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EMC Test report for Diamond core drill

**Models: DM14; CB744; CB733; QDM-350; KDMS450;
DM10; DM12; DM9; KDMS350; EVO3.5**

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By order of Lee Yeong Industrial Co., Ltd.



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Document

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1 CONCLUSION

The report is issued to base on original test report Ref. No. 3133903.50 dated on 2013-09-04 including the following modifications:

- Add new models.

CB744; CB733; QDM-350; KDMS450 are same as DM14, only the types are different.

DM12; DM9; KDMS350; EVO3.5 are same as DM10, only the types are different.

After review, no test is considered necessary.

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 DM14 intended for residential use. This product has electronic control circuit and earth connection.

According to the declaration from manufacturer, models DM14 and DM10 are identical except the rated no-load speed.

Due to the similarity between them, model DM14 was selected for the full tests and the corresponding data is representative for model DM10 as well.



Figure 1 Overview

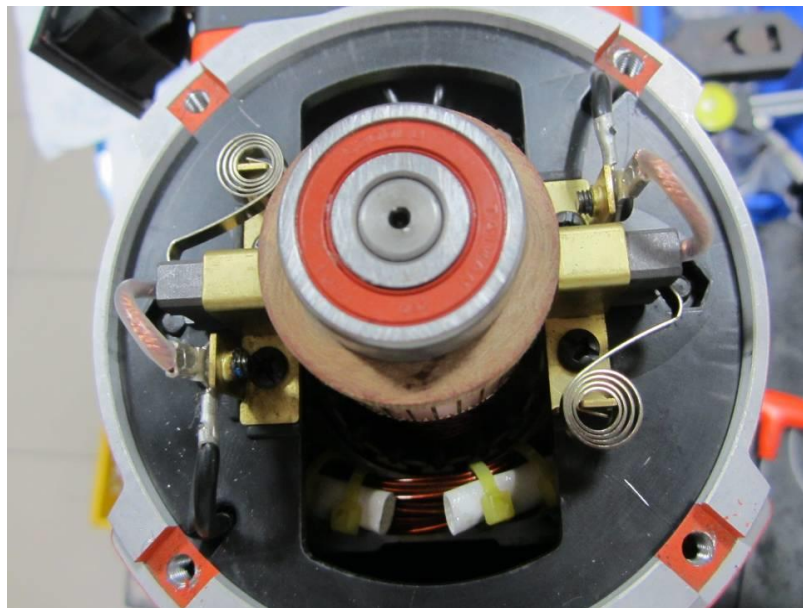


Figure 2 Internal view

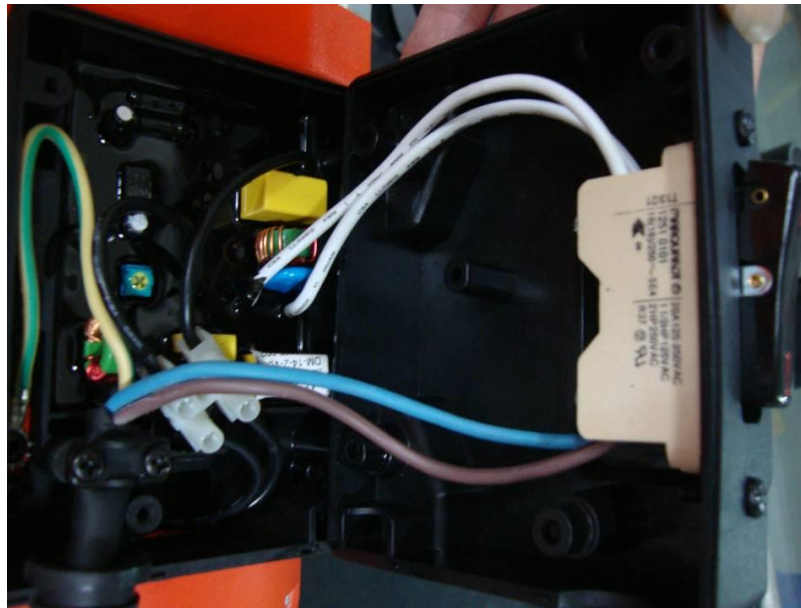


Figure 3 Internal view

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	DM14
Representative type	CB744; CB733; QDM-350; KDMS450; DM10; DM12; DM9; KDMS350; EVO3.5
Ratings	220-240 V; 50-60 Hz; 16 A; Class I DM14; CB744; CB733; QDM-350; KDMS450: $n_0 = 385 / 530 / 975 / 1340 \text{ min}^{-1}$; $\varnothing 355 \text{ mm}$; DM10; DM12; DM9; KDMS350; EVO3.5: $n_0 = 450 / 810 / 1300 \text{ min}^{-1}$; $\varnothing 250 \text{ mm}$;

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	Global Certification Corp.
Address	No.146, Sec. 2, Xiangzhang Rd., Xizhi Dist., New Taipei City 221, Taiwan
Date	Feb. 2013
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: $U = 3.38$ dB

Disturbance Power Expanded Uncertainty: $U = 3.92$ dB

4 EMISSION TEST RESULTS

4.1 Mains conducted disturbance voltage

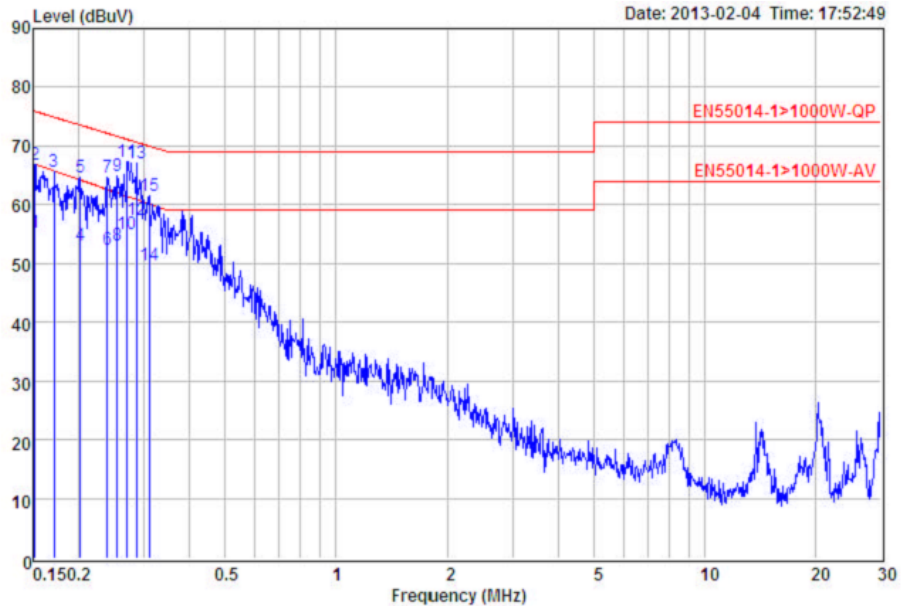
Standard	EN 55014-1 (Tools)	
Frequency [MHz]	QP [dB(μV)]	AV [dB(μV)]
0,15 – 0,35	66 – 59 *)	59 – 49 *)
0,35 – 5	59	49
5 – 30	64	54

*) Limits decreasing linearly with the logarithm of the frequency

	Rated motor power not exceeding 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

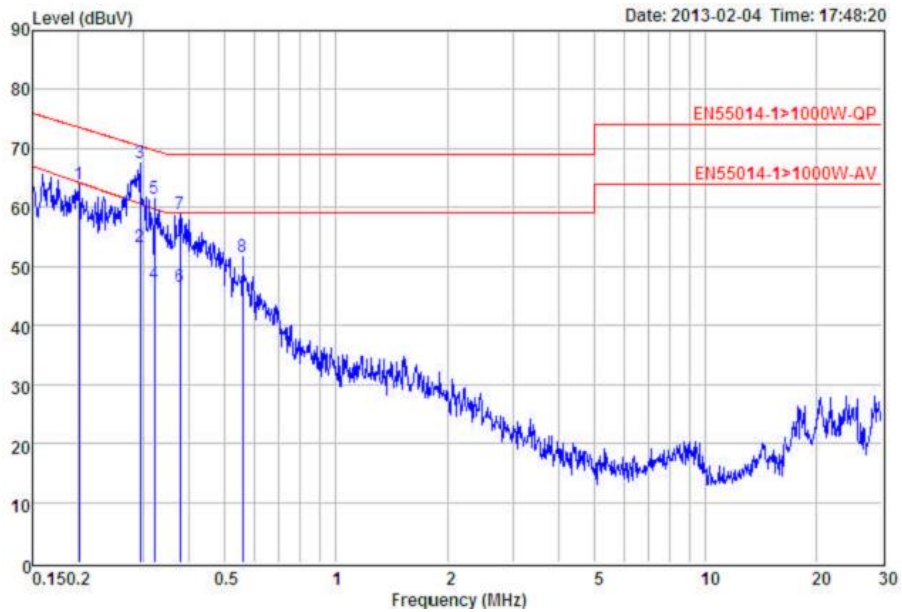
Port	AC mains
Test method	LISN
Mode	On mode with an artificial hand, no load

Line



	Read Freq	Read Level	Level	Factor	Over Limit	Limit Line	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	
1	0.15	55.40	55.30	-0.10	-11.60	66.90	Average
2	0.15	67.00	66.90	-0.10	-9.01	75.91	Peak
3	0.17	65.73	65.63	-0.10	-9.28	74.91	Peak
4	0.20	53.30	53.19	-0.11	-11.01	64.20	Average
5	0.20	64.84	64.73	-0.11	-8.82	73.55	Peak
6	0.24	52.40	52.29	-0.11	-10.31	62.60	Average
7	0.24	64.66	64.55	-0.11	-7.60	72.15	Peak
8	0.25	53.09	52.98	-0.11	-9.07	62.05	Average
9	0.25	65.10	64.99	-0.11	-6.68	71.67	Peak
10	0.27	55.09	54.98	-0.11	-6.47	61.45	Average
11	0.27	67.55	67.44	-0.11	-3.70	71.14	Peak
12	0.29	57.49	57.38	-0.11	-3.52	60.90	Average
13	0.29	67.11	67.00	-0.11	-3.66	70.66	Peak
14	0.31	49.79	49.68	-0.11	-10.47	60.15	Average
15	0.31	61.63	61.52	-0.11	-8.48	70.00	Peak

Neutral



	Read Freq	Read Level	Level	Factor	Over Limit	Limit Line	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	
1	0.20	64.01	63.90	-0.11	-9.69	73.59	Peak
2	0.29	53.40	53.28	-0.12	-7.37	60.65	Average
3	0.29	67.62	67.50	-0.12	-2.94	70.44	Peak
4	0.32	47.21	47.08	-0.13	-12.72	59.80	Average
5	0.32	61.55	61.42	-0.13	-8.28	69.70	Peak
6	0.38	46.70	46.57	-0.13	-12.43	59.00	Average
7	0.38	59.05	58.92	-0.13	-10.08	69.00	Peak
8	0.56	51.68	51.54	-0.14	-17.46	69.00	Peak

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 *)

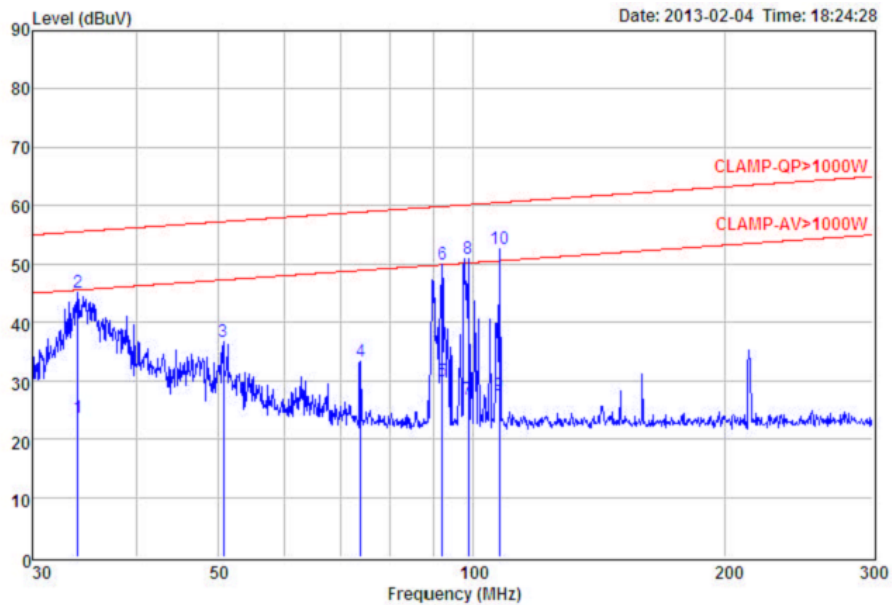
*) Limits increasing linearly with the frequency

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

	Rated motor power not exceeding 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



	Freq	Read Level	Level	Factor	Over Limit	Limit Line	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	
1	33.97	23.60	23.60	0.00	-21.94	45.54	Average
2	33.97	45.04	45.04	0.00	-27.50	72.54	Peak
3	50.71	36.71	36.71	0.00	-37.57	74.28	Peak
4	73.81	33.28	33.28	0.00	-42.63	75.91	Peak
5	92.07	29.80	29.80	0.00	-20.07	49.87	Average
6	92.07	49.94	49.94	0.00	-26.93	76.87	Peak
7	98.88	26.80	26.80	0.00	-23.38	50.18	Average
8	98.88	50.91	50.91	0.00	-26.27	77.18	Peak
9	107.68	27.60	27.60	0.00	-22.95	50.55	Average
10	107.68	52.68	52.68	0.00	-24.87	77.55	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:

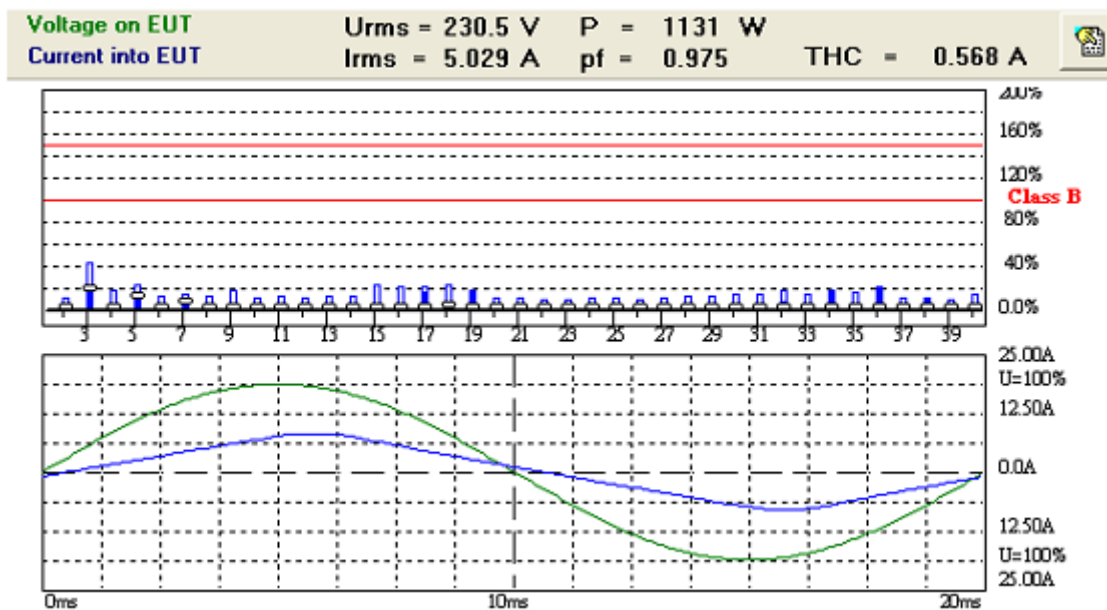
PASS

4.3 Harmonic currents

Standard	EN 61000-3-2
Port	AC Mains supply
Rated power	3200 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 Result: Pass Source qualification: Normal
 Urms = 230.5V Freq = 50.000 Range: 25 A
 Irms = 5.029A lpk = 8.301A cf = 1.650
 P = 1131W S = 1159VA pf = 0.975
 THDi = 11.3 % THDu = 0.10 % Class B

Order	Freq. [Hz]	Iavg [A]	Irms [A]	I _{max} [A]	Limit [A]	Status Pass/Fail
1	50	5.0644	5.0018	6.0654		Pass
2	100	0.0005	0.0076	0.1358	1.6200	Pass
3	150	0.5695	0.5432	1.3931	3.4500	Pass
4	200	0.0003	0.0015	0.0931	0.6450	Pass
5	250	0.1612	0.1511	0.3418	1.7100	Pass
6	300	0.0001	0.0015	0.0443	0.4500	Pass
7	350	0.0524	0.0488	0.1312	1.1550	Pass
8	400	0.0000	0.0076	0.0320	0.3450	Pass
9	450	0.0004	0.0137	0.0916	0.6000	Pass
10	500	0.0000	0.0076	0.0244	0.2760	Pass
11	550	0.0001	0.0015	0.0488	0.4950	Pass
12	600	0.0000	0.0015	0.0198	0.2300	Pass
13	650	0.0000	0.0031	0.0320	0.3150	Pass
14	700	0.0000	0.0000	0.0198	0.1971	Pass
15	750	0.0001	0.0061	0.0458	0.2250	Pass
16	800	0.0000	0.0015	0.0305	0.1725	Pass
17	850	0.0000	0.0275	0.0381	0.1985	Pass
18	900	0.0009	0.0031	0.0305	0.1533	Pass
19	950	0.0000	0.0259	0.0259	0.1776	Pass
20	1000	0.0000	0.0000	0.0107	0.1380	Pass
21	1050	0.0000	0.0061	0.0137	0.1607	Pass
22	1100	0.0000	0.0000	0.0092	0.1255	Pass
23	1150	0.0000	0.0015	0.0107	0.1467	Pass
24	1200	0.0000	0.0000	0.0092	0.1150	Pass
25	1250	0.0000	0.0015	0.0107	0.1350	Pass
26	1300	0.0000	0.0000	0.0076	0.1062	Pass
27	1350	0.0000	0.0015	0.0107	0.1250	Pass
28	1400	0.0000	0.0000	0.0092	0.0986	Pass
29	1450	0.0000	0.0000	0.0107	0.1164	Pass
30	1500	0.0000	0.0015	0.0107	0.0920	Pass
31	1550	0.0000	0.0000	0.0122	0.1089	Pass
32	1600	0.0000	0.0046	0.0137	0.0862	Pass
33	1650	0.0000	0.0000	0.0122	0.1023	Pass
34	1700	0.0000	0.0107	0.0122	0.0812	Pass
35	1750	0.0000	0.0015	0.0122	0.0964	Pass
36	1800	0.0000	0.0122	0.0137	0.0767	Pass
37	1850	0.0000	0.0015	0.0076	0.0912	Pass
38	1900	0.0000	0.0046	0.0061	0.0726	Pass
39	1950	0.0000	0.0000	0.0061	0.0865	Pass
40	2000	0.0000	0.0015	0.0076	0.0690	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*
T _{max} (dt > 3,3%)	≤ 500 ms
d _C	≤ 3,3%
d _{MAX}	≤ 7%

Results

T _{max} (dt > 3,3%)	0,0 ms
Maximum voltage change d _{MAX}	3,680%
Relative Voltage change d _C	0,990%
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.

* 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 overvoltage 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 μ 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 4 Conducted Emission test setup



Figure 5 Disturbance power test setup

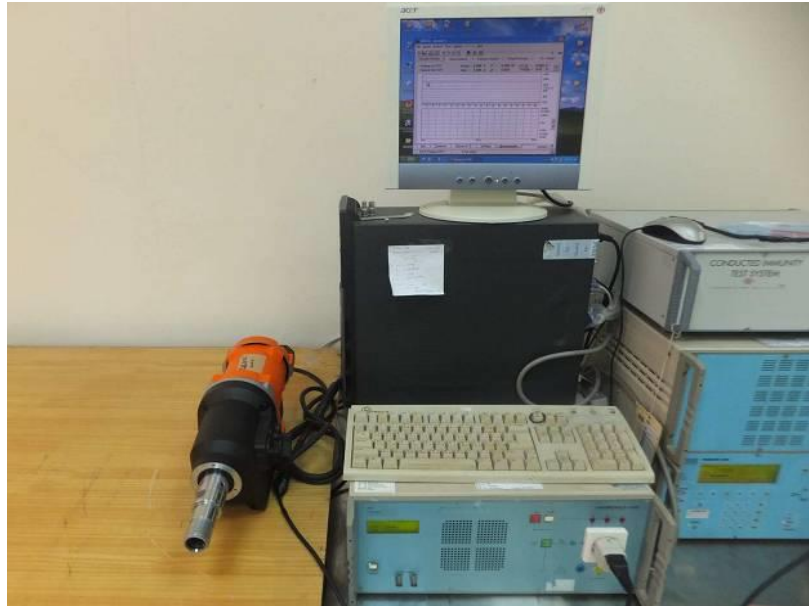


Figure 6 Harmonics & Flicker test setup



Figure 7 ESD test setup



Figure 8 EFT & Surge & DIPS test setup



Figure 9 RF Conducted immunity test setup

-----END-----