Immunity to conducted radio frequency disturbance

Set-up
The test is performed on a large ground reference plane. EUT is placed on a wooden table 10 cm above the reference plane. Cables for AC mains and cables going to and from support equipment plus interconnecting cables are isolated from the ground plane by a 5 cm isolating support.

Procedure
Disturbance is applied via a coupling/decoupling network (CDN) or a capacitive coupling clamp (EM Clamp) to each port separately.

All ports on EUT not subject to testing are furnished with decoupling networks to achieve RF isolation of the EUT during test. As decoupling networks Nemko use the CDNs normally used to apply the disturbance.
One of the CDNs have a 50Ω termination attached to its RF input port, this CDN behaves as true 150Ω loop.
Which CDN to select is decided according to the priority given in §7.2 of the reference standard.

For AC ports, DC ports, coax lines and 2- or 4-lines balanced communication lines a CDN is used to apply the disturbance. On other multiple signal cables an EM Clamp is used to apply the disturbance.
A signal level/type as specified below is applied in the defined frequency range. The frequency is swept through the range with a step width and a dwell time per frequency as specified below.

Instruments used during measurement

Instrument list:
RF Generator: HP / 8656B (LR-1026) (11/2014)
Voltmeter: R&S / URV5 (LR-192) (11/2013)
CDN: FCC / 801-M2-16 (LR-1312) (06/2014)
Injection Clamp: Fischer (LR-1482) (06/2014)

Comments
No recorded comments.

Severity

Port:	DC Input Port; Signal Port
Frequency range:	0.150 – 80 MHz
Step size:	1%
Dwell time:	3 seconds
Modulation:	80% AM, 400 Hz

Conformity

Verdict:	PASS
Test engineer:	Jan G Eriksen

DETAILED TEST LOG

Note: The choice of test levels could differ from the procedure, based on the nature of EUT.
Note: An asterisk (*) indicates tests not within the scope of accreditation.
Note: Possible test case performances: <space> = Not tested, or letters indicating level of performance.

Tested Port	Injection Method	Return Path	Applied Level [Vrms]	Required Criteria	Complied Criteria	Result
Signal Port (LAN+PoE)	EM CLAMP	CDN-M2	3 1)	A	A	PASS
DC Input Port (+24V DC)	CDN-M2	Capacitive	3 1)	A	A	PASS

NOTE: 1) including 10Vrms on spot frequencies 2, 3, 4, 6.2, 8.8, 12.6, 16.5, 18.8, 22 and 25 MHz

CONCLUSION

No operation errors were detected during or after the applied test(s).

SAFETY IN THE VICINITY OF RADIATING EQUIPMENT

TEST DESCRIPTION

Method
The calculation is performed in the far-field using the Power Density formula from EN 50383 page 51.

$$S = \frac{GP}{4\pi d^2}$$

Where: S = Power Flux Density
P = Power input to antenna
G = far field antenna gain relative to isotropic radiator
d = distance to antenna

Reference
IEC 60945 (2002) Ed. 4 Clause 12.2 Electromagnetic radio frequency radiation
EN 50385 (August 2002) Clause 4
EN 50383 (August 2002) Clause 8.3.2 Far-field

Compliance Criteria
The criteria are taken from the IEC 60945 Clause 12.2.3 required result:
Where appropriate, the maximum distance from the EUT at which the power density level of 100 W/m² and 10 W/m² of the radio frequency radiation has been measured shall be included in the equipment manual.

Procedure
The calculations have been performed according to the EN 50385 and EN 50383. The bases for the calculations have been taken from the TÜV Document 75924802 Report 01 Issue 1 March 2014.

Instruments used during measurement
Instrument list: No instruments were used.

Comments
No recorded comments.

Severity		Conformity	
Port:	Enclosure port	Verdict:	No verdict*
Frequency:	406 MHz	Test engineer:	Bjørn Nordset

*This is a calculation of safe distances for the inclusion in the equipment manual.

DETAILED TEST LOG

Parameter	Value
Prediction Frequency	406 MHz
Radiated near field limit (λ/4)	18.5 cm
Measured Output Power (NTP)	39 dBm (7943 mW) (Note 2)
Maximum Antenna Gain	5.18 dBi (Note 2)
Calculated distance from the EUT for 100 W/m^2	16 cm (Note 1)
Calculated distance from the EUT for 10 W/m^2	48 cm

Note 1. The calculation is not accurate within the near field below 18.5 cm, but the distance is close enough for the RF field to be reasonably homogenous.
Note 2. The values for Output Power and Antenna Gain are from TÜV Document 75924802 Report 01 Issue 1 March 2014.
Note 3. The calculations assume a duty cycle of 100%, the value measured in the TÜV Document is 98.1%.

CONCLUSION

The calculated distances have been found according to the IEC60945 Clause 12.2.

THERMAL SHOCK TEST

TEST DESCRIPTION

Reference
RTCM Paper 77-2002/SC110-STD, § A11.0 Thermal Shock Test.

Procedure
$A11.1 Low-Temperature Thermal Shock test.
The EUT was placed in a chamber the minimum stowage temperature, -30 °C for at least 3 hours. Then the EUT was totally immersed in fresh water at a temperature of +2.8 °C for 10 seconds before being allowed to float free in the same water maintained at the same temperature. The EUT did self activate 25 seconds after first being immersed.

The EUT was removed from the water and allowed to dry before placed in the chamber with -30 °C for at least 3 hours. Then the EUT was totally immersed in salt water (5% NaCl) at a temperature of +0.8 °C for 10 seconds before being allowed to float free in the same water maintained at the same temperature. The EUT did self activate 10 seconds after first being immersed.

$A11.2 High-Temperature Thermal Shock Test
The EUT were removed from the salt water, washed in fresh water and allowed to dry before placed in the chamber with +72.6 °C for at least 3 hours. Then the EUT was totally immersed in fresh water at a temperature of +30 °C for 10 seconds before being allowed to float free in the same water maintained at the same temperature. The EUT did self activate 10 seconds after first being immersed.

Functional check
At the end of the test, after the EUT was returned to normal environmental conditions, a functional check was carried out.

Instruments used during test

Instrument list:	Climatic Chamber:Vötsch / VC 4100 (N-4339) (05/2014) Digital Thermometer: Yokogawa 2455 (N-2539) (03/2015)

Comments
No recorded comments.

Severity		**Conformity**	
Temperature:	-30 °C to 2.8 °C -30 °C to 0.8 °C +72.6 °C to 30 °C	Verdict:	PASS
Duration:		Test engineer:	Steinar Jensen Espen Eriksen

CONCLUSION
No operational errors were detected during or after the applied test(s)

LOW TEMPERATURE (STORAGE)

TEST DESCRIPTION

Method
EN 60068-2-48 (1999) (IEC 60068-2-48 (1982))

Reference
IEC 60945 (2002) Ed.4; § 8.4.1 Low temperature storage test (portable equipment)
IEC 61097-2 (2008), § 5.17.3 Dry Heat Cycle.

Procedure
The EUT 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, the EUT shall be returned to normal environmental conditions and then subjected to a performance check as specified in the relevant equipment standard.

Functional check
At the end of the test, after the EUT was returned to normal environmental conditions, a functional check was carried out.

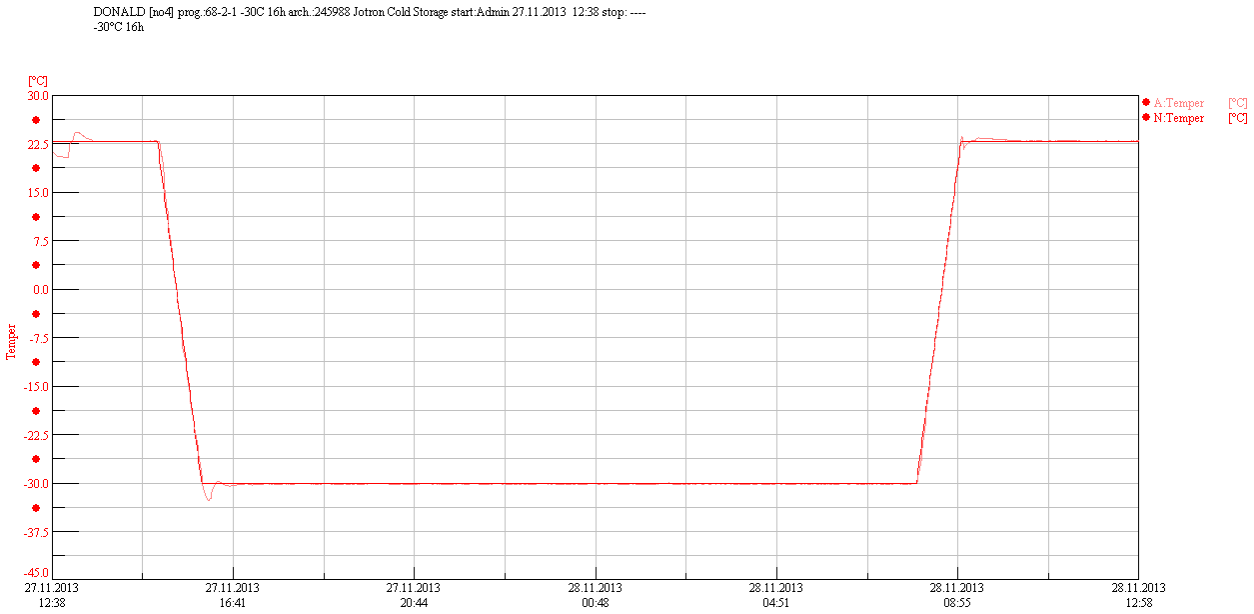
Instruments used during test

Instrument list: Climatic Chamber:Vötsch / VC 4100 (N-4339) (05/2014)
DC Power Supply: TTi CPX400DP (N-4595) (N/A)

Comments
No recorded comments.

Severity		Conformity	
Temperature:	-30 °C	Verdict:	PASS
Duration:	16h	Test engineer:	Steinar Jensen

DETAILED TEST LOG



CONCLUSION
No operation errors were detected during or after the applied test(s)

LOW TEMPERATURE (OPERATIONAL)

TEST DESCRIPTION

Method
EN 60068-2-1 (2007) (IEC 60068-2-1 (2007))
Test Ad: Cold for heat-dissipating specimen with gradual change of temperature.

Reference
IEC 60945 (2002) Ed.4; § 8.2.2 Low Temperature functional test (portable, exposed and submerged equipment)
IEC 61097-2 (2008), § 5.17.3 Dry Heat Cycle.

Procedure
An initial measurement of insulation resistance was performed.
The specimen was then placed inside the chamber and left de-energized. The chamber temperature was reduced to the specified test temperature by a rate less than 1K/min. From the time stable test temperature was obtained, the EUT was subject to the conditions for the duration specified under Conditions.
During the last hour of the exposure the specimen was energized and a functional test was performed.
After recovery a functional test was performed under standard conditions.
A measurement of insulation resistance was performed at the end.

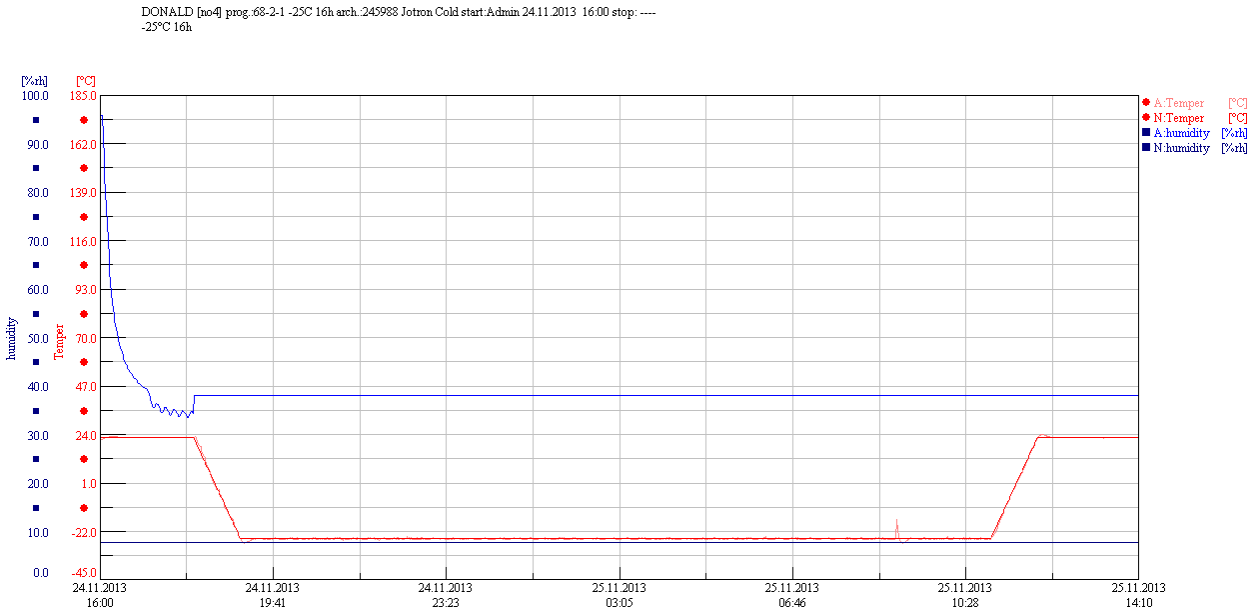
Instruments used during test

Instrument list: Climatic Chamber:Vötsch / VC 4100 (N-4339) (05/2014)
DC Power Supply: TTi CPX400DP (N-4595) (N/A)

Comments
No recorded comments.

Severity		Conformity	
Temperature:	-25 °C	Verdict:	PASS
Duration:	16h	Test engineer:	Steinar Jensen

DETAILED TEST LOG



CONCLUSION

No operation errors were detected during or after the applied test(s)

DRY HEAT (STORAGE)

TEST DESCRIPTION

Method
EN 60068-2-2 (2007) (IEC 60068-2-2 (2007))
EN 60068-2-48 (1999) (IEC 60068-2-48 (1982))

Reference standard
IEC 60945 (2002) Ed.4; § 8.2.1 Dry Heat storage test (portable, exposed and submerged equipment)
RTCM Paper 77-2002/SC110-STD, § A3.0 Dry Heat Cycle.
IEC 61097-2 (2008), § 5.17.1 Dry Heat Cycle.

Procedure
The EUT shall be placed in a chamber at normal room temperature and relative humidity. 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 EUT shall be returned to normal environmental conditions and then subjected to a performance check as specified in the relevant equipment standard (see 7.1).

Functional check
At the end of the test, after the EUT was returned to normal environmental conditions, a functional check was carried out.

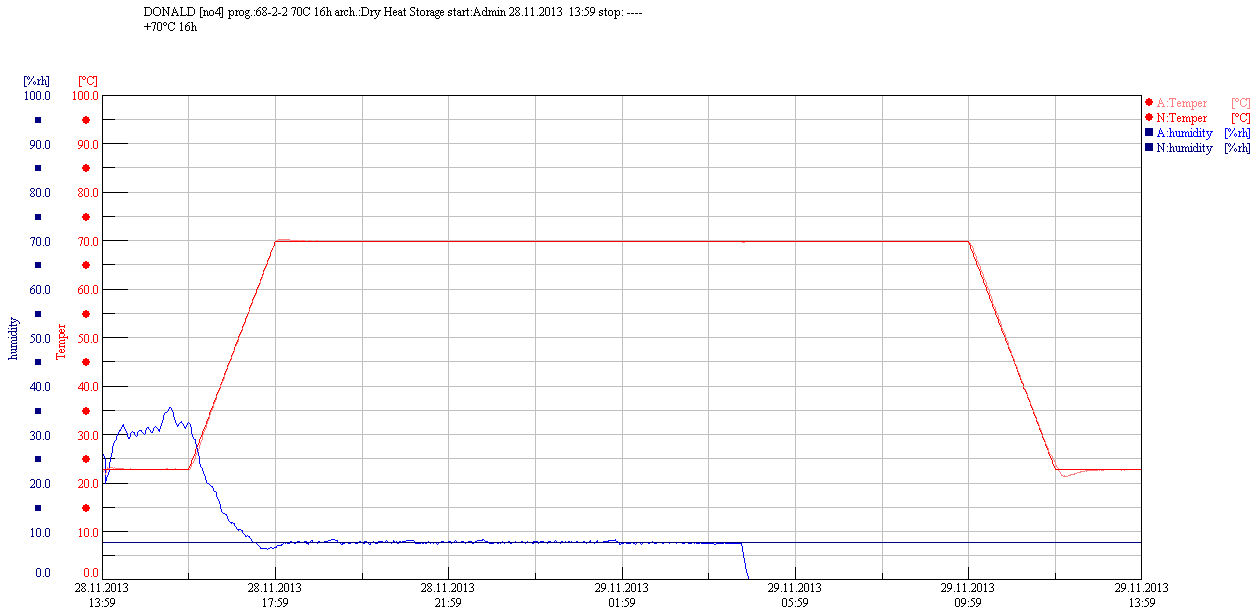
Instruments used during measurement

Instrument list: Climatic Chamber:Vötsch / VC 4100 (N-4339) (05/2014)
DC Power Supply: TTi CPX400DP (N-4595) (N/A)

Comments
No comments.

Severity		Conformity	
Temperature:	+70 ºC	Verdict:	PASS
Duration:	16 hours	Test engineer:	Steinar Jensen

DETAILED TEST LOG



CONCLUSION
The functional test was performed during the last hour of the conditioning. No malfunction was observed during the exposure, the function of the EUT was found OK after the recovery.

DRY HEAT (OPERATIONAL)

TEST DESCRIPTION

Method
EN 60068-2-2 (2007) (IEC 60068-2-2 (2007))
Test Bb Dry heat for non heat-dissipating specimen with gradual change of temperature.
Test Bd: Dry heat for heat-dissipating specimen with gradual change of temperature.

Reference
IEC 60945 (2002) Ed.4; § 8.2.1 Dry Heat storage test (portable, exposed and submerged equipment)
RTCM Paper 77-2002/SC110-STD, § A3.0 Dry Heat Cycle.
IEC 61097-2 (2008), § 5.17.1 Dry Heat Cycle.

Procedure
The specimen was placed in a chamber at normal conditions, in operating state. The temperature was then raised to and maintained at the test severity for a period of 16 h.
During the last hour of the exposure the specimen was subject to a functional test.

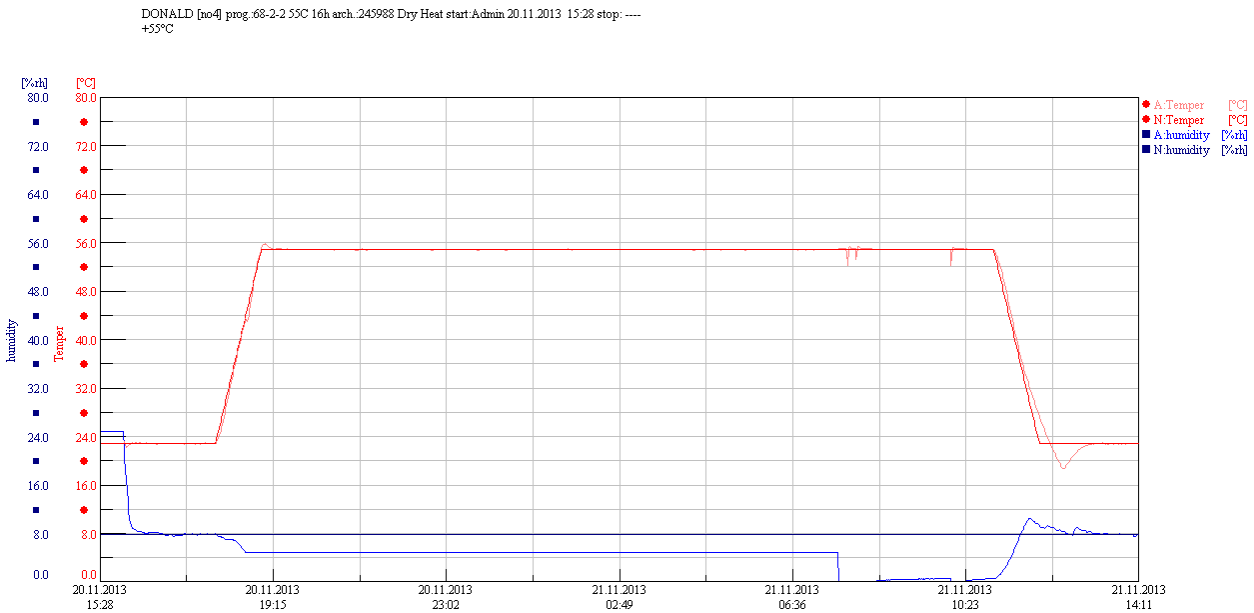
Instruments used during measurement

Instrument list: Climatic Chamber:Vötsch / VC 4100 (N-4339) (05/2014)
DC Power Supply: TTi CPX400DP (N-4595) (N/A)

Comments
No comments.

Severity		Conformity	
Temperature:	+55ºC	Verdict:	PASS
Duration:	16 hours	Test engineer:	Steinar Jensen

DETAILED TEST LOG



CONCLUSION

The functional test was performed during the last hour of the conditioning. No malfunction was observed during the exposure, the function of the EUT was found OK after the recovery.

DAMP HEAT

TEST DESCRIPTION

Method
EN 60068-2-30 (2007) (IEC 60068-2-30 (2007))

Method
IEC 60945 (2002) Ed.4; § 8.3.1 Damp Heat functional test (portable, exposed and submerged equipment)
RTCM Paper 77-2002/SC110-STD, § A4.0 Damp Heat Cycle.
IEC 61097-2 (2008), § 5.17.2 Damp Heat Cycle

Procedure
An initial measurement of insulation resistance was performed.
The test chamber was pre-conditioned to 25ºC and 95%RH. The specimen was placed inside the test chamber, energized and in normal operating condition. The chamber conditions were raised to +40ºC and 93% RH over a period of 3 hours. From the time stable test conditions were obtained, the specimen was subject to the conditions for the duration specified under Conditions. The test cycle was repeated as specified under Conditions.
During the first 2 hours of the first cycle, the specimen was subject to a functional test.
At the start of the second cycle, the specimen was de-energized. However, during the last 2 hours of the second cycle, the specimen was energized again and subject to a functional test and then de-energized again.
After recovery the specimen was energized and subject to an insulation resistance measurement under standard conditions.

Instruments used during measurement

Instrument list:	Climatic Chamber:Vötsch / VC 4100 (N-4339) (05/2014) DC Power Supply: TTi CPX400DP (N-4595) (N/A)

Comments
No recorded comments.

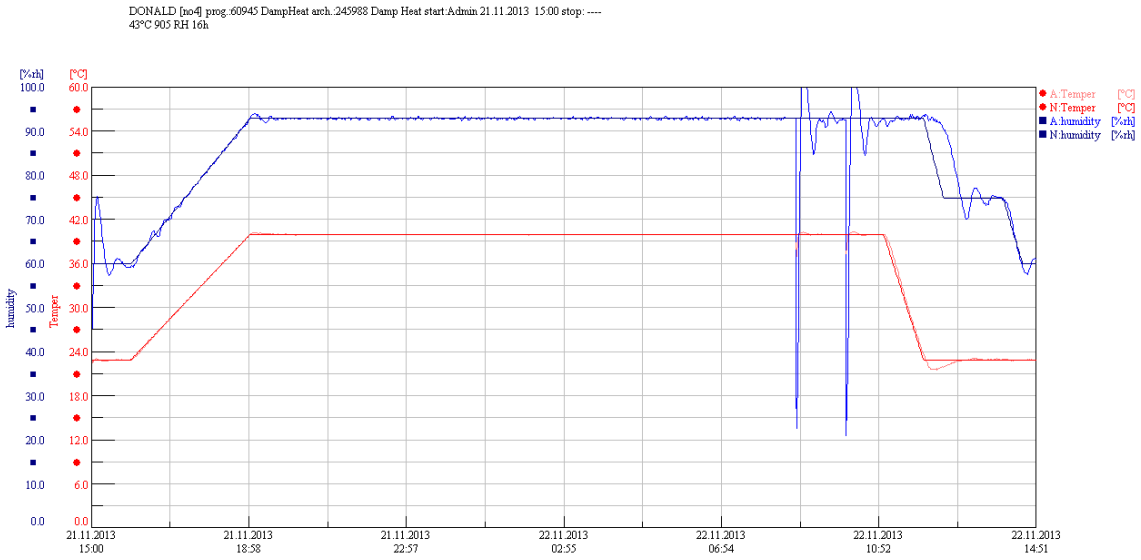
Severity

Temperature:	40°C
Humidity:	93%RH
Duration:	16h

Conformity

Verdict:	PASS
Test engineer:	Steinar Jensen

DETAILED TEST LOG



CONCLUSION

No operation errors were detected during or after the applied test(s).

OIL RESISTANCE

TEST DESCRIPTION

Reference standard
IEC 60945 (2002) Ed.4; § 8.11 Oil resistance test (portable)
IEC 61097-2 (2008), § 5.17.10 Oil resistance test.

Procedure
The equipment was immersed inside a climatic chamber for a period of 3h in a mineral oil as specified belove at a temperature of 19°C ±5°C.

- aniline point: 120°C ±5°C
- flash point: minimum 240°C
- viscosity: 10-25 cSt at 99°C

The following oil was used:

- ASTM Oil No.1 (IRM 901)

After the test, the equipment was cleaned in accordance with the manufacturer's instructions.
The requirement of the performance check was fulfilled. There was no harmful deterioration such as cracking, swelling, dissolution or change of mechanical qualities, visible to the naked eye.

Instruments used during measurement

Instrument list: Climatic Chamber: Vötsch / VCV 7100-5/S (N-4342) (05/2014)

Comments
Only a pieace of the bracket was submerged for this test. The material of the EPIRB has been tested elsewhere previously. This oil resistance test was performed since the material of the bracket has been changed since the previous test.

Severity	
Temperature:	19ºC ±5°C
Duration:	3h
Oil type:	IRM 901

Conformity	
Verdict:	PASS
Test engineer:	Finn-Tore Jørgensen

CONCLUSION

The EUT is considered to fulfill the requirement regarding the Oil resistance.

SALT MIST/CORROSION

TEST DESCRIPTION

Method
EN 60068-2-52 (1996) (IEC 60068-2-52 (1996))
Test Kb: Salt mist, cyclic (sodium chloride solution)

Reference
IEC 60945 (2002) Ed.4; § 8.12 Corrosion (salt mist)
IEC 61097-2 (2008), § 5.17.11 Corrosion Test

Procedure
The specimen was subject to 4 cycles of salt mist exposure followed by a damp heat conditioning.

First part of the cycle comprises a 2h exposure to salt mist in a salt spray chamber at 15-35°C. The second part of the cycle comprises a 7 day conditioning period in damp heat conditions at 40°C and 93%Rh.

The specimen was left de-energized during this test.

After the test the specimen was dried and then visually inspected for any damages and/or corrosions. Finally the specimen was energized and subject to a functional test.

Instruments used during measurement

Instrument list: Salt mist chamber: Weiss Technik SSC-1000 (N-2184) (06/2013)
Climatic Chamber: Vötsch / VC 4100 (N-4344) (05/2014)

Comments
Both the main unit and the holder/release mechanism were subjected to the test.

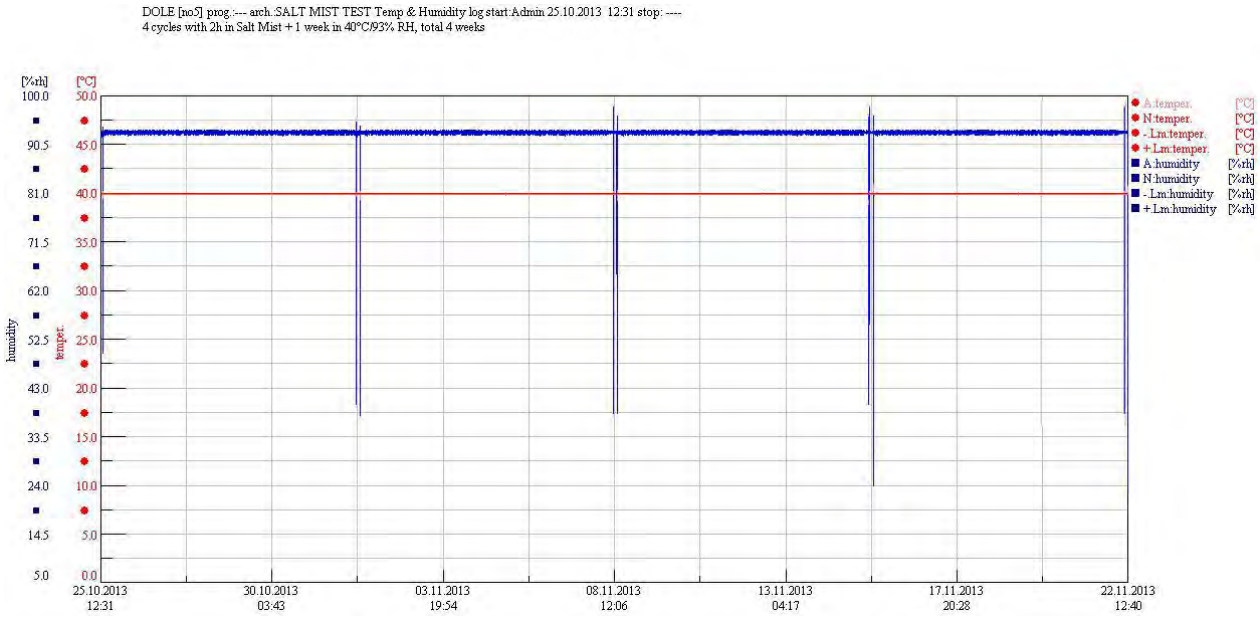
Severity

Duration salt spray:	2h
Temperature $_{\text{Salt spray chamber}}$:	25°C ± 10°C
Duration humidity:	7 days
Temperature $_{\text{Humidity chamber}}$:	40°C ± 2°C
RH $_{\text{Humidity chamber}}$:	90% to 95% RH
Salt compound:	1kg NaCl in 19l water
Number of cycles:	4 cycles

Conformity

Verdict:	PASS
Test engineer(s):	Finn-Tore Jørgensen

TEMPERATURE AND HUMIDITY LOG IN THE CLIMATIC CHAMBER, 4X7 DAYS.



CONCLUSION

The EUT is considered to fulfill the requirement regarding the corrosion test. No corrosion damages were observed after the applied test. After the corrosion test, the EUT functioned as specified by the manufacturer.

SALT MIST/CORROSION (RTCM REQUIREMENT)

TEST DESCRIPTION

Method
EN 60068-2-52 (1996) (IEC 60068-2-52 (1996))
Test Kb: Salt mist, cyclic (sodium chloride solution)

Reference
RTCM Paper 77-2002/SC110-STD, § A7.0 Salt Fog Test.

Procedure
Before exposing the EUT to salt fog, it was conditioned for duration 2 hours at a temperature of 35° C ± 2°C. After this conditioning and with the ambient temperature maintained at 35 C, salt fog was added and maintained at the saturation point for 48 hours. The salt fog was prepared from a 5% ± 1% salt (sodium chloride) solution.

After exposure to salt fog, the EUT was permitted to dry at room temperature (20° C ± 5° C) for 24 hours before being exposed to another period of 12 hours of salt fog exposure at 35° C. Upon completion of this exposure and after a 12 hour drying period at room temperature, the exterior of the unit was inspected for corrosion, peeling paint, and other signs of deterioration and the aliveness test were conducted.

Instruments used during measurement

Instrument list: Salt mist chamber: Weiss Technik / SSC-1000 (N-2184) (06/2013)
Climatic Chamber: Vötsch / VC 4100 (N-4344) (05/2014)

Comments
Both the main unit and the holder/release mechanism were subjected to the test.

Severity	
Duration conditioning	2h @ 35°C ± 2°C
Duration salt spray:	48h + 12 h
Temperature $_{\text{Salt spray chamber}}$:	35°C ± 2°C
Duration room temperature:	24h + 12h @ 20°C ± 5°C
Temperature $_{\text{Climatic chamber}}$:	35°C ± 2°C
Salt compound:	1kg NaCl into 19l water
Number of cycles:	1 cycle

Conformity	
Verdict:	PASS
Test engineer(s):	Finn-Tore Jørgensen

STABILITY AND BUOYANCY TEST

TEST DESCRIPTION

Reference standard
RTCM Paper 77-2002/SC110-STD, § A15.0 Stability and buoyancy test.
IEC 61097-2 (2008), § 5.3.2.2 Buoyancy test.

Procedure
Stability:
With the antenna deployed in it's normal operating position, the EUT should, when rotated to a horizontal position about any axes, submerged just below the surface, and released, pass through an upright position within 2 seconds:

Result:
When rotated and submerged as described above, the EUT passes through an upright position within below 0,5 seconds after release.

Buoyancy:
The equipment shall be immersed in calm fresh water and one of the following methods of measurement shall be used:

- the buoyant force shall be measured when the EPIRB is totally submerged in fresh water. The buoyant force shall be then divided by the measured gravity force. The result shall be recorded; or:
- the buoyancy may be calculated by dividing the volume of the unit above the waterline by the total volume of the EPIRB. The result shall be recorded

Requirement
The value of buoyancy shall be at least 5 %.

Instruments used during measurement
Instrument list: Immersion tank: Nemko (N-2713)

Comments
Only the main unit was subjected to the test.

Test Data		**Conformity**	
Total volume of the EUT:	2570ml	Verdict:	PASS
Volume of the EUT above waterline:	569ml	Test engineer:	Finn-Tore Jørgensen

CONCLUSION
The EUT is considered to fulfill the requirement regarding the stability and buoyancy test. Calculated value was 22.2%.

SINUSOIDAL VIBRATION

TEST DESCRIPTION

Method
EN 60068-2-06 (2008) (IEC 60068-2-06 (2007))
Test Fc: Vibration (sinusoidal)

Reference standard
IEC 60945 (2002) Ed.4 ;

Procedure
Frequency sweeps were carried out in three mutually perpendicular planes, X, Y and Z. During the sweeps critical positions were monitored to detect any resonances. Frequencies with a resonance with an amplification factor (Q) above 5 were recorded for later endurance testing.

Endurance tests were performed at the resonant plane at the frequencies detected during the sweeps. Each resonant frequency was tested for 120 minutes.
(If no frequencies are detected during the sweeps, endurance tests are performed at 30Hz at each plane for 120 minutes)

During endurance testing functional tests were performed.
(Performance deterioration and/or mechanical damage lead to failure of the test)

Note: Critical frequency is a frequency at which the equipment being tested may exhibit:
- Malfunction and/or performance deterioration
- Mechanical resonances and/or other response effects occur, e.g. chatter

Instruments used during measurement

Instrument list:

Accelerometer: PCB / 353B31 (N-4479) (07/2014)
Accelerometer: PCB / 353C15 (N-4488) (07/2014)
Accelerometer: PCB / 353B15 (N-4487) (07/2014)
Accelerometer: Dytran / 3225M23 (N-4434) (07/2014)

Shaker: LDS / V850 (N-4332) (N/A)
Power Amplifier: LDS / SPA30KCE (N-4332.02) (N/A)
Vibration controller: Spectral Dynamics Puma (N-4332-3) (01/2014)
Vibration controller software: 6.6.5.RP1

Shaker: LDS / V730: (N-4333.01) (N/A)
Power Amplifier: (N-4333.02) LDS DPA 10/5 K (N/A)
Vibration controller: Spectral Dynamics Puma (N-4333-3) (01/2014)
Vibration controller software: 6.6.5.RP1

Comments
No recorded comments.

Severity

Frequency range:	5Hz – 100Hz
Sweep rate:	0.5 octave/min
Amplitude:	5Hz – 13.2Hz : 2mm (p-p) 13.2Hz – 100Hz: ± 0.7gn
Number of axes:	3 mutually perpendicular axes
Endurance criteria:	Endurance at resonances ≥ 5:1 (if no resonance, then 30Hz.)
Endurance duration:	120 minutes at each recorded frequency

Conformity

Verdict:	PASS
Test engineer:	Jarle Skogland

RESONANT POSITIONS

Axis	Position	Sweep number	Q-factor>2 (amplification)	Frequency
X	EUT external	1 (ch.2)	3.70	100
	Bracket foot	1 (ch.3)	1.93	95.2
	Beacon	1 (ch.4)	2.63	97.8
Y	EUT external	2 (ch.2)	1.20	100
	Bracket foot	2 (ch.3)	1.79	50.2
	Beacon	2 (ch.4)	5.76	55.5
Z	EUT external	3 (ch.2)	-	-
	Bracket foot	3 (ch.3)	4.77	85.1
	Beacon	3 (ch.4)	4.92	85.1

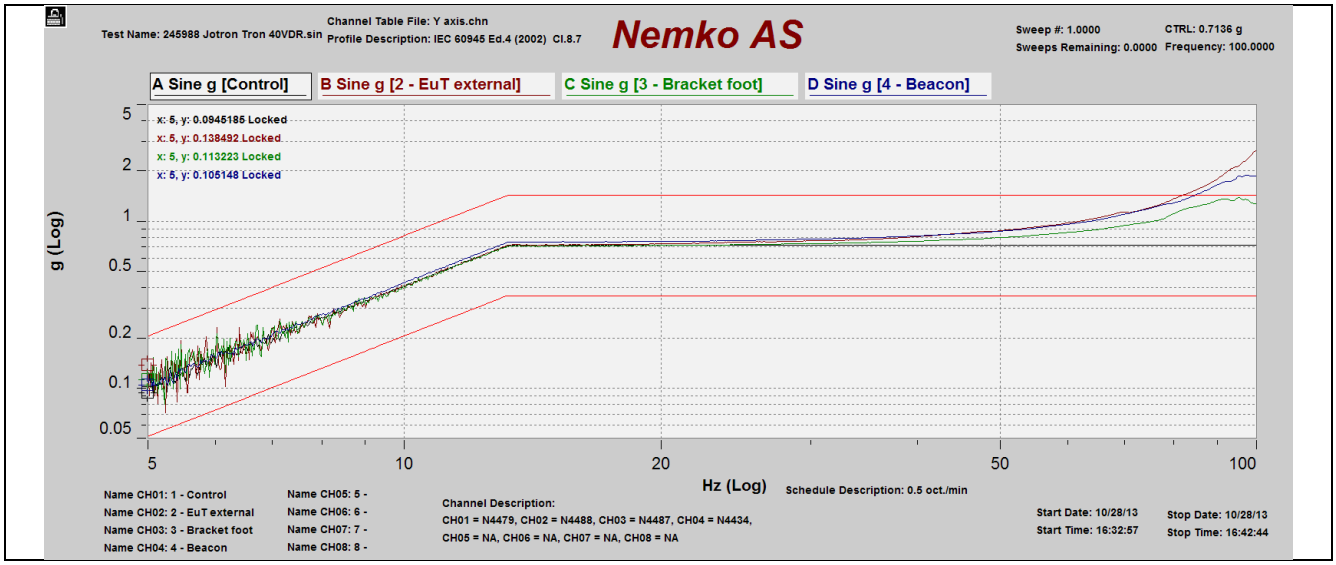
ENDURANCE TEST LOG

Axis	Frequency	Duration	Functional test	Result
X	100Hz	120min	Before, during and after test	PASS
Y	55.5Hz	120min	Before, during and after test	PASS
Z	85.1Hz	120min	Before, during and after test	PASS

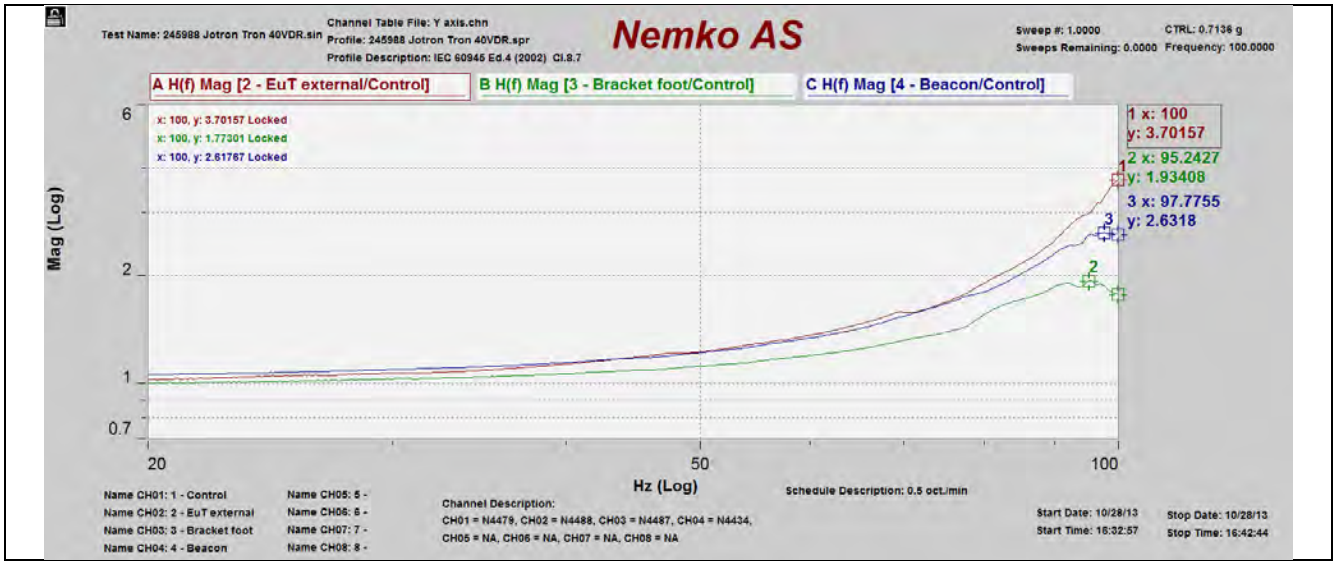
CONCLUSION

No operation errors or damages were detected during or after the endurance tests.

Sweep no.1 – X-axis



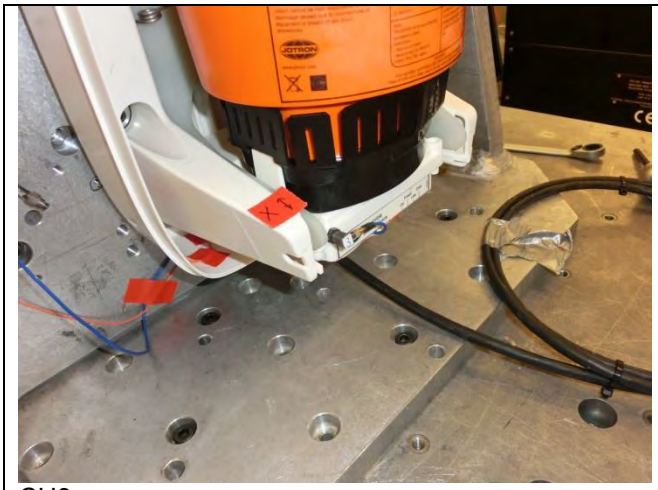
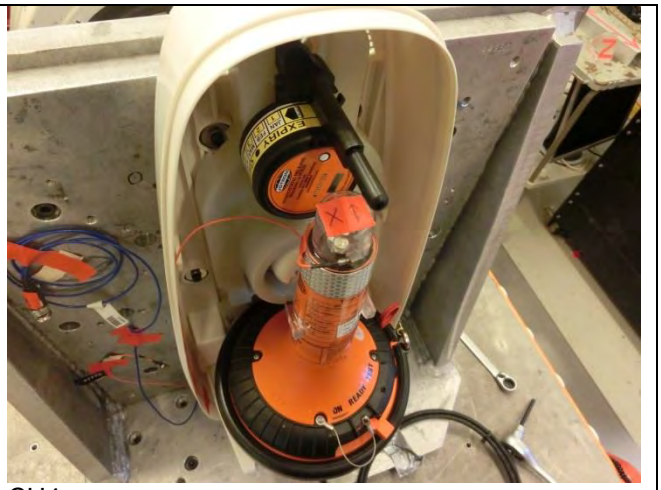
Sweep profile



Amplification factor

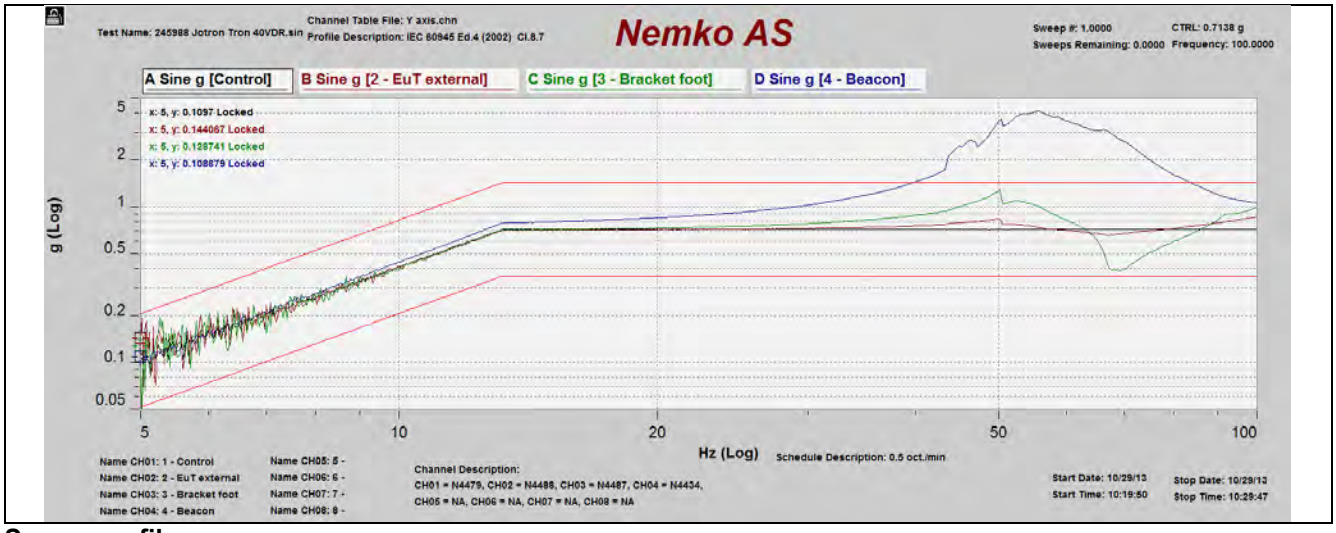
CH1

CH2

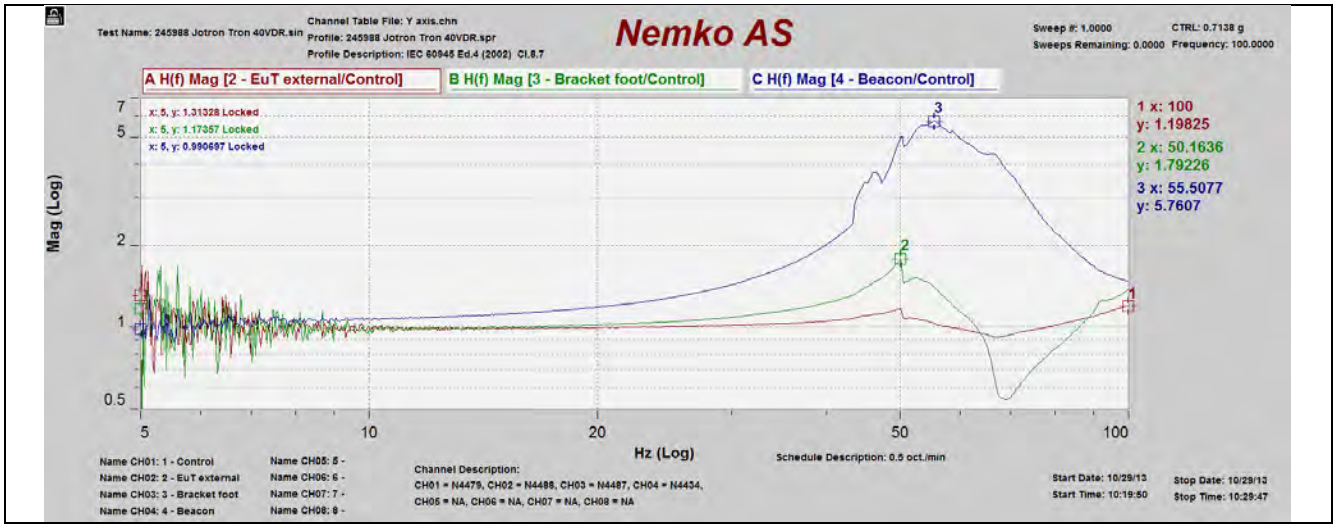
	
CH3	CH4

Accelerometer positions

Sweep no.2 – Y-axis

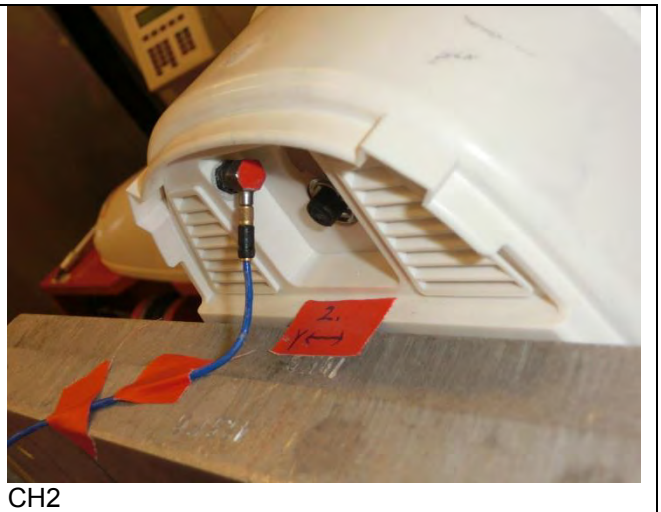


Sweep profile

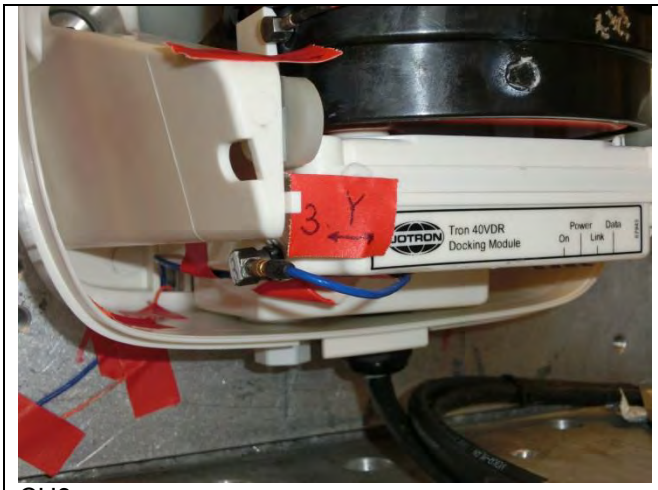


Amplification factor

CH1

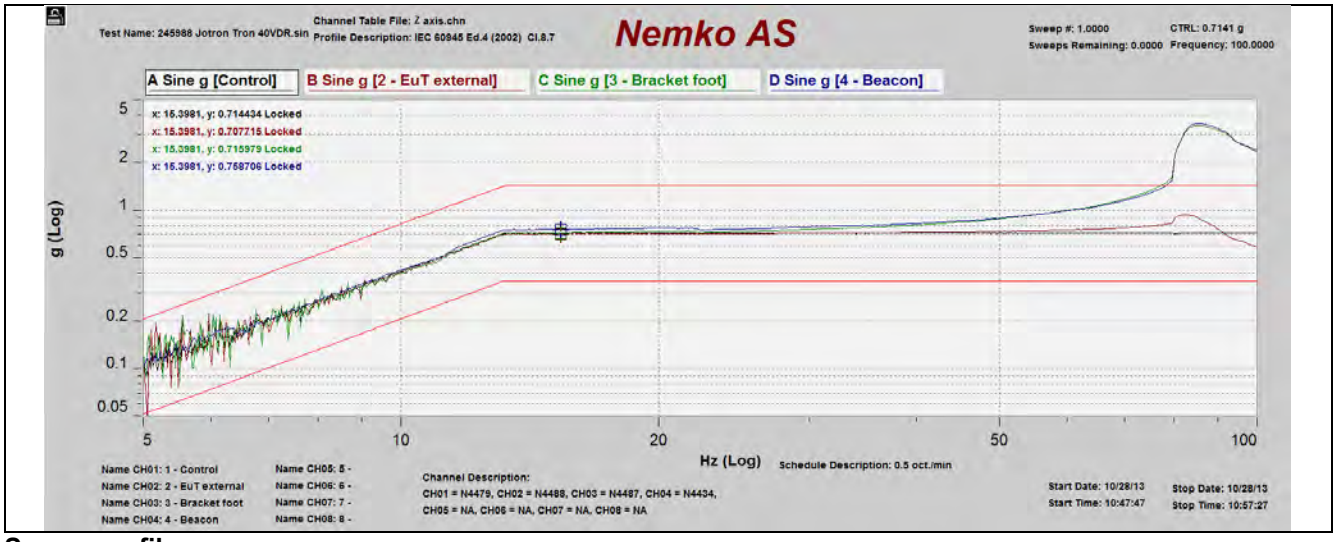


CH2

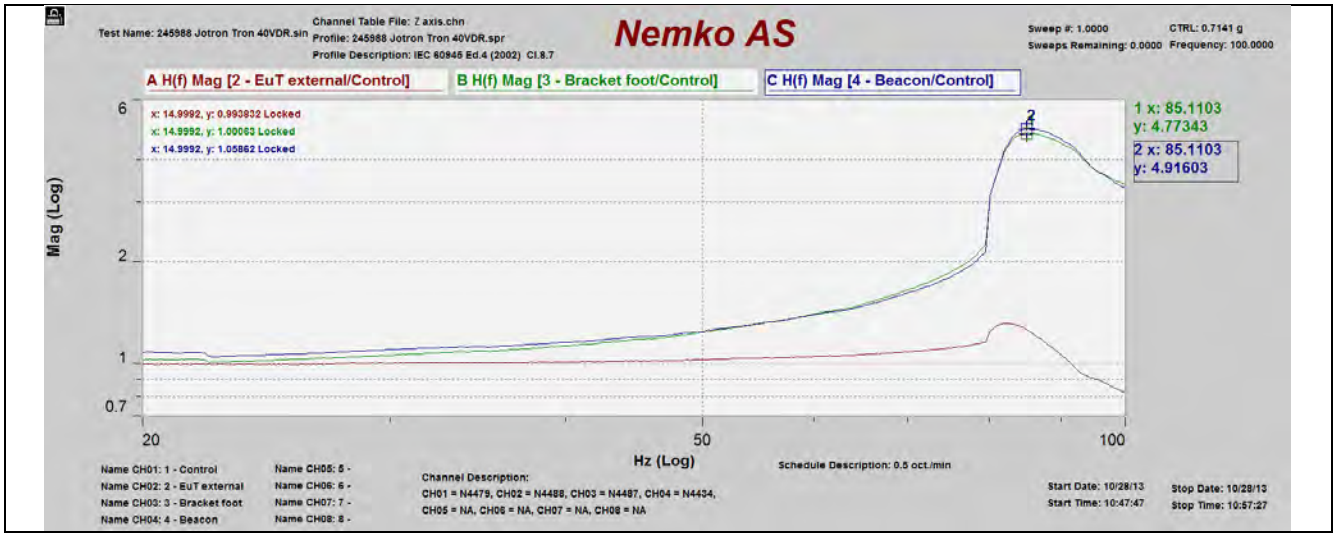
	
CH3	CH4

Accelerometer positions

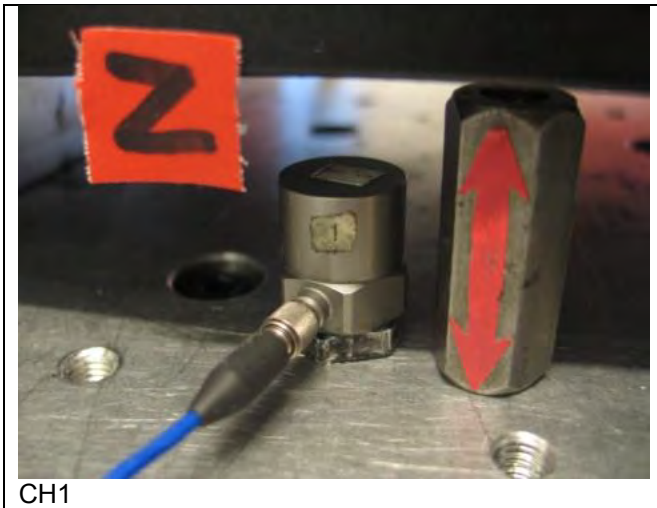
Sweep no.3 – Z-axis



Sweep profile

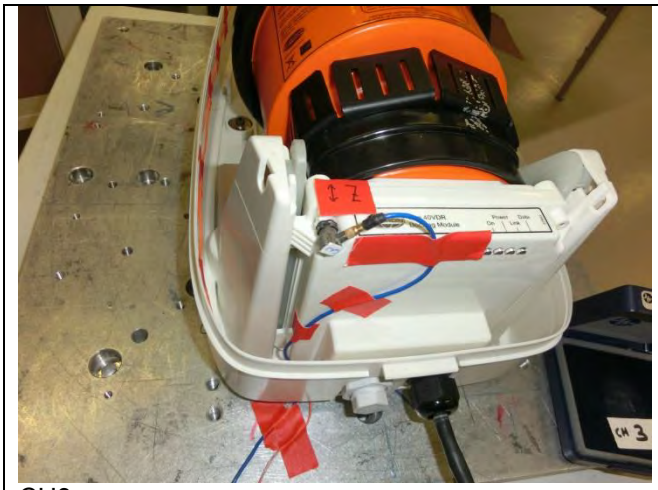


Amplification factor



CH1

CH2

	
CH3	CH4

Accelerometer positions

SINUSOIDAL VIBRATION (RTCM SPECIFICATION)

TEST DESCRIPTION

Method
EN 60068-2-06 (2008) (IEC 60068-2-06 (2007))
Test Fc: Vibration (sinusoidal)

Reference standard
RTCM Paper 77-2002/SC110-STD, § A5.0 Vibration Test.

Procedure
Frequency sweeps were carried out in three mutually perpendicular axes, X, Y and Z. The sweeps were performed in the frequency range 4 – 33 Hz.
For each axis the sweeps were performed with a sweep rate of 1.2175 oct/min, giving a total sweep time of 30 minutes.

Upon completion of the vibration test, an exterior mechanical inspection was performed and an aliveness test was conducted.

The EUT did not activate during the vibration test.

Instruments used during measurement

Instrument list:

Accelerometer: PCB / 353B31 (N-4479) (07/2014)
Accelerometer: PCB / 353C15 (N-4488) (07/2014)
Accelerometer: PCB / 353B15 (N-4487) (07/2014)
Accelerometer: Dytran / 3225M23 (N-4434) (07/2014)

Shaker: LDS / V850 (N-4332) (N/A)
Power Amplifier: LDS / SPA30KCE (N-4332.02) (N/A)
Vibration controller: Spectral Dynamics Puma (N-4332-3) (01/2014)
Vibration controller software: 6.6.5.RP1

Shaker: LDS / V730: (N-4333.01) (N/A)
Power Amplifier: (N-4333.02) LDS DPA 10/5 K (N/A)
Vibration controller: Spectral Dynamics Puma (N-4333-3) (01/2014)
Vibration controller software: 6.6.5.RP1

Comments
No recorded comments.

Severity

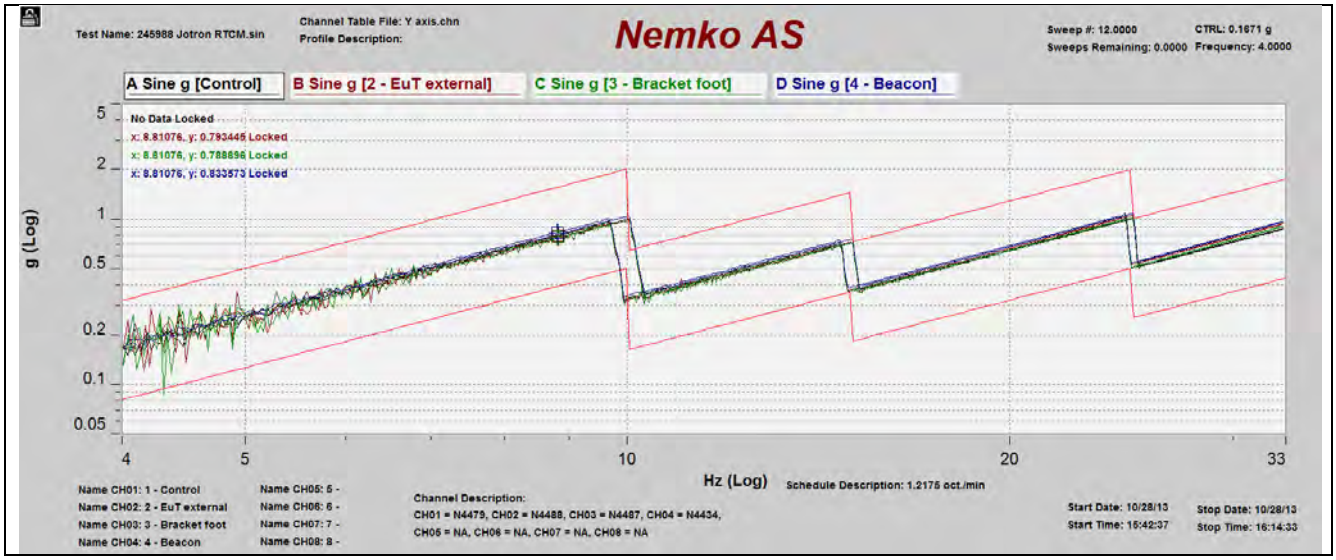
Frequency range:	4Hz – 33Hz
Sweep rate:	1.2175 octave/min
Amplitude:	4Hz – 10Hz : 5.0mm (p-p) 10Hz – 15Hz : 1.6mm (p-p) 15Hz – 25Hz : 0.4mm (p-p) 25Hz – 33Hz : 0.4mm (p-p)
Number of axes:	3 mutually perpendicular axes
Endurance duration:	30 minutes for each axis

Conformity

Verdict:	PASS
Test engineer:	Jarle Skogland

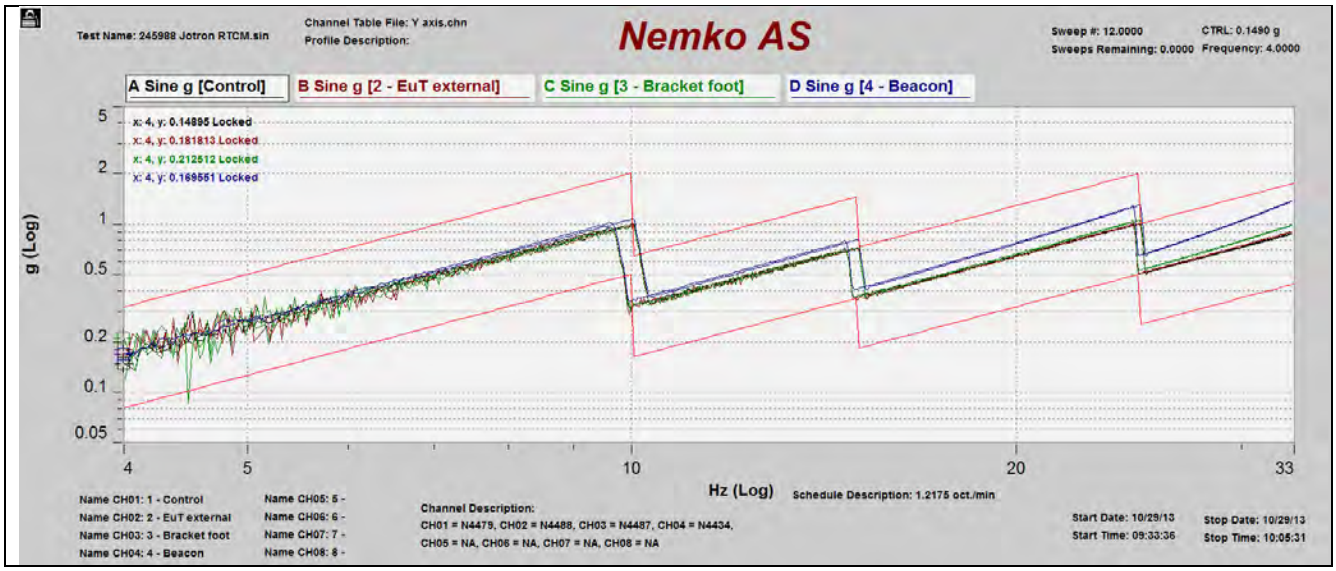
CONCLUSION
No operational errors or damages were detected during or after the vibration tests.

Sweep no.1 – X-axis



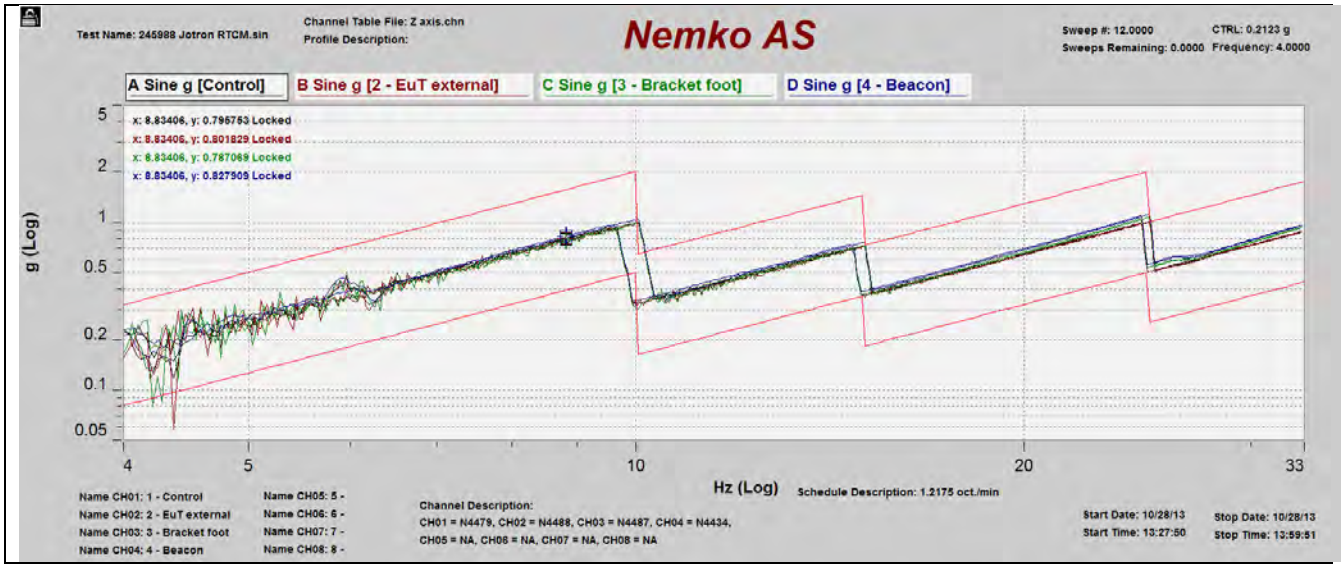
Sweep profile

Sweep no.2 – Y-axis



Sweep profile

Sweep no.3 – Z-axis



Sweep profile

MECHANICAL SHOCK

TEST DESCRIPTION

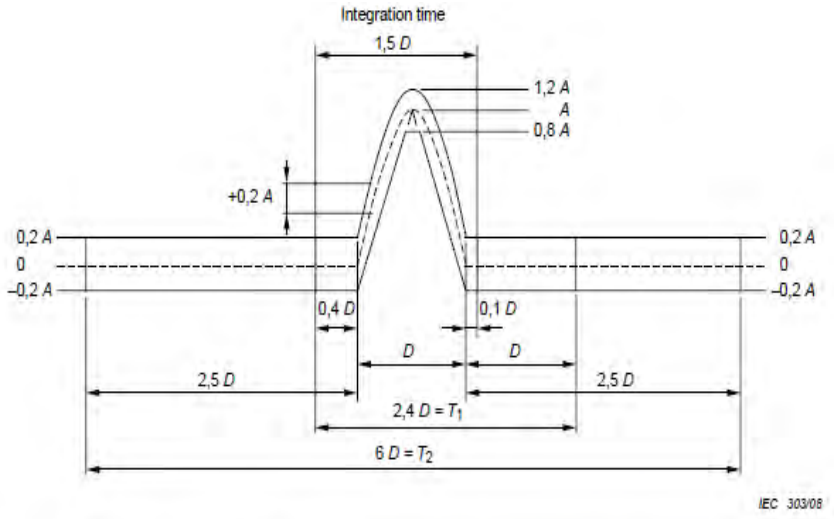
Method
EN IEC 60068-2-27 (2009) (IEC 60068-2-27 (2008)) Test Ea

Reference standard
RTCM Paper 77-2002/SC110-STD, § A6.0 Bump test.
IEC 61097-2 (2008), § 5.17.7 Ruggedness test.

Procedure
The EUT was secured to the testing equipment through its normal attachments intended for use in service conditions and mounted in the normal operating position. Additional straps or other holding means were not used. The shock test was conducted to give a measure of confidence that the equipment will meet service conditions.

The EUT was subjected to the shock test according to the following profile:
Peak Acceleration: 98 m/s2
Pulse Duration: 16 ms
Waveshape: Half-cycle Sinewave
Test Axis: Vertical
Number of Bumps: 4000 (2000 for each direction)

Upon completion of the shock test, an exterior mechanical inspection was performed and an aliveness test conducted.



Key (applicable for all three Figures 1 to 3)

– – – nominal pulse	A = peak acceleration of nominal pulse
—— limits of tolerance	T_1 = minimum time during which the pulse shall be monitored for shocks produced using a conventional shock-testing machine
D = duration of nominal pulse	T_2 = minimum time during which the pulse shall be monitored for shocks produced using a vibration generator

Instruments used during measurement

Instrument list:

Accelerometer: PCB / 353B31 (N-4479) (07/2014)
Accelerometer: PCB / 353C15 (N-4488) (07/2014)
Accelerometer: PCB / 353C15 (N-4489) (07/2014)

Shaker: LDS / V730: (N-4333.01) (N/A)
Power Amplifier: (N-4333.02) LDS DPA 10/5 K (N/A)
Vibration controller: Spectral Dynamics Puma (N-4333-3) (01/2014)
Vibration controller software: 6.6.5.RP1

Comments

No recorded comments.

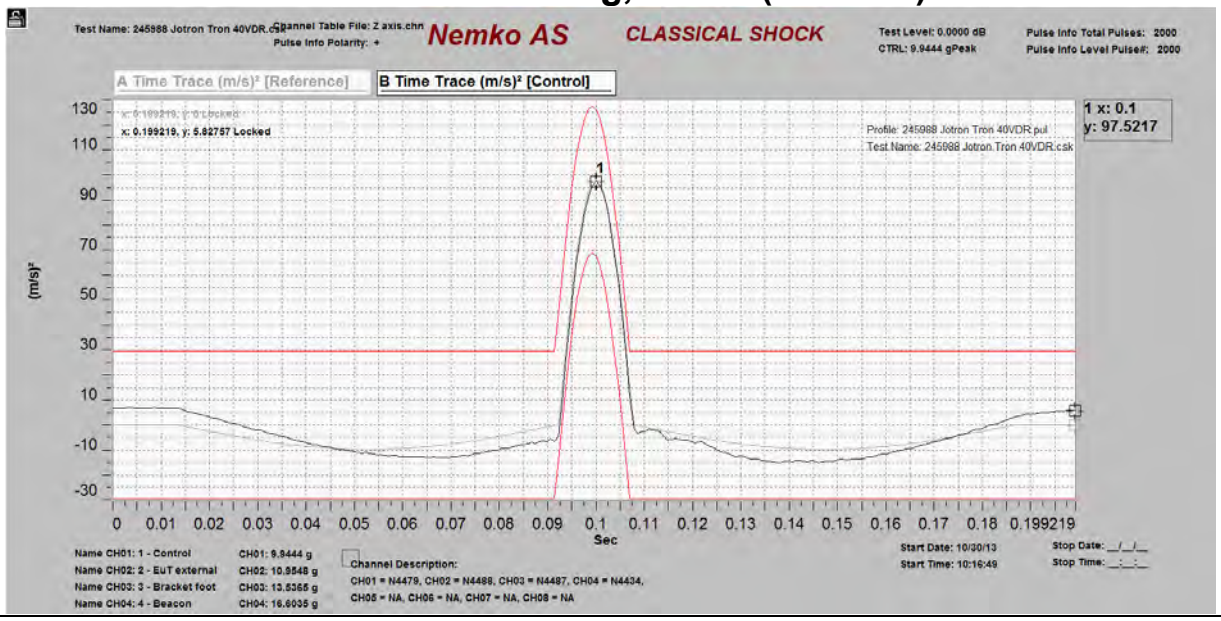
Severity	
Puls type:	Half sine, 16ms
Pre/post pulse	-
Amplitude:	10g
Duration:	2000 positive, 2000 negative
Number of axes:	One axis (vertical)

Conformity	
Verdict:	PASS
Test engineer:	Jarle Skogland

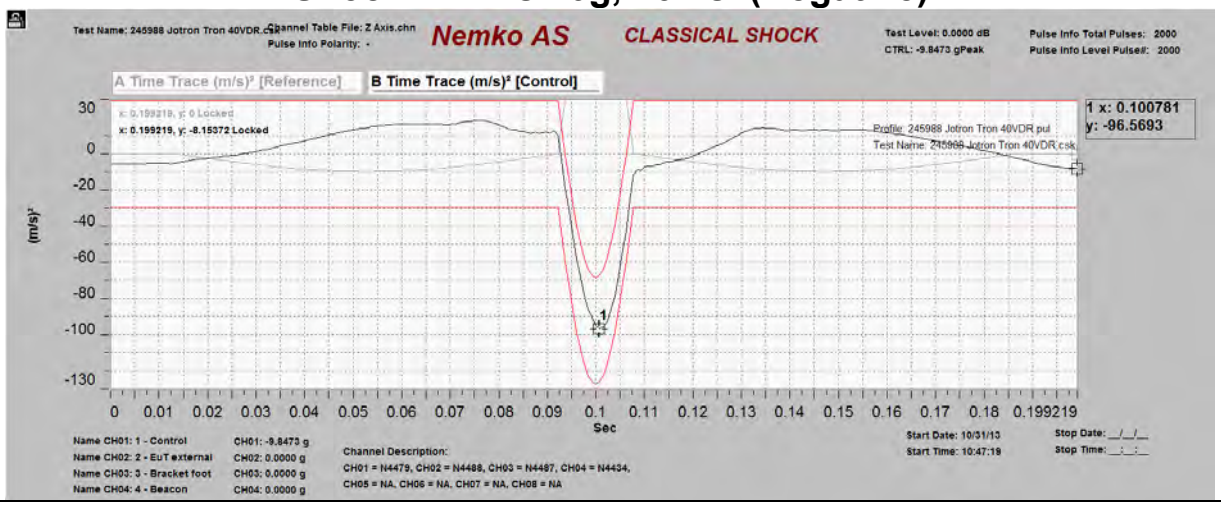
CONCLUSION

No operation errors or damages were detected during or after the applied test(s)

Shock Z Axis 10g, 16ms (Positive)



Shock Z Axis 10g, 16ms (Negative)



DROP ON HARD SURFACE

TEST DESCRIPTION

Reference
IEC 60945 (2002) Ed.4; § 8.6 Drop test (portable)
RTCM Paper 77-2002/SC110-STD, § A8.1 Drop test on hard surface.
IEC 61097-2 (2008), § 5.17.5.1 Drop on hard surface.

Procedure
A series of six drops was carried out; one on each face of the EUT.
The test surface was a piece of solid hard wood with a thickness of at least 150 mm and a mass of 42 kg. The height of the lowest part of the EUT relative to the test surface at the moment of release was 1000 mm ± 10 mm.

The EUT was stored at minimum stowage temperature (-30°C) for 2 hours. The drop test was then performed within five minutes after removed from the temperature chamber. The EUT was oriented in its normal floating position and dropped from a height of 1 meter above the test surface.

The EUT was subjected to this test configured for use as in operational circumstances. At the end of the test the EUT was subjected to a performance check, and examined for external indications of damage.

Instruments used during measurement

Instrument list: Free Fall Jig: Nemko (N-4504)
Hard wood block: Nemko (N-4538) (11/2015)
Ruler (N-3414) (01/2016)

Comments
The main unit (EPIRB) was subjected to the test.

Severity		**Conformity**	
Height:	1m *	Verdict:	PASS
Repetitions:	6 (one on each surface)	Test engineer:	Finn-Tore Jørgensen Espen Eriksen

* Lowest point of EUT; 1m above the upper surface of the wood block

CONCLUSION
No operation errors were detected during or after the applied test(s). No damages were detected and the EUT functioned as normal after the applied test(s).

INGRESS PROTECTION (IP)

TEST DESCRIPTION

Method
EN 60529 Ed.2.1 (2001) Degrees of protection provided by enclosures (IP Code)

Procedure
The jointed test finger may penetrate up to its 80 mm length, but adequate clearance shall be kept. The protection is satisfactory if adequate clearance is kept between the access probe and hazardous parts.

Instruments used during measurement

Instrument list:	Jointed test finger Ø=12mm, Ljungmann (N-3525) (02/2016)

Comments
No recorded comments.

Severity		**Conformity**	
IP numeral:	IP 2X	Verdict:	PASS
		Test engineer:	FT Jørgensen

CONCLUSION
The finger probe did not penetrate.

LEAKAGE AND IMMERSION TESTS

TEST DESCRIPTION

Reference
RTCM Paper 77-2002/SC110-STD, § A9.0 Leakage and Immersion tests.
IEC 61097-2 (2008), § 3.3.2 Immersion, Buoyancy and drop into water.

Procedure
The EUT was turned OFF during the leakage and immersion tests and the tests performed in the following sequence.

1. The equipment was placed in an atmosphere of +65° ± 3° C for one hour. It was immediately immersed in water at +20° ± 3° C to a depth of 100 ± 5 mm, measured from the highest point of the equipment to the surface of the water, for a period of 48 hours.

2. The EUT was immersed under a 10 meter head of water for 5 minutes.

3. At the end of the test period the equipment was subjected to a performance check, and then was inspected for damage and visible ingress of water.

Instruments used during measurement

Instrument list:
Immersion tank: Nemko / N-2713
Pressure tank: Nemko / N-1736
Manometer: CVK / (0…6 bar) (N-3532) (10/2013)
Stop watch: Sport Timer (N-4582) (07/2014)

Severity		**Conformity**	
Depth:	1m	Verdict:	PASS
Water Preassure	0.1 bar	Test engineers:	Finn-Tore Jørgensen
Treat time	48 hours		

Severity		**Conformity**	
Depth:	10m	Verdict:	PASS
Water Preassure	1.0 bar	Test engineers:	Finn-Tore Jørgensen
Teat time	5 minutes		

CONCLUSION

No ingress of water was observed after the applied tests.

COMPASS SAFE DISTANCE

TEST DESCRIPTION

Method
EN ISO 694 (2001) Ships and marine technology. Positioning of magnetic compasses in ships.

Reference
EN 60945 (2002), Section 11.2
IEC 61097-2 (2008), § 5.20 Compass Safe Distance.

Procedure
Compass safe distance is the distance between the nearest point of the EUT and the subject compass, where an unacceptable compass deviation occur
For a standard compass, the horizontal magnetic flux shall be less than 0.942 mGauss (compass deviation of 5.4°/H).
For a steering/standby/emergency compass, the horizontal magnetic flux shall be less than 3.142 mGauss (compass deviation of 18°/H).

The compass safe distance is measured with a DC milligaussmeter. The EUT is first rotated to determine the worst case direction. Secondly the EUT is moved towards/away from the measurement probe until the required field is measured. The distance is then measured.

Measurements are made at 3 EUT conditions:
1) Non-energized (in the magnetic condition received from customer)
2) Non-energized after magnetisation in a 1 Gauss (80A/m) DC field, with a superimposed stabilising 50Hz AC field of 18 Gauss (1430A/m) *
3) Energized and in normal operating condition

* Test 2) may be omitted if the application of a strong magnetic field may damage the EUT

Instruments used during measurement

Instrument list: Magnetometer: Bartington/ Mag-01H (N-4651) (04/2014)
Probe: Bartington / Mag Probe C (N-4651.01) (04/2014)

Comments
No magnetization was performed, in fear of damaging the specimen.

Conformity

Test engineer: Roger Berget

DETAILED TEST LOG

Condition	Standard Compass	Other Compass	Strongest Direction
Non-energized	70 cm	40 cm	Front
Non-energized after magnetisation	-	-	-
Energized and operating	65 cm	37 cm	Front

CONCLUSION

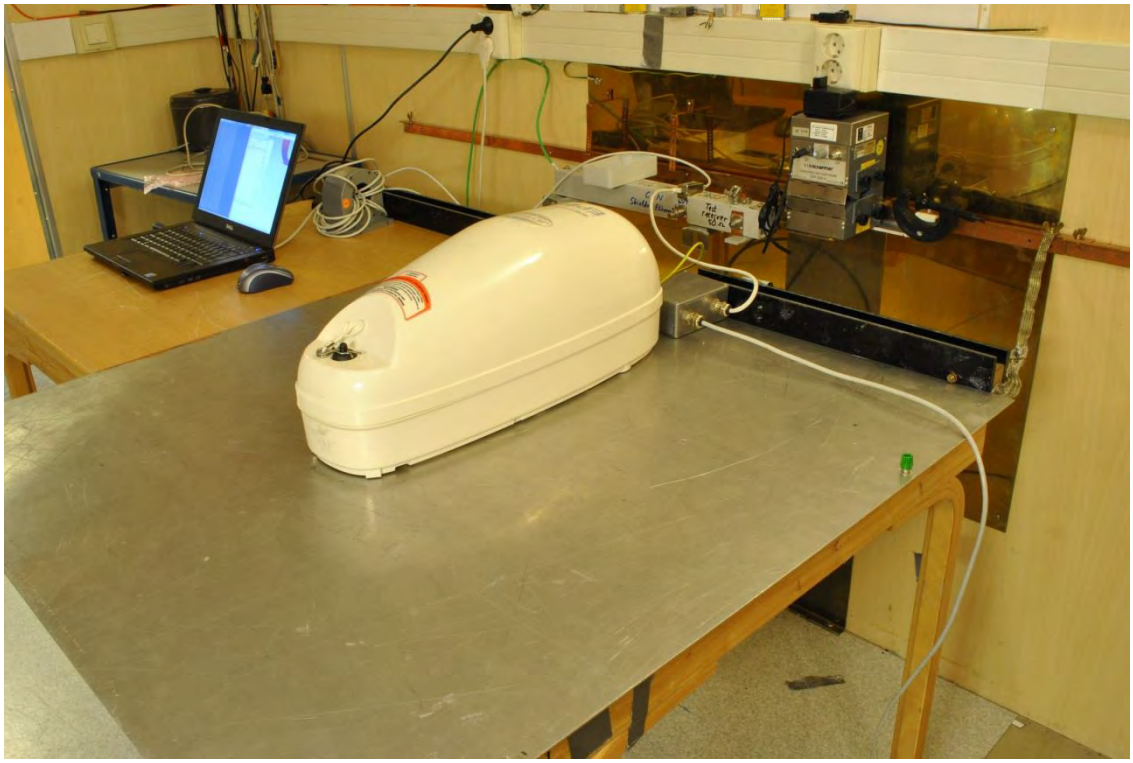
Based on the above measurements the overall Compass Safe Distance is considered to be = 80 cm.

Annexes

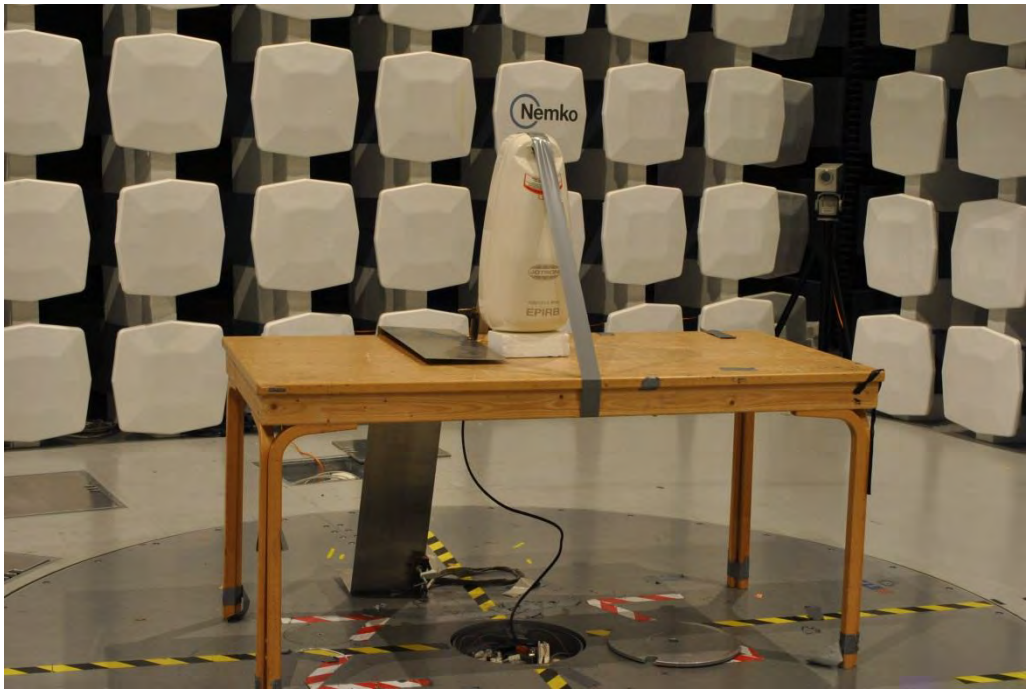
A.1 UNCERTAINTY FIGURES

Measurement	Uncertainty
Conducted Emissions AMN: Voltage Probe: Current Probe: ISN:	 ± 3.8 dB (9 kHz – 150 kHz) ± 3.5 dB (150 kHz – 30 MHz) ± 2.7 dB (150 kHz – 30 MHz) ± 2.7 dB (150 kHz – 30 MHz) ± 4.7 dB (150 kHz – 30 MHz)
Discontinuous Conducted Emissions	± 4.3 dB (150 kHz – 30 MHz)
Common-Mode Terminal Voltage	± 2.8 dB (30 MHz – 300 MHz)
Disturbance Power	± 3.4 dB (30 MHz – 300 MHz)
Radiated Electromagnetic Field	± 2.7 dB (9 kHz – 30 MHz)
Radiated Emissions (3 meter)	± 3.5 dB (150 kHz – 30 MHz) ± 4.8 dB (30 MHz – 200 MHz) ± 4.4 dB (200 MHz – 1000 MHz) ± 4.8 dB (1 – 6GHz)
Radiated Emissions (10 meter)	± 4.1 dB (30 MHz – 200 MHz) ± 4.2 dB (200 MHz – 1000 MHz)
Harmonic Current Emissions	± 7.1%
Flicker	± 7.7%
Electrostatic Discharges	± 10 % (peak voltage) ± 30 % (pulse shape)
Radiated RF Field	± 2.4 dB
Electric Fast Transients	± 10 % (peak voltage) ± 30 % (pulse shape)
Surge	± 10 % (peak voltage) ± 30 % (rise time) ± 20 % (duration)
Conducted RF Disturbance	± 2.8 dB (150 kHz – 26 MHz) ± 3.7 dB (26 MHz – 80 MHz)
Power Frequency Magnetic Field	± 2 %
Dips/Interruptions	± 5 % (voltage) ± 10% (zero crossing control) ± 10º (phase relationship)
Vibration	± 5.6 % (acceleration) ± 0.01% (frequency)
Temperature	± 2.5K
Humidity	± 6 %Rh
Voltage	± 1.5 %
Frequency	± 0.2 %
The instruments specified are subject to periodic calibrations and internal controls. This ensures, with a 95 percent confidence level, that the instruments remain within the calibrated levels.	

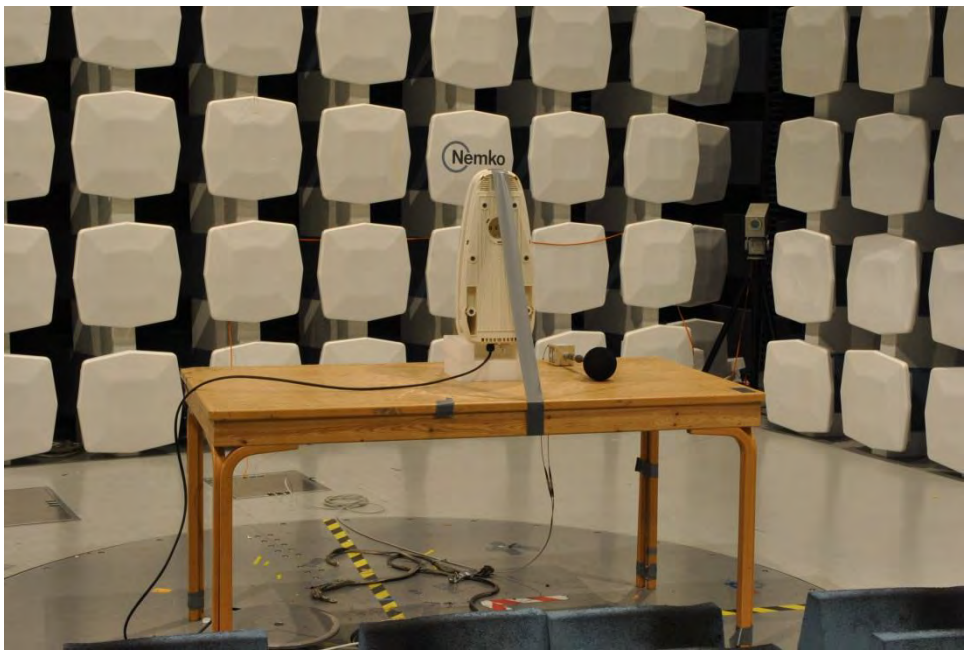
A.2 PHOTOS



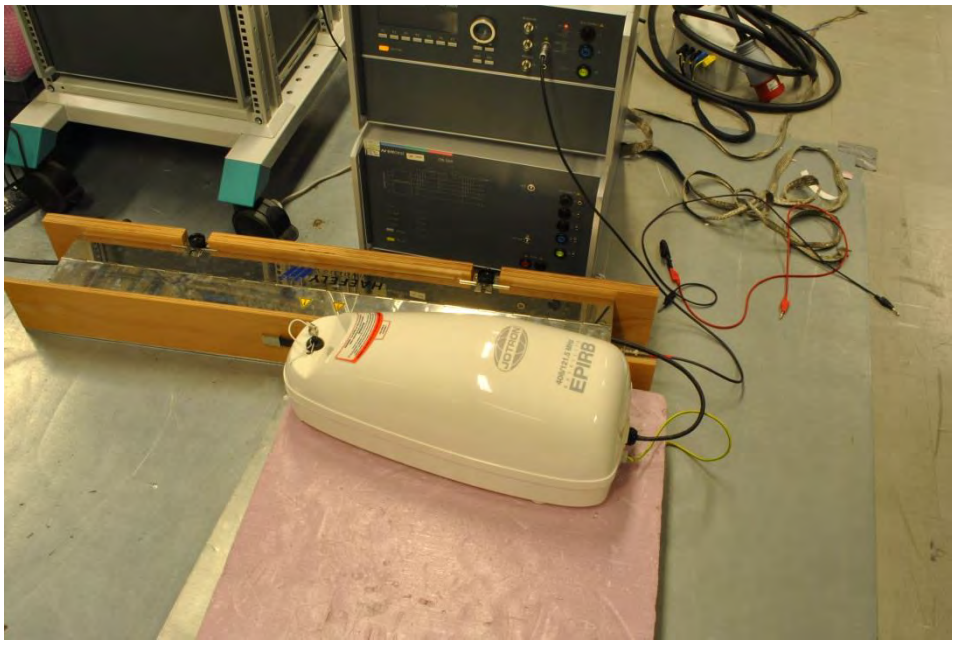
Notes: Test set-up for Conducted Emissions



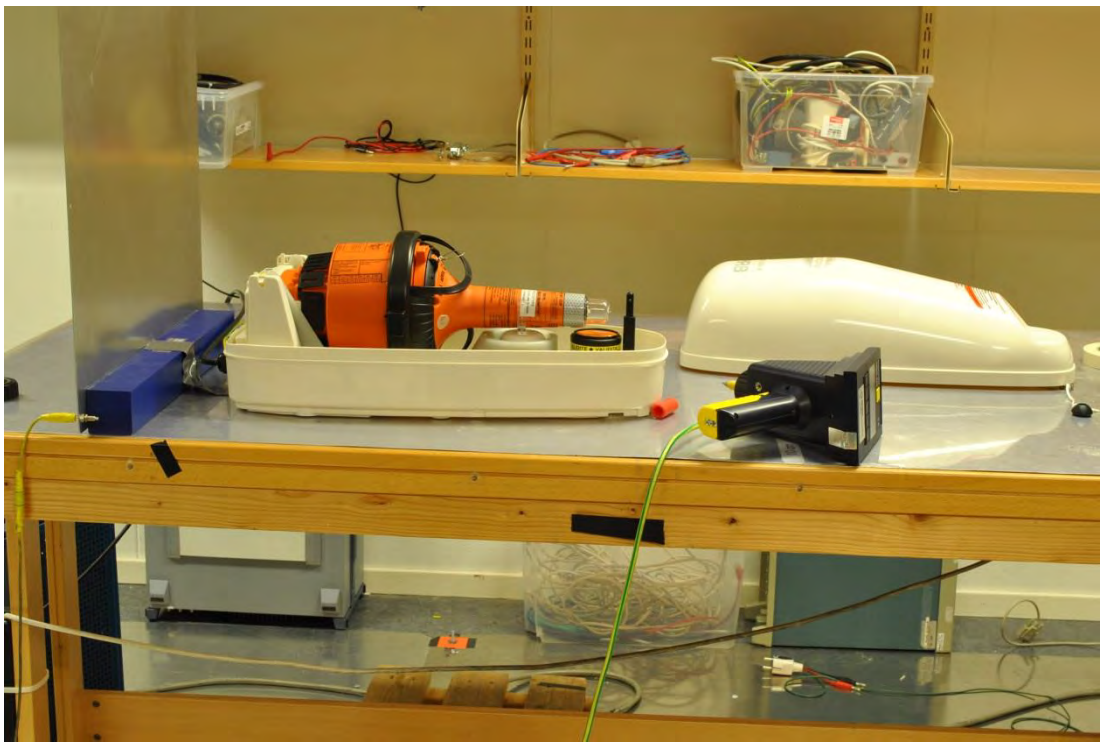
Notes: Test set-up for Radiated Emissions



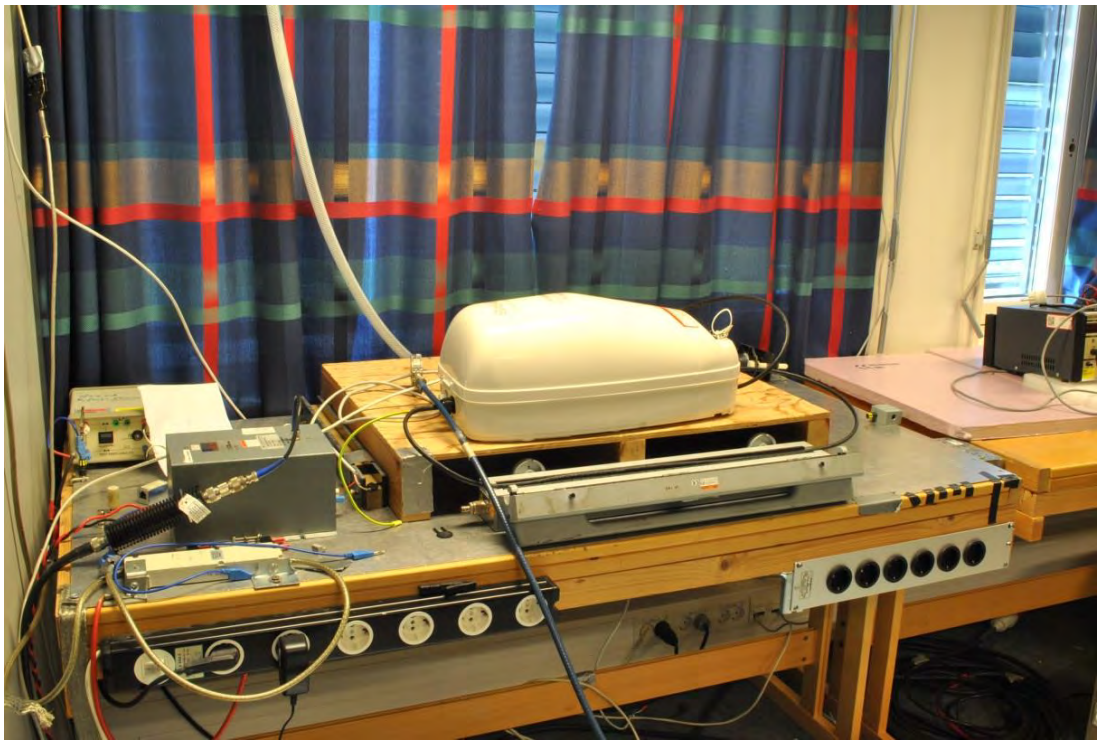
Notes: Test set-up for Radiated RF Field immunity – field immunity was performed without grounding the EUT as this was a worse test



Notes: Test set-up for Electric Fast Transients

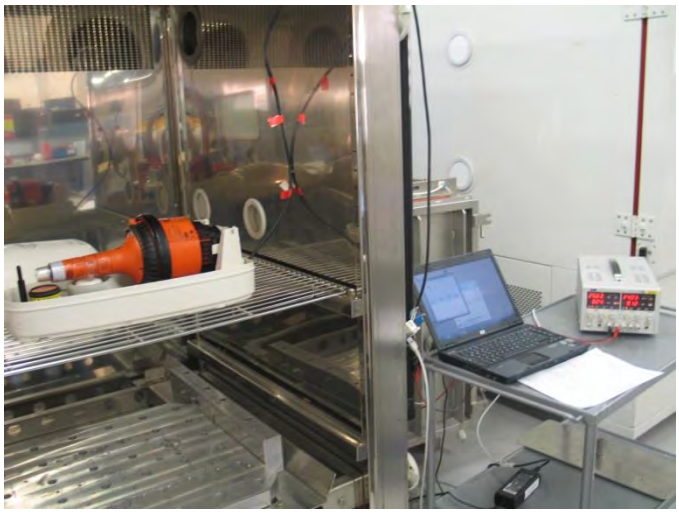


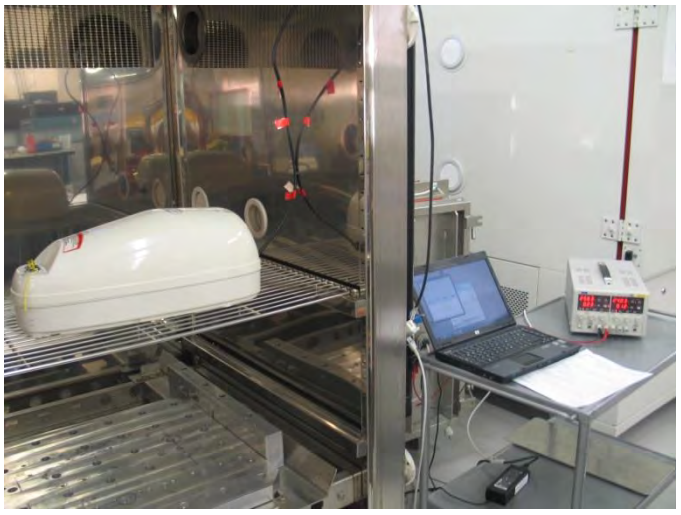
Notes: Test set-up for ESD



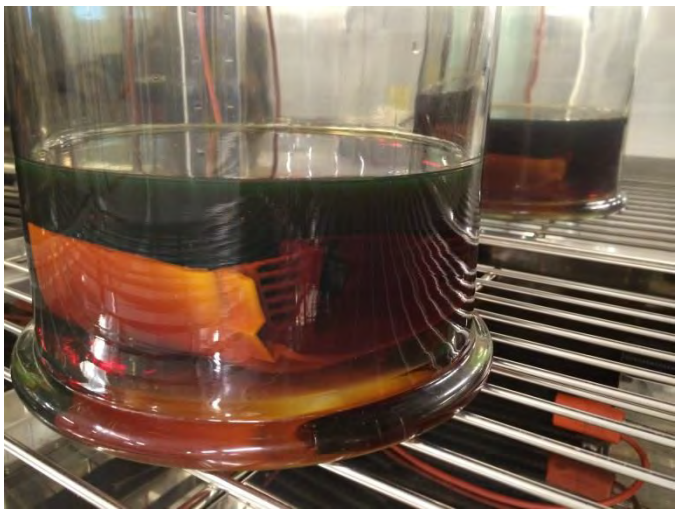
Notes: Test set-up for Conducted RF Disturbance

Notes: Test set-up for Thermal Shock Tests

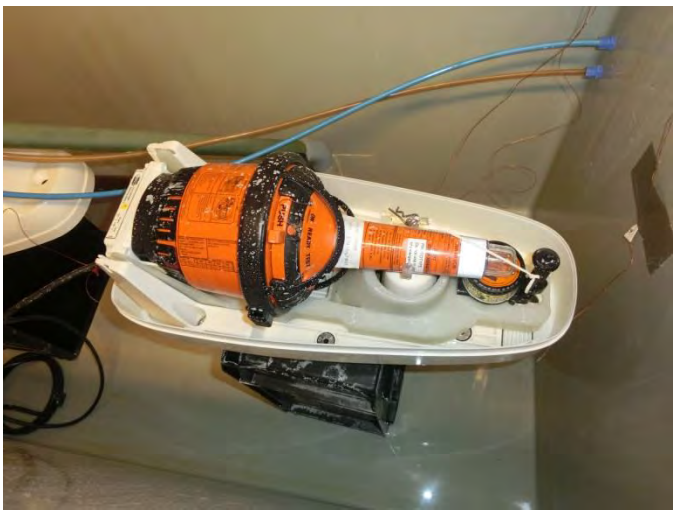




Notes: Test set-up for Temperature/Humidity tests

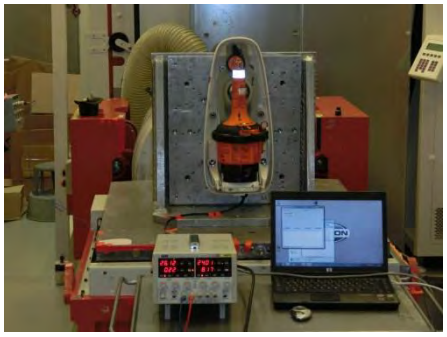


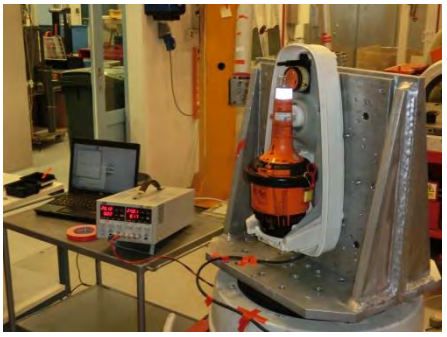
Notes: Test set-up for Oil Resistance Test

Notes: Test set-up for Salt Mist/Corrosion test

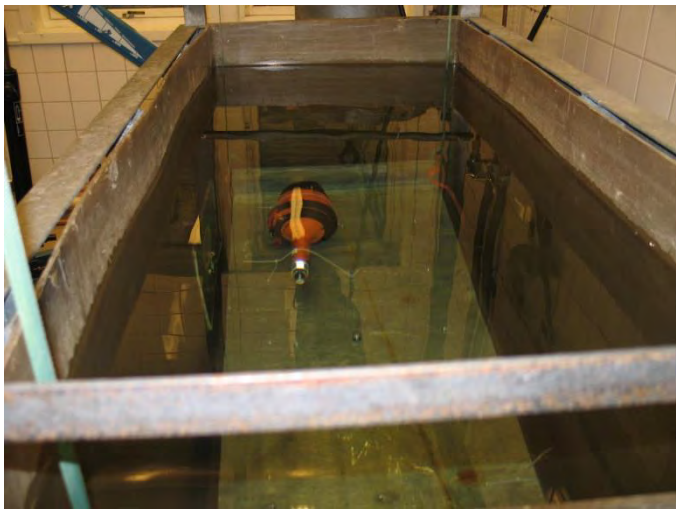

Notes: Test set-up for Stability and Buoyancy tests





Notes: Test set-up for Vibration and Shock tests (X, Y and Z)

Notes: Test set-up for Drop on hard surface



Notes: Test set-up for Leakage and Immersion tests

A.3 WITNESSED TESTS

The following tests have been performed by Jotron personell and witnessed by Nemko.
The tests have been performed partly at Jotron premises and partly at third parties premises.

MARKING

TEST DESCRIPTION

Method
-

Reference
EN 61966-1 (2013) §4.3.4.4 and §6.1.4.c

Procedure
The capsule, together with any outermost shell, shall be of a highly visible fluorescent orange colour, marked with retro-reflective materials that comply with the relevant requirements of IMO A.658(16) and marked with the legend:

"VOYAGE DATA RECORDER – DO NOT OPEN –
REPORT TO AUTHORITIES"

The above was verified and witnessed.

Conformity

Verdict:	PASS
Test engineer:	Øyvind Eggen
Witnessed by	Espen Eriksen

EXCESSIVE CONDITIONS

TEST DESCRIPTION

Reference
EN 60945 (2002) §5.2.3. and §7.2 / (Safety)

Procedure
EN 60945 (2002) §7.2.
Means shall be incorporated for the protection of equipment from the effects of excessive current and voltage, transients and accidental reversal of the power supply polarity or phase sequence

Procedure
These conditions exceed the extreme test conditions in which the EUT is required to operate, with or without performance degradation, as indicated in the equipment standard.
Excessive current is defined as greater than normal working current. Excessive voltage is greater than that specified for Extreme Power Supply.

Protection shall be provided against such excesses at an appropriate level chosen by the manufacturer and, when activated, may require the EUT to be reset, for example by fuse replacement. The power supply shall be adjusted to cause activation of the protection and after EUT reset, a performance check under normal test conditions shall be carried out.

Power supply misconnections are also regarded as excessive conditions. Where appropriate, the EUT shall be subjected to an input from a power supply of reversed polarity or improper phase sequence for a period of 5 min. After completion of the test, and reset of the protection of the EUT, if required, the power supply shall be connected normally and a performance check shall be carried out.

Test voltage
Vnom = 24/48V DC
Excessive voltage: Vnom + 30% + 1.6V (chosen by the manufacturer) = 64V DC
Excessive voltage: Vnom - 10% - 0.6V (chosen by the manufacturer) = 21V DC

Instruments used during measurement

Instrument list:	Digital. Multimeter: HP / 34401A, (09/2014) DC Power Supply: TTi / CPx 400D (N/A)

Comments
No recorded comments.

Conformity

Verdict:	PASS
Test engineer:	Arnt Løke
Witnessed by:	Espen Eriksen

DETAILED TEST LOG

Condition	Voltage	Current	Action	Result
Normal temperature	0.0V DC	0mA	OFF	PASS
Normal temperature	64.048V DC	90mA	ON	PASS
Normal temperature	Reverse polarity	0mA	5 min. ON	PASS
Normal temperature	64.048V DC	90mA	ON	PASS
Normal temperature	0.0V DC	0mA	OFF	PASS
Normal temperature	20.984V DC	300mA	ON	PASS
Normal temperature	Reverse polarity	0mA	5 min. ON	PASS
Normal temperature	20.984V DC	300mA	ON	PASS

AUTOMATIC RELEASE AND ACTIVATION TEST

TEST DESCRIPTION

Reference
IEC 61097-2 (2008) cl. A.2.2

Procedure
The Satellite EPIRB installed in the automatic release mechanism (the bracket) was mounted to a test fixture and submerged to a depth of 4 meters.

The Satellite EPIRB shall be automatically released and float free before reaching the depth of 4 meters.

The test is repeated with the specimen in normal mounted orientation and pre-conditioned to; Ambient temperature, Minimum stowage temperature, Maximum stowage temperature.

With the specimen pre-conditioned to Ambient temperature, the test was also repeated for the following mounted orientations; Rolling 90º starboard, Rolling 90º port, Pitching 90º bow down, Pitching 90º stern down, Upside down.

Instruments used during measurement
Instrument list: Thermometer: FLUKE / 51II (Jotron Instrument: JE-00655) (04/2014)

Comments
These tests were witnessed tests performed in Sandefjord Public Swimming Hall.
The tests were performed by Jotron (Bjørn Rishovd and Terje Nyrén) and witnessed by Nemko.

Severities

Pre-conditioning:	2 hours
Ambient temperature:	+25ºC
Min stowage:	-30ºC
Max stowage:	+70ºC

Conformity

Verdict:	PASS
Witnessed by:	Espen Eriksen

DETAILED TEST LOG

Pre-condition	Mounted Orientation	Release depth	Activation (yes/no)	Result (PASS)
Minimum Stowage Temperature	Normal	400 cm	Yes	PASS
Maximum Stowage Temperature	Normal	250 cm	Yes	PASS
Ambient Temperature	Normal	300 cm	Yes	PASS
	Rolling 90º starboard	250 cm	Yes	PASS
	Rolling 90º port	250 cm	Yes	PASS
	Pitching 90º bow down	250 cm	Yes	PASS
	Pitching 90º stern down	300 cm	Yes	PASS
	Upside Down	260 cm	Yes	PASS

CONCLUSION
The release mechanism and the automatic activation comply with the requirements.

DROP INTO WATER

TEST DESCRIPTION

Method

Reference
IEC 61097-2 (2008)

Procedure
The Satellite EPIRB was tested by the manual self-test function prior to the test.

The Satellite EPIRB was then dropped three times from a height of 20 m into water.

Each drop was initiated from a different orientation as follows; antenna vertical up, antenna vertical down, antenna horizontal.

After each drop the specimen was inspected for seawater contact activation, mechanical damages and tested by the manual self-test function and the beacon tester.

Instruments used during measurement

Instrument list: Jotron Instrument: DELL Beacon Tester BT 100S

Comments
These tests were witnessed tests performed at a pier at the Sandefjord Key area. The tested specimen was dropped into sea water from a crane with a rope attached. The rope had a 20 meter marking to ensure the drop height was at (or above) the required 20 meters.
The tests were performed by Jotron (Bjørn Rishovd and Terje Nyrén) and witnessed by Nemko.

Severity		Conformity	
Height:	20 meter	Verdict:	PASS
Repetitions:	3 times	Witnessed by:	Espen Eriksen

CONCLUSION

Automatic activation by seawater
No damages were detected after the applied test.
No operational faults were detected.

TEST TO PREVENT RELEASE WHEN WATER WASHES OVER THE UNIT

TEST DESCRIPTION

Method

Reference
IEC 61097-2 (2008) cl. A.2.4

Procedure
The Satellite EPIRB installed in the automatic release mechanism (the bracket) was mounted to a rotatable test fixture.

The specimen was subject to a water stream from a hose for a period of 5 minutes from each side (front, back, left and right side (180 º). The water stream was elevated by 23º, compared to the base of the antenna.

These tests were witnessed tests performed at the Sandefjord Fire Station. A fire truck with associated pumps and other equipment were used to obtain a water jet strem of 2300 liters/min. The water jet stream was controlled and operated by personnel at the fire station.

Comments
The test was supervised by Jotron (Bjørn Rishovd and Terje Nyrén) and witnessed by Nemko.

Severities	
Nozzle diameter::	63.5 mm
Delivery rate:	2300 l/min
Nozzle distance:	3.6 m
Nozzle height:	1.4 m above antenna base

Conformity	
Verdict:	PASS
Witnessed by:	Espen Eriksen

CONCLUSION
The specimen did not release, nor activate, by the applied water stream. It is considered to comply with the requirements.

MEANS TO FACILITATE GRAPPLING AND RECOVERY

TEST DESCRIPTION

Reference
IEC 61996-1 (2013) cl. 6.1.14.7

Procedure
The float-free capsule was checked visually for means to facilitate grappling and recovery. It was confirmed that the design does not increase risk of fouling during release. The capsule was released into water and grappling demonstrated by Jotron personell.

Comments
The test was supervised by Jotron (Bjørn Rishovd and Øyvind Eggen) and witnessed by Nemko.

Conformity	
Verdict:	PASS
Witnessed by:	Espen Eriksen

CONCLUSION

The specimen did not release, nor activate, by the applied water stream. It is considered to comply with the requirements.

RESITANCE TO TAMPERING

TEST DESCRIPTION

Reference
IEC 61996-1 (2013) cl. 4.3.4.1.3-5/4.4.3/6.1.4a clause 1-5

Section 6.1.4a clause 1 to 4
Access to the physical parts of the VDR capsule is not possible without damaging the platic bumper used to attach the VDR capsule to the buoy.There is a label clearly indicating that the unit should only be opened by authorized personel. Pictures of this arrangement can be viewed in the Marking chapter. This label has to be visually damaged in order to open the unit because it covers the access to the assembly screws.
Clause 3 and 4 is not relevant to the recording medium.

Procedure section 6.1.4a – clause 5
This test demonstrates that the VDR capsule has built-in mechanisms to provide the VDR system with safety functionality to resist tampering of data. The setup of the safety mechanisms can be selected and configured by the user. The access methods that will be tested are:

- Webmin – the web based configuration tool capable of configuring most aspects of the capsule.
- SSH – secure shell – also capable of configure the storage module and add / delete data files.
- FTP – File transfere protocol
- Samba – common internet File System (Microsoft specified protocol)

The VDR capsule is pre-configured with the following users:

- admin – password admin1 (This user is special for webmin and cannot be used for general login)
- root - password root1
- guest – password guest1
- jotron – password jotron1
- jotron-ro – password Jotron-ro1

Users; Guest, Jotron and Jotron-ro has the recording media as their “home” catalog.

Instruments used during measurement
A personal computer running Windows operating XP system connected to the VDR capsule using 100Mb network. Both the computer and the VDR capsule are connected to the same network.

Comments
These tests were performed at Jotron’s premises at Skoppum.

The test was performed by Jotron (Mads Olav Le Maire) and witnessed by Nemko.

Conformity	
Verdict:	PASS
Witnessed by:	Espen Eriksen

DETAILED TEST LOG, SECTION 6.1.4A – CLAUSE 5

Test Item	Check	Remarks	Result (PASS)
From the PC, connect to the VDR capsule using an internet browser. The URL should be: vdr.local:10000. Login as user admin and a password different from admin1. Login with password admin1. Repeat the test with one of the other users.	Check that login as admin is unsuccessful without the correct password. Check that login is not possible with one of the other configured users.	None	PASS
From a PC connect to the VDR capsule using a SSH client (putty). Login as user jotron and a password different from jotron1. Login with password jotron1. Repeat the test with one of the other users.	Check that login as jotron is unsuccessful without the correct password. Check that login as another user requires the correct password for this user.	None	PASS
From a PC connect to the VDR capsule using a FTP client (filezilla). Login as user guest and a password different from guest1. Login with password guest1.	Check that login as guest is unsuccessful without the correct password. Check that user guest has read only access. Check that user guest is 'ftp jailed' to the SSD disk mount.	None	PASS
From a PC connect to the VDR capsule using a FTP client (filezilla). Login as user Jotron and a password different from jotron1. Login with password jotron1.	Check that login as jotron is unsuccessful without the correct password. Check that user jotron has read-write access. Check that user Jotron has access to the rest of the file system.	None	PASS
From a PC connect to the VDR capsule by using the file browser. The path should be \\vdr.local. Login as user Jotron and a password different from jotron1. Login with password jotron1.	Check that login as jotron is unsuccessful without the correct password. The shared SSD disk is available for both read and write.	None	PASS
From a PC connect to the VDR capsule by using the file browser. The path should be \\vdr.local. Login as user Jotron-ro and a password different from Jotron-ro1. Login with password jotronro-1.	Check that login as Jotron-ro is unsuccessful without the correct password. The shared SSD disk is available only for reading.	None	PASS

CONCLUSION

The tests were demonstrated without errors or unexpected behaviour.

INFORMATION FOR USE BY AN INVESTIGATION AUTHORITY

TEST DESCRIPTION

Reference
IEC 61996 (2013) cl. 5.5.3 c

Procedure
This test demonstrates how data can be retrieved from the VDR capsule under special circumstances when the ethernet interface for some reason is unavailable, but the processor card of the capsule is intact.

Instruments used during measurement
A personal computer running Windows XP operating system connected to the detached processor card of the VDR capsule using a micro USB connector.

Comments
These tests were performed at Jotron's premises at Skoppum.

The test was performed by Jotron (Mads Olav Le Maire) and witnessed by Nemko.

Conformity

Verdict:	PASS
Witnessed by:	Espen Eriksen

DETAILED TEST LOG

Test Item	Check	Remarks	Result (PASS)
Connect the USB cable between the PC and the processorcard. Allow one minute for boot-up. From a PC, connect to the VDR capsule by using the file browser. The path should be \\vdr.local. Login as user Jotron-ro with password Jotron-ro1.	Check that login is possible and that files can be copied from the capsule. Check that it is not possible to write to or delete files.	None	PASS

CONCLUSION
The tests were demonstrated without errors or unexpected behaviour.

WRITE AND VERIFY TESTS

TEST DESCRIPTION

Reference
IEC 61996-1 (2013) cl. 6.1.2.1/6.1.14

Procedure
This test demonstrates logging and recovery of data with detailed error checking of the result. Since the vdr capsule is a general purpose logging unit, without any knowledge of the data being logged, a dedicated test application is used for verification.

About the test application.
This test will use a special test application running on a PC to write test files to the VDR capsule. Each test file is one megabyte large, and contains random data and a checksum. Immediately after being written, the file is read back and verified. Any errors are listed. After files are written to the capsule, a test reading back files, verifying these, and checking for missing files can be run.
Due to the large disk, this test takes significant time. All the tests have been run utilizing the whole disk, but during witness audit, the solid state disk is set up with a smaller partition utilizing 10% of the physical size. By this the tests can be run within a reasonable time.

Instruments used during measurement
A personal computer with Jotron VDR test program version 1.0 and Filezilla FTP client.

Comments
These tests were performed at Jotron's premises at Skoppum.

The test was performed by Jotron (Mads Olav Le Maire) and witnessed by Nemko.

Conformity

Verdict:	PASS
Witnessed by:	Espen Eriksen

Test Item	Check	Remark	Result
From a PC connect to the VDR capsule by using the file browser. The path should be \\vdr.local. Login as user Jotron with password. Map the network drive to drive letter z: Start the test application and press the Start button in the Write Control section.	Check that files written are listed on the statusline. Check that no errors occur in the output window. Observe that write failes due to the fact that the disk is filled up. (Windows explorer propery.)	None	PASS
From the test application start the Checkout test.	Check that verified files are listed on the statusline. Check that no sequence errors are listed in the output window. (Missing files)	None	PASS
Start a FTP session using filezilla as client. Connect to vdr.local with password guest and password guest1.	Download the entire logging catalog on the disk, check that no error occurs.	None	PASS
From the test application press the "Delete all files" button	Check that deleted files are listed on the statusline. Using windows explorer, check that all files are removed and the space recovered.	None	PASS

CONCLUSION
The tests were demonstrated without errors or unexpected behaviour.

DATA INTEGRITY UNDER FLOAT-FREE OPERATION

TEST DESCRIPTION

Reference
IEC 61996-1 (2013) cl. 6.1.14.2-6, 5.4.2.2

6.1.14.2 Pre-loaded test data.
The Tron-40VDR storage module is a general purpose logging unit capable of storing computer files. It will be used by several vendors, all having their own way of storing information. Since no standard input data is available on this level of test, the following is assumed to fullfill the requirements for data integrity:

- A special computer program developed as part of the storage module project, and kept under version control by Jotron, is used to write and verify data.
- The files written, contains random data and is of random length. Each file contains a checksum of the data and a sequence number.
- The program is capable of traversing the whole media, identifying missing files and files with bad checksums. This functionality will be used to verify the storage media after the tests.
-

Approx. 70% of the disk was pre-recorded before the test, to mimic approx. 48 hour of real recorded data.

6.1.14.3 Tests.
After performing relevant IEC 61097-2 tests the test outlined in the “Detailed test log” at the end of this chapter was performed.

6.1.14.4 Data integrity under float-free operation
The EUT shall be tested to verify that the data stored up to the moment of releasing the capsule is not corrupted by the deployment of the capsule or by the transmission of locating and homing signals.

a) Performance checks shall be performed on the capsule after being released under different deployment scenarios, including:
- having been manually released after manually set to the transmission mode;
- having been manually released without being set to the transmission mode;
- automatic release;
- with different sequences of disconnecting data and power inputs, if relevant.

b) The EUT, with a full set of data stored, shall be set into the test transmission mode (in a suitable arrangement in order not to alert SAR facilities and not floating in water, in order to represent the worst case condition). The beacon transmissions shall be maintained for a duration of 7 days.

6.1.14.5 Required results
After completion of the tests, the stored data shall be retrieved following the manufacturer’s instructions, which may include error correcting. Repairs to the final recording medium shall be limited to connectors and cables. Mechanical or corrosive damage to the recording medium incurred during the test that results in corruption or loss of data, shall constitute a failure. For the purposes of playback, the recording medium may be removed from the EUT and installed into standard replay equipment as supplied by the manufacturer. Recordings shall meet the requirements of the performance test specification in 6.1.1.3 with at least 99 % of the data being recoverable.

Procedure
Since the Tron 40VDR Storage module is a general purpose logging unit capable of storing computer files, the tests depends on the following assumptions:

- The CIFS (common internet file system) protocol defined by Microsoft is used for writing and reading data to the VDR capsule.
- Data written to the capsule during the test is random by nature, but each file written contains a sequence number in its filename, and a checksum embedded in the data payload. This makes it possible to find potentially missing files and the check the integrity of each file written while traversing the file system. The test program is developed by Jotron as part of the VDR project.
- Approx. 70% of the disk is pre-recorded and stored before the test, to mimic approx. 48 hour of real recorded data as described in 6.1.14.2. These data files will not be manipulated during the test, but a complete verification will be done after all the tests have been done. No errors are assumed to be detected

in these files.

- Each of the deployment tests is using the same scenario, and verification is done after each test to see how much data that is lost during the abnormal shutdown of the VDR capsule. The total loss of data is then calculated by taking the pre-recorded data into consideration.

Preconditions
Connect a complete Tron 40VDR buoy to a computer running the windows operating system. By using the CIFS protocol, map the Tron 40VDR buoy storage module to the computers file system as a drive letter. The storage module will contain pre-loaded data to approx. 70% (40GB) of the capacity of the storage module.

Test program
The test program is written and maintained by Jotron as and is placed under version control. The version used during the test is tagged by the label “61996-1_test_6.1.14”.

Comments
These tests were performed at Jotron’s premises by Jotron (Mads Olav Le Maire) and witnessed by Nemko.

Conformity

Verdict:	PASS
Witnessed by:	Espen Eriksen

DETAILED TEST LOG

Test 6.1.14.4a – scenario 1: manually release after manually set to transmission mode:

Item	Comments	Result
Start recording files of 300kbytes continuously to the VDR capsule.	2014-06-05T12:27:28 Write test Started.	PASS
After approx. 1 minute, deploy the activation scenario, and wait for the recording process to fail. Stop the recording scenario.	2014-06-05T12:33:08Failing to write: Z:/test/122927-000004/123005-000859-vdr 2014-06-05T12:33:08 Write test Stopped.	PASS
Insert the VDR unit into the bracket. Allow one minute startup time. Run the verification program to find out which files are missing.	2014-06-05T12:40:45 Verify test Completed. Number of files missing: 23 Number of files with crc errors: 8 Calculated loss: 31 files * 0.3MB = 9.3MB Approx. loss in percentage: (9.3/381) = 0.025%	PASS

Test 6.1.14.4a – scenario 2: manually release without set to transmission mode:

Item	Comments	Result
Start recording files of 300kbytes continuously to the VDR capsule.	2014-06-05T12:50:12 Write test Started.	PASS
After approx. 1 minute, deploy the activation scenario, and wait for the recording process to fail. Stop the recording scenario.	2014-06-05T12:54:49Failing to write: Z:/test/125111-000002/125149-000450-vdr 2014-06-05T12:54:49 Write test Stopped.	PASS
Insert the VDR unit into the bracket. Allow one minute startup time. Run the verification program to find out which files are missing.	2014-06-05T12:56:59 Verify test Completed. Number of files missing: 12 Number of files with crc errors: 23 Calculated loss: 35 files * 0.3MB = 10.5MB Approx. loss in percentage: (10.5/381) = 0.028%	PASS

Test 6.1.14.4a – scenario 3: disconnect power cable:

Item	Comments	Result
Start recording files of 300kbytes continuously to the VDR capsule.	2014-06-05T13:11:34 Write test Started.	PASS
After approx. 1 minute, deploy the activation scenario, and wait for the recording process to fail. Stop the recording scenario.	2014-06-05T13:16:18Failing to write: Z:/test/131234-000002/131313-000482-vdr 2014-06-05T13:16:18 Write test Stopped.	PASS
Reconnect power cable Allow one minute startup time. Run the verification program to find out which files are missing.	2014-06-05T13:20:15 Verify test Completed. Number of files missing: 19 Number of files with crc errors: 13 Calculated loss: 32 files * 0.3MB = 9.6MB Approx. loss in percentage: (9.6/381) = 0.025%	PASS

Test 6.1.14.4a – scenario 4: disconnect LAN cable:

Item	Comments	Result
Start recording files of 300kbytes continuously to the VDR capsule.	2014-06-05T13:25:22 Write test Started.	PASS
After approx. 1 minute, deploy the activation scenario, and wait for the recording process to fail. Stop the recording scenario.	2014-06-05T13:30:21Failing to write: Z:/test/132622-000002/132717-000581-vdr 2014-06-05T13:30:21 Write test Stopped.	PASS
Reconnect the LAN cable Allow one minute startup time. Run the verification program to find out which files are missing.	2014-06-05T13:33:34 Verify test Completed. Number of files missing: 0 Number of files with crc errors: 1 Calculated loss: 1 files * 0.3MB = 0.3MB Approx. loss in percentage: (9.3/381) = 0.0008%	PASS

Test 6.1.14.4a – Scenario 5: Automatic release:

Item	Comments	Result
Start recording files of 300kbytes continuously to the VDR capsule.	2014-06-05T15:12:04 Write test Started.	PASS
After approx. 1 minute, immerse the Tron 40VDR with bracket into water until the EPIRB is automatically released and wait for the recording process to fail. Stop the recording scenario.	2014-06-05T15:15:33Failing to write: Z:/test/151354-000004/151420-000823-vdr 2014-06-05T15:15:33 Write test Stopped.	PASS
Verification is done during the verification of pre-recorded data.	2014-06-05T15:46:34 Verify test Completed. Number of files missing: 23 Number of files with crc errors: 22 Calculated loss: 45 files * 0.3MB = 13.5MB Approx. loss in percentage: (13.5/381) = 0.035%	PASS

Test 6.1.14.5 - Verification of the pre-recorded data after all the 6.1.14.4a tests are finished.

Item	Comments	Result
Start the verification process of the pre-recorded data.	2014-06-05T15:58:31 Verify test Started.	PASS
After the verification process has terminated, check for any files missing and any corrupted computer files.	2014-06-05T19:47:37 Verify test Completed. Number of files missing: -73003. Number of files with crc errors: 0. (In this case the start count when counting files is 0, hence the negative value of missing files which actually is the number of counted files.)	PASS
Display property page of test catalogue in windows explorer. And note the size, number of files and folders.	Size 38,1GB (40 948 473 176 bytes) Contains: 73 003 Files, 366 Folders.	PASS

Test 6.1.14.5 - Verification of the pre-recorded data after the 6.1.14.4b test is finished.

Item	Comments	Result
Start with a pre-recorded buoy….	2014-05-31T 15:12:00 58,4 GB of data pre-recorded data available.	PASS
Start the verification process of the pre-recorded data.	2014-06-06T15:50:02 Verify test Started.	PASS
After the verification process has terminated, check for any files missing and any corrupted computer files.	2014-06-06T21:13:46 Verify test Completed. Number of files missing: -104000 Number of files with crc errors: 0. (In this case the start count when counting files is 0, hence the negative value of missing files which actually is the number of counted files.)	PASS
Display property page of test catalogue in windows explorer. And note the size, number of files and folders.	Size 54,2GB (58 220 717 568 bytes) Contains: 104 000 Files, 2080 Folders.	PASS

6.1.14.6 Aids to location 5.3.2

The relevant tests can be found in report from TUV 75924802 Report 01 Issue 3 chapter 2.6 and in the enclosed report “Tron 40VDR – Low duty cycle light test performed by Jotron”.

CONCLUSION

No errors were found in the large block of preloaded data after the tests. Because the relative small amount of data recorded during each test, only the lost data is used in the percentage calculation. Adding the correctly recorded data in each test, would have improved the result insignificantly.

The test demonstrates that the loss of data is well below the required 1% limit. All the data loss found during the tests has to do with the abnormal shutdown of the VDR capsule caused by the release situation which is expected. No data loss of earlier written data has been detected.

RECORDING INTEGRITY – BIT ERROR RATE

TEST DESCRIPTION

Reference
IEC 61996-1 ed2.0 cl. 6.1.10b (bit error section)

Procedure
This test is conducted in order to substantiate that the VDR capsule exceeds the requirement of the bit error rate test described in section 6.1.10 b) of 61996-1 Ed 2.0. At the heart of the VDR capsule, is a modern embedded computer, with a state of the art storage medium. In this concept, several layers of error corrections and possibility re-transmissions are used to ensure that data is not corrupted or lost in any way:

- The SSD disk takes care of the data integrity at the flash memory level.
- The serial data interface and protocol delivers data to and from the SSD disk.
- The file system ensures data integrity
- The network interface provides reliability through TCP/IP networking.

All these mechanisms ensure the overall reliability, and it would be considered as unacceptable to find any bit errors during storage and read back from the VDR capsule.

Description of the test:

- A special written test program with the following characteristics was run on the personal computer:
  - The program is capable of writing an unlimited number of files in a number of catalogues until the space left reported by the drive signals that it is almost filled up. (less than 500mb left)
    - Each file has a sequence number embedded in the filename in order to determine missing files during the verification process.
    - When 50 files have been written to a catalogue, a new catalogue is automatically generated, and writing will continue here.
    - Each file contains a random number of bytes between 100kbytes and 1mbytes of random generated data. A 32 bit checksum of the data is computed and stored in the file for verification.
  - The program is able to do a verifying process automatically when the write process has finished due to the space left limit is exceeded. This process will consist of the following:
    - The whole disk is traversed catalogue by catalogue, file by file.
    - The file names are continuously compared with an incrementing sequence number in order to monitor potential missing files.
    - The content of each file is read back; checksum is computed from the random data and compared to the checksum stored in the file during the write process.
  - The test program is not optimized for fast transfer and read-back, so the transfer rate is quite low.

Preconditions
The test was done using a complete VDR system complete with bracket and docking module powered over Ethernet from a standard PoE switch (TP-Link TL-SF1008P). The EUT was connected to a personal computer running windows operating system. The “common internet file system” protocol (CIFS)) was used for the test, and the VDR capsule was mapped as a drive letter on the personal computer. All access was done through this mapped drive.

Comments
These tests were performed at Jotron’s premises at Skoppum.

The test was performed by Jotron (Mads Olav Le Maire) and witnessed by Nemko.

Pre-conditioning: The SSD drive is empty

Conformity

Verdict:	PASS
Witnessed by:	Espen Eriksen

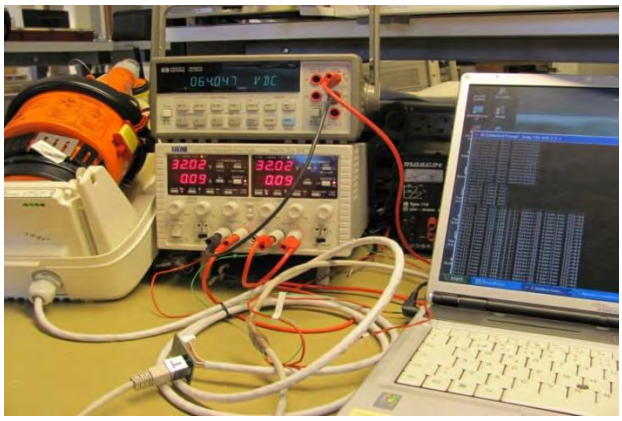
DETAILED TEST LOG

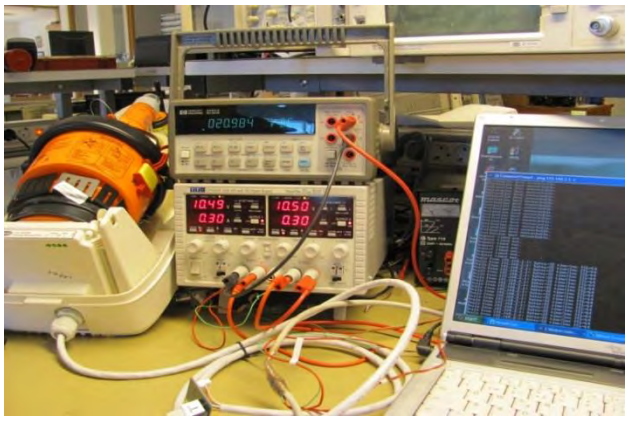
Item	Comments	Result
Start recording files to the VDR capsule.	23.05.2014 16:05.06 The test was started	OK
Wait for the write process complete after filling up the SSD disk.	24.05.2014 13.32.49 The write process completed without errors. During this process 104000 files were written in 2080 catalogues. 58.167 Gbytes is used.The total number of bytes written will overflow several times during the process and ends up at 1908824576 bytes.	OK
Wait for the verify process to complete	25.05.2014 16.06.47 The verify process completes. ▪ 0 files were missing and all could be read back ▪ 0 files contained any checksum errors. The total number of bytes read ended up at 1908824576 after several overlows indicating that the number of bytes read back is identical to the number of bytes written	OK

CONCLUSION

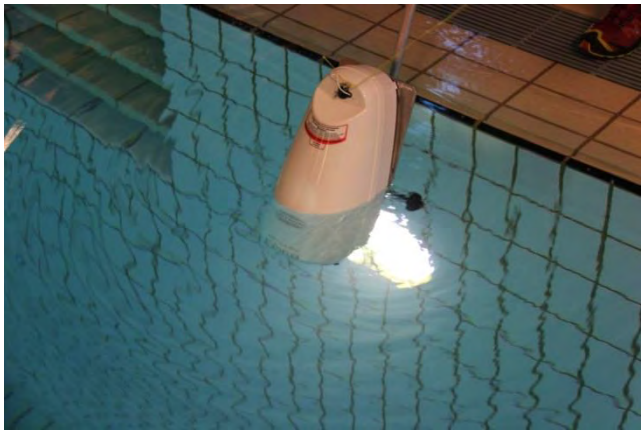
During the test 58.167 gigabytes of data were written to and read from the VDR capsule. This is equivalent to $4653.36 * 10^8$ bits were written without any errors detected. This clearly demonstrates that the VDR capsule exceeds the bit error rate of 1 in 10^8 bit.

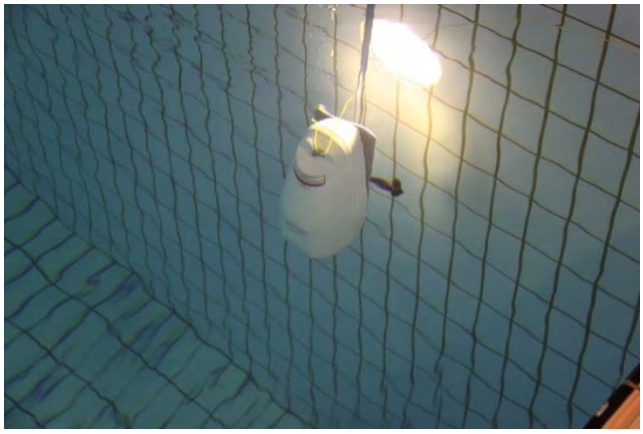
A.4 PHOTOS (WITNESSED TESTS)

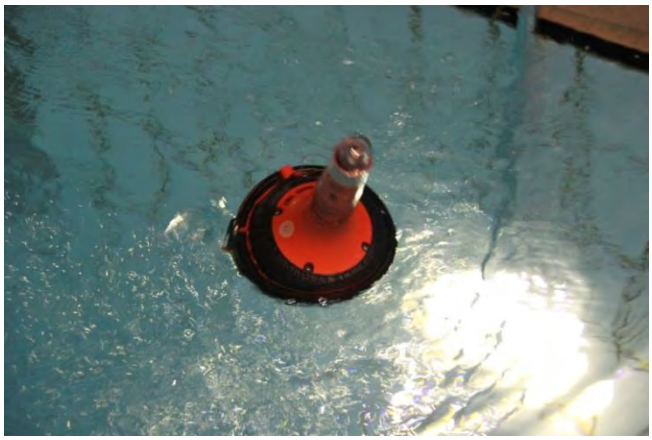




Notes: Test setup for Excessive conditions

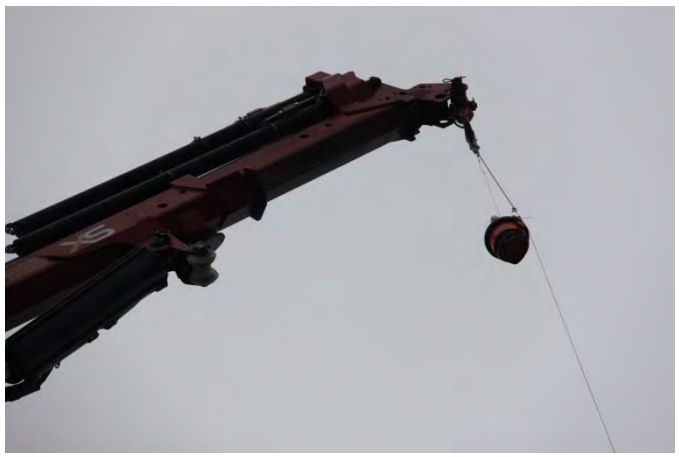






Notes: Test set-up for Automatic release and activation tests






Notes: Test set-up for Drop into water

Notes: Test set-up for test to prevent release when water washes over the unit

Notes: Means to facilitate grappling of capsule

A.5 TEST-REPORT SOLAR RADIATION

REPORT

Contact person
Mattias Viktorsson
Energy Technology
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Date 2014-05-05 Reference 4P03312 Page 1 (2)

Nemko AS
Postboks 73, Blindern
NO-0314 OSLO
Norge

Solar simulation of Tron 40VDR and FB40

(4 appendices)

Test item

Tron 40VDR/FB40.

Place and date of testing

The objects arrived at SP April 10th 2014 and were in good condition. Testing was carried out at/by SP's Energy Technology Section from April 24th 2014 until April 28th 2014.

Test arrangement

The test was performed with 56 Thorn CSI lamps and 14 Osram UV lamps. The test objects were placed in a case. The air in the case were circulated with a fan and regulated to the right temperature with electric heaters together with a control system.

Test equipment

Test equipment	Identification
Solar simulator	SPs Large Scale Solar Simulator
Data logger, HP 34970A	SP inventory nr. 202 389, 202390
Thermocouple according to	ETks-QD DA 5
Pyranometer Schenk star 3403	SP inventory nr. 202105

Measuring uncertainty

Temperature measurement	±1 °C*
Irradiance	±10 %

* Measuring uncertainty that depends on the application method is not included.

Typical example of application problems can be air between test object and thermocouple or colour difference between test object and application method e.g. tape/adhesive substance

SP Technical Research Institute of Sweden

Postal address
SP
Box 857
SE-501 15 BORÅS
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Västeråsen
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+46 10 516 50 00
+46 33 13 55 02
info@sp.se

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Date 2014-05-05 Reference 4P03312 Page 2 (2)

Test parameters

Desired values:

Solar Radiation Exposure	According to IEC 60945 8.10 Solar radiation
Ambient temperature	55°C
Total time of sunlight	80 h

See appendix 1 for measured temperature sensors

The irradiance was also measured during the test.

Test results

No residual deformation found on the test object. See pictures in appendix 2.

This test report relates only to the actual item tested. All samples are none tested and shows no deformation before the UV test.

The measured test values are presented in appendices 1 and 3.

SP Technical Research Institute of Sweden
Energy Technology - Climate Simulation

Performed by

Mattias Viktorsson

Signed by: Mattias Viktorsson
Reason: I am the author of this document
Date & Time: 2014-05-13 13:26:32 +02:00

Mattias Viktorsson

Examined by

Pia Tiljander

Signed by: Pia Tiljander (Tik)
Reason: I have reviewed this document
Date & Time: 2014-05-13 13:34:58 +02:00

Pia Tiljander

Appendices

Appendix 1: Average temperatures during the test (from 1,5 h to 80 h:
Appendix 2: Pictures
Appendix 3: Diagrams over the measured temperatures.
Appendix 4: Drawing

REPORT

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Appendix 1

Average temperatures during the test (from 1,5 h to 80 h:

Sensor	Average value, °C
Ambient	57
X-87910 Tron 40VDR	90
X-87920 FB40	81
BST (Black Standard Sensor)	95

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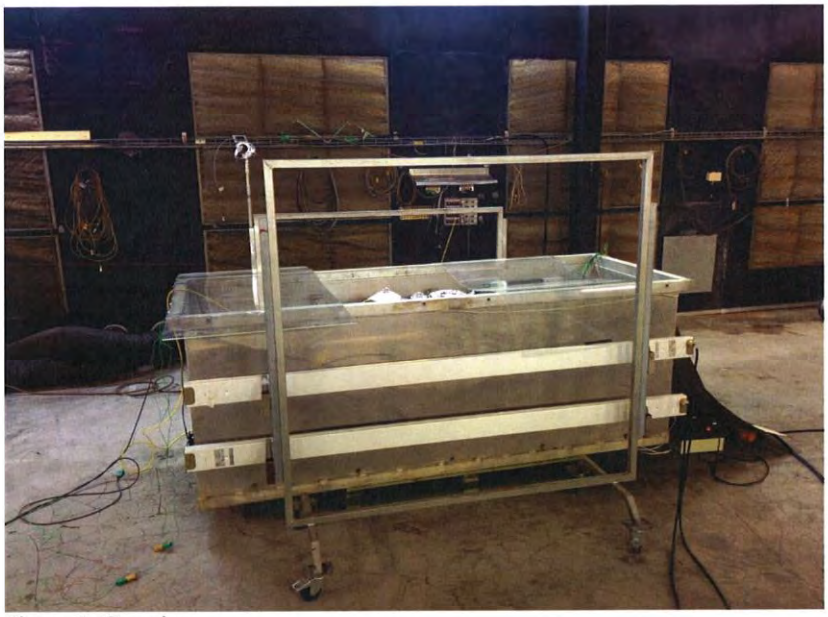
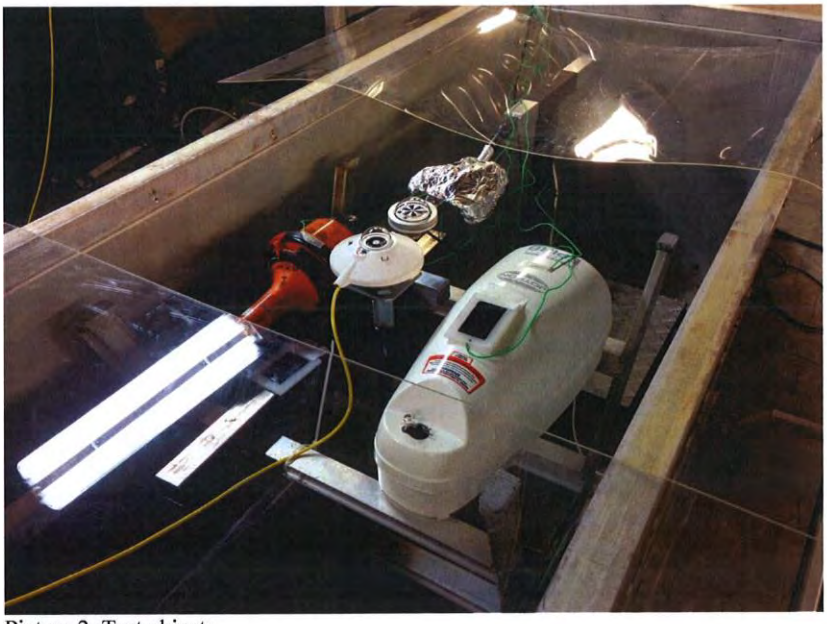
Appendix 2

Pictures



Picture 1: Overview



Picture 2: Test objects

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Appendix 2

Picture 3: Test objects

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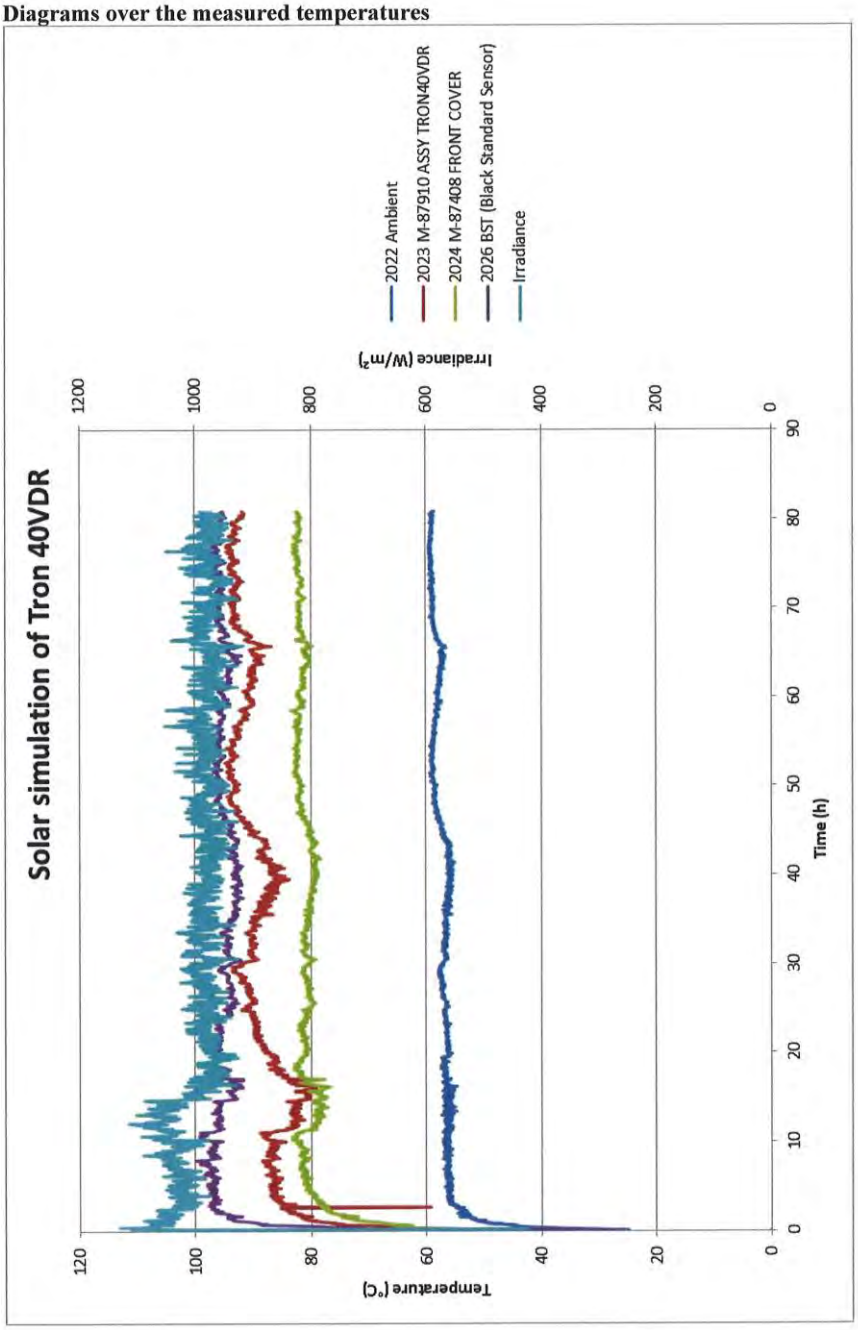
Appendix 3

Diagrams over the measured temperatures



SP Technical Research Institute of Sweden

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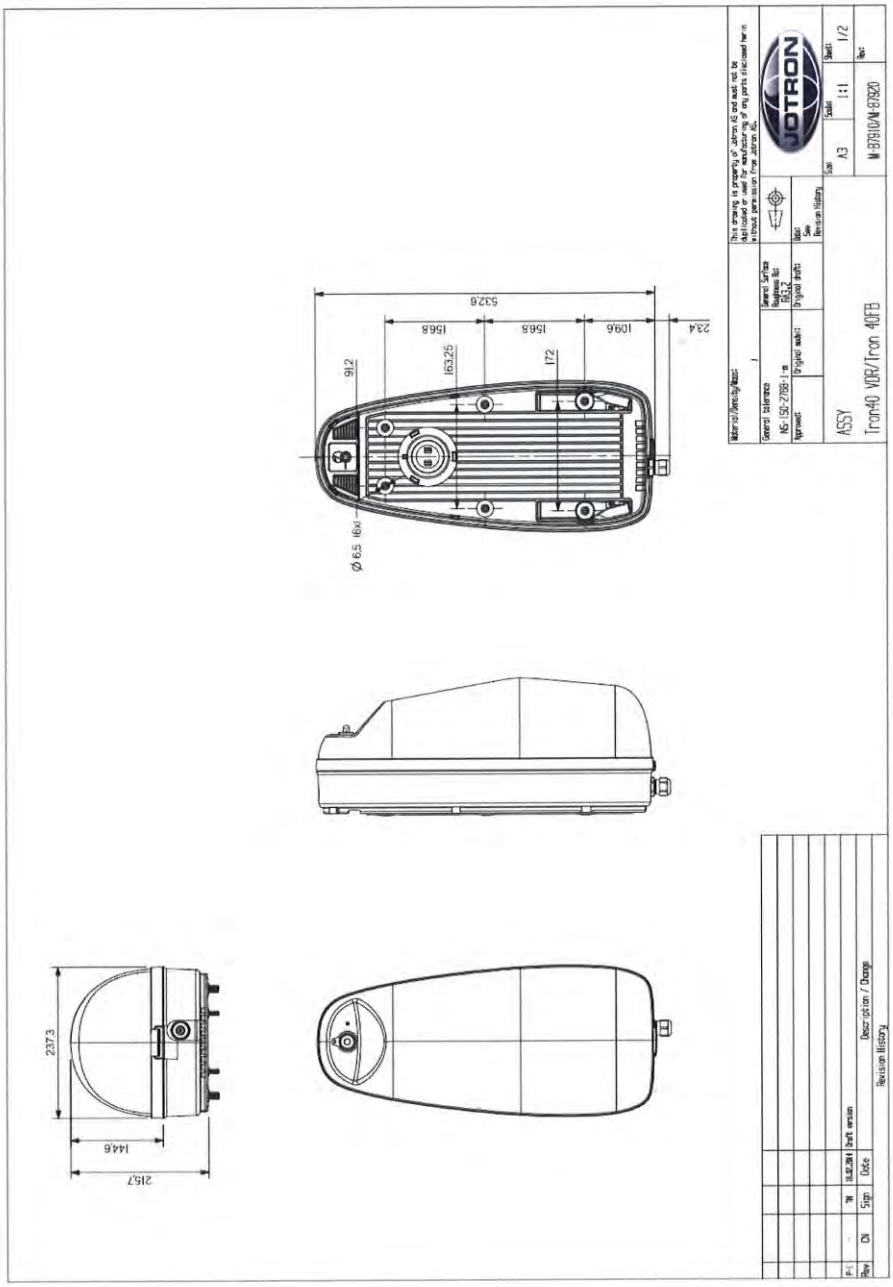
Appendix 4

Drawing



A.6 CUSTOMER SUPPLIED INFORMATION

The following tests have been performed by Jotron or other third parties

JOTRON	Test Report	Version D
	Tron 40VDR	Page 1 of 10

Project name:

Tron 40VDR
Low duty cycle light tests performed by Jotron AS

Document title:

Jotron test report

Document reference:

Jotron test report.DOC

A	20140121	Test report	ØE	AF	
Rev	*Issue Date*	*Reason for Issue*	*Made by*	*Checked by*	*Approved by*

Project no: 201201 / *Contract no:*	*Customer Doc.no:*
Jotron File Name:	*Jotron File no:*

LIST OF CONTENTS

1. STROBE LIGHT TESTS

1.1 Test specifications and sequence

The effective luminous intensity shall be at least an arithmetic mean of 0.5 cd over the entire upper hemisphere as determined below. The flash rate shall be 20 to 30 times per minute. The flash duration shall be between 10^{-6} s and 10^{-1} s.

The effective luminous intensity shall be measured at 49 points over the upper hemisphere of the satellite EPIRB. The satellite EPIRB shall be floated in a container of fresh water to determine its waterline, which shall then be marked on the body of the satellite EPIRB and used as the baseline for the following tests. The effective luminous intensity shall be measured in accordance with the following table. The arithmetic mean effective luminous intensity of all 49 points shall be at least 0,50 cd. No points shall have an effective luminous intensity of less than 0.2cd.

1.2 Test program

The effective luminous intensity, flash duration and flash rate shall be checked at the normal temperature and at the extreme temperatures. The effective luminous intensity shall be defined by the following formula as indicated in IMO Resolution MSC.81(70) – Testing of life-saving appliances, 10.4.9:

$$\frac{\int_{t_1}^{t_2} i \cdot dt}{0{,}2 + (t_2 - t_1)}$$

For 50msec pulse (t2-t1)=0,05

$$\frac{\int_{t_1}^{t_2} i \cdot dt}{0{,}25} = 4\int_{t_1}^{t_2} i \cdot dt$$

where

i is the instantaneous intensity;

0,2 is the Blondel-Rey constant;

$t_2 - t_1$ are the time limits of integration in seconds at which the intensity is i or greater.

1.3 Equipment under test

Name : **Tron 40VDR**
Ser. Nr: **075**

1.4 Test site

Jotron AS, Skoppum

1.5 Test Equipment

IL 1700 Light measuring equipment with calibration certificates.
SED033 sensor with type Y filter and type L30 lens.

1.6 Description of light test

The test site was covered inside with black textiles and the light measure equipment was mounted. The calibration factor for lux measurement was installed in the IL 1700.

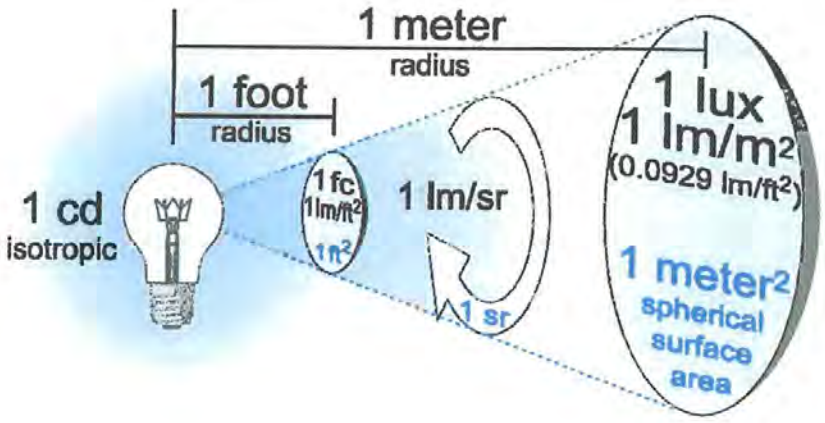


Figure 1.6 The relation between the units

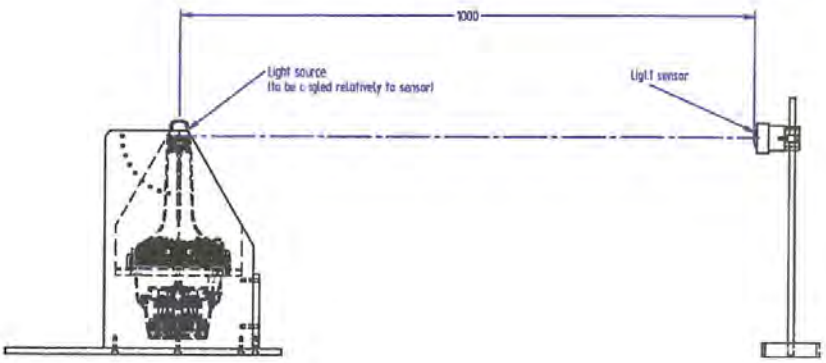
From this relation we can conclude that if we use a distance of 1 meter between the sensor and the light source, 1 lux is equivalent to 1 candela. The pulse width is 50ms.

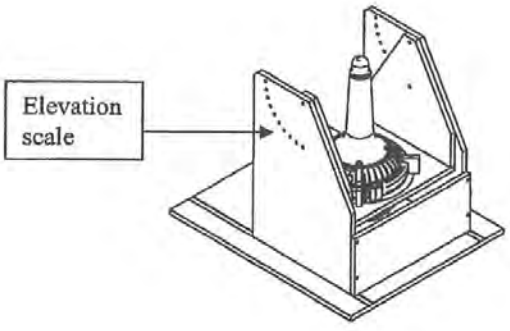
1.6.1 Conclusion

The light source of the EUT is to be placed 1 meter from the sensor. The IL 1700 is set to zero point the background lightning and to measure integrated light. The integrated light can then be measured during 4 pulses, and the final value will be directly in candela.

1.7 Test Jig drawings

The EPIRB can be set to the right elevation and rotated to the right azimuth.





1.8 Test Jig pictures

Figure 1.8a Showing test jig and light sensor with lens and a measure stick

Figure 1.8b Front of IL 1700

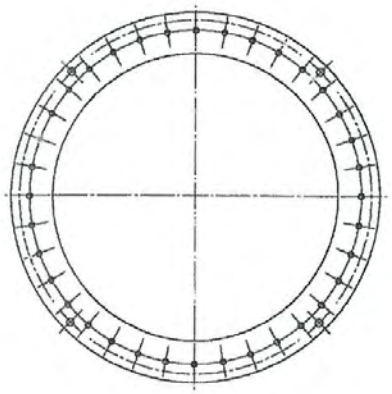


Figure 1.8c Azimuth scale

1.9 Calibration certificate

Kalibreringsbevis
Certificate of calibration

Teknologisk Institutt

Oppdragsgiver/Client Jotron AS Att.: P.boks 54 3280 TJODALYNG	Bevisnr./*Certificate no.*	12-229296
	Kalibreringsdato/*Date of calibration*	29.08.2012
	Utskriftsdato/*Date of issue*	29.08.2012
	Anb. ny kal./*Recommended due date*	29.08.2013
	Antall sider/*No. of pages*	1 av *of* 2

Kalibrert utstyr/*Calibrated equipment*

Kundens ID *Clients ID*	Fabrikat *Manufacturer*	Modell *Model*	Objekt *Object*	Serienr. *Serial no*	TI ID *TI ID*
JE-415	International Light	IL1700	Research Radiometer	4651	423565

Kalibreringsnormaler/*Calibration standards*

TI106534

Kalibreringsdata/*Calibration data*

Status/*Status*	Kal. med justering / Cal. with adjustments
Kalibreringsprosedyre/*Calibration procedure*	LP 4007
Temperatur og fuktighet/*Temperature and humidity*	23°C±2°, <70% RH

Merknader/*Comments*

Instrument er optimalisert med ny verdi for Factor Select 4.

Kalibrert av/*Calibration performed by*

Arne Figenschou

Instrumentet er kalibrert i henhold til dokumenterte prosedyrer som kan forevises på forespørsel, og mot måleenormaler som er sporbare til nasjonale eller internasjonale normaler.

This instrument is calibrated according to documented procedures which will be available upon request, and against measuring standards traceable to national or international standards.

Teknologisk Institutt as

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Besøksadresse: Kabelgaten 2, 0580 Oslo
Telefon: +47 22865000
Telefaks: +47 22734502
Org.nr. 942 340 680
E-post: firmapost@ti.no
Web: www.teknologisk.no

Kongsberg: Pb. 1019, NO-3601 Kongsberg
Stavanger: Forusbeen 10, NO-4033 Stavanger
Haugesund: Pb. 93, NO-4299 Avaldsnes
Bergen: Pb. 23, NO-5346 Ågotnes

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	Tron 40VDR	Page 8 of 10

Kalibreringsbevis
Certificate of calibration

Bevisnr. *Certificate no.* 12-229296
Side *Page* 2 av *of* 2
Dato *Date* 29.08.2012

Teknologisk Institutt

Måleprotokoll Kalibrering

Måleresultat for: Radiometer i system med hvittlysdetektor
Modell: IL1700 Research Radiometer

Detector: SED033 #8237
Filter: Y #28008
Input Optic: L30 #293

Kalibreringsutførelse.
Kompareringsmåling mot TT's referanse Radiometer.
Standard Radiometer benyttet ved komparering er identisk med International Light IL1700.

Radiometerets detektor er kalibrert mot hvittlysreferanse ved rett lysinnfall.
Kalibrering er foretatt med klasse A lyskilde
Fargetemperatur 2850 K.
Referansedetektor er cosinus korrigert for rett lysinnfall med stjerat spektral følsomhet ved 555 nm i henhold til CIE Photopic Standard.

Innstillinger for Photopic illuminance sensitivity factor vist i Kommentar.
IL1700 +5V Bias: Off, DC function

Måleresultat ved komparering.

Nominell måleverdi	Avlest Radiometer [1]	Avvik		Avlest Radiometer [2]	Avvik	
Lux	Lux	Lux	%	Lux	Lux	%
20,0	18,6	-1,4	-7,0	19,5	-0,5	-2,5
100,0	96,0	-4,0	-4,0	100	0,0	0,0
300	290	-10	-3,3	303	3	1,0
500	480	-20	-4,0	510	10	2,0
1000	980	-20	-2,0	1000	0	0,0
2000	2000	0	0,0	2000	0	0,0
3000	3050	50	1,7	3000	0	0,0
5000	4800	-200	-4,0	4900	-100	-2,0
6000	5800	-200	-3,3	5900	-100	-1,7

Måleusikkerhet.
Måleusikkerhet referanse Radiometer er ±4,8% ved dekningsfaktor k = 2.
Måleusikkerhet ved komparering er ±5%.
Input Optic Lens L30 #293 er en High Gain Lens med ±8 grader synsfelt.
Referanse detektor det kompareres mot er av type Wide Eye Diffuser med relativ spatial respons på ±30 grader.

Sporbarhet.
NIST, U.S. National Institute of Standards and Technology

Kommentar.
Før kalibrering er instrument satt til akklimatisering i romtemperatur i minst 24 timer.
[1] Måleresultat med verdier for Factor Select 4 før endring var 1,620E-7 (A) (lux-1)
[2] Måleresultat med verdier for Factor Select 4 endret til 1,511E-7 (A) (lux-1)

1.10 Light test

The flash rate of the light to be controlled.

1.10.1 Flash rate

The flash rate was: **21**

1.10.2 Test results

Test No.1: Effective luminous intensity at minus 20 degrees

Azimuth (in Degrees)	Elevation (in Degrees)								
	10	20	30	40	50	60	70	80	90
0	1,6	1,6	1,1	1,2	1,6	0,8	0,7	0,9	0,9

Table 1.10a Effective luminous intensity at minus 20 degrees

Test No.2: Effective luminous intensity at normal temperature

Azimuth (in Degrees)	Elevation (in Degrees)								
	10	20	30	40	50	60	70	80	90
0	1,6	1,5	1,2	1,3	1,7	0,8	0,7	0,9	0,8
45	1,6	1,4	1,1	1,2					
90	1,4	1,3	0,9	1,1	1,3	0,9	0,7	0,9	
135	1,5	1,2	0,9	1,2					
180	1,5	1,3	1,0	1,2	1,4	0,9	0,6	1,0	
225	1,6	1,3	1,0	1,1					
270	1,6	1,3	1,1	1,1	1,4	0,9	0,6	0,9	
315	1,6	1,4	1,1	1,2					

Table 1.10b Effective luminous intensity at normal temperature

Test No.3: Effective luminous intensity at plus 55 degrees

Azimuth (in Degrees)	Elevation (in Degrees)								
	10	20	30	40	50	60	70	80	90
180	1,4	1,3	1,0	1,1	1,4	0,8	0,6	1,0	0,8

Table 1.10c Effective luminous intensity at plus 55 degrees

1.11 Test summary

Test No.	Test	IEC 61097-2 Ed 3	Result (Pass/Fail)	Date
1	At minus 20 degrees	5.3.3.3	P	20140121
2	At normal temperature	5.3.3.3	P	20140121
3	At plus 55 degrees	5.3.3.3	P	20140121

Authorized By:

Bjørn Rishovd
Certification Manager
Jotron AS

Jotron AS
Jotron UK Ltd.
Jotron Phontech AS
Jotron Consultas AS
Jotron Asia Pte. Ltd.
Jotron USA, Inc.
UAB Jotron

Tron 40VDR

PARTICULAR DESIGN REQUIREMENTS

Reference
IEC 61996-1 ed2.0 cl. 5.2.2.2, 5.2.2.3 and 5.3.2

5.2.2.2 Light

Please see: **10062014_Jotron_Light_measurment.pdf**

5.2.2.3 Locating transmitter

The Tron 40VDR is equipped with GPS receiver with accuracy better than 4s of arc and protocols used for transmitting position is Standard Location Protocol, EPIRB with MMSI and EPIRB with Serial number, with a position resolution of 4 s of arc.
Test details can be found in report "**75924802 Report 01 Issue 3.pdf"** section 2.1 and 2.10.6

5.3.2 Float-free capsule

Tron 40VDR is transmitting the Morse letter 'V' using the homing transmitter on frequency 121.5MHz after transition of the 406 MHz signal.

Item	Requirement	Measured	Result
Dot length (one unit)	115ms ± 5%	110.6ms	Pass
Modulation frequency	1kHz ± 50Hz	988Hz	Pass
Letter length	12 units	12 units	Pass

Jotron AS
Jotron UK Ltd.
Jotron Phontech AS
Jotron Consultas AS
Jotron Asia Pte. Ltd.
Jotron USA, Inc.
UAB Jotron

Tron 40VDR

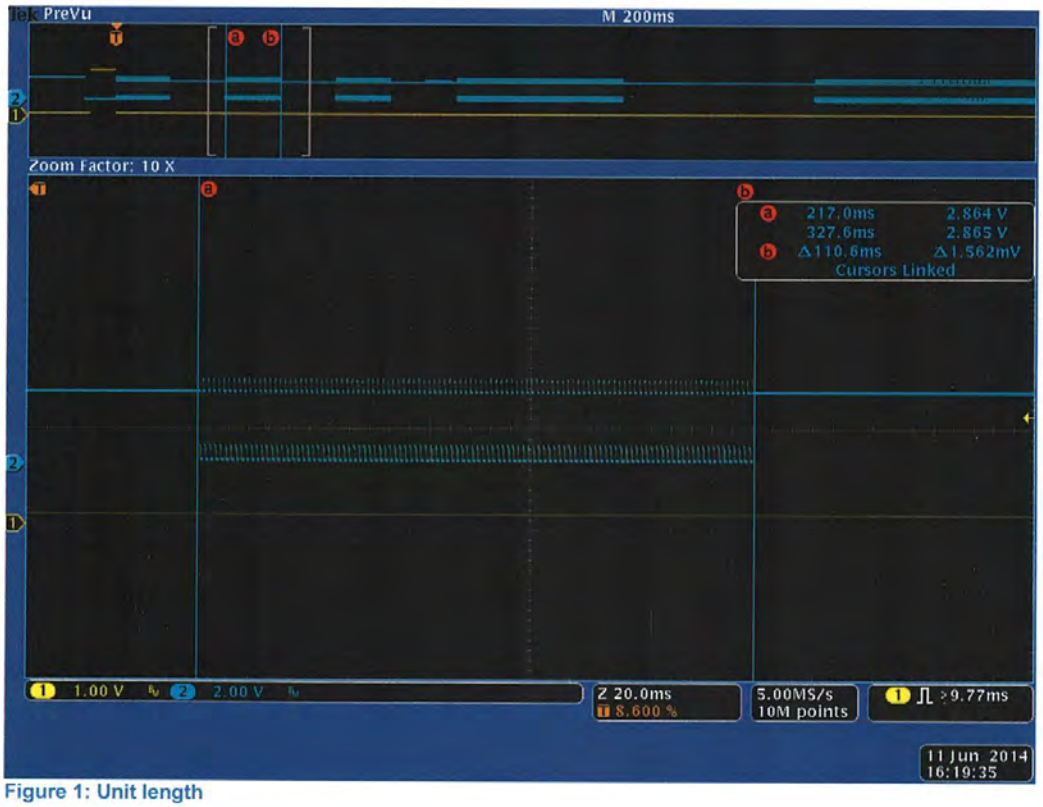

Figure 1: Unit length

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Jotron Consultas AS
Jotron Asia Pte. Ltd.
Jotron USA, Inc.
UAB Jotron

Tron 40VDR

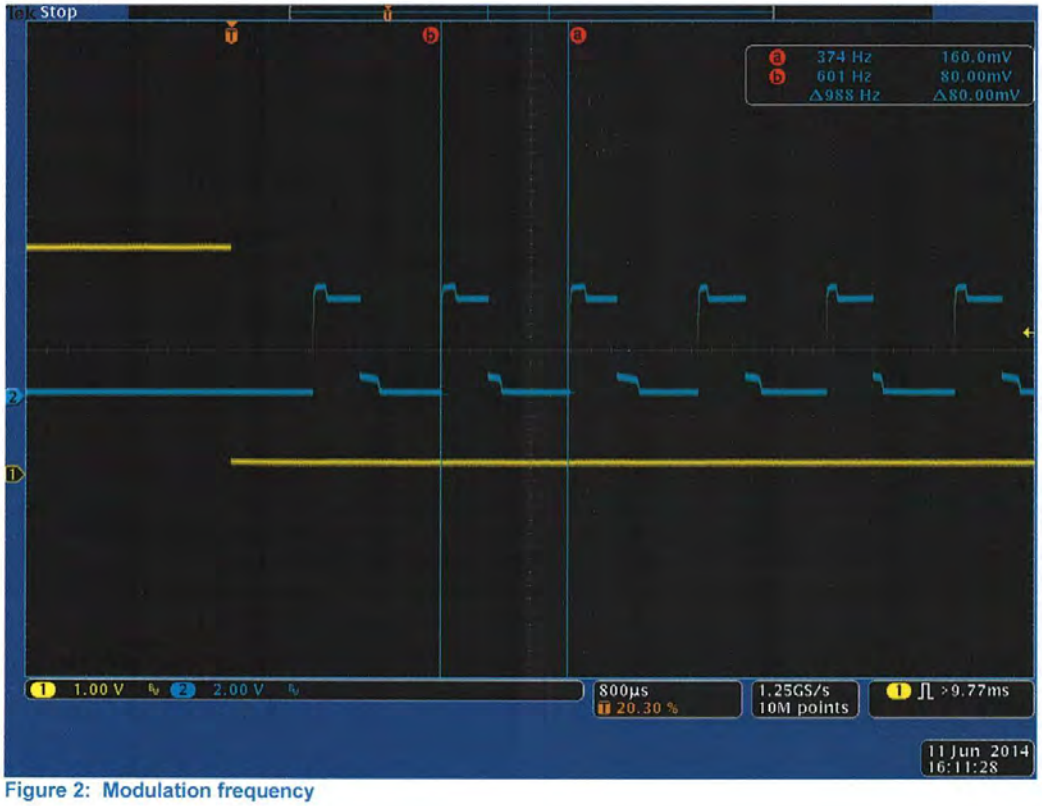

Figure 2: Modulation frequency

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Jotron Consultas AS
Jotron Asia Pte. Ltd.
Jotron USA, Inc.
UAB Jotron

Tron 40VDR

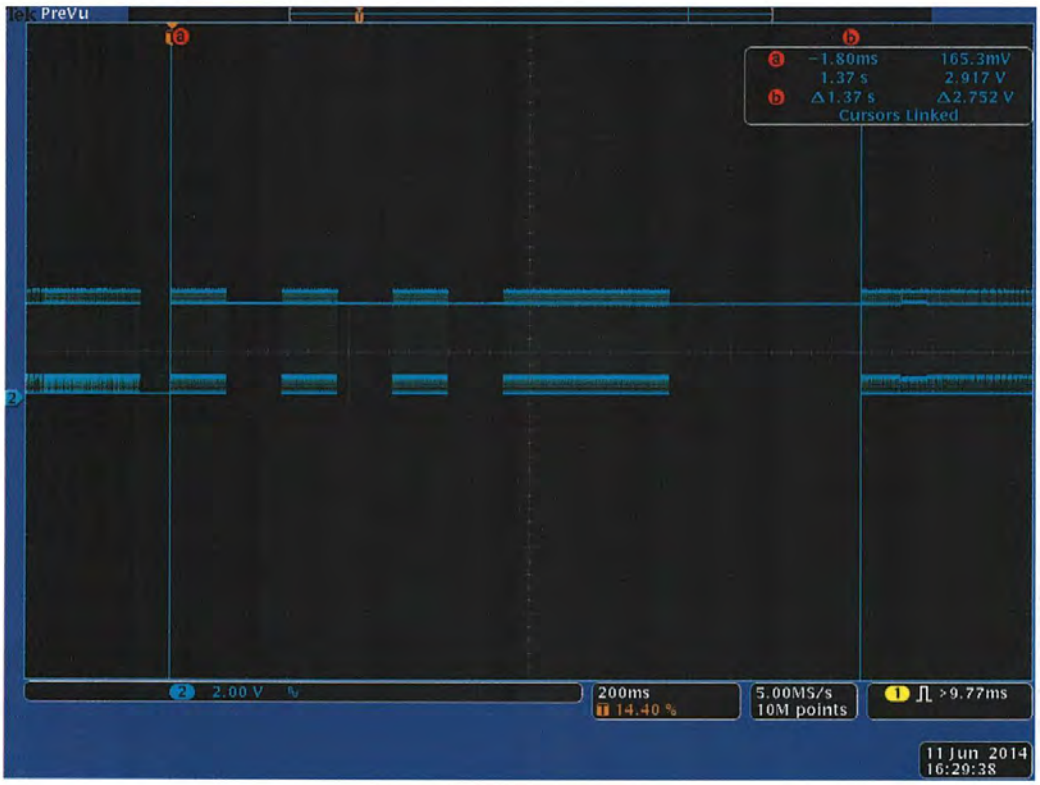

Figure 3: Letter length