Nemko-CCL, Inc.

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

Test Report

Certification

Test Of: T1985AA, T1986AA, T1981AA, T1982AA, and BOISB-0907-00

FCC ID#:
CNTFAT1981AA and CNTBOISB090700

Test Specification:
FCC PART 15, Subpart C

Test Report Serial No: 210928-3.2

Applicant:

Hewlett-Packard Company
3000 Hanover Street
Palo Alto, CA 94304

Date of Test: June 14, 2012

Report Issue Date: July 3, 2012

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: Hewlett-Packard Company
- Manufacturer: Hewlett-Packard Company

- Brand Name: HP
- Model Number: T1985AA, T1986AA, T1981AA, and T1982AA
- FCC ID Number: CNTFAT1981AA

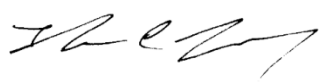
- Brand Name: HP
- Model Number: BOISB-0907-00
- FCC ID Number: CNTBOISB090700

On this 3rd day of July 2012, 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.

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: Hewlett-Packard Company
3000 Hanover Street
Palo Alto, CA 94304

Contact Name: David P. Adams
Title: Technical Regulations Manager

1.2 Manufacturer:

Company Name: Hewlett-Packard Company
3000 Hanover Street
Palo Alto, CA 94304

Contact Name: David P. Adams
Title: Technical Regulations Manager

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name: HP
Model Number: BOISB-0907-00
Serial Number: USL22020012
Dimensions: 5.4 cm x 8.255 cm x 1.11 cm

2.2 Description of EUT:

The BOISB-0907-00 is an RFID reader operating at 13.56 MHz for use in entry control systems. Data interface and power is provided using a PS/2 port of the host system. The EUT uses passive RFID tags. For testing, an external 5 VDC power supply was connected to the USB to PS/2 adapter to power the EUT. Typically, power is provided over the PS/2 port of the host system.

The T1985AA, T1986AA, T1981AA, and T1982AA are electrically identical to the BOISB-0907-00 except in labeling for marketing purposes.

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: HP MN: BOISB-0907-00 (Note 1) SN: USL22020012	CNTBOISB090700	RFID Reader	See Section 2.4
BN: Samsung MN: N130 SN: ZLCM93HS900480X	Declaration of Conformity	Netbook Computer	USB/USB to PS/2 Adapter and cable (Note 2) Ethernet/Cat 5e cable
BN: TRENDnet MN: TE100-S8P SN: 0243C3A16540	Declaration of Conformity	5 port Ethernet switch	Ethernet/Cat 5e

Brand Name Model Number Serial No.	FCC ID Number	Description	Name of Interface Ports / Interface Cables
BN: Microsoft MN: Wheel Mouse Optical 1.1A SN: None	Declaration of Conformity	USB Mouse	USB/USB cable (Note 3)

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

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

2.4 Interface Ports on EUT:

Name of Port(s)	No. of Ports Fitted to EUT	Cable Descriptions/Length
Interface	1	Cable with 6 pin DIN connector/1.7 meters

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 C (47 CFR 15)
15.203, 15.207, and 15.225

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

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 as shown in paragraphs (b) and (c) of this section, for an intentional radiator 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

(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.

3.2.4 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 February 15, 2012 (90504). This site has been fully described in a report submitted to Industry Canada, and was accepted under Industry Canada Assigned Code 2041A-2 through February 14, 2015.

Nemko-CCL, Inc. is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2012.

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 on 3 orthogonal axes. The worst-case emissions were with the BOISB-0907-00 connected to the laptop computer and scanning a tag while placed vertically on the EUT table.

4.3 EUT Exercise Software:

Internal firmware was used to exercise the EUT.

SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 Class B of FCC Part 15, Subpart B

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
15.225(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 internal loop antenna that is soldered to the PCB and is not user replaceable.

Result

The EUT complies with the requirements.

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)	50.0	55.2	-5.7
0.23	Hot Lead	Peak (Note 1)	46.6	52.5	-19.5
0.28	Hot Lead	Peak (Note 1)	46.0	50.8	-3.7
0.33	Hot Lead	Peak (Note 1)	44.2	49.3	-4.6
0.43	Hot Lead	Peak (Note 1)	40.9	47.3	-3.2
0.56	Hot Lead	Peak (Note 1)	38.0	46.0	-2.7
0.72	Hot Lead	Peak (Note 1)	32.1	46.0	-8.3
20.35	Hot Lead	Peak (Note 1)	38.0	50.0	-13.2
21.75	Hot Lead	Peak (Note 1)	36.3	50.0	-3.7
0.15	Neutral Lead	Peak (Note 1)	50.0	56.0	-0.8
0.17	Neutral Lead	Peak (Note 1)	48.7	54.8	-6.4
0.27	Neutral Lead	Peak (Note 1)	46.9	51.1	-7.7
0.33	Neutral Lead	Peak (Note 1)	43.9	49.3	-5.2

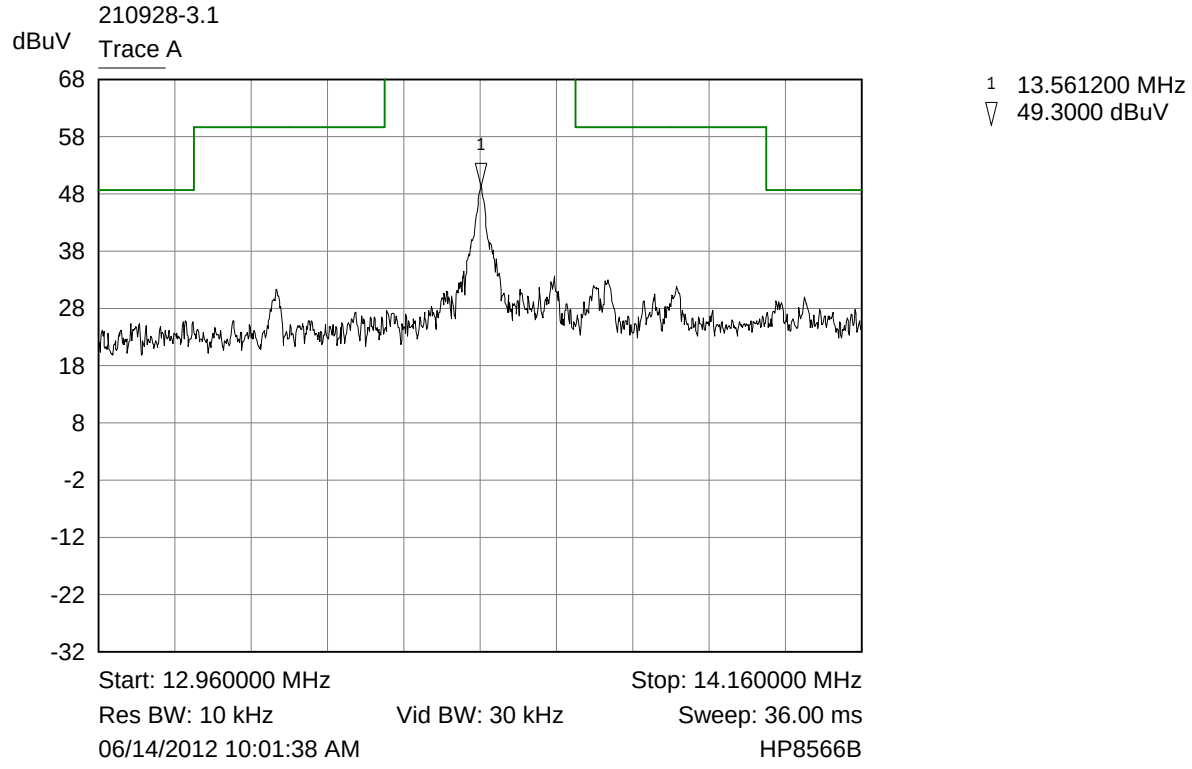
Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBµV)	Limit (dBµV)	Margin (dB)
0.41	Neutral Lead	Peak (Note 1)	41.9	47.7	-23.9
0.46	Neutral Lead	Peak (Note 1)	39.6	46.8	-6.1
0.62	Neutral Lead	Peak (Note 1)	34.9	46.0	-12.3
20.35	Neutral Lead	Peak (Note 1)	36.0	50.0	-4.9
Note 1: The reference detector 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.					

Result

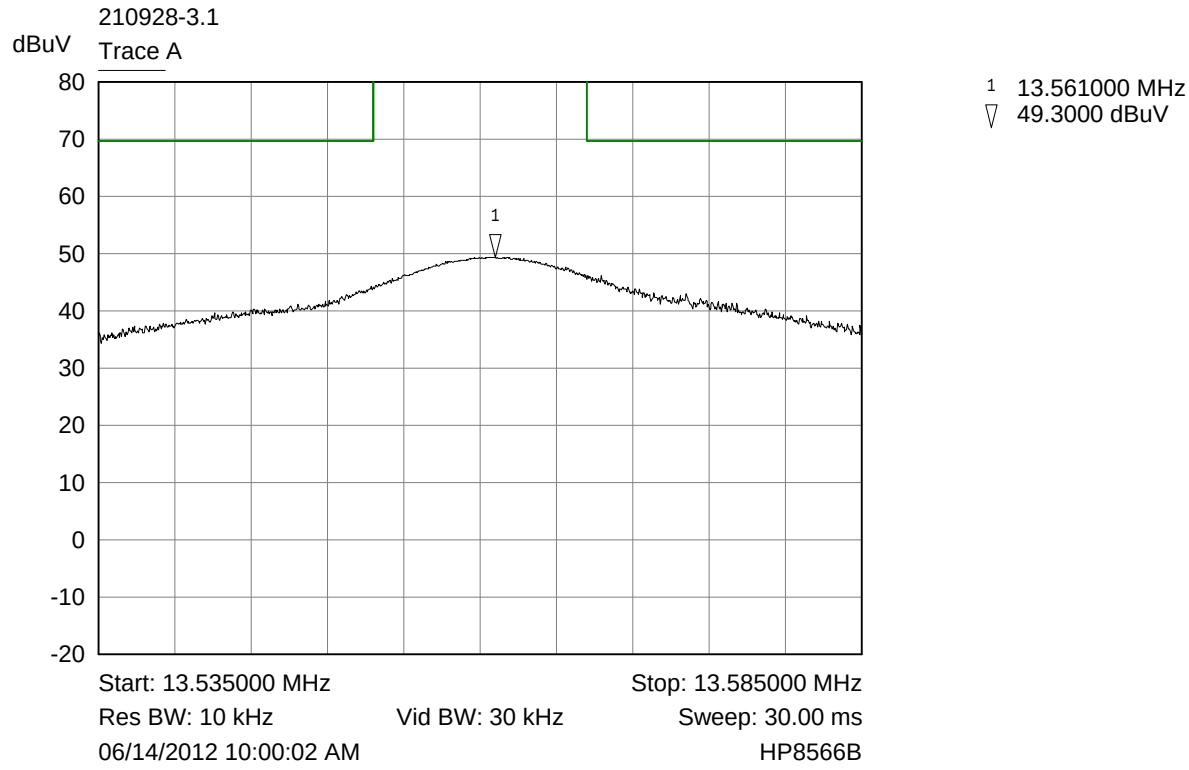
The EUT complied with the requirements by 0.8 dB.

6.2.3 §15.225 (a) – (c) Radiated Disturbance Data (13.110 – 14.010 MHz)

The plots below show the fundamental frequency compared to the limits of FCC §15.225 (a) – (c).



Trace A Vertical Placement - 10 meter measurement distance



Result

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

6.2.3 §15.225 (d) Radiated Disturbance Data (4 MHz – 136 MHz, excluding the range 13.110 – 14.010 MHz)

The transmitter was tested for spurious emissions from 4 MHz to 136 MHz using the limits of §15.209. The worst-case emission test data is shown in the table below. The EUT was also tested for emissions from the digital circuitry of the device using the limits of §15.109 and was found compliant. The results of this testing is shown in Nemko-CCL report #210928-2.

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)	18.7	11.6	30.3	48.6	-18.3
40.68	Peak (Note 1)	14.5	14.0	28.5	40.0	-11.5
54.24	Peak (Note 1)	16.9	9.9	26.8	40.0	-13.2

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	Limit (dBμV/m) (Note 2)	Margin (dB)
67.80	Peak (Note 1)	17.6	8.6	26.2	40.0	-13.8
81.36	Peak (Note 1)	19.3	9.0	28.3	40.0	-11.7
94.92	Peak (Note 1)	18.1	10.5	28.6	43.5	-14.9
108.48	Peak (Note 1)	20.1	11.1	31.2	43.5	-12.3
122.04	Peak (Note 1)	15.0	9.8	24.8	43.5	-18.7
135.60	Peak (Note 1)	14.1	9.9	24.0	43.5	-19.5
Note 1: The reference detector used for the measurements was peak or quasi-peak and the data was compared to the quasi-peak limit.						

Result

The EUT complied with the specification for emissions outside the band 13.110 to 14.010 MHz by 11.5 dB.

6.2.3.1 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.

6.2.4 §15.225(e) Frequency Stability

The EUT was tested for frequency stability as specified in §15.225(e). Changing the AC mains voltage of the host system does not change the voltage supplied to the EUT. The voltage to the EUT was varied from 85% to 115% of the nominal 5 VDC of the PS/2 power source. The EUT carrier signal is to maintained within ±0.01% (1356 Hz) of the operating frequency (13.56 MHz). The tables below show the stability of the fundamental frequency when subject to temperature extremes and when subjected to voltage variations.

Time	+20ºC	+50ºC	-20ºC
Start	13,560,740	13,560,580	13,560,740
2 minutes	13,560,730	13,560,620	13,560,740
5 minutes	13,560,730	13,560,620	13,560,740
10 Minutes	13,560,740	13,560,610	13,560,730

5.00 VDC/+20ºC	4.25 VDC/+20ºC	5.75 VDC/+20ºC
13,560,660	13,560,680	13,560,660

Result

The EUT complied with the specification as the fundamental frequency drifted down 50 Hz and up 80 Hz from the operating frequency of 13, 560, 660 Hz.

6.2.5 §15.225(f) RFID Tags

The RFID tag used with this system is passive and is included with this filing.

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.

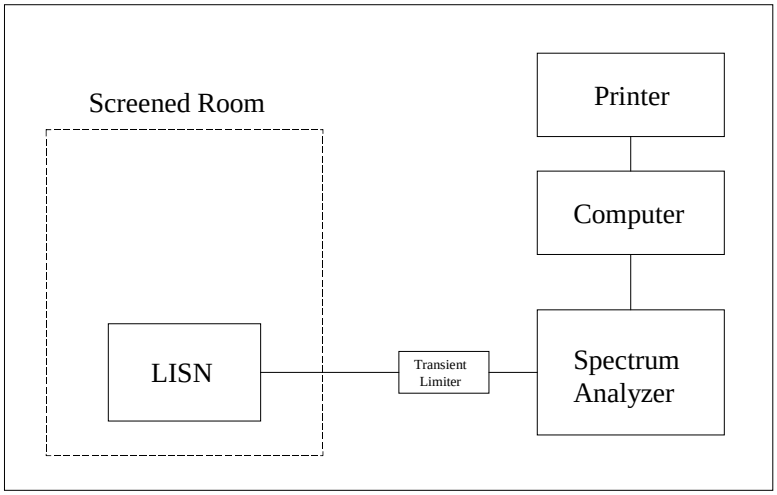
For AC mains port testing, desktop EUT are placed on a non-conducting table at least 0.8 meters from the metallic floor and placed 40 cm from the vertical coupling plane (copper plating in the wall behind EUT table). Floor standing equipment is placed directly on the earth grounded floor.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	Nemko-CCL, Inc.	N/A	N/A	11/16/2011
Test Software	Nemko-CCL, Inc.	Conducted Emissions	Revision 1.2	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	01/17/2012

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	01/18/2012
LISN	EMCO	3825/2	9305-2099	03/12/2012
Conductance Cable Wanship Site #2	Nemko-CCL, Inc.	Cable J	N/A	12/14/2011
Transient Limiter	Hewlett Packard	11947A	3107A02266	12/14/2011

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 30 MHz to 1000 MHz 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 RBW of 10 kHz and VBW of 30 kHz were used to measure frequencies below 30 MHz.

A loop antenna was used to measure the frequency range of 4 MHz to 30 MHz. A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz, at a distance of 3 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.

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.

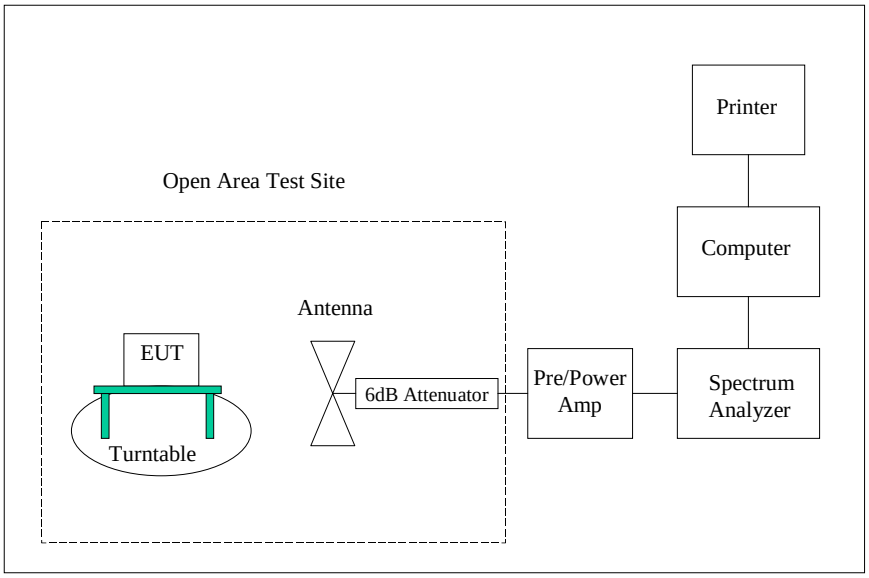
Desktop EUT are measured on a non-conducting table 0.8 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

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	11/16/2011
Test Software	Nemko-CCL, Inc.	Radiated Emissions	Revision 1.3	N/A
Spectrum Analyzer/Receiver	Rhode & Schwarz	1302.6005.40	100064	07/28/2011
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	01/17/2012
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	01/18/2012
Loop Antenna	EMCO	6502	2011	03/11/2011
Biconilog Antenna	EMCO	3142	9601-1009	04/21/2011
3 Meter Radiated Emissions Cable Wanship Site #2	Microcoax	UFB205A-0-4700-000000	1295	05/10/2011

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
10 Meter Radiated Emissions Cable Wanship Site #2	Nemko-CCL, Inc.	Cable L	N/A	12/14/2011
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	08/25/2011
6 dB Attenuator	Hewlett Packard	8491A	32835	12/14/2011

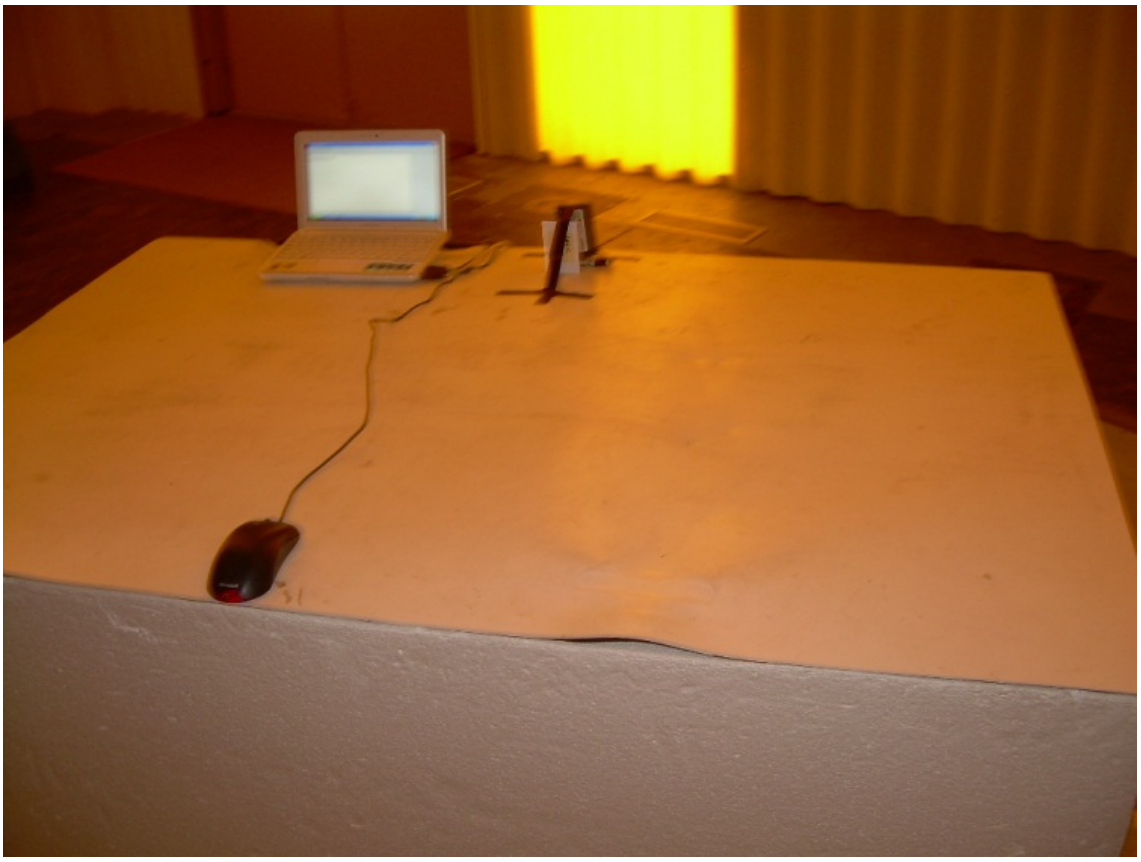
An independent calibration laboratory or Nemko-CCL, Inc. personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology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

Radiated Emissions Test Setup

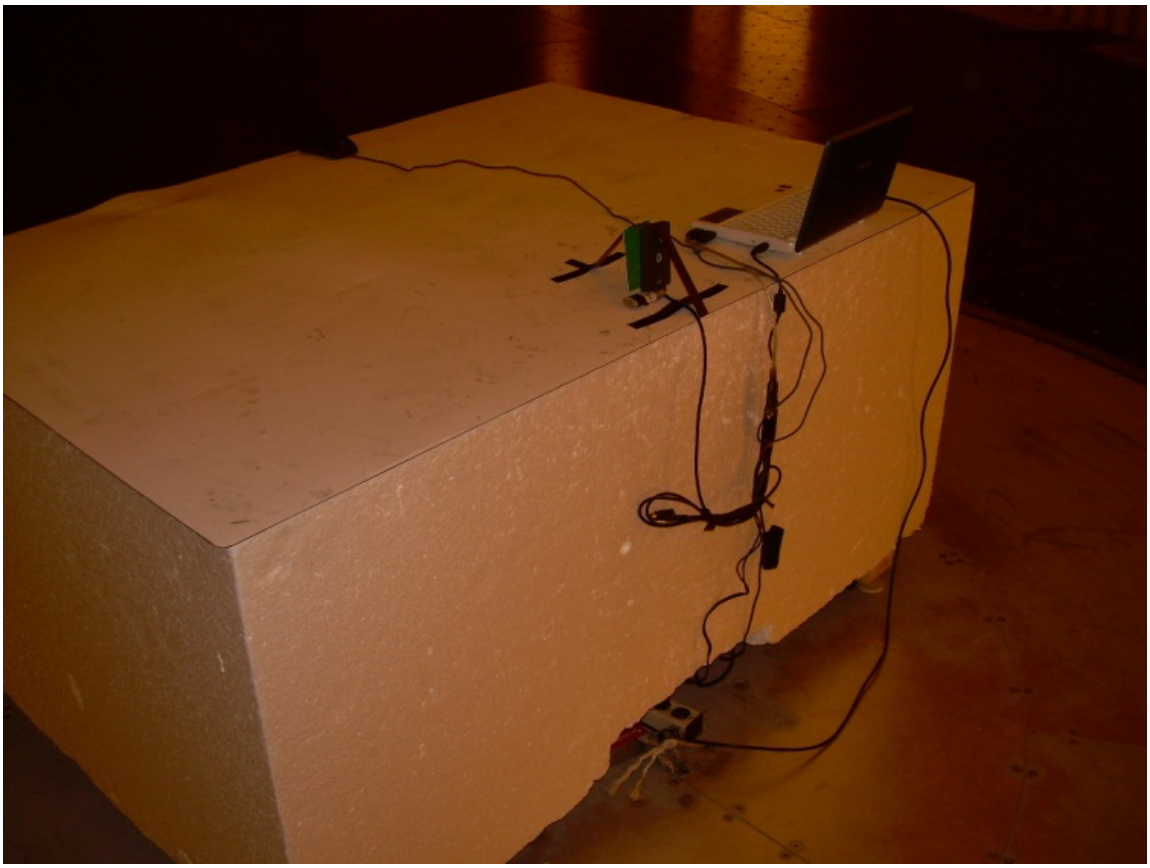


APPENDIX 2 PHOTOGRAPHS

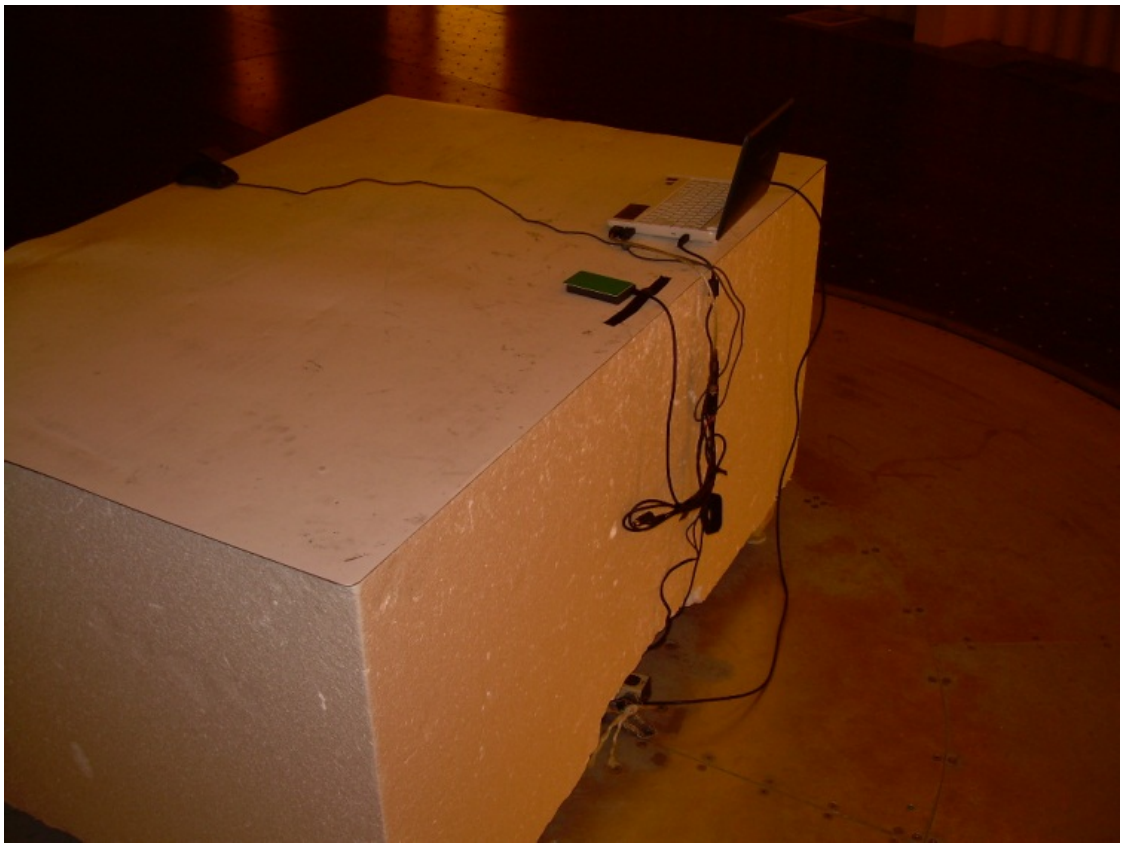
Photograph 1 – Front View Radiated Disturbance Worst Case Configuration



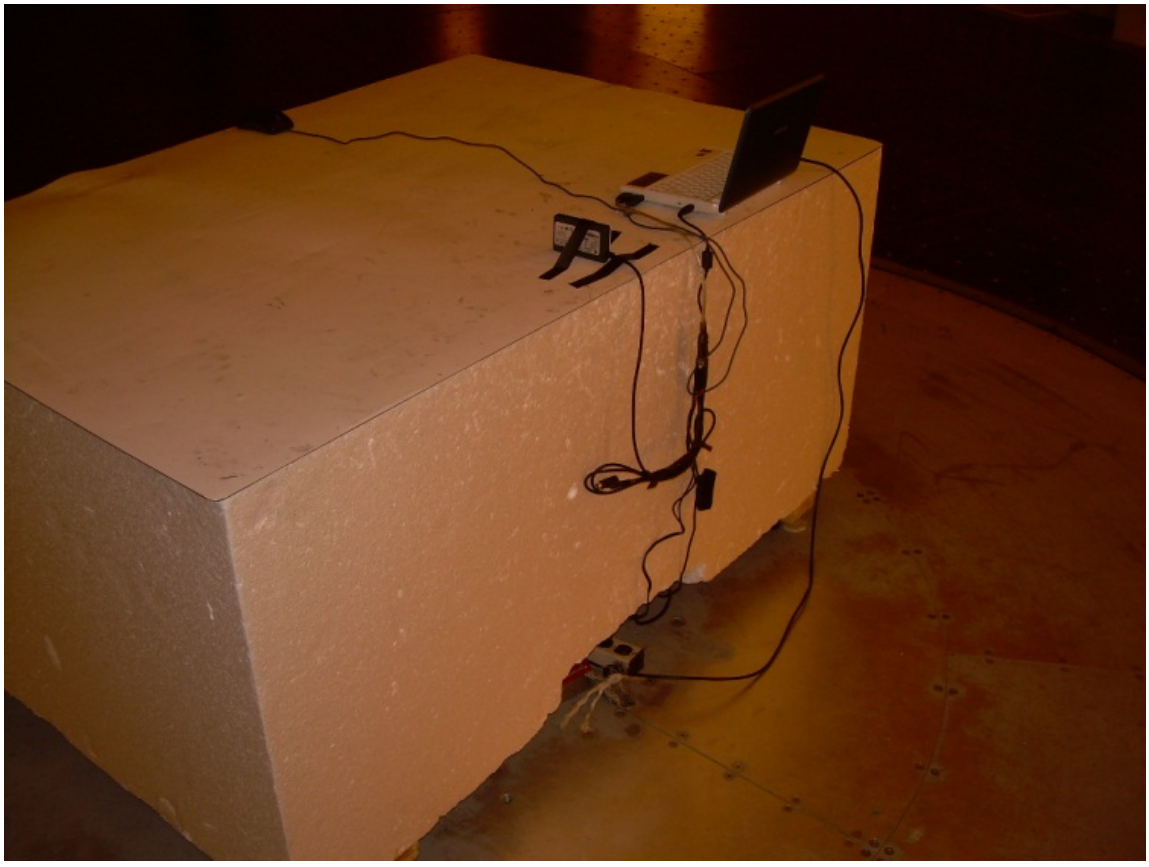
Photograph 2 – Back View Radiated Disturbance Worst Case Configuration



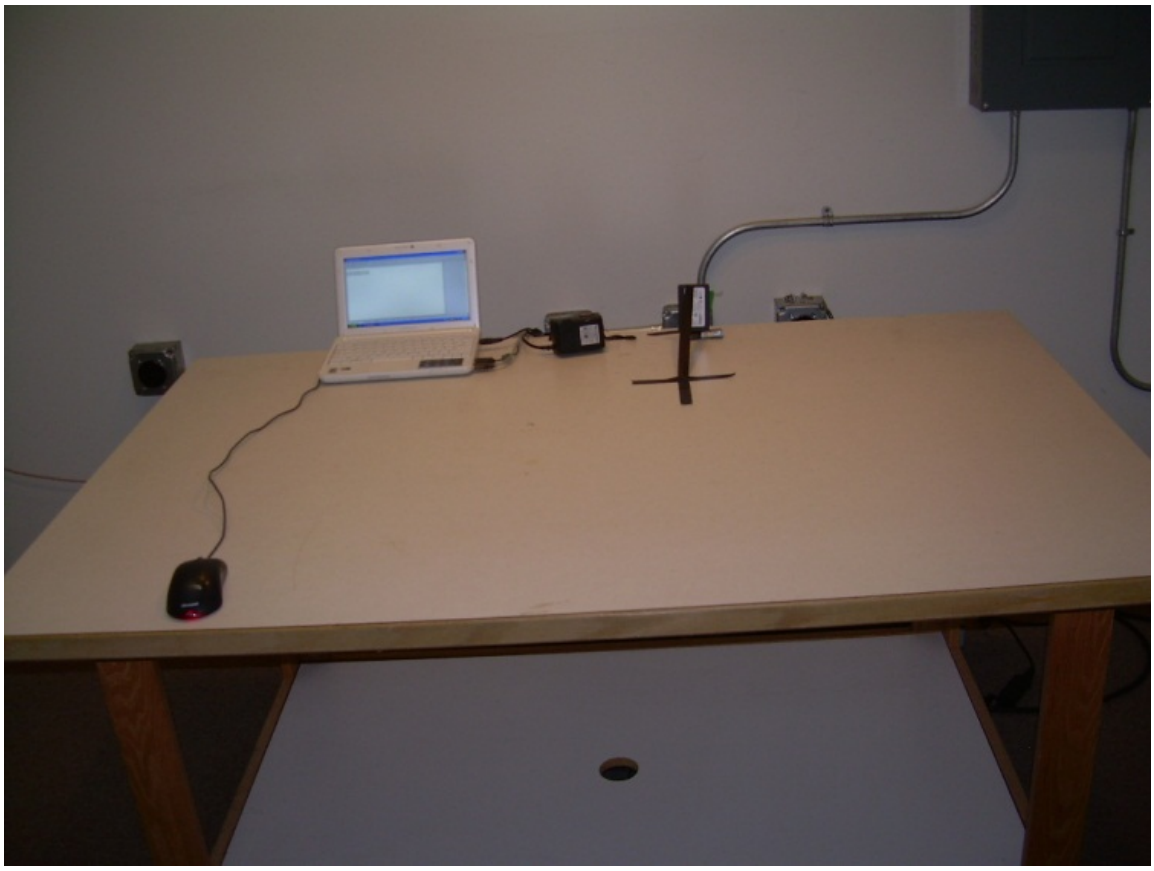
Photograph 3 – View of Radiated Disturbance – EUT Horizontal Placement



Photograph 4 – View of Radiated Disturbance – EUT On Edge Placement



Photograph 5 – Front View Conducted Disturbance Worst Case Configuration

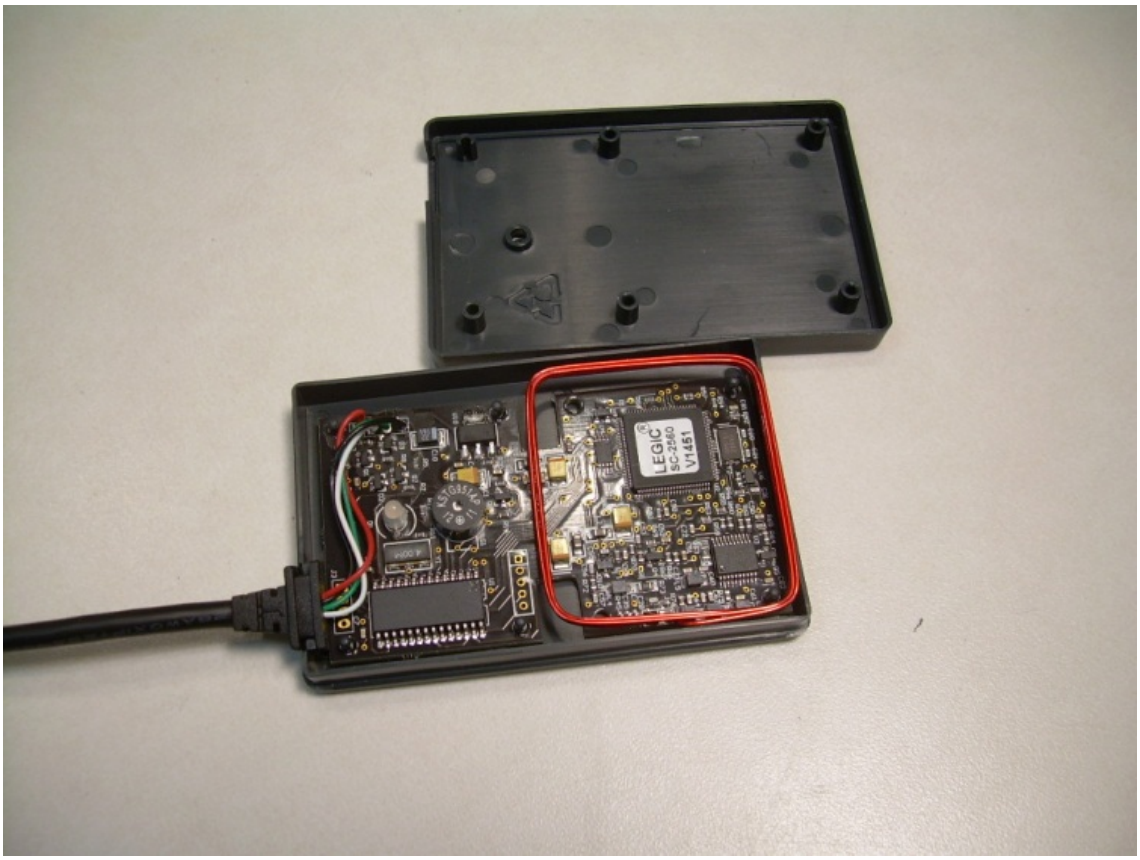


Photograph 6 – Back View Conducted Disturbance Worst Case Configuration

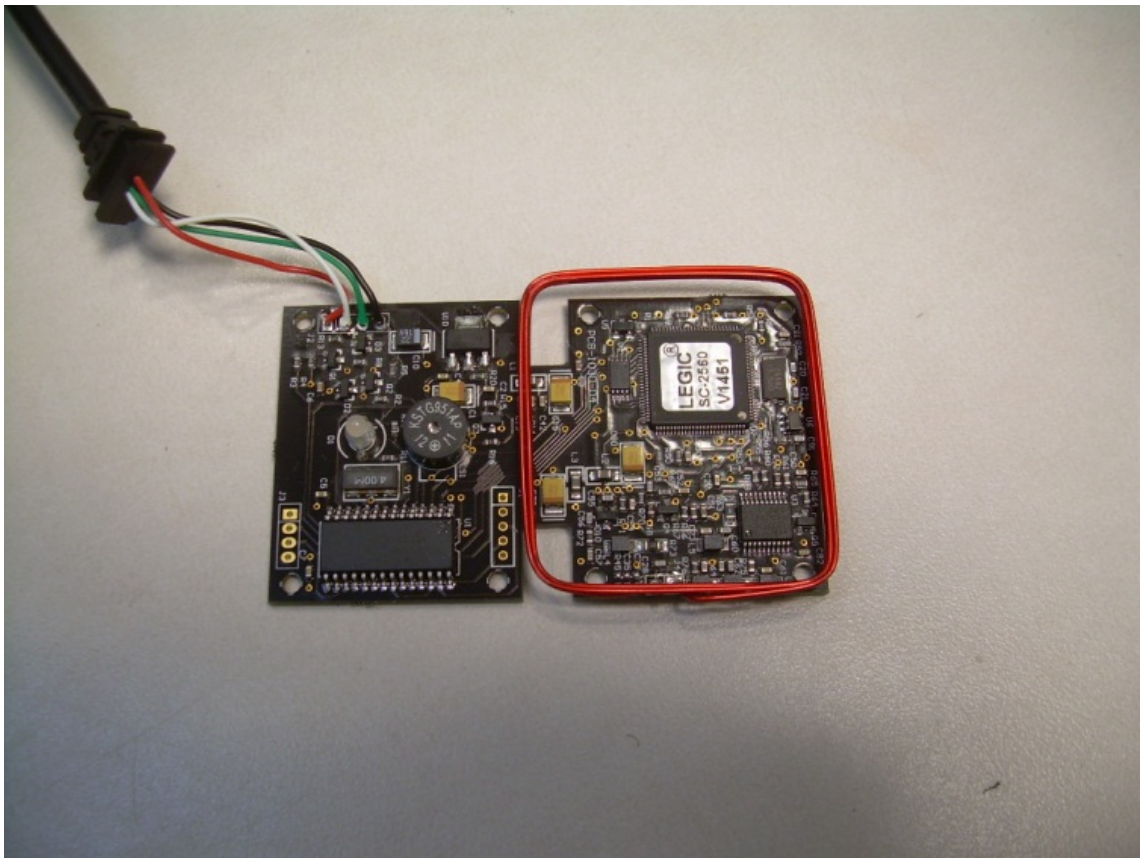
Photograph 7 – Front View of the EUT

Photograph 8 – Back View of the EUT

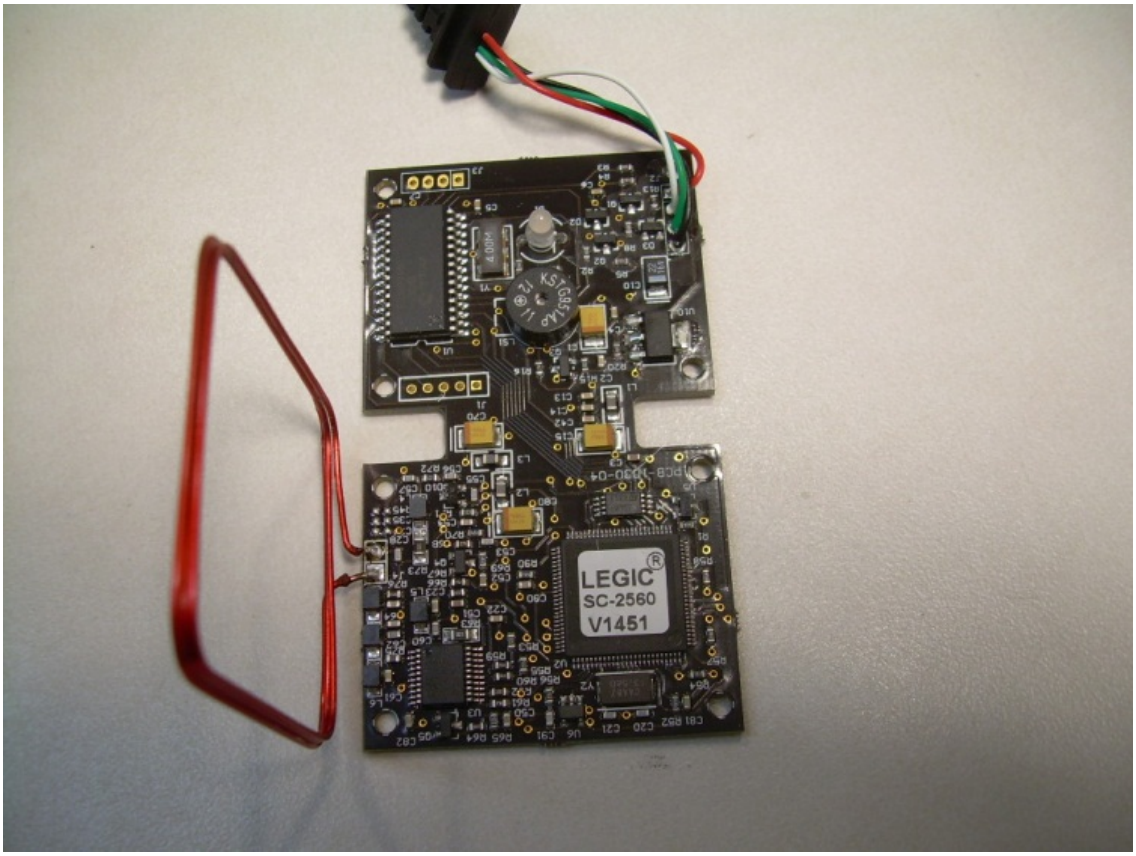
Photograph 9 – Internal View of the EUT



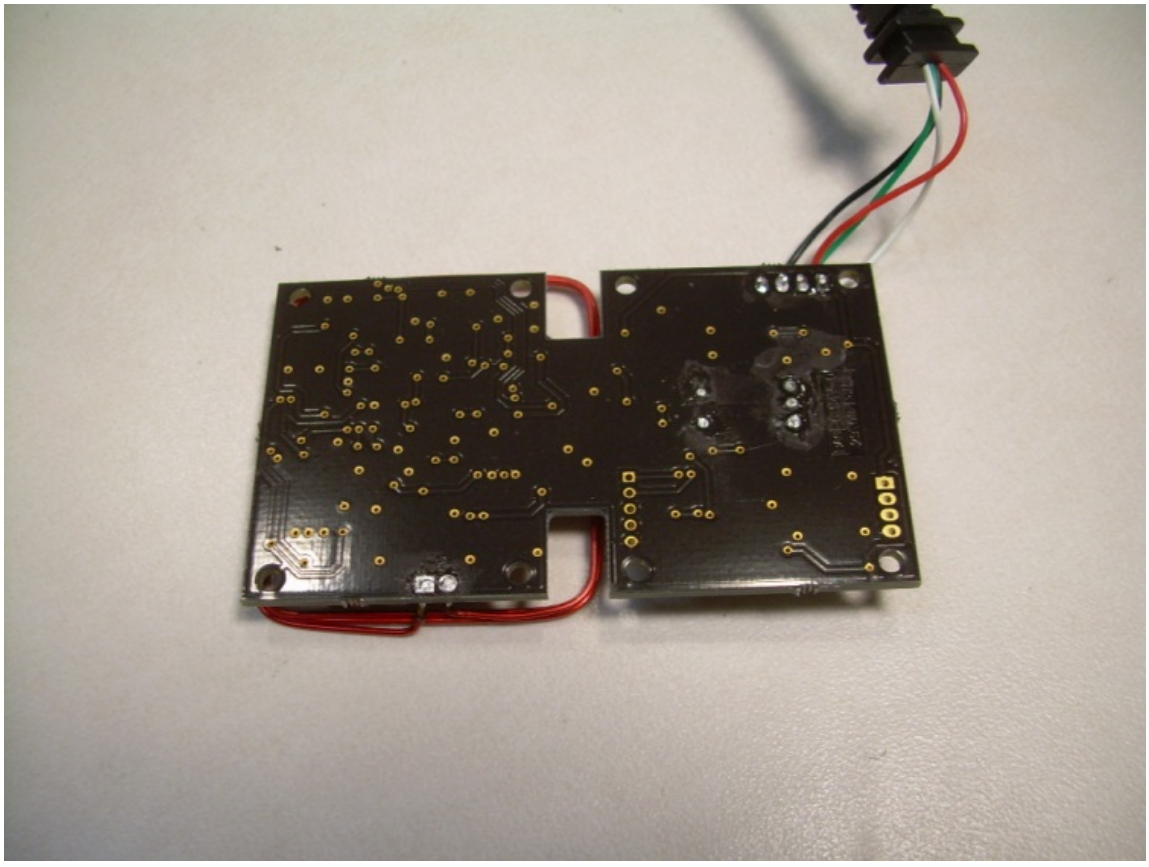
Photograph 10 – View of the Component Side of the PCB



Photograph 11 – View of the Component Side of the PCB with Antenna Moved



Photograph 12 – View of the Trace Side of the PCB



APPENDIX 3 FCC Part 15/ICES-003 COMPLIANCE INFORMATION

A3.1 LABEL AND COMPLIANCE STATEMENT

The label of the Hewlett-Packard Company T1985AA and BOISB-0907-00 are shown in documents filed for certification.

A3.2 BLOCK DIAGRAM

A block diagram showing the clock frequencies and signal paths of the Hewlett-Packard Company T1985AA and BOISB-0907-00 is shown in documents filed for certification.

A3.3 USER'S MANUAL

A copy of the User's manual containing the FCC warning statement is shown in documents filed for certification.