Nemko-CCL, Inc.

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

Test Report

Certification

Test Of: 7756V, 7756X, PDRS-7504, GSRS-7504, & ASRS-7504

FCC ID: EZSDEI7756

Test Specification: FCC PART 15, Subpart C

Test Report Serial No: 230383-9-2.2

Applicant:
DEI Headquarters Inc.
1 Viper Way
Vista, CA 92081
U.S.A

Dates of Test: May 29 - June 7, 2013

Report Issue Date: July 11, 2013

Accredited Testing Laboratory By:

NVLAP Lab Code 100272-0

CERTIFICATION OF ENGINEERING REPORT

This report has been prepared by Nemko-CCL, Inc. to document compliance of the device described below with the requirements of Federal Communications Commission (FCC) Part 15, Subpart C. This report may be reproduced in full; partial reproduction may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

- Applicant: DEI Headquarters Inc.
- Manufacturer: DEI Headquarters Inc.
- Brand Name: DEI Headquarters Inc.
- Model Numbers: 7756V, 7756X, PDRS-7504, GSRS-7504, & ASRS-7504
- FCC ID Number: EZSDEI7756

On this 11th day of July 2013, I, individually and for Nemko-CCL, Inc., certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge, and are made in good faith.

Although NVLAP has recognized that the Nemko-CCL, Inc. 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.

Nemko-CCL, Inc.

Tested by: Mark M. Feil
EMC Engineer

Reviewed by: Thomas C. Jackson
General Manager

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SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name: DEI Headquarters Inc.
1 Viper Way
Vista, CA 92081

Contact Name: Minas Minassian
Title: Sr. Director, HW/RF Systems

1.2 Manufacturer:

Company Name: DEI Headquarters Inc.
1 Viper Way
Vista, CA 92081

Contact Name: Minas Minassian
Title: Sr. Director, HW/RF Systems

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

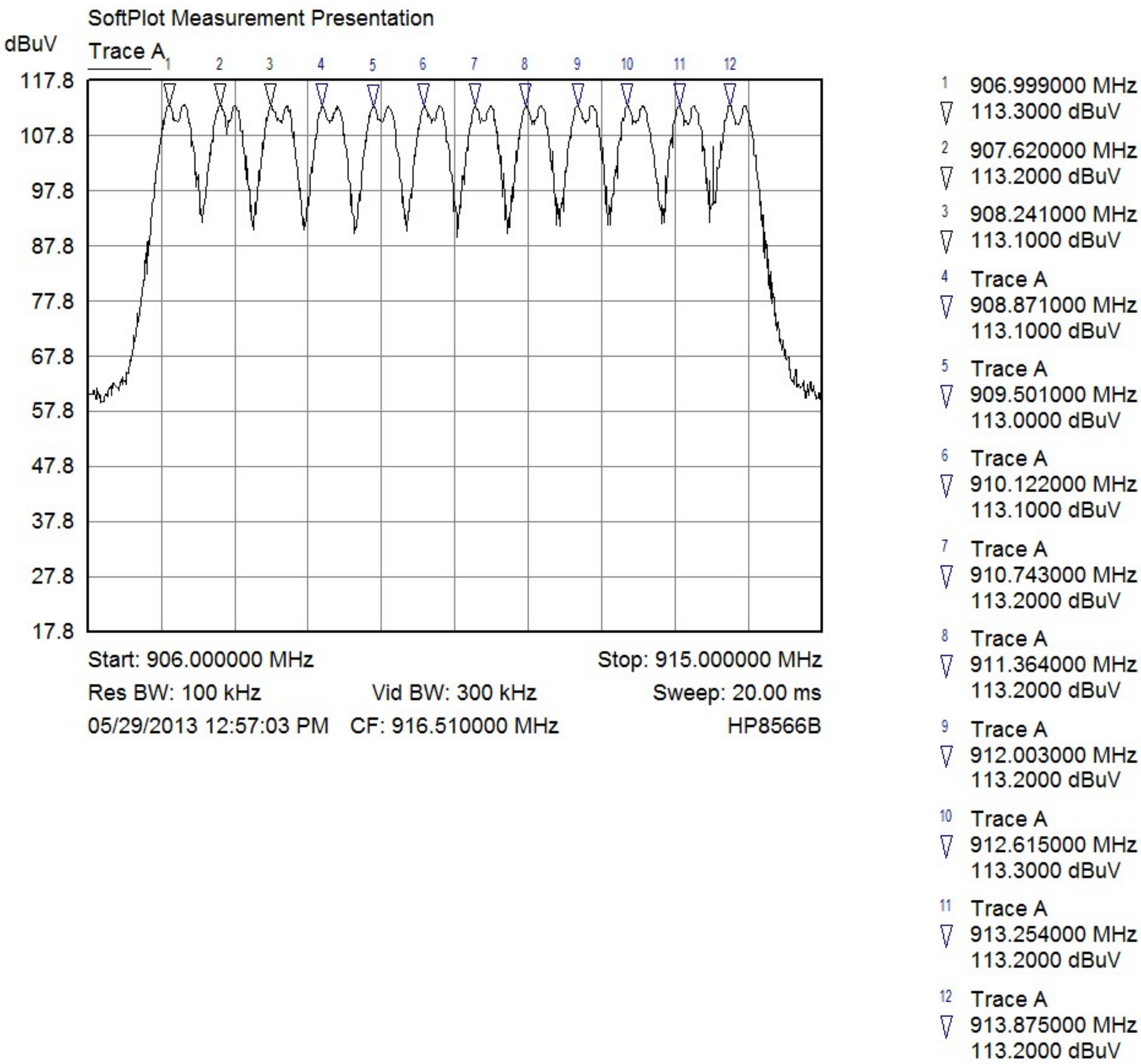
2.1 Identification of EUT:

Brand Name:	DEI Headquarters Inc.
Model Numbers:	7756V, 7756X, PDRS-7504, GSRS-7504, & ASRS-7504
Dimensions:	6.7 cm x 3.6 cm x 0.8 cm

2.2 Description of EUT:

The 7756V was tested as a representative of models 7756X, PDRS-7504, GSRS-7504, & ASRS-7504. The differences in the models are cosmetic only. The 7756V, only, will be referred to throughout the remainder of this report. The 7756V is a handheld key fob, exercised by push buttons to arm/disarm, lock/unlock, start vehicle systems, etc. A continuous transmit mode was configured by the applicant for RF testing. The device is powered by a 3.7 V battery.

The 7756V transceiver operates using 25 channels, spaced 620 KHz apart, in the 902 MHz to 928 MHz frequency band. The 7756V transceiver uses a helical antenna extending from a trace on the PCB. Testing was performed at the upper channel (923.835 MHz), the middle channel (916.395 MHz), and the lower channel (907.095 MHz). See the plots of the channels below.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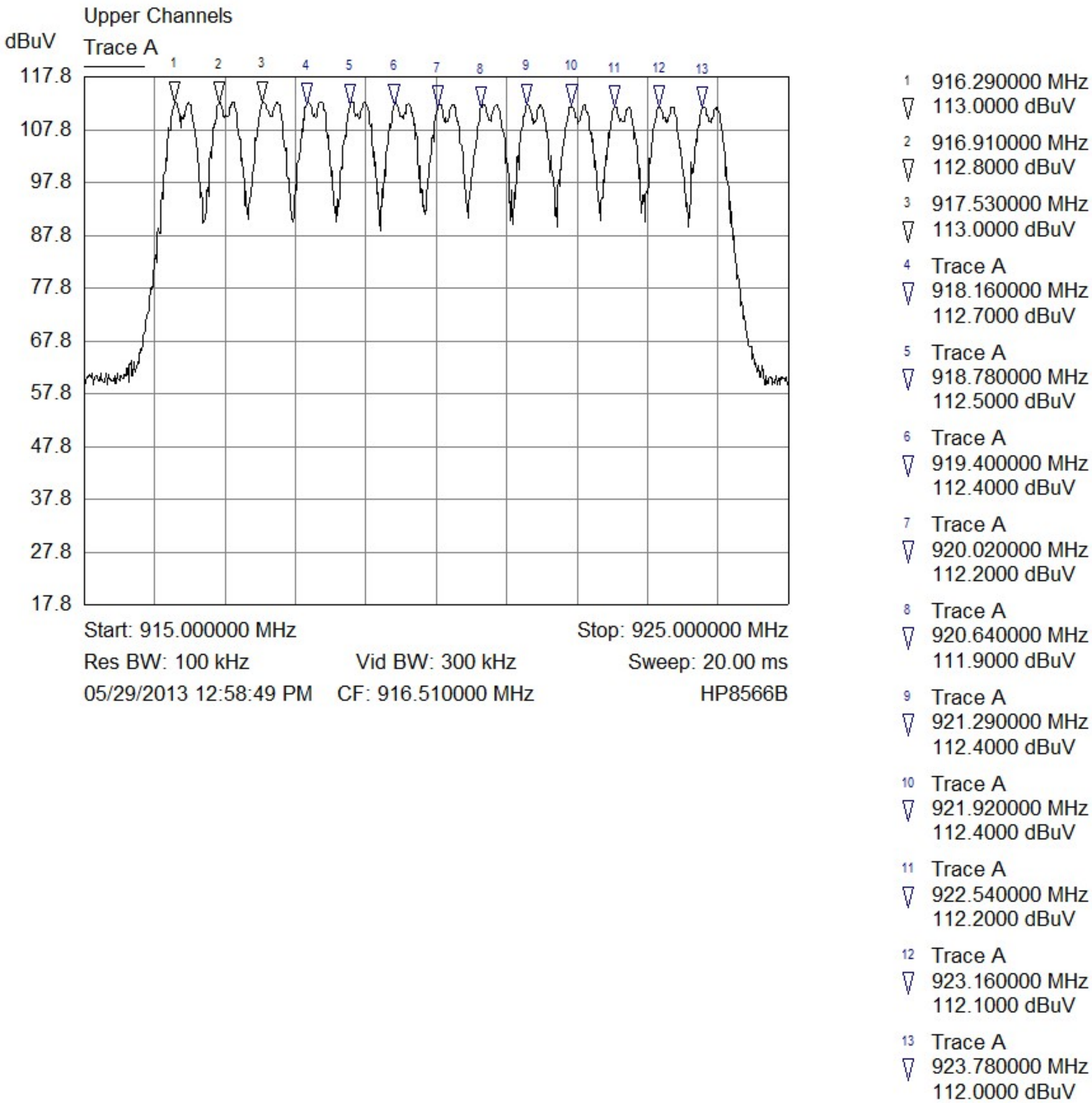
117.8
107.8
97.8
87.8
77.8
67.8
57.8
47.8
37.8
27.8
17.8
Start: 906.000000 MHz
Stop: 915.000000 MHz
Res BW: 100 kHz
Vid BW: 300 kHz
Sweep: 20.00 ms
05/29/2013 12:57:03 PM
CF: 916.510000 MHz
HP8566B
1 906.999000 MHz 113.3000 dBuV
2 907.620000 MHz 113.2000 dBuV
3 908.241000 MHz 113.1000 dBuV
4 Trace A 908.871000 MHz 113.1000 dBuV
5 Trace A 909.501000 MHz 113.0000 dBuV
6 Trace A 910.122000 MHz 113.1000 dBuV
7 Trace A 910.743000 MHz 113.2000 dBuV
8 Trace A 911.364000 MHz 113.2000 dBuV
9 Trace A 912.003000 MHz 113.2000 dBuV
10 Trace A 912.615000 MHz 113.3000 dBuV
11 Trace A 913.254000 MHz 113.2000 dBuV
12 Trace A 913.875000 MHz 113.2000 dBuV



This report covers the circuitry of the devices subject to FCC Part 15, Subpart C. The circuitry of the device subject to FCC Part 15, Subpart B has been tested and found to comply. See Nemko-CCL report #230383-9-1.1.

2.3 EUT and Support Equipment:

The EUT and support equipment used during the test are listed below:

Brand Name Model Number Serial Number	FCC ID Number or Compliance	Description	Name of Interface Ports / Interface Cables
BN: DEI Headquarters Inc. MN: 7756V (Note 1)	EZSDEI7756	Key fob remote	None

Note: (1) EUT

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

2.4 Modification Incorporated/Special Accessories on EUT:

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

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specification:

Title:	FCC PART 15, Subpart C (47 CFR 15) 15.203 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 §15.247 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 pseudo randomly 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 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 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 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 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 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.

(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 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 stave 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 and FCC KDB 558074, Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247. Testing was performed at Nemko-CCL, Inc. Wanship open area test site #2, located at 29145 Old Lincoln Highway, Wanship, UT. This site has been registered with the FCC, and was renewed February 15, 2012 (90504). This registration is valid for three years.

Nemko-CCL, Inc. is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2013.

SECTION 4.0 OPERATION OF EUT DURING TESTING

4.1 Operating Environment:

Power Supply: 3.7 V DC (battery)

4.2 Operating Modes:

The transmitter was tested while in a constant transmit mode at the desired frequency, using either the upper, middle, or lower channel, and on three orthogonal axes. A new battery(s) was used for testing.

4.3 EUT Exercise Software:

DEI Headquarters Inc. software was used to exercise the transmitter.

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
15.247(a)	Channel Separation	902 – 928	Complied
15.247(a)	20 dB Bandwidth	902 – 928	Complied
15.247(a)	Time of Occupancy	902 – 928	Complied
15.247(b)	Peak Output Power	902 – 928	Complied
15.247(c)	Operation with Antennas with Directional Gains >6 dBi	N/A	Not Applicable
15.247(d)	Spurious Emissions	0.032 – 9250	Complied
15.247(e)	Peak Power Spectral Density	902 – 928	Not Applicable
15.247(f)	Hybrid System Requirements	N/A	Not Applicable
15.247(g)	Channel Usage	902 – 928	Complied (Note 1)
15.247(h)	Channel Intelligence/Avoidance	902 – 928	Complied (Note 1)
15.247(i)	RF Safety	902 – 928	Complied (Note 1)
Note 1: Compliance with these requirements is shown in documents filed with the FCC at the time of Certification.			

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. Measurements were made following the guidance of FCC DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. A list of the test equipment used during the measurements can be found in Appendix 1 of this report.

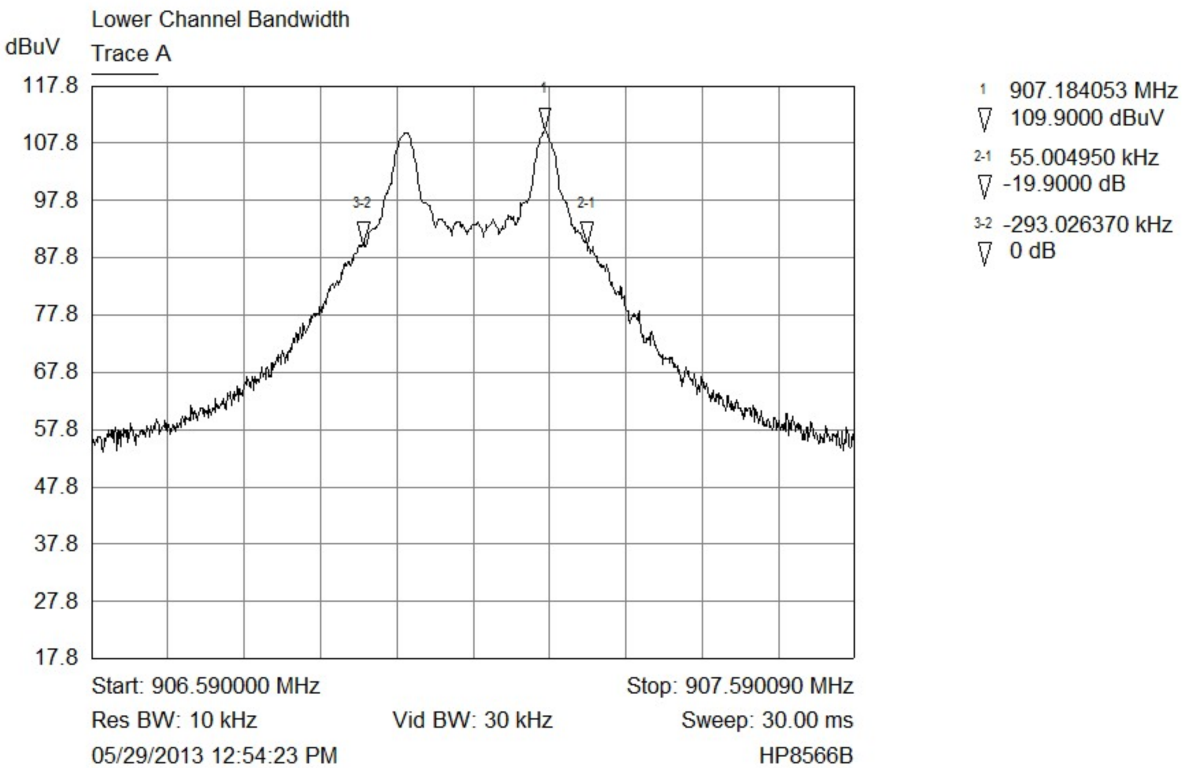
6.2 Test Results:

6.2.1 §15.247(a)(1) Emission Bandwidth and Occupancy

Frequency (MHz)	Emission 20 dB Bandwidth (kHz)
907.095	293
916.395	284
923.835	282

RESULT

In the configuration tested, the 20 dB bandwidth was greater than 250 kHz and less than 500 kHz. The occupancy time is less than 0.4 s in a 10 s period; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plots below).


Lower Channel Bandwidth
Trace A
dBuV
117.8
107.8
97.8
87.8
77.8
67.8
57.8
47.8
37.8
27.8
17.8
1 907.184053 MHz
109.9000 dBuV
2-1 55.004950 kHz
-19.9000 dB
3-2 -293.026370 kHz
0 dB
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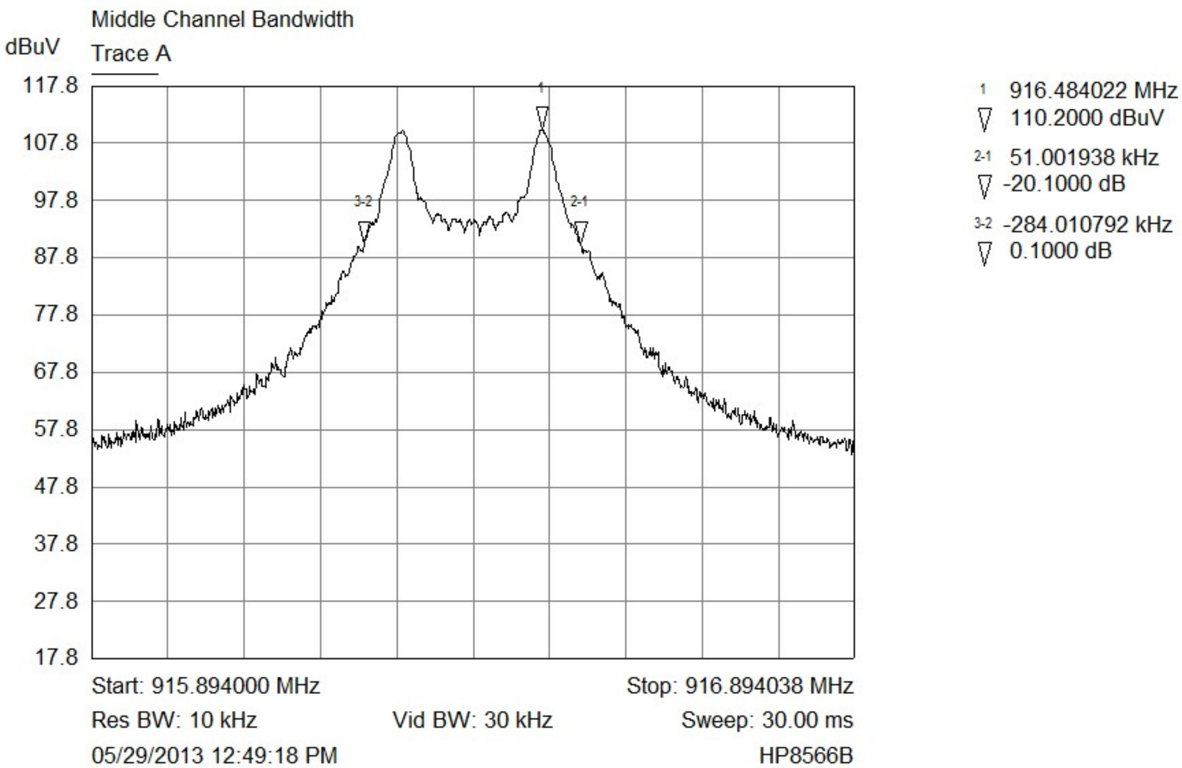
HP8566B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Trace A
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97.8
87.8
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67.8
57.8
47.8
37.8
27.8
17.8
1
3-2
2-1
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05/29/2013 12:49:18 PM
HP8566B
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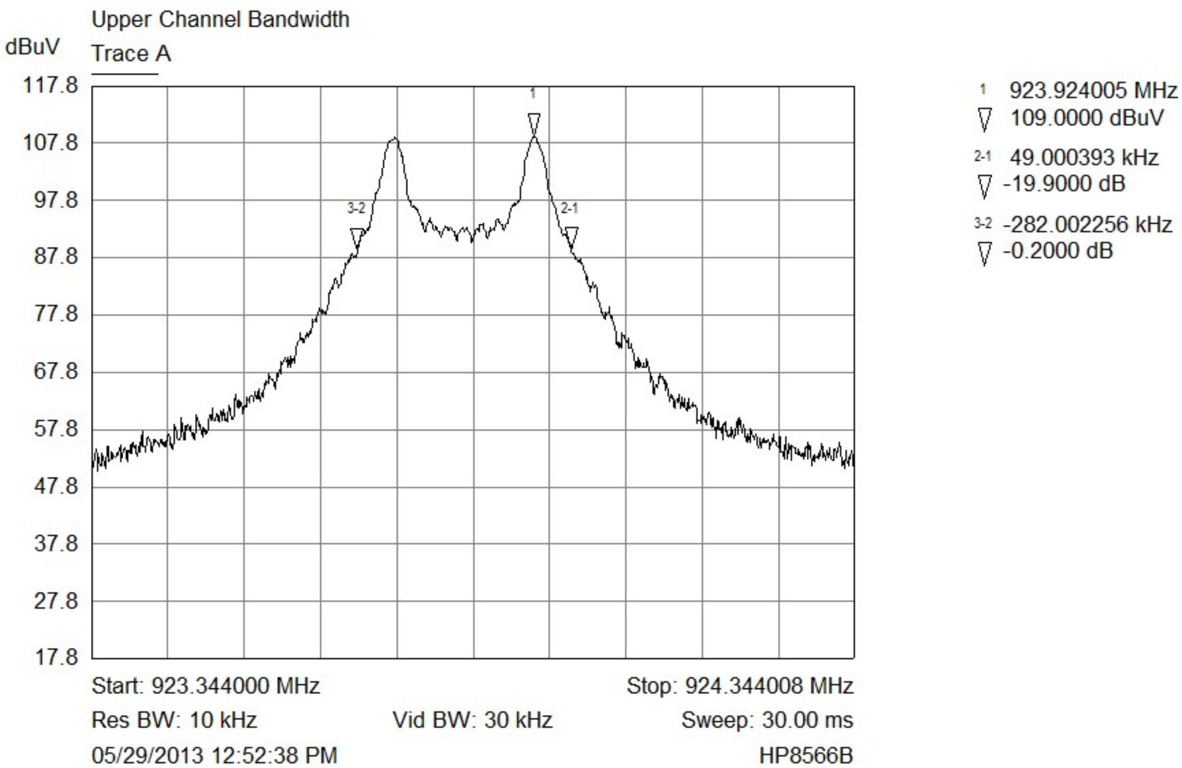
2-1 51.001938 kHz
-20.1000 dB
3-2 -284.010792 kHz
0.1000 dB


Upper Channel Bandwidth
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107.8
97.8
87.8
77.8
67.8
57.8
47.8
37.8
27.8
17.8
1
3-2
2-1
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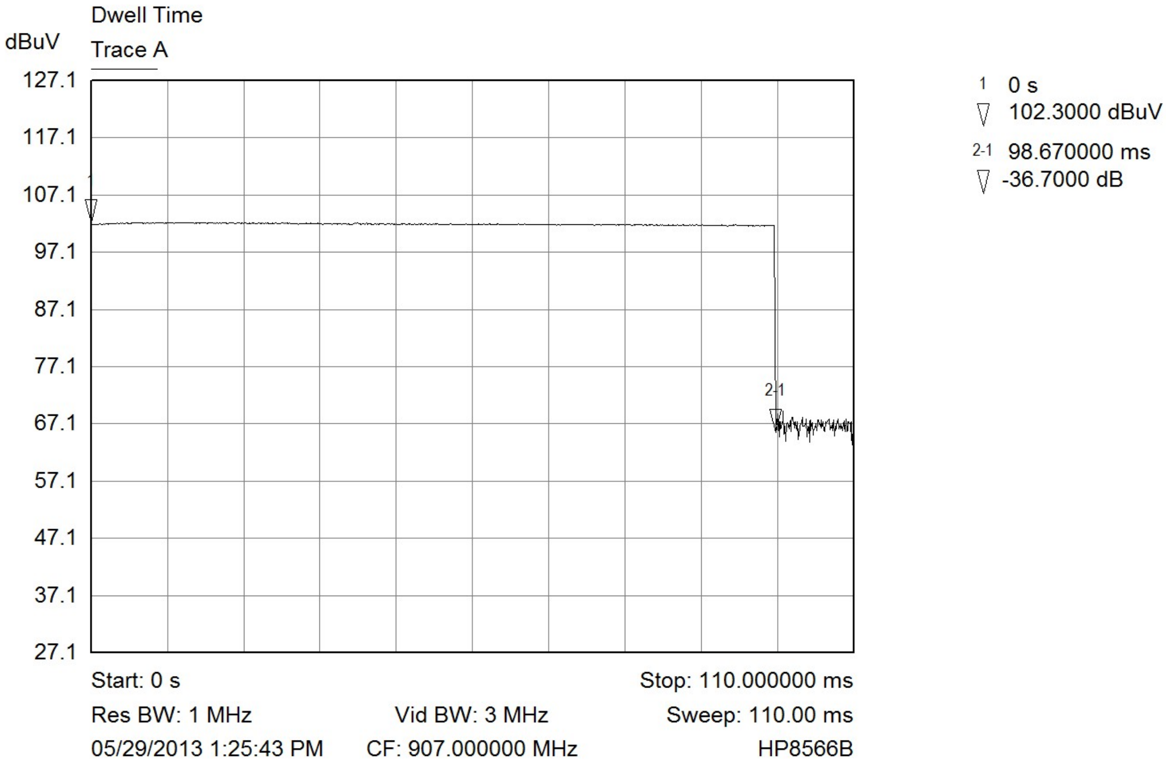
Res BW: 10 kHz
Vid BW: 30 kHz
Sweep: 30.00 ms
05/29/2013 12:52:38 PM
HP8566B
1 923.924005 MHz
109.0000 dBuV
2-1 49.000393 kHz
-19.9000 dB
3-2 -282.002256 kHz
-0.2000 dB


Dwell Time
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127.1
117.1
107.1
97.1
87.1
77.1
67.1
57.1
47.1
37.1
27.1
1 0 s
102.3000 dBuV
2-1 98.670000 ms
-36.7000 dB
Start: 0 s
Stop: 110.000000 ms
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 110.00 ms
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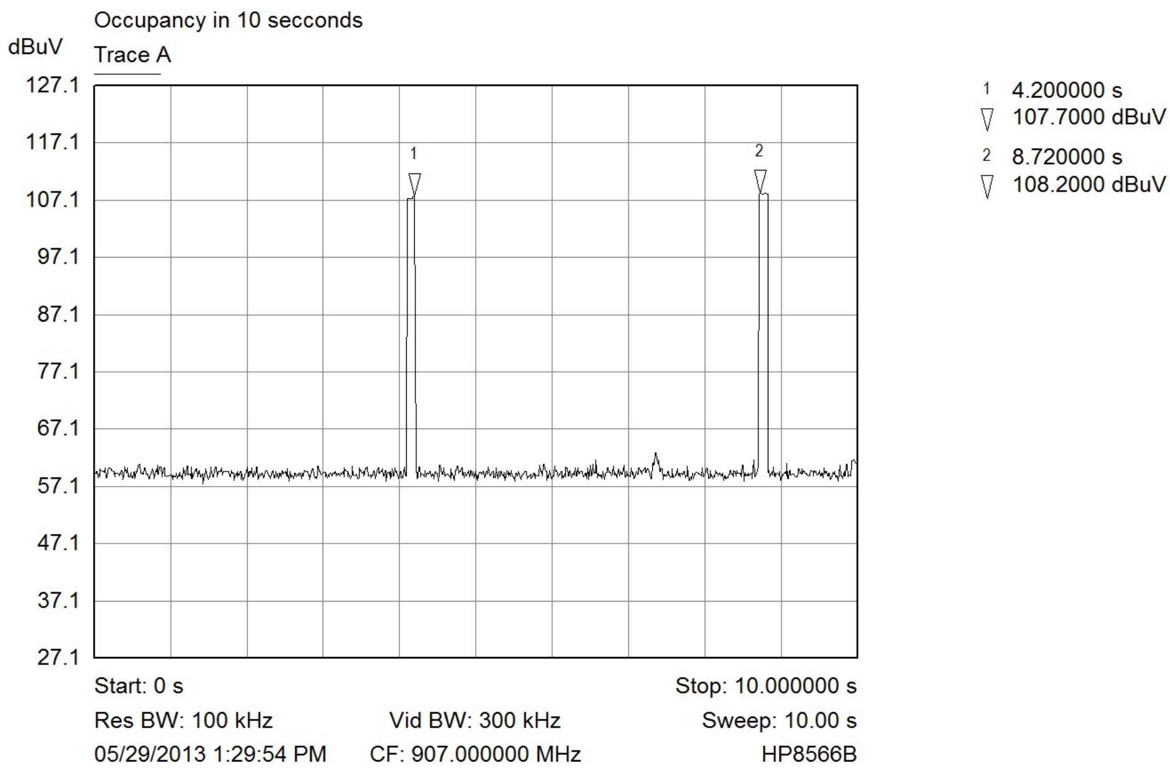
CF: 907.000000 MHz
HP8566B



2 hits at 98.7 ms = 0.197 s occupancy

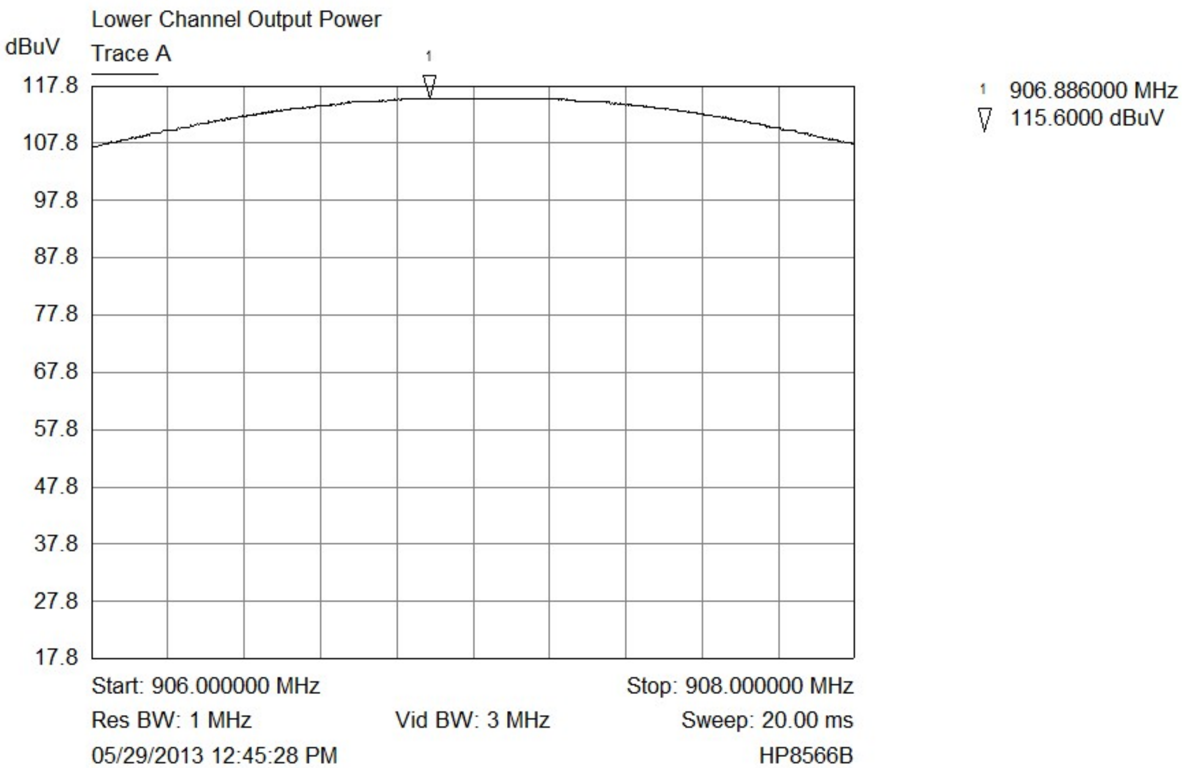
6.2.2 §15.247(b)(2) Peak Output Power

The maximum peak RF radiated output power measured for this device was or 115.6 dBuV or 0.109 Watts. The limit is specified as 0.25 Watts conducted power to an antenna less than or equal to 6 dBi. A conducted power of 0.25 W to a 6 dBi antenna at a 3 meter measurement distance would produce a limit of 125.2 dBuV or 1 W; therefore, the EUT complies with specification §15.247(b)(2) for peak output power, as the radiated output falls below both radiated and conducted power limits. The antenna has a gain, as specified by the applicant, of 0 dBi.

Frequency (MHz)	Measured Output Power (dBuV)	Measured Output Power (mW)
907.095	115.6	108.2
916.395	114.8	90.6
923.835	114.1	77.1

RESULT

In the configuration tested, the RF peak output power was less than 0.25 Watts; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plots below).


Lower Channel Output Power
dBuV
Trace A
117.8
107.8
97.8
87.8
77.8
67.8
57.8
47.8
37.8
27.8
17.8
1
1 906.886000 MHz
115.6000 dBuV
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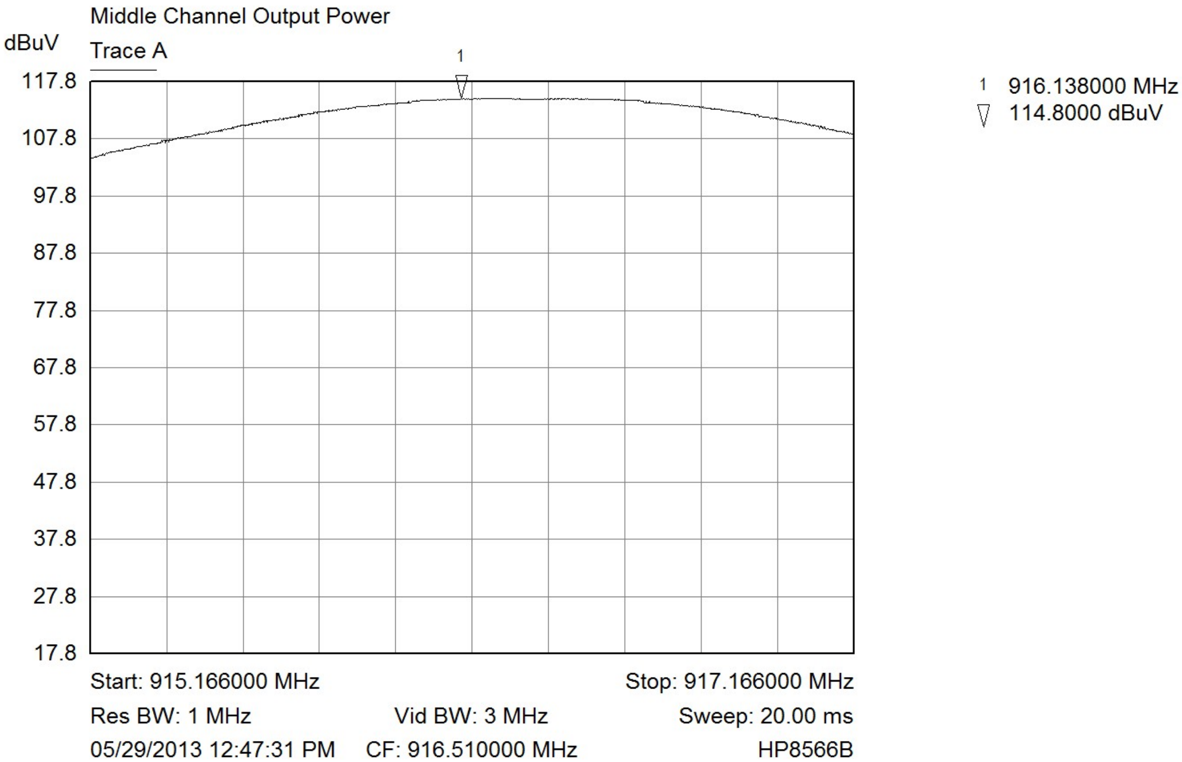
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107.8
97.8
87.8
77.8
67.8
57.8
47.8
37.8
27.8
17.8
1
1 916.138000 MHz
114.8000 dBuV
Start: 915.166000 MHz
Stop: 917.166000 MHz
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Vid BW: 3 MHz
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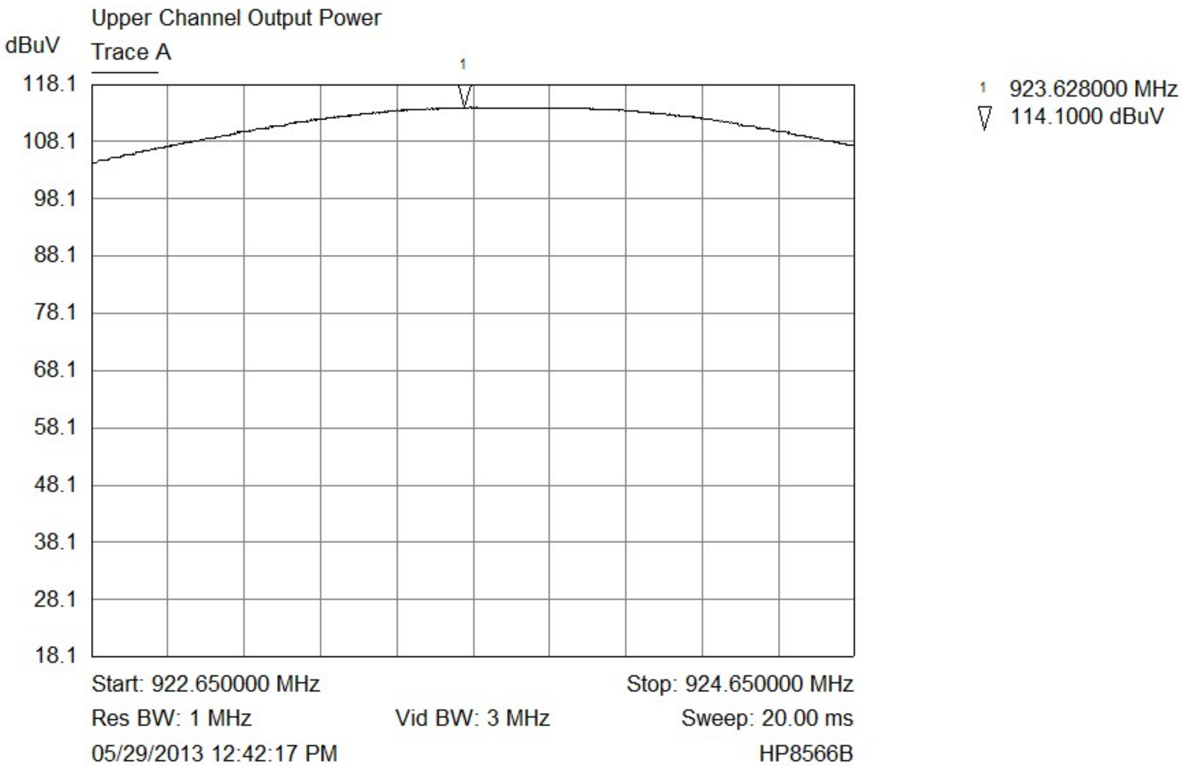
HP8566B


Upper Channel Output Power
dBuV
Trace A
118.1
108.1
98.1
88.1
78.1
68.1
58.1
48.1
38.1
28.1
18.1
1
1 923.628000 MHz
114.1000 dBuV
Start: 922.650000 MHz
Stop: 924.650000 MHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 20.00 ms
05/29/2013 12:42:17 PM
HP8566B

6.2.3 §15.247(d) Spurious Emissions

6.2.3.1 Radiated Emissions

The frequency range from the lowest frequency used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure incidental radiated emissions. The EUT presented worst case emissions when placed on edge. The tables below show the worst-case emissions measured from the EUT. The noise floor was a minimum of 6 dB below the limit. The emissions in the restricted bands must meet the limits specified in **§**15.209. Tabular data for each of the spurious emissions is shown below for each of the units. Plots of the band edges are also shown.

Average Factor

The EUT operates at a maximum duty cycle of 98.7%. A correction factor of -0.1 dB will be applied to the average detection measurements. For details of the duty cycle calculation, see Appendix 3.

RESULT

All emissions were found to be within the respective limits; including those in the restricted bands of **§**15.205. Emissions outside the restricted bands were also compared to, and found within the restricted band limits, which are tighter; therefore, the EUT complies with the specification.

Transmitting at the Lowest Frequency (907.095 MHz)

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Amp Adjusted Meas. (dB)	Correction Factor (dB)	Averaging Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1814.2	Peak	Vertical	45.3	13.6	29.9	0.0	43.5	74.0	-30.5
1814.2	Average	Vertical	42.5	10.8	29.9	-0.1	40.7	54.0	-13.4
1814.2	Peak	Horizontal	44.9	13.2	29.9	0.0	43.1	74.0	-30.9
1814.2	Average	Horizontal	42.1	10.4	29.9	-0.1	40.3	54.0	-13.8
2721.3	Peak	Vertical	44.3	12.6	32.9	0.0	45.5	74.0	-28.5
2721.3	Average	Vertical	41.1	9.4	32.9	-0.1	42.3	54.0	-11.7
2721.3	Peak	Horizontal	41.7	10.0	32.9	0.0	42.9	74.0	-31.1
2721.3	Average	Horizontal	37.1	5.4	32.9	-0.1	38.3	54.0	-15.8
3628.4	Peak	Vertical	41.1	9.3	35.8	0.0	45.1	74.0	-28.9
3628.4	Average	Vertical	36.4	4.6	35.8	-0.1	40.4	54.0	-13.7
3628.4	Peak	Horizontal	38.8	7.0	35.8	0.0	42.8	74.0	-31.2
3628.4	Average	Horizontal	33.6	1.8	35.8	-0.1	37.6	54.0	-16.5
4535.5	Peak	Vertical	41.9	10.0	37.1	0.0	47.1	74.0	-26.9
4535.5	Average	Vertical	37.2	5.3	37.1	-0.1	42.4	54.0	-11.7
4535.5	Peak	Horizontal	45.5	13.6	37.1	0.0	50.7	74.0	-23.3
4535.5	Average	Horizontal	42.5	10.6	37.1	-0.1	47.7	54.0	-6.4
5442.6	Peak	Vertical	36.6	4.9	39.2	0.0	44.1	74.0	-29.9
5442.6	Average	Vertical	27.8	-3.9	39.2	-0.1	35.3	54.0	-18.8
5442.6	Peak	Horizontal	37.5	5.8	39.2	0.0	45.0	74.0	-29.0
5442.6	Average	Horizontal	28.0	-3.7	39.2	-0.1	35.5	54.0	-18.6
6349.7	Peak	Vertical	37.2	5.9	39.9	0.0	45.7	74.0	-28.3
6349.7	Average	Vertical	28.8	-2.5	39.9	-0.1	37.3	54.0	-16.8
6349.7	Peak	Horizontal	36.1	4.8	39.9	0.0	44.6	74.0	-29.4
6349.7	Average	Horizontal	26.7	-4.6	39.9	-0.1	35.2	54.0	-18.9
7256.8	Peak	Vertical	35.2	4.6	41.9	0.0	46.4	74.0	-27.6
7256.8	Average	Vertical	26.8	-3.8	41.9	-0.1	38.0	54.0	-16.1
7256.8	Peak	Horizontal	35.8	5.2	41.9	0.0	47.0	74.0	-27.0
7256.8	Average	Horizontal	27.9	-2.7	41.9	-0.1	39.1	54.0	-15.0

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Amp Adjusted Meas. (dB)	Correction Factor (dB)	Averaging Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
8163.9	Peak	Vertical	32.3	2.1	43.3	0.0	45.4	74.0	-28.6
8163.9	Average	Vertical	20.0	-10.2	43.3	-0.1	33.1	54.0	-21.0
8163.9	Peak	Horizontal	31.6	1.4	43.3	0.0	44.7	74.0	-29.3
8163.9	Average	Horizontal	19.7	-10.5	43.3	-0.1	32.8	54.0	-21.3
9071.0	Peak	Vertical	32.0	2.0	44.4	0.0	46.5	74.0	-27.5
9071.0	Average	Vertical	20.0	-10.0	44.4	-0.1	34.5	54.0	-19.6
9071.0	Peak	Horizontal	33.9	3.9	44.4	0.0	48.4	74.0	-25.6
9071.0	Average	Horizontal	26.0	-4.0	44.4	-0.1	40.5	54.0	-13.6

Transmitting at the Middle Frequency (916.395 MHz)

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Amp Adjusted Meas. (dB)	Correction Factor (dB)	Averaging Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1832.8	Peak	Vertical	56.4	24.7	30.0	0.0	54.7	74.0	-19.3
1832.8	Average	Vertical	55.5	23.8	30.0	-0.1	53.8	54.0	-0.3
1832.8	Peak	Vertical	51.6	19.9	30.0	0.0	49.9	74.0	-24.1
1832.8	Average	Vertical	50.3	18.6	30.0	-0.1	48.6	54.0	-5.5
2749.2	Peak	Vertical	48.6	16.9	33.0	0.0	49.9	74.0	-24.1
2749.2	Average	Vertical	46.6	14.9	33.0	-0.1	47.9	54.0	-6.2
2749.2	Peak	Vertical	42.2	10.5	33.0	0.0	43.5	74.0	-30.5
2749.2	Average	Vertical	38.0	6.3	33.0	-0.1	39.3	54.0	-14.8
3665.6	Peak	Vertical	47.3	15.5	35.9	0.0	51.4	74.0	-22.6
3665.6	Average	Vertical	44.6	12.8	35.9	-0.1	48.7	54.0	-5.4
3665.6	Peak	Vertical	46.8	15.0	35.9	0.0	50.9	74.0	-23.1
3665.6	Average	Vertical	44.3	12.5	35.9	-0.1	48.4	54.0	-5.7
4582.0	Peak	Vertical	48.4	16.5	37.2	0.0	53.7	74.0	-20.3
4582.0	Average	Vertical	43.8	11.9	37.2	-0.1	49.1	54.0	-5.0
4582.0	Peak	Vertical	46.4	14.5	37.2	0.0	51.7	74.0	-22.3
4582.0	Average	Vertical	42.9	11.0	37.2	-0.1	48.2	54.0	-5.9
5498.4	Peak	Vertical	38.2	6.5	39.3	0.0	45.8	74.0	-28.2
5498.4	Average	Vertical	31.3	-0.4	39.3	-0.1	38.9	54.0	-15.2
5498.4	Peak	Vertical	35.6	3.9	39.3	0.0	43.2	74.0	-30.8
5498.4	Average	Vertical	26.9	-4.8	39.3	-0.1	34.5	54.0	-19.6
6414.8	Peak	Vertical	37.2	5.9	39.9	0.0	45.8	74.0	-28.2
6414.8	Average	Vertical	29.5	-1.8	39.9	-0.1	38.1	54.0	-16.0
6414.8	Peak	Vertical	35.1	3.8	39.9	0.0	43.7	74.0	-30.3
6414.8	Average	Vertical	26.7	-4.6	39.9	-0.1	35.3	54.0	-18.8
7331.2	Peak	Vertical	35.3	4.7	42.1	0.0	46.8	74.0	-27.2
7331.2	Average	Vertical	27.0	-3.6	42.1	-0.1	38.5	54.0	-15.6
7331.2	Peak	Vertical	35.2	4.6	42.1	0.0	46.7	74.0	-27.3
7331.2	Average	Vertical	26.0	-4.6	42.1	-0.1	37.5	54.0	-16.6

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Amp Adjusted Meas. (dB)	Correction Factor (dB)	Averaging Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
8247.6	Peak	Vertical	33.3	3.1	43.4	0.0	46.6	74.0	-27.4
8247.6	Average	Vertical	22.9	-7.3	43.4	-0.1	36.2	54.0	-17.9
8247.6	Peak	Vertical	31.9	1.7	43.4	0.0	45.2	74.0	-28.8
8247.6	Average	Vertical	20.7	-9.5	43.4	-0.1	34.0	54.0	-20.1
9164.0	Peak	Vertical	33.5	3.6	44.4	0.0	48.0	74.0	-26.0
9164.0	Average	Vertical	24.5	-5.4	44.4	-0.1	39.0	54.0	-15.1
9164.0	Peak	Vertical	33.8	3.9	44.4	0.0	48.3	74.0	-25.7
9164.0	Average	Vertical	26.1	-3.8	44.4	-0.1	40.6	54.0	-13.5

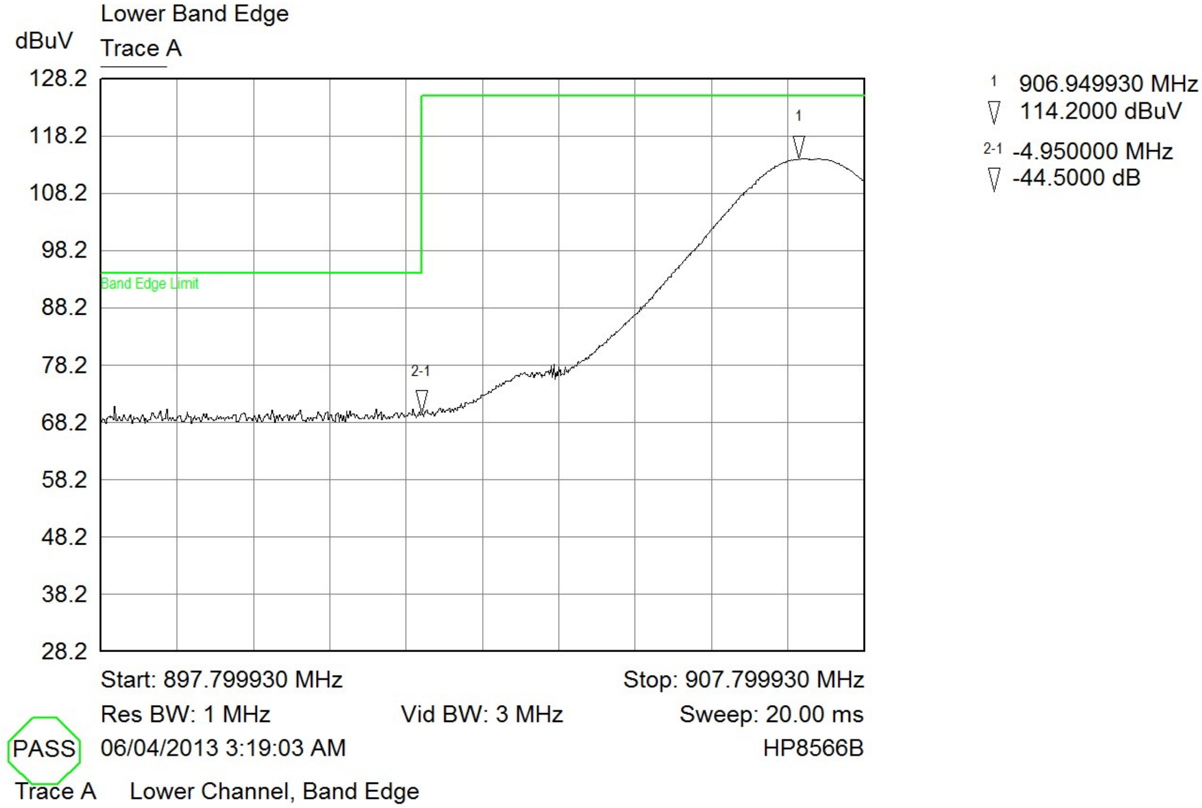
Transmitting at the Highest Frequency (923.835 MHz)

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Amp Adjusted Meas. (dB)	Correction Factor (dB)	Averaging Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1847.6	Peak	Vertical	50.2	18.5	30.1	0.0	48.6	74.0	-25.4
1847.6	Average	Vertical	48.6	16.9	30.1	-0.1	47.0	54.0	-7.1
1847.6	Peak	Vertical	47.6	15.9	30.1	0.0	46.0	74.0	-28
1847.6	Average	Vertical	43.5	11.8	30.1	-0.1	41.9	54.0	-12.2
2771.5	Peak	Vertical	44.2	12.5	33.1	0.0	45.6	74.0	-28.4
2771.5	Average	Vertical	41.1	9.4	33.1	-0.1	42.5	54.0	-11.6
2771.5	Peak	Vertical	38.5	6.8	33.1	0.0	39.9	74.0	-34.1
2771.5	Average	Vertical	33.0	1.3	33.1	-0.1	34.4	54.0	-19.7
3695.3	Peak	Vertical	46.0	14.2	36.0	0.0	50.2	74.0	-23.8
3695.3	Average	Vertical	43.5	11.7	36.0	-0.1	47.7	54.0	-6.4
3695.3	Peak	Vertical	45.6	13.8	36.0	0.0	49.8	74.0	-24.2
3695.3	Average	Vertical	43.1	11.3	36.0	-0.1	47.3	54.0	-6.8
4619.1	Peak	Vertical	48.0	16.1	37.3	0.0	53.4	74.0	-20.6
4619.1	Average	Vertical	43.7	11.8	37.3	-0.1	49.1	54.0	-5.0
4619.1	Peak	Vertical	46.2	14.3	37.3	0.0	51.6	74.0	-22.4
4619.1	Average	Vertical	43.5	11.6	37.3	-0.1	48.9	54.0	-5.2
5542.9	Peak	Vertical	37.4	5.7	39.4	0.0	45.1	74.0	-28.9
5542.9	Average	Vertical	29.0	-2.7	39.4	-0.1	36.7	54.0	-17.4
5542.9	Peak	Vertical	34.7	3.0	39.4	0.0	42.4	74.0	-31.6
5542.9	Average	Vertical	25.6	-6.1	39.4	-0.1	33.3	54.0	-20.8
6466.7	Peak	Vertical	35.8	4.5	39.9	0.0	44.4	74.0	-29.6
6466.7	Average	Vertical	28.3	-3.0	39.9	-0.1	36.9	54.0	-17.2
6466.7	Peak	Vertical	33.0	1.7	39.9	0.0	41.6	74.0	-32.4
6466.7	Average	Vertical	25.5	-5.8	39.9	-0.1	34.1	54.0	-20.0
7390.6	Peak	Vertical	35.6	5.0	42.3	0.0	47.3	74.0	-26.7
7390.6	Average	Vertical	28.5	-2.1	42.3	-0.1	40.2	54.0	-13.9
7390.6	Peak	Vertical	35.3	4.7	42.3	0.0	47.0	74.0	-27.0
7390.6	Average	Vertical	28.1	-2.5	42.3	-0.1	39.8	54.0	-14.3

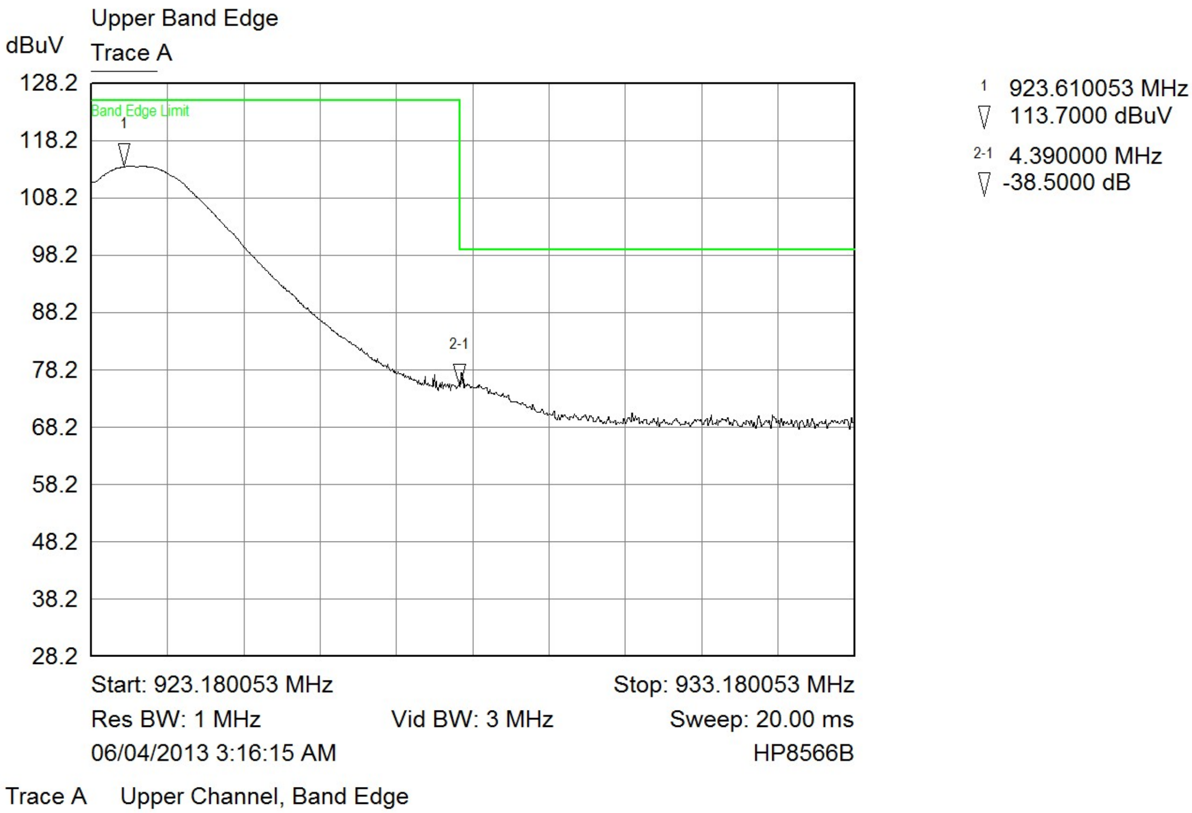
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Amp Adjusted Meas. (dB)	Correction Factor (dB)	Averaging Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
8314.4	Peak	Vertical	32.1	2.0	43.5	0.0	45.5	74.0	-28.5
8314.4	Average	Vertical	21.3	-8.8	43.5	-0.1	34.7	54.0	-19.4
8314.4	Peak	Vertical	31.1	1.0	43.5	0.0	44.5	74.0	-29.5
8314.4	Average	Vertical	19.9	-10.2	43.5	-0.1	33.3	54.0	-20.8
9238.2	Peak	Vertical	33.4	3.5	44.5	0.0	48.0	74.0	-26.0
9238.2	Average	Vertical	24.4	-5.5	44.5	-0.1	39.0	54.0	-15.1
9238.2	Peak	Vertical	37.7	7.8	44.5	0.0	52.3	74.0	-21.7
9238.2	Average	Vertical	26.0	-3.9	44.5	-0.1	40.6	54.0	-13.5

No other emissions in the restricted bands were seen above the noise floor. Noise floor was greater than 6 dB below the limit.

Lower Band Edge Plot



Upper Band Edge Plot



6.2.4 §15.247(i) Exposure to RF Energy

See documents filed with the FCC for certification.

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

A1.1 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.

A loop antenna was used to measure emissions below 30 MHz. Emission readings more than 20 dB below the limit at any frequency may not be listed in the reported data. For frequencies between 9 kHz and 30 MHz, or the lowest frequency generated or used in the device greater than 9 kHz, and less than 30 MHz, the spectrum analyzer resolution bandwidth was set to 9 kHz and the video bandwidth was set to 30 kHz. For average measurements, the spectrum analyzer average detector was used.

For frequencies above 30 MHz, 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 measurements above 1000 MHz the spectrum analyzer’s resolution bandwidth was set to 1 MHz and the average detector of the analyzer was used.

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 and 1 meter from the EUT. The readings obtained by the antenna 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 are 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.

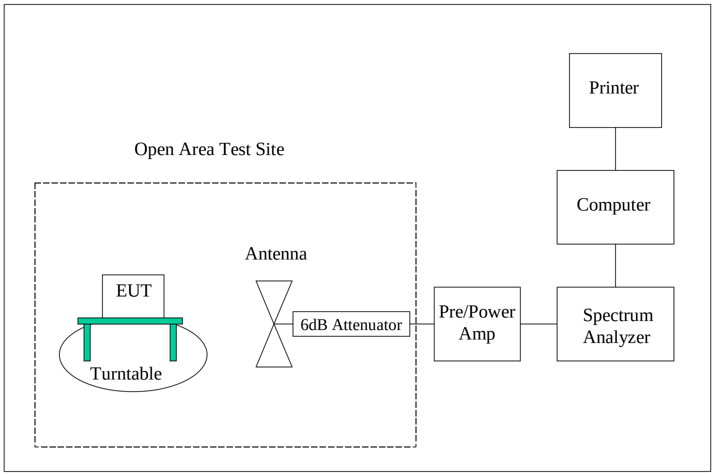
Desktop intentional radiators are measured on a non-conducting table 0.8 meters above the ground plane. The table is placed on a turntable which is level with the ground plane. The turntable has slip rings, which supply AC power to the intentional radiator. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

For radiated emission testing at 30 MHz or above that is performed at distances closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Due Date of Calibration
Wanship Open Area Test Site #2	Nemko-CCL, Inc.	N/A	N/A	12/07/2012	12/07/2013
Test Software	Nemko-CCL, Inc.	Radiated Emissions	Revision 1.3	N/A	N/A
Spectrum Analyzer/Receiver	Rohde & Schwarz	ESU40	100064	07/28/2012	07/28/2013
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	02/06/2013	02/06/2014
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	02/06/2013	02/06/2014
Loop Antenna	EMCO	6502	9111-2675	03/04/2013	03/04/2015
Biconilog Antenna	EMCO	3142	9601-1008	10/10/2012	10/10/2014
Double Ridged Guide Antenna	EMCO	3115	9604-4779	03/07/2013	03/07/2015
900 MHz Filter	Microtronics	HPM50108-03	001	05/17/2013	05/17/2014
High Frequency Amplifier	Miteq	AFS4-01001800-43-10P-4	1096455	05/06/2013	05/06/2014
6' High Frequency Cable	Microcoax	UFB197C-0-0720-000000	1296	05/02/2013	05/02/2014
20' High Frequency Cable	Microcoax	UFB197C-1-3120-000000	1297	05/02/2013	05/02/2014
3 Meter Radiated Emissions Cable Wanship Site #2	Microcoax	UFB205A-0-4700-000000	1295	05/02/2013	05/02/2014
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	08/27/2012	08/27/2013

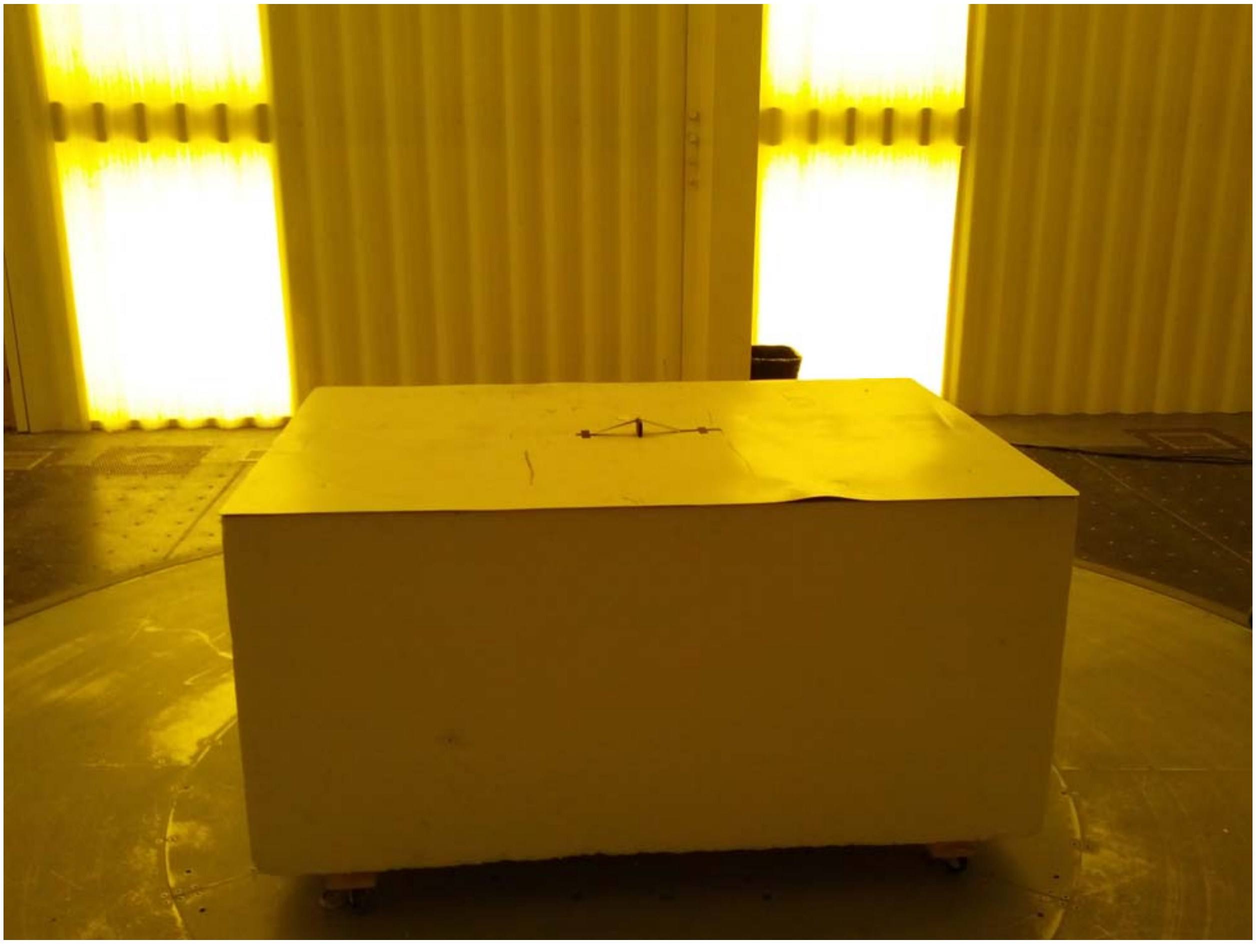
An independent calibration laboratory or Nemko-CCL, Inc. personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology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

Radiated Emissions Test Setup

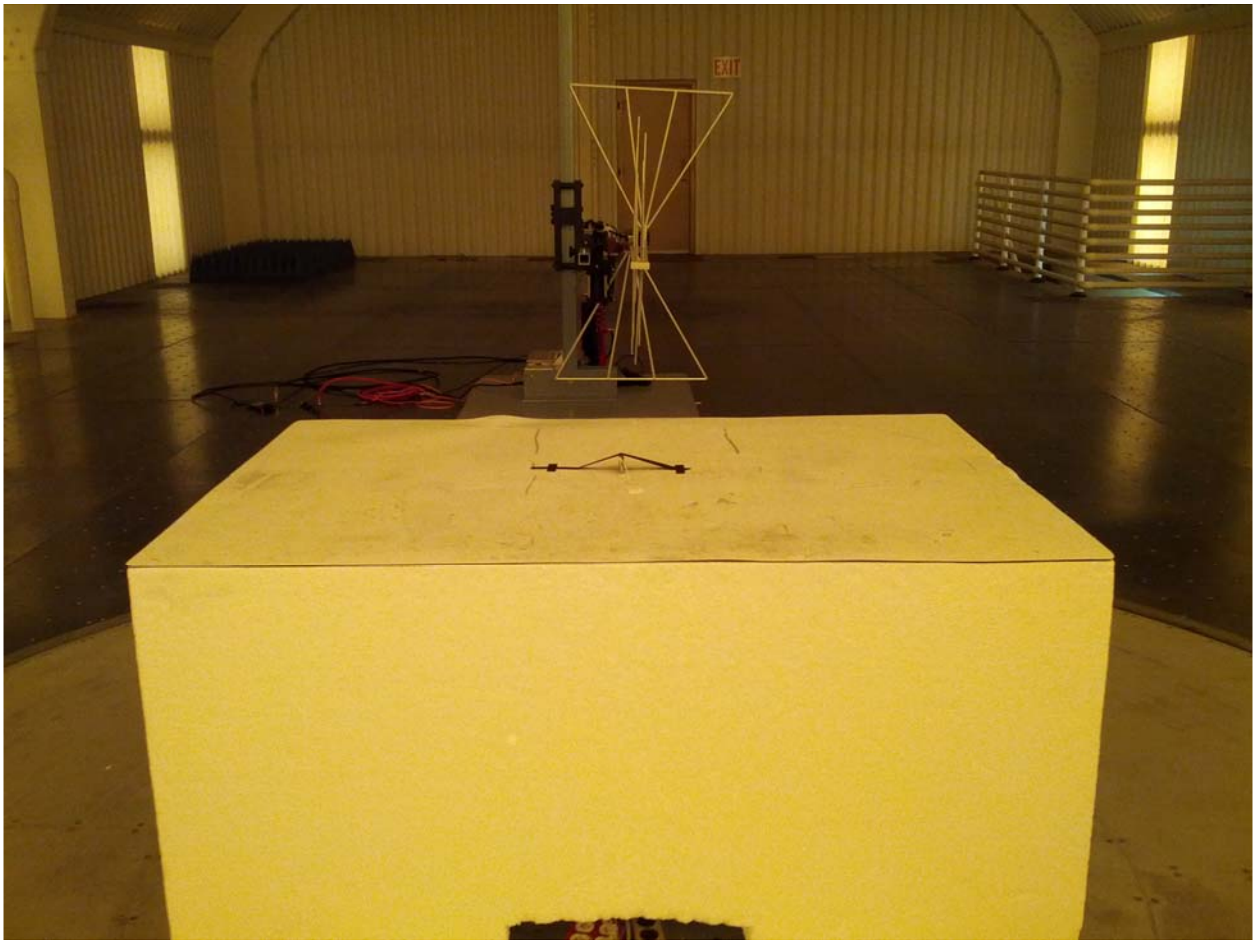


APPENDIX 2 PHOTOGRAPHS

Photograph 1 – Front View Radiated Disturbance Worst Case Configuration (EUT on edge)



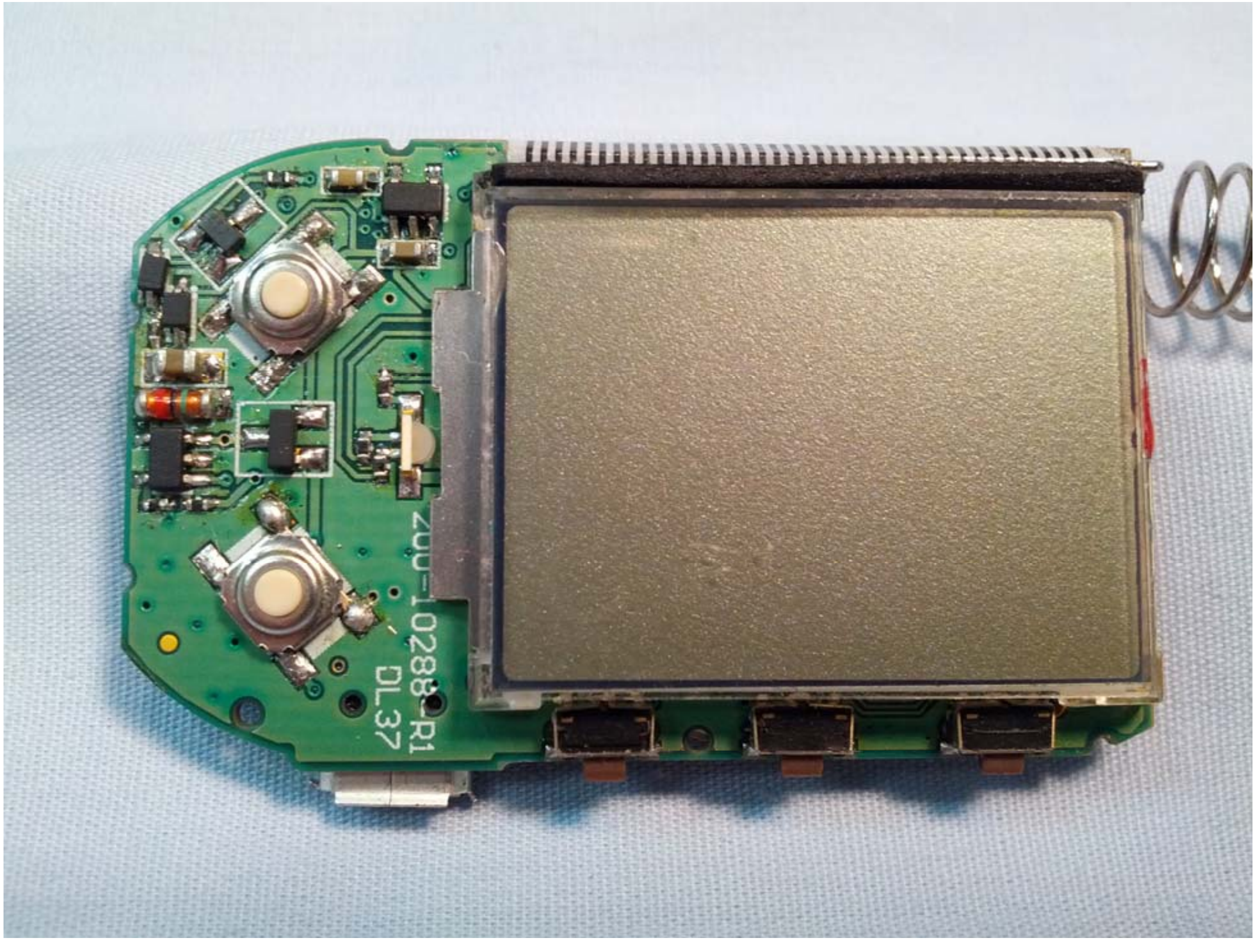
Photograph 2 – Back View Radiated Disturbance Worst Case Configuration (EUT on edge)



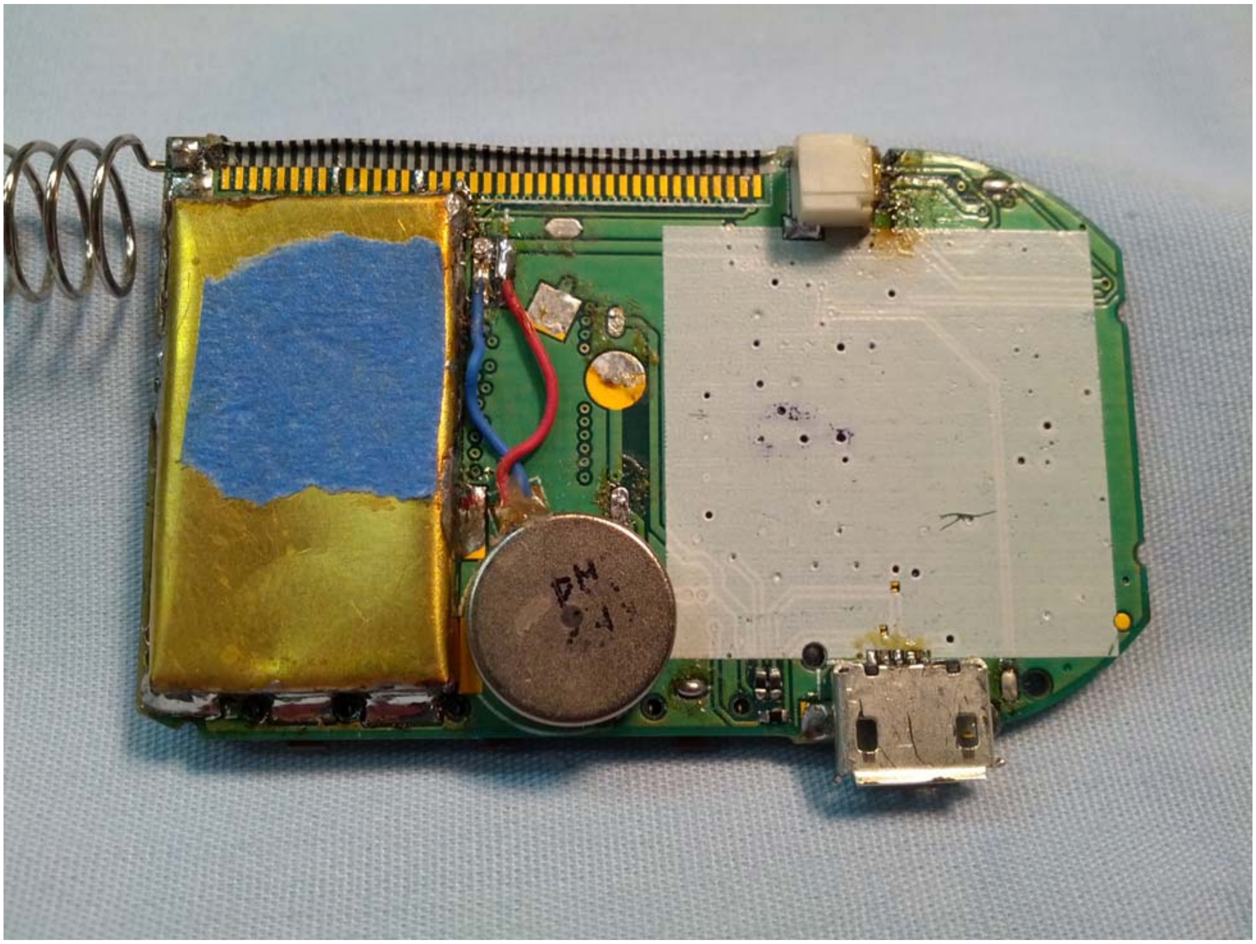
Photograph 3 – EUT Orientation for Radiated Tests - Flat

Photograph 4 – EUT Orientation for Radiated Tests - Vertical

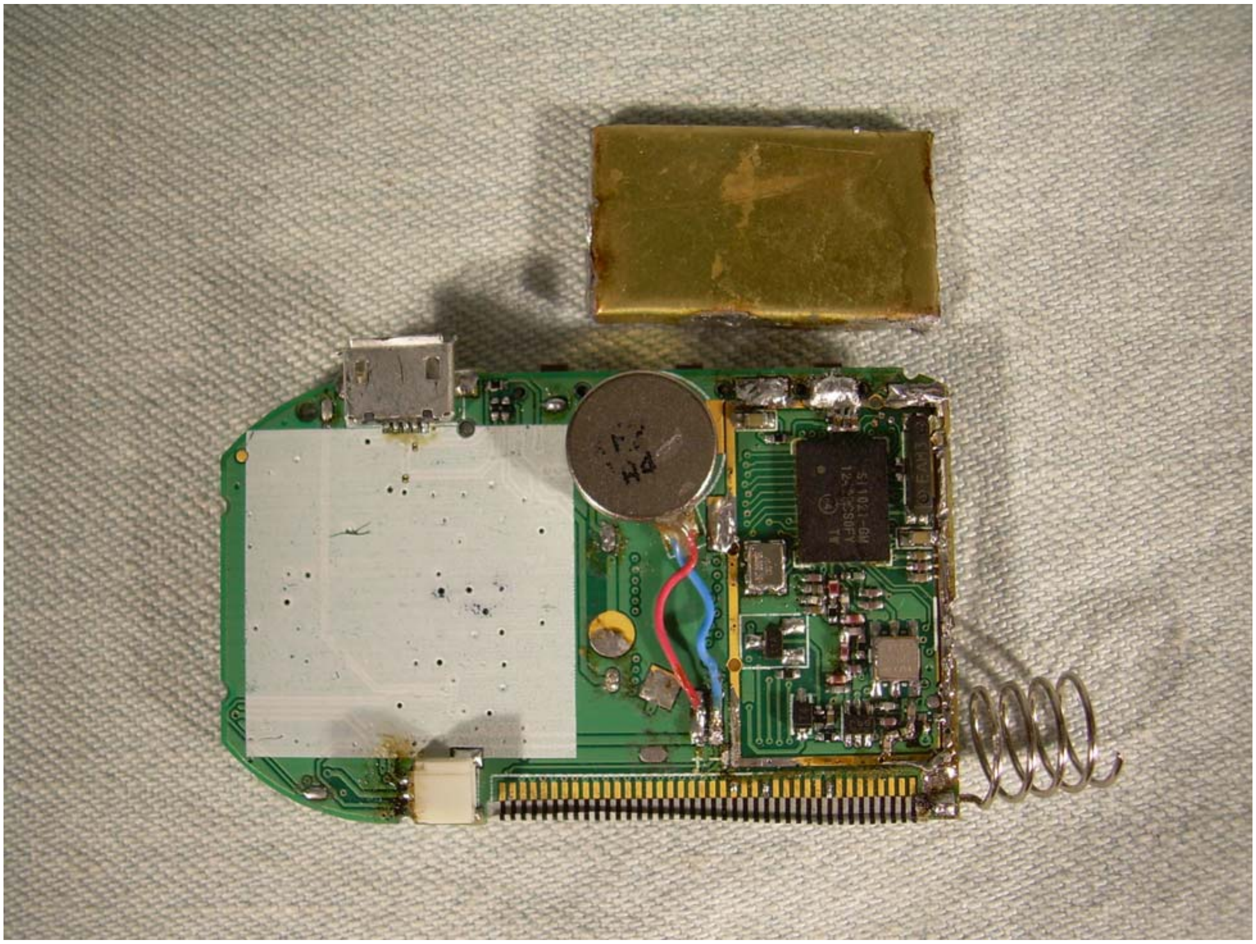
Photograph 5 – View of the Front Side of the PCB



Photograph 6 – View of the Back Side of the PCB



Photograph 7 – View of the Back Side of the PCB with RF Shield Removed



APPENDIX 3 AVERAGE FACTOR CALCULATION

The average factor is calculated by taking the average over the 100 millisecond period over which the average is greatest, as specified in §15.35(C). The pulse widths and pulse period needed to make the average factor and duty calculations are shown in the graphs below.

Pulse Period: 98.7 ms

Total On Time for Pulse Period / Total On Time for Worst 100 ms:
1 pulse x 98.7 = 98.7 ms

Duty Cycle (using the full pulse width shown below):
98.7 ms / 100 ms = 98.7 %

Average Factor (using the worst case 100 ms period shown below):
20 log (0.987) = -0.1 dB