



**FCC CFR47 PART 15 SUBPART C  
CERTIFICATION**

**TEST REPORT**

**FOR**

**802.11 b/g ACCESS POINT**

**MODEL NUMBER: AR5BAP-00033**

**FCC ID: PPD-AR5BAP-00033**

**REPORT NUMBER: 03U2214-1**

**ISSUE DATE: OCTOBER 23, 2003**

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# 1. TEST RESULT CERTIFICATION

**COMPANY NAME:** Atheros Communications, Inc.  
529 Almanor Ave.  
Sunnyvale, CA 94085

**EUT DESCRIPTION:** 802.11 B/G ACCESS POINT

**MODEL:** AR5BAP-00033

**DATE TESTED:** AUGUST 27 – OCTOBER 22, 2003


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:** This document reports conditions under which testing was conducted and results of tests performed. 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.

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## 2. EUT DESCRIPTION

The EUT is an 802.11b/g transceiver operating in the 2400-2483.5 MHz band.

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

Frequency Band (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	23.41	219.28
2412 - 2462	802.11g Normal	25.25	334.97
2412 - 2462	802.11g Turbo	23.94	247.74

The radio has the option of either two configurations, configuration 1 is two external antennas, and configuration 2 is one external antenna and one internal antenna. The maximum antenna gain of the external antenna is 1.5 dBi and the maximum gain of the internal antenna is 0.0 dBi.

### 3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/1992, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

### 4. FACILITIES AND ACCREDITATION

The open area test sites and conducted measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, 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>.



No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

## 5. CALIBRATION AND UNCERTAINTY

### 5.1. 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.

### 5.2. MEASUREMENT UNCERTAINTY

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

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%.

### 5.3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
Spectrum Analyzer	HP	E4446A	US42510266	7/23/2004
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	11/20/2003
RF Filter Section	HP	85420E	3705A00256	11/20/2003
Antenna, Bicon/Log, 25 ~ 2000 MHz	ARA	LPB-2520/A	1185	3/6/2004
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	10/13/2004
Line Filter	Lindgren	LMF-3489	497	CNR
LISN, 10 kHz ~ 30 MHz	FCC	50/250-25-2	114	10/13/2004
EMI Test Receiver	R & S	ESHS 20	827129/006	7/17/2004
Peak Power Meter	Agilent	E4416A	GB41291160	11/7/2004
Peak / Average Power Sensor	Agilent	E9327A	US40440755	11/7/2004
Spectrum Analyzer	Agilent	E4407B	US400241238	1/27/2004
10dB Attenuator	Weinschel	56-10	K16148	N/A
2.4-2.5GHz Reject Filter	Micro-Tronics	BRM50702	1	N/A
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	2/4/2004
Amplifier 1-26GHz	MITEQ	NSP2600-SP	924341	4/25/2004
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	2/4/2004
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	9001-3245	2/4/2004

## 6. SETUP OF EQUIPMENT UNDER TEST

### SUPPORT EQUIPMENT

Device Type	Manufacturer	Model Number	Serial Number
USED FOR CONDUCTED TESTS			
Laptop	Toshiba	NA	J291200E8019
AC Adapter	Toshiba	PA3083U-1ACA	0536906G
12 VDC Power Adapter	Netgear	DV-1280-3UP	N/A
USED FOR RADIATED TESTS			
Laptop	IBM	THINKPAD	FX-0127003108
AC Adapter	IBM	O2K6661	N/A
AC Adapter (5.0VDC)	CUI, INC.	PSA-0151-A05	N/A

### CONDUCTED TEST SETUPS

The EUT was connected to the remote laptop via its Ethernet port. The EUT antenna port was connected to the appropriate test instruments as applicable for each test procedure. During the testing process the EUT was operated in a continuous mode.

### RADIATED TEST SETUPS

The EUT was connected to the remote laptop via its Ethernet port. Two configurations were tested and are documented in this report. Configuration 1 is the EUT with two external antennas, and configuration 2 is with one external antenna and one internal antenna. The worst-case results of the two external antenna configurations are reported for the external antenna results. During the testing process the EUT was operated in a continuous mode.



**I/O CABLES (CONFIG#1- TWO EXTERNAL ANTENNAS)**

Cable No	I/O Port	# of I/O Port	Connector Type	Type of Cable	Cable Length	Data Traffic	Bundled	Remark
1	RF ANTENNA	1	UFL	SHIELDED	0.2M	YES	NO	N/A
2	RF ANTENNA	1	UFL	SHIELDED	.13M	YES	NO	N/A
3	DC PWR	1	DC PWR	UNSHIELDED	1.86M	NO	NO	N/A
4	ETHERNET	4	RJ45	UNSHIELDED	1.86M	YES	NO	N/A
5	DC PWR	1	DC PWR	UNSHIELDED	1.86M	NO	NO	FERRITE LAPTOP END
6	AC PWR	1	AC PWR	UNSHIELDED	1.86M	NO	NO	N/A

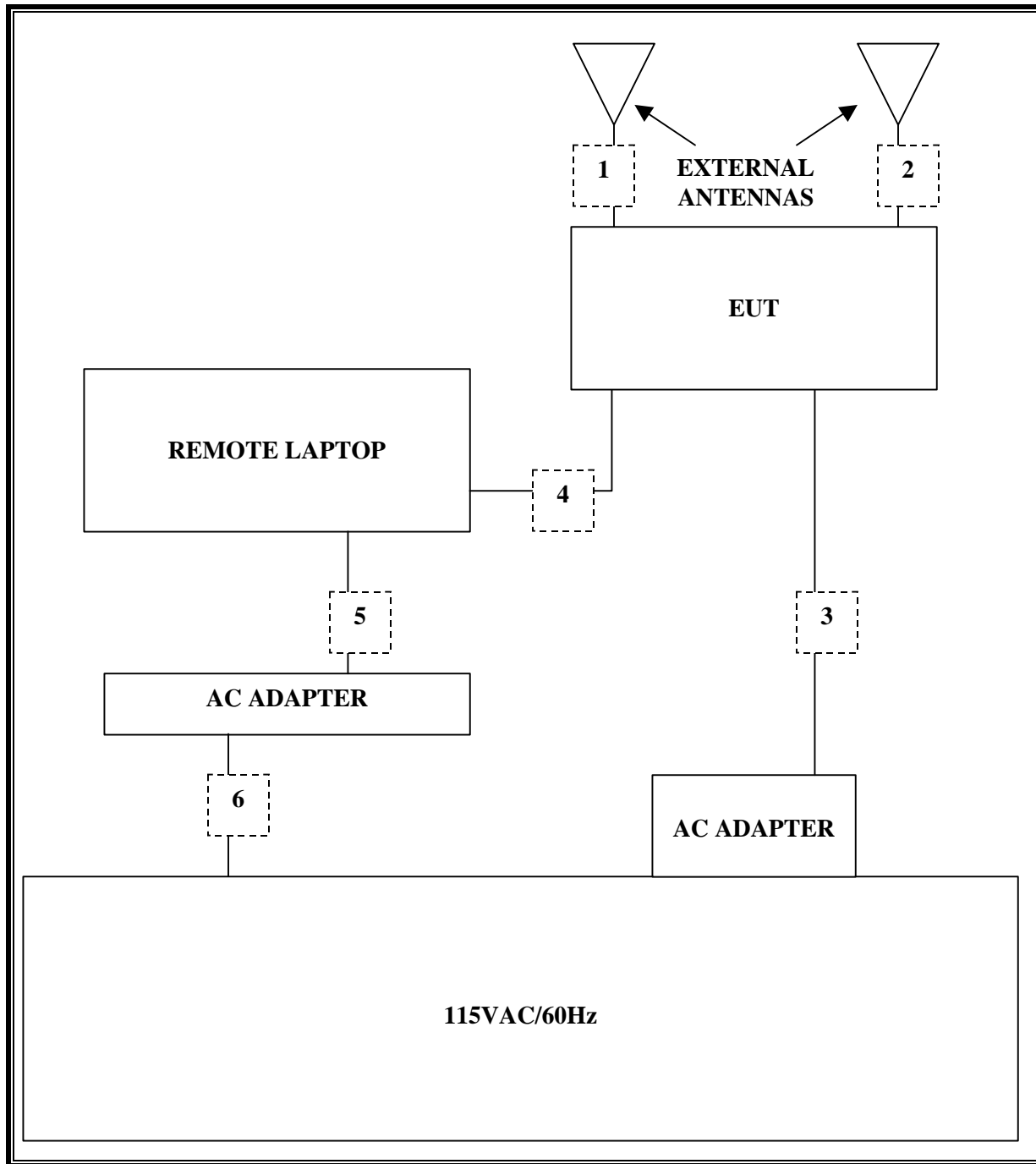
**I/O CABLES (CONFIG#2- ONE EXTERNAL ANTENNA ONE EXTERNAL ANTENNA)**

Cable No	I/O Port	# of I/O Port	Connector Type	Type of Cable	Cable Length	Data Traffic	Bundled	Remark
1	RF ANTENNA	1	UFL	SHIELDED	.13M	YES	NO	N/A
2	DC PWR	1	DC PWR	UNSHIELDED	1.86M	NO	NO	N/A
3	ETHERNET	4	RJ45	UNSHIELDED	1.86M	YES	NO	N/A
4	DC PWR	1	DC PWR	UNSHIELDED	1.86M	NO	NO	FERRITE LAPTOP END
5	AC PWR	1	AC PWR	UNSHIELDED	1.86M	NO	NO	N/A

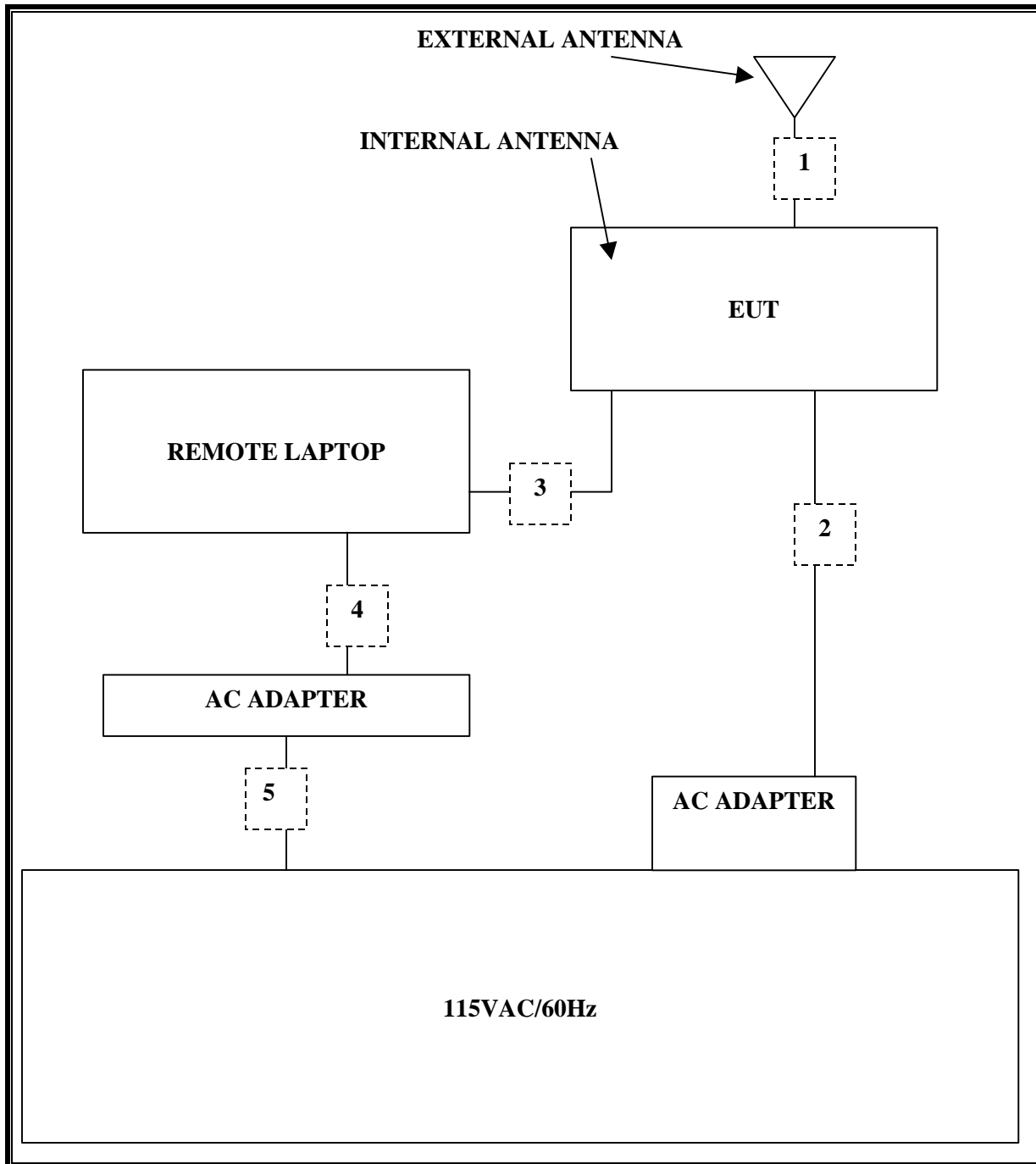
**TEST SETUP**

The EUT was connected to the remote laptop via its Ethernet port. Two configurations were tested and are documented in this report. Configuration 1 is the EUT with two external antennas, and configuration 2 is one external antenna and one internal antenna. The worst-case results of the two external antenna configurations are reported. During the testing process the EUT was operated in a continuous mode.

**SETUP DIAGRAM FOR TESTS (CONFIGURATION #1)**



**SETUP DIAGRAM FOR TESTS (CONFIGURATION #2)**



**SETUP FOR DIGITAL DEVICE TESTS**

**SUPPORT EQUIPMENT**

PERIPHERAL SUPPORT EQUIPMENT LIST				
Device Type	Manufacturer	Model	Serial Number	FCC ID
AC ADAPTER (5.0VDC)	CUI, INC.	PSA-0151-A05	N/A	DoC
REMOTE LAPTOP	IBM	THINKPAD	FX-0127003108	DoC
AC ADAPTER	IBM	O2K6661	N/A	N/A
REMOTE HUB	NETGEAR	FS105	FS15A13026746	DoC
AC ADAPTER	NETGEAR	UL110-0520	CE-05330	N/A

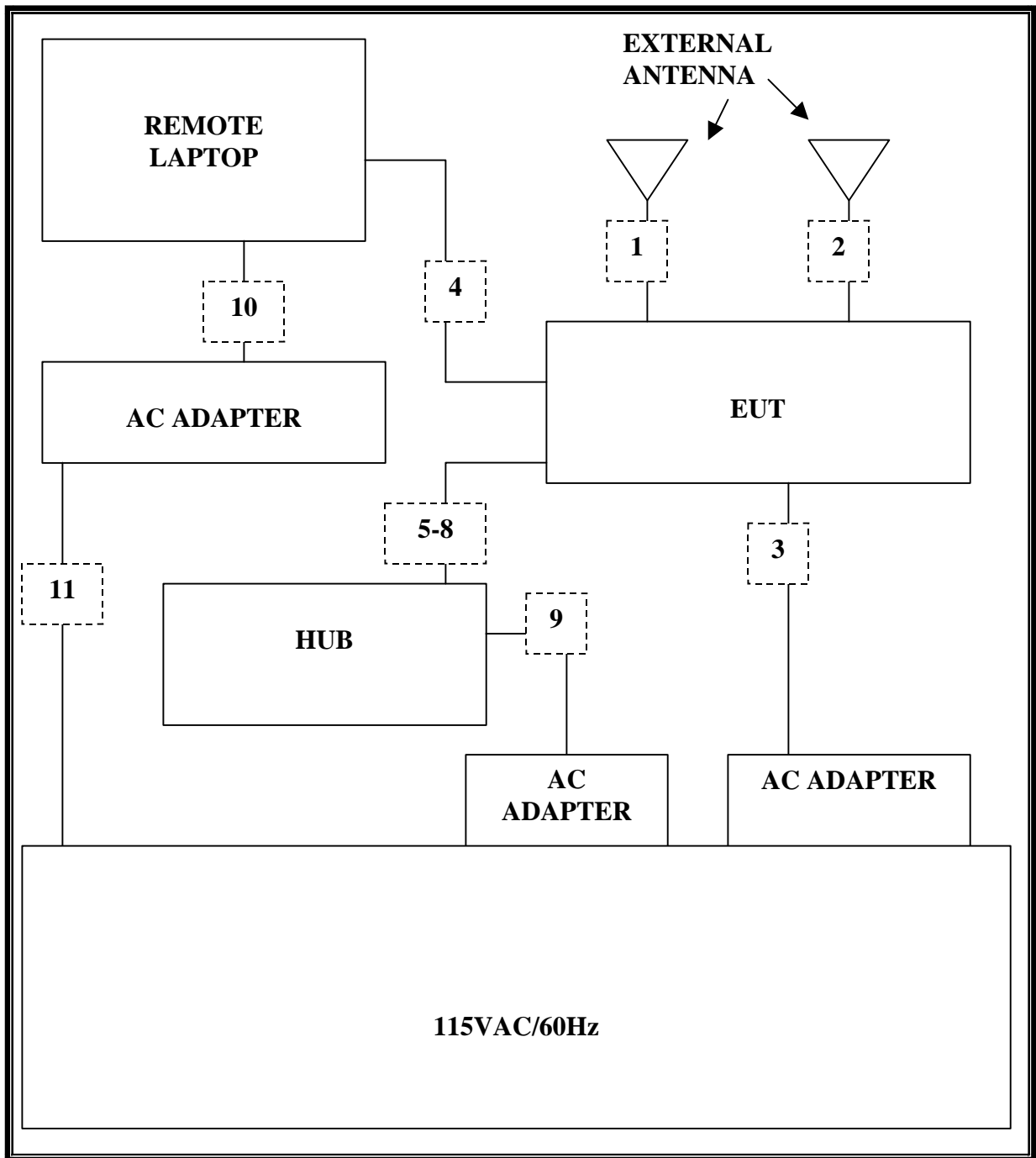
**I/O CABLES**

Cable No	I/O Port	# of I/O Port	Connector Type	Type of Cable	Cable Length	Data Traffic	Bundled	Remark
1	RF ANTENNA	1	UFL	SHIELDED	0.2M	YES	NO	N/A
2	RF ANTENNA	1	UFL	SHIELDED	.13M	YES	NO	N/A
3	DC PWR	1	DC PWR	UNSHIELDED	1.86M	NO	NO	N/A
4	ETHERNET	1	RJ45	SHIELDED	1.86M	YES	NO	N/A
5-8	ETHERNET	4	RJ45	SHIELDED	1.86M	YES	NO	N/A
9	DC PWR	1	DC PWR	UNSHIELDED	1.86M	NO	NO	N/A
10	DC PWR	1	DC PWR	UNSHIELDED	1.86M	NO	NO	FERRITE LAPTOP END
11	AC PWR	1	AC PWR	UNSHIELDED	1.86M	NO	NO	N/A

**TEST SETUP**

The EUT was connected to the remote laptop and remote hub via its Ethernet ports. The worst-case configuration (two external antennas) was tested. During the testing process the EUT was in continuous transmit mode and pinging the remote hub.

**SETUP DIAGRAM FOR DIGITAL DEVICE TESTS**



## 7. APPLICABLE LIMITS AND TEST RESULTS

### 7.1. 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 100 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	12000	500	11500
Middle	2437	12000	500	11500
High	2462	12000	500	11500

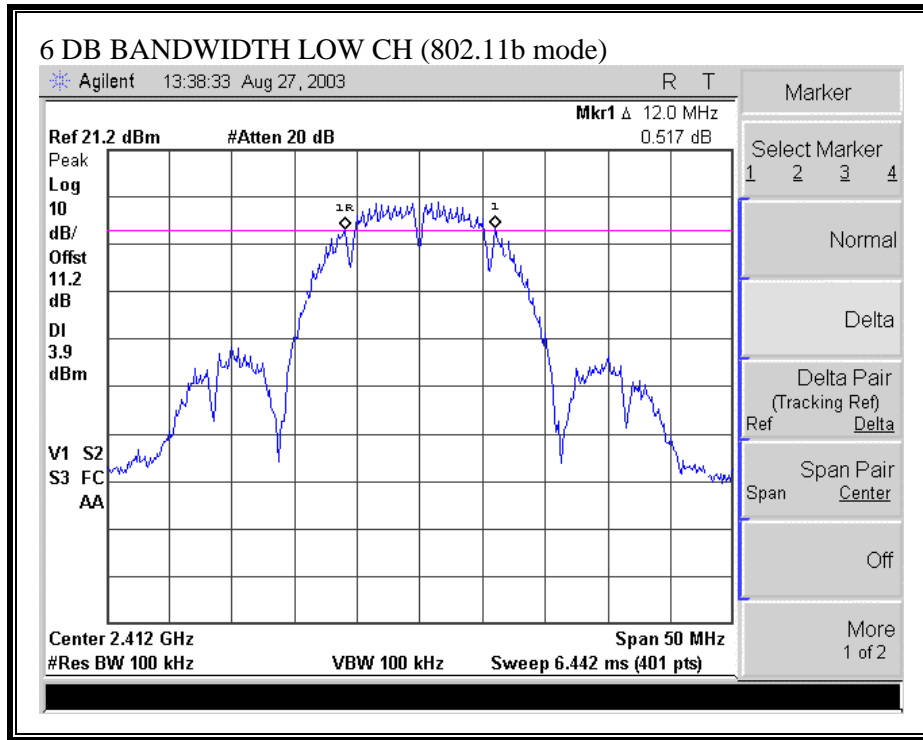
##### 802.11g Normal Mode

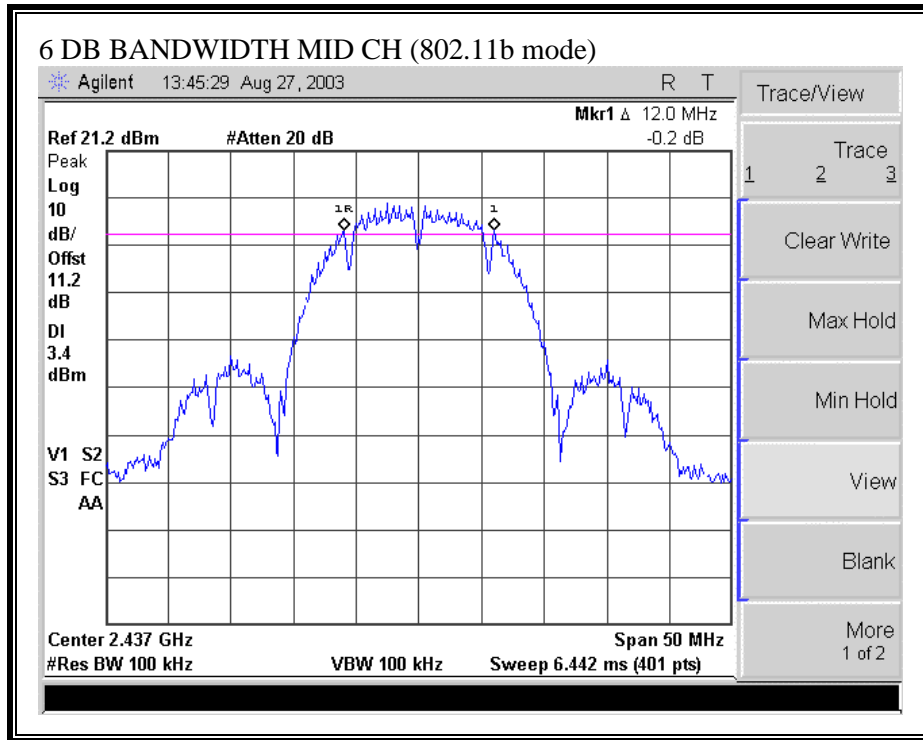
Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2412	16400	500	15900
Middle	2437	16300	500	15800
High	2462	16550	500	16050

##### 802.11g Turbo Mode

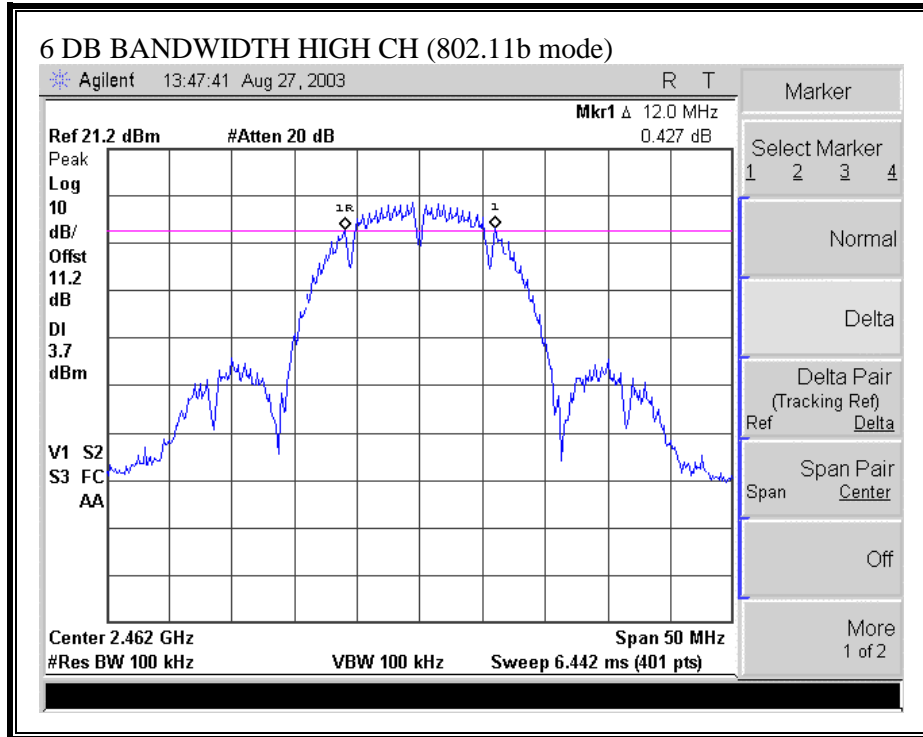
Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Middle	2437	31500	500	31000

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

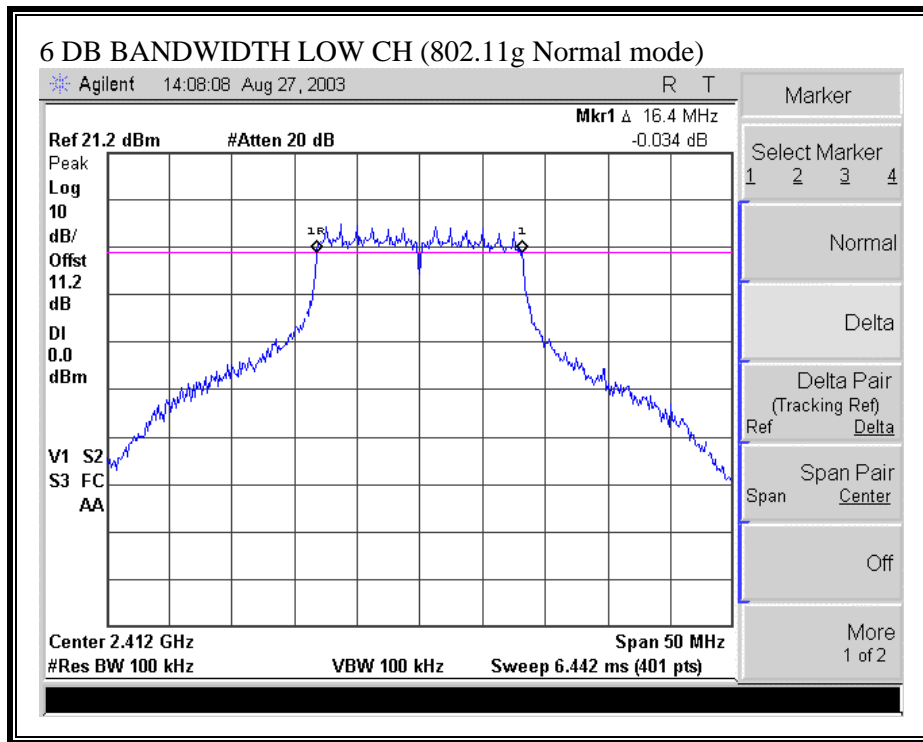


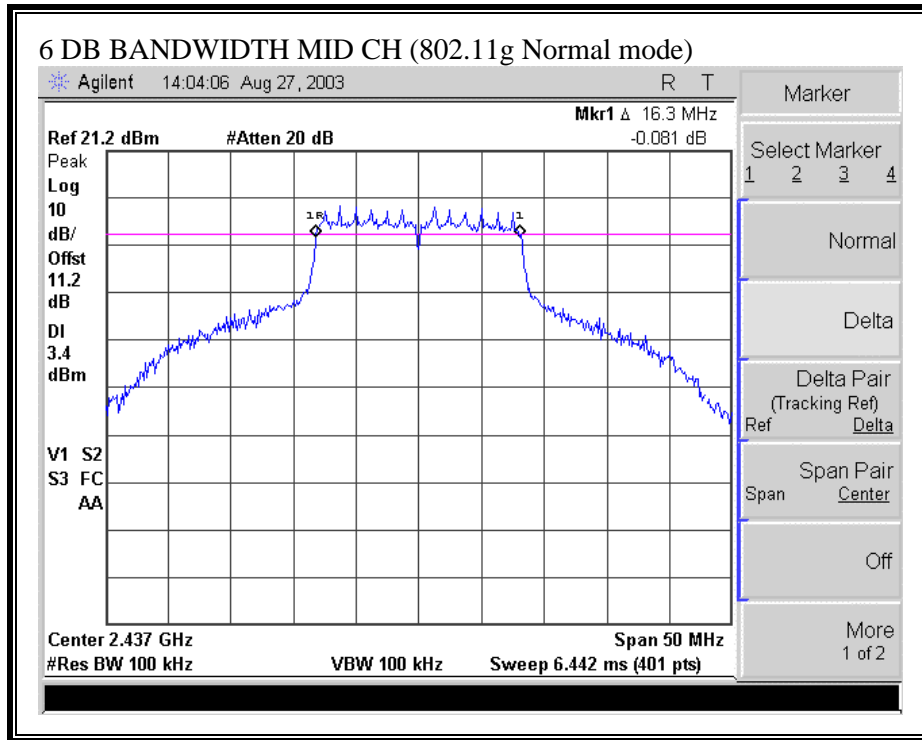


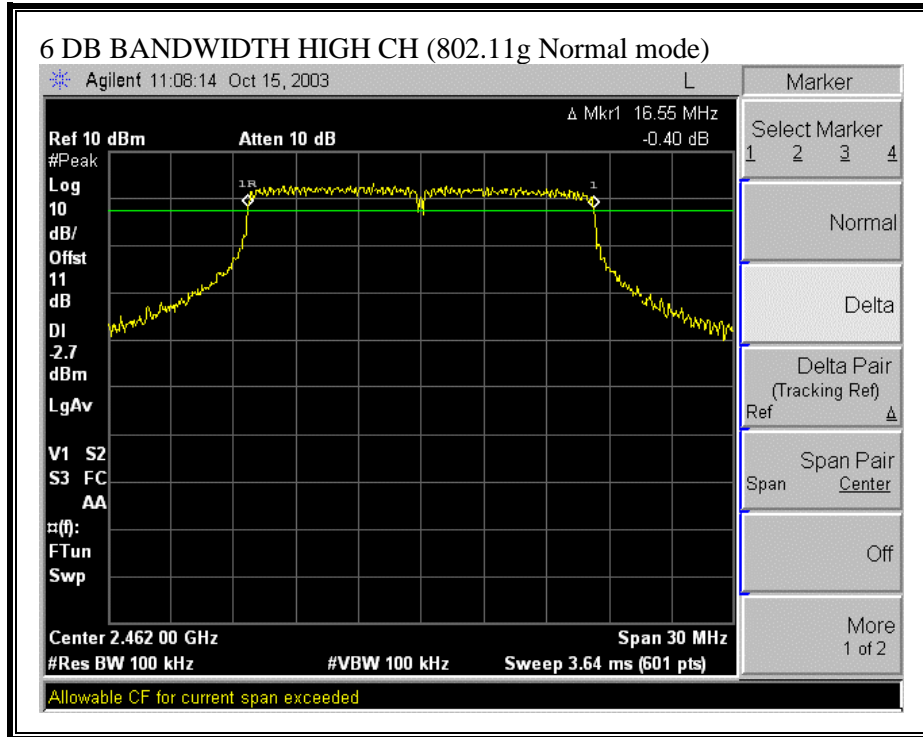




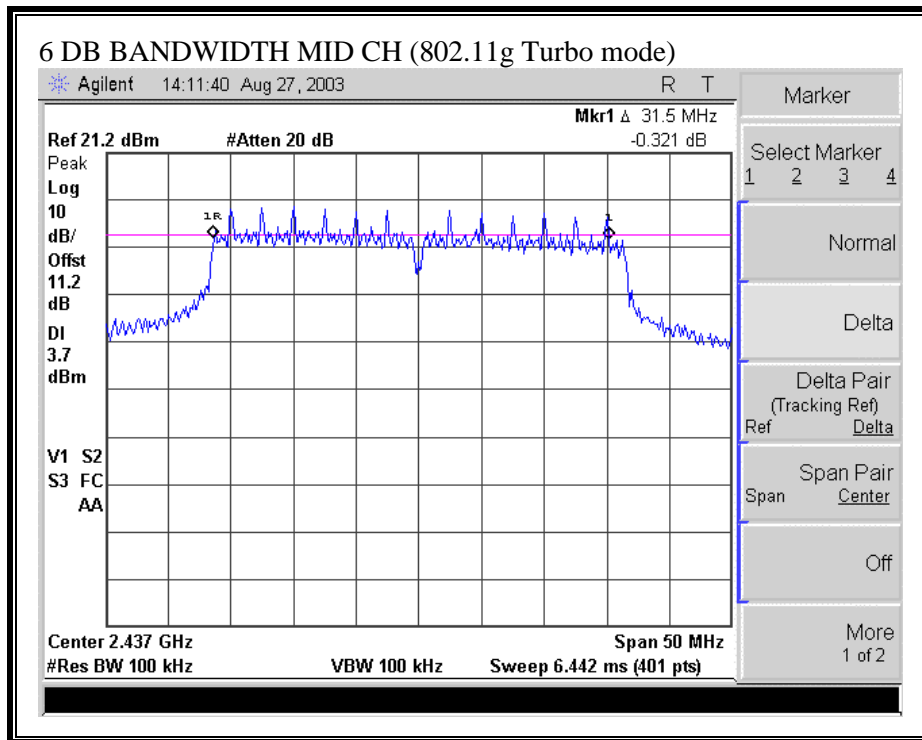
**6 DB BANDWIDTH (802.11g NORMAL MODE)**







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



## 7.2. 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	15.4741
Middle	2437	15.8241
High	2462	15.9349

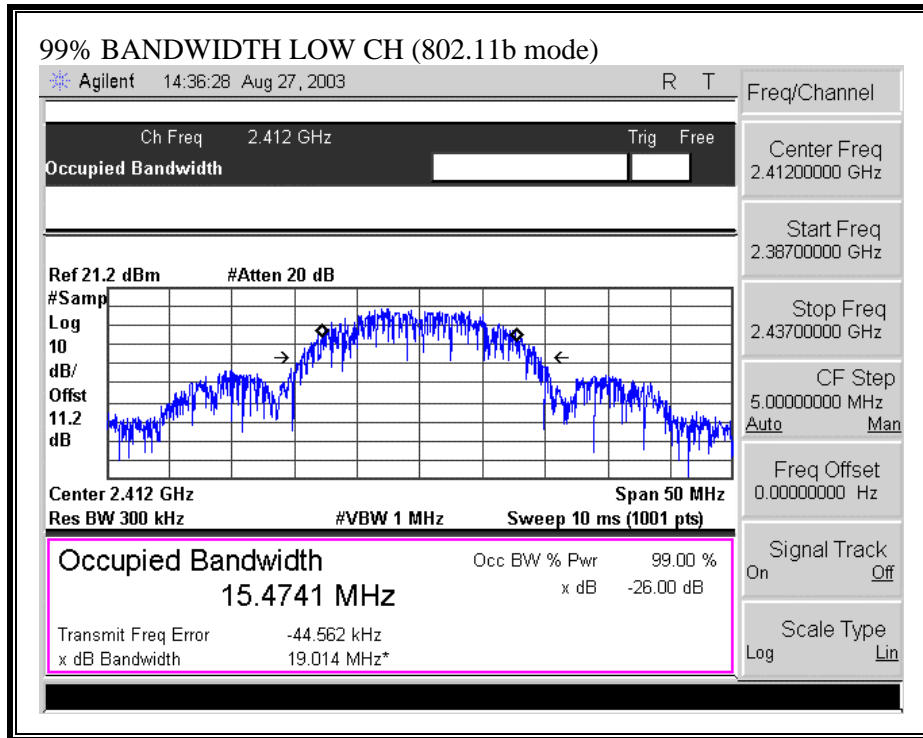
#### 802.11g Normal Mode

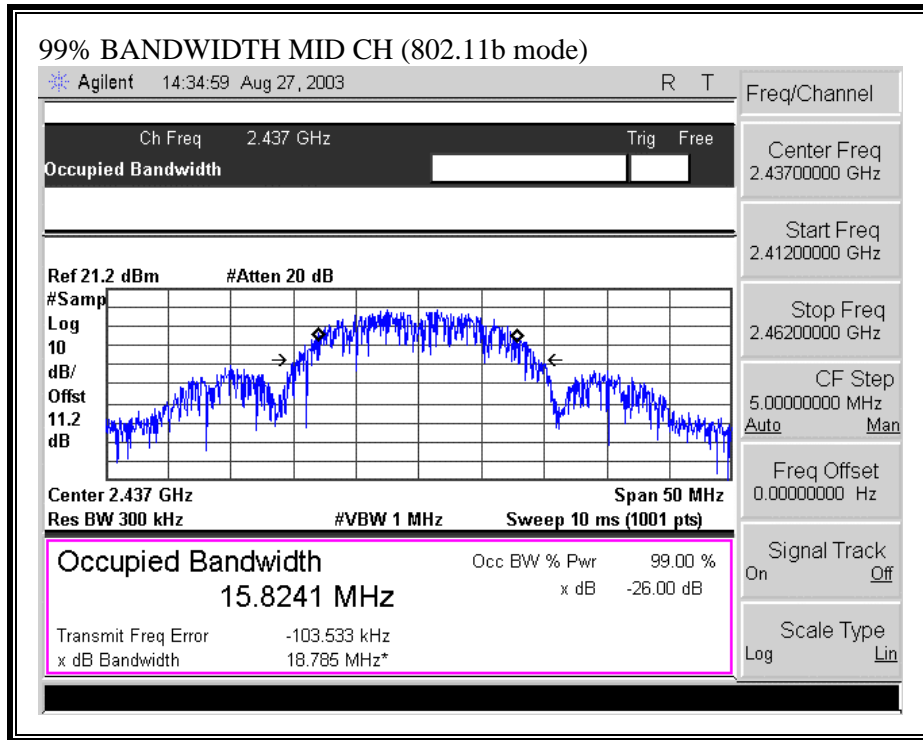
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.6258
Middle	2437	16.6869
High	2462	16.5908

#### 802.11g Turbo Mode

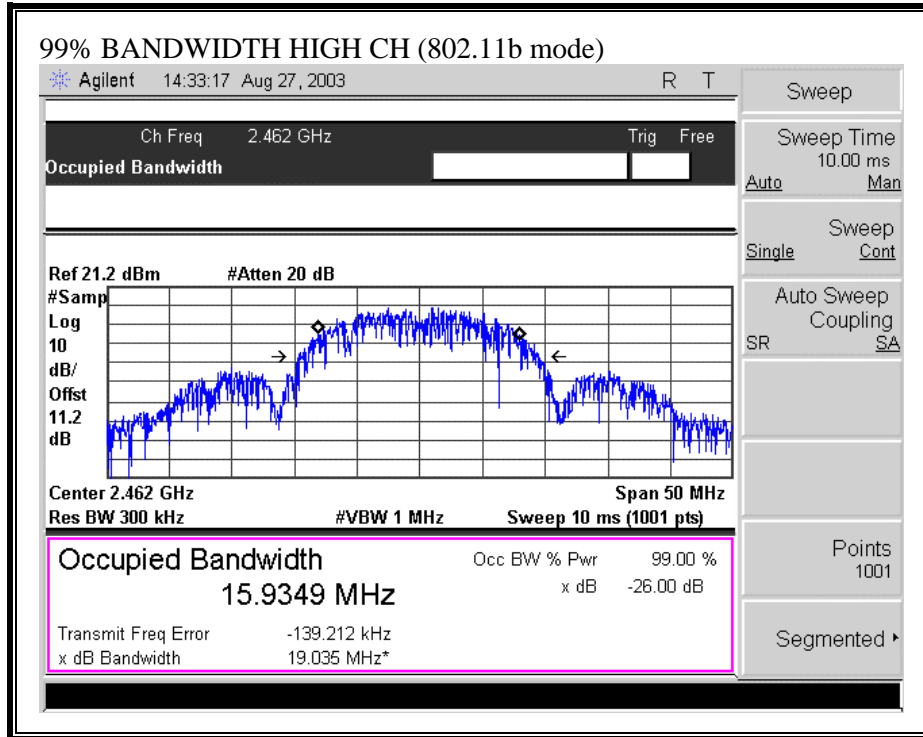
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Middle	2437	33.7989

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

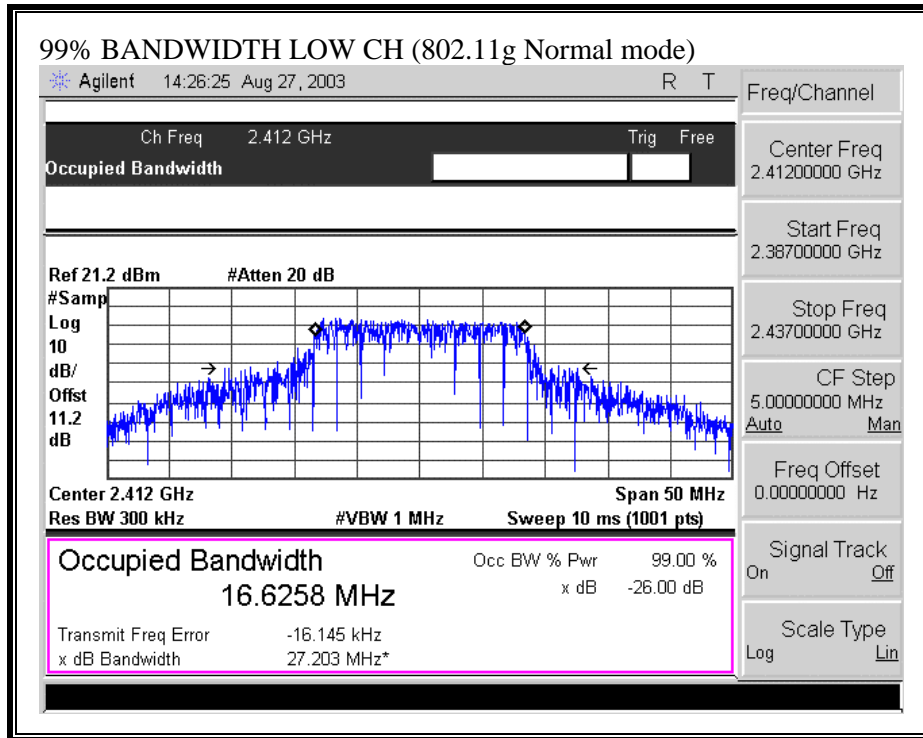


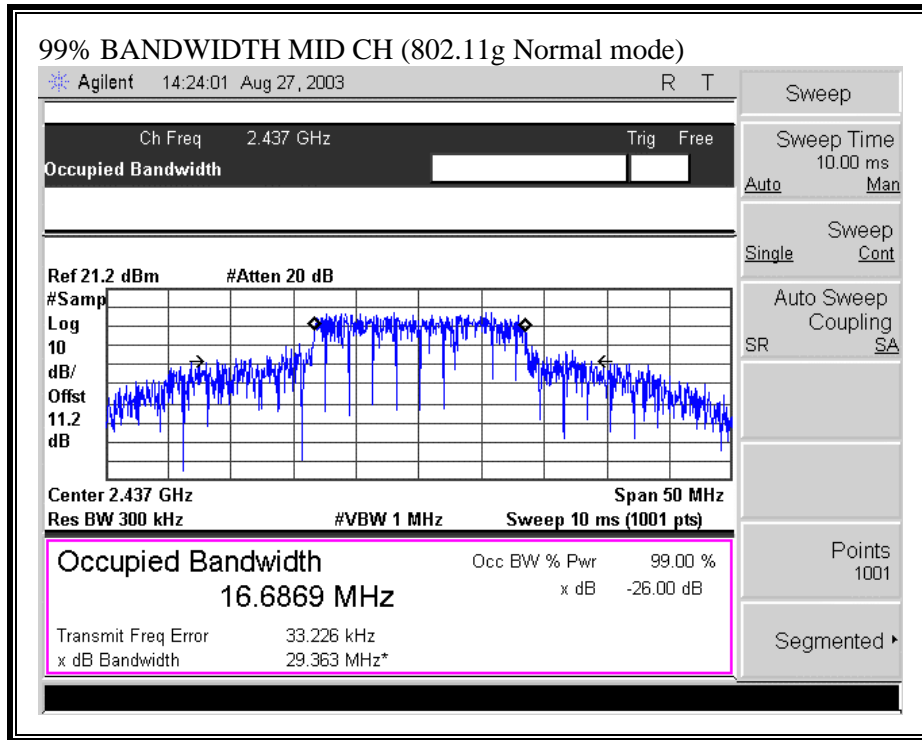


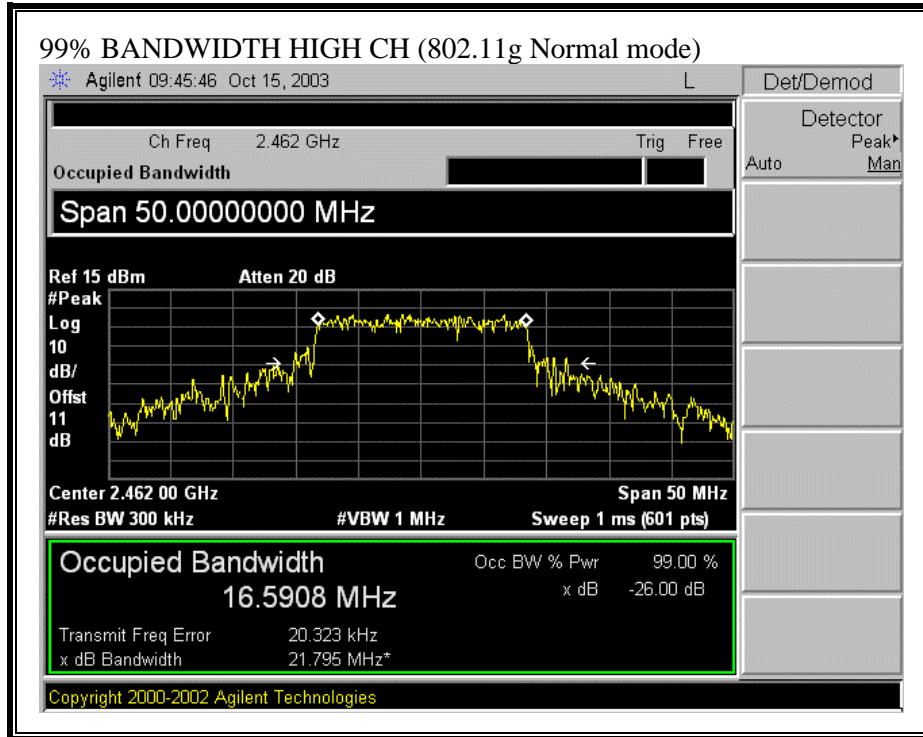




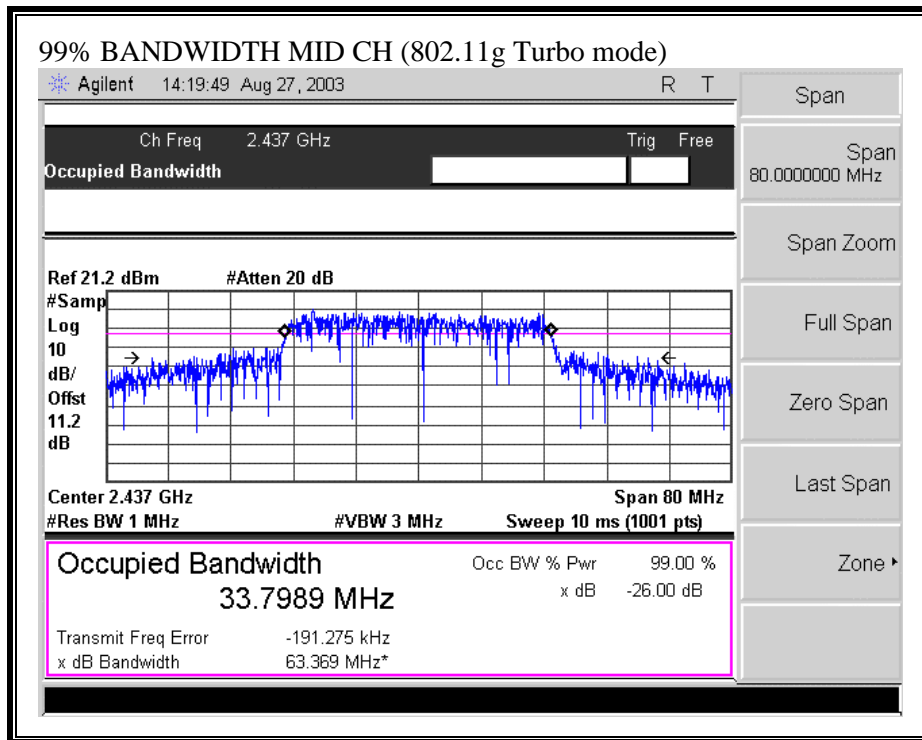
**99% BANDWIDTH (802.11g NORMAL MODE)**







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



### **7.3. 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) (4) Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 1.5 dBi, therefore the limit is 30 dBm.

#### **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**

No non-compliance noted:

802.11b Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	23.24	30	-6.76
Middle	2437	23.41	30	-6.59
High	2462	23.19	30	-6.81

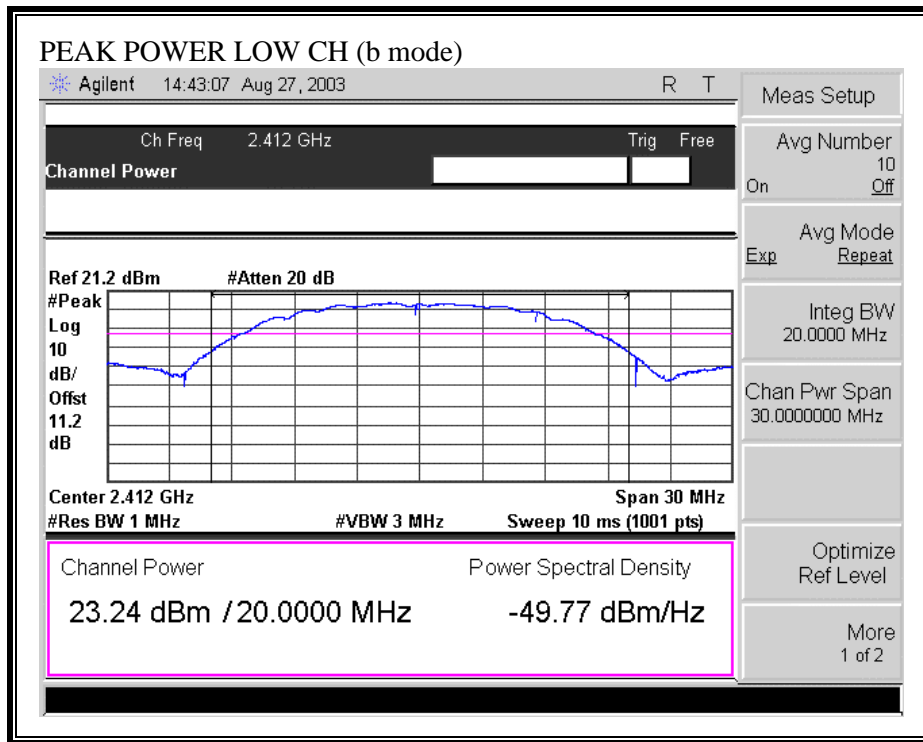
802.11g Normal Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	22.24	30	-7.76
Middle	2437	25.25	30	-4.75
High	2462	22.56	30	-7.44

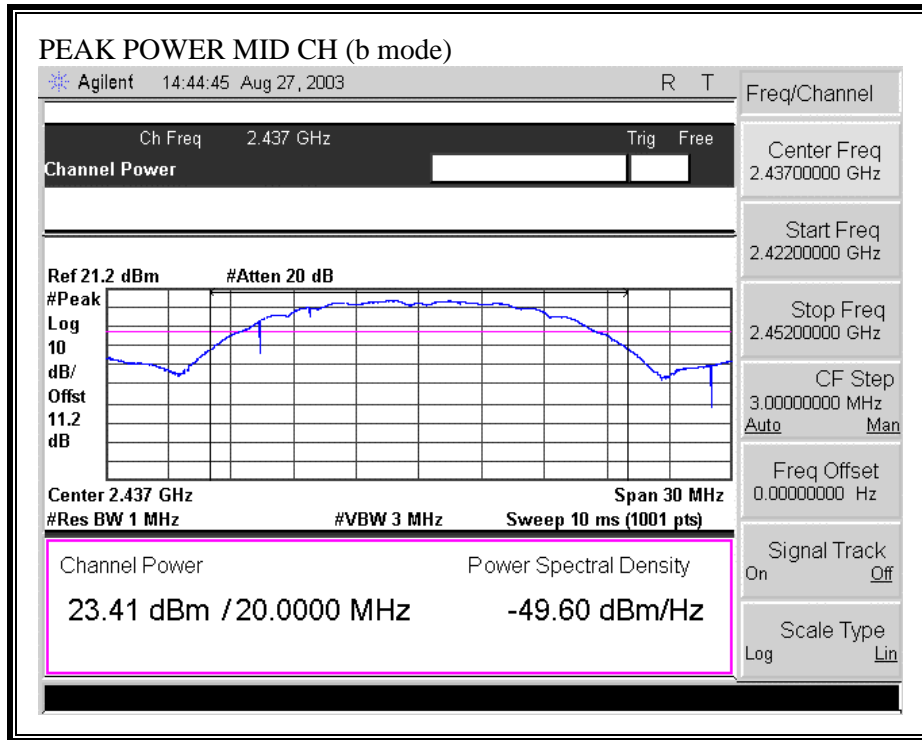
802.11g Turbo Mode

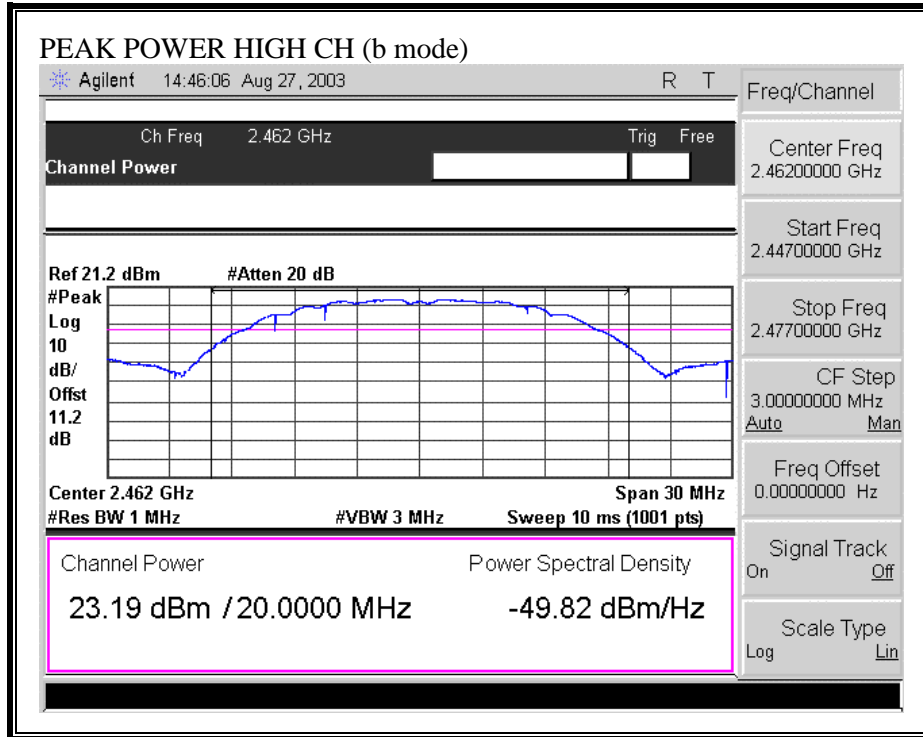
Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Middle	2437	23.94	30	-6.06

**OUTPUT POWER (802.11b MODE)**

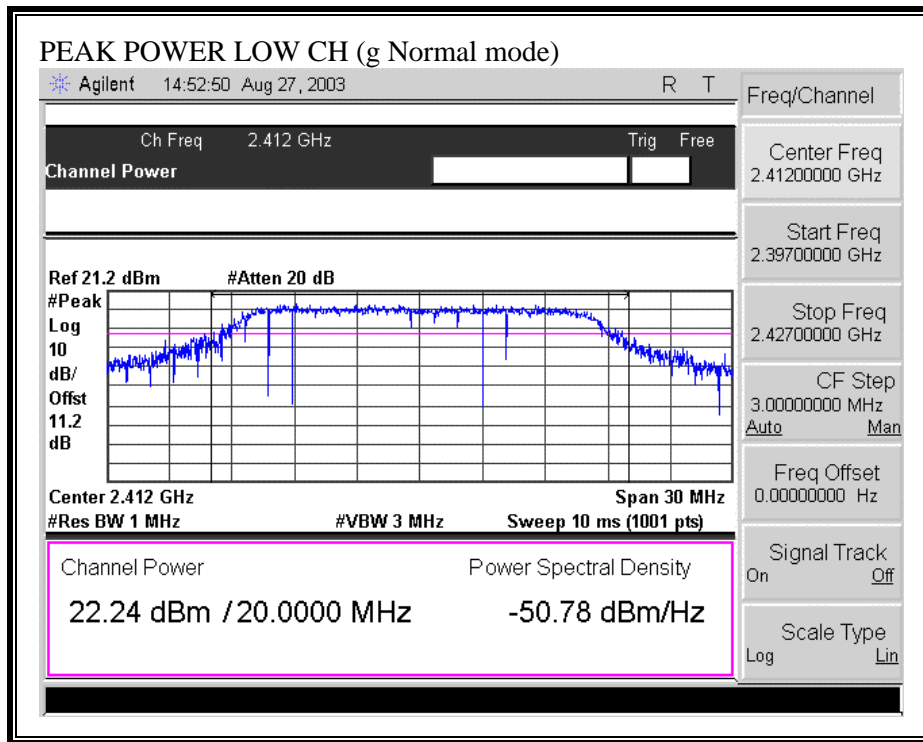


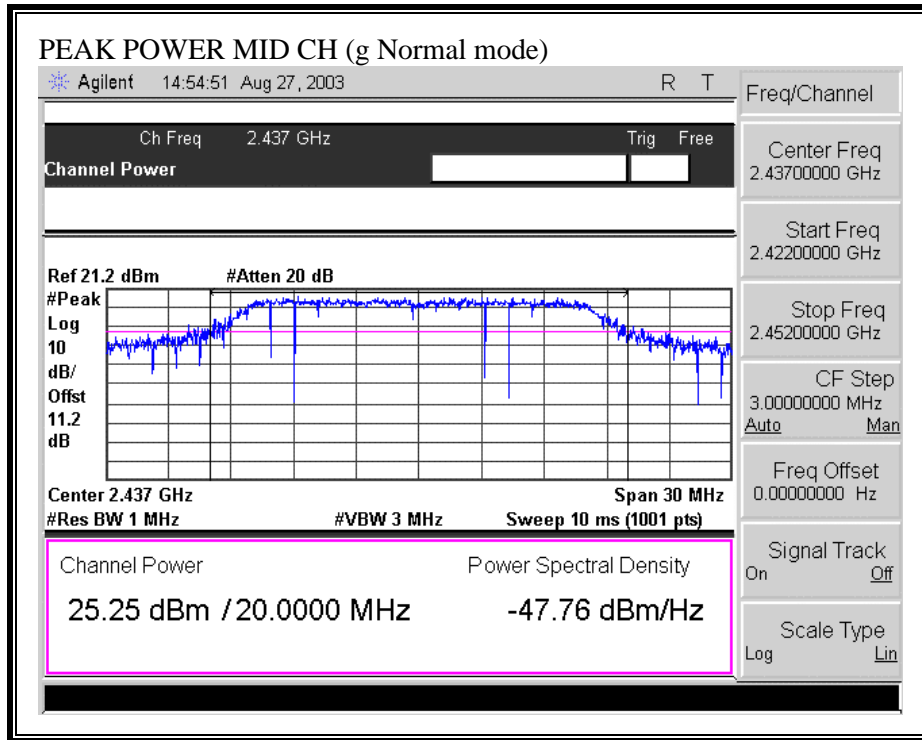


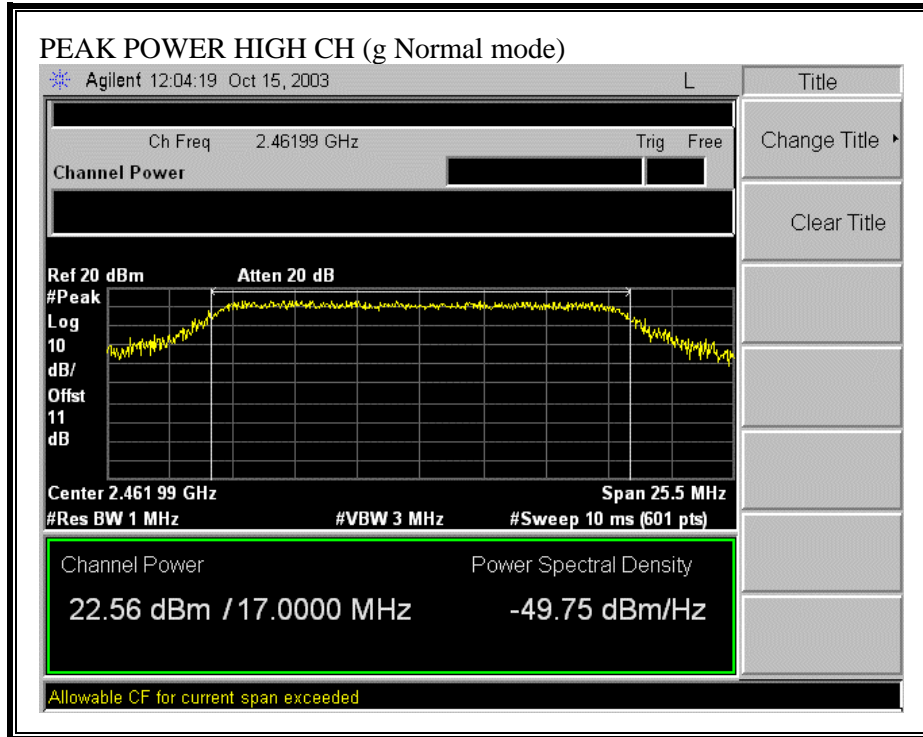




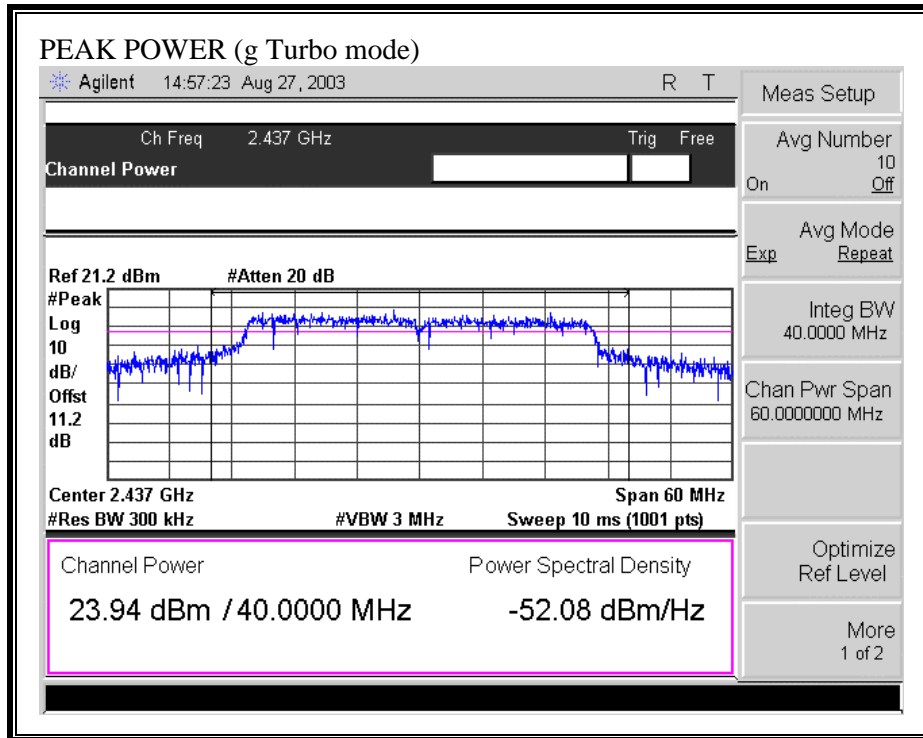
**OUTPUT POWER (802.11g NORMAL MODE)**







**OUTPUT POWER (802.11g TURBO MODE)**



## 7.4. MAXIMUM PERMISSIBLE EXPOSURE

### LIMITS

§15.247 (b) (5) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See §1.1307(b)(1) of this chapter.

### 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 mW and 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

$$d = 0.282 * 10^{((P + G) / 20) / \sqrt{S}} \quad \text{Equation (1)}$$

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>

Equation (1) and the measured peak power is used to calculate the MPE distance.

### **LIMITS**

S = 1.0 mW / cm<sup>2</sup> from 1.1310 Table 1

### **RESULTS**

No non-compliance noted:

Mode	Power Density Limit (mW/cm <sup>2</sup> )	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
802.11b	1.0	23.41	1.50	4.96
802.11g Normal	1.0	25.25	1.50	6.13
802.11g Turbo	1.0	23.94	1.50	5.28

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.



## 7.5. 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 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### 802.11b Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	2412	20.26
Middle	2437	20.07
High	2462	20.14

#### 802.11g Normal Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	2412	16.91
Middle	2437	20.15
High	2462	17.34

#### 802.11g Turbo Mode

Channel	Frequency (MHz)	Average Power (dBm)
Middle	2437	20.20

## 7.6. 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	-2.79	8	-10.79
Middle	2437	-3.30	8	-11.30
High	2462	-2.76	8	-10.76

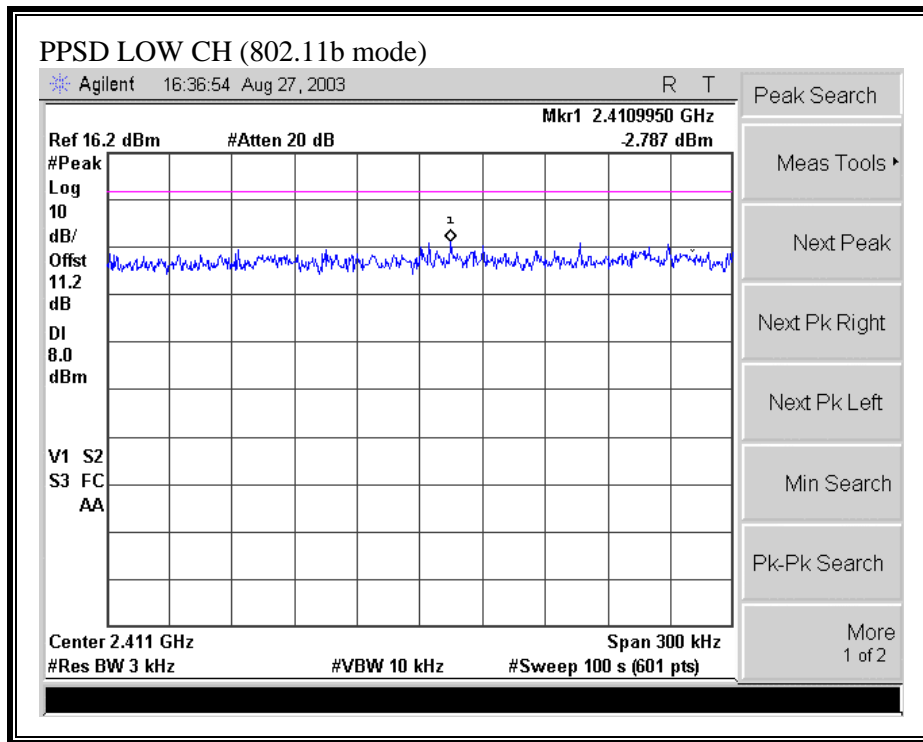
#### 802.11g Normal Mode

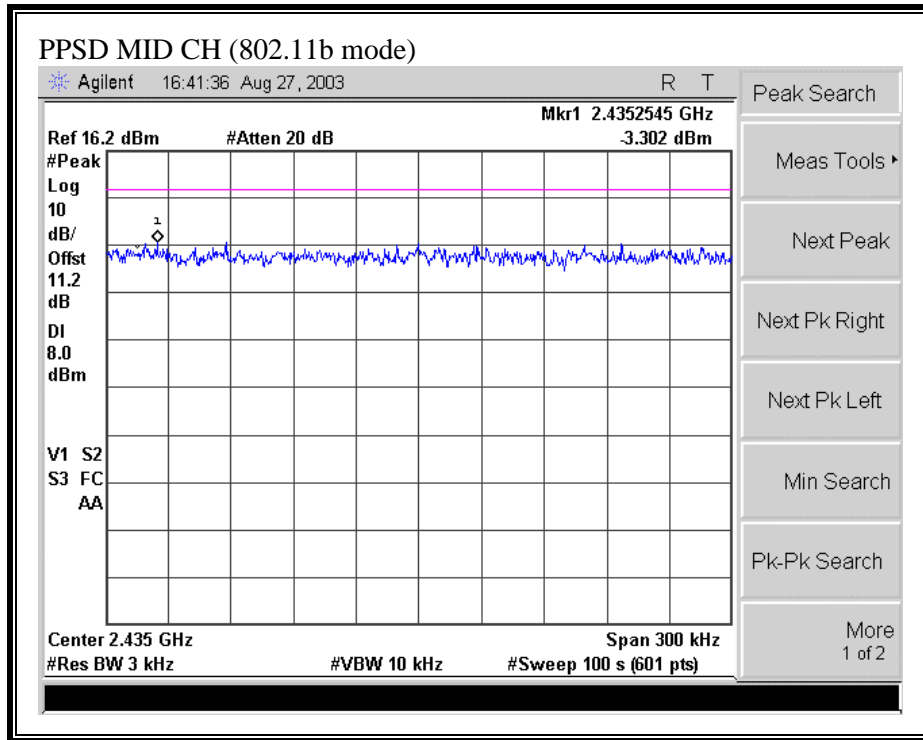
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-7.27	8	-15.27
Middle	2437	-1.32	8	-9.32
High	2462	4.51	8	-3.49

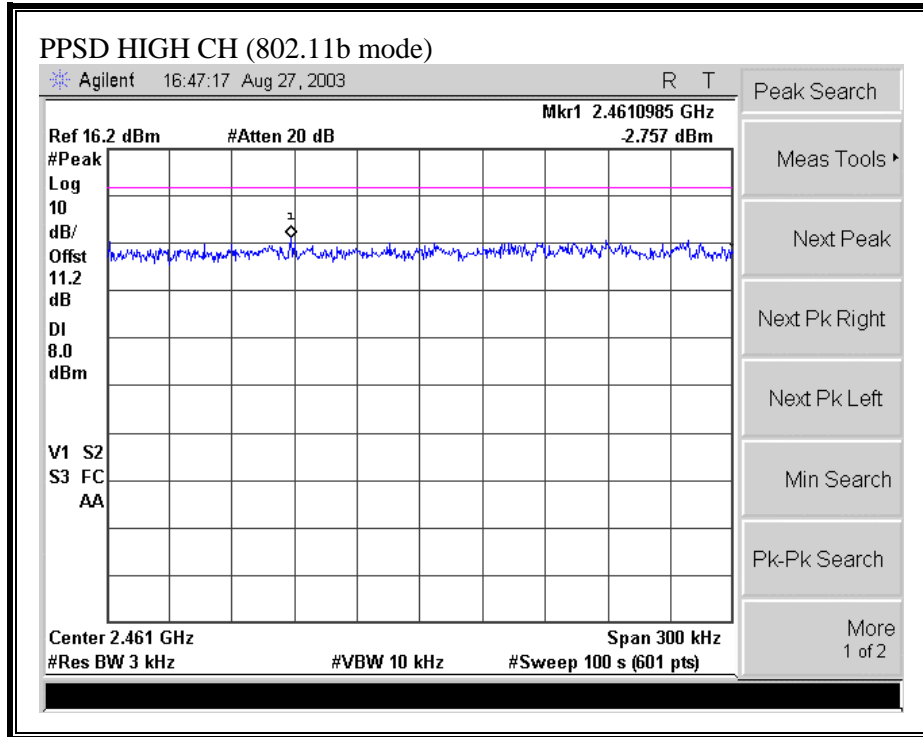
#### 802.11g Turbo Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Middle	2437	-1.75	8	-9.75

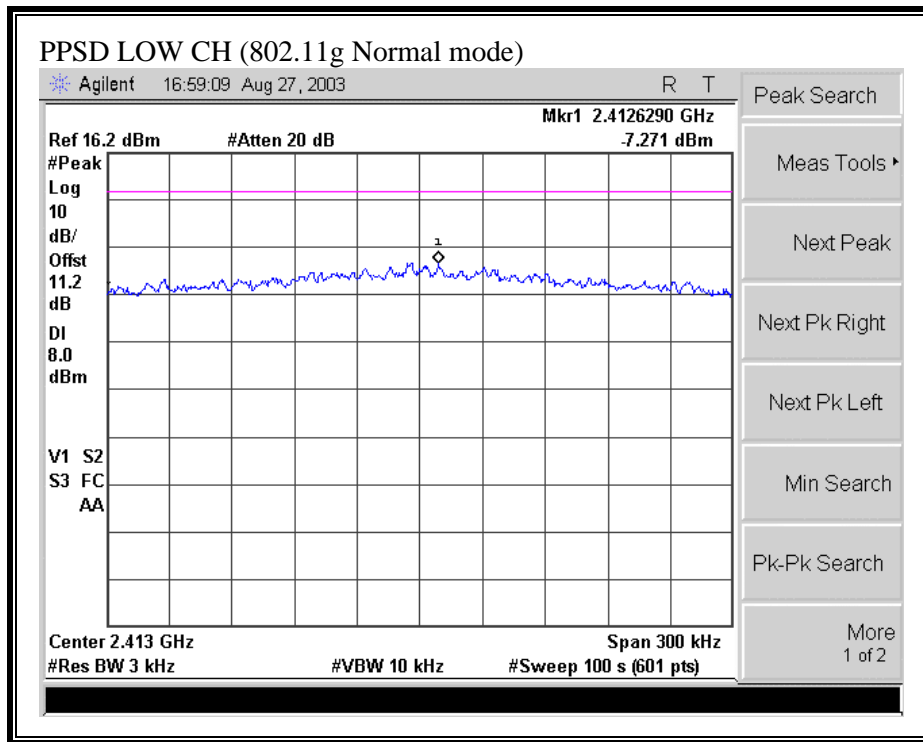
**PEAK POWER SPECTRAL DENSITY (802.11b MODE)**



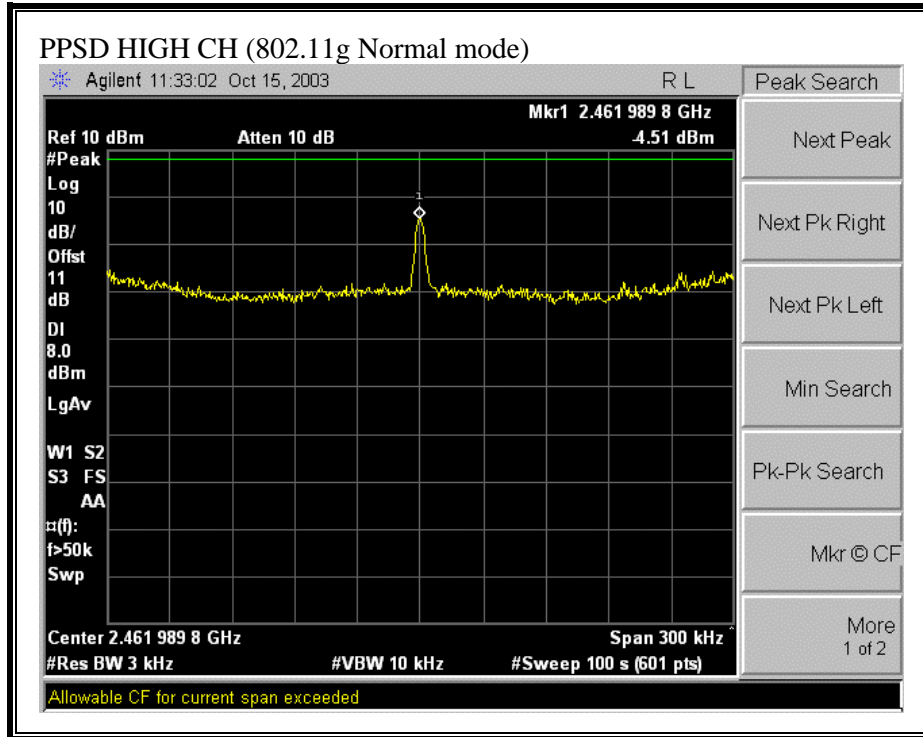




**PEAK POWER SPECTRAL DENSITY (802.11g NORMAL MODE)**

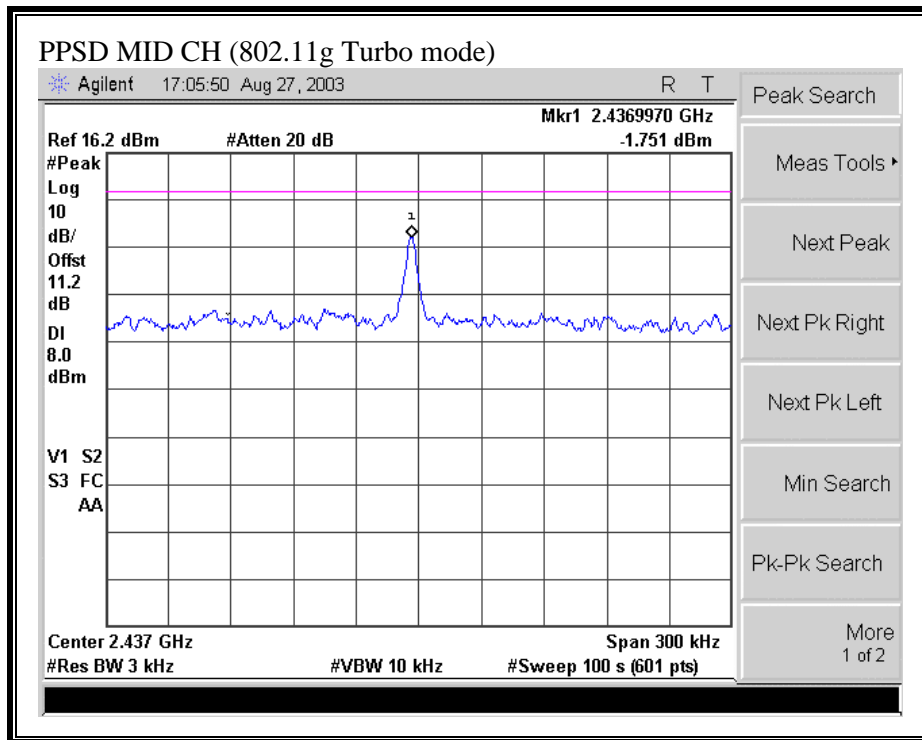








**PEAK POWER SPECTRAL DENSITY (802.11g TURBO MODE)**



## 7.7. 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)).

### TEST PROCEDURE

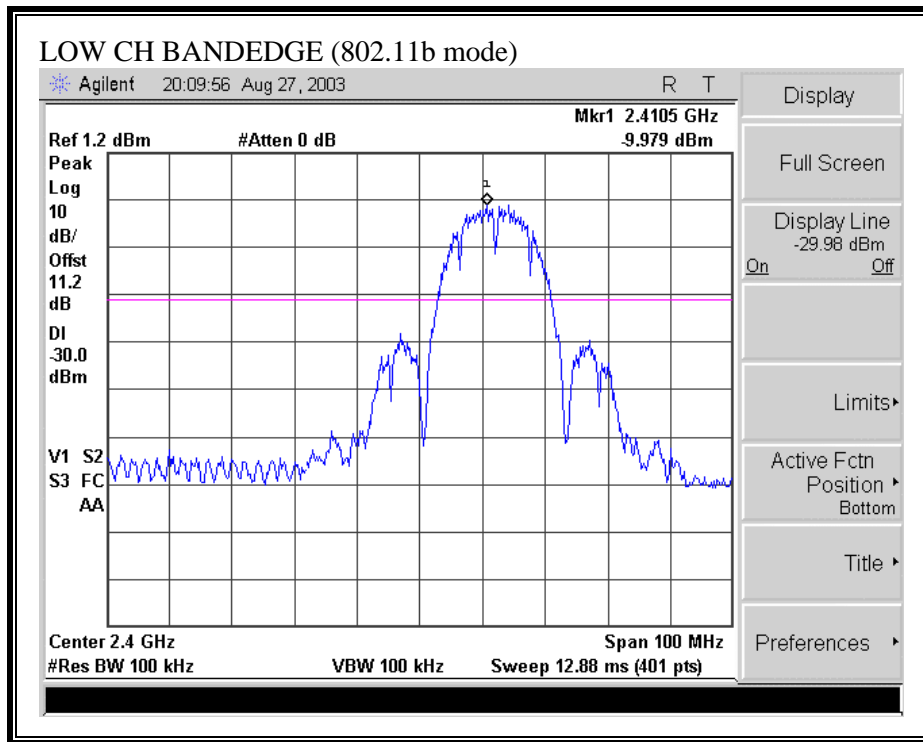
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

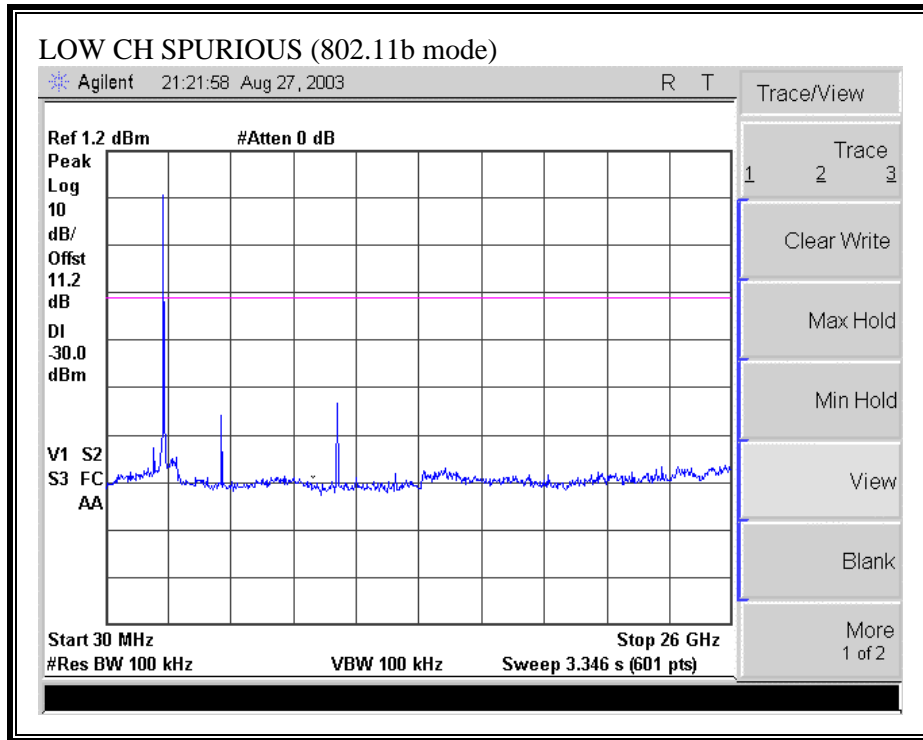
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

### RESULTS

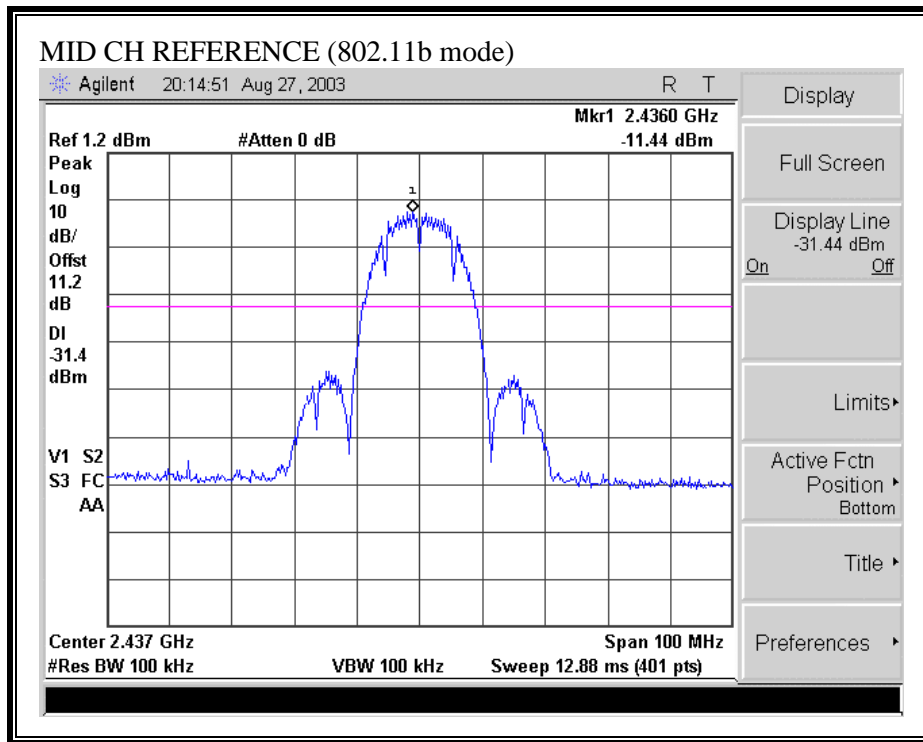
No non-compliance noted:

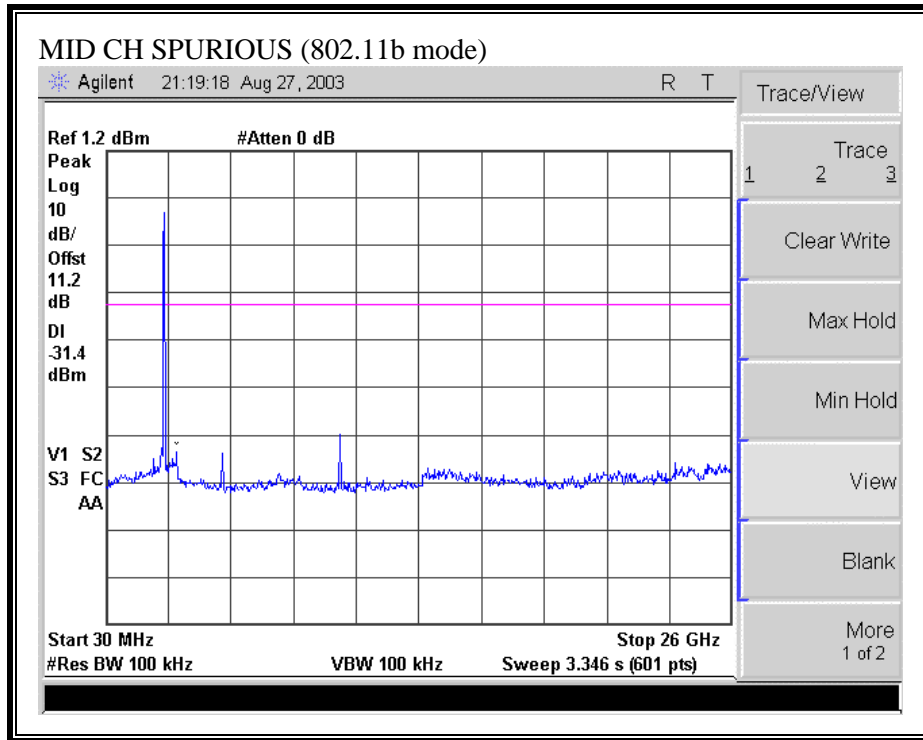
**SPURIOUS EMISSIONS, LOW CHANNEL (802.11b MODE)**



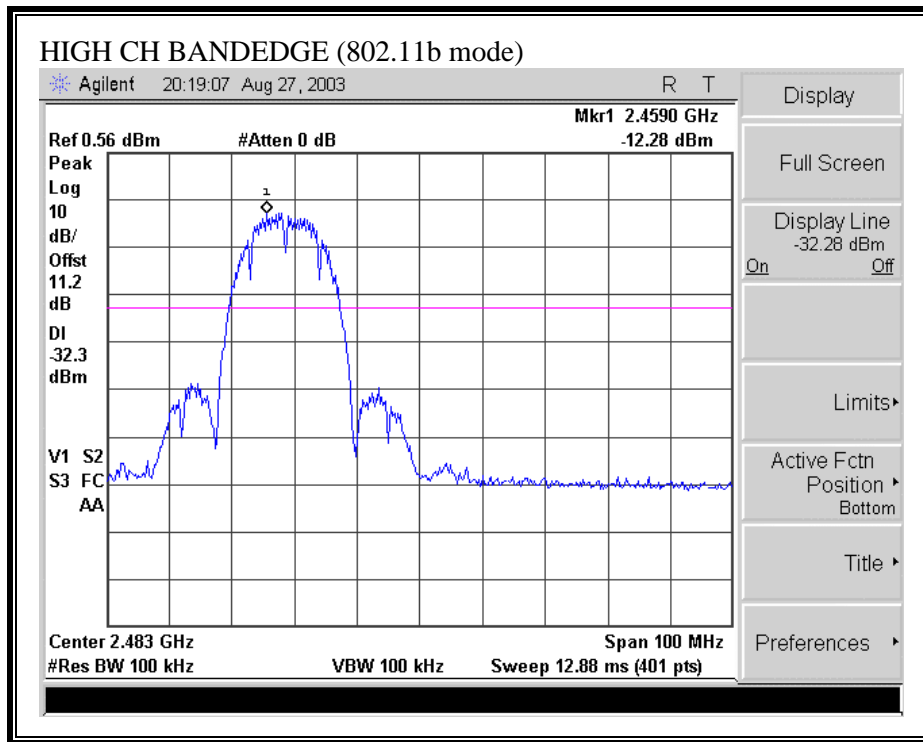


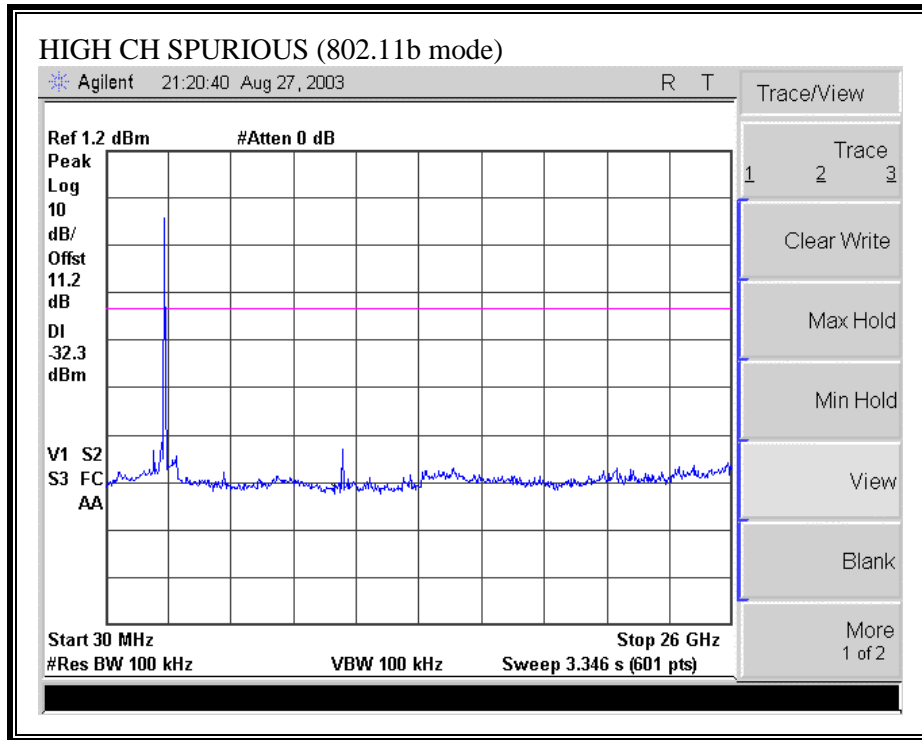
**SPURIOUS EMISSIONS, MID CHANNEL (802.11b MODE)**





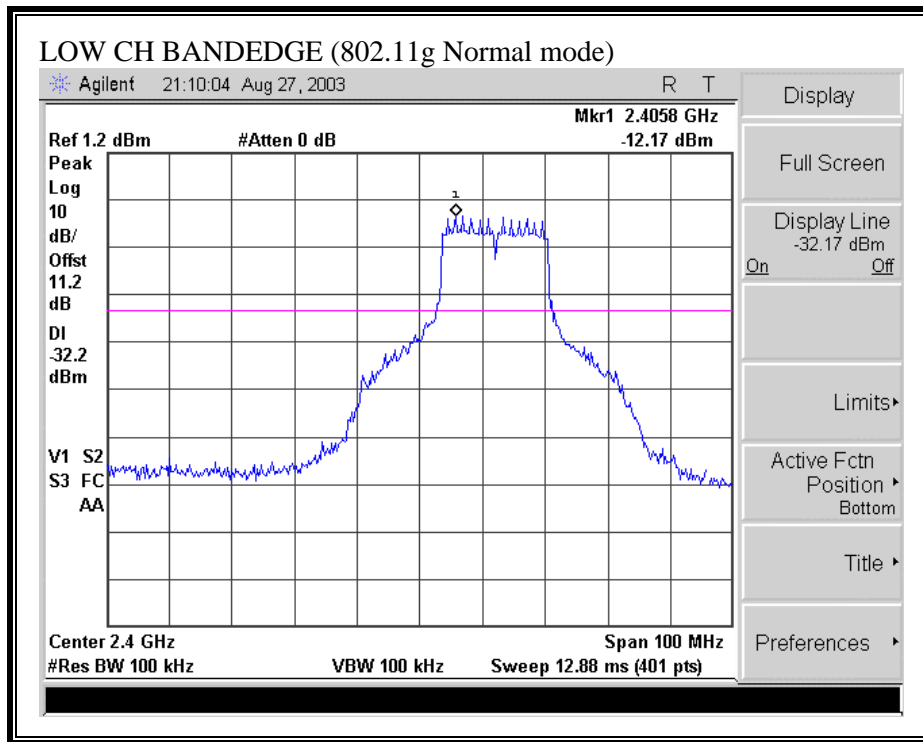
**SPURIOUS EMISSIONS, HIGH CHANNEL (802.11b MODE)**

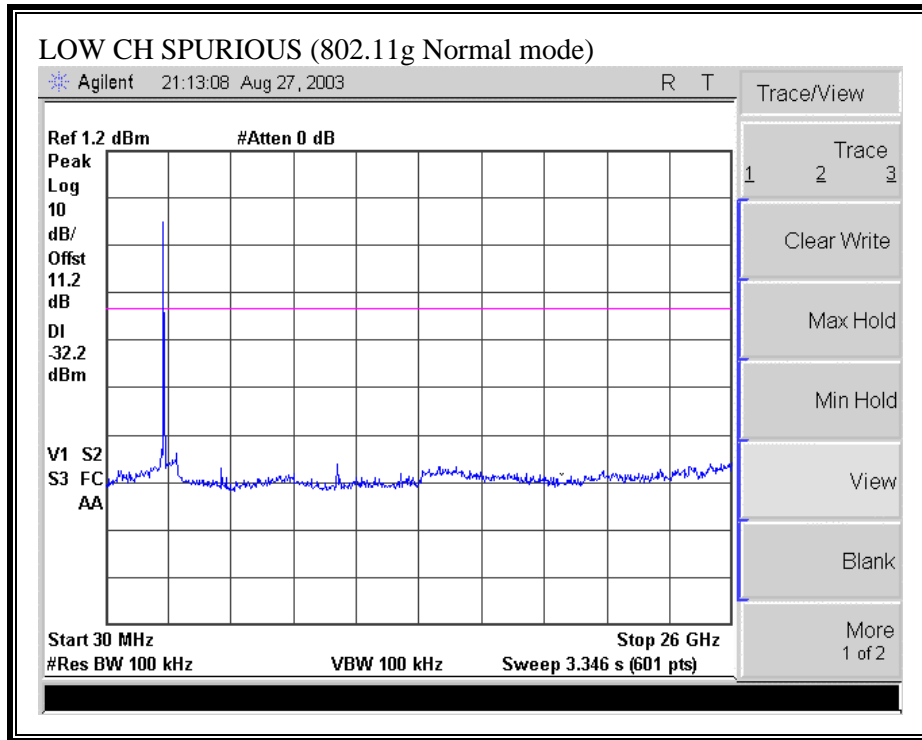




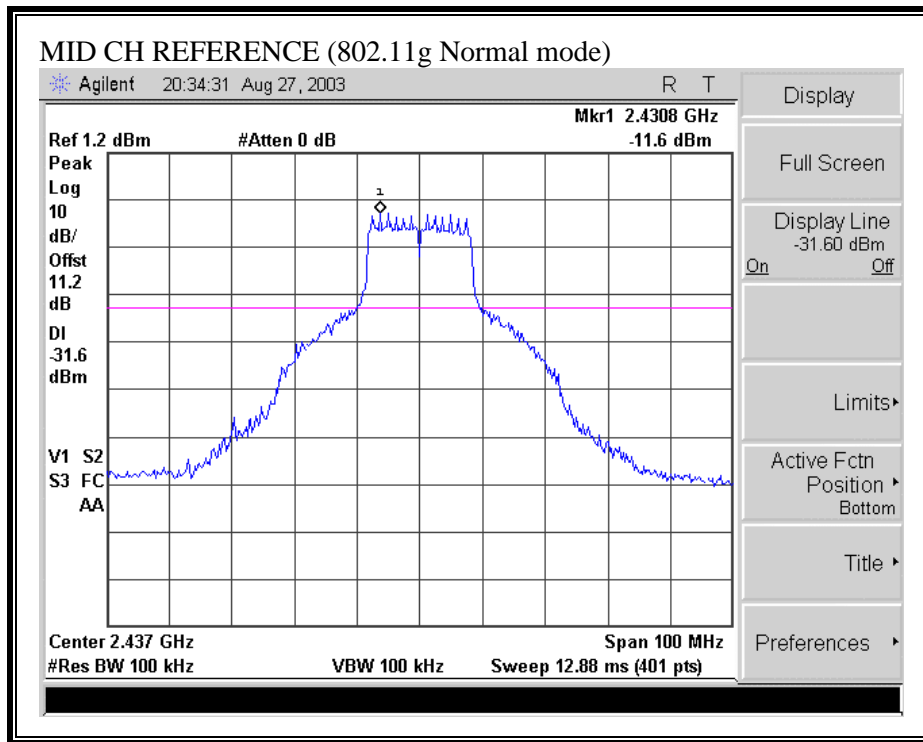


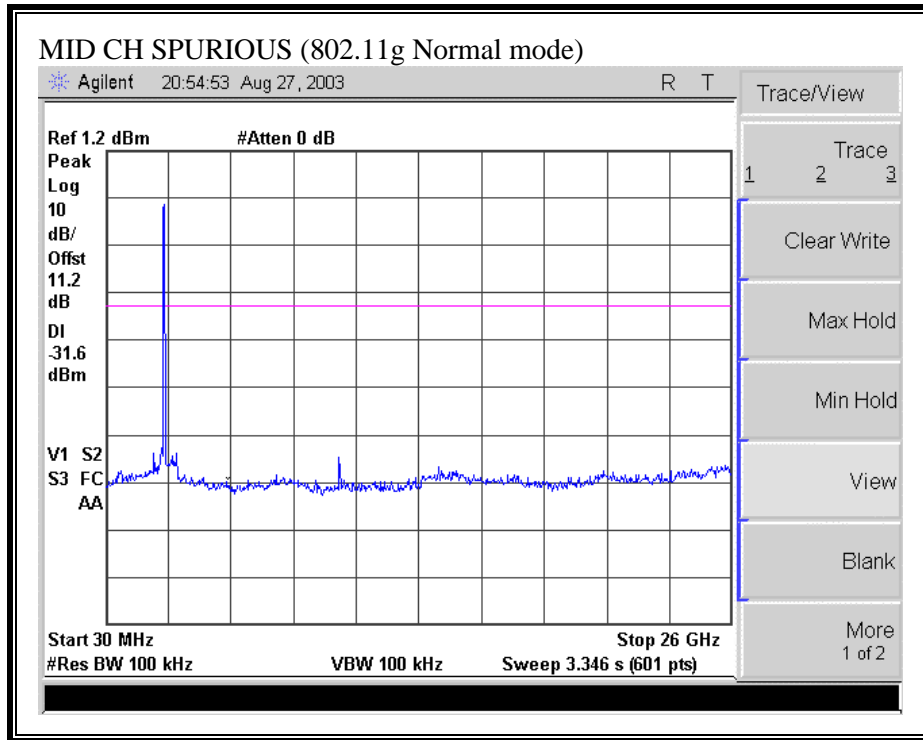
**SPURIOUS EMISSIONS, LOW CHANNEL (802.11g NORMAL MODE)**



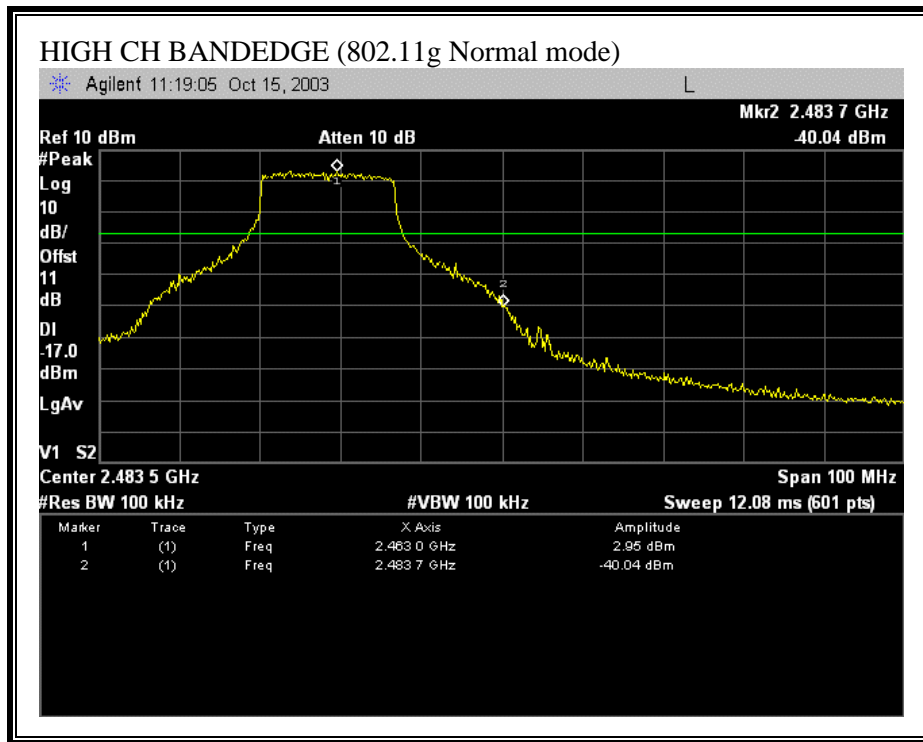


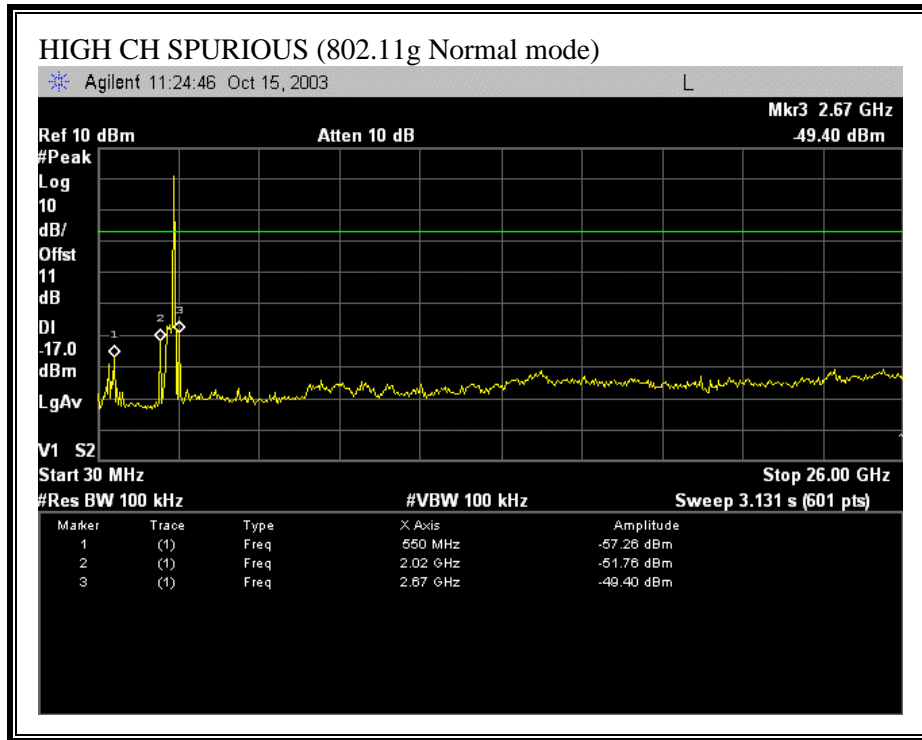
**SPURIOUS EMISSIONS, MID CHANNEL (802.11g NORMAL MODE)**



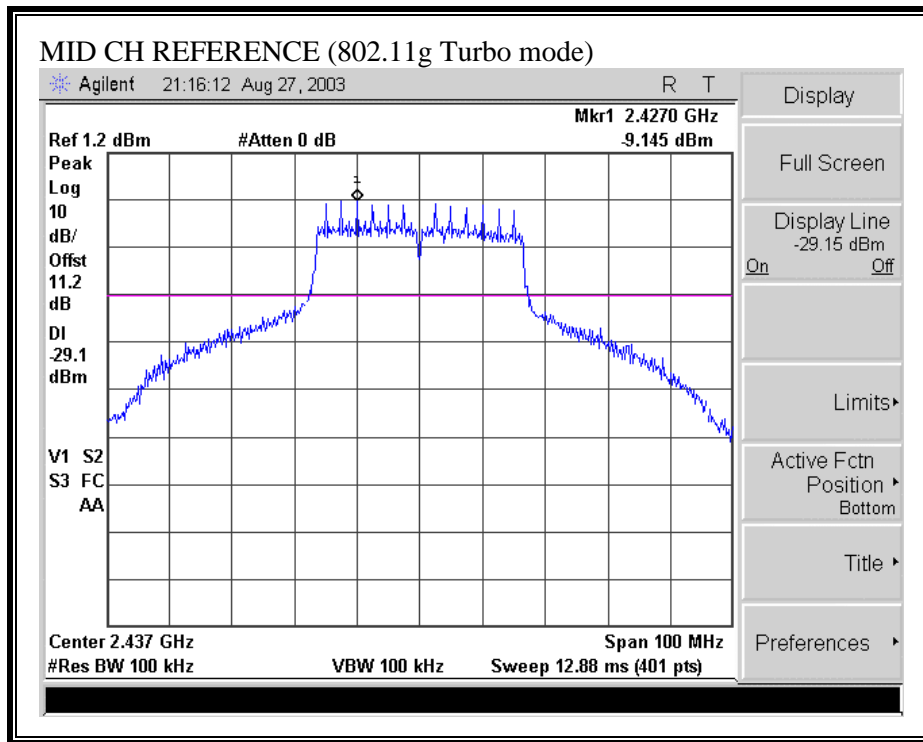


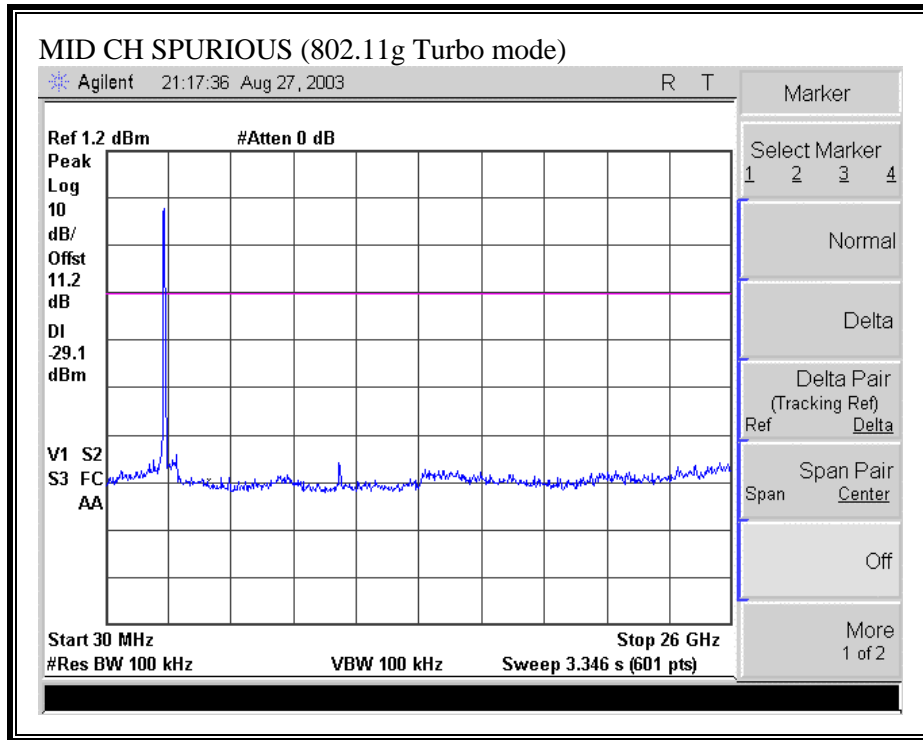
**SPURIOUS EMISSIONS, HIGH CHANNEL (802.11g NORMAL MODE)**





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







## 7.8. RADIATED 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 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41			

<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.

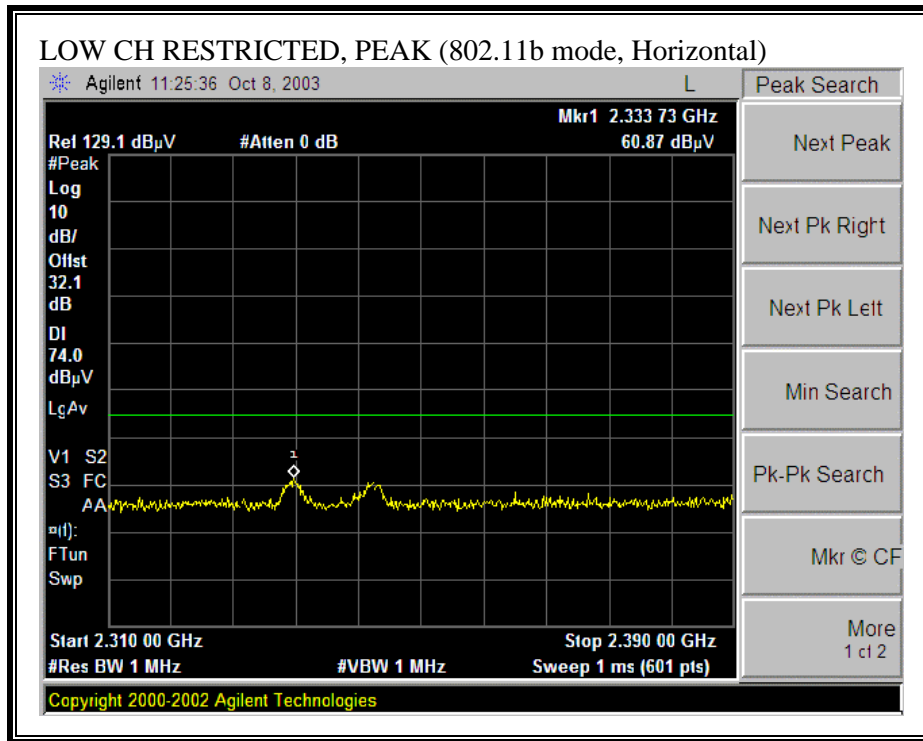
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

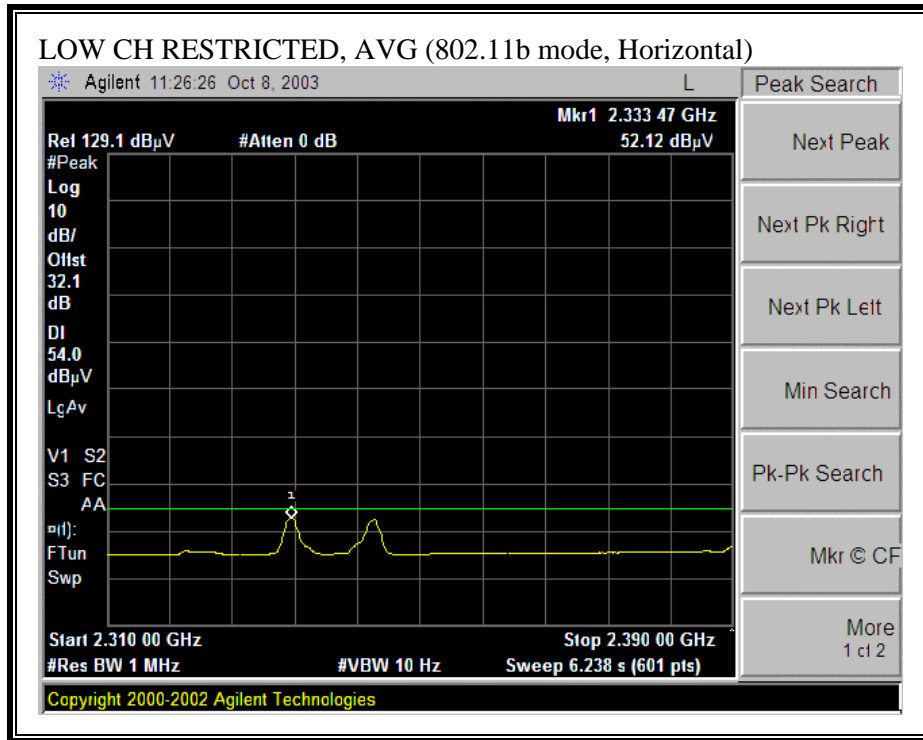
## **RESULTS**

No non-compliance noted:

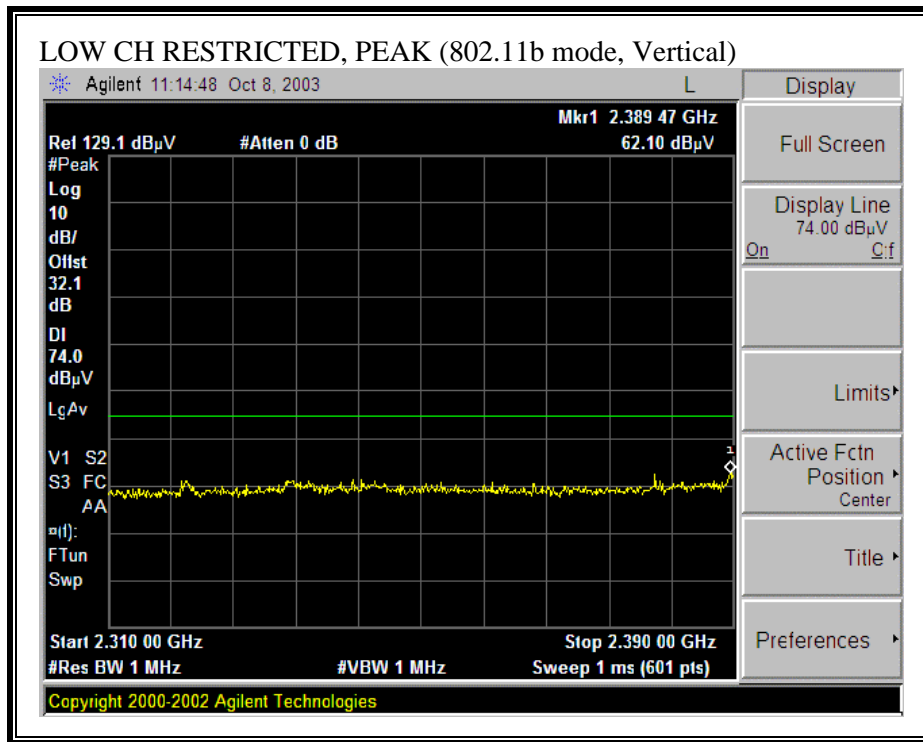
### 7.8.1. RADIATED EMISSIONS (EXTERNAL ANTENNA)

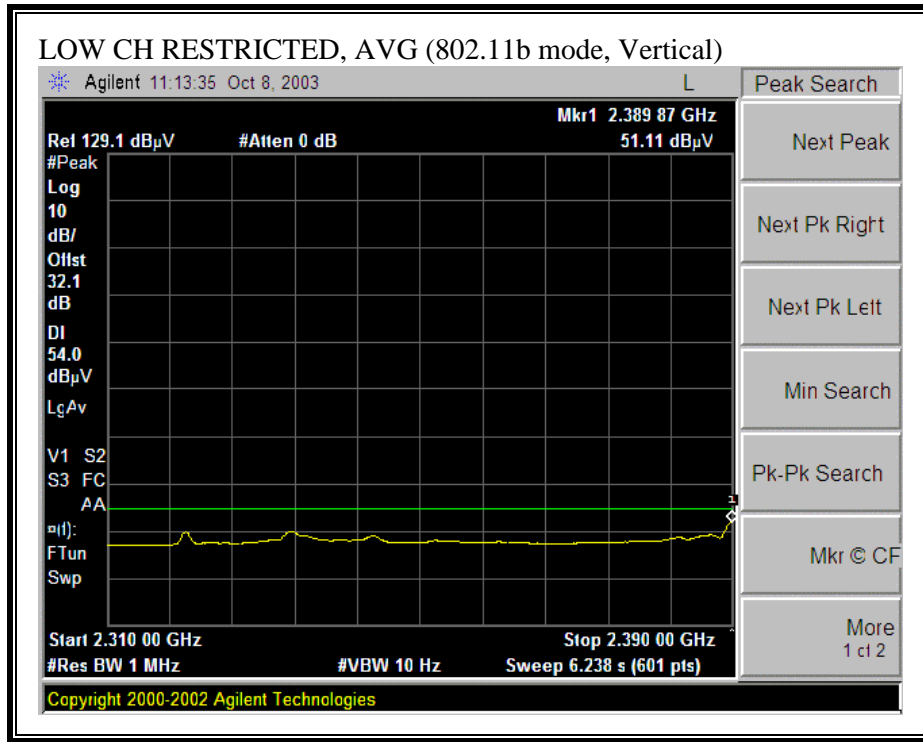
#### RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, HORIZONTAL)



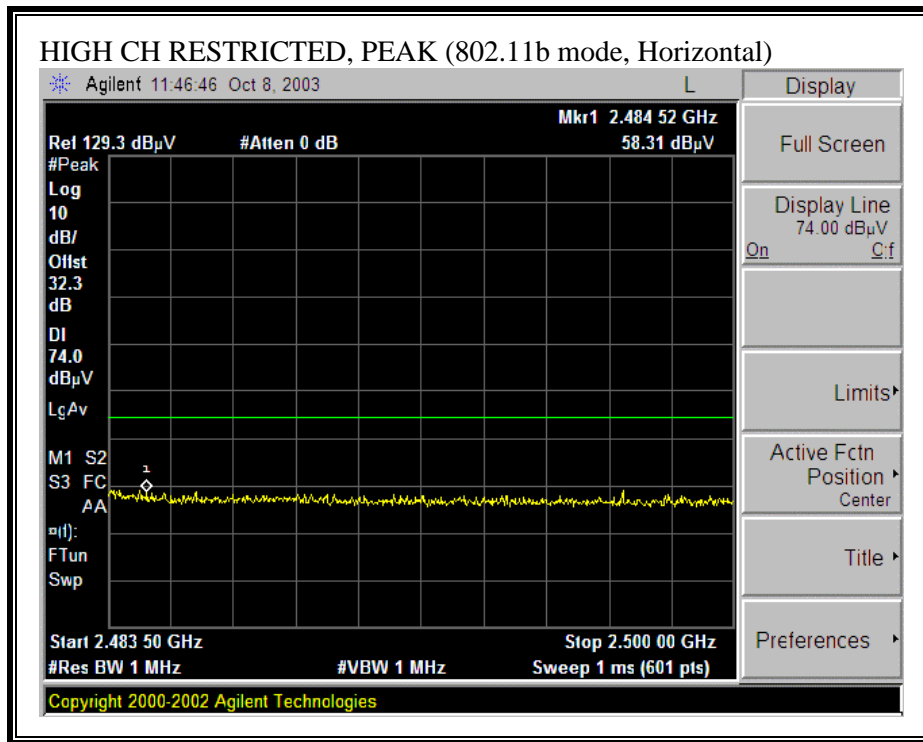


**RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, VERTICAL)**

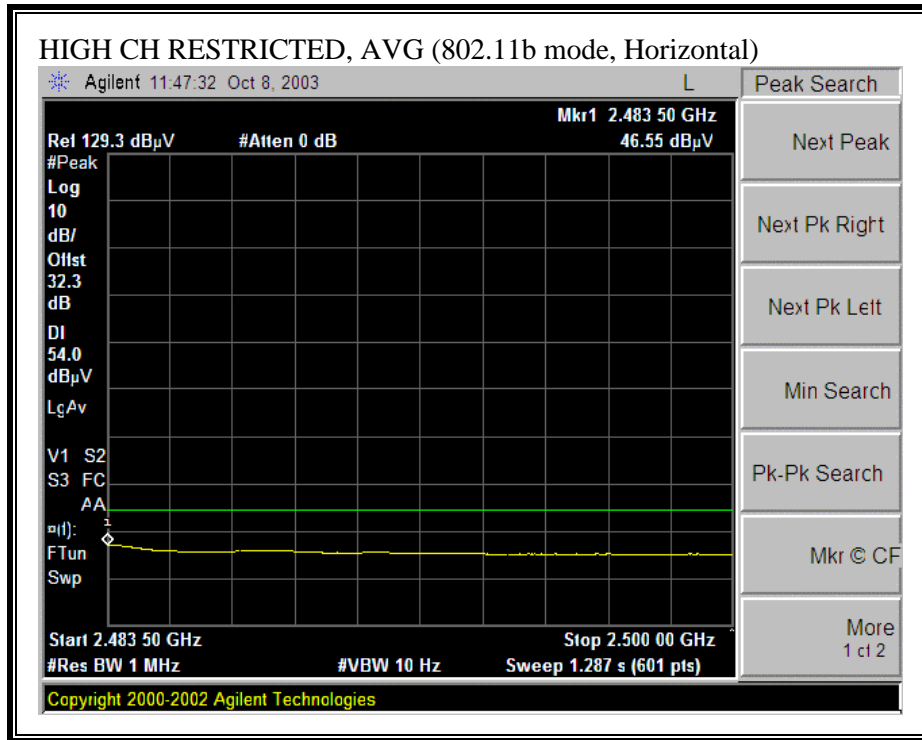




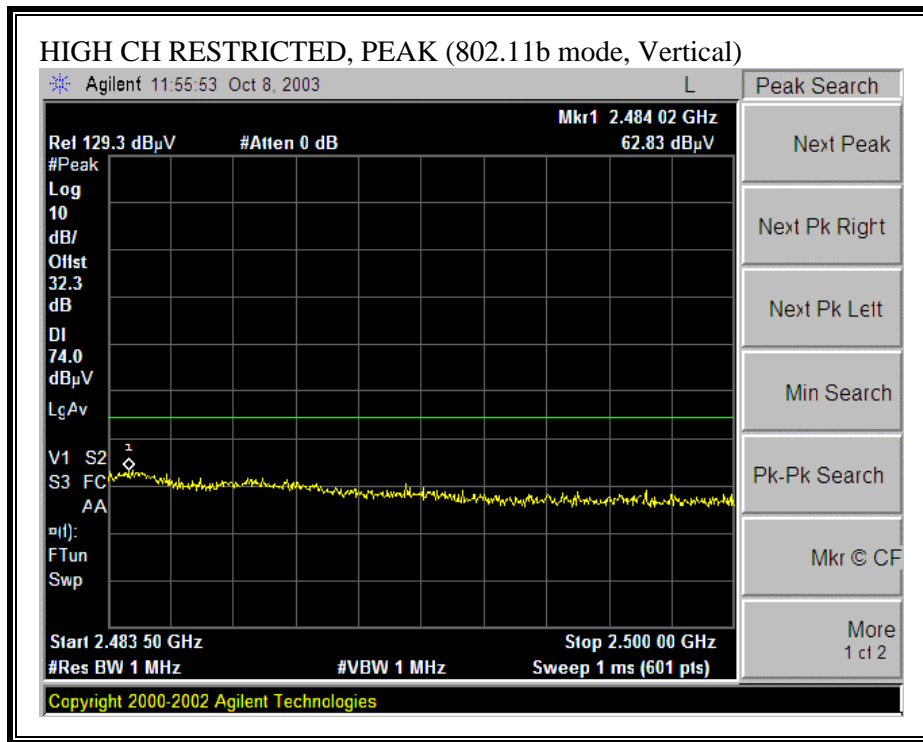
**RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, HORIZONTAL)**

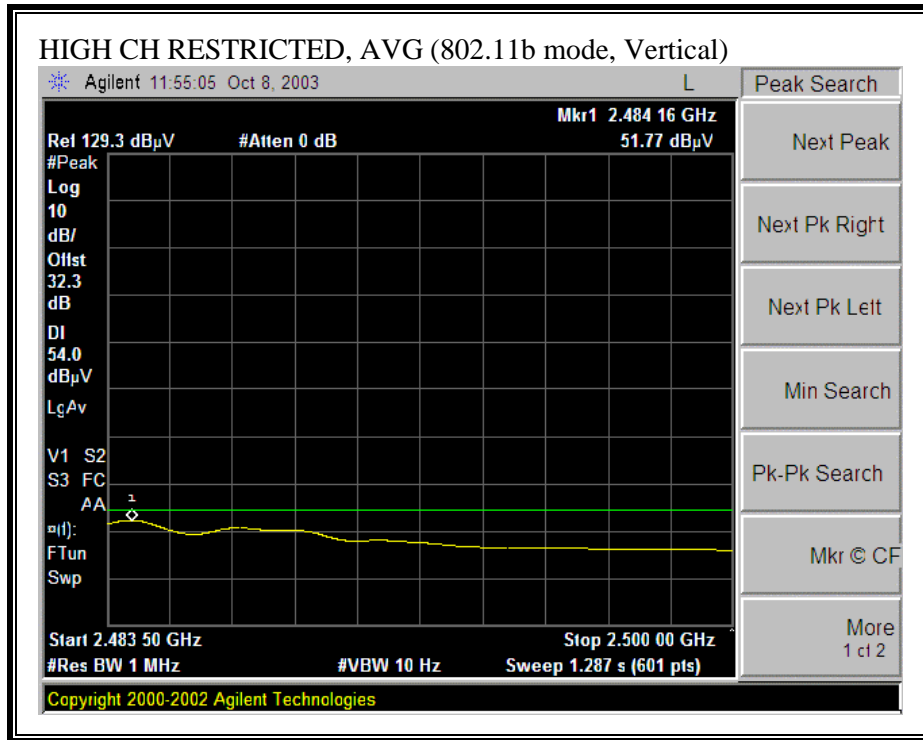






**RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, VERTICAL)**





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

10/02/03 High Frequency Measurement  
 Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: William Zhuang  
 Project #: 03U2214  
 Company Name: Atheros Communications  
 EUT Descrip.: 802.11 b/g Cardbus AP33  
 EUT M/N: AP33-022-58  
 Test Target: FCC 15.247  
 Mode Oper: Tx, b mode, external antenna

Test Equipment:

EMCO Horn 1-18GHz T73; S/N: 6717 @1m	Pre-amplifier 1-26GHz T86 Mitreq 924341	Spectrum Analyzer	Horn > 18GHz	Limit FCC 15.205
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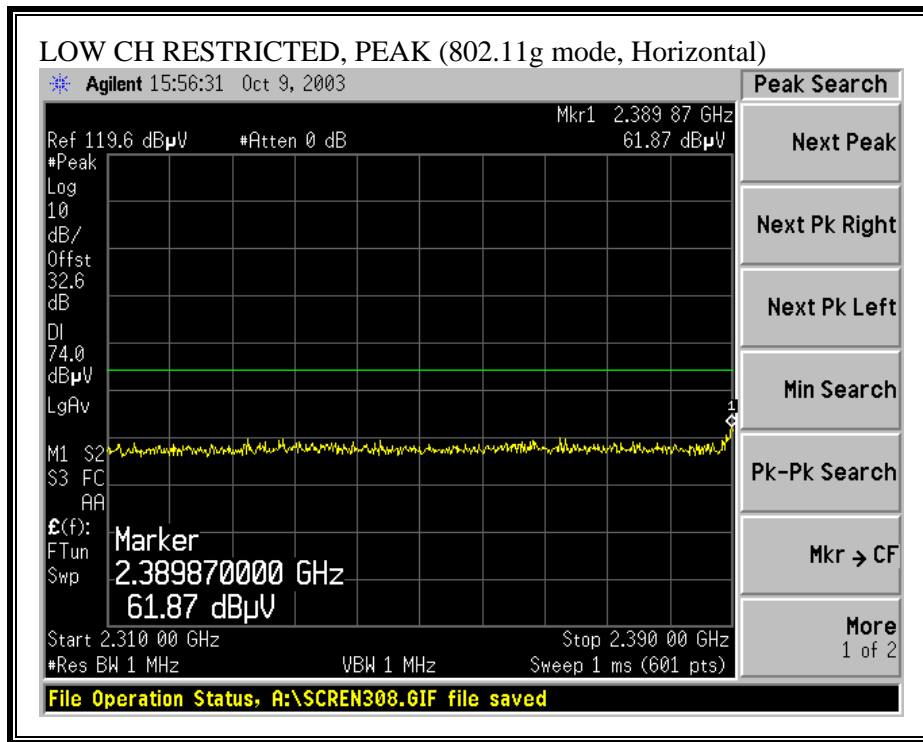
Hi Frequency Cables:  (2 ft)  (2~3 ft)  (4~6 ft)  (12 ft)

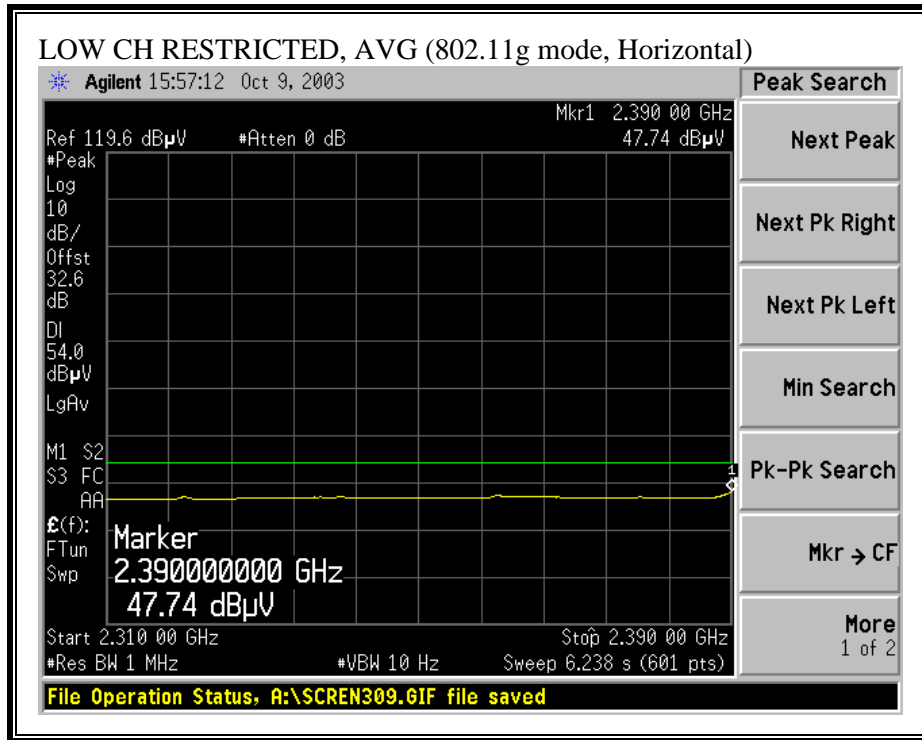
Peak Measurements: 1 MHz Resolution Bandwidth, 1 MHz Video Bandwidth  
 Average Measurements: 1 MHz Resolution Bandwidth, 10Hz Video Bandwidth

f GHz	Dist feet	Read Pk dBuV	Read Avg dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes
LOW CHANNEL															
4.824	9.8	59.8	56.3	33.9	3.9	-45.6	0.0	1.0	52.9	49.5	74.0	54.0	-21.1	-4.5	V
4.824	9.8	51.9	40.5	33.9	3.9	-45.6	0.0	1.0	45.0	33.6	74.0	54.0	-29.0	-20.4	H
MIDDLE CHANNEL															
4.874	9.8	60.6	57.5	33.9	3.9	-45.6	0.0	1.0	53.7	50.7	74.0	54.0	-20.3	-3.3	V
4.874	9.8	52.7	41.0	33.9	3.9	-45.6	0.0	1.0	45.8	34.1	74.0	54.0	-28.2	-19.9	H
7.311	9.8	54.7	41.5	36.8	4.9	-46.6	0.0	1.0	50.8	37.6	74.0	54.0	-23.2	-16.4	V
7.311	9.8	53.6	41.5	36.8	4.9	-46.6	0.0	1.0	49.7	37.6	74.0	54.0	-24.3	-16.4	H
HIGH CHANNEL															
4.924	9.8	57.2	52.6	34.0	3.9	-45.7	0.0	1.0	50.3	45.7	74.0	54.0	-23.7	-8.3	V
4.924	9.8	51.9	39.4	34.0	3.9	-45.7	0.0	1.0	45.1	32.6	74.0	54.0	-28.9	-21.4	H
7.386	9.8	54.1	41.6	36.9	5.0	-46.5	0.0	1.0	50.4	37.9	74.0	54.0	-23.6	-16.1	V
7.386	9.8	54.4	41.5	36.9	5.0	-46.5	0.0	1.0	50.7	37.8	74.0	54.0	-23.3	-16.2	H
NO OTHER SPURIOUS EMISSIONS WERE DETECTED ABOVE THE NOISE FLOOR															

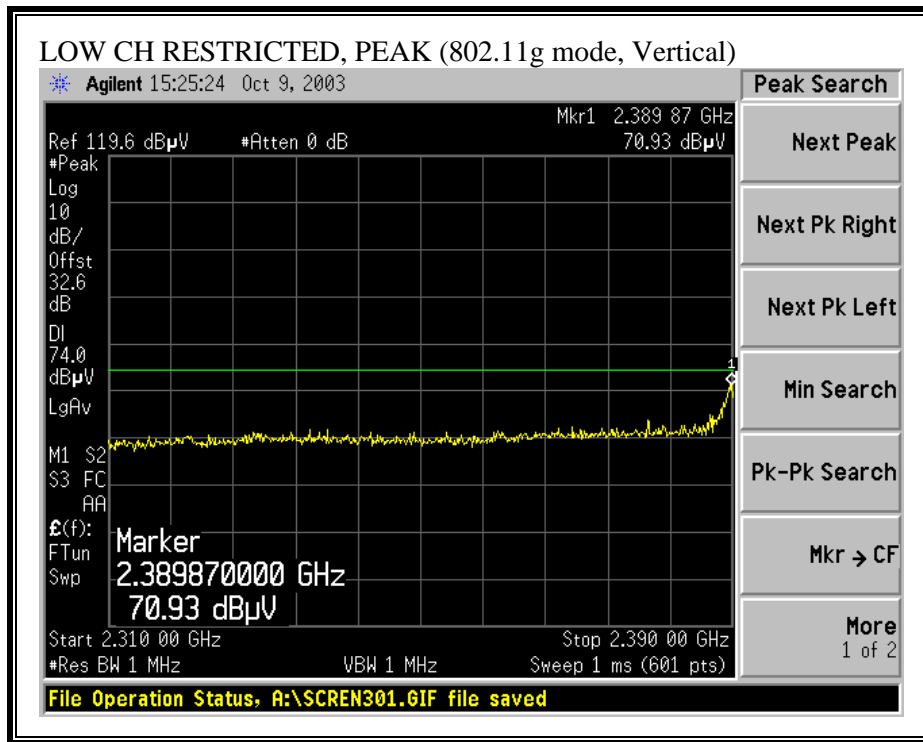
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

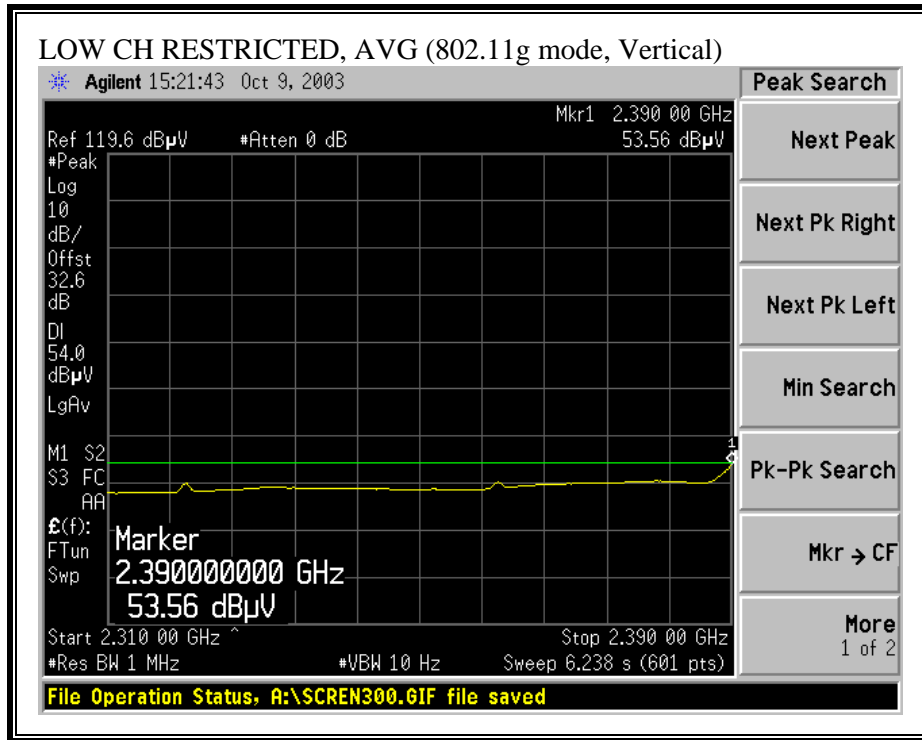
**RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, HORIZONTAL)**





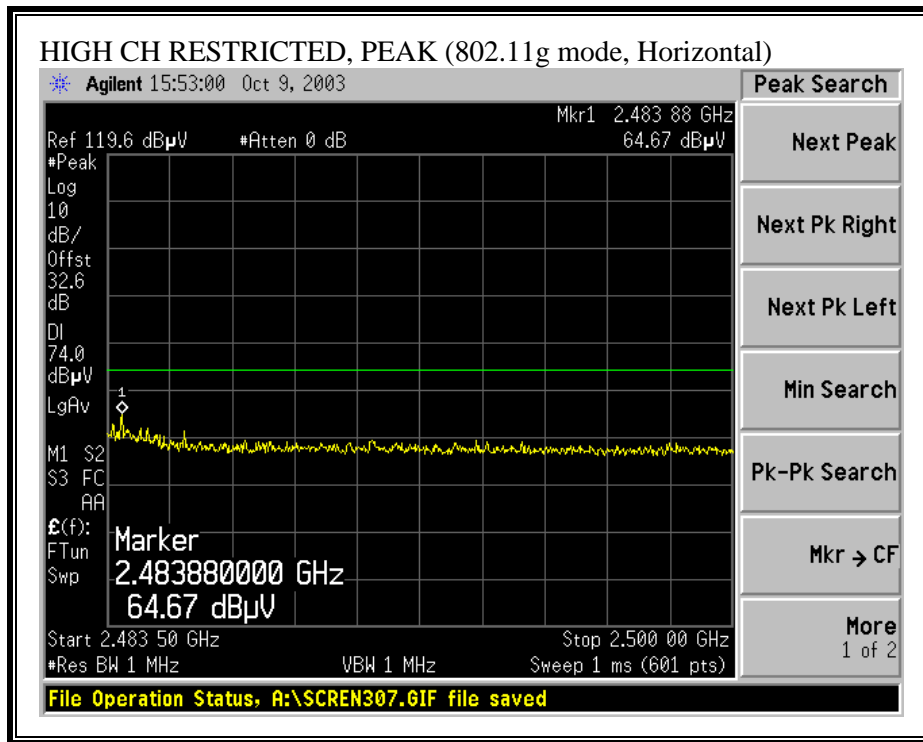
**RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, VERTICAL)**

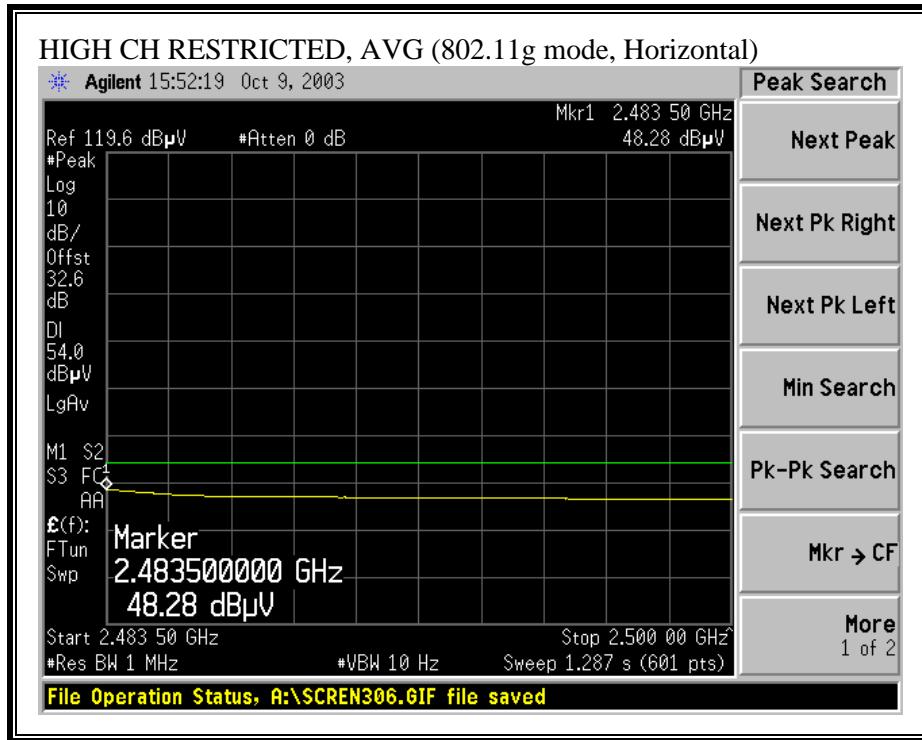




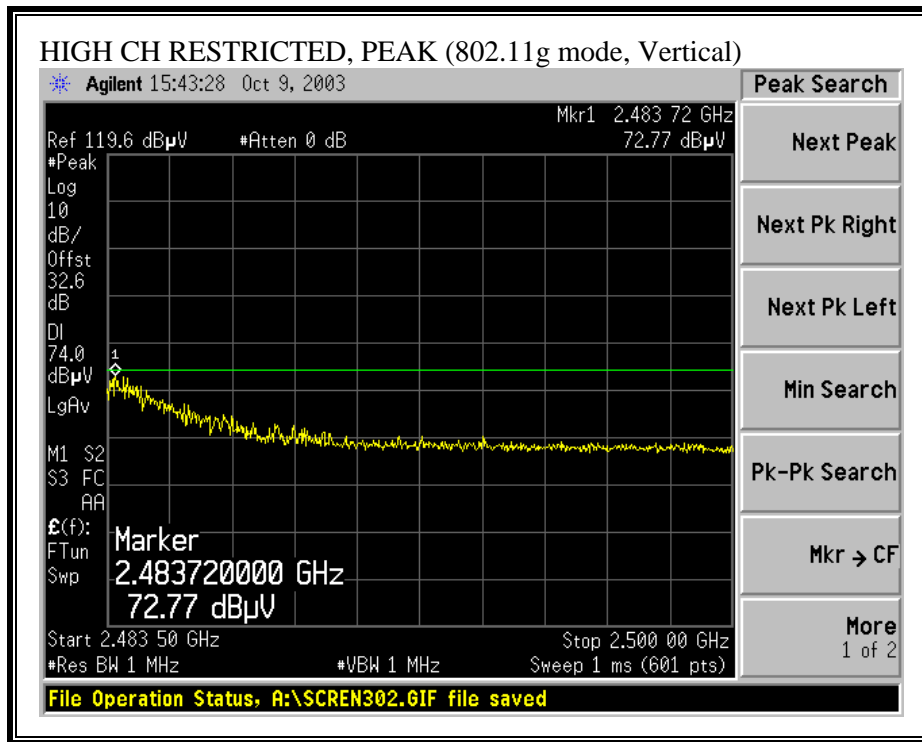


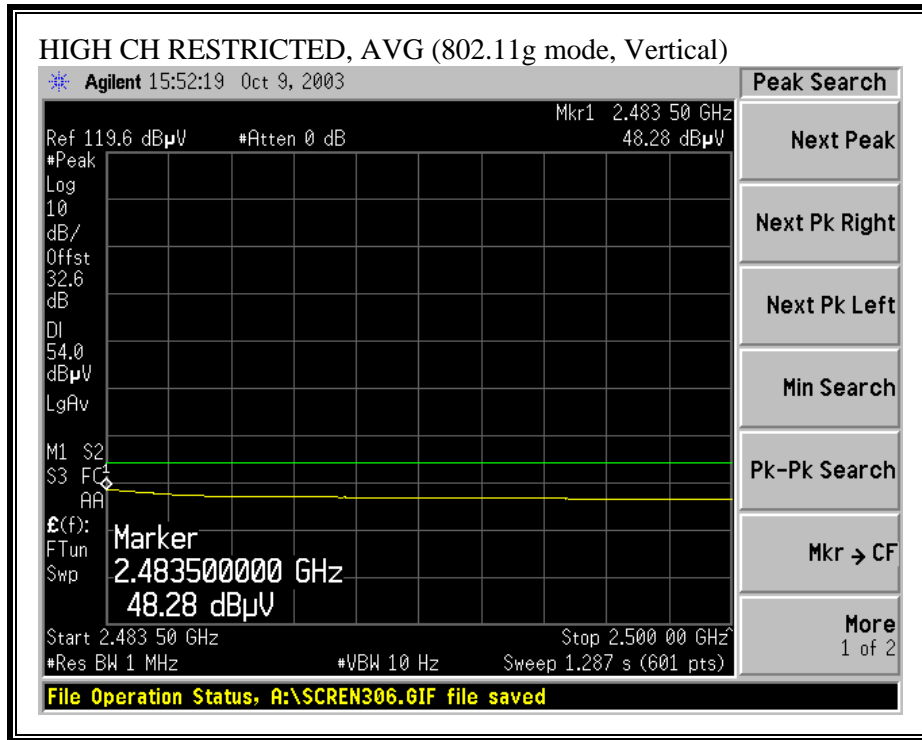
**RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, HORIZONTAL)**





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





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

10/02/03 High Frequency Measurement  
 Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: William Zhuang  
 Project #: 03U2214  
 Company Name: Atheros Communications  
 EUT Descrip.: 802.11 b/g Cardbus AP33  
 EUT M/N: AP33-022-58  
 Test Target: FCC 15.247  
 Mode Oper: Tx, g mode, external antenna

**Test Equipment:**

EMCO Horn 1-18GHz	Pre-amplifier 1-26GHz	Spectrum Analyzer	Horn > 18GHz	Limit
T73; S/N: 6717 @1m	T86 Miteq 924341			FCC 15.205

Hi Frequency Cables:

<input checked="" type="checkbox"/> (2 ft)	<input type="checkbox"/> (2~3 ft)	<input type="checkbox"/> (4~6 ft)	<input checked="" type="checkbox"/> (12 ft)
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Peak Measurements: 1 MHz Resolution Bandwidth  
 1MHz Video Bandwidth

Average Measurements: 1 MHz Resolution Bandwidth  
 10Hz Video Bandwidth

f GHz	Dist feet	Read Pk dBuV	Read Avg dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes
LOW CHANNEL															
4.824	9.8	54.0	39.5	33.9	3.9	-45.6	0.0	1.0	47.2	32.6	74.0	54.0	-26.8	-21.4	V
4.824	9.8	51.6	38.5	33.9	3.9	-45.6	0.0	1.0	44.7	31.6	74.0	54.0	-29.3	-22.4	H
MIDDLE CHANNEL															
4.874	9.8	57.7	44.1	33.9	3.9	-45.6	0.0	1.0	50.9	37.3	74.0	54.0	-23.1	-16.7	V
4.874	9.8	52.3	39.6	33.9	3.9	-45.6	0.0	1.0	45.5	32.7	74.0	54.0	-28.5	-21.3	H
7.311	9.8	54.6	41.6	36.8	4.9	-46.6	0.0	1.0	50.7	37.8	74.0	54.0	-23.3	-16.2	V
7.311	9.8	54.7	41.7	36.8	4.9	-46.6	0.0	1.0	50.8	37.8	74.0	54.0	-23.2	-16.2	H
HIGH CHANNEL															
4.924	9.8	52.7	39.7	34.0	3.9	-45.7	0.0	1.0	45.8	32.9	74.0	54.0	-28.2	-21.1	V
4.924	9.8	52.7	39.5	34.0	3.9	-45.7	0.0	1.0	45.9	32.7	74.0	54.0	-28.1	-21.3	H
7.386	9.8	53.4	41.7	36.9	5.0	-46.5	0.0	1.0	49.7	38.0	74.0	54.0	-24.3	-16.0	V
7.386	9.8	54.2	41.7	36.9	5.0	-46.5	0.0	1.0	50.5	38.0	74.0	54.0	-23.5	-16.0	H
NO OTHER SPURIOUS DETECTED ABOVE THE NOISE FLOOR															

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		

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

10/02/03 High Frequency Measurement  
 Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: William Zhuang  
 Project #: 03U2214  
 Company Name: Atheros Communications  
 EUT Descr.: 802.11 b/g Cardbus AP33  
 EUT M/N: AP33-022-58  
 Test Target: FCC 15.247  
 Mode Oper: Tx, g turbo mode, Mid Ch. external antenna

Test Equipment:

EMCO Horn 1-18GHz	Pre-amplifier 1-26GHz	Spectrum Analyzer	Horn > 18GHz	Limit
T73; S/N: 6717 @1m	T86 Miteq 924341			FCC 15.205

Hi Frequency Cables:  (2 ft)  (2~3 ft)  (4~6 ft)  (12 ft)

Peak Measurements: 1 MHz Resolution Bandwidth  
 1 MHz Video Bandwidth

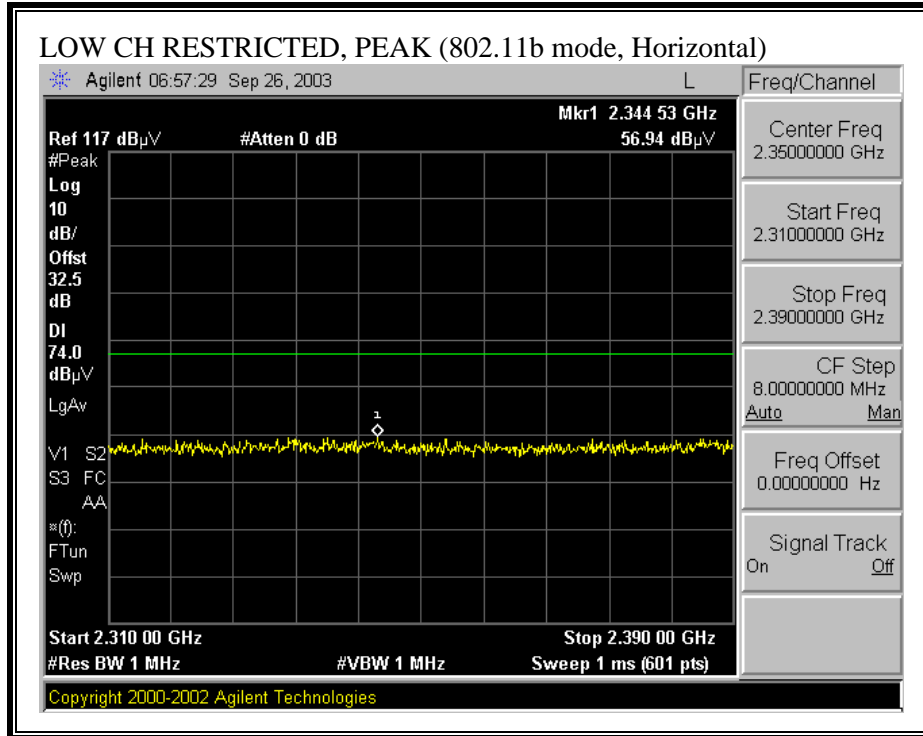
Average Measurements: 1 MHz Resolution Bandwidth  
 10 Hz Video Bandwidth

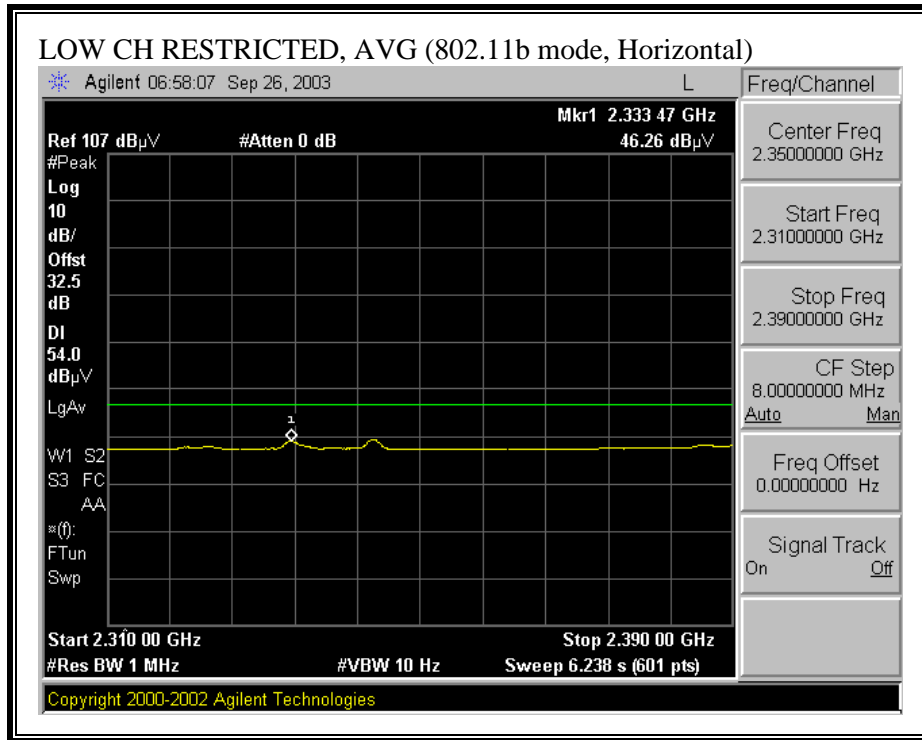
f	Dist	Read Pk	Read Avg	AF	CL	Amp	D Corr	HPF	Peak	Avg	Pk Lim	Avg Lim	Pk Mar	Avg Mar	Notes
GHz	feet	dBuV	dBuV	dB/m	dB	dB	dB		dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	
MIDDLE CHANNEL TURBO															
4.874	9.8	54.5	42.2	33.9	3.9	-45.6	0.0	1.0	47.7	35.4	74.0	54.0	-26.3	-18.6	Y
4.874	9.8	52.3	39.3	33.9	3.9	-45.6	0.0	1.0	45.5	32.5	74.0	54.0	-28.5	-21.5	H
7.311	9.8	54.3	41.4	36.8	4.9	-46.6	0.0	1.0	50.5	37.6	74.0	54.0	-23.5	-16.4	Y
7.311	9.8	53.3	41.5	36.8	4.9	-46.6	0.0	1.0	49.4	37.6	74.0	54.0	-24.6	-16.4	H
NO OTHER SPURIOUS EMISSIONS DETECTED ABOVE THE NOISE FLOOR															

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		

### 7.8.2. RADIATED EMISSIONS (INTERNAL ANTENNA)

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







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

