

**Test Report (pdf copy)
EMC Testing of
immerSUN II
for
4ECO Ltd**

Document number 11395/TR/2

Project number C1485

Author: *S Brennan*
.....
S Brennan
Senior EMC Technician

Checked: *M Nicholson*
.....
M Nicholson, BEng (Hons), iNCE
Acting Laboratory Manager

Approved: *M Nicholson*
.....
M Nicholson, BEng (Hons), iNCE
Acting Laboratory Manager

Issue	Description	Issue by	Date
2	Second Issue	MJN	28 th August 2014

Disclaimers: Tests marked "not UKAS accredited" are not included in the UKAS accreditation schedule of our laboratory. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The uncertainties are for a confidence probability of not less than 95%

This report shall not be reproduced, except in full, without the prior written approval of York EMC Services (2007) Ltd

This test reports relates only to the unit(s) tested



1574



Instrumentation, Consultancy
and Research, Training

**A BIS
designated
Notified Body
No 1892**
Consultancy



**INVESTORS
IN PEOPLE**

York EMC Services (2007) Ltd
UNIVERSITY of York
Heslington,
York,
YO10 5DD,
UK

T: +44 (0)1904 324440
F: +44 (0)1904 324434
E: enquiry@yorkemc.co.uk

www.yorkemc.co.uk

Registered in England and Wales
Company Reg No. 6048589
VAT Reg No. GB 647 2055 41

CONTENTS

1	Introduction	4
2	Test Specification	5
2.1	Environment	5
2.2	Relevant standards	5
2.2.1	Emissions	5
2.2.2	Immunity	6
3	Test Results	8
3.1	Conducted emissions (150kHz to 30MHz).....	8
3.2	Radiated emissions (30MHz to 1000MHz).....	10
3.3	Harmonic emissions	12
3.4	Flicker.....	13
3.5	Radiated Immunity (80MHz to 1000MHz).....	14
3.6	Immunity to ESD	15
3.7	Immunity to EFT/B.....	16
3.8	Conducted RF Immunity (150kHz to 230MHz)	17
3.9	Immunity to Surge	18
3.10	Voltage Dips and Interruptions.....	19
4	Summary	20
4.1	Emissions	20
4.2	Immunity.....	21
4.3	Compliance statement.....	21
5	Appendices	22
5.1	Appendix 1 Conducted emission test method.....	22
5.2	Appendix 2 Radiated emission test method (30MHz to 300MHz)	23
5.3	Appendix 3 Harmonic emissions test method (50Hz to 2000Hz).....	24
5.4	Appendix 4 Flicker test method	25
5.5	Appendix 5 Radiated immunity test method.....	26
5.6	Appendix 6 Immunity to ESD test method	27
5.7	Appendix 7 Immunity to EFT/B test method.....	28
5.8	Appendix 8 Immunity to Surge test method	29
5.9	Appendix 9 Conducted RF immunity test method.....	30
5.10	Appendix 10 Immunity to voltage dips and interruptions test method	31
5.11	Appendix 11 ESD test point locations	32
5.12	Appendix 12 Conducted emissions test results (150kHz to 30MHz)	33
5.13	Appendix 13 Radiated emissions test results (30MHz to 1000MHz).....	35
5.14	Appendix 14 Harmonic emissions results	36

5.15 Appendix 15 Flicker results 42

5.16 Appendix 16 EUT test configurations 44

5.17 Appendix 17 Reporting the results 50

5.18 Appendix 18 Equipment used 51

5.19 Appendix 19 Customers test equipment used 52

5.20 Appendix 20 Modification States 53

5.21 Appendix 21 Test Report History 54

5.22 Appendix 22 Harmonics repeatability outcomes 55

1 Introduction

Name and address of laboratory: York EMC Services (2007) Ltd
Three Lane Ends Business Centre
Methley Road
Castleford
West Yorkshire
WF10 1PN
UKAS testing laboratory N° 1574

Name and address of client: 4ECO Ltd
3 Church View Business Centre
Binbrook
Lincolnshire
LN8 6BY

The test results contained in this test report relate only to the unit(s) tested.

Equipment under test	Energy Management Unit
Manufacturer	4ECO Ltd
Product name	immerSUN II
Serial number	211651
Model number	T1060
Date of receipt of EUT	30 th April 2014
Method of receipt	Brought by customer
Date(s) of test(s)	30 th April, 1 st , 2 nd May and 4 th July 2014 28 th August 2014
Date(s) when EUT was out of laboratory's control	None
Method of disposal	Taken by customer
Personnel witnessing tests	The testing was part witnessed by Mr Lee Sutton of 4ECO Ltd
Any other relevant information	None

2 Test Specification

2.1 Environment

The equipment is intended for use in the residential, commercial, light industrial and industrial environments.

2.2 Relevant standards

2.2.1 Emissions

Product Specific Standard	Basic Standard	Class/limit	Test
EN55014-1:2006 +A2:2011	Radiated emissions EN55016-2-3:2006	Limits as Table 3	6 & 10
	Conducted emissions (ac power) EN55014-1:2006 +A2:2011	Limits as Table 1	1

Basic Standard	Class/limit	Test
Harmonic emissions EN61000-3-2:2006 +A1:2009 +A2:2009	A	2
Flicker EN61000-3-3:2008	As defined in EN61000-3-3:2008	3

Note 1: The EUT was tested in one mode of operation.

Note 2: Testing took place in Ramp Mode, this is a test mode which ramps the output voltage continuously up and down from 30% to 100% of the input voltage, this is done in 1% steps and changes at the zero cross point. Therefore to ramp up from 30% to 100% takes around 1.4 seconds.

Note 3: Only the tests listed were requested by the customer.

2.2.2 Immunity

Product Specific Standard	Basic Standard	Level	Test
EN55014-2:1997 +A1:2001 +A2:2008	ESD EN61000-4-2:1995 +A1:1998 +A2:2001 (See Notes 2 & 3)	± 4kV air, ± 8kV contact	5
	Radiated Immunity EN61000-4-3:2006 +A1:2008	3V/m, 80MHz-1000MHz, 80% 1kHz AM	7
	EFT/B EN61000-4-4:2004	± 1kV ac power, ± 1kV signal ports	10 & 11
	Conducted RF Immunity EN61000-4-6:2007 +corr:2007	1kHz 80% AM, 150kHz-230MHz, 3Vrms ac power, 3Vrms signal ports	8 & 9
	Surge EN61000-4-5:2006	± 2kV ac power, line to earth, ± 1kV ac power, line to line	13
	Voltage Dips and Interruptions EN61000-4-11:2004	30% dip for 0.5 periods, 60% dip for 5 periods, 100% dip for 250 periods	4

Note 1: The EUT was tested in one mode of operation.

Note 2: EN55014-2:1997+A1:2001+A2:2008 references dated basic standards. In cases where amendments to basic standards have been included in the testing, it is specifically stated as such.

Note 3: EN 55014-2:1997+A1:2001 +A2:2008 refers to EN 61000-4-2:1995+A1 +A2 for the ESD test. The test shall be performed according to EN61000-4-2:1995+A1+A2, however, the ESD simulator is calibrated according to the later version of the standard, EN 61000-4-2:2009.

Note 4: Testing took place in Ramp Mode, this is a test mode which ramps the output voltage continuously up and down from 30% to 100% of the input voltage, this is done in 1% steps and changes at the zero cross point. Therefore to ramp up from 30% to 100% takes around 1.4 seconds.

Performance criteria

The following parameters were monitored during immunity testing.

Parameter	Nominal value/state	Unacceptable change
Heater red LED	LED pulsing	LED failing to pulse, LED on continuously, LED extinguishing
EUT display	Normal text	Text becoming corrupted or display becoming blank

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.

Performance criteria for immunity testing is divided into three categories:

Criterion A

Tests: Radiated immunity and Conducted Immunity.

During test, normal performance within specification limits. The above parameters and unacceptable change apply.

Criterion B

Tests: Voltage Dips, ESD, Fast transients and Surge

During test temporary degradation or loss of function which is self recovering.

Criterion C

Tests: Five second mains interruption.

During testing, temporary degradation or loss of function or performance which requires operator intervention or system reset occurs.

3 Test Results

3.1 Conducted emissions (150kHz to 30MHz)

Mode of operation	Description	Mode No.
	230V ac powered, EUT in Ramp test mode	1

Test standard	Test description	Class/limit
EN55014-1:2006 +A2:2011	Conducted emissions, (ac power port)	Limits as Table 1

Results	Mode	Figure	Result	Comments
	1	C01	Pass	230V ac power i/p, continuous emissions (composite plot Live & Neutral conductors)
	1	C02	Pass	230V ac power i/p, discontinuous emissions (Live conductor)
	1	C03	Pass	230V ac power i/p, discontinuous emissions (Neutral conductor)

Continuous emissions QP Results					
QP Results	Mode	Freq (MHz)	QP level (dBuV)	Limit (dBuV)	Comments
	1	0.150	63.6	66	230V ac power, Neutral conductor
		0.335	48.4	59	230V ac power, Neutral conductor
		0.800	44.4	56	230V ac power, Live conductor
		0.955	44.4	56	230V ac power, Live conductor
		1.400	44.4	56	230V ac power, Neutral conductor
		18.580	49.6	60	230V ac power, Live conductor

Continuous emissions Average Results					
Average Results	Mode	Freq (MHz)	Average level (dBuV)	Limit (dBuV)	Comments
	1	0.800	39.6	46	230V ac power, Live conductor
		0.890	38.7	46	230V ac power, Neutral conductor
		0.955	39.7	46	230V ac power, Live conductor
		18.58	42.4	50	230V ac power, Live conductor
		1.245	38.2	46	230V ac power, Neutral conductor
		1.490	38.8	46	230V ac power, Live conductor

Note 1: The graphical data can be found in Appendix 12.

Modifications	Required for this test	Modification state
Continuous Emissions	None	1
Discontinuous emissions	None	0

3.2 Radiated emissions (30MHz to 1000MHz)

Mode of operation	Description	Mode No.
	230V ac powered, EUT in Ramp test mode	1

Test standard	Test description	Class/limit
EN55016-2-3:2006	Radiated emissions	Limits as Table 3

Results	Mode	Figure	Result	Comments
	1	R01	N/A	Fixed height anechoic chamber measurement.
		R02	Pass	These measurements were carried out on an Open Area Test Site (OATS)

Frequency (MHz)	Polarity (H/V)	Height (m)	Angle (degrees)	Detector Type	Measurement distance (m)	Spec distance (m)	E field @ spec distance (dBuV/m)	E field Limit (dBuV/m)	Margin (dB)	Result
44.700	V	1	0	QP	10	10	9.8	30.0	20.2	Compliant
46.440	V	1	0	QP	10	10	18.6	30.0	11.4	Compliant
48.960	V	1	0	QP	10	10	22.0	30.0	8.0	Compliant
50.820	V	1	0	QP	10	10	24.5	30.0	5.5	Compliant
51.300	V	1	0	QP	10	10	25.3	30.0	4.7	Compliant
52.320	V	1	0	QP	10	10	26.5	30.0	3.5	Compliant
53.040	V	1	0	QP	10	10	25.0	30.0	5.0	Compliant
53.760	V	1	0	QP	10	10	21.8	30.0	8.2	Compliant
56.220	V	1	0	QP	10	10	19.7	30.0	10.3	Compliant
57.240	V	1	0	QP	10	10	16.7	30.0	13.3	Compliant

Note 1: The graphical data can be found in Appendix 13.

Modifications	Required for this test	Modification state

	None	0
--	------	---

3.3 Harmonic emissions

Mode of operation	Description	Mode No.
	230V ac powered, EUT in Ramp test mode	1

Test standard	Test description	Class/limit
EN61000-3-2:2006 +A1:2009 +A2:2009	Harmonic emissions	A

Results	Mode	Figure	Result	Comments
	1	H01	Pass	Result A (Appendix 22)
		H02	Pass	Result A (Appendix 22)

Note 1: The graphical data can be found in Appendix 14.

Modifications	Required for this test	Modification state
	None	0

3.4 Flicker

Mode of operation	Description	Mode No.
	230V ac powered, EUT in Ramp test mode	1

Test standard	Test description	Class/limit
EN61000-3-3:2008	Flicker	As defied in EN61000-3-3:2008

Results	Mode	Figure	Result	Comments
	1	F01	Pass	None
		F02	Pass	Inrush (Amendment A1)

Note 1: The graphical data can be found in Appendix 15.

Modifications	Required for this test	Modification state
	None	0

3.5 Radiated Immunity (80MHz to 1000MHz)

Mode of operation	Description	Mode No.
	230V ac powered, EUT in Ramp test mode	1

Test standard	Description	Dwell time (s)	Level
EN61000-4-3:2006 +A1:2008	Radiated immunity	3	3V/m, 80MHz-1000MHz, 80% 1kHz AM

Climatic conditions	Temperature (°C)	Humidity (%)
	20	43

Results	Mode	EUT face	Test Distance	Pol'n	Result	Observed effects & deviations from standard
	1	0°	3	H	Pass	None
		90°	3	H	Pass	None
		180°	3	H	Pass	None
		270°	3	H	Pass	None
		0°	3	V	Pass	None
		90°	3	V	Pass	None
		180°	3	V	Pass	None
		270°	3	V	Pass	None

Note 1: The front face of the EUT is deemed to be 0°, which is then turned in a clockwise direction and measured at 90° intervals.

Modifications	Required for this test	Modification state
	None	0

3.6 Immunity to ESD

Mode of operation	Description	Mode No.
	230V ac powered, EUT in Ramp test mode	1

Test standard	Test description	Number of discharges	Level
EN61000-4-2:1995 +A1:1998 +A2:2001	ESD	10 at each point, per level, per polarity.	± 4kV contact, ± 8kV air

Climatic conditions	Temperature (°C)	Humidity (%)
	23	44

Results	Mode	Discharge Points	Result	Observed effects & deviations from standard
	1	A1	Pass	None
		A2	Pass	None
		A3	Pass	None
		A4	Pass	None
		C1	Pass	None
		C2	Pass	None
		C3	Pass	None
		C4	Pass	None
		H1-H4	Pass	None
		V1-V4	Pass	None

Note 1: The locations of the test points are contained in Appendix 11.

Modifications	Required for this test	Modification state
	None	0

3.7 Immunity to EFT/B

Mode of operation	Description	Mode No.
	230V ac powered, EUT in Ramp test mode	1

Test standard	Description	Application time (s)	Level
EN61000-4-4:2004	EFT/B	60	± 1kV ac power, ± 1kV signal ports

Climatic conditions	Temperature (°C)	Humidity (%)
	21	47

Results	Mode	Cable	Injection	Result	Observed effects & deviations from standard
	1	230V ac mains	Direct	Pass	None
		CT clamp cables x 2	Indirect	Pass	None
		230V ac load output	Direct	Pass	None

Notes: None

Modifications	Required for this test	Modification state
	None	0

3.8 Conducted RF Immunity (150kHz to 230MHz)

Mode of operation	Description	Mode No.
	230V ac powered, EUT in Ramp test mode	1

Test standard	Description	Dwell time (s)	Level
EN61000-4-6:2007 +corr:2007	Conducted RF Immunity	3	1kHz 80% AM, 150kHz-230MHz, 3Vrms ac power, 3Vrms signal ports

Climatic conditions	Temperature (°C)	Humidity (%)
	21	48

Results	Mode	Cable	Injection	Result	Observed effects & deviations from standard
	1	230V ac mains	CDN	Pass	None
		CT clamp cables x 2	Clamp	Pass	None
		230V ac load output	CDN	Pass	None

Notes: None.

Modifications	Required for this test	Modification state
	None	0

3.9 Immunity to Surge

Mode of operation	Description	Mode No.
	230V ac powered, EUT in Ramp test mode	1

Test standard	Description	Time between surges	Level
EN61000-4-5:2006	Surge	60s	± 2kV ac power, line to earth, ± 1kV ac power, line to line

Climatic conditions	Temperature (°C)	Humidity (%)
	21	46

Results	Mode	Cable	Injection	Result	Observed effects & deviations from standard
	1	230V ac mains	Direct	Pass	None

Note 1: See Appendix 8 for further details on the method of application of the surges.

Modifications	Required for this test	Modification state
	In order to pass Surge testing the customer performed the following modification. A surge protection circuit, consisting of a MOV and triac with a TVS diode was installed. Also extra filtering to the output, consisting of a common mode inductor, X and Y caps.	1

3.10 Voltage Dips and Interruptions.

Mode of operation	Description	Mode No.
	230V ac powered, EUT in Ramp test mode	1

Test standard	Description	Dips applied	Interval (s)	Level
EN61000-4-11:2004	Voltage Dips and Interruptions	3 dips	60 seconds	30% dip for 0.5 periods, 60% dip for 5 periods, 100% dip for 250 periods

Climatic conditions	Temperature (°C)	Humidity (%)
	22	47

Results	Mode	Cable	Result	Observed effects & deviations from standard
	1	230V ac power	Pass	None

Notes: None

Modifications	Required for this test	Modification state
	None	0

4 Summary

4.1 Emissions

Product Specific Standard	EN55014-1:2006 +A2:2011
----------------------------------	-------------------------

Basic Standard	Class/limit	Result
Radiated emissions EN55016-2-3:2006	Limits as Table 3	Pass
Conducted emissions EN55014-1:2006 +A2:2011	Limits as Table 1	Pass

Harmonic emissions EN61000-3-2:2006 +A1:2009 +A2:2009	A	Pass
Flicker EN61000-3-3:2008	As defined in EN61000-3-3:2008	Pass

Note 1: The EUT was tested in one mode of operation.

Note 2: Testing took place in Ramp Mode, this is a test mode which ramps the output voltage continuously up and down from 30% to 100% of the input voltage, this is done in 1% steps and changes at the zero cross point. Therefore to ramp up from 30% to 100% takes around 1.4 seconds.

Note 3: Only the tests listed were requested by the customer.

4.2 Immunity

Product Specific Standard	EN55014-2:1997 +A1:2001 +A2:2008
----------------------------------	----------------------------------

Basic Standard	Level	Criterion	Result
ESD EN61000-4-2:1995 +A1:1998 +A2:2001 (See Notes 2 & 3)	± 4kV air, ± 8kV contact	B	Pass
Radiated Immunity EN61000-4-3:2006 +A1:2006	3V/m, 80MHz-1000MHz, 80% 1kHz AM	A	Pass
EFT/B EN61000-4-4:2004	± 2kV ac power, ± 1kV signal ports	B	Pass
Conducted RF Immunity EN61000-4-6:2007 +corr:2007	1kHz 80% AM, 150kHz-230MHz, 3Vrms ac power, 3Vrms signal ports	A	Pass
Surge EN61000-4-5:2006	± 2kV ac power, line to earth, ± 1kV ac power, line to line	B	Pass
Voltage Dips and Interruptions EN61000-4-11:2004	30% dip for 0.5 periods, 60% dip for 5 periods	B	Pass
Voltage Interruptions EN61000-4-11:2004	100% dip for 250 periods	C	Pass

Note 1: The EUT was tested in one mode of operation.

Note 2: EN55014-2:1997+A1:2001+A2:2008 references dated basic standards. In cases where amendments to basic standards have been included in the testing, it is specifically stated as such.

Note 3: EN 55014-2:1997+A1:2001 +A2:2008 refers to EN 61000-4-2:1995+A1 +A2 for the ESD test. The test shall be performed according to EN61000-4-2:1995+A1+A2, however, the ESD simulator is calibrated according to the later version of the standard, EN 61000-4-2:2009.

Note 4: Testing took place in Ramp Mode, this is a test mode which ramps the output voltage continuously up and down from 30% to 100% of the input voltage, this is done in 1% steps and changes at the zero cross point. Therefore to ramp up from 30% to 100% takes around 1.4 seconds.

4.3 Compliance statement

The immerSUN II, as tested, was shown to meet the requirements of the tests listed in 4.1 and 4.2 of this report.

5 Appendices

5.1 Appendix 1 Conducted emission test method

5.1.1 Test information

Standards	EN55014-1:2006 +A2:2008
YES Test Method	CEP19
Equipment Used	Rohde & Schwarz ESHS10 receiver Rohde & Schwarz ESH3-Z5 LISN Chase 9206 transient limiter

Note: Specific set-ups for the EUT are shown in EUT test configurations section of this report (where applicable).

5.2 Appendix 2 Radiated emission test method (30MHz to 300MHz)

5.2.1 Test information

Standards	EN55016-2-3:2006
YES Test Method	CEP23
Equipment Used	Rohde & Schwarz receiver Bilog antenna Rohde & Schwarz positioning mast and controller EMCO 2m diameter turntable and controller

Note: Specific set-ups for the EUT are shown in EUT test configurations section of this report (where applicable).

5.3 Appendix 3 Harmonic emissions test method (50Hz to 2000Hz)

5.3.1 Test information

Standard	EN61000-3-2:2006 +A1:2009 +A2:2009
YES Test Method	CEP17
Measurement uncertainty	Greater of 5% of limit or 0.2% of rated current
Equipment Used	California Instruments PACS-1 California Instruments 5001ix

Note: Specific set-ups for the EUT are shown in EUT test configurations section of this report (where applicable).

5.4 Appendix 4 Flicker test method

5.4.1 Test information

Standard	EN61000-3-3:2008
YES Test Method	CEP18
Measurement uncertainty	5% of the permissible limits
Equipment Used	California Instruments PACS-1 California Instruments 5001ix

Note: Specific set-ups for the EUT are shown in EUT test configurations section of this report (where applicable).

5.5 Appendix 5 Radiated immunity test method

5.5.1 Test information

Standards	EN61000-4-3:2006 +A1:2008
YES Test Method	CEP30
Equipment Used	Anechoic Chamber RF Signal Generator Power Meter with Probes RF Power Amplifier Broadband Antenna Control Computer

Note: Specific set-ups for the EUT are shown in EUT test configurations section of this report (where applicable).

5.6 Appendix 6 Immunity to ESD test method

5.6.1 Test information

Standard	EN61000-4-2:1995 +A1:1998 +A2:2001
YES Test Method	CEP40
Measurement uncertainty	The uncertainties associated with the applied pulse characteristics, calculated at a probability confidence of 95%, were all within the tolerance limits given in the appropriate standard.
Equipment Used	ESD Generator

Note: Specific set-ups for the EUT are shown in EUT test configurations section of this report (where applicable).

5.7 Appendix 7 Immunity to EFT/B test method

5.7.1 Test information

Standard	EN61000-4-4:2004
YES Test Method	CEP41
Measurement Uncertainty	The uncertainties associated with the applied pulse characteristics, calculated at a probability confidence of 95%, were all within the tolerance limits given in the appropriate standard.
Equipment Used	EFT 503 Electrical Fast Transient / Burst Generator

Note: Specific set-ups for the EUT are shown in EUT test configurations section of this report (where applicable).

For ac power lines, the test is applied in common mode as follows:

EUT with Live, Neutral & Earth	EUT with Live & Neutral
live, neutral & earth conductors	live & neutral conductors

For dc lines, the test is applied in common mode as follows:

EUT with 0V & +ve supply
0V & +ve conductor

5.8 Appendix 8 Immunity to Surge test method

5.8.1 Test information

Standard	EN61000-4-5:2006
YES Test Method	CEP42
Measurement Uncertainty	The uncertainties associated with the applied pulse characteristics, calculated at a probability confidence of 95%, were all within the tolerance limits given in the appropriate standard.
Equipment Used	Schaffner Surge Generator

Note: Specific set-ups for the EUT are shown in EUT test configurations section of this report (where applicable).

For ac lines 5 positive and 5 negative pulse is applied at each of 0°, 90°, 180 ° and 270° (making 40 pulses) for each severity level up to and including the required severity level (where applicable) and in the following configurations

Live to neutral

Live to earth

Neutral to earth

5.9 Appendix 9 Conducted RF immunity test method

5.9.1 Test information

Standards	EN61000-4-6:2007 +corr:2007
YES Test Method	CEP2
Equipment Used	Screened enclosure RF Signal Generator Power Meter with Probes RF Power Amplifier Coupling Units as required Control Computer

Note: Specific set-ups for the EUT are shown in EUT test configurations section of this report (where applicable).

5.10 Appendix 10 Immunity to voltage dips and interruptions test method

5.10.1 Test information

Standard	EN61000-4-11:2004
YES Test Method	CEP43
Measurement Uncertainty	The uncertainties associated with the applied pulse characteristics, calculated at a probability confidence of 95%, were all within the tolerance limits given in the appropriate standard.
Equipment Used	UCS500

Note: Specific set-ups for the EUT are shown in EUT test configurations section of this report (where applicable).

5.11 Appendix 11 ESD test point locations

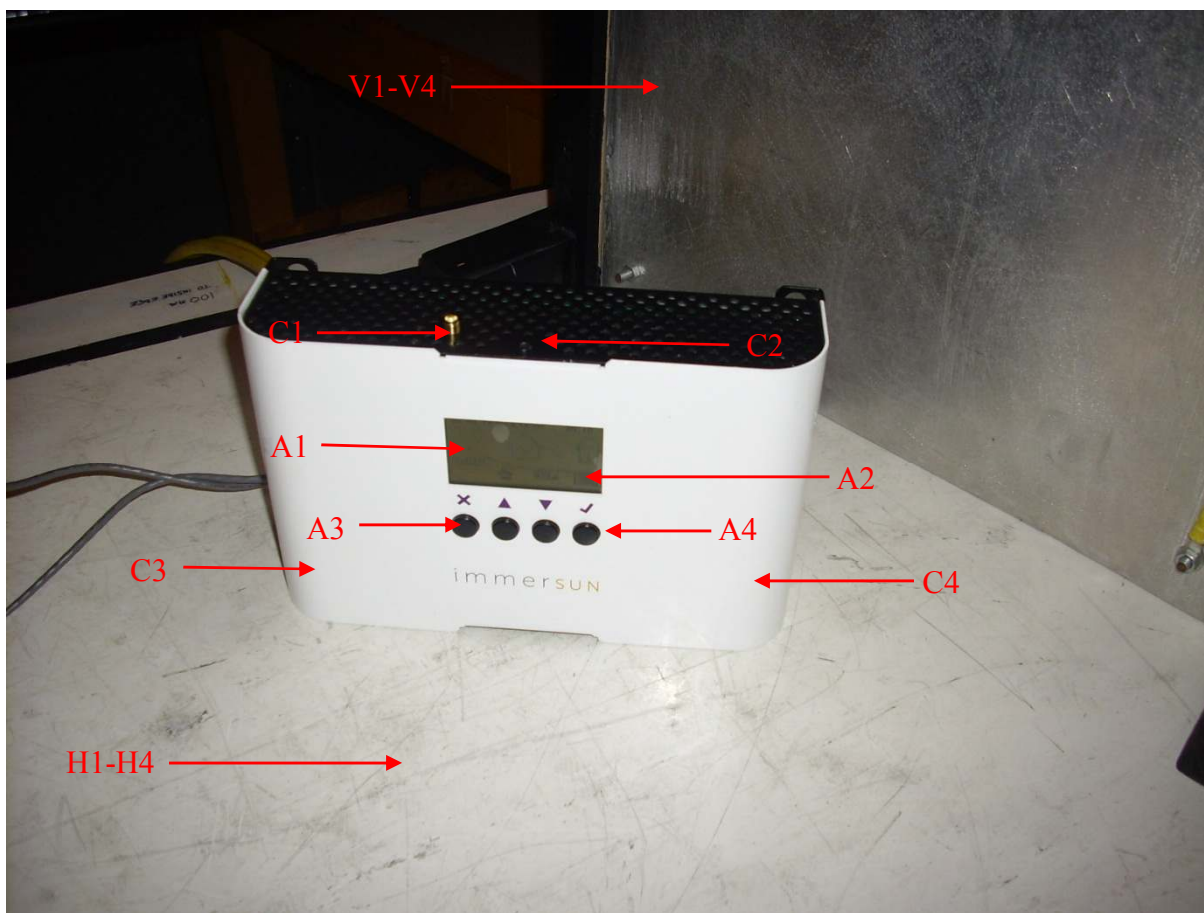


Figure 5.11.1 ESD test point locations.

Discharge	Discharge Location	Discharge Type
A1	Display	Air
A2	Display	Air
A3	Control buttons	Air
A4	Control buttons	Air
C1	Antenna base	Contact
C2	Fixing screw	Contact
C3	Outer casing	Contact
C4	Outer casing	Contact
H1-H4	Horizontal coupling plane	Contact
V1-V4	Vertical coupling plane	Contact

Figure 5.11.2 ESD test point locations table.

5.12 Appendix 12 Conducted emissions test results (150kHz to 30MHz)

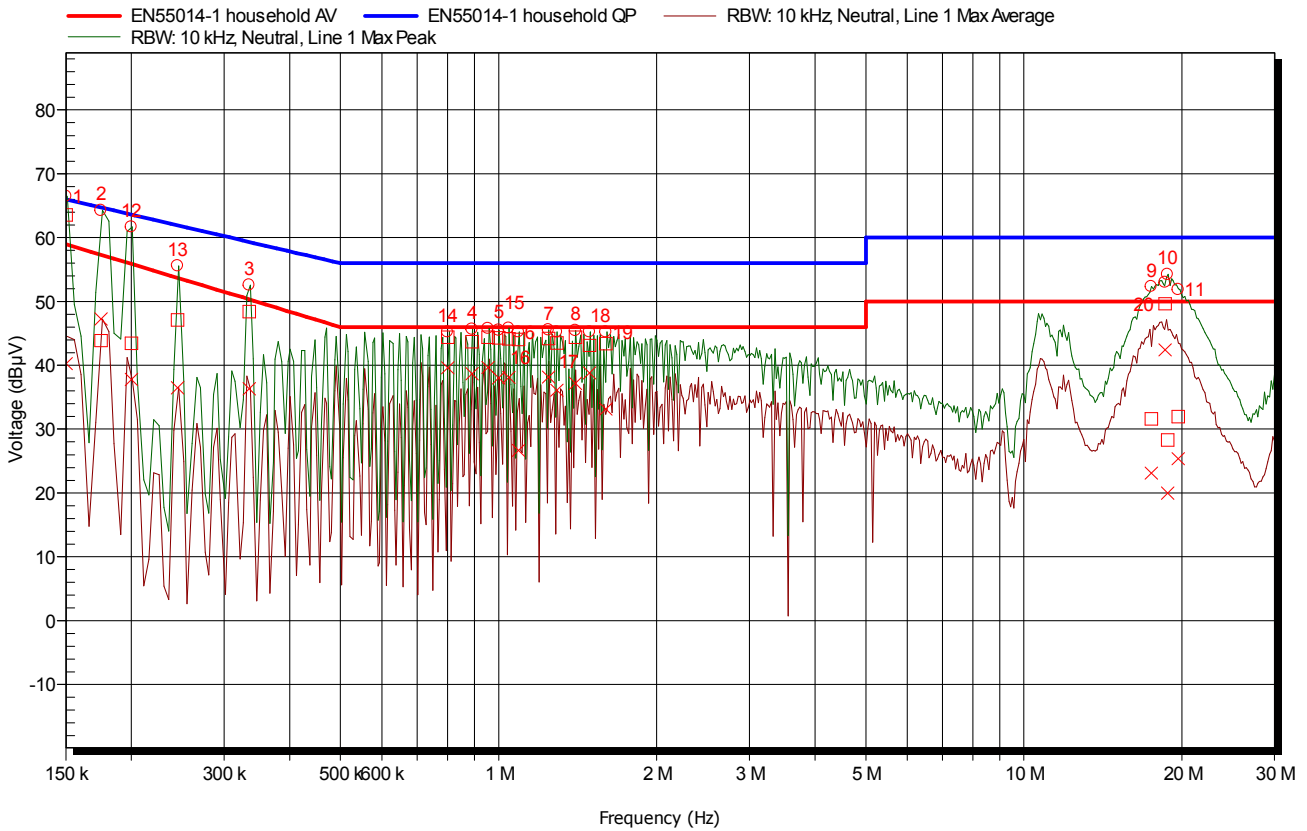


Figure 5.12.1 Conducted emissions results, 230V ac power, C01 (composite plot Live & neutral conductors).

C1485DE01.drd		Discontinuous Interference Tests				Reference: DE01	
Apparatus Code:						Tested by: MJN	
Manufacturer: 4ECO							
Live Conductor							
RUN A: May 06, 2014: 10.46 AM						Run Duration: 120 mins 0 secs	
Duration limit: 120 mins						(excluding 65 secs paused)	
Continuous limit: 0.600 secs							
Click limit: 40 (any channel)							
Switching Operations: 1 Rate: 0.01							
Channel no:	1	2	3	4	5	6	
	150kHz	500kHz	1.4MHz	30MHz			
Sensitivity [dBuV]:	66	56	56	60			
Short Clicks:	2	2	2	0			
Long Clicks:	0	0	0	0			
Total:	2	2	2	0			
Click Rate:	0.02	0.02	0.02	0.00			
Continuous[s]:	0.00	0.00	0.00	0.00			
Apparatus Passes (subject to exceptions)							
Click rate not > 5 and no long clicks.							
Run time limit reached							

Figure 5.12.2 Discontinuous conducted emissions result, C02 (230V i/p Live conductor)

C1485DE02.drd		Discontinuous Interference Tests				Reference: DE01	
Apparatus Code:						Tested by: MJN	
Manufacturer: 4ECO							
RUN A: May 06, 2014: 01.30 PM						Run Duration: 120 mins 0 secs	
Duration limit: 120 mins						(excluding 81 secs paused)	
Continuous limit: 0.600 secs							
Click limit: 40 (any channel)							
Switching Operations: 1 Rate: 0.01							
Channel no:	1	2	3	4	5	6	
	150kHz	500kHz	1.4MHz	30MHz			
Sensitivity (dBuV):	66	56	56	60			
Short Clicks:	1	1	1	0			
Long Clicks:	0	0	0	0			
Total:	1	1	1	0			
Click Rate:	0.01	0.01	0.01	0.00			
Continuous(s):	0.00	0.00	0.00	0.00			
Apparatus Passes (subject to exceptions)							
Click rate not > 5 and no long clicks.							
Run time limit reached							

Figure 5.12.3 Discontinuous conducted emissions result, C03 (230V i/p Neutral conductor)

5.13 Appendix 13 Radiated emissions test results (30MHz to 1000MHz)

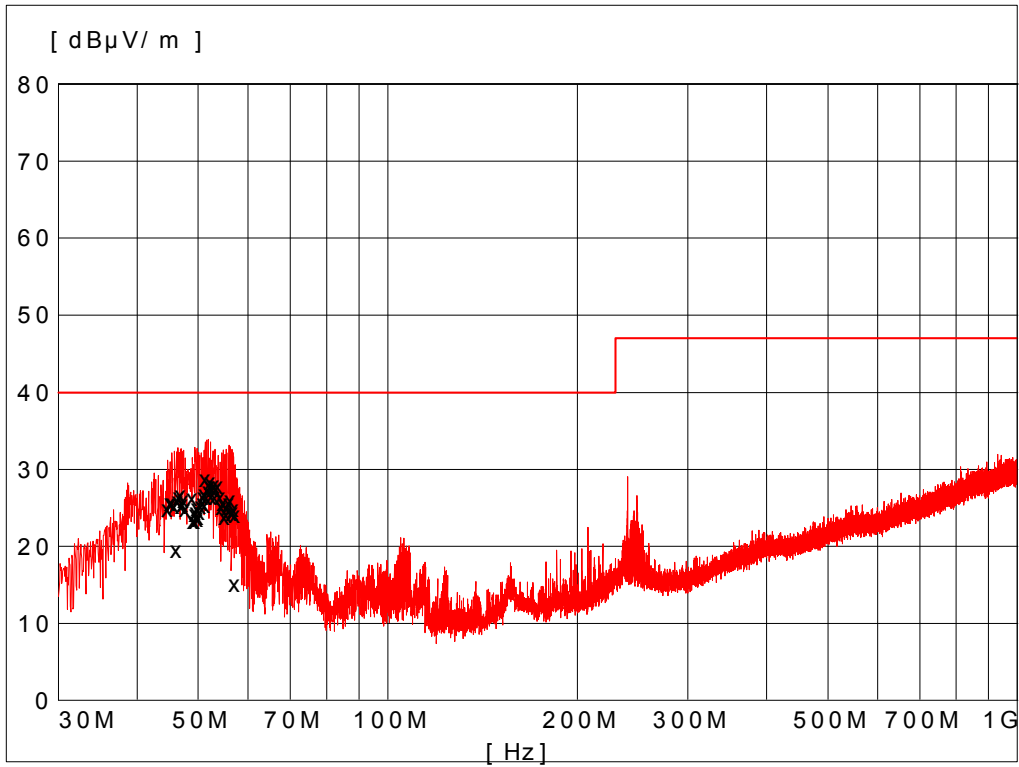


Figure 5.13.1 Radiated emissions results, (R01, Chamber).

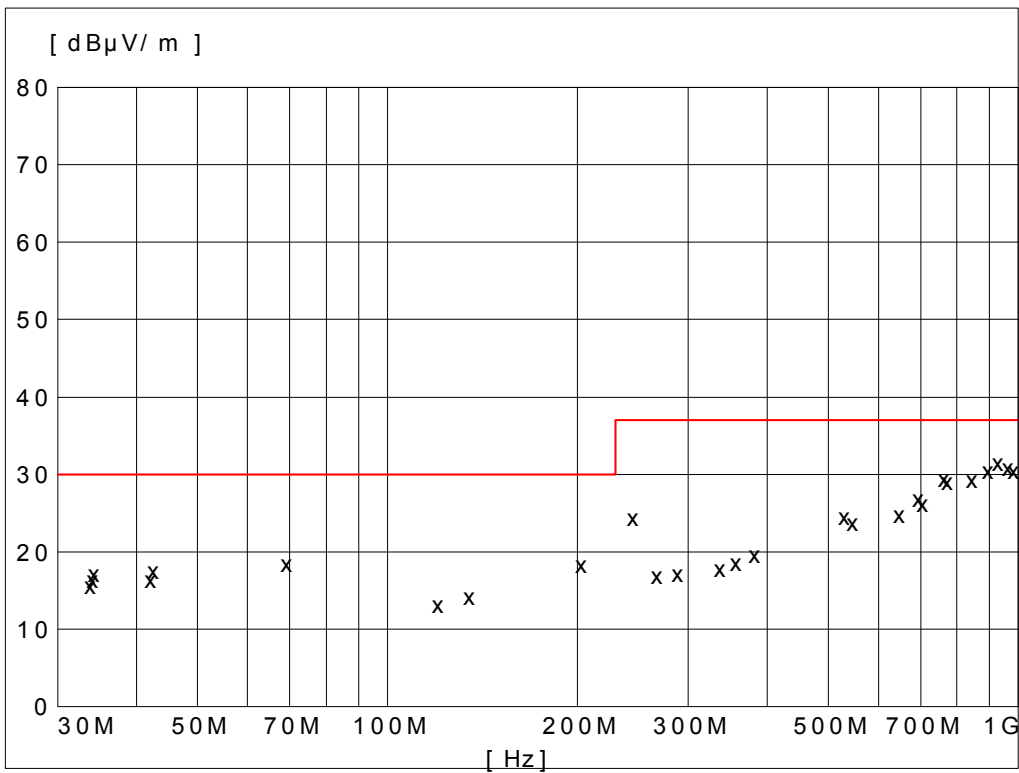


Figure 5.13.2 Radiated emissions results, (R02, OATS).

5.14 Appendix 14 Harmonic emissions results

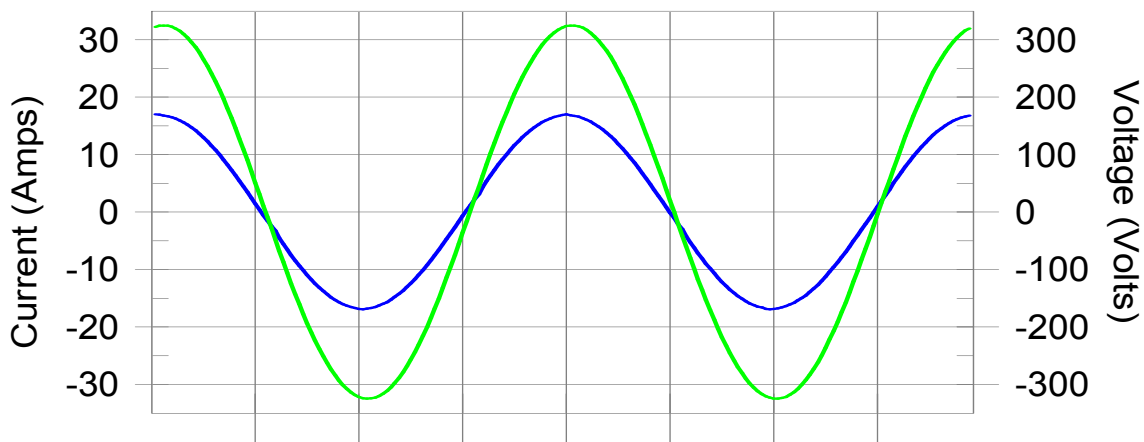
Harmonics – Class-A per Ed. 3.0 (2006)(Run time) incl. inter-harmonics

EUT: immersun
Test category: Class-A per Ed. 3.0 (2006) (European limits)
Test date: 04/07/2014
Test duration (min): 2.5
Comment: C1485 H03
Customer: 4ECO

Tested by: D Horry
Test Margin: 100
Start time: 12:58:31
End time: 13:01:23
Data file name: H-000955.cts_data

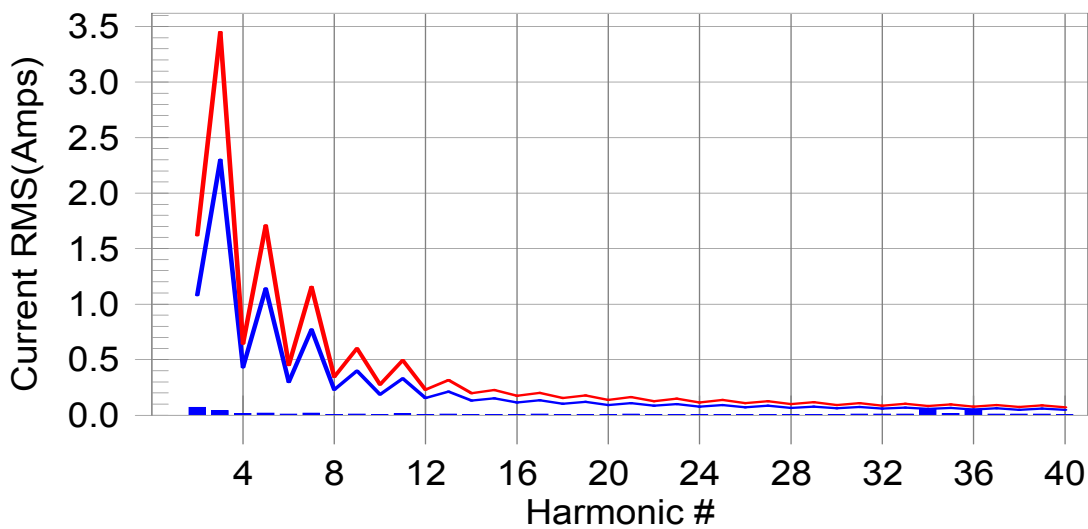
Test Result: Pass Source qualification: Normal

Current & voltage waveforms



Harmonics and Class A limit line

European Limits



Test result: Pass Worst harmonic was #36 with 73.53% of the limit.

Current Test Result Summary (Run time)

EUT: immersun Tested by: D Horry
 Test category: Class-A per Ed. 3.0 (2006) (European limits) Test Margin: 100
 Test date: 04/07/2014 Start time: 12:58:31 End time: 13:01:23
 Test duration (min): 2.5 Data file name: H-000955.cts_data
 Comment: C1485 H03
 Customer: 4ECO

Test Result: Pass Source qualification: Normal
 THC(A): 0.09 I-THD(%): 1.46 POHC(A): 0.025 POHC Limit(A): 0.263

Highest parameter values during test:

V_RMS (Volts): 230.00	Frequency(Hz): 50.00
I_Peak (Amps): 17.031	I_RMS (Amps): 11.883
I_Fund (Amps): 8.968	Crest Factor: 2.046
Power (Watts): 2051.9	Power Factor: 0.998

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.047	1.080	4.3	0.070	1.620	4.30	Pass
3	0.030	2.300	1.3	0.043	3.450	1.23	Pass
4	0.010	0.430	2.3	0.016	0.645	2.42	Pass
5	0.012	1.140	1.0	0.017	1.710	0.98	Pass
6	0.005	0.300	1.7	0.009	0.450	2.02	Pass
7	0.015	0.770	1.9	0.019	1.155	1.68	Pass
8	0.004	0.230	2.0	0.006	0.345	1.86	Pass
9	0.008	0.400	2.0	0.010	0.600	1.71	Pass
10	0.003	0.184	2.4	0.005	0.276	1.90	Pass
11	0.010	0.330	3.0	0.013	0.495	2.69	Pass
12	0.003	0.153	0.0	0.004	0.230	1.82	Pass
13	0.010	0.210	4.6	0.011	0.315	3.49	Pass
14	0.002	0.131	0.0	0.004	0.197	1.87	Pass
15	0.005	0.150	3.3	0.007	0.225	3.22	Pass
16	0.002	0.115	0.0	0.003	0.173	1.93	Pass
17	0.010	0.132	7.8	0.011	0.199	5.50	Pass
18	0.002	0.102	0.0	0.003	0.153	2.28	Pass
19	0.003	0.118	0.0	0.004	0.178	2.35	Pass
20	0.003	0.092	0.0	0.004	0.138	2.83	Pass
21	0.009	0.107	8.6	0.010	0.161	6.18	Pass
22	0.003	0.084	0.0	0.003	0.125	2.80	Pass
23	0.005	0.098	5.0	0.006	0.147	3.89	Pass
24	0.003	0.077	0.0	0.004	0.115	3.17	Pass
25	0.007	0.090	7.9	0.008	0.135	5.74	Pass
26	0.003	0.071	0.0	0.003	0.106	3.06	Pass
27	0.007	0.083	8.8	0.008	0.125	6.25	Pass
28	0.003	0.066	0.0	0.003	0.099	3.21	Pass
29	0.006	0.078	7.4	0.006	0.116	5.51	Pass
30	0.003	0.061	0.0	0.004	0.092	4.06	Pass
31	0.009	0.073	11.8	0.009	0.109	8.43	Pass
32	0.007	0.058	12.5	0.010	0.086	11.99	Pass
33	0.007	0.068	10.3	0.008	0.102	8.33	Pass
34	0.037	0.054	68.6	0.053	0.081	64.98	Pass
35	0.011	0.064	17.0	0.015	0.096	15.21	Pass
36	0.038	0.051	73.5	0.053	0.077	69.18	Pass
37	0.009	0.061	14.0	0.010	0.091	11.35	Pass
38	0.007	0.048	15.0	0.010	0.073	14.05	Pass
39	0.008	0.058	14.1	0.010	0.087	11.48	Pass
40	0.004	0.046	0.0	0.004	0.069	6.52	Pass

Voltage Source Verification Data (Run time)

EUT: immersun Tested by: D Horry
 Test category: Class-A per Ed. 3.0 (2006) (European limits) Test Margin: 100
 Test date: 04/07/2014 Start time: 12:58:31 End time: 13:01:23
 Test duration (min): 2.5 Data file name: H-000955.cts_data
 Comment: C1485 H03
 Customer: 4ECO

Test Result: Pass Source qualification: Normal

Highest parameter values during test:

Voltage (Vrms): 230.00	Frequency(Hz): 50.00
I_Peak (Amps): 17.031	I_RMS (Amps): 11.883
I_Fund (Amps): 8.968	Crest Factor: 2.046
Power (Watts): 2051.9	Power Factor: 0.998

Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.076	0.460	16.63	OK
3	0.403	2.069	19.49	OK
4	0.053	0.460	11.55	OK
5	0.052	0.920	5.65	OK
6	0.019	0.460	4.14	OK
7	0.040	0.690	5.85	OK
8	0.024	0.460	5.13	OK
9	0.039	0.460	8.43	OK
10	0.029	0.460	6.32	OK
11	0.035	0.230	15.33	OK
12	0.022	0.230	9.59	OK
13	0.023	0.230	10.13	OK
14	0.012	0.230	5.18	OK
15	0.014	0.230	5.97	OK
16	0.011	0.230	4.59	OK
17	0.015	0.230	6.71	OK
18	0.011	0.230	4.99	OK
19	0.012	0.230	5.26	OK
20	0.025	0.230	10.96	OK
21	0.006	0.230	2.69	OK
22	0.016	0.230	7.07	OK
23	0.012	0.230	5.17	OK
24	0.011	0.230	4.81	OK
25	0.010	0.230	4.28	OK
26	0.009	0.230	4.09	OK
27	0.010	0.230	4.45	OK
28	0.007	0.230	2.83	OK
29	0.007	0.230	3.19	OK
30	0.006	0.230	2.50	OK
31	0.014	0.230	6.00	OK
32	0.005	0.230	2.31	OK
33	0.014	0.230	6.19	OK
34	0.017	0.230	7.35	OK
35	0.013	0.230	5.60	OK
36	0.019	0.230	8.44	OK
37	0.015	0.230	6.48	OK
38	0.006	0.230	2.43	OK
39	0.017	0.230	7.45	OK
40	0.020	0.230	8.72	OK

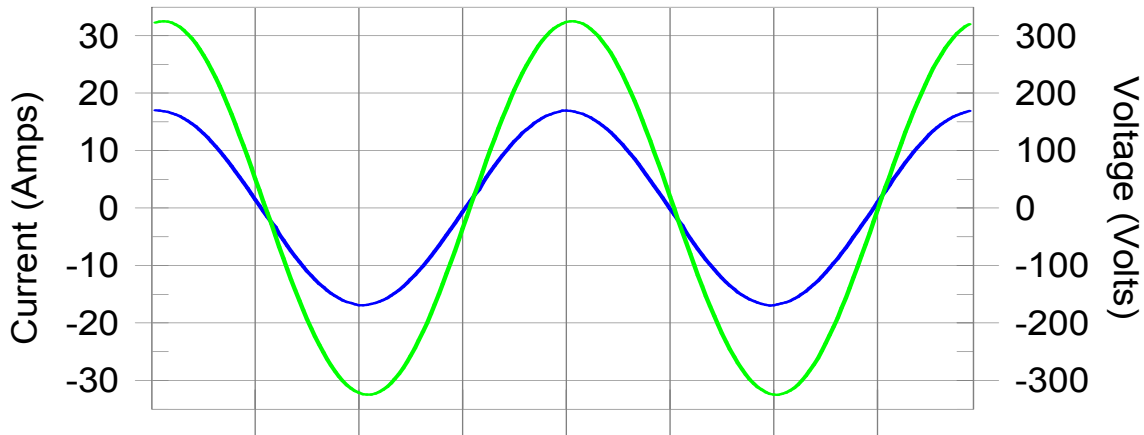
Harmonics – Class-A per Ed. 3.0 (2006)(Run time) incl. inter-harmonics

EUT: immersun
Test category: Class-A per Ed. 3.0 (2006) (European limits)
Test date: 04/07/2014
Test duration (min): 2.5
Comment: C1485 H04
Customer: 4ECO

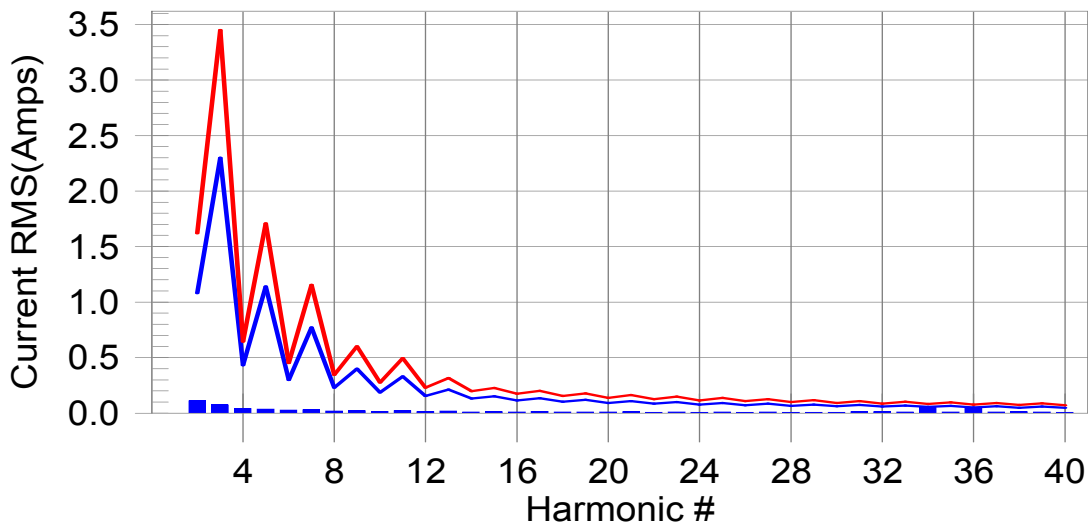
Tested by: D Horry
Test Margin: 100
Start time: 13:03:36
End time: 13:06:27
Data file name: H-000956.cts_data

Test Result: Pass Source qualification: Normal

Current & voltage waveforms



Harmonics and Class A limit line European Limits



Test result: Pass Worst harmonic was #36 with 72.37% of the limit.

Current Test Result Summary (Run time)

EUT: immersun Tested by: D Horry
 Test category: Class-A per Ed. 3.0 (2006) (European limits) Test Margin: 100
 Test date: 04/07/2014 Start time: 13:03:36 End time: 13:06:27
 Test duration (min): 2.5 Data file name: H-000956.cts_data
 Comment: C1485 H04
 Customer: 4ECO

Test Result: Pass Source qualification: Normal
 THC(A): 0.13 I-THD(%): 2.35 POHC(A): 0.028 POHC Limit(A): 0.251
 Highest parameter values during test:

V_RMS (Volts): 230.00	Frequency(Hz): 50.00
I_Peak (Amps): 17.064	I_RMS (Amps): 11.906
I_Fund (Amps): 8.823	Crest Factor: 1.990
Power (Watts): 2017.9	Power Factor: 0.998

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.080	1.080	7.4	0.112	1.620	6.92	Pass
3	0.055	2.300	2.4	0.072	3.450	2.09	Pass
4	0.029	0.430	6.7	0.041	0.645	6.39	Pass
5	0.027	1.140	2.4	0.035	1.710	2.06	Pass
6	0.019	0.300	6.2	0.026	0.450	5.78	Pass
7	0.024	0.770	3.1	0.031	1.155	2.64	Pass
8	0.014	0.230	6.1	0.019	0.345	5.61	Pass
9	0.017	0.400	4.2	0.020	0.600	3.33	Pass
10	0.011	0.184	6.2	0.016	0.276	5.68	Pass
11	0.015	0.330	4.5	0.020	0.495	3.99	Pass
12	0.010	0.153	6.2	0.013	0.230	5.77	Pass
13	0.015	0.210	7.1	0.017	0.315	5.47	Pass
14	0.008	0.131	6.3	0.011	0.197	5.73	Pass
15	0.009	0.150	6.3	0.013	0.225	5.62	Pass
16	0.007	0.115	6.4	0.010	0.173	5.77	Pass
17	0.013	0.132	10.1	0.015	0.199	7.66	Pass
18	0.007	0.102	6.6	0.009	0.153	5.97	Pass
19	0.007	0.118	6.2	0.009	0.178	5.21	Pass
20	0.006	0.092	6.9	0.009	0.138	6.26	Pass
21	0.011	0.107	10.2	0.013	0.161	8.00	Pass
22	0.006	0.084	7.1	0.008	0.125	6.37	Pass
23	0.008	0.098	8.4	0.010	0.147	6.67	Pass
24	0.006	0.077	7.5	0.008	0.115	6.92	Pass
25	0.008	0.090	8.9	0.010	0.135	7.32	Pass
26	0.005	0.071	7.6	0.007	0.106	6.72	Pass
27	0.009	0.083	11.4	0.011	0.125	8.83	Pass
28	0.005	0.066	7.8	0.007	0.099	7.19	Pass
29	0.007	0.078	8.5	0.008	0.116	7.14	Pass
30	0.005	0.061	8.7	0.007	0.092	7.79	Pass
31	0.010	0.073	13.7	0.012	0.109	10.68	Pass
32	0.008	0.058	14.2	0.012	0.086	13.56	Pass
33	0.008	0.068	12.1	0.010	0.102	10.23	Pass
34	0.037	0.054	68.0	0.051	0.081	62.55	Pass
35	0.009	0.064	13.8	0.010	0.096	10.42	Pass
36	0.037	0.051	72.4	0.050	0.077	64.85	Pass
37	0.009	0.061	15.2	0.011	0.091	12.22	Pass
38	0.008	0.048	16.5	0.011	0.073	15.69	Pass
39	0.009	0.058	14.7	0.010	0.087	11.28	Pass
40	0.005	0.046	11.4	0.007	0.069	10.57	Pass

Voltage Source Verification Data (Run time)

EUT: immersun Tested by: D Horry
 Test category: Class-A per Ed. 3.0 (2006) (European limits) Test Margin: 100
 Test date: 04/07/2014 Start time: 13:03:36 End time: 13:06:27
 Test duration (min): 2.5 Data file name: H-000956.cts_data
 Comment: C1485 H04
 Customer: 4ECO

Test Result: Pass Source qualification: Normal

Highest parameter values during test:

Voltage (Vrms): 230.00	Frequency(Hz): 50.00
I_Peak (Amps): 17.064	I_RMS (Amps): 11.906
I_Fund (Amps): 8.823	Crest Factor: 1.990
Power (Watts): 2017.9	Power Factor: 0.998

Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.079	0.460	17.22	OK
3	0.403	2.069	19.49	OK
4	0.052	0.460	11.36	OK
5	0.049	0.920	5.37	OK
6	0.021	0.460	4.53	OK
7	0.038	0.690	5.47	OK
8	0.023	0.460	5.01	OK
9	0.040	0.460	8.76	OK
10	0.029	0.460	6.35	OK
11	0.036	0.230	15.82	OK
12	0.022	0.230	9.61	OK
13	0.021	0.230	8.93	OK
14	0.012	0.230	5.15	OK
15	0.016	0.230	6.94	OK
16	0.011	0.230	4.72	OK
17	0.012	0.230	5.39	OK
18	0.012	0.230	5.26	OK
19	0.008	0.230	3.58	OK
20	0.025	0.230	11.02	OK
21	0.006	0.230	2.63	OK
22	0.017	0.230	7.34	OK
23	0.010	0.230	4.41	OK
24	0.011	0.230	4.82	OK
25	0.010	0.230	4.15	OK
26	0.010	0.230	4.42	OK
27	0.011	0.230	4.80	OK
28	0.008	0.230	3.53	OK
29	0.007	0.230	3.05	OK
30	0.009	0.230	3.73	OK
31	0.015	0.230	6.37	OK
32	0.019	0.230	8.12	OK
33	0.014	0.230	6.17	OK
34	0.082	0.230	35.50	OK
35	0.012	0.230	5.11	OK
36	0.080	0.230	34.90	OK
37	0.016	0.230	7.01	OK
38	0.017	0.230	7.26	OK
39	0.016	0.230	7.00	OK
40	0.022	0.230	9.55	OK

5.15 Appendix 15 Flicker results

Flicker Test Summary per EN/IEC61000-3-3 (Run time)

EUT: immersun
 Test category: All parameters (European limits)
 Test date: 04/07/2014
 Test duration (min): 10
 Comment: C1485 F03
 Customer: 4ECO

Tested by: D Horry
 Test Margin: 100
 Start time: 13:11:18
 End time: 13:21:39
 Data file name: F-000957.cts_data

Test Result: Pass

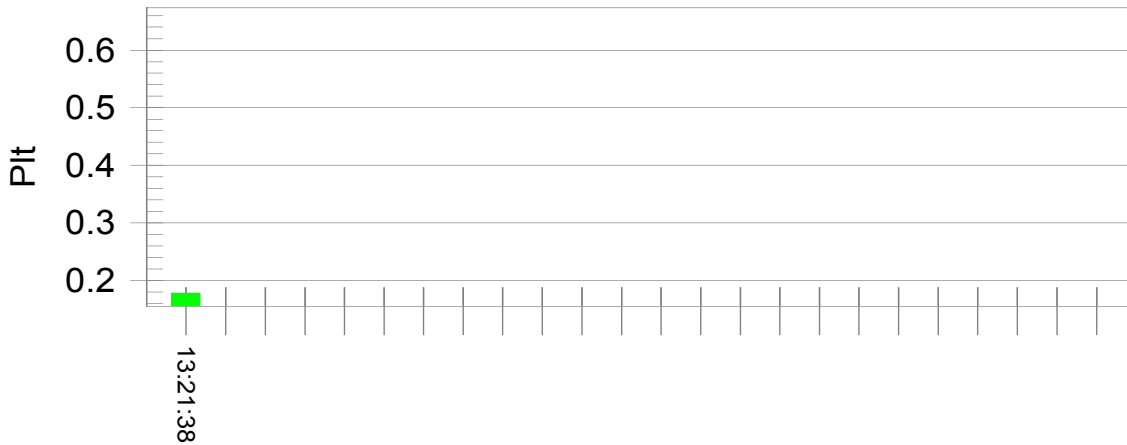
Status: Test Completed

Pst and limit line

European Limits



Plt and limit line



Parameter values recorded during the test:

Vrms at the end of test (Volt):	229.73		
Highest dt (%):	0.15	Test limit (%):	3.30 Pass
Time(mS) > dt:	0.0	Test limit (mS):	500.0 Pass
Highest dc (%):	0.69	Test limit (%):	3.30 Pass
Highest dmax (%):	-1.70	Test limit (%):	4.00 Pass
Highest Pst (10 min. period):	0.409	Test limit:	1.000 Pass
Highest Plt (2 hr. period):	0.179	Test limit:	0.650 Pass

Flicker Test Summary per EN/IEC61000-3-3 (Run time)

EUT: immersun	Tested by: D Horry
Test category: 24 x dmax Test	Test Margin: 100
Test date: 04/07/2014	Start time: 13:23:32
Test duration (min): 26	End time: 13:48:28
Comment: C1485 F04	Data file name: F-000958.cts_data
Customer: 4ECO	

Test Result: Pass

Status: Test Completed

European Limits

Parameter values recorded during the test:

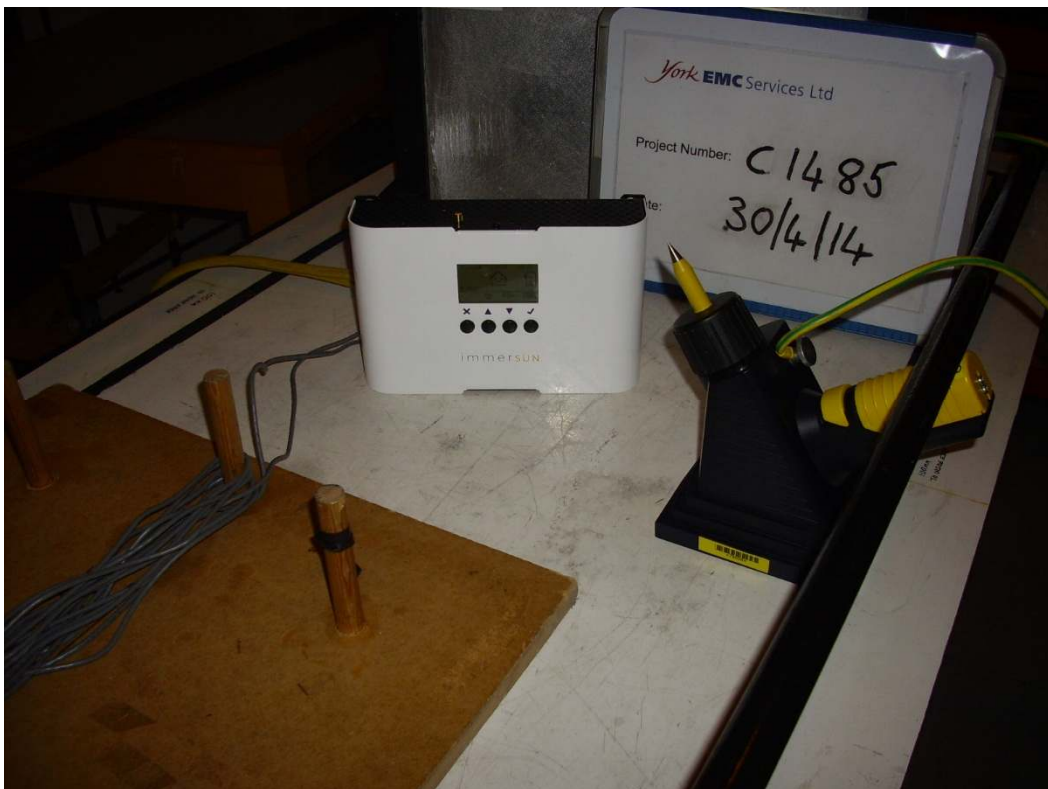
Vrms at the end of test (Volt):	229.98	
Average dmax (%):	0.17	Test limit (%): 4.00

Test Number	Dmax	
1	0.000	Lowest dmax (Disregarded)
2	0.000	
3	0.000	
4	0.000	
5	0.180	
6	0.180	
7	0.250	
8	-0.313	Highest dmax (Disregarded)
9	-0.257	
10	-0.257	
11	0.042	
12	0.121	
13	0.121	
14	0.121	
15	0.121	
16	-0.228	
17	-0.228	
18	-0.294	
19	-0.294	
20	-0.294	
21	-0.294	
22	-0.294	
23	0.077	
24	0.077	
Average of 22 Dmax	0.170	
Lowest Dmax	0.000	
Highest Dmax	-0.313	

5.16 Appendix 16 EUT test configurations



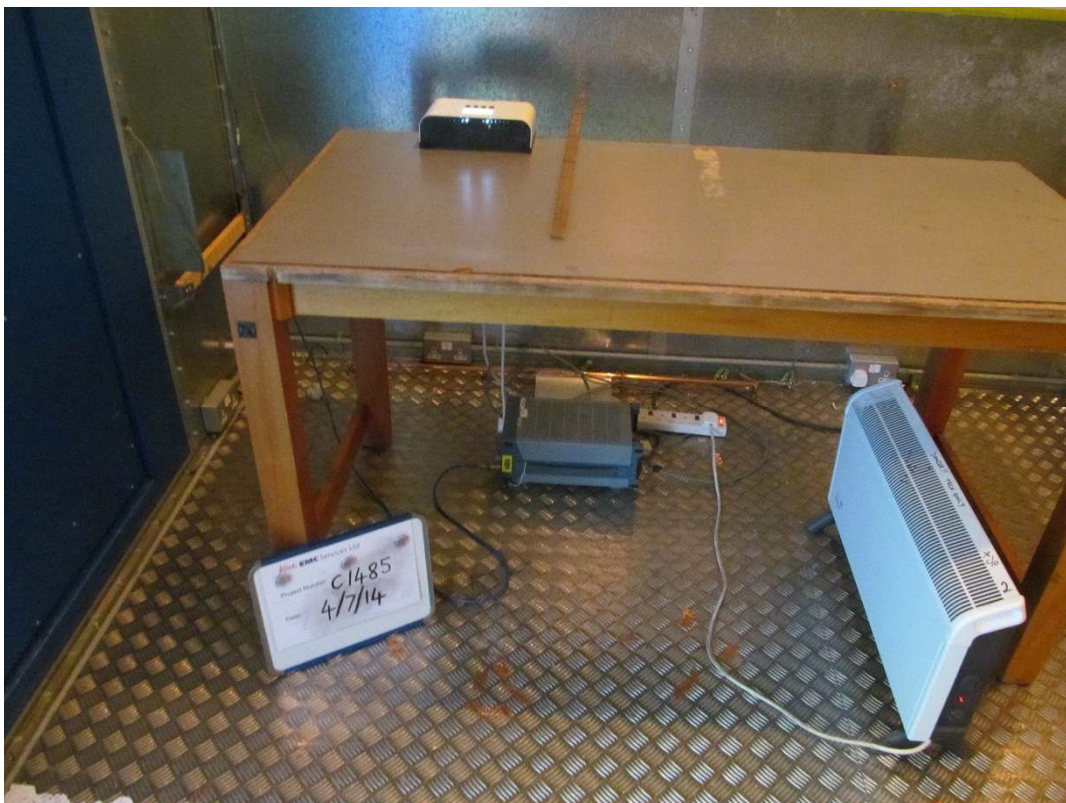
Photograph 5.16.1 Radiated emissions testing, 30MHz to 1000MHz



Photograph 5.16.2 Immunity to ESD testing



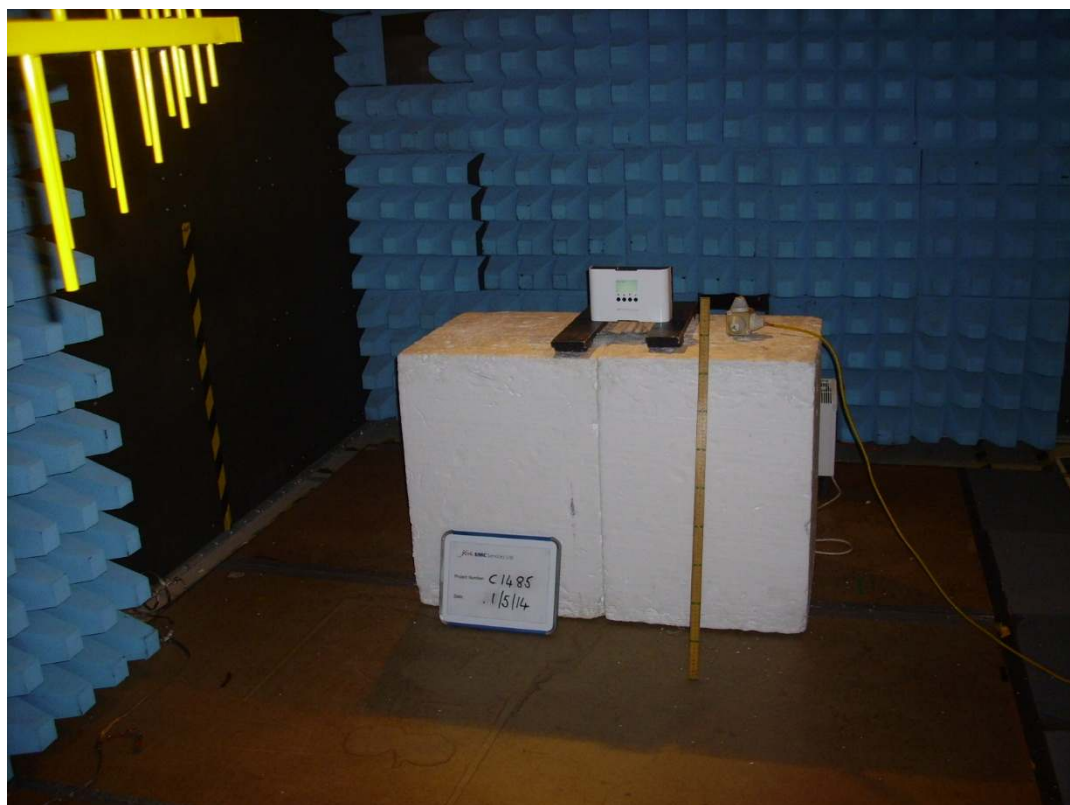
Photograph 5.16.3 Voltage dips and interruptions testing



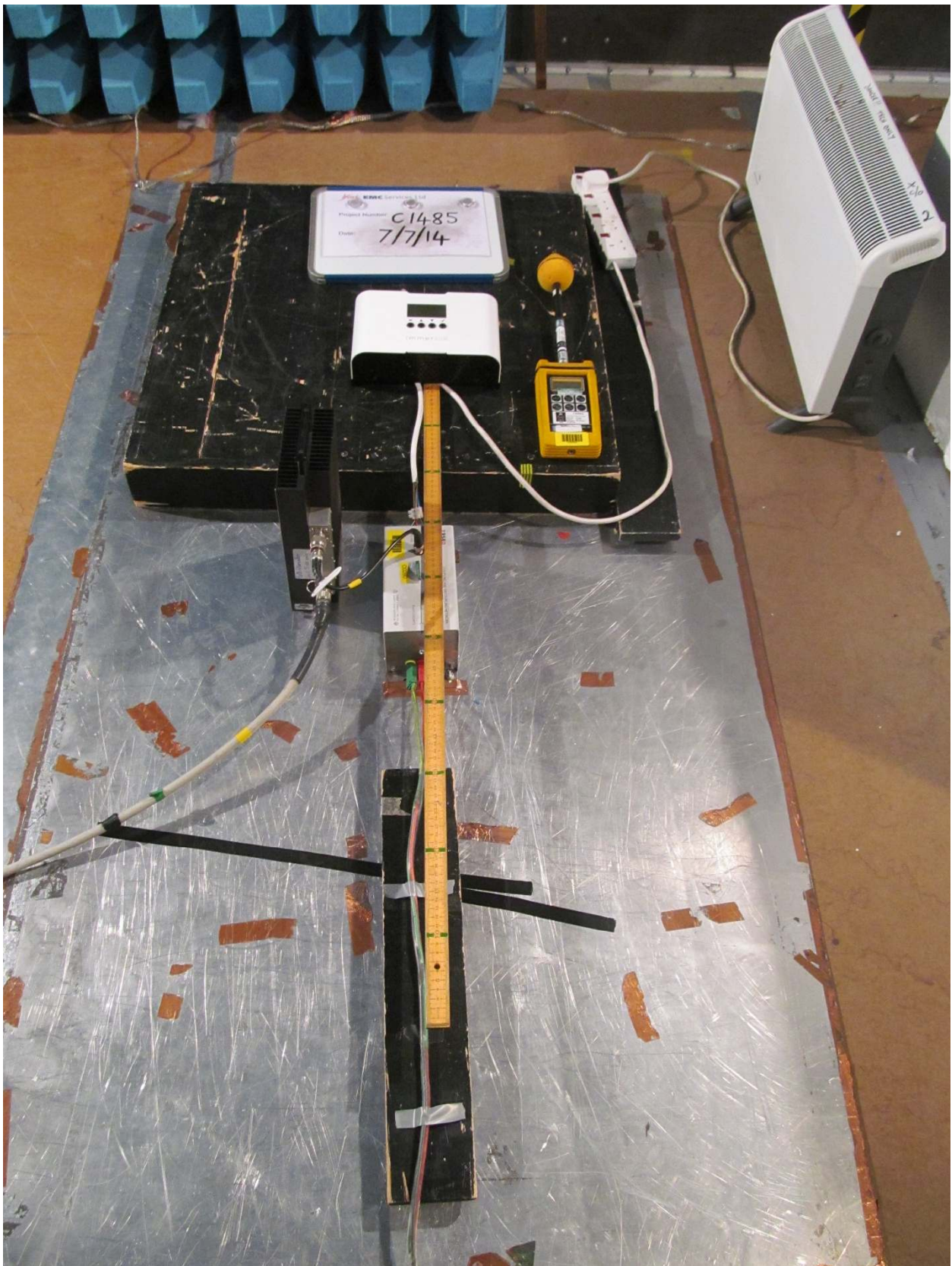
Photograph 5.16.4 Conducted emissions testing



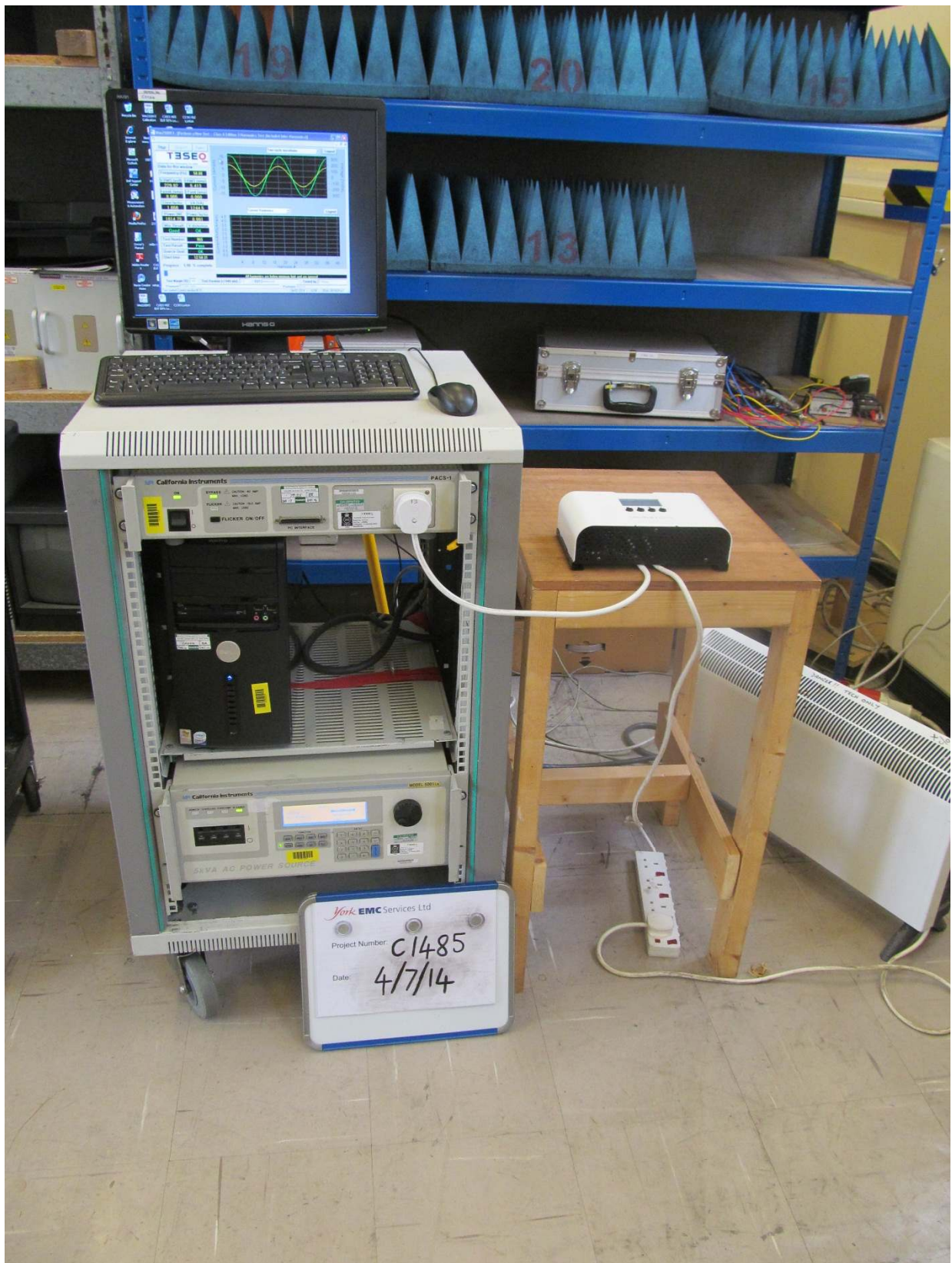
Photograph 5.16.5 Immunity to Surge testing



Photograph 5.16.6 Radiated Immunity testing



Photograph 5.16.7 Conducted RF Immunity testing



Photograph 5.16.8 Harmonics and Flicker testing



Photograph 5.16.9 Immunity to EFT/B testing

5.17 Appendix 17 Reporting the results

For test standards referring to EN 55022 and EN 55011: Measurement data is presented according to:
“EN55016-4-2: 2004 Specification for radio disturbance and immunity measuring apparatus and methods Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements”

The measurement uncertainty is as follows for radiated and conducted emissions:

Test	<i>U_{lab}</i>	<i>U_{cispr}</i>
Conducted emissions (mains port) 150kHz to 30MHz	3.4dB	3.6dB
Radiated disturbance 30MHz to 1GHz	5.0dB (maximum)	5.2dB

For both the above tests, since $U_{lab} < U_{cispr}$, compliance is deemed to occur if no measured disturbance exceeds the disturbance limit.

5.18 Appendix 18 Equipment used

Equipment	No.	Cal Type	Used	Equipment	No.	Cal Type	Used
AR FM2000 Field Probe Set	78211	UKAS		SML03 Signal Generator	B0820	UKAS	✓
Blackstar Function Generator	78200	In-house		Schaffner NSG1025 EFT/B Gen	78136	UKAS	
Chase Van Veen Loop	78217	In-house		Schaffner NSG2025 EFT/B Gen	78006	UKAS	
Chase CBL 6112B Bilog Antenna	78708	UKAS	✓	Schaffner NSG2050 + PNW2055	78178	UKAS	✓
Chase CBL 6140 X-Wing Antenna	78310	In-house		R&S SMT06 Signal Generator	79124	UKAS	
Chase CBL 6140 X-Wing Antenna	78309	In-house	✓	Lem-Heme Current Probe	78482	NCS	
Chase CFL 9206 Transient Limiter	78101	In-house		Schaffner NSG435 ESD Simulator	78008	UKAS	✓
Chase CFL 9206 Transient Limiter	78087	In-house	✓	Schlumberger 1200 Signal Processor	78682	NCS	
Chase HLA6120 Loop Antenna	78128	NPL		Schaffner NSG650 + CDN113	78478	UKAS	
Chase MDS21 Absorbing Clamp	78195	UKAS		Schaffner NSG2050 + PNW2056	78458	UKAS	
Fischer FCC-801-M1-16 CDN	78240	UKAS		Schaffner voltage probe CVP2200	78596	UKAS	
Fischer FCC-801-M2-25 CDN	78241	UKAS		Schaffner current probe SMZ11	78569	UKAS	
Fischer FCC-801-M2-16 CDN	78400	UKAS		Schaffner current probe	79020	UKAS	
Fischer FCC-801-M3-16 CDN	79002	UKAS		Schaffner 40 ohm load	78570	In-house	
Fischer FCC-801-M3-25 CDN	78242	UKAS		Schaffner Chase CBL6111C	78707	UKAS	
Fischer FCC-801-M4-25 CDN	78045	UKAS		Schaffner Chase CBL6112B	78708	Manufac	
Emco Horn Antenna	78347	UKAS	✓	Schaffner INA 175 surge CDN	78461	In-house	
Fischer FCC-801-T2	78372	UKAS		Schaffner INA 172 surge CDN	78462	In-house	
Fluke 45 Digital Mutimeter	78655	UKAS		Solar 9108-IN Current Probe	78545	UKAS	✓
Fluke 85 Digital Mutimeter	78375	UKAS	✓	Van Veen Loop	78215	In-house	
Gould 475 Digital Oscilloscope	78057	UKAS		Fischer FCC-801-M3-25 CDN	79008	UKAS	✓
HP LF spectrum analyser	79129	UKAS		Fischer FCC-801 M1-16 CDN	79001	UKAS	
HP programmable power supply	78657	UKAS		EM Test UCS 500	79059	UKAS	✓
HP spectrum analyser	78662	UKAS		CDN 118	78460	NCS	
ISO-TECH ICA32N transducer	78677	NCS		Schaffner clamp	79045	In-house	✓
ISO-TECH 9053 LCR meter	78487	NCS		Keytek AC line qualifier	78350	UKAS	
NSG435 ESD Generator	C0264	UKAS	✓	Spitzenberger & Spies	78131	NCS	
Keytek MZ-15/EC ESD Simulator	78133	UKAS		Arb Waveform Generator	79116	In-house	
LEM HEME clamp	78483	NCS		6dB attenuator	79073	In-house	✓
Intek Function Generator	78673	UKAS		HP Dynamic Signal Analyzer	79121	In-house	
R&S ESH3-Z5 LISN	78037	UKAS		Magnetic immunity loop (multi)	78722	In-house	
R&S ESH3-Z5 LISN	78119	UKAS	✓	Wandel & Golterman EFA-2	78551	Manufac	
R&S ESHS 10 Receiver	78035	UKAS		Schaffner EFT/B clamp	79184	In-house	✓
R&S ESHS10 Receiver	79182	UKAS	✓	Wandel & Golterman EMC 20	79005	Manufac	✓
R&S ESVS 30 Receiver	79183	UKAS	✓	Variac	78192	In-house	
R&S ESVS 10 Receiver	C0225	UKAS	✓	AR FM2000 Field Probe Set	78108	UKAS	✓
R&S ESVS 30 Receiver	78107	UKAS		650V Transformer	78123	In-House	
California Instruments PACS-1	79135	UKAS	✓	HCP	79099	In-house	✓
California Instruments 5001x	79136	UKAS	✓	VCP	79101	In-house	✓
MV 2616	79149	In-house	✓	EFT 503	79132	UKAS	✓
Schaffner Discontinuous Analyser	79215	UKAS	✓	Fischer clamp	78043	In-house	
Variac	C0179	In-house	✓	AR Coupler	79096	In-house	✓

Unit 9 immunity rack	Used	
Equipment		No. Cal Type
R&S SMY01 Signal Generator		78038 UKAS
AR800-4.2GHZ amplifier		79095 NCS
R&S NRVD Power Meter		78039 UKAS
AR Directional Coupler		79096 In-house
R&S URV5-Z2 10V Insertion Unit		78315 UKAS
R&S NRV5-Z2 Power Sensor		78317 UKAS
Chase CBL 6140 X-Wing Antenna		78310 In-house

Unit 5 immunity rack	Used	✓
Equipment		No. Cal Type
R&S SMX Signal Generator		78117 UKAS
AR150W220A 150W Amplifier		78308 NCS
Schaffner CBA9443 amplifier		78682 In-house
R&S NRVD Power Meter		78314 UKAS
AR DC2600 Directional Coupler		78311 In-house
AR DC6080 Directional Coupler		78312 In-house
R&S URV5-Z2 10V Insertion Unit (9)		78040 UKAS
R&S URV5-Z4 100V Insertion Unit		78041 UKAS
Chase CBL 6140 X-Wing Antenna		78309 In-house

NCS - Not on calibration schedule

5.19 Appendix 19 Customers test equipment used

Equipment	Serial number	Type number
Dimplex Heater (used as load)	Series B	DXC30

5.20 Appendix 20 Modification States

Modification state	Modification
0	As supplied by the customer.
1	In order to pass Surge testing the customer performed the following modification. A surge protection circuit, consisting of a MOV and triac with a TVS diode was installed. Also extra filtering to the output, consisting of a common mode inductor, X and Y caps.

5.21 Appendix 21 Test Report History

Issue	Modification details
1	Original issue of the test report
2	Corrected the dated references to EN55014-1. Repeated EFT/B to EN6100-4-4:2004. Added EFT/B and conducted RF tests for the EUT load output.

5.22 Appendix 22 Harmonics repeatability outcomes

Result A

The mains harmonics tests passes. All current limits were met and the repeatability requirements were satisfied.

Result B

Two measurements of the harmonic currents generated by the EUT have been made and have shown to be below the relevant limit line specified in EN61000-3-2:2006.

Clause 6.2.3.1 of EN61000-3-2:2006 requires that the repeatability of the measurement should be better than $\pm 5\%$. Analysis of the data from the two measurements shows that this is not the case for the EUT in question.

Using this analysis, the harmonic currents from the two measurements have been found not to be within $\pm 5\%$ and therefore the requirements of clause 6.2.3.1 are not met. According to EN61000-3-2:2006, the repeatability requirements are an integral part of the requirements of the standard. Therefore the EUT does not meet the requirements of EN61000-3-2:2006 despite having harmonic currents that are below the limit.

Result C

The mains harmonics tests fails. Current limits were not met.