NVLAP LAB CODE 200707-0

FCC PART 15.247

MEASUREMENT AND TEST REPORT

For

White Mountain Technologies Limited

3rd FL, Jonsim Place, 228 Queen's Road, Wanchai, Hong Kong.

FCC ID: YBHXRAHBGU11

Report Type:	Product Type:
Original Report	XRanger 802.11b/g High Power (HP-USB)

Test Engineer:	Weir Zhong
Report Number:	RSZ10040104
Report Date:	2010-07-13
Reviewed By:	Merry Zhao EMC Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *White Mountain Technologies Limited's* product, model number: *XRAHBGU11 (FCC ID: YBHXRAHBGU11) or* the "EUT" as referred to in this report is a *XRanger 802.11 b/g High Power (HP-USB),* which measures approximately: 23.5 cm L x 19.2 cm W x 2.5 cm H, rated input voltage: DC 5V provided by PC.

** All measurement and test data in this report was gathered from production sample serial number: 1004004 (Assigned by BACL, Shenzhen). The EUT was received on 2010-04-01.*

Objective

This Type approval report is prepared on behalf of *White Mountain Technologies Limited in* accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

N/A

Test Methodology

All measurements contained in this report were conducted 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.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located in the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 21, 2007. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratories Corp. (Shenzhen) is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200707-0).

NVLAP LAB CODE 200707-0

The current scope of accreditations can be found at http://ts.nist.gov/Standards/scopes/2007070.htm

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For 802.11b and 802.11g mode, 11 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437	/	/

EUT was tested with Channel 1, 6 and 11.

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

EUT Exercise Software

The test was performed under RT307X_V1.1.0.8 about power:
802.11b: TX Power level 8, data rate: 1 Mbps.
802.11g: TX Power level 8, data rate: 6 Mbps.

Equipment Modifications

No modification was made to the unit tested.

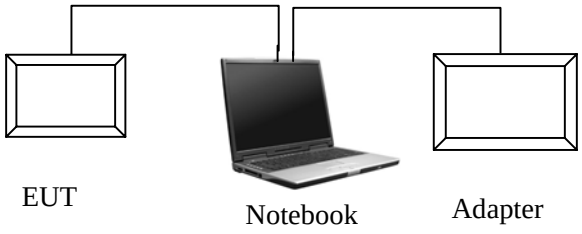
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
IBM	Notebook	T40	N/A	N/A

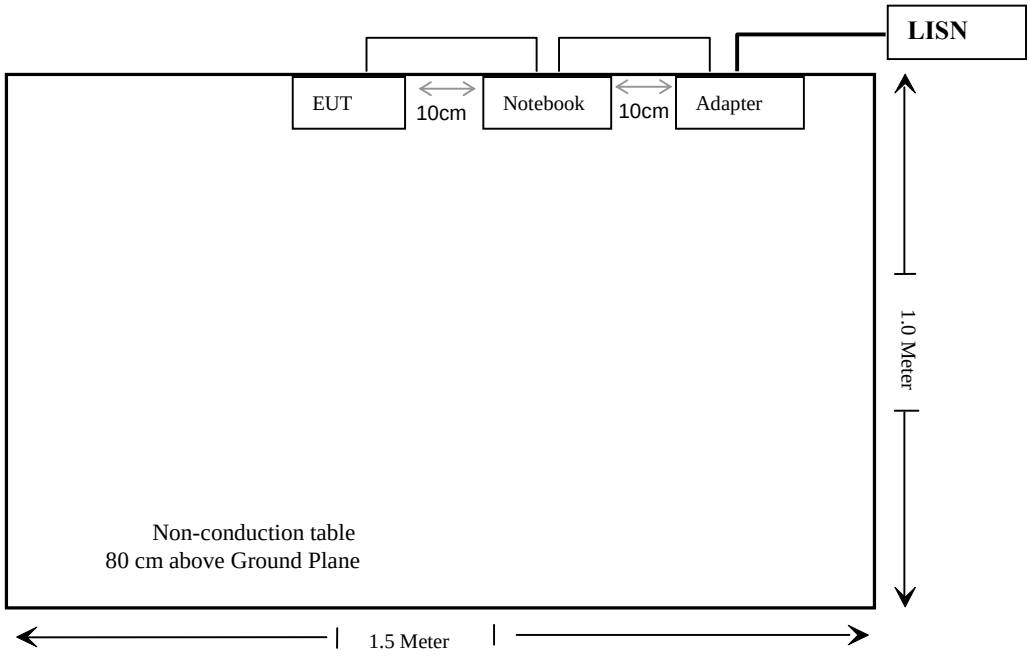
External I/O Cable

Cable Description	Length (m)	From/Port	To
Unshielded Undetachable USB Cable	0.5	PC/USB Port	EUT
Unshielded Undetachable DC Cable	1.5	Adapter/DC Port	Notebook
Unshielded Undetachable AC Cable	1.5	Adapter/AC Port	LISN

Configuration of Test Setup



Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b)(1), §2.1091	Maximum Permissible exposure (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a),	Conducted Emissions	Compliant
§15.247(d)	Spurious Emissions at Antenna Port	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant*
§15.247 (a)(2)	6 dB Bandwidth	Compliant
§15.247(b)(3), (b)(4), (c)	Maximum Peak Output Power	Compliant
§15.247(d)	100kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

*With measurement uncertainty!

FCC §15.247(i) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to FCC §15.247 (i), §1.1307 (b)(1) and §2.1091, systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

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

MPE Predication

Predication of MPE limit at a given distance

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

Where:

S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally ***numeric*** gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Mode	Frequency (MHz)	Maximum Antenna Gain		Conducted Output Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
802.11b	2412	12	15.85	22.77	189.234	20	0.597	1.0
802.11g	2437	12	15.85	20.76	119.124	20	0.376	1.0

Result:

The predicted power density level at 20 cm is 0.597 mw/cm^2 for 802.11b, 0.376 mw/cm^2 for 802.11g, which is below the uncontrolled exposure limit of 1.0 mw/cm^2, The EUT is used at least 20 cm away from user's body. It is determined as mobile equipment and complies with the MPE limit.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC§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 user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to 47 CFR FCC section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT used a phased array smart antenna system (SAS) technology, the phased array is a combination of 8 elements, the element gain is 3 dBi, the calculated total gain is 12 dBi, and the antenna is PCB type which is not allowed the end-user to acdcess. Please refer to the EUT internal photos.

Result: Compliant.

FCC §15.207 (a) - CONDUCTED EMISSIONS

Applicable Standard

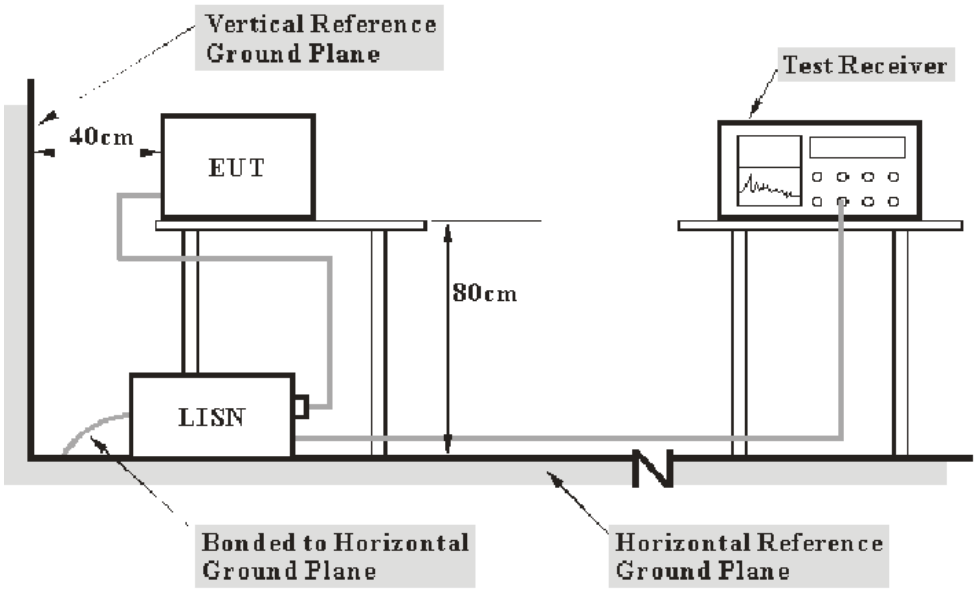
FCC§15.207

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at Bay Area Compliance Laboratory Corp. (Shenzhen) is ±2.4 dB.

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter of PC was connected to a 120 VAC/60 Hz power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	***IF B/W***
150 kHz – 30 MHz	9 kHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	830245/006	2010-03-03	2011-03-02
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	892107/021	2010-03-09	2011-03-08

*** Statement of Traceability:** Bay Area Compliance Laboratory Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

During the conducted emission test, the adapter of PC was connected to the LISN.

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

All data was recorded in the Quasi-peak and average detection mode.

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207, with the worst margin reading of:

12.77 dB at **1.600 MHz** in the **Line** conductor mode for **802.11b**
11.72 dB at **1.600 MHz** in the **Neutral** conductor mode for **802.11b**
12.72 dB at **1.600 MHz** in the **Line** conductor mode for **802.11g**
11.57 dB at **1.600 MHz** in the **Neutral** conductor mode for **802.11g**

Test Data

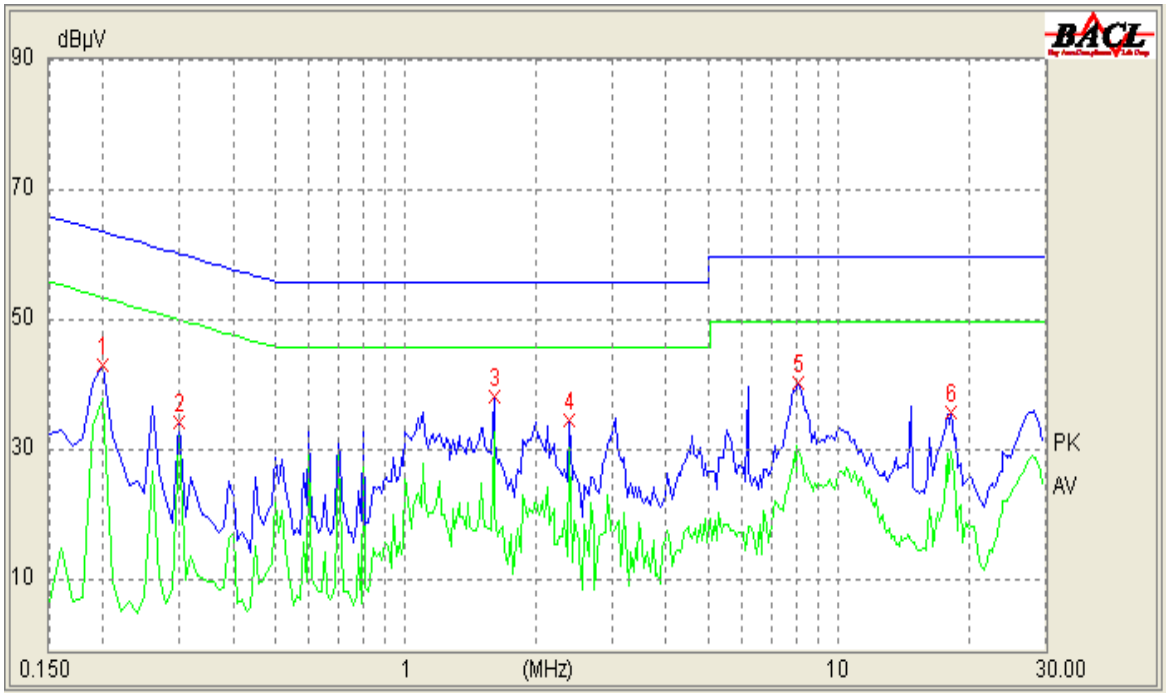
Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	56 %
ATM Pressure:	100.0 kPa

The testing was performed by Weir Zhong on 2010-04-19.

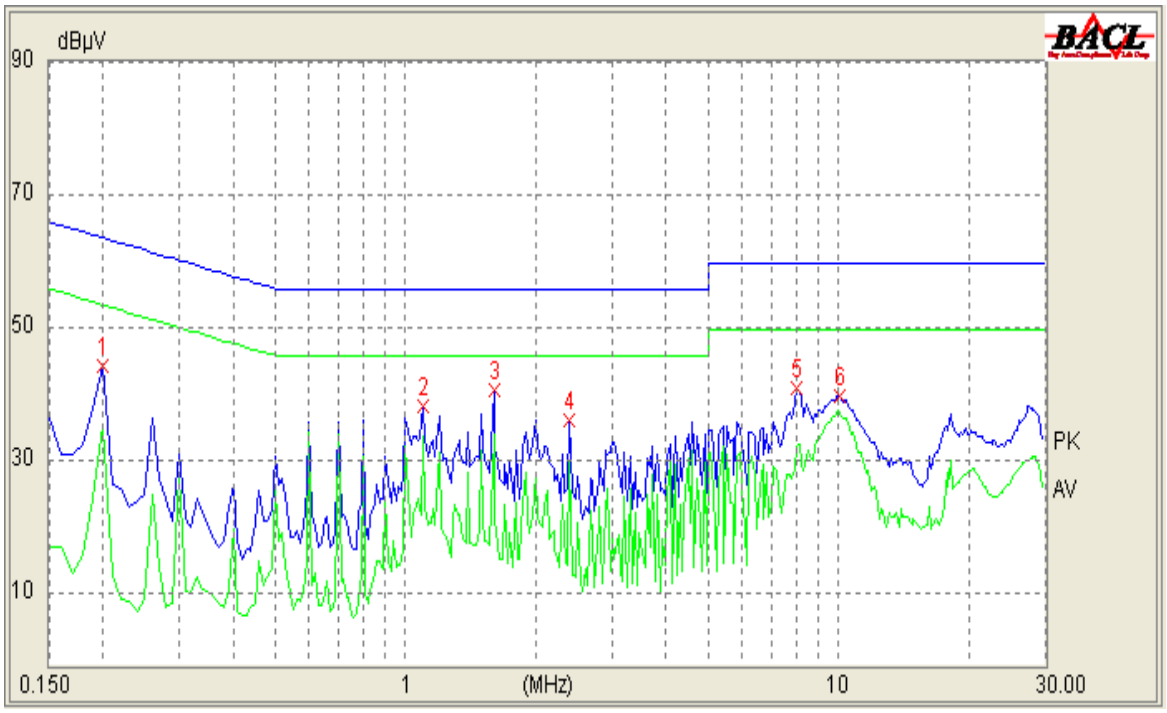
802.11b Mode:

120 V/60 Hz, Line



Conducted Emissions			FCC Part 15.207		
Frequency (MHz)	Correction Factor (dB)	Cord. Result (dBµV)	Limit (dBµV)	Margin (dB)	Detector (PK/AV/QP)
1.600	10.10	33.23	46.00	12.77	AV
2.400	10.10	30.76	46.00	15.24	AV
0.200	10.10	38.33	53.69	15.36	AV
0.300	10.10	32.66	50.28	17.62	AV
8.030	10.20	31.20	50.00	18.80	AV
18.240	10.30	30.12	50.00	19.88	AV
1.600	10.10	36.10	56.00	19.90	QP
0.200	10.10	42.60	63.69	21.09	QP
2.400	10.10	31.61	56.00	24.39	QP
8.090	10.20	33.73	60.00	26.27	QP
0.300	10.10	33.83	60.28	26.45	QP
18.240	10.30	31.63	60.00	28.37	QP

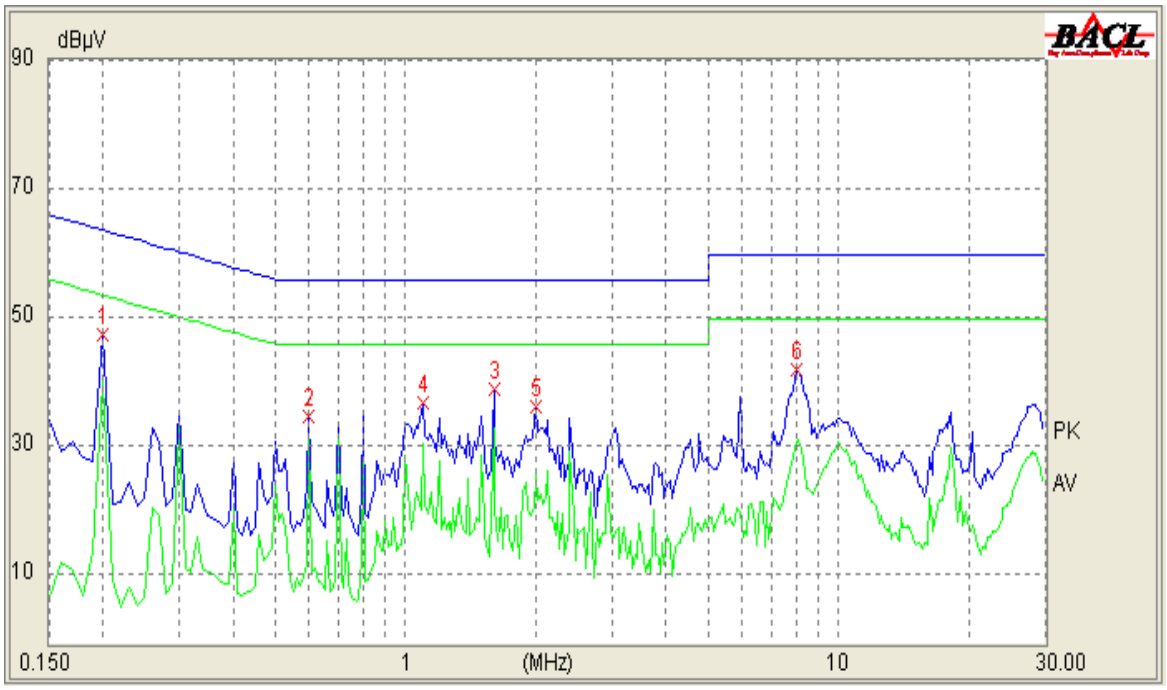
120 V/60 Hz, Neutral:



Conducted Emissions			FCC Part 15.207		
Frequency (MHz)	**Correction Factor (dB)**	**Cord. Result (dBµV)**	**Limit (dBµV)**	**Margin (dB)**	**Detector (PK/AV/QP)**
1.600	10.10	34.28	46.00	11.72	AV
1.100	10.10	34.01	46.00	11.99	AV
10.020	10.30	37.82	50.00	12.18	AV
2.400	10.10	30.32	46.00	15.68	AV
8.020	10.20	32.53	50.00	17.47	AV
0.200	10.10	35.52	53.69	18.17	AV
1.600	10.10	37.09	56.00	18.91	QP
1.100	10.10	36.54	56.00	19.46	QP
0.200	10.10	41.88	63.69	21.81	QP
10.120	10.30	38.09	60.00	21.91	QP
8.010	10.20	36.59	60.00	23.41	QP
2.400	10.10	31.80	56.00	24.20	QP

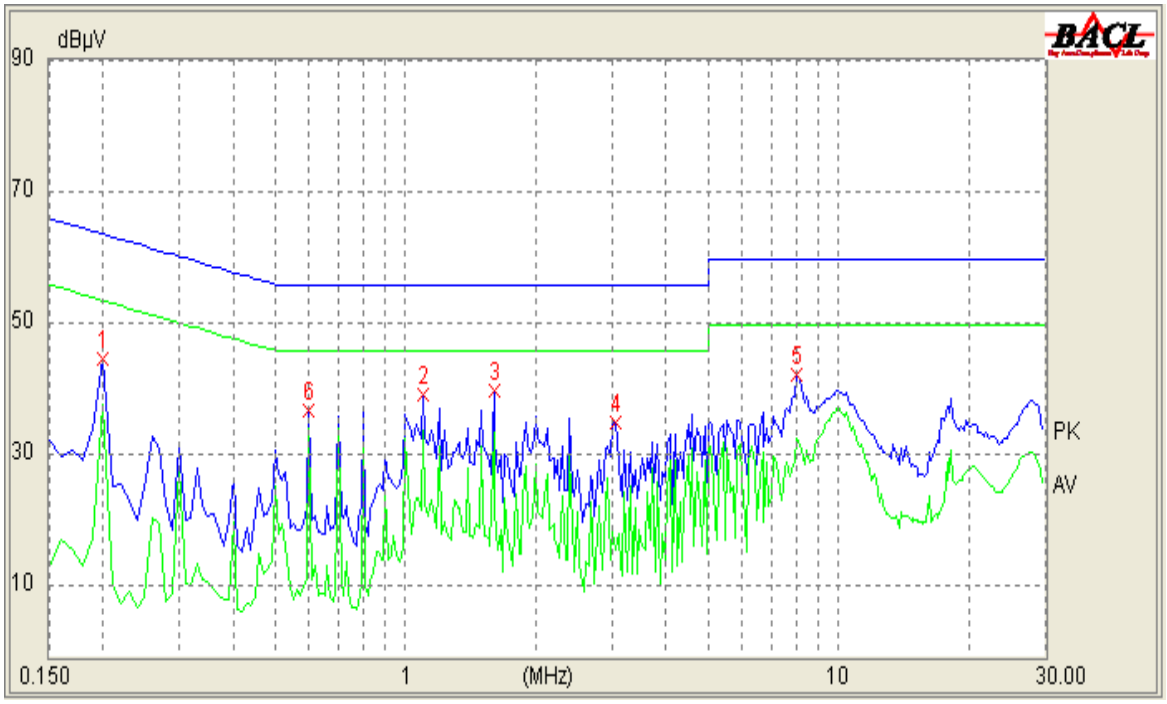
802.11g Mode:

120 V/60 Hz,Line



Conducted Emissions			FCC Part 15.207		
Frequency (MHz)	Correction Factor (dB)	Cord. Result (dBµV)	Limit (dBµV)	Margin (dB)	Detector (PK/AV/QP)
1.600	10.10	33.28	46.00	12.72	AV
0.200	10.10	40.28	53.69	13.41	AV
0.600	10.10	31.99	46.00	14.01	AV
1.100	10.10	30.68	46.00	15.32	AV
8.010	10.20	31.11	50.00	18.89	AV
0.200	10.10	44.54	63.69	19.15	QP
1.600	10.10	36.22	56.00	19.78	QP
2.000	10.10	25.83	46.00	20.17	AV
8.010	10.20	37.60	60.00	22.40	QP
1.100	10.10	33.24	56.00	22.76	QP
0.600	10.10	33.07	56.00	22.93	QP
2.000	10.10	30.29	56.00	25.71	QP

120 V/60 Hz, Neutral:



Conducted Emissions			FCC Part 15.207		
Frequency (MHz)	Correction Factor (dB)	Cord. Result (dBµV)	Limit (dBµV)	Margin (dB)	Detector (PK/AV/QP)
0.600	10.10	34.43	46.00	11.57	AV
1.100	10.10	34.19	46.00	11.81	AV
1.600	10.10	33.67	46.00	12.33	AV
0.200	10.10	37.86	53.69	15.83	AV
8.020	10.20	32.73	50.00	17.27	AV
1.600	10.10	37.74	56.00	18.26	QP
1.100	10.10	35.85	56.00	20.15	QP
0.600	10.10	35.37	56.00	20.63	QP
8.010	10.20	38.37	60.00	21.63	QP
0.200	10.10	41.98	63.69	21.71	QP
3.050	10.10	15.99	46.00	30.01	AV
3.050	10.10	24.69	56.00	31.31	QP

FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

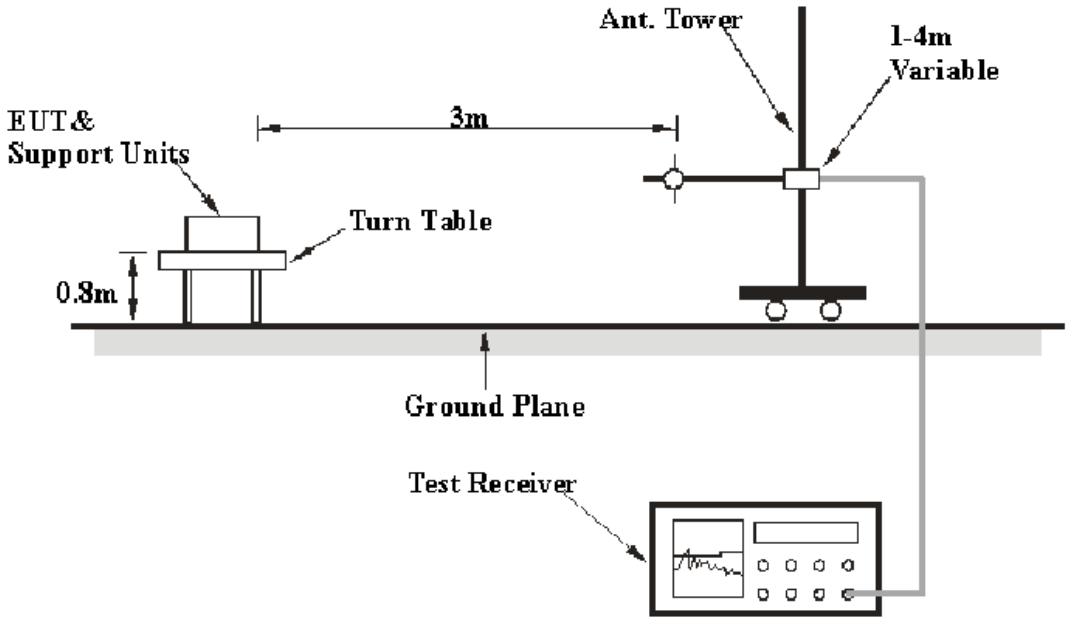
FCC §15.247 (d); §15.209; §15.205;

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 best estimate of the uncertainty of a radiation emissions measurement at Bay Area Compliance Laboratories Corp. (Shenzhen) is ±4.0 dB.

EUT Setup



The radiated emission tests were performed in the 3 meters chamber B test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

The adapter of PC was connected to a 120 VAC/60 Hz power source.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	***RBW***	***Video B/W***	***Detector***
30MHz – 1000 MHz	100 kHz	300 kHz	QP
1000 MHz – 25 GHz	1 MHz	3 MHz	PK
1000 MHz – 25 GHz	1 MHz	10 Hz	AV

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	HP8447D	2944A09795	2009-08-02	2010-08-02
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2009-11-24	2010-11-24
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2010-03-11	2011-03-11
HP	Amplifier	2VA-213+	T-E27H	2010-03-08	2011-03-08
Sunol Sciences	Horn Antenna	DRH-118	A052604	2009-05-05	2010-05-04
Rohde & Schwarz	Spectrum Analyzer	FSEM30	849720/019	2009-07-08	2010-07-08

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

For the radiated emissions test, the adapter of PC 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.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1GHz and peak and Average detection modes for frequencies above 1GHz.

Corrected Amplitude & Margin Calculation

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

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - 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 limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247, with the worst margin reading of:

30 -1000 MHz:

802.11b (wost case): **4.9 dB** at **48.015500 MHz** in the **Vertical** polarization
802.11g (wost case): **7.2 dB** at **71.958750 MHz** in the **Vertical** polarization

Above 1 GHz:

802.11b (Low Channel): **3.78 dB** at **7236.00 MHz** in the **Horizontal** polarization
802.11b (Middle Channel): **2.53 dB** at **4874.00 MHz** in the **Horizontal** polarization
802.11b (High Channel): **2.59 dB** at **7386.00 MHz** in the **Horizontal** polarization

802.11g (Low Channel): **4.78 dB** at **7236.00 MHz** in the **Horizontal** polarization
802.11g (Middle Channel): **2.65 dB** at **7311.00 MHz** in the **Horizontal** polarization
802.11g (High Channel): **2.91 dB** at **7386.00 MHz** in the **Horizontal** polarization

Test Data

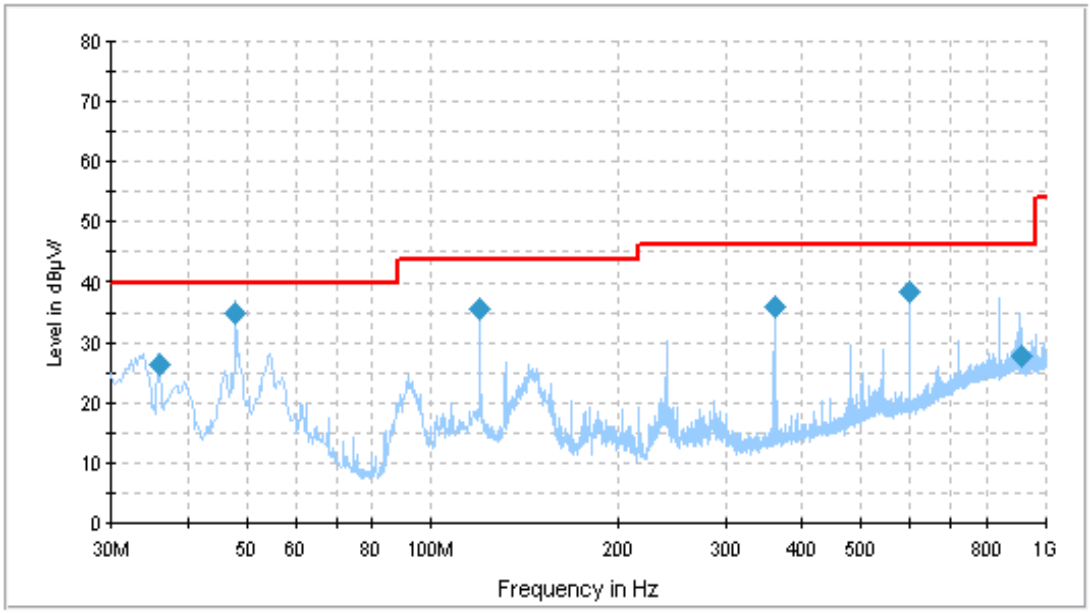
Environmental Conditions

Temperature:	24 °C
Relative Humidity:	56 %
ATM Pressure:	100.0kPa

The testing was performed by Weir Zhong on 2010-04-07.

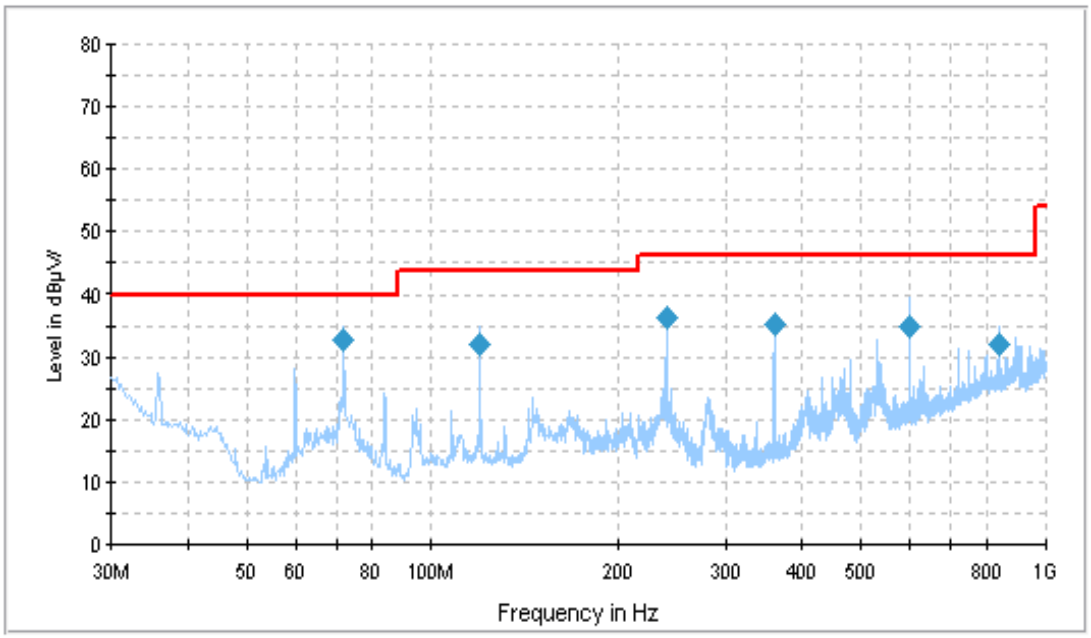
30-1000 MHz:

Test Mode: Transmitting (802.11b worse case)



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Position (degree)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
48.015500	35.1	101.0	V	309.0	-18.0	40.0	4.9
600.072500	38.6	100.0	V	145.0	-5.77	46.0	7.4
120.000000	35.8	100.0	V	296.0	-13.7	43.5	7.7
360.038250	36.2	167.0	V	129.0	-10.67	46.0	9.8
36.006500	26.5	100.0	V	278.0	-8.68	40.0	13.5
909.007750	27.9	101.0	V	241.0	-1.23	46.0	18.1

Test Mode: Transmitting (802.11g wost case)



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Position (degree)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
71.958750	32.8	229.0	V	7.0	-18.10	40.0	7.2
240.020250	36.4	257.0	V	353.0	-14.13	46.0	9.6
360.041750	35.3	242.0	V	357.0	-10.67	46.0	10.7
600.104750	35.0	323.0	V	42.0	-5.77	46.0	11.0
119.969750	32.0	252.0	V	255.0	-13.03	43.5	11.5
840.191000	32.0	251.0	V	274.0	-2.13	46.0	14.0

Above 1 GHz:

802.11b Mode:

Indicated		Detector (PK/AV)	Table Angle Degree	Test Antenna		Correction Factor			FCC Part 15.247/15.209			
Frequency (MHz)	S.A. Reading (dBμV/m)			Height (m)	Polar (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comment
Low Channel (2412 MHz)												
7236.00	33.27	AV	227	1.7	H	39.2	5.24	27.49	50.22	54	3.78*	harmonic
4824.00	36.91	AV	182	1.9	H	36.3	4.30	27.51	50.00	54	4.00*	harmonic
7236.00	32.6	AV	269	1.0	V	38.0	5.24	27.49	48.35	54	5.65	harmonic
4824.00	49.95	PK	182	1.9	H	36.3	4.30	27.51	63.04	74	10.96	harmonic
4824.00	30.04	AV	197	1.8	V	35.0	4.30	27.51	41.83	54	12.17	harmonic
7236.00	43.89	PK	227	1.7	H	39.2	5.24	27.49	60.84	74	13.16	harmonic
7236.00	43.19	PK	269	1.0	V	38.0	5.24	27.49	58.94	74	15.06	harmonic
4824.00	43.96	PK	197	1.8	V	35.0	4.30	27.51	55.75	74	18.25	harmonic
2310.22	22.83	AV	225	1.5	H	30.3	3.00	27.54	28.59	54	25.41	spurious
2310.22	22.98	AV	266	1.6	V	30.0	3.00	27.54	28.44	54	25.56	spurious
2310.22	36.54	PK	225	1.5	H	30.3	3.00	27.54	42.30	74	31.70	spurious
2310.22	36.67	PK	266	1.6	V	30.0	3.00	27.54	42.13	74	31.87	spurious
Middle Channel (2437 MHz)												
4874.00	38.17	AV	205	1.0	H	36.3	4.51	27.51	51.47	54	2.53*	harmonic
7311.00	33.70	AV	266	1.4	V	38.0	5.35	27.49	49.56	54	4.44	harmonic
7311.00	32.46	AV	226	1.7	H	39.2	5.35	27.49	49.52	54	4.48	harmonic
4874.00	50.85	PK	205	1.0	H	36.3	4.51	27.51	64.15	74	9.85	harmonic
4874.00	31.10	AV	268	1.5	V	35.0	4.51	27.51	43.10	54	10.90	harmonic
7311.00	43.67	PK	226	1.7	H	39.2	5.35	27.49	60.73	74	13.27	harmonic
7311.00	44.31	PK	266	1.4	V	38.0	5.35	27.49	60.17	74	13.83	harmonic
4874.00	44.52	PK	268	1.5	V	35.0	4.51	27.51	56.52	74	17.48	harmonic
1042.08	24.52	AV	215	1.5	H	25.1	1.91	26.85	24.68	54	29.32	spurious
1042.08	24.48	AV	214	1.2	V	23.8	1.91	26.85	23.34	54	30.66	spurious
1042.08	38.43	PK	215	1.5	H	25.1	1.91	26.85	38.59	74	35.41	spurious
1042.08	37.91	PK	214	1.2	V	23.8	1.91	26.85	36.77	74	37.23	spurious
HighChannel (2462 MHz)												
7386.00	34.3	AV	228	1.8	H	39.2	5.40	27.49	51.41	54	2.59*	harmonic
4924.00	37.83	AV	214	1.0	H	36.3	4.60	27.51	51.22	54	2.78*	harmonic
7386.00	33.1	AV	266	1.4	V	38.0	5.40	27.49	49.01	54	4.99	harmonic
4924.00	32.5	AV	166	1.5	V	35.0	4.60	27.51	44.59	54	9.41	harmonic
4924.00	50.57	PK	214	2.0	H	36.3	4.60	27.51	63.96	74	10.04	harmonic
7386.00	44.68	PK	228	1.8	H	39.2	5.40	27.49	61.79	74	12.21	harmonic
7386.00	43.56	PK	266	1.4	V	38.0	5.40	27.49	59.47	74	14.53	harmonic
4924.00	45.58	PK	166	1.5	V	35.0	4.60	27.51	57.67	74	16.33	harmonic
2488.15	24.12	AV	218	1.6	H	31.0	3.15	27.60	30.67	54	23.33	spurious
2488.15	23.62	AV	217	1.3	V	30.4	3.15	27.60	29.57	54	24.43	spurious
2488.15	38.26	PK	218	1.6	H	31.0	3.15	27.60	44.81	74	29.19	spurious
2488.15	37.89	PK	217	1.3	V	30.4	3.15	27.60	43.84	74	30.16	spurious

** Within measurement uncertainty.*

802.11g Mode:

Indicated		Detector (PK/AV)	Table Angle Degree	Test Antenna		Correction Factor			FCC Part 15.247/15.209			
Frequency (MHz)	S.A. Reading (dBμV/m)			Height (m)	Polar (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comment
Low Channel (2412 MHz)												
7236.00	32.27	AV	162	1.9	H	39.2	5.24	27.49	49.22	54	4.78	harmonic
7236.00	48.03	PK	162	1.9	H	39.2	5.24	27.49	64.98	74	9.02	harmonic
4824.00	30.13	AV	206	1.0	H	36.3	4.30	27.51	43.22	54	10.78	harmonic
7236.00	26.51	AV	266	1.3	V	38.0	5.24	27.49	42.26	54	11.74	harmonic
7236.00	42.86	PK	266	1.3	V	38.0	5.24	27.49	58.61	74	15.39	harmonic
4824.00	44.79	PK	206	1.0	H	36.3	4.30	27.51	57.88	74	16.12	harmonic
4824.00	24.10	AV	264	1.2	V	35.0	4.30	27.51	35.89	54	18.11	harmonic
4824.00	38.54	PK	264	1.2	V	35.0	4.30	27.51	50.33	74	23.67	harmonic
2310.20	22.78	AV	166	1.5	H	30.3	3.00	27.54	28.54	54	25.46	spurious
2310.20	22.84	AV	230	1.2	V	30.0	3.00	27.54	28.3	54	25.70	spurious
2310.20	36.95	PK	230	1.2	V	30.0	3.00	27.54	42.41	74	31.59	spurious
2310.20	36.39	PK	166	1.5	H	30.3	3.00	27.54	42.15	74	31.85	spurious
Middle Channel (2437 MHz)												
7311.00	34.29	AV	164	1.6	H	39.2	5.35	27.49	51.35	54	2.65*	harmonic
4874.00	34.15	AV	207	1.8	H	36.3	4.51	27.51	47.45	54	6.55	harmonic
7311.00	50.23	PK	164	1.6	H	39.2	5.35	27.49	67.29	74	6.71	harmonic
7311.00	28.31	AV	271	1.4	V	38.0	5.35	27.49	44.17	54	9.83	harmonic
4874.00	48.55	PK	207	1.8	H	36.3	4.51	27.51	61.85	74	12.15	harmonic
7311.00	43.94	PK	271	1.4	V	38.0	5.35	27.49	59.80	74	14.20	harmonic
4874.00	26.89	AV	260	1.8	V	35.0	4.51	27.51	38.89	54	15.11	harmonic
4874.00	41.19	PK	260	1.8	V	35.0	4.51	27.51	53.19	74	20.81	harmonic
1045.11	24.67	AV	163	1.7	H	25.1	1.91	26.85	24.83	54	29.17	spurious
1045.11	25.01	AV	267	1.2	V	23.8	1.91	26.85	23.87	54	30.13	spurious
1045.11	38.15	PK	163	1.7	H	25.1	1.91	26.85	38.31	74	35.69	spurious
1045.11	38.92	PK	267	1.2	V	23.8	1.91	26.85	37.78	74	36.22	spurious
HighChannel (2462 MHz)												
7386.00	33.98	AV	165	1.8	H	39.2	5.40	27.49	51.09	54	2.91*	harmonic
4924.00	34.34	AV	208	1.0	H	36.3	4.60	27.51	47.73	54	6.27	harmonic
7386.00	49.38	PK	165	1.8	H	39.2	5.40	27.49	66.49	74	7.51	harmonic
7386.00	27.12	AV	266	1.8	V	38.0	5.40	27.49	43.03	54	10.97	harmonic
4924.00	48.47	PK	208	1.0	H	36.3	4.60	27.51	61.86	74	12.14	harmonic
4924.00	28.10	AV	165	1.9	V	35.0	4.60	27.51	40.19	54	13.81	harmonic
7386.00	43.64	PK	266	1.8	V	38.0	5.40	27.49	59.55	74	14.45	harmonic
4924.00	42.36	PK	165	1.9	V	35.0	4.60	27.51	54.45	74	19.55	harmonic
2483.89	23.58	AV	210	1.6	H	31.0	3.15	27.60	30.13	54	23.87	spurious
2483.89	23.61	AV	162	1.3	V	30.4	3.15	27.60	29.56	54	24.44	spurious
2483.89	38.17	PK	210	1.6	H	31.0	3.15	27.60	44.72	74	29.28	spurious
2483.89	37.50	PK	162	1.3	V	30.4	3.15	27.60	43.45	74	30.55	spurious

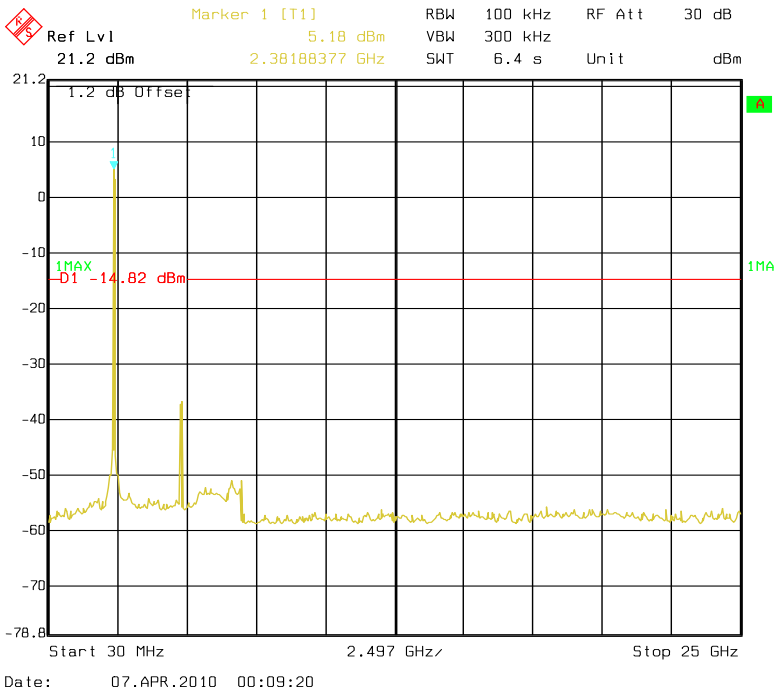
** Within measurement uncertainty.*

Antenna Port Conducted Spurious Emissions

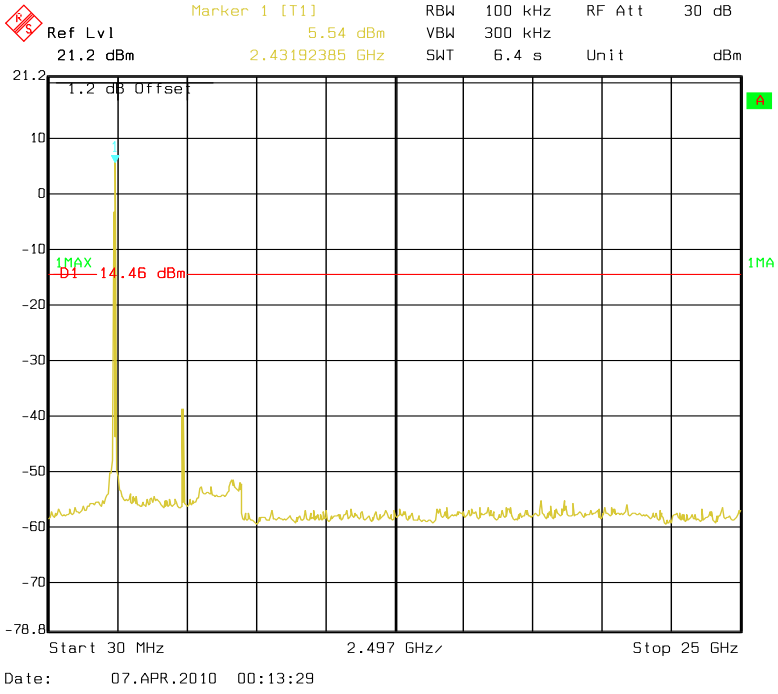
Channel Frequency (MHz)	Delta Value (dBc)	Limit (dBc)	Ref. Plot	Result
802.11b Mode				
2412	*	20	PLOT1	PASS
2437	*	20	PLOT2	PASS
2462	*	20	PLOT3	PASS
802.11g Mode				
2412	*	20	PLOT4	PASS
2437	*	20	PLOT5	PASS
2462	*	20	PLOT6	PASS

Please refer to the following plots.

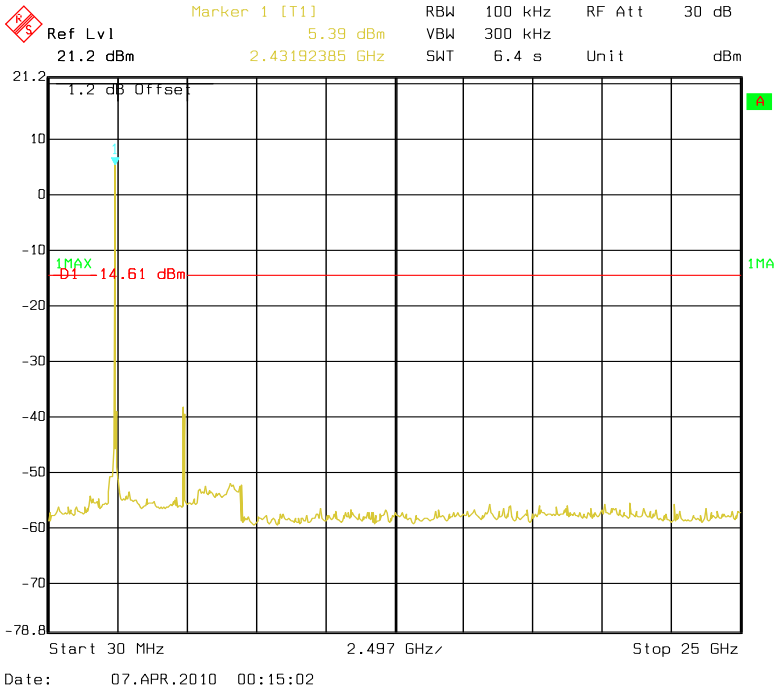
Plot 1: 802.11b Low Channel



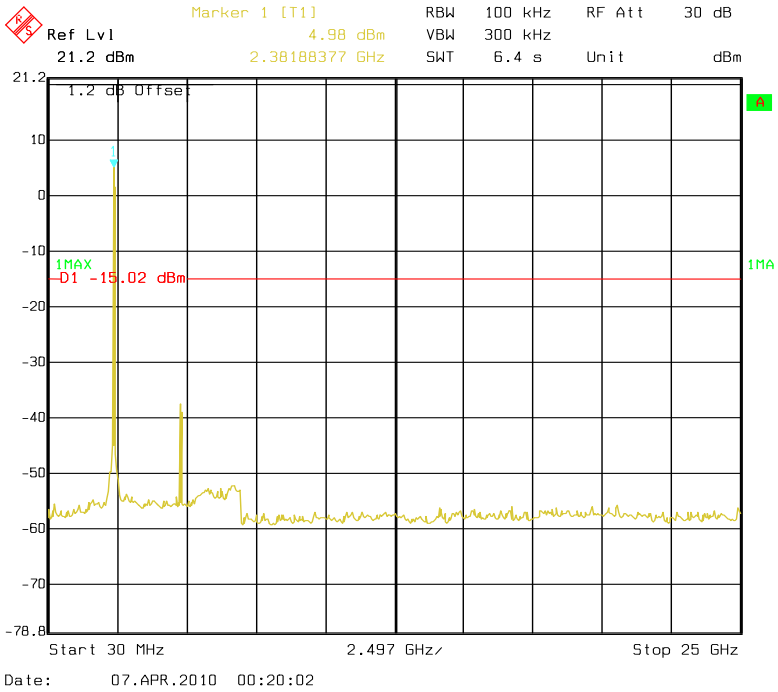
Plot 2: 802.11b Middle Channel



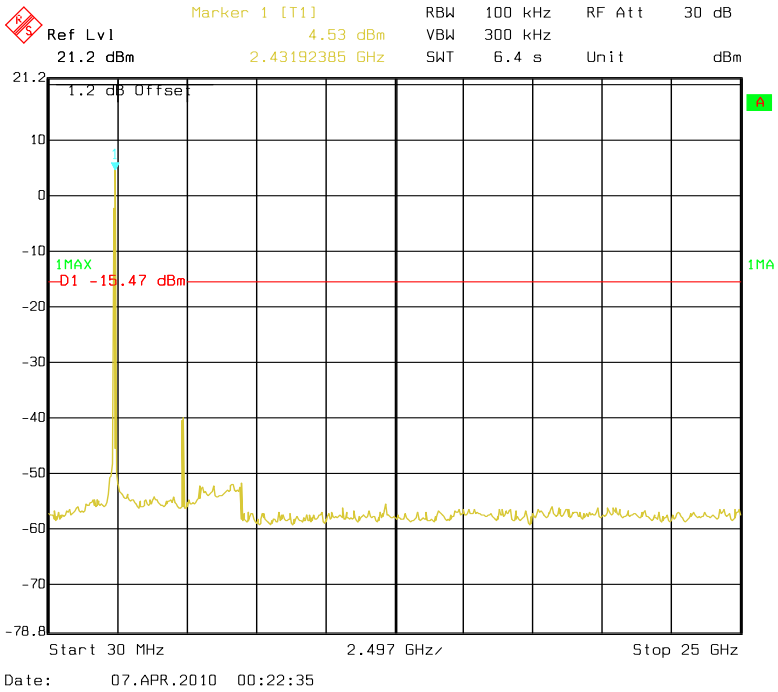
Plot 3: 802.11b High Channel



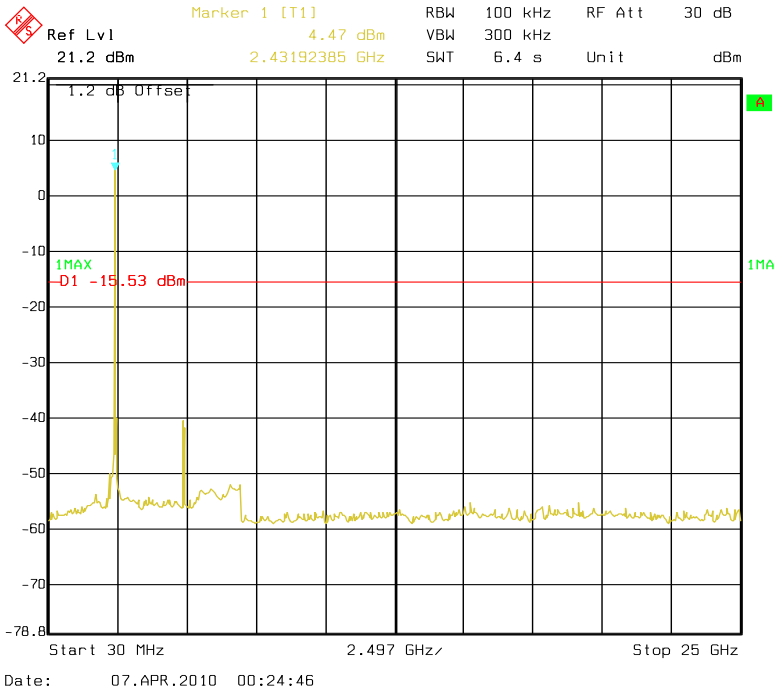
Plot 4: 802.11g Low Channel



Plot 5: 802.11g Middle Channel



Plot 6: 802.11g High Channel



FCC §15.247(a) (2) – 6 dB BANDWIDTH TESTING

Applicable Standard

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.

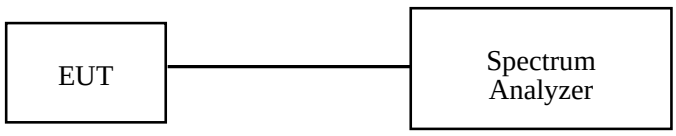
Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2009-11-24	2010-11-24

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test 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 emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.



Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56%
ATM Pressure:	100.0kPa

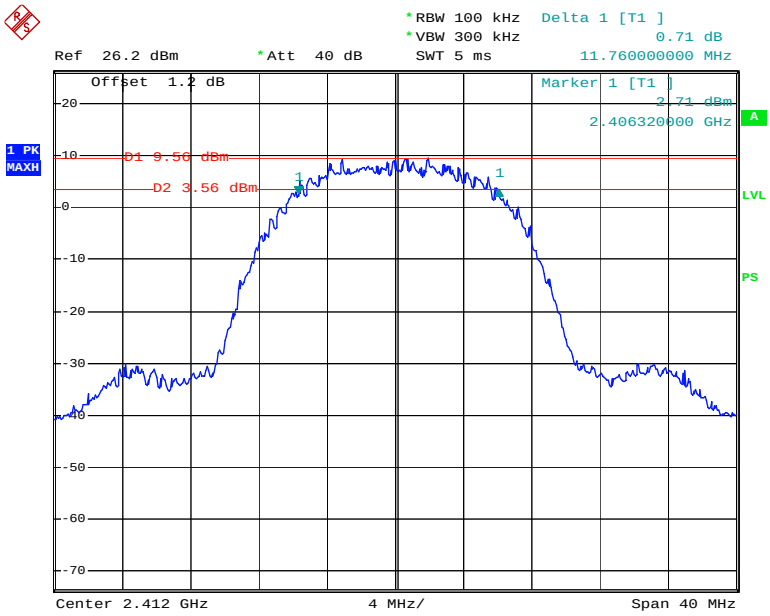
The testing was performed by Weir Zhong on 2010-04-06.

Test Result: Pass.

Please refer to the following tables and plots.

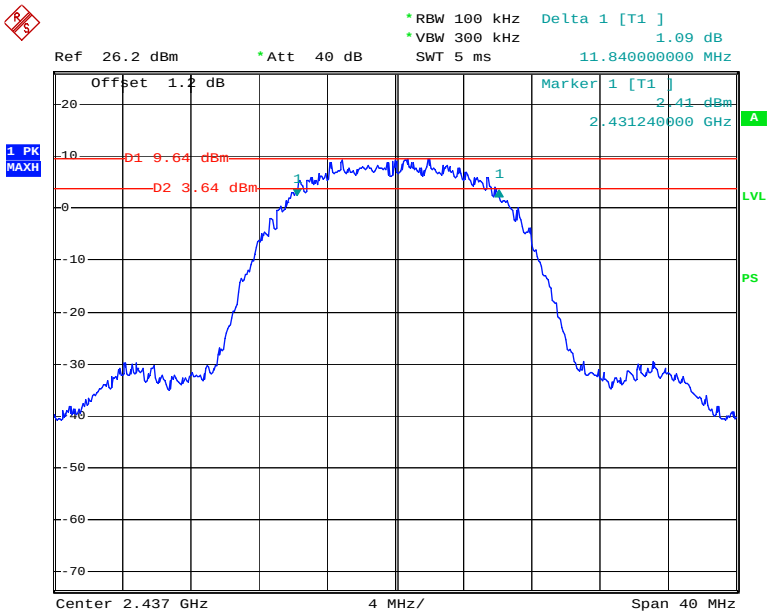
Channel	Frequency (MHz)	Data Rate (Mbps)	Measured 6 dB Bandwidth (MHz)	FCC Part 15.247 Limit (kHz)
802.11b Mode				
Low	2412	11	11.76	> 500
Middle	2437	11	11.84	> 500
High	2462	11	11.60	> 500
802.11g Mode				
Low	2412	54	16.64	> 500
Middle	2437	54	16.56	> 500
High	2462	54	16.64	> 500

802.11b Low Channel



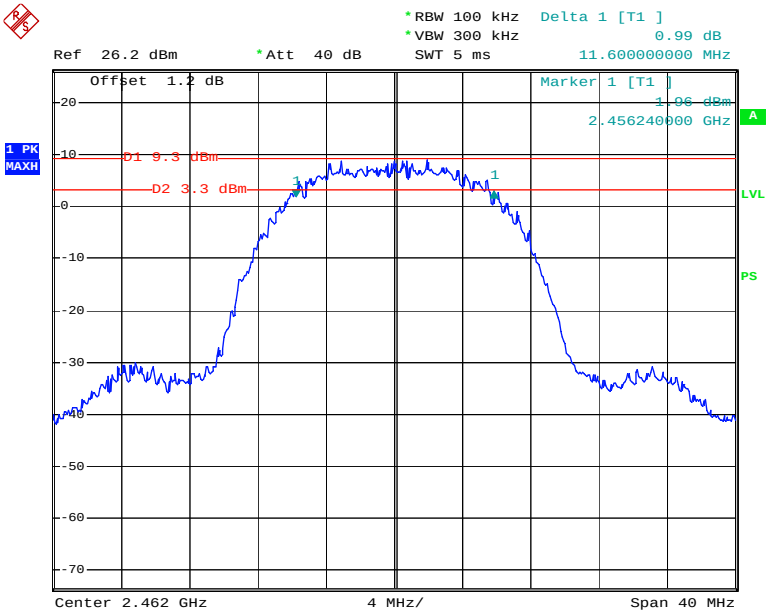
Date: 6.APR.2010 14:29:53

802.11b Middle Channel



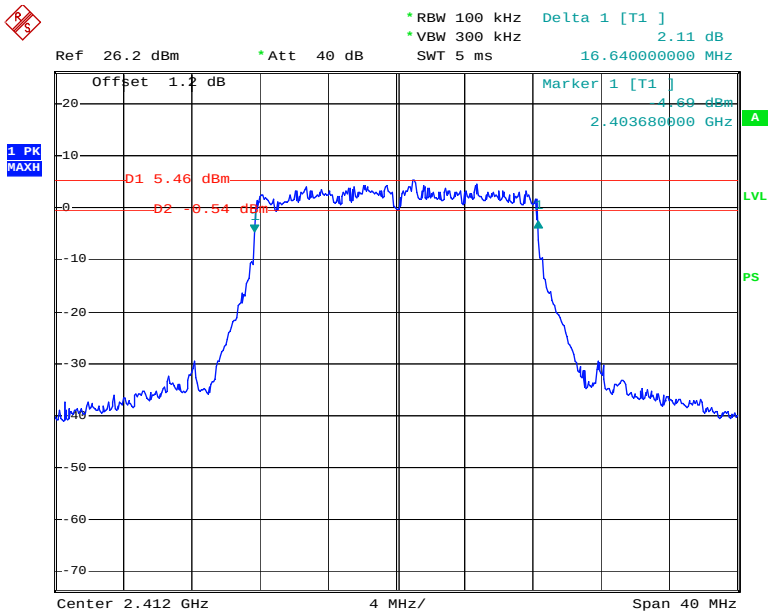
Date: 6.APR.2010 14:32:26

802.11b High Channel



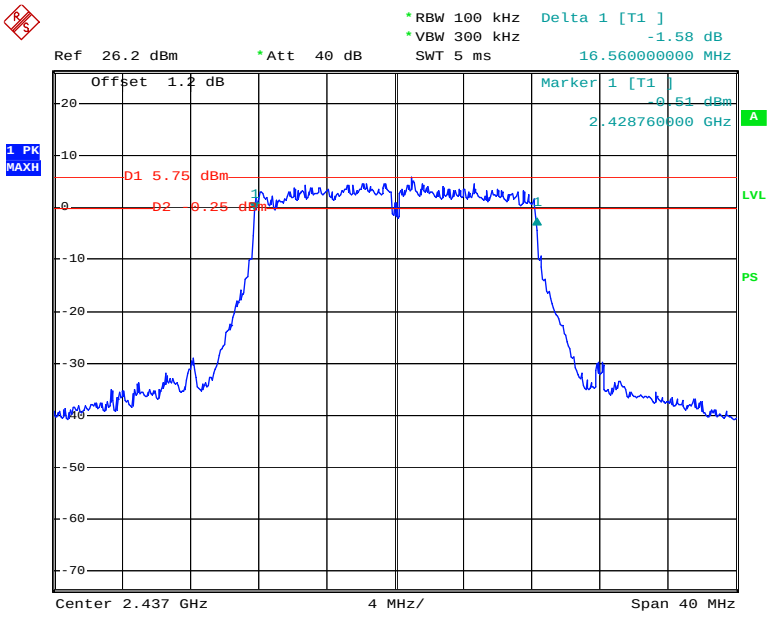
Date: 6.APR.2010 14:35:00

802.11g Low Channel



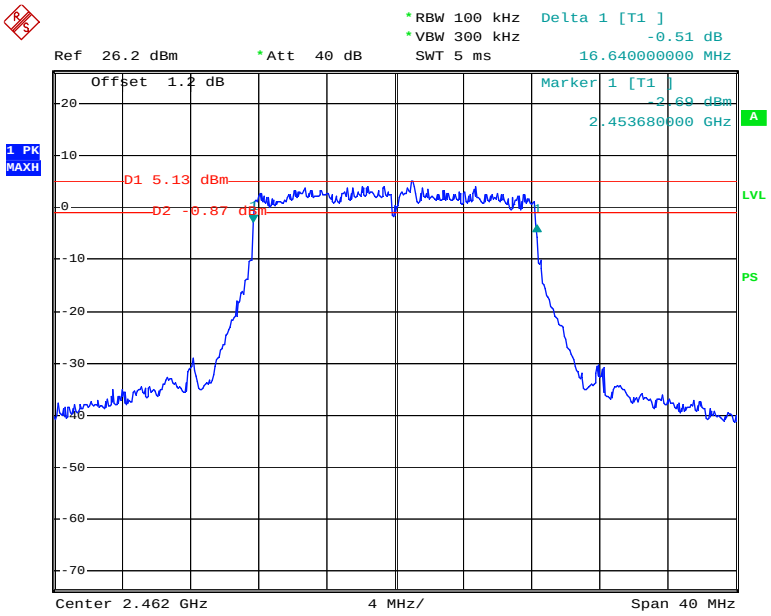
Date: 6.APR.2010 14:38:17

802.11g Middle Channel



Date: 6.APR.2010 14:39:56

802.11g High Channel



Date: 6.APR.2010 14:42:43

FCC §15.247(b)(3), (b)(4) & (c) - MAXIMUM PEAK OUTPUT POWER

Applicable Standard

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

According to §15.247(b)(4) , The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to §15.247 (c), Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:
(i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.
(iii) Fixed, point-to-point operation, as used in paragraphs (c)(1)(i) and (c)(1)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

(2) In addition to the provisions in paragraphs (b)(1), (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:
(i) Different information must be transmitted to each receiver.
(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do 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.

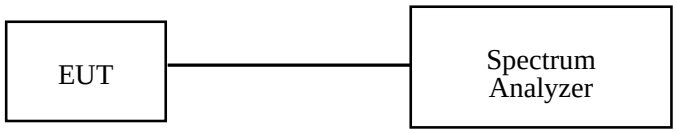
Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2009-11-24	2010-11-24

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test 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 an EMI Test Receiver.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.0kPa

The testing was performed by Weir Zhong on 2010-05-10.

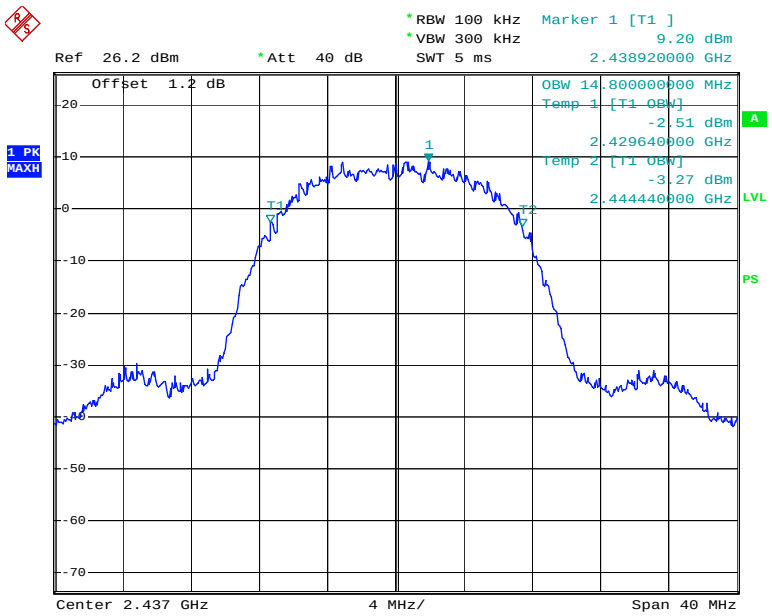
Test Mode: Transmitting

Radio Mode	Channel	Frequency (MHz)	Conducted Output Power (dBm)	Conducted Output Power Limit (dBm)
802.11b	Low	2412	22.77	28
	Middle	2437	22.74	28
	High	2462	22.60	28
802.11g	Low	2412	20.65	28
	Middle	2437	20.76	28
	High	2462	20.22	28

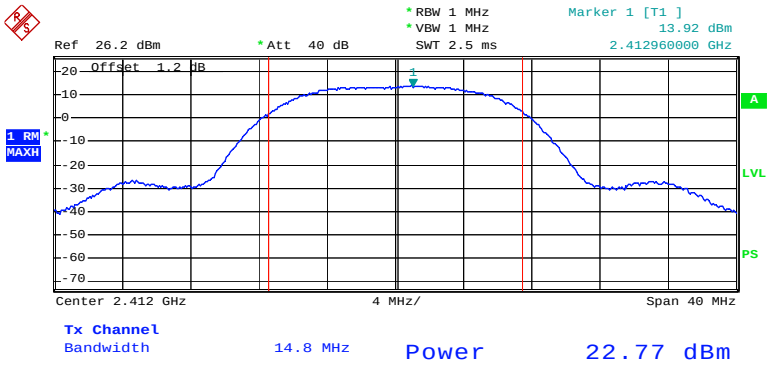
Note: The smart antenna system is a phase array, which is combined by 8- element phase array. Element gain is 3 dBi, the calculated gain is: 3+10 lg (8) = 12 dBi. It is working as a point to point system; the conducted output power limit needs to be reduced as 30-(12-6)/3=28 dBm.

802.11b Mode:

99% Occupied Bandwith

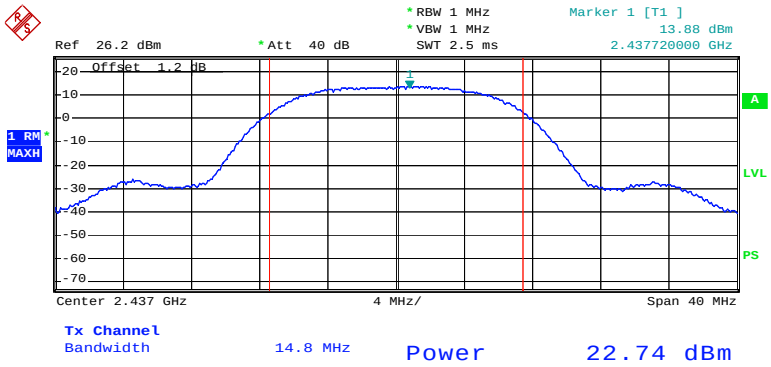


802.11b RF Output Power, Low Channel



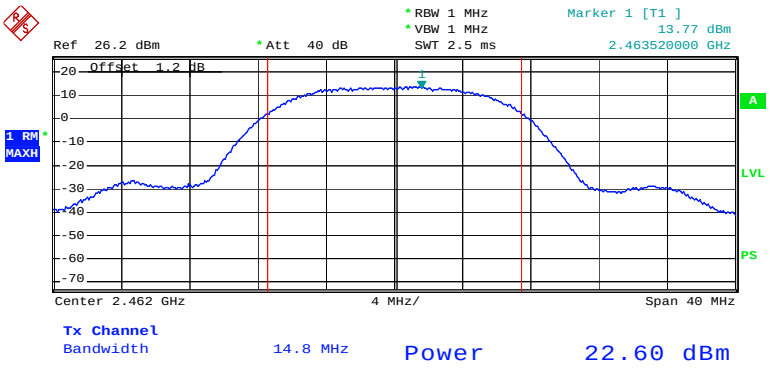
Date: 10.MAY.2010 20:13:12

802.11b RF Output Power, Middle Channel



Date: 10.MAY.2010 20:11:55

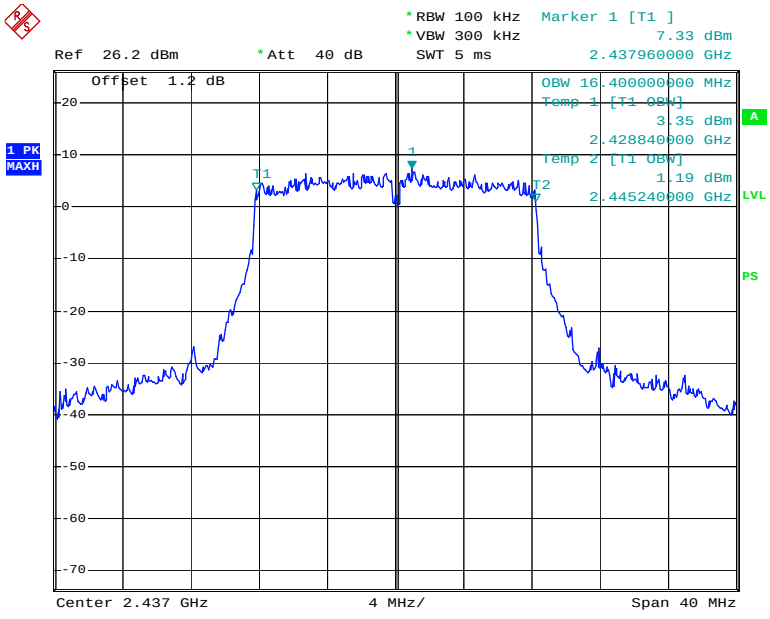
802.11b RF Output Power, High Channel



Date: 10.MAY.2010 20:14:51

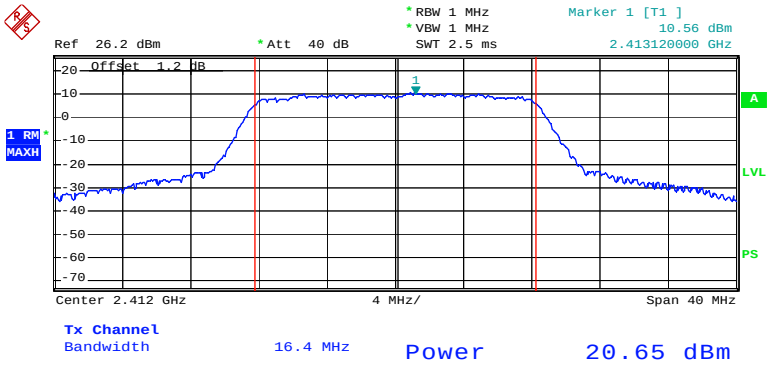
802.11g Mode:

99% Occupied Bandwith



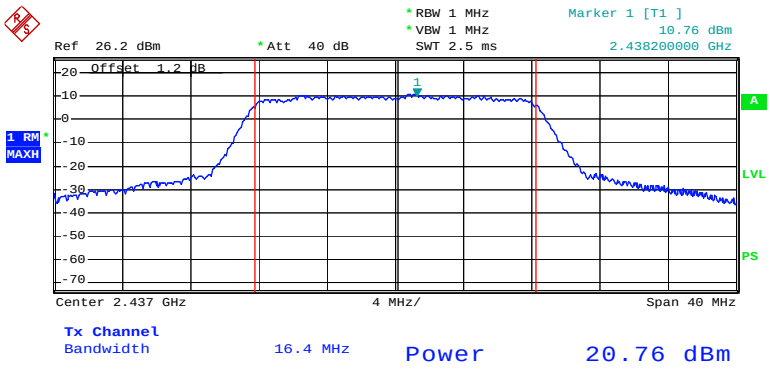
Date: 10.MAY.2010 20:29:00

802.11g RF Output Power, Low Channel



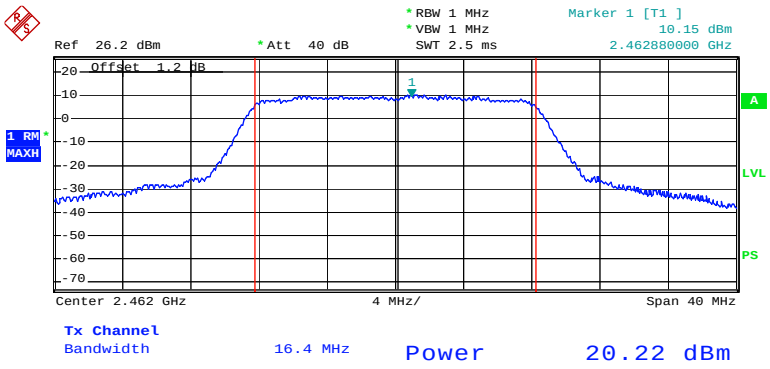
Date: 10.MAY.2010 20:27:17

802.11g RF Output Power, Middle Channel



Date: 10.MAY.2010 20:26:27

802.11g RF Output Power, High Channel



Date: 10.MAY.2010 20:28:00

FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

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)).

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2009-11-24	2010-11-24

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test 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 RBW to 1 MHz and VBW of spectrum analyzer to 1 MHz 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.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.0kPa

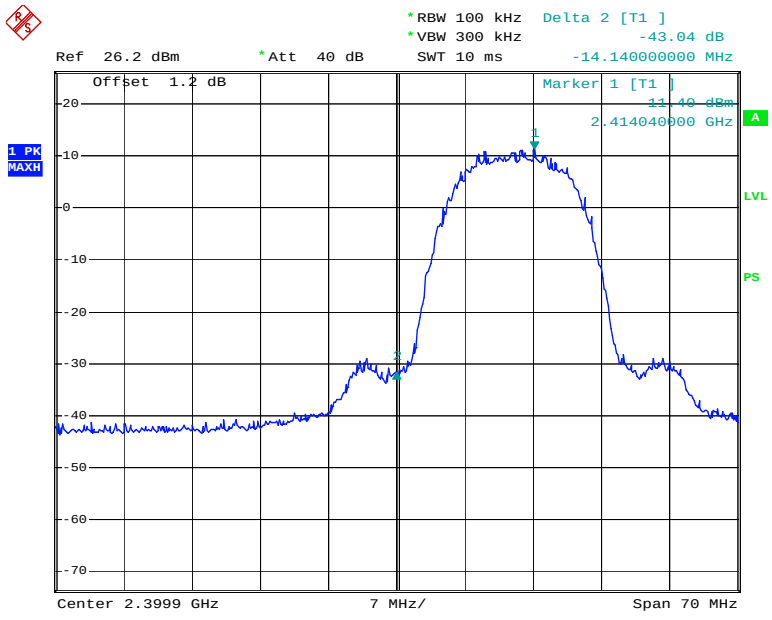
The testing was performed by Weir Zhong on 2010-04-06.

Test Result: *Compliant.*

Frequency (MHz)	Delta Value (dBc)	Limit (dBc)	Result
802.11b Mode			
2399.9	43.04	20	Pass
2483.6	49.90	20	Pass
802.11g Mode			
2399.9	34.82	20	Pass
2483.6	46.27	20	Pass

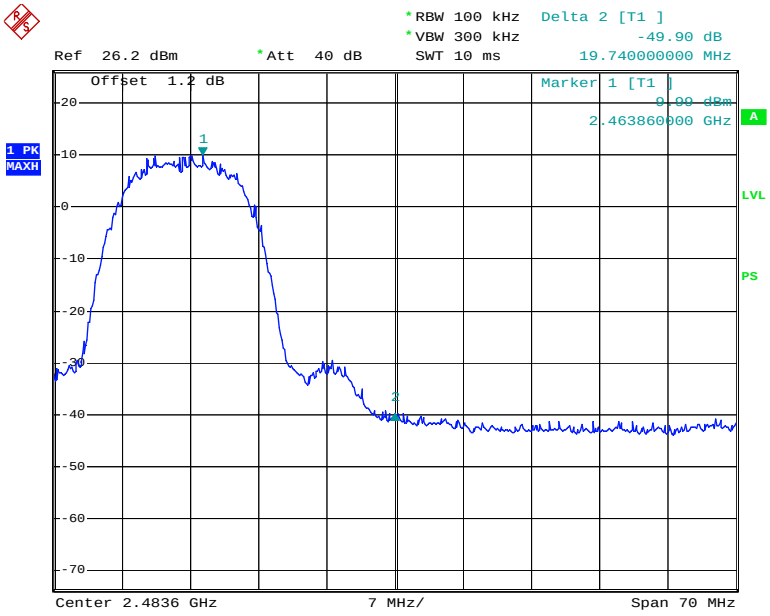
Please refer to following plots.

802.11b: Band Edge, Left Side



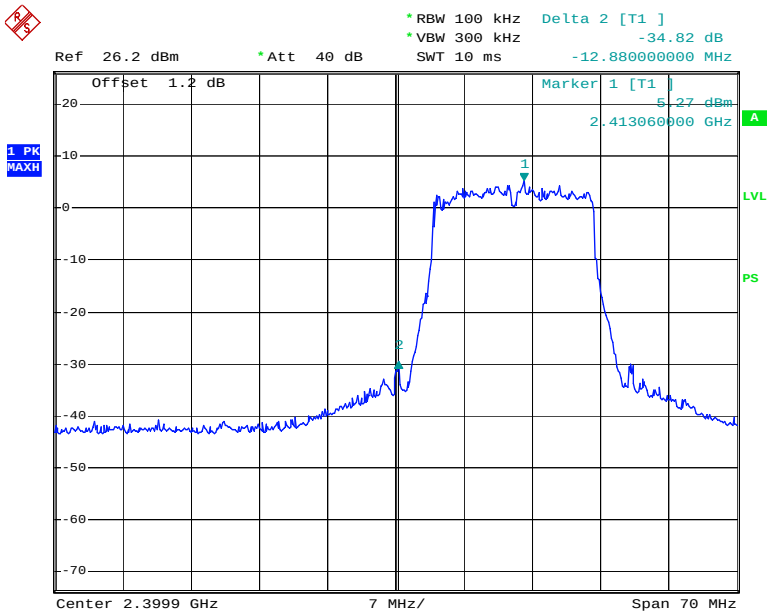
Date: 6.APR.2010 14:57:24

802.11b: Band Edge, Right Side



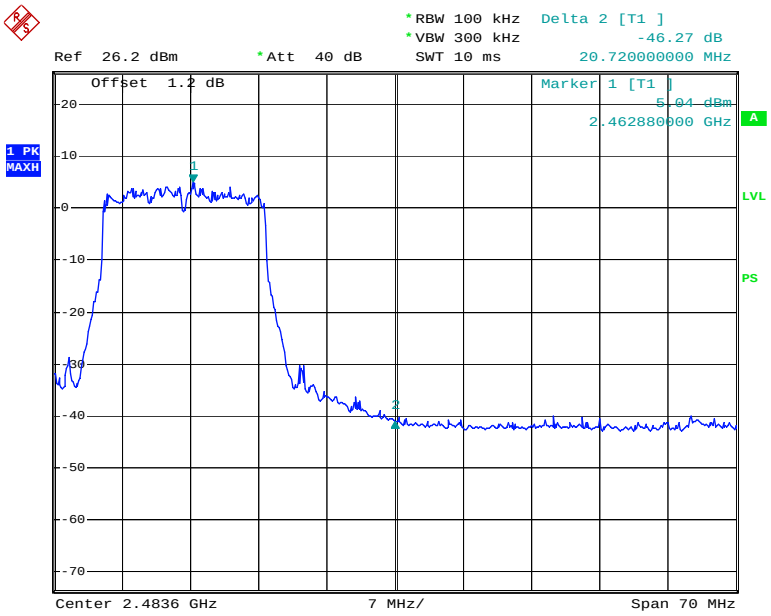
Date: 6.APR.2010 14:58:54

802.11g: Band Edge, Left Side



Date: 6.APR.2010 14:54:47

802.11g: Band Edge, Right Side



Date: 6.APR.2010 14:49:33

FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2009-11-24	2010-11-24

*** Statement of Traceability:** Bay Area Compliance Lab Corp. (ShenZhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test 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.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.0kPa

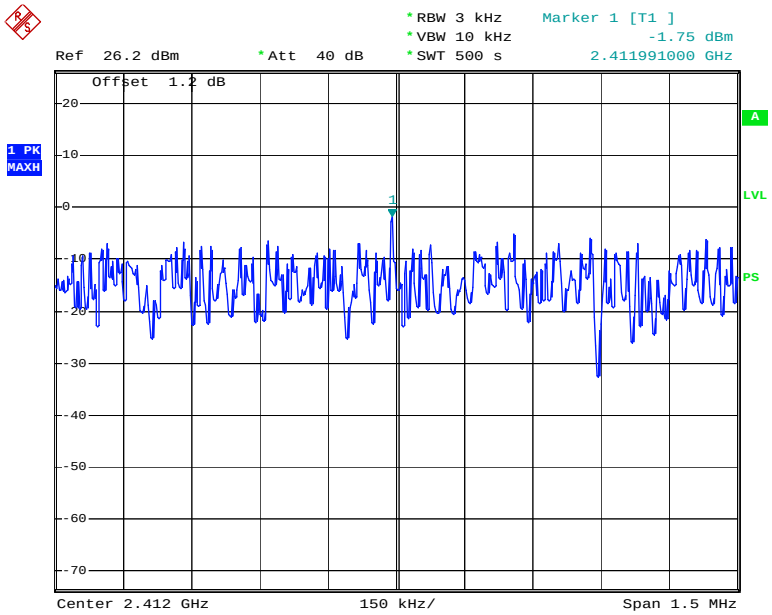
The testing was performed by Weir Zhong on 2010-04-07 to 2010-04-12

Test Mode: Transmitting

Test Result: Pass

Channel	Frequency (MHz)	Power Spectal Density (dBm/3kHz)	Part 15.247 Limit (dBm/3kHz)	Result
802.11b Mode				
Low	2412	-1.75	8	Pass
Middle	2437	-1.07	8	Pass
High	2462	-1.64	8	Pass
802.11g Mode				
Low	2412	-3.73	8	Pass
Middle	2437	-3.23	8	Pass
High	2462	-3.82	8	Pass

Power Spectral Density, 802.11b Low Channel



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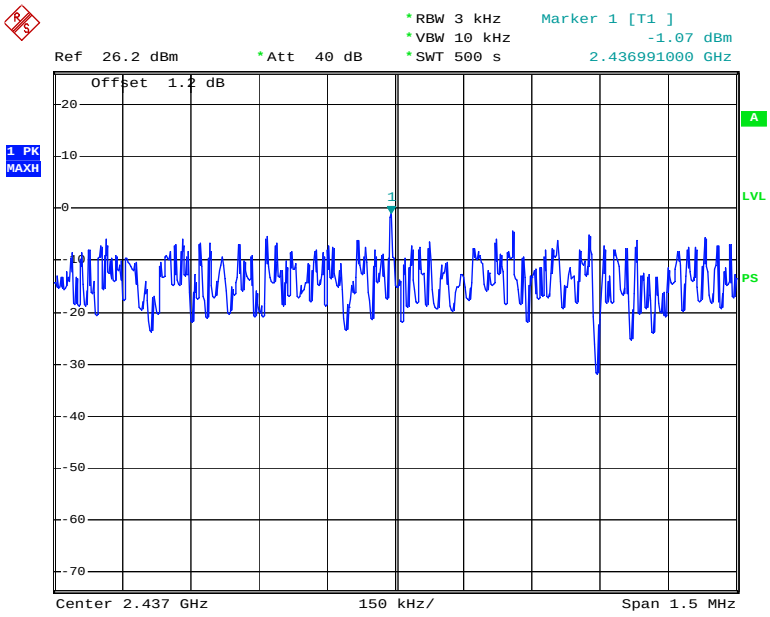
Power Spectral Density, 802.11b Middle Channel



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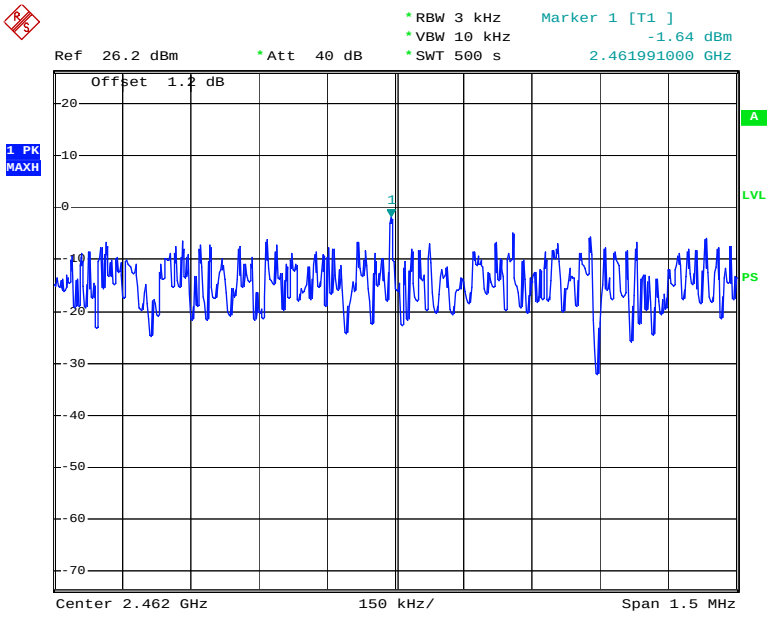
Power Spectral Density, 802.11b High Channel



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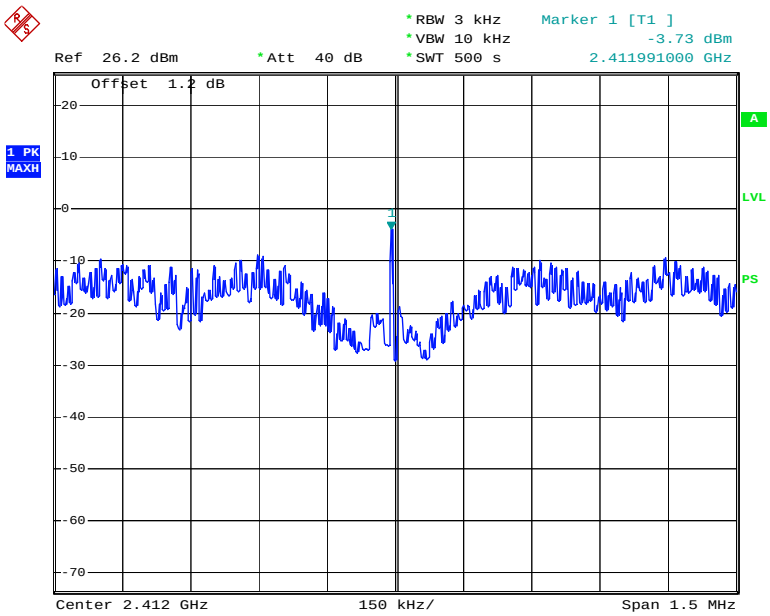
Power Spectral Density, 802.11g Low Channel



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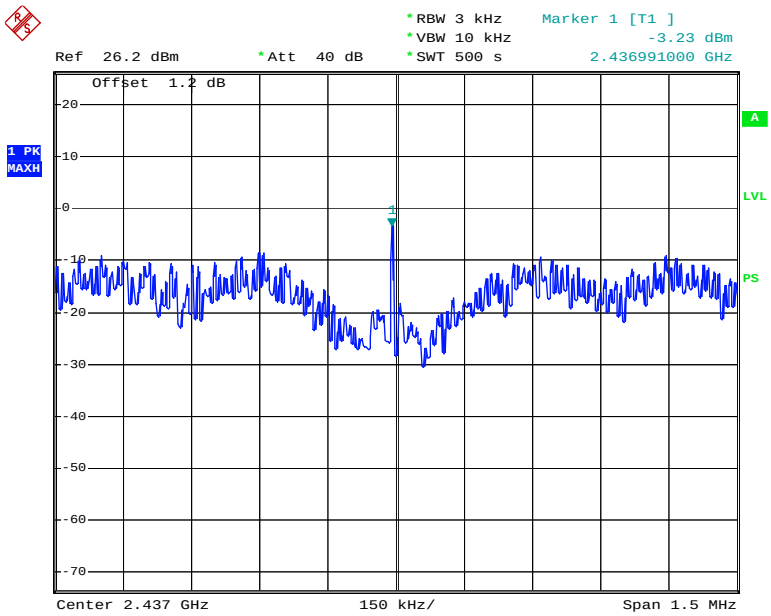
Power Spectral Density, 802.11g Middle Channel



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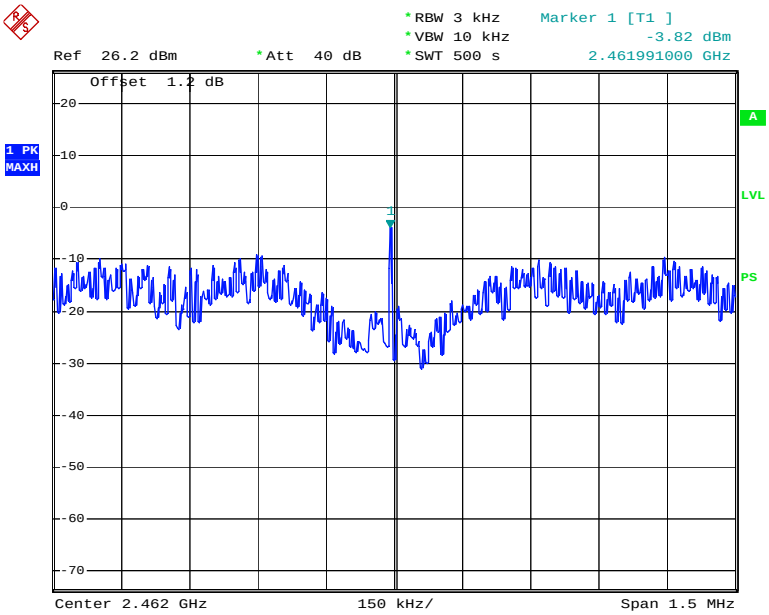
Power Spectral Density, 802.11g High Channel



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