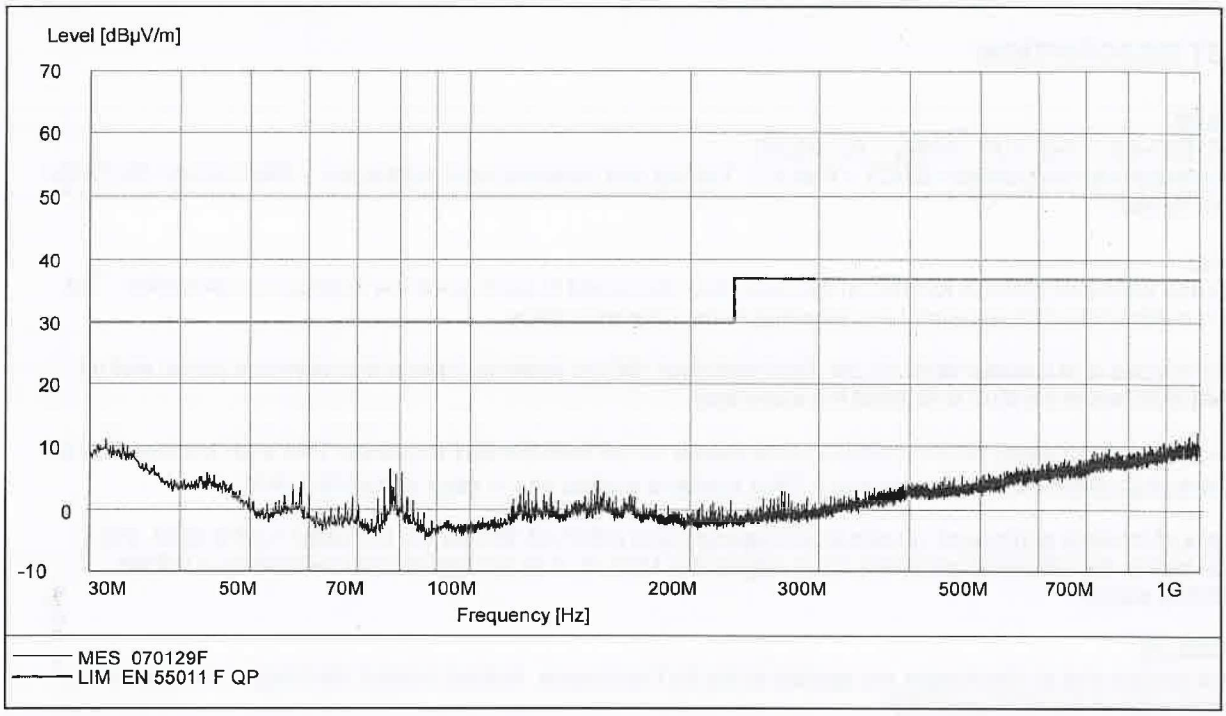
DISTURBANCE PREVIEW



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. ("x" = horizontal antenna positions / "+" = vertical antenna positions. Measurement data are presented below)

FREQUENCY LIST

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Azimut	Hight	Verdict [Pass/Fail]

QUASI PEAK DETECTOR DATA (HORIZONTAL)

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Azimut	Hight	Verdict [Pass/Fail]

QUASI PEAK DETECTOR DATA (VERTICAL)

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Azimut	Hight	Verdict [Pass/Fail]

ВЯРНО
ОРИГИ

IMMUNITY – ELECTROSTATIC DISCHARGES

TEST DESCRIPTION

Method
EN 61000-4-2 (1995) + A1 (1998) + A2 (2001)
Electromagnetic compatibility (EMC) -- Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test.

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 EFT 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.

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

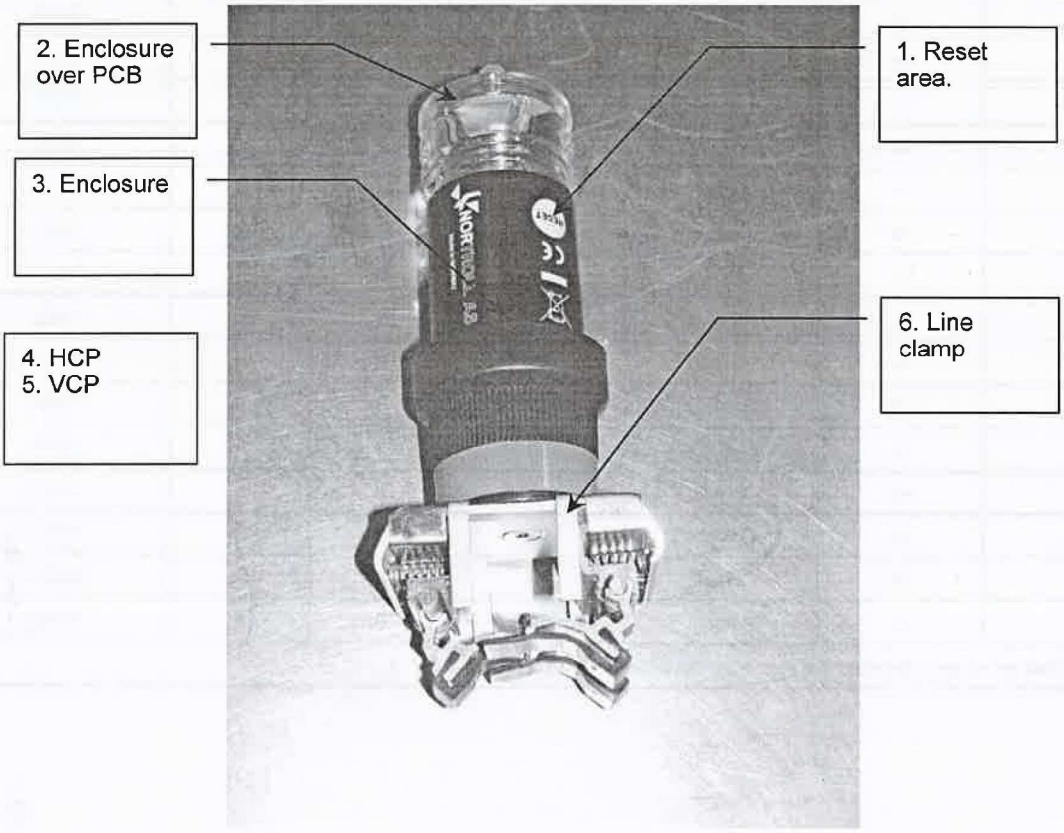
Instrument list: ESD Generator: Schaffner NSG 435 (N-3355) (3/07)

Comments
No recorded comments.

Severity		**Conformity**	
Port:	Enclosure Port	Verdict:	PASS
		Test engineer:	Jon Fredrik Mo

ВЯРНО
ОРИГИ

Description of test 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 (clause 6.2).

Test Point	Applied Level [kV]	Discharge Type	Number of Discharges	Required Criteria	Complied Criteria	Result
1	+4	Air	10	B	A	PASS
1	-4	Air	10	B	A	PASS
1	+8	Air	10	B	A	PASS
1	-8	Air	10	B	A	PASS
2	+4	Air	10	B	A	PASS
2	-4	Air	10	B	A	PASS
2	+8	Air	10	B	A	PASS
2	-8	Air	10	B	A	PASS

3	+4	Air	10	B	A	PASS
3	-4	Air	10	B	A	PASS
3	+8	Air	10	B	A	PASS
3	-8	Air	10	B	A	PASS
4	+2	Contact	10	B	A	PASS
4	-2	Contact	10	B	A	PASS
4	+4	Contact	10	B	A	PASS
4	-4	Contact	10	B	A	PASS
5	+2	Contact	10	B	A	PASS
5	-2	Contact	10	B	A	PASS
5	+4	Contact	10	B	A	PASS
5	-4	Contact	10	B	A	PASS
6	+2	Contact	10	B	A	PASS
6	-2	Contact	10	B	A	PASS
6	+4	Contact	10	B	A	PASS
6	-4	Contact	10	B	A	PASS
Note: No operation errors were detected during or after the applied test(s)						

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IMMUNITY – RADIATED RF DISTURBANCE

TEST DESCRIPTION

Method
EN 61000-4-3 (2002) + A1 (2002) + IS1 (2004)
Electromagnetic compatibility (EMC) -- Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test.

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:
Amplifier: Amplifier Research 1000L (N-3463) (-/-)
Amplifier: Amplifier Research 25S1G4A (N-4030) (-/-)
Amplifier: Amplifier Research 200W1000M7 (N-3464) (-/-)
Antenna: EMCO 3149 (N-4227) (-/-)
Antenna: EMCO 3115 (N-3453) (-/-)
Field Probe: Amplifier Research FP4080 (N-4029) (11/06)
Power Meter: Rohde&Schwarz NRVD (N-3573) (5/07)
RF Generator: Rohde&Schwarz SMT03 (N-3643) (5/08)
System Interface: EMC Automation SI - 200 (N-3644) (-/-)

Comments
No recorded comments.

Severity		Conformity	
Port:	Enclosure Port	Verdict:	PASS
Frequency range:	80 - 2700 MHz	Test engineer:	Jon Fredrik Mo
Step size:	1 %		
Dwell time:	3 Sec		
Modulation:	80% AM @ 1 kHz		
Field generation:	Testing has been performed in an anechoic chamber using antennas to apply the field		

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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 (clause 6.2).

Orientation [deg]	Applied Level	Antenna Polarization	Required Criteria	Complied Criteria	Result
0	10V/m	HORIZONTAL	A	A	PASS
90	10V/m	HORIZONTAL	A	A	PASS
180	10V/m	HORIZONTAL	A	A	PASS
270	10V/m	HORIZONTAL	A	A	PASS
0	10V/m	VERTICAL	A	A	PASS
90	10V/m	VERTICAL	A	A	PASS
180	10V/m	VERTICAL	A	A	PASS
270	10V/m	VERTICAL	A	A	PASS
Note: No operation errors were detected during or after the applied test(s)					

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IMMUNITY – POWER FREQUENCY MAGNETIC FIELDS

TEST DESCRIPTION

Method
EN 61000-4-8 (1993) + A1 (2001)
Electromagnetic compatibility (EMC) -- Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test.

Set-up
The EuT is placed in the centre of the coil above a ground reference plane.

Procedure
The tests are performed with a single squared 100x100cm coil.

The EuT is exposed to the magnetic field of a magnitude and frequency as specified below, while the performance is monitored and reported. Then the coil orientation is changed to repeat the testing in the 3 orthogonal axes (X, Y and Z).

Instruments used during measurement

Instrument list: CS Test System: Schaffner Best EMC (N-4103) (5/07)

Comments
No recorded comments.

Severity		**Conformity**	
Port:	Enclosure Port	Verdict:	PASS
Duration:	3 min	Test engineer:	Jon Fredrik Mo

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 (clause 6.2).

Axis [X/Y/Z]	Applied Level	Field Frequency	Required Criteria	Complied Criteria	Result
X	30A/m	50Hz	A	A	Pass
Y	30A/m	50Hz	A	A	Pass
Z	30A/m	50Hz	A	A	Pass
Note: No operation errors were detected during or after the applied test(s)					

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Annexes

UNCERTAINTY FIGURES

Mains Port Disturbance Voltage	± 3.8 dB (9 kHz – 150 kHz) ± 3.5 dB (150 kHz – 30 MHz)
Load Port Disturbance Voltage	± 2.7 dB (150 kHz – 30 MHz)
Signal Port Disturbance Voltage	± 2.7 dB (150 kHz – 30 MHz)
Discontinuous Disturbance Voltage	± 4.3 dB (150 kHz – 30 MHz)
Insertion Loss	± 2.5 dB (150 kHz – 1.605 MHz)
Disturbance Power	± 3.4 dB (30 MHz – 300 MHz)
Radiated Electromagnetic Field	± 2,7 dB (9 kHz – 30 MHz)
Radiated Disturbance (3 meter)	± 4.8 dB (150 kHz – 30 MHz) ± 4.8 dB (30 MHz – 200 MHz) ± 4.4 dB (200 MHz – 1000 MHz)
Radiated Disturbance (10 meter)	± 4.1 dB (30 MHz – 200 MHz) ± 4.2 dB (200 MHz – 1000 MHz)
Harmonic Current Emissions	± 2.1mA
Flicker	± 0.64 V (Dc and Dmax) ± 5 % (Pst and Plt)
Electrostatic Discharges	The instruments specified are subject to periodic calibration. Monthly controls ensure, with 95% confidence level, that the instruments remain within the calibrated levels
Radiated RF Field	The instruments specified are subject to periodic calibration. Monthly controls ensure, with 95% confidence level, that the instruments remain within the calibrated levels
Electric Fast Transients	The instruments specified are subject to periodic calibration. Monthly controls ensure, with 95% confidence level, that the instruments remain within the calibrated levels
Surge	The instruments specified are subject to periodic calibration. Monthly controls ensure, with 95% confidence level, that the instruments remain within the calibrated levels
Conducted RF Disturbance	The instruments specified are subject to periodic calibration. Monthly controls ensure, with 95% confidence level, that the instruments remain within the calibrated levels
Power Frequency Magnetic Field	The instruments specified are subject to periodic calibration. Monthly controls ensure, with 95% confidence level, that the instruments remain within the calibrated levels
Dips/Interruptions	The instruments specified are subject to periodic calibration. Monthly controls ensure, with 95% confidence level, that the instruments remain within the calibrated levels
Notes:	

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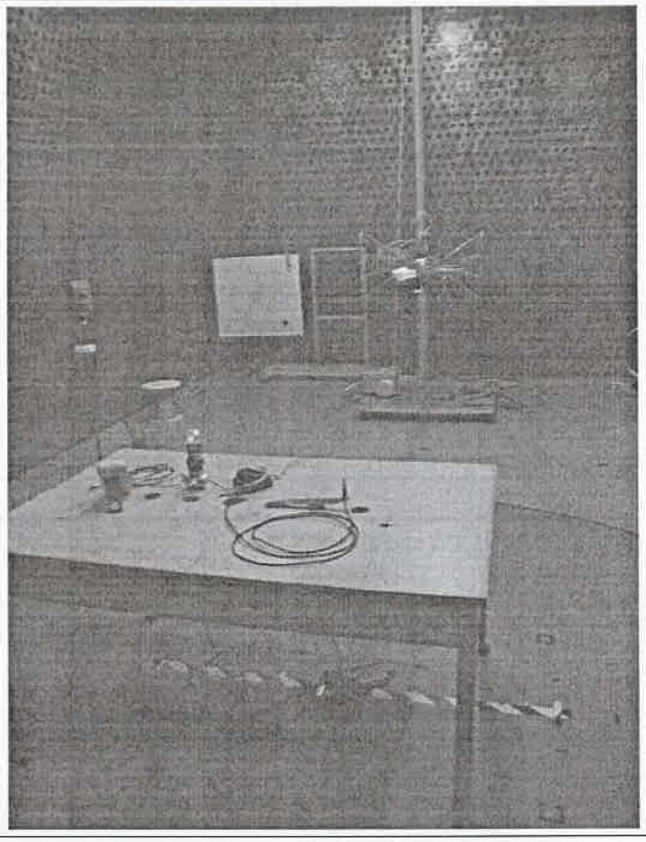
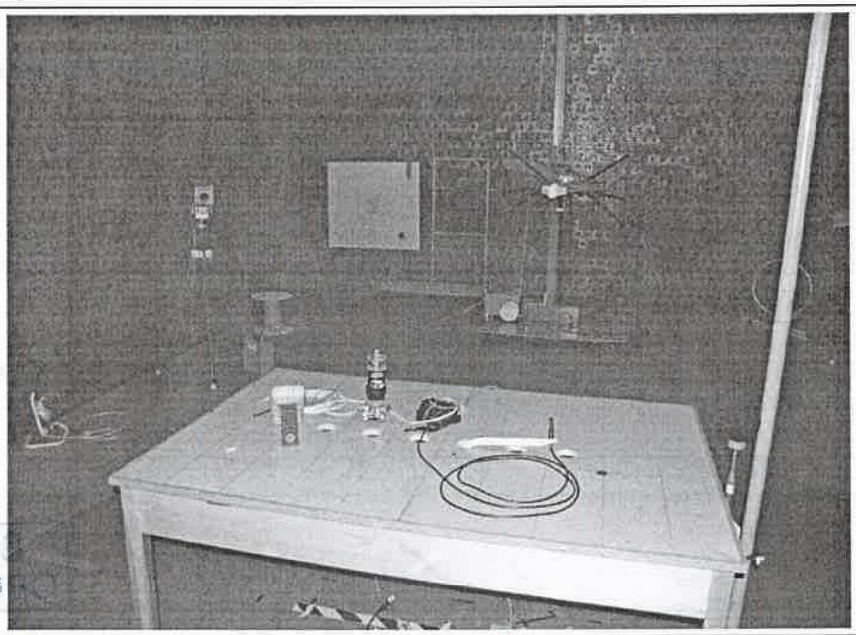
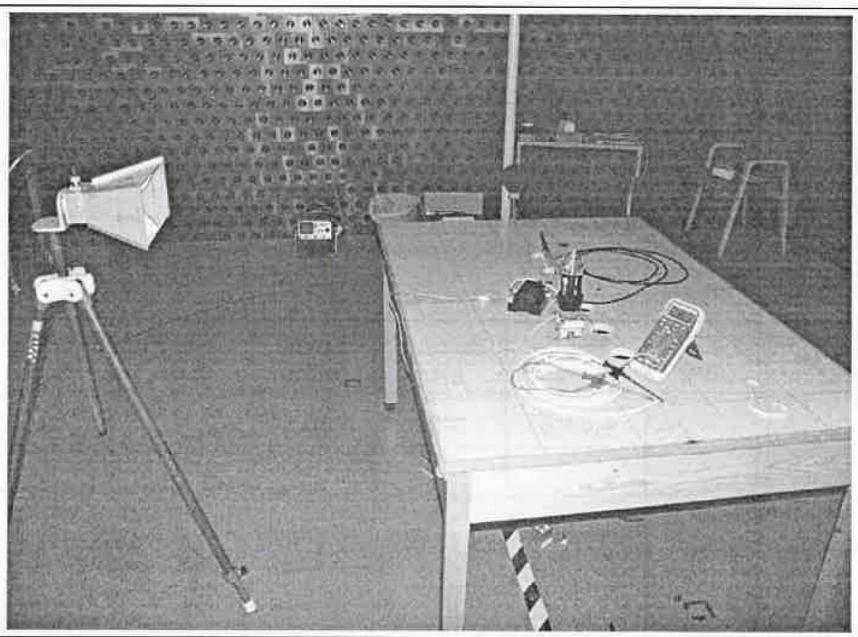
PHOTOS



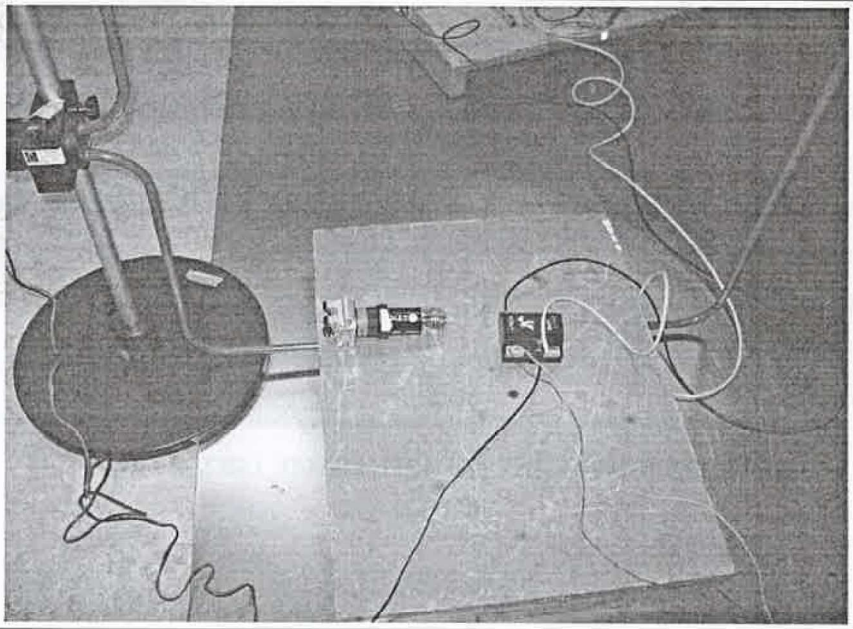
Notes: Radiated electromagnetic field test set up.



Notes: Radiated RF field immunity test set up. <1GHz



Notes: Radiated RF field immunity test set up. >1GHz



Notes: Power frequency magnetic field test set up.

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SPURIOUS RADIATIONS BY EN 300 440

Spurious Emissions Radiated - Transmitter operating
Power level at which the measurement has been performed: 1 mW
Modulated signal: Power Source: 12 V dc

Spurious Emissions Level								
EUT: Nortroll								
-			2,44 GHz			-		
Freq. MHz	Bandw. kHz	Level (nW)	Freq. GHz	Bandw. kHz	Level (dBm)	Freq. MHz	Bandw. kHz	Level (nW)
-	-	-	4,8818	1000	- 35,3	-	-	-
All others	-	*						
Measurement uncertainty			25 – 1000MHz - +1.9/-2.4 dB 1 – 8 GHz - +1.8/-2.1 dB 8 – 18 GHz - +1.9/-2.4 dB					

* More than 10dB below the limits
Reference antenna: Up to 1 GHz: dipole. Above 1GHz: isotropic.
Bandwidth (kHz) refers to the bandwidth of the measuring receiver. Detector: PK

A prescan has been performed in order to detect possible spurious emissions (25 - 4000 MHz)

Limits Clause 8.8.5

47 MHz to 74 MHz 87,5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies ≤1000 MHz	Frequencies >1000 MHz
4,0 nW	- 36 dBm	- 30 dBm

Test Equipment Used: LR1410, LR 1337,LR1260, LR1261, LR1101, LR1330

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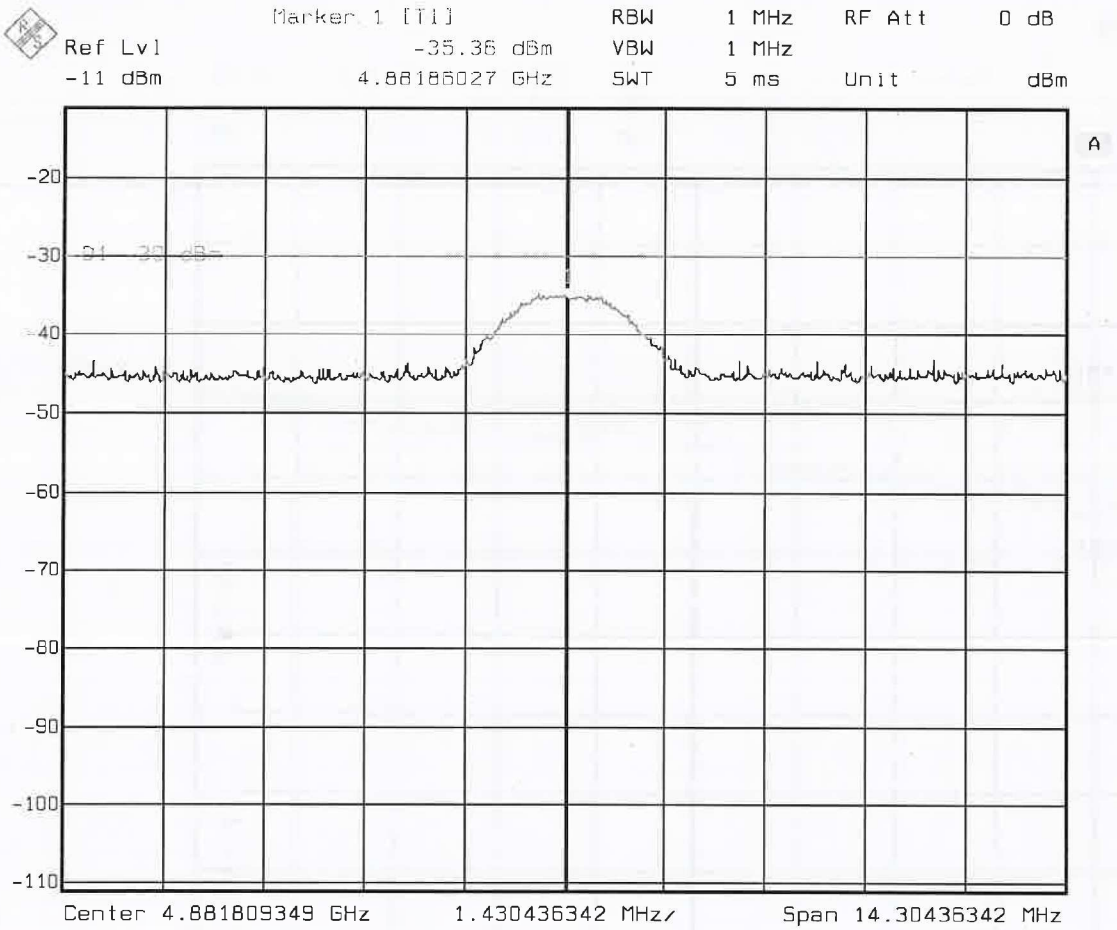
See plot below:



Plot showing TX spurious emission, 2. harmonic at 4,881809349 GHz
Limit: - 30 dBm

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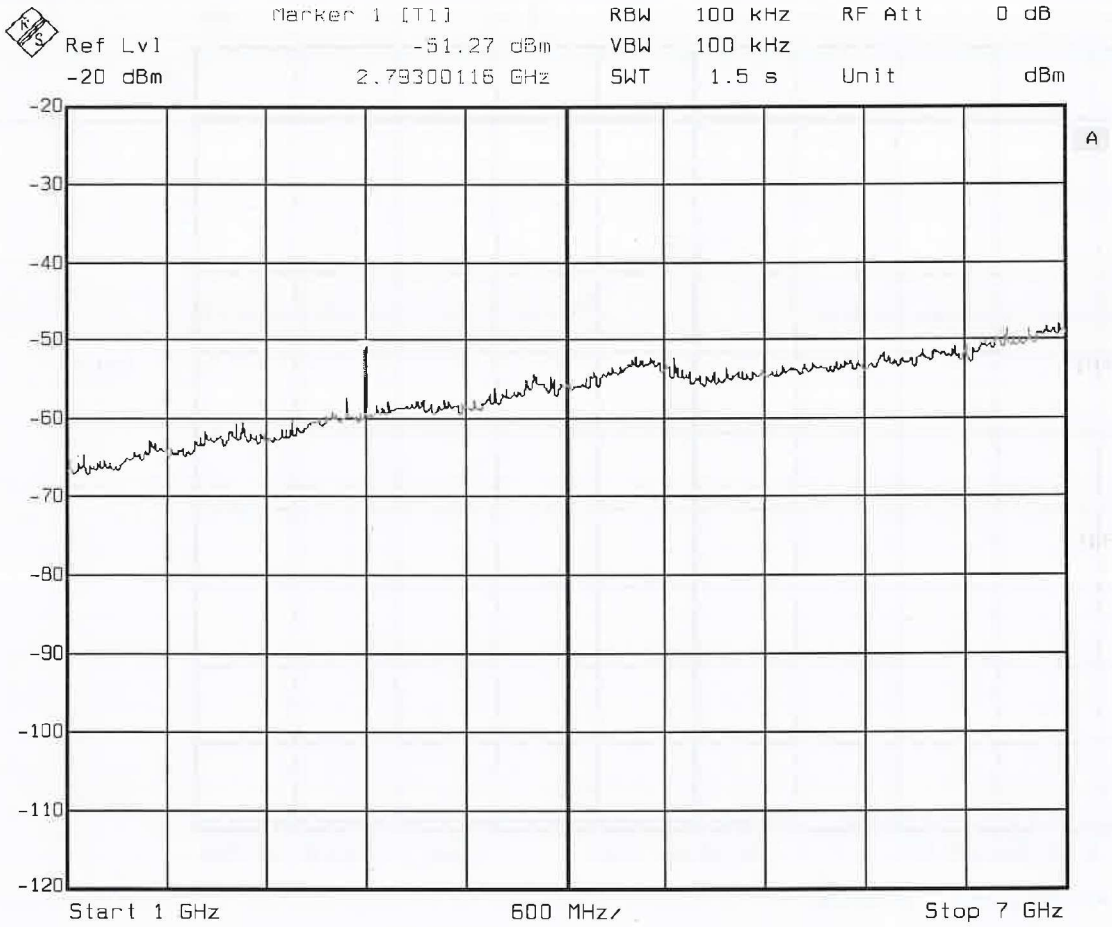
Spurious Emissions Radiated - Transmitter on standby, (RX-mode)

See plot below:



Plot showing RX spurious emissions in the range 1 – 7 GHz.

Spurious Emissions Level, RX mode								
EUT: Nortroll								
-			2,44 GHz			-		
Freq. MHz	Bandw. kHz	Level (nW)	Freq. GHz	Bandw. kHz	Level (dBm)	Freq. MHz	Bandw. kHz	Level (nW)
-	-	-	2,7930	1000	- 51,2	-	-	-
All others	-	*						
Measurement uncertainty			25 – 1000MHz - +1.9/-2.4 dB 1 – 8 GHz - +1.8/-2.1 dB 8 – 18 GHz - +1.9/-2.4 dB					

* More than 10dB below the limits
Limit: - 47 dBm
Reference antenna: Up to 1 GHz: dipole. Above 1GHz: isotropic.
Bandwidth (kHz) refers to the bandwidth of the measuring receiver.

A prescan has been performed in order to detect possible spurious emissions.

Limits Clause 8.8.5

47 MHz to 74 MHz 87,5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies ≤1000 MHz	Frequencies >1000 MHz
2,0 nW	2,0 nW	20,0 nW

Test Equipment Used: LR1410, LR 1337,LR1260, LR1261, LR1101, LR1330

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Test Equipment Used

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the testhouse.

No.	Instrument/ancillary	Type of instrument/ancillary	Manufacturer	Ref. no.
1	FSEK30	Spectrum Analyzer	Rohde & Schwarz	LR 1337
2	SME03	Signal generator	Rohde & Schwarz	LR 1238
3	SMP04	Signal generator	Rohde & Schwarz	LR 1336
4	SMHU52	Signal generator	Rohde & Schwarz	LR 1240
5	53310A	Modulation Domain Analyzer	Hewlett Packard	LR 1483
6	AFG320	Arbitrary Generator	Sony Tektronix	S.No.: J311690
7	8470B	Crystal Detector	Hewlett Packard	LR 1207
8	8449B	Preamplifier	Hewlett Packard	LR 1322
9	4HC3000/18000	Highpass filter	Trilithic	S.No.: 9849045
10	ESVS30	Measuring Receiver	Rohde & Schwarz	LR 1101
11	ESN	Measuring Receiver	Rohde & Schwarz	LR 1237
12	ESAI	Measuring Receiver	Rohde & Schwarz	LR 1090
13	6810.17B	Attenuator	Narda	LR1212
14	745-69	Step Attenuator	Narda	LR 1442
15	WE 1506A	Power Splitter	Weinchel	LR 244
16	WE 1506A	Power Splitter	Weinchel	LR 245
17	H-9	Hybrid	Anzac	LR 86
18	H-9	Hybrid	Anzac	LR 257
19	S212DS	RF Switch	Narda	LR 1244
20	3115	Horn Antenna	EMCO	LR 1226
21	PM7320-X	Horn Antenna	Sivers Lab	LR 102
22	DBF-520-20	Horn Antenna	Systron Donner	LR 100
23	638	Horn Antenna	Narda	LR 1480
24	HL223	Biconical Antenna	Rohde & Schwarz	LR 1261
25	HK116	Logperiod Antenna	Rohde & Schwarz	LR 1260
26	HFH2-Z2	Loop Antenna	Rohde & Schwarz	LR 285
27	ESH3-Z5	Two Line V-Network	Rohde & Schwarz	LR 1076
28	80S	Signal Generator	Powertron	LT 502

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Nemko

Report No. E07283.02

Test Report

Product	Programmable fault current indicator
Name and address of the applicant	Nortroll AS Havneveien 6 7600 Levanger, NORWAY
Name and address of the manufacturer	Nortroll AS Havneveien 6 7600 Levanger, NORWAY
Model	LineTroll LT110Eμr
Rating	3,6V internal battery
Brand name	Nortroll
Serial number	-
Additional information	-
Tested according to	EN 60068-2-1 (1993) + A1 (1993) + A2 (1994) EN 60068-2-2 (1993) + A1 (1993) + A2 (1994) EN 60068-2-11 (1999) EN 60068-2-14 (1999) EN 60068-2-30 (2005) EN 60529 (1991) + A1 (2000) EN 60255-21-1 (1995) EN 60255-21-2 (1995) ANSI 495 (1986) (§4.4.1) IEC 62262 (2002)
Order number	141463
Tested in period	2007-02-06 to 2010-01-19
Issue date	2010-02-11
Name and address of the testing laboratory	Nemko P.O. Box 73 Blindern, N-0314 Oslo, Norway Telephone (+47) 22 96 03 30 Fax (+47) 22 96 05 50

[redacted]

Prepared by [Jarle Skogland] Approved by [Roger Berget]

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REVISIONS

Revision number	Date	Order #	Description
00	2009-06-09	80086	- Initial version
01	2010-02-04	141463	- Ingress protection upgraded to IP68, Severity: 48h @15 feet dept (4.5m). - Impact test: IK09 added.
02	2010-02-11	141463	Corrected some typing errors

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.

This report shall not be reproduced except in full without the written approval of Nemko.

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.

The instruments specified in immunity testing are subject to periodic calibration. Monthly controls ensure, with 95% confidence that the instruments remain within the calibrated levels.

MEASUREMENT UNCERTAINTY

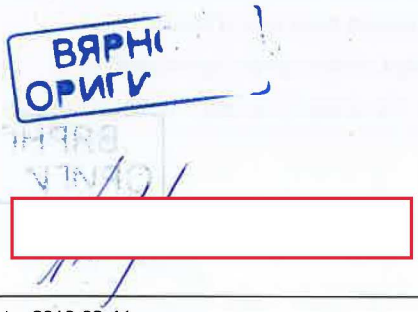
Measurement uncertainties are calculated or considered for all instruments and instrument set-ups used during these tests. Uncertainty figures are found in an appendix to this report.

Further information about measurement uncertainties is provided on request.

EVALUATION OF RESULTS

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).

The instrumentation accuracy is within limits agreed by the IECEE/CTL (ref. Nemko proc. P227).



EQUIPMENT UNDER TEST (EUT)

SYSTEM DESCRIPTION

The equipment under test is a phase mounted programmable fault current indicator for 6-69kV overhead lines. The indicator indicates earth- and short-circuit faults.

MODEL VARIATIONS

The following model variations are considered covered by this report

VA no.	Variant	Comment	Investigated
1	LT110Eμr		Yes
2	LT110Eμ	Without radio function	No*
Notes: Items that are shaded have been subject to testing documented in this report. Opinions expressed regarding application of test results to variant models are not part of our current accreditation.			

* A test sample of LT110Eμ (same, but without radio function) was tested for Ingress Protection IP68. The sample tested for ingress protection, where a version without drain holes and ventilation.

PORTS AND CABLES

No ports or cables provided.

AVAILABLE OPERATING MODES

The equipment can be programmed in several functional operating modes. The following settings have been used during these testing.

FU no.	Operating mode	Comment	Investigated
1	Switch setting LT110Eμr :0-0-0-1-0-0-1-0	Di/dt Current level = 6A Start/stop Criteria = Voltage Timer reset = 2h Auto Reset & CB tripping = ON	Yes
Notes: -			

ACCESSORIES APPLIED DURING TEST

AE no.	Description	Manufacturer	Type	Serial no.
1	Collector	Nortroll	ComTroll 110C Quicklink Collector	-
2	DC power supply	Delta	Power Supply SM602	N-2043
Notes: -				

ADDITIONAL INFORMATION RELATED TO TESTING

Testing levels have been decided by the customer specification provided to Nemko.

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GENERAL TEST CONDITIONS

LOCATION

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

x	**Gaustad site** Gaustadalleen 30, N-0314 Oslo, Norway	Norwegian Accreditation (Identification # TEST 033)
	Skar site Maridalsveien 621, N-0890 Oslo, Norway	Norwegian Accreditation (Identification # TEST 033)
	Kjeller site Gåsevikveien 8, N-1300 Kjeller, Norway	Norwegian Accreditation (Identification # TEST 031)

All Nemko test facilities are accredited by Norsk Akkreditering, according to ISO 17025.
Note: Nemko is an EU Competent/Notified Body for the EMC Directive and the Radio & Telecommunications Terminal Equipment (R&TTE) Directive.

AMBIENT CONDITIONS

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

The climatic conditions in the laboratory environment were according to EN 60068-1 (1988) + A1 (1992):

Ambient temperature	Within 15 - 35°C (EN 60068-1: 15 - 35°C)
Relative humidity	Within 25 - 75%RH (EN 60068-1: 25 - 75%RH)
Atmospheric pressure	100kPa (EN 60068-1: 86 – 106kPa)

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

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TEST EQUIPMENT

Test equipment used during testing is calibrated regularly and subject to periodic controls to confirm calibration status.

TE no.	Description	Manufacturer	Type	Serial no.
1	Freezer	Weiss Technik	LK130	N-4095
2	Climatic chamber	Vötch	HC0020	N-3155 (Cæsar)
3	Climatic chamber	Vötch	VC 4034	N-3949 (Petronelle)
4	Climatic chamber	ACS	CH340	N-4262
5	Salt mist chamber	Weiss Technik	S1000 SSC	N-2184
6	Damp Heat chamber:	Vötch	VEKZ 20/60/S,DV	N-2607
6	Rain and Spray	DtC-Lenze as / S.A. Sistel	90s23	N-3549
7	Dust chamber	PTL Bomberg	PSS 45	N-1202
8	- Chamber (IPX8) - Manometer	N/A DEWIT	N/A 07.01204.4-03	Chamber: N-1736 Manometer: N3279
9	Shaker Power Amplifier Controller Software Accelerometer	LDS LDS LDS Dactron Kistler	V721 PA2000 Dacton Shaker Control - 8628B50 - 8628B50 - 8732A500	N-1455 N-1455 N-1455 Version 6.3050 SN: C56241 SN: C56243 SN: 2044816
10	Striking element	N/A	IK09	N3973
Notes:				

FUNCTIONS MONITORED DURING ENVIRONMENTAL TESTS

In order to verify acceptable performance by the EuT during the applied tests, the following functions were monitored

#	Function	Monitoring method
1	No false detections	Visual on the LEDs and readout from communication
2	Radio communication Tx	LT110Eμr was set to transmit continuously and read by ComTroll 110C.
3	Radio communication Rx	A test signal was sent from Comtroll 110C, LT110 Eμr receives the signal and transmits back to Comtroll 110C, relays closes.
Notes: -		

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SUMMARY OF TESTING

APPLIED TESTS

Test items	Test methods	Severity	Remarks	Result
Low Temperature (Cold)	EN 60068-2-1 Test Aa (sudden change of temperature)	Temperature: -40°C Duration: 2h	Function tested before, under and after the exposure.	PASS
Dry Heat	EN 60068-2-2 Test Ba (sudden change of temperature)	- Temperature: +70°C - Temperature: +85°C Duration: 2h	Function tested before, under and after the exposure. +85°C was also tested during the change of temperature test.	PASS
Damp Heat (Cyclic)	EN 60068-2-30 Test Db	Temperature: +23°C to +55°C Humidity: 95%RH Duration: 12+12h Cycles: 6	Function tested before, under and after the exposure.	PASS
Change of temperature	ANSI 495-1986 (4.4.1) EN 60068-2-14 Test Na	Temperature: -40 to + +55°C to 85°C Duration: until temperature equilibrium of Eut. Cycles: 5	Test object moved between three test chambers with different temperature. Function tested before, during ten two minutes of chamber change and after the end of the test.	PASS
Salt mist	EN 60068-2-11 Test Ka	Chamber temperature: +35°C Salt solution temperature: +35°C Duration: 168h continuously	The Eut was placed in the salt mist test chamber at and sprayed for 168h with a salt mist solution containing 5 weight units NaCl in 95 weight unit demineralized water with temperature +35°C. After the spraying period the EUT was stored under normal conditions (+23°C, 40% RH) for one hour before the Function of the Eut was tested. The Eut was not cleaned for salt before the function test.	PASS
Ingress Protection	EN 60529	IP6X * (Dust Tight.):	The Eut was exposed 8h in the dust conditions. No ingress of dust detected after the exposure of the Eut.	PASS*
Ingress Protection	EN 60529	IPX8 * (Protected against the effects of continuous immersion in water): Severity tested: 48hours @ 15 feet dept (4,5m = 0.45Bar)	No ingress of water causing harmful effect detected.	PASS*
Vibration (Sinus)	EN 60255-21-1	Class II: Acc: 2gn Freq: 10-150Hz Duration: 20 sweep cycles at 1 min / octave Axes: 3	Functional test before, under and after the exposure	PASS

Test items	Test methods	Severity	Remarks	Result
Shock	EN 60255-21-2	Class I: Acc: 15gn Pulse: Half sine 11ms Axes: 3 (6 directions) Repeat: 3 times	Functional test before and after each test	PASS
Bump	EN 60255-21-2	Class I: Acc: 10gn Pulse: Half sine 16ms Axes: 3 (6 directions) Repeat: 1000 times	Functional test before, under and after the exposure	PASS
Impact test	IEC 62262	IK09 (Impact energy 10J) Striking element: - Mass: 5kg - Fall height: 200mm	5 impacts on each of the exposed faces. No damage detected on either enclosure or the mounting clamp (two clamps evaluated plastic and aluminium)	PASS

DEVIATIONS AND EVALUATIONS

*The sample tested for ingress protection, where a version without drain holes and ventilation.
The version including drain hole and ventilation is not evaluated for Ingress Protection.

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Test Results

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LOGS AND PHOTOS

Notes: Equipment under Climatical test

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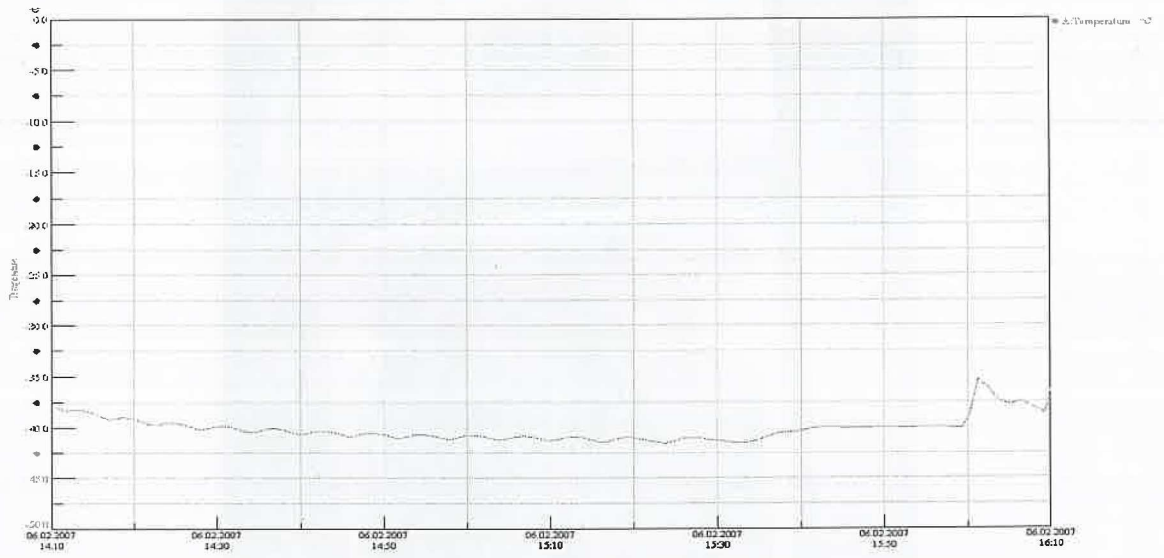
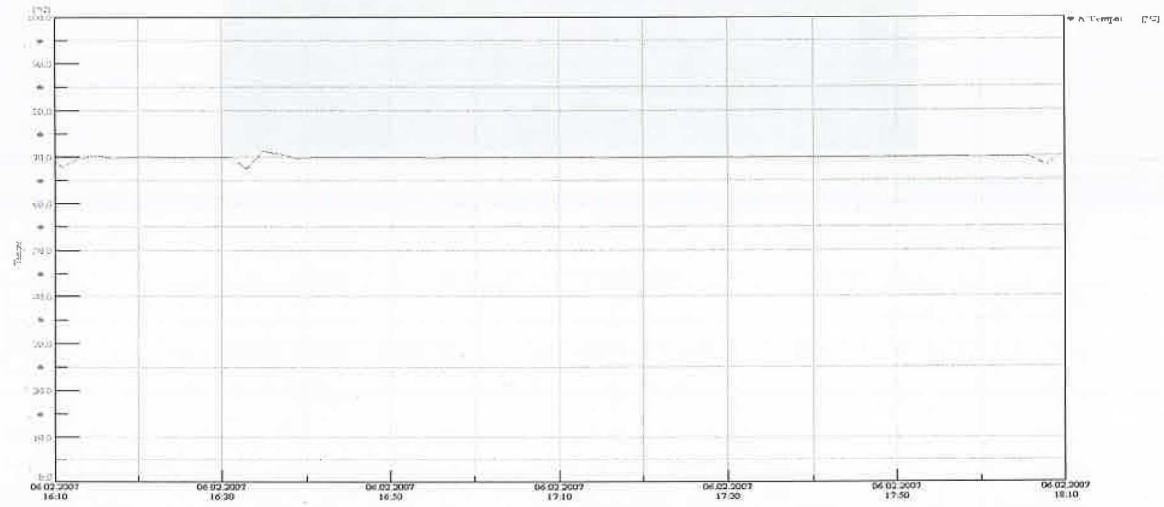


Notes: Low Temperature (Cold)



Notes: Dry Heat test

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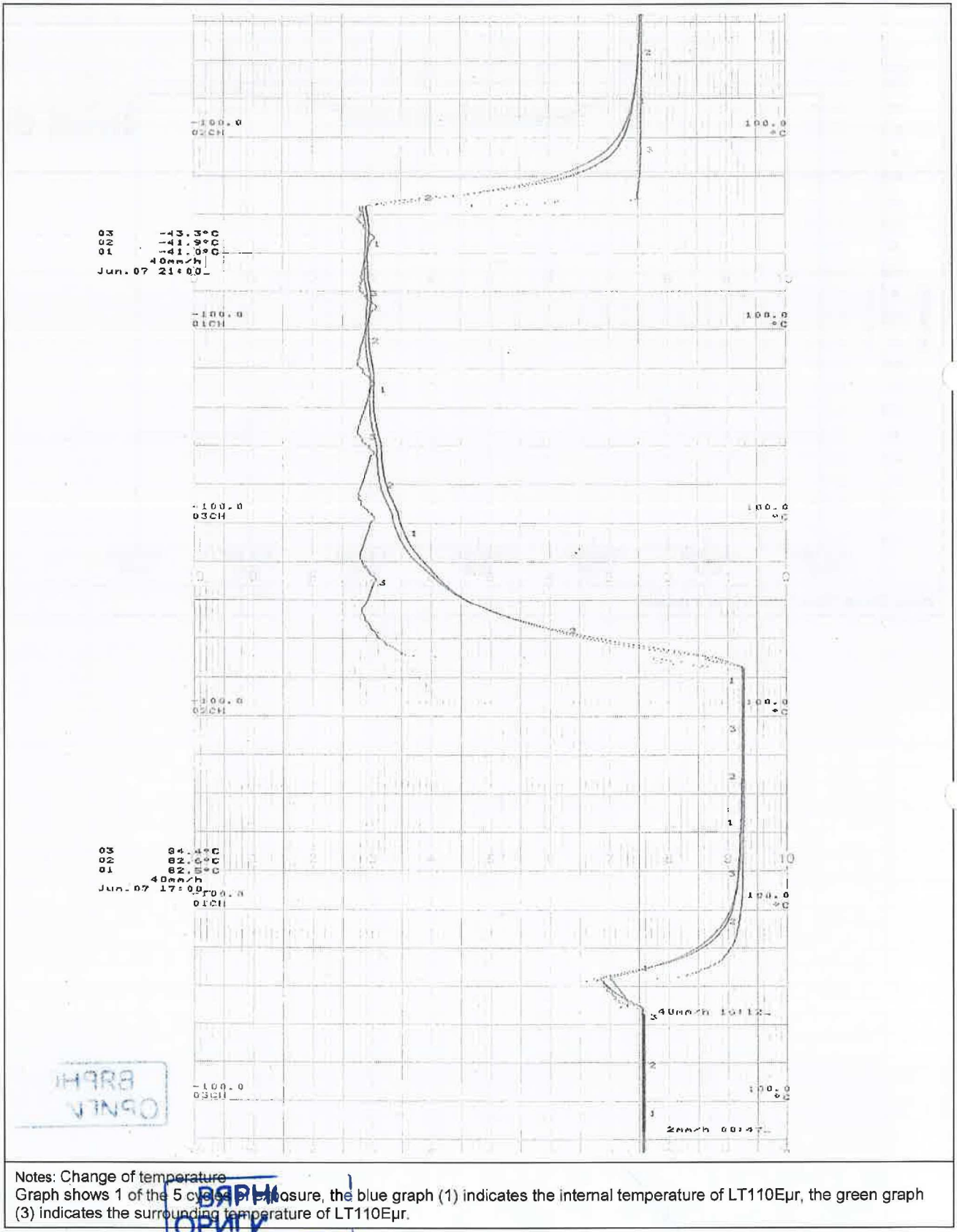
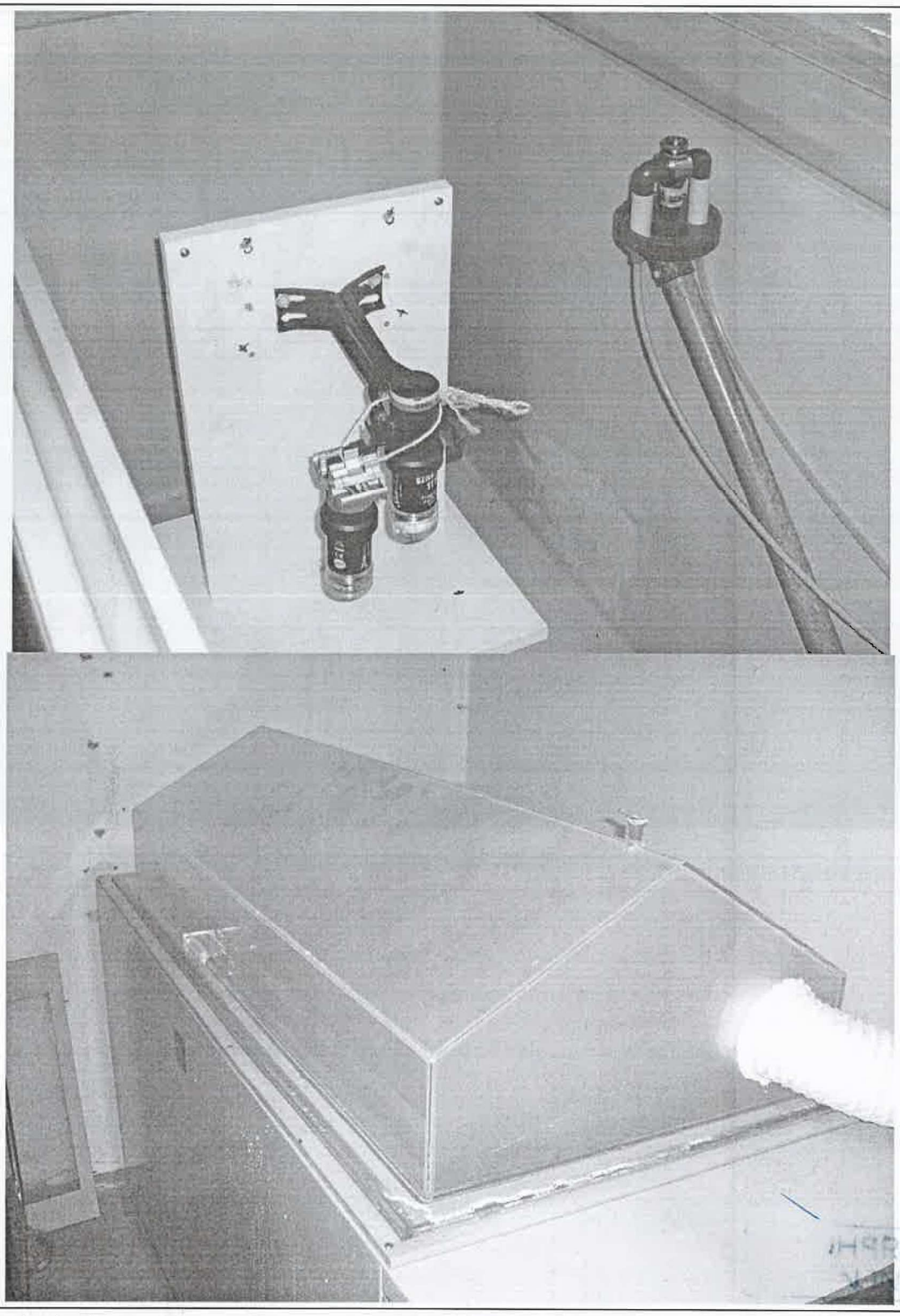
Notes: Damp Heat (Cyclic) (1 of 6 cycles)

ВЯРНО
ОРИГИ



Notes: Change of temperature
Graph shows 1 of the 5 cycles of exposure, the blue graph (1) indicates the internal temperature of LT110Eμr, the green graph (3) indicates the surrounding temperature of LT110Eμr.



Notes: Salt mist chamber

ВЯРНО
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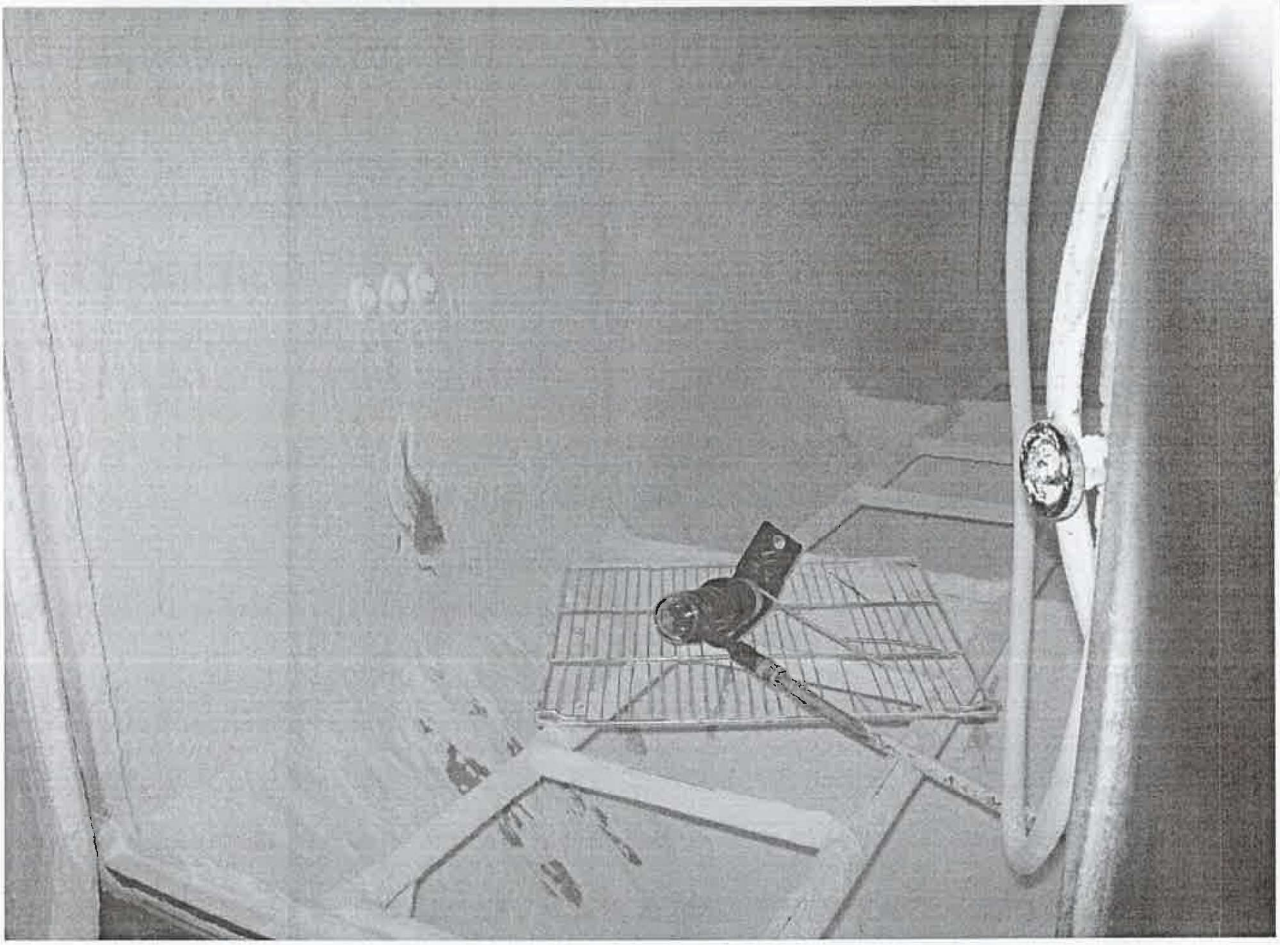

Notes: Ingress Protection (dust)

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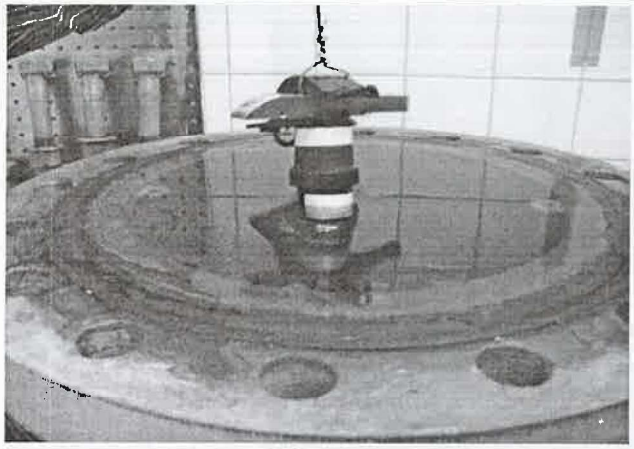

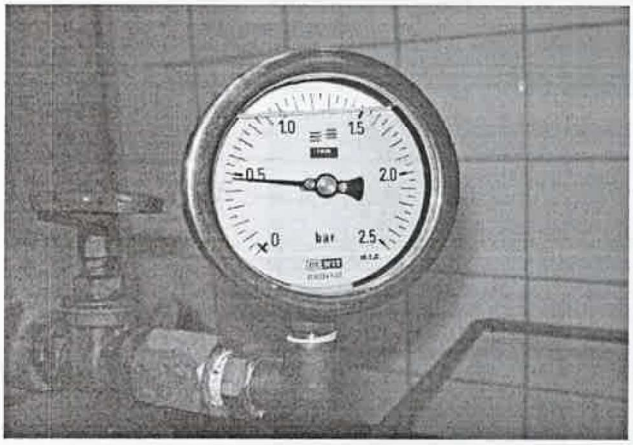

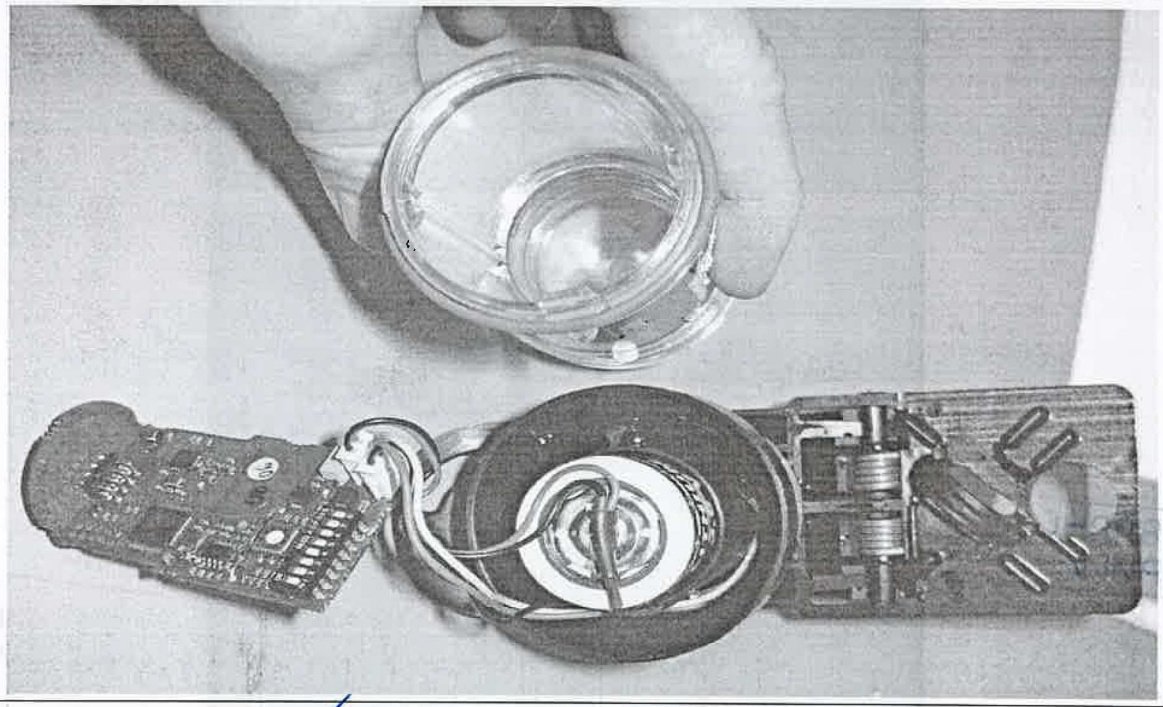

Notes: Ingress Protection (IPX8)

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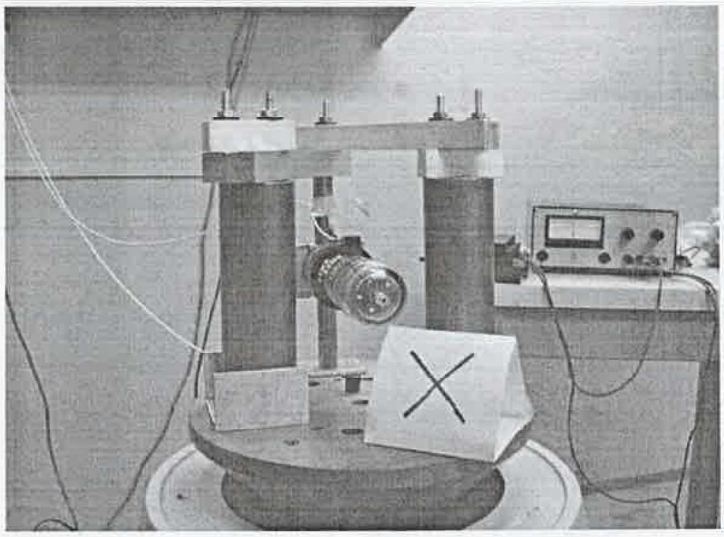
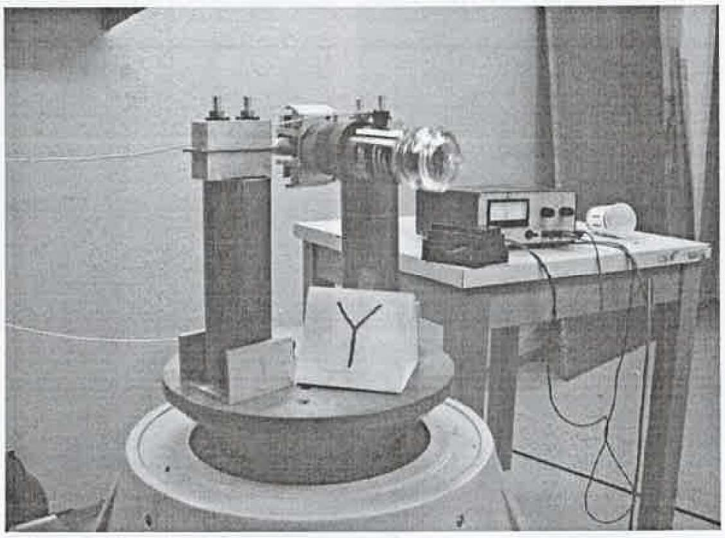
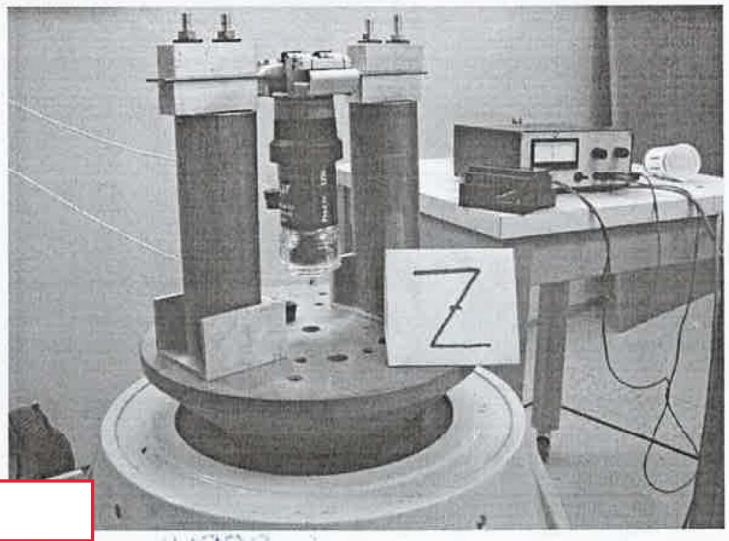
Date: 2010-02-11







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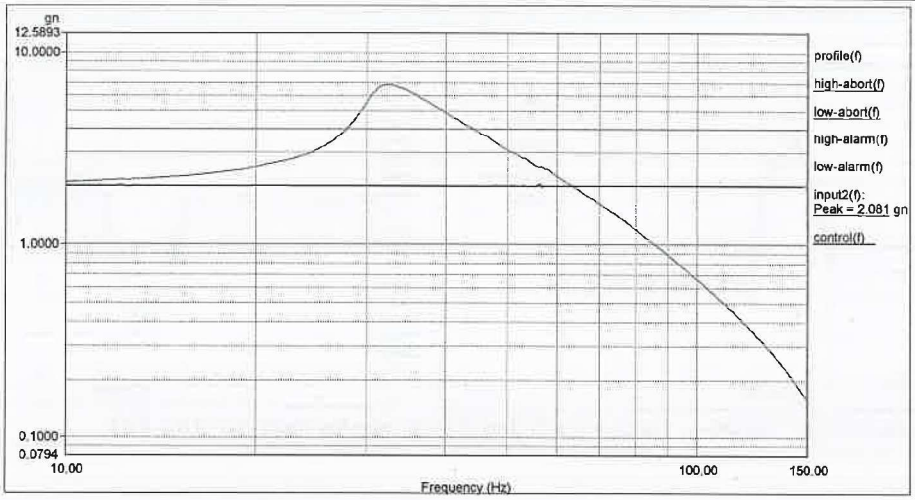
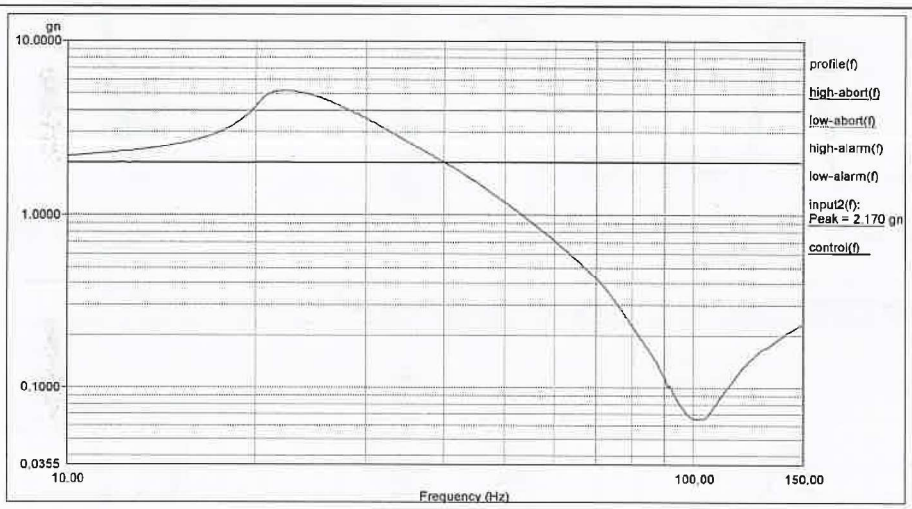
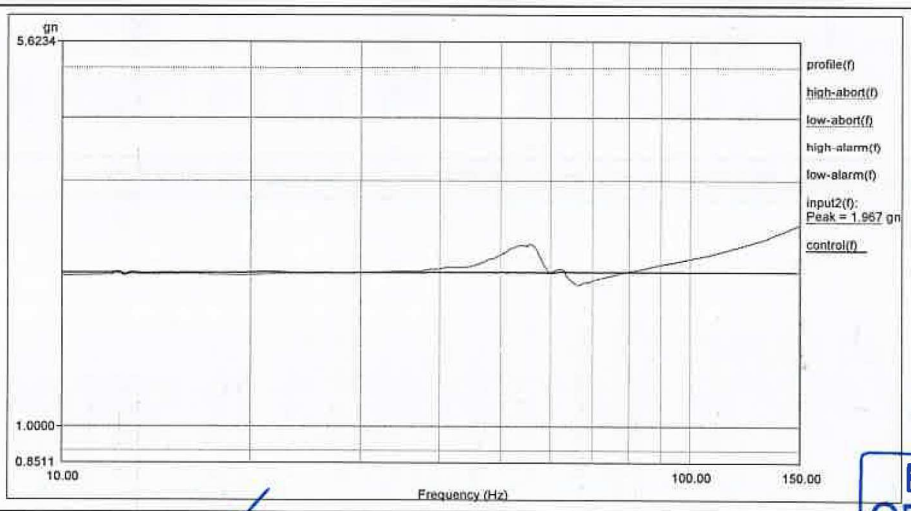
Notes: Vibration, Shock, bump in X, Y and Z axis



Notes: Vibration, X axis, the blue graph (input2) indicates the response of the EUT



Notes: Vibration, Y axis, the blue graph (input2) indicates the response of the EUT



ВЯРНО
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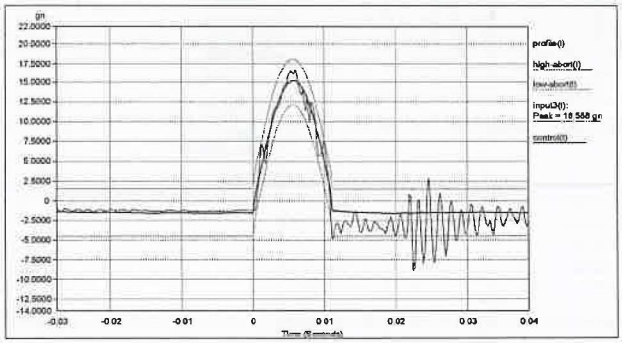
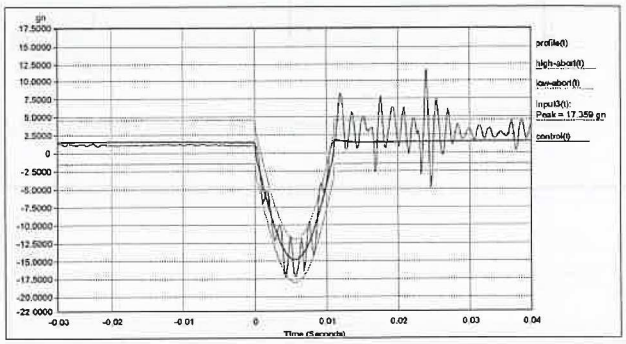
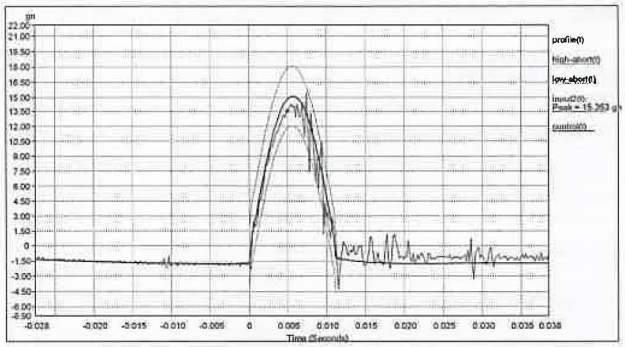
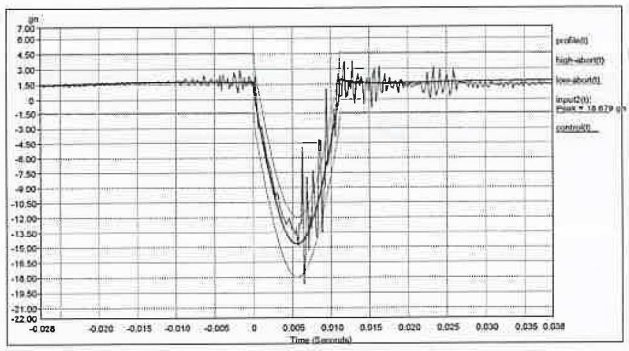
Notes: Vibration, Z axis, the blue graph (input2) indicates the response of the EUT



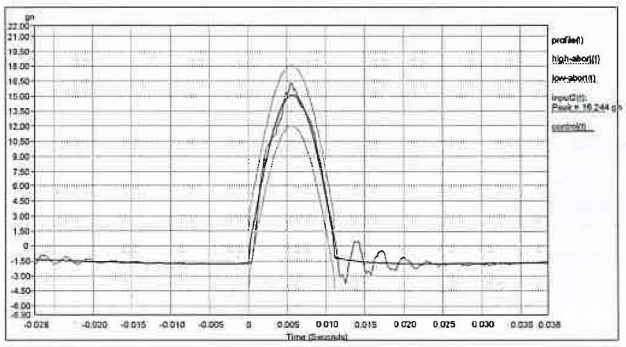


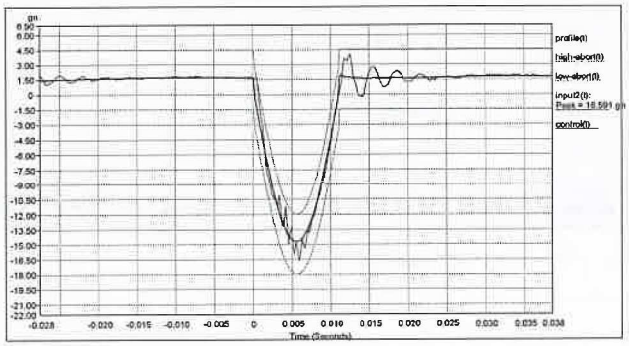
Notes: Shock, X axis (Positive, Negative), the blue graph (input3) indicates the response of the EUT





Notes: Shock, Y axis (Positive, Negative), the blue graph (input2) indicates the response of the EUT





Notes: Shock, Z axis (Positive, Negative), the blue graph (input2) indicates the response of the EUT

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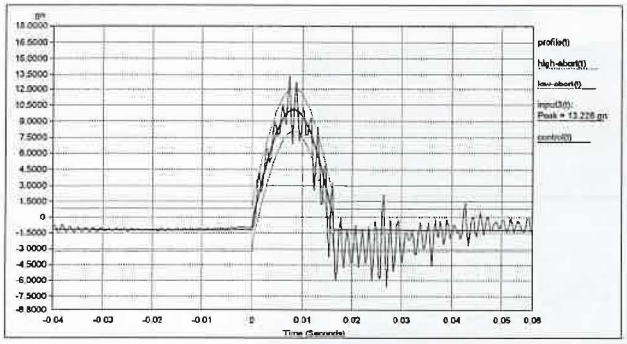
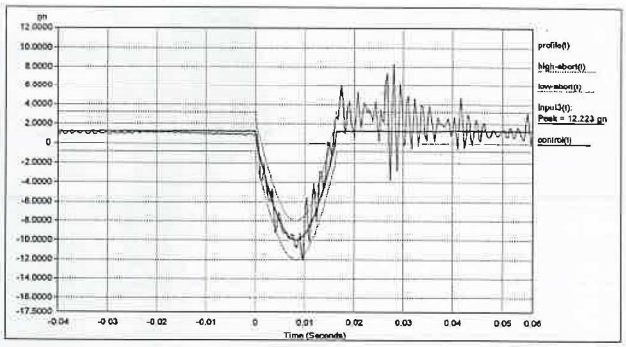
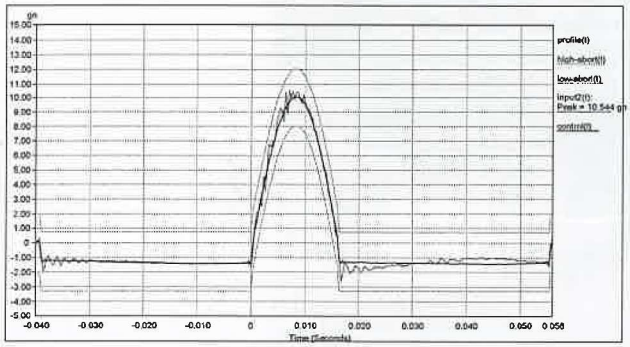
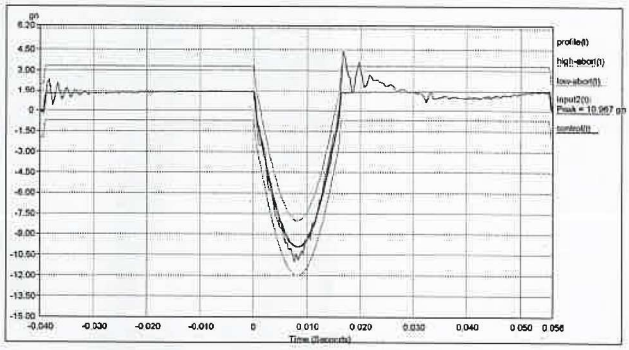




Notes: Bump, X axis (Positive, Negative), the blue graph (input3) indicates the response of the EUT





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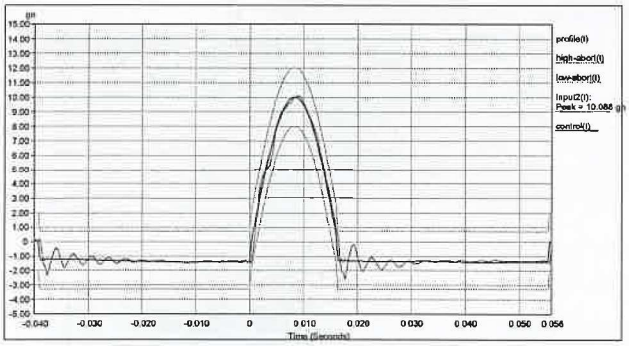

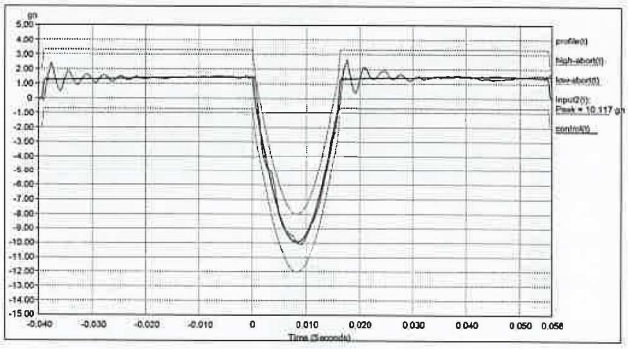

Notes: Bump, Z axis (Positive, Negative), the blue graph (input2) indicates the response of the EUT

ВЯРНО
ОРИГ

Notes: Impact tests

LR F2387

Short-Time Current Test of Fault Indicator

Atle Lenes

SINTEF Energy Research

November 2004

www.energy.sintef.no

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SINTEF

TEST REPORT

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TITLE

Short-Time Current Test of Fault Indicator

TEST CONDUCTED BY (AUTHOR(S))

Atle Lenes (Author)

/ajf

CLIENT(S)

Nortroll AS, Postboks 133, 7601 Levanger

LR NO.	DATE	CLIENT'S REF.
LR F2387	2004-11-01	Terje Venseth

ELECTRONIC FILE CODE	RESPONSIBLE
041015al142054	Rolf Hegerberg, Laboratory Manger

PROJECT NO.	NUMBER OF PAGES	TEST LOCATION
14X27047	6	High Current Laboratory, SINTEF Energy Research

TEST OBJECT	TEST OBJECT RECEIVED
LINETROLL 110Eμ. Phasemounted fault indicator for MV overhead line network. CABLETROLL 2600. Fault indicator for mounting on MV cable network	2004-06-25

TEST PROGRAM	DATE OF TEST
IEEE 495-1986: Testing Faulted Circuit Indicators, Part 4.4.8 – 10.	2004-06-25

SUMMARY

Short-time current tests are performed for two fault circuit indicators. The fault indicators were mounted on a cable and exposed to short circuits. After short-circuits the indicators were running through several tests to verify that the short circuit exposure has not harmed the fault indicators.

The results from the tests show that the fault indicators LINETROLL 110Eμ and CABLETROLL 2600 did withstand two short-time currents of 25 kA and a duration of 0,17 s. The trip current test and the reset test after the short circuit showed that the fault indicators has not been harmed of the short-circuit. All test are performed at approx. 20°C. The trip verification rating test is not performed at various temperatures throughout the specified temperature range for the indicators.

The test results relate only to the items tested

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KEYWORDS

SELECTED BY AUTHOR(S)		
	Fault indicator	Short-circuit