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

**FOR**

**2.4 & 5 GHz 802.11 MINICARD**

**MODEL NUMBER: AR5BXB72**

**FCC ID: PPD-AR5BXB72-L**

**REPORT NUMBER: 06U10634-1**

**ISSUE DATE: OCTOBER 23, 2006**

*Prepared for*

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

*Prepared by*

**COMPLIANCE CERTIFICATION SERVICES**
**561F MONTEREY ROAD**
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**LAB CODE:200065-0**

Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| -- | 10/19/2006 | Initial Issue | Thu |

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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:** 2.4 & 5 GHz 802.11 MINICARD

**MODEL:** AR5BXB72

**DATE TESTED:** OCTOBER 02 - 10, 2006

| 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:

EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:

VIEN TRAN
EMC ENGINEER
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 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 AR5BXB72 is designed for 802.11a/b/g/n applications using the AR541X/51XX chipset. It has three receive chains and two transmit chains, implemented with two outside chains (Chain 0 and 2) as Tx/Rx and the middle chain (chain 1) as Rx only.

## 5.2. MANUFACTURER'S DESCRIPTION OF MODEL DIFFERENCES

Both models AR5BXB72 and AR5BXB72-L are identical product and same hardware configuration, it just for the marketing purpose only.

## 5.3. CLASS II PERMISSIVE CHANGE DESCRIPTION

Installed 2.4 & 5 GHz 802.11 Minicard (WLAN FCC ID: PPD-AR5BXB72-L) in tablet laptop (LENOVO ThinkPad X60 Tablet_1.0 SIV A).

## 5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a set of three identical PIFA antennas with maximum gain is 1.52 dBi in the 2.4 GHz band and 2.13 dBi in the 5.8 GHz band

## 5.5. 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 4 Build # 7 Art 11n.

## 5.6. WORST-CASE CONFIGURATION AND MODE

The worst-case data rates are determined to be as follows for each mode, based on the investigations by measuring the average power, peak power and PPSD across all the data rates, bandwidths, modulations and spatial stream modes.

Thus all emissions tests were made with following data rates:

- 802.11b mode, 20 MHz Channel Bandwidth, 1 Mb/s, CCK Modulation, Spatial Stream 1.
- 802.11g mode, 20 MHz Channel Bandwidth, 9 Mb/s, OFDM Modulation, Spatial Stream
- 802.11a mode, 20 MHz Channel Bandwidth, 9 Mb/s, OFDM Modulation, Spatial Stream
- 802.11n HT20 mode, 20 MHz Channel Bandwidth, MCS0, 6.5 Mb/s, OFDM Modulation, Spatial Stream 1.
- 802.11n HT40 mode, 40 MHz Channel Bandwidth, MCS0, 13.5 Mb/s, OFDM Modulation, Spatial Stream 1.

The worst-case configuration for tests below 1 GHz is the mode and channel with the highest power: 802.11b mode, mid channel.

The portable configuration at Z-Axis has the worst field strength emissions for both portable & mobile configurations. So, all radiated emissions tests were performed at Z-axis portable configuration.

Baseline testing demonstrated that the Power Spectral Density as measured through a combiner with both chains operating simultaneously is less than the sum of the Power Spectral Density of each individual chain when added linearly.

## 5.7. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| PERIPHERAL SUPPORT EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Serial Number** | **FCC ID** |
| AC Adapter | Lenovo | ThinkPad X60 Tablet 1.0 SIV B | 91B52 | N/A |
| Latop | Lenovo | ThinkPad X60 Tablet 1.0 SIV A | 91A14 | N/A |

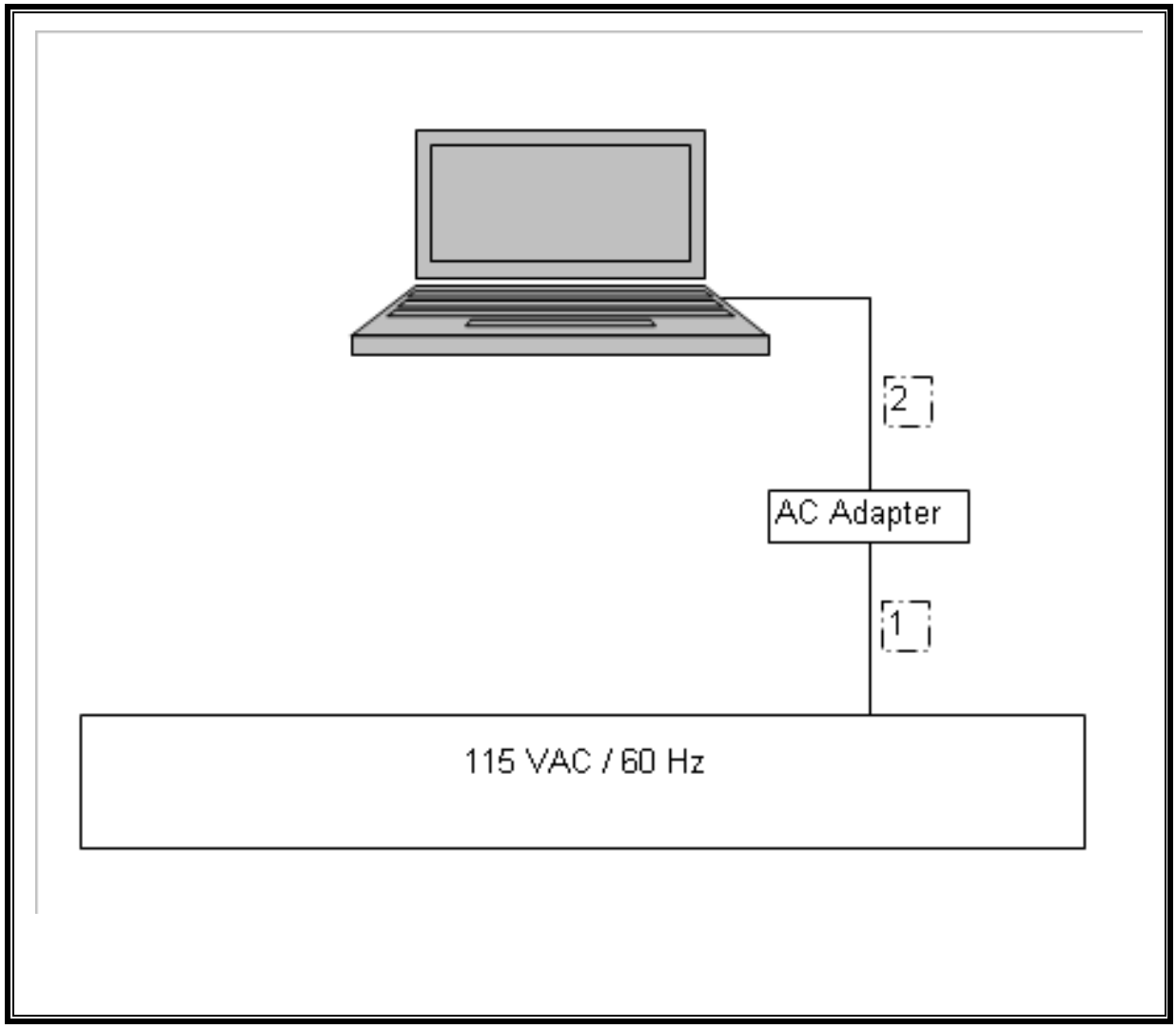
### I/O CABLES

| I/O CABLE LIST | | | | | | |
|---|---|---|---|---|---|---|
| **Cable No.** | **Port** | **# of Identical Ports** | **Connector Type** | **Cable Type** | **Cable Length** | **Remarks** |
| 1 | AC | 1 | US115 | Shielded | .50m | No |
| 2 | DC | 2 | DC | Shielded | 1.0m | Ferrite on laptop's end |

### TEST SETUP

The EUT is installed in the host laptop computer 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** |
| Spectrum Analyzer 3 Hz ~ 44 GHz | Agilent / HP | E4446A | MY43360112 | 5/3/2007 |
| Antenna, Horn 1 ~ 18 GHz | ETS | 3117 | 29310 | 4/22/2007 |
| Preamplifier, 1 ~ 26 GHz | Miteq | NSP2600-SP | 924342 | 9/2/2007 |
| EMI Receiver, 9 kHz ~ 2.9 GHz | Agilent / HP | 8542E | 3942A00286 | 2/4/2007 |
| RF Filter Section | Agilent / HP | 85420E | 3705A00256 | 2/4/2007 |
| Antenna, Bilog 30 MHz ~ 2 Ghz | Sunol Sciences | JB1 | A121003 | 9/3/2007 |
| LISN, 10 kHz ~ 30 MHz | Solar | 8012-50-R-24-BNC | 8379443 | 8/30/2007 |
| LISN, 10 kHz ~ 30 MHz | FCC | LISN-50/250-25-2 | 2023 | 8/30/2007 |
| EMI Test Receiver | R & S | ESHS 20 | 827129/006 | 11/3/2006 |

# 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 |
| [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 Field Strength Measurement Distance

| (MHz) | (microvolts/meter) | (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.

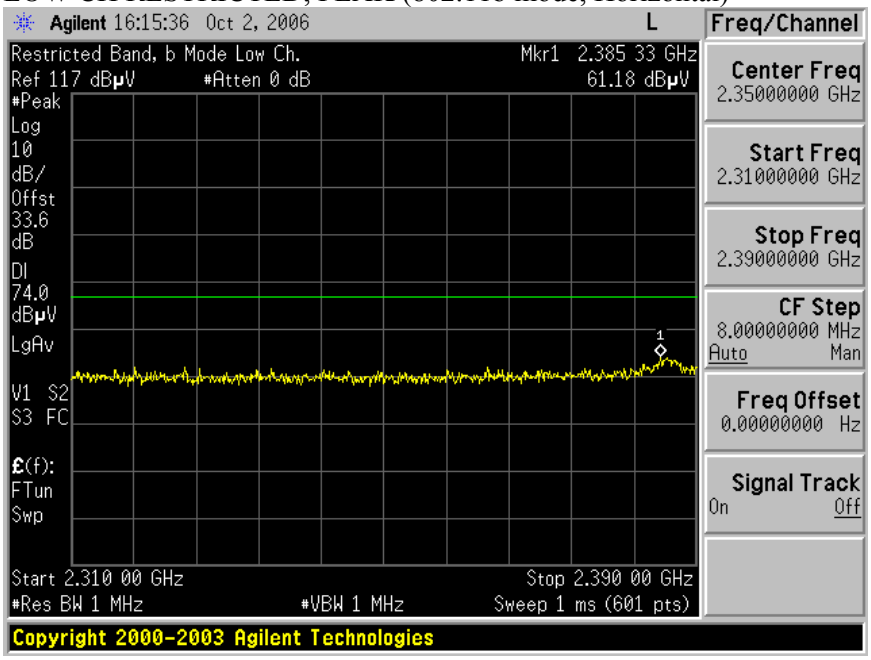
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

## 7.1.2. TRANSMITTER ABOVE 1 GHz FOR 2400 TO 2483.5 MHz BAND

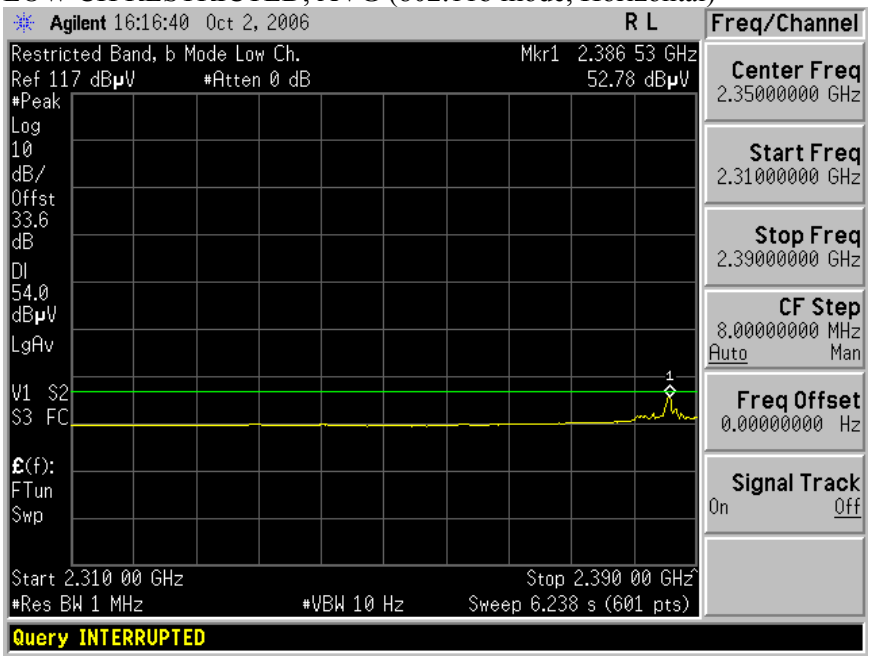
**11b**

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

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

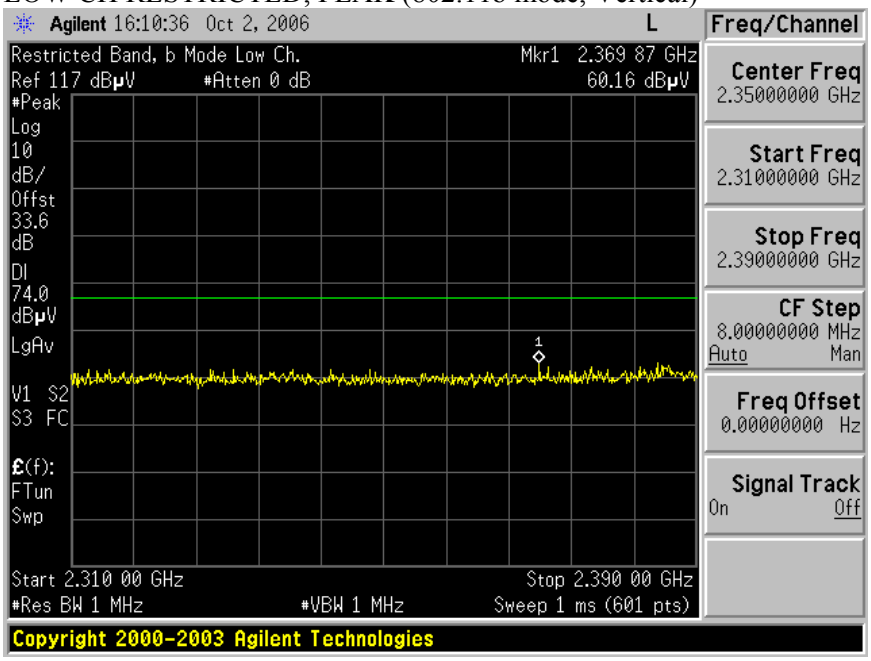


LOW CH RESTRICTED, AVG (802.11b mode, Horizontal)

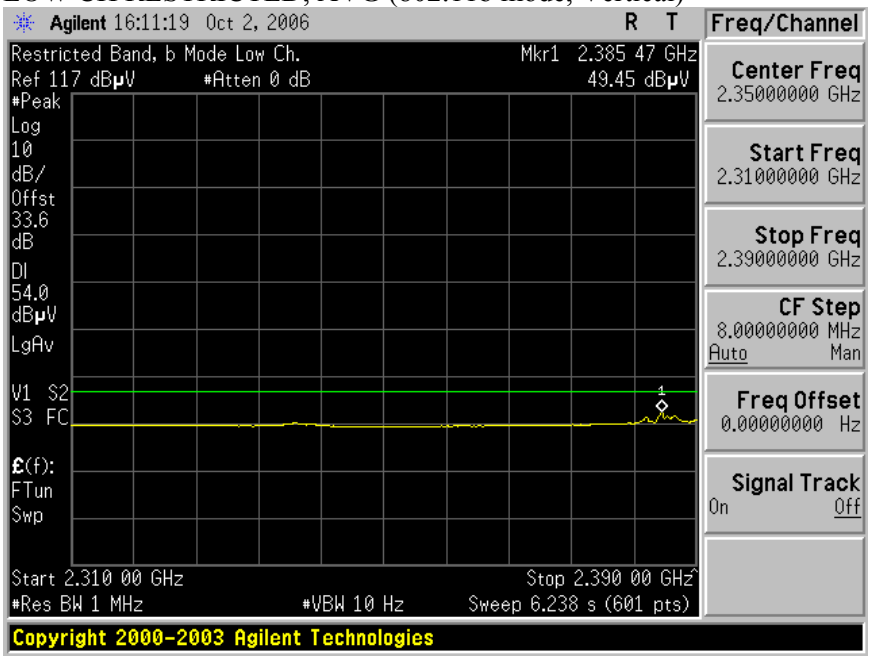


**RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, VERTICAL)**

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

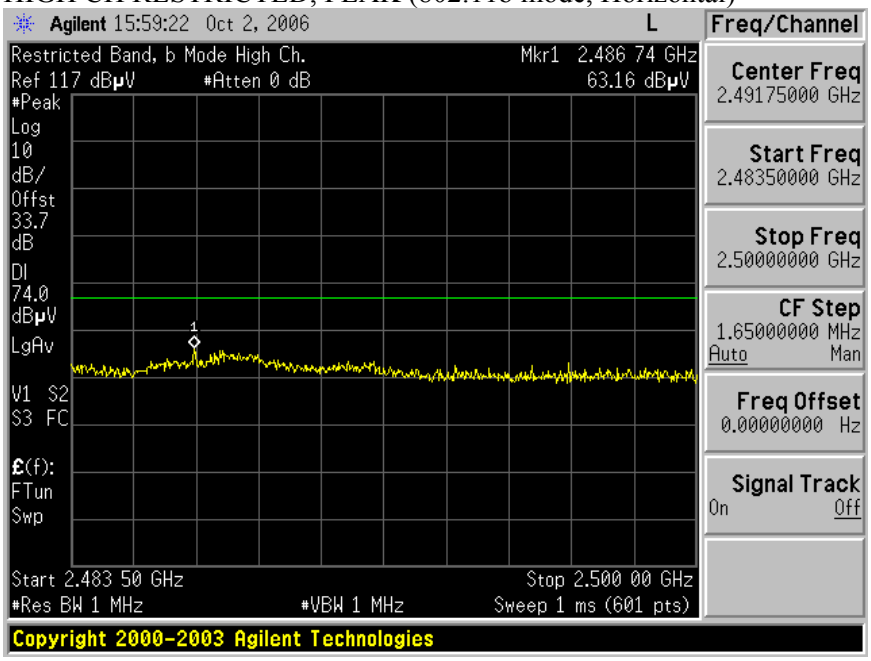


LOW CH RESTRICTED, AVG (802.11b mode, Vertical)

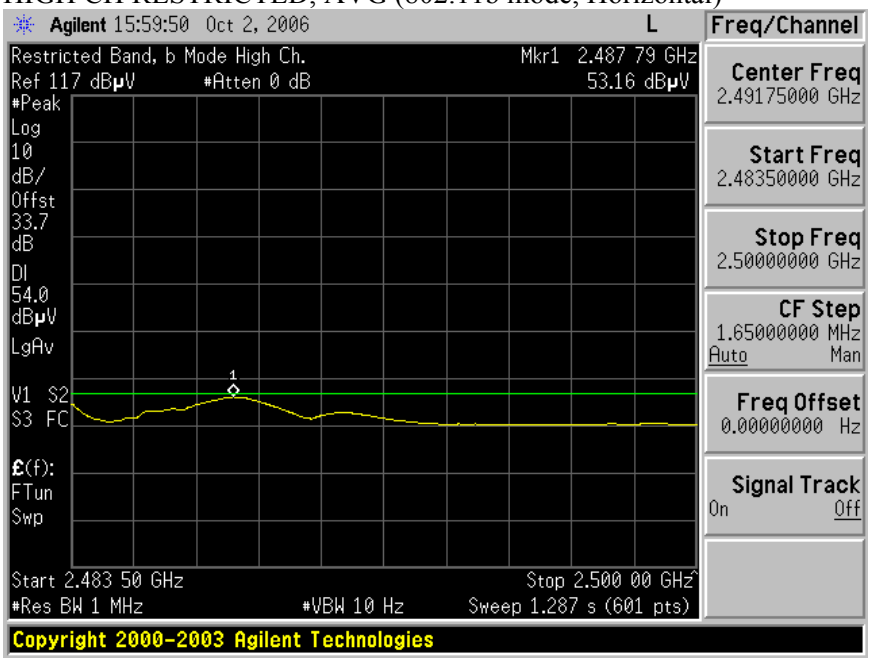


**RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, HORIZONTAL)**

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

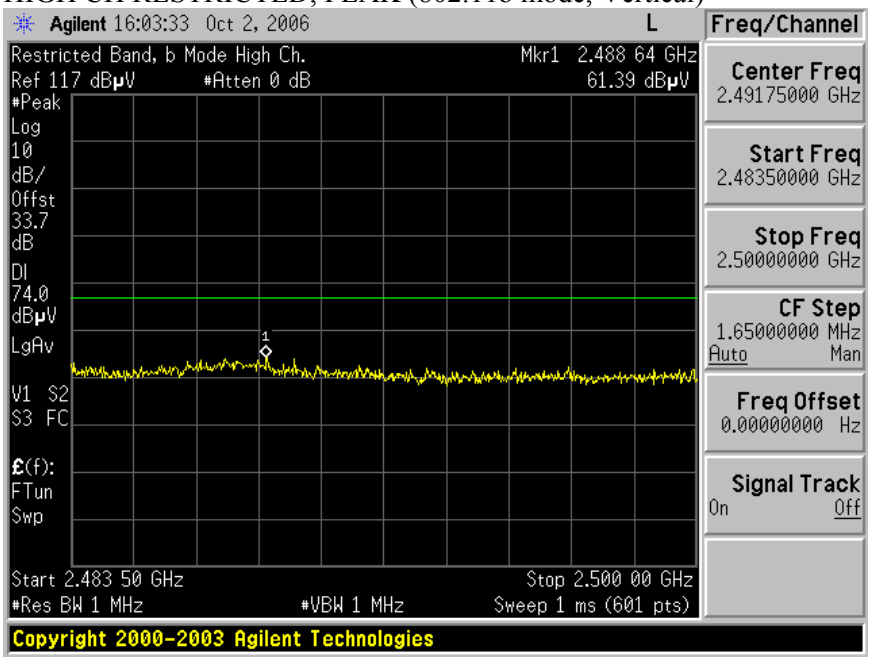


HIGH CH RESTRICTED, AVG (802.11b mode, Horizontal)

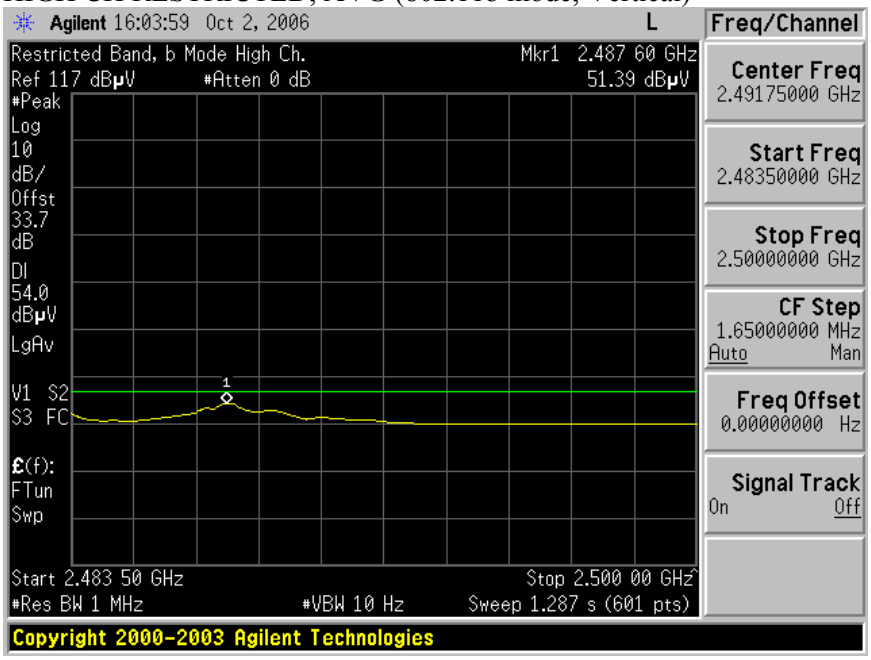


**RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, VERTICAL)**

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



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



## HARMONICS AND SPURIOUS EMISSIONS (b MODE)

High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Company: Production Development Lab., Lenovo (Japan) Ltd
Project #: 06U10634
Date: 10/03/06
Test Engineer: Vien Tran
Configuration: EUT only
Mode: Tx 11b

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T120; S/N: 29310 @3m | T87 Miteq 924342 | | | FCC 15.205 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | Vien 187215002 | Vien 197209005 | HPF_4.0GHz | |

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

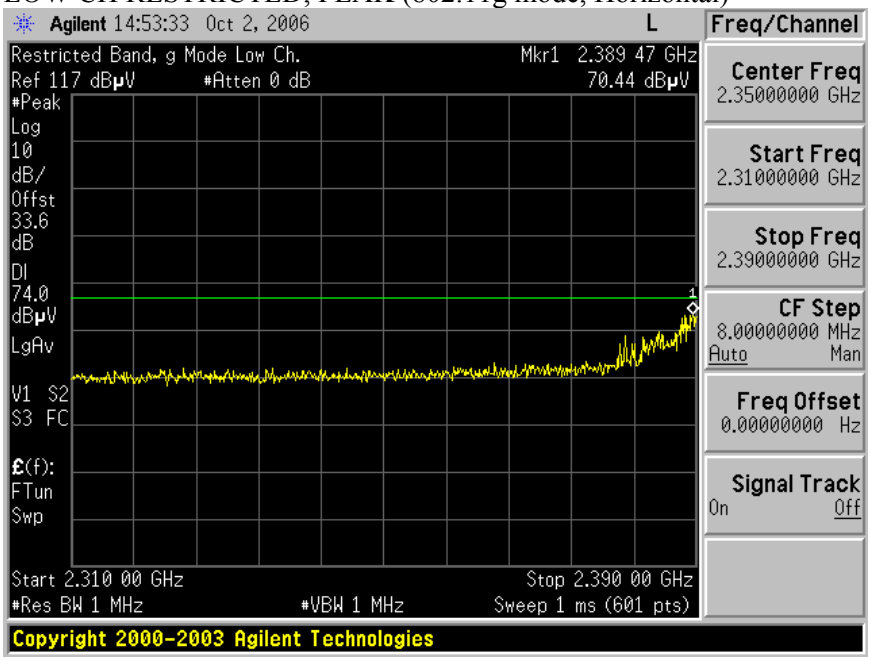
| f GHz | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOW CH, 2412 MHz | | | | | | | | | | | | | | | |
| 4.824 | 3.0 | 57.7 | 52.4 | 33.7 | 2.9 | -45.3 | 0.0 | 0.6 | 49.6 | 44.4 | 74 | 54 | -24.4 | -9.6 | H |
| 12.060 | 3.0 | 48.5 | 36.9 | 37.7 | 4.8 | -40.0 | 0.0 | 0.9 | 51.9 | 40.3 | 74 | 54 | -22.1 | -13.7 | H |
| 4.824 | 3.0 | 57.0 | 52.8 | 33.7 | 2.9 | -45.3 | 0.0 | 0.6 | 48.9 | 44.7 | 74 | 54 | -25.1 | -9.3 | V |
| 12.060 | 3.0 | 47.7 | 36.3 | 37.7 | 4.8 | -40.0 | 0.0 | 0.9 | 51.1 | 39.7 | 74 | 54 | -22.9 | -14.3 | V |
| MID CH. 2437 MHz | | | | | | | | | | | | | | | |
| 4.874 | 3.0 | 56.2 | 51.3 | 33.7 | 3.0 | -45.3 | 0.0 | 0.6 | 48.2 | 43.3 | 74 | 54 | -25.8 | -10.7 | H |
| 7.311 | 3.0 | 50.3 | 39.4 | 35.2 | 4.2 | -43.2 | 0.0 | 0.6 | 47.1 | 36.2 | 74 | 54 | -26.9 | -17.8 | H |
| 12.185 | 3.0 | 49.0 | 37.3 | 37.7 | 4.9 | -40.1 | 0.0 | 0.9 | 52.4 | 40.7 | 74 | 54 | -21.6 | -13.3 | H |
| 4.874 | 3.0 | 55.6 | 48.6 | 33.7 | 3.0 | -45.3 | 0.0 | 0.6 | 47.6 | 40.6 | 74 | 54 | -26.4 | -13.4 | V |
| 7.311 | 3.0 | 50.0 | 38.9 | 35.2 | 4.2 | -43.2 | 0.0 | 0.6 | 46.8 | 35.7 | 74 | 54 | -27.2 | -18.3 | V |
| 12.185 | 3.0 | 48.4 | 37.4 | 37.7 | 4.9 | -40.1 | 0.0 | 0.9 | 51.8 | 40.8 | 74 | 54 | -22.2 | -13.2 | V |
| HIGH CH. 2462 MHz | | | | | | | | | | | | | | | |
| 4.924 | 3.0 | 54.7 | 49.4 | 33.8 | 3.1 | -45.4 | 0.0 | 0.6 | 46.8 | 41.5 | 74 | 54 | -27.2 | -12.5 | H |
| 7.386 | 3.0 | 51.0 | 38.9 | 35.2 | 4.2 | -43.1 | 0.0 | 0.6 | 47.9 | 35.8 | 74 | 54 | -26.1 | -18.2 | H |
| 12.310 | 3.0 | 48.6 | 37.3 | 37.6 | 4.9 | -40.2 | 0.0 | 0.9 | 51.9 | 40.6 | 74 | 54 | -22.1 | -13.4 | H |
| 4.924 | 3.0 | 54.5 | 47.8 | 33.8 | 3.1 | -45.4 | 0.0 | 0.6 | 46.6 | 39.9 | 74 | 54 | -27.4 | -14.1 | V |
| 7.386 | 3.0 | 50.8 | 38.9 | 35.2 | 4.2 | -43.1 | 0.0 | 0.6 | 47.7 | 35.8 | 74 | 54 | -26.3 | -18.2 | V |
| 12.310 | 3.0 | 49.3 | 37.3 | 37.6 | 4.9 | -40.2 | 0.0 | 0.9 | 52.6 | 40.6 | 74 | 54 | -21.4 | -13.4 | V |
| No other emissions were detected above 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 | | |

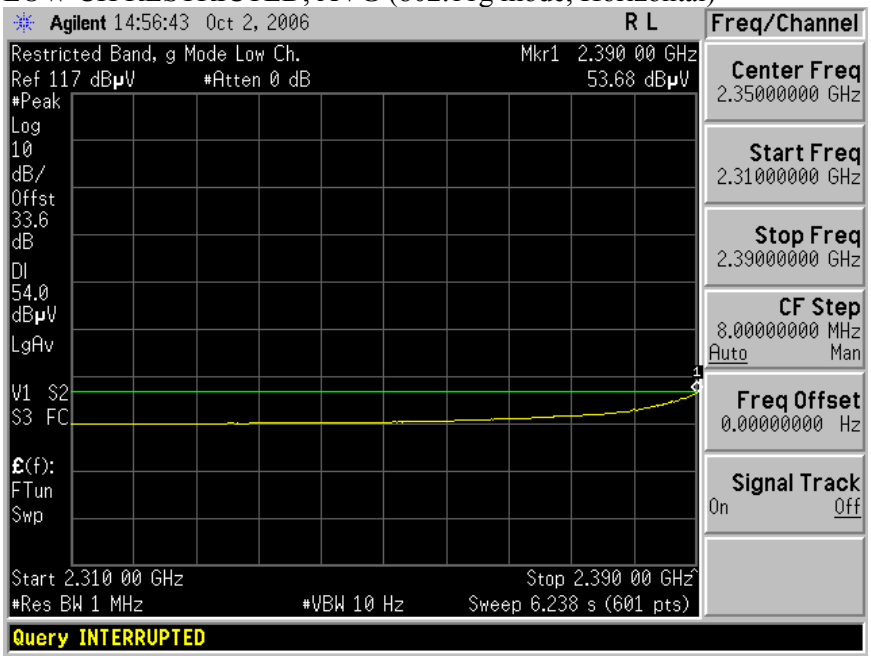
**11g**

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

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

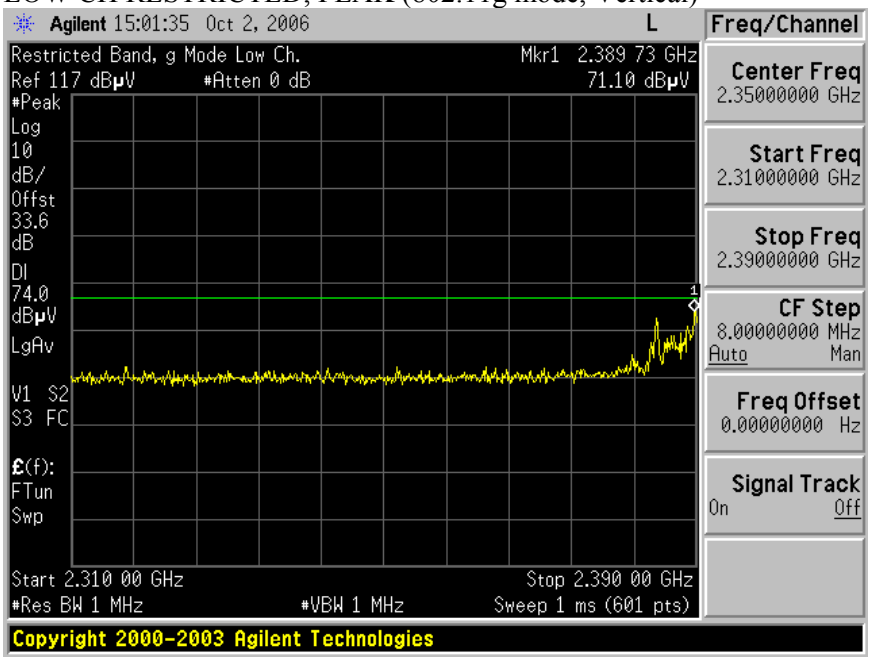


LOW CH RESTRICTED, AVG (802.11g mode, Horizontal)

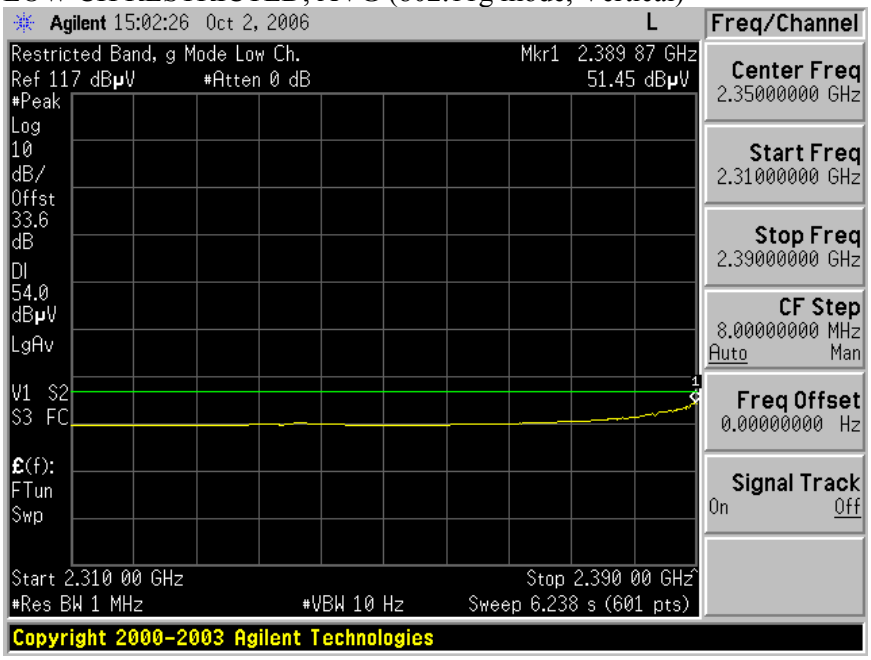


**RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, VERTICAL)**

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

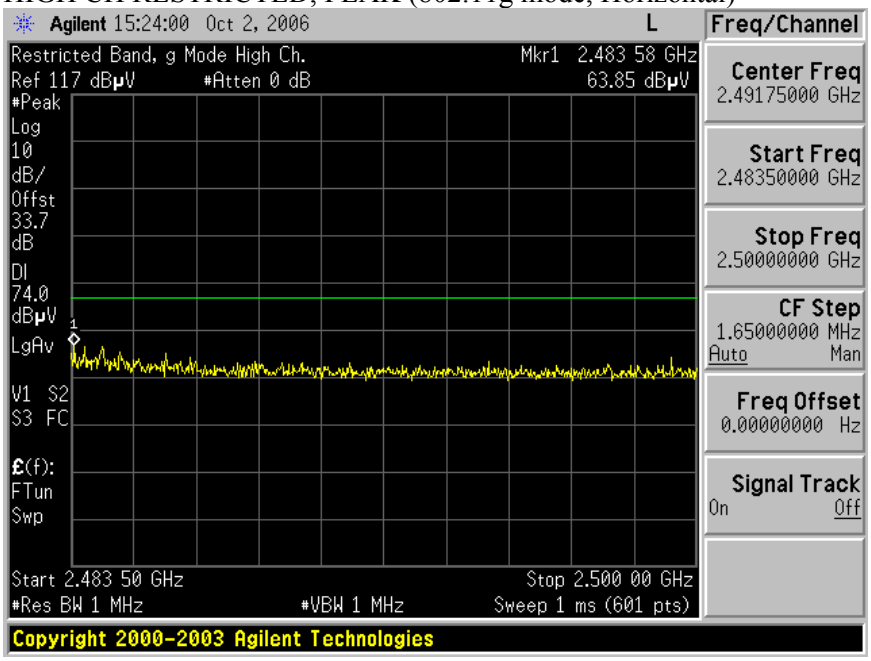


LOW CH RESTRICTED, AVG (802.11g mode, Vertical)

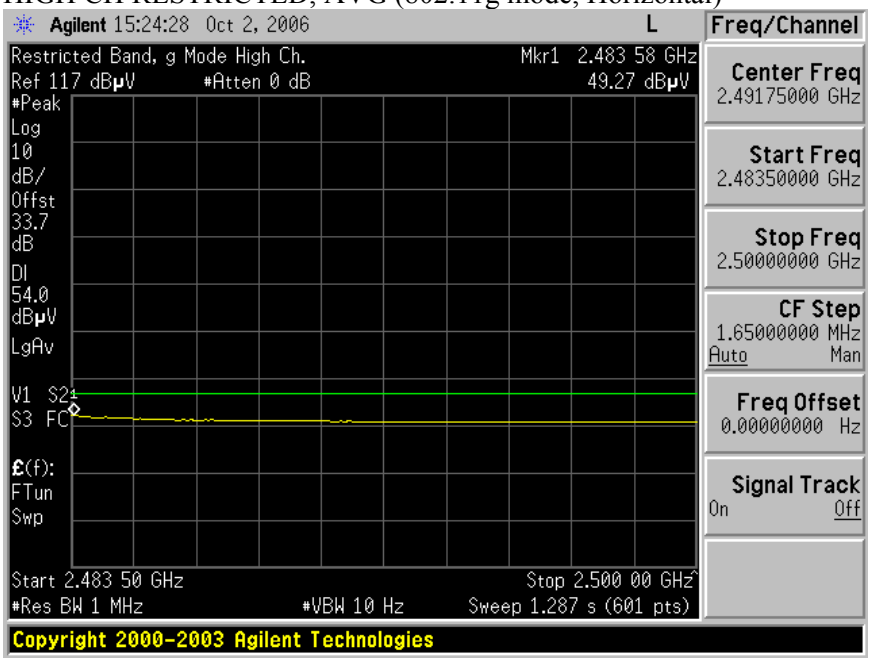


**RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, HORIZONTAL)**

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

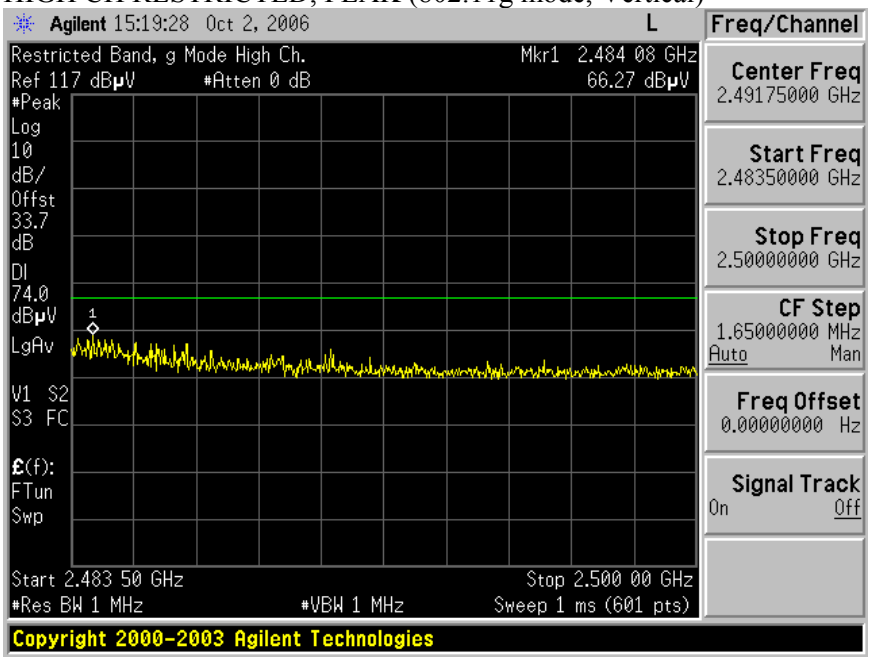


HIGH CH RESTRICTED, AVG (802.11g mode, Horizontal)

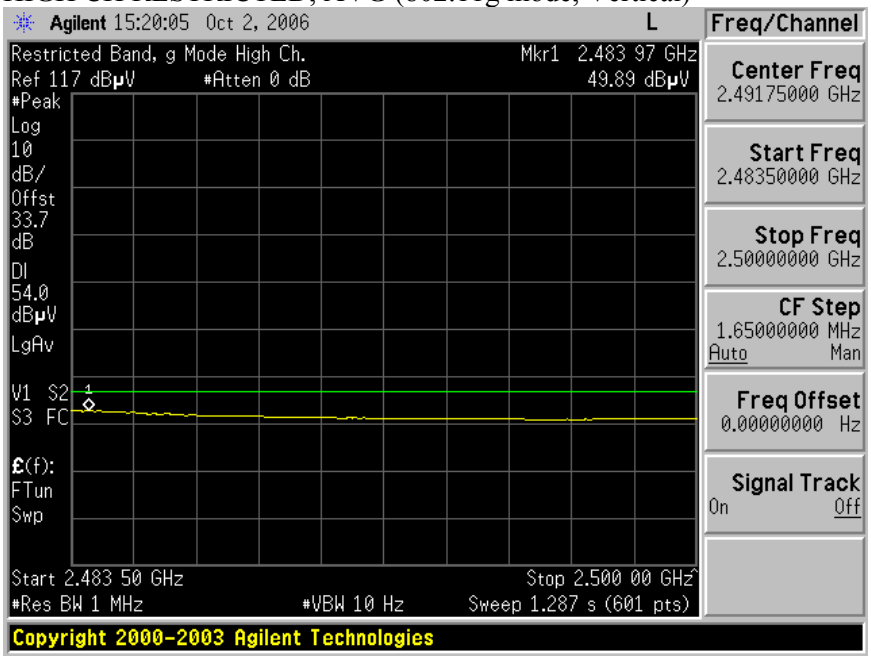


**RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, VERTICAL)**

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



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



## HARMONICS AND SPURIOUS EMISSIONS (g MODE)

High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Company: Production Development Lab., Lenovo (Japan) Ltd
Project #: 06U10634
Date: 10/03/06
Test Engineer: Vien Tran
Configuration: EUT only
Mode: Tx 11g

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T120; S/N: 29310 @3m | T87 Miteq 924342 | | | FCC 15.205 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | Vien 187215002 | Vien 197209005 | HPF_4.0GHz | |

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

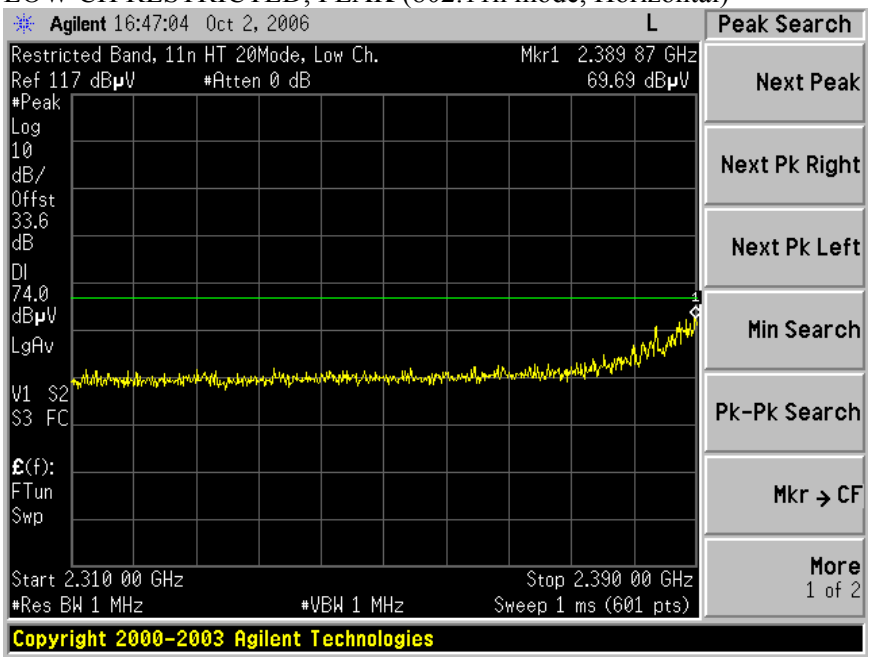
| f GHz | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOW CH, 2412 MHz | | | | | | | | | | | | | | | |
| 4.824 | 3.0 | 51.3 | 39.2 | 33.7 | 2.9 | -45.3 | 0.0 | 0.6 | 43.2 | 31.1 | 74 | 54 | -30.8 | -22.9 | H |
| 12.060 | 3.0 | 52.3 | 39.2 | 37.7 | 4.8 | -40.0 | 0.0 | 0.9 | 55.7 | 42.6 | 74 | 54 | -18.3 | -11.4 | H |
| 4.824 | 3.0 | 51.3 | 41.6 | 33.7 | 2.9 | -45.3 | 0.0 | 0.6 | 43.2 | 33.5 | 74 | 54 | -30.8 | -20.5 | V |
| 12.060 | 3.0 | 52.1 | 39.2 | 37.7 | 4.8 | -40.0 | 0.0 | 0.9 | 55.5 | 42.6 | 74 | 54 | -18.5 | -11.4 | V |
| MID CH. 2437 MHz | | | | | | | | | | | | | | | |
| 4.874 | 3.0 | 54.9 | 43.9 | 33.7 | 3.0 | -45.3 | 0.0 | 0.6 | 46.9 | 35.9 | 74 | 54 | -27.1 | -18.1 | H |
| 7.311 | 3.0 | 52.8 | 41.1 | 35.2 | 4.2 | -43.2 | 0.0 | 0.6 | 49.6 | 37.9 | 74 | 54 | -24.4 | -16.1 | H |
| 12.185 | 3.0 | 48.8 | 37.4 | 37.7 | 4.9 | -40.1 | 0.0 | 0.9 | 52.2 | 40.8 | 74 | 54 | -21.8 | -13.2 | H |
| 4.874 | 3.0 | 52.8 | 41.5 | 33.7 | 3.0 | -45.3 | 0.0 | 0.6 | 44.8 | 33.5 | 74 | 54 | -29.2 | -20.5 | V |
| 7.311 | 3.0 | 53.6 | 42.2 | 35.2 | 4.2 | -43.2 | 0.0 | 0.6 | 50.4 | 39.0 | 74 | 54 | -23.6 | -15.0 | V |
| 12.185 | 3.0 | 49.4 | 37.5 | 37.7 | 4.9 | -40.1 | 0.0 | 0.9 | 52.8 | 40.9 | 74 | 54 | -21.2 | -13.1 | V |
| HIGH CH. 2462 MHz | | | | | | | | | | | | | | | |
| 4.924 | 3.0 | 51.3 | 39.2 | 33.8 | 3.1 | -45.4 | 0.0 | 0.6 | 43.4 | 31.3 | 74 | 54 | -30.6 | -22.7 | H |
| 7.386 | 3.0 | 51.5 | 38.9 | 35.2 | 4.2 | -43.1 | 0.0 | 0.6 | 48.4 | 35.8 | 74 | 54 | -25.6 | -18.2 | H |
| 12.310 | 3.0 | 49.7 | 37.5 | 37.6 | 4.9 | -40.2 | 0.0 | 0.9 | 53.0 | 40.8 | 74 | 54 | -21.0 | -13.2 | H |
| 4.924 | 3.0 | 51.9 | 39.8 | 33.8 | 3.1 | -45.4 | 0.0 | 0.6 | 44.0 | 31.9 | 74 | 54 | -30.0 | -22.1 | V |
| 7.386 | 3.0 | 50.8 | 38.7 | 35.2 | 4.2 | -43.1 | 0.0 | 0.6 | 47.7 | 35.6 | 74 | 54 | -26.3 | -18.4 | V |
| 12.310 | 3.0 | 49.7 | 37.5 | 37.6 | 4.9 | -40.2 | 0.0 | 0.9 | 53.0 | 40.8 | 74 | 54 | -21.0 | -13.2 | V |
| | | | | No other emissions were detected above 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 | | |

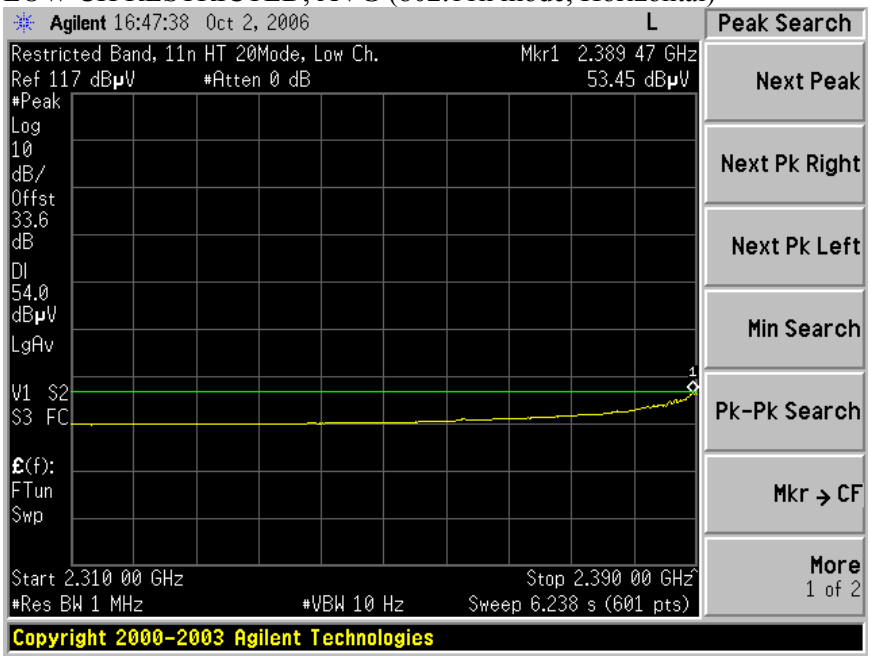
**11n HT20**

**RESTRICTED BANDEDGE (n HT20 MODE, LOW CHANNEL, HORIZONTAL)**

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

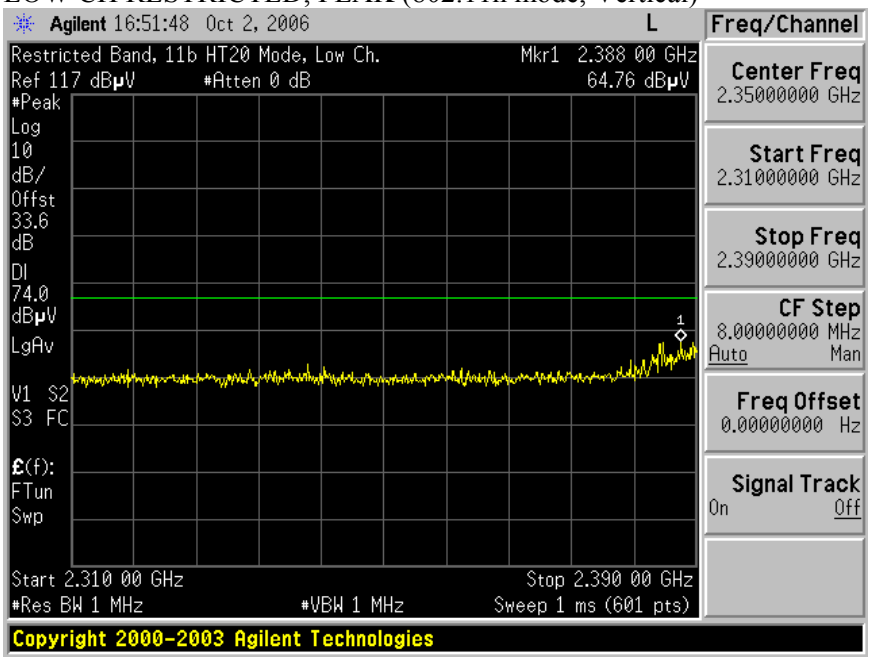


LOW CH RESTRICTED, AVG (802.11n mode, Horizontal)

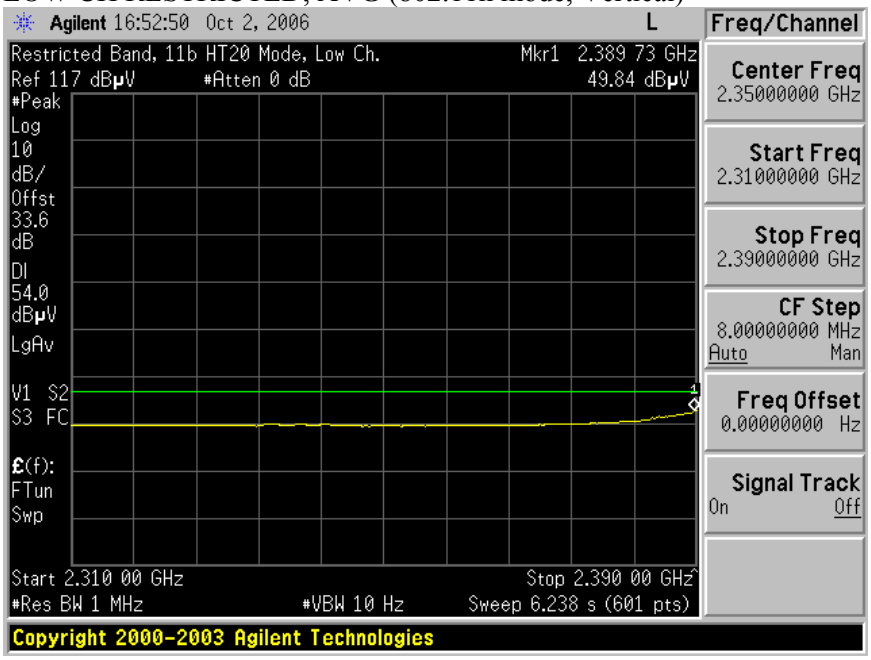


**RESTRICTED BANDEDGE (n HT20 MODE, LOW CHANNEL, VERTICAL)**

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

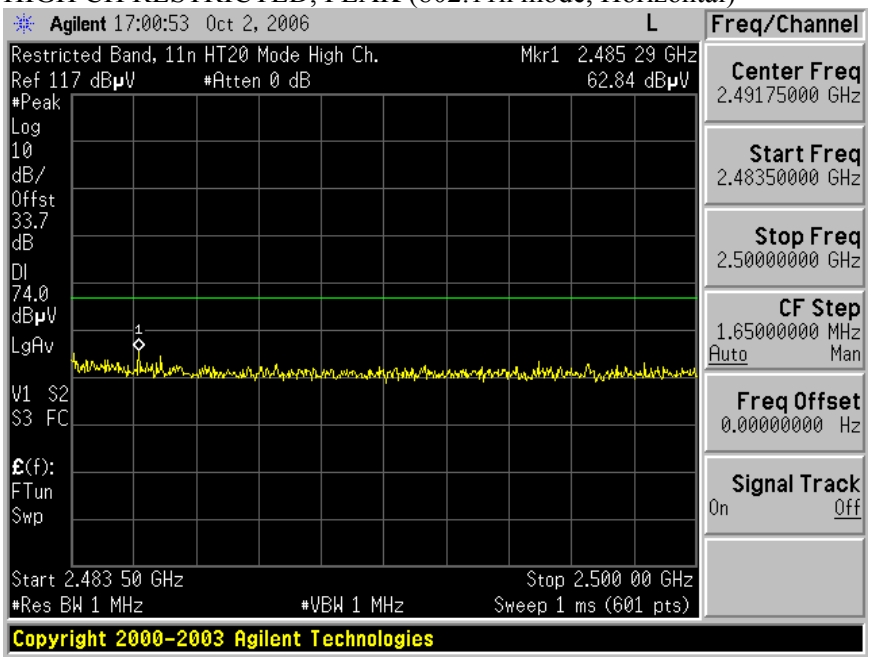


LOW CH RESTRICTED, AVG (802.11n mode, Vertical)

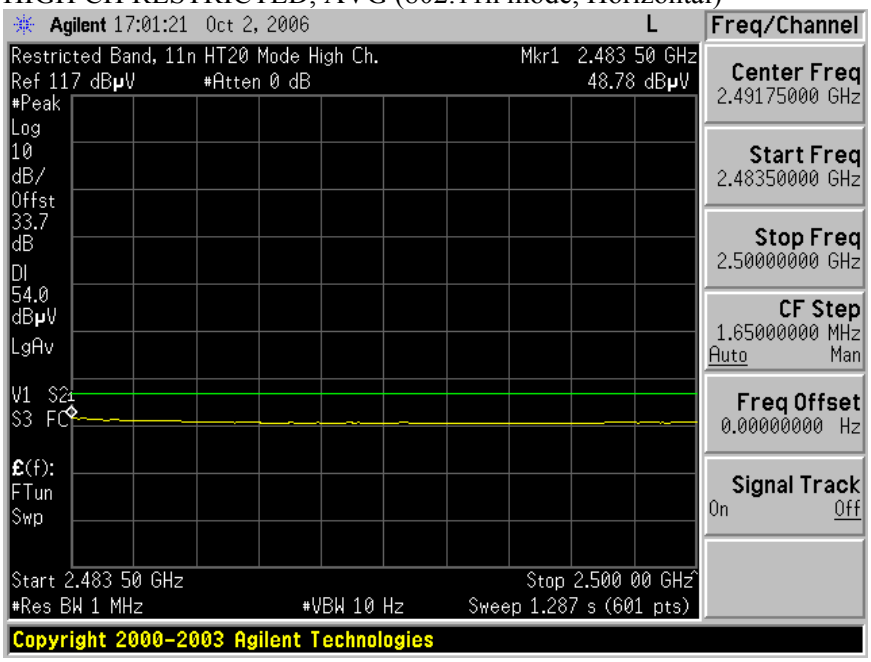


**RESTRICTED BANDEDGE (n HT20 MODE, HIGH CHANNEL, HORIZONTAL)**

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

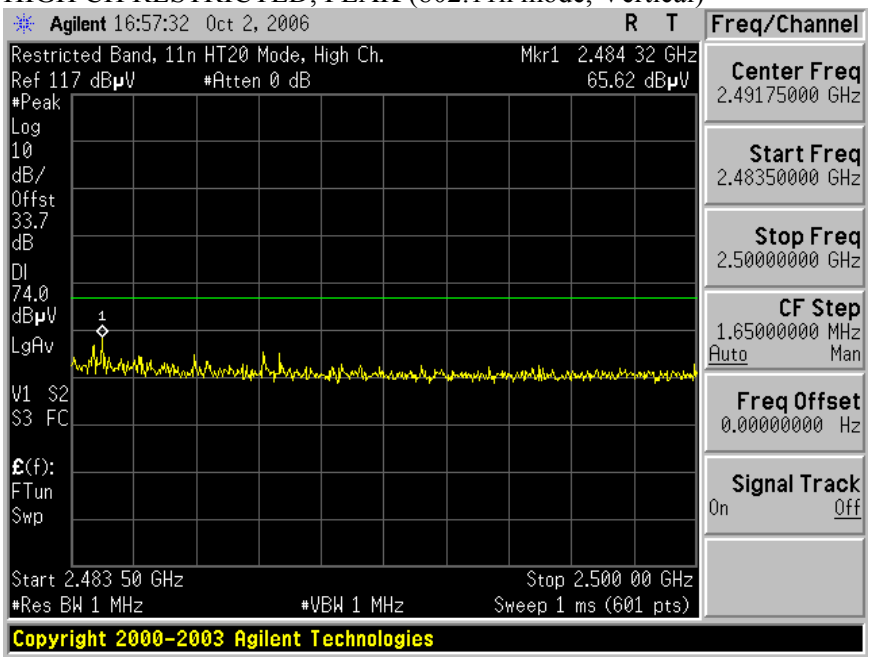


HIGH CH RESTRICTED, AVG (802.11n mode, Horizontal)

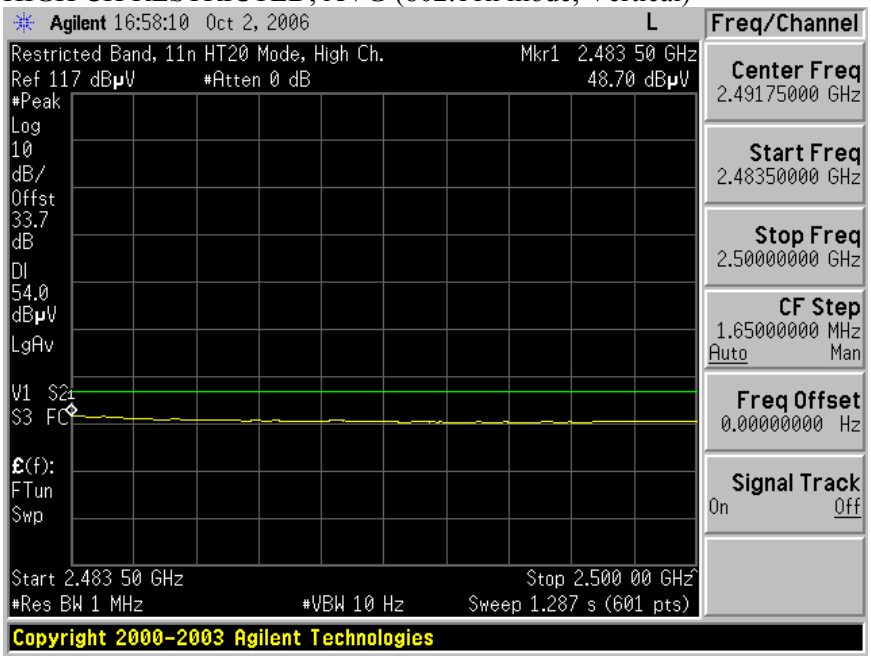


**RESTRICTED BANDEDGE (11n HT20 MODE, HIGH CHANNEL, VERTICAL)**

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



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



## HARMONICS AND SPURIOUS EMISSIONS (11n HT 20 MODE)

High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Company: Production Development Lab., Lenovo (Japan) Ltd
Project #: 06U10634
Date: 10/03/06
Test Engineer: Vien Tran
Configuration: EUT only
Mode: Tx 11n HT20

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T120; S/N: 29310 @3m | T87 Miteq 924342 | | | FCC 15.205 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | Vien 187215002 | Vien 197209005 | HPF_4.0GHz | |

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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOW CH, 2412 MHz | | | | | | | | | | | | | | | |
| 4.824 | 3.0 | 51.1 | 39.0 | 33.7 | 2.9 | -45.3 | 0.0 | 0.6 | 43.0 | 30.9 | 74 | 54 | -31.0 | -23.1 | H |
| 12.060 | 3.0 | 49.3 | 37.3 | 37.7 | 4.8 | -40.0 | 0.0 | 0.9 | 52.7 | 40.7 | 74 | 54 | -21.3 | -13.3 | H |
| 4.824 | 3.0 | 51.8 | 39.0 | 33.7 | 2.9 | -45.3 | 0.0 | 0.6 | 43.7 | 30.9 | 74 | 54 | -30.3 | -23.1 | V |
| 12.060 | 3.0 | 49.5 | 37.3 | 37.7 | 4.8 | -40.0 | 0.0 | 0.9 | 52.9 | 40.7 | 74 | 54 | -21.1 | -13.3 | V |
| | | | | | | | | | | | | | | | |
| MID CH. 2437 MHz | | | | | | | | | | | | | | | |
| 4.874 | 3.0 | 54.2 | 42.0 | 33.7 | 3.0 | -45.3 | 0.0 | 0.6 | 46.2 | 34.0 | 74 | 54 | -27.8 | -20.0 | H |
| 7.311 | 3.0 | 51.1 | 38.9 | 35.2 | 4.2 | -43.2 | 0.0 | 0.6 | 47.9 | 35.7 | 74 | 54 | -26.1 | -18.3 | H |
| 12.185 | 3.0 | 49.8 | 37.7 | 37.7 | 4.9 | -40.1 | 0.0 | 0.9 | 53.2 | 41.1 | 74 | 54 | -20.8 | -12.9 | H |
| 4.874 | 3.0 | 51.2 | 39.2 | 33.7 | 3.0 | -45.3 | 0.0 | 0.6 | 43.2 | 31.2 | 74 | 54 | -30.8 | -22.8 | V |
| 7.311 | 3.0 | 51.9 | 39.0 | 35.2 | 4.2 | -43.2 | 0.0 | 0.6 | 48.7 | 35.8 | 74 | 54 | -25.3 | -18.2 | V |
| 12.185 | 3.0 | 49.4 | 37.7 | 37.7 | 4.9 | -40.1 | 0.0 | 0.9 | 52.8 | 41.1 | 74 | 54 | -21.2 | -12.9 | V |
| | | | | | | | | | | | | | | | |
| HIGH CH. 2462 MHz | | | | | | | | | | | | | | | |
| 4.924 | 3.0 | 52.0 | 39.3 | 33.8 | 3.1 | -45.4 | 0.0 | 0.6 | 44.1 | 31.4 | 74 | 54 | -29.9 | -22.6 | H |
| 7.386 | 3.0 | 51.4 | 38.8 | 35.2 | 4.2 | -43.1 | 0.0 | 0.6 | 48.3 | 35.7 | 74 | 54 | -25.7 | -18.3 | H |
| 12.310 | 3.0 | 49.4 | 37.4 | 37.6 | 4.9 | -40.2 | 0.0 | 0.9 | 52.7 | 40.7 | 74 | 54 | -21.3 | -13.3 | H |
| 4.924 | 3.0 | 51.5 | 39.5 | 33.8 | 3.1 | -45.4 | 0.0 | 0.6 | 43.6 | 31.6 | 74 | 54 | -30.4 | -22.4 | V |
| 7.386 | 3.0 | 50.9 | 38.9 | 35.2 | 4.2 | -43.1 | 0.0 | 0.6 | 47.8 | 35.8 | 74 | 54 | -26.2 | -18.2 | V |
| 12.310 | 3.0 | 49.6 | 37.5 | 37.6 | 4.9 | -40.2 | 0.0 | 0.9 | 52.9 | 40.8 | 74 | 54 | -21.1 | -13.2 | V |

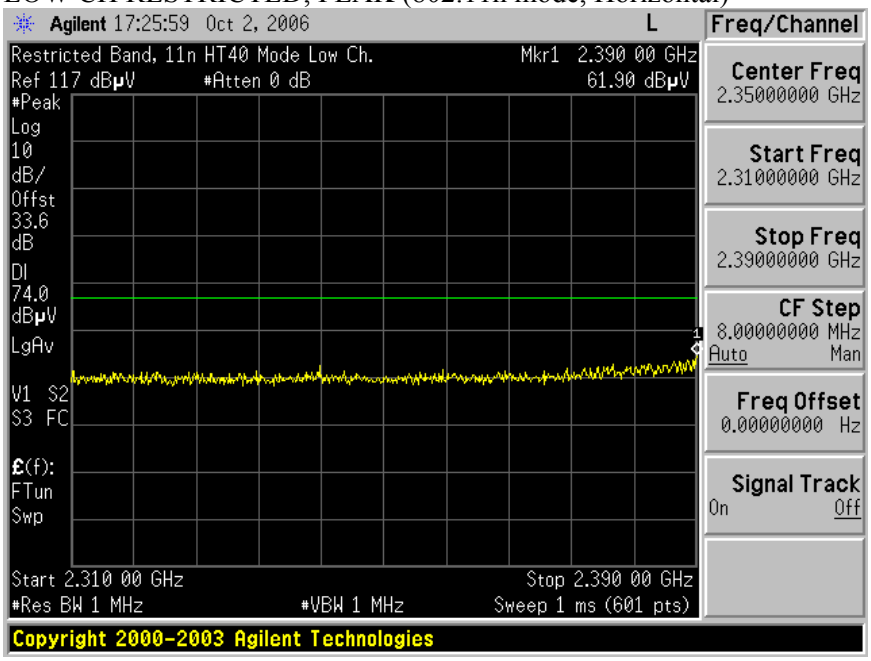
No other emissions were detected above system noise floor

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

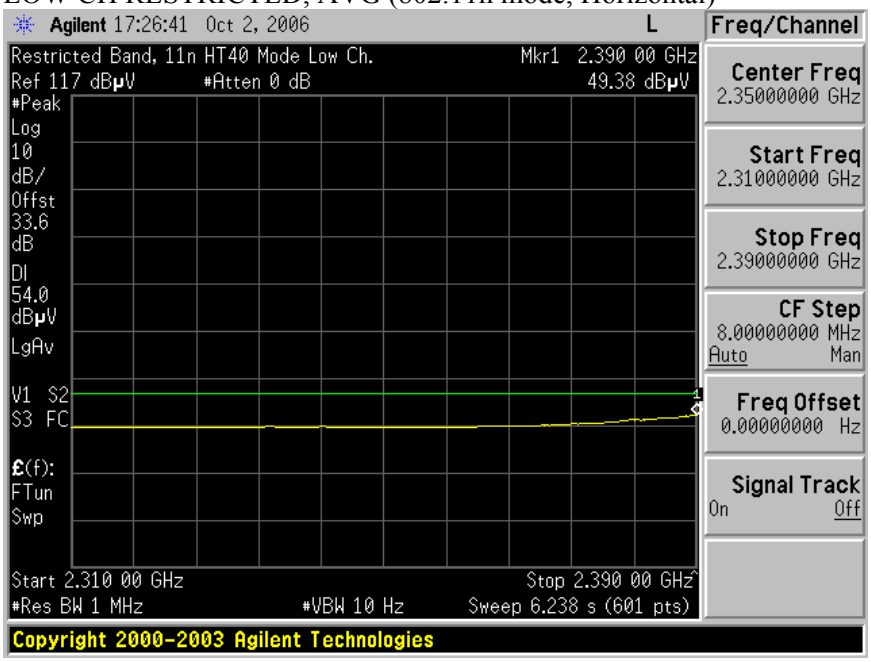
**11n HT40**

**RESTRICTED BANDEDGE (n HT40 MODE, LOW CHANNEL, HORIZONTAL)**

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

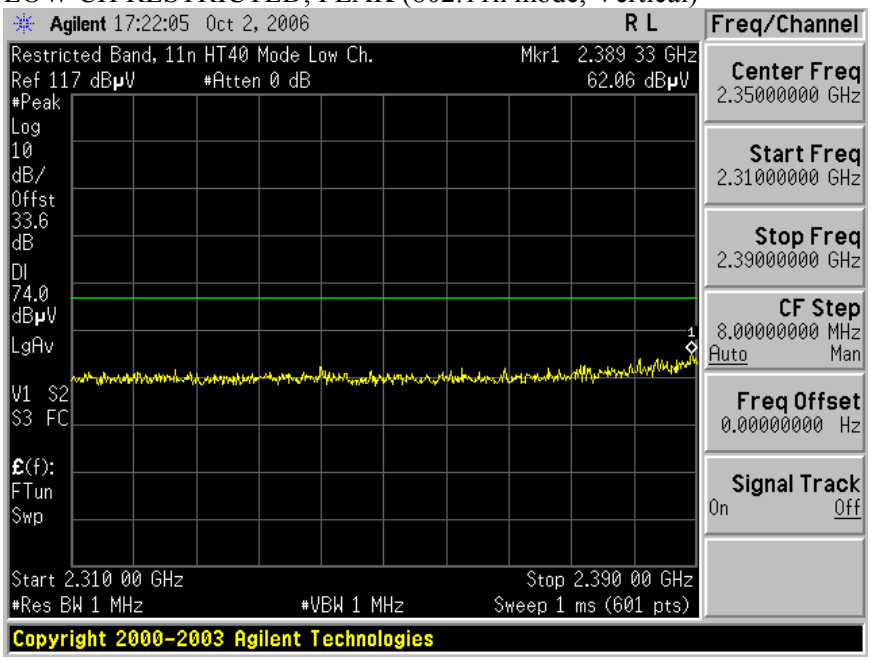


LOW CH RESTRICTED, AVG (802.11n mode, Horizontal)

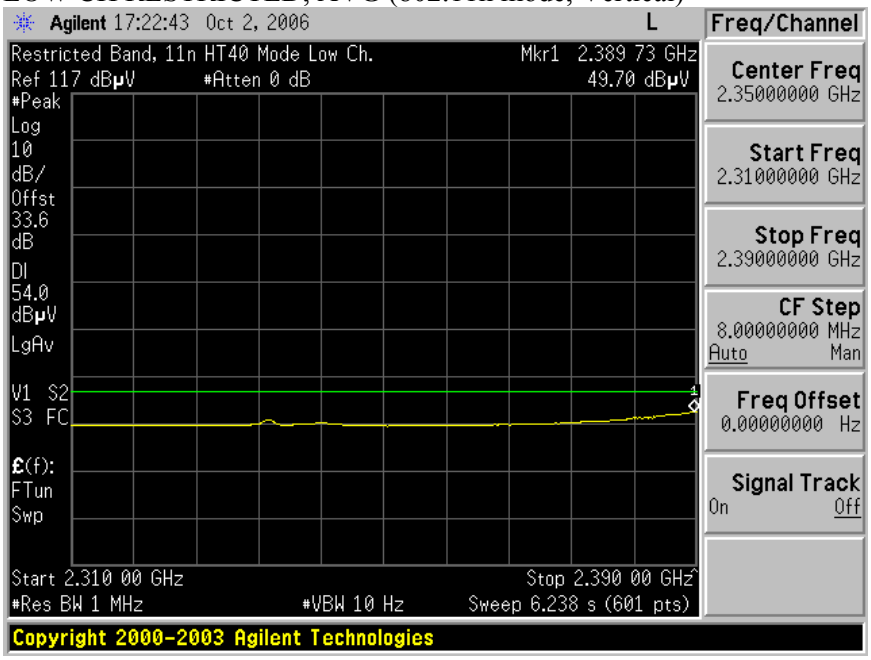


**RESTRICTED BANDEDGE (n HT40 MODE, LOW CHANNEL, VERTICAL)**

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

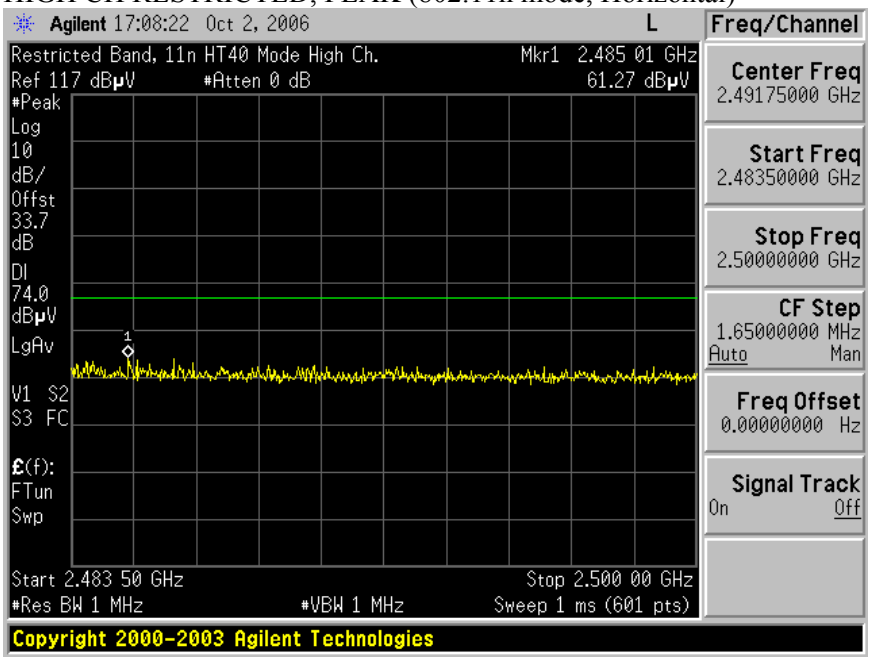


LOW CH RESTRICTED, AVG (802.11n mode, Vertical)

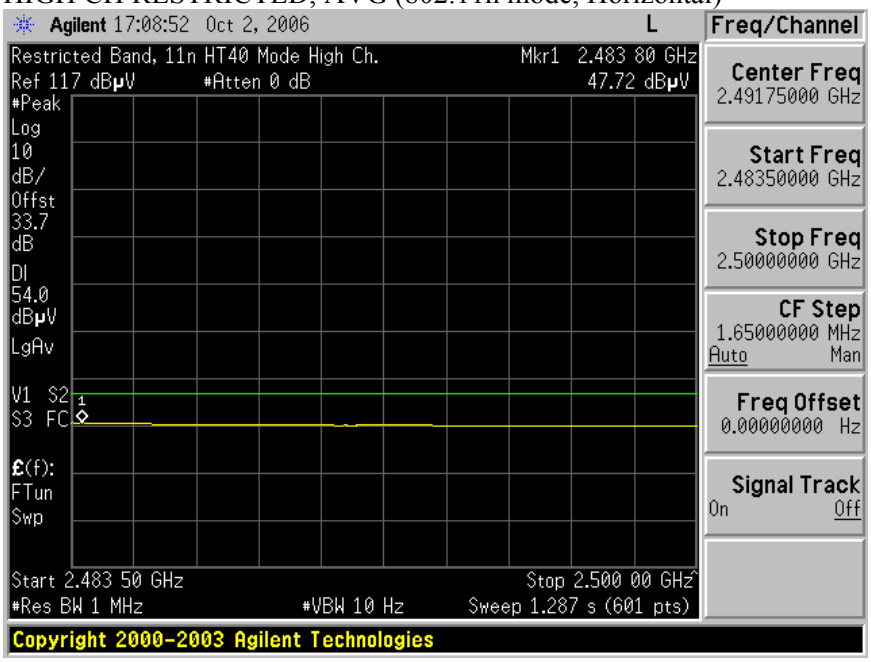


**RESTRICTED BANDEDGE (n HT40 MODE, HIGH CHANNEL, HORIZONTAL)**

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

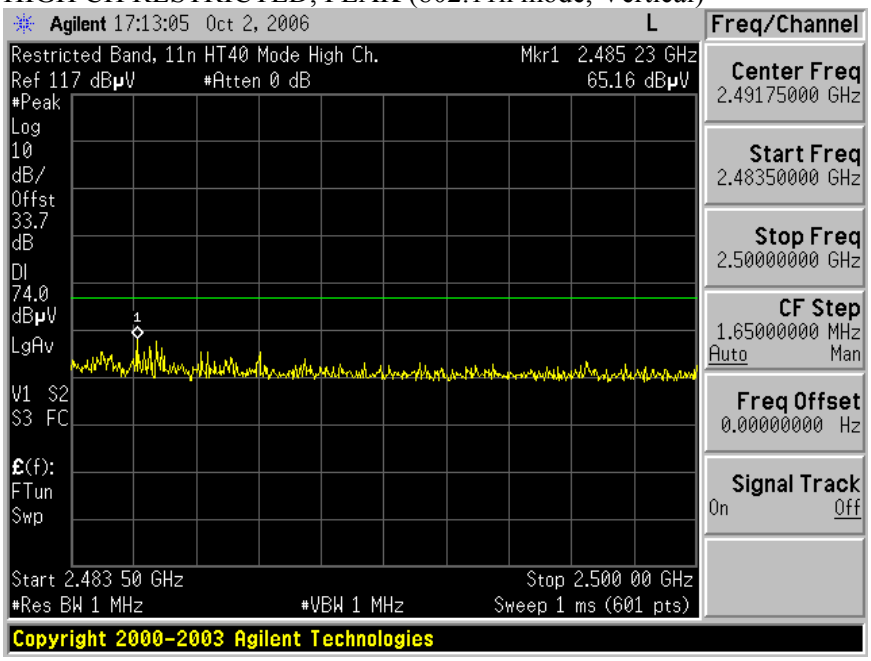


HIGH CH RESTRICTED, AVG (802.11n mode, Horizontal)

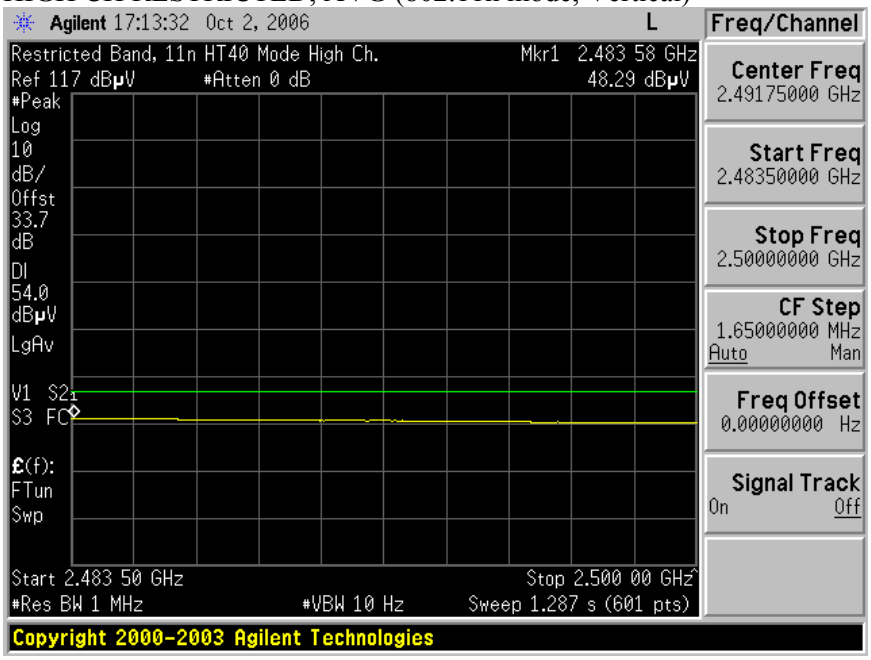


**RESTRICTED BANDEDGE (11n HT40 MODE, HIGH CHANNEL, VERTICAL)**

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



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



## HARMONICS AND SPURIOUS EMISSIONS (11n HT 40 MODE)

High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Company: Production Development Lab., Lenovo (Japan) Ltd
Project #: 06U10634
Date: 10/04/06
Test Engineer: Chien Ho
Configuration: EUT only
Mode: Tx 2.4 GHz 11n HT40

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T120; S/N: 29310 @3m | T87 Miteq 924342 | | | FCC 15.205 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | Vien 187215002 | Vien 197209005 | HPF_4.0GHz | |

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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOW CH 2422 MHz | | | | | | | | | | | | | | | |
| 4.844 | 3.0 | 51.1 | 39.1 | 33.7 | 3.0 | -45.3 | 0.0 | 0.6 | 43.1 | 31.1 | 74 | 54 | -30.9 | -22.9 | H |
| 7.266 | 3.0 | 52.3 | 39.2 | 35.2 | 4.2 | -43.3 | 0.0 | 0.6 | 49.0 | 35.9 | 74 | 54 | -25.0 | -18.1 | H |
| 12.110 | 3.0 | 49.9 | 37.7 | 37.7 | 4.9 | -40.1 | 0.0 | 0.9 | 53.3 | 41.1 | 74 | 54 | -20.7 | -12.9 | H |
| 4.844 | 3.0 | 51.4 | 39.2 | 33.7 | 3.0 | -45.3 | 0.0 | 0.6 | 43.4 | 31.2 | 74 | 54 | -30.6 | -22.8 | V |
| 7.266 | 3.0 | 51.4 | 39.1 | 35.2 | 4.2 | -43.3 | 0.0 | 0.6 | 48.1 | 35.8 | 74 | 54 | -25.9 | -18.2 | V |
| 12.110 | 3.0 | 50.0 | 37.2 | 37.7 | 4.9 | -40.1 | 0.0 | 0.9 | 53.4 | 40.6 | 74 | 54 | -20.6 | -13.4 | V |
| | | | | | | | | | | | | | | | |
| MID CH 2437 MHz | | | | | | | | | | | | | | | |
| 4.874 | 3.0 | 52.8 | 40.1 | 33.7 | 3.0 | -45.3 | 0.0 | 0.6 | 44.8 | 32.1 | 74 | 54 | -29.2 | -21.9 | H |
| 7.311 | 3.0 | 51.5 | 38.9 | 35.2 | 4.2 | -43.2 | 0.0 | 0.6 | 48.3 | 35.7 | 74 | 54 | -25.7 | -18.3 | H |
| 12.185 | 3.0 | 51.1 | 37.9 | 37.7 | 4.9 | -40.1 | 0.0 | 0.9 | 54.5 | 41.3 | 74 | 54 | -19.5 | -12.7 | H |
| 4.874 | 3.0 | 52.1 | 39.6 | 33.7 | 3.0 | -45.3 | 0.0 | 0.6 | 44.1 | 31.6 | 74 | 54 | -29.9 | -22.4 | V |
| 7.311 | 3.0 | 51.9 | 39.0 | 35.2 | 4.2 | -43.2 | 0.0 | 0.6 | 48.7 | 35.8 | 74 | 54 | -25.3 | -18.2 | V |
| 12.185 | 3.0 | 50.6 | 37.8 | 37.7 | 4.9 | -40.1 | 0.0 | 0.9 | 54.0 | 41.2 | 74 | 54 | -20.0 | -12.8 | V |
| | | | | | | | | | | | | | | | |
| HIGH CH 2452 MHz | | | | | | | | | | | | | | | |
| 4.904 | 3.0 | 51.2 | 39.2 | 33.8 | 3.0 | -45.3 | 0.0 | 0.6 | 43.3 | 31.3 | 74 | 54 | -30.7 | -22.7 | H |
| 7.356 | 3.0 | 51.3 | 38.8 | 35.2 | 4.2 | -43.1 | 0.0 | 0.6 | 48.2 | 35.7 | 74 | 54 | -25.8 | -18.3 | H |
| 12.260 | 3.0 | 50.2 | 37.4 | 37.6 | 4.9 | -40.1 | 0.0 | 0.9 | 53.5 | 40.7 | 74 | 54 | -20.5 | -13.3 | H |
| 4.904 | 3.0 | 52.4 | 39.2 | 33.8 | 3.0 | -45.3 | 0.0 | 0.6 | 44.5 | 31.3 | 74 | 54 | -29.5 | -22.7 | V |
| 7.356 | 3.0 | 51.4 | 38.8 | 35.2 | 4.2 | -43.1 | 0.0 | 0.6 | 48.3 | 35.7 | 74 | 54 | -25.7 | -18.3 | V |
| 12.260 | 3.0 | 49.3 | 37.4 | 37.6 | 4.9 | -40.1 | 0.0 | 0.9 | 52.6 | 40.7 | 74 | 54 | -21.4 | -13.3 | V |
| | | | | | | | | | | | | | | | |

No other emissions were detected above 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 | | |

## 7.1.3. TRANSMITTER ABOVE 1 GHz FOR 5725 TO 5850 MHz BAND 11a

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

High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Company: Production Development Lab., Lenovo (Japan) Ltd
Project #: 06U10634
Date: 10/04/06
Test Engineer: Chien Ho
Configuration: EUT only
Mode: Tx 5.8 GHz 11a

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T120; S/N: 29310 @3m | T87 Miteq 924342 | | | FCC 15.205 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | Vien 187215002 | Vien 197209005 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOW CH 5745 MHz | | | | | | | | | | | | | | | |
| 11.490 | 3.0 | 49.6 | 36.4 | 37.6 | 4.8 | -39.8 | 0.0 | 0.7 | 52.9 | 39.7 | 74 | 54 | -21.1 | -14.3 | H |
| 11.490 | 3.0 | 50.6 | 37.2 | 37.6 | 4.8 | -39.8 | 0.0 | 0.7 | 53.9 | 40.5 | 74 | 54 | -20.1 | -13.5 | V |
| MID CH 5785 MHz | | | | | | | | | | | | | | | |
| 11.570 | 3.0 | 50.3 | 38.6 | 37.6 | 4.8 | -39.8 | 0.0 | 0.7 | 53.6 | 41.9 | 74 | 54 | -20.4 | -12.1 | H |
| 11.570 | 3.0 | 49.7 | 36.8 | 37.6 | 4.8 | -39.8 | 0.0 | 0.7 | 53.0 | 40.1 | 74 | 54 | -21.0 | -13.9 | V |
| HIGH CH 5825 MHz | | | | | | | | | | | | | | | |
| 11.650 | 3.0 | 49.2 | 37.8 | 37.7 | 4.8 | -39.8 | 0.0 | 0.7 | 52.5 | 41.1 | 74 | 54 | -21.5 | -12.9 | H |
| 11.650 | 3.0 | 48.8 | 37.4 | 37.7 | 4.8 | -39.8 | 0.0 | 0.7 | 52.1 | 40.7 | 74 | 54 | -21.9 | -13.3 | V |
| No other emissions were detected above 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 | | |

## 11n HT20

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

High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Company: Production Development Lab., Lenovo (Japan) Ltd
Project #: 06U10634
Date: 10/04/06
Test Engineer: Chien Ho
Configuration: EUT only
Mode: Tx 5.8 GHz 11n HT20

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T120; S/N: 29310 @3m | T87 Miteq 924342 | | | FCC 15.205 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | Vien 187215002 | Vien 197209005 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOW CH 5745 MHz | | | | | | | | | | | | | | | |
| 11.490 | 3.0 | 52.5 | 40.1 | 37.6 | 4.8 | -39.8 | 0.0 | 0.7 | 55.8 | 43.4 | 74 | 54 | -18.2 | -10.6 | H |
| 11.490 | 3.0 | 48.8 | 37.1 | 37.6 | 4.8 | -39.8 | 0.0 | 0.7 | 52.1 | 40.4 | 74 | 54 | -21.9 | -13.6 | V |
| MID CH 5785 MHz | | | | | | | | | | | | | | | |
| 11.570 | 3.0 | 49.1 | 38.4 | 37.6 | 4.8 | -39.8 | 0.0 | 0.7 | 52.4 | 41.7 | 74 | 54 | -21.6 | -12.3 | H |
| 11.570 | 3.0 | 51.4 | 39.4 | 37.6 | 4.8 | -39.8 | 0.0 | 0.7 | 54.7 | 42.7 | 74 | 54 | -19.3 | -11.3 | V |
| HIGH CH 5825 MHz | | | | | | | | | | | | | | | |
| 11.650 | 3.0 | 51.0 | 37.8 | 37.7 | 4.8 | -39.8 | 0.0 | 0.7 | 54.3 | 41.1 | 74 | 54 | -19.7 | -12.9 | H |
| 11.650 | 3.0 | 50.1 | 37.2 | 37.7 | 4.8 | -39.8 | 0.0 | 0.7 | 53.4 | 40.5 | 74 | 54 | -20.6 | -13.5 | V |
| No other emissions were detected above 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 | | |

## 11n HT40

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

High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Company: Production Development Lab., Lenovo (Japan) Ltd
Project #: 06U10634
Date: 10/04/06
Test Engineer: Chien Ho
Configuration: EUT only
Mode: Tx 5.8 GHz 11n HT40

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T120; S/N: 29310 @3m | T87 Miteq 924342 | | | FCC 15.205 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | Vien 187215002 | Vien 197209005 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOW CH 5755 MHz | | | | | | | | | | | | | | | |
| 11.510 | 3.0 | 49.7 | 37.0 | 37.6 | 4.8 | -39.8 | 0.0 | 0.7 | 53.0 | 40.3 | 74 | 54 | -21.0 | -13.7 | H |
| 11.510 | 3.0 | 49.0 | 36.9 | 37.6 | 4.8 | -39.8 | 0.0 | 0.7 | 52.3 | 40.2 | 74 | 54 | -21.7 | -13.8 | V |
| MID CH 5785 MHz | | | | | | | | | | | | | | | |
| 11.570 | 3.0 | 49.5 | 37.1 | 37.6 | 4.8 | -39.8 | 0.0 | 0.7 | 52.8 | 40.4 | 74 | 54 | -21.2 | -13.6 | H |
| 11.570 | 3.0 | 48.8 | 37.0 | 37.6 | 4.8 | -39.8 | 0.0 | 0.7 | 52.1 | 40.3 | 74 | 54 | -21.9 | -13.7 | V |
| HIGH CH 5815 MHz | | | | | | | | | | | | | | | |
| 11.630 | 3.0 | 49.4 | 37.0 | 37.7 | 4.8 | -39.8 | 0.0 | 0.7 | 52.7 | 40.3 | 74 | 54 | -21.3 | -13.7 | H |
| 11.630 | 3.0 | 49.6 | 37.1 | 37.7 | 4.8 | -39.8 | 0.0 | 0.7 | 52.9 | 40.4 | 74 | 54 | -21.1 | -13.6 | V |
| No other emissions were detected above 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 | | |

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

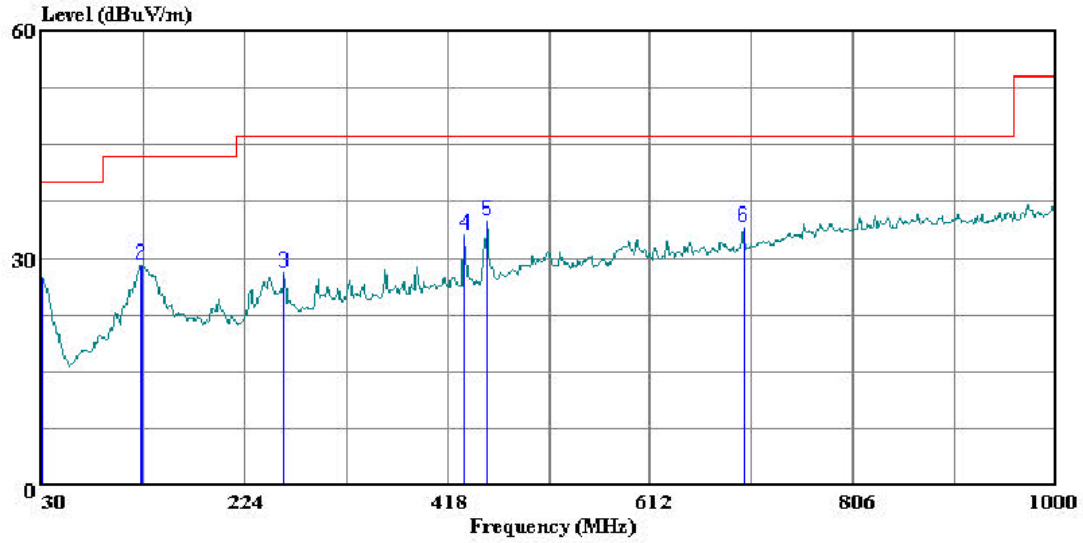
**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)**

**2.4 GHz BAND**

HORIZONTAL PLOT

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

Data#: 2 File#: 06U10634.EMI Date: 10-03-2006 Time: 07:53:53




(Audix ATC)

Trace: 1 Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Test Operator:: Vien Tran
Company: : Product Development Lab, Lenovo
Project #: : 06U10634
Configuration:: EUT
Mode of Oper.:: Tx 2.4GHZ Band
Target: : FCC Class B

HORIZONTAL DATA

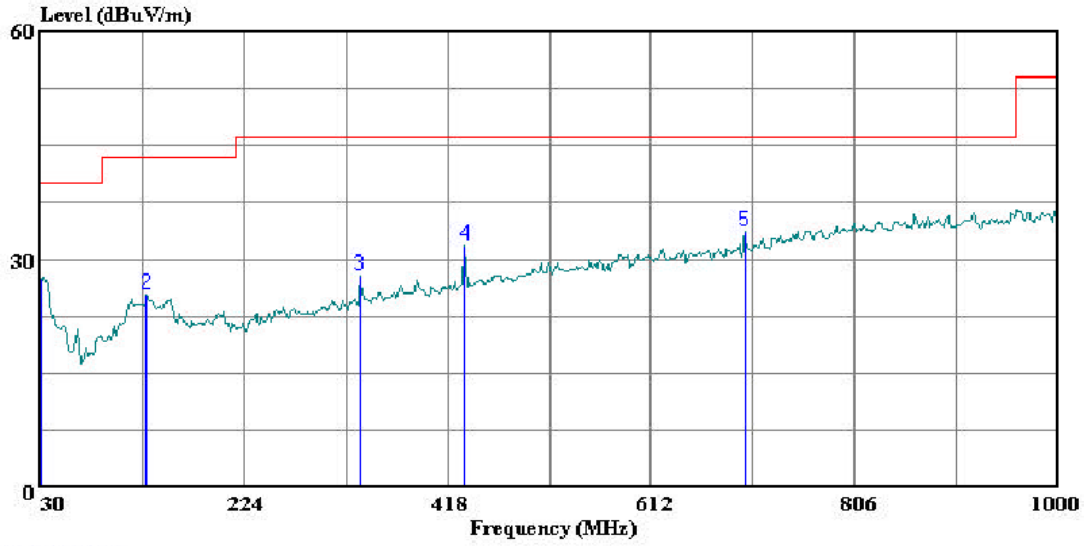
| | Freq | Read Level | Factor | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | |
| 1 | 30.000 | 6.87 | 20.45 | 27.32 | 40.00 | -12.68 | Peak |
| 2 | 125.060 | 13.83 | 15.26 | 29.09 | 43.50 | -14.42 | Peak |
| 3 | 261.830 | 13.77 | 14.35 | 28.12 | 46.00 | -17.89 | Peak |
| 4 | 434.490 | 14.27 | 18.84 | 33.11 | 46.00 | -12.89 | Peak |
| 5 | 455.830 | 15.65 | 19.33 | 34.98 | 46.00 | -11.02 | Peak |
| 6 | 701.240 | 11.01 | 23.09 | 34.10 | 46.00 | -11.90 | 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#: 4 File#: 06U10634.EMI Date: 10-03-2006 Time: 08:01:24




(Audix ATC)

Trace: 3 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator:: Vien Tran
Company: : Product Development Lab, Lenovo
Project #: : 06U10634
Configuration:: EUT
Mode of Oper.:: Tx 2.4GHZ Band
Target: : FCC Class B

VERTICAL DATA

| | Freq | Read Level | Factor | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | |
| 1 | 30.000 | 7.05 | 20.45 | 27.50 | 40.00 | -12.50 | Peak |
| 2 | 130.880 | 10.17 | 15.09 | 25.26 | 43.50 | -18.24 | Peak |
| 3 | 334.580 | 11.21 | 16.53 | 27.74 | 46.00 | -18.26 | Peak |
| 4 | 434.490 | 12.85 | 18.84 | 31.69 | 46.00 | -14.31 | Peak |
| 5 | 701.240 | 10.50 | 23.09 | 33.59 | 46.00 | -12.41 | Peak |

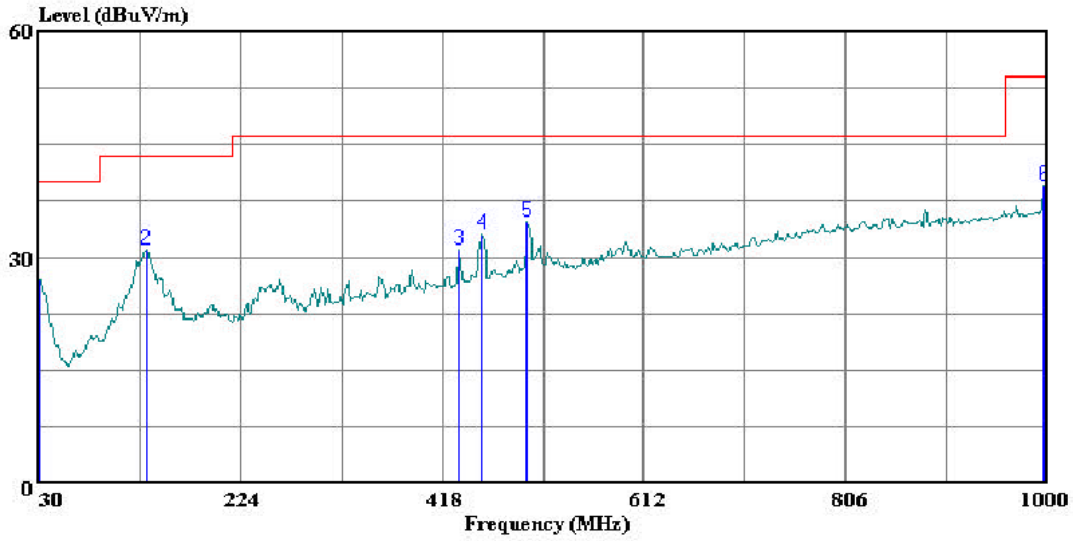
## SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

## 5 GHz BAND

HORIZONTAL PLOT

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

Data#: 8 File#: 06u10634.emi Date: 10-03-2006 Time: 08:27:06




(Audix ATC)

Trace: 7 Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Test Operator:: Vien Tran
Company: : Product Development Lab, Lenovo
Project #: : 06U10634
Configuration:: EUT
Mode of Oper.:: Tx 5 GHz Band
Target: : FCC Class B

HORIZONTAL DATA

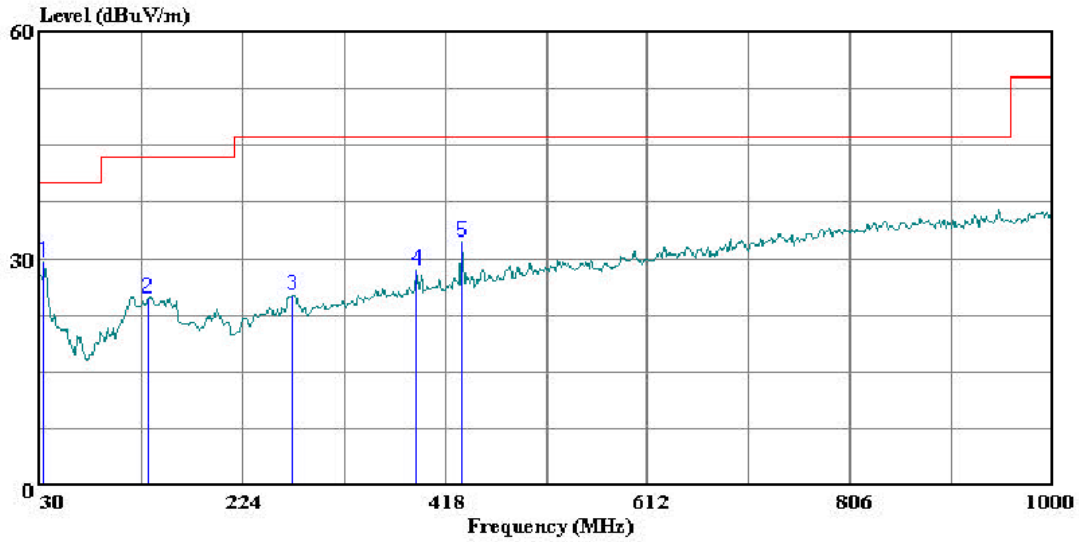
| | Freq | Read Level | Factor | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | |
| 1 | 30.000 | 6.54 | 20.45 | 26.99 | 40.00 | -13.01 | Peak |
| 2 | 133.790 | 15.94 | 15.02 | 30.96 | 43.50 | -12.54 | Peak |
| 3 | 434.490 | 12.12 | 18.84 | 30.96 | 46.00 | -15.04 | Peak |
| 4 | 455.830 | 13.77 | 19.33 | 33.10 | 46.00 | -12.90 | Peak |
| 5 | 499.480 | 14.43 | 20.22 | 34.65 | 46.00 | -11.35 | Peak |
| 6 | 997.090 | 12.60 | 26.91 | 39.51 | 54.00 | -14.49 | 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#: 6 File#: 06U10634.EMI Date: 10-03-2006 Time: 08:12:38




(Audix ATC)

Trace: 5 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator:: Vien Tran
Company: : Product Development Lab, Lenovo
Project #: : 06U10634
Configuration:: EUT
Mode of Oper.:: Tx 5 GHz Band
Target: : FCC Class B

VERTICAL DATA

| | Freq | Read Level | Factor | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | |
| 1 | 33.880 | 10.41 | 19.05 | 29.46 | 40.00 | -10.54 | Peak |
| 2 | 133.790 | 9.68 | 15.02 | 24.70 | 43.50 | -18.80 | Peak |
| 3 | 271.530 | 10.45 | 14.65 | 25.10 | 46.00 | -20.90 | Peak |
| 4 | 390.840 | 10.60 | 17.83 | 28.43 | 46.00 | -17.57 | Peak |
| 5 | 434.490 | 13.25 | 18.84 | 32.09 | 46.00 | -13.91 | 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 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:

**2.4 GHz BAND**

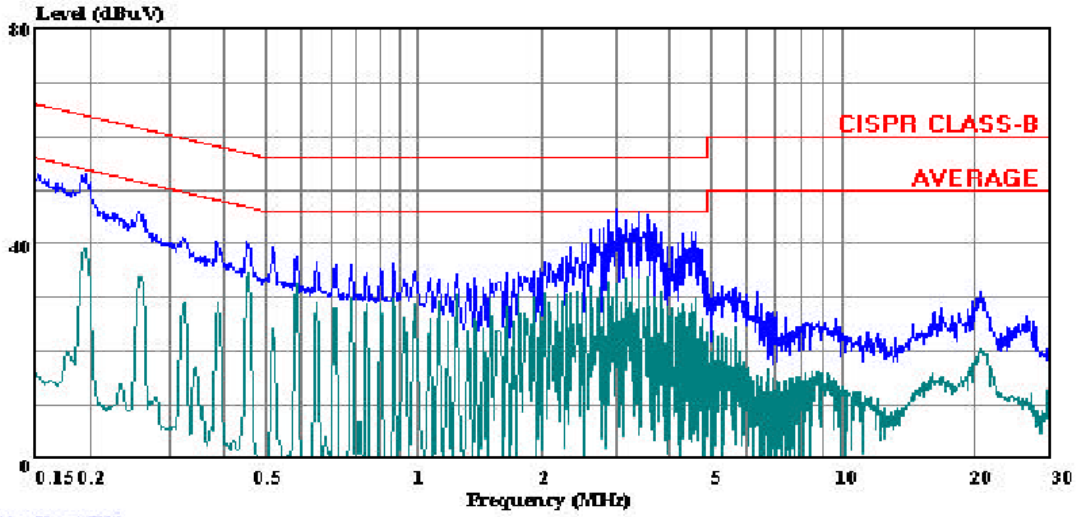
**6 WORST EMISSIONS**

| 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 |
| 0.19 | 52.86 | -- | 39.28 | 0.00 | 64.04 | 54.04 | -11.18 | -14.76 | L1 |
| 0.45 | 40.40 | -- | 34.72 | 0.00 | 56.88 | 46.88 | -16.48 | -12.16 | L1 |
| 3.51 | 46.08 | -- | 37.87 | 0.00 | 56.00 | 46.00 | -9.92 | -8.13 | L1 |
| 0.19 | 51.64 | -- | 37.35 | 0.00 | 64.04 | 54.04 | -12.40 | -16.69 | L2 |
| 0.45 | 39.70 | -- | 30.41 | 0.00 | 56.88 | 46.88 | -17.18 | -16.47 | L2 |
| 3.51 | 45.10 | -- | 29.91 | 0.00 | 56.00 | 46.00 | -10.90 | -16.09 | 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#: 21 File#: 06u10634.emi Date: 10-03-2006 Time: 12:59:50

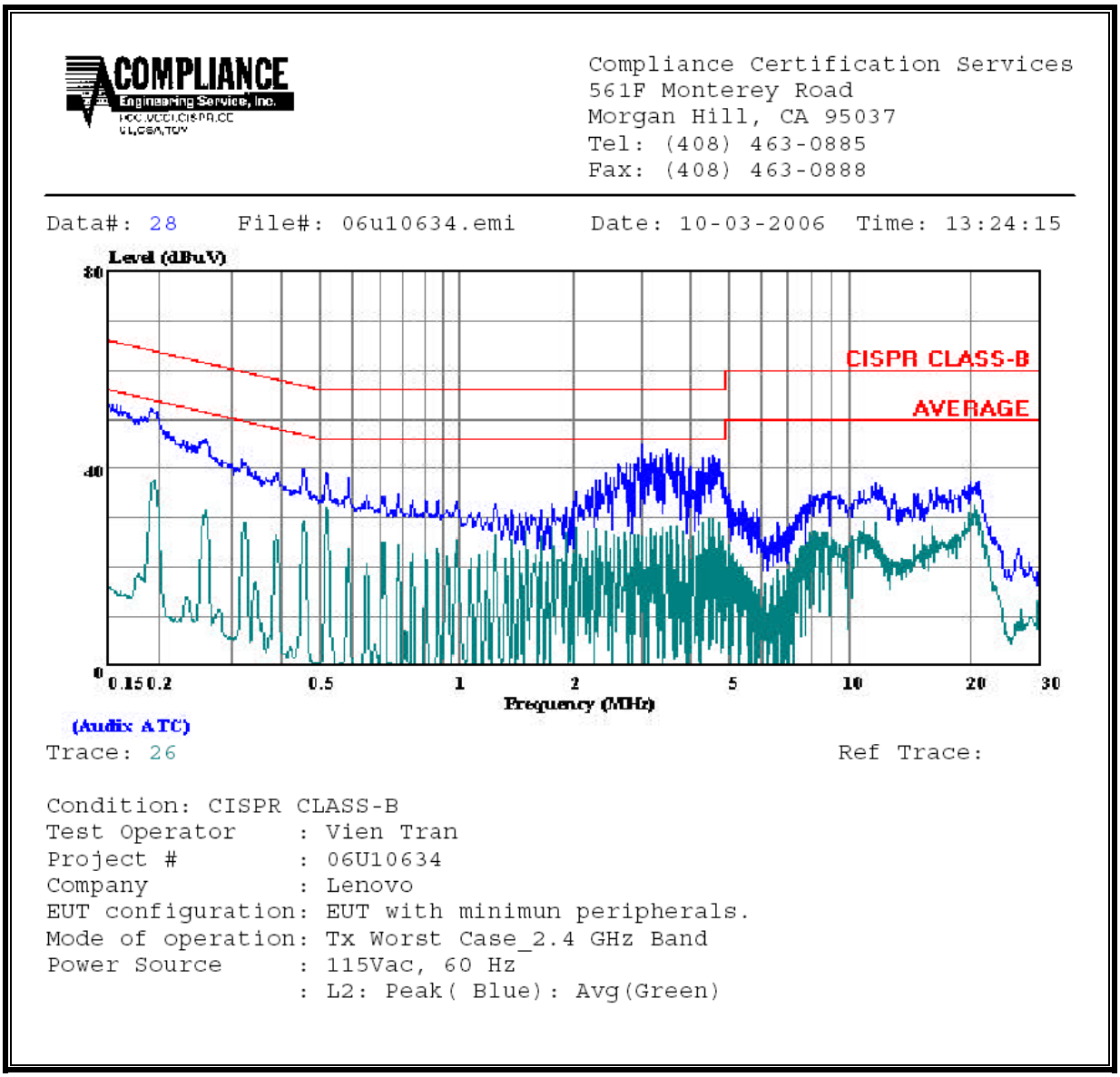



(Audix ATC)

Trace: 19 Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Vien Tran
Project # : 06U10634
Company : Lenovo
EUT configuration: EUT with minimun peripherals.
Mode of operation: Tx Worst Case_2.4 GHz Band
Power Source : 115Vac, 60 Hz
: L1: Peak( Blue): Avg(Green)

**LINE 2 RESULTS**



**5 GHz BAND**

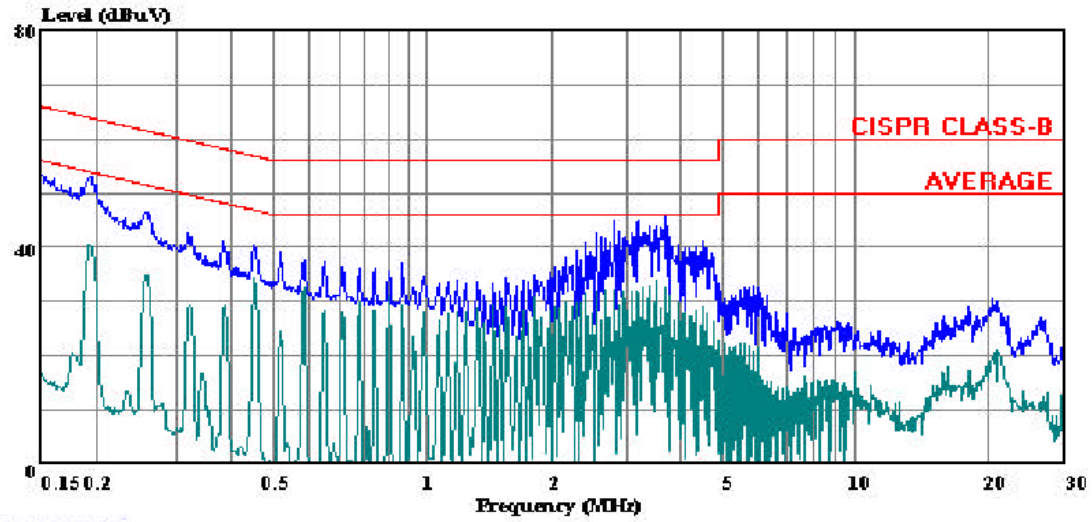
**6 WORST EMISSIONS**

| 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 |
| 0.19 | 52.93 | -- | 40.69 | 0.00 | 63.91 | 53.91 | -10.98 | -13.22 | L1 |
| 0.26 | 46.36 | -- | 34.85 | 0.00 | 61.46 | 51.46 | -15.10 | -16.61 | L1 |
| 3.76 | 45.68 | -- | 34.40 | 0.00 | 56.00 | 46.00 | -10.32 | -11.60 | L1 |
| 0.19 | 52.06 | -- | 37.41 | 0.00 | 63.91 | 53.91 | -11.85 | -16.50 | L2 |
| 0.26 | 46.04 | -- | 32.20 | 0.00 | 61.46 | 51.46 | -15.42 | -19.26 | L2 |
| 3.24 | 43.98 | -- | 32.12 | 0.00 | 56.00 | 46.00 | -12.02 | -13.88 | 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#: 7 File#: 06U10634.EMI Date: 10-03-2006 Time: 12:24:06



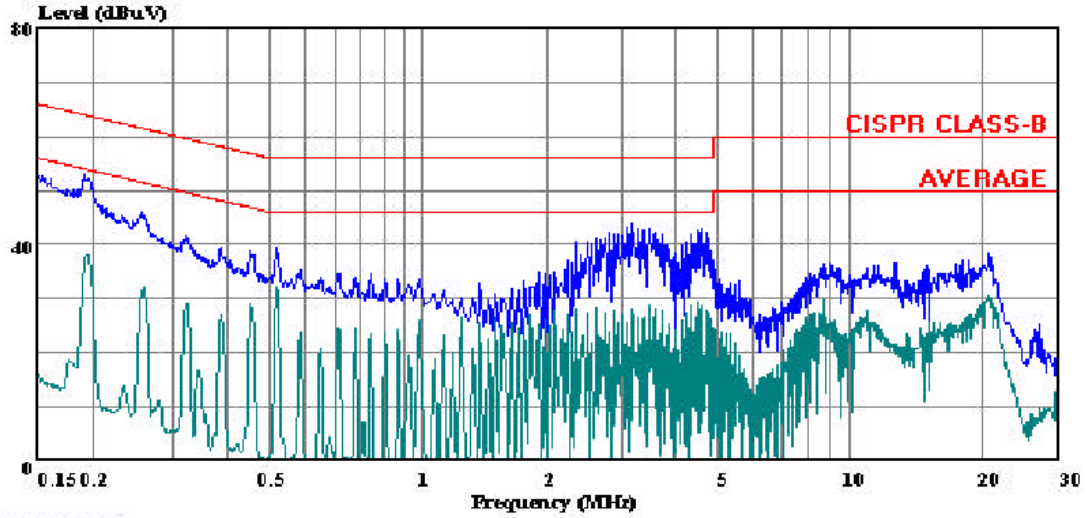

Trace: 5 Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Vien Tran
Project # : 06U10634
Company : Lenovo
EUT configuration: EUT with minimun peripherals.
Mode of operation: Tx 5 GHz Band
Power Source : 115Vac, 60 Hz
: L1: Peak( Blue): Avg(Green)

**LINE 2 RESULTS**

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

Data#: 14 File#: 06u10634.emi Date: 10-03-2006 Time: 12:40:37




Trace: 12 Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Vien Tran
Project # : 06U10634
Company : Lenovo
EUT configuration: EUT with minimun peripherals.
Mode of operation: Tx 5 GHz Band
Power Source : 115Vac, 60 Hz
: L2: Peak( Blue): Avg(Green)