Report No. E14142.00

Test Report
Electromagnetic Compatibility

Product	Charger for wheelchairs
Name and address of the applicant	J.K. Medico ApS Ole Wiisbye Kallshøj, Dam Enge 30, DK-3660 Stenløse, Denmark
Name and address of the manufacturer	J.K. Medico ApS Ole Wiisbye Kallshøj, Dam Enge 30, DK-3660 Stenløse, Denmark
Model	CCC410S
Rating	330W/460VA 230V AC 50Hz
Trademark	J.K. Medico
Serial number	142001
Additional information	Class II
Tested according to	EN 60601-1-2 (2007)
Order number	253035
Tested in period	May 2014
Issue date	2014-05-27
Name and address of the testing laboratory	**Nemko Group** Nemko AS Gaustadalléen 30, P.O.Box 73 Blindern, 0314 Oslo, Norway Telephone (+47) 22 96 03 30 Fax (+47) 22 96 05 50

ilac-MRA NORWEGIAN ACCREDITATION TEST 033

An accredited technical test executed under the Norwegian accreditation scheme

Prepared by [Kristian Osvoll]	Approved by [Roger Berget]

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REVISIONS

Revision #	Date	Order #	Description
00	2014-05-27	253035	First issued

GENERAL REMARKS

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

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

CALIBRATION

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

MEASUREMENT UNCERTAINTY

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

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

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

Uncertainty figures are found in an appendix to this report.

Further information about measurement uncertainties is provided on request.

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

The instrumentation accuracy and measurement uncertainties are within limits specified by CISPR 16-4-1.

DESCRIPTION OF TESTED DEVICE (EUT)

PRODUCT DESCRIPTION

CCC410S is a charger designed for batteries, 40-100 Ah. The charger is typically used for outdoor wheelchairs and other power consuming applications. A computer-controlled charging process makes it possible to utilize the charger for different types of batteries.

Hardware identity and/or version: 1410 (year and week no. of tested unit)
Software identity and/or version: CCC4_rehab version 211212

AVAILABLE PORTS

This equipment is fitted with the following electrical ports.

PO no.	Port Name	Port Type	Count	Comment
1	Mains Port	AC Input Port	1	-
2	DC Port	DC Output Port	1	-

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	Mains cable	No	2	2
2	DC output cable	No	2	2

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	Battery charging	-	Yes
2	Standby	-	Yes

ACCESSORIES APPLIED DURING TEST

AE no.	Description	Manufacturer	Model	Serial no.
1	Batteries 2 x 12V 60Ah	-	-	-

EQUIPMENT MODIFICATIONS

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

MO no.	Modification	Purpose
1	The capacitor C52 was removed.	In order to pass Conducted Emissions test.

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

LABORATORY ACCREDITATIONS

Norsk Akkreditering – TEST 033
P06 – Electromagnetic Compatibility

VCCI – Membership No. 3220

POWER SUPPLIED TO EUT

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

Voltage type: 230V AC 50Hz
Grounding: Not grounded

AMBIENT CONDITIONS

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

Normal ambient test conditions:

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

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

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: Charging monitored	**Description:** Charging monitored	**Description:** Visual (LED's) and by monitor the charging voltage.

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

PERFORMANCE CRITERIA

During immunity testing, each function of the equipment that is associated with ESSENTIAL PERFORMANCE shall be tested in the mode that is most critical from a patient outcome perspective, based upon a risk analysis.
If the risk analysis is not performed, all functions of the equipment shall be considered ESSENTIAL PERFORMANCE for the purpose of immunity testing.

- **No risk analysis has been presented. All functions are considered for ESSENTIAL PERFORMANCE.**

Under the test conditions specified in EN 60601-1-2 §36.202, the equipment or system shall be able to provide the essential performance and remain safe. The following degradations associated with essential performance and safety shall not be allowed:

- component failures
- changes in programmable parameters
- reset to factory defaults
- change of operating mode
- false alarms
- cessation or interruption of any intended operation, even if accompanied by an alarm
- initiation of any unintended operation, including unintended or uncontrolled motion, even if accompanied by an alarm
- error of a displayed numerical value sufficiently large to affect diagnosis or treatment
- noise on a waveform in which the noise is indistinguishable from physiologically-produced signals or the noise interferes with interpretation of physiologically-produced signals
- artefact or distortion in an image in which the artefact is indistinguishable from physiologically-produced signals or the noise interferes with interpretation of physiologically-produced signals
- failure of automatic diagnosis or treatment equipment and systems to diagnose or treat, even if accompanied by an alarm

For equipment or systems with multiple functions, the criteria apply to each function parameter and channel

Note: The Detailed Test Logs of each test case use the nomenclature "EP" when ESSENTIAL PERFORMANCE is maintained, and "DP" when DEGRADATION OF PERFORMANCE that does not affect ESSENTIAL PERFORMANCE or safety is detected. "OI" is used when the equipment or system have a deviation from the ESSENTIAL PERFORMANCE, provided that the equipment or system remains safe, experiences no component failures and is restorable to the pre-test state with OPERATOR INTERVENTION

SUMMARY OF TESTING

APPLIED STANDARDS

» **EN 60601-1-2 (2007)** *Medical electrical equipment – Part 1-2: General requirements for basic safety and essential performance – Collateral standard: Electromagnetic compatibility – Requirements and tests*

APPLIED TESTS

Test items	Test methods	Result
Conducted Emissions	EN 60601-1-2 (2007) EN 55011 (2009) + A1 (2010)	PASS
Discontinuous Conducted Emissions	EN 60601-1-2 (2007) EN 55014-1 (2006) + A1 (2009) + A2 (2011)	N/A
Radiated Emissions (30MHz-1000MHz)	EN 60601-1-2 (2007) EN 55011 (2009) + A1 (2010)	PASS
Harmonic Current Emissions	EN 60601-1-2 (2007) EN 61000-3-2 (2006) + A1 (2009) + A2 (2009)	PASS
Voltage Variations/Fluctuations/Flicker	EN 60601-1-2 (2007) EN 61000-3-3 (2008)	PASS
Electrostatic Discharge (ESD) Immunity	EN 60601-1-2 (2007) EN 61000-4-2 (2009), Ed.2.0	PASS
Radiated RF Disturbance Immunity	EN 60601-1-2 (2007) EN 61000-4-3 (2008), Ed.3.1	PASS
Electric Fast Transients Immunity	EN 60601-1-2 (2007) EN 61000-4-4 (2010), Ed.2.1	PASS
Surge Immunity	EN 60601-1-2 (2007) EN 61000-4-5 (2006), Ed.2.0	PASS
Conducted RF Disturbance Immunity	EN 60601-1-2 (2007) EN 61000-4-6 (2009), Ed.3.0	PASS
Power Frequency Magnetic Field Immunity	EN 60601-1-2 (2007) EN 61000-4-8 (2010), Ed.2.0	N/A
Dips and Interruptions Immunity	EN 60601-1-2 (2007) EN 61000-4-11 (2004), Ed.2.0	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.
<floor-standing > EuT is placed on a wooden table 10 cm above the reference ground plane.
<tabletop> EuT is placed on a 80 cm high wooden table and aligned 40 cm from the reference ground plane (wall).
EuT is connected to an Artificial Mains Network (AMN) by its power cable, which is adjusted to 100cm length by folding.

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 and, if required, with the average detector.

Instruments used during measurement

Instrument list:	AMN: Rohde&Schwarz / ESH2-Z5 (N-3558) (02/2015) EMI Receiver: Rohde&Schwarz / ESHS 30 (N-3529) (08/2014) Pulse Limiter: Rohde&Schwarz / ESH3-Z2 (N-3821) (11/2015)

Comments
No recorded comments.

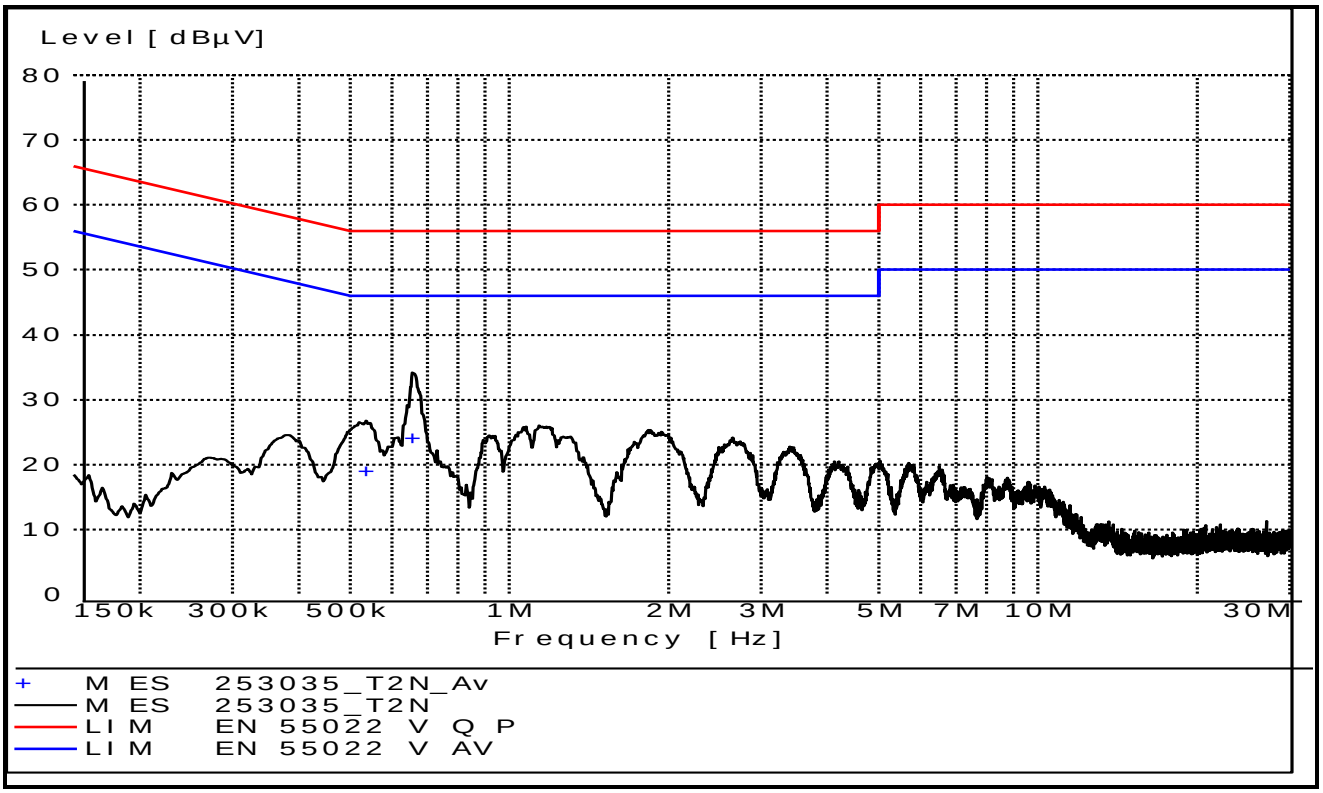
Severity

Port:	AC Input Port
Frequency range:	0.15 – 30 MHz
Frequency step:	5 kHz
Dwell time:	20 mSec
Bandwidth:	10 kHz

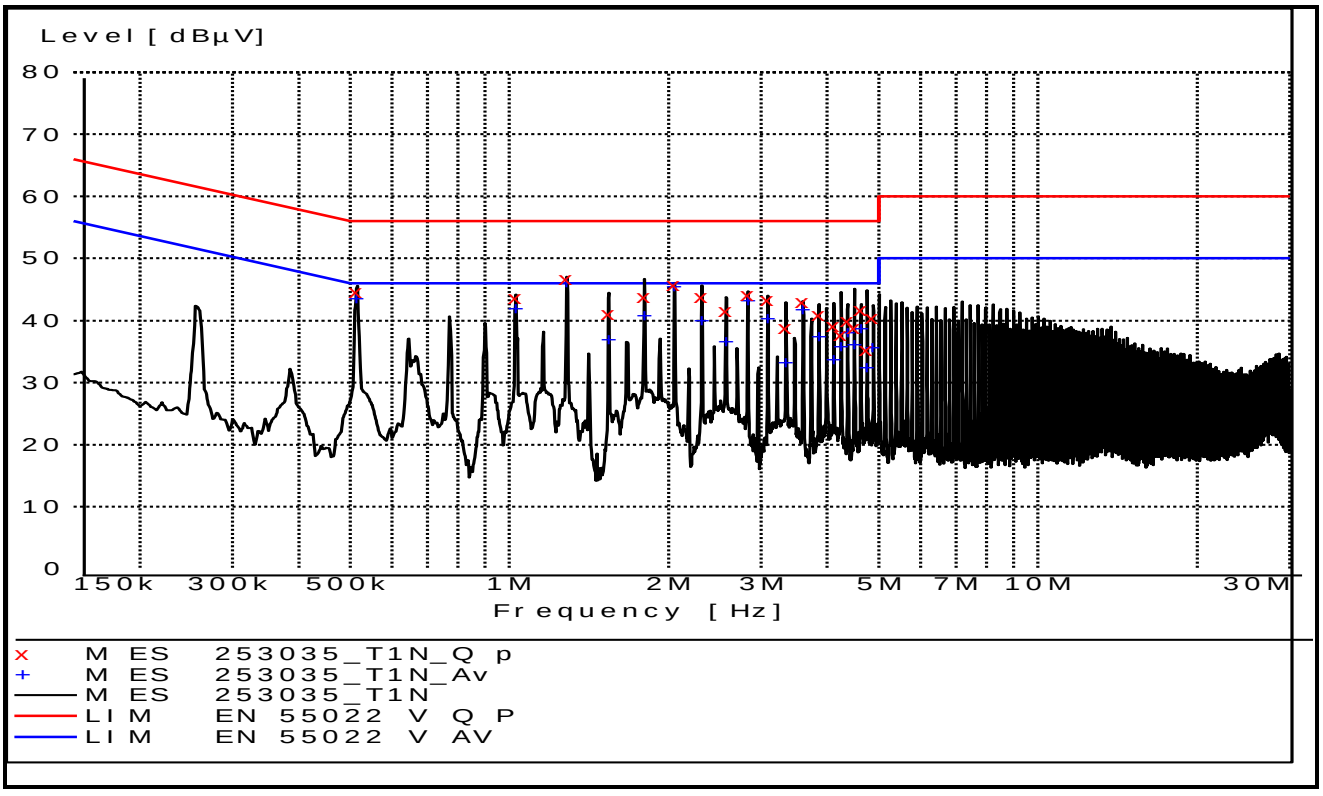
Conformity

Verdict:	Pass
Test engineer:	Kristian Osvoll

EMISSION SPECTRUM (STANDBY)



EMISSION SPECTRUM (CHARGING)



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]	QP Level [dBuV]	Corr. [dB]	Margin [dB]	Limit [dBuV]	Det	Position	Verdict [Pass/Fail]
			Standby				
-	-	-	-	-	-	-	Pass
			Charging				
0.515000	44.60	10.20	56.00	11.40	QP	L1	Pass
1.030000	43.60	10.20	56.00	12.40	QP	L1	Pass
1.285000	46.70	10.20	56.00	9.30	QP	N	Pass
1.545000	41.10	10.20	56.00	14.90	QP	L1	Pass
1.800000	43.80	10.20	56.00	12.20	QP	N	Pass
2.055000	45.80	10.30	56.00	10.20	QP	L1	Pass
2.315000	43.80	10.30	56.00	12.20	QP	L1	Pass
2.570000	41.50	10.30	56.00	14.50	QP	N	Pass
2.830000	44.10	10.30	56.00	11.90	QP	L1	Pass
3.085000	43.40	10.30	56.00	12.60	QP	L1	Pass
3.345000	38.80	10.30	56.00	17.20	QP	N	Pass
3.600000	43.00	10.30	56.00	13.00	QP	N	Pass
3.860000	40.90	10.30	56.00	15.10	QP	N	Pass
4.115000	39.20	10.40	56.00	16.80	QP	N	Pass
4.245000	37.70	10.40	56.00	18.30	QP	N	Pass
4.375000	39.90	10.40	56.00	16.10	QP	N	Pass
4.500000	38.80	10.40	56.00	17.20	QP	N	Pass
4.630000	41.70	10.40	56.00	14.30	QP	N	Pass
4.760000	35.30	10.40	56.00	20.70	QP	N	Pass
4.885000	40.40	10.40	56.00	15.60	QP	L1	Pass

AVERAGE DETECTOR DATA

Frequency [MHz]	QP Level [dBuV]	Corr. [dB]	Margin [dB]	Limit [dBuV]	Det	Position	Verdict [Pass/Fail]
			Standby				
0.535000	19.00	10.20	46.00	27.00	AV	L1	Pass
0.655000	24.10	10.20	46.00	21.90	AV	L1	Pass
			Charging				
0.515000	43.50	10.20	46.00	2.50	AV	L1	Pass
1.030000	42.00	10.20	46.00	4.00	AV	L1	Pass
1.285000	45.70	10.20	46.00	0.30	AV	N	Pass
1.545000	36.90	10.20	46.00	9.10	AV	L1	Pass
1.800000	40.70	10.20	46.00	5.30	AV	N	Pass
2.055000	45.30	10.30	46.00	0.70	AV	L1	Pass
2.315000	40.00	10.30	46.00	6.00	AV	L1	Pass
2.570000	36.50	10.30	46.00	9.50	AV	N	Pass
2.830000	43.20	10.30	46.00	2.80	AV	L1	Pass
3.085000	40.30	10.30	46.00	5.70	AV	L1	Pass
3.345000	33.20	10.30	46.00	12.80	AV	N	Pass
3.600000	41.80	10.30	46.00	4.20	AV	N	Pass
3.860000	37.40	10.30	46.00	8.60	AV	N	Pass
4.115000	33.70	10.40	46.00	12.30	AV	N	Pass
4.245000	35.80	10.40	46.00	10.20	AV	N	Pass
4.375000	38.00	10.40	46.00	8.00	AV	N	Pass
4.500000	36.10	10.40	46.00	9.90	AV	N	Pass
4.630000	38.70	10.40	46.00	7.30	AV	N	Pass
4.760000	32.40	10.40	46.00	13.60	AV	N	Pass
4.885000	35.70	10.40	46.00	10.30	AV	L1	Pass

RADIATED EMISSIONS (30MHZ-1000MHZ)

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.

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

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

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

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

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

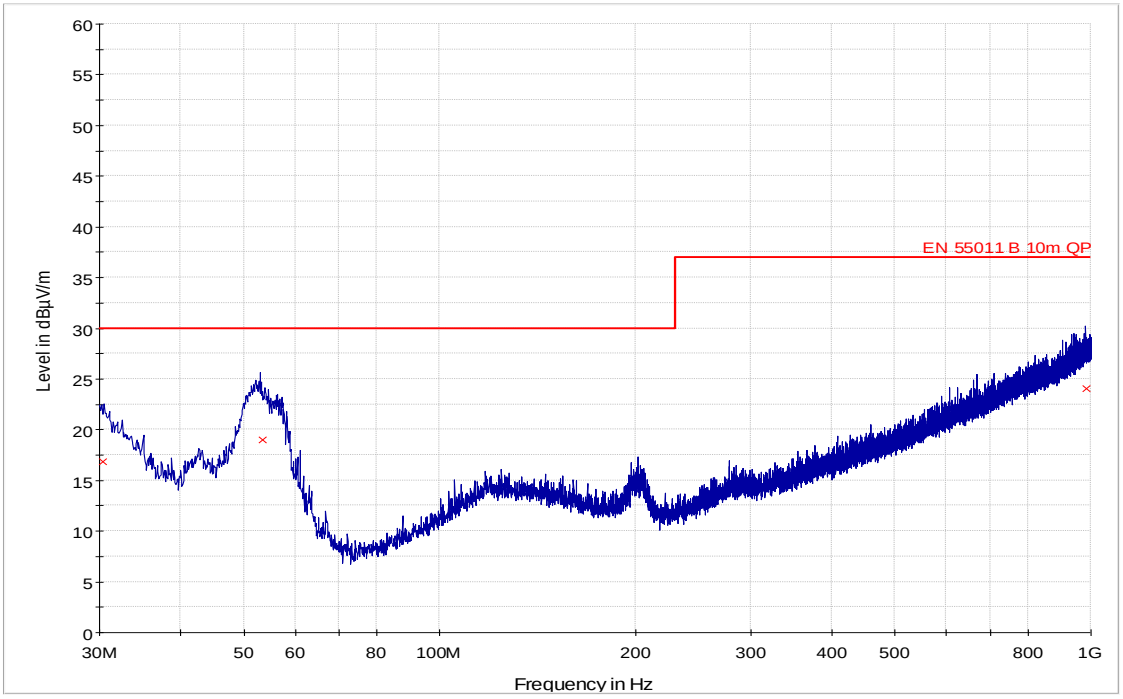
Instruments used during measurement

Instrument list:
Antenna, bilog: Sunol Sciences Inc. / JB3 (N-4525) (12/2014)
EMI Receiver: Rohde&Schwarz / ESU40 (LR-1639) (08/2014)
Preamplifier: Teseq / LNA 6900 (LR-1593) (N/A)

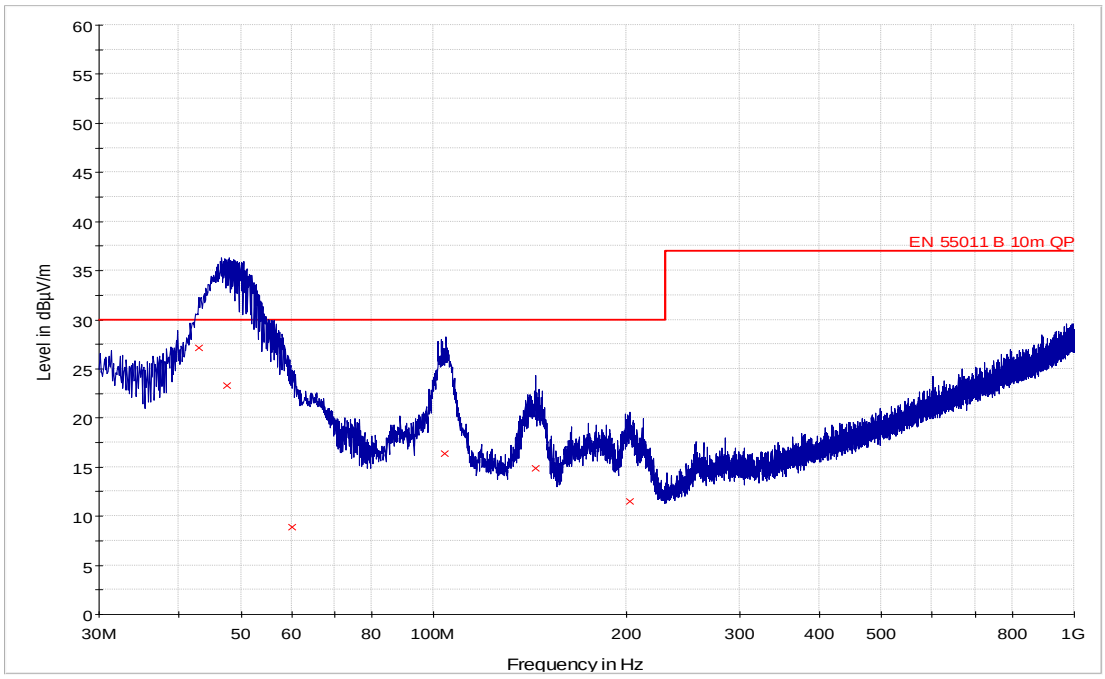
Comments
No recorded comments.

Severity		**Conformity**	
Port:	Enclosure Port	Verdict:	Pass
Frequency range:	30 MHz – 1000 MHz	Test engineer:	Kristian Osvoll
Sweep time:	20 mSec		
RBW:	120 kHz	VBW:	1 MHz
Meas. distance:	10 m	Meas. height:	100-400 cm

EMISSION SPECTRUM (STANDBY)



EMISSION SPECTRUM (CHARGING)



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]	Pol [H/V]	Azimuth [deg]	Verdict [Pass/Fail]
Standby								
30.316278	16.9	-2.8	13.1	30.0	350.0	V	201.0	Pass
53.366760	19.0	-14.6	11.0	30.0	127.0	V	153.0	Pass
982.281880	24.0	3.9	13.0	37.0	151.0	H	73.0	Pass
Charging								
42.945920	27.2	-11.2	2.8	30.0	100.0	V	63.0	Pass
47.444360	23.3	-12.8	14.7	30.0	100.0	V	130.0	Pass
60.041280	8.9	-16.4	21.1	30.0	323.0	V	80.0	Pass
104.019400	16.4	-11.7	13.6	30.0	100.0	V	91.0	Pass
144.130880	14.9	-9.9	15.1	30.0	394.0	H	106.0	Pass
202.516320	11.5	-10.8	18.5	30.0	100.0	V	302.0	Pass

HARMONIC CURRENT EMISSIONS

TEST DESCRIPTION

Method
EN 61000-3-2 (2006)
Electro-magnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 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 1st to 40th of the mains frequency (50 Hz or 60 Hz).
An overview of the harmonic emission is presented as numeric and as graphics below.

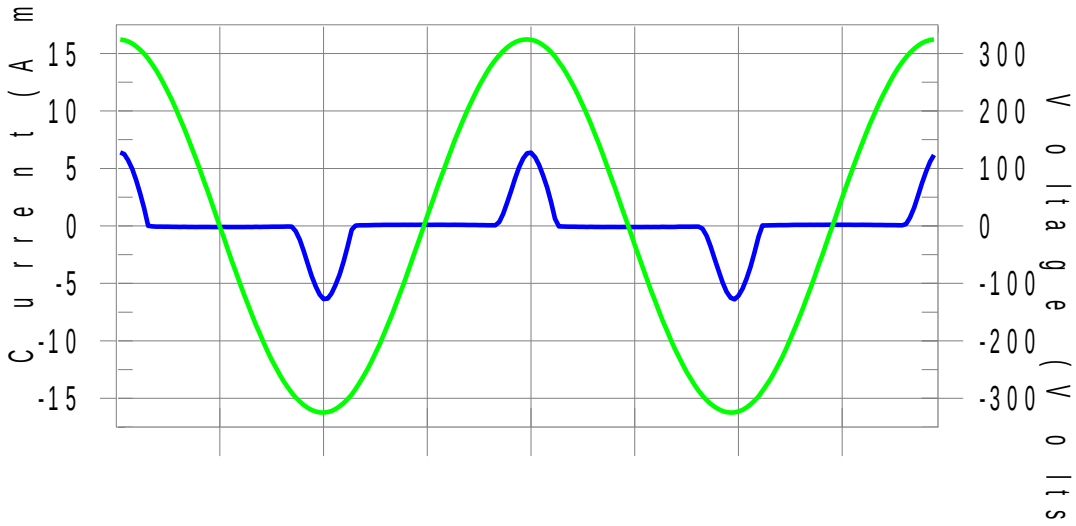
Instruments used during measurement

Instrument list: Power Analyzer: California Instruments / 10001iX (LR-1549) (10/2014)

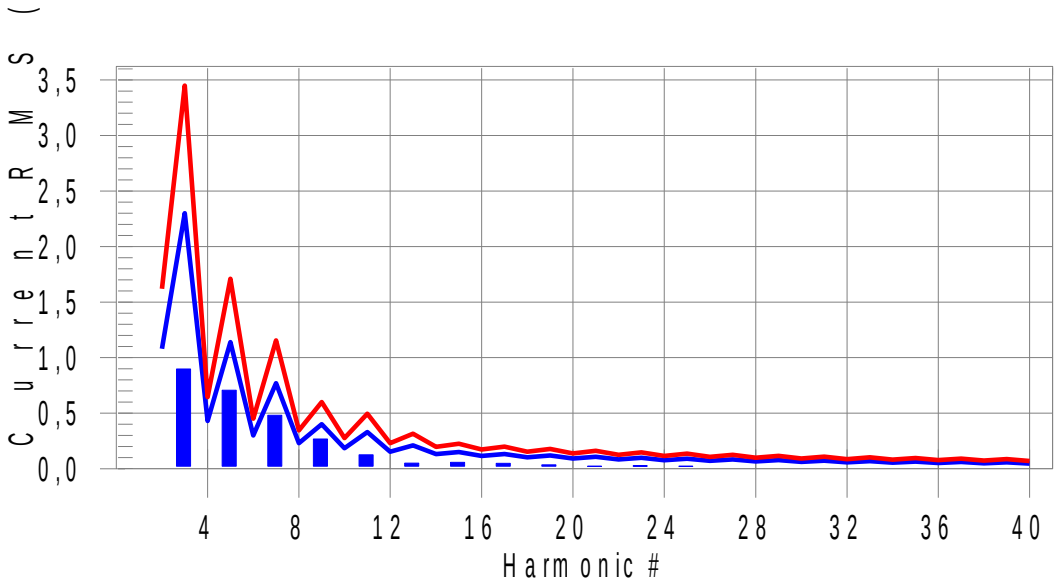
Comments
No recorded comments.

Severity		**Conformity**	
Port:	AC Input Port	Verdict:	Pass
Class identifier:	A	Test engineer:	Kristian Osvoll
Duration:	2.5 min		

CURRENT & VOLTAGE WAVESHAPE



HARMONIC CONTENTS – GRAPHIC PRESENTATION



HARMONIC CONTENTS – NUMERIC PRESENTATION

Highest parameter values during test:

V_RMS (Volts):	230,01	Frequency(Hz):	50,00
I_Peak (Amps):	6,413	I_RMS (Amps):	2,300
I_Fund (Amps):	1,002	Crest Factor:	3,115
Power (Watts):	260,0	Power Factor:	0,663

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0,002	1,080	0,0	0,003	1,620	0,19	Pass
3	0,683	2,300	29,7	0,898	3,450	26,03	Pass
4	0,002	0,430	0,0	0,003	0,645	0,40	Pass
5	0,558	1,140	48,9	0,707	1,710	41,34	Pass
6	0,002	0,300	0,0	0,002	0,450	0,44	Pass
7	0,404	0,770	52,4	0,481	1,155	41,62	Pass
8	0,001	0,230	0,0	0,001	0,345	0,41	Pass
9	0,250	0,400	62,5	0,267	0,600	44,42	Pass
10	0,001	0,184	0,0	0,001	0,276	0,38	Pass
11	0,124	0,330	37,5	0,126	0,495	25,37	Pass
12	0,001	0,153	0,0	0,001	0,230	0,35	Pass
13	0,048	0,210	23,1	0,050	0,315	16,02	Pass
14	0,001	0,131	0,0	0,001	0,197	0,33	Pass
15	0,043	0,150	28,5	0,057	0,225	25,49	Pass
16	0,000	0,115	0,0	0,001	0,173	0,35	Pass
17	0,046	0,132	34,5	0,049	0,199	24,66	Pass
18	0,001	0,102	0,0	0,001	0,153	0,40	Pass
19	0,034	0,118	28,5	0,035	0,178	19,52	Pass
20	0,001	0,092	0,0	0,001	0,138	0,42	Pass
21	0,020	0,107	18,3	0,021	0,161	13,01	Pass
22	0,000	0,084	0,0	0,001	0,125	0,43	Pass
23	0,017	0,098	17,6	0,026	0,147	17,35	Pass
24	0,000	0,077	0,0	0,000	0,115	0,42	Pass
25	0,019	0,090	21,5	0,022	0,135	16,51	Pass
26	0,000	0,071	0,0	0,001	0,106	0,51	Pass
27	0,017	0,083	20,1	0,017	0,125	13,71	Pass
28	0,001	0,066	0,0	0,001	0,099	0,59	Pass
29	0,012	0,078	15,5	0,013	0,116	11,46	Pass
30	0,000	0,061	0,0	0,000	0,092	0,54	Pass
31	0,011	0,073	14,5	0,014	0,109	13,19	Pass
32	0,000	0,058	0,0	0,001	0,086	0,66	Pass
33	0,011	0,068	16,4	0,013	0,102	12,41	Pass
34	0,000	0,054	0,0	0,000	0,081	0,60	Pass
35	0,010	0,064	15,8	0,011	0,096	10,94	Pass
36	0,000	0,051	0,0	0,001	0,077	0,66	Pass
37	0,008	0,061	12,9	0,008	0,091	9,22	Pass
38	0,000	0,048	0,0	0,000	0,073	0,66	Pass
39	0,007	0,058	0,0	0,009	0,087	10,17	Pass
40	0,000	0,046	0,0	0,000	0,069	0,68	Pass

VOLTAGE CHANGES/FLUCTUATIONS/FLICKER

TEST DESCRIPTION

Method
EN 61000-3-3 (2008)
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 supply was provided to the EuT from an ideal power supply unit. The power supply unit provided standardized supply 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 / 10001iX (LR-1549) (10/2014)

Comments
No recorded comments.

Severity		**Conformity**	
Port:	AC Input Port	Verdict:	Pass
Duration:	1 min	Test engineer:	Kristian Osvoll

NUMERIC PRESENTATION

Parameter	Limit	Measured	Result
Dmax	4 %	1.46 %	PASS
Dc	3.3 %	0 %	PASS
Dt	500 msec	0 msec	PASS
Pst	1.0	-	N/A
Plt	0.65	-	N/A

ELECTROSTATIC DISCHARGE (ESD) 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 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.

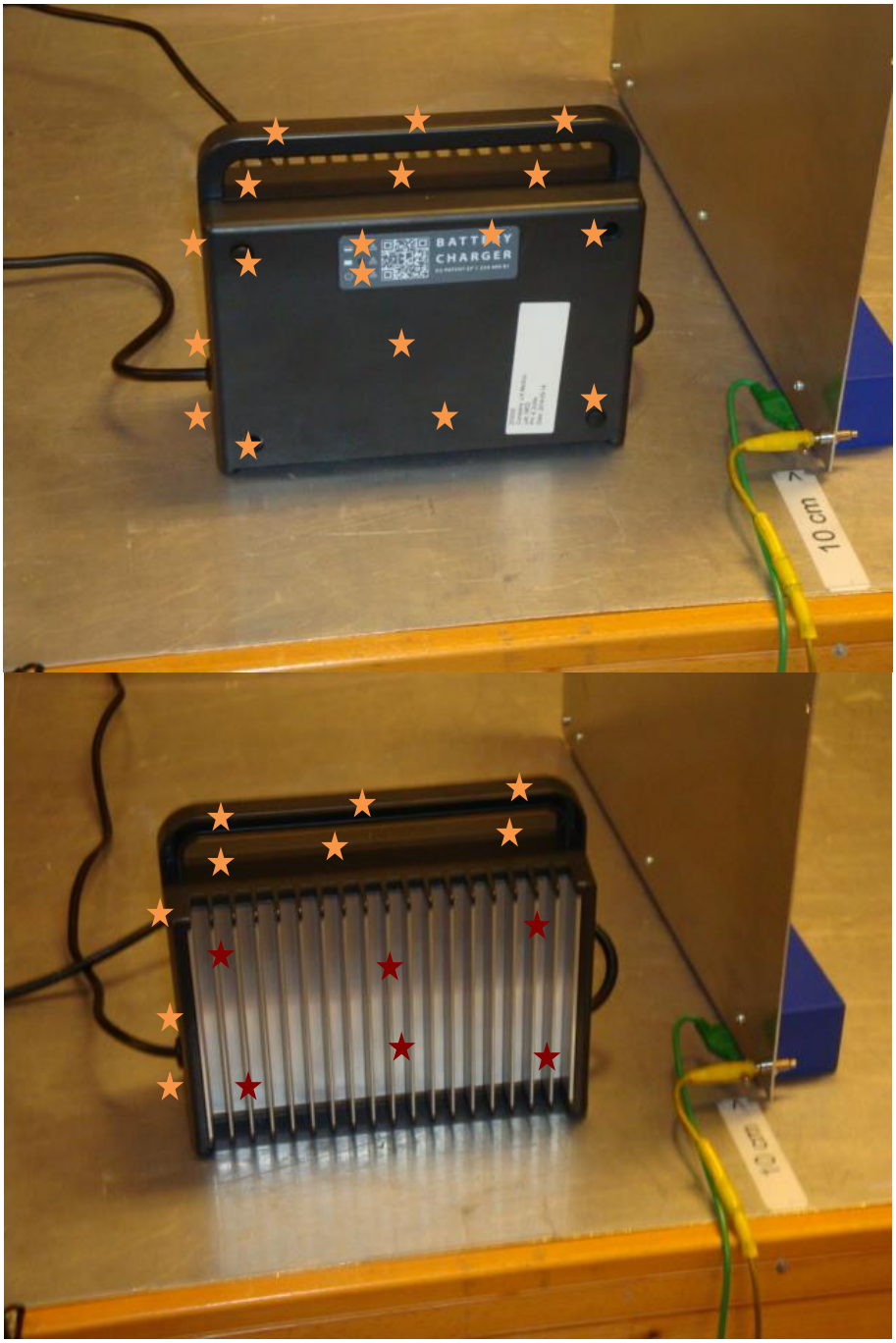
Discharges are applied at increasing levels to each test point.

Instruments used during measurement
Instrument list: ESD Generator: EM Test AG / ESD30N (N-4643) (01/2015)

Comments
No recorded comments.

Severity		**Conformity**	
Port:	Enclosure Port	Verdict:	Pass
		Test engineer:	Kristian Osvoll

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
Plastic parts of enclosure	±4, ±8	Air	ND	EP	EP	PASS
Handle	±4, ±8	Air	ND	EP	EP	PASS
Label	±4, ±8	Air	ND	EP	EP	PASS
Metal parts of enclosure (heatsink)	±2, ±4, ±6	Contact	10	EP	EP	PASS
HCP	±2, ±4, ±6	Contact	10	EP	EP	PASS
VCP	±2, ±4, ±6	Contact	10	EP	EP	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 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, GF: Amplifier Research / 120S1G4M3 (LR-1595) (N/A)
Amplifier, RF: Amplifier Research / 500W100A (LR-1354) (N/A)
Antenna Log-periodic: Rohde&Schwarz / HL 023A1 (LR-0282) (N/A)
Antenna Horn: EMCO / 3115 (N-3452) (N/A)
Field Probe: Amplifier Research / FP4080 (LR-1424) (06/2014)
Generator, RF: Rohde&Schwarz / SMB100A (LR-1603) (04/2016)
Power Meter: Rohde&Schwarz / NRVD 857.8008.02 (LR-1347) (10/2014)

Comments
No recorded comments.

Severity		**Conformity**	
Port:	Enclosure Port	Verdict:	Pass
Frequency range:	80 – 2700 MHz	Test engineer:	Kristian Osvoll
Step size:	1%		
Dwell time:	3 sec		
Modulation:	80% @ 1kHz		
Field generation:	Testing has been performed in an anechoic chamber using antennas to apply the field		

DETAILED TEST LOG

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

Frequency range [MHz]	Field strength [V/m]	Azimuth [deg]	Polarization	Required Criteria	Complied Criteria	Result
80 - 2700	3	0°	HOR	EP	EP	Pass
80 - 2700	3	90°	HOR	EP	EP	Pass
80 - 2700	3	180°	HOR	EP	EP	Pass
80 - 2700	3	270°	HOR	EP	EP	Pass
80 - 2700	3	0°	VER	EP	EP	Pass
80 - 2700	3	90°	VER	EP	EP	Pass
80 - 2700	3	180°	VER	EP	EP	Pass
80 - 2700	3	270°	VER	EP	EP	Pass

CONCLUSION

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

ELECTRIC FAST TRANSIENTS IMMUNITY

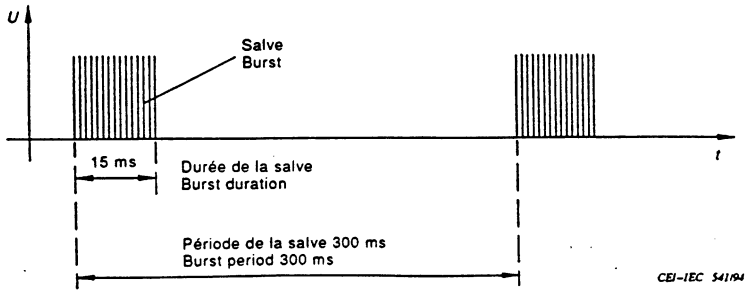
TEST DESCRIPTION

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: Generator: EM Test AG / UCS 500 N7 (LR-1608) (05/2014)

Comments
No recorded comments.

Severity		Conformity	
Port:	AC input Port	Verdict:	Pass
Duration:	2 min	Test engineer:	Kristian Osvoll

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
AC Input Port (N+L1)	±0.5, ±1, ±2	CDN	EP	EP	Pass

CONCLUSION

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

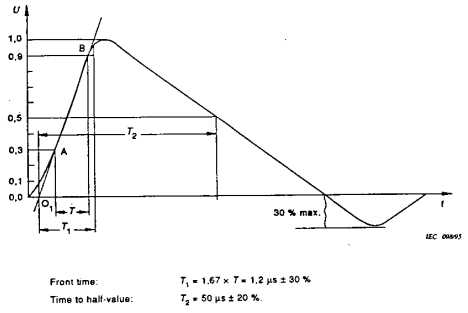
SURGE IMMUNITY

TEST DESCRIPTION

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

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 at least 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: Generator: EM Test AG / UCS 500 N7 (LR-1608) (05/2014)

Comments
No recorded comments.

Severity		**Conformity**	
Port:	AC input Port	Verdict:	Pass
Intervals:	60 sec.	Test engineer:	Kristian Osvoll

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.

Wire	Phase angle [deg]	Applied Level [kV]	Tests per level	Required Criteria	Complied Criteria	Result
AC Input Port (N to L1)	0°, 90°, 180°, 270°	±0.5, ±1	5	EP	EP	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)
Attenuator: Narda Safety Test Solutions GmbH / 765-6 (LR-1318) (N/A)
Generator, signal: Rohde&Schwarz / SMB100A (LR-1649) (05/2014)
Power Meter: Rohde&Schwarz / NRP2 (LR-1652) (09/2014)
CDN: Teseq / CDN M216 (N-4545) (09/2014)

Comments
No recorded comments.

Severity

Port:	AC input Port
Frequency range:	0.15 – 80 MHz
Step size:	1%
Dwell time:	3 sec
Modulation:	80% @ 1kHz

Conformity

Verdict:	Pass
Test engineer:	Kristian Osvoll

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
AC Input Port	CDN-M2	Capacitive	3	EP	EP	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 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: Motorized Variac: EM Test AG / MV 2616 (LR-1610) (N/A)
Ultra Compact simulator: EM Test AG / UCS 500 N7 (LR-1608) (05/2014)

Comments
No recorded comments.

Severity

Port:	AC Input Port
Intervals	20 sec
Repetitions:	3

Conformity

Verdict:	Pass
Test engineer:	Kristian Osvoll

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					
30% Dip	230	161	25	0	EP	EP	PASS
30% Dip	230	161	25	180	EP	EP	PASS
60% Dip	230	92	5	0	EP	EP	PASS
60% Dip	230	92	5	180	EP	EP	PASS
100% Dip	230	0	1	0	EP	EP	PASS
100% Dip	230	0	1	180	EP	EP	PASS
100% Interruption	230	0	250	0	EP	EP [1)]	PASS
100% Interruption	230	0	250	180	EP	EP [1)]	PASS

CONCLUSION

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

The following observations are made:

1) The charger switches OFF and then resumes normal operation (charging) after interruption.

Annexes

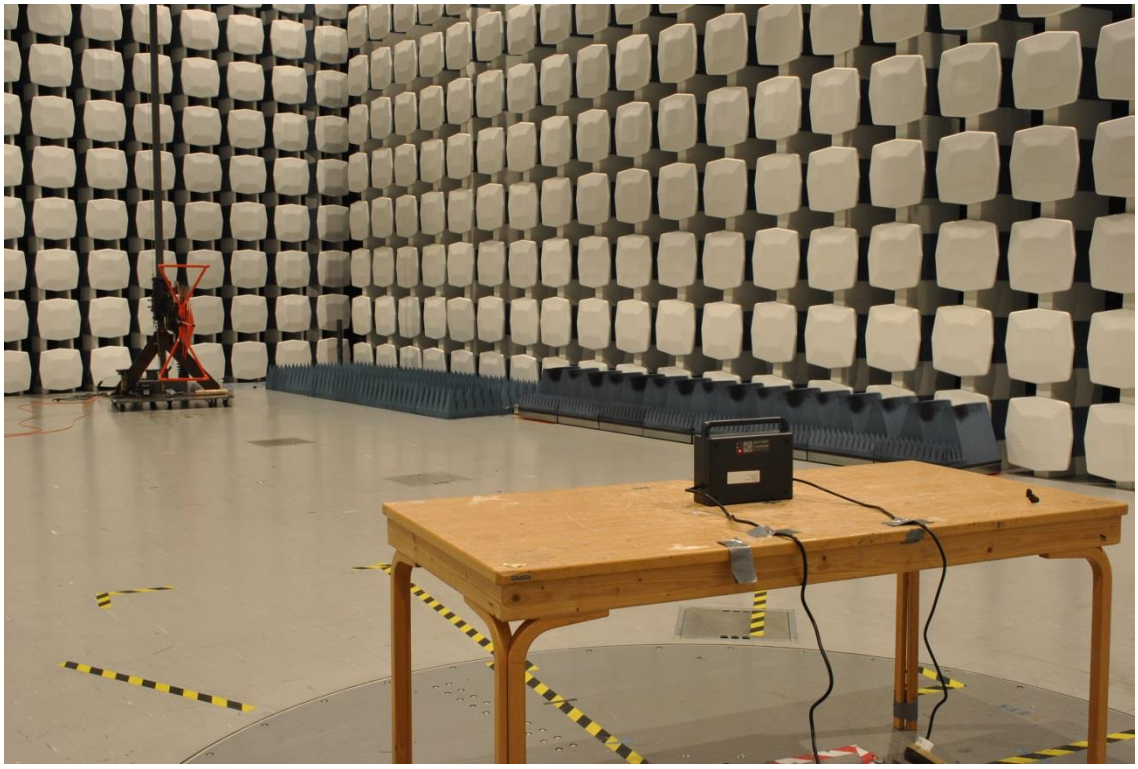
UNCERTAINTY FIGURES

Measurement	Uncertainty
Conducted Emissions AMN: Voltage Probe: Current Probe: ISN:	 ± 3.8 dB (9 kHz – 150 kHz) ± 3.5 dB (150 kHz – 30 MHz) ± 2.7 dB (150 kHz – 30 MHz) ± 2.7 dB (150 kHz – 30 MHz) ± 4.7 dB (150 kHz – 30 MHz)
Discontinuous Conducted Emissions	± 4.3 dB (150 kHz – 30 MHz)
Common-Mode Terminal Voltage	± 2.8 dB (30 MHz – 300 MHz)
Disturbance Power	± 3.4 dB (30 MHz – 300 MHz)
Radiated Electromagnetic Field	± 2.7 dB (9 kHz – 30 MHz)
Radiated Emissions (3 meter)	± 3.5 dB (150 kHz – 30 MHz) ± 4.8 dB (30 MHz – 200 MHz) ± 4.4 dB (200 MHz – 1000 MHz) ± 4.8 dB (1 – 6GHz)
Radiated Emissions (10 meter)	± 4.1 dB (30 MHz – 200 MHz) ± 4.2 dB (200 MHz – 1000 MHz)
Harmonic Current Emissions	± 7.1%
Flicker	± 7.7%
Electrostatic Discharges	± 10 % (peak voltage) ± 30 % (pulse shape)
Radiated RF Field	± 2.4 dB
Electric Fast Transients	± 10 % (peak voltage) ± 30 % (pulse shape)
Surge	± 10 % (peak voltage) ± 30 % (rise time) ± 20 % (duration)
Conducted RF Disturbance	± 2.8 dB (150 kHz – 26 MHz) ± 3.7 dB (26 MHz – 80 MHz)
Power Frequency Magnetic Field	± 2 %
Dips/Interruptions	± 5 % (voltage) ± 10% (zero crossing control) ± 10º (phase relationship)

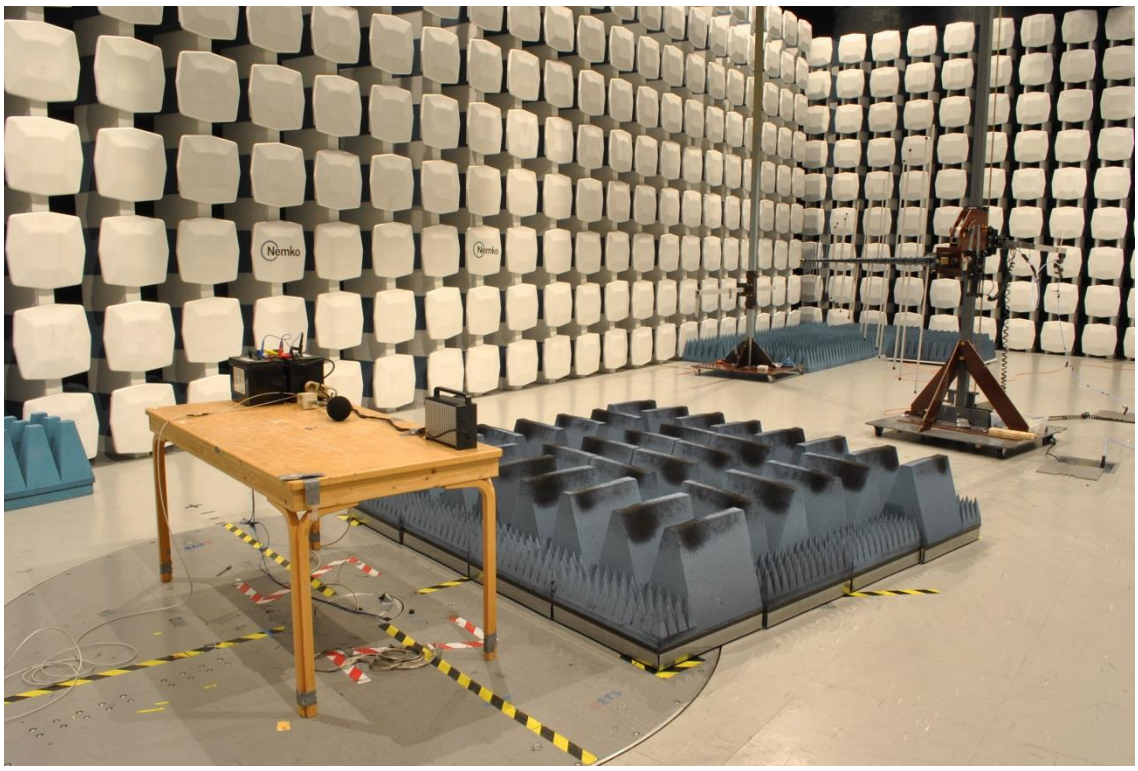
The instruments specified are subject to periodic calibrations and internal controls. This ensures, with a 95 percent confidence level, that the instruments remain within the calibrated levels.

PHOTOS

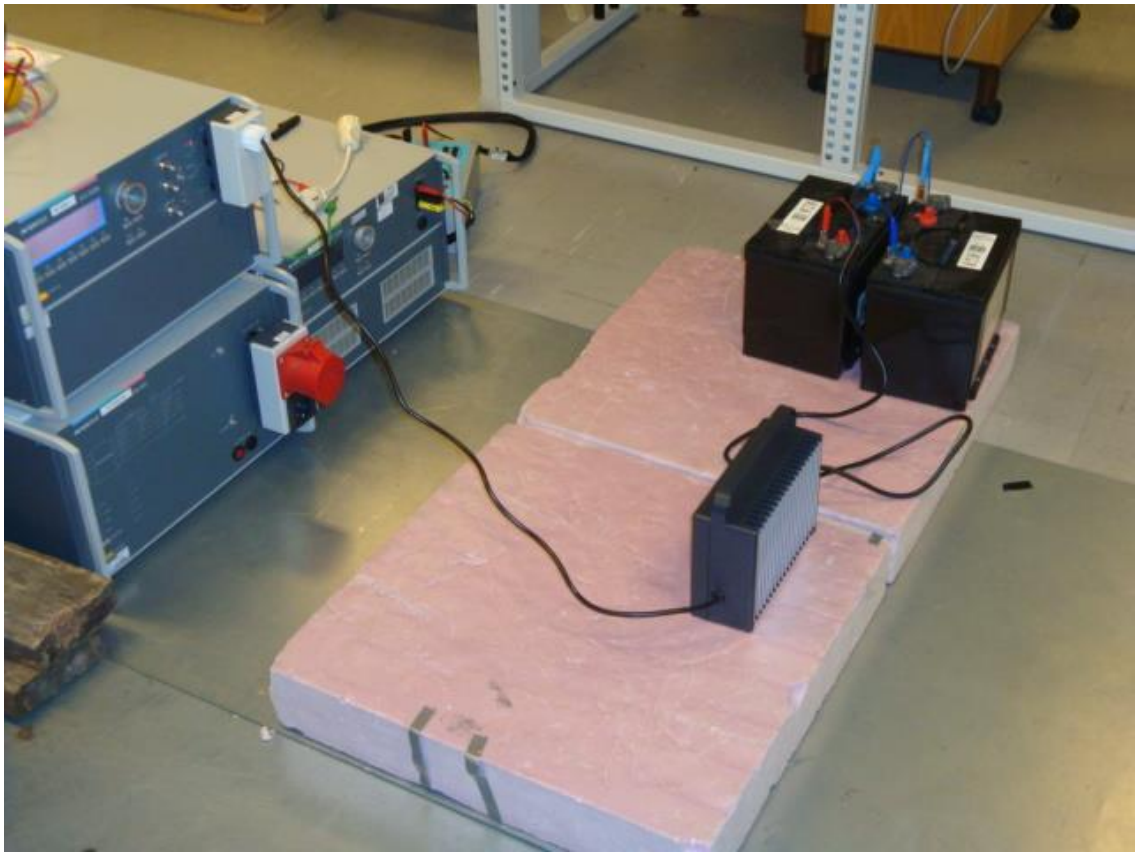
Notes: Test set-up for Conducted Emissions



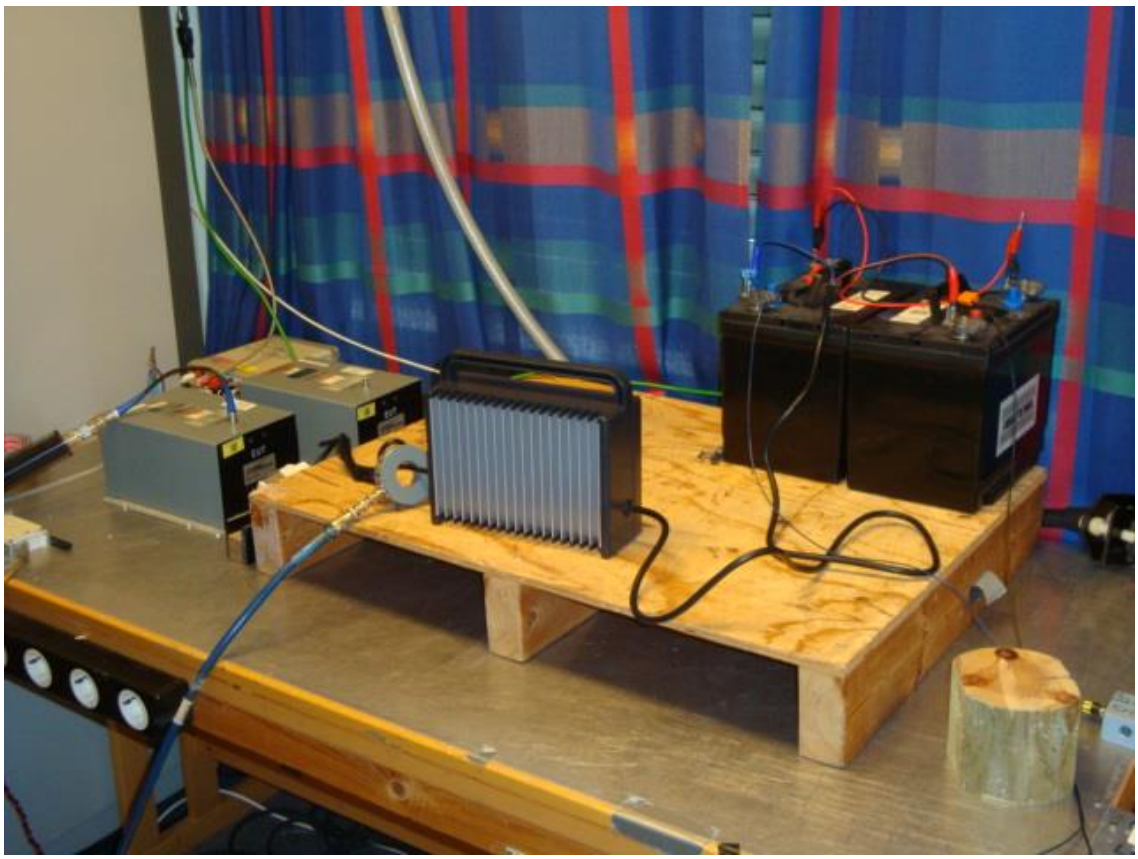
Notes: Test set-up for Radiated Emissions



Notes: Test set-up for Radiated RF Field immunity



Notes: Test set-up for Electric Fast Transients, Surges and Dips



Notes: Test set-up for Conducted RF Disturbance