



NVLAP LAB CODE 200707-0



# FCC PART 15.247

## MEASUREMENT AND TEST REPORT

For

### FORTINET INC

1090 Kifer Road Sunnyvale, CA 94086 USA

**FCC ID: TVE3045**

<b>This Report Concerns:</b> <input checked="" type="checkbox"/> Original Report		<b>Equipment Type:</b> FORTIWIFI-50B
<b>Test Engineer:</b>	Henry Yang <i>Henry Yang</i>	
<b>Report No.:</b>	RBJ07032151	
<b>Test Date:</b>	2007-04-03 to 2007-06-08	
<b>Report Date:</b>	2007-06-08	
<b>Reviewed By:</b>	EMC Manager: Boni Baniqued <i>Boni Baniqued</i>	
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**Note:** This test report is for the customer shown above and their specific product only. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratory Corp. (Shenzhen). This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government

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## GENERAL INFORMATION

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### Product Description for Equipment under Test (EUT)

The *FORTINET INC*'s product, FCC ID: TVE3045 or the "EUT" as referred to in this report is a *FORTIWIFI-50B*, which measures approximately: 21.6 cm L x 14.8 cm W x 3.7 cm H, rated input voltage: DC 12V.

AC/DC Adapter:

Manufacturer: Sunny Computer Technology Co., LTD.

Model: STD-1203

PART No.: STD-1203-FTN

Input: 100-240V-0.8 A Max 50/60Hz 70-80VA

Output: 12V 3.0A

Output power: 36w max

*\* The test data gathered are from production sample, serial number: 0703120. Provided by the manufacturer, we receive the EUT on 2007-03-21.*

### Objective

This Type approval report is prepared on behalf of *FORTINET INC* 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, 15.209 and 15.247 rules.

### Related Submittal(s)/Grant(s)

No related submittal(s).

### 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 Laboratory 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 Laboratory Corp. (Shenzhen) to collect radiated and conducted emission measurement 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 Laboratory 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 04, 2004. 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 and Industrial Canada registration test site No.: 5500A. 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 Laboratory Corp. (Shenzhen) is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200707-0). The current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2007070.htm>

**Host System Configuration List and Details**

Manufacturer	Description	Model	Serial Number	FCC ID
Intel	Motherboard	D865GKD	11S19R1949ZJ1WCB46J1J4	DoC
IBM	Power	HIPRO-A2307F3T	11S49P2191ZJ1TAR47D1PG	DoC
IBM	Hard Disk	IC35L090AW207-0	VNVC32G3GGSS52T	DoC
ALPS	3.5' Floppy	06P5226	11S06P5226ZJ1W25328053	DoC
Hitachi-LG	DVD-Rom	LTN-489S	B4F511412	DoC
Intel	Ethernet	PRO 10/100 VE	N/A	DoC
IBM	PC	ThinkCentre A50	99Y5681	DoC
ProMOS	Memory	V826616J24SATG-C0	BD070964H	DoC
Intel	CPU	Pentium4 2800MHz	N/A	DoC

**Local Support Equipment List and Details**

Manufacturer	Description	Model	Serial Number	FCC ID
Logitech	Keyboard	Y-SM48	SY513U68933	DoC
Logitech	Mouse	M-SAW83A	HCA31707689	DoC
IBM	CRT Monitor	6737-66W	23-P3242	BEJT17H D
HP	Laser Jet5L	C3941A	JPTVOB2337	DoC
SAST	Modem	AEM-2100	293	DoC
NETGEAR	POE Switch	FS108P	FS27154CA003408	DoC

**External I/O Cable**

Cable Description	Length (m)	From/Port	To
Shielded Detachable Keyboard Cable	1.50	Keyboard Port / Host	Keyboard
Shielded Detachable Mouse Cable	1.50	Mouse Port / Host	Mouse
Shielded Detachable VGA Cable	1.50	VGA Port/Host	Monitor
Shielded Detachable Power Cable	1.20	EUT	Adapter

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## SYSTEM TEST CONFIGURATION

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### Description of Test Configuration

The system was configured for testing with additional control unit as shown on the configuration of test setup on page 8.

Note:

For 802.11b, the worst emission at 11Mbps

For 802.11g, the worst emission at 54 Mbps

### EUT Exercise Software

The exercise software is available.

### Special Accessories

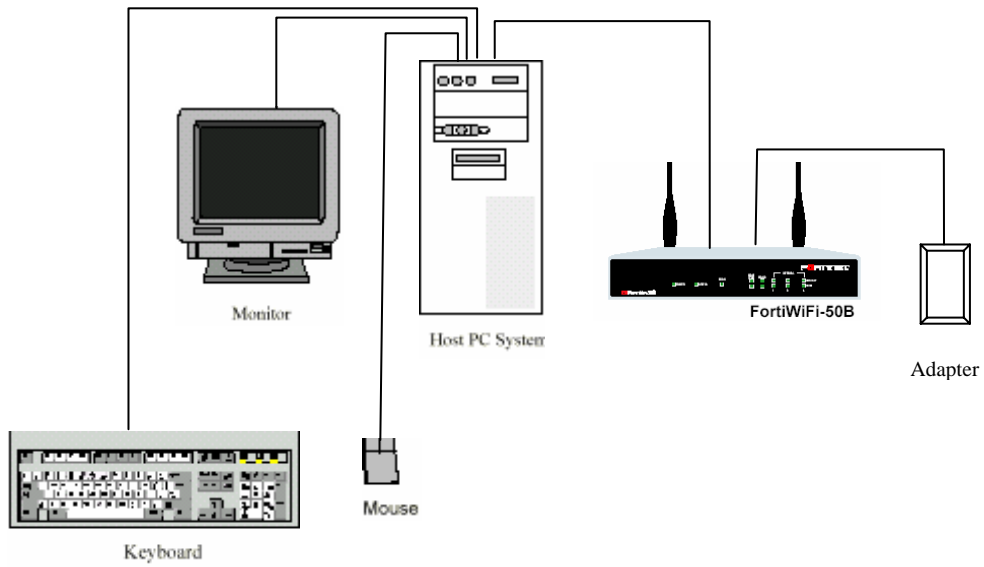
The special Accessories were provided by Bay Area Compliance Laboratory Corp. (Shenzhen).

### Equipment Modifications

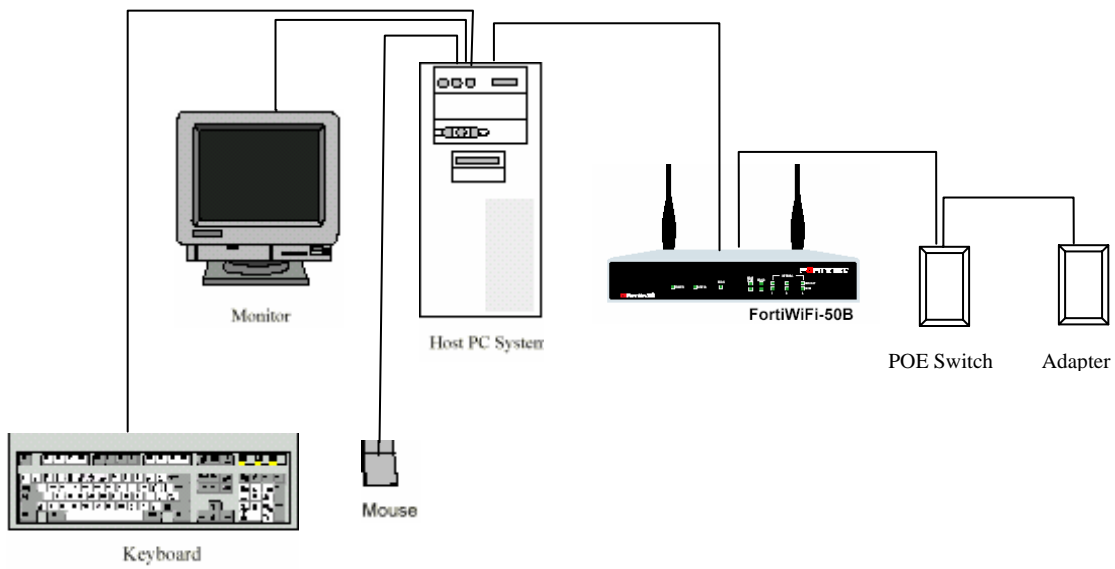
Bay Area Compliance Laboratory Corp. (Shenzhen) has not done any modification on the EUT.

### Configuration of Test Setup

Adapter Mode:



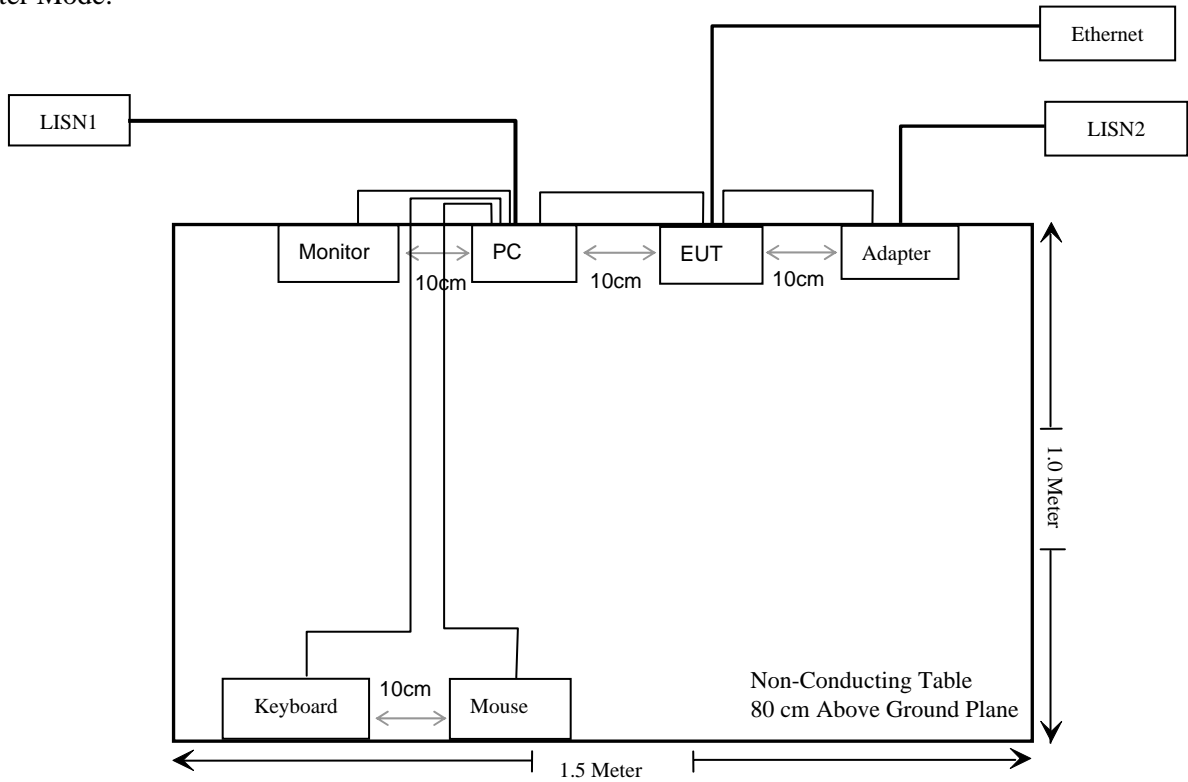
POE Mode:



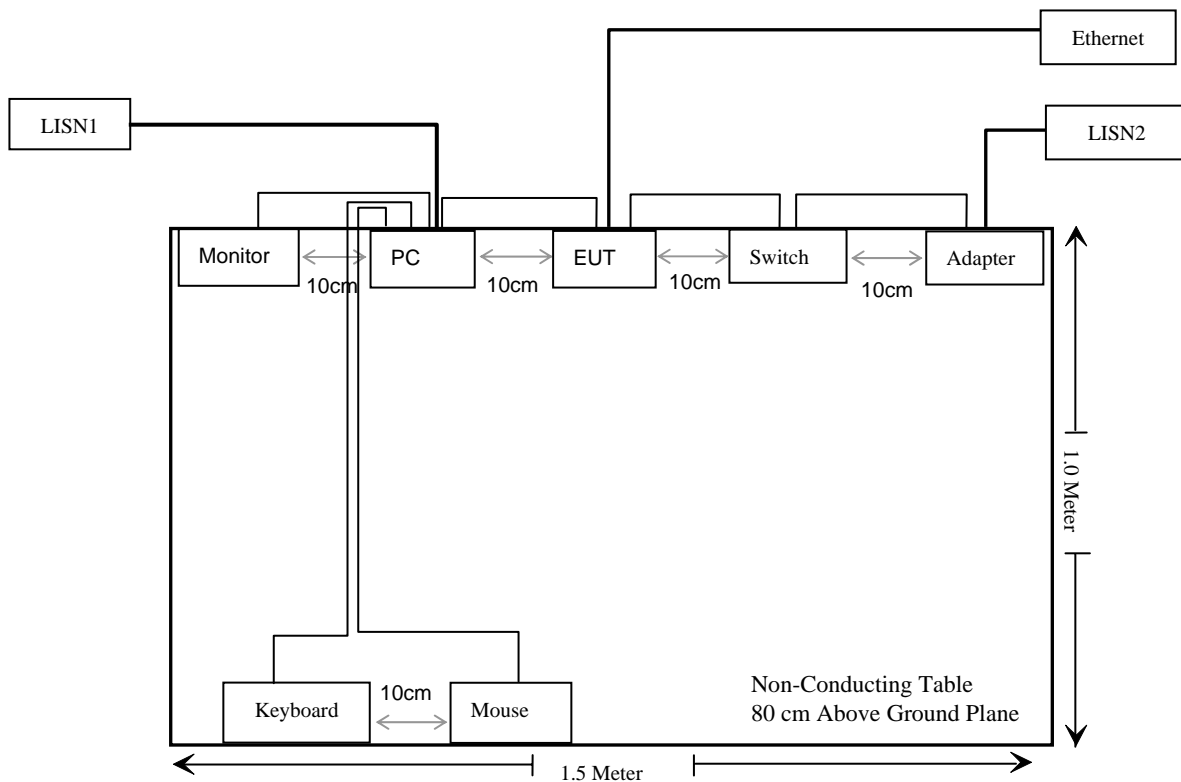


### Block Diagram of Test Setup

Adapter Mode:



POE Mode:



**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
§15.207 (a)	Conducted Emission	Compliant
§15.247 (i), §1.1307 (b)(1)	Maximun Permissible exposure (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.205	Restricted Band	Compliant
§15.205, §15.209, §15.247(d)	Radiated Emission	Compliant
§15.247 (a)(2)	6 dB Bandwidth	Compliant
§15.247(a)(1)	Channel Separation Test	N/A
§15.247(a)(1)(iii)	Time of occupancy (Dwell Time)	N/A
§15.247(a)(1)(iii)	Quantity of hopping channel Test	N/A
§15.247(b)(3)	Peak Output Power Measurement	Compliant
§15.247(d)	Band edges testing	Compliant
§15.247(e)	Power Density	Compliant

**§15.247 (i) and §1.1307 (b) (1) - MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

**Limit**

According to §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.

Radio frequency radiation exposure was calculated based on § 1.1310 limits.

Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minute)
<b>Limits for Occupational/Controlled Exposures</b>				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30-300.	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6

f = frequency in MHz

\* = Plane-wave equivalent power density

**Test Data**

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

**For 802.11b:**

Maximum peak output power at antenna input terminal: 13.10mW

Safety distance: 20 cm

Prediction frequency: 2412.0MHz

Antenna Gain (typical): 5 dBi

Power density at prediction frequency at 20 cm = 0.013 mW/cm<sup>2</sup>

MPE limit for uncontrolled exposure at prediction frequency: 1 mW/cm<sup>2</sup>

**For 802.11g:**

Maximum peak output power at antenna input terminal: 8.49mW

Safety distance: 20 cm

Prediction frequency: 2412.0MHz

Antenna Gain (typical): 5 dBi

Power density at prediction frequency at 20 cm = 0.008 mW/cm<sup>2</sup>

MPE limit for uncontrolled exposure at prediction frequency: 1 mW/cm<sup>2</sup>

**Test Result:** Compliance at 20 cm distance.

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## **§15.203 - ANTENNA REQUIREMENT**

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### **Standard Applicable**

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. And according to FCC 47 CFR 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 two antennae used in this product are both omni- directional antenna with SMA plug reverse connector. The maximum gain is 5 dBi.

**Result:** Compliance.

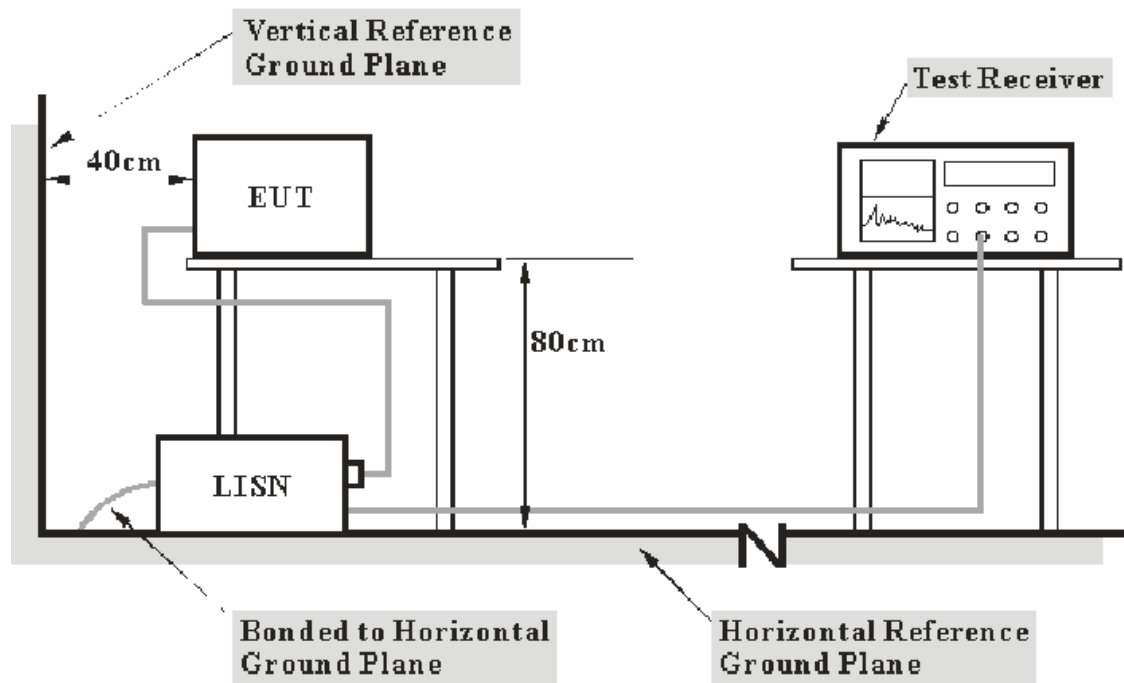
## §15.207 (a) - CONDUCTED EMISSIONS

### 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  $\pm 2.4$  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 Class B 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 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:

<i>Frequency Range</i>	<i>IF B/W</i>
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	ESCI	100035	2006-09-29	2007-09-29
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	892107/021	2007-03-26	2008-03-26

\* Com-Power's LISN were used as the supporting equipment.

\* **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 connected to the outlet of 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:

**5.80 dB** at **1.680 MHz** in the **Neutral** conductor mode (POE mode)  
**5.90 dB** at **3.855 MHz** in the **Live** conductor mode (Adapter mode)

**Test Data****Environmental Conditions**

<b>Temperature:</b>	22 ° C
<b>Relative Humidity:</b>	55%
<b>ATM Pressure:</b>	100.0 kPa

The testing was performed by Henry Yang on 2007-04-11.

Test Mode: Transmitting

**POE Mode:**

LINE CONDUCTED EMISSIONS				FCC PART 15 CLASS B	
Frequency (MHz)	Amplitude (dBμV)	Detector (QP/AV)	Phase (Live/Neutral)	Limit (dBμV)	Margin (dB)
1.680	40.20	AV	Neutral	46.00	5.80
1.545	39.80	AV	Neutral	46.00	6.20
1.755	39.50	AV	Live	46.00	6.50
1.620	39.40	AV	Live	46.00	6.60
2.685	39.20	AV	Neutral	46.00	6.80
21.300	43.00	AV	Neutral	50.00	7.00
3.765	39.00	AV	Neutral	46.00	7.00
2.835	39.00	AV	Live	46.00	7.00
2.955	38.70	AV	Neutral	46.00	7.30
1.890	38.60	AV	Live	46.00	7.40
2.970	38.10	AV	Live	46.00	7.90
20.880	40.60	AV	Live	50.00	9.40
21.300	46.10	QP	Neutral	60.00	13.90
20.880	45.60	QP	Live	60.00	14.40
3.765	41.10	QP	Neutral	56.00	14.90
1.680	40.90	QP	Neutral	56.00	15.10
1.545	40.90	QP	Neutral	56.00	15.10
2.955	40.60	QP	Neutral	56.00	15.40
1.755	40.60	QP	Live	56.00	15.40
1.620	40.30	QP	Live	56.00	15.70
2.835	40.20	QP	Live	56.00	15.80
2.685	40.10	QP	Neutral	56.00	15.90
2.970	39.70	QP	Live	56.00	16.30
1.890	39.70	QP	Live	56.00	16.30



**Adapter Mode:**

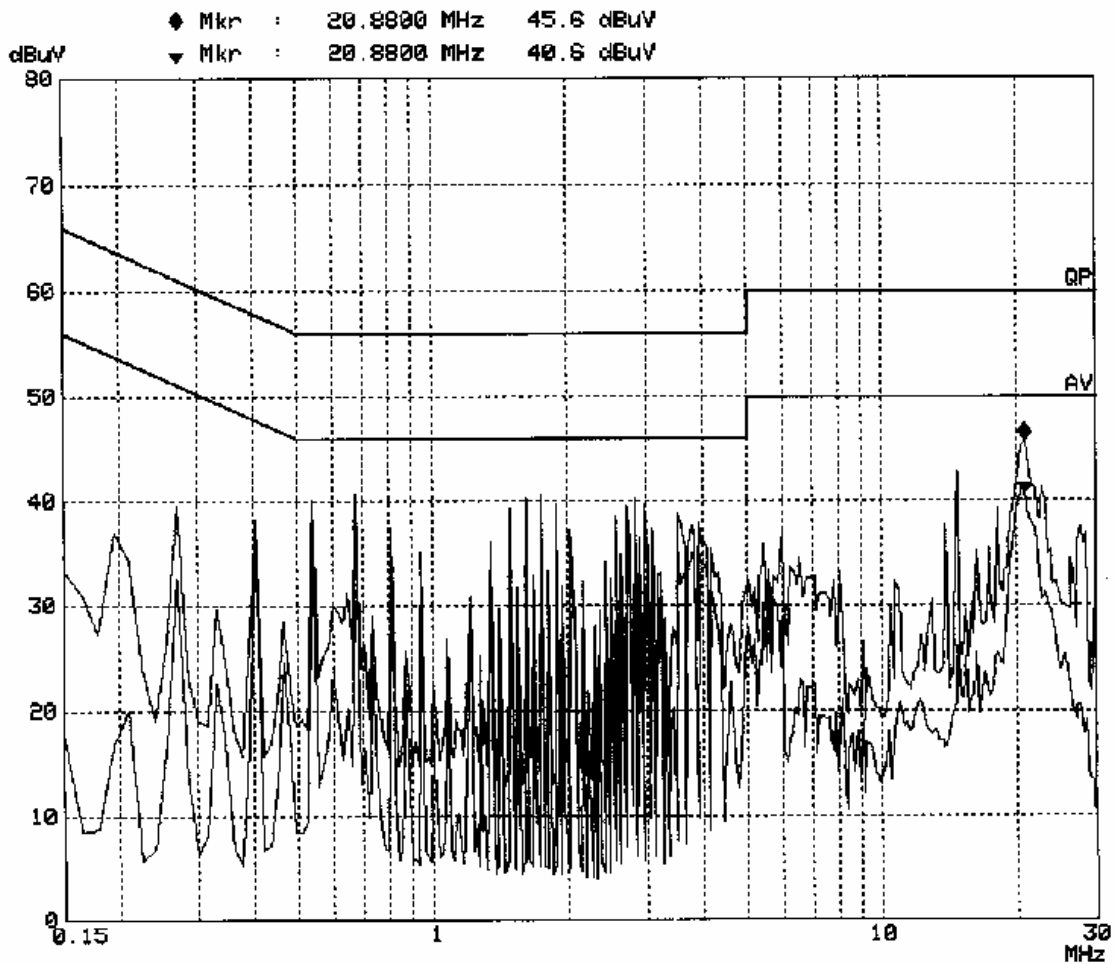
LINE CONDUCTED EMISSIONS				FCC PART 15 CLASS B	
Frequency (MHz)	Amplitude (dB $\mu$ V)	Detector (QP/AV)	Phase (Live/Neutral)	Limit (dB $\mu$ V)	Margin (dB)
3.855	50.10	QP	Live	56.00	5.90
3.705	49.40	QP	Live	56.00	6.60
2.025	37.40	AV	Neutral	46.00	8.60
1.890	37.30	AV	Neutral	46.00	8.70
1.755	36.70	AV	Neutral	46.00	9.30
1.620	36.40	AV	Neutral	46.00	9.60
3.705	35.50	AV	Live	46.00	10.50
5.985	49.40	QP	Neutral	60.00	10.60
2.220	34.20	AV	Live	46.00	11.80
1.815	33.40	AV	Live	46.00	12.60
5.865	46.60	QP	Live	60.00	13.40
2.355	32.00	AV	Live	46.00	14.00
10.335	43.90	QP	Neutral	60.00	16.10
1.755	39.80	QP	Neutral	56.00	16.20
1.620	39.40	QP	Neutral	56.00	16.60
1.890	39.30	QP	Neutral	56.00	16.70
2.025	38.90	QP	Neutral	56.00	17.10
2.220	38.00	QP	Live	56.00	18.00
1.815	37.40	QP	Live	56.00	18.60
3.855	27.00	AV	Live	46.00	19.00
2.355	36.20	QP	Live	56.00	19.80
5.865	27.50	AV	Live	50.00	22.50
5.985	26.80	AV	Neutral	50.00	23.20
10.335	21.80	AV	Neutral	50.00	28.20

**Plot(s) of Test Data**

Plot(s) of Test Data is presented hereinafter as reference.

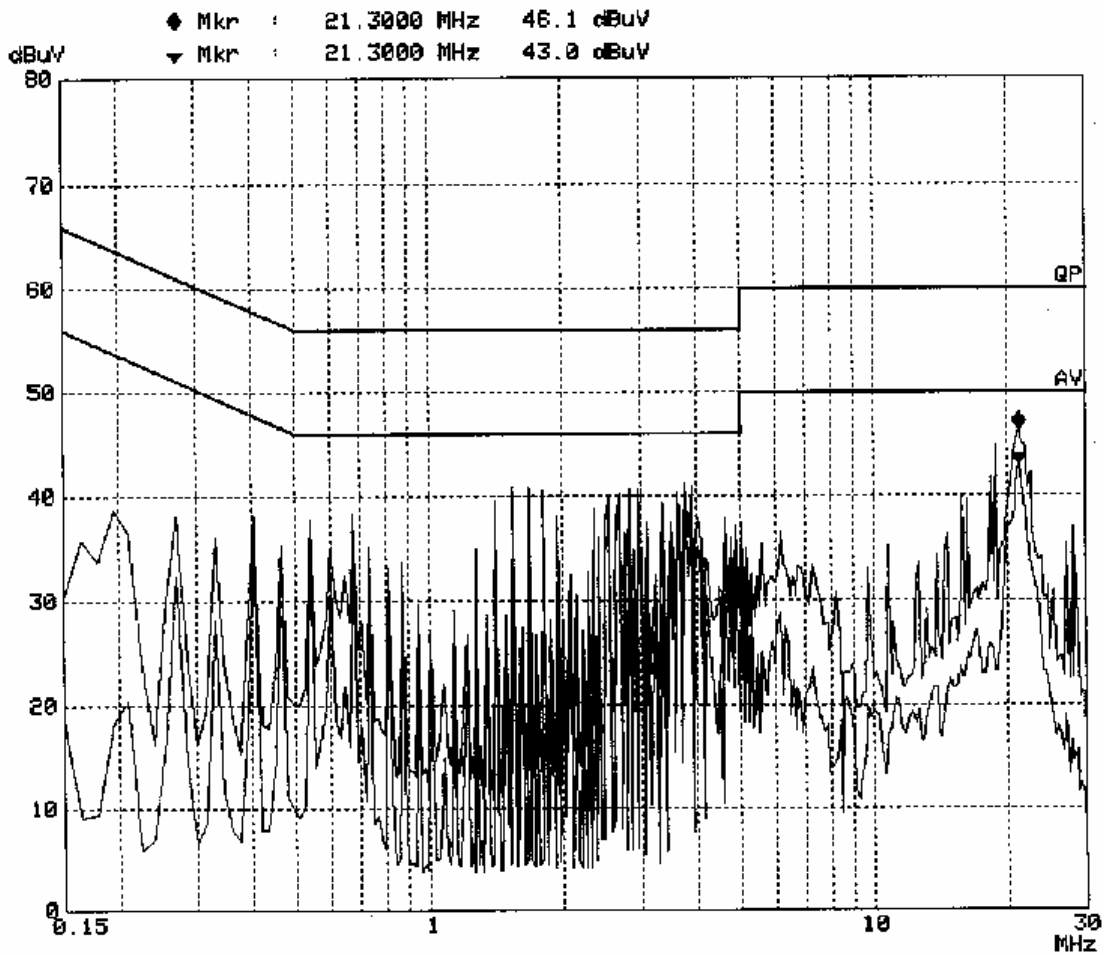
# Conducted Emission Test FCC Part 15

EUT: FORTIWIFI-50B M/N: FW-50B  
Manuf: FORTINET  
Op Cond: RUNNING-POB  
Operator: HENRY YANG  
Test Spec: AC 120V/60HZ L  
Comment: Temp:25'C Humi:56%  
Date: 11. Apr 07 16:47



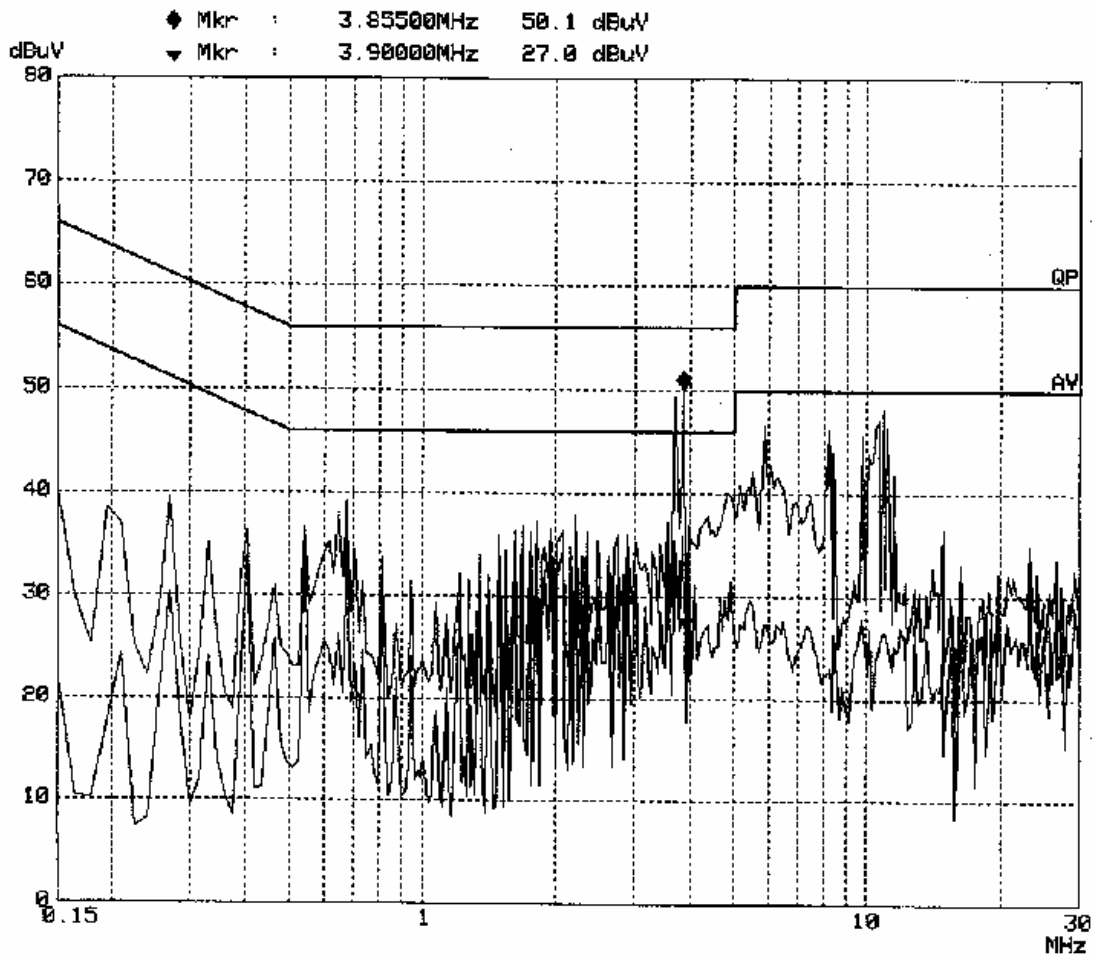
# Conducted Emission Test FCC Part 15

EUT: FORTIWIFI-50B M/N;FW-50B  
Manuf: FORTINET  
Op Cond: RUNNING-POE  
Operator: HENRY YANG  
Test Spec: AC 120V/60HZ N  
Comment: Temp:25'C Humi:56%  
Date: 11. Apr 07 17:00



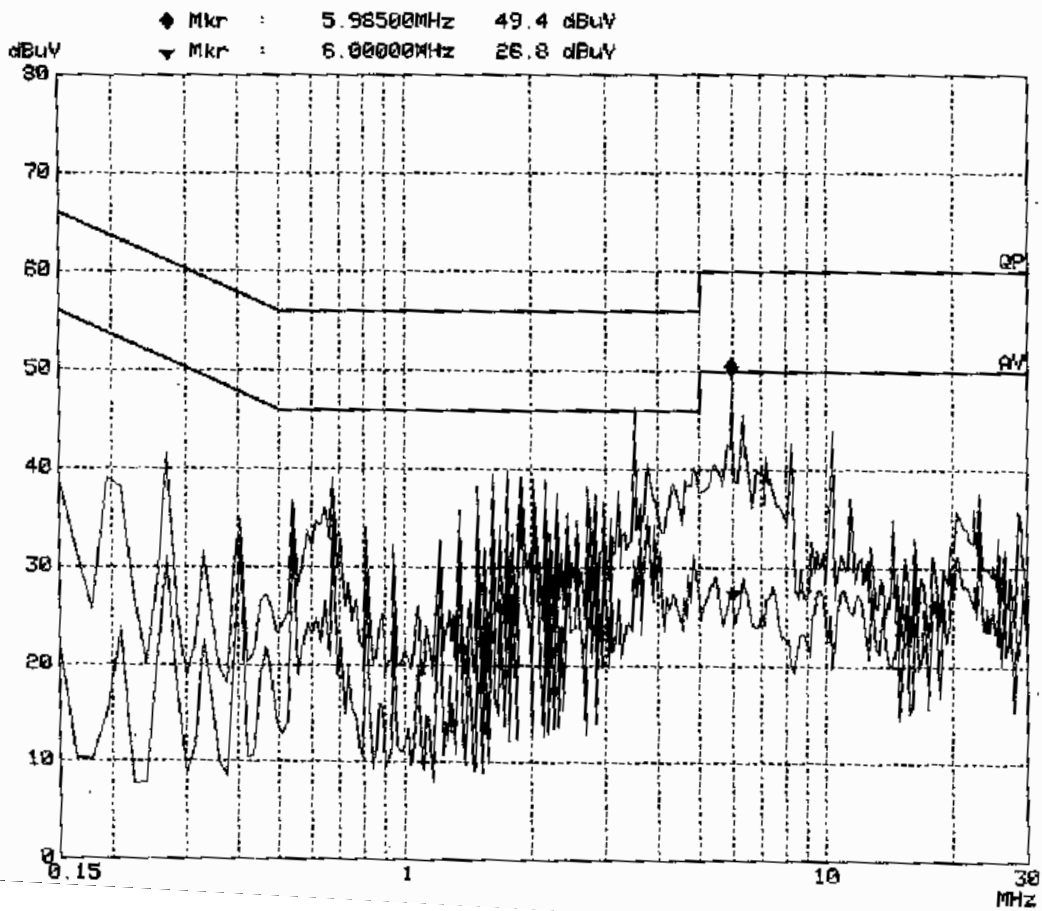
# CONDUCTED EMISSION TEST FCC Part 15

EUT: FORTIWIFI-50B M/N:FW-50B  
Manuf: FORTINET  
Op Cond: Running(802.11b )  
Operator: Henry  
Test Spec: AC 120V/60Hz L  
Comment: Temp:25'C Humi:56%  
Date: 11. Apr 07 13:55



# CONDUCTED EMISSION TEST FCC Part 15

EUT: FORTIWIFI-50B M/N:FW-50B  
Manuf: FORTINET  
Op Cond: Running(802.11b)  
Operator: Henry  
Test Spec: AC 120V/60Hz N  
Comment: Temp:25'C Humi:56%  
Date: 11. Apr 07 13:47



## §15.205, §15.209, §15.247 - RADIATED EMISSIONS

### Applicable Standard

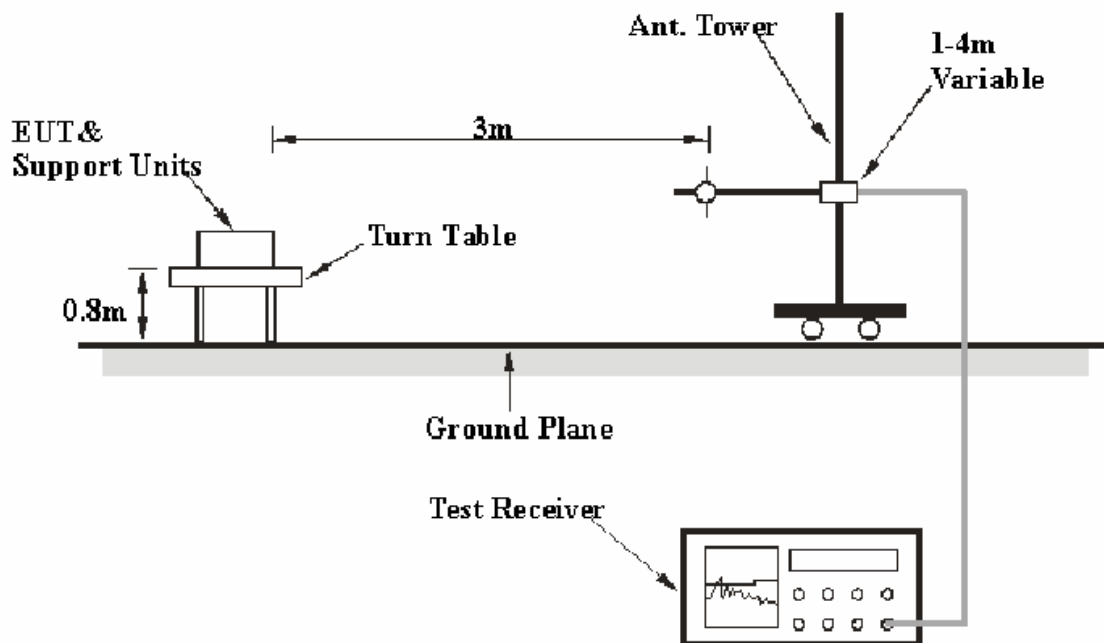
According to FCC §15.247 (d)

### 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 Laboratory Corp. (Shenzhen) is  $\pm 4.0$  dB.

### EUT Setup



The radiated emission tests were performed in the 3-meter Chamber, 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 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:

<i>Frequency Range</i>	<i>RBW</i>	<i>Video B/W</i>
30MHz – 1000 MHz	100 kHz	300 kHz
1000 MHz – 25 GHz	1 MHz	3 MHz

## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	HP8447D	2944A09795	2006-11-15	2007-11-15
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2006-09-29	2007-09-29
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2006-08-14	2007-08-14
HP	Amplifier	8449B	3008A00277	2006-09-29	2007-09-29
Sunol Sciences	Horn Antenna	DRH-118	A052604	2006-09-25	2007-09-25
Agilent	Spectrum Analyzer	8564E	3943A01781	2006-11-22	2007-11-22

\* **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

For the radiated emissions test, the adapter 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.

All data was recorded in the PK&AV detection mode.

## Corrected Amplitude & Margin Calculation

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

$$\text{Corr. Ampl.} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Limit} - \text{Corr. Ampl.}$$

**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:

Below 1GHz:

- 6.40 dB** at **893.921500 MHz** in the **Veritical** polarization, (POE Mode, 802.11b)
- 7.1 dB** at **662.361000 MHz** in the **Veritical polarization**, (Adapter mode, 802.11b)
- 7.1 dB** at **663.361001 MHz** in the **Horizontcal** polarization, (Adapter mode, 802.11g)

Above 1GHz:

- 7.96 dB** at **4824 MHz** in the **Horizontcal** polarization, 802.11b (Low Channel)
- 10.21 dB** at **4884 MHz** in the **Horizontcal** polarization, 802.11b (Middle Channel)
- 10.36dB** at **7386 MHz** in the **Vertical** polarization, 802.11b (High Channel)
- 10.20dB** at **4824 MHz** in the **Vertical** polarization, 802.11g (Low Channel)
- 9.80dB** at **7326 MHz** in the **Horizontcal** polarization, 802.11g (Middle Channel)
- 10.31dB** at **4924 MHz** in the **Horizontcal** polarization, 802.11g (High Channel)

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	25 ° C
<b>Relative Humidity:</b>	52%
<b>ATM Pressure:</b>	100.9 kPa

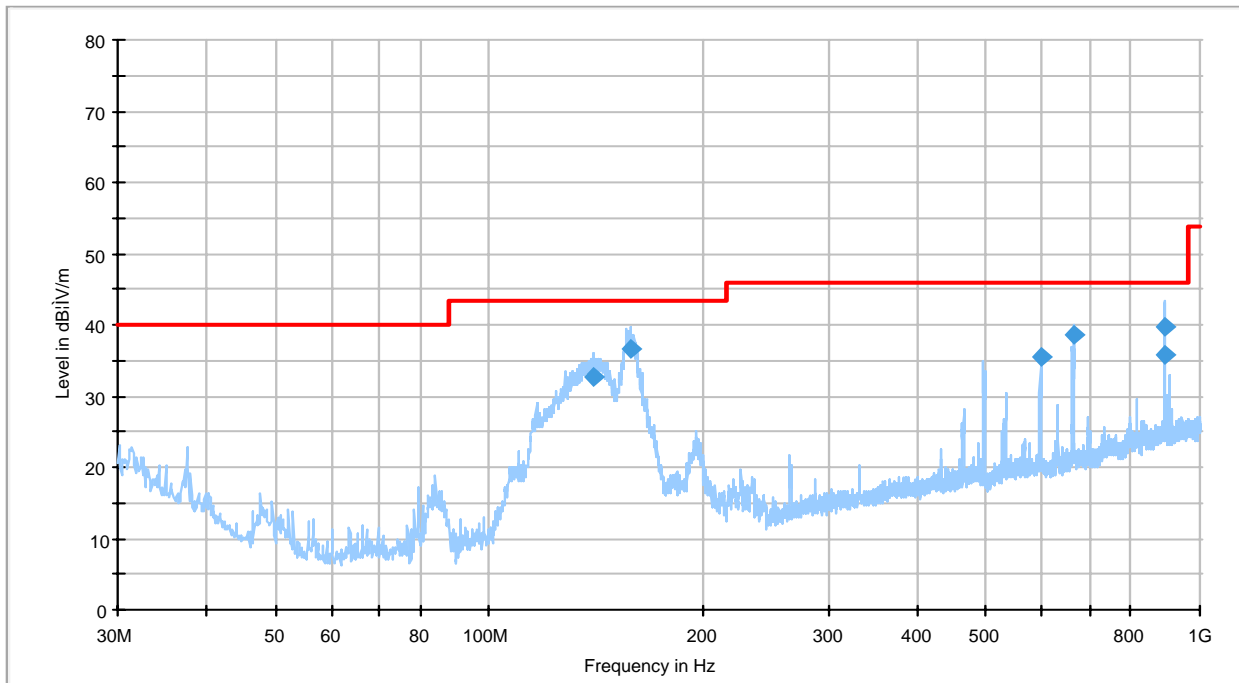
*The testing was performed by Henry Yang on 2007-03-02.*

*Test Mode: Transmitting*

*Below 1GHz:*

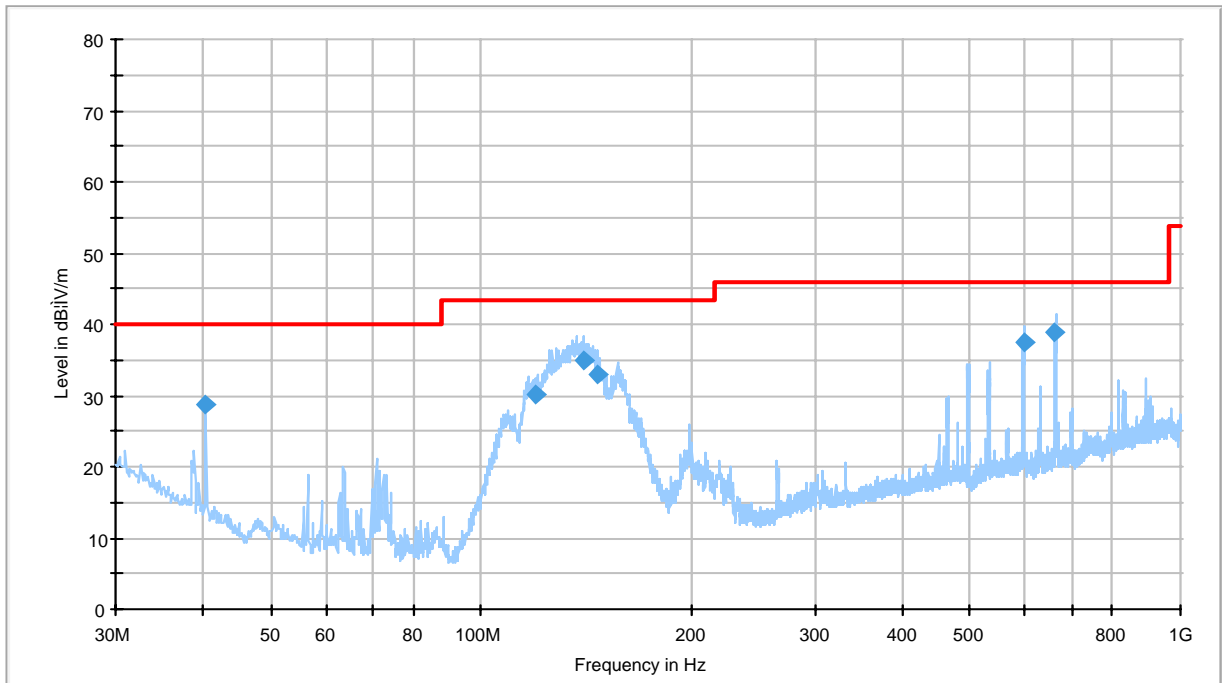


POE Mode (802.11b):



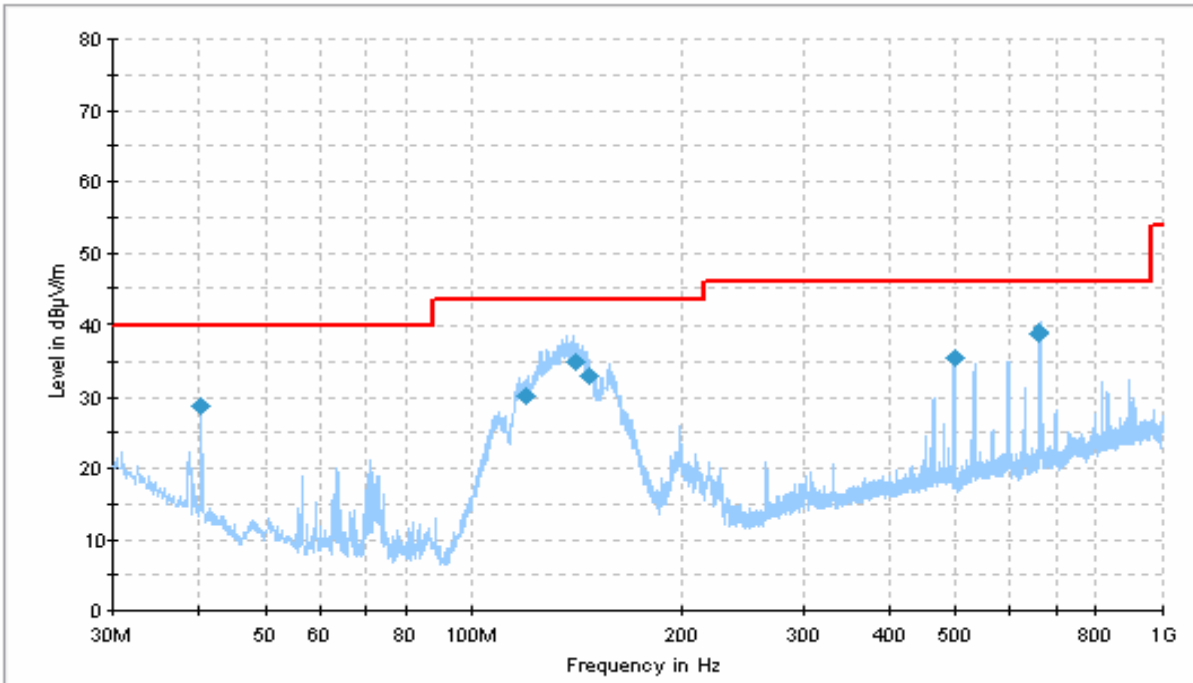
Frequency (MHz)	QuasiPeak (dBµV/m)	Antenna Height (cm)	Polarity	Turntable Position (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
893.921500	39.6	182.0	V	77.0	-0.2	46.0	6.4
158.015425	36.6	197.0	H	0.0	-12.0	43.5	6.9
665.488675	38.5	100.0	V	89.0	-3.7	46.0	7.5
890.714425	35.9	376.0	V	118.0	-0.3	46.0	10.1
596.225500	35.4	222.0	H	0.0	-4.7	46.0	10.6
140.197850	32.6	310.0	H	199.0	-11.0	43.5	10.9

Adapter mode (802.11b)



Frequency (MHz)	QuasiPeak (dBµV/m)	Antenna Height (cm)	Polarity	Turntable Position (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
662.361000	38.9	118.0	H	278.0	-3.8	46.0	7.1
140.191875	35.0	187.0	H	182.0	-11.0	43.5	8.5
596.314850	37.5	187.0	H	53.0	-4.7	46.0	8.5
146.403200	33.0	198.0	H	26.0	-11.6	43.5	10.5
40.297450	28.7	391.0	V	104.0	-12.2	40.0	11.3
119.919100	30.0	273.0	H	33.0	-11.6	43.5	13.5

Adapter mode (802.11g)



Frequency (MHz)	QuasiPeak (dBµV/m)	Antenna Height (cm)	Polarity	Turntable Position (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
663.361001	38.9	118.0	H	278.0	-3.8	46.0	7.1
141.191875	35.0	187.0	H	182.0	-11.0	43.5	8.5
492.314851	37.1	187.0	H	53.0	-4.7	46.0	8.9
146.403200	33.0	198.0	H	26.0	-11.6	43.5	10.5
41.237450	28.7	391.0	V	104.0	-12.2	40.0	11.3
119.919100	30.0	273.0	H	33.0	-11.6	43.5	13.5

Above 1GHz:

Adapter mode (802.11b):

Frequency (MHz)	Reading (dBuV)	Detector PK/QP/AV	Direction Degree	Height (m)	Polar H / V	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBuV/m)	FCCC Limit (dBuV/m)	Margin (dB)
Low Channel											
4824	33.5	AV	0	1.5	H	34.7	4.64	26.8	46.04	54	7.96
7236	32.55	AV	0	1.5	H	37.0	4.51	29.7	44.36	54	9.64
4824	30.66	AV	0	1.5	V	34.7	4.64	26.8	43.2	54	10.80
7236	31.02	AV	0	1.5	V	37.0	4.51	29.7	42.83	54	11.17
4824	43.61	PK	180	1.0	H	34.7	4.64	26.8	56.15	74	17.85
7236	42.33	PK	90	1.0	V	37.0	4.51	29.7	54.14	74	19.86
4824	41.22	PK	180	1.0	V	34.7	4.64	26.8	53.76	74	20.24
7236	41.36	PK	90	1.0	H	37.0	4.51	29.7	53.17	74	20.83
Middle Channel											
4884	31.25	AV	0	1.5	H	34.7	4.64	26.8	43.79	54	10.21
4884	30.56	AV	0	1.5	V	34.7	4.64	26.8	43.1	54	10.90
7326	30.99	AV	0	1.5	V	37.0	4.75	29.7	43.04	54	10.96
7326	30.26	AV	0	1.5	H	37.0	4.75	29.7	42.31	54	11.69
4884	42.23	PK	180	1.0	H	34.7	4.64	26.8	54.77	74	19.23
7326	42.35	PK	90	1.0	V	37.0	4.75	29.7	54.4	74	19.60
4884	41.65	PK	180	1.0	V	34.7	4.64	26.8	54.19	74	19.81
7326	41.36	PK	90	1.0	H	37.0	4.75	29.7	53.41	74	20.59
High Channel											
7386	31.59	AV	0	1.5	V	37.0	4.75	29.7	43.64	54	10.36
4924	31.12	AV	0	1.5	V	34.7	4.55	26.8	43.57	54	10.43
7386	31.02	AV	0	1.5	H	37.0	4.75	29.7	43.07	54	10.93
4924	30.51	AV	0	1.5	H	34.7	4.55	26.8	42.96	54	11.04
7386	43.24	PK	90	1.0	V	37.0	4.75	29.7	55.29	74	18.71
4924	42.36	PK	180	1.0	V	34.7	4.55	26.8	54.81	74	19.19
7386	42.69	PK	90	1.0	H	37.0	4.75	29.7	54.74	74	19.26
4924	41.57	PK	180	1.0	H	34.7	4.55	26.8	54.02	74	19.98

Adapter mode (802.11g):

Frequency (MHz)	Reading (dBuV)	Detector PK/QP/AV	Direction Degree	Height (m)	Polar H / V	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBuV/m)	FCCC Limit (dBuV/m)	Margin (dB)
Low Channel											
4824	4824	4824	4824	4824	4824	4824	4824	4824	4824	4824	4824
4824	4824	4824	4824	4824	4824	4824	4824	4824	4824	4824	4824
7236	7236	7236	7236	7236	7236	7236	7236	7236	7236	7236	7236
4824	4824	4824	4824	4824	4824	4824	4824	4824	4824	4824	4824
4824	4824	4824	4824	4824	4824	4824	4824	4824	4824	4824	4824
4824	4824	4824	4824	4824	4824	4824	4824	4824	4824	4824	4824
7236	7236	7236	7236	7236	7236	7236	7236	7236	7236	7236	7236
4824	4824	4824	4824	4824	4824	4824	4824	4824	4824	4824	4824
Middle Channel											
7326	7326	7326	7326	7326	7326	7326	7326	7326	7326	7326	7326
4884	4884	4884	4884	4884	4884	4884	4884	4884	4884	4884	4884
7326	7326	7326	7326	7326	7326	7326	7326	7326	7326	7326	7326
4884	4884	4884	4884	4884	4884	4884	4884	4884	4884	4884	4884
4884	4884	4884	4884	4884	4884	4884	4884	4884	4884	4884	4884
7326	7326	7326	7326	7326	7326	7326	7326	7326	7326	7326	7326
7326	7326	7326	7326	7326	7326	7326	7326	7326	7326	7326	7326
4884	4884	4884	4884	4884	4884	4884	4884	4884	4884	4884	4884
High Channel											
4924	4924	4924	4924	4924	4924	4924	4924	4924	4924	4924	4924
7386	7386	7386	7386	7386	7386	7386	7386	7386	7386	7386	7386
7386	7386	7386	7386	7386	7386	7386	7386	7386	7386	7386	7386
4924	4924	4924	4924	4924	4924	4924	4924	4924	4924	4924	4924
4924	4924	4924	4924	4924	4924	4924	4924	4924	4924	4924	4924
7386	7386	7386	7386	7386	7386	7386	7386	7386	7386	7386	7386
7386	7386	7386	7386	7386	7386	7386	7386	7386	7386	7386	7386
4924	4924	4924	4924	4924	4924	4924	4924	4924	4924	4924	4924

## §15.247(a) (2) –6dB 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	2006-09-29	2007-09-29

\* **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

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

<b>Temperature:</b>	25 ° C
<b>Relative Humidity:</b>	53%
<b>ATM Pressure:</b>	100.9 kPa

*The testing was performed by Henry Yang on 2007-04-03, 2007-06-07..*

*Test Mode: Running*

**802.11b mode:**

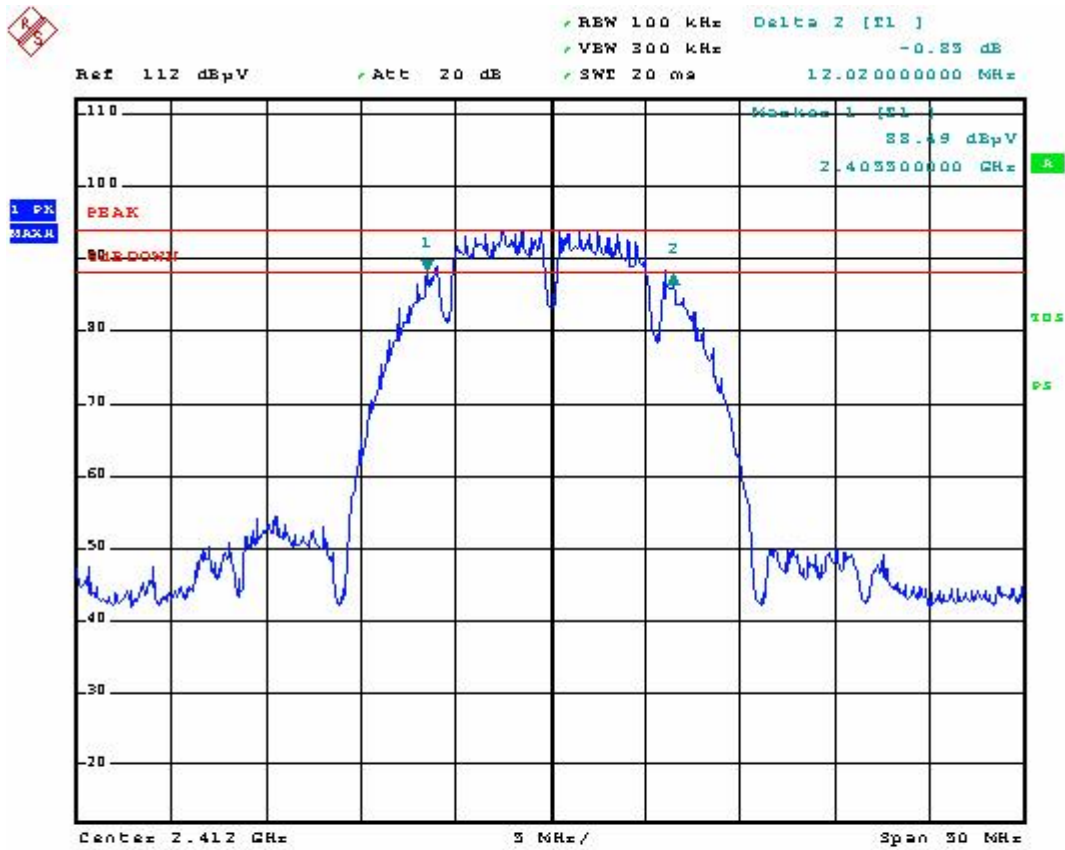
Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)
Low Channel	2412	12.2	>500
Mid Channel	2442	11.9	>500
High Channel	2462	12.1	>500

**802.11g mode:**

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)
Low Channel	2412	12.6	>500
Mid Channel	2442	12.3	>500
High Channel	2462	12.4	>500

**Test Result:** Pass

### 802.11b Low channel

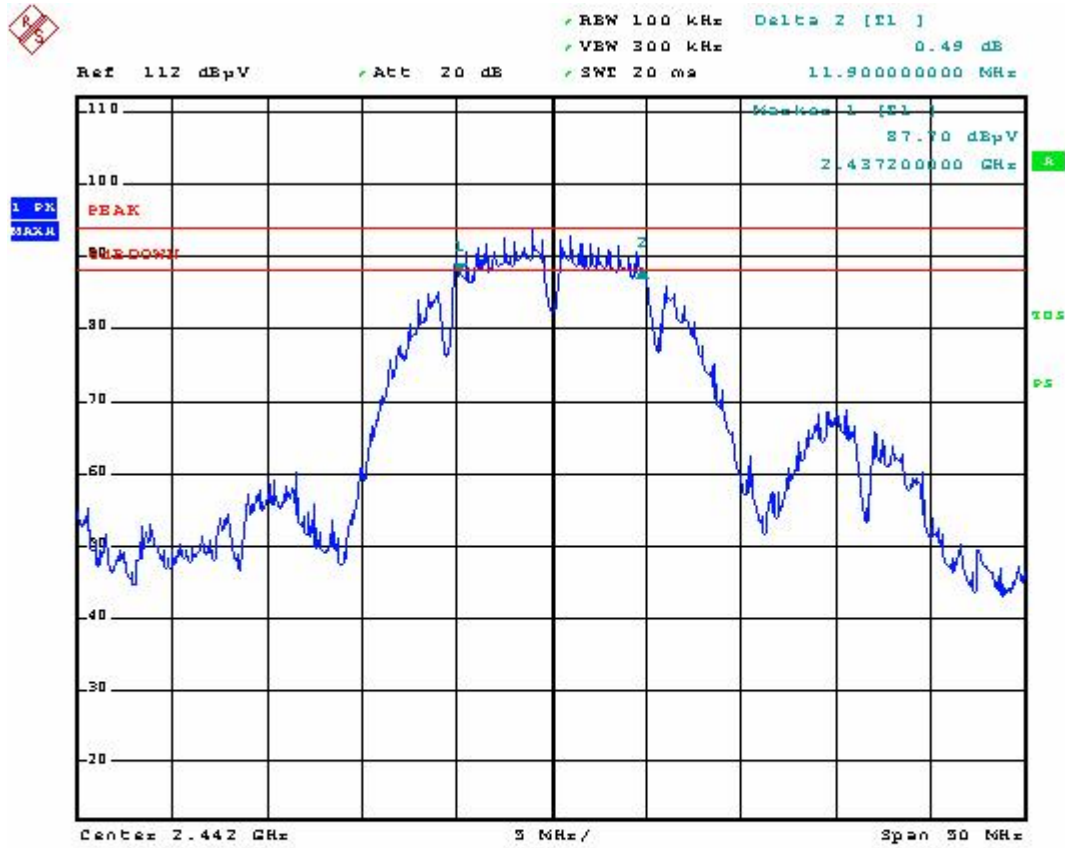


802.11B 6dB BANDWIDTH LOW CHANNEL

Date: 7 JUN 2007 18:32:29



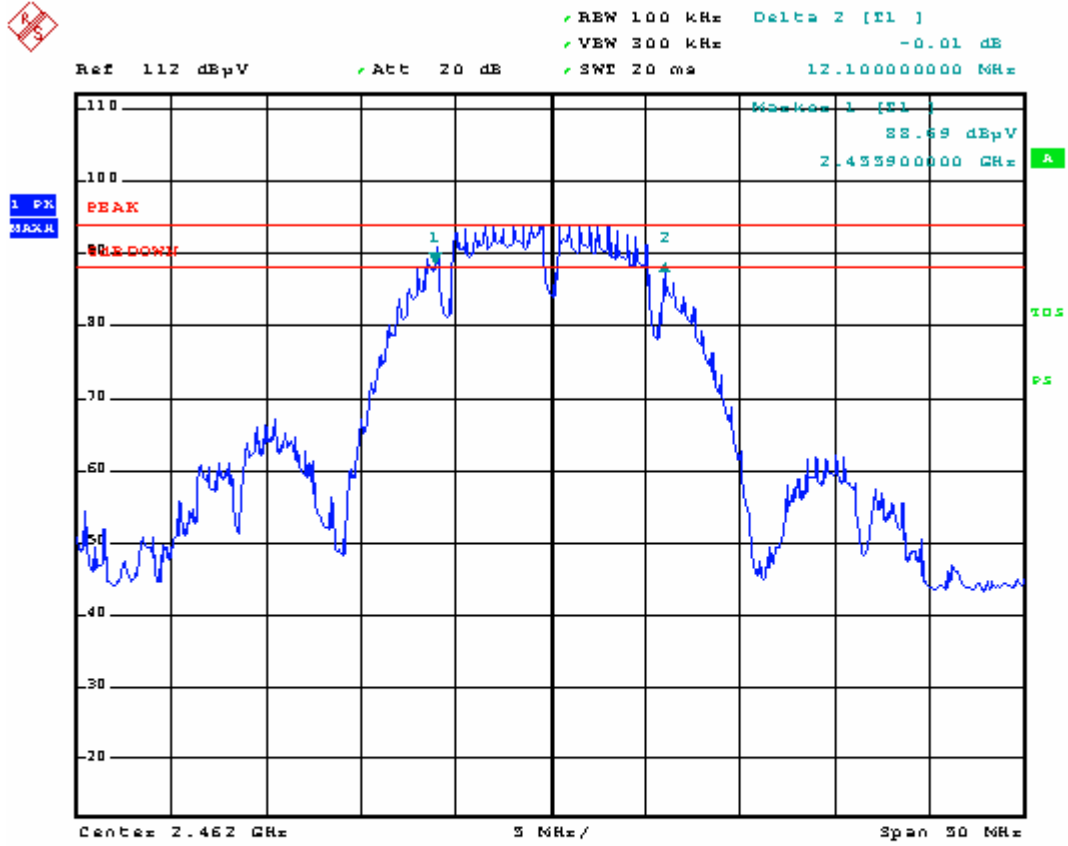
### 802.11b Middle Channel



802.11B 6dB BANDWIDTH MID CHANNEL

Date: 7.JUN.2007 18:30:56

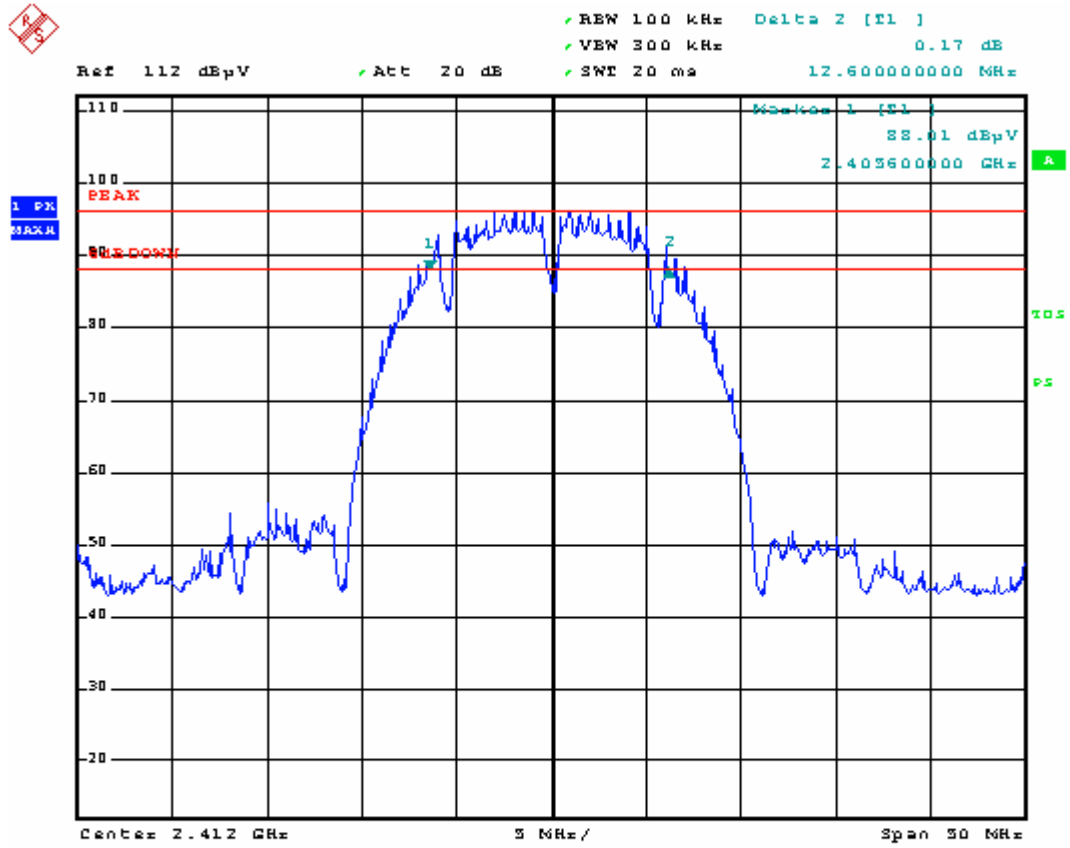
### 802.11b High channel



802.11B 6dB BANDWIDTH HIGH CHANNEL

Date: 3.APR.2007 18:27:26

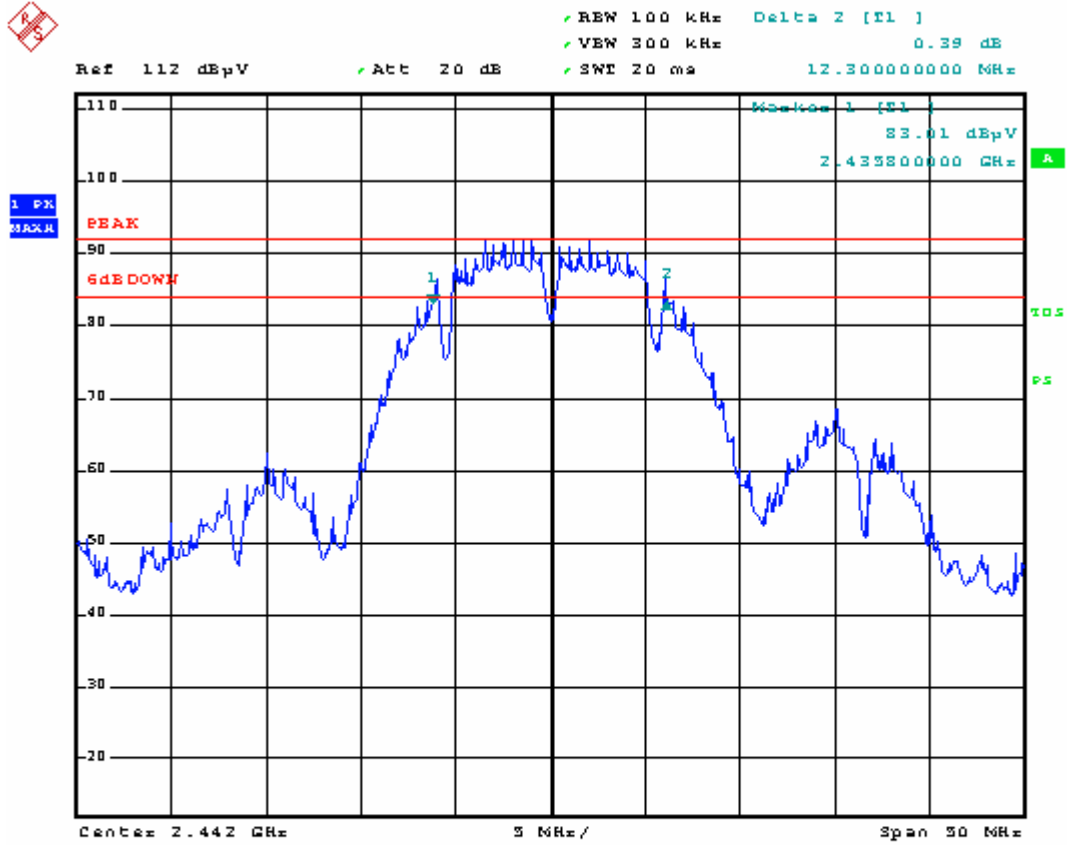
### 802.11g Low Channel



802.11G 6dB BANDWIDTH LOW CHANNEL

Date: 3.APR.2007 18:36:18

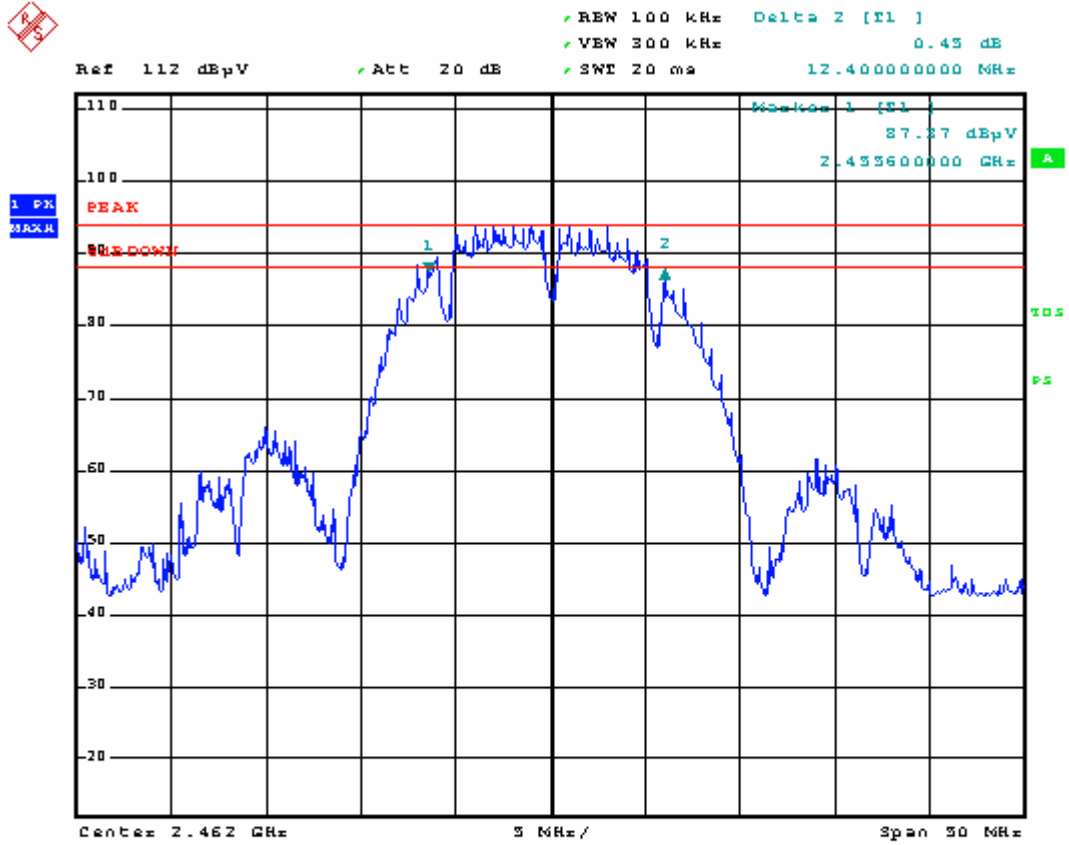
### 802.11g Middle Channel



802.11G 6dB BANDWIDTH MID CHANNEL

Date: 3.APR.2007 18:40:17

### 802.11g High Channel



802.11G 6dB BANDWIDTH HIGH CHANNEL

Date: 3.APR.2007 18:42:56

## §15.247(b) (3) - PEAK OUTPUT POWER MEASUREMENT

### 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.

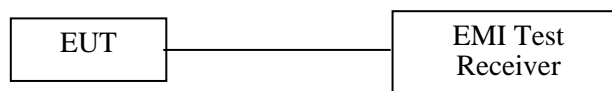
### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde&Schwarz	EMI Test Receiver	ESCI	100035	2006-09-29	2007-09-29

\* **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

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

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	53%
<b>ATM Pressure:</b>	100.9 kPa

*The testing was performed by Henry Yang on 2007-05-30.*

*Test mode: Running*

**802.11b:**

Channel	Channel Frequency (MHz)	Reading Power (dBm)	Cable Loss (dB)	Power Output (dBm)	Limit (dBm)
Low Channel	2412	9.66	1.51	11.17	30
Mid Channel	2442	9.59	1.52	11.11	30
High Channel	2462	9.26	1.55	10.81	30

**802.11g:**

Channel	Channel Frequency (MHz)	Reading Power (dBm)	Cable Loss (dB)	Power Output (dBm)	Limit (dBm)
Low Channel	2412	7.78	1.51	9.29	30
Mid Channel	2442	7.49	1.52	9.01	30
High Channel	2462	6.91	1.55	8.46	30

**Test Result:** Pass

## §15.247(d) - BAND EDGES TESTING

### 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	2006-09-29	2007-09-29

\* **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

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 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.  
**Note:** For Restricted Band  
 RBW=1MHz  
 VBW=1 MHz
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**

<b>Temperature:</b>	18 °C
<b>Relative Humidity:</b>	53 %
<b>ATM Pressure:</b>	100.9 kPa

The testing was performed by Henry Yang on 2007-05-30, 2007-05-31.

Test Mode: Running

*A. BAND EDGES*

Radio Mode	Emission Frequency (MHz)	Emission Level (dBuV/m)	Bandedge (dBc)	Limit (dBc)	Margin (dB)
802.11b	2399.76	53.5	46.71	20	27.71
	2483.6	46.54	59.03	20	39.03
802.11g	2399.9	52.93	46.90	20	26.90
	2483.62	45.54	59.03	20	39.03

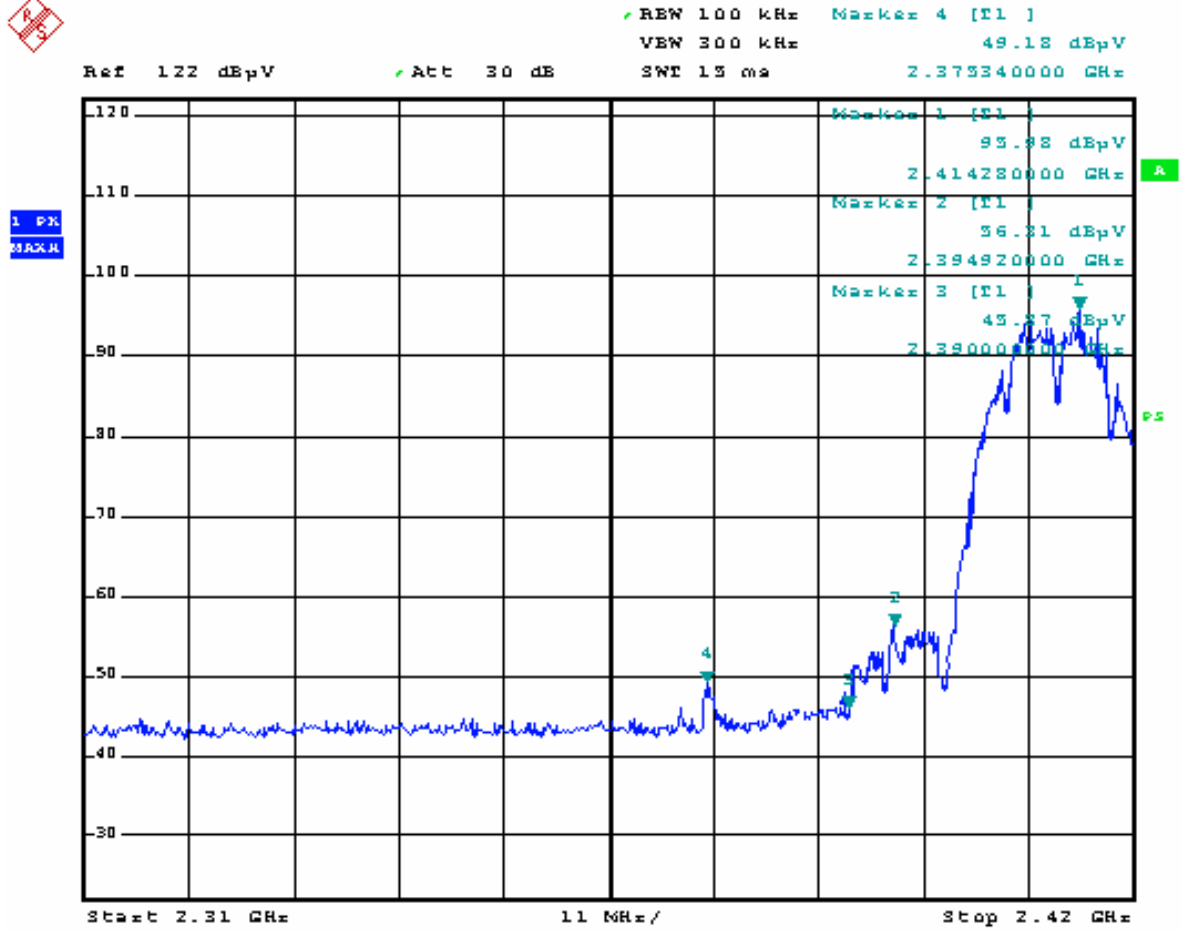
NOTE:  
BANDEDGE=HIGHEST PK – EMISSION LEVEL

*B. RESTRICTED BANDS*

Frequency (MHz)	Emission Frequency (MHz)	Detector Type	Polarity V/H	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
802.11b						
2412	2375.34	PK	V	49.18	74	24.82
		AV	V	48.69	54	5.31
	2390.00	PK	V	45.37	74	28.63
		AV	V	44.66	54	9.34
2462	2483.60	PK	V	46.74	74	27.26
		AV	V	45.99	54	8.01
	2484.92	PK	V	49.96	74	24.04
		AV	V	49.01	54	4.99
802.11g						
2412	2364.12	PK	V	48.29	74	25.71
		AV	V	47.06	54	6.94
	2390.00	PK	V	52.38	74	21.62
		AV	V	51.49	54	2.51
2462	2483.60	PK	V	46.74	74	27.26
		AV	V	45.99	54	8.01
	2483.92	PK	V	49.96	74	24.04
		AV	V	48.93	54	5.07

**Test result:** Please refer to the following plots

802.11b, 2412 MHz



802.11b-lowerbandedge

Date: 30.MAY.2007 16:35:01

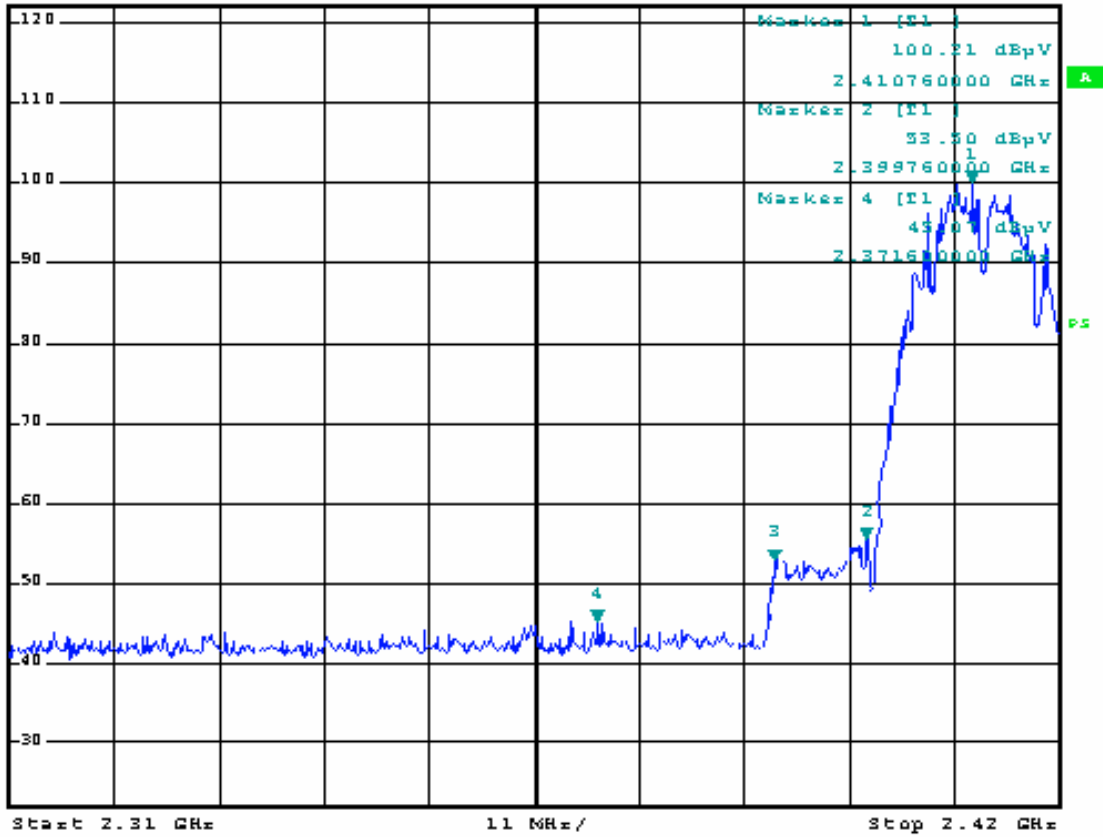


RES 1 MHz Masker 3 [T1 ]  
VEN 1 MHz 52.80 dBpV  
SWE 13 ms 2.390000000 GHz

Ref 122 dBpV

Att 30 dB

1 Pk  
VIXY



802.11b-restrictband

Date: 30.MAY.2007 17:06:19



Marker 1 [T1]

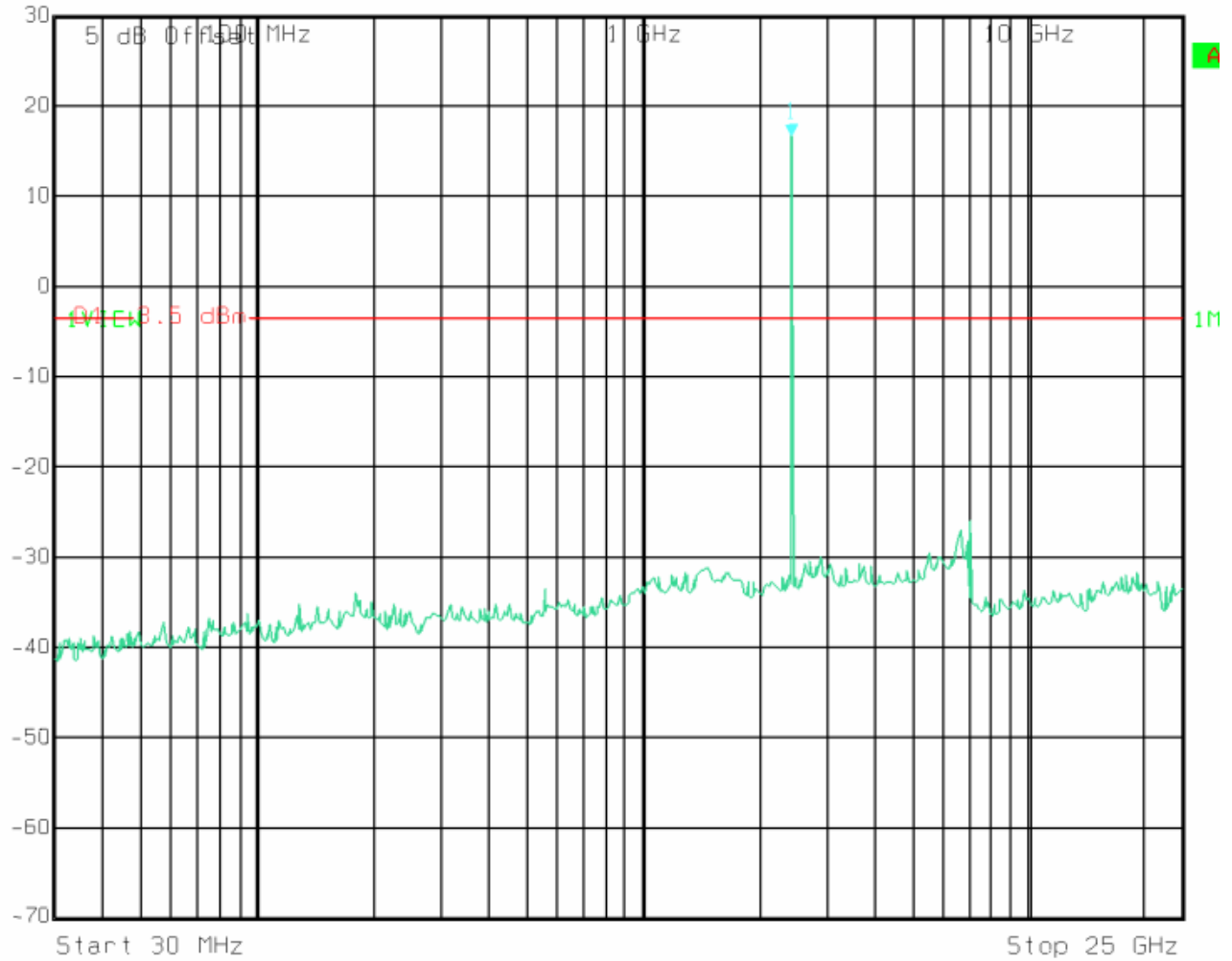
RBW 100 kHz RF Att 50 dB

Ref Lvl 16.58 dBm

VBW 300 kHz

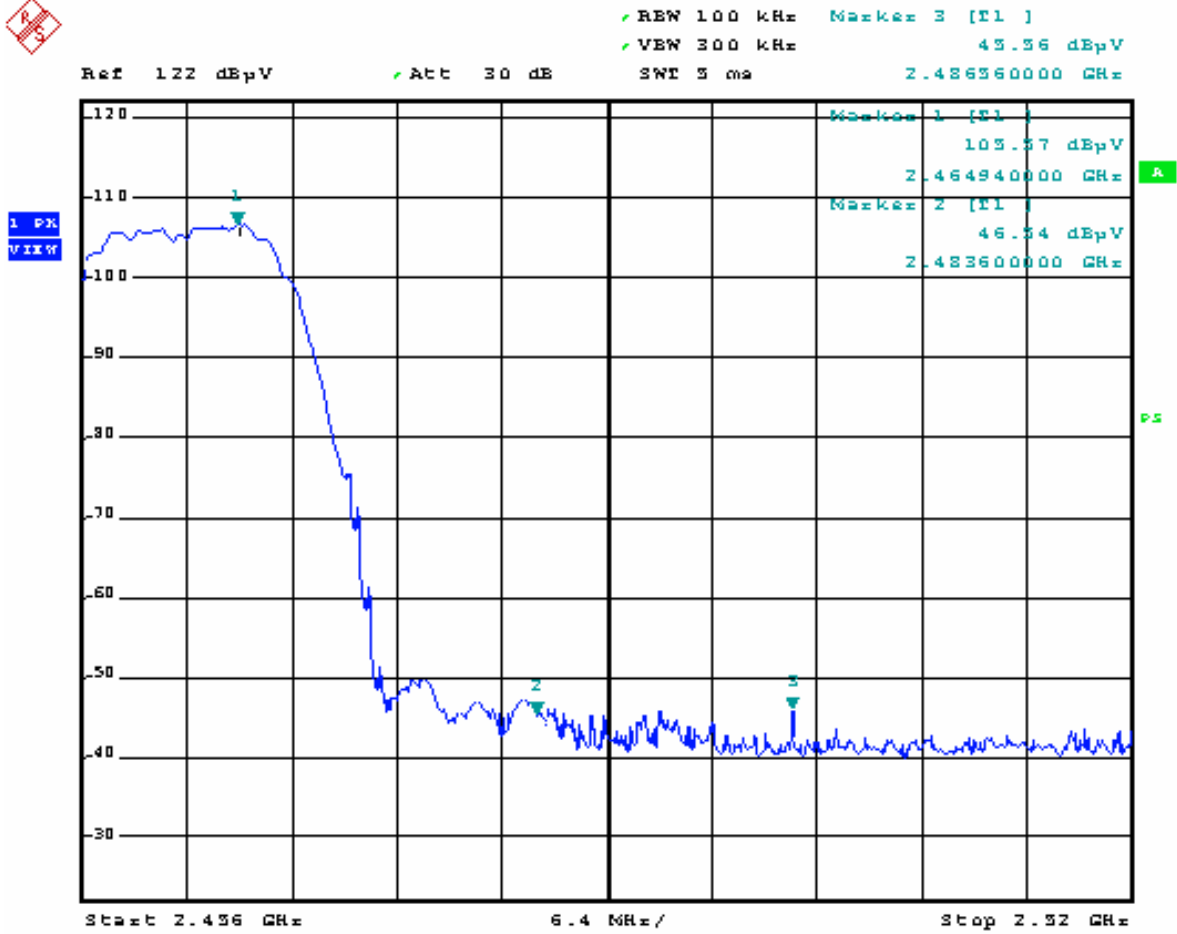
30 dBm 2.41235101 GHz

SWT 6.4 s Unit dBm



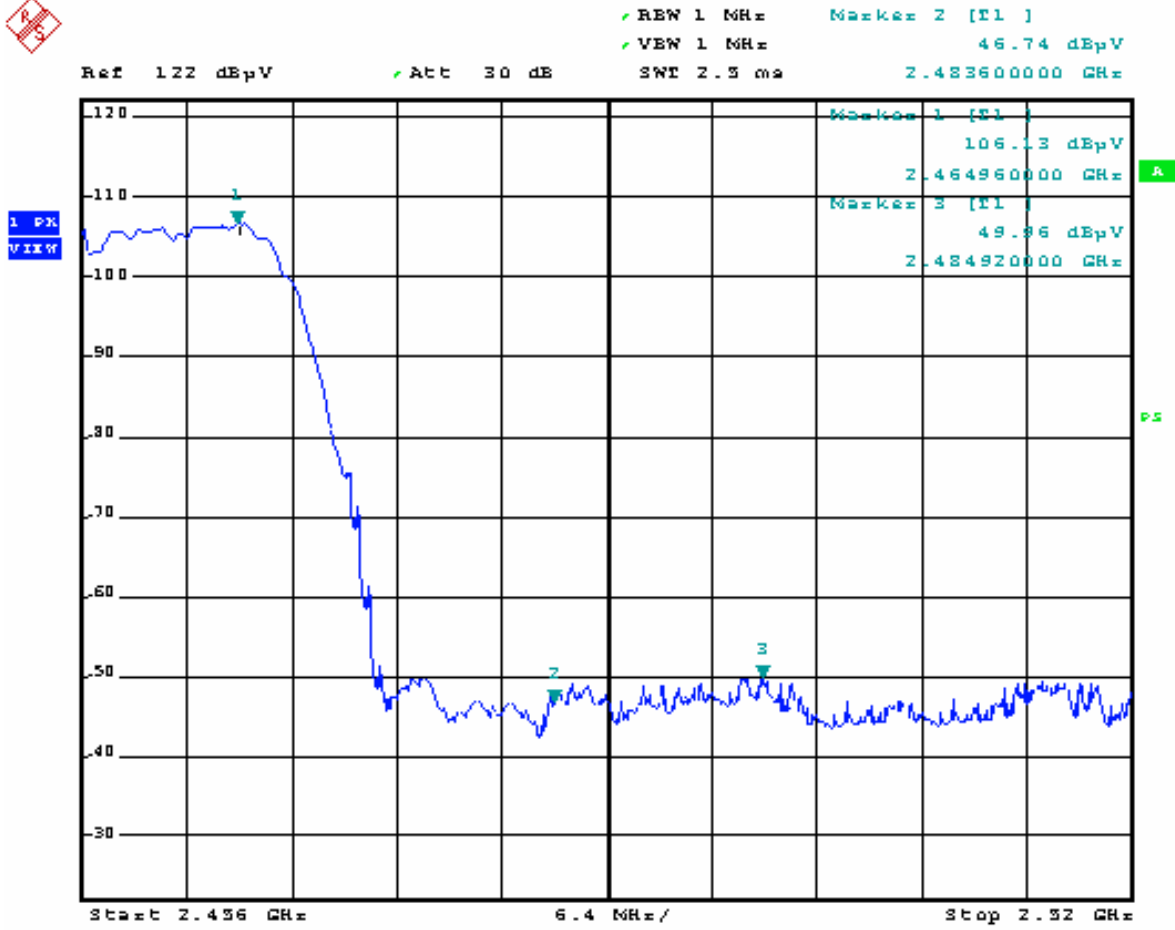
Date: 31.MAY 2007 15:25:24

802.11b, 2462 MHz



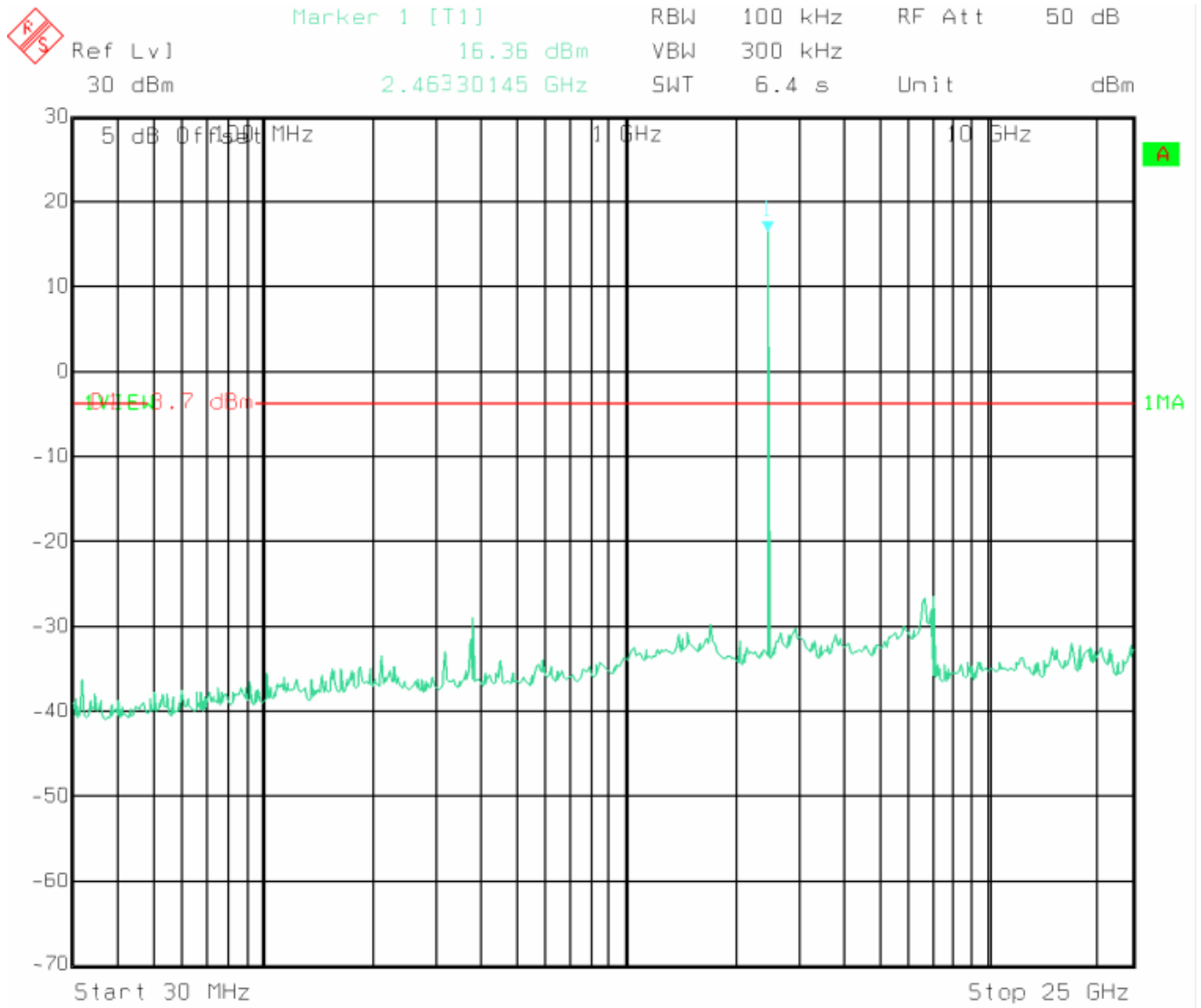
802.11b-uperbandedge

Date: 30.MAY.2007 17:34:39



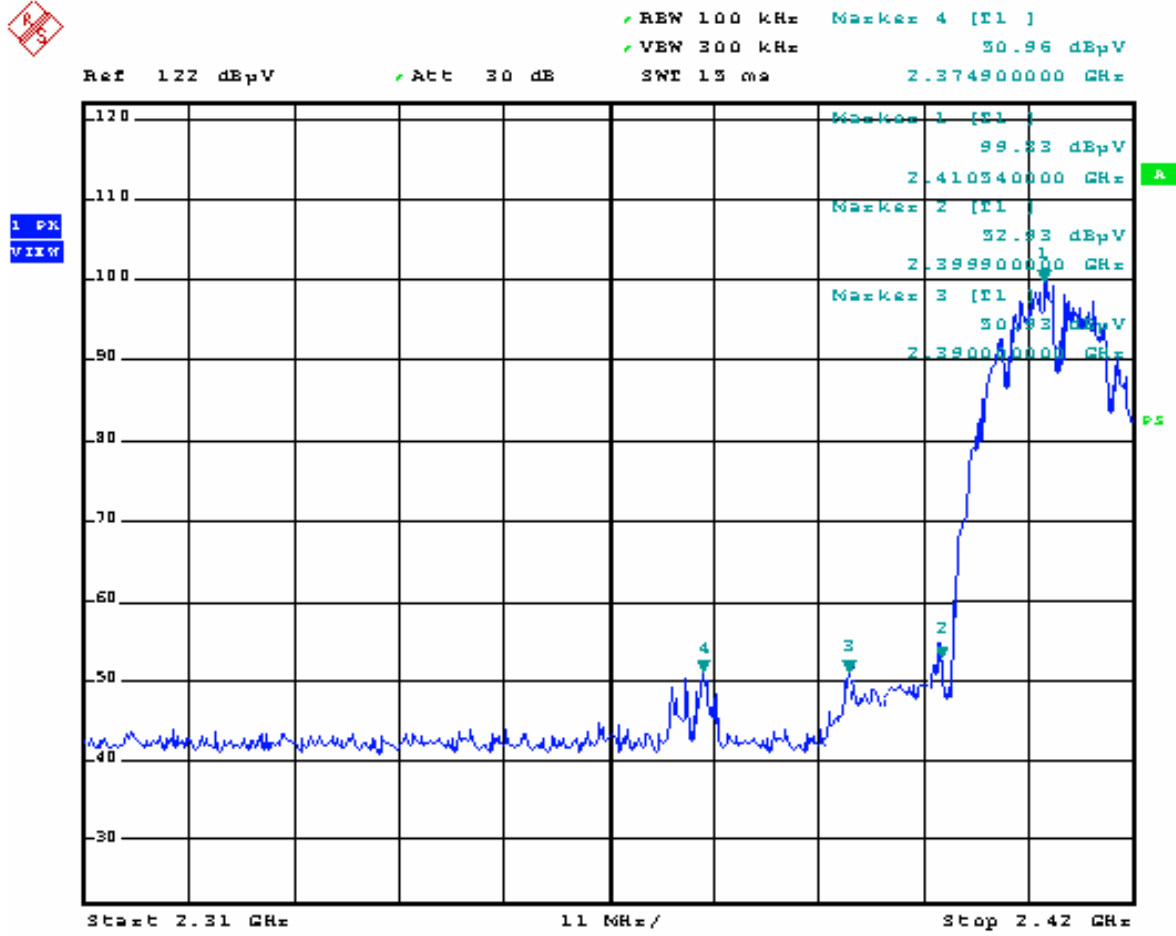
802.11b-upperrestrictband

Date: 30.MAY.2007 17:37:12



Date: 31.MAY 2007 15:34:02

### 802.11g, 2412 MHz



802.11g-lowbandedge

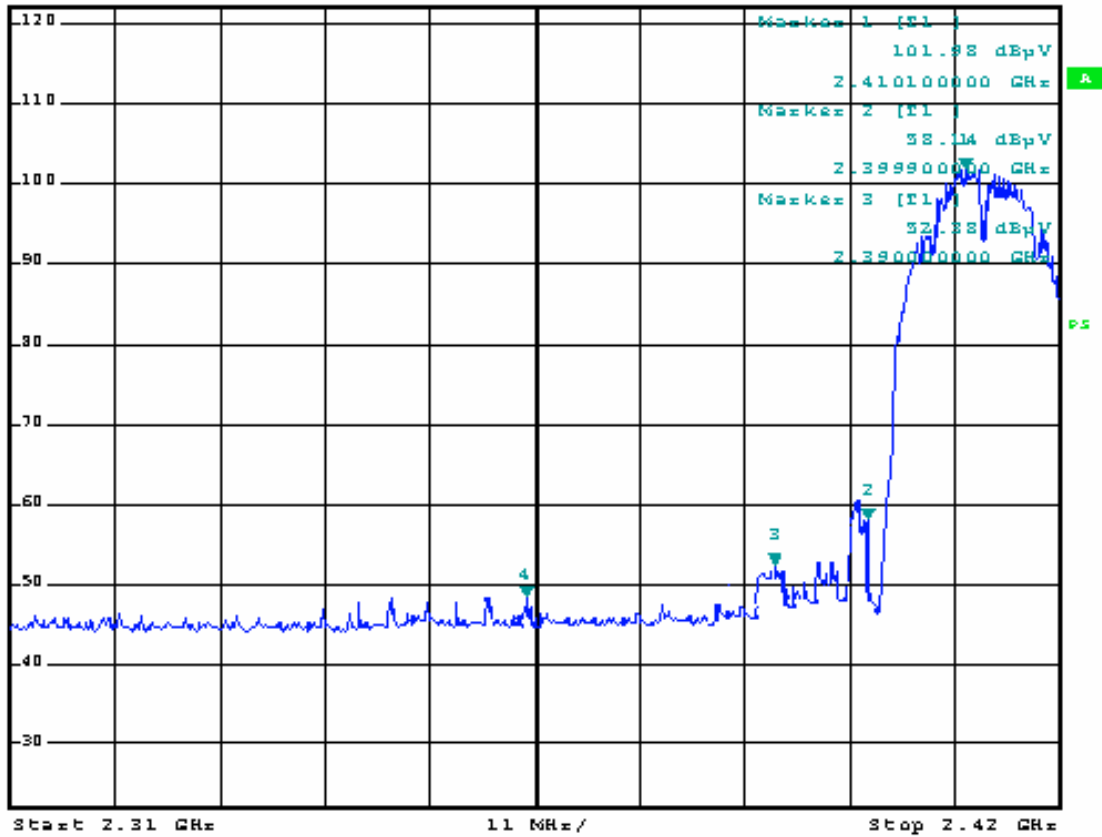
Date: 30.MAY.2007 17:45:20





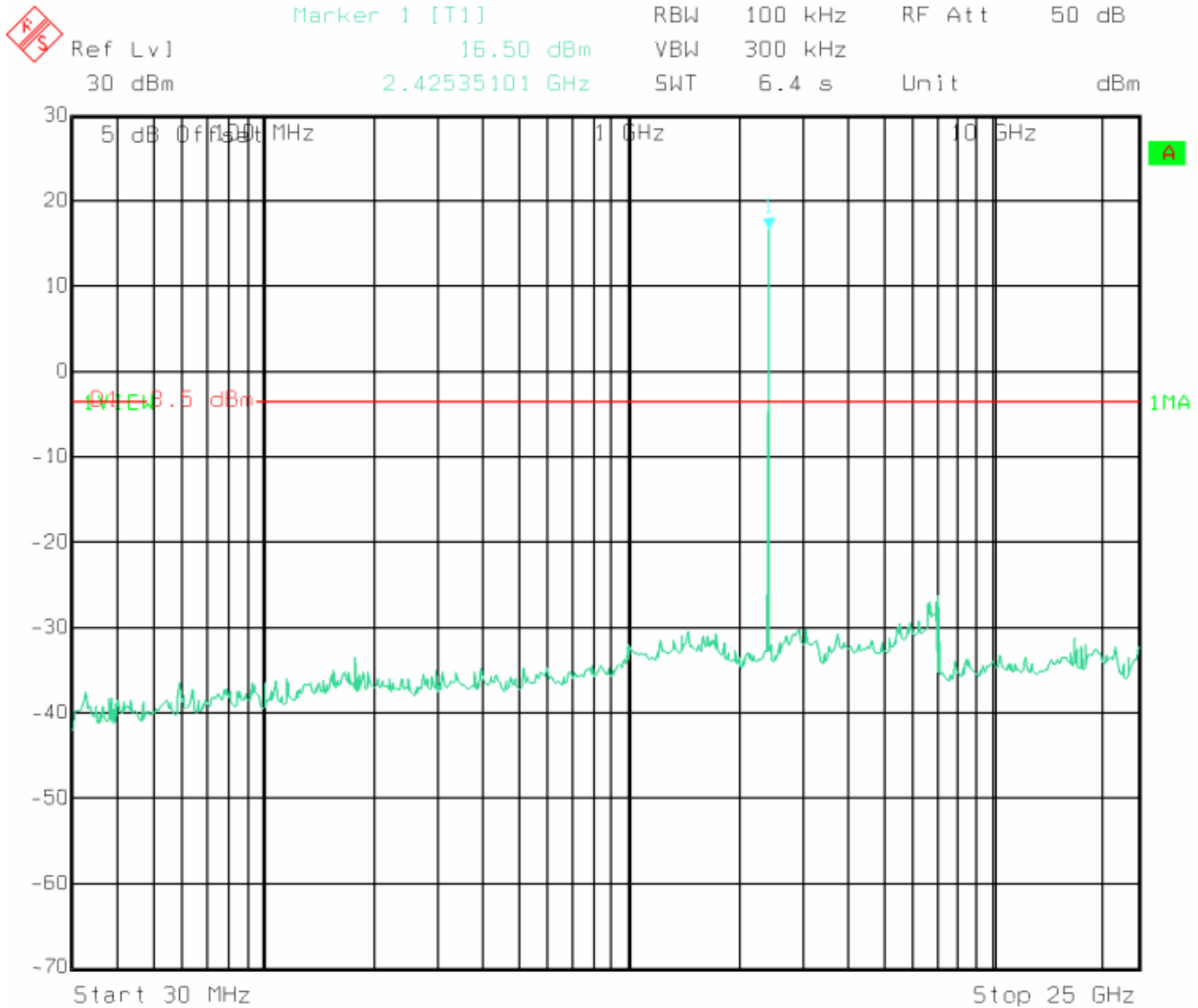
1 PK  
VIEW

Ref 122 dB $\mu$ V     Att 30 dB     SWF 3 ms     Marker 4 [T1]     48.29 dB $\mu$ V     2.364120000 GHz



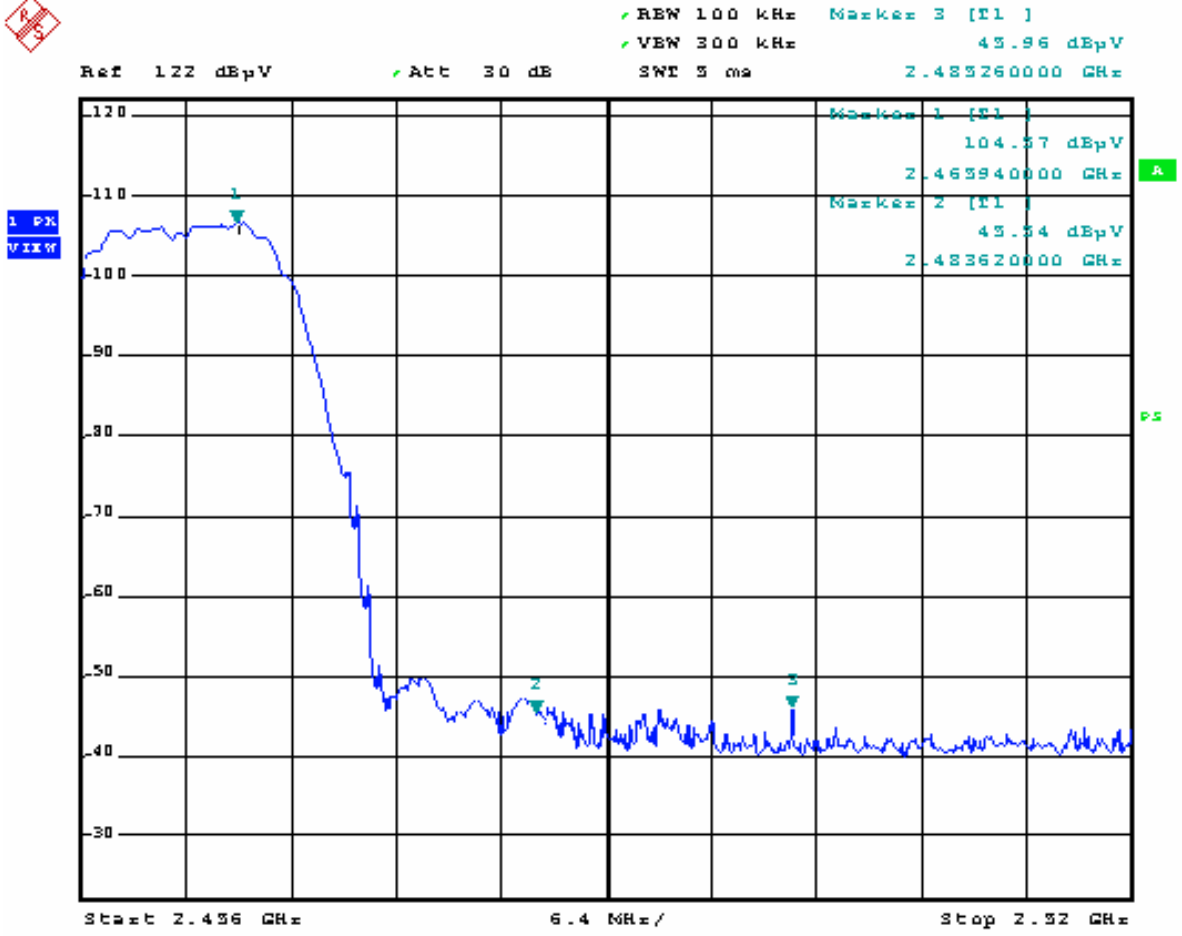
802.11g-lowrestrictband

Date: 30.MAY.2007 17:46:52



Date: 31.MAY 2007 15:43:21

802.11g: 2462 MHz



802.11g-upperbandedge

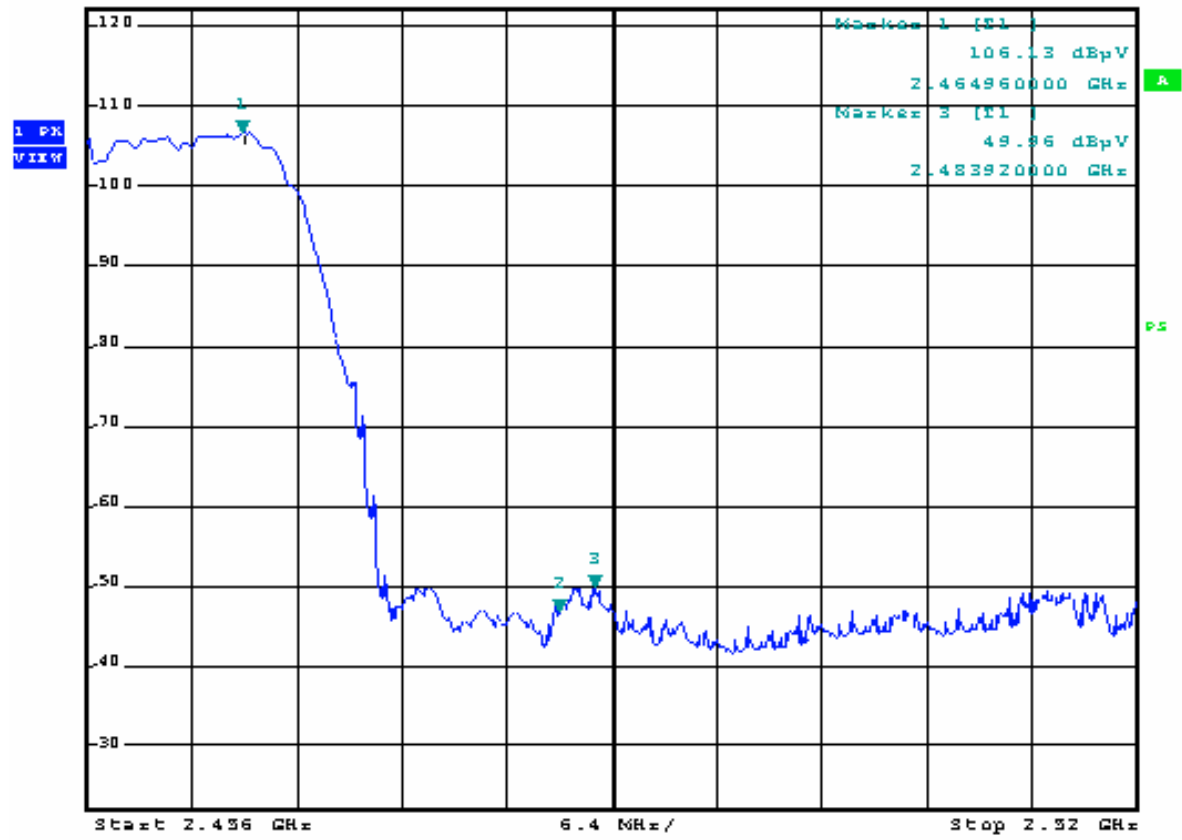
Date: 30.MAY.2007 17:34:39



Ref 122 dBV Att 30 dB SWI 2.5 ms

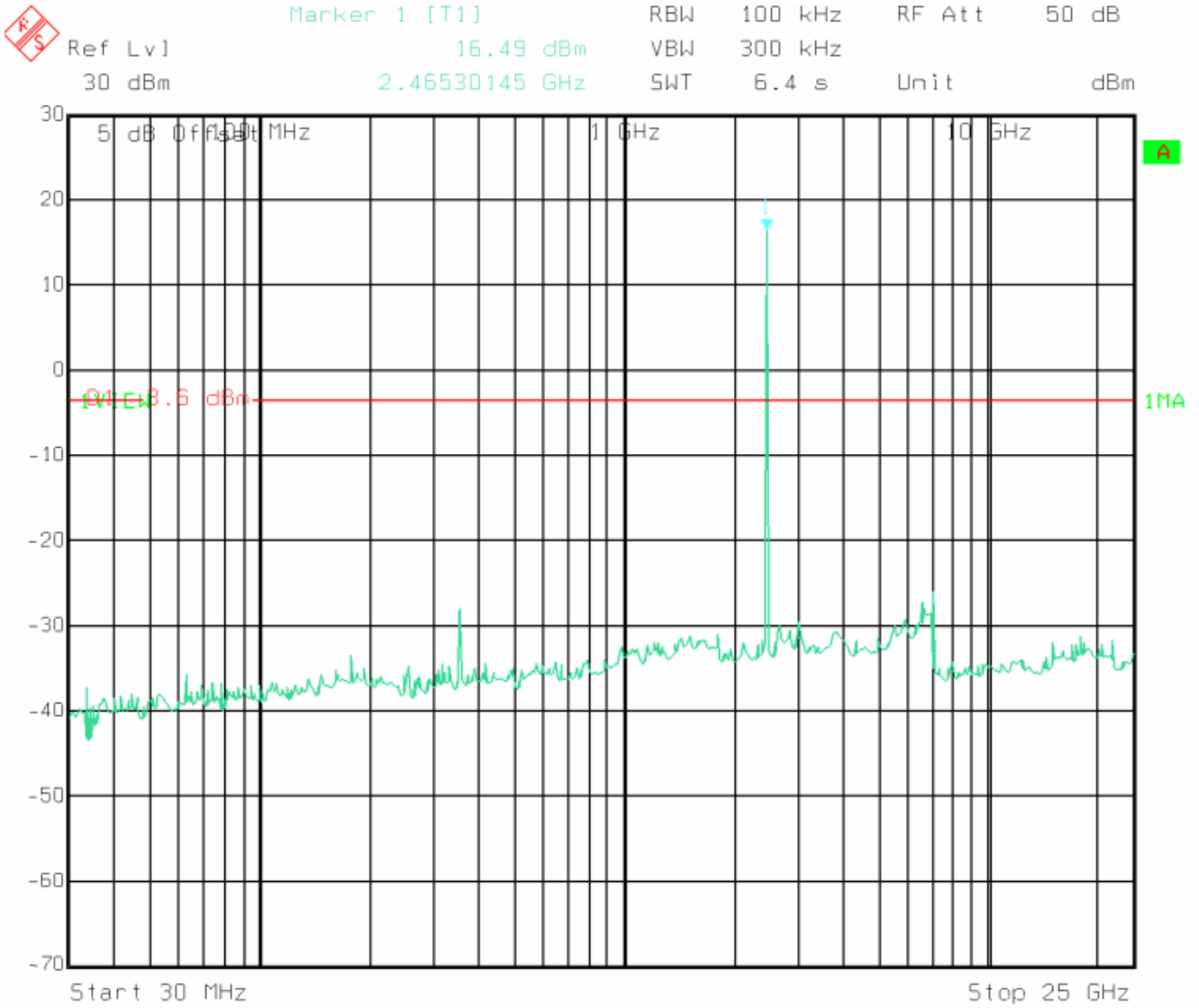
REW 1 MHz Mask 2 [F1] 46.74 dBV 2.483600000 GHz

VEW 1 MHz



802.11g-upperrestrictband

Date: 30.MAY.2007 17:37:12



Date: 31.MAY 2007 15:48:09

## §15.247(e) – POWER 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
WUHUAN	Temperature & Humidity Chamber	HTP205	20021115	2006-12-28	2007-12-28
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2006-09-29	2007-09-29

\* **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**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	53 %
<b>ATM Pressure:</b>	100.9 kPa

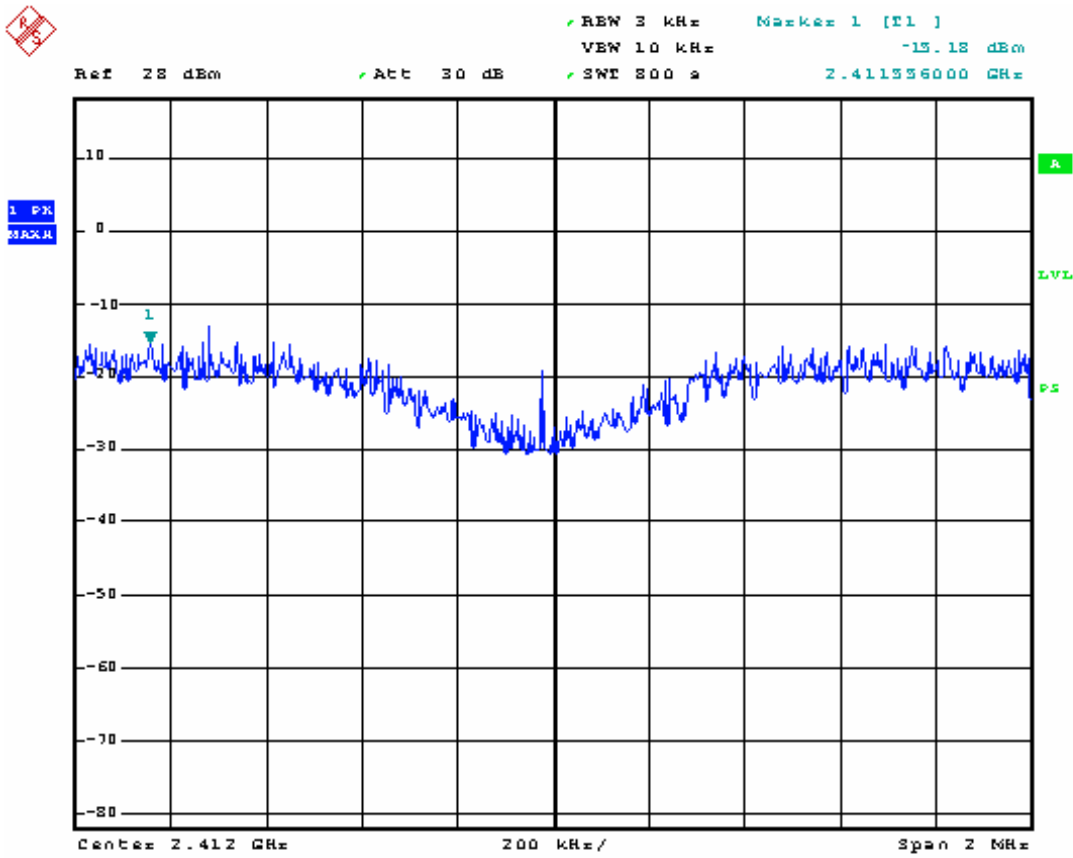
*The testing was performed by Henry Yang on 2007-06-08.*

**Test Result:** Pass

*Test Mode: Running*

<b>Channel Frequency (MHz)</b>	<b>Data Rate (Mbps)</b>	<b>PSD (dBm/3kHz)</b>	<b>Limit (dBm)</b>
802.11b			
2412	11	-13.18	8
2442	11	-12.74	8
2462	11	-11.10	8
802.11g			
2412	54	-12.43	8
2442	54	-12.25	8
2462	54	-11.01	8

### 802.11b Low Channel

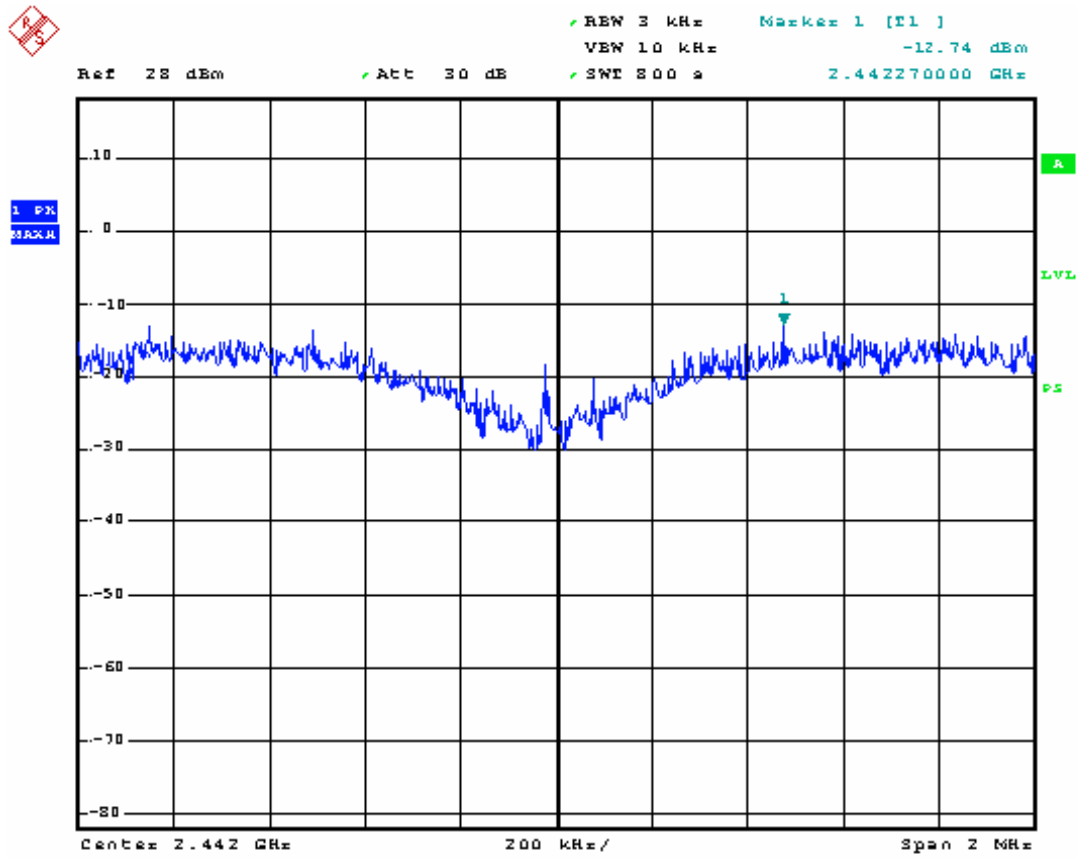


Peak power spectral density (802.11b-- 2412MHz)

Date: 8.JUN.2007 10:10:56



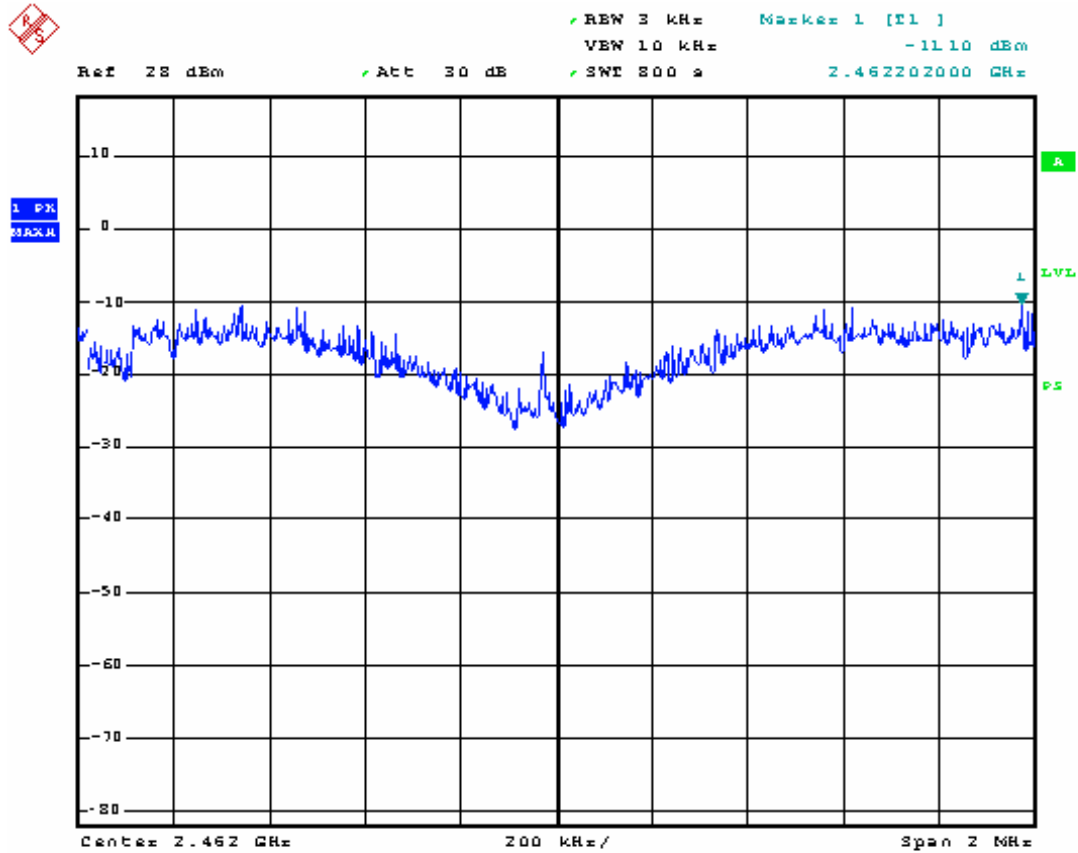
### 802.11b Middle Channel



Peak power spectral density (802.11b-- 2442MHz)

Date: 8.JUN.2007 10:12:01

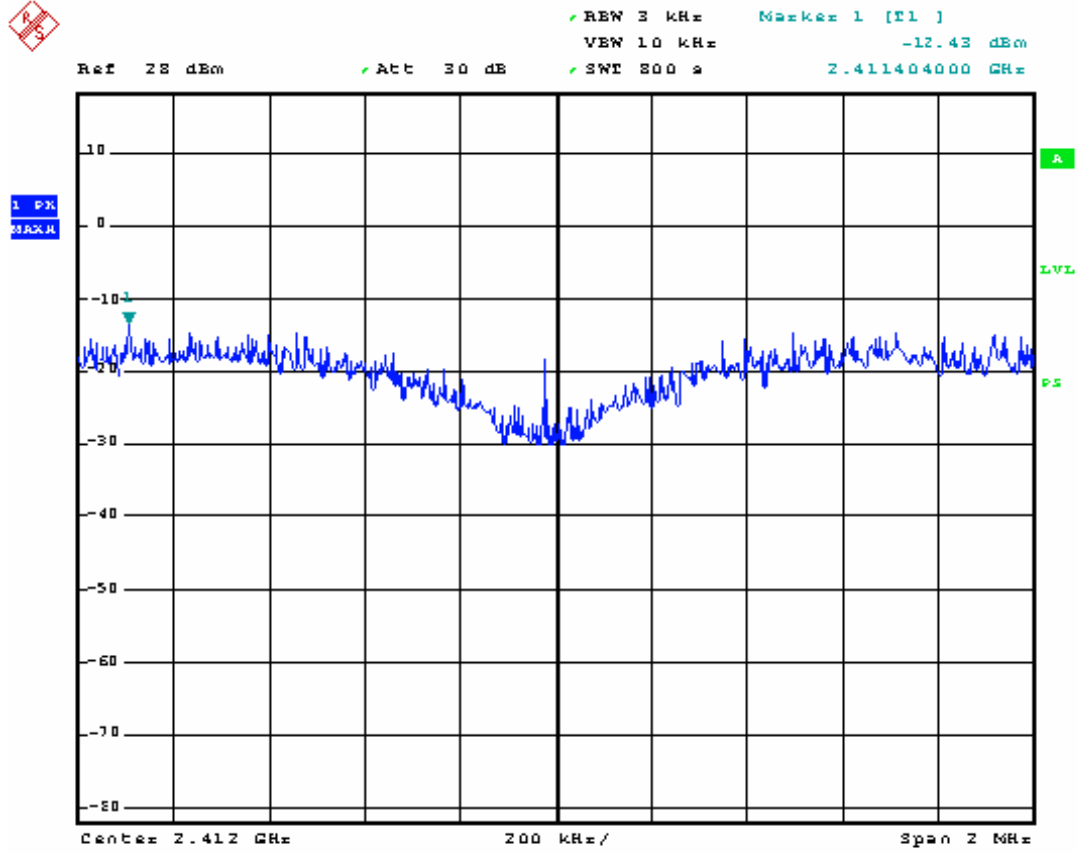
### 802.11b High Channel



Peak power spectral density (802.11b-- 2462MHz)

Date: 8.JUN.2007 10:14:14

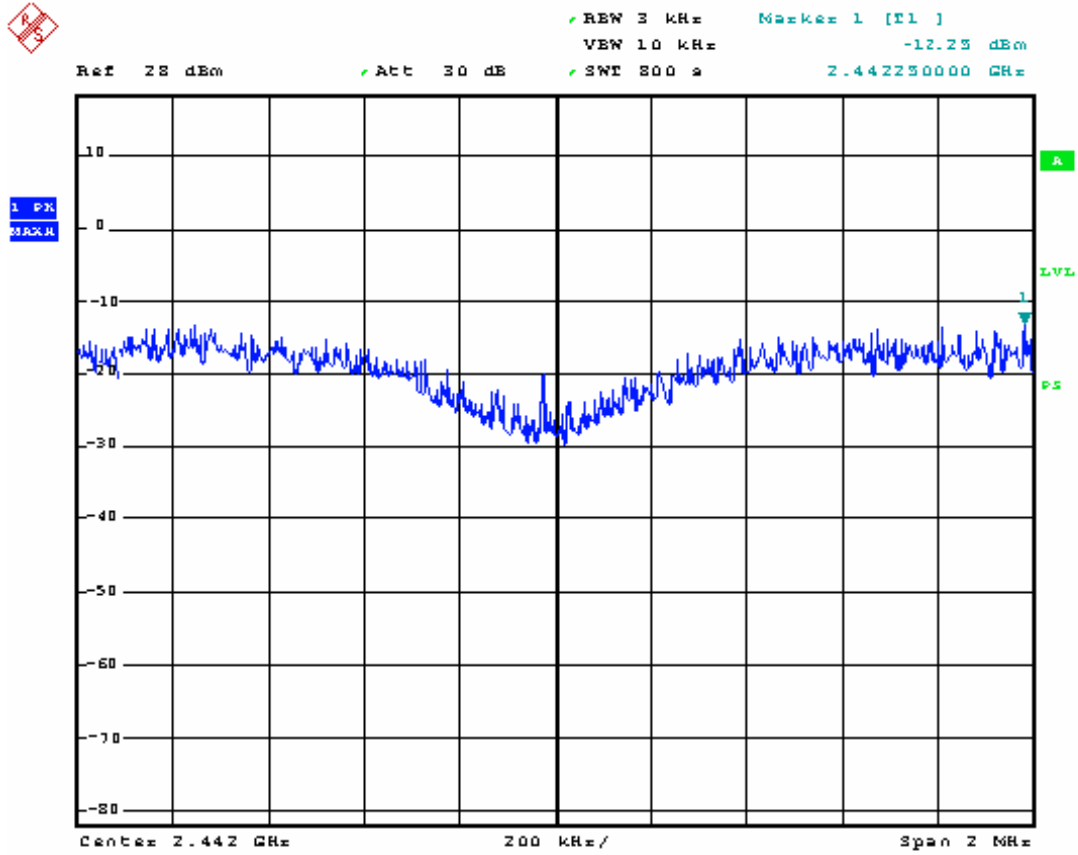
### 802.11g Low Channel



Peak power spectral density (802.11g-- 2412MHz)

Date: 8.JUN.2007 13:44:29

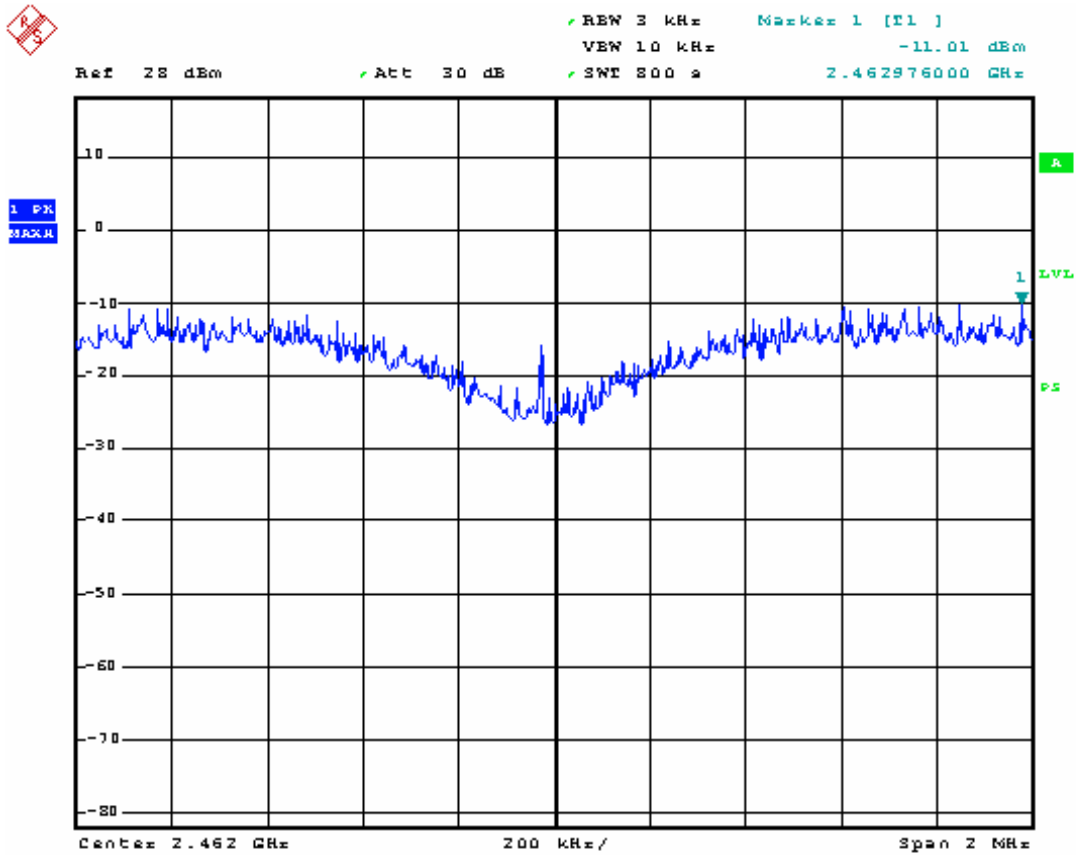
### 802.11g Middle Channel



Peak power spectral density (802.11g-- 2442MHz)

Date: 8.JUN.2007 13:50:39

### 802.11g High Channel



Peak power spectral density (802.11g-- 2462MHz)

Date: 8.JUN.2007 13:59:56