COMMUNICATION CERTIFICATION LABORATORY

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

Test Report

Certification

Test Of:

Electronic Runway Handheld Key FOB

FCC ID:

UPBERUN0001

Test Specification:

FCC PART 15, Subpart C

Test Report: 1402

Applicant:

Freedom Innovations LLC.
425 N 400 E
Gunnison, UT 84634

Date of Test: March 25, 2008

Issue Date: May 28, 2008

Accredited Testing Laboratory By:

NVLAP

NVLAP Lab Code 100272-0

CERTIFICATION OF ENGINEERING REPORT

This report has been prepared by Communication Certification Laboratory to determine compliance of the device described below with the certification requirements of 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: Freedom Innovations LLC.
- Manufacturer: Freedom Innovations LLC.
- Brand Name: Freedom Innovations
- Model Number: Electronic Runway Handheld Key FOB
- FCC ID: UPBERUN0001

On this 28th day of May 2008, I, individually, and for Communication Certification Laboratory, 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 Communication Certification Laboratory EMC testing facilities are in good standing, NVLAP does not endorse the product described in this report.

COMMUNICATION CERTIFICATION LABORATORY

Tested by: Norman P. Hansen
EMC Technician

TABLE OF CONTENTS

SECTION 1.0 CLIENT INFORMATION

1.1 Client Information:

Company Name: Freedom Innovations LLC.
425 N 400 E
Gunnison, UT 84634

Contact Name: Wade Snarr
Title: Design Engineer

1.2 Manufacturer:

Company Name: Freedom Innovations LLC.
425 N 400 E
Gunnison, UT 84634

Contact Name: Wade Snarr
Title: Design Engineer

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name:	Freedom Innovations
Model Number:	Electronic Runway Handheld Key FOB
Serial Number:	None
Options Fitted:	N/A

2.2 Description of EUT:

The Electronic Runway Handheld Key FOB device is a transmitter to wirelessly link to the Electronic Runway. The Electronic Runway is a system to change the angle of an artificial ankle in a prosthetic device. The Electronic Runway Handheld Key FOB operates at 433.9 MHz. The Electronic Runway Handheld Key FOB powers on with the press of any button and then pressing one of the buttons signals the system to move. Transmission ends with the release of the button. The Electronic Runway Handheld Key FOB powers down after 2 seconds of inactivity.

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specification:

Title:	FCC PART 15, Subpart C (47 CFR 15). Section 15.203 Section 15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.
Purpose of Test:	The tests were performed to demonstrate Initial compliance.

3.2 Methods & Procedures:

3.2.1 §15.203

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 §15.231

(a) The provision of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as Shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video, and the radio control of toys is not permitted. Data is permitted to be

sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmission are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

(b) In addition to the provisions of §15.205, the field strength of emission from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 –130	1,250	125
130 – 174	1,250 to 3,750 **	125 to 375 **
174 – 260	3,750	375
260 – 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** Linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field 94 strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

(1) the above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provision in §15.35 for averaging pulsed emission and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emission in the above table are based on the fundamental frequency of the intentional radiator. Spurious emission shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

(d) For devices operating within the frequency band 40.66-40.70 MHz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be ±0.01%. This frequency tolerance shall be maintained for a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation on 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.

(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided that intentional radiator complies with the provisions of paragraphs (b) through (d) of this section except the field strength table in paragraph (b) of this section is replaced by the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66 - 40.70	1,000	100
70 –130	500	50
130 – 174	500 to 1,500 **	50 to 150 **
174 – 260	1,500	150
260 – 470	1,500 to 5,000 **	150 to 500 **
Above 470	5,000	500

** Linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 22.72727(F) - 454.545; for the band 260-470 MHz, uV/m at 3 meters = 16.6667(F) - 2833.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent periods between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

3.3 Test Procedure

The line conducted and radiated emissions testing was performed according to the procedures in ANSI C63.4 (2003). Testing was performed at CCL's Wanship open area test site #2, located at 550 West Wanship Road, Wanship, UT. This site has been fully described in a report submitted to the FCC, and was accepted in a letter dated June 6, 2006 (90504).

CCL participates in the National Voluntary Laboratory Accreditation Program (NVLAP) and has been accepted under NVLAP Lab Code:100272-0, which is effective until September 30, 2008.

SECTION 4.0 OPERATION OF EUT DURING TESTING

4.1 Operating Environment:

Power Supply: 3.0 VDC (CR2032 battery)

4.2 Operating Modes:

The Electronic Runway Handheld Key FOB was tested in three orientations, horizontal flat, horizontal edge, and vertical. The worst-case emissions were with the EUT transmitting constantly.

4.3 EUT Exercise Software:

No software was required.

SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 FCC PART 15, Subpart C Section 15.231

5.1.1 Summary of Tests:

Section	Test Performed	Frequency Range (MHz)	Result
15.203	Antenna Requirements	N/A	Complied
15.231 (a)	Periodic Operation	433.9	Complied
15.231 (b)	Radiated Emissions	30 to 4339	Complied
15.231 (c)	Bandwidth	433.9	Complied
15.231 (d)	Frequency Stability	40.66 to 40.70	Not Applicable
15.231 (e)	Radiated Emissions	30 to 4339	Not Applicable

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:

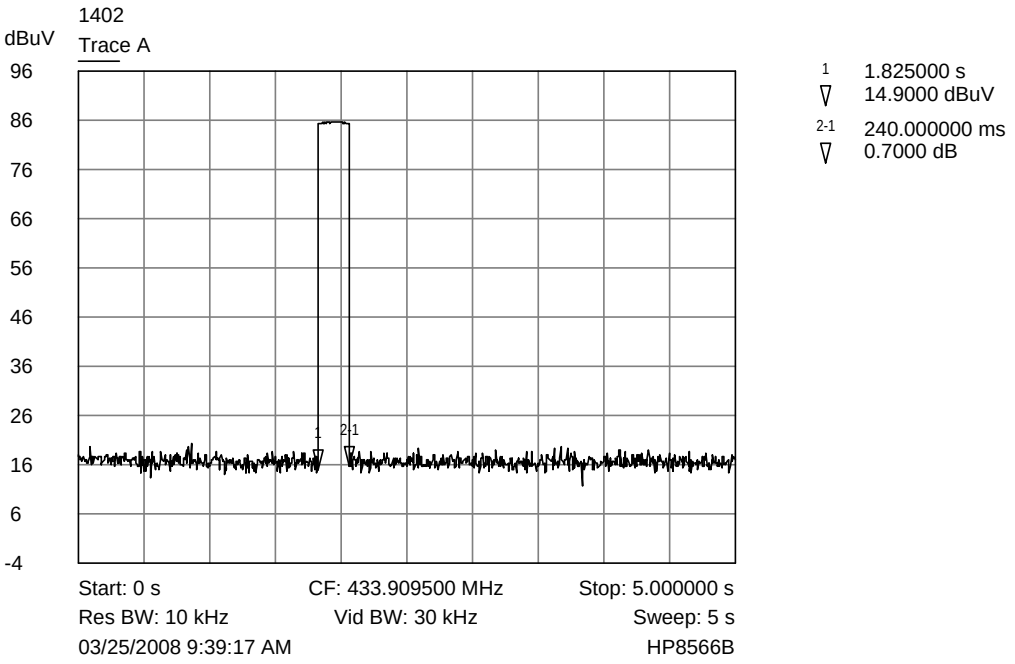
This section contains the test results only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Appendix 1 of this report.

6.2 Test Results:

6.2.1 §15.231(a)

Demonstration of Compliance:

1. A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released. The plot below shows the transmitter button depressed to activate the transmitter and then immediately released.



Trace A transmitter activated and button released

2. The Electronic Runway Handheld Key FOB cannot be automatically activated. The Electronic Runway Handheld Key FOB only transmits if manually activated.

3. The Electronic Runway Handheld Key FOB does not transmit at regular predetermined intervals. The Electronic Runway Handheld Key FOB only transmits if manually activated.

RESULT

In the configuration tested, the EUT complied with the requirements of this section.

6.2.2 §15.231(b) Radiated Emissions

Demonstration of Compliance:

The Electronic Runway Handheld Key FOB operates at 433.9 MHz, therefore; the field strength of the fundamental must be less than 10995.8 μV/m (80.8 dBμV/m) at 3 meters and the field strength of the harmonics must be attenuated 20 dB below the maximum permitted fundamental strength or 60.8 dBμV/m at 3 meters.

The limits for a distance of 3 meters are determined using the formula:

Limit in the 260 – 470 MHz band = 41.6667(F) – 7083.3333

Where F is the frequency in MHz

Emissions in the restricted bands of §15.205 must meet the limits specified in §15.209.

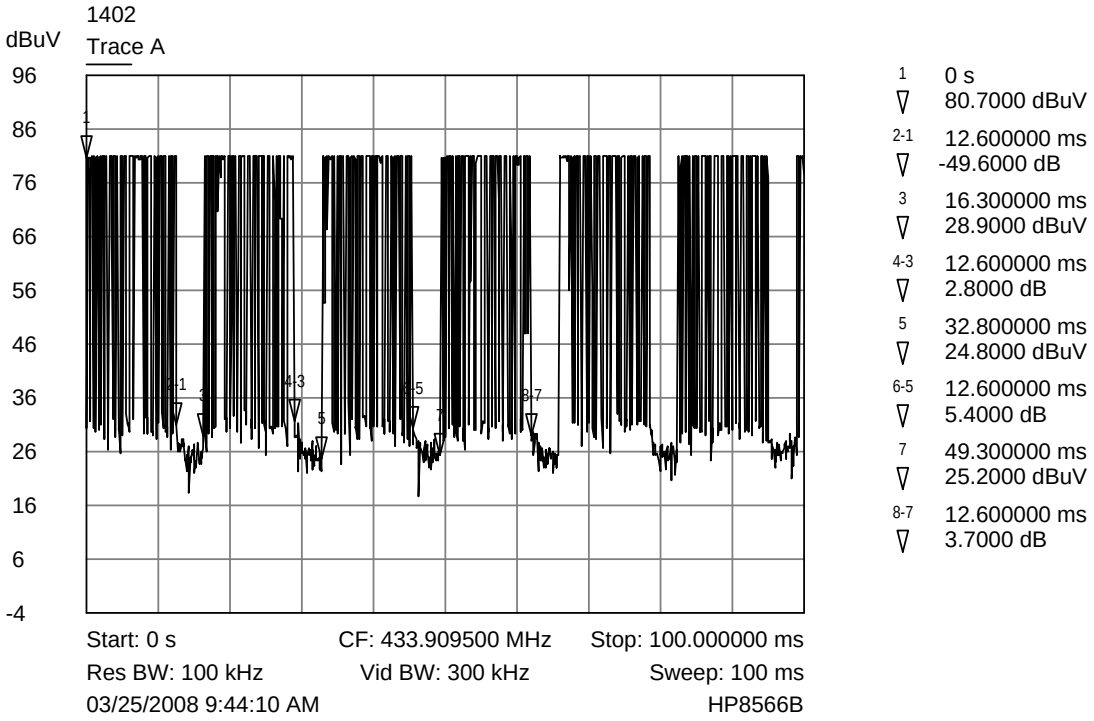
Measurement Data Fundamental and Harmonic Emissions:

The frequency range from 30 MHz to the tenth harmonic of the highest fundamental frequency was investigated to measure any radiated emissions.

A diagram of the test configuration and test equipment used is enclosed in Appendix 1.

Pulsed Emission Averaging Factor

The Electronic Runway Handheld Key FOB transmitter is a pulsed emission device; therefore, the method of §15.35 for averaging a pulsed emission may be used. The plot of the pulse train and the average factor calculations are shown below:



Trace A 100 ms pulse train plot

Average factor calculation

From the above plot, the pulse train is 16.3 ms (marker 1 to marker 3). The Electronic Runway Handheld Key FOB uses Manchester pulse modulation. The duty cycle using this modulation technique is 50%. There are 32 pulses in 12.6 ms and then 3.6 ms of off time before the next pulse. This means there is a total of 6.3 ms of on time (12.6 ms/2) in the pulse train (16.3 ms).

The Average Factor is calculated by the equation:

Average Factor = 20 log (on time/pulse train time)
= 20 log (6.3 ms/16.3 ms)
= -8.26 dB

The peak measurements were adjusted using –8.3 dB as the average factor.

Radiated Interference Level Data

Frequency MHz	Placement of EUT	Detector	Receiver Reading dBμV	Correction Factor dB	Average Factor dB	Field Strength dBμV/m	Limit dBμV/m	Delta dB
433.9	Vertical	Peak	59.0	19.7	-8.3	70.4	80.8	-10.4
868.8	On-Edge	Peak	20.3	27.5	-8.3	39.5	60.8	-21.3
1301.7*	Vertical	Peak	28.6	28.7	-8.3	49.0	54.0	-5.0
1735.6	On-Edge	Peak	27.2	31.0	-8.3	49.9	60.8	-10.9
2169.6	On-Edge	Peak	31.8	32.4	-8.3	55.9	60.8	-4.9
2603.4	Horizontal	Peak	18.3	33.6	-8.3	43.6	60.8	-17.2
3037.3	Horizontal	Peak	9.7	34.6	-8.3	36.0	60.8	-24.8
3471.2	Vertical	Peak	8.1	35.9	-8.3	35.7	60.8	-25.1
3905.1*	Horizontal	Peak	6.4	37.5	-8.3	35.6	54.0	-18.4
4339.0*	Vertical	Peak	7.0	38.4	-8.3	37.1	54.0	-16.9
* Emissions within restricted bands								

Sample Field Strength Calculation:

The field strength is calculated by adding the Correction Factor (Antenna Factor + Cable Factor) and the Average Factor to the measured level of 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 + AV Where

FS = Field Strength
RA = Receiver Amplitude Reading
CF = Correction Factor (Antenna Factor + Cable Factor)
AV = Averaging Factor

Assume a receiver reading of 44.2 dBμV is obtained from the receiver, with an average factor of –8.6 dB and a correction factor of 17.5 dB. The field strength is calculated by adding the correction factor and the average factor, giving a field strength of 53.1 dBμV/m, FS = 44.2 + 17.5 + (-8.6) = 53.1 dBμV/m

RESULT

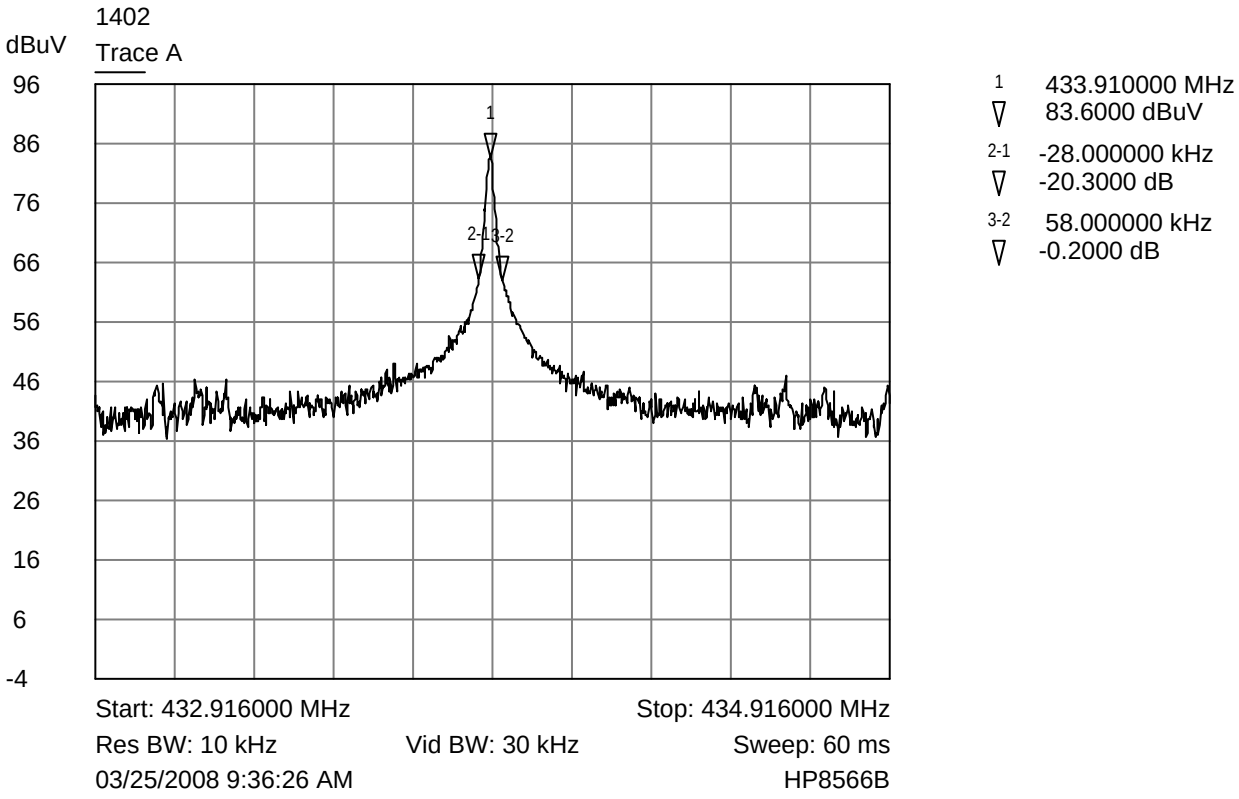
In the configuration tested, the EUT complied with the requirements of this section.

6.2.3 §15.231(c) Bandwidth

Demonstration of Compliance:

The bandwidth of the emission must not be wider than 0.25% of the center frequency. The center frequency is 433.9 MHz, therefore the bandwidth must not be wider than 1.08475 MHz. The Electronic Runway Handheld Key FOB bandwidth was 58 kHz, therefore it meets the bandwidth requirements. See spectrum analyzer plot below.

Bandwidth Plot



Trace A Bandwidth plot

6.2.4 §15.231(d) Frequency Stability

The EUT does not operate in the frequency band 40.66 to 40.70 MHz; therefore this test is not applicable.

6.2.5 §15.231(e) Reduced Field Strengths

The EUT transmissions do not exceed the periodic rate of operation specified in paragraph (a); therefore, this test is not applicable.

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

The radiated emission from the intentional radiator was measured using a spectrum analyzer. The resolution bandwidth was set at 100 kHz and the video bandwidth was set at 300 kHz. 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.

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 1 GHz to 4.34 GHz, 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.

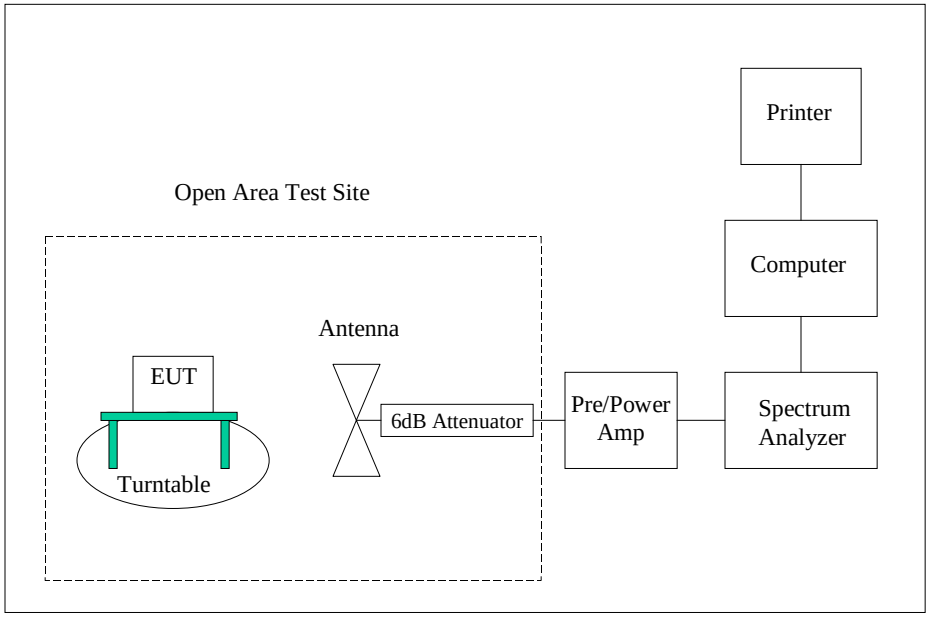
The configuration of the intentional radiator was varied to find the maximum radiated emission. The intentional radiator was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there were multiple interface ports all of the same type, 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 intentional radiator is measured on a non-conducting table 0.8 meter 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	CCL	N/A	N/A	10/24/2007
Test Software	CCL	Conducted Emissions	Revision 1.2	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	10/31/2007
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	11/12/2007
LISN	EMCO	3825/2	9508-2435	03/13/2008
Conductance Cable Wanship Site #2	CCL	Cable J	N/A	12/31/2007
Transient Limiter	Hewlett Packard	11947A	3107A02266	12/31/2007

An independent calibration laboratory or 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 - View of the Radiated Emission Test Setup
(Vertical Alignment)

Photograph 2 - View of the Radiated Emission Test Setup
(Horizontal Face Alignment)

Photograph 3 - View of the Radiated Emission Test Setup
(Horizontal Flat Alignment)

Photograph 4 - Front View of the EUT

Photograph 5 - Back View of the EUT

Photograph 6 - View of the Component Side of the PCB

Photograph 7 - View of the Trace Side of the PCB