



**FCC CFR47 PART 15 SUBPART E  
CLASS II PERMISSIVE CHANGE  
CERTIFICATION TEST REPORT  
FOR**

**802.11a/b/g/n PCI EXPRESS MINI CARD**

**MODEL NUMBER: AR5BXB72P**

**FCC ID: PPD-AR5BXB72P**

**REPORT NUMBER: 07U10937-1, Revision B**

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*Prepared for*

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**NVLAP LAB CODE 200065-0**

Revision History

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|-------------|-----------------------|------------------------|-------------------|
| --          | 04/15/07              | Initial Issue          | T. Chan           |
| B           | 07/17/07              | Corrected model number | S. Radecki        |

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** ATHEROS COMMUNICATIONS, INC.  
5480 GREAT AMERICA PARKWAY  
SANTA CLARA, CA 95054, USA

**EUT DESCRIPTION:** 802.11a/b/g/n PCI EXPRESS MINI CARD

**MODEL TESTED:** AR5BXB72P

**SERIAL NUMBER:** 6F648D4FSX5GD (EUT CARD)  
PT386519 (EUT Laptop)

**DATE TESTED:** APRIL 09-10, 2007

| 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.

Approved & Released For CCS By:

Tested By:



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ENGINEERING SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

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THANH NGUYEN  
EMC TECHNICIAN  
COMPLIANCE CERTIFICATION SERVICES

## 2. TEST METHODOLOGY

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

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, 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 AR5BXB72P is designed for 802.11a/b/g/n applications using the AR541X/51XX chipset with a PCI Express Mini card interface. It has three receive chains and two transmit chains (2x3 Configuration).

### **5.2. DESCRIPTION OF CLASS II CHANGE**

Adding portable configuration to operation in the 5470-5725 MHz band.

### **5.3. DESCRIPTION OF AVAILABLE ANTENNAS**

The EUT utilizes a set of three identical PIFA antennas, manufactured by WNC, with a maximum gain of 7.44 dBi in the 5.5 GHz band.

### **5.4. SOFTWARE AND FIRMWARE**

The EUT driver software installed in the host support equipment during testing was AR5002, ANWI Diagnostic Kernel Drive.

The test utility software used during testing was Art Software Revision 0.3 Build #3 Art 11n, AtherosAirPortDK.kext.

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

The worst-case mode from the original filing, as determined by the highest spurious emissions levels, is the 802.11n HT20 and 802.11n HT40 Mode.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| PERIPHERAL SUPPORT EQUIPMENT LIST |              |              |                 |        |
|-----------------------------------|--------------|--------------|-----------------|--------|
| Description                       | Manufacturer | Model        | Serial Number   | FCC ID |
| Laptop                            | Apple        | MAC BOOK Pro | PT386519        | DoC    |
| Mouse                             | Apple        | A1152        | KY5350QDTU3MA   | DoC    |
| AC Adapter                        | Apple        | A52          | Y56230009TLYDVT | DoC    |

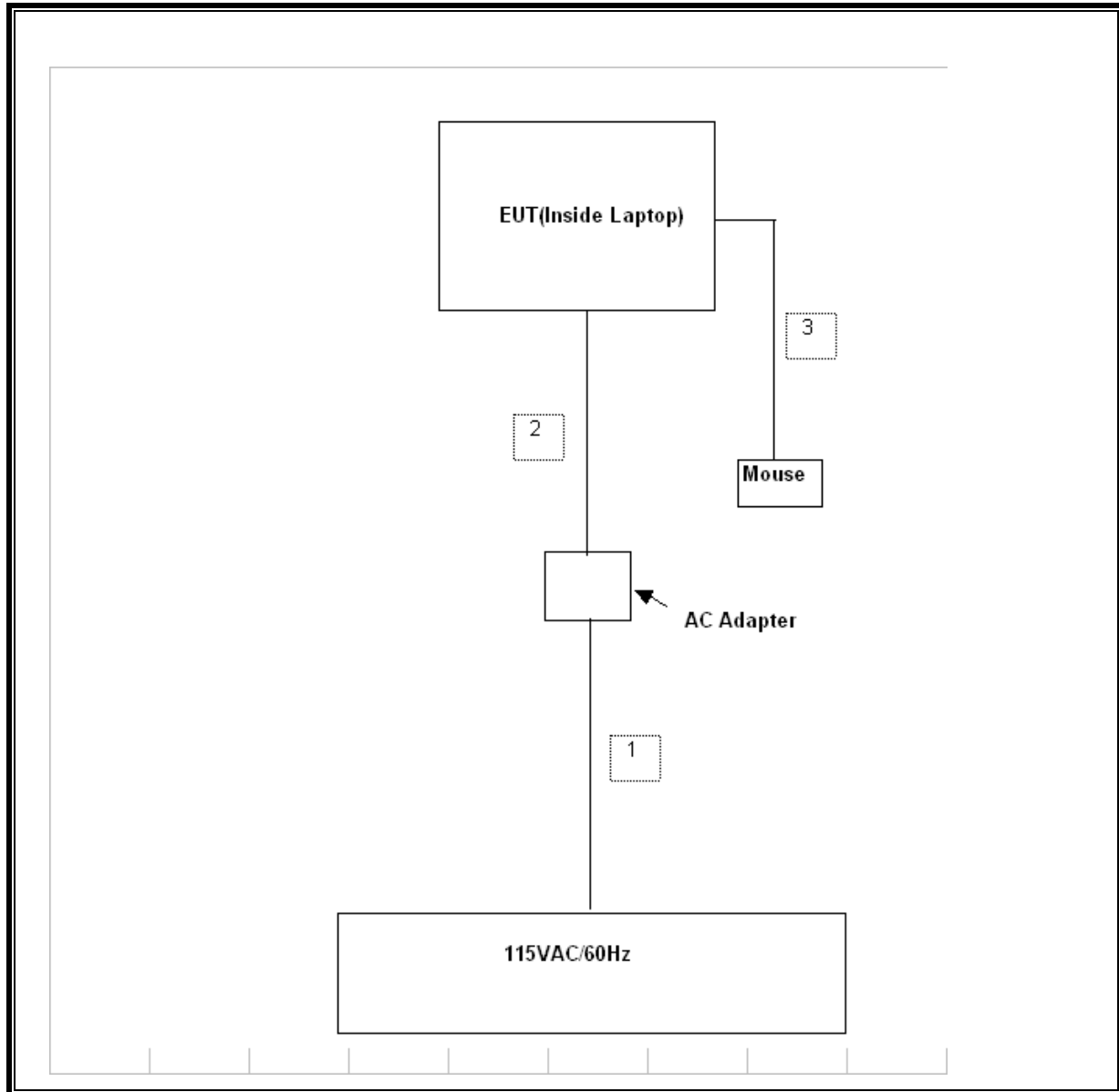
### I/O CABLES

| I/O CABLE LIST |      |                      |                |             |              |         |
|----------------|------|----------------------|----------------|-------------|--------------|---------|
| Cable No.      | Port | # of Identical Ports | Connector Type | Cable Type  | Cable Length | Remarks |
| 1              | AC   | 1                    | US 115V        | Un-shielded | 1.5m         | No      |
| 2              | DC   | 1                    | Apple DC       | Un-shielded | 1.5m         | No      |
| 3              | USB  | 1                    | USB            | Un-shielded | .7m          | No      |

### TEST SETUP

The EUT is installed in the host laptop computer. 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    |
| Quasi-Peak Adaptor              | Agilent / HP   | 85650A           | 3145A01654    | 1/21/2008  |
| SA Display Section 2            | Agilent / HP   | 85662A           | 2816A16696    | 4/7/2008   |
| SA RF Section, 1.5 GHz          | Agilent / HP   | 85680B           | 2814A04227    | 1/7/2008   |
| Antenna, Bilog 30 MHz ~ 2 Ghz   | Sunol Sciences | JB1              | A121003       | 8/13/2007  |
| Antenna, Horn 1 ~ 18 GHz        | ETS            | 3117             | 29301         | 4/22/2007  |
| Preamplifier, 1 ~ 26.5 GHz      | Agilent / HP   | 8449B            | 3008A00561    | 10/3/2007  |
| Spectrum Analyzer 3 Hz ~ 44 GHz | Agilent / HP   | E4446A           | US42070220    | 11/26/2007 |
| LISN, 10 kHz ~ 30 MHz           | FCC            | LISN-50/250-25-2 | 2023          | 9/15/2007  |
| LISN, 10 kHz ~ 30 MHz           | Solar          | 8012-50-R-24-BNC | 8379443       | 9/15/2007  |
| EMI Test Receiver               | R & S          | ESHS 20          | 827129/006    | 1/27/2008  |

## 7. LIMITS AND RESULTS

### 7.1. RADIATED EMISSIONS

#### 7.1.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

##### LIMITS

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

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

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

<sup>2</sup> Above 38.6

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

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

| Frequency<br>(MHz) | Field Strength<br>(microvolts/meter) | Measurement Distance<br>(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 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.

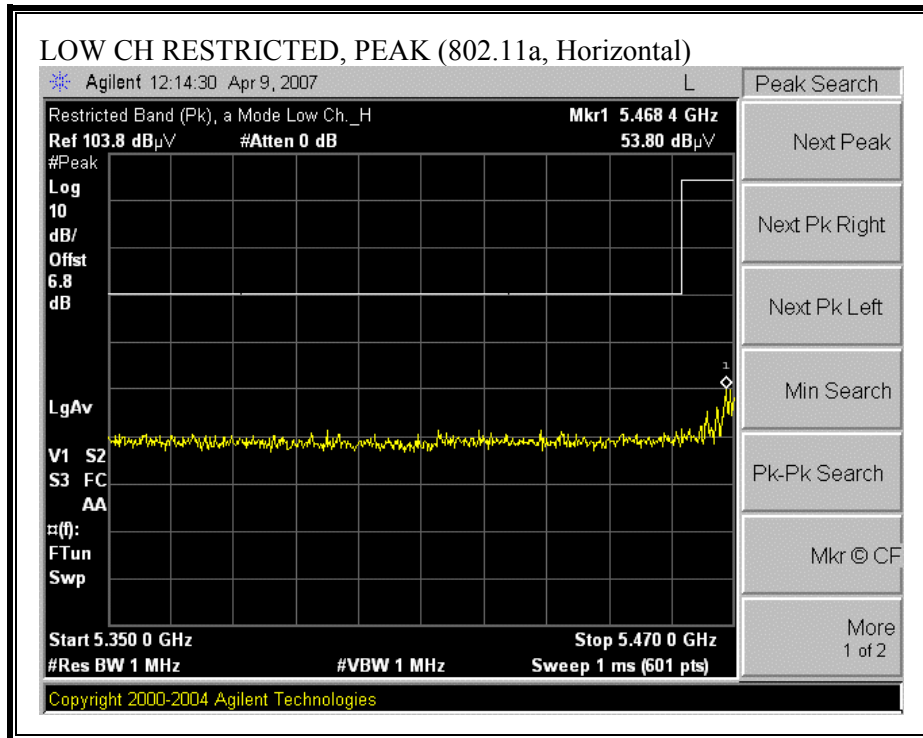
## 7.1.2. TRANSMITTER ABOVE 1 GHZ FOR 5470 TO 5725 MHz BAND

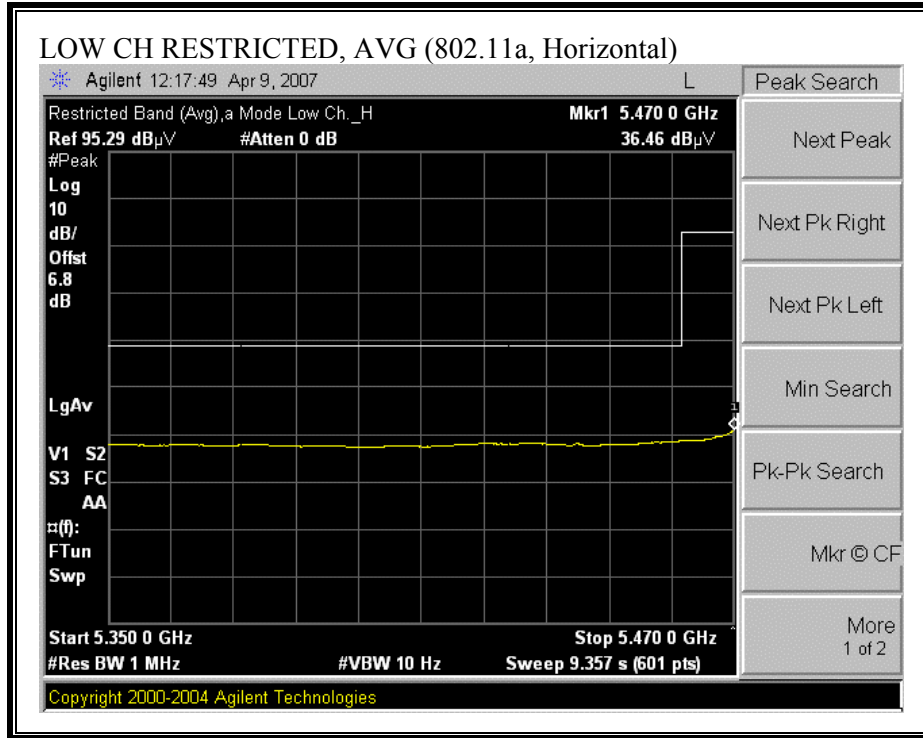
### **REPORTING NOTES**

The nearby restricted band stops 10 MHz below the authorized band. A single plot is taken to show both restricted band emission levels and out-of-band radiated spurious emission levels at and near the lower authorized bandedge. The out-of-band spurious limits of -7 dBm Peak EIRP and -27 dBm Average EIRP are converted to the equivalent 3 meter field strengths of 88.2 dBuV/m Peak and 68.2 dBuV/m Average, respectively, for reporting purposes.

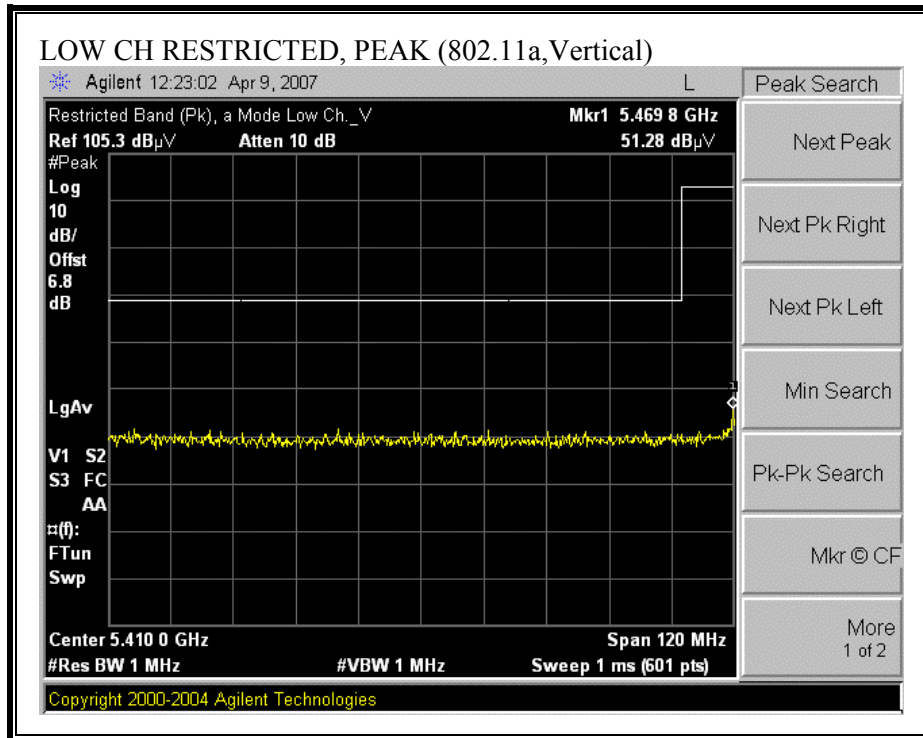
The out-of- band radiated spurious emission levels at and near the upper authorized bandedge are reported as EIRP values.

**RESTRICTED BAND & BANDEDGE (802.11a Mode LOW CHANNEL, HORIZONTAL)**

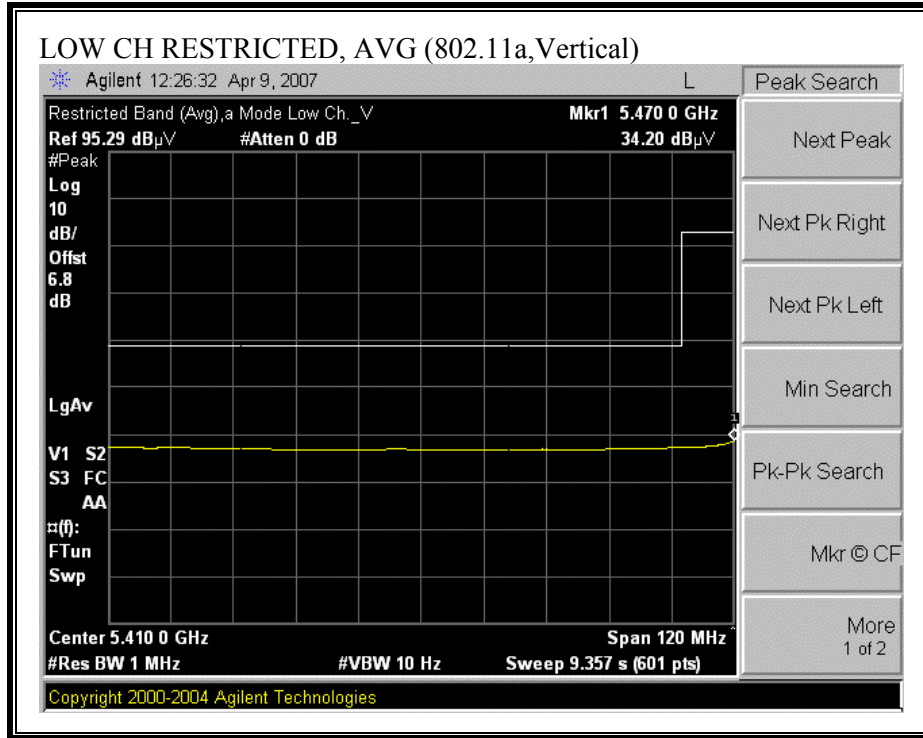




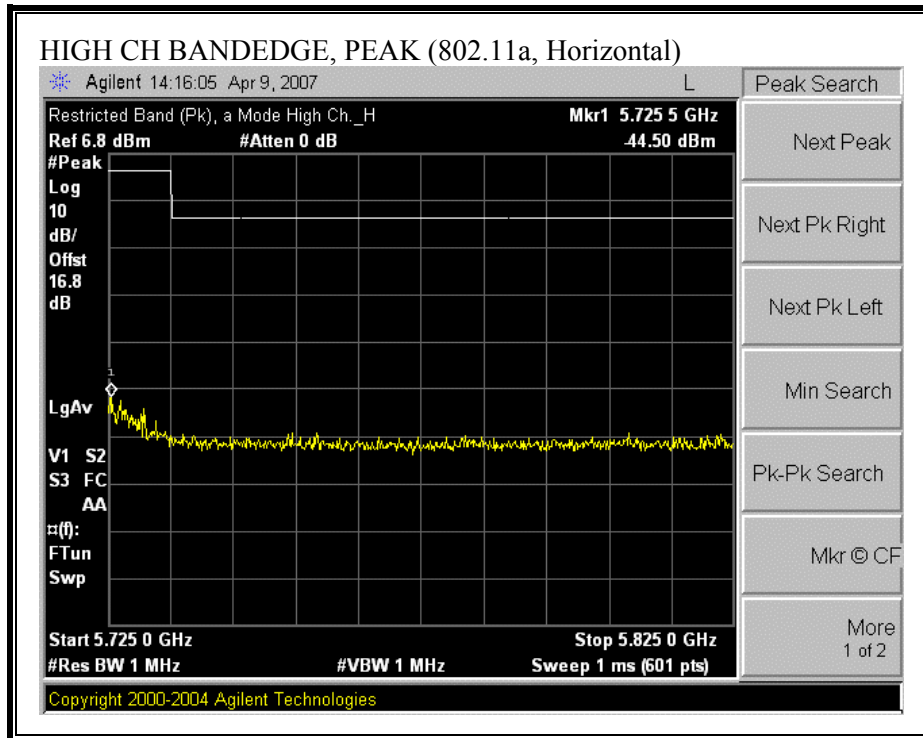
**RESTRICTED BAND & BANDEDGE (802.11a MODE, LOW CHANNEL, VERTICAL)**

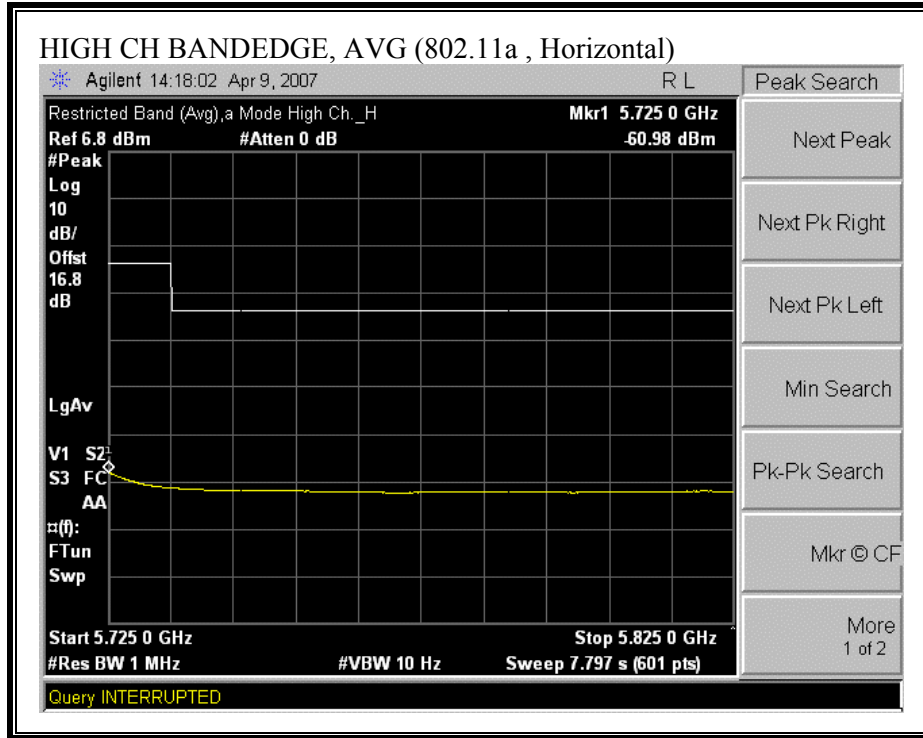




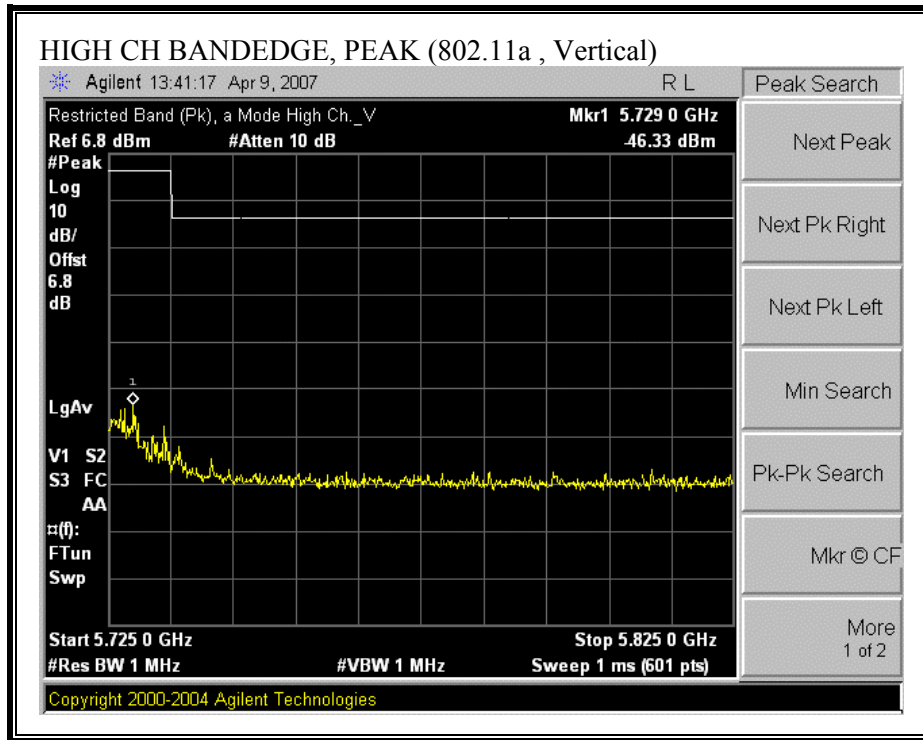


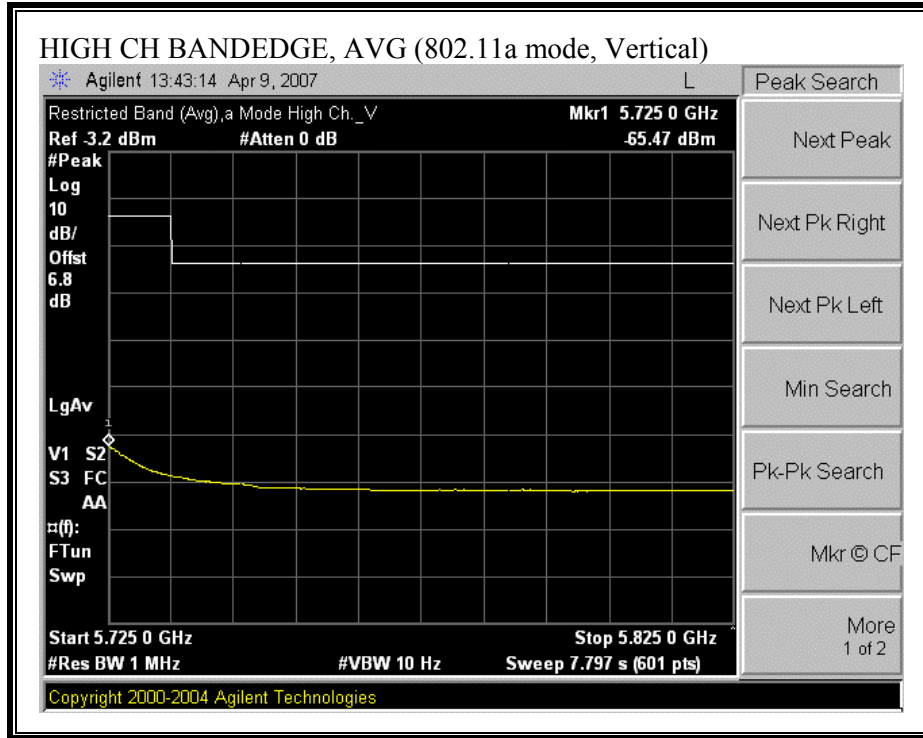
**BANDEDGE (802.11a, HIGH CHANNEL, HORIZONTAL)**



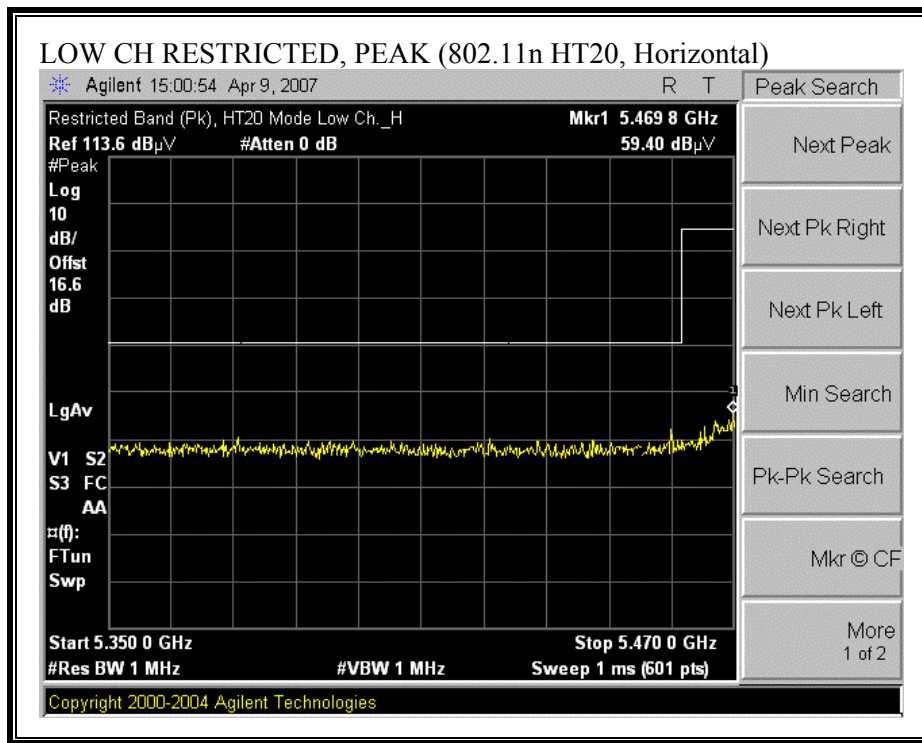


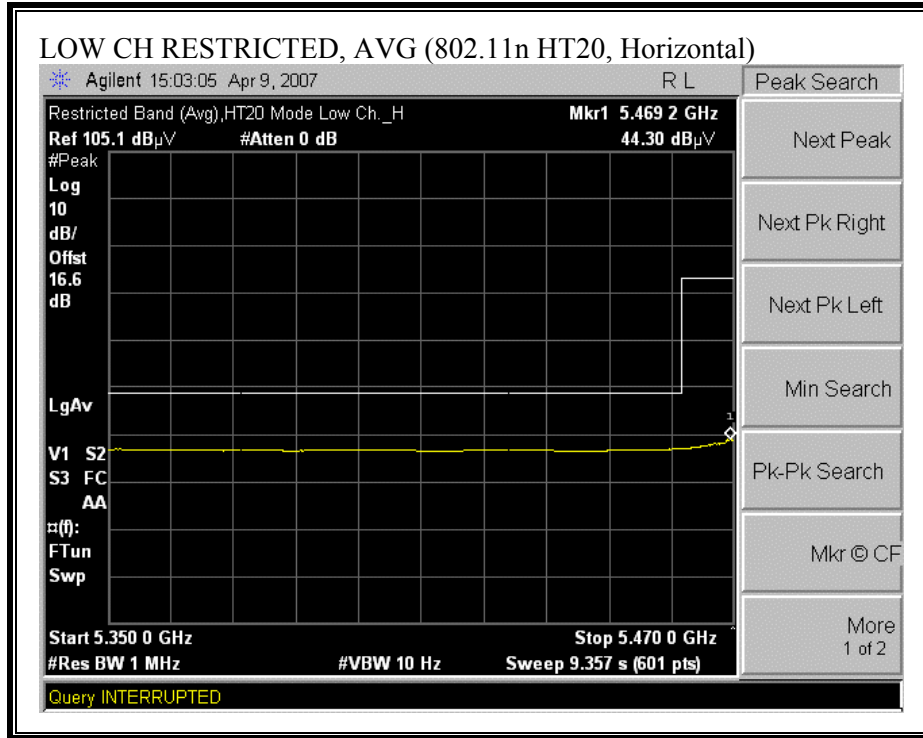
**BANDEDGE (802.11a, HIGH CHANNEL, VERTICAL)**



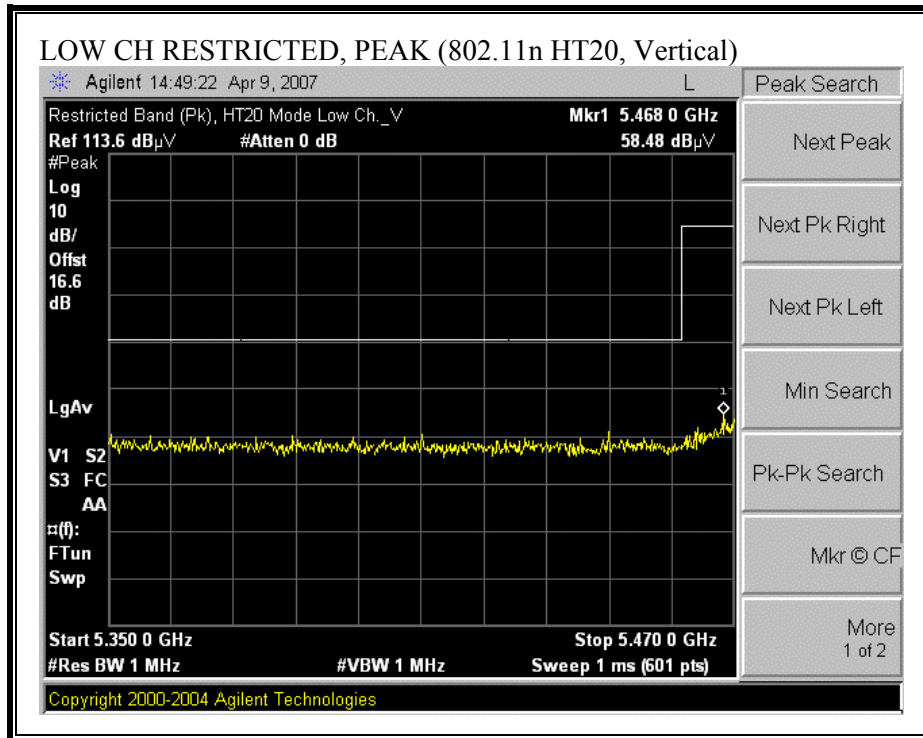


**RESTRICTED BAND & BANDEDGE (802.11n HT20 LOW CHANNEL, HORIZONTAL)**

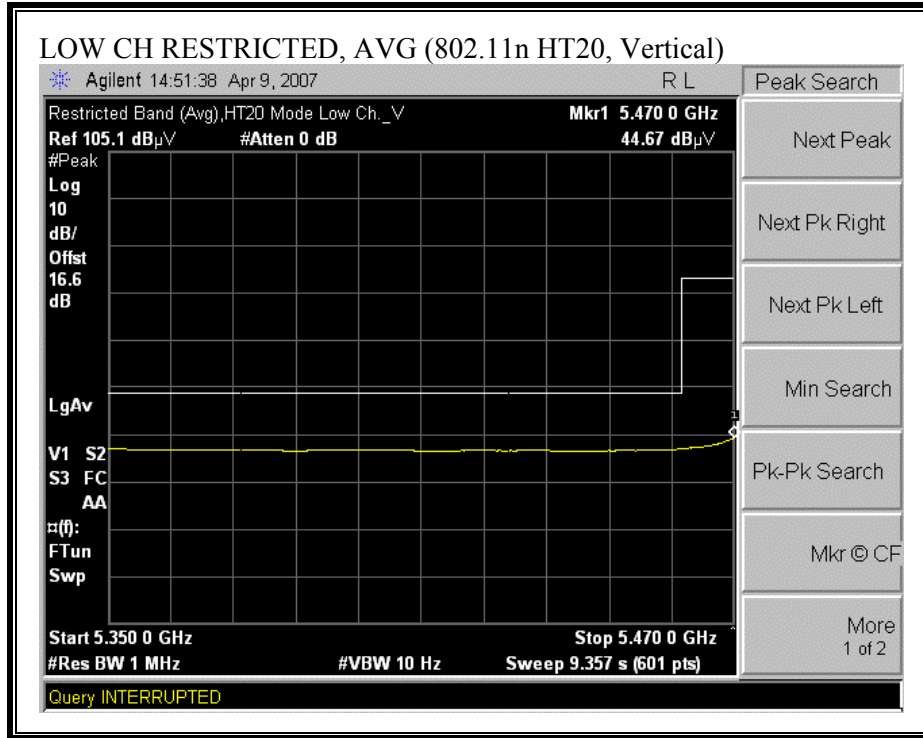




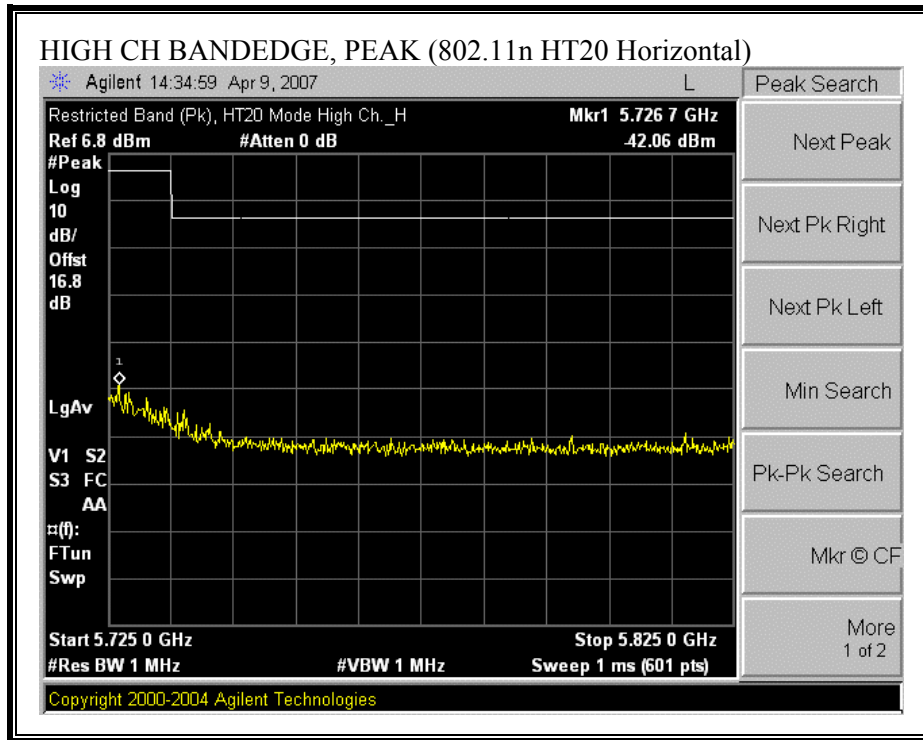
**RESTRICTED BAND & BANDEDGE (802.11a MODE, LOW CHANNEL, VERTICAL)**

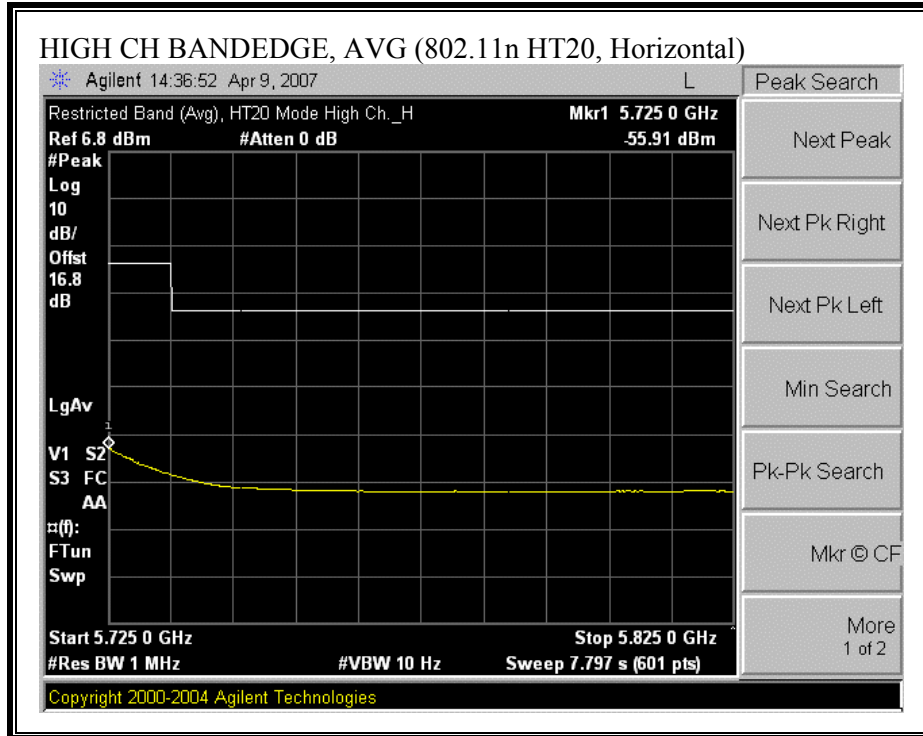




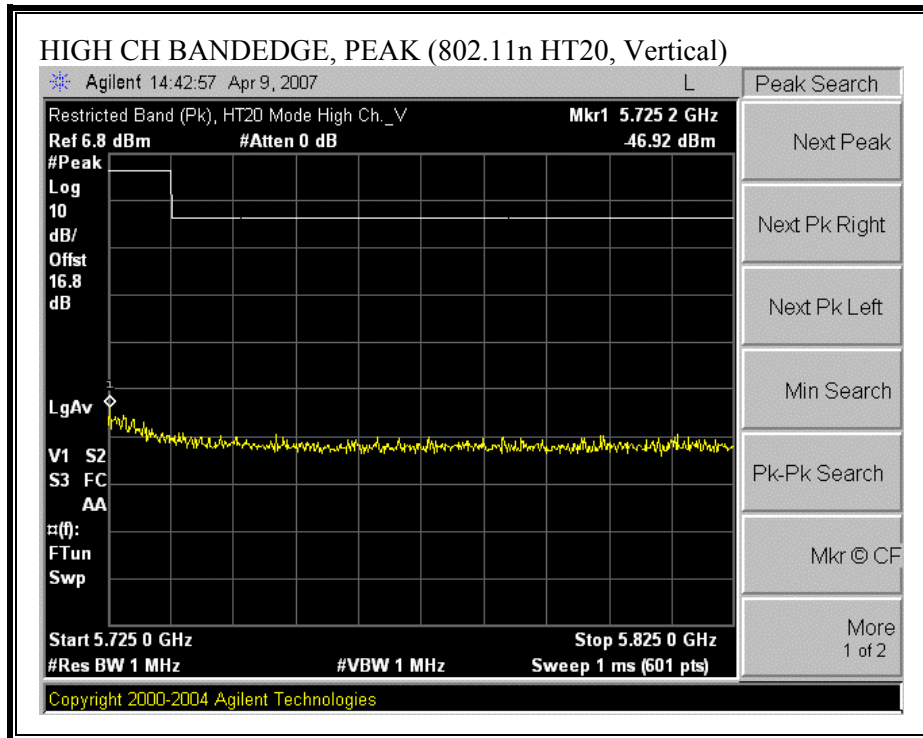


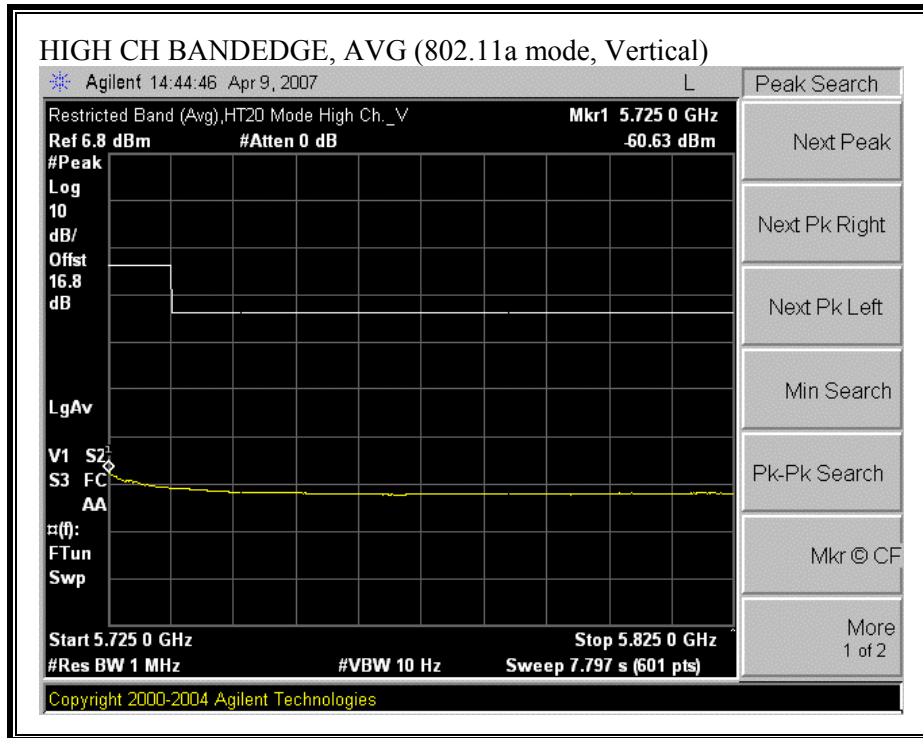
**BANDEDGE (802.11n HT20, HIGH CHANNEL, HORIZONTAL)**



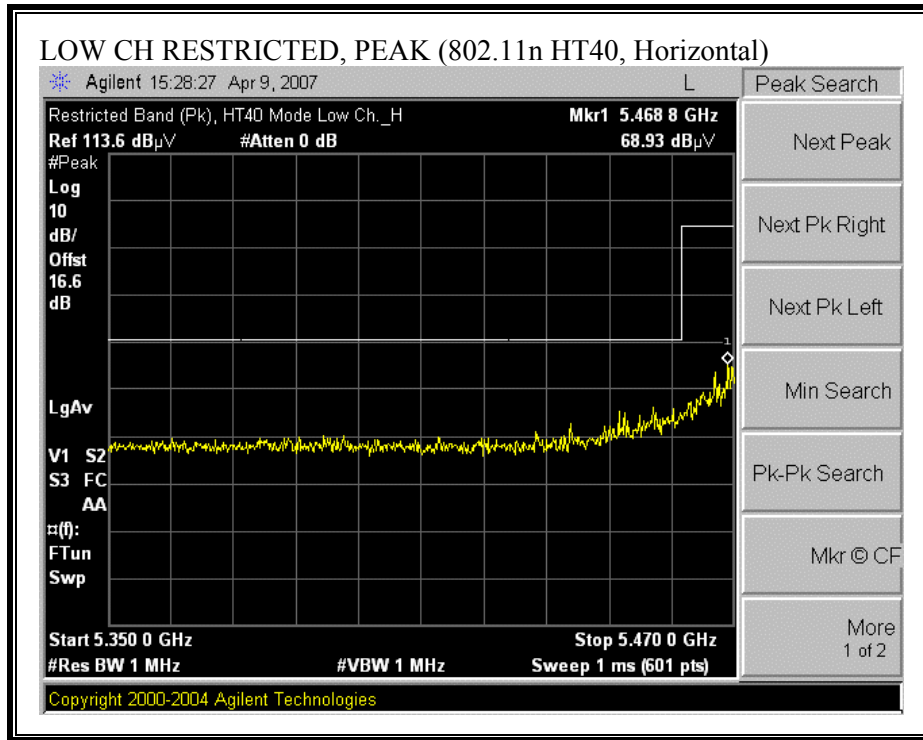


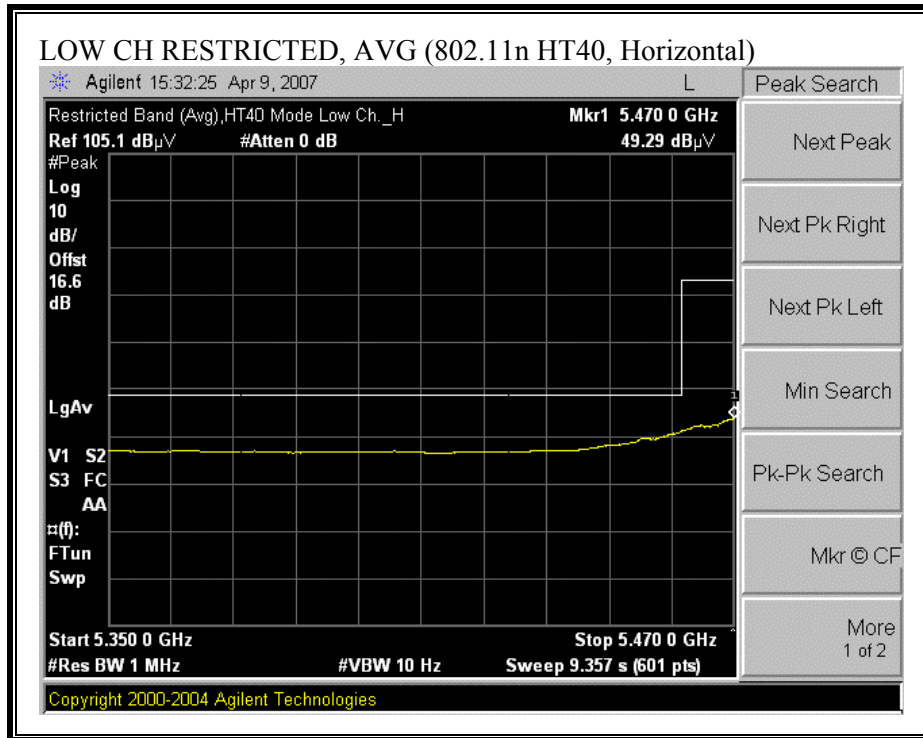
**BANDEDGE (802.11n HT20, HIGH CHANNEL, VERTICAL)**



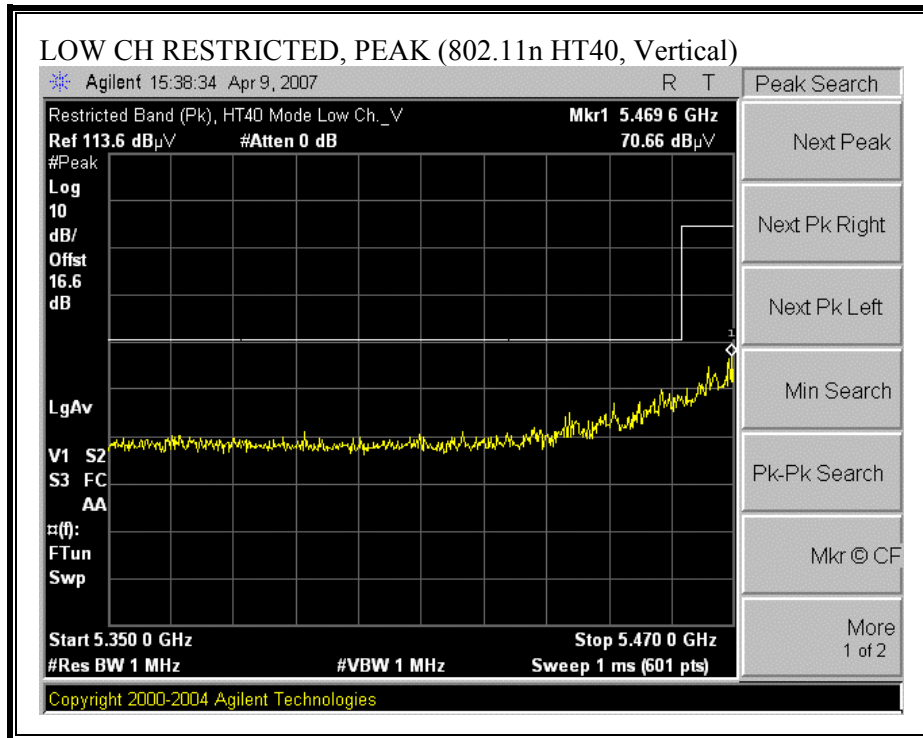


**RESTRICTED BAND & BANDEDGE (802.11n HT40 LOW CHANNEL, HORIZONTAL)**

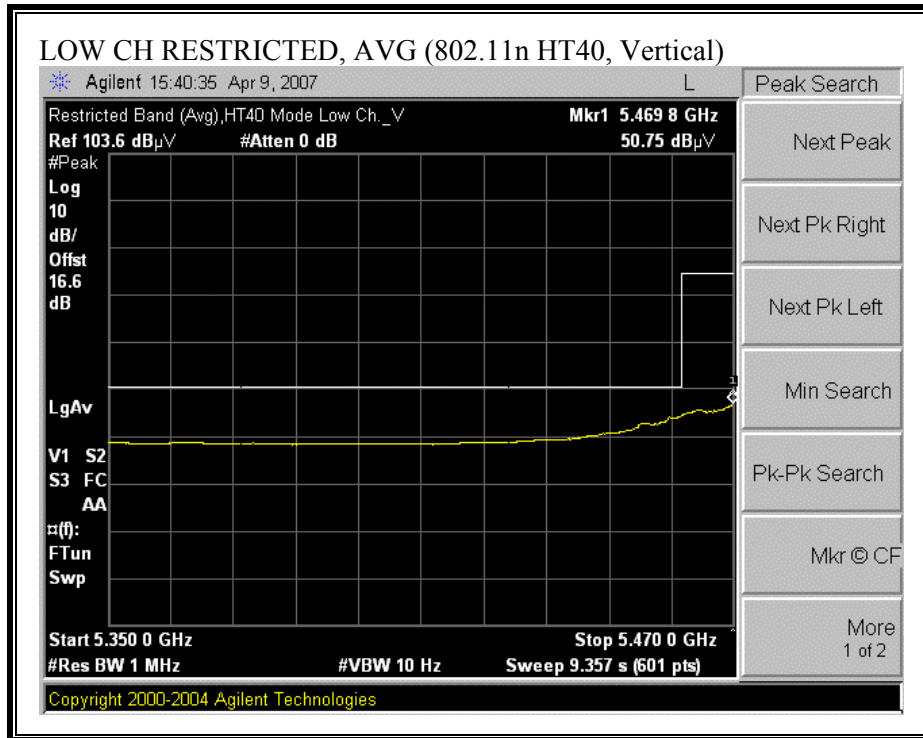




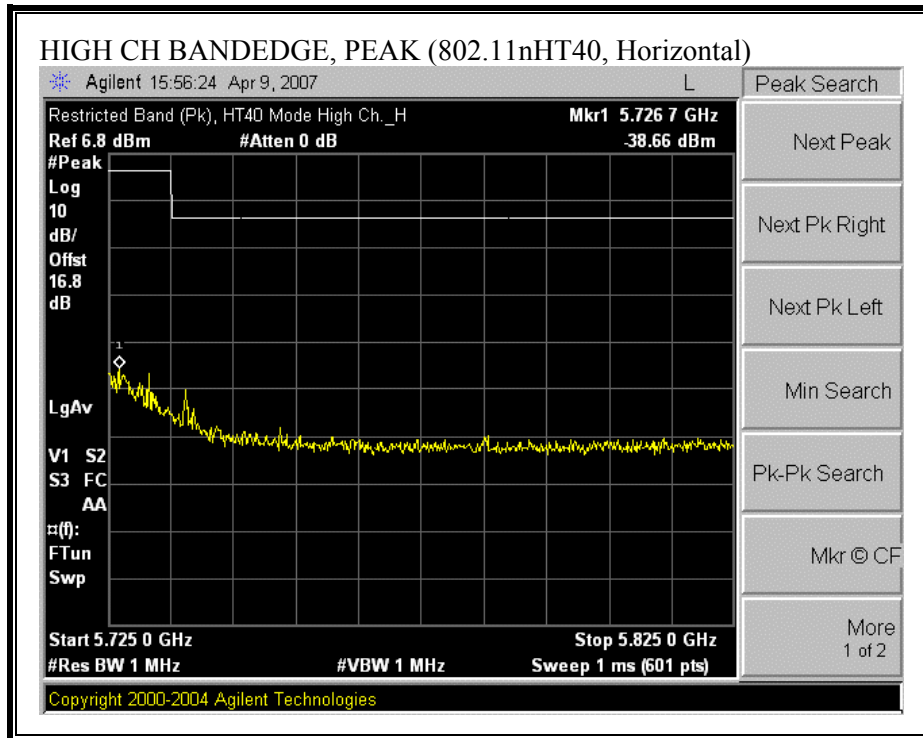
**RESTRICTED BAND & BANDEDGE (802.11n HT40, LOW CHANNEL, VERTICAL)**

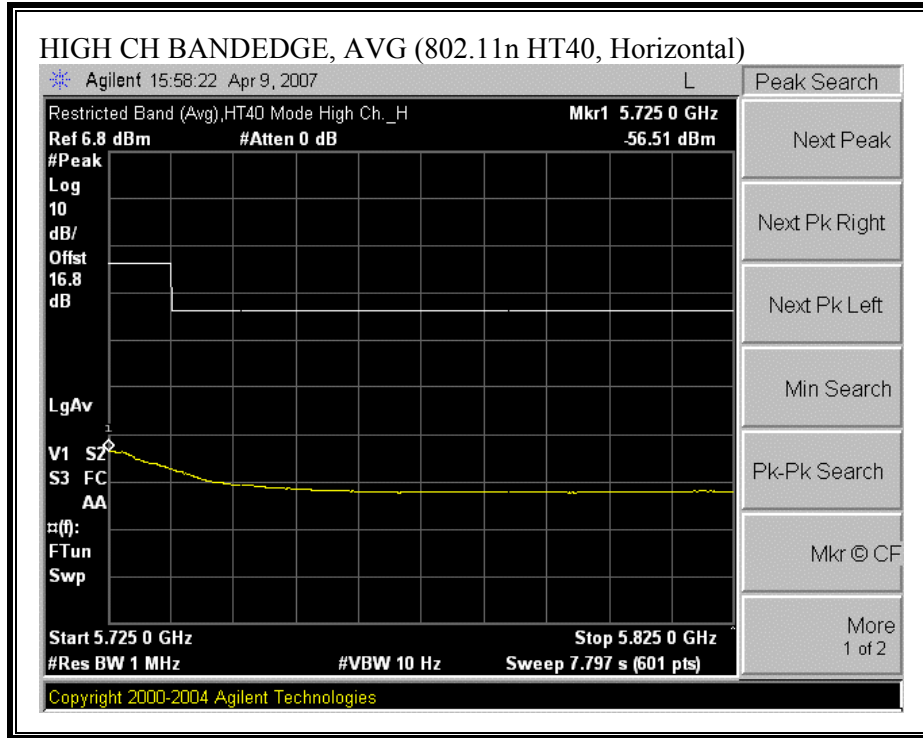




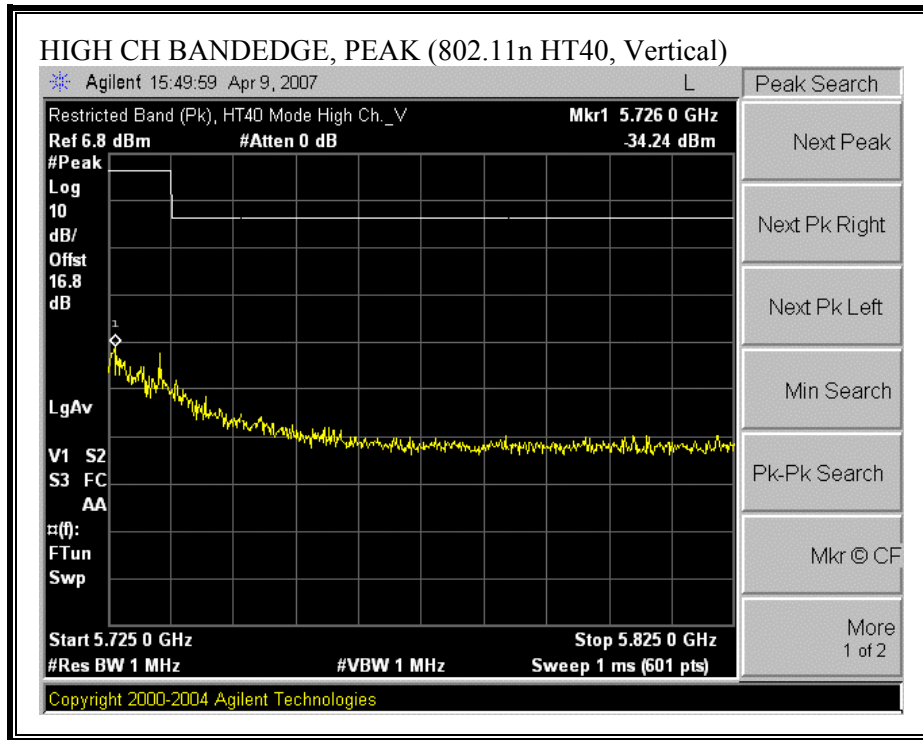


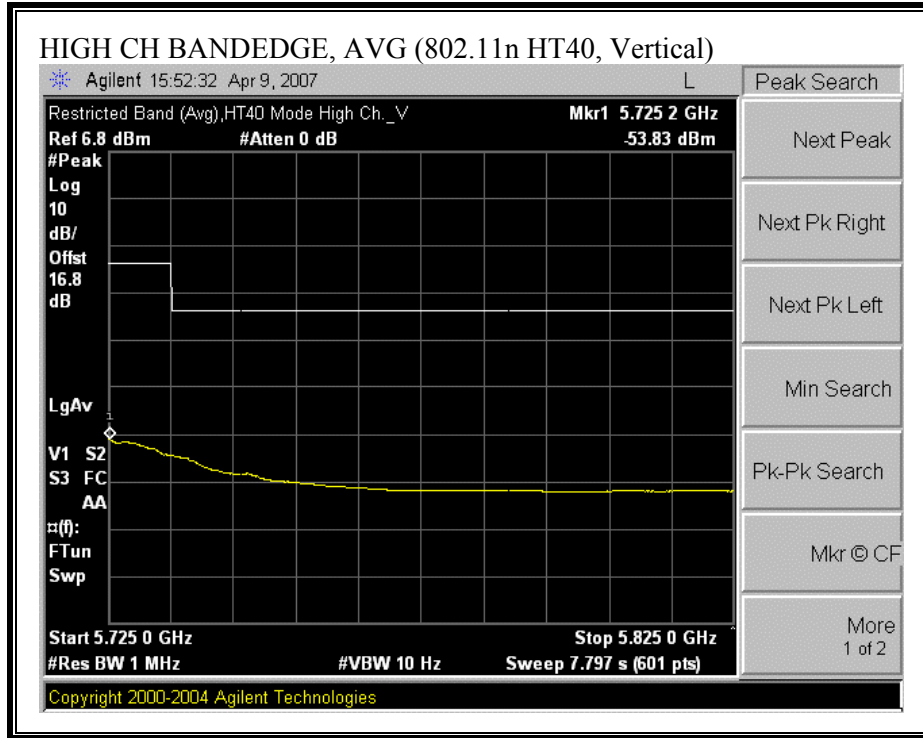
**BANDEDGE (802.11n HT40, HIGH CHANNEL, HORIZONTAL)**





**BANDEDGE (802.11n HT40, HIGH CHANNEL, VERTICAL)**





**HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)**

**High Frequency Measurement**

Compliance Certification Services, Fremont 5 meter chamber B

Company: APPLE COMPUTER INC.  
 Project #: 07U10937  
 Date: 4-9-2007  
 Test Engineer: Mengitu Mekuria  
 Configuration: EUT Inside the Laptop  
 Mode: Tx 11a

**Test Equipment:**

|                                      |   |                        |              |                     |
|--------------------------------------|---|------------------------|--------------|---------------------|
| Horn 1-18GHz<br>T119; S/N: 29301 @3m | Pre-amplifier 1-26GHz<br>T145 Agilent 3008A0050 | Pre-amplifier 26-40GHz | Horn > 18GHz | Limit<br>FCC 15.209 |
|--------------------------------------|---|------------------------|--------------|---------------------|

Hi Frequency Cables

|              |              |                                   |     |               |   |
|--------------|--------------|-----------------------------------|-----|---------------|---|
| 2 foot cable | 3 foot cable | 12 foot cable<br>Gordon 203134001 | HPF | Reject Filter | <b>Peak Measurements</b><br>RBW=VBW=1MHz<br><b>Average Measurements</b><br>RBW=1MHz; VBW=10Hz |
|--------------|--------------|-----------------------------------|-----|---------------|---|

| f GHz   | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fldr 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 5500MHz</b>                               |          |              |                |         |       |        |           |         |             |            |               |                |           |            |             |
| 1.040   | 3.0      | 55.4         | 33.2           | 27.8    | 2.9   | -36.1  | 0.0       | 0.0     | 50.1        | 27.8       | 74            | 54             | -23.9     | -26.2      | H           |
| 1.330   | 3.0      | 46.8         | 33.3           | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 43.1        | 29.6       | 74            | 54             | -30.9     | -24.4      | H           |
| 1.997   | 3.0      | 46.5         | 32.1           | 31.6    | 4.1   | -35.4  | 0.0       | 0.0     | 46.7        | 32.3       | 74            | 54             | -27.3     | -21.7      | H           |
| 1.013   | 3.0      | 53.4         | 32.2           | 27.7    | 2.9   | -36.1  | 0.0       | 0.0     | 47.9        | 26.7       | 74            | 54             | -26.1     | -27.3      | V           |
| 1.330   | 3.0      | 49.0         | 34.9           | 29.0    | 3.3   | -35.9  | 0.0       | 1.0     | 46.3        | 32.2       | 74            | 54             | -27.7     | -21.8      | V           |
| 1.997   | 3.0      | 50.1         | 33.3           | 31.6    | 4.1   | -35.4  | 0.0       | 0.0     | 50.3        | 33.5       | 74            | 54             | -23.7     | -20.5      | V           |
| <b>MID Ch 5600MHz</b>                               |          |              |                |         |       |        |           |         |             |            |               |                |           |            |             |
| 1.007   | 3.0      | 51.3         | 33.0           | 27.7    | 2.9   | -36.1  | 0.0       | 0.0     | 45.7        | 27.4       | 74            | 54             | -28.3     | -26.6      | H           |
| 1.330   | 3.0      | 46.5         | 33.3           | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 42.8        | 29.6       | 74            | 54             | -31.2     | -24.4      | H           |
| 1.500   | 3.0      | 47.0         | 31.4           | 29.6    | 3.5   | -35.8  | 0.0       | 0.0     | 44.3        | 28.7       | 74            | 54             | -29.7     | -25.3      | H           |
| 1.997   | 3.0      | 47.5         | 30.7           | 31.6    | 4.1   | -35.4  | 0.0       | 0.0     | 47.7        | 30.9       | 74            | 54             | -26.3     | -23.1      | H           |
| 1.040   | 3.0      | 52.3         | 32.6           | 27.8    | 2.9   | -36.1  | 0.0       | 0.0     | 46.9        | 27.2       | 74            | 54             | -27.1     | -26.8      | V           |
| 1.330   | 3.0      | 48.9         | 34.3           | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 45.2        | 30.6       | 74            | 54             | -28.8     | -23.4      | V           |
| 1.990   | 3.0      | 49.8         | 33.4           | 31.5    | 4.0   | -35.4  | 0.0       | 0.0     | 50.0        | 33.6       | 74            | 54             | -24.0     | -20.4      | V           |
| 2.490   | 3.0      | 46.8         | 30.0           | 31.9    | 4.6   | -35.1  | 0.0       | 0.0     | 48.2        | 31.4       | 74            | 54             | -25.8     | -22.6      | V           |
| <b>High ch 5700MHz</b>                              |          |              |                |         |       |        |           |         |             |            |               |                |           |            |             |
| 1.007   | 3.0      | 52.0         | 33.4           | 27.7    | 2.9   | -36.1  | 0.0       | 0.0     | 46.4        | 27.9       | 74            | 54             | -27.6     | -26.1      | V           |
| 1.330   | 3.0      | 46.6         | 33.8           | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 42.9        | 30.1       | 74            | 54             | -31.1     | -23.9      | V           |
| 1.500   | 3.0      | 48.2         | 32.2           | 29.6    | 3.5   | -35.8  | 0.0       | 0.0     | 45.5        | 29.5       | 74            | 54             | -28.5     | -24.5      | V           |
| 1.997   | 3.0      | 47.2         | 30.8           | 31.6    | 4.1   | -35.4  | 0.0       | 0.0     | 47.4        | 31.0       | 74            | 54             | -26.6     | -23.0      | V           |
| 1.003   | 3.0      | 54.6         | 33.7           | 27.7    | 2.9   | -36.1  | 0.0       | 0.0     | 49.0        | 28.1       | 74            | 54             | -25.0     | -25.9      | H           |
| 1.330   | 3.0      | 48.2         | 34.2           | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 44.6        | 30.5       | 74            | 54             | -29.4     | -23.5      | H           |
| 1.993   | 3.0      | 50.0         | 34.3           | 31.5    | 4.0   | -35.4  | 0.0       | 0.0     | 50.2        | 34.5       | 74            | 54             | -23.8     | -19.5      | H           |
| 2.490   | 3.0      | 46.5         | 30.0           | 31.9    | 4.6   | -35.1  | 0.0       | 0.0     | 47.8        | 31.4       | 74            | 54             | -26.2     | -22.6      | H           |
| No other emissions were detected above noise floor. |          |              |                |         |       |        |           |         |             |            |               |                |           |            |             |

Rev. 5.1.6

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

**HARMONICS AND SPURIOUS EMISSIONS (802.11n HT20 MODE)**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m chamber B

Company: APPLE COMPUTER INC.  
 Project #: 07U10937  
 Date: 4-9-2007  
 Test Engineer: Mengitu Mekuria  
 Configuration: EUT Inside the Laptop  
 Mode: Tx 802.11n HT20

**Test Equipment:**

|                                      |   |                        |              |                     |
|--------------------------------------|---|------------------------|--------------|---------------------|
| Horn 1-18GHz<br>T119; S/N: 29301 @3m | Pre-amplifier 1-26GHz<br>T145 Agilent 3008A0050 | Pre-amplifier 26-40GHz | Horn > 18GHz | Limit<br>FCC 15.209 |
|--------------------------------------|---|------------------------|--------------|---------------------|

Hi Frequency Cables

|              |              |                                   |     |               |   |
|--------------|--------------|-----------------------------------|-----|---------------|---|
| 2 foot cable | 3 foot cable | 12 foot cable<br>Gordon 203134001 | HPF | Reject Filter | Peak Measurements<br>RBW=VBW=1MHz<br>Average Measurements<br>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 5500MHz</b>                              |          |              |               |         |       |        |           |         |             |            |               |                |           |            |             |
| 1.000  | 3.0      | 56.6         | 34.7          | 27.7    | 2.9   | -36.2  | 0.0       | 0.0     | 51.0        | 29.1       | 74            | 54             | -23.0     | -24.9      | H           |
| 1.330  | 3.0      | 47.2         | 33.9          | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 43.5        | 30.2       | 74            | 54             | -30.5     | -23.8      | H           |
| 1.997  | 3.0      | 46.8         | 32.4          | 31.6    | 4.1   | -35.4  | 0.0       | 0.0     | 47.0        | 32.6       | 74            | 54             | -27.0     | -21.4      | H           |
| 1.010  | 3.0      | 54.0         | 31.9          | 27.7    | 2.9   | -36.1  | 0.0       | 0.0     | 48.5        | 26.4       | 74            | 54             | -25.5     | -27.6      | V           |
| 1.330  | 3.0      | 50.0         | 35.3          | 29.0    | 3.3   | -35.9  | 0.0       | 1.0     | 47.4        | 32.6       | 74            | 54             | -26.6     | -21.4      | V           |
| 1.997  | 3.0      | 51.3         | 33.3          | 31.6    | 4.1   | -35.4  | 0.0       | 0.0     | 51.5        | 33.5       | 74            | 54             | -22.5     | -20.5      | V           |
| 2.460  | 3.0      | 51.7         | 32.8          | 31.8    | 4.6   | -35.1  | 0.0       | 0.0     | 53.0        | 34.1       | 74            | 54             | -21.0     | -19.9      | V           |
| <b>MID Ch 5600MHz</b>                              |          |              |               |         |       |        |           |         |             |            |               |                |           |            |             |
| 1.007  | 3.0      | 51.3         | 33.4          | 27.7    | 2.9   | -36.1  | 0.0       | 0.0     | 45.7        | 27.8       | 74            | 54             | -28.3     | -26.2      | H           |
| 1.330  | 3.0      | 48.7         | 34.2          | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 45.1        | 30.5       | 74            | 54             | -28.9     | -23.5      | H           |
| 1.997  | 3.0      | 45.0         | 30.0          | 31.6    | 4.1   | -35.4  | 0.0       | 0.0     | 45.2        | 30.2       | 74            | 54             | -28.8     | -23.8      | H           |
| 1.040  | 3.0      | 53.0         | 34.4          | 27.8    | 2.9   | -36.1  | 0.0       | 0.0     | 47.6        | 29.1       | 74            | 54             | -26.4     | -24.9      | V           |
| 1.330  | 3.0      | 48.2         | 33.8          | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 44.5        | 30.1       | 74            | 54             | -29.5     | -23.9      | V           |
| 1.990  | 3.0      | 48.6         | 33.9          | 31.5    | 4.0   | -35.4  | 0.0       | 0.0     | 48.7        | 34.1       | 74            | 54             | -25.3     | -19.9      | V           |
| 2.490  | 3.0      | 46.3         | 30.2          | 31.9    | 4.6   | -35.1  | 0.0       | 0.0     | 47.7        | 31.6       | 74            | 54             | -26.3     | -22.4      | V           |
| <b>High ch 5700MHz</b>                             |          |              |               |         |       |        |           |         |             |            |               |                |           |            |             |
| 1.000  | 3.0      | 52.4         | 33.8          | 27.7    | 2.9   | -36.2  | 0.0       | 0.0     | 46.8        | 28.2       | 74            | 54             | -27.2     | -25.8      | H           |
| 1.330  | 3.0      | 47.1         | 32.3          | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 43.4        | 28.7       | 74            | 54             | -30.6     | -25.3      | H           |
| 1.997  | 3.0      | 47.3         | 32.0          | 31.6    | 4.1   | -35.4  | 0.0       | 0.0     | 47.5        | 32.2       | 74            | 54             | -26.5     | -21.8      | H           |
| 2.483  | 3.0      | 46.5         | 30.0          | 31.9    | 4.6   | -35.1  | 0.0       | 0.0     | 47.9        | 31.4       | 74            | 54             | -26.1     | -22.6      | H           |
| 1.003  | 3.0      | 50.3         | 32.3          | 27.7    | 2.9   | -36.1  | 0.0       | 0.0     | 44.7        | 26.7       | 74            | 54             | -29.3     | -27.3      | V           |
| 1.330  | 3.0      | 49.5         | 34.9          | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 45.8        | 31.2       | 74            | 54             | -28.2     | -22.8      | V           |
| 1.993  | 3.0      | 50.7         | 35.4          | 31.5    | 4.0   | -35.4  | 0.0       | 0.0     | 50.9        | 35.6       | 74            | 54             | -23.1     | -18.4      | V           |
| 2.490  | 3.0      | 46.0         | 31.0          | 31.9    | 4.6   | -35.1  | 0.0       | 0.0     | 47.4        | 32.4       | 74            | 54             | -26.6     | -21.6      | V           |
| No other emissions were detected above noise floor |          |              |               |         |       |        |           |         |             |            |               |                |           |            |             |
| Rev. 5.1.6   |          |              |               |         |       |        |           |         |             |            |               |                |           |            |             |

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

**HARMONICS AND SPURIOUS EMISSIONS (802.11n HT40 MODE)**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5 meter chamber B

Company: APPLE COMPUTER INC.  
 Project #: 07U10937  
 Date: 4-9-2007  
 Test Engineer: Mengitu Mekuria  
 Configuration: EUT Inside the Laptop  
 Mode: Tx 802.11n HT40

**Test Equipment:**

|                      |                       |                       |              |            |
|----------------------|-----------------------|-----------------------|--------------|------------|
| Horn 1-18GHz         | Pre-amplifer 1-26GHz  | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit      |
| T119; S/N: 29301 @3m | T145 Agilent 3008A005 |                       |              | FCC 15.209 |

Hi Frequency Cables

|              |              |                  |     |               |  |
|--------------|--------------|------------------|-----|---------------|--|
| 2 foot cable | 3 foot cable | 12 foot cable    | HPF | Reject Filter | Peak Measurements<br>RBW=VBW=1MHz<br>Average Measurements<br>RBW=1MHz ; VBW=10Hz |
|              |              | Gordon 203134001 |     |               |  |

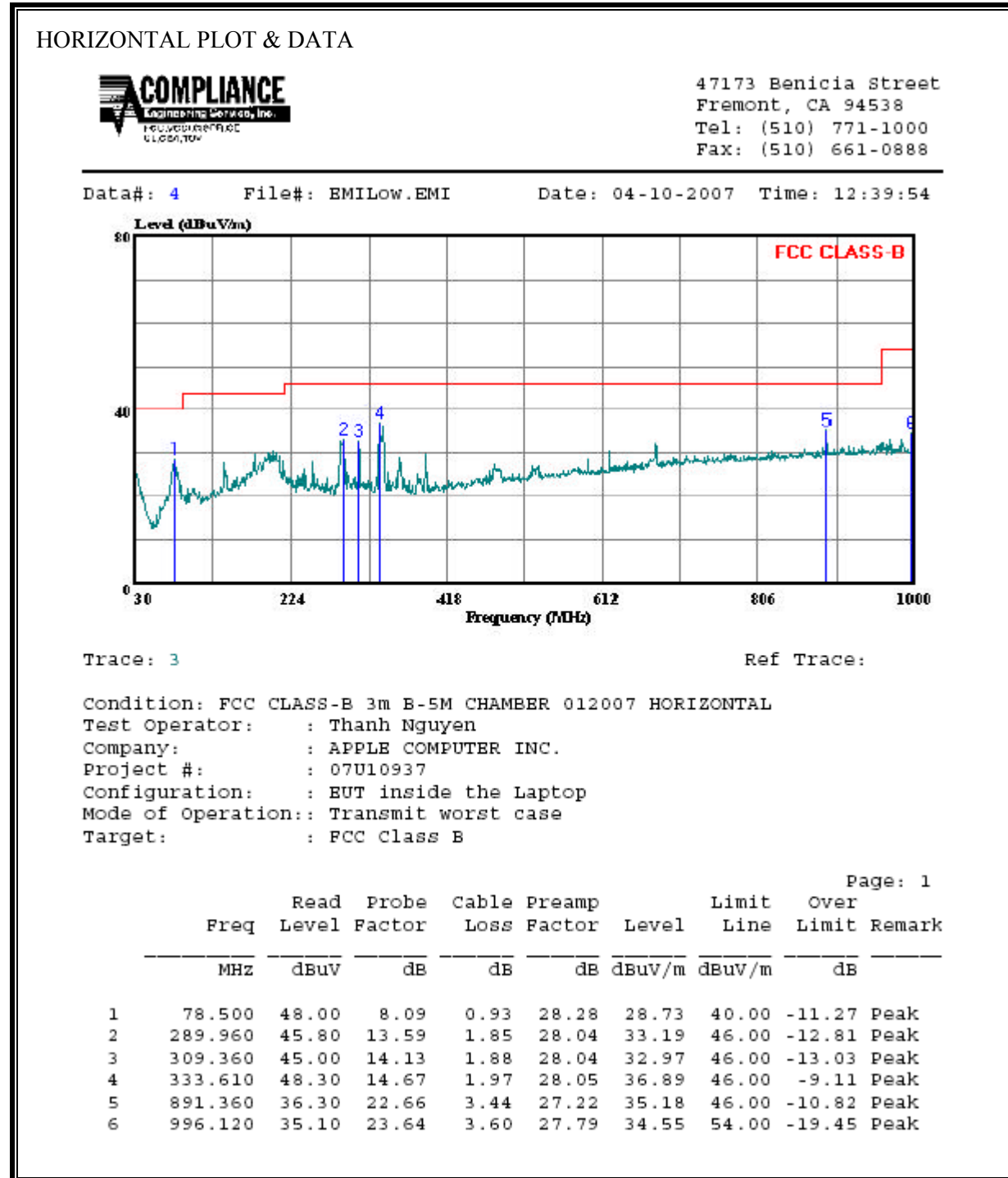
| f GHz   | Dist (m) | Read Pk dBuV | Read Avg dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Filt dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|---|----------|--------------|---------------|---------|-------|--------|-----------|---------|-------------|------------|---------------|----------------|-----------|------------|-------------|
| <b>Low ch 5510MHz</b>                               |          |              |               |         |       |        |           |         |             |            |               |                |           |            |             |
| 1.003   | 3.0      | 50.6         | 32.1          | 27.7    | 2.9   | -36.1  | 0.0       | 0.0     | 45.0        | 26.5       | 74            | 54             | -29.0     | -27.5      | H           |
| 1.330   | 3.0      | 47.5         | 33.2          | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 43.8        | 29.5       | 74            | 54             | -30.2     | -24.5      | H           |
| 1.997   | 3.0      | 47.6         | 33.7          | 31.6    | 4.1   | -35.4  | 0.0       | 0.0     | 47.8        | 33.9       | 74            | 54             | -26.2     | -20.1      | H           |
| 1.003   | 3.0      | 51.2         | 32.4          | 27.7    | 2.9   | -36.1  | 0.0       | 0.0     | 45.6        | 26.8       | 74            | 54             | -28.4     | -27.2      | V           |
| 1.330   | 3.0      | 49.7         | 34.5          | 29.0    | 3.3   | -35.9  | 0.0       | 1.0     | 47.0        | 31.8       | 74            | 54             | -27.0     | -22.2      | V           |
| 1.997   | 3.0      | 49.6         | 33.8          | 31.6    | 4.1   | -35.4  | 0.0       | 0.0     | 49.8        | 34.0       | 74            | 54             | -24.2     | -20.0      | V           |
| 2.450   | 3.0      | 53.4         | 33.5          | 31.8    | 4.6   | -35.1  | 0.0       | 0.0     | 54.7        | 34.8       | 74            | 54             | -19.3     | -19.2      | V           |
| <b>MID Ch 5600MHz</b>                               |          |              |               |         |       |        |           |         |             |            |               |                |           |            |             |
| 1.007   | 3.0      | 52.7         | 34.4          | 27.7    | 2.9   | -36.1  | 0.0       | 0.0     | 47.2        | 28.9       | 74            | 54             | -26.8     | -25.1      | H           |
| 1.330   | 3.0      | 47.6         | 33.1          | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 43.9        | 29.4       | 74            | 54             | -30.1     | -24.6      | H           |
| 1.997   | 3.0      | 45.3         | 30.3          | 31.6    | 4.1   | -35.4  | 0.0       | 0.0     | 45.5        | 30.5       | 74            | 54             | -28.5     | -23.5      | H           |
| 1.040   | 3.0      | 50.6         | 32.8          | 27.8    | 2.9   | -36.1  | 0.0       | 0.0     | 45.2        | 27.4       | 74            | 54             | -28.8     | -26.6      | V           |
| 1.330   | 3.0      | 49.2         | 34.1          | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 45.5        | 30.4       | 74            | 54             | -28.5     | -23.6      | V           |
| 1.990   | 3.0      | 49.2         | 33.2          | 31.5    | 4.0   | -35.4  | 0.0       | 0.0     | 49.4        | 33.4       | 74            | 54             | -24.6     | -20.6      | V           |
| 2.490   | 3.0      | 46.5         | 29.4          | 31.9    | 4.6   | -35.1  | 0.0       | 0.0     | 47.8        | 30.8       | 74            | 54             | -26.2     | -23.2      | V           |
| <b>High ch 5690MHz</b>                              |          |              |               |         |       |        |           |         |             |            |               |                |           |            |             |
| 1.000   | 3.0      | 53.3         | 35.7          | 27.7    | 2.9   | -36.2  | 0.0       | 0.0     | 47.7        | 30.1       | 74            | 54             | -26.3     | -23.9      | H           |
| 1.330   | 3.0      | 46.1         | 32.1          | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 42.4        | 28.4       | 74            | 54             | -31.6     | -25.6      | H           |
| 1.997   | 3.0      | 45.7         | 31.1          | 31.6    | 4.1   | -35.4  | 0.0       | 0.0     | 45.9        | 31.3       | 74            | 54             | -28.1     | -22.7      | H           |
| 2.483   | 3.0      | 45.9         | 29.5          | 31.9    | 4.6   | -35.1  | 0.0       | 0.0     | 47.3        | 30.8       | 74            | 54             | -26.7     | -23.2      | H           |
| 1.003   | 3.0      | 52.1         | 34.0          | 27.7    | 2.9   | -36.1  | 0.0       | 0.0     | 46.6        | 28.4       | 74            | 54             | -27.4     | -25.6      | V           |
| 1.330   | 3.0      | 50.1         | 34.6          | 29.0    | 3.3   | -35.9  | 0.0       | 0.0     | 46.4        | 30.9       | 74            | 54             | -27.6     | -23.1      | V           |
| 1.993   | 3.0      | 50.8         | 35.5          | 31.5    | 4.0   | -35.4  | 0.0       | 0.0     | 51.0        | 35.7       | 74            | 54             | -23.0     | -18.3      | V           |
| 2.450   | 3.0      | 52.4         | 30.2          | 31.8    | 4.6   | -35.1  | 0.0       | 0.0     | 53.7        | 31.5       | 74            | 54             | -20.3     | -22.5      | V           |
| No other emissions were detected above noise floor. |          |              |               |         |       |        |           |         |             |            |               |                |           |            |             |
| Rev. 5.1.6  |          |              |               |         |       |        |           |         |             |            |               |                |           |            |             |

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



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

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



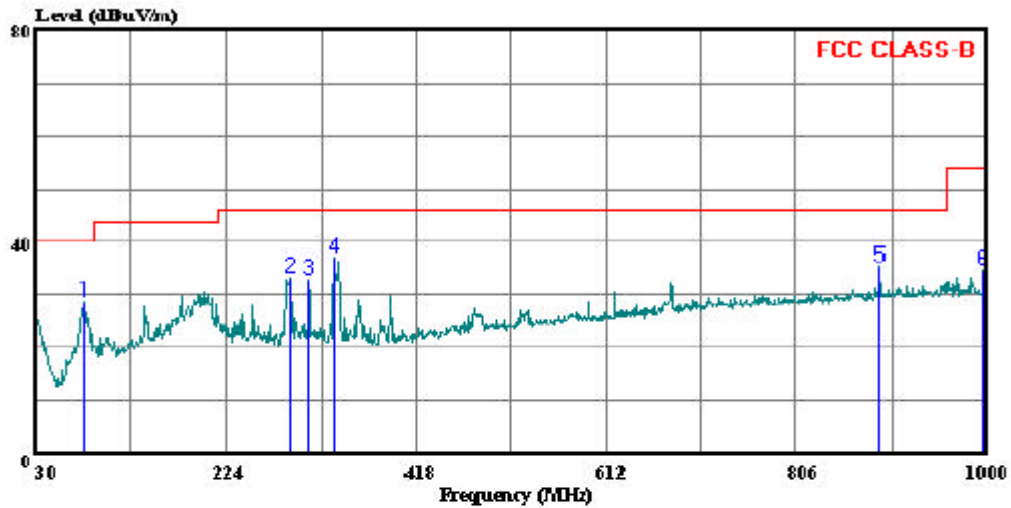
**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)**

VERTICAL PLOT & DATA



47173 Benicia Street  
 Fremont, CA 94538  
 Tel: (510) 771-1000  
 Fax: (510) 661-0888

Data#: 4 File#: EMILOW.EMI Date: 04-10-2007 Time: 12:39:54



Trace: 3

Ref Trace:

Condition: FCC CLASS-B 3m B-5M CHAMBER 012007 VERTICAL  
 Test Operator: : Thanh Nguyen  
 Company: : ATHEROS  
 Project #: : 07U10937  
 Configuration: : EUT inside the Laptop  
 Mode of Operation: : Transmit worst case  
 Target: : FCC Class B

Page: 1

|   | Read Freq | Probe Level | Probe Factor | Cable Loss | Preamp Factor | Level  | Limit  | Over   | Remark |
|---|-----------|-------------|--------------|------------|---------------|--------|--------|--------|--------|
|   | MHZ       | dBuV        | dB           | dB         | dB            | dBuV/m | dBuV/m | dB     |        |
| 1 | 78.500    | 48.00       | 8.09         | 0.93       | 28.28         | 28.73  | 40.00  | -11.27 | Peak   |
| 2 | 289.960   | 45.80       | 13.59        | 1.85       | 28.04         | 33.19  | 46.00  | -12.81 | Peak   |
| 3 | 309.360   | 45.00       | 14.13        | 1.88       | 28.04         | 32.97  | 46.00  | -13.03 | Peak   |
| 4 | 333.610   | 48.30       | 14.67        | 1.97       | 28.05         | 36.89  | 46.00  | -9.11  | Peak   |
| 5 | 891.360   | 36.30       | 22.66        | 3.44       | 27.22         | 35.18  | 46.00  | -10.82 | Peak   |
| 6 | 996.120   | 35.10       | 23.64        | 3.60       | 27.79         | 34.55  | 54.00  | -19.45 | Peak   |

## 7.2. 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.

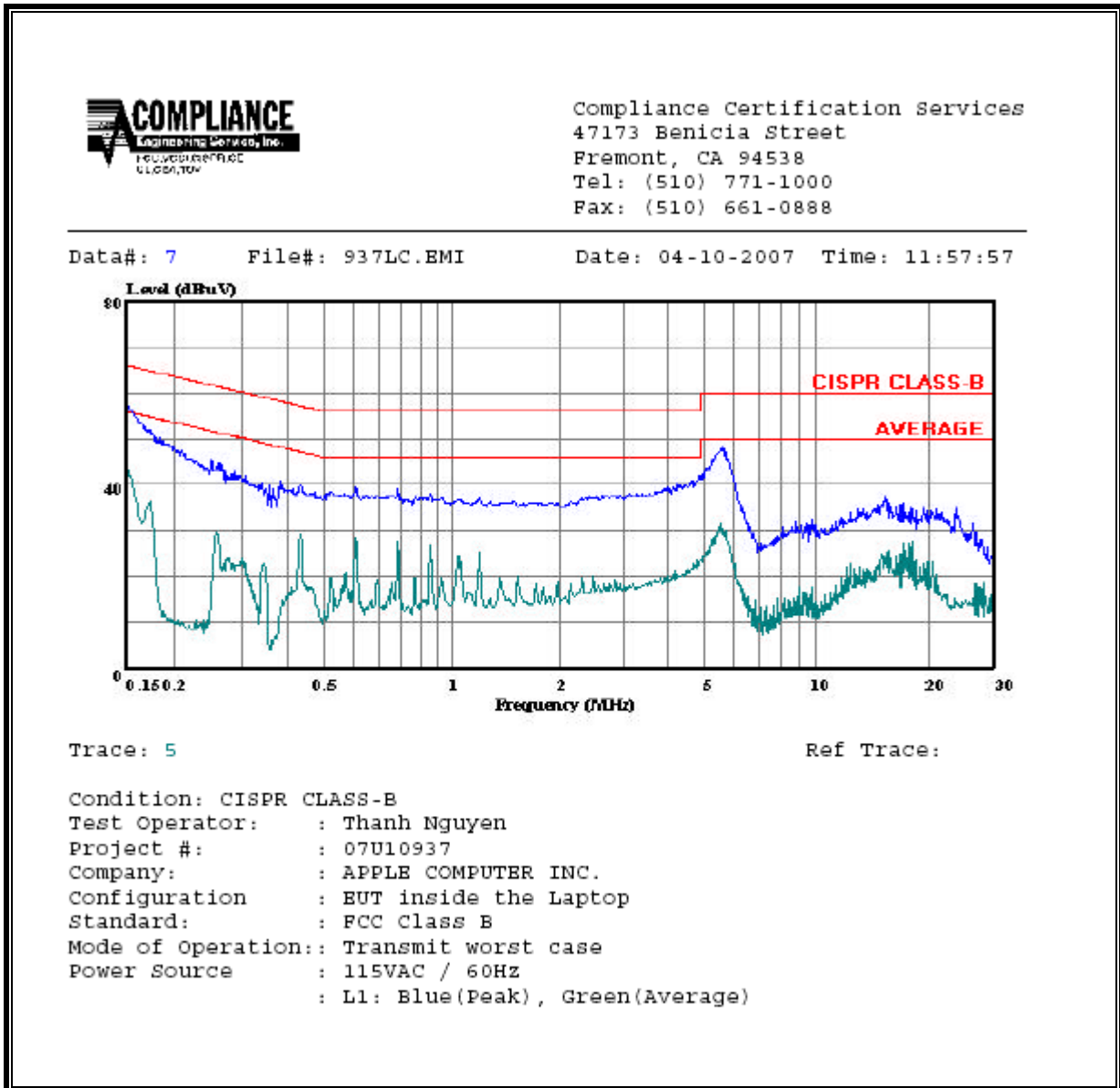
### RESULTS

No non-compliance noted:

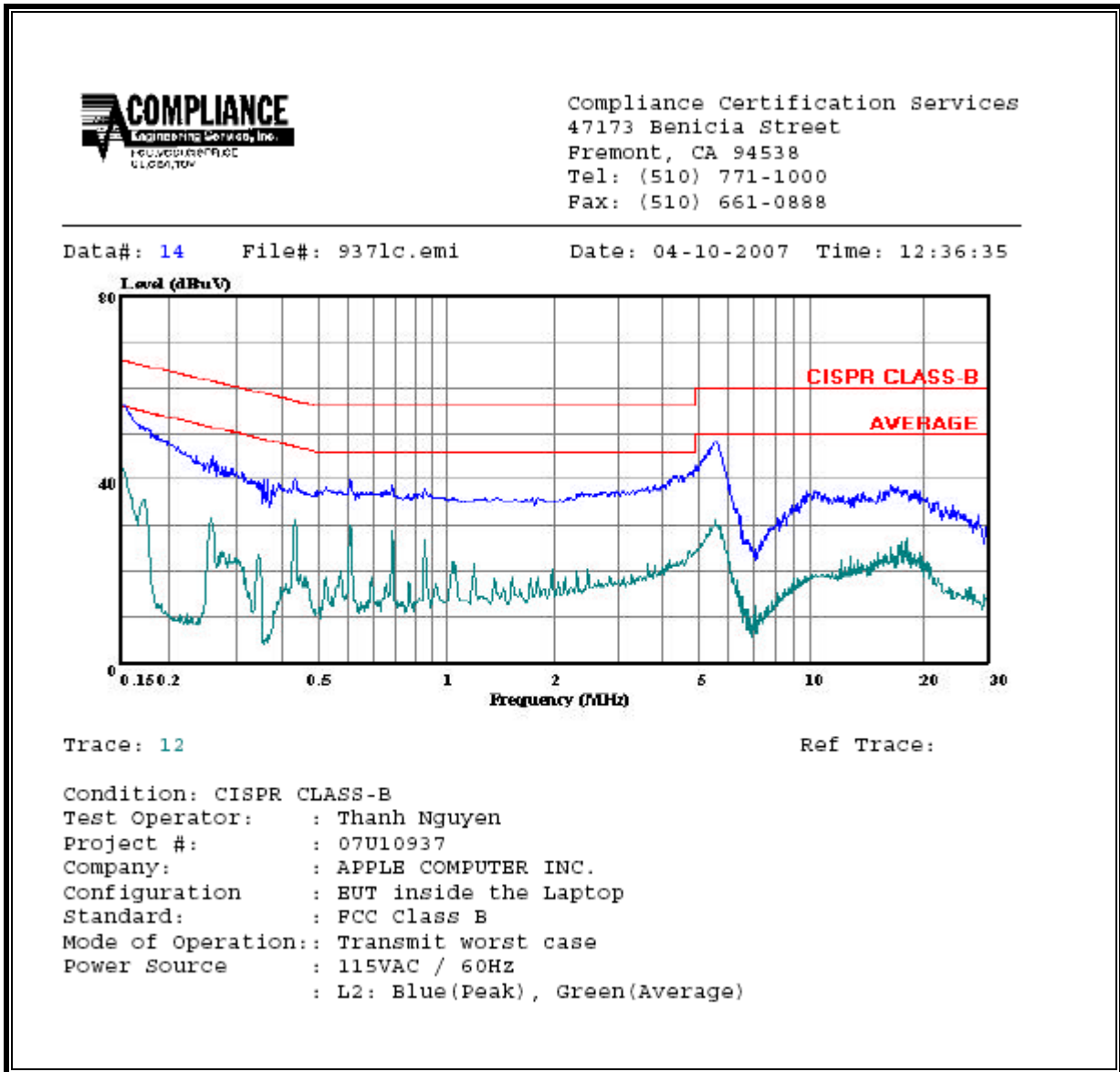
**6 WORST EMISSIONS**

| CONDUCTED EMISSIONS DATA (115VAC 60Hz) |           |           |           |       |       |       |         |         |         |        |
|--|-----------|-----------|-----------|-------|-------|-------|---------|---------|---------|--------|
| Freq.                                  | Reading   |           |           | Class | Limit | EN_B  |         | Margin  |         | Remark |
| (MHz)                                  | PK (dBuV) | QP (dBuV) | AV (dBuV) | (dB)  | QP    | AV    | QP (dB) | AV (dB) | L1 / L2 |        |
| 0.15                                   | 57.75     | --        | 42.23     | 0.00  | 66.00 | 56.00 | -8.25   | -13.77  | L1      |        |
| 0.61                                   | 39.56     | --        | 28.30     | 0.00  | 56.00 | 46.00 | -16.44  | -17.70  | L1      |        |
| 5.74                                   | 47.67     | --        | 31.55     | 0.00  | 60.00 | 50.00 | -12.33  | -18.45  | L1      |        |
| 0.15                                   | 57.34     | --        | 42.89     | 0.00  | 66.00 | 56.00 | -8.66   | -13.11  | L2      |        |
| 0.61                                   | 39.71     | --        | 30.19     | 0.00  | 56.00 | 46.00 | -16.29  | -15.81  | L2      |        |
| 5.65                                   | 48.09     | --        | 31.21     | 0.00  | 60.00 | 50.00 | -11.91  | -18.79  | L2      |        |
| 6 Worst Data                           |           |           |           |       |       |       |         |         |         |        |

**LINE 1 RESULTS**



**LINE 2 RESULTS**



Trace: 12

Ref Trace:

Condition: CISPR CLASS-B  
Test Operator: : Thanh Nguyen  
Project #: : 07U10937  
Company: : APPLE COMPUTER INC.  
Configuration : EUT inside the Laptop  
Standard: : FCC Class B  
Mode of operation: : Transmit worst case  
Power Source : 115VAC / 60Hz  
: L2: Blue(Peak) , Green(Average)