



**FCC CFR47 PART 15 SUBPART C  
CERTIFICATION**

**TEST REPORT**

**FOR**

**802.11A/G PCI ADAPTER**

**MODEL NUMBER: AIR-PI21AG-A-K9**

**FCC ID: LDK102051**

**REPORT NUMBER: 03U2286-1**

**ISSUE DATE: OCTOBER 28, 2003**

*Prepared for*  
**CISCO SYSTEMS, INC.  
170 WEST TASMAN  
SAN JOSE, CA 95134  
USA**

*Prepared by*  
**COMPLIANCE CERTIFICATION SERVICES  
561F MONTEREY ROAD,  
MORGAN HILL, CA 95037, USA  
TEL: (408) 463-0885  
FAX: (408) 463-0888**



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## 1. TEST RESULT CERTIFICATION

**COMPANY NAME:** CISCO SYSTEMS, INC.  
170 WEST TASMAN  
SAN JOSE, CA 95134, USA

**EUT DESCRIPTION:** 802.11A/G PCI ADAPTER

**MODEL:** AIR-PI21AG-A-K9

**DATE TESTED:** SEPTEMBER 30 - OCTOBER 28, 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.


**Note:** The 2.4 and 5.8 GHz bands are applicable to this report; another band of operation (5.2 GHz) is documented in a separate report.

Approved & Released For CCS By:

Tested By:



MICHAEL HECKROTTE  
CHIEF ENGINEER  
COMPLIANCE CERTIFICATION SERVICES



CHIN PANG  
EMC TECHNICIAN  
COMPLIANCE CERTIFICATION SERVICES

## 2. EUT DESCRIPTION

The EUT is an 802.11a/b/g transceiver on a PCI card.

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	21.24	133.05
2412 - 2462	802.11g Normal	19.95	98.86
5785 - 5825	802.11a Normal	19.98	99.54

The radio utilizes a single flying lead straight antenna, with a maximum assembly (including cable) gain of 1.17 dBi in the 2.4 GHz band and 0.6 dBi in the 5.8 GHz band.

### 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 AND MEASUREMENT EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due Date
EMI Test Receiver	R & S	ESHS 20	827129/006	4/18/04
LISN 10 KHz-30MHz	FCC	50/250-25-2	114	11/6/03
Line Filter	Lindgren	LMF-3489	497	NCR
LISN 10 KHz-30MHz	Solar	8012-50-R-24-BNC	837990	11/6/03
Bilog Antenna	AR	LPB-25201A	1185	3/6/04
EMI Receiver	HP	8542E	3942A00280	11/20/03
RF Filter Section	HP	85420E	3705A00256	11/20/03
Pre-Amplifier, 1-26GHz	Miteq	NSP2600-SP	924342	4/15/04
PSA Spectrum Analyzer	Agilent	E4446A	NA	1/23/04
Horn	EMCO	3115	2238	2/4/04
3.0 HPF	MicroTronic	HPM13194	001	NCR
7.6GHz HPF	Microwave	HP7600-9SS	NA	NCR

## 6. SETUP OF EQUIPMENT UNDER TEST

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Device Type	Manufacturer	Model	Serial Number	FCC ID
Monitor	Dell	M780	5322DE20E049	DoC
Keyboard	Dell	SK-8110	NA	DoC
Mouse	Dell	M-SAW34	LZA30519730	DZL211029
PC	Dell	DHP	J4V181S	DoC

### I/O CABLES

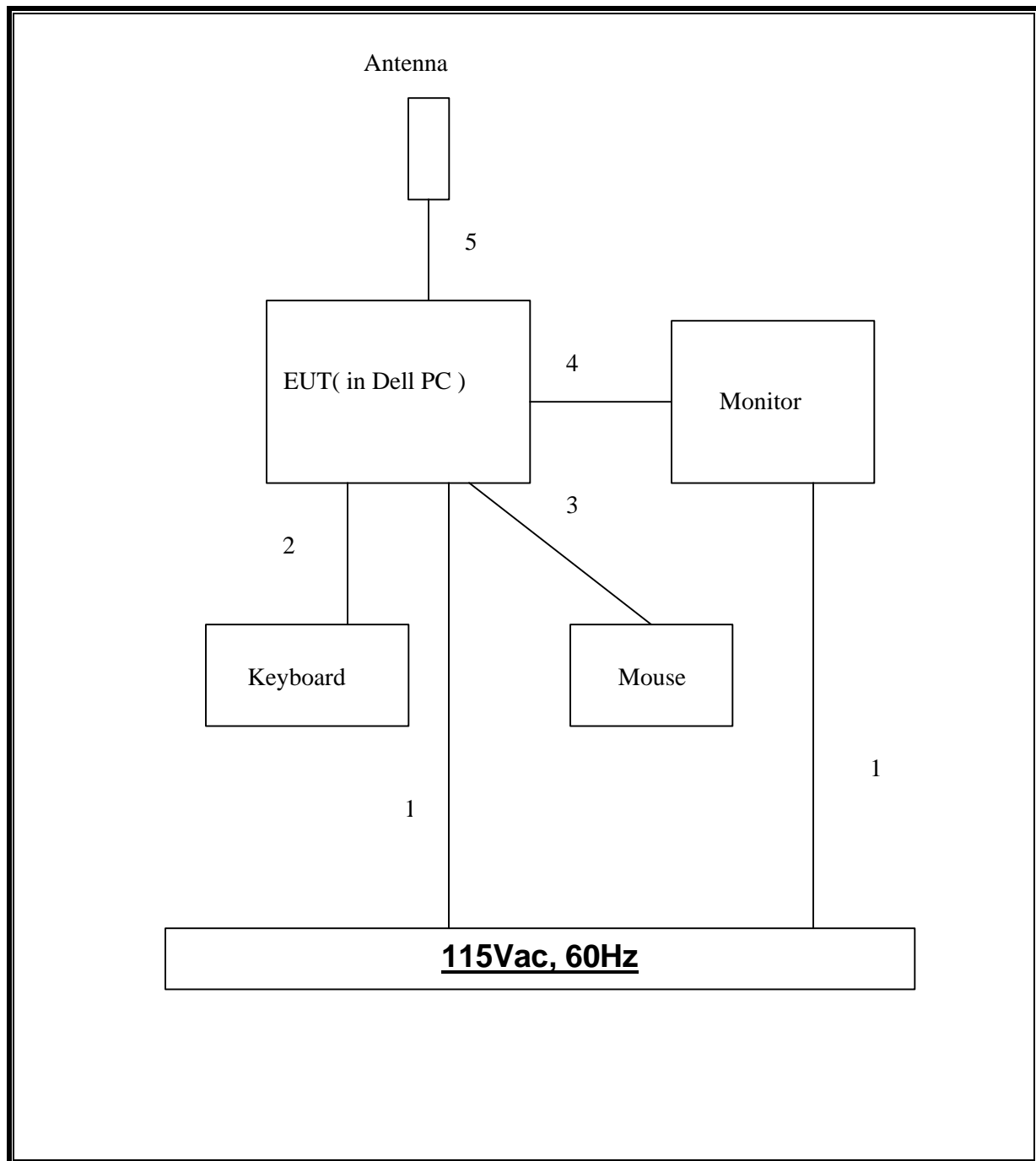
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	AC	Un-Shielded	2m	Bundled cable for LC test
2	KB	1	PS/2	Un-Shielded	2m	NA
3	Mouse	1	PS/2	Un-Shielded	2m	NA
4	Video	1	DB15	Shielded	1m	One Torroid on each end
5	Antenna	1	Antenna	Un-Shielded	1m	NA

### TEST SETUP

The EUT is installed in a host computer during the tests. Test software exercised the radio card.



**SETUP DIAGRAM FOR TESTS**



## **SETUP INFORMATION FOR DIGITAL DEVICE TESTS**

### **SUPPORT EQUIPMENT**

PERIPHERAL SUPPORT EQUIPMENT LIST				
Device Type	Manufacturer	Model	Serial Number	FCC ID
Monitor	Dell	M780	5322DE20E049	DoC
Keyboard	Dell	SK-8110	NA	DoC
Mouse	Dell	M-SAW34	LZA30519730	DZL211029
PC	Dell	DHP	J4V181S	DoC
Modem	ACEEX	1414	9013540	1FAXDM1414
Printer	HP	2225C	2541S41679	BS46XU2225C

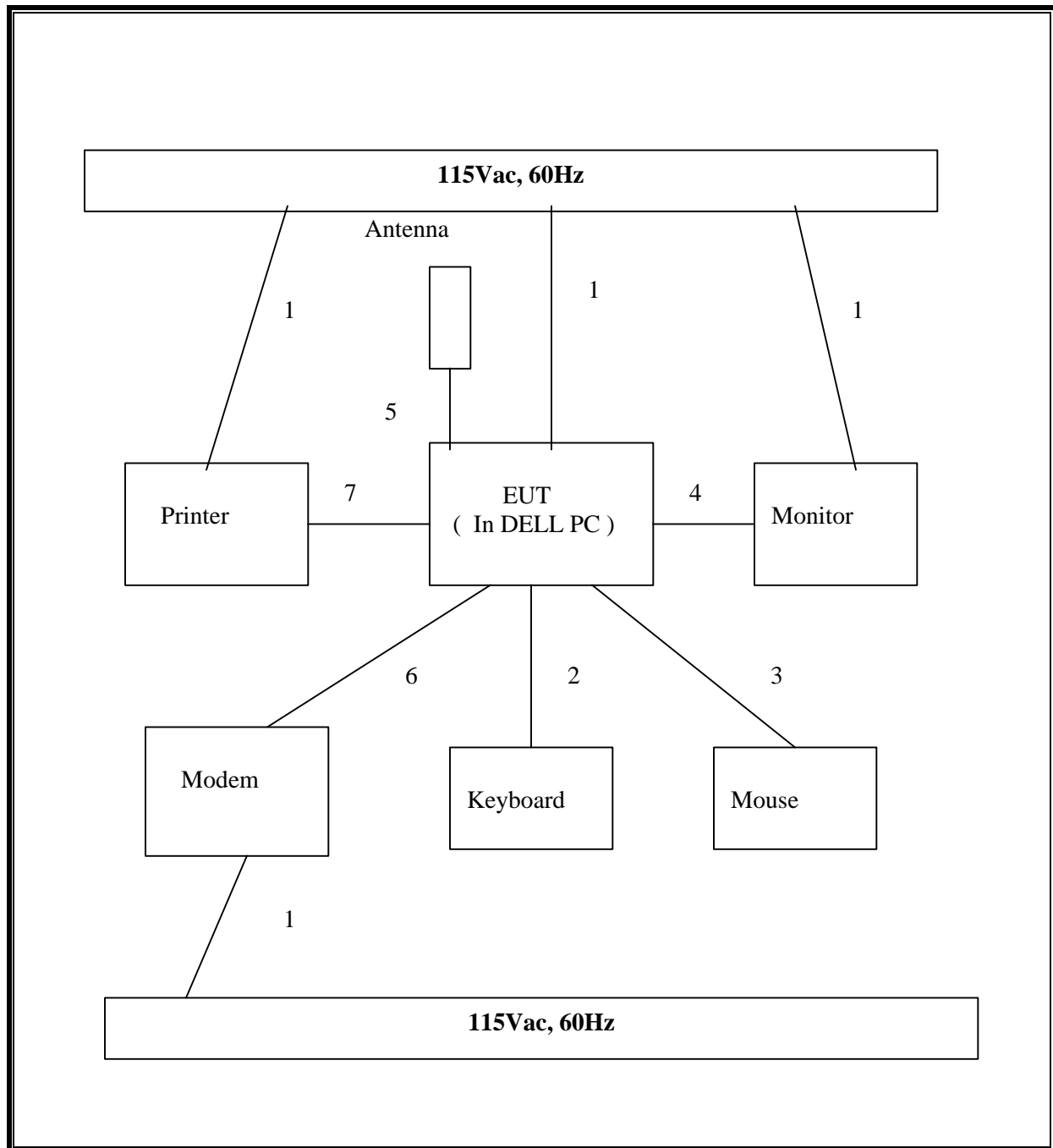
### **I/O CABLES**

Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	4	AC	Un-Shielded	2m	Bundled cable for LC test
2	KB	1	PS/2	Un-Shielded	2m	NA
3	Mouse	1	PS/2	Un-Shielded	2m	NA
4	Video	1	DB15	Shielded	1m	One Torroid on each end
5	Antenna	1	Antenna	Un-Shielded	1m	NA
6	Serial	1	DB9	Un-Shielded	1m	NA
7	Parallel	1	DB25	Shielded	2m	NA

### **TEST SETUP**

The EUT is installed in a host computer during the tests. Test software exercised the host computer and radio card.

**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.

#### 2.4 GHz BAND RESULTS

No non-compliance noted:

##### 802.11b Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2412	12370	500	11870
Middle	2437	11230	500	10730
High	2462	11930	500	11430

##### 802.11g Normal Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2412	16430	500	15930
Middle	2437	16600	500	16100
High	2462	16430	500	15930

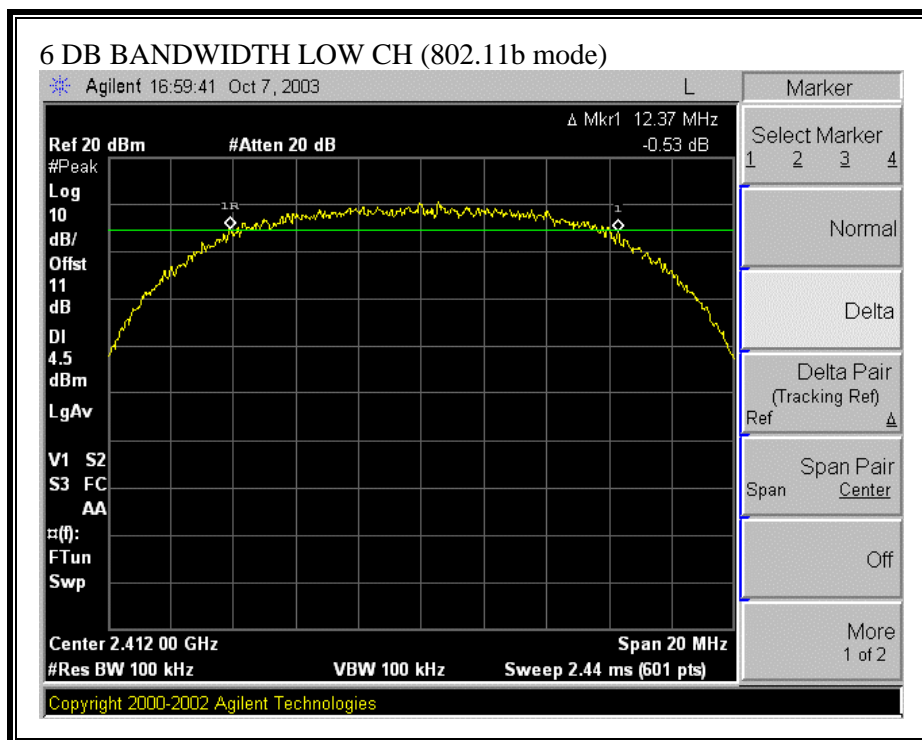
## **5.8 GHz BAND RESULTS**

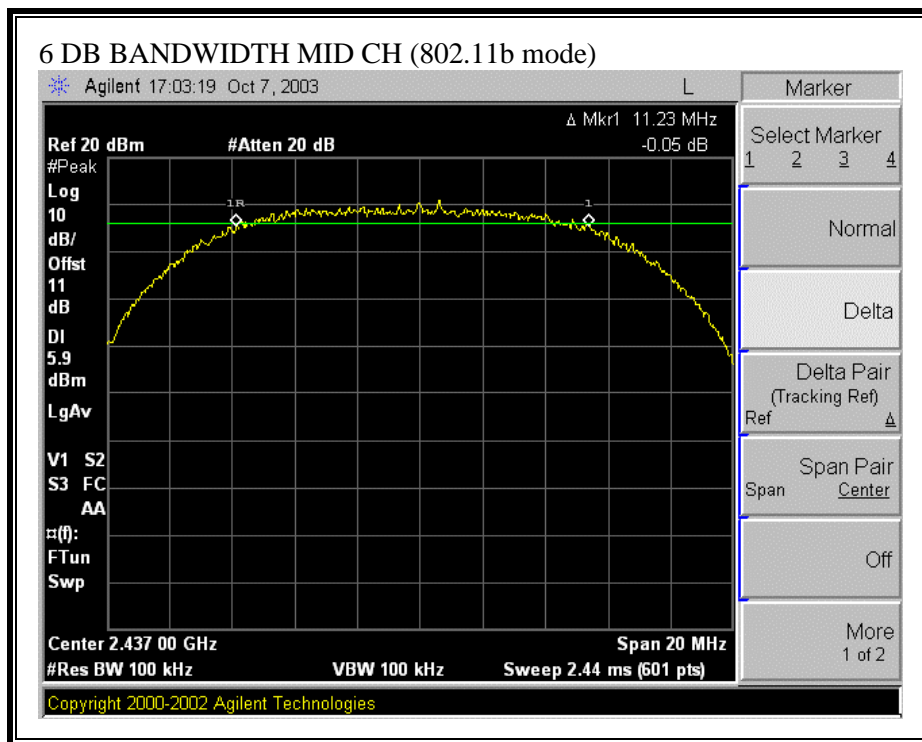
No non-compliance noted:

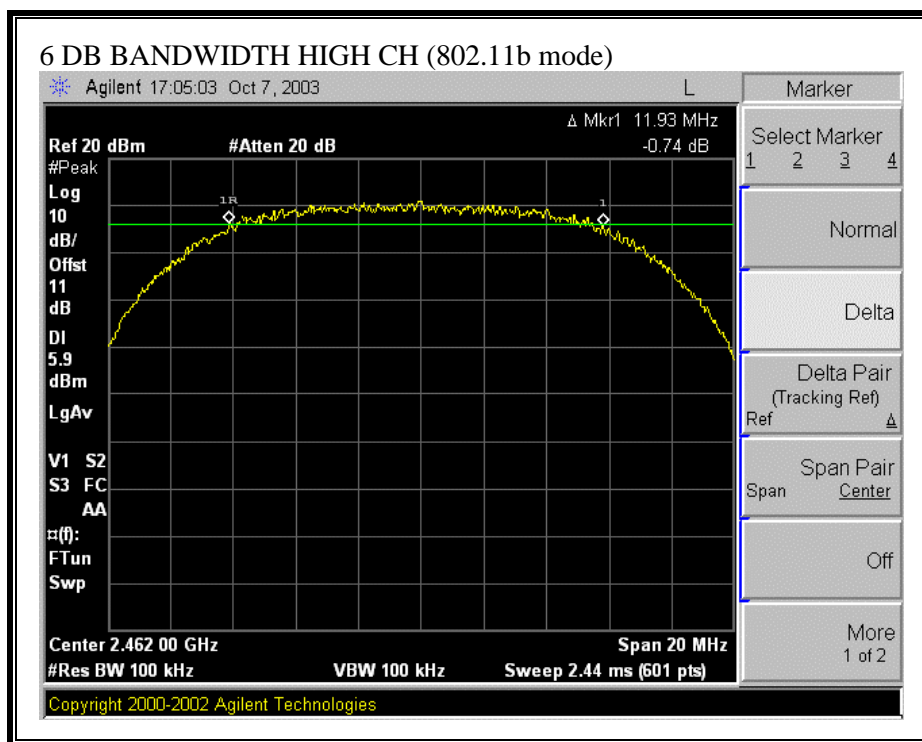
### 802.11a Normal Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	5745	16600	500	16100
Middle	5785	16600	500	16100
High	5825	16530	500	16030

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

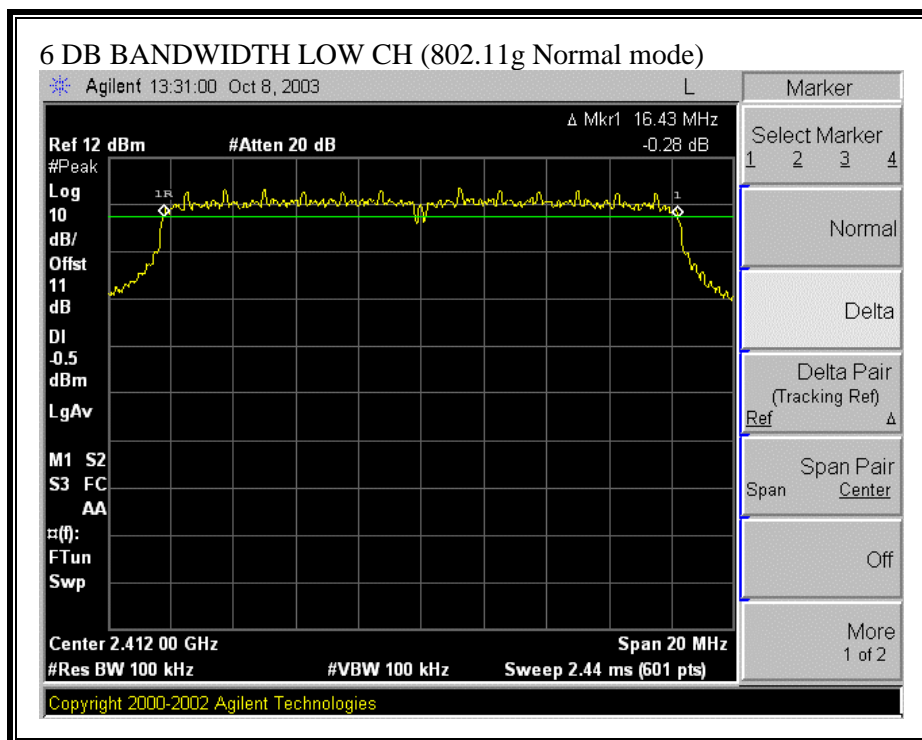


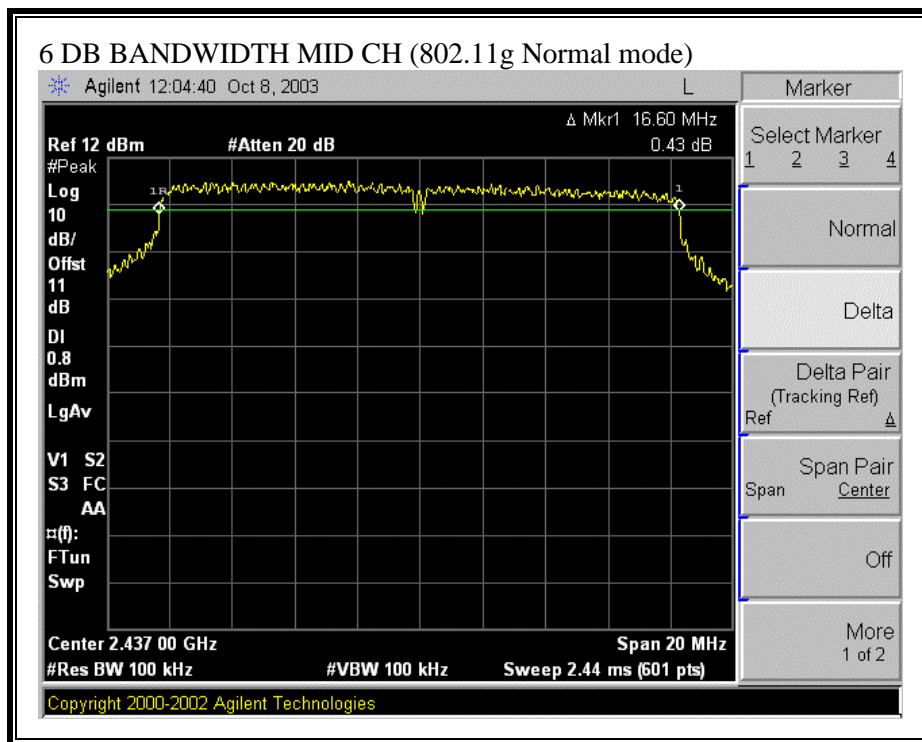


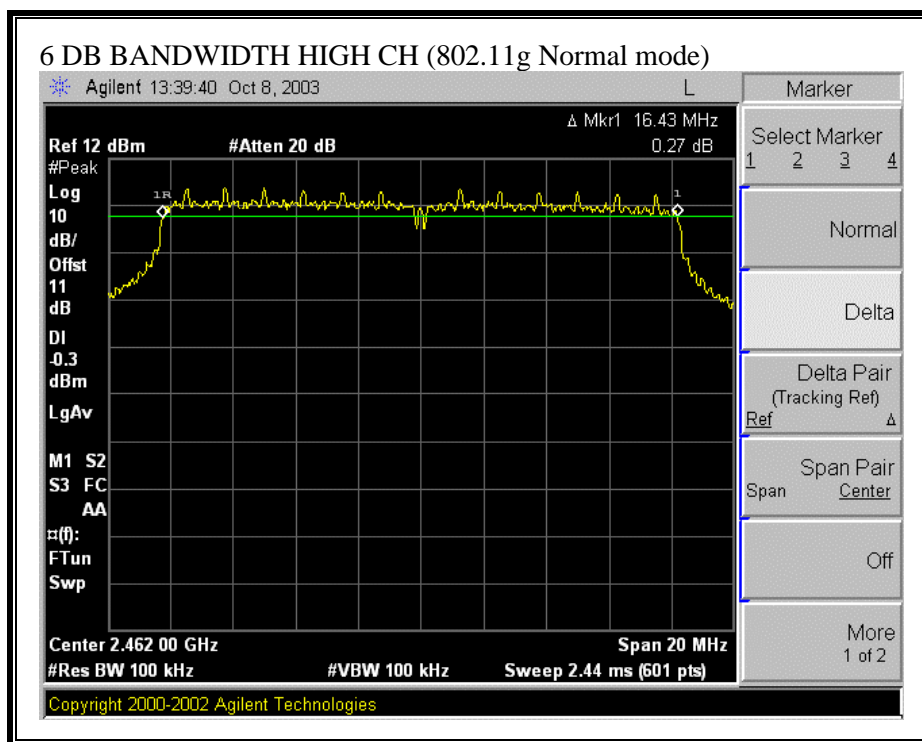




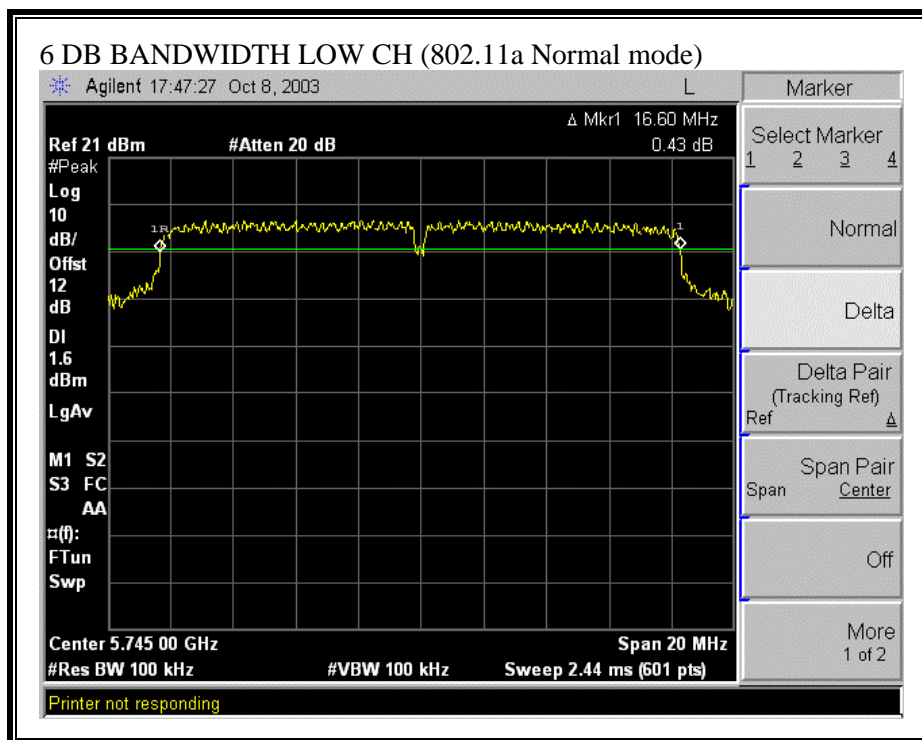
**6 DB BANDWIDTH (802.11g NORMAL MODE)**

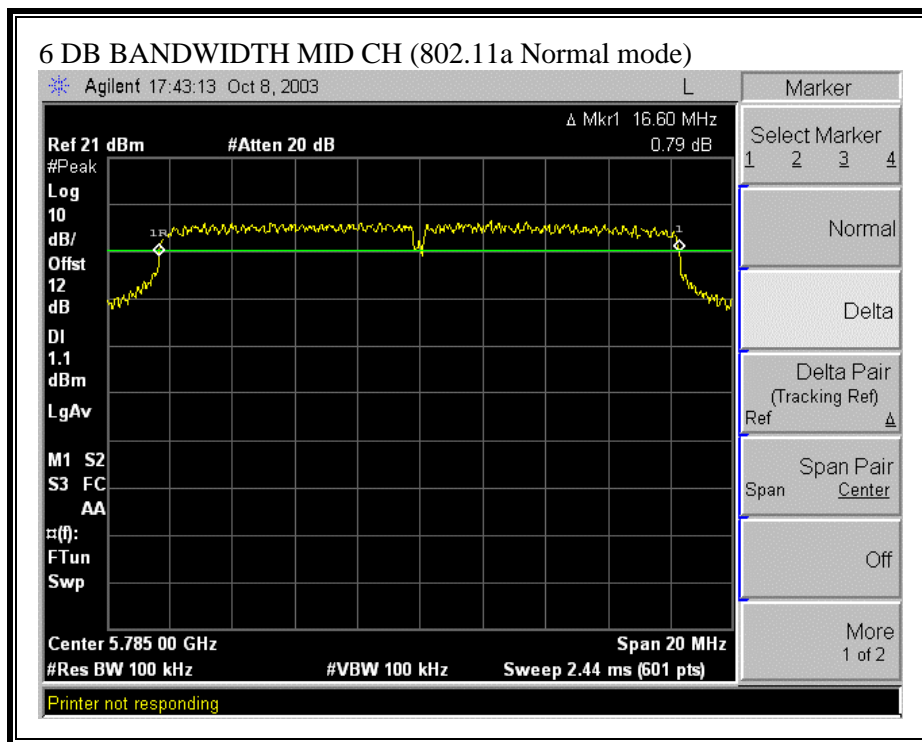


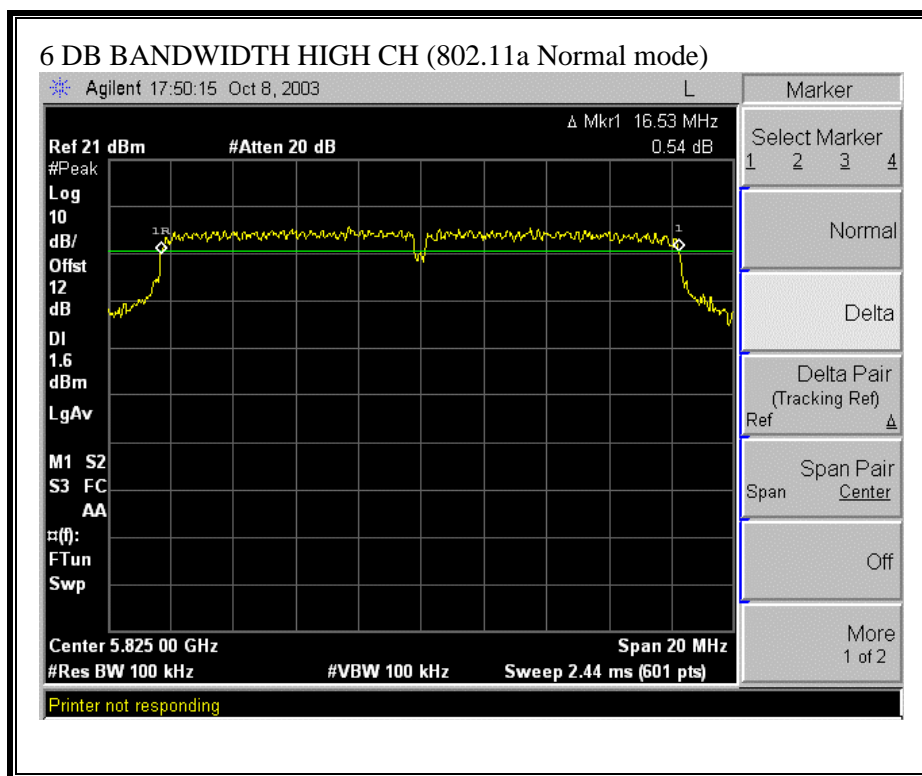




**6 DB BANDWIDTH (802.11a MODE)**







## 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.

### 2.4 GHz BAND RESULTS

No non-compliance noted:

#### 802.11b Mode

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	15.189
Middle	2437	15.377
High	2462	15.269

#### 802.11g Normal Mode

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.513
Middle	2437	16.641
High	2462	16.631

## **5.8 GHz BAND RESULTS**

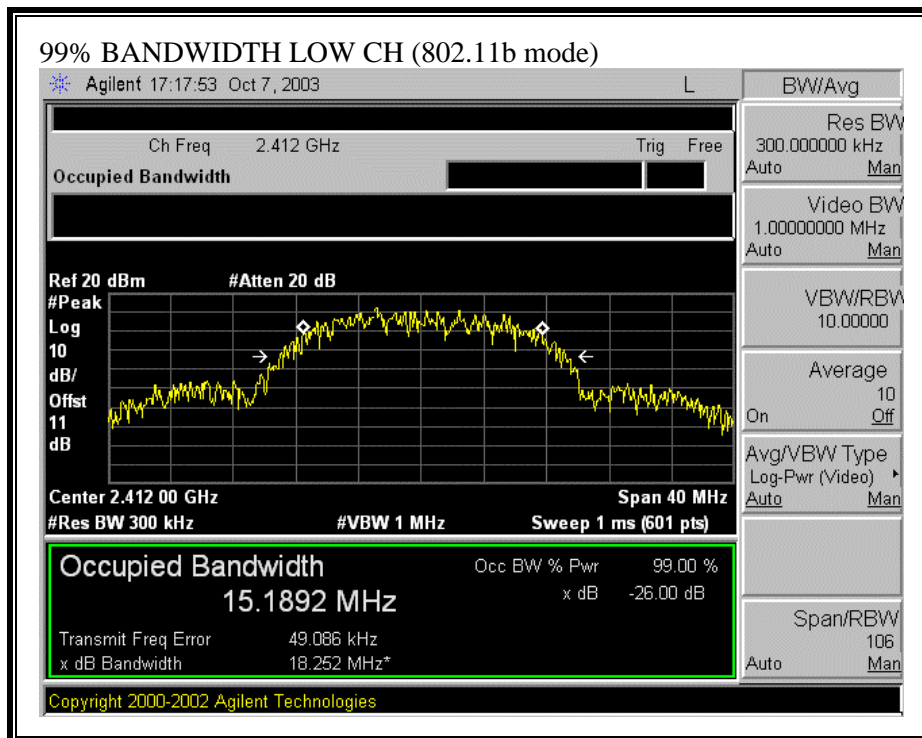
No non-compliance noted:

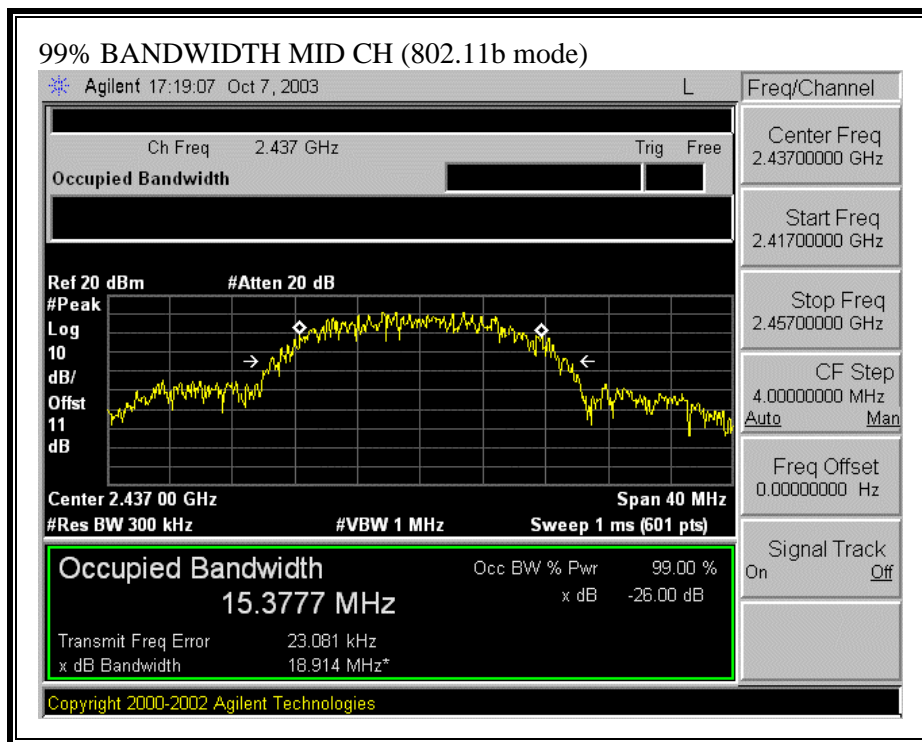
### 802.11a Normal Mode

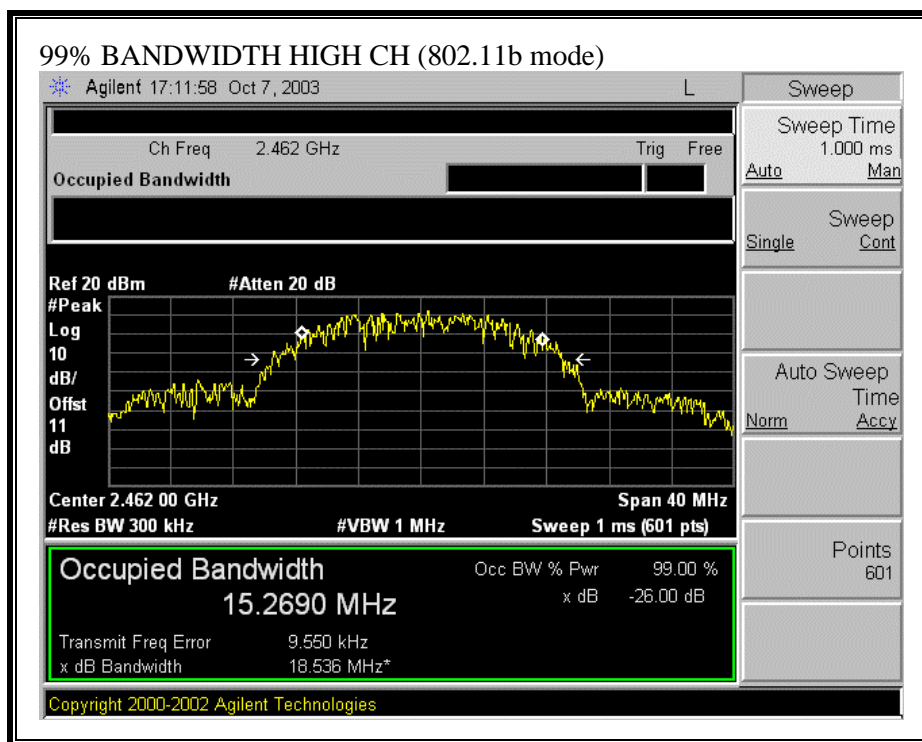
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	16.8646
Middle	5785	16.9938
High	5825	16.6596



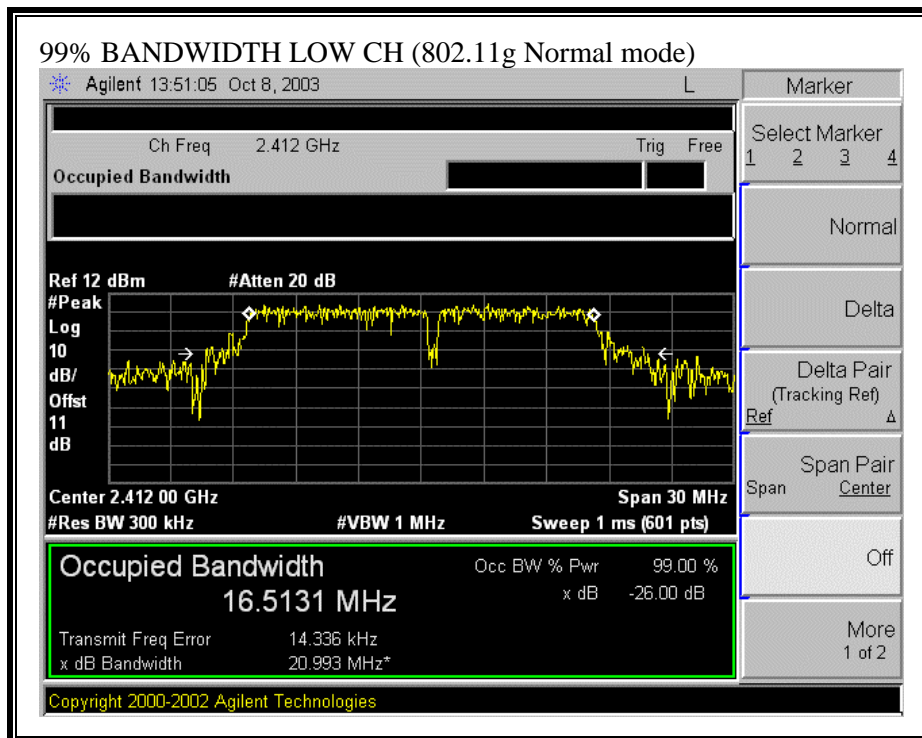
**99% BANDWIDTH (802.11b MODE)**

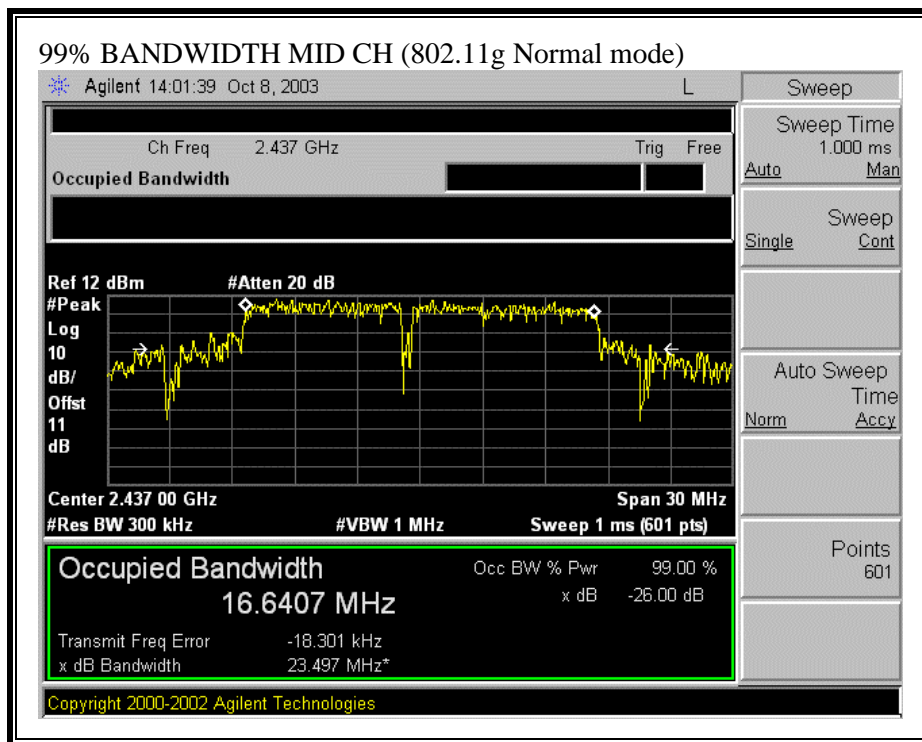


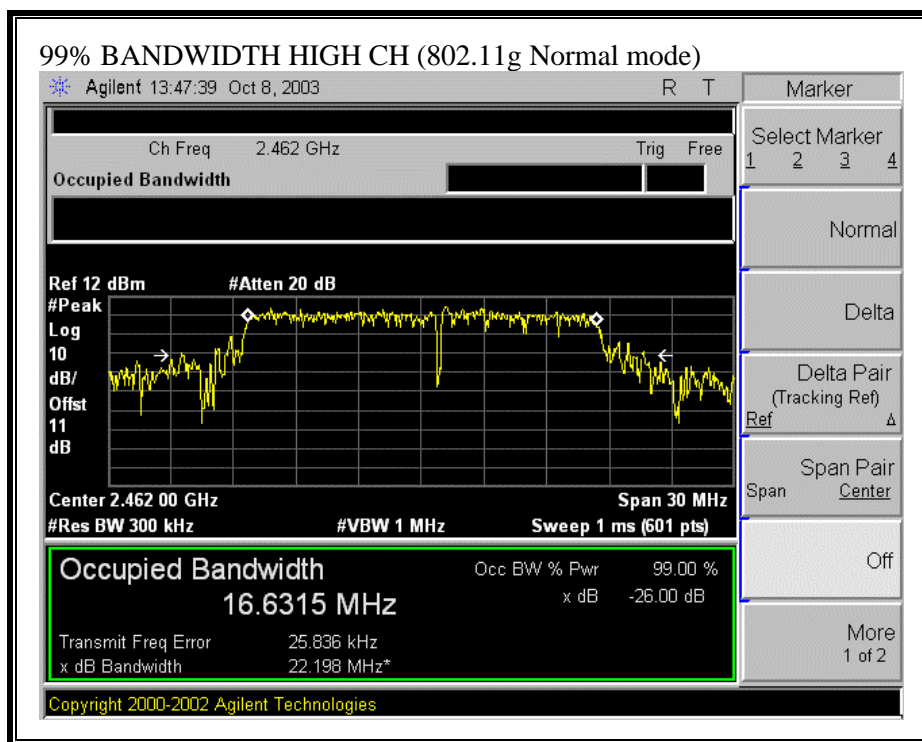




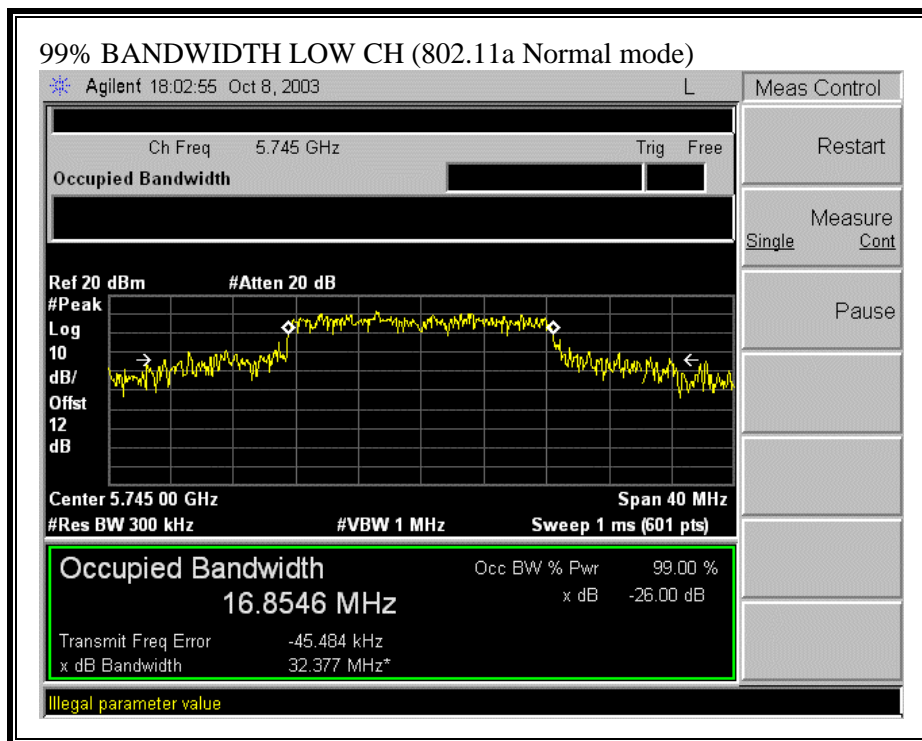
**99% BANDWIDTH (802.11g NORMAL MODE)**

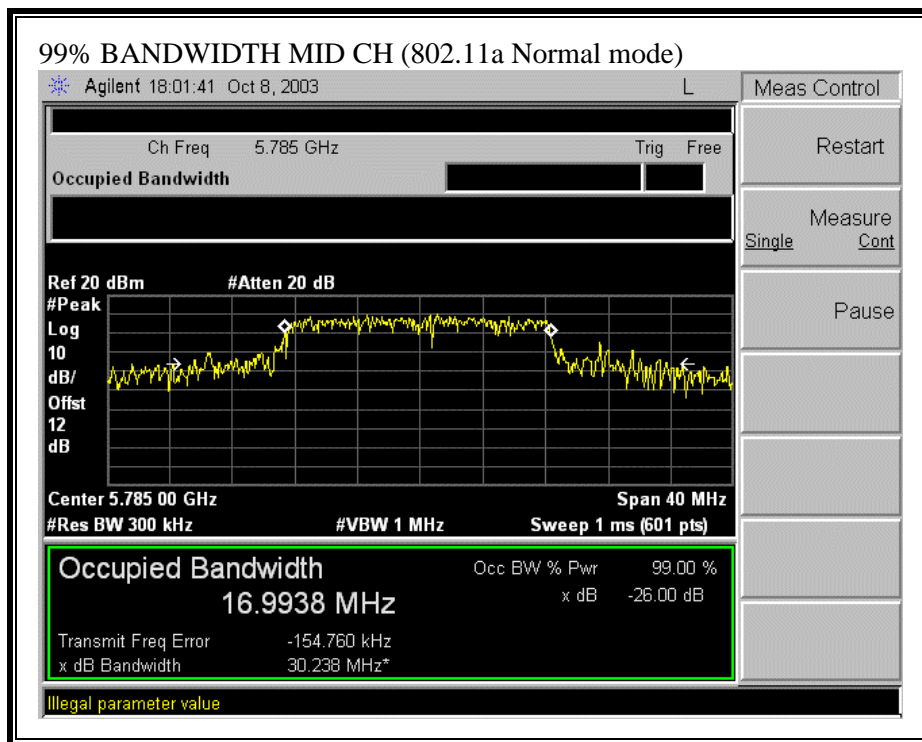




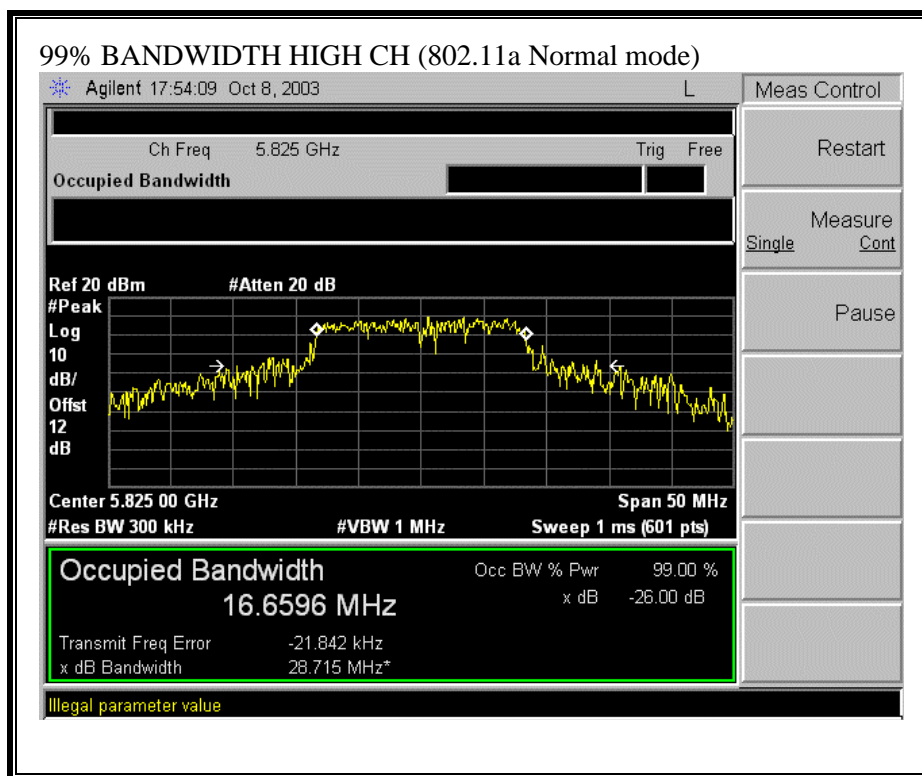


**99% BANDWIDTH (802.11a MODE)**









### **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 1.17 dBi in the 2.4 GHz band and 0.6 dBi in the 5.8 GHz band, 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.

## **2.4 GHZ BAND RESULTS**

No non-compliance noted:

### 802.11b Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	20.87	30	-9.13
Middle	2437	21.21	30	-8.79
High	2462	21.24	30	-8.76

### 802.11g Normal Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	19.53	30	-10.47
Middle	2437	19.71	30	-10.29
High	2462	19.95	30	-10.05

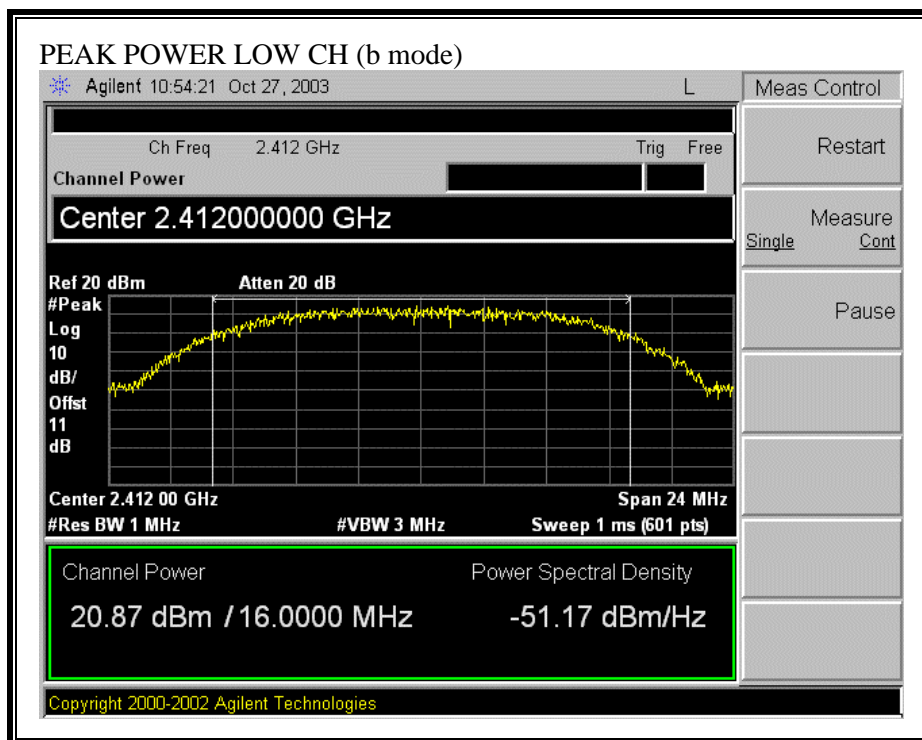
## **5.8 GHZ BAND RESULTS**

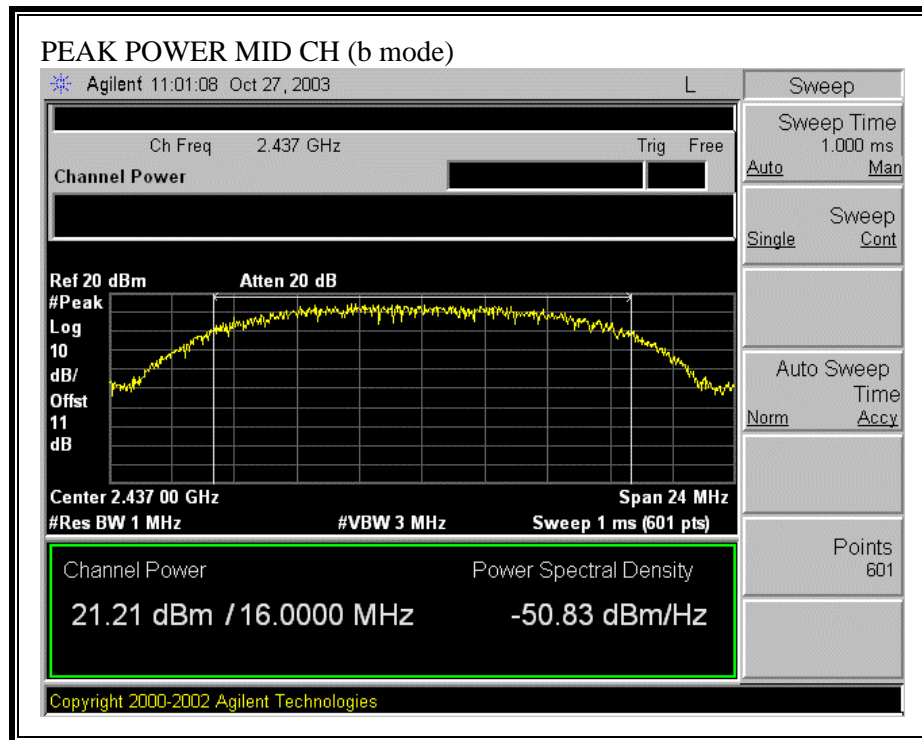
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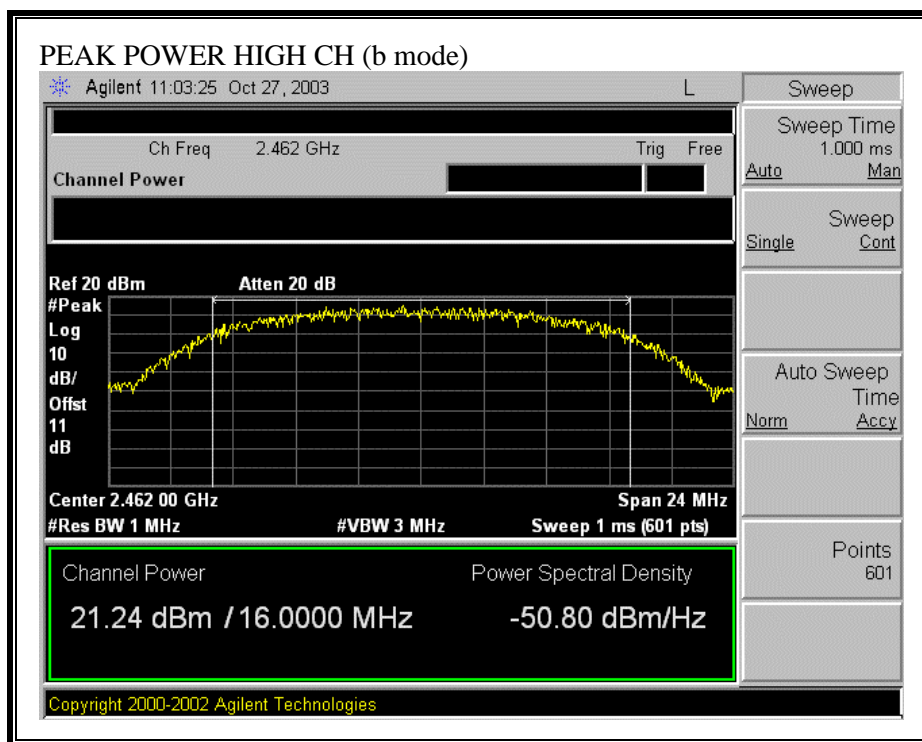
### 802.11a Normal Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	19.51	30	-10.49
Middle	5785	19.63	30	-10.37
High	5825	19.98	30	-10.02

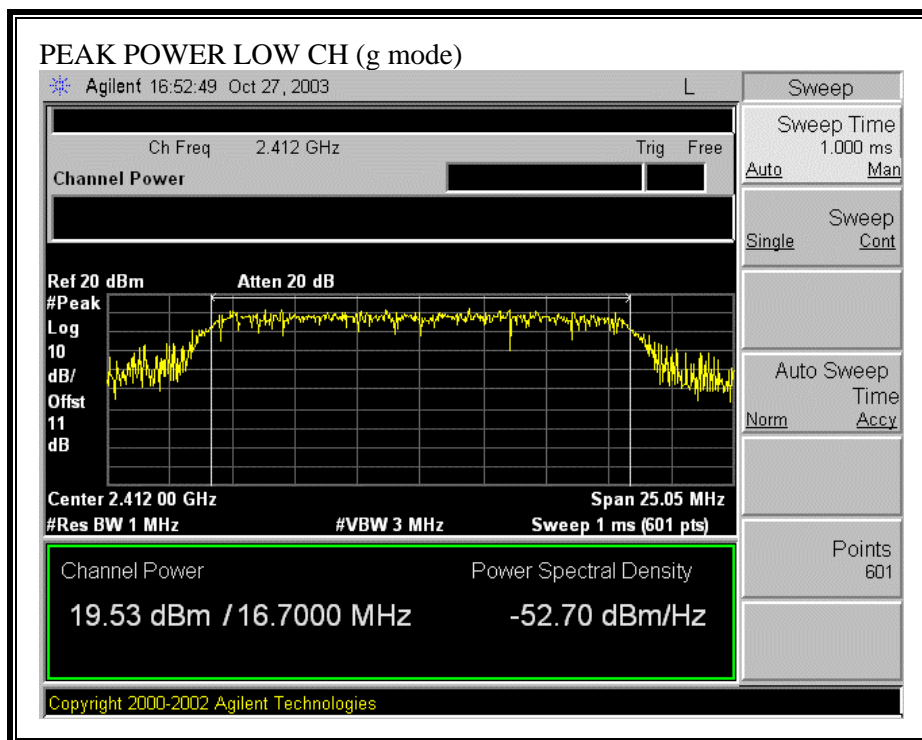
**OUTPUT POWER (802.11b MODE)**

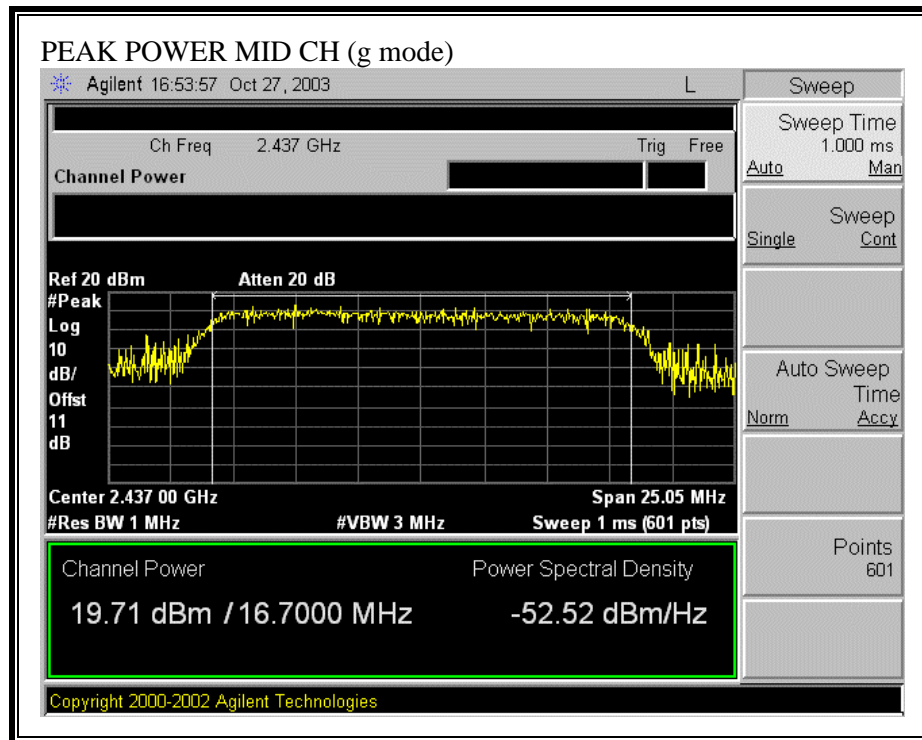




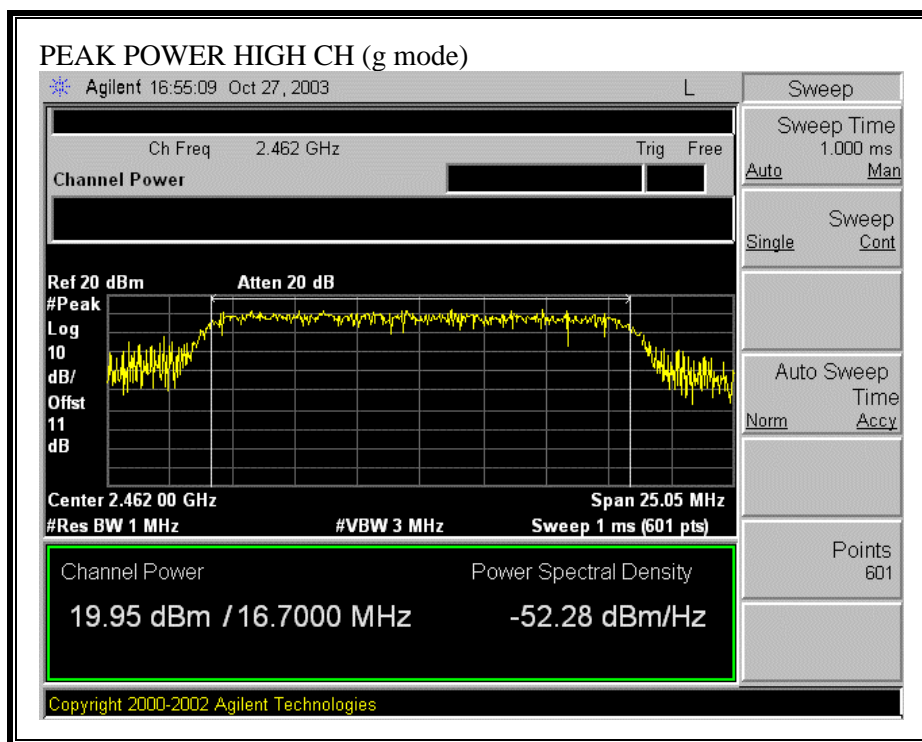


**OUTPUT POWER (802.11g NORMAL MODE)**

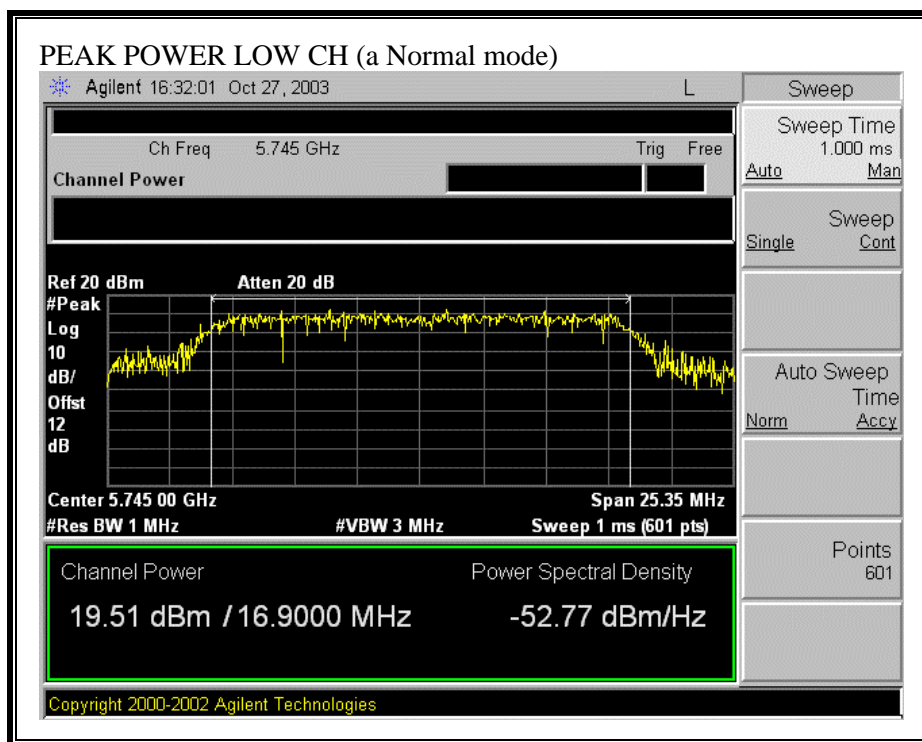


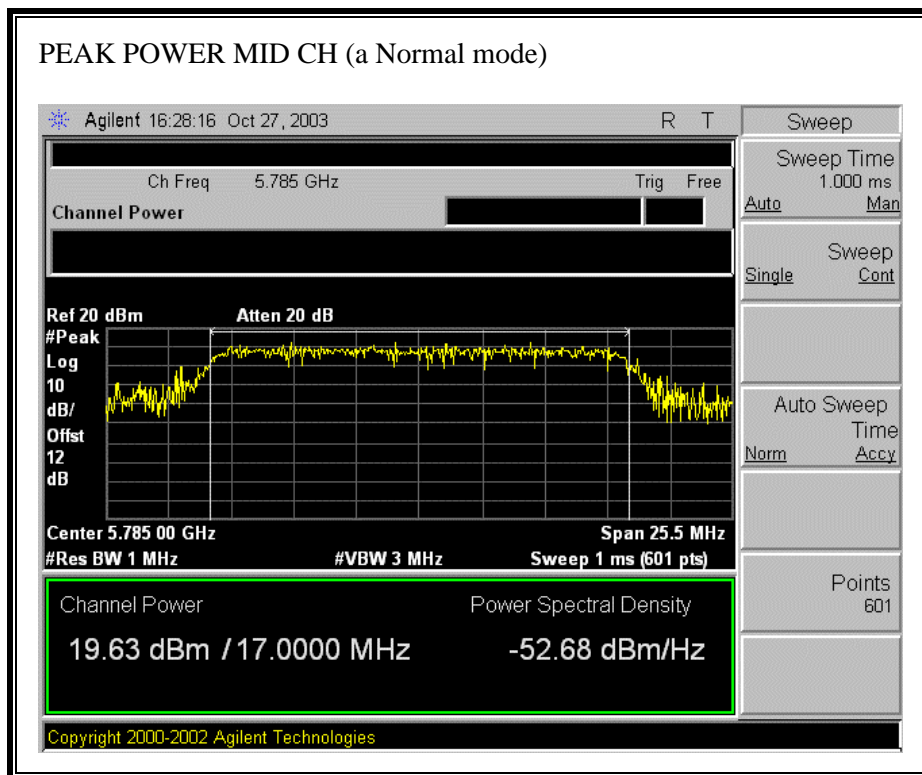


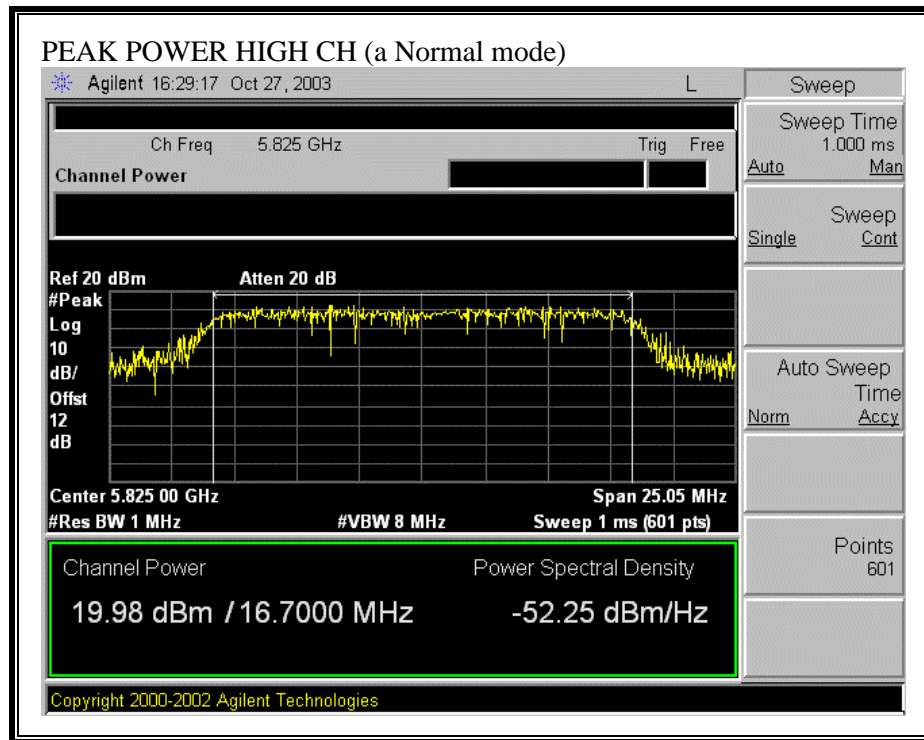




OUTPUT POWER (802.11a NORMAL MODE)







## 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

## **2.4 GHz BAND 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	21.24	1.17	3.72
802.11g Normal	1.0	19.95	1.17	3.21

## **5.8 GHz BAND RESULTS**

No non-compliance noted:

Mode	Power Density Limit (mW/cm <sup>2</sup> )	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
802.11a Normal	1.0	19.98	0.60	3.01

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.

### 2.4 GHZ BAND RESULTS

No non-compliance noted:

The cable assembly insertion loss of 11dB (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	18.60
Middle	2437	18.80
High	2462	18.73

#### 802.11g Normal Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	2412	15.40
Middle	2437	15.77
High	2462	15.41

## **5.8 GHZ BAND RESULTS**

No non-compliance noted:

The cable assembly insertion loss of 12 dB (including 10 dB pad and 2 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

### 802.11a Normal Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	5745	15.47
Middle	5785	15.53
High	5825	15.55



## 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.

### 2.4 GHz BAND RESULTS

No non-compliance noted:

#### 802.11b Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	0.81	8	-7.19
Middle	2437	1.28	8	-6.72
High	2462	1.43	8	-6.57

#### 802.11g Normal Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-2.55	8	-10.55
Middle	2437	-1.53	8	-9.53
High	2462	-2.44	8	-10.44

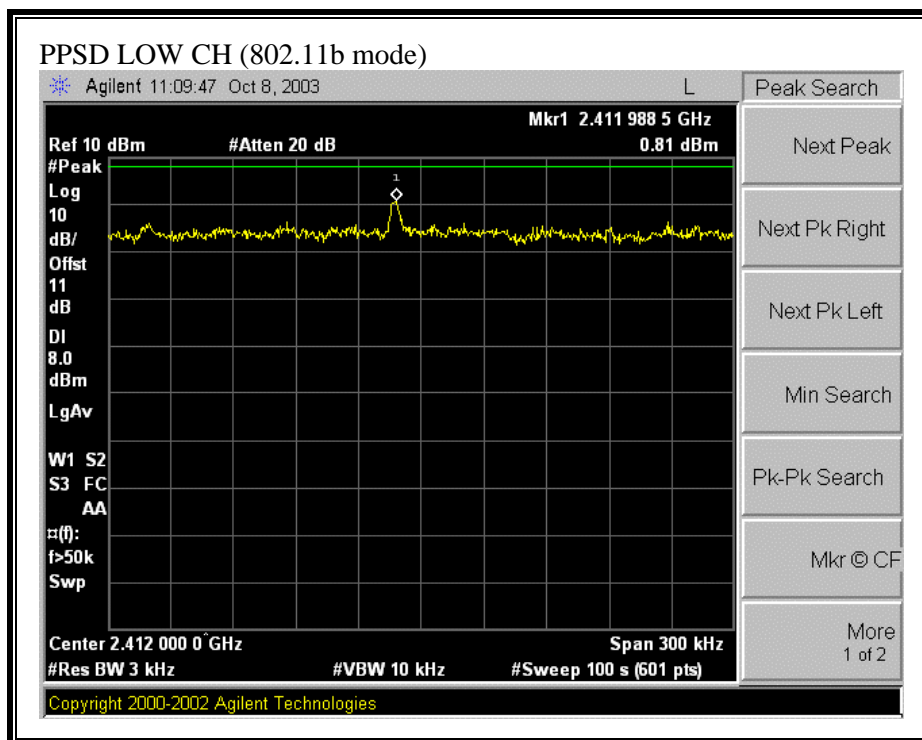
## **5.8 GHz BAND RESULTS**

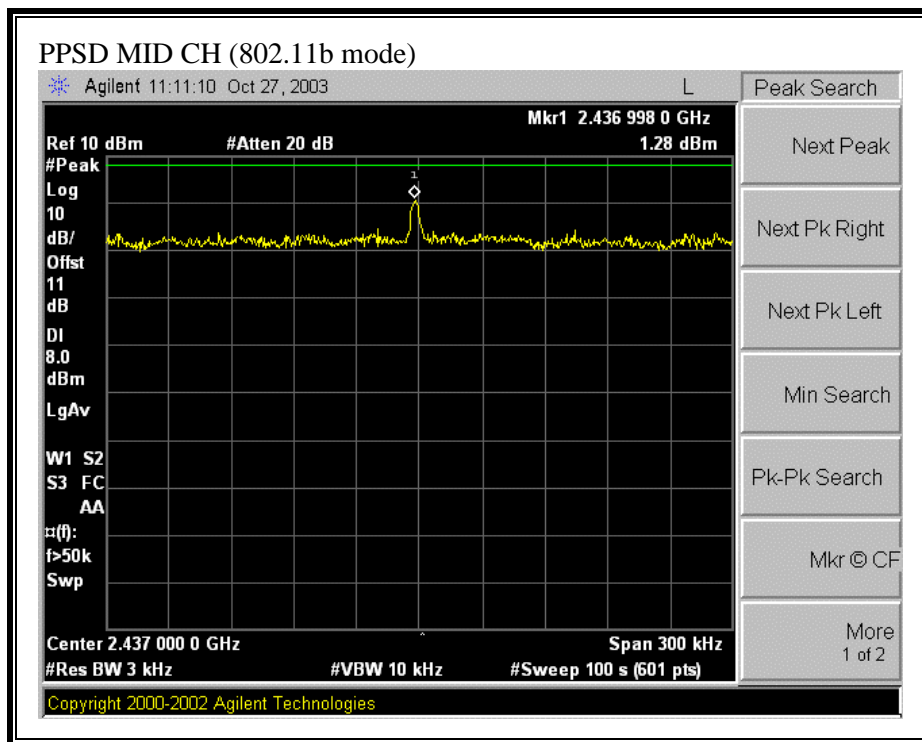
No non-compliance noted:

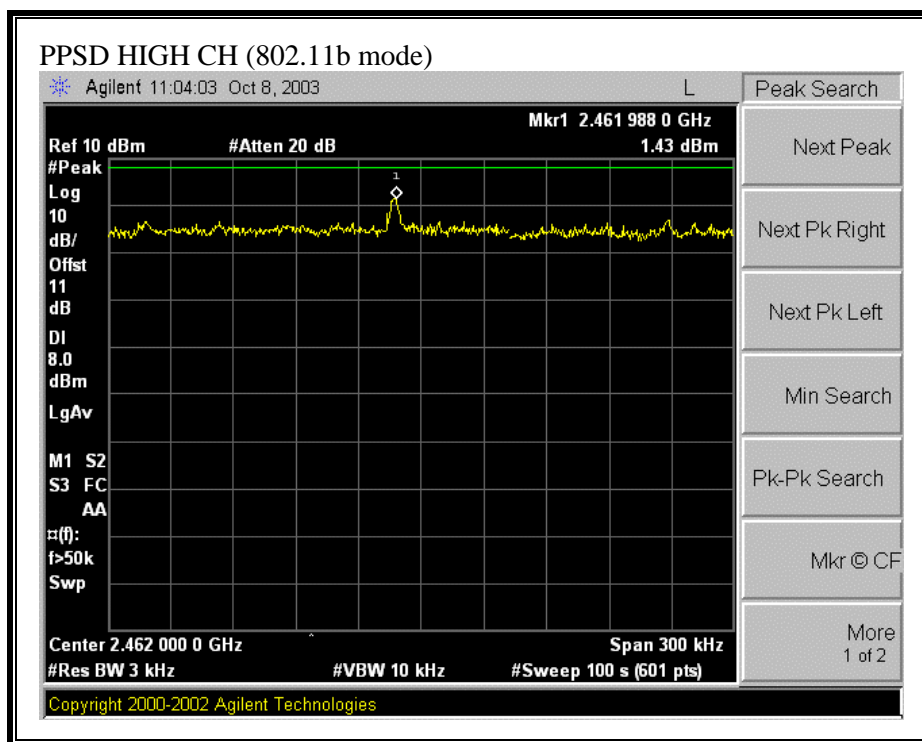
### 802.11a Normal Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-9.78	8	-17.78
Middle	5785	-8.41	8	-16.41
High	5825	-9.03	8	-17.03

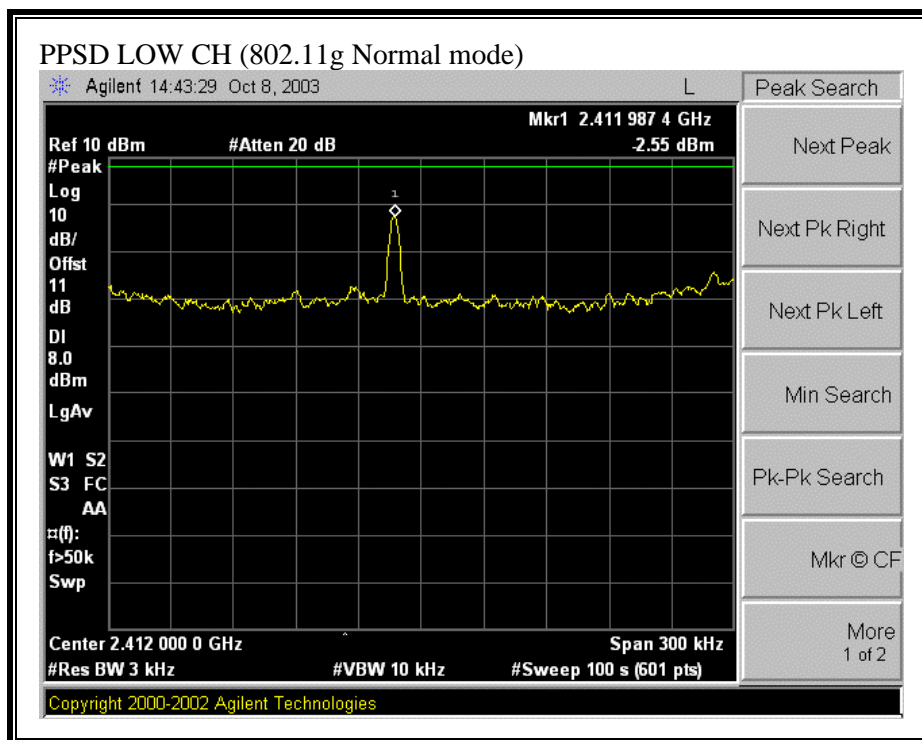
**PEAK POWER SPECTRAL DENSITY (802.11b MODE)**

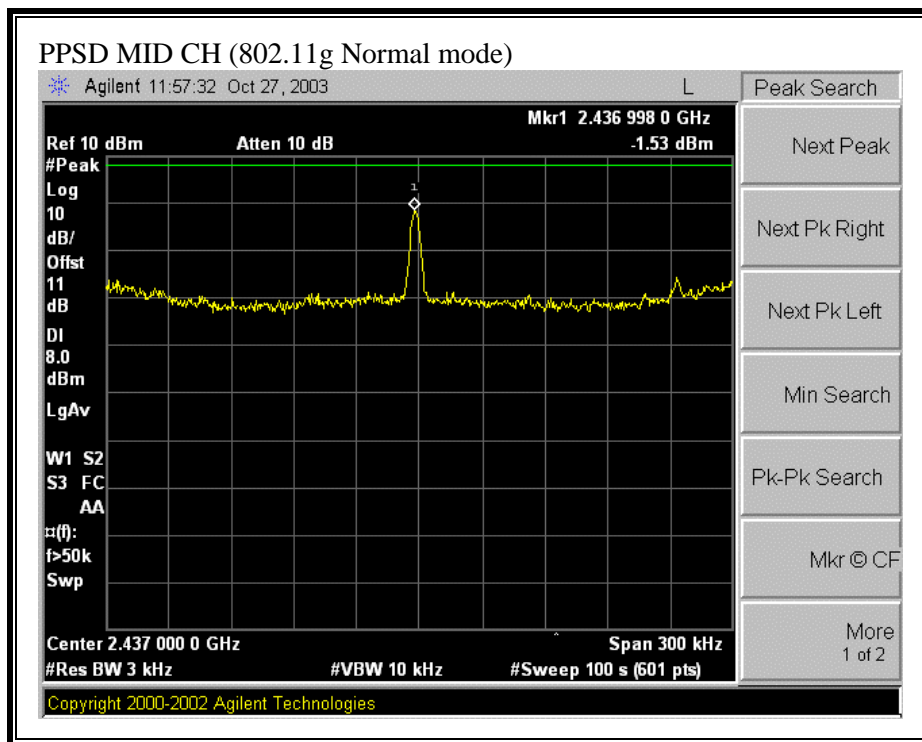


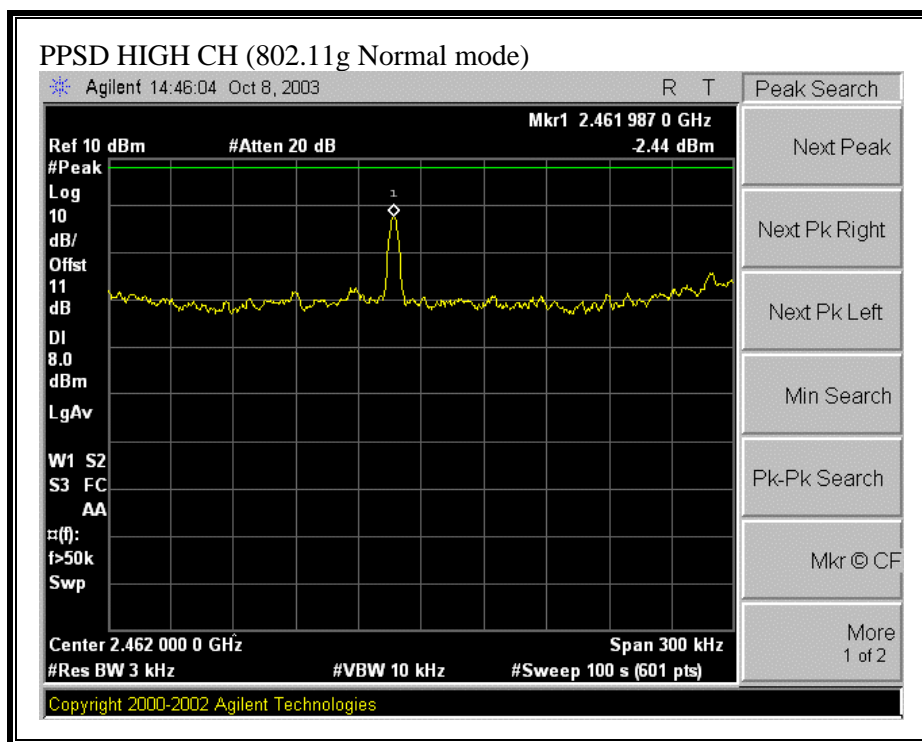




**PEAK POWER SPECTRAL DENSITY (802.11g NORMAL MODE)**

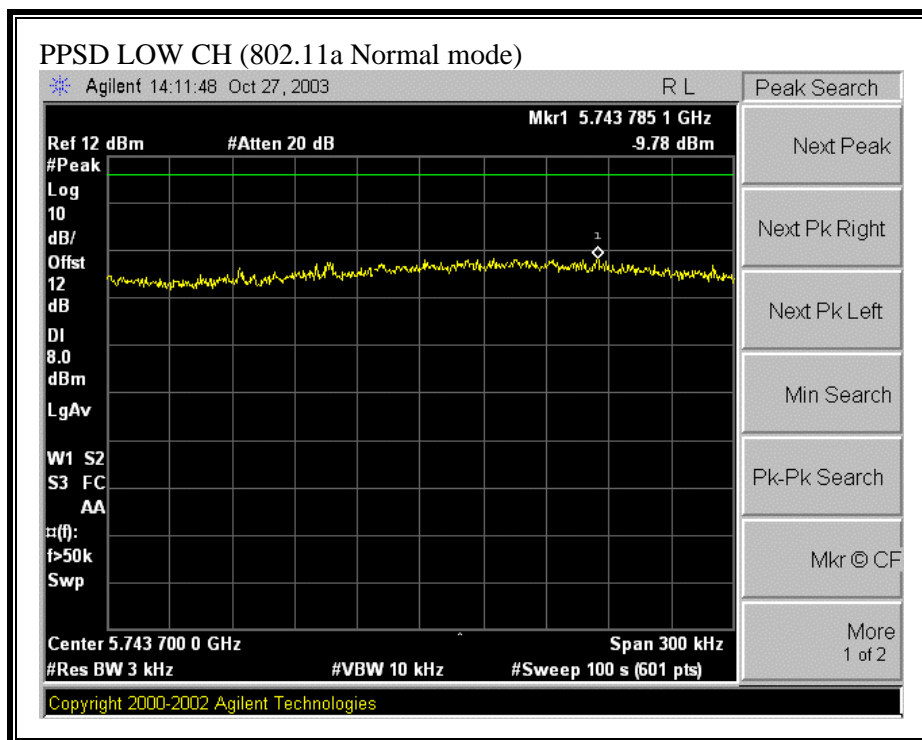


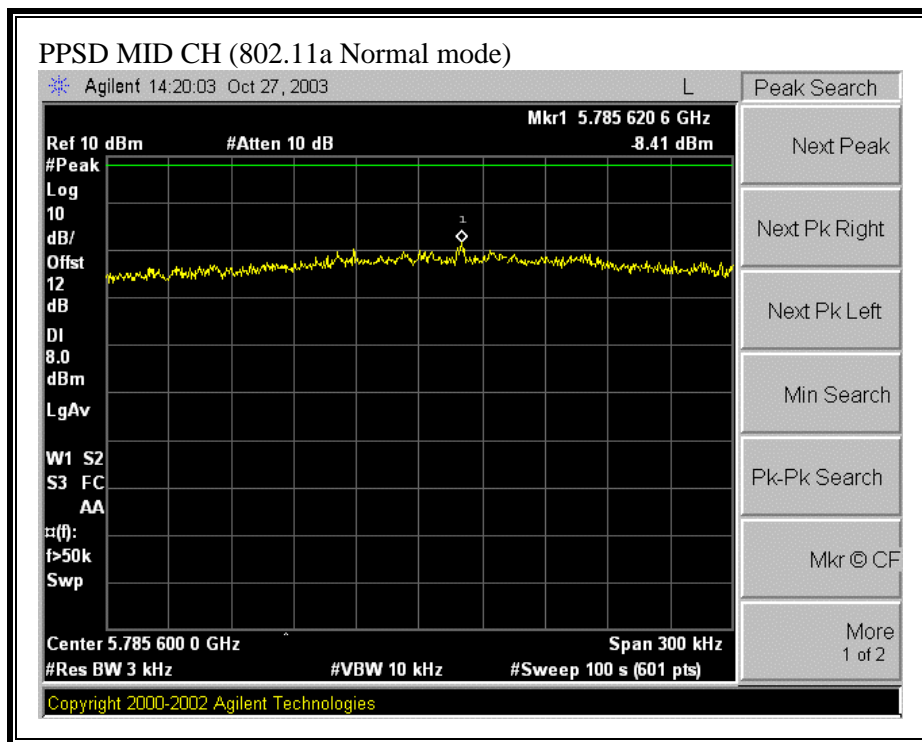


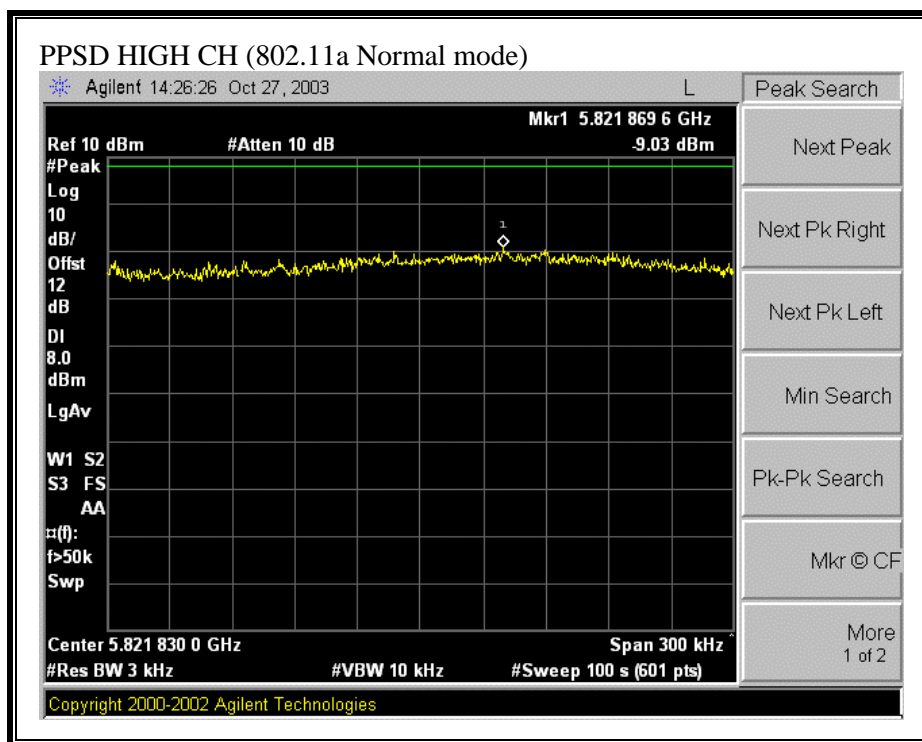




**PEAK POWER SPECTRAL DENSITY (802.11a NORMAL MODE)**







## **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.

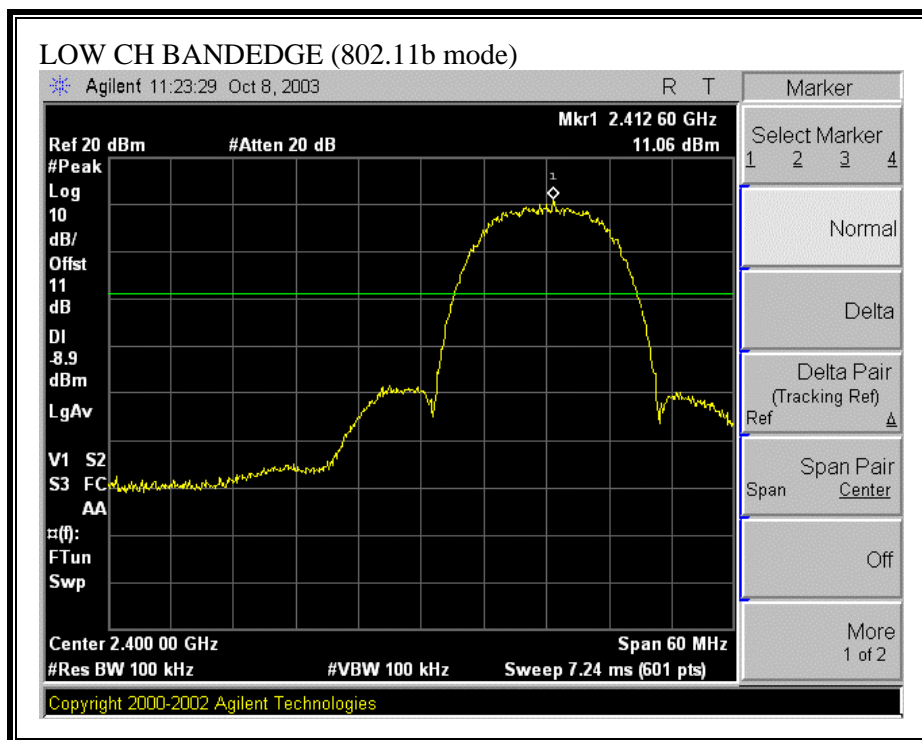
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

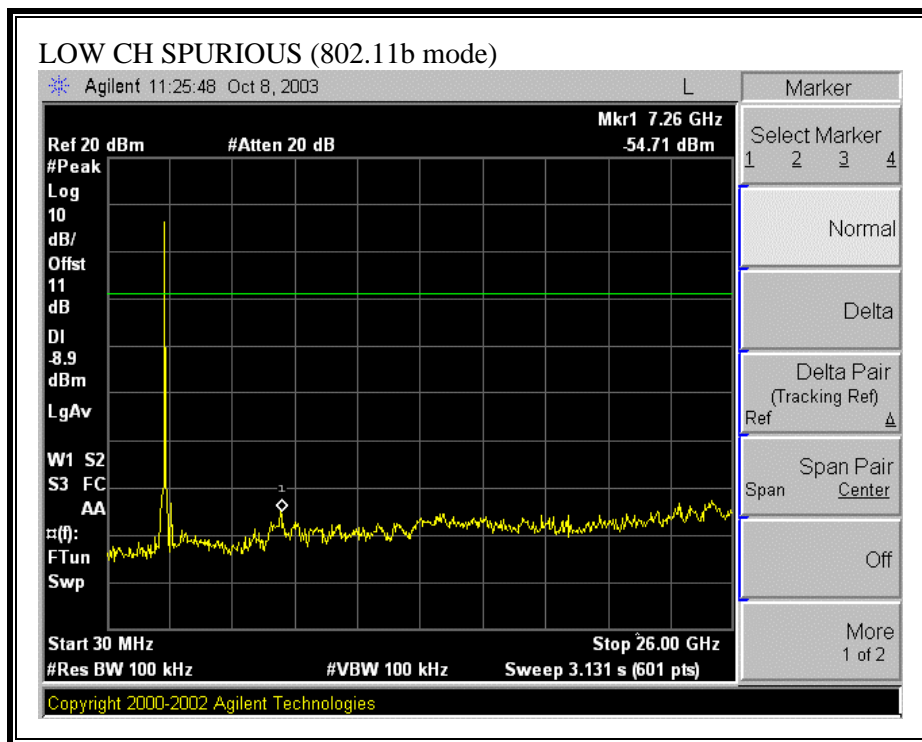
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 5.8 GHz band.

### **RESULTS**

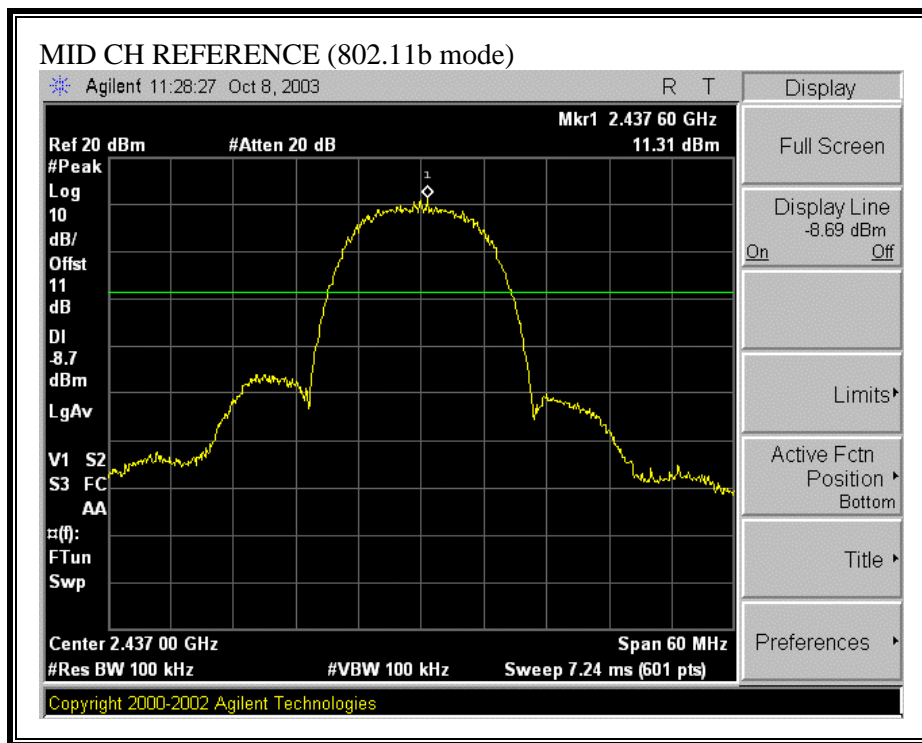
No non-compliance noted:

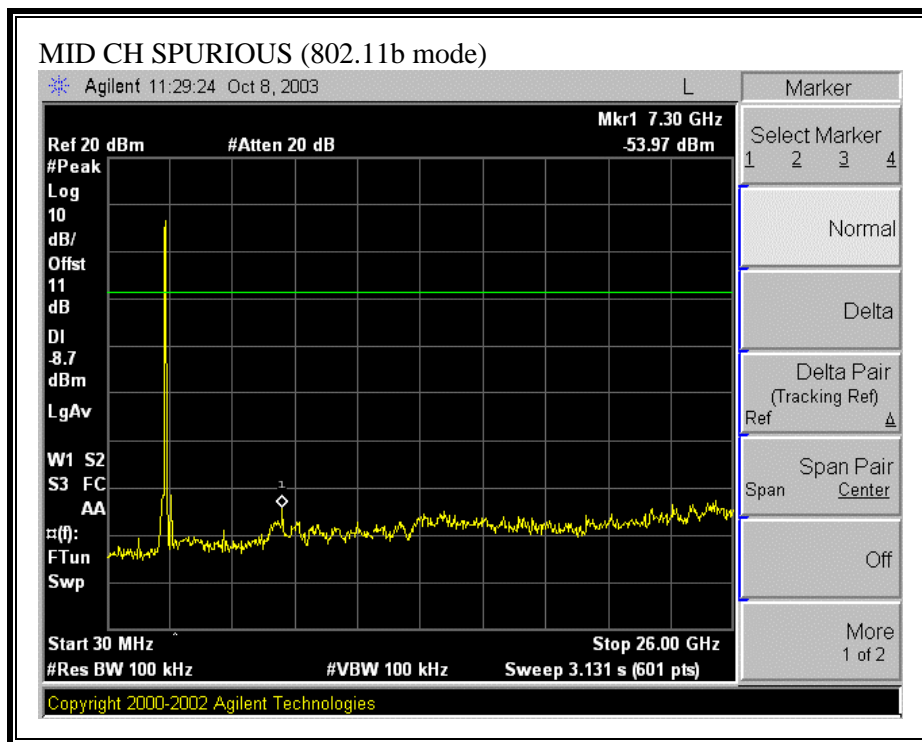
**SPURIOUS EMISSIONS, LOW CHANNEL (802.11b MODE)**





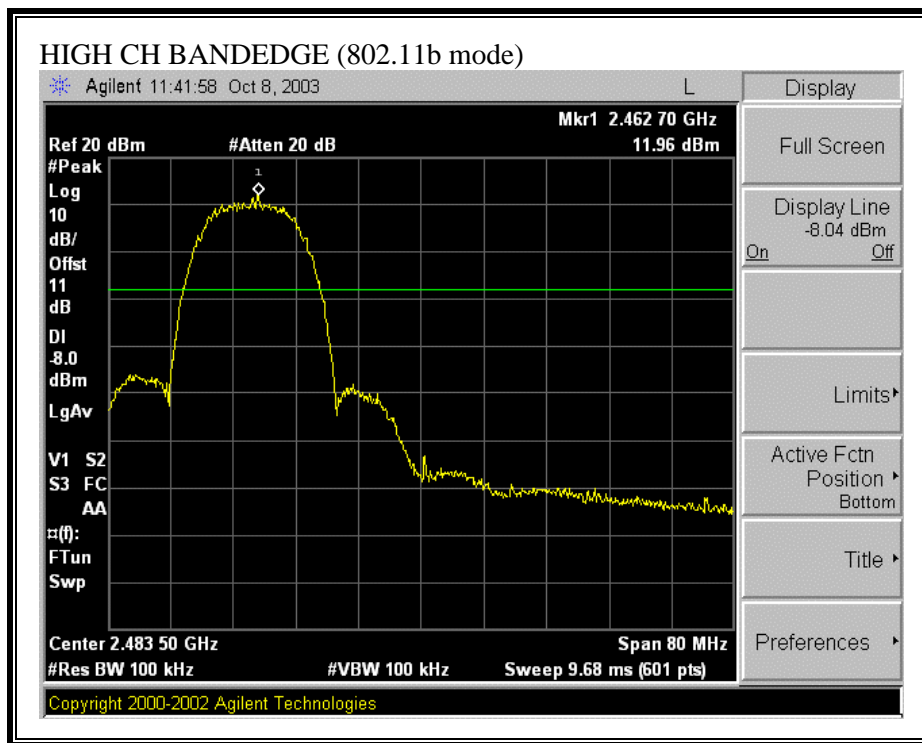
**SPURIOUS EMISSIONS, MID CHANNEL (802.11b MODE)**

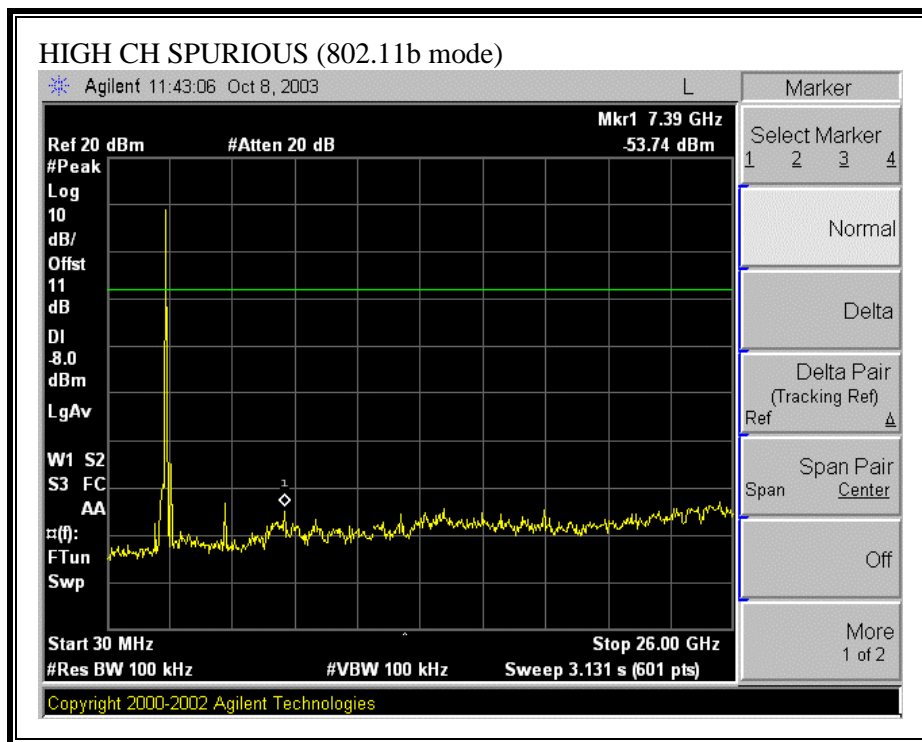




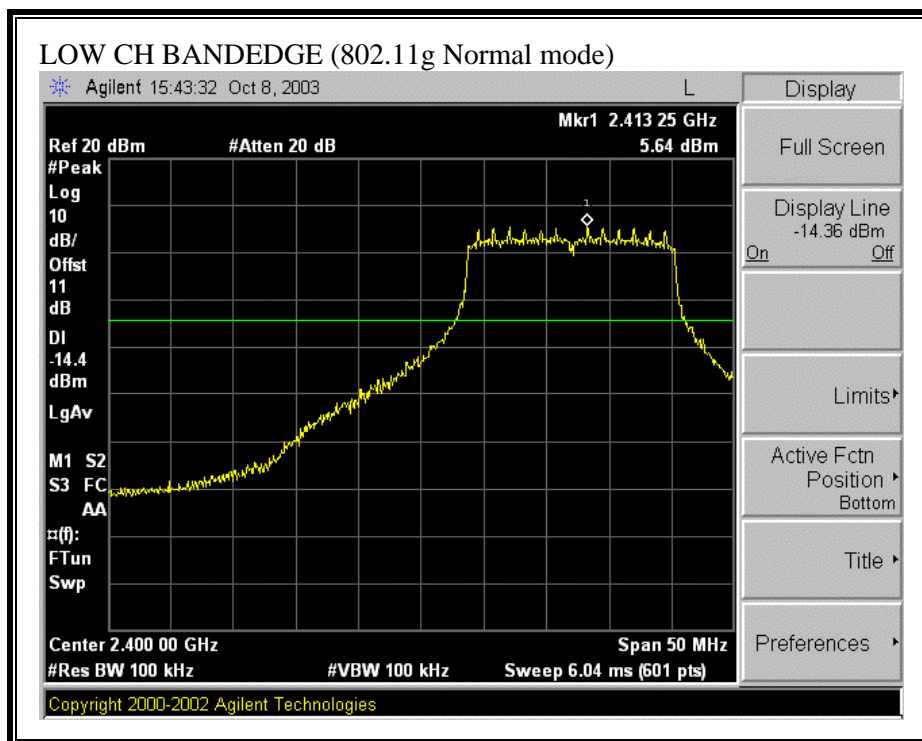


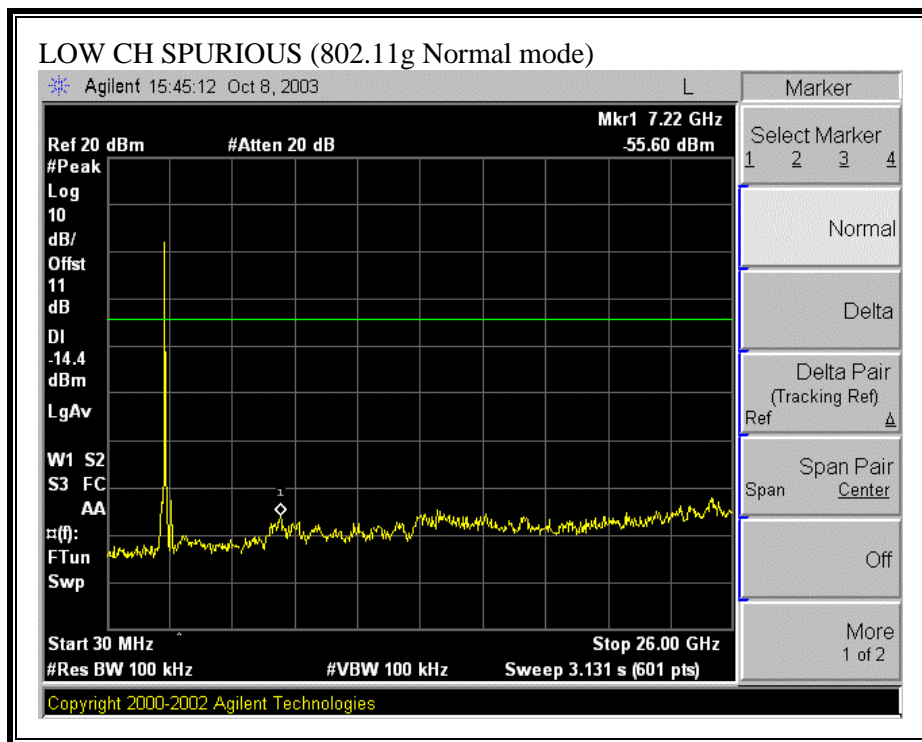
**SPURIOUS EMISSIONS, HIGH CHANNEL (802.11b MODE)**



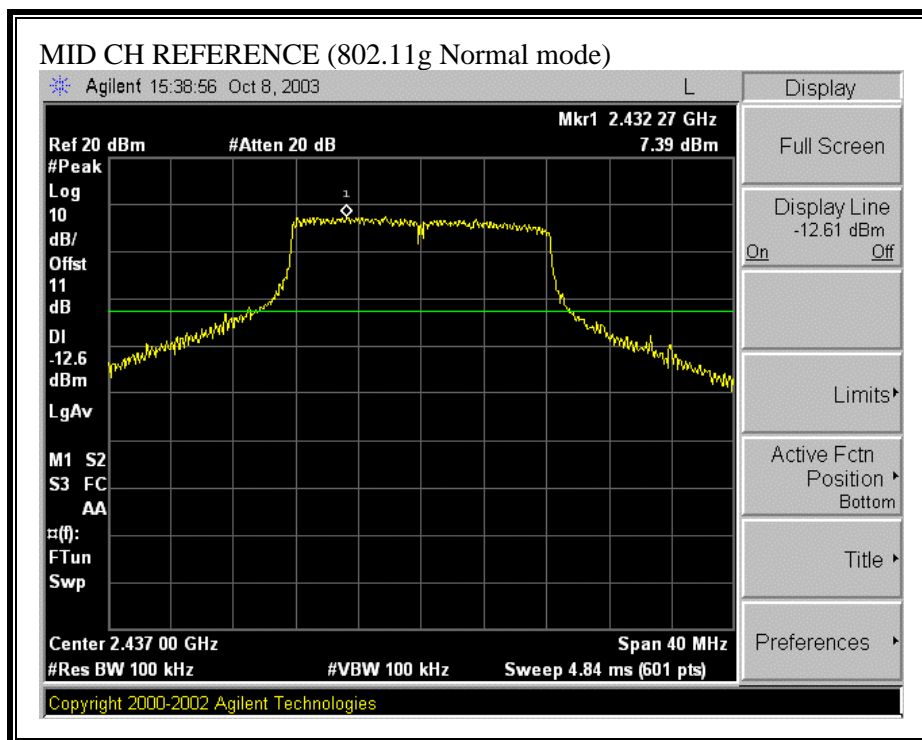


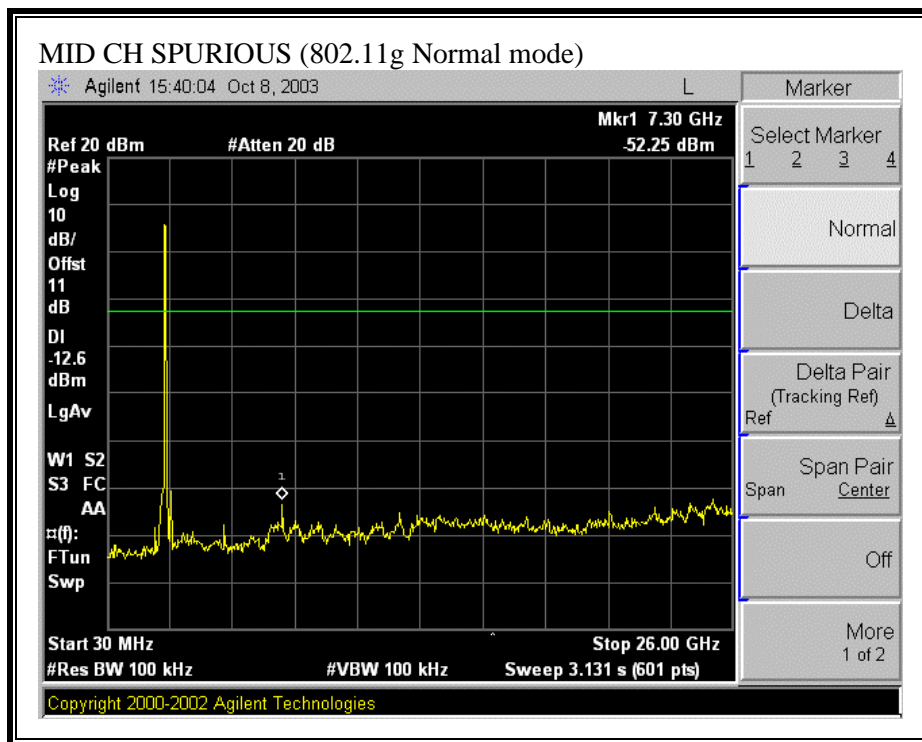
**SPURIOUS EMISSIONS, LOW CHANNEL (802.11g NORMAL MODE)**



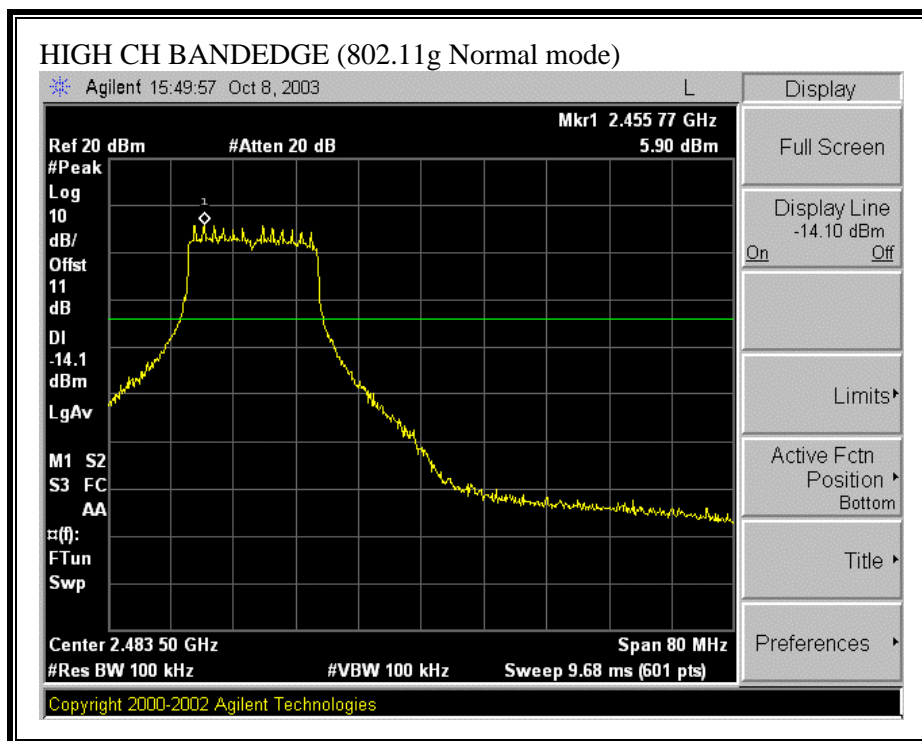


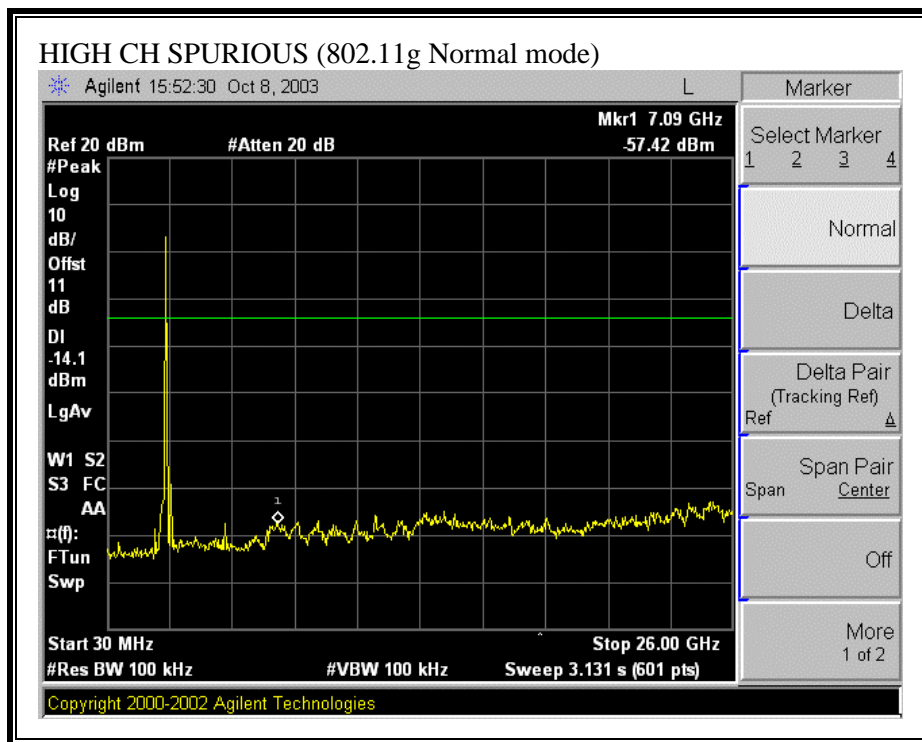
**SPURIOUS EMISSIONS, MID CHANNEL (802.11g NORMAL MODE)**





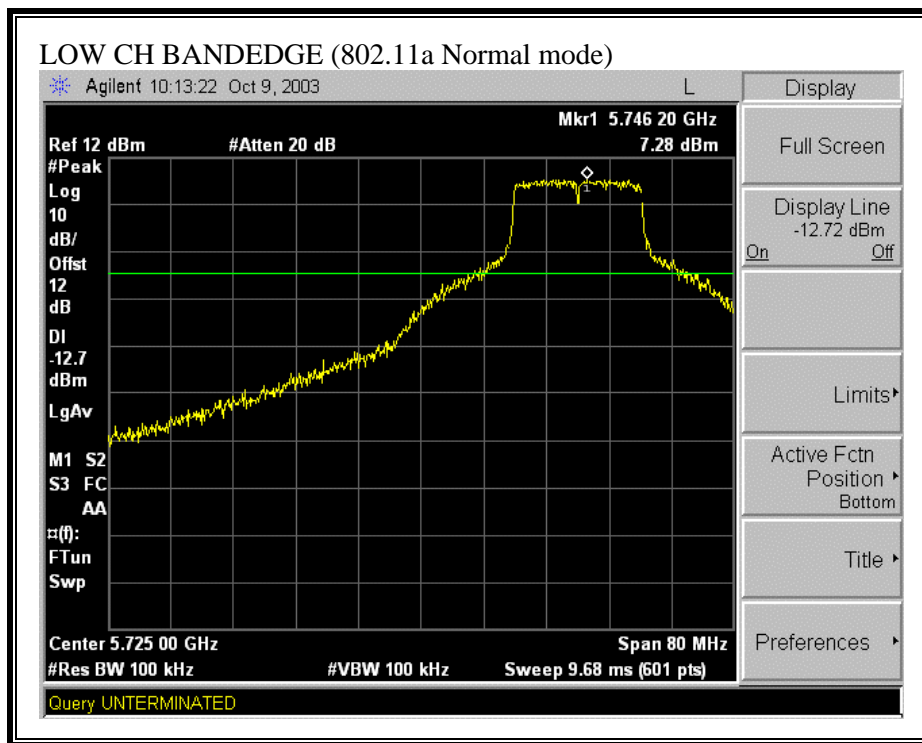
**SPURIOUS EMISSIONS, HIGH CHANNEL (802.11g NORMAL MODE)**

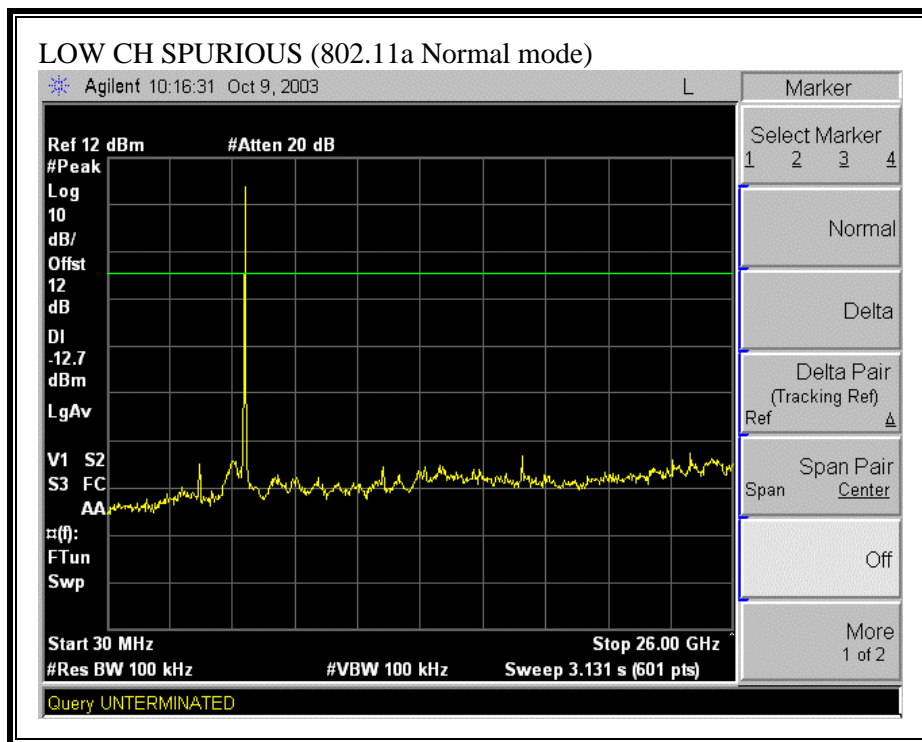


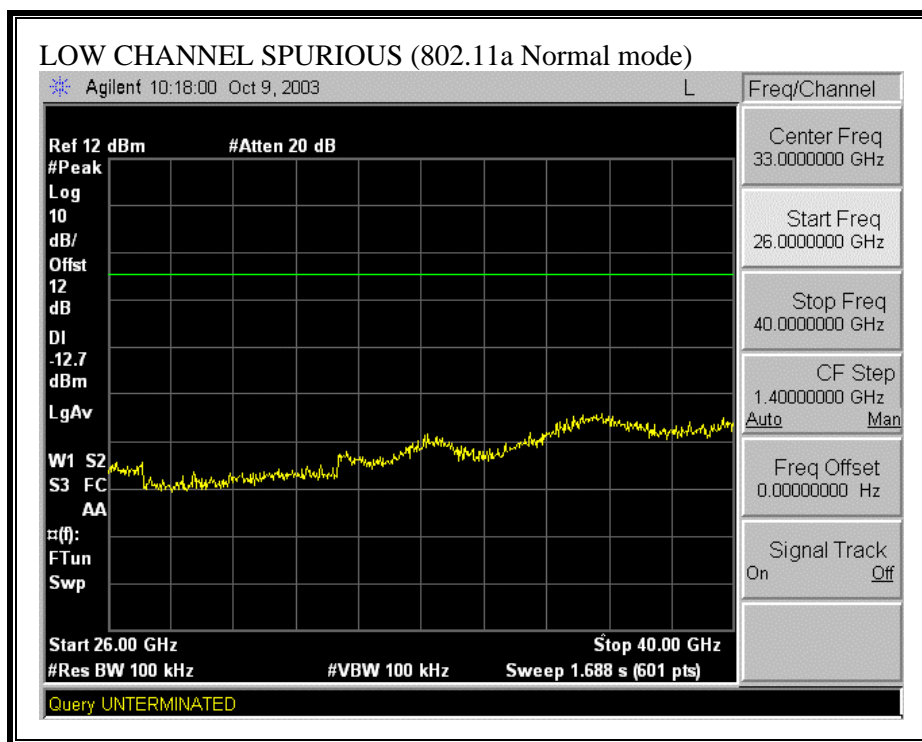




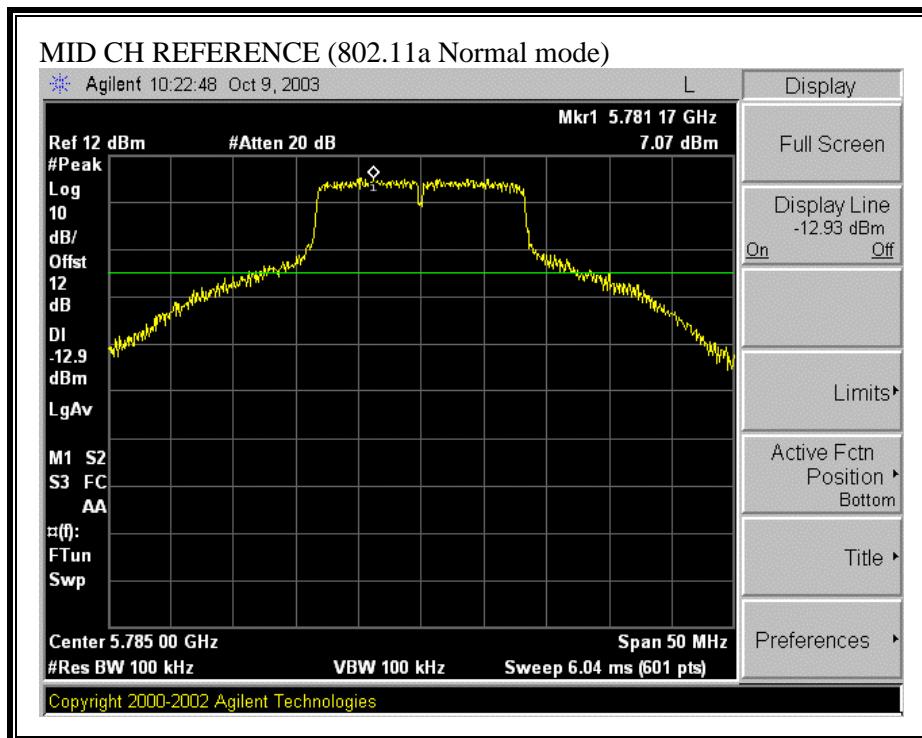
**SPURIOUS EMISSIONS, LOW CHANNEL (802.11a NORMAL MODE)**

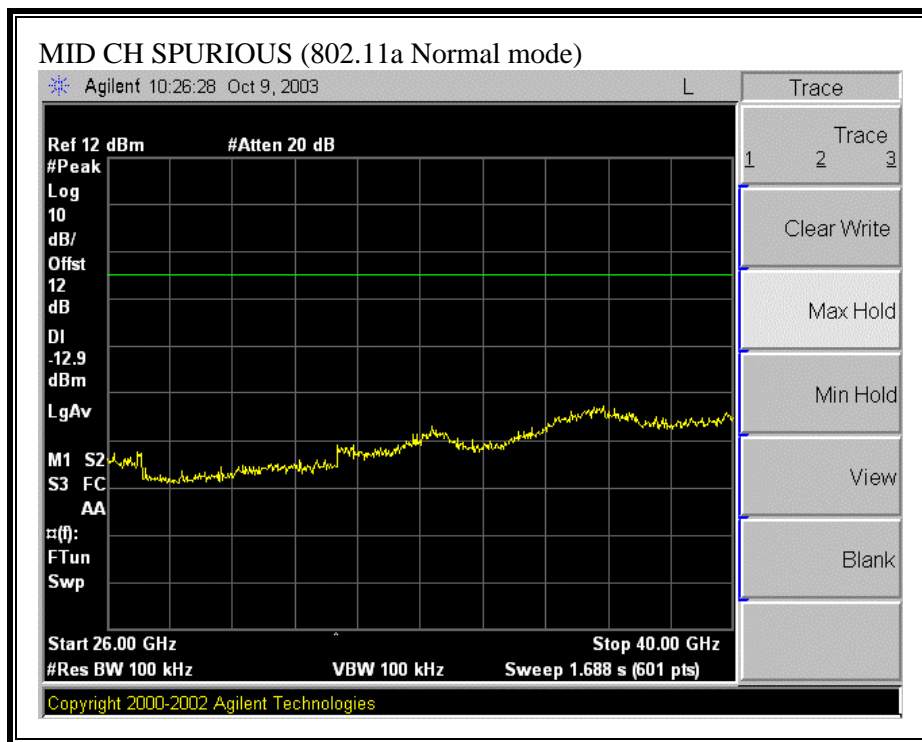


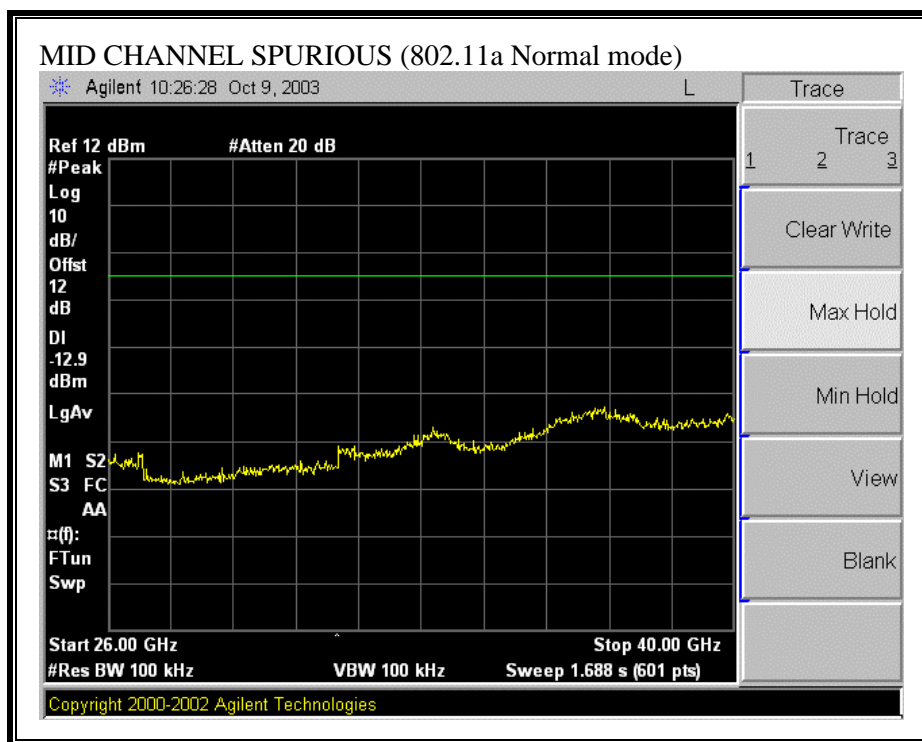




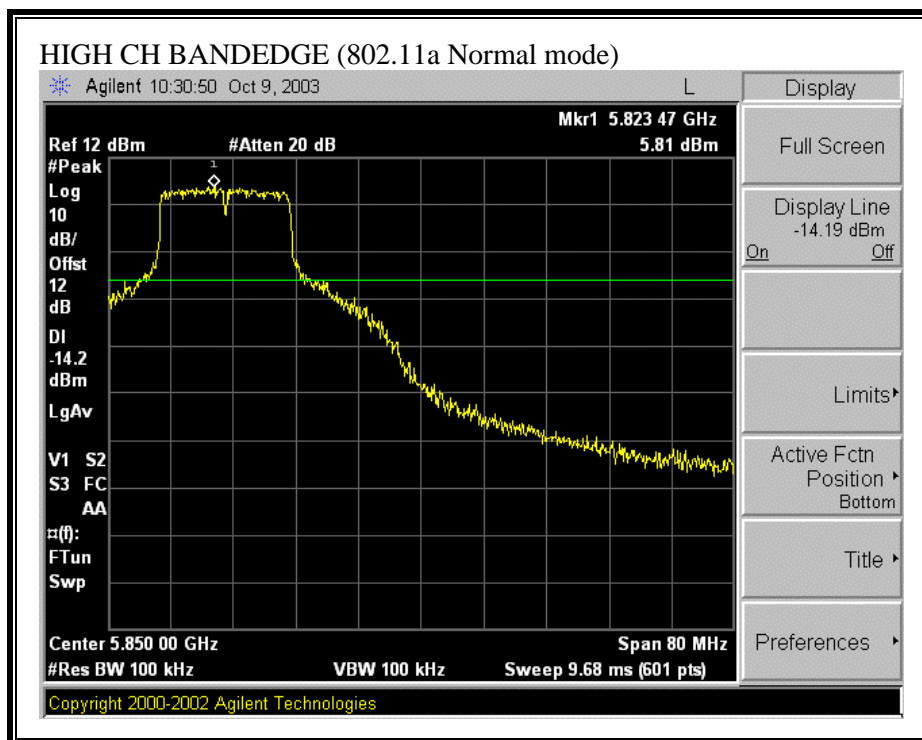
**SPURIOUS EMISSIONS, MID CHANNEL (802.11a NORMAL MODE)**

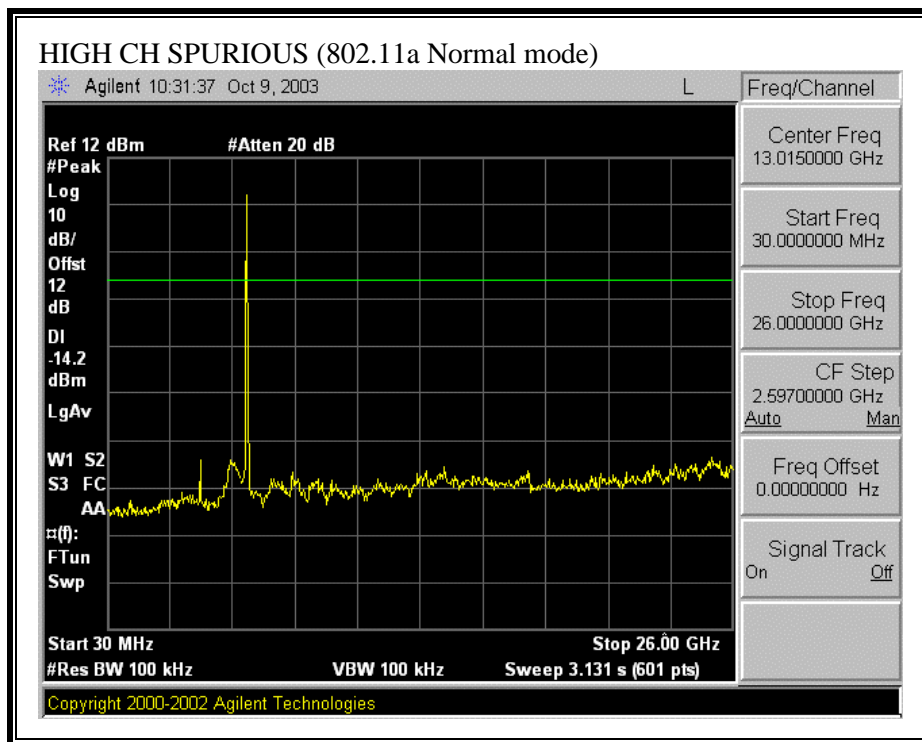




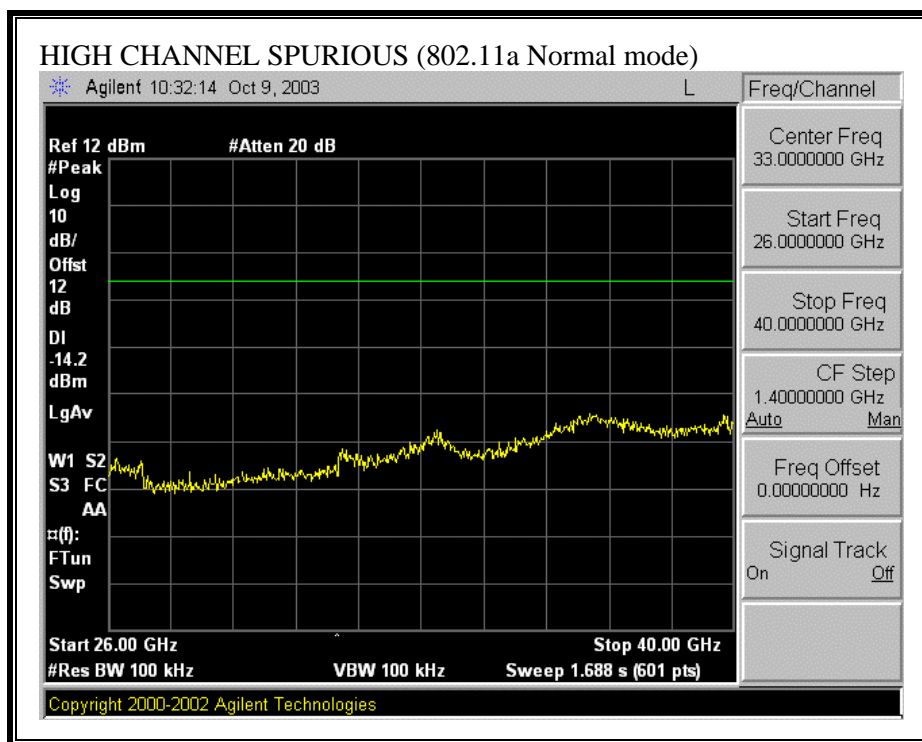


**SPURIOUS EMISSIONS, HIGH CHANNEL (802.11a NORMAL MODE)**









## 7.8. RADIATED EMISSIONS

### 7.8.1. 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 - 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 of 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 of the 5.8 GHz band.

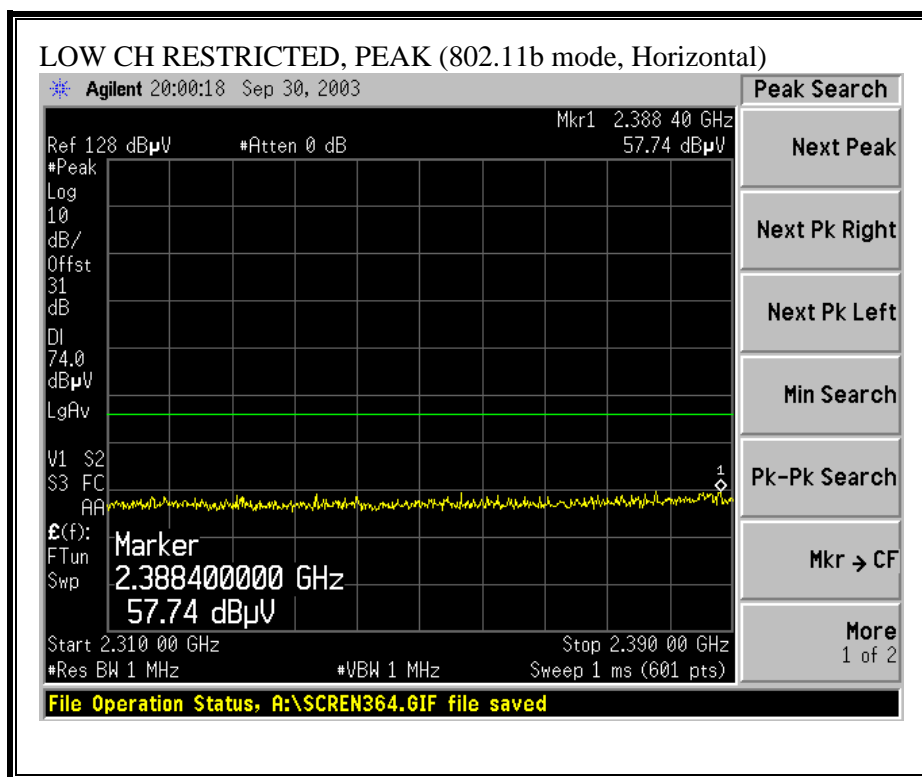
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

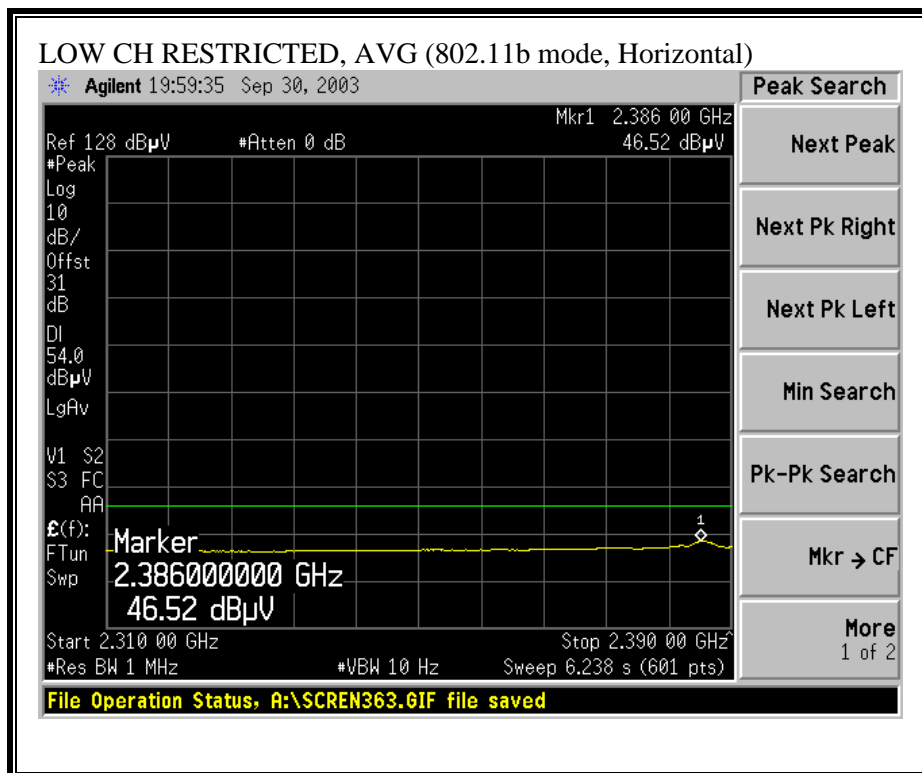
## **RESULTS**

No non-compliance noted:

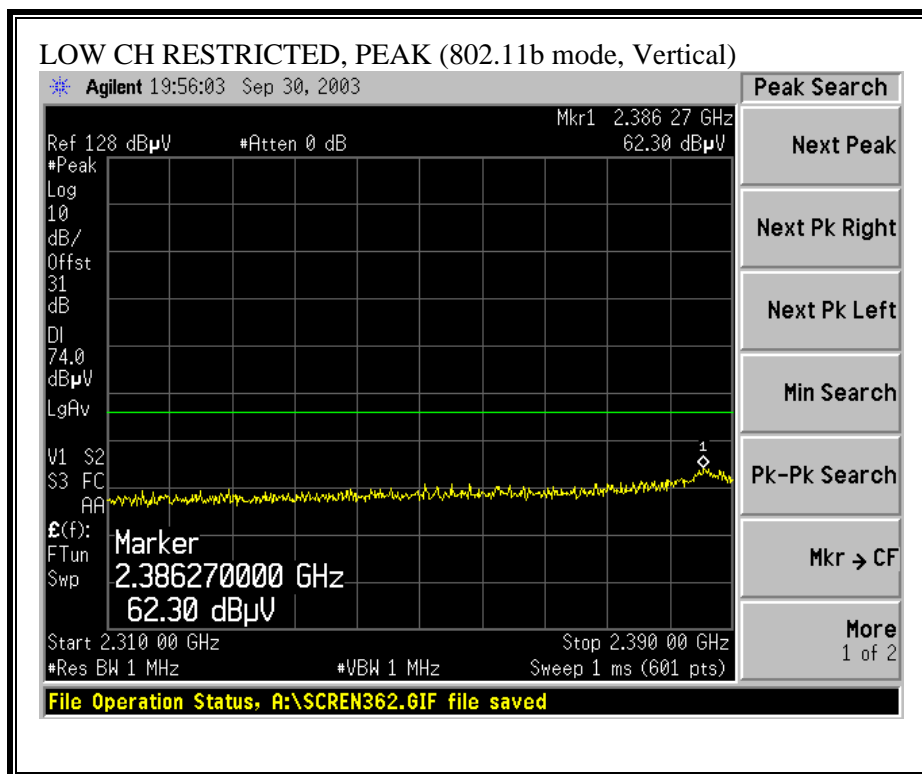
## 7.8.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ

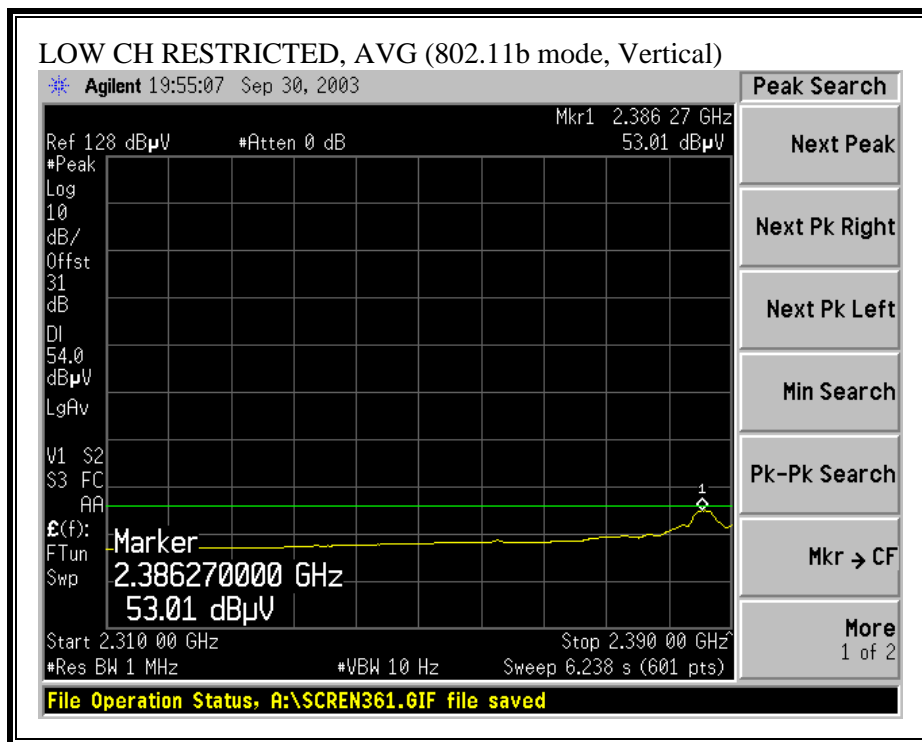
### RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, HORIZONTAL)





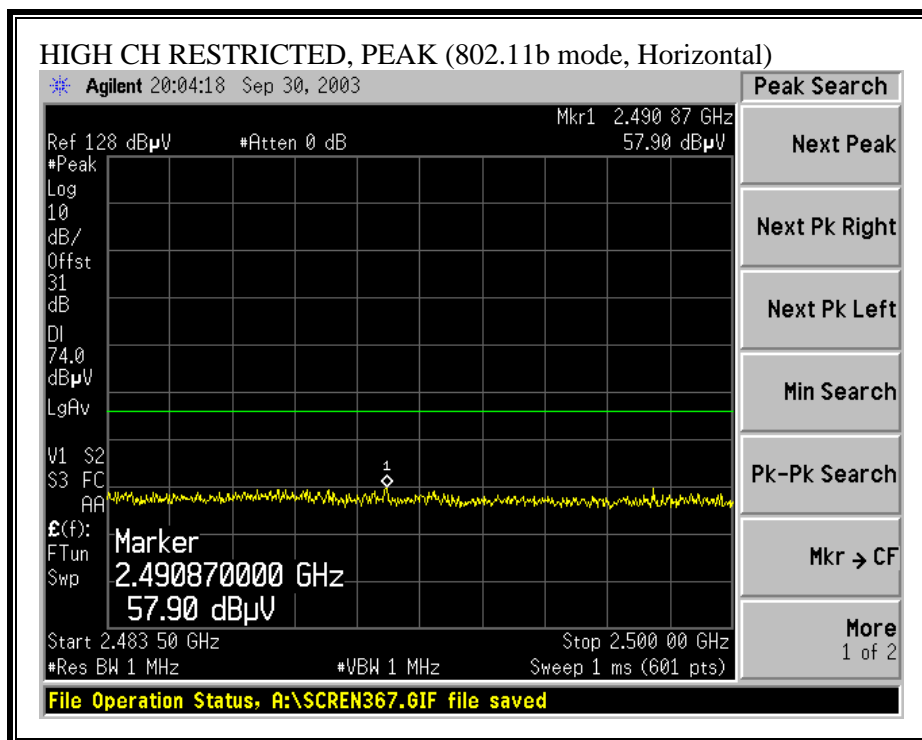
**RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, VERTICAL)**

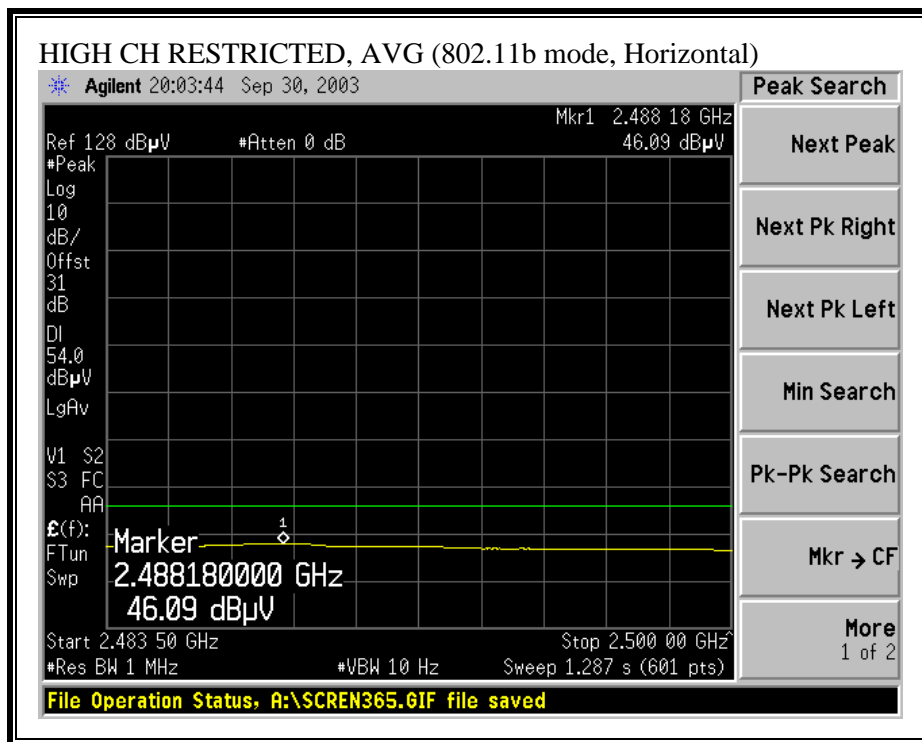




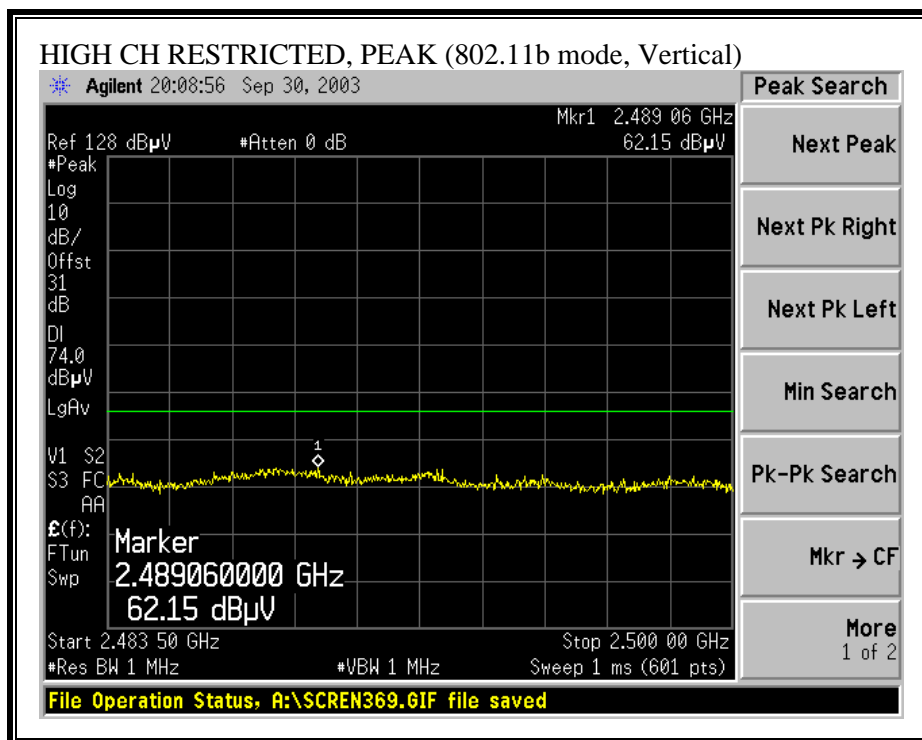


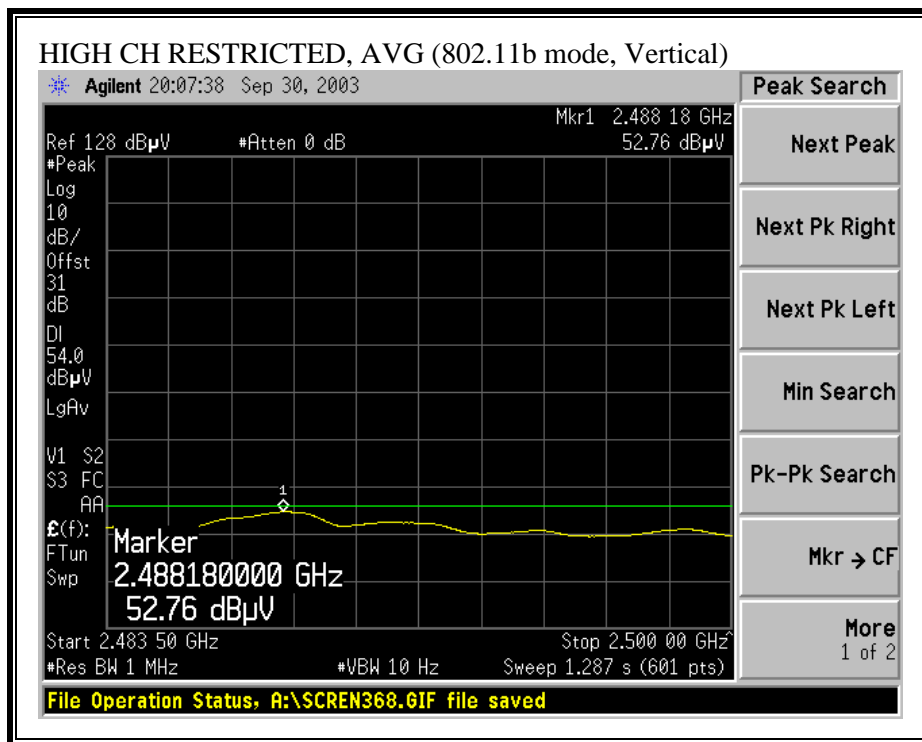
**RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, HORIZONTAL)**





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

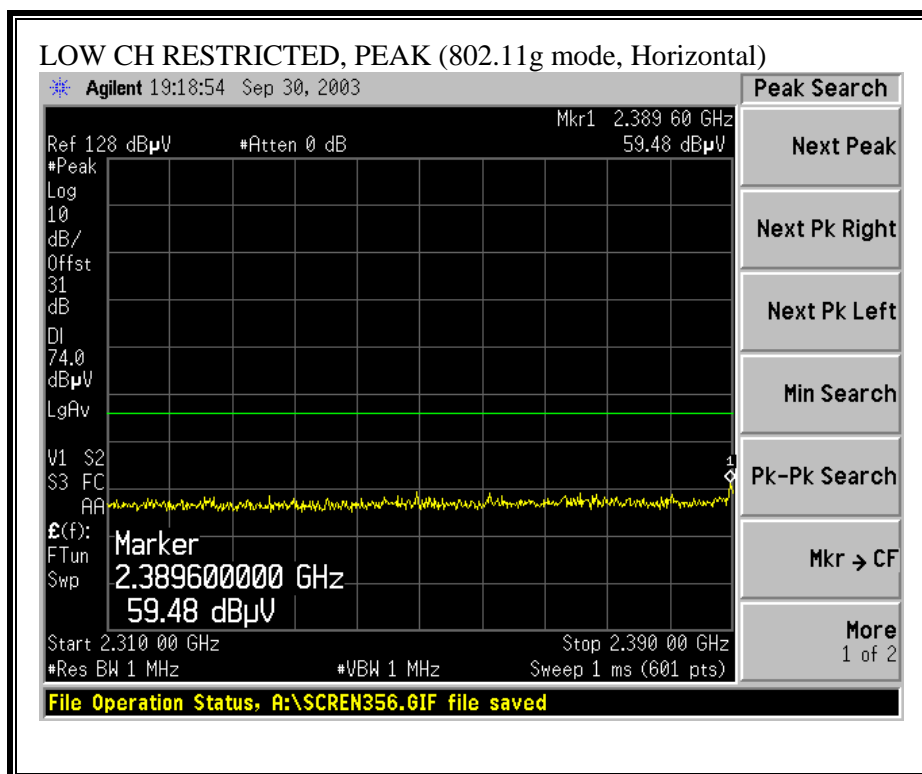


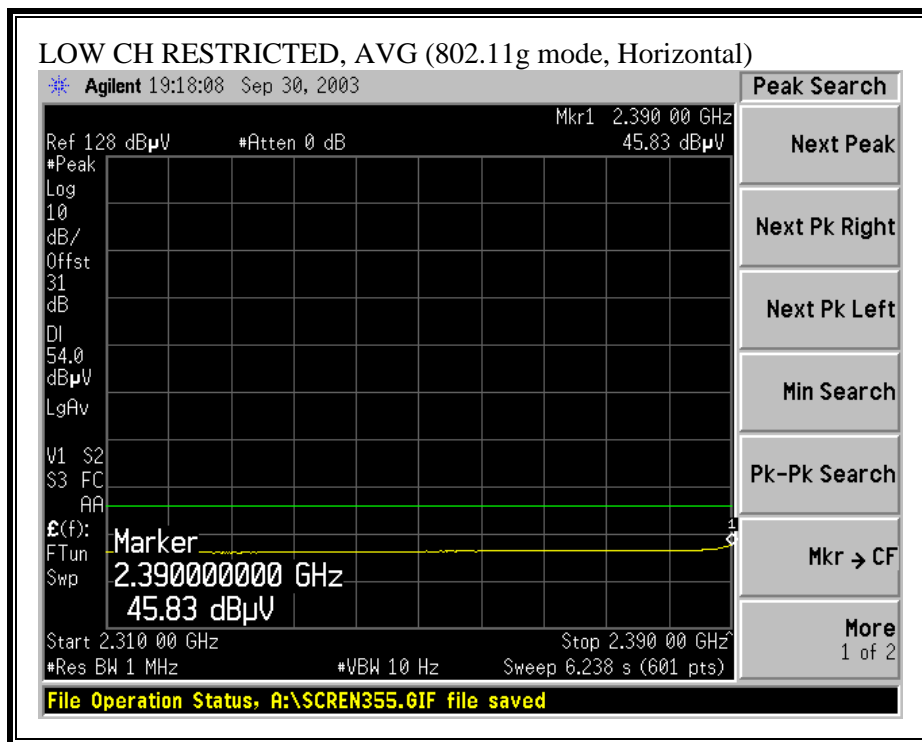


**HARMONICS AND SPURIOUS EMISSIONS (b MODE, L M & H CHANNEL)**

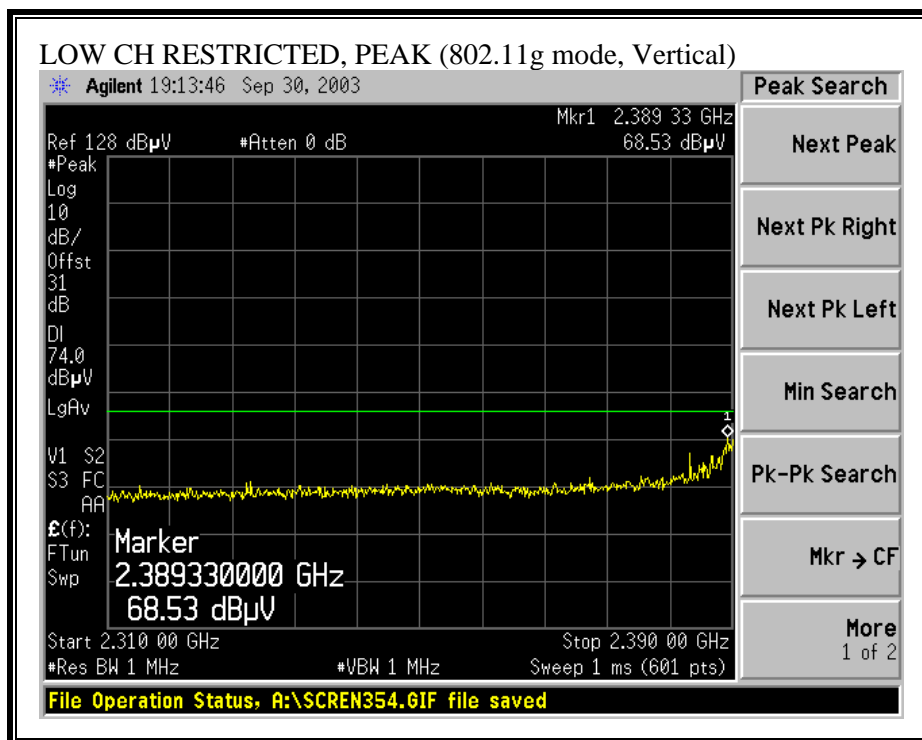
10/07/03 <b>High Frequency Measurement</b> <b>Compliance Certification Services, Morgan Hill Open Field Site</b>																
Test Engr: Chin Pang Project #: 03u2286-1 Company: Ambit Microsystem Corporation EUT Descrip.: 802.11 a/b/g Comb Module PCI EUT M/N: TBD Test Target: FCC 15.247 Mode Oper: Tx																
<b>Test Equipment:</b>																
EMCO Horn 1-18GHz T60; S/N: 2238 @3m		Pre-amplifier 1-26GHz T87 Miteq 924342		Spectrum Analyzer Agilent E4446A Analyzer		Horn > 18GHz										
<input type="checkbox"/> Hi Frequency Cables <input type="checkbox"/> (2 ft) <input checked="" type="checkbox"/> (2 ~ 3 ft) <input type="checkbox"/> (4 ~ 6 ft) <input checked="" type="checkbox"/> (12 ft)								<b>Peak Measurements:</b> 1 MHz Resolution Bandwidth 1MHz Video Bandwidth				<b>Average Measurements:</b> 1 MHz Resolution Bandwidth 10Hz Video Bandwidth				
11b																
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	
<b>Transmitting at low ch</b>																
4.824	9.8	55.2	41.0	33.1	3.9	-44.7	0.0	1.0	48.5	34.3	74.0	54.0	-25.5	-19.7	V	
7.236	9.8	58.0	48.0	36.1	5.1	-44.6	0.0	1.0	55.7	45.6	74.0	54.0	-18.3	-8.4	V	
4.824	9.8	54.3	42.7	33.1	3.9	-44.7	0.0	1.0	47.6	36.0	74.0	54.0	-26.4	-18.0	H	
7.236	9.8	56.0	46.6	36.1	5.1	-44.6	0.0	1.0	53.6	44.2	74.0	54.0	-20.4	-9.8	H	
<b>Transmitting at mid ch</b>																
4.874	9.8	58.2	45.7	33.1	4.0	-44.7	0.0	1.0	51.5	39.0	74.0	54.0	-22.5	-15.0	V	
7.311	9.8	55.0	45.3	36.2	5.2	-44.5	0.0	1.0	52.8	43.1	74.0	54.0	-21.2	-10.9	V	
4.874	9.8	55.0	44.2	33.1	4.0	-44.7	0.0	1.0	48.3	37.5	74.0	54.0	-25.7	-16.5	H	
7.311	9.8	53.7	42.7	36.2	5.2	-44.5	0.0	1.0	51.5	40.5	74.0	54.0	-22.5	-13.5	H	
<b>Transmitting at high ch</b>																
4.924	9.8	61.2	49.0	33.2	4.0	-44.8	0.0	1.0	54.5	42.4	74.0	54.0	-19.5	-11.6	V	
7.386	9.8	56.0	46.0	36.3	5.2	-44.5	0.0	1.0	54.0	44.0	74.0	54.0	-20.0	-10.0	V	
4.924	9.8	52.5	40.0	33.2	4.0	-44.8	0.0	1.0	45.9	33.4	74.0	54.0	-28.1	-20.6	H	
7.386	9.8	53.0	43.2	36.3	5.2	-44.5	0.0	1.0	51.0	41.2	74.0	54.0	-23.0	-12.8	H	
No other emissions were detected above system noise																
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)**

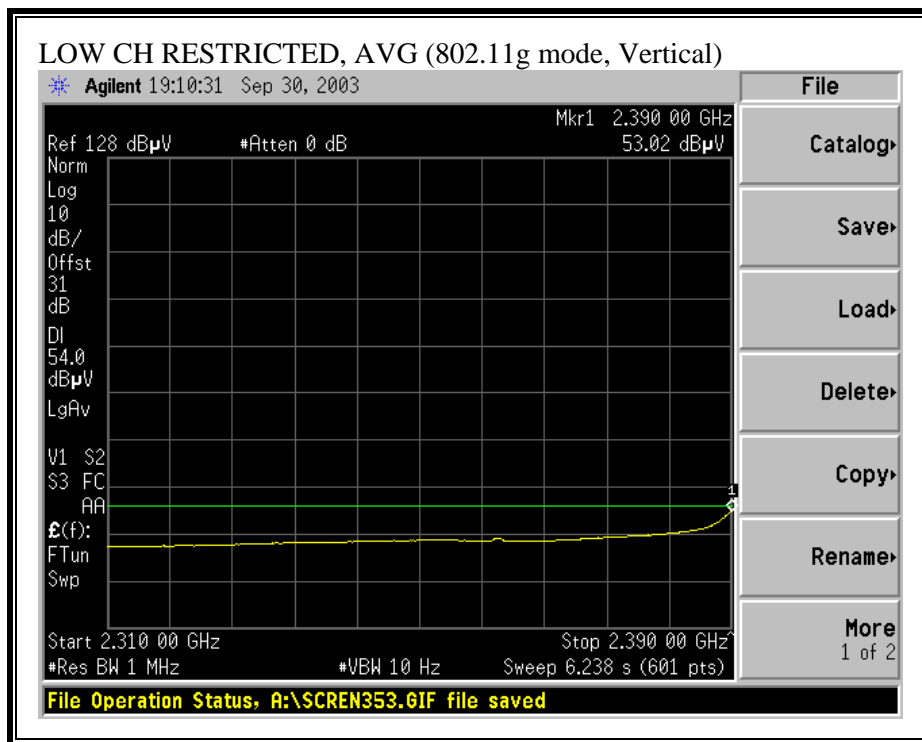




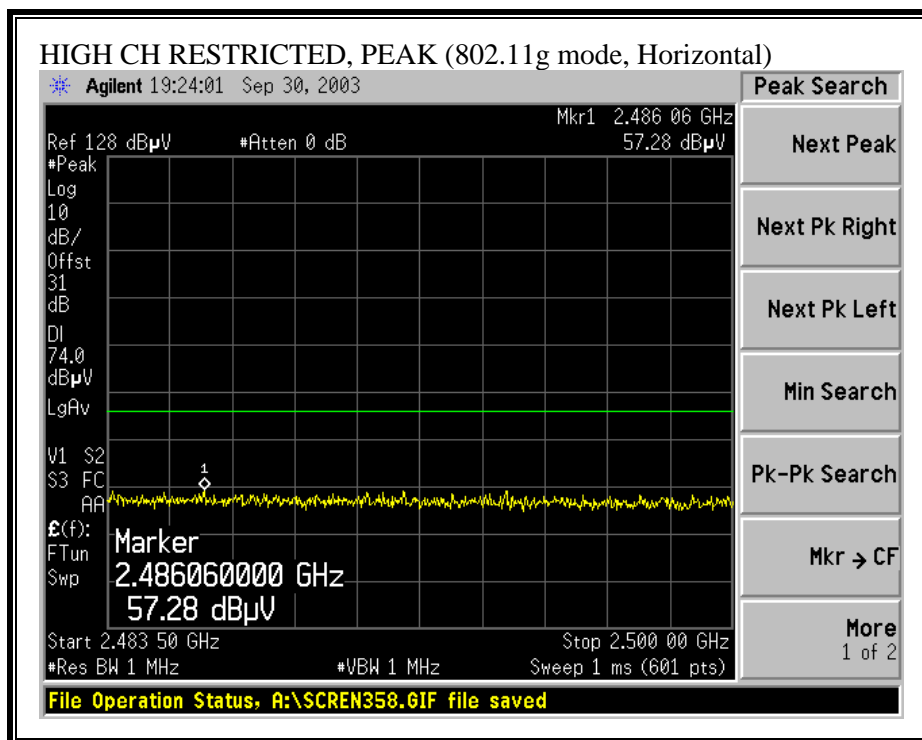
**RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, VERTICAL)**

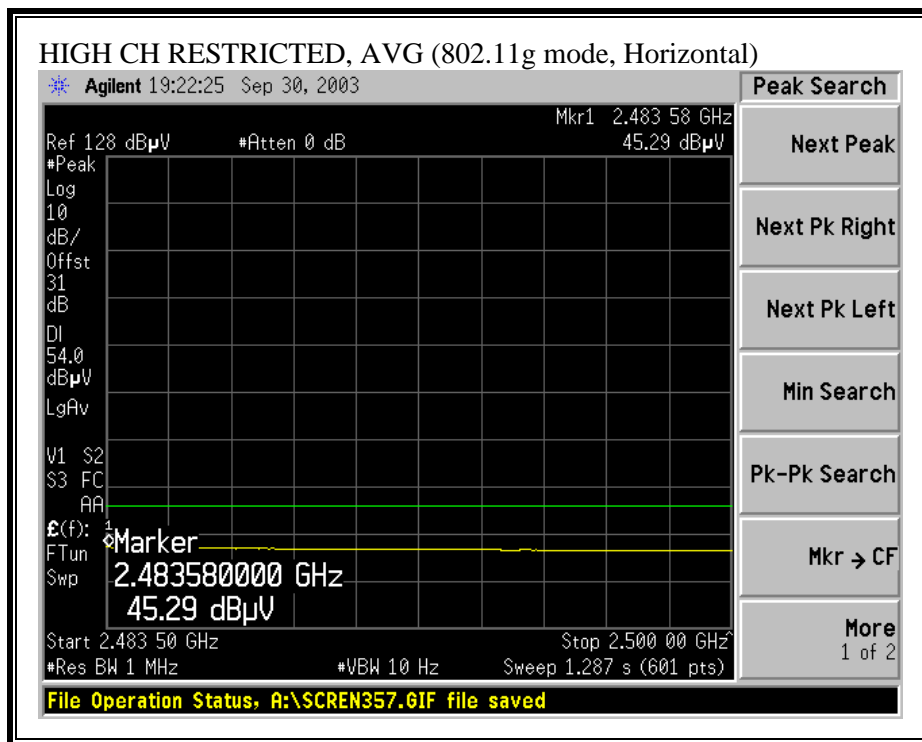




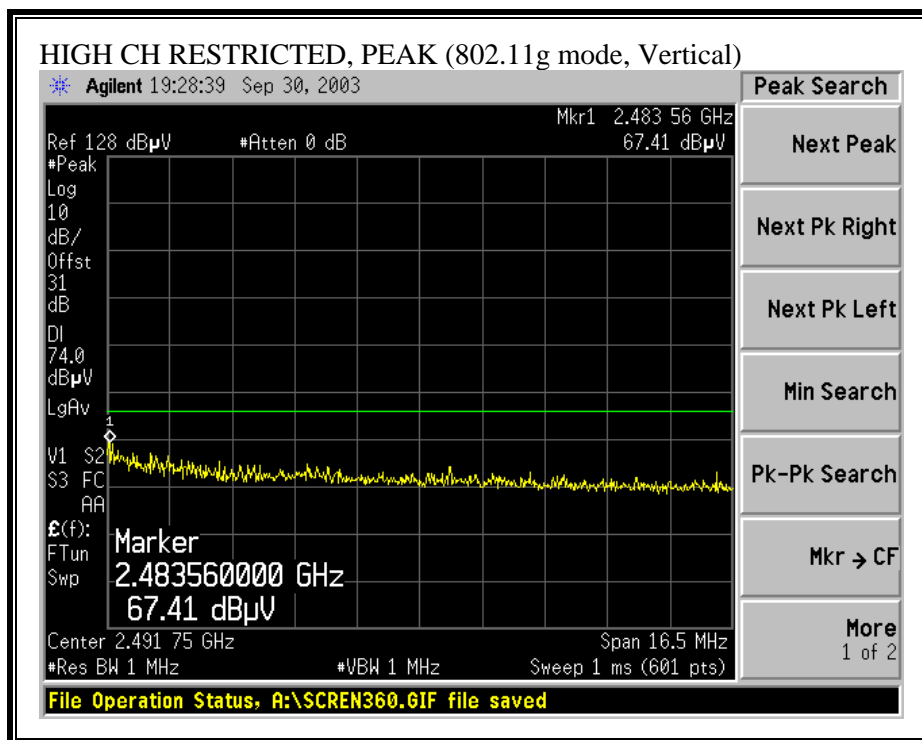


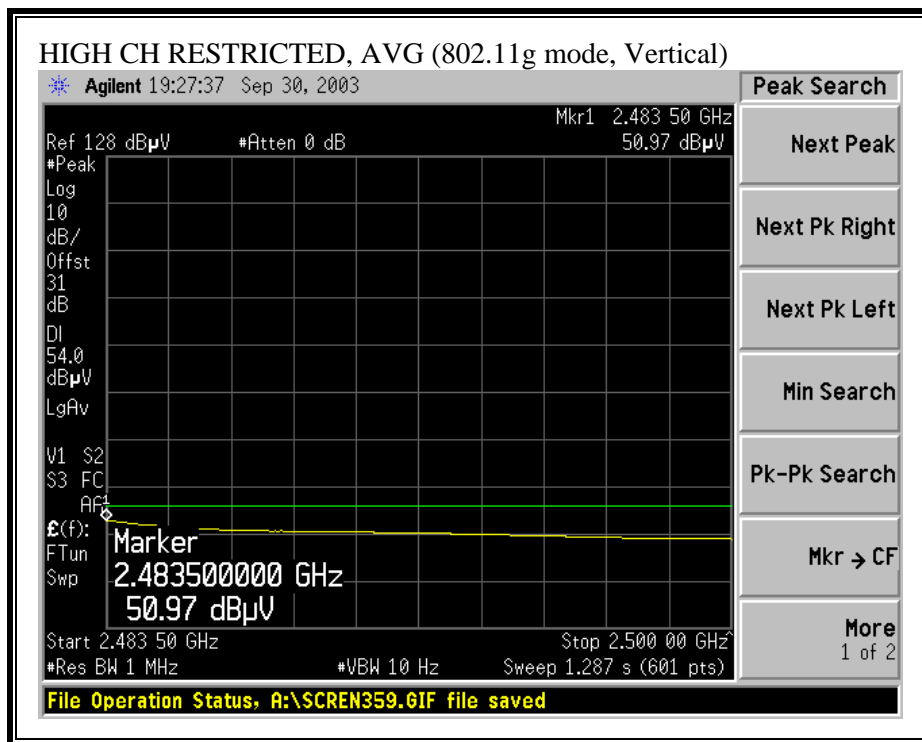
**RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, HORIZONTAL)**





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





**HARMONICS AND SPURIOUS EMISSIONS (g NORMAL MODE, L M & H CHANNEL)**

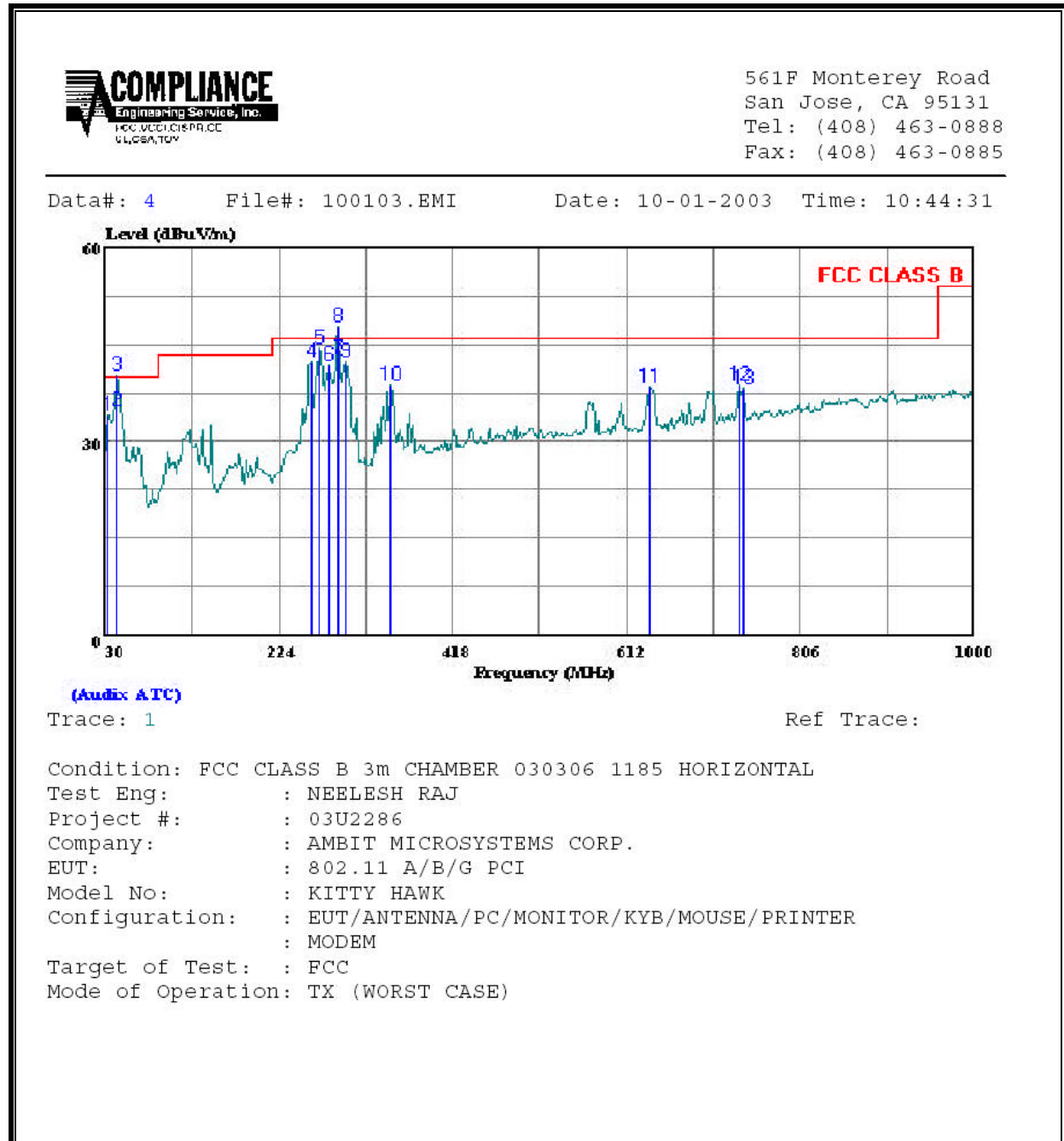
10/07/03 <b>High Frequency Measurement</b> Compliance Certification Services, Morgan Hill Open Field Site																
Test Engr:Chin Pang Project #:03u2286-1 Company:Ambit Microsystem Corporation EUT Descip.:802.11 a/b/g Comb Module PCI EUT M/N: TBD Test Target:FCC 15.247 Mode Oper:Tx																
<b>Test Equipment:</b>																
EMCO Horn 1-18GHz T60; S/N: 2238 @3m		Pre-amplifier 1-26GHz T87 Miteq 924342		Spectrum Analyzer Agilent E4446A Analyzer		Horn > 18GHz										
<b>Hi Frequency Cables:</b> <input type="checkbox"/> (2 ft) <input checked="" type="checkbox"/> (2 ~ 3 ft) <input type="checkbox"/> (4 ~ 6 ft) <input checked="" type="checkbox"/> (12 ft)																
<b>Peak Measurements:</b> 1 MHz Resolution Bandwidth 1MHz Video Bandwidth																
<b>Average Measurements:</b> 1 MHz Resolution Bandwidth 10Hz Video Bandwidth																
11g																
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	
<b>Transmitting at low ch</b>																
4.824	9.8	51.1	39.0	33.1	3.9	-44.7	0.0	1.0	44.4	32.3	74.0	54.0	-29.6	-21.7	V	
7.236	9.8	53.5	39.3	36.1	5.1	-44.6	0.0	1.0	51.1	37.0	74.0	54.0	-22.9	-17.0	V	
4.824	9.8	51.0	39.0	33.1	3.9	-44.7	0.0	1.0	44.3	32.3	74.0	54.0	-29.7	-21.7	H	
7.236	9.8	51.0	38.7	36.1	5.1	-44.6	0.0	1.0	48.6	36.3	74.0	54.0	-25.4	-17.7	H	
<b>Transmitting at mid ch</b>																
4.874	9.8	57.1	44.0	33.1	4.0	-44.7	0.0	1.0	50.4	37.3	74.0	54.0	-23.6	-16.7	V	
7.311	9.8	63.7	44.3	36.2	5.2	-44.5	0.0	1.0	61.5	42.1	74.0	54.0	-12.5	-11.9	V	
4.874	9.8	50.0	38.0	33.1	4.0	-44.7	0.0	1.0	43.3	31.3	74.0	54.0	-30.7	-22.7	H	
7.311	9.8	56.8	43.0	36.2	5.2	-44.5	0.0	1.0	54.6	40.8	74.0	54.0	-19.4	-13.2	H	
<b>Transmitting at high ch</b>																
4.924	9.8	55.0	43.2	33.2	4.0	-44.8	0.0	1.0	48.4	36.6	74.0	54.0	-25.6	-17.4	V	
7.386	9.8	53.0	46.0	36.3	5.2	-44.5	0.0	1.0	51.0	44.0	74.0	54.0	-23.0	-10.0	V	
4.924	9.8	49.9	37.0	33.2	4.0	-44.8	0.0	1.0	43.3	30.4	74.0	54.0	-30.7	-23.6	H	
7.386	9.8	50.0	37.5	36.3	5.2	-44.5	0.0	1.0	48.0	35.5	74.0	54.0	-26.0	-18.5	H	
No other emissions were detected above system noise.																
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 (a NORMAL MODE, L M & H CHANNEL)**

10/10/03 <b>High Frequency Measurement</b> <b>Compliance Certification Services, Morgan Hill Open Field Site</b>																
Test Engr:Chin Pang Project #:03u2286-1 Company:Ambit Microsystem Corporation EUT Descip.:802.11 a/b/g Comb Module PCI EUT M/N: TBD Test Target:FCC 15.247 Mode Oper:Tx																
<b>Test Equipment:</b>																
EMCO Horn 1-18GHz T60; S/N: 2238 @3m				Pre-amplifier 1-26GHz T87 Miteq 924342				Spectrum Analyzer Agilent E4446A Analyzer				Horn > 18GHz				
<b>Hi Frequency Cables</b> <input type="checkbox"/> (2 ft) <input checked="" type="checkbox"/> (2 ~ 3 ft) <input type="checkbox"/> (4 ~ 6 ft) <input checked="" type="checkbox"/> (12 ft)																
<b>Peak Measurements:</b> 1 MHz Resolution Bandwidth 1MHz Video Bandwidth																
<b>Average Measurements:</b> 1 MHz Resolution Bandwidth 10Hz Video Bandwidth																
11a																
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	
<b>Transmitting at low ch,</b>																
11.490	9.8	50.0	38.3	38.7	6.9	-41.5	0.0	1.0	55.1	43.4	74.0	54.0	-18.9	-10.6	V	
17.235	9.8	55.0	43.0	42.2	8.7	-46.1	0.0	1.0	60.8	48.8	74.0	54.0	-13.2	-5.2	V	
11.490	9.8	49.0	38.0	38.7	6.9	-41.5	0.0	1.0	54.1	43.1	74.0	54.0	-19.9	-10.9	H	
17.235	9.8	53.0	41.0	42.2	8.7	-46.1	0.0	1.0	58.8	46.8	74.0	54.0	-15.2	-7.2	H	
<b>Transmitting at mid ch</b>																
11.570	9.8	52.3	40.0	38.8	6.9	-41.6	0.0	1.0	57.4	45.1	74.0	54.0	-16.6	-8.9	V	
17.355	9.8	53.3	41.0	42.6	8.7	-46.0	0.0	1.0	59.6	47.3	74.0	54.0	-14.4	-6.7	V	
11.570	9.8	51.0	39.7	38.8	6.9	-41.6	0.0	1.0	56.1	44.8	74.0	54.0	-17.9	-9.2	H	
17.355	9.8	53.0	40.6	42.6	8.7	-46.0	0.0	1.0	59.3	46.9	74.0	54.0	-14.7	-7.1	H	
<b>Transmitting at high ch</b>																
11.650	9.8	52.0	39.3	38.9	7.0	-41.7	0.0	1.0	57.1	44.4	74.0	54.0	-16.9	-9.6	V	
17.475	9.8	53.3	40.7	36.3	8.8	-46.0	0.0	1.0	53.3	40.7	74.0	54.0	-20.7	-13.3	V	
11.650	9.8	51.0	39.0	38.9	7.0	-41.7	0.0	1.0	56.1	44.1	74.0	54.0	-17.9	-9.9	H	
17.475	9.8	53.0	40.6	43.1	8.8	-46.0	0.0	1.0	59.8	47.4	74.0	54.0	-14.2	-6.6	H	
No other emissions were detected above system noise.																
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									

### 7.8.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHZ

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





Page: 1

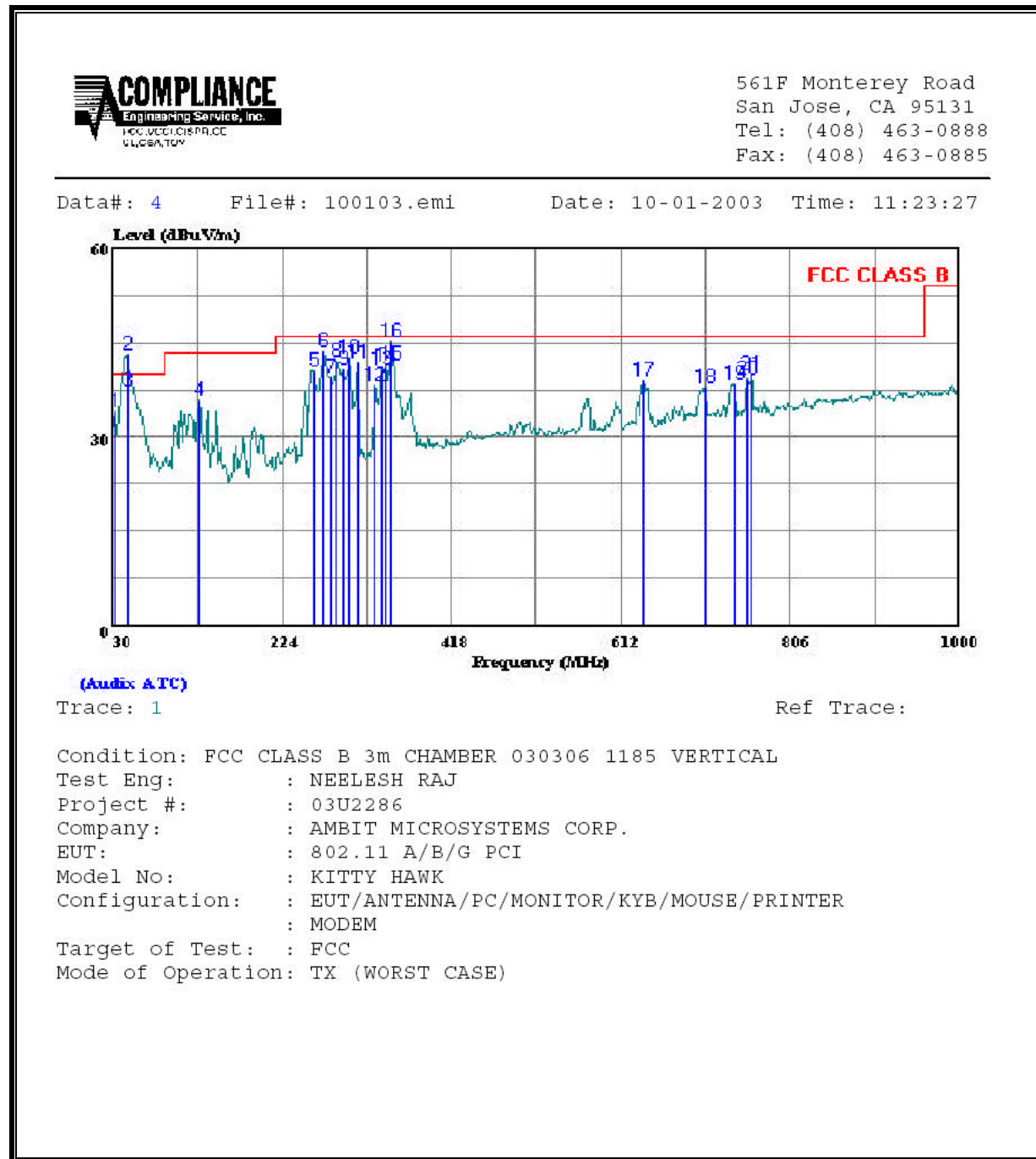
	Freq	Read Level	Probe Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV/m	dBuV/m	dB	
1	31.940	16.55	16.97	0.56	34.08	40.00	-5.92	Peak
2	43.580	18.22	16.05	0.64	34.92	40.00	-5.08	QP
3 *	43.580	23.35	16.14	0.64	40.13	40.00	0.13	Peak
4	259.890	28.83	11.82	1.59	42.24	46.00	-3.76	Peak
5	269.590	30.99	11.88	1.61	44.48	46.00	-1.52	Peak
6	279.290	28.16	11.94	1.64	41.74	46.00	-4.26	Peak
7	288.990	29.13	11.99	1.67	42.79	46.00	-3.21	QP

Data#: 4 File#: 100103.EMI Date: 10-01-2003 Time: 10:44:31

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	Freq	Read Level	Probe Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV/m	dBuV/m	dB	
8 *	288.990	34.21	12.00	1.66	47.87	46.00	1.87	Peak
9	298.690	28.57	12.05	1.73	42.35	46.00	-3.65	Peak
10	349.130	23.53	13.31	1.87	38.71	46.00	-7.29	Peak
11	638.190	17.83	18.03	2.65	38.51	46.00	-7.49	Peak
12	737.130	16.77	19.04	2.91	38.72	46.00	-7.28	Peak
13	741.980	16.27	19.11	2.90	38.28	46.00	-7.72	Peak

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



Page: 1

	Freq	Read Level	Probe Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV/m	dBuV/m	dB	
1	31.940	16.55	16.97	0.56	34.08	40.00	-5.92	Peak
2 *	46.490	26.44	15.91	0.65	43.01	40.00	3.01	Peak
3	46.490	21.11	15.57	0.66	37.34	40.00	-2.66	QP
4	128.940	24.92	9.79	1.05	35.76	43.50	-7.75	Peak
5	259.890	27.22	11.82	1.59	40.63	46.00	-5.37	Peak
6	271.530	30.07	11.89	1.61	43.57	46.00	-2.43	Peak
7	279.290	25.86	11.94	1.64	39.44	46.00	-6.56	Peak

Data#: 4 File#: 100103.emi Date: 10-01-2003 Time: 11:23:27

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	Freq	Read Level	Probe Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV/m	dBuV/m	dB	
8	286.080	28.49	11.98	1.69	42.16	46.00	-3.84	Peak
9	293.840	26.97	12.03	1.71	40.71	46.00	-5.29	Peak
10	300.630	28.70	12.06	1.71	42.47	46.00	-3.53	Peak
11	310.330	27.65	12.32	1.78	41.75	46.00	-4.25	Peak
12	329.730	23.47	12.85	1.83	38.15	46.00	-7.85	Peak
13	337.490	25.92	13.02	1.85	40.79	46.00	-5.21	Peak
14	342.340	26.19	13.14	1.85	41.18	46.00	-4.82	Peak
15	349.130	26.54	13.28	1.86	41.68	46.00	-4.32	QP
16	349.130	30.01	13.31	1.87	45.19	46.00	-0.81	Peak
17	638.190	18.21	18.03	2.65	38.89	46.00	-7.11	Peak
18	708.030	16.62	18.67	2.75	38.04	46.00	-7.96	Peak
19	741.980	16.34	19.11	2.90	38.35	46.00	-7.65	Peak
20	756.530	16.96	19.28	2.92	39.16	46.00	-6.84	Peak
21	761.380	17.72	19.34	2.92	39.98	46.00	-6.02	Peak

## 7.9. 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.

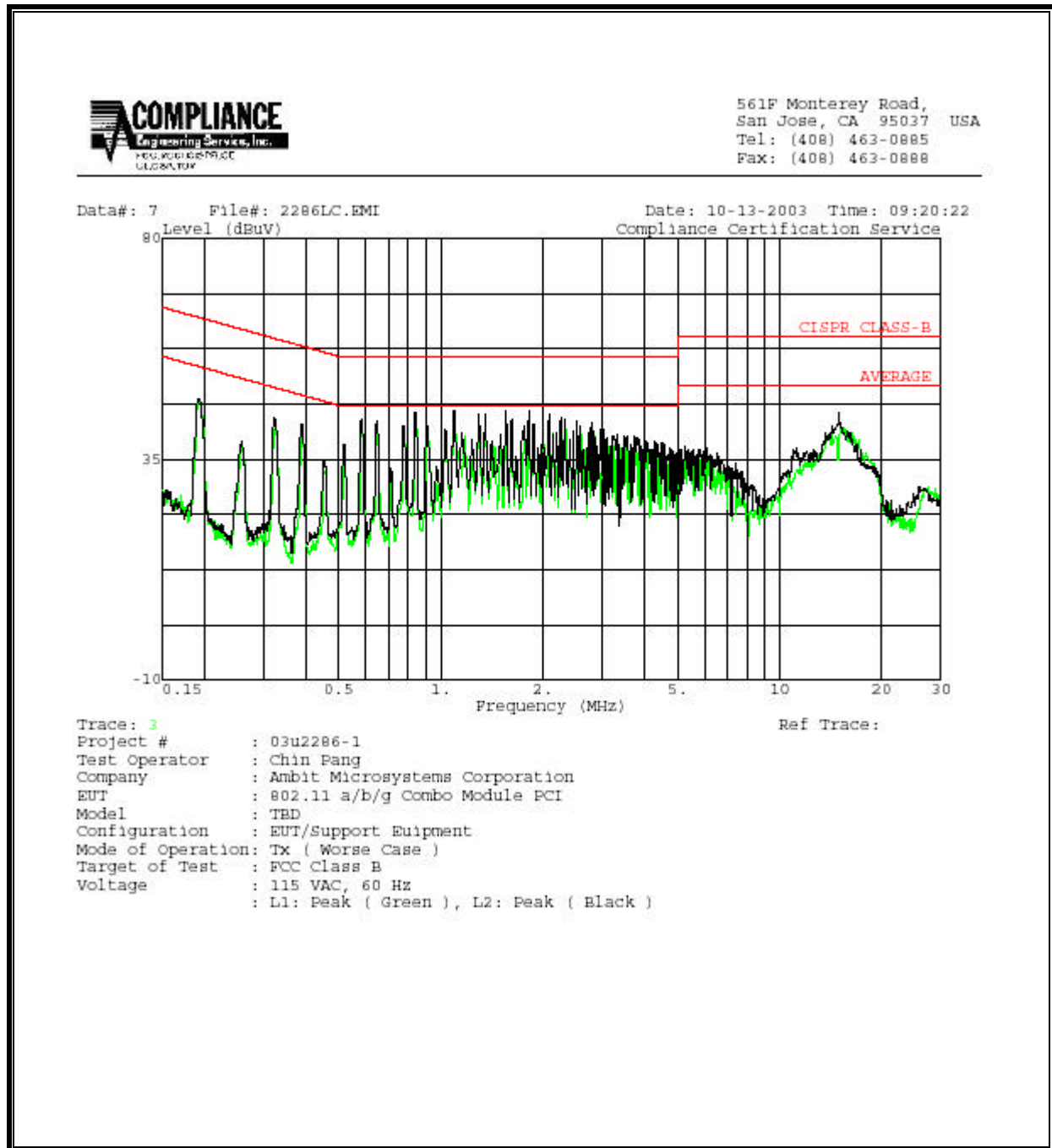
### RESULTS

No non-compliance noted:

# **6 WORST EMISSIONS**

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.84	42.32	--	--	0.00	56.00	46.00	-13.68	-3.68	L1
1.09	43.52	--	--	0.00	56.00	46.00	-12.48	-2.48	L1
2.31	43.00	--	--	0.00	56.00	46.00	-13.00	-3.00	L1
0.84	44.46	--	--	0.00	56.00	46.00	-11.54	-1.54	L2
1.09	45.04	--	--	0.00	56.00	46.00	-10.96	-0.96	L2
1.82	44.74	--	--	0.00	56.00	46.00	-11.26	-1.26	L2
6 Worst Data									

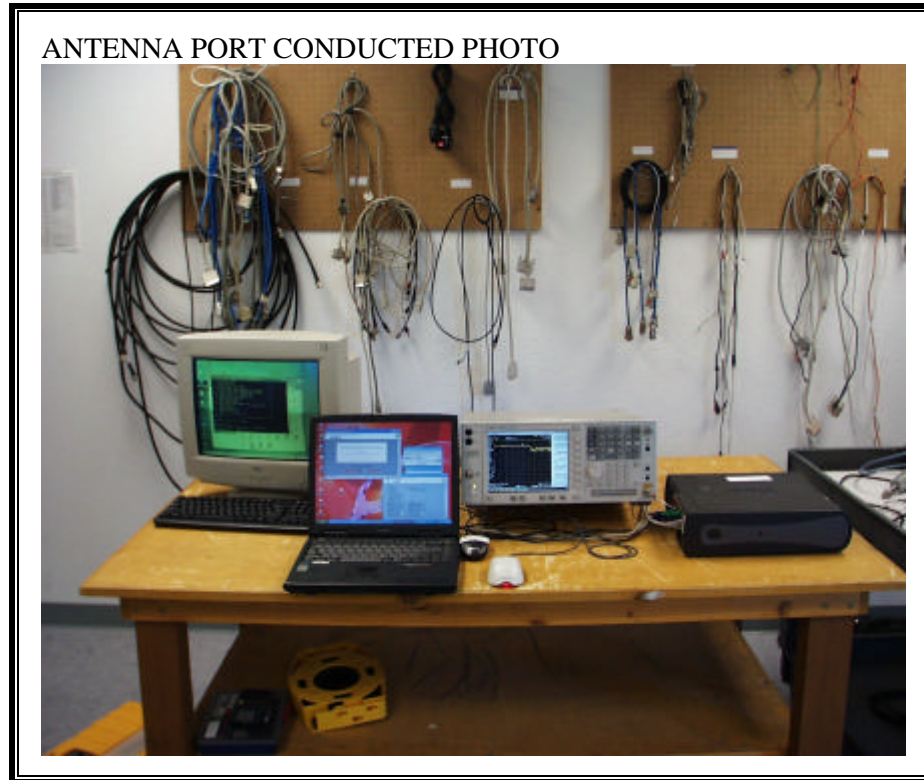
## LINE 1 AND LINE 2 RESULTS



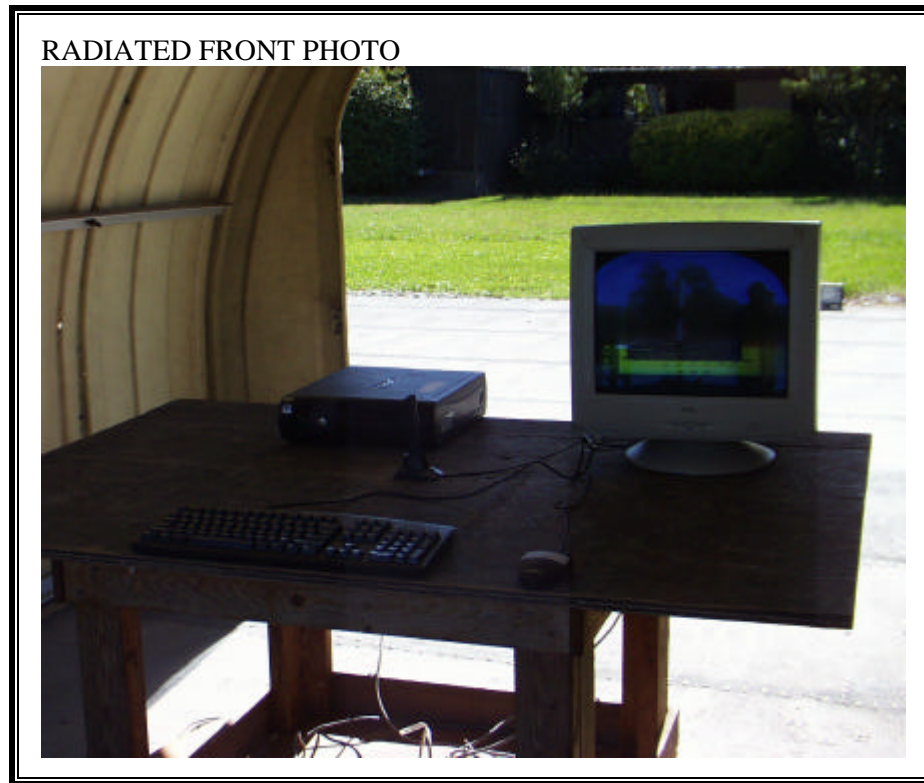


## 8. SETUP PHOTOS

### ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP



**RADIATED RF MEASUREMENT SETUP**

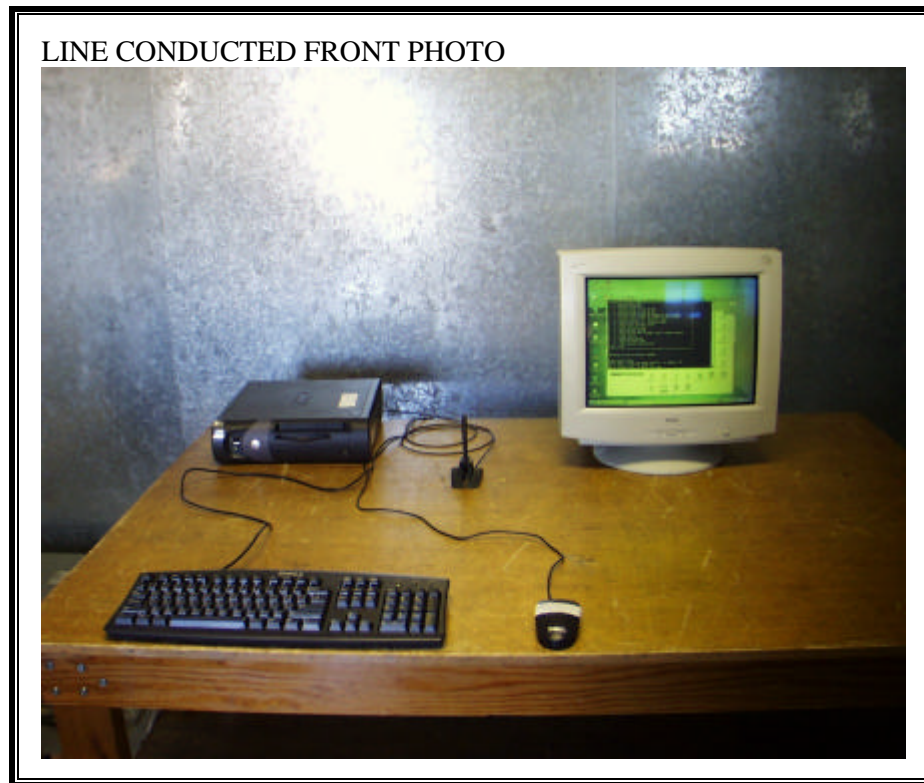




RADIATED BACK PHOTO



**POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP**



LINE CONDUCTED BACK PHOTO



**END OF REPORT**