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EMC COMPLIANCE REPORT

In accordance with:

EN 61000-6-3: 2007 (plus amendment1: 2011)

Seeley International Pty Ltd

ENV

Fixed Evaporative Air Cooler

REPORT: E1402-0421-1
DATE: February, 2014



Accreditation Number: 18553
Accredited for compliance with ISO/IEC 17025

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.



Certificate of Compliance

EMC Bayswater Test Report: E1402-0421-1
Issue Date: February, 2014

Product(s): Fixed Evaporative Air Cooler
Model No: ENV
Serial No: ENV13330001
Product No: 086903 (Breezair branded, European Market)
086927 (Braemar branded, Australia Market)

Client Details: Mr Craig Simkin
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Test Specification: EN 61000-6-3: 2007 (plus amendment1: 2011)
Generic standards – Emission standard for residential, commercial and light-industrial environments.

Results Summary:	Radiated Disturbance	Complied*
	Mains Terminal Disturbance Voltage	Complied*
	DC Power Port Disturbance Voltage	Not Applicable
	Harmonic Current Emissions	Complied
	Voltage Changes, Fluctuations & Flicker	Complied
	*Discontinuous Disturbances	Complied
	Conducted Disturbance at Telecommunications/Network Port	Not Applicable
	*No discontinuous disturbances were observed	
	*Modification required, refer to section 3.3	

Test Date(s): 8th January, 3rd & 4th February, 2014

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The modified Seeley International Pty Ltd, ENV, Fixed Evaporative Air Cooler, complied with the applicable requirements of EN 61000-6-3: 2007 (plus amendment1: 2011).

Prepared by:



Approved by:



20/02/2014 10:07

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Neville Liyanapatabendige
(Senior Test Engineer)

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Date

EMC Compliance Report *for* Seeley International Pty Ltd

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1. Introduction

Electromagnetic compatibility (EMC) tests were performed on a Seeley International Pty Ltd, ENV, Fixed Evaporative Air Cooler in accordance with the requirements of EN 61000-6-3: 2007 (plus amendment1: 2011).

2. Summary of Results

The EUT complied with the applicable requirements of EN 61000-6-3: 2007 (plus amendment1: 2011).

Test	Result
Radiated disturbance (Horizontal antenna polarisation)	Complied with quasi-peak limit by 7.9dB
Radiated disturbance (Horizontal antenna polarisation)	Complied with quasi-peak limit by 2.2dB ⁺
Mains Terminal Disturbance Voltage (Line 1)	Complied with quasi-peak limit by 17.0dB Complied with average limit by 16.7dB
Mains Terminal Disturbance Voltage (Line 2)	Complied with quasi-peak limit by 15.6dB Complied with average limit by 16.6dB
Mains Terminal Disturbance Voltage (Line 3)	Complied with quasi-peak limit by 17.6dB Complied with average limit by 19.3dB
Mains Terminal Disturbance Voltage (Neutral Line)	Complied with quasi-peak limit by 21.5dB Complied with average limit by 19.3dB
Discontinuous Disturbances	Complied
Harmonic Current Emissions	Complied, Class A
Voltage Changes, Fluctuation & Flicker	Complied

⁺Refer to relevant section for statement of Measurement Uncertainty.

Table 1: Results Summary

3. Product Sample, Configuration & Modifications

3.1. Product Sample Details

The EUT (Equipment Under Test), as supplied by the client, is described as follows:

Product: Fixed Evaporative Air Cooler
Model No: ENV
Serial No: ENV13330001
Product No: 086903 (Breezair branded, European Market)
086927 (Braemar branded, Australia Market)

Specification: 380-415VAC, 50Hz (3 phase with neutral), 6.5A per phase

The EUT is a large commercial/industrial evaporative cooler, used to provide ventilation and cooling to offices, workshops and warehouses.

The highest internal frequency of the device is 8MHz.

(Refer to photographs in Appendix B for views of the EUT)

3.2. Configuration

The EUT was supplied with 415VAC, 50Hz (3 phase with neutral). A wall controller and a BMS controller were connected to the EUT.

For worst-case emission configuration, all the testing was performed in ventilation mode and fan speed set to maximum except for Mains Terminal Disturbance Voltage test.

The EUT was operated in ventilation mode with lowest fan speed (one bar in wall controller) for Mains Terminal Disturbance Voltage worst-case emission configuration.

Customer supplied the EUT to operate in ventilation mode only (fan only operation, operation of water circulation and drain pumps did not occur). As specified by the customer there is no noticeable difference to emission testing between ventilation mode versus cooling mode during pre-compliance testing).

The operating mode and fan speed settings were configured using the wall controller.

3.3. Modifications

The following modifications were made by the customer to the EUT to comply with Radiated Disturbance testing:

- ❶ Changed switch mode power supply to analogue power supply.
- ❷ A Würth ferrite, (part number 742 711 32) was placed on each pump cable (3 cables) with a single pass through the ferrites as close as possible to distribution board.
- ❸ A Würth ferrite, (part number 742 712 22) was placed on each fan motor control cable (3 cables) with a single pass through the ferrites as close as possible to distribution board.
- ❹ A Würth ferrite, (part number 742 712 22) was placed on each fan motor control cable (3 cables) with a single pass through the ferrites as close as possible to fan motors (3 motors).
- ❺ A Würth ferrite, (part number 742 712 22) was placed on each fan motor power cable (3 cables) with a single pass through the ferrites (single full turn) as close as possible to fan motors (3 motors)
- ❻ A Würth ferrite, (part number 742 711 31) was placed on wall controller communication cable with two wire pass through the ferrites as close as possible to distribution board.
- ❼ Plastic cable glands on fan motors were changed to metallic glands.

(Refer to photographs 28 to 34 in Appendix B for views of the modifications)

The following modification was made by the customer to the EUT to comply with Mains Terminal Disturbance Voltage test:

- ❸ Corcom 20AY01 three phase RFI filter was fitted to the three phase mains input inside the cooler (customer supplied mains filter installed in a waterproof plastic container).

(Refer to photographs 37 to 39 in Appendix B for views of the modification)

Test	Modification							
	①	②	③	④	⑤	⑥	⑦	⑧
Radiated Disturbance	✓	✓	✓	✓	✓	✓	✓	x
Mains Terminal Disturbance Voltage	✓	✓	✓	✓	✓	✓	✓	✓
Harmonics and Flicker	✓	✓	✓	✓	✓	✓	✓	✓

Table 2: Summary of fitted modifications per test

EMC Bayswater takes no responsibility for any modifications made to the EUT specifically to achieve EMC compliance and hence these modifications may only be satisfactory for that purpose under the stated EUT test conditions. The customer must check that the proposed modifications meet all the product design, functional, safety or other compliance requirements.

4. Test Facility & Equipment

4.1. Test Facility

Radiated Disturbance Measurements were taken in the indoor Open Area Test Site (iOATS) facility at EMC Technologies Pty Ltd, located at 176 Harrick Road, Keilor Park, Victoria, 3042, Australia.

Mains Terminal Disturbance Voltage measurements were taken in a shielded enclosure at EMC Bayswater Pty Ltd, located at 18/88 Merrindale Drive, Croydon South, Victoria, 3136, Australia.

Harmonic Current Emissions and Voltage Changes, Fluctuation & Flicker measurements were taken at EMC Bayswater Pty Ltd, located at 18/88 Merrindale Drive, Croydon South, Victoria, 3136, Australia

4.2. Test Equipment

Refer to Appendix A for the measurement instrument list.

5. Referenced Standards

EN 61000-6-3: 2007 (plus amendment1: 2011)

Generic standards – Emission standard for residential, commercial and light-industrial environments.

CISPR 16-1-2: 2004

Specification for radio disturbance and immunity measuring apparatus and methods – Part 1.2: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Conducted disturbances.

CISPR 16-1-4:2008

Specification for radio disturbance and immunity measuring apparatus and methods Part 1.4: Radio disturbance and immunity measuring apparatus - Ancillary equipment - Radiated disturbances.

CISPR 16-2-1: 2005

Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements.

CISPR 16-2-3: 2003

Specification for radio disturbance and immunity measuring apparatus and methods – Part 2.3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements.

CISPR 22: 2006

Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.

AS/NZS CISPR 14.1: 2003

Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Emission.

EN 61000-3-2: 2006 (plus amendments to 2009)

Limits for harmonic current emissions (equipment input current less than or equal to 16A per phase)

EN 61000-3-3: 2008

Limitation of voltage fluctuations and flicker in low voltage supply systems for equipment with rated current less than or equal to 16A.

6. Radiated Disturbance (Radiated Emissions)

6.1. Test Procedure

Radiated Emissions were measured 3 metres away from the EUT in the iOATS (indoor Open Area Test Site) facility, which is a CISPR 16-1-4 compliant semi-anechoic chamber with ground plane.

The EUT was placed on a metallic support (customer supplied the EUT with a metallic support which was on four rubber wheels of 10cm radius), at a height of 105cm above the ground plane. For both horizontal and vertical antenna polarizations, the peak detector was set to MAX-HOLD and the range selected continuously scanned. The antenna height was varied from 1 to 4 metres and the turntable slowly rotated, in order to find the worst-case emission arrangement. Quasi peak, Peak and Average measurements were performed at spot frequencies where the peak emission was close to, or exceeded the applicable limit line. In the frequency range 1GHz to 6GHz the antenna height was fixed at 1m.

Plots of the accumulated measurement data for both horizontal and vertical antenna polarizations, including all transducer correction factors were produced.

(Refer to photographs 26 & 27 in Appendix B for views of the test configuration)

6.2. Limits

The Equipment Under Test (EUT) shall meet the limits in the following table:

Frequency Range (MHz)	Limits (dB μ V/m)
	Quasi-Peak
30 to 230	40
230 to 1000	47
NOTE The lower limit shall apply at the transition frequency.	

Table 3: Limits for Radiated Disturbance at 3m (30-1000MHz)

Frequency Range (MHz)	Limits (dB μ V/m)	
	Peak	Average
1000 to 3000	70	50
3000 to 6000	74	54
NOTE The lower limit shall apply at the transition frequency.		

Table 4: Limits for Radiated Disturbance at 3m (1-6GHz)

6.3. Test Results

Radiated Disturbance measurements are tabulated below. Quasi peak measurements were performed at spot frequencies where the peak emission was close to, or exceeded the applicable limit line.

(Refer to graphs 1 & 2 in Appendix C)

Frequency (MHz)	Result Quasi-peak (dB μ V/m)	Limit Quasi-peak (dB μ V/m)	Delta limit (dB)
76.912	21.8	30.0	-8.2
78.820	18.7	30.0	-11.3
84.096	18.0	30.0	-12.0
84.488	18.1	30.0	-11.9
87.288	19.8	30.0	-10.2
87.658	20.0	30.0	-10.0
92.636	16.9	30.0	-13.1
154.800	19.8	30.0	-10.2
159.880	20.2	30.0	-9.8
167.516	22.1	30.0	-7.9*
174.360	20.4	30.0	-9.6

**Worst-case emission*

Table 5: Radiated Disturbance – Horizontal antenna polarisation

Frequency (MHz)	Result Quasi-peak (dB μ V/m)	Limit Quasi-peak (dB μ V/m)	Delta limit (dB)
32.426	24.2	30.0	-5.8
38.872	21.8	30.0	-8.2
40.542	22.6	30.0	-7.4
48.645	26.0	30.0	-4.0 ⁺
57.456	24.1	30.0	-5.9
61.024	26.1	30.0	-3.9 ⁺
62.144	24.8	30.0	-5.2
64.741	23.0	30.0	-7.0
76.321	27.6	30.0	-2.4 ⁺
77.283	27.8	30.0	-2.2⁺
79.831	25.5	30.0	-4.5 ⁺
86.868	19.6	30.0	-10.4
105.680	16.6	30.0	-13.4
107.320	16.8	30.0	-13.2
139.400	20.3	30.0	-9.7
140.280	21.5	30.0	-8.5
142.840	21.7	30.0	-8.3
146.040	22.8	30.0	-7.2
149.120	22.5	30.0	-7.5
152.285	22.2	30.0	-7.8
156.937	23.0	30.0	-7.0
160.440	21.5	30.0	-8.5
167.652	20.6	30.0	-9.4
177.280	17.5	30.0	-12.5
188.360	14.5	30.0	-15.5
294.440	25.2	37.0	-11.8
311.560	22.6	37.0	-14.4
321.326	21.6	37.0	-15.4
337.864	17.2	37.0	-19.8

**Worst-case emission, ⁺refer to measurement uncertainty below*

Table 6: Radiated Disturbance – Vertical antenna polarisation

The measurement uncertainty was calculated at ± 5.1 dB. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of $k=2$ which gives a level of confidence of approximately 95%.

Climatic Conditions	
Temperature:	21 - 23°C
Humidity:	40 - 42%

Table 7: Climatic conditions

Comments: Radiated emissions were below the specified limits.

Assessment: The modified EUT complied with the Radiated Disturbance requirements of EN 61000-6-3: 2007 (plus amendment1: 2011).

7. Mains Terminal Disturbance Voltage (Conducted Emissions)

7.1. Test Procedure

The EUT was positioned 105 cm above a ground plane with the mains cable connected to the power port of a LISN located 0.8 m away. The measuring port of the LISN was connected to the measuring receiver.

In order to avoid unwanted ambient signals, power to the LISN was supplied via power line filters fitted to the shielded enclosure wall.

The mains flexible cord provided by the manufacturer is required to be 0.8 m long for these measurements. If the manufacturer supplies a non-removable power lead, in excess of 0.8 m, the cable in excess of 0.8 m is folded into a bundle approximately 0.4 m in length.

Both the active and neutral lines were tested, in turn.

(Refer to Photographs 35 & 36 in Appendix B for views of the test configuration)

7.2. Limits

The Equipment Under Test (EUT) shall meet the limits in the following tables, as applicable. This includes the average limit and the quasi-peak limit when using an average detector and quasi-peak detector, respectively.

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-Peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.5 to 5	56	46
5 to 30	60	50
NOTE 1 The lower limit shall apply at the transition frequencies. NOTE 2 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

Table 8: Limits for Mains Terminal Disturbance Voltage

7.3. Test Results

Mains Terminal Disturbance Voltage measurements are tabulated below.

(Refer to graphs 3 to 6 in Appendix C)

Quasi – Peak Measurements				Average Measurements			
Frequency (MHz)	Result (dB μ V)	Limit (dB μ V)	Delta Limit (dB)	Frequency (MHz)	Result (dB μ V)	Limit (dB μ V)	Delta Limit (dB)
0.170	47.6	65.0	-17.4	0.166	38.4	55.2	-16.8
0.182	47.4	64.4	-17.0*	0.182	37.7	54.4	-16.7*
0.198	44.1	63.7	-19.6	0.198	34.7	53.7	-19.0
6.886	35.1	60.0	-24.9	6.918	27.7	50.0	-22.3

**Worst-case emissions*

Table 9: Mains Terminal Disturbance Voltage – L1

Quasi – Peak Measurements				Average Measurements			
Frequency (MHz)	Result (dB μ V)	Limit (dB μ V)	Delta Limit (dB)	Frequency (MHz)	Result (dB μ V)	Limit (dB μ V)	Delta Limit (dB)
0.154	46.0	65.8	-19.8	0.154	33.7	55.8	-22.1
0.166	49.6	65.2	-15.6*	0.166	38.2	55.2	-17.0
0.182	46.8	64.4	-17.6	0.182	37.8	54.4	-16.6*
6.810	32.3	60.0	-27.7	6.810	25.4	50.0	-24.6

**Worst-case emissions*

Table 10: Mains Terminal Disturbance Voltage – L2

Quasi – Peak Measurements				Average Measurements			
Frequency (MHz)	Result (dB μ V)	Limit (dB μ V)	Delta Limit (dB)	Frequency (MHz)	Result (dB μ V)	Limit (dB μ V)	Delta Limit (dB)
0.170	47.3	65.0	-17.7	0.154	33.6	55.8	-22.2
0.182	46.8	64.4	-17.6*	0.182	35.1	54.4	-19.3*
6.718	34.1	60.0	-25.9	6.690	28.0	50.0	-22.0

**Worst-case emissions*

Table 11: Mains Terminal Disturbance Voltage – L3

Quasi – Peak Measurements				Average Measurements			
Frequency (MHz)	Result (dB μ V)	Limit (dB μ V)	Delta Limit (dB)	Frequency (MHz)	Result (dB μ V)	Limit (dB μ V)	Delta Limit (dB)
0.166	33.6	65.2	-31.6	0.166	29.1	55.2	-26.1
1.202	18.5	56.0	-37.5	1.246	14.9	46.0	-31.1
2.494	19.1	56.0	-36.9	2.478	13.3	46.0	-32.7
6.826	38.5	60.0	-21.5*	6.826	30.7	50.0	-19.3*
6.886	38.0	60.0	-22.0	6.918	30.5	50.0	-19.5

**Worst-case emissions*

Table 12: Mains Terminal Disturbance Voltage – Neutral Line

The measurement uncertainty was calculated at ± 2.9 dB. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of $k=2$ which gives a level of confidence of approximately 95%.

Climatic Conditions	
Temperature:	30°C
Humidity:	31%

Table 13: Climatic conditions

Comments: Mains Terminal Disturbance Voltage measurements were below the specified quasi-peak and average limits.

Assessment: The modified EUT complied with the Mains Terminal Disturbance Voltage requirements of EN 61000-6-3: 2007 (plus amendment1: 2011).

8. Harmonic Current Emissions (EN 61000-3-2)

8.1. Test Procedure

The EUT was tested for harmonic current emissions in accordance with EN 61000-3-2. The EUT was connected to a harmonics analyser.

The test duration was 5 minutes. The results were produced in graphical and tabular form.

To establish limits for similar types of harmonic current distortion, the EUT must be categorised in one of the four defined classes.

Class A:

- Balanced three-phase equipment
- Household appliances, excluding equipment identified as Class D
- Tools, excluding portable tools
- Dimmers for incandescent lamps
- Audio equipment

Equipment not specified in one of the three other classes shall be considered as Class A equipment.

Class B:

- Portable tools
- Arc welding equipment which is not professional equipment

Class C:

- Lighting equipment

Class D:

Equipment having a specified power according to 6.2.2 less than or equal to 600 W, of the following types:

- Personal computers and personal computer monitors
- Television receivers

The EUT was determined to be a Class A device, and was subsequently tested to Class A limits.

(Refer to photograph 40 in Appendix B for a view of the test configuration)

8.2. Requirements

EUT passes if all average values of the Individual Harmonic Currents (I_{avg}) are below 100% of the individual limits and all maximum values of the Individual Harmonic Currents (I_{max}) are below 150% of the Individual Limits.

Exceptions:

- Average values of some Individual Harmonic Currents may be up to 150% if the Partial Harmonic Current (PHC) is lower than the PHC which is calculated from the Limit Currents.
- Individual Harmonic Currents less than 5mA or less than 0.6% of I_{rms} are disregarded.

General :

- Maximum and Average values are calculated over the full test-time
- The individual measurements are taken over every 16 periods and smoothed with an 1.5 second filter.

8.3. Test Results

Harmonic Number	Item	Measured Value	Limit 100%	Limit 150%	Delta Limit 100%	Delta Limit 150%
2	Average harmonic current	0.046	1.080	-	-1.034	-
	Maximum harmonic current	0.120	-	1.620	-	-1.500
3	Average harmonic current	0.332	2.300	-	-1.968	-
	Maximum harmonic current	0.390	-	3.450	-	-3.060
4	Average harmonic current	0.016	0.430	-	-0.414	-
	Maximum harmonic current	0.032	-	0.645	-	-0.613
5	Average harmonic current	0.952	1.140	-	-0.188	-
	Maximum harmonic current	0.957	-	1.710	-	-0.753
6	Average harmonic current	0.008	0.300	-	-0.292	-
	Maximum harmonic current	0.014	-	0.450	-	-0.436
7	Average harmonic current	0.469	0.770	-	-0.301	-
	Maximum harmonic current	0.473	-	1.155	-	-0.682
8	Average harmonic current	0.006	0.230	-	-0.224	-
	Maximum harmonic current	0.014	-	0.345	-	-0.331
9	Average harmonic current	0.076	0.400	-	-0.324	-
	Maximum harmonic current	0.083	-	0.600	-	-0.517
10	Average harmonic current	0.005	0.184	-	-0.179	-
	Maximum harmonic current	0.011	-	0.276	-	-0.265
11	Average harmonic current	0.179	0.330	-	-0.151	-
	Maximum harmonic current	0.182	-	0.495	-	-0.313
12	Average harmonic current	0.004	0.153	-	-0.149	-
	Maximum harmonic current	0.008	-	0.230	-	-0.222
13	Average harmonic current	0.133	0.210	-	-0.077	-
	Maximum harmonic current	0.134	-	0.315	-	-0.181
14	Average harmonic current	0.004	0.131	-	-0.128	-
	Maximum harmonic current	0.008	-	0.197	-	-0.189
15	Average harmonic current	0.041	0.150	-	-0.109	-
	Maximum harmonic current	0.045	-	0.225	-	-0.180
16	Average harmonic current	0.003	0.115	-	-0.112	-
	Maximum harmonic current	0.006	-	0.173	-	-0.167
17	Average harmonic current	0.067	0.132	-	-0.066	-
	Maximum harmonic current	0.069	-	0.199	-	-0.130
18	Average harmonic current	0.002	0.102	-	-0.100	-
	Maximum harmonic current	0.005	-	0.153	-	-0.148
19	Average harmonic current	0.053	0.118	-	-0.065	-
	Maximum harmonic current	0.054	-	0.178	-	-0.124
20	Average harmonic current	0.002	0.092	-	-0.090	-
	Maximum harmonic current	0.005	-	0.138	-	-0.133
21*	Average harmonic current	0.024	0.107	-	-0.083	-
	Maximum harmonic current	0.027	-	0.161	-	-0.134

Table 14: Harmonic Current Emissions measurement – L1

Harmonic Number	Item	Measured Value	Limit 100%	Limit 150%	Delta Limit 100%	Delta Limit 150%
22	Average harmonic current	0.002	0.084	-	-0.082	-
	Maximum harmonic current	0.004	-	0.125	-	-0.121
23*	Average harmonic current	0.027	0.098	-	-0.070	-
	Maximum harmonic current	0.028	-	0.147	-	-0.119
24	Average harmonic current	0.001	0.077	-	-0.075	-
	Maximum harmonic current	0.004	-	0.115	-	-0.111
25*	Average harmonic current	0.027	0.090	-	-0.063	-
	Maximum harmonic current	0.028	-	0.135	-	-0.107
26	Average harmonic current	0.001	0.071	-	-0.069	-
	Maximum harmonic current	0.003	-	0.106	-	-0.103
27*	Average harmonic current	0.016	0.083	-	-0.068	-
	Maximum harmonic current	0.017	-	0.125	-	-0.108
28	Average harmonic current	0.001	0.066	-	-0.065	-
	Maximum harmonic current	0.002	-	0.099	-	-0.097
29*	Average harmonic current	0.014	0.078	-	-0.064	-
	Maximum harmonic current	0.014	-	0.116	-	-0.102
30	Average harmonic current	0.001	0.061	-	-0.060	-
	Maximum harmonic current	0.003	-	0.092	-	-0.089
31*	Average harmonic current	0.014	0.073	-	-0.058	-
	Maximum harmonic current	0.015	-	0.109	-	-0.094
32	Average harmonic current	0.001	0.058	-	-0.057	-
	Maximum harmonic current	0.002	-	0.086	-	-0.084
33*	Average harmonic current	0.010	0.068	-	-0.058	-
	Maximum harmonic current	0.011	-	0.102	-	-0.091
34*	Average harmonic current	0.001	0.054	-	-0.053	-
	Maximum harmonic current	0.002	-	0.081	-	-0.079
35*	Average harmonic current	0.008	0.064	-	-0.057	-
	Maximum harmonic current	0.008	-	0.096	-	-0.088
36	Average harmonic current	0.001	0.051	-	-0.050	-
	Maximum harmonic current	0.002	-	0.077	-	-0.075
37*	Average harmonic current	0.008	0.061	-	-0.053	-
	Maximum harmonic current	0.008	-	0.091	-	-0.083
38	Average harmonic current	0.000	0.048	-	-0.048	-
	Maximum harmonic current	0.002	-	0.073	-	-0.071
39*	Average harmonic current	0.007	0.058	-	-0.051	-
	Maximum harmonic current	0.008	-	0.087	-	-0.079
40	Average harmonic current	0.000	0.046	-	-0.046	-
	Maximum harmonic current	0.002	-	0.069	-	-0.067
	*Partial odd harmonic current	0.055	0.251	-	-0.197	-

Table 15: Harmonic Current Emissions measurement – L1 continued

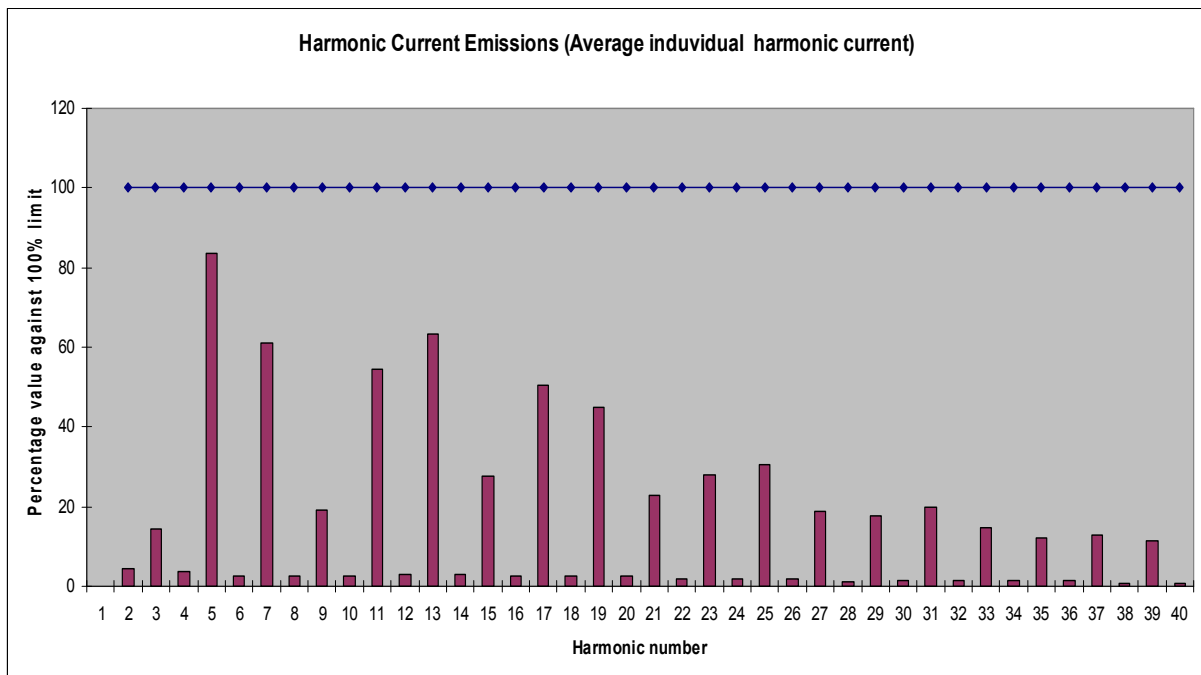


Table 16: Harmonic Current Emissions measurement – L1 – Average values of individual harmonic current

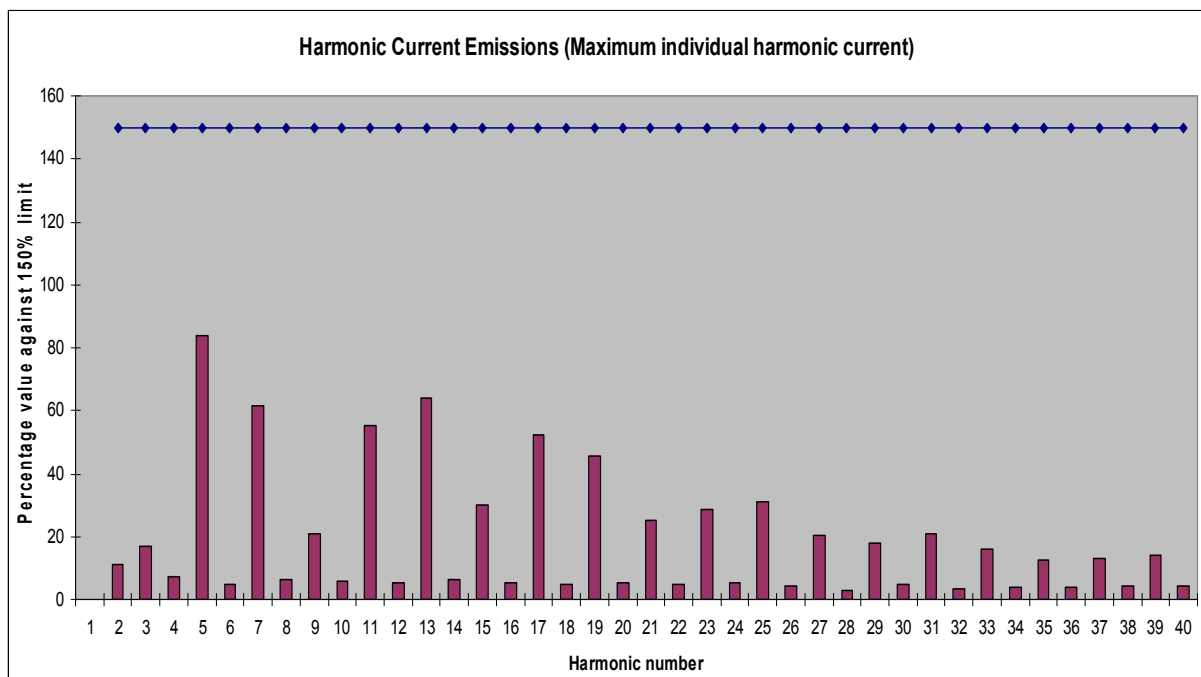


Table 17: Harmonic Current Emissions measurement – L1 – Maximum values of individual harmonic current

Harmonic Number	Item	Measured Value	Limit 100%	Limit 150%	Delta Limit 100%	Delta Limit 150%
2	Average harmonic current	0.049	1.080	-	-1.031	-
	Maximum harmonic current	0.130	-	1.620	-	-1.490
3	Average harmonic current	0.279	2.300	-	-2.021	-
	Maximum harmonic current	0.345	-	3.450	-	-3.105
4	Average harmonic current	0.016	0.430	-	-0.414	-
	Maximum harmonic current	0.034	-	0.645	-	-0.611
5	Average harmonic current	1.005	1.140	-	-0.135	-
	Maximum harmonic current	1.010	-	1.710	-	-0.700
6	Average harmonic current	0.012	0.300	-	-0.288	-
	Maximum harmonic current	0.027	-	0.450	-	-0.423
7	Average harmonic current	0.349	0.770	-	-0.421	-
	Maximum harmonic current	0.360	-	1.155	-	-0.795
8	Average harmonic current	0.006	0.230	-	-0.224	-
	Maximum harmonic current	0.010	-	0.345	-	-0.335
9	Average harmonic current	0.020	0.400	-	-0.380	-
	Maximum harmonic current	0.031	-	0.600	-	-0.569
10	Average harmonic current	0.005	0.184	-	-0.179	-
	Maximum harmonic current	0.012	-	0.276	-	-0.264
11	Average harmonic current	0.201	0.330	-	-0.129	-
	Maximum harmonic current	0.207	-	0.495	-	-0.288
12	Average harmonic current	0.005	0.153	-	-0.148	-
	Maximum harmonic current	0.012	-	0.230	-	-0.218
13	Average harmonic current	0.092	0.210	-	-0.118	-
	Maximum harmonic current	0.098	-	0.315	-	-0.217
14	Average harmonic current	0.003	0.131	-	-0.129	-
	Maximum harmonic current	0.004	-	0.197	-	-0.193
15	Average harmonic current	0.013	0.150	-	-0.137	-
	Maximum harmonic current	0.017	-	0.225	-	-0.208
16	Average harmonic current	0.004	0.115	-	-0.111	-
	Maximum harmonic current	0.009	-	0.173	-	-0.164
17	Average harmonic current	0.077	0.132	-	-0.056	-
	Maximum harmonic current	0.084	-	0.199	-	-0.115
18	Average harmonic current	0.003	0.102	-	-0.099	-
	Maximum harmonic current	0.006	-	0.153	-	-0.147
19	Average harmonic current	0.028	0.118	-	-0.091	-
	Maximum harmonic current	0.031	-	0.178	-	-0.147
20	Average harmonic current	0.001	0.092	-	-0.091	-
	Maximum harmonic current	0.002	-	0.138	-	-0.136
21*	Average harmonic current	0.008	0.107	-	-0.099	-
	Maximum harmonic current	0.009	-	0.161	-	-0.152

Table 18: Harmonic Current Emissions measurement – L2

Harmonic Number	Item	Measured Value	Limit 100%	Limit 150%	Delta Limit 100%	Delta Limit 150%
22	Average harmonic current	0.002	0.084	-	-0.081	-
	Maximum harmonic current	0.006	-	0.125	-	-0.119
23*	Average harmonic current	0.045	0.098	-	-0.053	-
	Maximum harmonic current	0.047	-	0.147	-	-0.100
24	Average harmonic current	0.002	0.077	-	-0.075	-
	Maximum harmonic current	0.004	-	0.115	-	-0.111
25*	Average harmonic current	0.012	0.090	-	-0.079	-
	Maximum harmonic current	0.014	-	0.135	-	-0.121
26	Average harmonic current	0.001	0.071	-	-0.070	-
	Maximum harmonic current	0.002	-	0.106	-	-0.104
27*	Average harmonic current	0.006	0.083	-	-0.077	-
	Maximum harmonic current	0.007	-	0.125	-	-0.118
28	Average harmonic current	0.002	0.066	-	-0.064	-
	Maximum harmonic current	0.004	-	0.099	-	-0.095
29*	Average harmonic current	0.023	0.078	-	-0.055	-
	Maximum harmonic current	0.025	-	0.116	-	-0.091
30	Average harmonic current	0.001	0.061	-	-0.060	-
	Maximum harmonic current	0.002	-	0.092	-	-0.090
31*	Average harmonic current	0.005	0.073	-	-0.067	-
	Maximum harmonic current	0.007	-	0.109	-	-0.102
32	Average harmonic current	0.000	0.058	-	-0.057	-
	Maximum harmonic current	0.001	-	0.086	-	-0.085
33*	Average harmonic current	0.004	0.068	-	-0.064	-
	Maximum harmonic current	0.005	-	0.102	-	-0.097
34*	Average harmonic current	0.001	0.054	-	-0.053	-
	Maximum harmonic current	0.003	-	0.081	-	-0.078
35*	Average harmonic current	0.013	0.064	-	-0.051	-
	Maximum harmonic current	0.015	-	0.096	-	-0.081
36	Average harmonic current	0.000	0.051	-	-0.051	-
	Maximum harmonic current	0.001	-	0.077	-	-0.076
37*	Average harmonic current	0.002	0.061	-	-0.058	-
	Maximum harmonic current	0.003	-	0.091	-	-0.088
38	Average harmonic current	0.000	0.048	-	-0.048	-
	Maximum harmonic current	0.001	-	0.073	-	-0.072
39*	Average harmonic current	0.003	0.058	-	-0.054	-
	Maximum harmonic current	0.004	-	0.087	-	-0.083
40	Average harmonic current	0.000	0.046	-	-0.046	-
	Maximum harmonic current	0.002	-	0.069	-	-0.067
	*Partial odd harmonic current	0.054	0.251	-	-0.197	-

Table 19: Harmonic Current Emissions measurement – L2 continued

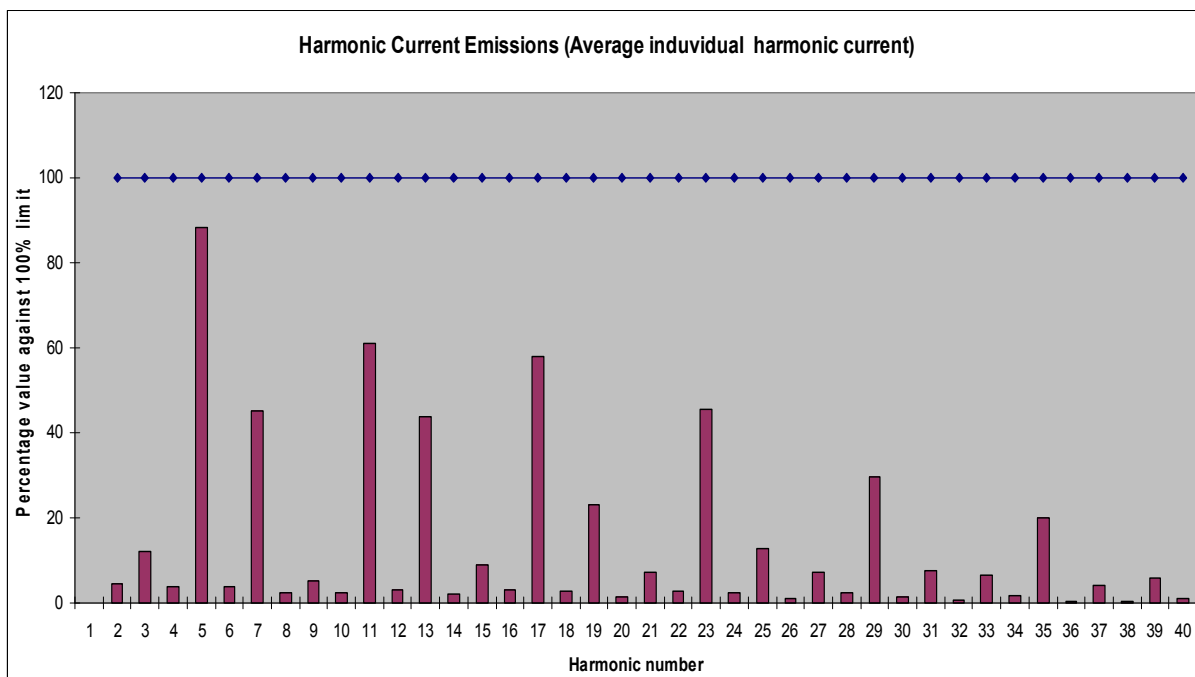


Table 20: Harmonic Current Emissions measurement – L2 – Average values of individual harmonic current

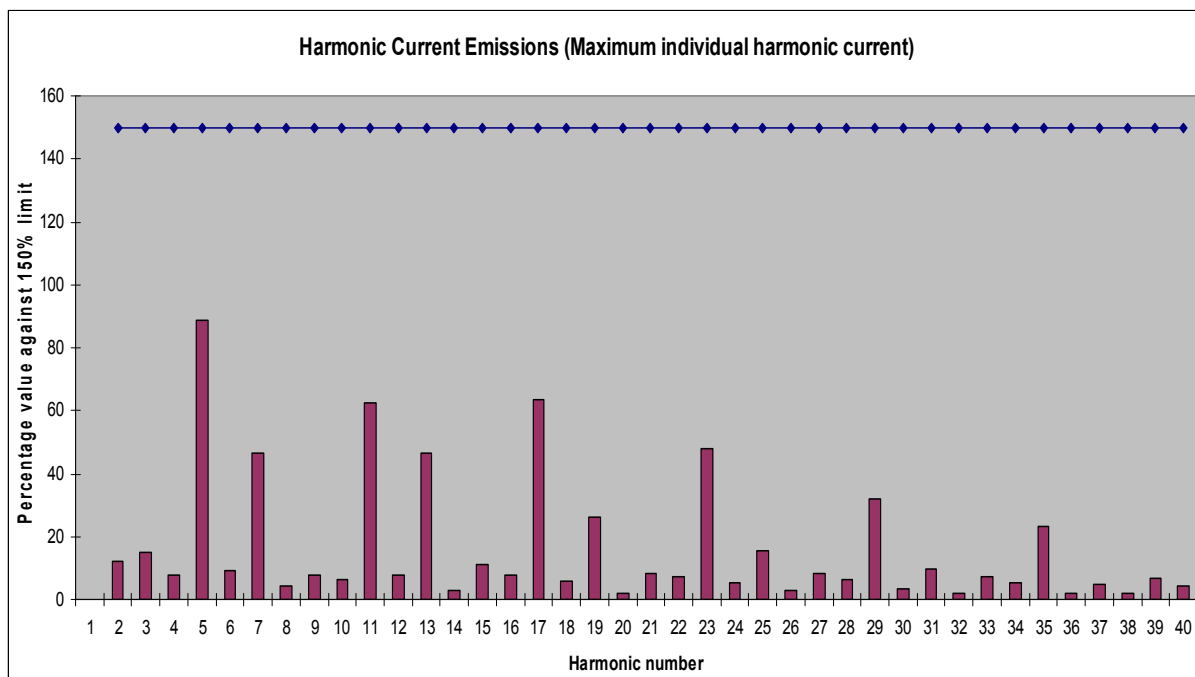


Table 21: Harmonic Current Emissions measurement – L2 – Maximum values of individual harmonic current

Harmonic Number	Item	Measured Value	Limit 100%	Limit 150%	Delta Limit 100%	Delta Limit 150%
2	Average harmonic current	0.045	1.080	-	-1.035	-
	Maximum harmonic current	0.130	-	1.620	-	-1.490
3	Average harmonic current	0.491	2.300	-	-1.809	-
	Maximum harmonic current	0.549	-	3.450	-	-2.901
4	Average harmonic current	0.018	0.430	-	-0.412	-
	Maximum harmonic current	0.029	-	0.645	-	-0.616
5	Average harmonic current	0.891	1.140	-	-0.249	-
	Maximum harmonic current	0.904	-	1.710	-	-0.806
6	Average harmonic current	0.010	0.300	-	-0.290	-
	Maximum harmonic current	0.023	-	0.450	-	-0.427
7	Average harmonic current	0.488	0.770	-	-0.282	-
	Maximum harmonic current	0.502	-	1.155	-	-0.653
8	Average harmonic current	0.007	0.230	-	-0.223	-
	Maximum harmonic current	0.011	-	0.345	-	-0.334
9	Average harmonic current	0.055	0.400	-	-0.346	-
	Maximum harmonic current	0.058	-	0.600	-	-0.542
10	Average harmonic current	0.006	0.184	-	-0.178	-
	Maximum harmonic current	0.011	-	0.276	-	-0.265
11	Average harmonic current	0.154	0.330	-	-0.176	-
	Maximum harmonic current	0.160	-	0.495	-	-0.335
12	Average harmonic current	0.004	0.153	-	-0.149	-
	Maximum harmonic current	0.009	-	0.230	-	-0.221
13	Average harmonic current	0.129	0.210	-	-0.081	-
	Maximum harmonic current	0.135	-	0.315	-	-0.180
14	Average harmonic current	0.004	0.131	-	-0.128	-
	Maximum harmonic current	0.006	-	0.197	-	-0.191
15	Average harmonic current	0.037	0.150	-	-0.113	-
	Maximum harmonic current	0.040	-	0.225	-	-0.185
16	Average harmonic current	0.003	0.115	-	-0.112	-
	Maximum harmonic current	0.006	-	0.173	-	-0.167
17	Average harmonic current	0.054	0.132	-	-0.078	-
	Maximum harmonic current	0.060	-	0.199	-	-0.139
18	Average harmonic current	0.003	0.102	-	-0.099	-
	Maximum harmonic current	0.006	-	0.153	-	-0.147
19	Average harmonic current	0.065	0.118	-	-0.053	-
	Maximum harmonic current	0.070	-	0.178	-	-0.108
20	Average harmonic current	0.002	0.092	-	-0.090	-
	Maximum harmonic current	0.004	-	0.138	-	-0.134
21*	Average harmonic current	0.025	0.107	-	-0.082	-
	Maximum harmonic current	0.026	-	0.161	-	-0.135

Table 22: Harmonic Current Emissions measurement – L3

Harmonic Number	Item	Measured Value	Limit 100%	Limit 150%	Delta Limit 100%	Delta Limit 150%
22	Average harmonic current	0.002	0.084	-	-0.081	-
	Maximum harmonic current	0.004	-	0.125	-	-0.121
23*	Average harmonic current	0.020	0.098	-	-0.078	-
	Maximum harmonic current	0.022	-	0.147	-	-0.125
24	Average harmonic current	0.002	0.077	-	-0.075	-
	Maximum harmonic current	0.004	-	0.115	-	-0.111
25*	Average harmonic current	0.031	0.090	-	-0.059	-
	Maximum harmonic current	0.034	-	0.135	-	-0.101
26	Average harmonic current	0.001	0.071	-	-0.069	-
	Maximum harmonic current	0.002	-	0.106	-	-0.104
27*	Average harmonic current	0.015	0.083	-	-0.068	-
	Maximum harmonic current	0.016	-	0.125	-	-0.109
28	Average harmonic current	0.001	0.066	-	-0.064	-
	Maximum harmonic current	0.003	-	0.099	-	-0.096
29*	Average harmonic current	0.010	0.078	-	-0.068	-
	Maximum harmonic current	0.011	-	0.116	-	-0.105
30	Average harmonic current	0.001	0.061	-	-0.060	-
	Maximum harmonic current	0.002	-	0.092	-	-0.090
31*	Average harmonic current	0.016	0.073	-	-0.057	-
	Maximum harmonic current	0.018	-	0.109	-	-0.091
32	Average harmonic current	0.001	0.058	-	-0.056	-
	Maximum harmonic current	0.002	-	0.086	-	-0.084
33*	Average harmonic current	0.009	0.068	-	-0.059	-
	Maximum harmonic current	0.010	-	0.102	-	-0.092
34*	Average harmonic current	0.001	0.054	-	-0.053	-
	Maximum harmonic current	0.002	-	0.081	-	-0.079
35*	Average harmonic current	0.006	0.064	-	-0.059	-
	Maximum harmonic current	0.007	-	0.096	-	-0.089
36	Average harmonic current	0.001	0.051	-	-0.050	-
	Maximum harmonic current	0.002	-	0.077	-	-0.075
37*	Average harmonic current	0.008	0.061	-	-0.053	-
	Maximum harmonic current	0.010	-	0.091	-	-0.081
38	Average harmonic current	0.001	0.048	-	-0.048	-
	Maximum harmonic current	0.002	-	0.073	-	-0.071
39*	Average harmonic current	0.005	0.058	-	-0.052	-
	Maximum harmonic current	0.006	-	0.087	-	-0.081
40	Average harmonic current	0.000	0.046	-	-0.046	-
	Maximum harmonic current	0.002	-	0.069	-	-0.067
	*Partial odd harmonic current	0.052	0.251	-	-0.199	-

Table 23: Harmonic Current Emissions measurement – L3 continued

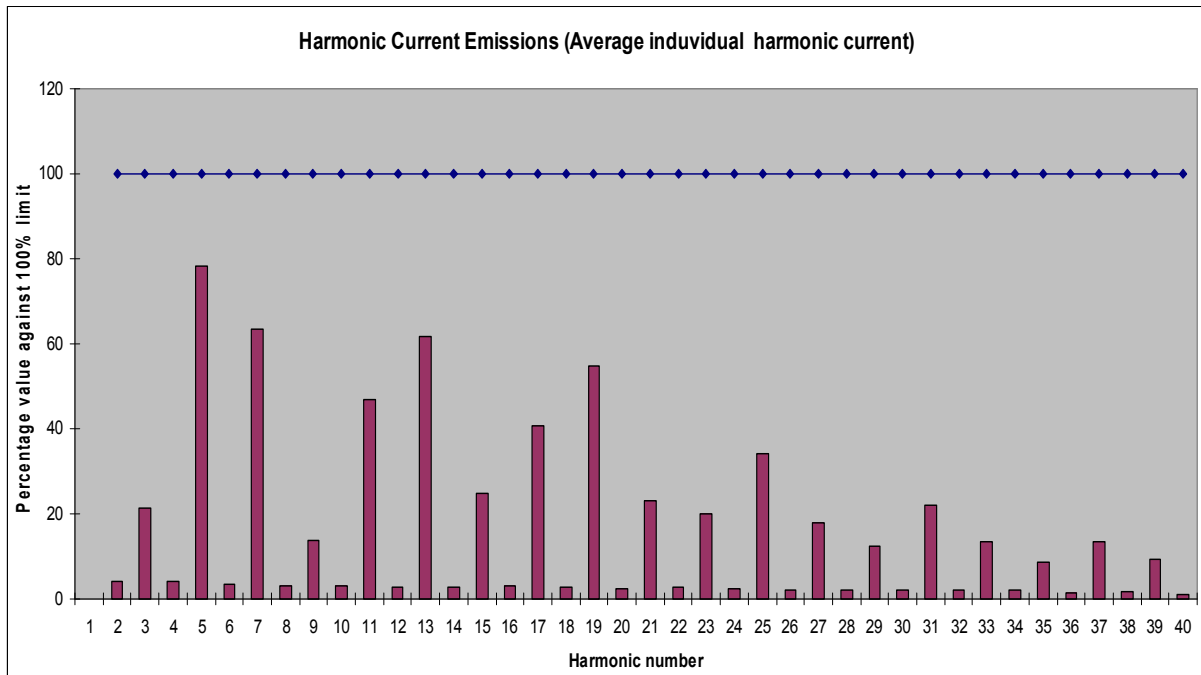


Table 24: Harmonic Current Emissions measurement – L3 – Average values of individual harmonic current

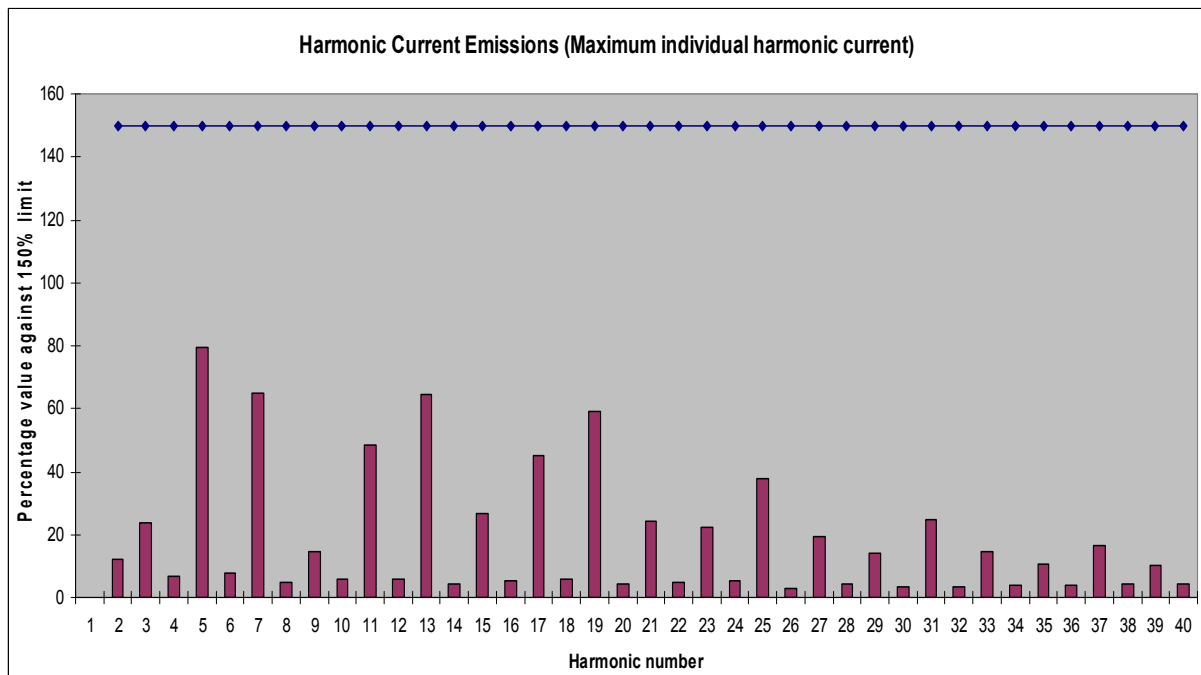


Table 25: Harmonic Current Emissions measurement – L3 – Maximum values of individual harmonic current

Climatic Conditions	
Temperature:	31°C
Humidity:	31%

Table 26: Climatic conditions

Comments: Harmonic Current Emissions were below the limit for Class A equipment.

Assessment: The modified EUT complied with the Harmonic Current Emissions requirements of EN 61000-3-2: 2006 (plus amendments to 2009)

9. Voltage Changes, Fluctuations & Flicker (EN 61000-3-3)

9.1. Test Procedure

The EUT was tested for Voltage Change, Fluctuations and Flicker in accordance with EN 61000-3-3. The EUT was connected to a flicker analyser.

The test duration was 120 minutes, consisting of 12 short-term observation periods of 10 minutes. The results were produced in graphical and tabular form.

(Refer to photograph 40 in Appendix B for a view of the test configuration)

9.2. Requirements

The EUT is deemed to comply if the following conditions are achieved:

- The value of P_{st} shall not be greater than 1.0.
- The value of P_{it} shall not be greater than 0.65.
- The value of $d(t)$ during a voltage change shall not exceed 3.3% for more than 500 ms.
- The relative steady-state voltage change, d_c , shall not exceed 3.3%.
- The maximum relative voltage change d_{max} , shall not exceed:
 - a) 4% without additional conditions;
 - b) 6% for equipment, which is:
 - Switched manually, or
 - Switched automatically more frequently than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds), or manual restart, after a power supply interruption.
 - c) 7% for equipment, which is
 - Attended whilst in use (for example: hair dryers, vacuum cleaners, kitchen equipment such as mixers, garden equipment such as lawn mowers, portable tools such as electric drills), or
 - Switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds) or manual restart, after a power supply interruption.

In the case of equipment having several separately controlled circuits in accordance with Section 6.6 of EN 61000-3-3, conditions b) and c) shall apply only if there is delayed or manual restart after a power supply interruption; for all equipment with automatic switching which is energised immediately on restoration of supply after a power supply interruption, conditions a) shall apply; for all equipment with manual switching, conditions b) or c) shall apply depending on the rate of switching. P_{st} and P_{it} requirements shall not be applied to voltage changes caused by manual switching.

The conditions are not applied to voltage changes associated with emergency switching or emergency interruptions.

9.3. Test Results

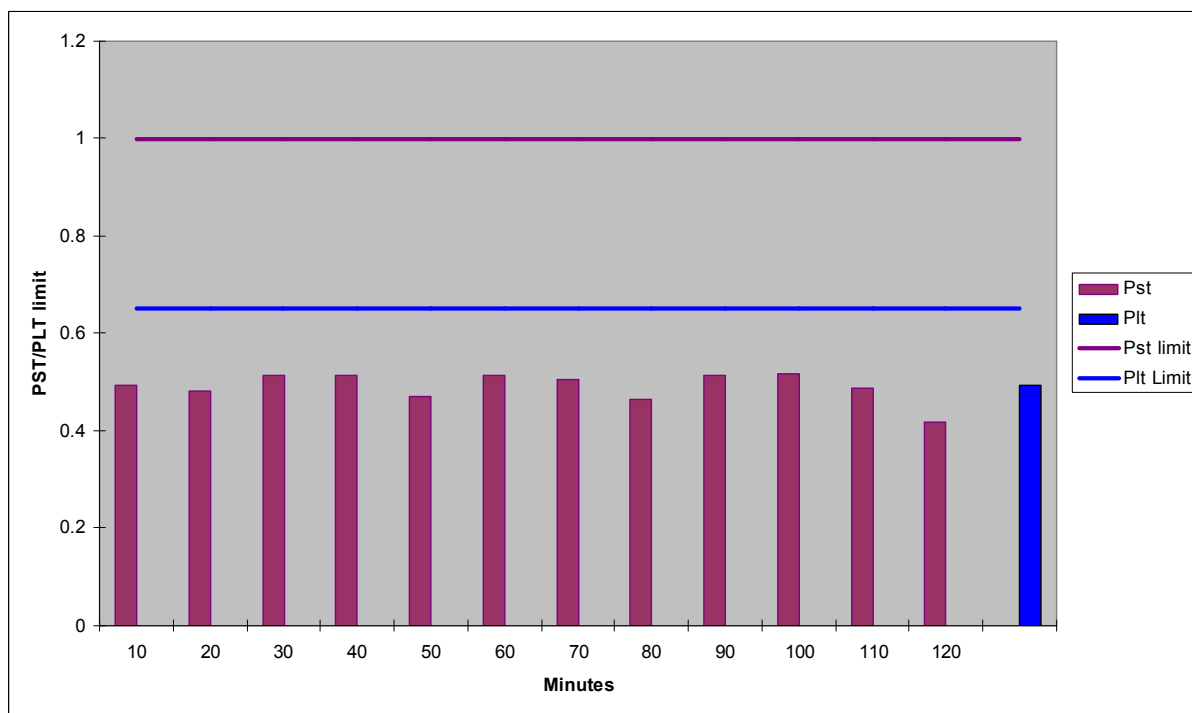


Table 27: Voltage Changes, Fluctuations and Flicker measurements – L1

Line	Item	Value	Limit	Delta limit
L1	Maximum Short-term Flicker Indicator (P_{st})	0.518	1.000	-0.482
	Long-term Flicker Indicator (P_{lt})	0.493	0.650	-0.157

Table 28: Voltage Changes, Fluctuations and Flicker measurements – L1

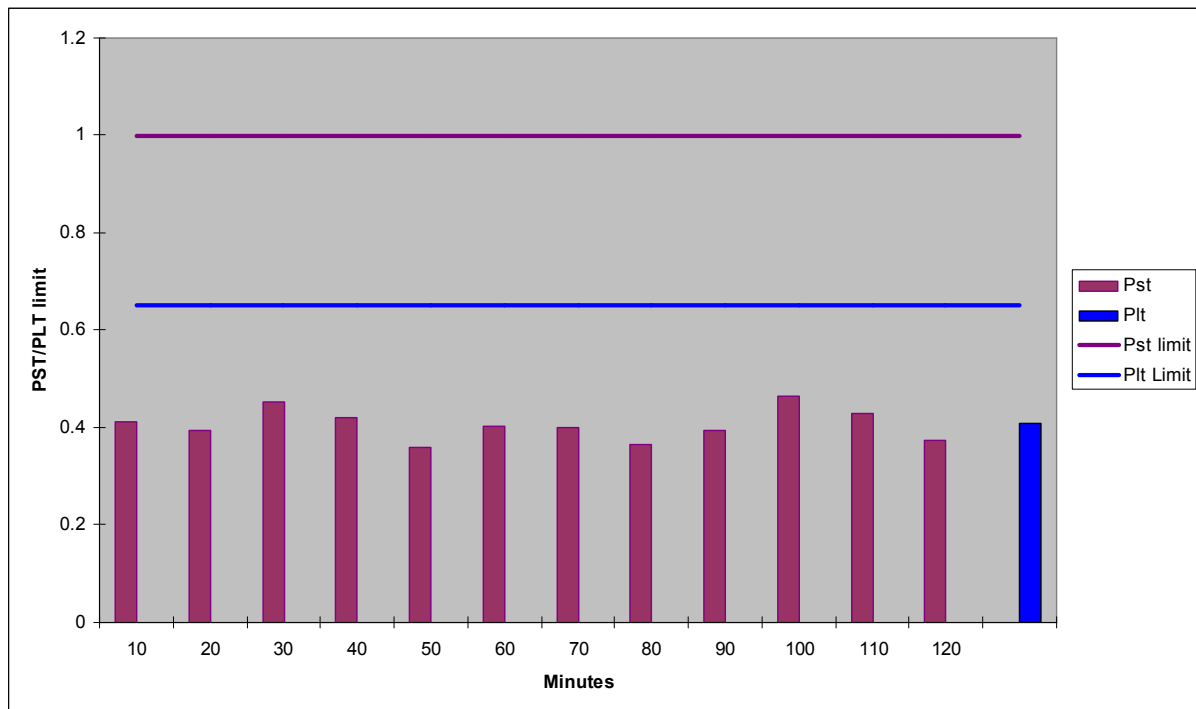


Table 29: Voltage Changes, Fluctuations and Flicker measurements – L2

Line	Item	Value	Limit	Delta limit
L1	Maximum Short-term Flicker Indicator (P_{st})	0.464	1.000	-0.536
	Long-term Flicker Indicator (P_{lt})	0.408	0.650	-0.242

Table 30: Voltage Changes, Fluctuations and Flicker measurements – L2

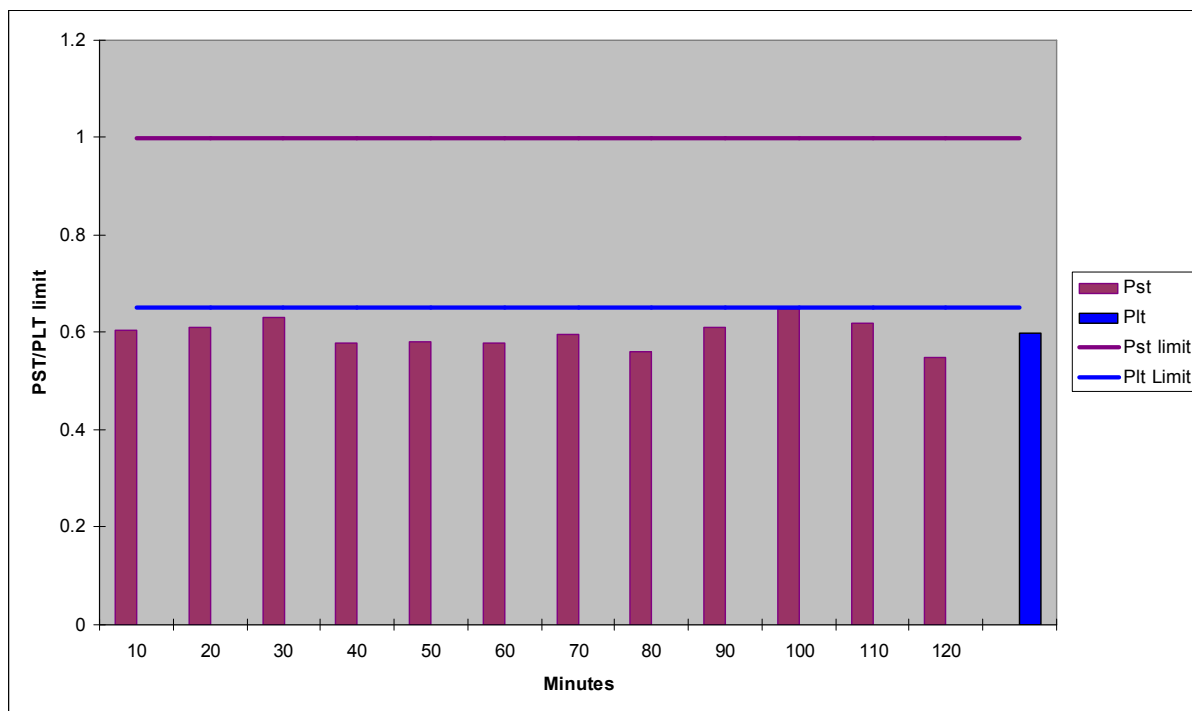


Table 31: Voltage Changes, Fluctuations and Flicker measurements – L3

Line	Item	Value	Limit	Delta limit
L1	Maximum Short-term Flicker Indicator (P_{st})	0.649	1.000	-0.351
	Long-term Flicker Indicator (P_{lt})	0.598	0.650	-0.052

Table 32: Voltage Changes, Fluctuations and Flicker measurements – L3

Climatic Conditions	
Temperature:	31°C
Humidity:	31%

Table 33: Climatic conditions

Comments: Voltage Changes, Fluctuations and Flicker measurements were below the specified limits.

Assessment: The modified EUT complied with the Voltage Changes, Fluctuations and Flicker requirements of EN 61000-3-3: 2008.

10. Conclusion

The modified Seeley International Pty Ltd, ENV, Fixed Evaporative Air Cooler complied with the applicable requirements of EN 61000-6-3: 2007 (plus amendment1: 2011).

Appendix A – Test Equipment

Inv	Equipment	Make	Model No	Serial No	Calibration	
					Due	Type
Radiated Disturbance (Radiated Emissions)						
R037*	EMI Receiver	Rohde & Schwarz	ESU 40	100182	Feb 14	E
A363*	Biconilog Antenna	Sunol Sciences	JB6	A012312	Apr 14	E
C422*	CABLE, Coax	EMCT	P1to10mSR	N/A	Feb 14	I
C437*	CABLE, Coax	Rojone	CA-02013A13A700-08R	Lot 64602	Feb 14	I
Room12*	Indoor OATS (iOATS)	Frankonia	-	-	Dec 13	V
Mains Terminals Disturbance Voltage (Conducted Emissions)						
818	EMI Receiver	Rohde & Schwarz	ESIB40	100295	Aug 14	E
44	Transient Limiter	Hewlett Packard	11947A	2820A00132	Jan 15	I
232	LISN, Three Phase	Schwarzbeck	NNLK 8121	8121216	Mar 14	E
793	Cable, Coax, Multiflex MF141	Huber+Suhner	84025724/1806	C351	Apr 14	I
810	Cable, Coax, Multiflex MF141	Huber+Suhner	84025730/1806	C324	Aug 14	I
666	Enclosure, Semi-Anechoic, No 1	RFI Ind	S800 iOATS	1229	Dec 14	I
Harmonics and Flicker						
1089	ANALYSER, Power Quality	Hioki	3196	030916297	Oct 14	E
1089c	Clamp Sensor	Hioki	9661	-	Oct 14	E
1089d	Clamp Sensor	Hioki	9661	-	Oct 14	E
1089e	Clamp Sensor	Hioki	9661	-	Oct 14	E
General Equipment						
997	Hygrometer, Temp, Humidity	RS	408	6109	Mar 14	E

V: Verification of operation against an internal reference

I: Internal calibration against a NATA traceable standard

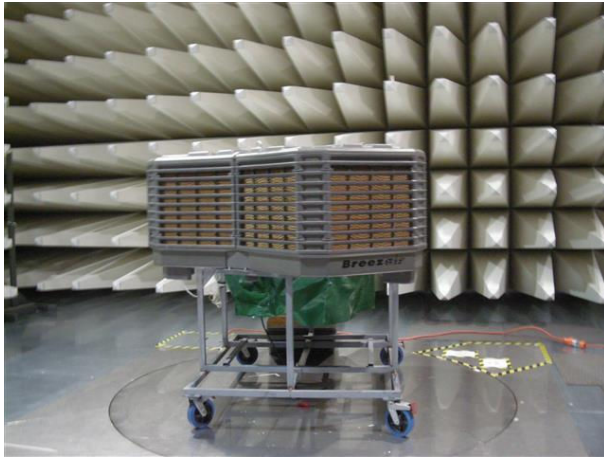
E: External calibration by a NATA endorsed facility

N/A: Not Applicable

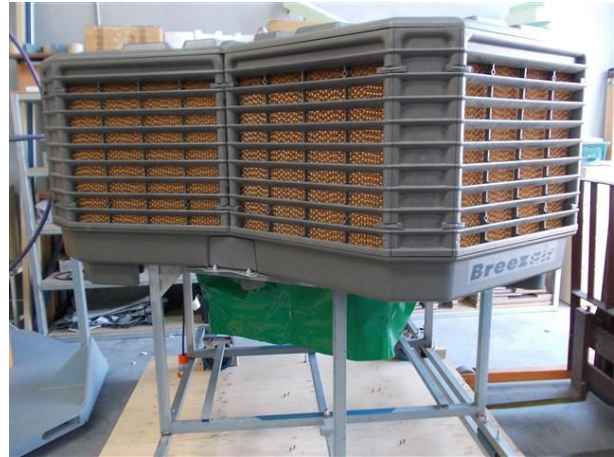
**Property of EMC Technologies Pty Ltd*

Appendix B – Photographs

Number	Photograph Description
1	EUT – ENV Cooler – External views
2	
3	
4	EUT – Wall controller – External views
5	
6	
7	EUT – BMS controller – External views
8	
9	EUT – ENV Cooler – Internal views
10	
11	
12	
13	
14	
15	EUT – Wall controller – Internal views
16	
17	EUT – BMS controller – Internal views
18	
19	EUT – ENV Cooler – Identification labels
20	
21	EUT – ENV Cooler – Fan motors (3 motors) - Identification labels
22	
23	
24	EUT – Wall controller – Identification label
25	
26	Radiated Disturbance – Test configuration
27	
28	Radiated Disturbance – Modifications
29	
30	
31	
32	
33	
34	
35	Mains Terminal Disturbance Voltage – Test configuration
36	
37	Mains Terminal Disturbance Voltage – AC Mains filter modification
38	
39	
40	Harmonics current emissions and voltage change, fluctuation and flicker – Test configuration



Photograph 1



Photograph 2



Photograph 3



Photograph 4



Photograph 5



Photograph 6



Photograph 7



Photograph 8



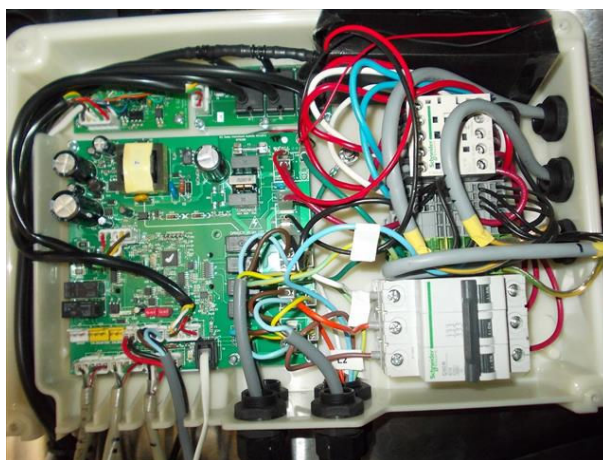
Photograph 9



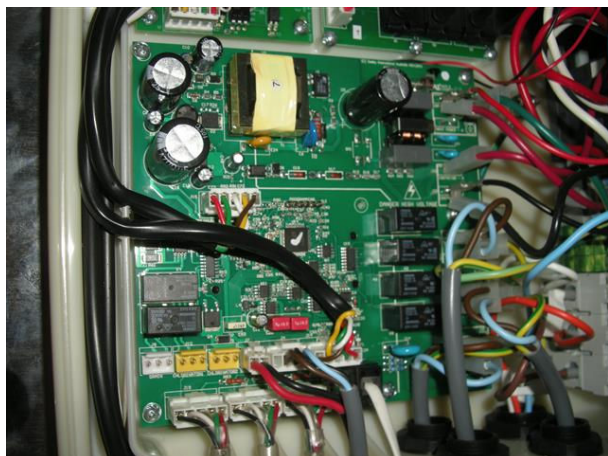
Photograph 10



Photograph 11



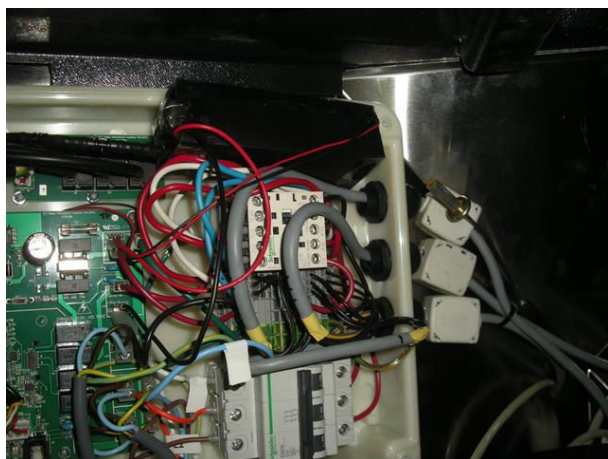
Photograph 12



Photograph 13



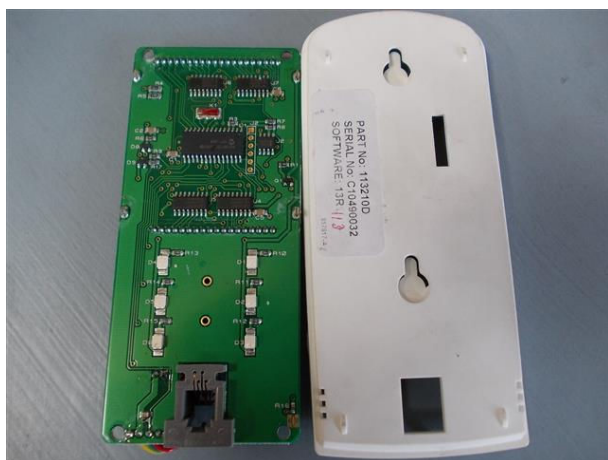
Photograph 14



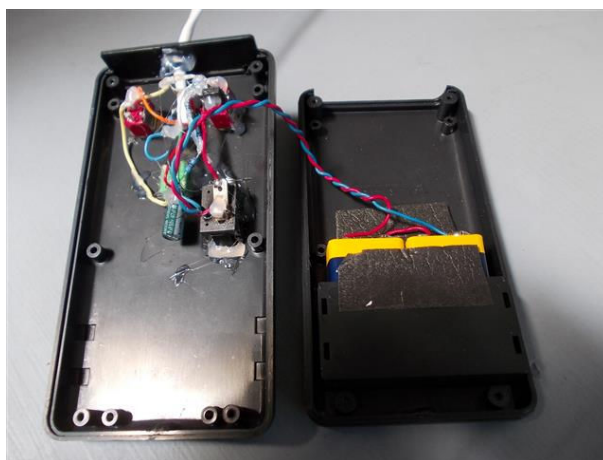
Photograph 15



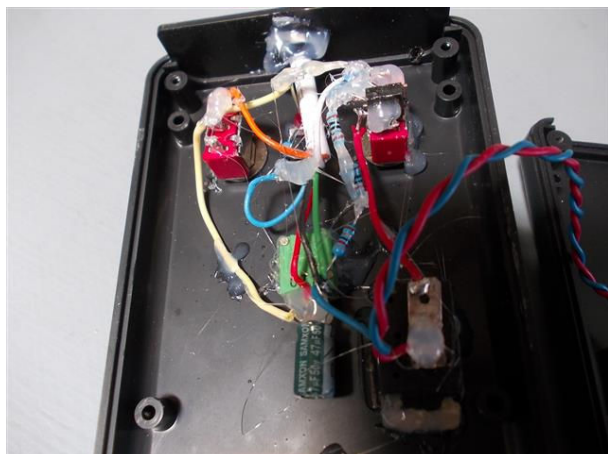
Photograph 16



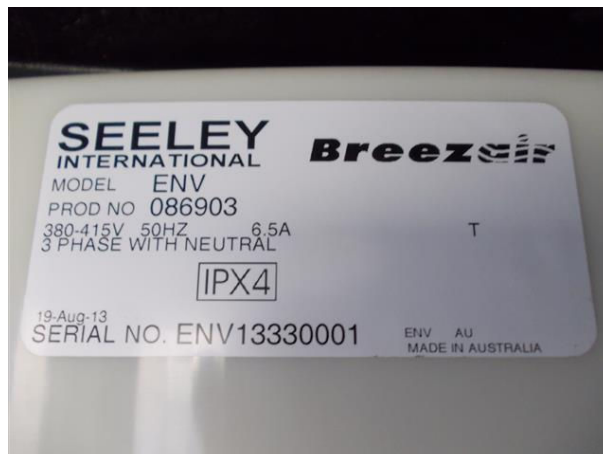
Photograph 17



Photograph 18



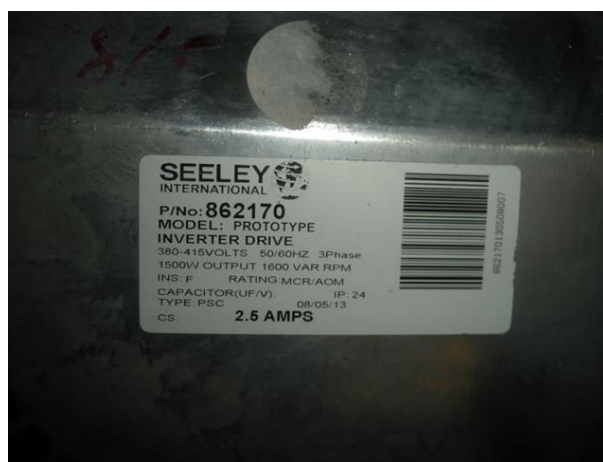
Photograph 19



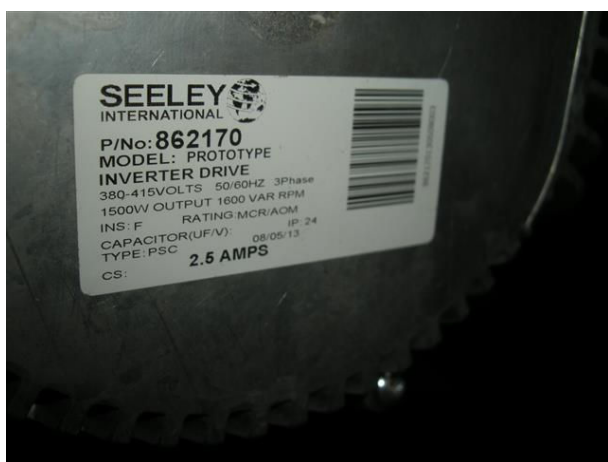
Photograph 20



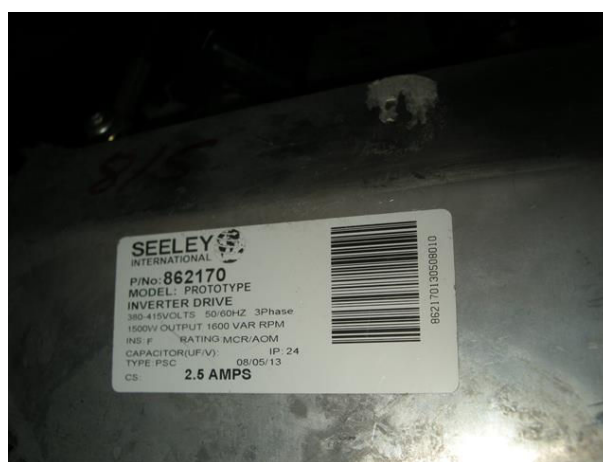
Photograph 21



Photograph 22



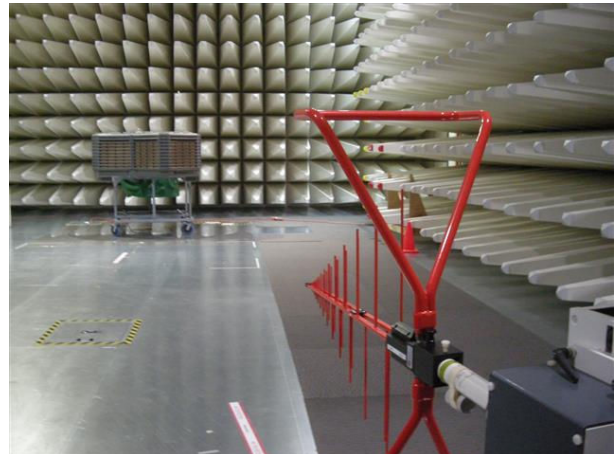
Photograph 23



Photograph 24



Photograph 25



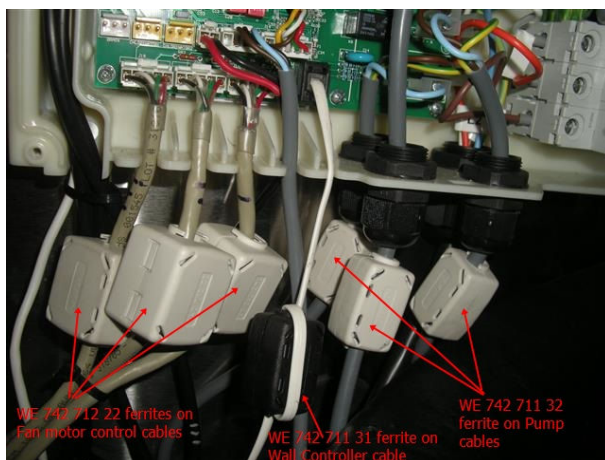
Photograph 26



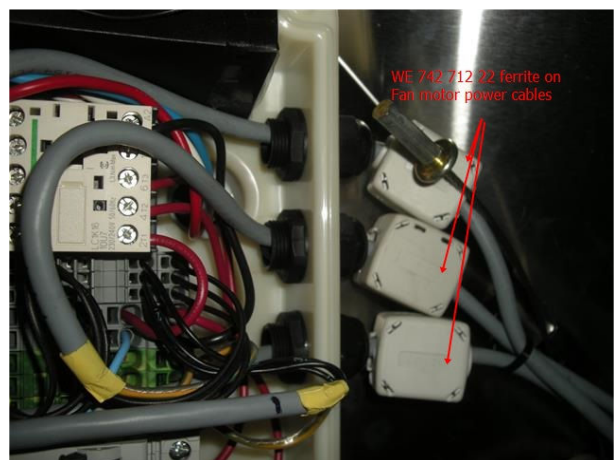
Photograph 27



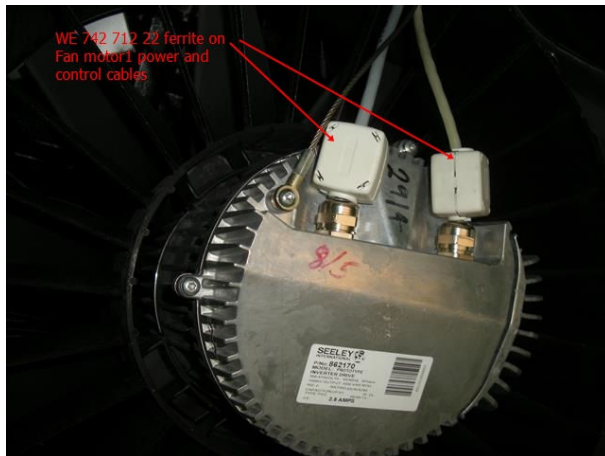
Photograph 28



Photograph 29



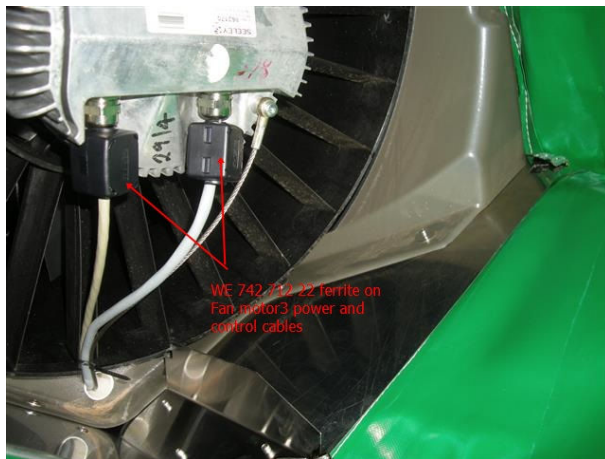
Photograph 30



Photograph 31



Photograph 32



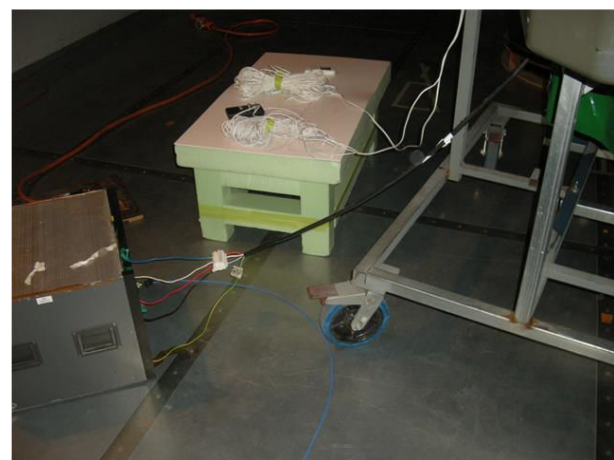
Photograph 33



Photograph 34



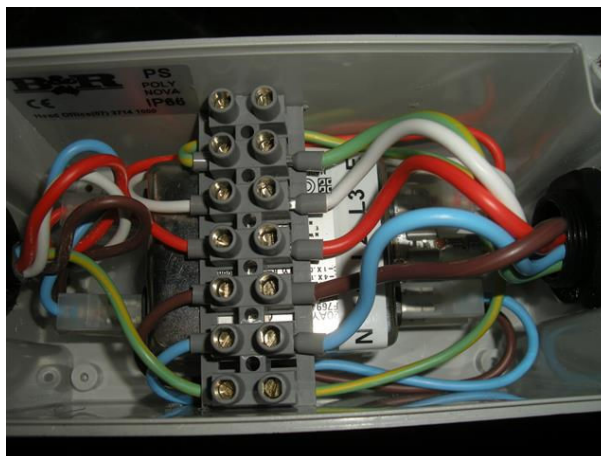
Photograph 35



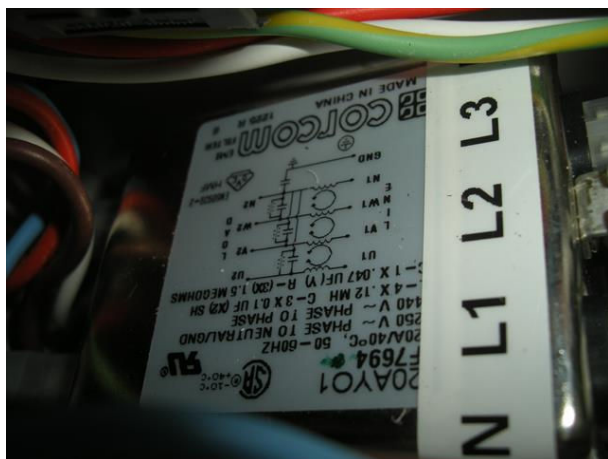
Photograph 36



Photograph 37



Photograph 38



Photograph 39



Photograph 40

Appendix C – Measurement Graphs

No.	Test	Graph Description
1	Radiated Disturbance	Horizontal Antenna Polarisation (30MHz to 1GHz)
2		Vertical Antenna Polarisation (30MHz to 1GHz)
3	Mains Terminal Disturbance Voltage	Line 1
4		Line 2
5		Line 3
6		Neutral Line

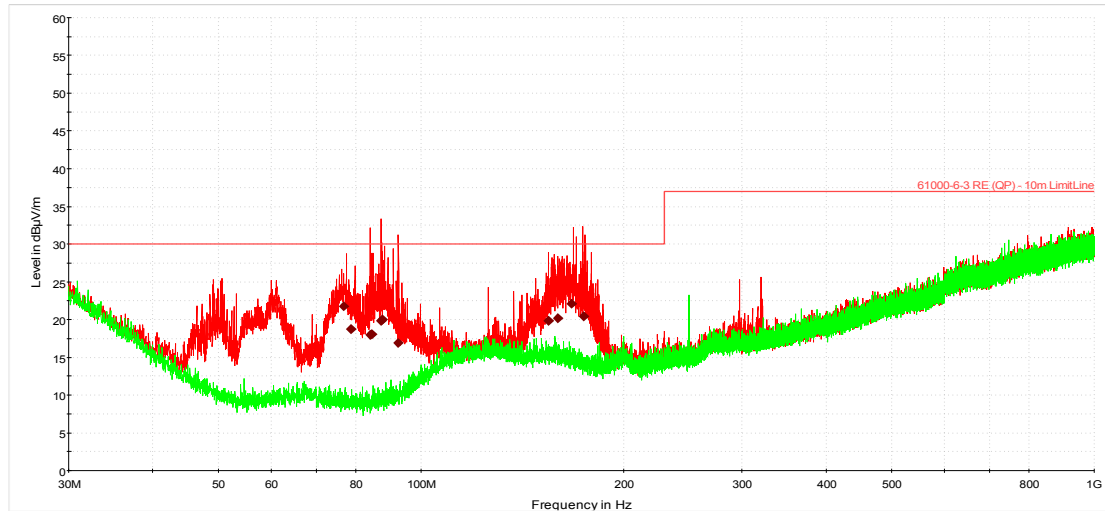


EMC Bayswater Pty. Ltd.

**EN 61000-6-3: 2007 (plus amendment1: 2011) -
Radiated Disturbance
Seeley International Pty Ltd - ENV - Fixed Evaporative Air
Cooler
Horizontal Antenna Polarisation – 30MHz to 1GHz**

Job Number: E1402-0421-1

Test Engineer: NL



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Graph 1

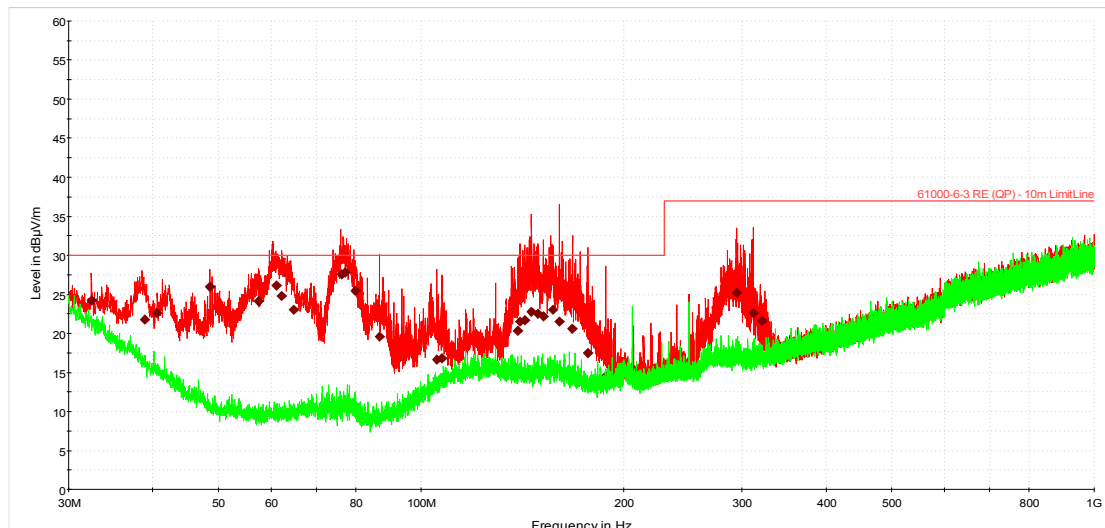


EMC Bayswater Pty. Ltd.

**EN 61000-6-3: 2007 (plus amendment1: 2011) -
Radiated Disturbance
Seeley International Pty Ltd - ENV - Fixed Evaporative Air
Cooler
Vertical Antenna Polarisation – 30MHz to 1GHz**

Job Number: E1402-0421-1

Test Engineer: NL



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Graph 2

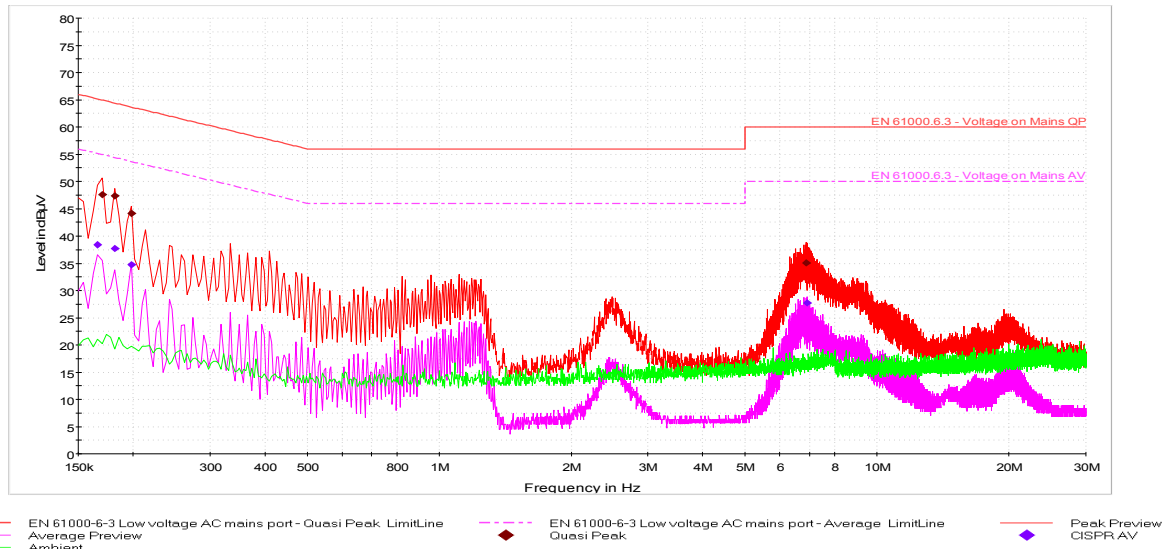


EMC Bayswater Pty. Ltd.

**EN 61000-6-3: 2007 (plus amendment1: 2011) - Mains
Terminal Disturbance Voltage**
**Seeley International Pty Ltd - ENV - Fixed Evaporative Air
Cooler**
L1

Job Number: E1402-0421-1

Test Engineer: NL



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Graph 3

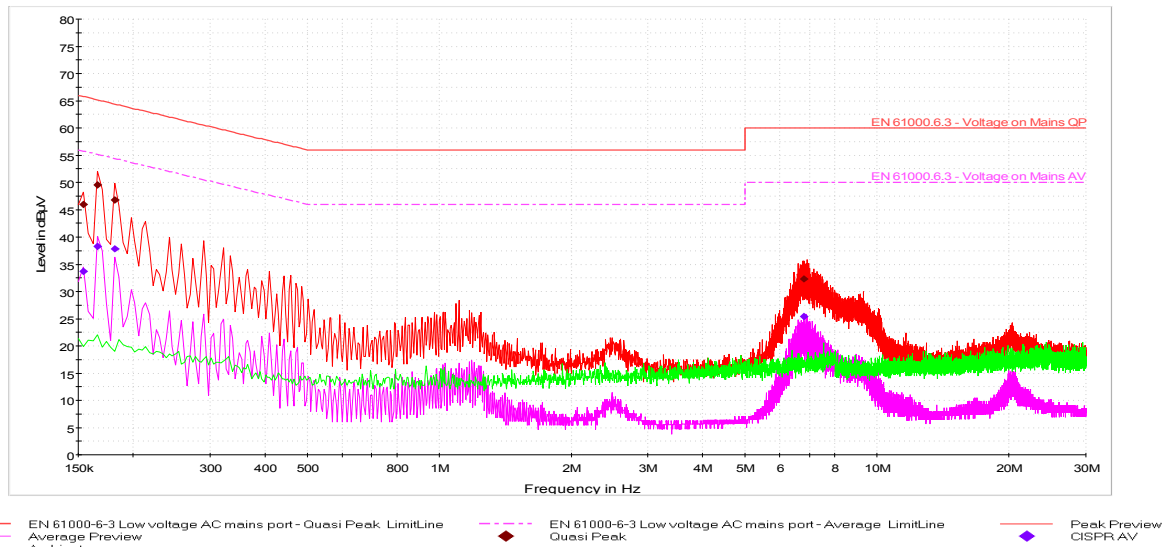


EMC Bayswater Pty. Ltd.

**EN 61000-6-3: 2007 (plus amendment1: 2011) - Mains
Terminal Disturbance Voltage**
**Seeley International Pty Ltd - ENV - Fixed Evaporative Air
Cooler**
L2

Job Number: E1402-0421-1

Test Engineer: NL



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Graph 4

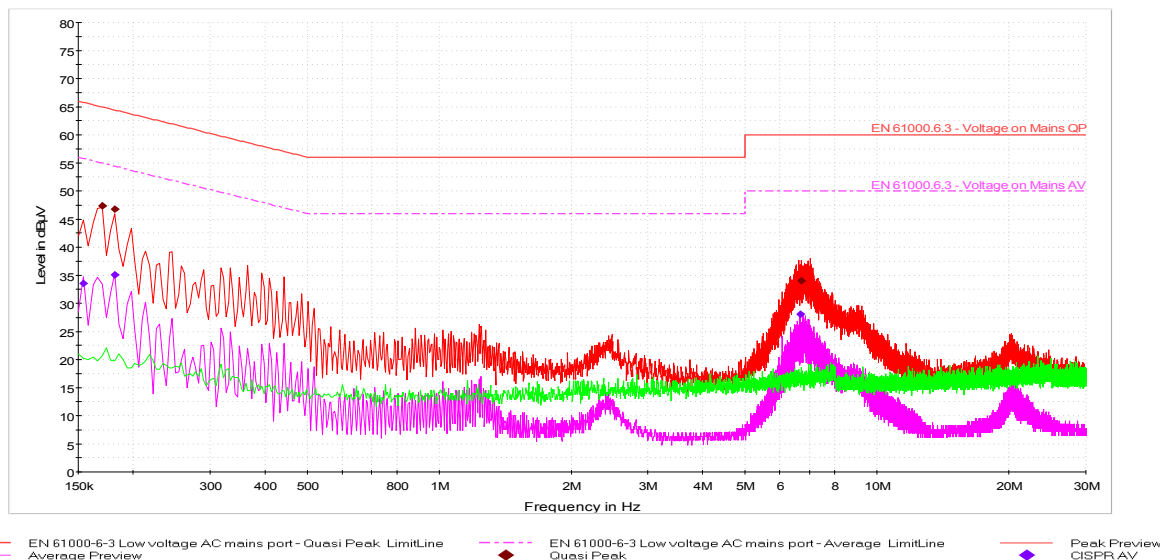


EMC Bayswater Pty. Ltd.

**EN 61000-6-3: 2007 (plus amendment1: 2011) - Mains
Terminal Disturbance Voltage**
**Seeley International Pty Ltd - ENV - Fixed Evaporative Air
Cooler**
L3

Job Number: E1402-0421-1

Test Engineer: NL



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Graph 5

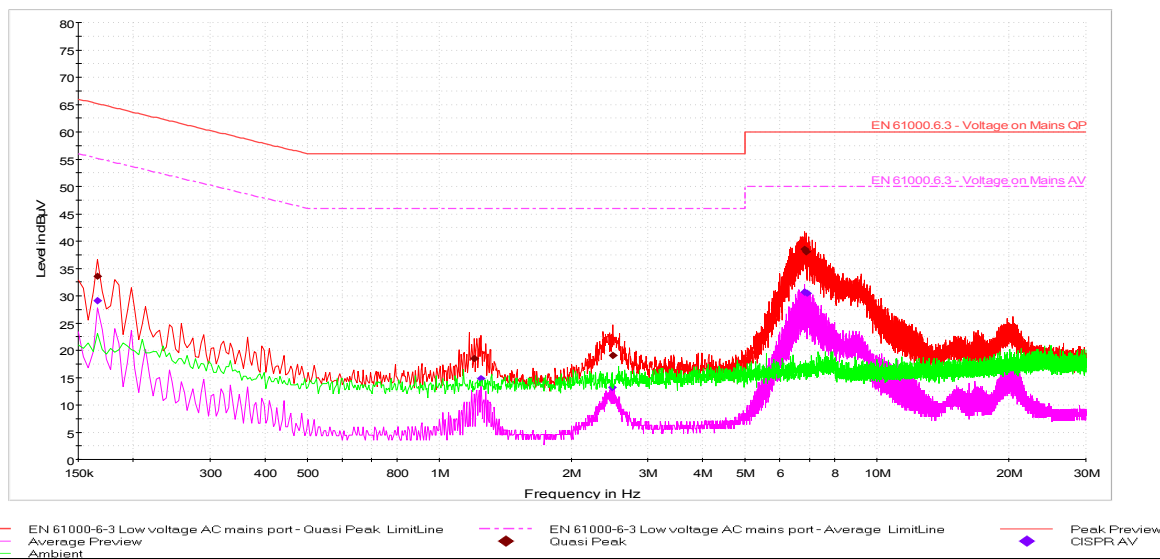


EMC Bayswater Pty. Ltd.

**EN 61000-6-3: 2007 (plus amendment1: 2011) - Mains
Terminal Disturbance Voltage**
**Seeley International Pty Ltd - ENV - Fixed Evaporative Air
Cooler**
Neutral Line

Job Number: E1402-0421-1

Test Engineer: NL



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Graph 6