

EMC TEST REPORT

No. 1223059D, Ed. 3

Electromagnetic disturbances

EQUIPMENT UNDER TEST

Equipment : Wall type fan
 Tested type / model : VL-100U5-E
 Additional type / model*: VL-100EU5-E
 Manufacturer : Mitsubishi Electric Corporation Nakatsugawa Work
 Tested by request of : Mitsubishi Electric Corporation Nakatsugawa Work

* See opinions and interpretation, clause 2.3

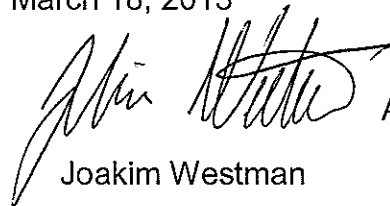
SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report the equipment complies with the requirements according to the following standards.

EN 55 014-1: 2006 +A1: 2009 +A2: 2011
 EN 61 000-3-2: 2006 +A1: 2009 +A2: 2009
 EN 61 000-3-3: 2008
 EN 55 014-2: 1997 +A1:2001 +A2:2008

Date of issue: March 18, 2013

Tested by:



Joakim Westman

Approved by:



Harri Satama

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Ed.	Date	Description
1	February 19, 2013	First release
2	March 5, 2013	Editorial changes on page 4
3	March 18, 2013	Updated/removed information regarding Intertek accreditation on page 1 and in paragraph 3.2

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1. CLIENT INFORMATION

The EUT has been tested by request of

Company: Mitsubishi Electric Corporation Nakatsugawa
Work
1-3 Komaba-cho
Nakatsugawa City
Gifu-Pref 508-8666
Japan
Name of contact: Hiroki Aoki

2. EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT

Equipment: Wall type fan
Tested type/Model: VL-100U5-E
Additional type / model: VL-100EU5-E
Brand name: Mitsubishi
Serial number: -
Manufacturer: Mitsubishi Electric Corporation Nakatsugawa
Work
Rating: 220-240 V AC, 30-34W
50Hz, Class I

2.2 Additional information about the EUT

The EUT was tested with the following cables:

Cable	Type
Mains power	Three wire

2.3 Opinions and interpretations

The following type is also included as additional types/type in this test report:
VL100EU5-E

The difference as compared to the tested type is (according to the manufacturer):
VL100EU5-E is made for permanent installation shall be connected to at external speed control (mechanical type).

The difference is considered not to imply different EMC-characteristics when compared to the tested type. Therefore, this type is not tested, but considered to have the same EMC-characteristics as the tested type.

3. TEST SPECIFICATIONS

3.1 Standards

EN 55 014-1: 2006 + A1: 2009 +A2: 2011: Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission

EN 61 000-3-2: 2006: +A1: 2009 + A2:2009 Limits for harmonic current emissions (equipment input current \leq 16A per phase).

EN 61 000-3-3: 2008: Limitation of voltage fluctuations and flicker in low voltage supply systems for equipment with rated current \leq 16A.

EN 55 014-2: 1997 + A1:2001 +A2: 2008: Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity – Product family standard.

Referring to the following basic standards:

EN 61 000-4-2: 1995 +A1:1998 + A2: 2001 Required test level:	Electrostatic discharge immunity test. Contact discharge 4 kV, air discharge 8 kV.
EN 61 000-4-3: 2006 +A1:2008 Required test level:	Radiated, radio frequency, electromagnetic field immunity test. 3 V/m, AM 80% (1 kHz), 80 - 1000 MHz
EN 61 000-4-4: 2004 Required test level:	Electrical fast transient/burst immunity test. 1,0 kV AC power port, 0,5 kV DC power port, signal/control lines.
EN 61 000-4-5: 2006 Required test level:	Surge immunity test. Common mode 2 kV, differential mode 1 kV on AC power port.
EN 61 000-4-6: 2007 + corr. August: 2007 Required level:	Immunity to conducted disturbances, induced by radio-frequency fields. 3 V, 1V AM 80% (1 kHz), 0,15 - 230 MHz.
EN 61 000-4-11: 2004 Required test level:	Voltage dips, short interruptions and voltage variations immunity tests. 30 % reduction (500 ms), 60 % reduction (200 ms) and 100 % reduction (10 ms).

3.2 Additions, deviations and exclusions from standards and accreditation

No additions, deviations or exclusions have been made from standard and accreditation.

3.3 Mode of operation during test

The EUT was supplied with 230 VAC, 50Hz.

Emission:

Emission measurement between 0,15MHz and 300MHz: The EUT was checked at frequency 0,16 MHz and 50MHz when the voltage was varied between 220V-10%(198V) and 240V+10% (264V), this to ensure the highest disturbance mode.

Flicker:

The EUT was manually started and stopped during test.

Mains terminal disturbance voltage and continuous disturbance power:

Tests were performed in operating mode with high speed and low speed.

4. TEST SUMMARY

The tests has been carried out at the Intertek Semko AB premises in Kista, Sweden.
The results in this report apply only to sample tested:

	Test	Result	Note
Emission	EN 55014-1: Mains terminal disturbance voltage	Pass	
Emission	EN 55014-1: Mains terminal discontinuous disturbance voltage	-	1
Emission	EN 55014-1: Continuous disturbance power	Pass	
Emission	EN 61000-3-2: Harmonics	-	2
Emission	EN 61000-3-3: Voltage fluctuations - Flicker	Pass	
Immunity	EN 61000-4-2: Electrostatic discharge	-	3
Immunity	EN 61000-4-3: Radiated electromagnetic fields	-	3
Immunity	EN 61000-4-4: Electrical fast transients	-	3
Immunity	EN 61000-4-5: Surge immunity requirements	-	3
Immunity	EN 61000-4-6: Conducted immunity requirements	-	3
Immunity	EN 61000-4-11: Voltage dips and interruptions	-	3

Notes:

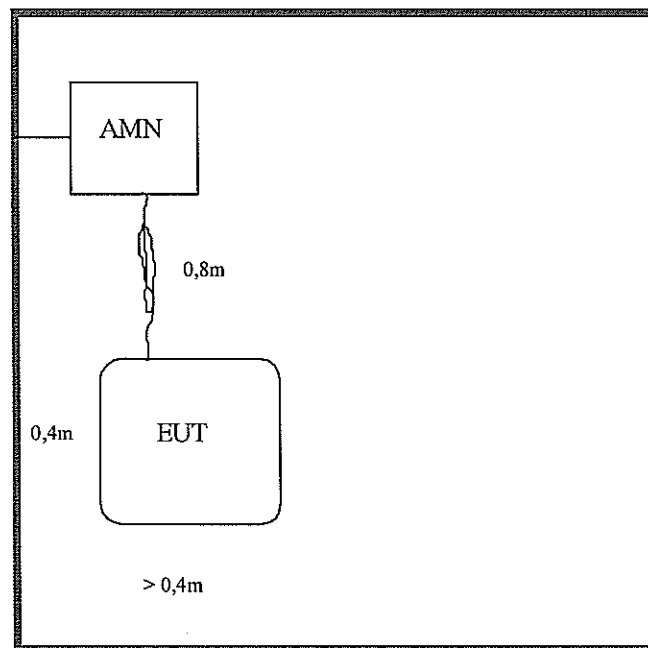
- 1: Not applicable, the EUT has no means to generate discontinuous disturbances
- 2: The EUT is rated <75W, according to EN61000-3-2 paragraph 7 no limits apply.
- 3: Not applicable, the EUT have no clock frequency above 15 MHz and is classified as category I equipment according to EN55014-2.

5. MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE IN THE FREQUENCY RANGE 0,15 MHz TO 30 MHz

5.1 Operating environment

Temperature: 23 °C
Relative Humidity: 20 %

5.2 Test set-up and test procedure



The mains terminal disturbance voltage was measured with the equipment under test (EUT) in a screened room. The EUT was connected to an artificial mains network (AMN), both were placed on a non-metallic table 0,8 m above a metallic, grounded floor. The EUT was placed 0,4 m from the reference ground plane (RGP) wall and 0,8 m from the AMN.

Amplitude measurements were performed with a quasi-peak detector and, if required, with an average detector.

5.3 Measurement uncertainty

Mains terminal disturbance voltage, quasi-peak detection: $\pm 3,6$ dB
Mains terminal disturbance voltage, average detection: $\pm 3,6$ dB

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT in the above mentioned way.

Measurement uncertainty is calculated in accordance with EA-4/02:1997.
The measurement uncertainty is given with a confidence of 95%.

5.4 Test equipment

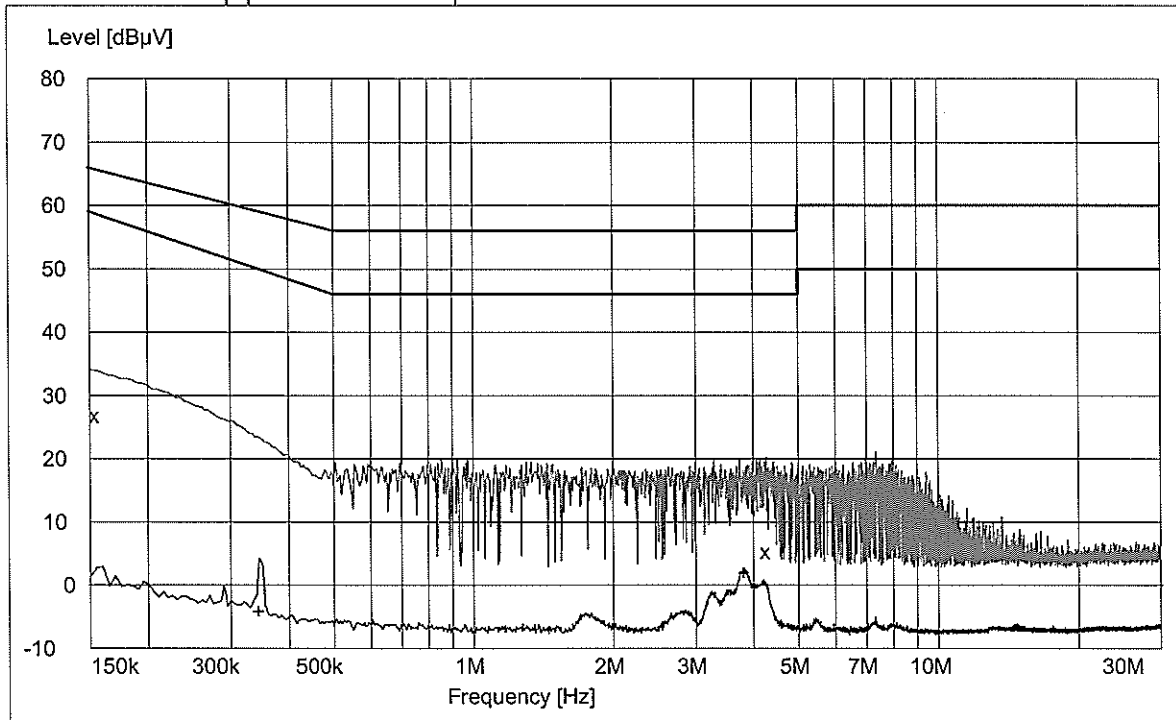
Test site:	Shielded room		
Equipment	Manufacturer	Type	Intertek Semko id No.
Measurement receiver	Rohde & Schwarz	ESHS 30	3149
Artificial mains network	Rohde & Schwarz	ESH3-Z5	2727

5.5 Test protocol

Date of test: February 4, 2013

Operating, high speed

An overview sweep performed with a peak detector:

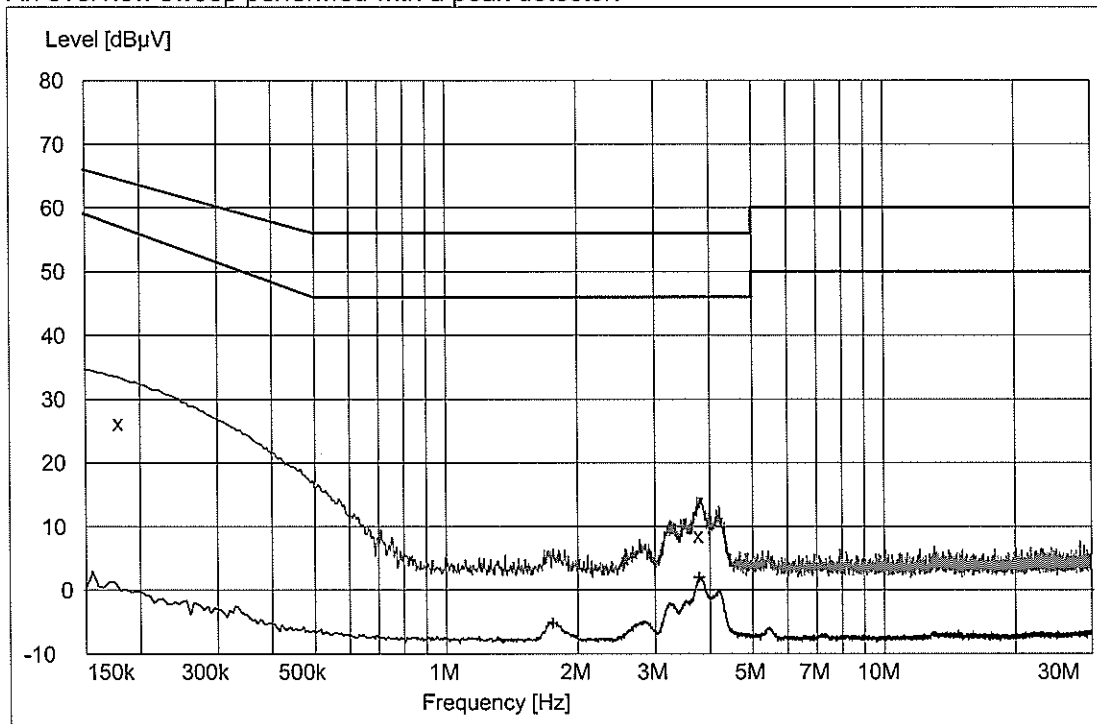


Frequency /MHz	Quasi-Peak		Average	
	Disturbance level /dB(µV)	Limit /dB(µV)	Disturbance level /dB(µV)	Limit /dB(µV)
0,15	27,8	66,0	<20,0	59,0
0,16	27,3	65,5	<20,0	58,3
0,24	23,3	62,1	<20,0	53,9
0,55	<20,0	56,0	<20,0	46,0
1,00	<20,0	56,0	<20,0	46,0
1,40	<20,0	56,0	<20,0	46,0
2,00	<20,0	56,0	<20,0	46,0
3,50	<20,0	56,0	<20,0	46,0
6,00	<20,0	56,0	<20,0	46,0
10,00	<20,0	60,0	<20,0	50,0
22,00	<20,0	60,0	<20,0	50,0
30,00	<20,0	60,0	<20,0	50,0

Limit according to EN 55 014-1 (2006), for household appliance

Operating, low speed

An overview sweep performed with a peak detector:



Frequency /MHz	Quasi-Peak		Average	
	Disturbance level /dB(µV)	Limit /dB(µV)	Disturbance level /dB(µV)	Limit /dB(µV)
0,15	27,8	66,0	<20,0	59,0
0,16	27,3	65,5	<20,0	58,3
0,18	26,3	64,5	<20,0	57,0
0,24	23,3	62,1	<20,0	53,9
0,55	<20,0	56,0	<20,0	46,0
1,00	<20,0	56,0	<20,0	46,0
1,40	<20,0	56,0	<20,0	46,0
2,00	<20,0	56,0	<20,0	46,0
3,50	<20,0	56,0	<20,0	46,0
6,00	<20,0	56,0	<20,0	46,0
10,00	<20,0	60,0	<20,0	50,0
22,00	<20,0	60,0	<20,0	50,0
30,00	<20,0	60,0	<20,0	50,0

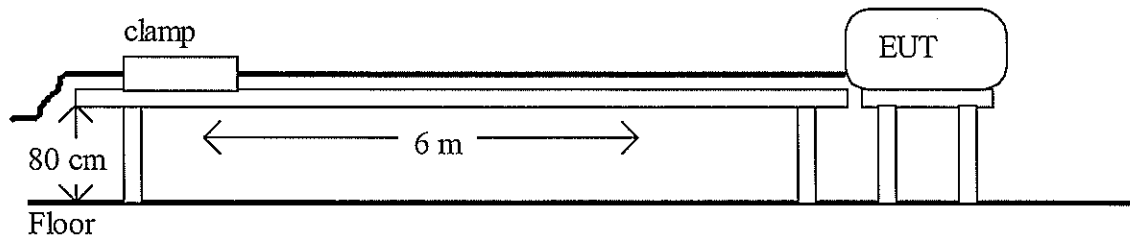
Limit according to EN 55 014-1 (2006), for household appliance

**6. CONTINUOUS DISTURBANCE POWER
IN THE FREQUENCY RANGE 30 MHz TO 300 MHz**

6.1 Operating environment

Temperature: 20 °C
Relative Humidity: 22 %

6.2 Test set-up and test procedure



The disturbance power has been measured with the EUT placed on a non-metallic table at least 0,4 m from other metallic objects. The cable was extended to more than 6 m. The absorbing clamp was placed around the cable and adjusted along the cable to obtain maximum disturbance.

Amplitude measurements were performed with a quasi-peak detector and, if required, with an average detector.

6.3 Measurement uncertainty

Disturbance power, quasi-peak detection: ± 4,2 dB
Disturbance power, average detection: ± 4,2 dB

The measurement uncertainty describes the overall uncertainty of the given measured value during operation of the EUT in the above mentioned way.

Measurement uncertainty is calculated in accordance with EA-4/02:1997.
The measurement uncertainty is given with a confidence of 95%.

6.4 Test equipment

Test site: Wire-mesh shielded enclosure

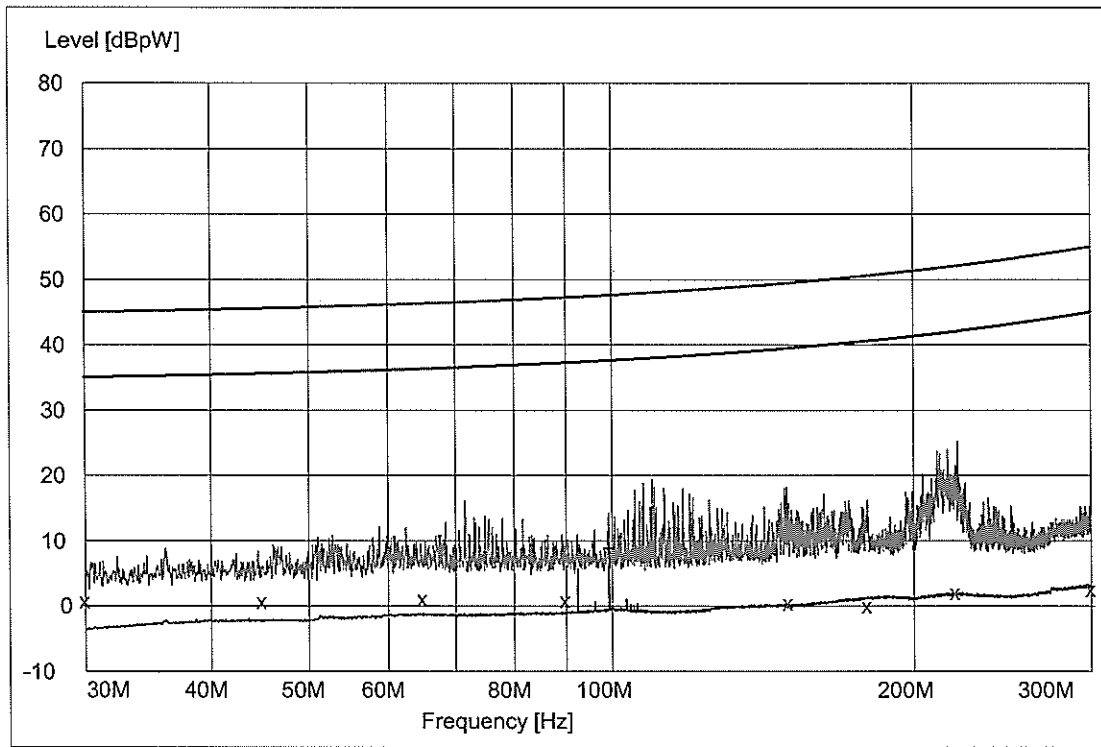
Equipment	Manufacturer	Type	Intertek Semko No.
Measurement receiver	Rohde & Schwarz	ESVS 10	7995
Software	Rohde & Schwarz	ESK1	
Absorbing clamp	Lüthi	MDS 21	1316

6.5 Test protocol

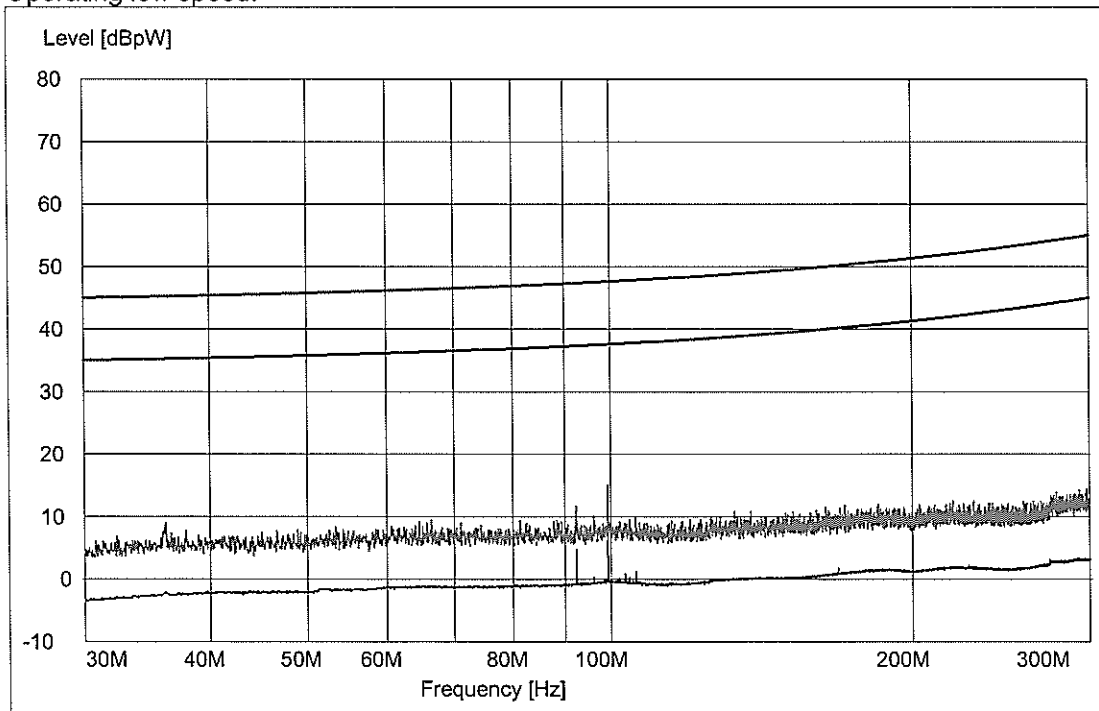
Date of test: February 6, 2013

Operating high speed:

A peak overview sweep with the clamp placed close to the EUT:



Operating low speed:



High speed

Frequency /MHz	Quasi-Peak		Average	
	Disturbance level /dB(pW)	Limit /dB(pW)	Disturbance level /dB(pW)	Limit /dB(pW)
30,00	<15,0	45,0	<15,0	35,0
45,00	<15,0	45,6	<15,0	35,6
65,00	<15,0	46,3	<15,0	36,3
90,00	<15,0	47,2	<15,0	37,2
150,00	<15,0	49,4	<15,0	39,4
180,00	<15,0	50,6	<15,0	40,6
220,00	<15,0	52,0	<15,0	42,0
300,00	<15,0	55,0	<15,0	45,0

Limit according to EN 55 014-1 (2006), for household appliance

Low speed:

Frequency /MHz	Quasi-Peak		Average	
	Disturbance level /dB(pW)	Limit /dB(pW)	Disturbance level /dB(pW)	Limit /dB(pW)
30,00	<15,0	45,0	<15,0	35,0
45,00	<15,0	45,6	<15,0	35,6
65,00	<15,0	46,3	<15,0	36,3
90,00	<15,0	47,2	<15,0	37,2
150,00	<15,0	49,4	<15,0	39,4
180,00	<15,0	50,6	<15,0	40,6
220,00	<15,0	52,0	<15,0	42,0
300,00	<15,0	55,0	<15,0	45,0

Limit according to EN 55 014-1 (2006), for household appliance

7. VOLTAGE FLUCTUATIONS - FLICKER, EN 61 000-3-3

7.1 Operating environment

Temperature: 22 °C
Relative Humidity: 20 %

7.2 Test set-up and test procedure

The voltage changes at the supply terminals were measured using the voltage method.

The test voltage was supplied from an AC source which meets the requirements according to the standard.

The voltage source has virtually zero internal impedance and is connected to a reference impedance:

$$Z = 0,4 + j0,25 \Omega \text{ (total impedance)}$$

The short-term flicker P_{st} is measured during a time interval of 10 minutes.

The long-term flicker P_{lt} is evaluated from 12 subsequently measured short-term flicker values.

P_{st} , P_{lt} , d_c , d_{max} , T and $d(t)$ are measured at the EUT terminals after the reference impedance.

7.3 Measurement uncertainty

The measurement uncertainty for flicker, P_{st} and P_{lt} is: $\pm 6,9 \%$.

The measurement uncertainty for voltage fluctuations, d_{max} , d_c and $d(t)$ $\pm 3,7 \%$

Measurement uncertainty is calculated in accordance with EA-4/02:1997.

The measurement uncertainty is given with a confidence of 95%.

7.4 Test equipment

Equipment	Manufacturer	Type	Intertek Semko No.
Harmonic/flicker analyzer	EM	DPA 503	12709
AC Power source	EM	ACS 503	30604
Flicker impedance	EM	AIF 503 S1	30605
Software	EM	ISMDPA, Ver. 3.3	

7.5 Test protocol

Date of test: February 5, 2013

Test	Measured value	Limit	Pass/Fail	Comments
P_{st}	-	1,0	-	
P_{lt}	-	0,65	-	
d_c (automatic switching)	-	3,3%	-	
d_{max} (automatic switching)	-	4,0%	-	
T (automatic switching)	-	500 ms	-	
d_c (manual switching)	0,04	3,3%	Pass	
d_{max} (manual switching)	0,11	6,0/7,0%	Pass	
T (manual switching)	0	500 ms	Pass	

P_{st} = Short-term flicker

P_{lt} = Long-term flicker

d_{max} = The maximum relative voltage change

d_c = The relative steady-state voltage change

$d(t)$ = The relative voltage change as a function of time

T = Time when $d(t) > d_c$

APPENDIX I - TEST SET-UP PHOTOS

Mains continuous disturbances:



Continuous radiated power:

