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## **EMC Test report for Electric drywall sander**

**Model: HS225**

Shanghai, date of issue: 2012-08-13

Author : Richie Tang

By order of Lee Yeong Industrial Co., Ltd. at Douliu City, Yunlin County, Taiwan

A handwritten signature in black ink that reads 'Richie Tang'.

A handwritten signature in black ink that reads 'sky zhang'.

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author : Richie Tang

reviewed : Sky Zhang

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DEKRA Testing and Certification China Ltd. DOCUMENT

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## 1 CONCLUSION

The equipment under test (EUT) does meet the essential requirements of the EMC Directive 2004/108/EC.

The tests described in this report do not result in the right to use any approval mark as conferred by DEKRA. As far as the tests were based on certain specifications, these are mentioned in the report.

The conclusion and results stated in this test report are based on a non-recurrent examination of sample(s) provided by the applicant.

### 1.1 Model description

The apparatus as supplied for the test is an electric drywall sander, model HS225 intended for residential use. The EUT has electronic control circuit but no earth connection.

This electric drywall sander is specially designed for sanding of drywall or plaster walls and ceilings for both new construction and renovation work.



Figure 1 Overview

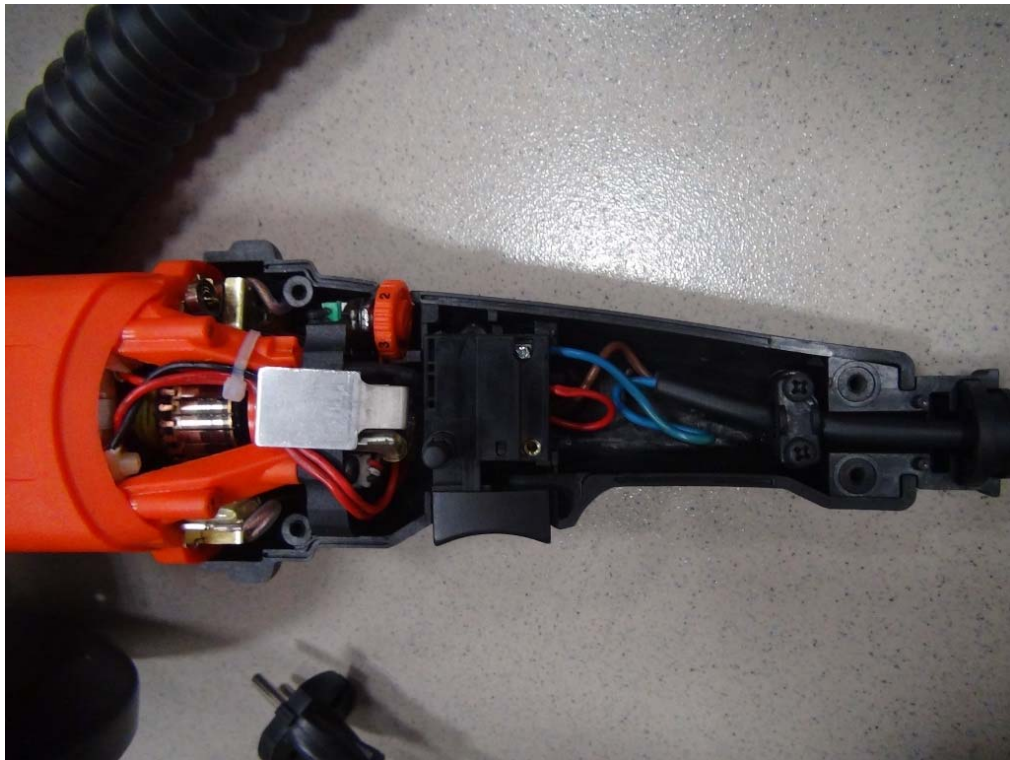


Figure 2 Internal view

The operating modes as stated in the user manual are on with variant speed levels and off modes.

## 1.2 Environment

The requirements and standards apply to equipment intended for use in:

✓	Residential (domestic) environment
✓	Commercial and light-industrial environment
	Industrial environment
	Medical environment

## 1.3 Classification

The standard EN 55014-2 is subdivided in four categories. For each category, the specific immunity requirements are formulated.

	<b>Category 1</b>	Apparatus containing no electronic control circuitry
✓	<b>Category 2</b>	Apparatus containing electronic control circuitry with no internal clock or oscillator frequency higher than 15 MHz.
	<b>Category 3</b>	Battery powered apparatus containing electronic control circuitry with no internal clock higher than 15 MHz.
	<b>Category 4</b>	All other apparatus.

## 2 SUMMARY

This chapter presents an overview of standards and results. Refer to the next chapters for details of measured test results and applied test levels.

### 2.1 Applied standards

Standard	Year	Title
EN 55014-1	2006	Emission – Electrical motor-operated and thermal appliances for household and similar purposes, electrical tools and similar electrical apparatus
A1	2009	
A2	2011	
EN 55014-2	1997	Immunity - Household appliances, electric tools and similar
A1	2001	
A2	2008	
EN 61000-3-2	2006	Limits for harmonic currents emissions
A1	2009	
A2	2009	
EN 61000-3-3	2008	Limitation of voltage fluctuations and flicker

### 2.2 Overview of results

Emission tests	Result
Mains conducted disturbance voltage	<b>PASS</b>
Radiated emission	<b>PASS</b>
Harmonic current emission	<b>PASS</b>
Limitation of voltage fluctuations (flicker)	<b>PASS</b>

Immunity tests	Result
Electrostatic Discharges (ESD)	<b>PASS</b>
Electrical fast transient (EFT)	<b>PASS</b>
Surge transients	<b>PASS</b>
Conducted RF disturbances	<b>PASS</b>
Power supply voltage interruptions & dips	<b>PASS</b>

### 3 GENERAL INFORMATION

#### 3.1 Product Information

Equipment under test	Electric drywall sander
Trade mark	AGP
Tested Type	HS225
U nominal	110-120 Vac or 220-240 Vac; 50-60 Hz
P rated	1200 W

#### 3.2 Customer Information

Applicant/Manufacturer	Lee Yeong Industrial Co., Ltd.
Contact person	Mr. Larry Yang
Telephone	+886 5 557 1635 (Ext. 107)
Telefax	+886 5 557 1716
Address	No.2, Kejia Road, Douliu City, Yunlin County 64057, Taiwan

Factory	Lee Yeong Industrial Co., Ltd.
Contact person	Mr. Larry Yang
Telephone	+886 5 5518 689
Telefax	+886 5 5518 635
Address	No.2, Kejia Road, Douliu City, Yunlin County 64057, Taiwan

### 3.3 Test data

Location	Global Certification Corp.
Address	No.146, Sec. 2, Xiangzhang Rd., Xizhi Dist., New Taipei City 221, Taiwan
Date	Oct. 2011
Supervised by	Richie Tang

### 3.4 Environmental conditions

Tests have been performed in a controlled laboratory environment, where the environmental conditions are maintained within the applicable ranges.

Ambient temperature	15 °C – 35 °C
Relative Humidity air	30% - 60%

### Measurement Uncertainty

Conducted Emission Expanded Uncertainty:  $U = 3.38$  dB

Disturbance Power Expanded Uncertainty:  $U = 3.92$  dB



## 4 EMISSION TEST RESULTS

### 4.1 Mains conducted disturbance voltage

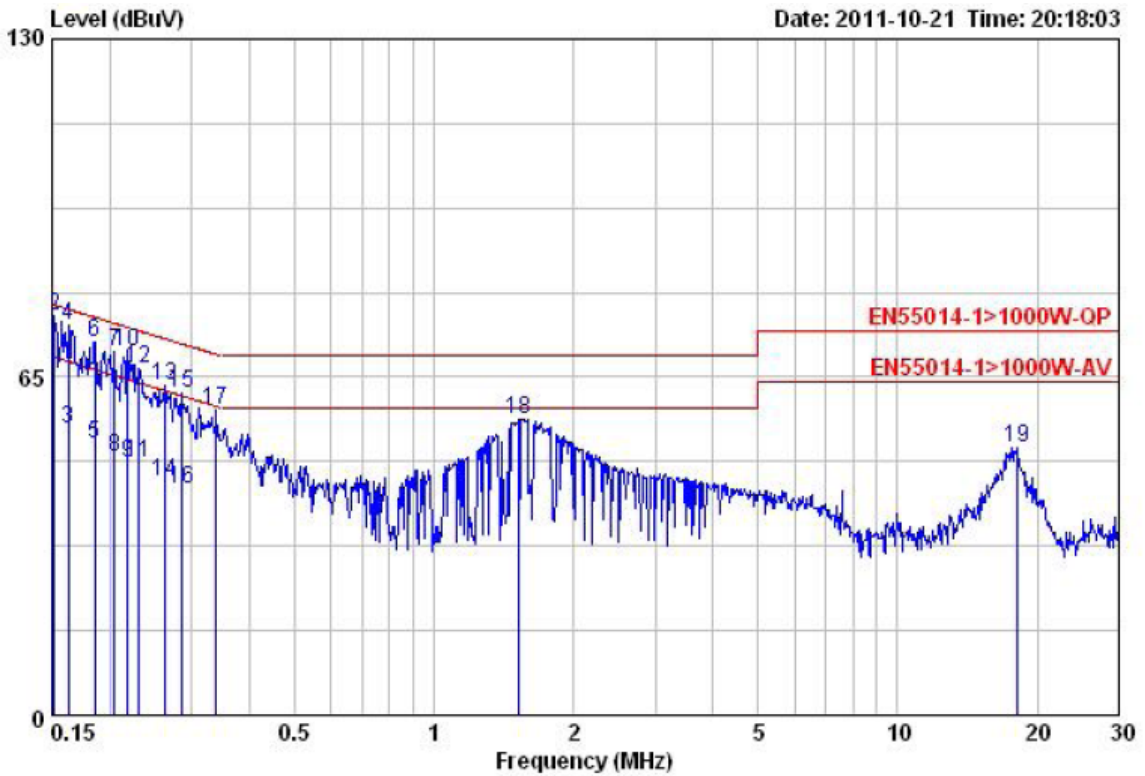
Standard	EN 55014-1 (Tools)	
Frequency [MHz]	QP [dB(μV)]	AV [dB(μV)]
0,15 – 0,35	66 – 59 *)	59 – 49 *)
0,35 – 5	59	49
5 – 30	64	54

\*) Limits decreasing linearly with the logarithm of the frequency

	Rated power below 700 W	Limits as above
	Rated power between 700 and 1000 W	Limits +4 dB
✓	Rated power above 1000 W	Limits +10 dB

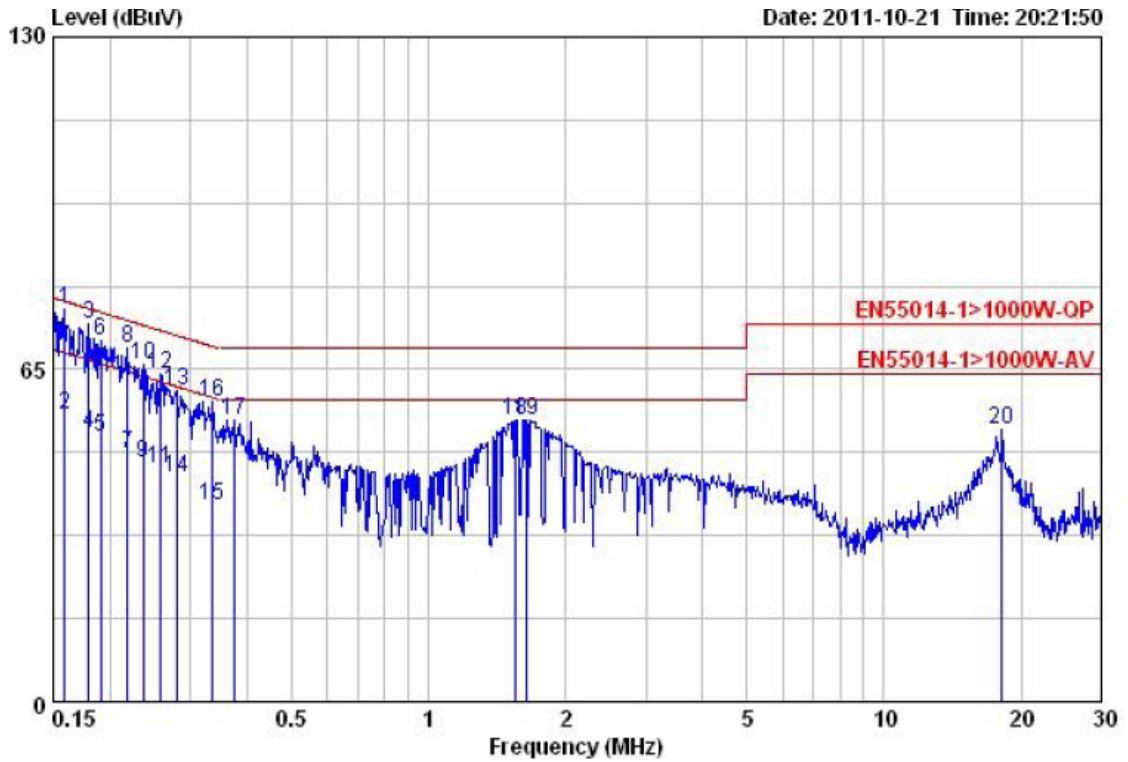
Port	AC mains
Test method	LISN
Mode	High speed with an artificial hand, no load

Line



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.15	45.44	10.25	55.69	68.87	-13.18	Average
2	0.15	66.43	10.25	76.68	78.87	-2.19	Peak
3	0.16	44.73	10.25	54.98	68.06	-13.08	Average
4	0.16	64.85	10.25	75.10	78.06	-2.96	Peak
5	0.19	42.03	10.24	52.27	66.50	-14.23	Average
6	0.19	61.42	10.24	71.66	76.50	-4.84	Peak
7	0.21	59.67	10.24	69.91	75.31	-5.40	Peak
8	0.21	39.34	10.24	49.58	65.31	-15.73	Average
9	0.22	38.35	10.24	48.59	64.56	-15.97	Average
10	0.22	59.71	10.24	69.95	74.56	-4.61	Peak
11	0.23	38.38	10.24	48.62	63.87	-15.25	Average
12	0.23	56.29	10.24	66.53	73.87	-7.34	Peak
13	0.26	53.30	10.24	63.54	72.43	-8.89	Peak
14	0.26	34.81	10.24	45.05	62.43	-17.38	Average
15	0.28	51.67	10.25	61.92	71.43	-9.51	Peak
16	0.28	33.19	10.25	43.44	61.43	-17.99	Average
17	0.34	48.38	10.25	58.63	69.37	-10.74	Peak

Neutral



	Read Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.16	65.56	11.15	76.71	78.31	-1.60	Peak
2	0.16	44.88	11.15	56.03	68.31	-12.28	Average
3	0.18	62.90	11.14	74.04	76.87	-2.83	Peak
4	0.18	41.54	11.14	52.68	66.87	-14.19	Average
5	0.19	40.52	11.14	51.66	66.19	-14.53	Average
6	0.19	59.32	11.14	70.46	76.19	-5.73	Peak
7	0.22	37.25	11.14	48.39	64.56	-16.17	Average
8	0.22	58.01	11.14	69.15	74.56	-5.41	Peak
9	0.24	35.70	11.14	46.84	63.62	-16.78	Average
10	0.24	54.80	11.14	65.94	73.62	-7.68	Peak
11	0.26	34.34	11.14	45.48	62.62	-17.14	Average
12	0.26	52.88	11.14	64.02	72.62	-8.60	Peak
13	0.28	49.67	11.14	60.81	71.62	-10.81	Peak
14	0.28	32.51	11.14	43.65	61.62	-17.97	Average
15	0.34	27.42	11.13	38.55	59.50	-20.95	Average
16	0.34	47.42	11.13	58.55	69.50	-10.95	Peak

Conclusion:

**PASS**

## 4.2 Radiated emission

Standard	EN 55014-1	
Frequency [MHz]	QP [dB(pW)]	AV [dB(pW)]
30 – 300	45 – 55 *)	35 – 45 *)

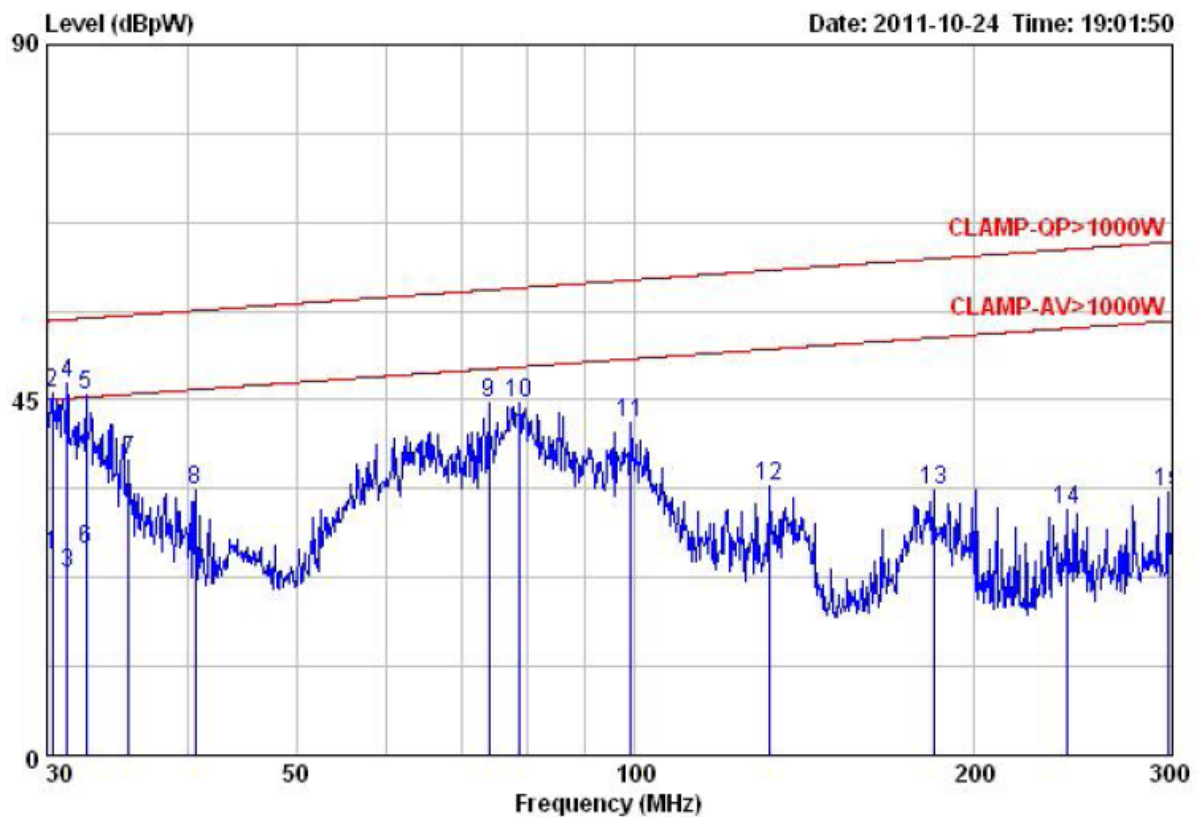
\*) Limits increasing linearly with the frequency

For tools the following limits apply to the AC Mains port:

	Rated power below 700 W	Limits as above
	Rated power between 700 and 1000 W	Limits +4 dB
✓	Rated power above 1000 W	Limits +10 dB

Port	AC Mains
Mode	Middle speed with no load

## Results



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB $\mu$ V	dB	dB $\mu$ V	dB $\mu$ V	dB	
1	30.35	9.54	15.78	25.32	45.06	-19.74	Average
2	30.35	30.08	15.78	45.86	55.06	-9.20	Peak
3	31.27	7.31	15.75	23.06	45.19	-22.13	Average
4	31.27	31.33	15.75	47.08	55.19	-8.11	Peak
5	32.52	29.90	15.72	45.62	55.36	-9.74	Peak
6	32.52	10.31	15.72	26.03	45.36	-19.33	Average
7	35.49	21.74	15.63	37.37	55.74	-18.37	Peak
8	40.66	18.13	15.47	33.60	56.33	-22.73	Peak
9	74.15	29.94	14.69	44.63	58.94	-14.31	Peak
10	78.91	29.75	14.78	44.53	59.21	-14.68	Peak
11	99.11	27.93	14.21	42.14	60.20	-18.06	Peak
12	131.56	20.22	13.86	34.08	61.43	-27.35	Peak
13	184.13	19.30	14.30	33.60	62.89	-29.29	Peak
14	241.61	16.82	14.20	31.02	64.07	-33.05	Peak
15	297.25	17.90	15.33	33.23	64.97	-31.74	Peak

No other significant emissions were measured at the frequency range of interest employing both the QP and AV detectors.

Refer to chapter 6 for the test set-up.

According to clause 4.1.2.3.2 (EN 55014-1):

Appliances are deemed to comply in the frequency range from 300 MHz to 1 000 MHz if both of the following conditions (1) and 2)) are fulfilled:

- 1) all emission readings from the equipment under test shall be lower than the applicable limits (Table 2a) reduced by the margin (Table 2b);
- 2) the maximum clock frequency shall be less than 30 MHz.

**Conclusion:**

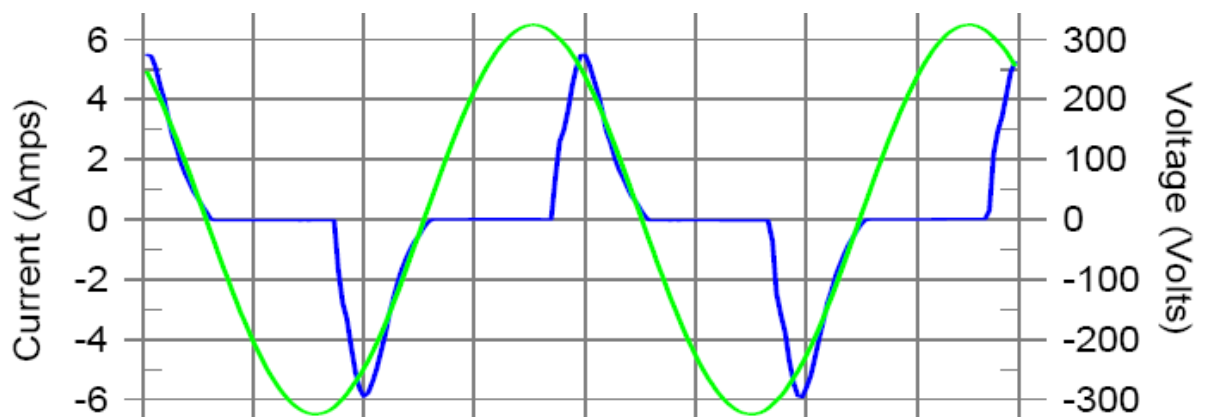
**PASS**

### 4.3 Harmonic currents

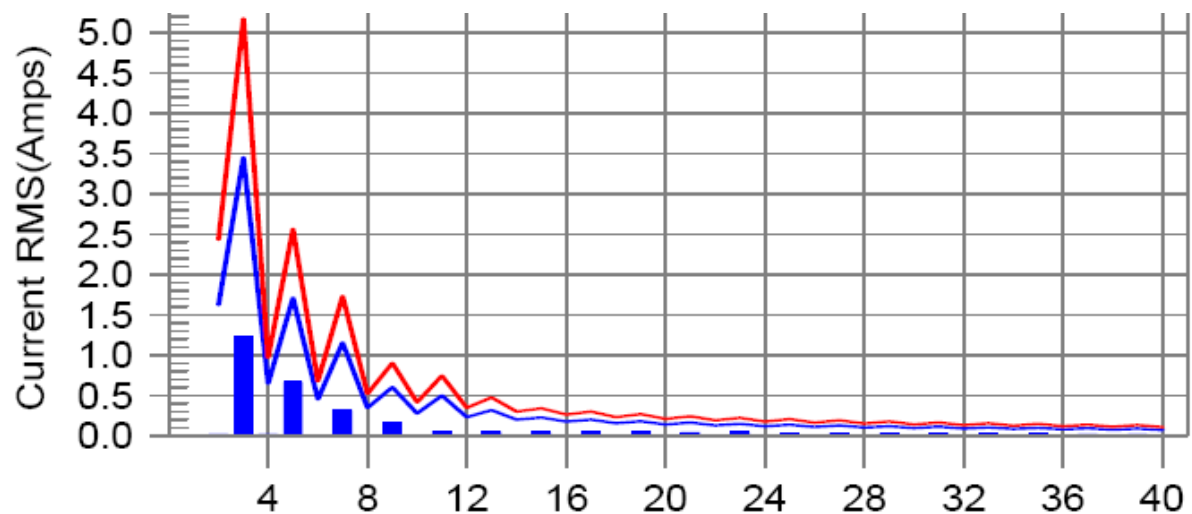
Standard	EN 61000-3-2
Port	AC Mains supply
Rated power	1100 W
Mode	On mode

	Class A	All apparatus not classified as Class B, C or D
✓	Class B	Portable tools
	Class C	Lighting equipment
	Class D	Personal computers, television receivers

#### Current & voltage waveforms



#### Harmonics and Class B limit line European Limits





**Test Result: Pass**      **Source qualification: Normal**  
**THC(A): 1.30**    **I-THD(%): 88.56**    **POHC(A): 0.088**    **POHC Limit(A): 0.377**  
**Highest parameter values during test:**  
     **V\_RMS (Volts): 229.44**                      **Frequency(Hz): 50.00**  
     **I\_Peak (Amps): 6.032**                      **I\_RMS (Amps): 2.267**  
     **I\_Fund (Amps): 1.655**                      **Crest Factor: 2.779**  
     **Power (Watts): 265.4**                      **Power Factor: 0.531**

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.015	1.620	0.9	0.018	2.430	0.75	Pass
3	1.094	3.450	31.7	1.222	5.175	23.62	Pass
4	0.013	0.645	2.0	0.016	0.968	1.69	Pass
5	0.604	1.710	35.3	0.664	2.565	25.90	Pass
6	0.010	0.450	2.4	0.012	0.675	1.83	Pass
7	0.283	1.155	24.5	0.310	1.733	17.88	Pass
8	0.007	0.345	0.0	0.008	0.518	0.00	Pass
9	0.155	0.600	25.9	0.162	0.900	18.06	Pass
10	0.004	0.276	0.0	0.005	0.414	0.00	Pass
11	0.056	0.495	11.3	0.059	0.743	7.93	Pass
12	0.003	0.230	0.0	0.004	0.344	0.00	Pass
13	0.043	0.315	13.6	0.046	0.473	9.79	Pass
14	0.003	0.197	0.0	0.004	0.296	0.00	Pass
15	0.040	0.225	17.7	0.043	0.338	12.84	Pass
16	0.003	0.173	0.0	0.004	0.259	0.00	Pass
17	0.040	0.199	20.2	0.042	0.297	14.27	Pass
18	0.004	0.153	0.0	0.005	0.230	0.00	Pass
19	0.044	0.178	24.8	0.046	0.266	17.34	Pass
20	0.004	0.138	0.0	0.005	0.207	0.00	Pass
21	0.037	0.161	22.9	0.039	0.241	16.10	Pass
22	0.004	0.125	0.0	0.005	0.188	0.00	Pass
23	0.040	0.147	26.9	0.042	0.220	18.92	Pass
24	0.004	0.115	0.0	0.005	0.173	0.00	Pass
25	0.034	0.135	24.9	0.035	0.203	17.16	Pass
26	0.004	0.106	0.0	0.005	0.159	0.00	Pass
27	0.031	0.125	24.5	0.033	0.188	17.66	Pass
28	0.004	0.099	0.0	0.005	0.148	0.00	Pass
29	0.029	0.116	24.7	0.030	0.175	16.95	Pass
30	0.004	0.092	0.0	0.005	0.138	0.00	Pass
31	0.023	0.110	21.2	0.025	0.163	15.48	Pass
32	0.004	0.086	0.0	0.004	0.129	0.00	Pass
33	0.023	0.102	22.2	0.024	0.153	15.58	Pass
34	0.003	0.081	0.0	0.004	0.122	0.00	Pass
35	0.018	0.096	19.2	0.019	0.145	13.18	Pass
36	0.003	0.077	0.0	0.004	0.115	0.00	Pass
37	0.017	0.092	18.3	0.018	0.137	13.37	Pass
38	0.003	0.073	0.0	0.004	0.109	0.00	Pass
39	0.015	0.087	17.4	0.016	0.130	12.02	Pass
40	0.003	0.069	0.0	0.003	0.104	0.00	Pass

**Conclusion:**

**PASS**

#### 4.4 Voltage fluctuations (Flicker)

Standard	EN 61000-3-3
Port	AC Mains supply
Voltage	230 V <sub>AC</sub>
Mode	On mode

Equipment intended to be connected to 230/400 V<sub>AC</sub> 50 Hz supply systems may not produce voltage fluctuations in the supply systems due to variation of the input current above the limits as stated below.

P <sub>ST</sub>	Not applicable*
P <sub>LT</sub>	Not applicable*
dt > 3,3%	≤ 500 ms
d <sub>C</sub>	≤ 3,3%
d <sub>MAX</sub>	≤ 4%

#### Results

Relative voltage change characteristic dt	0,0 ms
Maximum voltage change d <sub>MAX</sub>	0,921%
Relative Voltage change d <sub>C</sub>	0,360%
Short term flicker P <sub>ST</sub>	Not applicable*
Long term flicker P <sub>LT</sub>	Not applicable*

In addition, this test was conducted in accordance with Annex B of EN 61000-3-3:2008.

\* The EUT belongs to hand-held tools (portable tools without heating elements), according to EN 61000-3-3, clause A.9, P<sub>ST</sub> and P<sub>LT</sub> shall not be evaluated.

**Conclusion:**

**PASS**



## 5 IMMUNITY TEST RESULTS

### 5.1 Electrostatic discharge immunity

Electrostatic discharges (ESD) are the result of persons or objects that accumulate static electricity due to for instance walking on synthetic carpets. The ESD can influence the operation of equipment or damage its electronics, either by a direct discharge or indirectly by coupling or radiation. Both effects are simulated during the tests.

#### Requirements

Standard	EN 55014-2
Basic standard	EN 61000-4-2
Port	Enclosure
Performance criterion	B; During the test degradation is allowed. No change of operating state or stored data is allowed.
Air discharges	8 kV
Contact discharges	4 kV
Mode	On mode

#### Performed tests

Air discharges	✓	4 kV	✓	8 kV		15 kV		
Contact discharges	✓	2 kV	✓	4 kV		8 kV		
Via coupling planes	✓	Horizontal			✓	Vertical		
Polarity	✓	Positive			✓	Negative		
Set-up	✓	Table-top				Floor standing		
Ambient temperature	21 °C							
Relative Humidity air	48%							

#### Observations

During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance was observed.

#### Conclusion:

**PASS**

## 5.2 Electrical Fast Transient immunity

The EFT immunity test simulates disturbances by bursts of very short transients caused for example by switching off loads such as an AC motor or bouncing relay contacts. The transients are likely to disturb electronics but less likely to cause damage.

### Requirements

Standard	EN 55014-2			
Basic standard	EN 61000-4-4			
Performance criterion	B; During the test degradation is allowed. No change of operating state or stored data is allowed.			
Pulse characteristics	5/50 ns			
Peak Voltage; Port	1 kV; AC input power port			
Repetition frequency	✓	5 kHz		2,5 kHz

### Performed tests

Tested Voltage; Port	1 kV; AC input power port			
Mode	On mode			
Injection method	✓	CDN		Capacitive clamp
Polarity	✓	Positive	✓	Negative
Set-up	✓	Table-top		Floor standing

### Observations

During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance was observed.

### Conclusion:

**PASS**

### 5.3 Surge transient immunity

The surge transient immunity test simulates the surges that are caused by overvoltages due to indirect (induced) lightning transients. The pulse is a slow transient with high-energy contents and due to its long duration may cause damage to an unprotected EUT.

#### Requirements

Standard	EN 55014-2
Basic standard	EN 61000-4-5
Performance criterion	B; During the test degradation is allowed. No change of operating state or stored data is allowed.
Pulse characteristics	1,2/50 $\mu$ s
Peak Voltage; Port	1 kV; AC input power port (Line to line)

#### Performed tests

Tested Voltage; Port	1 kV; AC input power port (Line to line)		
Mode	On mode		
Polarity	✓	Positive	✓ Negative

#### Observations

During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance was observed.

#### Conclusion:

# PASS

## 5.4 RF Conducted immunity

During this test the immunity of the equipment for induced or conducted electromagnetic fields is checked. Fields generated by radio and other transmitters cause RF voltages in long cables like the mains network. This test reproduces these induced disturbing voltages by injecting them to the EUT via the cabling.

### Requirements

Standard	EN 55014-2
Basic standard	EN 61000-4-6
Performance criterion	A; Operation as intended
Frequency range	0,15 – 230 MHz
Modulation	1 kHz – 80% AM
Test level; Port	3 V; AC input power port

### Performed tests

Tested level; Port	3 V; AC input power port		
Mode	On mode		
Frequency range	0,15 – 230 MHz		
Dwell time	3 seconds		
Injection method	✓	CDN-M2	EM clamp

### Observations

During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance was observed.

### Conclusion:

**PASS**

## 5.5 Power supply interruptions and dips

### Requirements

Basic standard	EN 61000-4-11
Performance criterion	B; During the test degradation is allowed. No change of operating state or stored data is allowed. C; Temporary, self-recoverable loss of function is allowed.

Standard	EN 55014-2			
AC input power port			50 Hz	60 Hz
	C	$U_{NOM} - 30\%$	(25 periods)	(30 periods)
	C	$U_{NOM} - 60\%$	(10 periods)	(12 periods)
	C	$U_{NOM} - 100\%$	(0,5 period)	(0,5 period)

### Performed tests

Tested voltage	AC input power port, 240 V <sub>AC</sub>		
Mode	On mode		
AC input power port	50 Hz		60 Hz
	$U_{NOM} - 30\%$ (25 periods)		$U_{NOM} - 30\%$ (30 periods)
	$U_{NOM} - 60\%$ (10 periods)		$U_{NOM} - 60\%$ (12 periods)
	$U_{NOM} - 100\%$ (0,5 period)		$U_{NOM} - 100\%$ (0,5 period)

### Observations

During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance was observed.

### Conclusion:

**PASS**

## 6 IDENTIFICATION OF THE EQUIPMENT UNDER TEST

The photograph shows the tested device.



Figure 3 Conducted Emission test setup



Figure 4 Disturbance power test setup



Figure 5 Harmonics & Flicker & Surge & DIPS test setup



Figure 6 ESD test setup



Figure 7 EFT test setup



Figure 8 CS test setup