

FCC PART 15.247

MEASUREMENT AND TEST REPORT

For

Wi2Wi, Inc.

2107 N. First Street, Ste. 540
San Jose, CA 95131, USA

FCC ID: U9R-W2CBW003
Model: W2CBW003

Report Type: <input checked="" type="checkbox"/> Original Report	Product Type: 802.11b/g +Bluetooth Module
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1 GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The Wi2Wi, Inc. product, *FCC ID: U9R-W2CBW003, model: W2CBW003*, or the “EUT” as referred to in this report, is a 802.11b/g + Bluetooth module. Unlike a typical module the W2CBW003 includes all radio components, clocking and regulation for a complete WLAN radio subsystem. It also included in the solution is Wi2Wi's coexistence solution for simultaneous operation of Wi-Fi and Bluetooth Radios.

The small, compact, low power design is targeted specifically for the developers of portable electronics such as MP3/MP4 players, PDAs and Smart Phones. The W2CBW003 features one of the smallest footprints in the industry and provides the interfaces commonly required by handheld/portable devices. The W2CBW003 offers a single module integration of Wi-Fi and Bluetooth functionality into end-user products.

The transceiver uses 78 channels for frequency hopping in the 2402 to 2480 MHz band. The lowest channel is centered at 2402 MHz and the highest channel is centered at 2480 MHz.

The transceiver uses OFDM and CCK modulation for the 802.11b/g module; GFSK, $\pi/4$ DQPSK, 8DPSK modulation for the Bluetooth module.

1.2 Mechanical Description of EUT

The Wi2Wi, Inc. product, *FCC ID: U9R-W2CBW003, model: W2CBW003*, measures approximately 12 mmL x 12 mmW x 1.4 mmH, and weighs approximately 1 g.

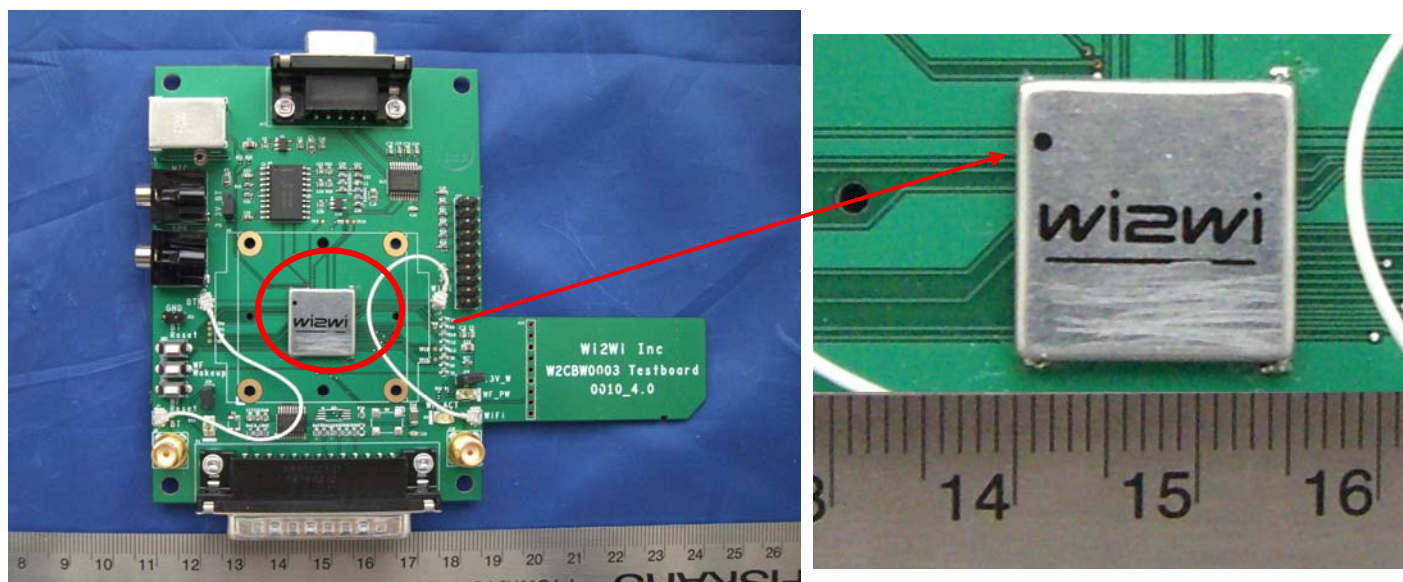
**The test data gathered are from production sample, serial number: 07110114, provided by the manufacturer.*

1.3 Antenna Description

The antenna used is portable, center fed, whip antenna. It is a coaxial sleeve design with an omni-directional pattern.

Item Number	Model/Type	
Antenna 1.	Model number:	HG2403RD-RSF
	Manufacturer:	HyperLink Technologies, Inc.
	Frequency Range:	2400-2500 MHz
	Connector Type/ Maximum Gain	Reverse Polarity SMA Plug/ 3 dBi
	Antenna Type/ Pattern:	Monopole/omni-directional
	Measurement:	Length: 13 mmD x 137 mmL; Weight: 23 g

1.4 EUT Photograph



EUT built on the support board

EUT

Please refer to Exhibit C for more EUT photographs.

1.5 Objective

This type approval report is prepared on behalf of *Wi2Wi Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for Output Power, Antenna Requirements, 6 dB Bandwidth, and power spectral density, 100 kHz Bandwidth of Band Edges Measurement, Spurious Emissions, Conducted and Radiated Spurious Emissions.

1.6 Related Submittal(s)/Grant(s)

Please refer to Bay Area Compliance Laboratories Corp's report number: R0703307-247 BT (*FCC ID: U9R-W2CBW003*) for Bluetooth test results.

1.7 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.8 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from ± 2.0 for Conducted Emissions tests and ± 4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.9 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11, 1997 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the test methods and procedures set forth in ANSI C63.4-2003 & TIA/EIA-603.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: R-2463 and C-2698. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is a National Institute of Standards and Technology (NIST) accredited laboratory under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>.

2 SYSTEM TEST CONFIGURATION

2.1 Justification

The host system was configured for testing according to ANSI C63.4-2003.

The EUT was tested in the testing mode to represent *worst-case* results during the final qualification test.

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

2.2 EUT Exercise Software

The EUT is programmed with the following data rate settings that were used during testing:

Channel	2412 MHz	2437 MHz	2462 MHz
802.11b Data rate	11Mbps	11Mbps	11Mbps
802.11g Data rate	54Mbps	54Mbps	54Mbps

2.3 Special Accessories

There were no special accessories were required, included, or intended for use with EUT during these tests.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Toshiba	Laptop	Satellite R15-S829	Y5040228H

3 SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.247(e)(i) §2.1091	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§ 15.207 (a)	Conducted Emissions	Compliant
§2.1051 & §15.247(d)	Spurious Emissions at Antenna Port	Compliant
§15.205	Restricted Band	Compliant
§15.109, 15.209 (a) & §15.247(d)	Radiated Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Bandwidth	Compliant
§15.247 (b)(3)	Maximum Peak Output Power	Compliant
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247 (e)	Power Spectral Density	Compliant

4 § 15.247 (e) (i) and § 2.1091 - RF EXPOSURE

4.1 Applicable Standard

According to §15.247(e)(i) and §1.1307(b)(1), 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 level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

4.2 MPE Prediction

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal (dBm): 15.24

Maximum peak output power at antenna input terminal (mW): 33.42

Prediction distance (cm): 20

Prediction frequency (MHz): 2462

Maximum Antenna Gain, typical (dBi): 3

Maximum Antenna Gain (numeric): 1.995

Power density of prediction frequency at 20.0 cm (mW/cm²): 0.0133

MPE limit for uncontrolled exposure at prediction frequency (mW/cm²): 1.0

4.3 Test Result

The power density level at 20 cm is 0.0133 mW/cm², which is below the uncontrolled exposure limit of 1.0mW/cm² at 2462 MHz.

5 §15.203 - ANTENNA REQUIREMENT

5.1 Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to § 15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2 Result

The antenna, model: HG2403RD-RSF for this device is a center fed monopole whip antennae with a maximum gain of 3 dBi that uses a reverse polarity SMA connector thus complying with the 15.203 unique coupling requirement.

☒ **Compliant**

☐ **N/A**

Please refer to the following antenna photo for details.



Antenna photo

6 §15.207 - CONDUCTED EMISSIONS

6.1 Section 15.207 Conducted limits:

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 μ 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 boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	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.

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4 – 2003 measurement procedure. The specification used was FCC Class B limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The laptop was connected with LISN-1.

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
R&S	Receiver, EMI Test	ESCI 1166.5950K03	100337	2007-03-08
R&S	LISN, Artificial Mains	ESH2-Z5	871884/039	2006-11-14

* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

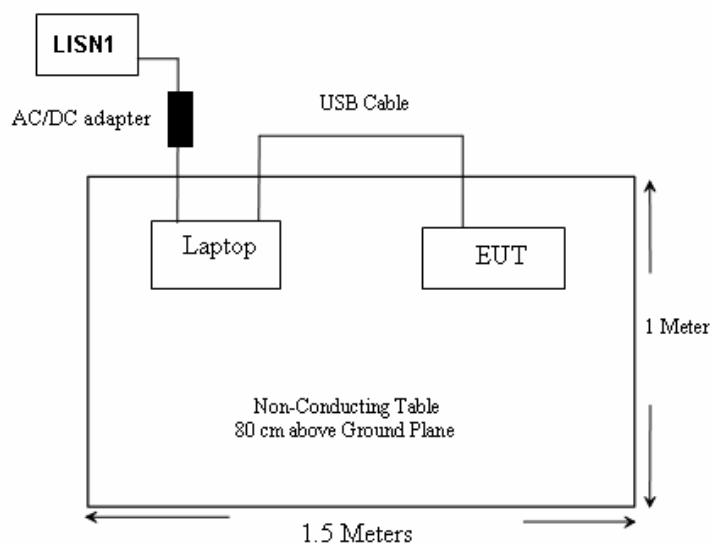
6.4 Test Procedure

During the conducted emissions test, the power cord of the laptop was connected to the mains outlet of the LISN-1.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a “QP”. Average readings are distinguished with an “Ave”.

6.5 Test Setup Diagram



6.6 Environmental Conditions

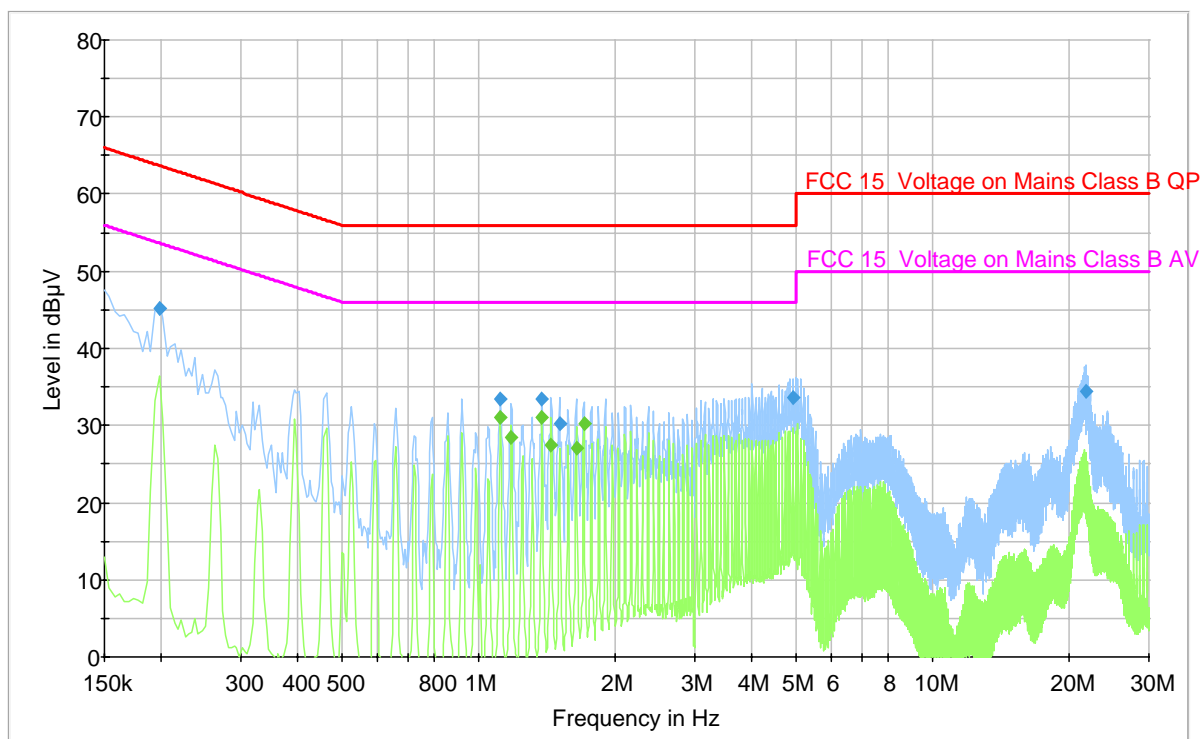
Temperature:	20 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by James Ma from 2007-05-31.*

6.7 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC standard's conducted emissions limits for Class B devices, with the *worst* margin reading of:

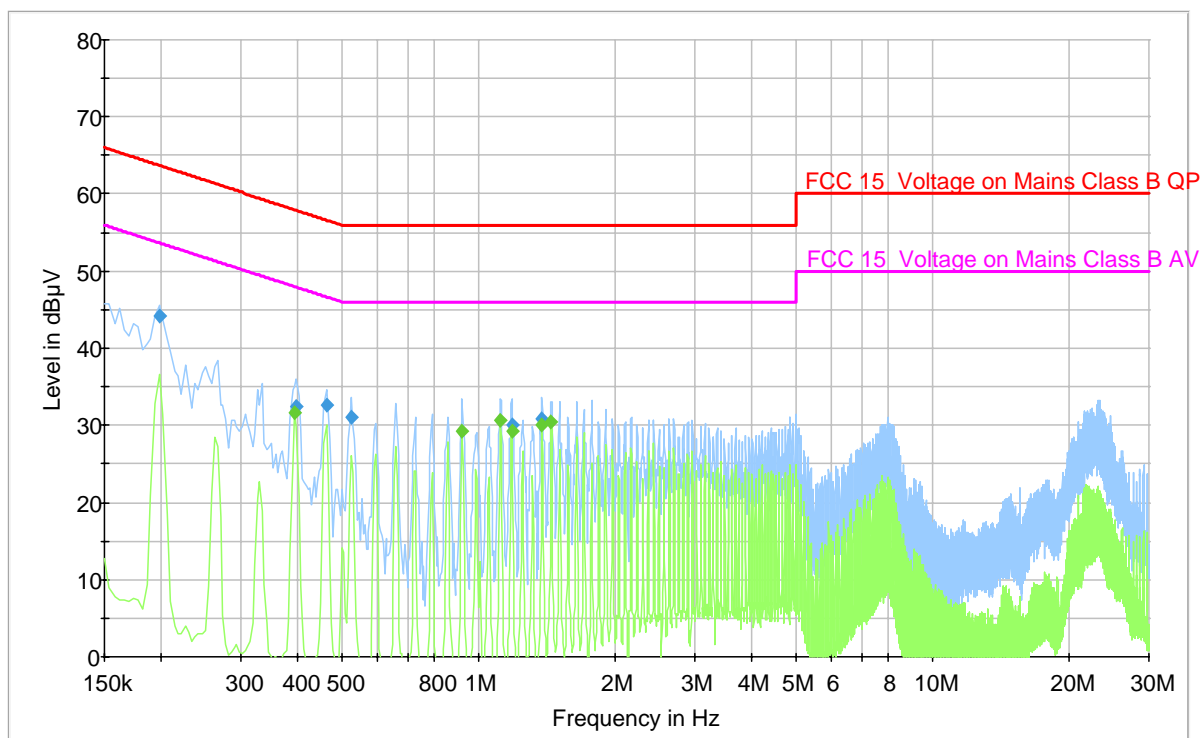
-15.0 dB at 1.118000 MHz Hot conductor

120V/60 Hz Hot:**Final Measurement Quasi-Peak Detector**

Frequency (MHz)	Quasi-Peak (dBμV)	Conductor (H/N)	Limit (dBμV)	Margin (dB)
0.198000	45.2	H	63.7	-18.5
4.934000	33.7	H	56.0	-22.3
1.118000	33.5	H	56.0	-22.5
1.382000	33.5	H	56.0	-22.5
1.510000	30.3	H	56.0	-25.7
21.782000	34.3	H	60.0	-25.7

Final Measurement Average Detector

Frequency (MHz)	Average (dBμV)	Conductor (H/N)	Limit (dBμV)	Margin (dB)
1.118000	31.0	H	46.0	-15.0
1.382000	31.0	H	46.0	-15.0
1.710000	30.2	H	46.0	-15.8
1.182000	28.5	H	46.0	-17.5
1.446000	27.5	H	46.0	-18.5
1.642000	27.0	H	46.0	-19.0

120V/60 Hz Neutral:**Final Measurement Quasi-Peak Detector**

Frequency (MHz)	Quasi-Peak (dBμV)	Conductor (H/N)	Limit (dBμV)	Margin (dB)
0.198000	44.2	N	63.7	-19.4
0.462000	32.7	N	56.7	-23.9
0.526000	31.1	N	56.0	-24.9
1.382000	30.9	N	56.0	-25.1
0.398000	32.4	N	57.9	-25.5
1.186000	30.1	N	56.0	-25.9

Final Measurement Average Detector

Frequency (MHz)	Average (dBμV)	Conductor (H/N)	Limit (dBμV)	Margin (dB)
1.118000	30.6	N	46.0	-15.4
1.446000	30.4	N	46.0	-15.6
1.382000	30.1	N	46.0	-15.9
0.394000	31.7	N	48.0	-16.3
0.922000	29.2	N	46.0	-16.8
1.186000	29.2	N	46.0	-16.8

7 §2.1051 & §15.247(d) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

7.1 Applicable Standard

For §15.247(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.

Requirements: CFR 47, §2.1051.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1057.

7.2 Measurement Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

7.3 Equipment Lists

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2007-02-23

* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

7.4 Test Setup Diagram



7.5 Environmental Conditions

Temperature:	20 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

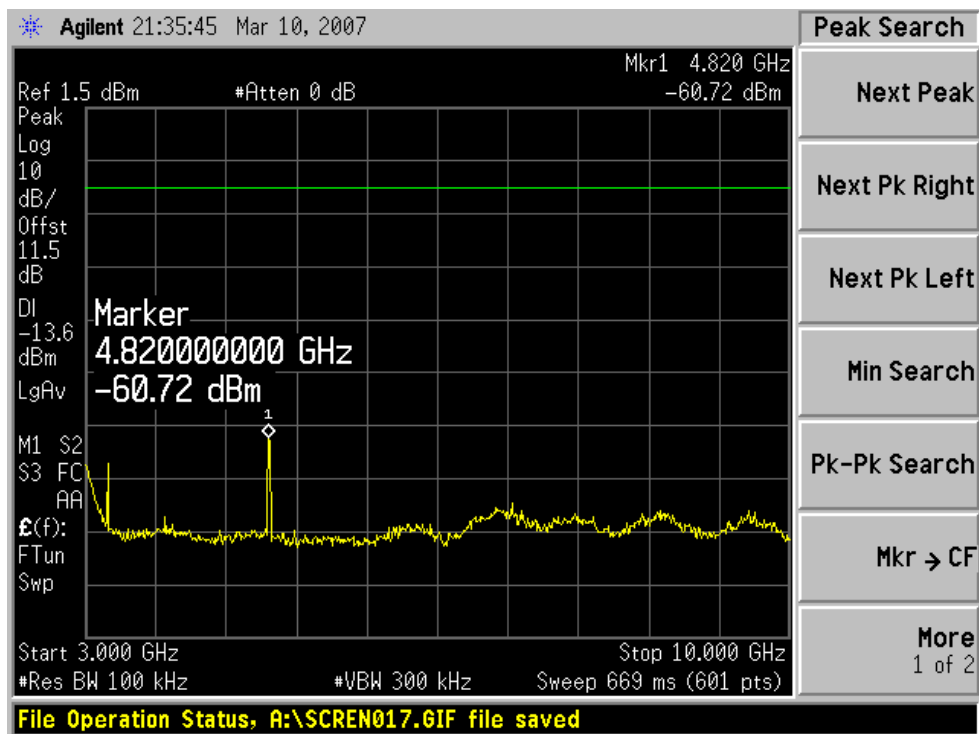
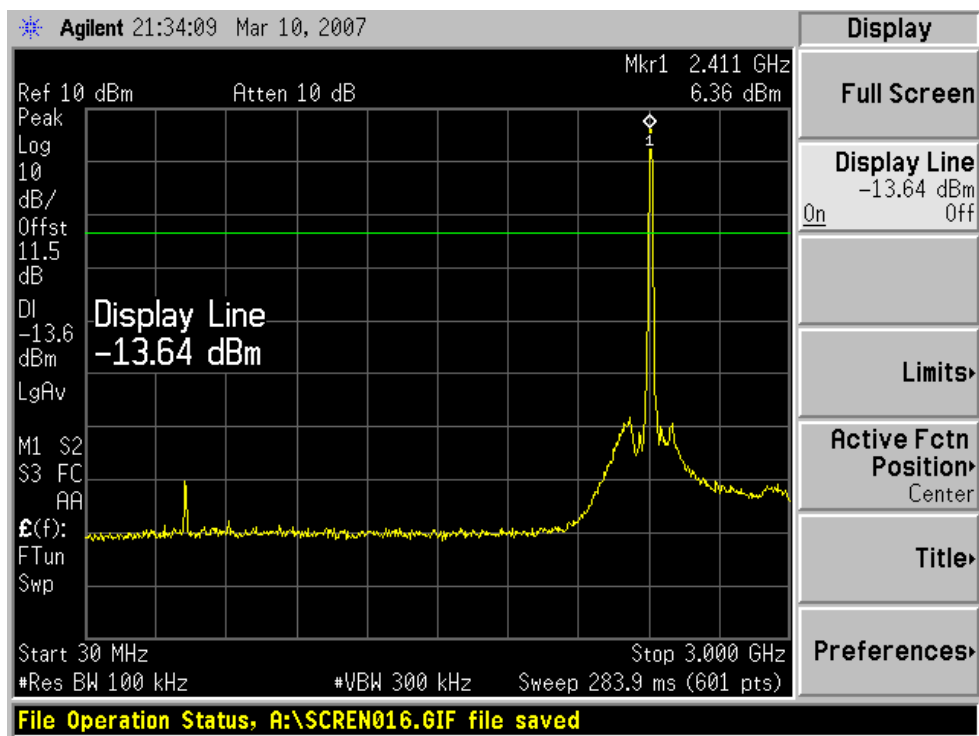
* The testing was performed by James Ma from 2007-04-10.

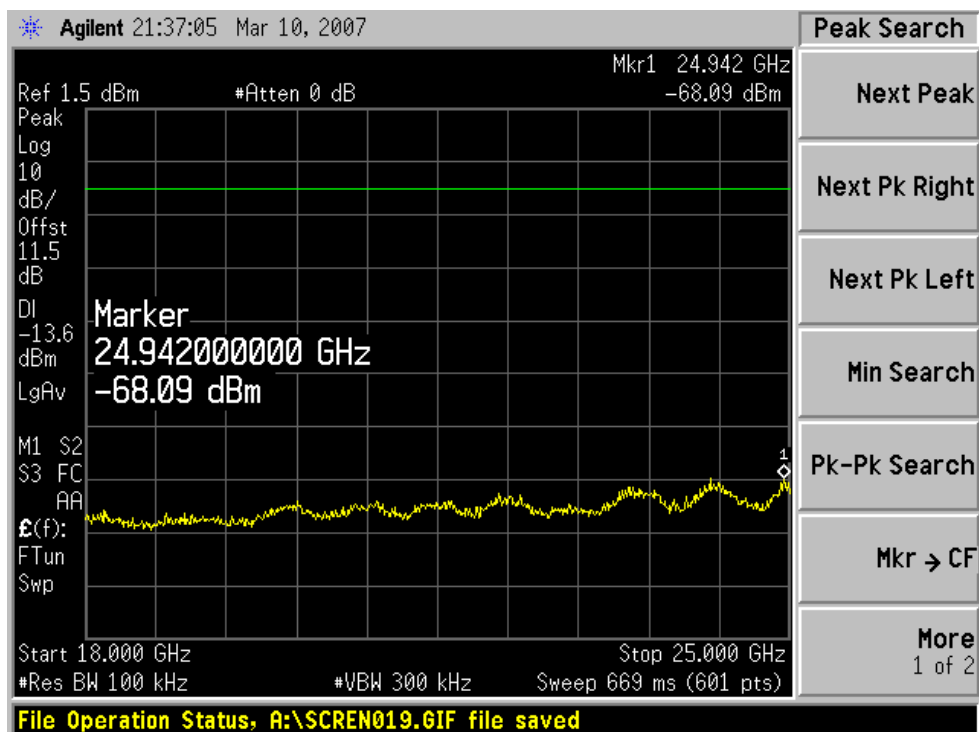
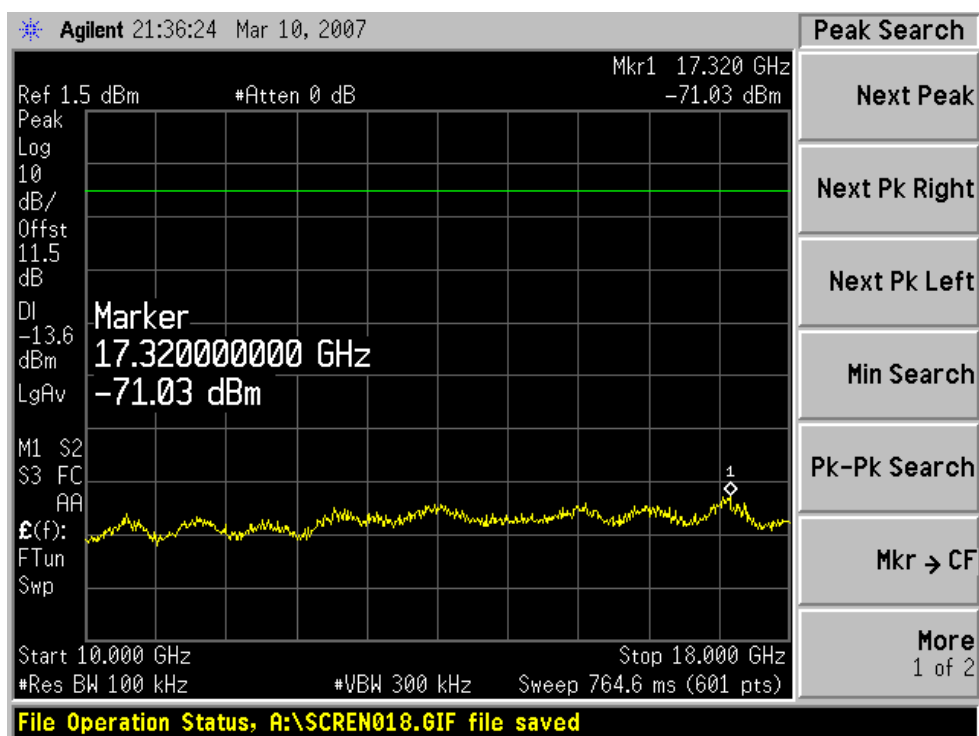
7.6 Measurement Result:

Please refer to following pages for plots of spurious emissions.

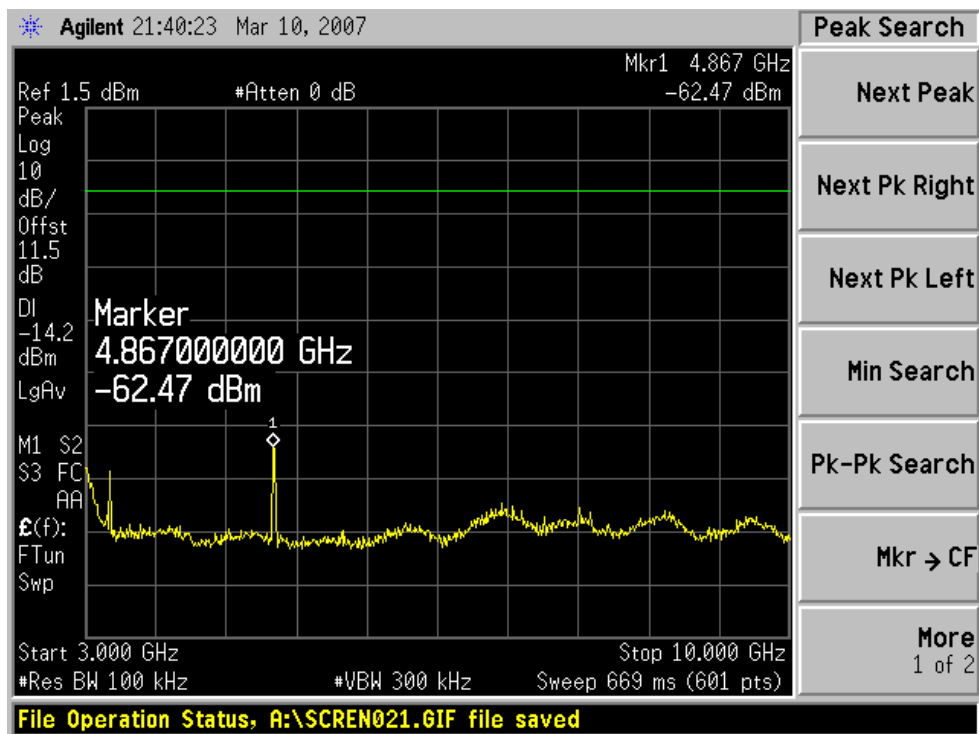
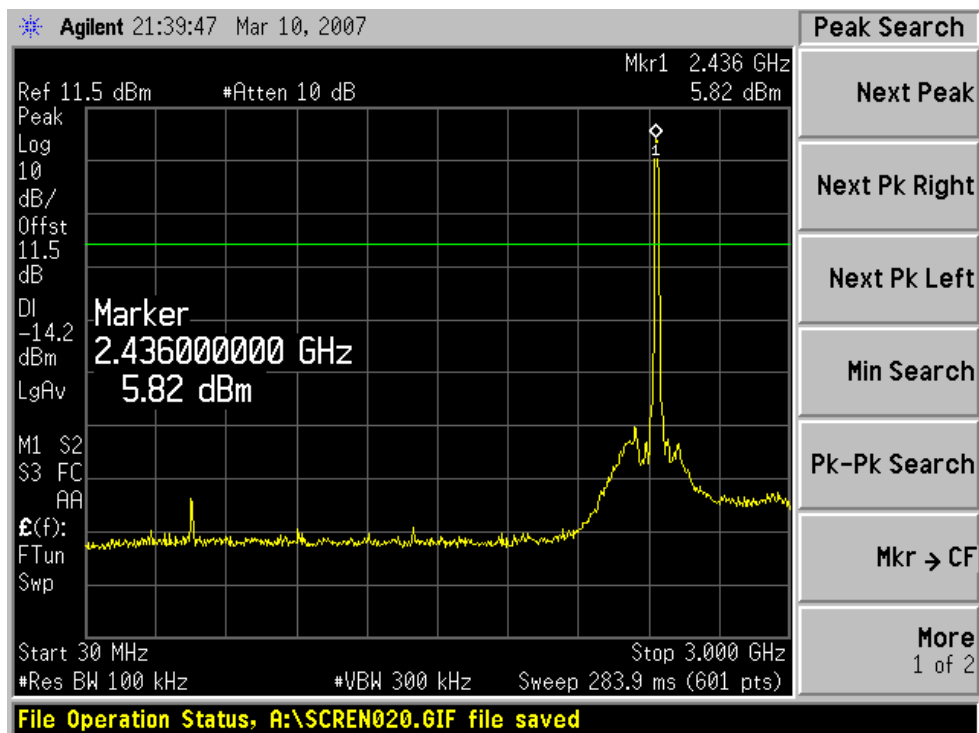
802.11b

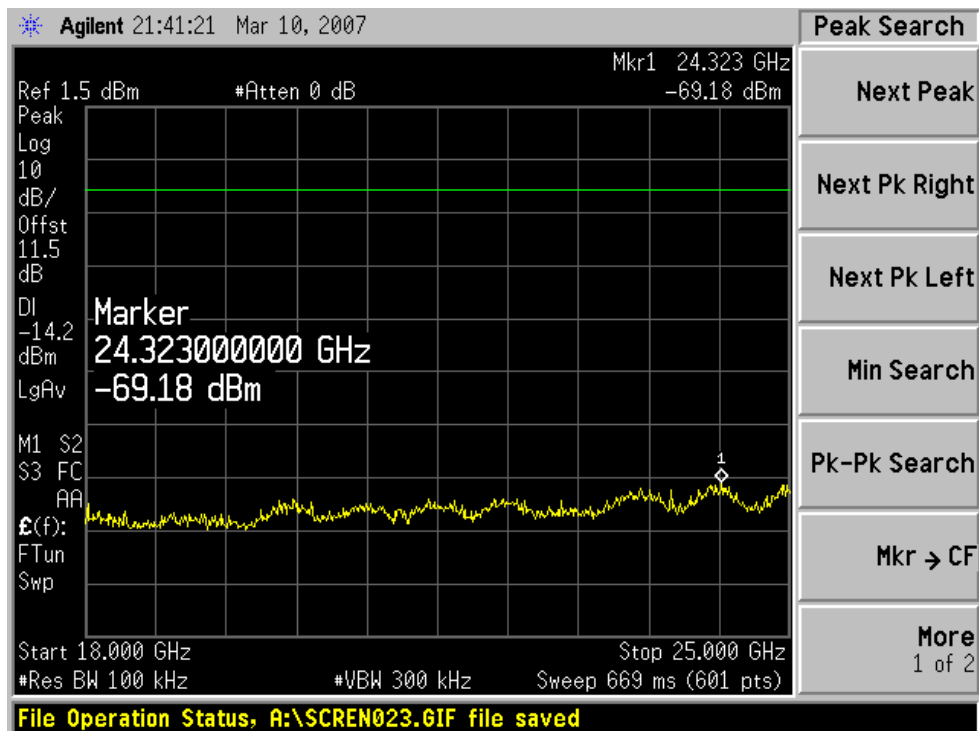
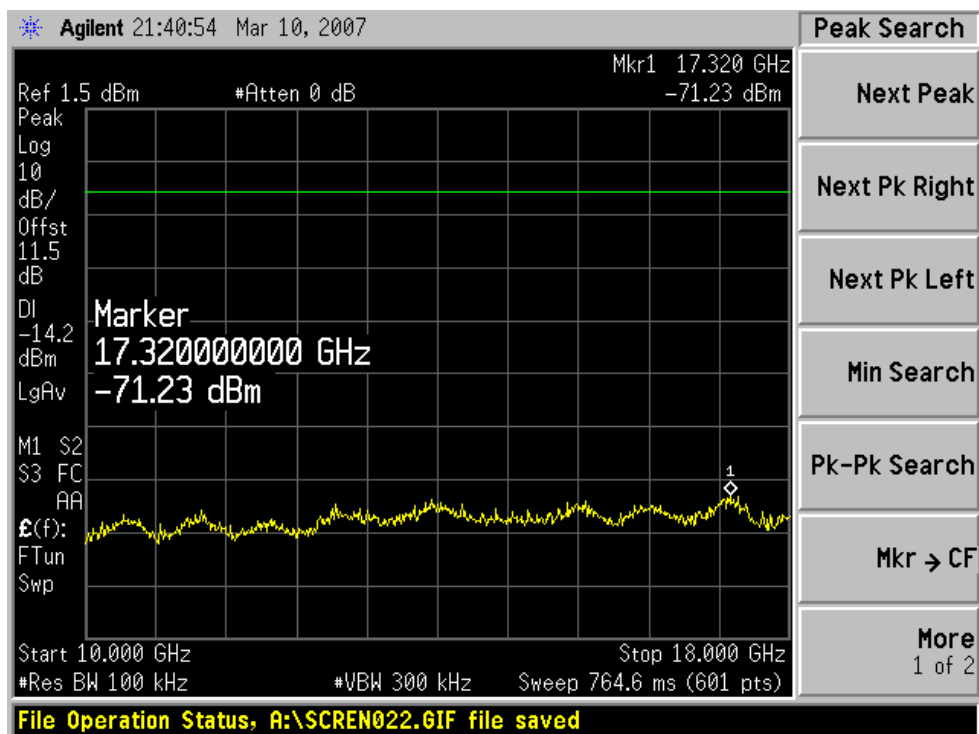
Low Channel



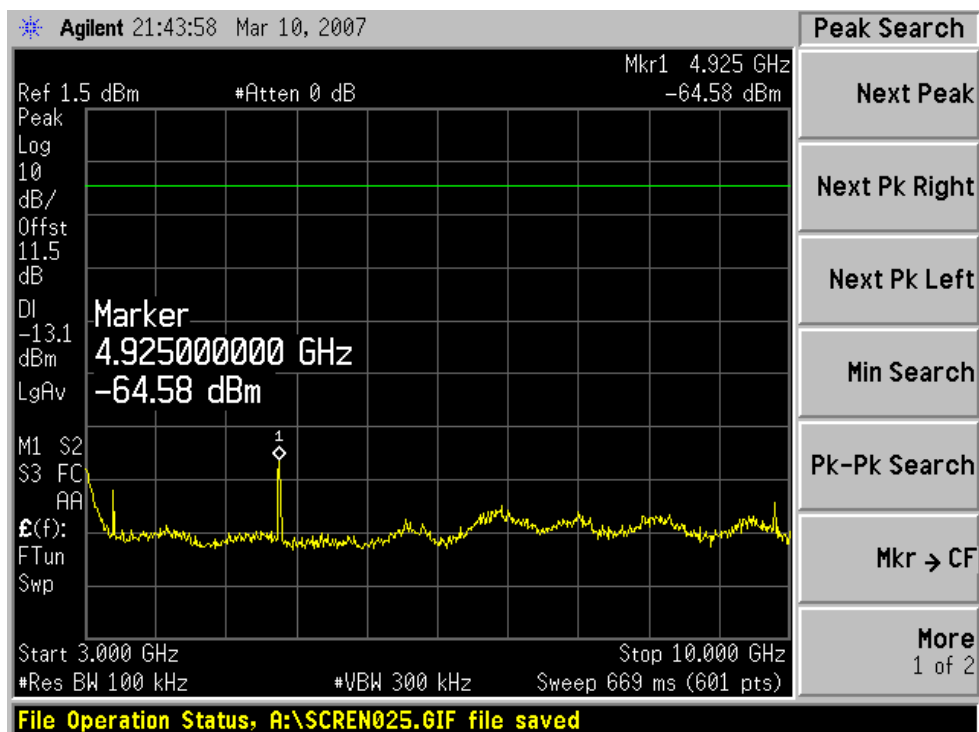
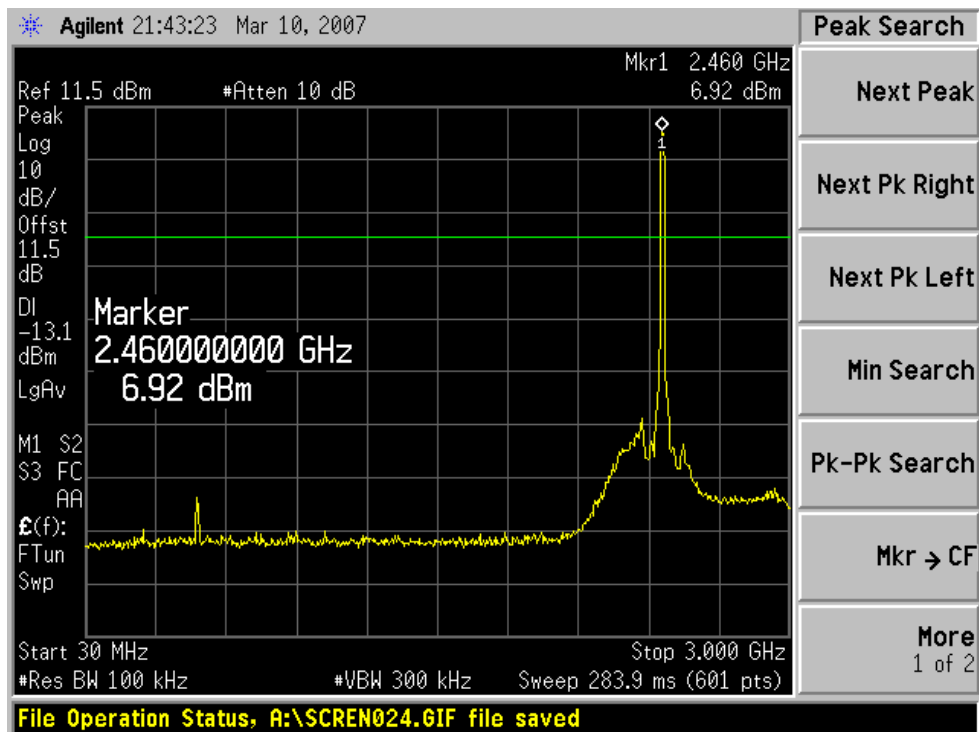


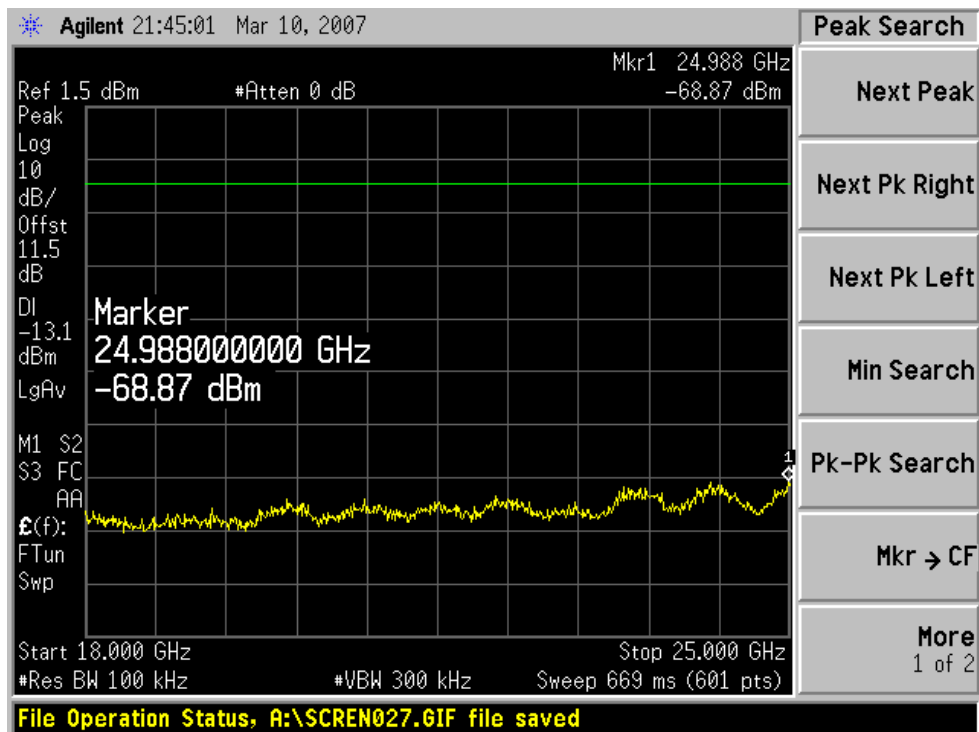
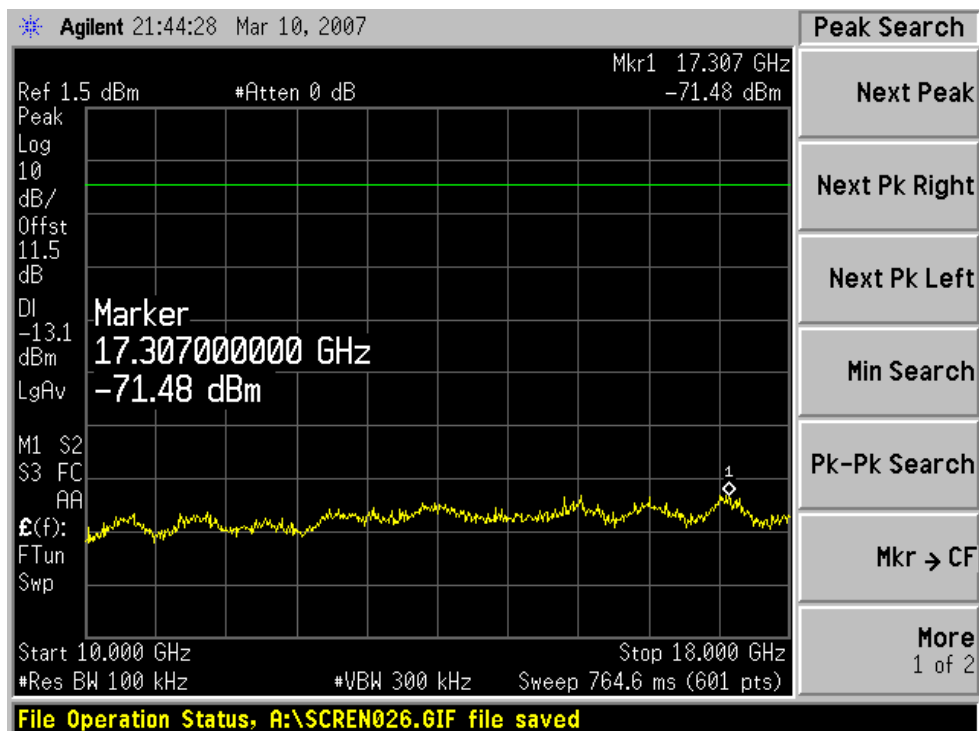
Middle Channel





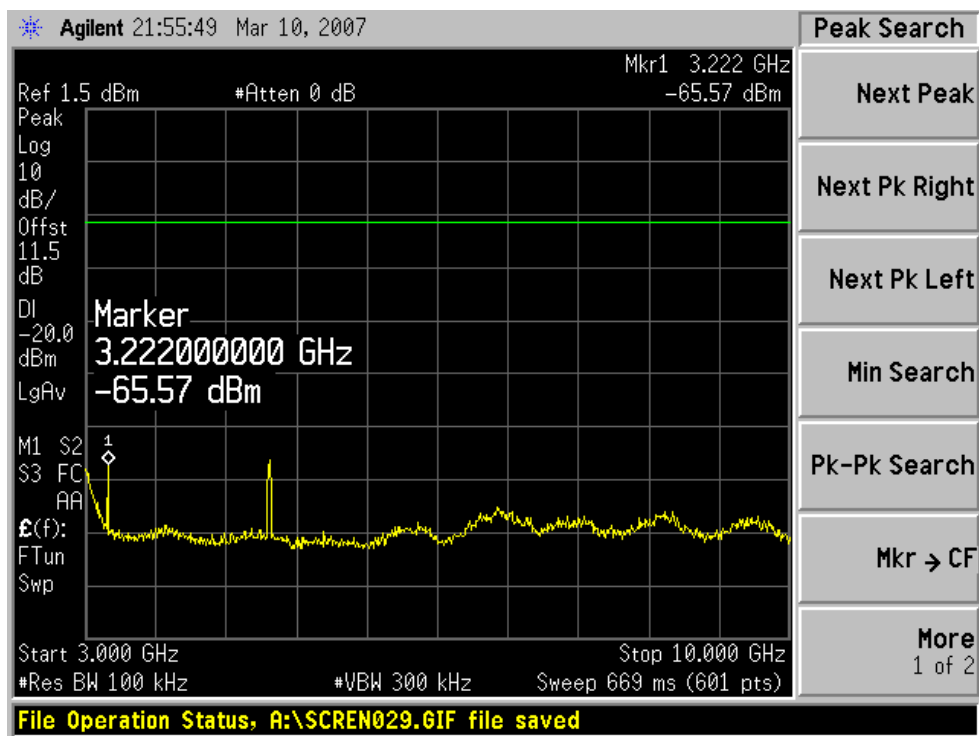
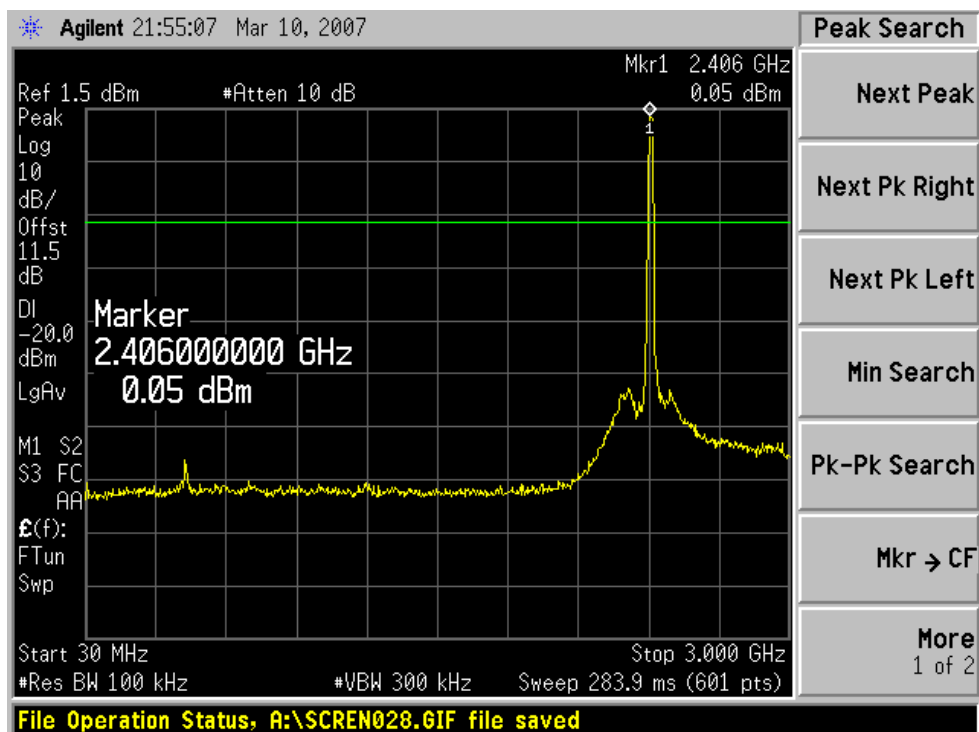
High Channel

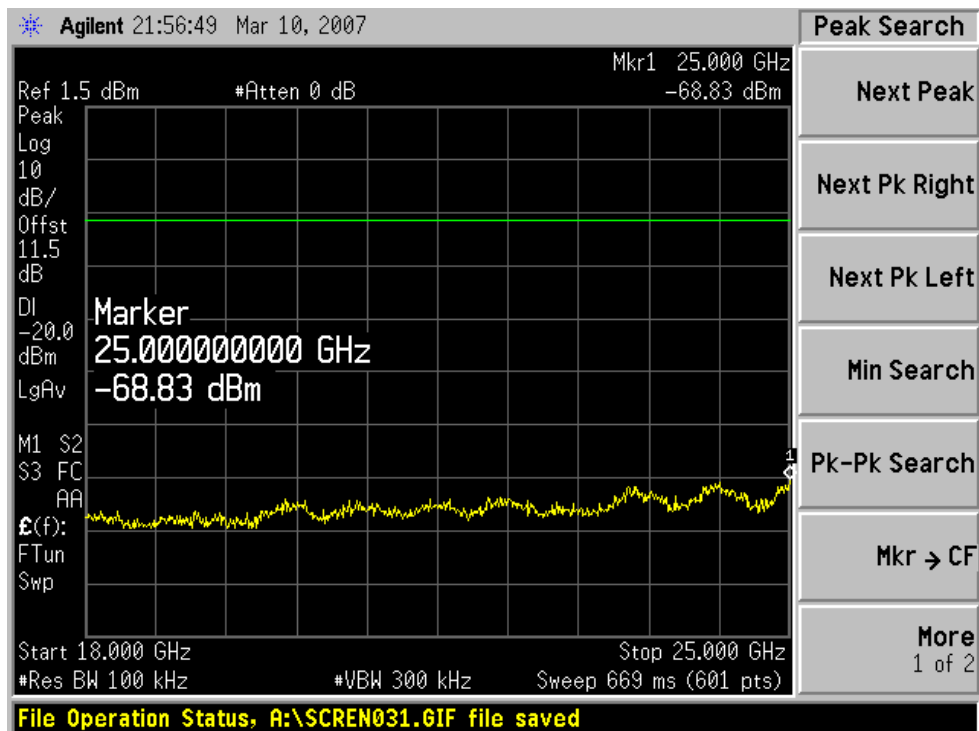
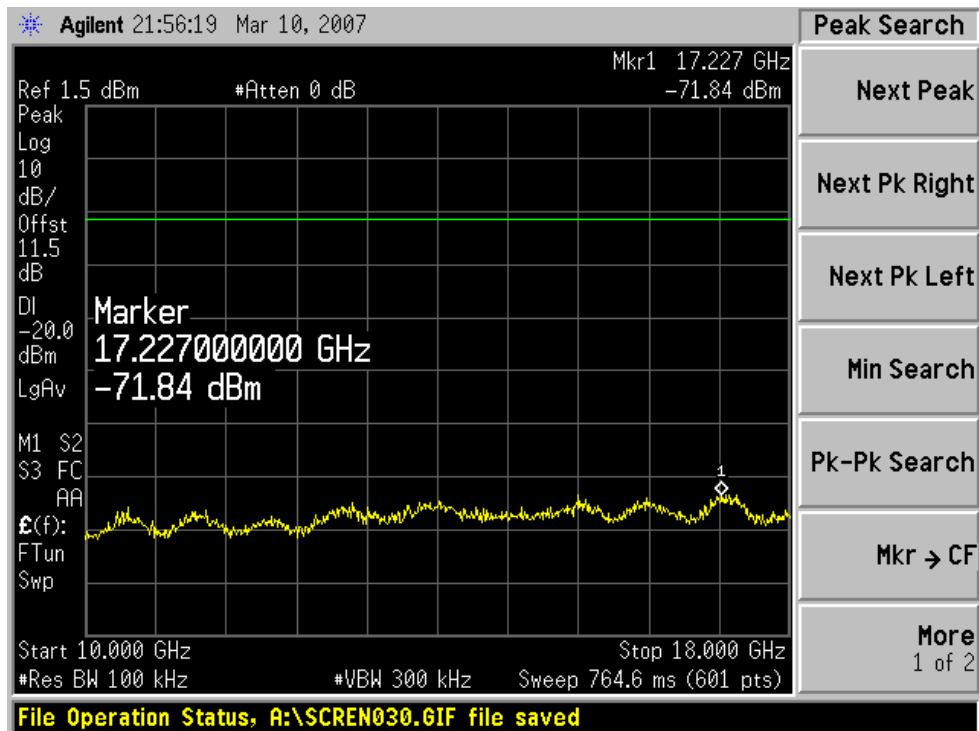




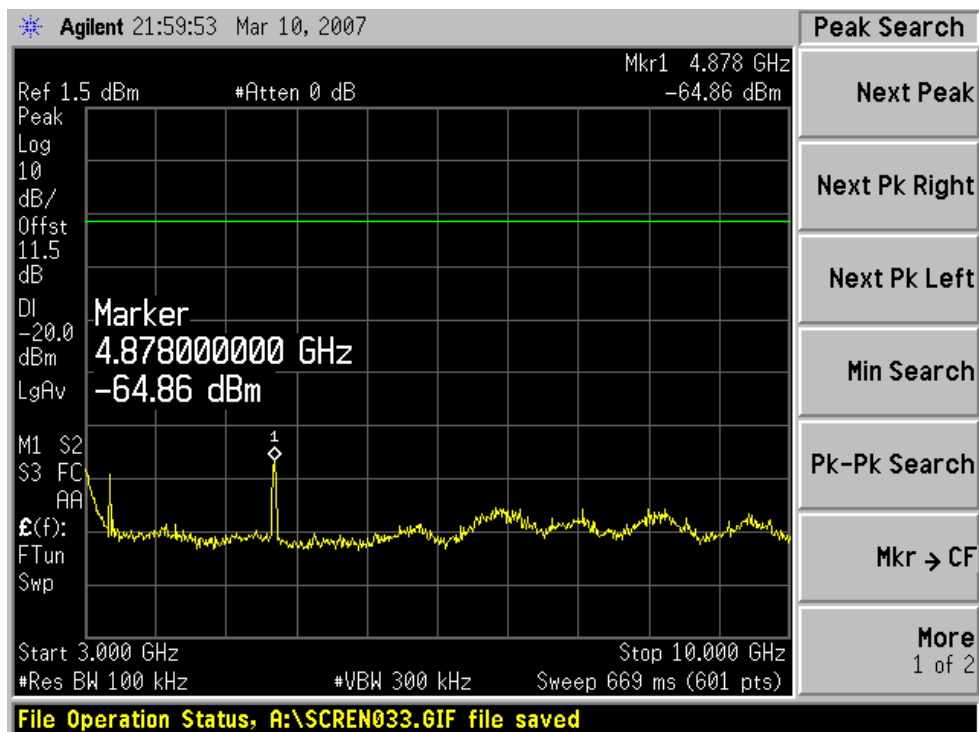
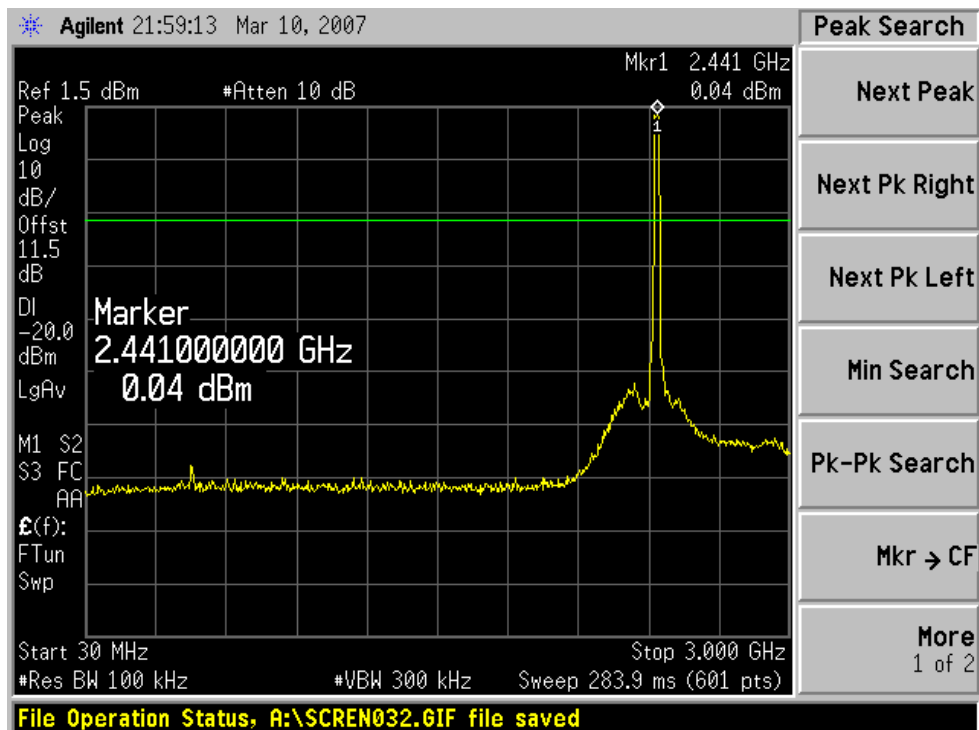
802.11g

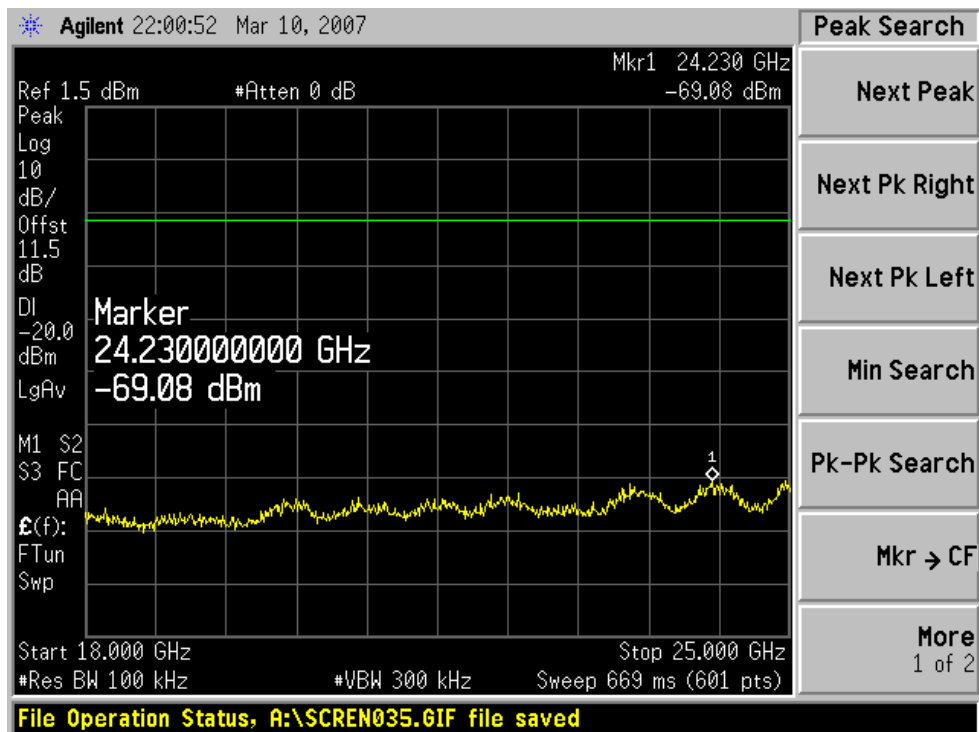
Low Channel



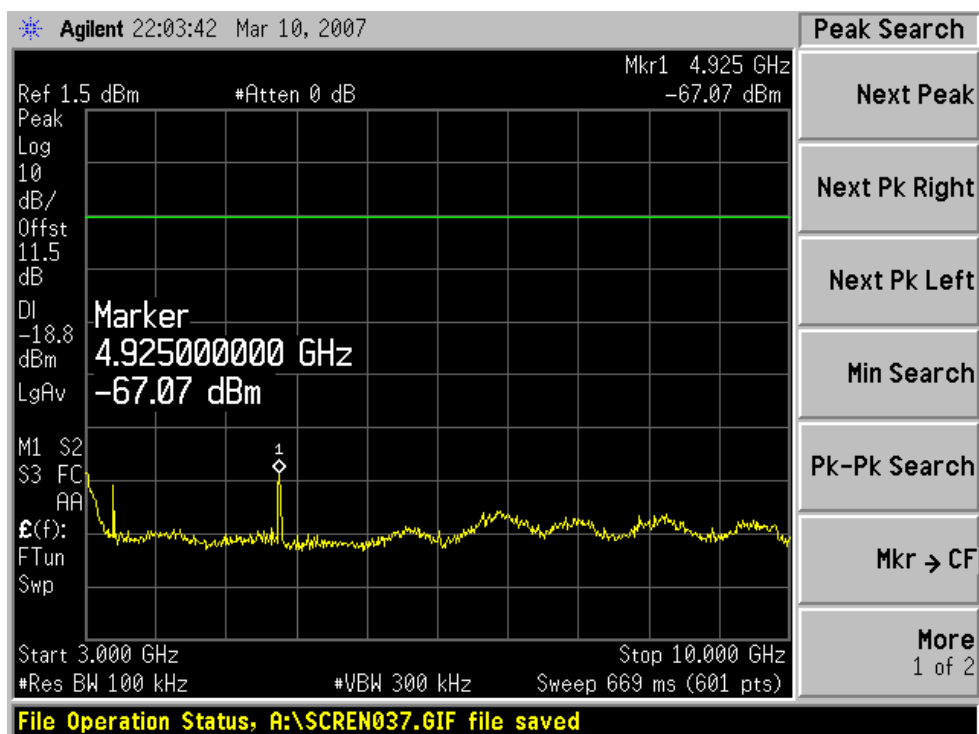
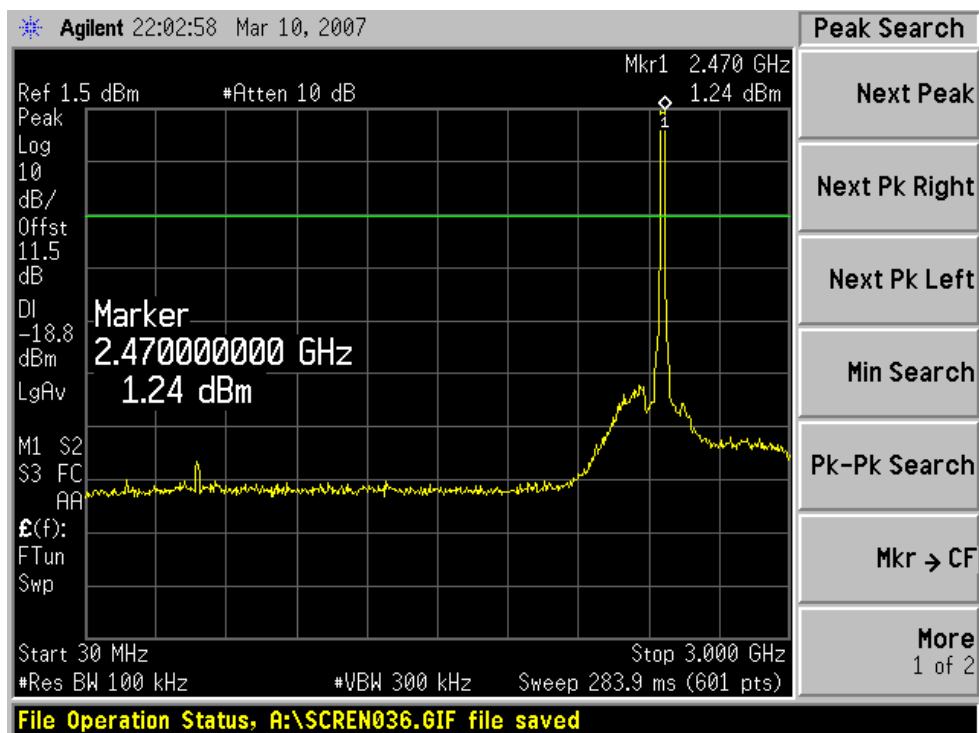


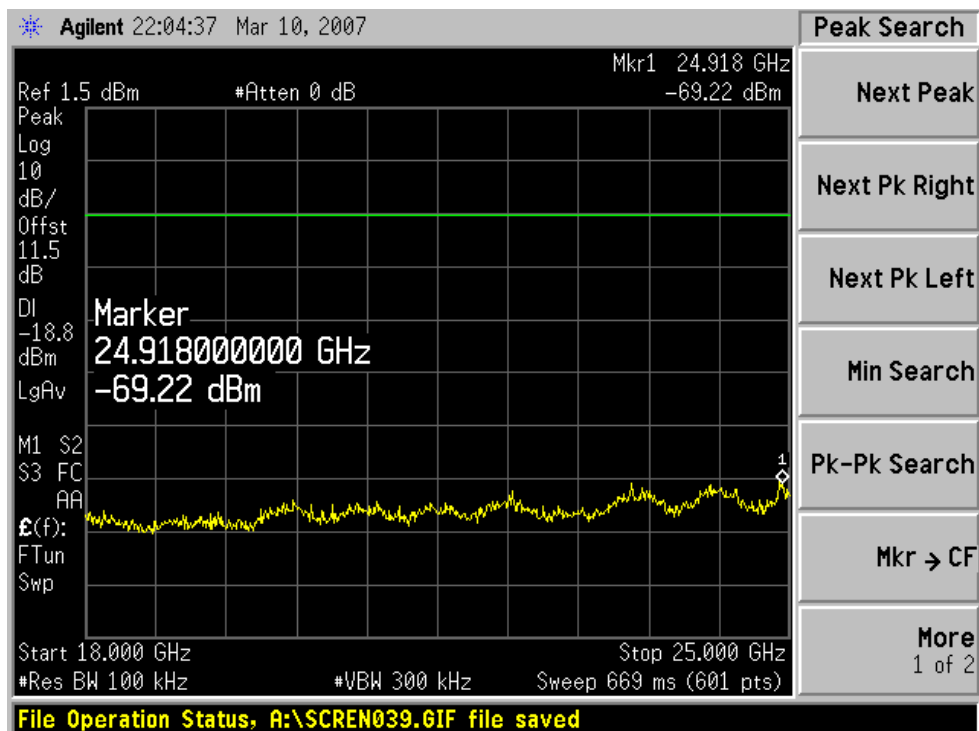
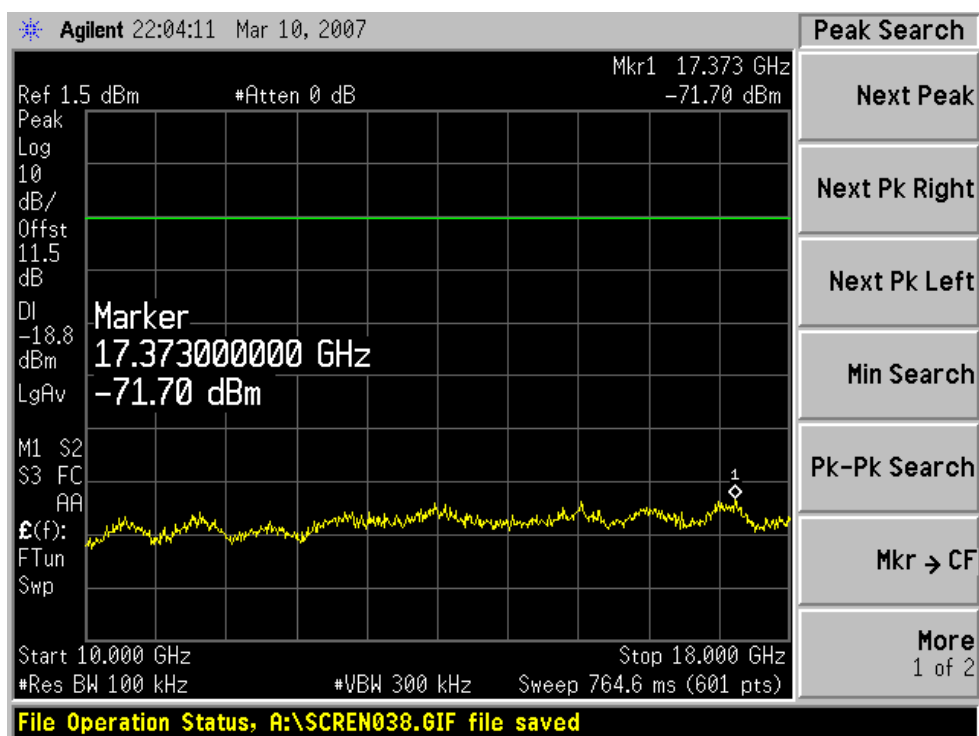
Middle Channel





High Channel





8 §15.109, §15.205, §15.209 & §15.247(c) - SPURIOUS RADIATED EMISSIONS

8.1 Applicable Standard

As per 15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per 15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per 15.247(c)(1)(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.

As Per 15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5.35 – 5.46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 – 167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3.3458 – 3.358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

As per §15.247 (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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

8.2 Test Setup

The radiated emissions tests were performed in the 3-meter open area test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

8.3 EUT Setup

The radiated emissions tests were performed using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

8.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Sonoma Instruments	Pre amplifier	317	260407	2006-03-20 (2 yrs)
HP	Pre amplifier	8449B	3147A00400	2006-08-21
Sunol Science Corp	Combination Antenna	JB3 Antenna	A020106-3	2007-03-05
Agilent	Spectrum Analyzer	E4440A	MY44303352	2007-23-07
A.R.A	Antenna Horn	DRG-118/A	1132	2006-08-17

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

8.5 Test Procedure

For the radiated emissions test, the EUT, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 mete, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000MHz:

$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000MHz:

- (1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
- (2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

8.6 Corrected Amplitude & Margin Calculation

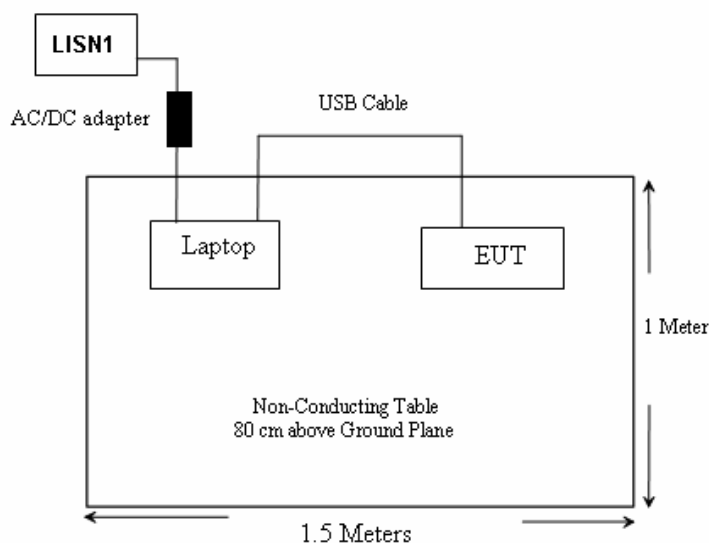
The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corrected Amplitude} - \text{FCC Limit}$$

8.7 Test Setup Diagram



8.8 Environmental Conditions

Temperature:	22 °C
Relative Humidity:	56 %
ATM Pressure:	104.1 kPa

* The testing was performed by James Ma from 2007-04-10.

8.9 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247, and had the worst margin of:

Unintentional Radiated Emissions:

-1.4 dB at 384.050000 MHz in the **Horizontal** polarization, 30 – 1000 MHz

802.11b

-10.8 dB at 7236.0000 MHz in the **Vertical** polarization for Low Channel, 1GHz – 25GHz

-10.9 dB at 7311.0000 MHz in the **Vertical** polarization for Middle Channel, 1GHz – 25GHz

-10.8 dB at 7386.0000 MHz in the **Vertical** polarization for High Channel, 1GHz – 25GHz

802.11g

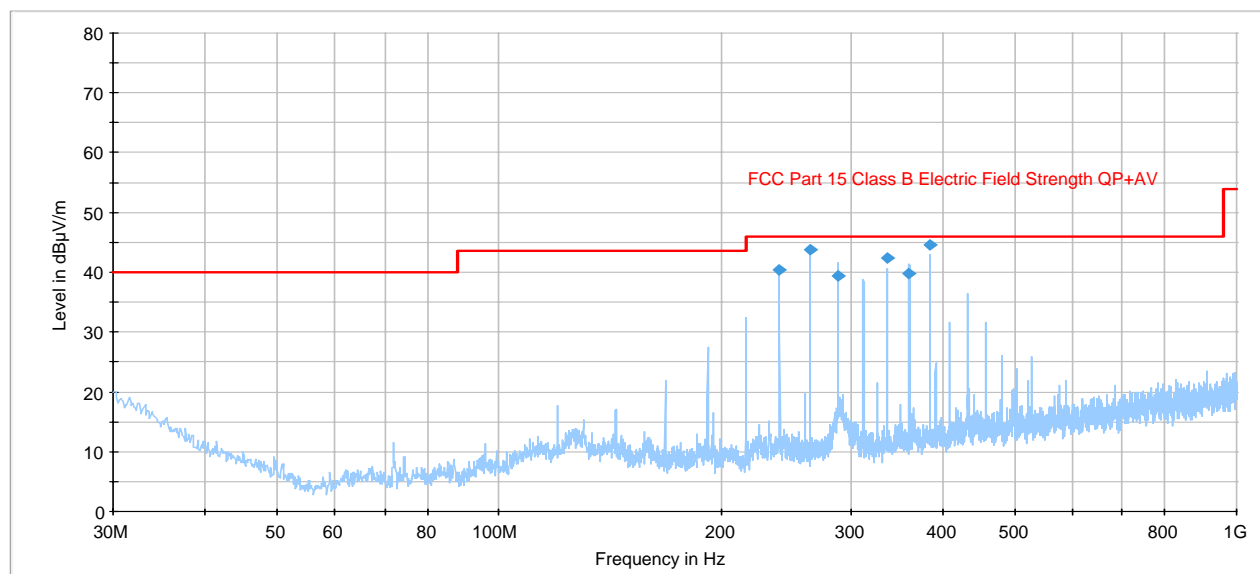
-6.8 dB at 7236.0000 MHz in the **Vertical** polarization for Low Channel, 1GHz – 25GHz

-8.9 dB at 7311.0000 MHz in the **Vertical** polarization for Middle Channel, 1GHz – 25GHz

-10.8 dB at 7386.0000 MHz in the **Vertical** polarization for High Channel, 1GHz – 25GHz

8.10 Radiated Emissions Test plot & data:

Primary scan 30MHz -1GHz



Frequency (MHz)	Quasi-Peak (dBμV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (degrees)	Limit (dBμV/m)	Margin (dB)
384.050000	44.6	98.0	H	138.0	46.0	-1.4
264.052500	43.8	101.0	H	170.0	46.0	-2.2
336.036250	42.5	99.0	H	159.0	46.0	-3.5
240.046250	40.5	97.0	H	157.0	46.0	-5.5
360.042500	39.7	98.0	H	22.0	46.0	-6.3
288.060000	39.3	101.0	H	32.0	46.0	-6.7

8.11 Radiated Spurious Emissions Test Data**8.11.1 802.11b, 2412 - 2462 MHz, Measured at 3 meters, 1 GHz – 25 GHz**

Low channel 2412 MHz

Frequency (MHz)	Reading (dBμV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comments
2412.00	111.9	220	1.5	V	28.2	4.4	36.2	108.3			Fund/Peak
2412.00	97.7	320	1.5	H	28.2	4.4	36.2	94.1			Fund/Peak
2412.00	104.1	220	1.8	V	28.2	4.4	36.2	100.5			Ave
2412.00	91.6	320	1.5	H	28.2	4.4	36.2	88.0			Ave
7236.00	30.2	90	2.0	V	37.6	12.3	36.9	43.2	54	-10.8	Ave
7236.00	29.5	200	1.0	H	37.6	12.3	36.9	42.5	54	-11.5	Ave
4824.00	35.7	270	2.4	V	32.1	6.0	34.4	39.4	54	-14.6	Ave
4824.00	30.4	180	2.3	H	32.1	6.0	34.4	34.1	54	-19.9	Ave
7236.00	40.6	90	2.0	V	37.6	12.3	36.9	53.6	74	-20.4	Peak
7236.00	38.1	200	1.0	H	37.6	12.3	36.9	51.1	74	-22.9	Peak
4824.00	44.1	45	1.7	V	32.1	6.0	34.4	47.8	74	-26.2	Peak
4824.00	39.8	70	1.7	H	32.1	6.0	34.4	43.5	74	-30.5	Peak

Middle channel 2437 MHz

Frequency (MHz)	Reading (dBμV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comments
2437.00	110.3	45	1.0	V	28.2	4.4	36.2	106.7			Fund/Peak
2437.00	99.2	45	1.2	H	28.2	4.4	36.2	95.6			Fund/Peak
2437.00	104.6	45	1.0	V	28.2	4.4	36.2	101.0			Ave
2437.00	94.1	45	1.2	H	28.2	4.4	36.2	90.5			Ave
7311.00	30.1	30	1.3	V	37.6	12.3	36.9	43.1	54	-10.9	Ave
7311.00	29.1	180	1.0	H	37.6	12.3	36.9	42.1	54	-11.9	Ave
4874.00	31.7	35	1.5	V	32.1	6.0	34.4	35.4	54	-18.6	Ave
4874.00	30.0	160	2.2	H	32.1	6.0	34.4	33.7	54	-20.3	Ave
7311.00	37.2	30	1.3	V	37.6	12.3	36.9	50.2	74	-23.8	Peak
7311.00	35.3	180	1.0	H	37.6	12.3	36.9	48.3	74	-25.7	Peak
4874.00	41.8	35	1.5	V	32.1	6.0	34.4	45.5	74	-28.5	Peak
4874.00	40.0	160	2.2	H	32.1	6.0	34.4	43.7	74	-30.3	Peak

High channel 2462 MHz

Frequency (MHz)	Reading (dBμV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comments
2462.00	110.0	40	1.3	V	28.2	4.4	36.2	106.4			Fund/Peak
2462.00	98.6	180	1.2	H	28.2	4.4	36.2	95.0			Fund/Peak
2462.00	103.7	40	1.3	V	28.2	4.4	36.2	100.1			Ave
2462.00	92.1	180	1.2	H	28.2	4.4	36.2	88.5			Ave
7386.00	30.2	270	2.4	V	37.6	12.3	36.9	43.2	54	-10.8	Ave
7386.00	29.4	180	1.2	H	37.6	12.3	36.9	42.4	54	-11.6	Ave
4924.00	34.2	60	2.0	V	32.1	6.0	34.4	37.9	54	-16.1	Ave
4924.00	32.7	90	2.1	H	32.1	6.0	34.4	36.4	54	-17.6	Ave
7386.00	36.8	270	2.4	V	37.6	12.3	36.9	49.8	74	-24.2	Peak
7386.00	34.2	180	1.2	H	37.6	12.3	36.9	47.2	74	-26.8	Peak
4924.00	42.9	60	2.0	V	32.1	6.0	34.4	46.6	74	-27.4	Peak
4924.00	40.0	90	2.1	H	32.1	6.0	34.4	43.7	74	-30.3	Peak

8.11.2 802.11g: 2412 – 2462 MHz, Measured at 3 meters

Low channel 2412 MHz

Frequency (MHz)	Reading (dBμV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comments
2412.00	107.2	50	1.5	V	28.2	4.4	36.2	103.6			Fund/Peak
2412.00	95.0	60	1.5	H	28.2	4.4	36.2	91.4			Fund/Peak
2412.00	101.2	50	1.8	V	28.2	4.4	36.2	97.6			Ave
2412.00	87.3	60	1.5	H	28.2	4.4	36.2	83.7			Ave
7236.00	34.2	90	2.0	V	37.6	12.3	36.9	47.2	54	-6.8	Ave
7236.00	31.8	200	1.0	H	37.6	12.3	36.9	44.8	54	-9.2	Ave
4824.00	36.4	270	2.4	V	32.1	6.0	34.4	40.1	54	-13.9	Ave
4824.00	33.6	180	2.3	H	32.1	6.0	34.4	37.3	54	-16.7	Ave
7236.00	42.1	90	2.0	V	37.6	12.3	36.9	55.1	74	-18.9	Peak
7236.00	37.3	200	1.0	H	37.6	12.3	36.9	50.3	74	-23.7	Peak
4824.00	44.2	45	1.7	V	32.1	6.0	34.4	47.9	74	-26.1	Peak
4824.00	42.1	70	1.7	H	32.1	6.0	34.4	45.8	74	-28.2	Peak

Middle channel 2437 MHz

Frequency (MHz)	Reading (dBμV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comments
2437.00	107.8	45	1.0	V	28.2	4.4	36.2	104.2			Fund/Peak
2437.00	96.7	45	1.2	H	28.2	4.4	36.2	93.1			Fund/Peak
2437.00	101.6	45	1.0	V	28.2	4.4	36.2	98.0			Ave
2437.00	89.4	45	1.2	H	28.2	4.4	36.2	85.8			Ave
7311.00	32.1	30	1.3	V	37.6	12.3	36.9	45.1	54	-8.9	Ave
7311.00	29.7	180	1.0	H	37.6	12.3	36.9	42.7	54	-11.3	Ave
4874.00	36.8	35	1.5	V	32.1	6.0	34.4	40.5	54	-13.5	Ave
4874.00	34.0	160	2.2	H	32.1	6.0	34.4	37.7	54	-16.3	Ave
7311.00	39.6	30	1.3	V	37.6	12.3	36.9	52.6	74	-21.4	Peak
7311.00	36.4	180	1.0	H	37.6	12.3	36.9	49.4	74	-24.6	Peak
4874.00	42.7	35	1.5	V	32.1	6.0	34.4	46.4	74	-27.6	Peak
4874.00	40.2	160	2.2	H	32.1	6.0	34.4	43.9	74	-30.1	Peak

High channel 2462 MHz

Frequency (MHz)	Reading (dBμV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comments
2462.00	108.1	60	1.3	V	28.2	4.4	36.2	104.5			Fund/Peak
2462.00	96.6	180	1.2	H	28.2	4.4	36.2	93.0			Fund/Peak
2462.00	100.0	60	1.3	V	28.2	4.4	36.2	96.4			Ave
2462.00	88.2	180	1.2	H	28.2	4.4	36.2	84.6			Ave
7386.00	30.2	270	2.4	V	37.6	12.3	36.9	43.2	54	-10.8	Ave
7386.00	29.4	180	1.2	H	37.6	12.3	36.9	42.4	54	-11.6	Ave
4924.00	35.2	60	2.0	V	32.1	6.0	34.4	38.9	54	-15.1	Ave
4924.00	33.7	90	2.1	H	32.1	6.0	34.4	37.4	54	-16.6	Ave
7386.00	36.5	270	2.4	V	37.6	12.3	36.9	49.5	74	-24.5	Peak
7386.00	34.4	180	1.2	H	37.6	12.3	36.9	47.4	74	-26.6	Peak
4924.00	41.3	60	2.0	V	32.1	6.0	34.4	45.0	74	-29.0	Peak
4924.00	40.0	90	2.1	H	32.1	6.0	34.4	43.7	74	-30.3	Peak

9 §15.247(a) (2) – 6 dB BANDWIDTH

9.1 Applicable Standard

According to §15.247(a)(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

9.2 Measurement Procedure

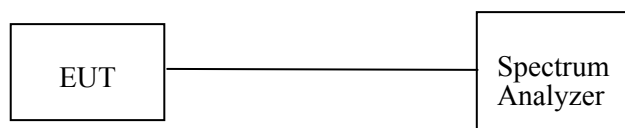
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emissions bandwidth. (6 dB bandwidth for DTS)
4. Repeat above procedures until all frequencies measured were complete.

9.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2007-02-23

* **Statement of Traceability:** **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

9.4 Test Setup Diagram



9.5 Environmental Conditions

Temperature:	20 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

* The testing was performed by James Ma from 2007-04-10.

9.6 Summary of Test Results

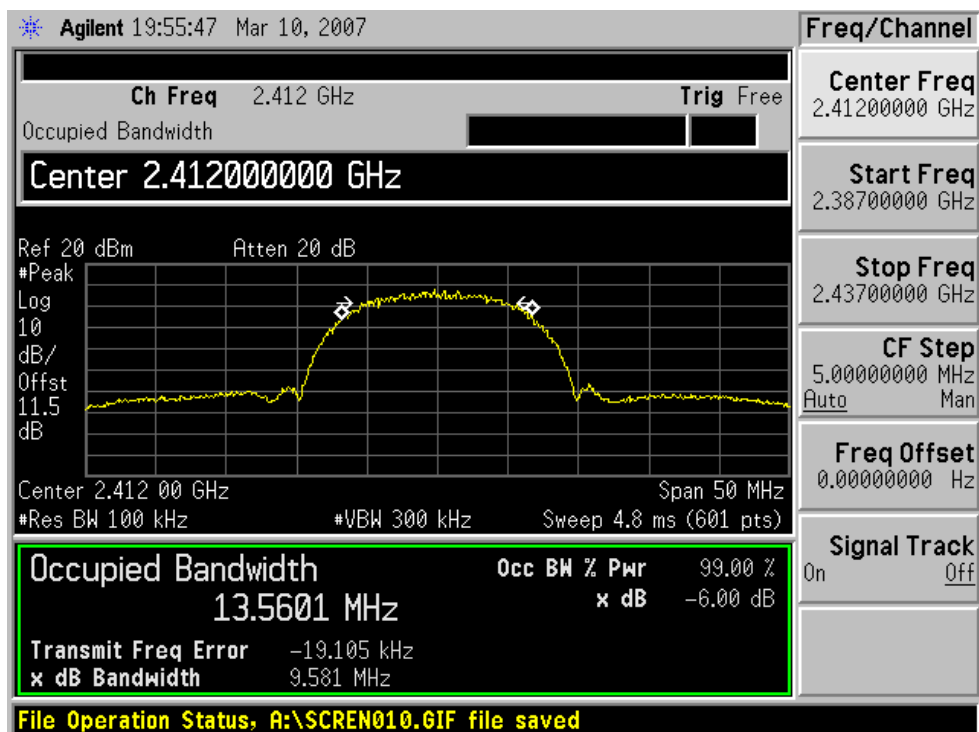
Please refer to the plots.

Channel	Frequency (MHz)	6 dB BW (kHz)	Limit (kHz)	Result
802.11 b				
Low	2412	9581	500	Compliant
Middle	2437	9589	500	Compliant
High	2462	9588	500	Compliant
802.11 g				
Low	2412	16615	500	Compliant
Middle	2437	16620	500	Compliant
High	2462	16623	500	Compliant

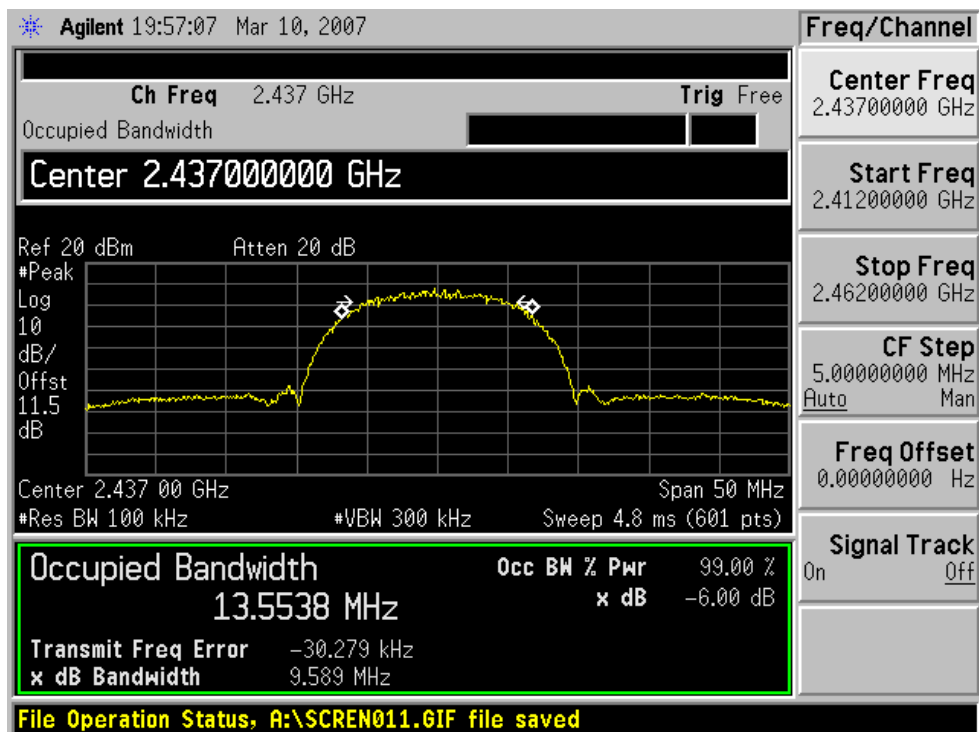
Please refer to the following plots for detailed test results

802.11b

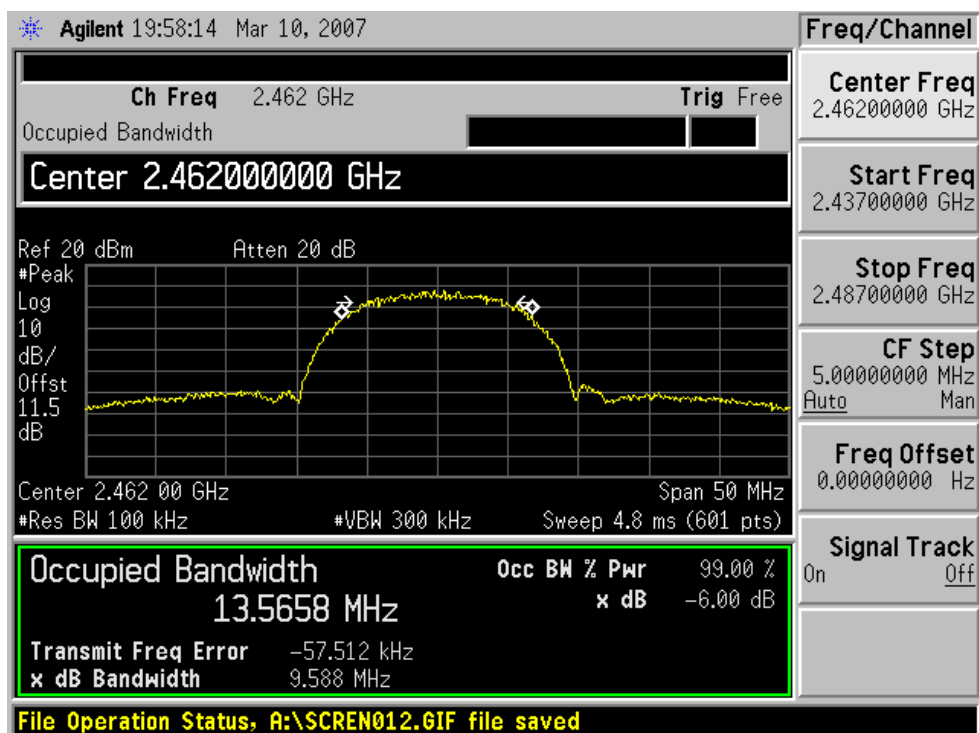
Low Channel



Middle Channel

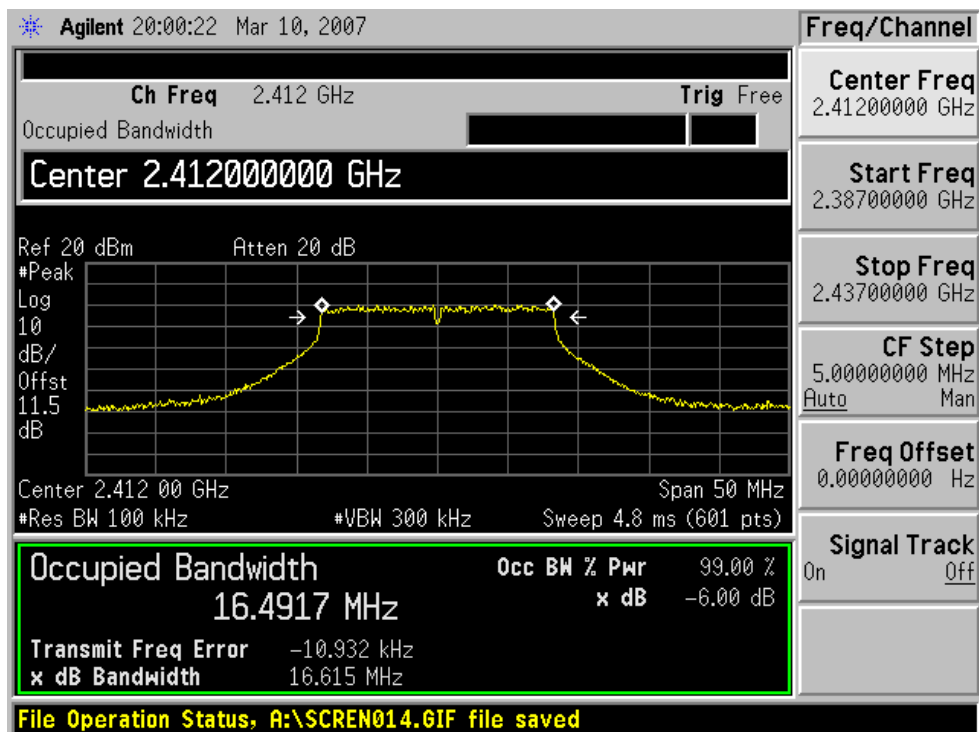


High Channel

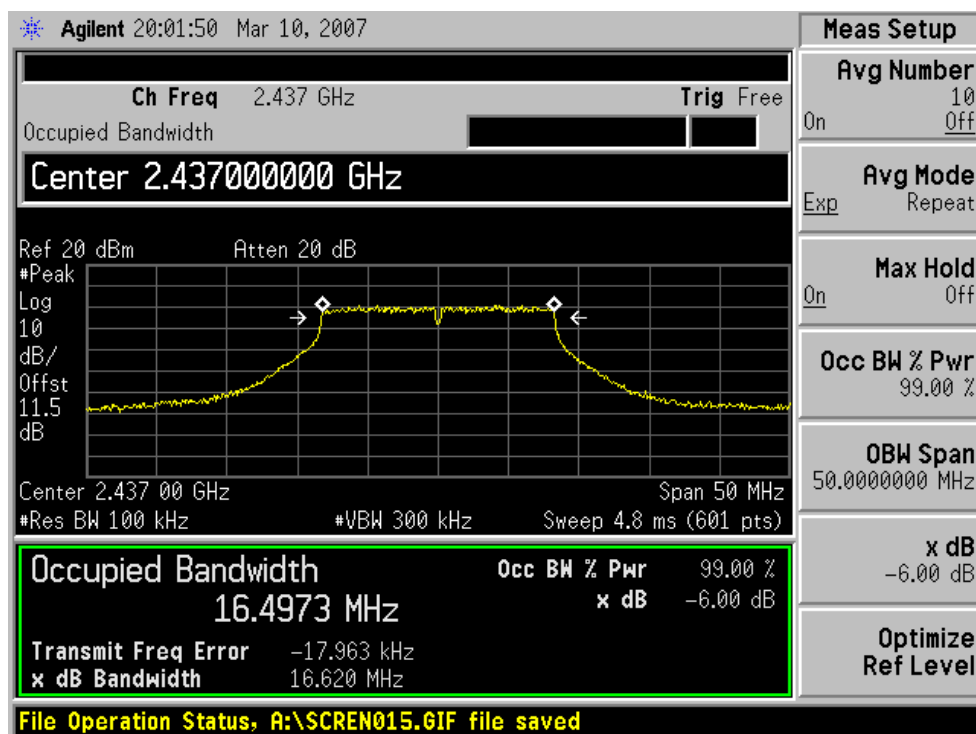


802.11g

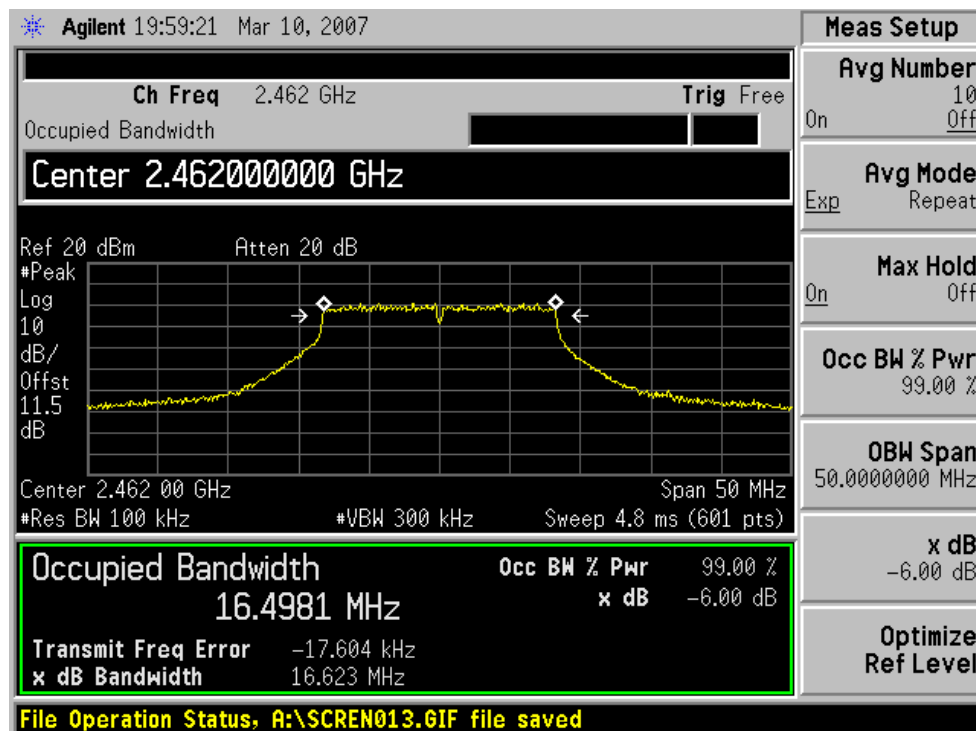
Low Channel



Middle Channel



High Channel



10 §15.247(b) - PEAK OUTPUT POWER MEASUREMENT

10.1 Applicable Standard

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

§15.247(b) (3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

§15.247(b) (4) (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.

10.2 Measurement Procedure

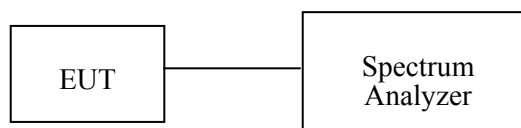
1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.

10.3 Equipment Lists

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2007-02-23

* **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

10.4 Test Setup Diagram



10.5 Environmental Conditions

Temperature:	20 °C
Relative Humidity:	44 %
ATM Pressure:	102.0 kPa

* The testing was performed by James Ma from 2007-04-10.

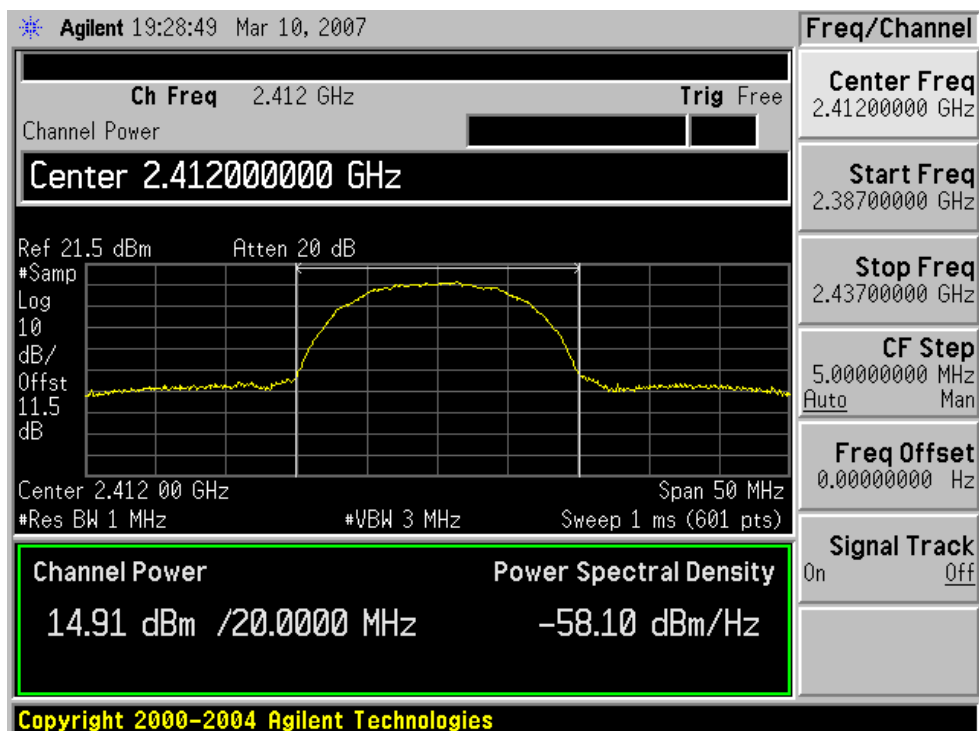
10.6 Summary of Test Results

Frequency (MHz)	Max Power (dBm)	Max Power (mW)	Limit (mW)	Result
802.11b				
2412	14.91	30.97	1000	Compliant
2437	15.11	32.43	1000	Compliant
2462	15.24	33.42	1000	Compliant
802.11g				
2412	12.62	18.28	1000	Compliant
2437	12.59	18.16	1000	Compliant
2462	12.85	19.28	1000	Compliant

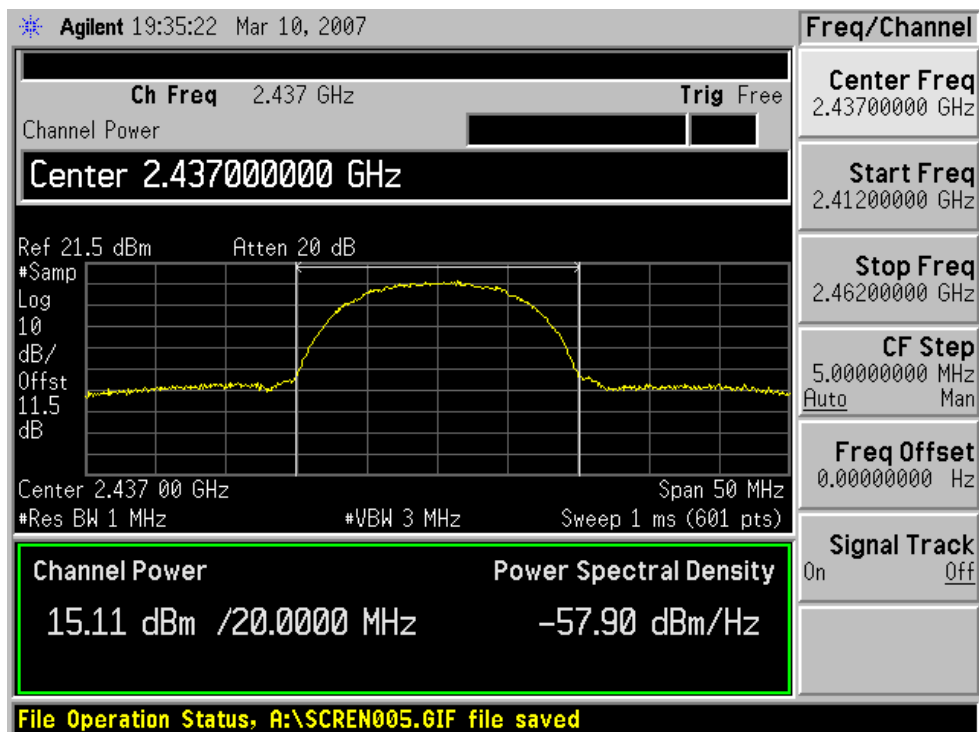
Please refer to the following plots for detailed test results

10.6.3 802.11b

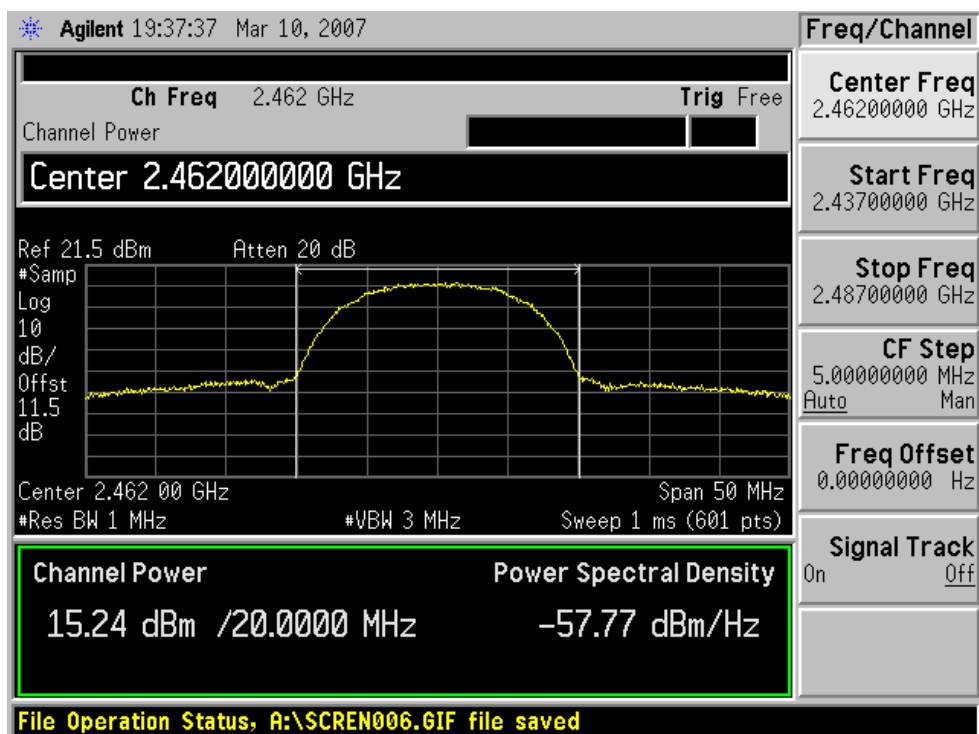
Low Channel



Middle Channel

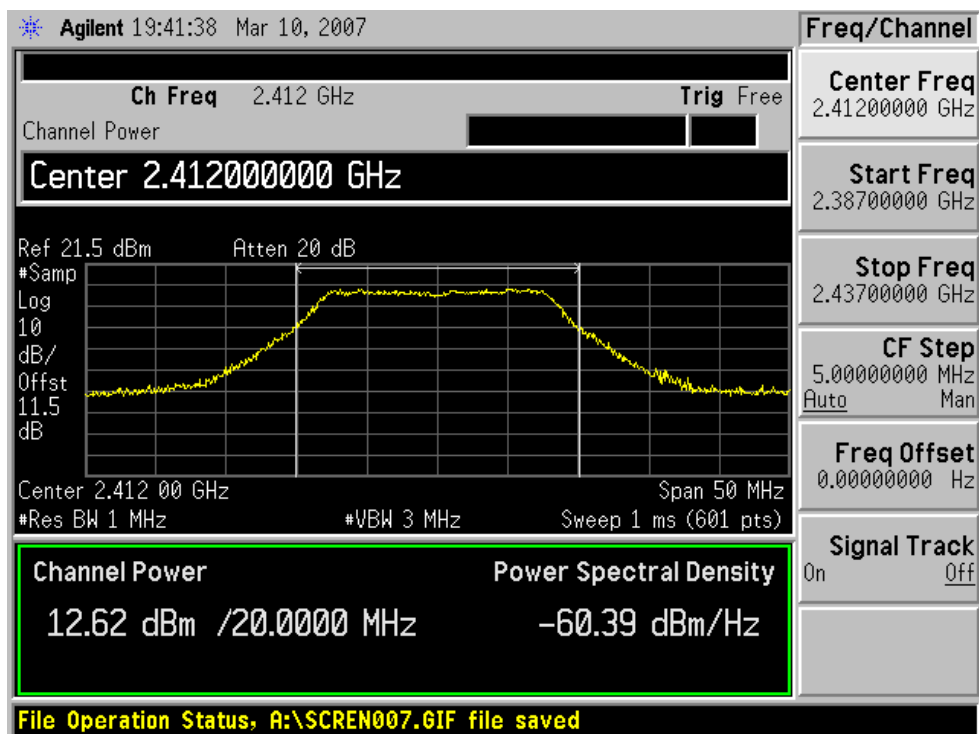


High Channel

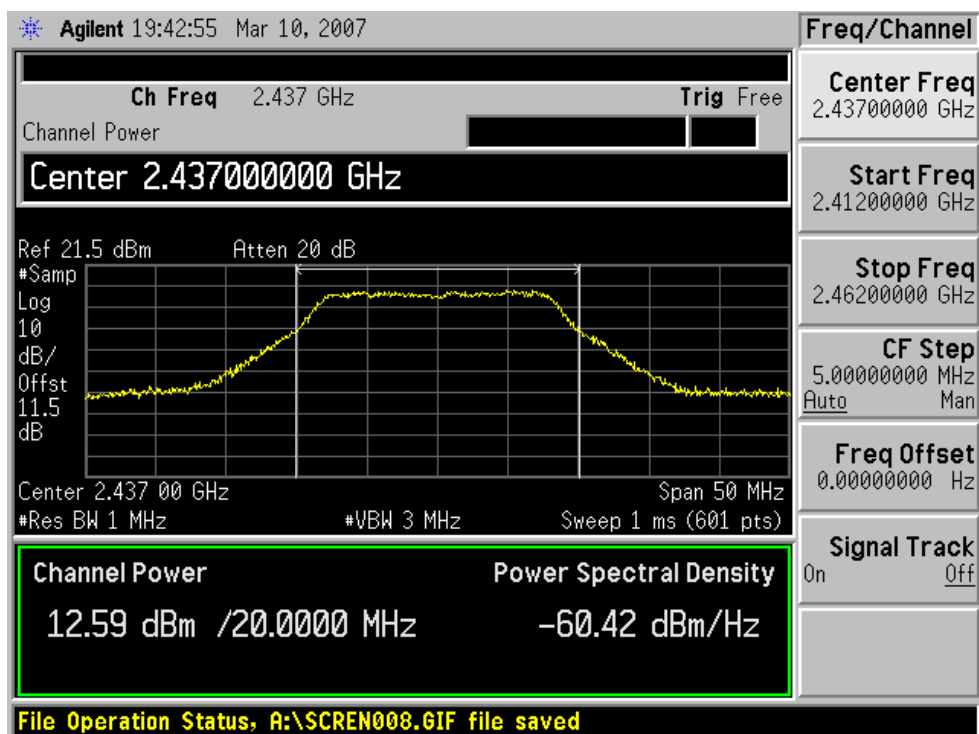


10.6.4 802.11g

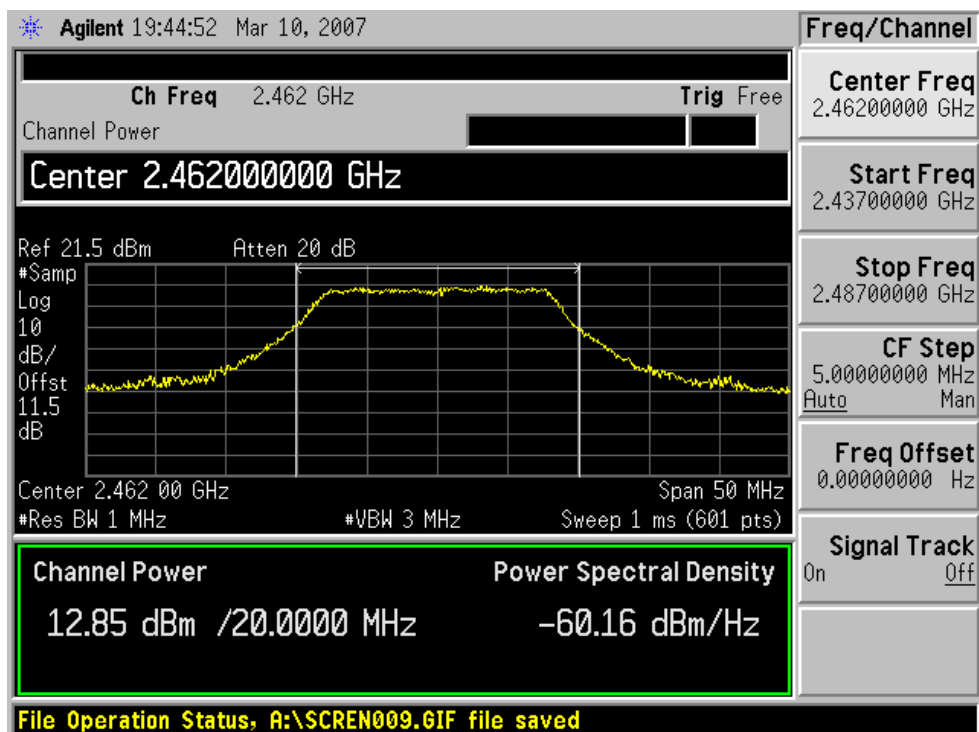
Low Channel



Middle Channel



High Channel



11 §15.247(d) - 100 kHz BANDWIDTH OF BAND EDGES

11.1 Applicable Standard

According to §15.247(d), in *any* 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

11.2 Measurement Procedure

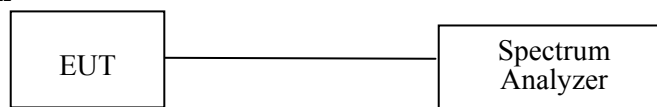
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

11.3 Equipment Lists

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2007-02-23

* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

11.4 Test Setup Diagram



11.5 Environmental Conditions

Temperature:	20 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

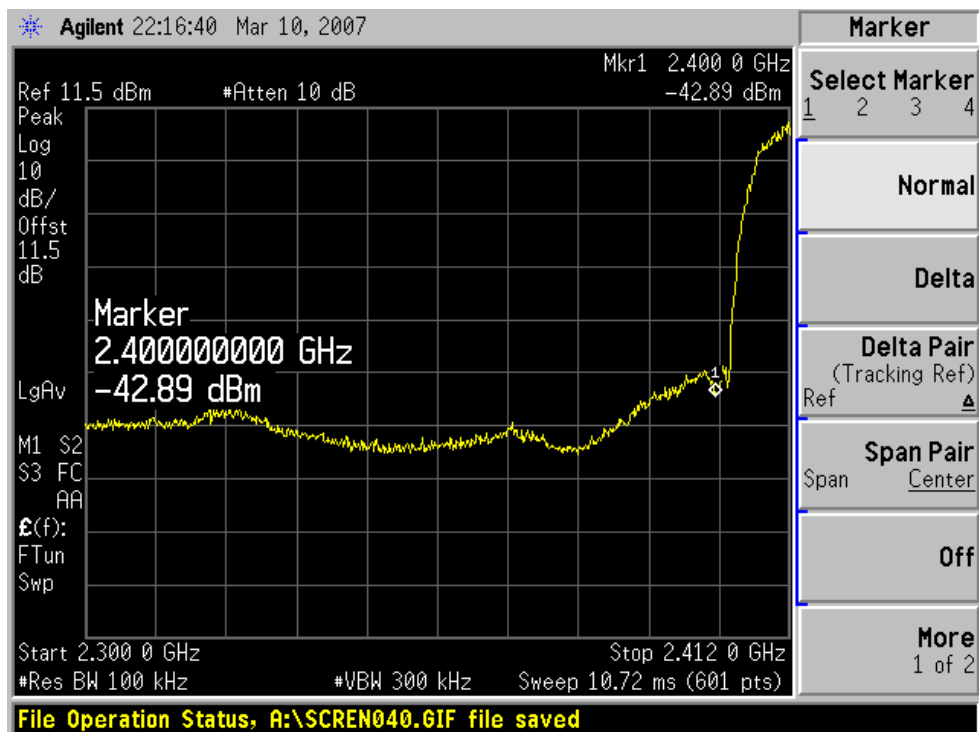
*The testing was performed by James Ma from 2007-04-10.

11.6 Measurement Result

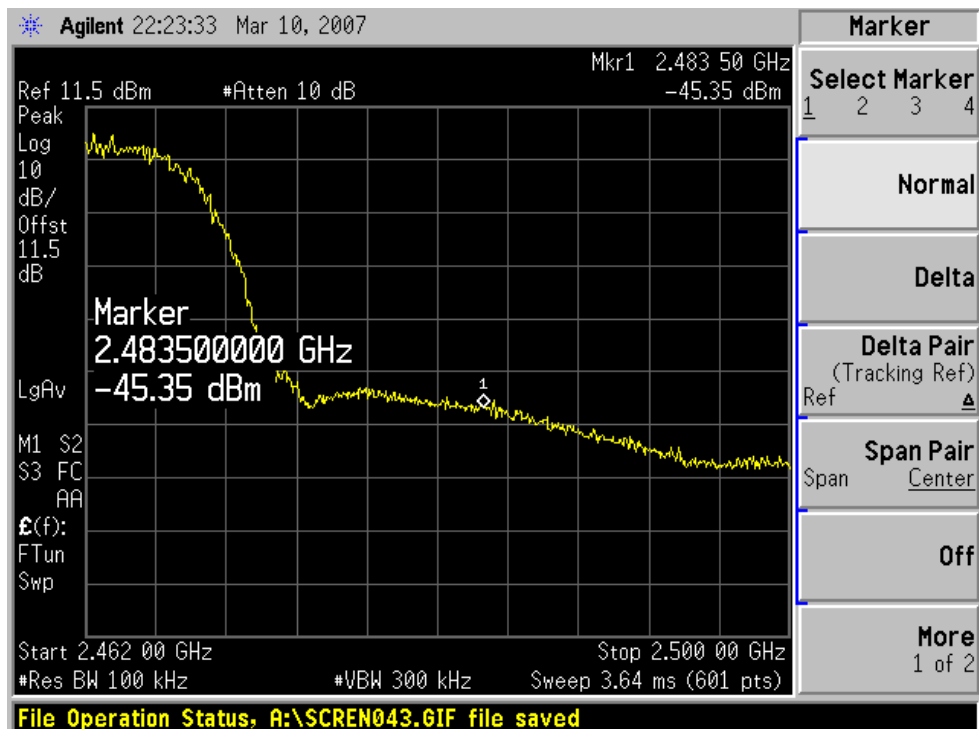
Please refer to following pages for plots of band edge.

11.6.5 802.11b

Low Channel

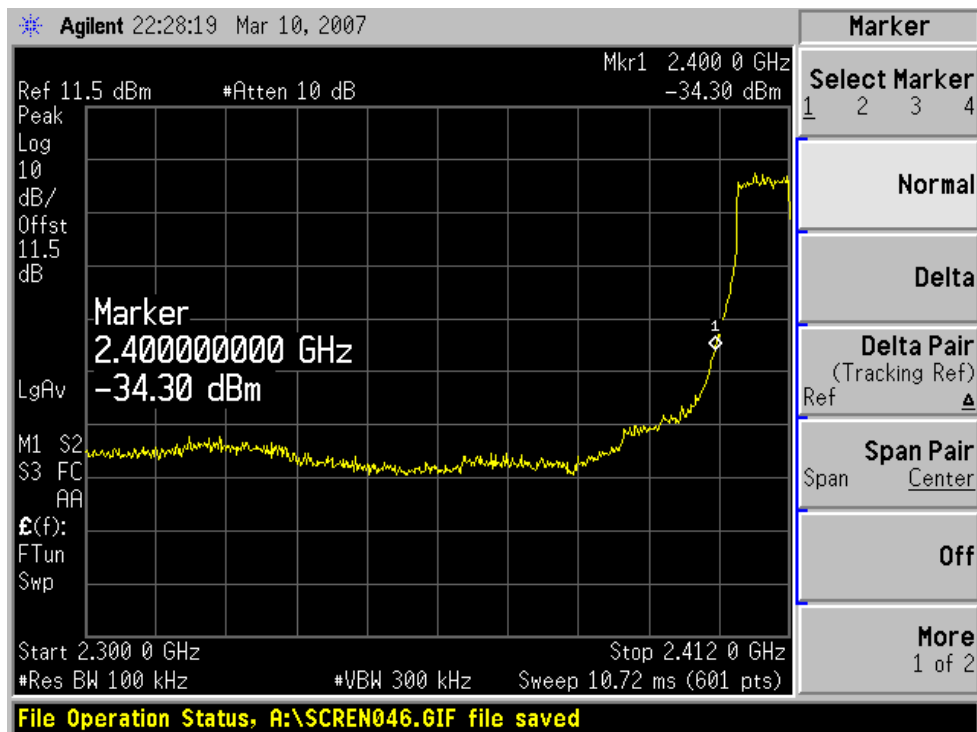


High Channel

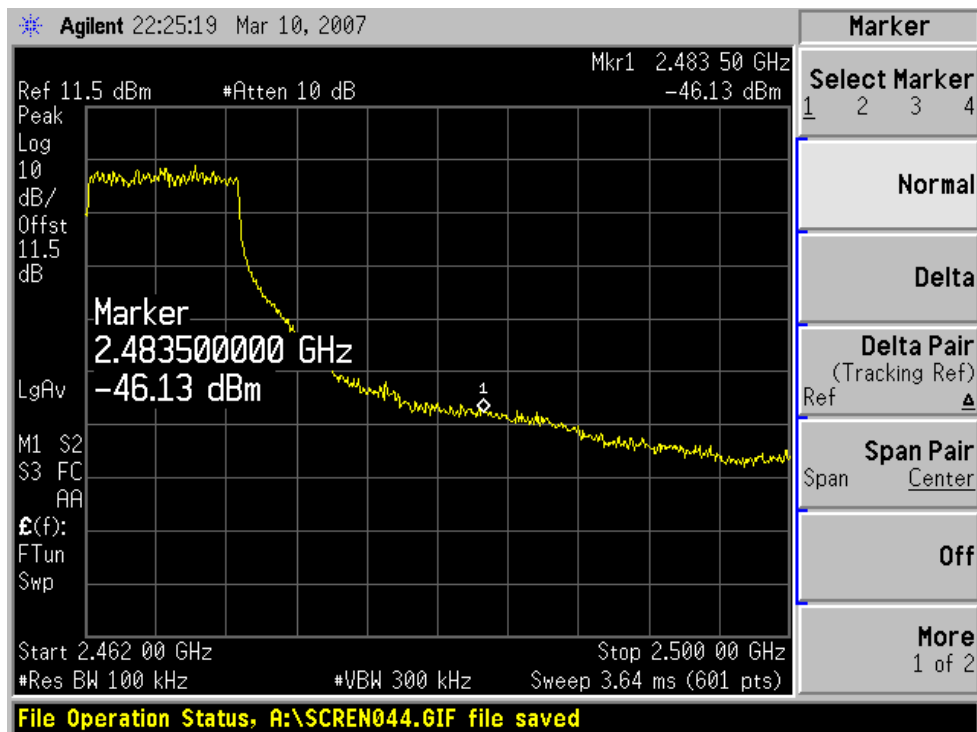


11.6.6 802.11g

Low Channel



High Channel



12 §15.247(e) - POWER SPECTRAL DENSITY

12.1 Applicable Standard

According to §15.247 (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.

12.2 Measurement Procedure

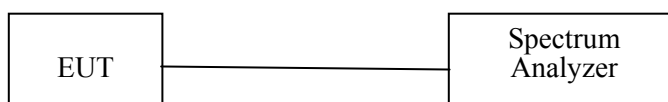
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 1.5MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value. (DTS)
4. Repeat above procedures until all frequencies measured were complete.

12.3 Equipment Lists

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2007-02-23

* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

12.4 Test Setup Diagram



12.5 Environmental Conditions

Temperature:	20 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

*The testing was performed by James Ma from 2007-04-10.

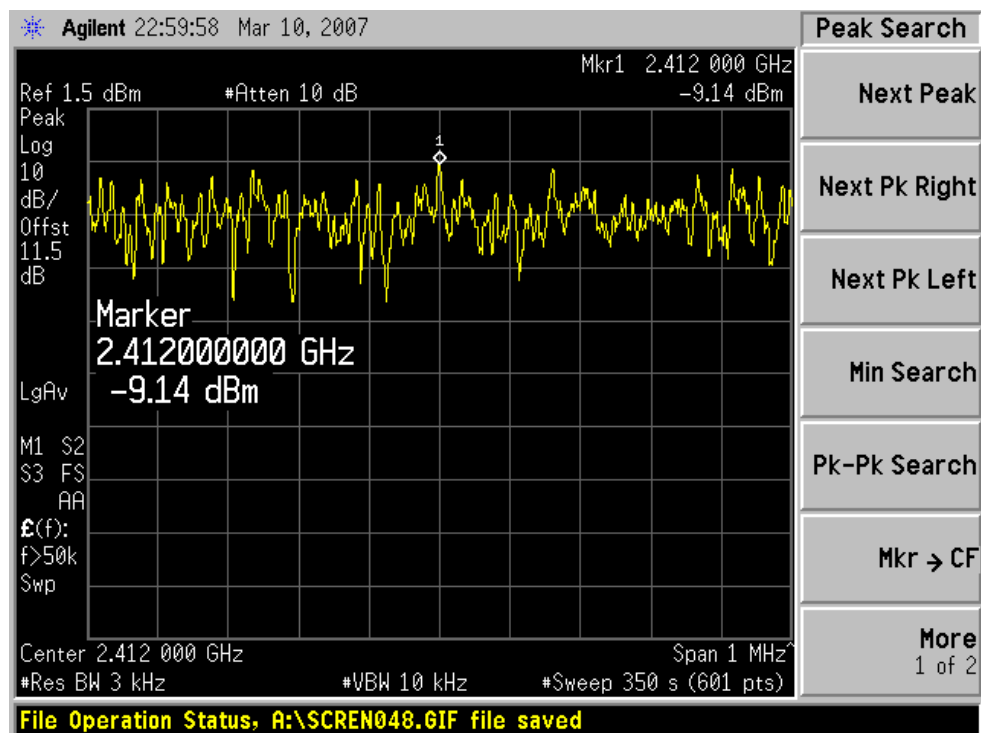
12.6 Summary of Test Results

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Result
802.11b			
2412	-9.14	8	Compliant
2437	-8.94	8	Compliant
2462	-7.28	8	Compliant
802.11g			
2412	-14.60	8	Compliant
2437	-14.79	8	Compliant
2462	-13.72	8	Compliant

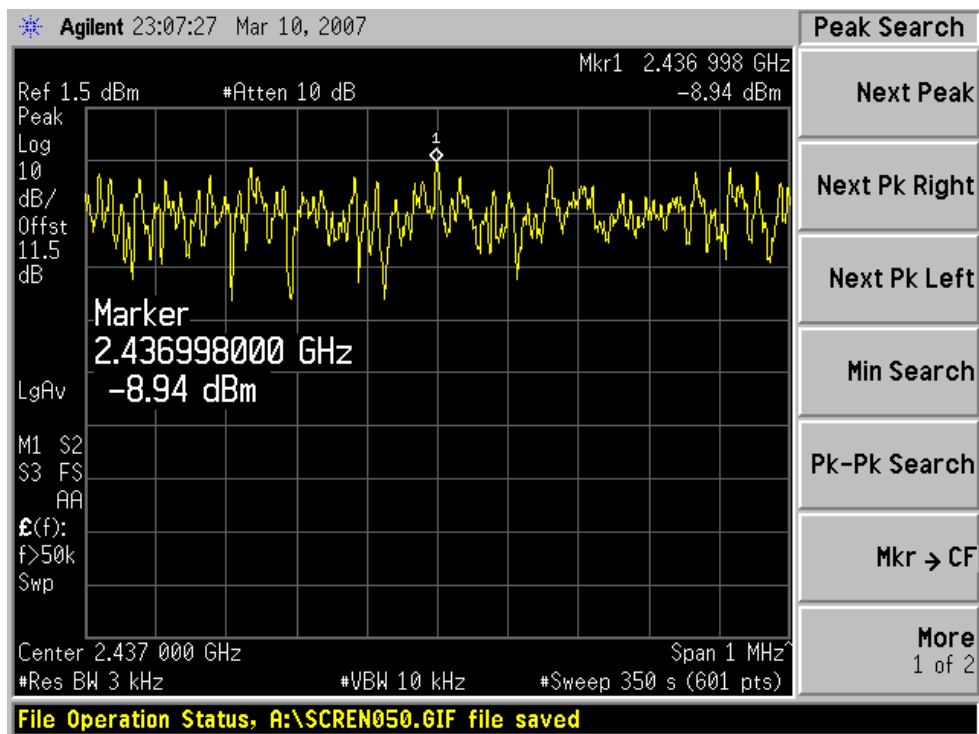
Please refer to the following plots for detailed test results

12.6.7 802.11b

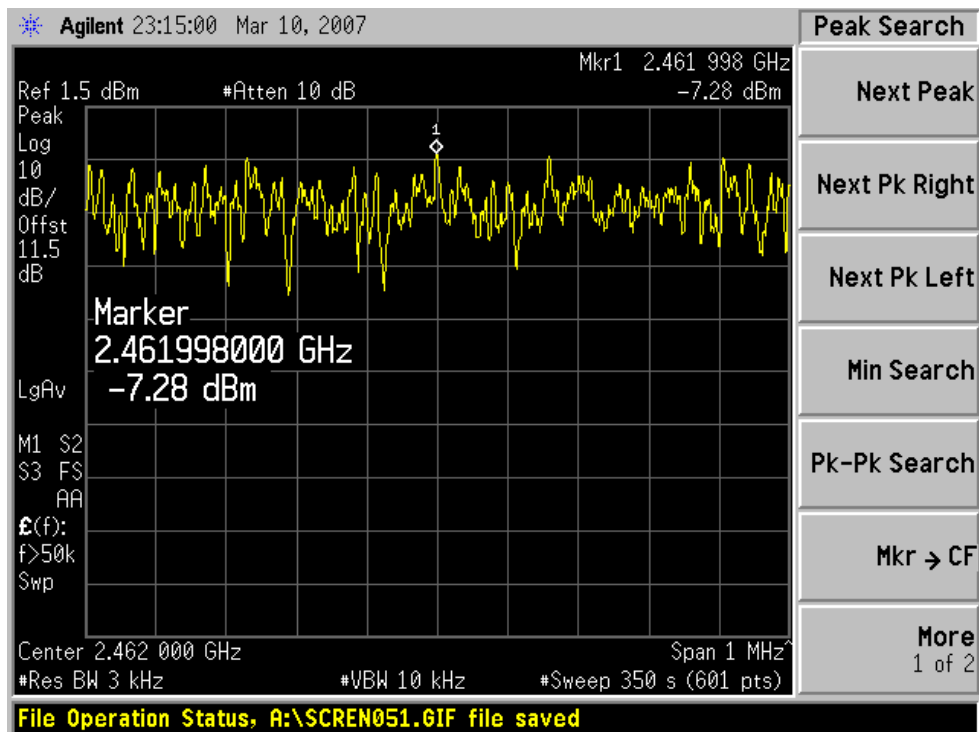
Low Channel

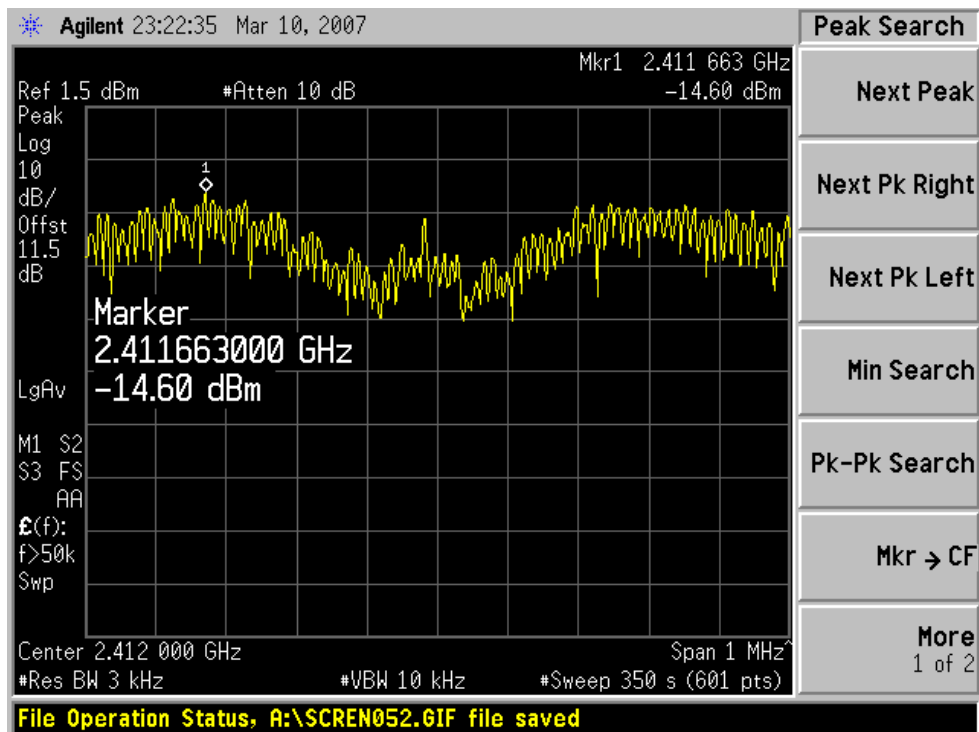
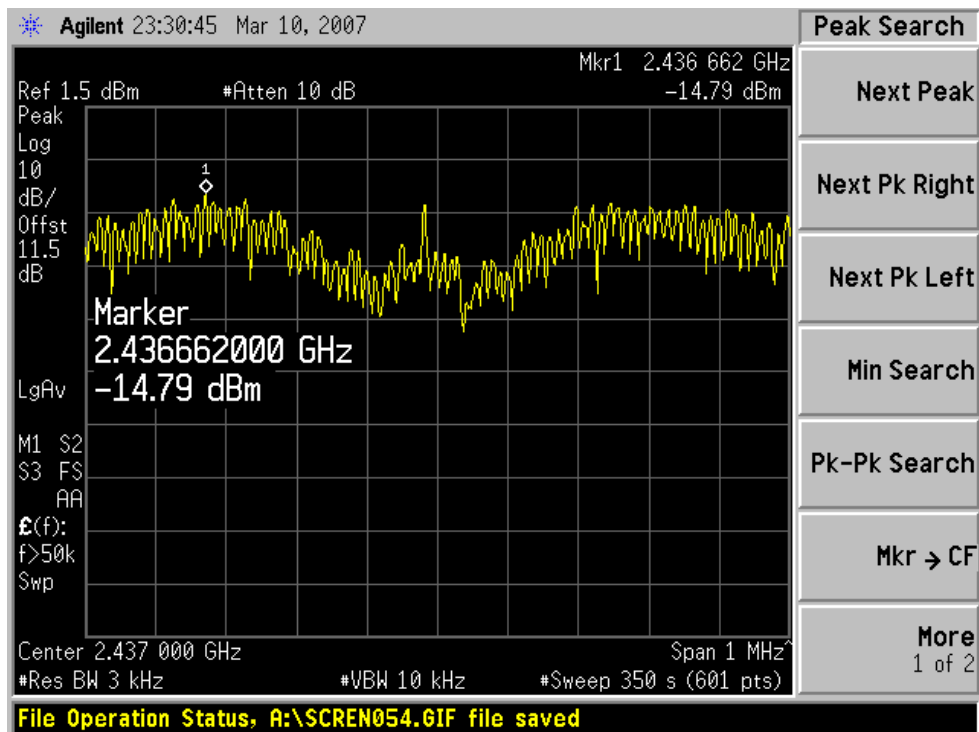


Middle Channel

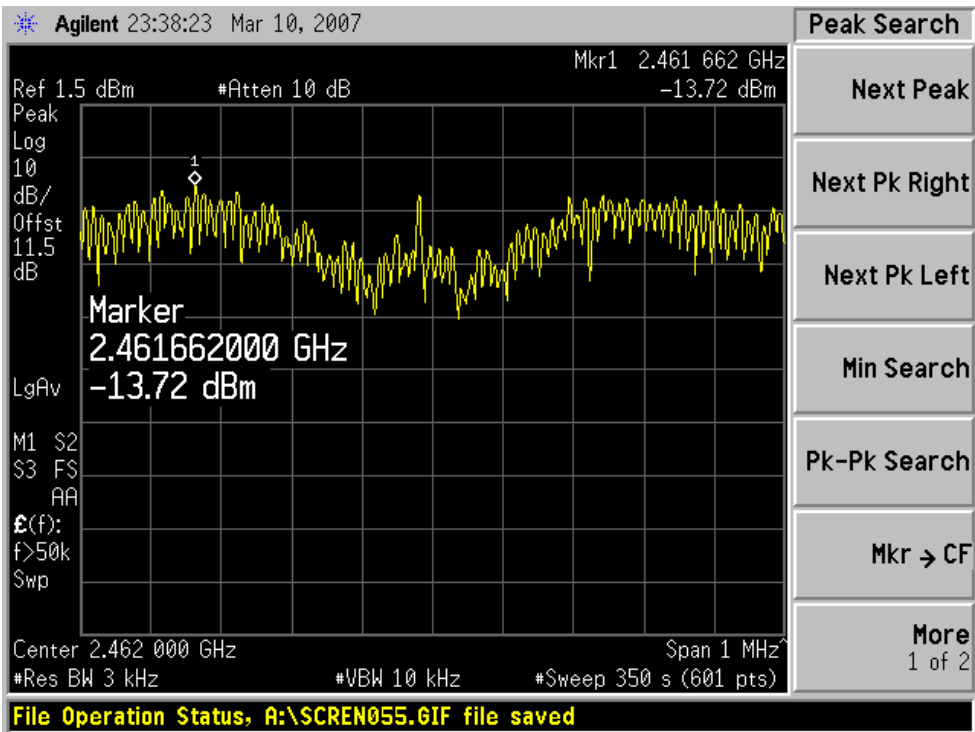


High Channel



12.6.8 802.11g**Low Channel****Middle Channel**

High Channel



13 EXHIBIT A - FCC ID LABEL INFORMATION

13.1 FCC § 2.925 Identification of equipment

(a) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following:

(1) FCC Identifier consisting of the two elements in the exact order specified in §2.926. The FCC Identifier shall be preceded by the term *FCC ID* in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification.

Example: FCC ID XXX123. XXX—Grantee Code 123—Equipment Product Code

13.2 FCC ID Labeling Requirements as per FCC § 15.19

(a) In addition to the requirements in part 2 of this chapter, a device subject to certification, or verification shall be labeled as follows:

(3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified above is required to be affixed only to the main control unit. If the EUT is integrated within another device then a label affixed to the host shall also state, "Contains FCC ID:XXXXXX"

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

13.3 Suggested FCC ID Label

Model: W2CBW003

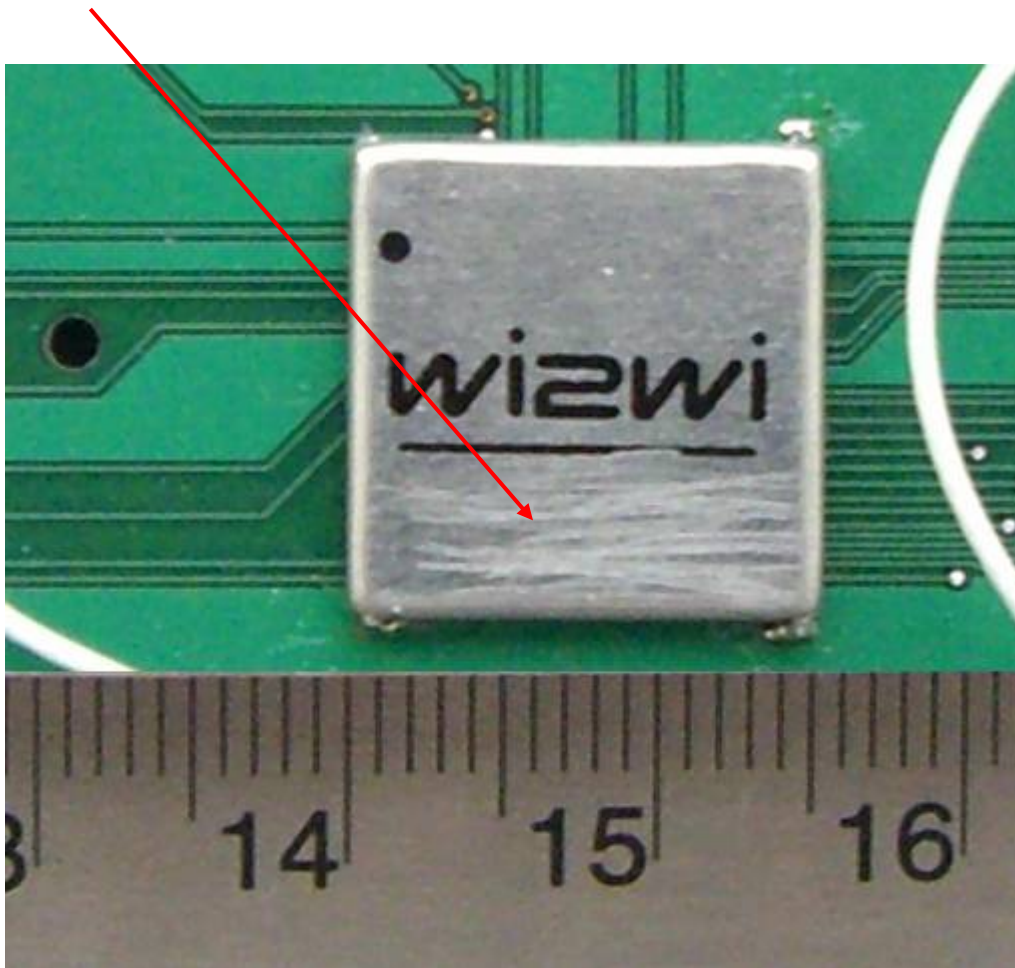
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC ID: U9R-W2CBW003**IC: 7089A-W2CBW003**

Wi2Wi, Inc.



13.4 Suggested Label Location

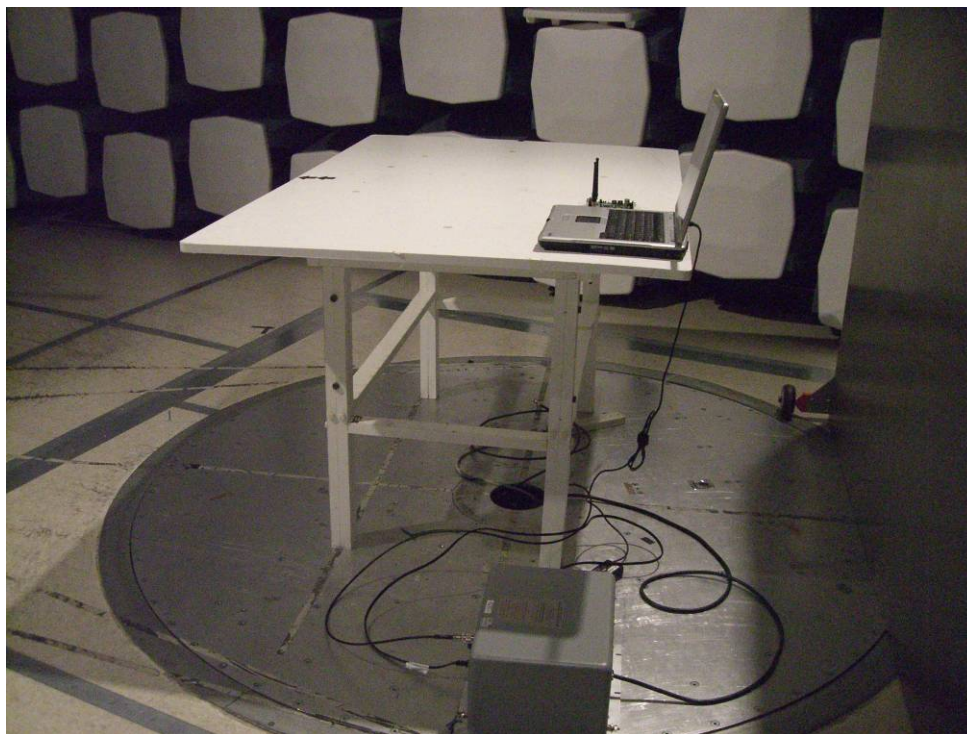


14 EXHIBIT B - TEST SETUP PHOTOGRAPHS

14.1 Conducted Emissions –Front View



14.2 Conducted Emissions – Side View



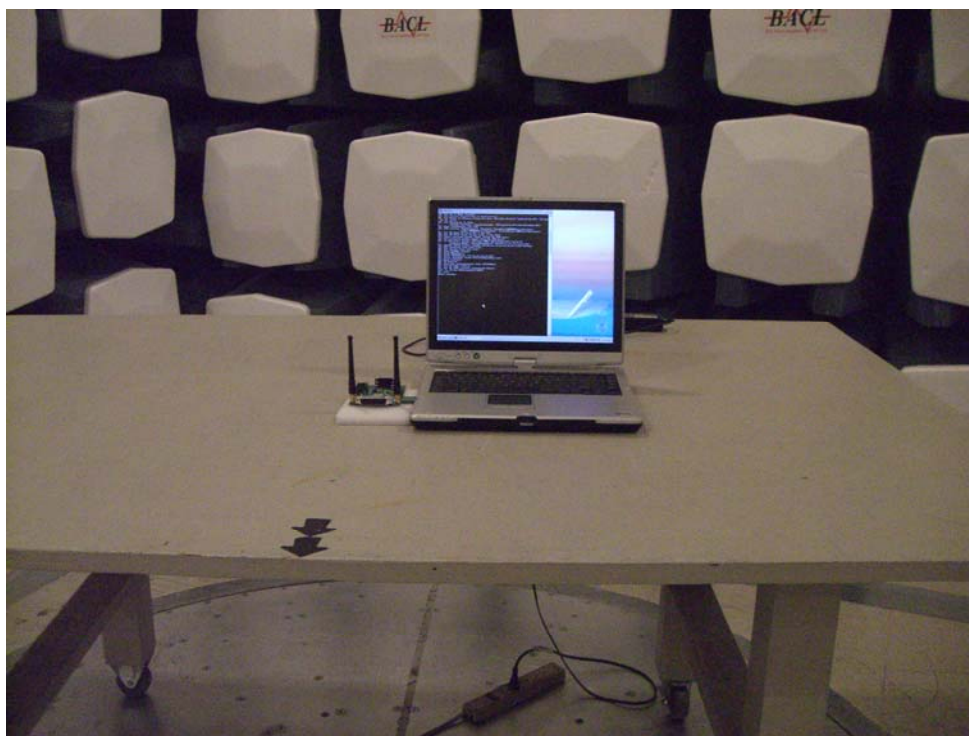
14.3 Unintentional Radiated Emissions – Front View



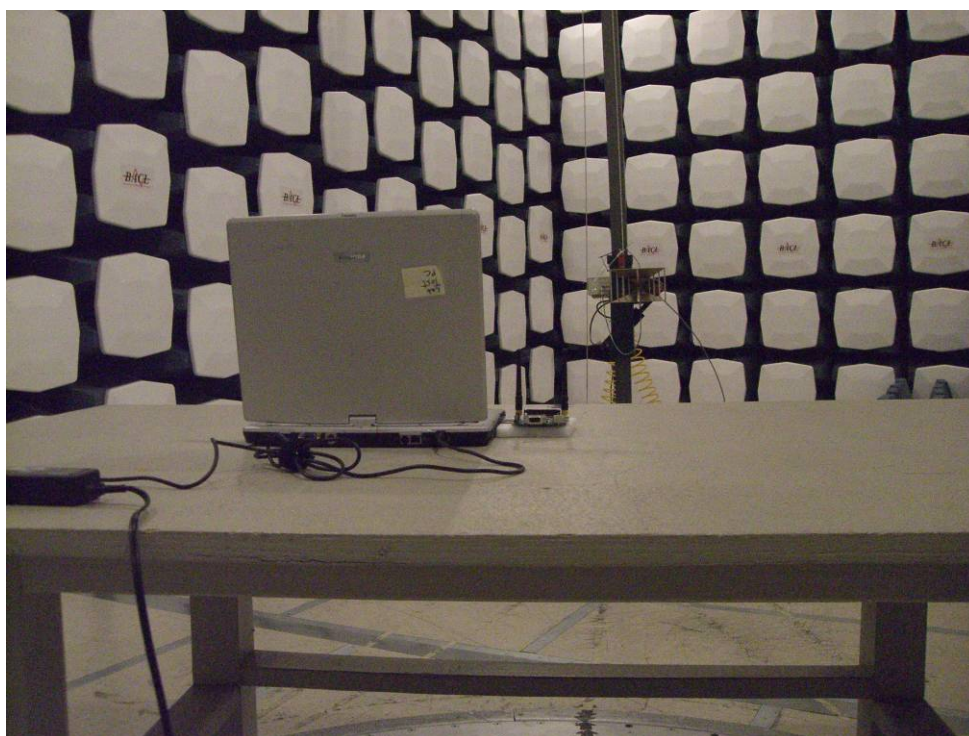
14.4 Unintentional Radiated Emissions – Rear View



14.5 Radiated Emissions – Front View

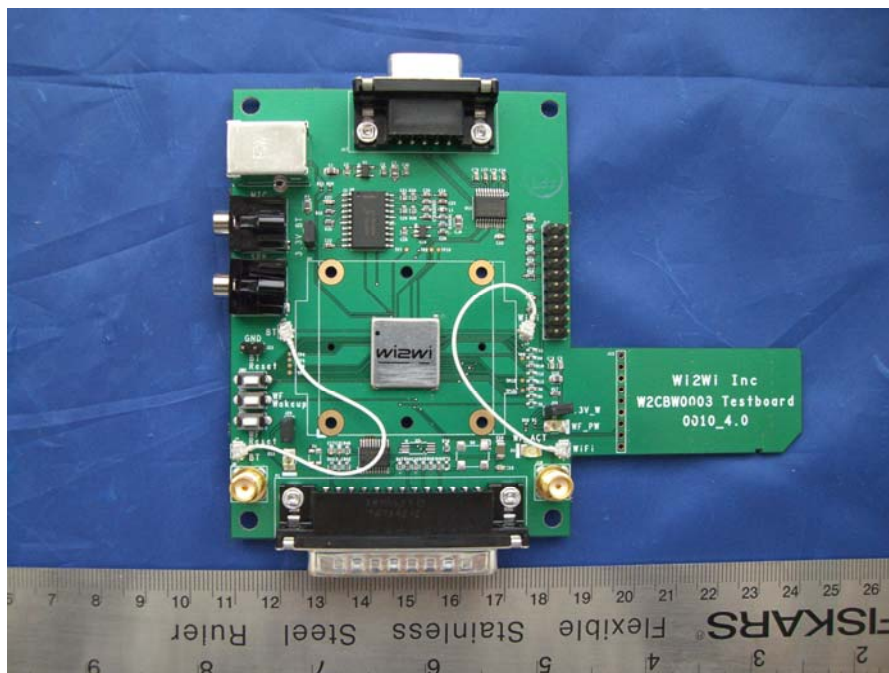


14.6 Radiated Emissions – Rear View

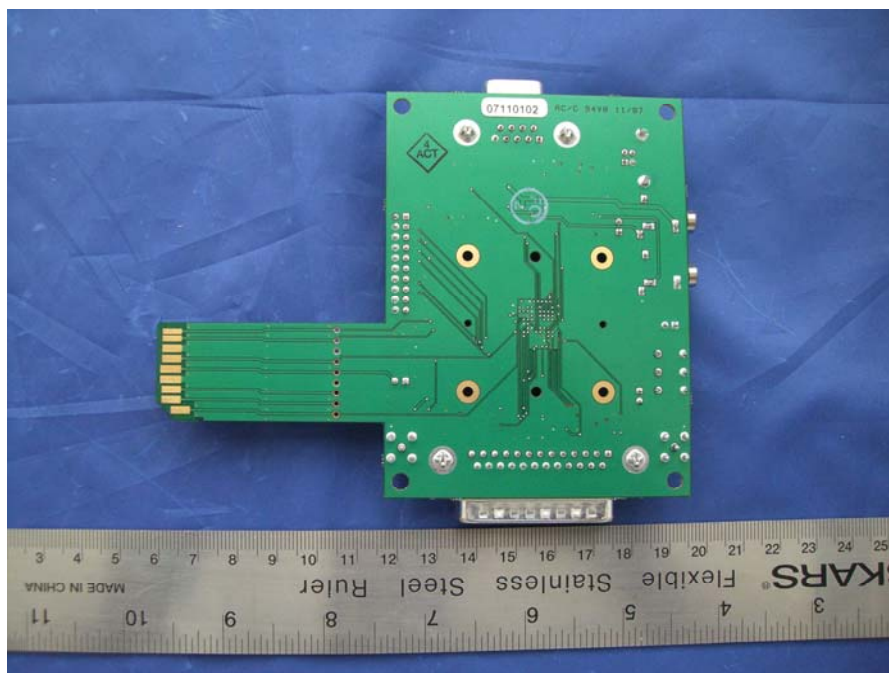


15 EXHIBIT C - EUT PHOTOGRAPHS

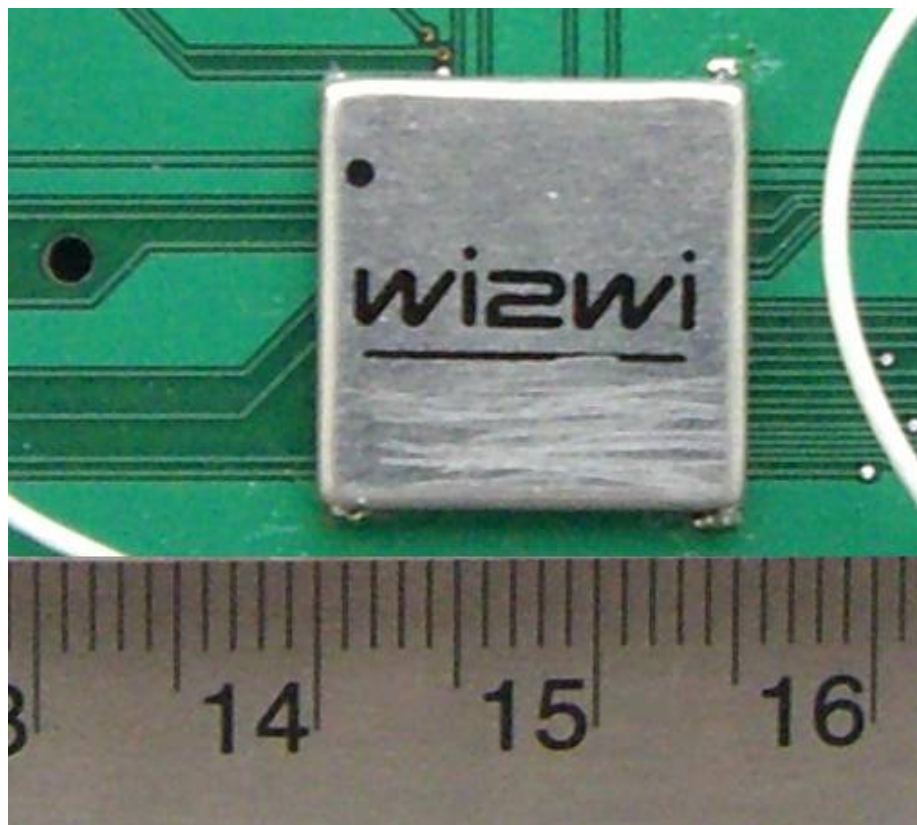
15.1 EUT Built in the Test Board



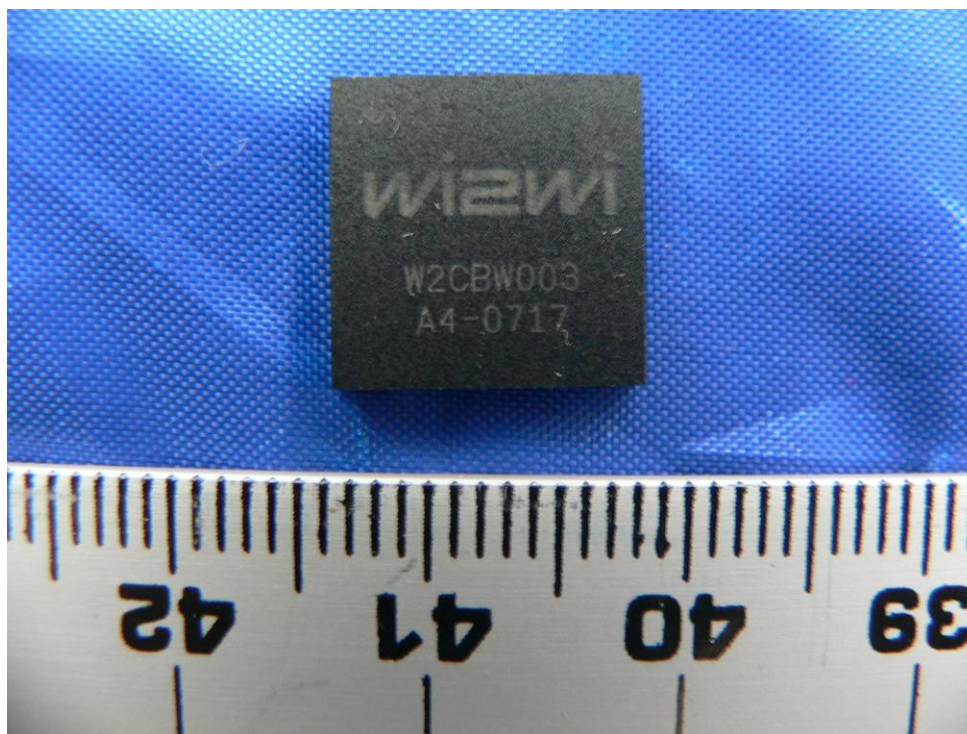
15.2 Test Board Solder Side View



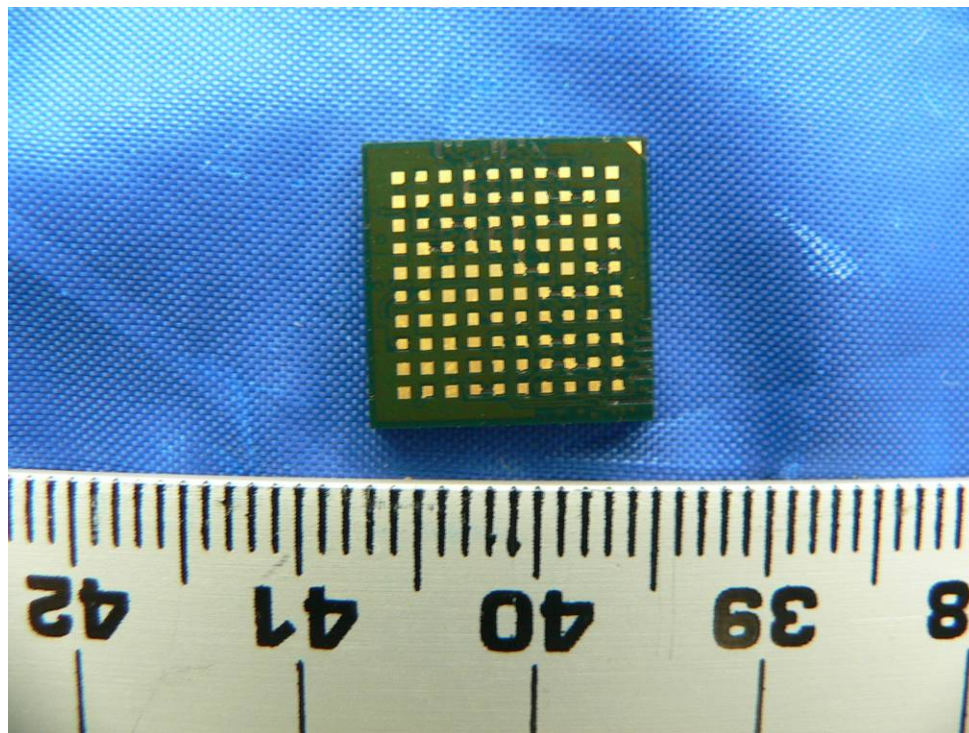
15.3 EUT Front View



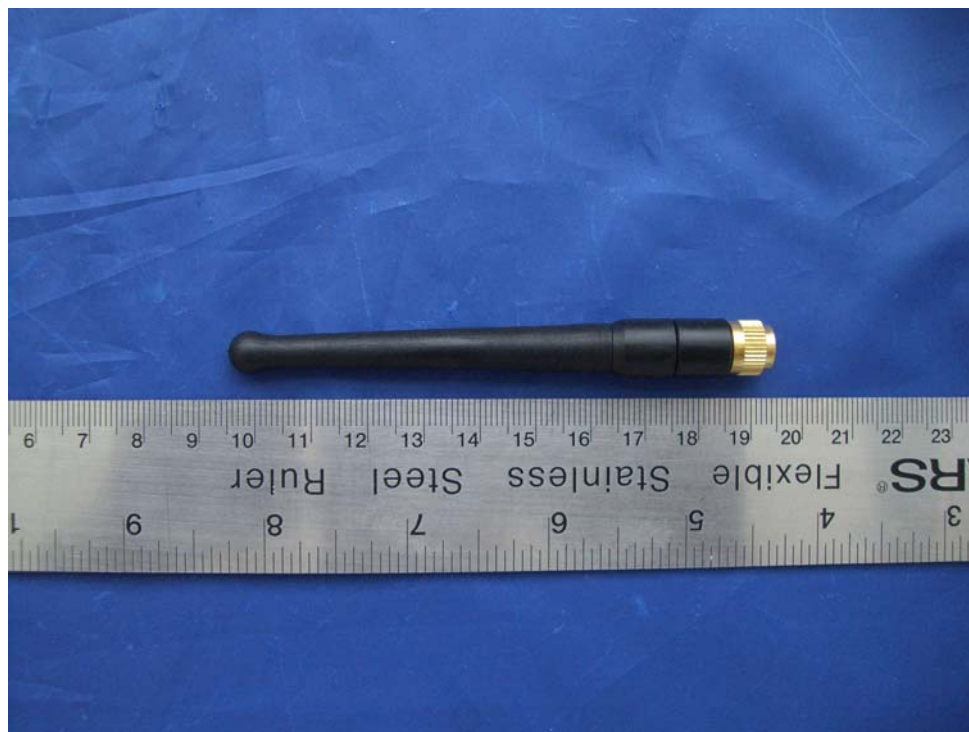
15.4 EUT without Shielding View 1



15.5 EUT without Shielding View 2



15.6 Testing Antenna View



END OF REPORT