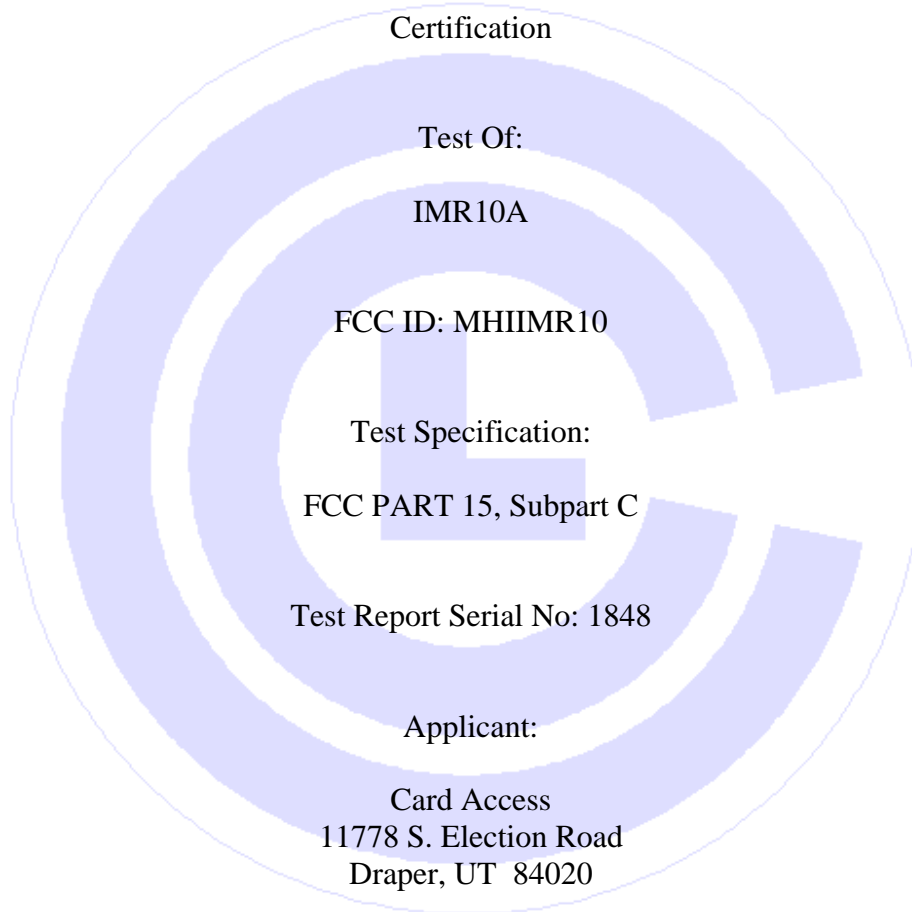


# COMMUNICATION CERTIFICATION LABORATORY

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

## Test Report



Date of Test: September 23, 2008

Issue Date: October 13, 2008

Accredited Testing Laboratory By:



NVLAP Lab Code 100272-0

**CERTIFICATION OF ENGINEERING REPORT**


This report has been prepared by Communication Certification Laboratory 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: Card Access
- Manufacturer: Card Access
- Brand Name: Card Access
- Model Number: IMR10A
- FCC ID Number: MHIIMR10

On this 13<sup>th</sup> day of October 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 accredited the Communication Certification Laboratory 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.

COMMUNICATION CERTIFICATION LABORATORY

  
Tested by: Jeffrey L. Draney  
EMC Technician

## TABLE OF CONTENTS

	<u>PAGE</u>
<u>SECTION 1.0 CLIENT INFORMATION</u> .....	4
<u>SECTION 2.0 EQUIPMENT UNDER TEST (EUT)</u> .....	5
<u>SECTION 3.0 TEST SPECIFICATION, METHODS &amp; PROCEDURES</u> .....	8
<u>SECTION 4.0 OPERATION OF EUT DURING TESTING</u> .....	16
<u>SECTION 5.0 SUMMARY OF TEST RESULTS</u> .....	18
<u>SECTION 6.0 MEASUREMENTS, EXAMINATIONS AND DERIVED RESULTS</u> .....	19
<u>APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT</u> .....	31
<u>APPENDIX 2 PHOTOGRAPHS</u> .....	34

**SECTION 1.0 CLIENT INFORMATION**

**1.1 Applicant:**

Company Name: Card Access  
11778 S. Election Road  
Draper, UT 84020  
U.S.A.

Contact Name: Greg Hill  
Title: Engineer

**1.2 Manufacturer:**

Company Name: Card Access  
11778 S. Election Road  
Draper, UT 84020  
U.S.A.

Contact Name: Greg Hill  
Title: Engineer

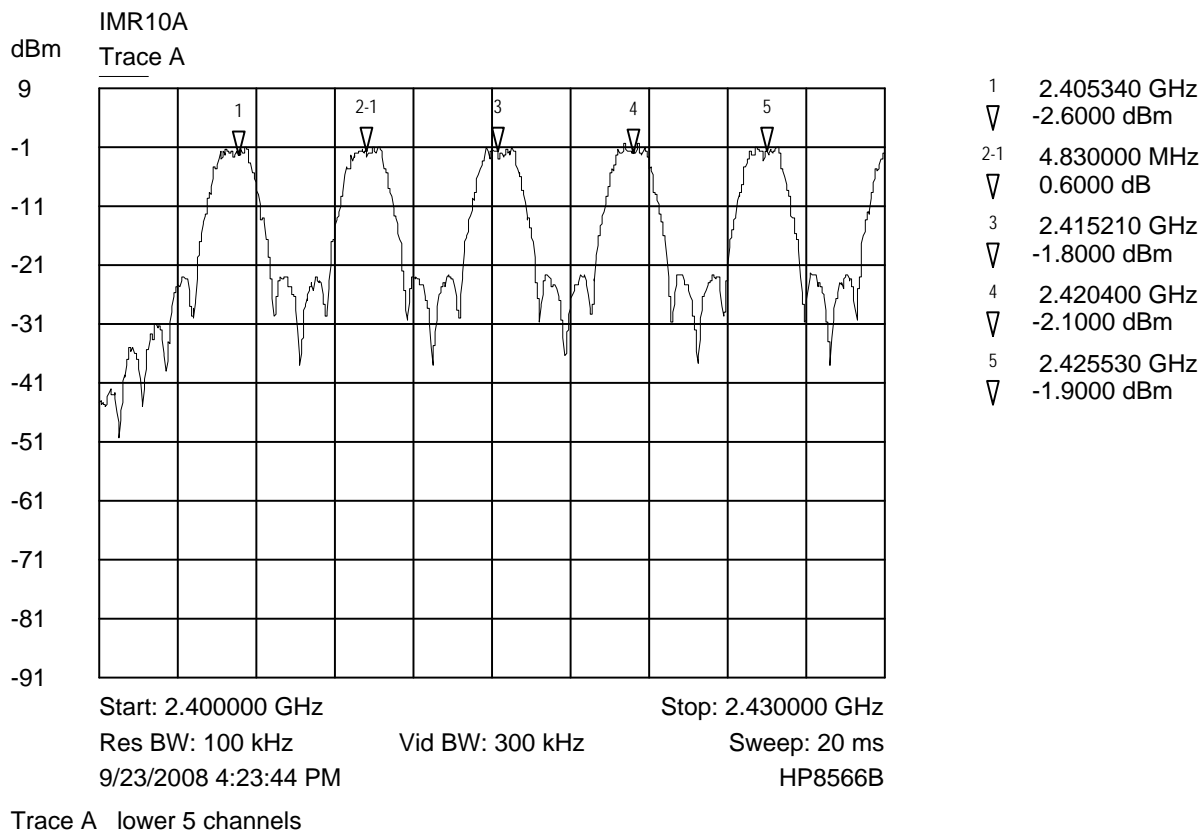
**SECTION 2.0 EQUIPMENT UNDER TEST (EUT)****2.1 Identification of EUT:**

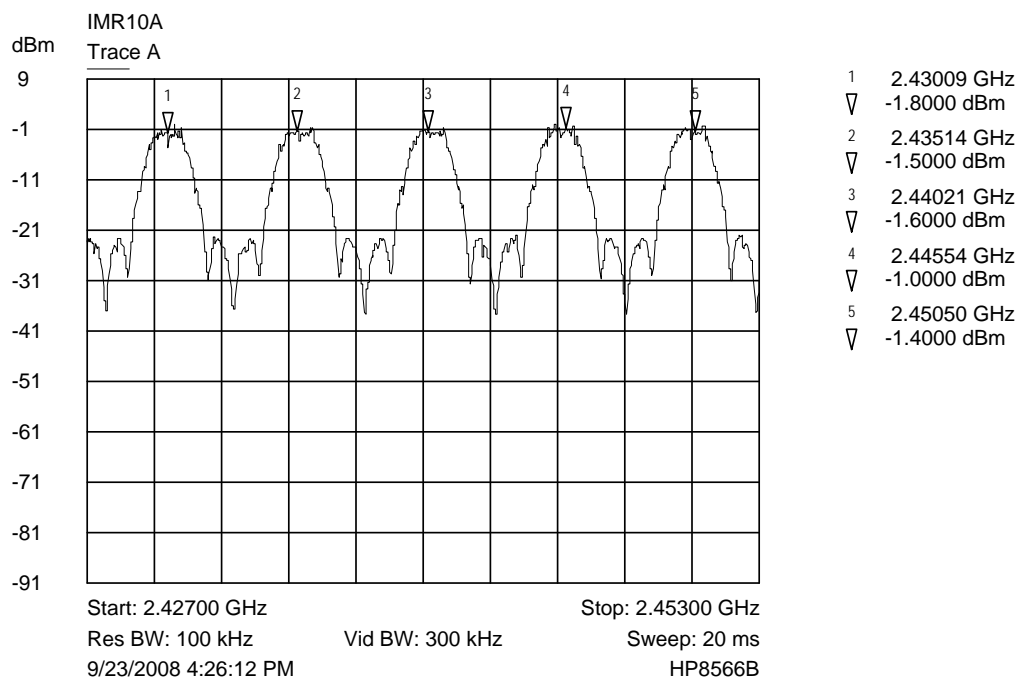
Brand Name:	Card Access
Model Number:	IMR10A
Serial Number:	None
Options Fitted:	N/A
Country of Manufacture:	U.S.A.

**2.2 Description of EUT:**

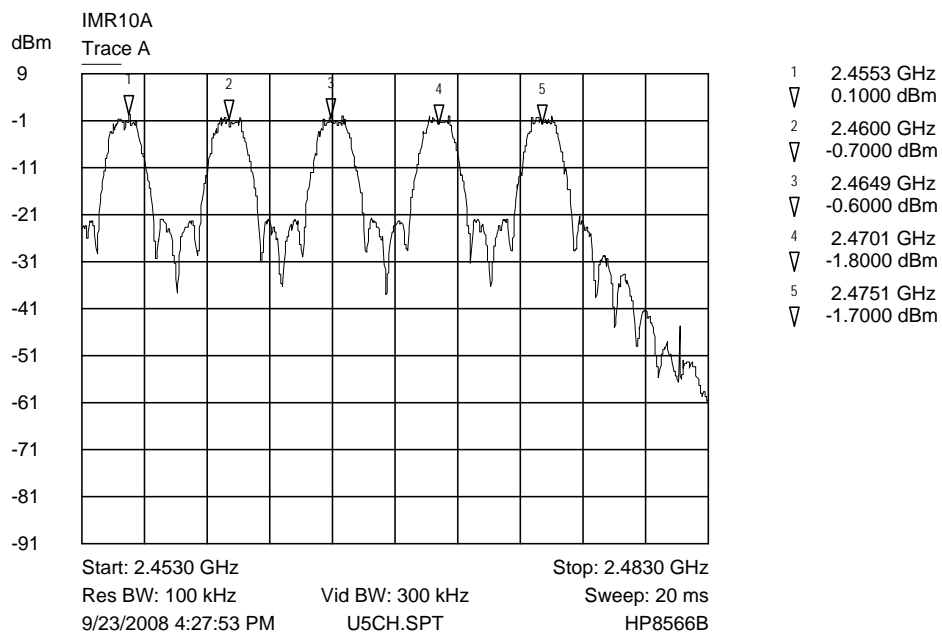
The IMR10A is a handheld remote control with a Zigbee transceiver designed to work with the Control4 home automation system. The IMR10A is powered by two AAA batteries.

The EUT uses 15 channels in the 2.4 to 2.4835 GHz band. See the following plots.





Trace A middle 5 channels



Trace A upper 5 channels

This report covers the transmitter that is required to meet the requirements of FCC Part 15, Subpart C. The receiver and digital circuitry, subject to other standards, is covered in separate testing and report.

**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: Card Access MN: IMR10A (Note 1)	MHIIMR10	Handheld Remote Control	None

Note: (1) EUT

**2.4 Modification Incorporated/Special Accessories on EUT:**

No modifications were made to the IMR10A during testing to comply with the specification.

Signature: \_\_\_\_\_

Typed Name: Greg Hill

Title: Engineer

**SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES****3.1 Test Specification:**

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

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

**3.2 Requirements:****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  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.



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

\*Decreases with the logarithm of the frequency.

(b) The shown limit in paragraph (a) of this Section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

- (1) For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.
- (2) For all other carrier current systems: 1000 µV within the frequency band 535-1705 kHz, as measured using a 50 µH/50 ohms LISN.
- (3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in Section 15.205 and Section 15.209, 15.221, 15.223, 15.225 or 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

### **3.2.3 §15.247 Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz**

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

(ii) Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

(2) Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 -

5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

(iii) Fixed, point-to-point operation, as used in paragraphs (c)(4)(i) and (c)(4)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

(2) In addition to the provisions in paragraphs (b)(1), (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do [the word "do" should be deleted from this sentence] emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as

applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of  $10 \log$  (number of array elements or staves) plus the directional gain of the element or staff having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

(iv) Transmitters that emit a single directional beam shall operate under the provisions of paragraph (c)(1) of this section.

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also

comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

(f) For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

(i) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this Chapter.

Note: Spread spectrum systems are sharing these bands on a noninterference basis with systems supporting critical Government requirements that have been allocated the usage of these bands, secondary only to ISM equipment operated under the provisions of Part 18 of this Chapter. Many of these Government systems are airborne radiolocation systems that emit a high EIRP which can cause interference to other users. Also, investigations of the effect of spread spectrum interference to U. S. Government operations in the 902-928 MHz band may require a future decrease in the power limits allowed for spread spectrum operation.

### **3.3 Test Procedure:**

The 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 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 June 6, 2006 (90504).

CCL is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2009.

For radiated emissions 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.

**SECTION 4.0 OPERATION OF EUT DURING TESTING****4.1 Operating Environment:**

Power Supply: 3 VDC (2-AAA Batteries)

**4.2 Operating Modes:**

The worst-case emissions were with the IMR10A placed on its side on the EUT table and transmitting. The IMR10A was tested at the lowest frequency, middle frequency, and the highest frequency to meet the requirements of §15.31(m).

**4.3 EUT Exercise Software:**

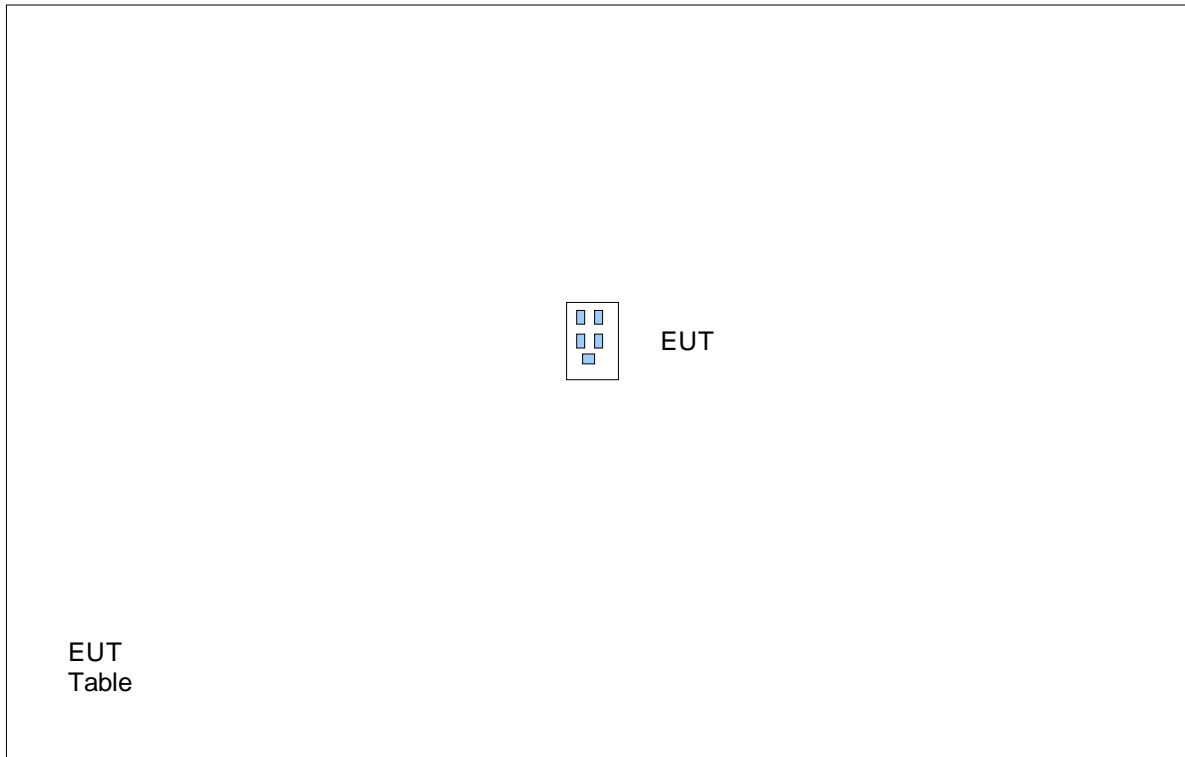
Card Access software was used to control the IMR10A transmitter.

**4.4 Configuration & Peripherals:**

The IMR10A was placed on the table and connected to the support equipment listed in Section 2.3 via each port listed in Section 2.4. Shown in Section 4.5 is a block diagram of the test configuration.



**4.5 Block Diagram of Test Configuration:**



**SECTION 5.0 SUMMARY OF TEST RESULTS****5.1 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	Not Applicable
15.247(a)	Bandwidth Requirement	2400 - 2483.5	Complied
15.247(b)	Peak Output Power	2400 - 2483.5	Complied
15.247(c)	Antenna Conducted Spurious Emissions	30 - 25000	Complied
15.247(c)	Radiated Spurious Emissions	30 - 25000	Complied
15.247(d)	3 kHz Peak Power Spectral Density	2400 - 2483.5	Complied
15.247(e)	Reserved Paragraph	N/A	Not Applicable
15.247(f)	Hybrid System Requirements	2400 - 2483.5	Not Applicable
15.247(g)	Frequency Hopping Channel Usage	2400 - 2438.5	Not Applicable
15.247(h)	Frequency Hopping Intelligence	2400 - 2483.5	Not Applicable
15.247(i)	RF Exposure	2400 - 2483.5	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 and determinations 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 Requirement**

The antenna used for testing was a 2.2 dBi chip antenna mounted on the circuit board.

**6.2.2 Conducted Disturbance at Mains Ports Data**

The EUT receives power from two AAA batteries; therefore line conducted emissions are not applicable.

**6.2.3 §15.247(a)****6.2.3.1 §15.247(a)(2) Emission Bandwidth**

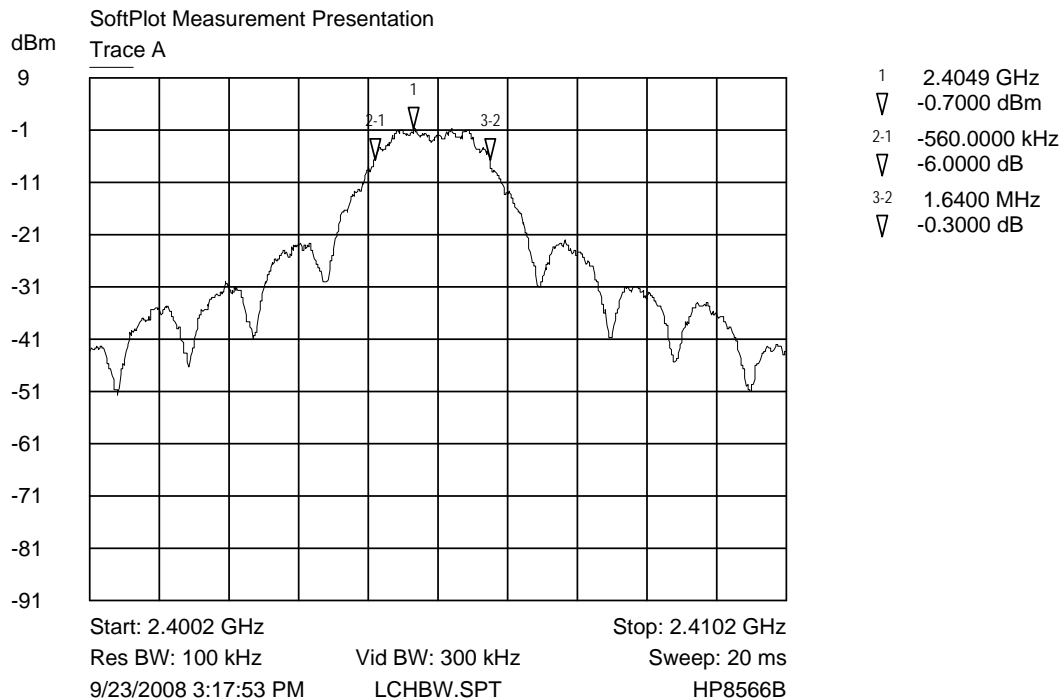
A diagram of the test configuration and the test equipment used is enclosed in Appendix 1.

Frequency (MHz)	Emission 6dB Bandwidth (kHz)
2405.32	1640
2440.42	1620
2475.50	1590

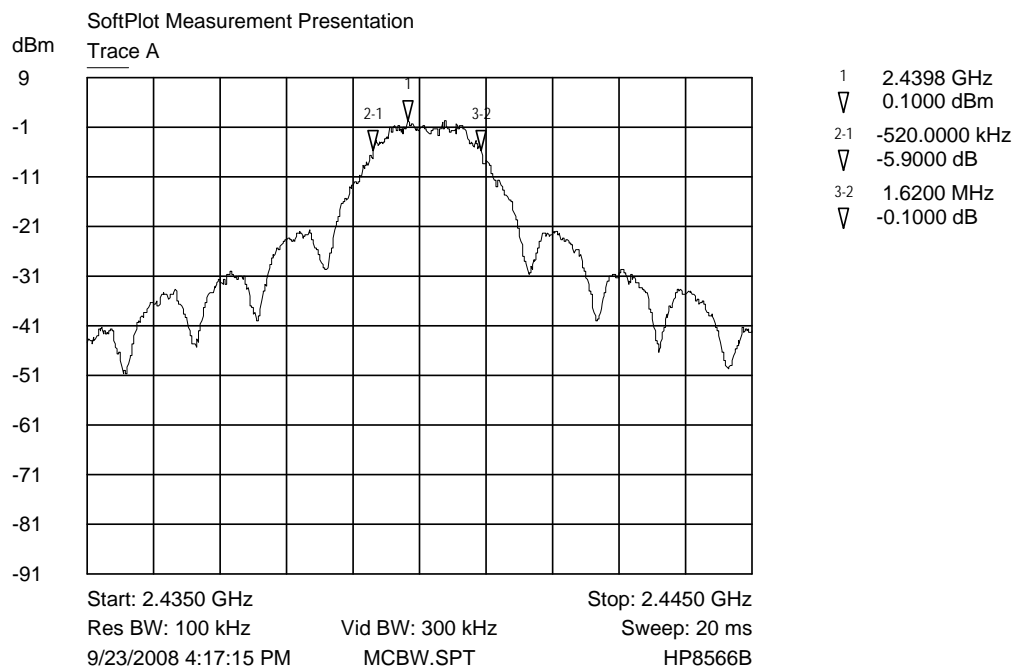
**RESULT**

In the configuration tested, the 6 dB bandwidth was greater than 500 kHz; therefore, the EUT complied with the requirements

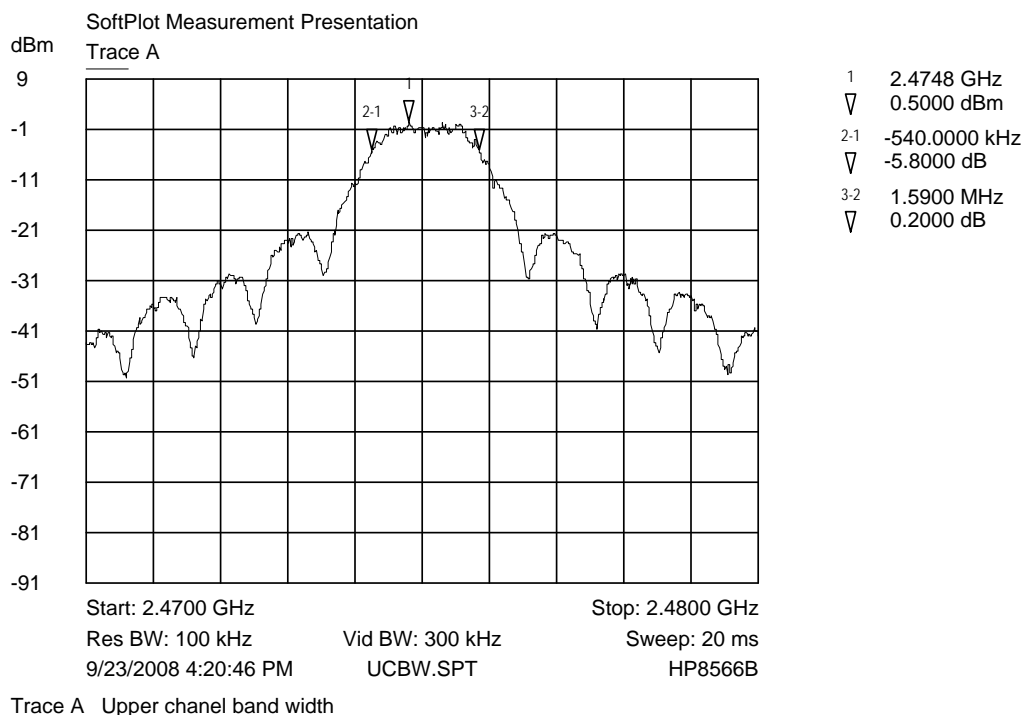
of the specification (see spectrum analyzer plots below).



Trace A low channel bandwidth



Trace A Middle channel band width



#### 6.2.4 §15.247(b)(3) Peak Conducted Power Requirement

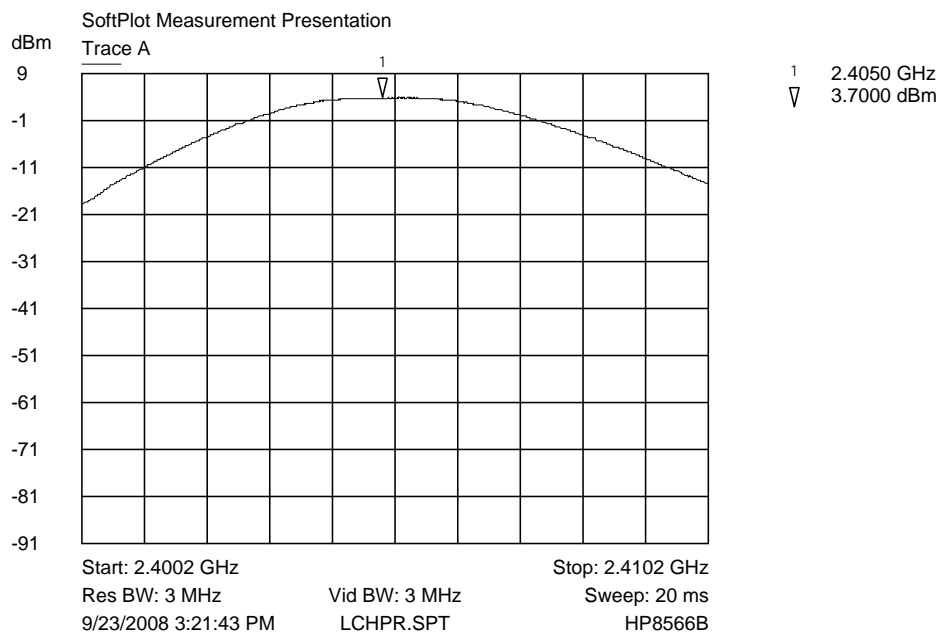
The maximum peak RF Conducted output power measured for this device was 3.16 mW or 5.0 dBm. The maximum directional gain of the antenna is less than 6 dBi; therefore, the maximum output power is not required to be reduced from the value measured.

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

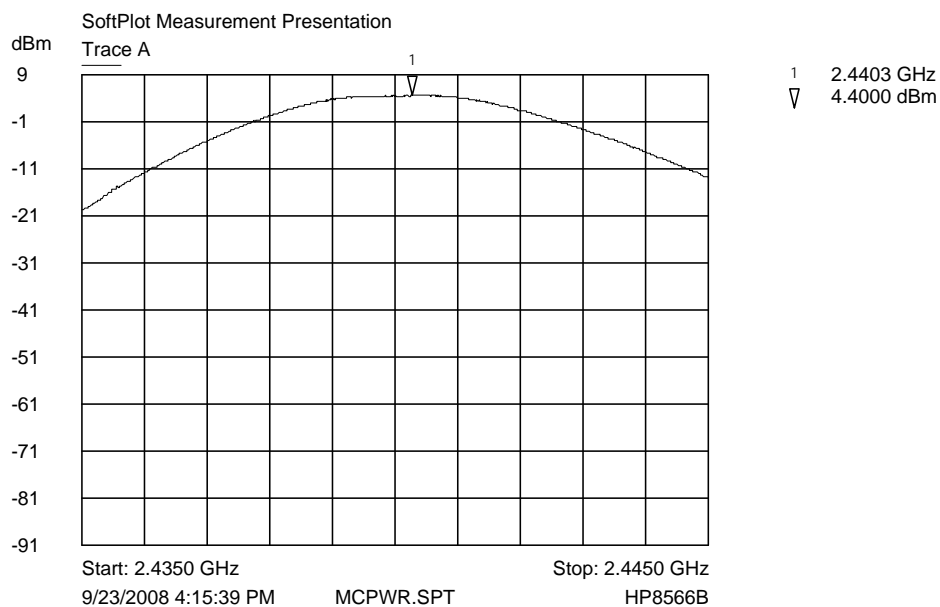
Frequency (MHz)	Measured Output Power (dBm)	Measured Output Power (mW)
2405.0	3.70	2.34
2440.3	4.40	2.75
2474.9	5.00	3.16

**RESULT**

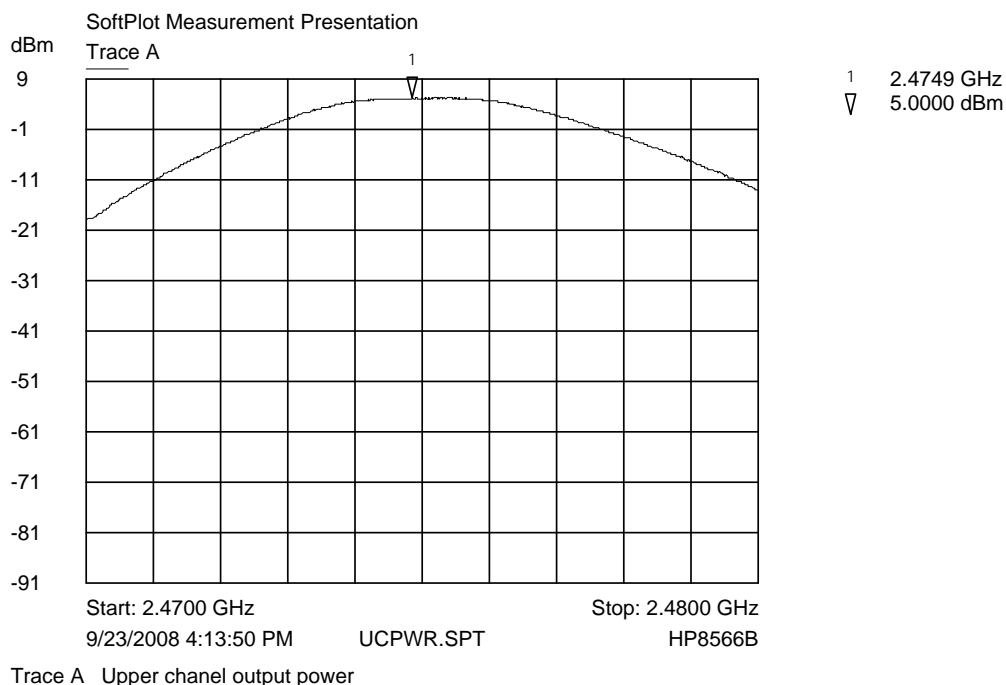
In the configuration tested, the RF peak output power was less than 1 Watt; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plots below).



Trace A low channel Power



Trace A Middle channel output power



### 6.2.5 §15.247(d) Spurious Emission Measurements

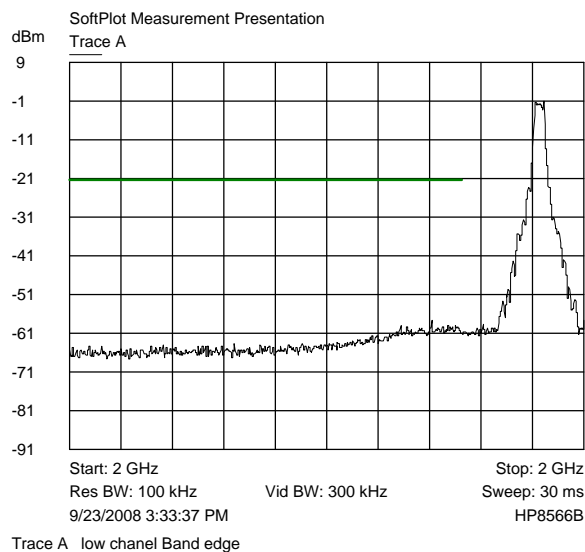
#### 6.2.5.1 Conducted Measurements at the Antenna Port

The conducted spurious emissions, in any 100 kHz bandwidth outside the operating band, must be attenuated to at least 20 dB below the measured fundamental emission level. The measured level using a 100 kHz RBW was -1.6; therefore, the spurious conducted emissions must be attenuated below -21.6 dBm. See the tables and plots below:

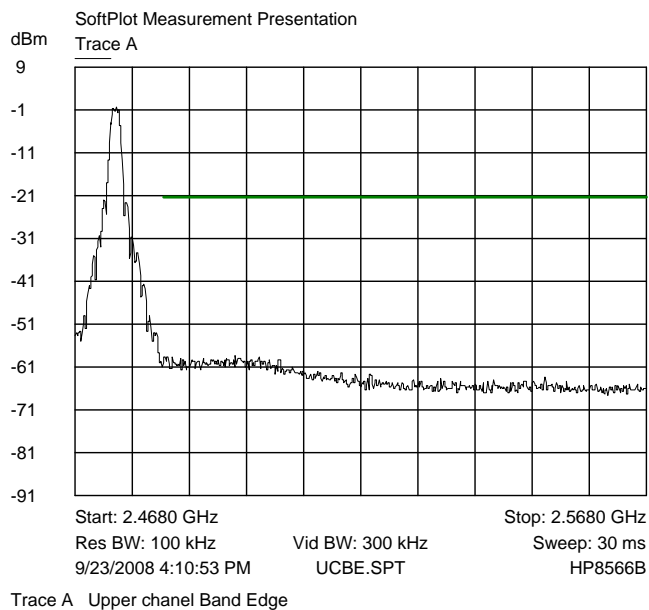
2405 MHz			
Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Margin (dB)
4810	-67.6	-21.6	-46.0
7215	-62.4	-21.6	-40.8
9620	-64.0	-21.6	-42.4
12025	-64.8	-21.6	-43.2
14430	-59.7	-21.6	-38.1
16835	-57.9	-21.6	-36.3
19240	-52.4	-21.6	-30.8
21645	-53.9	-21.6	-32.3
24050	-54.0	-21.6	-32.4

2440 MHz			
Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Margin (dB)
4880	-66.8	-21.6	-54.3
7320	-62.7	-21.6	-41.1
9760	-63.6	-21.6	-42.0
12200	-60.7	-21.6	-39.1
14640	-57.2	-21.6	-35.6
17080	-57.8	-21.6	-36.2
19520	-50.6	-21.6	-29.0
21960	-52.5	-21.6	-30.9
24400	-51.6	-21.6	-30.0

2475 MHz			
Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Margin (dB)
4950	-61.7	-21.6	-40.1
7425	-63.2	-21.6	-41.6
9900	-62.1	-21.6	-40.5
12375	-68.5	-21.6	-46.9
14850	-58.8	-21.6	-37.2
17325	-53.2	-21.6	-31.6
19800	-51.6	-21.6	-30.0
22275	-49.9	-21.6	-28.3
24750	-50.5	-21.6	-28.9







## RESULT

All emissions were below -19.7; therefore, the EUT complies with the requirement.

### 6.2.5.2 Radiated Emissions in the Restricted Bands of §15.205

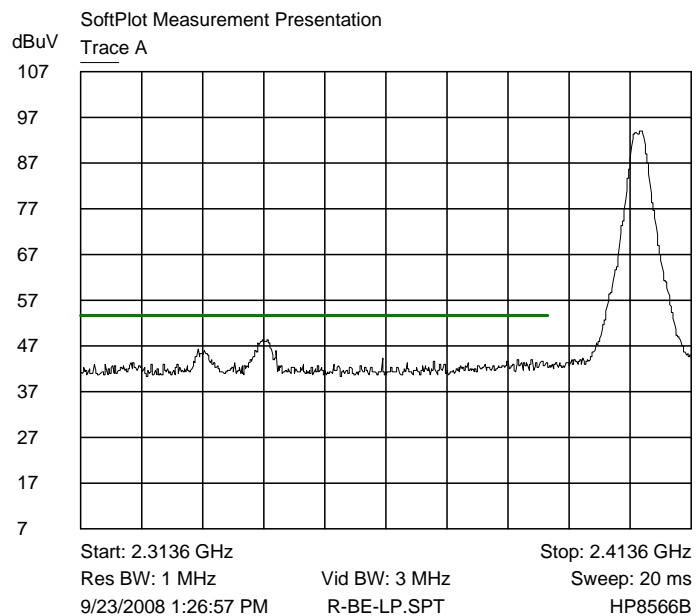
The radiated spurious emissions that fall in restricted bands, as specified in §15.205, must comply with the limits of §15.209. See the tables and plots below:

2405 MHz							
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4810	Peak	Vertical	21.2	36.0	57.2	74.0	-16.8
4810	Average	Vertical	13.3	36.0	49.3	54.0	-4.7
4810	Peak	Horizontal	20.3	36.0	56.3	74.0	-17.7
4810	Average	Horizontal	11.0	36.0	47.0	54.0	-7.0
7215	Peak	Vertical	19.6	40.3	59.9	74.0	-14.1
7215	Average	Vertical	8.3	40.3	48.6	54.0	-5.4
7215	Peak	Horizontal	18.1	40.3	58.4	74.0	-15.6
7215	Average	Horizontal	6.5	40.3	46.8	54.0	-7.2

2440 MHz							
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4880	Peak	Vertical	19.6	36.1	55.8	74.0	-18.2
4880	Average	Vertical	10.8	36.1	47.0	54.0	-7.0
4880	Peak	Horizontal	17.9	36.1	54.1	74.0	-19.9
4880	Average	Horizontal	9.4	36.1	45.6	54.0	-8.4
7320	Peak	Vertical	18.9	40.6	59.5	74.0	-14.5
7320	Average	Vertical	4.8	40.6	45.4	54.0	-8.6
7320	Peak	Horizontal	17.8	40.6	58.4	74.0	-15.6
7320	Average	Horizontal	3.9	40.6	44.5	54.0	-9.5

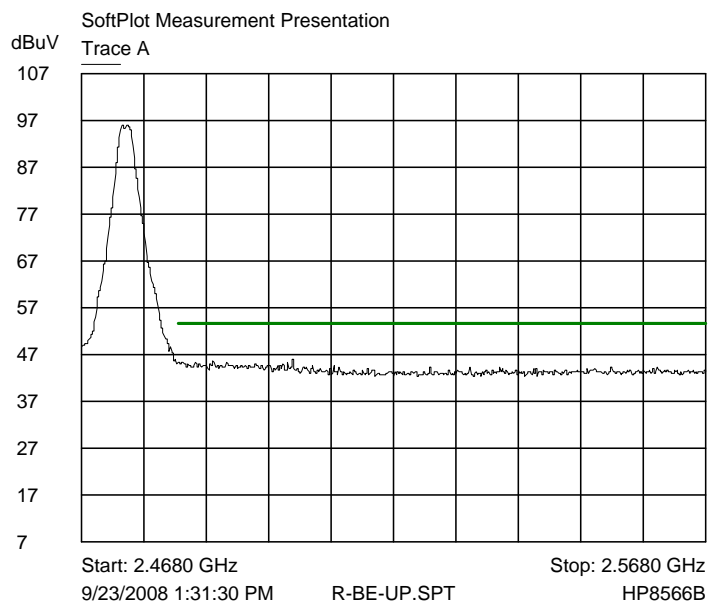
2475 MHz							
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4950	Peak	Vertical	20.2	36.3	56.5	74.0	-17.5
4950	Average	Vertical	13.5	36.3	49.8	54.0	-4.2
4950	Peak	Horizontal	18.6	36.3	54.9	74.0	-19.1
4950	Average	Horizontal	9.3	36.3	45.6	54.0	-8.4
7425	Peak	Vertical	17.7	40.8	58.5	74.0	-15.5
7425	Average	Vertical	5.6	40.8	46.4	54.0	-7.6
7425	Peak	Horizontal	18.1	40.8	59.0	74.0	-15.0
7425	Average	Horizontal	4.1	40.8	45.0	54.0	-9.0

No other emissions were seen in the restricted bands at a measurement distance of 1 meter. There was greater than 6 dB between the noise floor and the average limit.



Vertical

Trace A Peak detection corrected trace - lower band edge radiated



Vertical

Trace A Peak detection corrected trace - upper band edge radiated

**RESULT**

All radiated emissions in the restricted bands of §15.205 were below the specified limit.

**6.2.5.3 Sample Field Strength Calculation for Radiated Measurements:**

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:

$$FS = RA + CF \quad \text{Where}$$

FS = Field Strength

RA = Receiver Amplitude Reading (Receiver Reading - Amplifier Gain)

CF = Correction Factor (Antenna Factor + Cable Factor)

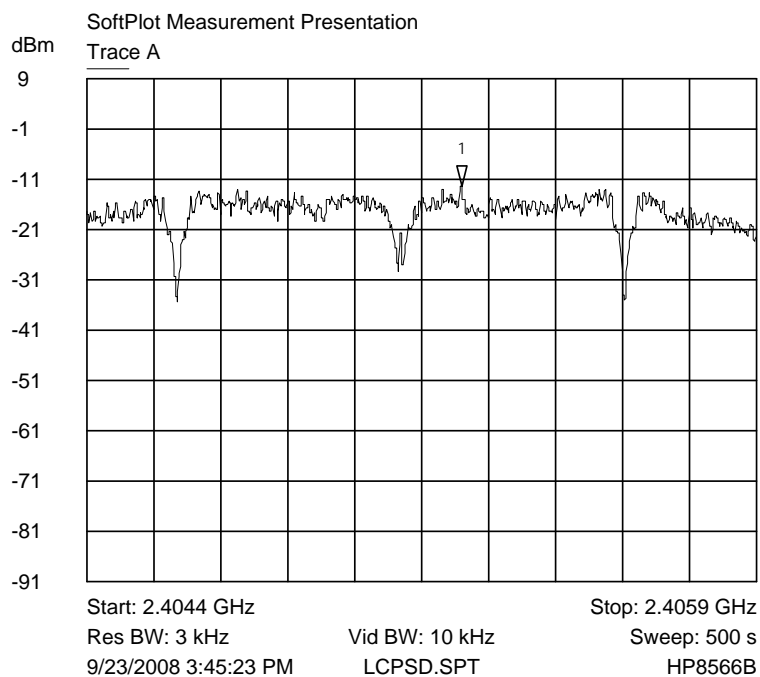
Assume a receiver reading of 42.5 dBμV is obtained from the receiver, an amplifier gain of 26.5 dB and a correction factor of 8.5 dB/m. The field strength is calculated by subtracting the amplifier gain and adding the correction factor, giving a field strength of 24.5 dBμV/m,  $FS = (42.5 - 26.5) + 8.5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

**6.2.6 §15.247(e) Peak Power Spectral Density**

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. The plots are shown below and the results of this testing are summarized in the table below.

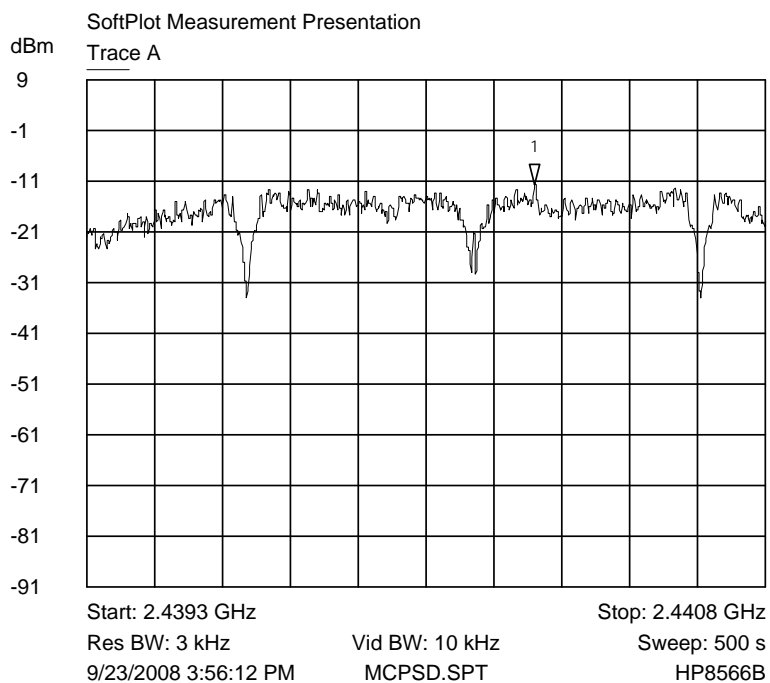
Frequency (MHz)	Measurement (dBm)	Criteria (dBm)	Margin (dBm)
2405.2	-12.4	8.0	-20.4
2440.2	-11.9	8.0	-19.9
2475.2	-11.3	8.0	-19.3

A diagram of the test setup is included in Appendix 1. The spectrum analyzer RBW was set to 3 kHz and the VBW set greater than the RBW. The span was set to 1.5 MHz and the sweep was set to 500 seconds (Sweep = (Span/3 kHz)).



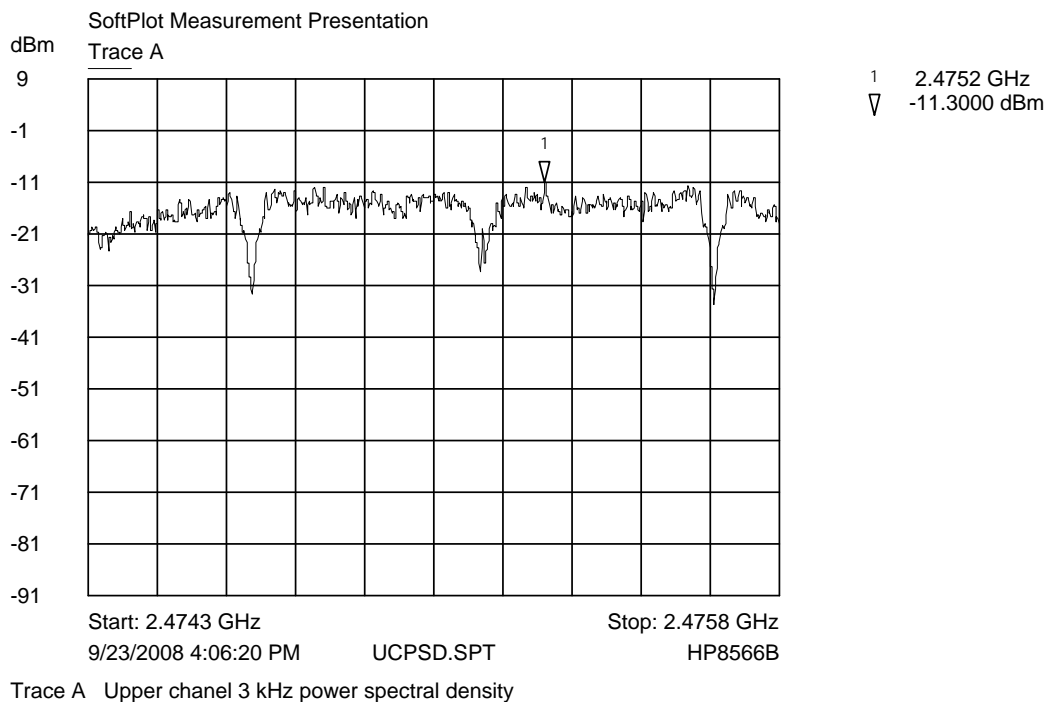
1 2.4052 GHz  
▽ -12.4000 dBm

Trace A low channel 3 kHz power spectral density



1 2.4402 GHz  
▽ -11.9000 dBm

Trace A middle channel 3 kHz power spectral density



## RESULT

The maximum 3 kHz peak power spectral density was -11.3 dBm. The limit is 8 dBm. The EUT complies with the specification by 19.3 dB.

### 6.2.7 §15.247(i) Exposure to RF Energy

MPE data and calculations are found in Exhibit 11 of the submittal files.

**APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT****A1.1 Radiated Emissions in Restricted Bands:**

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

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

The configuration of the EUT was varied to find the maximum radiated emission. The EUT was connected to the peripherals listed in Section 2.3 via the interconnecting cables listed in Section 2.4. A technician manually manipulated these interconnecting cables to obtain worst-case radiated disturbance. The EUT was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there 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 equipment is 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.

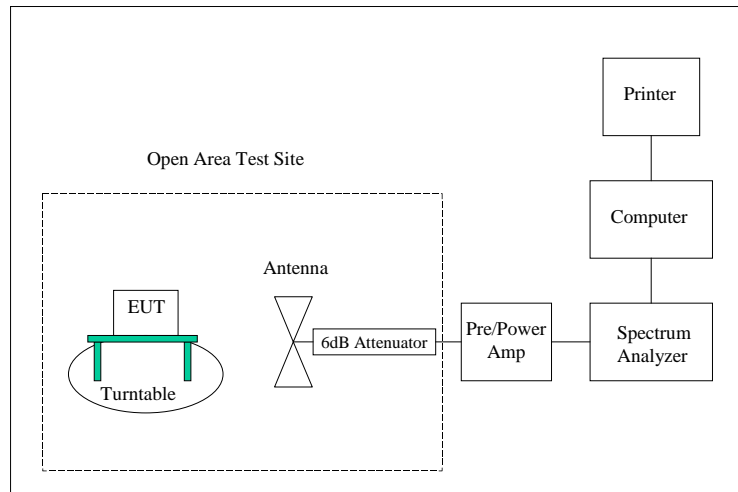
Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	CCL	N/A	N/A	10/24/2007
Test Software	CCL	Radiated Emissions	Revision 1.3	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2332A02726	04/29/2008

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00287	04/02/2008
Biconilog Antenna	EMCO	3142	9601-1009	10/10/2007
Double Ridged Guide Antenna	EMCO	3115	9604-4779	03/17/2008
Amplifier	Hewlett Packard	11975A	2738A2030	05/18/2006
Harmonic Mixer	Hewlett Packard	11970K	3003A05756	04/19/2006
High Frequency Amplifier	Miteq	AFS4-01001800-43-10P-4	1096455	05/29/2007
20' High Frequency Cable	Utiflex	UFA210A-1-2400-30050U	1175	04/01/2008
3 Meter Radiated Emissions Cable Wanship Site #2	CCL	Cable K	N/A	12/31/2007
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	08/28/2008
6 dB Attenuator	Hewlett Packard	8491A	32835	12/31/2007

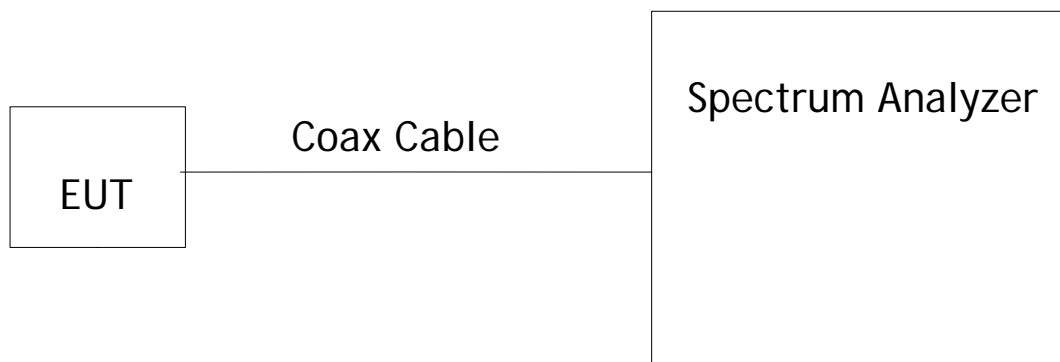
An independent calibration laboratory or CCL personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting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



Radiated Emissions Test Setup

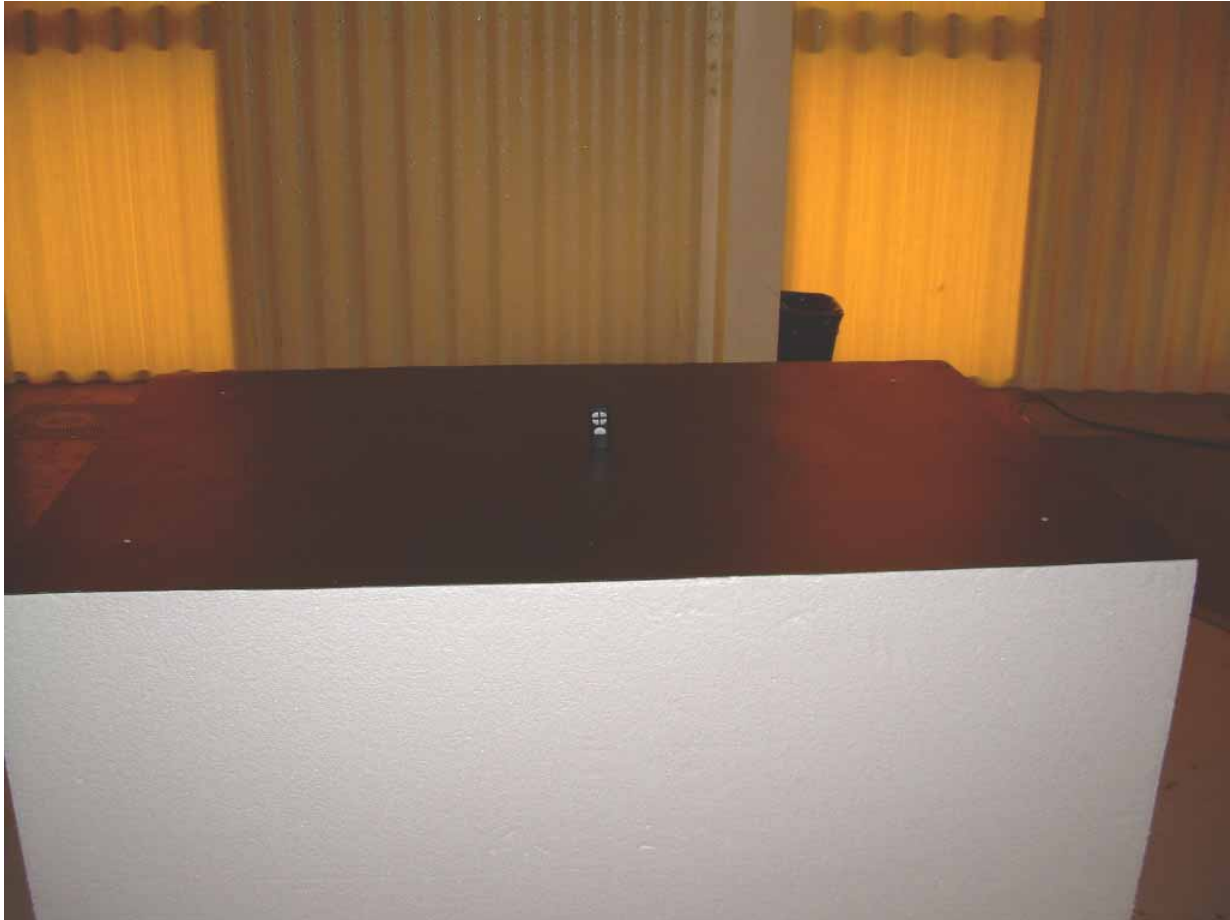
**A1.2 Measurements at the Antenna Port**

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Spectrum Analyzer	Hewlett Packard	8566B	2332A02726	04/29/2008
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00287	04/02/2008
Cable	CCL	Coax w/SMA	001175	04/01/2008
6 dB Attenuator	Hewlett Packard	8491A	32835	12/31/2007



**APPENDIX 2 PHOTOGRAPHS**

Photograph 1 - Front View Radiated Emissions in Restricted Bands Configuration



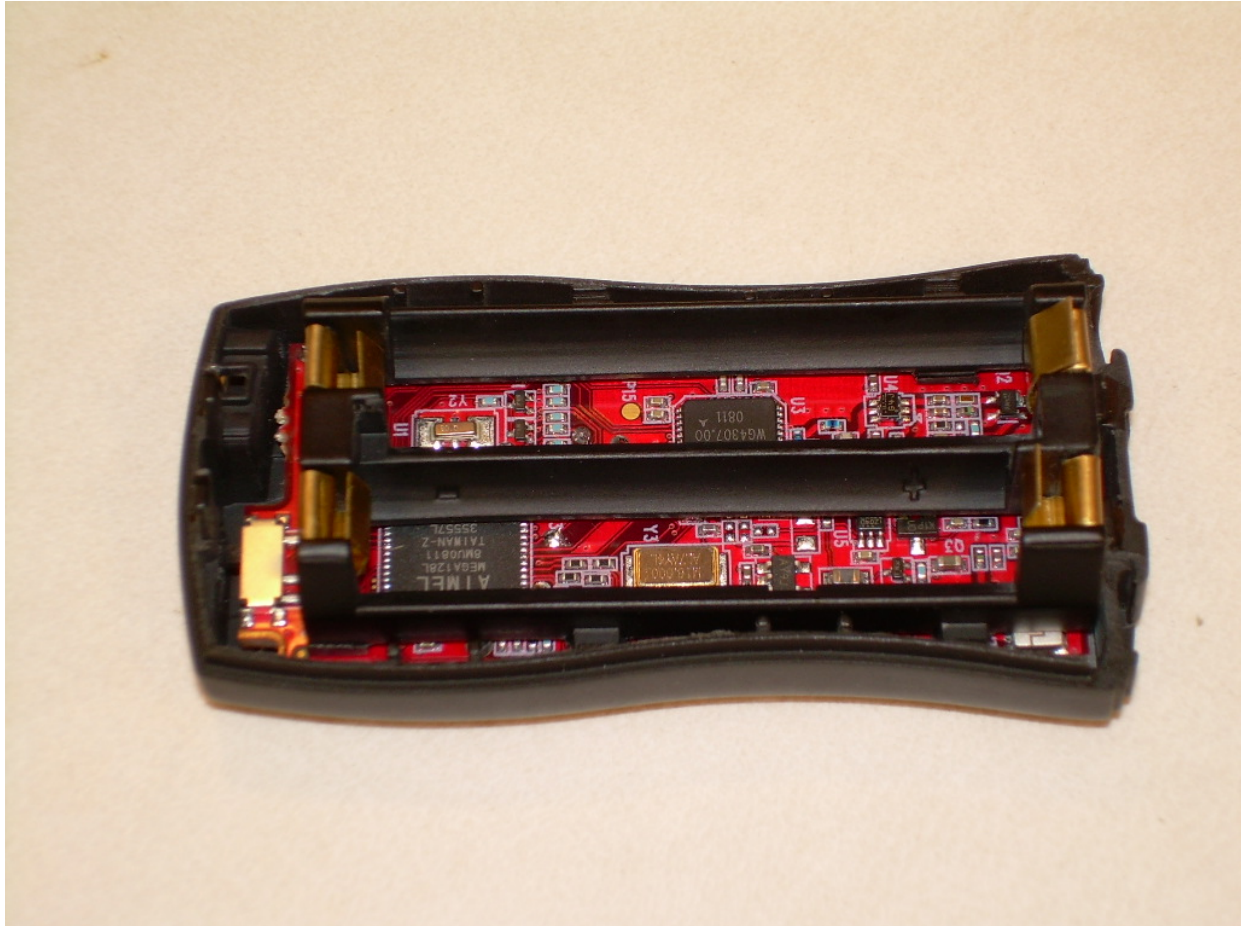
Photograph 2 - Front View of the EUT



Photograph 3 - Back View of the EUT

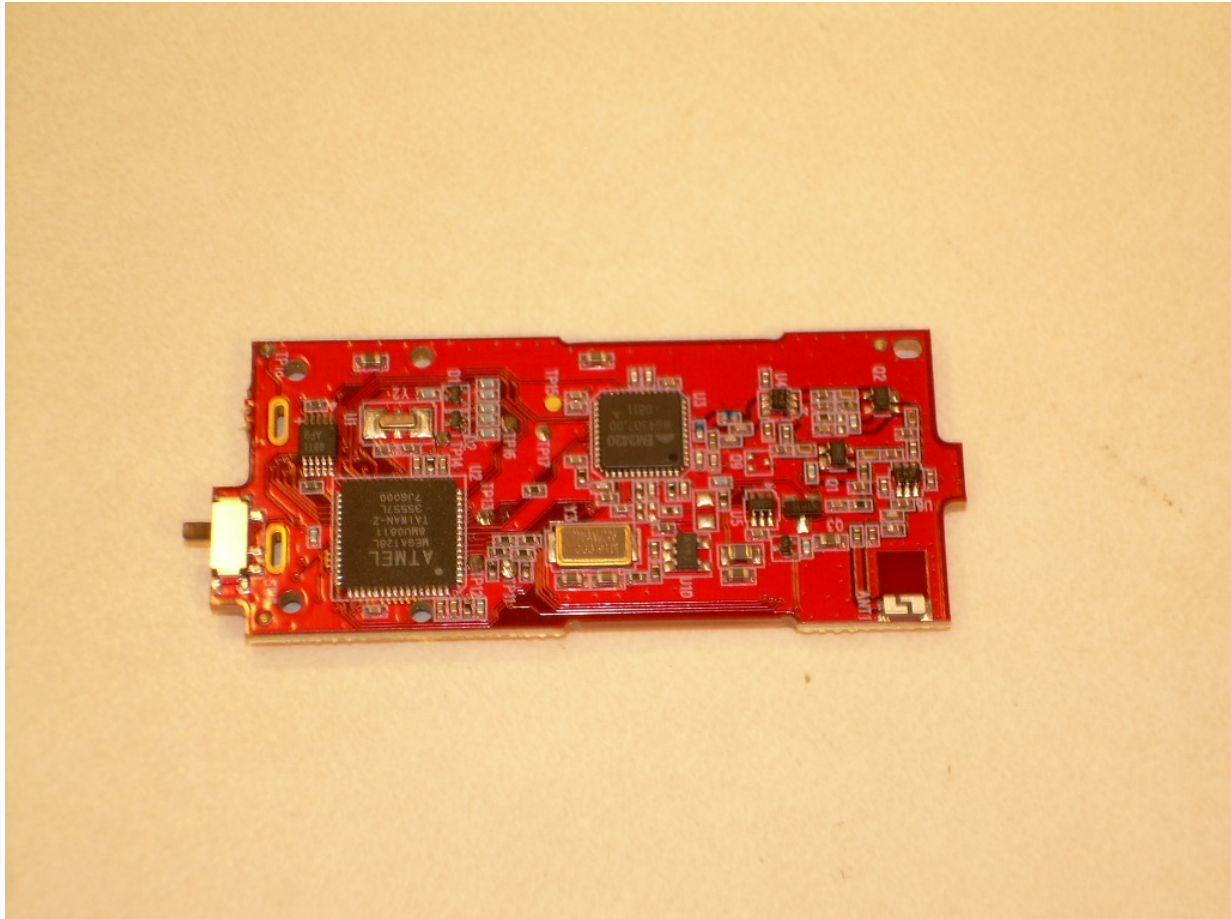


Photograph 4 - Internal View Front of the EUT





Photograph 5 - View of the Component Side of the PCB



Photograph 6 - View of the Trace Side of the PCB

