

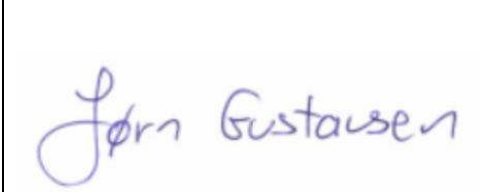



## Test Report

|  |  |  |   |
|--|--|--|---|
| Product  | Convactor Heaters  |  |   |
| Name and address of the applicant  | Adax Fabrikker A/S<br>Postboks 38<br>3061 SVELVIK  |  |   |
| Name and address of the manufacturer   | Adax Fabrikker A/S<br>Postboks 38<br>3061 SVELVIK  |  |   |
| Model  | NP nn xKDT   |  |   |
| Rating   | 400-2000W 230/400V AC 50Hz   |  |   |
| Brand name   | ADAX   |  |   |
| Serial number  | -  |  |   |
| Additional information   | Tested model: NP 20 KDT 2000W 230V AC 50Hz   |  |   |
| Tested according to  | EN 55014-1 (2006) + A1 (2009)<br>EN 61000-3-2 (2006) + A1 (2009) + A2 (2009)<br>EN 61000-3-3 (2008)<br>EN 55014-2 (1997) + A1 (2001) + A2 (2008) |  |   |
| Order number   | 189609   |  |   |
| Tested in period   | 2007-07-26 to 2007-07-27   |  |   |
| Issue date   | 2011-11-28   |  |   |
| Name and address of the testing laboratory   | <br>P.O. Box 73 Blindern,<br>N-0314 Oslo, Norway              | Telephone<br>(+47) 22 96 03 30<br>Fax<br>(+47) 22 96 05 50   | <br>ACCREDITED REPORT<br>REF: NA-TEST 033<br><b>An accredited technical test executed under the Norwegian accreditation scheme</b> |
| <br>Prepared by [Jørn Gustavsen]  |  | <br>Approved by per [Roger Berget] |   |
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## REVISIONS

| Revision # | Date       | Order # | Description                        |
|------------|------------|---------|------------------------------------|
| 00         | 2007-07-27 | 89776   | -                                  |
| 01         | 2011-11-28 | 189609  | Update of reference standards only |
|            |            |         |                                    |

## 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

Convectur Heaters with electronic controls.

### MODEL VARIATIONS

The following model variations are considered covered by this report

| VA no. | Variant   | Comment       | Investigated |
|--------|-----------|---------------|--------------|
| 1      | NP 20 KDT | 2000W 230V AC | Yes          |
| 2      | NP 04 KDT | 400W 230V AC  | No           |
| 3      | NP 06 KDT | 600W 230V AC  | No           |
| 4      | NP 08 KDT | 600W 230V AC  | No           |
| 5      | NP 10 KDT | 1000W 230V AC | No           |
| 6      | NP 12 KDT | 1200W 230V AC | No           |
| 7      | NP 14 KDT | 1400W 230V AC | No           |
| 8      | NP 04 DT  | 400W 400V AC  | No           |
| 9      | NP 06 DT  | 600W 400V AC  | No           |
| 10     | NP 08 DT  | 600W 400V AC  | No           |
| 11     | NP 10 DT  | 1000W 400V AC | No           |
| 12     | NP 12 DT  | 1200W 400V AC | No           |
| 13     | NP 14 DT  | 1400W 400V AC | No           |
| 14     | NP 20 DT  | 2000W 400 VAC | 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.

Note:

NP= Neo Panel

KDT= With cable, plug and digital thermostat.

DT= With Digital thermostat for fixed installation.

### PORTS AVAILABLE

This equipment is fitted with the following electrical ports.

| PO no. | Port Name     | Type    | Count | Comment |
|--------|---------------|---------|-------|---------|
| 1      | AC input Port | 230V AC | 1     | -       |

Notes:

### AVAILABLE OPERATING MODES

The following functional operating modes are available and are considered applicable under intended use.

| FU no. | Operating mode | Comment | Investigated |
|--------|----------------|---------|--------------|
| 1      | Heating        | -       | Yes          |
| 2      | Standby        | -       | -            |

Notes:

### ADDITIONAL INFORMATION RELATED TO TESTING

No further information.

## GENERAL TEST CONDITIONS

### LOCATION

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

|          |  |  |
|----------|--|--|
| <b>X</b> | <b>Gaustad site</b><br>Gaustadalleen 30,<br>N-0314 Oslo, Norway  | Norwegian Accreditation<br>(Identification # TEST 033) |
|          | <b>Skar site</b><br>Maridalsveien 621,<br>N-0890 Oslo, Norway    | Norwegian Accreditation<br>(Identification # TEST 033) |
|          | <b>Kjeller site</b><br>Gåsevikveien 8,<br>N-1300 Kjeller, Norway | Norwegian Accreditation<br>(Identification # TEST 031) |

All Nemko test facilities are accredited by Norsk Akkreditering, according to ISO 17025.

Note: Nemko is a EU Competent/Notified Body for the EMC Directive and the Radio & Telecommunications Terminal Equipment (R&TTE) Directive.

### POWER SUPPLIED TO EUT

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

Voltage type: 230V AC 50Hz

Grounding: Grounded through its power connection

### CLIMATIC 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 was according to EN 60068-1 (1988) + A1 (1992):

|                      |                                  |
|----------------------|----------------------------------|
| Ambient temperature  | 23°C (EN 60068-1: 15 - 35°C)     |
| Relative humidity    | 45%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.

## EVALUATION OF PERFORMANCE

### FUNCTIONS MONITORED DURING IMMUNITY TESTS

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

| #      | Function | Monitoring method |
|--------|----------|-------------------|
| 1      | Display  | Visual            |
| 2      | Heating  | Temperature       |
| Notes: |          |                   |

### PERFORMANCE CHECKS

The following functional tests were conducted to verify correct performance of the EuT before and after each test.

| #      | Functional test   |
|--------|---|
| 1      | All function was tested before and after each test to verify normal behavior. |
| Notes: |   |

### PERFORMANCE CRITERIA

The following performance criteria have been applied during the immunity tests.

| Criteria | General description  | Criteria modified by manufacturer |
|----------|--|-----------------------------------|
| 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 | -                                 |
| 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                 | -                                 |
| 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   | -                                 |
| Notes:   |  |                                   |

## SUMMARY OF TESTING

### APPLIED STANDARDS

- » **EN 55014-1 (2006)  
+ A1 (2009)** *Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus -- Part 1: Emission*
  
- » **EN 61000-3-2 (2006)  
+ A1 (2009)  
+ A2 (2009)** *Electromagnetic compatibility (EMC) -- Part 3-2: Limits - Limits for harmonic current emissions (equipment input current up to and including 16 A per phase)*
  
- » **EN 61000-3-3 (2008)** *Electromagnetic compatibility (EMC) -- Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection*
  
- » **EN 55014-2 (1997)  
+ A1 (2001)  
+ A1 (2008)** *Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus -- Part 2: Immunity - Product family standard*

### APPLIED TESTS

| Test items                        | Test methods  | Result |
|-----------------------------------|---|--------|
| Mains Port Disturbance Voltage    | EN 55014-1 (2006) + A1 (2009)   | PASS   |
| Loads Port Disturbance Voltage    | EN 55014-1 (2006) + A1 (2009)   | NA     |
| Discontinuous Disturbance Voltage | EN 55014-1 (2006) + A1 (2009)   | NA     |
| Disturbance Power                 | EN 55014-1 (2006) + A1 (2009)   | PASS   |
| Harmonics                         | EN 61000-3-2 (2006) + A2 (2009) + A2 (2009)                               | PASS   |
| Flicker                           | EN 61000-3-3 (2008)   | PASS   |
| Electrostatic Discharges          | EN 55014-2 (1997) + A1 (2001) + A2 (2008)<br>EN 61000-4-2 (2001), Ed.1.2  | PASS   |
| Radiated RF Field                 | EN 55014-2 (1997) + A1 (2001) + A2 (2008)<br>EN 61000-4-3 (2001), Ed.2.0  | NA     |
| Electric Fast Transients          | EN 55014-2 (1997) + A1 (2001) + A2 (2008)<br>EN 61000-4-4 (2001), Ed.1.1  | PASS   |
| Surge                             | EN 55014-2 (1997) + A1 (2001) + A2 (2008)<br>EN 61000-4-5 (2001), Ed.1.1  | PASS   |
| Conducted RF Disturbance          | EN 55014-2 (1997) + A1 (2001) + A2 (2008)<br>EN 61000-4-6 (2003), Ed.2.0  | PASS   |
| Dips/Interruptions                | EN 55014-2 (1997) + A1 (2001) + A2 (2008)<br>EN 61000-4-11 (2001), Ed.1.1 | PASS   |

Note: An asterisk (\*) placed after the verdict in the Result column indicates test items that are not within Nemko's scope of accreditation.

Note: 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**

Nemko has not recorded any deviations to the applied standards.  
Nemko has made no general evaluations.

# Test Results



## EMISSION – MAINS PORT DISTURBANCE VOLTAGE

### TEST DESCRIPTION

#### Method

CISPR 16-2-1 Ed.1.1 (2005)

Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-1: Methods of measurement of disturbances and immunity - Conducted disturbance measurements.

#### Set-up

The measurements were performed in a shielded enclosure. EuT was connected to an Artificial Mains Network (AMN) and placed on a wooden table 10cm (floor-standing) or 80cm (tabletop) above the grounded floor and 40cm from the reference ground plane (wall). EuT was connected to the AMN by its power cable, which was adjusted to 100cm length by folding.

#### 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.

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

The frequency was swept in the range specified under Severity.

A comparison of the results obtained from the different wires was 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 was exceeding the applicable [limit - offset], the emission was also measured with the quasi-peak detector and, if required, with the average detector.

#### Instruments used during measurement

Instrument list:           EMI Receiver: Rohde&Schwarz ESHS 30 (N-3529) (8/07)  
                                  LISN: Rohde&Schwarz ESH2-Z5 (N-3558) (10/07)  
                                  Puls Limiter: Rohde&Schwarz ESH3-Z2 (N-3932) (06/08)

#### Comments

No recorded comments.

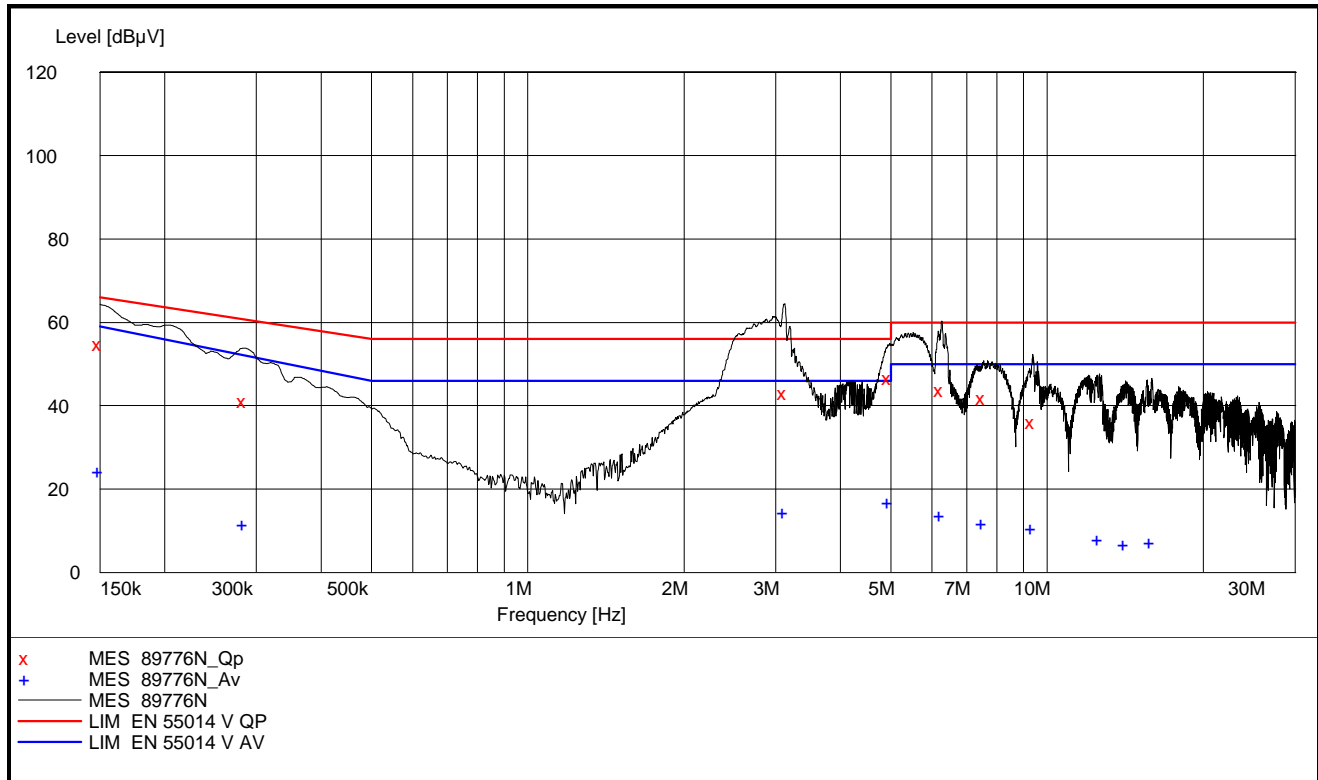
#### Severity

|                  |                   |
|------------------|-------------------|
| Port:            | AC Input Port     |
| Frequency range: | 0.15 - 30 MHz     |
| Frequency step:  | 100 Hz / 5 kHz    |
| Dwell time:      | 50 mSec / 20 mSec |
| Bandwidth:       | 200 Hz / 10 kHz   |

#### Conformity

|                |                |
|----------------|----------------|
| Verdict:       | Pass           |
| Test engineer: | Jørn Gustavsen |

## DISTURBANCE PREVIEW



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 [dBuV] | Af [dB] | Limit [dBuV] | Margin [dB] | Det | Position | Verdict [Pass/Fail] |
|-----------------|--------------|---------|--------------|-------------|-----|----------|---------------------|
| 0.150000        | 54.80        | 10.10   | 66.00        | -11.20      | QP  | N        | Pass                |
| 0.285000        | 41.10        | 10.10   | 60.70        | -19.60      | QP  | N        | Pass                |
| 3.120000        | 43.10        | 10.30   | 56.00        | -12.90      | QP  | L1       | Pass                |
| 4.970000        | 46.70        | 10.40   | 56.00        | -9.30       | QP  | L1       | Pass                |
| 6.265000        | 43.70        | 10.40   | 60.00        | -16.30      | QP  | L1       | Pass                |
| 7.535000        | 41.70        | 10.50   | 60.00        | -18.30      | QP  | L1       | Pass                |
| 9.380000        | 35.90        | 10.50   | 60.00        | -24.10      | QP  | N        | Pass                |

**AVERAGE DETECTOR DATA**

| Frequency [MHz] | Level [dBuV] | Af [dB] | Limit [dBuV] | Margin [dB] | Det | Position | Verdict [Pass/Fail] |
|-----------------|--------------|---------|--------------|-------------|-----|----------|---------------------|
| 0.150000        | 24.40        | 10.10   | 59.00        | -34.60      | AV  | N        | Pass                |
| 0.285000        | 11.70        | 10.10   | 52.10        | -40.40      | AV  | N        | Pass                |
| 3.120000        | 14.50        | 10.30   | 46.00        | -31.50      | AV  | L1       | Pass                |
| 4.970000        | 16.90        | 10.40   | 46.00        | -29.10      | AV  | L1       | Pass                |
| 6.265000        | 13.70        | 10.40   | 50.00        | -36.30      | AV  | L1       | Pass                |
| 7.535000        | 11.90        | 10.50   | 50.00        | -38.10      | AV  | L1       | Pass                |
| 9.380000        | 10.70        | 10.50   | 50.00        | -39.30      | AV  | N        | Pass                |
| 12.610000       | 8.00         | 10.70   | 50.00        | -42.00      | AV  | N        | Pass                |
| 14.160000       | 6.80         | 10.80   | 50.00        | -43.20      | AV  | L1       | Pass                |
| 15.895000       | 7.20         | 10.90   | 50.00        | -42.80      | AV  | N        | Pass                |

## EMISSION – DISTURBANCE POWER

### TEST DESCRIPTION

#### Method

CISPR 16-2-2 Ed.1.2 (2005)

Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-2: Methods of measurement of disturbances and immunity – Measurement of disturbance power.

#### Set-up

The measurements were performed in a shielded enclosure. EuT was connected to the end of an automatic "absorbing clamp" slideway. EuT was placed on a wooden table 10 cm (floor standing) / 80 cm (tabletop) above the floor and at least 80 cm from any conductive structure. EuT was placed as close as possible to the absorbing clamp's zero-point (start of slideway) and the mains cable was extended to at least 6 meter length. The mains cable was then lead thru the "absorbing clamp" (which is a current probe followed by 50 cm of highly absorptive ferrite) and along the clamp slideway path.

#### Procedure

A screening test was first performed to decide the most disturbing operating mode of the EuT and deciding the proper dwell time for the measurements.

A measurement was then run at the clamps zero-point.

The frequency was swept in the range specified under Severity.

At the frequencies where the peak values of the emission were exceeding the applicable [limit - offset], a "maximum search" was performed to find the maximum emitting point along the cable. This was done by moving the clamp along the cable (from 0 to 5 meter) and constantly measures the emission. The clamp was then moved back to the maximum point where the emission was also measured with the quasi-peak detector and, if required, with the average detector.

#### Instruments used during measurement

Instrument list:            Clamp: Rohde&Schwarz MDS 21 (N-4275) (12/07)  
   EMI Receiver: Rohde&Schwarz ESVS20 (N-2886) (7/07)

#### Comments

No recorded comments.

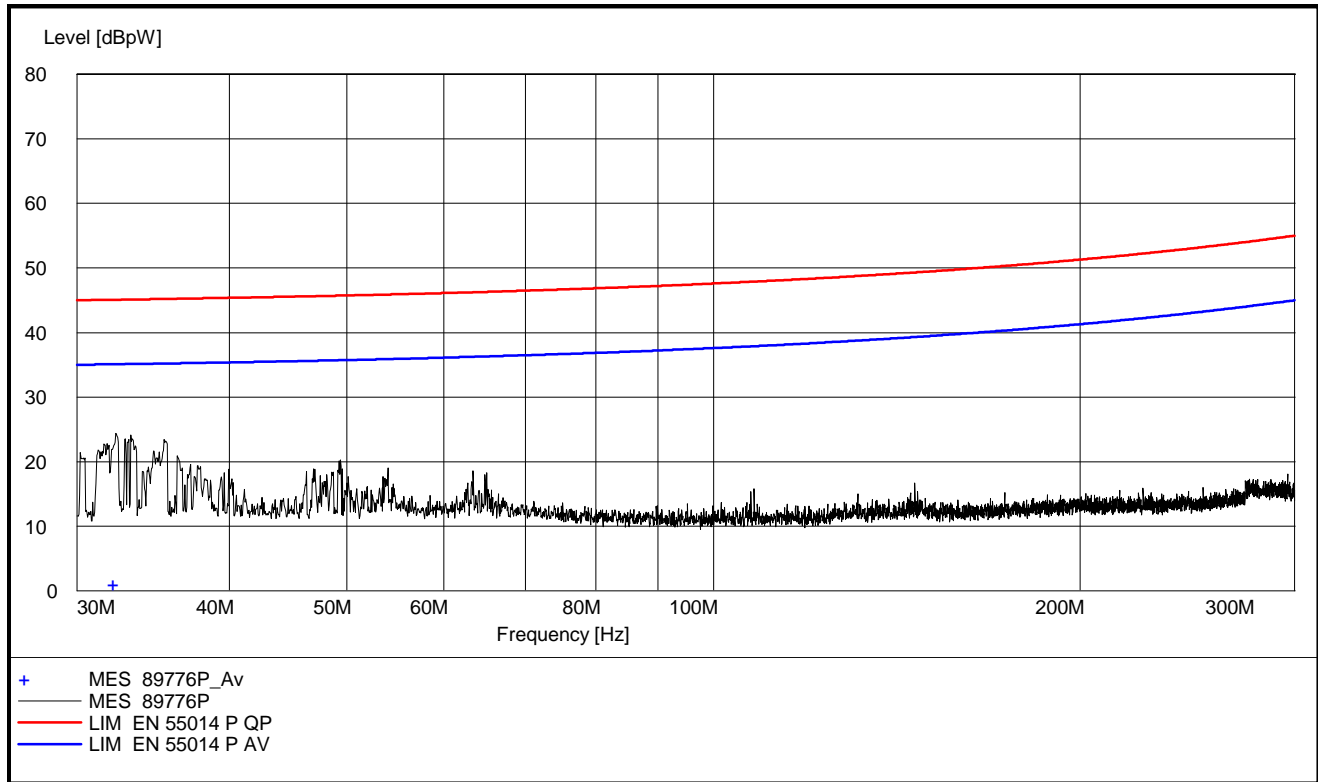
#### Severity

|                  |                  |
|------------------|------------------|
| Port:            | AC Input Port    |
| Frequency range: | 30 MHz – 300 MHz |
| Frequency step:  | 80 kHz           |
| Dwell time:      | 100 mSec         |
| Bandwidth:       | 120 kHz          |

#### Conformity

|                |                |
|----------------|----------------|
| Verdict:       | Pass           |
| Test engineer: | Jørn Gustavsen |

### DISTURBANCE PREVIEW



Note: This preview is a peak detector scan at the clamps 0 point. Any quasi-peak or average detector measurements are conducted at a localised maxima ("x" = quasi-peak / "+" = average. Measurement data are presented below)

### QUASI PEAK DETECTOR DATA

| Frequency [MHz] | Level [dBuV] | Af [dB] | Limit [dBuV] | Margin [dB] | Det | Position | Verdict [Pass/Fail] |
|-----------------|--------------|---------|--------------|-------------|-----|----------|---------------------|
| -               | -            | -       | -            | -           | -   | -        | Pass                |

### AVERAGE DETECTOR DATA

| Frequency [MHz] | Level [dBuV] | Af [dB] | Limit [dBuV] | Margin [dB] | Det | Position | Verdict [Pass/Fail] |
|-----------------|--------------|---------|--------------|-------------|-----|----------|---------------------|
| 32.280000       | 1.10         | 2.90    | 35.1         | -34.00      | AV  | 81.0     | Pass                |

## POWER QUALITY – HARMONIC DISTORTION

### TEST DESCRIPTION

#### Method

EN 61000-3-2 (2001)

Electro-magnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current  $\leq 16$  A per phase).

#### Set-up

EuT is connected to the Power Analyser system. A steady and undistorted AC mains is supplied to the EuT from a power supply matrix.

#### Procedure

10 seconds after the energizing of the EuT, the current harmonics is monitored for the time specified below.

Measurements are run on all active phases, searching for current harmonics 1<sup>st</sup> to 40<sup>th</sup> of the mains frequency (50 Hz or 60 Hz).

An overview of the harmonic emission is presented as numeric and as graphics below.

#### Instruments used during measurement

Instrument list: [Power Analyzer: California Instruments C15000iX-400-CTS \(N-4082\) \(3/08\)](#)

#### Comments

No recorded comments.

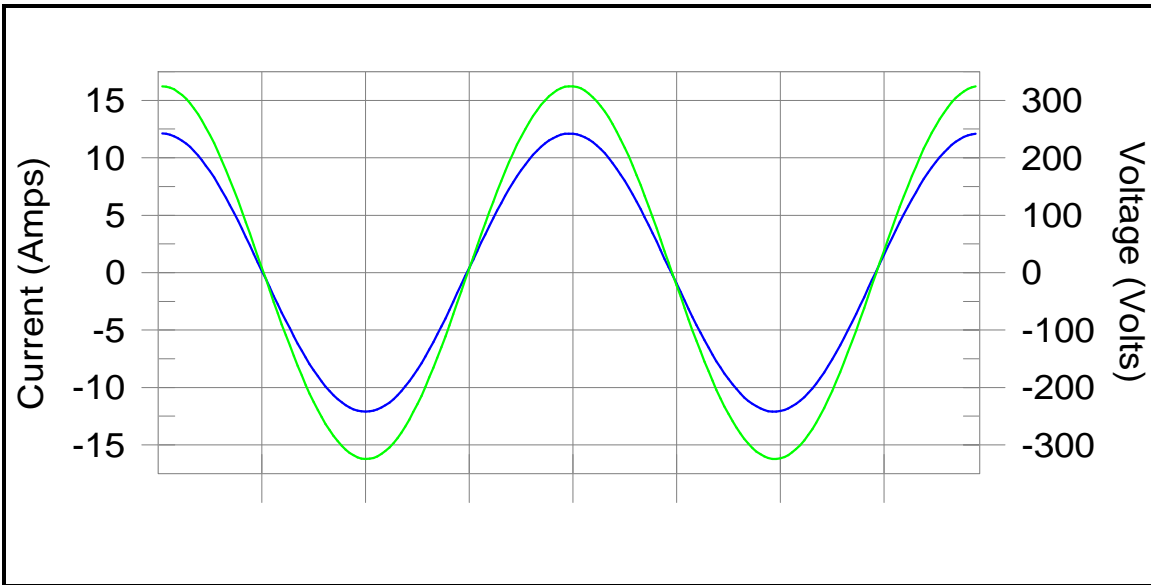
#### Severity

|                   |               |
|-------------------|---------------|
| Port:             | AC Input Port |
| Class identifier: | A             |
| Duration:         | 2,5Min        |

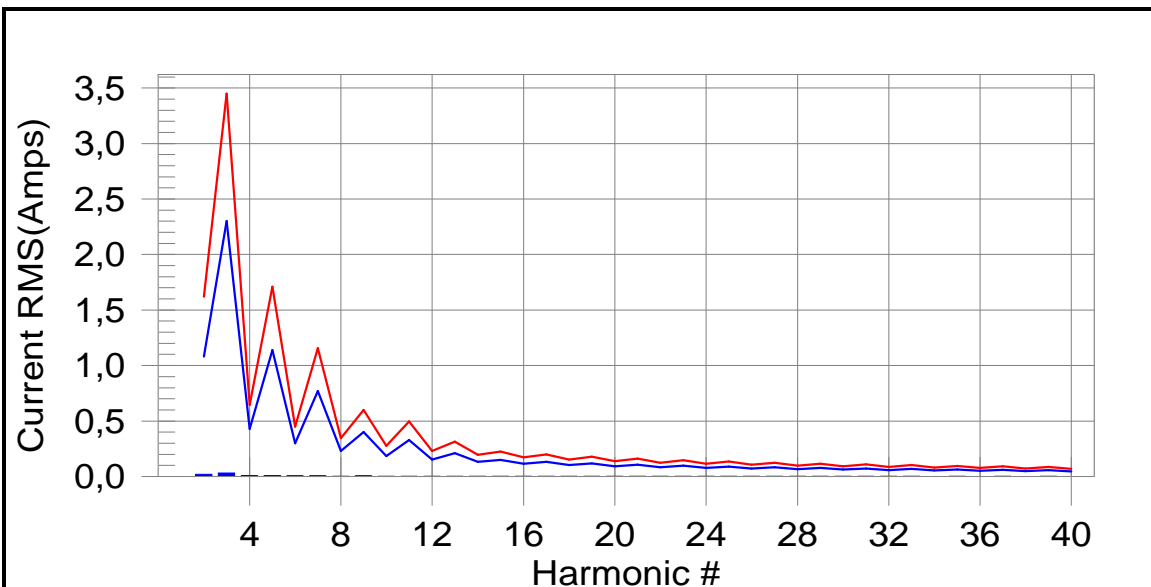
#### Conformity

|                |                |
|----------------|----------------|
| Verdict:       | Pass           |
| Test engineer: | Jørn Gustavsen |

**CURRENT & VOLTAGE WAVESHAPES**



**HARMONIC CONTENTS – GRAPHIC PRESENTATION**



**HARMONIC CONTENTS – NUMERIC PRESENTATION**

| Harm# | Harms(avg) | 100%Limit | %of Limit | Harms(max) | 150%Limit | %of Limit | Status |
|-------|------------|-----------|-----------|------------|-----------|-----------|--------|
| 2     | 0,016      | 1,080     | 1,5       | 0,021      | 1,620     | 1,32      | Pass   |
| 3     | 0,024      | 2,300     | 1,0       | 0,032      | 3,450     | 0,93      | Pass   |
| 4     | 0,005      | 0,430     | 1,3       | 0,008      | 0,645     | 1,25      | Pass   |
| 5     | 0,005      | 1,140     | 0,5       | 0,008      | 1,710     | 0,49      | Pass   |
| 6     | 0,003      | 0,300     | 1,0       | 0,005      | 0,450     | 1,07      | Pass   |
| 7     | 0,005      | 0,770     | 0,7       | 0,007      | 1,155     | 0,59      | Pass   |
| 8     | 0,002      | 0,230     | 1,0       | 0,004      | 0,345     | 1,03      | Pass   |
| 9     | 0,004      | 0,400     | 0,9       | 0,005      | 0,600     | 0,81      | Pass   |
| 10    | 0,002      | 0,184     | 1,1       | 0,003      | 0,276     | 1,24      | Pass   |
| 11    | 0,002      | 0,330     | 0,7       | 0,004      | 0,495     | 0,71      | Pass   |
| 12    | 0,002      | 0,153     | 1,1       | 0,003      | 0,230     | 1,12      | Pass   |
| 13    | 0,003      | 0,210     | 1,3       | 0,004      | 0,315     | 1,18      | Pass   |
| 14    | 0,001      | 0,131     | 0,9       | 0,002      | 0,197     | 1,05      | Pass   |
| 15    | 0,003      | 0,150     | 1,8       | 0,003      | 0,225     | 1,54      | Pass   |
| 16    | 0,001      | 0,115     | 1,2       | 0,002      | 0,173     | 1,22      | Pass   |
| 17    | 0,002      | 0,132     | 1,6       | 0,003      | 0,199     | 1,50      | Pass   |
| 18    | 0,001      | 0,102     | 1,3       | 0,002      | 0,153     | 1,28      | Pass   |
| 19    | 0,002      | 0,118     | 1,8       | 0,003      | 0,178     | 1,64      | Pass   |
| 20    | 0,001      | 0,092     | 1,1       | 0,002      | 0,138     | 1,18      | Pass   |
| 21    | 0,002      | 0,107     | 1,9       | 0,003      | 0,161     | 1,62      | Pass   |
| 22    | 0,001      | 0,084     | 1,1       | 0,002      | 0,125     | 1,28      | Pass   |
| 23    | 0,002      | 0,098     | 1,7       | 0,002      | 0,147     | 1,54      | Pass   |
| 24    | 0,001      | 0,077     | 1,1       | 0,001      | 0,115     | 1,17      | Pass   |
| 25    | 0,003      | 0,090     | 2,9       | 0,004      | 0,135     | 2,69      | Pass   |
| 26    | 0,001      | 0,071     | 1,2       | 0,001      | 0,106     | 1,23      | Pass   |
| 27    | 0,002      | 0,083     | 3,0       | 0,003      | 0,125     | 2,63      | Pass   |
| 28    | 0,001      | 0,066     | 1,2       | 0,001      | 0,099     | 1,22      | Pass   |
| 29    | 0,001      | 0,078     | 1,9       | 0,002      | 0,116     | 1,67      | Pass   |
| 30    | 0,001      | 0,061     | 1,3       | 0,001      | 0,092     | 1,35      | Pass   |
| 31    | 0,001      | 0,073     | 1,9       | 0,002      | 0,109     | 1,67      | Pass   |
| 32    | 0,001      | 0,058     | 1,3       | 0,001      | 0,086     | 1,33      | Pass   |
| 33    | 0,001      | 0,068     | 2,0       | 0,002      | 0,102     | 1,78      | Pass   |
| 34    | 0,001      | 0,054     | 1,2       | 0,001      | 0,081     | 1,22      | Pass   |
| 35    | 0,001      | 0,064     | 1,8       | 0,001      | 0,096     | 1,51      | Pass   |
| 36    | 0,001      | 0,051     | 1,2       | 0,001      | 0,077     | 1,27      | Pass   |
| 37    | 0,001      | 0,061     | 2,1       | 0,002      | 0,091     | 1,71      | Pass   |
| 38    | 0,001      | 0,048     | 1,2       | 0,001      | 0,073     | 1,22      | Pass   |
| 39    | 0,001      | 0,058     | 1,9       | 0,001      | 0,087     | 1,71      | Pass   |
| 40    | 0,001      | 0,046     | 1,2       | 0,001      | 0,069     | 1,15      | Pass   |



# POWER QUALITY – FLICKER

## TEST DESCRIPTION

### Method

EN 61000-3-3 (1995) + A1 (2001)

Electro-magnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection.

### Set-up

EuT was connected to the Power Analyser system. A steady and undistorted AC mains was supplied to the EuT from an ideal power supply matrix. The power supply provided a standardized mains impedance by means of synthetic programmable impedances.

### Procedure

Measurements were performed to monitor the required flicker parameters. The measuring time depends on which parameters are measured:

- 2 hours when Long Time Flicker assessment (Plt) is to be made.
- 10 minutes when Short Time Flicker assessment (Pst) is to be made
- 1 or 10 minutes when only Dmax, Dc and Dt is to be assessed (depending on EuT switch-rate)

A measurement table and a graphic presentation of the probability function of Short Time Flicker during this session (if measured) are presented in the report.

### Instruments used during measurement

Instrument list: [Power Analyzer: California Instruments C15000iX-400-CTS \(N-4082\) \(3/08\)](#)

### Comments

No recorded comments.

### Severity

Port: [AC Input Port](#)  
 Duration: [120min](#)

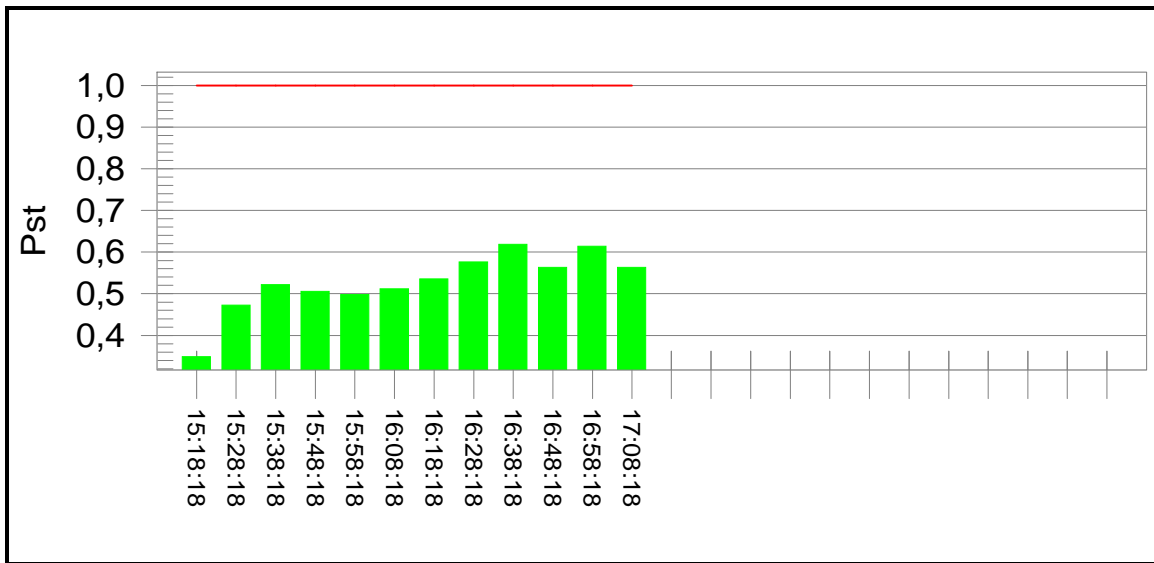
### Conformity

Verdict: [Pass](#)  
 Test engineer: [Jørn Gustavsen](#)

## NUMERIC PRESENTATION

| Parameter | Limit    | Measured | Result |
|-----------|----------|----------|--------|
| Dmax      | 4 %      | 1.47 %   | PASS   |
| Dc        | 3.3 %    | 1.43 %   | PASS   |
| Dt        | 500 msec | 0.0 msec | PASS   |
| Pst       | 1.0      | 0.619    | PASS   |
| Plt       | 0.65     | 0.536    | PASS   |
| Note:     |          |          |        |

**FLICKER PROBABILITY – PST**



# 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) (3/08)

### Comments

No recorded comments.

### Severity

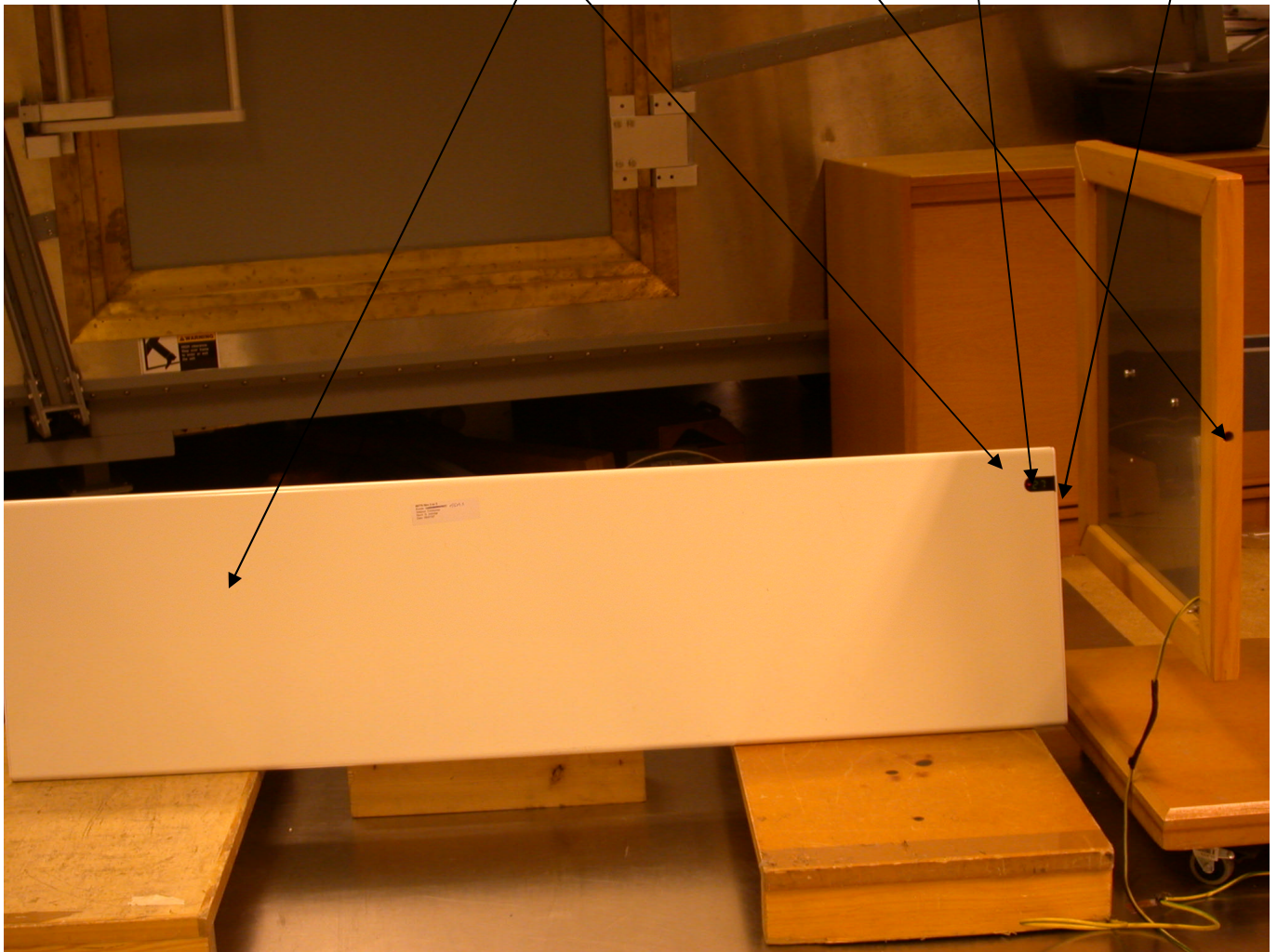
Port: Enclosure Port

### Conformity

Verdict: Pass

Test engineer: Jørn Gustavsen

**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 |
|---|--------------------|----------------|----------------------|-------------------|-------------------|--------|
| Display   | +4                 | Air            | 10                   | B                 | A                 | PASS   |
| Display   | -4                 | Air            | 10                   | B                 | A                 | PASS   |
| Display   | +8                 | Air            | 10                   | B                 | A                 | PASS   |
| Display   | -8                 | Air            | 10                   | B                 | A                 | PASS   |
| Buttons   | +4                 | Air            | 10                   | B                 | A                 | PASS   |
| Buttons   | -4                 | Air            | 10                   | B                 | A                 | PASS   |
| Buttons   | +8                 | Air            | 10                   | B                 | A                 | PASS   |
| Buttons   | -8                 | Air            | 10                   | B                 | A                 | PASS   |
| VCP   | +2                 | Contact        | 10                   | B                 | A                 | PASS   |
| VCP   | -2                 | Contact        | 10                   | B                 | A                 | PASS   |
| VCP   | +4                 | Contact        | 10                   | B                 | A                 | PASS   |
| VCP   | -4                 | Contact        | 10                   | B                 | A                 | PASS   |
| Meta body   | +2                 | Contact        | 10                   | B                 | A                 | PASS   |
| Meta body   | -2                 | Contact        | 10                   | B                 | A                 | PASS   |
| Meta body   | +4                 | Contact        | 10                   | B                 | A                 | PASS   |
| Meta body   | -4                 | Contact        | 10                   | B                 | A                 | PASS   |
| Note: No operation errors were detected during or after the applied test(s) |                    |                |                      |                   |                   |        |

# IMMUNITY – ELECTRIC FAST TRANSIENTS

## TEST DESCRIPTION

### Method

EN 61000-4-4 (1995) + A1 (2001) + A2 (2001)  
 Electromagnetic compatibility (EMC) -- Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test.

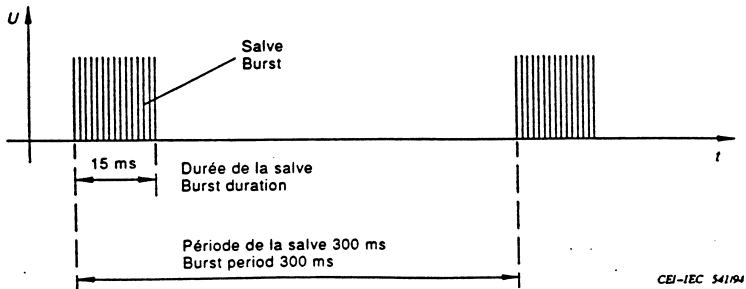
### Set-up

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 (floor standing) / 80 cm (tabletop) above the reference plane, and all cables attached to the EuT is isolated the same way.

### Procedure

Transients are applied at increasing levels to each single line at the AC or DC mains port using a coupling network, and other remaining ports using a capacitive coupling clamp.



### Instruments used during measurement

Instrument list: CS Test System: Schaffner Best EMC (N-4103) (5/08)

### Comments

No recorded comments.

### Severity

Port: AC Input Port  
 Duration: 2min

### Conformity

Verdict: Pass  
 Test engineer: Jørn Gustavsen

## 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).

| Port               | Applied Level [kV] | Injection Method | Required Criteria | Complied Criteria | Result |
|--------------------|--------------------|------------------|-------------------|-------------------|--------|
| AC Input Port (N)  | +1                 | CDN              | B                 | A                 | PASS   |
| AC Input Port (N)  | -1                 | CDN              | B                 | A                 | PASS   |
| AC Input Port (L1) | +1                 | CDN              | B                 | A                 | PASS   |
| AC Input Port (L1) | -1                 | CDN              | B                 | A                 | PASS   |
| AC Input Port (PE) | +1                 | CDN              | B                 | A                 | PASS   |
| AC Input Port (PE) | -1                 | CDN              | B                 | A                 | PASS   |

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

# IMMUNITY – SURGE

## TEST DESCRIPTION

### Method

EN 61000-4-5 (1995) + A1 (2001)

Electromagnetic compatibility (EMC) -- Part 4-5: Testing and measurement techniques - Surge immunity test.

### Set-up

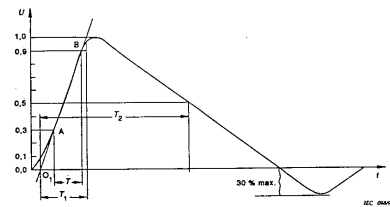
The surge generator is connected to earth via a low impedance connection. No presence of an earth/reference plane is necessary. The surge test is only applicable to AC mains.

### Procedure

For each test level and for each wire tested, the surges are applied at different phase angles, usually with 90° steps.

Differential mode surges are applied live-to-neutral and live-to-live, with a source impedance of 2Ω. Common mode surges are applied line-to-ground and neutral-to-ground, with a source impedance of 12Ω.

The surges are applied with time intervals of 60 seconds.



Front time:  $T_1 = 1.67 \times T = 1.2 \mu s \pm 30\%$   
 Time to half-value:  $T_2 = 50 \mu s \pm 20\%$

Figure 2 – Waveform of open-circuit voltage (1,2/50 μs)  
 (waveform definition according to IEC 60-1)

### Instruments used during measurement

Instrument list: CS Test System: Schaffner Best EMC (N-4103) (5/08)

### Comments

No recorded comments.

### Severity

Port: AC Input Port  
 Intervals: 60sec

### Conformity

Verdict: Pass  
 Test engineer: Jørn Gustavsen



## 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).

| Wire  | Phase angle [deg] | Applied Level [kV] | Number of impulses | Required Criteria | Complied Criteria | Result |
|---|-------------------|--------------------|--------------------|-------------------|-------------------|--------|
| AC Input Port (N to PE)   | 0/90/180/270      | +0.5               | 5                  | B                 | A                 | PASS   |
| AC Input Port (N to PE)   | 0/90/180/270      | -0.5               | 5                  | B                 | A                 | PASS   |
| AC Input Port (N to PE)   | 0/90/180/270      | +1                 | 5                  | B                 | A                 | PASS   |
| AC Input Port (N to PE)   | 0/90/180/270      | -1                 | 5                  | B                 | A                 | PASS   |
| AC Input Port (N to PE)   | 0/90/180/270      | +2                 | 5                  | B                 | A                 | PASS   |
| AC Input Port (N to PE)   | 0/90/180/270      | -2                 | 5                  | B                 | A                 | PASS   |
| AC Input Port (L1 to PE)  | 0/90/180/270      | +0.5               | 5                  | B                 | A                 | PASS   |
| AC Input Port (L1 to PE)  | 0/90/180/270      | -0.5               | 5                  | B                 | A                 | PASS   |
| AC Input Port (L1 to PE)  | 0/90/180/270      | +1                 | 5                  | B                 | A                 | PASS   |
| AC Input Port (L1 to PE)  | 0/90/180/270      | -1                 | 5                  | B                 | A                 | PASS   |
| AC Input Port (L1 to PE)  | 0/90/180/270      | +2                 | 5                  | B                 | A                 | PASS   |
| AC Input Port (L1 to PE)  | 0/90/180/270      | -2                 | 5                  | B                 | A                 | PASS   |
| AC Input Port (N to L1)   | 0/90/180/270      | +0.5               | 5                  | B                 | A                 | PASS   |
| AC Input Port (N to L1)   | 0/90/180/270      | -0.5               | 5                  | B                 | A                 | PASS   |
| AC Input Port (N to L1)   | 0/90/180/270      | +1                 | 5                  | B                 | A                 | PASS   |
| AC Input Port (N to L1)   | 0/90/180/270      | -1                 | 5                  | B                 | A                 | PASS   |
| Note: No operation errors were detected during or after the applied test(s) |                   |                    |                    |                   |                   |        |

# IMMUNITY – CONDUCTED RF DISTURBANCE

## TEST DESCRIPTION

### Method

EN 61000-4-6 (1996) + A1 (2001)

Electromagnetic compatibility (EMC) -- Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields.

### Set-up

The test is performed on a 2 x 2 meter 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 150 Ω termination of the EuT during test. As decoupling networks Nemko use the CDNs normally used to apply the disturbance, the CDNs input port is terminated with a 50 Ω termination to make them act as true decoupling networks.

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.

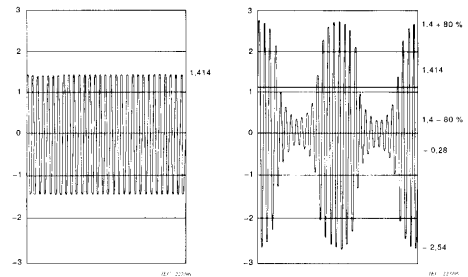


Figure 4a – Unmodulated RF signal  
U<sub>pp</sub> = 2,82 V, U<sub>min</sub> = 1,00 V

Figure 4b – Modulated RF signal 80 % AM  
U<sub>pp</sub> = 5,09 V, U<sub>min</sub> = 1,12 V

### Instruments used during measurement

Instrument list: Amplifier: Amplifier Research 75A250 (N-3883) (-/-)  
 Attenuator: Narda FSCM 99899 769-6 (N-4189) (-/-)  
 Copl/Decoupl Network: FCC FCC-801-6-M3 (N-3814) (-/-)  
 Power Meter: Boonton 9200C (N-3718) (10/07)  
 RF Generator: Rohde&Schwarz SMG (N-2885) (2/09)

### Comments

No recorded comments.

### Severity

|                  |                |
|------------------|----------------|
| Port:            | AC Input Port  |
| Frequency range: | 0.15 - 230 MHz |
| Step size:       | 1 %            |
| Dwell time:      | 3 Sec          |
| Modulation:      | 80% AM @ 1 kHz |

### Conformity

|                |                |
|----------------|----------------|
| Verdict:       | Pass           |
| Test engineer: | Jørn Gustavsen |

## 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).

| Port          | Applied Level | Injection Method | Required Criteria | Complied Criteria | Result |
|---------------|---------------|------------------|-------------------|-------------------|--------|
| AC Input Port | 3V            | CDN              | A                 | A                 | Pass   |

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

## IMMUNITY – DIPS AND INTERRUPTIONS

### TEST DESCRIPTION

#### Method

EN 61000-4-11 (1994) + A1 (2001)

Electromagnetic compatibility (EMC) -- Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests.

#### Set-up

Only the general laboratory conditions apply. No special requirements are defined for the configuration of the EuT. The AC power input of the EuT is connected to the power simulator system that generates the dips and interruptions.

#### Procedure

The dips and interruptions were applied at different phase angles, 0°, 90° and 270°. The duration of each dip and interruption is specified below. EuT was given at least 10 seconds periods to recover between each test. The number of tests applied at each phase angle is specified below.

#### Instruments used during measurement

Instrument list: CS Test System: Schaffner Best EMC (N-4103) (5/08)

#### Comments

No recorded comments.

#### Severity

|              |               |
|--------------|---------------|
| Port:        | AC Input Port |
| Intervals    | 20sec         |
| Repetitions: | 3             |

#### Conformity

|                |                |
|----------------|----------------|
| Verdict:       | Pass           |
| Test engineer: | Jørn Gustavsen |

## 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).

| Type              | Phase Angle [deg] | Voltage Level |      | Duration | Required Criteria | Complied Criteria | Result |
|-------------------|-------------------|---------------|------|----------|-------------------|-------------------|--------|
|                   |                   | Nominal       | Test |          |                   |                   |        |
| 30% Dip           | 0                 | 230           | 161  | 1sec     | C                 | A                 | PASS   |
| 60% Dip           | 0                 | 230           | 92   | 200msec  | C                 | A                 | PASS   |
| 100% Interruption | 0                 | 230           | 0    | 10msec   | C                 | A                 | PASS   |

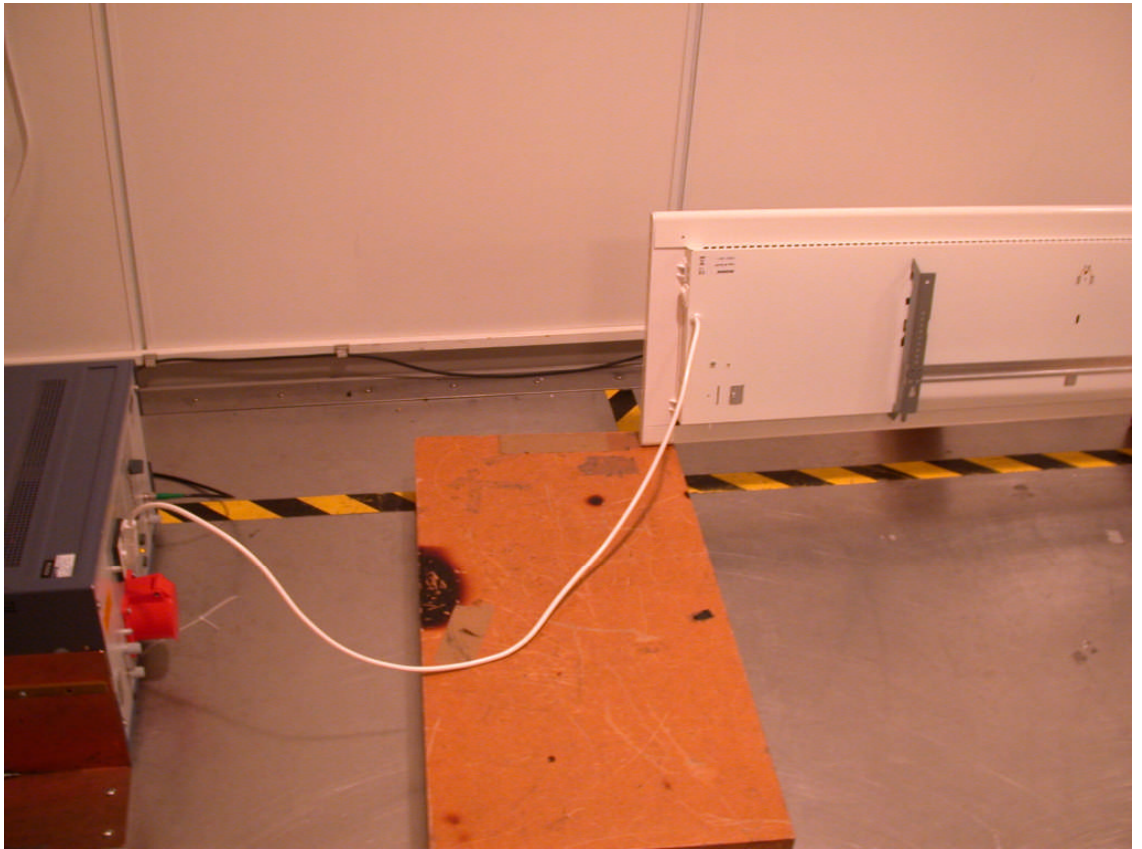
Note: No operation errors were detected during or after the applied test(s)

# Annexes

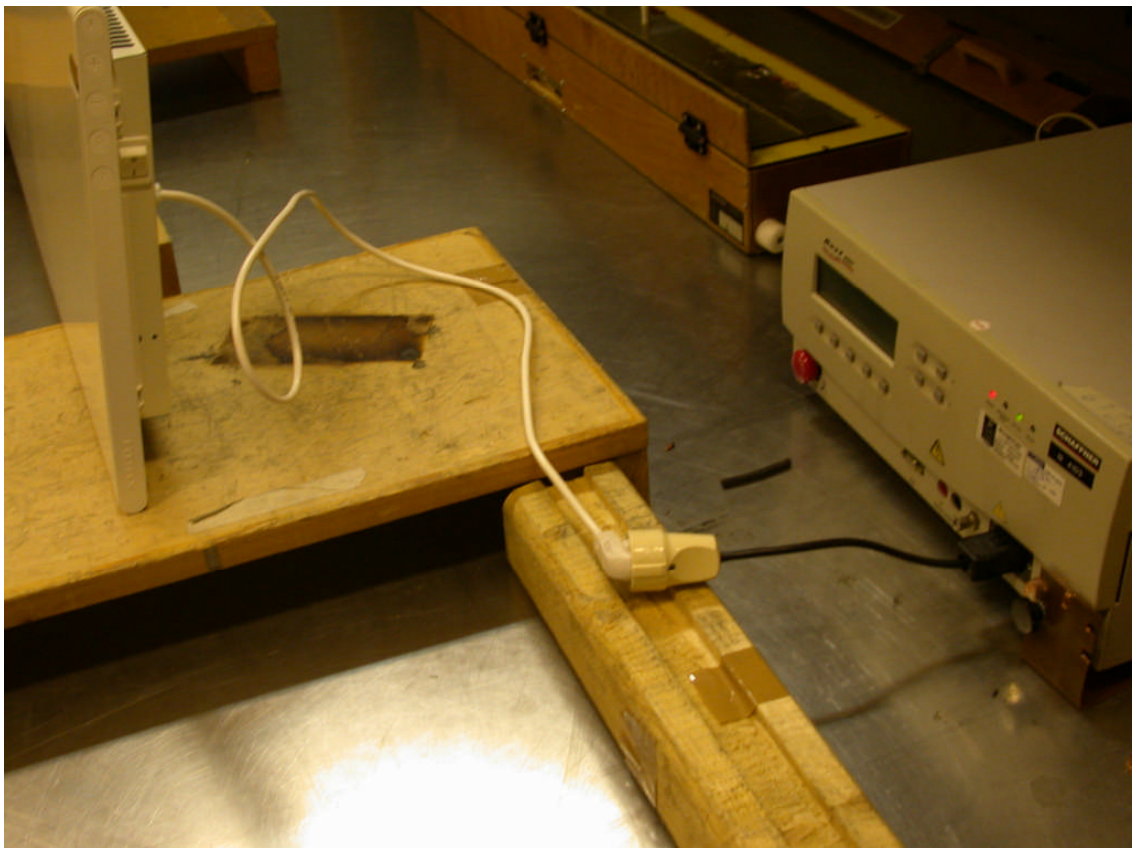
## UNCERTAINTY FIGURES

|                                   |   |
|-----------------------------------|---|
| Mains Port Disturbance Voltage    | $\pm 3.8$ dB (9 kHz – 150 kHz)<br>$\pm 3.5$ dB (150 kHz – 30 MHz)   |
| Load Port Disturbance Voltage     | $\pm 2.7$ dB (150 kHz – 30 MHz)   |
| Signal Port Disturbance Voltage   | $\pm 2.7$ dB (150 kHz – 30 MHz)   |
| Discontinuous Disturbance Voltage | $\pm 4.3$ dB (150 kHz – 30 MHz)   |
| Insertion Loss                    | $\pm 2.5$ dB (150 kHz – 1.605 MHz)  |
| Disturbance Power                 | $\pm 3.4$ dB (30 MHz – 300 MHz)   |
| Radiated Electromagnetic Field    | $\pm 2,7$ dB (9 kHz – 30 MHz)   |
| Radiated Disturbance (3 meter)    | $\pm 4.8$ dB (150 kHz – 30 MHz)<br>$\pm 4.8$ dB (30 MHz – 200 MHz)<br>$\pm 4.4$ dB (200 MHz – 1000 MHz)   |
| Radiated Disturbance (10 meter)   | $\pm 4.1$ dB (30 MHz – 200 MHz)<br>$\pm 4.2$ dB (200 MHz – 1000 MHz)  |
| Harmonic Current Emissions        | $\pm 2.1$ mA  |
| Flicker                           | $\pm 0.64$ V (Dc and Dmax)<br>$\pm 5$ % (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:                            |   |

**PHOTOS**

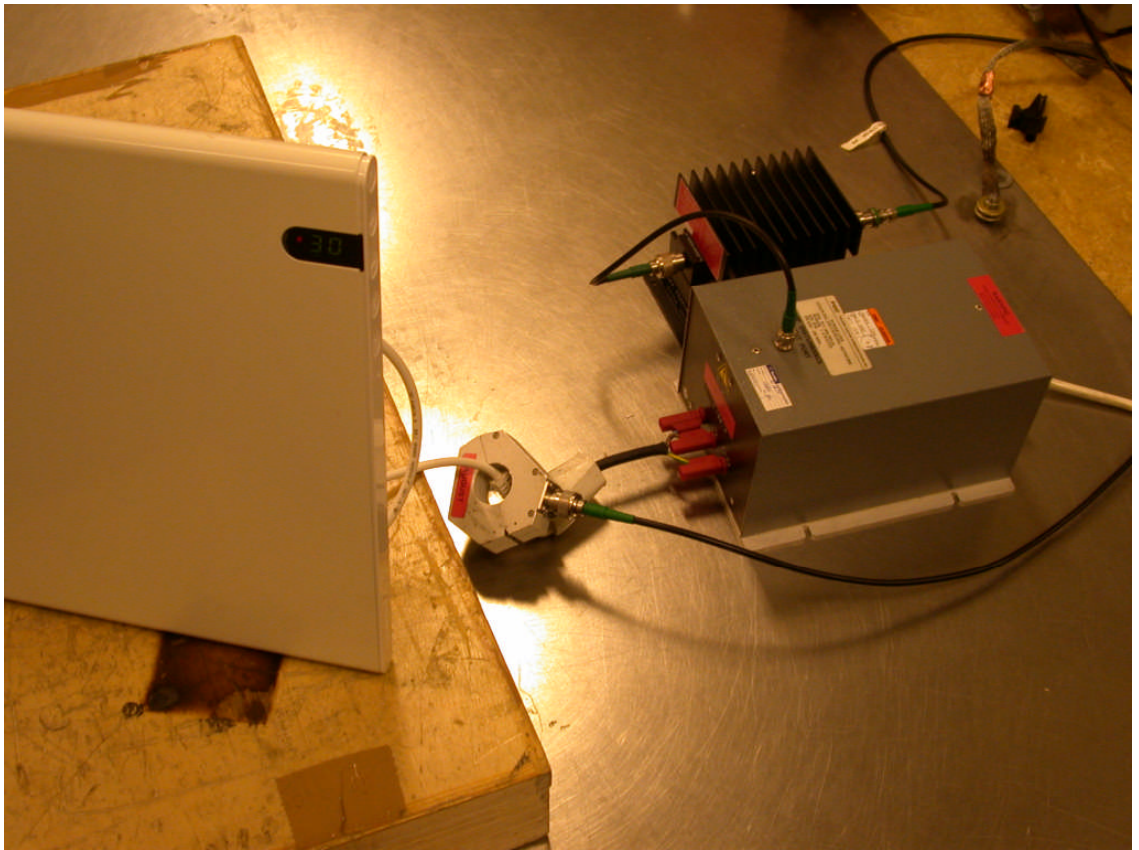


Notes: Mains Port Disturbance Voltage



Notes: Electric Fast Transients, Surge and Dips/Interruptions

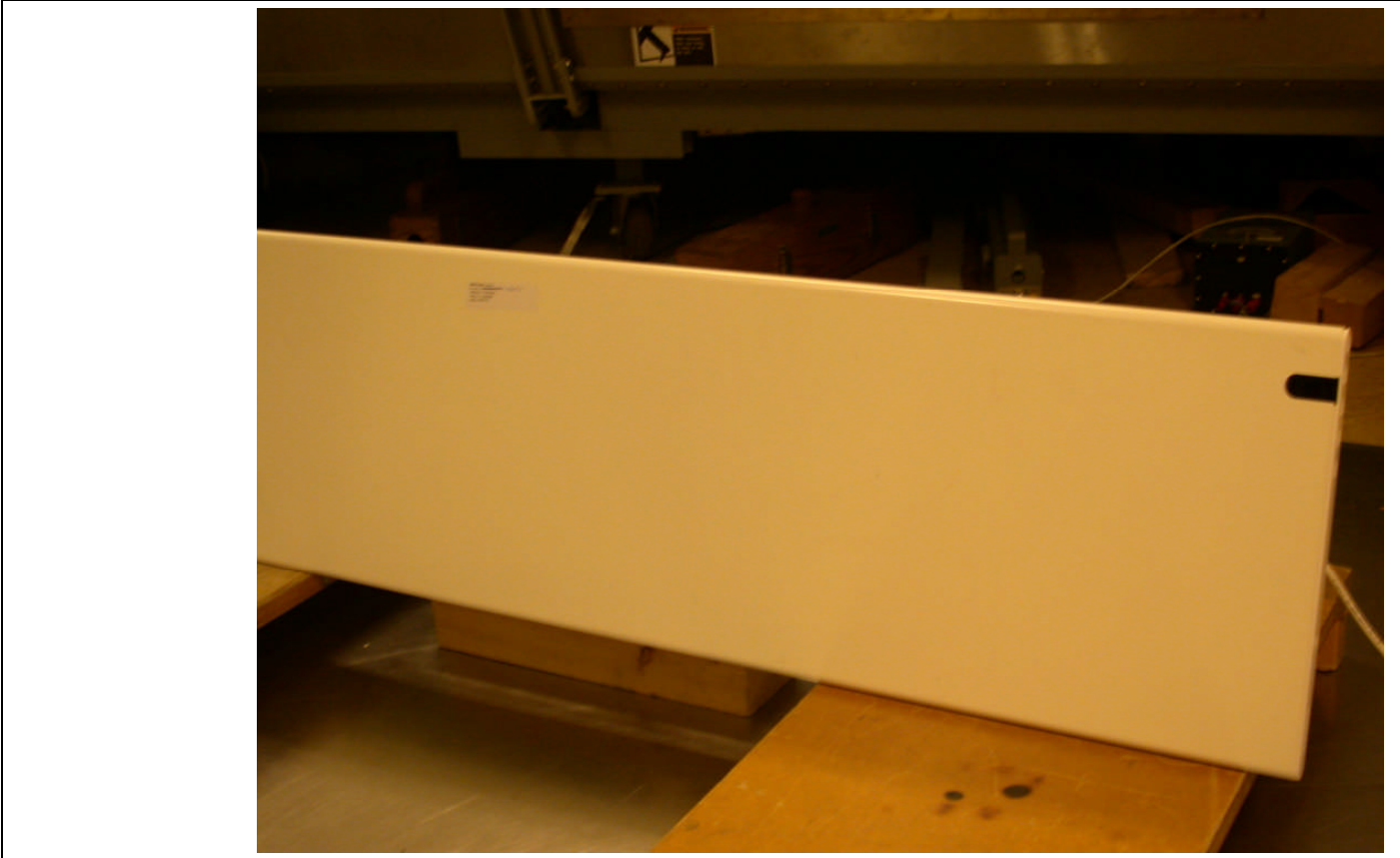




Notes: Conducted RF Disturbance



Notes: Marking Label



Notes: EuT