



**FCC CFR47 PART 15 SUBPART C  
CERTIFICATION  
TEST REPORT**

**FOR**

**DUAL BAND 802.11 a/b/g FIXED WIRELESS NODE**

**MODEL NUMBER: SP-3500**

**FCC ID: RV7-SC4110  
IC: 5550A-SC4110**

**REPORT NUMBER: 07U11219-6B**

**ISSUE DATE: MARCH 26, 2008**

*Prepared for*  
**SKYPILOT NETWORKS INC.  
2055 LAURELWOOD ROAD 2<sup>nd</sup> FLOOR  
SANTA CLARA, CA 95054-2747**

*Prepared by*  
**COMPLIANCE CERTIFICATION SERVICES  
47173 BENICIA STREET  
FREMONT, CA 94538, USA  
TEL: (510) 771-1000  
FAX: (510) 661-0888**



**NVLAP LAB CODE 200065-0**

---

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
<u>---</u>	<u>02/08/08</u>	<u>Initial Issue</u>	<u>T. Chan</u>
<u>B</u>	<u>3/25/2008</u>	<u>Revised Section 7.1.3 and Added MPE Co-Location</u>	<u>T. Chan</u>

**TABLE OF CONTENTS**

**1. ATTESTATION OF TEST RESULTS..... 4**

**2. TEST METHODOLOGY ..... 5**

**3. FACILITIES AND ACCREDITATION ..... 5**

**4. CALIBRATION AND UNCERTAINTY..... 5**

    4.1. *MEASURING INSTRUMENT CALIBRATION*..... 5

    4.2. *MEASUREMENT UNCERTAINTY*..... 5

**5. EQUIPMENT UNDER TEST..... 6**

    5.1. *DESCRIPTION OF EUT* ..... 6

    5.2. *MAXIMUM OUTPUT POWER* ..... 6

    5.3. *DESCRIPTION OF AVAILABLE ANTENNAS*..... 6

    5.4. *SOFTWARE AND FIRMWARE* ..... 6

    5.5. *WORST-CASE CONFIGURATION AND MODE*..... 6

    5.6. *DESCRIPTION OF 2.4 GHz BAND TEST SETUP* ..... 6

**6. ITEST AND MEASUREMENT EQUIPMENT..... 9**

**7. LIMITS AND RESULTS ..... 10**

    7.1. *CHANNEL TESTS FOR THE 2400 TO 2483.5 MHz BAND* ..... 10

        7.1.1. 6 dB BANDWIDTH ..... 10

        7.1.2. 99% BANDWIDTH..... 17

        7.1.3. PEAK OUTPUT POWER ..... 24

        7.1.4. AVERAGE POWER..... 32

        7.1.5. PEAK POWER SPECTRAL DENSITY ..... 33

        7.1.6. CONDUCTED SPURIOUS EMISSIONS..... 40

**8. RADIATED EMISSIONS FOR 2400 TO 2483.5 MHz BAND ..... 53**

    8.1.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS ..... 53

    8.1.2. TRANSMITTER ABOVE 1 GHz ..... 56

    8.1.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz..... 74

**9. POWERLINE CONDUCTED EMISSIONS..... 76**

**10. MAXIMUM PERMISSIBLE EXPOSURE ..... 80**

**11. SETUP PHOTOS ..... 84**

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SKYPILOT NETWORKS, INC.  
2055 LAURELWOOD ROAD 2nd FLOOR  
SANTA CLARA, CA 95054-2747

**EUT DESCRIPTION:** DUAL BAND 802.11 a/b/g FIXED WIRELESS NODE

**MODEL TESTED:** SP-3500

**SERIAL NUMBER:** F07040003

**DATE TESTED:** DECEMBER 07-12, 2006

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	NO NON-COMPLIANCE NOTED

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

Tested By:



---

THU CHAN  
EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

---

WILLIAM ZHUANG  
EMC ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Road, Fremont, California 94538, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

This device is a dual band WLAN radio operating in the 5.5 to 5.7GHz 802.11a and 2.4GHz 802.11b/g. The 5GHz radio uses a proprietary mesh protocol and the 2.4 GHz radio uses the standard WiFi protocol.

The model number was changed after testing commenced.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

2400 to 2483.5 MHz Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	18.16	65.46
2412 - 2462	802.11g	23.43	220.29

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a dipole antenna with a maximum gain of 7.4 dBi in the 2.4 GHz band.

### 5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was SpCpeSw, rev. 4.

### 5.5. WORST-CASE CONFIGURATION AND MODE

In our opinion the worst-case data rate is determined to be 1 Mb/s in the 802.11b mode and 6 Mb/s in the 802.11g and 802.11a modes.

### 5.6. DESCRIPTION OF 2.4 GHz BAND TEST SETUP

## SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop PC	QuickNote	A929	GAYR22190154	DoC
PC AC Adapter	Lite-on Electronics	PA-1900-05	250109400C	DoC
POE Adapter	SkyPilot	POE	640-00009-01	N/A

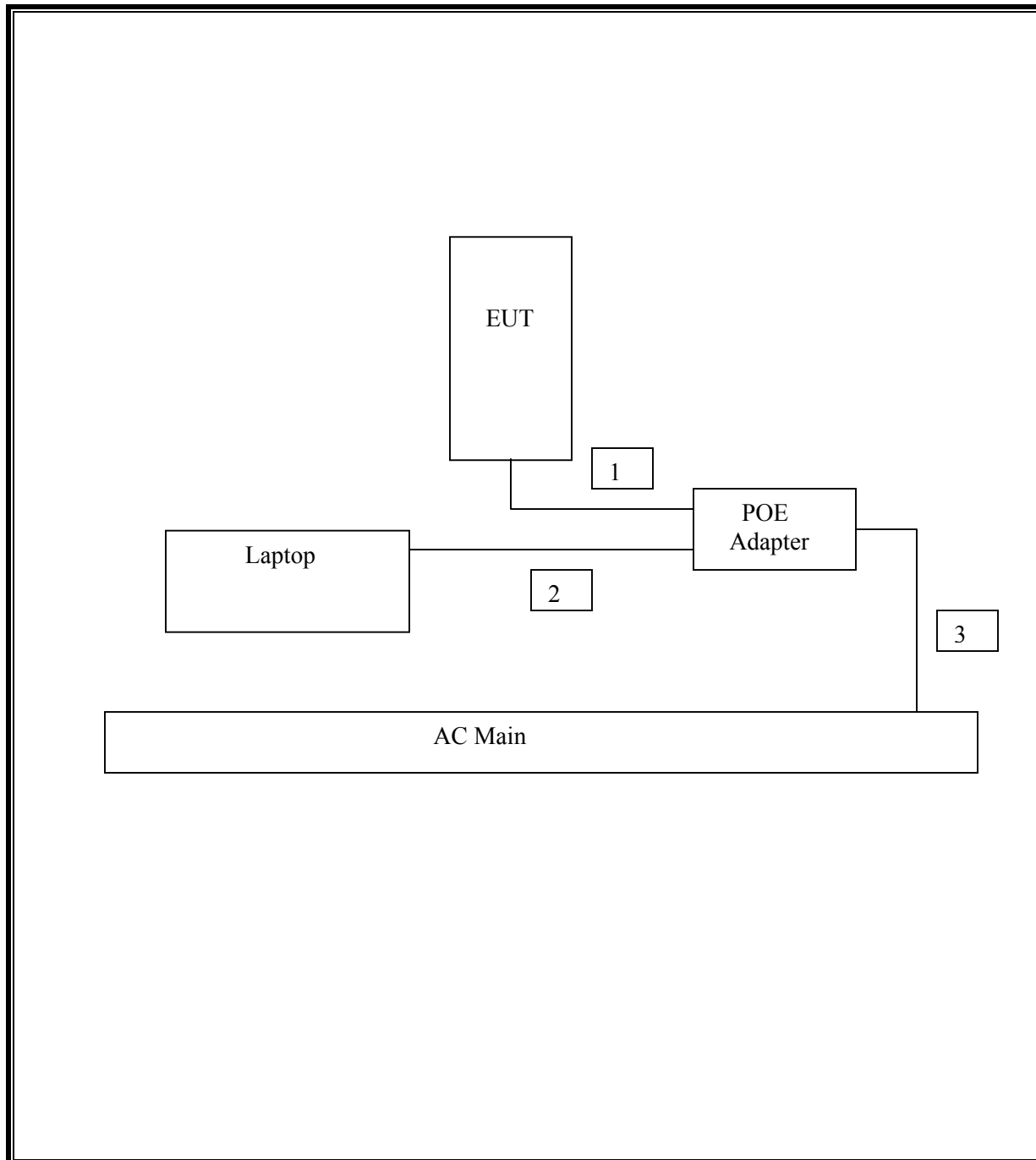
**I/O CABLES**

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	LAN	1	RJ45	Unshielded	1m	N/A
2	LAN	1	RJ45	Unshielded	1m	N/A
3	AC	1	AC Power	Unshielded	1.8m	N/A

**TEST SETUP**

The EUT is outside a host laptop computer via an ethernet cable and POE Adaptor during the tests. Test software exercised the radio card.

**SETUP DIAGRAM FOR TESTS**





## 6. ITEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the 2.4 GHz band tests documented in this report, which were performed during the period from December 7 to 12, 2006:

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	8/7/2008
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	9/28/2008
Horn, 1-18GHz	EMCO	3115	C00872	4/15/2008
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	9/27/2008
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	8/7/2008
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	9/28/2008
Horn, 1-18GHz	EMCO	3115	C00872	4/15/2008
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	9/27/2008
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	1/27/2008
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/25/2008
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	9/29/2008
Preamplifier, 1300 MHz	Agilent / HP	8447D	NA	5/9/2008
EMI Receiver, 2.9 GHz	Agilent / HP	8542E	C00957	6/12/2008
RF Filter Section, 2.9 GHz	Agilent / HP	85420E	C00958	6/12/2008
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	9/28/2008
2.4-2.5 GHz Reject Filter	Micro-Tronics	BRM50702	1	CNR

## 7. LIMITS AND RESULTS

### 7.1. CHANNEL TESTS FOR THE 2400 TO 2483.5 MHz BAND

#### 7.1.1. 6 dB BANDWIDTH

##### LIMIT

§15.247 (a) (2) For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

##### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

##### RESULTS

No non-compliance noted:

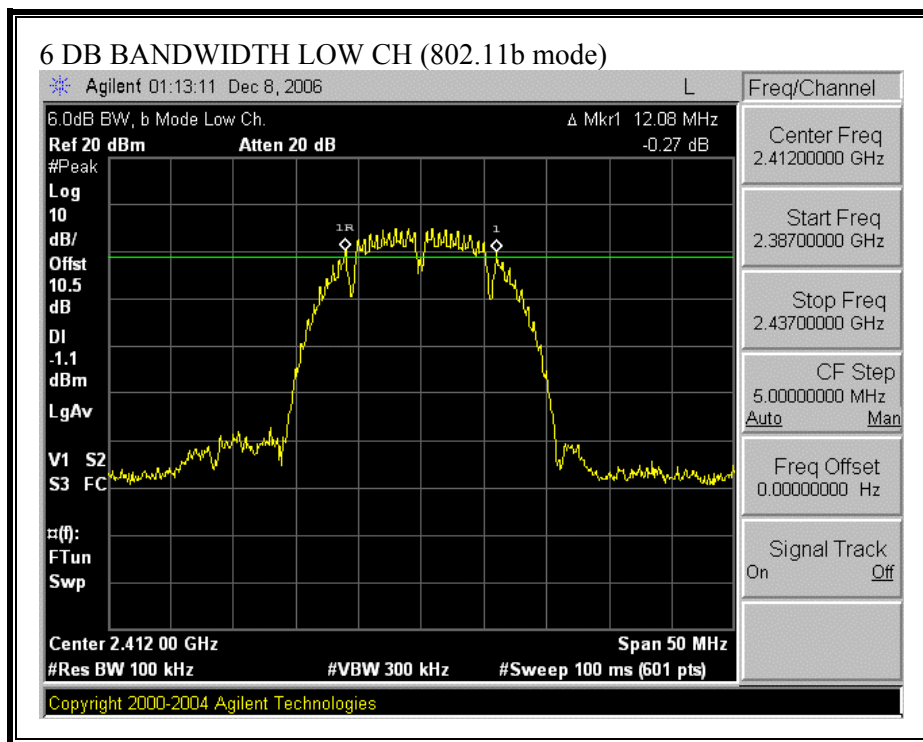
##### 802.11b Mode

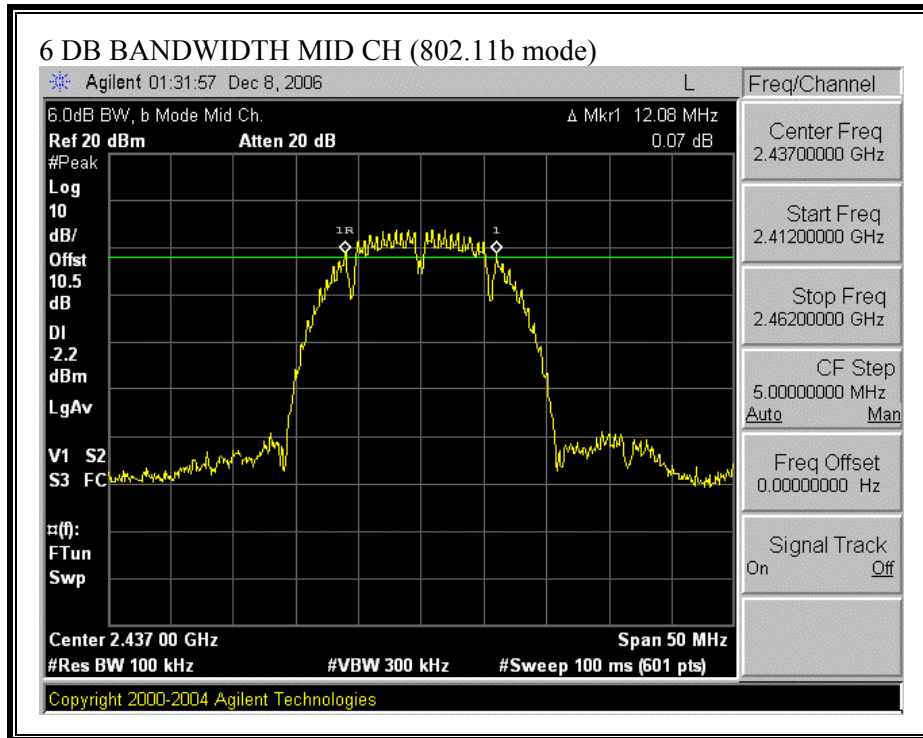
Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2412	12083.33	500	11583
Middle	2437	12083.33	500	11583
High	2462	12083.33	500	11583

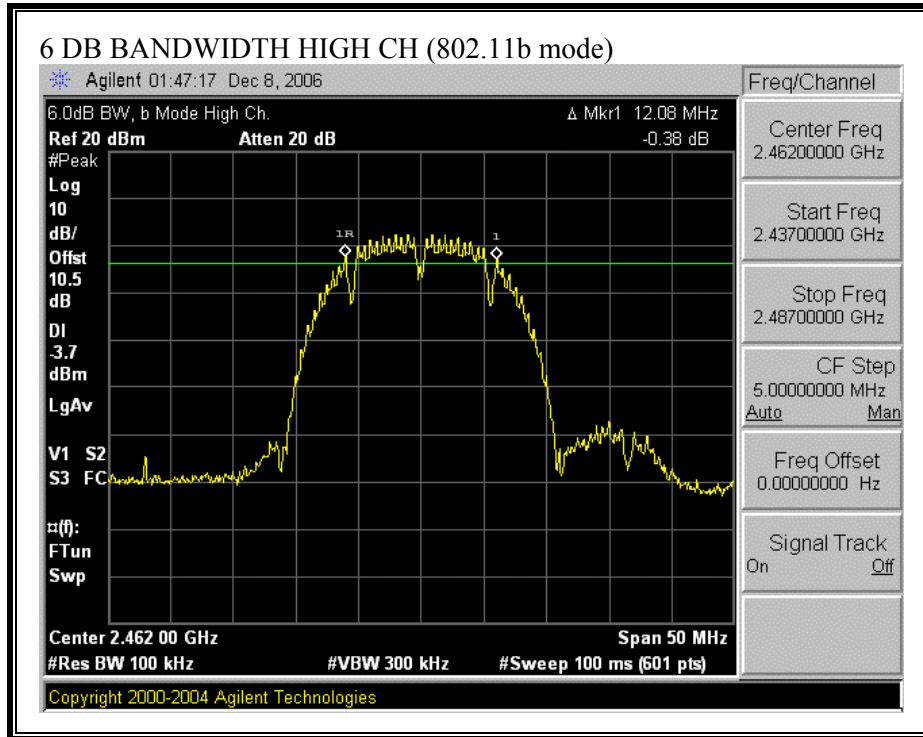
##### 802.11g Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2412	16416.67	500	15917
Middle	2437	16416.67	500	15917
High	2462	16416.67	500	15917

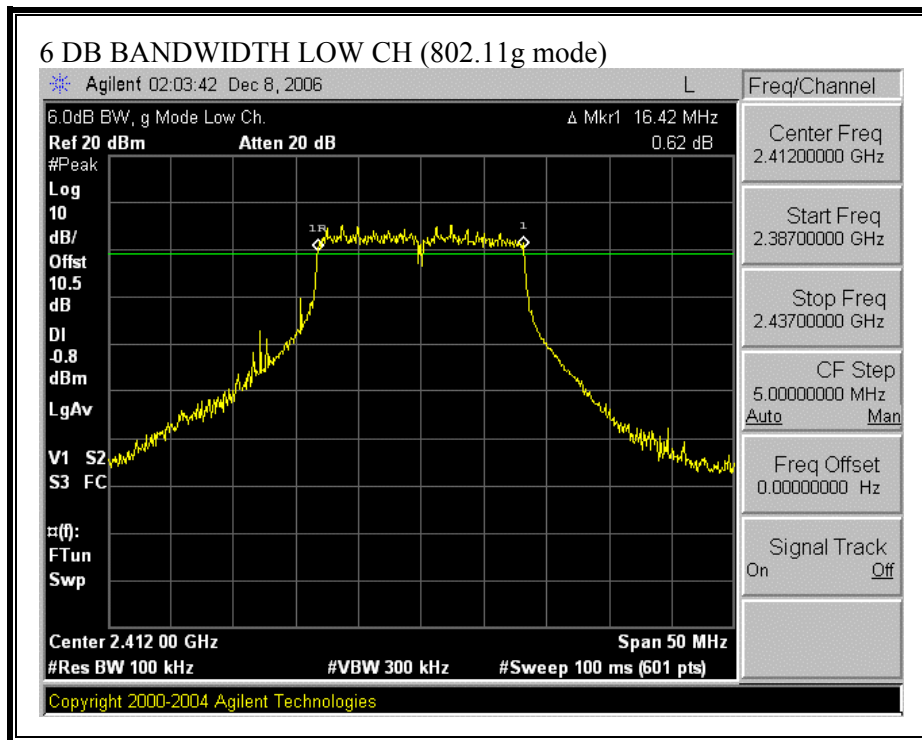
**6 DB BANDWIDTH (802.11b MODE)**

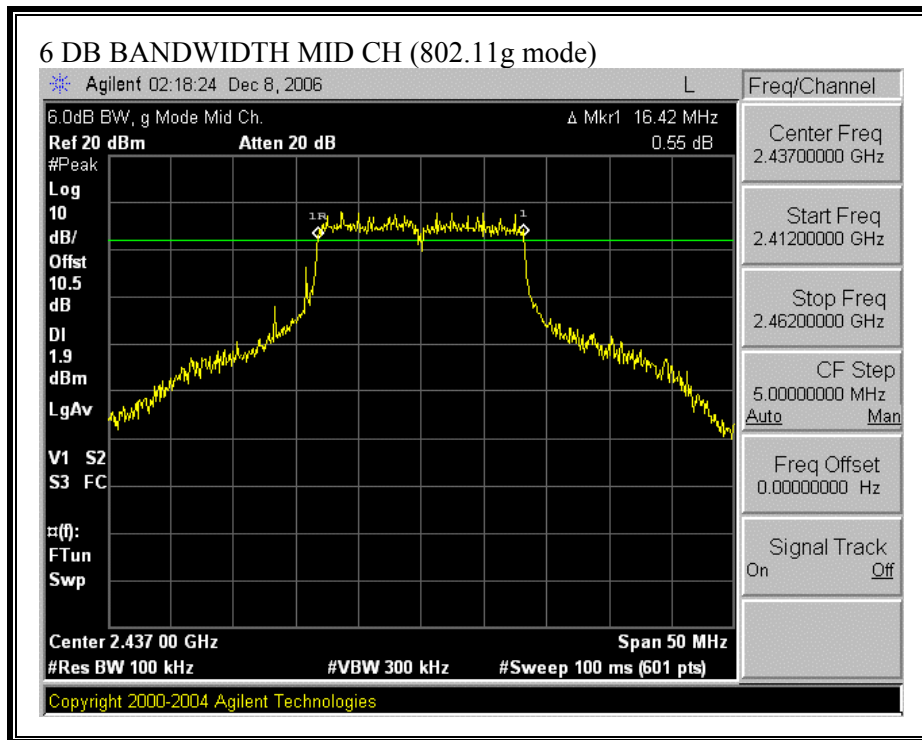


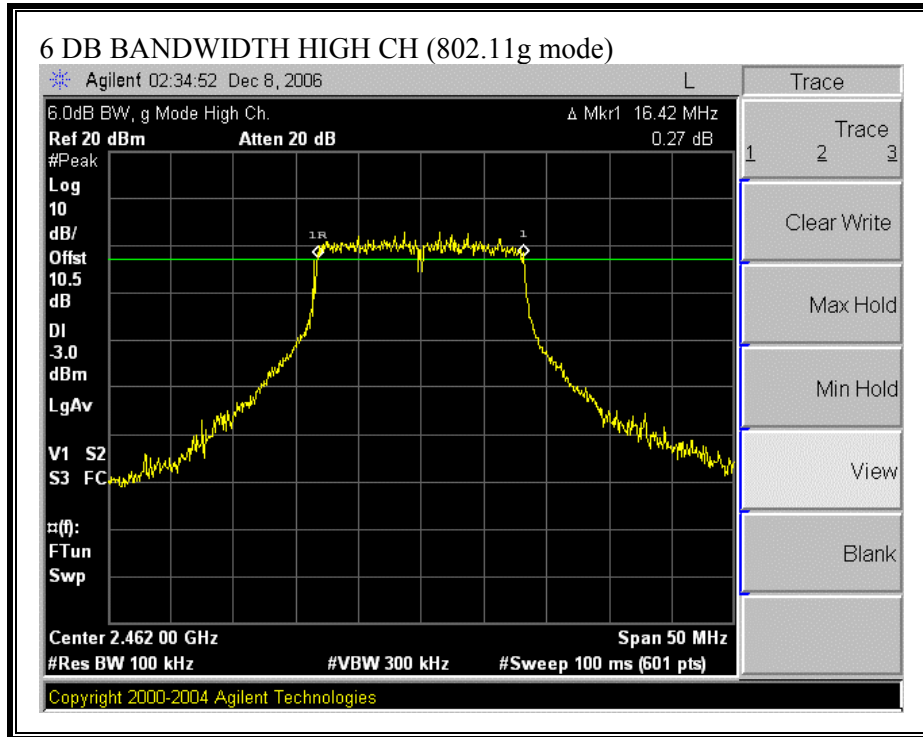




**6 DB BANDWIDTH (802.11g MODE)**









### 7.1.2. 99% BANDWIDTH

#### LIMIT

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

#### RESULTS

No non-compliance noted:

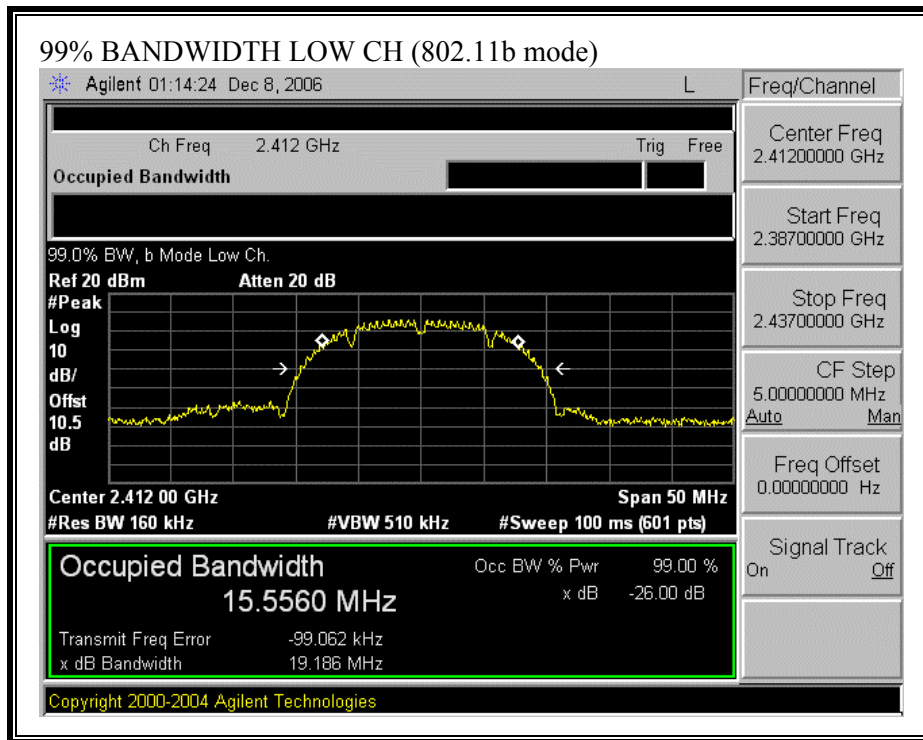
##### 802.11b Mode

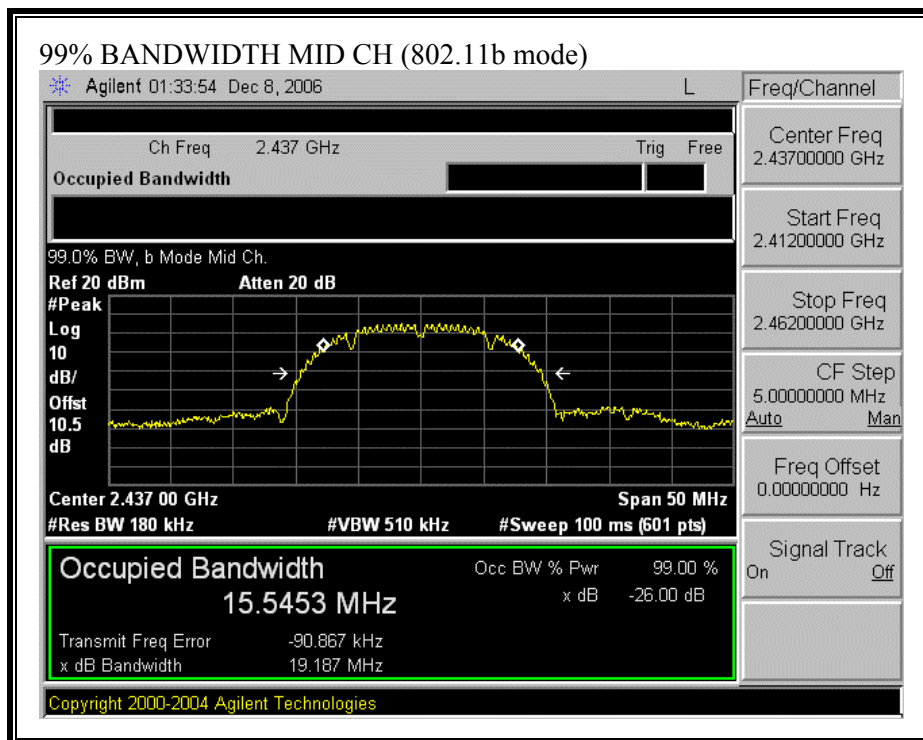
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	15.556
Middle	2437	15.545
High	2462	15.537

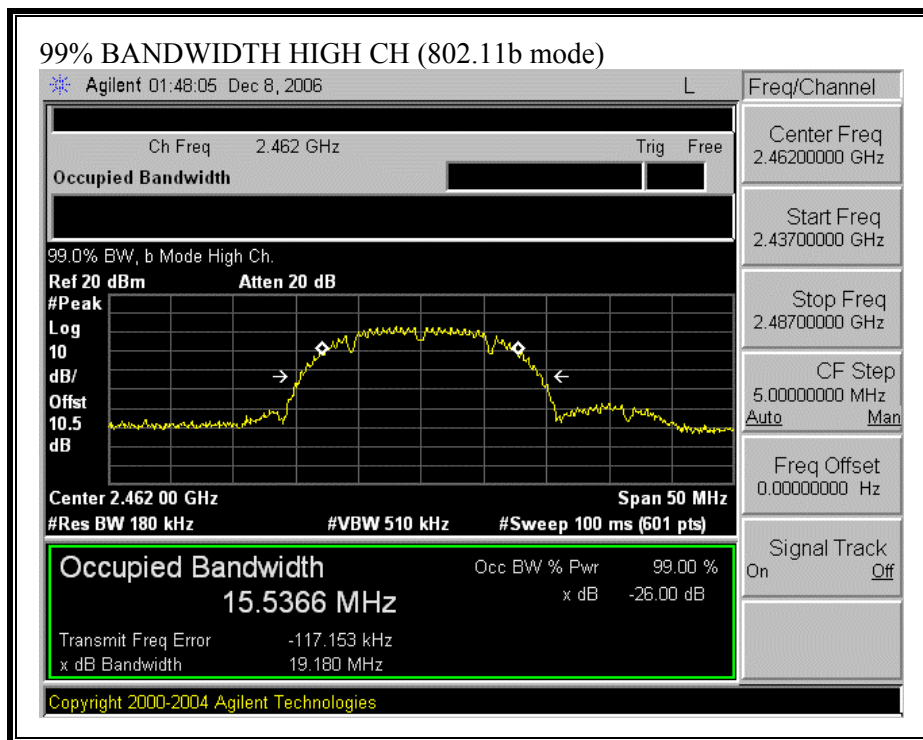
##### 802.11g Mode

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.654
Middle	2437	16.777
High	2462	16.655

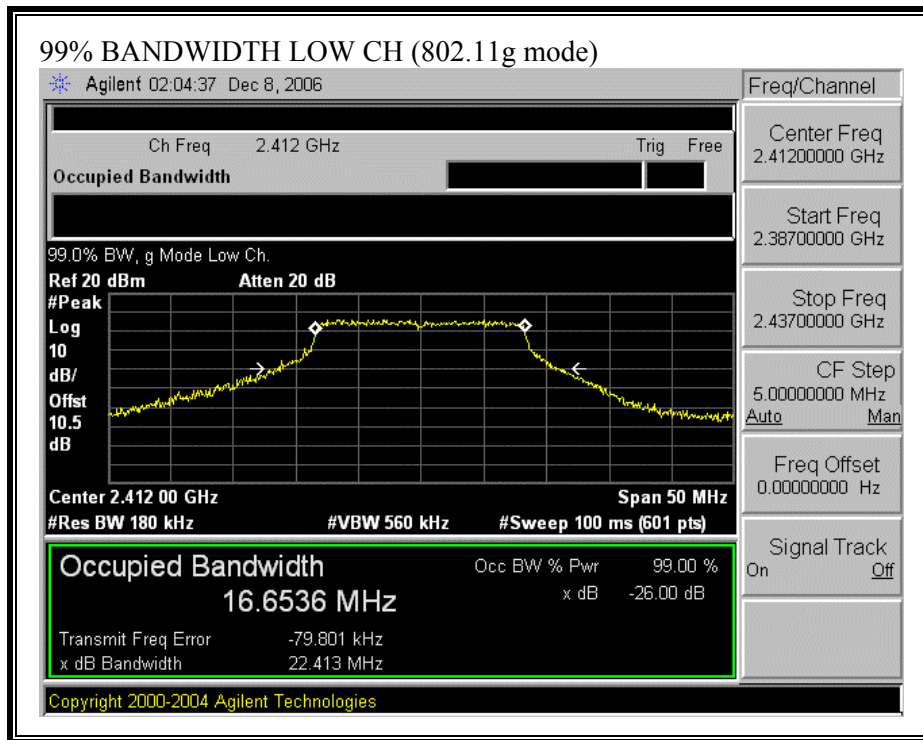
**99% BANDWIDTH (802.11b MODE)**

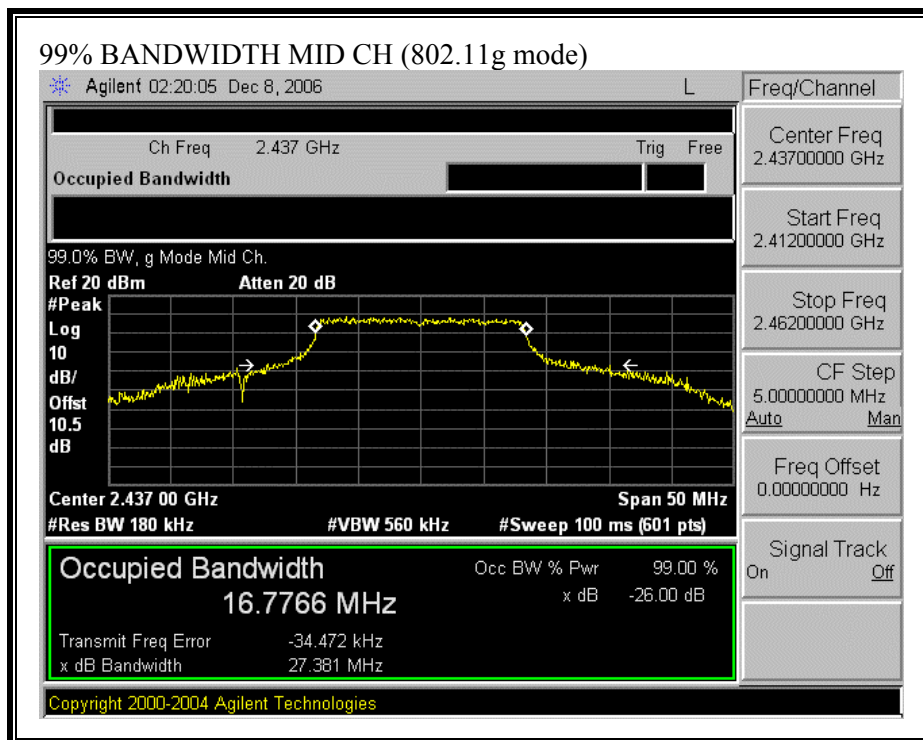


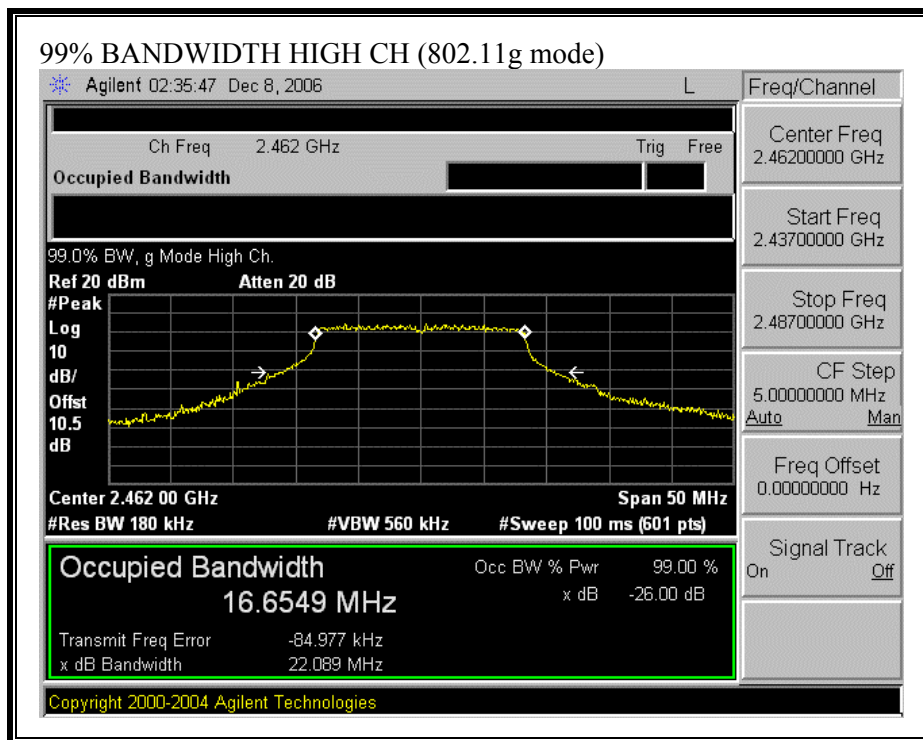




**99% BANDWIDTH (802.11g MODE)**







### **7.1.3. PEAK OUTPUT POWER**

#### **PEAK POWER LIMIT**

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

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

§15.247 (b) (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.

§15.247 (b) (4) (i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

#### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.



**RESULTS**

The maximum antenna gain is 7.4 dBi exclusively for fixed, point-to-point operations, therefore the limit is 30 dBm.

No non-compliance noted:

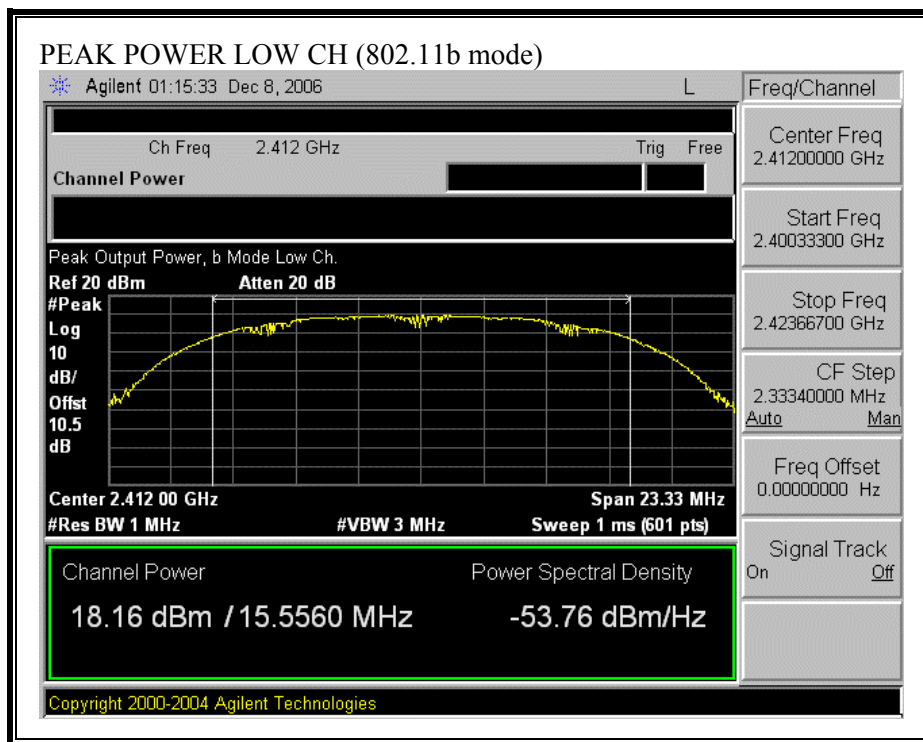
802.11b Mode

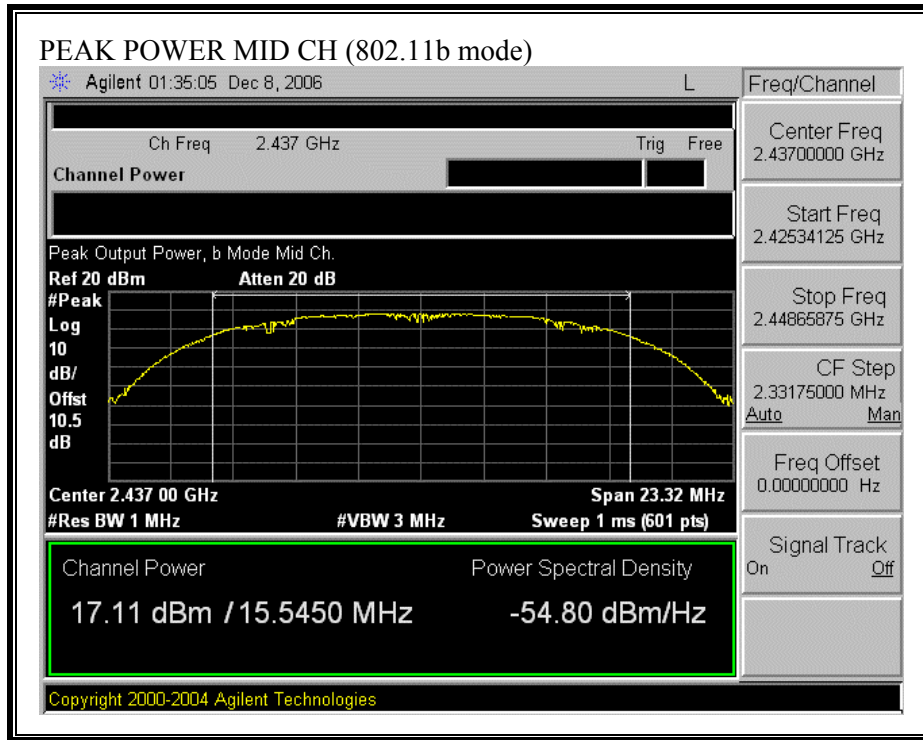
Channel	Frequency (MHz)	Peak (dBm)	Limit (dBm)	Margin (dB)
Low	2412	18.16	28.6	-10.44
Middle	2437	17.11	28.6	-11.49
High	2462	15.01	28.6	-13.59

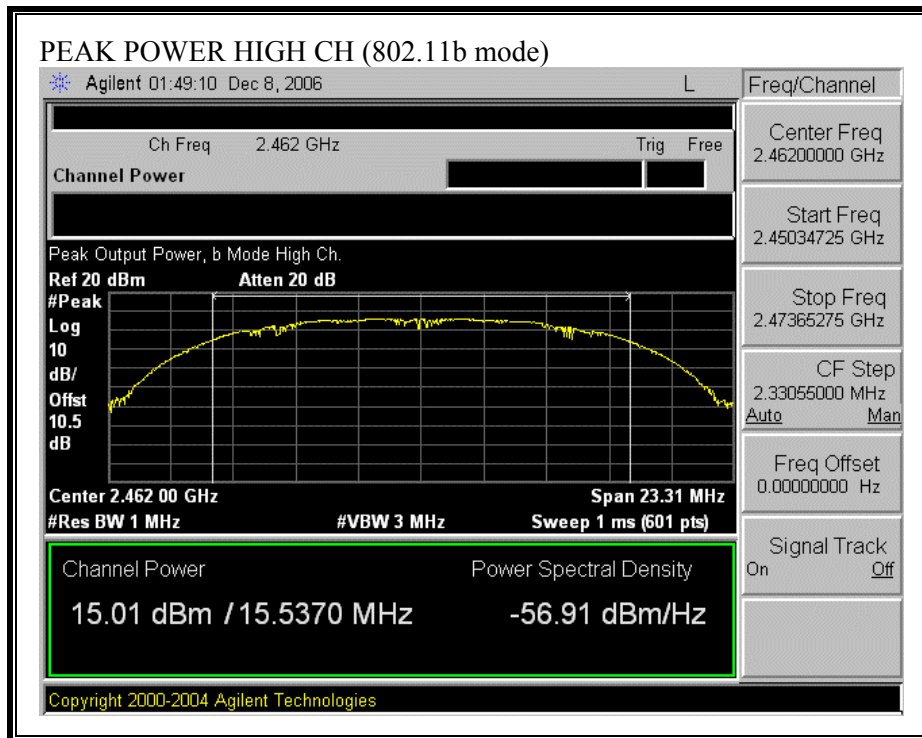
802.11g Mode

Channel	Frequency (MHz)	Peak (dBm)	Limit (dBm)	Margin (dB)
Low	2412	20.55	28.6	-8.05
Middle	2437	23.43	28.6	-5.17
High	2462	18.48	28.6	-10.12

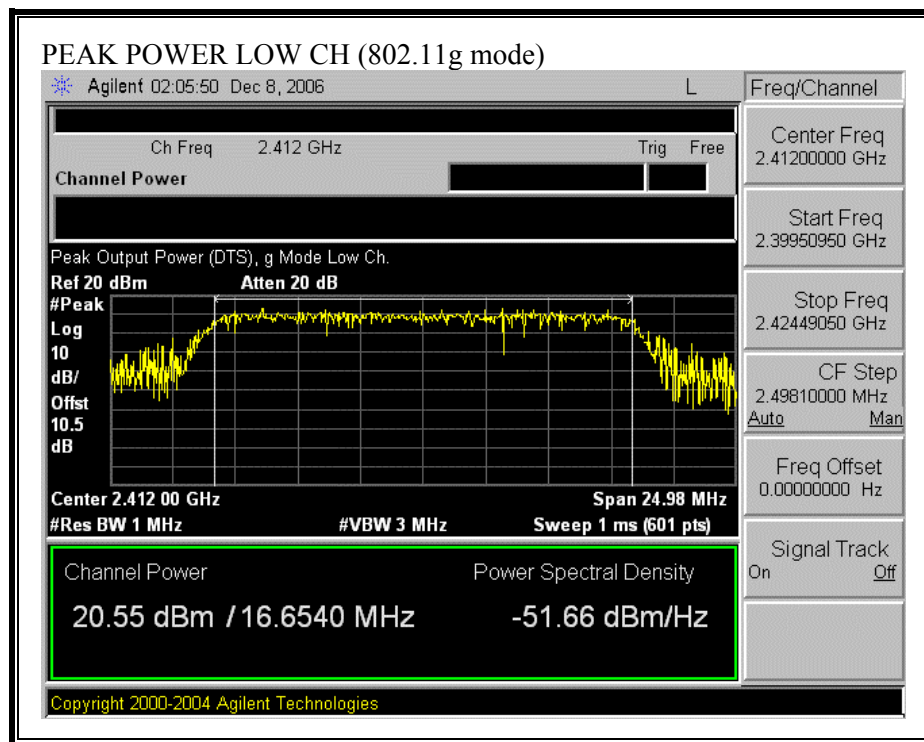
**OUTPUT POWER (802.11b MODE)**

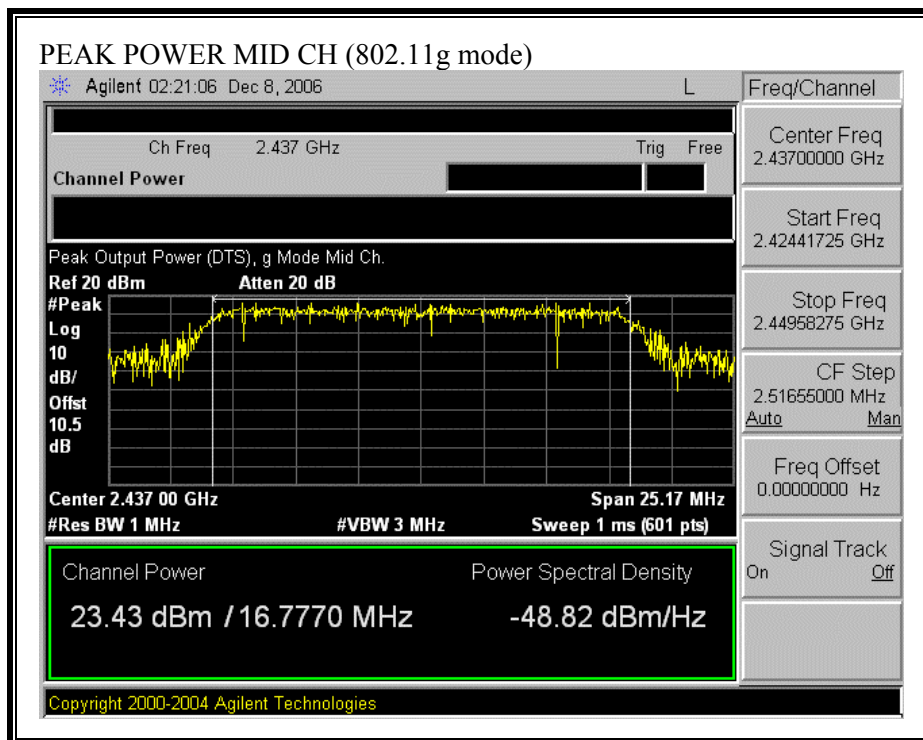


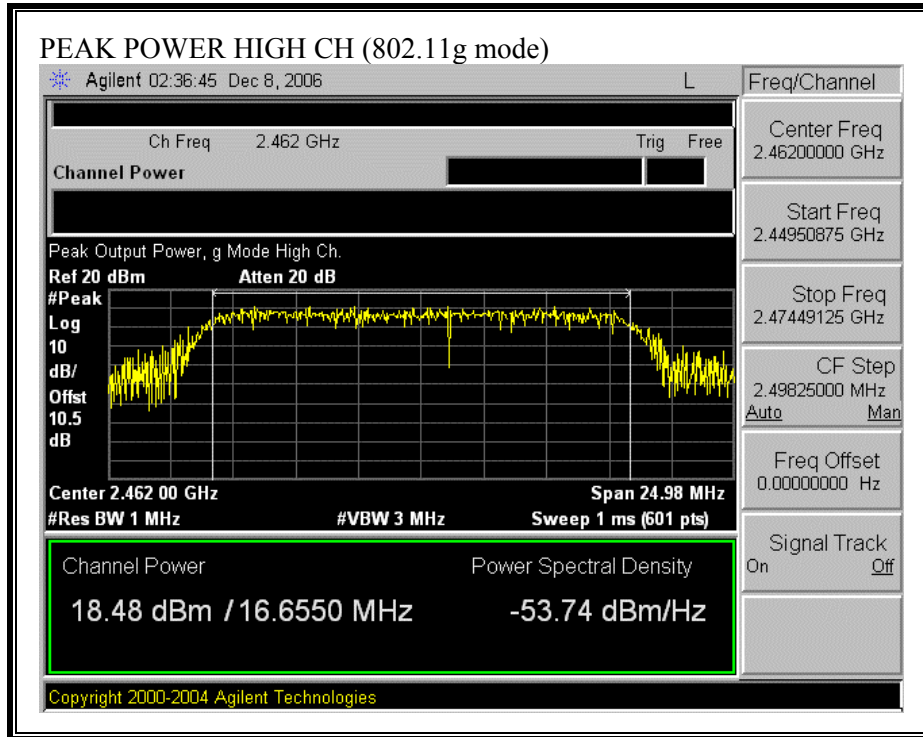




**OUTPUT POWER (802.11g MODE)**







### 7.1.4. AVERAGE POWER

#### AVERAGE POWER LIMIT

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

No non-compliance noted:

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### 802.11b Mode

Channel	Frequency (MHz)	Power (dBm)
Low	2412	14.70
Middle	2437	13.87
High	2462	12.33

#### 802.11g Mode

Channel	Frequency (MHz)	Power (dBm)
Low	2412	15.42
Middle	2437	17.41
High	2462	12.45



### 7.1.5. PEAK POWER SPECTRAL DENSITY

#### LIMIT

§15.247 (d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = 3 kHz and VBW > 3 kHz, sweep time = span / 3 kHz, and video averaging is turned off. The PPSD is the highest level found across the emission in any 3 kHz band.

#### RESULTS

No non-compliance noted:

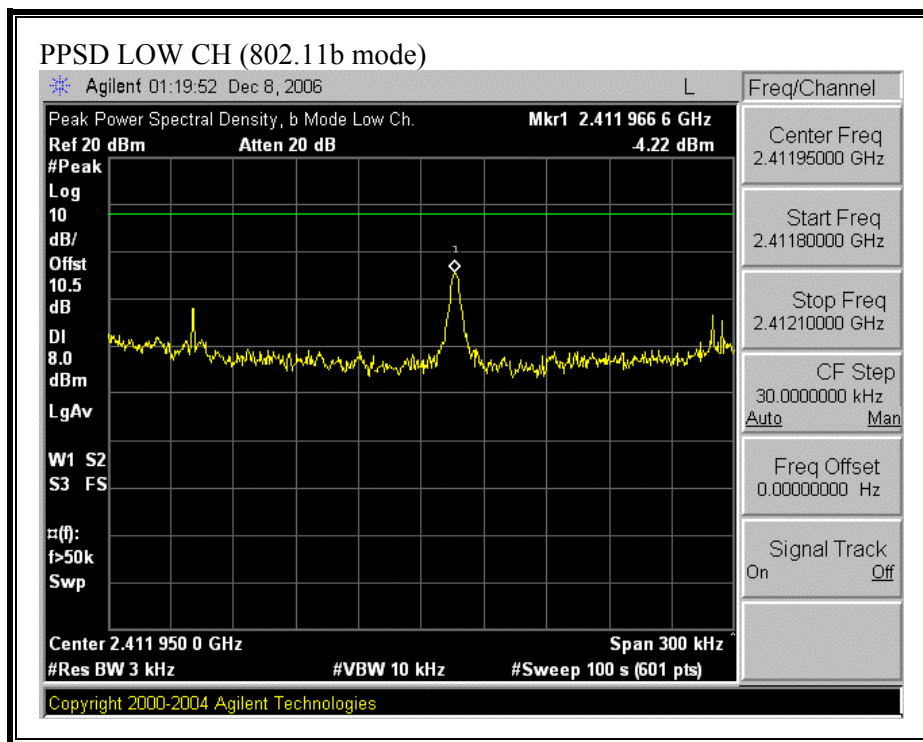
##### 802.11b Mode

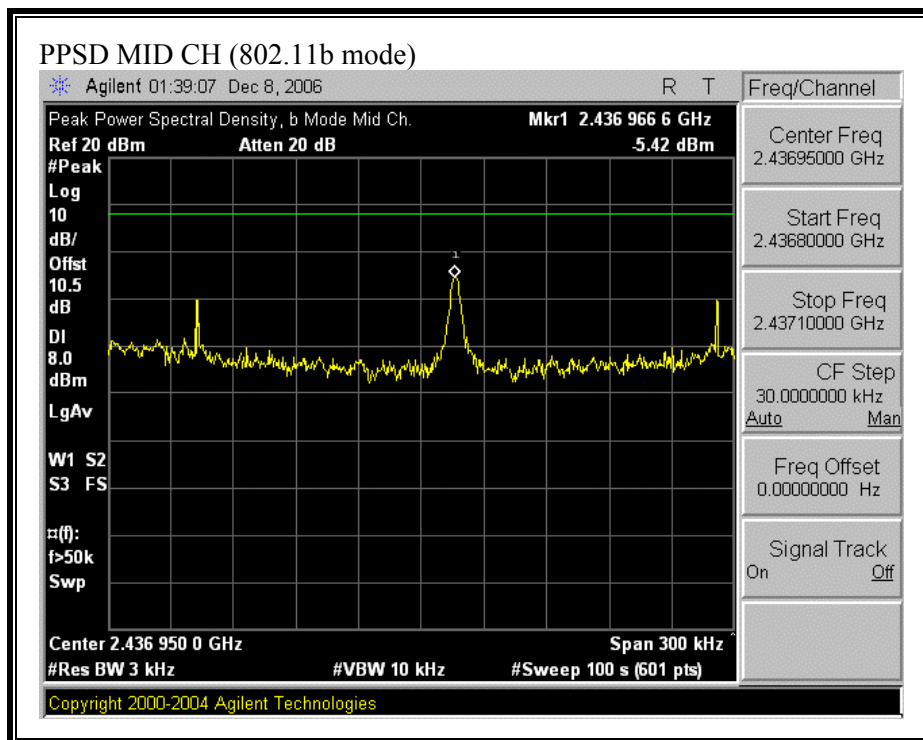
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-4.22	8	-12.22
Middle	2437	-5.42	8	-13.42
High	2462	-7.86	8	-15.86

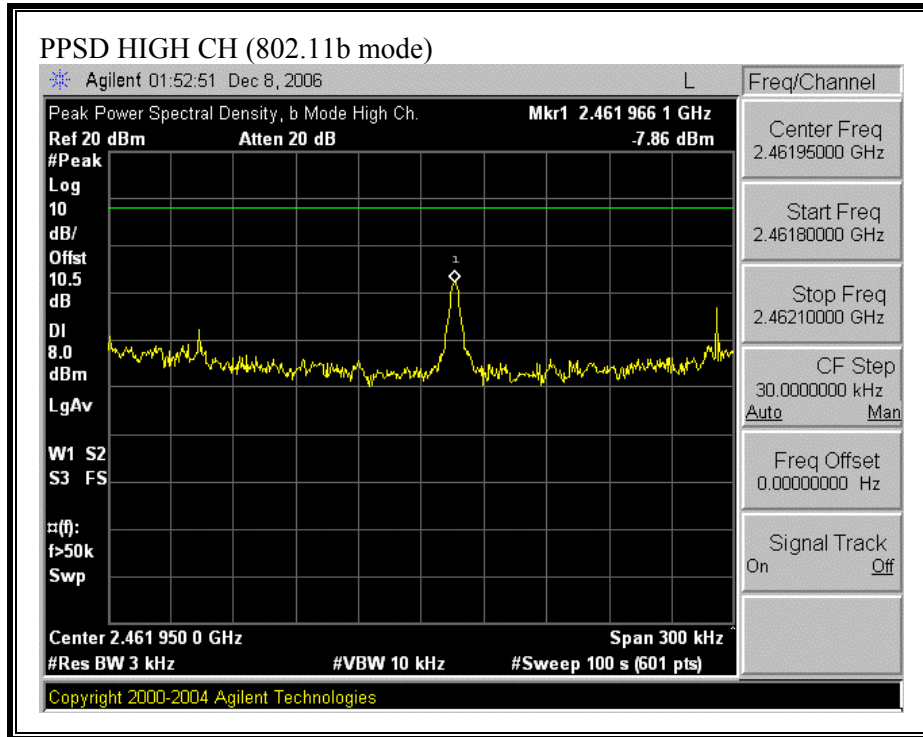
##### 802.11g Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-3.08	8	-11.08
Middle	2437	-1.37	8	-9.37
High	2462	-4.97	8	-12.97

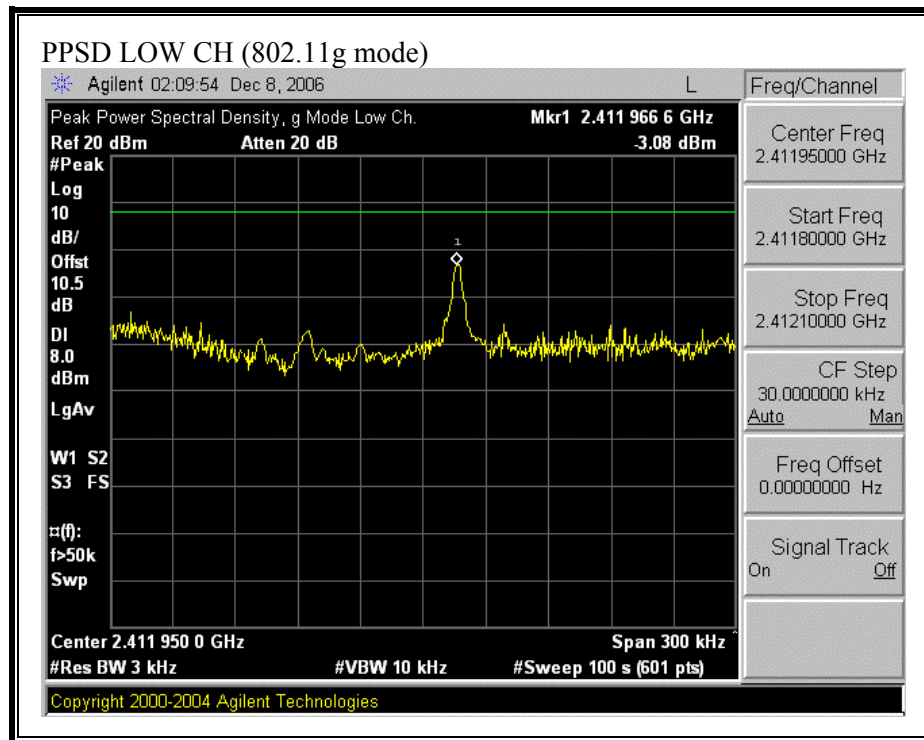
**PEAK POWER SPECTRAL DENSITY (802.11b MODE)**

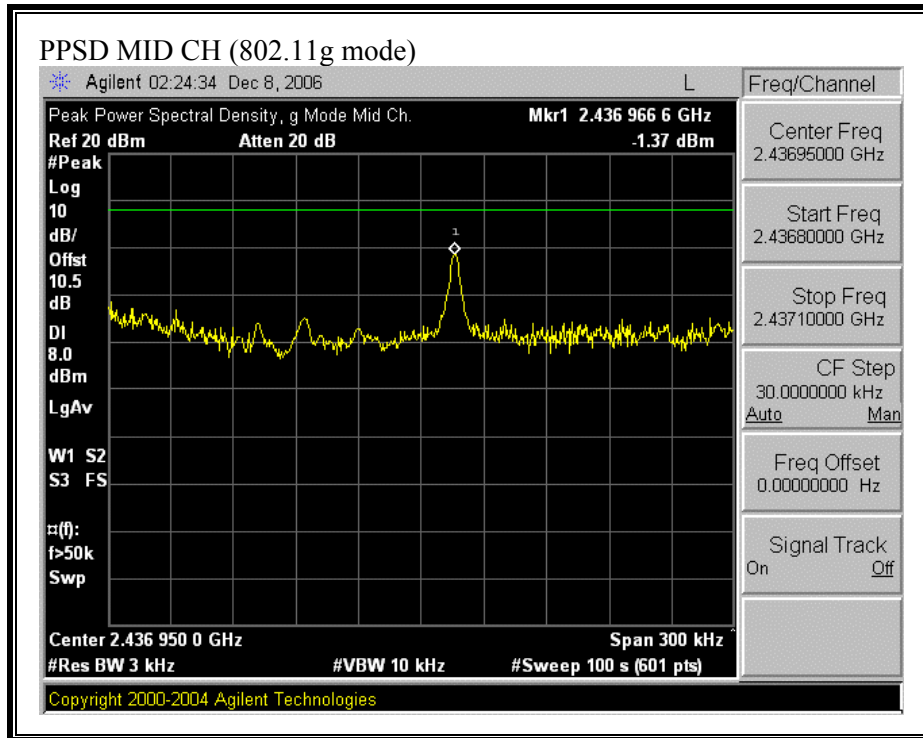


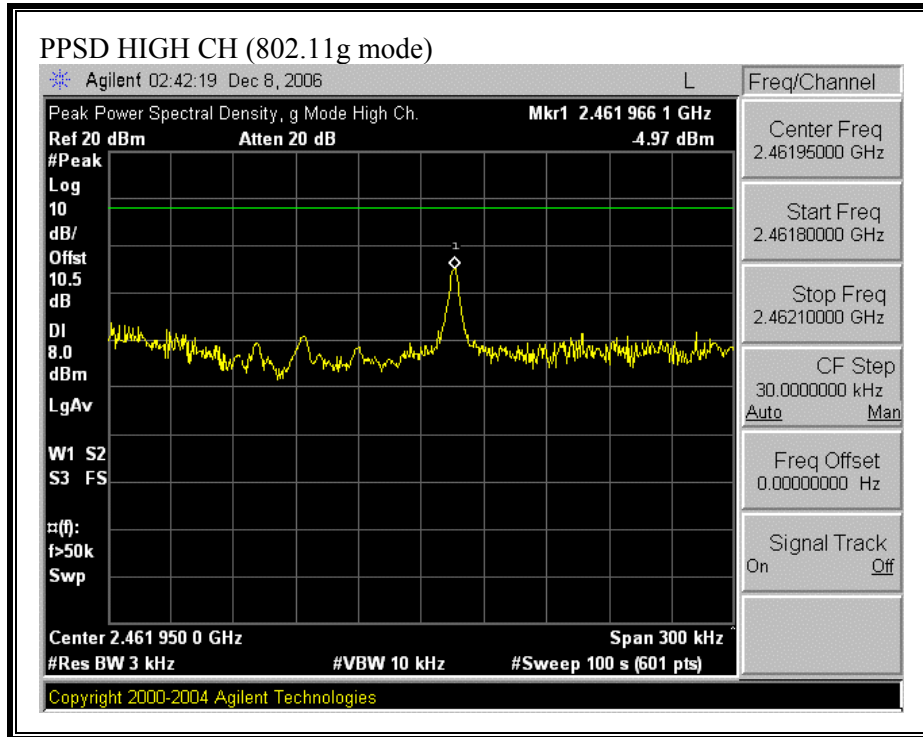




**PEAK POWER SPECTRAL DENSITY (802.11g MODE)**







## 7.1.6. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

§15.247 (c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. 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)).

Conducted power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

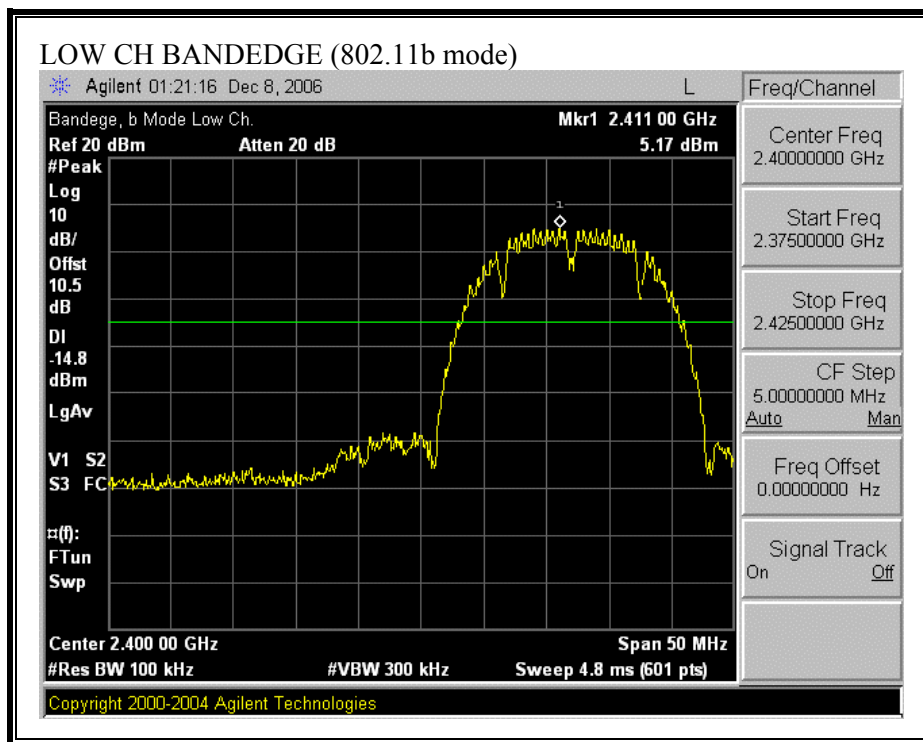
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

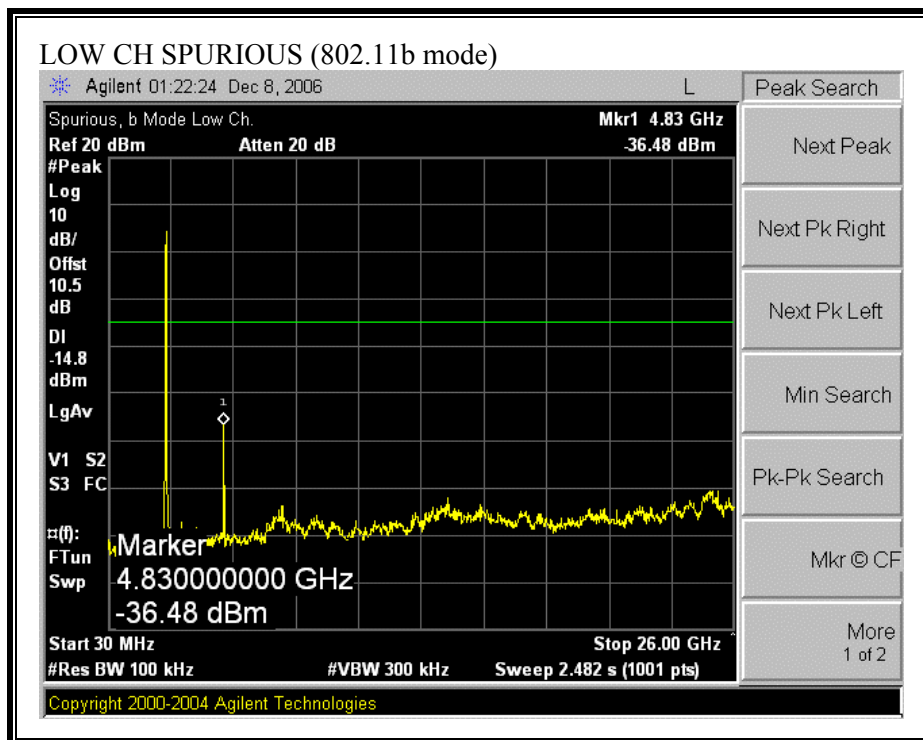
### RESULTS

No non-compliance noted:

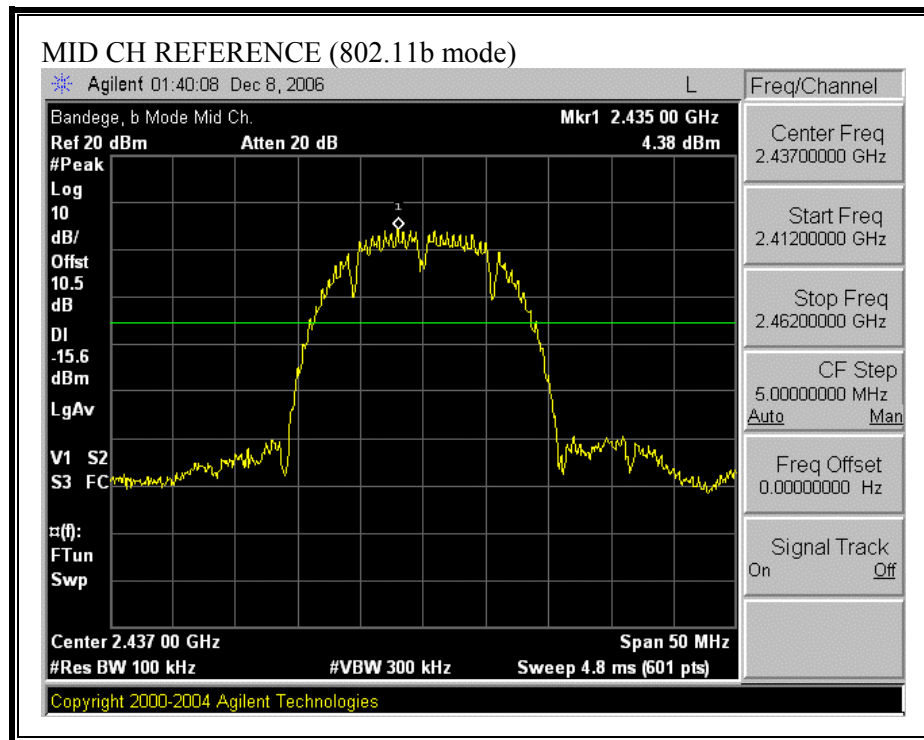


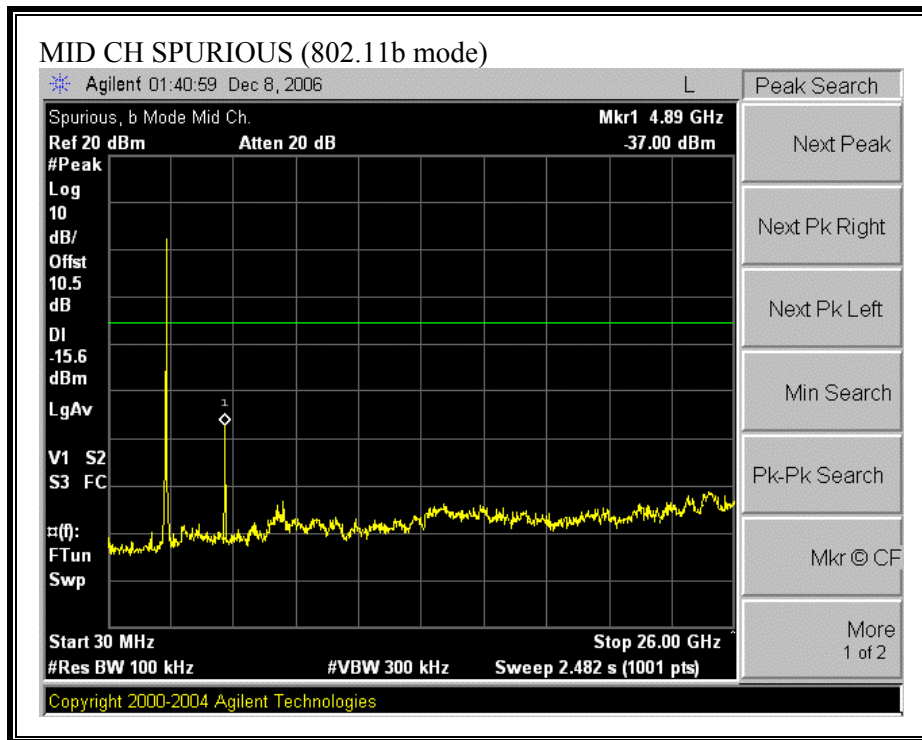
**SPURIOUS EMISSIONS, LOW CHANNEL (802.11b MODE)**



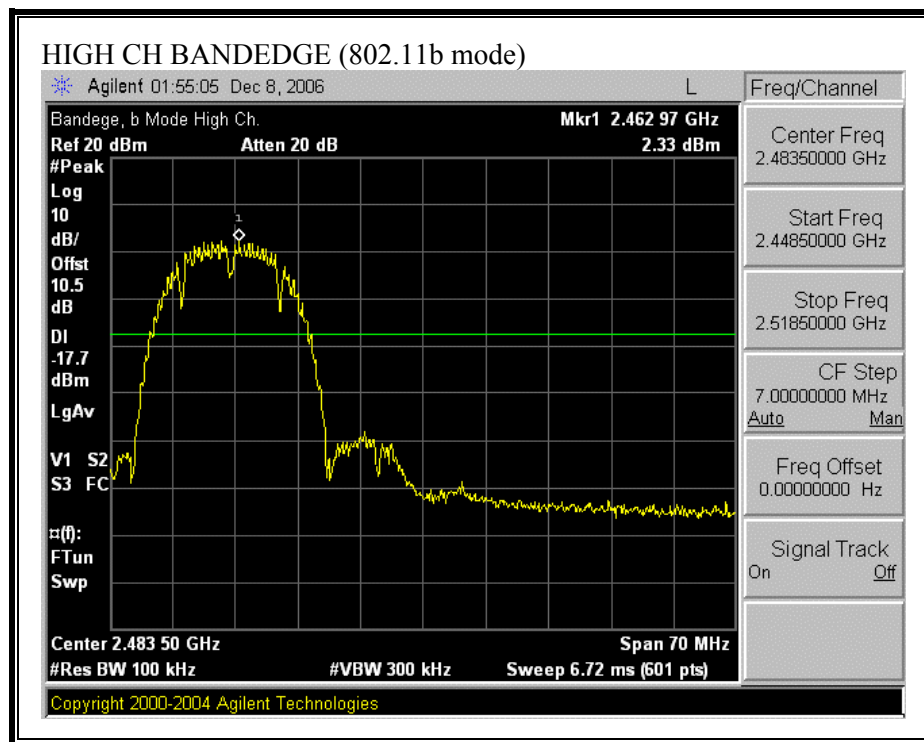


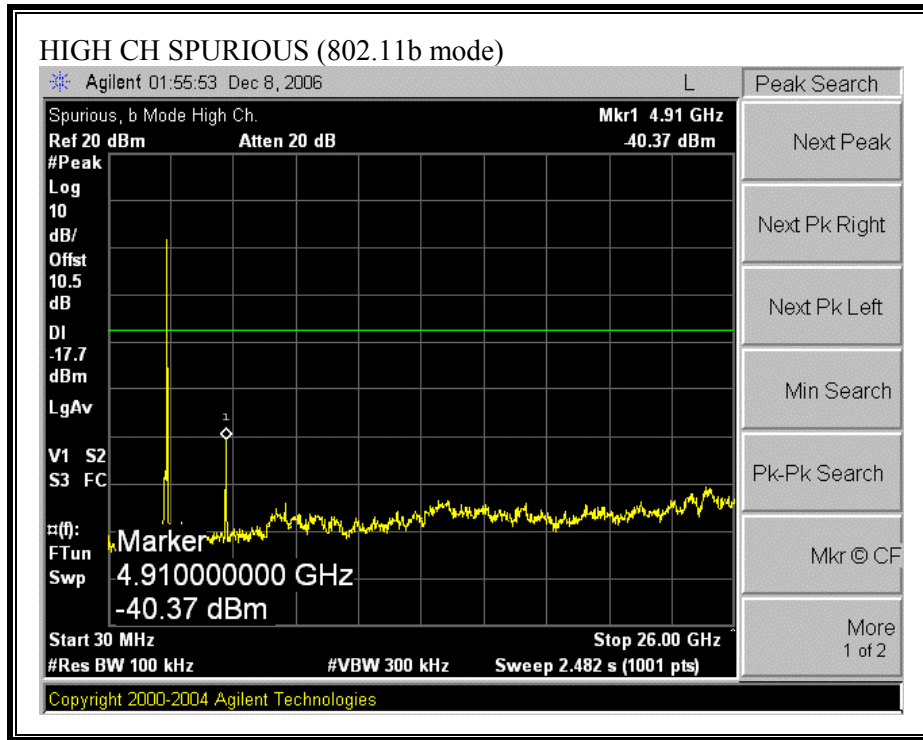
**SPURIOUS EMISSIONS, MID CHANNEL (802.11b MODE)**



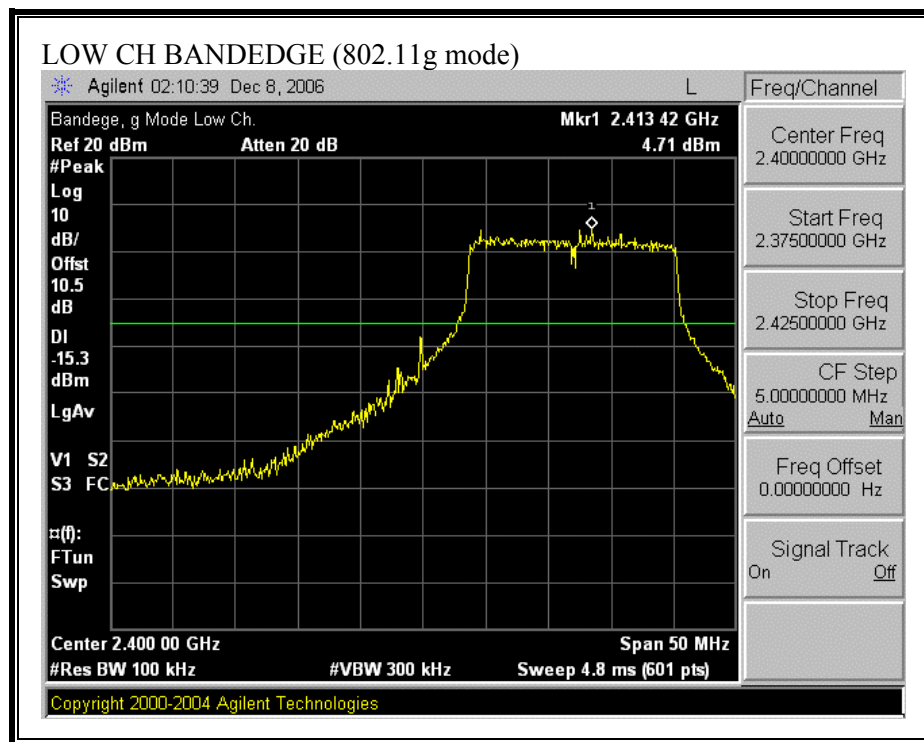


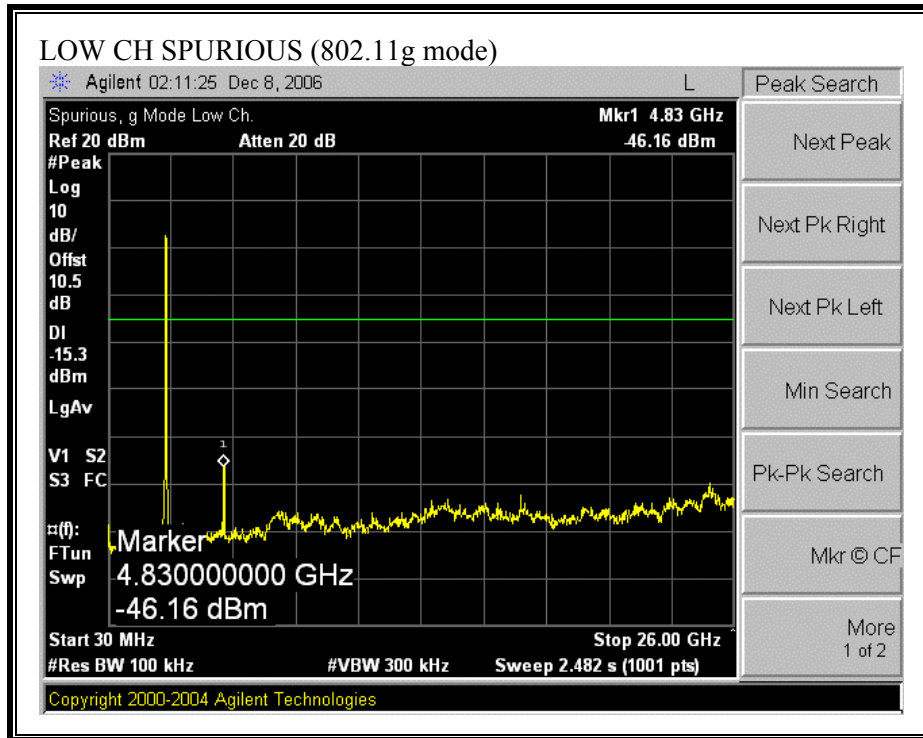
**SPURIOUS EMISSIONS, HIGH CHANNEL (802.11b MODE)**





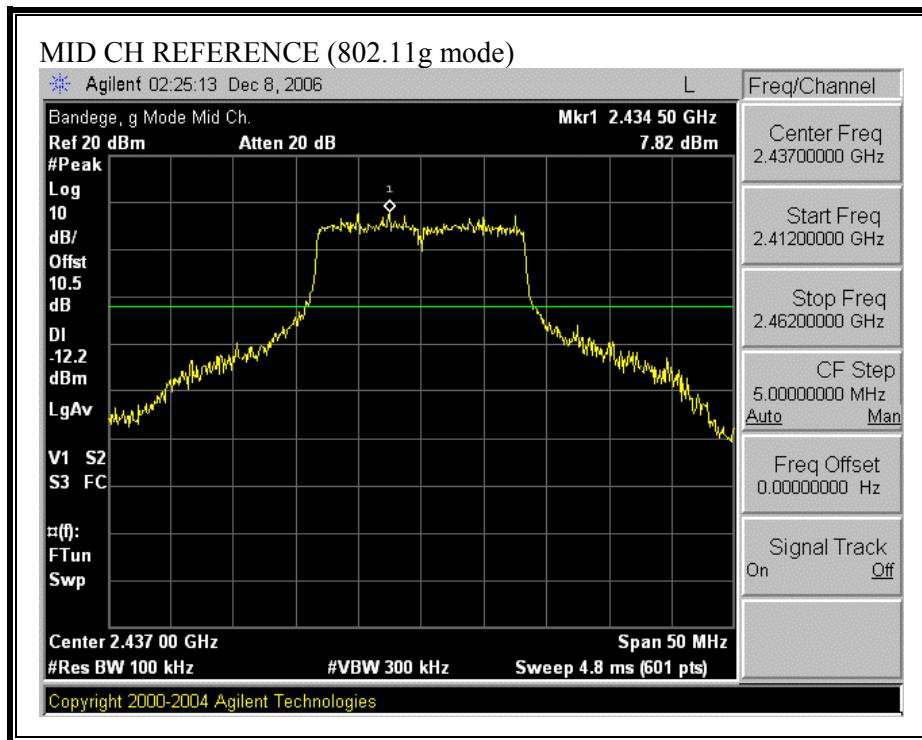
**SPURIOUS EMISSIONS, LOW CHANNEL (802.11g MODE)**

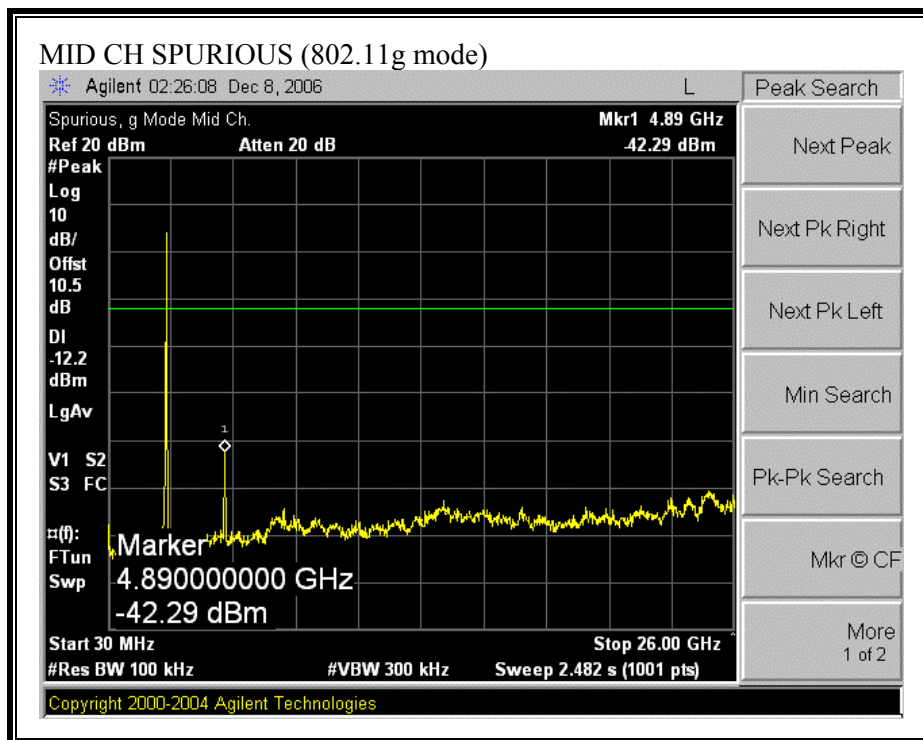




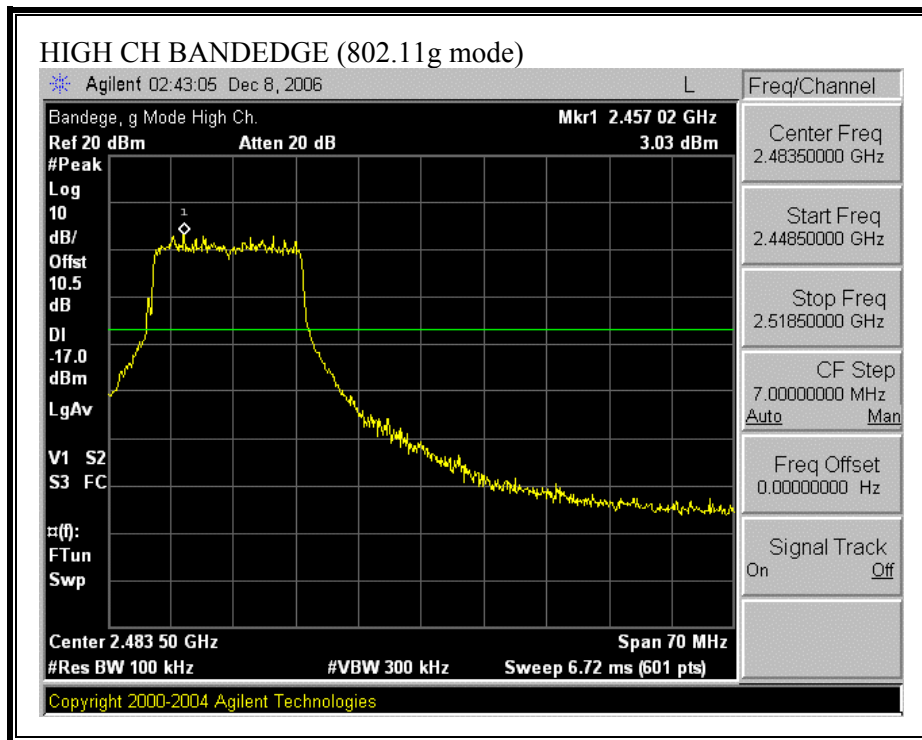


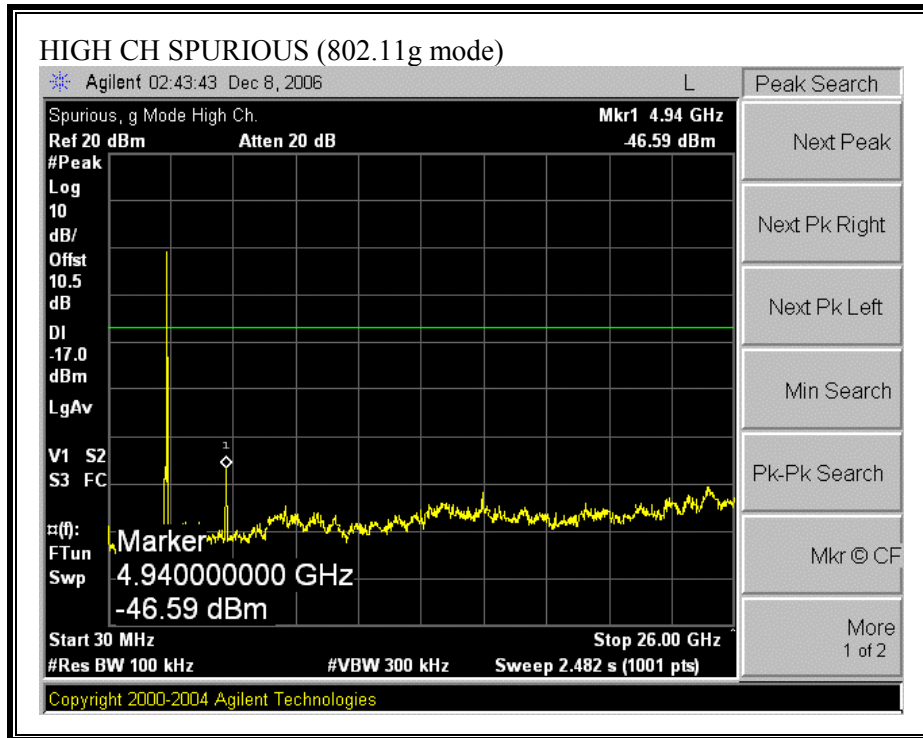
**SPURIOUS EMISSIONS, MID CHANNEL (802.11g MODE)**





**SPURIOUS EMISSIONS, HIGH CHANNEL (802.11g MODE)**





## 8. RADIATED EMISSIONS FOR 2400 TO 2483.5 MHz BAND

### 8.1.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

#### LIMITS

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41	322 - 335.4		

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

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

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

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

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

## **TEST PROCEDURE**

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

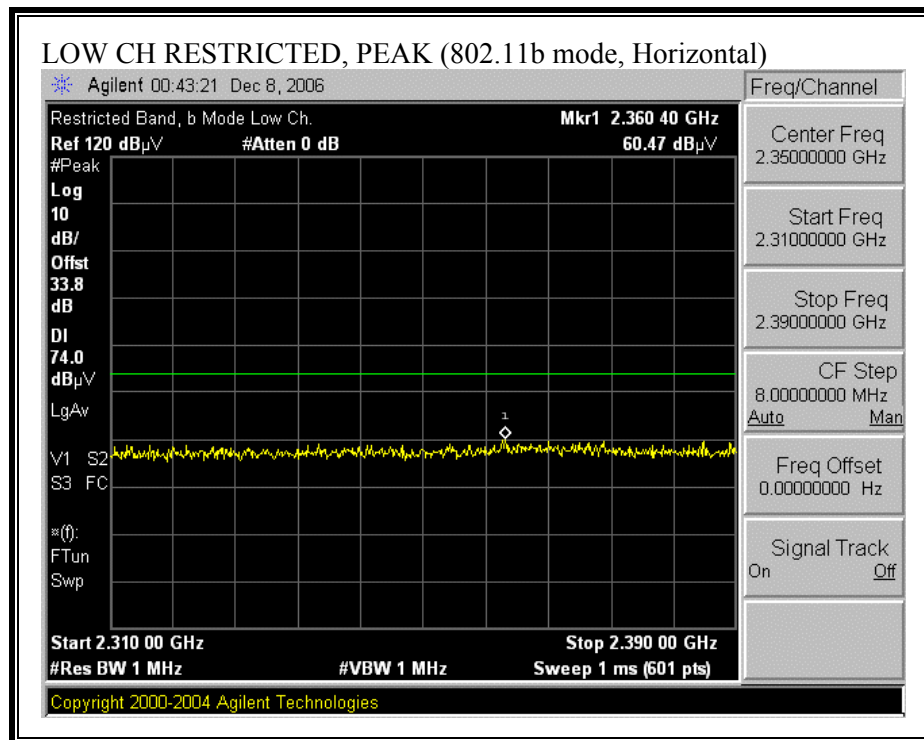
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

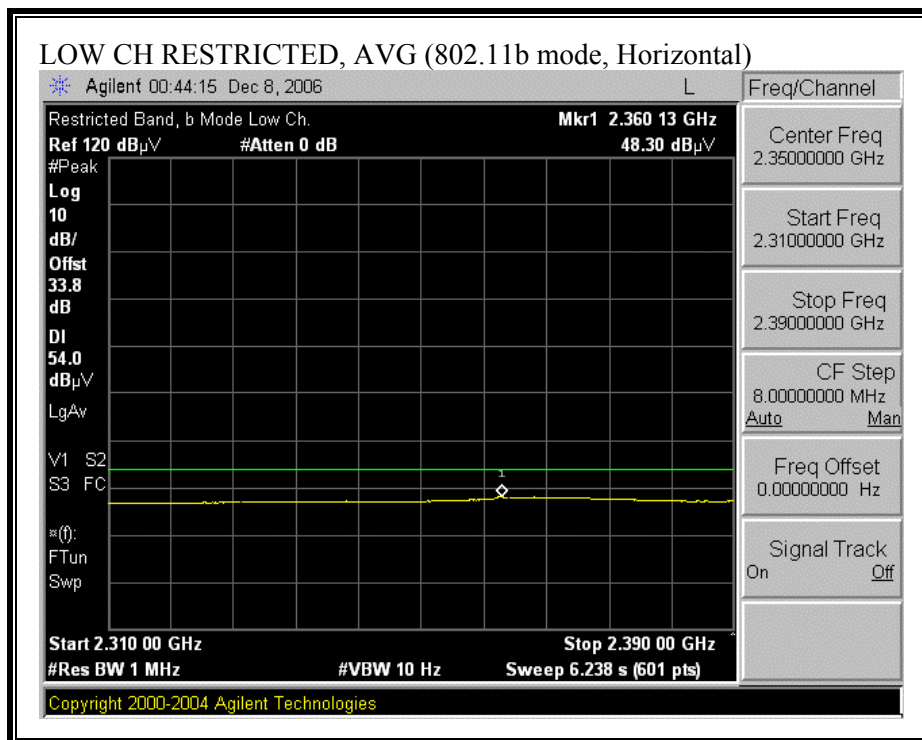
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

### 8.1.2. TRANSMITTER ABOVE 1 GHz

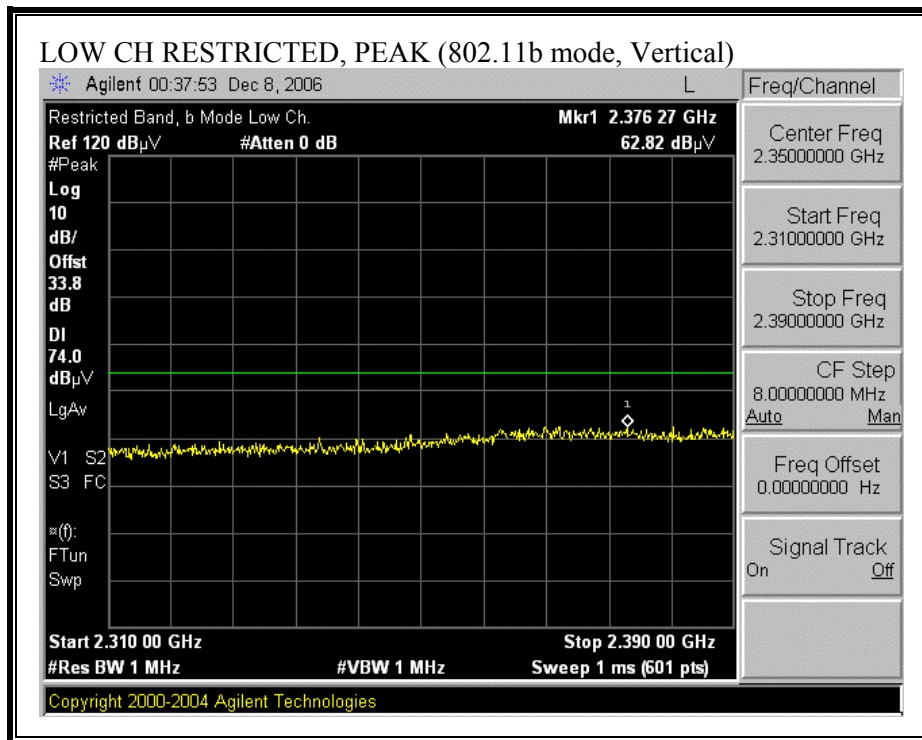
#### RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, HORIZONTAL)

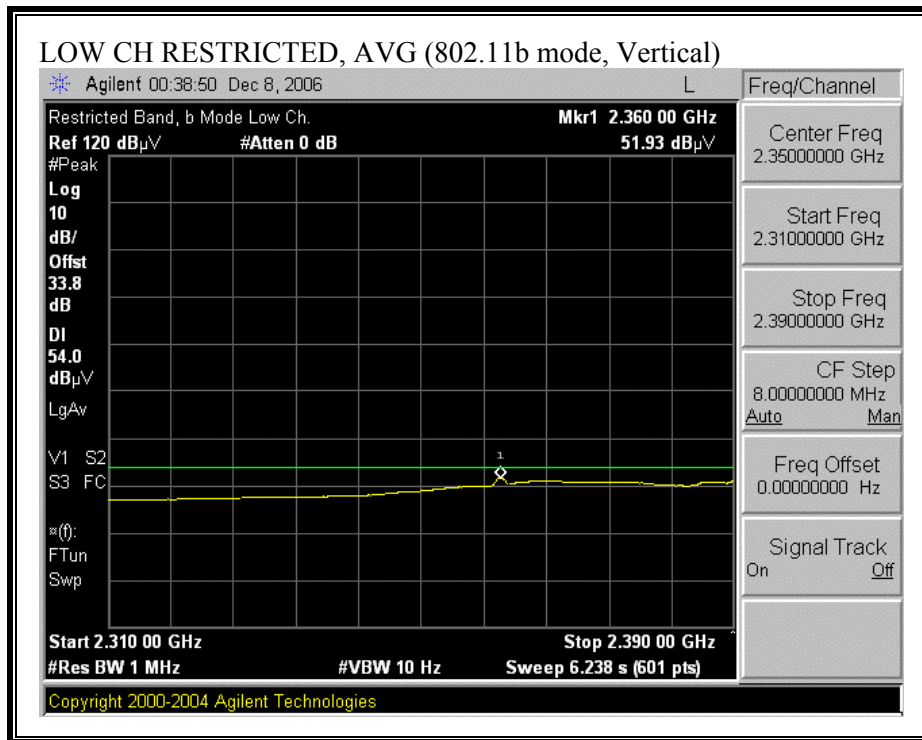




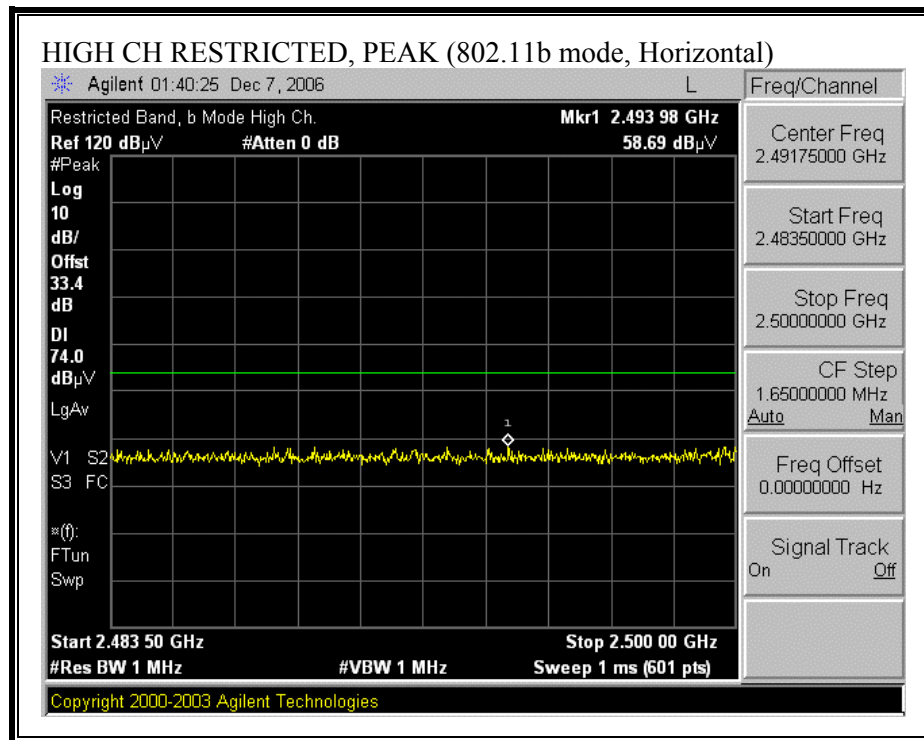


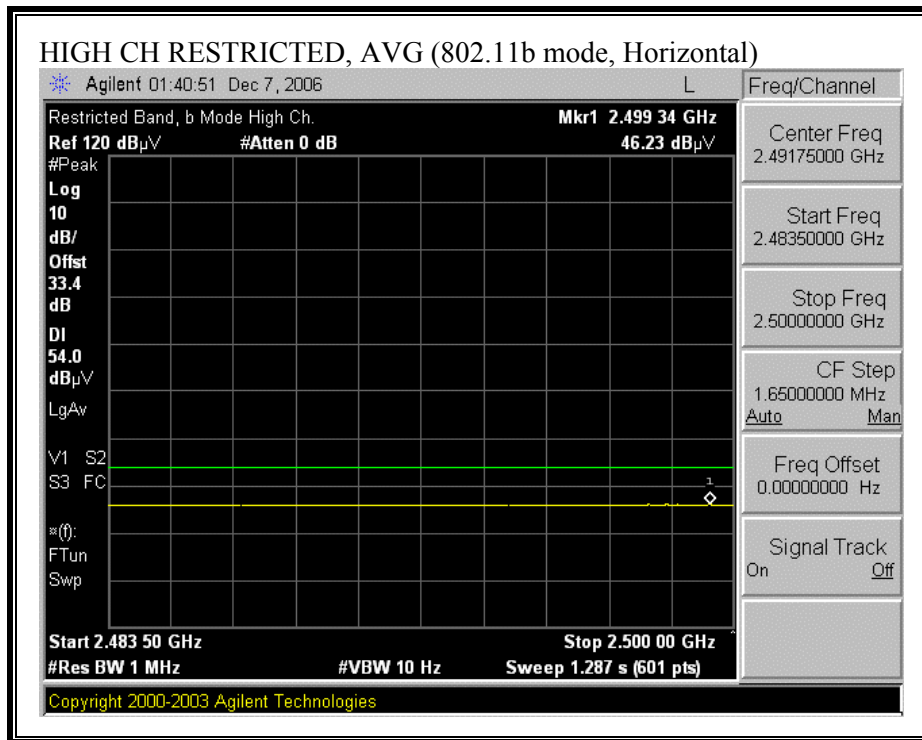
**RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, VERTICAL)**



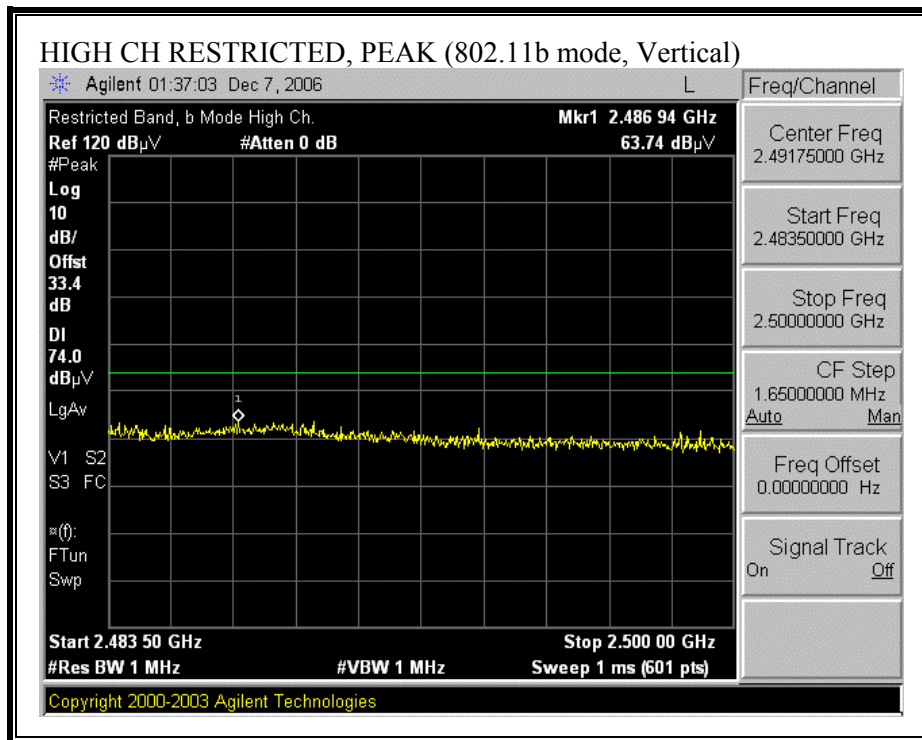


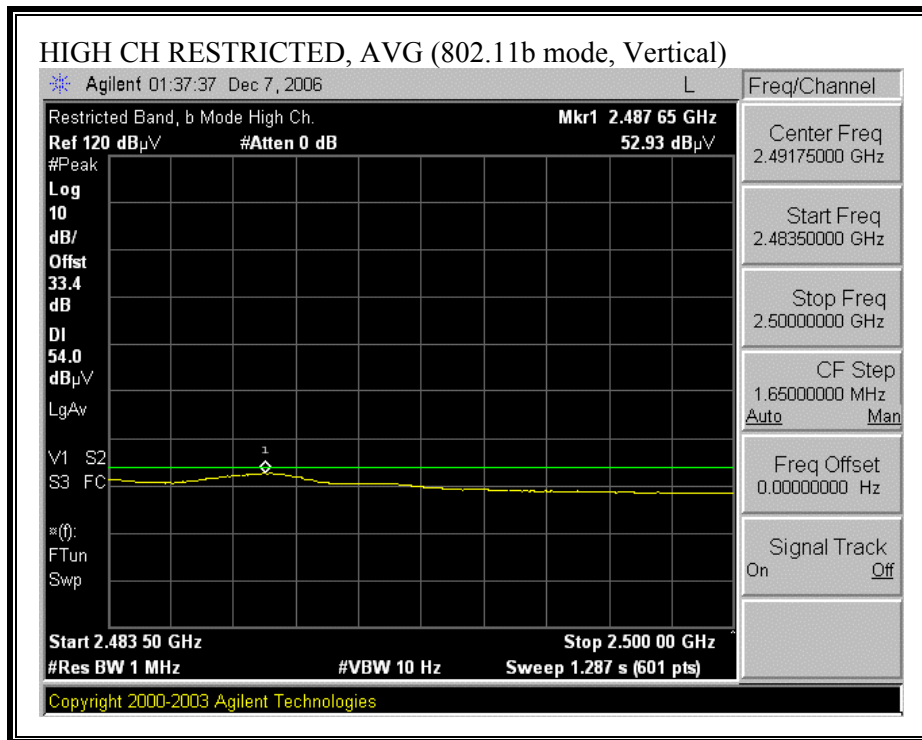
**RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, HORIZONTAL)**





**RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, VERTICAL)**

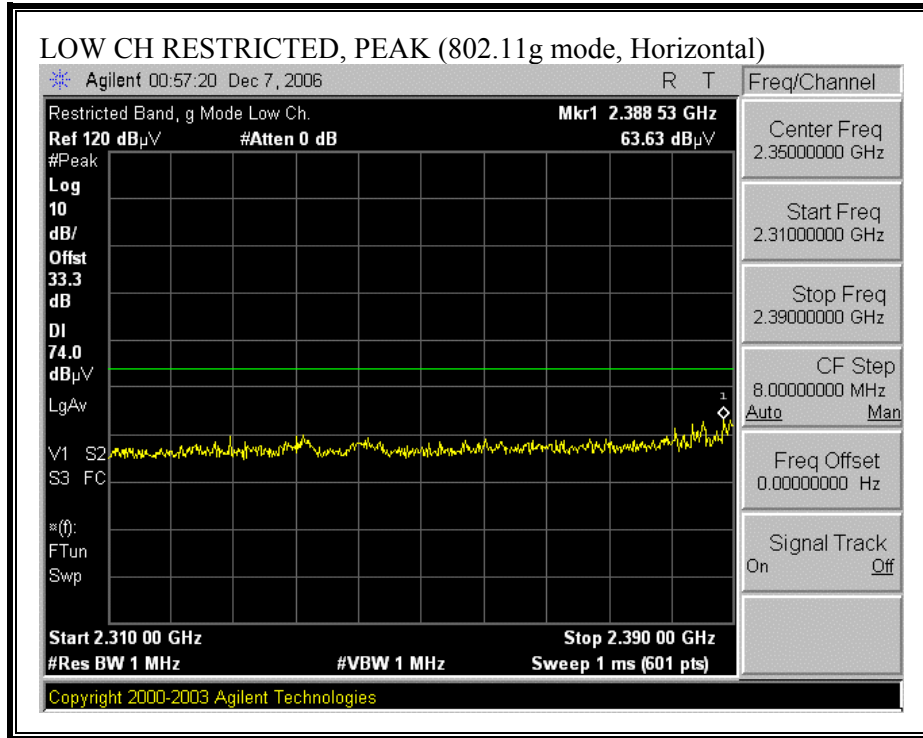


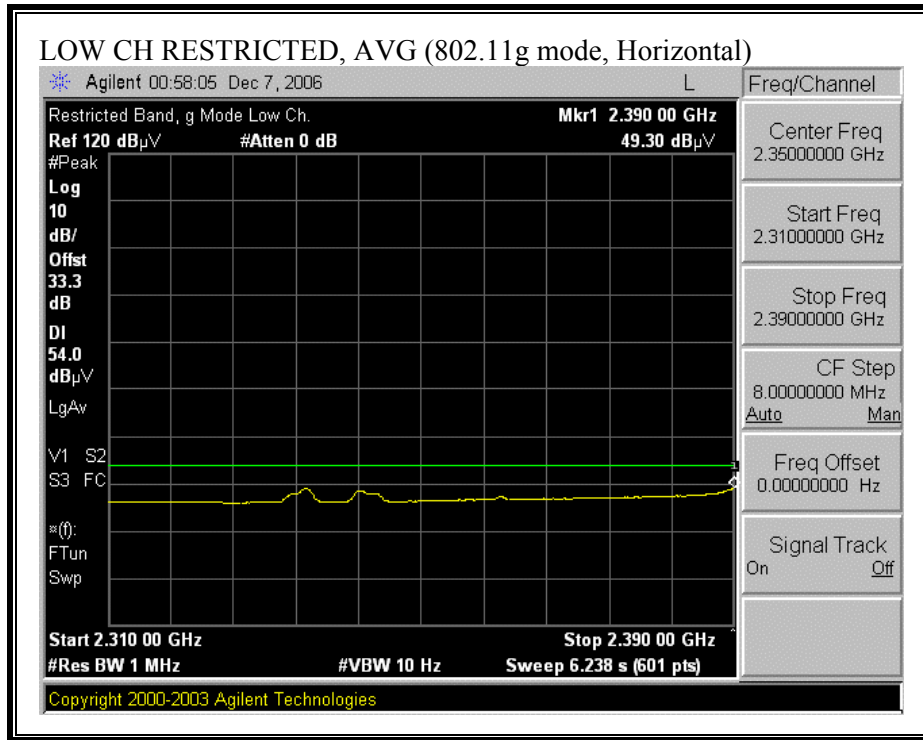


**HARMONICS AND SPURIOUS EMISSIONS (b MODE)**

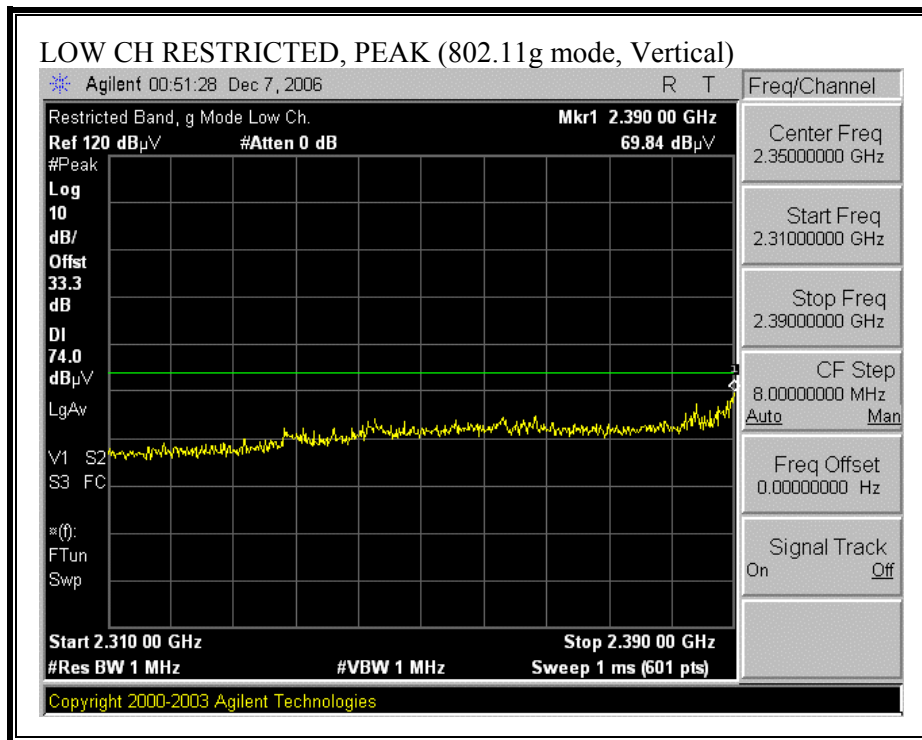
01/08/08 High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber																
Test Engr: William Zhuang																
Project #: 07U11219																
Company: SkyPilot Networks																
EUT Descr.: 802.11 a/b/g Fixed Wireless Node																
EUT M/N: SkyAccess DualBand																
Test Target: FCC 15.247																
Mode Oper: Tx b Mode																
f	Measurement Frequency		Amp	Preamp Gain		Avg Lim		Average Field Strength Limit								
Dist	Distance to Antenna		D Corr	Distance Correct to 3 meters		Pk Lim		Peak Field Strength Limit								
Read	Analyzer Reading		Avg	Average Field Strength @ 3 m		Avg Mar		Margin vs. Average Limit								
AF	Antenna Factor		Peak	Calculated Peak Field Strength		Pk Mar		Margin vs. Peak Limit								
CL	Cable Loss		HPF	High Pass Filter												
f	Dist	Read Pk	Read Avg	AF	CL	Amp	D Corr	Ftr	Peak	Avg	Pk Lim	Avg Lim	Pk Mar	Avg Mar	Notes	
GHz	(m)	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)	
<b>Low Ch.</b>																
4.824	3.0	54.2	52.3	33.7	3.6	-36.5	0.0	0.0	55.0	53.1	74.0	54.0	-19.0	-0.9	V	
7.236	3.0	48.8	42.5	35.2	4.3	-36.2	0.0	0.0	52.0	45.7	74.0	54.0	-22.0	-8.3	V	
4.824	3.0	52.5	50.3	33.7	3.6	-36.5	0.0	0.0	53.3	51.1	74.0	54.0	-20.7	-2.9	H	
7.236	3.0	44.3	35.9	35.2	4.3	-36.2	0.0	0.0	47.5	39.1	74.0	54.0	-26.5	-14.9	H	
<b>Mid Ch.</b>																
4.874	3.0	54.5	52.6	33.7	3.6	-36.5	0.0	0.0	55.4	53.5	74.0	54.0	-18.6	-0.5	V	
7.311	3.0	45.2	36.9	35.2	4.3	-36.2	0.0	0.0	48.4	40.1	74.0	54.0	-25.6	-13.9	V	
4.874	3.0	51.6	49.1	33.7	3.6	-36.5	0.0	0.0	52.5	49.9	74.0	54.0	-21.6	-4.1	H	
7.311	3.0	44.6	36.4	35.2	4.3	-36.2	0.0	0.0	47.8	39.6	74.0	54.0	-26.2	-14.4	H	
<b>High Ch.</b>																
4.924	3.0	54.9	52.7	33.8	3.6	-36.5	0.0	0.0	55.8	53.6	74.0	54.0	-18.2	-0.4	V	
7.386	3.0	46.2	38.2	35.2	4.3	-36.2	0.0	0.0	49.4	41.4	74.0	54.0	-24.6	-12.6	V	
4.924	3.0	51.0	47.8	33.8	3.6	-36.5	0.0	0.0	51.8	48.7	74.0	54.0	-22.2	-5.3	H	
7.386	3.0	44.1	34.3	35.2	4.3	-36.2	0.0	0.0	47.4	37.6	74.0	54.0	-26.6	-16.4	H	

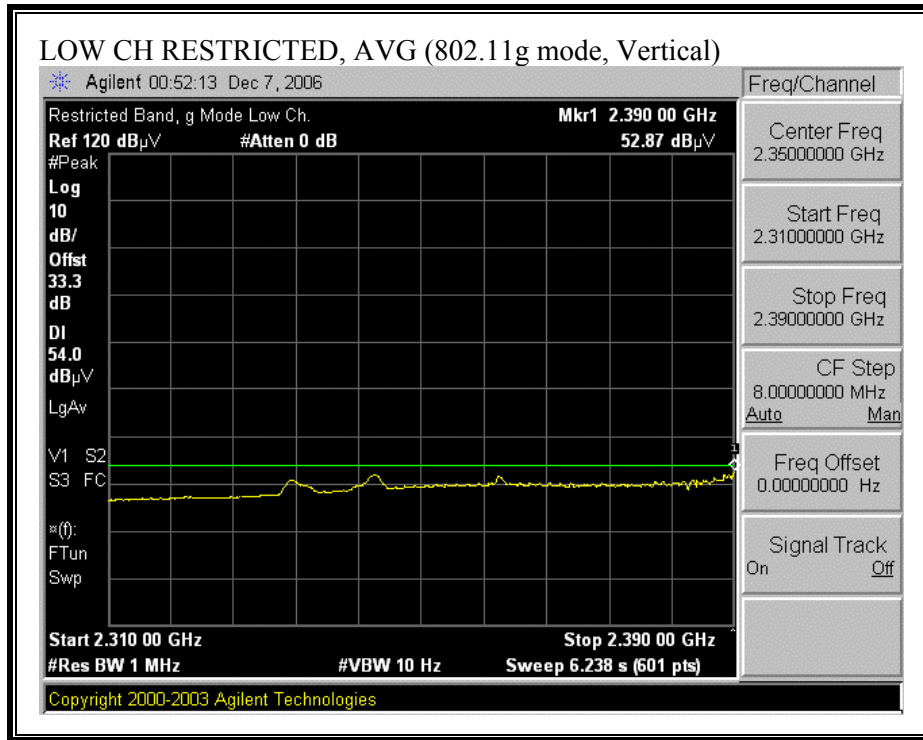




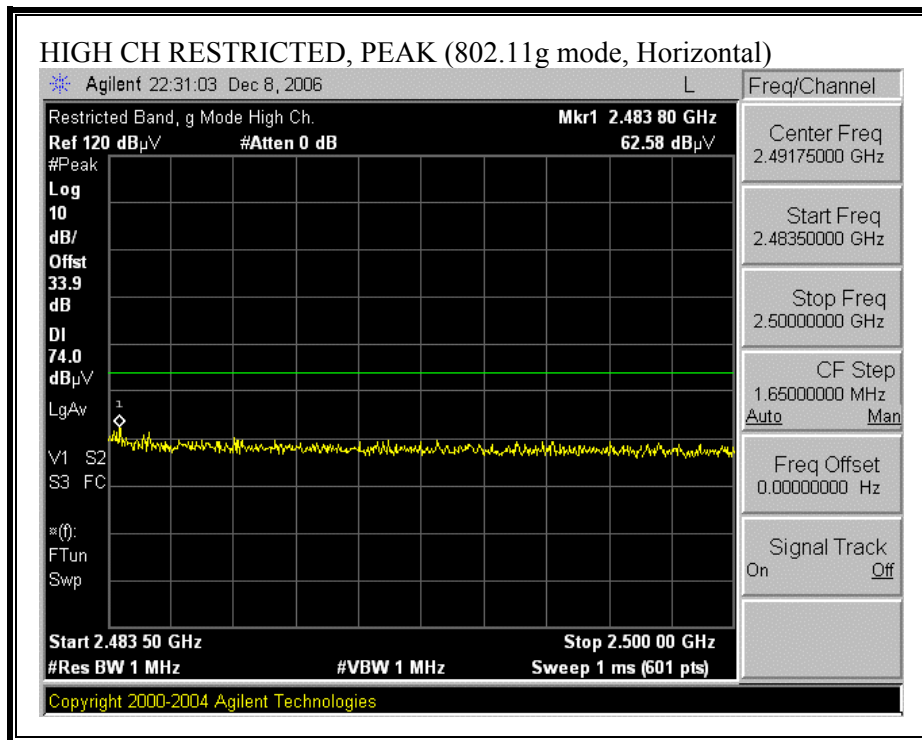


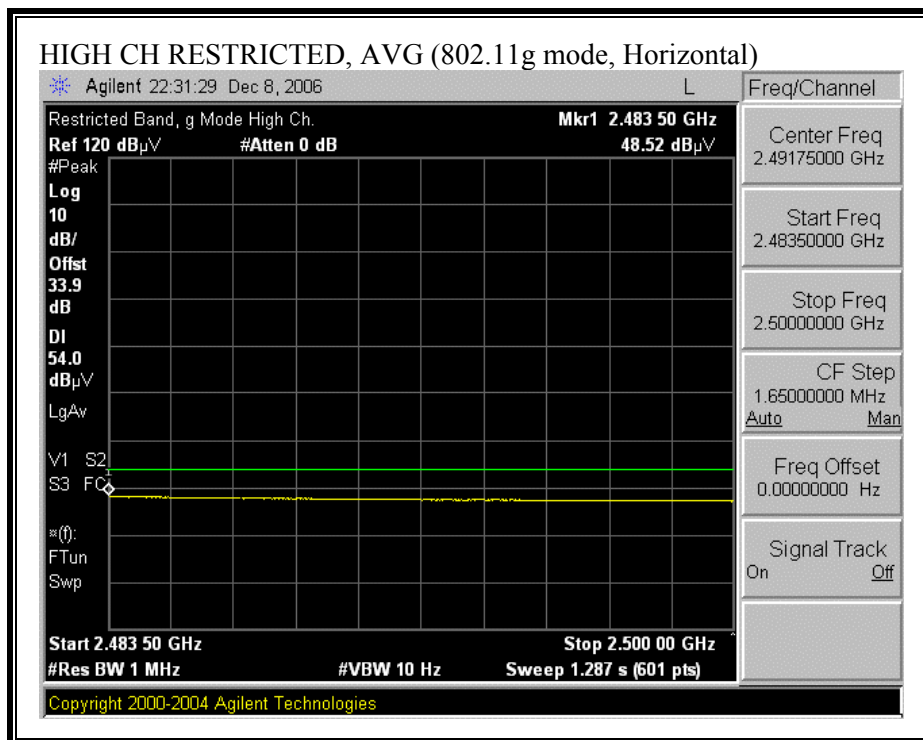
**RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, VERTICAL)**



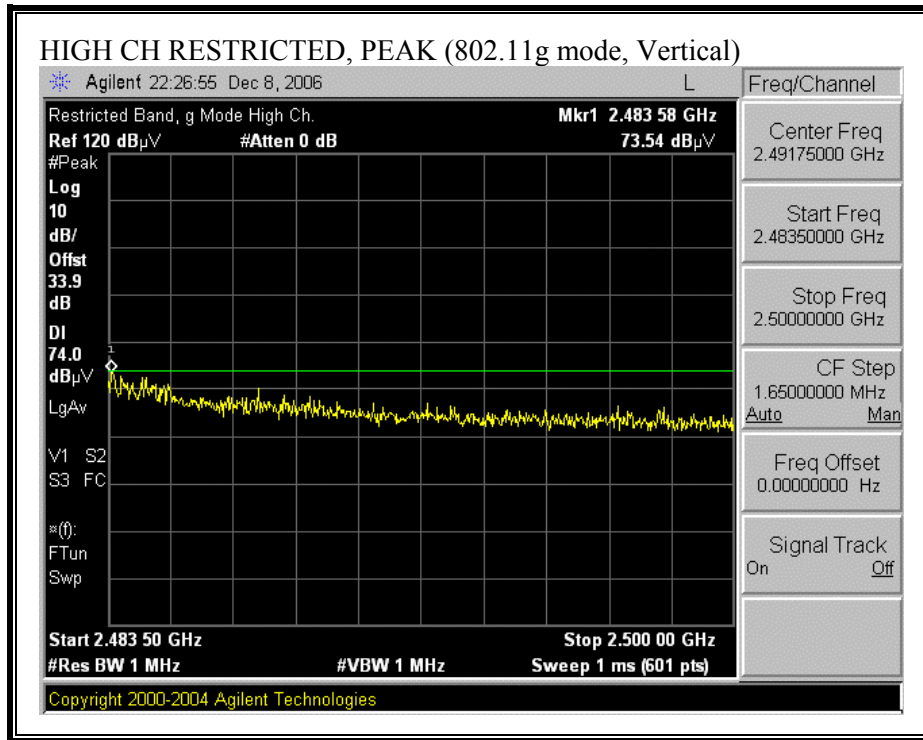


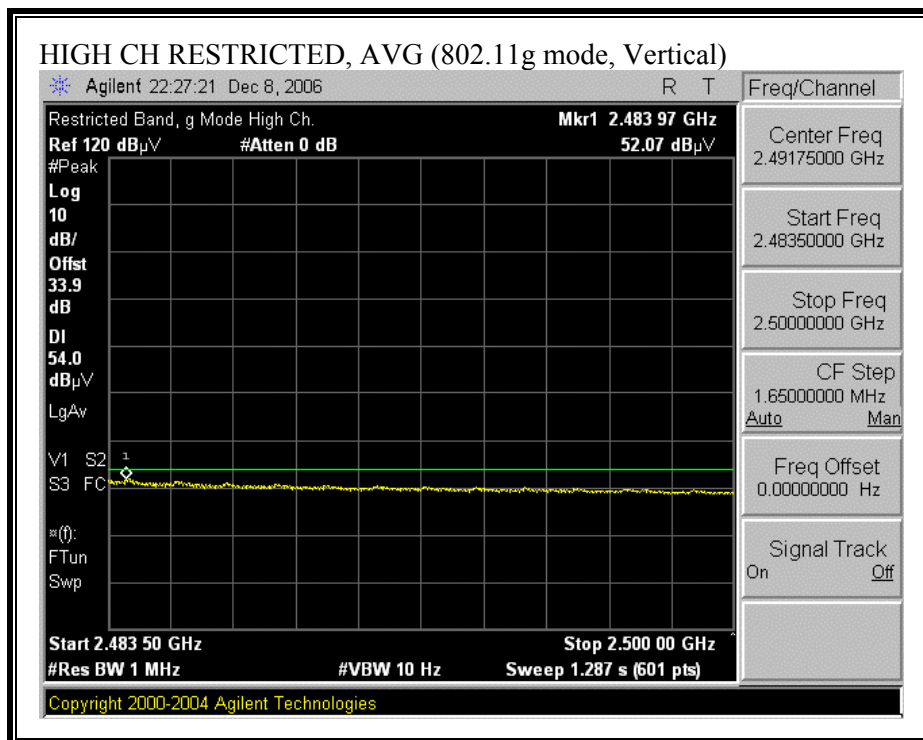
**RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, HORIZONTAL)**





**RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, VERTICAL)**





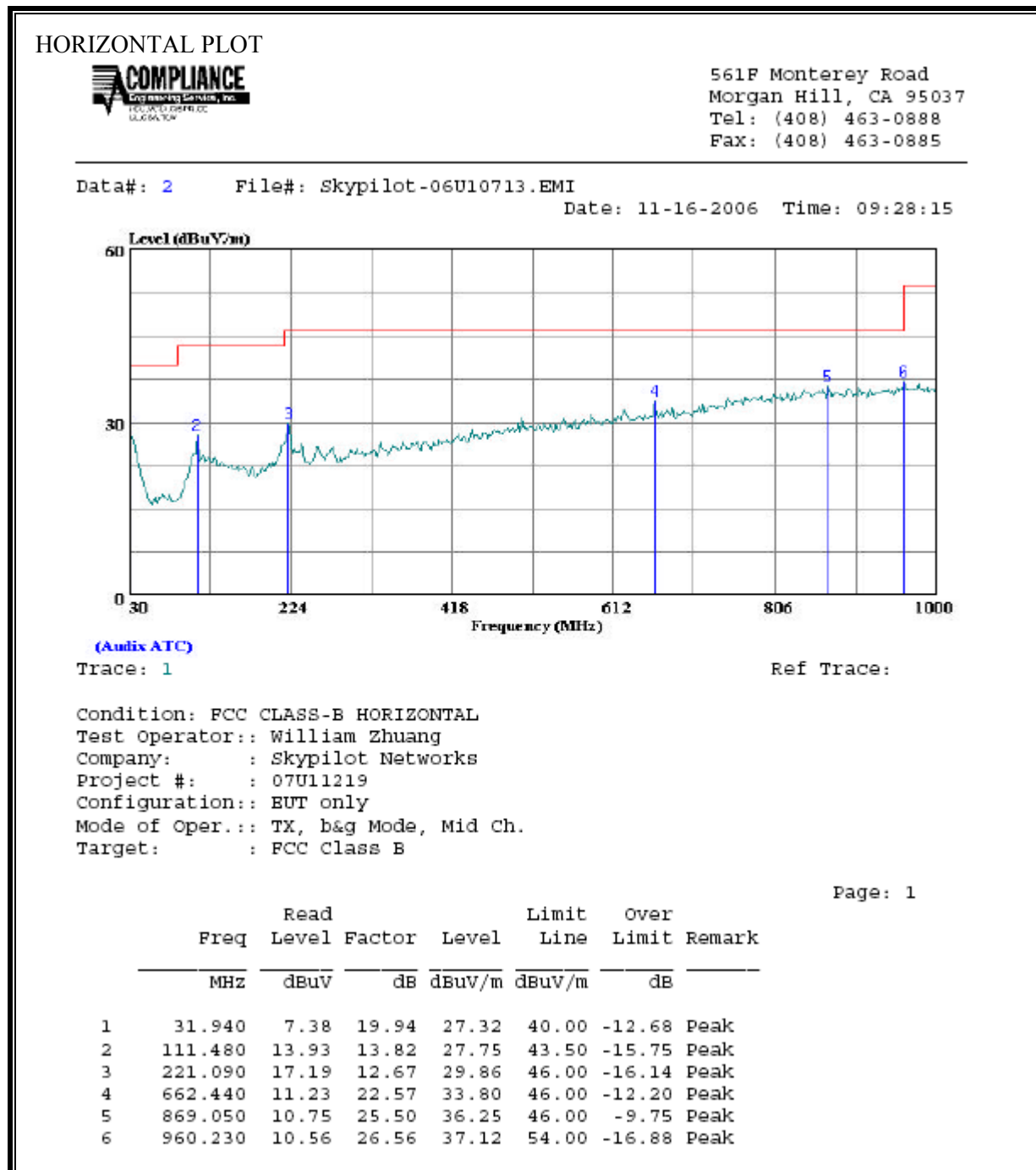


**HARMONICS AND SPURIOUS EMISSIONS (g MODE)**

01/08/08 High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber																
Test Engr: William Zhuang																
Project #: 06U10713																
Company: Skypilot Networks																
EUT Descr.: 802.11 a/b/g Fixed Wireless Node																
EUT M/N: SkyAccess DualBand																
Test Target: FCC 15.247																
Mode Oper: Tx g Mode																
f	Measurement Frequency		Amp	Preamp Gain		Avg Lim Average Field Strength Limit										
Dist	Distance to Antenna		D Corr	Distance Correct to 3 meters		Pk Lim Peak Field Strength Limit										
Read	Analyzer Reading		Avg	Average Field Strength @ 3 m		Avg Mar Margin vs. Average Limit										
AF	Antenna Factor		Peak	Calculated Peak Field Strength		Pk Mar Margin vs. Peak Limit										
CL	Cable Loss		HPF	High Pass Filter												
f GHz	Dist (m)	Read Pk dBuV	Read Avg dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fitr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)	
<b>Low Ch.</b>																
4.824	3.0	53.2	39.4	33.7	2.8	-36.5	0.0	0.6	53.8	40.0	74.0	54.0	-20.2	-14.0	V	
7.236	3.0	48.8	35.7	35.2	3.3	-36.2	0.0	0.6	51.7	38.6	74.0	54.0	-22.4	-15.4	V	
4.824	3.0	49.4	37.0	33.7	2.8	-36.5	0.0	0.6	50.0	37.7	74.0	54.0	-24.0	-16.3	H	
7.236	3.0	45.3	32.9	35.2	3.3	-36.2	0.0	0.6	48.2	35.8	74.0	54.0	-25.8	-18.2	H	
<b>Mid Ch.</b>																
4.874	3.0	55.9	42.1	33.7	2.8	-36.5	0.0	0.6	56.6	42.8	74.0	54.0	-17.4	-11.2	V	
7.311	3.0	51.0	38.0	35.2	3.3	-36.2	0.0	0.6	54.0	40.9	74.0	54.0	-20.0	-13.1	V	
4.874	3.0	50.0	37.1	33.7	2.8	-36.5	0.0	0.6	50.6	37.8	74.0	54.0	-23.4	-16.2	H	
7.311	3.0	45.1	33.1	35.2	3.3	-36.2	0.0	0.6	48.0	36.0	74.0	54.0	-26.0	-18.0	H	
<b>High Ch.</b>																
4.924	3.0	56.3	36.3	33.8	3.6	-36.5	0.0	0.6	57.8	37.8	74.0	54.0	-16.2	-16.2	V	
7.386	3.0	49.2	33.3	35.2	4.3	-36.2	0.0	0.6	53.1	37.2	74.0	54.0	-20.9	-16.8	V	
4.924	3.0	51.1	33.9	33.8	3.6	-36.5	0.0	0.6	52.6	35.4	74.0	54.0	-21.4	-18.6	H	
7.386	3.0	43.4	31.0	35.2	4.3	-36.2	0.0	0.6	47.3	34.9	74.0	54.0	-26.7	-19.1	H	

### 8.1.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



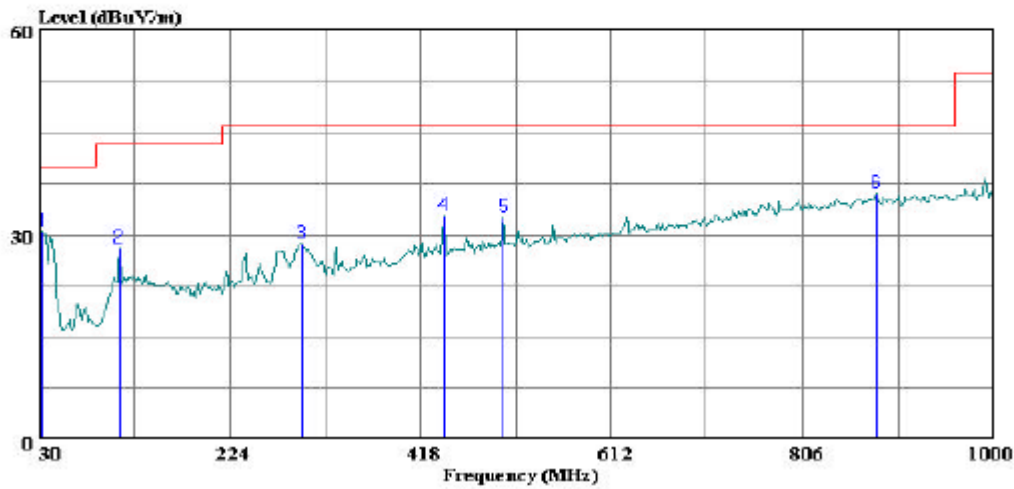
**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)**

VERTICAL PLOT



561F Monterey Road  
 Morgan Hill, CA 95037  
 Tel: (408) 463-0888  
 Fax: (408) 463-0885

Data#: 4 File#: Skypilot-06U10713.EMI Date: 11-16-2006 Time: 09:35:05



(Auxiliary ATC)

Trace: 3

Ref Trace:

Condition: FCC CLASS-B VERTICAL  
 Test Operator: William Zhuang  
 Company: Skypilot Networks  
 Project #: 07U11219  
 Configuration: BUT only  
 Mode of Oper.: TX, b&g Mode, Mid Ch.  
 Target: FCC Class B

Page: 1

	Read Freq	Read Level	Factor	Level	Limit	Over	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	33.880	11.55	19.05	30.60	40.00	-9.40	Peak
2	111.480	14.20	13.82	28.02	43.50	-15.48	Peak
3	297.720	13.09	15.59	28.68	46.00	-17.32	Peak
4	441.280	13.74	19.02	32.76	46.00	-13.24	Peak
5	502.390	12.30	20.24	32.54	46.00	-13.46	Peak
6	880.690	10.42	25.71	36.13	46.00	-9.87	Peak

## 9. POWERLINE CONDUCTED EMISSIONS

### LIMIT

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

### TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The resolution bandwidth is set to 9 kHz for both peak detection and quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

Line conducted data is recorded for both NEUTRAL and HOT lines.

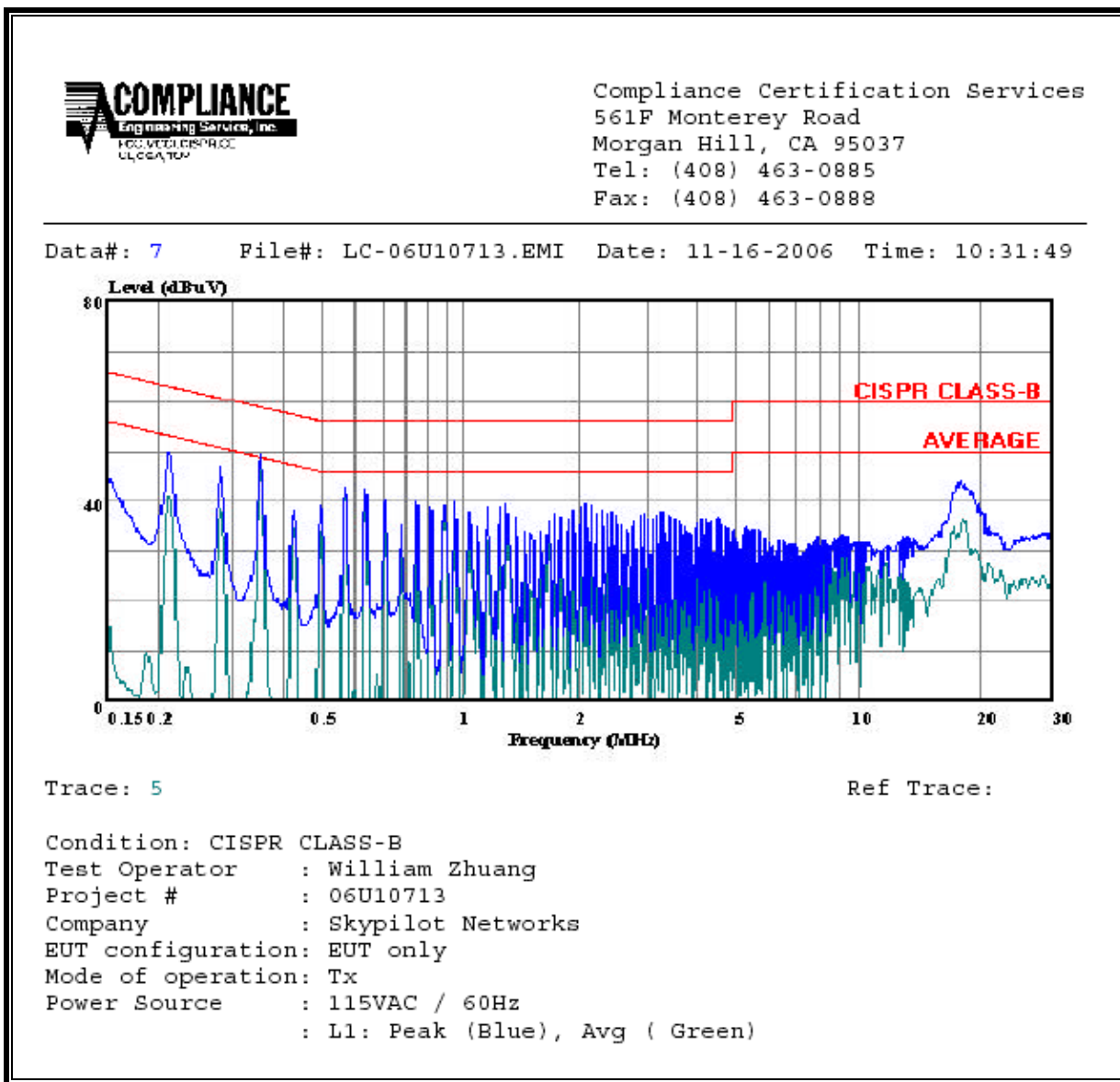
### RESULTS

No non-compliance noted:

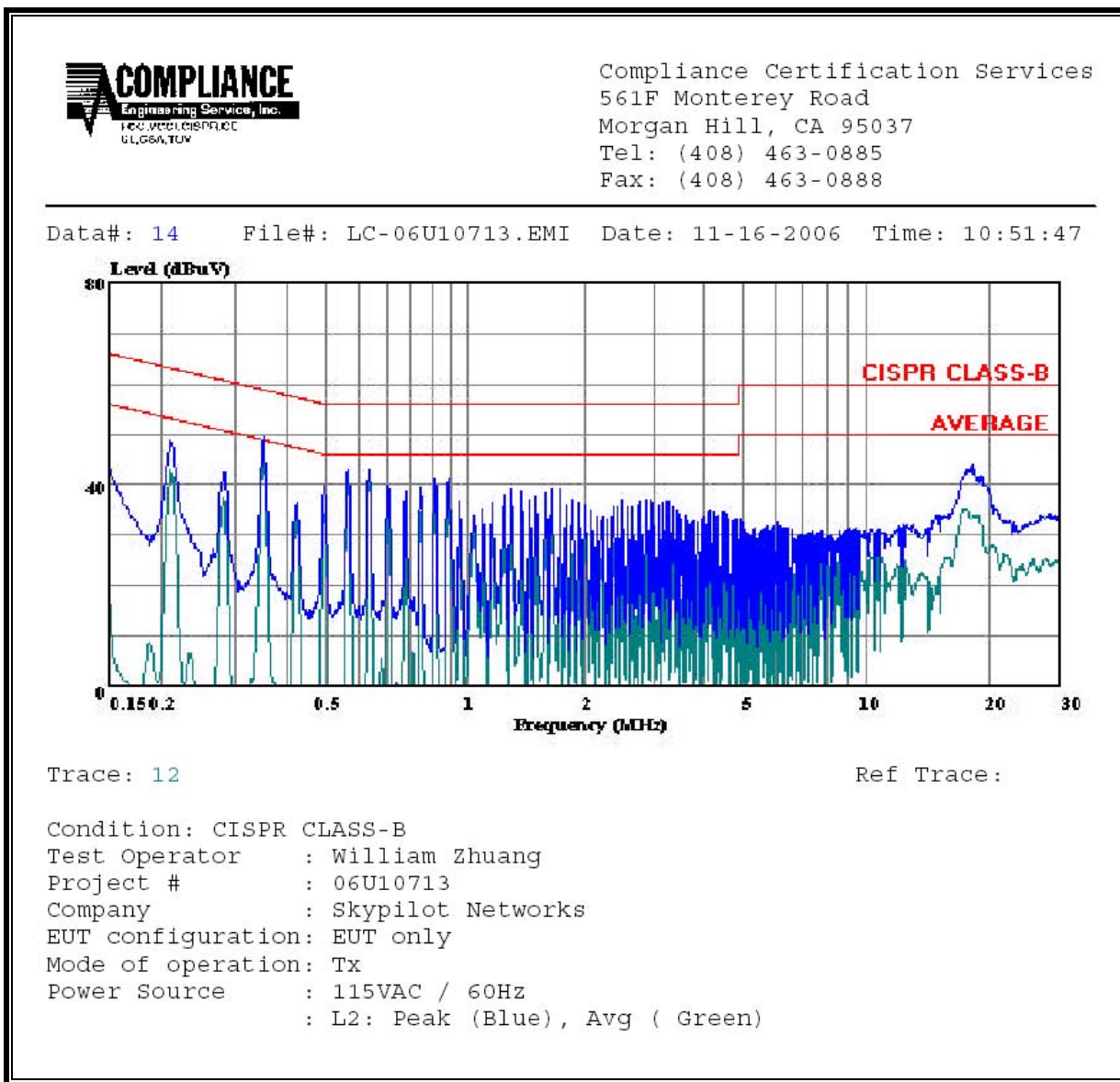
**6 WORST EMISSIONS**

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	FCC B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.21	49.88	--	41.18	0.00	63.17	53.17	-13.29	-11.99	L1
0.35	49.50	--	47.25	0.00	58.87	48.87	-9.37	-1.62	L1
17.94	44.39	--	35.97	0.00	60.00	50.00	-15.61	-14.03	L1
0.21	48.80	--	43.00	0.00	63.24	53.24	-14.44	-10.24	L2
0.35	49.52	--	47.60	0.00	58.92	48.92	-9.40	-1.32	L2
18.33	43.88	--	35.39	0.00	60.00	50.00	-16.12	-14.61	L2
6 Worst Data									

**LINE 1 RESULTS**



**LINE 2 RESULTS**



## 10. MAXIMUM PERMISSIBLE EXPOSURE

### LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—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 (minutes)
(A) Limits for Occupational/Controlled Exposures				
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
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34 .....	614	1.63	*(100)	30
1.34–30 .....	824/f	2.19/f	*(180/f <sup>2</sup> )	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
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

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.



## CALCULATIONS

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

Changing to units of Power to mW and Distance to cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = 100 * d \text{ (m)}$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000)) * G) / (3770 * S)}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW/cm<sup>2</sup>

Substituting the logarithmic form of power and gain using:

$$P \text{ (mW)} = 10^{(P \text{ (dBm)} / 10)} \text{ and}$$

$$G \text{ (numeric)} = 10^{(G \text{ (dBi)} / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm<sup>2</sup>

Rearranging terms to calculate the power density at a specific distance yields

$$S = 0.0795 * 10^{((P + G) / 10)} / (d^2)$$

**LIMITS**

From §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm<sup>2</sup>

**RESULTS**

No non-compliance noted: (MPE distance equals 20 cm)

<b>Mode</b>	<b>MPE Distance (cm)</b>	<b>Output Power (dBm)</b>	<b>Antenna Gain (dBi)</b>	<b>Power Density (mW/cm<sup>2</sup>)</b>
802.11b	20.0	18.16	7.40	0.07
802.11g	20.0	23.43	7.40	0.24

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

**CO-LOCATED MPE CALCULATIONS**

For multiple colocated transmitters operating simultaneously the total power density can be calculated by summing the Power \* Gain product (in linear units) of each transmitter.

yields

$$d = 0.282 * \sqrt{((P1 * G1) + (P2 * G2) + \dots + (Pn * Gn)) / S}$$

where

- d = distance in cm
- Px = Power of transmitter x in mW
- Gx = Numeric gain of antenna x
- S = Power Density in mW/cm<sup>2</sup>

In the table below, Power and Gain are entered in units of dBm and dBi respectively, then converted to their linear forms for the purpose of the calculations.

**LIMITS**

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm<sup>2</sup>

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m<sup>2</sup>

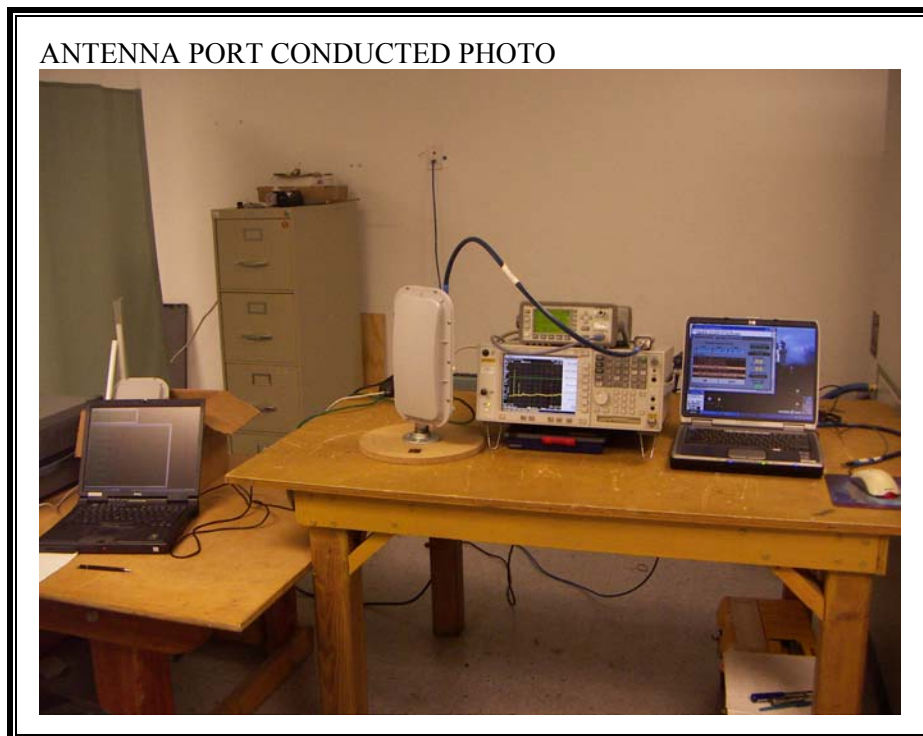
**RESULTS**

(MPE distance equals 20 cm)

Mode	Band	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)	FCC Power Density (mW/cm <sup>2</sup> )	IC Power Density (W/m <sup>2</sup> )
WLAN	2.4 GHz	23.43	7.40			
WLAN	5.6 GHz	12.46	16.50			
Combined				20.0	0.40	3.97

## 11. SETUP PHOTOS

### ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP

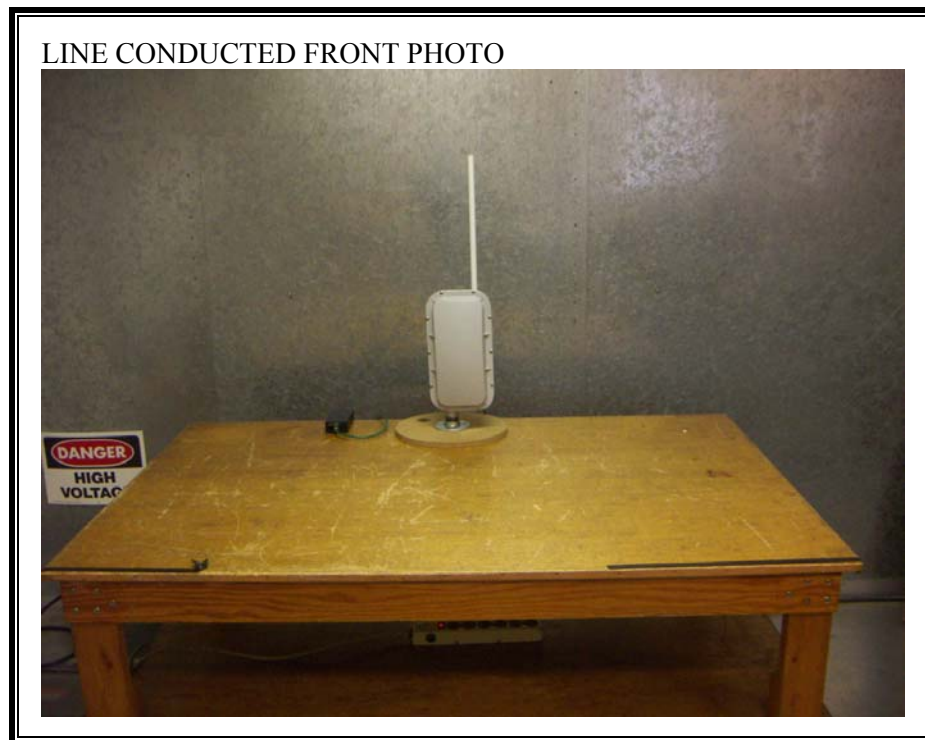


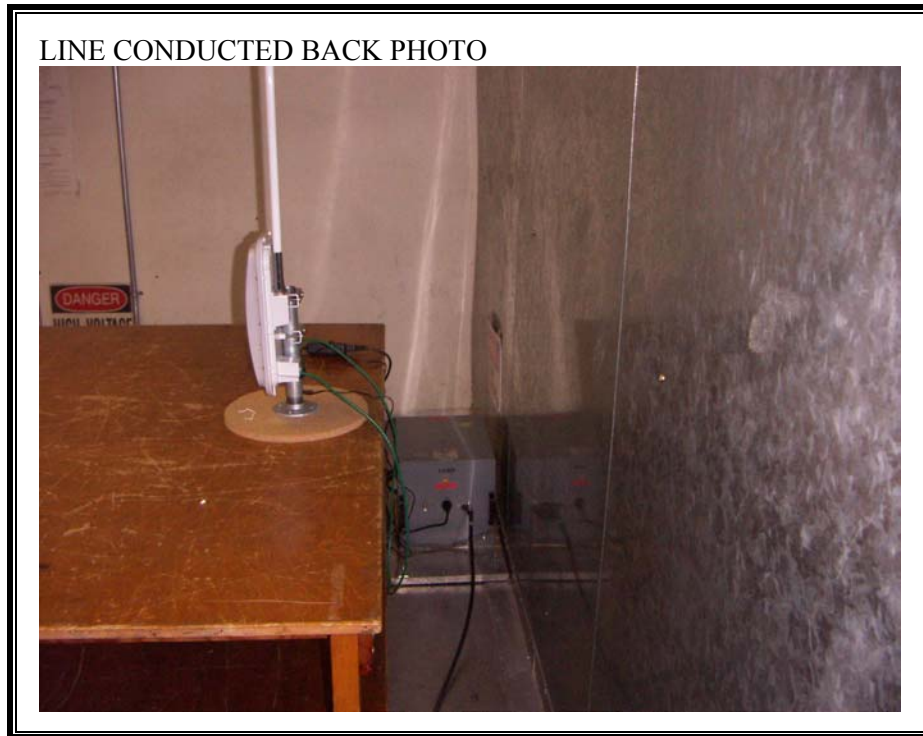
**RADIATED RF MEASUREMENT SETUP**





**POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP**





**END OF REPORT**