

Prüfbericht - Nr.: 15044257 001 <i>Test Report No.:</i>		Seite 1 von 28 <i>Page 1 of 28</i>			
Auftraggeber: <i>Client:</i>		Bestway Inflatables & Material Corp. No. 3065 Cao An Road, Shanghai 201812, P.R. China			
Gegenstand der Prüfung: <i>Test item:</i>		SPA			
Bezeichnung: <i>Identification:</i>		#54112 #54113	Serien-Nr.: N/A <i>Serial No.:</i>		
Wareneingangs-Nr.: <i>Receipt No.:</i>		153164903	Eingangsdatum: 14.04.2011 <i>Date of receipt:</i>		
Prüfart: <i>Testing location:</i>		Refer to section 1.1			
Prüfgrundlage: <i>Test specification:</i>		EN 55014-1:2006+A1 EN 55014-2:1997+A1+A2 EN 61000-3-3:2008 EN 61000-3-2:2006+A1+A2			
Prüfresultat: <i>Test Result:</i>		Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). <i>The test item passed the test specification(s).</i>			
Prüflaboratorium: <i>Testing Laboratory:</i>		TÜV Rheinland (Shanghai) Co., Ltd.			
geprüft/ tested by:		kontrolliert/ reviewed by:			
05.08.2011	Li Yanhua/PE		05.08.2011	Yang Xiaobao/TC	
<i>Datum</i> <i>Date</i>	<i>Name/Stellung</i> <i>Name/Position</i>	<i>Unterschrift</i> <i>Signature</i>	<i>Datum</i> <i>Date</i>	<i>Name/Stellung</i> <i>Name/Position</i>	<i>Unterschrift</i> <i>Signature</i>
Sonstiges/ Other Aspects:					
The above two models have the same electrical characteristics. And the only differences between them are in type designation on their rating labels and the water pool (different material, size and capacity). Therefore, only model #54112 was selected to perform tests.					
Abkürzungen:		Abbreviations:			
P(ass) = entspricht Prüfgrundlage		P(ass) = passed			
F(ail) = entspricht nicht Prüfgrundlage		F(ail) = failed			
N/A = nicht anwendbar		N/A = not applicable			
N/T = nicht getestet		N/T = not tested			
<p>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</p> <p><i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i></p>					

TEST SUMMARY

- 4.1.1 HARMONICS ON AC MAINS
Result:
Passed
- 4.1.2 VOLTAGE CHANGES, VOLTAGE FLUCTUATIONS AND FLICKER ON AC MAINS
Result:
Passed
- 4.1.3 MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE
Result:
Passed
- 4.1.4 DISCONTINUOUS INTERFERENCE ON AC MAINS
Result:
Passed
- 4.2.1 DISTURBANCE POWER
Result:
Passed
- 4.2.2 RADIATED EMISSION
Result:
Passed
- 5.1.1 ELECTROSTATIC DISCHARGE
Result:
Passed
- 5.2.1 FAST TRANSIENTS ON AC POWER LINES
Result:
Passed
- 5.2.2 INJECTED CURRENT INTO AC POWER PORT
Result:
Passed
- 5.2.3 SURGES TO AC POWER PORT
Result:
Passed
- 5.2.4 VOLTAGE DIPS AND INTERRUPTIONS TO AC POWER PORT
Result:
Passed

Contents

1	TEST SITES	4
1.1	TEST FACILITIES.....	4
1.2	LIST OF TEST AND MEASUREMENT INSTRUMENTS	4
2	GENERAL PRODUCT INFORMATION	5
2.1	PRODUCT FUNCTION AND INTENDED USE	5
2.2	RATINGS AND SYSTEM DETAILS.....	5
2.3	INDEPENDENT OPERATION MODES.....	5
2.4	NOISE GENERATING AND NOISE SUPPRESSING PARTS.....	5
2.5	SUBMITTED DOCUMENTS	5
3	TEST SET-UP AND OPERATION MODES	6
3.1	PRINCIPLE OF CONFIGURATION SELECTION.....	6
3.2	PHYSICAL CONFIGURATION FOR TESTING	6
3.3	TEST OPERATION AND TEST SOFTWARE.....	6
3.4	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT.....	6
3.5	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE	6
4	TEST RESULTS EMISSION	7
4.1	EMISSION IN THE FREQUENCY RANGE UP TO 30 MHz.....	7
4.1.1	<i>Harmonics on AC Mains</i>	7
4.1.2	<i>Voltage changes, voltage fluctuations and flicker on AC mains</i>	9
4.1.3	<i>Mains Terminal Continuous Disturbance Voltage</i>	10
4.1.4	<i>Discontinuous Interference on AC Mains</i>	13
4.2	EMISSION IN THE FREQUENCY RANGE ABOVE 30 MHz	14
4.2.1	<i>Disturbance Power</i>	14
4.2.2	<i>Radiated emission</i>	16
5	TEST RESULTS IMMUNITY.....	17
5.1	ENCLOSURE.....	18
5.1.1	<i>Electrostatic Discharge</i>	18
5.2	INPUT AND OUTPUT AC POWER PORTS.....	19
5.2.1	<i>Fast Transients on AC Power Lines</i>	19
5.2.2	<i>Injected Current into AC Power Port</i>	20
5.2.3	<i>Surges to AC Power Port</i>	21
5.2.4	<i>Voltage dips and interruptions to AC Power Port</i>	22
6	PHOTOGRAPHS OF THE TEST SET-UP.....	23
7	LIST OF TABLES.....	28
8	LIST OF FIGURES.....	28
9	LIST OF PHOTOGRAPHS	28

1 Test Sites

1.1 Test Facilities

Laboratory: TÜV Rheinland (Shanghai) Co., Ltd.
Address: 10-15/F, Huatsing Building, No. 88, Lane 777, West Guangzhong Road
Zhabei District, Shanghai 200072, P.R.China

The used test equipment is in accordance with CISPR 16-1 series standards for measurement of radio interference.

1.2 List of Test and Measurement Instruments

Table 1: List of test and measurement equipment

No.	Equipment	Model	Serial no.	Cal. due date
1.	Harmonic emission/voltage fluctuation and flicker test system	Proflin 2105-400-413-LNS	55907, 72292	09.06.2012
2.	EMI test receiver	ESIB26	100227	22.05.2012
3.	Artificial mains network	NNB 42	04/10048	15.02.2012
4.	Artificial mains network	ESH3-Z5	100325	30.06.2012
5.	Discontinuous interference analyzer	DIA 1512 D	21005	16.08.2011
6.	Absorbing clamp	AMZ 41	20356	11.10.2011
7.	Barometer	DYM3	08102717	12.04.2012
8.	ESD generator	NSG 437	392	30.11.2011
9.	EFT/B generator	NSG 2025	20283	10.06.2012
10.	Surge generator	NSG 2050	200421-502LU	10.06.2012
11.	RF generator	NSG 2070	1083	22.05.2012
12.	Coupling/decoupling network	CDN M016	20810	06.07.2012
13.	Voltage dips and short interruptions test system	NSG 1007-5-400-413-LNS, NSG 2200-1	55907, 200230-053EK	10.06.2012

2 General Product Information

2.1 Product Function and Intended Use

The EUT (equipment under test) is an ordinary SPA for household and similar use. For the further information, refer to the user's manual.

2.2 Ratings and System Details

System input voltage : AC 220-240V
Frequency : 50Hz
Rated power : 2050W
Protection class : II

Identities and differences:

The above two models have the same electrical characteristics. And the only differences between them are in type designation on their rating labels and the water pool (different material, size and capacity). Therefore, only model #54112 was selected to perform tests. Refer to the Constructional Data Form for further information.

2.3 Independent Operation Modes

The basic operation modes are: "On" or "Off" with protection electronic circuit for both models.

Refer to the Constructional Data Form for further information.

2.4 Noise Generating and Noise Suppressing Parts

Refer to the Constructional Data Form for further information.

2.5 Submitted Documents

Circuit diagram, Constructional Data Form for EMC and label.

3 Test Set-up and Operation Modes

3.1 Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible emission level. The test conditions were adapted accordingly in reference to the instructions for use.

Refer to the related paragraph of this report.

Immunity: The equipment under test (EUT) was configured to have its highest possible susceptibility against the tested phenomena. The test conditions were adapted accordingly in reference to the instructions for use.

Refer to the related paragraph of this report.

3.2 Physical Configuration for Testing

Refer to the related paragraph of this report.

3.3 Test Operation and Test Software

Refer to the related paragraph of this report. No software was used.

3.4 Special Accessories and Auxiliary Equipment

None.

3.5 Countermeasures to achieve EMC Compliance

The tested sample contained noise suppression capacitors and inductors as described in the circuit diagram and Constructional Data Form. No special measure is employed to achieve the requirement.

4 Test Results EMISSION

4.1 Emission in the Frequency Range up to 30 MHz

4.1.1 Harmonics on AC Mains

Result:	Passed
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Date of testing : 30.06.2011
Test procedure : EN 61000-3-2:2006+A1+A2
Test duration : 2.5min
Harmonic order : 2 – 40th
Frequency range : 0 – 2kHz
Ambient conditions : Temperature: 25.6° C; Relative humidity: 57%

Following are the measurement results, which were obtained via an automatic measurement system.

Table 2: Harmonic currents measurement result

Equipment category: Class A; Test Voltage: AC 229.67V; 50Hz

Fundamental current I1: 8.535A; Power factor: 0.994; Active input power: 1960.5W.

Harmonic order	Result (avg.) (A)	100% limit (A)	Result (max.) (A)	150% limit (A)	Result
2	0.005	1.080	0.008	1.620	Pass
3	0.949	2.300	0.955	3.450	Pass
4	0.004	0.430	0.006	0.645	Pass
5	0.145	1.140	0.146	1.710	Pass
6	0.003	0.300	0.004	0.450	Pass
7	0.067	0.770	0.068	1.155	Pass
8	0.001	0.230	0.002	0.345	Pass
9	0.014	0.400	0.014	0.600	Pass
10	0.002	0.184	0.002	0.276	Pass
11	0.024	0.330	0.024	0.495	Pass
12	0.001	0.153	0.002	0.230	Pass
13	0.007	0.210	0.008	0.315	Pass
14	0.001	0.131	0.001	0.197	Pass
15	0.013	0.150	0.013	0.225	Pass
16	0.001	0.115	0.001	0.173	Pass
17	0.005	0.132	0.005	0.199	Pass
18	0.001	0.102	0.001	0.153	Pass
19	0.006	0.118	0.006	0.178	Pass
20	0.001	0.092	0.001	0.138	Pass
21	0.004	0.107	0.004	0.161	Pass
22	0.001	0.084	0.001	0.125	Pass
23	0.003	0.098	0.003	0.147	Pass
24	0.000	0.077	0.001	0.115	Pass
25	0.002	0.090	0.002	0.135	Pass
26	0.001	0.071	0.001	0.106	Pass
27	0.001	0.083	0.001	0.125	Pass
28	0.000	0.066	0.000	0.099	Pass
29	0.002	0.078	0.002	0.116	Pass
30	0.000	0.061	0.001	0.092	Pass
31	0.002	0.073	0.002	0.110	Pass
32	0.000	0.058	0.001	0.086	Pass
33	0.002	0.068	0.002	0.102	Pass
34	0.000	0.054	0.000	0.081	Pass
35	0.001	0.064	0.002	0.096	Pass
36	0.000	0.051	0.001	0.077	Pass
37	0.002	0.061	0.002	0.092	Pass
38	0.000	0.048	0.000	0.073	Pass
39	0.001	0.058	0.001	0.087	Pass
40	0.000	0.046	0.001	0.069	Pass

4.1.2 Voltage changes, voltage fluctuations and flicker on AC mains

Result:	Passed
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Date of testing : 30.06.2011
 Test procedure : EN 61000-3-3:2008
 Ambient conditions : Temperature: 25.6° C; Relative humidity: 57%

According to the characteristics of the sample, as specified by clause 5 of the basic standard, following limits apply:

- the value of $d(t)$ during a voltage change shall not exceed 3.3% for more than 500ms;
- the relative steady-state voltage change, d_c , shall not exceed 3.3%;
- the maximum relative voltage change d_{max} , shall not exceed 7%;
- the value of P_{st} shall not be greater than 1.0;
- the value of P_{lt} shall not be greater than 0.65.

The measurement was carried in accordance with Annex B of the basic standard. Following are the measurement results obtained via an automatic testing system.

Table 3: Voltage fluctuations and flicker measurement results

	d_c	$d_{max}(average)$	$d(t)$	P_{st}	P_{lt}
Limits	3.3%	7%	3.3%/500ms	1.0	0.65
Result	0.65%	3.77%	3.10%/0ms	0.493	0.217

4.1.3 Mains Terminal Continuous Disturbance Voltage

Result:**Passed**

Date of testing : 29.06.2011
Test procedure : EN 55014-1:2006+A1 and CISPR 16-1 series standards
Frequency range : 0.15 – 30MHz
Kind of test site : Shielded room
Ambient condition : Temperature: 25.6°C; Relative humidity: 57%

Test Setup

Input voltage : AC 262V, 50Hz
Operational mode : On
Artificial hand : N/A
Earthing : No earthing (as class II equipment)

The measurement setup was made according to EN 55014-1:2006+A1 in a shielded room.

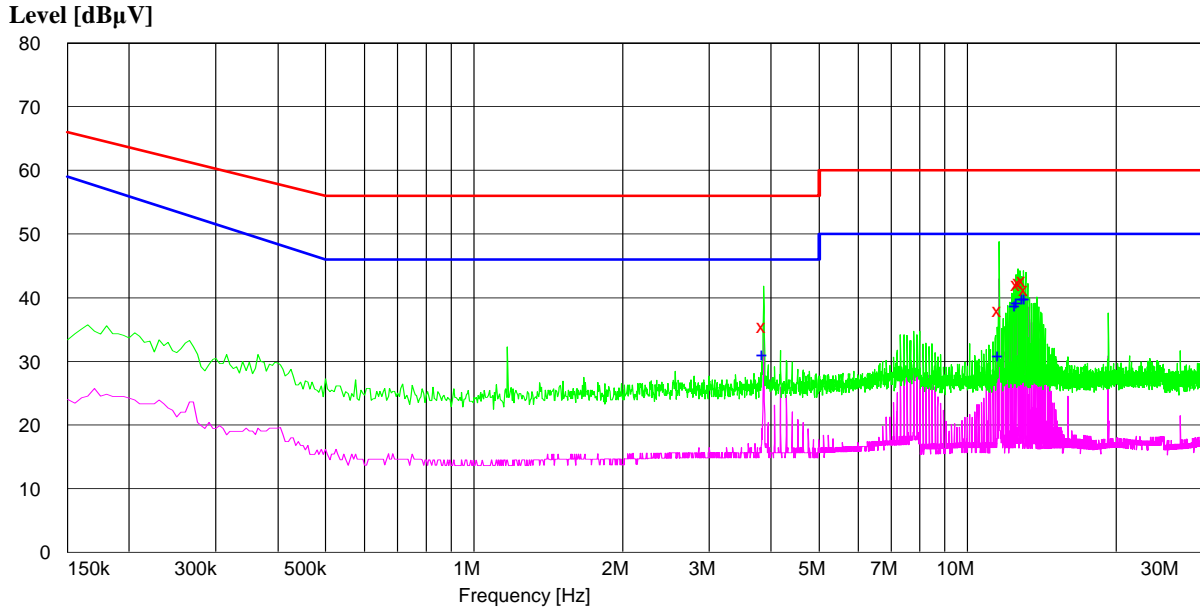
The measurement equipment like test receivers, quasi-peak detector and Artificial Mains Network (AMN) are in compliance with CISPR 16-1 series standards. The tested object was operated under its rated voltage and its rated frequency. Prior to the measurements the test object operated about 15 minutes (warm-up) in order to stabilize its operating conditions and to ensure reliable measurement values.

Furthermore an internal calibration with the test receiver was conducted prior to each measurement.

The tested object was set-up on a 0.1m wooden support. The EUT was set 0.8m away from the AMN. The cord longer than necessary to be connected to the AMN was folded forth and back parallel so as to form a bundle with a length between 0.3m and 0.4m.

The disturbance voltage was determined according to clause 5 of EN 55014-1:2006+A1 while measuring the line and neutral conductor by turns.

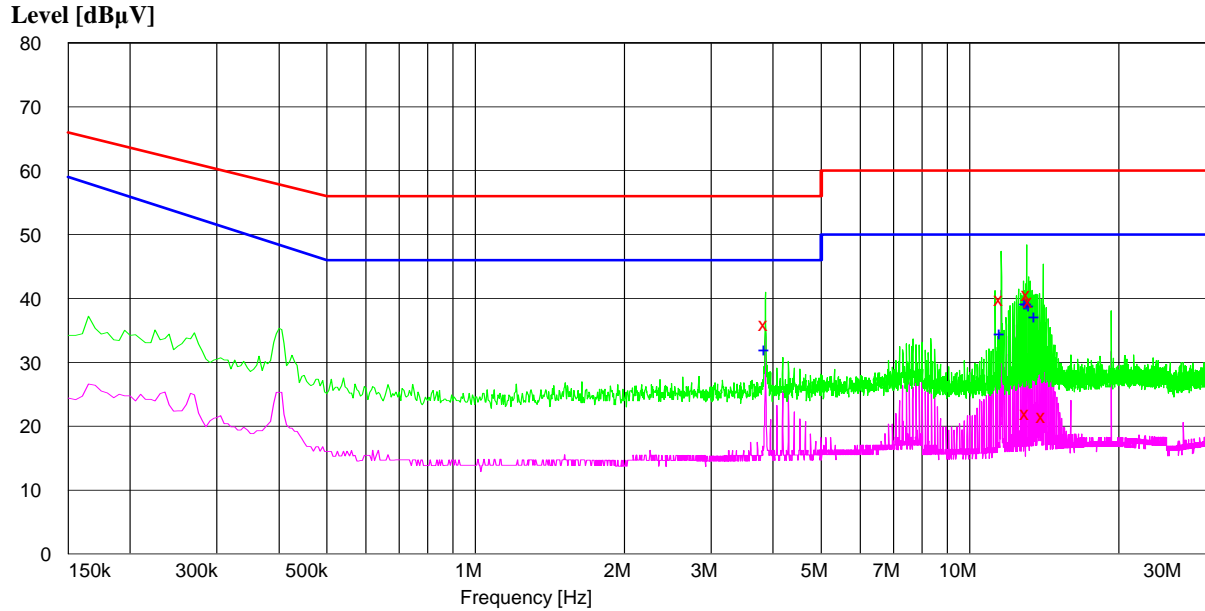
The following figures and tables were those measured by an automatic measuring system. Both Quasi-peak and Average value were measured. In addition, by adjusting input voltage, Quasi-peak and Average value were measured and listed respectively where they had a maximum in previous scanning survey. In the figures, “×” means Quasi-peak value and “+” means Average value which was measured in final measurement.

Figure 1: Spectral diagram, Conducted Emission, 150kHz – 30MHz, L

Final quasi-peak measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line
3.865000	35.60	20.4	56.0	20.4	L1
11.590000	38.00	21.1	60.0	22.0	L1
12.655000	42.10	21.1	60.0	17.9	L1
12.770000	42.50	21.1	60.0	17.5	L1
13.005000	42.70	21.1	60.0	17.3	L1
13.120000	41.40	21.0	60.0	18.6	L1

Final average measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line
3.865000	31.10	20.4	46.0	14.9	L1
11.590000	31.00	21.1	50.0	19.0	L1
12.540000	38.80	21.1	50.0	11.2	L1
12.655000	39.30	21.1	50.0	10.7	L1
13.005000	39.90	21.1	50.0	10.1	L1
13.120000	40.00	21.0	50.0	10.0	L1

Figure 2: Spectral diagram, Conducted Emission, 150kHz – 30MHz, N

Final quasi-peak measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line
3.860000	36.10	20.2	56.0	19.9	N
11.575000	40.00	20.7	60.0	20.0	N
13.040000	22.10	20.9	60.0	37.9	N
13.120000	40.70	20.9	60.0	19.3	N
13.235000	39.60	20.9	60.0	20.4	N
14.070000	21.50	21.0	60.0	38.5	N

Final average measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line
3.860000	32.20	20.2	46.0	13.8	N
11.575000	34.60	20.7	50.0	15.4	N
13.005000	39.20	20.9	50.0	10.8	N
13.120000	39.30	20.9	50.0	10.7	N
13.235000	39.00	20.9	50.0	11.0	N
13.585000	37.30	20.9	50.0	12.7	N

4.1.4 Discontinuous Interference on AC Mains

Result:	Passed
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Date of testing	: 30.06.2011
Test procedure	: EN 55014-1:2006+A1 and CISPR 16-1 series standards
Kind of test site	: shielded room
Port	: Mains
Basic standard	: EN 55014-1:2006+A1
Frequency range	: 0.15 – 30MHz
Limit	: EN 55014-1:2006+A1, clause 4.2, household appliance
Operating condition	: EN 55014-1:2006+A1, clause 7.3.4
Ambient condition	: Temperature: 25.6°C; Relative humidity: 57%

Measuring configuration and description

The discontinuous disturbance on AC mains in the frequency range from 0.15 to 30MHz was measured in accordance to EN 55014-1:2006+A1.

The measurement setup was made according to EN 55014-1:2006+A1, clause 4.2 in a shielded room. A discontinuous interference analyzer was used for the measurement of clicks. The click rate N shall be determined for a duty-cycle of $(50 \pm 10)\%$ of the control device, unless otherwise specified. If the duty-cycle of $(50 \pm 10)\%$ cannot be reached, the highest possible duty-cycle shall be applied instead.

The EUT was operated in a manner specified by clause 7.3.4 of EN 55014-1:2006+A1.

Table 4: Result of discontinuous interference

Measured Frequency (MHz)	0.15	0.5	1.4	30
Continuous disturbance limit (dB μ V)	66.0	56.0	56.0	60.0
Last Time T (min)	120 mins			
Click Number n1 of <10ms	14	15	9	0
Click Number n2 of >10ms	1	1	1	0
Total Click Number n=n1+n2	15	16	10	0
Click rate N	0.12	0.13	0.13	0.13
Discontinuous disturbance limit Lq (dB μ V)	110	100	100	104
Number of clicks permitted to exceed Lq	3	4	2	0
Number of clicks exceeding Lq	0	0	0	0

According to the clause 7.4.2.6 of EN 55014-1:2006+A1, the EUT is deemed to comply with the limits because it meets the requirements of the upper quartile method.

4.2 Emission in the Frequency Range above 30 MHz

4.2.1 Disturbance Power

Result:	Passed
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Date of testing	: 29.06.2011
Port	: Mains
Basic standard	: EN 55014-1:2006+A1
Frequency range	: 30 – 300MHz
Limit	: EN 55014-1:2006+A1, clause 4.1.2, household appliance
Ambient condition	: Temperature: 25.6°C; Relative humidity: 57%

Test Setup

Input voltage	: AC 262V, 50Hz
Operational mode	: On
Earthing	: No earthing. (as class II equipment)

Measuring configuration and description

The measurement setup was made according to EN 55014-1:2006+A1.

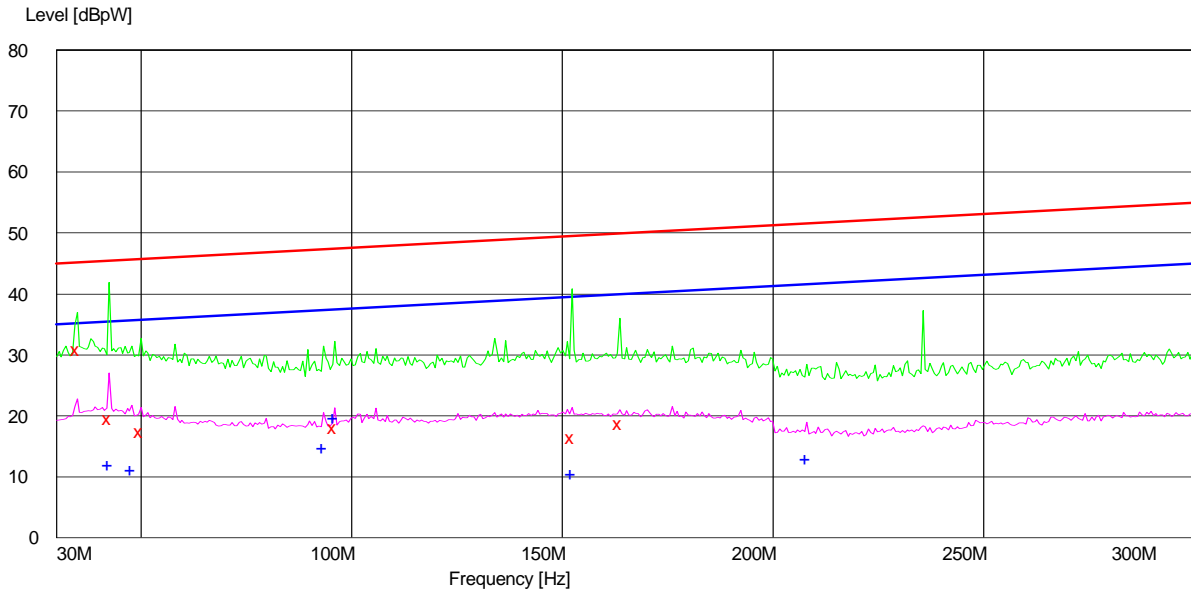
The measurement equipment like test receivers and absorption clamp are in compliance with CISPR 16-1 series standards. The test object has been operated by its rated voltage and rated frequency. Prior to the measurements the test objects operated about 10 minutes (warm-up) in order to stabilize their operating conditions and to ensure reliable measurement values.

Furthermore an internal calibration with the test receiver was conducted prior to each measurement.

The tested object was set-up on a wooden support.

The disturbance power was determined according to clause 6 of EN 55014-1:2006+A1. The length of power cord of EUT plus that of the extension cord was 6.0m.

The measurement was performed by operating the EUT in normal operation mode. The figures and tables below were those measured in the operation mode. Both Quasi-peak and Average value were measured. In final measurement, by moving the absorption clamp along the power supply cord and the extension-power cord from the test object, and meanwhile adjust input voltage, Quasi-peak and Average value were measured and listed respectively where they had a maximum in previous scanning survey. In the figures, “×” means Quasi-peak value and “+” means Average value which was measured in final measurement.

Figure 3: Spectral diagram, Disturbance Power, AC Mains, 30 – 300MHz

Final quasi-peak measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
34.869739	30.90	8.6	45.2	14.2
42.444890	19.50	9.0	45.5	25.9
50.020040	17.50	7.6	45.7	28.3
96.012024	18.10	5.0	47.4	29.4
152.284569	16.40	5.7	49.5	33.2
163.647295	18.70	5.3	49.9	31.2

Final average measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
42.444890	12.00	9.0	35.5	23.4
47.855711	11.20	8.1	35.7	24.5
93.306613	14.80	4.8	37.3	22.5
96.012024	19.70	5.0	37.4	17.7
152.284569	10.50	5.7	39.5	29.1
208.016032	13.00	3.3	41.6	28.6

4.2.2 Radiated emission

Result:**Passed**

Test procedure : EN 55014-1:2006+A1
Test port : Enclosure
Frequency range : 30 - 1000MHz
Limit : Quasi-peak limits (10m test distance):
30-230MHz, 30dB μ V/m;
230-1000MHz, 37dB μ V/m;

According to a) of Clause 4.1.2.3.2 of EN 55014-1:2006+A1:

“ Appliances are deemed to comply in the frequency range from 300MHz to 1000MHz if both 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 30MHz.”

The EUT is deemed to meet the requirements without actual testing, as the EUT fulfilled the above two conditions.

5 Test Results IMMUNITY

During the immunity tests, the EUT was operated under conditions specified by clause 3.1 of this report.

Performance criterion A: The apparatus shall continue to operate as intended during the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended.

Performance criterion B: The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. During the test, degradation of performance is allowed.

Performance criterion C: Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls, or by any operation specified in the instructions for use.

Date of testing: 01.07.2011

Room temperature : 25.6°C
Relative humidity : 56-57%

According to the electrical characteristics and EN 55014-2:1997+A1+A2, the EUT belongs to category II equipment.

5.1 Enclosure

5.1.1 Electrostatic Discharge

Result:	Passed
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The immunity against electrostatic discharge was tested in accordance with EN 55014-2:1997+A1+A2. Test setup and ESD-Generator are according to IEC 61000-4-2 which is specified by EN 55014-2:1997+A1+A2.

The EUT is placed on a 0.1m wooden support above the ground plane. And the minimum distance between the EUT and all other conductive structures except the ground plane beneath the EUT is more than 0.5m.

The reference ground plane is an aluminium sheet of 0.25mm minimum thickness. The reference ground plane is connected to the protective earth. The size of the ground plane is 2m x 2m.

Vertical coupling plane of dimensions 0.5m x 0.5m is placed parallel to and positioned at a distance of 0.1m from the EUT.

Charge voltage	: ±4.0kV (Contact Discharge), ±8.0kV (Air Discharge)
Polarity	: positive / negative
Number of discharges	: ≥10
Performance criteria	: B

Table 5: ESD, Positive / Negative Polarity

Position	Kind of Discharge	Result	Remarks
Plastic enclosure	Air discharge ±8kV	Pass	No disturbance of function
Power cord	Air discharge ±8kV	Pass	Ditto
Seam	Air discharge ±8kV	Pass	Ditto
Buttons and displaying panel	Air discharge ±8kV	Pass	Ditto
Coupling plane (VCP)	Contact discharge ±4kV	Pass	Ditto

5.2 Input and Output AC Power Ports

5.2.1 Fast Transients on AC Power Lines

Result:	Passed
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The immunity against fast transients on AC power lines was tested in accordance to EN 55014-2:1997+A1+A2. Test setup and the fast transient noise generator was according to IEC 61000-4-4 which is specified by EN 55014-2:1997+A1+A2.

The EUT is placed on a 0.1m wooden support above the ground plane. And the minimum distance between the EUT and all other conductive structures except the ground plane beneath the EUT is more than 0.5m.

The length between the coupling device and the EUT is $0.5m \pm 0.05m$. The cord length more than 0.5m, the excess length of this cable shall be folded to avoid a flat coil and situated at a distance of 0.1m above the ground reference plane.

The reference ground plane is an aluminium sheet of 0.25mm minimum thickness. The reference ground plane is connected to the protective earth. The size of the ground plane is 2m x 2m.

Test voltage	: 1kV
Polarity	: negative/positive
Repetition frequency	: 5kHz
Test duration	: $\geq 120\text{sec}$
Tr/Tn	: 5ns/50ns
Performance criteria	: B

Table 6: Burst, AC Power lines, Positive and Negative Polarity

Port	Result	Remarks
AC power input port	$\pm 1\text{kV}$ Pass	No disturbance of function

5.2.2 Injected Current into AC Power Port

Result:	Passed
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The immunity against injected current into AC power port was tested according to EN 55014-2:1997+A1+A2 in a shielded room. Test setup and the test generator was according to IEC 61000-4-6 which is specified by EN 55014-2:1997+A1+A2.

The EUT is placed on a ground reference plane and shall be insulated from it by an insulating support 0.1m thick. And the minimum distance between the EUT and all other conductive structures except the ground plane beneath the EUT is more than 0.5m.

The EUT comprised a single unit. The coupling and decoupling networks were inserted on the power supply connection. The coupling and decoupling networks was placed on the ground reference plane, making direct contact with it at about 0.1 – 0.3 meter from EUT. The cable between EUT and CDN is as short as possible and not bundled nor wrapped. The height of cable between the EUT and the coupling and decoupling networks above the ground reference plane was 50mm.

Voltage level	: 3V(rms)(unmodulated)
Environmental phenomena	: r.f. current, common mode, 1kHz, 80% AM
Source impedance	: 150 Ω
Frequency range	: 0.15 – 230 MHz
Frequency step	: 1%
Dwell time	: 3s
Performance criteria	: A

Table 7: Injected current, AC Power Port

Line	Result	Remarks
AC power input port	Pass	No disturbance of function

5.2.3 Surges to AC Power Port

Result:	Passed
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The immunity against surges to AC power port was tested in accordance to EN 55014-2:1997+A1+A2. Test setup and the Combination Wave Generator (CWG) was according to IEC 61000-4-5 which is specified by EN 55014-2:1997+A1+A2.

The EUT is placed on a 0.1m wooden support above the ground plane.

Open-circuit test voltage	: 1kV (phase to neutral)
Tr/Tn	: 1.2/50 μ s (open-circuit voltage) 8/20 μ s (short-circuit current)
Test numbers	: 5 positive and 5 negative pulses
Phase	: 90°, 270°
Repetition rate	: 1 surge/min
Performance criteria	: B

Table 8: Surges to AC Power lines, positive/negative

Line	Result	Remarks
Phase to neutral 1kV	Pass	No disturbance of function

5.2.4 Voltage dips and interruptions to AC Power Port

Result:	Passed
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The immunity against voltage dips and interruptions to AC power port was tested in accordance to EN 55014-2:1997+A1+A2. Test setup and the test generator was according to IEC 61000-4-11 which is specified by EN 55014-2:1997+A1+A2. The EUT was placed directly on a 0.1m wooden support.

Performance criteria	: C	
Test level (in % U_T) and	: 0	0.5 periods
duration (in periods of the	40	10 periods
rated frequency)	70	25 periods

Table 9: Test condition and Test Result for Voltage dips

Test level (in % U_T)	Duration	Performance criteria	Result	Remarks
0	0.5 (10ms)	C	Pass	No disturbance of function
40	10 (200ms)	C	Pass	During the testing, the pump flickered and after testing, it recovered automatically.
70	25 (500ms)	C	Pass	Ditto

6 Photographs of the Test Set-Up

Photograph 1: Set-up for measurement of harmonic and voltage fluctuation



Photograph 2: Set-up for disturbance voltage



Photograph 3: Set-up for measurement of clicks



Photograph 4: Set-up for disturbance power



Photograph 5: Set-up for immunity test of electrostatic discharge



Photograph 6: Set-up for immunity test of surge on AC power line



Photograph 7: Set-up for immunity test of fast transients/burst on AC power line



Photograph 8: Set-up for immunity test of injected current on AC power line



Photograph 9: Set-up for immunity test of voltage dips and short interruptions



7 List of Tables

Table 1: List of test and measurement equipment.....	4
Table 2: Harmonic currents measurement.....	8
Table 3: Voltage fluctuations and flicker measurement results	9
Table 4: Result of discontinuous interference	13
Table 5: ESD, Positive / Negative Polarity	18
Table 6: Burst, AC Power lines, Positive and Negative Polarity	19
Table 7: Injected current, AC Power Port	20
Table 8: Surges to AC Power lines, positive/negative	21
Table 9: Test condition and Test Result for Voltage dips	22

8 List of Figures

Figure 1: Spectral diagram, Conducted Emission, 150kHz – 30MHz, L.....	11
Figure 2: Spectral diagram, Conducted Emission, 150kHz – 30MHz, N.....	12
Figure 3: Spectral diagram, Disturbance Power, AC Mains, 30 – 300MHz	15

9 List of Photographs

Photograph 1: Set-up for measurement of harmonic and voltage fluctuation	23
Photograph 2: Set-up for disturbance voltage	23
Photograph 3: Set-up for measurement of clicks	24
Photograph 4: Set-up for disturbance power	24
Photograph 5: Set-up for immunity test of electrostatic discharge	25
Photograph 6: Set-up for immunity test of surge on AC power line.....	25
Photograph 7: Set-up for immunity test of fast transients/burst on AC power line.....	26
Photograph 8: Set-up for immunity test of injected current on AC power line.....	26
Photograph 9: Set-up for immunity test of voltage dips and short interruptions.....	27