COMMUNICATION CERTIFICATION LABORATORY

1940 West Alexander Street
Salt Lake City, UT 84119
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Test Report

Type of Report: Certification

TEST OF: 050305 Wireless Numeric Control
&
050306 Wireless Numeric Receiver

FCC ID: P8G-50306

To FCC PART 15, Subpart C
(15.203, 15.207, 15.247)

Test Report Serial No: 73-8147

Applicant:

Cover Pools, Inc.
66 East 3335 South
Salt Lake City, UT 84115

Dates of Test: July 18 & 19, 2005

Issue Date: August 3, 2005

Equipment Receipt Date: July 18, 2005

Accredited Testing Laboratory By:

NVLAP®

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, Sections 15.203, 15.207, and 15.247. 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: Cover Pools, Inc.
- Manufacturer: Cover Pools, Inc.
- Brand Name: Cover Pools
- Model Number: 050305 Wireless Numeric Control
  050306 Wireless Numeric Receiver
- FCC ID Number: P8G-50306

On this 3rd day of August 2005, 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, 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

Norman P Hansen

Tested by: Norman P. Hansen
EMC Technician

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SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name: Cover Pools, Inc.
66 East 3335 South
Salt Lake City, UT 84115

Contact Name: LaMont Drechsel
Title: Director of Advanced Development

1.2 Manufacturer:

Company Name: Cover Pools, Inc.
66 East 3335 South
Salt Lake City, UT 84115

Contact Name: LaMont Drechsel
Title: Director of Advanced Development

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name:	Cover Pools, Inc.
Model Numbers:	050305 Wireless Numeric Control 050306 Wireless Numeric Receiver
Serial Number:	None
Options Fitted:	N/A
Country of Manufacture:	U.S.A.

2.2 Description of EUT:

The 050305 Wireless Numeric Control is a keypad transceiver operating in the 902 to 928 MHz band and is used to send commands to the 050306 Wireless Numeric Receiver. The 050306 Wireless Numeric Receiver is a transceiver that is located near the mechanical equipment that moves a cover to either uncover or cover a pool. Both units use the same transceiver board. The differences are that the 050305 fits an electrical outlet box and uses an antenna soldered directly to the PCB. The antenna is a 3.0″ stranded 26 gauge wire. The 050306 does not have the keypad and uses an external antenna. Three antennas were tested with the 050306; a dipole antenna, Cover Pools Part Number 110140 was the first, the second was an Antenna Factor Part Number ANT-916-CW-QW, and the third was an Antenna Factor Splatch Part Number ANT-916-SP. All antennas had a gain of less than 3 dBi.

The EUT operates from 3 AA batteries and has no provision for connection to the AC mains or a device connected to the AC mains.

The table below shows the channels the EUT operates on:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	903.00	9	909.00	17	915.00	25	921.00
2	903.75	10	909.75	18	915.75	26	921.75
3	904.50	11	910.50	19	916.50	27	922.50
4	905.25	12	911.25	20	917.25	28	923.25
5	906.00	13	912.00	21	918.00	29	924.00
6	906.75	14	912.75	22	918.75	30	924.75
7	907.50	15	913.50	23	919.50	31	925.50
8	908.25	16	914.25	24	920.25	32	926.25

2.3 EUT and Support Equipment:

The FCC ID numbers for all the EUT and support equipment used during the test (including inserted cards) are listed below:

Brand Name Model Number Serial No.	FCC ID Number	Description	Name of Interface Ports / Interface Cables
BN: Cover Pools MN: 050305 Wireless Numeric Control (Note 1)	P8G-50306	Keypad Transceiver Control Assembly	See Section 2.4
BN: Cover Pools MN: 050306 Wireless Numeric Receiver (Note 1)	P8G-50306	Transceiver Assembly	See Section 2.4
BN: Cover Pools MN: 110140	N/A	Dipole Antenna	Antenna/SMA connector on coax cable
BN: Antenna Factor MN: ANT-916-CW-QW	N/A	Monopole Antenna	Antenna/SMA connector on coax cable
BN: Antenna Factor MN: ANT-916-SP	N/A	Splatch Antenna	Antenna/SMA connector on coax cable

Note 1: EUT

2.4 Interface Ports on EUT:

The EUT has only the antenna interface port on the 050306 Wireless Numeric Receiver. The 050305 Wireless Numeric Keypad has no interface ports.

2.5 Modification Incorporated/Special Accessories on EUT:

There were no modifications or special accessories required to comply with the specification.

Signature: _____

Typed Name: LaMont Drechsel

Title: Director of Advanced Development

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 15.247

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 §15.247 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. 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 non-overlapping 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 which use fewer than 75 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 non-overlapping 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 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 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

(4) Except as shown in paragraphs (b)(4)(i), (ii), and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the peak 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.

(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 peak 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 peak output power.

(iii) Fixed, point-to-point operation, as used in paragraphs (b)(4)(i) and (b)(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.

(5) 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.

(c) 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. 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)).

(d) For digitally modulated systems, 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.

(e) [Reserved]

(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. 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.

3.2.3 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 August 11, 2003 (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, 2005.

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: 4.5 VDC from AA batteries

4.2 Operating Modes:

The transmitter was in a constant transmit mode at the desired frequency.

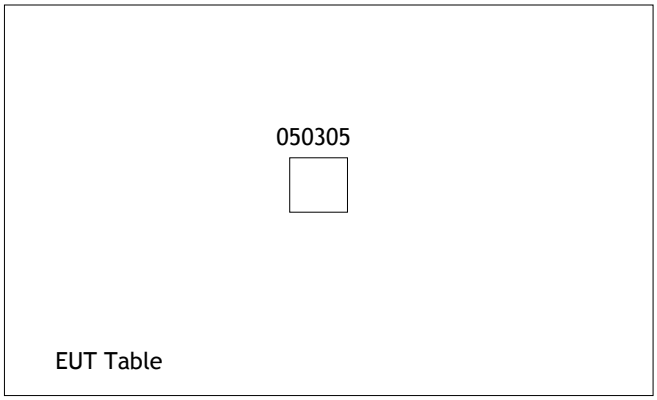
4.3 EUT Exercise Software:

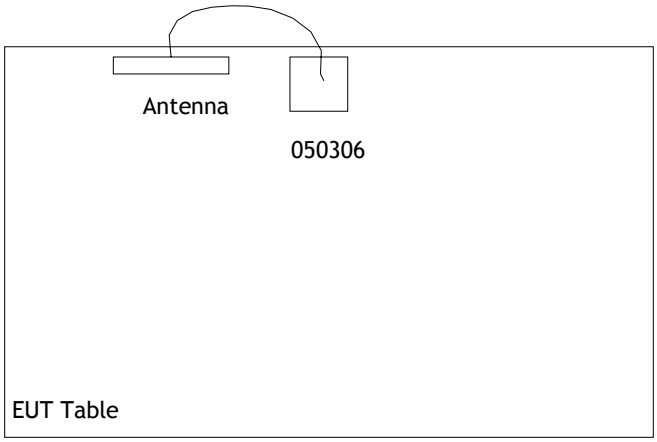
Internal firmware was used to exercise the EUT.

4.4 Configuration & Peripherals:

The 050305 Wireless Numeric Control & 050306 Wireless Numeric Receiver 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 (Note 1)
15.247(a)	Bandwidth Requirement	902 – 928	Complied
15.247(b)	Peak Output Power	902 – 928	Complied
15.247(c)	Antenna Conducted Spurious Emissions	30 - 9280	Complied
15.247(c)	Radiated Spurious Emissions	30 - 9280	Complied
15.247(d)	Peak Power Spectral Density	902 – 928	Complied
15.247(e)	Reserved Paragraph	N/A	Not Applicable
15.247(f)	Hybrid System Requirements	902 – 928	Not Applicable
15.247(g)	Frequency Hopping Channel Usage	902 – 928	Not Applicable
15.247(h)	Frequency Hopping Intelligence	902 – 928	Not Applicable
Note 1: The EUT has no provision for receiving power from the AC mains or a device connected to the AC mains; therefore, this test is 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 §15.203 Antenna Requirements

The EUT must be professionally installed. The transmit/keypad model has a whip antenna soldered directly to the PCB. The receive module uses an SMA connector. The three antennas specified for use with this device were tested. The type and model of the antennas are listed in Section 2.2 of this report.

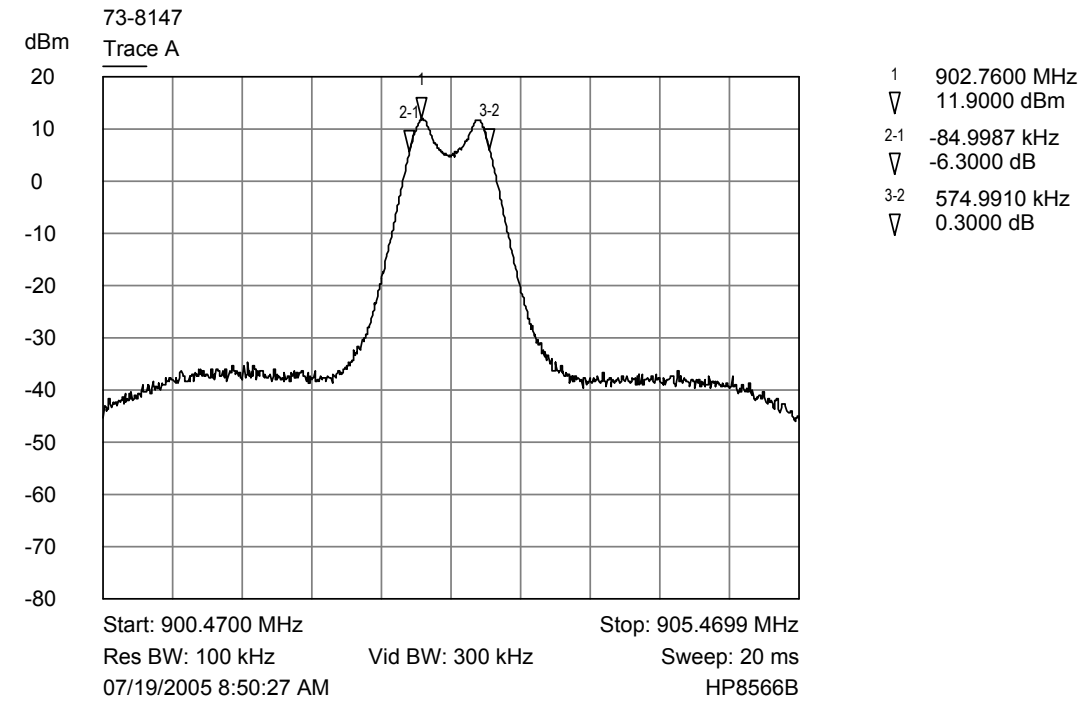
6.2.2 §15.247(a)(2) Emission Bandwidth

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

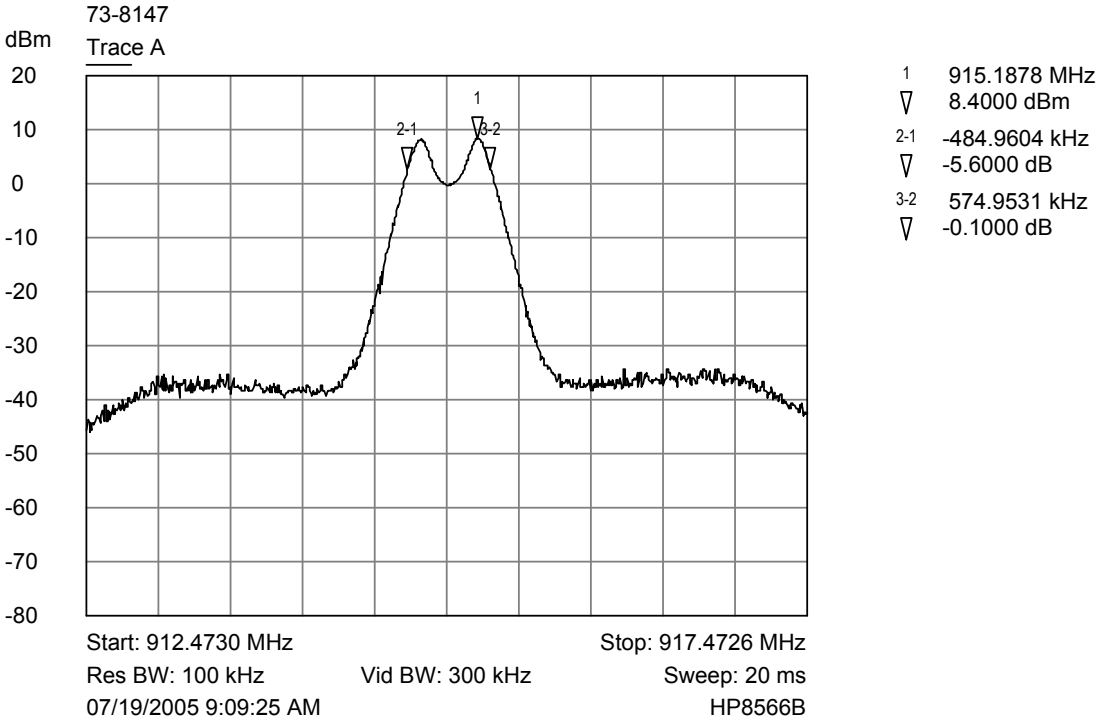
Frequency (MHz)	Emission 6dB Bandwidth (kHz)
903.00	575
915.00	575
926.25	570

RESULT

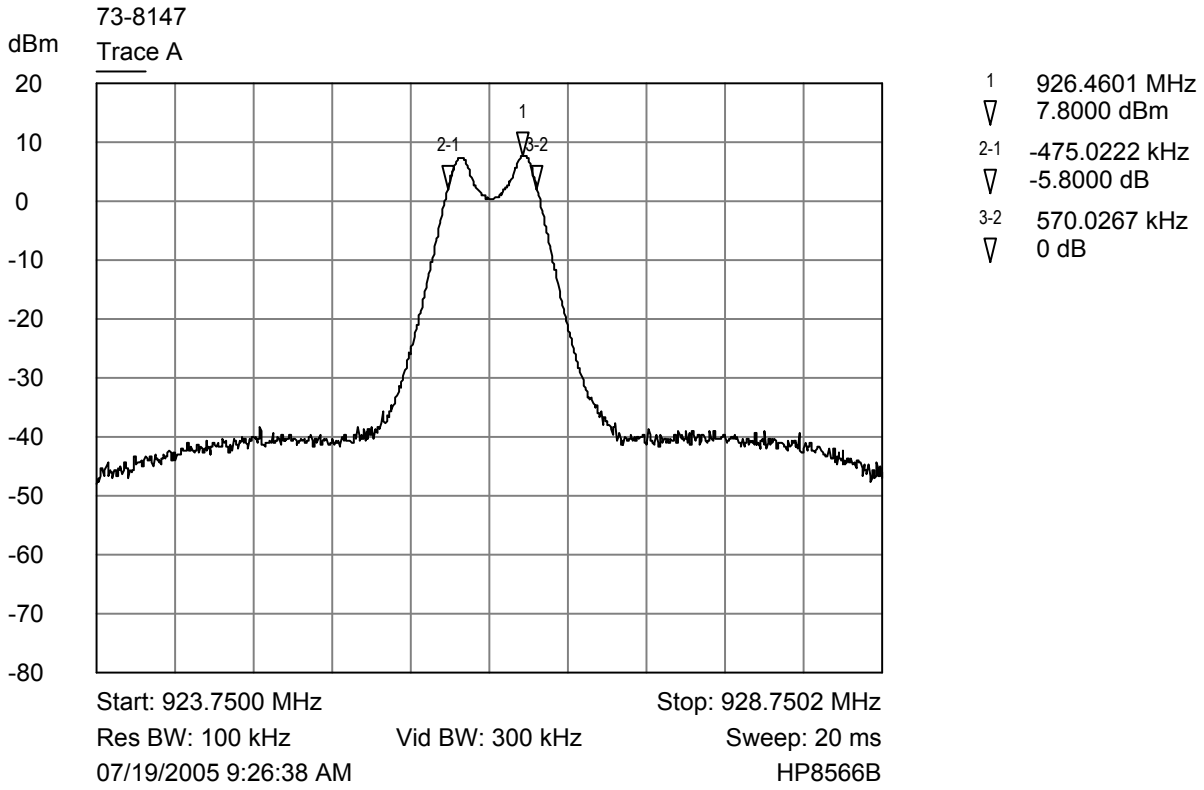
In the configuration tested, the 6 dB bandwidth was greater than 500 kHz; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plots below).



Trace A Lowest channel - bandwidth plot



Trace A Middle channel - bandwidth plot



Trace A Highest channel - bandwidth plot

6.2.3 §15.247(b)(3) Peak Output Power

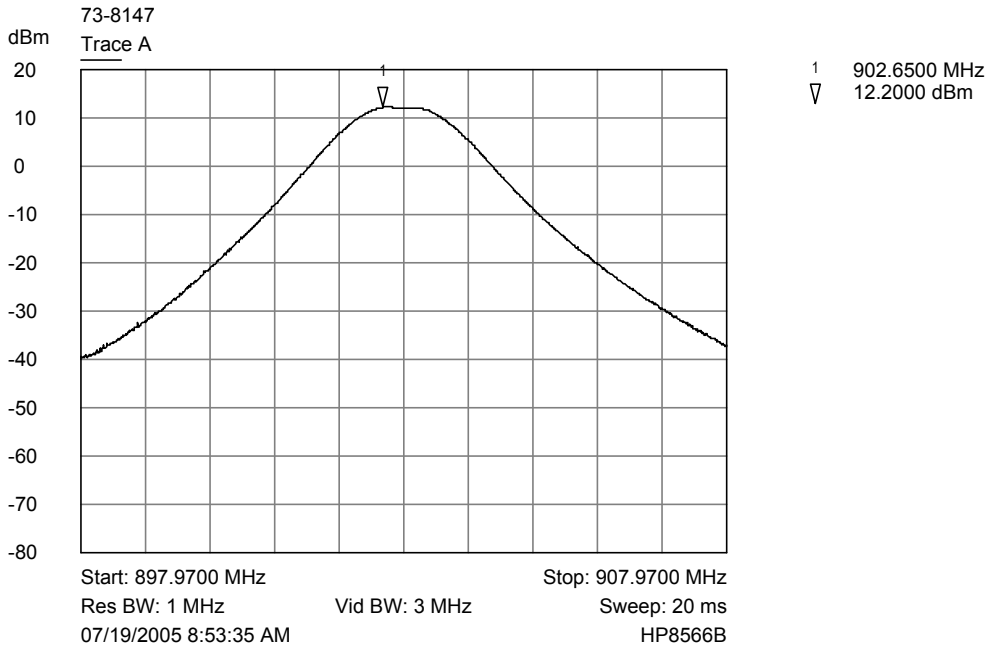
The maximum peak RF Conducted output power measured for this device was 16.6 mW or 12.2 dBm. The maximum directional gain of the antenna is less than 6 dBi; therefore, the maximum output power is not required to be reduced from the value measured.

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

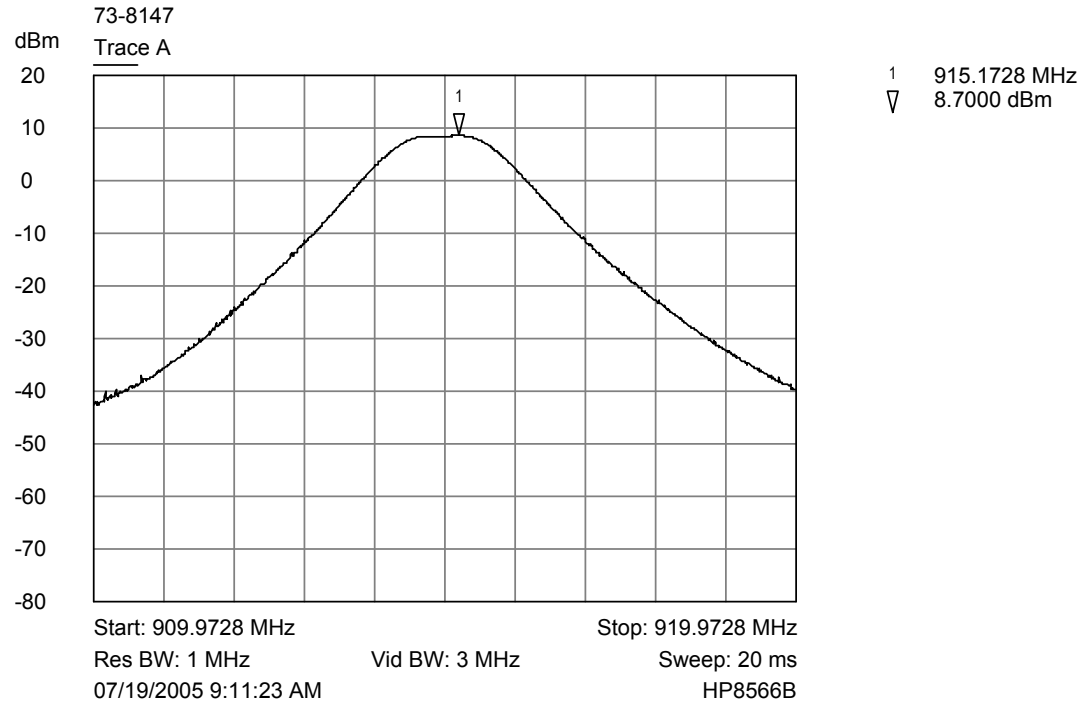
Frequency (MHz)	Measured Output Power (dBm)	Measured Output Power (mW)
903.00	12.2	16.6
915.00	8.7	7.4
926.25	8.1	6.5

RESULT

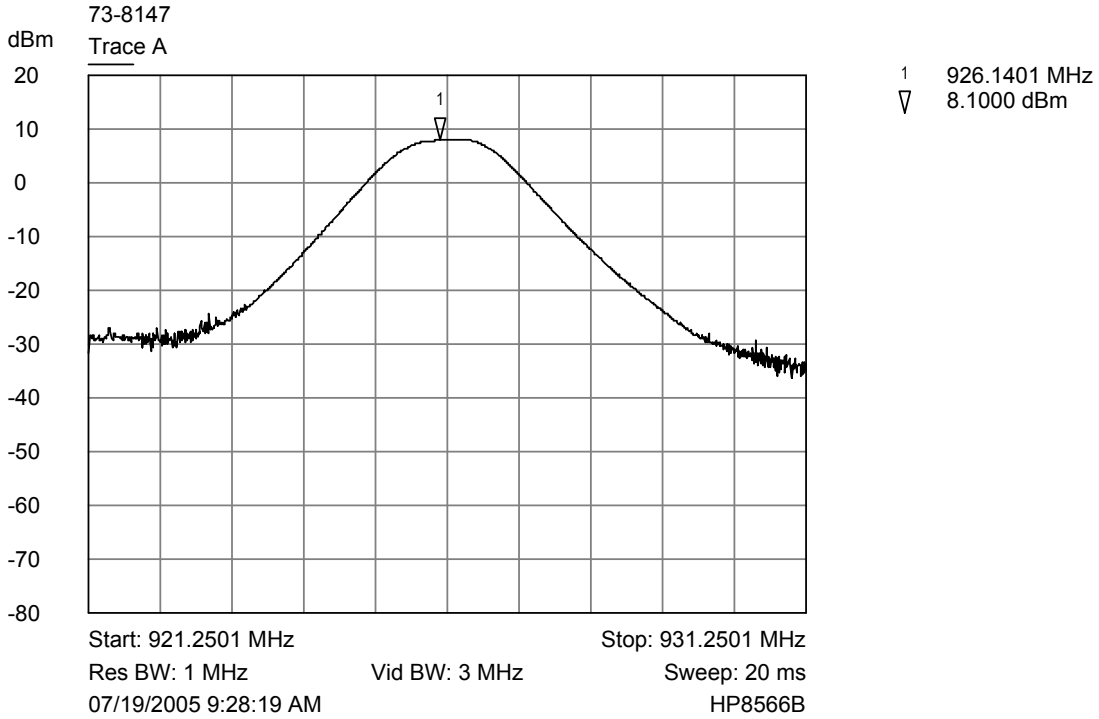
In the configuration tested, the RF peak output power was less than 1 Watt; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plots below).



Trace A Lowest channel - output power plot



Trace A Middle channel - output power plot



Trace A Highest channel - output power plot

6.2.4 §15.247(c) Spurious Emissions

6.2.4.1 Conducted Spurious Emissions

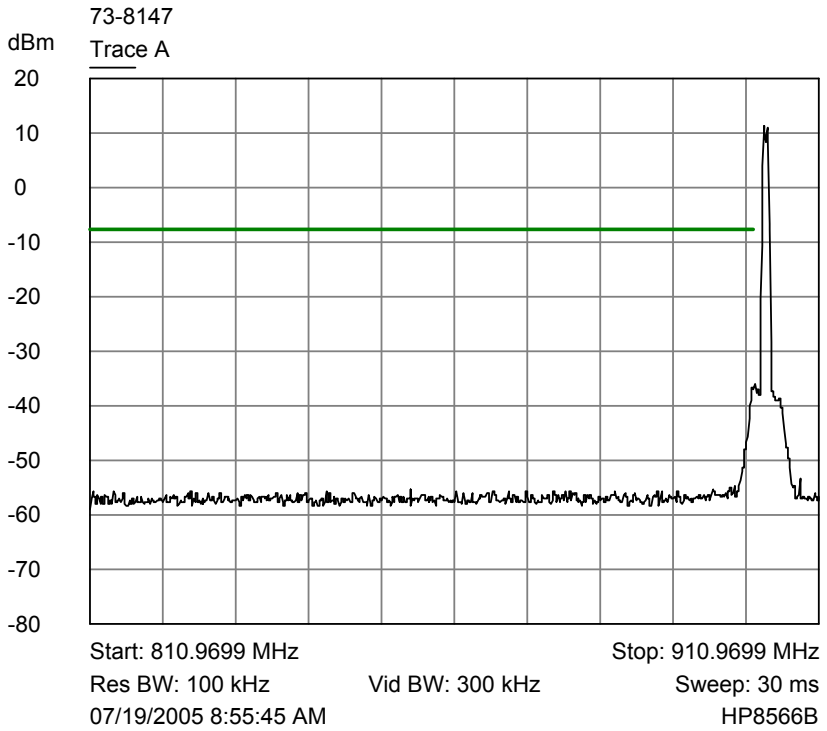
The frequency range from 10 MHz to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. Shown below are plots with the EUT tuned to the upper and lower channels. These demonstrate compliance with the provisions of this section at the band edges. The tables following the band edge plots shows the measurement data from spurious emissions noted across the frequency range when transmitting at the lowest frequency, middle frequency, and upper frequency.

The emissions must be attenuated 20 dB below the highest power level measured within the authorized band as measured with a 100 kHz RBW; the highest level measured with a 100 kHz RBW was 12.2 dBm therefore, the criteria is 12.2 – 20.0 = -7.8 dBm.

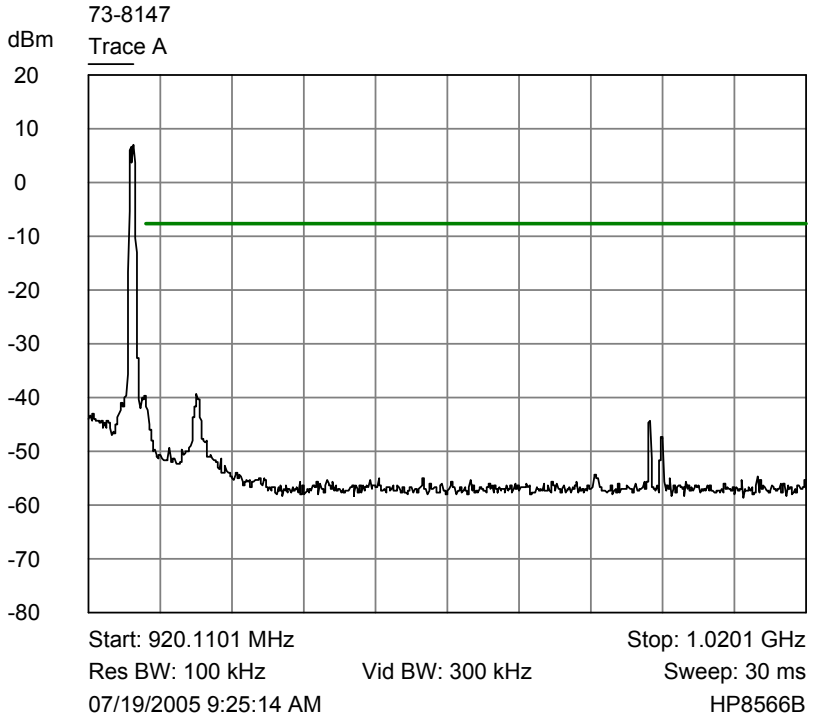
A diagram of the test configuration and the test equipment used is provided in Appendix 1.

RESULT

Spurious emissions must be attenuated below –7.8 dBm. The highest emission noted was at –24.7 dBm; therefore, the EUT complies with the specification by a margin of 16.9 dB.



Trace A Lowest channel - Conducted band edge plot



Trace A Highest channel - Conducted band edge plot

Transmitting on the Lowest Channel (903.00 MHz)

Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)	Margin (dB)
1805.30	-24.7	-7.8	-16.9
2707.95	-44.2	-7.8	-36.4
3610.60	-45.6	-7.8	-37.8
4513.25	-57.3	-7.8	-49.5
5415.90	-62.1	-7.8	-54.3
6318.55	-70.3	-7.8	-62.5
7221.20	-70.1	-7.8	-62.3
8123.85	-66.1	-7.8	-58.3
9026.50	-70.1	-7.8	-62.3

Transmitting on the Middle Channel (915.00 MHz)

Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)	Margin (dB)
1830.34	-28.7	-7.8	-20.9
2745.51	-61.2	-7.8	-53.4
3660.68	-41.5	-7.8	-33.7
4575.85	-60.3	-7.8	-52.5
5491.02	-64.9	-7.8	-57.1
6406.19	-64.5	-7.8	-56.7
7321.36	-67.3	-7.8	-59.5
8236.53	-66.0	-7.8	-58.2
9151.70	-69.3	-7.8	-61.5

Transmitting on the Highest Channel (926.25 MHz)

Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)	Margin (dB)
1852.28	-43.6	-7.8	-35.8
2778.42	-52.3	-7.8	-44.5
3704.56	-46.6	-7.8	-38.8
4630.70	-65.0	-7.8	-57.2
5556.84	-68.1	-7.8	-60.3
6482.98	-65.7	-7.8	-57.9
7409.12	-68.9	-7.8	-61.1
8335.26	-71.7	-7.8	-63.9
9261.40	-69.4	-7.8	-61.6

6.2.4.2 Radiated Emissions in the Restricted Bands of §15.205

The frequency range from 30 MHz to 25 GHz was investigated to measure any radiated emissions in the restricted bands. Shown below are plots with the EUT tuned to the upper and lower channels. These demonstrate compliance with the provisions of this section at the band edges. The tables following the plots show measurements of any emission that fell into the restricted bands of §15.205. The emissions in the restricted bands must meet the limits specified in §15.209.

A diagram of the test configuration and the test equipment used is enclosed in Appendix 1. For frequencies below 1000 MHz RBW = 100 kHz and VBW = 300 kHz, For frequencies above 1000 MHz RBW = 1 Mhz and VBW = 3 MHz. For average readings the VBW was reduced to 10 Hz.

AVERAGE FACTOR

The EUT does not use pulsed operation; therefore, there is not an average factor for this device.

RESULT

All emissions in the restricted bands of §15.205 met the limits specified in §15.209; therefore, the EUT complies with the specification.

The tables below show the worst-case radiated emissions seen during testing of the EUT using all configurations at the lower, middle, and upper channels.

Transmitting at the Lowest Frequency (903.00 MHz)

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2709.00	Peak	Vertical	31.1	30.7	61.8	74.0	-12.2
2709.00	Average	Vertical	21.3	30.7	52.0	54.0	-2.0
2709.00	Peak	Horizontal	32.3	30.7	63.0	74.0	-11.0
2709.00	Average	Horizontal	22.9	30.7	53.6	54.0	-0.4
3612.00	Peak	Vertical	26.5	33.3	59.8	74.0	-14.2
3612.00	Average	Vertical	15.8	33.3	49.1	54.0	-4.9

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
3612.00	Peak	Horizontal	25.0	33.3	58.3	74.0	-15.7
3612.00	Average	Horizontal	11.9	33.3	45.2	54.0	-8.8
4515.00	Peak	Vertical	25.9	34.4	59.0	74.0	-15.0
4515.00	Average	Vertical	15.0	34.4	48.5	54.0	-5.5
4515.00	Peak	Horizontal	28.1	34.4	62.5	74.0	-11.5
4515.00	Average	Horizontal	15.3	34.4	49.7	54.0	-4.3
8127.00	Peak	Vertical	3.3	40.3	43.6	74.0	-30.4
8127.00	Average	Vertical	-7.6	40.3	32.7	54.0	-21.3
8127.00	Peak	Horizontal	3.4	40.3	43.7	74.0	-30.3
8127.00	Average	Horizontal	-7.2	40.3	33.1	54.0	-20.9
9030.00	Peak	Vertical	1.6	41.8	43.4	74.0	-30.6
9030.00	Average	Vertical	-10.7	41.8	32.5	54.0	-21.5
9030.00	Peak	Horizontal	1.7	41.8	43.5	74.0	-30.5
9030.00	Average	Horizontal	-10.7	41.8	32.5	54.0	-21.5

Transmitting at the Middle Frequency (915.00 MHz)

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2745.00	Peak	Vertical	27.1	30.8	57.9	74.0	-16.1
2745.00	Average	Vertical	17.6	30.8	48.4	54.0	-5.6
2745.00	Peak	Horizontal	29.0	30.8	59.8	74.0	-14.2
2745.00	Average	Horizontal	18.4	30.8	49.2	54.0	-4.8
3660.00	Peak	Vertical	27.0	33.5	60.5	74.0	-13.5
3660.00	Average	Vertical	16.1	33.5	49.6	54.0	-4.4
3660.00	Peak	Horizontal	28.4	33.5	61.9	74.0	-12.1
3660.00	Average	Horizontal	18.1	33.5	51.6	54.0	-2.4
4575.00	Peak	Vertical	26.9	34.6	61.5	74.0	-12.5
4575.00	Average	Vertical	15.1	34.6	49.7	54.0	-4.3
4575.00	Peak	Horizontal	26.4	34.6	61.0	74.0	-13.0
4575.00	Average	Horizontal	15.4	34.6	50.0	54.0	-4.0
7320.00	Peak	Vertical	4.7	39.0	43.7	74.0	-30.3
7320.00	Average	Vertical	-7.7	39.0	31.3	54.0	-22.7

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
7320.00	Peak	Horizontal	4.4	39.0	43.4	74.0	-30.6
7320.00	Average	Horizontal	-7.0	39.0	32.0	54.0	-22.0
8235.00	Peak	Vertical	3.3	40.3	43.6	74.0	-30.4
8235.00	Average	Vertical	-7.6	40.3	32.7	54.0	-21.3
8235.00	Peak	Horizontal	3.4	40.3	43.7	74.0	-30.3
8235.00	Average	Horizontal	-7.2	40.3	33.1	54.0	-20.9
9150.00	Peak	Vertical	1.6	41.8	43.4	74.0	-30.6
9150.00	Average	Vertical	-10.7	41.8	32.5	54.0	-21.5
9150.00	Peak	Horizontal	1.7	41.8	43.5	74.0	-30.5
9150.00	Average	Horizontal	-10.7	41.8	32.5	54.0	-21.5

Transmitting at the Highest Frequency (926.25 MHz)

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2778.75	Peak	Vertical	30.9	31.0	61.9	74.0	-12.1
2778.75	Average	Vertical	21.8	31.0	52.8	54.0	-1.2
2778.75	Peak	Horizontal	31.0	31.0	62.0	74.0	-12.0
2778.75	Average	Horizontal	21.8	31.0	52.8	54.0	-1.2
3705.00	Peak	Vertical	26.7	33.6	60.3	74.0	-13.7
3705.00	Average	Vertical	17.0	33.6	50.6	54.0	-3.4
3705.00	Peak	Horizontal	26.9	33.6	60.5	74.0	-13.5
3705.00	Average	Horizontal	15.6	33.6	49.2	54.0	-4.8
4631.25	Peak	Vertical	26.4	34.8	61.2	74.0	-12.8
4631.25	Average	Vertical	14.7	34.8	49.5	54.0	-4.5
4631.25	Peak	Horizontal	25.8	34.8	60.6	74.0	-13.4
4631.25	Average	Horizontal	14.8	34.8	49.6	54.0	-4.4
7410.00	Peak	Vertical	-7.7	39.0	31.3	54.0	-22.7
7410.00	Average	Vertical	4.4	39.0	43.4	74.0	-30.6
7410.00	Peak	Horizontal	-7.0	39.0	32.0	54.0	-22.0
7410.00	Average	Horizontal	3.3	40.3	43.6	74.0	-30.4
8336.25	Peak	Vertical	-7.6	40.3	32.7	54.0	-21.3
8336.25	Average	Vertical	3.4	40.3	43.7	74.0	-30.3

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
8336.25	Peak	Horizontal	-7.2	40.3	33.1	54.0	-20.9
8336.25	Average	Horizontal	-7.7	39.0	31.3	54.0	-22.7

6.2.5 §15.247(d) Peak Power Spectral Density

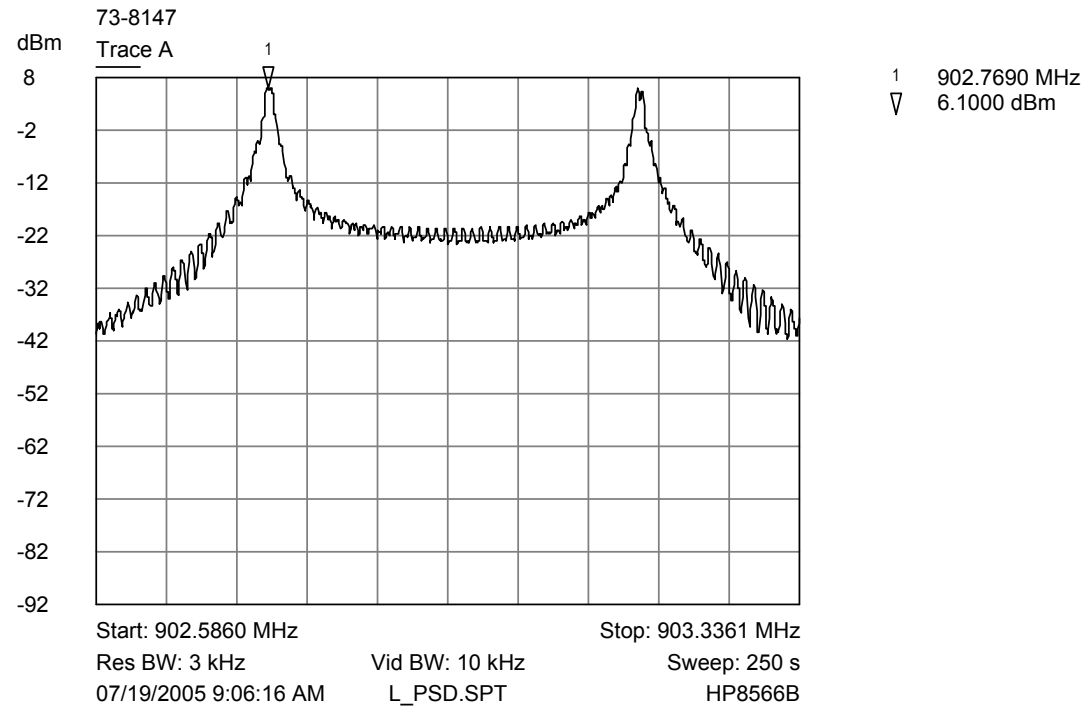
The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. The plots are shown below and the results of this testing is summarized in the table below.

Frequency (MHz)	Measurement (dBm)	Criteria (dBm)	Margin (dBm)
903.00	6.1	8.0	-1.9
915.00	3.2	8.0	-4.8
926.25	2.2	8.0	-5.8

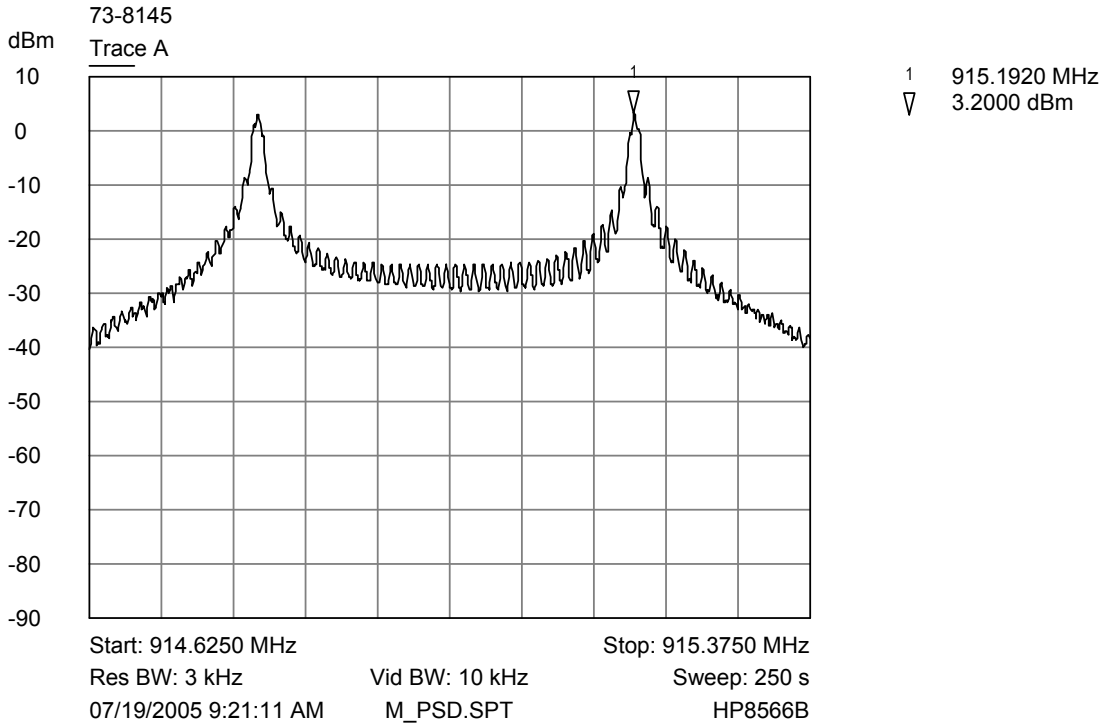
A diagram of the test setup is included in Appendix 1. The spectrum analyzer RBW was set to 3 kHz and the VBW set greater than the RBW. The span was set to 0.750 MHz and the sweep was set to 250 seconds **(**sweep = (Span/3 kHz)**)**.

RESULT

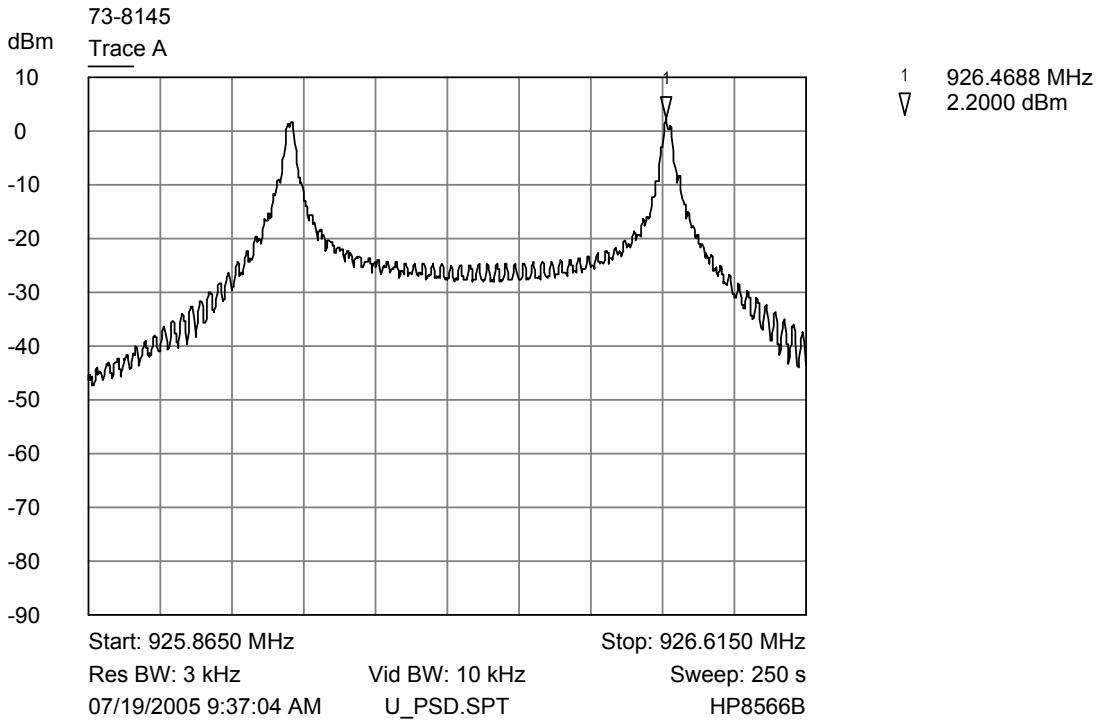
The maximum peak power spectral density was 6.1 dBm. The limit is 8 dBm. The EUT complies with the specification by 1.9 dBm.



Trace A Lowest channel - 3 kHz power spectral density plot



Trace A Middle channel - 3 kHz power spectral density plot



Trace A Highest channel - 3 kHz power spectral density plot

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

§15.247(a)(2) Emission Bandwidth

The EUT was directly connected to the spectrum analyzer via the antenna output port as shown in the block diagram below.

The measurements were performed on three channels, as per 47 CFR 15.31(m), one near the bottom of the spectrum, one near the middle of the spectrum and one near the top of the spectrum.

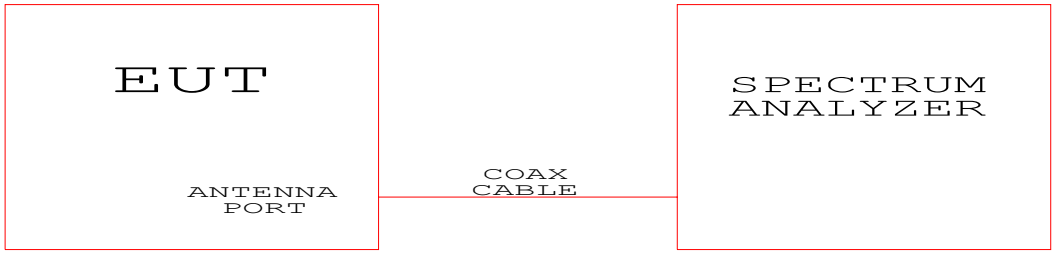
The spectrum analyzer's resolution bandwidth and video bandwidth were set as follows:

RBW = 100 kHz
VBW = 300 kHz

Type of Equipment	Manufacturer	Model Number	Serial Number
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711
Quasi-Peak Detector	Hewlett Packard	85650A	3107A01582
Low Loss Cable (1 dB)	N/A	N/A	N/A

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.

Test Configuration Block Diagram



§15.247(b)(3) Peak Output Power

The EUT was directly connected to the spectrum analyzer via the antenna output port as shown in the block diagram below.

The measurements were performed on three channels, as per 47 CFR 15.31(m), one near the bottom of the spectrum, one near the middle of the spectrum and one near the top of the spectrum.

The spectrum analyzer's resolution bandwidth and video bandwidth were set as follows:

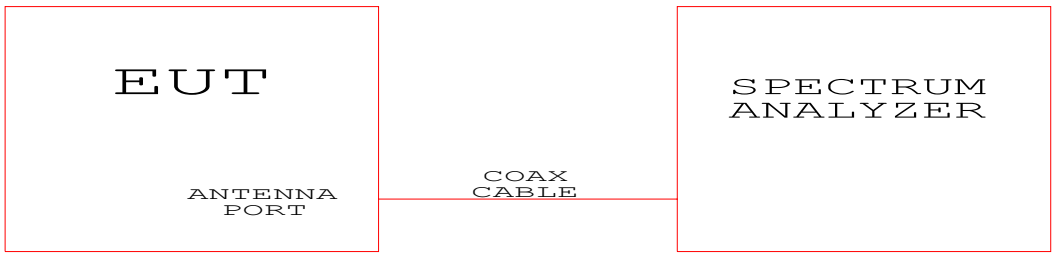
RBW = 1 MHz

VBW = 3 MHz

Type of Equipment	Manufacturer	Model Number	Serial Number
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711
Quasi-Peak Detector	Hewlett Packard	85650A	3107A01582
Low Loss Cable (1 dB)	N/A	N/A	N/A

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.

Test Configuration Block Diagram



§15.247(c) Conducted Spurious Emissions

The EUT was directly connected to the spectrum analyzer via the antenna output port as shown in the block diagram below.

The measurements were performed on three channels, as per 47 CFR 15.31(m), one near the bottom of the spectrum, one near the middle of the spectrum and one near the top of the spectrum.

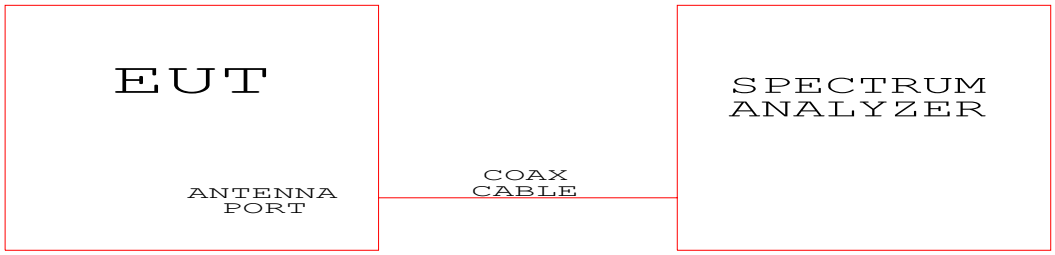
The spectrum analyzer's resolution bandwidth and video bandwidth were set as follows:

RBW = 100 kHz
VBW = 300 kHz

Type of Equipment	Manufacturer	Model Number	Serial Number
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711
Quasi-Peak Detector	Hewlett Packard	85650A	3107A01582
Low Loss Cable (1 dB)	N/A	N/A	N/A

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.

Test Configuration Block Diagram



§15.247(c) Radiated Spurious Emissions in the Restricted Bands

The radiated emissions from the intentional radiator were measured using a spectrum analyzer with a quasi-peak adapter for peak and quasi-peak readings. An amplifier and preamplifier were used to increase the sensitivity of the measuring instrumentation. The quasi-peak adapter uses a bandwidth of 120 kHz, with the spectrum analyzer's resolution bandwidth set at 1 MHz, for readings in the 30 to 1000 MHz frequency ranges. For peak emissions above 1000 MHz the spectrum analyzer’s resolution bandwidth was set to 1 MHz and the video bandwidth was set to 3 MHz. For average emissions above 1000 MHz the spectrum analyzer’s resolution bandwidth was set to 1 MHz and the video bandwidth was set to 10 Hz.

A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz and a Double Ridge Guide Horn antenna was used to measure the frequency range of 1 GHz to 18 GHz, and a Pyramidal Horn antenna was used to measure the frequency range of 18 GHz to 25 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.

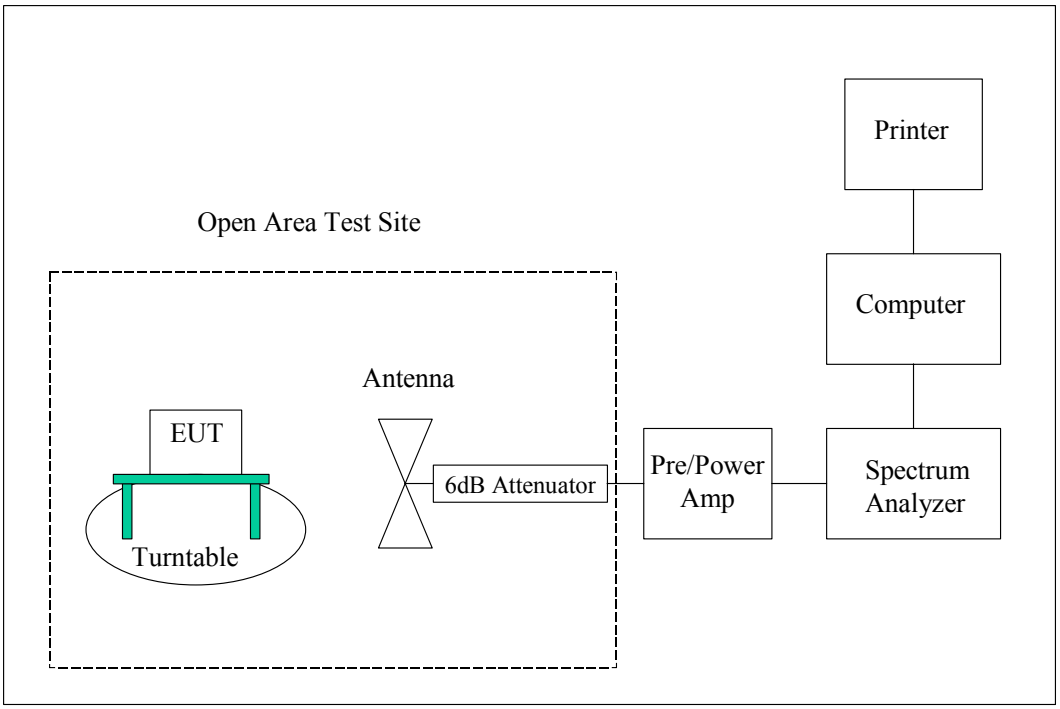
The configuration of the intentional radiator was varied to find the maximum radiated emission. The intentional radiator was connected to the peripherals listed in Section 2.4 via the interconnecting cables listed in Section 2.5. These interconnecting cables were manipulated manually by a technician to obtain worst case radiated emissions. 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 radiators are measured on a non-conducting table 80 centimeters above the ground plane. The table is placed on a turntable which is level with the ground plane. The turntable has slip rings, which supply AC power to the intentional radiator. 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	10/25/2004
Test Software	CCL	Radiated Emissions	Revision 1.3	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	10/11/2004
Quasi-Peak Detector	Hewlett Packard	85650A	3107A01582	10/11/2004
Biconilog Antenna	EMCO	3142	9601-1009	12/28/2004
Double Ridged Guide Antenna	EMCO	3115	9604-4779	05/26/2005
High Frequency Amplifier	Hewlett Packard	8449B	3008A00990	05/25/2005
3 Meter Radiated Emissions Cable Wanship Site #2	CCL	Cable K	N/A	12/09/2004
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	09/15/2004
6 dB Attenuator	Hewlett Packard	8491A	32835	12/09/2004

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



§15.247(d) Peak Power Spectral Density

The EUT was directly connected to the spectrum analyzer via the antenna output port as shown in the block diagram below.

The measurements were performed on three channels, as per 47 CFR 15.31(m), one near the bottom of the spectrum, one near the middle of the spectrum and one near the top of the spectrum.

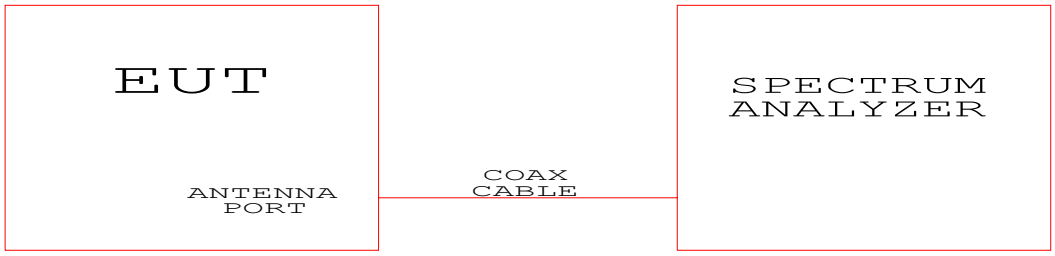
The spectrum analyzer's resolution bandwidth and video bandwidth were set as follows:

RBW = 3 kHz
VBW = 10 kHz

Type of Equipment	Manufacturer	Model Number	Serial Number
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711
Quasi-Peak Detector	Hewlett Packard	85650A	3107A01582
Low Loss Cable (1 dB)	N/A	N/A	N/A

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.

Test Configuration Block Diagram



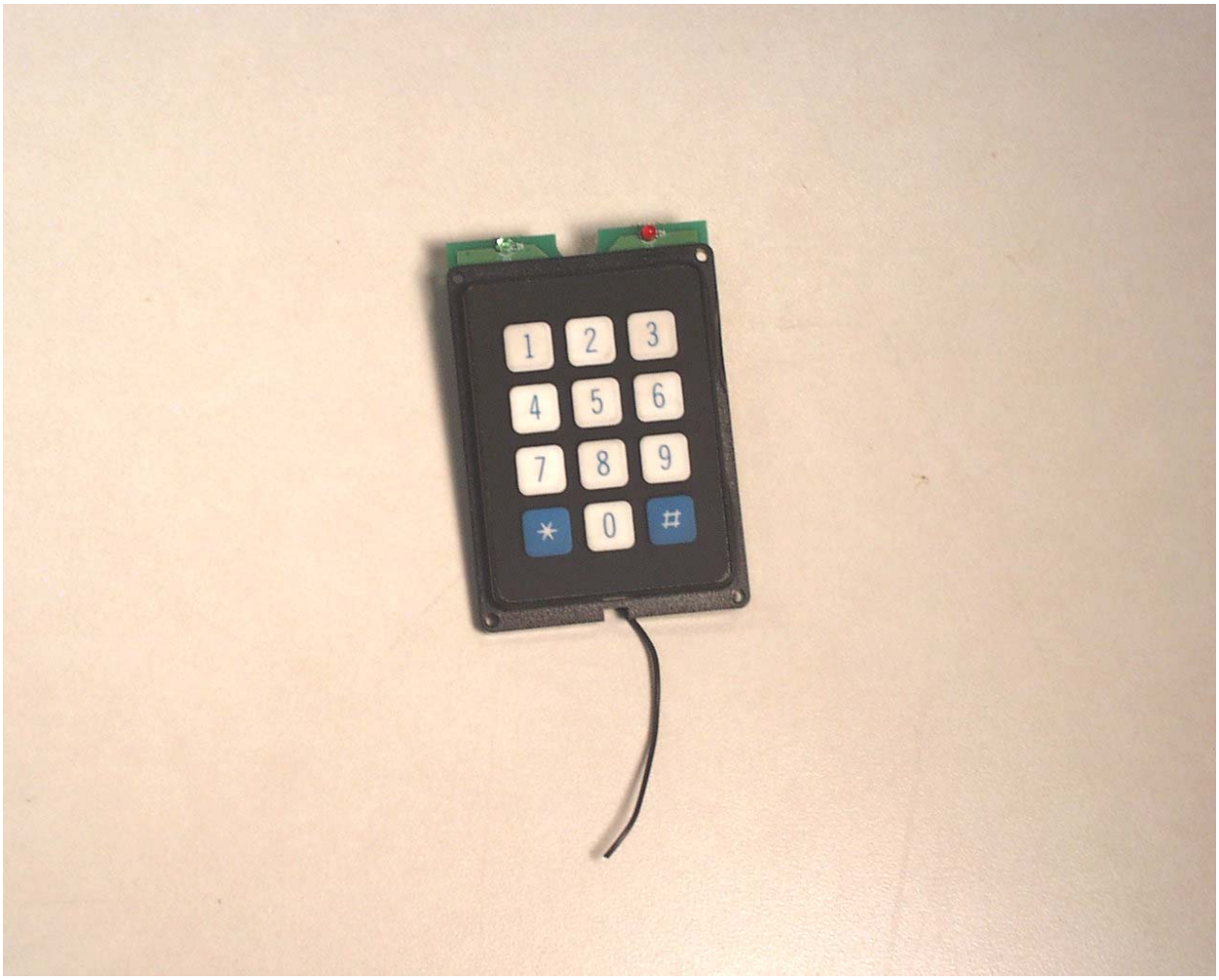
APPENDIX 2 PHOTOGRAPHS

Photograph 1 –Radiated Spurious Emission Configuration
(050305 Wireless Numeric Controller)

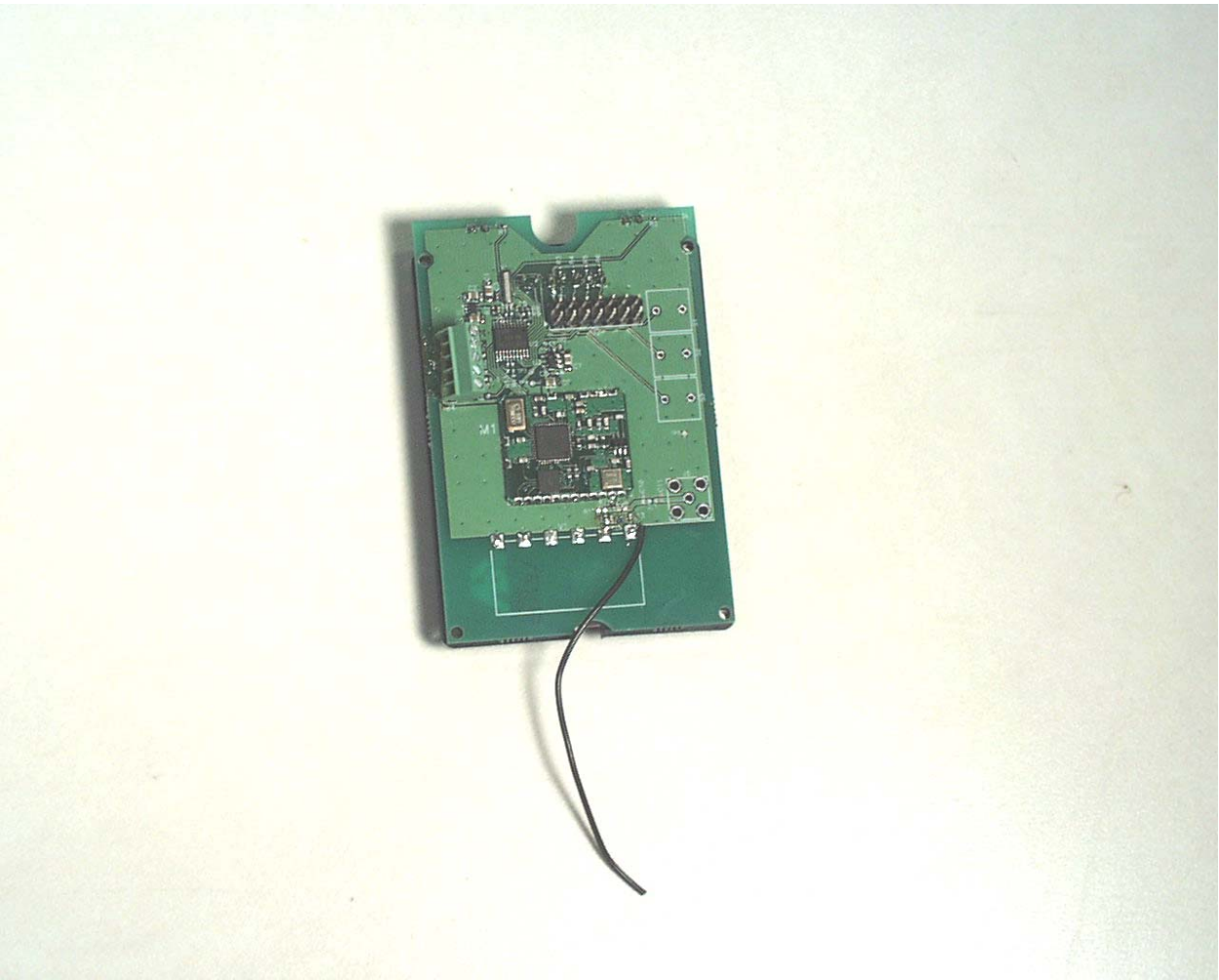
Photograph 2 - Radiated Spurious Emission Configuration
(050305 Wireless Numeric Receiver w/Splatch Antenna)

Photograph 3 – Radiated Spurious Emission Configuration
(050305 Wireless Numeric Receiver w/Monopole Antenna)

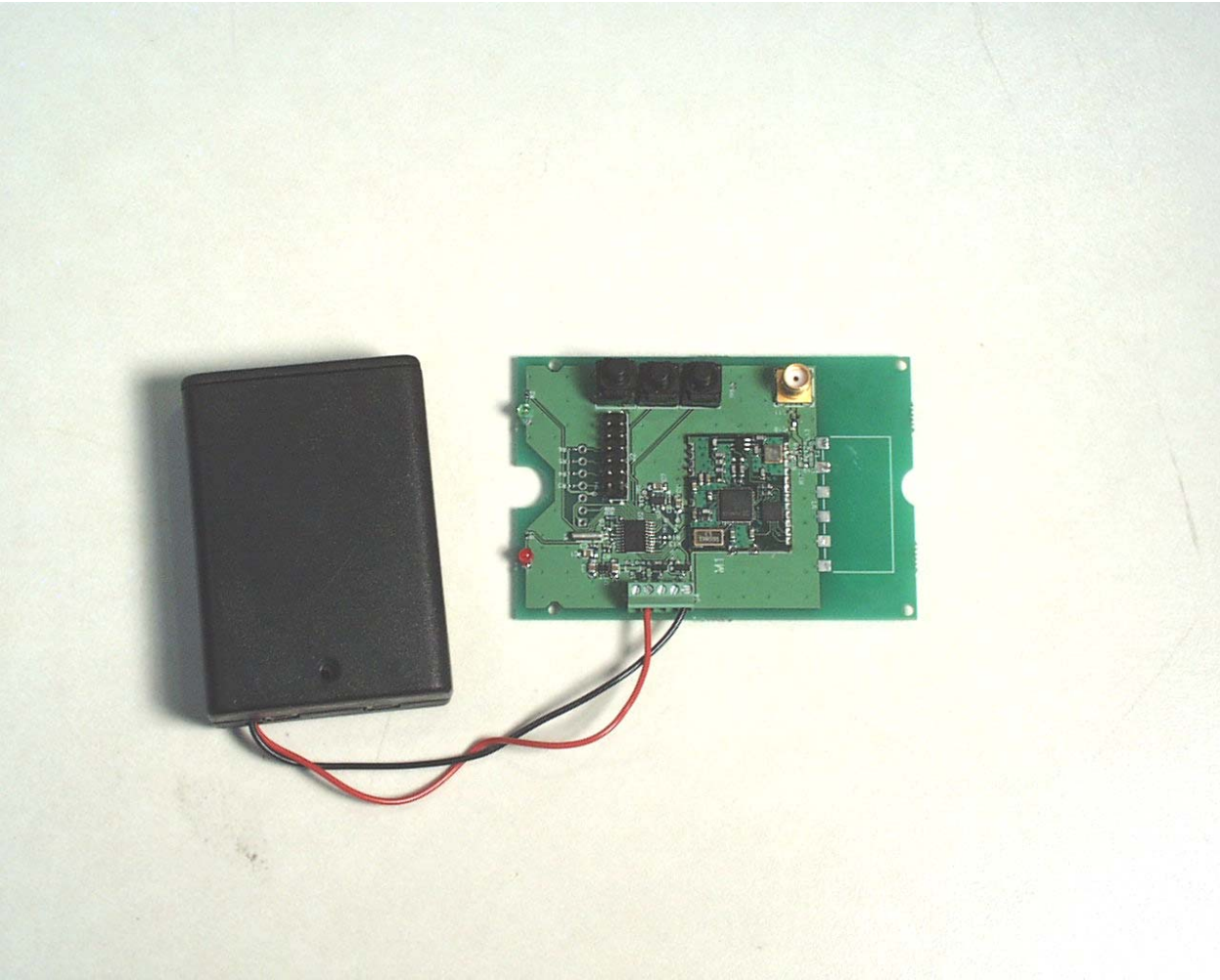
Photograph 4 – Front View of the 050305 Wireless Numeric Keypad



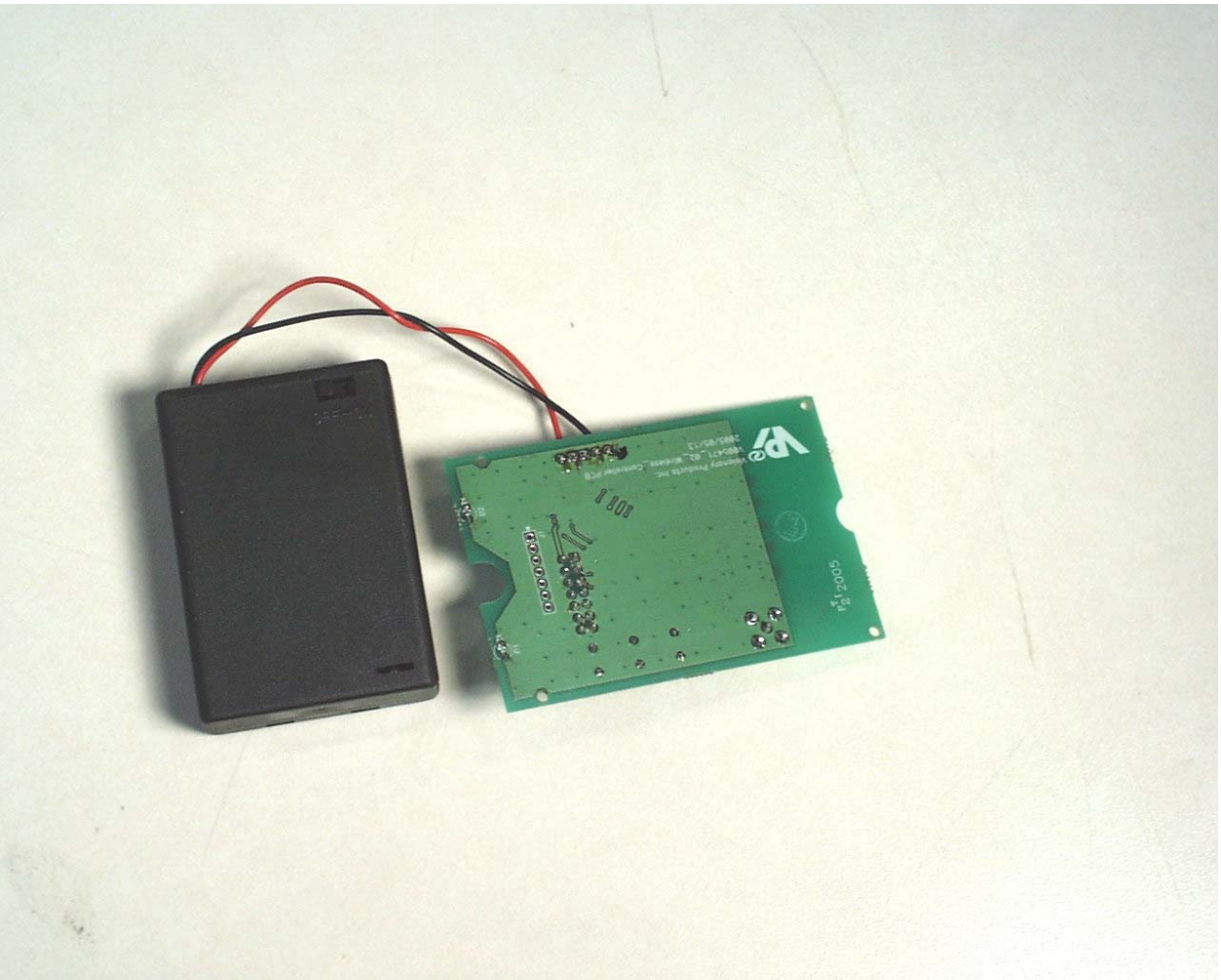
Photograph 5 - Back View of the 050305 Wireless Numeric Keypad



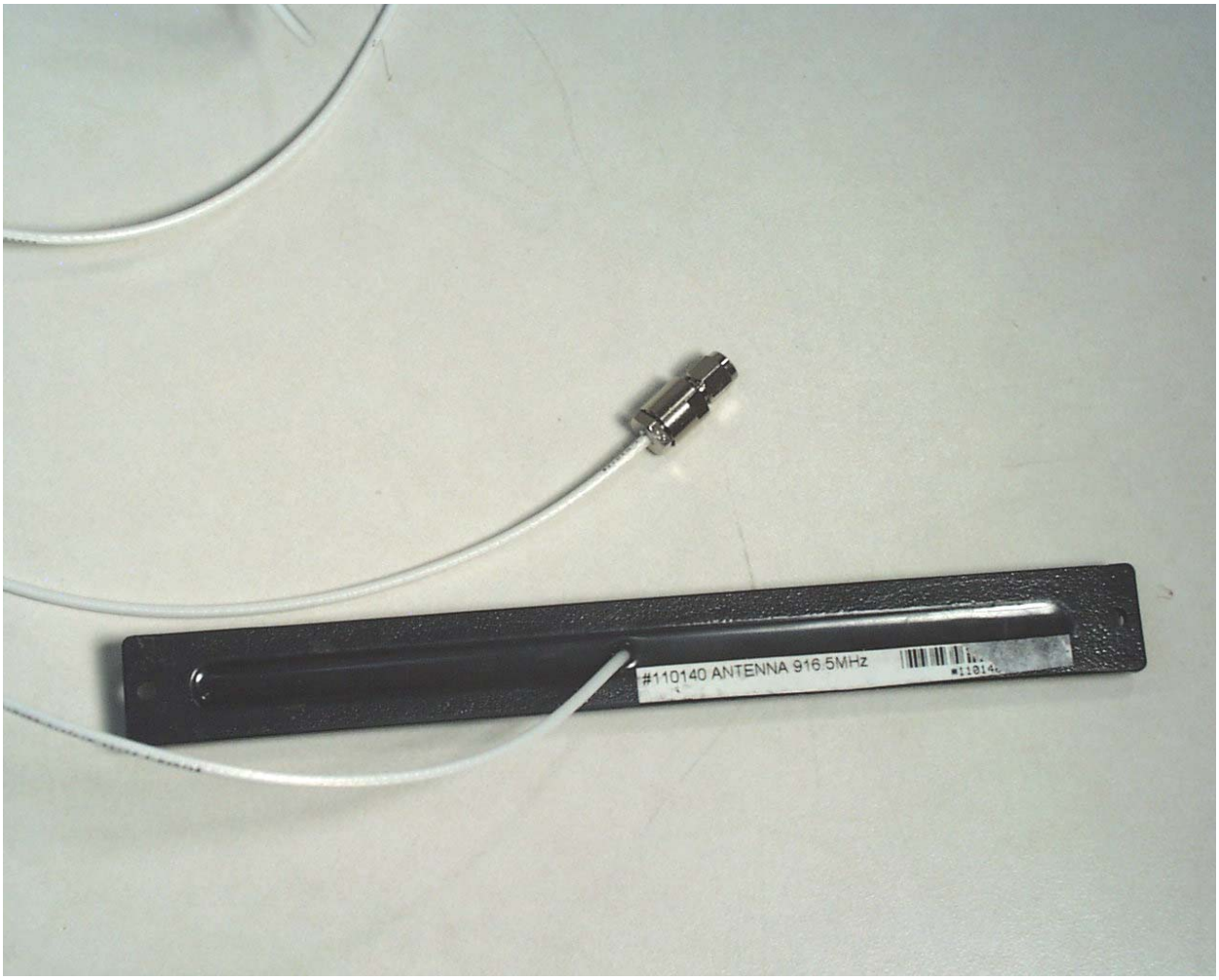
Photograph 6 – Top View of the 050306 Wireless Numeric Receiver



Photograph 7 – Back View of the 050306 Wireless Numeric Receiver

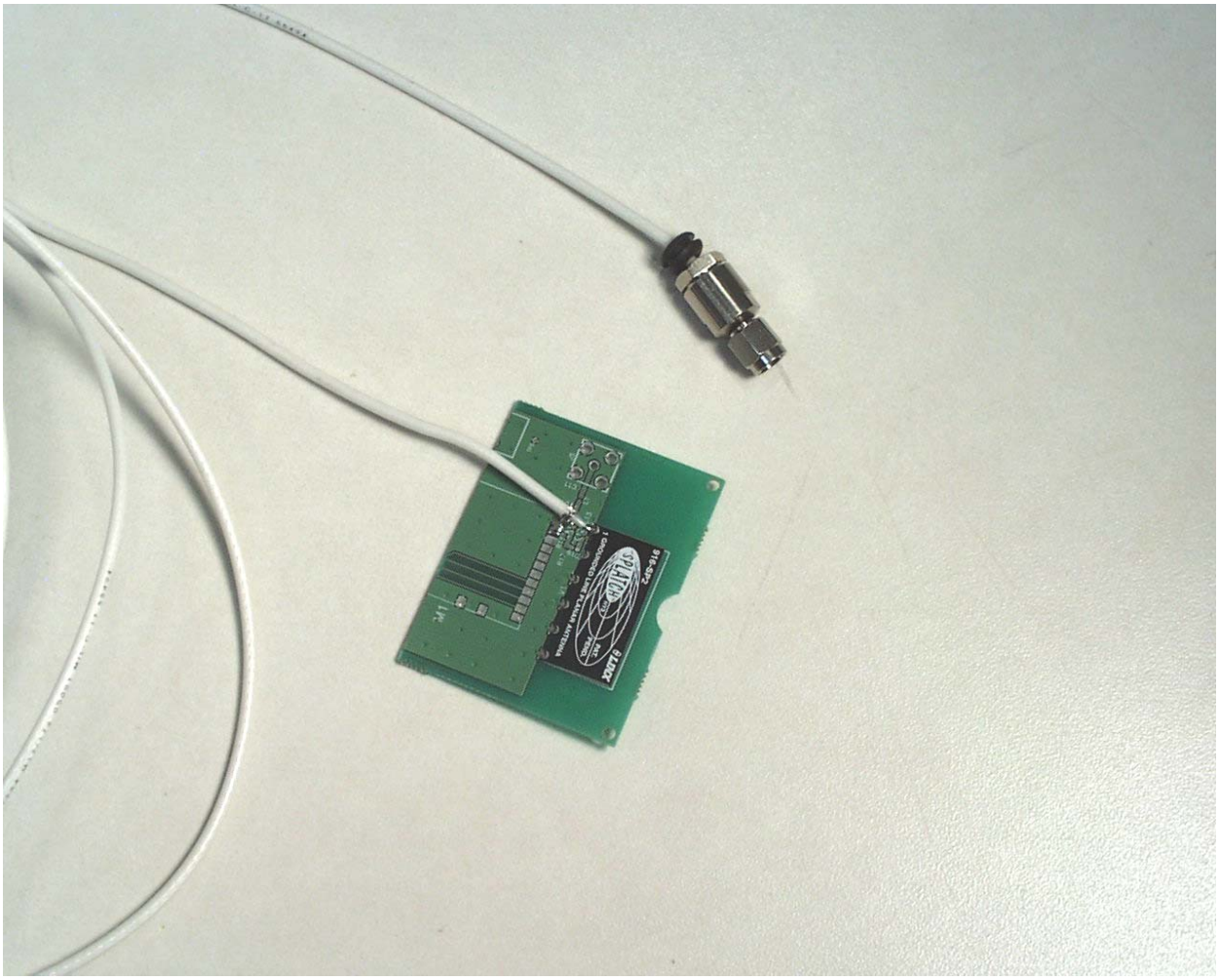
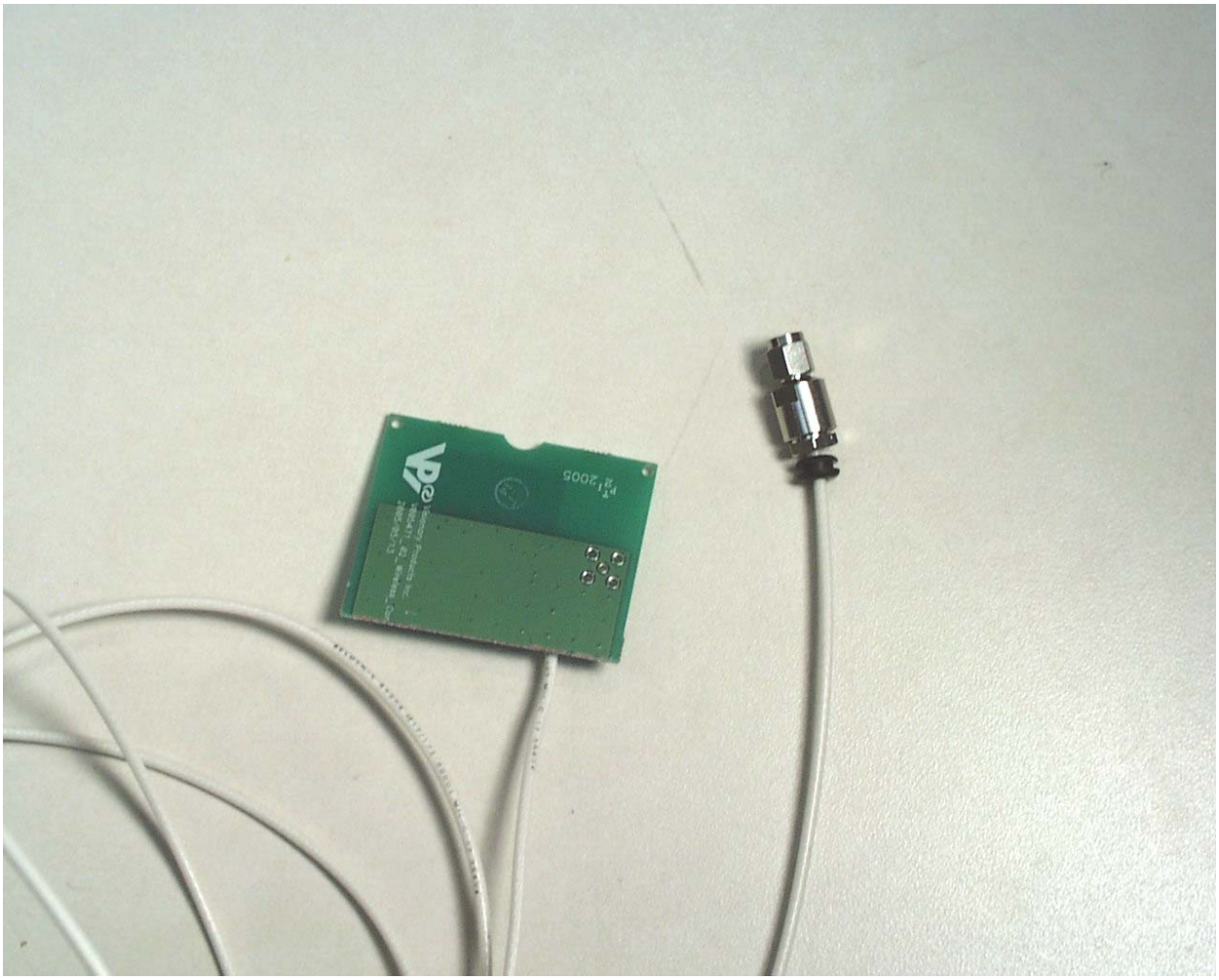


Photograph 8 – Dipole Antenna



Photograph 9 – Monopole Antenna

Photograph 10 - Top Side of the Splatch Antenna



Photograph 11 – Trace Side of the Splatch Antenna