ncee labs
Product Compliance Solutions

4740 Discovery Drive | Lincoln, NE 68521
tel- 402.323.6233 | tel -888.657.6860 | fax - 402.323.6238
info@nceelabs.com | http://nceelabs.com

EMC Test Report

Prepared for: Fike

Address: 704 SW 10th St. Blue Springs, MO 64015

On behalf of: Jeff Kleoppel of KCEMC

EUT: Output Analyzer

Test Report No.: R20180725-21

Approved By:

Nic S. Johnson, NCE
Technical Manager
iNARTE Certified EMC Engineer #EMC-003337-NE

Date: 23 October 2018

Total Pages: 22

ACCREDITED
TESTING LABORATORY
CERTIFICATE NO. 1953.01

Revision Page

Rev. No.	Date	Description
Original	23 October 2018	Original –NJohnson Prepared by NGavvala & KVepuri

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1 Summary of Test Results

The EUT was tested for compliance to the following harmonized standards;

1.1 Emissions Test Results

US Code of Federal Regulations, Title 47, FCC Part 15, Class A
Industry Canada ICES-003, Issue 6
EN 55011:2009/A1:2010
CISPR 11:2015

Below is a summary of the test results. Complete results of testing can be found in Section 3.

Table 1 - Emissions Test Results

Emissions Tests	Test Method and Limits	Result
Radiated Emissions	FCC Part 15.109 and ICES-003 using ANSI C63.4:2014, EN 55011:2009/A1:2010	PASS
Conducted Emissions	FCC Part 15.107 and ICES-003 using ANSI C63.4:2014, EN 55011:2009/A1:2010	PASS

1.2 Immunity Test Results

EN 61326-1:2013, Annex A

Below is a summary of the test results. Complete results can be found in Section 3.

Table 2 - Immunity Test Results

Tests	Test Method and Limits	Result
ESD	IEC 61000-4-2:2008 ±4kV Contact Discharge, ±8 kV Air discharge	Criteria A
Radiated Immunity	IEC 61000-4-3:2006/A1:2007/A2:2010 3V/m, 80MHz - 1GHz, 3V/m; 1.4GHz - 2.0GHz; 3V/m: 2.0GHz – 2.7GHz, 2 sec. dwell	Criteria A
Power Frequency Magnetic Field	IEC 61000-4-8:2009; 3A/m, 50/60Hz, 1min/axis	Not required Note 'a'

Note 'a' : Only to magnetically sensitive equipment. CRT display interference is allowed above 1A/m.'

2 EUT Description

The Equipment Under Test (EUT) was an Output Analyzer from Fike.

2.1 Equipment under Test (EUT)

Table 3 - Equipment under Test (EUT)

Model	Output Analyzer
Manufacturer	Fike
Serial	Unit 1
EUT Received Date	10/1/2018
EUT Tested Date	10/1/2018 - 10/5/2018

2.2 Laboratory Description

All testing was performed at the following Facility:

The Nebraska Center for Excellence in Electronics (NCEE Labs)
4740 Discovery Drive
Lincoln, NE 68521

A2LA Certificate Number: 1953.01
FCC Accredited Test Site Designation No: US1060
Industry Canada Test Site Registration No: 4294A-1
NCC CAB Identification No: US0177

Environmental conditions varied slightly throughout the tests:
Relative humidity of 53 ± 4%
Temperature of 23 ± 3° Celsius

2.3 EUT Setup

The EUT was powered by 5 VDC internal rechargeable battery for all tests unless specified.

For immunity tests, the display on the EUT was monitored for deviations in performance.

3 Test Results

3.1 Radiated Emissions

Test:	FCC Part 15.109 and ICES-003 using ANSI C63.4:2014, EN 55011		
Test Specifications:	Class A		
Test Result:	Complies	**Date:**	10/5/2018

3.1.1 Test Description

Radiated emissions measurements were made from 30 MHz to 13 GHz inside a semi-anechoic chamber. The EUT was rotated 360°, the antenna height varied from 1 – 4 meters and both the vertical and horizontal antenna polarizations examined. The results were compared against the limits. Measurements were made by first using a spectrum analyzer to acquire the signal spectrum; individual frequencies were then measured using a CISPR 16.1 compliant receiver with the following bandwidth setting:

30 MHz – 1 GHz: 120kHz IF bandwidth, 60kHz steps10m test Distance

3.1.2 Test Results

No emissions measurements were found in excess of the limits. Test result data can be seen below. All measurements were compared to the limits.

3.1.3 Test Environment

Testing was performed at the NCEE Labs Lincoln facility in the 10m semi-anechoic chamber. Laboratory environmental conditions varied slightly throughout the test:

Relative humidity of 43 ± 5%

Temperature of 23 ±2° C

3.1.4 Test Setup

See Section 2.3 for further details.

3.1.5 Test Equipment Used

Serial No.	Manufacturer	Model	Description	Last Cal.
1647	EMCO	3142B	Bicon Antenna	02 Aug 2017**
100037	Rohde & Schwarz	ES126	EMI Test Receiver	30 Jan 2018
6415	EMCO-ETS	3115	DRG Horn	26 Jan 2018
3545700803	Rohde & Schwarz	TS-PR18	Preamplifier	09 Mar 2018*
2575	Rohde & Schwarz	ES-K1	Software v.1.60	N/A

*Internal Characterization **Extended Cal

3.1.6 Test Pictures and/or Figures

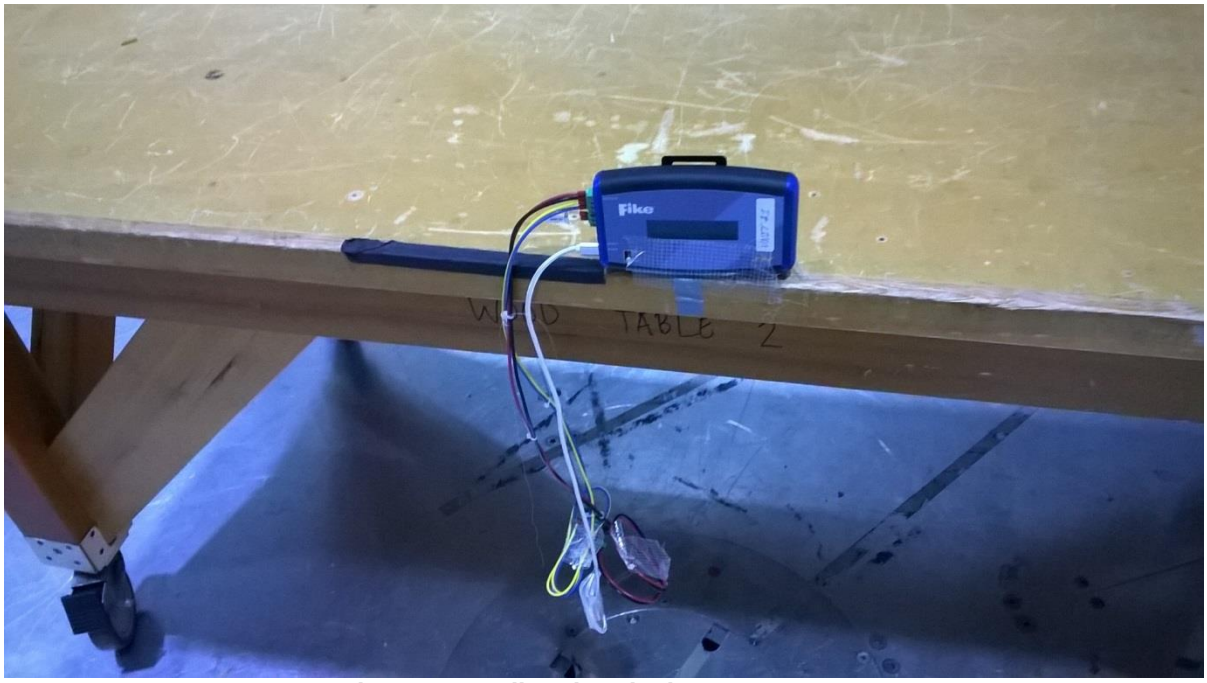

Figure 1 - Radiated Emissions Test Set-up

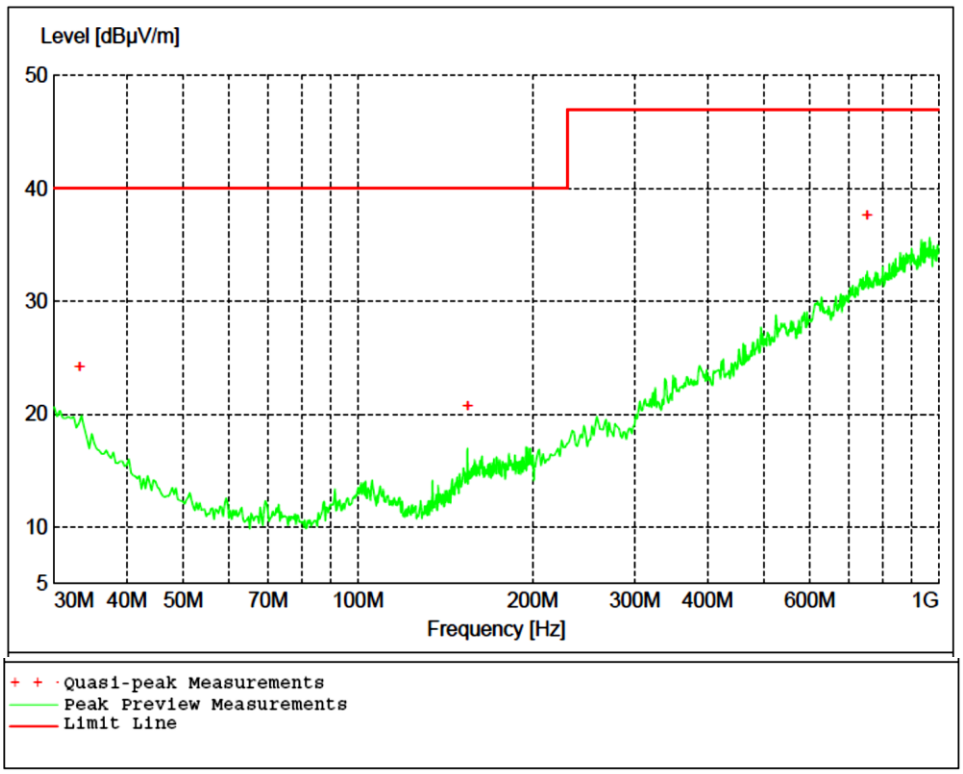

Figure 2 - Radiated Emissions Plot

Table 4 - Radiated Emissions Quasi-peak Measurements

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg	
33.180000	24.25	40.00	15.80	150	25	VERT
154.560000	20.78	40.00	19.20	149	273	VERT
753.520000	37.65	47.00	9.40	236	148	VERT

3.2 Conducted Emissions

Test:	FCC Part 15.107 and ICES-003 using ANSI C63.4:2014, EN 55011		
Test Specifications:	Class A		
Test Result:	Complies	**Date:**	10/1/2018

3.2.1 Test Description

Conducted emissions measurements were made from 150kHz to 30MHz via a 50µH Line Impedance Stabilization Network (LISN). The results were compared against the limits. Measurements were made on both the line and neutral conductors by first using a spectrum analyzer to acquire the signal spectrum; individual frequencies were then measured using a CISPR 16.1 compliant receiver with the following bandwidth setting:

150kHz – 30MHz: 9kHz IF bandwidth, 5kHz steps

3.2.2 Test Results

No measurement results were found to be in excess of the limits. A plot of the results can be seen below.

3.2.3 Test Environment

Testing was performed at the NCEE Labs Lincoln facility on the conducted emissions ground plane. Laboratory environmental conditions varied slightly throughout the test:

Relative humidity of 43 ± 5%

Temperature of 23 ±2^{o} C

3.2.4 Test Setup

Conducted emissions tests on the DC power adapter were performed at 230 VAC / 50 Hz. See Section 2.3 for further details.

3.2.5 Test Equipment Used

Serial No.	Manufacturer	Model	Description	Last Cal.
836679/010	Rohde & Schwarz	ESH3-Z5	Artificial Mains	26 Jul 2018
100037	Rohde & Schwarz	ES126	EMI Test Receiver	30 Jan 2018
2575	Rohde & Schwarz	ES-K1	Software v.1.60	N/A

3.2.6 Test Pictures and/or Figures

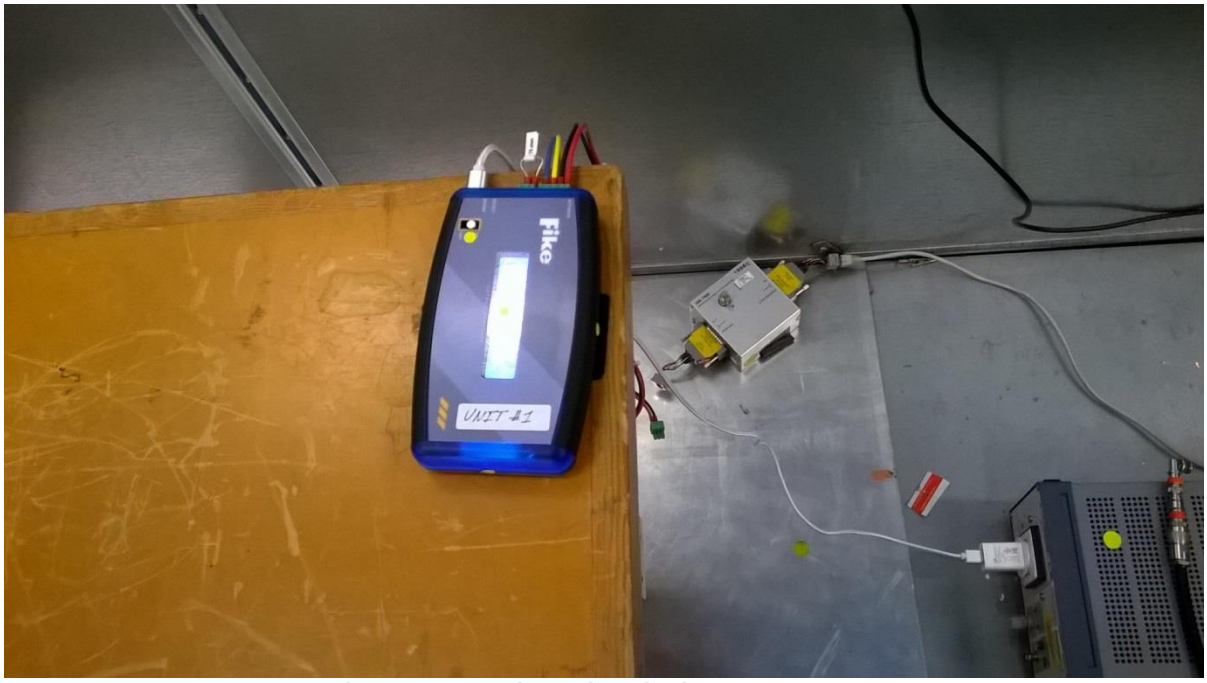

Figure 3 - Conducted Emissions Test Setup

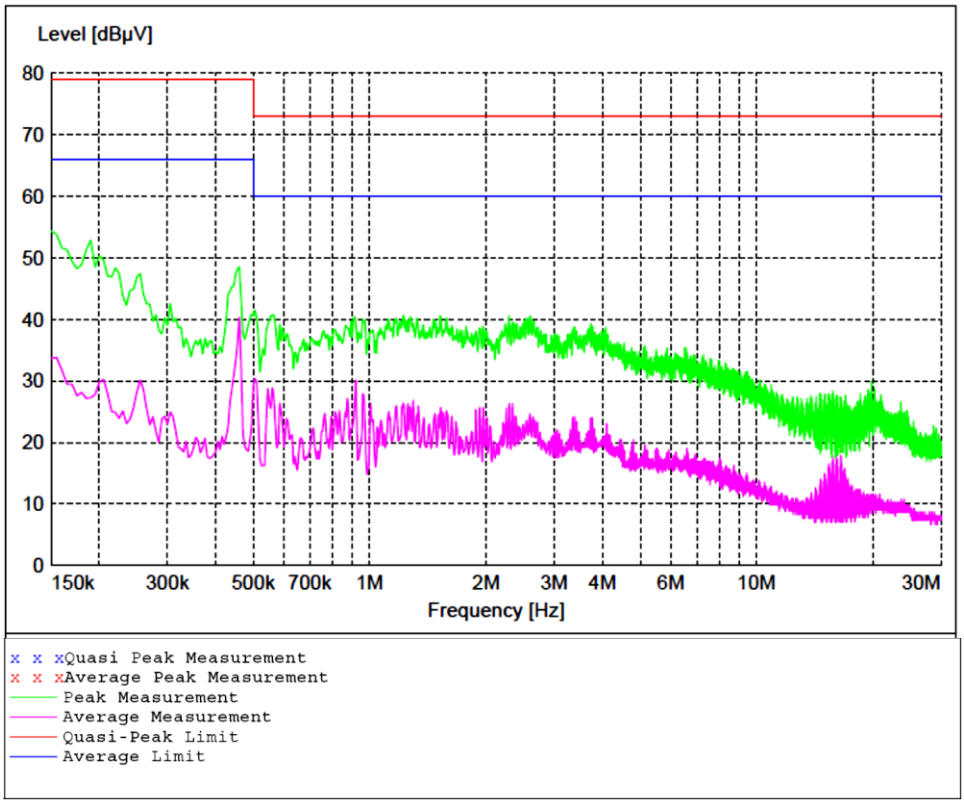

Figure 4 - Conducted Emissions Plot

All Measurements were found to be at least 10 dB below the limits.

3.3 ESD

Test:	EN 61326-1		
Test Method:	IEC 61000-4-2		
Test Specifications:	±4 kV Contact Discharge, ±8 kV Air Discharge		
Test Result:	A	**Date:**	10/5/2018

3.3.1 Test Description

The waveform shall be discharged to the EUT 10 times per test point per polarity per voltage level. Electrostatic discharges shall be applied to the housing shield, but not to the inner pins of the shielded port or cable connectors. Testing started at the least voltage and increased in severity to the maximum voltage. Horizontal Coupling plane and Vertical Coupling plane were tested on all 6 sideds

3.3.2 Test Results

The EUT experienced no degradation in performance according to the manufacturer's performance criteria. This corresponds to immunity criteria "A".
The test pictures and/or figures can be seen below.

3.3.3 Test Environment

Testing was performed at the NCEE Labs Lincoln facility on a horizontal ground plane. Laboratory environmental conditions varied slightly throughout the test.

Temperature was 24 ±2° C
Relative humidity was 51 ± 5%

3.3.4 Test Setup

The EUT was tested while powered with 230VAC/50Hz to the AC/DC power adapter. See Section 2.3 for further details. No contact discharge points are identified and some of the air discharge points are identified with the yellow dots.

3.3.5 Test Equipment Used

Serial No.	Manufacturer	Model	Description	Last Cal.
1081	Teseq	NSG 438	ESD Probe	2018 Jan 30
ID # 2130155	Omega	iTHX-SD	3m Temp. Humidity Meter	2018 Jan 31

3.3.6 Test Pictures and/or Figures

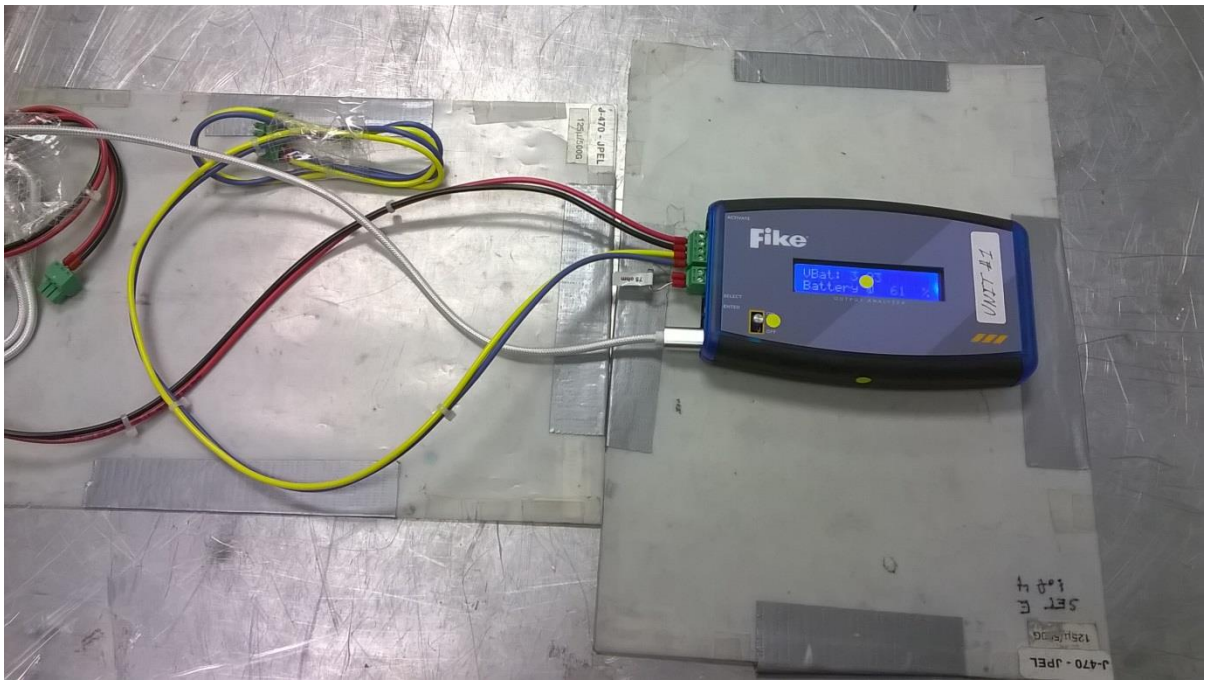

Figure 5 - ESD Test Setup

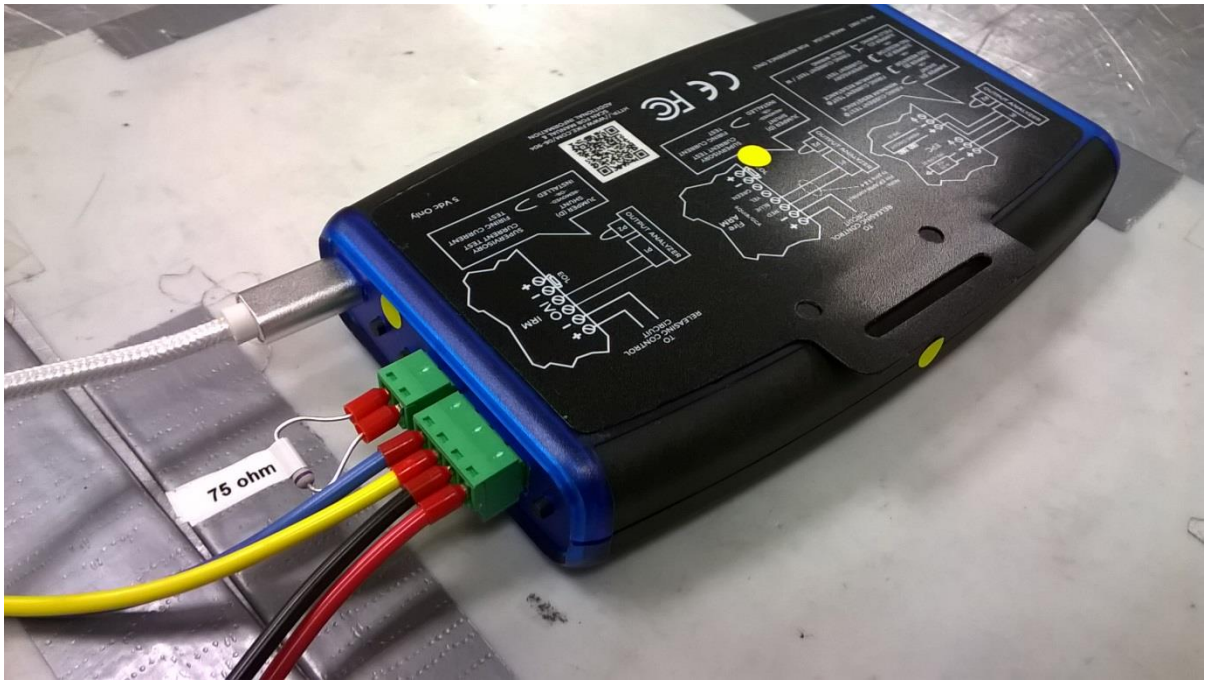

Figure 6 - ESD Test Points

Figure 7 - ESD Test Points

Figure 8 - ESD Test Points

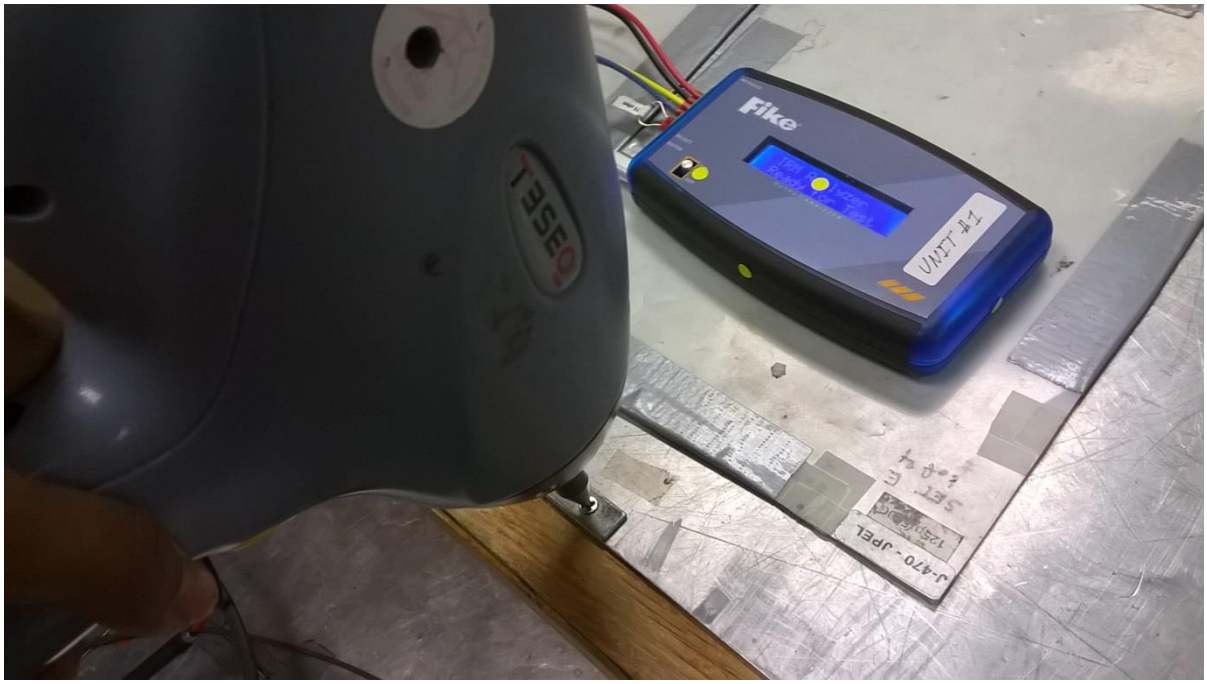

Figure 9 - ESD, Horizontal Coupling plane

Figure 10 - ESD, Vertical Coupling plane

3.4 Radiated Immunity

Test:	EN 61326-1:2013		
Test Method:	IEC 61000-4-3		
Test Specifications:	3 V/m, 2s, 80 MHz-1GHz, 80%, AM, 1 kHz rate 3 V/m, 2s, 1.4 GHz-2GHz, 80%, AM, 1 kHz rate 3 V/m, 2s, 2 GHz-2.7GHz, 80%, AM, 1 kHz rate		
Test Result:	A	**Date:**	10/4/2018

3.4.1 Test Description

An amplitude modulated uniform field was swept from the frequencies specified, with the frequency increasing 1% each step and dwelling on each frequency for the specified time. The EUT was placed in the field and oriented such that specified number of sides and the cabling were exposed to the field and was tested in both vertically and horizontally polarized fields.

Number of sides tested: 6 sides

3.4.2 Test Results

The EUT experienced no degradation in performance according to the manufacturer's performance criteria. This corresponds to immunity criteria "A".
The test pictures and/or figures can be seen below.

3.4.3 Test Environment

Testing was performed at the NCEE Labs Lincoln facility in the RF immunity chamber. Laboratory environmental conditions varied slightly throughout the test:

Temperature of 23 ±2^{o} C
Relative humidity of 48 ± 5%

3.4.4 Test Setup

The EUT was tested while powered with rechargeable internal battery. See Section 2.3 for further details.

3.4.5 Test Equipment Used

Serial No.	Manufacturer	Model	Description	Last Cal.
101313	Rohde & Schwarz	SML03	Signal Generator 3.3GH	2018 Jan 31**
9071	Rohde & Schwarz	EMC32-C	Software v.6.30.10	CNR*
300416	Amplifier Research	150W1000M3	Amplifier	CNR*
301539	Amplifier Research	30SIG3M3	Amplifier	CNR*
837157/005	Rohde & Schwarz	URV5-Z2	10V Insertion Unit	2018 Aug 07
832871/004	Rohde & Schwarz	URY-Z4	100V Insertion Unit	2018 Sept 10
837333/057	Rohde & Schwarz	NRVD	Power Meter	2018 Aug 06
29562	Teseq	CBL 6144	Bilog Antenna	CNR*

CNR* - Calibration Not Required
**2-year calibration cycle

3.4.6 Test Pictures and/or Figures

Figure 11 - Radiated Immunity Test Setup, Side A
All six sides have been tested in similar fashion

Test photo is representative and not the actual test setup.

Annex A: Measurement Uncertainty

Where relevant, the following measurement uncertainty levels apply to tests performed in this test report:

Test	Frequency Range	NCEE Labs Uncertainty Value (dB)	Maximum Uncertainty Values per CISPR 16-4-2:2003
AC Line Conducted Emissions	150kHz - 30MHz	3.30	3.60
Radiated Emissions, 10m	30MHz - 1GHz	3.82	5.20

Expanded uncertainty values are calculated to a confidence level of 95%.

NCEE Labs meets the maximum uncertainty requirements per CISPR 16-4-2:2003, and therefore does not require a minimum passing margin to state that an EUT is less than the field strength limits of the applicable CISPR, IEC or EN limit per CISPR 16-4-2:2003, Section 4.1.

Annex B: Sample Field Strength Calculation

Radiated Emissions

The field strength is calculated in decibels (dB) 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 = R + AF – (-CF + AG)

where FS = Field Strength

R = Receiver Amplitude Receiver reading in dBμV

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Preamplifier Amplifier Gain

Assume a receiver reading of 55.00 dBμV is obtained. The Antenna Factor of 12.00 and a Cable Factor of 1.10 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.10 dBμV/m.

FS = 55.00 + 12.00 – (-1.10 + 20.00) = 48.1 dBμV/m

The 48.1 dBμV/m value can be mathematically converted to its corresponding level in μV/m.

Level in μV/m = Common Antilogarithm [(48.1 dBμV/m)/20]= 254.1 μV/m

Conducted Emissions

Receiver readings are compared directly to the conducted emissions limits in decibels (dB) by adding the cable loss and LISN insertion loss to the receiver reading. The basic equations with a sample calculation is as follows;

FS = R + IL – (-CF)

where V = Conducted Emissions Voltage Measurement

R = Receiver reading in dBμV

IL = LISN Insertion Loss

CF = Cable Attenuation Factor

Assume a receiver reading of 52.00 dBμV is obtained. The LISN insertion loss of 0.80 dB and a Cable Factor of 1.10 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dBμV/m.

V = 52.00 + 0.80 – (-1.10) = 53.90 dBμV/m

The 53.90 dBμV/m value can be mathematically converted to its corresponding level in μV/m.

Level in μV/m = Common Antilogarithm [(48.1 dBμV/m)/20]= 495.45 μV/m

*Note: NCEE Labs uses the Rohde and Schwarz ES-K1 software package. In this software, all cable losses are listed as negative. This is why cable loss is subtracting in the preceding equations.

Margin is calculated by taking the limit and subtracting the Field

Annex C: Performance Criteria

Critical Functions of the EUT:

A critical function is a function of the EUT to be monitored during immunity testing for degradation in performance. Examples are; measurements of temperature displayed on an LCD display, automated turn on and shut off of a relay, or continuous operation of a motor. Please describe any critical functions of the EUT below and what the expected performance is and tolerances are.

Performance Criteria:

Immunity:
Performance Criteria A
The device shall continue to operate during the test. This equipment shall not reset or blank the display for more than 5 seconds during the test.

Performance Criteria B
The device shall continue to operate after the test. This equipment may reset during the test.

Performance criteria:

Performance criterion A: During testing, normal performance within the specification limit.

Performance criterion B: During testing, temporary degradation, or loss of function or performance which is self-recovering.

Performance criterion C: During testing, temporary degradation or loss of function or performance which requires operator intervention or system reset occurs. This can include loss of recorded data.

Performance criterion D: Any performance that does not meet the requirements of criterion A, B or C. This often means that the equipment can no longer perform its critical functions and requires maintenance services beyond normal use.

REPORT END