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EMC Test report for Diamond Core Drill

Models: DM51P; DM51D; DME51P; DMC51P; DME51D; DMC51D; TD5W; DM52P; DM52D; DME52P; DMC52P; DME52D; DMC52D; SD17P

Shanghai, date of issue: 2015-12-11

Author : Richie Tang

By order of Lee Yeong Industrial Co., Ltd. at Yunlin County 64057, Taiwan

author : Richie Tang reviewed : Sky Zhang

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Document

DEKRA Testing and Certification (Shanghai) Ltd.
3F #250 Jiangchangsan Road Building 16 Headquarter Economy Park Shibei Hi-Tech Park,
Zhabei District Shanghai 200436 CHINA
Telephone +86 21 60567666. Telefax +86 21 60567555

CONTENTS

1 CONCLUSION

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 a diamond core drill; model DM52P intended for residential use. This product has electronic control circuit but no earth connection.

According to the declaration from manufacturer, all models are identical except the shape of the handle and the speed adjustable device.

Models	Speed adjustable	Shape of main handle
DM51P; DME51P; DMC51P	No	P type
DM51D; DME51D; DMC51D	No	D type
TD5W	No	P type or D type
DM52P; DME52P; DMC52P	Yes	P type
DM52D; DME52D; DMC52D	Yes	D type
SD17P	Yes	P type or D type

Due to the similarity between them, model DM52P was selected for the full tests and the corresponding data is representative for other models as well.

Figure 1 Overview

Figure 2 Rating label

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.

	Category 1	Apparatus containing no electronic control circuitry
✓	**Category 2**	Apparatus containing electronic control circuitry with no internal clock or oscillator frequency higher than 15 MHz.
	Category 3	Battery powered apparatus containing electronic control circuitry with no internal clock higher than 15 MHz.
	Category 4	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	2014	Limits for harmonic currents emissions
EN 61000-3-3	2013	Limitation of voltage fluctuations and flicker

2.2 Overview of results

Emission tests	Result
Mains conducted disturbance voltage	**PASS**
Disturbance Power	**PASS**
Harmonic current emission	**PASS**
Limitation of voltage fluctuations (flicker)	**PASS**

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

3 GENERAL INFORMATION

3.1 Product Information

Equipment under test	Diamond Core Drill
Trade mark	AGP
Tested Type	DM52P
Representative types	DM51P; DM51D; DME51P; DMC51P; DME51D; DMC51D; TD5W; DM52D; DME52P; DMC52P; DME52D; DMC52D; SD17P
Ratings	DM51P; DM51D; DME51P; DMC51P; DME51D; DMC51D; TD5W: 110-120 V or 220-240 V; 50-60 Hz; 1800 W; n_0=3600 min^{-1}; DM52P; DM52D; DME52P; DMC52P; DME52D; DMC52D; SD17P: 110-120 V or 220-240 V; 50-60 Hz; 1800 W; n_0=1800/3600 min^{-1}; Class II

3.2 Customer Information

Applicant	Lee Yeong Industrial Co., Ltd.
Address	No.2, Kejia Road, Douliu City, Yunlin County 64057, Taiwan

Manufacturer	Lee Yeong Industrial Co., Ltd.
Address	No.2, Kejia Road, Douliu City, Yunlin County 64057, Taiwan

Factory	Lee Yeong Industrial Co., Ltd.
Address	No.2, Kejia Road, Douliu City, Yunlin County 64057, Taiwan

3.3 Test data

Location	DEKRA Testing and Certification (Shanghai) Ltd.
Address	1 F., No. 250, Jiangchangsan Road, Shanghai City, China
Date	Apr. 2015
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%

3.5 Measurement Uncertainty

Conducted Emission Expanded Uncertainty: U = 3.22 dB
Disturbance Power Expanded Uncertainty: U = 2.38 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		

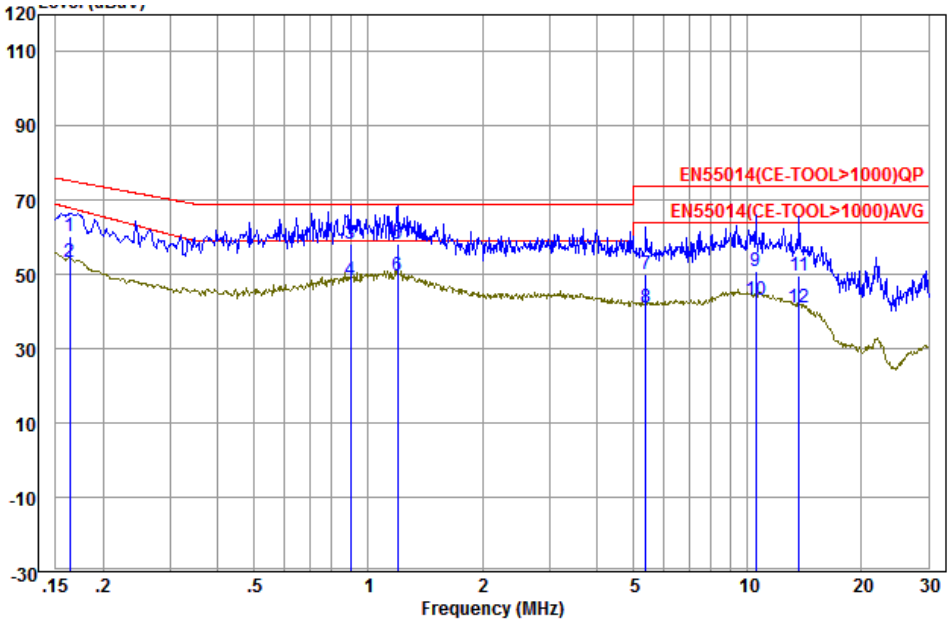
*) Limits decreasing linearly with the logarithm of the frequency

	Rated power below 700 W	Limits as above
	Rated motor power above 700 and not exceeding 1000 W	Limits +4 dB
✓	Rated power above 1000 W	Limits +10 dB

Port	AC mains
Test method	LISN
Mode	On mode with artificial hand, no load

Results with 110-120 Vac

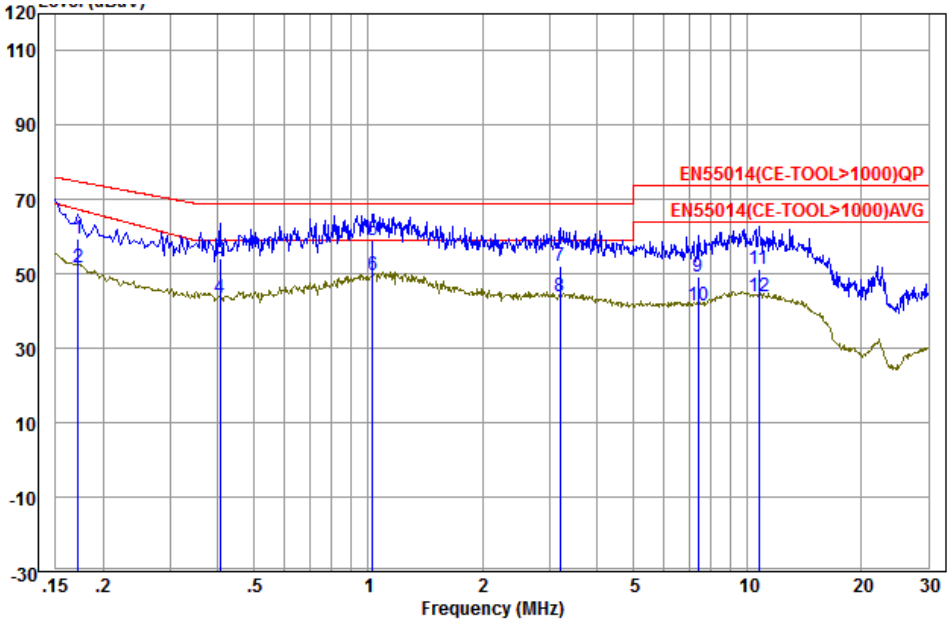
Line



		Freq	Limit Line	Level	Read Level	Factor	Cable Loss	Over Limit	Remark
		MHz	dBuV	dBuV	dBuV	dB	dB	dB	
1		0.16	75.30	60.53	49.71	10.82	1.16	-14.77	QP
2		0.16	68.00	53.39	42.57	10.82	1.16	-14.61	Average
3		0.90	69.00	58.11	47.17	10.94	1.30	-10.89	QP
4		0.90	59.00	48.46	37.52	10.94	1.30	-10.54	Average
5	qp	1.20	69.00	58.48	47.51	10.97	1.33	-10.52	QP
6	pp	1.20	59.00	49.84	38.87	10.97	1.33	-9.16	Average
7		5.39	74.00	49.95	38.98	10.97	1.31	-24.05	QP
8		5.39	64.00	41.04	30.07	10.97	1.31	-22.96	Average
9		10.51	74.00	51.09	39.97	11.12	1.44	-22.91	QP
10		10.51	64.00	43.27	32.15	11.12	1.44	-20.73	Average
11		13.70	74.00	49.83	38.50	11.33	1.63	-24.17	QP
12		13.70	64.00	41.12	29.79	11.33	1.63	-22.88	Average

.

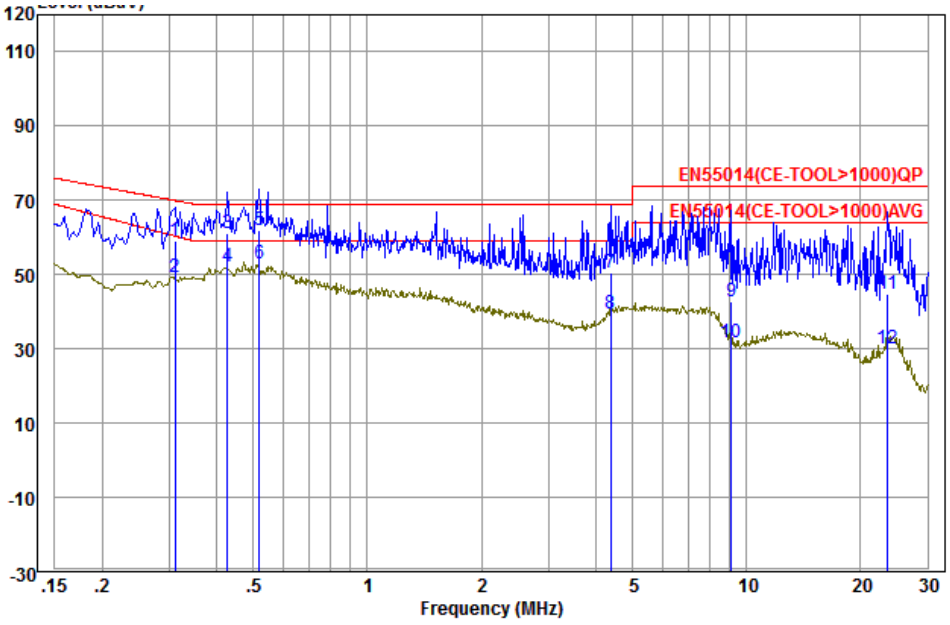
Neutral



		Freq	Limit Line	Level	Read Level	Factor	Cable Loss	Over Limit	Remark
		MHz	dBuV	dBuV	dBuV	dB	dB	dB	
1		0.17	74.86	59.55	48.71	10.84	1.15	-15.31	QP
2		0.17	67.37	51.87	41.03	10.84	1.15	-15.50	Average
3		0.41	69.00	54.09	43.36	10.73	1.10	-14.91	QP
4		0.41	59.00	43.71	32.98	10.73	1.10	-15.29	Average
5	qp	1.03	69.00	59.22	48.29	10.93	1.30	-9.78	QP
6	pp	1.03	59.00	49.55	38.62	10.93	1.30	-9.45	Average
7		3.21	69.00	52.30	41.29	11.01	1.35	-16.70	QP
8		3.21	59.00	44.16	33.15	11.01	1.35	-14.84	Average
9		7.41	74.00	49.38	38.34	11.04	1.36	-24.62	QP
10		7.41	64.00	41.43	30.39	11.04	1.36	-22.57	Average
11		10.73	74.00	51.31	40.13	11.18	1.45	-22.69	QP
12		10.73	64.00	43.98	32.80	11.18	1.45	-20.02	Average

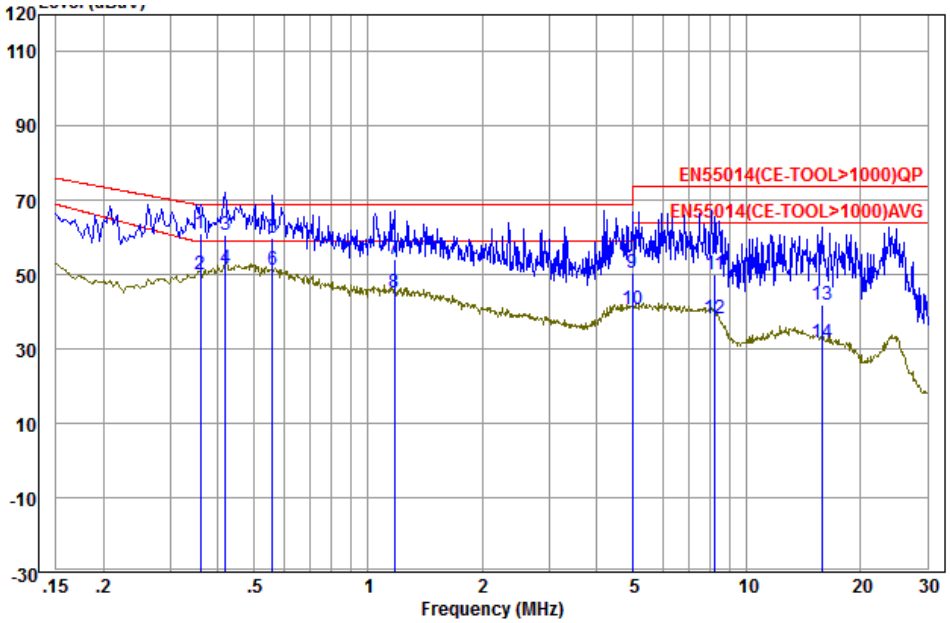
Results with 220-240 Vac

Line



		Freq	Limit Line	Level	Read Level	Factor	Cable Loss	Over Limit	Remark
		MHz	dBuV	dBuV	dBuV	dB	dB	dB	
1		0.31	69.96	59.07	48.39	10.68	1.10	-10.89	QP
2		0.31	60.37	49.34	38.66	10.68	1.10	-11.03	Average
3		0.43	69.00	61.16	50.47	10.69	1.10	-7.84	QP
4		0.43	59.00	52.05	41.36	10.69	1.10	-6.95	Average
5	qp	0.52	69.00	62.05	51.33	10.72	1.12	-6.95	QP
6	pp	0.52	59.00	52.82	42.10	10.72	1.12	-6.18	Average
7		4.38	69.00	50.63	39.66	10.97	1.31	-18.37	QP
8		4.38	59.00	39.55	28.58	10.97	1.31	-19.45	Average
9		9.11	74.00	42.65	31.58	11.07	1.39	-31.35	QP
10		9.11	64.00	31.66	20.59	11.07	1.39	-32.34	Average
11		23.51	74.00	44.72	34.84	9.88	0.18	-29.28	QP
12		23.51	64.00	30.12	20.24	9.88	0.18	-33.88	Average

Neutral



		Freq	Limit Line	Level	Read Level	Factor	Cable Loss	Over Limit	Remark
		MHz	dBuV	dBuV	dBuV	dB	dB	dB	
1	qp	0.36	69.00	61.22	50.48	10.74	1.10	-7.78	QP
2		0.36	59.00	50.30	39.56	10.74	1.10	-8.70	Average
3		0.42	69.00	60.85	50.12	10.73	1.10	-8.15	QP
4	pp	0.42	59.00	51.59	40.86	10.73	1.10	-7.41	Average
5		0.56	69.00	59.88	49.10	10.78	1.16	-9.12	QP
6		0.56	59.00	51.38	40.60	10.78	1.16	-7.62	Average
7		1.17	69.00	54.13	43.18	10.95	1.32	-14.87	QP
8		1.17	59.00	45.17	34.22	10.95	1.32	-13.83	Average
9		4.98	69.00	50.42	39.45	10.97	1.30	-18.58	QP
10		4.98	59.00	40.91	29.94	10.97	1.30	-18.09	Average
11		8.24	74.00	50.21	39.15	11.06	1.37	-23.79	QP
12		8.24	64.00	38.28	27.22	11.06	1.37	-25.72	Average
13		15.89	74.00	41.76	30.27	11.49	1.74	-32.24	QP
14		15.89	64.00	31.58	20.09	11.49	1.74	-32.42	Average

Refer to chapter 6 for the test set-up.

Conclusion:

PASS

4.2 Disturbance Power

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

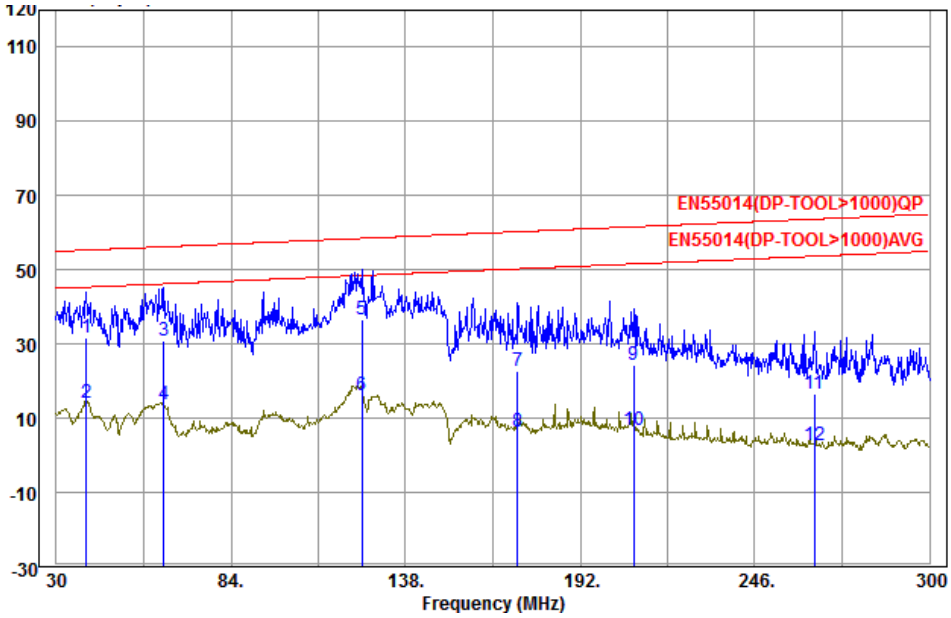
*) Limits increasing linearly with the frequency

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

	Rated power below 700 W	Limits as above
	Rated motor power above 700 and not exceeding 1000 W	Limits +4 dB
✓	Rated power above 1000 W	Limits +10 dB

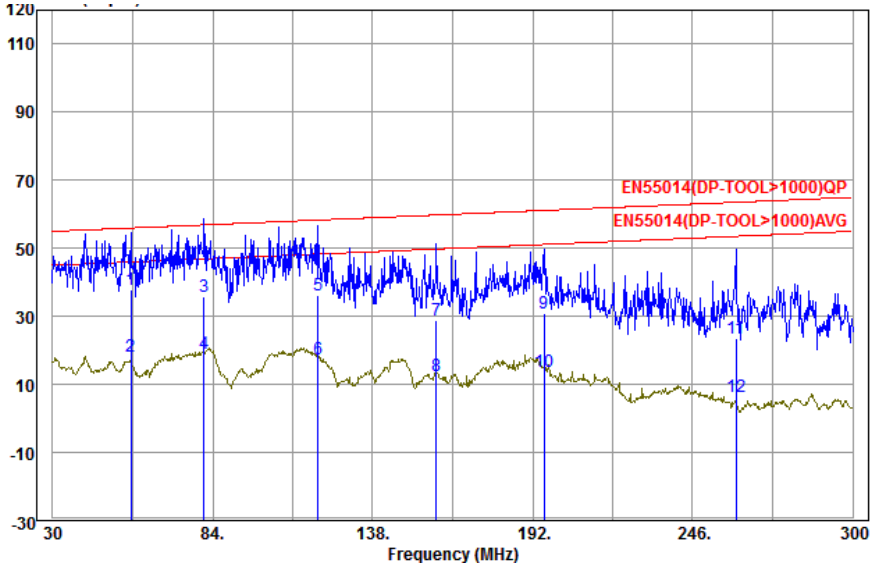
Port	AC Mains
Mode	On mode with no load

Results with 110-120 Vac



		Freq	Limit Line	Level	Read Level	Factor	Cable Loss	Over Limit	Remark
		MHz	dBpW	dBpW	dBpW	dB	dB	dB	
1		39.18	55.35	31.83	11.06	20.77	1.23	-23.52	QP
2	av	39.18	45.35	14.24	-6.53	20.77	1.23	-31.11	Average
3		63.21	56.24	30.93	12.17	18.76	1.33	-25.31	QP
4		63.21	46.24	13.63	-5.13	18.76	1.33	-32.61	Average
5	pp	124.50	58.51	36.75	18.62	18.13	1.60	-21.76	QP
6		124.50	48.51	16.23	-1.90	18.13	1.60	-32.28	Average
7		172.56	60.29	22.81	4.33	18.48	1.90	-37.48	QP
8		172.56	50.29	6.57	-11.91	18.48	1.90	-43.72	Average
9		208.47	61.62	24.53	5.90	18.63	2.05	-37.09	QP
10		208.47	51.62	6.81	-11.82	18.63	2.05	-44.81	Average
11		264.36	63.69	16.61	-2.42	19.03	2.57	-47.08	QP
12		264.36	53.69	2.65	-16.38	19.03	2.57	-51.04	Average

Results with 220-240 Vac



		Freq	Limit Line	Level	Read Level	Factor	Cable Loss	Over Limit	Remark
		MHz	dBpW	dBpW	dBpW	dB	dB	dB	
1	pp	56.46	55.99	37.84	18.84	19.00	1.10	-18.15	QP
2	av	56.46	45.99	18.32	-0.68	19.00	1.10	-27.67	Average
3		81.03	56.90	35.86	17.11	18.75	1.43	-21.04	QP
4		81.03	46.90	18.95	0.20	18.75	1.43	-27.95	Average
5		119.64	58.33	36.23	18.28	17.95	1.42	-22.10	QP
6		119.64	48.33	17.25	-0.70	17.95	1.42	-31.08	Average
7		159.60	59.81	28.66	10.04	18.62	2.05	-31.15	QP
8		159.60	49.81	12.35	-6.27	18.62	2.05	-37.46	Average
9		195.78	61.15	31.08	12.25	18.83	2.23	-30.07	QP
10		195.78	51.15	13.85	-4.98	18.83	2.23	-37.30	Average

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

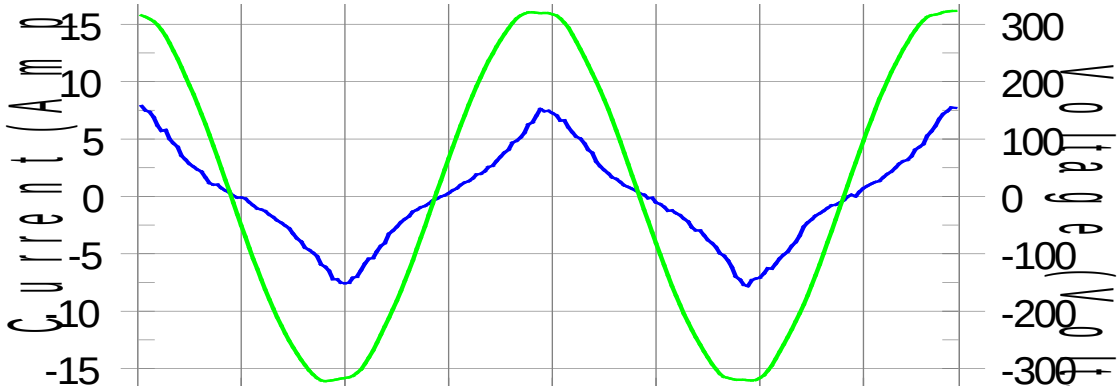
4.3 Harmonic currents

Standard	EN 61000-3-2
Port	AC Mains supply
Rated power	1800 W

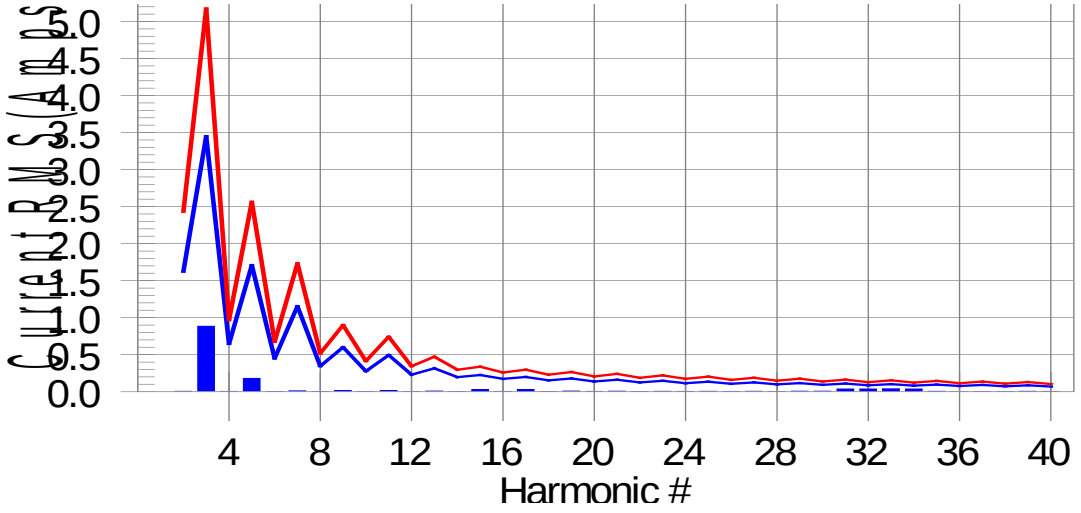
	Class A	All apparatus not classified as Class B, C or D
✓	Class B	Portable tools
	Class C	Lighting equipment
	Class D	Personal computers, television receivers

Results

Current & voltage waveforms



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



Test Result: Pass **Source qualification: Normal**

THC(A): 0.79 **I-THD(%): 21.95** **POHC(A): 0.000** **POHC Limit(A): 0.377**

Highest parameter values during test:

V_RMS (Volts):	**229.67**	**Frequency(Hz):**	**50.00**
I_Peak (Amps):	**8.068**	**I_RMS (Amps):**	**4.202**
I_Fund (Amps):	**3.926**	**Crest Factor:**	**1.942**
Power (Watts):	**894.5**	**Power Factor:**	**0.971**

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.005	1.620	0.3	0.007	2.430	0.00	Pass
3	0.775	3.450	22.5	0.886	5.175	17.12	Pass
4	0.003	0.645	0.5	0.005	0.968	0.00	Pass
5	0.164	1.710	9.6	0.181	2.565	7.07	Pass
6	0.003	0.450	0.6	0.004	0.675	0.00	Pass
7	0.004	1.155	0.4	0.014	1.733	0.00	Pass
8	0.003	0.345	0.7	0.004	0.518	0.00	Pass
9	0.014	0.600	2.3	0.016	0.900	0.00	Pass
10	0.002	0.276	0.8	0.003	0.414	0.00	Pass
11	0.013	0.495	2.6	0.017	0.743	0.00	Pass
12	0.002	0.230	1.0	0.003	0.344	0.00	Pass
13	0.009	0.315	2.8	0.011	0.473	0.00	Pass
14	0.002	0.197	1.3	0.004	0.296	0.00	Pass
15	0.008	0.225	3.7	0.030	0.338	8.86	Pass
16	0.002	0.173	1.4	0.006	0.259	0.00	Pass
17	0.008	0.199	4.2	0.031	0.297	10.36	Pass
18	0.002	0.153	1.4	0.004	0.230	0.00	Pass
19	0.007	0.178	3.7	0.010	0.266	0.00	Pass
20	0.002	0.138	1.4	0.006	0.207	0.00	Pass
21	0.006	0.161	3.6	0.009	0.241	0.00	Pass
22	0.002	0.125	1.4	0.005	0.188	0.00	Pass
23	0.005	0.147	3.5	0.007	0.220	0.00	Pass
24	0.002	0.115	1.7	0.006	0.173	0.00	Pass
25	0.005	0.135	3.5	0.007	0.203	0.00	Pass
26	0.002	0.106	1.8	0.005	0.159	0.00	Pass
27	0.004	0.125	3.6	0.006	0.188	0.00	Pass
28	0.002	0.099	2.0	0.004	0.148	0.00	Pass
29	0.004	0.116	3.7	0.009	0.175	0.00	Pass
30	0.003	0.092	2.8	0.009	0.138	0.00	Pass
31	0.006	0.110	5.1	0.038	0.163	23.27	Pass
32	0.009	0.086	10.0	0.038	0.129	29.83	Pass
33	0.005	0.102	5.4	0.041	0.153	26.96	Pass
34	0.009	0.081	11.1	0.039	0.122	31.59	Pass
35	0.004	0.096	3.7	0.006	0.145	0.00	Pass
36	0.002	0.077	2.0	0.003	0.115	0.00	Pass
37	0.003	0.092	3.6	0.004	0.137	0.00	Pass
38	0.002	0.073	2.5	0.004	0.109	0.00	Pass
39	0.003	0.087	3.7	0.007	0.130	0.00	Pass
40	0.002	0.069	3.0	0.006	0.104	0.00	Pass

Conclusion:

PASS

4.4 Voltage fluctuations (Flicker)

Standard	EN 61000-3-3
Port	AC Mains supply
Voltage	230 V_{AC}
Mode	On mode

Equipment intended to be connected to 230/400 V_{AC} 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_{ST}	Not applicable*
P_{LT}	Not applicable*
dt > 3,3%	≤ 500 ms
d_C	≤ 3,3%
d_{MAX}	≤ 7%

Results

Relative voltage change characteristic dt	0,0 ms
Maximum voltage change d_{MAX}	0,943%
Relative Voltage change d_C	0,342%
Short term flicker P_{ST}	Not applicable*
Long term flicker P_{LT}	Not applicable*

In addition, this test was conducted in accordance with Annex B of EN 61000-3-3:2013.

* The EUT belongs to hand-held tools (portable tools without heating elements), according to EN 61000-3-3, clause A.9, P_{ST} and P_{LT} 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 µs
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			50 Hz	60 Hz
AC input power port	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	
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

----------END----------