# FCC CFR47 CERTIFICATION
# CLASS II PERMISSIVE CHANGE
# TEST REPORT

**FOR**

**BROADCOM 802.11ag WIRELESS LAN PCI-E MINI CARD**

**MODEL NUMBER: BCM94311MCAG**

**FCC ID: QDS-BRCM1019**

**REPORT NUMBER: 05U3830-4**

**ISSUE DATE: NOVEMBER 29, 2005**

*Prepared for*
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Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| A | 11/29/05 | Initial Issue | Thu |

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# 1. ATTESTATION OF TEST RESULTS

| | |
|---|---|
| **COMPANY NAME:** | Broadcom Corp.<br>190 Mathilda Place<br>Sunnyvale, CA 94086, USA |
| **EUT DESCRIPTION:** | Broadcom 802.11ag Wireless LAN PCI-E Mini Card |
| **MODEL:** | BCM94311MCAG |
| **SERIAL NUMBER:** | 378 |
| **DATE OF ORIGINAL TESTS:** | November 09 to 15, 2005 |

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| FCC PART 15 SUBPART E | 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.

**Note:** The 802.11ag UNII Band is applicable to this report; another 2.4 GHz and 5.8 GHz DGT bands of operation are in separate report.

Approved & Released For CCS By:

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COMPLIANCE CERTIFICATION SERVICES

Tested By:

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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.ccsemc.com.

# 4. CALIBRATION AND UNCERTAINTY

## 4.1. MEASURING INSTRUMENT CALIBRATION

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

## 4.2. MEASUREMENT UNCERTAINTY

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

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

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

# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The EUT is an 802.11a/b/g transceiver module, operating in the UNII 5150 -5350 MHz.

The radio module is manufactured by Broadcom Corp.

## 5.2. CLASS II PERMISSIVE CHANGE DESCRIPTION

The EUT was originally certified on August 03, 2005 with a peak antenna gain of 5.1 dBi in the frequency range of 5150 – 5350 MHz. The major change filed under this application is adding a PIFA Stamped metal antenna with a maximum gain of 5.6 dBi at the 5150 – 5350 MHz band.

## 5.3. MODIFICATION

No modification was made during the testing.

## 5.4. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power same as previous project 05U3487-3B.

5150 to 5250 MHz Authorized Band

| Frequency Range (MHz) | Mode | Output Power (dBm) | Output Power (mW) |
|---|---|---|---|
| 5180 - 5250 | 802.11a | 14.63 | 29.04 |

5250 to 5350 MHz Authorized Band

| Frequency Range (MHz) | Mode | Output Power (dBm) | Output Power (mW) |
|---|---|---|---|
| 5250 - 5320 | 802.11a | 16.51 | 44.77 |

## 5.5. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA Stamped metal antenna manufactured by Hitachi Cable, Ltd., Model number HFT17-DL07, which has a maximum gain of 5.6dBi at 5.2GHz band.

## 5.6. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host support equipment during testing was BCM94311, version. 3.100.53.0

The test utility software used during testing was wl_tools.

## 5.7. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The highest measured output powers were at 5300 MHz for 11a.

The worst-case data rate for this channel is determined to be 6 Mb/s for 11a mode based on previous experience with WLAN product design architectures.

Thus all emissions tests were made in the 802.11a mode, 5300 MHz, 6 Mb/s.

**WORSRT-CASE POWER AND BIT RATE SETTING**

The following power in the packet (dBm) was tuned during test at the worst case data rates detailed.

| 802.11a - 5.2 GHz UNII BAND | | | | | |
|---|---|---|---|---|---|
| CHANNEL | 36 | 40 | 52 | 60 | 64 |
| (MHz) | 5180 | 5200 | 5260 | 5300 | 5320 |
| Band Edge | | | | | |
| (dBm) | 14.5 | 14.5 | X | 17 | 16.5 |
| Emission | | | | | |
| (dBm) | 17 | x | 17 | x | 17* |
| Bit Rate | | | | | |
| (Mbps) | 54 Mbps for Peak reading & 6 Mbps for Average reading | | | | |
| | | | | | |
| *NOTE: | For the rest of the RF Conducted and Radiated Emission tests, channel 13 is | | | | |
| | to 17dBm for worst case power to cover all high channels_Channel 60 (17dBr | | | | |
| | and Channel 64 (16.5dBm) | | | | |

## 5.8. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| Description | Manufacturer | Model | Serial Number | FCC ID |
|---|---|---|---|---|
| Laptop | HP | Pavilion dv4030us | CNE52005T6 | DoC |
| AC Adapter | HP | PPP0009S | CT 57BC30AU4RO0L0 | DoC |
| Extended Card | ADEXELEC | PEX1-MINI | 01/01/1900 | N/A |

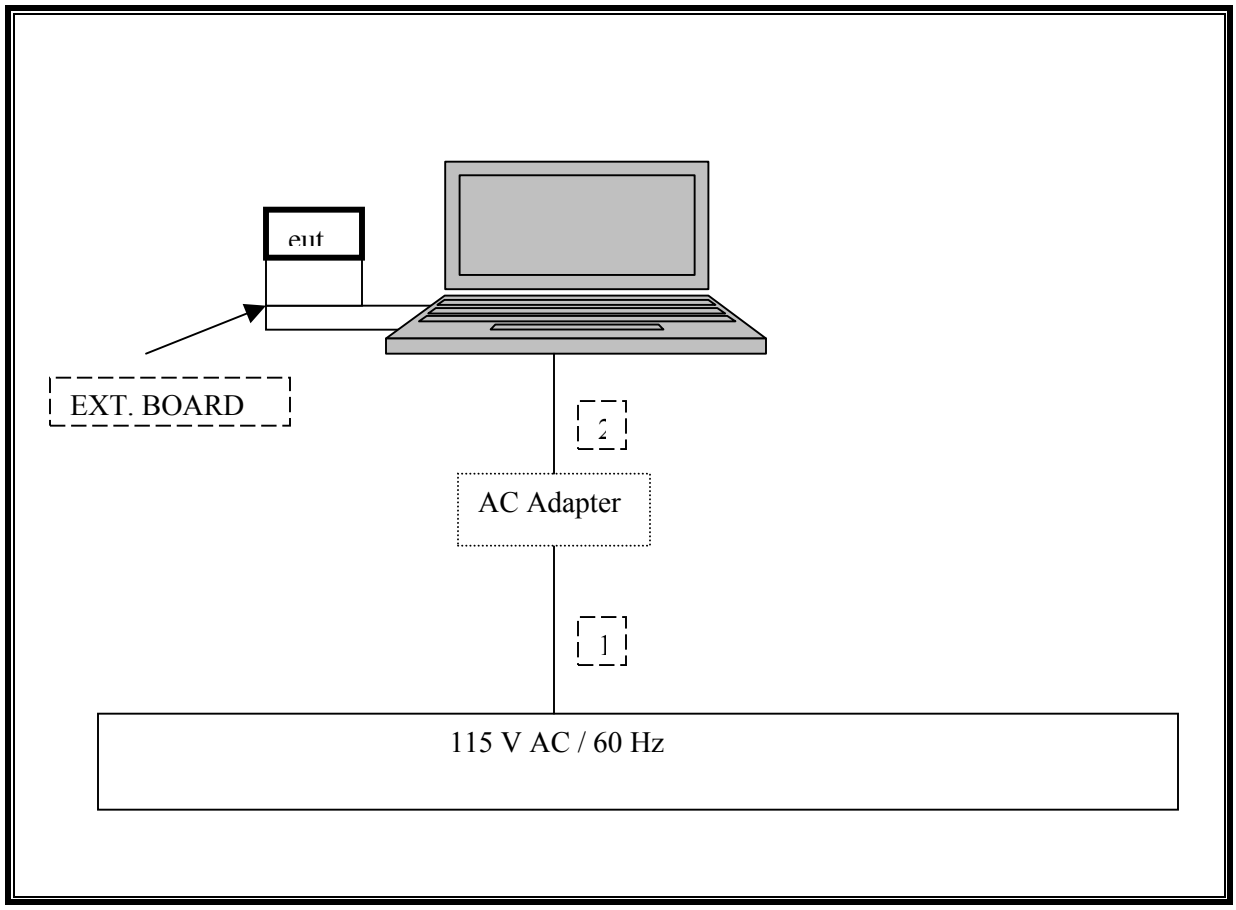
**I/O CABLES**

| I/O CABLE LIST | | | | | | |
|---|---|---|---|---|---|---|
| Cable No. | Port | # of Identica Ports | Connector Type | Cable Type | Cable Length | Remarks |
| 1 | AC Power | 1 | AC power | Unshielded | 1.5 m | N/A |
| 2 | DC Power | 1 | DC Power | Unshielded | 1.5 m | N/A |

**TEST SETUP**

The EUT is installed in a host laptop computer via a card bus-to-mini PCI adapter / extension board during the tests. Test software exercised the radio card.

**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 | 10/22/2006 |
| Site A Line Stabilizer / Conditioner | Tripplite | LC-1800a | A0051681 | CNR |
| LISN, 10 kHz ~ 30 MHz | FCC | LISN-50/250-25-2 | 2023 | 08/30/2006 |
| LISN, 10 kHz ~ 30 MHz | Solar | 8012-50-R-24-BNC | 8379443 | 10/21/2006 |
| Spectrum Analyzer | HP | E4446A | US42510266 | 08/25/2006 |
| Antenna, Horn 1 ~ 18 GHz | EMCO | 3117 | 29310 | 09/12/2006 |
| Antenna, Horn 18 ~ 26 GHz | ARA | SWH-28 | 1007 | 06/02/2006 |
| Antenna, Horn 26 ~ 40 GHz | ARA | MWH-2640/B | 1029 | 12/03/2005 |
| Preamplifier, 1 ~ 26.5 GHz | HP | 8449B | 3008A00369 | 08/17/2006 |
| PreAmplifier 26-40 GHz | MITEQ | NSP4000-SP2 | 924343 | 06/01/2006 |
| Peak Power Meter | Agilent | E4416A | GB41291160 | 11/07/2006 |
| Peak / Average Power Sensor | Agilent | E9327A | US40440755 | 11/07/2006 |
| RF Filter Section | HP | 85420E | 3705A00256 | 11/21/2005 |
| EMI Receiver, 9 kHz ~ 2.9 GHz | HP | 8542E | 3942A00286 | 11/21/2005 |
| Bilog Antenna 30MHz---- 2Ghz | Sunol Sciences | JB1 Antenna | A121003 | 12/22/2005 |
| 7.6 GHz High Pass Filter | Micro Tronics | HPM13350 | 1 | N/A |
| 5.75 - 5.8 Reject Filter | Micro Tronics | BRC13192 | 2 | N/A |

# 7. LIMIT AND TEST RESULTS

## 7.1. CHANNEL TESTS FOR THE 5250 – 5350 MHz BAND

### 7.1.1. 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 ($mW/cm^2$) | 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 | *($900/f^2$) | 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 | *($180/f^2$) | 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 ($mW/cm^2$) | Averaging time (minutes) |
|---|---|---|---|---|
| 30–300 | 27.5 | 0.073 | 0.2 | 30 |
| 300–1500 | | | f/1500 | 30 |
| 1500–100,000 | | | 1.0 | 30 |

f = frequency in MHz
* = Plane-wave equivalent power density

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

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

## CALCULATIONS

Given

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

and

$S = E ^ 2 / 3770$

where

E = Field Strength in Volts/meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power Density in milliwatts/square centimeter

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

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

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

P (mW) = P (W) / 1000 and
d (cm) =100 * d (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^2

Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and
G (numeric) = 10 ^ (G (dBi) / 10)

yields

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

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

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

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

**LIMITS**

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

**RESULTS**

No non-compliance noted.

| Mode | MPE Distance (cm) | Output Power (dBm) | Antenna Gain (dBi) | Power Density (mW/cm^2) |
|---|---|---|---|---|
| 802.11a | 20.0 | 16.63 | 5.60 | 0.03 |

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.

# 7.2. 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 |
| [1]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 | ([2]) |
| 13.36 - 13.41 | | | |

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] 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 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

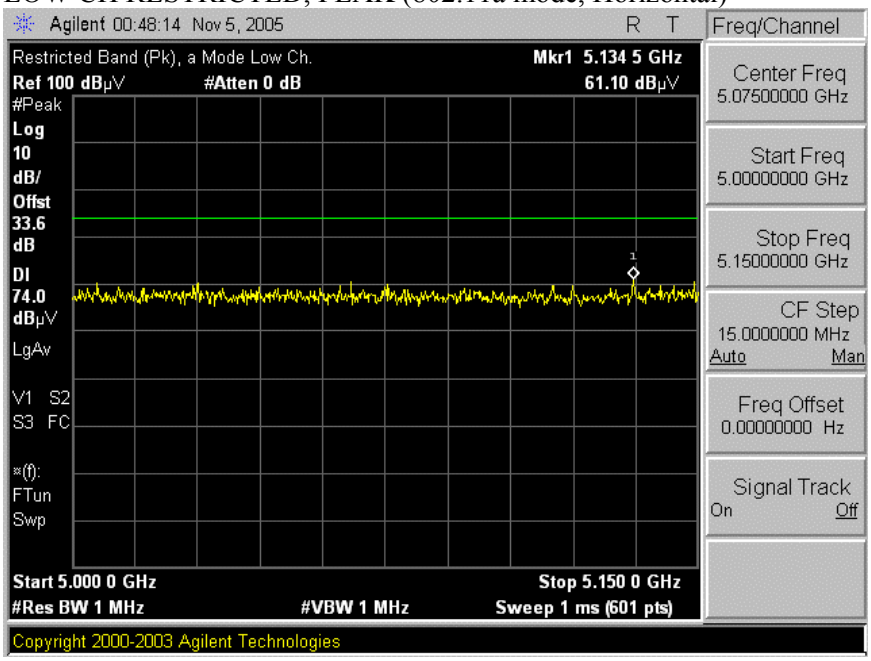
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

## 7.2.2. TRANSMITTER ABOVE 1 GHZ FOR 5150 TO 5350 MHz BAND

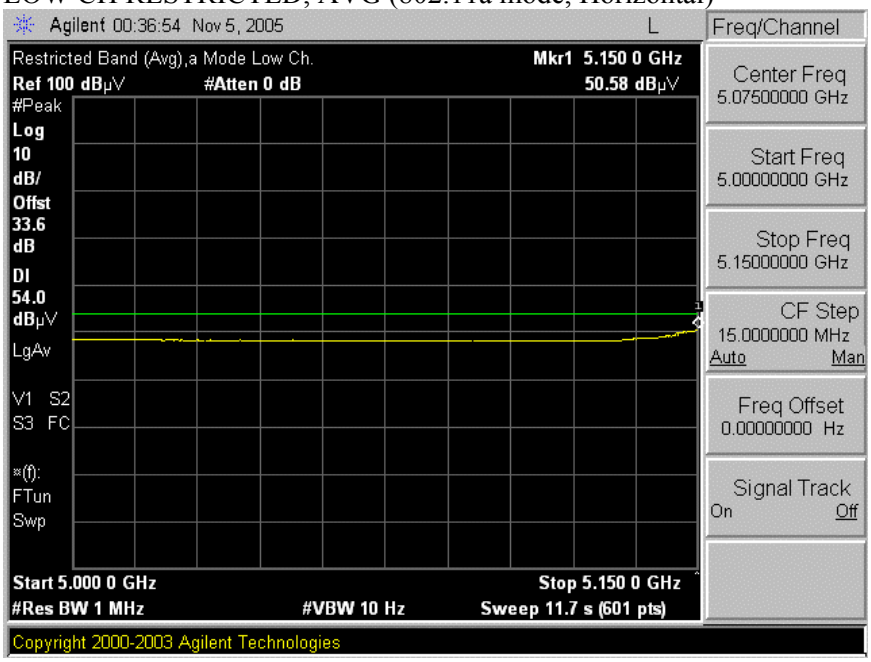
**CH 36, 5180 MHz – POWER = 14.5dBm**

**RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, HORIZONTAL)**

LOW CH RESTRICTED, PEAK (802.11a mode, Horizontal)

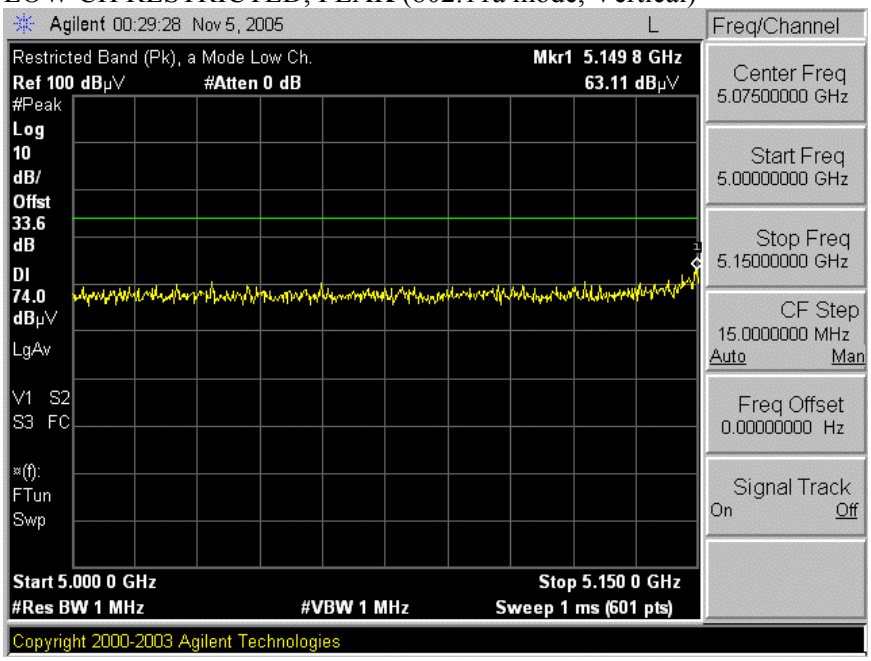


LOW CH RESTRICTED, AVG (802.11a mode, Horizontal)

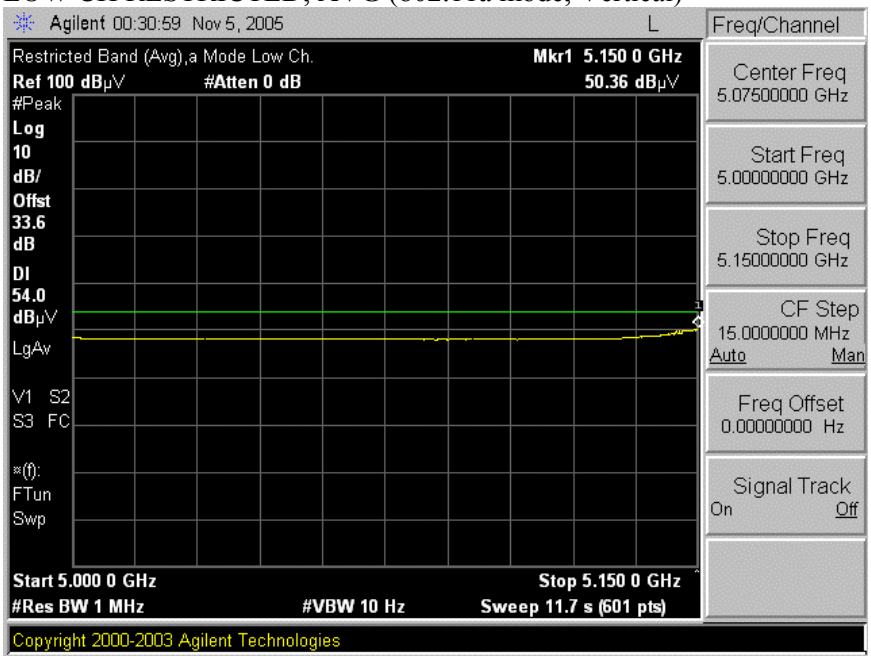


**RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, VERTICAL)**

LOW CH RESTRICTED, PEAK (802.11a mode, Vertical)



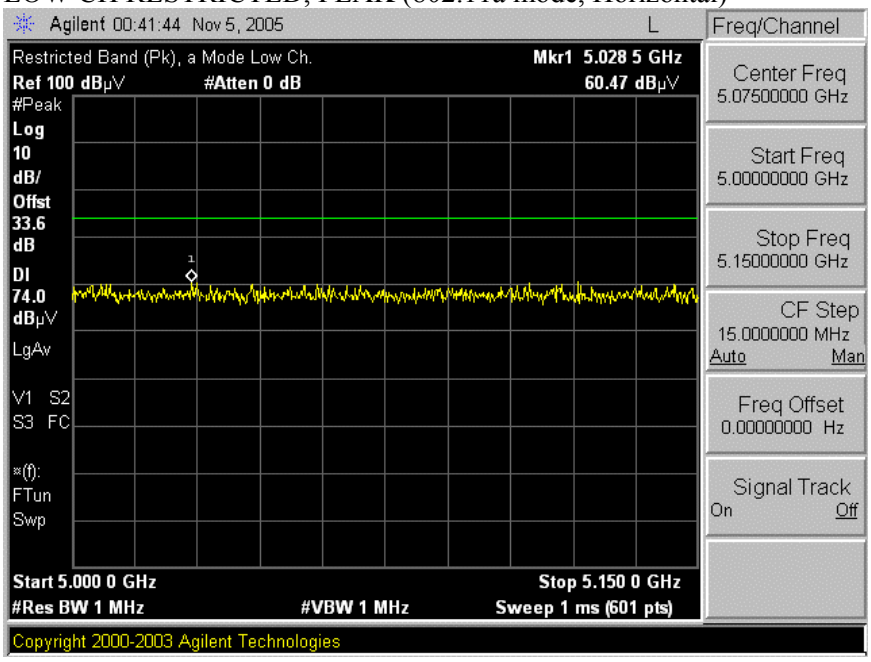
LOW CH RESTRICTED, AVG (802.11a mode, Vertical)



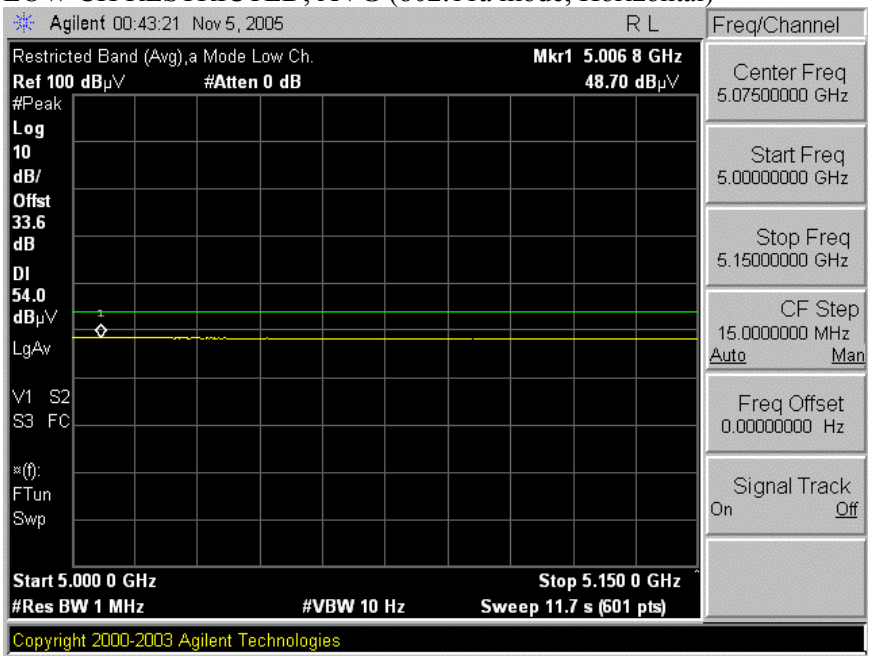
**CH 40, 5200 MHz – POWER = 14.5dBm**

**RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, HORIZONTAL)**

LOW CH RESTRICTED, PEAK (802.11a mode, Horizontal)

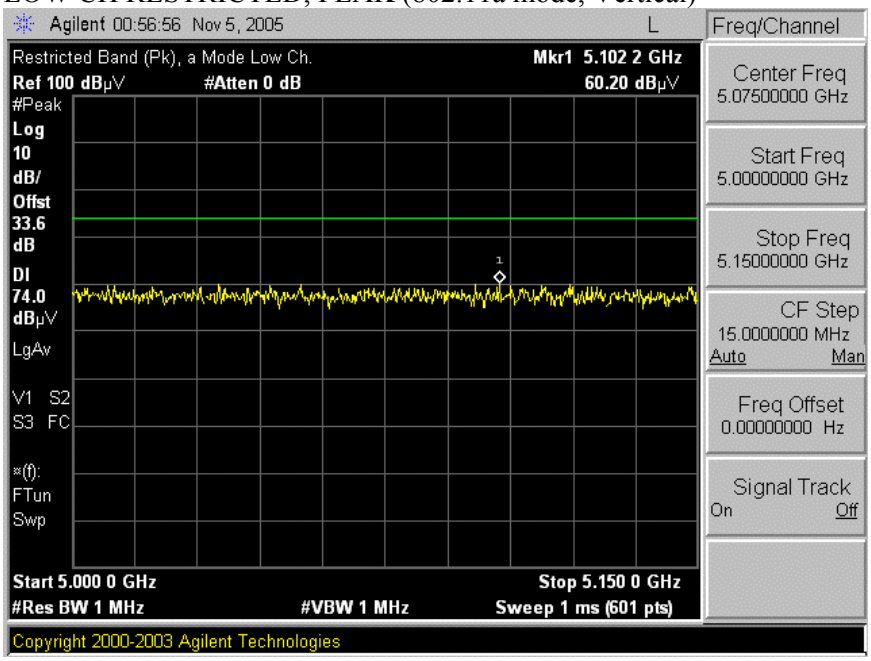


LOW CH RESTRICTED, AVG (802.11a mode, Horizontal)

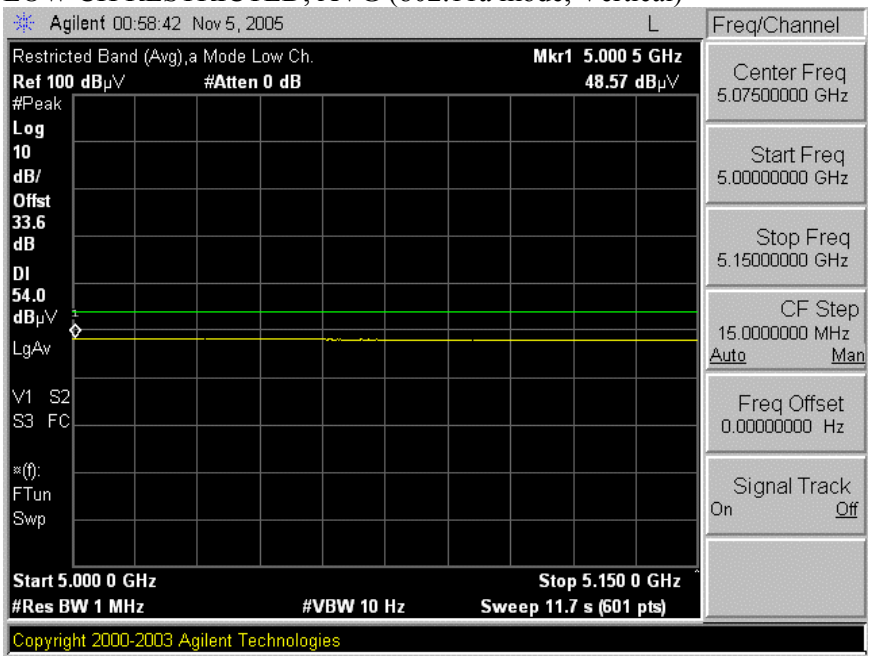


**RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, VERTICAL)**

LOW CH RESTRICTED, PEAK (802.11a mode, Vertical)



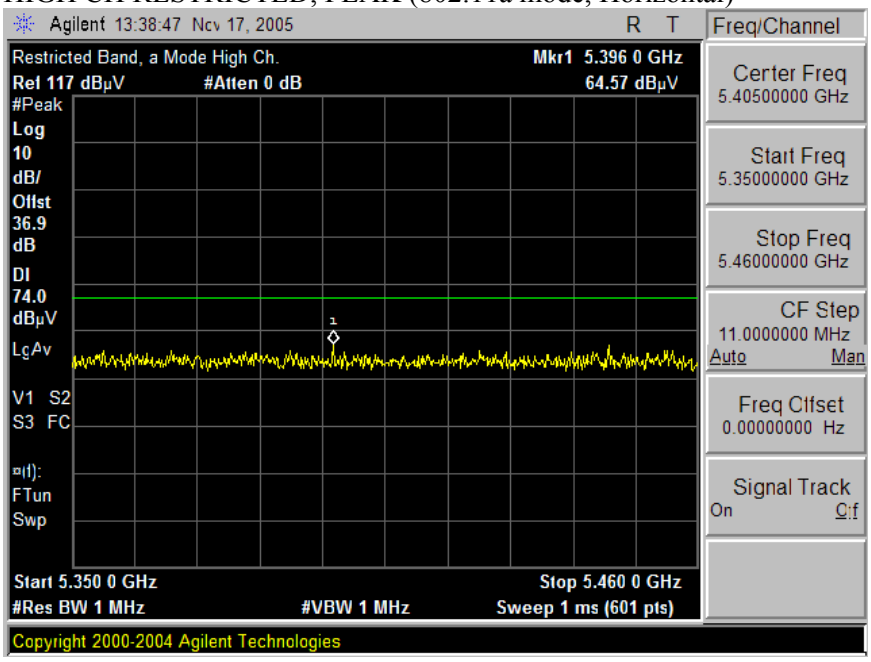
LOW CH RESTRICTED, AVG (802.11a mode, Vertical)



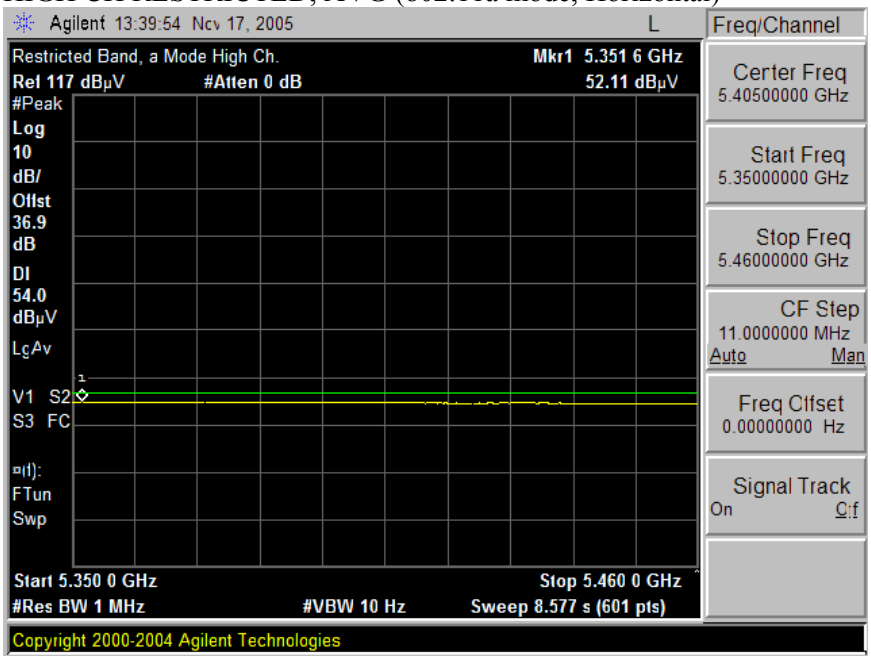
**CH 60, 5300 MHz – POWER = 17dBm**

**RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, HORIZONTAL)**

HIGH CH RESTRICTED, PEAK (802.11a mode, Horizontal)

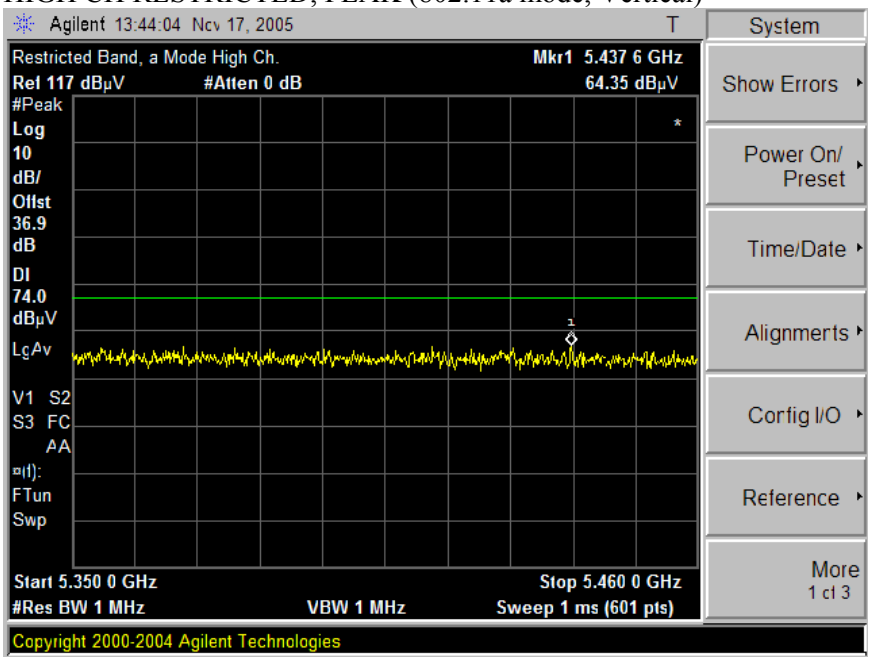


HIGH CH RESTRICTED, AVG (802.11a mode, Horizontal)

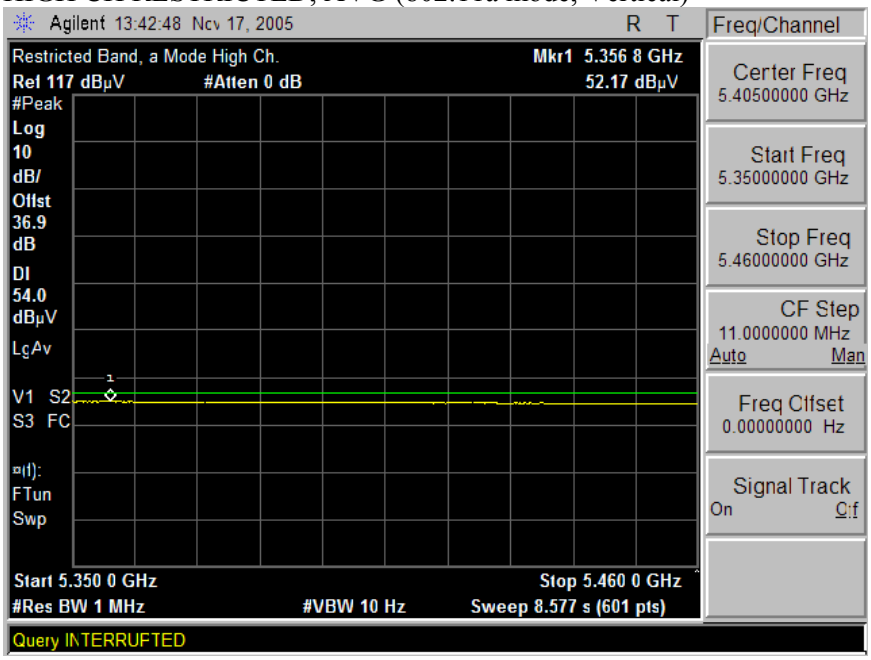


**RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, VERTICAL)**

HIGH CH RESTRICTED, PEAK (802.11a mode, Vertical)



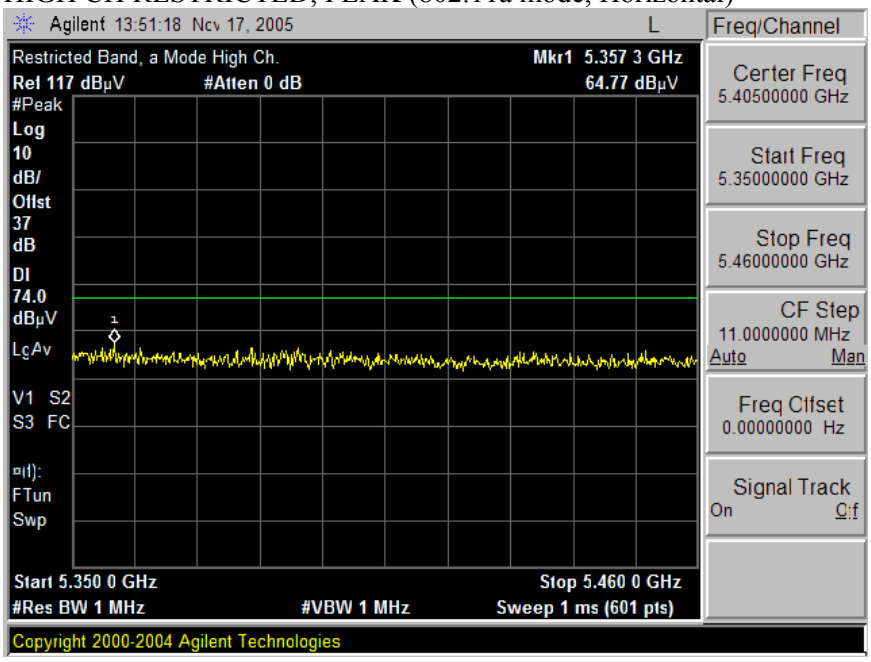
HIGH CH RESTRICTED, AVG (802.11a mode, Vertical)



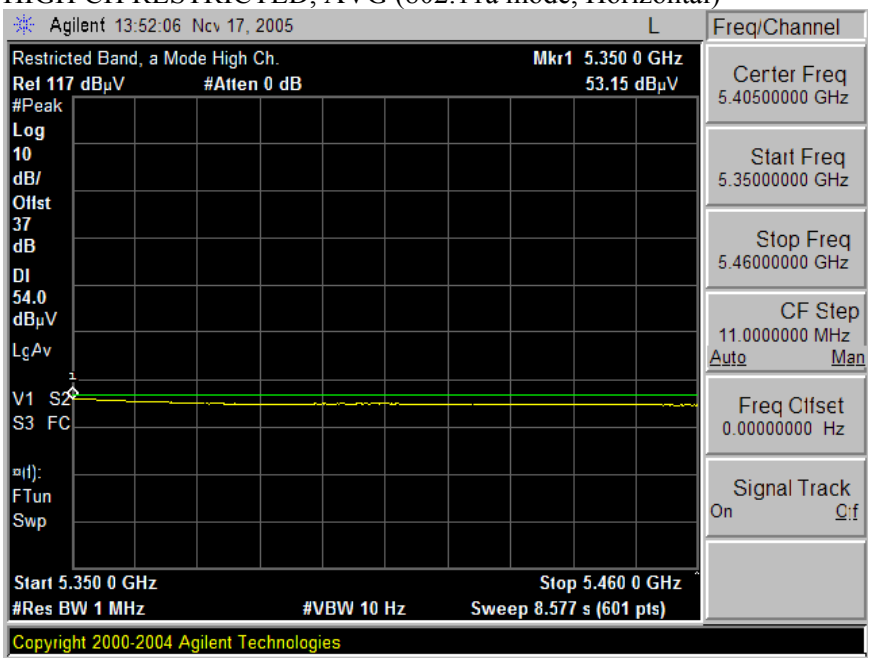
**CH 64, 5320 MHz – POWER = 16.5dBm**

**RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, HORIZONTAL)**

HIGH CH RESTRICTED, PEAK (802.11a mode, Horizontal)

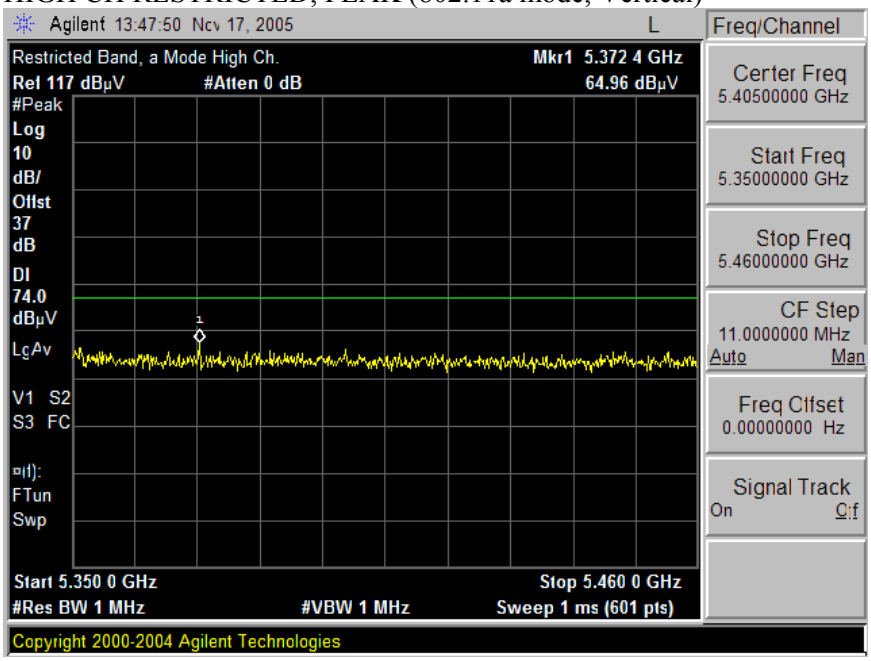


HIGH CH RESTRICTED, AVG (802.11a mode, Horizontal)

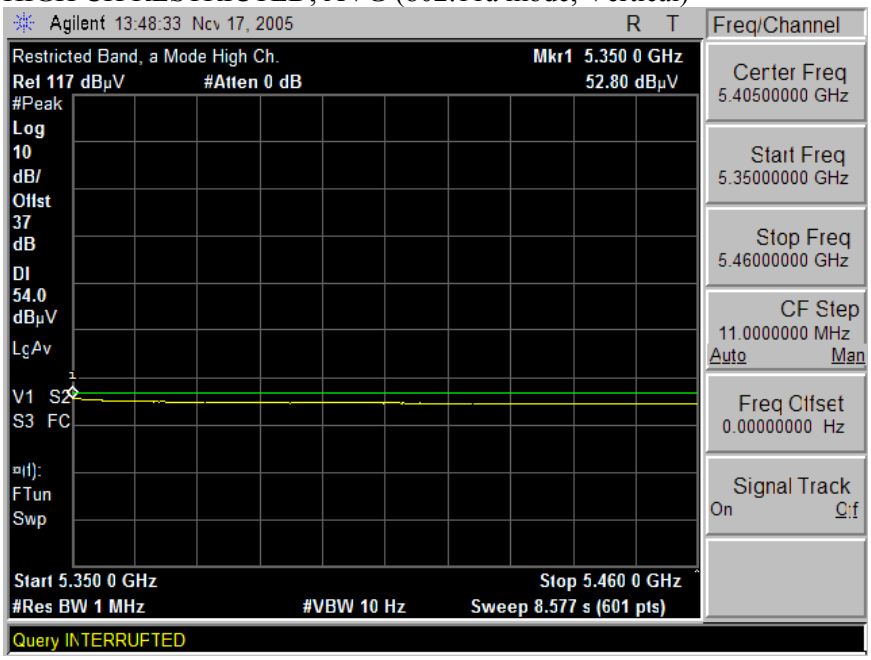


**RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, VERTICAL)**

HIGH CH RESTRICTED, PEAK (802.11a mode, Vertical)



HIGH CH RESTRICTED, AVG (802.11a mode, Vertical)



## HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)

CHANNEL 36, 52, & 64, BITE RATE: 54Mbps for Peak & 6Mbps for Average

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

**Test Engr:Thanh Nguyen**
**Project #: 05U3830**
**Company: BROADCOM**
**EUT Descrip.:802.11ag Mini PCI Express Card**
**EUT M/N:BCM94311MCAG**
**Test Target:FCC 15.407**
**Mode Oper:11a_5180 - 5320 MG_TX LOW, MID, HI CHANNEL ( CH 36, 52, 64) _ HARMONIC & SPUR**

**Test Equipment:**

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T120; S/N: 29310 @1m | T34 HP 8449B | | | FCC 15.209 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| Thanh 177079008 | | Thanh 208946003 | HPF_7.6GHz | |

**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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tx Ch 36, 5180MHz | | | | | | | | | | | | | | | |
| 10.360 | 3.0 | 49.5 | 35.9 | 38.1 | 3.9 | -32.6 | 0.0 | 0.8 | 59.7 | 46.0 | 74 | 54 | -14.3 | -8.0 | V |
| 15.540 | 3.0 | 43.4 | 32.6 | 40.4 | 4.7 | -32.2 | 0.0 | 0.7 | 57.1 | 46.3 | 74 | 54 | -16.9 | -7.7 | V |
| 10.360 | 3.0 | 48.4 | 34.3 | 38.1 | 3.9 | -32.6 | 0.0 | 0.8 | 58.6 | 44.5 | 74 | 54 | -15.4 | -9.5 | H |
| 15.540 | 3.0 | 43.7 | 32.6 | 40.4 | 4.7 | -32.2 | 0.0 | 0.7 | 57.4 | 46.3 | 74 | 54 | -16.6 | -7.7 | H |
| Tx Ch 52, 5260MHz | | | | | | | | | | | | | | | |
| 10.520 | 3.0 | 49.7 | 36.4 | 38.2 | 3.9 | -32.6 | 0.0 | 0.8 | 60.0 | 46.6 | 74 | 54 | -14.0 | -7.4 | V |
| 15.780 | 3.0 | 41.2 | 32.3 | 40.5 | 4.8 | -32.2 | 0.0 | 0.7 | 55.1 | 46.2 | 74 | 54 | -18.9 | -7.8 | V |
| 10.520 | 3.0 | 44.9 | 34.8 | 38.2 | 3.9 | -32.6 | 0.0 | 0.8 | 55.2 | 45.1 | 74 | 54 | -18.8 | -8.9 | H |
| 15.780 | 3.0 | 41.9 | 32.3 | 40.5 | 4.8 | -32.2 | 0.0 | 0.7 | 55.7 | 46.1 | 74 | 54 | -18.3 | -7.9 | H |
| Tx Ch 64=5320 MHz | | | | | | | | | | | | | | | |
| 10.640 | 3.0 | 49.2 | 35.0 | 38.2 | 4.0 | -32.6 | 0.0 | 0.8 | 59.6 | 45.4 | 74 | 54 | -14.4 | -8.6 | V |
| 15.960 | 3.0 | 43.2 | 33.9 | 40.6 | 4.8 | -32.1 | 0.0 | 0.7 | 57.2 | 47.9 | 74 | 54 | -16.8 | -6.1 | V |
| 10.640 | 3.0 | 47.3 | 33.6 | 38.2 | 4.0 | -32.6 | 0.0 | 0.8 | 57.7 | 44.0 | 74 | 54 | -16.3 | -10.0 | H |
| 15.960 | 3.0 | 42.1 | 31.9 | 40.6 | 4.8 | -32.1 | 0.0 | 0.7 | 56.1 | 45.9 | 74 | 54 | -17.9 | -8.1 | H |
| NO OTHER EMISSIONS WERE DETECTED ABOVE NOISE FLOOR AFTER 3rd HARMONIC | | | | | | | | | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 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 | | |

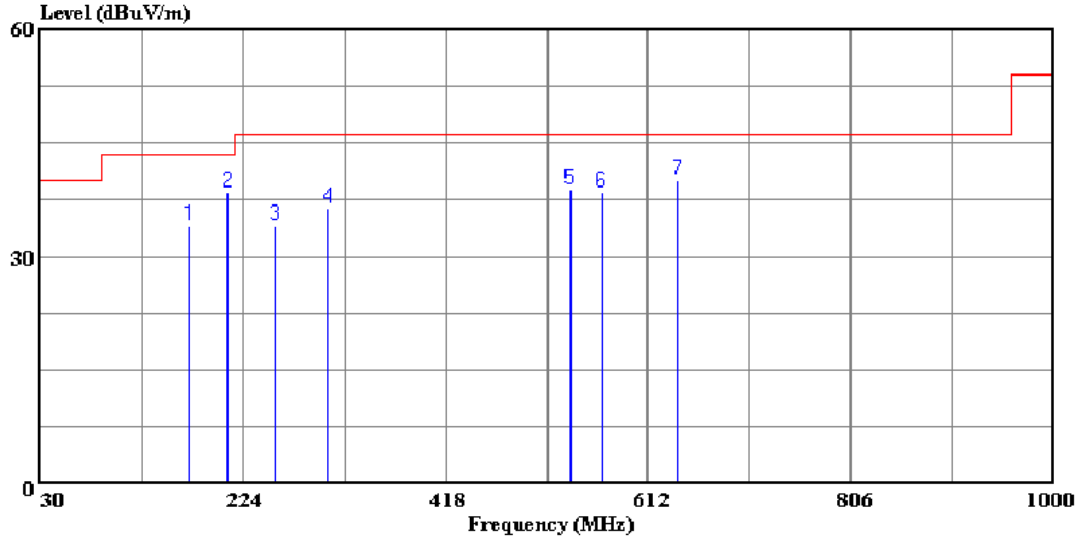
## 7.2.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

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

HORIZONTAL PLOT

COMPLIANCE Engineering Services, Inc.
561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 10 File#: emissions.EMI Date: 11-10-2005 Time: 21:09:26




(Audix ATC)

Trace: Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Test Operator: : Thanh Nguyen
Project #: : 05U3830
Company: : BroadCom Corporation
EUT: : 802.11 a/b/g WLAN PCI-E Mini Card
Model No. : BCM94311MCAG
Configuration : EUT Plug in the Extended card, HP Laptop
Target of Test : FCC Class B
Mode of Operation: Tx a Mode upper band, worst channel

HORIZONTAL DATA

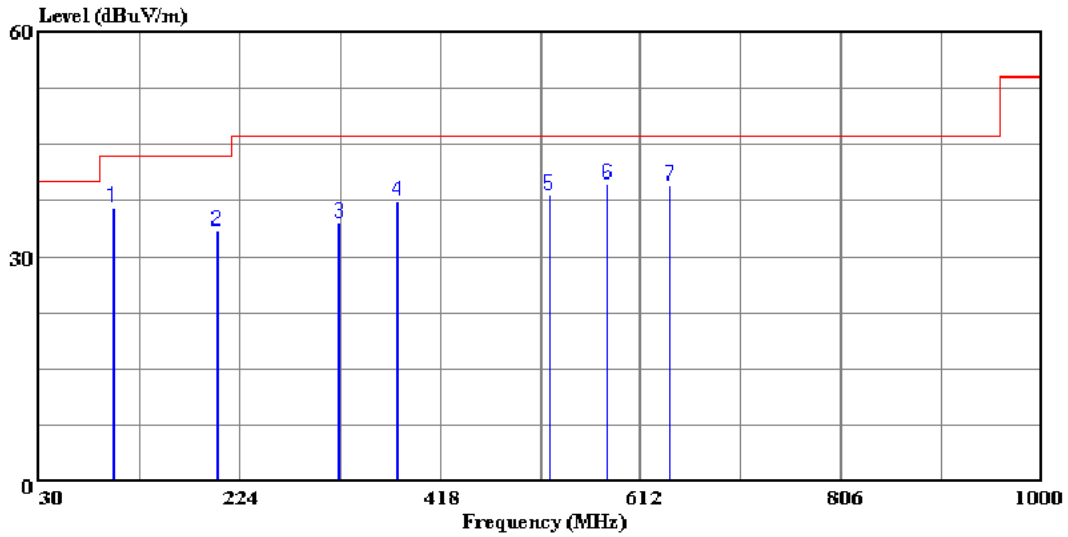
| | Freq | Read Level | Factor | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | |
| 1 | 172.590 | 20.81 | 13.31 | 34.12 | 43.50 | -9.38 | Peak |
| 2 | 209.450 | 25.23 | 13.21 | 38.43 | 43.50 | -5.07 | Peak |
| 3 | 255.040 | 19.97 | 14.09 | 34.06 | 46.00 | -11.94 | Peak |
| 4 | 305.480 | 20.48 | 15.80 | 36.28 | 46.00 | -9.72 | Peak |
| 5 | 537.310 | 18.06 | 20.72 | 38.77 | 46.00 | -7.23 | Peak |
| 6 | 567.380 | 17.23 | 21.12 | 38.35 | 46.00 | -7.65 | Peak |
| 7 | 640.130 | 17.98 | 22.18 | 40.16 | 46.00 | -5.84 | 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#: 12 File#: emissions.EMI Date: 11-10-2005 Time: 21:18:10




(Audix ATC)

Trace: Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator: : Thanh Nguyen
Project #: : 05U3830
Company: : BroadCom Corporation
EUT: : 802.11 a/b/g WLAN PCI-E Mini Card
Model No. : BCM94311MCAG
Configuration : EUT Plug in the Extended card, HP Laptop
Target of Test : FCC Class B
Mode of Operation: Tx a Mode upper band, worst channel

VERTICAL DATA

| | Freq | Read Level | Factor | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | |
| 1 | 101.780 | 24.68 | 11.77 | 36.45 | 43.50 | -7.05 | Peak |
| 2 | 201.690 | 19.13 | 14.32 | 33.45 | 43.50 | -10.05 | Peak |
| 3 | 320.030 | 18.41 | 16.14 | 34.55 | 46.00 | -11.45 | Peak |
| 4 | 376.290 | 19.84 | 17.53 | 37.37 | 46.00 | -8.63 | Peak |
| 5 | 523.730 | 17.63 | 20.62 | 38.25 | 46.00 | -7.75 | Peak |
| 6 | 579.990 | 18.30 | 21.30 | 39.60 | 46.00 | -6.40 | Peak |
| 7 | 640.130 | 17.30 | 22.18 | 39.48 | 46.00 | -6.52 | 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 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

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

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

* Decreases with the logarithm of the frequency.

### TEST PROCEDURE

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

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

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

### RESULTS

No non-compliance noted:

## 6 WORST EMISSIONS

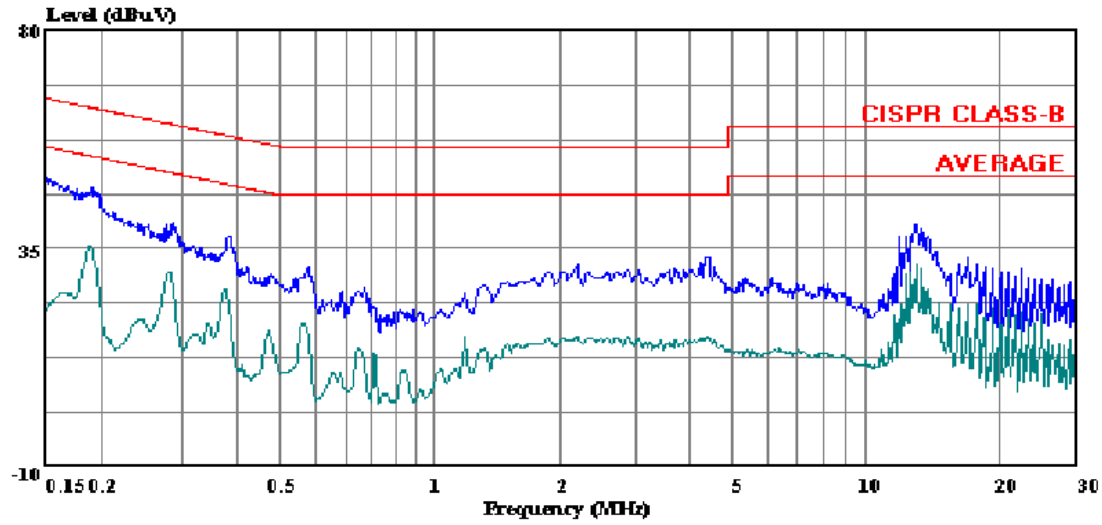
CONDUCTED EMISSIONS DATA (115VAC 60Hz)

| Freq. | Reading | | | Closs | Limit | FCC_B | Margin | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| (MHz) | PK (dBuV) | QP (dBuV) | AV (dBuV) | (dB) | QP | AV | QP (dB) | AV (dB) | L1 / L2 |
| 0.15 | 48.84 | -- | -- | 0.00 | 66.00 | 56.00 | -17.16 | -7.16 | L1 |
| 0.19 | 47.52 | -- | -- | 0.00 | 64.04 | 54.04 | -16.52 | -6.52 | L1 |
| 13.13 | 39.80 | -- | -- | 0.00 | 60.00 | 50.00 | -20.20 | -10.20 | L1 |
| 0.15 | 49.10 | -- | -- | 0.00 | 66.00 | 56.00 | -16.90 | -6.90 | L2 |
| 0.19 | 47.50 | -- | -- | 0.00 | 64.04 | 54.04 | -16.54 | -6.54 | L2 |
| 13.13 | 38.72 | -- | -- | 0.00 | 60.00 | 50.00 | -21.28 | -11.28 | L2 |
| 6 Worst Data | | | | | | | | | |

**LINE 1 RESULTS**

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

Data#: 28 File#: 3830.emi Date: 11-14-2005 Time: 17:30:53



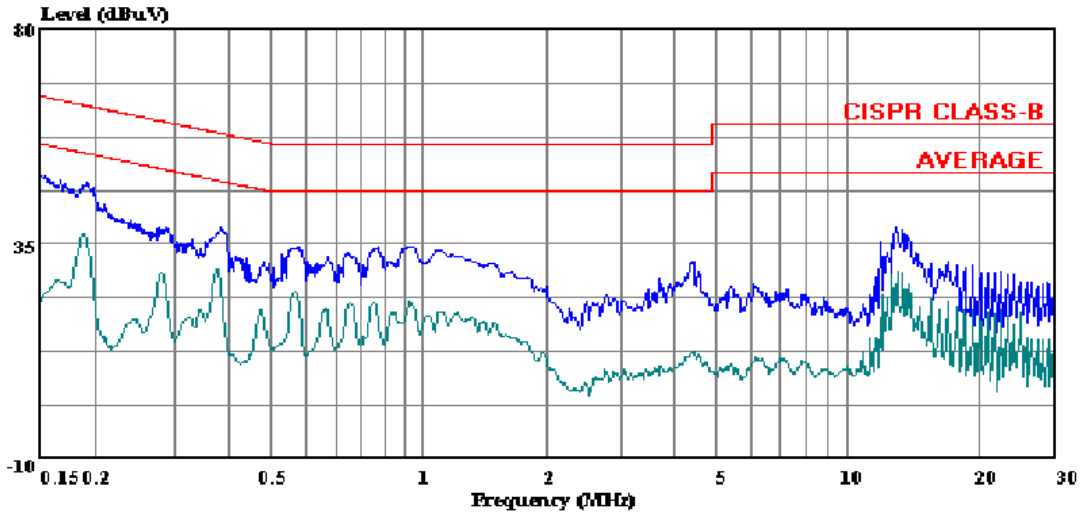

Trace: 26 Ref Trace:

Condition: CISPR CLASS-B
Project # : 05U3830
Company : Broadcom
EUT Descrip : 802.11ag WLAN PCI-E Mini Card
Model : BCM94311MACG
EUT Config : EUT/Laptop
Mode Of Oper : 5 GHz _ TX Worst Case
Target of Test: FCC Class B
Power Source: : 115VAC, 60Hz
: L1: Peak ( Black ), Avg ( Green)
Test Operator : Vien Tran

**LINE 2 RESULTS**

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

Data#: 35 File#: 3830.emi Date: 11-14-2005 Time: 17:52:17



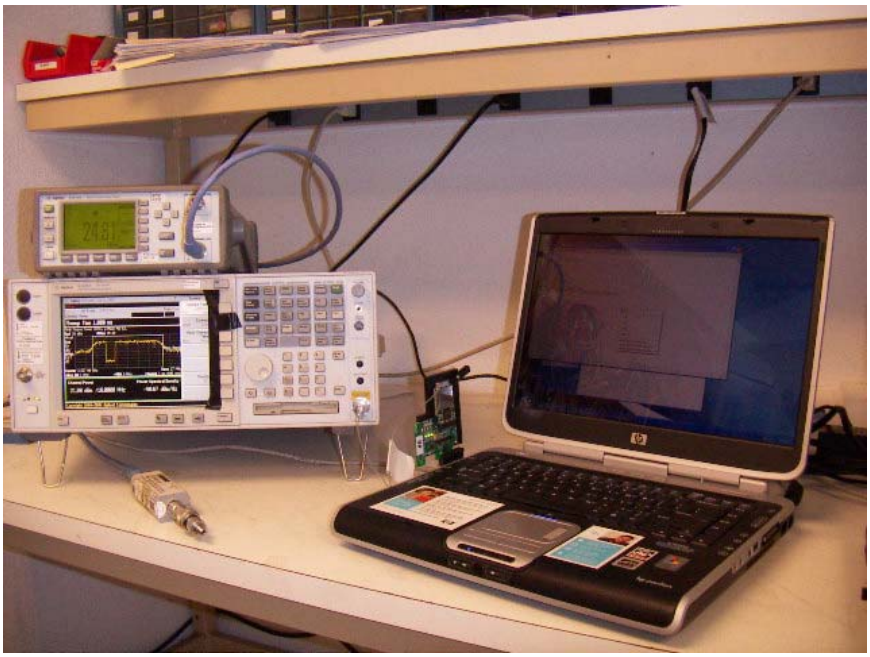

Trace: 33 Ref Trace:

Condition: CISPR CLASS-B
Project # : 05U3830
Company : Broadcom
EUT Descrip : 802.11ag WLAN PCI-E Mini Card
Model : BCM94311MCAG
EUT Config : EUT/Laptop
Mode Of Oper : 5 GHz Band _ TX Worst Case
Target of Test: FCC Class B
Power Source: : 115VAC, 60Hz
: L2: Peak ( Black ), Avg ( Green)
Test Operator : Vien Tran

# 8. SETUP PHOTOS

**RF CONDUCTED SETUP**

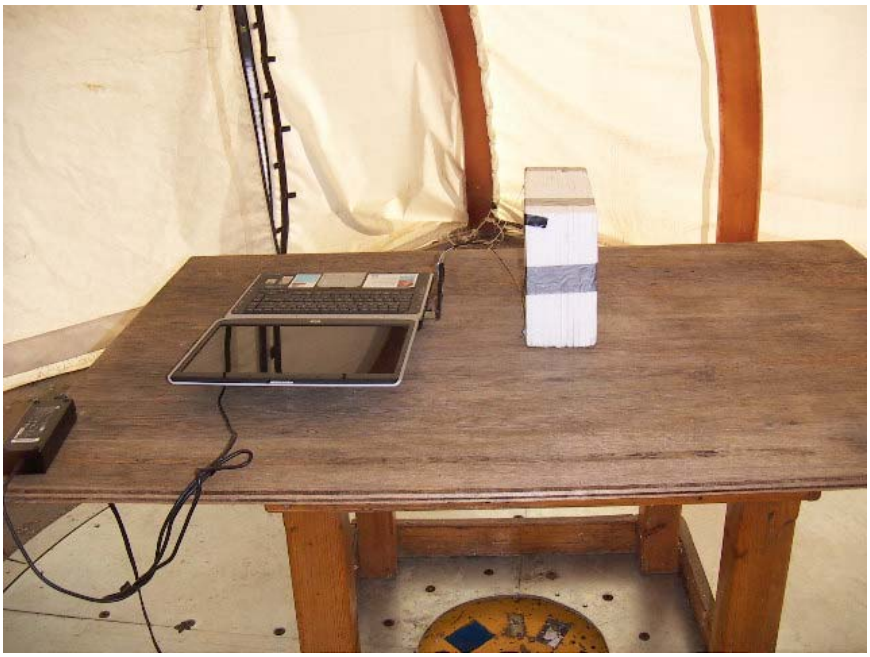
ANTENNA PORT CONDUCTED PHOTO



## RADIATED RF MEASUREMENT SETUP

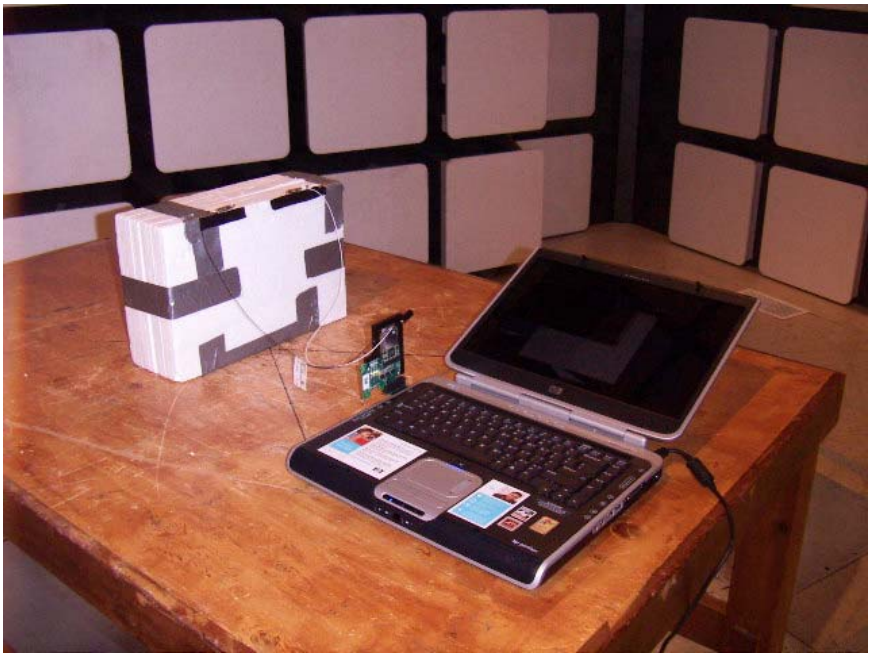
RADIATED FRONT PHOTO – FOR ABOVE 1GHZ TEST

RADIATED BACK PHOTO – FOR ABOVE 1GHZ TEST



RADIATED SIDE PHOTO – FOR ABOVE 1GHZ TEST

RADIATED PHOTO – FOR BELOW 1GHZ TEST



## POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP

LINE CONDUCTED FRONT PHOTO

LINE CONDUCTED BACK PHOTO


# END OF REPORT