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## EMC Test report for Diamond core drill

**Model: DM160**

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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 a diamond core drill; model DM160 intended for residential use. This product has electronic control circuit and earth connection.



Figure 1 Overview

The operating modes as stated in the user manual are on with variant speeds 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>
Disturbance Power	<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	Diamond core drill
Trade mark	AGP
Tested Type	DM160
Ratings	110-120 Vac; 50-60 Hz; 1700 W; 220-240 Vac; 50-60 Hz; 2000 W; $n_0=850 / 1640 / 3450 \text{ min}^{-1}$ ; Class I

#### 3.2 Customer Information

Applicant/Manufacturer	Lee Yeong Industrial Co., Ltd.
Contact person	Ms. Diane Wu
Telephone	+886 5 551 8689
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Factory	Lee Yeong Industrial Co., Ltd.
Contact person	Ms. Diane Wu
Telephone	+886 5 551 8689
Telefax	+886 5 551 8635
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	Feb. 2012
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

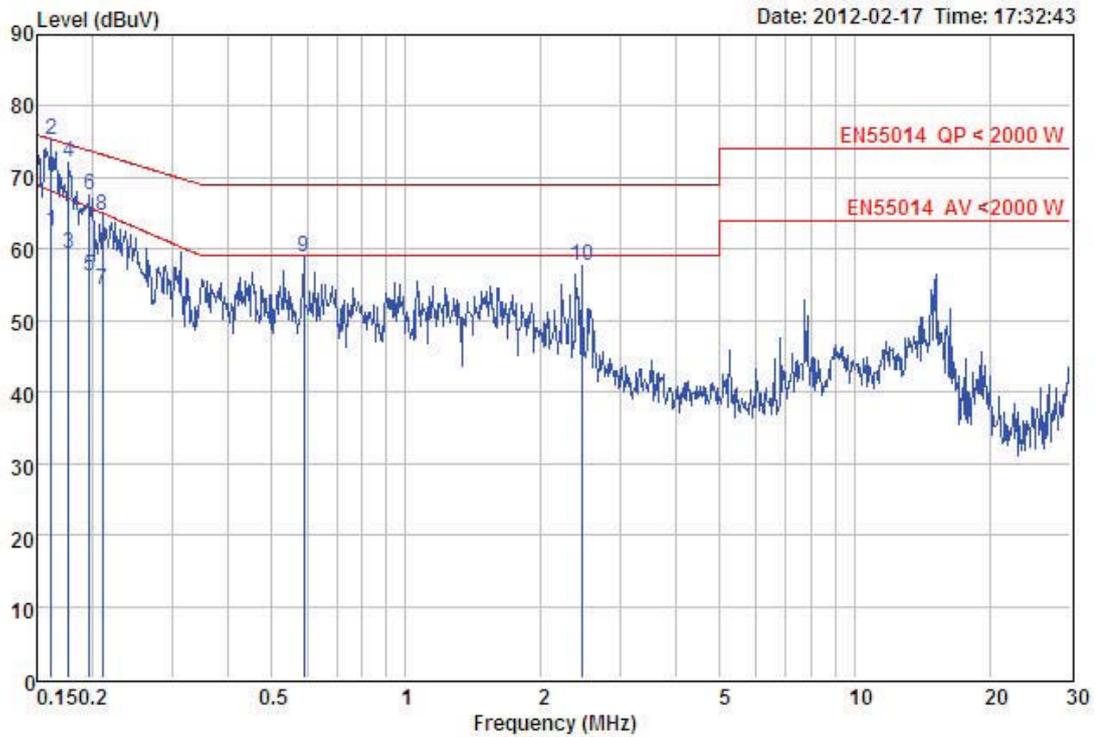
Standard	EN 55014-1 (Tools)					
Frequency [MHz]	QP [dB(μV)]			AV [dB(μV)]		
0,15 – 0,35	66	–	59 *)	59	–	49 *)
0,35 – 5	59			49		
5 – 30	64			54		

\*) 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	On mode with an artificial hand, no load

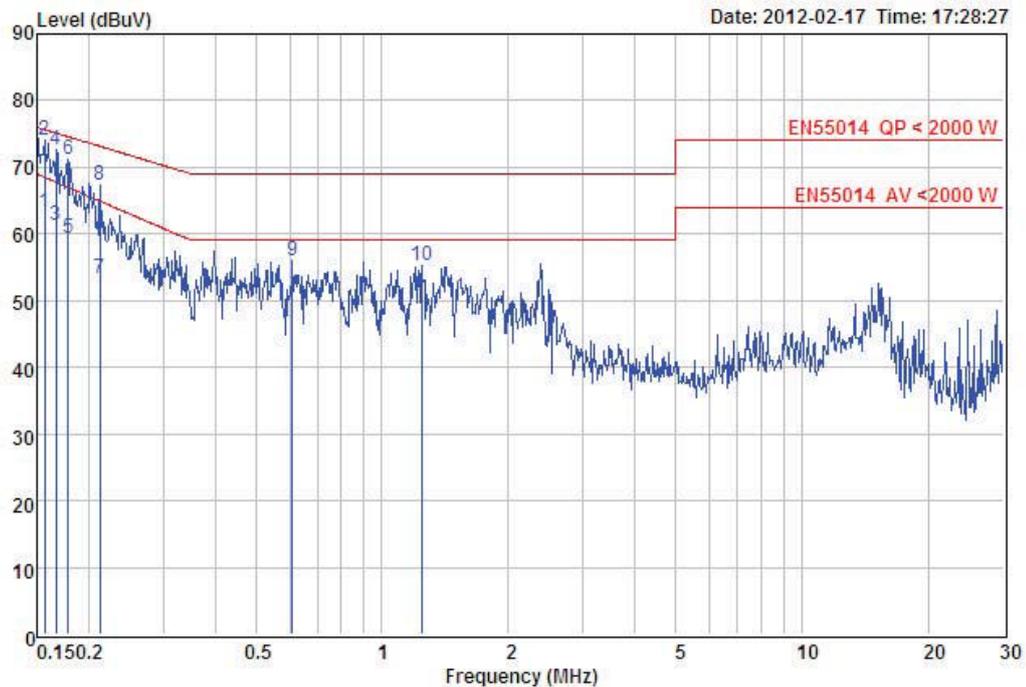
**Line**



	Read		Limit	Over			
	Freq	Level	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.16	52.20	10.31	62.51	68.12	-5.61	Average
2	0.16	64.95	10.31	75.26	75.39	-0.13	Peak
3	0.18	49.00	10.31	59.31	67.06	-7.75	Average
4	0.18	61.84	10.31	72.15	74.64	-2.49	Peak
5	0.20	46.00	10.30	56.30	65.81	-9.51	Average
6	0.20	57.27	10.30	67.57	73.77	-6.20	Peak
7	0.21	44.00	10.30	54.30	65.06	-10.76	Average
8	0.21	54.35	10.30	64.65	73.24	-8.59	Peak
9	0.59	48.60	10.32	58.92	69.00	-10.08	Peak
10	2.46	47.31	10.47	57.78	69.00	-11.22	Peak

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

**Neutral**



	Read		Limit	Over			
	Freq	Level	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.16	53.00	10.28	63.28	68.50	-5.22	Average
2	0.16	63.89	10.28	74.17	75.65	-1.48	Peak
3	0.17	50.99	10.28	61.27	67.75	-6.48	Average
4	0.17	62.27	10.28	72.55	75.12	-2.57	Peak
5	0.18	48.99	10.27	59.26	67.00	-7.74	Average
6	0.18	60.96	10.27	71.23	74.60	-3.37	Peak
7	0.21	43.00	10.25	53.25	64.94	-11.69	Average
8	0.21	57.14	10.25	67.39	73.15	-5.76	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.

**Conclusion:**

**PASS**

#### 4.2 Disturbance Power

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

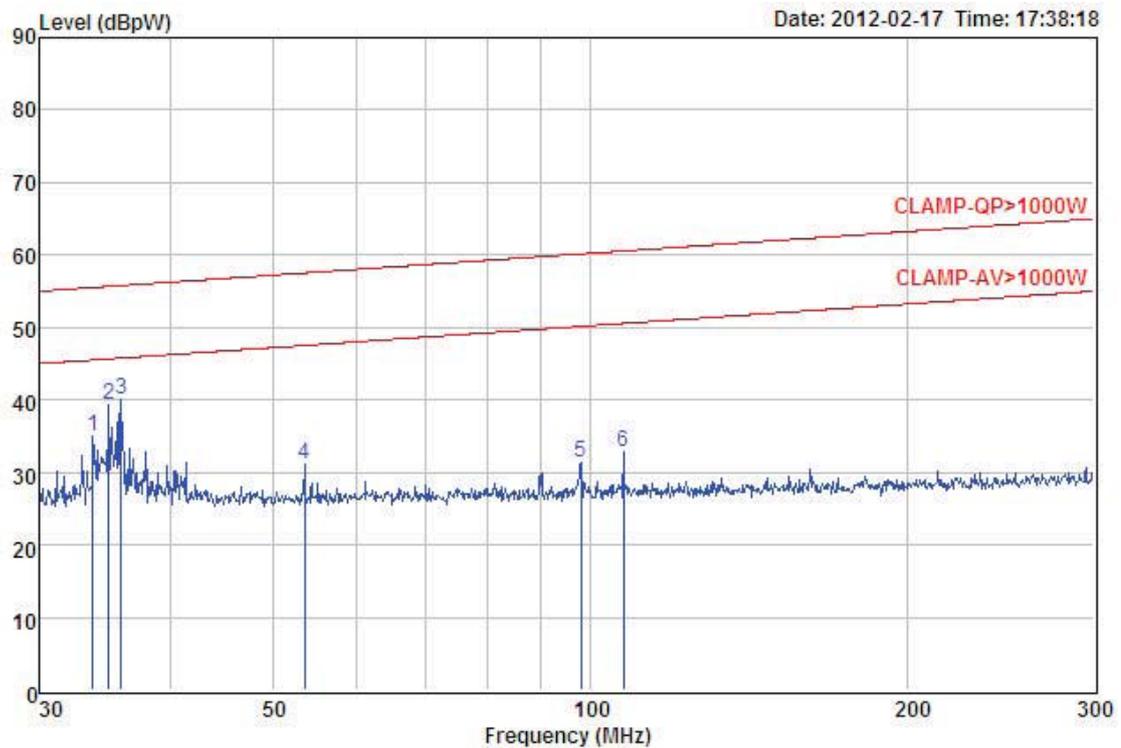
\*) Limits increasing linearly with the frequency

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

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

Port	AC Mains
Mode	On mode with no load

#### Results



	Read	Limit	Over			
Freq	Level	Factor	Level	Line	Limit	Remark
MHz	dBpW		dB	dBpW	dBpW	dB
1	33.74	34.41	0.64	35.05	55.52	-20.47 Peak
2	34.92	38.65	0.65	39.30	55.67	-16.37 Peak
3	35.90	39.41	0.66	40.07	55.79	-15.72 Peak
4	53.47	30.35	0.84	31.19	57.52	-26.33 Peak
5	98.20	30.15	1.18	31.33	60.16	-28.83 Peak
6	107.68	31.49	1.28	32.77	60.56	-27.79 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	2000 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

Test completed, Result: PASSED

Order	Freq. [Hz]	Iavg [A]	Irms [%]	Irms% [%]	Irms%L [A]	Imax [%]	Imax%L [A]	Limit	Status	Vrms [V]	Phase [deg]
1	60	2.4491	2.3547	77.908	2.7045		230.43				0.00
2	120	0.0923	0.0873	2.8877	8.0815	0.1062	9.8334	1.0800		0.1963	0.00
3	180	1.7746	1.6992	56.220	73.879	1.9525	84.892	2.3000		0.1963	0.00
4	240	0.0648	0.0623	2.0598	14.478	0.0714	16.607	0.4300		0.0736	0.00
5	300	0.8704	0.8350	27.625	73.242	0.9552	83.789	1.1400		0.0491	0.00
6	360	0.0389	0.0391	1.2924	13.021	0.0415	13.835	0.3000		0.0736	0.00
7	420	0.2836	0.2777	9.1882	36.066	0.3021	39.237	0.7700		0.1473	0.00
8	480	0.0193	0.0238	0.7876	10.349	0.0256	11.146	0.2300		0.0491	0.00
9	540	0.0685	0.0720	2.3829	18.005	0.0732	18.311	0.4000		0.0245	0.00
10	600	0.0000	0.0159	0.5250	8.6245	0.0177	9.6197	0.1840		0.0245	0.00
11	660	0.0629	0.0610	2.0194	18.496	0.0653	19.790	0.3300		0.1227	0.00
12	720	0.0000	0.0110	0.3635	7.1650	0.0122	7.9611	0.1533		0.0245	0.00
13	780	0.0424	0.0403	1.3328	19.182	0.0446	21.217	0.2100		0.0491	0.00
14	840	0.0000	0.0104	0.3433	7.8948	0.0128	9.7524	0.1314		0.0245	0.00
15	900	0.0540	0.0525	1.7367	34.993	0.0580	38.656	0.1500		0.0736	0.00
16	960	0.0000	0.0104	0.3433	9.0226	0.0134	11.676	0.1150		0.0245	0.00
17	1020	0.0456	0.0446	1.4742	33.664	0.0476	35.970	0.1324		0.0245	0.00
18	1080	0.0000	0.0079	0.2625	7.7621	0.0110	10.747	0.1022		0.0245	0.00
19	1140	0.0329	0.0330	1.0905	27.832	0.0354	29.894	0.1184		0.0736	0.00
20	1200	0.0000	0.0055	0.1817	5.9708	0.0073	7.9611	0.0920		0.0245	0.00
21	1260	0.0294	0.0293	0.9693	27.344	0.0305	28.483	0.1071		0.0245	0.00

22	1320	0.0000	0.0043	0.1414	5.1084	0.0061	7.2977	0.0836	0.0245	0.00
23	1380	0.0000	0.0134	0.4443	13.726	0.0134	13.726	0.0978	0.0736	0.00
24	1440	0.0000	0.0049	0.1616	6.3689	0.0061	7.9611	0.0767	0.0245	0.00
25	1500	0.0000	0.0146	0.4847	16.276	0.0153	16.954	0.0900	0.0245	0.00
26	1560	0.0000	0.0043	0.1414	6.0372	0.0049	6.8996	0.0708	0.0245	0.00
27	1620	0.0000	0.0092	0.3029	10.986	0.0104	12.451	0.0833	0.0491	0.00
28	1680	0.0000	0.0037	0.1212	5.5728	0.0055	8.3592	0.0657	0.0000	0.00
29	1740	0.0000	0.0110	0.3635	14.160	0.0128	16.520	0.0776	0.0245	0.00
30	1800	0.0000	0.0043	0.1414	6.9660	0.0067	10.947	0.0613	0.0245	0.00
31	1860	0.0000	0.0104	0.3433	14.296	0.0128	17.660	0.0726	0.0245	0.00
32	1920	0.0000	0.0043	0.1414	7.4304	0.0067	11.676	0.0575	0.0245	0.00
33	1980	0.0000	0.0128	0.4241	18.799	0.0153	22.380	0.0682	0.0245	0.00
34	2040	0.0000	0.0049	0.1616	9.0226	0.0061	11.278	0.0541	0.0245	0.00
35	2100	0.0000	0.0092	0.3029	14.242	0.0122	18.989	0.0643	0.0245	0.00
36	2160	0.0000	0.0043	0.1414	8.3592	0.0061	11.942	0.0511	0.0245	0.00
37	2220	0.0000	0.0122	0.4039	20.074	0.0140	23.085	0.0608	0.0245	0.00
38	2280	0.0000	0.0043	0.1414	8.8236	0.0073	15.126	0.0484	0.0245	0.00
39	2340	0.0000	0.0085	0.2827	14.811	0.0110	19.043	0.0577	0.0245	0.00
40	2400	0.0000	0.0049	0.1616	10.615	0.0098	21.230	0.0460	0.0245	0.00

Urms = 230.5V Freq = 59.981 Range: 10 A  
Irms = 3.022A Ipk = 7.935A cf = 2.625  
P = 304.1W S = 696.7VA pf = 0.436  
THDi = 63.2 % THDu = 0.20 %

**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>	≤ 7%

#### Results

Relative voltage change characteristic dt	0,0 ms
Maximum voltage change d <sub>MAX</sub>	1,673%
Relative Voltage change d <sub>C</sub>	0,870%
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) 2 kV; AC input power port (Line to earth)

#### Performed tests

Tested Voltage; Port	1 kV; AC input power port (Line to line) 2 kV; AC input power port (Line to earth)		
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-M3	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		
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 2 Conducted Emission test setup



Figure 3 Disturbance power test setup



Figure 4 Harmonics & Flicker & Surge & DIPS test setup



Figure 5 ESD test setup



Figure 6 EFT test setup



Figure 7 Conducted RF disturbances immunity test setup