



**FCC CFR47 PART 15 SUBPART E  
CERTIFICATION  
TEST REPORT  
FOR**

**802.11 A/G HALF SIZE MINI PCI WLAN MODULE**

**MODEL NUMBER: PA3459U-1MPC; PA3461U/E-1MPC (FOR OPTION)**

**FCC ID: CJ6UPA3459WL**

**REPORT NUMBER: 05U3390-2**

**ISSUE DATE: MAY 23, 2005**

*Prepared for*  
**TOSHIBA CORPORATION DIGITAL MEDIA NETWORK COMPANY  
2-9 SUEHIRO-CHO, OME  
TOKYO, 198-8710, JAPAN**

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

**NVLAP<sup>®</sup>**  
**LAB CODE:200065-0**

Revision History

<u>Rev.</u>	<u>Revisions</u>	<u>Revised By</u>
-------------	------------------	-------------------

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS</b>	<b>4</b>
<b>2. TEST METHODOLOGY</b>	<b>5</b>
<b>3. FACILITIES AND ACCREDITATION</b>	<b>5</b>
<b>4. CALIBRATION AND UNCERTAINTY</b>	<b>5</b>
4.1. MEASURING INSTRUMENT CALIBRATION	5
4.2. MEASUREMENT UNCERTAINTY	5
<b>5. EQUIPMENT UNDER TEST</b>	<b>6</b>
5.1. DESCRIPTION OF EUT	6
5.2. MAXIMUM OUTPUT POWER	6
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	6
5.4. MANUFACTURER'S DESCRIPTION OF MODEL DIFFERENCES	6
5.5. SOFTWARE AND FIRMWARE	7
5.6. WORST-CASE CONFIGURATION AND MODE	7
5.7. DESCRIPTION OF TEST SETUP	7
<b>6. TEST AND MEASUREMENT EQUIPMENT</b>	<b>9</b>
<b>7. LIMITS AND RESULTS</b>	<b>10</b>
7.1. CHANNEL TESTS	10
7.1.1. EMISSION BANDWIDTH	10
7.1.2. PEAK POWER	14
7.1.3. MAXIMUM PERMISSIBLE EXPOSURE	19
7.1.4. AVERAGE POWER	22
7.1.5. PEAK POWER SPECTRAL DENSITY	23
7.1.6. PEAK EXCURSION	28
7.1.7. CONDUCTED SPURIOUS EMISSIONS	32
7.2. RADIATED EMISSIONS	36
7.2.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS	36
7.2.2. TRANSMITTER ABOVE 1 GHz	39
7.2.5. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz	57
7.3. POWERLINE CONDUCTED EMISSIONS	65
<b>8. SETUP PHOTOS</b>	<b>69</b>

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** TOSHIBA CORPORATION DIGITAL MEDIA NETWORK COMPANY  
2-9 SUEHIRO-CHO, OME  
TOKYO, 198-8710, JAPAN

**EUT DESCRIPTION:** 802.11A/G HALF SIZE MINI-PCI WLAN MODULE

**MODEL:** PA3459U-1MPC

**MODEL (FOR OPTION):** PA3461U/E-1MPC

**SERIAL NUMBER:** 1152T000018

**DATE TESTED:** MAY 09 - 19, 2005

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

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

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

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

Approved & Released For CCS By:

Tested By:



---

THU CHAN  
EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

---

CHIN PANG  
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 EUT is a MiniPCI 802.11a/b/g (Without Turbo ) transceiver module.

The radio module is manufactured by ATHEROS COMMUNICATIONS, INC.

The EUT module is installed and tested inside the Firebolt Laptop.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

5150 to 5250 MHz Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5180 - 5250	802.11a	14.71	29.58

5250 to 5350 MHz Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5250 - 5320	802.11a	14.92	31.05

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes four PIFA Film type antennas; each has a maximum gain as follows:

PIFA type antennas:

1. HTL017 - 4.24 dBi at 2.4GHz without cable loss;
2. HTL017 - 4.12 dBi at 5.8GHz without cable loss;
3. HTL004 - 4.18 dBi at 2.4GHz without cable loss;
4. TIAN01 - 4.66 dBi at 5.2GHz without cable loss.

The HTL017 antenna, which has the highest gain of 2.4GHz and 5.8GHz bands; also the TIAN01 antenna, which has the highest gain of 5.2GHz bands, so both antennas represent the worst-case scenario.

### 5.4. MANUFACTURER'S DESCRIPTION OF MODEL DIFFERENCES

The two modules are identical and only differ in model number.

## 5.5. SOFTWARE AND FIRMWARE

The test firmware was installed in the EUT during testing.

The test utility software used during testing was art program "ART\_V52build58\_all".

## 5.6. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest average output power. The highest measured average output powers were at 2412 MHz for b/g mode, 5320 MHz for a mode (UNII), and 5745 MHz for a mode (DTS). The EUT is tested at mobile and portable of two different configurations.

## 5.7. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Toshiba	PPM20U-AAAA8	Z3044588-JU	DoC
AC Adapater	Toshiba	ADP-80RH	148162	DoC

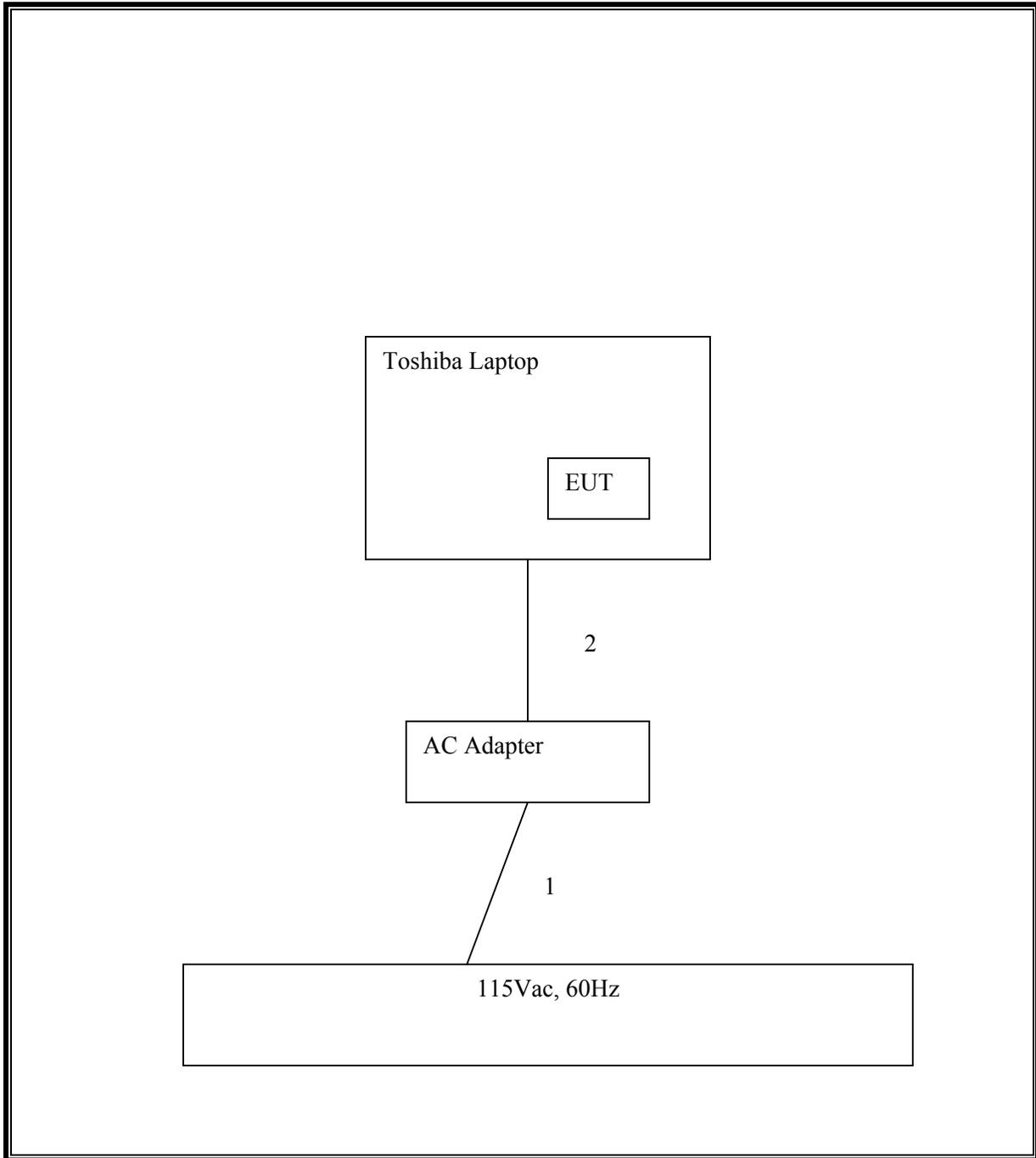
### I/O CABLES

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

### TEST SETUP

The EUT is installed in a 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
Antenna, Horn 1 ~ 18 GHz	EMCO	3117	3/21/1980	9/12/2005
Amplifier 1-26GHz	MITEQ	NSP2600-SP	924342	8/17/05
Antenna, Horn 18 ~ 26 GHz	ARA	SWH-28	1007	9/12/05
30MHz---- 2Ghz	Sunol Sciences	JB1 Antenna	A121003	9/12/05
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	3/6/06
RF Filter Section	HP	85420E	3705A00256	3/6/06
EMI Test Receiver	R & S	ESHS 20	827129/006	10/22/05
Site A Line Stabilizer / Conditioner	Tripplite	LC-1800a	A0051681	CNR
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	837990	10/21/05
Peak / Average Power Sensor	Agilent	E9327A	US40440755	2/10/06
Spectrum Analyzer	HP	E4446A	US42510266	8/25/05
7.6GHz HPF	MicroTronic	HPM13195	2	CNR
5470-5725MHz Reject Filter	MicroTronic	BRC13191	1	CNR
Antenna, Horn 18 ~ 26 GHz	ARA	SWH-28	1007	9/12/05
Peak Power Meter	Agilent	E4416A	GB41291160	1/9/06
4.0 GHz HPF	MicroTronic	HPM13351	1	CNR

## 7. LIMITS AND RESULTS

### 7.1. CHANNEL TESTS

#### 7.1.1. EMISSION BANDWIDTH

##### LIMIT

§15.403 (i) Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

##### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 26 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

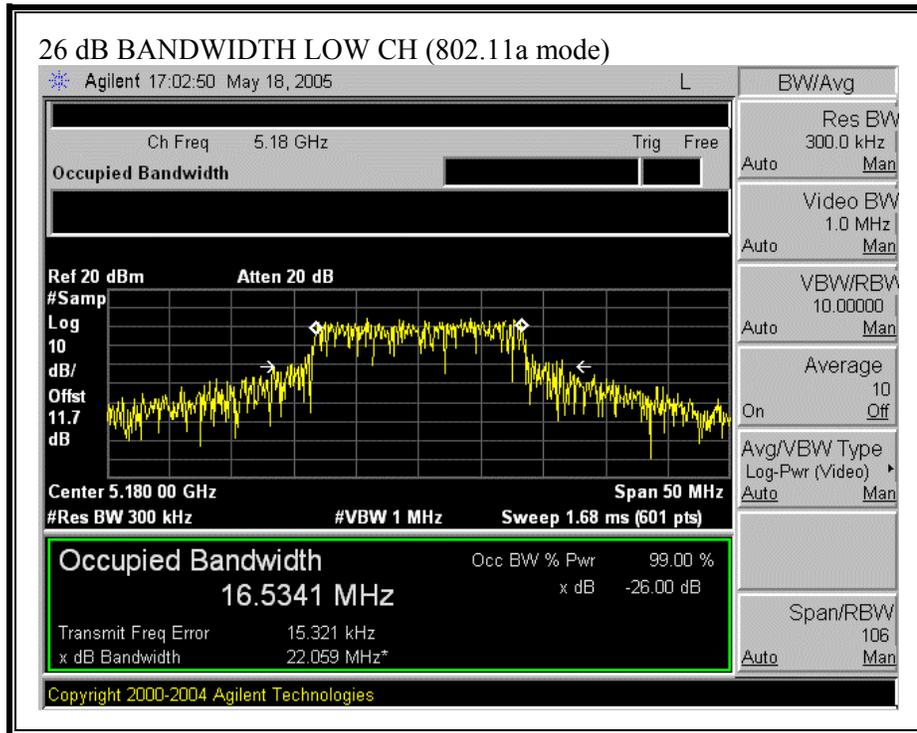
##### RESULTS

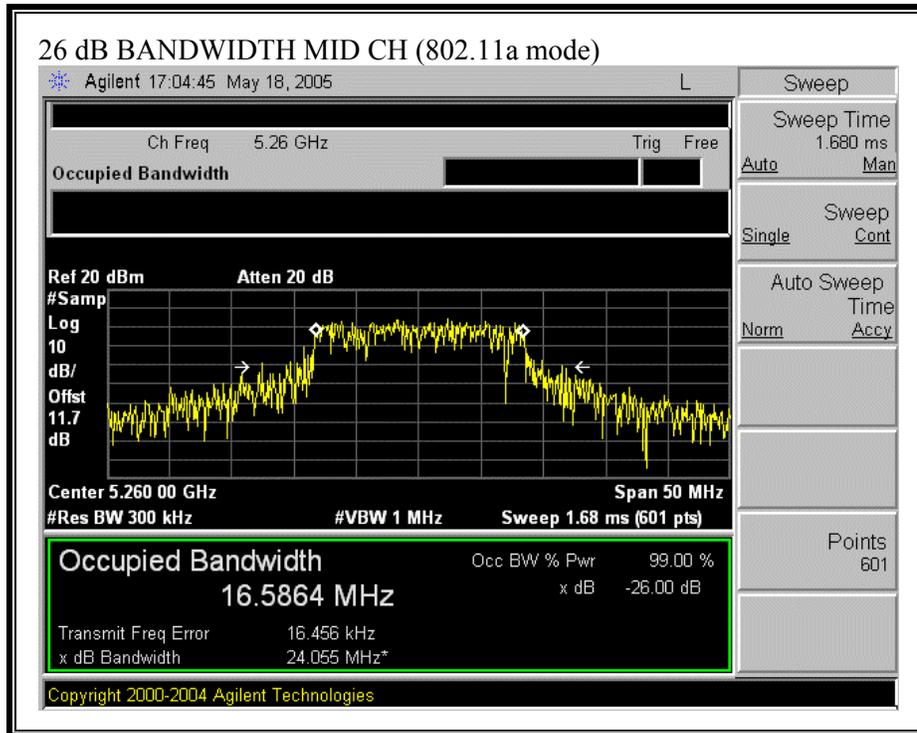
No non-compliance noted:

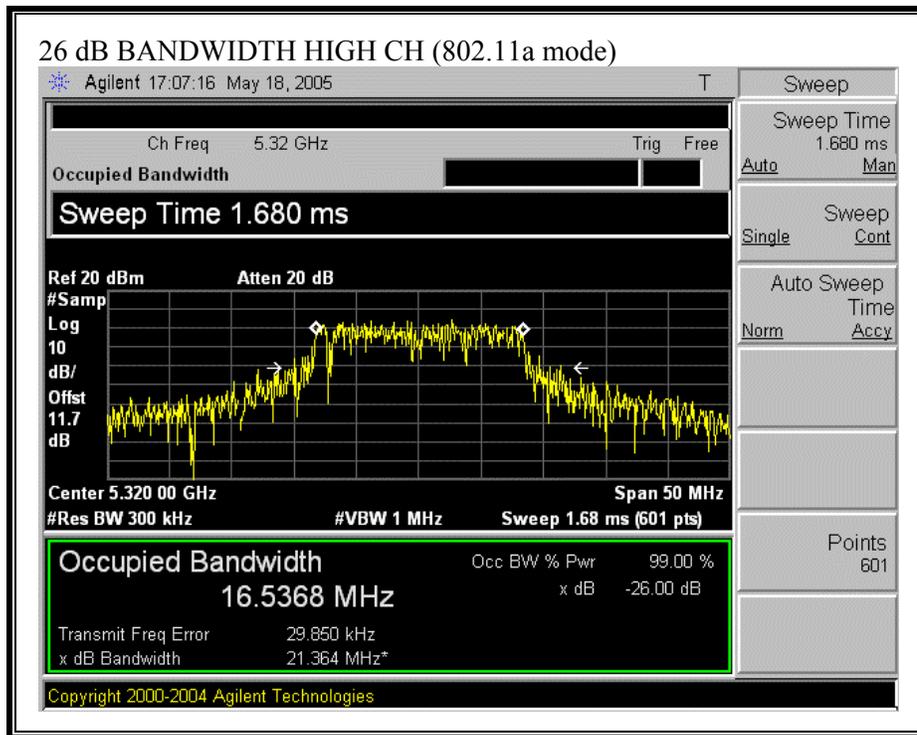
802.11a Mode

Channel	Frequency (MHz)	B (MHz)	10 Log B (dB)
Low	5180	22.06	13.44
Middle	5260	24.06	13.81
High	5320	21.36	13.30

**26 dB EMISSION BANDWIDTH (802.11a MODE)**







## 7.1.2. PEAK POWER

### LIMIT

§15.407 (a) (1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§15.407 (a) (1) For the band 5.25-5.35 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

**LIMITS AND RESULTS**

No non-compliance noted:

Limit in 5150 to 5250 MHz Band

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	17	22.06	17.44	4.66	17.00

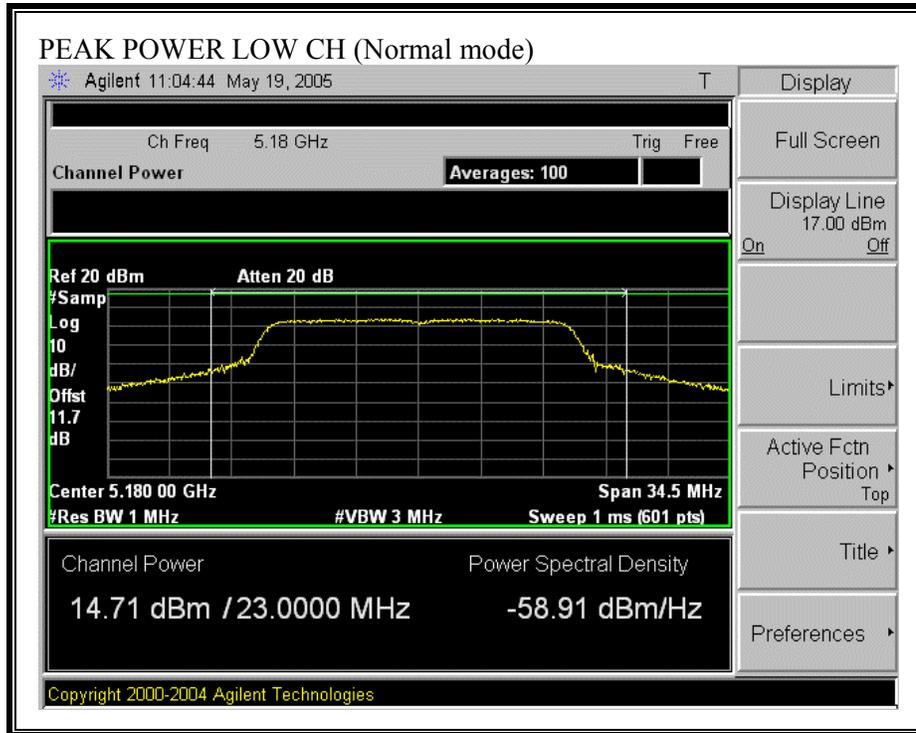
Limit in 5250 to 5350 MHz Band

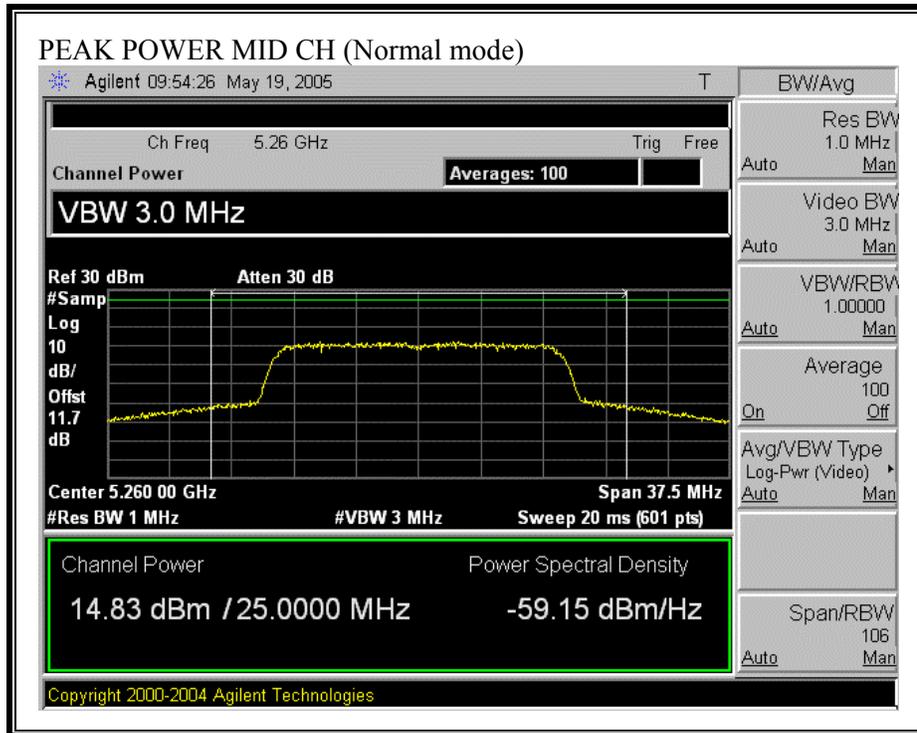
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Mid	5260	24	24.06	24.81	4.66	24.00
High	5320	24	21.36	24.30	4.66	24.00

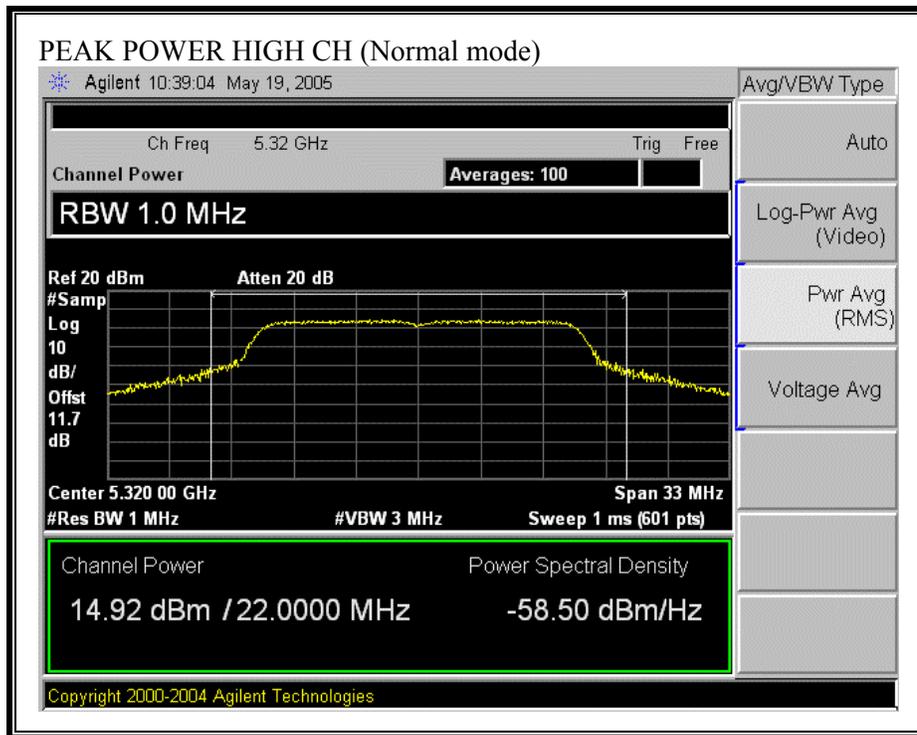
Results

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	14.71	17.00	-2.29
Mid	5260	14.83	24.00	-9.17
High	5320	14.92	24.00	-9.08

**PEAK POWER (NORMAL MODE)**







### 7.1.3. MAXIMUM PERMISSIBLE EXPOSURE

#### LIMITS

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

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

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

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

f = frequency in MHz

\* = Plane-wave equivalent power density

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

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

## **CALCULATIONS**

Given

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

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

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

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

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

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

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

yields

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

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

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

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

Substituting the logarithmic form of power and gain using:

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

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

yields

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

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

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

Equation (1) and the measured peak power is used to calculate the MPE distance.

**LIMITS**

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

**RESULTS**

No non-compliance noted:

<b>Mode</b>	<b>Power Density Limit (mW/cm<sup>2</sup>)</b>	<b>Output Power (dBm)</b>	<b>Antenna Gain (dBi)</b>	<b>MPE Distance (cm)</b>
802.11a	1.0	14.92	4.66	2.69

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

### 7.1.4. AVERAGE POWER

#### AVERAGE POWER LIMIT

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

No non-compliance noted:

The cable assembly insertion loss of 11.7dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

802.11a Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	5180	15.01
Middle	5260	15.20
High	5320	15.36

### **7.1.5. PEAK POWER SPECTRAL DENSITY**

#### **LIMIT**

§15.407 (a) (1) For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§15.407 (a) (1) For the band 5.25-5.35 GHz, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain = 4.66dBi, therefore there is no reduction due to antenna gain.

#### **TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

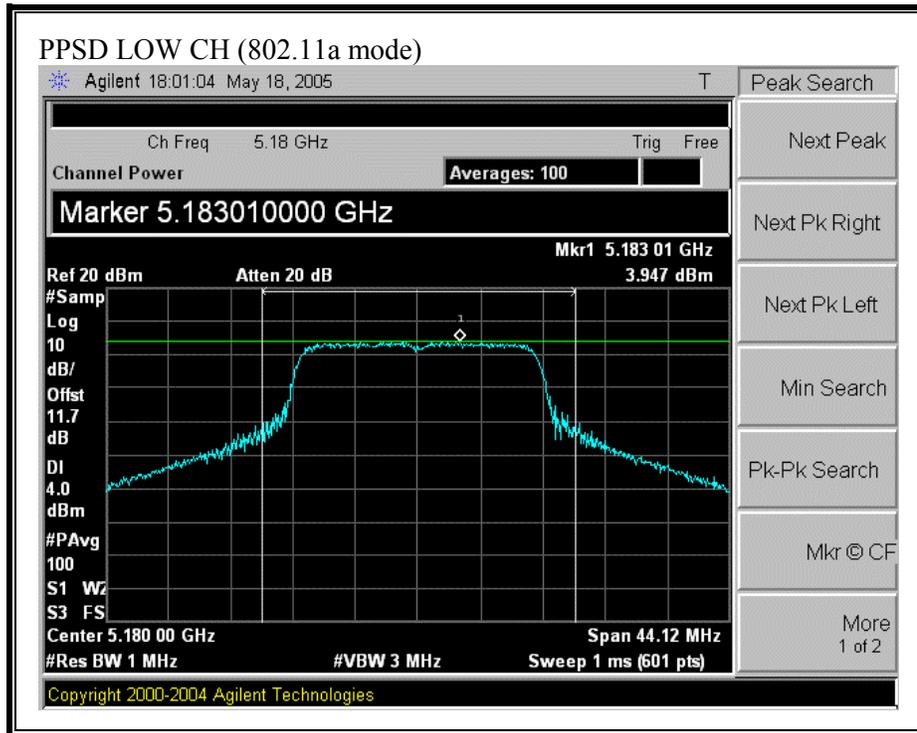
**RESULTS**

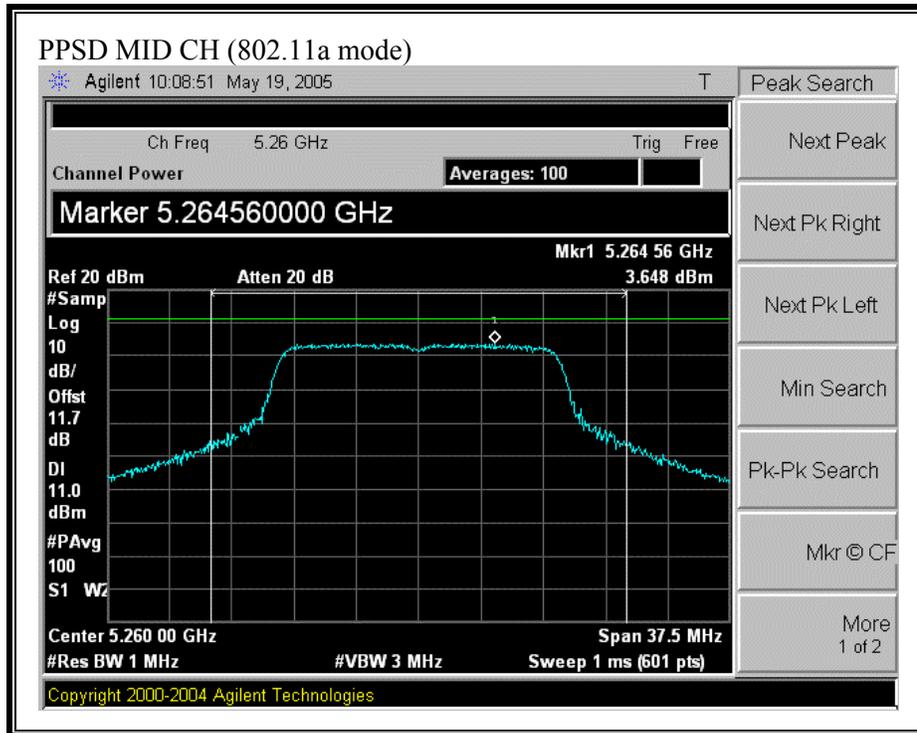
No non-compliance noted:

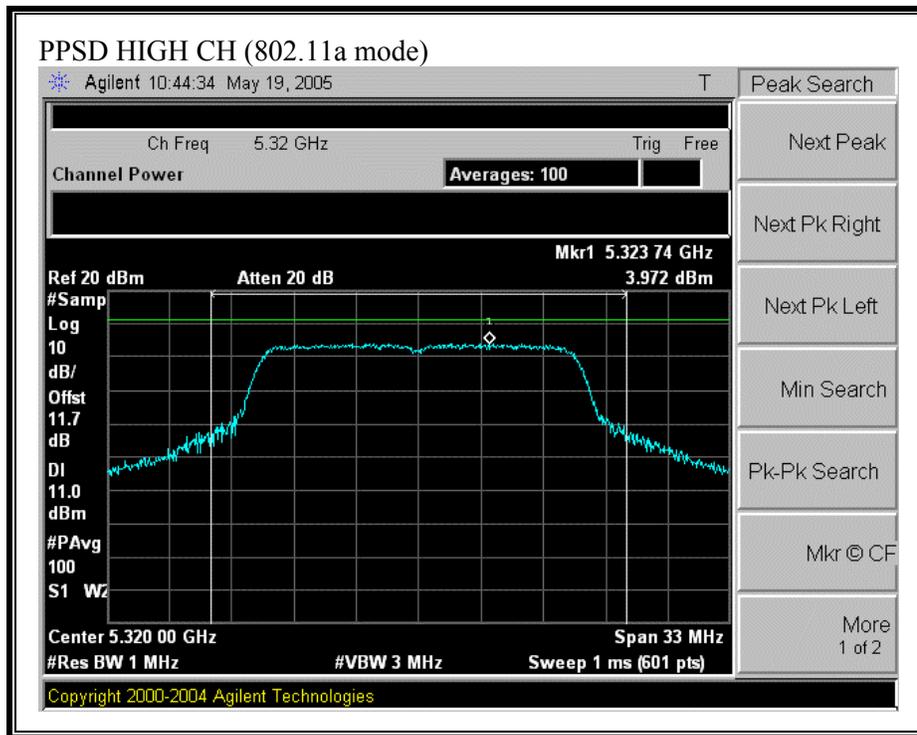
802.11a Mode

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>PPSD (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
Low	5180	3.95	4.00	-0.05
Mid	5260	3.65	11.00	-7.35
High	5320	3.97	11.00	-7.03

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







### 7.1.6. PEAK EXCURSION

#### LIMIT

§15.407 (a) (6) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

#### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

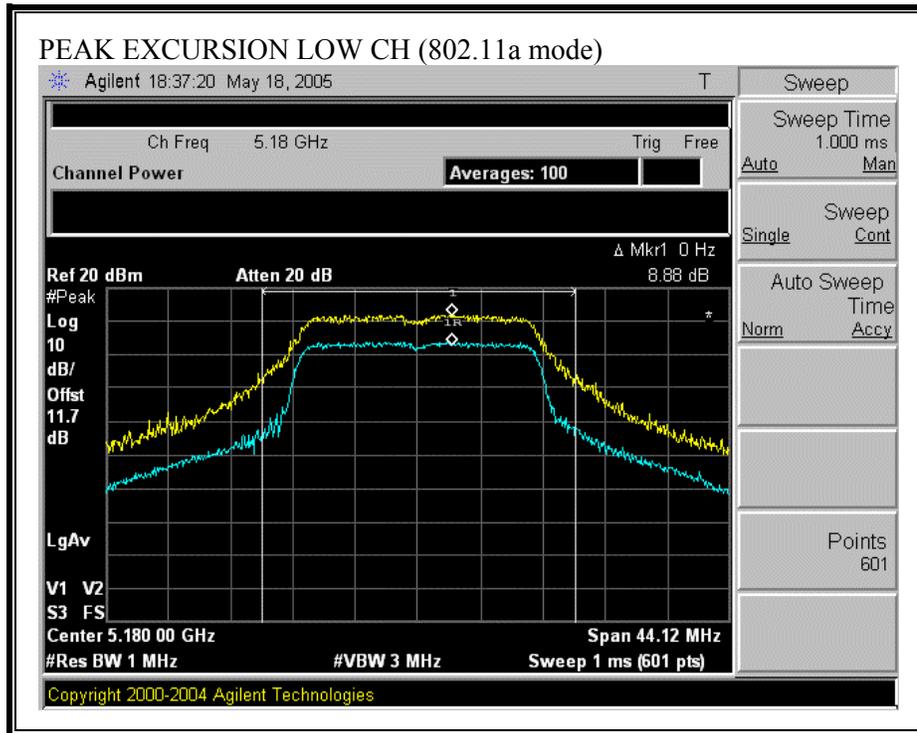
#### RESULTS

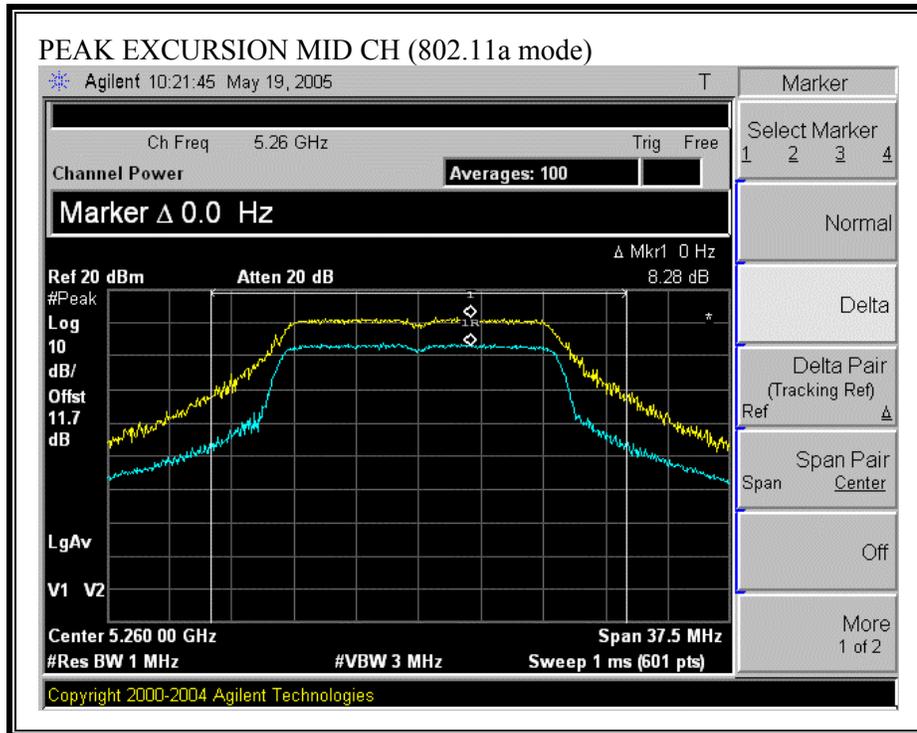
No non-compliance noted:

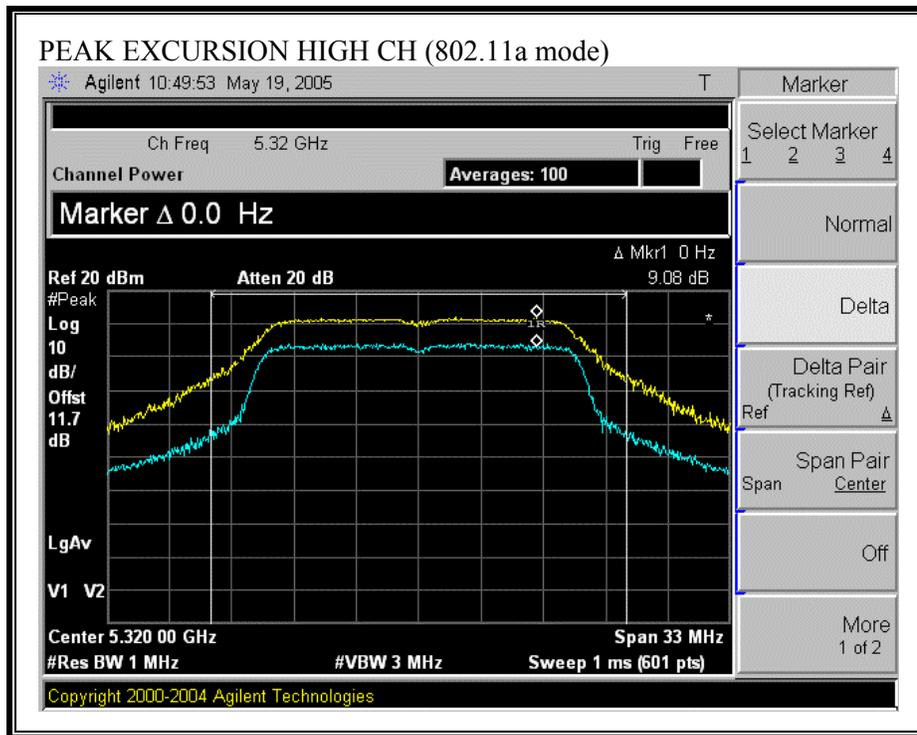
802.11a Mode

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	8.88	13	-4.12
Middle	5200	8.28	13	-4.72
High	5240	9.08	13	-3.92

**PEAK EXCURSION (802.11a MODE)**







## **7.1.7. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

§15.407 (b) (1 & 2) For transmitters operating in the 5.15-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm / MHz.

### **TEST PROCEDURE**

Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

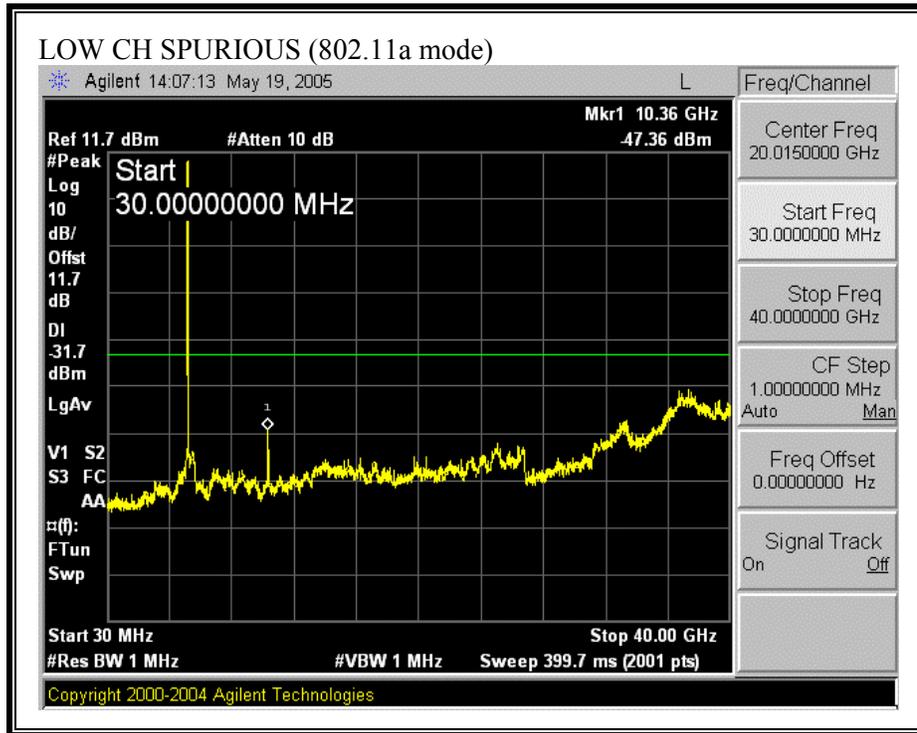
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements are made.

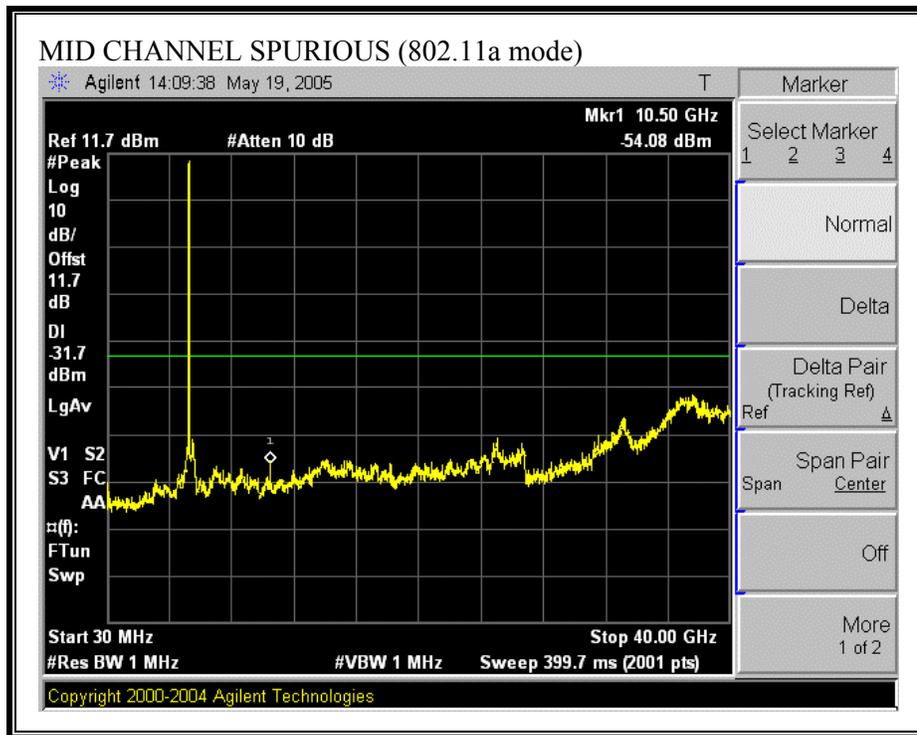
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

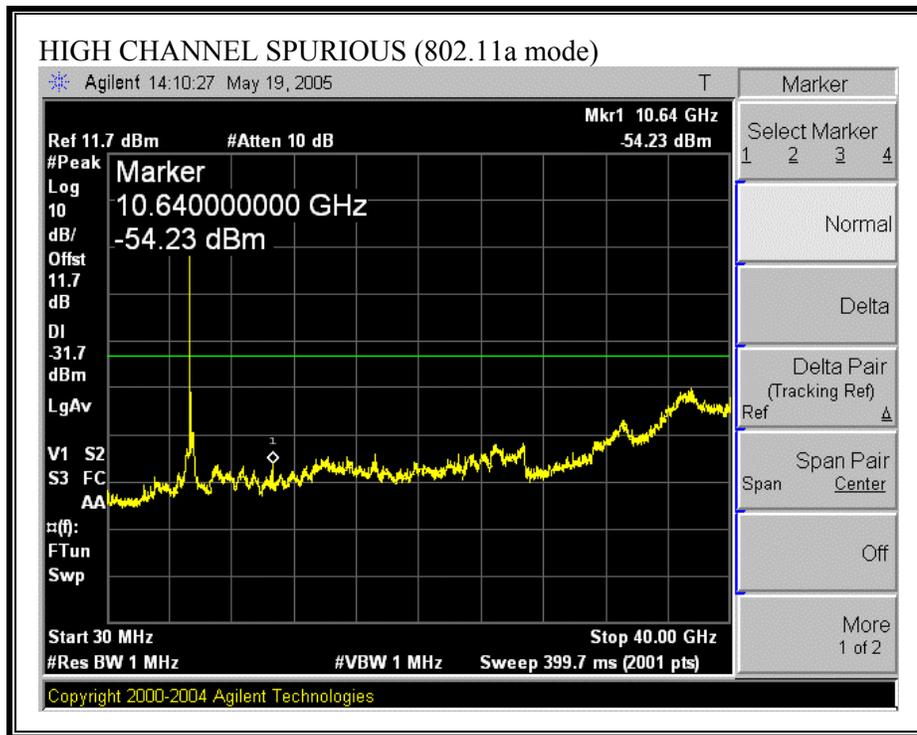
### **RESULTS**

No non-compliance noted:

**SPURIOUS EMISSIONS (802.11a MODE)**







## 7.2. RADIATED EMISSIONS

### 7.2.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

#### LIMITS

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

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

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

<sup>2</sup> Above 38.6

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

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

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

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

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

## **TEST PROCEDURE**

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

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

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

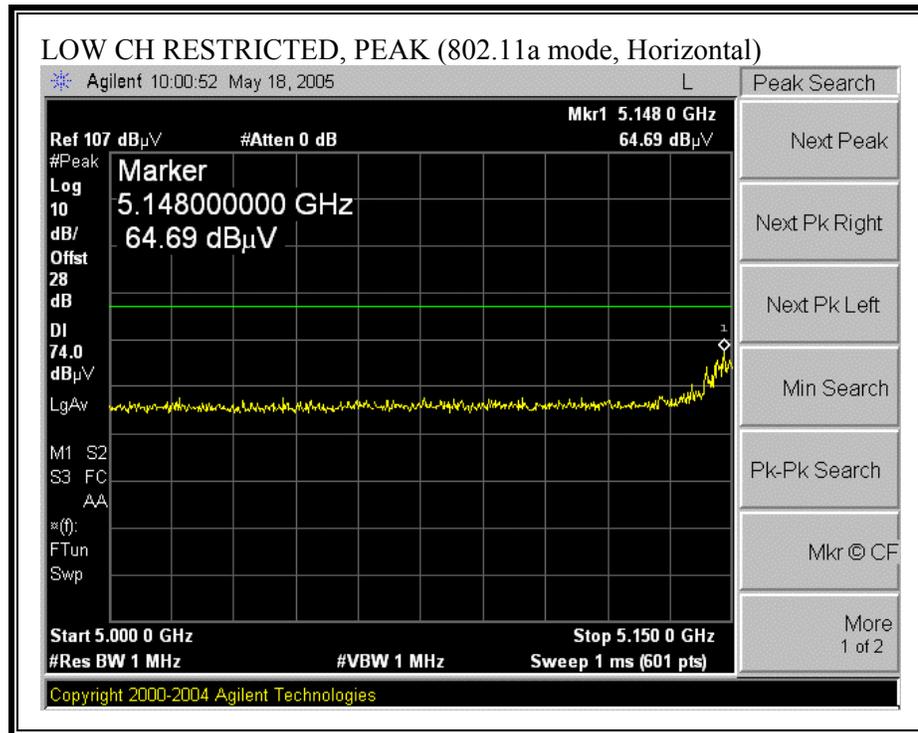
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each band.

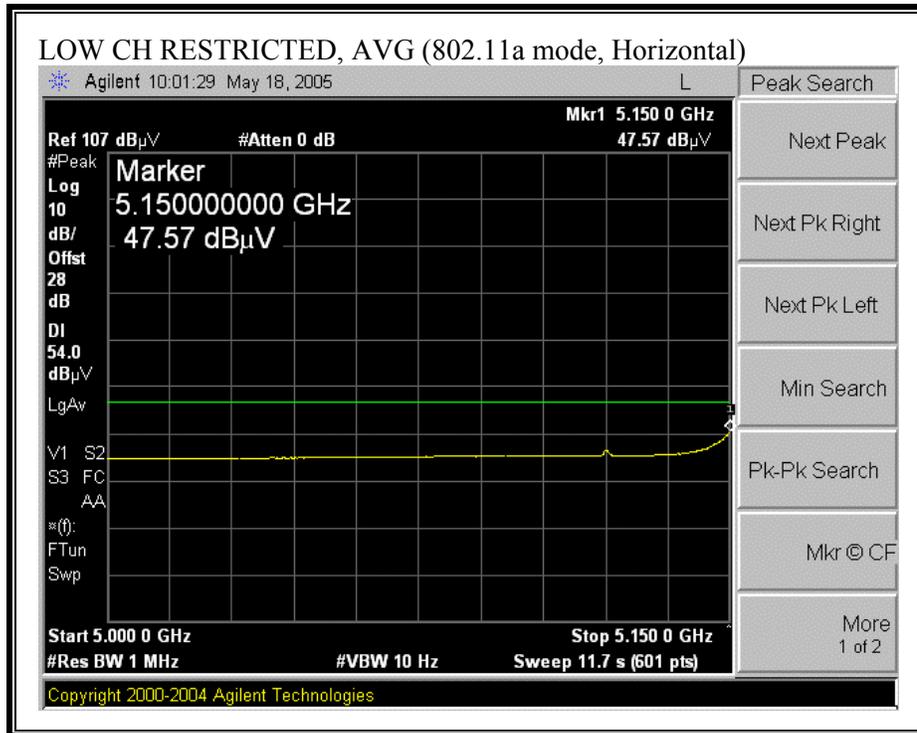
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

## 7.2.2. TRANSMITTER ABOVE 1 GHz

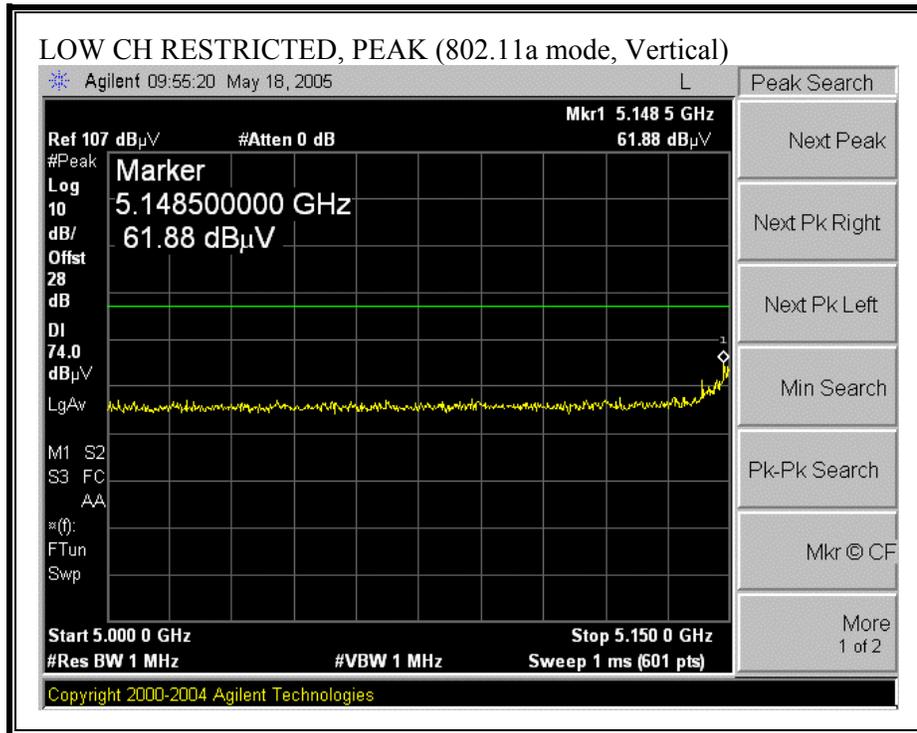
### Mobile CONFIGURATION

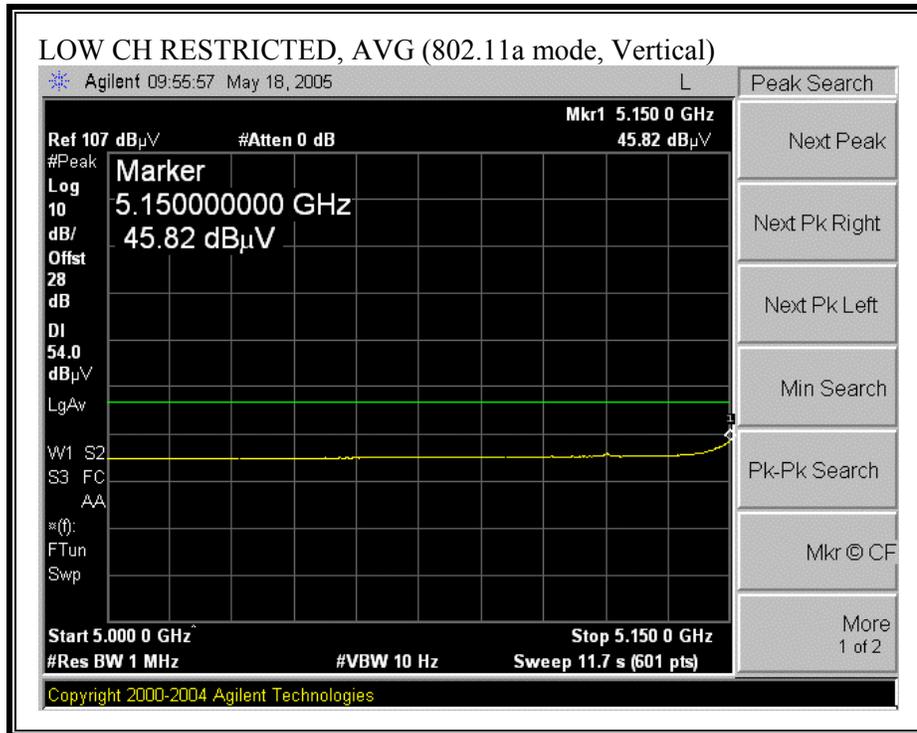
### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



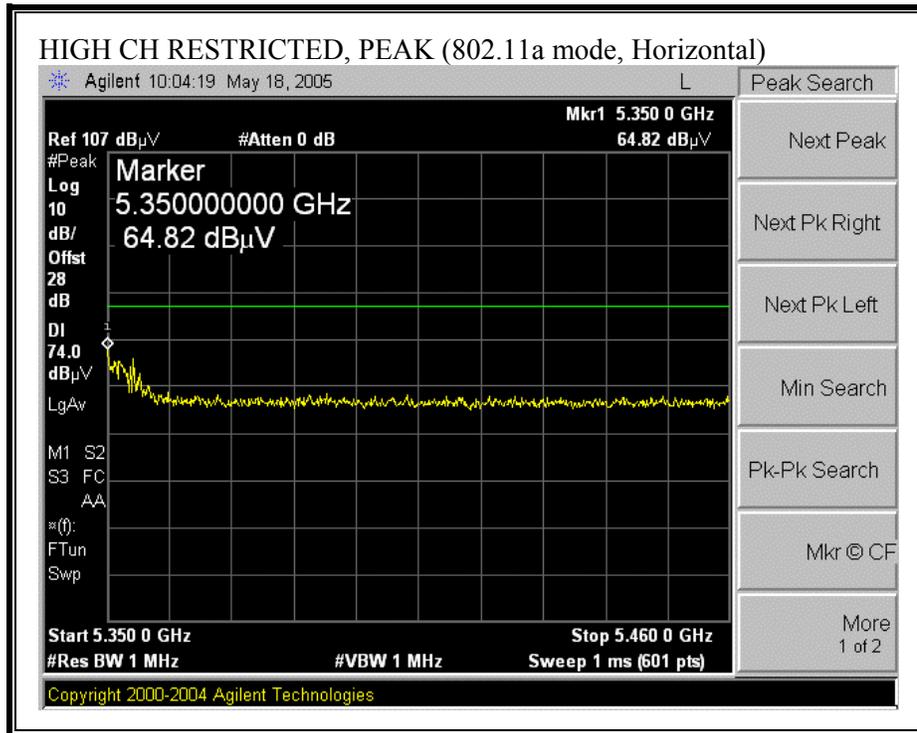


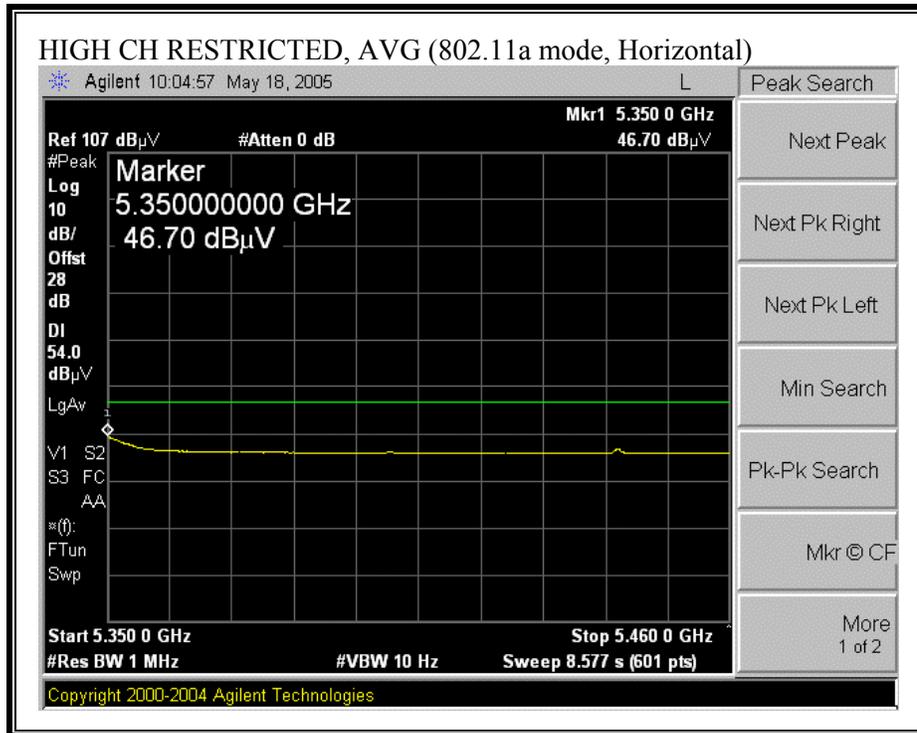
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



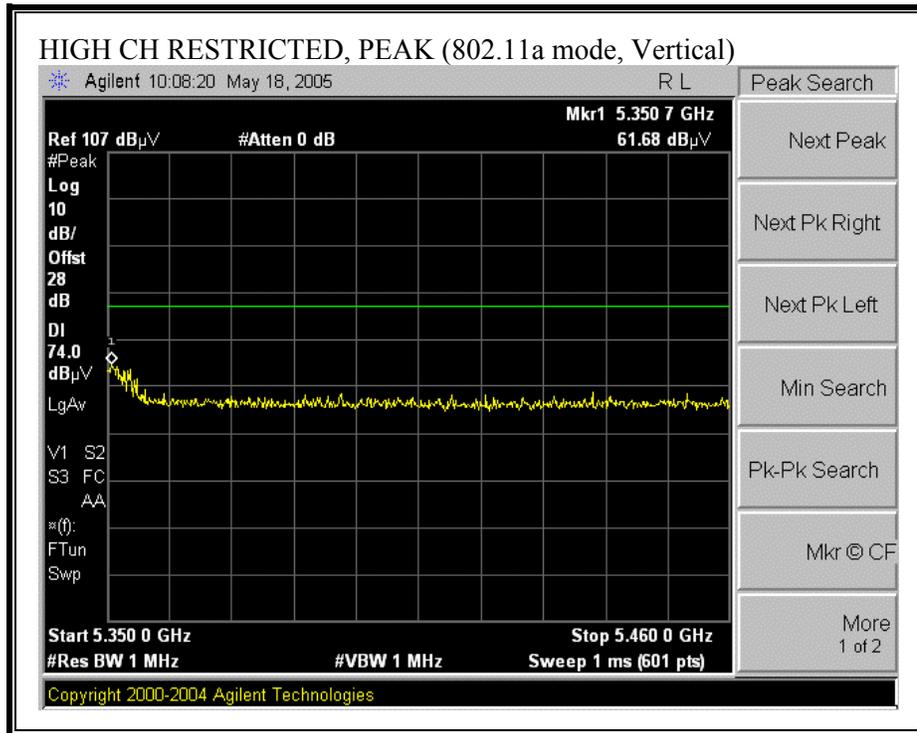


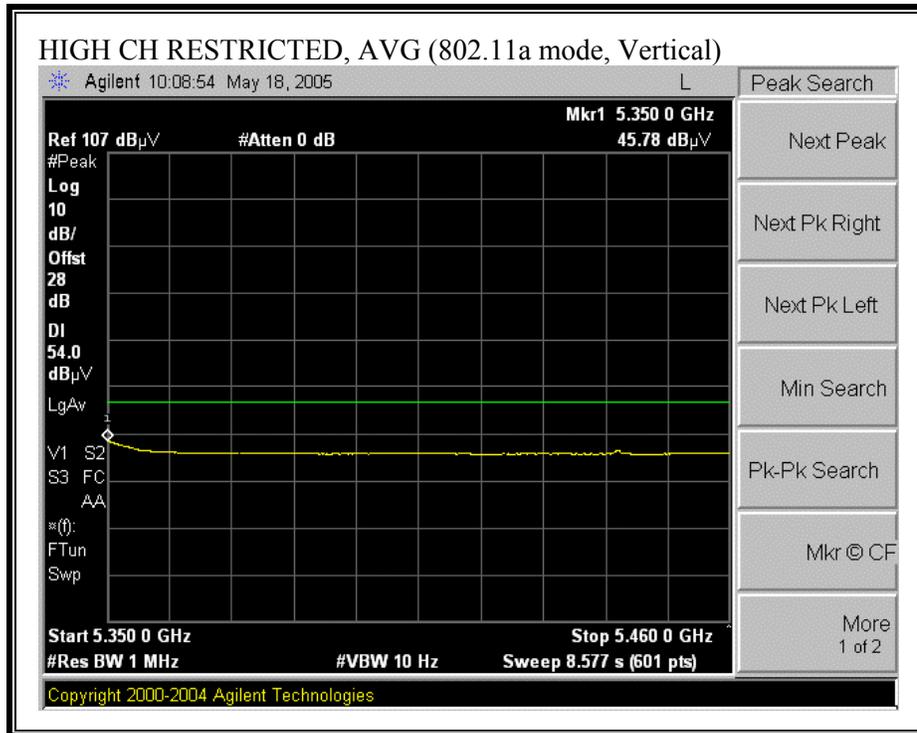
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**





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





**HARMONICS AND SPURIOUS EMISSIONS**

05/18/05 **High Frequency Measurement**  
 Compliance Certification Services, Morgan Hill Open Field Site

**Test Engr:** Chin Pang  
**Project #:** 05U3390  
**Company:** Toshiba America Information Systems, Inc.  
**EUT Descrip.:** 802.11 a/b/g MB62HL Half size Mini-PCI WLAN Module  
**EUT M/N:** PA-3459U-1MPC  
**Test Target:** FCC 15.407  
**Mode Oper:** 5.2 GHz Band Transmitting, Mobile Configuration  
**Average Power Meter:** Low = 15.01 dBm, Mid = 15.2 dBm, High = 15.36 dBm

**Test Equipment:**

EMCO Horn 1-18GHz T60; S/N: 2238 @3m	Pre-amplifier 1-26GHz T87 Miteq 924342	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit FCC 15.205
---	---	------------------------	--------------	---------------------

Hi Frequency Cables

2 foot cable	3 foot cable	4 foot cable 4_Thanh	12 foot cable 12_Neelesh	HPF HPF_7.6GHz	Reject Filter R_001
--------------	--------------	-------------------------	-----------------------------	-------------------	------------------------

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

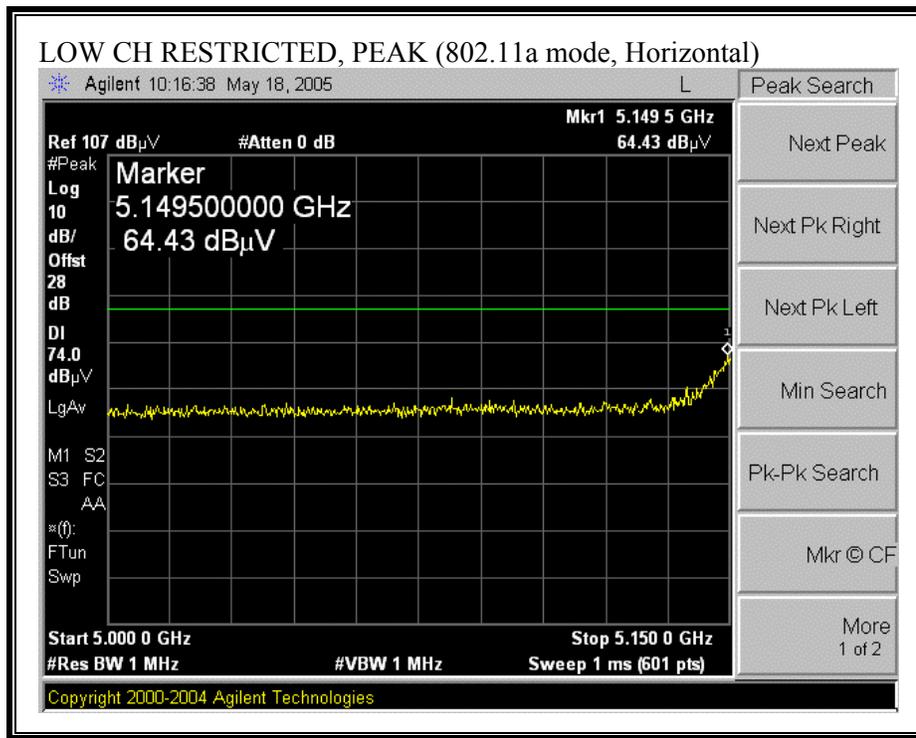
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
<b>low ch</b>															
15.540	3.0	59.6	46.0	39.0	7.9	-44.9	0.0	0.7	62.3	48.7	74	54	-11.7	-5.3	V
15.540	3.0	56.6	44.5	39.0	7.9	-44.9	0.0	0.7	59.3	47.2	74	54	-14.7	-6.8	H
<b>mid ch</b>															
15.780	3.0	65.0	47.4	38.8	7.9	-44.9	0.0	0.7	67.6	50.0	74	54	-6.4	-4.0	V
15.780	3.0	58.0	45.0	38.8	7.9	-44.9	0.0	0.7	60.6	47.6	74	54	-13.4	-6.4	V
<b>high ch</b>															
10.640	3.0	48.5	36.8	38.2	6.9	-41.1	0.0	0.8	53.2	41.5	74	54	-20.8	-12.5	V
15.960	3.0	61.0	47.0	38.7	8.0	-44.9	0.0	0.7	63.5	49.5	74	54	-10.5	-4.5	V
10.640	3.0	45.8	34.0	38.2	6.9	-41.1	0.0	0.8	50.5	38.7	74	54	-23.5	-15.3	H
15.960	3.0	59.0	45.0	38.7	8.0	-44.9	0.0	0.7	61.5	47.5	74	54	-12.5	-6.5	H

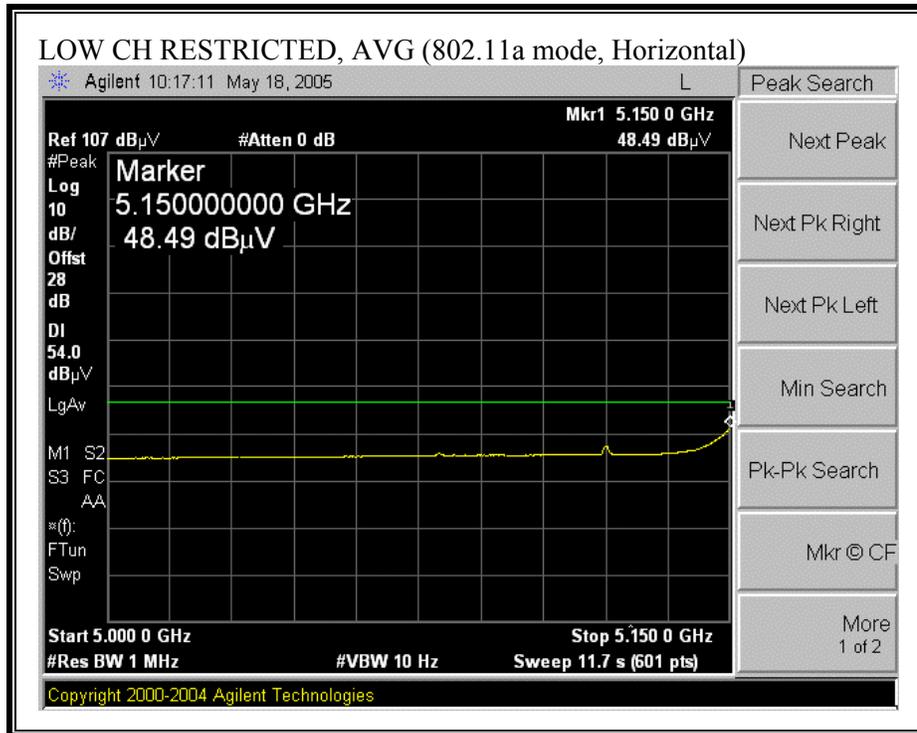
Note: No other emissions were detected above the system noise floor.

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

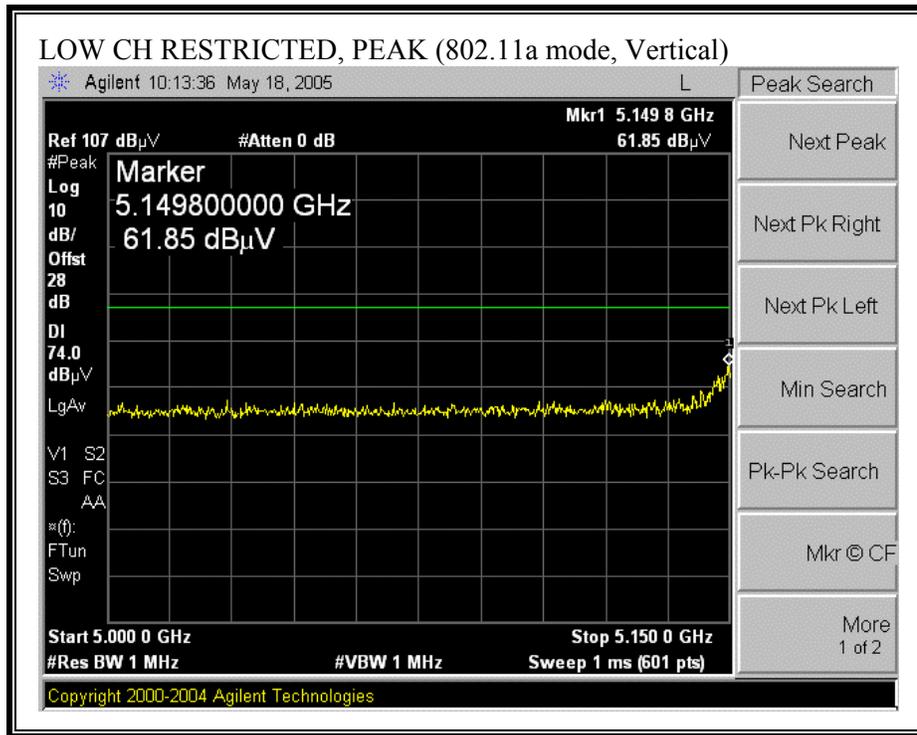
**Mobile CONFIGURATION**

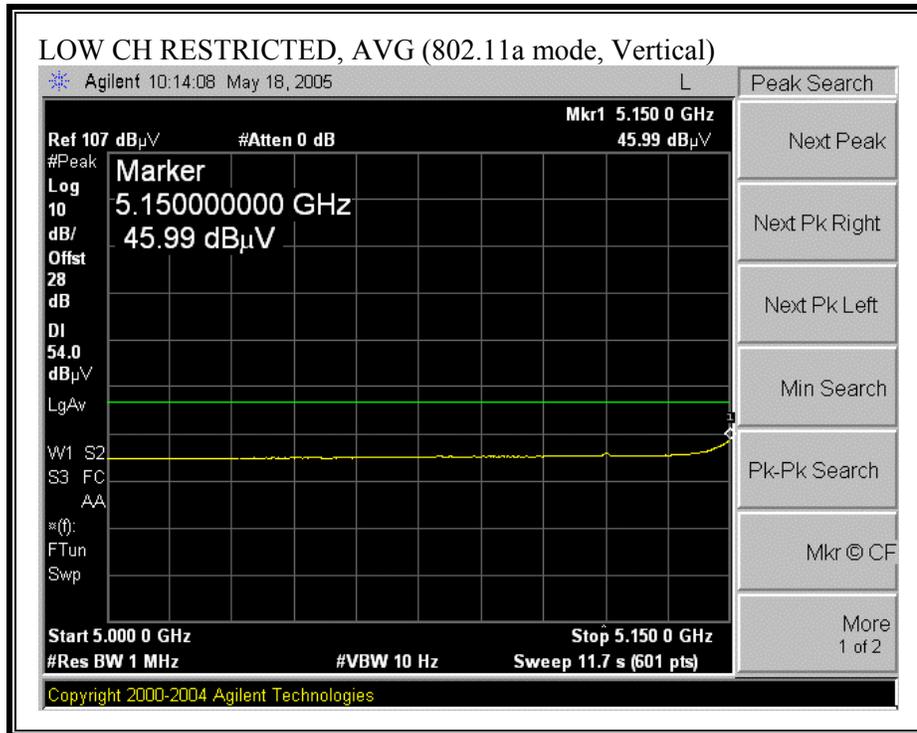
**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**



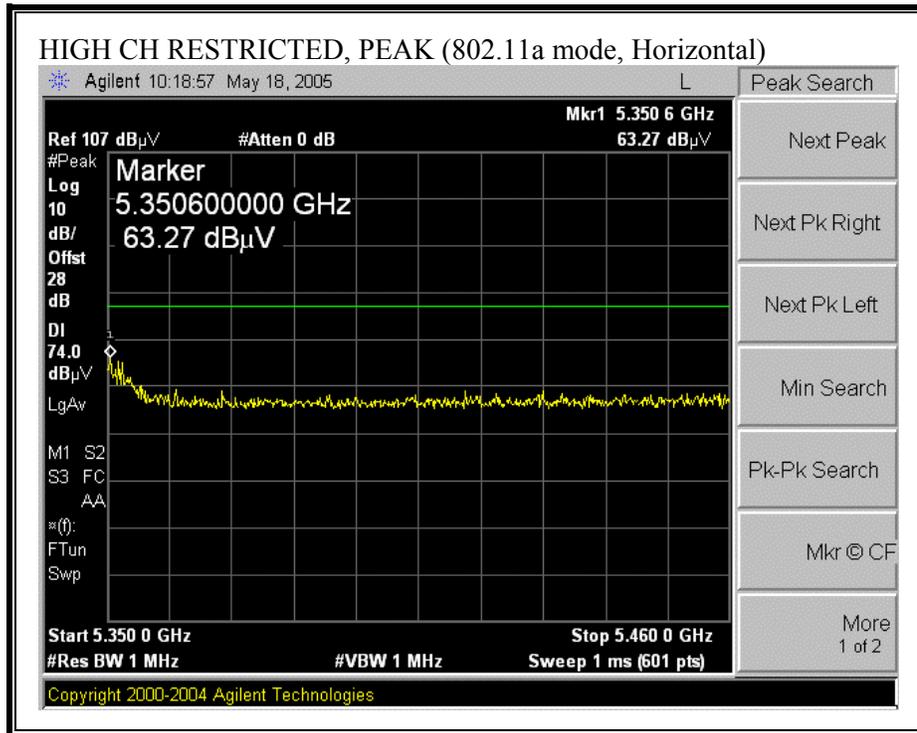


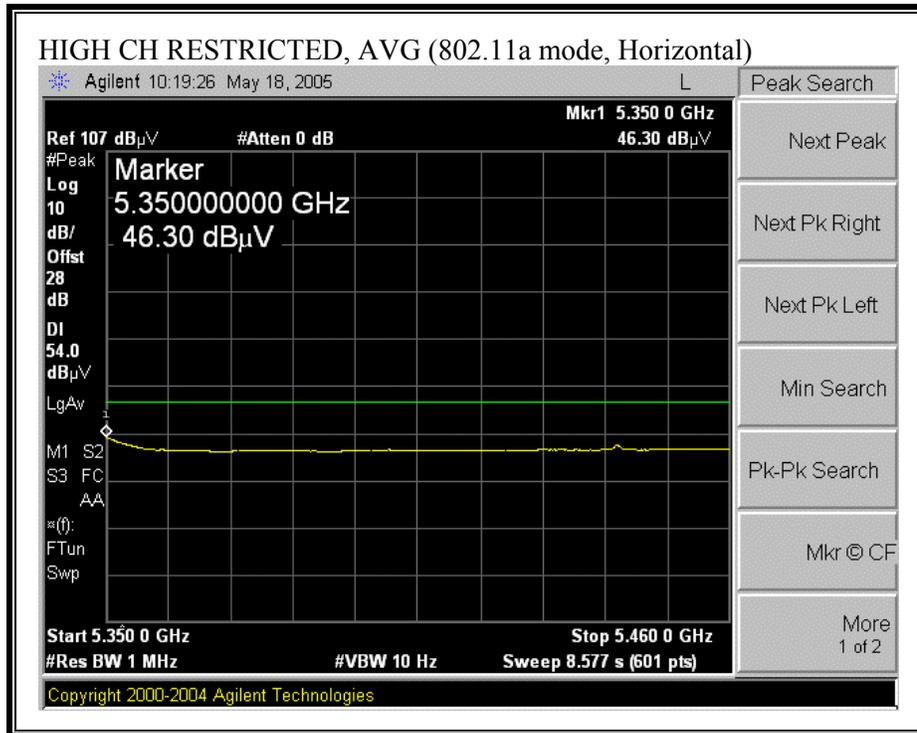
**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



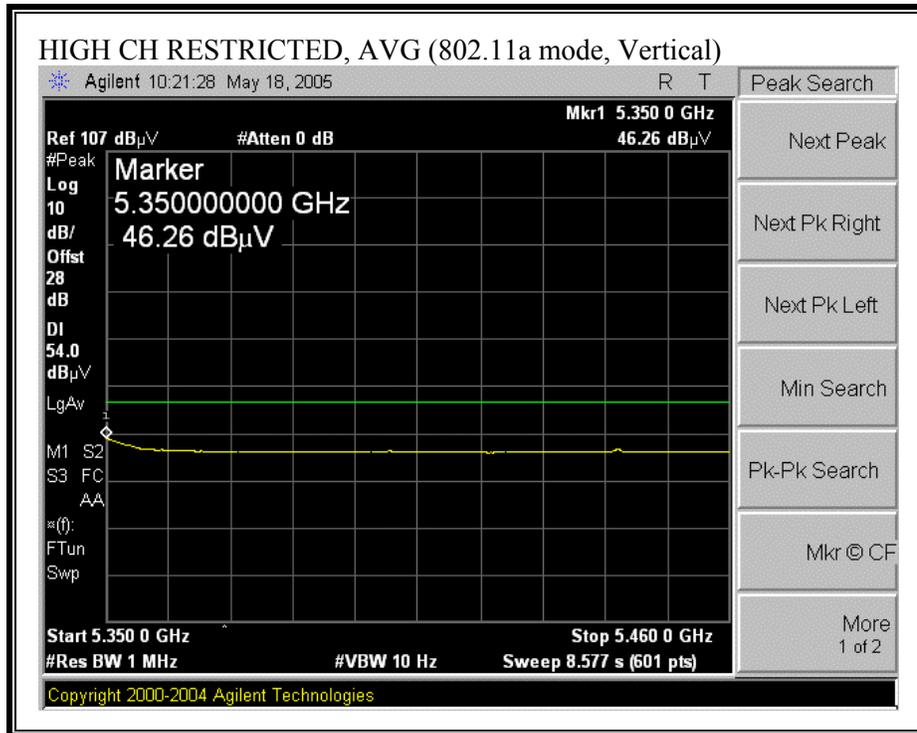


**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**









**HARMONICS AND SPURIOUS EMISSIONS**

05/18/05 **High Frequency Measurement**  
 Compliance Certification Services, Morgan Hill Open Field Site

**Test Engr:** Chin Pang  
**Project #:** 05U3390  
**Company:** Toshiba America Information Systems, Inc.  
**EUT Descrip.:** 802.11 a/b/g MB62HL Half size Mini-PCI WLAN Module  
**EUT M/N:** PA-3459U-1MPC  
**Test Target:** FCC 15.407  
**Mode Oper:** 5.2 GHz Band Transmitting, Portable Configuration  
**Average Power Meter:** Low = 15.01 dBm, Mid = 15.2dBm, High = 15.36 dBm

**Test Equipment:**

EMCO Horn 1-18GHz T60; S/N: 2238 @3m	Pre-amplifier 1-26GHz T87 Miteq 924342	Pre-amplifier 26-40GHz	Horn >18GHz	Limit FCC 15.205
Hi Frequency Cables				Peak Measurements RBW=VBW=1MHz
2 foot cable	3 foot cable	4 foot cable 4_Thanh	12 foot cable 12_Neelesh	Average Measurements RBW=1MHz ; VBW=10Hz
HPF HPF_7.6GHz		Reject Filter R_001		

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
<b>low ch</b>															
15.540	3.0	59.7	45.6	39.0	7.9	-44.9	0.0	0.7	62.4	48.3	74	54	-11.6	-5.7	V
15.540	3.0	54.0	40.0	39.0	7.9	-44.9	0.0	0.7	56.7	42.7	74	54	-17.3	-11.3	H
<b>mid ch</b>															
15.780	3.0	61.0	46.5	38.8	7.9	-44.9	0.0	0.7	63.6	49.1	74	54	-10.4	-4.9	V
15.780	3.0	58.1	43.0	38.8	7.9	-44.9	0.0	0.7	60.7	45.6	74	54	-13.3	-8.4	H
<b>high ch</b>															
10.640	3.0	51.0	39.0	38.2	6.9	-41.1	0.0	0.8	55.7	43.7	74	54	-18.3	-10.3	V
15.960	3.0	61.3	47.5	38.7	8.0	-44.9	0.0	0.7	63.8	50.0	74	54	-10.2	-4.0	V
10.640	3.0	47.0	36.0	38.2	6.9	-41.1	0.0	0.8	51.7	40.7	74	54	-22.3	-13.3	H
15.960	3.0	59.2	45.3	38.7	8.0	-44.9	0.0	0.7	61.7	47.8	74	54	-12.3	-6.2	H

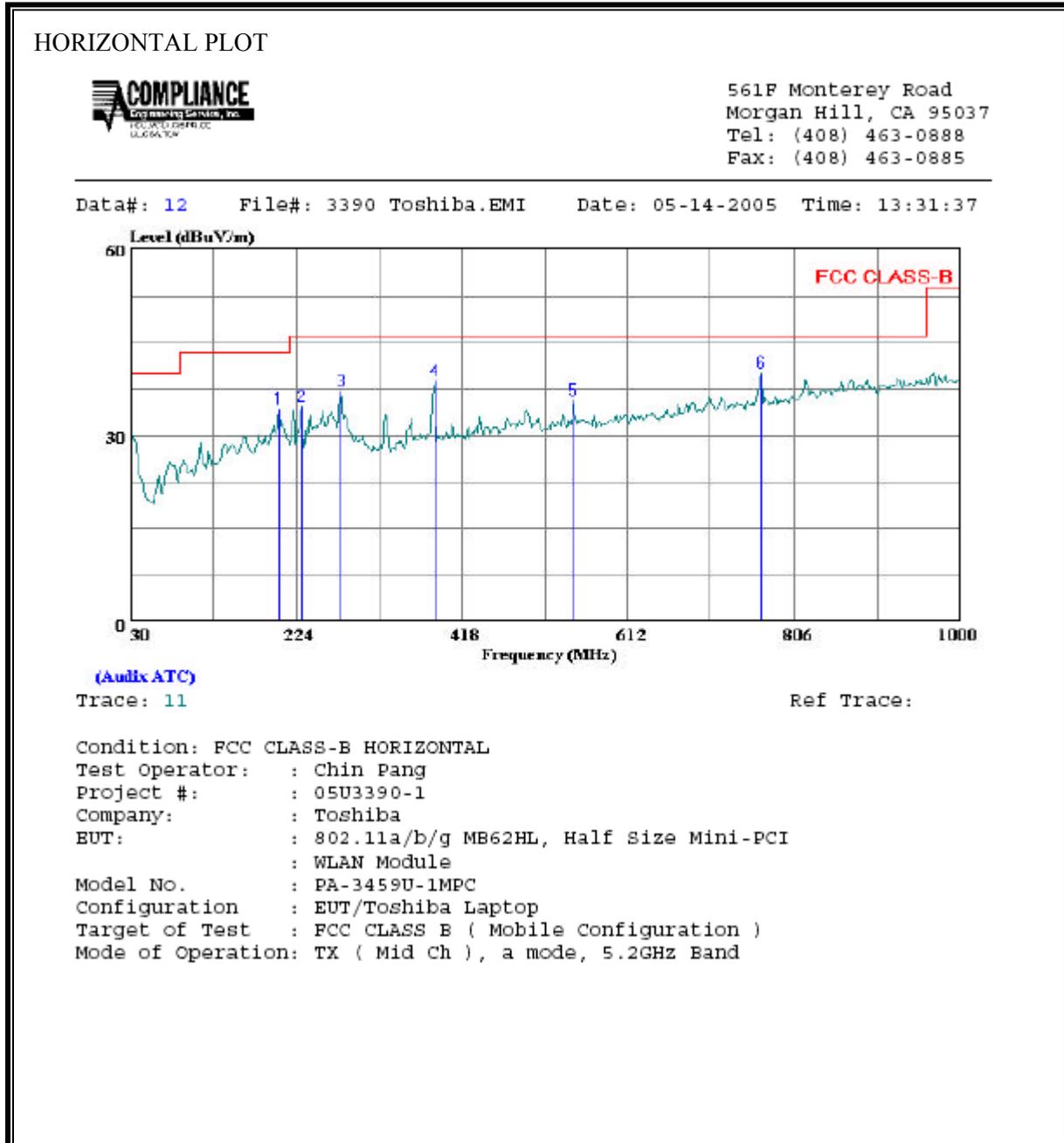
Note: No other emissions were detected above the system noise floor.

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

## 7.2.5 WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

### MOBILE CONFIGURATION

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

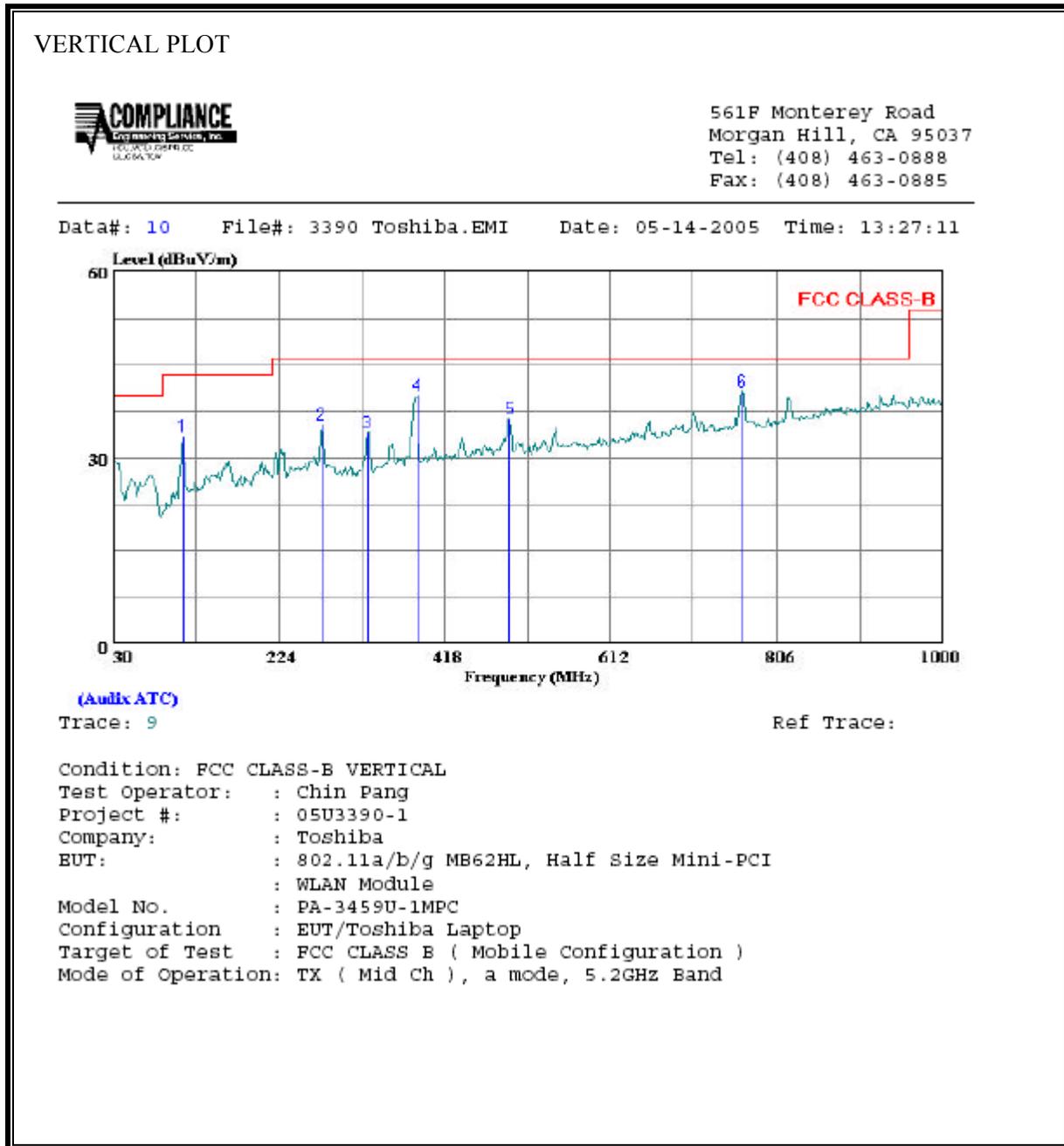


HORIZONTAL DATA

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	203.630	20.17	14.01	34.18	43.50	-9.32	Peak
2	230.790	21.53	13.08	34.61	46.00	-11.39	Peak
3	276.380	22.42	14.85	37.27	46.00	-8.73	Peak
4	385.990	21.20	17.73	38.93	46.00	-7.07	Peak
5	547.980	14.89	20.86	35.75	46.00	-10.25	Peak
6	766.230	16.02	24.09	40.11	46.00	-5.89	Peak

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



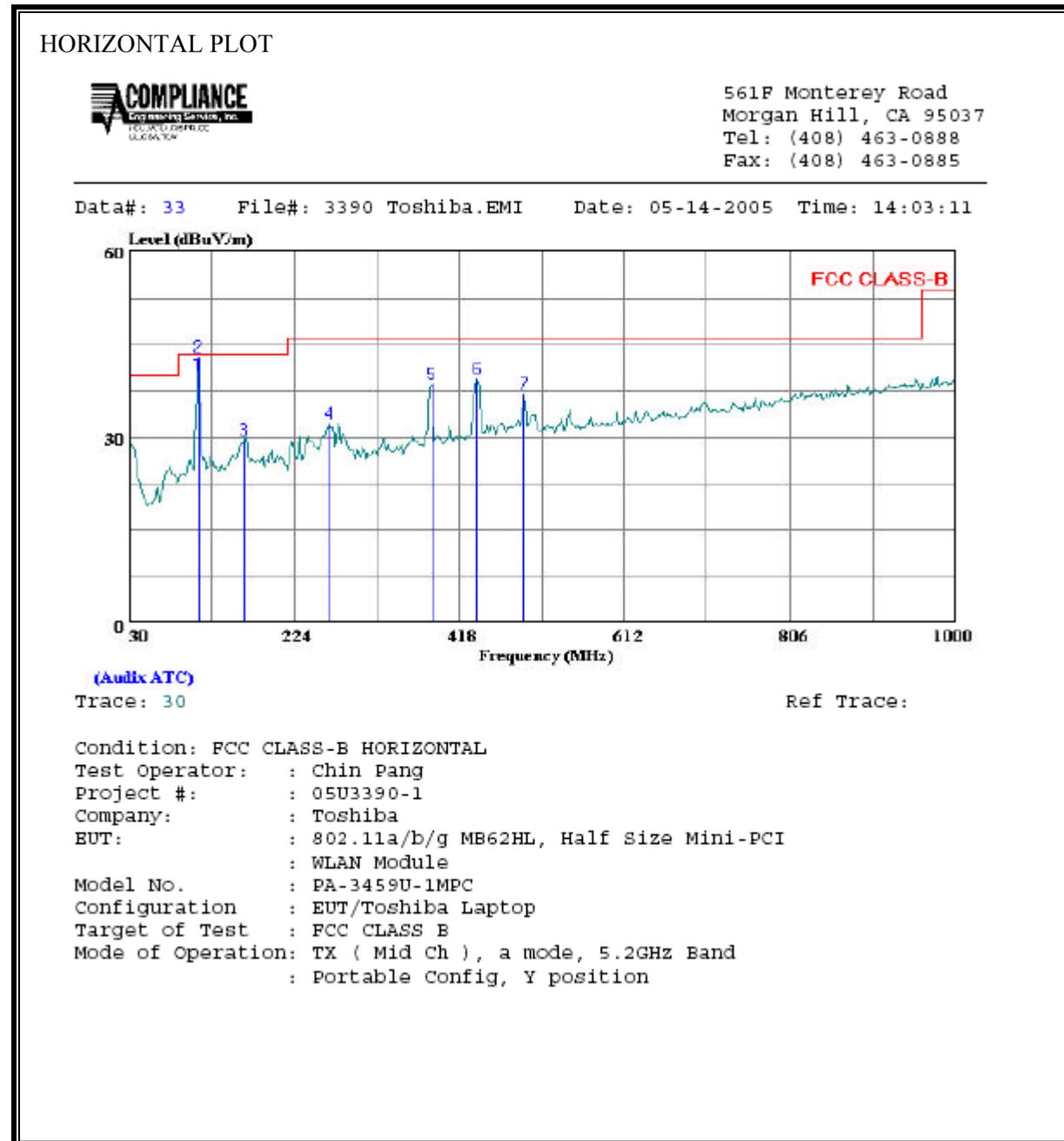
VERTICAL DATA

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	111.480	19.55	13.82	33.37	43.50	-10.13	Peak
2	274.440	20.44	14.76	35.20	46.00	-10.80	Peak
3	327.790	17.65	16.35	34.00	46.00	-12.00	Peak
4	385.990	22.26	17.73	39.99	46.00	-6.01	Peak
5	494.630	16.28	20.14	36.42	46.00	-9.58	Peak
6	765.260	16.61	24.09	40.70	46.00	-5.30	Peak

**PORTABLE CONFIGURATION**

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

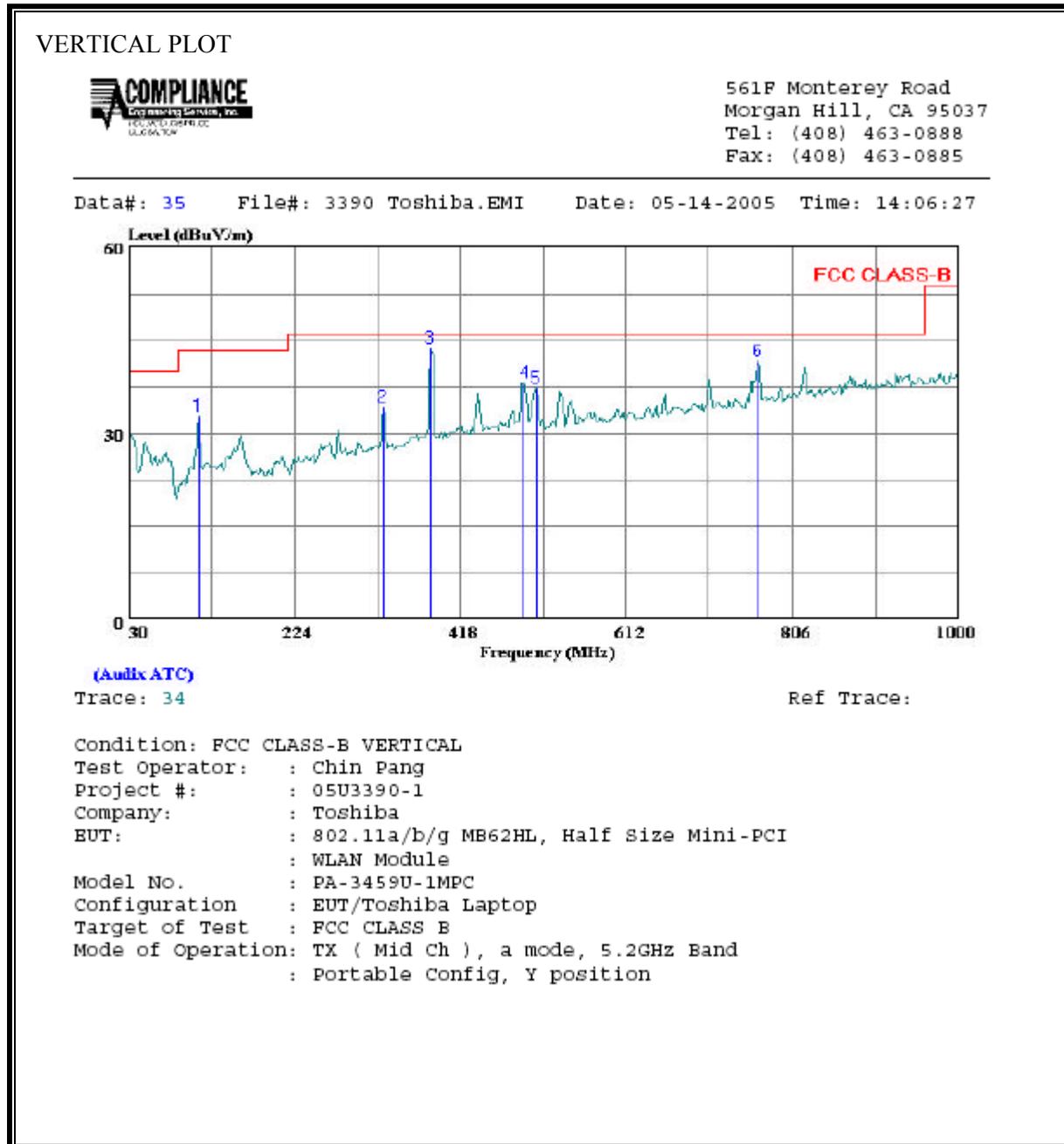


HORIZONTAL DATA

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	111.420	26.40	13.67	40.07	43.50	-3.43	QP
2	111.480	29.08	13.82	42.90	43.50	-0.60	Peak
3	164.830	15.86	13.61	29.47	43.50	-14.03	Peak
4	264.740	17.86	14.39	32.25	46.00	-13.75	Peak
5	385.990	20.95	17.73	38.68	46.00	-7.32	Peak
6	439.340	20.52	18.96	39.48	46.00	-6.52	Peak
7	494.630	16.83	20.14	36.97	46.00	-9.03	Peak

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



VERTICAL DATA

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	111.480	19.01	13.82	32.83	43.50	-10.67	Peak
2	327.790	17.86	16.35	34.21	46.00	-11.79	Peak
3	383.080	26.19	17.69	43.88	46.00	-2.12	Peak
4	492.690	18.05	20.11	38.16	46.00	-7.84	Peak
5	507.240	17.05	20.31	37.36	46.00	-8.64	Peak
6	764.290	17.73	24.09	41.82	46.00	-4.18	Peak

### 7.3. POWERLINE CONDUCTED EMISSIONS

#### LIMIT

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

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

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

\*Decreases with the logarithm of the frequency.

#### TEST PROCEDURE

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

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

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

#### RESULTS

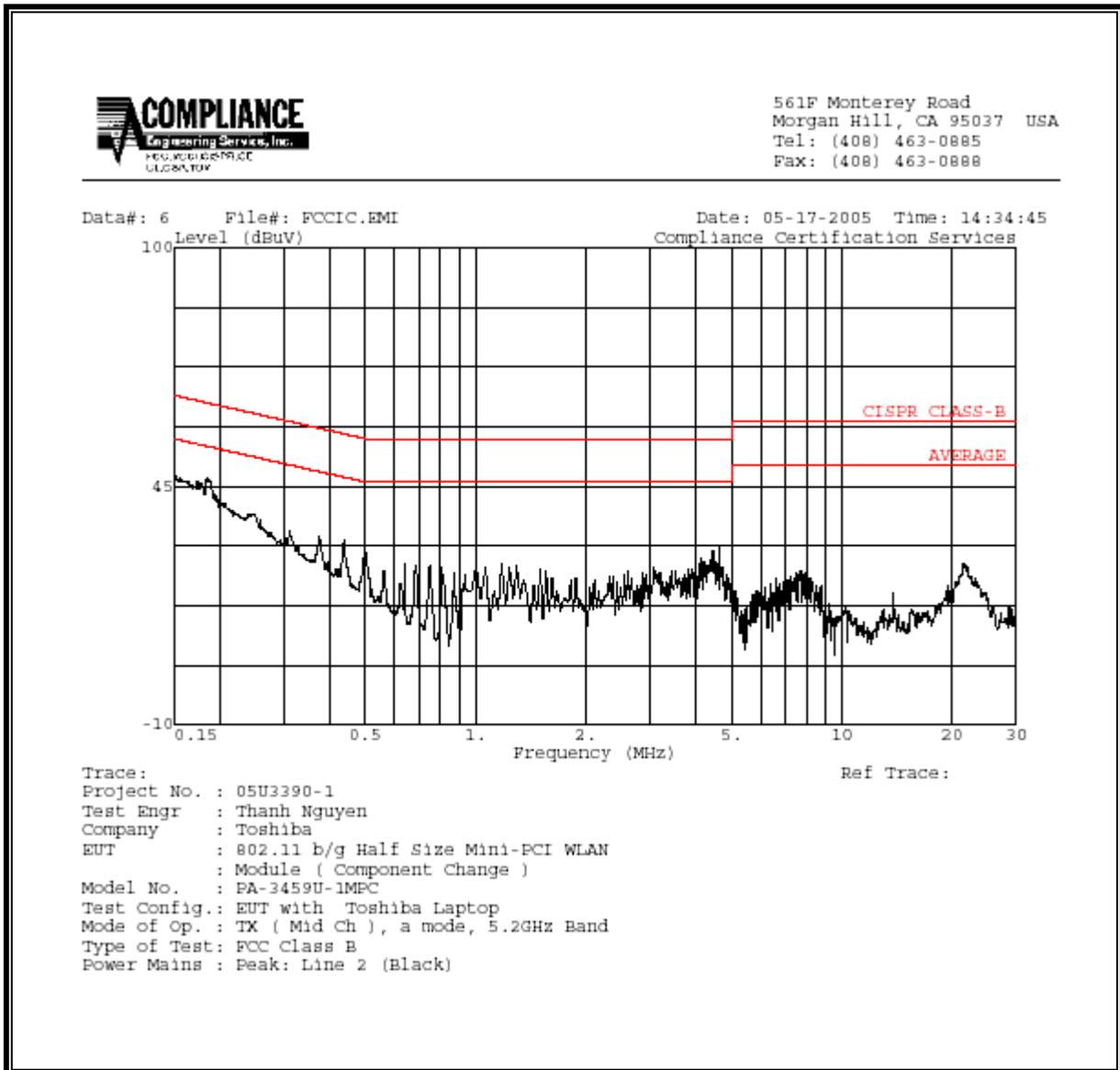
No non-compliance noted:

**6 WORST EMISSIONS**

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq. (MHz)	Reading			Class (dB)	Limit QP	EN B AV	Margin		Remark L1 / L2
	PK (dBuV)	QP (dBuV)	AV (dBuV)				QP (dB)	AV (dB)	
0.18	48.08	--	--	0.00	64.30	54.30	-16.22	-6.22	L1
4.18	33.46	--	--	0.00	56.00	46.00	-22.54	-12.54	L1
21.71	29.68	--	--	0.00	60.00	50.00	-30.32	-20.32	L1
0.18	46.98	--	--	0.00	64.30	54.30	-17.32	-7.32	L2
4.62	31.10	--	--	0.00	56.00	46.00	-24.90	-14.90	L2
21.49	27.40	--	--	0.00	60.00	50.00	-32.60	-22.60	L2
6 Worst Data									



**LINE 2 RESULTS**



(Please be noted that Pages 69 thru 79 have been extracted as Setup Photos, this is the end of body of the report).