Nemko-CCL, Inc.

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

Test Report

Certification

Test Of:
T1985AA, T1986AA,
T1981AA and T1982AA

FCC ID#:
CNTFAT1981AA

Test Specification:
FCC PART 15, Subpart C

Test Report Serial No: 59009-3.1

Applicant:
Hewlett Packard Company
11311 Chinden Blvd.
Boise, ID 83714

Date of Test: October 18, 2010

Issue Date: October 19, 2010

Accredited Testing Laboratory By:

NVLAP

NVLAP Lab Code 100272-0

CERTIFICATION OF ENGINEERING REPORT

This report has been prepared by Nemko-CCL 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: Hewlett Packard Company
- Manufacturer: RF IDeas, Inc.
- Brand Name: Hewlett Packard
- Model Numbers: T1985AA, T1986AA, T1981AA, and T1982AA
- FCC ID Number: CNTFAT1981AA

On this 19th day of October 2010, I, individually, and for Nemko-CCL, 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 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

Tested by: Norman P. Hansen
EMC Technician

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SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name: Hewlett Packard Company
11311 Chinden Blvd.
Boise, ID 83714

Contact Name: Eric Hoffman
Title: Product Regulations Manager

1.2 Manufacturer:

Company Name: RF IDeas, Inc.
1250 South Grove Avenue, Suite 302
Barrington, IL 60010

Contact Name: Shiung Lo
Title: Engineer

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name: Hewlett Packard
Model Numbers: T1985AA, T1986AA, T1981AA, and T1982AA
Serial Number: US083201535
Country of Manufacture: U.S.A.

2.2 Description of EUT:

The EUT is a series of RFID readers operating at 13.56 MHz for use in entry control systems. Models covered are the T1981AA, T1982AA, T1985AA, and T1986AA. Data interface and power is provided using a USB port of the host system. All models are identical in hardware with changes in the software for the different applications. The T1981AA was tested as a representative sample of the series.

This report covers the transmitter requirements of FCC Subpart C only. The other circuitry, subject to other paragraphs and standards, is to be tested and covered in a separate report. See Nemko-CCL report #159009-2.1.

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: Hewlett Packard MN: T1981AA (Note 1) SN: US083201535	CNTFAT1981AA	RFID Reader	See Section 2.4
BN: Samsung MN: N130 SN:ZLCM93HS900480Y	DoC	Computer	USB/USB cable (Note 2) Network/Cat 5e cable

Brand Name Model Number Serial No.	FCC ID Number	Description	Name of Interface Ports / Interface Cables
BN: Microsoft MN: Wheelmouse Optical 1.1A USB SN: None	DoC	Mouse	USB/USB cable (Note 3)
BN: TRENDnet MN: TEG-S50TXE SN: None	DoC	5 port LAN switch	Ethernet/Cat 5 cable w/RJ45 connectors

Note: (1) EUT.
(2) Interface port connected to EUT (See Section 2.4)
(3) Mouse cable permanently attached.

2.4 Interface Ports on EUT:

Name of Port	No. of Ports Fitted to EUT	Cable Descriptions/Length
USB	1	USB cable/10 cm to 1.8 m

2.5 Modification Incorporated/Special Accessories on EUT:

There were no modifications or special accessories required to comply with the specification. This report is not complete without an accompanying signed attestation, included as Appendix 3, that the product will have all of the documented modifications incorporated into the product when manufactured and placed on the market.

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specification:

Title:	FCC PART 15, Subpart C (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 §15.203 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 §15.225 Operation within the Band 13.110 – 14.010 MHz

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

(e) The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

(f) In the case of radio frequency powered tags designed to operate with a device authorized under this section, the tag may be approved with the device or be considered as a separate device subject to its own authorization. Powered tags approved with a device under a single application shall be labeled with the same identification number as the device.

3.2.2 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 fully described in a report submitted to the FCC, and was accepted in a letter dated March 11, 2009 (90504).

Nemko-CCL, Inc. is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2011.

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. An inverse proportionality factor of 40 dB per decade is used below 30 MHz.

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 EUT was tested when placed on three orthogonal axes. The worst-case emissions were with the T1981AA connected to the host system using the 1.8 meter cable, placed on edge on the EUT table, and communicating with the host system via the USB port. See Photograph 1 of Appendix 2.

4.3 EUT Exercise Software:

No software was required to exercise the EUT.

SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 FCC Part 15, Subpart C

5.1.1 Summary of Tests:

Paragraph	Requirement	Frequency Range (MHz)	Result
15.203	Antenna Requirements	Structural requirement	Complied
15.207	Conducted Disturbance at Mains Ports	0.15 to 30	Complied
15.225(a)	Field Strength	13.553 – 13.567	Complied
15.225(b)	Field Strength	13.410 -13.553 13.567 – 13.710	Complied
15.225(c)	Field Strength	13.110 – 13.410 13.710 – 14.010	Complied
15.225(d)	Field Strength	4.0 – 13.110 14.010 - 1000	Complied
15.225(e)	Frequency Stability	13.110 – 14.010	Complied
15.225(f)	RFID Tag	13.110 – 14.010	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 uses an antenna that is internal to the EUT and is soldered to the PCB.

RESULT

The EUT complied with the specification.

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)
0.17	Hot Lead	Peak (Note 1)	49.5	55.2	-5.7
0.19	Hot Lead	Peak (Note 1)	45.3	54.1	-8.8
0.21	Hot Lead	Peak (Note 1)	41.7	53.1	-11.4
0.45	Hot Lead	Peak (Note 1)	33.7	46.9	-13.2
10.00	Hot Lead	Peak (Note 1)	36.4	50.0	-13.6
13.60	Hot Lead	Peak (Note 1)	41.2	50.0	-8.8
0.17	Neutral Lead	Peak (Note 1)	49.2	55.2	-6.0
0.18	Neutral Lead	Peak (Note 1)	44.0	55.0	-11.0
0.45	Neutral Lead	Peak (Note 1)	36.1	46.9	-10.8
9.80	Neutral Lead	Peak (Note 1)	37.1	50.0	-12.9
10.18	Neutral Lead	Peak (Note 1)	37.4	50.0	-12.6
13.60	Neutral Lead	Peak (Note 1)	41.9	50.0	-8.1

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.

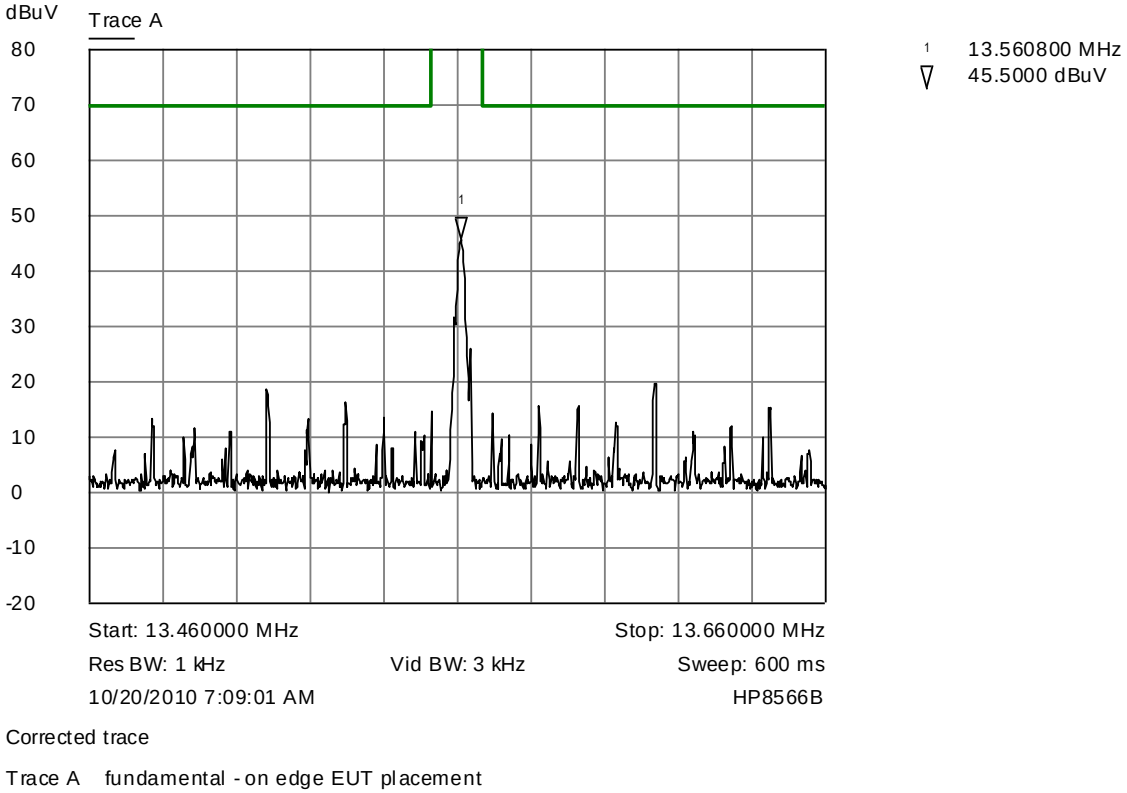
Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

RESULT

The EUT complied with the specification limit by a margin of 5.7 dB.

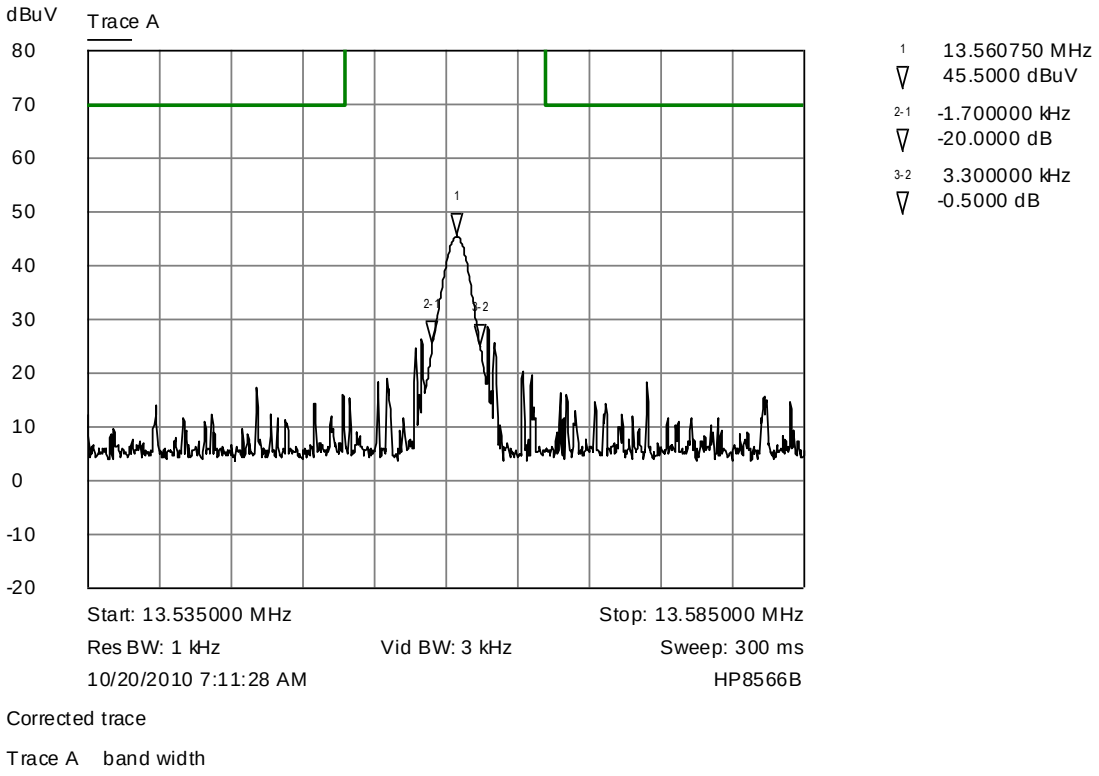
6.2.3 Radiated Disturbance Data (13.110 – 14.010 MHz)

The plot below shows the fundamental frequency compared to the limits of FCC §15.225 (a) – (c). The plot below covers the range 13.46 MHz to 13.66 MHz. No other emissions were seen in the 13.110 MHz to 14.010 MHz. A plot showing the emission bandwidth to be 3.3 kHz is also shown below.



Corrected trace

Trace A fundamental - on edge EUT placement



RESULT

The EUT complied with the specification for emissions in the band 13.110 to 14.010 MHz.

6.2.4 Radiated Disturbance Data

The table below shows the emissions of the EUT outside the frequency band of 13.110 – 14.010 MHz compared to the emission limits found in FCC §15.225(d).

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	Limit (dBμV/m) (Note 2)	Margin (dB)
27.12	Peak (Note 1)	20.2	11.0	31.2	48.6	-17.4
40.68	Peak (Note 1)	8.9	13.4	22.3	40.0	-17.7
54.24	Peak (Note 1)	20.3	9.2	29.5	40.0	-10.5
67.80	Peak (Note 1)	17.1	7.7	24.8	40.0	-15.2
81.36	Peak (Note 1)	11.5	8.1	19.6	43.5	-23.9
94.92	Peak (Note 1)	15.2	9.7	24.9	43.5	-18.6
108.48	Peak (Note 1)	18.4	10.1	28.5	43.5	-15.0
122.04	Peak (Note 1)	11.7	8.6	20.3	43.5	-23.2
135.60	Peak (Note 1)	14.6	8.6	23.2	43.5	-20.3

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

Note 2: The measurement distance for frequencies below 30 MHz was 10 meters. For frequencies at or above 30 MHz a 3 meter measurement distance was used.

RESULT

The EUT complied with the specification limit by a margin of 10.5 dB.

6.2.5 Frequency Stability

The EUT was tested for frequency stability as specified in §15.225(e). The table below shows the stability of the fundamental frequency when subject to temperature extremes. The EUT is powered by a USB compliant host system. Varying the AC mains voltage by 15% will not change the +5.0 VDC supplied to the EUT.

Time	+20ºC	+50ºC	-20ºC
Start	13560400	13560465	13560495
2 minutes	13560300	13560500	13560445
5 minutes	13560700	13560535	13560465
10 Minutes	13560500	13560520	13560460

RESULT

The EUT complied with the specification as the frequency drift was less than 0.01% (1356 Hz) of the fundamental frequency.

6.2.6 RFID Tags

The RFID tag used with this system is passive and is included with this filing. See §15.225(f).

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 Where

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 Emissions 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.

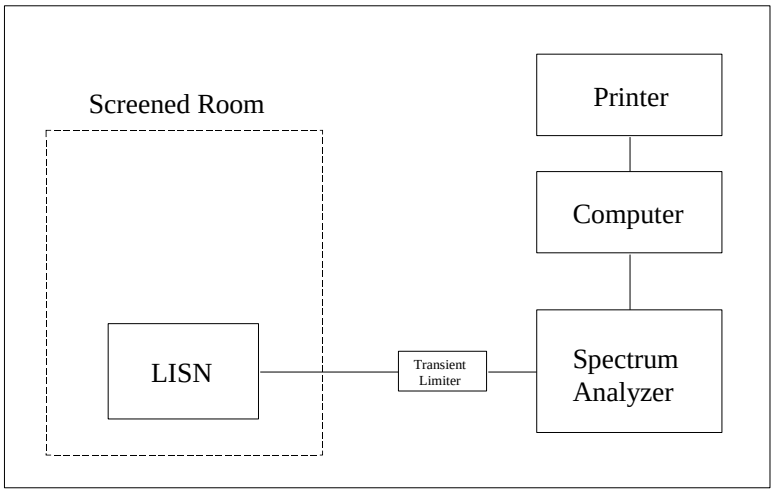
For AC mains port testing, desktop EUT are placed on a non-conducting table at least 0.8 meters from the metallic floor and placed 40 cm from the vertical coupling plane (copper plating in the wall behind EUT table). Floor standing equipment is placed directly on the earth grounded floor.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	Nemko-CCL, Inc.	N/A	N/A	10/08/2009
Test Software	Nemko-CCL, Inc.	Conducted Emissions	Revision 1.2	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2332A02726	01/12/2010
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00287	01/12/2010

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
LISN	EMCO	3825/2	9305-2099	03/08/2010
Conductance Cable Wanship Site #2	Nemko-CCL, Inc.	Cable J	N/A	12/31/2009
Transient Limiter	Hewlett Packard	11947A	3107A02266	12/31/2009

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 Emissions:

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 was 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 10 kHz resolution bandwidth was used for measuring frequencies below 30 MHz.

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. An active loop antenna was used to measure frequencies below 30 MHz at a distance of 10 meters.

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 was 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.

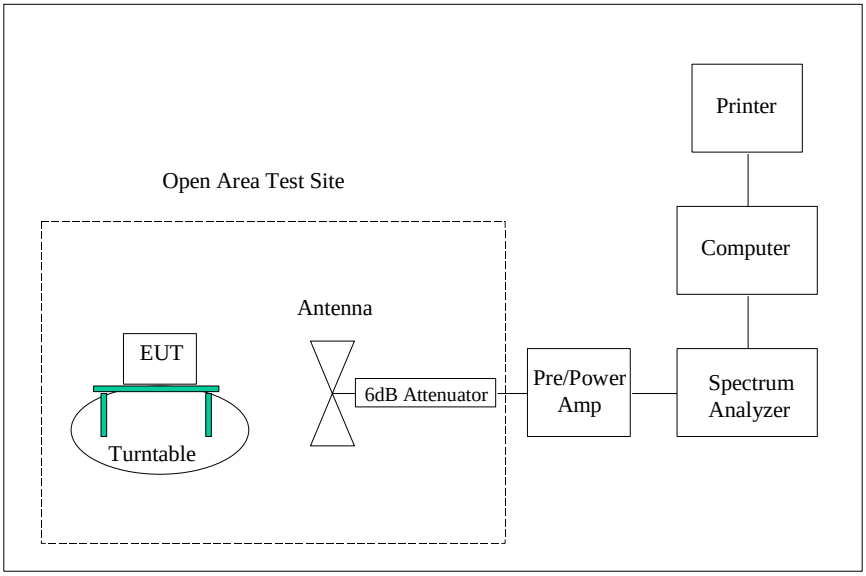
Desktop EUT are measured on a non-conducting table 0.8 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	Nemko-CCL, Inc.	N/A	N/A	10/08/2009
Test Software	Nemko-CCL, Inc.	Radiated Emissions	Revision 1.3	N/A
Spectrum Analyzer/Receiver	Rohde & Schwarz	1302.6005.40	100064	07/30/2010
Spectrum Analyzer	Hewlett Packard	8566B	2332A02726	01/12/10
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00287	01/12/10
Loop Antenna	EMCO	6502	9111-2675	03/12/2009
Biconilog Antenna	EMCO	3142	9601-1009	08/21/2009
High Frequency Amplifier	Miteq	AFS4-01001800-43-10P-4	1096455	06/04/2009

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
20’ Cable	Utiflex	UFA210A-1-2400-30050U	1175	03/04/2010
3 Meter Radiated Emissions Cable Wanship Site #2	Nemko-CCL, Inc.	Cable K	N/A	12/31/2009
10 Meter Radiated Emissions Cable Wanship Site #2	Nemko-CCL, Inc.	Cable L	N/A	12/31/2009
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	08/25/2010
6 dB Attenuator	Hewlett Packard	8491A	32835	12/31/2009

An independent calibration laboratory or Nemko-CCL 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.

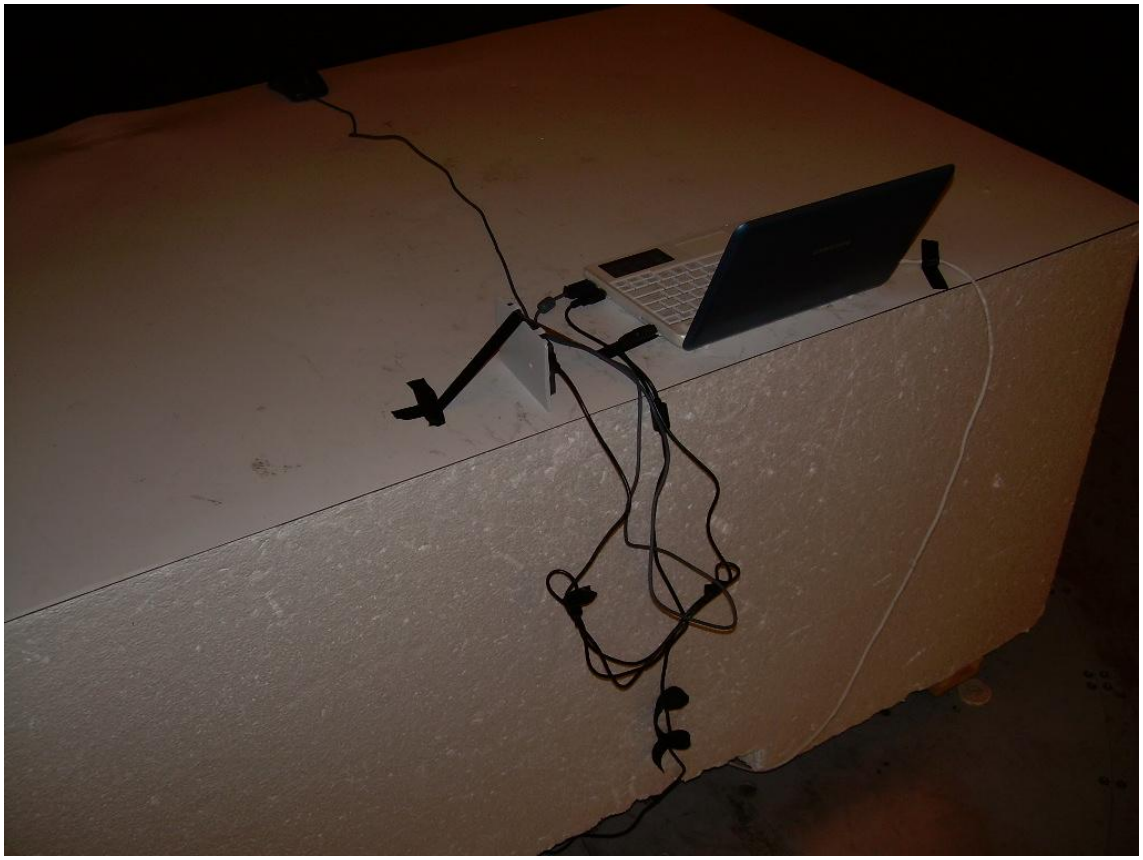
Radiated Emissions Test Setup



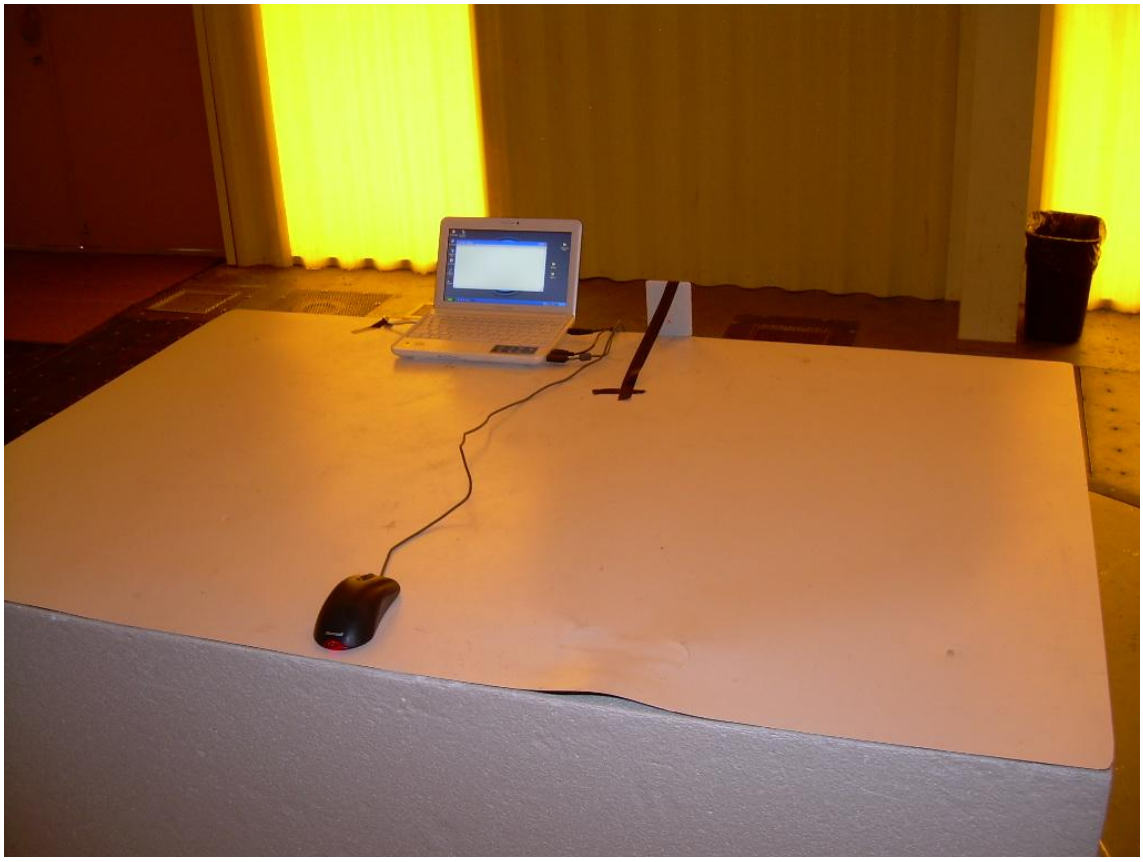
APPENDIX 2 PHOTOGRAPHS

Photograph 1 – Front View Radiated Test Setup – On Edge EUT Placement

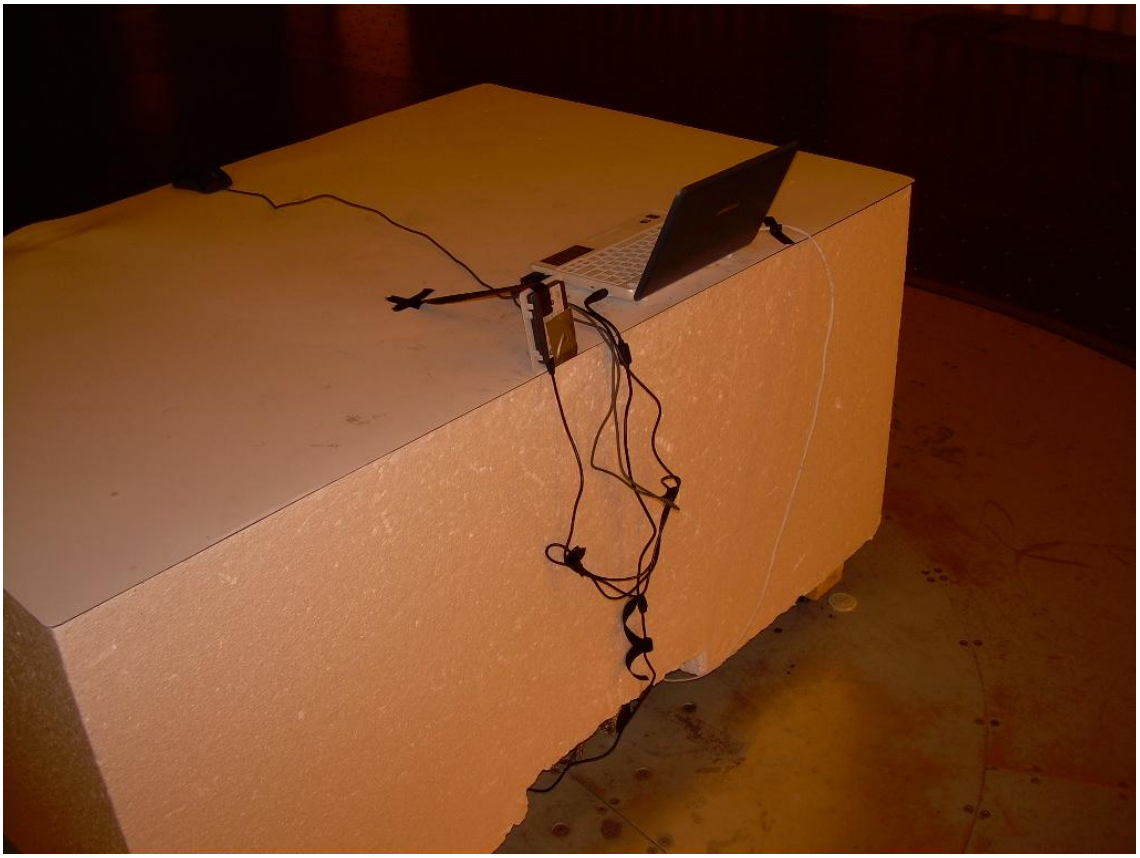
Photograph 2 – Back View Radiated Test Setup – On-Edge EUT Placement



Photograph 3 – Front View Radiated Test Setup - Vertical EUT Placement

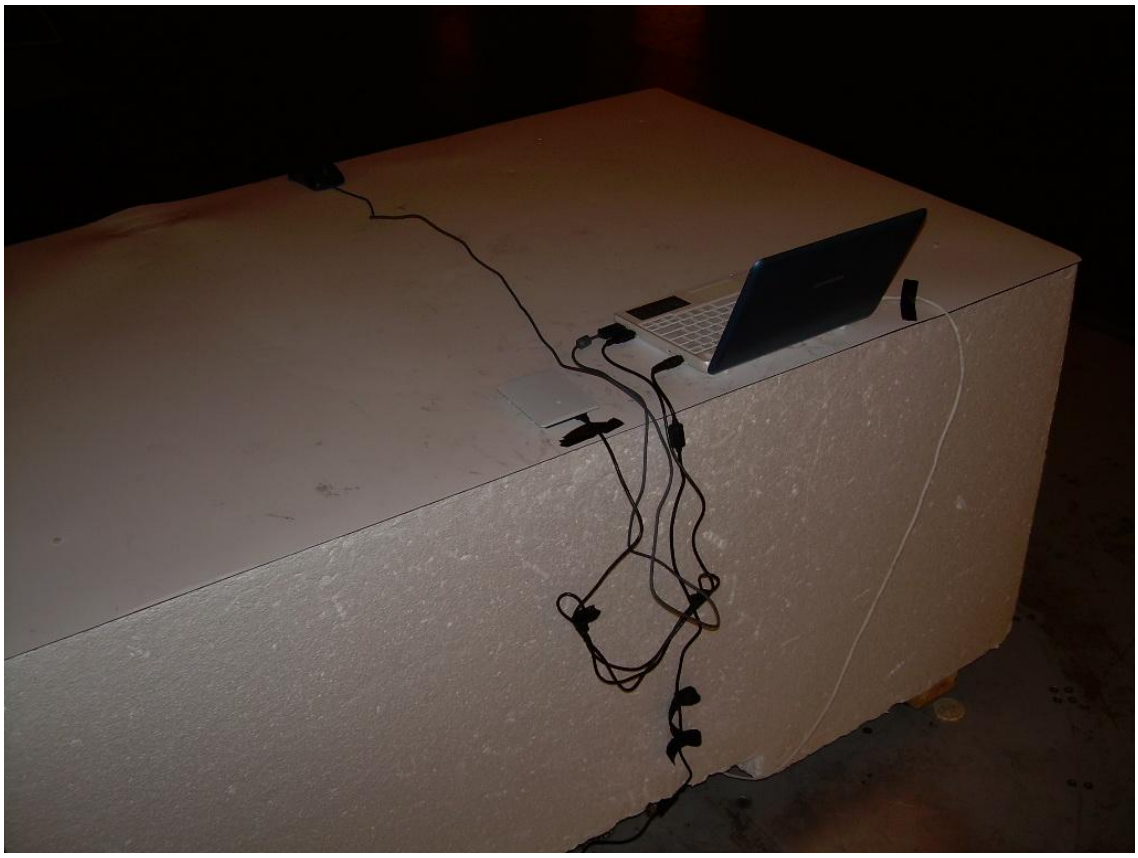


Photograph 4 – Back View Radiated Test Setup - Vertical EUT Placement

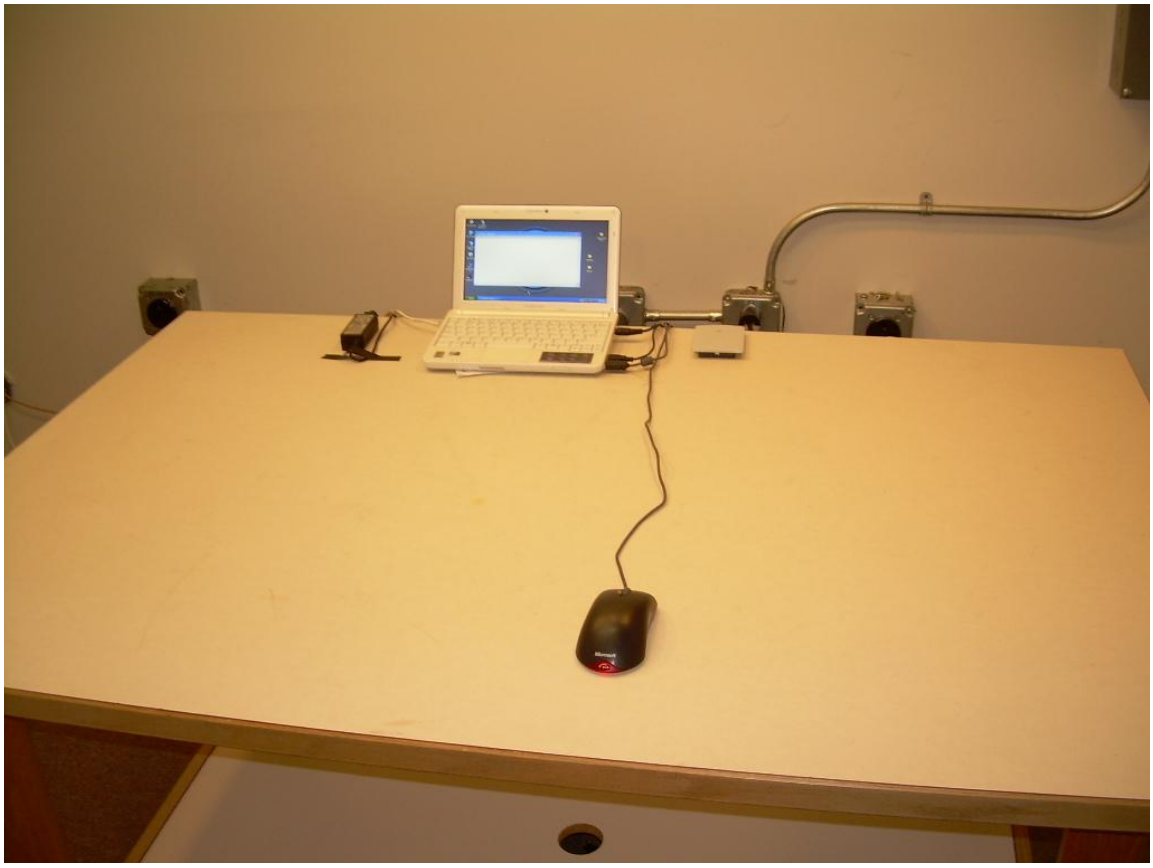


Photograph 5 – Front View Radiated Test Setup - Horizontal EUT Placement

Photograph 6 – Back View Radiated Test Setup - Horizontal EUT Placement



Photograph 7 – Front View Conducted Emissions at the AC Mains Setup

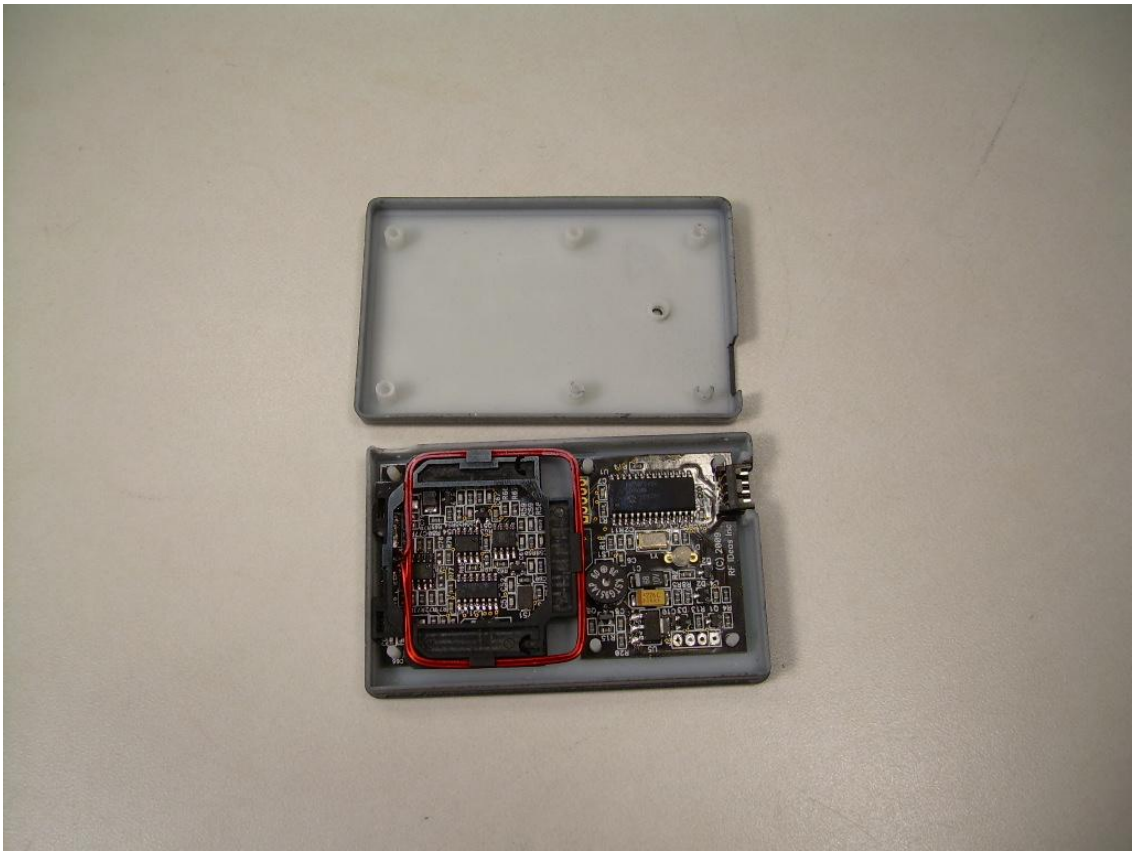


Photograph 8 – Back View Conducted Emissions at the AC Mains Setup

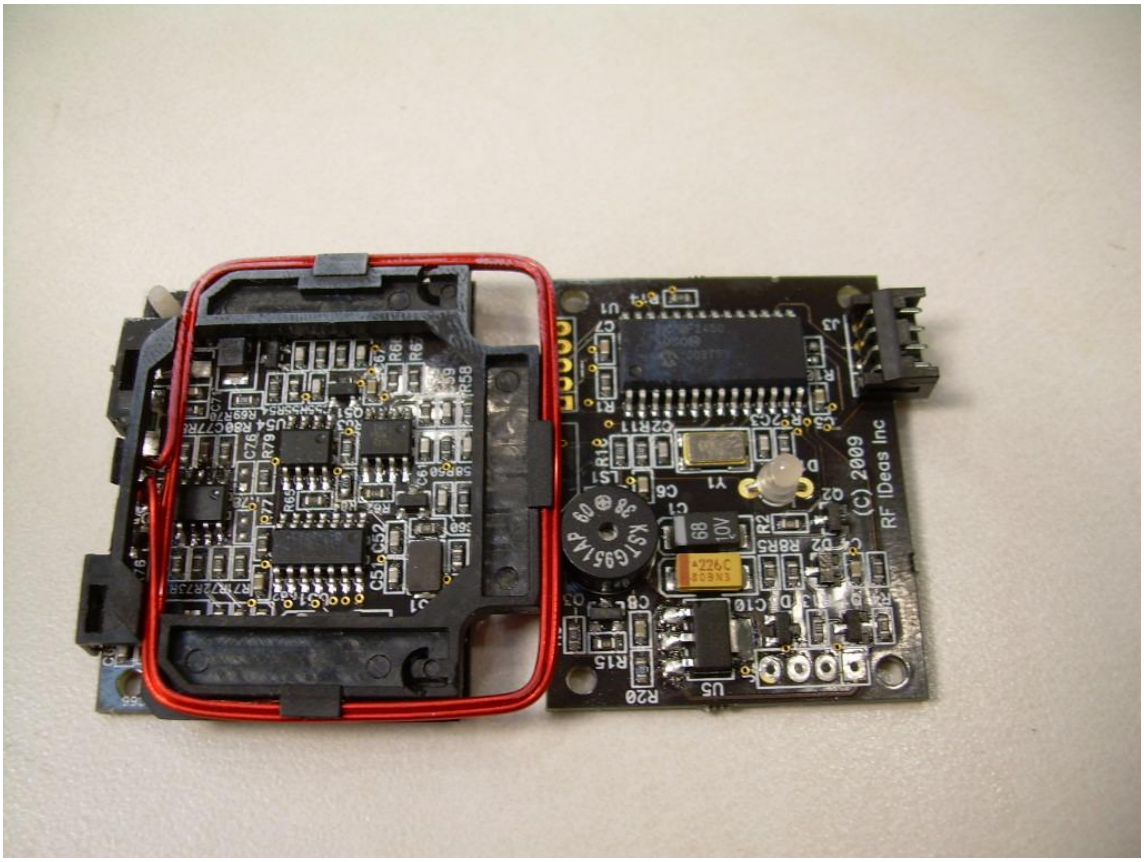
Photograph 9 – Front View of the EUT

Photograph 10 – Back View of the EUT

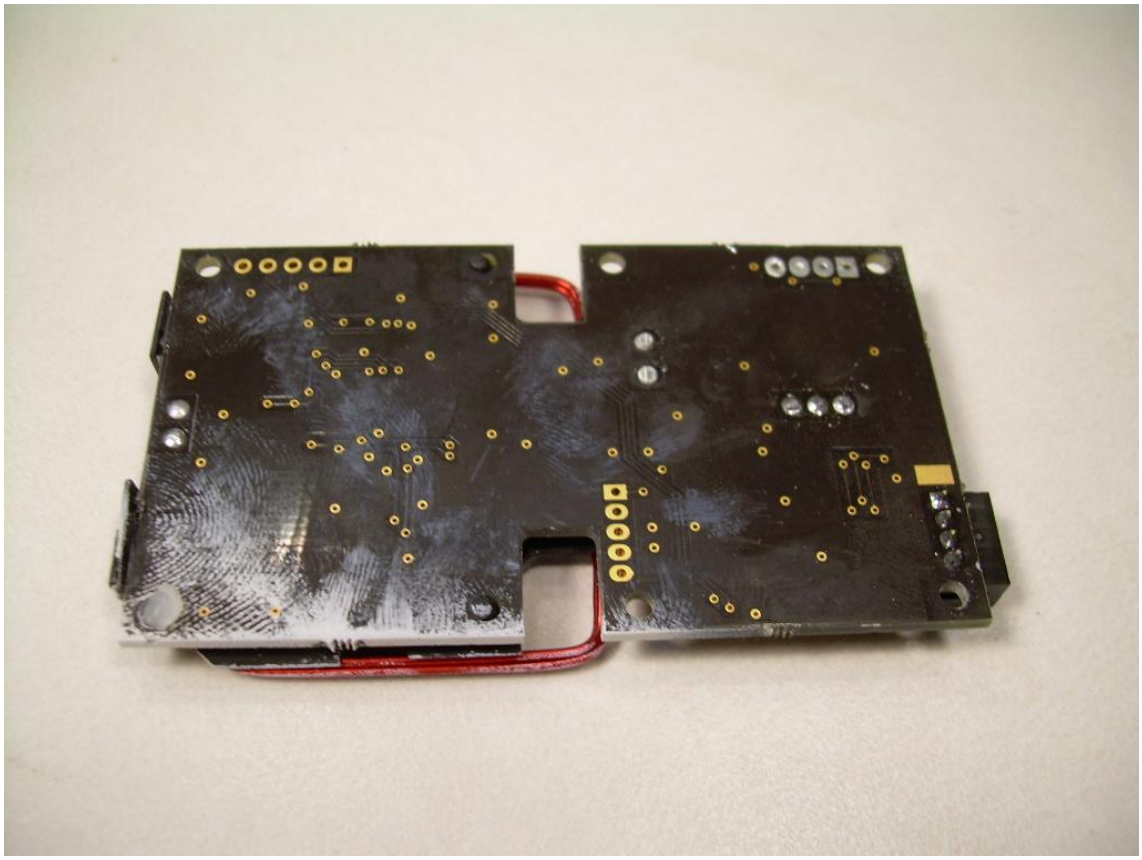
Photograph 11 – Internal View of the EUT



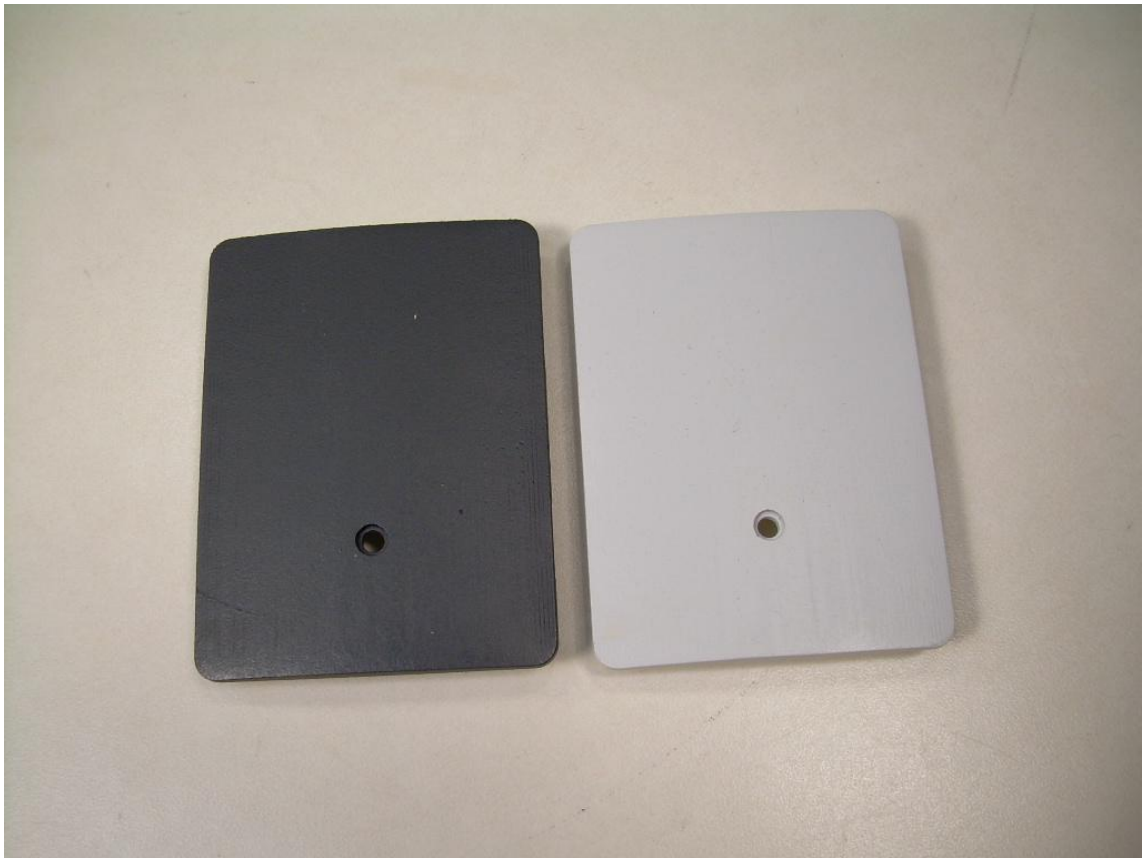
Photograph 12 – View of the Component Side of the EUT PCB



Photograph 13 – View of the Trace Side of the EUT PCB



Photograph 14 – View of the Front Side of the Plastic Faceplates



Photograph 15 – View of the Back Side of the Plastic Faceplates

APPENDIX 3 MANUFACTURER'S STATEMENT/ATTESTATION

The manufacturer or responsible party for the equipment tested hereby affirms:

a) That he/she has reviewed and concurs that the tests shown in this report are reflective of the operational characteristics of the device for which certification is sought;
b) That the device in this test report will be representative of production units;
c) That the product will have all of the documented modifications incorporated into the product when manufactured and placed on the market;
d) That all changes in hardware and software/firmware to the subject device will be reviewed.
e) That any changes impacting the attributes, functionality or operational characteristics documented in this report will be communicated to the body responsible for approving or certifying the subject equipment.

Printed name of official	Signature of official	Date

NOTE—This affirmation must be signed by the responsible party before it is submitted to a regulatory body for approval.