



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

**FOR**

**802.11 B/G ACCESS POINT**

**MODEL NUMBER: BWR54G1**

**FCC ID: TDK-BWR54G1**

**REPORT NUMBER: 05U3488-1B**

**ISSUE DATE: JULY 5, 2005**

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# 1 ATTESTATION OF TEST RESULTS

**COMPANY NAME:** BOUNTIFUL WIFI LLC  
707 WEST 700 SOUTH, SUITE 202A  
WOODS CROSS, UT 84087, U.S.A

**EUT DESCRIPTION:** 802.11b/g ACCESS POINT

**MODEL:** BWR54G1

**SERIAL NUMBER:** 01550

**DATE TESTED:** JUNE 10-14, 2005

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

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

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

Approved & Released For CCS By:

Tested By:



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ENGINEERING MANAGER  
COMPLIANCE CERTIFICATION SERVICES

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EMC ENGINEER  
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## 2 TEST METHODOLOGY

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

## 3 FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 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.cseemc.com>.

## 4 CALIBRATION AND UNCERTAINTY

### 4.1 MEASURING INSTRUMENT CALIBRATION

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

### 4.2 MEASUREMENT UNCERTAINTY

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

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

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

## 5 EQUIPMENT UNDER TEST

### 5.1 DESCRIPTION OF EUT

The EUT is an 802.11b/g Access Point.

### 5.2 MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

2400 to 2483.5 MHz Authorized Band

| Frequency Range (MHz) | Mode    | Output Power (dBm) | Output Power (mW) |
|-----------------------|---------|--------------------|-------------------|
| 2412 - 2462           | 802.11b | 29.14              | 820.35            |
| 2412 - 2462           | 802.11g | 28.40              | 691.83            |

### 5.3 DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes two identical Dipole antennas, each with a maximum gain of 2.2dBi. One is for transmit, the other is for receive.

### 5.4 SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 2005JUN07.

The test utility software used during testing was ART program “ ART 5.2build58 “

### 5.5 WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The highest measured output power was at 2462MHz, b mode with data rate 1Mb/s.

## 5.6 MODIFICATION INFORMATION

A clamp-on ferrite was added to the AC adapter cable to comply with the radiated emission limit in the 30Mhz to 1000MHz range. The ferrite used is Fair-Rite Products Corporation, part number 0431167281.

Bountiful WiFi attests that this ferrite, or the equivalent solid (non clamp-on) ferrite, will be installed on the power cable, as shown in the photo below, on all units.



  
David K. Egbert  
Bountiful WiFi

## 5.7 DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| PERIPHERAL SUPPORT EQUIPMENT LIST |              |             |                            |        |
|-----------------------------------|--------------|-------------|----------------------------|--------|
| Description                       | Manufacturer | Model       | Serial Number              | FCC ID |
| Laptop                            | IBM          | ThinkPad    | FX-0171                    | DoC    |
| AC dapter                         | IBM          | AA2131      | 11S02K6746Z1Z2UFI<br>BM5CS | DoC    |
| AC dapter                         | ITE          | HK-B120-A05 | 43423499                   | DoC    |

### I/O CABLES

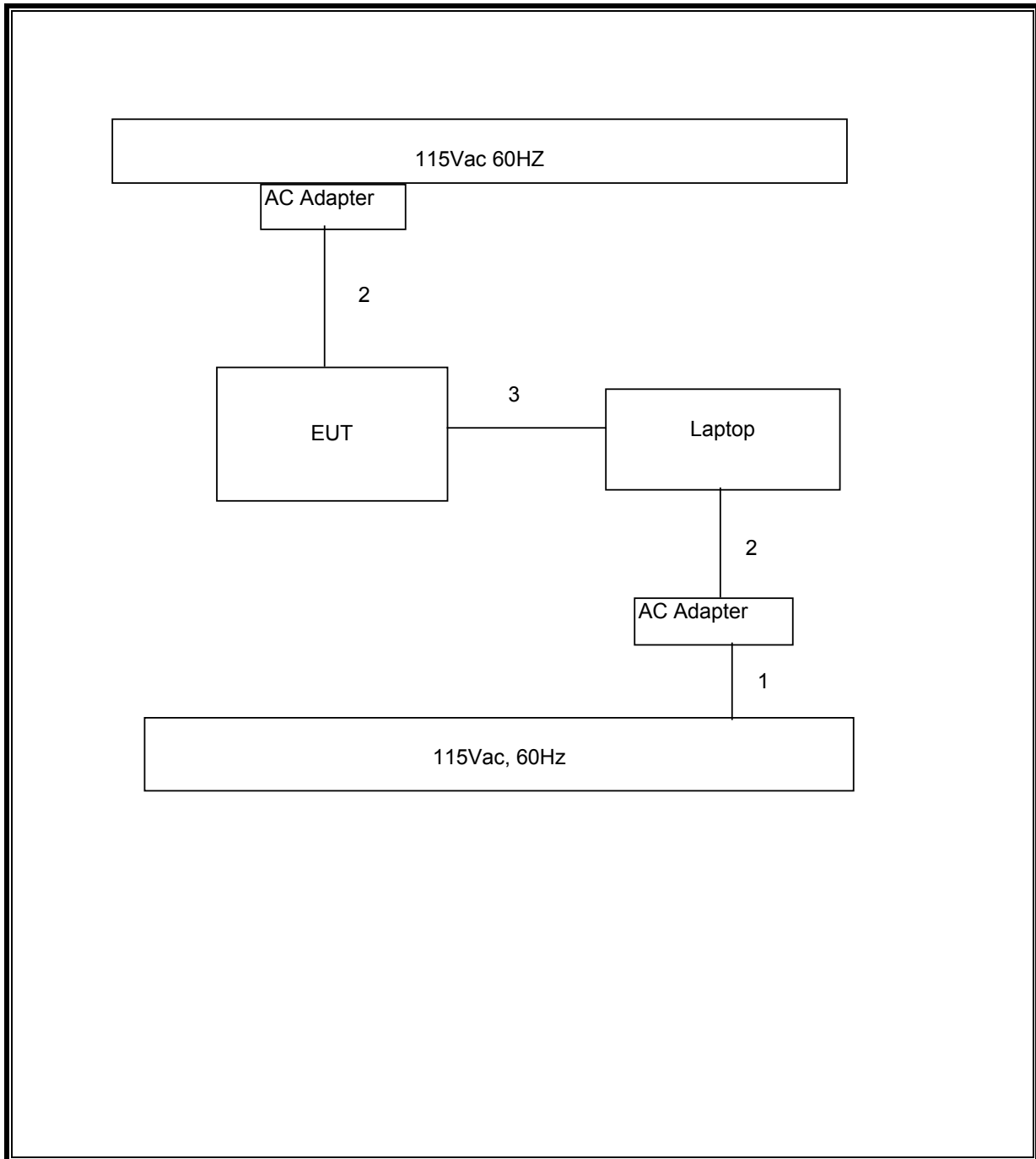
| I/O CABLE LIST |          |                      |                |             |              |         |
|----------------|----------|----------------------|----------------|-------------|--------------|---------|
| Cable No.      | Port     | # of Identical Ports | Connector Type | Cable Type  | Cable Length | Remarks |
| 1              | AC       | 1                    | US 115V        | Un-shielded | 2m           | No      |
| 2              | DC       | 1                    | DC             | Un-shielded | 1m           | Yes     |
| 3              | Ethernet | 1                    | RJ45           | Un-shielded | 5m           | Yes     |

### TEST SETUP

The EUT Access Point is connected to a laptop computer via a RJ45 cable during the tests. Test software exercised the EUT.



**SETUP DIAGRAM FOR TESTS**



## 6 TEST AND MEASUREMENT EQUIPMENT

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

| TEST EQUIPMENT LIST                  |                |                  |               |            |
|--------------------------------------|----------------|------------------|---------------|------------|
| Description                          | Manufacturer   | Model            | Serial Number | Cal Due    |
| EMI Test Receiver                    | R & S          | ESHS 20          | 827129/006    | 10/22/2005 |
| Site A Line Stabilizer / Conditioner | Tripplite      | LC-1800a         | A0051681      | CNR        |
| LISN, 10 kHz ~ 30 MHz                | FCC            | LISN-50/250-25-2 | 2023          | 8/30/2005  |
| LISN, 10 kHz ~ 30 MHz                | Solar          | 8012-50-R-24-BNC | 8379443       | 10/21/2005 |
| Spectrum Analyzer                    | HP             | E4446A           | US42510266    | 8/25/2005  |
| Antenna, Horn 1 ~ 18 GHz             | EMCO           | 3117             | 29310         | 9/12/2005  |
| 4.0 High Pass Filter                 | Micro Tronics  | HPM13351         | 1             | CNR        |
| Amplifier 1-26GHz                    | MITEQ          | NSP2600-SP       | 924342        | 8/17/2005  |
| 30MHz--- 2Ghz                        | Sunol Sciences | JB1 Antenna      | A121003       | 9/12/2005  |
| EMI Receiver, 9 kHz ~ 2.9 GHz        | HP             | 8542E            | 3942A00286    | 3/6/2006   |
| RF Filter Section                    | HP             | 85420E           | 3705A00256    | 3/6/2006   |
| Peak Power Meter                     | Agilent        | E4416A           | GB41291160    | 2/9/2006   |
| Peak / Average Power Sensor          | Agilent        | E9327A           | US40440755    | 2/10/2006  |
| Preamplifier, 1 ~ 26.5 GHz           | HP             | 8449B            | 3008A00369    | 8/17/2005  |

## 7 LIMITS AND RESULTS

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

#### 7.1.1 6 dB BANDWIDTH

##### LIMIT

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

##### TEST PROCEDURE

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

##### RESULTS

No non-compliance noted:

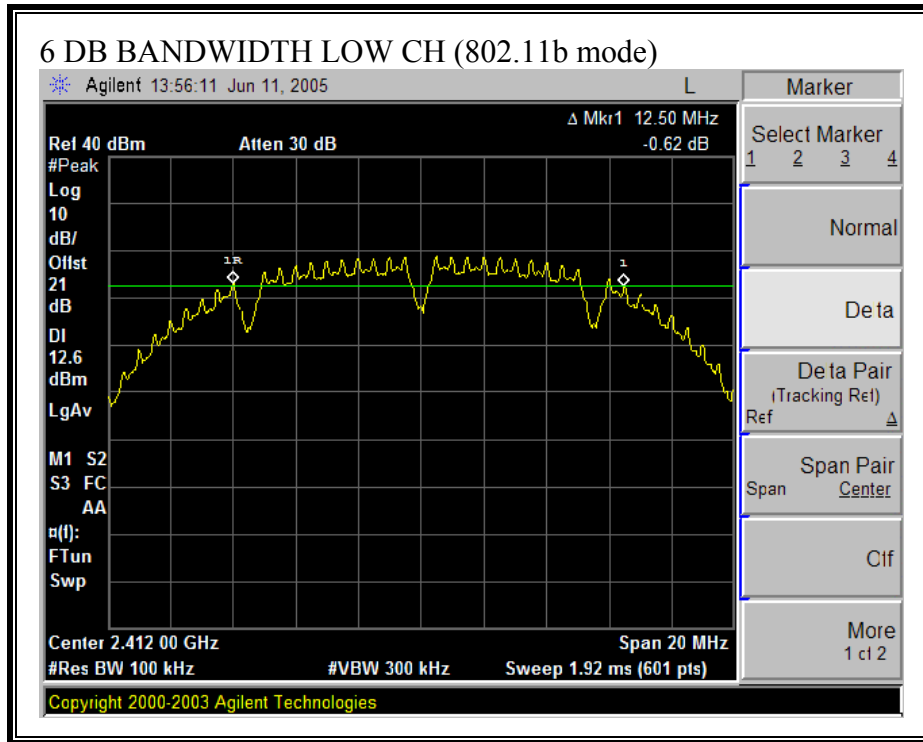
##### 802.11b Mode

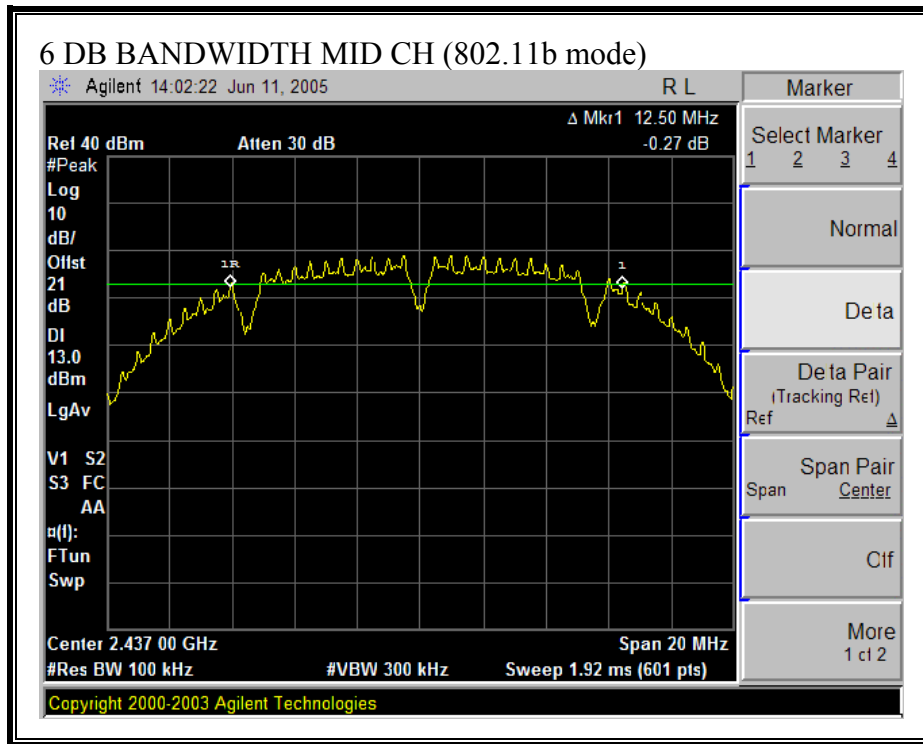
| Channel | Frequency (MHz) | 6 dB Bandwidth (kHz) | Minimum Limit (kHz) | Margin (kHz) |
|---------|-----------------|----------------------|---------------------|--------------|
| Low     | 2412            | 12500                | 500                 | 12000        |
| Middle  | 2437            | 12500                | 500                 | 12000        |
| High    | 2462            | 12500                | 500                 | 12000        |

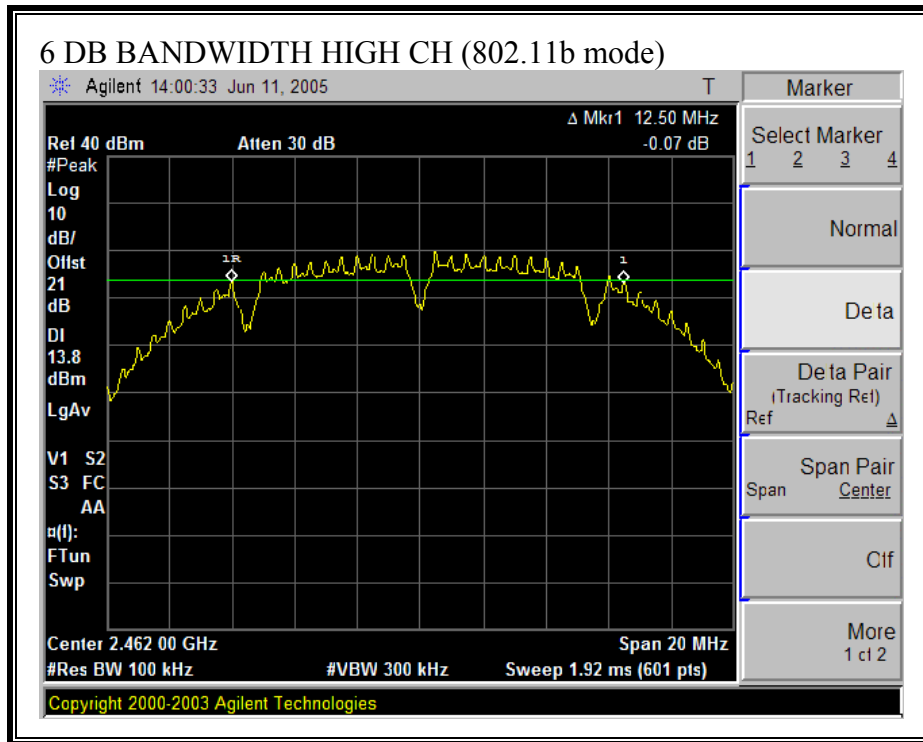
##### 802.11g Mode

| Channel | Frequency (MHz) | 6 dB Bandwidth (kHz) | Minimum Limit (kHz) | Margin (kHz) |
|---------|-----------------|----------------------|---------------------|--------------|
| Low     | 2412            | 16440                | 500                 | 15940        |
| Middle  | 2437            | 16380                | 500                 | 15880        |
| High    | 2462            | 16440                | 500                 | 15940        |

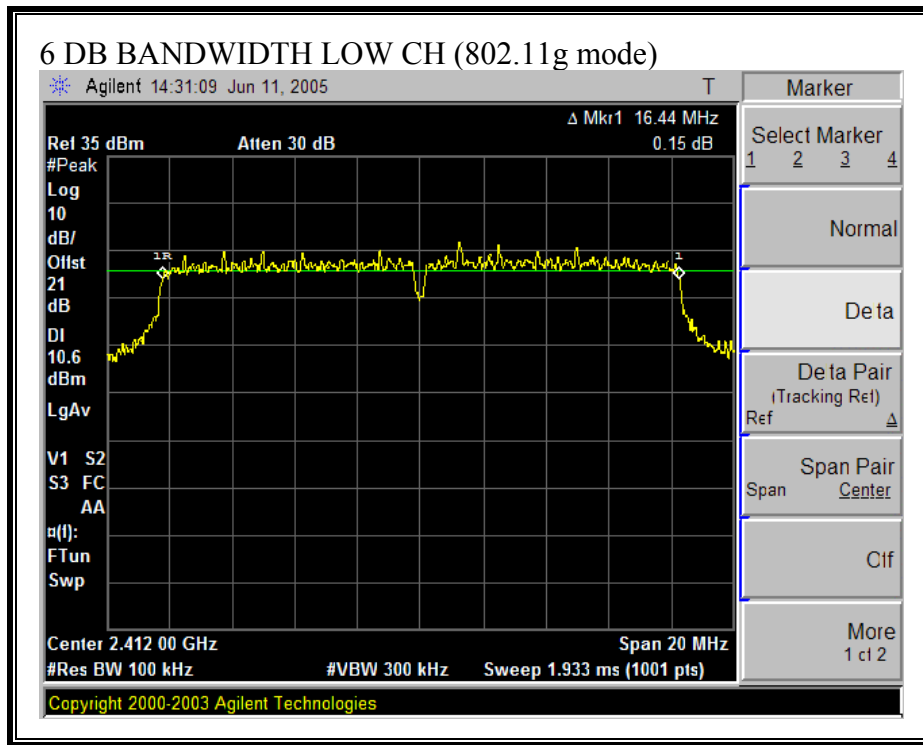
**6 DB BANDWIDTH (802.11b MODE)**







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









## 7.1.2 99% BANDWIDTH

### LIMIT

None: for reporting purposes only.

### TEST PROCEDURE

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

### RESULTS

No non-compliance noted:

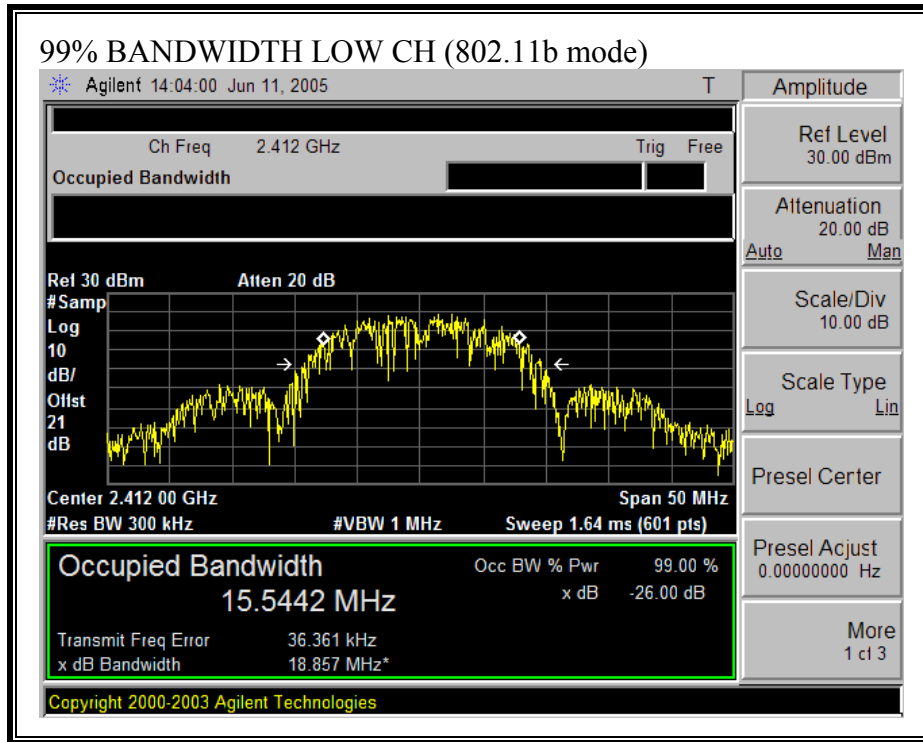
#### 802.11b Mode

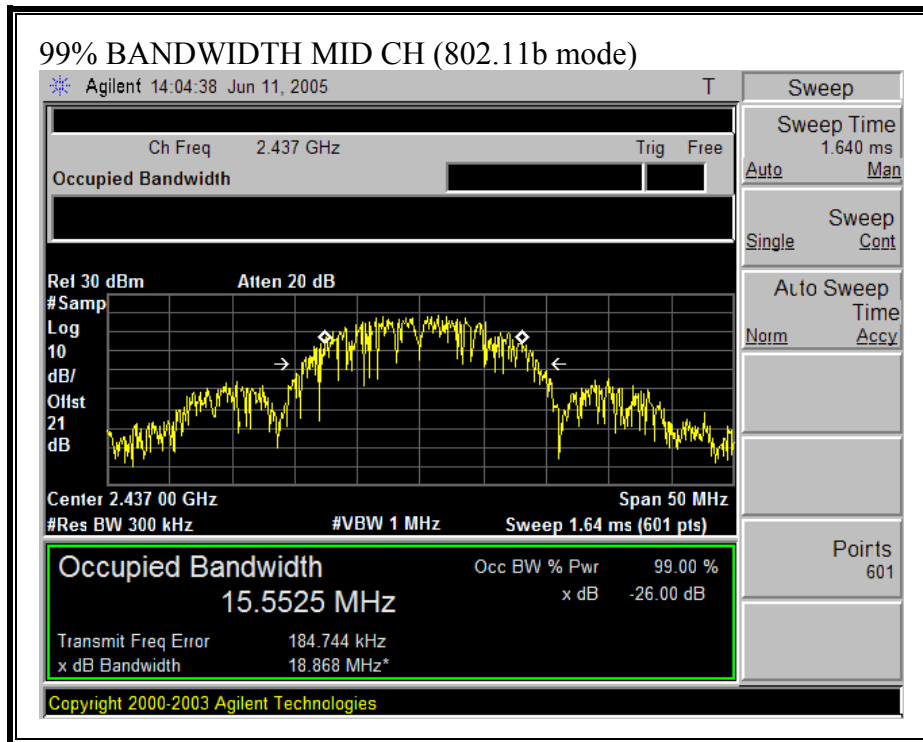
| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|
| Low     | 2412            | 15.54               |
| Middle  | 2437            | 15.55               |
| High    | 2462            | 15.62               |

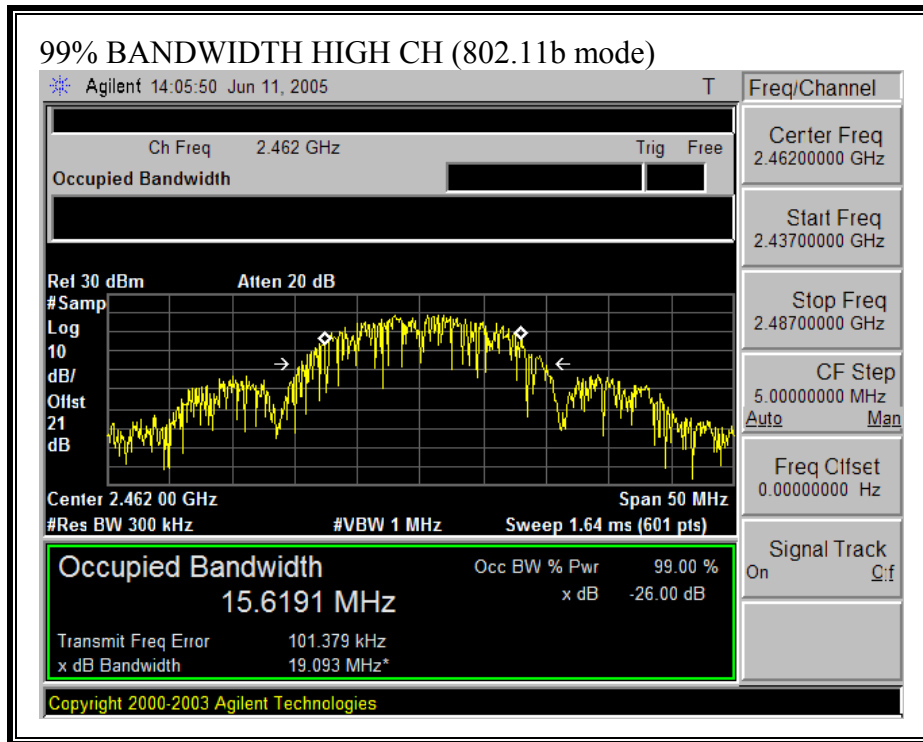
#### 802.11g Mode

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|
| Low     | 2412            | 16.55               |
| Middle  | 2437            | 16.56               |
| High    | 2462            | 16.55               |

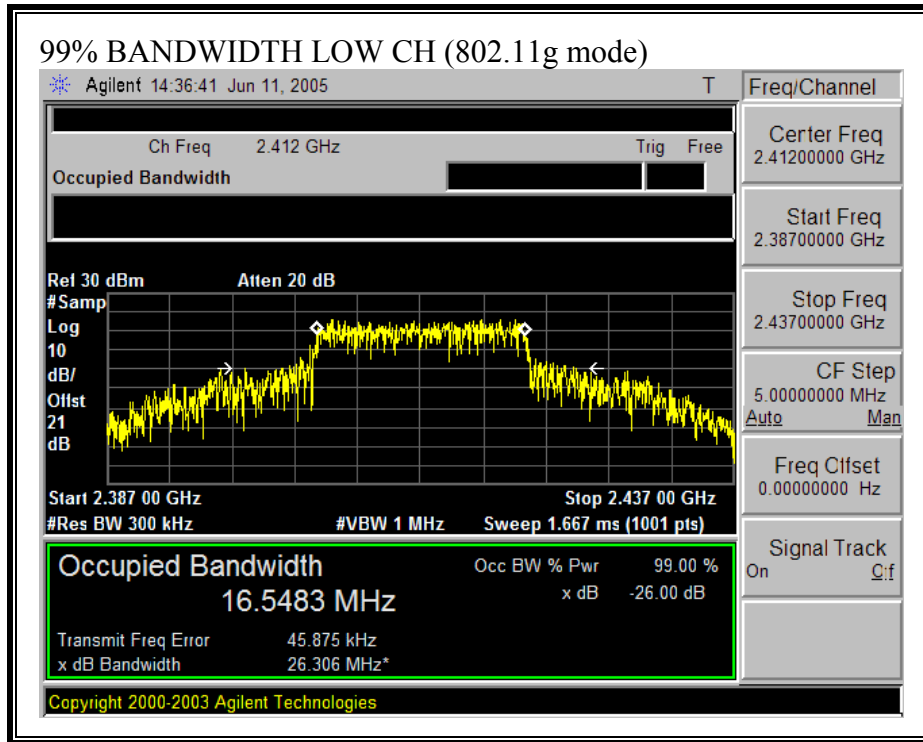
**99% BANDWIDTH (802.11b MODE)**

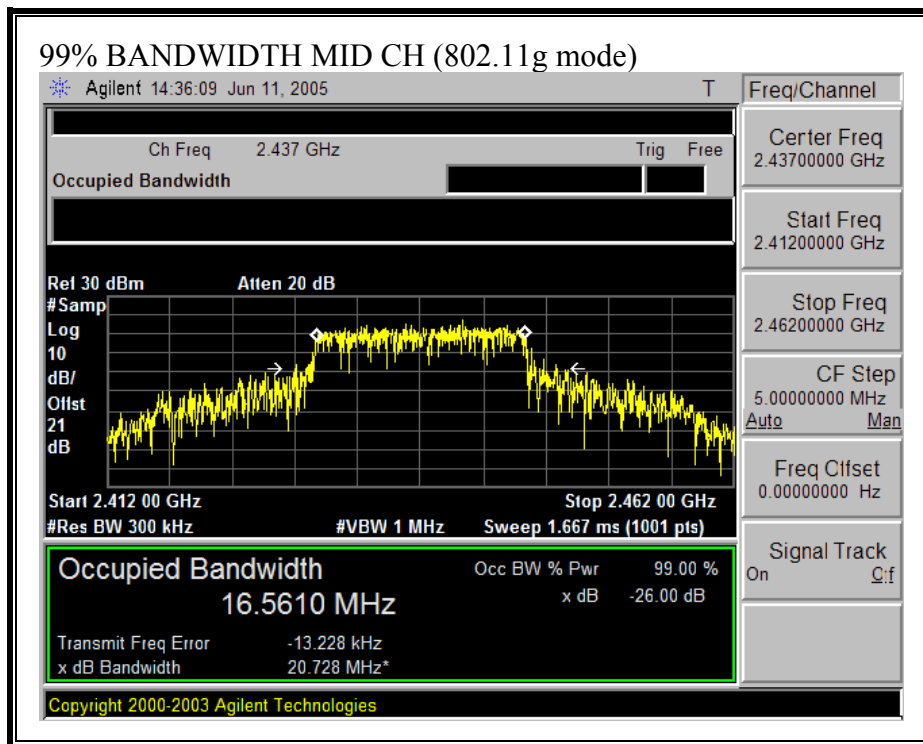


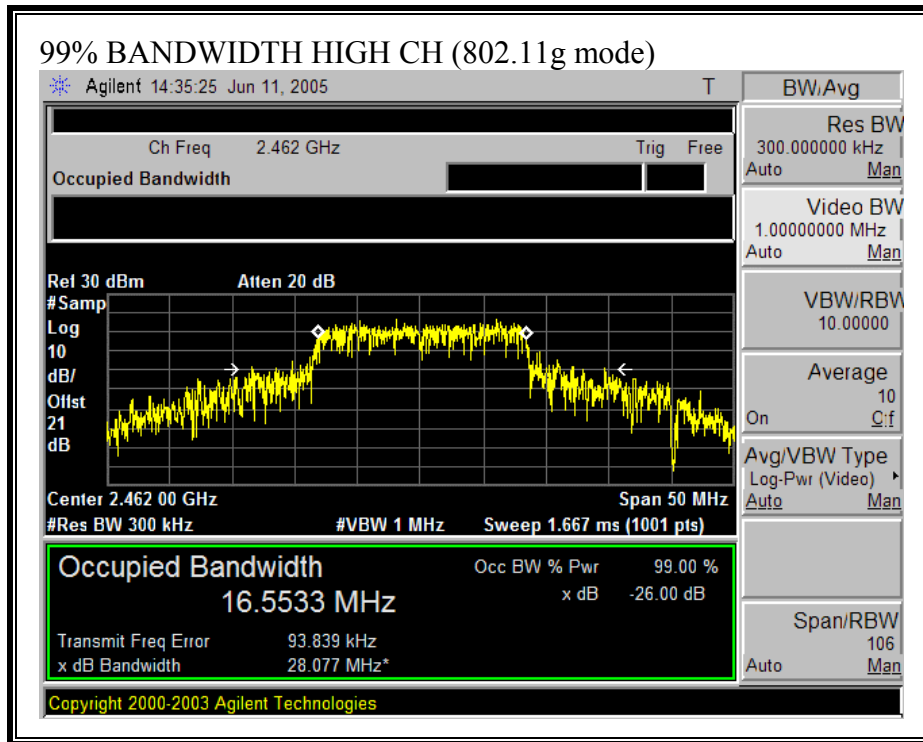




**99% BANDWIDTH (802.11g MODE)**









### 7.1.3 PEAK OUTPUT POWER

#### **PEAK POWER LIMIT**

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

§15.247 (b) (4) Except as shown in paragraphs (b)(4) (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.

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

#### **TEST PROCEDURE**

The test is performed in accordance with FCC document “Measurement of Digital Transmission Systems Operating under Section 15.247”, March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

**RESULTS**

The maximum antenna gain is 2.2 dBi for other than fixed, point-to-point operations, therefore the limit is 30 dBm.

No non-compliance noted:

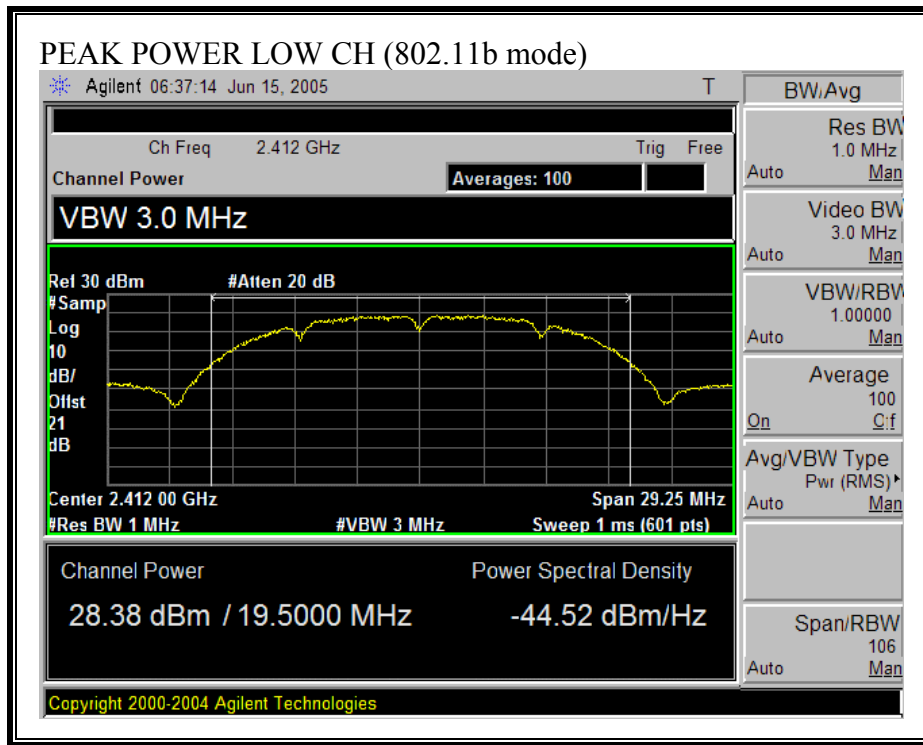
802.11b Mode

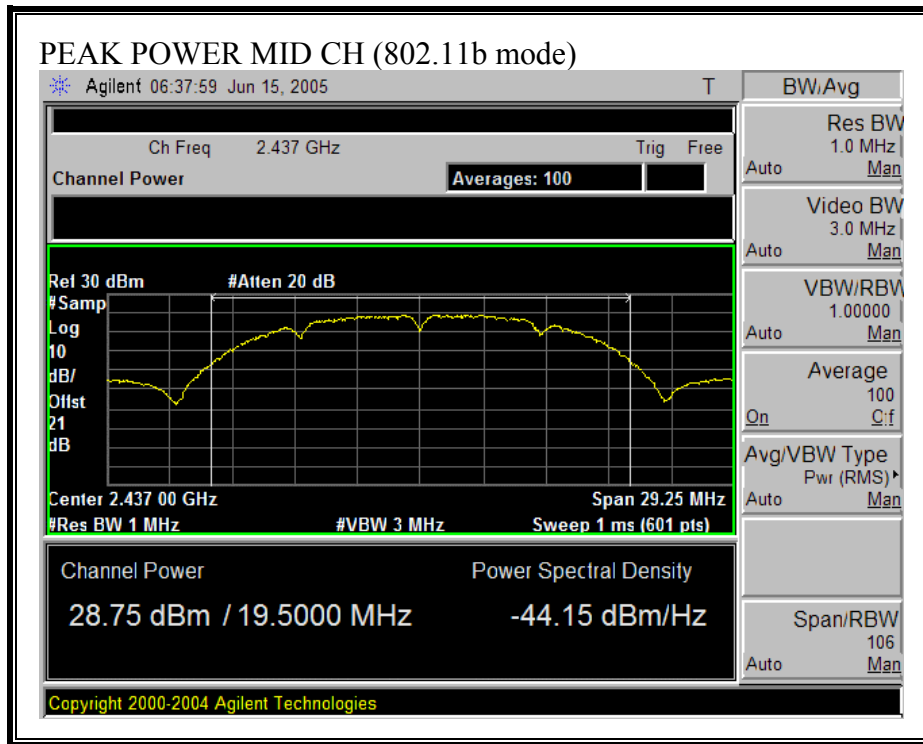
| <b>Channel</b> | <b>Frequency (MHz)</b> | <b>Peak Power (dBm)</b> | <b>Limit (dBm)</b> | <b>Margin (dB)</b> |
|----------------|------------------------|-------------------------|--------------------|--------------------|
| Low            | 2412                   | 28.38                   | 30                 | -1.62              |
| Middle         | 2437                   | 28.75                   | 30                 | -1.25              |
| High           | 2462                   | 29.14                   | 30                 | -0.86              |

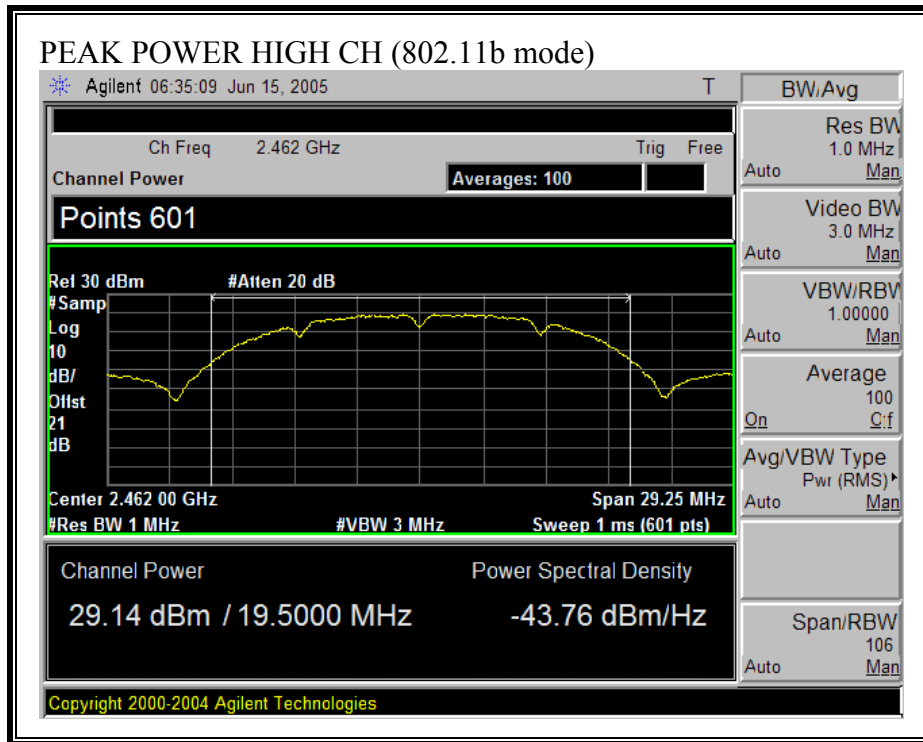
802.11g Mode

| <b>Channel</b> | <b>Frequency (MHz)</b> | <b>Peak Power (dBm)</b> | <b>Limit (dBm)</b> | <b>Margin (dB)</b> |
|----------------|------------------------|-------------------------|--------------------|--------------------|
| Low            | 2412                   | 25.74                   | 30                 | -4.26              |
| Middle         | 2437                   | 28.11                   | 30                 | -1.89              |
| High           | 2462                   | 28.40                   | 30                 | -1.60              |

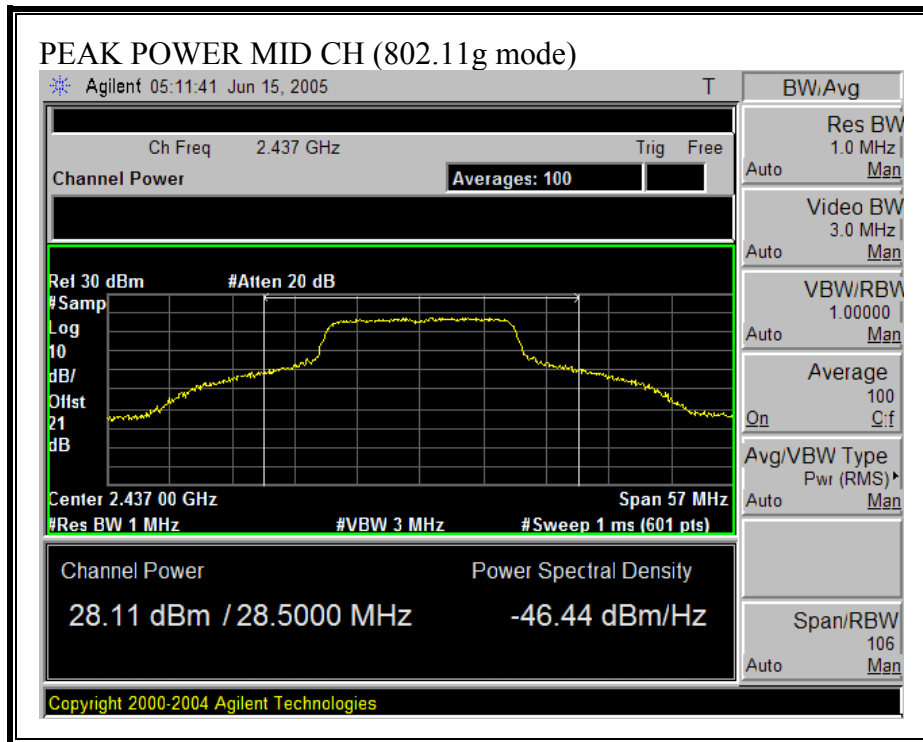
**OUTPUT POWER (802.11b MODE)**

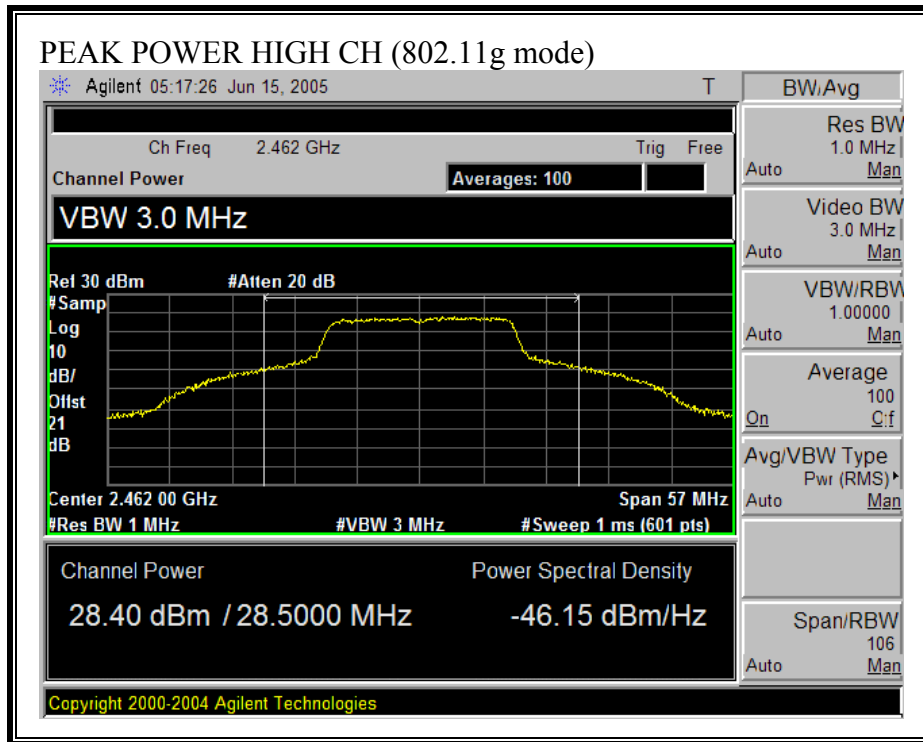














### 7.1.4 MAXIMUM PERMISSIBLE EXPOSURE

#### LIMITS

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

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

| Frequency range (MHz)                                   | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|---|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| (A) Limits for Occupational/Controlled Exposures        |                               |                               |                                     |                          |
| 0.3–3.0 .....   | 614                           | 1.63                          | *(100)                              | 6                        |
| 3.0–30 .....  | 1842/f                        | 4.89/f                        | *(900/f <sup>2</sup> )              | 6                        |
| 30–300 .....  | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300–1500 .....  | .....                         | .....                         | f/300                               | 6                        |
| 1500–100,000 .....                                      | .....                         | .....                         | 5                                   | 6                        |
| (B) Limits for General Population/Uncontrolled Exposure |                               |                               |                                     |                          |
| 0.3–1.34 .....  | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34–30 .....   | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 30                       |

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

| Frequency range (MHz) | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|-----------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| 30–300 .....          | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300–1500 .....        | .....                         | .....                         | f/1500                              | 30                       |
| 1500–100,000 .....    | .....                         | .....                         | 1.0                                 | 30                       |

f = frequency in MHz

\* = Plane-wave equivalent power density

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

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

#### 7.1.4.1

CALCULATIONS

Given

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

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

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

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

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

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

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

yields

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

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

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

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

Substituting the logarithmic form of power and gain using:

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

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

yields

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

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**

From §1.1310 Table 1 (B),  $S = 1.0 \text{ mW/cm}^2$

**RESULTS**

No non-compliance noted:

| <b>Mode</b> | <b>Power Density<br/>Limit<br/>(mW/cm<sup>2</sup>)</b> | <b>Output<br/>Power<br/>(dBm)</b> | <b>Antenna<br/>Gain<br/>(dBi)</b> | <b>MPE<br/>Distance<br/>(cm)</b> |
|-------------|--|-----------------------------------|-----------------------------------|----------------------------------|
| 802.11b     | 1.0  | 29.14                             | 2.20                              | 10.41                            |
| 802.11g     | 1.0  | 28.40                             | 2.20                              | 9.56                             |

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.

### 7.1.5 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 21dB (including 20 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) | Power (dBm) |
|---------|-----------------|-------------|
| Low     | 2412            | 28.48       |
| Middle  | 2437            | 28.85       |
| High    | 2462            | 29.25       |

#### 802.11g Mode

| Channel | Frequency (MHz) | Power (dBm) |
|---------|-----------------|-------------|
| Low     | 2412            | 25.80       |
| Middle  | 2437            | 28.22       |
| High    | 2462            | 27.60       |

## 7.1.6 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:

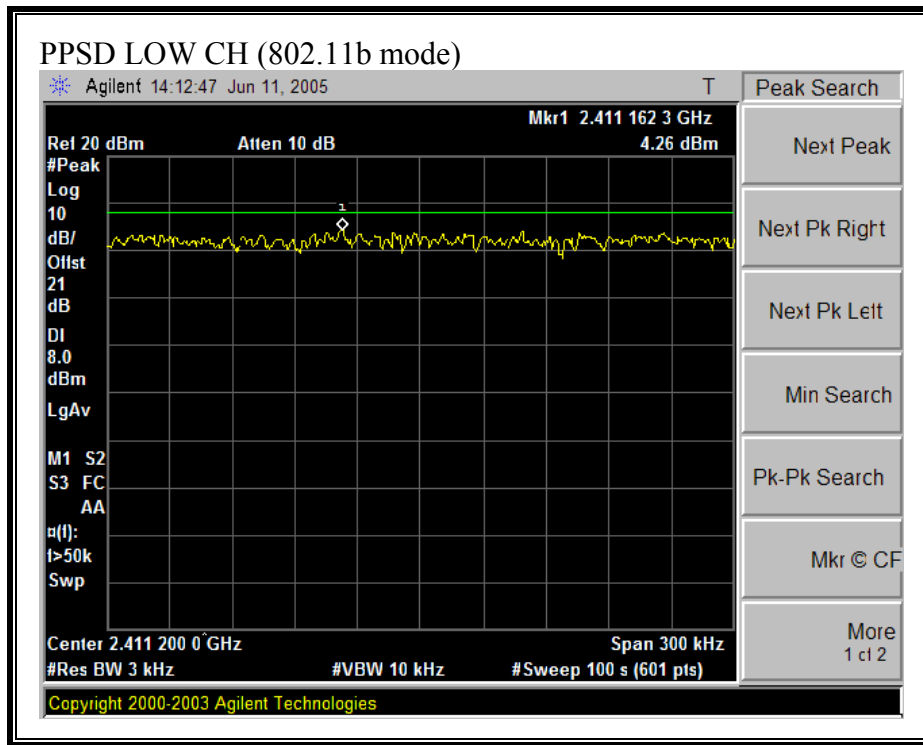
#### 802.11b Mode

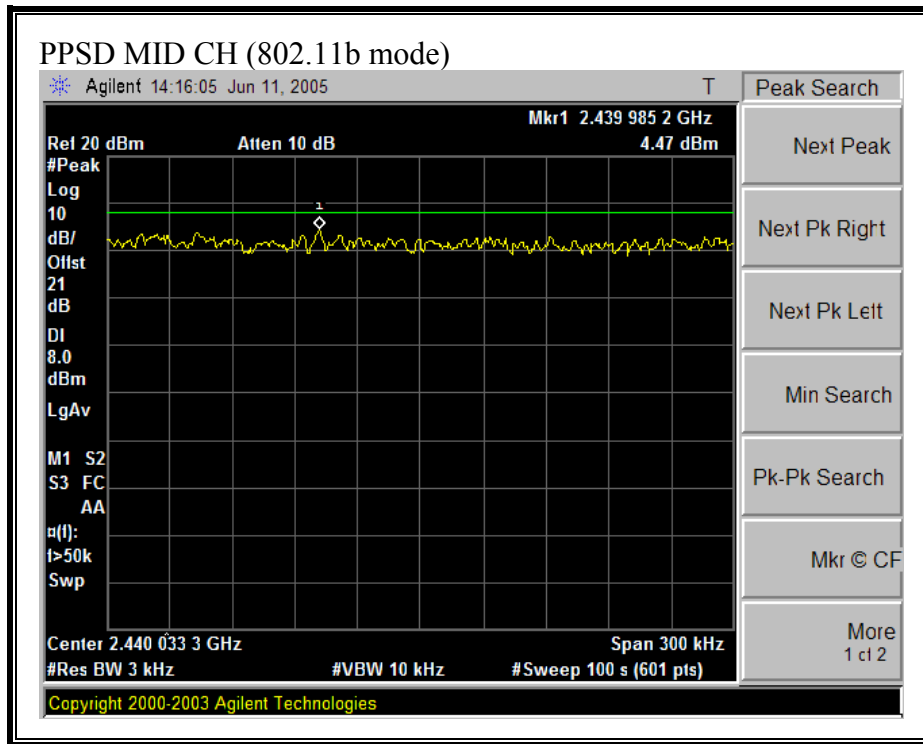
| Channel | Frequency (MHz) | PPSD (dBm) | Limit (dBm) | Margin (dB) |
|---------|-----------------|------------|-------------|-------------|
| Low     | 2412            | 4.26       | 8           | -3.74       |
| Middle  | 2437            | 4.47       | 8           | -3.53       |
| High    | 2462            | 5.11       | 8           | -2.89       |

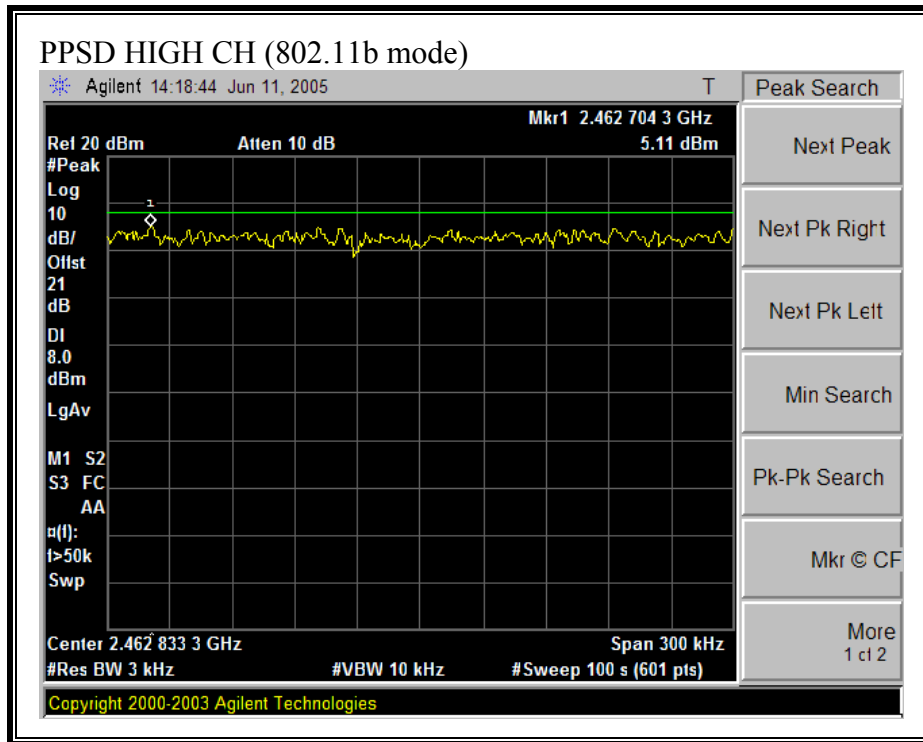
#### 802.11g Mode

| Channel | Frequency (MHz) | PPSD (dBm) | Limit (dBm) | Margin (dB) |
|---------|-----------------|------------|-------------|-------------|
| Low     | 2412            | 1.23       | 8           | -6.77       |
| Middle  | 2437            | 2.39       | 8           | -5.61       |
| High    | 2462            | 2.61       | 8           | -5.39       |

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

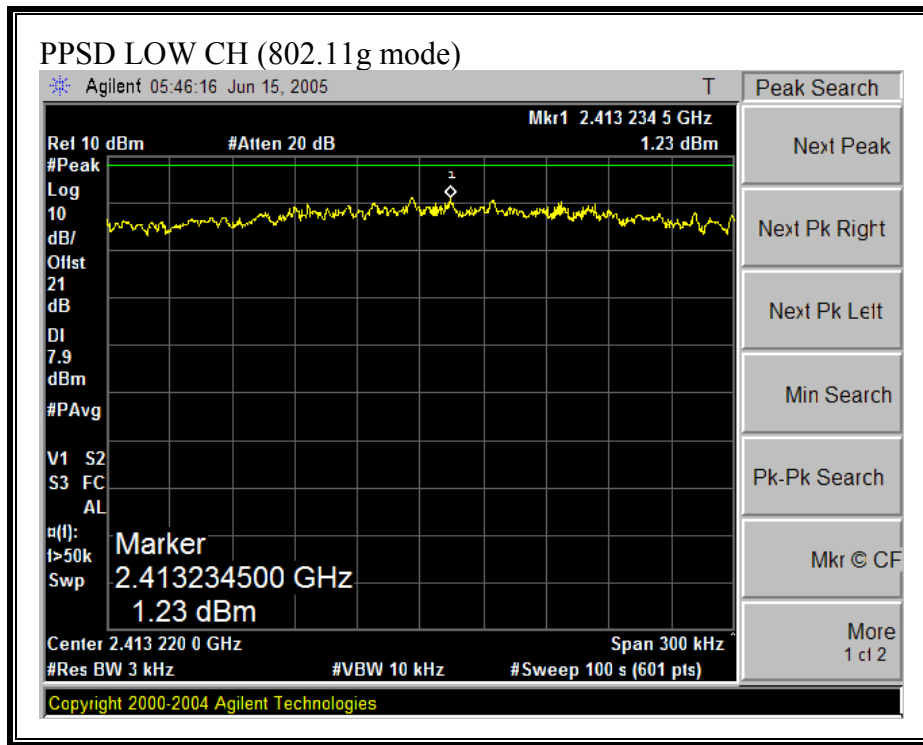


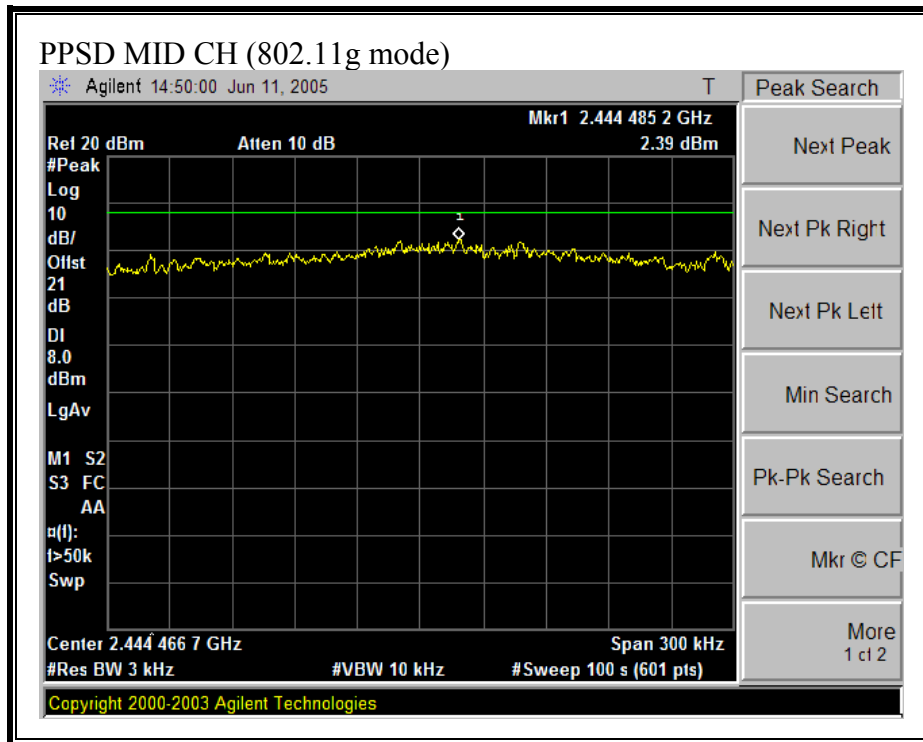


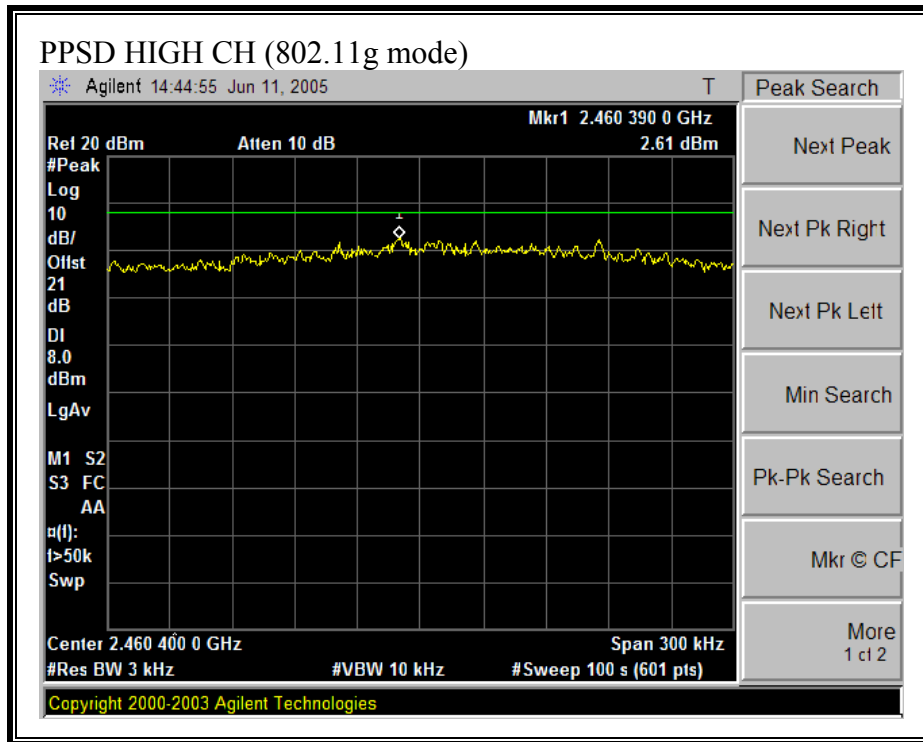




**PEAK POWER SPECTRAL DENSITY (802.11g MODE)**







## 7.1.7 CONDUCTED SPURIOUS EMISSIONS

### 7.1.7.1 LIMITS

§15.247 (d) 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions, which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Conducted power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

### 7.1.7.2 TEST PROCEDURE

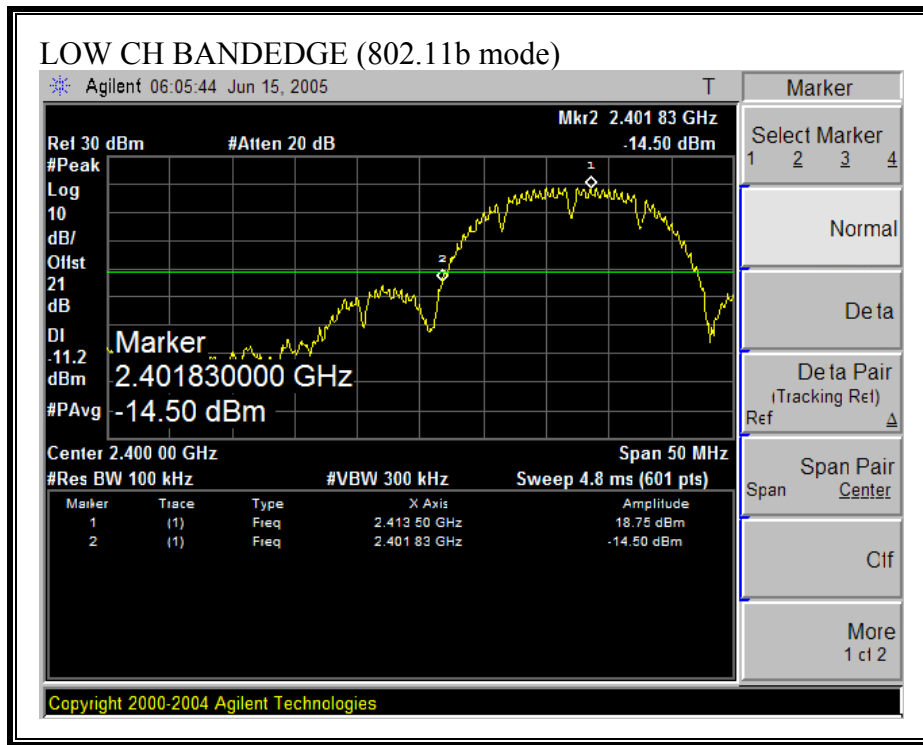
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

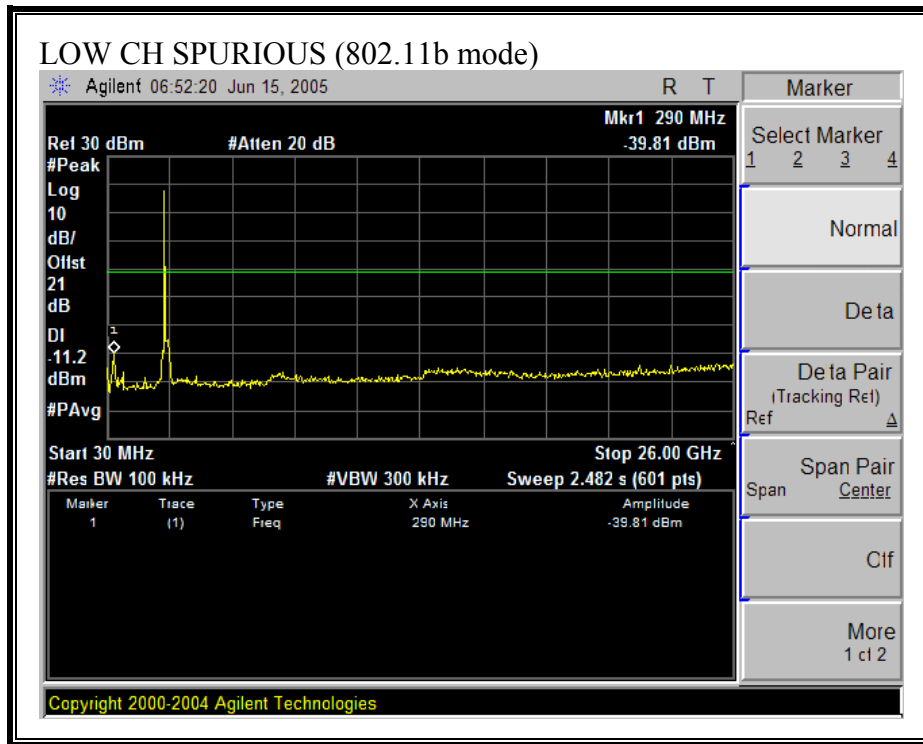
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

### RESULTS

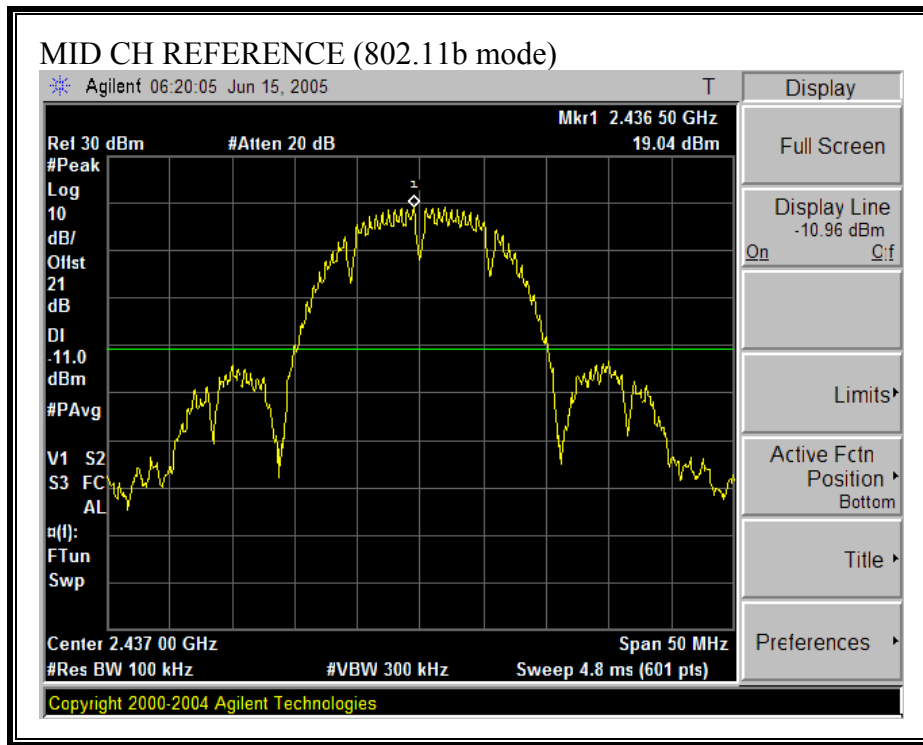
No non-compliance noted:

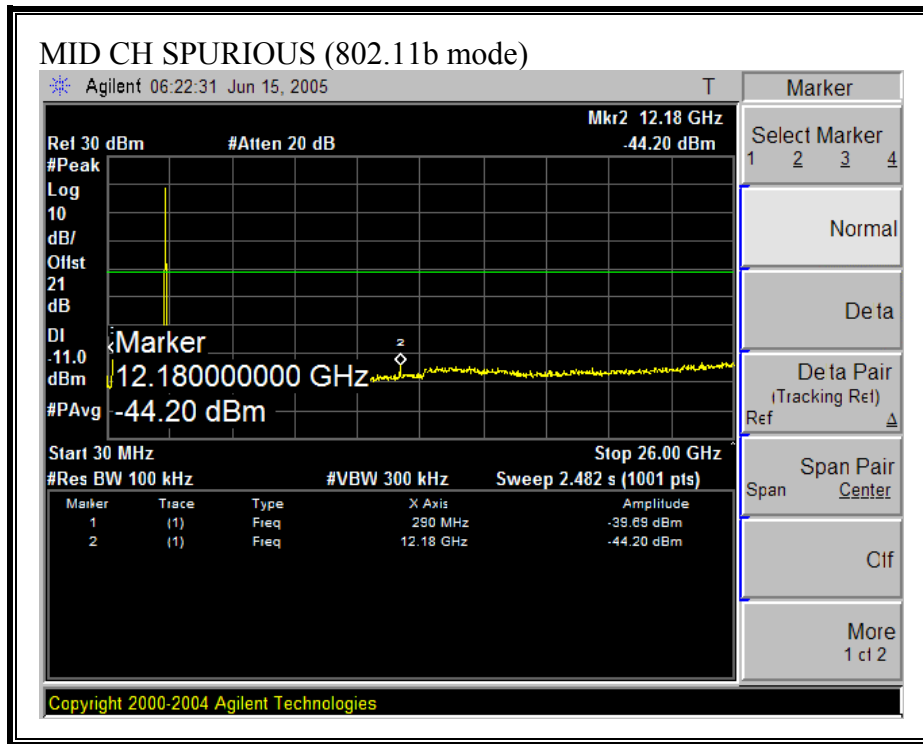
**SPURIOUS EMISSIONS, LOW CHANNEL (802.11b MODE)**





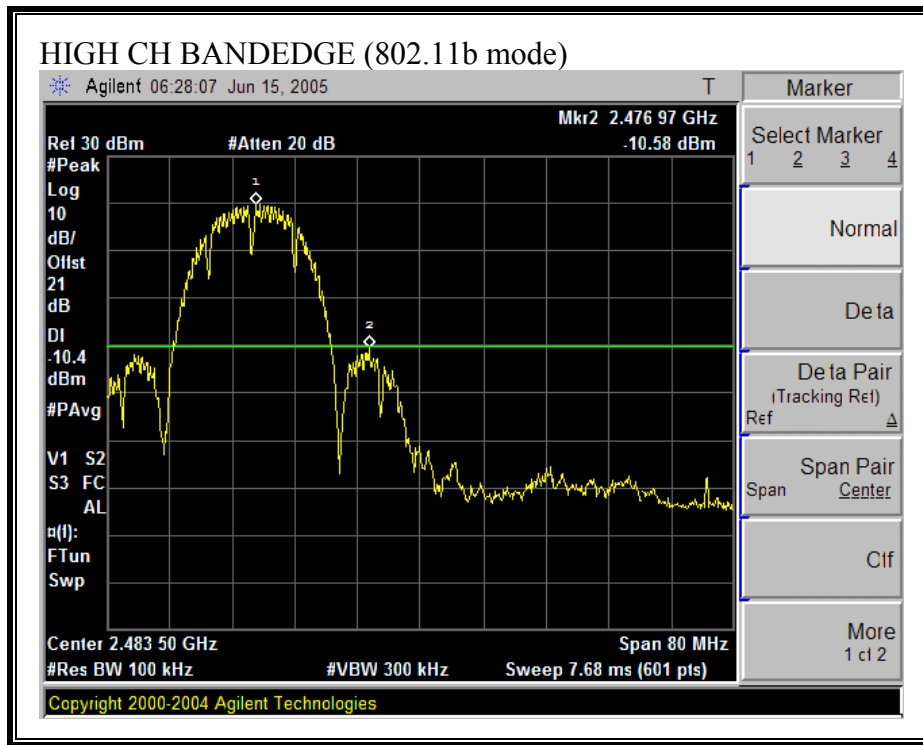
**SPURIOUS EMISSIONS, MID CHANNEL (802.11b MODE)**

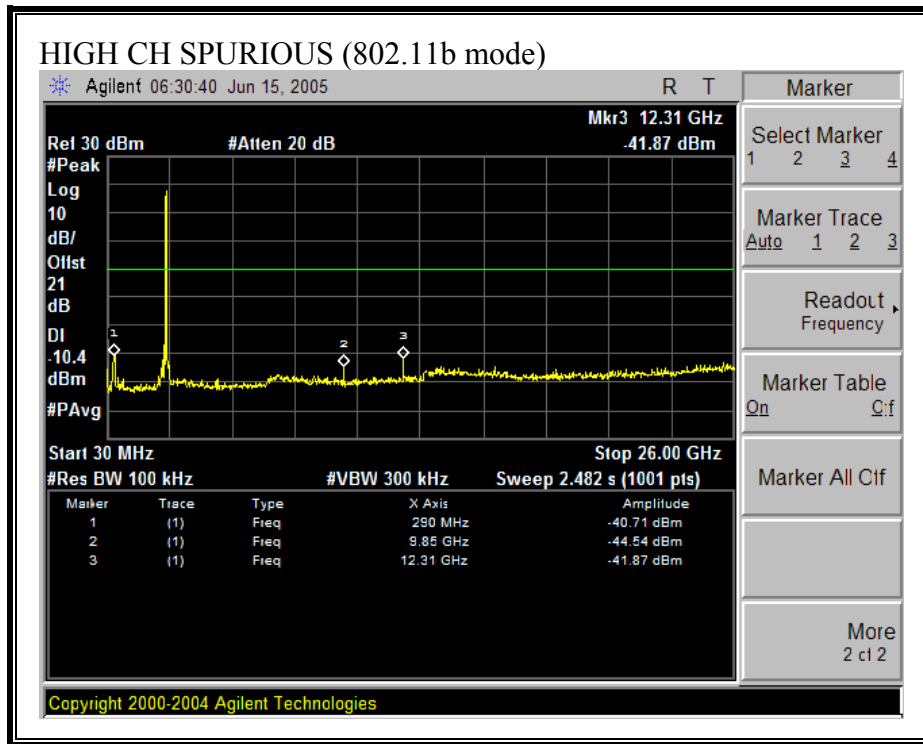




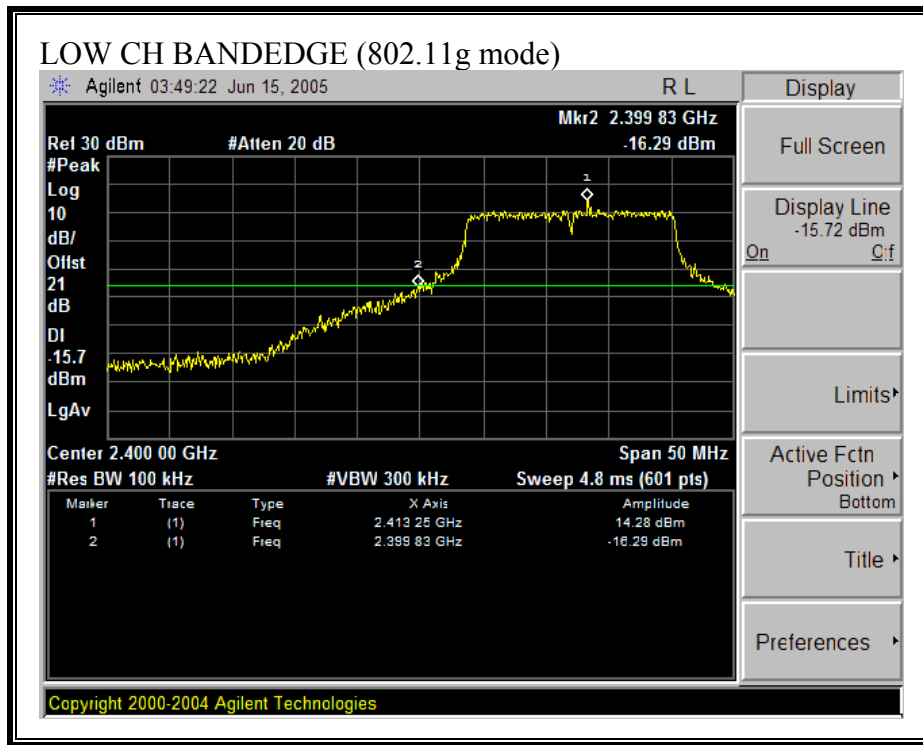


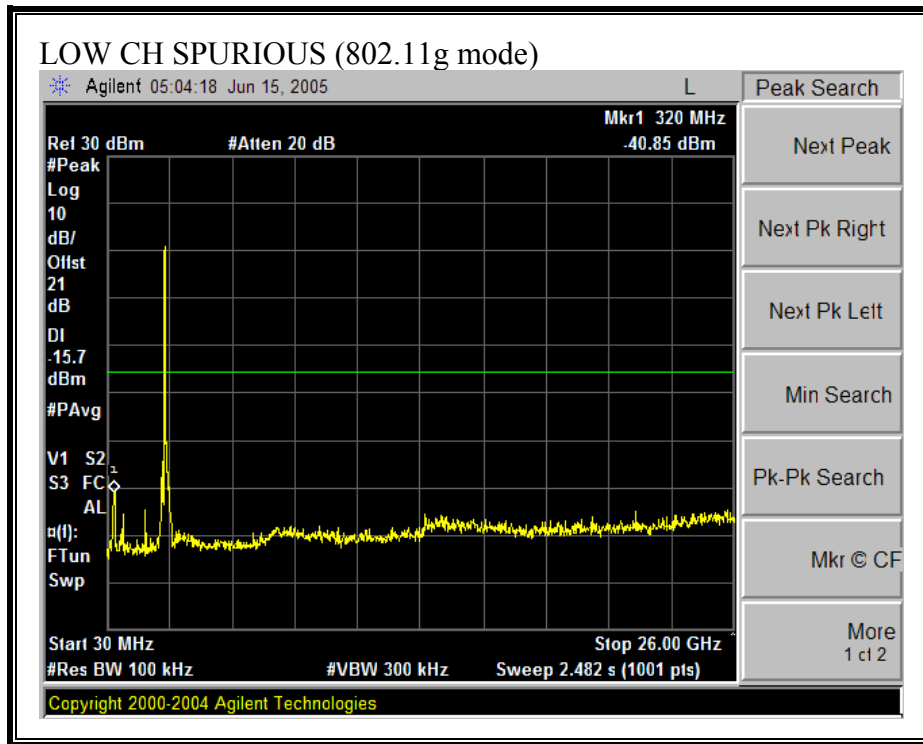
**SPURIOUS EMISSIONS, HIGH CHANNEL (802.11b MODE)**



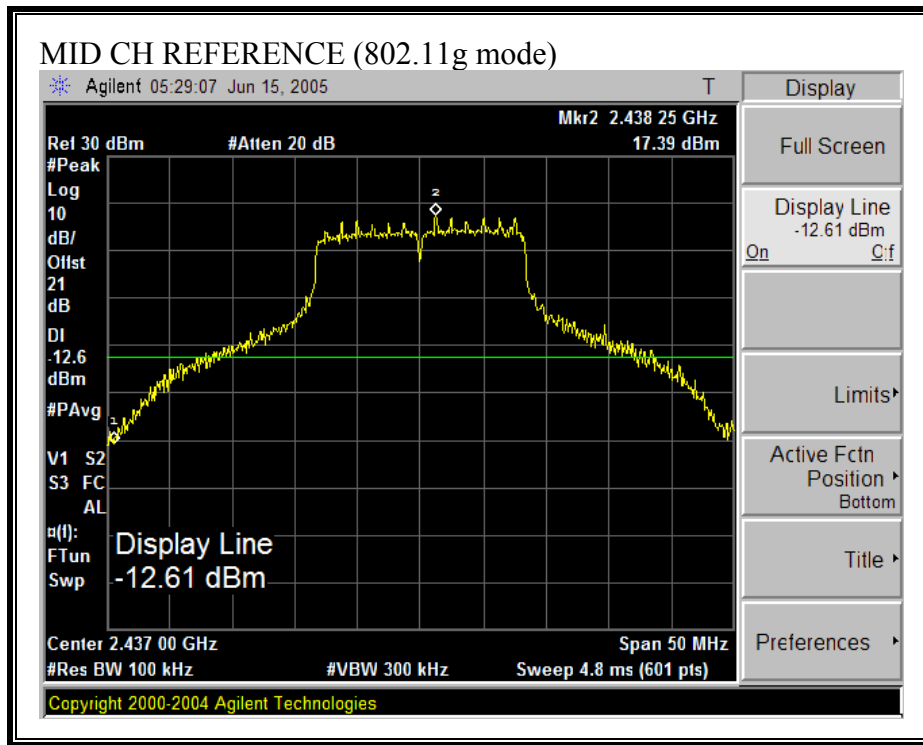


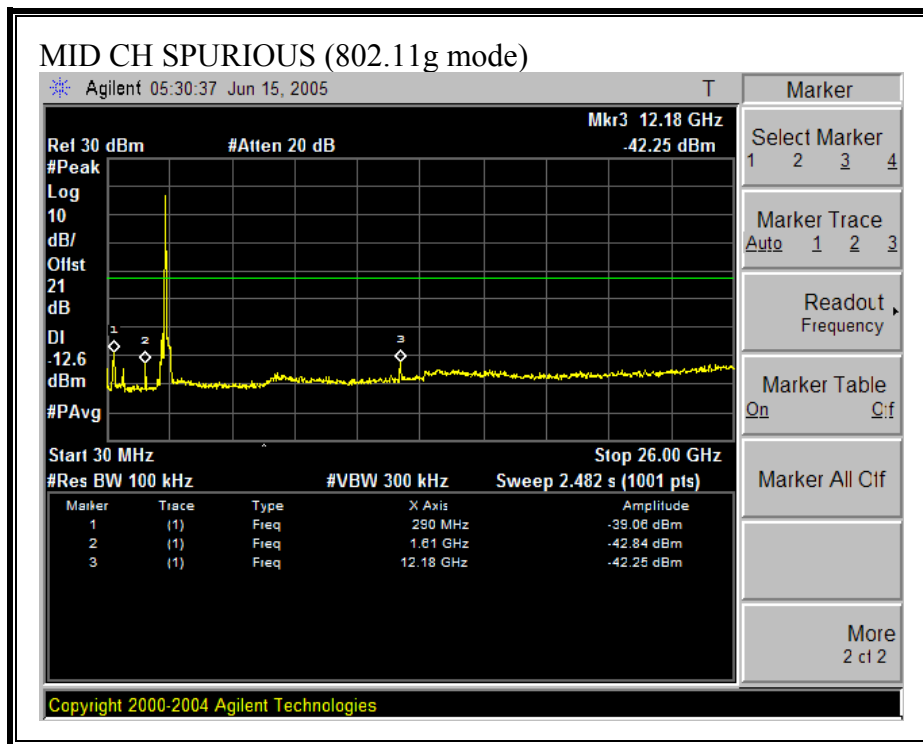
**SPURIOUS EMISSIONS, LOW CHANNEL (802.11g MODE)**



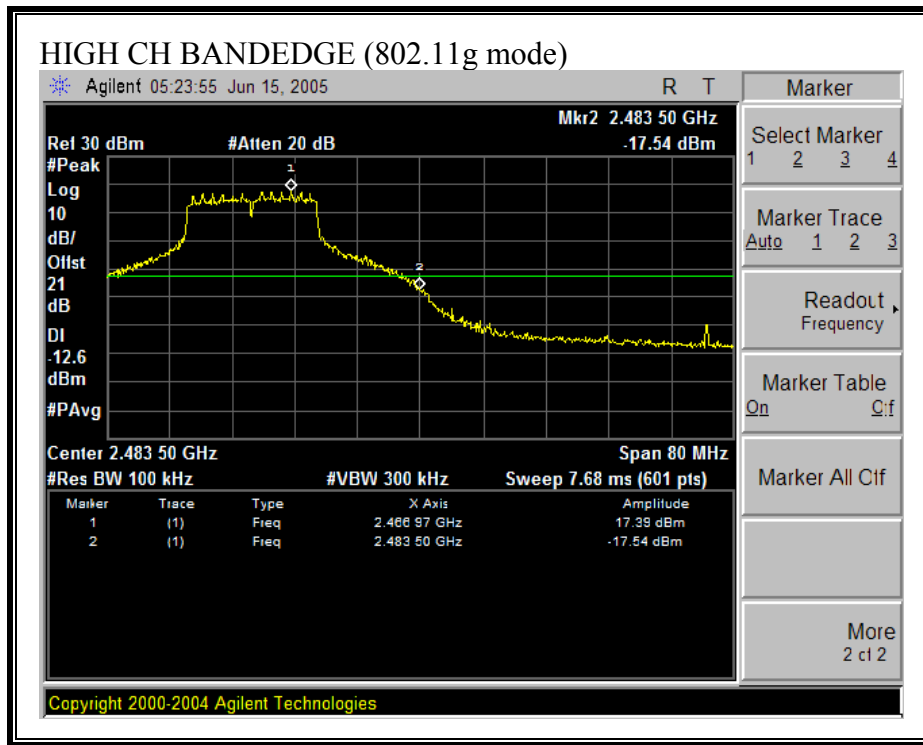


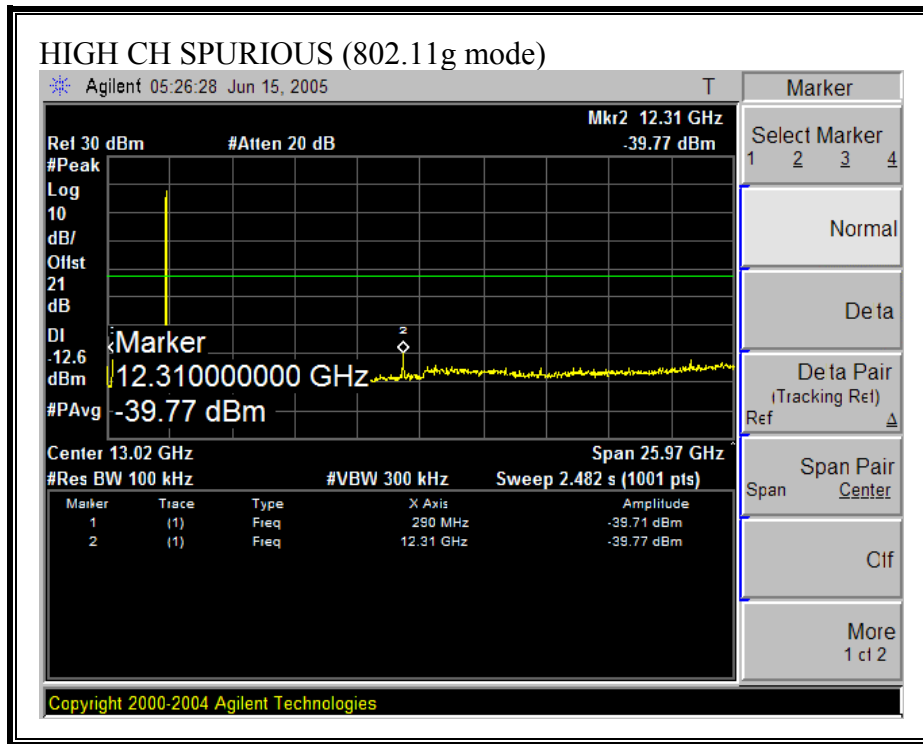
**SPURIOUS EMISSIONS, MID CHANNEL (802.11g MODE)**





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







## 7.2 RADIATED EMISSIONS

### 7.2.1 TRANSMITTER RADIATED SPURIOUS EMISSIONS

#### LIMITS

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

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

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

<sup>2</sup> Above 38.6

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

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

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

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

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

### **TEST PROCEDURE**

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

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

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

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

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

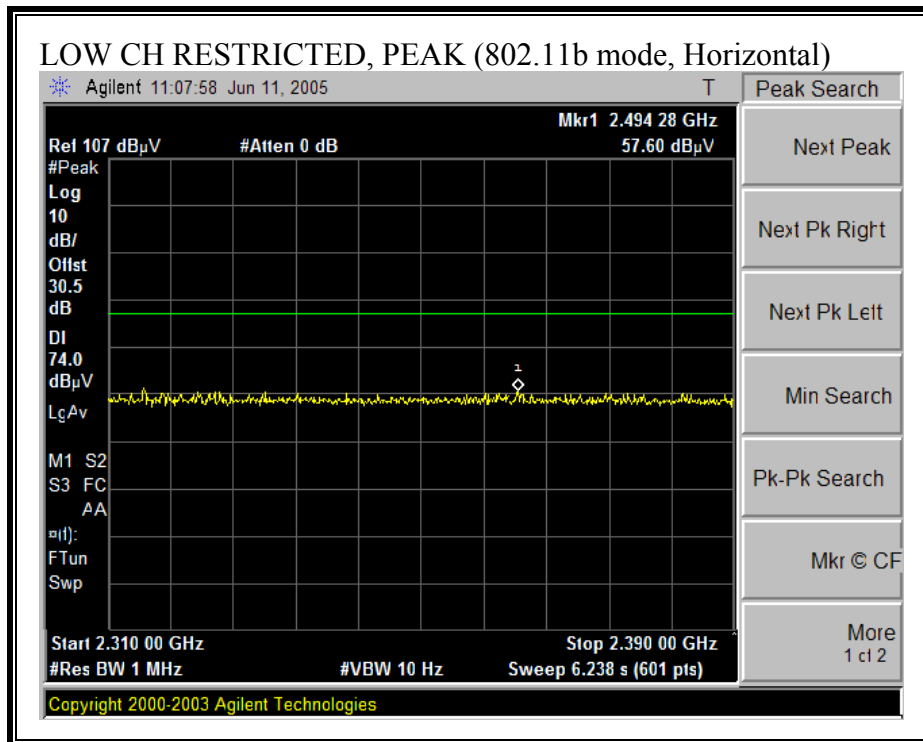
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

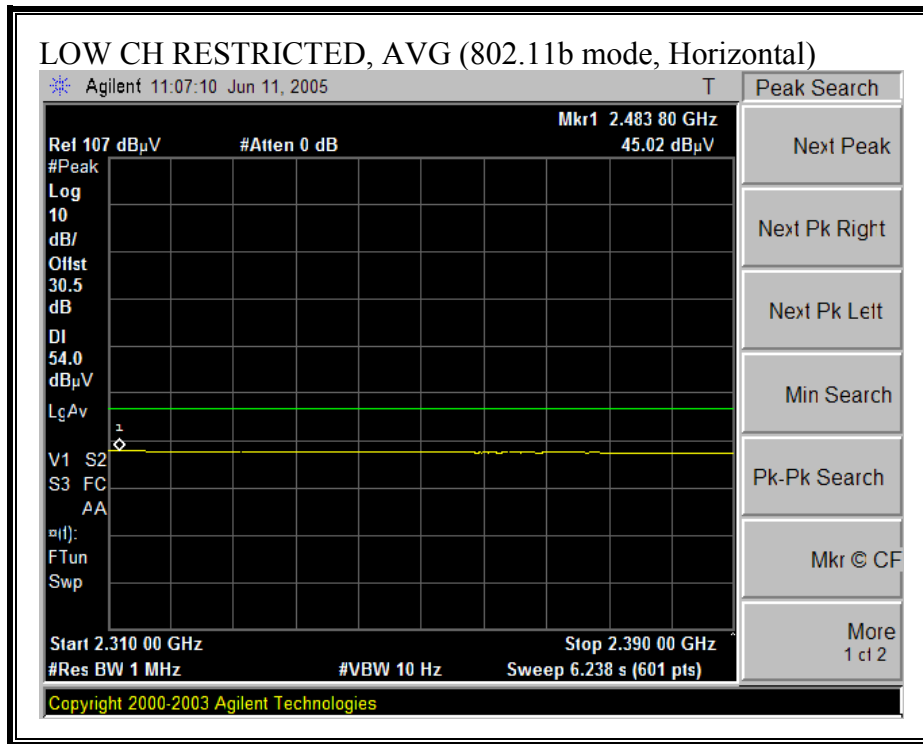
### **RESULTS**

No non-compliance noted:

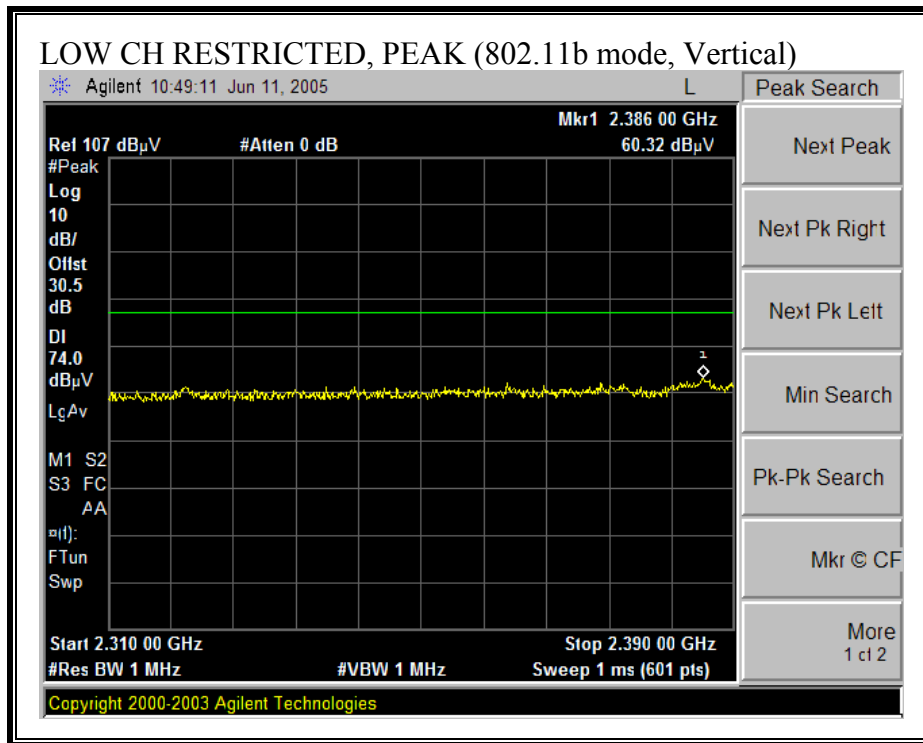
### 7.2.2 TRANSMITTER ABOVE 1 GHz FOR 2400 TO 2483.5 MHz BAND

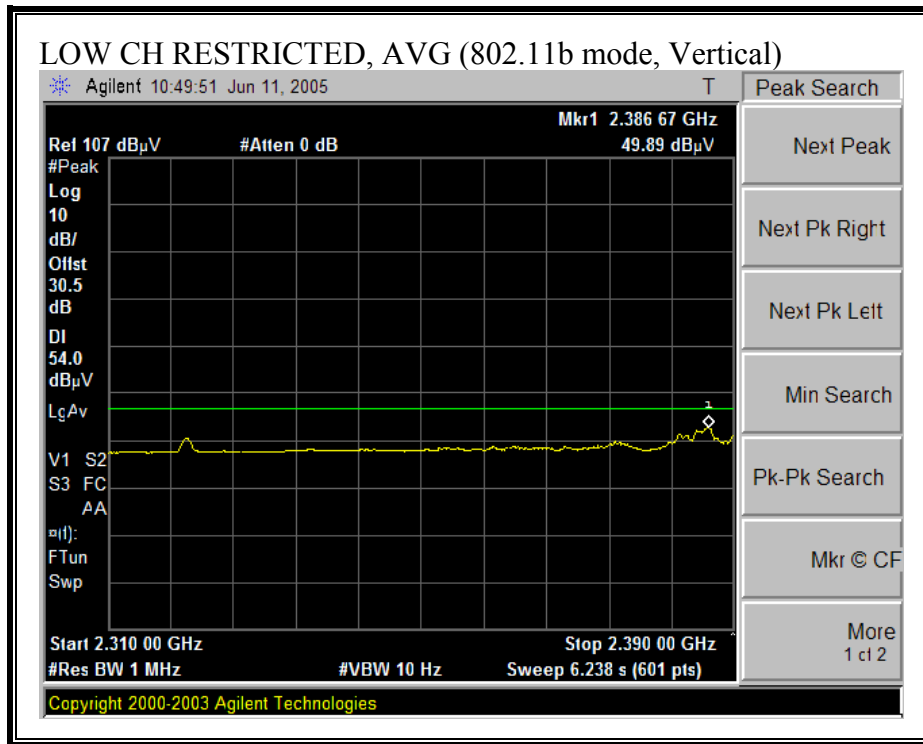
#### RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, HORIZONTAL)



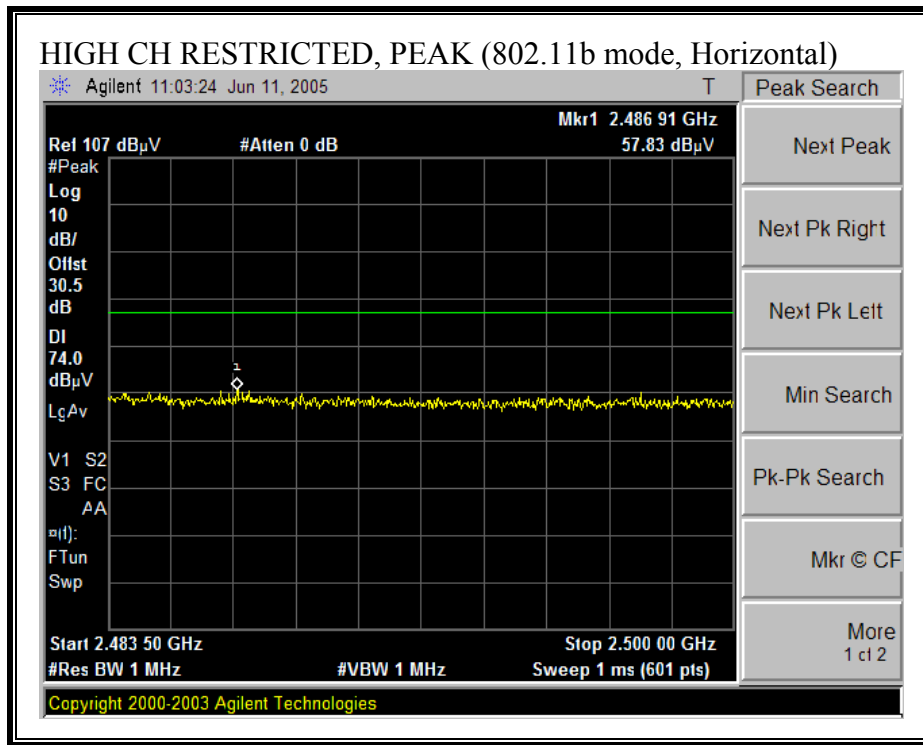


**RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, VERTICAL)**

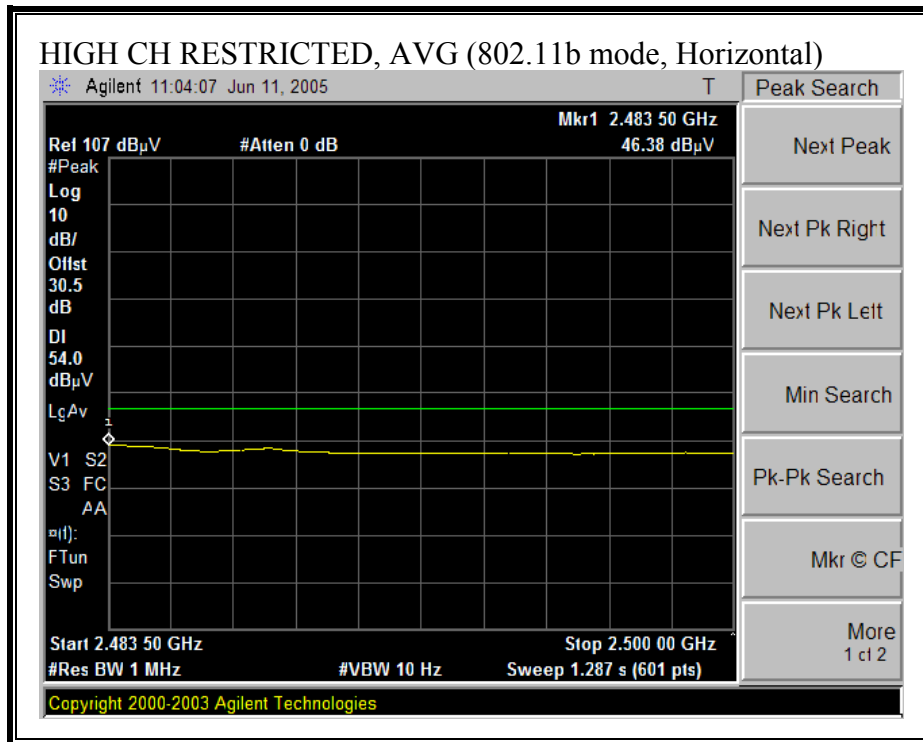




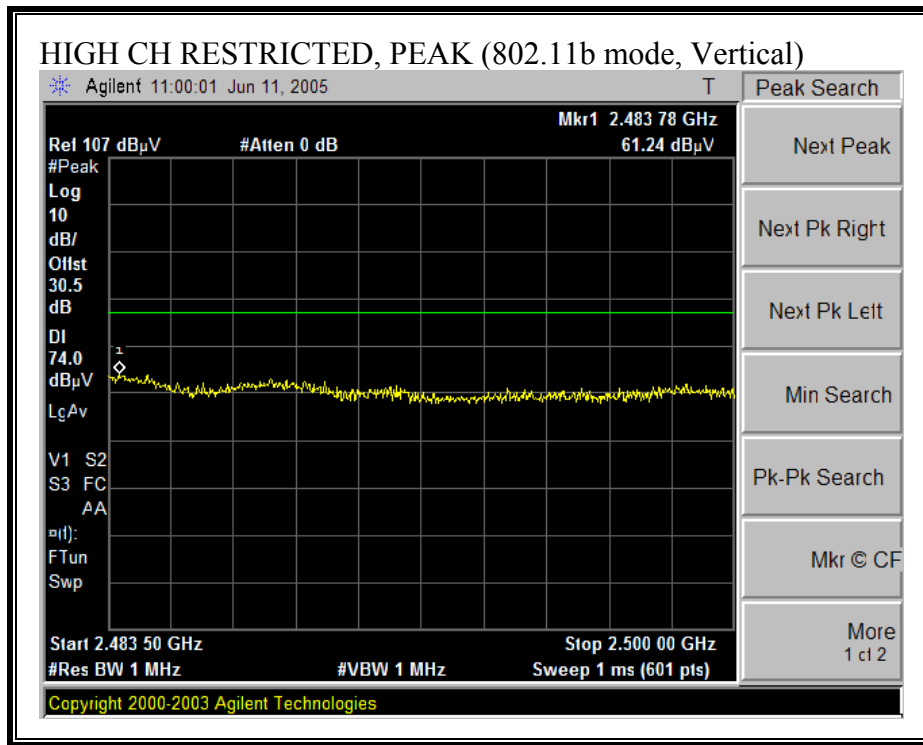
**RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, HORIZONTAL)**

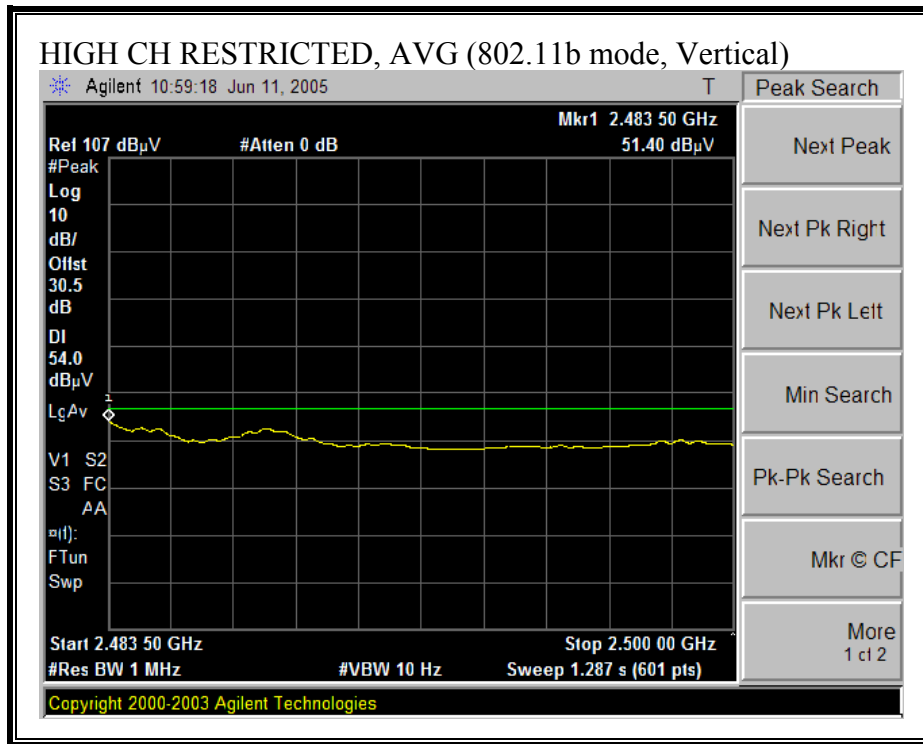






**RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, VERTICAL)**





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

06/11/05 High Frequency Measurement  
 Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: Chin Pang  
 Project #: 05U3488-1  
 Company: Card Access Inc.  
 EUT Descrip.: 802.11b/g Access Point 1 antenna Set  
 EUT M/N: BWR54G1  
 Test Target: FCC 15.247  
 Mode Oper: TX, b mode  
 Average Power Meter: Low = 28.48dBm, Mid = 28.85dBm, High = 29.25 dBm

Test Equipment:

EMCO Horn 1-18GHz  
 T73; S/N: 6717 @3m

Pre-amplifier 1-26GHz  
 T63 Miteq 646456

Pre-amplifier 26-40GHz

Horn > 18GHz

Limit  
 FCC 15.205

Hi Frequency Cables

2 foot cable  
 3 foot cable  
 4 foot cable  
 12 foot cable

4\_Thanh  
 12\_Neelesh

HPF  
 HPF\_4.0GHz

Reject Filter

Peak Measurements  
 RBW=VBW=1MHz

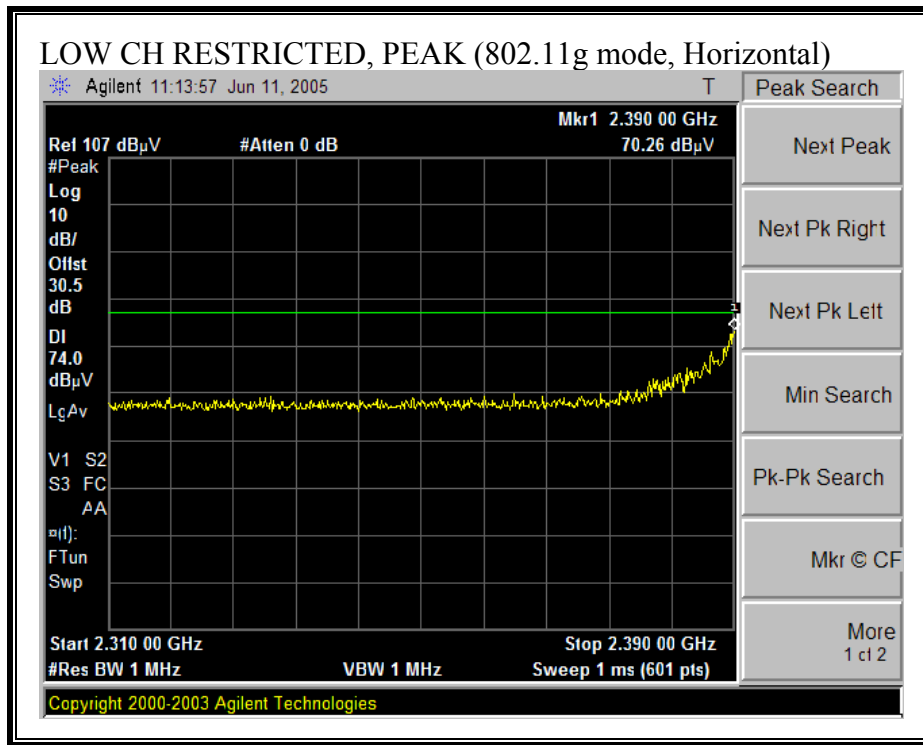
Average Measurements  
 RBW=1MHz ; VBW=10Hz

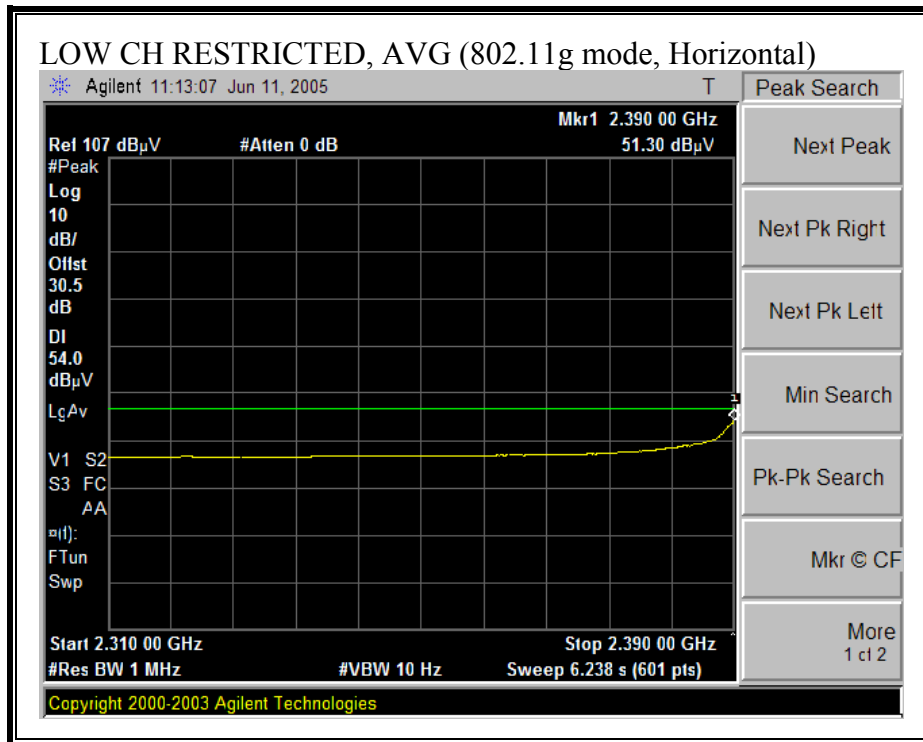
| f GHz          | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|----------------|----------|--------------|----------------|---------|-------|--------|-----------|---------|-------------|------------|---------------|----------------|-----------|------------|-------------|
| <b>Low Ch</b>  |          |              |                |         |       |        |           |         |             |            |               |                |           |            |             |
| 4.824          | 3.0      | 57.4         | 53.0           | 33.7    | 4.1   | -37.9  | 0.0       | 0.6     | 57.9        | 53.5       | 74            | 54             | -16.1     | -0.5       | V           |
| 4.824          | 3.0      | 55.5         | 53.0           | 33.7    | 4.1   | -37.9  | 0.0       | 0.6     | 56.0        | 53.5       | 74            | 54             | -18.0     | -0.5       | H           |
| <b>Mid Ch</b>  |          |              |                |         |       |        |           |         |             |            |               |                |           |            |             |
| 4.874          | 3.0      | 55.7         | 52.9           | 33.8    | 4.1   | -37.9  | 0.0       | 0.6     | 56.3        | 53.5       | 74            | 54             | -17.7     | -0.5       | V           |
| 7.311          | 3.0      | 46.6         | 36.8           | 35.5    | 5.4   | -36.9  | 0.0       | 0.6     | 51.2        | 41.4       | 74            | 54             | -22.8     | -12.6      | V           |
| 4.874          | 3.0      | 55.1         | 51.8           | 33.8    | 4.1   | -37.9  | 0.0       | 0.6     | 55.7        | 52.4       | 74            | 54             | -18.3     | -1.6       | H           |
| 7.311          | 3.0      | 45.0         | 36.0           | 35.5    | 5.4   | -36.9  | 0.0       | 0.6     | 49.6        | 40.6       | 74            | 54             | -24.4     | -13.4      | H           |
| <b>High Ch</b> |          |              |                |         |       |        |           |         |             |            |               |                |           |            |             |
| 4.924          | 3.0      | 54.0         | 51.0           | 33.8    | 4.1   | -37.9  | 0.0       | 0.6     | 54.7        | 51.7       | 74            | 54             | -19.3     | -2.3       | V           |
| 7.386          | 3.0      | 49.0         | 43.5           | 35.6    | 5.4   | -36.9  | 0.0       | 0.6     | 53.8        | 48.3       | 74            | 54             | -20.2     | -5.7       | V           |
| 4.924          | 3.0      | 55.0         | 51.6           | 33.8    | 4.1   | -37.9  | 0.0       | 0.6     | 55.7        | 52.3       | 74            | 54             | -18.3     | -1.7       | H           |
| 7.386          | 3.0      | 52.7         | 48.3           | 35.6    | 5.4   | -36.9  | 0.0       | 0.6     | 57.5        | 53.1       | 74            | 54             | -16.5     | -0.9       | H           |

Note: No other emissions were detected above f

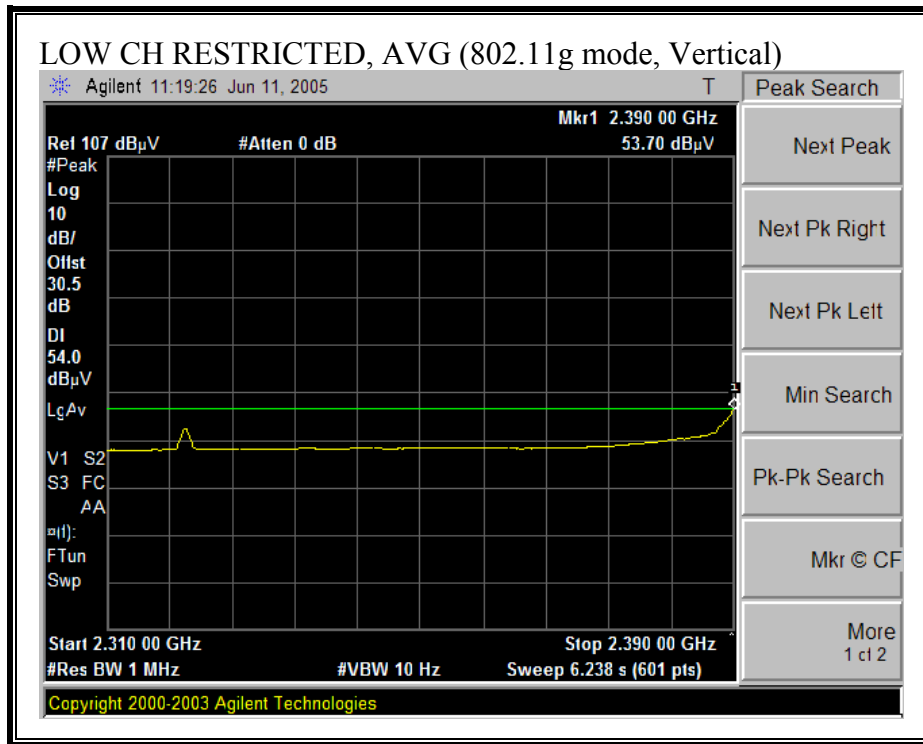
|      |                       |        |                                |         |                              |
|------|-----------------------|--------|--------------------------------|---------|------------------------------|
| f    | Measurement Frequency | Amp    | Preamp Gain                    | 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)**



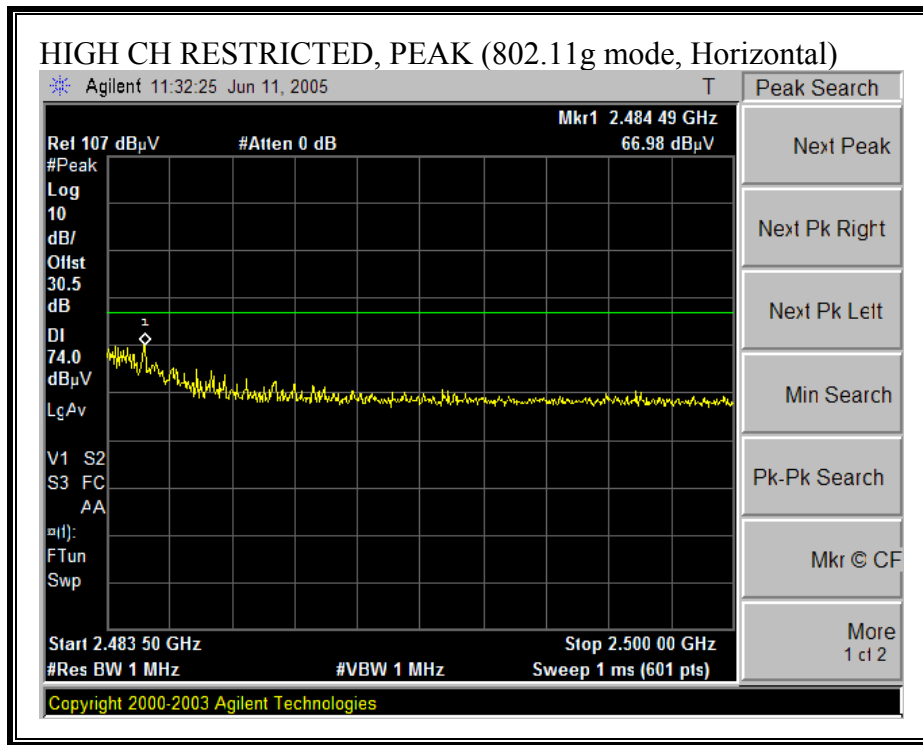


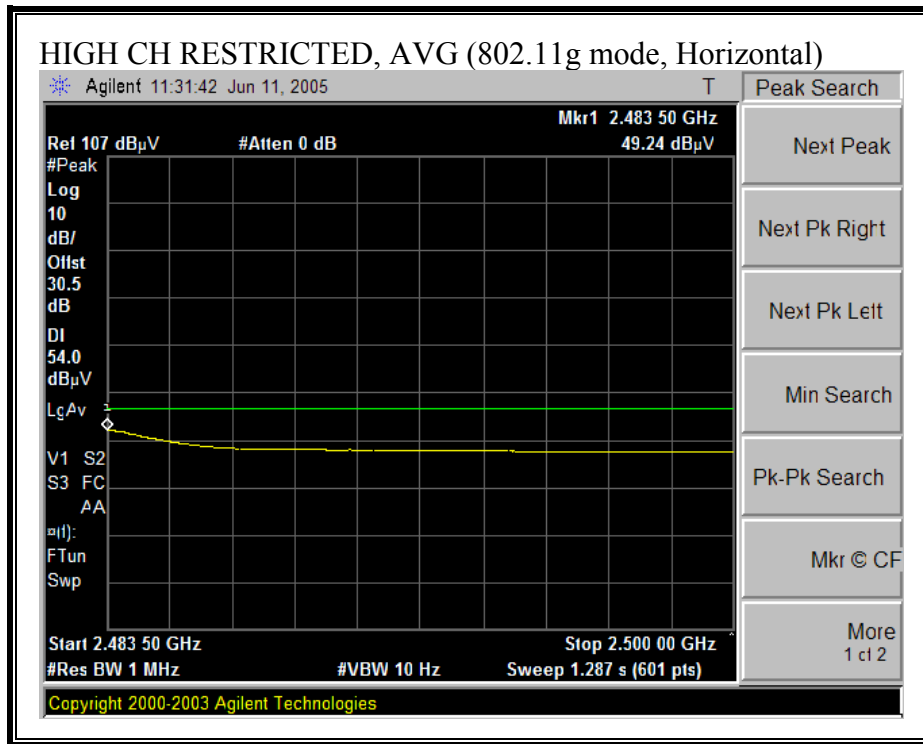




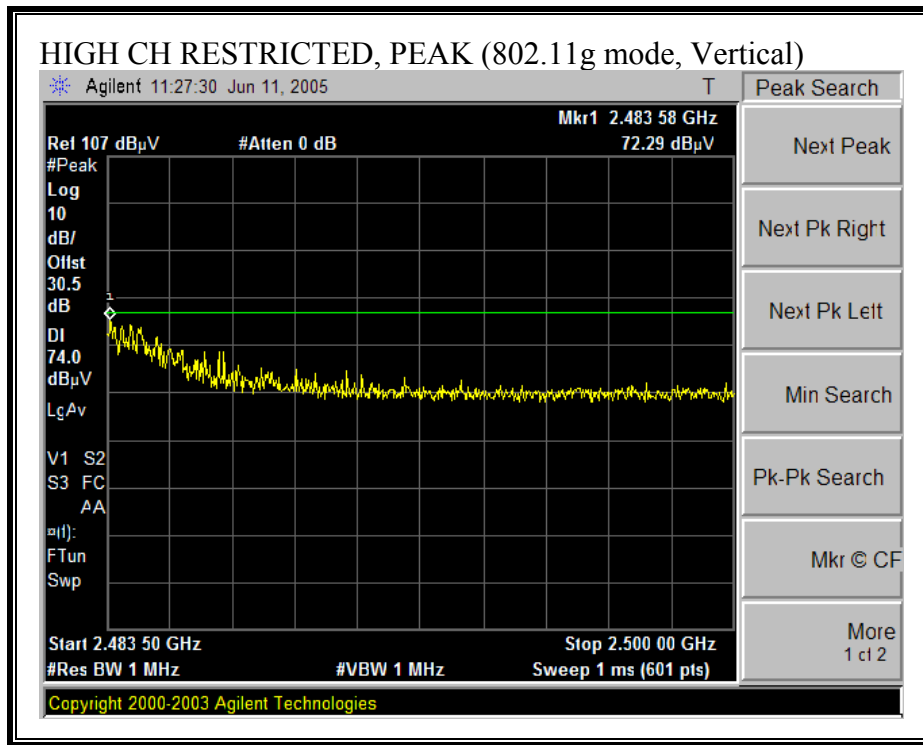


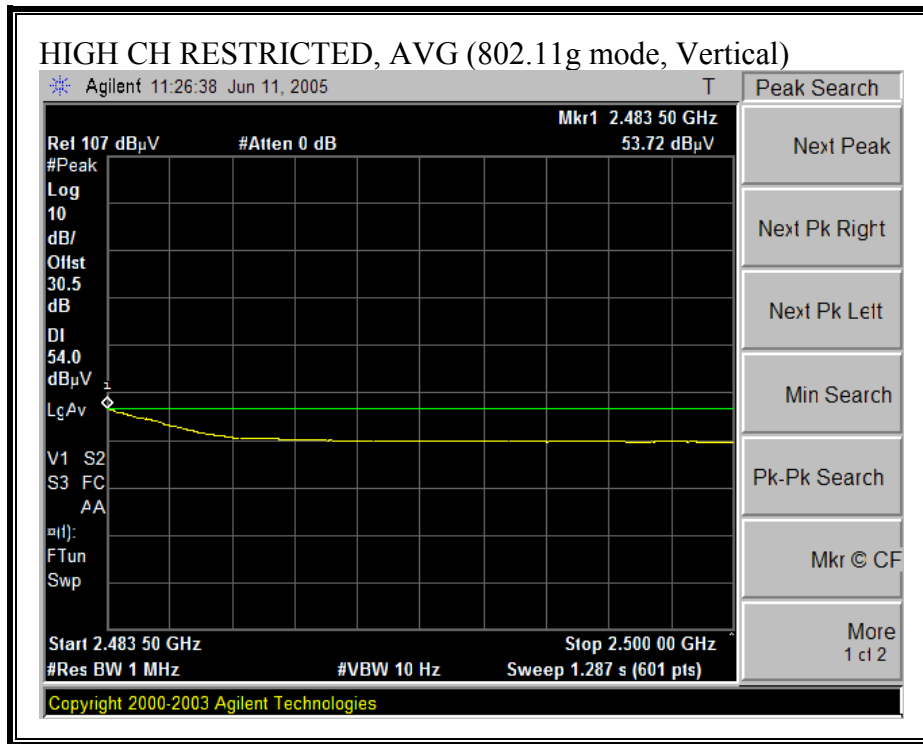
**RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, HORIZONTAL)**





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





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

06/11/05 High Frequency Measurement  
 Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: Chin Pang  
 Project #: 05U3488-1  
 Company: Card Access Inc.  
 EUT Descrip.: 802.11b/g Access Point 1 antenna Set  
 EUT M/N: BWR54G1  
 Test Target: FCC 15.247  
 Mode Oper.: TX, g mode  
 Average Power Meter: Low = 25.80dBm, Mid = 28.22 dBm, High = 27.60 dBm  
 art=18

Test Equipment:

|   |   |                        |              |                     |
|---|---|------------------------|--------------|---------------------|
| EMCO Horn 1-18GHz<br>T73; S/N: 6717 @3m | Pre-amplifier 1-26GHz<br>T63 Miteq 646456 | Pre-amplifier 26-40GHz | Horn > 18GHz | Limit<br>FCC 15.205 |
|---|---|------------------------|--------------|---------------------|

Hi Frequency Cables

|              |              |                         |                            |                   |               |
|--------------|--------------|-------------------------|----------------------------|-------------------|---------------|
| 2 foot cable | 3 foot cable | 4 foot cable<br>4_Thanh | 12 foot cable<br>12_Neelsh | HPF<br>HPF_4.0GHz | Reject Filter |
|--------------|--------------|-------------------------|----------------------------|-------------------|---------------|

Peak Measurements  
 RBW=VBW=1MHz

Average Measurements  
 RBW=1MHz ; VBW=10Hz

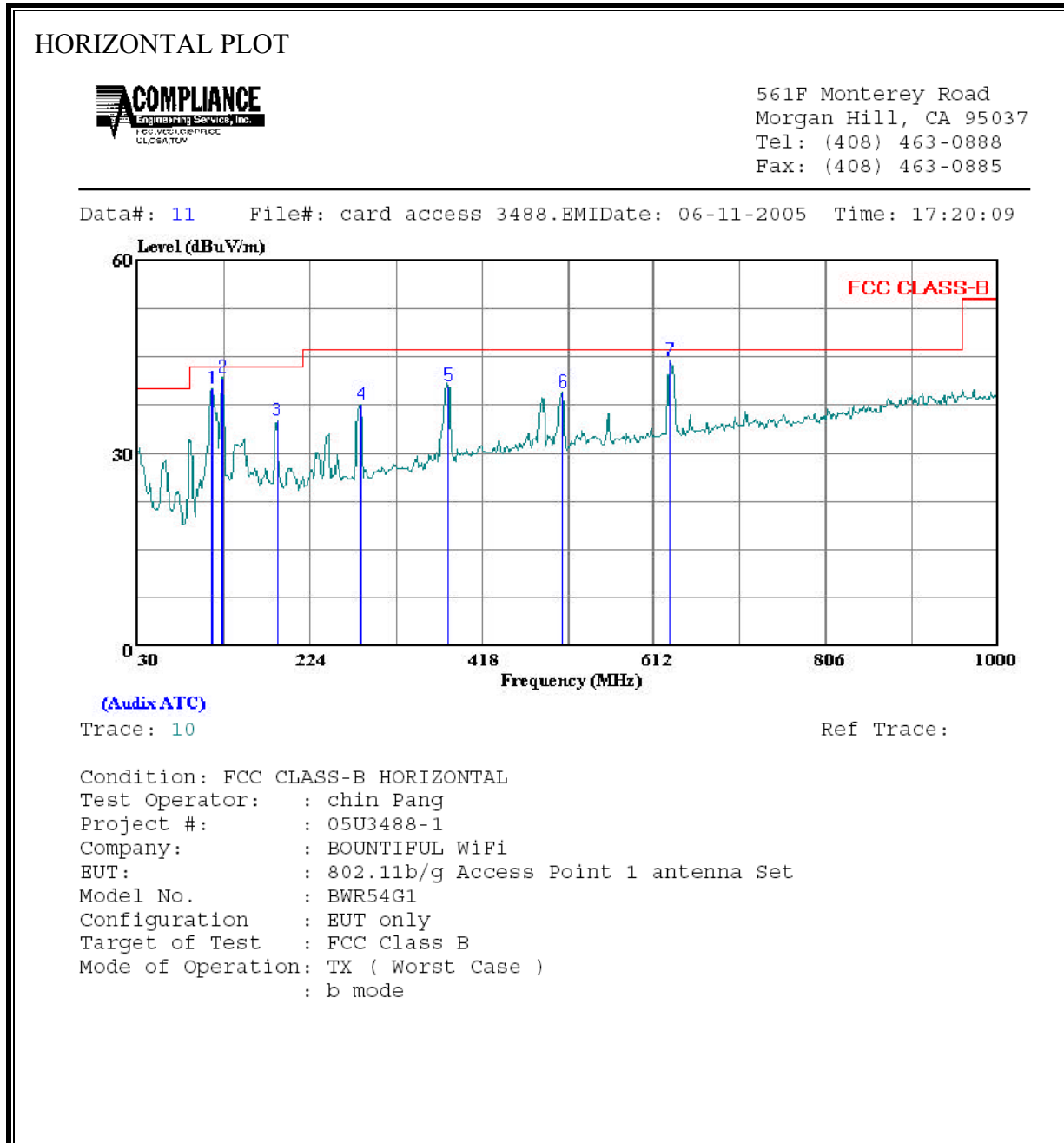
| f GHz          | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|----------------|----------|--------------|----------------|---------|-------|--------|-----------|---------|-------------|------------|---------------|----------------|-----------|------------|-------------|
| <b>Low Ch</b>  |          |              |                |         |       |        |           |         |             |            |               |                |           |            |             |
| 4.824          | 3.0      | 56.0         | 41.5           | 33.7    | 4.1   | -37.9  | 0.0       | 0.6     | 56.5        | 42.0       | 74            | 54             | -17.5     | -12.0      | V           |
| 12.185         | 3.0      | 54.0         | 38.5           | 38.5    | 7.3   | -37.7  | 0.0       | 0.9     | 63.1        | 47.6       | 74            | 54             | -10.9     | -6.4       | V           |
| 4.824          | 3.0      | 53.5         | 40.0           | 33.7    | 4.1   | -37.9  | 0.0       | 0.6     | 54.0        | 40.5       | 74            | 54             | -20.0     | -13.5      | H           |
| 12.060         | 3.0      | 56.0         | 40.5           | 38.5    | 7.3   | -37.6  | 0.0       | 0.9     | 65.1        | 49.6       | 74            | 54             | -8.9      | -4.4       | H           |
| <b>Mid Ch</b>  |          |              |                |         |       |        |           |         |             |            |               |                |           |            |             |
| 4.874          | 3.0      | 53.0         | 40.6           | 33.8    | 4.1   | -37.9  | 0.0       | 0.6     | 53.6        | 41.2       | 74            | 54             | -20.4     | -12.8      | V           |
| 7.311          | 3.0      | 46.0         | 34.0           | 35.5    | 5.4   | -36.9  | 0.0       | 0.6     | 50.6        | 38.6       | 74            | 54             | -23.4     | -15.4      | V           |
| 12.185         | 3.0      | 53.1         | 38.6           | 38.5    | 7.3   | -37.7  | 0.0       | 0.9     | 62.2        | 47.7       | 74            | 54             | -11.8     | -6.3       | V           |
| 4.874          | 3.0      | 53.7         | 41.6           | 33.8    | 4.1   | -37.9  | 0.0       | 0.6     | 54.3        | 42.2       | 74            | 54             | -19.7     | -11.8      | H           |
| 7.311          | 3.0      | 47.7         | 35.0           | 35.5    | 5.4   | -36.9  | 0.0       | 0.6     | 52.3        | 39.6       | 74            | 54             | -21.7     | -14.4      | H           |
| 12.185         | 3.0      | 51.0         | 36.0           | 38.5    | 7.3   | -37.7  | 0.0       | 0.9     | 60.1        | 45.1       | 74            | 54             | -13.9     | -8.9       | H           |
| <b>High Ch</b> |          |              |                |         |       |        |           |         |             |            |               |                |           |            |             |
| 4.924          | 3.0      | 53.8         | 39.6           | 33.8    | 4.1   | -37.9  | 0.0       | 0.6     | 54.5        | 40.3       | 74            | 54             | -19.5     | -13.7      | V           |
| 7.386          | 3.0      | 48.6         | 35.0           | 35.6    | 5.4   | -36.9  | 0.0       | 0.6     | 53.4        | 39.8       | 74            | 54             | -20.6     | -14.2      | V           |
| 12.310         | 3.0      | 51.7         | 37.4           | 38.5    | 7.3   | -37.8  | 0.0       | 0.9     | 60.7        | 46.4       | 74            | 54             | -13.3     | -7.6       | V           |
| 4.924          | 3.0      | 54.2         | 42.0           | 33.8    | 4.1   | -37.9  | 0.0       | 0.6     | 54.9        | 42.7       | 74            | 54             | -19.1     | -11.3      | H           |
| 7.386          | 3.0      | 57.0         | 43.3           | 35.6    | 5.4   | -36.9  | 0.0       | 0.6     | 61.8        | 48.1       | 74            | 54             | -12.2     | -5.9       | H           |
| 12.310         | 3.0      | 52.3         | 37.5           | 38.5    | 7.3   | -37.8  | 0.0       | 0.9     | 61.3        | 46.5       | 74            | 54             | -12.7     | -7.5       | H           |

Note: No other emissions were detected above the system 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               |         |                              |

### 7.2.3 WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

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



HORIZONTAL DATA

Page: 1

|   | Freq    | Read Level | Factor | Level  | Limit Line | Over Limit | Remark |
|---|---------|------------|--------|--------|------------|------------|--------|
|   | MHz     | dBuV       | dB     | dBuV/m | dBuV/m     | dB         |        |
| 1 | 114.390 | 25.64      | 14.46  | 40.10  | 43.50      | -3.40      | Peak   |
| 2 | 126.030 | 26.57      | 15.25  | 41.82  | 43.50      | -1.68      | Peak   |
| 3 | 187.140 | 22.13      | 12.87  | 35.00  | 43.50      | -8.50      | Peak   |
| 4 | 281.230 | 22.62      | 14.99  | 37.61  | 46.00      | -8.39      | Peak   |
| 5 | 380.170 | 22.93      | 17.59  | 40.52  | 46.00      | -5.48      | Peak   |
| 6 | 509.180 | 19.08      | 20.36  | 39.44  | 46.00      | -6.56      | Peak   |
| 7 | 630.430 | 22.44      | 22.00  | 44.44  | 46.00      | -1.56      | Peak   |

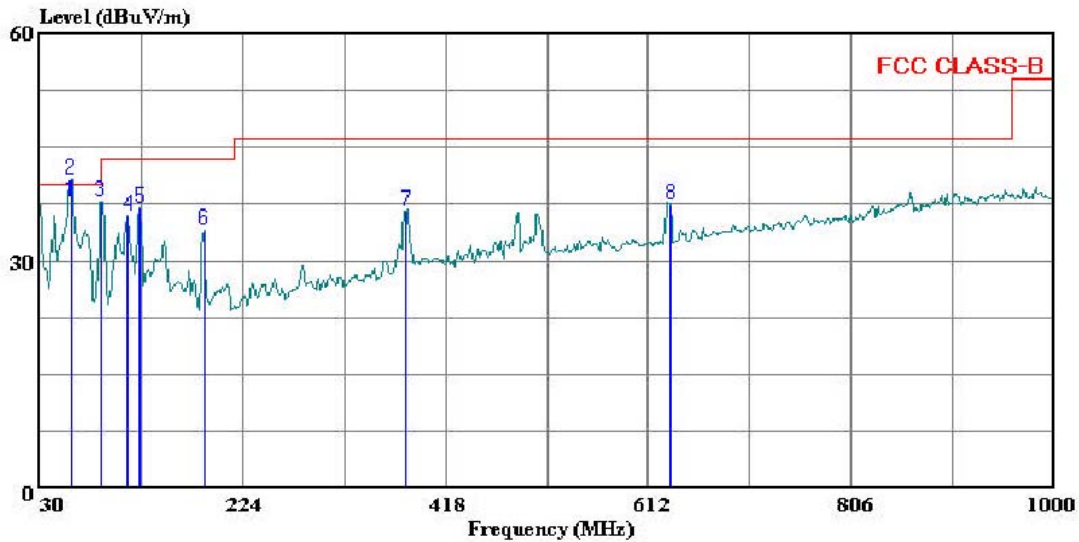
**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)**

VERTICAL PLOT



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

Data#: 15 File#: card access 3488.EMIDate: 06-11-2005 Time: 17:24:51



(Auxiliary ATC)

Trace: 12

Ref Trace:

Condition: FCC CLASS-B VERTICAL  
Test Operator: : chin Pang  
Project #: : 05U3488-1  
Company: : BOUNTIFUL WiFi  
EUT: : 802.11b/g Access Point 1 antenna Set  
Model No. : BWR54G1  
Configuration : EUT only  
Target of Test : FCC Class B  
Mode of Operation: TX ( Worst Case )  
: b mode  
: add a ferite on power cable



VERTICAL DATA

Page: 1

|     | Freq    | Read Level | Factor | Level  | Limit Line | Over Limit | Remark |
|-----|---------|------------|--------|--------|------------|------------|--------|
|     | MHz     | dBuV       | dB     | dBuV/m | dBuV/m     | dB         |        |
| 1   | 60.070  | 29.09      | 8.71   | 37.80  | 40.00      | -2.20      | QP     |
| 2 * | 60.070  | 31.92      | 8.71   | 40.63  | 40.00      | 0.63       | Peak   |
| 3   | 88.200  | 29.21      | 8.56   | 37.77  | 43.50      | -5.73      | Peak   |
| 4   | 114.390 | 21.43      | 14.46  | 35.89  | 43.50      | -7.61      | Peak   |
| 5   | 126.030 | 21.65      | 15.25  | 36.90  | 43.50      | -6.60      | Peak   |
| 6   | 187.140 | 21.26      | 12.87  | 34.13  | 43.50      | -9.37      | Peak   |
| 7   | 380.170 | 19.05      | 17.59  | 36.64  | 46.00      | -9.36      | Peak   |
| 8   | 633.340 | 15.31      | 22.05  | 37.36  | 46.00      | -8.64      | Peak   |

### 7.3 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.

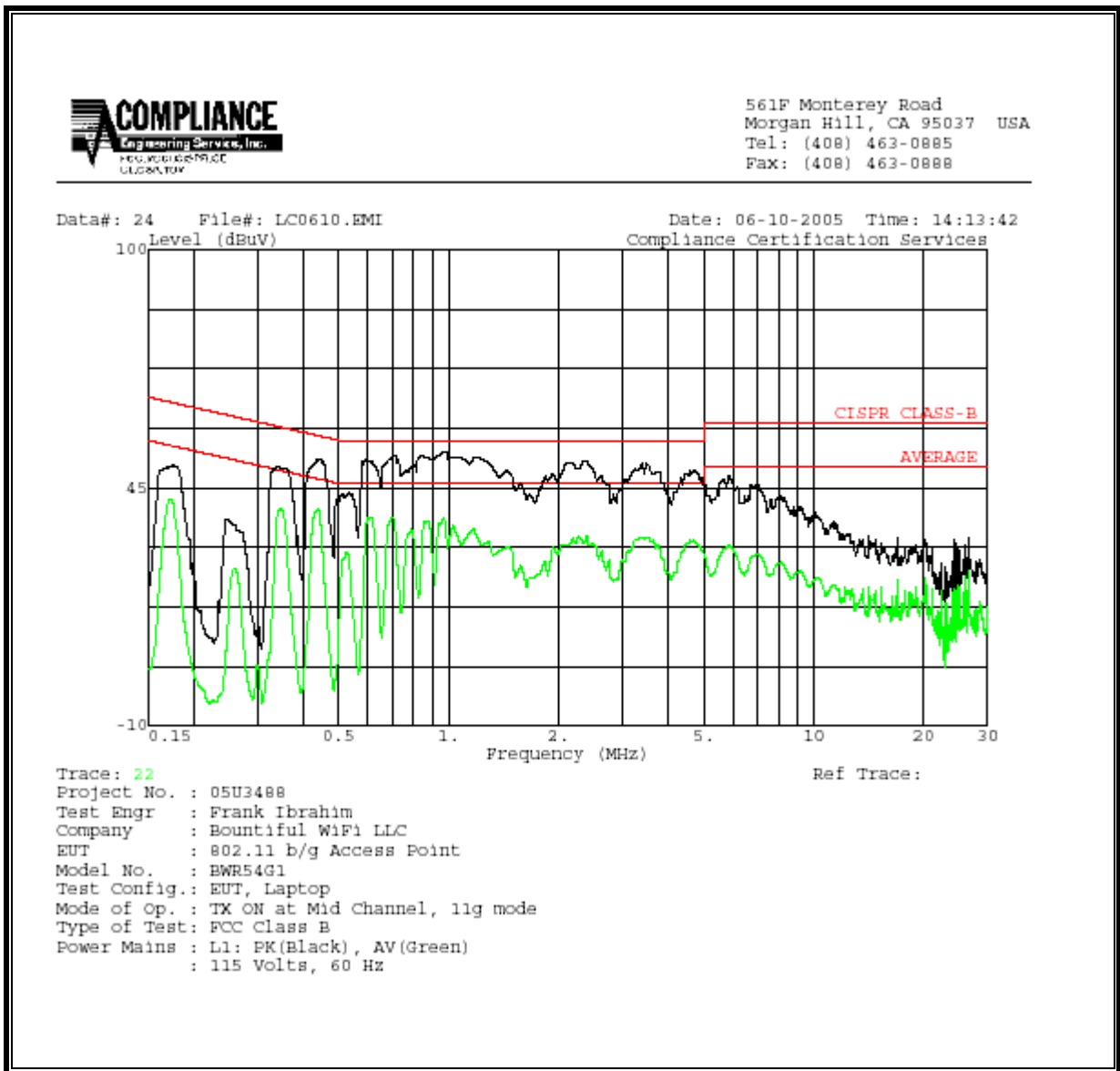
#### RESULTS

No non-compliance noted:

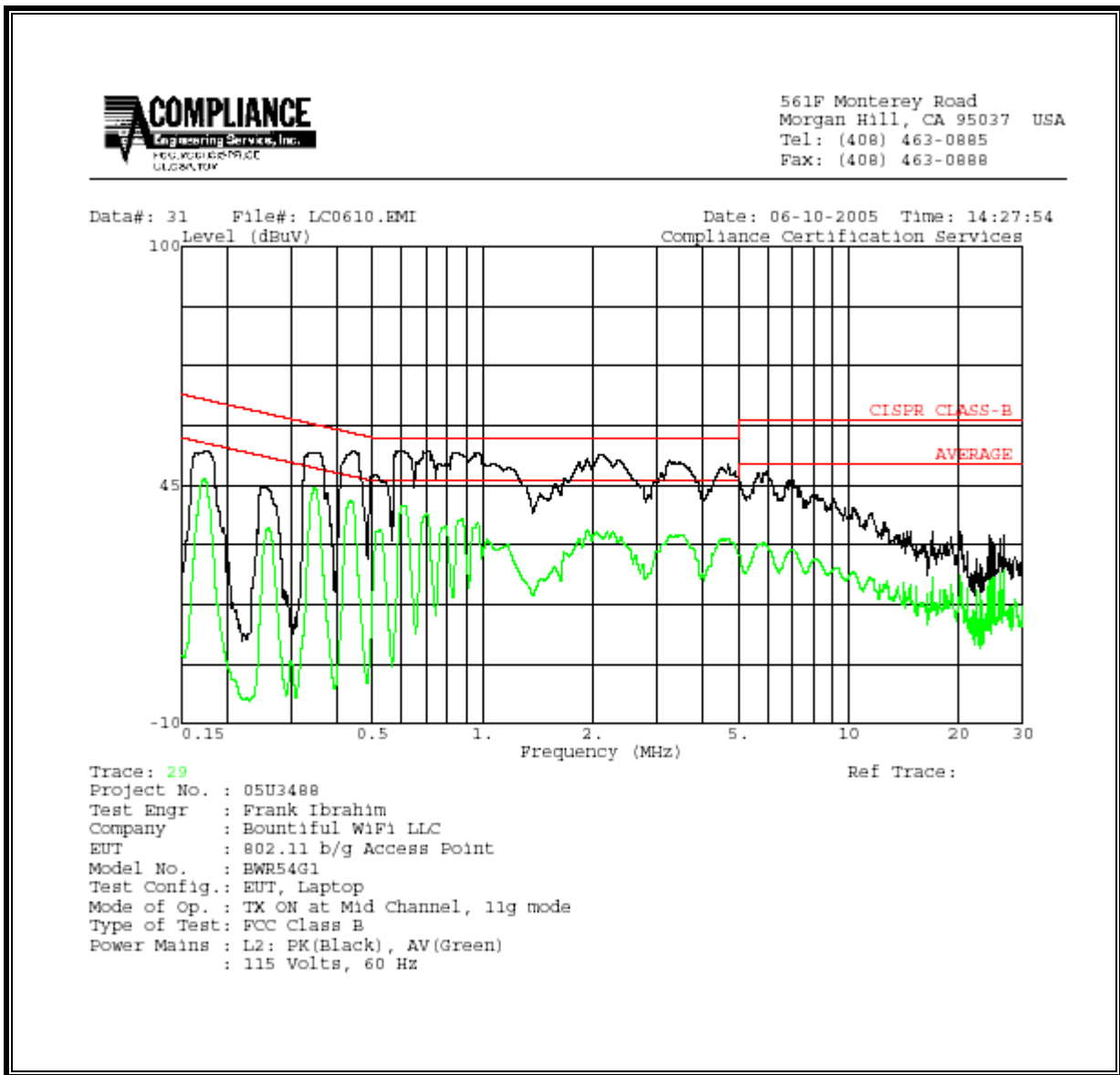
**6 WORST EMISSIONS**

| CONDUCTED EMISSIONS DATA (115VAC 60Hz) |           |           |           |       |       |       |         |         |         |
|--|-----------|-----------|-----------|-------|-------|-------|---------|---------|---------|
| Freq.                                  | Reading   |           |           | Class | Limit | FCC B | Margin  |         | Remark  |
| (MHz)                                  | PK (dBuV) | QP (dBuV) | AV (dBuV) | (dB)  | QP    | AV    | QP (dB) | AV (dB) | L1 / L2 |
| 0.71                                   | 52.47     | --        | 38.00     | 0.00  | 56.00 | 46.00 | -3.53   | -8.00   | L1      |
| 0.97                                   | 53.40     | --        | 27.84     | 0.00  | 56.00 | 46.00 | -2.60   | -18.16  | L1      |
| 2.33                                   | 51.28     | --        | 33.50     | 0.00  | 56.00 | 46.00 | -4.72   | -12.50  | L1      |
| 0.60                                   | 52.80     | --        | 40.24     | 0.00  | 56.00 | 46.00 | -3.20   | -5.76   | L2      |
| 0.97                                   | 52.34     | --        | 36.26     | 0.00  | 56.00 | 46.00 | -3.66   | -9.74   | L2      |
| 2.11                                   | 51.94     | --        | 34.30     | 0.00  | 56.00 | 46.00 | -4.06   | -11.70  | L2      |
| 6 Worst Data                           |           |           |           |       |       |       |         |         |         |

**LINE 1 RESULTS**

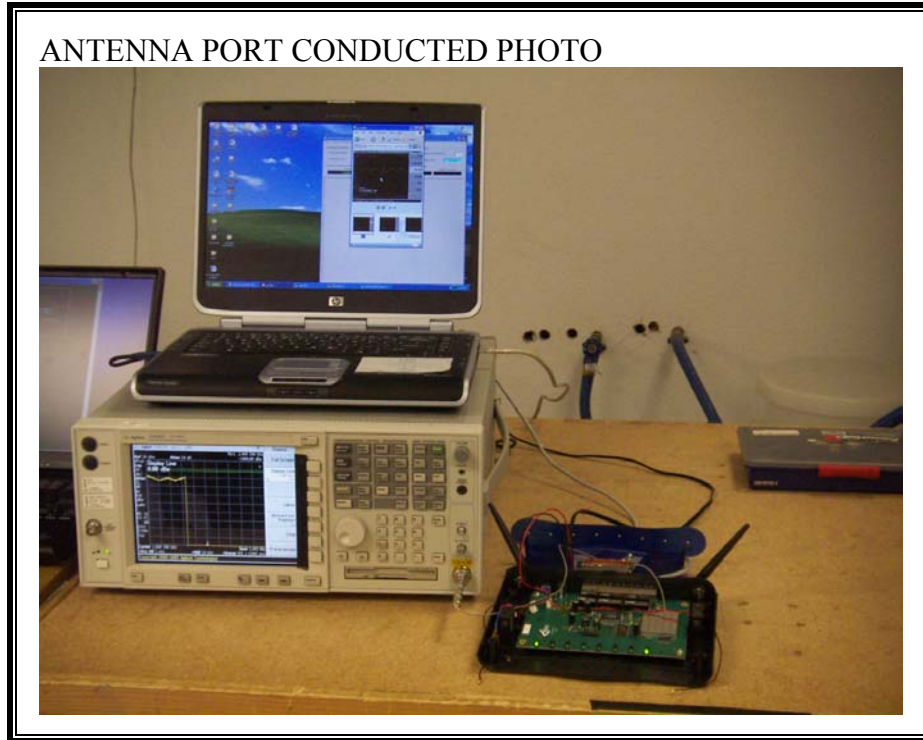


**LINE 2 RESULTS**

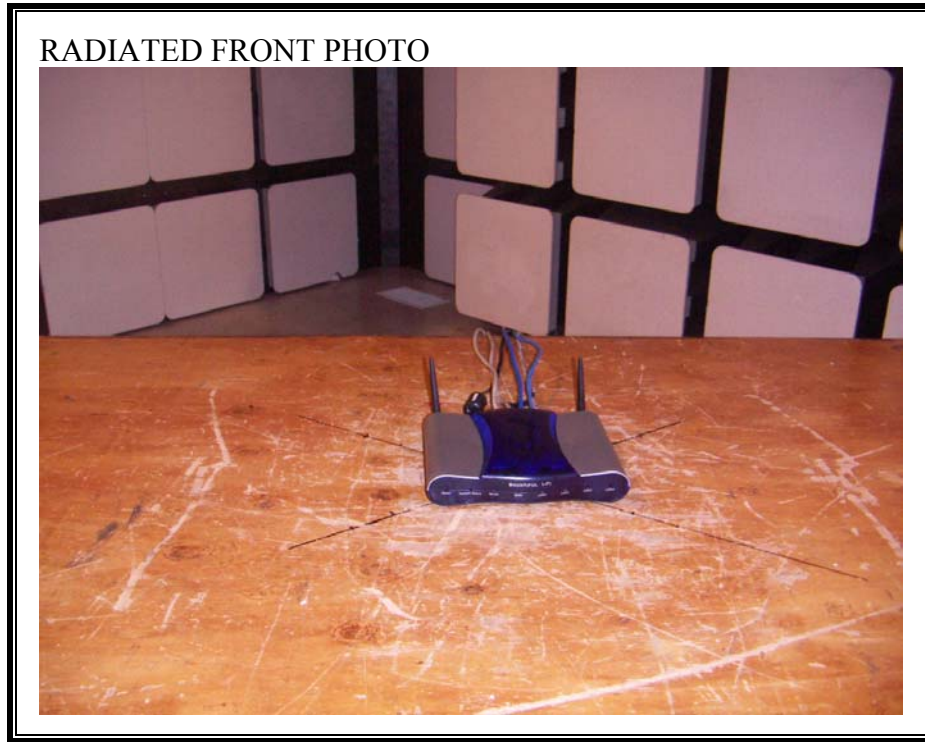


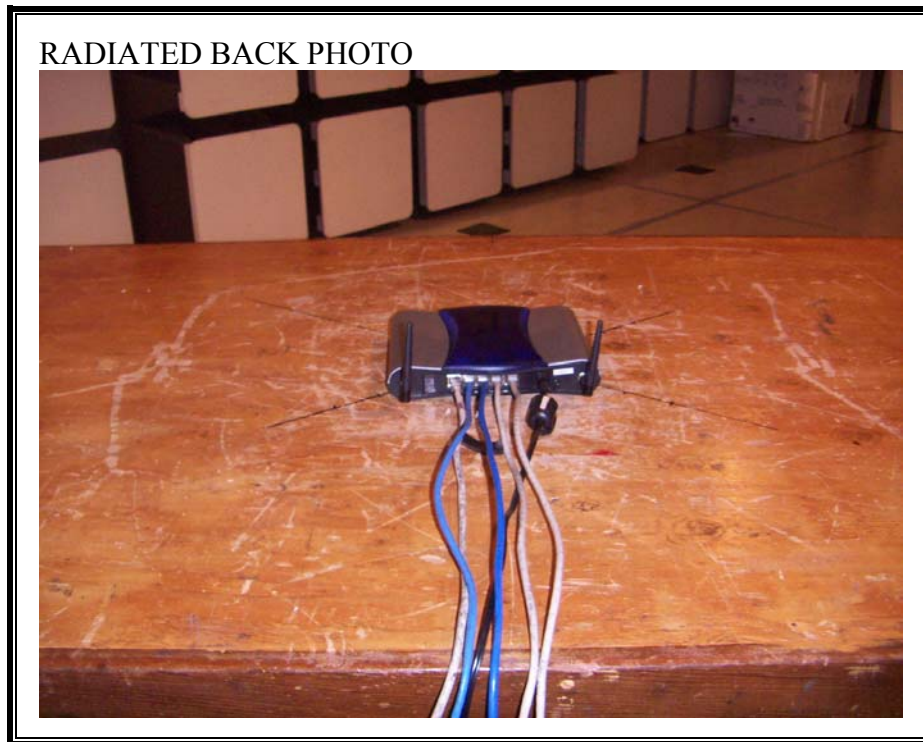
## 8 SETUP PHOTOS

### ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP



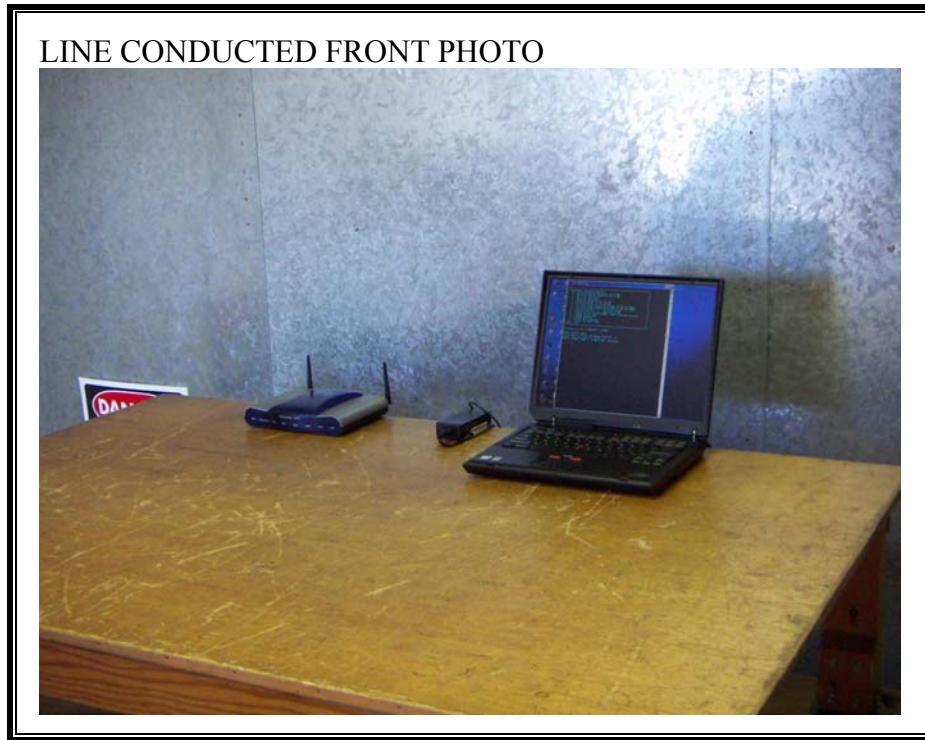
**RADIATED RF MEASUREMENT SETUP**







**POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP**





**END OF REPORT**