FCC CFR47 PART 15 SUBPART C
CLASS II PERMISSIVE CHANGE
TEST REPORT

FOR

802.11 a/b/g WLAN MINI PCI MODULE

MODEL NUMBER: J07H069.01

FCC ID: MCLJ07H06903

REPORT NUMBER: 03U2433-1

ISSUE DATE: DECEMBER 31, 2003

Prepared for
AMBIT MICROSYSTEMS CORPORATION
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SCIENCE-BASED INDUSTRAIL PARK, TAIWAN, R.O.C.

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1. TEST RESULT CERTIFICATION

COMPANY NAME: AMBIT MICROSYSTEMS CORPORATION
5F-1, 5 HSIN-AN ROAD, HSINCU
SCIENCE BASED INDUSTRIAL PARK, TAIWAN, R.O.C.

EUT DESCRIPTION: 802.11 A/B/G WLAN MINI PCI MODULE

MODEL: J07H069.01

DATE TESTED: DECEMBER 23-31, 2003

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: This document reports conditions under which testing was conducted and results of tests performed. 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.

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

Approved & Released For CCS By:

MIKE HECKROTTE
CHIEF ENGINEER
COMPLIANCE CERTIFICATION SERVICES

Tested By:

NEELESH RAJ
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. EUT DESCRIPTION

2.1. DESCRIPTION OF EUT

The EUT is an 802.11a/b/g transceiver in a mini-PCI form factor.

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

Frequency Band (MHz)	Output Power (W)	Output Power (dBm)
2412 - 2462	0.158	21.99
5745 - 5825	0.118	20.72

2.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The radio module is intended to be used with an additional antenna pair.

The main antenna is a Wistron J12B1394-1 PIFA Antenna with a maximum assembly gain (including cable loss) of 2.78 dBi in the 2400 – 2483.5 MHz band and 1.82 dBi in the 5725 - 5850 MHz band. The auxiliary antenna is a Wistron J12B1394-2 PIFA Antenna with a maximum assembly gain (including cable loss) of 2.12 dBi in the 2400 – 2483.5 MHz band and 0.76 dBi in the 5725 - 5850 MHz band.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/2001, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

4. 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.

No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

5. CALIBRATION AND UNCERTAINTY

5.1. 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.

5.2. 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%.

5.3. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST

Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	2/4/2004
Preamplifier, 1 ~ 26 GHz	Miteq	NSP10023988	646456	4/25/2004
Spectrum Analyzer 3Hz ~ 26.5GHz	Agilent	E4440A	US41421507	5/8/2004
Antenna, Horn, 18 ~ 26 GHz	ARA	MWH-1826/B	1013	2/2/2004
Peak Power Meter	Agilent	E4416A	GB41291160	11/7/2004
Peak / Average Power Sensor	Agilent	E9327A	US40440755	11/7/2004
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	11/21/2004
RF Filter Section	HP	85420E	3705A00256	11/21/2004
Antenna, Bicon/Log, 25 ~ 2000 MHz	ARA	LPB-2520/A	1185	3/6/2004
EMI Test Receiver	R & S	ESHS 20	827129/006	7/17/2004
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	10/13/2004
Line Filter	Lindgren	LMF-3489	497	CNR
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	10/13/2004
Antenna, Horn 1 ~ 18 GHz	EMC Test Systems	3117	29301	12/6/2004
2.4-2.5 GHz Reject Filter	Micro-Tronics	BRM50702	3	N/A
5.15-5.35 GHz Reject Filter	Micro-Tronics	BRC13190	2	N/A
5.725-5.875 GHz	Micro-Tronics	BRC13192	2	N/A
10 dB Attenuator	Weinschel	56-10	1	N/A

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

TEST PERIPHERALS				
Device Type	Manufacturer	Model Number	Serial Number	FCC ID
LAPTOP	HP	NX9100 (HP TRUMAN)	N/A	N/A
AC ADAPTER	HP	PPP016H	F3-0308000334A	N/A

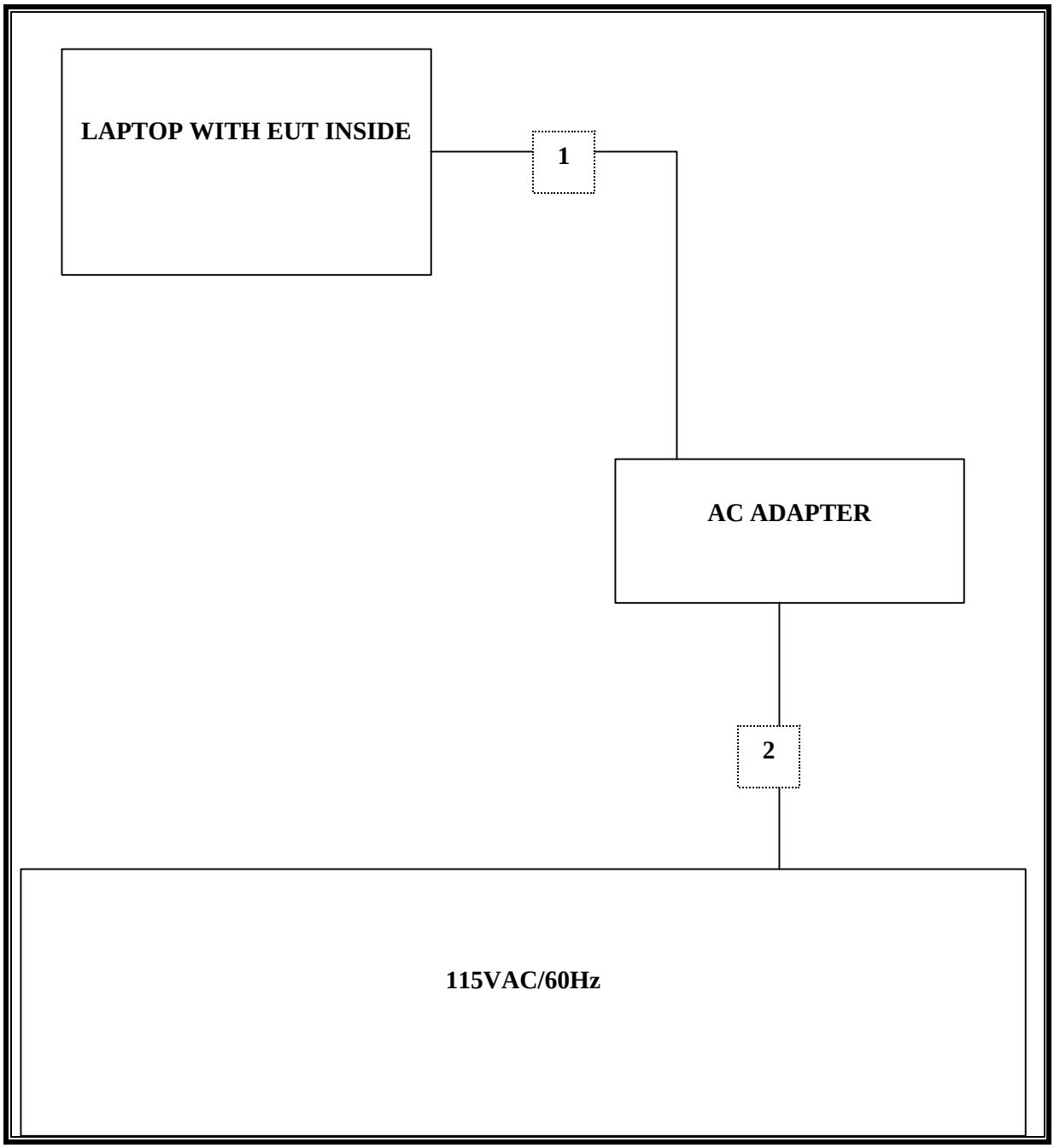
I/O CABLES

TEST I / O CABLES							
Cable No	I/O Port	# of I/O Port	Connector Type	Type of Cable	Cable Length	Data Traffic	Remark
1	DC PWR	1	DC PWR	SHIELDED	1.86M	NO	FERRITE BEAD AT BOTH ENDS
2	AC PWR	1	AC PWR	UNSHIELDED	1.86M	NO	US (3 PRONG)

TEST SETUP

The EUT is installed inside the host laptop under the keyboard. The EUT has two antennas, a main and an auxiliary antenna. The main antenna is located at the top right hand corner of the LCD screen and the auxiliary antenna is located at the top left hand at corner of LCD screen. During the testing process the EUT was in continuously transmit mode.

SETUP DIAGRAM FOR TESTS



7. APPLICABLE LIMITS AND TEST RESULTS

7.1. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

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

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

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

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

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

CALCULATIONS

Given

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

and

$S = E \wedge 2 / 3770$

where

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

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

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

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

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

yields

$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$
$d = 0.282 * \sqrt{(P * G / S)}$

where

d = distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW/cm^2

Substituting the logarithmic form of power and gain using:

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

yields

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

where

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

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

LIMITS

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

2.4 GHz BAND RESULTS

No non-compliance noted:

Band (MHz)	Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
2412 - 2462	1.0	21.99	2.78	4.88

5.8 GHz BAND RESULTS

No non-compliance noted:

Band (MHz)	Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
5745 - 5825	1.0	20.72	1.82	3.78

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

7.2. RADIATED EMISSIONS

7.2.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

LIMITS

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

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

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

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

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

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

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

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

TEST PROCEDURE

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

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

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

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels of 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 of the 5.8 GHz band.

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

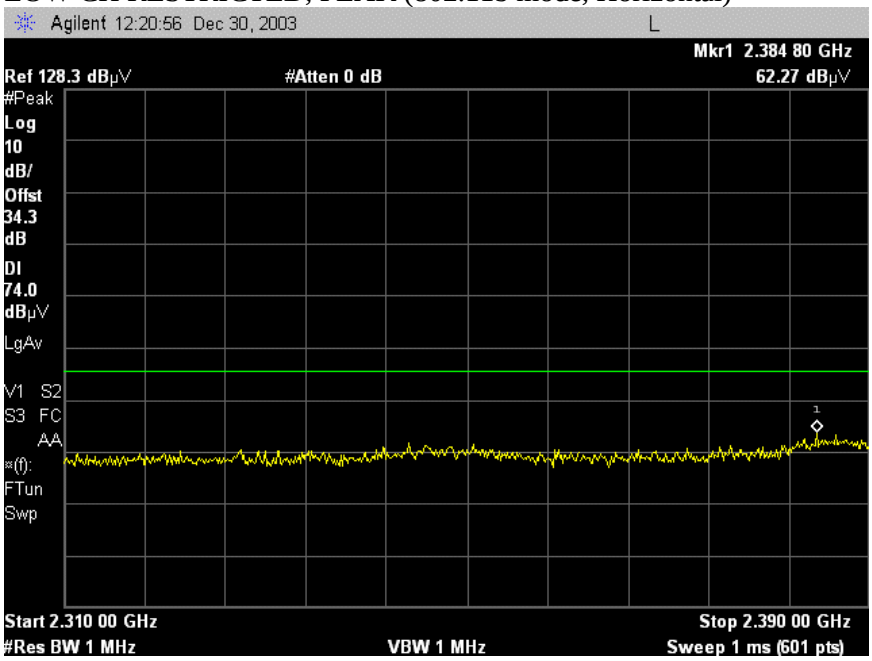
RESULTS

No non-compliance noted:

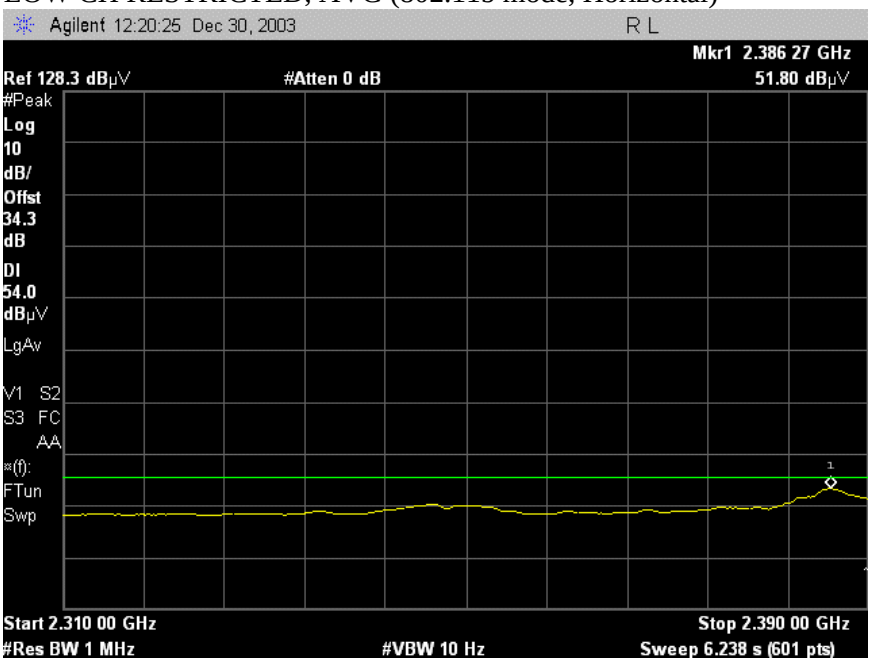
7.2.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ

RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, HORIZONTAL)

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

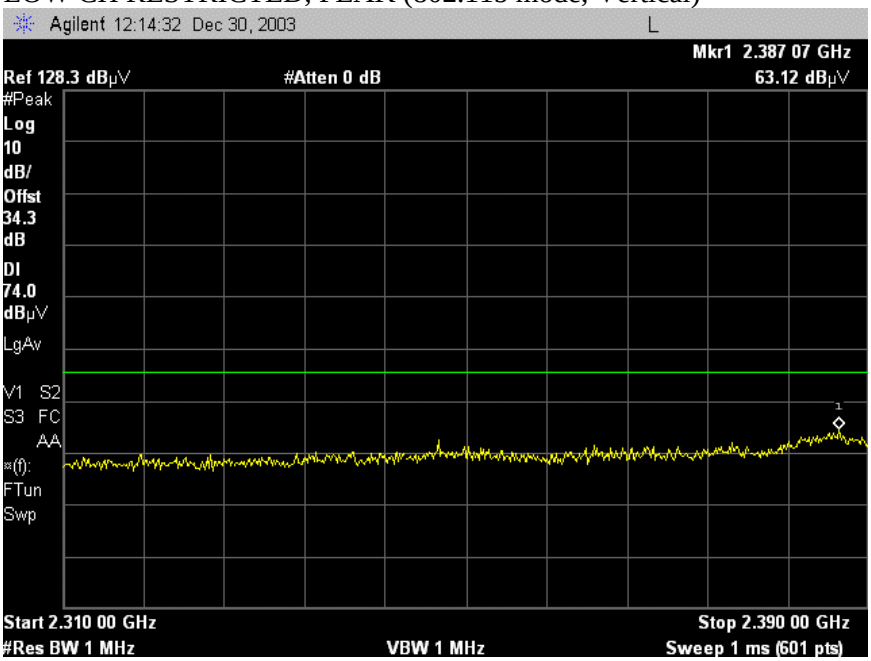


LOW CH RESTRICTED, AVG (802.11b mode, Horizontal)

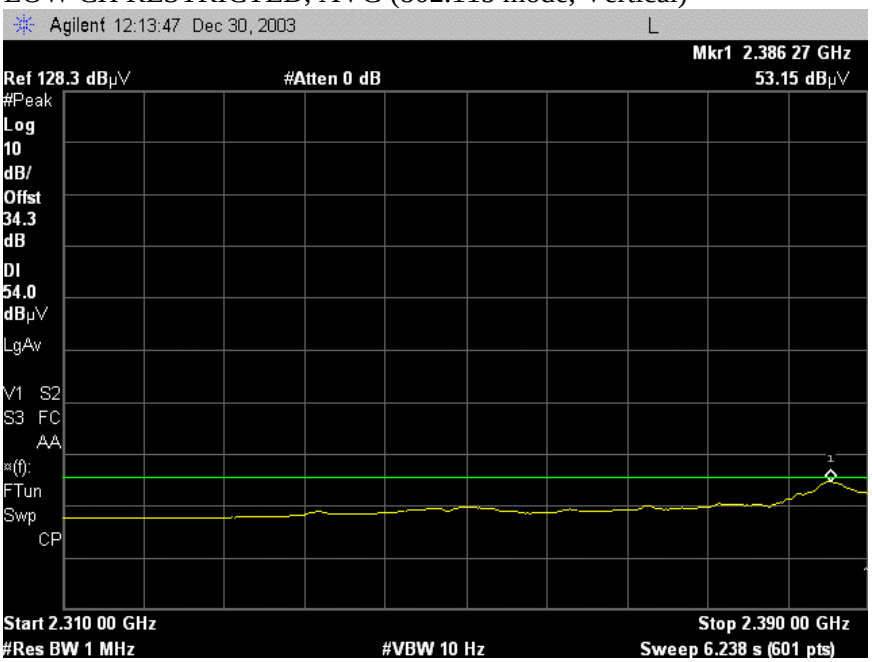


RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, VERTICAL)

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

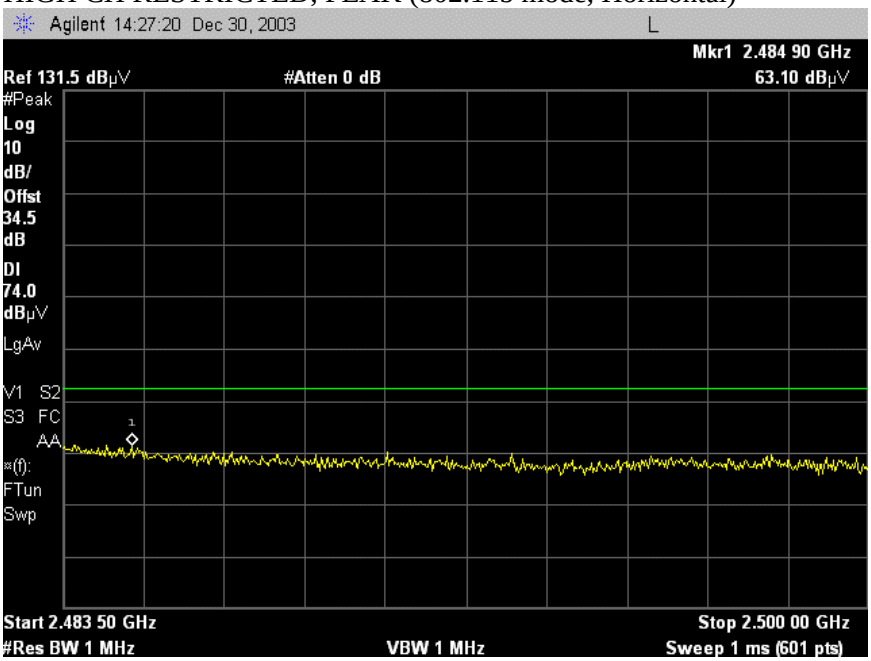


LOW CH RESTRICTED, AVG (802.11b mode, Vertical)

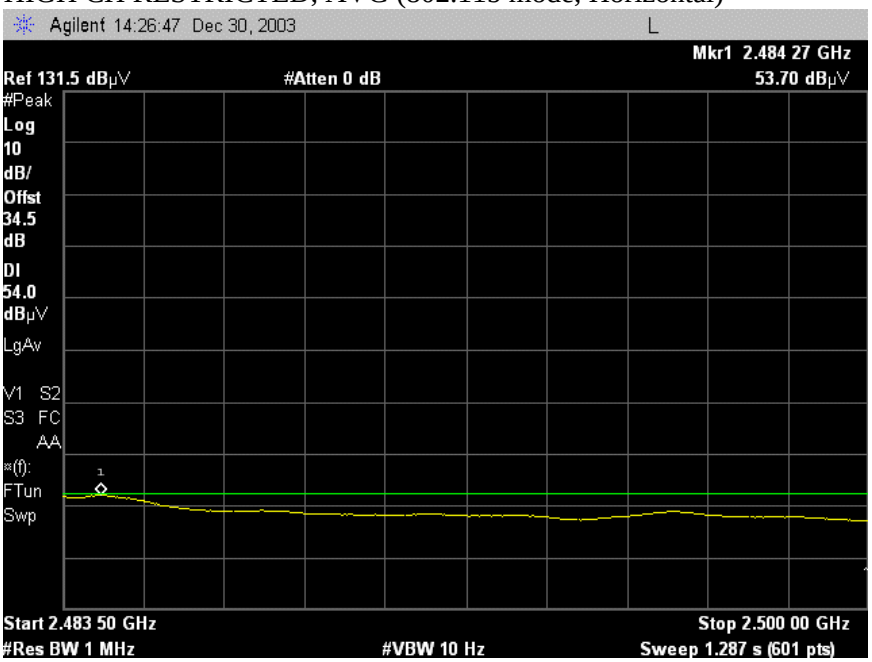


RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, HORIZONTAL)

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

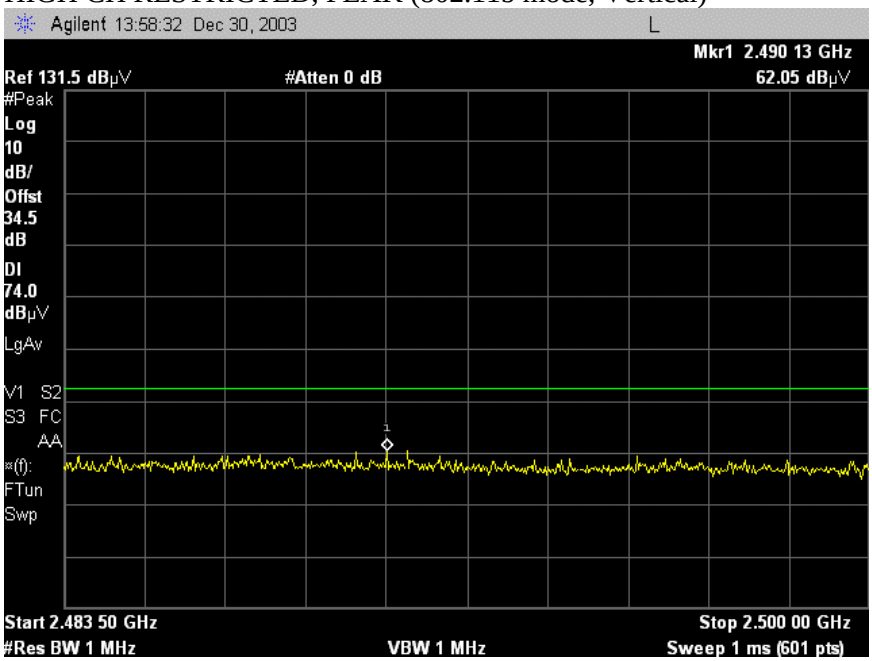


HIGH CH RESTRICTED, AVG (802.11b mode, Horizontal)

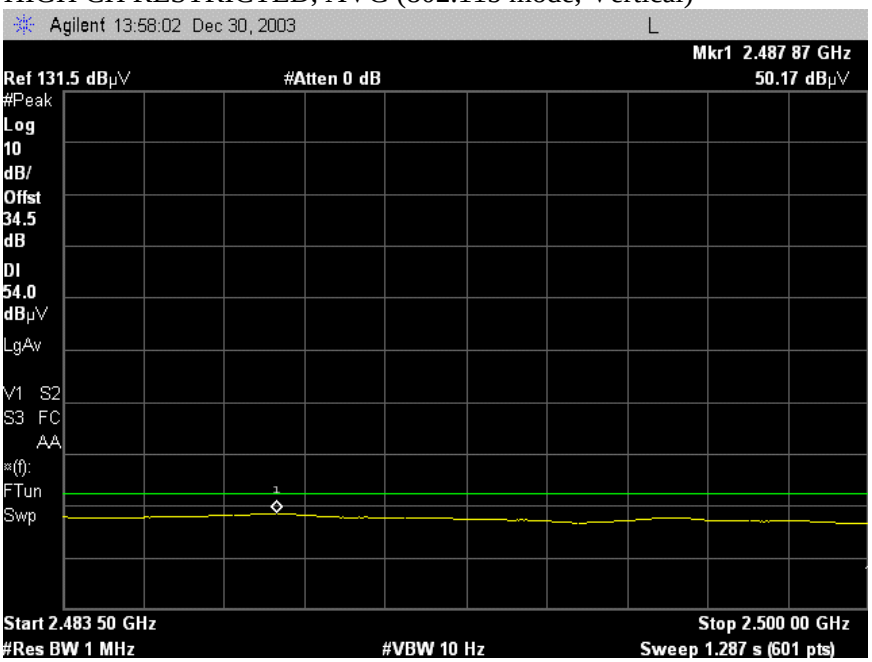


RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, VERTICAL)

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



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



HARMONICS AND SPURIOUS EMISSIONS (b MODE)

12/29/03 High Frequency Measurement

Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: NEELESH RAJ
Project #: 03U2433
Company: HEWLETT PACKARD
EUT Descrip.: 802.11 A/B/G J07H069.01
EUT M/N: NX9100(HP TRUMAN)
Test Target: FCC
Mode Oper: TX(NORMAL)

Test Equipment:

EMCO Horn 1-18GHz	Pre-amplifer 1-26GHz	Spectrum Analyzer	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T63 Mitreq 646456	Agilent E4446A Analyzer		FCC 15.205

Hi Frequency Cables: ☐ (2 ft) ☑ (2 ~ 3 ft) ☐ (4 ~ 6 ft) ☑ (12 ft)

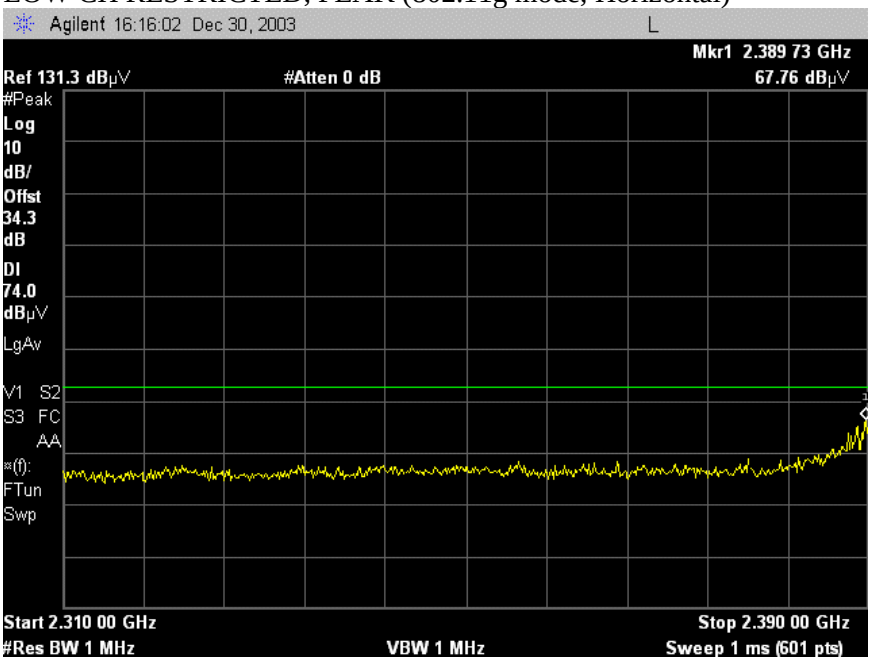
Peak Measurements: 1 MHz Resolution Bandwidth, 10Hz Video Bandwidth
Average Measurements: 1 MHz Resolution Bandwidth, 10Hz Video Bandwidth

f GHz	Dist feet	Read Pk dBuV	Read Avg dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes
		LOW CHANNEL (2412MHz) (B)													
4.824	9.8	42.0	34.1	33.1	2.9	-35.3	0.0	1.0	43.7	35.8	74.0	54.0	-30.3	-18.2	V (NOISE FLOOR)
4.824	9.8	43.0	34.2	33.1	2.9	-35.3	0.0	1.0	44.7	35.9	74.0	54.0	-29.3	-18.1	H (NOISE FLOOR)
12.060	9.8	40.7	31.4	39.3	5.1	-34.9	0.0	1.0	51.2	41.9	74.0	54.0	-22.8	-12.1	V (NOISE FLOOR)
12.060	9.8	40.6	31.4	39.3	5.1	-34.9	0.0	1.0	51.1	41.9	74.0	54.0	-22.9	-12.1	H (NOISE FLOOR)
		MIDDLE CHANNEL (2437MHz) (B)													
4.874	9.8	42.3	34.2	33.1	3.0	-35.3	0.0	1.0	44.1	36.0	74.0	54.0	-29.9	-18.0	V (NOISE FLOOR)
4.874	9.8	42.2	34.0	33.1	3.0	-35.3	0.0	1.0	44.0	35.8	74.0	54.0	-30.0	-18.2	H (NOISE FLOOR)
7.311	9.8	39.0	31.5	36.2	3.8	-34.6	0.0	1.0	45.4	37.9	74.0	54.0	-28.6	-16.1	V (NOISE FLOOR)
7.311	9.8	39.8	31.4	36.2	3.8	-34.6	0.0	1.0	46.2	37.8	74.0	54.0	-27.8	-16.2	H (NOISE FLOOR)
12.185	9.8	40.3	31.3	39.4	5.2	-35.1	0.0	1.0	50.7	41.7	74.0	54.0	-23.3	-12.3	V (NOISE FLOOR)
12.185	9.8	41.0	31.2	39.4	5.2	-35.1	0.0	1.0	51.4	41.6	74.0	54.0	-22.6	-12.4	H (NOISE FLOOR)
		HIGH CHANNEL (2462MHz) (B)													
4.924	9.8	47.6	41.7	33.2	3.0	-35.3	0.0	1.0	49.4	43.5	74.0	54.0	-24.6	-10.5	V
4.924	9.8	48.9	43.7	33.2	3.0	-35.3	0.0	1.0	50.7	45.5	74.0	54.0	-23.3	-8.5	H
7.386	9.8	42.2	31.3	36.3	3.8	-34.5	0.0	1.0	48.8	37.9	74.0	54.0	-25.2	-16.1	V (NOISE FLOOR)
7.386	9.8	41.7	31.2	36.3	3.8	-34.5	0.0	1.0	48.3	37.8	74.0	54.0	-25.7	-16.2	H (NOISE FLOOR)
12.310	9.8	38.0	31.0	39.4	5.2	-35.3	0.0	1.0	48.3	41.3	74.0	54.0	-25.7	-12.7	V (NOISE FLOOR)
12.310	9.8	38.1	30.9	39.4	5.2	-35.3	0.0	1.0	48.4	41.2	74.0	54.0	-25.6	-12.8	H (NOISE FLOOR)
		NO OTHER SPURIOUS EMISSIONS DETECTED ABOVE THE SYSTEM NOISE FLOOR													

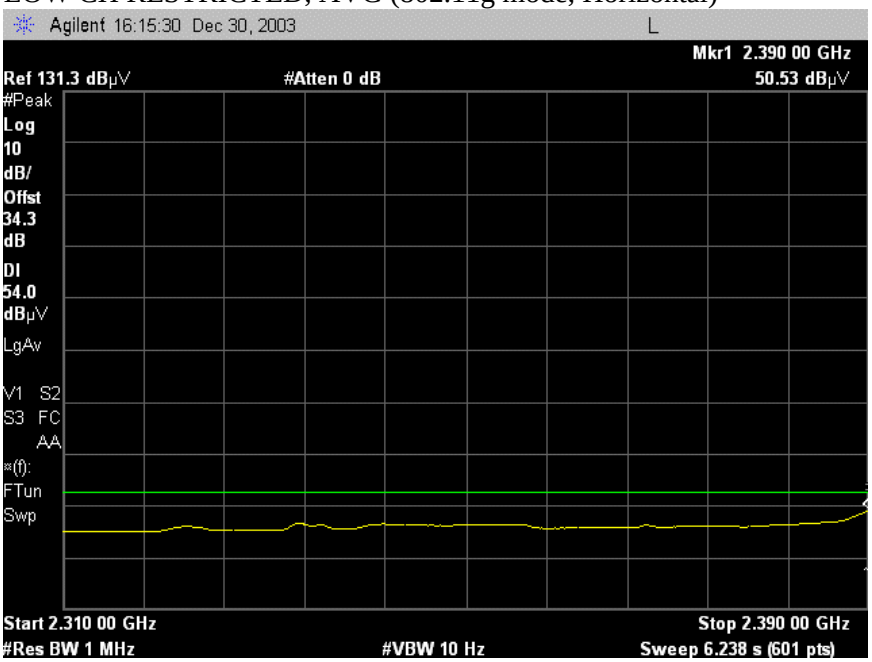
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field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

RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, HORIZONTAL)

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

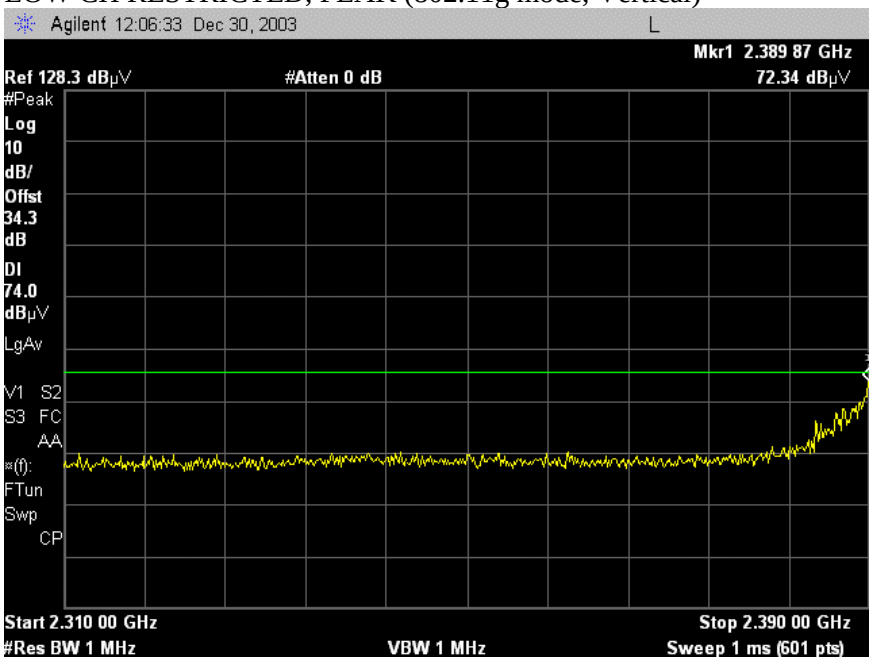


LOW CH RESTRICTED, AVG (802.11g mode, Horizontal)

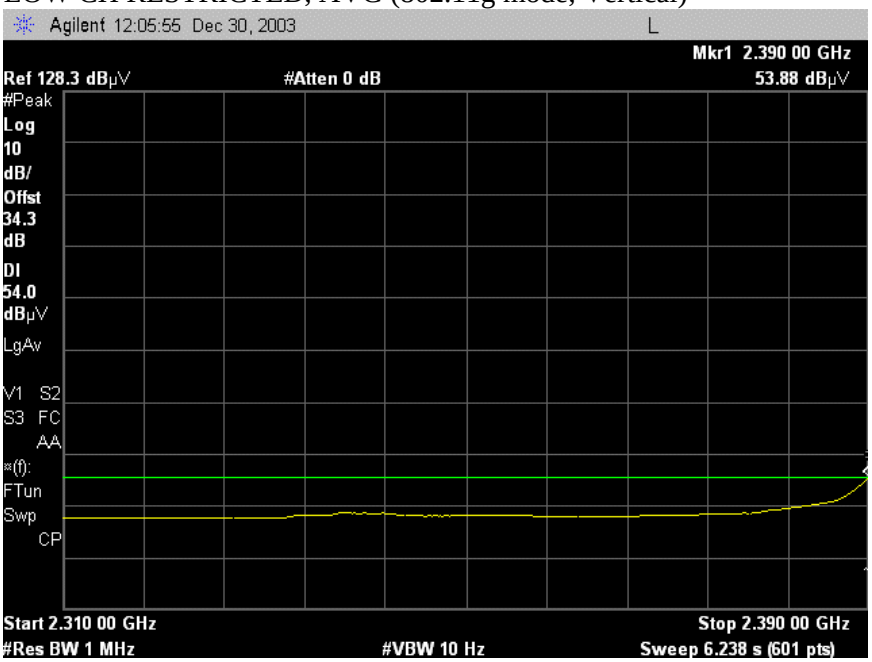


RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, VERTICAL)

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

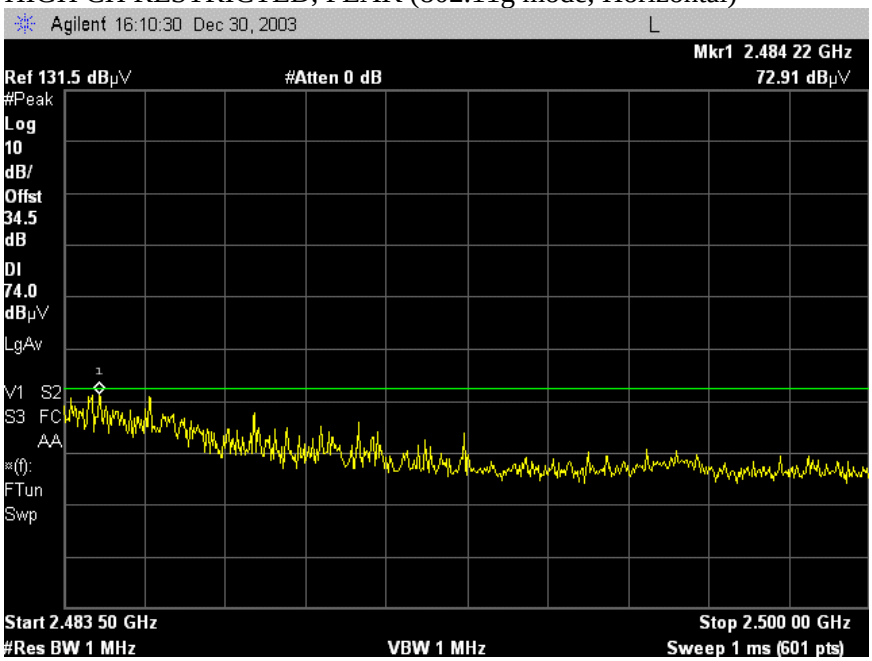


LOW CH RESTRICTED, AVG (802.11g mode, Vertical)



RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, HORIZONTAL)

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



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