

Unico Inc

TEST REPORT

SCOPE OF WORK

EMC Testing – Blower Unit, Model(s): MB2430EC

REPORT NUMBER

103807635DAL-003

ISSUE DATE

3-May-2019

PAGES

57

DOCUMENT CONTROL NUMBER

Non-Specific EMC Report Shell Rev. December 2017

© 2017 INTERTEK



EMC TEST REPORT
(FULL COMPLIANCE)

Report Number: 103807635DAL-003

Project Number: G103807635

Report Issue Date: 3-May-2019

Model(s) Tested: MB2430EC

**Model(s) Not Tested but
declared equivalent by the**

client: M1218BL1-EC3, M3036BL1-EC3, and M3642BL1-EC3

Standards: EN 61000-6-3:2007

Electromagnetic compatibility (EMC) - Part 6-3: Generic standards -
Emission standard for residential, commercial and light-industrial
environments. A1:2011,

EN 61000-6-1:2007

Electromagnetic compatibility (EMC) - Part 6-1: Generic standards -
Immunity for residential, commercial and light-industrial environment

EN 61000-3-3:2013

Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of
voltage changes, voltage fluctuations and flicker in public low-voltage
supply systems, for equipment with rated current ≤ 16 A per phase and
not subject to conditional connection

EN 61000-3-2:2014

Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for
harmonic current emissions (equipment input current ≤ 16 A per phase)

Tested by:
Intertek Testing Services NA, Inc.
1809 10th Street Suite 400
Plano, TX 75074
USA

Client:
Unico Inc
1120 Intagliata Drive
Arnold, MO 63010
USA

Report prepared by

Tyler Driggers

Tyler Driggers
Compliance Investigator

Report reviewed by

William B Cullen

William Cullen
EMC Team Lead



Total Quality. Assured.

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

Table of Contents

1	<i>Introduction and Conclusion</i>	5
2	<i>Test Summary</i>	5
3	<i>Client Information</i>	7
4	<i>Description of Equipment Under Test and Variant Models</i>	7
5	<i>System Setup and Method</i>	9
6	<i>Radiated Emissions</i>	11
7	<i>AC Mains Conducted Emissions</i>	17
8	<i>Harmonics</i>	22
9	<i>Flicker</i>	28
10	<i>Electrostatic Discharge Immunity Test</i>	32
11	<i>Radiated, radio-frequency, electromagnetic field immunity test</i>	39
12	<i>Electrical Fast Transient/Burst Immunity Test</i>	43
13	<i>Immunity to Surge</i>	46
14	<i>Conducted, radio-frequency, electromagnetic field immunity test</i>	49
15	<i>Power Frequency Magnetic Field Immunity Test</i>	53
16	<i>Voltage Dips / Interruptions Immunity Tests</i>	54
17	<i>Revision History</i>	57

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complies with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	
4	Description of Equipment Under Test and Variant Models	
5	System Setup and Method	
6	Radiated Emissions (CISPR 16-2-3:2006)	Pass
7	AC Mains Conducted Emissions (CISPR 16-2-1:2008)	Pass
8	Harmonics (EN 61000-3-2:2014)	Pass
9	Flicker (EN 61000-3-3:2013)	Pass
10	Electro-Static Discharge Immunity Test (IEC 61000-4-2:2008)	Pass
11	Radiated, Radio-Frequency, Electromagnetic Immunity (IEC 61000-4-3:2006, AMD1:2007, AMD2:2010)	Pass
12	Electrical Fast Transient/Burst Immunity Test (IEC 61000-4-4:2012)	Pass
13	Immunity to Surges (IEC 61000-4-5:2014)	Pass
14	Conducted, Radio-Frequency, Electromagnetic Immunity Test (IEC 61000-4-6:2013)	Pass
15	Power Frequency Magnetic Field Immunity Test (IEC 61000-4-8:2009)	Pass

Section	Test full name	Result
16	Voltage Dips/Interruptions Immunity Test (IEC 61000-4-11:2004)	Pass
17	Revision History	

3 Client Information

This EUT was tested at the request of:

Client: Unico Inc
1120 Intagliata Drive
Arnold, MO 63010
USA

Contact: Craig Messmer
Telephone: 3147541623
Email: craig@unicosystem.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Unico Inc
1120 Intagliata Drive
Arnold, MO 63010
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Blower Unit	Unico Inc	MB2430EC	1901A369393

Receive Date:	February 8, 2019
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
The Unico Inc Blower Unit is an air handler.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
208/230V	7.6A	60/50	Single Phase

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Blowing 100%

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	firmware version is 3.21

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

The models M1218BL1-EC3, M3036BL1-EC3, and M3642BL1-EC3 are equivalent. The M1218 and M2430 use the same 1/2hp motor and the M3036, M3642, and M4860 use the same 1hp motor. Every unit uses the same control box, the only difference between the units is cabinet geometry, blower wheel size, and blower wheel housing.

5 System Setup and Method

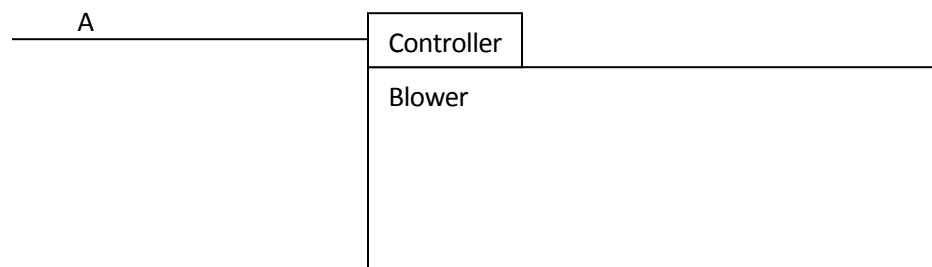
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
A	Power cord	1.0	None	None	EUT

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None	---	---	---

5.1 Method:

Configuration as required by EN 61000-6-3.

5.2 EUT Block Diagram:



5.3 EUT Performance Criteria and Monitoring:

Performance as required by EN 61000-6-1.

Product Specific Performance:

No.	Description
1	Blower unit stays on and at highest speed

Description of how performance was observed during testing:

No.	Description
1	Visually
2	Audibly

General notes: A Fair-Rite P/N 2631540002 was required to be added to the AC input internal to the unit to be compliant with Radiated and Conducted Emissions.

6 Radiated Emissions

6.1 Method

Tests are performed in accordance with CISPR 16-2-3.

TEST SITE: 3m SAC

Site Designation: The Panashield 3 meter Semi Anechoic Chamber has a bore sight antenna and a 2-meter turntable with a 4400lbs capability.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
Radiated Emissions, 3m	10kHz-30 MHz	4.2 dB	N/A dB
Radiated Emissions, 3m	30-1000 MHz	3.5 dB	6.3 dB
Radiated Emissions, 1m	1-18 GHz	3.9 dB	5.5 dB
Radiated Emissions, 3m	1-18 GHz	3.5 dB	5.5 dB
Radiated Emissions, 1m	18-26 GHz	3.9 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength in dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V/m}$$

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where UF = Net Reading in } \mu\text{V}$$

$$NF = \text{Net Reading in dB}\mu\text{V}$$

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
4138	RF cable	MegaPhase	F520-N1N1-276	17174602001	10/23/2019	10/22/2020
4137	RF Cable	MegaPhase	F520-N1N1-118	17174601001	10/23/2019	10/22/2020
4134	RF Cable	MegaPhase	F520-N1N1-118	17174601003	10/23/2019	10/22/2020
1324	Antenna - 20 MHz to 6 GHz	Sunol Sciences	JB6	A101612	10/30/2018	10/30/2019
3566	Mast controller	ETS Lindgren	2090	205641	VBU	VBU
188	Turntable/Tower Controller	Sunol	SC99V	020201-1	VBU	VBU
1179	Preamplifier 1-1000MHz 33dB Typical Gain	Com Power	PAM-103	441028	11/26/2018	11/26/2019
3005	EMI Receiver- Freq Range 20Hz to 40GHz	Rhode & Schwarz	ESU 40	100136	3/18/2019	3/17/2020

Software Utilized:

Name	Manufacturer	Asset #	Version
Total Integrated Laboratory Environment	ETS-Lindgren	1330	6.0

Profile

Name	Manufacturer	Asset #	Version/Rev
Master Radiated Emissions	ETS-Lindgren	1330-004	11/11

6.3 Results:

The sample tested was found to Comply.

6.4 Setup Photographs:



Figure 6-1 Radiated Emissions Test Setup Front

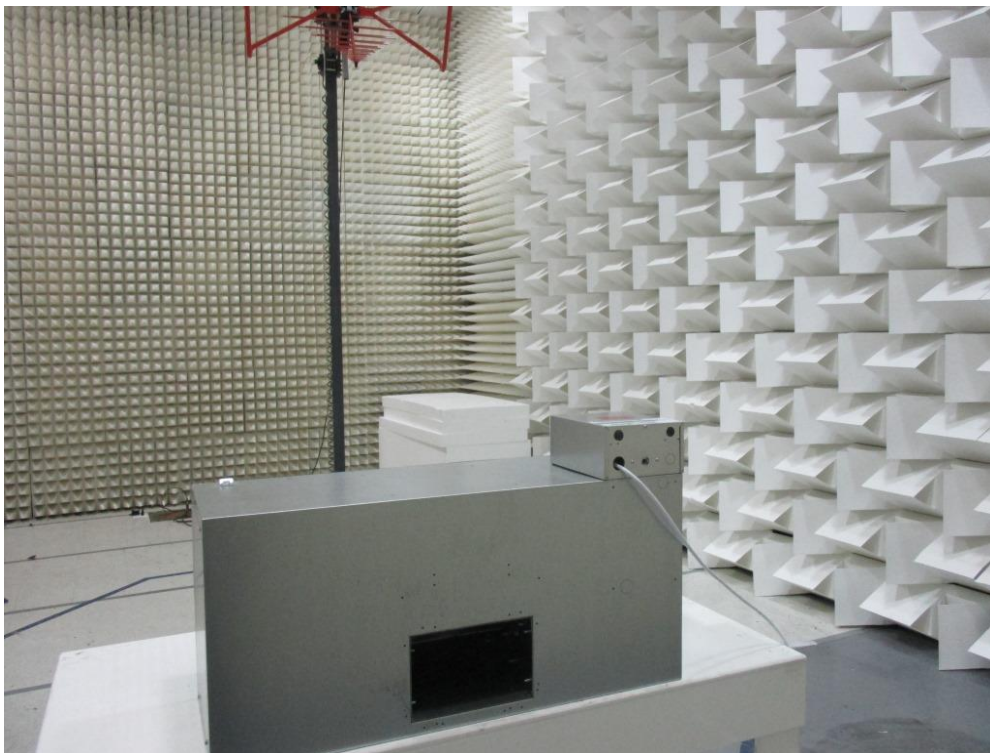


Figure 6-2 Radiated Emissions Test Setup Back

6.5 Plots/Data:

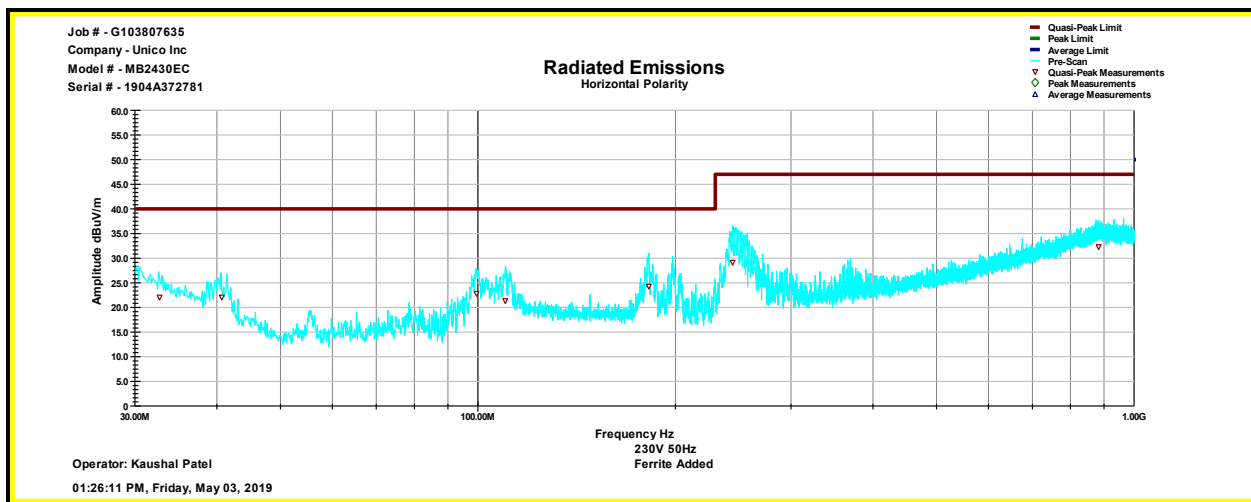


Figure 6-3 Radiated Emissions 230V 50Hz With Ferrite 3 May 2019 Horizontal Polarity

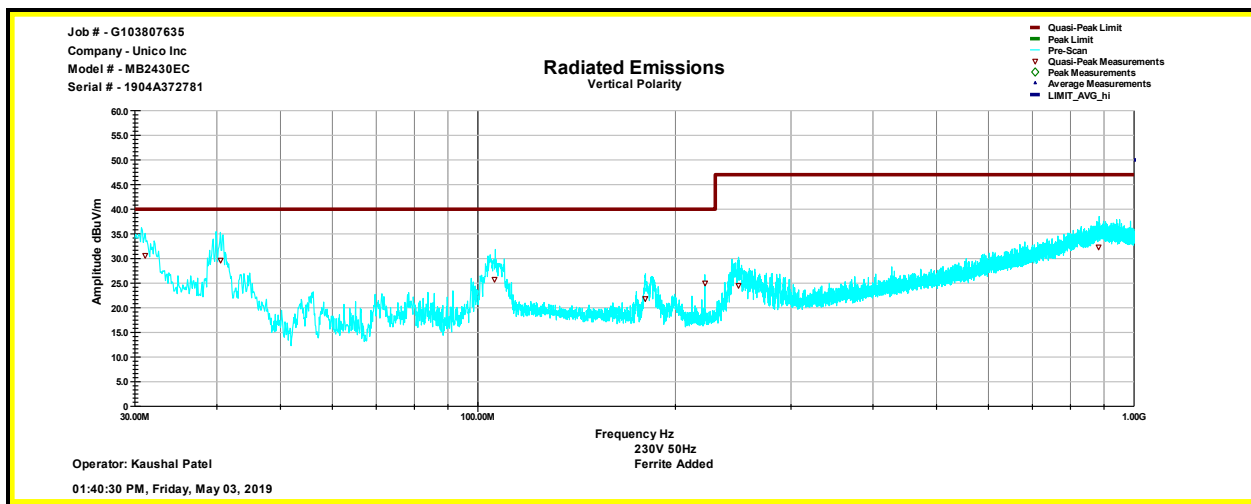


Figure 6-4 Radiated Emissions 230V 50Hz With Ferrite 3 May 2019 Vertical Polarity

Table 6-1 Radiated Emissions 230V 50Hz With Ferrite 3 May 2019 Quasi-Peak Measurements 3m Horizontal

Freq. MHz	Antenna Height cm	Azimuth degrees	Receiver Reading dBuV/m	Antenna Factor dB	PreAmp Factor dB	Cable Factor dB	Final QP Reading dBuV/m	Limit QP dBuV/m	Margin QP dB
32.73	350.0	268.0	30.6	26.2	35.5	0.9	22.2	40.0	-17.8
40.72	249.0	174.0	36.4	20.1	35.5	1.0	22.0	40.0	-18.0
99.42	250.0	178.0	40.5	16.3	35.5	1.5	22.9	40.0	-17.1
110.04	260.0	178.0	36.6	18.7	35.5	1.6	21.4	40.0	-18.6
182.43	134.0	42.0	40.1	17.5	35.4	2.1	24.3	40.0	-15.7
244.69	100.0	178.0	43.6	18.3	35.3	2.5	29.0	47.0	-18.0
882.27	286.0	300.0	30.4	28.8	31.9	4.8	32.2	47.0	-14.8

Table 6-2 Radiated Emissions 230V 50Hz With Ferrite 3 May 2019 Quasi-Peak Measurements 3m Vertical

Freq. MHz	Antenna Height cm	Azimuth degrees	Receiver Reading dBuV/m	Antenna Factor dB	PreAmp Factor dB	Cable Factor dB	Final QP Reading dBuV/m	Limit QP dBuV/m	Margin QP dB
31.09	164.0	230.0	38.0	27.3	35.5	0.8	30.6	40.0	-9.4
40.59	150.0	242.0	44.1	20.2	35.5	1.0	29.7	40.0	-10.3
106.18	150.0	311.0	41.6	17.9	35.5	1.6	25.7	40.0	-14.3
179.96	150.0	287.0	37.5	17.5	35.4	2.1	21.8	40.0	-18.2
221.79	160.0	81.0	40.4	17.5	35.3	2.3	24.9	40.0	-15.1
249.47	226.0	171.0	39.1	18.3	35.3	2.5	24.6	47.0	-22.4
885.09	231.0	38.0	30.6	28.8	31.9	4.9	32.4	47.0	-14.6

Test Personnel: Kaushal Patel Test Date: May 3, 2019
Supervising/Reviewing Engineer:
(Where Applicable) Tyler Driggers Limit Applied: NA
Product Standard: EN 61000-6-3 Ambient Temperature: 23.3°C
Input Voltage: 230V 50Hz Relative Humidity: 45.7%
Pretest Verification w/ Ambient Signals or Atmospheric Pressure: 988.8mbars
BB Source: Yes

Deviations, Additions, or Exclusions: To be compliant, a Fair-Rite PN 2631540002 was added to the AC input internal to the unit.

7 AC Mains Conducted Emissions

7.1 Method

Tests are performed in accordance with CISPR 16-2-1.

TEST SITE: Vertical Ground Reference Plane

Site Designation: The Vertical Ground Reference Plane is Intertek built Vertical and Horizontal Planes greater than 2m X 2m.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
AC Line Conducted Emissions	9 kHz - 150 kHz	3.43 dB	3.8dB
AC Line Conducted Emissions	150 kHz - 30 MHz	2.85 dB	3.4dB
Telco Port Emissions	150 kHz - 30 MHz	1.92 dB	5.0dB
AC Line Conducted Emissions with a Current Probe	150 kHz - 30 MHz	1.8	2.9

As shown in the table above our conducted emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculations

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where NF = Net Reading in dB μ V

RF = Reading from receiver in dB μ V

LF = LISN or ISN Correction Factor in dB

CF = Cable Correction Factor in dB

AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where UF = Net Reading in } \mu\text{V}$$

NF = Net Reading in dB μ V

Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 285.1 \mu\text{V/m}$$

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
3729	EMI Receiver Old Den-073 20 Hz - 26 GHz	RHODE & SCHWARZ	ESU 26	100265	02/05/2018	02/05/2019
3611	Transient Limiter	Hewlett-Packard	11947A	3107A0 1975	6/7/2018	06/08/2019
974	DC to 18GHz coaxial RF Cable 3m Em Chamb	MegaPhase	F520NNNK3 15	F520N NNK31 5	10/23/2018	10/24/2019
1559	Line Impedance Stabilization Network 9khz to 30MHz	Com-Power Corp	LI-215A	191941	6/29/2018	06/30/2019

Software Utilized:

Name	Manufacturer	Asset #	Version
Total Integrated Laboratory Environment	ETS-Lindgren	1330	6.0

Profile

Name	Manufacturer	Asset #	Version/Rev
Master Conducted Emissions	ETS-Lindgren	1330-001	Ver11 Rev12

7.3 Results:

The sample tested was found to Comply.

7.4 Setup Photographs:



Figure 7-1 Conducted Emissions Test Setup Front



Figure 7-2 Conducted Emissions Test Setup Back

7.5 Plots/Data:

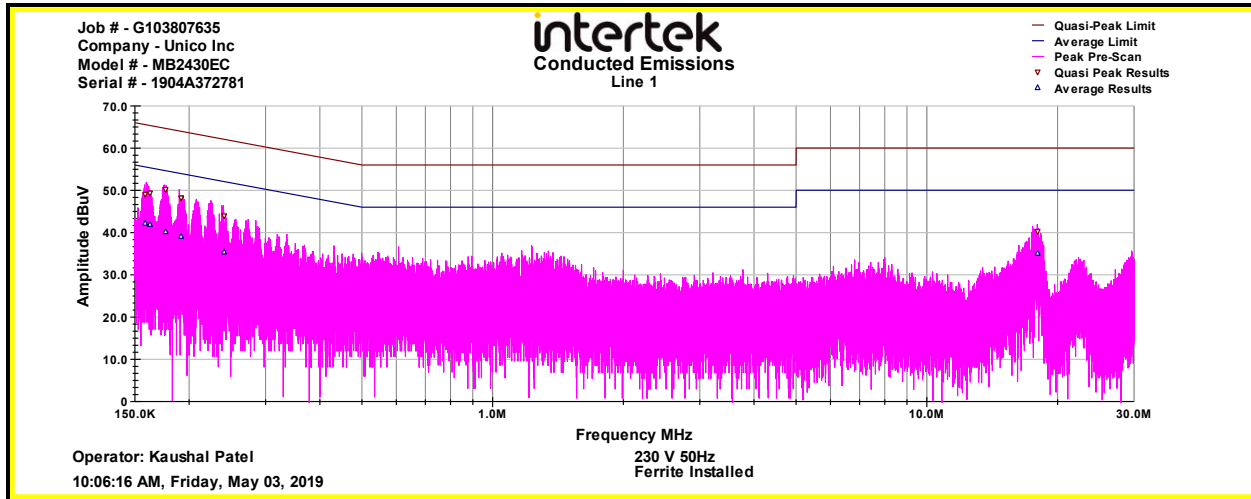


Figure 7-3 Conducted Emissions 230V 50Hz With Ferrite 3 May 2019 Line 1

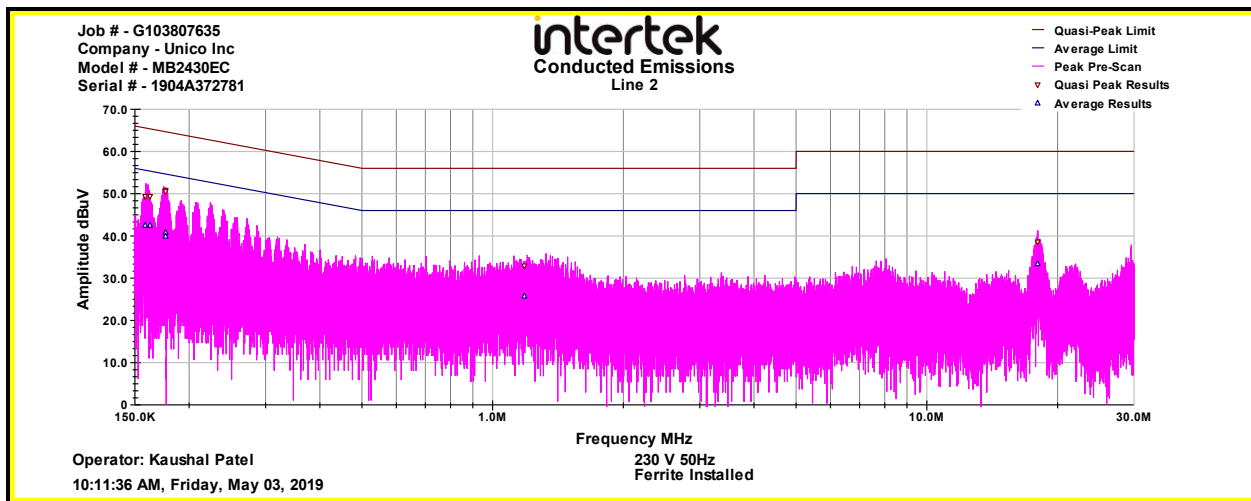


Figure 7-4 Conducted Emissions 230V 50Hz With Ferrite 3 May 2019 Line 2

Table 7-1 Conducted Emissions 230V 50Hz With Ferrite 3 May 2019 Line 1

Freq. MHz	QP Reading dBuV	Avg Reading dBuV	Cable Factor dB	Limiter Factor dB	Lisn Factor dB	Final QP Reading dBuV	Limit QP dBuV	Margin QP dB	Final Avg dBuV	Limit Avg dBuV	Margin Avg dB
0.16	38.422	31.580	0.211	10.271	0.122	49.026	65.568	-16.543	42.184	55.568	-13.384
0.16	38.621	31.408	0.211	10.270	0.120	49.222	65.361	-16.139	42.009	55.361	-13.352
0.16	38.621	31.408	0.211	10.270	0.120	49.222	65.361	-16.139	42.009	55.361	-13.352
0.18	39.596	29.642	0.214	10.263	0.120	50.193	64.625	-14.432	40.240	54.625	-14.386
0.19	37.669	28.527	0.217	10.257	0.110	48.253	63.950	-15.697	39.111	53.950	-14.839
0.24	33.437	24.703	0.224	10.239	0.102	44.003	62.062	-18.059	35.268	52.062	-16.794
17.97	29.930	24.711	0.402	10.010	0.030	40.371	60.000	-19.629	35.152	50.000	-14.848

Table 7-2 Conducted Emissions 230V 50Hz With Ferrite 3 May 2019 Line 2

Freq. MHz	QP Reading dBuV	Avg Reading dBuV	Cable Factor dB	Limiter Factor dB	Lisn Factor dB	Final QP Reading dBuV	Limit QP dBuV	Margin QP dB	Final Avg dBuV	Limit Avg dBuV	Margin Avg dB
0.16	38.668	31.84	0.21	10.271	0.12	49.272	65.57	-16.30	42.44	55.57	-13.13
0.16	38.837	31.90	0.21	10.270	0.12	49.438	65.36	-15.92	42.50	55.36	-12.86
0.16	38.837	31.90	0.21	10.270	0.12	49.438	65.36	-15.92	42.50	55.36	-12.86
0.18	40.174	30.11	0.21	10.263	0.11	50.765	64.67	-13.91	40.70	54.67	-13.97
0.18	39.751	29.49	0.21	10.263	0.11	50.341	64.63	-14.28	40.08	54.63	-14.54
1.19	22.314	15.39	0.28	10.088	0.09	32.769	56.00	-23.23	25.84	46.00	-20.16
18.00	28.127	23.03	0.40	10.010	0.03	38.569	60.00	-21.43	33.47	50.00	-16.53

Test Personnel:	<u>Kaushal Patel</u>	Test Date:	<u>May 3, 2019</u>
Supervising/Reviewing Engineer:			
(Where Applicable)	<u>Tyler Driggers</u>	Limit Applied:	<u>NA</u>
Product Standard:	<u>EN 61000-6-3</u>	Ambient Temperature:	<u>23.3°C</u>
Input Voltage:	<u>230V 50Hz</u>	Relative Humidity:	<u>45.7%</u>
Pretest Verification w/ Ambient Signals or BB Source:	<u>Yes</u>	Atmospheric Pressure:	<u>988.8mbars</u>

Deviations, Additions, or Exclusions: To be compliant, a Fair-Rite PN 2631540002 was added to the AC input internal to the unit.

8 Harmonics

8.1 Method

Tests are performed in accordance with IEC 61000-3-3.

TEST SITE: Immunity Room

Measurement Uncertainty

Measurement	Parameter	Expanded Uncertainty (k=2)	Permitted Error
Harmonics	Current	1.0%	±5.0%

As shown in the table above our Expanded Measurement Uncertainty for harmonic current U_{lab} is less than the corresponding measurement error allowed by IEC61000-3-2 and IEC61000-4-7, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required. There are currently no U_{CISPR} reference values in CISPR 16 for Harmonics.

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
4333	Ambient Data Logger	Extech	SD700	A.0864 09	03/27/2018	03/27/2019
1496	Model MX30KOC4Y20400 & CIC-PC-PCX Power Analyzer	Ametek	MX30KOC4Y 20400	1247A0 2352	11/13/2018	11/13/2019

Software Utilized:

Name	Manufacturer	Version
CTSMXL2	California Instruments Corp.	2.13.1

8.3 Results:

The sample tested was found to Comply.

8.4 Setup Photographs:



Figure 8-1 Harmonics Test Setup

8.5 Plots/Data:

Harmonics – Class-A per Ed. 4.0 (2014)(Run time)

EUT: M4860BL1-EC-

Tested by: Rick Hill

Test category: Class-A per Ed. 4.0 (2014) (European limits)

Test Margin: 100

Test date: 2/15/2019

Start time: 2:29:24 PM

End time: 2:39:36 PM

Test duration (min): 10

Data file name: CTSMXL_H-000937.cts_data

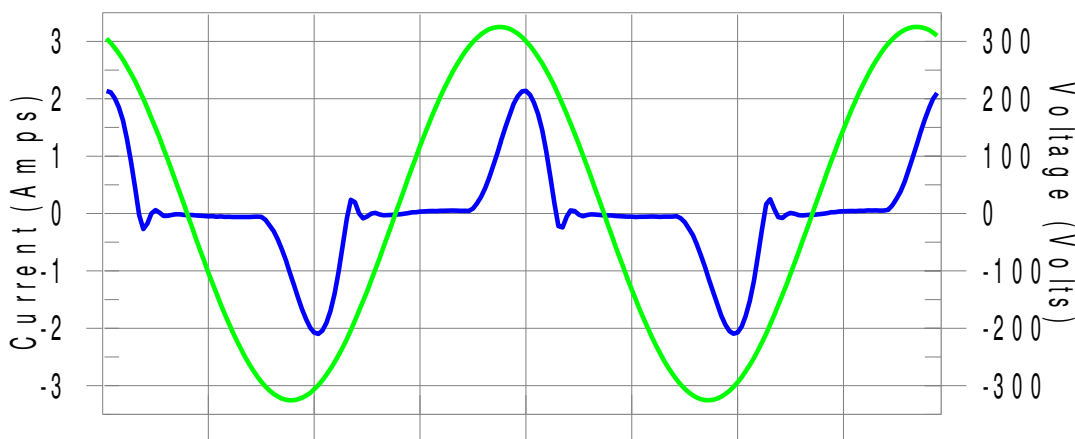
Comment: Comments

Customer: Unico

Test Result: Pass

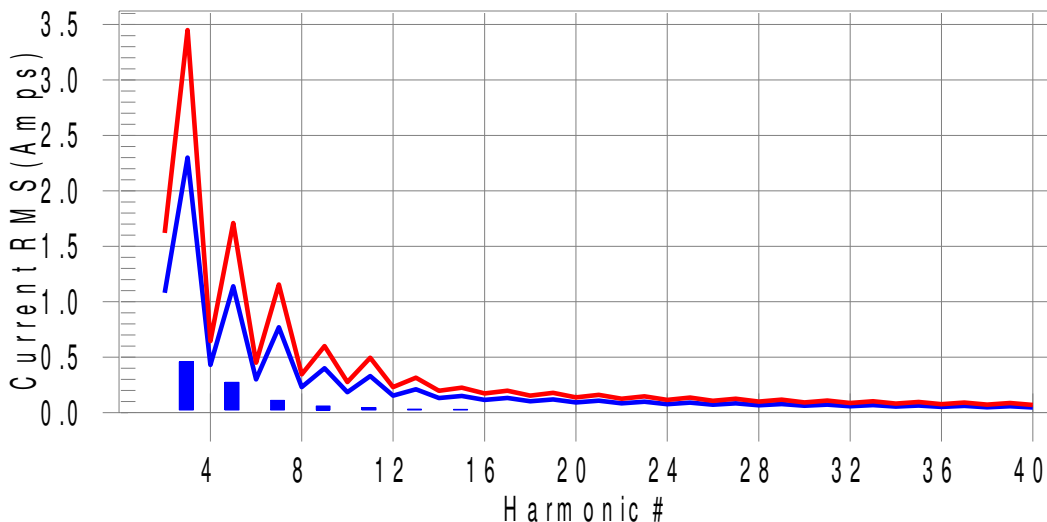
Source qualification: Normal

Current & voltage waveforms



Harmonics and Class A limit line

European Limits



Test result: Pass Worst harmonics H5-16.6% of 150% limit, H5-24% of 100% limit.

Current Test Result Summary (Run time)

EUT: M4860BL1-EC- Tested by: Rick Hill
 Test category: Class-A per Ed. 4.0 (2014) (European limits) Test Margin: 100
 Test date: 2/15/2019 Start time: 2:29:24 PM End time: 2:39:36 PM
 Test duration (min): 10 Data file name: CTSMXL_H-000937.cts_data
 Comment: Comments
 Customer: Unico

Test Result: Pass Source qualification: Normal
 THC(A): 0.552 I-THD(%): 89.4 POHC(A): 0.017 POHC Limit(A): 0.251

Highest parameter values during test:

V_RMS (Volts): 230.252 Frequency(Hz): 50.00
 I_Peak (Amps): 2.148 I_RMS (Amps): 0.885
 I_Fund (Amps): 0.619 Crest Factor: 2.467
 Power (Watts): 146.7 Power Factor: 0.725

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.017	1.080	1.6	0.017	1.620	1.1	Pass
3	0.457	2.300	19.9	0.486	3.450	14.1	Pass
4	0.007	0.430	1.7	0.007	0.645	1.2	Pass
5	0.274	1.140	24.0	0.285	1.710	16.6	Pass
6	0.007	0.300	2.4	0.008	0.450	1.7	Pass
7	0.111	0.770	14.4	0.113	1.155	9.7	Pass
8	0.003	0.230	N/A	0.003	0.345	N/A	Pass
9	0.059	0.400	14.9	0.062	0.600	10.4	Pass
10	0.001	0.184	N/A	0.001	0.276	N/A	Pass
11	0.046	0.330	13.9	0.047	0.495	9.5	Pass
12	0.001	0.153	N/A	0.001	0.230	N/A	Pass
13	0.032	0.210	15.1	0.033	0.315	10.6	Pass
14	0.001	0.131	N/A	0.001	0.197	N/A	Pass
15	0.028	0.150	19.0	0.030	0.225	13.2	Pass
16	0.001	0.115	N/A	0.001	0.173	N/A	Pass
17	0.021	0.132	16.2	0.022	0.198	11.3	Pass
18	0.000	0.102	N/A	0.000	0.153	N/A	Pass
19	0.018	0.118	15.6	0.019	0.178	10.6	Pass
20	0.000	0.092	N/A	0.000	0.138	N/A	Pass
21	0.011	0.107	10.7	0.012	0.161	7.3	Pass
22	0.000	0.084	N/A	0.000	0.125	N/A	Pass
23	0.009	0.098	9.3	0.010	0.147	6.6	Pass
24	0.000	0.077	N/A	0.000	0.115	N/A	Pass
25	0.005	0.090	5.9	0.005	0.135	4.0	Pass
26	0.000	0.071	N/A	0.000	0.107	N/A	Pass
27	0.004	0.083	N/A	0.004	0.125	N/A	Pass
28	0.000	0.066	N/A	0.000	0.099	N/A	Pass
29	0.003	0.078	N/A	0.003	0.116	N/A	Pass
30	0.000	0.061	N/A	0.000	0.092	N/A	Pass
31	0.002	0.073	N/A	0.002	0.109	N/A	Pass
32	0.000	0.058	N/A	0.000	0.086	N/A	Pass
33	0.002	0.068	N/A	0.002	0.102	N/A	Pass
34	0.000	0.054	N/A	0.000	0.081	N/A	Pass
35	0.001	0.064	N/A	0.002	0.096	N/A	Pass
36	0.000	0.051	N/A	0.000	0.077	N/A	Pass
37	0.001	0.061	N/A	0.001	0.091	N/A	Pass
38	0.000	0.048	N/A	0.001	0.073	N/A	Pass
39	0.001	0.058	N/A	0.002	0.087	N/A	Pass
40	0.000	0.046	N/A	0.001	0.069	N/A	Pass

Voltage Source Verification Data (Run time)


EUT: M4860BL1-EC- Tested by: Rick Hill
 Test category: Class-A per Ed. 4.0 (2014) (European limits) Test Margin: 100
 Test date: 2/15/2019 Start time: 2:29:24 PM End time: 2:39:36 PM
 Test duration (min): 10 Data file name: CTSMXL_H-000937.cts_data
 Comment: Comments
 Customer: Unico

Test Result: Pass Source qualification: Normal
 Measured source distortion is within the requirements of the standards
 Measurements are compliant with IEC/EN61000-3-2 Ed. 4 & IEC/EN61000-4-7 Ed. 2.1

Highest parameter values during test:

Voltage (Vrms):	230.252	Frequency(Hz):	50.00
I_Peak (Amps):	2.148	I_RMS (Amps):	0.885
I_Fund (Amps):	0.619	Crest Factor:	2.467
Power (Watts):	146.7	Power Factor:	0.725

Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.098	0.460	21.25	OK
3	0.092	2.072	4.42	OK
4	0.010	0.460	2.11	OK
5	0.062	0.921	6.70	OK
6	0.030	0.460	6.51	OK
7	0.081	0.691	11.69	OK
8	0.010	0.460	2.27	OK
9	0.073	0.460	15.87	OK
10	0.007	0.460	1.44	OK
11	0.043	0.230	18.77	OK
12	0.012	0.230	5.32	OK
13	0.041	0.230	17.79	OK
14	0.009	0.230	3.87	OK
15	0.047	0.230	20.33	OK
16	0.009	0.230	4.11	OK
17	0.043	0.230	18.60	OK
18	0.014	0.230	5.91	OK
19	0.039	0.230	16.73	OK
20	0.012	0.230	5.33	OK
21	0.031	0.230	13.68	OK
22	0.008	0.230	3.37	OK
23	0.027	0.230	11.67	OK
24	0.008	0.230	3.56	OK
25	0.017	0.230	7.57	OK
26	0.009	0.230	3.77	OK
27	0.013	0.230	5.77	OK
28	0.008	0.230	3.27	OK
29	0.014	0.230	6.22	OK
30	0.009	0.230	3.96	OK
31	0.010	0.230	4.55	OK
32	0.009	0.230	3.74	OK
33	0.012	0.230	5.35	OK
34	0.006	0.230	2.46	OK
35	0.010	0.230	4.48	OK
36	0.008	0.230	3.33	OK
37	0.011	0.230	4.65	OK
38	0.007	0.230	3.22	OK
39	0.008	0.230	3.65	OK
40	0.010	0.230	4.34	OK

Test Personnel:	<u>Rick Hill </u>	Test Date:	<u>February 15, 2019</u>
Supervising/Reviewing Engineer:			
(Where Applicable)		Limit Applied:	<u>A</u>
Product Standard:	<u>IEC 61000-3-2</u>	Ambient Temperature:	<u>22.5°C</u>
Input Voltage:	<u>230V 50Hz</u>	Relative Humidity:	<u>45.5%</u>
Pretest Verification w/ Artifact:	<u>NA</u>	Atmospheric Pressure:	<u>984.4mbars</u>

Deviations, Additions, or Exclusions: None

9 Flicker

9.1 Method

Tests are performed in accordance with IEC 61000-3-3.

TEST SITE: Immunity Room

Measurement Uncertainty

Measurement	Parameter	Expanded Uncertainty (k=2)	Permitted Error
Flicker	Pst	0.4 %	±8.0%
Flicker	dc	0.4%	±8.0%

As shown in the table above our Expanded Measurement Uncertainty for Pst and dc U_{lab} is less than the corresponding measurement error allowed by IEC 61000-3-3, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required. There are currently no U_{CISPR} reference values in CISPR 16 for Flicker.

9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
4333	Ambient Data Logger	Extech	SD700	A.0864 09	03/27/2018	03/27/2019
1496	Model MX30KOC4Y20400 & CIC-PC-PCX Power Analyzer	Ametek	MX30KOC4Y 20400	1247A0 2352	11/13/2018	11/13/2019

Software Utilized:

Name	Manufacturer	Version
CTSMXL2	California Instruments Corp.	2.13.1

9.3 Results:

The sample tested was found to Comply.

9.4 Setup Photographs:



Figure 9-1 Flicker Test Setup

9.5 Plots/Data:

Flicker Test Summary per EN/IEC61000-3-3 Ed. 3.0 (2013) (Run time)

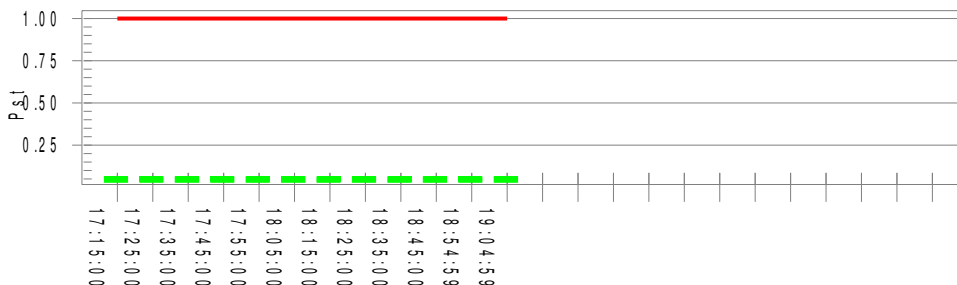
EUT: M4860BL1-EC- Tested by: Rick Hill
 Test category: All parameters (European limits) Test Margin: 100
 Test date: 2/15/2019 Start time: 5:04:39 PM End time: 7:06:12 PM
 Test duration (min): 120 Data file name: CTSMXL_F-000939.cts_data
 Comment: 100V 50Hz
 Customer: Unico

Test Result: Pass

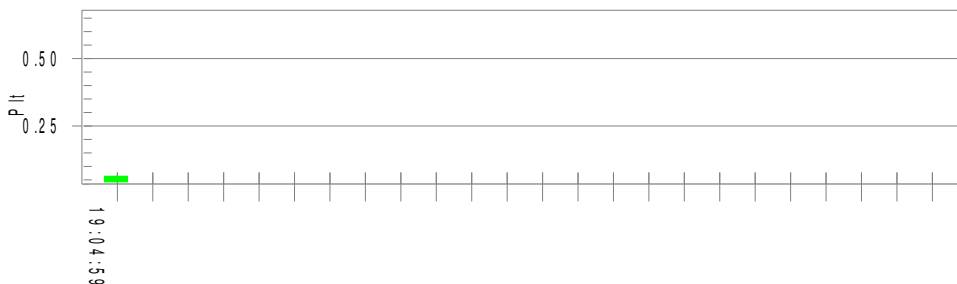
Status: Test Completed

Pst_t and limit line

European Limits




Plt and limit line



Parameter values recorded during the test:

Vrms at the end of test (Volt):	230.26		
Highest dt (%):	0.00	Test limit (%):	N/A N/A
T-max (mS):	0.0	Test limit (mS):	500.0 Pass
Highest dc (%):	0.00	Test limit (%):	3.30 Pass
Highest dmax (%):	-0.08	Test limit (%):	4.00 Pass
Highest Pst (10 min. period):	0.064	Test limit:	1.000 Pass
Highest Plt (2 hr. period):	0.064	Test limit:	0.650 Pass

Test Personnel: Rick Hill 
Supervising/Reviewing
Engineer:
(Where Applicable)
Product Standard: IEC 61000-3-3

Input Voltage: 230V 50Hz

Pretest Verification w/
Artifact: NA

Test Date: February 20, 2019

Limit Applied: All

Ambient
Temperature: 22.5°C
Relative Humidity: 45.5%
Atmospheric
Pressure: 984.4mbars

Deviations, Additions, or Exclusions: None

10 Electrostatic Discharge Immunity Test

10.1 Method

Tests are performed in accordance with IEC 61000-4-2.

TEST SITE: Vertical Ground Reference Plane

Site Designation: The Vertical Ground Reference Plane is Intertek built Vertical and Horizontal Planes greater than 2m X 2m.

10.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
4333	Ambient Data Logger	Extech	SD700	A.0864 09	03/27/2018	03/27/2019
4398	ESD Insulator Pad	Intertek	ESDIP	RLH001	VBU	VBU
4399	ESD Bleed Resistors	Intertek	ESDBLDR	GS001	VBU	VBU
3567	ESD Verticle Coupling Plane	Intertek	ESD Verticle	SKM00 2	VBU	VBU
3563	ESD Table	Intertek	ESD Table	SKM00 1	VBU	VBU
RE-59	ESD Simulator	Teseq	NSG438	1291	11/16/2018	11/16/2019

Software Utilized:

Name	Manufacturer	Version
None	---	---

10.3 Results:

The sample tested was found to Comply.

10.4 Setup Photographs:

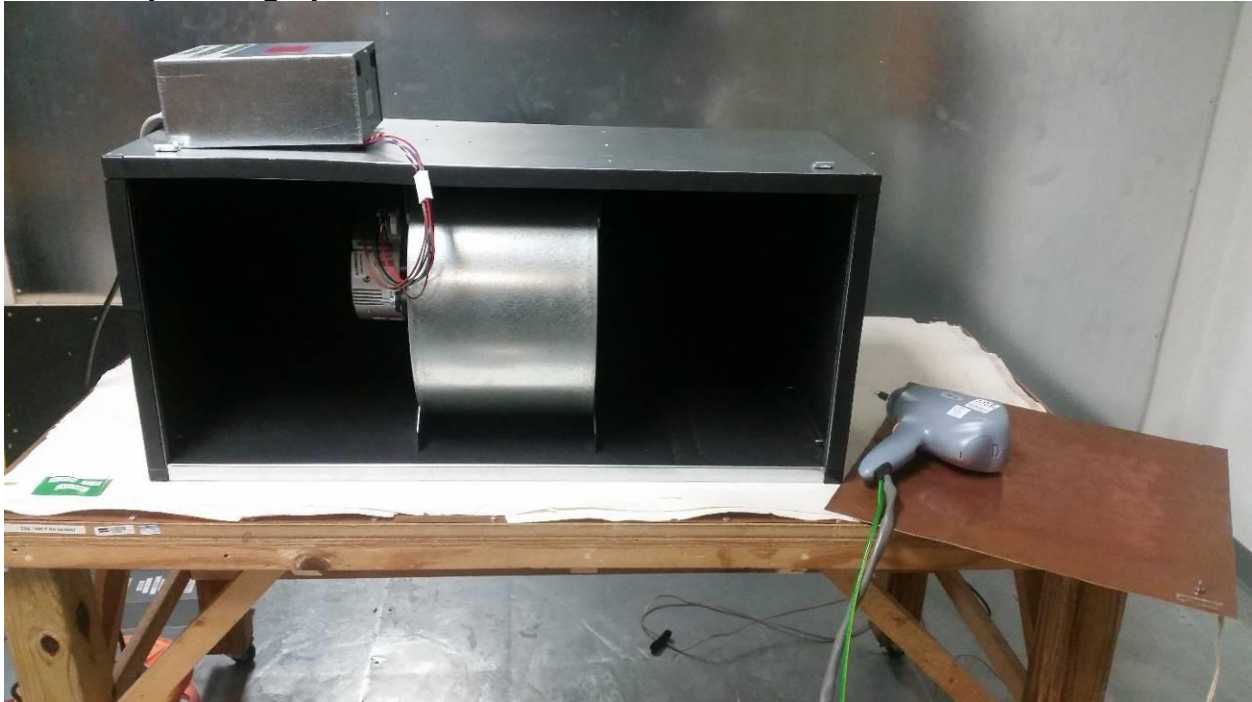


Figure 10-1 Electrostatic Discharge Test Setup
1

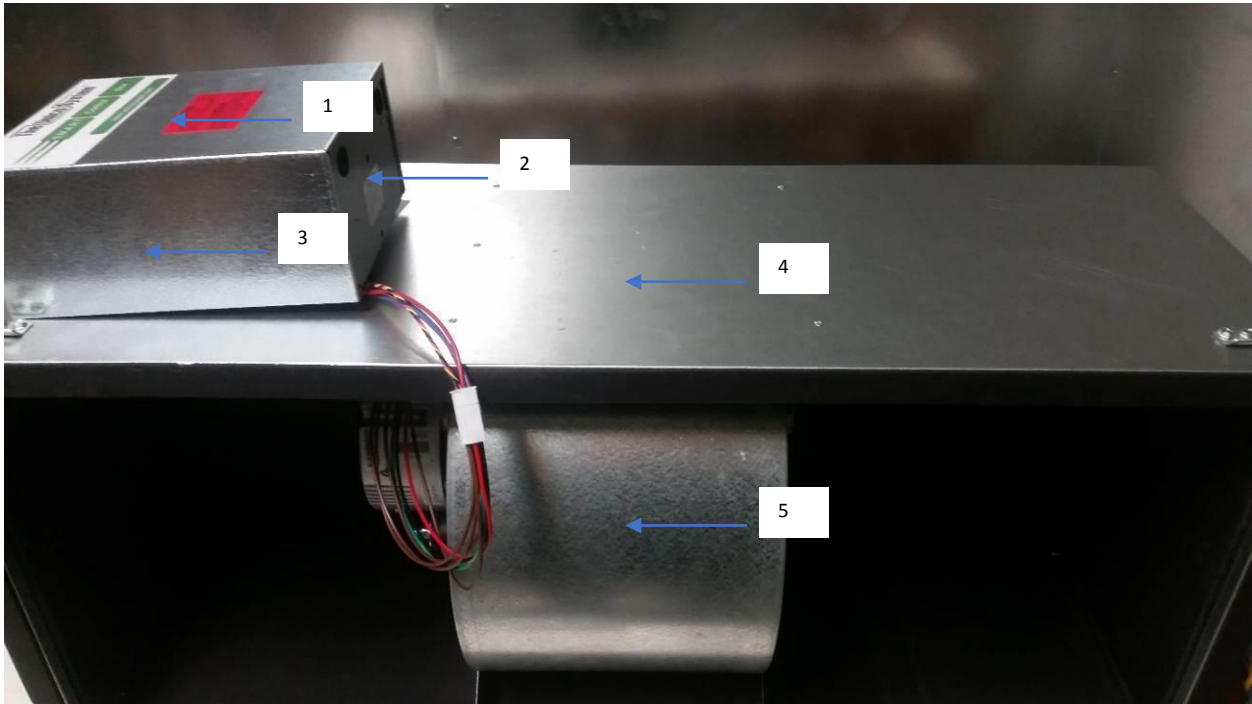


Figure 10-2 Electrostatic Discharge Test Setup 2



Figure 10-3 Electrostatic Discharge Test Setup 3

9





Figure 10-4 Electrostatic Discharge Test Setup 4



Figure 10-5 Electrostatic Discharge Test Setup

5



Figure 10-6 Electrostatic Discharge Test Setup VCP

10.5 Data:

Test Point	Discharge Voltage Type	Test Voltages, Polarities and Result Classification											
		2 kV		4 kV		6 kV		8 kV		15 kV		kV	
		Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg
HCP	Contact			A	A								
VCP	Contact			A	A								
1	Contact			A	A								
2	Contact			A	A								
3	Contact			A	A								
4	Contact			A	A								
5	Contact			A	A								
6	Contact			A	A								
7	Air	A	A	A	A			A	A				
8	Contact			A	A								
9	Contact			A	A								
10	Contact			A	A								
11	Contact			A	A								

Air Discharges only above 8 kV

Elvis Ulloa-Torres

Test Personnel: EUT
 Supervising/Reviewing Engineer: _____
 (Where Applicable)
 Product Standard: EN 61000-6-1
 Input Voltage: 230V 50Hz
 Waveform Verified on _____
 Oscilloscope: NA
 470k x 2 Strap(s)
 Verified: 951kΩ

Test Date: February 19, 2019
 Required Performance: B
 Test Levels: See Table Above
 Ambient Temperature: 30.6 °C
 Relative Humidity: 24.3 %
 Atmospheric Pressure: 990.2 mbars

Notes:

(A) The EUT met the requirements without any degradation of performance.

Deviations, Additions, or Exclusions: None

11 Radiated, radio-frequency, electromagnetic field immunity test

11.1 Method

Tests are performed in accordance with IEC 61000-4-3.

TEST SITE: Compact Chamber.

Site Designation: The Compact Chamber is a Braden Shielding Systems 3meter Semi Anechoic Chamber for performing a 16 point calibrated field immunity test.

11.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
4333	Ambient Data Logger	Extech	SD700	A.0864 09	03/27/2018	03/27/2019
3555	Broadband amplifier (80MHz - 1GHz) OLD Den ID 18779	Amplifier Research	200W1000M 7A	16049	VBU	VBU
3569	Coaxial Cable 3 meters	Maury Microwave	US-N-MM- 118	16 07 152	VBU	VBU
207	Antenna	Amplifier Research	AT5080	306847	VBU	VBU
3627	Spectrum Analyzer Old Den- 18814	Hewlett Packard	HP 8594E	3412A0 0103	02/26/2018	02/26/2019
569	Signal Generator	Rhode & Schwarz	SMR20	101111	12/6/2018	12/6/2019
152	Directional Coupler	Amplifier Research	DC6080	304859	6/10/2018	6/10/2019
4286	Power Amplifier 100watts 700MHz to 6GHz	Com Power	ARI-6000- 100W	1005	VBU	VBU
271	Double Ridge Guide Horn Antenna	A H Systems	SAS-571	787	VBU	VBU
4315	Dual Directional Coupler	Werlatone	C10117-10	115504	03/27/2018	03/27/2019
4471	Field Probe	ETS-Lindgren	HI-6113	219145	12/5/2018	12/5/2019
3044	2 Meter RF Cable 18GHz EMC lab	Maury Microwave	UC-N-MM- 78	14.01.3 91	7/18/2018	7/18/2019
3568	Cable	Maury Microwave	US-N-MM- 196	16 07 151	VBU	VBU

Software Utilized:

Name	Manufacturer	Asset #	Version
Total Integrated Laboratory Environment	ETS-Lindgren	1330	6.0

Profile

Name	Manufacturer	Asset #	Version/Rev
Master Radiated Immunity	ETS-Lindgren	1330-005	11/7

11.1 Results:

The sample tested was found to Comply.

11.2 Setup Photographs:



Figure 11-1 Radiated Immunity Test Setup

11.3 Data:

Field Level (V/m)	Frequency Range MHz	Antenna Polarity, Azimuths and Result Classification							
		Vertical				Horizontal			
		0	90	180	270	0	90	180	270
3	80 -1000	A	A	A	A	A	A	A	A
3	1400 - 2000	A	A	A	A	A	A	A	A
1	2000 - 2700	A	A	A	A	A	A	A	A

Test Personnel:	Rick Hill <i>Rick Hill</i>	Test Date:	February 19, 2019
Supervising/Reviewing Engineer:		Modulation:	1 kHz
(Where Applicable)		Required Performance:	A
Product Standard:	EN 61000-6-1	Test Levels:	See Table Above
Input Voltage:	230V 50Hz	Ambient Temperature:	23.8 °C
		Relative Humidity:	28.7 %
Field Level Monitored:	Yes	Atmospheric Pressure:	990.2 mbars

Notes:

(A) The EUT met the requirements without any degradation of performance.

Deviations, Additions, or Exclusions: None

12 Electrical Fast Transient/Burst Immunity Test

12.1 Method

Tests are performed in accordance with IEC 61000-4-4.

TEST SITE: Vertical Ground Reference Plane

Site Designation: The Vertical Ground Reference Plane is Intertek built Vertical and Horizontal Planes greater than 2m X 2m

12.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
4333	Ambient Data Logger	Extech	SD700	A.0864 09	03/27/2018	03/27/2019
4149	EFT Network	Thermo Fisher	E503	111230 1	2/11/2019	2/11/2020

Software Utilized:

Name	Manufacturer	Version
CEWare32	Thermo Electron Corp.	Version 4.00

12.3 Results:

The sample tested was found to Comply.

12.4 Setup Photographs:

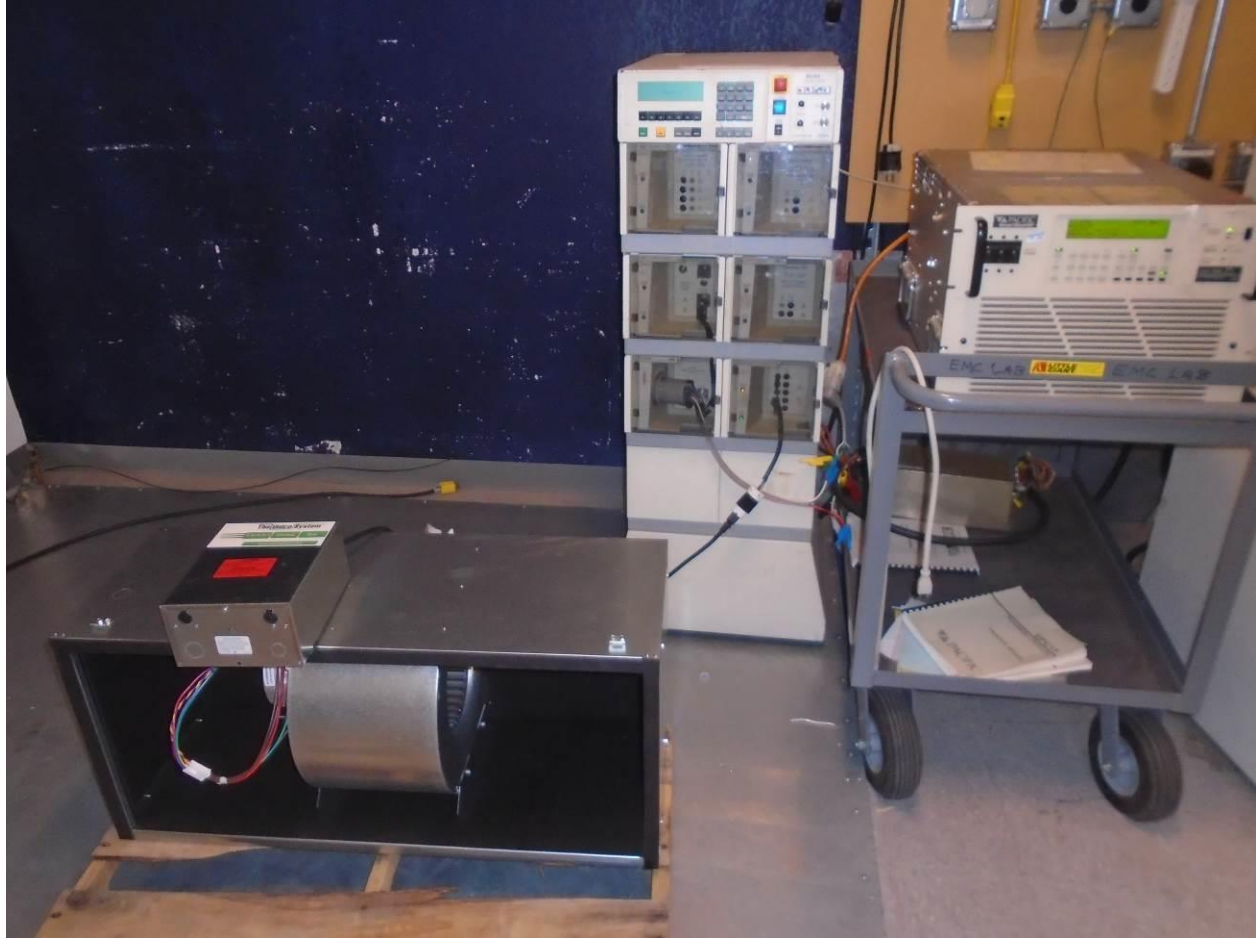


Figure 12-1 Fast Transients Test Setup

12.5 Test Data:

Test Point	Coupling Method	Test Voltages, Polarities, and Result Classification									
		0.25kV		0.5kV		1 kV		2 kV		4 kV	
		pos	neg	pos	neg	pos	neg	pos	neg	pos	neg
Power L1	Direct					A	A				
Power L2	Direct					A	A				
Power PE	Direct					A	A				

Test Personnel:	<u>Reshar Rouse RJR</u>	Test Date:	<u>3-May-2019</u>
Supervising/Reviewing Engineer:		Pulse Repetition Frequency:	<u>5kHz</u>
(Where Applicable)		Required Performance	<u>B</u>
Product Standard:	<u>EN 61000-6-1</u>	Test Levels:	<u>See Table Above</u>
Input Voltage:	<u>230V 50Hz</u>	Ambient Temperature:	<u>23.5 °C</u>
Waveform Verified on Oscilloscope:	<u>Yes</u>	Relative Humidity:	<u>28.9 %</u>
		Atmospheric Pressure:	<u>1002.7 mbars</u>

Notes:

(A) The EUT met the requirements without any degradation of performance.

Deviations, Additions, or Exclusions: None

13 Immunity to Surge

13.1 Method

Tests are performed in accordance with IEC 61000-4-5.

TEST SITE: Vertical Ground Reference Plane

Site Designation: The Vertical Ground Reference Plane is Intertek built Vertical and Horizontal Planes greater than 2m X 2m.

13.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
4333	Ambient Data Logger	Extech	SD700	A.0864 09	03/27/2018	03/27/2019
4149	Surge Network	Thermo Fisher	E503	111230 1	2/11/2019	2/11/2020

Software Utilized:

Name	Manufacturer	Version
CEWare32	Thermo Electron Corp.	Version 4.00

13.3 Results:

The sample tested was found to Comply.

13.4 Setup Photographs:



Figure 13-1 Combination Wave Surge Test Setup

13.5 Test Data:

Test	Test Voltages, Polarities, and Result Classification							
	0.5kV		1kV		2kV		4kV	
	pos	neg	pos	neg	pos	neg	pos	neg
L1-PE, at 0 deg	A	A	A	A	A	A		
L1-PE, at 90 deg	A	A	A	A	A	A		
L1-PE, at 180 deg	A	A	A	A	A	A		
L1-PE, at 270 deg	A	A	A	A	A	A		
N-PE, at 0 deg	A	A	A	A	A	A		
N-PE, at 90 deg	A	A	A	A	A	A		
N-PE, at 180 deg	A	A	A	A	A	A		
N-PE, at 270 deg	A	A	A	A	A	A		
L1-N, at 0 deg	A	A	A	A	A	A		
L1-N, at 90 deg	A	A	A	A				
L1-N, at 180 deg	A	A	A	A				
L1-N, at 270 deg	A	A	A	A				

Test Personnel:	<u>Reshar Rouse RJR</u>	Test Date:	<u>3-May-2019</u>
Supervising/Reviewing Engineer:			
(Where Applicable)		Required Performance:	<u>B</u>
Product Standard:	<u>EN 61000-6-1</u>	Test Levels:	<u>See Table Above</u>
Input Voltage:	<u>230V 50Hz</u>	Ambient Temperature:	<u>24.0 °C</u>
Waveform Verified on Oscilloscope:	<u>Yes</u>	Relative Humidity:	<u>29.0 %</u>
		Atmospheric Pressure:	<u>1002.6 mbars</u>

Notes:

(A) The EUT met the requirements without any degradation of performance.

Deviations, Additions, or Exclusions: None

14 Conducted, radio-frequency, electromagnetic field immunity test

14.1 Method

Tests are performed in accordance with IEC 61000-4-6.

TEST SITE: Vertical Ground Reference Plane

Site Designation: The Vertical Ground Reference Plane is Intertek built Vertical and Horizontal Planes greater than 2m X 2m

14.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
4333	Ambient Data Logger	Extech	SD700	A.086409	03/27/2018	03/27/2019
76	EM Injection Clamp	FCC	F-2031-23mm	357	9/24/2018	9/24/2019
95	Power Sensor	HP	HP 8482H	3318A072 68	05/09/2018	05/09/2019
83	Signal Generator	Rohde & Schwarz	SMY02	DE23662	01/16/2018	01/16/2019
3082	Power Amplifier	Com-Power Corp	ACS-250-100w	711970	VBU	VBU
4350	N to N low loss cable	abrind	24500F-NM-6	2271015	04/26/2018	04/26/2019
3043	2 Meter RF Cable 18GHz EMC lab	Maury Microwave	UC-N-MM-78	14.01.393	07/03/2018	07/03/2019
4293	6dB 300W Attenuator	JFW	50FH-006-300	none	02/26/2018	02/26/2019
88	Coupling Decoupling Network	FCC	FCC-801-M3-25A	01027	11/29/2018	11/29/2019

Software Utilized:

Name	Manufacturer	Asset #	Version
Total Integrated Laboratory Environment	ETS Lindgren	1330	Version 6

Profile:

Name	Manufacturer	Asset #	Version/Rev
Master Conducted Immunity	ETS Lindgren	1330-002	11/3

14.1 Results:

The sample tested was found to Comply.

14.2 Setup Photographs:



Figure 14-1 Conducted Immunity Test Setup



Figure 14-2 Conducted Immunity Test Setup

14.3 Test Data:

Injection Device Type	Port Description	Test Level (Vrms)	Result Classification
CDN	AC Power	3	A

Test Personnel:	<u>Reshar Rouse RJR</u>	Test Date:	<u>3-May-2019</u>
Supervising/Reviewing Engineer:		Modulation:	<u>1kHz</u>
(Where Applicable)		Required Performance	
Product Standard:	<u>EN 61000-6-1</u>	Test Levels:	<u>See Table Above</u>
		Ambient	
Input Voltage:	<u>230V 50Hz</u>	Temperature:	<u>22.6 °C</u>
		Relative Humidity:	<u>24.8 %</u>
Test Level Verification Performed:	<u>Yes</u>	Atmospheric Pressure:	<u>1002.2 mbars</u>

Notes:

(A) The EUT met the requirements without any degradation of performance.

Deviations, Additions, or Exclusions: None

15 Power Frequency Magnetic Field Immunity Test

15.1 Method

Client declares that the EUT does not contain any magnetically sensitive equipment such as but not limited to: CRT monitors, Hall Effect elements, electro-dynamic microphones, magnetic field sensors or audio frequency transformers. Test not applicable.

16 Voltage Dips / Interruptions Immunity Tests

16.1 Method

Tests are performed in accordance with IEC 61000-4-11.

TEST SITE: Immunity Lab.

16.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
4333	Ambient Data Logger	Extech	SD700	A.0864 09	03/27/2018	03/27/2019
1496	Model MX30KOC4Y20400 & CIC-PC-PCX Power Analyzer	Ametek	MX30KOC4Y 20400	1247A0 2352	11/13/2018	11/13/2019

Software Utilized:

Name	Manufacturer	Version
MX Series MXGUI	California Instruments	2.2.0.9 Feb. 22, 2010

16.3 Results:

The sample tested was found to Comply.


16.4 Setup Photographs:



Figure 16-1 Voltage Test Setup

16.5 Test Data:

Specification	Rated Voltage (Vac)	Frequency (Hz)	Voltage Test Level (%)	Voltage Dip (%)	Test Voltage (Vac)	Duration	Result Classification	
							0 deg	180 deg
0%UT for 0.5 Cycles	230	50	0	100	0.0	0.5 Cycle	A	A
0%UT for 1 Cycles	230	50	0	100	0.0	1 Cycles	A	A
70%UT for 25 Cycles	230	50	70	30	161	25 Cycles	A	A
0%UT for 250 Cycles	230	50	0	100	0.0	250 Cycles	B	B

Test Personnel:	Rick Hill 	Test Date:	February 15, 2019
Supervising/Reviewing Engineer:		Required Performance:	BBCC
(Where Applicable)		Test Levels:	See Table Above
Product Standard:	EN 61000-6-1	Ambient Temperature:	22.5°C
Input Voltage:	230V 50Hz	Relative Humidity:	45.5%
Waveform Verified on Oscilloscope:	Yes	Atmospheric Pressure:	984.4mbars

Notes:

- (A) The EUT met the requirements without any degradation of performance.
- (B) The EUT turned off but came back on and recovered when Voltage returned.

Deviations, Additions, or Exclusions: None

17 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	3-May-2019	103807635DAL-003	TD	WBC	Original Issue