No. 1116

Electromagnetic Compatibility

Test of:	8 Jet System with LED
Model Number:	BQBW0008/6
Applicant:	Trojan Plastics Ltd.
Test Type:	Compliance
Test Specification:	EN 55014-1: 2006 A2: 2011* EN 55014-2: 1997 A2: 2008 EN 61000-3-2: 2014 EN 61000-3-3: 2013
SGS Serial Number:	EMC227682/2
Date of Receipt:	27th July 2016
Date of Test(s):	11th August 2016 to 12th September 2016
Date of Issue:	16th September 2016
Issue Number:	1

*Tests marked * are not UKAS accredited*

Authorised Signatory

G. Hann
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1. Client Information

Company Name:	Trojan Plastics Ltd.
Address:	Trojan Plastics Ltd. Ramsden Mills Britannia Road Milsnbridge Huddersfield HD3 4QG
Contact Name:	Paul Grindley
Telephone:	01484 485421
Facsimile:	01484 485425

2. Equipment Under Test (EUT)

2.1 Identification Of EUT

Model Number:	BQBW0008/6
Unique Identifier:	006/8
Description of EUT:	An 8 jet whirlpool spa bath with LED lighting
Supply Voltage:	230V AC, 50Hz
Ports present:	Enclosure AC mains supply Control panel signal cable* LED light signal cable* * The client specified that the cable is restricted to less than 3m in length
Accessories Supplied:	None
EUT Category (EN 55014-2)	Category II

3. Test Specification, Methods and Procedures

3.1 Test Specification(s)

Standard	Title
EN 55014-1 : 2006 A2: 2011	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – *Part 1: Emission*
EN 55014-2 : 1997 A2: 2008	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – *Part 2: Immunity – Product family standard*
EN 61000-3-2 : 2014	Electromagnetic compatibility (EMC) *Part 3-2: Limits – Limits for harmonic current emissions (equipment input current up to and including 16 A per phase)*
EN 61000-3-3 : 2013	Electromagnetic compatibility (EMC) *Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker with rated current ≤16A per phase and not subject to conditional connection*

3.2 Purpose Of Test

To perform the relevant tests and assess the product for compliance with the above specification.

3.3 Methods and Procedures

The standards listed on the previous page refer to the following tests: -

Basic Standard	Date	Description
EN 55016-2-3	2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-3: Methods of measurement of disturbances and immunity –Radiated disturbance measurements *Radiated Emissions*
EN 55014-1 A2	2006 2011	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1:Emission *Discontinuous Emissions* *Conducted disturbance measurements* *Measurement of disturbance power*
EN 61000-3-2	2014	Electromagnetic compatibility *Limits for harmonic current emissions*
EN 61000-3-3	2013	Electromagnetic compatibility *Limitation of voltage fluctuations and flicker in low voltage supply systems for equipment with rated of 16A or less*
EN 61000-4-2 A1 A2	1995 1998 2001	Electromagnetic compatibility (EMC) – *Part 4-2: Testing and measurement techniques –* *Electrostatic Discharge Immunity test*
EN 61000-4-3 A1	2006 2008	Electromagnetic compatibility (EMC) – *Part 4-3: Testing and measurement techniques –* *Radiated, radio-frequency, electromagnetic field immunity test*
EN 61000-4-4	2004	Electromagnetic compatibility (EMC) – *Part 4-4: Testing and measurement techniques –* Electrical fast transient/burst immunity test
EN 61000-4-5	2006	Electromagnetic compatibility (EMC) – *Part 4-5: Testing and measurement techniques –* *Surge immunity test*
EN 61000-4-6 + corr	2007 2007	Electromagnetic compatibility (EMC) – *Part 4-6: Testing and measurement techniques –* *Immunity to conducted disturbances, induced by radio-frequency fields*
EN 61000-4-11	2004	Electromagnetic compatibility (EMC) – *Part 4-11: Testing and measurement techniques –* *Voltage dips, short interruptions and voltage variations immunity tests.*

Below is a list of the standards tested to:-

Basic Standard	Date	Description
EN 55016-2-3	2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-3: Methods of measurement of disturbances and immunity –Radiated disturbance measurements *Radiated Emissions*
EN 55014-1 A2	2006 2011*	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1:Emission *Discontinuous Emissions* *Conducted disturbance measurements* *Measurement of disturbance power*
EN 61000-3-2	2014	Electromagnetic compatibility *Limits for harmonic current emissions*
EN 61000-3-3	2013	Electromagnetic compatibility *Limitation of voltage fluctuations and flicker in low voltage supply systems for equipment with rated of 16A or less*
EN 61000-4-2	2009	Electromagnetic compatibility (EMC) – *Part 4-2: Testing and measurement techniques –* *Electrostatic Discharge Immunity test*
EN 61000-4-4	2012	Electromagnetic compatibility (EMC) – *Part 4-4: Testing and measurement techniques –* Electrical fast transient/burst immunity test
EN 61000-4-5	2006	Electromagnetic compatibility (EMC) – *Part 4-5: Testing and measurement techniques –* *Surge immunity test*
EN 61000-4-6	2009	Electromagnetic compatibility (EMC) – *Part 4-6: Testing and measurement techniques –* *Immunity to conducted disturbances, induced by radio-frequency fields*
EN 61000-4-11	2004	Electromagnetic compatibility (EMC) – *Part 4-11: Testing and measurement techniques –* *Voltage dips, short interruptions and voltage variations immunity tests.*

Tests marked * are not UKAS accredited

4. Deviations or Exclusions from the Test Specifications

For testing, the standards refer to dated basic standards. However for some tests, testing has been performed to later amended standards. Please refer to page 7 for details of which standards were tested to.

There were no other deviations or exclusions from the test specifications.

5. Operation of the EUT During Testing

5.1 Configuration and Peripherals

No peripherals or support equipment were required for the tests.

5.2 Operating Mode and Environmental Conditions

The EUT has the following modes of operation:-

i) Water jets on
ii) Led light on (various colour settings)
iii) Water jets on & led light on (various colour settings)

For emission tests, a pre-scan was performed on each of the above modes, with the compliance test performed on the worst case mode.

For immunity tests, testing was performed on mode iii) only. This was the mode determined by the client, to be the most critical operating mode.

The operating modes and environmental conditions used for each individual test are described in the test results section of this report.

5.3 Performance Criteria

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. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if 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, however, no change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

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.

For electrostatic discharge, Performance criterion C can be applied to category III toys not using score or data entered by the user. Examples are musical soft toys, sounding toys, etc.

5.4 EUT Specific Performance Criteria

Performance Criteria A

The LED light and the water jets are to function as intended during and after the tests.

Performance Criteria B

A change in the operation of the LED light and the water jets are allowed during the tests providing that operation self recovers after the tests.

Performance Criteria C

A change in the operation of the LED light and the water jets are allowed during the tests providing that operation can be recovered by the user by use of the controls after the test.

5.5 Monitoring of the EUT

The following was monitored during the test.

i) Visually monitoring the LED lights for any change of operating state.

ii) Visually monitoring the water jets for any change of operating state.

6. Test Results

6.1 General Comments

Details of the test methods used can be found in the SGS procedures manual.

6.2 Modifications Made to the EUT

No modifications were made to the EUT during the testing process.

6.3 Summary of Test Results

Basic Standard	Test	Result
EN 55014-1	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission *Conducted Emissions*	Complied
EN 55014-1	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission *Discontinuous Emissions*	Complied
EN 55014-1	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission *Measurement of Disturbance Power*	Note 1
EN 55016-2-3	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement *Radiated Emissions*	Complied
EN 61000-3-2	Electromagnetic compatibility *Harmonics*	Complied
EN 61000-3-3	Electromagnetic compatibility *Flicker*	Complied
EN 61000-4-2	Testing and measurement techniques. *Electrostatic discharge immunity test.*	Complied
EN 61000-4-3	Testing and measurement techniques. *Radio Frequency immunity test.*	Note 2
EN 61000-4-4	Testing and measurement techniques. *Electrical fast transient/burst immunity test.*	Complied
EN 61000-4-5	Testing and measurement techniques. *Surge immunity test.*	Complied
EN 61000-4-6	Testing and measurement techniques. *Conducted Immunity*	Complied
EN 61000-4-11	Testing and measurement techniques. Voltage Dips and interruptions	Complied

Note 1: Not applicable, the product complied with the radiated emissions measurement method limits.

Note 2: Not applicable, the EUT is category II apparatus containing no internal clocks or oscillator frequencies greater than 15 MHz

Results

In the configuration tested, the EUT complies with the test standards detailed above.

Full details of all tests can be found in the test results section of this report.

6.4 Conducted Emissions Test Results

Basic Standard	EN 55014-1 : 2006, A2: 2011
Limit	Table 1 Columns 2 and 3 (mains terminals)

Operating Mode

The compliance test was performed on mode iii), which was determined to be the worst case operating mode.

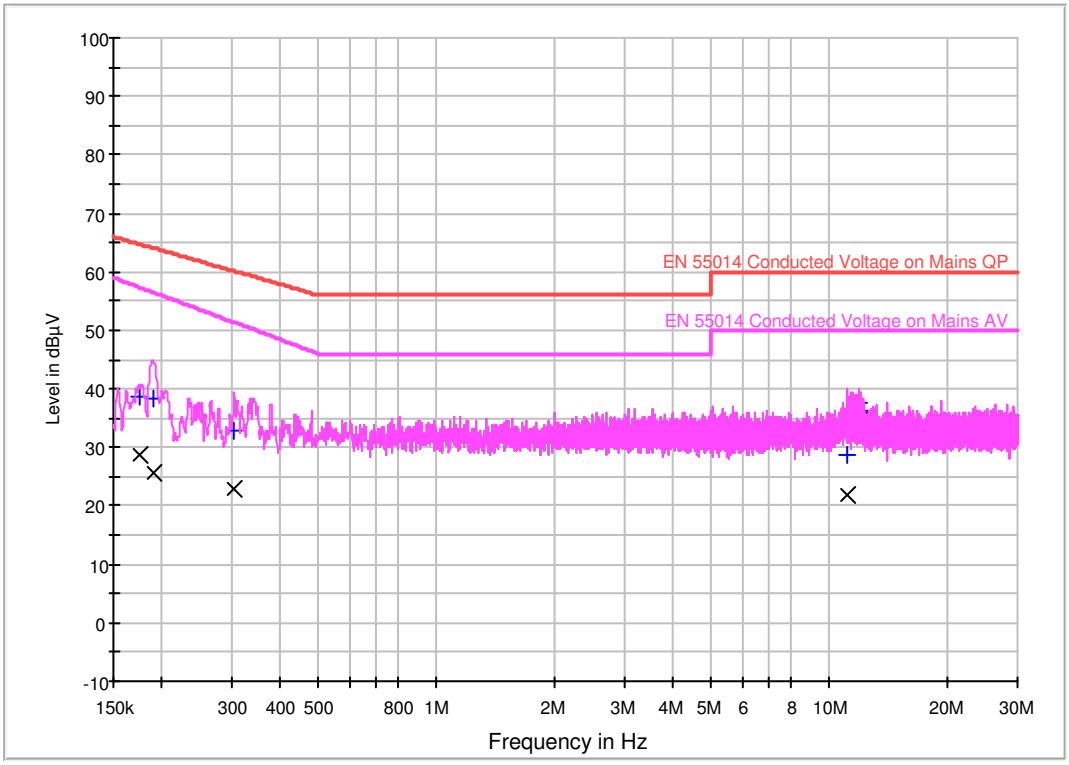
Refer to section 5.2 of this report for clarification of the operating modes.

Test Results

Live Terminal

Worst Case Emissions Peakscan

Mains Terminals QPK and CISPR-AVERAGE 15 sec measurements



Compliance Measurements

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	QuasiPeak Limit (dBµV)	CAverage Limit (dBµV)
0.174062	38.7	28.7	15000.0	9.000	64.76	57.39
0.188981	38.2	25.6	15000.0	9.000	64.08	56.51
0.304481	33.0	22.7	15000.0	9.000	60.12	51.36
11.095875	28.8	21.9	15000.0	9.000	60.00	50.00
11.893875	37.8	34.5	15000.0	9.000	60.00	50.00
11.956000	36.1	32.5	15000.0	9.000	60.00	50.00

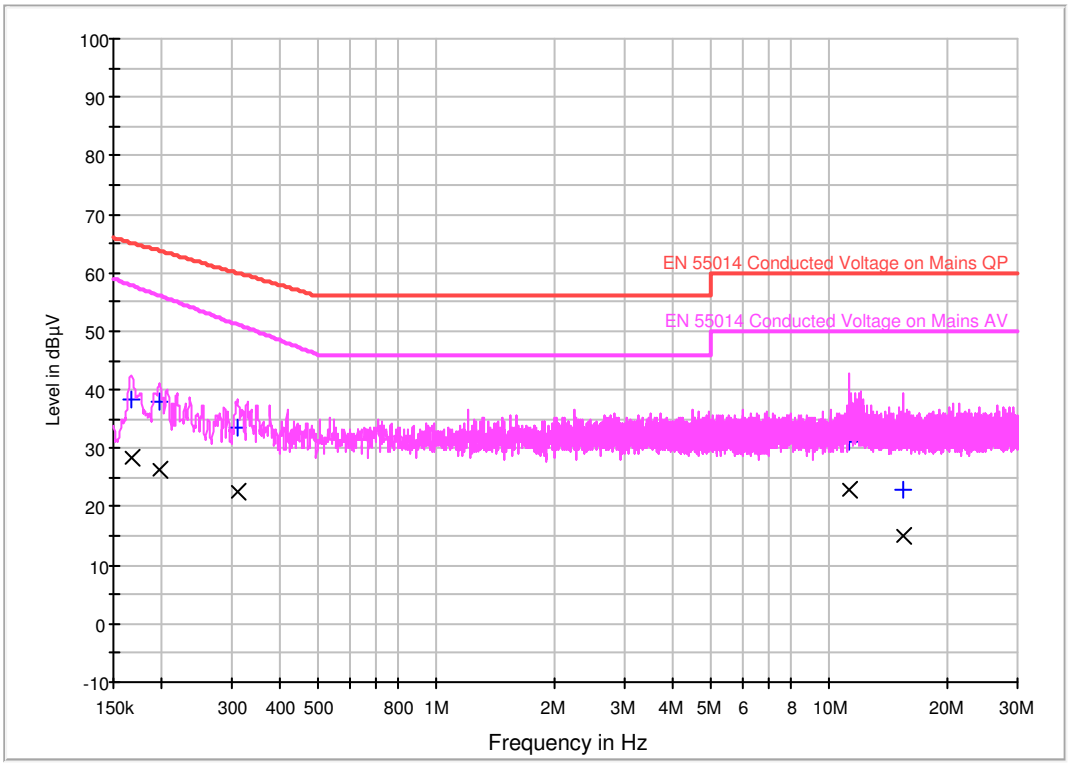
Preferred Frequency Measurements

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	QuasiPeak Limit (dBµV)	CAverage Limit (dBµV)
0.160000	34.2	21.2	15000.0	9.000	65.46	58.30
0.240000	33.8	24.4	15000.0	9.000	62.09	53.92
0.550000	22.7	14.5	15000.0	9.000	56.00	46.00
1.000000	17.7	12.6	15000.0	9.000	56.00	46.00
1.400000	14.7	11.6	15000.0	9.000	56.00	46.00
2.000000	14.5	11.5	15000.0	9.000	56.00	46.00
3.500000	15.4	10.6	15000.0	9.000	56.00	46.00
6.000000	15.2	10.6	15000.0	9.000	60.00	50.00
10.000000	24.8	19.5	15000.0	9.000	60.00	50.00
22.000000	17.0	12.2	15000.0	9.000	60.00	50.00
30.000000	16.8	12.2	15000.0	9.000	60.00	50.00

Neutral Terminal

Worst Case Emissions Peakscan

Mains Terminals QPK and CISPR-AVERAGE 15 sec measurements



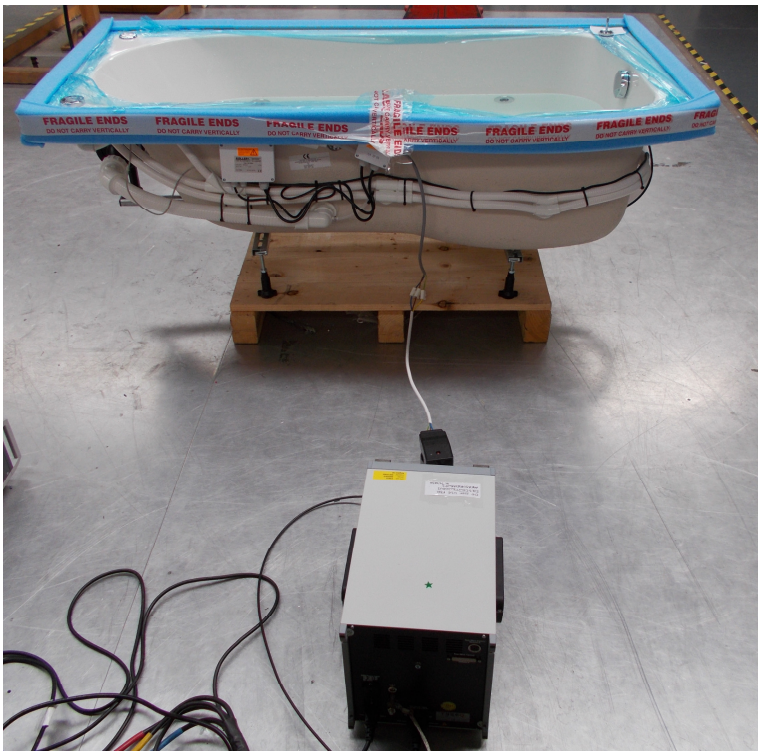
Compliance Measurements

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	QuasiPeak Limit (dBµV)	CAverage Limit (dBµV)
0.166362	38.5	28.4	15000.0	9.000	65.14	57.88
0.196681	38.0	26.2	15000.0	9.000	63.75	56.07
0.309775	33.7	22.7	15000.0	9.000	59.97	51.17
11.218375	31.0	22.8	15000.0	9.000	60.00	50.00
11.956000	35.6	32.0	15000.0	9.000	60.00	50.00
15.327000	22.8	15.1	15000.0	9.000	60.00	50.00

Preferred Frequency Measurements

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	QuasiPeak Limit (dBµV)	CAverage Limit (dBµV)
0.160000	34.1	21.2	15000.0	9.000	65.46	58.30
0.240000	33.0	21.8	15000.0	9.000	62.09	53.92
0.550000	22.6	14.5	15000.0	9.000	56.00	46.00
1.000000	18.6	12.7	15000.0	9.000	56.00	46.00
1.400000	14.6	11.7	15000.0	9.000	56.00	46.00
2.000000	14.5	11.5	15000.0	9.000	56.00	46.00
3.500000	15.5	10.7	15000.0	9.000	56.00	46.00
6.000000	15.2	10.7	15000.0	9.000	60.00	50.00
10.000000	23.2	18.0	15000.0	9.000	60.00	50.00
22.000000	16.3	11.7	15000.0	9.000	60.00	50.00
30.000000	16.9	12.2	15000.0	9.000	60.00	50.00

Conducted Emissions Test Configuration



Conducted Emissions Environmental Conditions

Power Supply	230VAC, 50Hz
Temperature	22°C
Relative Humidity	48%
Barometric Pressure	1019mb

Conducted Emissions Measurement Uncertainties

Amplitude	± 3.1dB

The uncertainties stated are calculated in accordance with the requirements of UKAS with a confidence level of 95%.

Conducted Emissions Test Equipment Used

Test Equipment	***Model***	***Serial No.***
LISN	Teseq NNB51	36101
Receiver	R & S ESCI 7 - 1166.5950.07	100876/007
Check Equip.	YORK CNE III	95/377 (RE12)
Software	EMC32	Version.8.54.0

6.5 Discontinuous Interference Test Results

Basic Standard	EN 55014-1 : 2006 A2: 2011

Operating Mode

The compliance test was performed on mode iii) and on the L1 supply terminal, which was determined to be the worst case operating mode and supply terminal.

Refer to section 5.2 of this report for clarification of the operating modes.

Test Results

(i) Determination of the Click Rate N

Frequency (MHz)	Limit L	Short Clicks	Long Clicks	Time Period T (mins)	Total Clicks n1	N = n1 / T
30*	60	0	0	30	0	N/A
1.4*	56	0	0	30	0	N/A
0.5	56	0	0	30	0	0
0.15	66	0	0	30	0	0

* Click rate at 0.5 MHz is used at these two frequencies.

No clicks measured

Note: If the click rate N is less than 5, all clicks are short, less than 20mS and 90% of these clicks are less than 10mS the product meets the requirements of the specification without further testing.

Discontinuous Interference Test Configuration

Discontinuous Interference Environmental Conditions

Power Supply	230V AC, 50Hz
Temperature	22.5°C
Relative Humidity	49%
Barometric Pressure	1007mb

Discontinuous Interference Measurement Uncertainties

Amplitude	± 3.3dB

The uncertainties stated are calculated in accordance with the requirements of UKAS with a confidence level of 95%.

Discontinuous Interference Test Equipment Used

Test Equipment	Model	Serial No.
LISN	Schwarzbeck NNLK 8121	8121361
Receiver	DIA1512C	5210
Check Equip.	Discontinuous Test piece	
Software	DIS9966	V2.5

6.6 Radiated Emissions Test Results

Basic Standard	EN 55016-2-3 : 2006
Limit	Table 3 of EN 55014-1: 2006, A2: 2011

Operating Mode

The compliance test was performed on mode iii), which was determined to be the worst case operating mode.

Refer to section 5.2 of this report for clarification of the operating modes.

Test Results

Note: All measurements were performed in an anechoic screened room.

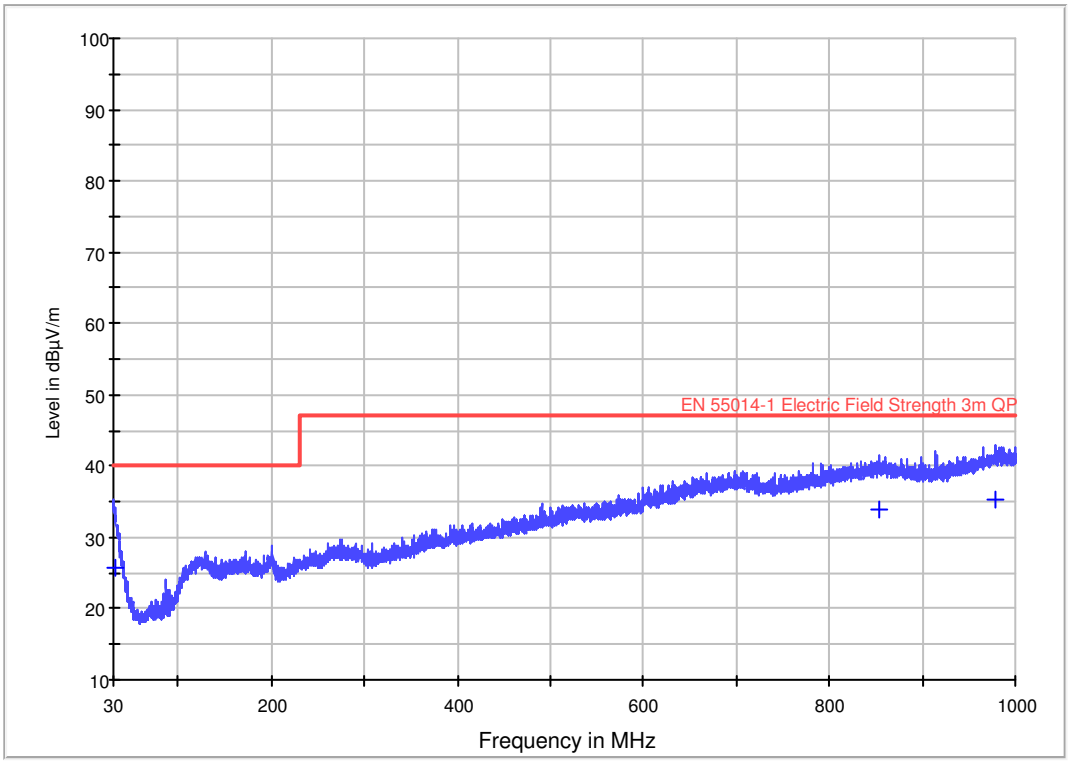
The graphical plots show the radiated emissions peak scan measurements. The tables indicate the quasi peak compliance measurements which were performed at frequencies where the peak emissions were closest to the limits.

The measurement distance was 3m and the limit has been adjusted using an inverse proportionality factor of 20dB per decade.

Horizontal Polarisation

Emissions Peakscan

Test Sweep 30-1000MHz



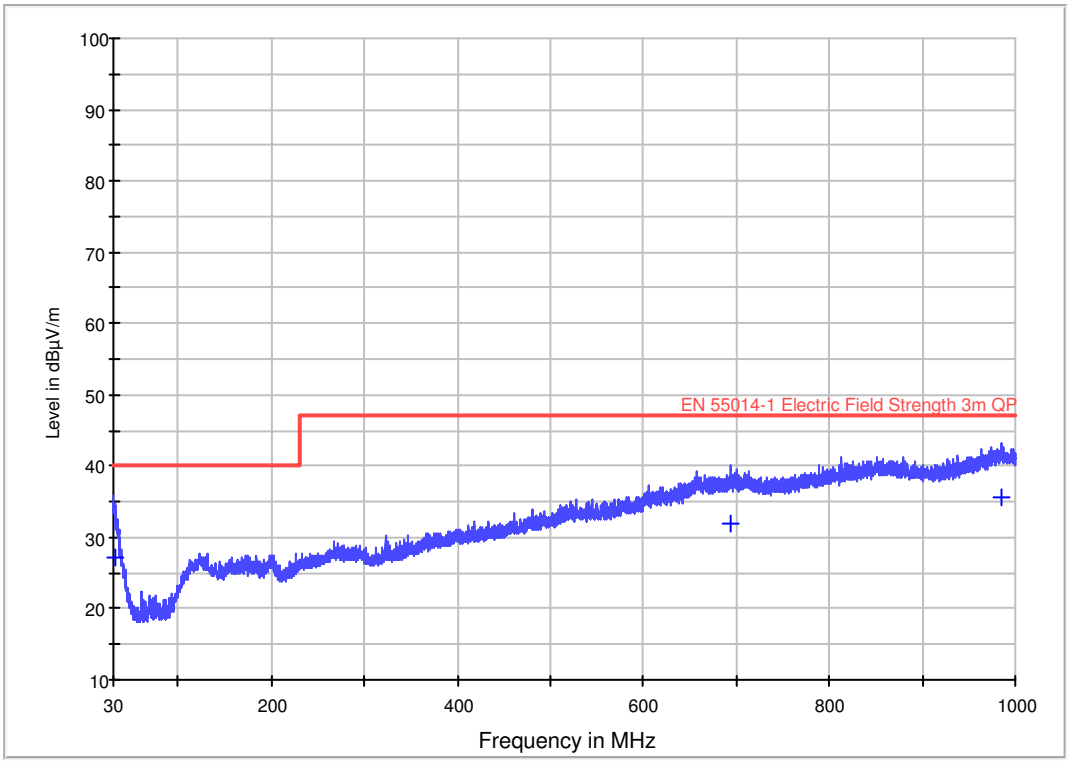
Quasi Peak Measurements

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Limit (dBµV/m)	Margin (dB)
32.940000	25.8	15000.0	120.000	100.0	0.0	40.0	-14.2
852.780000	33.9	15000.0	120.000	100.0	0.0	47.0	-13.1
978.180000	35.4	15000.0	120.000	100.0	0.0	47.0	-11.6

Vertical Polarisation

Emissions Peakscan

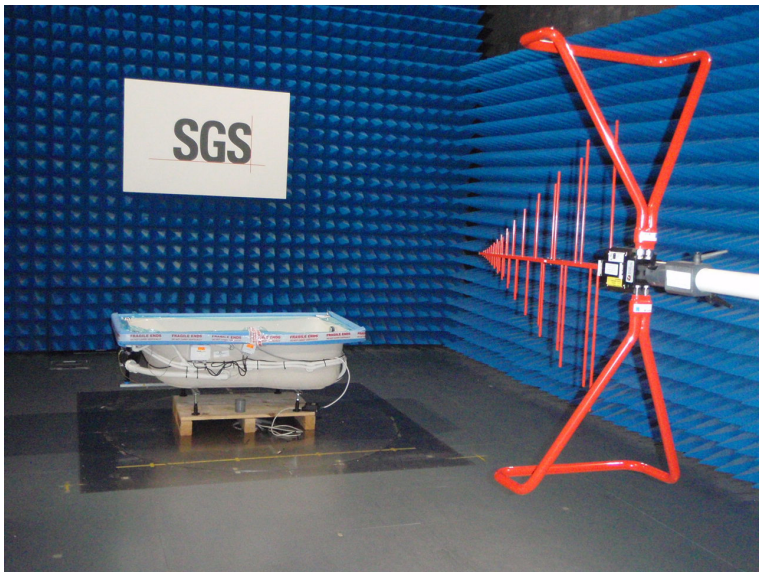
Test Sweep 30-1000MHz



Quasi Peak Measurements

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Limit (dBµV/m)	Margin (dB)
31.080000	27.1	15000.0	120.000	100.0	0.0	40.0	-12.9
694.800000	32.0	15000.0	120.000	100.0	0.0	47.0	-15.0
985.920000	35.7	15000.0	120.000	100.0	0.0	47.0	-11.3

Radiated Emissions Test Configuration



Radiated Emissions Environmental Conditions

Power Supply	230V AC, 50Hz
Temperature	24°C
Relative Humidity	44%
Barometric Pressure	1012mb

Radiated Emissions Measurement Uncertainties

Amplitude	± 5.1dB

The uncertainties stated are calculated in accordance with the requirements of UKAS with a confidence level of 95%.

Radiated Emissions Test Equipment Used

Test Equipment	***Model***	***Serial No.***
Receiver	R & S ESCI 7 - 1166.5950.07	100723/007
Antennas	Sunol Sciences JB6	A041613 (RE32)
Check Equip.	YORK CNE III	95/377 (RE12)
Cables	-	RE 136 & RE 140
Software	EMC32	Version.8.54.0

6.7 Harmonics Test Results

Basic Standard	EN 61000-3-2 : 2014
Equipment Classification	A
Test Time:	3 minutes

Operating Mode

The compliance test was performed on mode iii), which was determined to be the worst case operating mode.

Refer to section 5.2 of this report for clarification of the operating modes.

Test Results

Test Run 1

Order	Freq. [Hz]	Iavg [A]	Irms [A]	Imax [A]	Limit [A]
1	50	2.1153	2.1066	2.1414	
2	100	0.0000	0.0061	0.0073	1.0800
3	150	0.1196	0.1193	0.1212	2.3000
4	200	0.0000	0.0012	0.0015	0.4300
5	250	0.0671	0.0665	0.0681	1.1400
6	300	0.0000	0.0006	0.0009	0.3000
7	350	0.0000	0.0079	0.0085	0.7700
8	400	0.0000	0.0012	0.0012	0.2300
9	450	0.0000	0.0018	0.0021	0.4000
10	500	0.0000	0.0012	0.0012	0.1840
11	550	0.0000	0.0003	0.0006	0.3300
12	600	0.0000	0.0009	0.0009	0.1533
13	650	0.0000	0.0003	0.0006	0.2100
14	700	0.0000	0.0049	0.0052	0.1314
15	750	0.0000	0.0003	0.0006	0.1500
16	800	0.0000	0.0012	0.0015	0.1150
17	850	0.0000	0.0003	0.0009	0.1324
18	900	0.0000	0.0076	0.0079	0.1022
19	950	0.0000	0.0003	0.0006	0.1184
20	1000	0.0000	0.0070	0.0073	0.0920
21	1050	0.0000	0.0003	0.0006	0.1071
22	1100	0.0000	0.0055	0.0055	0.0836
23	1150	0.0000	0.0003	0.0006	0.0978
24	1200	0.0000	0.0021	0.0021	0.0767
25	1250	0.0000	0.0000	0.0003	0.0900
26	1300	0.0000	0.0003	0.0003	0.0708
27	1350	0.0000	0.0000	0.0003	0.0833
28	1400	0.0000	0.0000	0.0003	0.0657
29	1450	0.0000	0.0000	0.0003	0.0776
30	1500	0.0000	0.0000	0.0003	0.0613
31	1550	0.0000	0.0003	0.0003	0.0726
32	1600	0.0000	0.0000	0.0003	0.0575
33	1650	0.0000	0.0000	0.0003	0.0682
34	1700	0.0000	0.0000	0.0003	0.0541
35	1750	0.0000	0.0000	0.0003	0.0643
36	1800	0.0000	0.0000	0.0003	0.0511
37	1850	0.0000	0.0000	0.0003	0.0608
38	1900	0.0000	0.0000	0.0003	0.0484
39	1950	0.0000	0.0000	0.0003	0.0577
40	2000	0.0000	0.0000	0.0003	0.0460

Test Run 2

Order	Freq. [Hz]	Iavg [A]	Irms [A]	Imax [A]	Limit [A]
1	50	2.0630	2.0673	2.0749	
2	100	0.0000	0.0055	0.0064	1.0800
3	150	0.1194	0.1193	0.1208	2.3000
4	200	0.0000	0.0012	0.0012	0.4300
5	250	0.0667	0.0662	0.0677	1.1400
6	300	0.0000	0.0006	0.0006	0.3000
7	350	0.0000	0.0079	0.0085	0.7700
8	400	0.0000	0.0012	0.0012	0.2300
9	450	0.0000	0.0018	0.0018	0.4000
10	500	0.0000	0.0012	0.0012	0.1840
11	550	0.0000	0.0003	0.0006	0.3300
12	600	0.0000	0.0009	0.0009	0.1533
13	650	0.0000	0.0006	0.0006	0.2100
14	700	0.0000	0.0049	0.0049	0.1314
15	750	0.0000	0.0003	0.0006	0.1500
16	800	0.0000	0.0012	0.0012	0.1150
17	850	0.0000	0.0006	0.0009	0.1324
18	900	0.0000	0.0079	0.0079	0.1022
19	950	0.0000	0.0003	0.0006	0.1184
20	1000	0.0000	0.0073	0.0073	0.0920
21	1050	0.0000	0.0003	0.0006	0.1071
22	1100	0.0000	0.0052	0.0055	0.0836
23	1150	0.0000	0.0003	0.0006	0.0978
24	1200	0.0000	0.0021	0.0024	0.0767
25	1250	0.0000	0.0003	0.0003	0.0900
26	1300	0.0000	0.0003	0.0006	0.0708
27	1350	0.0000	0.0000	0.0003	0.0833
28	1400	0.0000	0.0000	0.0003	0.0657
29	1450	0.0000	0.0000	0.0003	0.0776
30	1500	0.0000	0.0000	0.0003	0.0613
31	1550	0.0000	0.0003	0.0003	0.0726
32	1600	0.0000	0.0000	0.0003	0.0575
33	1650	0.0000	0.0000	0.0003	0.0682
34	1700	0.0000	0.0000	0.0003	0.0541
35	1750	0.0000	0.0000	0.0003	0.0643
36	1800	0.0000	0.0000	0.0003	0.0511
37	1850	0.0000	0.0000	0.0003	0.0608
38	1900	0.0000	0.0000	0.0003	0.0484
39	1950	0.0000	0.0000	0.0003	0.0577
40	2000	0.0000	0.0000	0.0003	0.0460

The repeatability of the average value for the individual harmonic currents over the entire test observation period for both of the test runs were better than ±5 % of the applicable limit, as per the requirement of section 6.2.3.1 of EN 61000-3-2: 2014.

Harmonics Environmental Conditions

Power Supply	230V AC, 50Hz
Temperature	23°C
Relative Humidity	52%
Barometric Pressure	1015mb

Harmonics Measurement Uncertainties

Frequency	± 0.1%
Voltage	± 0.5% (45-450Hz)
Current	± 0.5%

The uncertainties stated are calculated in accordance with the requirements of UKAS with a confidence level of 95%.

Harmonics Test Equipment Used

Test Equipment	Model	Serial No.
Harmonics Analyser	HAR1H01B	HAR1000-50
Software	HARCS	Version 4.21
YORK Harmonics Test Piece	HFG01	719

6.8 Flicker Test Results

Basic Standard	EN 61000-3-3 : 2013
Test Time	10 minutes (1 observation period)
Parameters Evaluated	P_{st}, d_{max}, $d_{(t)}$, d_c,

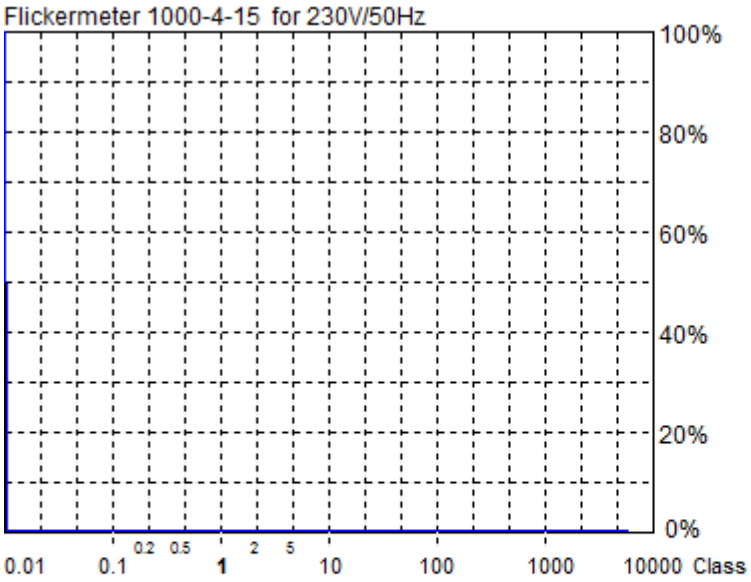
Assessment of short term or long term flicker

Operating Mode

The compliance test was performed on mode iii), which was determined to be the worst case operating mode.

Refer to section 5.2 of this report for clarification of the operating modes.

Compliance Test Results



Actual Flicker (Fli):	**0.00**
Short-term Flicker (Pst):	**0.07**
Limit (Pst):	1.00
Long-term Flicker (Plt):	**0.07**
Limit (Plt):	0.65
Maximum Relative Volt. Change (dmax):	**0.00%**
Limit (dmax):	4.00%
Relative Steady-state Voltage Change (dc):	**0.02%**
Limit (dc):	3.00%
Maximum Interval exceeding 3.00% (dt):	**0.00ms**
Limit (dt>Lim):	500ms

Flicker Emission - IEC 61000-3-3 , EN 61000-3-3

12/08/2016 11:03:17

Urms =	229.3	V	P =	449.9	W
Irms =	2.017	A	pf =	0.973	

Range:	5 A
V-nom:	230 V
TestTime:	10 min (100%)

Trojan Plastics Spa Bath

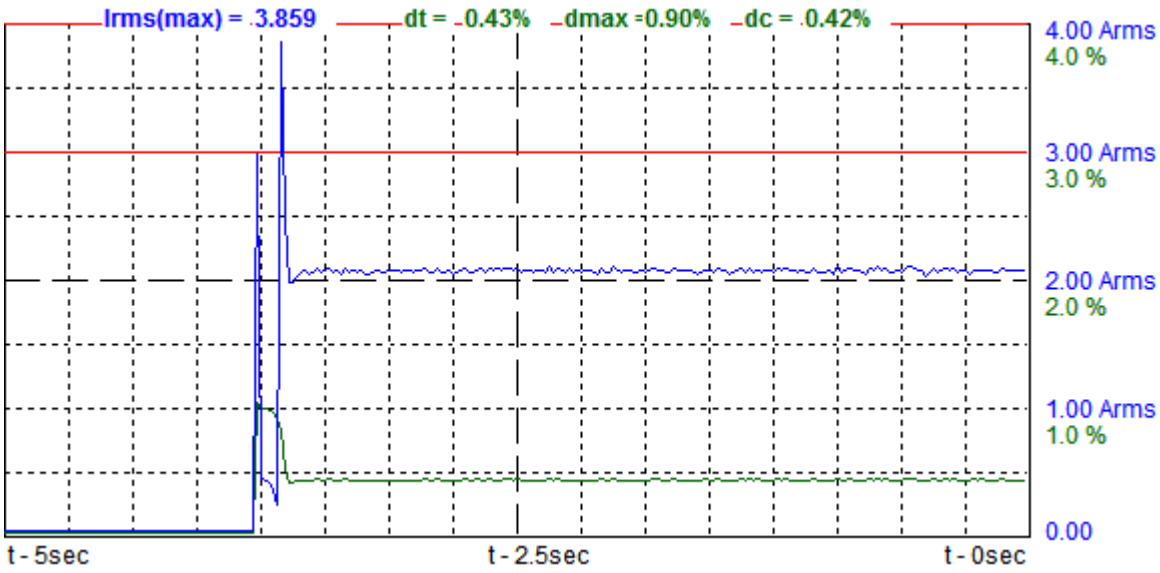
Test completed, Result: PASSED

HAR-1000 EMC-Partner

The product does not contain any automatic switching operations therefore the assessment of short term flicker (PST) or long term flicker (PLT) is not applicable.

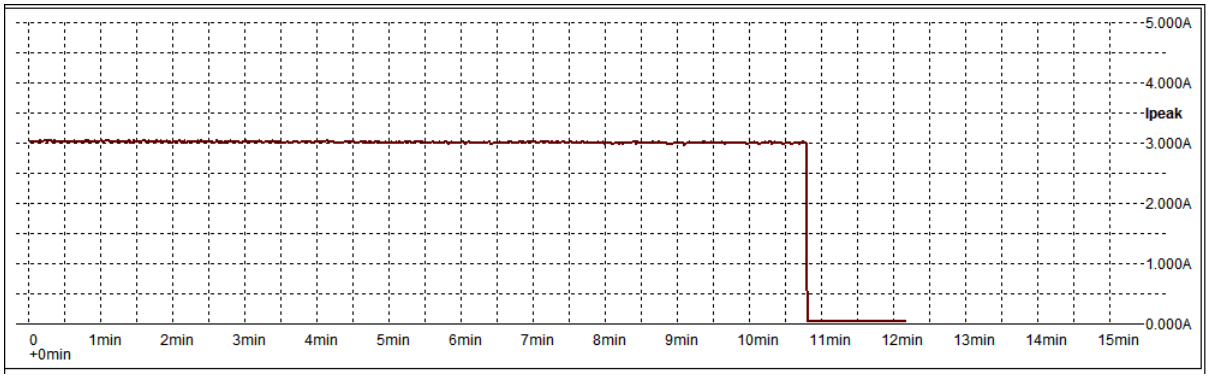
Assessment of voltage changes caused by switching

Graph showing worse case manual switch on measurement



The graph measurement above shows the maximum R.M.S. input current (including inrush current) evaluated over each 10ms half-period between zero-crossings during the worse case switching operation does not exceed 20A.

Graph showing supply current variation after initial switch on inrush



The graph measurement above shows the supply current after initial switch on inrush is within a variation band of 1.5A. The points shown in the graph where the supply current changes was where the product was manually switched off.

For voltage changes caused by manual switching, equipment is deemed to comply without further testing if the maximum r.m.s. input current (including inrush current) evaluated over each 10ms half-period between zero-crossings does not exceed 20A, and the supply current after inrush is within a variation band of 1.5A.

The product has met the requirements above and is therefore deemed to comply without further testing.

Flicker Environmental Conditions

Power Supply	230V AC, 50Hz
Temperature	23°C
Relative Humidity	50%
Barometric Pressure	1018mb

Flicker Measurement Uncertainties

P_{ST} Error	< ± 5%

The uncertainties stated are calculated in accordance with the requirements of UKAS with a confidence level of 95%.

Flicker Test Equipment Used

Test Equipment	Model	Serial No.
Flicker Analyser	HAR1H01B	HAR1000-50
Software	HARCS	Version 4.21
YORK Harmonics Test Piece	HFG01	719

6.9 Electrostatic Discharge Test Results

Basic Standard used as a guide	EN 61000-4-2 : 2009
Performance Criterion	B

Port: Enclosure
Test Level: ± 4 kV contact discharge
± 8 kV air discharge.
(Contact discharge is the preferred method, and air discharge is to be used where contact discharge is not possible).
Test Setup: Floor Mounted

Testing Method / Procedure

An initial test was performed at each of the selected test points/coupling planes, at a rate of 20 pulses per second (with a minimum of 20 pulses applied for each polarity and test voltage, as indicated in the table below).

Where discharges on a test point/coupling plane at 20 pulses per second had an effect on the EUT, the discharges were repeated on this test point/coupling plane at a rate of 1 pulse per second (with 10 pulses applied for each polarity and test voltage, as indicated in the table below).

Where testing at 20 pulses per second was observed to have no effect on the EUT, at least one test point was tested at a rate of 1 pulse per second, with 10 pulses applied for each polarity and test voltage, as indicated in the table below.

Operating Mode

The compliance test was performed on mode iii), which was determined by the client, to be the most critical operating mode.

Refer to section 5.2 of this report for clarification of the operating modes.

Test Results

Test Voltage (kV)	Discharge Type	Application Test Points	Discharge Rate	Number of Discharges*	Observation
± 4	Contact	4,5	20 pulse/sec	>20	Note 1
± 8	Air	1,2,3,6,7	20 pulse/sec	>20	Note 1
± 4	Contact	VCP	20 pulse/sec	>20	Note 1
± 4	Contact	4,5	1 pulse/sec	10	Note 1
± 8	Air	3	1 pulse/sec	10	Note 1
± 4	Contact	VCP	1 pulse/sec	10	Note 1

*Number of discharges applied for each polarity and test level at each test point.
Air discharge was applied only where contact discharge was not possible.
VCP = Vertical Coupling Plane

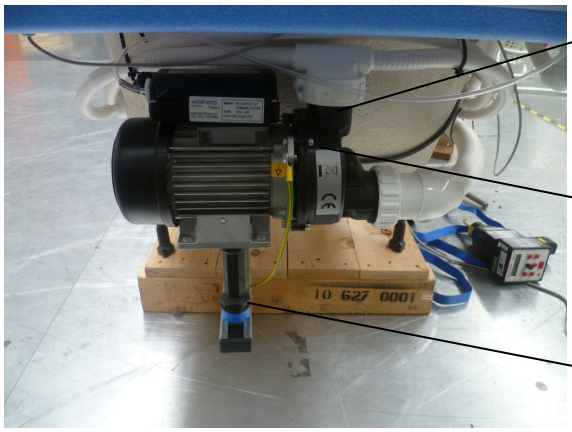
Note 1: No degradation in performance of the EUT was observed during the test.

For VCP tests, discharges were made on each of the four sides of the EUT.

Electrostatic Discharge Test Points

1. Light switch

2. Pump switch



3. Pump

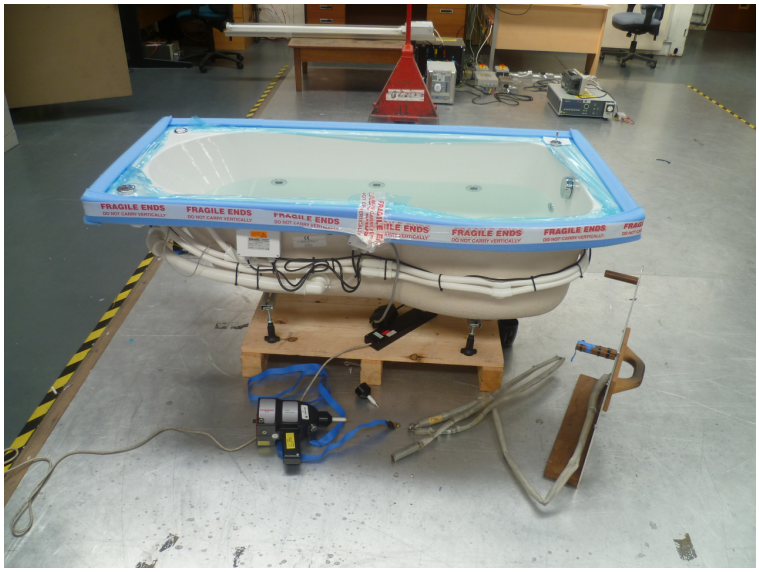
4. Pump housing screw

5. Metal bracket

6. Main input enclosure screw

7. Control box enclosure screw

Electrostatic Discharge Test Configuration



Electrostatic Discharge Environmental Conditions

Power Supply	230V AC, 50Hz
Temperature	23°C
Relative Humidity	47%
Barometric Pressure	1023mb

Electrostatic Discharge Measurement Uncertainties

The electrostatic discharge generator has been calibrated and the results are within the specified limits of EN 61000-4-2: 2009

Electrostatic Discharge Test Equipment Used

Test Equipment	Model	Serial No.
ESD Gun	SESD 200	50674
Pulse check unit	-	

6.10 Fast Transients Test Results

Basic Standard	EN 61000-4-4 : 2012
Performance Criterion	B

Port: Mains Supply Lead

Note: Testing is not applicable to signal cables less than 3m in length

Repetition Frequency: 5 kHz

Operating Mode

The compliance test was performed on mode iii), which was determined by the client, to be the most critical operating mode.

Refer to section 5.2 of this report for clarification of the operating modes.

Test Results

Cable	Test Voltage (± kV)	Line	Coupling (Direct / Clamp)	Observations
Mains	1	Live + Neutral + Earth	Direct	Note 1

The test duration was 2 minutes, with a 30-second recovery time.

Note 1: No degradation in performance of the EUT was observed during the test.

Fast Transients Test Configuration

Fast Burst Transients Environmental Conditions

Power Supply	230V AC, 50Hz
Temperature	23°C
Relative Humidity	50%
Barometric Pressure	1014mb

Fast Burst Transients Measurement Uncertainties

The transient generator has been calibrated and the results are within the specified limits of EN 61000-4-4: 2012

Fast Burst Transients Test Equipment Used

Test Equipment	Model	Serial No.
Transient Generator	UCS 500N5	V1115109245
Oscilloscope	Siglent SDS1202DL	SDS00001140109
Software	Iec.control	Version 5.2.6

6.11 Surge Test Results

Basic Standard	EN 61000-4-5 : 2006
Performance Criterion	B

Port: Mains Supply Lead
Time between pulses: 1 minute

Operating Mode

The compliance test was performed on mode iii), which was determined by the client, to be the most critical operating mode.

Refer to section 5.2 of this report for clarification of the operating modes.

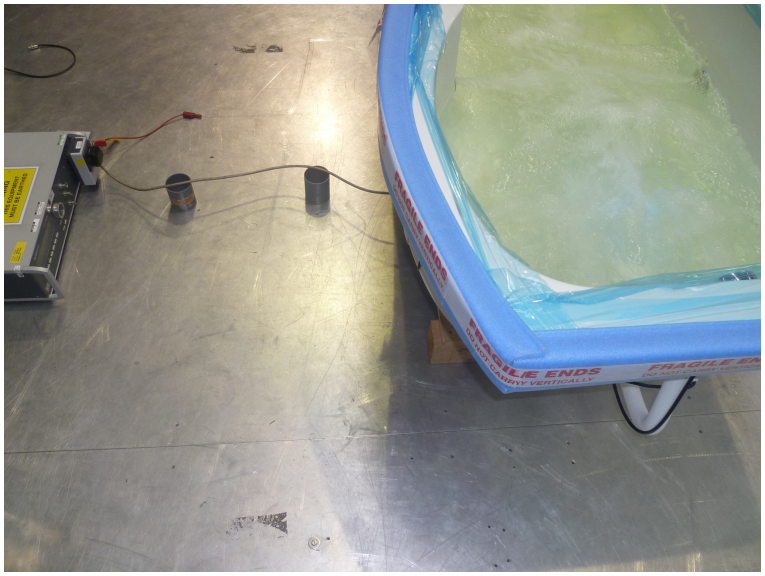
Test Results – AC Mains Supply

Pulse Application	Test Voltage (± kV)	Coupling Impedance	Phase Angle (Degrees)	Observations
Live - Earth	2	9uF+10Ω	90[1], 270[2]	Note 1
Neutral - Earth	2	9uF+10Ω	90[1], 270[2]	Note 1
Live - Neutral	1	18uF	90[1], 270[2]	Note 1

[1]: Five positive pulses applied.
[2]: Five negative pulses applied.

Note 1: No degradation in performance of the EUT was observed during the test.

Surge Test Configuration



Surge Environmental Conditions

Power Supply	230V AC, 50Hz
Temperature	22.5°C
Relative Humidity	54%
Barometric Pressure	1007mb

Surge Measurement Uncertainties

The surge generator has been calibrated and the results are within the specified limits of EN 61000-4-5: 2006

Surge Test Equipment Used

Test Equipment	Model	Serial No.
Transient Generator	UCS 500N5	V1115109245
Oscilloscope	Siglent SDS1202DL	SDS00001140109
Software	Iec.control	Version 5.2.6

6.12 Conducted Immunity Test Results

Basic Standard	EN 61000-4-6 : 2009
Performance Criterion	A

Port: Mains Supply Lead

Note: Testing is not applicable to signal cables less than 3m in length

Test Level: 3V
Frequency Range: 0.15 to 230MHz
Dwell Time: 2 seconds
Frequency Step Size: 1%
Modulation: 80%, 1 kHz Amplitude Modulation

Testing Method / Procedure

The test was performed with all equipment 10 cm above a groundplane (which was the floor of a screened room).

Operating Mode

The compliance test was performed on mode iii), which was determined by the client, to be the most critical operating mode.

Refer to section 5.2 of this report for clarification of the operating modes.

Test Results (Mains Supply Lead)

Test Voltage (Vrms)	Frequency Range (MHz)	Observations
3	0.15 – 230	Note 1

Note 1: No degradation in the performance of the EUT was observed during the test.

Conducted Immunity Test Configuration

Conducted Immunity Environmental Conditions

Power Supply	230V AC, 50Hz
Temperature	25°C
Relative Humidity	48%
Barometric Pressure	1015mb

Conducted Immunity Measurement Uncertainties

Injected Current Level	± 3.1dB

The uncertainties stated are calculated in accordance with the requirements of UKAS with a confidence level of 95%.

Conducted Immunity Test Equipment Used

Test Equipment	Model	Serial No.
Software	Chase CIS9942	Version 4.32
Signal generator	Marconi 2024	119071/37
Amplifier	25A250	15348
30dB Tenuline Coaxial Attenuator	Bird 8322	1025
Fixed 6dB Attenuator	-	(CI60)
Spectrum Analyser	FSP 1093.4495.30	100052
CDN	M3 - 801/6	10024

6.13 Voltage Dips Test Results

Basic Standard	EN 61000-4-11 : 2004

Port: Mains Supply Lead

Operating Mode

The compliance test was performed on mode iii), which was determined by the client, to be the most critical operating mode.

Refer to section 5.2 of this report for clarification of the operating modes.

Test Results

% Reduction	Duration (periods)	Observation	Performance Criterion
100	0.5	Note 1	C
60	10	Note 1	C
30	25	Note 1	C

Note 1: No degradation in performance of the EUT was observed during the test.

Voltage Dips Test Configuration

Voltage Dips Environmental Conditions

Power Supply	230V AC, 50 Hz
Temperature	23°C
Relative Humidity	50%
Barometric Pressure	1014mb

Voltage Dips Measurement Uncertainties

The voltage dips generator has been calibrated and the results are within the specified limits of EN 61000-4-11: 2004

Voltage Dips Test Equipment Used

Test Equipment	Model	Serial No.
Voltage Dips Generator	EM Test UCS 500N5	V1115109245
Tapped Transformer (40%,70% and 80% Test Level	EM Test V4780	P1312115891
Software	Iec.control	Version 5.2.6