Nemko-CCL, Inc.

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

Test Report

Certification

Test Of: CowAlert

FCC ID: WWP-COWALERT

Test Specification: FCC PART 15, Subpart C

Test Report Serial No: 234765-8.2

Applicant:
IceRobotics Ltd
Bankhead Steading
Bankhead Road
South Queensferry
Edinburgh EH30 9TF
United Kingdom

Date of Test: April 4 & 8-11, 2013

Report Issue Date: April 25, 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 requirements of Federal Communications Commission (FCC) Part 15, Subpart C. 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.

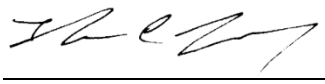
- Applicant: IceRobotics Ltd
- Manufacturer: IceRobotics Ltd
- Brand Name: IceRobotics
- Model Number: CowAlert
- FCC ID Number: WWP-COWALERT

On this 25th day of April 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 recognized that the Nemko-CCL, Inc. EMC testing facilities are in good standing, 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.

Tested by: Mark M. Feil
EMC Engineer



Reviewed by: Thomas C. Jackson
General Manager

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SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name: IceRobotics Ltd
Bankhead Steading
Bankhead Road
South Queensferry
Edinburgh EH30 9TF
United Kingdom

Contact Name: Fraser Arnot
Title: Operations Manager

1.2 Manufacturer:

Company Name: IceRobotics Ltd
Bankhead Steading
Bankhead Road
South Queensferry
Edinburgh EH30 9TF
United Kingdom

Contact Name: Fraser Arnot
Title: Operations Manager

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name:	IceRobotics
Model Number:	CowAlert
Dimensions:	EtherReader: 24.1 cm x 15.9 cm x 8.9 Trigger Box: 17.8 cm x 7.6 cm x 13.1 128 kHz Antenna: 75 cm x 75 cm x 0.6
Country of Manufacture:	United Kingdom

2.2 Description of EUT:

The CowAlert system—together with the IceQube—acquires data logs of animal movements, enabling analysis of such data. For testing, the system was powered by a Sanyo AD-173 or Celetron GP14-2001 power supply. The CowAlert System comprises a 128 kHz antenna, an antenna trigger box and the EtherReader which interfaces with a computer via Ethernet and wirelessly with an IceQube. The IceQube sensor is strapped to the leg of an animal for a period of a few weeks up to many years, during which time it gathers data of the movement of the animal. The IceQube does not transmit constantly. Transmission is activated via its 128 kHz inductor when the animal passes through the 128 Khz field produced by the antenna of the CowAlert System. Alternatively, or in addition, the IceQube can be programmed to transmit automatically at pre-defined time intervals.

There are three activation modes which result in three sets of transceiving frequencies within the 2400 MHz to 2483.5 MHz frequency band. “Double pulse” mode activates channels 8 (2402.6 MHz), 64 (2420.9 MHz), and 128 (2441.7 MHz). “Triple pulse” mode activates channels 50 (2416.3 MHz), 100 (2432.6 MHz), 150 (2448.9 MHz). “Timed download” mode activates channels 30 (2409.8 MHz), 200 (2465.2 MHz), 230 (2475.0 MHz). After activation the CowAlert system and the Ice Qube communicate with each other (transmit and receive) at 2.402-2.475 GHz for a few seconds while the data is downloaded, then the IceQube transmitter is turned off.

The CowAlert transmits at 128 kHz. Testing was performed at 128 kHz. Test results for the 2400 MHz - 2483.5 MHz frequency band are shown in Nemko-CCL report #234765-3.1. Plots of the tested channel are shown in section 6.2.3.1.

This report covers the circuitry of the devices subject to FCC Part 15, Subpart C. The circuitry of the device subject to FCC Part 15, Subpart B has been tested and found to comply. See Nemko-CCL report #234765-2.

2.3 EUT and Support Equipment:

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: IceRobotics MN: CowAlert (Note 1)	WWP-COWALERT	Transmitter activator and data downloader	See Section 2.4
BN: IceRobotics MN: IceQube	WWP-ICEQUBE	Data logger and transmitter	Wireless interface
BN: Samsung MN: N310 (Note 2)	N/A	Laptop computer	Ethernet / Cat5E

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

2.4 Interface Ports on EUT:

Name of Port	No. of Ports Fitted to EUT	Cable Descriptions/Length
Ethernet	1	Ethernet / Cat5E

2.5 Modification Incorporated/Special Accessories on EUT:

The following modifications were made to the EUT during testing to comply with the specification. This report is not complete without an accompanying signed attestation, that the product will have all of the documented modifications incorporated into the product when manufactured and placed on the market.

1. A 10,000 pf capacitor was placed from TA1 to TA2 on the EtherReader's output to the trigger box.

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specification:

Title: FCC PART 15, Subpart C (47 CFR 15)
15.203, 15.207, and 15.209

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 §15.203 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

3.2.2 §15.207 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.

3.2.3 §15.209 Radiated Emission Limits, General Requirements

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100 **	3
88-216	150 **	3
216-960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permItted under other sections of this part, e.g., §§ 15.231 and 15.241.

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

(e) The provisions in §§ 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which

radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

(f) In accordance with § 15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in § 15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in § 15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in § 15.109 that are applicable to the incorporated digital device.

(g) Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

3.3 Test Procedure

The conducted disturbance at mains ports and radiated disturbance testing was performed according to the procedures in ANSI C63.4: 2003 and using the guidance, DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, dated March 30, 2000. Testing was performed at 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, 2013.

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:

The transmitter was tested while in a constant transmit mode at the desired frequency, using the modulation schemes explained in section 2.2. The voltage to the transmitter was varied as required by §15.31(e) with no change seen in the transmitter characteristics.

4.3 EUT Exercise Software:

Internal IceRobotics firmware was used to exercise the transmitter.

SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 FCC Part 15, Subpart C

5.1.1 Summary of Tests:

Section	Environmental Phenomena	Frequency Range (MHz)	Result
15.203	Antenna Requirements	Structural requirement	Complied
15.207	Conducted Disturbance at Mains Ports	0.15 to 30	Complied
15.209	Radiated emissions	0.125 - 1000	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 §15.203 Antenna Requirements

The EUT is professionally installed and thus meets the requirements of §15.203.

6.2.2 §15.207 Conducted Disturbance at the AC Mains Ports

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBµV)	Limit (dBµV)	Margin (dB)
0.16	Hot Lead	Peak (Note 1)	51.6	55.5	-3.9
0.21	Hot Lead	Peak (Note 1)	44.2	53.3	-9.1
4.01	Hot Lead	Quasi-Peak (Note 1)	35.1	46.0	-10.9
4.35	Hot Lead	Peak (Note 1)	42.4	46.0	-3.6
4.44	Hot Lead	Peak (Note 1)	38.9	46.0	-7.1
4.63	Hot Lead	Peak (Note 1)	41.1	46.0	-4.9
4.69	Hot Lead	Peak (Note 1)	41.5	46.0	-4.5
6.05	Hot Lead	Peak (Note 1)	39.4	50	-10.6
6.45	Hot Lead	Peak (Note 1)	39.4	50	-10.6
24.9	Hot Lead	Peak (Note 1)	39.1	50	-10.9
3.12	Neutral Lead	Peak (Note 1)	40.0	46.0	-6.0
3.68	Neutral Lead	Peak (Note 1)	40.6	46.0	-5.4
3.85	Neutral Lead	Peak (Note 1)	41.1	46.0	-4.9
4.00	Neutral Lead	Peak (Note 1)	42.6	46.0	-3.4
4.15	Neutral Lead	Peak (Note 1)	42.2	46.0	-3.8
4.49	Neutral Lead	Quasi-Peak (Note 2)	44.8	56.0	-11.2
4.49	Neutral Lead	Average (Note 2)	19.4	46.0	-26.6
5.00	Neutral Lead	Peak (Note 1)	43.3	46.0	-2.7
5.90	Neutral Lead	Peak (Note 1)	40.4	50.0	-9.6

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBµV)	Limit (dBµV)	Margin (dB)
6.55	Neutral Lead	Peak (Note 1)	40.8	50.0	-9.2

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.

Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

RESULT

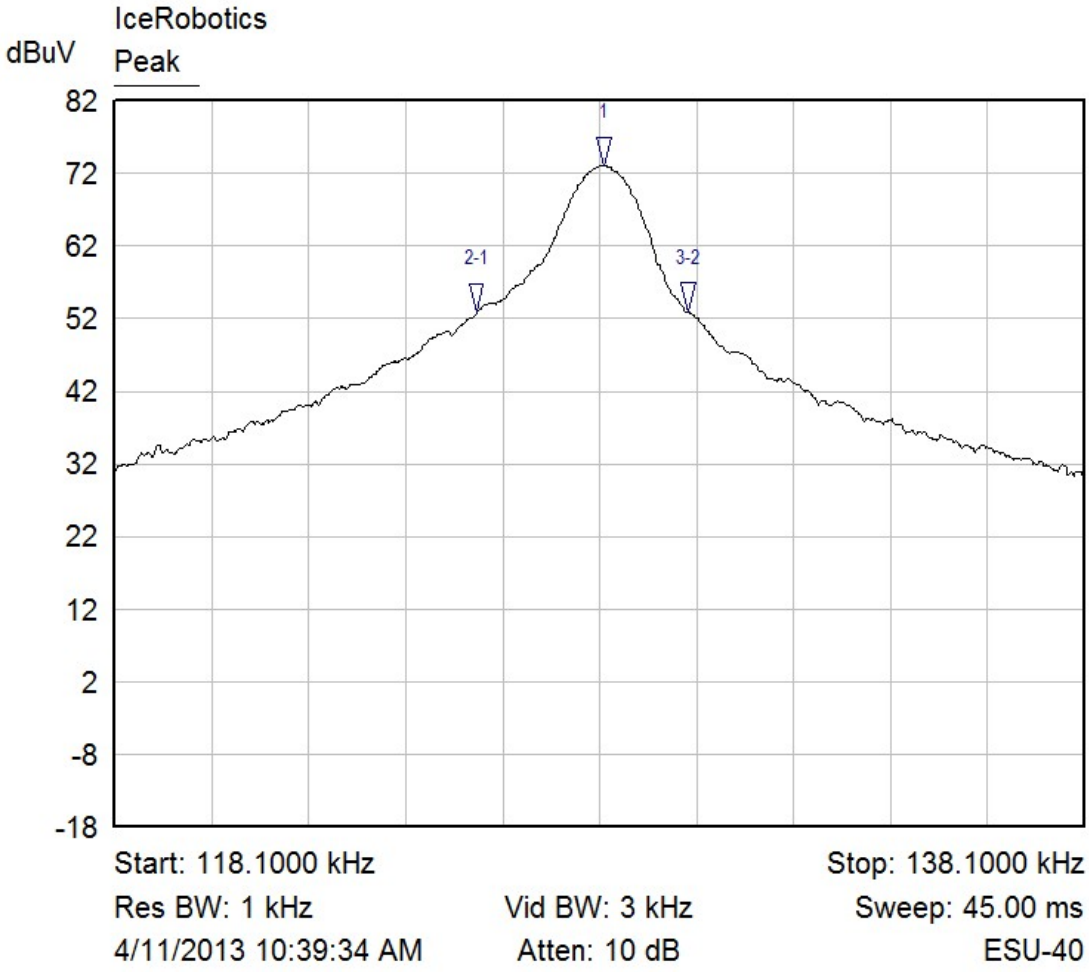
The EUT complied with the specification by 2.7 dB.

6.2.3 §15.209 Radiated Emissions

6.2.3.1 Fundamental Emission

The fundamental emission was measured at a 30 meter, 10 meter, and 3 meter distance. The limit is specified at a 300 meter distance. 40 dB/decade was used to adjust the limit to reflect the measurement distance used. A fundamental emission plot at 3 meters distance is also shown. The bandwidth of the emission is 4.36 kHz. For harmonics and spurious emissions, measurements are shown to the degree beyond which only noise floor was seen.

Frequency (MHz)	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Field Strength (dBµV/m)	3 m Limit (dBµV/m)	Margin (dB)
0.128	Peak	60.7	10.7	71.4	105.4	-34.0



Mkr	X-Axis	Value	Notes
1	128.1800 kHz	72.99 dBuV	
2-1	-2.6200 kHz	-20.09 dB	
3-2	4.3600 kHz	0.03 dB	

Peak 127 BW - 3 Meter

6.2.3.2 Harmonics and Spurious Emissions

Frequency (MHz)	Detection Mode	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	3 m Limit (dBμV/m)	Margin (dB)
0.256	Peak	40.1	10.5	50.6	99.4	-48.8
0.385	Peak	39.7	10.4	50.1	95.9	-45.8

RESULT

The EUT complied with the specification on this channel by 45.8 dB.

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

A1.1 §15.207 Conducted Disturbance at the AC Mains

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:

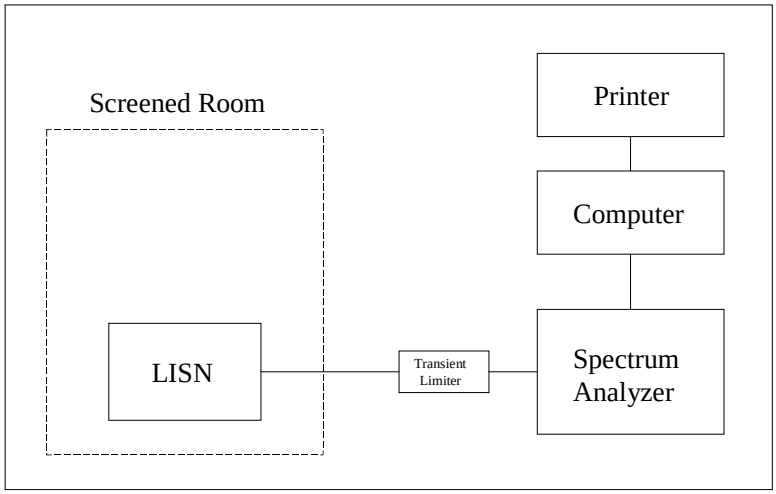
(a) Each power cord, which is terminated in a mains supply plug, shall be tested separately.
(b) Power cords, which are not specified by the manufacturer to be connected via a host unit, shall be tested separately.
(c) Power cords which are specified by the manufacturer to be connected via a host unit 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
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 §15.209 Radiated Measurements

The radiated emissions from the intentional radiator were measured using a spectrum analyzer with a quasi-peak adapter for peak and quasi-peak readings.

A loop antenna was used to measure emissions below 30 MHz. Emission readings more than 20 dB below the limit at any frequency may not be listed in the reported data. For frequencies between 9 kHz and 30 MHz, or the lowest frequency generated or used in the device greater than 9 kHz, and less than 30 MHz, the spectrum analyzer resolution bandwidth was set to 9 kHz and the video bandwidth was set to 30 kHz. For average measurements, the spectrum analyzer average detector was used.

For frequencies above 30 MHz, an amplifier and preamplifier 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. For peak emissions above 1000 MHz the spectrum analyzer's resolution bandwidth was set to 1 MHz and the video bandwidth was set to 3 MHz. For average measurements above 1000 MHz the spectrum analyzer's resolution bandwidth was set to 1 MHz and the average detector of the analyzer was used.

A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz and a Double Ridge Guide Horn antenna was used to measure the frequency range of 1 GHz to 18 GHz at a distance of 3 meters and/or 1 meter from the EUT. The readings obtained by the antenna are correlated to the levels obtained with a tuned dipole antenna by adding antenna factors.

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.

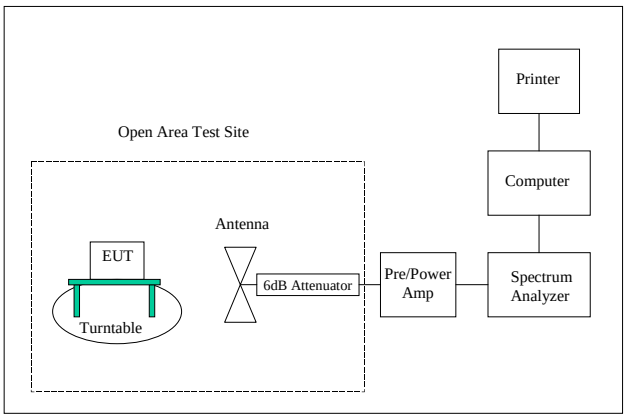
Desktop EUT are measured on a non-conducting table 0.8 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

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	Rhode & Schwarz	ESU40	100064	07/28/2012	07/28/2013
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
Loop Antenna	EMCO	6502	9111-2675	03/04/2013	03/04/2015
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
High Frequency Amplifier	Miteq	AFS4-01001800-43-10P-4	1096455	06/26/2012	06/26/2013
6’ High Frequency Cable	Microcoax	UFB197C-0-0720-000000	1296	05/14/2012	05/14/2013
20’ High Frequency Cable	Microcoax	UFB197C-1-3120-000000	1297	05/14/2012	05/14/2013
3 Meter Radiated Emissions Cable Wanship Site #2	Microcoax	UFB205A-0-4700-000000	1295	05/10/2011	05/10/2013
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	08/27/2012	08/27/2013
6 dB Attenuator	Hewlett Packard	8491A	32835	12/21/2012	12/21/2013

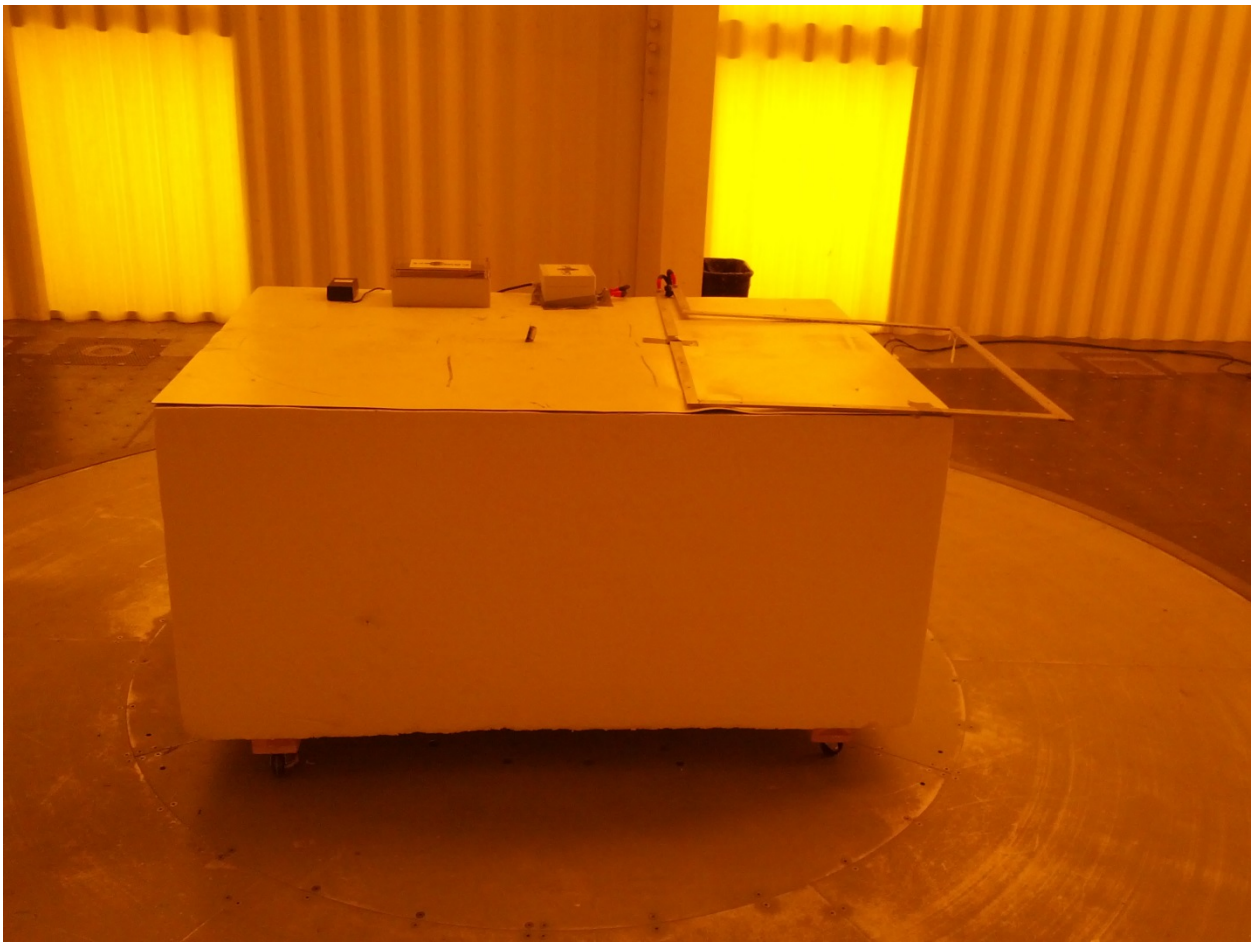
An independent calibration laboratory or Nemko-CCL, Inc. personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology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

Radiated Emissions Test Setup

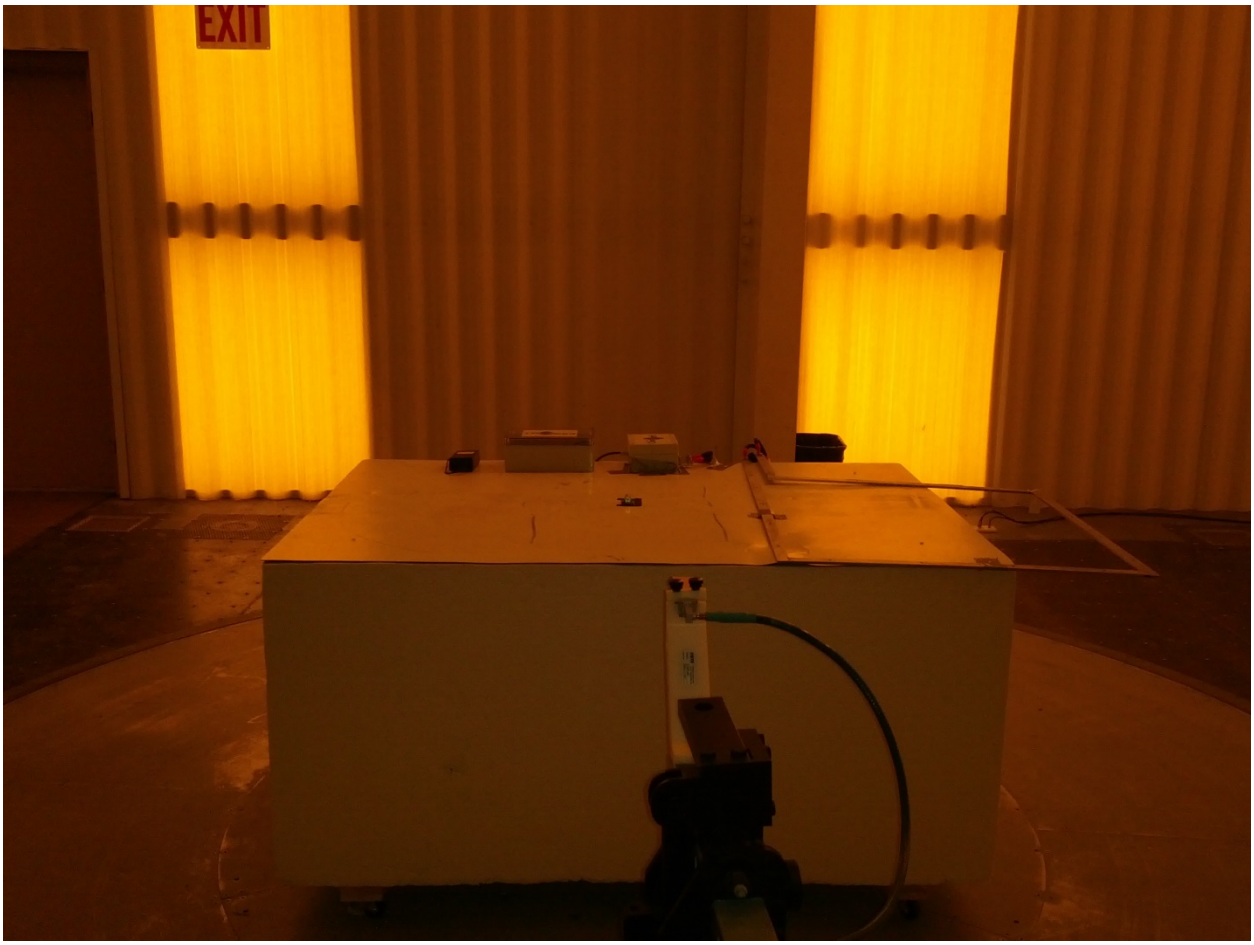


APPENDIX 2 PHOTOGRAPHS

Photograph 1 – Front View Radiated Disturbance Worst Case Configuration

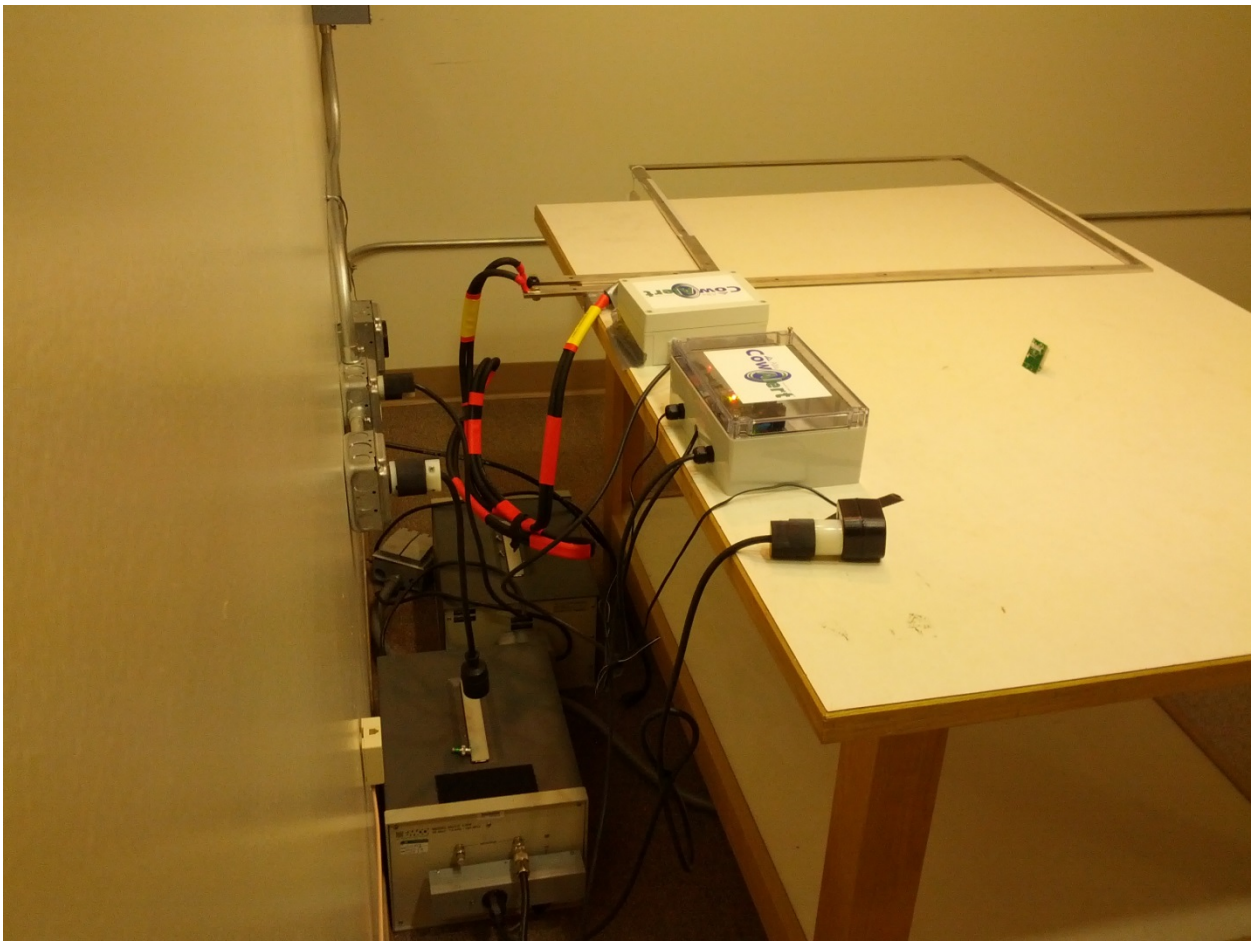


Photograph 2 – Back View Radiated Disturbance Worst Case Configuration

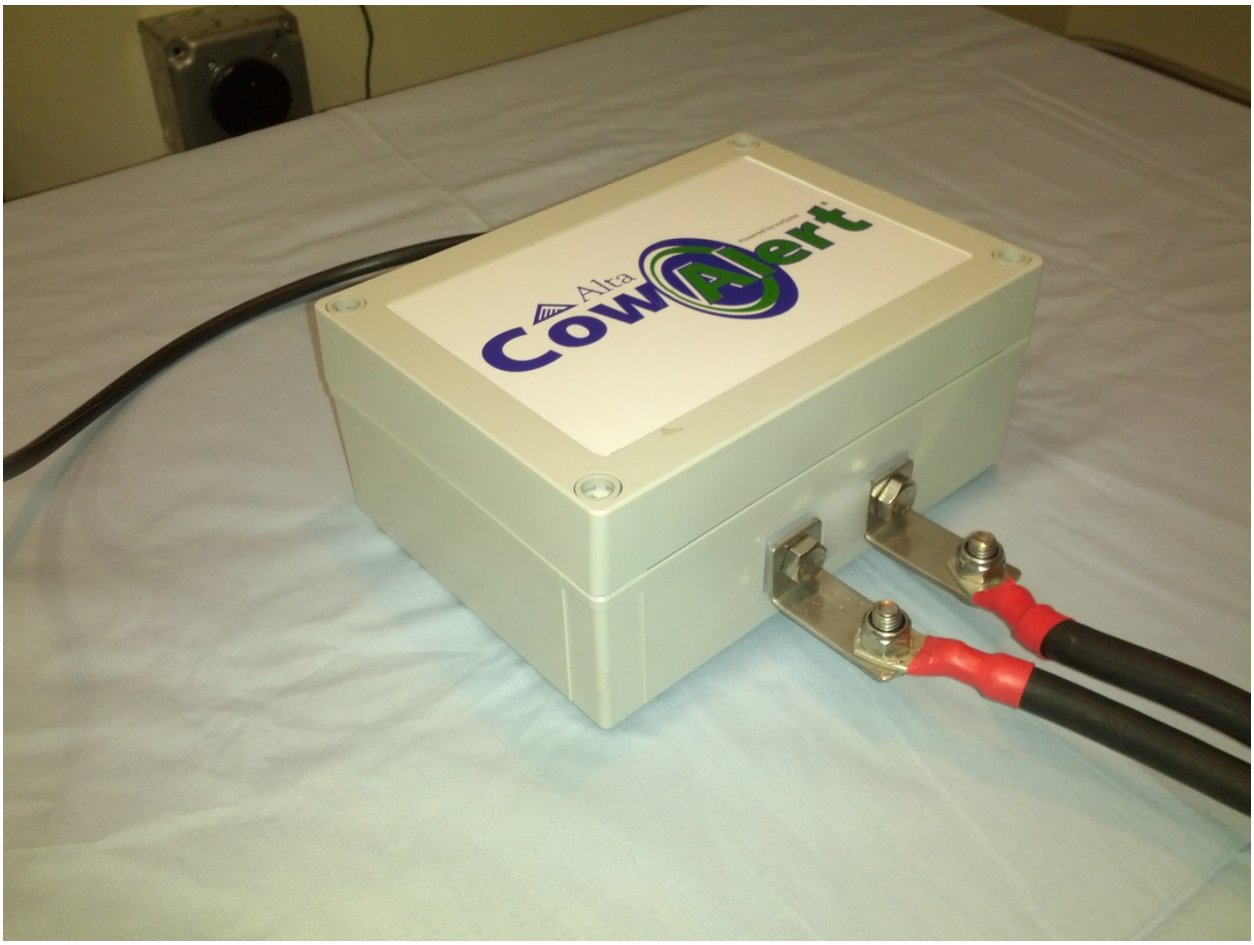


Photograph 3 – Front View Conducted Disturbance Worst Case Configuration

Photograph 4 – Back View Conducted Disturbance Worst Case Configuration

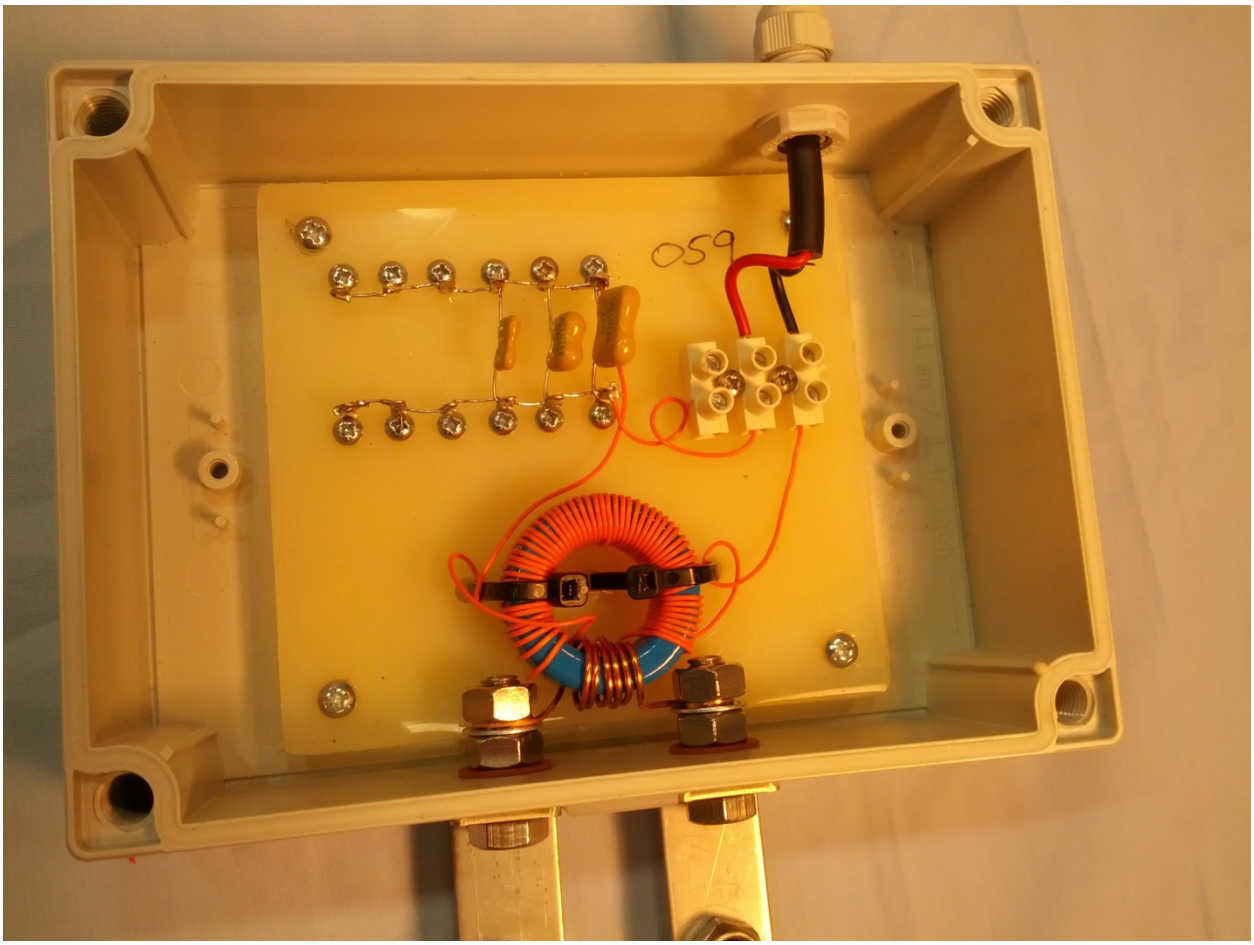


Photograph 5 – Front View of Trigger Box

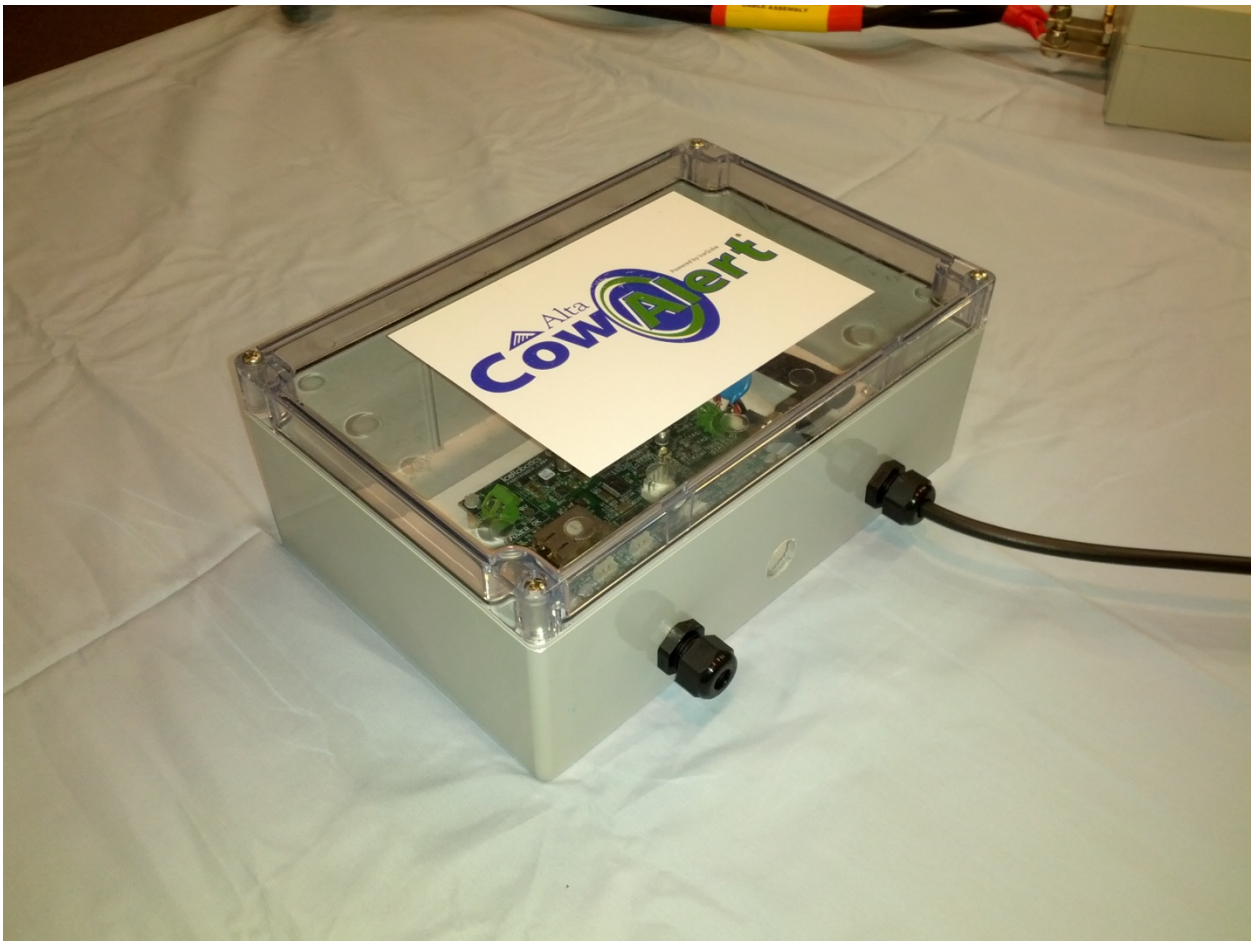


Photograph 6 – Rear View of Trigger Box

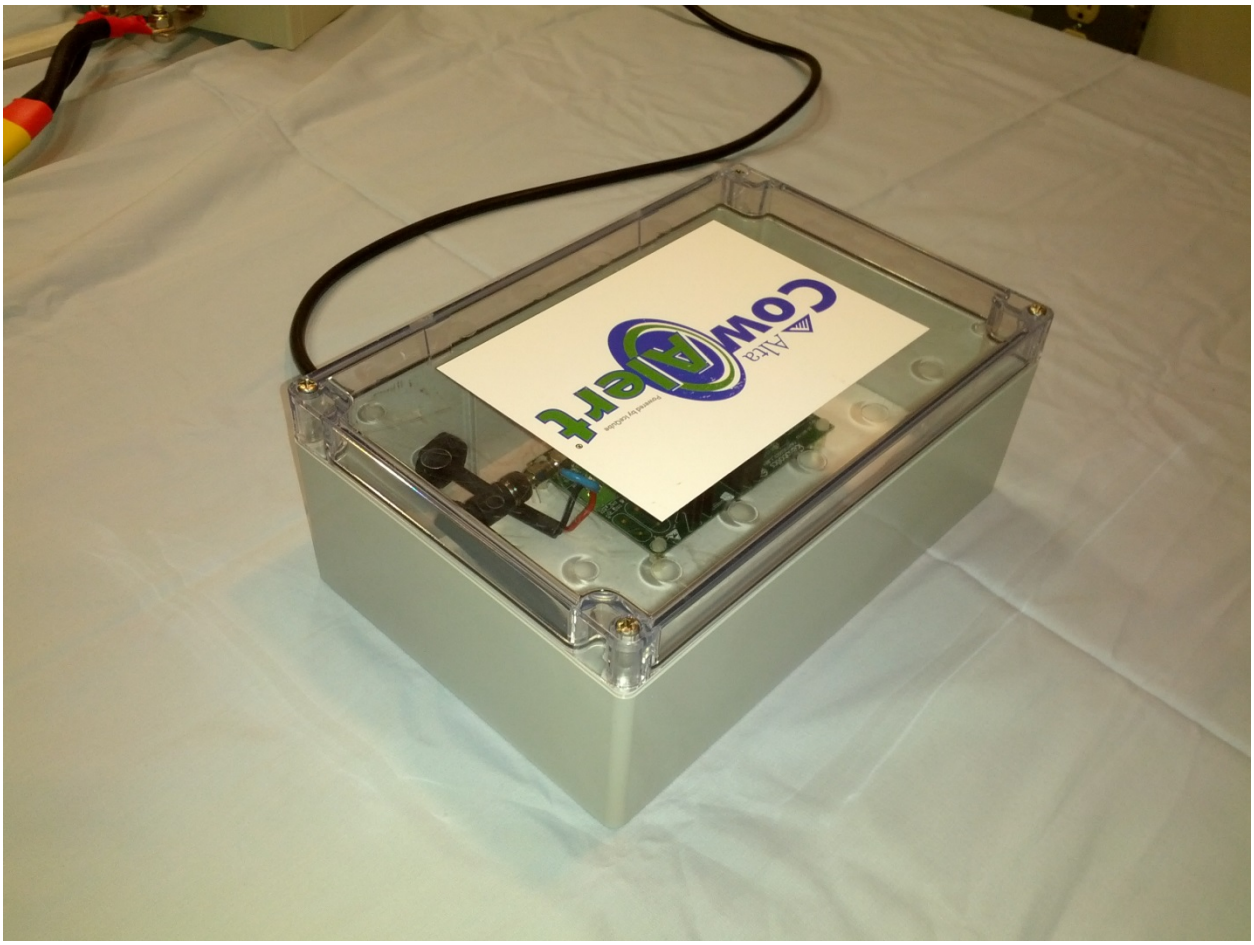
Photograph 7 – Internal View of Trigger Box (all components shown)



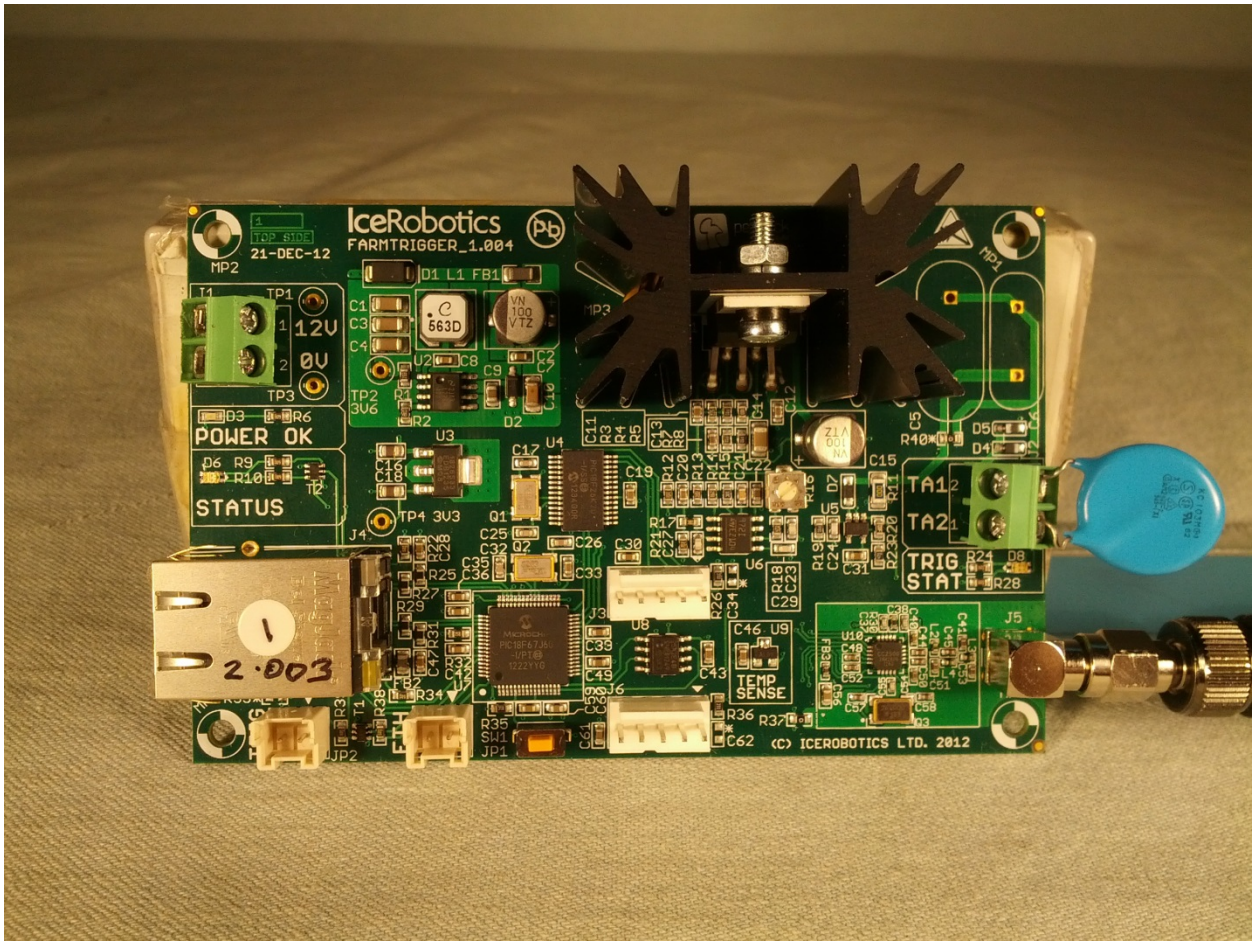
Photograph 8 – Front View of EtherReader



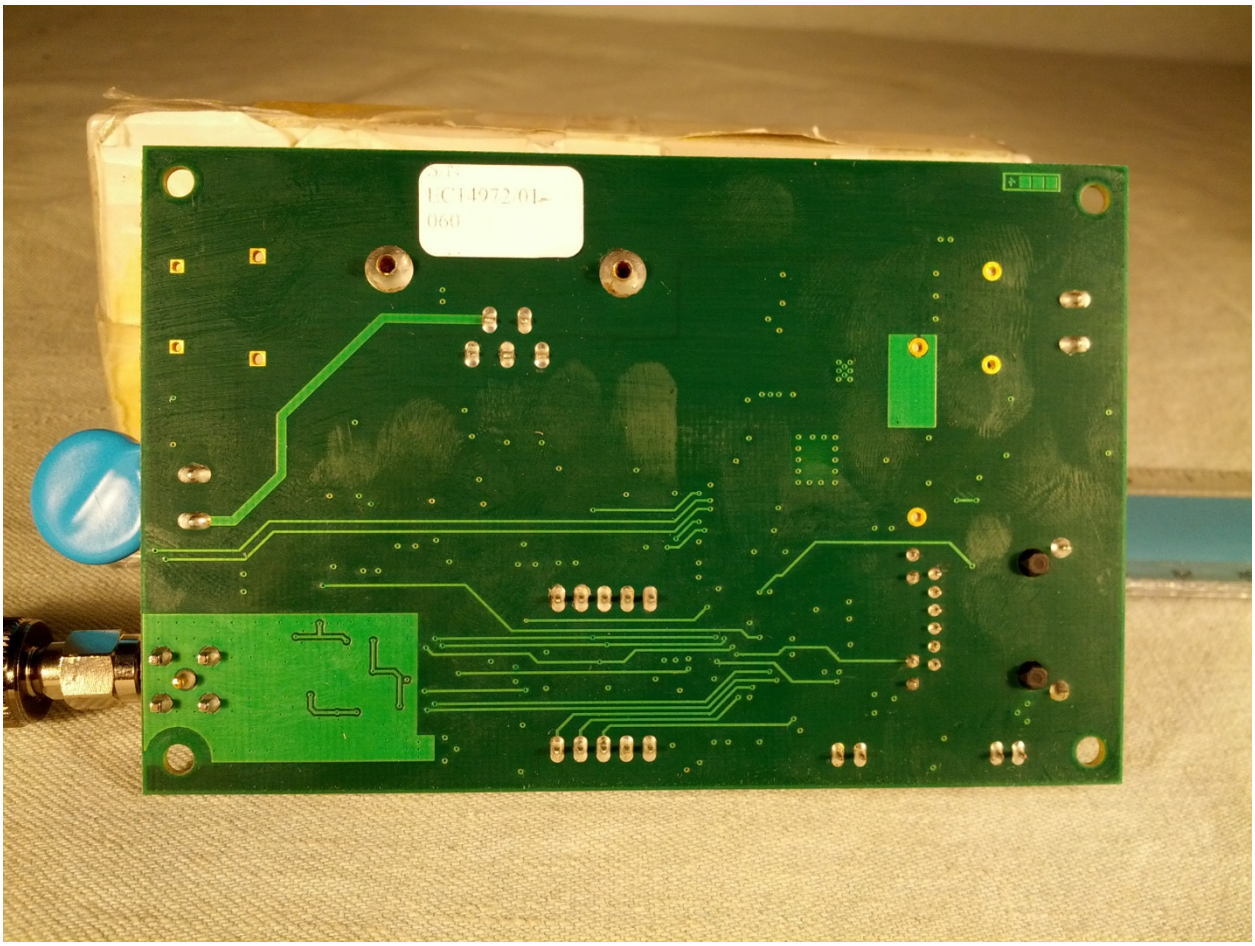
Photograph 9 – Rear View of EtherReader



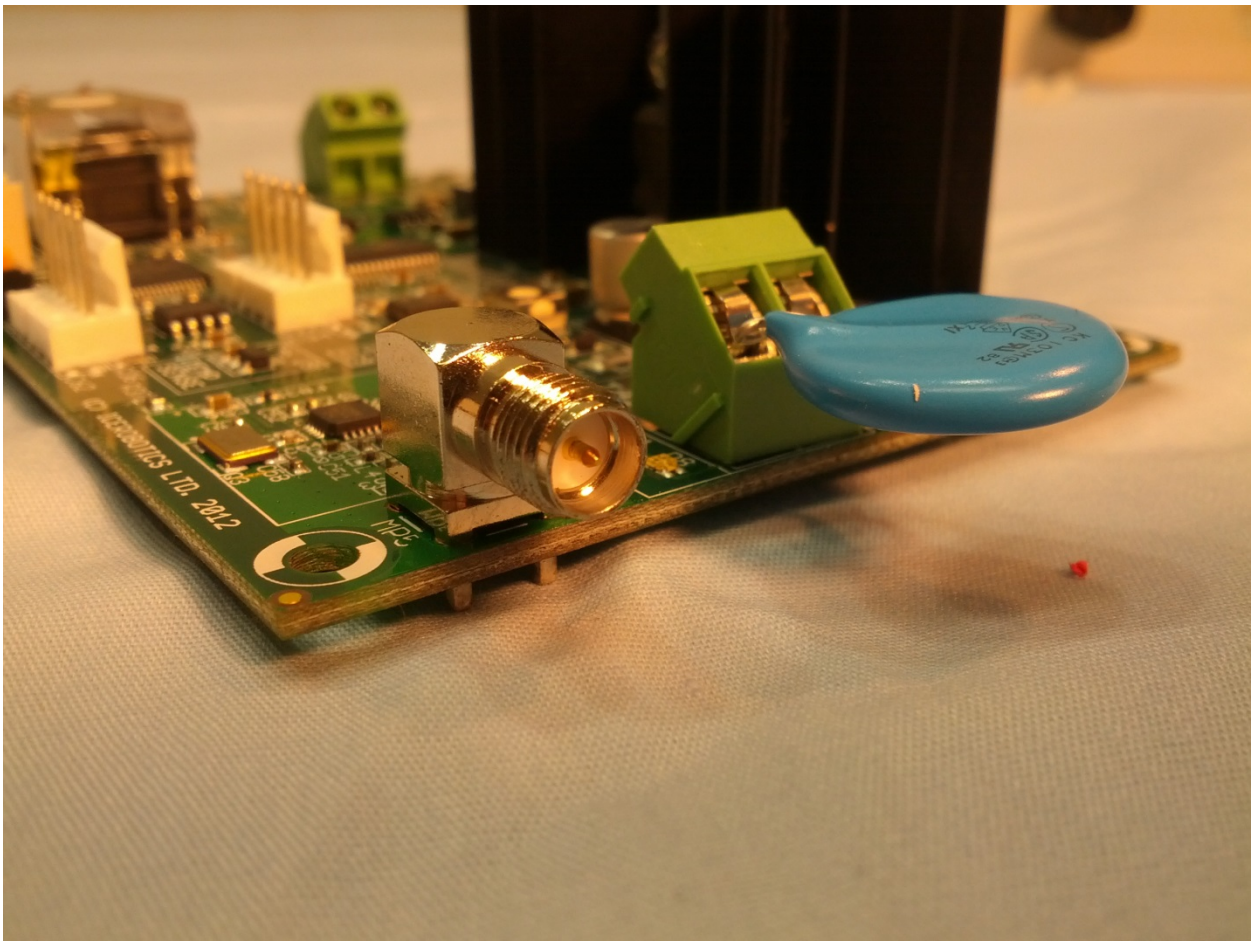
Photograph 10 – Front View of EtherReader PCB



Photograph 11 – Rear View of EtherReader PCB



Photograph 12 – View of the Antenna Connector



Photograph 13 – View of the 128 kHz Antenna