Test Report
EMC Testing of
MediPi Patient Unit
for
NHS Digital

Document number 12387TR1

Project number C3289

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

Checked: .....
M Render BSc, PhD, MIET, Senior Engineer

Approved: .....
M Render BSc, PhD, MIET, Senior Engineer

Issue	Description	Issue by	Date
1	First Issue	MR	31st May 2017

York EMC Services Ltd,
Market Square
University of York
Heslington
York
YO10 5DD
UK

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

www.yorkemc.com

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

CONTENTS

Test Report Change History

Issue	Date	Modification Details
1	31st May 2017	Original issue of test report
2		
3		
4		
5		
6		
7		
8		
9		
10		

Section 1Test Location

All testing was performed at;

York EMC Services Ltd	Unit 5
	Speedwell Road
	Castleford
	West Yorkshire
	WF10 5PY
Tel:	01977 731173
Website	http://www.yorkemc.com
UKAS Testing No.	1574

1.1 UKAS Accreditation

Tests marked "Not UKAS Accredited" in this report are not included in the UKAS Accreditation Schedule for our laboratory.

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

York EMC Services latest accreditation schedule can be found at;

http://www.ukas.org/testing/lab_detail.asp?lab_id=989&location_id=&vMenuOption=3

Section 2 Customer Information

Company name	NHS Digital
Address	Whitehall II
	6th Floor
	Leeds
	West Yorkshire
	LS1 4HR
Tel:	0113 397 3527
Contact	Mr Ian Dugdale
Email	ian.dugdale@nhs.net

Section 3 Equipment Details

3.1 Equipment Under Test (EUT)

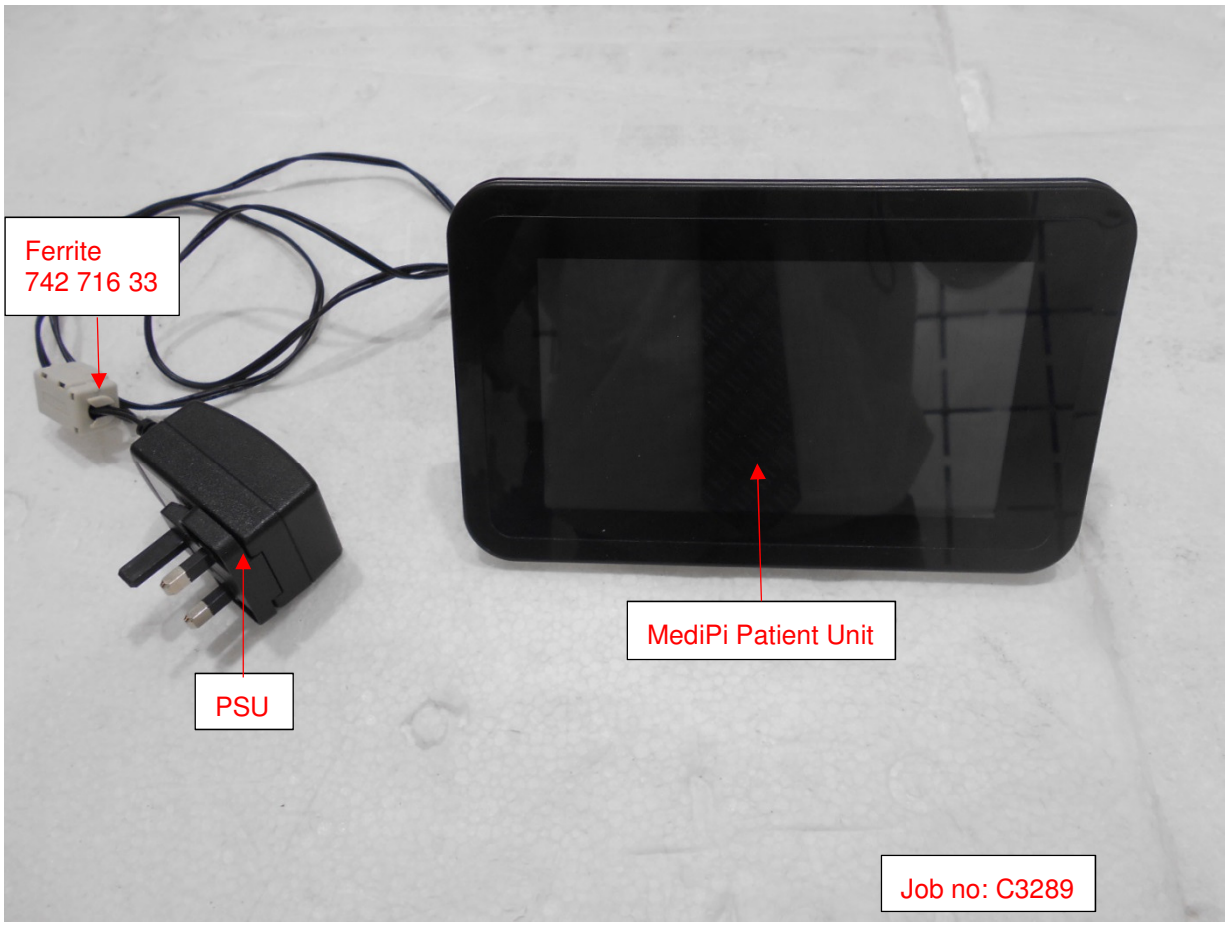
Date received:	7th April 2017							
EUT name:	MediPi Patient Unit							
Type/Part no:	MPU001							
Serial no:	001							
EUT description:	EUT is a raspberry Pi module configured to run from a battery to gather telemetry for remote patient monitoring. The device itself does not attach to a patient but is connected to transducers that are on the patient.							
No of units tested:	One							
EUT power:	230	V	50	Hz	Single phase		2.5	A
	5.1	V	DC, 13W					
Highest internal frequency:	1.2GHz							
Cables:	DC Battery Power		2	m	Unscreened		Terminated	
	Ethernet		>3	m	Unscreened		Terminated	
Size of EUT (m): MediPi Patient Unit	L: -	60mm	W: -	210mm		H: -	130mm	
Power supply	L: -	40mm	W: -	40mm		H: -	90mm	
Tested as	Table top							
Mode/s of operation	Standard patient mode, 230V ac, 5V dc powered, 2.5A							
Firmware Version	None given							
Client modification statement:	None							
Modifications incorporated during testing:	In order to pass radiated emissions testing, 30MHz to 1GHz, the following modifications took place: 1 x Wurth ferrite, 742 700 33, was fitted on both internal power leads. 1 x Wurth ferrite, 742 716 33, was fitted to the EUT end of the power lead. 1 x Wurth ferrite, 742 722 4, was fitted to the internal ribbon cable. The internal enclosure was copper lined, the HDMI, Ethernet and USB ports were programmatically disabled. Note: All tests were performed with this modification applied.							

Modifications

3.2 EUT Monitoring/Auxiliary Equipment

Equipment name	Type no.	Serial no
None	N/A	N/A

3.3 Configuration of EUT



Configuration of EUT

3.4 Criteria of Susceptibility

The following performance criteria was declared by the customer (in accordance with the standard) for the immunity testing on the equipment:

Parameter	Monitoring Method	Declared Performance	
Display Monitor	Visual Observation	A	Temporary interference to screen = acceptable Data transmission failure = acceptable, system will indicate to user on success else retry / resend Data corruption = not acceptable
		B	Temporary interference to screen = acceptable Data transmission failure = acceptable, system will indicate to user on success else retry / resend Data corruption = not acceptable, data held on device must not be corrupt; if any part of data transmitted / received is compromised the whole transmission should be rejected.
		C	Loss of measurement data = acceptable, Loss of data Patient data [Name etc] = acceptable - system will not be able to function- this is a failsafe condition. Loss of Scheduling data = Manual Tx only, user will be informed, this is a failsafe condition. Measurement Data transmission corruption = not acceptable, if data received does not match data sent this is a failure. Data corruption = not acceptable, data held on device must not be corrupt [if this is found to occur further review and mitigation may be required to bring to acceptable level].

The criteria of susceptibility are defined below

Performance criterion A	The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, 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 specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. 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, either of these may be derived from the product description and documentation and 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.	

Section 4 Result summary

The MediPi Patient Unit, as tested and modified, was shown to meet the requirements of the tests listed in Section 5 of this report. See the relevant sections of this report for details and results of each test.

Section 5Test Specifications

The tests were performed in accordance with York EMC Services Quotation/Test plan C3289/1.

5.1 Medical

EN 60601-1-2:2007+corrigendum:2010 **Medical electrical equipment – Part 1. General requirements for safety. Section 1.2 Collateral standard: Electromagnetic compatibility – Requirements and tests.**		
Note: **EN 60601-1-2:2007** references dated and undated basic standards. Standards with amendments have been used during testing, for reasons of equipment and/or facilities calibration, as indicated below		
Which references the following standards		
Standard	**Levels**	**Result**
Emissions		
Clause 6.1.1 Conducted emissions, AC Mains port *CISPR22*: 2010 Industrial, scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics – Limits and methods of measurement	Class B	Pass
Clause 6.1.1 Radiated emissions *CISPR22*: 2010 Industrial, scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics – Limits and methods of measurement	Class B Note: Testing is performed in an anechoic chamber at a measurement distance of 3m.	Pass
Clause 6.1.3.1 Test equipment calibrated and test performed to EN6000-3-2:2014 Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)	Class A	Pass
Clause 6.1.3.2 Test equipment calibrated and test performed to EN6000-3-2:2013 Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ≤ 16 A	Pst Dmax	Pass

EN 60601-1-2:2007+corrigendum:2010 **Medical electrical equipment – Part 1. General requirements for safety. Section 1.2 Collateral standard: Electromagnetic compatibility – Requirements and tests.**		
Note: **EN 60601-1-2:2007** references dated and undated basic standards. Standards with amendments have been used during testing, for reasons of equipment and/or facilities calibration, as indicated below		
Which references the following standards		
Standard	**Levels**	**Result**
Immunity		
Clause 6.2.2 EN61000-4-2: 1995 (Dated Standard) Test equipment calibrated to EN61000-4-2:2009 Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	± 8kV Air Discharge ± 6kV Contact Discharge	Pass
Clause 6.2.3 EN61000-4-3:2006 (Dated Standard) Test equipment calibrated to EN61000-4-3:2006 +A1:2008 +A2:2010 Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	3V/m 80-2500MHz (Not Life Supporting)	Pass
Clause 6.2.4 EN61000-4-4:2004 (Dated Standard) Test equipment calibrated to EN61000-4-4: 2012 Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	± 2kV AC Power lines	Pass
Clause 6.2.5 EN61000-4-5:2006 (Dated Standard) Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test	±2kV AC Line to earth ±1kV AC Line to Line	Pass

EN 60601-1-2:2007+corrigendum:2010

Medical electrical equipment – Part 1. General requirements for safety. Section 1.2 Collateral standard: Electromagnetic compatibility – Requirements and tests.

Note: **EN 60601-1-2:2007** references dated and undated basic standards. Standards with amendments have been used during testing, for reasons of equipment and/or facilities calibration, as indicated below

Which references the following standards

Standard	**Levels**	**Result**
Clause 6.2.6 EN61000-4-6:2007 (Dated Standard) Test calibrated to EN EN61000-4-6: 2014 Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	3Vrms 0.15-80MHz	Pass
Clause 6.2.8.1 EN61000-4-8:1993 (Dated Standard) Equipment calibrated and test performed to EN61000-4-8:2010 Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test	3 A/m 50Hz	Pass
Clause 6.2.7 EN61000-4-11:2004 (Dated Standard) Electromagnetic compatibility (EMC) - Part 4-11: Testing and measuring techniques - Voltage dips, short interruptions and voltage variations immunity tests	0% residual for 0.5 cycles 40% residual for 5 cycles 70% residual for 25 cycles 0% residual for 250 cycles	Pass

Section 6 Reporting of Results

For test standards referring to EN55016-2-1:2009 and EN55016-2-3:2006, 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	Ulab	Ucispr
Conducted emissions (mains port) 150kHz to 30MHz	3.4dB	3.6dB
Radiated disturbance 30MHz to 1GHz	5.0dB (maximum)	5.2dB
Radiated disturbance 1GHz to 6GHz	4.65dB	5.2dB

For the above tests, since *U*lab < *U*cispr, compliance is deemed to occur if no measured disturbance exceeds the disturbance limit.

Section 7 Conducted Emission Results

7.1 Test Specification

EN60601-1-2:2007 +Corr: 2010 Medical electrical equipment part 1-2. General requirements for basic safety and essential performance - Collateral standard; Electromagnetic compatibility- requirements and tests.

Referencing CISPR22: 2010

7.2 Test Equipment

Item	Asset Number
Rohde & Schwarz ESHS10	78035
Teseq CFL9206A	C0282
Rohde & Schwarz ESH3-Z5	78037

7.3 Power Input Lines

7.3.1 Date of Test

11/04/17

7.3.2 Test Area

Lab 2

7.3.3 Test Setup

This test was applied to the EUT's Live and Neutral lines. The EUT was configured in the screened room on;

- 80cm high table

and was positioned 40cm from the room wall. The EUT was then powered from the mains supply via a Line Impedance Stabilisation Network (LISN).

7.3.4 Test Setup Photograph

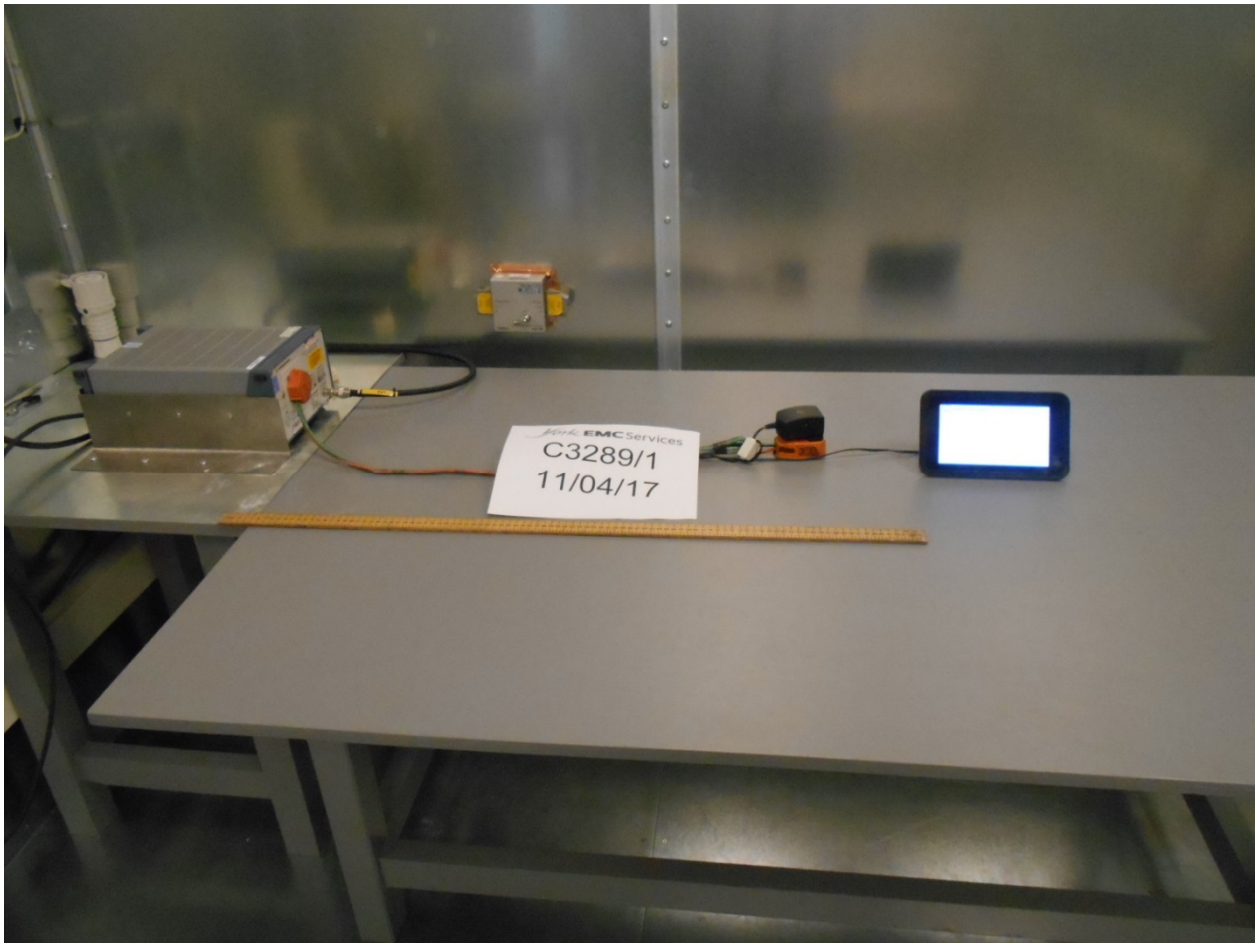
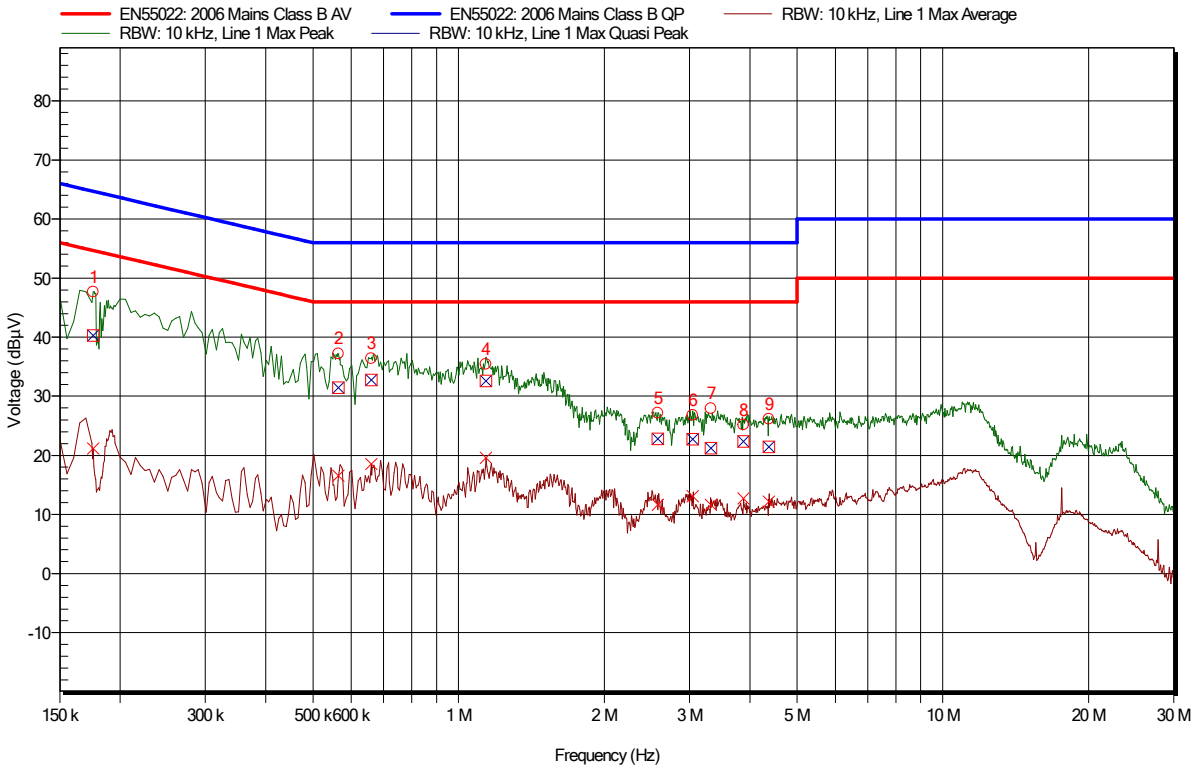


Photo 1 Conducted Emissions, Power Line

7.3.5 Plot Logs

7.3.5.1 230V 50Hz

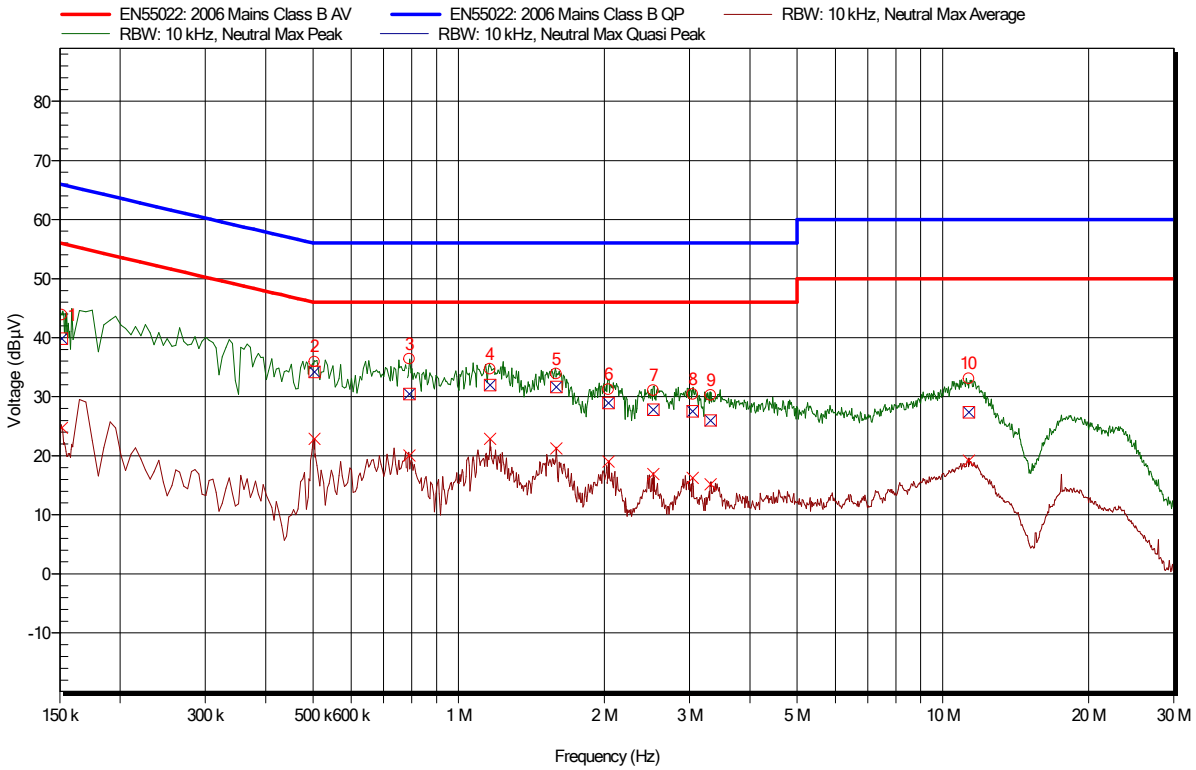
Plot No.	Date	Description
1	11/04/17	Live 230V 50Hz
2	11/04/17	Neutral 230V 50Hz



Input Power 230V 50Hz Plot 1 Live

Frequency	Peak	Average	Average Limit	Average Difference	Average Status	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Overall Status
	dBµV	dBµV	dBµV	dB		dBµV	dBµV	dB		
0.176	47.6	21.1	54.7	33.52	Pass	40.3	64.7	24.4	Pass	Pass
0.564	37.2	16.6	46.0	29.45	Pass	31.5	56.0	24.5	Pass	Pass
0.660	36.4	18.5	46.0	27.46	Pass	32.8	56.0	23.2	Pass	Pass
1.139	35.4	19.6	46.0	26.37	Pass	32.6	56.0	23.4	Pass	Pass
2.580	27.2	11.6	46.0	34.39	Pass	22.8	56.0	33.2	Pass	Pass
3.045	26.8	13.1	46.0	32.92	Pass	22.7	56.0	33.3	Pass	Pass

Input Power 230V 50Hz Live Peaks



Input Power 230V 50Hz Plot 2 Neutral

Frequency	Peak	Average	Average Limit	Average Difference	Average Status	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Overall Status
	dBµV	dBµV	dBµV	dB		dBµV	dBµV	dB		
0.151	43.8	24.7	55.9	31.19	Pass	39.8	65.9	26.1	Pass	Pass
0.504	35.9	22.9	46.0	23.14	Pass	34.2	56.0	21.8	Pass	Pass
0.792	36.4	20.0	46.0	25.96	Pass	30.5	56.0	25.5	Pass	Pass
1.161	34.6	22.8	46.0	23.15	Pass	31.9	56.0	24.1	Pass	Pass
1.590	33.9	21.2	46.0	24.76	Pass	31.6	56.0	24.4	Pass	Pass
2.040	31.2	19.0	46.0	26.97	Pass	29.0	56.0	27.0	Pass	Pass

Input Power 230V 50Hz Neutral Peaks

Section 8 Mains Harmonic Emission Results

8.1 Test Specification

EN 61000-3-2: 2014	Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current up to and including 16A per phase

8.2 Date of Test

11/04/17

8.3 Test Equipment

Item	Asset Number
California instruments PACS-1	79135
California instruments 5001ix	79136

8.4 Test Area

Lab 4

8.5 Test Setup

The California instruments 5001ix system was used to provide a 230V 50Hz voltage source with harmonic distortion within the requirements of the specification.

The test is performed twice to verify repeatability.

8.6 Class of EUT

EUT Class	A
EUT Behaviour	Long cyclic
Test time	2.5 minutes
EUT Power/Power Factor	5.7W 0.4 PF

8.7 Test Setup Photograph

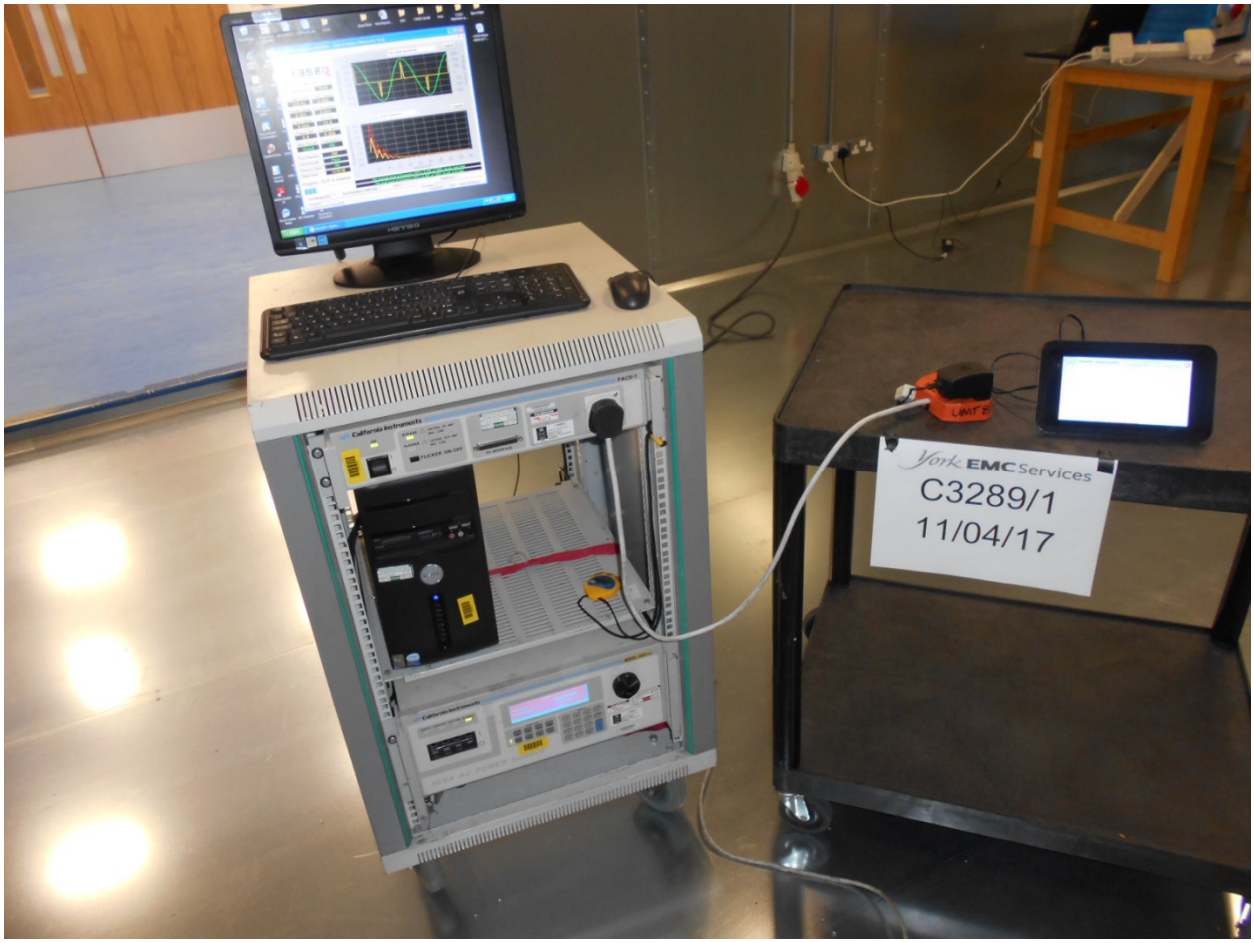


Photo 2 Mains Harmonics Emissions

8.8 Results

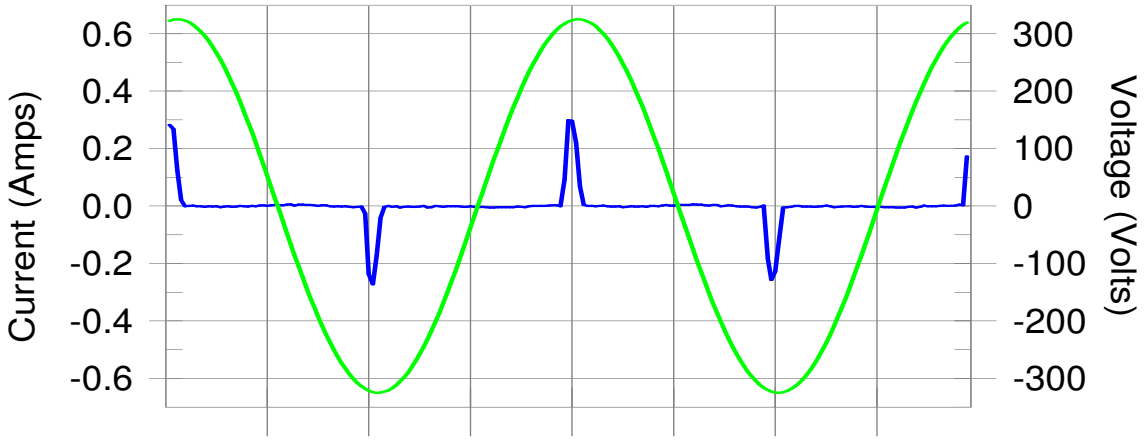
8.8.1 Results 1

Harmonics – Class-A per Ed. 3.0 (2005-11) (Run time)

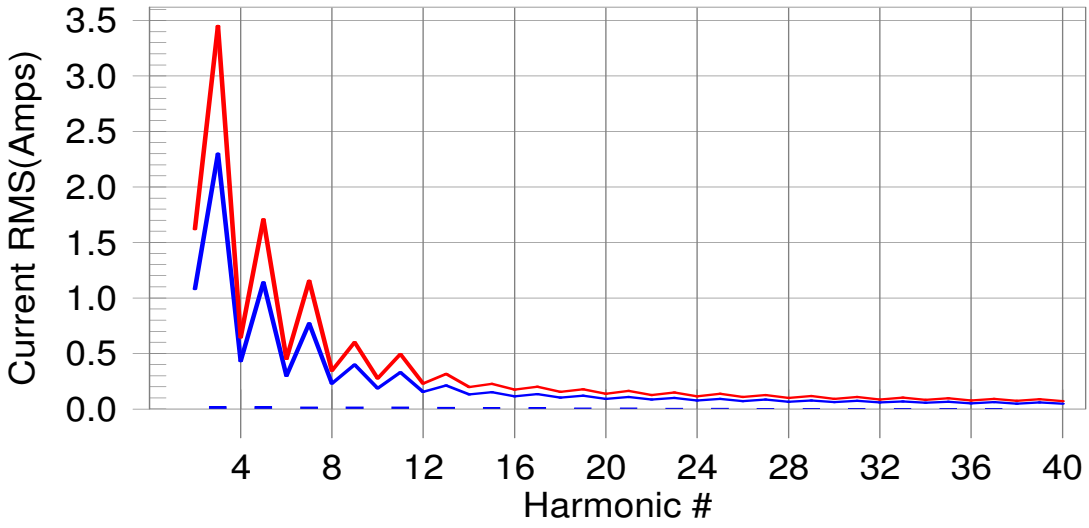
EUT: MediPi Unit **Tested by: SB**
Test category: Class-A per Ed. 3.0 (2005-11) (European limits) **Test Margin: 100**
Test date: 11/04/2017 **Start time: 13:28:30** **End time: 13:31:21**
Test duration (min): 2.5 **Data file name: H-000692.cts_data**
Comment: C3289_H01
Customer: NHS Digital

Test Result: Pass **Source qualification: Normal**

Current & voltage waveforms



Harmonics and Class A limit line **European Limits**



Test result: Pass Worst harmonic was #15 with 6.18% of the limit.

Current Test Result Summary (Run time)

EUT: MediPi Unit **Tested by: SB**
Test category: Class-A per Ed. 3.0 (2005-11) (European limits) **Test Margin: 100**
Test date: 11/04/2017 **Start time: 13:28:30** **End time: 13:31:21**
Test duration (min): 2.5 **Data file name: H-000692.cts_data**
Comment: C3289_H01
Customer: NHS Digital

Test Result: Pass **Source qualification: Normal**
THC (A): 0.05 **I-THD (%): 249.36** **POHC (A): 0.015** **POHC Limit (A): 0.251**
Highest parameter values during test:

V_RMS (Volts):	229.91	Frequency (Hz):	50.00
I_Peak (Amps):	0.350	I_RMS (Amps):	0.060
I_Fund (Amps):	0.023	Crest Factor:	5.996
Power (Watts):	5.5	Power Factor:	0.403

Harm#	Harms (avg)	100%Limit	%of Limit	Harms (max)	150%Limit	%of Limit	Status
2	0.001	1.080	0.1	0.001	1.620	0.06	Pass
3	0.021	2.300	0.9	0.022	3.450	0.64	Pass
4	0.001	0.430	0.1	0.001	0.645	0.12	Pass
5	0.020	1.140	1.7	0.021	1.710	1.21	Pass
6	0.001	0.300	0.2	0.001	0.450	0.15	Pass
7	0.019	0.770	2.5	0.020	1.155	1.71	Pass
8	0.001	0.230	0.2	0.001	0.345	0.19	Pass
9	0.018	0.400	4.5	0.019	0.600	3.09	Pass
10	0.001	0.184	0.3	0.001	0.276	0.23	Pass
11	0.017	0.330	5.0	0.017	0.495	3.46	Pass
12	0.001	0.153	0.4	0.001	0.230	0.28	Pass
13	0.015	0.210	7.2	0.016	0.315	4.95	Pass
14	0.001	0.131	0.4	0.001	0.197	0.33	Pass
15	0.014	0.150	9.1	0.014	0.225	6.18	Pass
16	0.001	0.115	0.5	0.001	0.173	0.36	Pass
17	0.012	0.132	9.0	0.012	0.199	6.12	Pass
18	0.001	0.102	0.5	0.001	0.153	0.39	Pass
19	0.010	0.118	8.7	0.010	0.178	5.86	Pass
20	0.000	0.092	0.5	0.001	0.138	0.41	Pass
21	0.009	0.107	8.1	0.009	0.161	5.42	Pass
22	0.000	0.084	0.5	0.001	0.125	0.42	Pass
23	0.007	0.098	7.2	0.007	0.147	4.85	Pass
24	0.000	0.077	0.5	0.001	0.115	0.44	Pass
25	0.006	0.090	6.3	0.006	0.135	4.22	Pass
26	0.000	0.071	0.5	0.000	0.106	0.45	Pass
27	0.004	0.083	5.3	0.004	0.125	3.58	Pass
28	0.000	0.066	0.5	0.000	0.099	0.46	Pass
29	0.003	0.078	4.4	0.003	0.116	2.99	Pass
30	0.000	0.061	0.5	0.000	0.092	0.47	Pass
31	0.003	0.073	3.7	0.003	0.109	2.49	Pass
32	0.000	0.058	0.5	0.000	0.086	0.49	Pass
33	0.002	0.068	3.3	0.002	0.102	2.24	Pass
34	0.000	0.054	0.5	0.000	0.081	0.51	Pass
35	0.002	0.064	3.2	0.002	0.096	2.21	Pass
36	0.000	0.051	0.5	0.000	0.077	0.54	Pass
37	0.002	0.061	3.3	0.002	0.091	2.29	Pass
38	0.000	0.048	0.6	0.000	0.073	0.55	Pass
39	0.002	0.058	3.4	0.002	0.087	2.38	Pass
40	0.000	0.046	0.6	0.000	0.069	0.58	Pass

Voltage Source Verification Data (Run time)

EUT: MediPi Unit **Tested by: SB**
Test category: Class-A per Ed. 3.0 (2005-11) (European limits) **Test Margin: 100**
Test date: 11/04/2017 **Start time: 13:28:30** **End time: 13:31:21**
Test duration (min): 2.5 **Data file name: H-000692.cts_data**
Comment: C3289_H01
Customer: NHS Digital

Test Result: Pass **Source qualification: Normal**

Highest parameter values during test:

Voltage (Vrms):	229.91	Frequency (Hz):	50.00
I_Peak (Amps):	0.350	I_RMS (Amps):	0.060
I_Fund (Amps):	0.023	Crest Factor:	5.996
Power (Watts):	5.5	Power Factor:	0.403

Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.167	0.460	36.27	OK
3	0.386	2.069	18.67	OK
4	0.040	0.460	8.64	OK
5	0.048	0.919	5.23	OK
6	0.040	0.460	8.72	OK
7	0.033	0.690	4.78	OK
8	0.036	0.460	7.82	OK
9	0.038	0.460	8.18	OK
10	0.023	0.460	4.95	OK
11	0.038	0.230	16.51	OK
12	0.019	0.230	8.47	OK
13	0.027	0.230	11.79	OK
14	0.018	0.230	7.83	OK
15	0.024	0.230	10.28	OK
16	0.019	0.230	8.23	OK
17	0.012	0.230	5.42	OK
18	0.015	0.230	6.72	OK
19	0.021	0.230	9.34	OK
20	0.026	0.230	11.51	OK
21	0.012	0.230	5.18	OK
22	0.015	0.230	6.60	OK
23	0.018	0.230	7.78	OK
24	0.010	0.230	4.41	OK
25	0.008	0.230	3.46	OK
26	0.012	0.230	5.35	OK
27	0.015	0.230	6.74	OK
28	0.010	0.230	4.23	OK
29	0.011	0.230	4.88	OK
30	0.010	0.230	4.19	OK
31	0.010	0.230	4.56	OK
32	0.009	0.230	3.78	OK
33	0.008	0.230	3.69	OK
34	0.006	0.230	2.78	OK
35	0.006	0.230	2.54	OK
36	0.007	0.230	3.16	OK
37	0.010	0.230	4.50	OK
38	0.006	0.230	2.61	OK
39	0.007	0.230	2.84	OK
40	0.019	0.230	8.40	OK

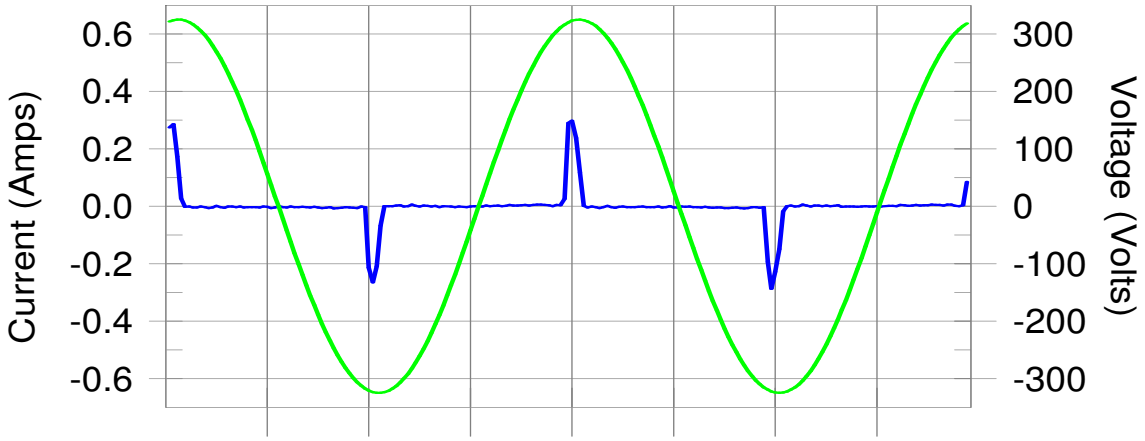
8.8.2 Results 2

Harmonics – Class-A per Ed. 3.0 (2005-11)(Run time)

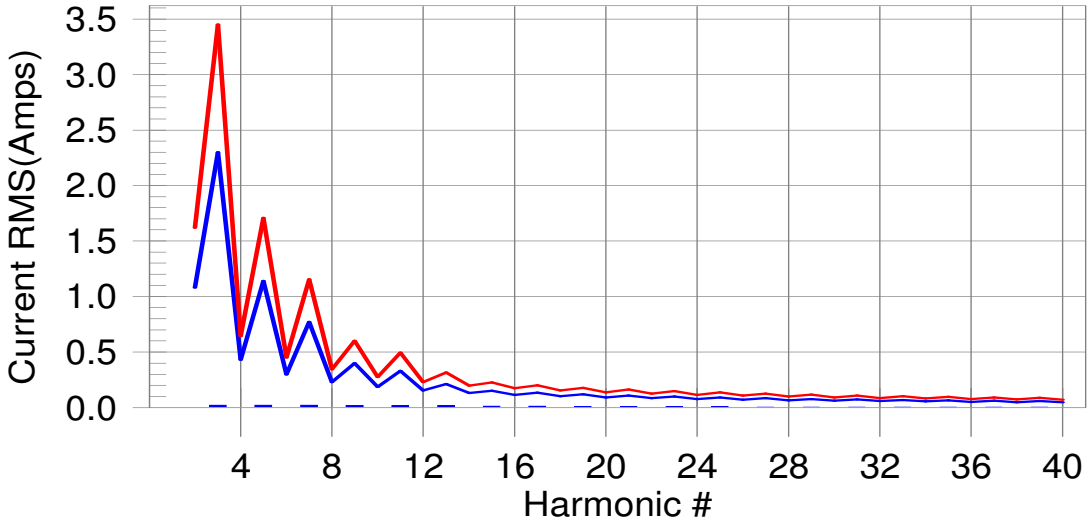
EUT: MediPi Unit Tested by: SB
Test category: Class-A per Ed. 3.0 (2005-11) (European limits) Test Margin: 100
Test date: 11/04/2017 Start time: 13:34:19 End time: 13:37:10
Test duration (min): 2.5 Data file name: H-000693.cts_data
Comment: C3289_H02
Customer: NHS Digital

Test Result: Pass Source qualification: Normal

Current & voltage waveforms



Harmonics and Class A limit line European Limits



Test result: Pass Worst harmonic was #15 with 6.22% of the limit.

Current Test Result Summary (Run time)

EUT: MediPi Unit **Tested by: SB**
Test category: Class-A per Ed. 3.0 (2005-11) (European limits) **Test Margin: 100**
Test date: 11/04/2017 **Start time: 13:34:19** **End time: 13:37:10**
Test duration (min): 2.5 **Data file name: H-000693.cts_data**
Comment: C3289_H02
Customer: NHS Digital

Test Result: Pass **Source qualification: Normal**
THC (A): 0.05 **I-THD (%): 244.41** **POHC (A): 0.015** **POHC Limit (A): 0.251**
Highest parameter values during test:

V_RMS (Volts):	229.91	Frequency (Hz):	50.00
I_Peak (Amps):	0.346	I_RMS (Amps):	0.062
I_Fund (Amps):	0.023	Crest Factor:	5.806
Power (Watts):	5.7	Power Factor:	0.403

Harm#	Harms (avg)	100%Limit	%of Limit	Harms (max)	150%Limit	%of Limit	Status
2	0.001	1.080	0.1	0.001	1.620	0.06	Pass
3	0.021	2.300	0.9	0.022	3.450	0.65	Pass
4	0.001	0.430	0.1	0.001	0.645	0.14	Pass
5	0.020	1.140	1.7	0.021	1.710	1.21	Pass
6	0.001	0.300	0.2	0.001	0.450	0.16	Pass
7	0.019	0.770	2.5	0.020	1.155	1.72	Pass
8	0.001	0.230	0.2	0.001	0.345	0.18	Pass
9	0.018	0.400	4.5	0.019	0.600	3.12	Pass
10	0.001	0.184	0.3	0.001	0.276	0.23	Pass
11	0.017	0.330	5.0	0.017	0.495	3.50	Pass
12	0.001	0.153	0.4	0.001	0.230	0.30	Pass
13	0.015	0.210	7.2	0.016	0.315	4.98	Pass
14	0.001	0.131	0.4	0.001	0.197	0.34	Pass
15	0.014	0.150	9.0	0.014	0.225	6.22	Pass
16	0.001	0.115	0.5	0.001	0.173	0.36	Pass
17	0.012	0.132	9.0	0.012	0.199	6.15	Pass
18	0.001	0.102	0.5	0.001	0.153	0.39	Pass
19	0.010	0.118	8.7	0.010	0.178	5.89	Pass
20	0.000	0.092	0.5	0.001	0.138	0.40	Pass
21	0.009	0.107	8.1	0.009	0.161	5.45	Pass
22	0.000	0.084	0.5	0.001	0.125	0.43	Pass
23	0.007	0.098	7.3	0.007	0.147	4.86	Pass
24	0.000	0.077	0.5	0.001	0.115	0.44	Pass
25	0.006	0.090	6.3	0.006	0.135	4.26	Pass
26	0.000	0.071	0.5	0.000	0.106	0.45	Pass
27	0.004	0.083	5.4	0.005	0.125	3.62	Pass
28	0.000	0.066	0.5	0.000	0.099	0.46	Pass
29	0.003	0.078	4.5	0.003	0.116	3.01	Pass
30	0.000	0.061	0.5	0.000	0.092	0.48	Pass
31	0.003	0.073	3.7	0.003	0.109	2.51	Pass
32	0.000	0.058	0.5	0.000	0.086	0.50	Pass
33	0.002	0.068	3.3	0.002	0.102	2.27	Pass
34	0.000	0.054	0.5	0.000	0.081	0.51	Pass
35	0.002	0.064	3.2	0.002	0.096	2.24	Pass
36	0.000	0.051	0.5	0.000	0.077	0.54	Pass
37	0.002	0.061	3.3	0.002	0.091	2.32	Pass
38	0.000	0.048	0.5	0.000	0.073	0.55	Pass
39	0.002	0.058	3.4	0.002	0.087	2.41	Pass
40	0.000	0.046	0.6	0.000	0.069	0.57	Pass

Voltage Source Verification Data (Run time)

EUT: MediPi Unit **Tested by: SB**
Test category: Class-A per Ed. 3.0 (2005-11) (European limits) **Test Margin: 100**
Test date: 11/04/2017 **Start time: 13:34:19** **End time: 13:37:10**
Test duration (min): 2.5 **Data file name: H-000693.cts_data**
Comment: C3289_H02
Customer: NHS Digital

Test Result: Pass **Source qualification: Normal**

Highest parameter values during test:

Voltage (Vrms):	**229.91**	**Frequency (Hz):**	**50.00**
I_Peak (Amps):	**0.346**	**I_RMS (Amps):**	**0.062**
I_Fund (Amps):	**0.023**	**Crest Factor:**	**5.806**
Power (Watts):	**5.7**	**Power Factor:**	**0.403**

Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.178	0.460	38.65	OK
3	0.402	2.069	19.42	OK
4	0.056	0.460	12.14	OK
5	0.060	0.919	6.51	OK
6	0.042	0.460	9.23	OK
7	0.045	0.690	6.54	OK
8	0.037	0.460	8.07	OK
9	0.038	0.460	8.25	OK
10	0.031	0.460	6.84	OK
11	0.038	0.230	16.46	OK
12	0.020	0.230	8.77	OK
13	0.029	0.230	12.54	OK
14	0.019	0.230	8.25	OK
15	0.026	0.230	11.11	OK
16	0.021	0.230	8.93	OK
17	0.017	0.230	7.22	OK
18	0.019	0.230	8.39	OK
19	0.023	0.230	10.00	OK
20	0.027	0.230	11.76	OK
21	0.013	0.230	5.55	OK
22	0.016	0.230	6.82	OK
23	0.020	0.230	8.85	OK
24	0.011	0.230	4.86	OK
25	0.010	0.230	4.28	OK
26	0.014	0.230	6.21	OK
27	0.016	0.230	7.13	OK
28	0.011	0.230	4.91	OK
29	0.013	0.230	5.49	OK
30	0.010	0.230	4.27	OK
31	0.012	0.230	5.43	OK
32	0.010	0.230	4.14	OK
33	0.010	0.230	4.34	OK
34	0.007	0.230	3.09	OK
35	0.007	0.230	3.08	OK
36	0.008	0.230	3.61	OK
37	0.012	0.230	5.16	OK
38	0.006	0.230	2.78	OK
39	0.007	0.230	3.25	OK
40	0.019	0.230	8.48	OK

8.8.3 Harmonics repeatability

Harm	Run1 Av1	Run1 Lim1	Run1 Result1	Run2 Av2	Run2 Lim2	Run2 Result2	5%of Limit	Difference	Both Pass	Within 5%
2	0.001	1.08	Pass	0.001	1.08	Pass	0.054	0	TRUE	TRUE
3	0.021	2.3	Pass	0.021	2.3	Pass	0.115	0	TRUE	TRUE
4	0.001	0.43	Pass	0.001	0.43	Pass	0.0215	0	TRUE	TRUE
5	0.02	1.14	Pass	0.02	1.14	Pass	0.057	0	TRUE	TRUE
6	0.001	0.3	Pass	0.001	0.3	Pass	0.015	0	TRUE	TRUE
7	0.019	0.77	Pass	0.019	0.77	Pass	0.0385	0	TRUE	TRUE
8	0.001	0.23	Pass	0.001	0.23	Pass	0.0115	0	TRUE	TRUE
9	0.018	0.4	Pass	0.018	0.4	Pass	0.02	0	TRUE	TRUE
10	0.001	0.184	Pass	0.001	0.184	Pass	0.0092	0	TRUE	TRUE
11	0.017	0.33	Pass	0.017	0.33	Pass	0.0165	0	TRUE	TRUE
12	0.001	0.153	Pass	0.001	0.153	Pass	0.00765	0	TRUE	TRUE
13	0.015	0.21	Pass	0.015	0.21	Pass	0.0105	0	TRUE	TRUE
14	0.001	0.131	Pass	0.001	0.131	Pass	0.00655	0	TRUE	TRUE
15	0.014	0.15	Pass	0.014	0.15	Pass	0.0075	0	TRUE	TRUE
16	0.001	0.115	Pass	0.001	0.115	Pass	0.00575	0	TRUE	TRUE
17	0.012	0.132	Pass	0.012	0.132	Pass	0.0066	0	TRUE	TRUE
18	0.001	0.102	Pass	0.001	0.102	Pass	0.0051	0	TRUE	TRUE
19	0.01	0.118	Pass	0.01	0.118	Pass	0.0059	0	TRUE	TRUE
20	0	0.092	Pass	0	0.092	Pass	0.0046	0	TRUE	TRUE
21	0.009	0.107	Pass	0.009	0.107	Pass	0.00535	0	TRUE	TRUE
22	0	0.084	Pass	0	0.084	Pass	0.0042	0	TRUE	TRUE
23	0.007	0.098	Pass	0.007	0.098	Pass	0.0049	0	TRUE	TRUE
24	0	0.077	Pass	0	0.077	Pass	0.00385	0	TRUE	TRUE
25	0.006	0.09	Pass	0.006	0.09	Pass	0.0045	0	TRUE	TRUE
26	0	0.071	Pass	0	0.071	Pass	0.00355	0	TRUE	TRUE
27	0.004	0.083	Pass	0.004	0.083	Pass	0.00415	0	TRUE	TRUE
28	0	0.066	Pass	0	0.066	Pass	0.0033	0	TRUE	TRUE
29	0.003	0.078	Pass	0.003	0.078	Pass	0.0039	0	TRUE	TRUE
30	0	0.061	Pass	0	0.061	Pass	0.00305	0	TRUE	TRUE
31	0.003	0.073	Pass	0.003	0.073	Pass	0.00365	0	TRUE	TRUE
32	0	0.058	Pass	0	0.058	Pass	0.0029	0	TRUE	TRUE
33	0.002	0.068	Pass	0.002	0.068	Pass	0.0034	0	TRUE	TRUE
34	0	0.054	Pass	0	0.054	Pass	0.0027	0	TRUE	TRUE
35	0.002	0.064	Pass	0.002	0.064	Pass	0.0032	0	TRUE	TRUE
36	0	0.051	Pass	0	0.051	Pass	0.00255	0	TRUE	TRUE
37	0.002	0.061	Pass	0.002	0.061	Pass	0.00305	0	TRUE	TRUE
38	0	0.048	Pass	0	0.048	Pass	0.0024	0	TRUE	TRUE
39	0.002	0.058	Pass	0.002	0.058	Pass	0.0029	0	TRUE	TRUE
40	0	0.046	Pass	0	0.046	Pass	0.0023	0	TRUE	TRUE
									TRUE	TRUE

Test Result: Pass

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

Section 9 Mains Voltage Fluctuation Results

9.1 Test Specification

EN61000-3-3: 2013 Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ≤ 16 A

9.2 Date of Test

11/04/17

9.3 Test Equipment

Item	Asset Number
California instruments PACS-1	79135
California instruments 5001ix	79136

9.4 Test Area

Lab 4

9.5 Test Setup

The California instruments 5001ix was used to provide a 230V 50Hz voltage source with voltage / frequency stability and harmonic distortion within the requirements of EN61000-3-3. The EUT was powered from this voltage source via the California instruments PACS-1. The impedance complies with the requirements of EN61000-3-3.

A test time of 10 minutes was then applied.

9.6 Class of EUT

Pst limits applied	Yes
Plt limits applied	No
Test time	10 minutes
Dmax level	4%

9.7 Dmax caused by manual switching

The EUT is connected to the California instruments PACS-1as before.

24 Dmax readings caused by manual switching are obtained and the final test result calculated by deleting the highest and lowest results and taking the arithmetical average of the remaining 22 values.

9.8 Test Setup Photograph`

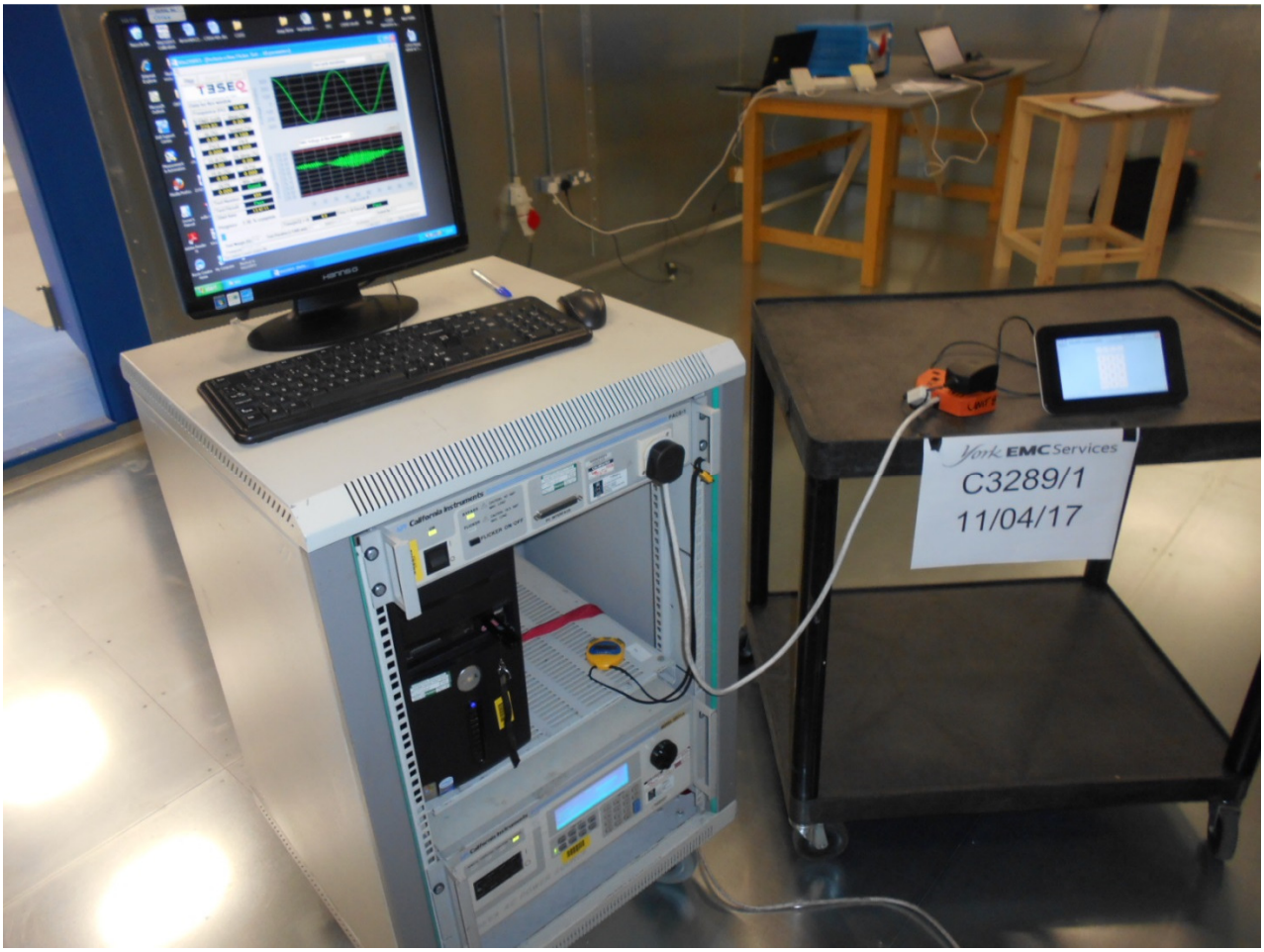


Photo 3 Mains Voltage Fluctuations

9.9 Results

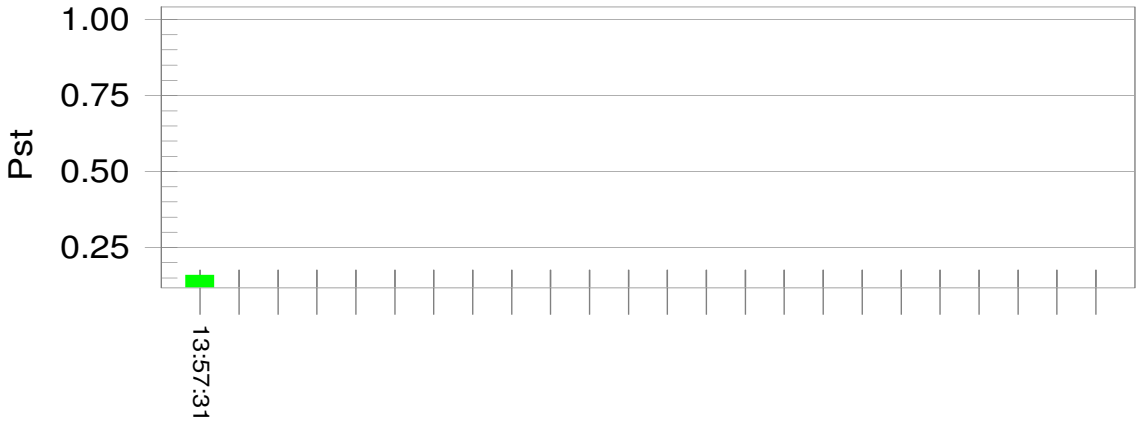
9.9.1 Flicker Results

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

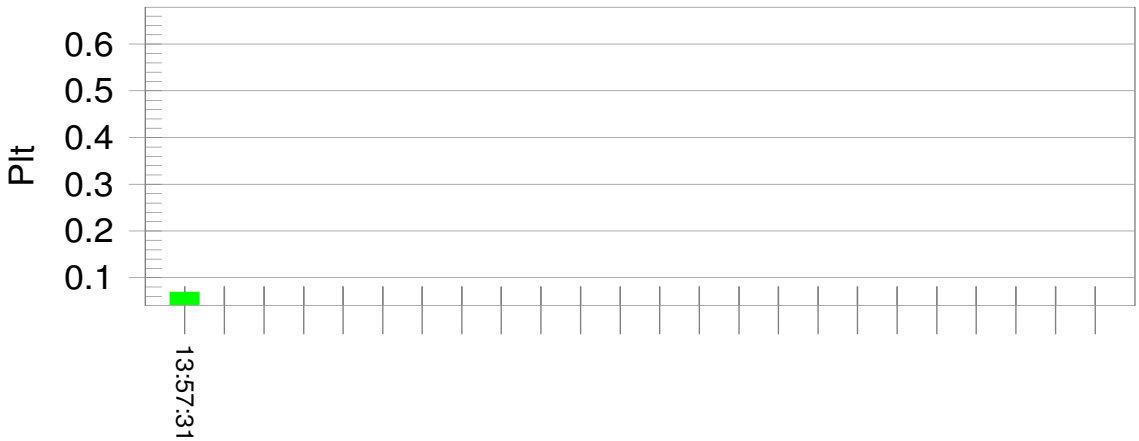
EUT: MediPi Unit **Tested by: SB**
Test category: All parameters (European limits) **Test Margin: 100**
Test date: 11/04/2017 **Start time: 13:47:11** **End time: 13:57:32**
Test duration (min): 10 **Data file name: F-000694.cts_data**
Comment: C3289_F01
Customer: NHS Digital

Test Result: Pass **Status: Test Completed**

Pst_i and limit line **European Limits**



Plt and limit line



Parameter values recorded during the test:

Vrms at the end of test (Volt):	**229.88**			
Highest dt (%):	**0.00**	**Test limit (%):**	**3.30**	**Pass**
Time (mS) > dt:	**0.0**	**Test limit (mS):**	**500.0**	**Pass**
Highest dc (%):	**0.00**	**Test limit (%):**	**3.30**	**Pass**
Highest dmax (%):	**0.00**	**Test limit (%):**	**4.00**	**Pass**
Highest Pst (10 min. period):	**0.160**	**Test limit:**	**1.000**	**Pass**
Highest Plt (2 hr. period):	**0.070**	**Test limit:**	**0.650**	**Pass**

9.9.2 Results for Dmax caused by manual switching

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

EUT: MediPi Unit **Tested by: SB**
Test category: 24 x dmax Test **Test Margin: 100**
Test date: 11/04/2017 **Start time: 13:59:50** **End time: 14:28:02**
Test duration (min): 60 **Data file name: F-000695.cts_data**
Comment: C3289_F02
Customer: NHS Digital

Test Result: Pass **Status: Test Completed**

European Limits

Parameter values recorded during the test:

Vrms at the end of test (Volt):	**229.85**		
Average dmax (%):	**0.23**	**Test limit (%):**	**4.00**

Test Number	Dmax	
1	0.000	Lowest dmax (Disregarded)
2	0.000	
3	0.000	
4	-0.209	
5	-0.209	
6	-0.381	Highest dmax (Disregarded)
7	-0.381	
8	-0.369	
9	-0.369	
10	-0.369	
11	-0.369	
12	-0.369	
13	-0.369	
14	-0.369	
15	-0.162	
16	-0.162	
17	-0.162	
18	-0.162	
19	-0.180	
20	-0.180	
21	-0.153	
22	-0.153	
23	-0.153	
24	-0.137	

Average of 22 Dmax	**0.227**
Lowest Dmax	**0.000**
Highest Dmax	**-0.381**

Section 10 Radiated Emission Results

10.1 Test Specification

EN60601-1-2:2007 +Corr: 2010 Medical electrical equipment part 1-2. General requirements for basic safety and essential performance - Collateral standard; Electromagnetic compatibility- requirements and tests.

Referencing *CISPR22: 2010*

10.2 Emissions measurements

10.2.1 Date of Test

10/04/17 &
21/04/17

10.2.2 Test Equipment

Item	Asset Number
Rohde & Schwarz ESVS20 Receiver	79847
Keysight PXA test receiver	C0338
Bonn BLMA 0118A-5A Pre amplifier	YO145
Chase CBL6111C Bilog Antenna	78707
EMCO 3115 Horn Antenna	78347

10.2.3 Test Area

Lab 1

10.2.4 Test Setup

For initial pre scan results, the EUT was configured in the chamber on a

- 80cm high table

The measurement was performed with an antenna to EUT separation distance of 3m.

Final measurements were made in a semi anechoic chamber at a separation distance of 3m. The results are maximised in orientation 0-360 degrees and height 1-4m.

10.2.5 Test Setup Photograph

Photo 4 Radiated Emissions, <1GHz

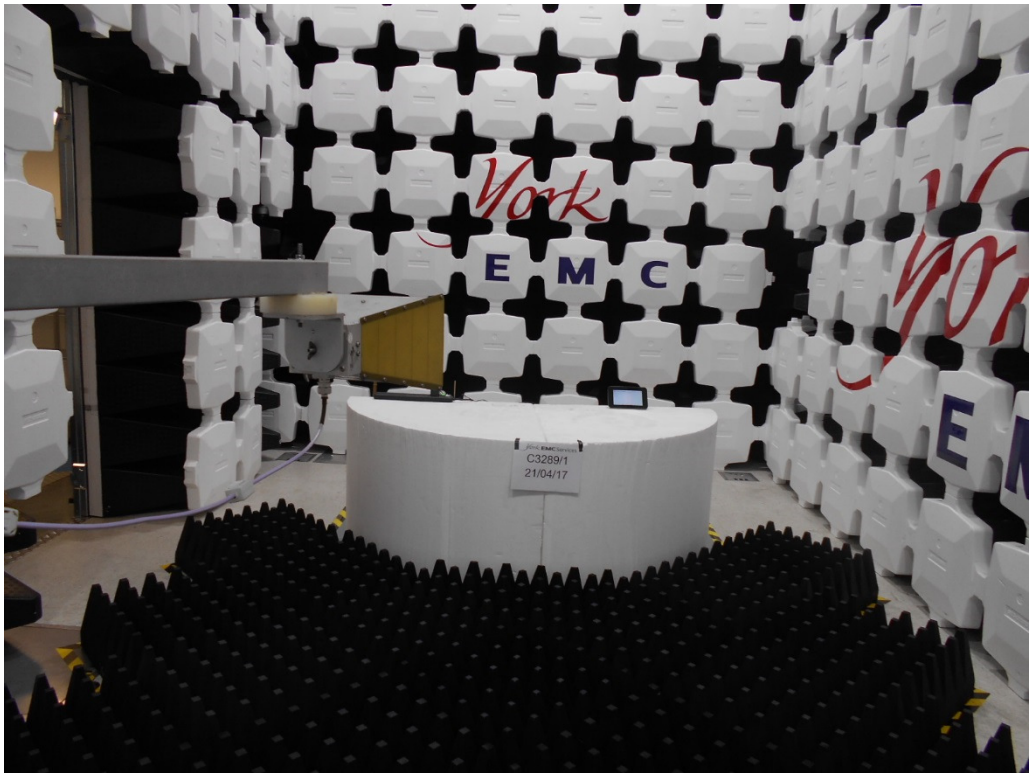
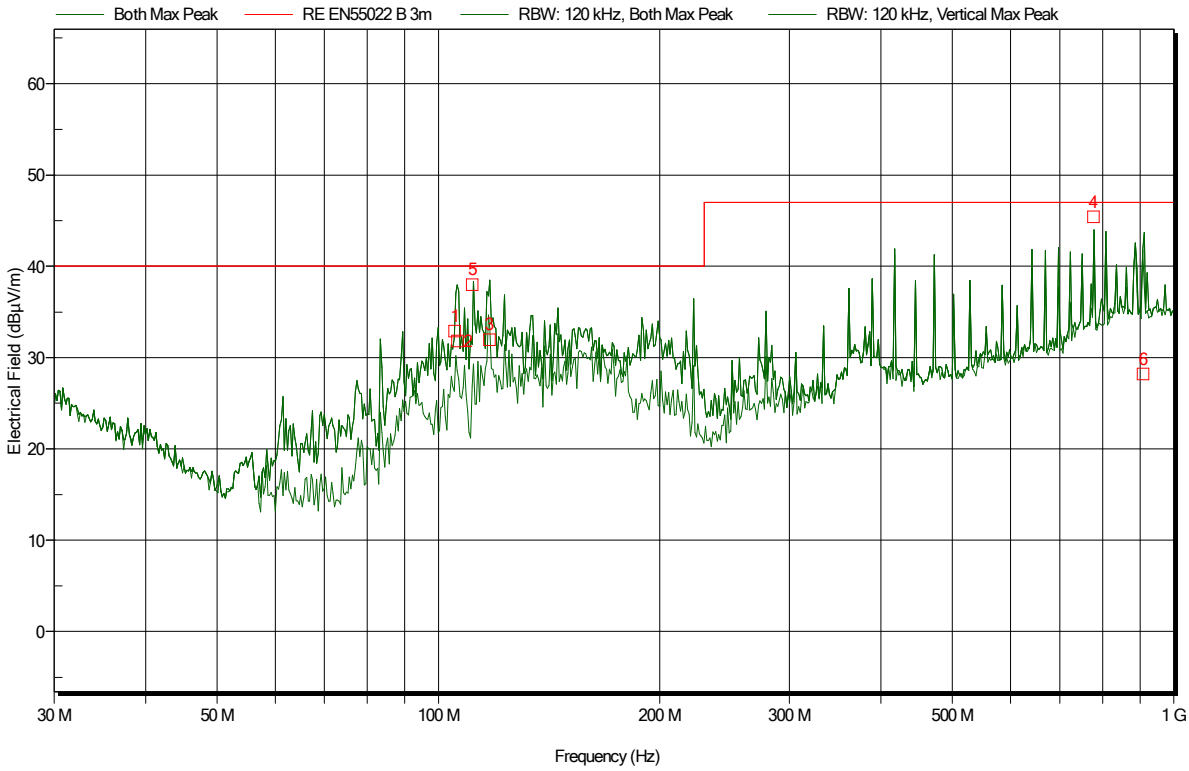


Photo 5 Radiated Emissions, >1GHz

10.2.6 Plot log electric field emissions, 30MHz to 1GHz

Plot No.	Date	Description
1	21/04/17	3m measurement, 1 to 4 meter height scan, in a semi anechoic chamber. Composite plot of EUT emissions.



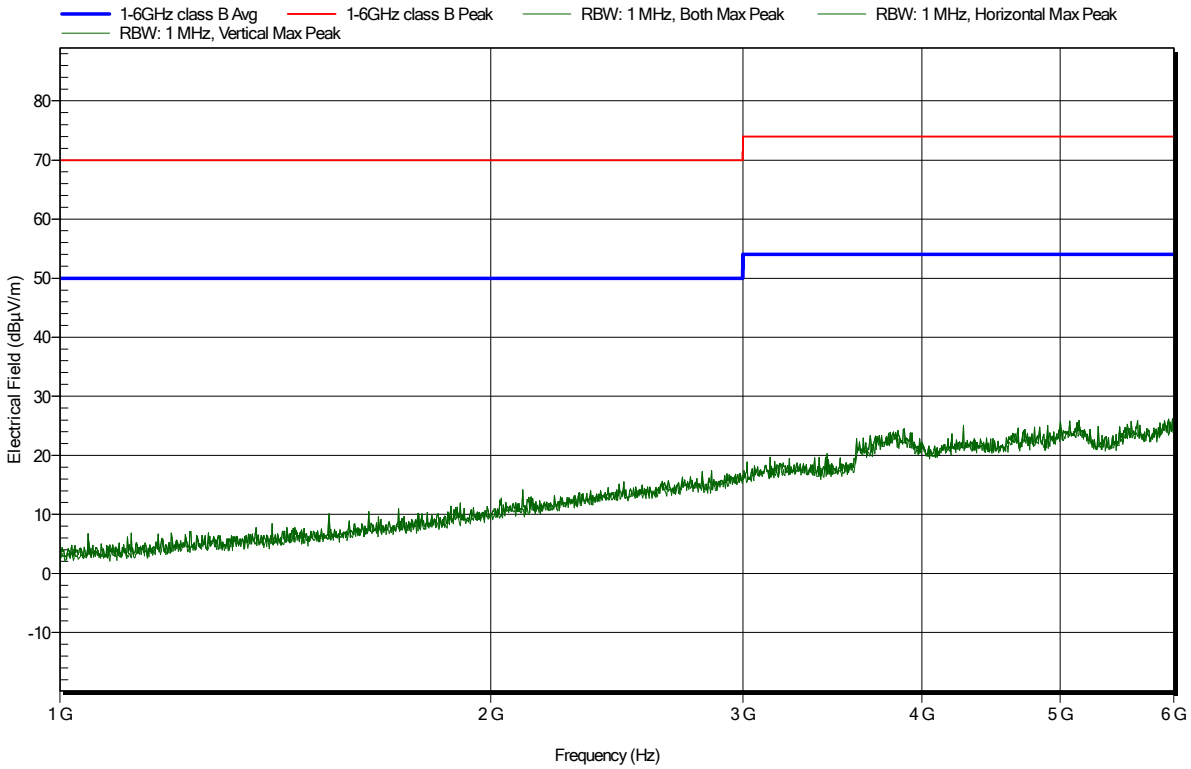
Plot 1, Radiated emissions 30MHz to 1GHz.

10.2.7 Results, 30-1000MHz

Frequency (MHz)	Quasi-peak dBµV/m	Quasi-peak limit dBµV/m	Quasi-peak difference	Quasi-peak correction	Quasi-peak status	Status	Angle (°)	Height (m)	Polarisation
105.18	32.9	40	-7.1	17.7	Pass	Pass	5°	3.0	Vertical
106.20	31.8	40	-8.2	17.8	Pass	Pass	350°	3.0	Vertical
111.24	38.0	40	-2.0	18.3	Pass	Pass	200°	2.8	Vertical
117.24	32.0	40	-8.0	18.8	Pass	Pass	340°	2.6	Vertical
777.78	45.4	47	-1.6	29.2	Pass	Pass	85°	1.6	Vertical
907.98	28.2	47	-18.8	29.9	Pass	Pass	320°	3.9	Vertical

10.2.8 Plot log, electric field emissions, >1GHz

Plot No.	Date	Description
1	21/04/17	3m measurement, fixed height antenna in a semi anechoic chamber. Composite plot of EUT emissions, peak and average.



Plot Radiated emissions, >1GHz 1

Note 1: There were no recorded emissions within 30dBµV/m of the limit line.

Section 11 Electrostatic Discharge Results

11.1 Test Specification

EN61000-4-2: 1995	Electromagnetic Compatibility (EMC) Part 4-2. Testing and measurement techniques - Electrostatic discharge immunity test
Criterion of Susceptibility	B
Test level	+/- 8kV Air discharge +/- 6kV Contact discharge All lower levels tested

11.2 Date of Test

12/04/17

11.3 Test Equipment

Item	Asset Number
NSG437 ESD Generator	C0429
Horizontal coupling plane	C0435
Vertical coupling plane	C0436

11.4 Test Conditions

Temperature	22°C
Humidity	40%

11.5 Test Area

Lab 2

11.6 Test Setup

Table top: A ground reference plane (HCP) of dimensions 1.6m x 0.8m was positioned on top of an 80cm high table and referenced to the screened room earth via 940kΩ (470kΩ resistor at each end of the cable). The EUT was placed on the HCP, insulated from it by 0.5mm insulation sheet. The EUT was positioned at least 1.0m from all the room walls.

11.7 Test Setup Photograph

Photo 6 ESD Test Setup

11.8 Test Points

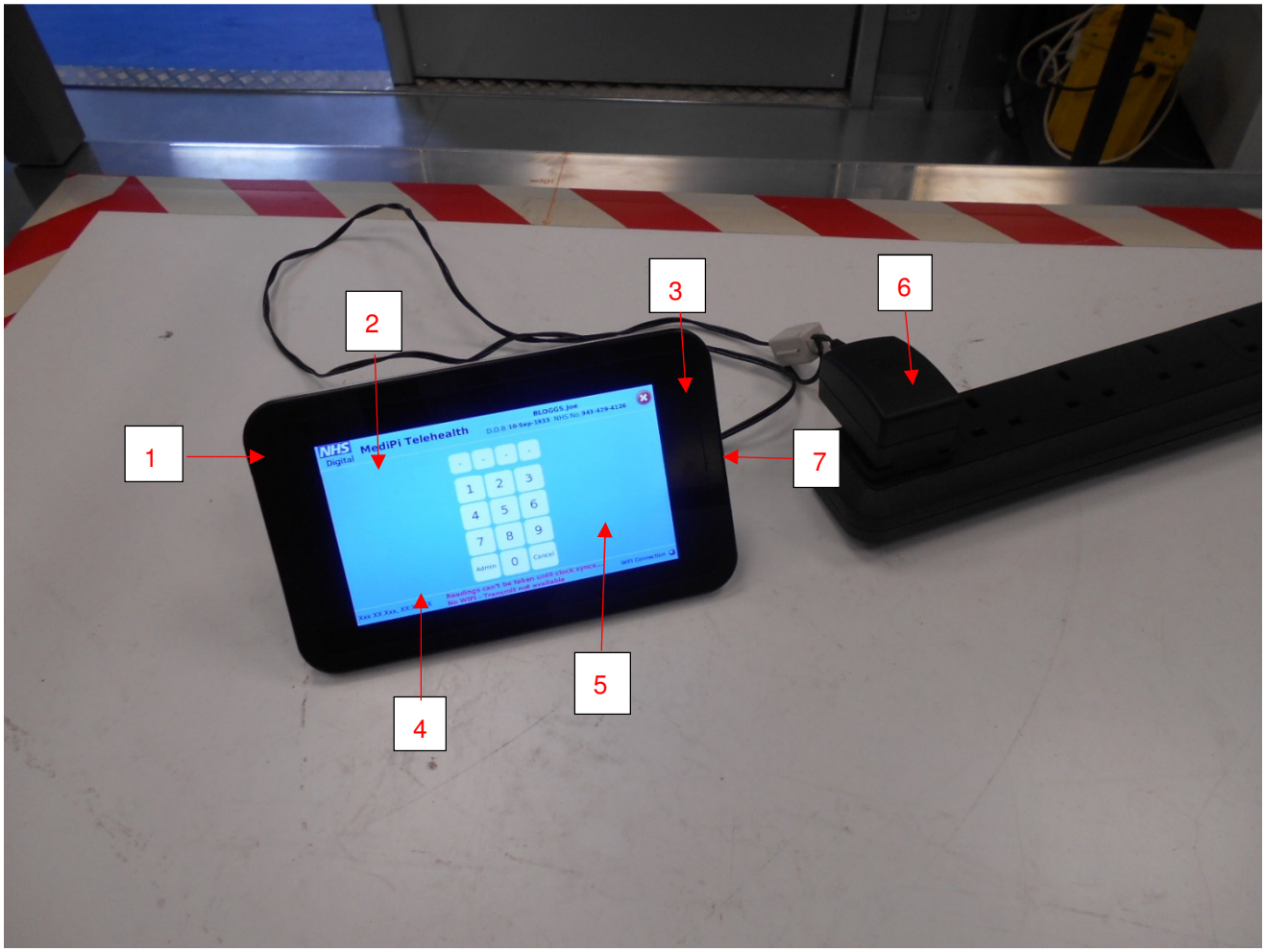


Photo 7 ESD Points 1

11.9 Results

Performance criterion B							
Test Point No.	**Description**	**No. of Apps**	**Type**	**Max Level kV**	**Pol +/-**	**Effect Witnessed**	**Result (Pass/Fail)**
1	Outer casing	20	Air	8	+/-	None	Pass
2	Screen	20	Air	8	+/-	None	Pass
3	Outer casing	20	Air	8	+/-	None	Pass
4	Screen	20	Air	8	+/-	None	Pass
5	Screen	20	Air	8	+/-	None	Pass
6	Power supply	20	Air	8	+/-	None	Pass
7	Socket	20	Contact	6	+/-	None	Pass
HCP1	Horizontal coupling plane	20	Contact	6	+/-	None	Pass
HCP2	Horizontal coupling plane	20	Contact	6	+/-	None	Pass
HCP3	Horizontal coupling plane	20	Contact	6	+/-	None	Pass
HCP4	Horizontal coupling plane	20	Contact	6	+/-	None	Pass
VCP1	Vertical coupling plane	20	Contact	6	+/-	None	Pass
VCP2	Vertical coupling plane	20	Contact	6	+/-	None	Pass
VCP3	Vertical coupling plane	20	Contact	6	+/-	None	Pass
VCP4	Vertical coupling plane	20	Contact	6	+/-	None	Pass

Section 12 Radiated RF Immunity Results

12.1 Test Specification

EN61000-4-3: 2006 Test equipment calibrated to EN61000-4-3: 2006 +A1:2008 + A2:2010	Electromagnetic Compatibility (EMC) Part 4-3. Testing and measurement techniques – Radiated, radio frequency, electromagnetic field immunity test
Criterion of Susceptibility	A
Test levels	80MHz to 2500MHz 3V/m 80% 1kHz AM The field was applied using a dwell time of 3 seconds and frequency step size of 1%.

12.2 Date of Test

07/04/17

12.3 Test Equipment

Item	Asset Number
Rohde & Schwarz NRVD	78039
Rohde & Schwarz NRV-Z5	C0117
R&S 0.69-6GHz Comb. Amp	C0424
C6277-10 RF Coupler	D0028
Wandel & Goltermann EMC-20 field monitor	79005
Teseq CBA1-500 amplifier	C0104
Chase X wing 1053 Antenna	79735
EMCO 3115 Horn Antenna	78347
R&S SMB100A 6GHz Sig Gen C0423	C0423

12.4 Test Conditions

Temperature	20°C
Humidity	40%

12.5 Test Area

Lab 1 Test chamber.

12.6 Test Setup

The EUT was installed in the semi-anechoic chamber 0.8m above the chamber floor. The uniform field is pre-calibrated in accordance with the standard.

12.7 Test Setup Photograph

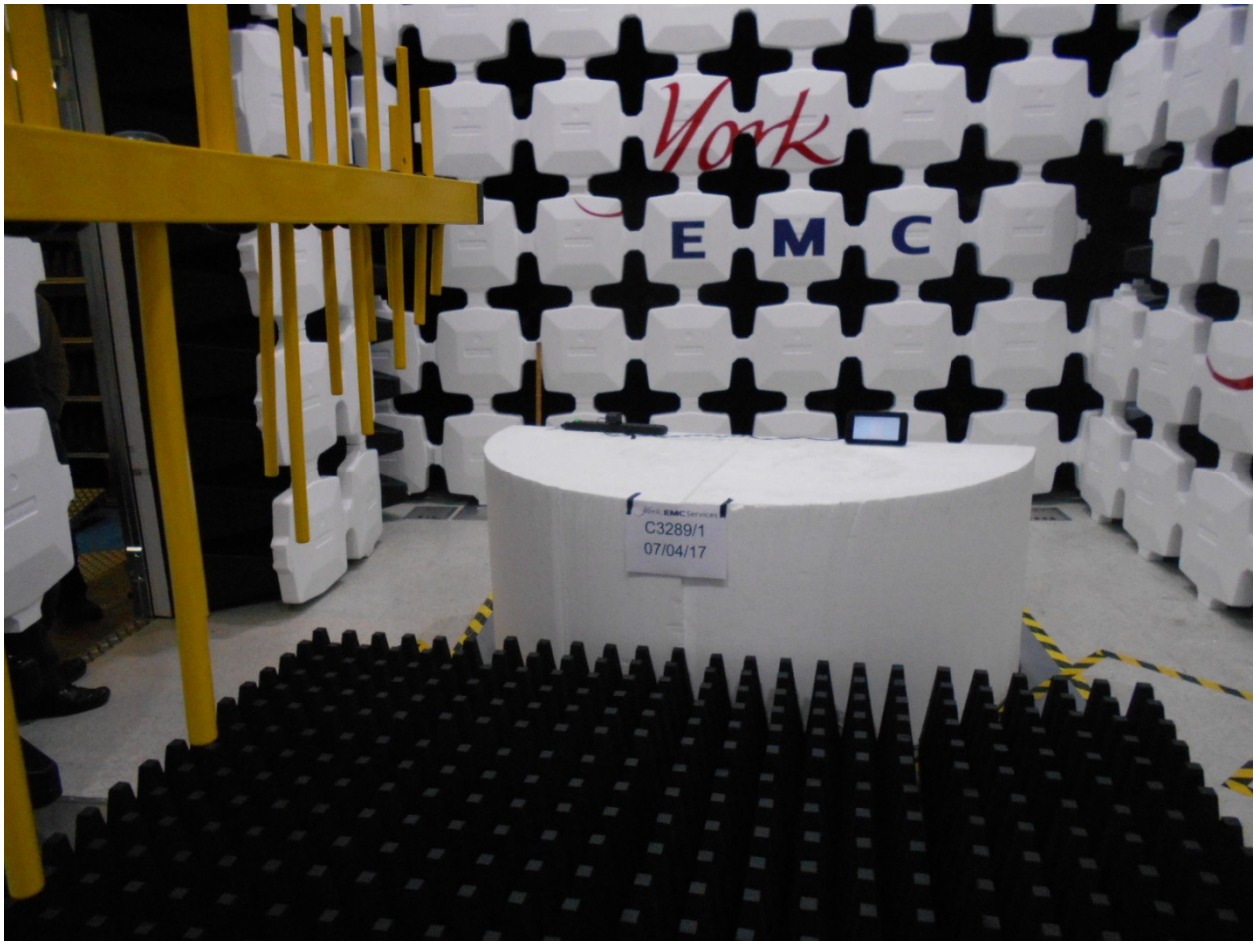


Photo 8 Radiated RF Immunity, <1GHz

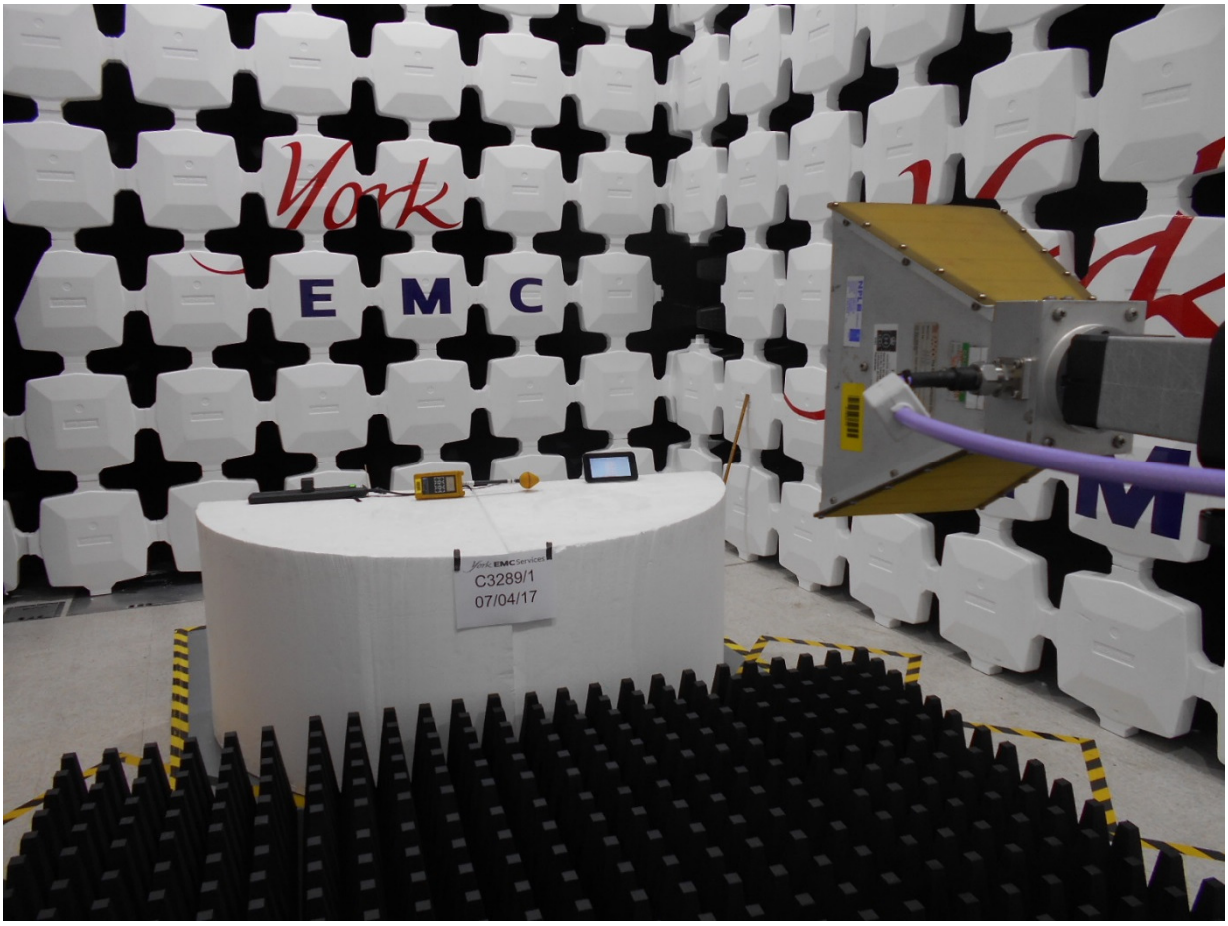


Photo 9 Radiated RF Immunity, >1GHz

12.8 Test Results

Performance criterion A				
Frequency MHz	**Level V/m**	**Polarity**	**Effect Witnessed**	**Result (Pass/Fail)**
0 degrees				
80-2500	3	H	None	Pass
80-2500	3	V	None	Pass
90 degrees				
80-2500	3	H	None	Pass
80-2500	3	V	None	Pass
180 degrees				
80-2500	3	H	None	Pass
80-2500	3	V	None	Pass
270 degrees				
80-2500	3	H	None	Pass
80-2500	3	V	None	Pass

Section 13 Electrical Fast Transient/Burst Immunity Results

13.1 Test Specification

EN61000-4-4: 2004 Test equipment calibrated to EN6100-4-4:2012	Electromagnetic Compatibility (EMC) Part 4-4. Testing and measurement techniques – Electrical fast transient/burst immunity test
Criterion of Susceptibility	B
Test levels	+/- 2kV AC power All lower levels tested

13.2 Date of Test

07/04/17

13.3 Test Equipment

Item	Asset Number
NSG3040 C0432	C0432

13.4 Test Conditions

Temperature	20°C
Humidity	40%

13.5 Test Area

Lab 2

13.6 Test Setup

For testing to EN61000-4-4:2004/2004 +A1/2012

AC power: The EUT was placed in the test area and separated from the ground reference plane via a 10cm insulator and more than 0.5m from the room walls. The EUT was powered from the Fast Transient generator mains output via a 0.5m cable and the transients were applied by direct injection.

13.7 Test Setup Photograph

Photo 10 EFT/B, Power lines

13.8 Results

Transients are applied at:				
Burst Frequency	5kHz	**Burst Period**	300ms	
Duration	15ms	**Test period**	1 minute at each polarity at each level All lower levels tested	
Performance criterion A/B				
Line under Test	**Max Level kV**	**Polarity +/-**	**Effect Witnessed**	**Result**
Live/Neutral/Earth	2	+	None	Pass
	2	-	None	Pass

Section 14 Surge Transient Immunity Results

14.1 Test Specification

EN61000-4-5: 2006	Electromagnetic Compatibility (EMC) Part 5. Testing and measurement techniques. Section 5. Surge immunity test.
Criterion of Susceptibility	B
Test levels	AC power lines +/- 2kV Line to earth +/- 1kV Line to line All lower levels tested.

14.2 Date of Test

11/04/17 & 12/04/17

14.3 Test Equipment

Item	Asset Number
NSG3040	C0432
NSG3060	C0431

14.4 Test Conditions

Temperature	22°C
Humidity	41%

14.5 Test Area

Lab 2

14.6 Test Setup

AC power: The EUT was powered through the Surge generator and surges applied via the Surge Generator coupling network.

During surge immunity testing the effective output impedance of the generator was 12 Ohms for line to earth testing and 2 Ohms for line to line testing.

The surges were applied in turn at the following points on the input power waveform:-0°, 90°, 180° and 270°.

'Section 8.2 of EN/IEC 61000-4-5 requires that any secondary surge protection is tested by applying surges at a level just below the worst case voltage breakdown level (let-through level) of the primary protection (for example varistors). The breakdown level (let-through level) was not known by the customer or made available, therefore only the standard surge test levels were applied during the surge test.'

14.7 Test Setup Photograph

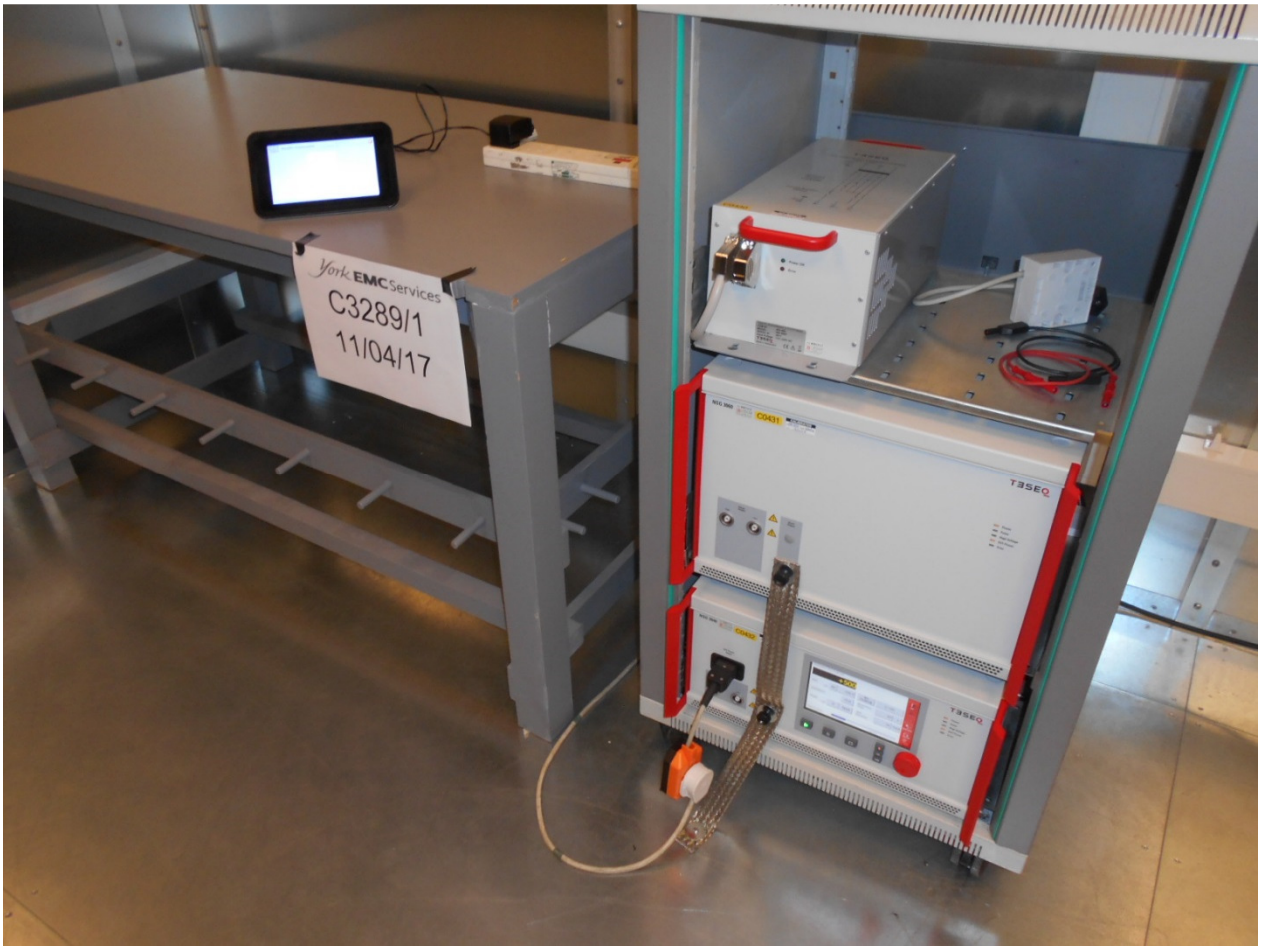


Photo 11 Surge, Power Lines

14.8 Results

Performance criterion B							
Line under Test	**Max Level kV**	**No. of Pulses**	**Phase Position degrees**	**Pol +/-**	**Effect Witnessed**	**Source impedance**	**Result (Pass/Fail)**
Live -Earth	2	5	0	+	None	12 ohms	Pass
	2	5	90	+	None	12 ohms	Pass
	2	5	180	+	None	12 ohms	Pass
	2	5	270	+	None	12 ohms	Pass
	2	5	0	-	None	12 ohms	Pass
	2	5	90	-	None	12 ohms	Pass
	2	5	180	-	None	12 ohms	Pass
	2	5	270	-	None	12 ohms	Pass
Neut- Earth	2	5	0	+	None	12 ohms	Pass
	2	5	90	+	None	12 ohms	Pass
	2	5	180	+	None	12 ohms	Pass
	2	5	270	+	None	12 ohms	Pass
	2	5	0	-	None	12 ohms	Pass
	2	5	90	-	None	12 ohms	Pass
	2	5	180	-	None	12 ohms	Pass
	2	5	270	-	None	12 ohms	Pass
Live-Neut	1	5	0	+	None	2 ohms	Pass
	1	5	90	+	None	2 ohms	Pass
	1	5	180	+	None	2 ohms	Pass
	1	5	270	+	None	2 ohms	Pass
	1	5	0	-	None	2 ohms	Pass
	1	5	90	-	None	2 ohms	Pass
	1	5	180	-	None	2 ohms	Pass
	1	5	270	-	None	2 ohms	Pass

Section 15 Conducted RF Immunity Results

15.1 Test Specification

EN61000-4-6: 2007	Electromagnetic Compatibility (EMC) Part 4-6. Testing and measurement techniques – Immunity to conducted disturbances induced by radio frequency fields
Criterion of Susceptibility	A
Test levels	3Vrms 0.15MHz to 80MHz 1kHz 80%AM The test level was applied using a dwell time of 3 seconds and frequency step size of 1%.

15.2 Date of Test

11/04/17

15.3 Test Equipment

Item	Asset No
Wandel & Goltermann EMC-20 field monitor	79005
Rohde & Schwarz SMY02	78653
R&S BBA150-A160 CRFI Amp	C0425
Rohde & Schwarz NRVD	C0115
Rohde & Schwarz URV5-Z2	78366
M3 CDN	C0440
6dB Attenuator	79044

15.4 Test Conditions

Temperature	23°C
Humidity	42%

15.5 Test Area

LAB 2

15.6 Test Setup

The EUT was isolated from the ground reference plane by 10cm insulator. The EUT cabling was isolated from the ground reference plane by 30-50mm insulators.

The disturbance is pre-calibrated in accordance with the standard.

15.7 Test Setup Photograph

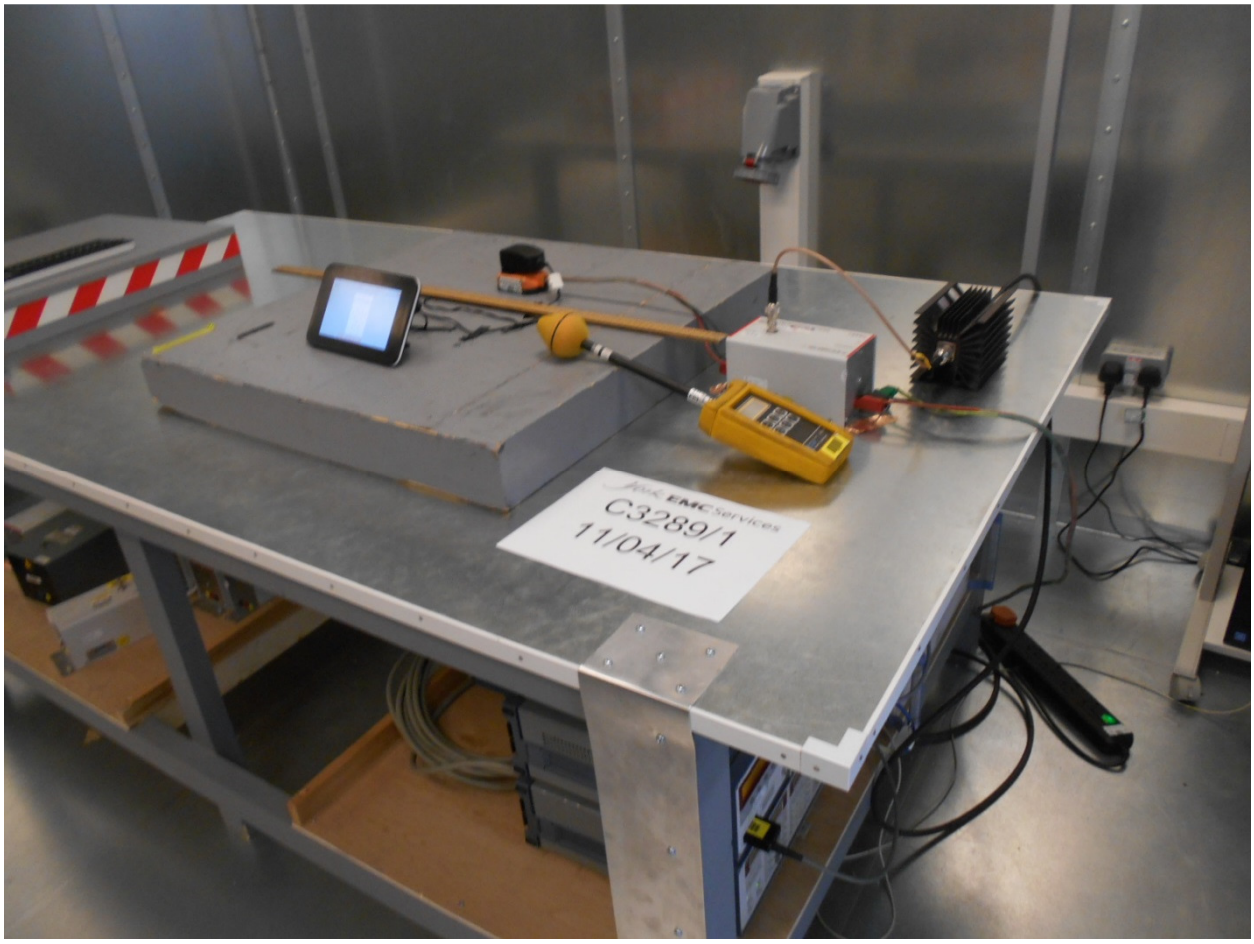


Photo 12 Conducted RF Immunity, Power Lines

15.8 Results

Performance criterion A				
Port Under Test	**Frequency MHz**	**Test Level Vrms**	**Effect Witnessed**	**Result (Pass/Fail)**
230V ac Supply	0.15 - 80	3	None	Pass

Section 16 Power Frequency Magnetic Field Immunity Results

16.1 Test Specification

EN61000-4-8: 1993	Electromagnetic Compatibility (EMC) Part 4-8. Testing and measurement techniques. Section 8. Power frequency magnetic field immunity test.
Criterion of Susceptibility	A
Test levels	3 A/M 50Hz

16.2 Date of Test

11/04/17

16.3 Test Equipment

Item	Asset Number
Multi-turn Magnetic Immunity Loop	78722
Wandel & Goltermann EFA 2	78551

16.4 Test Conditions

Temperature	21°C
Humidity	43%

16.5 Test Area

Lab 4

16.6 Test Setup

The test was performed with the EUT positioned in the centre of a Magnetic Field Induction Coil. The coil was connected to the power source at the EUT supply power frequency. The current through the coil was adjusted by varying the voltage to produce the required magnetic field in the centre of the coil.

The EUT was positioned in the coil in three orthogonal orientations for 3 minutes in order to ensure that all 3 axes of the EUT were subjected to the field.

16.7 Test Setup Photograph

Photo 13 Power Frequency Magnetic Immunity

16.8 Results

Performance criterion A				
Frequency Hz	**Field Strength A/m**	**Orientation of EUT in Field**	**Effect Witnessed**	**Result (Pass/Fail)**
50	3	1	None	Pass
50	3	2	None	Pass
50	3	3	None	Pass

Section 17 Voltage dips and interruptions

17.1 Test Specification

EN61000-4-11: 2004	Electromagnetic Compatibility (EMC) Part 11. Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests
Criterion of Susceptibility	B/C
Test levels	0% residual for 0.5 cycles 40% residual for 5 cycles 70% residual for 25 cycles 0% residual for 250 cycles

17.2 Date of Test

11/04/17

17.3 Test Equipment

Item	Asset Number
EM Test UCS500	79059
EM Test MV2616 motorised variac	79149
Carroll & Meynall variac	C0179
Fluke DMM	78375

17.4 Test Conditions

Temperature	21°C
Humidity	43%

17.5 Test Area

Lab 4

17.6 Test Setup

The EUT was connected to the UCS500 and the voltage dips were applied.

17.7 Test Setup Photograph

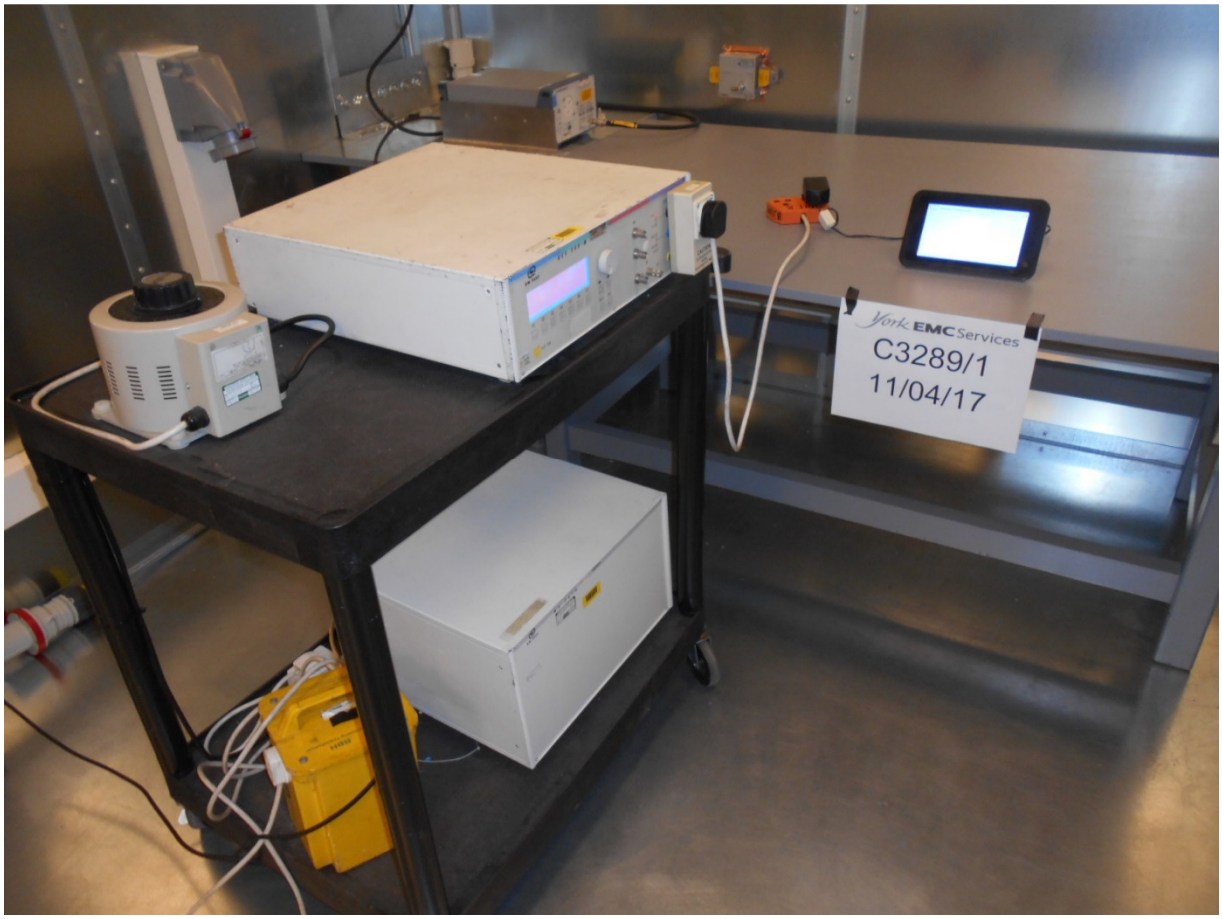


Photo 14 Voltage dips and interruptions immunity setup

17.8 Results

Residual voltage (%)	Duration (Cycles)	Number of voltage dips applied	Performance criterion	Effect Witnessed	Result (Pass/Fail)
0	0.5	3	B	None	Pass
40	5	3	B	None	Pass
70	25	3	B	None	Pass
0	250	3	C	None	Pass