



**FCC CFR47 PART 15 SUBPART C
CERTIFICATION
TEST REPORT**

FOR

802.11 a/b/g MODULE

MODEL NUMBER: BFD

FCC ID: P9J-BFD

REPORT NUMBER: 06U10287-1, REVISION C

ISSUE DATE: JULY 17, 2006

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Revision History

Rev.	Issue Date	Revisions	Revised By
--	06/27/06	Initial Issue	Thu
B	06/28/06	Updated power level in the table under section 5.5	Thu
C	07/17/06	Revised the statement of power level issue on Pages 28, 68, 146, and sections 5.5 & 7.2.4	Thu

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS.....	5
2. TEST METHODOLOGY.....	6
3. FACILITIES AND ACCREDITATION.....	6
4. CALIBRATION AND UNCERTAINTY.....	6
4.1. <i>MEASURING INSTRUMENT CALIBRATION.....</i>	6
4.2. <i>MEASUREMENT UNCERTAINTY.....</i>	6
5. EQUIPMENT UNDER TEST	7
5.1. <i>DESCRIPTION OF EUT.....</i>	7
5.2. <i>MAXIMUM OUTPUT POWER.....</i>	7
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i>	8
5.4. <i>SOFTWARE AND FIRMWARE.....</i>	8
5.5. <i>WORST-CASE CONFIGURATION AND MODE.....</i>	8
5.6. <i>DESCRIPTION OF TEST SETUP.....</i>	10
6. TEST AND MEASUREMENT EQUIPMENT	12
7. LIMITS AND RESULTS.....	13
7.1. <i>CHANNEL TESTS FOR THE 2400 TO 2483.5 MHz BAND.....</i>	13
7.1.1. 6 dB BANDWIDTH	13
7.1.2. 99% BANDWIDTH	20
7.1.3. PEAK OUTPUT POWER.....	27
7.1.4. MAXIMUM PERMISSIBLE EXPOSURE.....	35
7.1.5. AVERAGE POWER	38
7.1.6. PEAK POWER SPECTRAL DENSITY	39
7.1.7. CONDUCTED SPURIOUS EMISSIONS.....	46
7.2. <i>CHANNEL TESTS FOR THE 5725 TO 5850 MHz BAND.....</i>	59
7.2.1. 6 dB BANDWIDTH	59
7.2.2. 99% BANDWIDTH	63
7.2.3. PEAK OUTPUT POWER.....	67
7.2.4. MAXIMUM PERMISSIBLE EXPOSURE.....	72
7.2.5. AVERAGE POWER	75
7.2.6. PEAK POWER SPECTRAL DENSITY	76
7.2.7. CONDUCTED SPURIOUS EMISSIONS.....	80
7.3. <i>RADIATED EMISSIONS</i>	87
7.3.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS.....	87
7.3.2. TRANSMITTER ABOVE 1 GHz FOR 2400 TO 2483.5 MHz BAND.....	90
7.3.3. TRANSMITTER ABOVE 1 GHz FOR 5725 TO 5850 MHz BAND.....	144
7.3.4. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz.....	147

7.4. POWERLINE CONDUCTED EMISSIONS	155
8. SETUP PHOTOS.....	159

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: TROPOS NETWORKS
555 DEL REY AVENUE
SUNNYVALE, CA 94089 USA

EUT DESCRIPTION: 802.11a/b/g Module

MODEL: BFD

SERIAL NUMBER: 57

DATE TESTED: JUNE 01 TO JUNE 13, 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:

Tested By:



THU CHAN
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES



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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 an 802.11a/b/g transceiver module.

The radio module is manufactured by Tropos.

5.2. MAXIMUM OUTPUT POWER

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

2400 to 2483.5 MHz Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	28.57	719.45
2412 - 2462	802.11g	28.52	711.21

5725 to 5850 MHz Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5745 - 5825	802.11a	26.85	484.17

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an antenna chosen from six different antennas. These antenna types tested as list below per frequency band.

- _ For 2.4 GHz band, 3 antennas: 7.4 dBi Monopole, 10 dBi Monopole, and 12 dBi Sector.
- _ For 5.8 GHz band, 3 antennas: 9.1 dBi Monopole, 17 dBi sector, and 19 dBi Patch.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was Terminal Emulator program, transmitter and Receiver test mode control via command lines entries.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The highest measured output power was at 2462 MHz for 11b mode, 2437 MHz for 11g mode and 5785 MHz for 11a mode.

The worst-case data rate for this channel is determined to be 1 Mb/s for 11b mode, 6 Mb/s for 11g mode, and 6 Mb/s for 11a mode, based on previous experience with 802.11abg WLAN product design architectures.

Thus all emissions tests were made in the 802.11b mode, 2462 MHz, 1 Mb/s, 802.11g mode, 2437 MHz, 6 Mb/s, and 802.11a mode, 2437 MHz, 6 Mb/s.

Because the maximum out put power is limited by EIRP (36dBm) for b/g mode, therefore for Radiated Emission tests such as Band edge & Harmonic, the EUT was tested with all six different types of antenna. And for RF Conducted tests were performed with highest output power only. For a mode, the maximum output power was used of 26.9dBm for all measurements.

See table below for antenna gain and power setting per each antenna.

MODE / CHANNEL	MEASURED AVERAGE POWER (dBm)	Antenna(dBi)
2.4 GHz BAND		
b mode 2412	28.60	7.4 dBi Monopole
b mode 2437	28.60	7.4 dBi Monopole
b mode 2462	28.60	7.4 dBi Monopole
g mode 2412	28.60	7.4 dBi Monopole
g mode 2437	28.60	7.4 dBi Monopole
g mode 2462	28.60	7.4 dBi Monopole
b mode 2412	26.00	10 dBi Monopole
b mode 2437	26.00	10 dBi Monopole
b mode 2462	26.00	10 dBi Monopole
g mode 2412	26.00	10 dBi Monopole
g mode 2437	26.00	10 dBi Monopole
g mode 2462	26.00	10 dBi Monopole
b mode 2412	24.00	12 dBi Sector
b mode 2437	24.00	12 dBi Sector
b mode 2462	24.00	12 dBi Sector
g mode 2412	24.00	12 dBi Sector
g mode 2437	24.00	12 dBi Sector
g mode 2462	24.00	12 dBi Sector
5.8 GHz BAND		
a mode_5745	26.90	9.1 dBi Monopole
a mode_5785	26.90	9.1 dBi Monopole
a mode_5825	26.90	9.1 dBi Monopole
a mode_5745	26.90	17 dBi Sector P2P
a mode_5785	26.90	17 dBi Sector P2P
a mode_5825	26.90	17 dBi Sector P2P
a mode_5745	19.00	17 dBi Sector P2MP
a mode_5785	19.00	17 dBi Sector P2MP
a mode_5825	19.00	17 dBi Sector P2MP
a mode_5745	26.90	19 dBi Patch P2P
a mode_5785	26.90	19 dBi Patch P2P
a mode_5825	26.90	19 dBi Patch P2P

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	Dell	PA1900-02D2	N/A	N/A
Laptop	Dell	D505	N/A	DOC

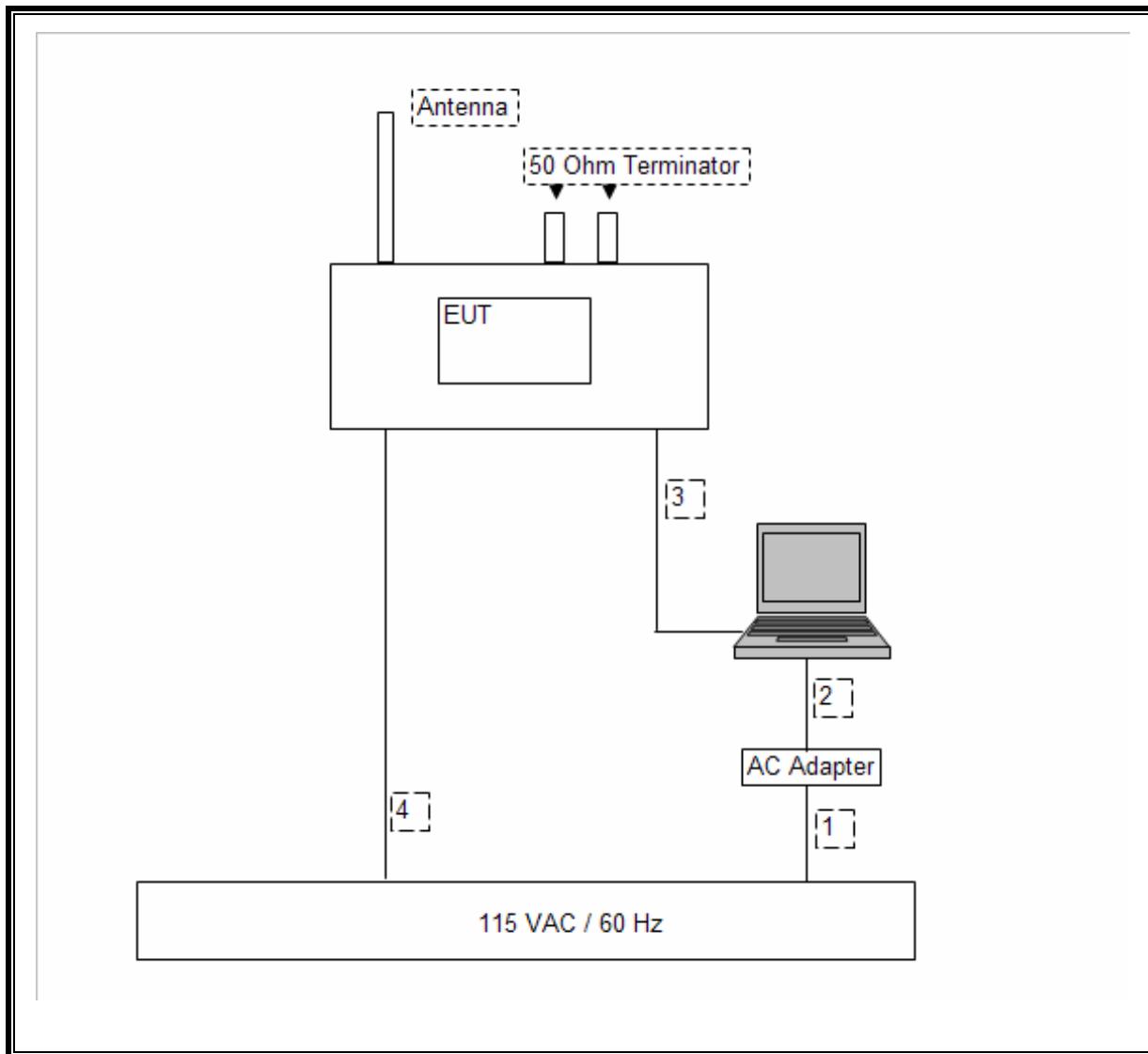
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	115 VAC	Un-shielded	.5 m	N/A
2	DC	1	DC	Shielded	0.8 m	To Laptop
3	RS-232	1	DB9	Un-shielded	1 m	From Laptop to EUT
4	AC	1	115 VAC	Shielded	1 m	To EUT

TEST SETUP

The EUT is connected to a laptop computer via an RS-232 cable during the tests. Test software exercised the radio.

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
Power Meter	Agilent / HP	438B	3125U09516	2/15/2007
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	MY43360112	4/28/2007
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	US42510266	10/19/2006
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	4/22/2007
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	4/22/2007
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	8/30/2006
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	8/30/2006
EMI Test Receiver	R & S	ESHS 20	827129/006	11/3/2006
EMI Receiver, 9 kHz ~ 2.9 GHz	Agilent / HP	8542E	3942A00286	2/4/2007
RF Filter Section	Agilent / HP	85420E	3705A00256	2/4/2007
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00561	10/3/2007
7.6 Highpass Filter	Micro-Tronics	HPM13195	1	CNR
4.0 Highpass Filter	Micro-Tronics	HPM13351	3	CNR

7. LIMITS AND RESULTS

7.1. CHANNEL TESTS FOR THE 2400 TO 2483.5 MHz BAND

7.1.1. 6 dB BANDWIDTH

LIMIT

§15.247 (a) (2) For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

No non-compliance noted:

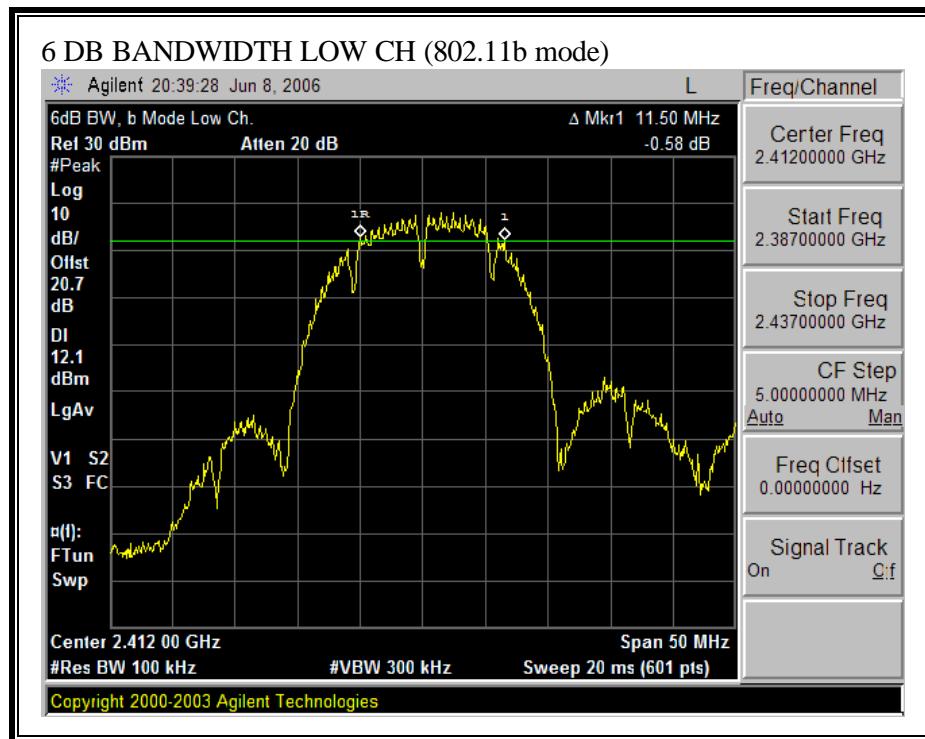
802.11b Mode

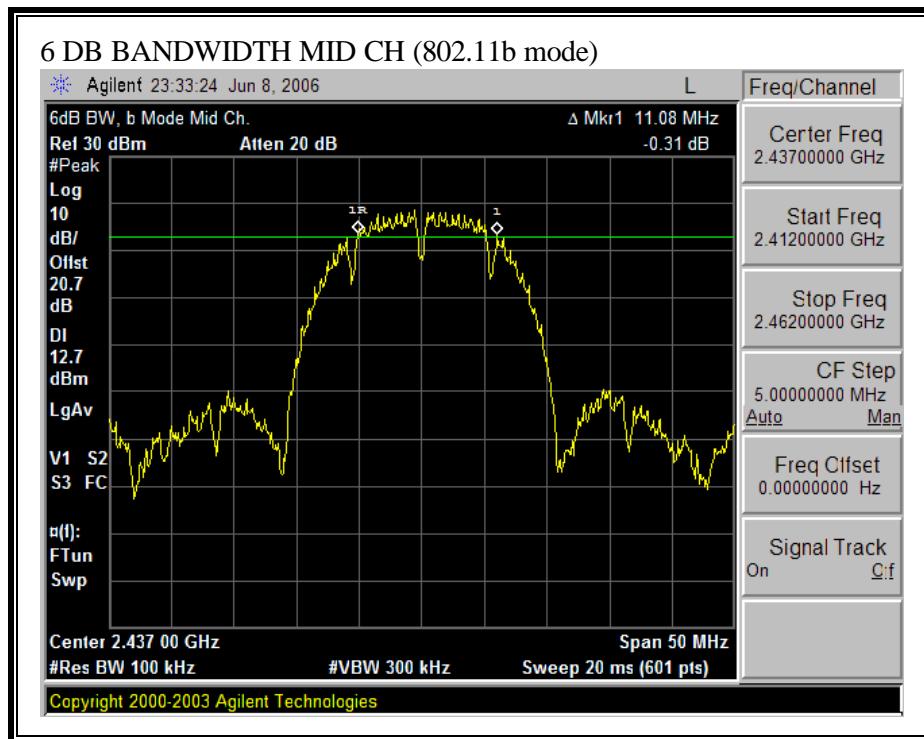
Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2412	11500.00	500	11000
Middle	2437	11083.33	500	10583
High	2462	11500.00	500	11000

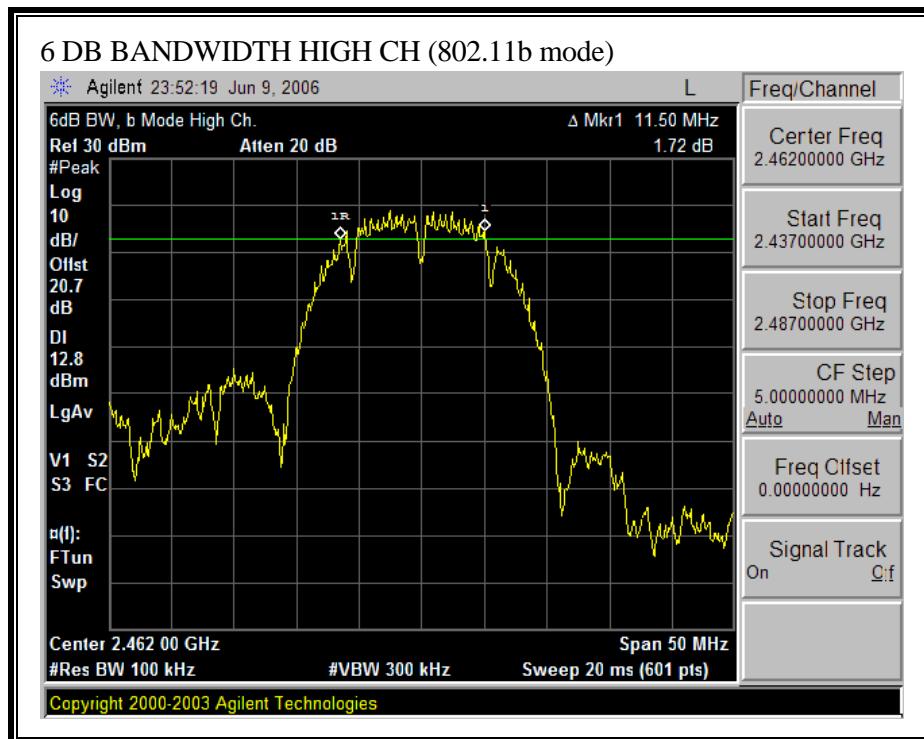
802.11g Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2412	15750.00	500	15250
Middle	2437	16333.33	500	15833
High	2462	16500.00	500	16000

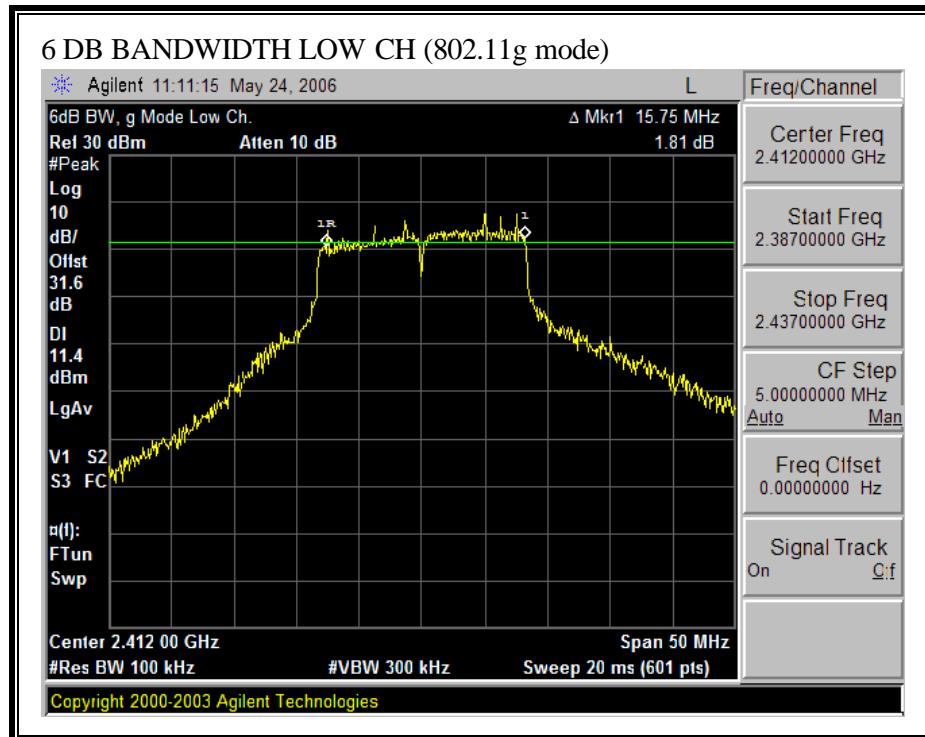
6 DB BANDWIDTH (802.11b MODE)

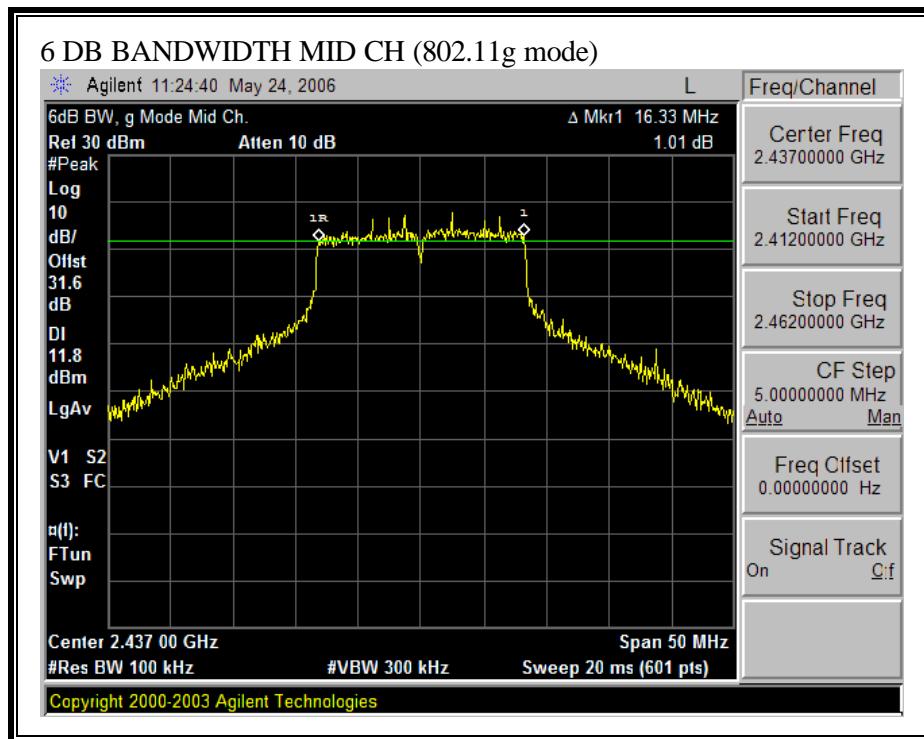


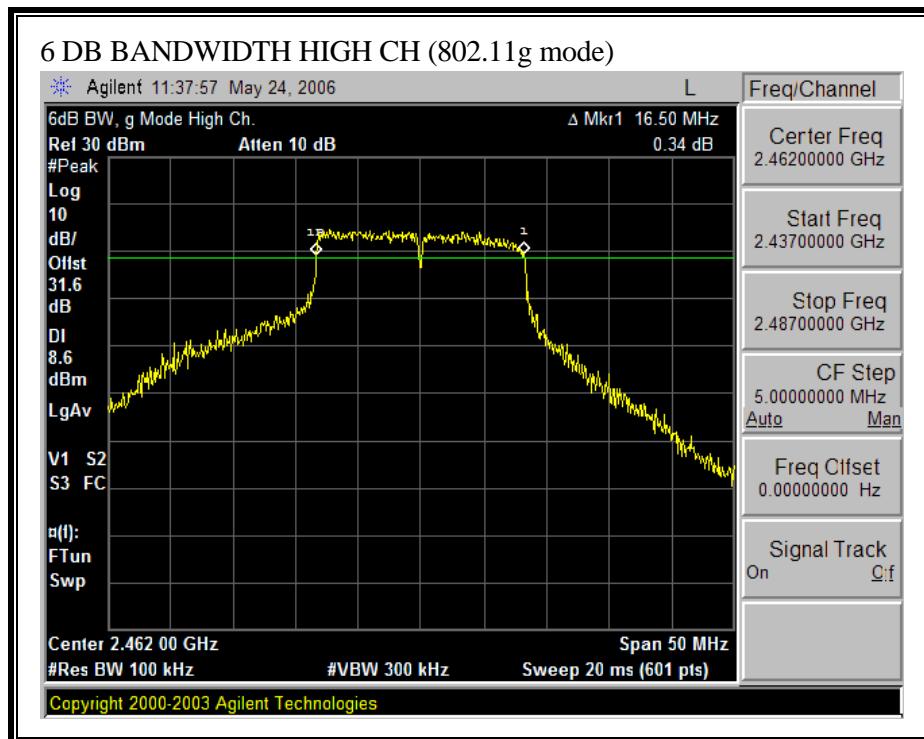




6 DB BANDWIDTH (802.11g MODE)







7.1.2. 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

No non-compliance noted:

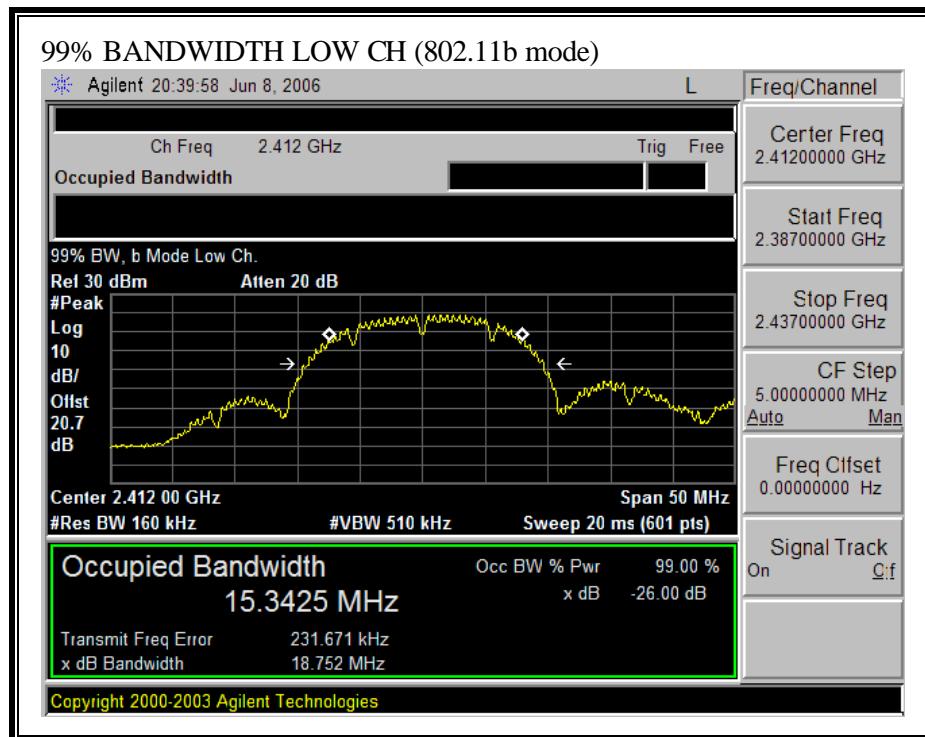
802.11b Mode

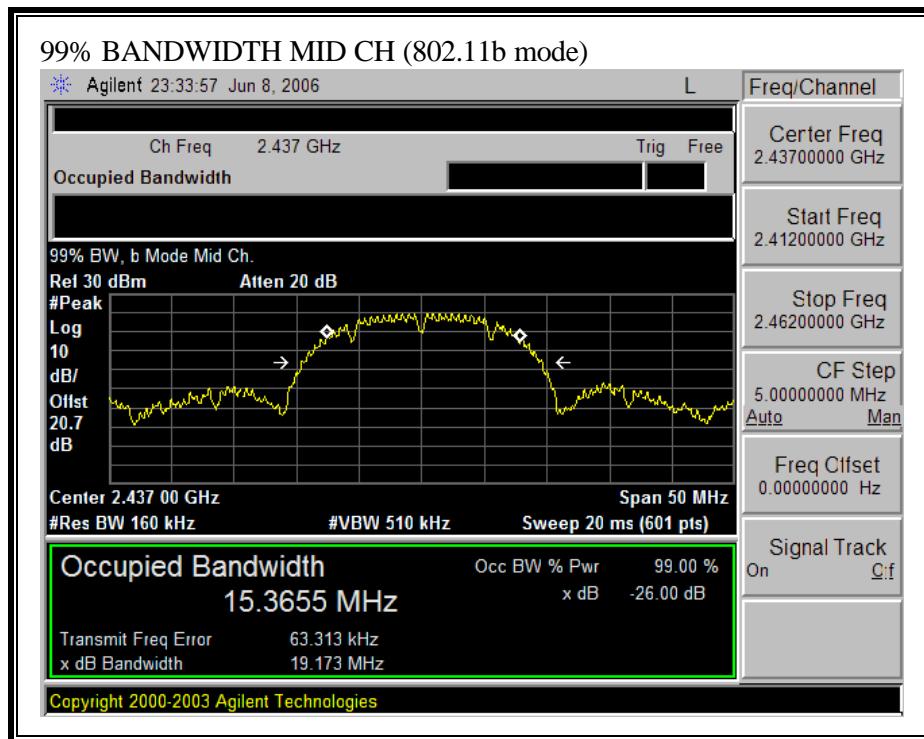
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	15.342
Middle	2437	15.365
High	2462	15.366

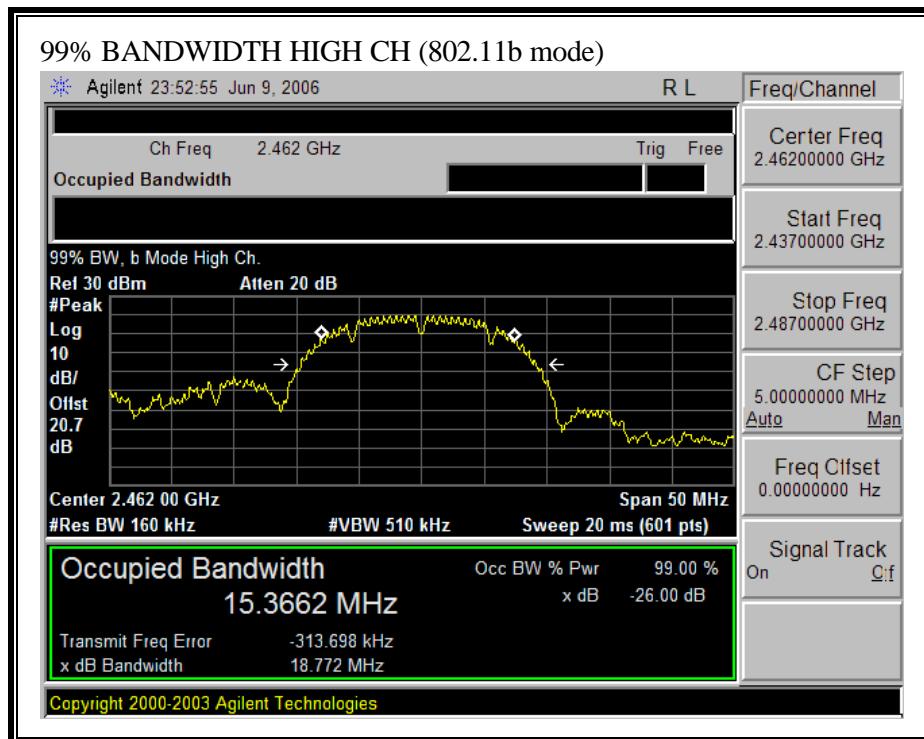
802.11g Mode

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	17.523
Middle	2437	17.349
High	2462	19.553

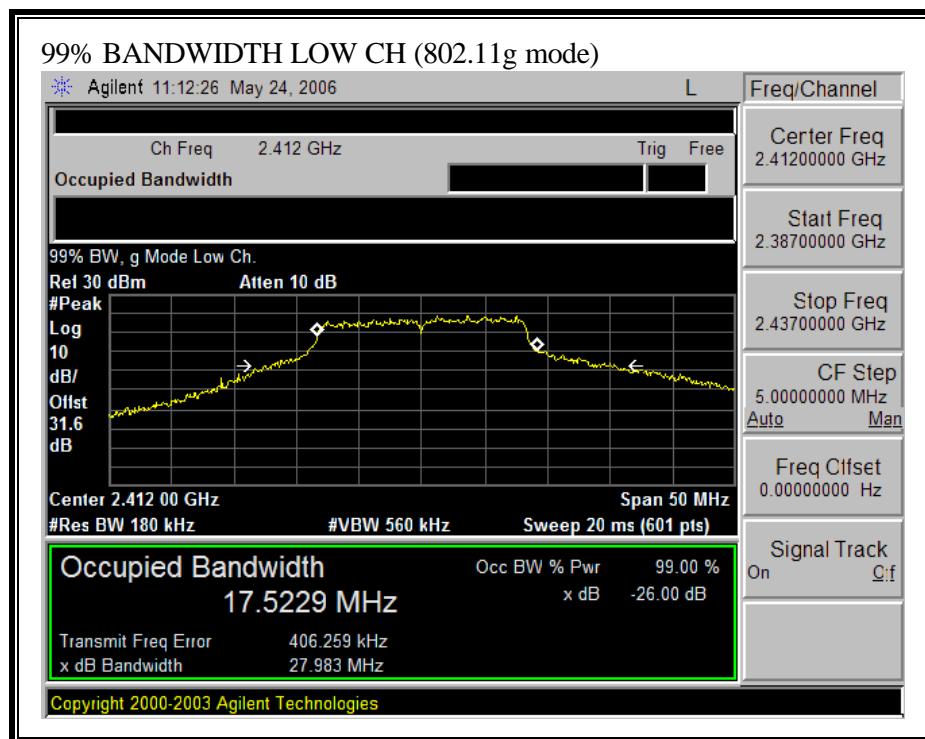
99% BANDWIDTH (802.11b MODE)

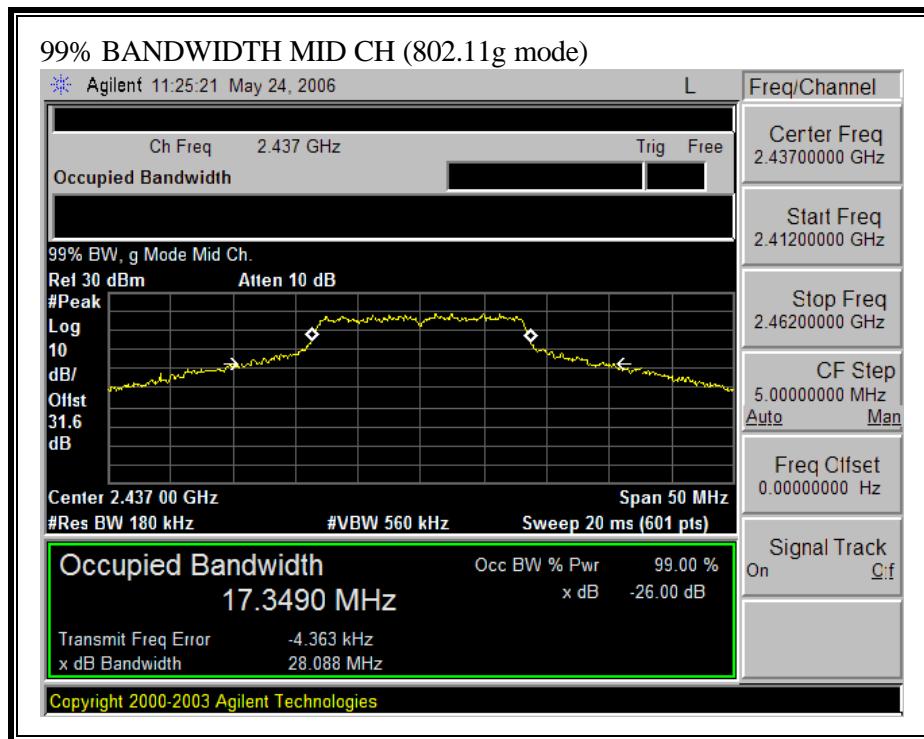


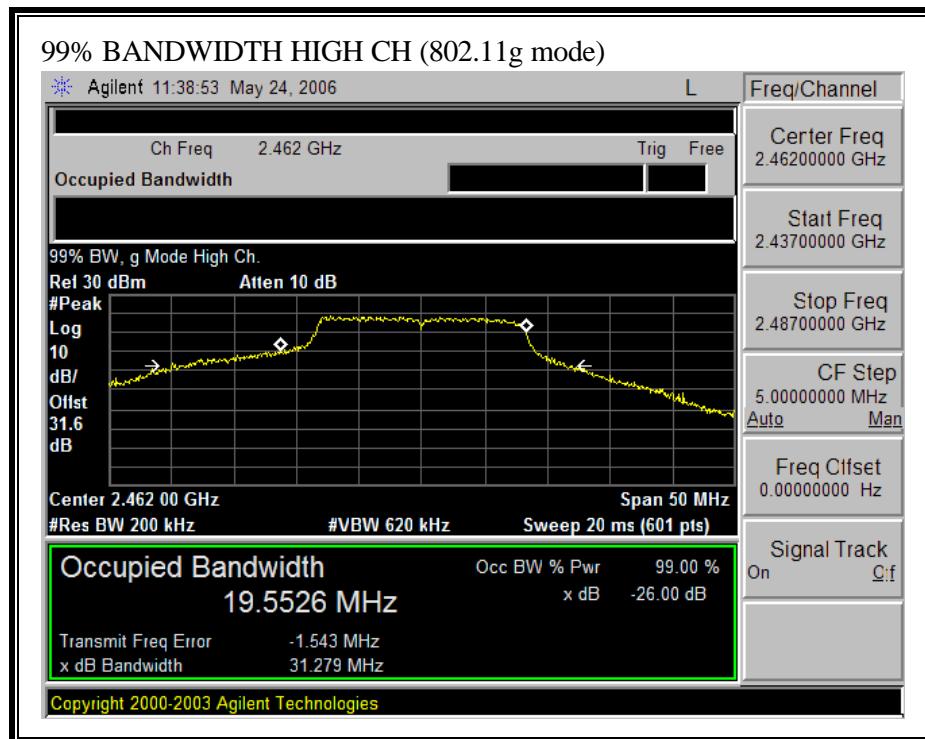




99% BANDWIDTH (802.11g MODE)







7.1.3. PEAK OUTPUT POWER

PEAK POWER LIMIT

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 watt.

§15.247 (b) (4) Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§15.247 (b) (4) (ii) Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.

RESULTS

In order to test with the highest power output, the lowest antenna gain is based on 7.4 dBi other than fixed, point-to-point operations; therefore the limit is 28.6 dBm.

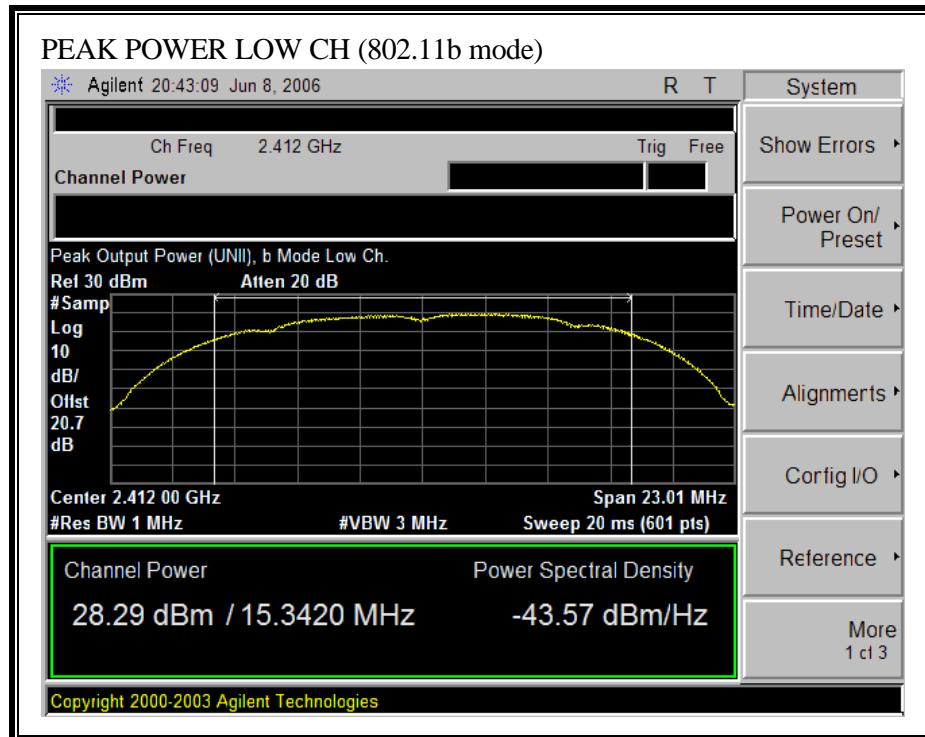
802.11b Mode

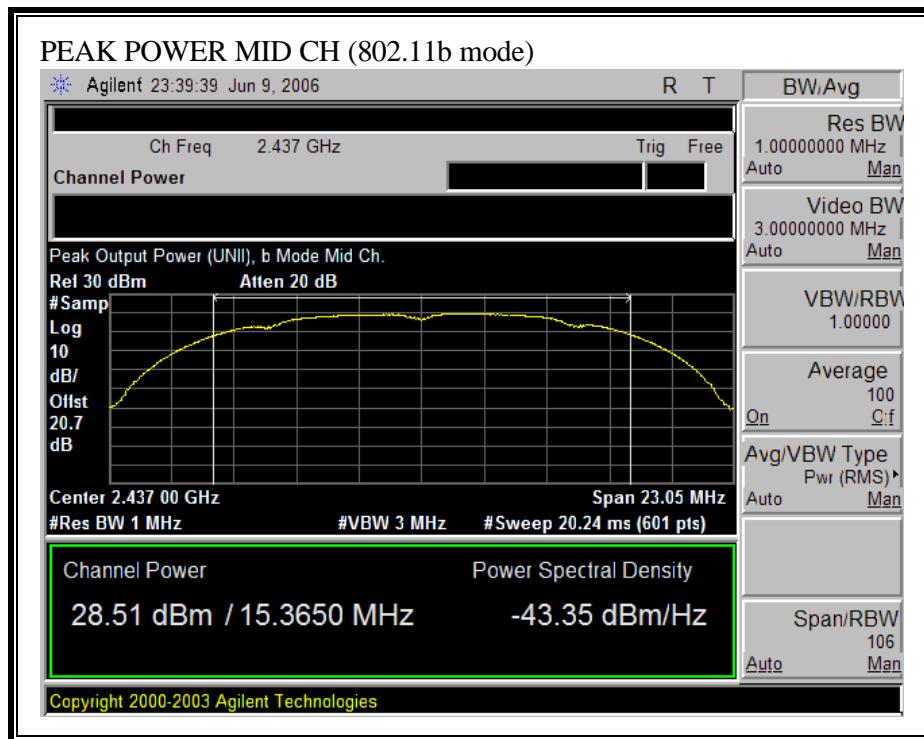
Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	28.29	28.6	-0.31
Middle	2437	28.51	28.6	-0.09
High	2462	28.57	28.6	-0.03

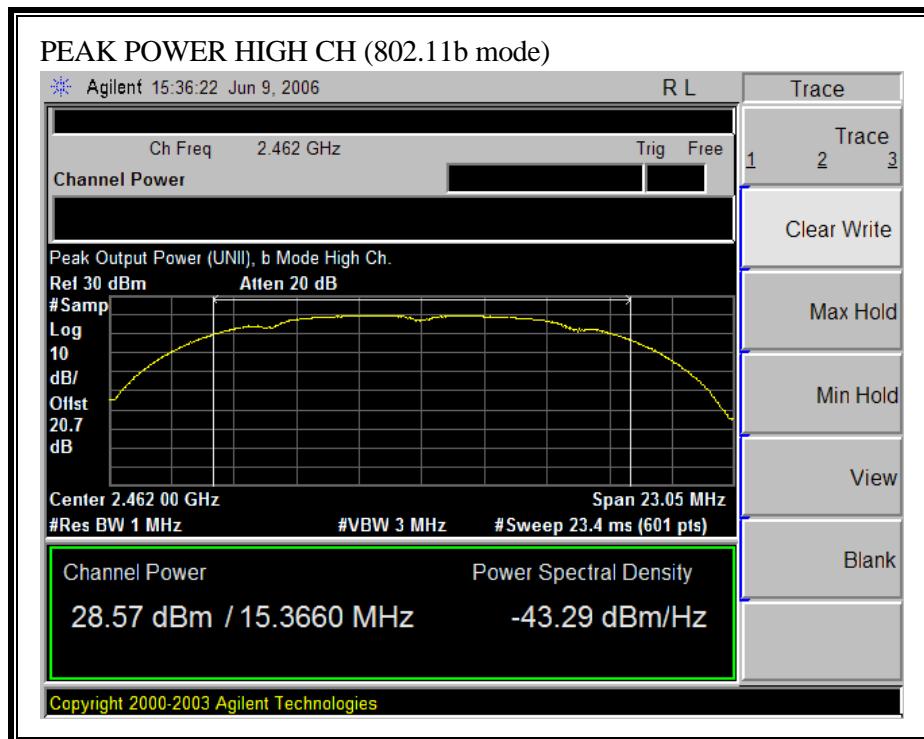
802.11g Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	27.76	28.6	-0.84
Middle	2437	28.52	28.6	-0.08
High	2462	27.89	28.6	-0.71

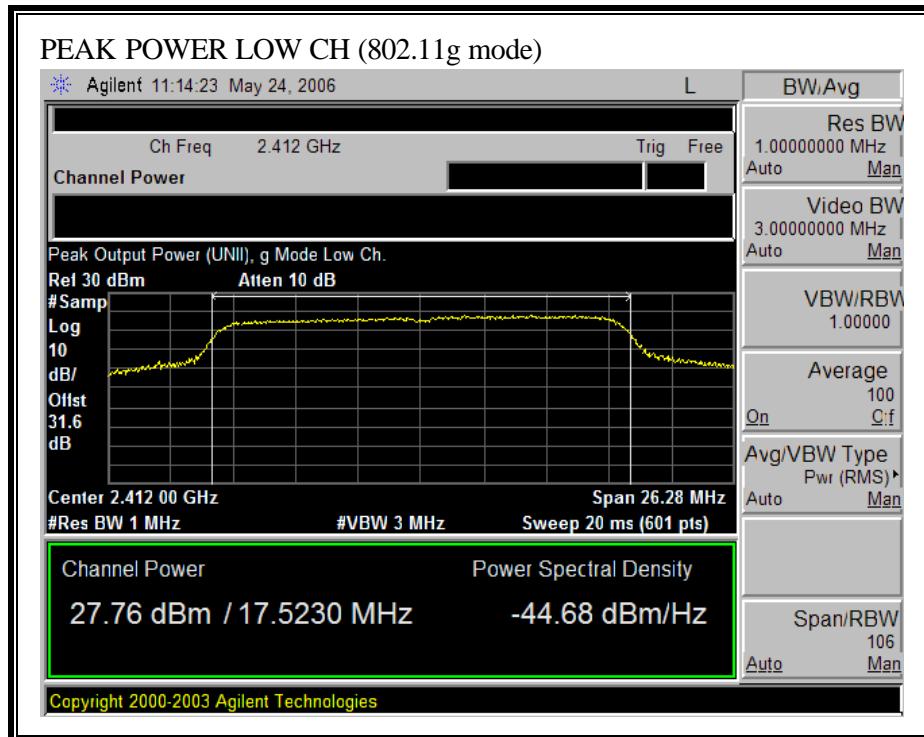
OUTPUT POWER (802.11b MODE)

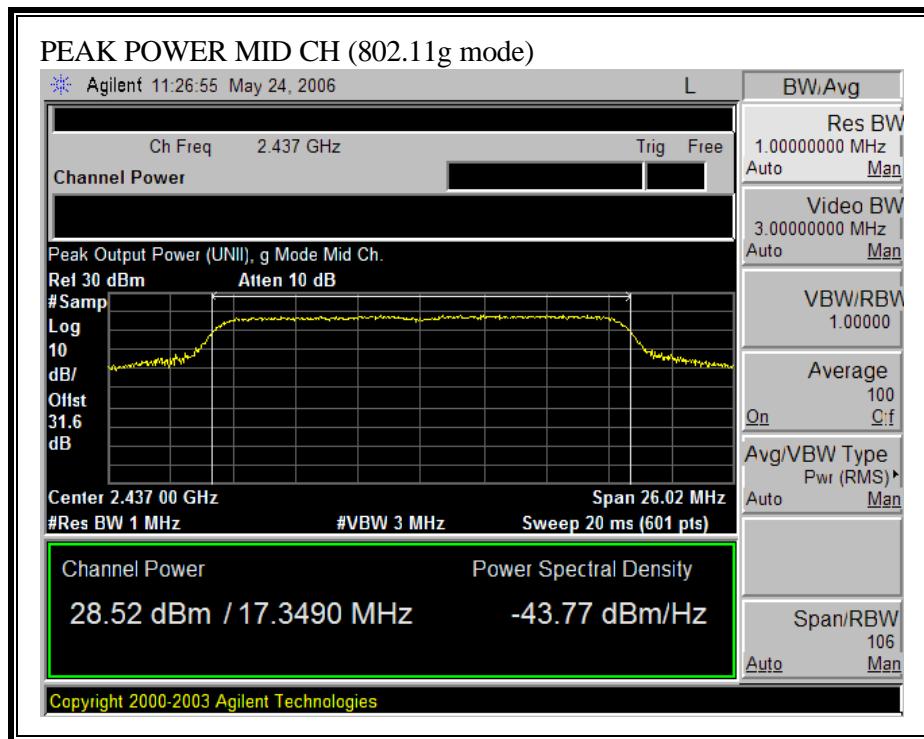


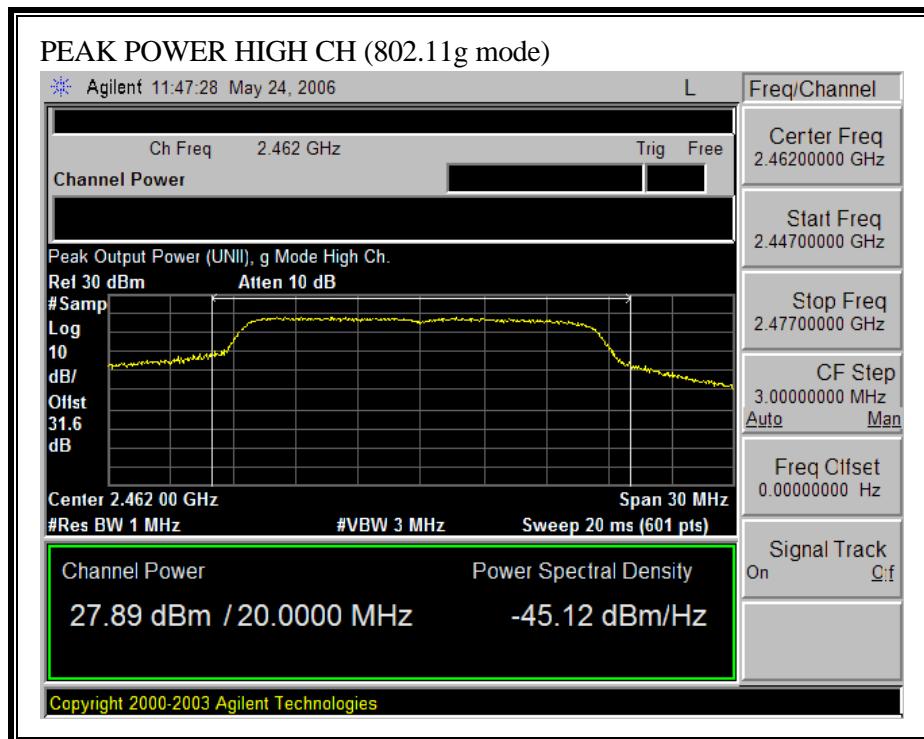




OUTPUT POWER (802.11g MODE)







7.1.4. 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	1842f	4.89f	*(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	824f	2.19f	*(180/f ²)	30

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

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

f = frequency in MHz

* = Plane-wave equivalent power density

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

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

CALCULATIONS

Given

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

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

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

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

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

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

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

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/cm²

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

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

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm²

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

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

LIMITS

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

RESULTS

No non-compliance noted

Mode	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm ²)
802.11b	20.0	28.57	7.40	0.79
802.11g	20.0	28.52	7.40	0.78

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.

7.1.5. 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 20.7 dB (including 20 dB pad and .7 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

802.11b Mode

Channel	Frequency (MHz)	Power (dBm)
Low	2412	28.30
Middle	2437	28.50
High	2462	28.40

802.11g Mode

Channel	Frequency (MHz)	Power (dBm)
Low	2412	27.60
Middle	2437	28.40
High	2462	27.50

7.1.6. PEAK POWER SPECTRAL DENSITY

LIMIT

§15.247 (d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST PROCEDURE

The test is performed in accordance with PSD Option 2 as documented in the FCC procedure “Measurement of Digital Transmission Systems Operating under Section 15.247”, dated March 23, 2005.

RESULTS

No non-compliance noted:

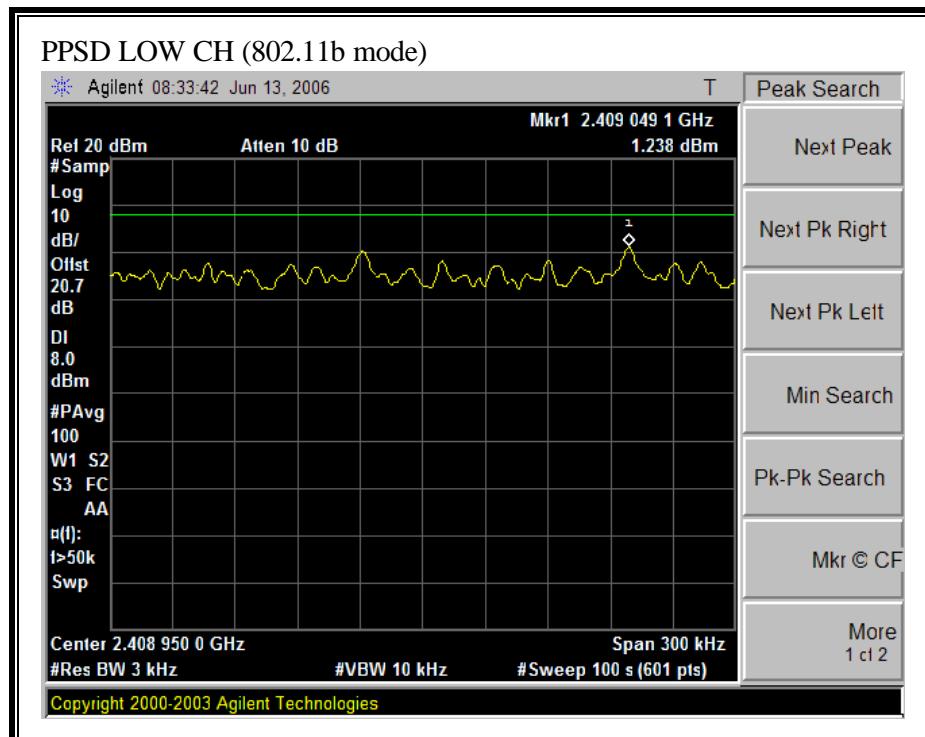
802.11b Mode

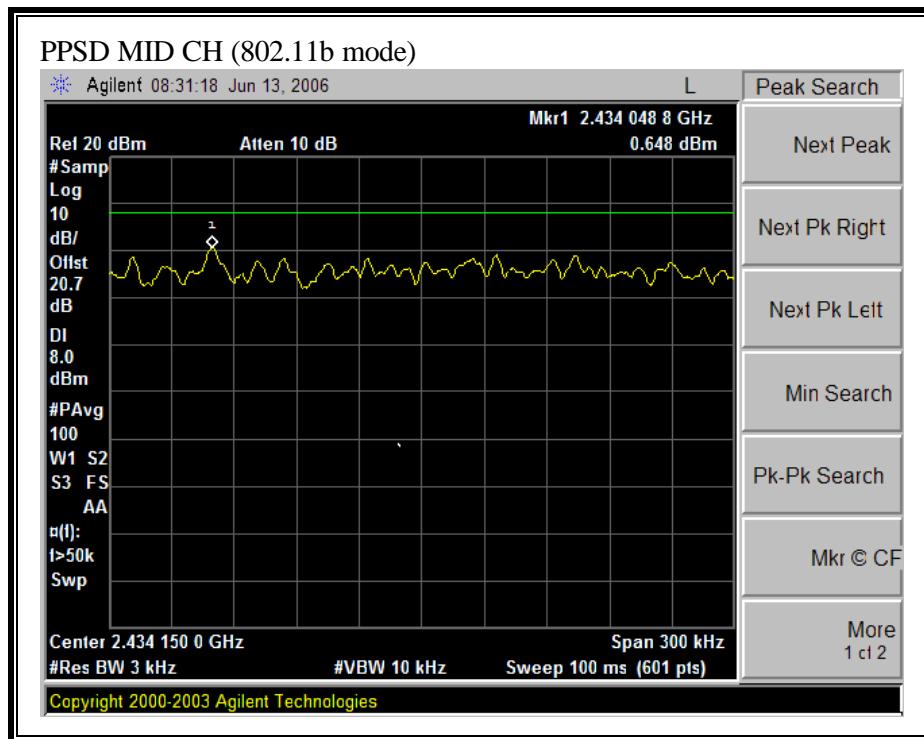
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-1.28	8	-9.28
Middle	2437	0.65	8	-7.35
High	2462	-0.13	8	-8.13

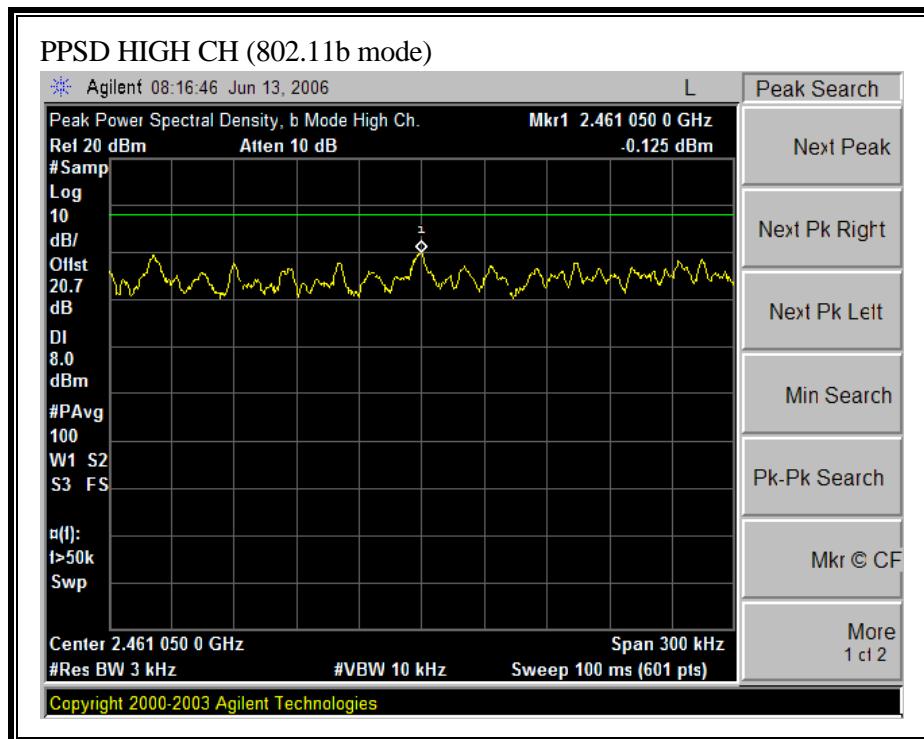
802.11g Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	0.94	8	-7.06
Middle	2437	0.53	8	-7.47
High	2462	-0.57	8	-8.57

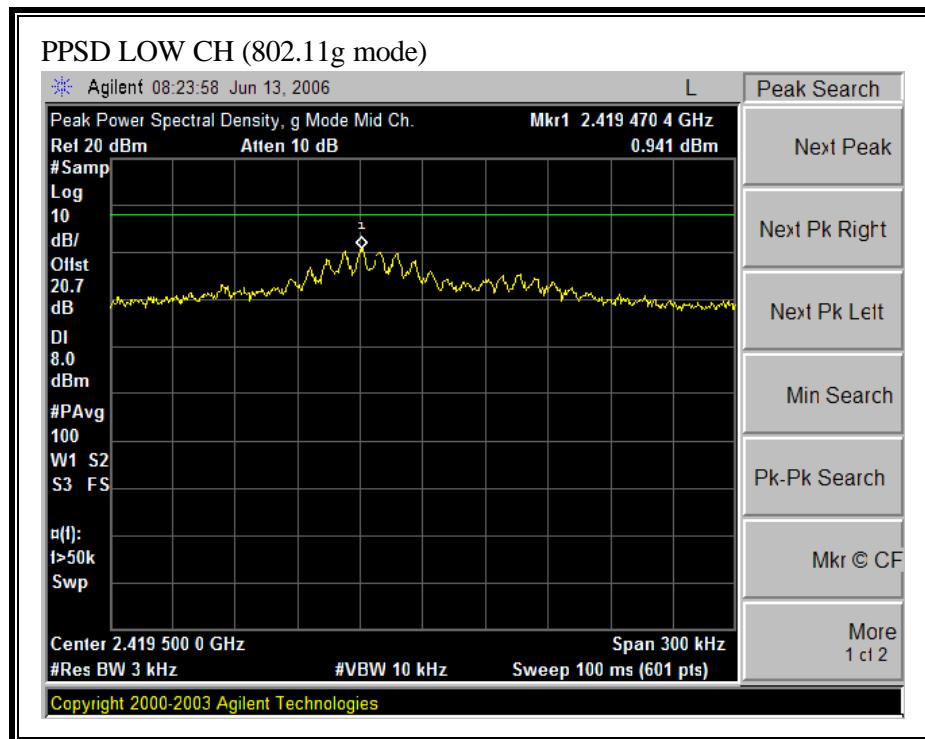
PEAK POWER SPECTRAL DENSITY (802.11b MODE)

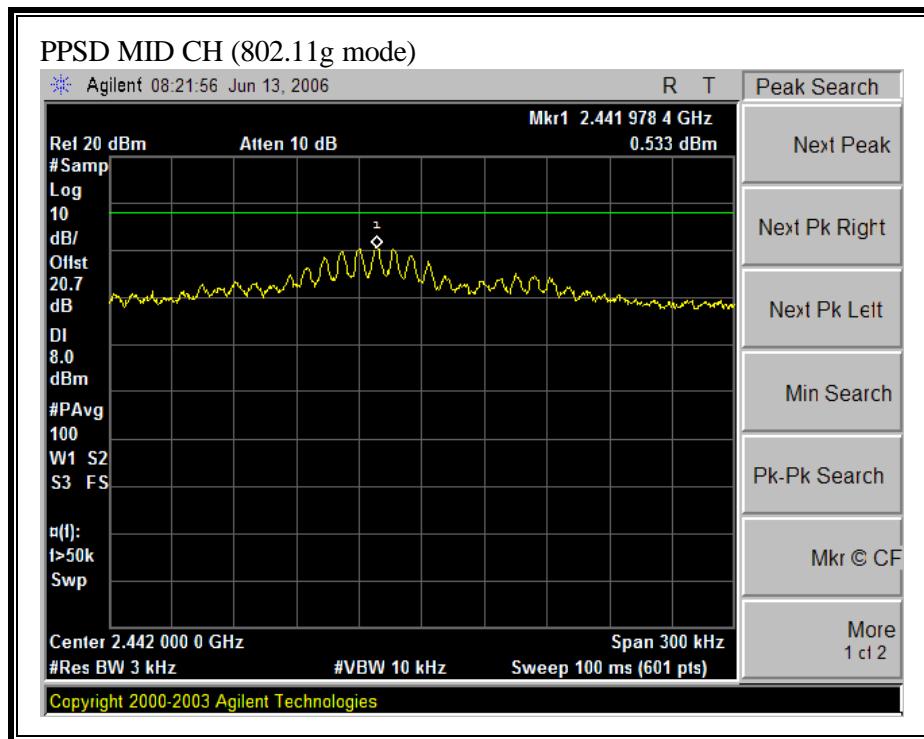


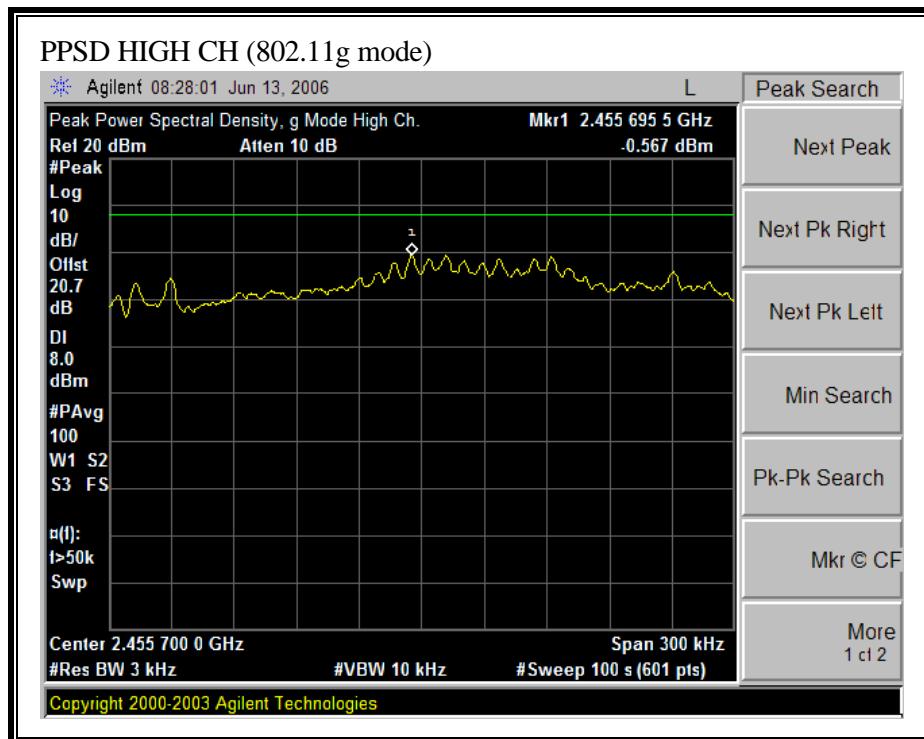




PEAK POWER SPECTRAL DENSITY (802.11g MODE)







7.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.247 (c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Conducted power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

TEST PROCEDURE

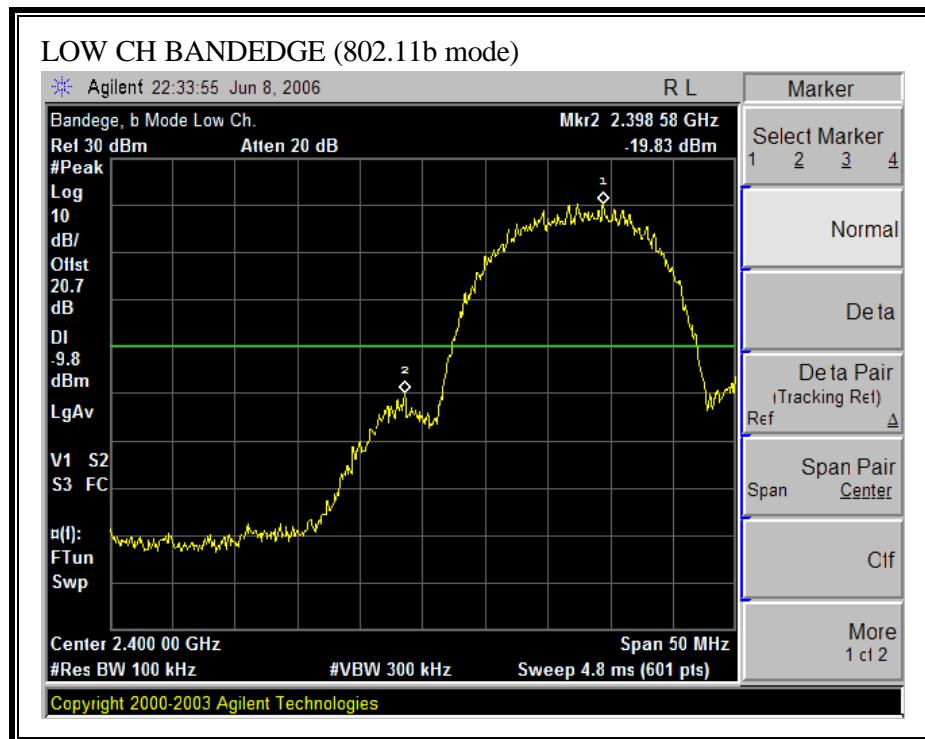
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

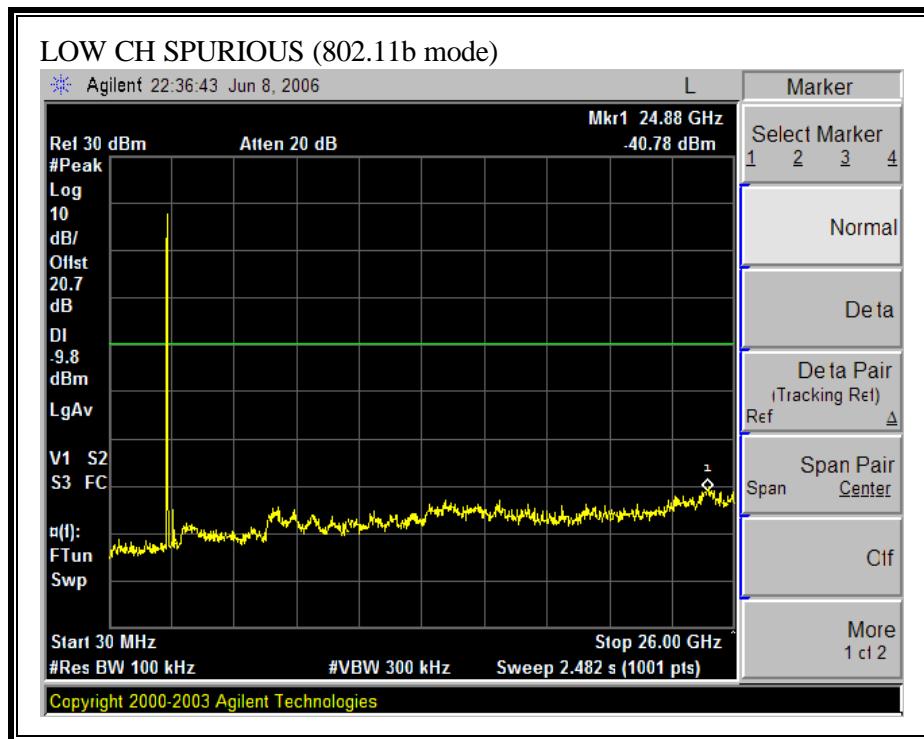
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

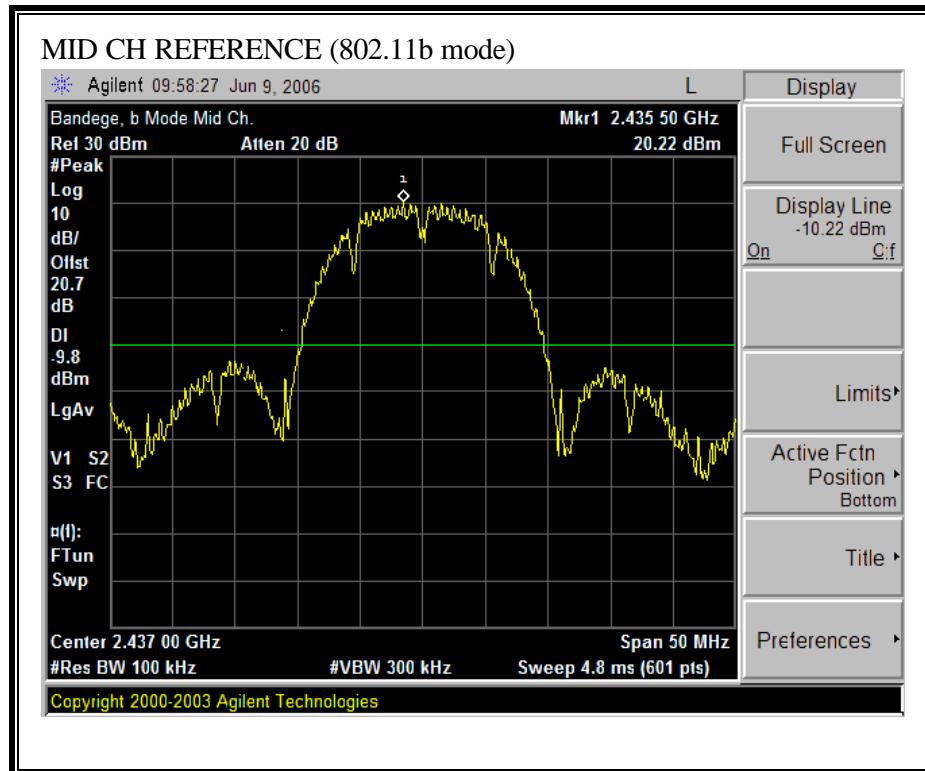
No non-compliance noted:

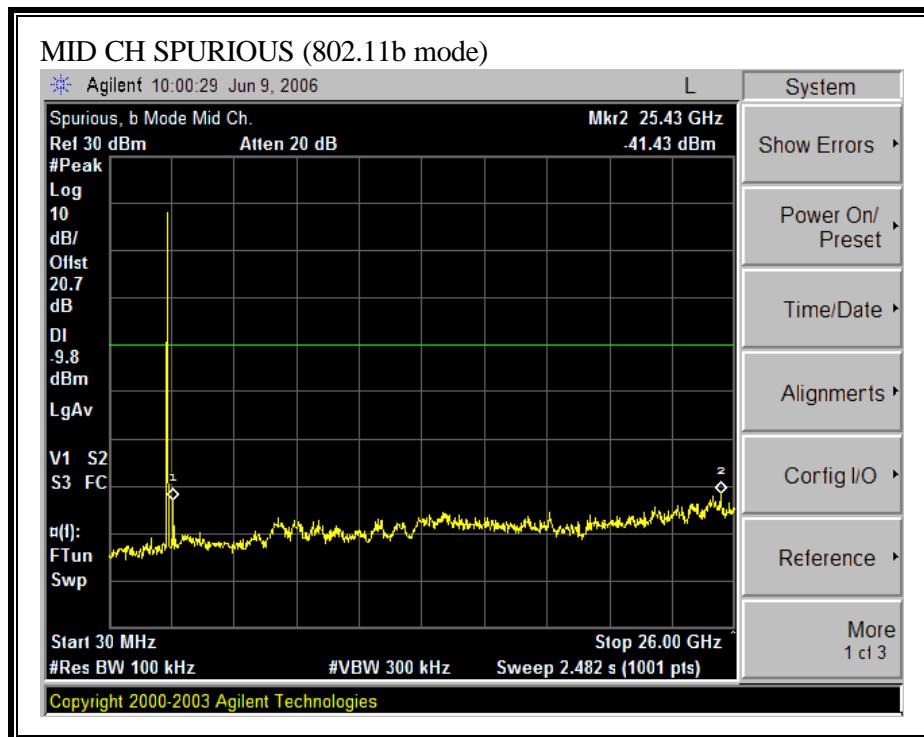
SPURIOUS EMISSIONS, LOW CHANNEL (802.11b MODE)



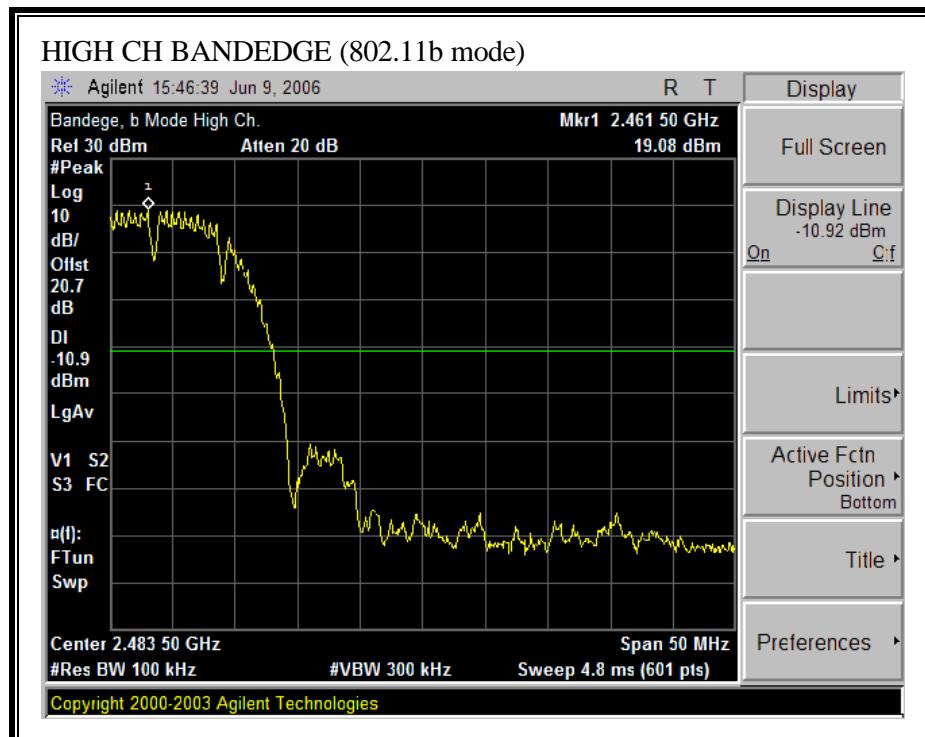


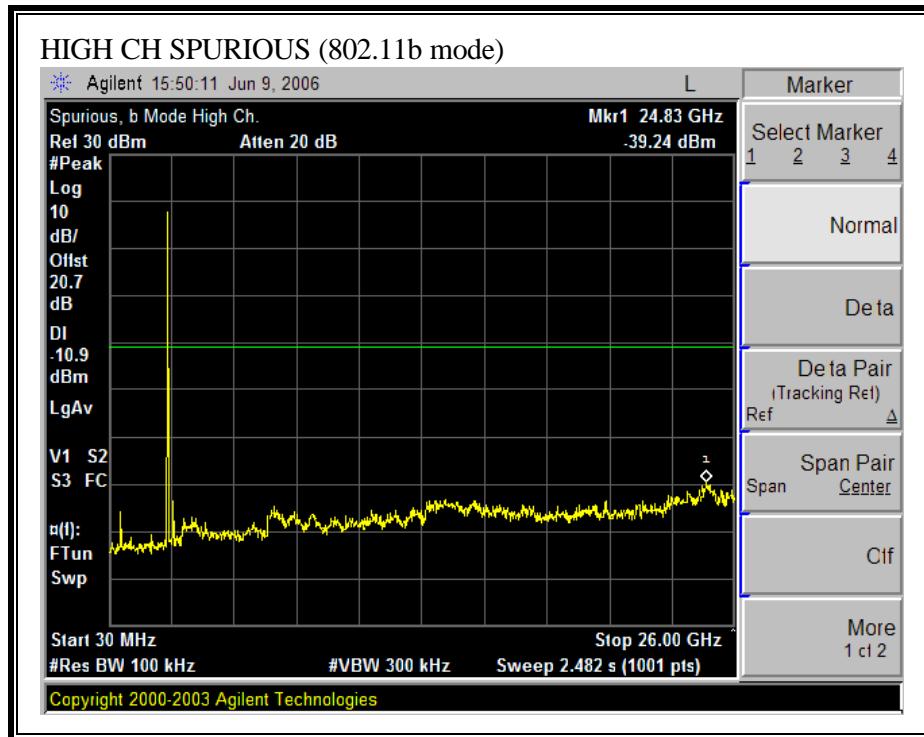
SPURIOUS EMISSIONS, MID CHANNEL (802.11b MODE)



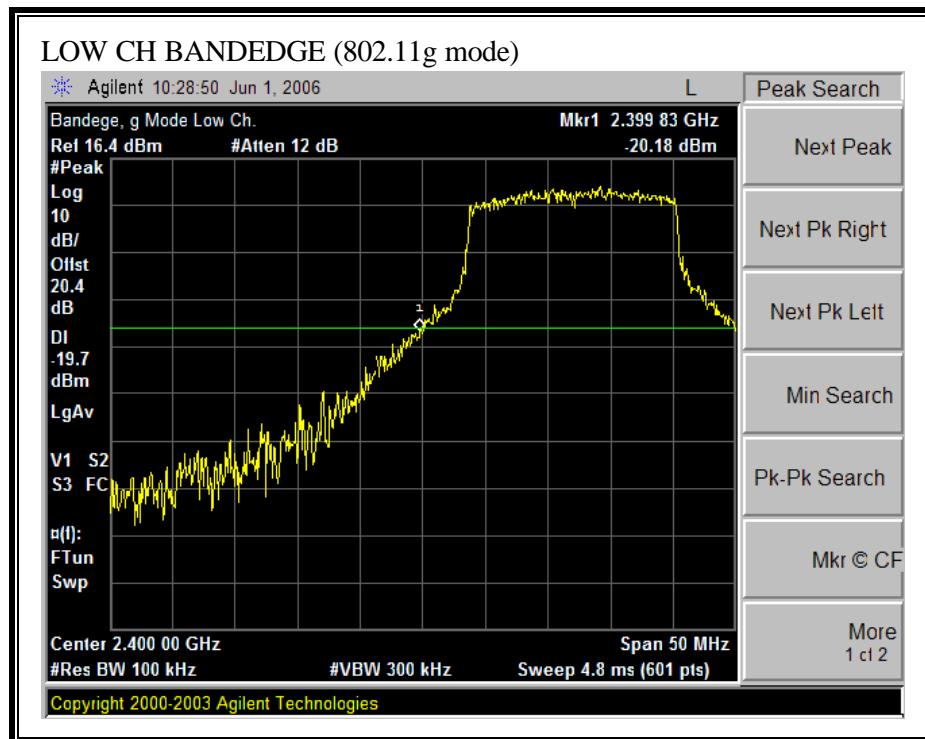


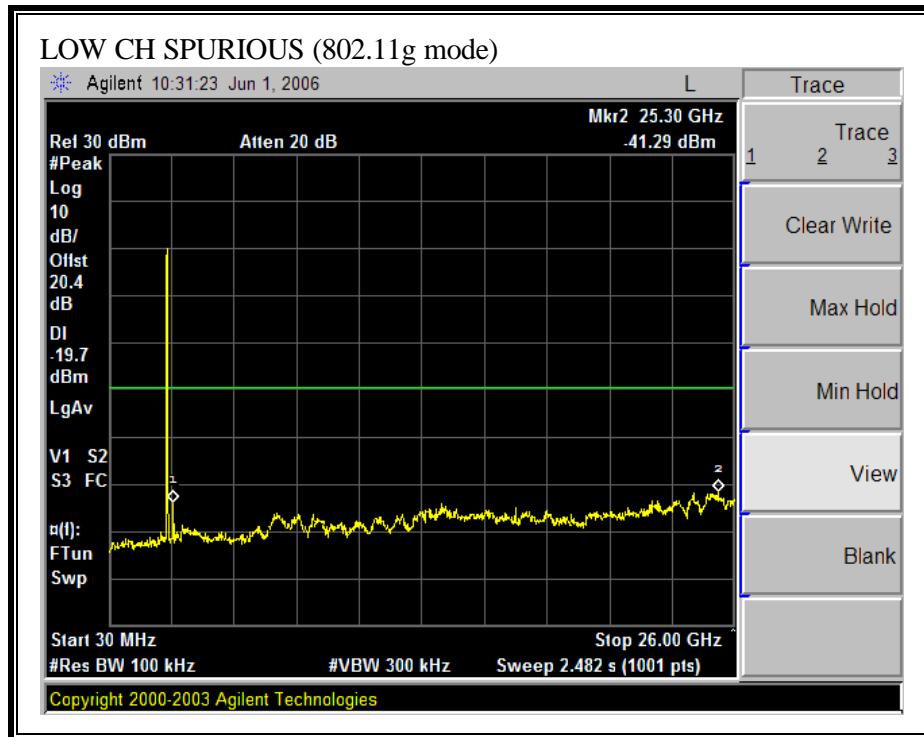
SPURIOUS EMISSIONS, HIGH CHANNEL (802.11b MODE)



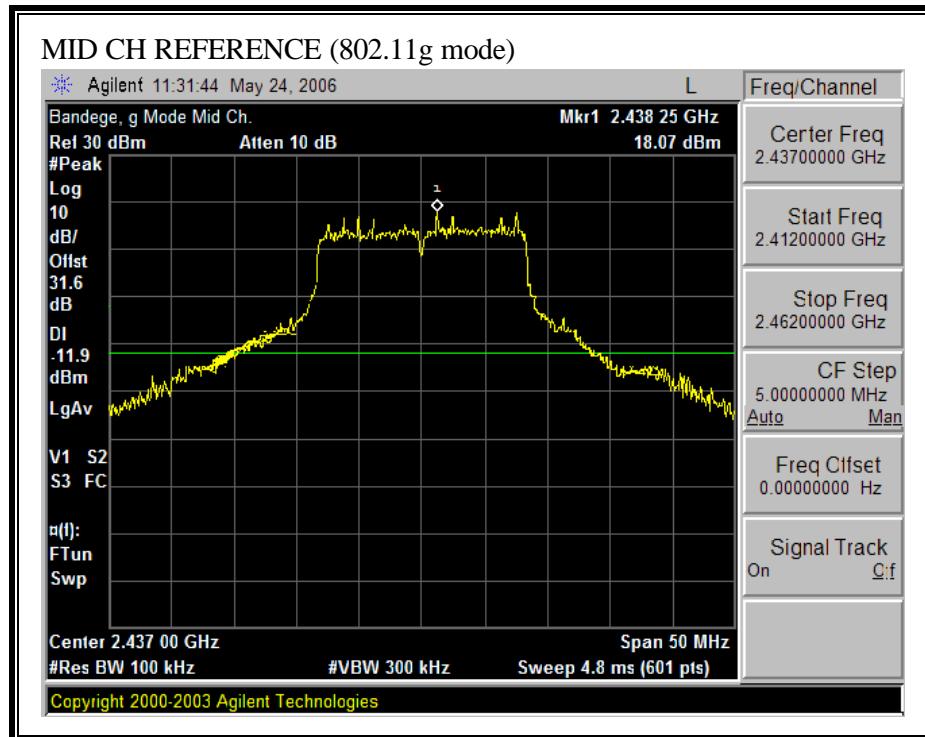


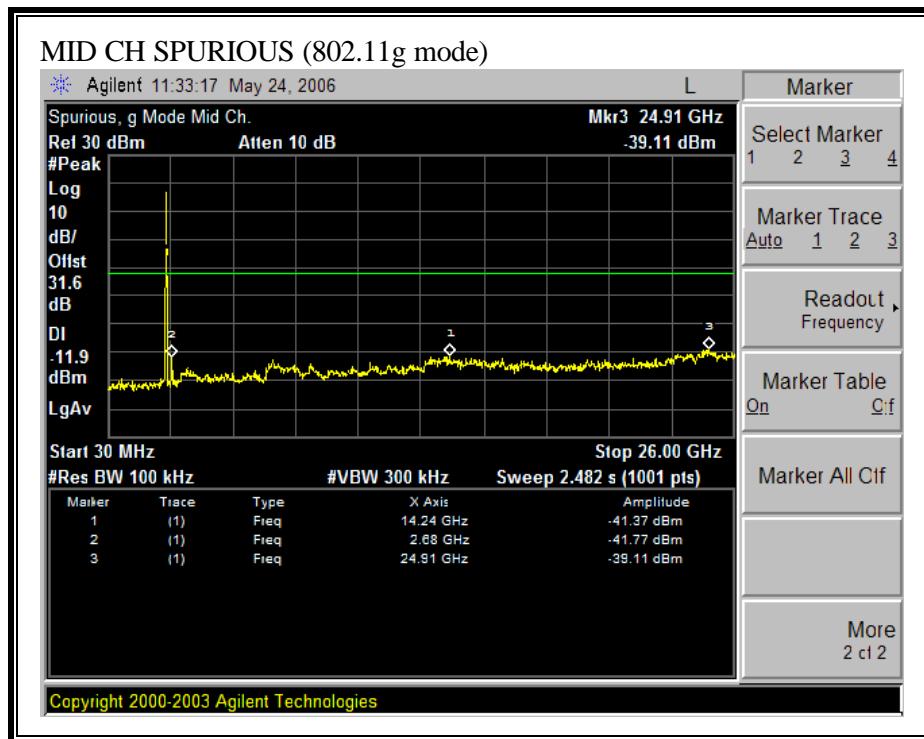
SPURIOUS EMISSIONS, LOW CHANNEL (802.11g MODE)



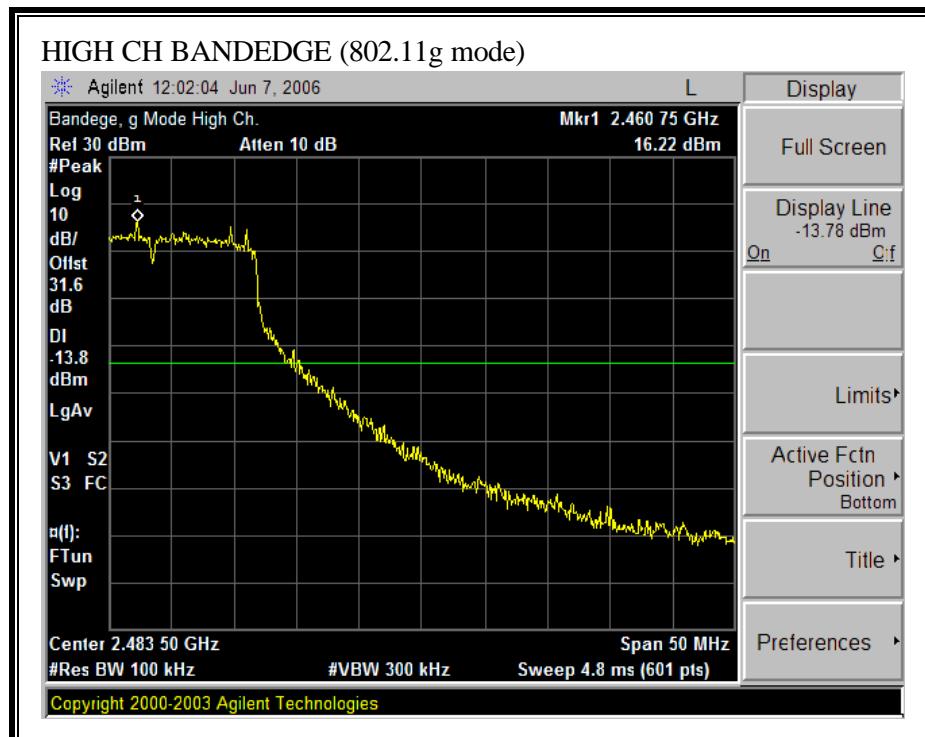


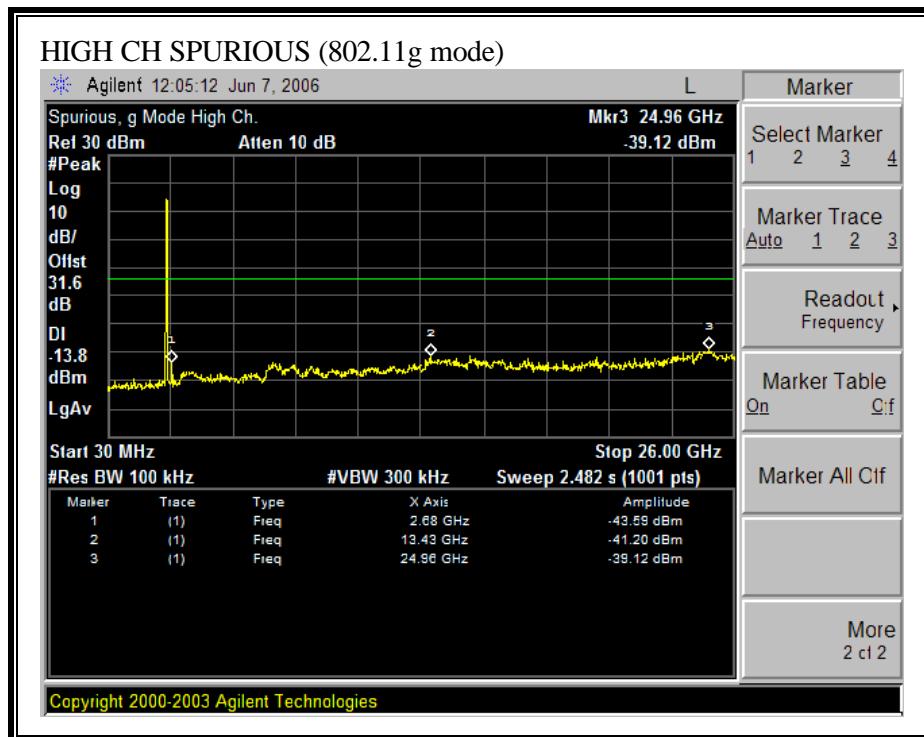
SPURIOUS EMISSIONS, MID CHANNEL (802.11g MODE)





SPURIOUS EMISSIONS, HIGH CHANNEL (802.11g MODE)





7.2. CHANNEL TESTS FOR THE 5725 TO 5850 MHz BAND

7.2.1. 6 dB BANDWIDTH

LIMIT

§15.247 (a) (2) For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

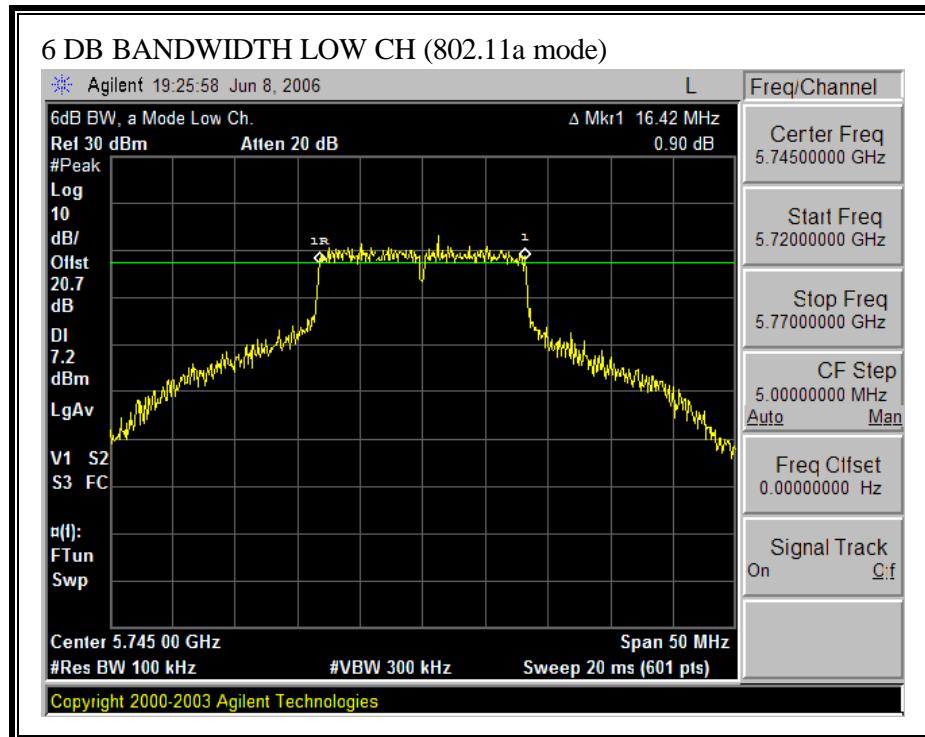
RESULTS

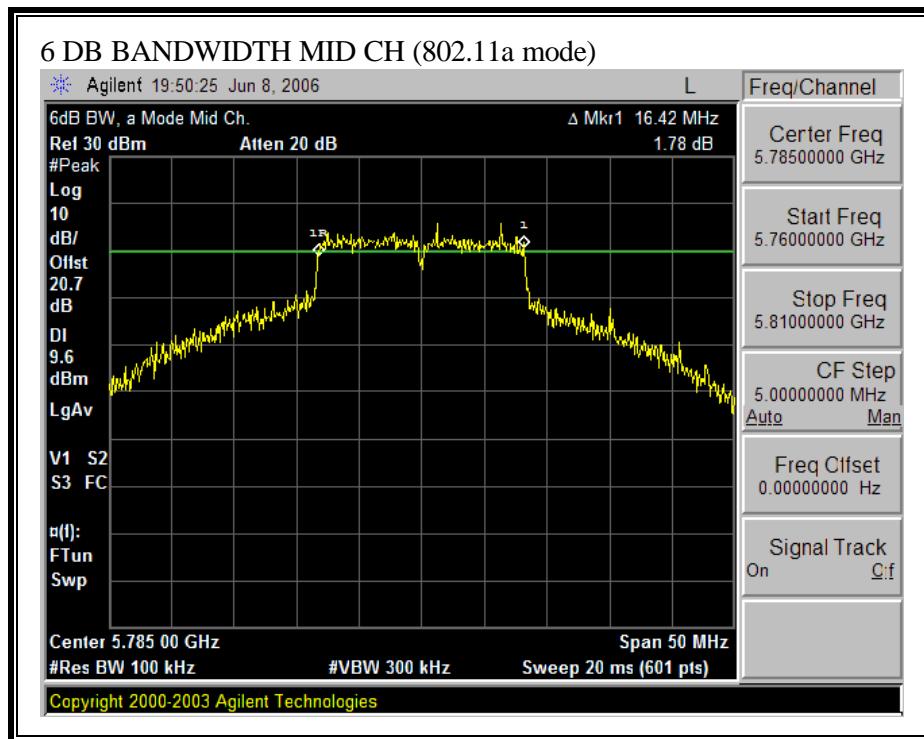
No non-compliance noted:

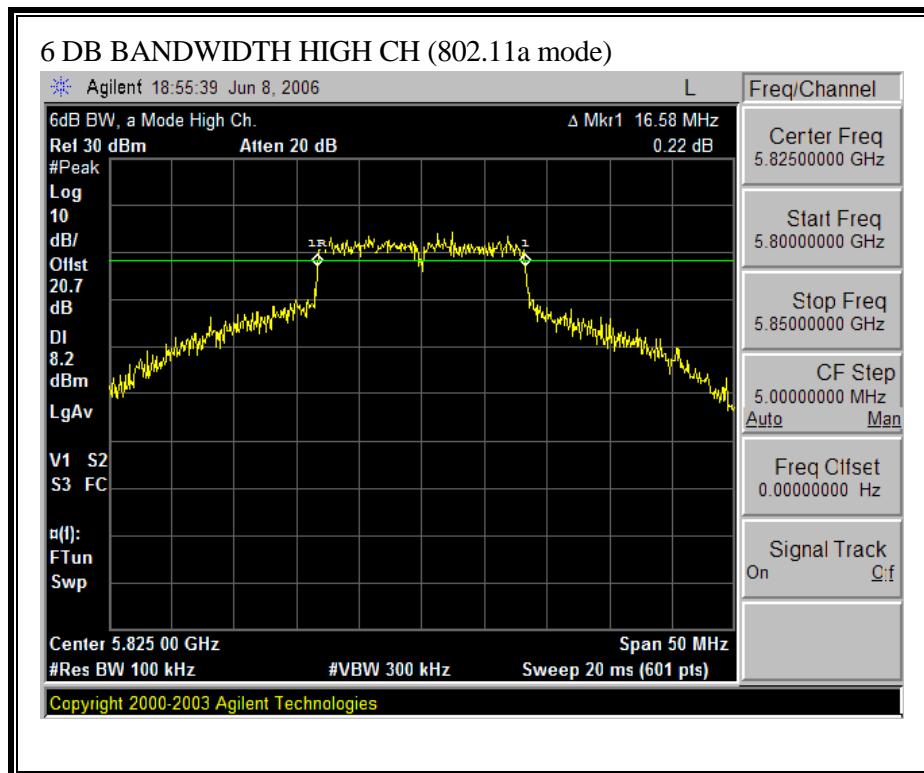
802.11a Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	5745	16416.667	500	15917
Middle	5785	16416.667	500	15917
High	5825	16583.333	500	16083

6 DB BANDWIDTH (802.11a MODE)







7.2.2. 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

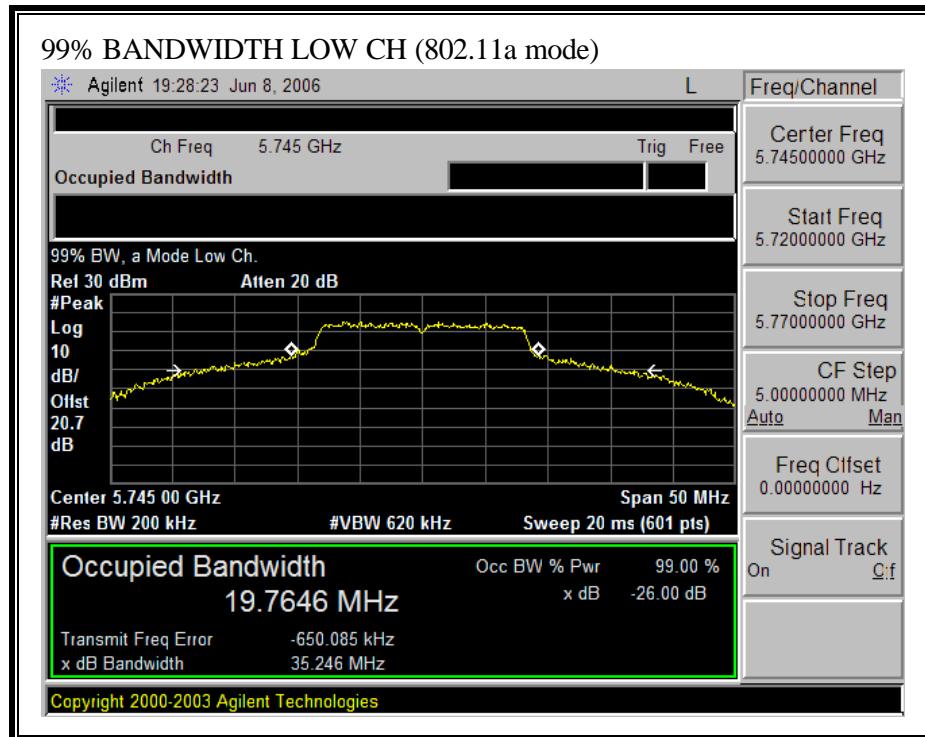
RESULTS

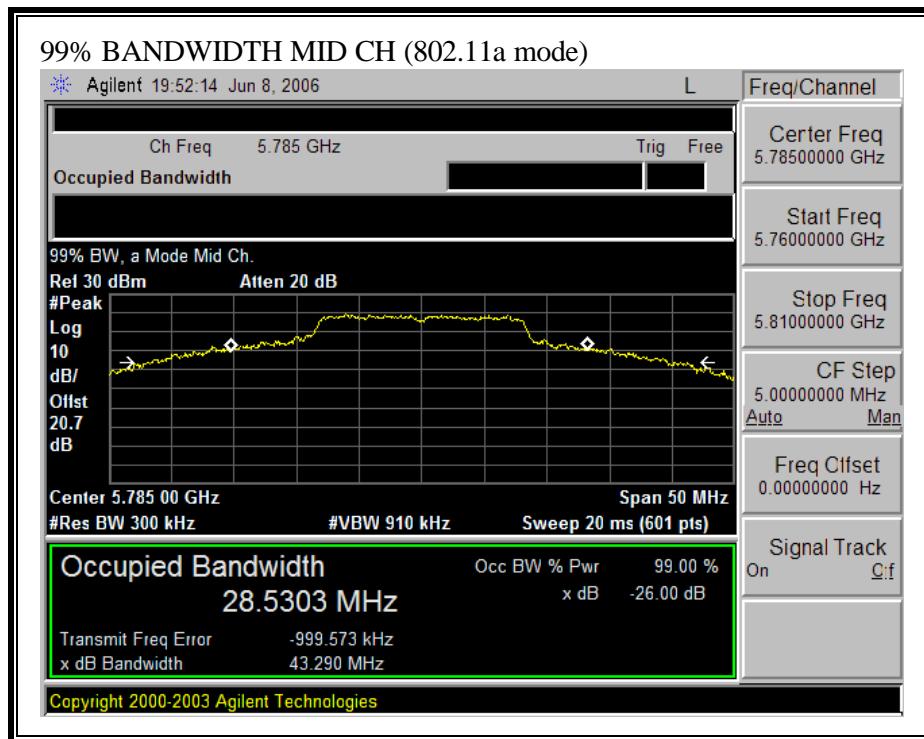
No non-compliance noted:

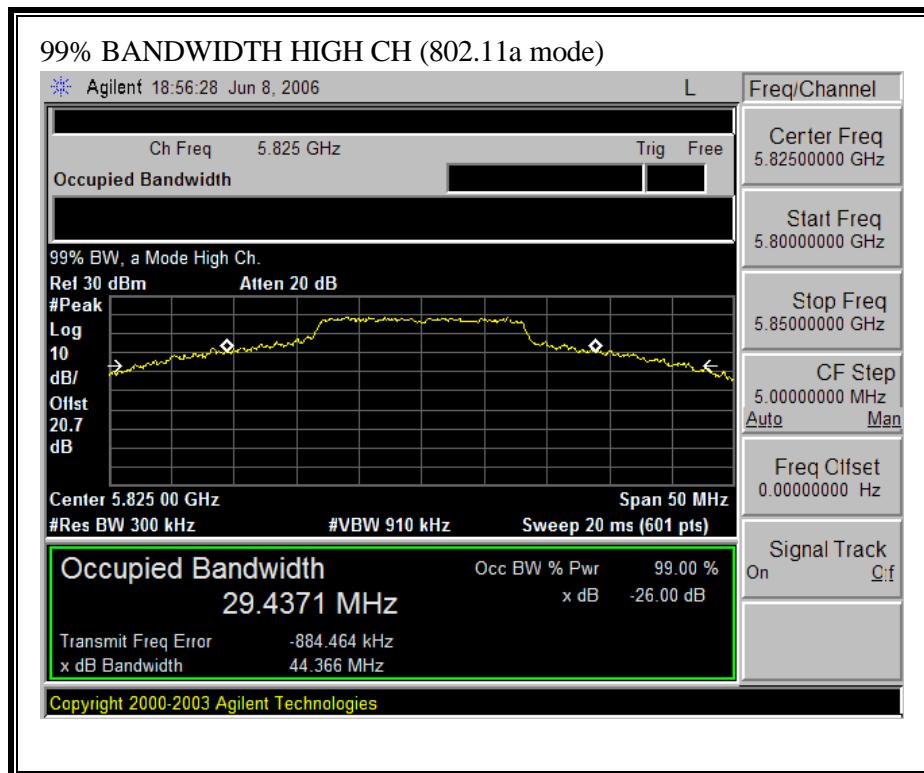
802.11a Mode

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	19.765
Middle	5785	28.530
High	5825	29.437

99% BANDWIDTH (802.11a MODE)







7.2.3. PEAK OUTPUT POWER

PEAK POWER LIMIT

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 watt.

§15.247 (b) (4) Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§15.247 (b) (4) (ii) Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.

RESULTS

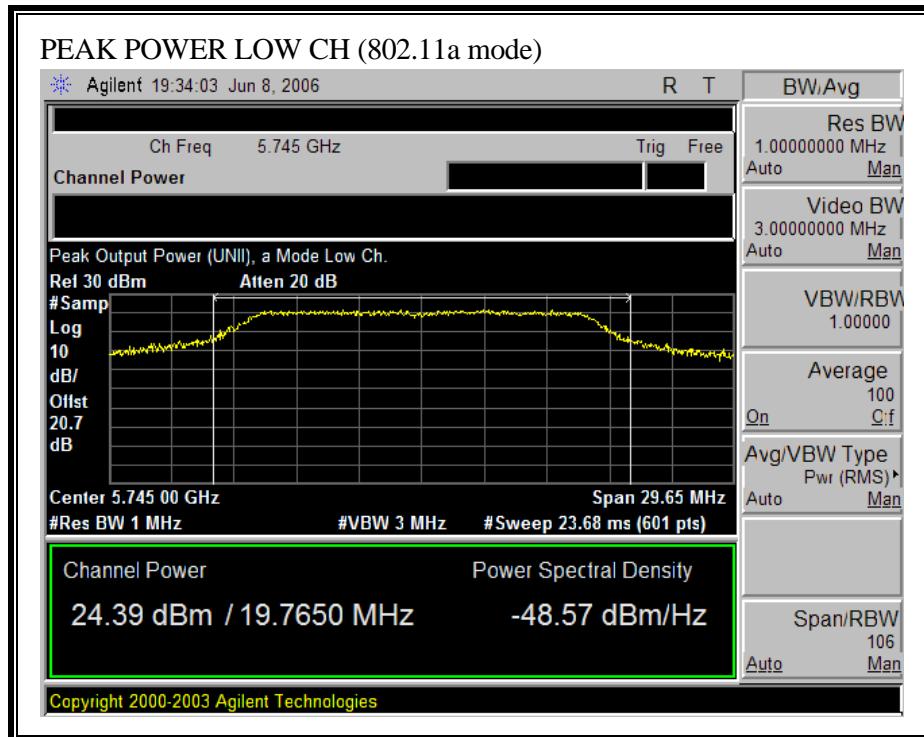
In order to test with the highest power output, the lowest antenna gain is based on 9.1 dBi other than fixed, point-to-point operations; therefore the limit is 26.9 dBm.

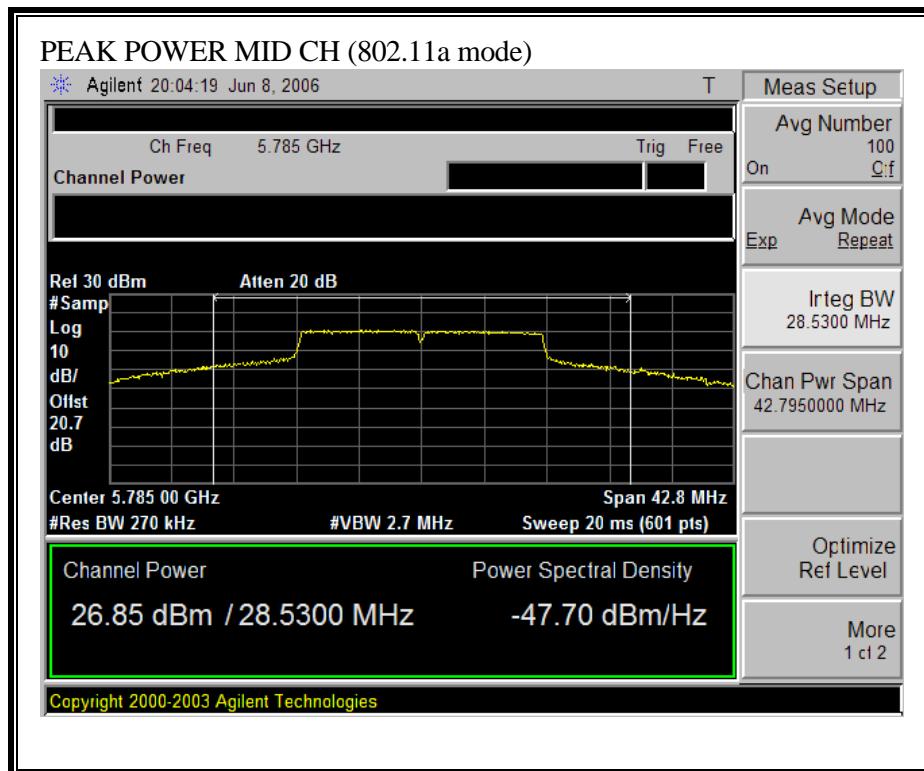
No non-compliance noted:

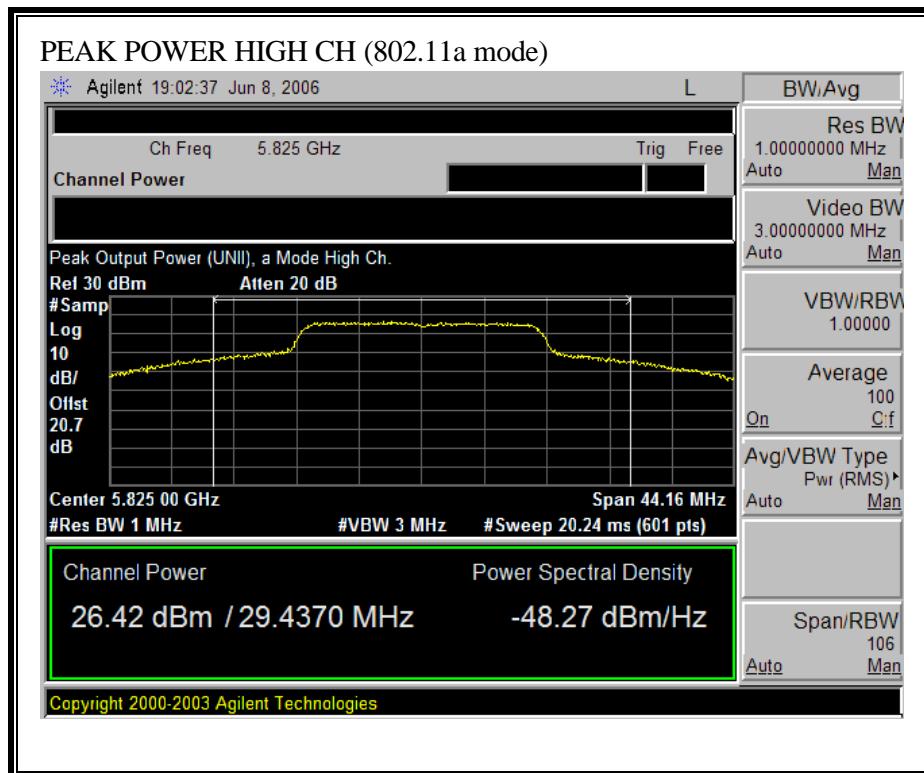
802.11a Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	24.39	26.9	-2.51
Middle	5785	26.85	26.9	-0.05
High	5825	26.42	26.9	-0.48

OUTPUT POWER (802.11a MODE)







7.2.4. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

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

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

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

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

f = frequency in MHz

* = Plane-wave equivalent power density

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

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

CALCULATIONS

Given

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

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

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

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

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

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

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

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/cm²

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

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

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm²

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

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

LIMITS

From §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm²

RESULTS

No non-compliance noted: (MPE distance equals 20 cm for P2MP antenna)

Mode	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm ²)
802.11a (P2MP)	20.0	26.85	9.10	0.78

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.

No non-compliance noted: (MPE distance is greater than 20 cm for P2P antenna)

Mode	Power Density Limit (mW/cm ²)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
802.11a (P2P)	1.0	26.85	19	55.3

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 20.7 dB (including 20 dB pad and 0.7 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	5745	24.40
Middle	5785	26.60
High	5825	26.60

7.2.5. PEAK POWER SPECTRAL DENSITY

LIMIT

§15.247 (d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST PROCEDURE

The test is performed in accordance with PSD Option 2 as documented in the FCC procedure "Measurement of Digital Transmission Systems Operating under Section 15.247", dated March 23, 2005.

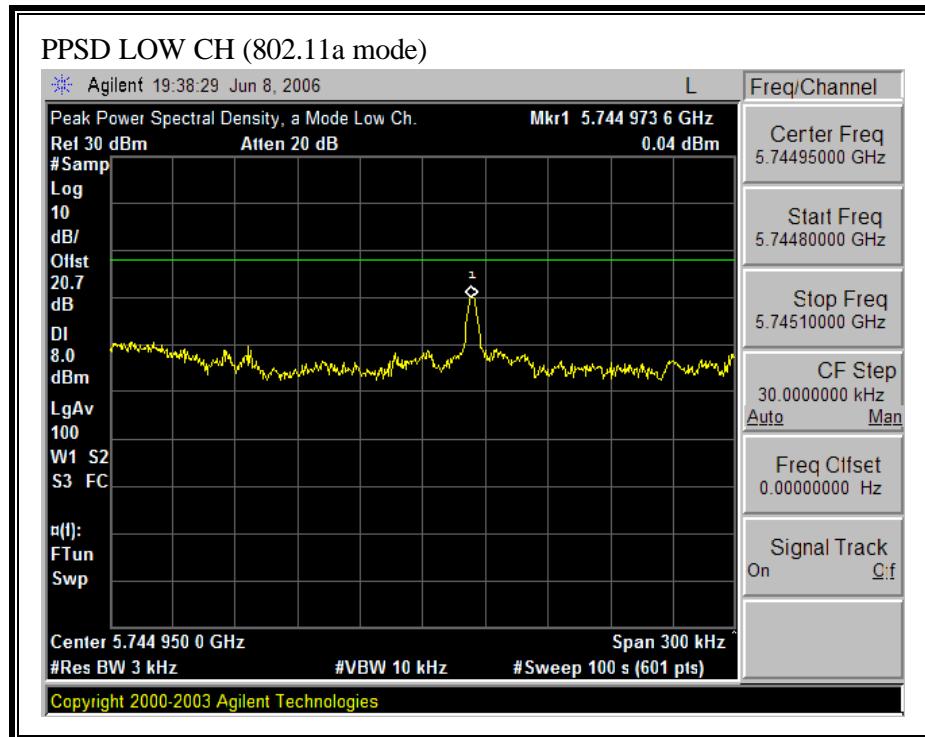
RESULTS

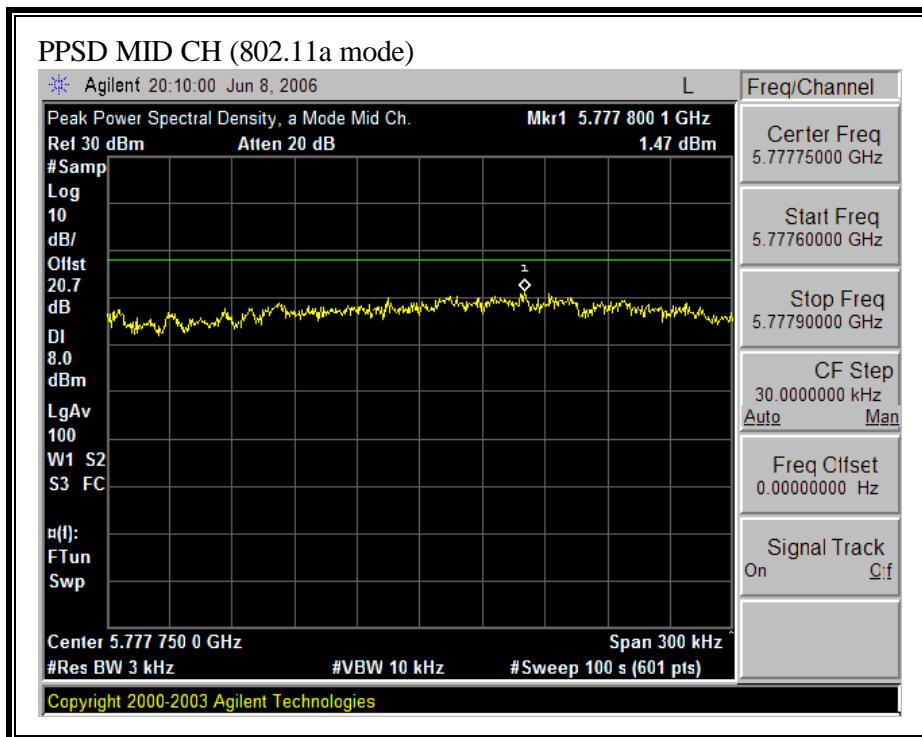
No non-compliance noted:

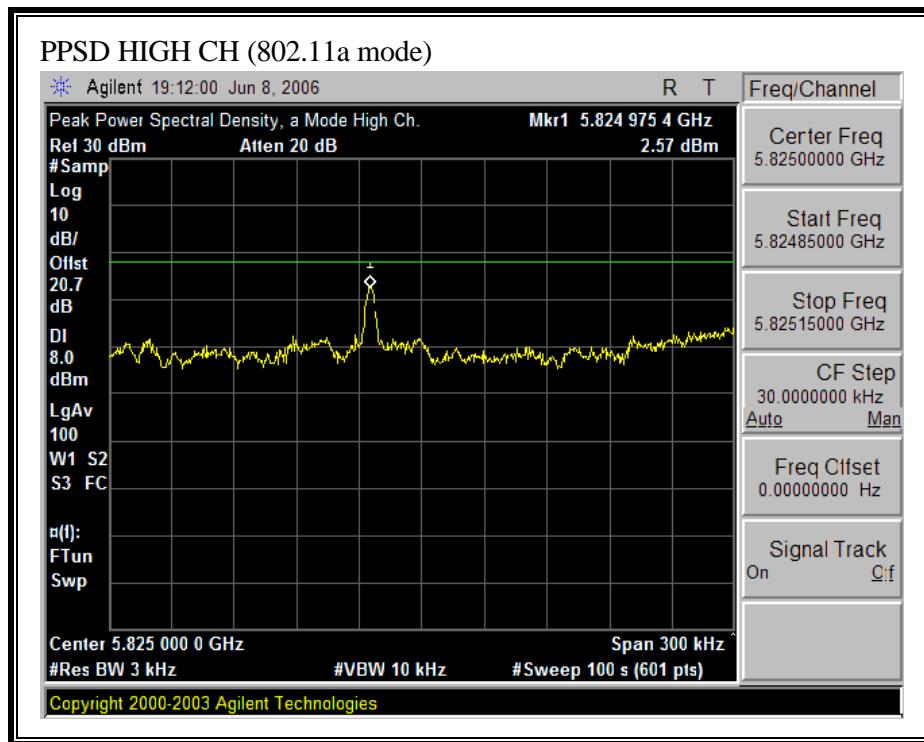
802.11a Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	0.04	8	-7.96
Middle	5785	1.47	8	-6.53
High	5825	2.57	8	-5.43

PEAK POWER SPECTRAL DENSITY (802.11a MODE)







7.2.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.247 (c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST PROCEDURE

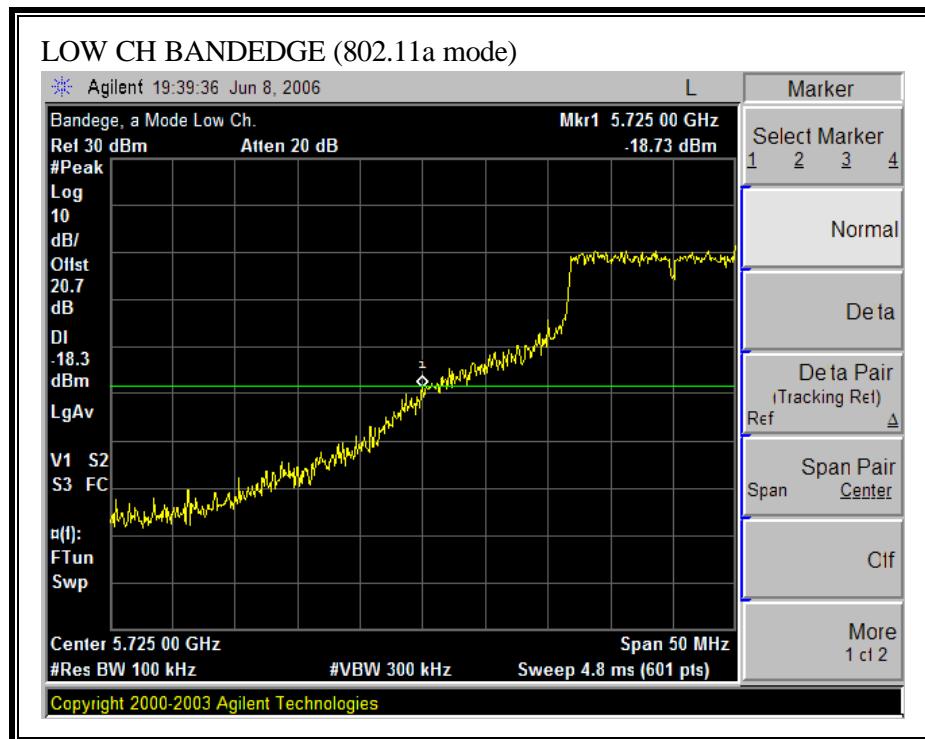
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

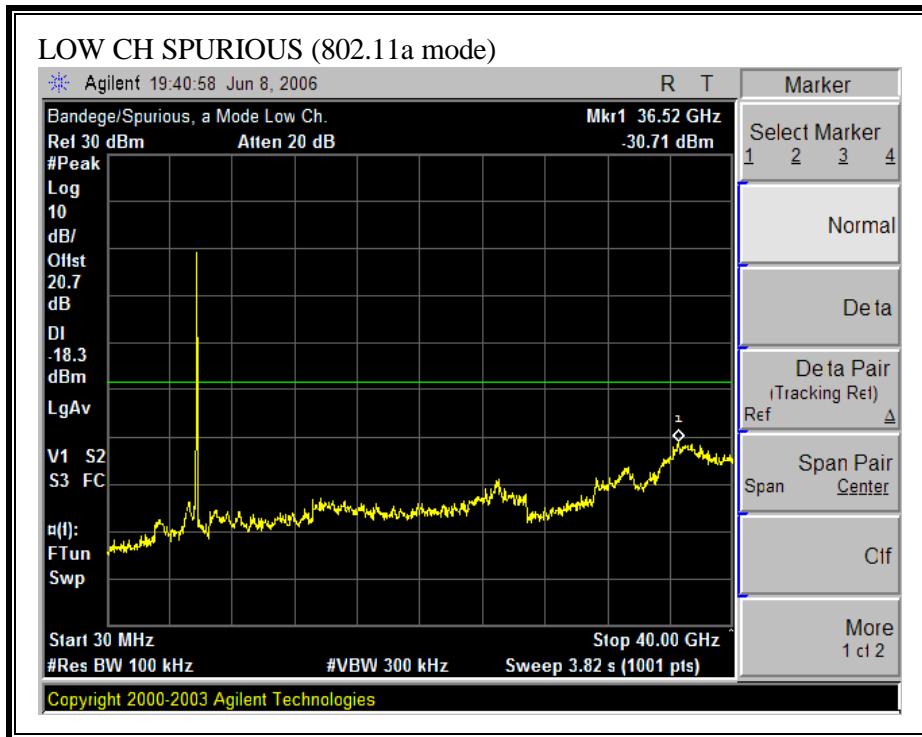
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

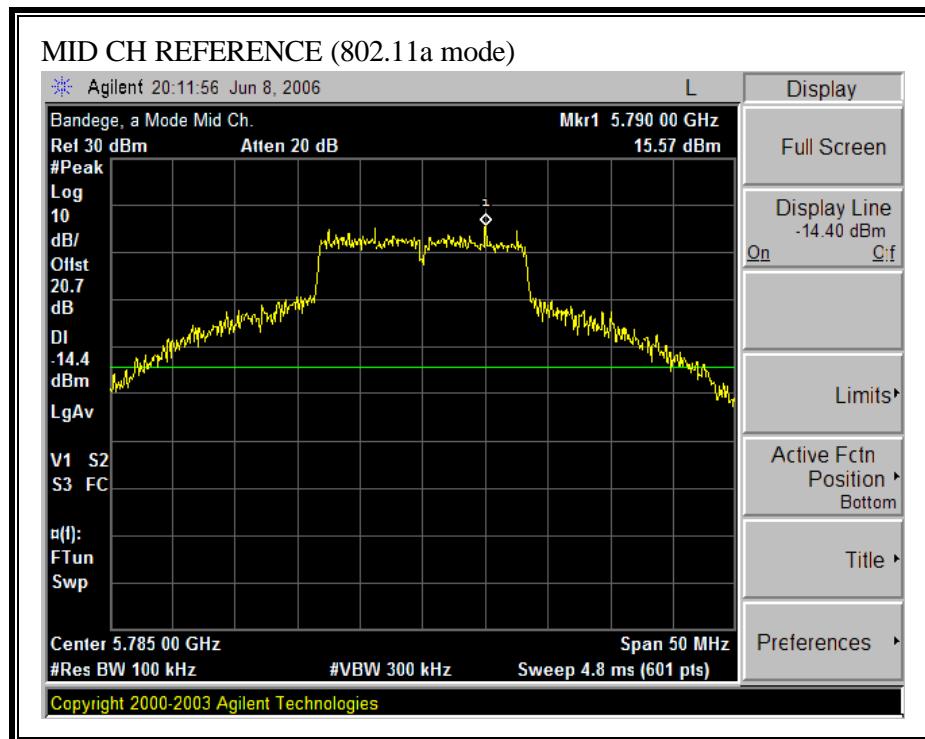
No non-compliance noted:

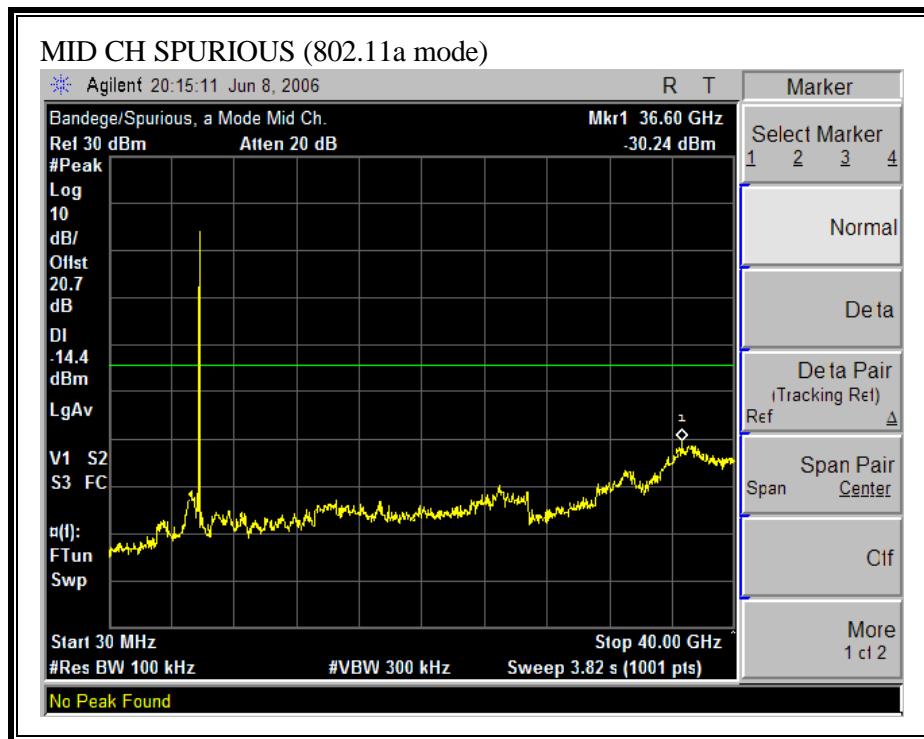
SPURIOUS EMISSIONS, LOW CHANNEL (802.11a MODE)



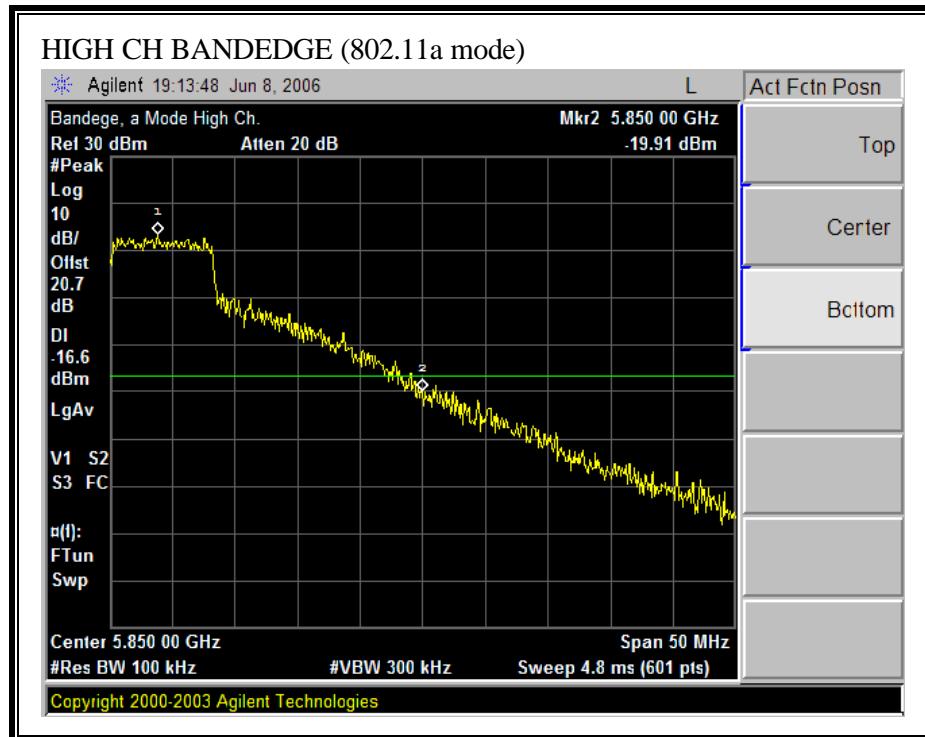


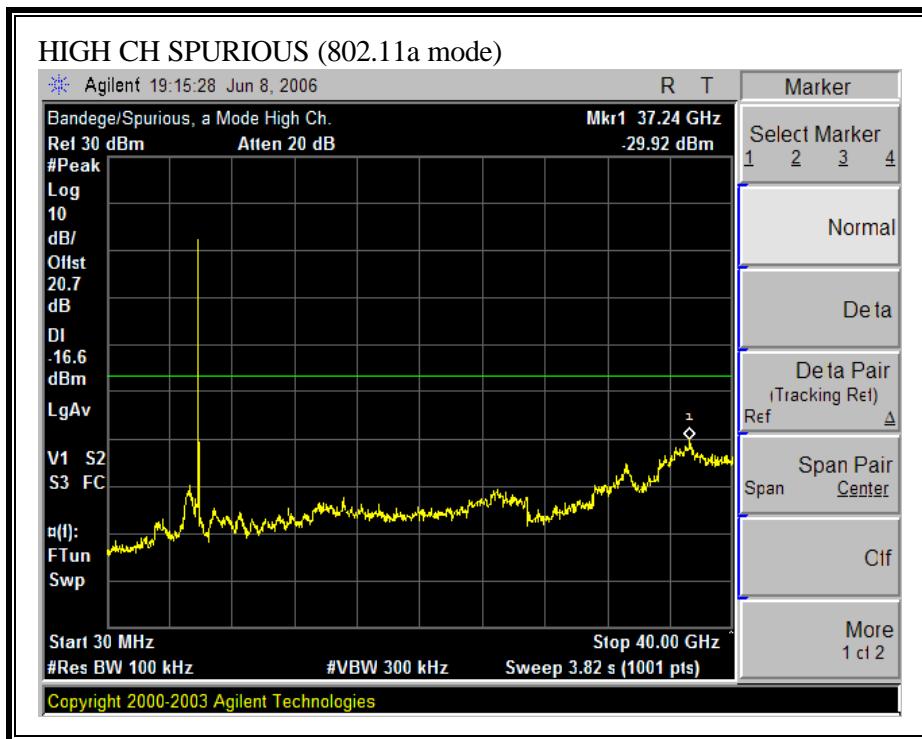
SPURIOUS EMISSIONS, MID CHANNEL (802.11a MODE)





SPURIOUS EMISSIONS, HIGH CHANNEL (802.11a MODE)





7.3. RADIATED EMISSIONS

7.3.1. 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 in the 2.4 GHz band.

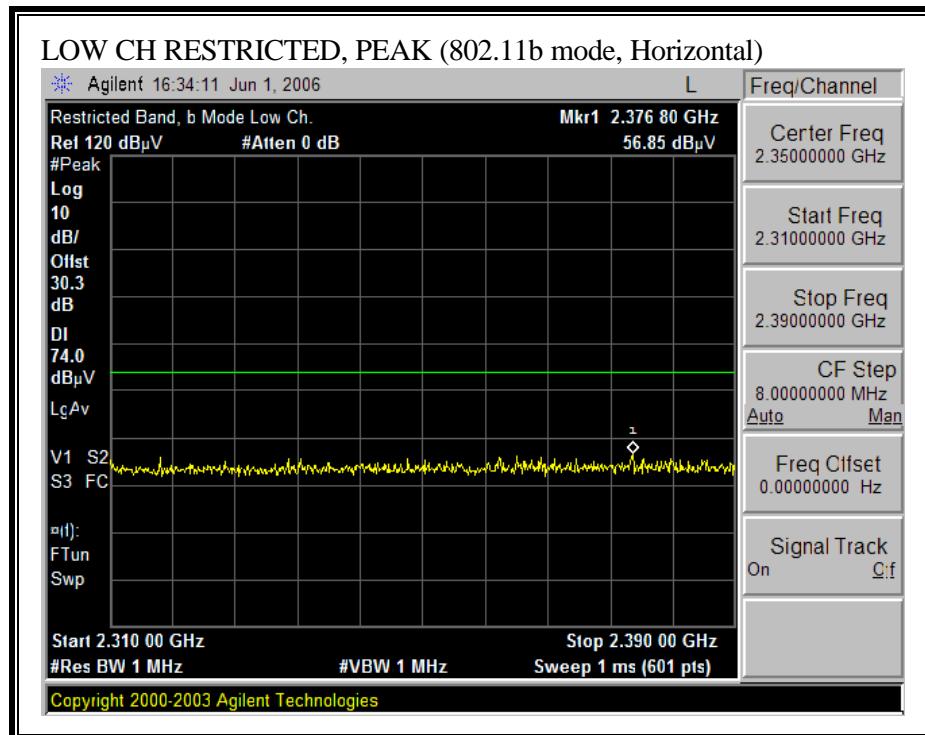
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

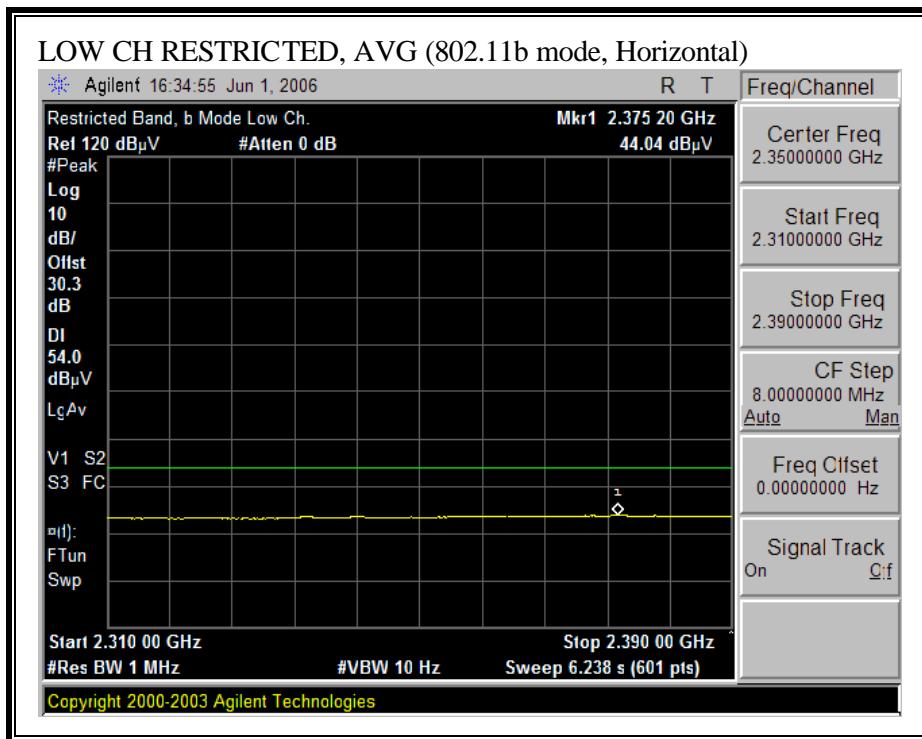
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

7.3.2. TRANSMITTER ABOVE 1 GHz FOR 2400 TO 2483.5 MHz BAND

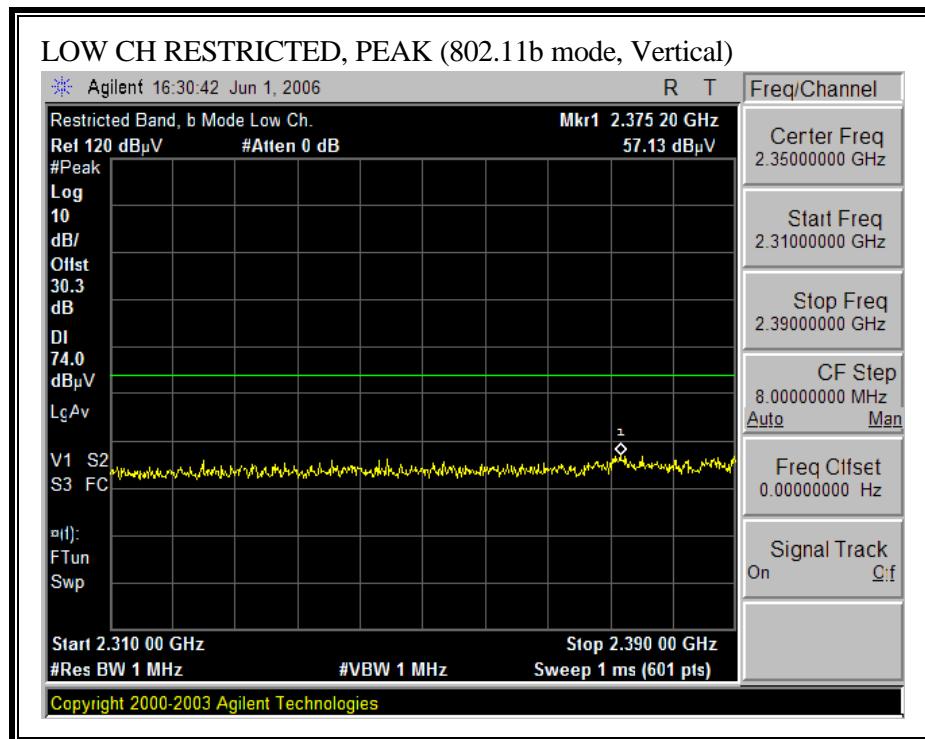
RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, HORIZONTAL)

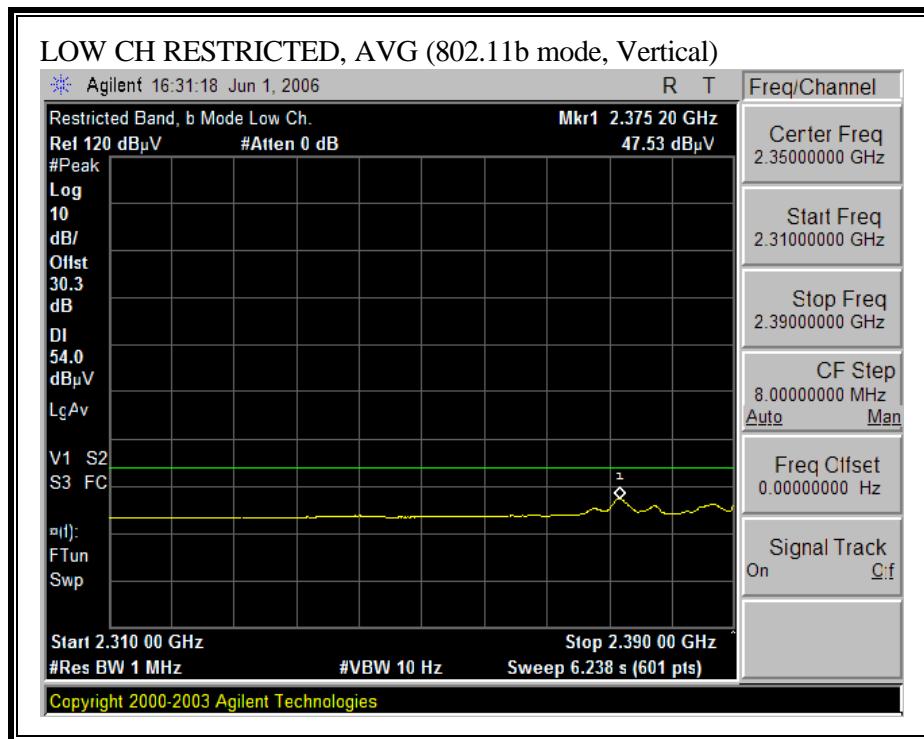
7.4 dBi MONOPOLE ANTENNA



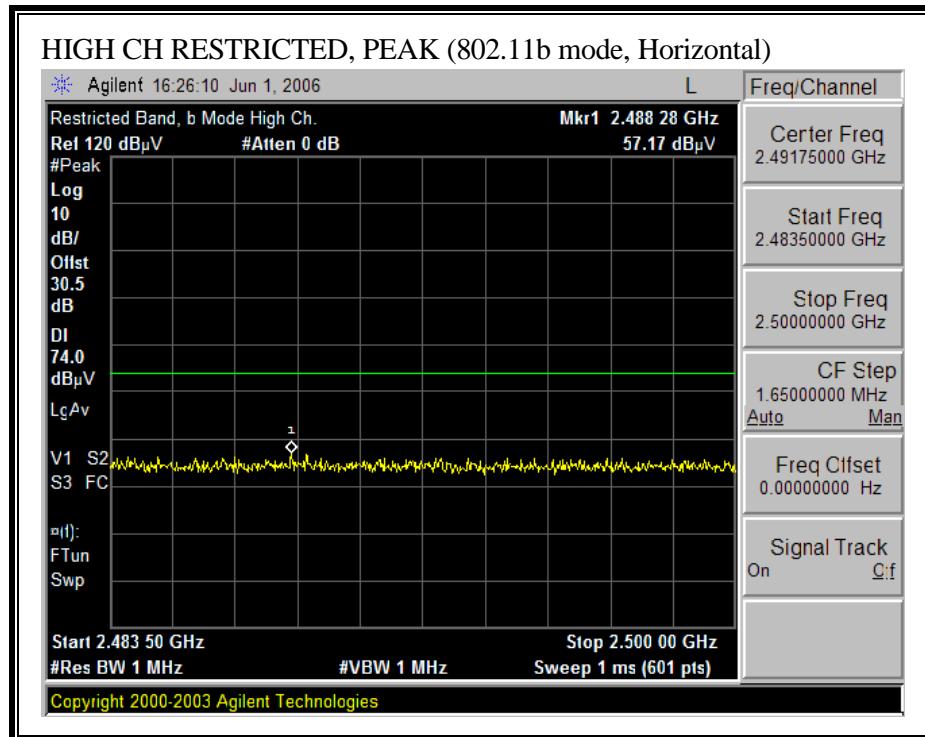


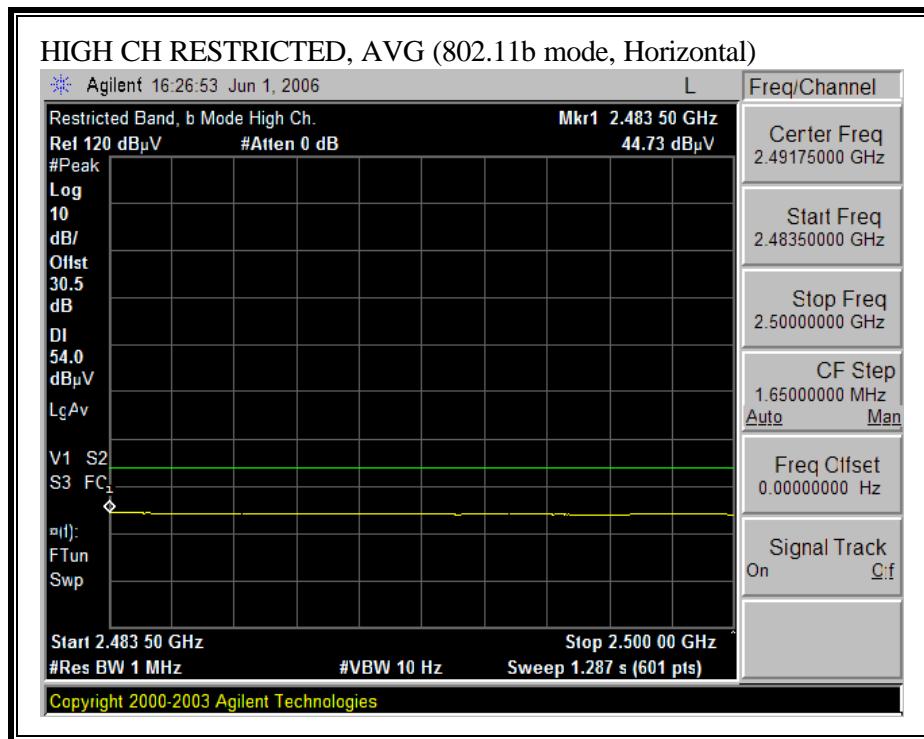
RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, VERTICAL)



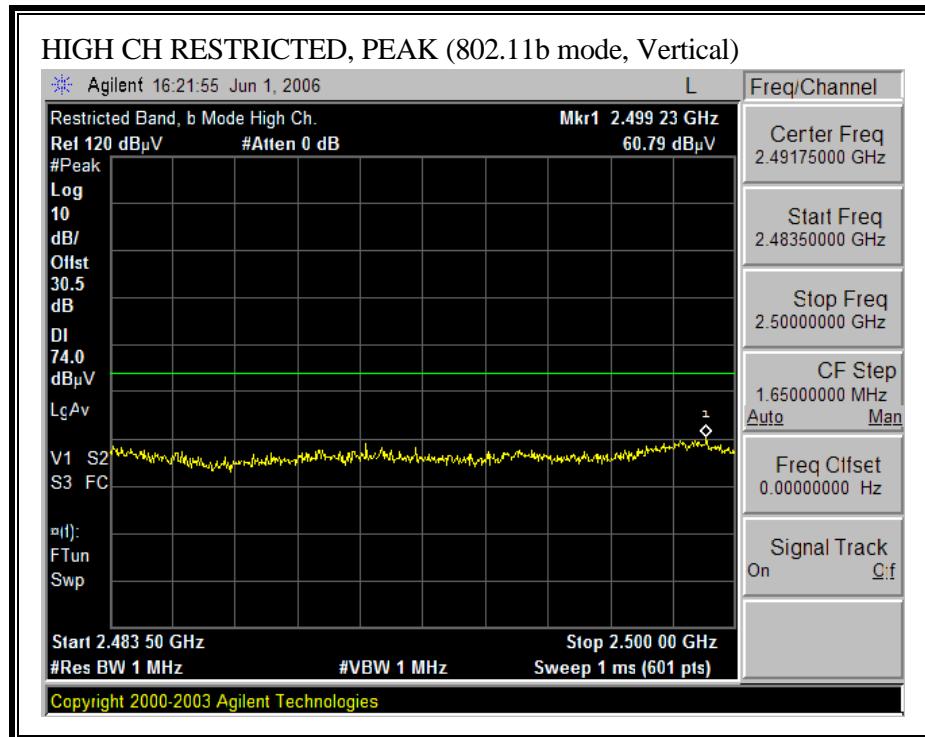


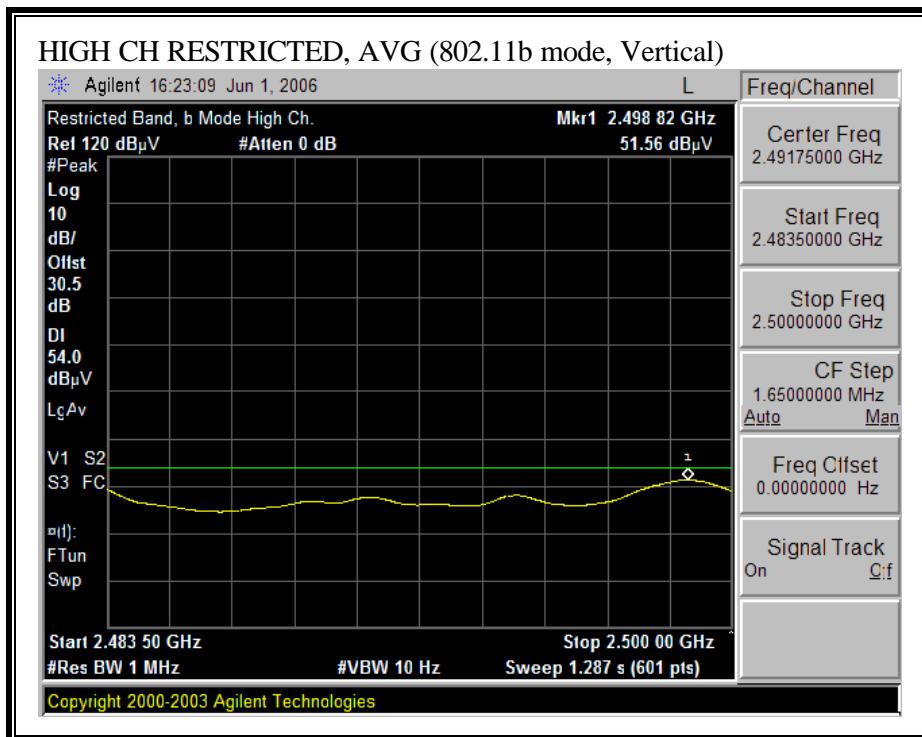
RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, VERTICAL)



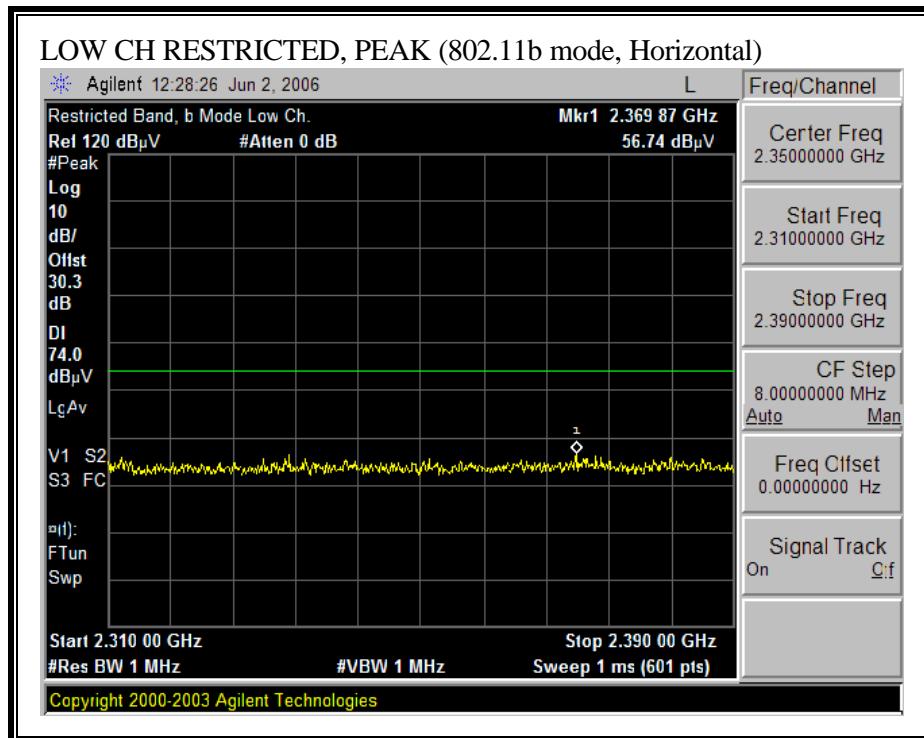


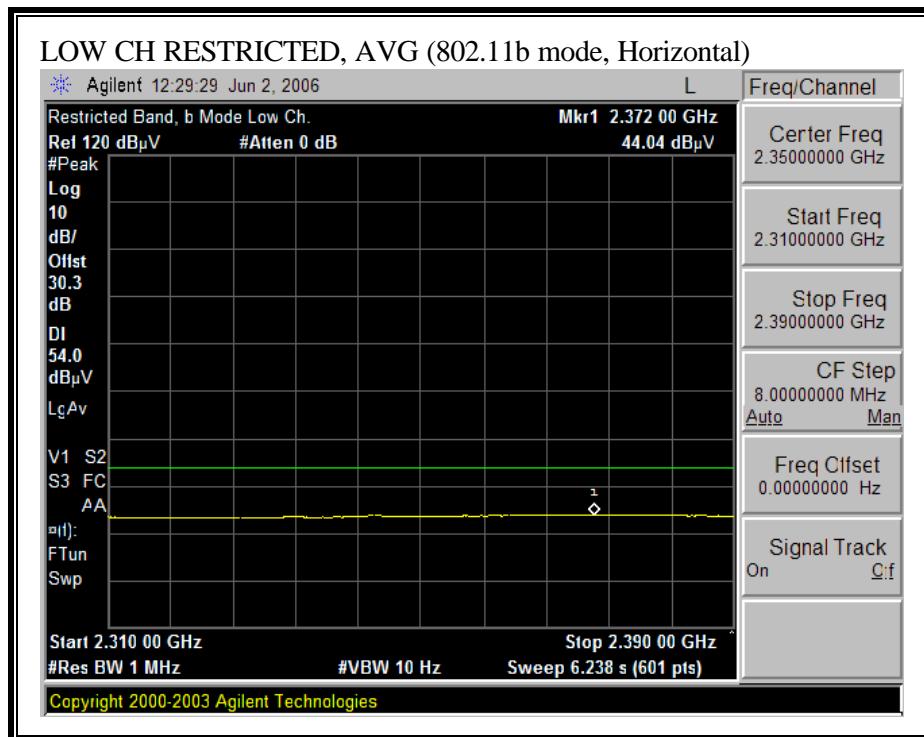
HARMONICS AND SPURIOUS EMISSIONS (b MODE)

High Frequency Measurement Compliance Certification Services, Morgan Hill Open Field Site															
Company: Tropos Project #: 06U10287 Date: 06/01/2006 Test Engineer: Vien Tran Configuration: EUT with 7.4dBi Monopole antenna Mode: Tx 11b_2.4 GHz Average Power Meter: Low, Mid, & High = 28.6 dBm															
Test Equipment:															
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit			
T60; S/N: 2238 @3m			T145 Agilent 3008A0056									FCC 15.205			
Hi Frequency Cables 2 foot cable 3 foot cable 12 foot cable HPF Reject Filter															
Vien 177079005 Vien 197209005 HPF_4.0GHz Reject Filter															
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	48.0	43.2	33.0	3.4	-34.8	0.0	0.6	50.1	45.3	74	54	-23.9	-8.7	V
4.824	3.0	45.0	33.7	33.0	3.4	-34.8	0.0	0.6	47.1	35.8	74	54	-26.9	-18.2	H
MID CH, 2437 MHz															
4.874	3.0	47.8	42.2	33.1	3.4	-34.9	0.0	0.6	50.0	44.4	74	54	-24.0	-9.6	V
7.311	3.0	45.4	34.6	35.5	3.9	-34.7	0.0	0.6	50.8	40.0	74	54	-23.2	-14.0	V
4.874	3.0	43.7	31.3	33.1	3.4	-34.9	0.0	0.6	45.9	33.5	74	54	-28.1	-20.5	H
7.311	3.0	43.0	31.5	35.5	3.9	-34.7	0.0	0.6	48.4	36.9	74	54	-25.6	-17.1	H
HIGH CH, 2462 MHz															
4.924	3.0	48.9	43.8	33.1	3.4	-34.9	0.0	0.6	51.2	46.1	74	54	-22.8	-7.9	V
7.386	3.0	46.3	35.7	35.6	3.9	-34.6	0.0	0.6	51.8	41.2	74	54	-22.2	-12.8	V
4.924	3.0	44.8	35.2	33.1	3.4	-34.9	0.0	0.6	47.1	37.5	74	54	-26.9	-16.5	H
7.386	3.0	44.2	32.7	35.6	3.9	-34.6	0.0	0.6	49.7	38.2	74	54	-24.3	-15.8	H
No other emissions were detected above system noise floor															
f Measurement Frequency Dist Distance to Antenna Read Analyzer Reading AF Antenna Factor CL Cable Loss					Amp Preamp Gain D Corr Distance Correct to 3 meters Avg Average Field Strength @ 3 m Peak Calculated Peak Field Strength HPF High Pass Filter					Avg Lim Average Field Strength Limit Pk Lim Peak Field Strength Limit Avg Mar Margin vs. Average Limit Pk Mar Margin vs. Peak Limit					

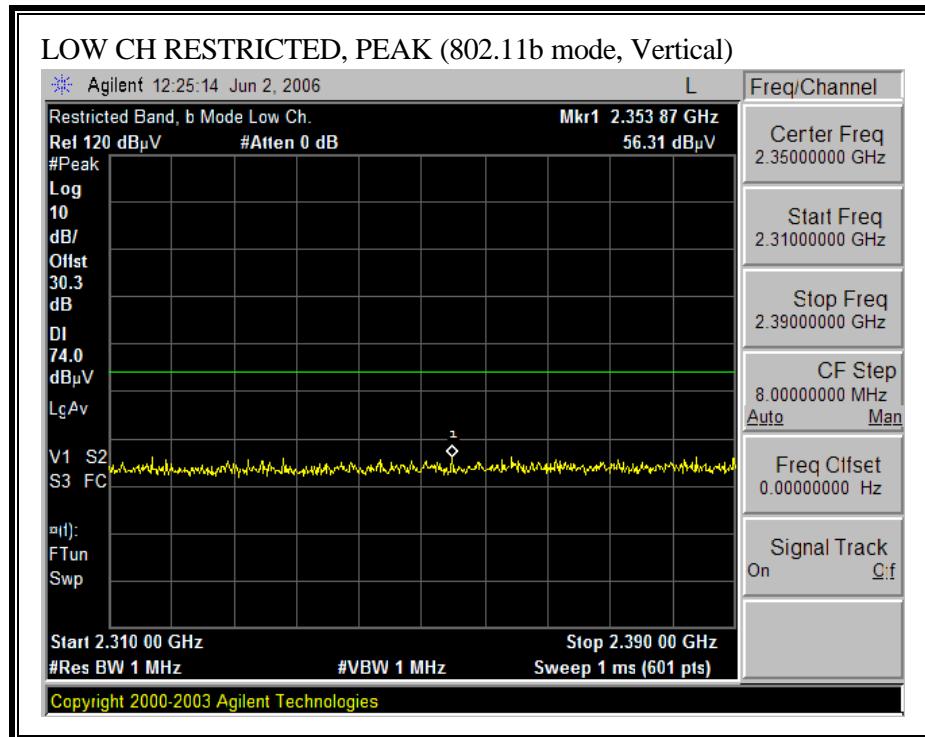
RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, HORIZONTAL)

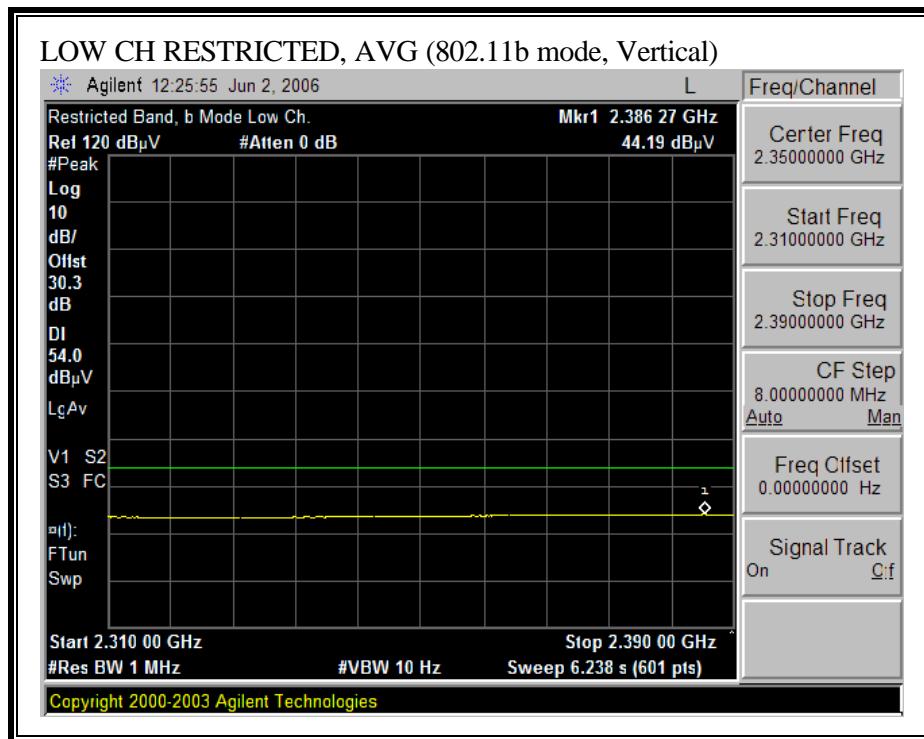
10 dBi MONOPOLE ANTENNA



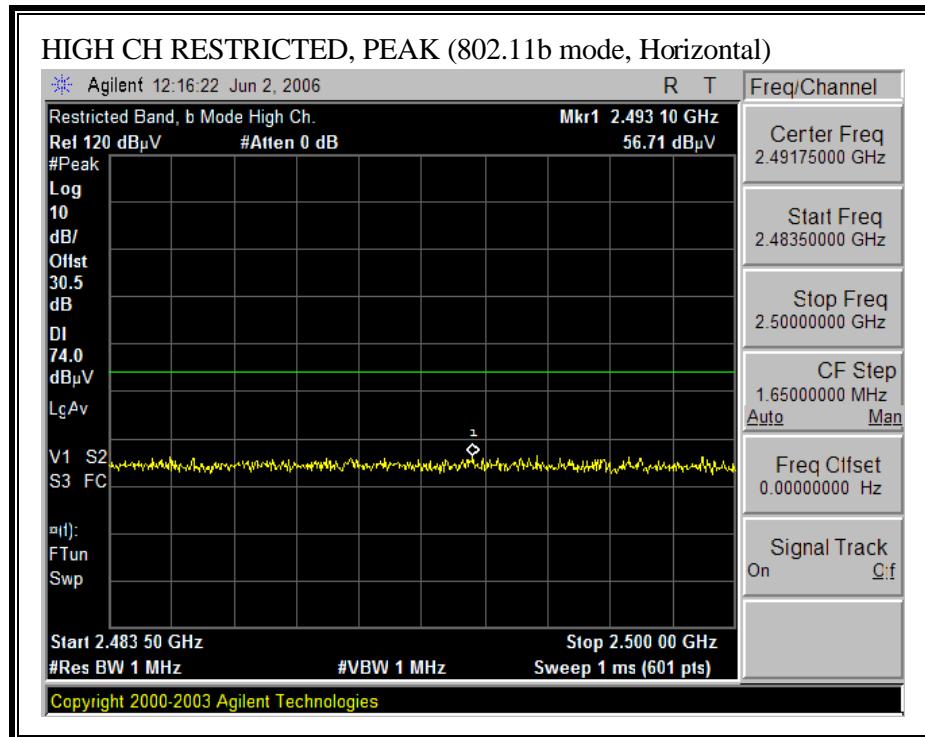


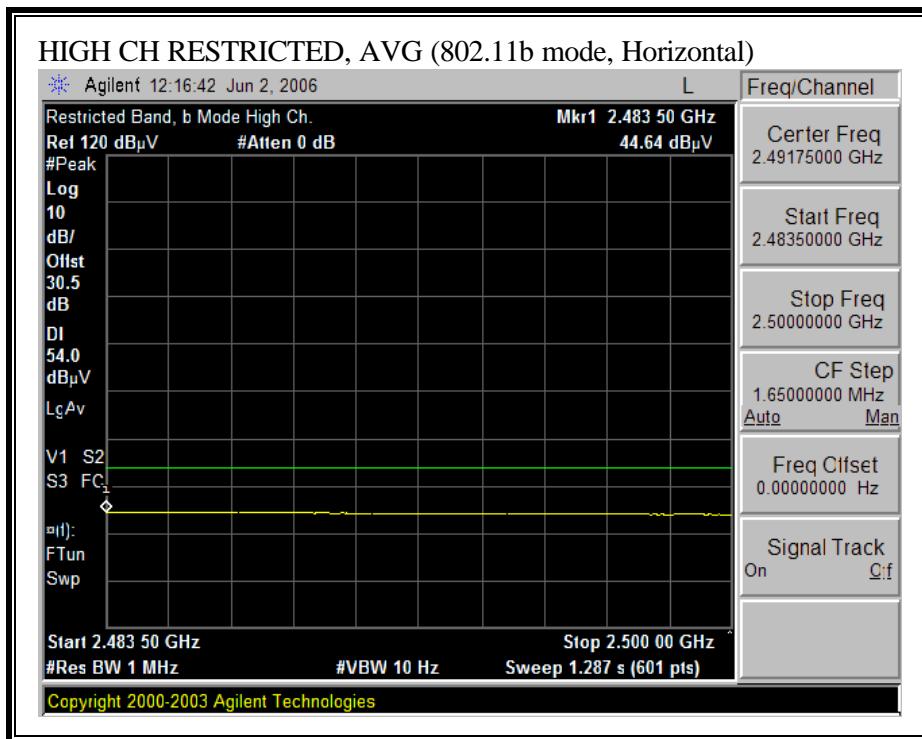
RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, VERTICAL)



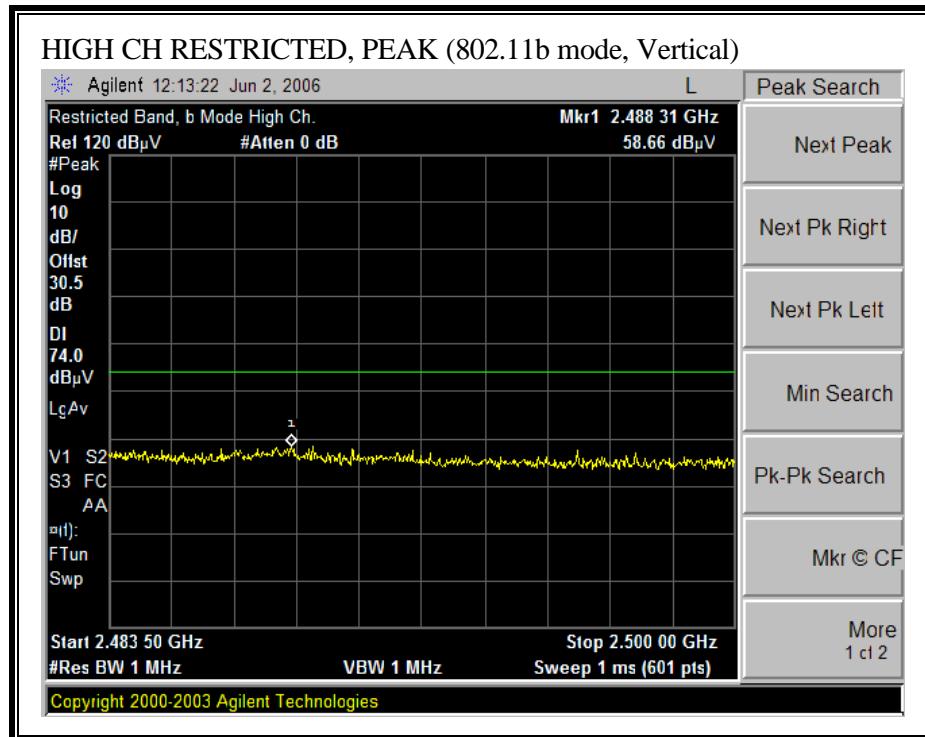


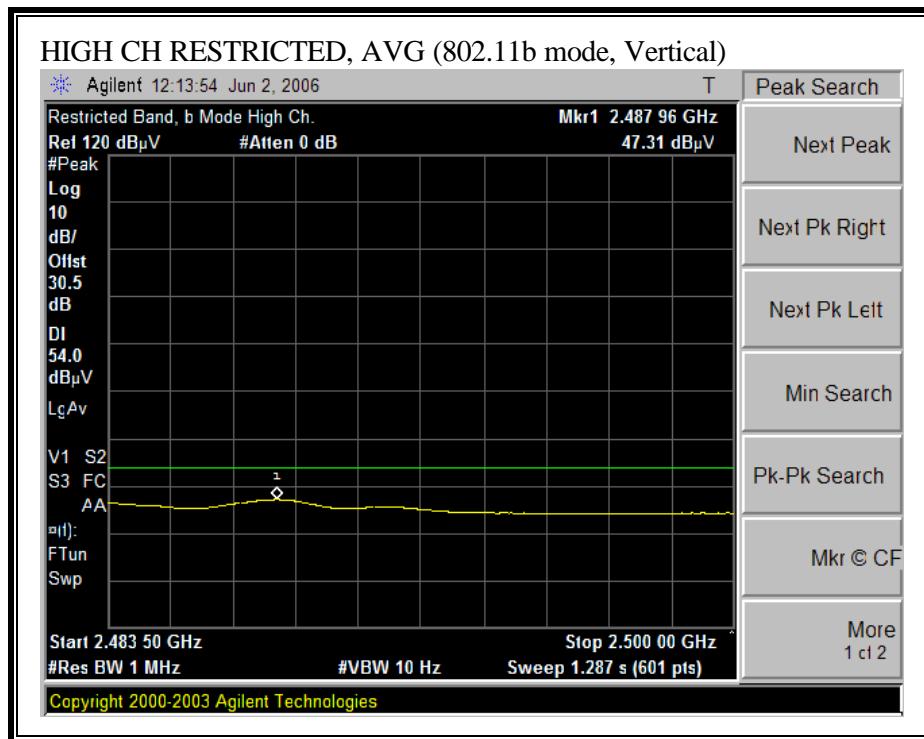
RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, VERTICAL)



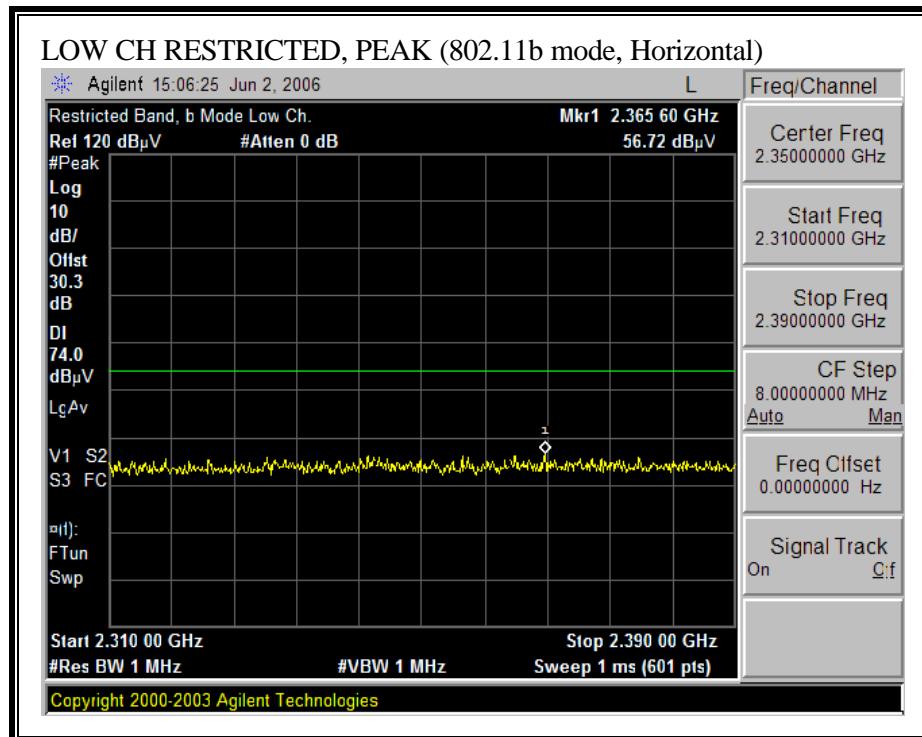


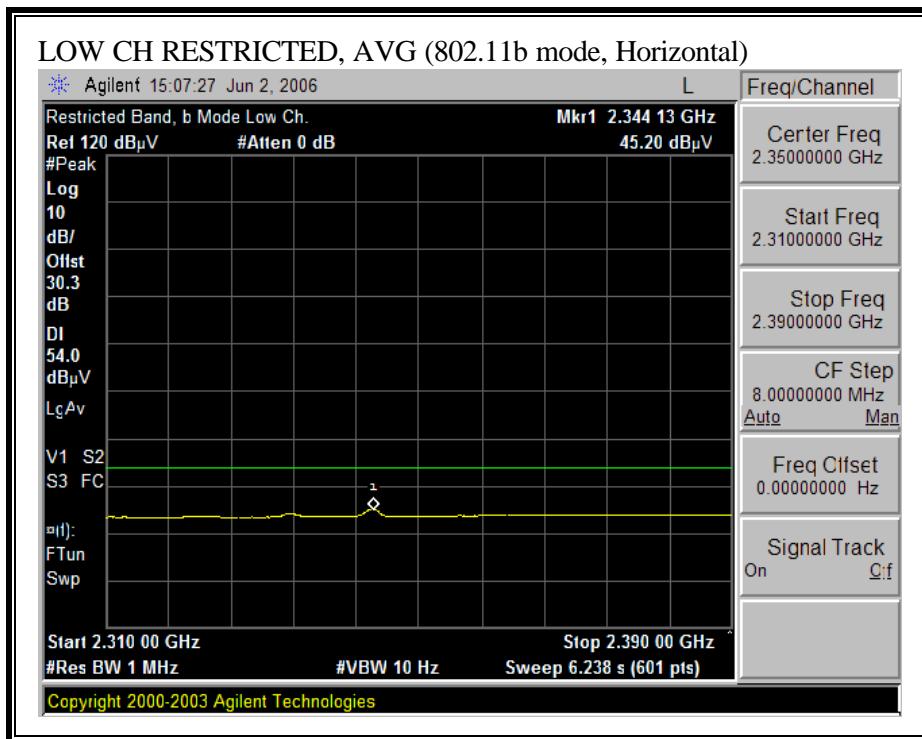
HARMONICS AND SPURIOUS EMISSIONS (b MODE)

High Frequency Measurement Compliance Certification Services, Morgan Hill Open Field Site																																																																																																																																																																																																																																																																																																												
<p>Company: Tropos Project #: 06U10287 Date: 06/07/2006 Test Engineer: Vien Tran Configuration: EUT with 10dBi Monopole antenna Mode: Tx 11b_2.4 GHz Average Power: Low, Mid, & High channels = 26 dBm</p> <p>Test Equipment:</p> <table border="1"> <tr> <td>Horn 1-18GHz</td> <td>Pre-amplifier 1-26GHz</td> <td>Pre-amplifier 26-40GHz</td> <td colspan="3">Horn > 18GHz</td> <td>Limit</td> </tr> <tr> <td>T73; S/N: 6717 @3m</td> <td>T144 Miteq 3008A00931</td> <td></td> <td colspan="3"></td> <td>FCC 15.205</td> </tr> <tr> <td colspan="6">Hi Frequency Cables</td> <td></td> </tr> <tr> <td>2 foot cable</td> <td>3 foot cable</td> <td>12 foot cable</td> <td>HPF</td> <td>Reject Filter</td> <td colspan="2"> Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz </td> </tr> <tr> <td>Vien 177079005</td> <td></td> <td>Vien 197209005</td> <td>HPF_4.0GHz</td> <td></td> <td colspan="2"></td> </tr> </table> <p>Measurement Data:</p> <table border="1"> <thead> <tr> <th>f GHz</th> <th>Dist (m)</th> <th>Read Pk dBuV</th> <th>Read Avg. dBuV</th> <th>AF dB/m</th> <th>CL dB</th> <th>Amp dB</th> <th>D Corr dB</th> <th>Fltr dB</th> <th>Peak dBuV/m</th> <th>Avg dBuV/m</th> <th>Pk Lim dBuV/m</th> <th>Avg Lim dBuV/m</th> <th>Pk Mar dB</th> <th>Avg Mar dB</th> <th>Notes (V/H)</th> </tr> </thead> <tbody> <tr> <td colspan="15">LOW CH, 2412 MHz</td> </tr> <tr> <td>4.824</td> <td>3.0</td> <td>50.0</td> <td>45.2</td> <td>33.3</td> <td>3.4</td> <td>-36.5</td> <td>0.0</td> <td>0.6</td> <td>50.8</td> <td>46.0</td> <td>74</td> <td>54</td> <td>-23.2</td> <td>-8.0</td> <td>V</td> </tr> <tr> <td>4.824</td> <td>3.0</td> <td>46.4</td> <td>36.8</td> <td>33.3</td> <td>3.4</td> <td>-36.5</td> <td>0.0</td> <td>0.6</td> <td>47.2</td> <td>37.6</td> <td>74</td> <td>54</td> <td>-26.8</td> <td>-16.4</td> <td>H</td> </tr> <tr> <td colspan="15">MID CH, 2437 MHz</td> </tr> <tr> <td>4.874</td> <td>3.0</td> <td>46.5</td> <td>37.5</td> <td>33.4</td> <td>3.4</td> <td>-36.5</td> <td>0.0</td> <td>0.6</td> <td>47.4</td> <td>38.4</td> <td>74</td> <td>54</td> <td>-26.6</td> <td>-15.6</td> <td>V</td> </tr> <tr> <td>7.311</td> <td>3.0</td> <td>45.1</td> <td>33.5</td> <td>35.0</td> <td>3.9</td> <td>-36.2</td> <td>0.0</td> <td>0.6</td> <td>48.4</td> <td>36.8</td> <td>74</td> <td>54</td> <td>-25.6</td> <td>-17.2</td> <td>V</td> </tr> <tr> <td>4.874</td> <td>3.0</td> <td>44.0</td> <td>32.8</td> <td>33.4</td> <td>3.4</td> <td>-36.5</td> <td>0.0</td> <td>0.6</td> <td>44.9</td> <td>33.7</td> <td>74</td> <td>54</td> <td>-29.1</td> <td>-20.3</td> <td>H</td> </tr> <tr> <td>7.311</td> <td>3.0</td> <td>43.2</td> <td>32.3</td> <td>35.0</td> <td>3.9</td> <td>-36.2</td> <td>0.0</td> <td>0.6</td> <td>46.5</td> <td>35.6</td> <td>74</td> <td>54</td> <td>-27.5</td> <td>-18.4</td> <td>H</td> </tr> <tr> <td colspan="15">HIGH CH, 2462 MHz</td> </tr> <tr> <td>4.924</td> <td>3.0</td> <td>47.2</td> <td>39.3</td> <td>33.4</td> <td>3.4</td> <td>-36.5</td> <td>0.0</td> <td>0.6</td> <td>48.2</td> <td>40.3</td> <td>74</td> <td>54</td> <td>-25.8</td> <td>-13.7</td> <td>V</td> </tr> <tr> <td>7.386</td> <td>3.0</td> <td>43.5</td> <td>32.2</td> <td>35.0</td> <td>3.9</td> <td>-36.2</td> <td>0.0</td> <td>0.6</td> <td>46.9</td> <td>35.6</td> <td>74</td> <td>54</td> <td>-27.1</td> <td>-18.4</td> <td>V</td> </tr> <tr> <td>4.924</td> <td>3.0</td> <td>44.4</td> <td>32.9</td> <td>33.4</td> <td>3.4</td> <td>-36.5</td> <td>0.0</td> <td>0.6</td> <td>45.4</td> <td>33.9</td> <td>74</td> <td>54</td> <td>-28.6</td> <td>-20.1</td> <td>H</td> </tr> <tr> <td>7.386</td> <td>3.0</td> <td>43.5</td> <td>32.8</td> <td>35.0</td> <td>3.9</td> <td>-36.2</td> <td>0.0</td> <td>0.6</td> <td>46.9</td> <td>36.2</td> <td>74</td> <td>54</td> <td>-27.1</td> <td>-17.8</td> <td>H</td> </tr> <tr> <td colspan="15">No other emissions were detected above system noise floor</td> </tr> <tr> <td colspan="5"> f Measurement Frequency Dist Distance to Antenna Read Analyzer Reading AF Antenna Factor CL Cable Loss </td> <td colspan="5"> Amp Preamp Gain D Corr Distance Correct to 3 meters Avg Average Field Strength @ 3 m Peak Calculated Peak Field Strength HPF High Pass Filter </td> <td colspan="5"> Avg Lim Average Field Strength Limit Pk Lim Peak Field Strength Limit Avg Mar Margin vs. Average Limit Pk Mar Margin vs. Peak Limit </td> </tr> </tbody> </table>															Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz			Limit	T73; S/N: 6717 @3m	T144 Miteq 3008A00931					FCC 15.205	Hi Frequency Cables							2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz		Vien 177079005		Vien 197209005	HPF_4.0GHz				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	50.0	45.2	33.3	3.4	-36.5	0.0	0.6	50.8	46.0	74	54	-23.2	-8.0	V	4.824	3.0	46.4	36.8	33.3	3.4	-36.5	0.0	0.6	47.2	37.6	74	54	-26.8	-16.4	H	MID CH, 2437 MHz															4.874	3.0	46.5	37.5	33.4	3.4	-36.5	0.0	0.6	47.4	38.4	74	54	-26.6	-15.6	V	7.311	3.0	45.1	33.5	35.0	3.9	-36.2	0.0	0.6	48.4	36.8	74	54	-25.6	-17.2	V	4.874	3.0	44.0	32.8	33.4	3.4	-36.5	0.0	0.6	44.9	33.7	74	54	-29.1	-20.3	H	7.311	3.0	43.2	32.3	35.0	3.9	-36.2	0.0	0.6	46.5	35.6	74	54	-27.5	-18.4	H	HIGH CH, 2462 MHz															4.924	3.0	47.2	39.3	33.4	3.4	-36.5	0.0	0.6	48.2	40.3	74	54	-25.8	-13.7	V	7.386	3.0	43.5	32.2	35.0	3.9	-36.2	0.0	0.6	46.9	35.6	74	54	-27.1	-18.4	V	4.924	3.0	44.4	32.9	33.4	3.4	-36.5	0.0	0.6	45.4	33.9	74	54	-28.6	-20.1	H	7.386	3.0	43.5	32.8	35.0	3.9	-36.2	0.0	0.6	46.9	36.2	74	54	-27.1	-17.8	H	No other emissions were detected above system noise floor															f Measurement Frequency Dist Distance to Antenna Read Analyzer Reading AF Antenna Factor CL Cable Loss					Amp Preamp Gain D Corr Distance Correct to 3 meters Avg Average Field Strength @ 3 m Peak Calculated Peak Field Strength HPF High Pass Filter					Avg Lim Average Field Strength Limit Pk Lim Peak Field Strength Limit Avg Mar Margin vs. Average Limit Pk Mar Margin vs. Peak Limit				
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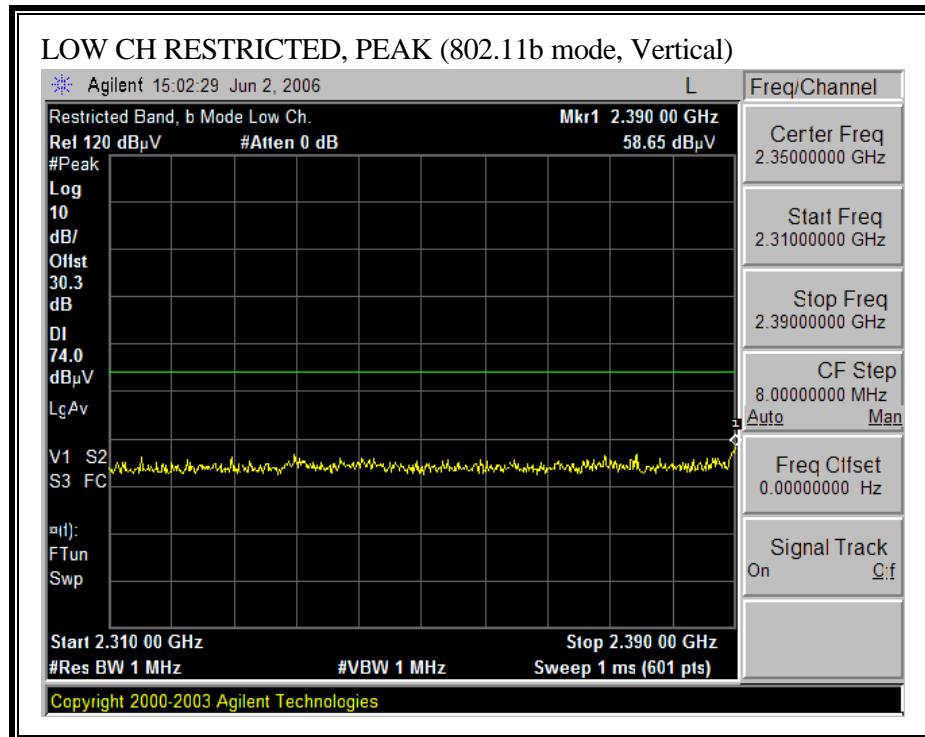
RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, HORIZONTAL)

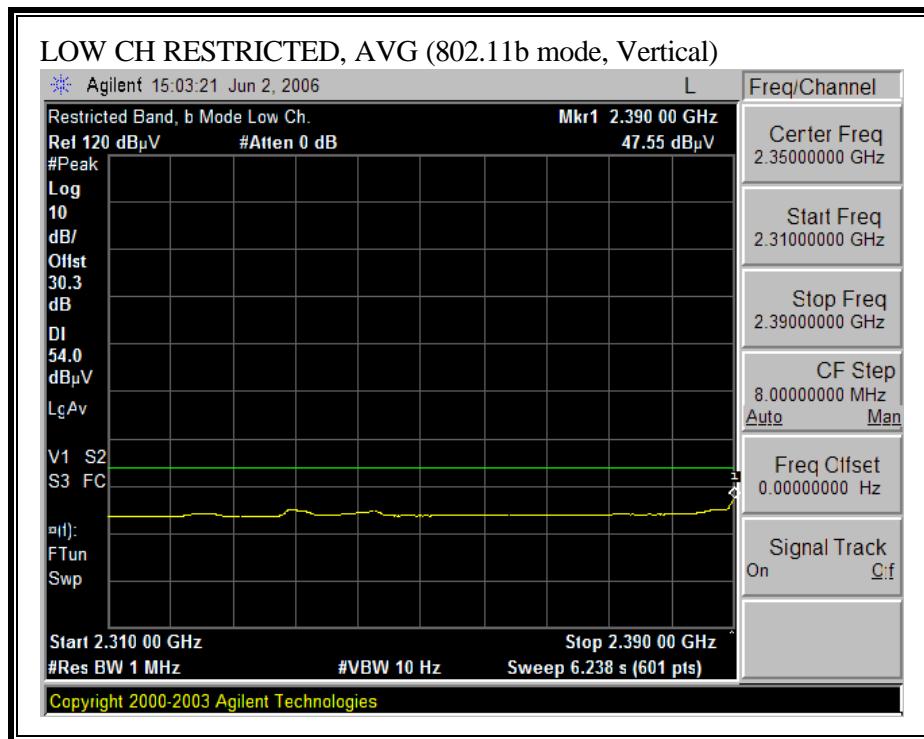
12 dBi SECTOR ANTENNA



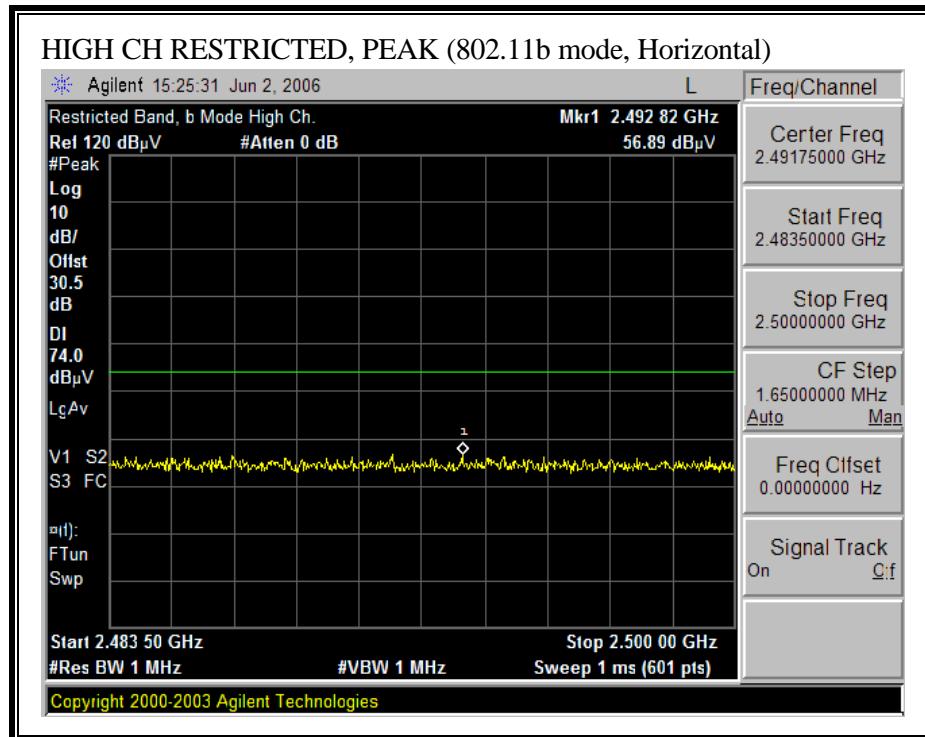


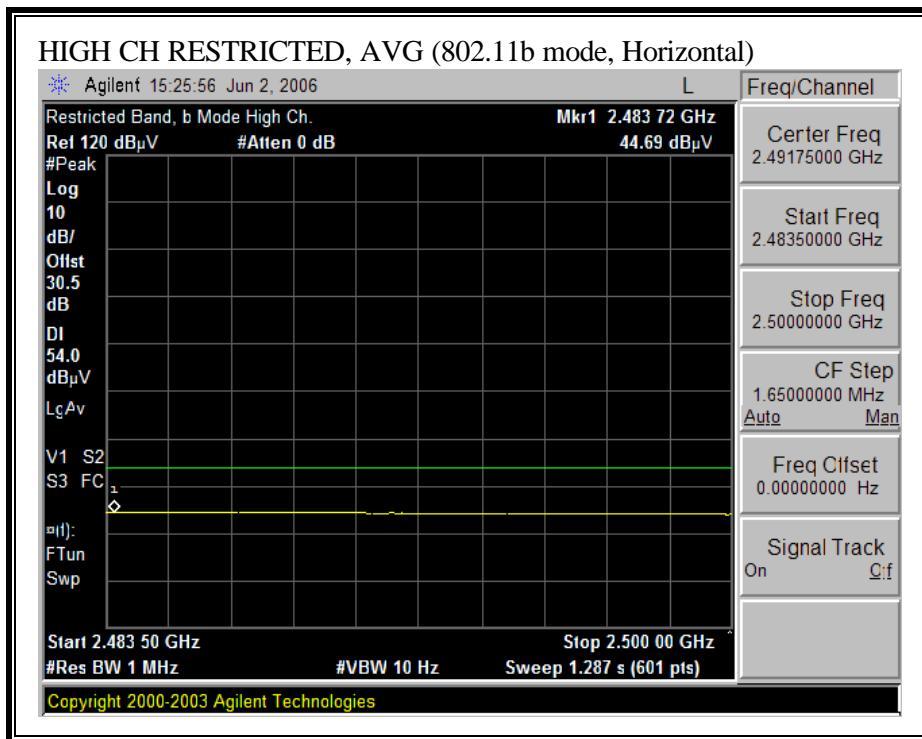
RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, VERTICAL)



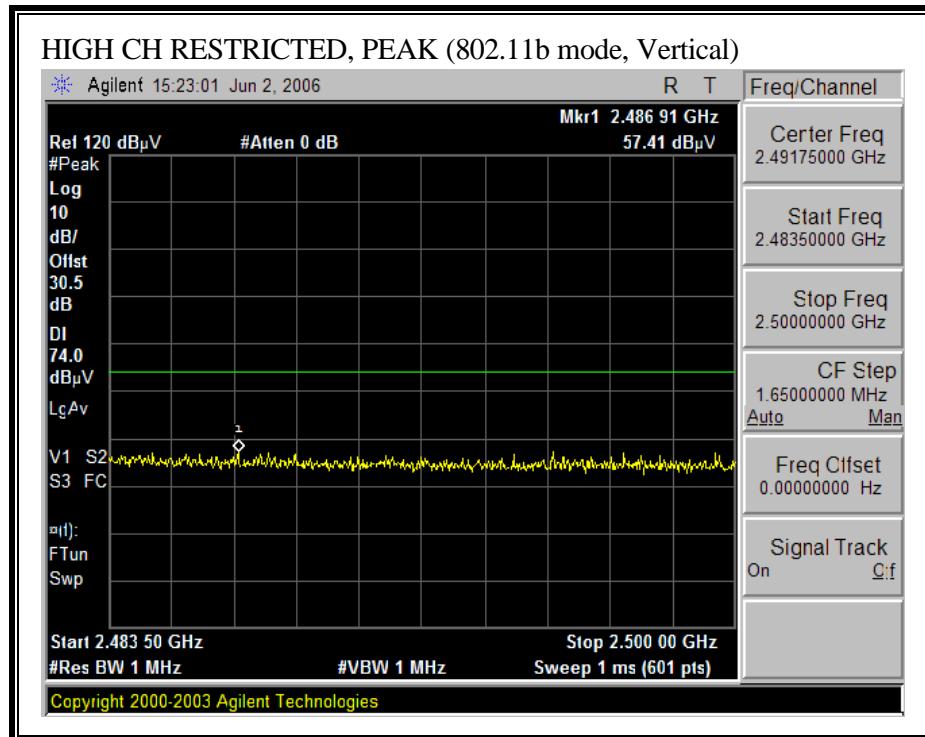


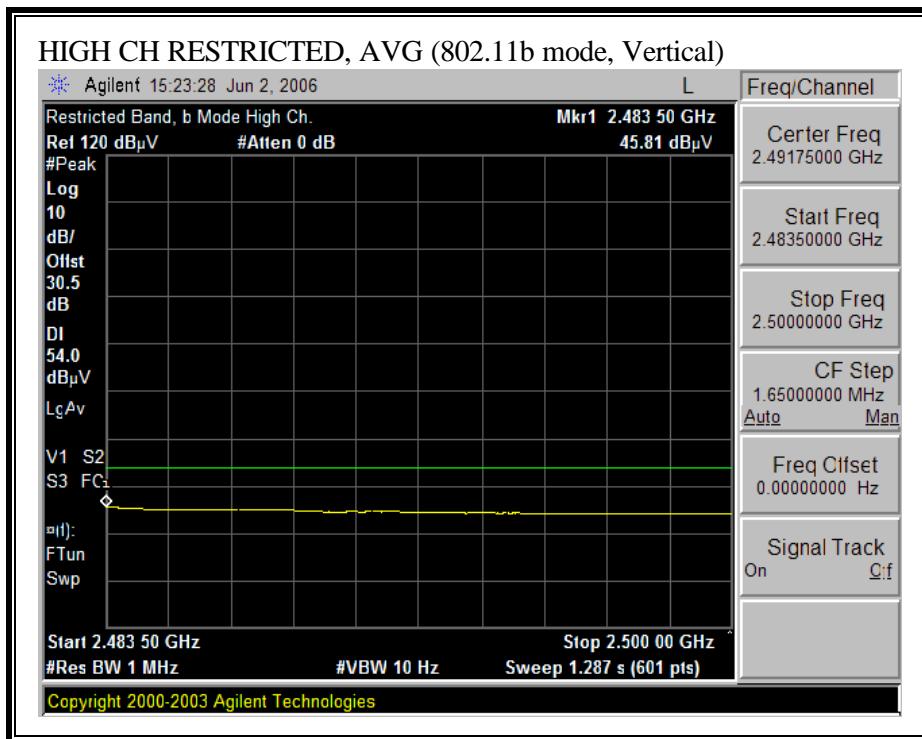
RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, VERTICAL)



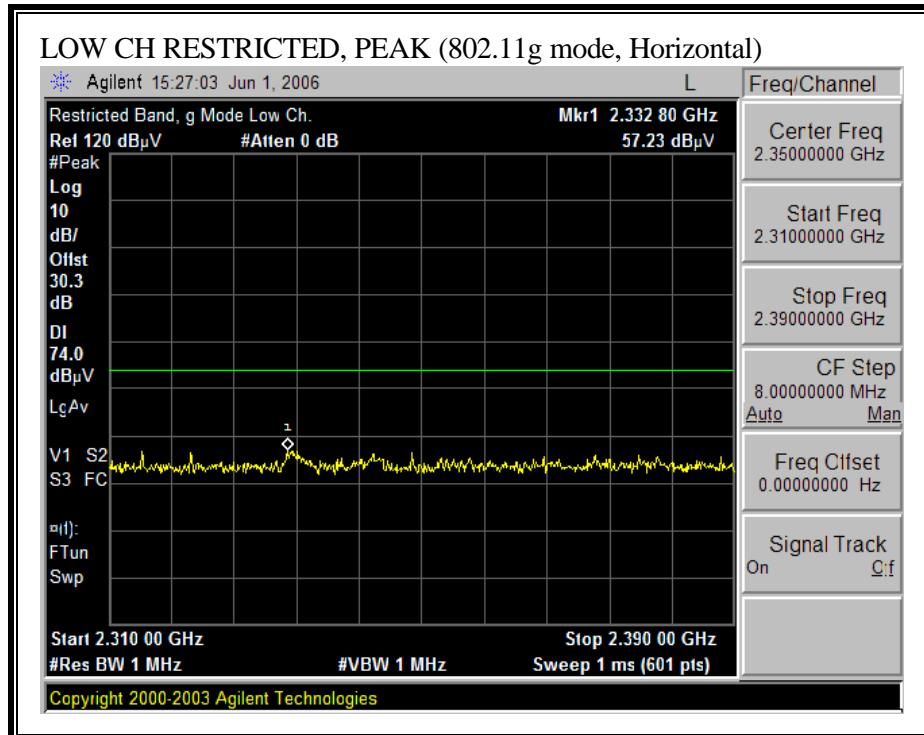


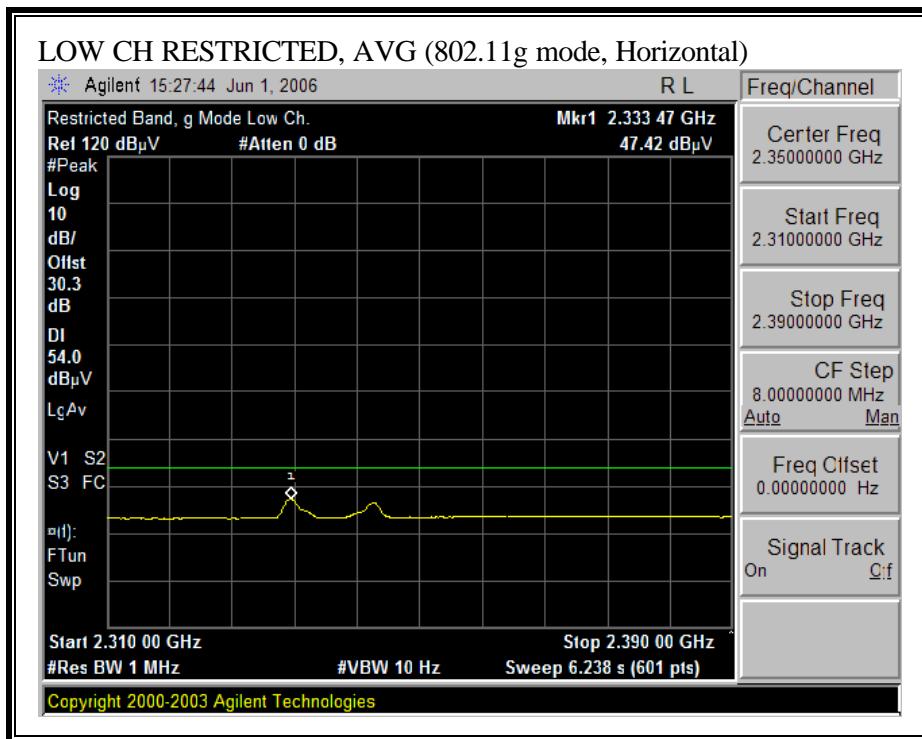
HARMONICS AND SPURIOUS EMISSIONS (b MODE)

High Frequency Measurement Compliance Certification Services, Morgan Hill Open Field Site																																																								
Company: Tropos Project #: 06U10287 Date: 06/07/2006 Test Engineer: Vien Tran Configuration: EUT with 12dBi Sector antenna Mode: Tx 11b_2.4 GHZ Average Power: Low, Mid, & High channels = 24 dBm																																																								
Test Equipment: <table border="1"> <tr> <td>Horn 1-18GHz</td> <td>Pre-amplifier 1-26GHz</td> <td>Pre-amplifier 26-40GHz</td> <td colspan="3">Horn > 18GHz</td> <td>Limit</td> </tr> <tr> <td>T73; S/N: 6717 @3m</td> <td>T144 Miteq 3008A00931</td> <td></td> <td colspan="3"></td> <td>FCC 15.205</td> </tr> <tr> <td colspan="5">Hi Frequency Cables</td> <td colspan="2"></td> </tr> <tr> <td>2 foot cable</td> <td>3 foot cable</td> <td>12 foot cable</td> <td>HPF</td> <td>Reject Filter</td> <td colspan="2"></td> </tr> <tr> <td>Vien 177079005</td> <td></td> <td>Vien 197209005</td> <td>HPF_4.0GHz</td> <td></td> <td colspan="2"></td> </tr> <tr> <td colspan="5"></td> <td colspan="2"> Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz </td> </tr> </table>															Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz			Limit	T73; S/N: 6717 @3m	T144 Miteq 3008A00931					FCC 15.205	Hi Frequency Cables							2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter			Vien 177079005		Vien 197209005	HPF_4.0GHz									Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz	
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GHz	(m)	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)																																									
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4.824	3.0	46.0	39.1	33.3	3.4	-36.5	0.0	0.6	46.8	39.9	74	54	-27.2	-14.1	V																																									
4.824	3.0	44.5	36.9	33.3	3.4	-36.5	0.0	0.6	45.3	37.7	74	54	-28.7	-16.3	H																																									
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7.311	3.0	44.5	32.4	35.0	3.9	-36.2	0.0	0.6	47.8	35.7	74	54	-26.2	-18.3	V																																									
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7.386	3.0	43.6	32.5	35.0	3.9	-36.2	0.0	0.6	47.0	35.9	74	54	-27.0	-18.1	V																																									
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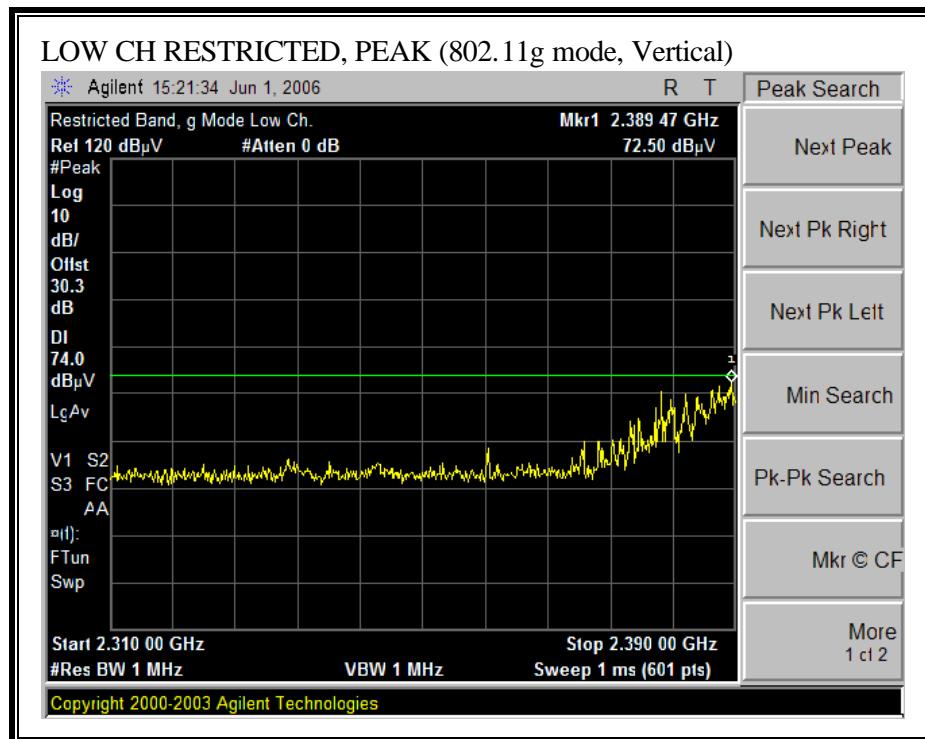
RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, HORIZONTAL)

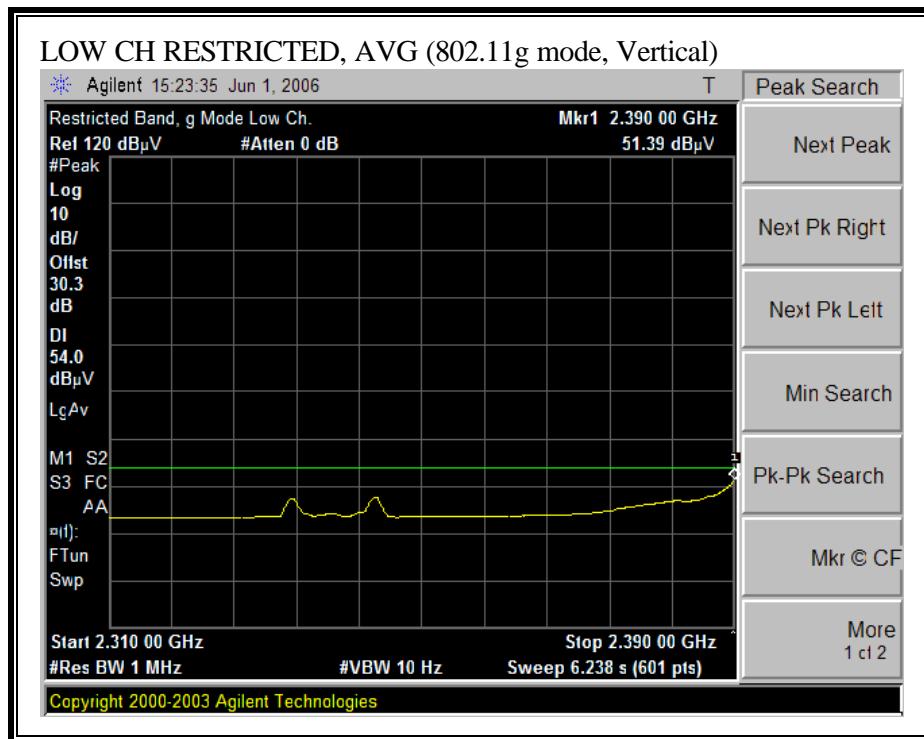
7.4 dBi MONOPOLE ANTENNA



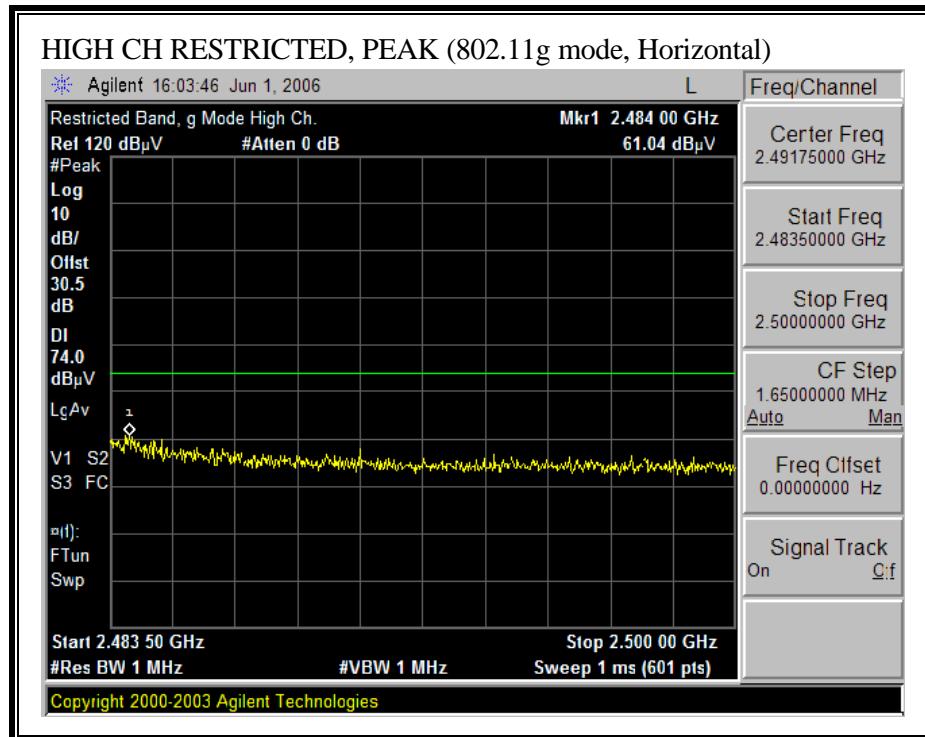


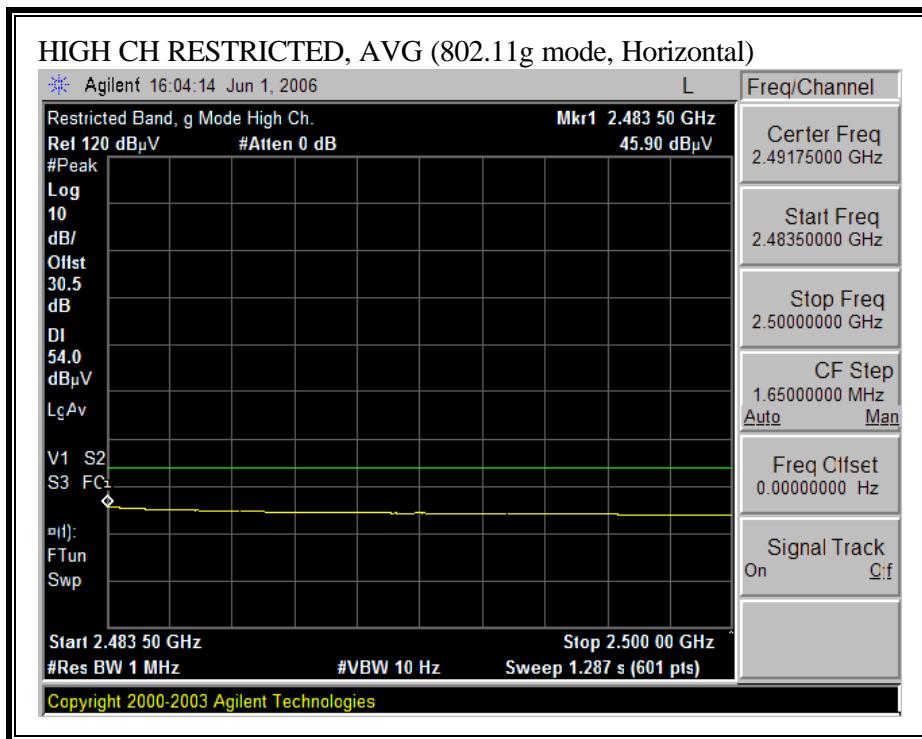
RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, VERTICAL)



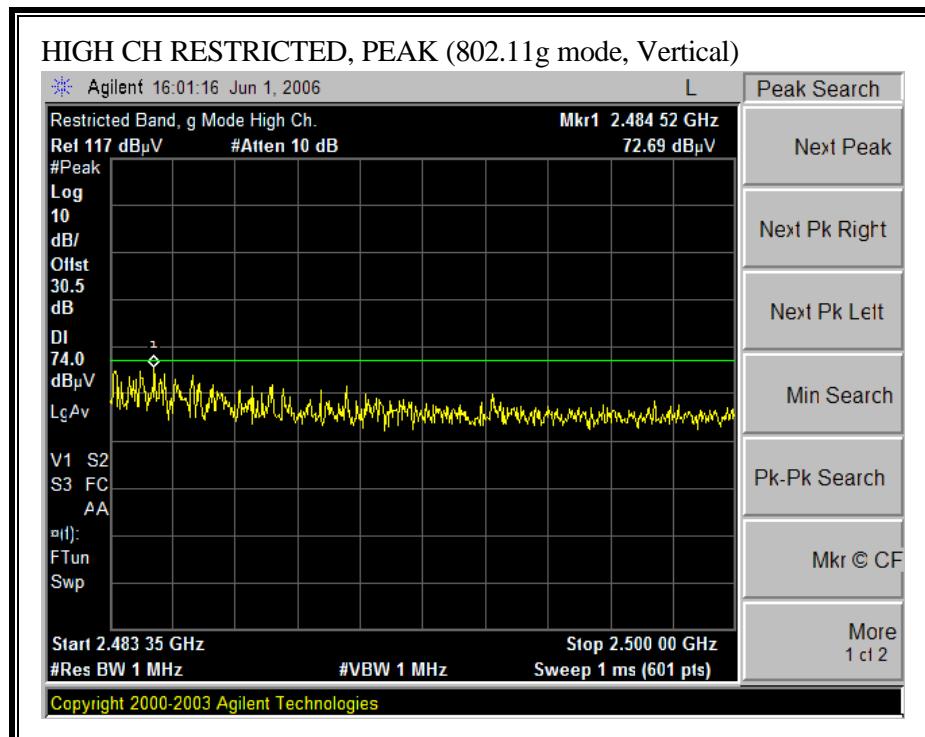


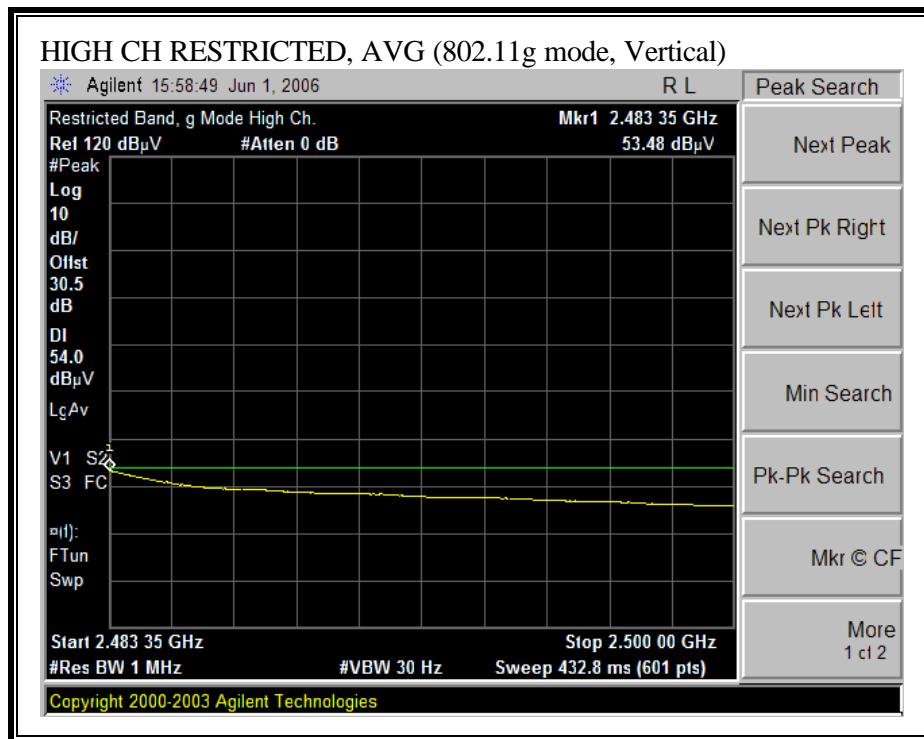
RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, VERTICAL)



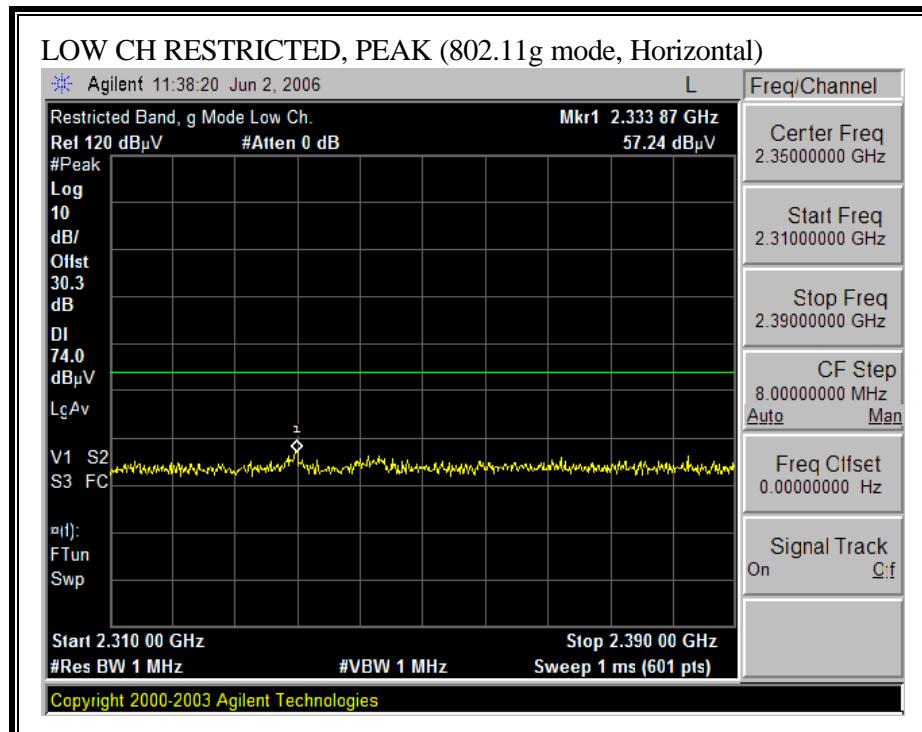


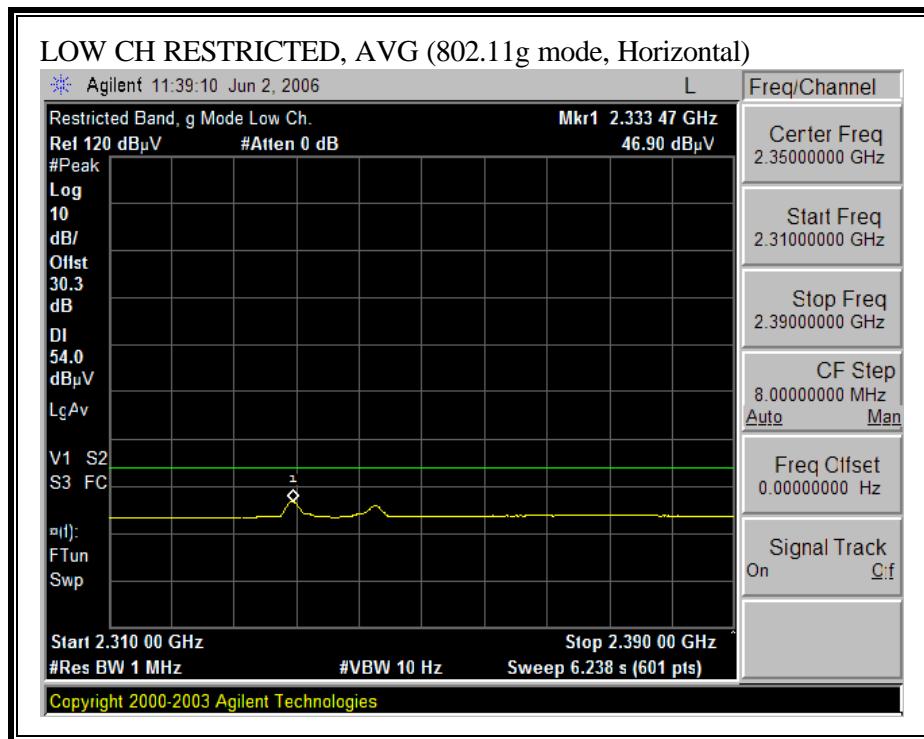
HARMONICS AND SPURIOUS EMISSIONS (g MODE)

High Frequency Measurement Compliance Certification Services, Morgan Hill Open Field Site															
Company: Tropos Project #: 06U10287 Date: 06/01/2006 Test Engineer: Vien Tran Configuration: EUT with 7.4dBi Monopole antenna Mode: Tx 11g_2.4 GHz Average Power: Low, Mid, & High channels = 28.6 dBm															
Test Equipment:															
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit			
T60; S/N: 2238 @3m			T145 Agilent 3008A0056									FCC 15.205			
Hi Frequency Cables															
2 foot cable			3 foot cable			12 foot cable			HPF			Reject Filter			
Vien 177079005						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	47.6	34.9	33.0	3.4	-34.8	0.0	0.6	49.7	37.0	74	54	-24.3	-17.0	V
4.824	3.0	44.0	31.3	33.0	3.4	-34.8	0.0	0.6	46.1	33.4	74	54	-27.9	-20.6	H
MID CH, 2437 MHz															
4.874	3.0	44.9	32.5	33.1	3.4	-34.9	0.0	0.6	47.1	34.7	74	54	-26.9	-19.3	V
7.311	3.0	55.0	37.1	35.5	3.9	-34.7	0.0	0.6	60.4	42.5	74	54	-13.6	-11.5	V
4.874	3.0	43.2	31.2	33.1	3.4	-34.9	0.0	0.6	45.4	33.4	74	54	-28.6	-20.6	H
7.311	3.0	49.3	35.0	35.5	3.9	-34.7	0.0	0.6	54.7	40.4	74	54	-19.3	-13.6	H
HIGH CH, 2462 MHz															
4.924	3.0	44.2	31.8	33.1	3.4	-34.9	0.0	0.6	46.5	34.1	74	54	-27.5	-19.9	V
7.386	3.0	45.0	32.6	35.6	3.9	-34.6	0.0	0.6	50.5	38.1	74	54	-23.5	-15.9	V
4.924	3.0	42.9	30.9	33.1	3.4	-34.9	0.0	0.6	45.2	33.2	74	54	-28.8	-20.8	V
7.386	3.0	43.9	31.4	35.6	3.9	-34.6	0.0	0.6	49.4	36.9	74	54	-24.6	-17.1	H
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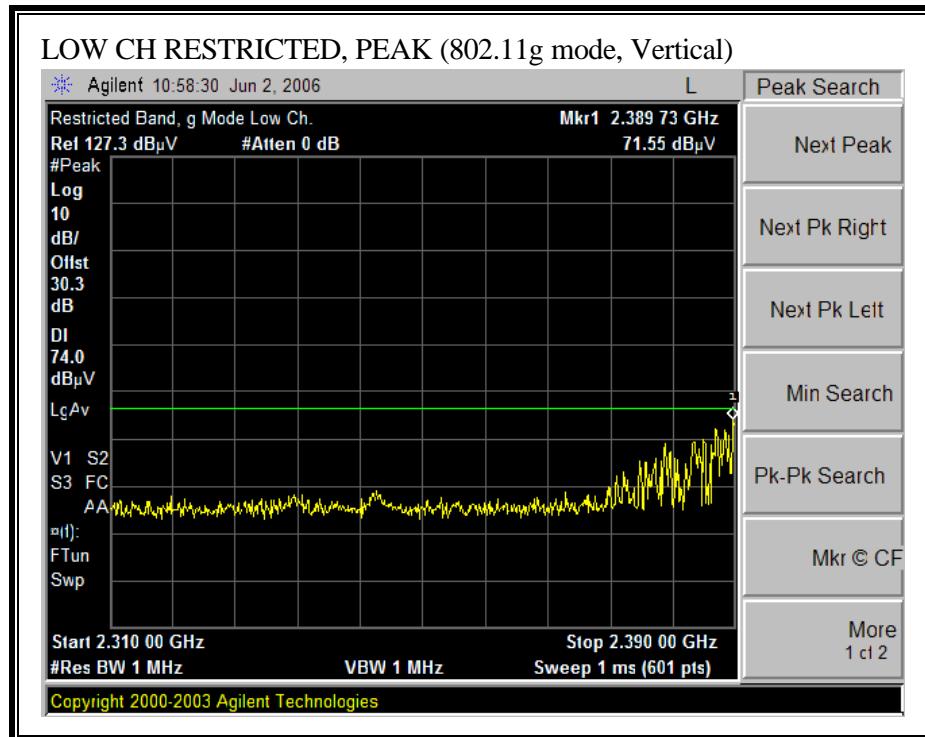
RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, HORIZONTAL)

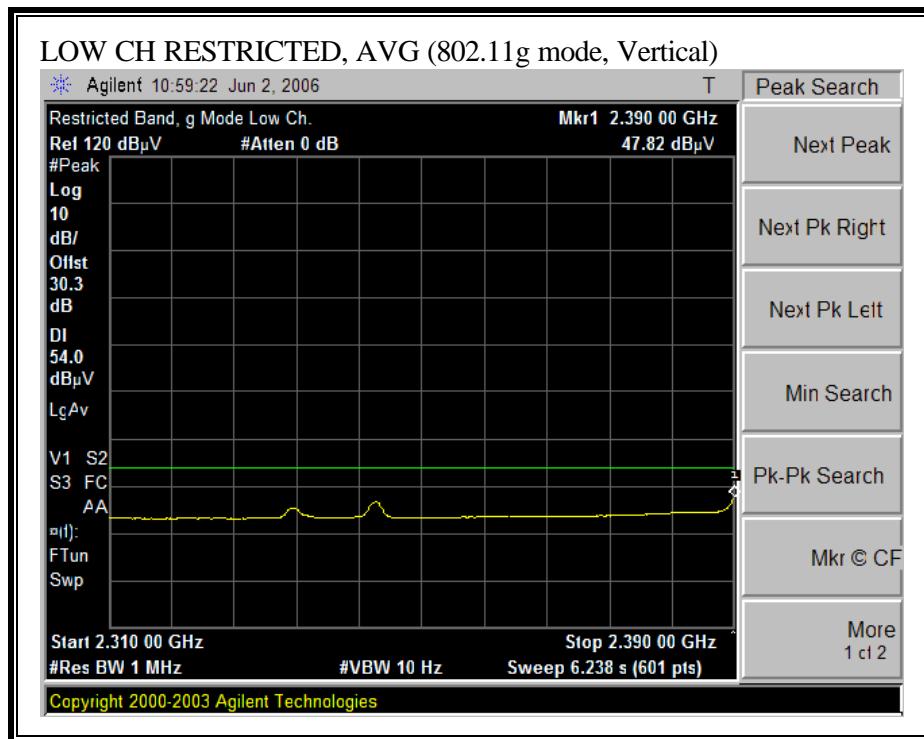
10 dBi MONOPOLE ANTENNA



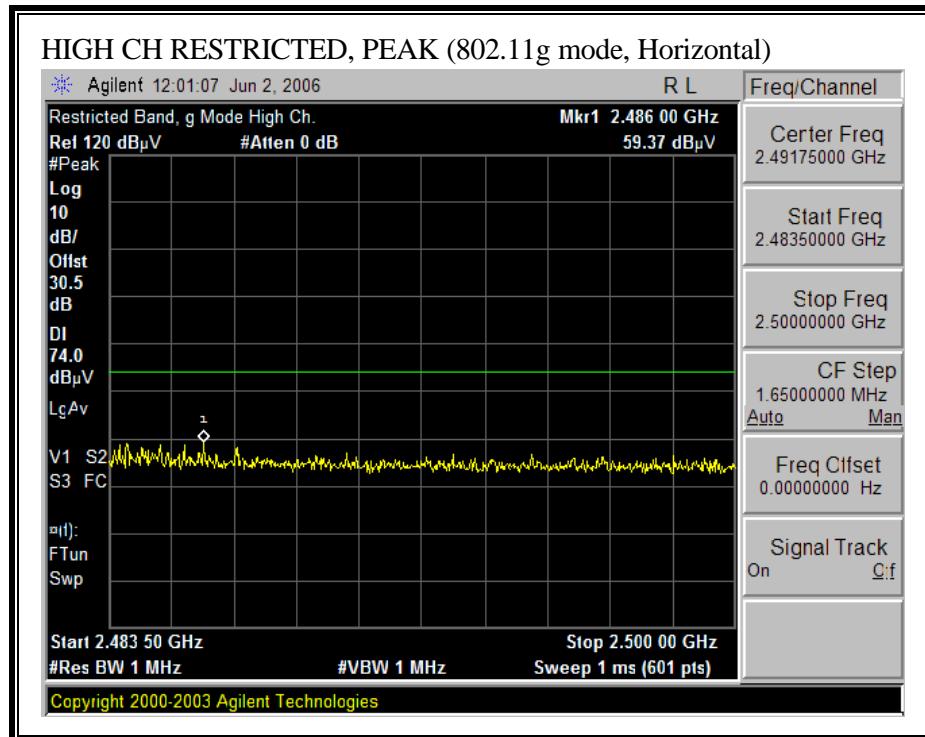


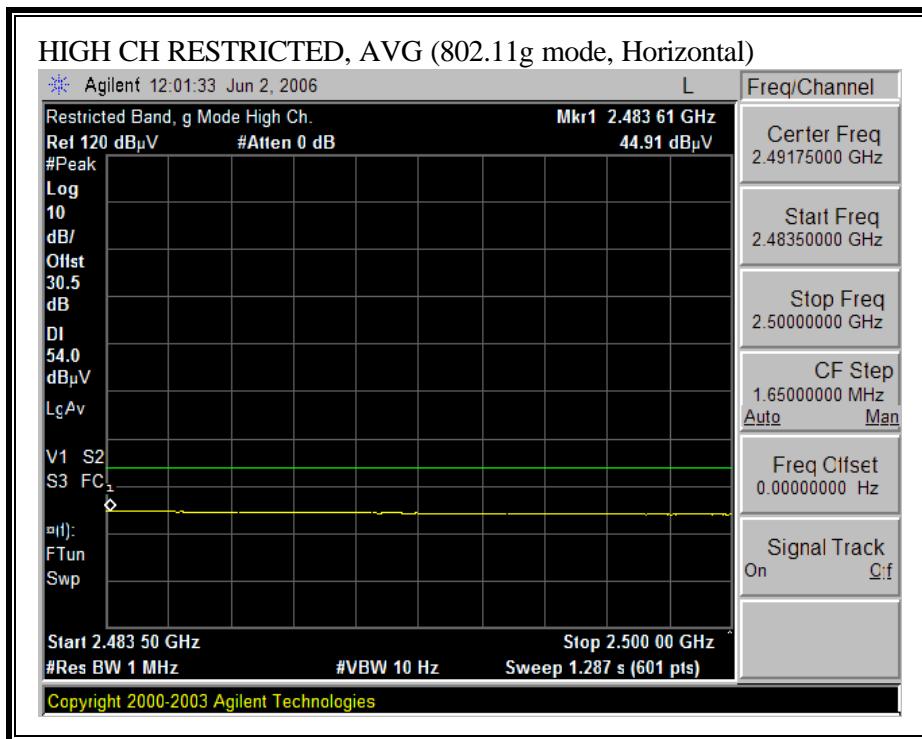
RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, VERTICAL)



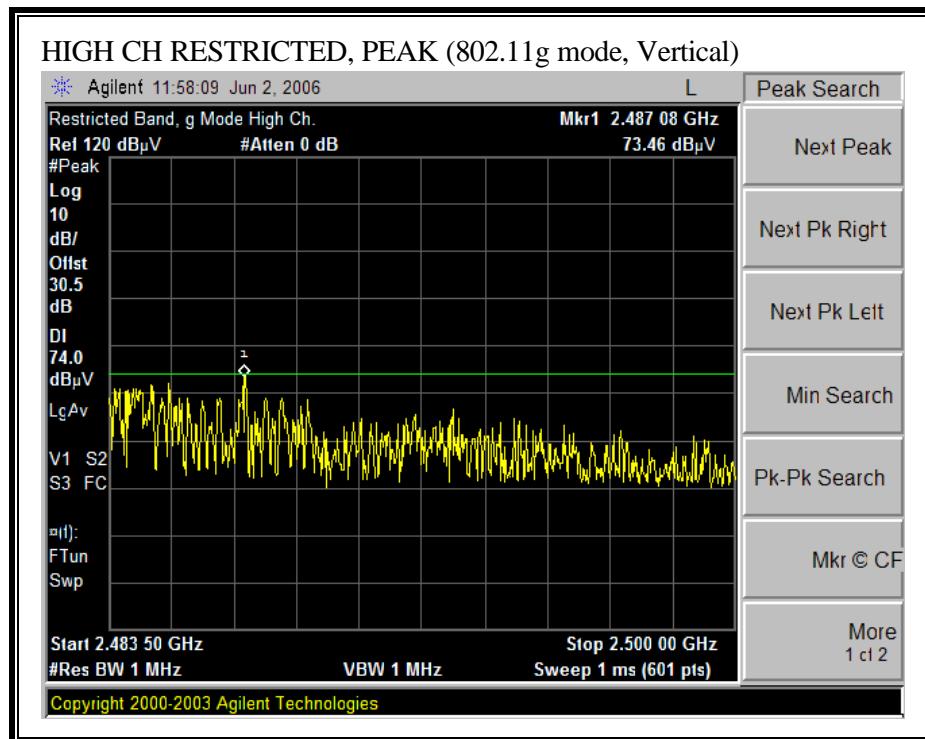


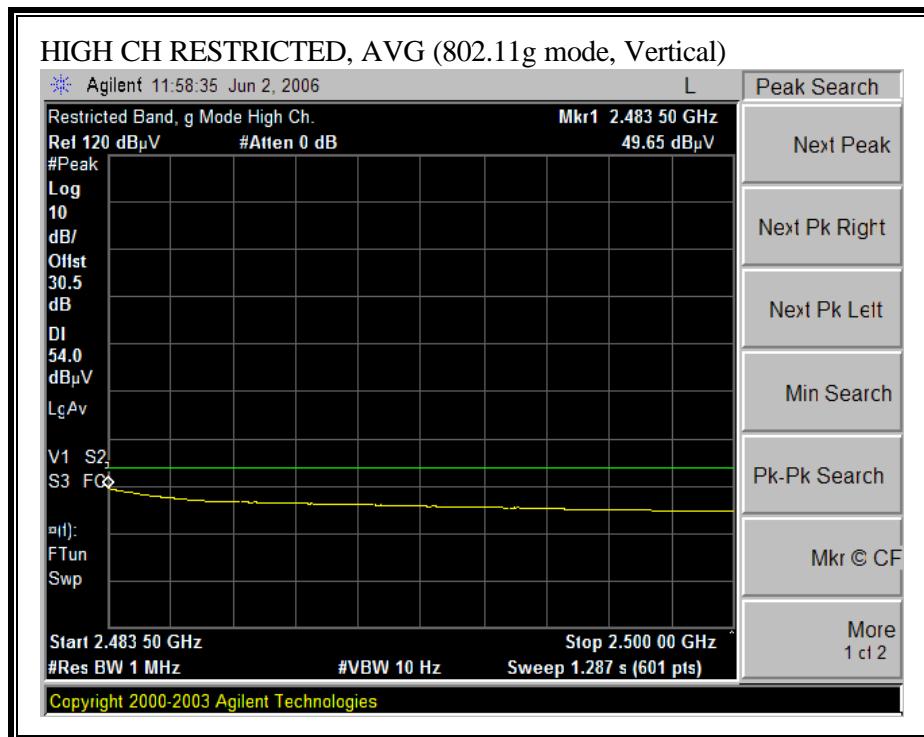
RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, VERTICAL)

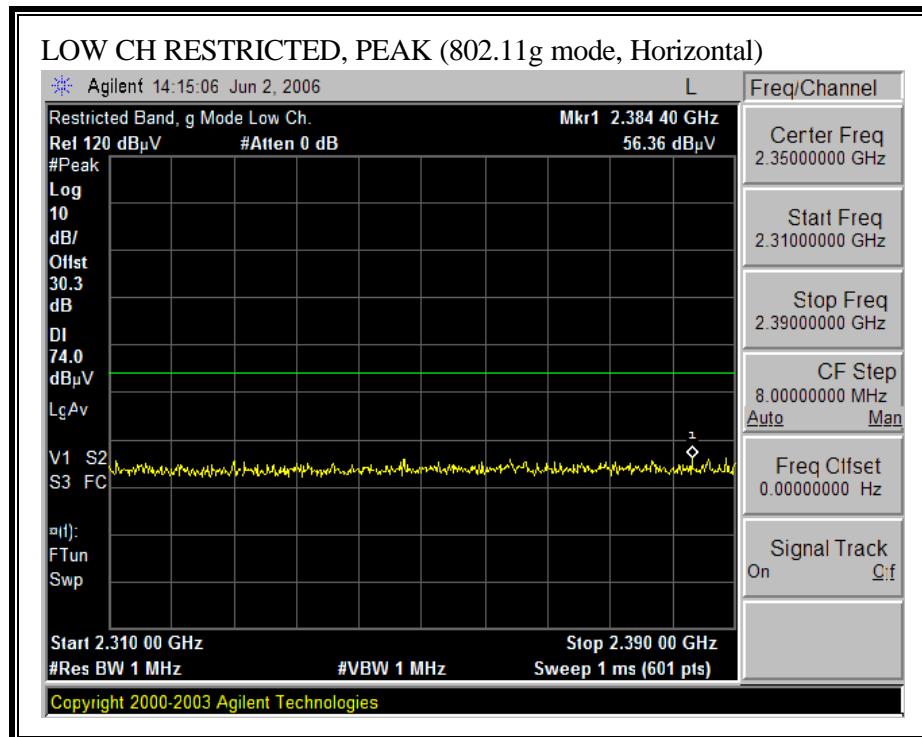


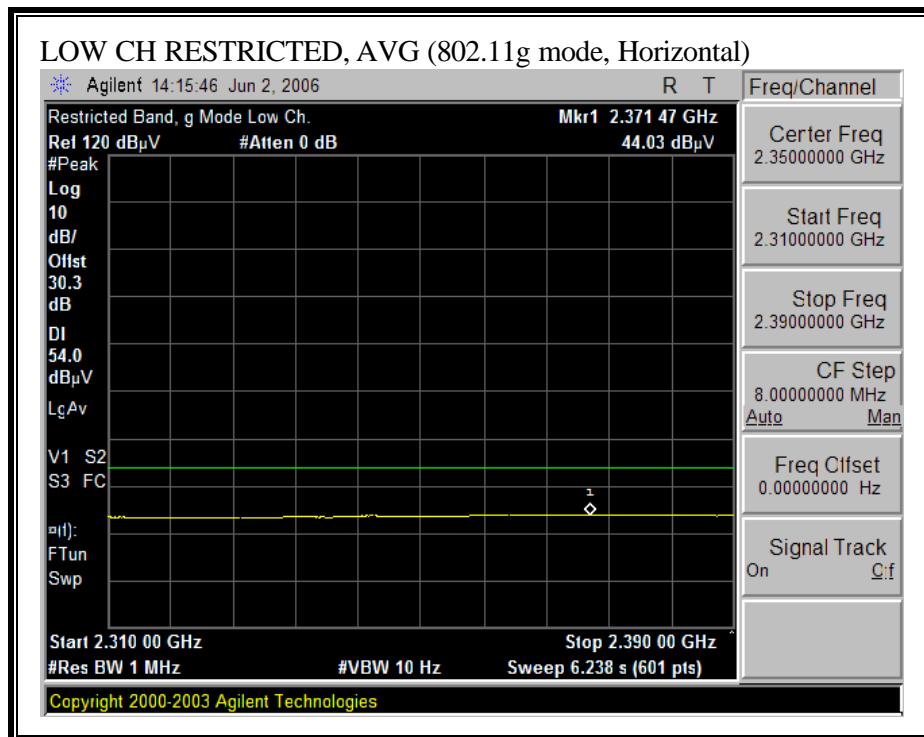


HARMONICS AND SPURIOUS EMISSIONS (g MODE)

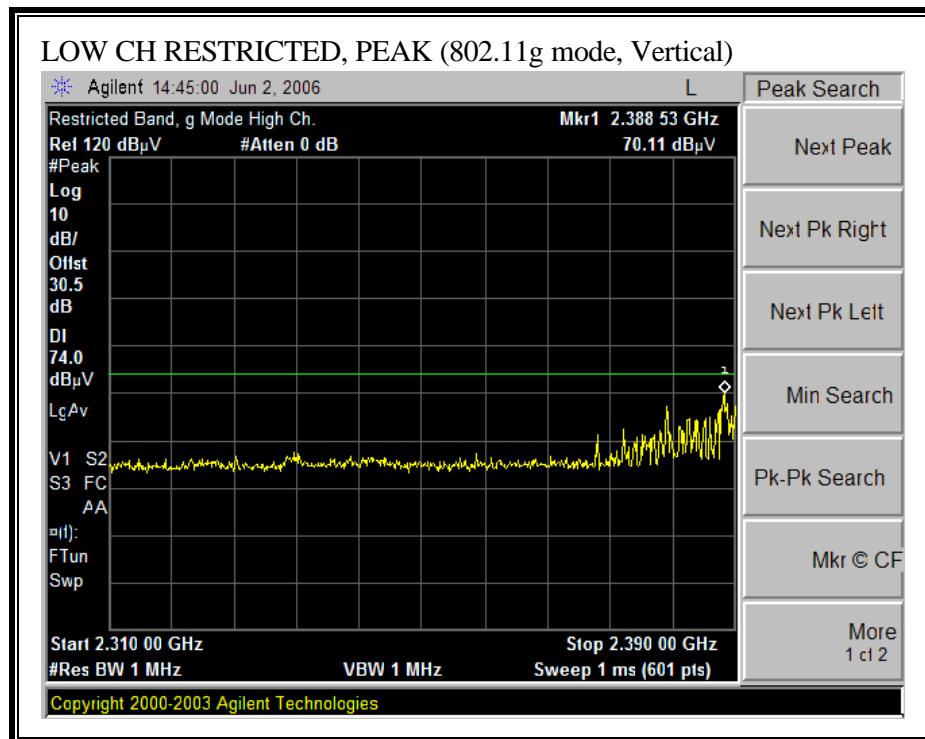
High Frequency Measurement Compliance Certification Services, Morgan Hill Open Field Site																																																																																																																																																																																																																																																																																																												
<p>Company: Tropos Project #: 06U10287 Date: 06/07/2006 Test Engineer: Vien Tran Configuration: EUT with 10dBi Monopole antenna Mode: Tx 11g_2.4 GHz Average Power: Low, Mid, & High channels = 26 dBm</p> <p>Test Equipment:</p> <table border="1"> <tr> <td>Horn 1-18GHz</td> <td>Pre-amplifier 1-26GHz</td> <td>Pre-amplifier 26-40GHz</td> <td colspan="3">Horn > 18GHz</td> <td>Limit</td> </tr> <tr> <td>T73; S/N: 6717 @3m</td> <td>T144 Miteq 3008A00931</td> <td></td> <td colspan="3"></td> <td>FCC 15.205</td> </tr> <tr> <td colspan="6">Hi Frequency Cables</td> <td></td> </tr> <tr> <td>2 foot cable</td> <td>3 foot cable</td> <td>12 foot cable</td> <td>HPF</td> <td>Reject Filter</td> <td colspan="2"> Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz </td> </tr> <tr> <td>Vien 177079005</td> <td></td> <td>Vien 197209005</td> <td>HPF_4.0GHz</td> <td></td> <td colspan="2"></td> </tr> </table> <p>Measurement Data:</p> <table border="1"> <thead> <tr> <th>f GHz</th> <th>Dist (m)</th> <th>Read Pk dBuV</th> <th>Read Avg. dBuV</th> <th>AF dB/m</th> <th>CL dB</th> <th>Amp dB</th> <th>D Corr dB</th> <th>Fltr dB</th> <th>Peak dBuV/m</th> <th>Avg dBuV/m</th> <th>Pk Lim dBuV/m</th> <th>Avg Lim dBuV/m</th> <th>Pk Mar dB</th> <th>Avg Mar dB</th> <th>Notes (V/H)</th> </tr> </thead> <tbody> <tr> <td colspan="15">LOW CH, 2412 MHz</td> </tr> <tr> <td>4.824</td> <td>3.0</td> <td>45.3</td> <td>33.8</td> <td>33.3</td> <td>3.4</td> <td>-36.5</td> <td>0.0</td> <td>0.6</td> <td>46.1</td> <td>34.6</td> <td>74</td> <td>54</td> <td>-27.9</td> <td>-19.4</td> <td>V</td> </tr> <tr> <td>4.824</td> <td>3.0</td> <td>43.7</td> <td>31.9</td> <td>33.3</td> <td>3.4</td> <td>-36.5</td> <td>0.0</td> <td>0.6</td> <td>44.5</td> <td>32.7</td> <td>74</td> <td>54</td> <td>-29.5</td> <td>-21.3</td> <td>H</td> </tr> <tr> <td colspan="15">MID CH, 2437 MHz</td> </tr> <tr> <td>4.874</td> <td>3.0</td> <td>44.3</td> <td>32.2</td> <td>33.4</td> <td>3.4</td> <td>-36.5</td> <td>0.0</td> <td>0.6</td> <td>45.2</td> <td>33.1</td> <td>74</td> <td>54</td> <td>-28.8</td> <td>-20.9</td> <td>V</td> </tr> <tr> <td>7.311</td> <td>3.0</td> <td>42.6</td> <td>32.3</td> <td>35.0</td> <td>3.9</td> <td>-36.2</td> <td>0.0</td> <td>0.6</td> <td>45.9</td> <td>35.6</td> <td>74</td> <td>54</td> <td>-28.1</td> <td>-18.4</td> <td>V</td> </tr> <tr> <td>4.874</td> <td>3.0</td> <td>43.9</td> <td>31.8</td> <td>33.4</td> <td>3.4</td> <td>-36.5</td> <td>0.0</td> <td>0.6</td> <td>44.8</td> <td>32.7</td> <td>74</td> <td>54</td> <td>-29.2</td> <td>-21.3</td> <td>H</td> </tr> <tr> <td>7.311</td> <td>3.0</td> <td>42.0</td> <td>31.2</td> <td>35.0</td> <td>3.9</td> <td>-36.2</td> <td>0.0</td> <td>0.6</td> <td>45.3</td> <td>34.5</td> <td>74</td> <td>54</td> <td>-28.7</td> <td>-19.5</td> <td>H</td> </tr> <tr> <td colspan="15">HI CH, 2462 MHz</td> </tr> <tr> <td>4.924</td> <td>3.0</td> <td>44.2</td> <td>31.7</td> <td>33.4</td> <td>3.4</td> <td>-36.5</td> <td>0.0</td> <td>0.6</td> <td>45.2</td> <td>32.7</td> <td>74</td> <td>54</td> <td>-28.8</td> <td>-21.3</td> <td>V</td> </tr> <tr> <td>7.386</td> <td>3.0</td> <td>43.6</td> <td>32.2</td> <td>35.0</td> <td>3.9</td> <td>-36.2</td> <td>0.0</td> <td>0.6</td> <td>47.0</td> <td>35.6</td> <td>74</td> <td>54</td> <td>-27.0</td> <td>-18.4</td> <td>V</td> </tr> <tr> <td>4.924</td> <td>3.0</td> <td>43.4</td> <td>31.7</td> <td>33.4</td> <td>3.4</td> <td>-36.5</td> <td>0.0</td> <td>0.6</td> <td>44.4</td> <td>32.7</td> <td>74</td> <td>54</td> <td>-29.6</td> <td>-21.3</td> <td>H</td> </tr> <tr> <td>7.386</td> <td>3.0</td> <td>42.9</td> <td>32.3</td> <td>35.0</td> <td>3.9</td> <td>-36.2</td> <td>0.0</td> <td>0.6</td> <td>46.3</td> <td>35.7</td> <td>74</td> <td>54</td> <td>-27.7</td> <td>-18.3</td> <td>H</td> </tr> <tr> <td colspan="15">No other emissions were detected above system noise floor</td> </tr> <tr> <td colspan="5"> f Measurement Frequency Dist Distance to Antenna Read Analyzer Reading AF Antenna Factor CL Cable Loss </td> <td colspan="5"> Amp Preamp Gain D Corr Distance Correct to 3 meters Avg Average Field Strength @ 3 m Peak Calculated Peak Field Strength HPF High Pass Filter </td> <td colspan="5"> Avg Lim Average Field Strength Limit Pk Lim Peak Field Strength Limit Avg Mar Margin vs. Average Limit Pk Mar Margin vs. Peak Limit </td> </tr> </tbody> </table>															Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz			Limit	T73; 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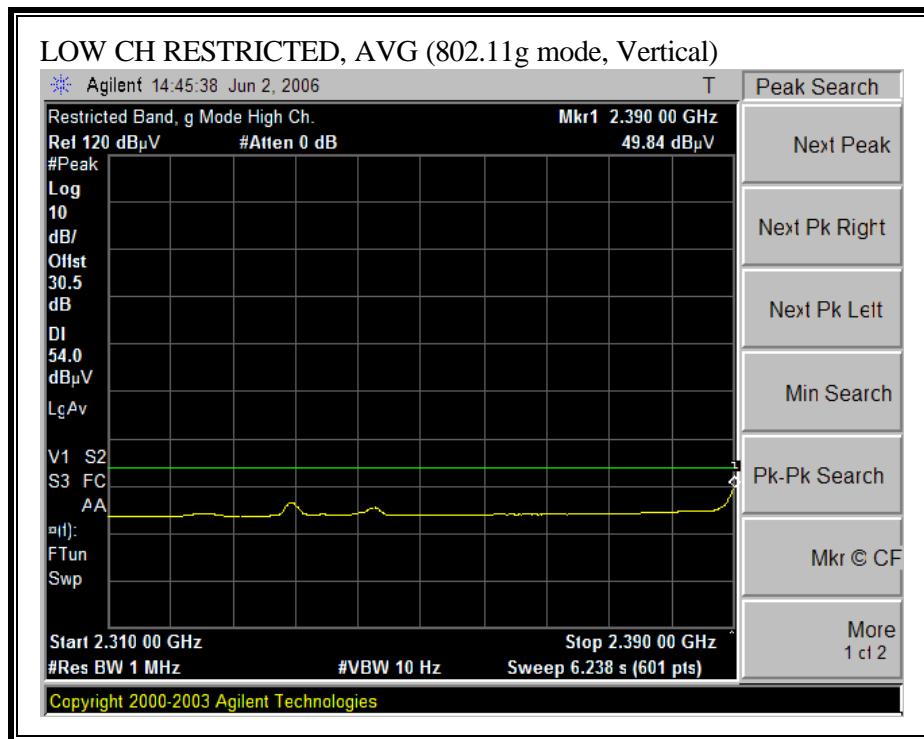
12 dBi SECTOR ANTENNA





RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, VERTICAL)





RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, HORIZONTAL)

