

Test Report

Product	AIS Mobile Station		
Name and address of the applicant	Kongsberg Seatex AS Pirsenteret N-7462 Trondheim, NORWAY		
Name and address of the manufacturer	Kongsberg Seatex AS Pirsenteret N-7462 Trondheim, NORWAY		
Model	AIS 300		
Rating	12-24V DC		
Trademark	 KONGSBERG		
Serial number	AIS300-141001 EMC, AIS300-141005 Salt Mist. AIS300-141002 rest of Environmental tests		
Additional information	Class A AIS		
Tested according to	EN 60945 (2002)		
Order number	239117 and 253637		
Tested in period	2013-07-16 to 2014-03-19 and 2014-02-12 to 2014-03-19		
Issue date	2015-02-19		
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	 
An accredited technical test executed under the Norwegian accreditation scheme			
 Prepared by [Thomas Dangle]		 Approved by [Jon Fredrik Mo]	
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REVISIONS

Revision #	Date	Order #	Description
00	2014-01-20	239117	-
01	2014-04-22	239117, 253637	Added Environmental tests
02	2015-02-19	239117, 253637	Editional changes in table for burst/fast transients 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.

Environmental chamber uncertainties are calculated according to IEC 60068-3-11.

Uncertainty figures are found in an appendix to this report.

Further information about measurement uncertainties is provided on request.

Evaluation of measurement results are only made after adding the measurement uncertainty to the obtained measurement data, as required by chapter 6.9 of EN 60945 (2002).

The instrumentation accuracy is within limits agreed by the IECEE/CTL (ref. Nemko proc. TM-NO/404).

DESCRIPTION OF TESTED DEVICE (EUT)

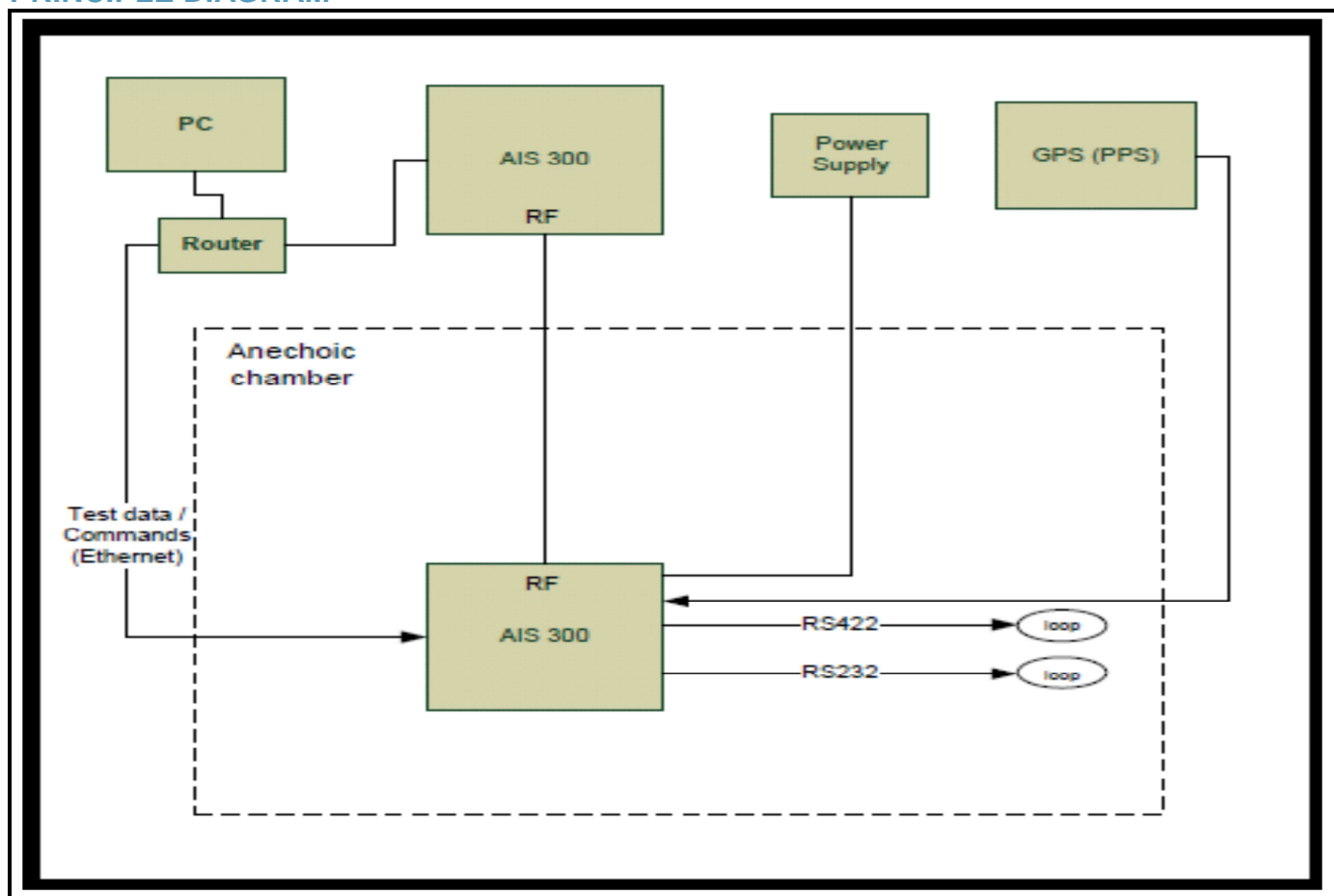
PRODUCT DESCRIPTION

The AIS 300 mobile station is a product that enables identification of other vessels, navigations aids fitted with VHF based AIS technology and virtual AIS AtoN. It contains a GPS receiver primarily used for time synchronization. It has a built-in VHF transmitter and three VHF receivers. It is designed to be a “black box” for integration towards other navigation equipment such as ECDIS/ECS and radar.

Hardware identity and/or version: AIS module; AC, IF board; Rev 3_mod

Software identity and/or version: 1.00.01b8

PRINCIPLE DIAGRAM



PRODUCT COMPONENTS

SC no.	Description	Manufacturer	Model	Serial no.
1	AIS 300	Kongsberg Seatex	AIS 300	AIS300-141001, AIS300-141002
2	GPS antenna	Procom	GPS 4	NA
3	VHF Antenna	Comrod	AV 7	NA

AVAILABLE PORTS

This equipment is fitted with the following electrical ports.

PO no.	Port Name	Port Type	Count	Comment
1	DC input	DC power input	1	/
2	RF VHF	N	1	/
3	GPS	TNC	1	/

PO no.	Port Name	Port Type	Count	Comment
4	LAN	RJ45	1	/
5	RS422	/	1	Connector P1
6	RS232	/	1	Connector P1
7	I/O	/	1	Connector P2
8	USB	A plug	1	For service only

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	DC power	Yes	/	> 3
2	RF VHF	Yes	Coaxial	> 3
3	RF GPS	Yes	Coaxial	> 3
4	LAN	No	/	> 3
5	RS422	Yes	/	> 3
6	RS232	Yes	/	> 3

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	TX and RX	AIS	Yes

ACCESSORIES APPLIED DURING TEST

AE no.	Description	Manufacturer	Model	Serial no.
1	AIS 300	Kongsberg Seatex	AIS 300	/
2	Network router	/	/	/
3	Test PC with AIS-monitoring software	/	/	/

EQUIPMENT MODIFICATIONS

The following equipment modifications were required to achieve compliance with the applied standards.

MO no.	Modification	Purpose
1	FPGA SW upgrade	Non-terminated pins (detected in connection with cold start)

ADDITIONAL INFORMATION RELATED TO TESTING

No further information.

GENERAL TEST CONDITIONS

TEST LABORATORY

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

Site	
<input checked="" type="checkbox"/> GAUSTAD	(Gaustadalleen 30, N-0314 Oslo, Norway)
<input checked="" type="checkbox"/> KJELLER	(Instituttveien 6, N-2007 Kjeller, Norway)
<input checked="" type="checkbox"/> SKAR	(Maridalsveien 621, N-0890 Oslo, Norway)

LABORATORY ACCREDITATIONS



Norsk Akkreditering – TEST 033

P06 – Electromagnetic Compatibility
P17 – Environmental Tests

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 its power connection

AMBIENT CONDITIONS

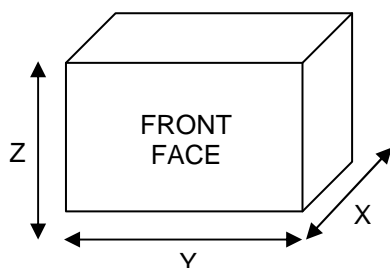
All EMC tests and measurements were performed in a shielded enclosure or in a controlled environment suitable for the tests conducted.

Normal ambient test conditions:

Ambient temperature: 20 - 23°C
Relative humidity: 20 - 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: The VHF link and LAN communication have been monitored. No failures were found.	Description: The VHF link and LAN communication have been monitored. No failures were found.	Description: The VHF link and LAN communication have been monitored. No failures were found.

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

ENVIRONMENTAL CLASSES

The following environmental classes are chosen:

Regulation	Tests	Location / Category
EN 60945	All	Protected

APPLIED TESTS

Test items	Test methods	Result
Conducted Emissions	EN 60945 (2002)	PASS
Radiated Emissions (150kHz-30MHz)	EN 60945 (2002)	PASS
Radiated Emissions (30MHz-2000MHz)	EN 60945 (2002)	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	N/A
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	N/A
Low Temperature	EN 60945 (2002) EN 60068-2-1 (2007), Ed.6.0	PASS
Dry Heat	EN 60945 (2002) EN 60068-2-2 (2007), Ed.5.0	PASS
Damp Heat	EN 60945 (2002)	PASS
Salt mist/Corrosion	EN 60945 (2002) EN 60068-2-52 (1996), Ed.2.0	PASS
Sinusoidal Vibration	EN 60945 (2002) EN 60068-2-6 (2008), Ed.6.0	PASS
Ingress Protection (IP)	EN 60945 (2002) IEC 60529 (2001), Ed.2.1	PASS
Compass Safe Distance	EN 60945 (2002) EN ISO 694 (2001)	PASS
Extreme Power Supply Conditions	EN 60945 (2002) IEC 60092-101 (1994)	PASS
Excessive Conditions	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

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 table above lists the edition of the basic standards used during testing.

Test Results

CONDUCTED EMISSIONS

TEST DESCRIPTION

Method

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

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: [EMI Receiver: Rohde&Schwarz / ESHS 10 \(N-3528\) \(06/2014\)](#)
 [LISN: Rohde&Schwarz / ESH3-Z5 \(N-3403\) \(11/2015\)](#)
 [Pulse Limiter: Rohde&Schwarz / ESH3-Z2 \(N-3932\) \(11/2014\)](#)

Comments

Spurious frequency at 280 kHz is equal to the limit.

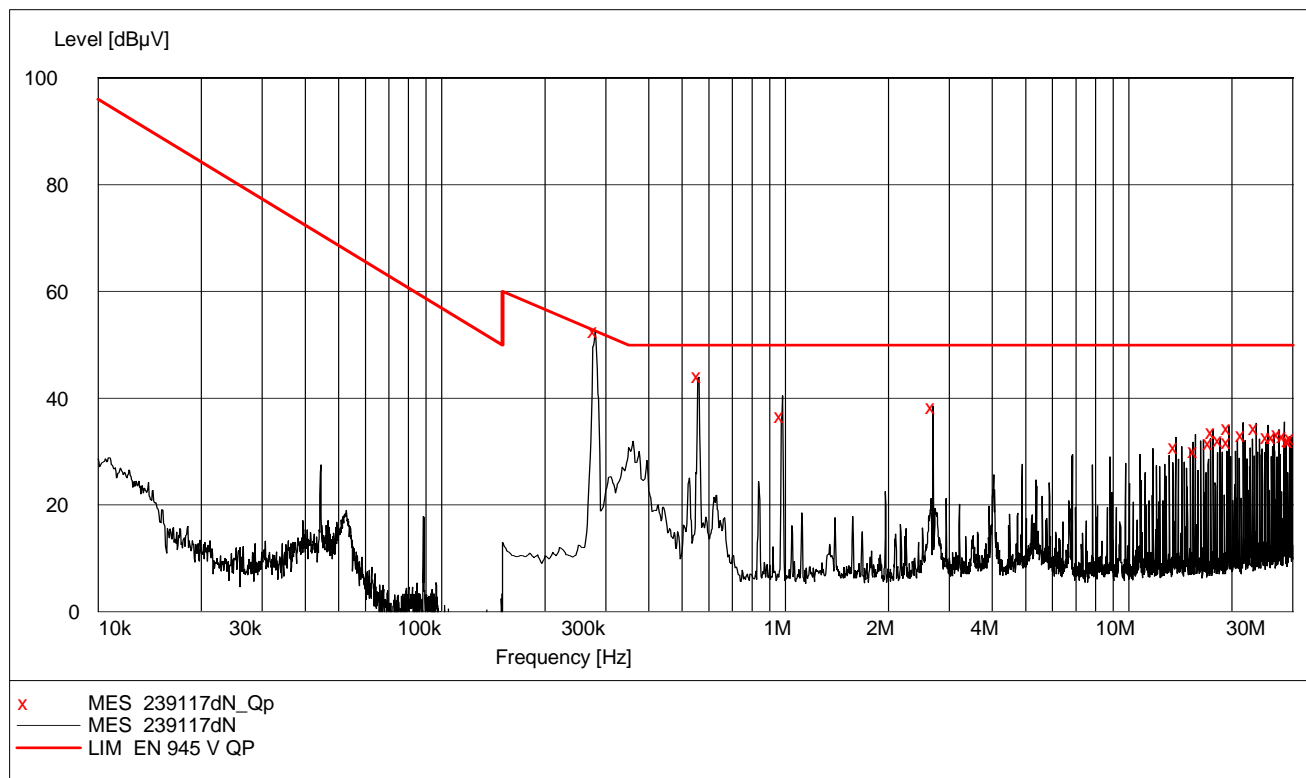
Severity

Port:	DC Port
Frequency range:	0.01 – 30 MHz
Frequency step:	100 Hz / 5 kHz
Dwell time:	100 mSec / 20 mSec
Bandwidth:	200 Hz / 9 kHz

Conformity

Verdict:	PASS
Test engineer:	BN

EMISSION SPECTRUM



Note: This preview is a merged result of all peak detector measurements carried out on this product. This preview includes measurements on all lines, but shows only the worst level at each frequency. Any quasi-peak or average detector measurements are carried out at the "worst case" wire. ("x" = quasi-peak / "+" = average. Measurement data are presented below)

QUASI PEAK DETECTOR DATA

Frequency [MHz]	Level [dBµV]	Af [dB]	Limit [dBµV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.280000	52.60	10.10	52.60	0.00	QP	-	Pass
0.560000	44.30	10.20	50.00	5.70	QP	+	Pass
0.980000	36.70	10.20	50.00	13.30	QP	+	Pass
2.690000	38.40	10.30	50.00	11.60	QP	+	Pass
13.695000	30.90	10.80	50.00	19.10	QP	+	Pass
15.650000	30.10	10.80	50.00	19.90	QP	+	Pass
17.300000	31.60	10.90	50.00	18.40	QP	-	Pass
17.610000	33.70	11.00	50.00	16.30	QP	+	Pass
18.415000	32.20	11.10	50.00	17.80	QP	-	Pass
19.530000	31.90	11.20	50.00	18.10	QP	-	Pass
19.570000	34.50	11.20	50.00	15.50	QP	+	Pass
21.520000	33.20	11.30	50.00	16.80	QP	+	Pass
23.480000	34.40	11.30	50.00	15.60	QP	+	Pass
25.435000	32.80	11.40	50.00	17.20	QP	+	Pass
26.420000	32.80	11.40	50.00	17.20	QP	+	Pass
27.400000	33.40	11.40	50.00	16.60	QP	+	Pass
28.370000	33.00	11.40	50.00	17.00	QP	+	Pass
29.355000	32.20	11.40	50.00	17.80	QP	+	Pass
29.575000	32.10	11.40	50.00	17.90	QP	-	Pass
29.850000	32.50	11.40	50.00	17.50	QP	-	Pass

RADIATED EMISSIONS(150KHZ-30MHZ)

TEST DESCRIPTION

Method

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

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: $E_{level} = E_{reading} + E_{antenna} + E_{cable}$.

Instruments used during measurement

Instrument list: EMI Receiver: Rohde&Schwarz / ESHS 10 (N-3528) (06/2014)
Antenna, loop: Rohde&Schwarz / HFH2-Z2 (LR-0285) (12/2015)

Comments

No recorded comments.

Severity

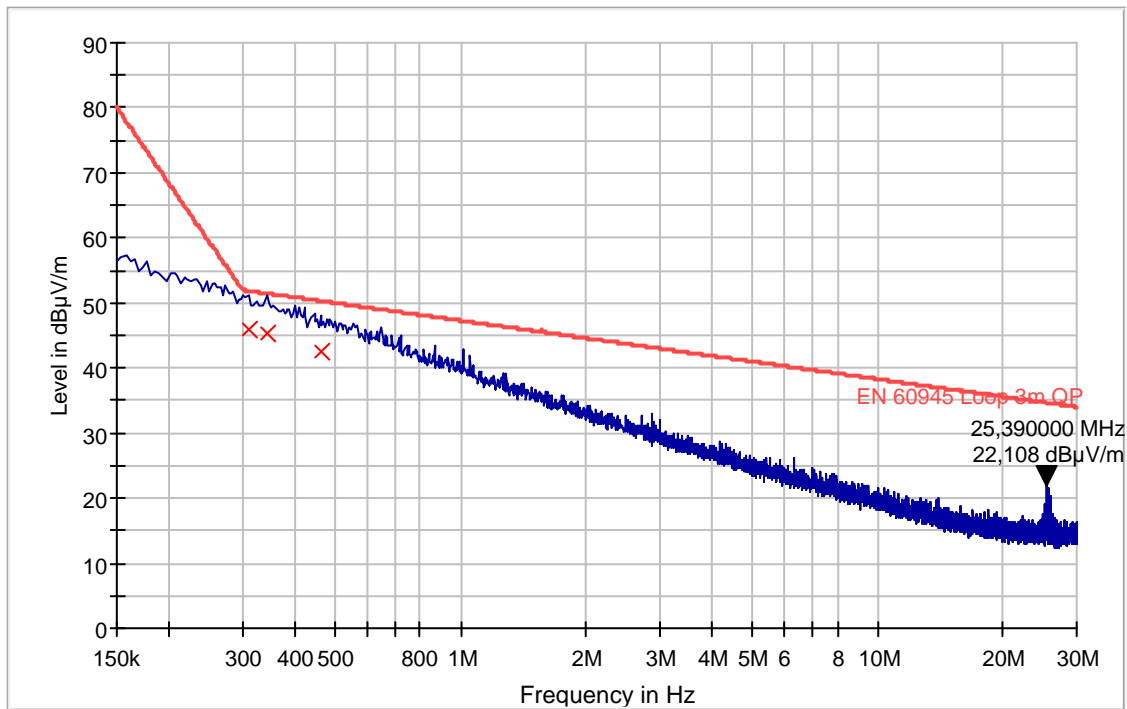
Port:	Enclosure Port
Frequency range:	150 kHz – 30 MHz
Frequency step:	5 kHz
Dwell time:	20 msec
Bandwidth:	10 kHz
Meas. distance:	3 m

Conformity

Verdict:	PASS
Test engineer:	BN

EMISSION SPECTRUM

IEC 60945 150k-30M Loop



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 [dBµV]	Corr. [dB]	Margin [dB]	Limit [dBµV]	Azimuth [deg]	Verdict [Pass/Fail]
0.310000	45.9	10.3	6.0	51.9	13.0	Pass
0.342000	45.3	10.3	6.2	51.5	159.0	Pass
0.462000	42.6	10.3	7.7	50.3	153.0	Pass

RADIATED EMISSIONS (30MHZ-2000MHZ)

TEST DESCRIPTION

Method

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

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: $E_{level} = E_{reading} + E_{antenna} + E_{cable} - E_{preamp}$.

Instruments used during measurement

Instrument list: Antenna, bilog: Sunol Sciences Inc. / JB3 (N-4525) (09/2013)
 EMI Receiver: Rohde&Schwarz / ESU40 (LR-1639) (06/2013)
 Preamplifier: Teseq / LNA 6900 (LR-1593) (N/A)

Comments

No recorded comments.

Severity

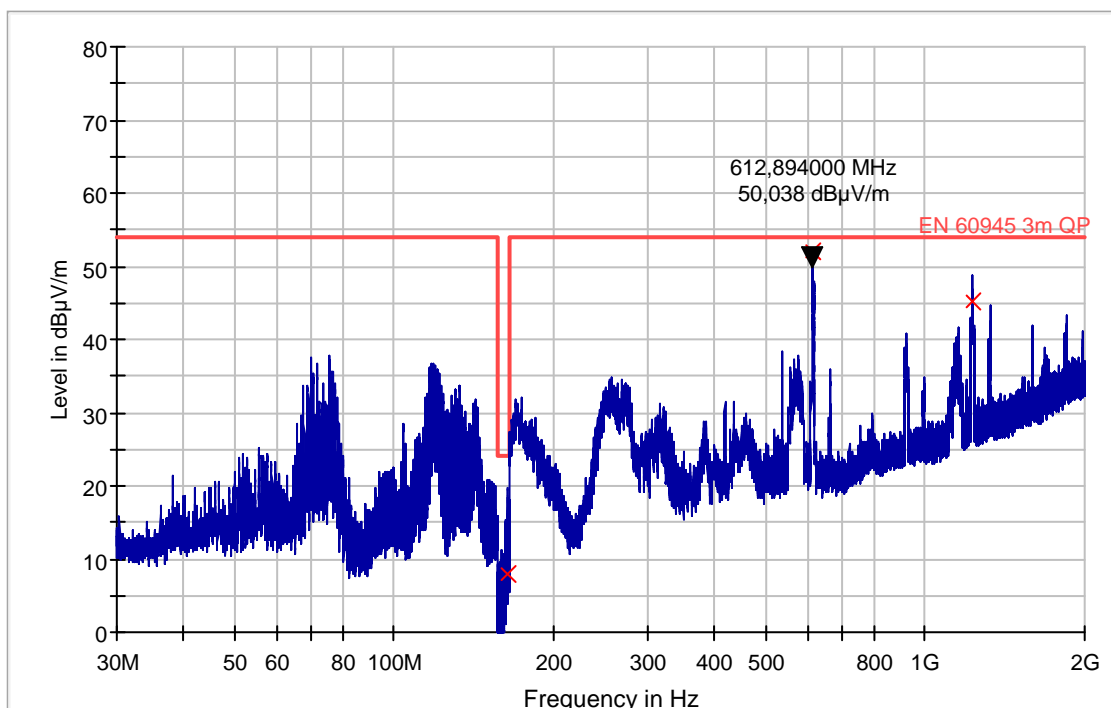
Port:	Enclosure Port
Frequency range:	30 MHz – 2000 MHz
Sweep time:	20 mSec
RBW:	120 kHz (9 kHz within 156-165MHz)
Meas. distance:	3 m

Conformity

Verdict:	PASS
Test engineer:	BN
VBW:	1 MHz
Meas. height:	100-400 cm

EMISSION SPECTRUM

IEC 60945 30-2000M 3m



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]	Corr. [dB]	Margin [dB]	Limit [dBuV/m]	Height [cm]	PoI [H/V]	Azimuth [deg]	Verdict [Pass/Fail]
163.527261	7.8	-13.1	16.2	24.0	281.0	H	248.0	Pass
612.879717	52.0	-1.2	2.0	54.0	121.0	V	77.0	Pass
1225.245410	45.1	5.9	8.9	54.0	100.0	H	180.0	Pass

ELECTROSTATIC DISCHARGES IMMUNITY

TEST DESCRIPTION

Method

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

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 80 cm (tabletop) above the reference plane, and all cables attached to the EuT are isolated in 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.

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 \(N-3355\) \(09/2014\)](#)

Comments

No recorded comments.

Severity

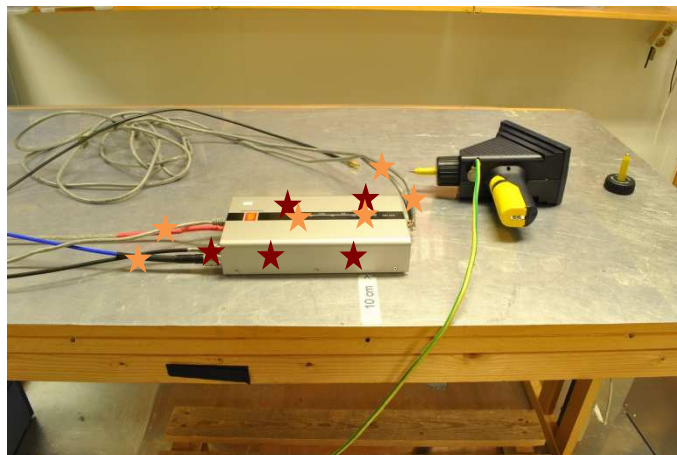
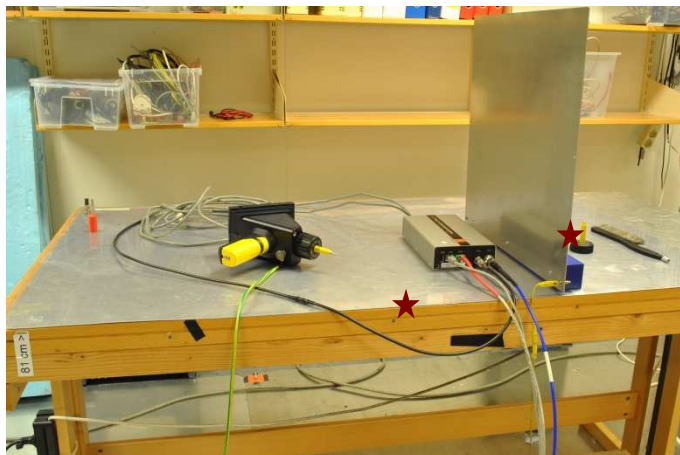
Port: [Enclosure Port](#)

Conformity

Verdict: [PASS](#)

Test engineer: [TD](#)

DESCRIPTION OF TEST POINTS



- ★ = 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
All cables	±4, ±8	Air	10	B	A	PASS
P1/P2 connectors	±4, ±8	Air	10	B	A	PASS
Metal connectors	±4, ±6	Contact	10	B	A	PASS
Housing	±4, ±6	Contact	10	B	A	PASS
Metal screws	±4, ±6	Contact	10	B	A	PASS
HCP	±4, ±6	Contact	10	B	A	PASS
VCP	±4, ±6	Contact	10	B	A	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.

Set-up

The tests are performed at 3 meter antenna distance in an anechoic chamber. EuT is placed on a wooden table 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.

Instruments used during measurement

Instrument list:

- Amplifier, GF: Amplifier Research / 120S1G4M3 (LR-1595) (N/A)
- Amplifier, RF: Amplifier Research / 500W100A (LR-1354) (N/A)
- Antenna Horn: EMCO / 3115 (N-3452) (N/A)
- Antenna Log-periodic: Rohde&Schwarz / HL 023A1 (LR-0282) (N/A)
- Field Probe: Amplifier Research / FP4080 (LR-1424) (06/2014)
- Generator, RF: Rohde&Schwarz / SMB100A (LR-1603) (04/2014)
- Power Meter: Rohde&Schwarz / NRVD 857.8008.02 (LR-1347) (03/2014)
- Probe, RF: Rohde&Schwarz / NRV-Z5 (LR-1372) (01/2015)
- Probe, RF: Rohde&Schwarz / NRV-Z5 (LR-1371) (01/2014)

Comments

No recorded comments.

Severity

Port:	Enclosure Port
Frequency range:	80 MHz – 2000 MHz
Step size:	1% log
Dwell time:	3 sec
Modulation:	AM 80% @ 400 Hz
Field generation:	Testing has been performed in an anechoic chamber using antennas to apply the field

Conformity

Verdict:	PASS
Test engineer:	TD

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	0°	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.

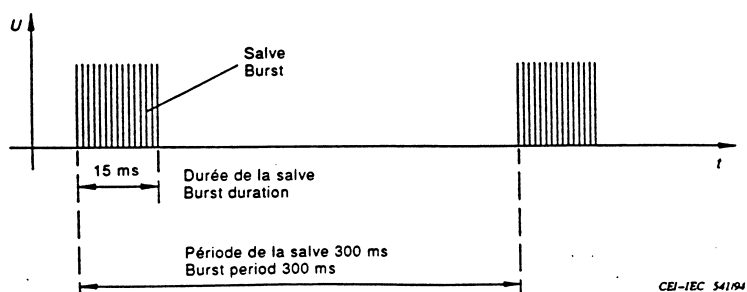
Set-up

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: Coupling Clamp, EFT/B: Haefely / IP4A (LR-1638) (04/2014)
Generator: EM Test AG / UCS 500 N7 (LR-1608) (05/2014)

Comments

No recorded comments.

Severity

Port: DC input, RF, GPS, LAN and I/O-port
Duration: 5min each polarity

Conformity

Verdict: PASS
Test engineer: TD

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
DC power input Port (N+L+PE)	±0.5	CDN	B	A	PASS
DC power input Port (N+L+PE)	±1	CDN	B	A	PASS
Signal Port (RF)	±0.5	CLAMP	B	A	PASS
Signal Port (RF)	±1	CLAMP	B	A	PASS
Signal Port (GPS)	±0.5	CLAMP	B	A	PASS
Signal Port (GPS)	±1	CLAMP	B	A	PASS
Signal Port (LAN)	±0.5	CLAMP	B	A	PASS
Signal Port (LAN)	±1	CLAMP	B	A	PASS
Signal Port (I/O)	±0.5	CLAMP	B	A	PASS
Signal Port (I/O)	±1	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.

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:

- Amplifier, RF: Amplifier Research / 75A250 (N-3816) (N/A)
- Amplifier, RF: Amplifier Research / 75A250 (N-3883) (N/A)
- Attenuator: Narda Safety Test Solutions GmbH / FSCM 99899 769-6 (N-4189) (N/A)
- CDN: Teseq / CDN-M3-16 (LR-1653) (N/A)
- EM Clamp: FCC / F-2031-23mm (LR-1482) (N/A)
- Generator, RF: Rohde&Schwarz / SMY 02 (N-3936) (05/2015)
- ISN 4-wire: Rohde&Schwarz / ENY41 (LR-1452) (N/A)
- Network Coupling/decoupling: FCC / FCC-801-M2-16 (LR-1312) (N/A)
- Power Meter: Agilent Technologies / EPM E4419B (N-4459) (10/2013)

Comments

No recorded comments.

Severity

Port:	DC input, RF, GPS, LAN and I/O
Frequency range:	150 kHz – 80 MHz
Step size:	1% log
Dwell time:	3 sec
Modulation:	AM 80% @ 400 Hz

Conformity

Verdict:	PASS
Test engineer:	TD

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
DC Input Port	CDN-M3	CDN-M3	10	A	A	PASS
RF Port	EM CLAMP	CDN-M3	10	A	A	PASS
GPS Port	EM CLAMP	CDN-M3	10	A	A	PASS
I/O Port	EM CLAMP	CDN-M3	10	A	A	PASS
LAN	ISN- ENY41	CDN-M3	10	A	A	PASS

CONCLUSION

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

DIPS AND INTERRUPTIONS IMMUNITY

TEST DESCRIPTION

Method

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

Set-up

Only the general laboratory conditions apply. No special requirements are defined for the configuration of the EuT. The DC power input of the EuT is connected to a DC power supply. The interruptions are generated as defined below.

Procedure

The duration of each interruption is 60 sec and EuT was given at least 60 seconds periods to recover between each test.

Instruments used during measurement

Instrument list: DC Lab Power supply

Comments

The EUT shuts down when power-off occurred and reboots itself at power-on. But the communication link to the test PC has to be established by the operator. No damage detected.

Severity

Port: DC Input Port
 Intervals: 60 sec
 Repetitions: 3 times

Conformity

Verdict: PASS
 Test engineer: TD

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.

Voltage Reduction	Voltage Level		Periods	Phase Angle [deg]	Required Criteria	Complied Criteria	Result
	Nominal	Test					
100% Interruption	24 V	0	60sec	-	C	C	PASS

CONCLUSION

The EUT shuts down when power-off occurred and reboots itself at power-on. But the communication link to the test PC has to be established by the operator.

LOW TEMPERATURE

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 standard

IEC 60945 (2002) Ed.4; Maritime navigation and radiocommunication equipment and systems §

8.4.2 Functional tests

8.4.2.4 Method of test (protected equipment)

Procedure

The EUT shall be placed in a chamber at normal room temperature and relative humidity. The temperature shall then be reduced to, and maintained at $-15^{\circ}\text{C} \pm 3^{\circ}\text{C}$, for a period of 10 h to 16 h. Any climatic control devices provided in the EUT may be switched on at the conclusion of this period. The EUT shall be switched on 30 min later, or after such period as agreed by the manufacturer, and shall be kept operational for at least 2 h during which period the EUT shall be subjected to a performance check test and check as specified in the relevant equipment standard. The requirements of the performance test and check shall be met.

Instruments used during test

Instrument list: Climatic Chamber: Vötsch / VC 4100 (N-4343) (12/2014)
DC Power Supply: TTi CPX400DP (N-4595)
Multimeter: Fluke / 289 (N-4645) (04/2014)

Comments

No recorded comments.

Severity

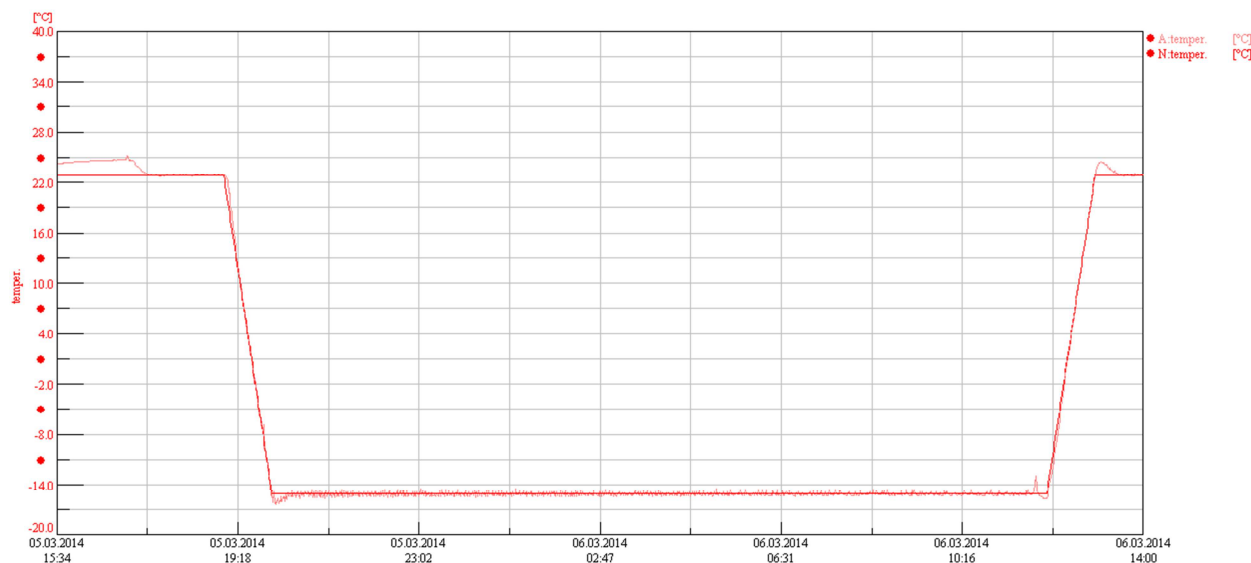
Temperature: -15°C
Duration: 16 hours

Conformity

Verdict: PASS
Test engineer: Steinar Jensen

DETAILED TEST LOG

DOFFEN [no6] prog.68-2-1 -15C 16h arch.:Kongsberg Cold start:Admin 5.3.2014 15:34 stop: ----
Cold EN/EC 60945 -15°C 16h



CONCLUSION

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

DRY HEAT

TEST DESCRIPTION

Method

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

Tests Bd: Dry heat tests for heat-dissipating specimens with gradual change of temperature.

Reference standard

IEC 60945 (2002) Ed.4; Maritime navigation and radiocommunication equipment and systems § 8.2.2 Functional test (portable, protected and exposed equipment)

Procedure

The EUT shall be placed in a chamber at normal room temperature and relative humidity. The EUT and, if appropriate, any climatic control devices with which it is provided shall then be switched on. The temperature shall then be raised to and maintained at $+55\text{ °C} \pm 3\text{ °C}$. At the end of a soak period of 10 h to 16 h at $+55\text{ °C} \pm 3\text{ °C}$, the EUT shall be subjected to a performance test and check as specified in the relevant equipment standard (see 7.1). The temperature of the chamber shall be maintained at $+55\text{ °C} \pm 3\text{ °C}$ during the whole performance test period. At the end of the test, the EUT shall be returned to normal environmental conditions.

The requirements of the performance test and check shall be met.

Instruments used during measurement

Instrument list: Climatic Chamber: Vötsch / VC 4100 (N-4343) (12/2014)
DC Power Supply: TTI CPX400DP (N-4595)
Multimeter: Fluke / 289 (N-4645) (04/2014)

Comments

No comments.

Severity

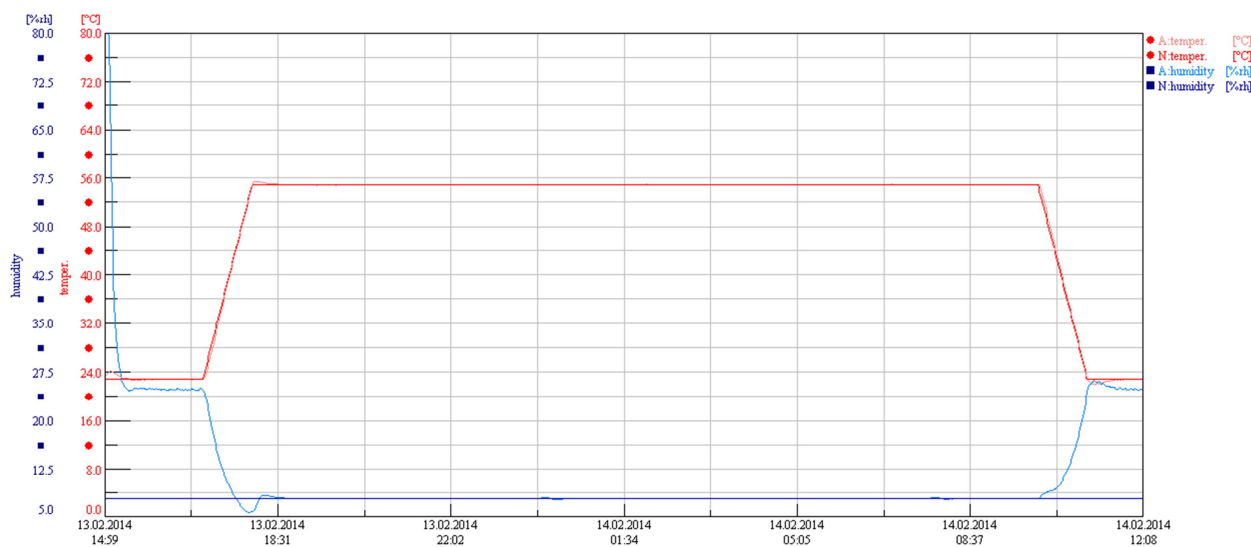
Temperature: +55°C
Duration: 16 hours

Conformity

Verdict: PASS
Test engineer: Steinar Jensen

DETAILED TEST LOG

DOFFEN [no6] prog.68-2-2.55C 16h arch.:253637 Kongsberg Seatex Dry Heat start:Admin 13.2.2014 14:59 stop:----
+55°C 16h



CONCLUSION

No malfunction was observed during the exposure, the function of the specimen was found OK during the last hour of the exposure and after recovery.

DAMP HEAT

TEST DESCRIPTION

Method

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

Reference standard

IEC 60945 (2002) Ed.4; Maritime navigation and radiocommunication equipment and systems § 8.3.1
Functional test (portable, exposed and submerged equipment)

Procedure

The EUT shall be placed in a chamber at normal room temperature and relative humidity. The temperature shall then be raised to $+40\text{ °C} \pm 2\text{ °C}$, and the relative humidity raised to $93\% \pm 3\%$ over a period of $3\text{ h} \pm 0,5\text{ h}$. These conditions shall be maintained for a period of 10 h to 16 h. Any climatic control devices provided in the EUT may be switched on at the conclusion of this period. The EUT shall be switched on 30 min later, or after such period as agreed by the manufacturer, and shall be kept operational for at least 2 h during which period the EUT shall be subjected to a performance check as specified in the relevant equipment standard. The temperature and relative humidity of the chamber shall be maintained as specified the whole test period. At the end of the test period and with the EUT still in the chamber, the chamber shall be brought to room temperature in not less than 1 h. At the end of the test the EUT shall be returned to normal environmental conditions.

Instruments used during measurement

Instrument list: Climatic Chamber: Vötsch / VC 4100 (N-4343) (12/2014)
 DC Power Supply: TTI CPX400DP (N-4595)
 Multimeter: Fluke / 289 (N-4645) (04/2014)

Comments

No recorded comments.

Severity

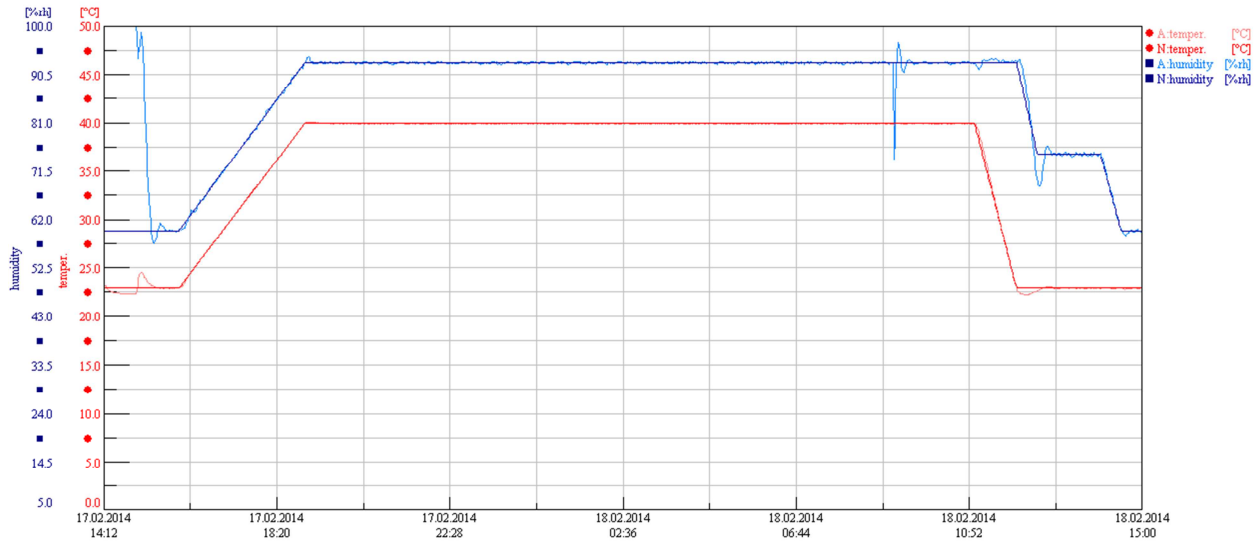
Temperature: 40°C
Humidity: 93%rh
Duration: 16 hours

Conformity

Verdict: PASS
Test engineer: Steinar Jensen

DETAILED TEST LOG

DOFFEN [no6] prog.60945 Damp.Heat arch.253637 Kongsberg Seatex.Damp Heat start:Admin 17.2.2014 14:12 stop: ----
 Damp Heat EN/IEC 60945 40°C 93%RH 16h



CONCLUSION

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

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)

Procedure

The specimen was subjected 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 ± 2 °C and a relative humidity between 90% and 95%.

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) (01/2015)
 Climatic Chamber: Vötsch / VC 4100 (N-4344) (05/2014)

Comments

No comments.

Severity

One cycle consist of:

Duration salt spray:	2h
Temperature <small>Salt spray chamber:</small>	25 °C ± 10 °C
Duration humidity:	7 days
Temperature <small>Humidity chamber:</small>	40°C ± 2°C
RH <small>Humidity chamber:</small>	90% to 95% RH
Salt compound dissolved in 19 litre of demineralized water:	1kg NaCl
Number of cycles:	4 cycles

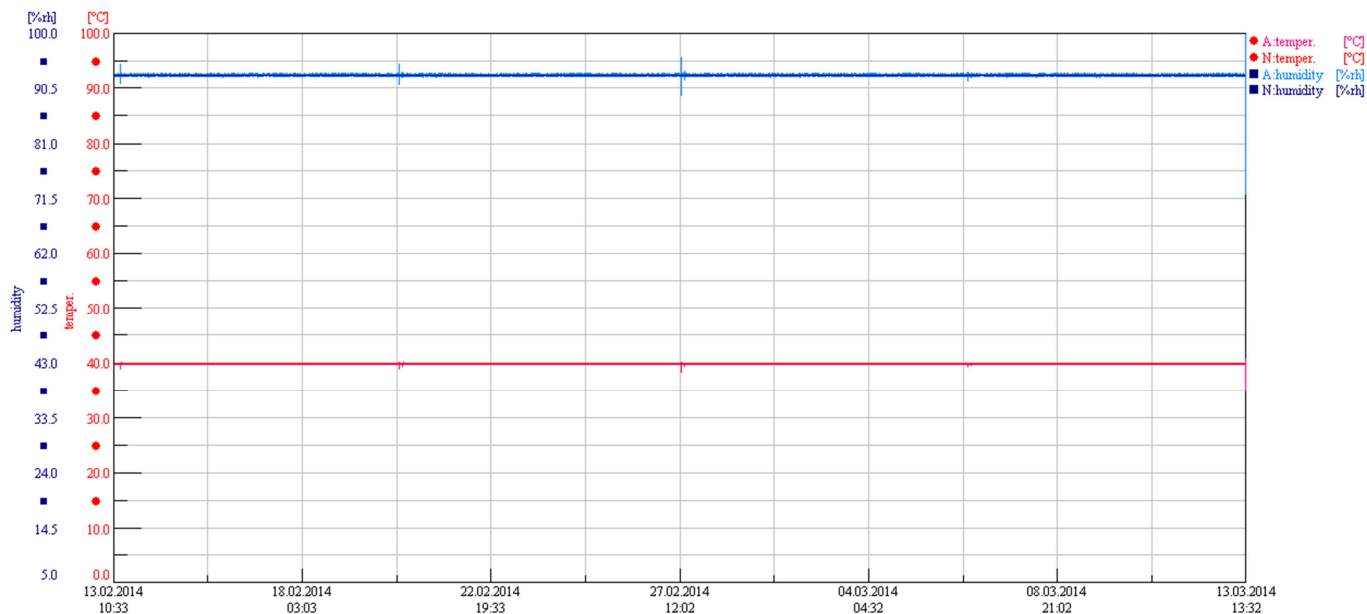
Conformity

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

DETAILED TEST LOG

Temperature and humidity log in the climatic chamber, 4x7 days.

DOLE [no] prog.---- arch. Salt mist start:Admin 13.2.2014 10:33 stop: Admin 10.3.2014 14:36
40°C 93%RH



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.

VIBRATION (SINUSOIDAL WITH RESONANCE SEARCH)

TEST DESCRIPTION

Method

EN 60068-2-6 (2008) Test Fc: Vibration (sinusoidal)

Reference standard

IEC 60945 (2002)

State of the specimens during conditioning

The specimen was mounted by its normal means of attachment in accordance with the manufacturer's instructions to a rigid fixture. The specimen was energized and in normal operational mode during the test.

Procedure

- Sweep from 5Hz to 13.2Hz 2mm (p-p). 13.2Hz to 100Hz with $\pm 0.7gn$.
- Endurance duration in case of no resonance condition, 120 minutes at 30 Hz, or at one detected frequency.
- Endurance duration at each resonance frequency at which $Q \geq 5$ is recorded - 120 minutes;
- During the vibration test, functional tests are to be carried out;
- Tests to be carried out in three mutually perpendicular planes:

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

Intermediate Measurements

During the endurance tests, the operation of the specimen was monitored.

Final measurements

After the endurance tests a functional test was carried out.

Instruments used during measurement

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

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: $\pm 0.7gn$
Number of axes:	3 mutually perpendicular axes
Endurance criteria:	Endurance at resonances $\geq 5 :1$ (if no resonance, then 30Hz.)
Endurance duration:	120 minutes at each recorded frequency

Conformity

Verdict:	PASS
Test engineer:	Steinar Jensen

RESONANT POSITIONS

Sweep No.	Axis	Accelerometer position	Channel no.	Critical frequency	
				Amp. factor	Frequency (Hz)
1	X	Slip table (control)	1	N/A	N/A
		EUT	2	-	-
2	Y	Slip table (control)	1	N/A	N/A
		EUT	2	-	-
3	Z	Slip table (control)	1	N/A	N/A
		EUT	2	-	-

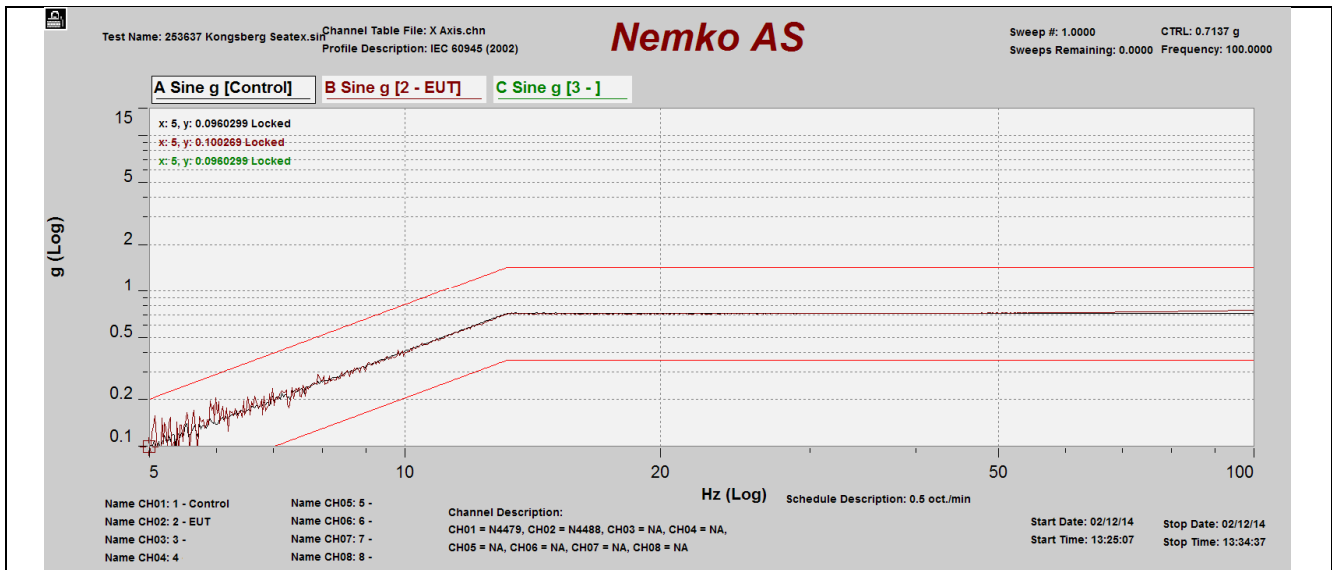
ENDURANCE TEST LOG

Axis	Frequency	Duration	Functional test	Result
X	30Hz	120min	Before, during and after test	PASS
Y	30Hz	120min	Before, during and after test	PASS
Z	30Hz	120min	Before, during and after test	PASS

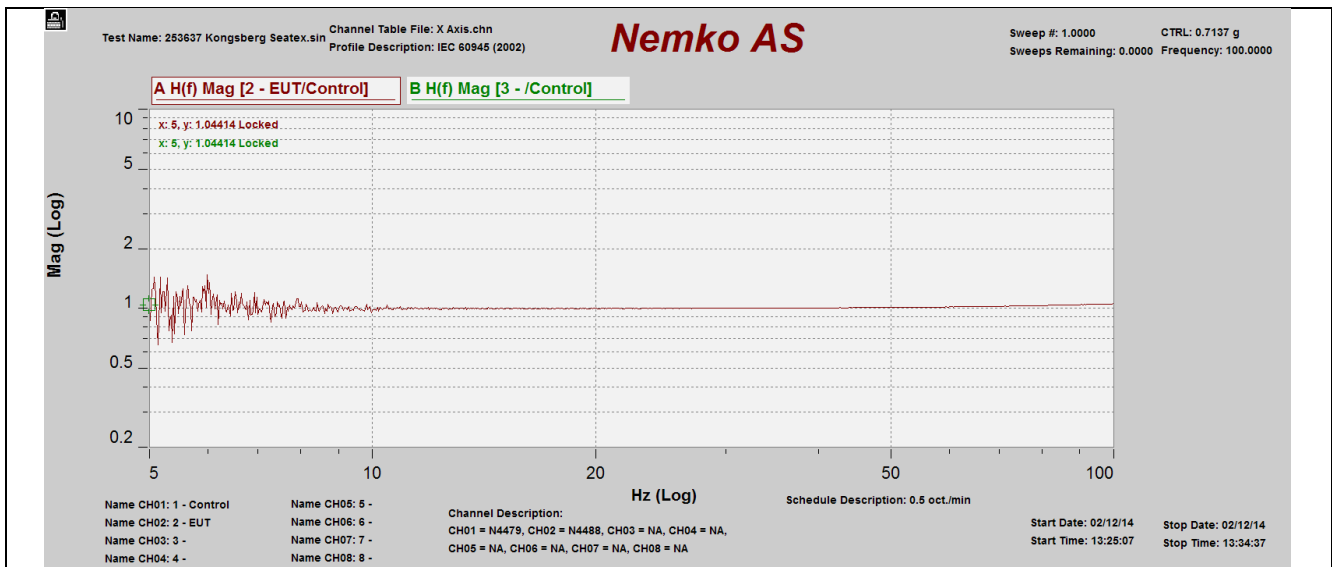
CONCLUSION

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

Sweep no.1 X Axis



Sweep profile



Amplification factor



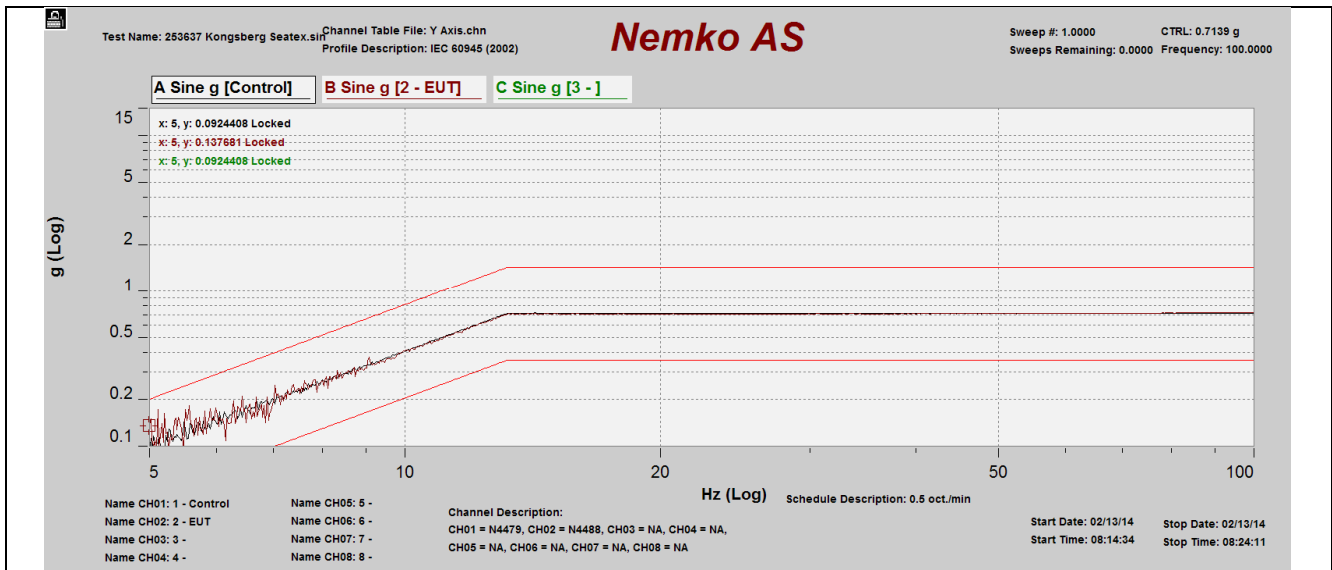
Ch. 1



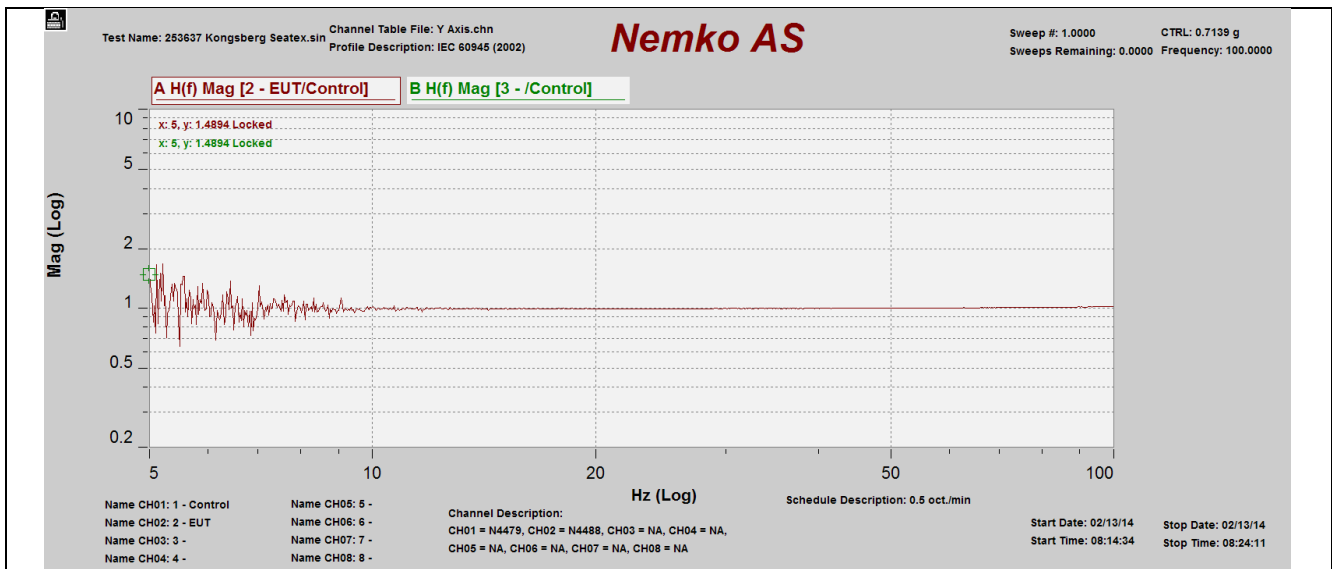
Ch. 2

Accelerometer positions

Sweep no.2 Y Axis



Sweep profile



Amplification factor



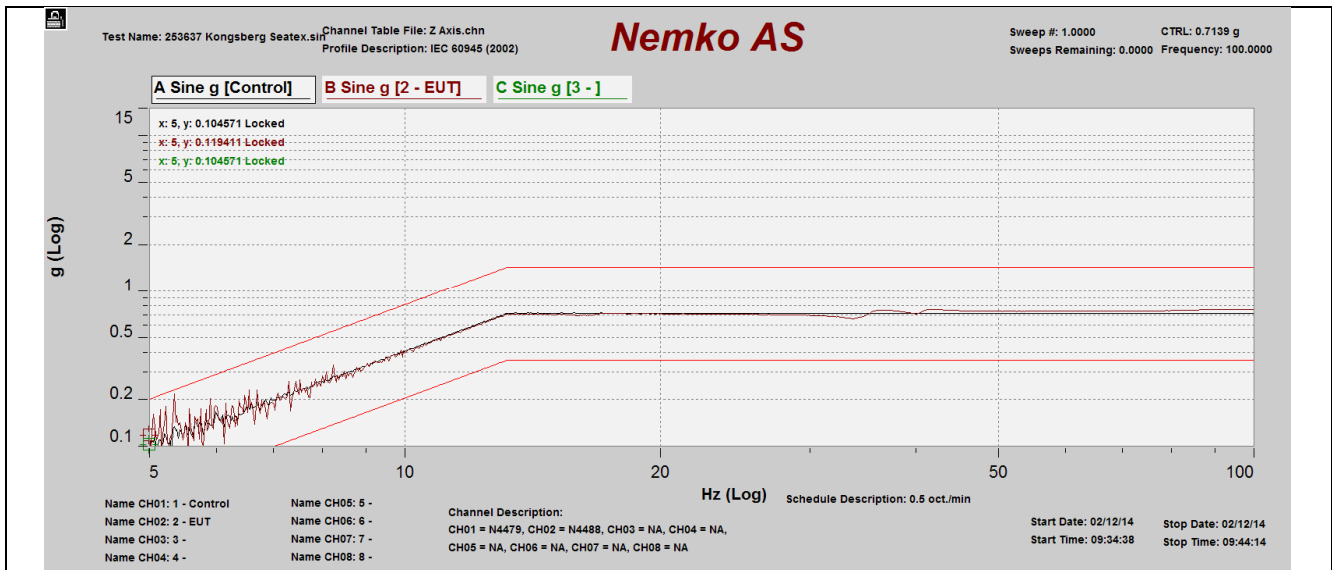
Ch. 1



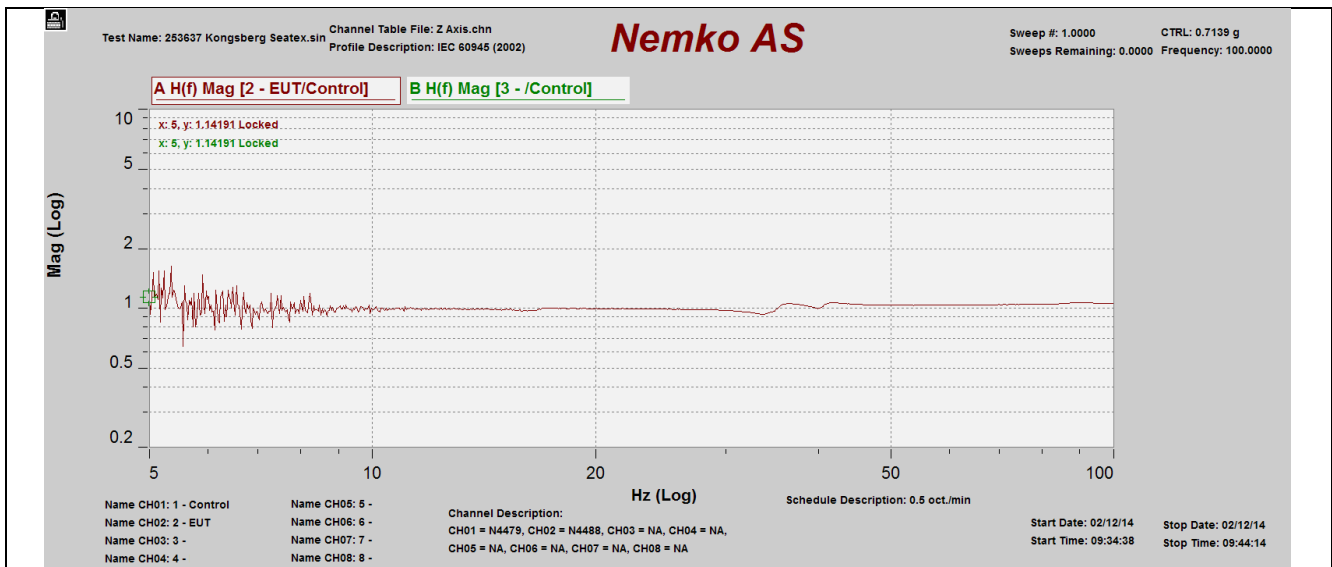
Ch. 2

Accelerometer positions

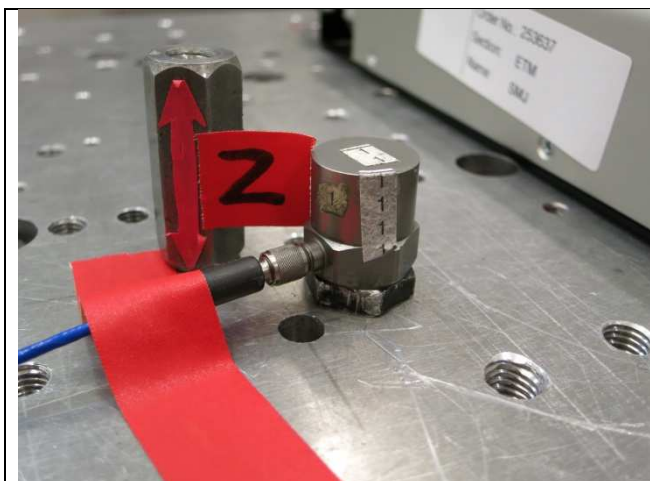
Sweep no.3 Z Axis



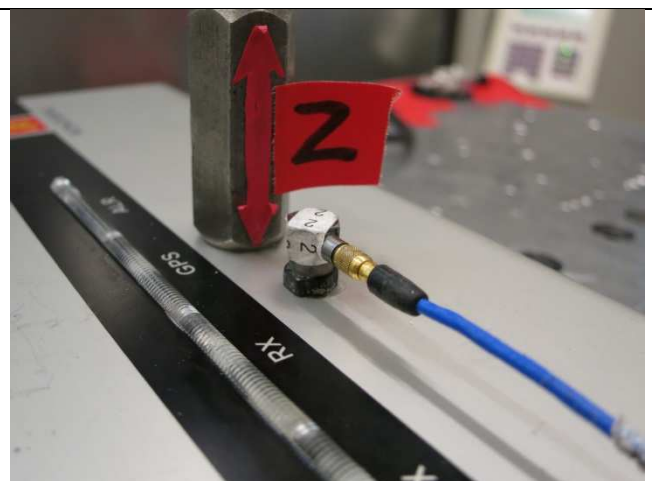
Sweep profile



Amplification factor



Ch. 1



Ch. 2

Accelerometer positions

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 $\varnothing=12\text{mm}$, Ljungmann (N-3525) (02/2016)

Comments

No recorded comments.

Severity

IP numeral:

IP 2X

Conformity

Verdict:

PASS

Test engineer:

Steinar Jensen

CONCLUSION

The finger probe did not penetrate.

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

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 N4551](#)

Comments

No recorded comments.

Conformity

Test engineer: [Roger Berget](#)

DETAILED TEST LOG

Condition	Standard Compass	Other Compass	Strongest Direction
Non-energized	11 cm	5 cm	Top
Non-energized after magnetisation	-	-	-
Energized and operating	18 cm	11 cm	Front

CONCLUSION

Based on the above measurements the overall Compass Safe Distance is considered to be = 20 cm

EXTREME POWER SUPPLY CONDITIONS

TEST DESCRIPTION

Method

-

Reference

EN 60945 (2002) §7.1

Procedure

Performance checks/tests have been performed at normal and at extreme power supply conditions prior to the environmental conditioning and then repeated after the Dry Heat test, the Damp Heat test and the Low Temperature test, as specified below.

The checks/tests were performed at extreme conditions as specified:

Power supply	Voltage variation [%]	Frequency variation [%]
AC	± 10	± 5
DC	+ 30 / - 10	Not applicable

Instruments used during measurement

Instrument list: DC Power Supply: TTi CPX400DP (N-4595)
Multimeter: Fluke / 289 (N-4645) (04/2014)

Comments

No recorded comments.

Severity

Vnom: 12-24V DC
Fnom: N/A

Conformity

Verdict: PASS
Test engineer: Steinar Jensen

DETAILED TEST LOG

Condition	Voltage	Frequency	Action	Result
Dry heat	12-24	N/A	Performance test	PASS
Dry heat	15.6-31.2	N/A	Performance check	PASS
Dry heat	10.8-21.6	N/A	Performance check	PASS
Damp heat	12-24	N/A	Performance check	PASS
Cold	12-24	N/A	Performance test	PASS
Cold	15.6-31.2	N/A	Performance check	PASS
Cold	10.8-21.6	N/A	Performance check	PASS
Normal temperature	12-24	N/A	Performance test	PASS
Normal temperature	15.6-31.2	N/A	Performance test	PASS
Normal temperature	10.8-21.6	N/A	Performance test	PASS

CONCLUSION

Proper performance was verified during normal and extreme power supply conditions at all the required test points

EXCESSIVE CONDITIONS

TEST DESCRIPTION

Method

-

Reference

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.

Instruments used during measurement

Instrument list: DC Power Supply: TTI CPX400DP (N-4595)
Multimeter: Fluke / 77 (N-2116) (12/2014)

Comments

No recorded comments.

Severity

Vnom: 24V DC
Excessive voltage: 34V DC

Conformity

Verdict: PASS
Test engineer: Steinar Jensen

DETAILED TEST LOG

Test Condition	Nominal	Excessive	Response Description	Result
Excessive Voltage	24V DC	34V DC	Normal Response	PASS
Reverse Polarity	24V DC	34V DC	No Response	PASS
Improper Phase Sequence	-	-	-	-

CONCLUSION

The protection was verified to be compliant 34V DC, which is considered as the upper limit by the manufacturer.

Annexes

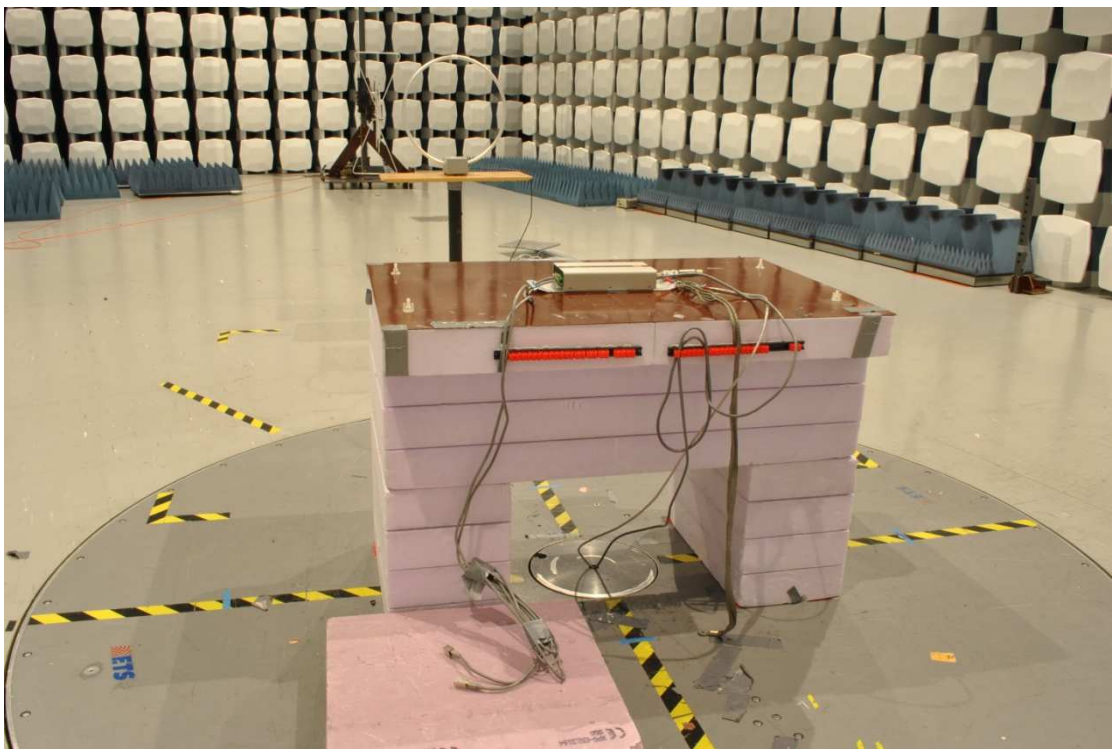
UNCERTAINTY FIGURES

Measurement	Uncertainty
Conducted Emissions	AMN: ± 3.8 dB (9 kHz – 150 kHz) ± 3.5 dB (150 kHz – 30 MHz) Voltage Probe: ± 2.7 dB (150 kHz – 30 MHz) Current Probe: ± 2.7 dB (150 kHz – 30 MHz) ISN: ± 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	$\pm 7.1\%$
Flicker	$\pm 7.7\%$
Electrostatic Discharges	$\pm 10\%$ (peak voltage) $\pm 30\%$ (pulse shape)
Radiated RF Field	± 2.4 dB
Electric Fast Transients	$\pm 10\%$ (peak voltage) $\pm 30\%$ (pulse shape)
Surge	$\pm 10\%$ (peak voltage) $\pm 30\%$ (rise time) $\pm 20\%$ (duration)
Conducted RF Disturbance	± 2.8 dB (150 kHz – 26 MHz) ± 3.7 dB (26 MHz – 80 MHz)
Power Frequency Magnetic Field	$\pm 2\%$
Dips/Interruptions	$\pm 5\%$ (voltage) $\pm 10\%$ (zero crossing control) $\pm 10^\circ$ (phase relationship)
Acoustic Noise	± 1 dB
Vibration	$\pm 5.6\%$ (acceleration) $\pm 0.01\%$ (frequency)
Temperature	± 2.5 K
Humidity	$\pm 6\%$ Rh
Voltage	$\pm 1.5\%$
Frequency	$\pm 0.2\%$
The instruments specified are subject to periodic calibrations and internal controls. This ensure, with a 95 percent confidence level, that the instruments remain within the calibrated levels.	

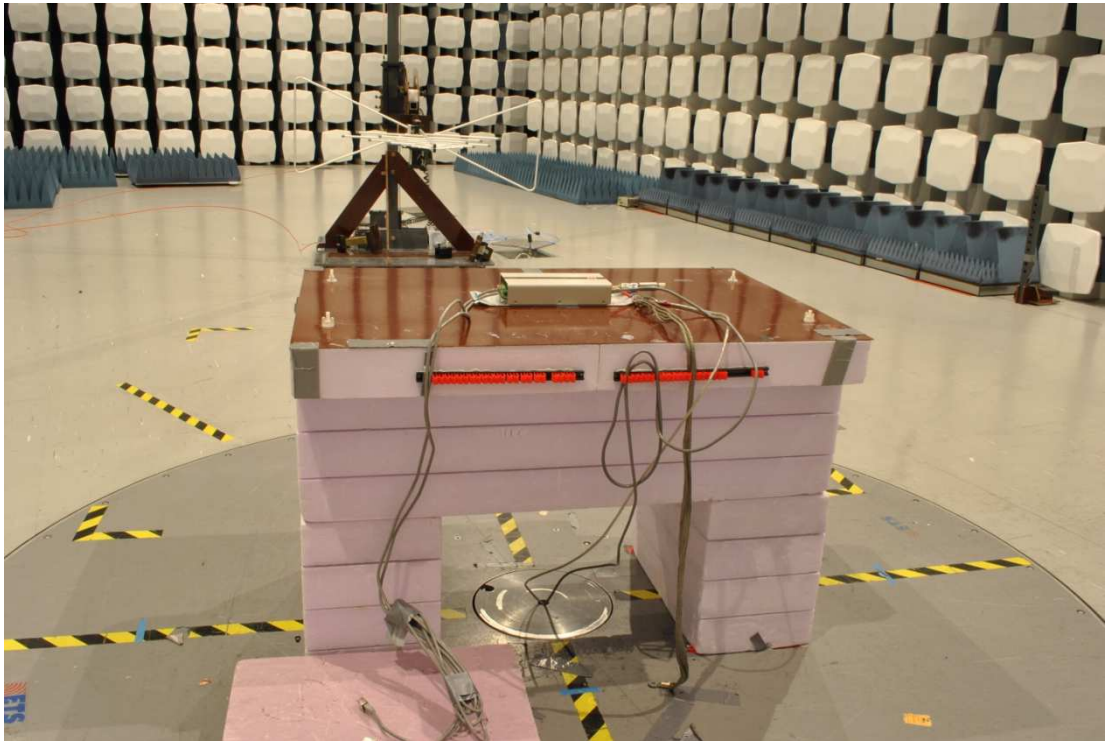
PHOTOS



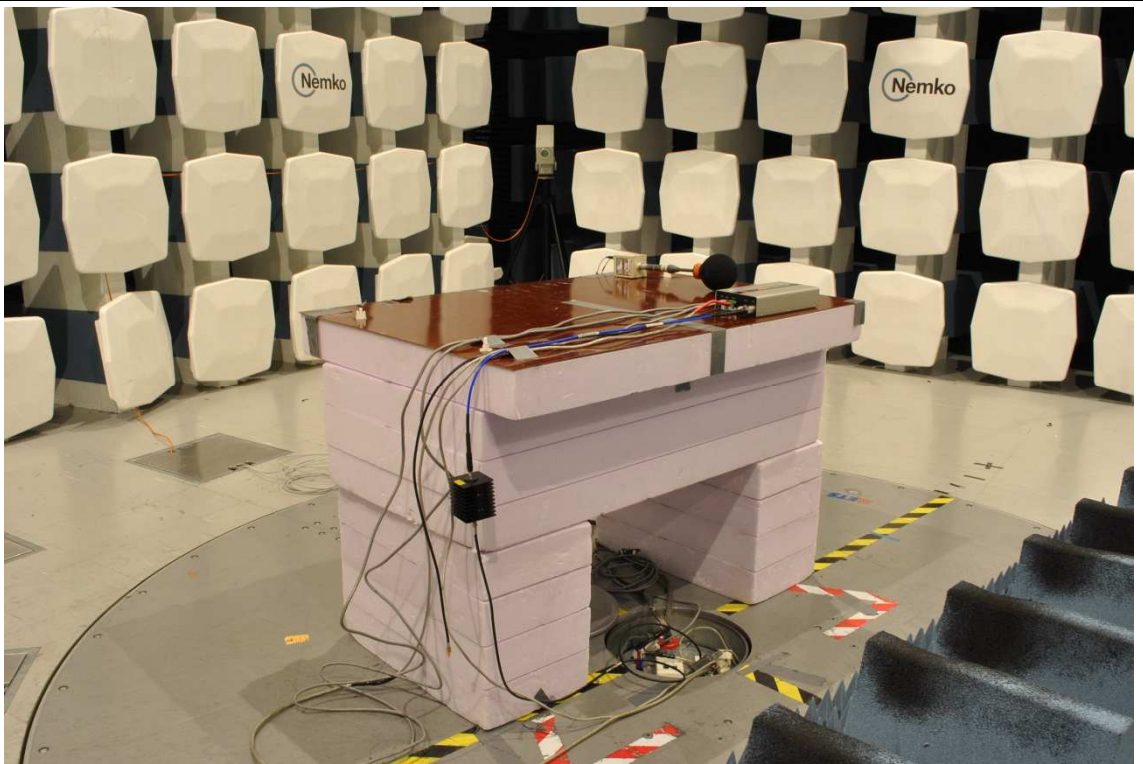
Notes: Test set-up for Conducted Emissions 10 kHz – 30 MHz



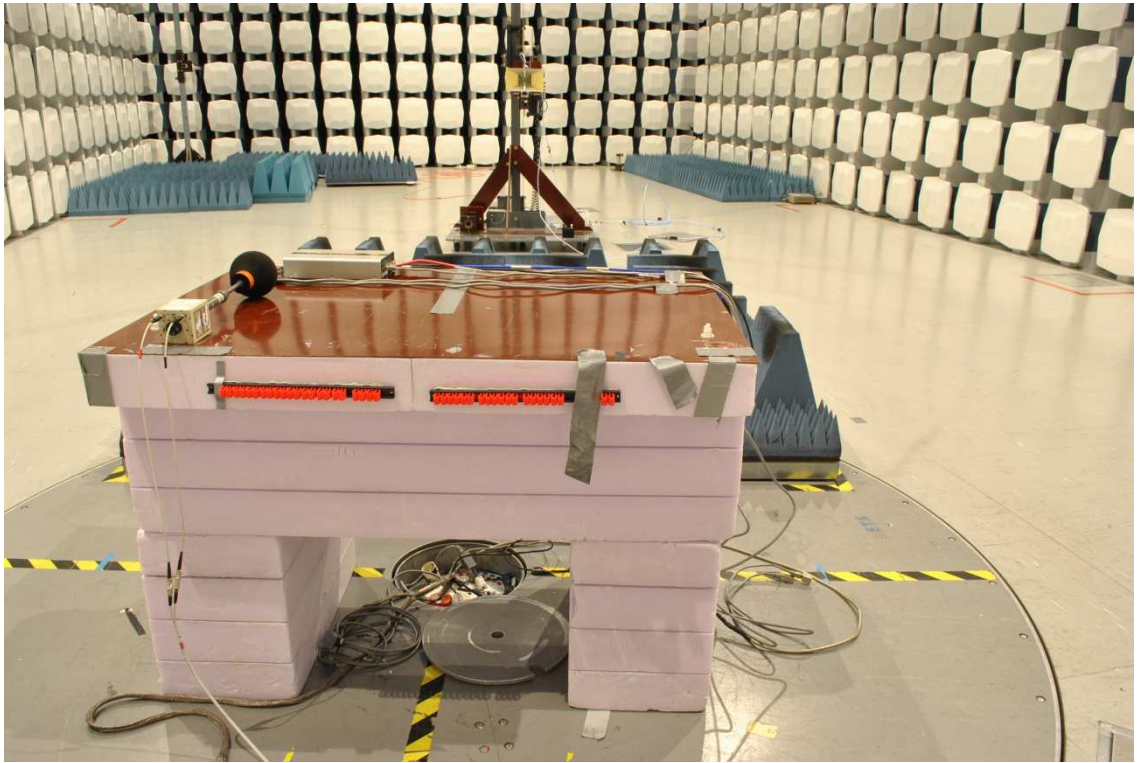
Notes: Test set-up for Radiated Emissions 150 kHz – 30 MHz



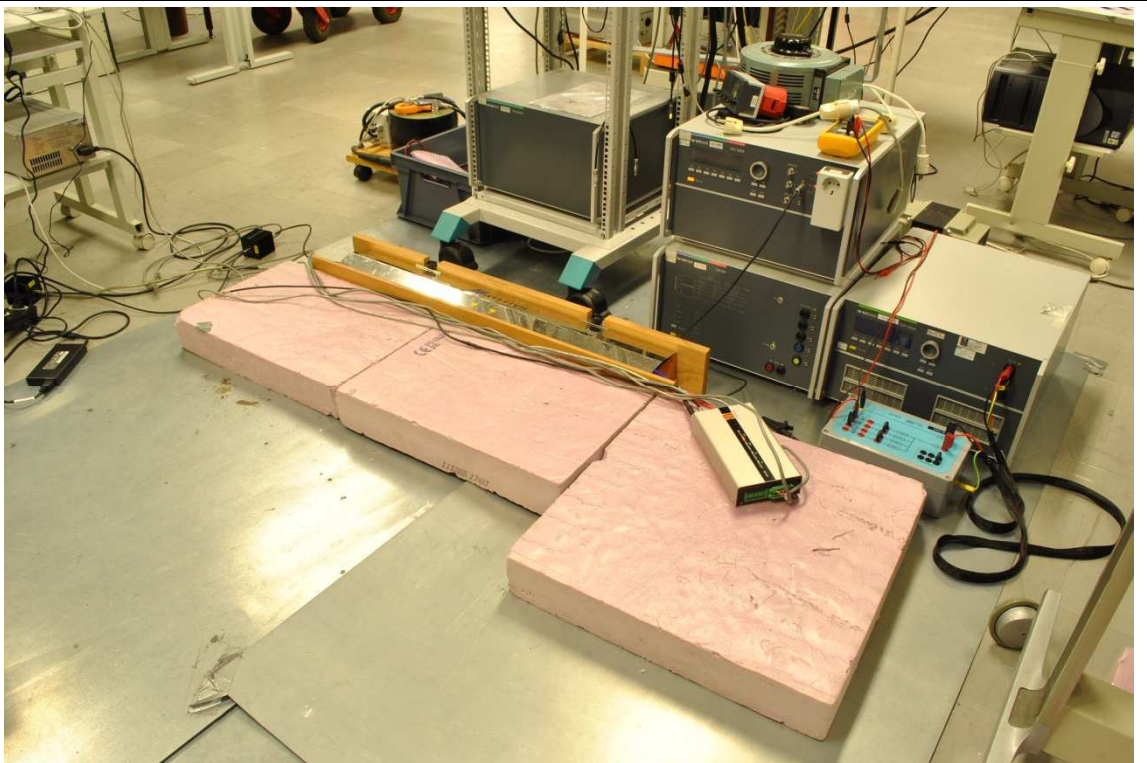
Notes: Test set-up for Radiated Emissions 30 – 2000 MHz



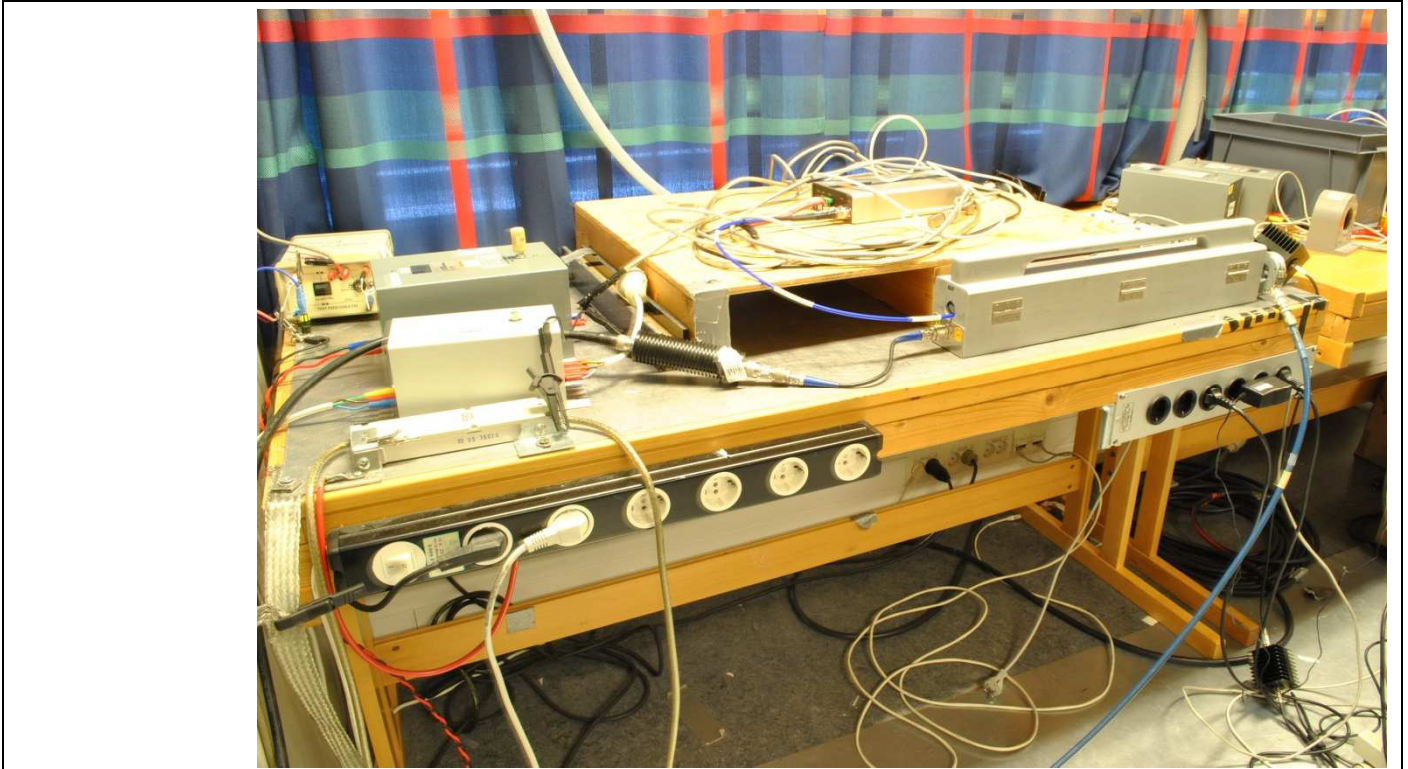
Notes: Test set-up for Radiated RF Disturbance Immunity



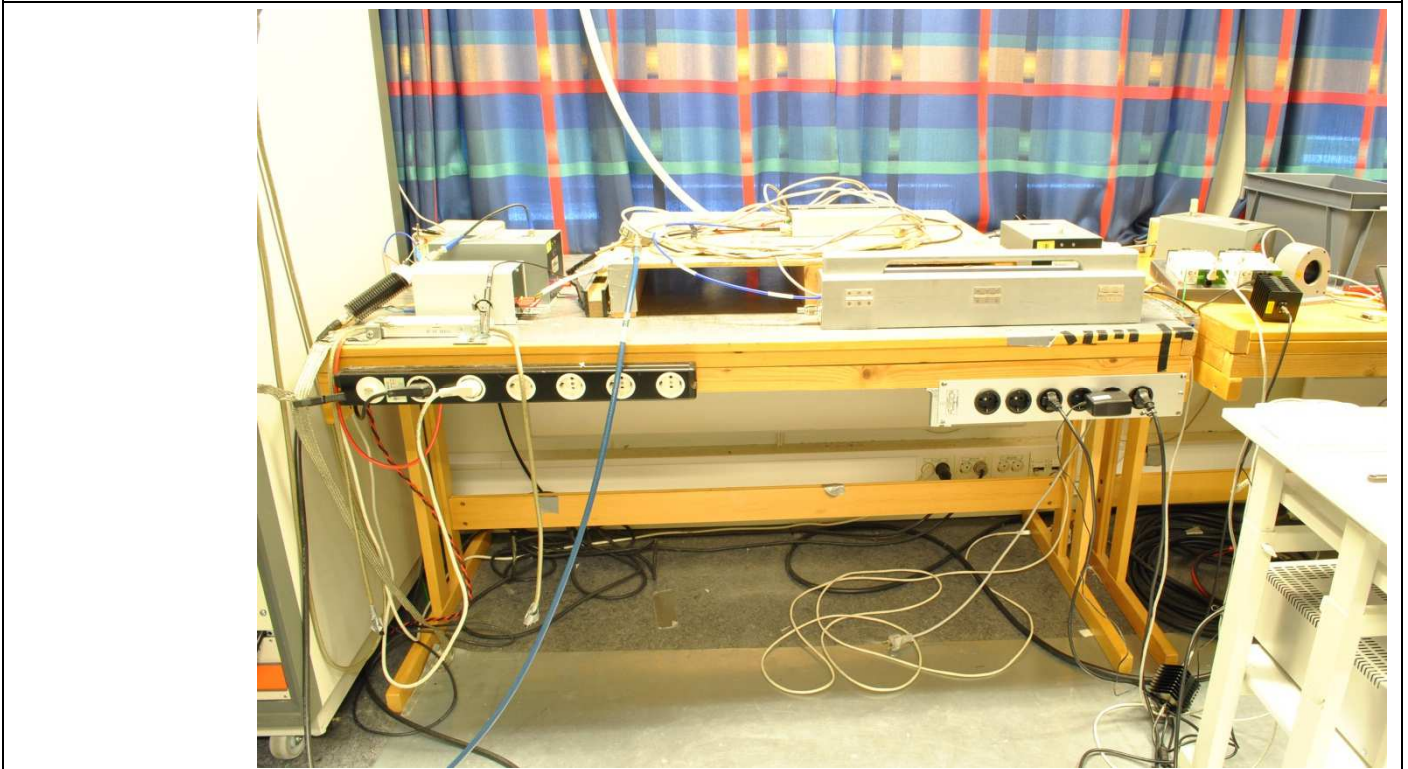
Notes: Test set-up for Radiated RF Disturbance Immunity



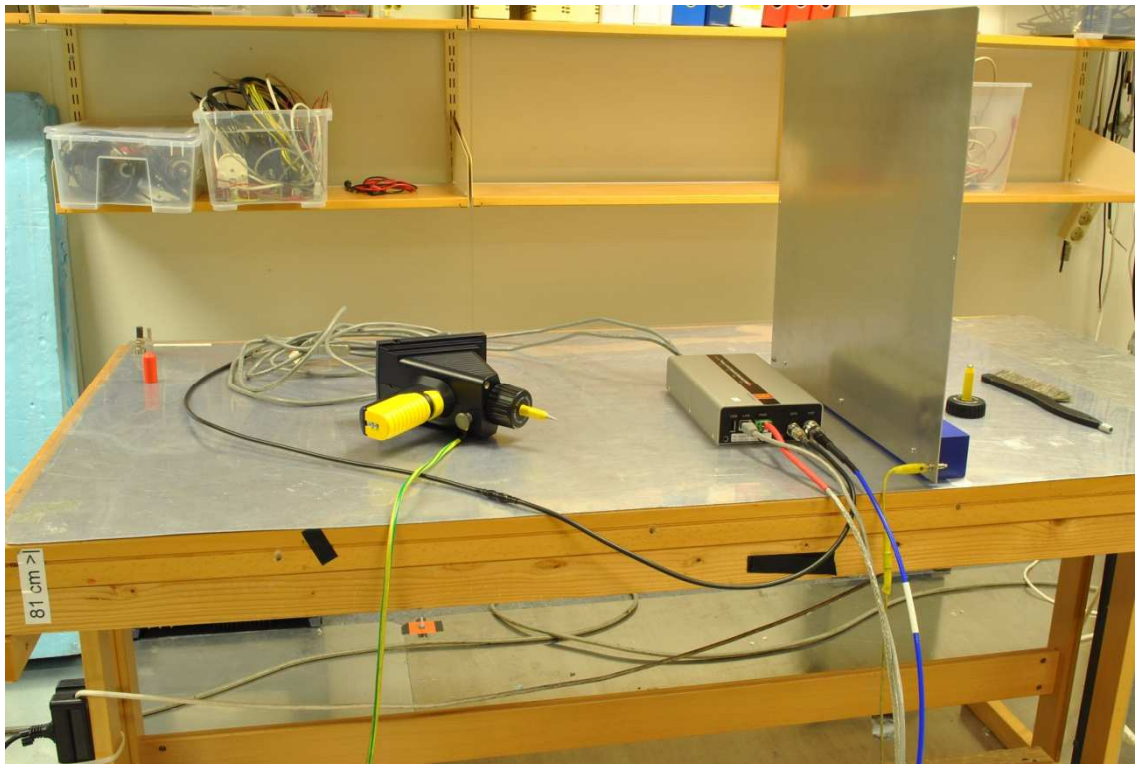
Notes: Test set-up for Electric Fast Transients Immunity



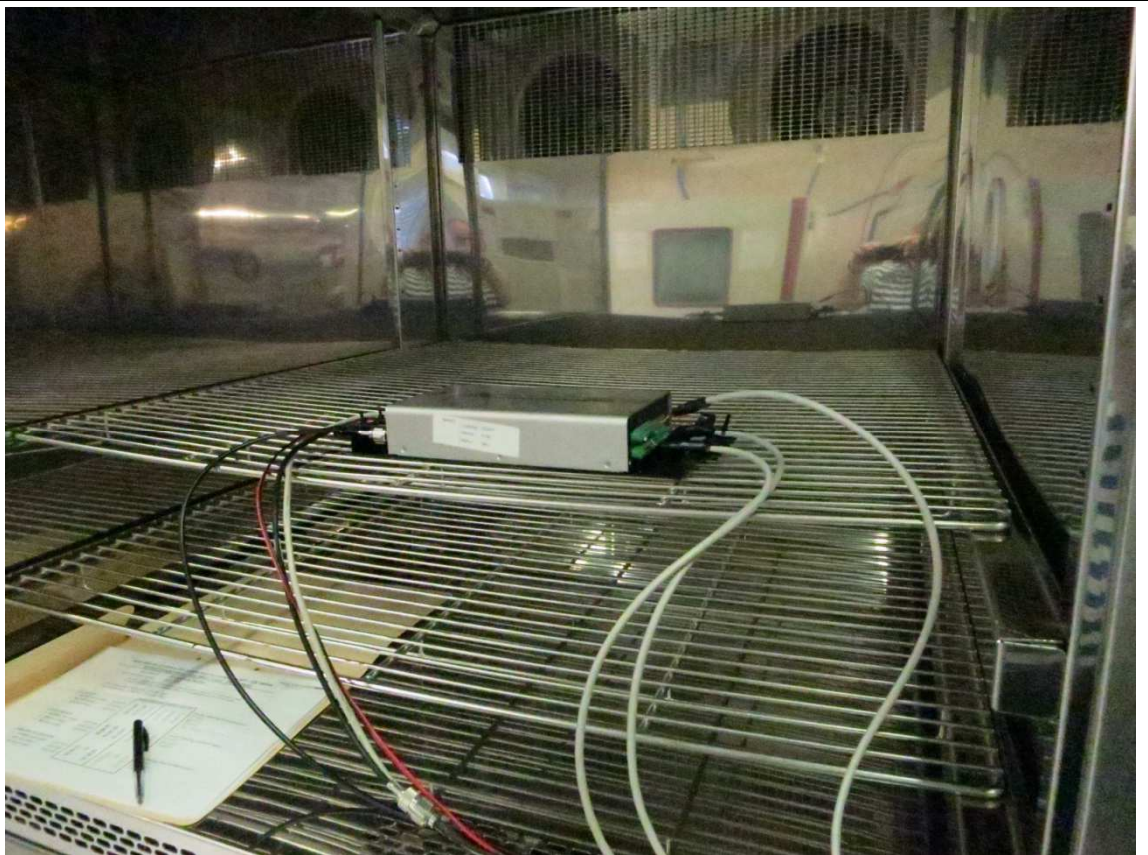
Notes: Test set-up for Conducted RF Disturbance Immunity



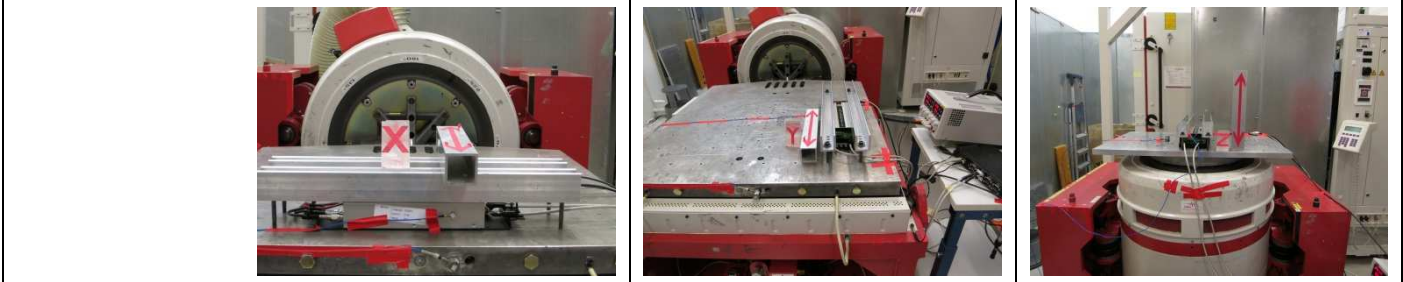
Notes: Test set-up for Conducted RF Disturbance Immunity



Notes: Test set-up for ESD

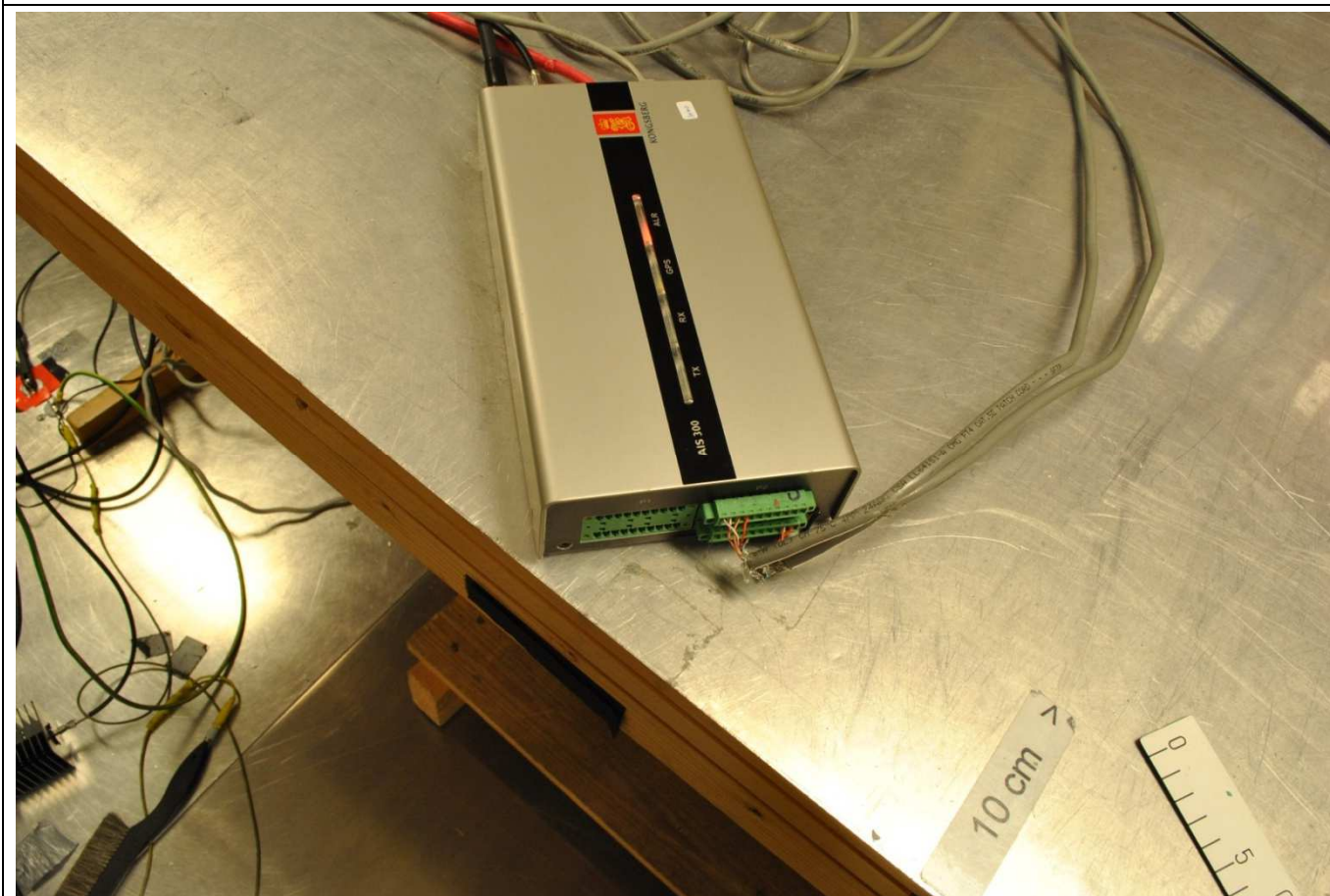
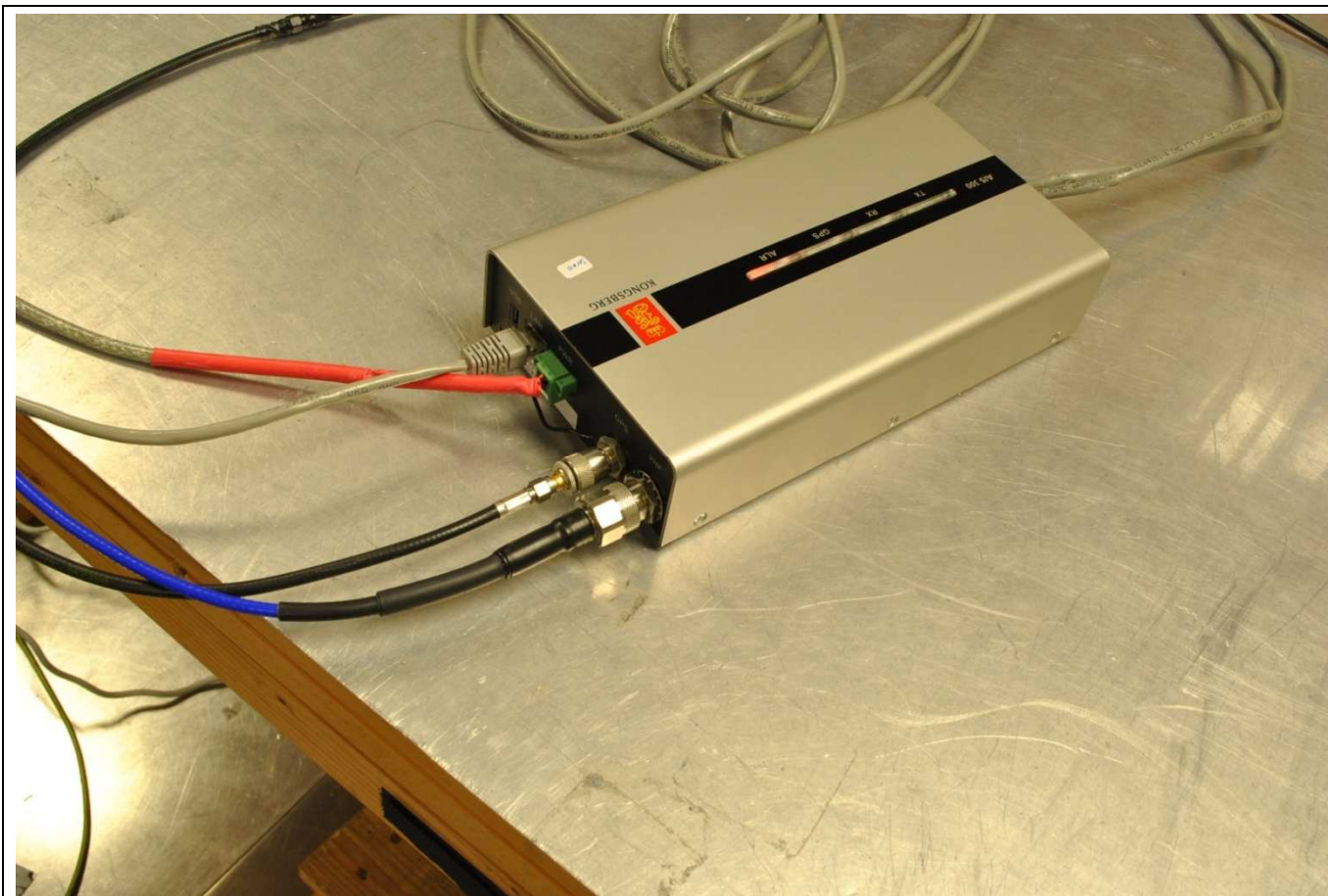


Notes: Test set-up for Temperature/Humidity tests



Notes: Test set-up for Vibration tests





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