FCC

Test Report

Click 650

As contracted by Wavetronix, Nemko performed FCC testing on the Click 650 on October 7, 2013. The following report documents the results of the test and is unedited by Wavetronix.

Tester contact information:

Nemko-CCL, Inc.
1940 West Alexander Street
Salt Lake City, UT 84119-2039

Nemko-CCL, Inc.

1940 West Alexander Street
Salt Lake City, UT 84119
801-972-6146

Test Report

Verification

Test Of: CLICK 650

Test Specification:

FCC PART 15, Subpart B

Test Report Serial No: 245485-2.1

Applicant:
Wavetronix, LLC
78 East 1700 South, Bldg. B
Provo, UT 84606
U.S.A

Date of Test: October 7, 2013

Report Issue Date: October 14, 2013

Accredited Testing Laboratory By:

NVLAP

NVLAP Lab Code 100272-0

CERTIFICATION OF ENGINEERING REPORT

This report has been prepared by Nemko-CCL, Inc. to document compliance of the device described below with the Class A requirements of Federal Communications Commission (FCC) Part 15, Subpart B. This report may be reproduced in full. Partial reproduction may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

- Applicant: Wavetronix, LLC
- Manufacturer: Wavetronix, LLC
- Brand Name: Wavetronix
- Model Number: CLICK 650

On this 14th day of October 2013, I, individually and for Nemko-CCL, Inc., certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge, and are made in good faith.

Although NVLAP has accredited the Nemko-CCL, Inc. EMC testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Nemko-CCL, Inc.

Norman P Hansen

Tested by: Norman P. Hansen
Test Technician

Reviewed by: Thomas C. Jackson
General Manager

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SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name:	Wavetronix, LLC 78 East 1700 South, Bldg. B Provo, UT 84606 U.S.A
Contact Name:	Paul Michalczuk
Title:	Engineer

1.2 Manufacturer:

Company Name:	Wavetronix, LLC 78 East 1700 South, Bldg. B Provo, UT 84606 U.S.A
Contact Name:	Paul Michalczuk
Title:	Engineer

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name:	Wavetronix
Model Number:	CLICK 650
Serial Number:	44656AD6F007A
Dimensions:	26 cm x 18.5 cm x 10 cm

2.2 Description of EUT:

The CLICK 650 is a cabinet interface device that allows traffic sensors to be powered and managed as well as interfacing the other devices of the traffic control system. Up to 4 sensors can be connected. Interface to other system devices is via Ethernet or serial connections.

2.3 EUT and Support Equipment:

The FCC ID numbers for all the EUT and support equipment used during the test are listed below:

Brand Name Model Number Serial No.	FCC ID Number	Description	Name of Interface Ports / Interface Cables
BN: Wavetronix MN: CLICK 650 (Note 1) SN: 44656AD6F007A	Verification	Cabinet Interface Device	See Section 2.4
BN: Wavetronix MN: SS225 SN: None	Verification	Sensor	Interface/Cable with Military type 8 pin connector and Phoenix Contact connector (Note 2)
BN: Dell MN: Latitude SN:None	DoC	Computer	Ethernet/Cat 5e cable
BN: Trendnet MN: TE100-S8P SN: 0243C3A16540	DoC	Ethernet Switch	LAN/Cat 5e cables (Note 2)

Note: (1) EUT
(2) Interface port connected to EUT (See Section 2.4)

The support equipment listed above was not modified in order to achieve compliance with this standard.

2.4 Interface Ports on EUT:

Name of Ports	No. of Ports Fitted to EUT	Cable Descriptions/Length
Sensors 1 – 4 (Rear Panel)	4	Cables with Military type 8 pin connectors and Phoenix Contact connectors/20 feet
Ethernet	1	Cat 5e cable/25 feet
Port 1 SDLC	1	Shielded cable with DB15 connectors/6 feet
Control	0	Ports using RJ11 and DB9 connectors are not supported in this application
USB	0	Port is not supported in this application
Sensors 1 – 4 (Front Panel)	0	RJ11 ports are not supported in this application

2.5 Modification Incorporated/Special Accessories on EUT:

There were no modifications or special accessories required to comply with the specification.

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specification:

Title: FCC PART 15, Subpart B (47 CFR 15)

Limits and methods of measurement of radio interference characteristics of radio frequency devices

Purpose of Test: The tests were performed to demonstrate initial compliance

3.2 Methods & Procedures:

3.2.1 §15.107 Conducted Limits

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHZ to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.5*	66 to 56*	56 to 46*
0.5 – 5	56	46
5 - 30	60	50

*Decreases with the logarithm of the frequency.

(b) For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHZ to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.5	79	66
0.5 – 30	73	60

3.2.2 §15.109 Radiated Limits

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field Strength (microvolts/meter)
30 - 88	100
88 - 216	150
216 - 960	200
Above 960	500

(b) The field strength of radiated emission from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of emission (MHz)	Field Strength (microvolts/meter)
30 - 88	90
88 - 216	150
216 - 960	210
Above 960	300

(c) In the emission tables above, the tighter limit applies at the band edges. §15.33 and §15.35 which specify the frequency range over which radiated emissions are to be measured and the detector functions and other measurement standards apply.

3.2.3 Test Procedure

The line conducted and radiated emissions testing was performed according to the procedures in ANSI C63.4:2003. Testing was performed at the Nemko-CCL, Inc. Wanship open area test site #2, located at 29145 Old Lincoln Highway, Wanship, UT. This site has been registered with the FCC, and was renewed February 15, 2012 (90504). This registration is valid for three years.

Nemko-CCL, Inc. is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2014.

SECTION 4.0 OPERATION OF EUT DURING TESTING

4.1 Operating Environment:

Power Supply:	120 VAC
AC Mains Frequency:	60 Hz

4.2 Operating Modes:

Each mode of operation was exercised to produce worst-case emissions. The worst-case emissions were with the CLICK 650 monitoring the sensor and data communicated over Ethernet to the computer.

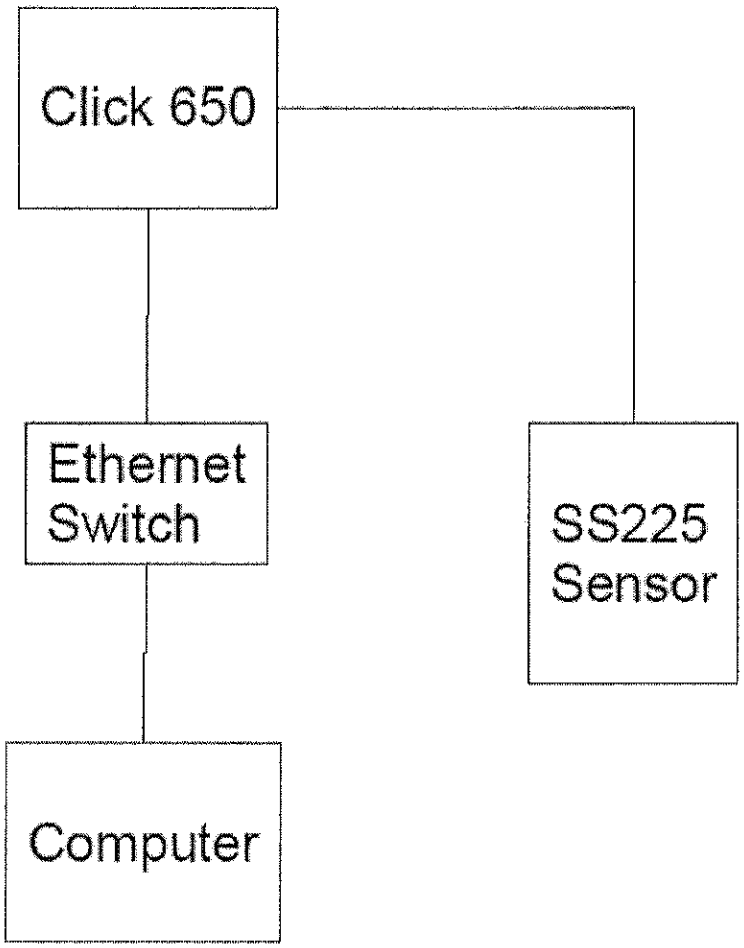
4.3 EUT Exercise Software:

Internal firmware was used to exercise the EUT.

4.4 Configuration & Peripherals:

The CLICK 650 was placed on the table and connected to the support equipment listed in Section 2.3 via each port listed in Section 2.4. Shown in Section 4.5 is a block diagram of the test configuration.

4.5 Block Diagram of Test Configuration:



SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 Class A of FCC Part 15, Subpart B

5.1.1 Summary of Tests:

Port	Environmental Phenomena	Frequency Range (MHz)	Result
AC Power	Conducted Disturbance at Mains Ports (Hot Lead to Ground)	0.15 to 30	Complied
AC Power	Conducted Disturbance at Mains Ports (Neutral Lead to Ground)	0.15 to 30	Complied
Enclosure	Radiated Disturbance (Vertical Polarity)	30 to 5000	Complied
Enclosure	Radiated Disturbance (Horizontal Polarity)	30 to 5000	Complied

5.2 Result

In the configuration tested, the EUT complied with the requirements of the specification.

SECTION 6.0 MEASUREMENTS, EXAMINATIONS AND DERIVED RESULTS

6.1 General Comments:

This section contains the test results only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Appendix 1 of this report.

6.2 Test Results:

6.2.1 Conducted Disturbance at Mains Ports Data (Hot Lead)

Frequency (MHz)	Detector	Measured Level (dBµV)	Class A Limit (dBµV)	Margin (dB)
0.31	Peak (Note 1)	56.2	66.0	-9.8
0.33	Peak (Note 1)	57.2	66.0	-8.8
0.35	Peak (Note 1)	55.7	66.0	-10.3
0.57	Peak (Note 1)	51.2	60.0	-8.8
0.62	Peak (Note 1)	54.0	60.0	-6.0
0.66	Peak (Note 1)	55.4	60.0	-4.6
Note 1: The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits.				

Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for this test was ± 3.3 dB.

RESULT

The EUT complied with the specification limit by a margin of 4.6 dB.

6.2.2 Conducted Disturbance at Mains Ports Data (Neutral Lead)

Frequency (MHz)	Detector	Measured Level (dBμV)	Class A Limit (dBμV)	Margin (dB)
0.29	Peak (Note 1)	56.0	66.0	-10.0
0.33	Peak (Note 1)	55.4	66.0	-10.6
0.37	Peak (Note 1)	54.7	66.0	-11.3
0.58	Peak (Note 1)	49.9	60.0	-10.1
0.66	Peak (Note 1)	52.6	60.0	-7.4
1.98	Peak (Note 1)	45.8	60.0	-14.2
Note 1: The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits.				

Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for this test was ± 3.3 dB.

RESULT

The EUT complied with the specification limit by a margin of 7.4 dB.

6.2.3 Radiated Disturbance Data (Vertical Polarity)

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	Class A 10 m Limit (dBμV/m)	Margin (dB)
42.4	Quasi-Peak (Note 1)	22.0	12.0	34.0	39.1	-5.1
56.4	Peak (Note 1)	23.8	8.5	32.3	39.1	-6.8
58.9	Peak (Note 1)	26.0	8.2	34.2	39.1	-4.9
84.9	Peak (Note 1)	26.3	7.8	34.1	39.1	-5.0
86.8	Quasi-Peak (Note 1)	25.7	8.1	33.8	39.1	-5.3
116.7	Peak (Note 1)	25.0	8.7	33.7	43.5	-9.8

Note 1: The reference detector used for the measurements was peak or quasi-peak and the data was compared to the quasi-peak limit.

Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for this test was ± 4.3 dB from 30 MHz to 200 MHz and ± 2.7 dB from 200 MHz to 1 GHz at a 10 meter measurement distance.

RESULT

The EUT complied with the specification limit by a margin of 4.9 dB.

6.2.4 Radiated Disturbance Data (Horizontal Polarity)

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	Class A 10 m Limit (dBμV/m)	Margin (dB)
116.5	Peak (Note 1)	11.2	9.0	20.2	43.5	-23.3
117.9	Peak (Note 1)	14.2	8.7	22.9	43.5	-20.6
249.6	Peak (Note 1)	11.4	14.3	25.7	46.4	-20.7
350.4	Peak (Note 1)	11.9	18.2	30.1	46.4	-16.3
400.0	Peak (Note 1)	3.7	20.0	23.7	46.4	-22.7
801.6	Peak (Note 1)	2.5	26.3	28.8	46.4	-17.6

Note 1: The reference detector used for the measurements was peak or quasi-peak and the data was compared to the quasi-peak limit.

Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for this test was ± 4.3 dB from 30 MHz to 200 MHz and ± 2.7 dB from 200 MHz to 1 GHz at a 10 meter measurement distance.

RESULT

The EUT complied with the specification limit by a margin of 16.3 dB.

6.3 Sample Field Strength Calculation:

The field strength is calculated by adding the Correction Factor (Antenna Factor + Cable Factor), to the measured level from the receiver. The receiver amplitude reading is compensated for any amplifier gain. The basic equation with a sample calculation is shown below:

FS = RA + CF

FS = Field Strength
RA = Receiver Amplitude Reading (Receiver Reading - Amplifier Gain)
CF = Correction Factor (Antenna Factor + Cable Factor)

Assume a receiver reading of 42.5 dBμV is obtained from the receiver, an amplifier gain of 26.5 dB and a correction factor of 8.5 dB/m. The field strength is calculated by subtracting the amplifier gain and adding the correction factor, giving a field strength of 24.5 dBμV/m, FS = (42.5 - 26.5) + 8.5 = 24.5 dBμV/m.

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

A1.1 Conducted Disturbance at Mains Ports:

The conducted disturbance at mains ports from the EUT was measured using a spectrum analyzer with a quasi-peak adapter for peak, quasi-peak and average readings. The quasi-peak adapter uses a bandwidth of 9 kHz, with the spectrum analyzer's resolution bandwidth set at 100 kHz, for readings in the 150 kHz to 30 MHz frequency ranges.

The conducted disturbance at mains ports measurements are performed in a screen room using a (50 Ω/50 µH) Line Impedance Stabilization Network (LISN).

Where mains flexible power cords are longer than 1 m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

Where the EUT is a collection of devices with each device having its own power cord, the point of connection for the LISN is determined from the following rules:

(a) Each power cord, which is terminated in a mains supply plug, shall be tested separately.
(b) Power cords, which are not specified by the manufacturer to be connected via a host unit, shall be tested separately.
(c) Power cords which are specified by the manufacturer to be connected via a host unit or other power supplying equipment shall be connected to that host unit and the power cords of that host unit connected to the LISN and tested.
(d) Where a special connection is specified, the necessary hardware to effect the connection is supplied by the manufacturer for the testing purpose.
(e) When testing equipment with multiple mains cords, those cords not under test are connected to an artificial mains network (AMN) different than the AMN used for the mains cord under test.

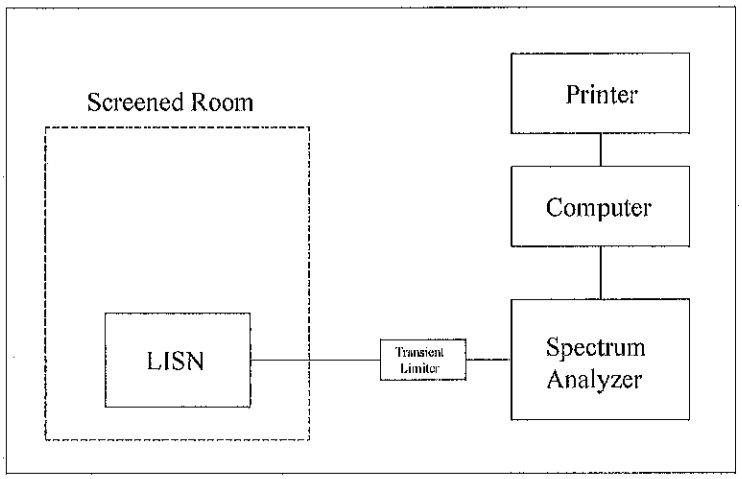
For AC mains port testing, desktop EUT are placed on a non-conducting table at least 0.8 meters from the metallic floor and placed 40 cm from the vertical coupling plane (copper plating in the wall behind EUT table). Floor standing equipment is placed directly on the earth grounded floor.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Due Date of Calibration
Wanship Open Area Test Site #2	Nemko-CCL, Inc.	N/A	N/A	12/07/2012	12/07/2013
Test Software	Nemko-CCL, Inc.	Conducted Emissions	Revision 1.2	N/A	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	02/06/2013	02/06/2014
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	02/06/2013	02/06/2014
LISN	EMCO	3825/2	9305-2099	03/12/2013	03/12/2014
Conductance Cable Wanship Site #2	Nemko-CCL, Inc.	Cable J	N/A	12/21/2012	12/21/2013

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Due Date of Calibration
Transient Limiter	Hewlett Packard	11947A	3107A02266	12/21/2012	12/21/2013

An independent calibration laboratory or Nemko-CCL, Inc. personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

Conducted Emissions Test Setup



A1.2 Radiated Disturbance:

The radiated disturbance from the EUT was measured using a spectrum analyzer with a quasi-peak adapter for peak and quasi-peak readings.

A preamplifier with a fixed gain of 26 dB and a power amplifier with a fixed gain of 22 dB were used to increase the sensitivity of the measuring instrumentation. The quasi-peak adapter uses a bandwidth of 120 kHz, with the spectrum analyzer's resolution bandwidth set at 1 MHz, for readings in the 30 to 1000 MHz frequency ranges.

A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz, at a distance of 3 or 10 meters from the EUT. The readings obtained by these antennas are correlated to the levels obtained with a tuned dipole antenna by adding antenna factors. A double-ridged guide antenna was used to measure the emissions at frequencies above 1000 MHz at a distance of 3 and/or 1 meter from the EUT.

The configuration of the EUT was varied to find the maximum radiated emission. The EUT was connected to the peripherals listed in Section 2.3 via the interconnecting cables listed in Section 2.4. A technician manually manipulated these interconnecting cables to obtain worst-case radiated disturbance. The EUT was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there were multiple interface ports all of the same type, cables are either placed on all of the ports or cables added to these ports until the emissions do not increase by more than 2 dB.

Desktop EUT are measured on a non-conducting table 0.8 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

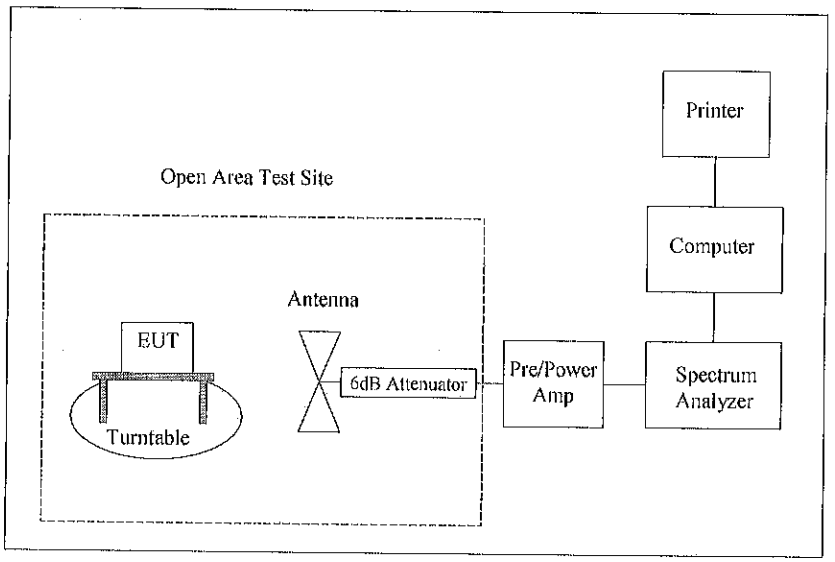
For radiated emission testing at 30 MHz or above that is performed at distances closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Due Date of Calibration
Wanship Open Area Test Site #2	Nemko-CCL, Inc.	N/A	N/A	12/07/2012	12/07/2013
Test Software	Nemko-CCL, Inc.	Radiated Emissions	Revision 1.3	N/A	N/A
Spectrum Analyzer/Receiver	Rohde & Schwarz	ESU40	100064	07/24/2013	07/24/2014
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	02/06/2013	02/06/2014
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	02/06/2013	02/06/2014
Biconilog Antenna	EMCO	3142	9601-1008	10/10/2012	10/10/2014
Double Ridged Guide Antenna	EMCO	3115	9409-4355	06/06/2012	06/06/2014

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Due Date of Calibration
High Frequency Amplifier	Miteq	AFS4-01001800-43-10P-4	1096455	05/06/2013	05/06/2014
20' High Frequency Cable	Microcoax	UFB197C-1-3120-000000	1297	05/02/2013	05/02/2014
10 Meter Radiated Emissions Cable Wanship Site #2	Nemko-CCL, Inc.	Cable L	N/A	12/21/2012	12/21/2013
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	08/26/2013	08/26/2014
6 dB Attenuator	Hewlett Packard	8491A	32835	12/21/2012	12/21/2013

An independent calibration laboratory or Nemko-CCL, Inc. personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

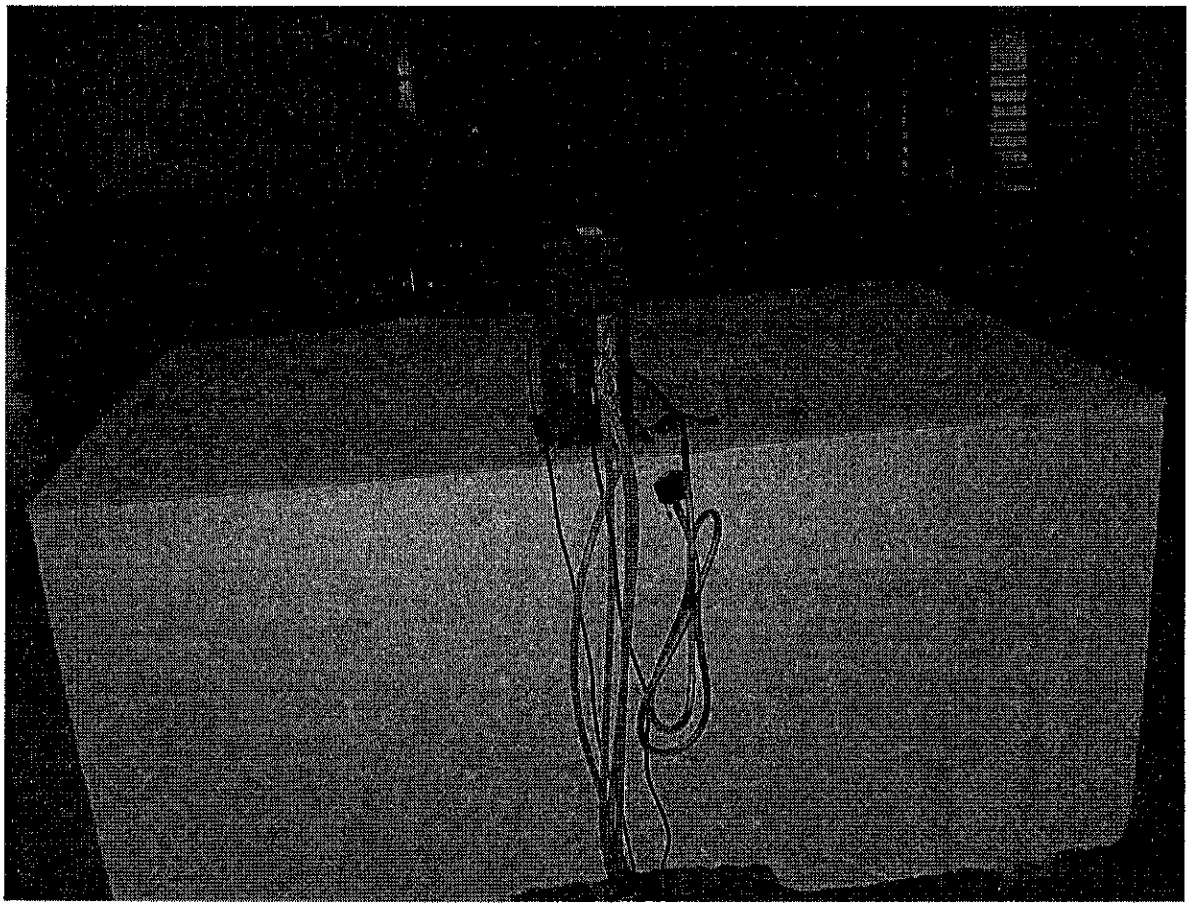
Radiated Emissions Test Setup



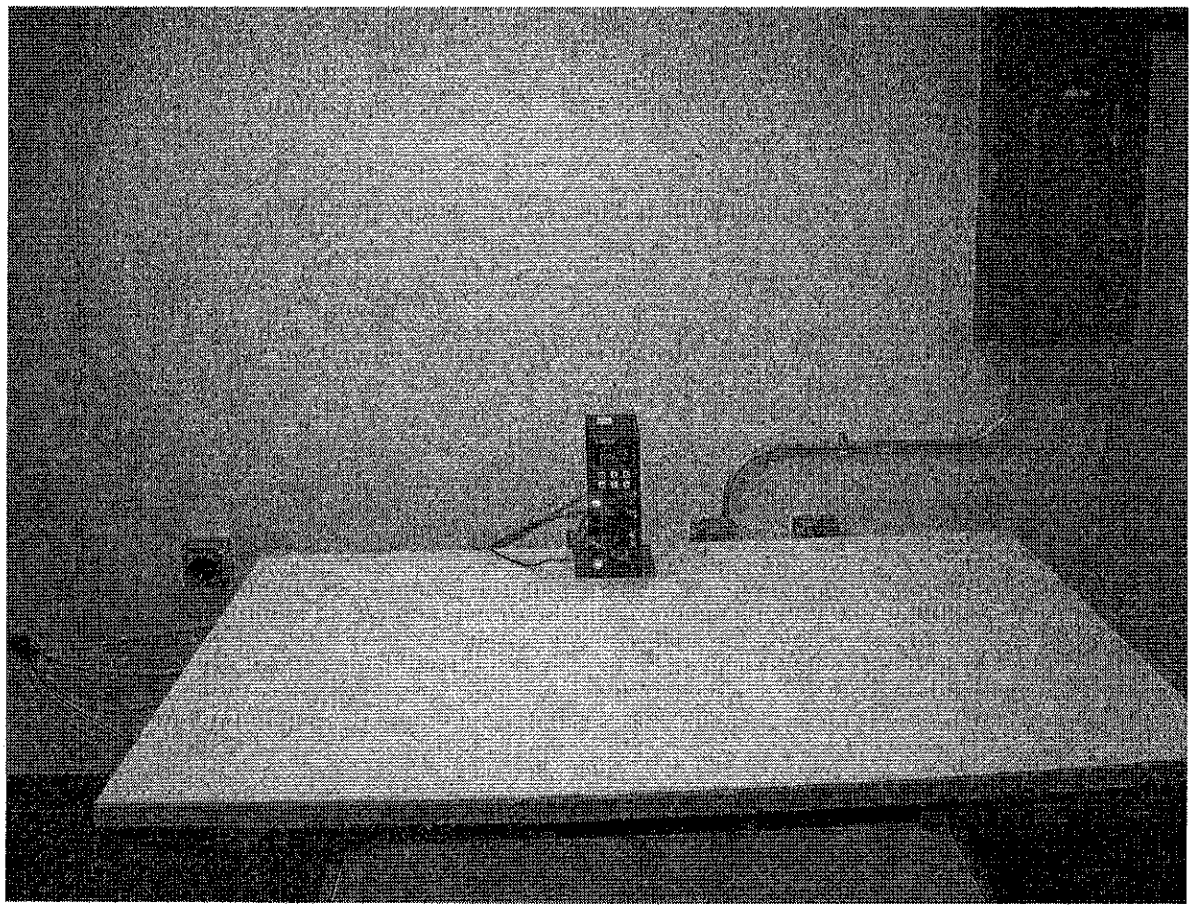
APPENDIX 2 PHOTOGRAPHS

Photograph 1 – Front View Radiated Disturbance Worst Case Configuration

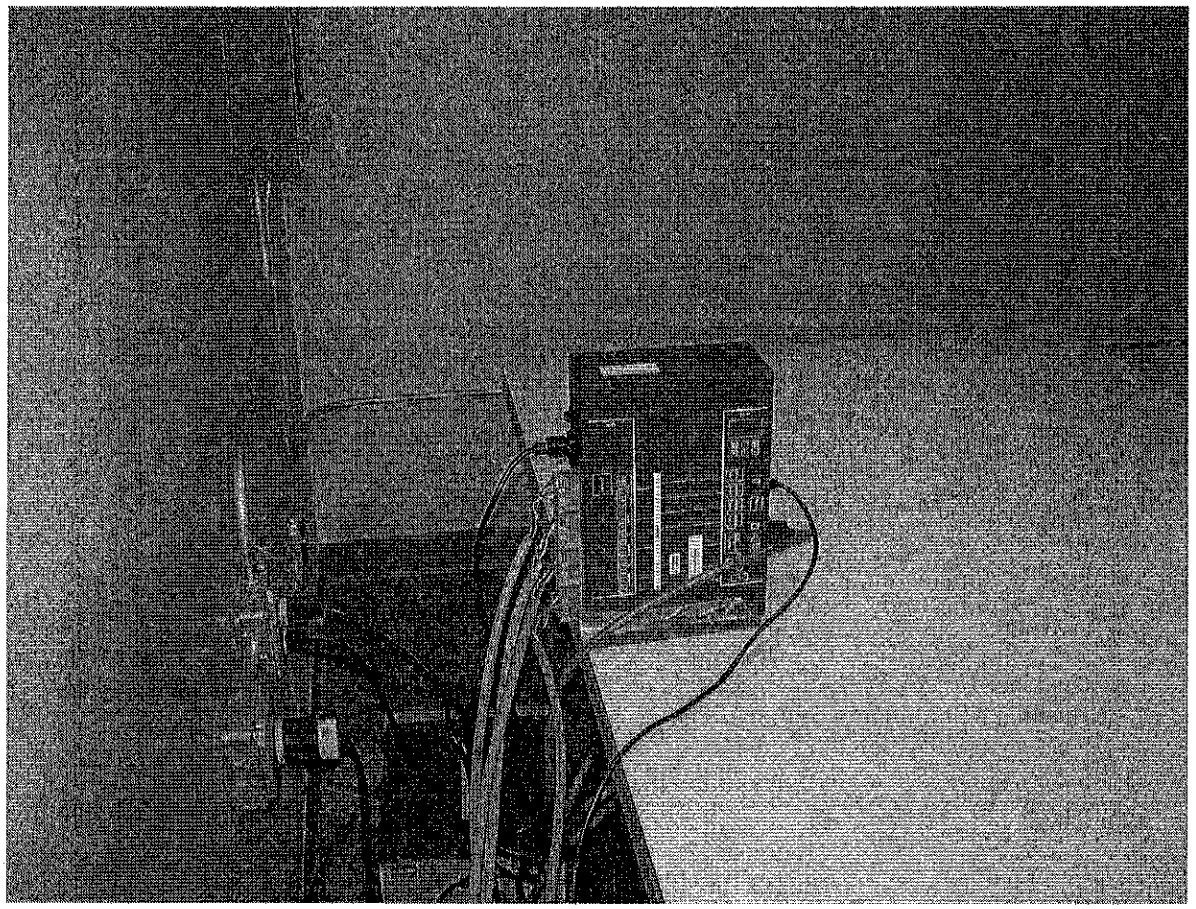
Photograph 2 – Back View Radiated Disturbance Worst Case Configuration



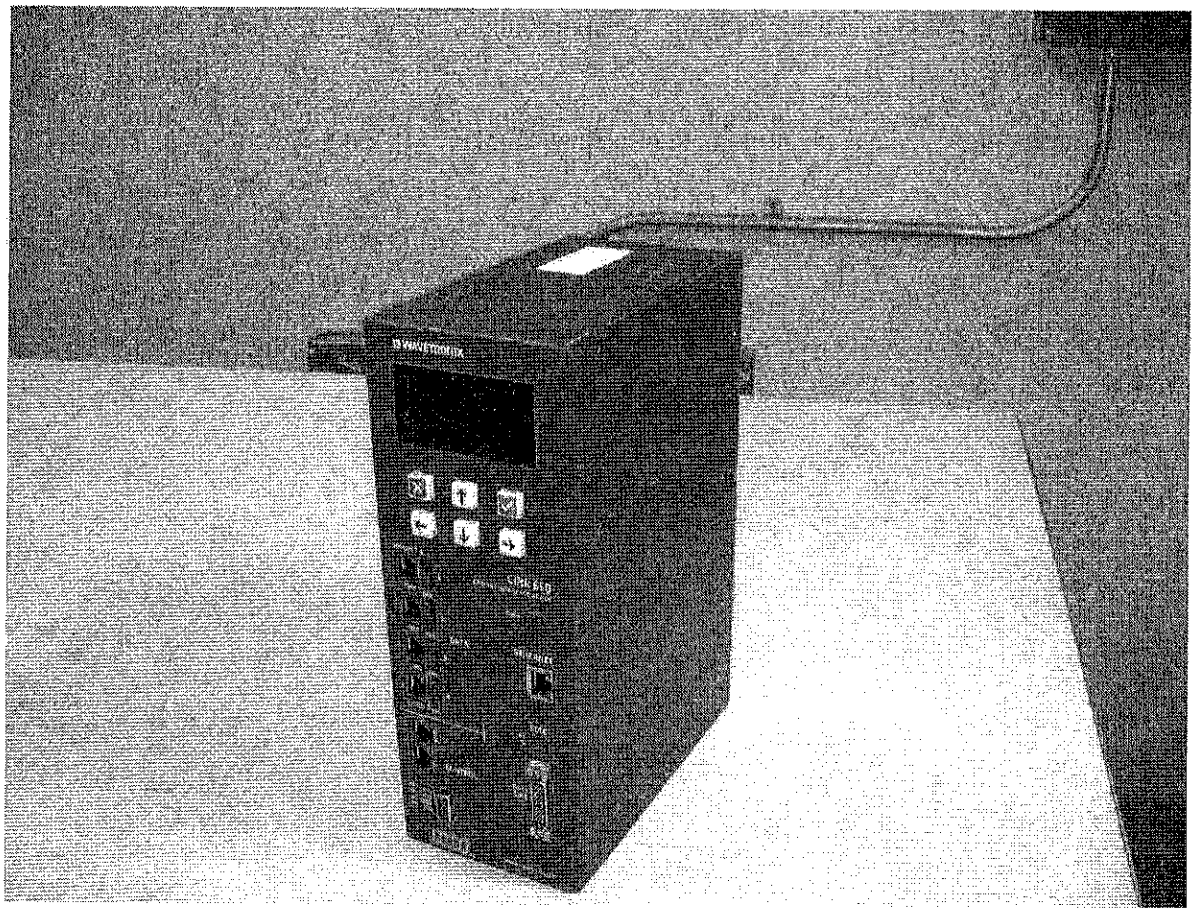
Photograph 3 – Front View Conducted Disturbance Worst Case Configuration



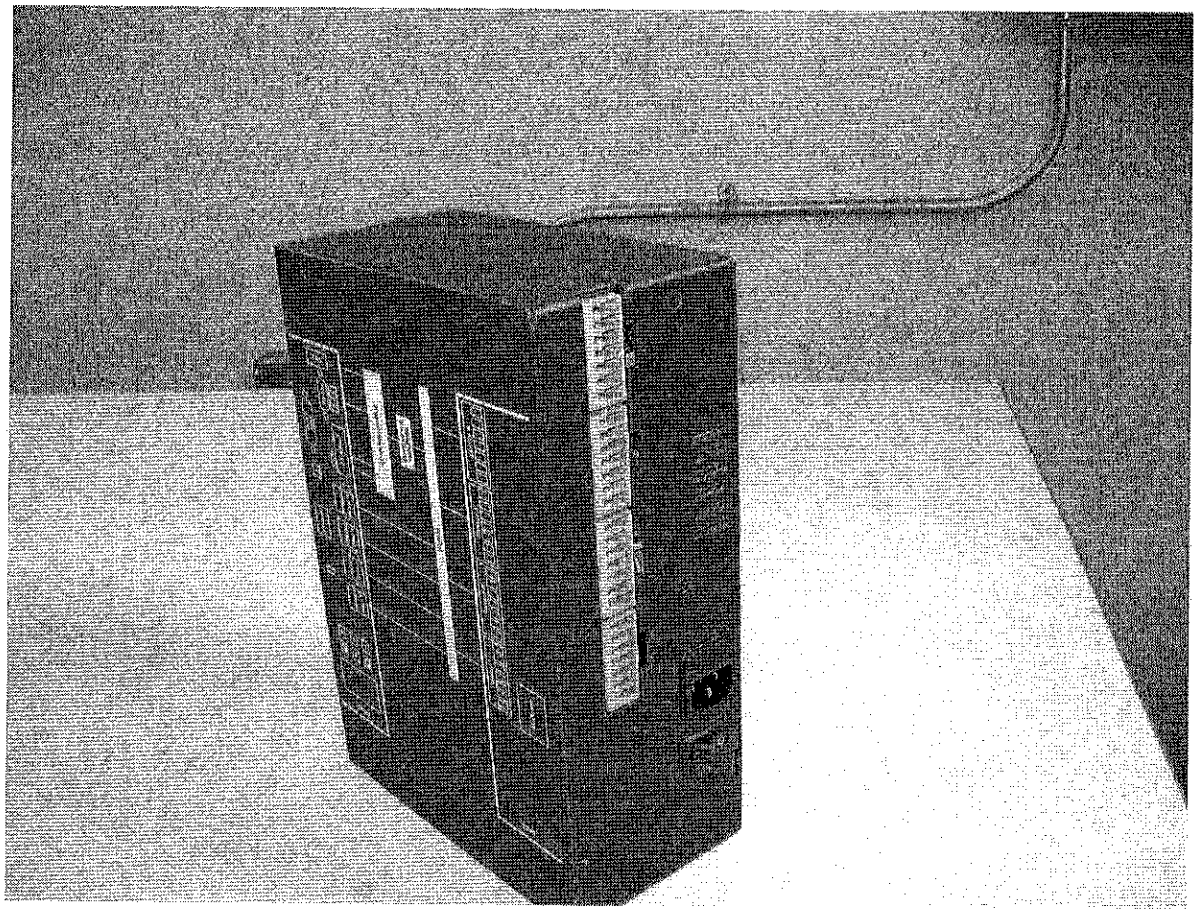
Photograph 4 – Back View Conducted Disturbance Worst Case Configuration



Photograph 5 – Front View of the EUT



Photograph 6 – Back View of the EUT



APPENDIX 3 FCC Part 15 COMPLIANCE INFORMATION

A3.1 LABEL AND COMPLIANCE STATEMENT

The label of the Wavetronix, LLC CLICK 650 was not available at the time of this report.

A3.2 BLOCK DIAGRAM

A block diagram showing the clock frequencies and signal paths of the Wavetronix, LLC CLICK 650 was not available at the time of this report.

A3.3 USER'S MANUAL

A copy of the User's manual containing the FCC warning statement was not available at the time of this report.