



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

FOR

802.11B/G WIRELESS ROUTER

MODEL NUMBER: WGR614v3 and WGT624v2

FCC ID: PY3WGR614V3

REPORT NUMBER: 03U2205-1

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Prepared for
**NETGEAR INC.
4500 GREAT AMERICA PARKWAY
SANTA CLARA
CA 95054, USA**

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LAB CODE:200065-0

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1. TEST RESULT CERTIFICATION

COMPANY NAME: NETGEAR INC.
4500 GREAT AMERICA PARKWAY
SANTA CLARA, CA 95054, USA

EUT DESCRIPTION: 802.11b/g wireless router

MODEL: WGR614v3 and WGT624v2

DATE TESTED: AUGUST 14 – SEPTEMBER 3, 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.

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2. EUT DESCRIPTION

The EUT is an 802.11b/g wireless router.

The EUT has a maximum peak output power of 25.25 dBm (335 mW) and an antenna gain of 1.8 dBi in the 2400 - 2483.5 MHz band. It is designed to be used with a single external dipole antenna.

WGT624v2 and WGR614v3 share exactly the same PCB layout, use exactly the same RF circuitry, the same antenna with the same output power from the same manufacturer. The only difference between the two models is as below:

- (1) In firmware, WGT624 has added packet bursting, compression, and fast frame mechanisms. The original hardware is already certified for channel bonding (also called Turbo mode by Atheros). The final Atheros firmware would allow dynamic bonding, which means that the AP/router would negotiate with the client Card to see if the client card supports channel bonding and.
- (2) Due to the added firmware, the hardware has to be upgraded from 2Mbyte Flash and 8Mbyte SDRAM to 4Mbyte Flash and 16Mbyte SDRAM .

The project was subcontracted by Netgear through Atheros. The references in all the plots are applicable to the Netgear products.

The circuit board assembly includes two RF output connectors, however only one is utilized. The circuit board assembly also includes a printed antenna at the auxiliary RF output connector, however this antenna is not used. A 50 ohm termination resistor is installed at the auxiliary RF output. The external antenna is connected to the main RF output connector.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/1992, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

4. FACILITIES AND ACCREDITATION

The open area test sites and conducted 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 C63.7, ANSI C63.4 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 measurement instruments utilized to perform the tests documented in this report have been calibrated in accordance with the manufacturer's recommendations, and are traceable to national standards.

5.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

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 AND MEASUREMENT EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due Date
Quasi-Peak Adapter	HP	85650A	2521A01038	7/16/2004
SA Display Section	HP	85662A	2314A04793	7/16/2004
SA RF Section	HP	85680A	2314A02604	7/16/2004
Preamplifier	HP	8447D	2944A06833	8/22/2003
Antenna, Biconical	Eaton	94455-1	1214	3/6/04
Antenna, Log Periodic	EMCO	3146	9107-3163	3/06/04
EMI Test Receiver	R & S	ESHS 20	827129/006	7/17/2004
LISN, 10 kHz ~ 30 MHz	FCC	50/250-25-2	114	9/6/2003
Spectrum Analyzer	AGILENT	E4446A	US42070220	1/13/04
Pre-amplifier	MITEQ	NSP2600-SP	924341	4/25/04
Horn Antenna	EMCO	3115	6717	2/4/04
Power Meter	AGILENT	E4416A	0841291160	11/7/04
Power Sensor	Agilent	E9327A	US40440755	08/09/03
Antenna, Biconical	Eaton	94455-1	1214	3/6/04
Antenna, Log Periodic	EMCO	3146	9107-3163	3/06/04
Preamplifier	Miteq	NSP10023988	646456	4/26/04
High Pass Filter (4.57GHz)	FSY Microwave	FM-4570-9SS	003	N.C.R.

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

Device Type	Manufacturer	Model Number	Serial Number	FCC ID
Laptop	Toshiba	NA	J291200E8019	Doc
Power Adapter	Toshiba	PA3083U-1ACA	0536906G	Doc
5V DC power adapter	Switching Adapter	RHC-060200-1	0319	DOC

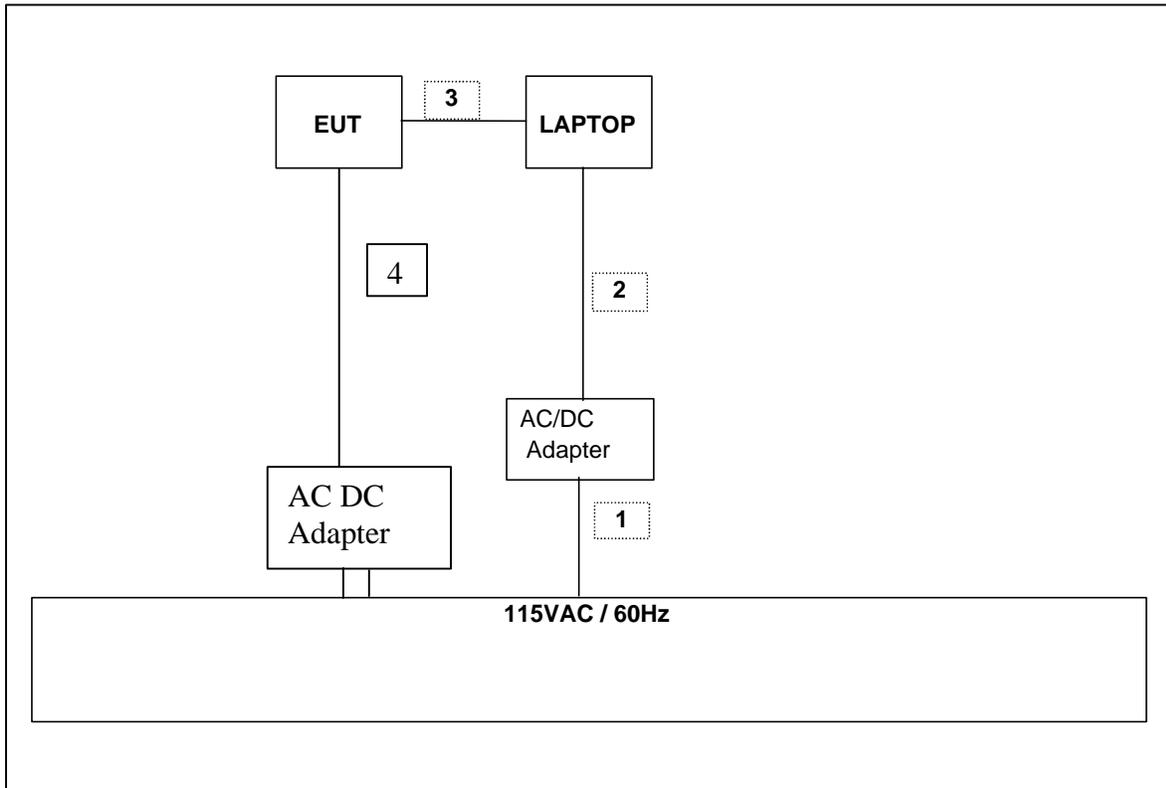
I/O CABLES

Cable No	I/O Port	# of I/O Port	Connector Type	Type of Cable	Cable Length	Data Traffic	Bundled	Remark
1	AC	2	US 115V	Un-shielded	1m	No	No	N/A
2	DC	1	DC	Un-shielded	1m	No	No	N/A
3	Ethernet	1	RJ45	Un-shielded	3m	Yes	Yes	N/A
4	DC	1	DC	Un-shielded	1m	No	No	Integrated with Adapter

TEST SETUP

The EUT was controlled by the laptop via Ethernet cable.

SETUP DIAGRAM



SETUP FOR DIGITAL DEVICE TESTS

SUPPORT EQUIPMENT

Device Type	Manufacturer	Model Number	Serial Number	FCC ID
Laptop	Toshiba	NA	J291200E8019	Doc
Power Adapter	Toshiba	PA3083U-1ACA	0536906G	Doc
5V DC power adapter	Switching Adapter	RHC-060200-1	0319	DOC
MODEM	ACEEX	1414	9013537	IFAXDM1414
PRINTER	HP	2225C	2541S41679	BS46XU2225C
Mouse	Microsoft	Intelemouse	63618-OEM-6345201	DoC
Mouse	Microsoft	Intelemouse	63618-OEM-6345201	DoC

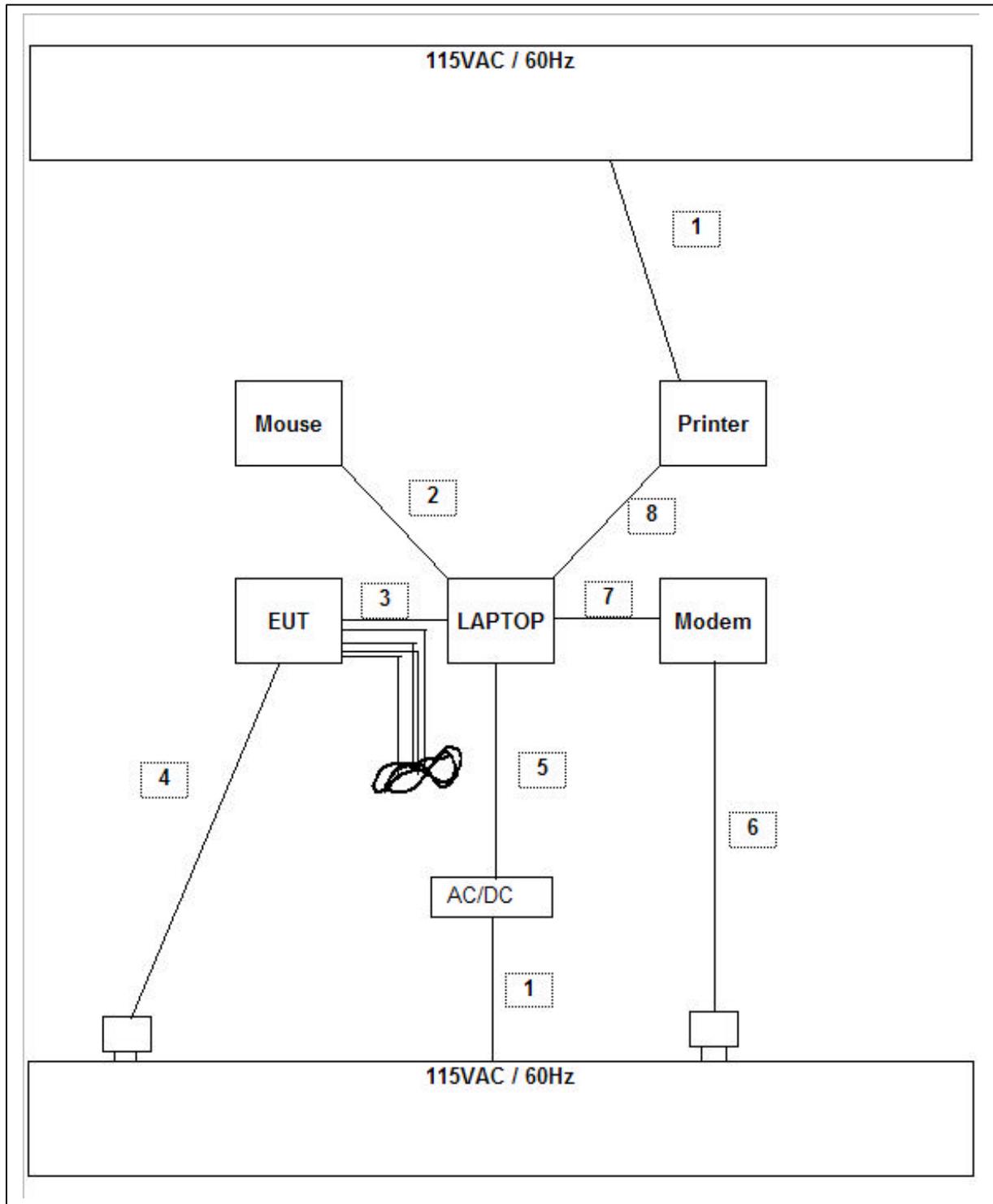
I/O CABLES

Cable No	I/O Port	# of I/O Port	Connector Type	Type of Cable	Cable Length	Data Traffic	Bundled	Remark
1	AC	2	US 115V	Un-shielded	1m	No	No	N/A
2	PS2		PS2	Un-shielded	2m	No	No	N/A
3	Ethernet	5	RJ45	Un-shielded	3m	Yes	Yes	N/A
4	DC	1	DC	Un-shielded	1m	No	No	Integrated with Adapter
5	DC	1	DC	Un-shielded	2m	No	No	N/A
6	DC	1	DC	Un-shielded	1m	No	No	Integrated with Adapter
7	Serial	1	DB9	Shielded	1m	Yes	No	N/A
8	Parallel	1	DB25	Shielded	2m	Yes	Yes	N/A

TEST SETUP

The EUT was controlled by the laptop via Ethernet cable.

SETUP DIAGRAM FOR DIGITAL DEVICE TESTS



7. APPLICABLE LIMITS AND TEST RESULTS

7.1. 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 100 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	12000	500	11500
Middle	2437	12000	500	11500
High	2462	12000	500	11500

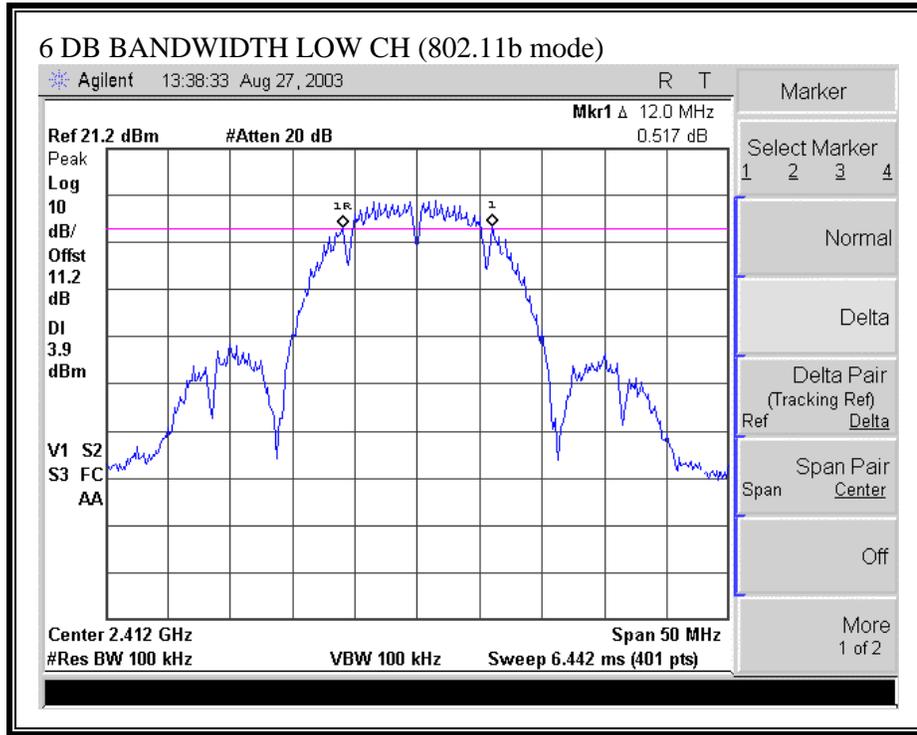
802.11g Normal Mode

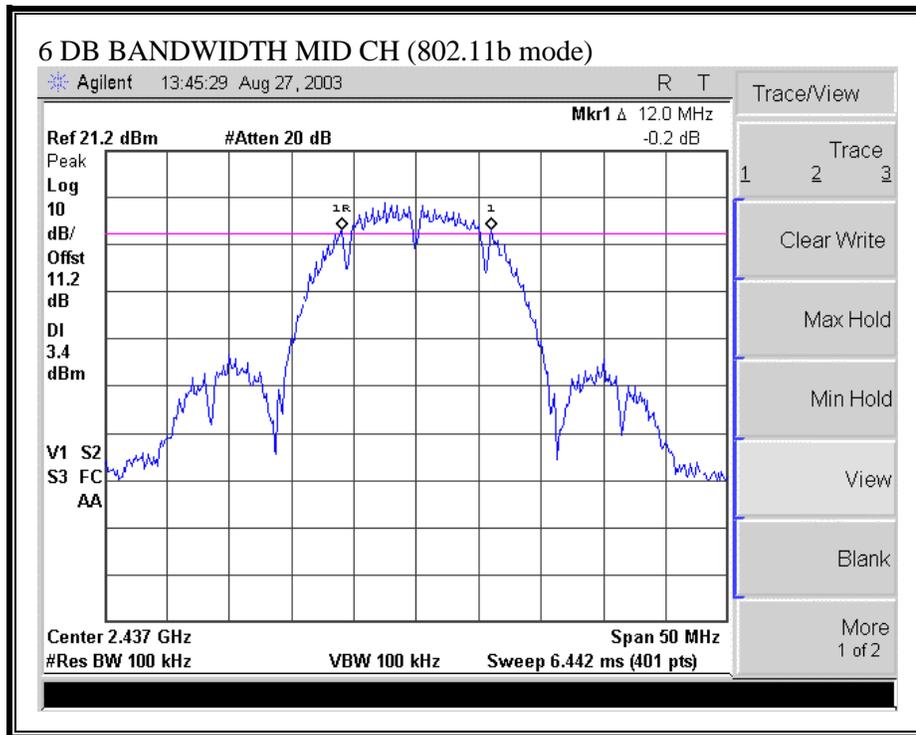
Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2412	16400	500	15900
Middle	2437	16300	500	15800
High	2462	16400	500	15900

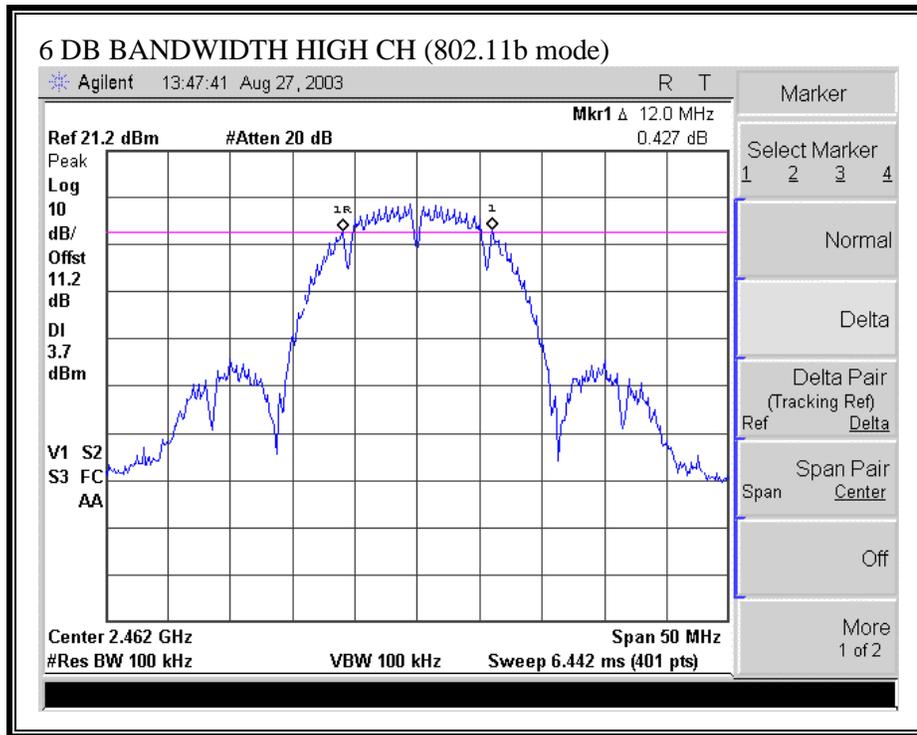
802.11g Turbo Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Middle	2437	31500	500	31000

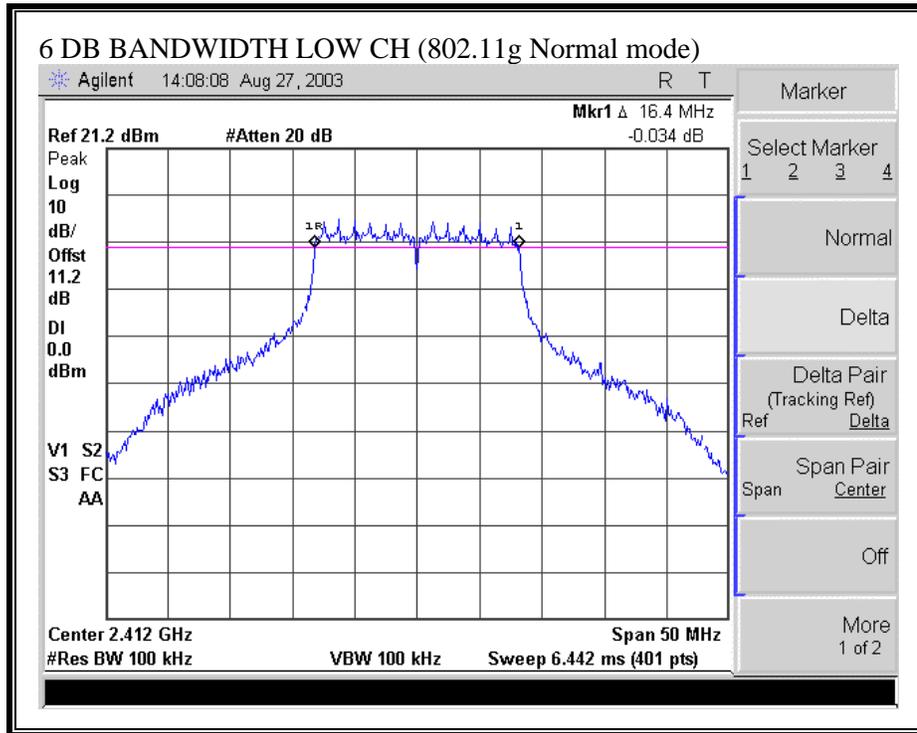
6 DB BANDWIDTH (802.11b MODE)

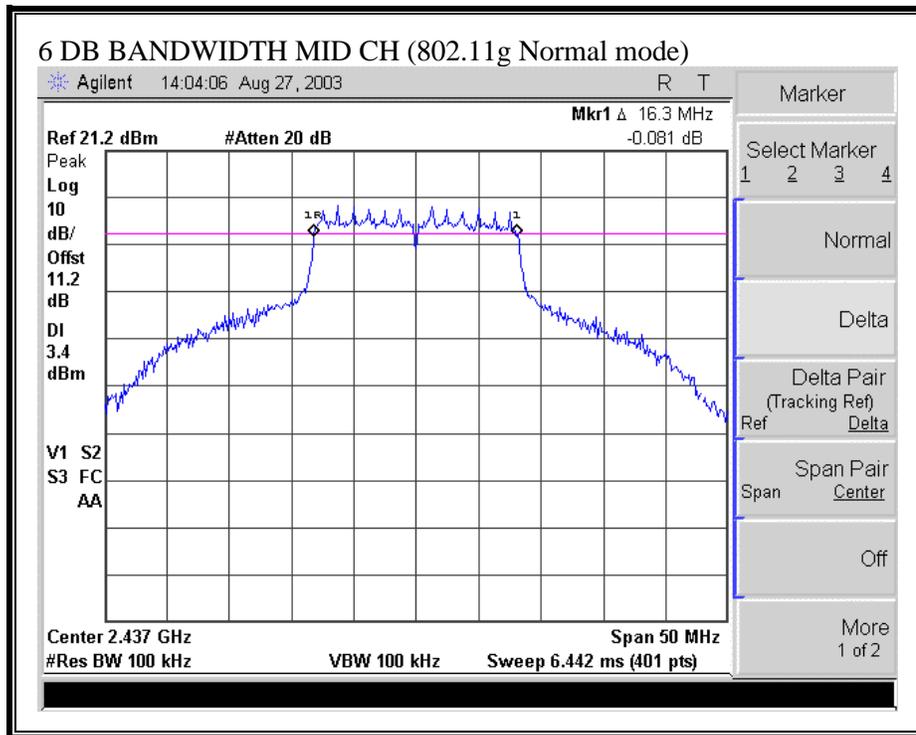


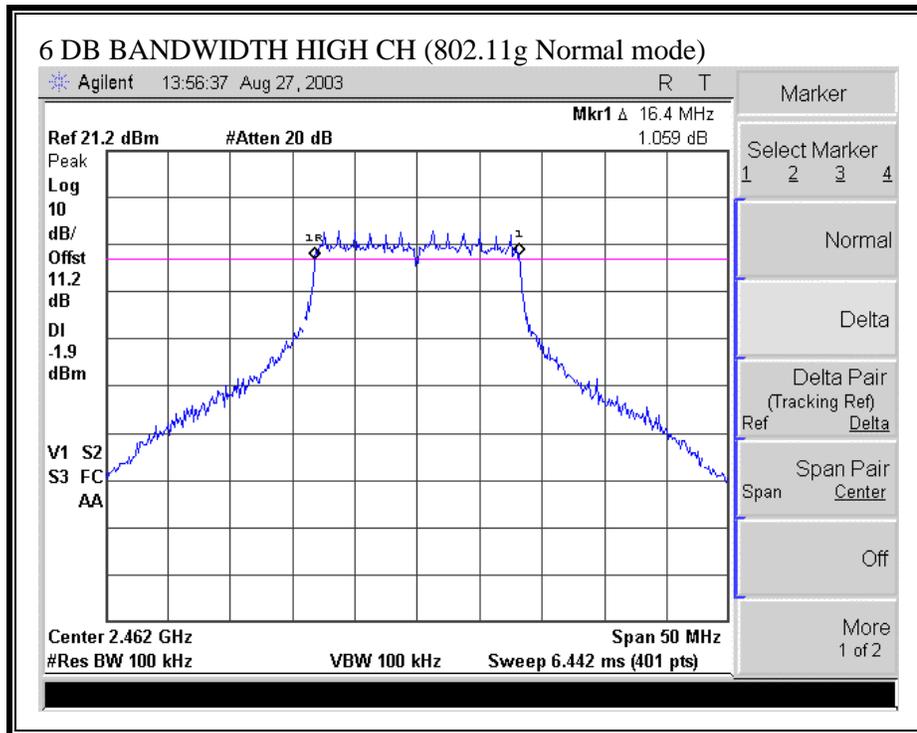




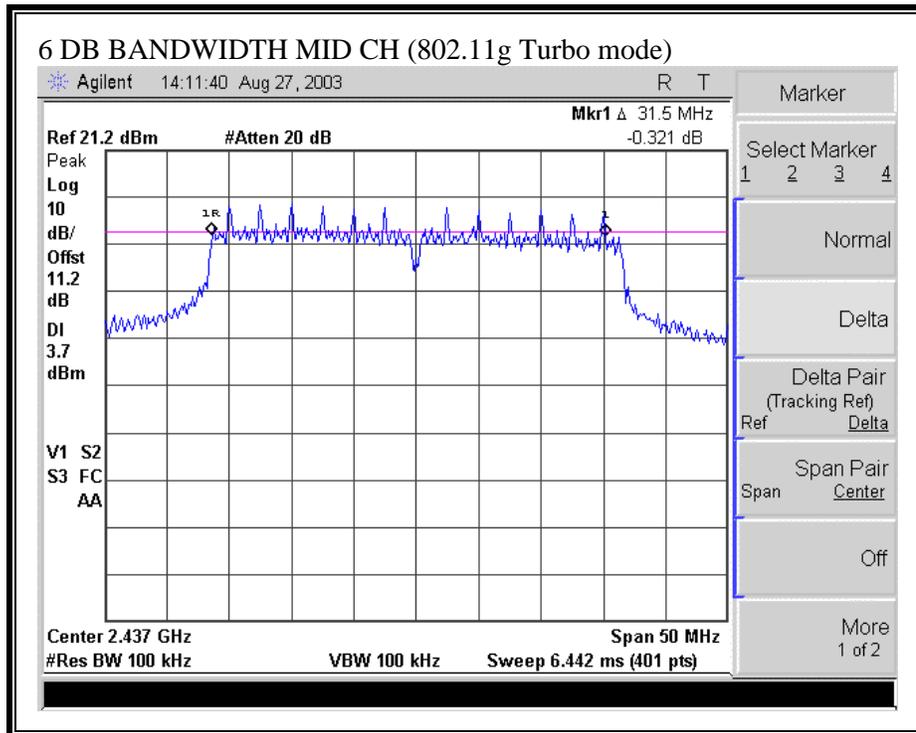
6 DB BANDWIDTH (802.11g NORMAL MODE)







6 DB BANDWIDTH (802.11g TURBO MODE)



7.2. 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	15.474
Middle	2437	15.824
High	2462	15.935

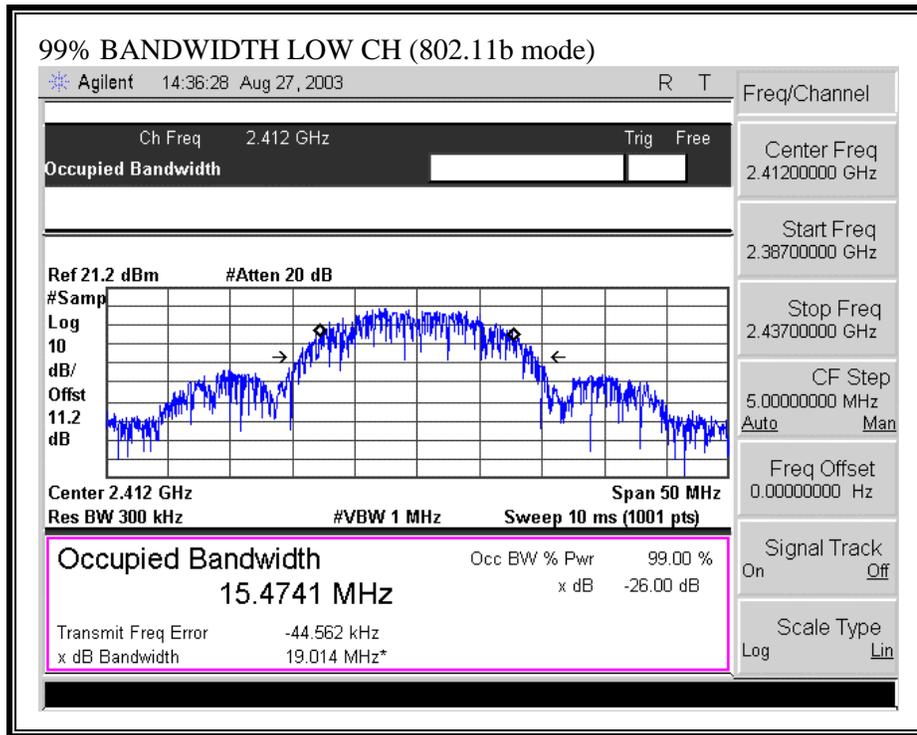
802.11g Normal Mode

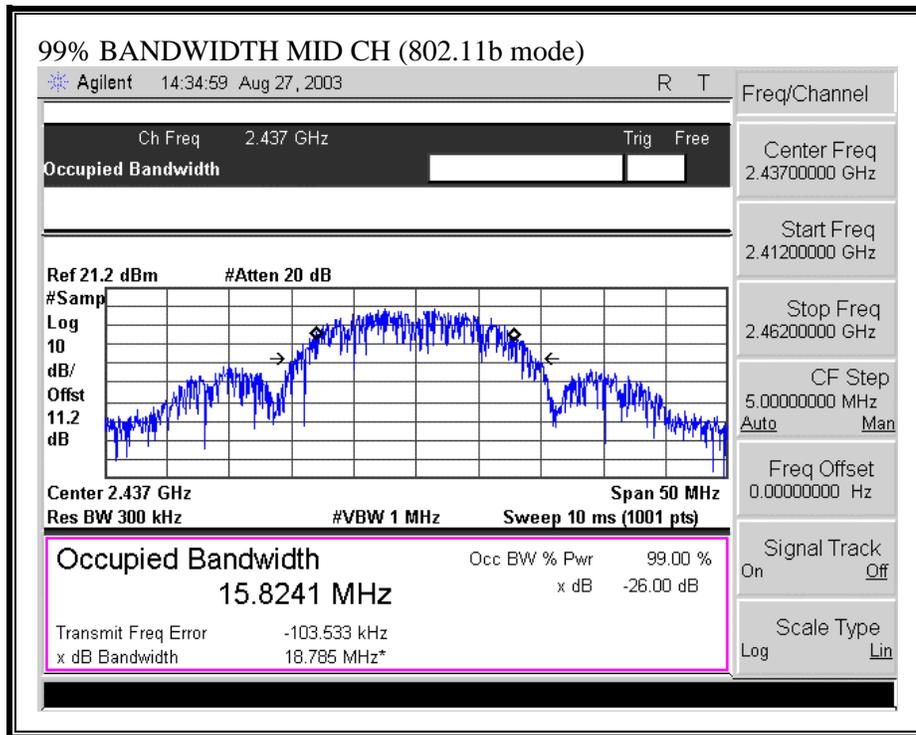
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.626
Middle	2437	16.687
High	2462	16.507

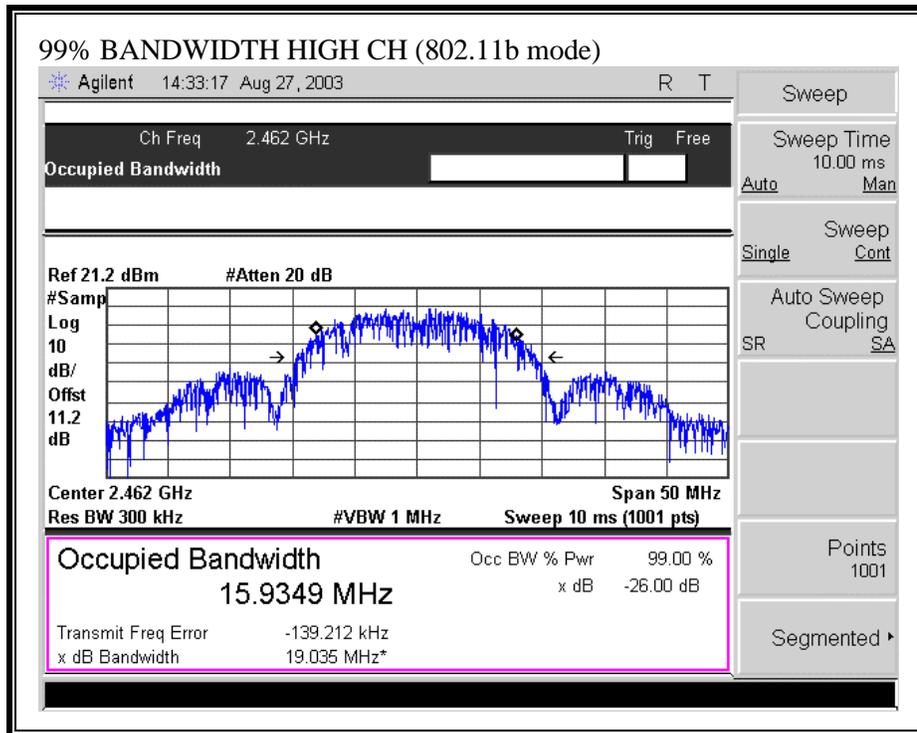
802.11g Turbo Mode

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Middle	2437	33.799

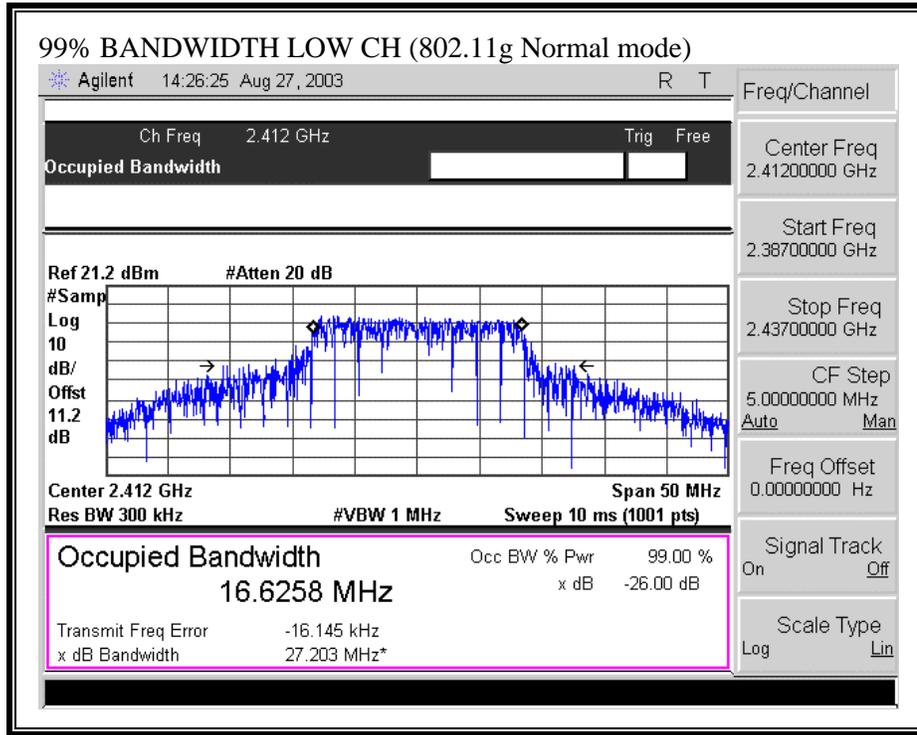
99% BANDWIDTH (802.11b MODE)

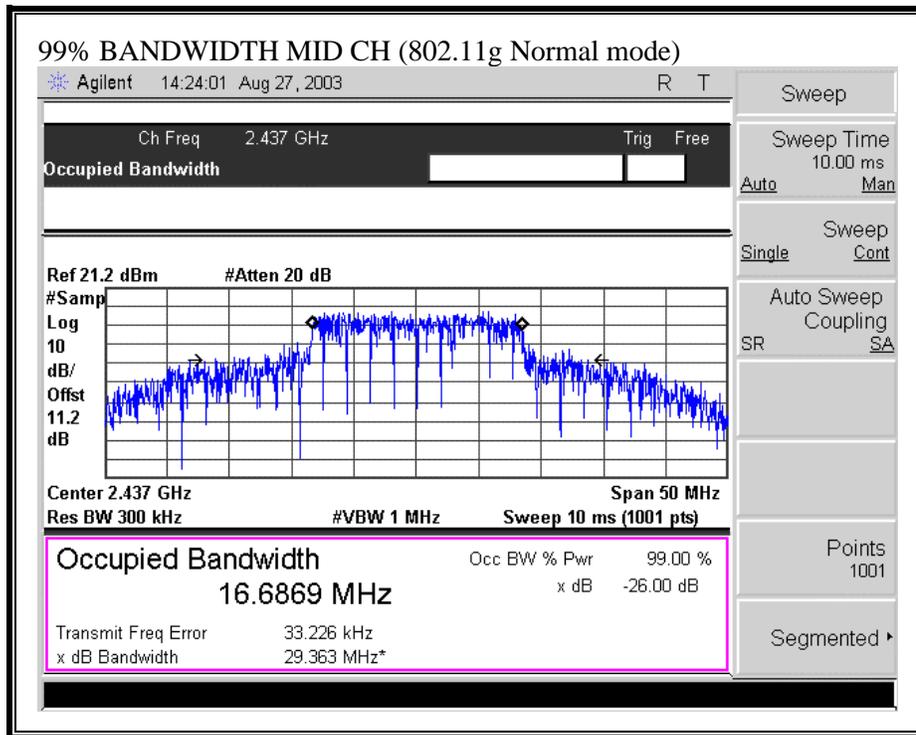


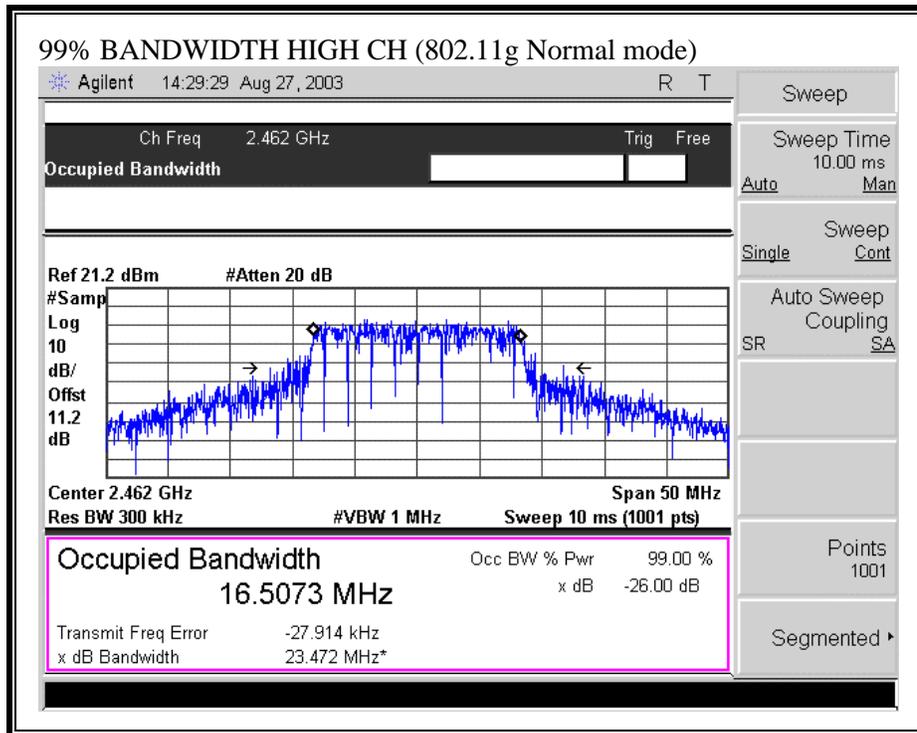




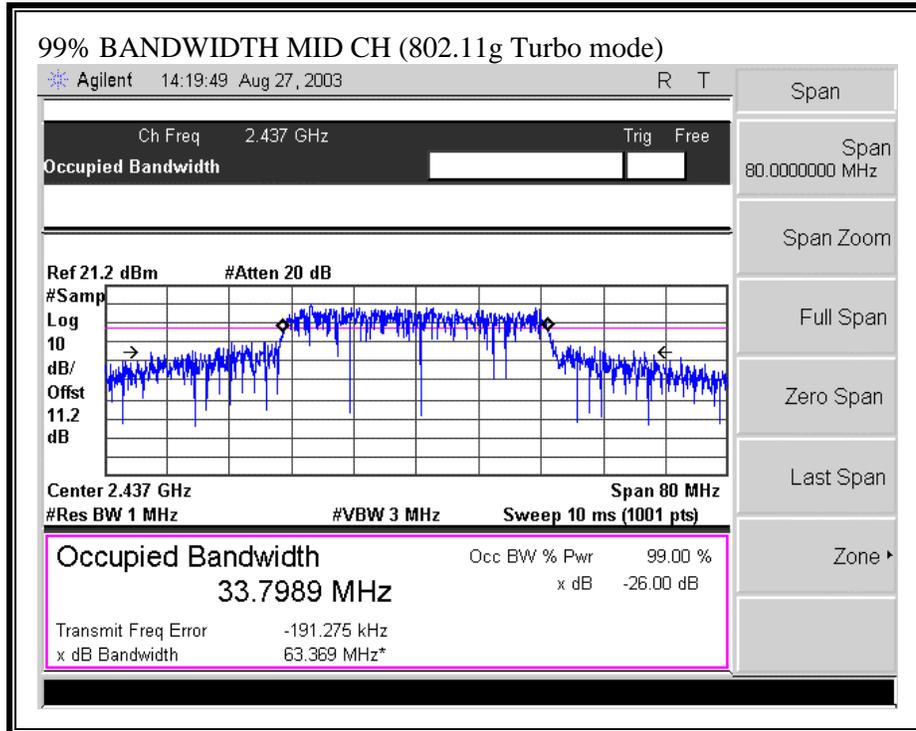
99% BANDWIDTH (802.11g NORMAL MODE)







99% BANDWIDTH (802.11g TURBO MODE)



7.3. 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.

The maximum antenna gain is 1.8 dBi, therefore the limit is 30 dBm.

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

No non-compliance noted:

802.11b Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	23.24	30	-6.76
Middle	2437	23.41	30	-6.59
High	2462	23.19	30	-6.81

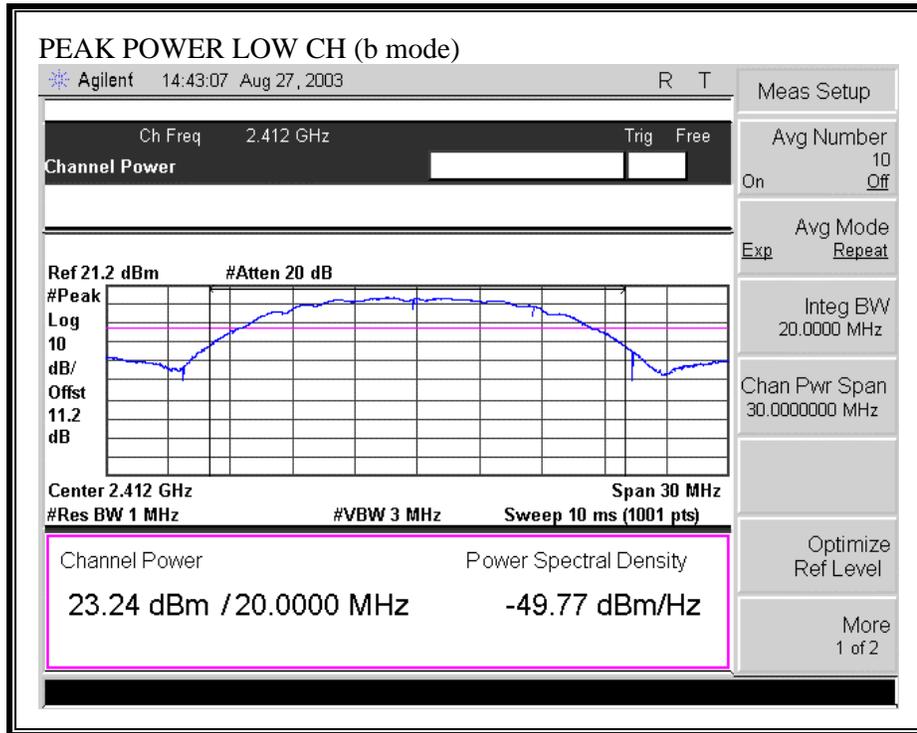
802.11g Normal Mode

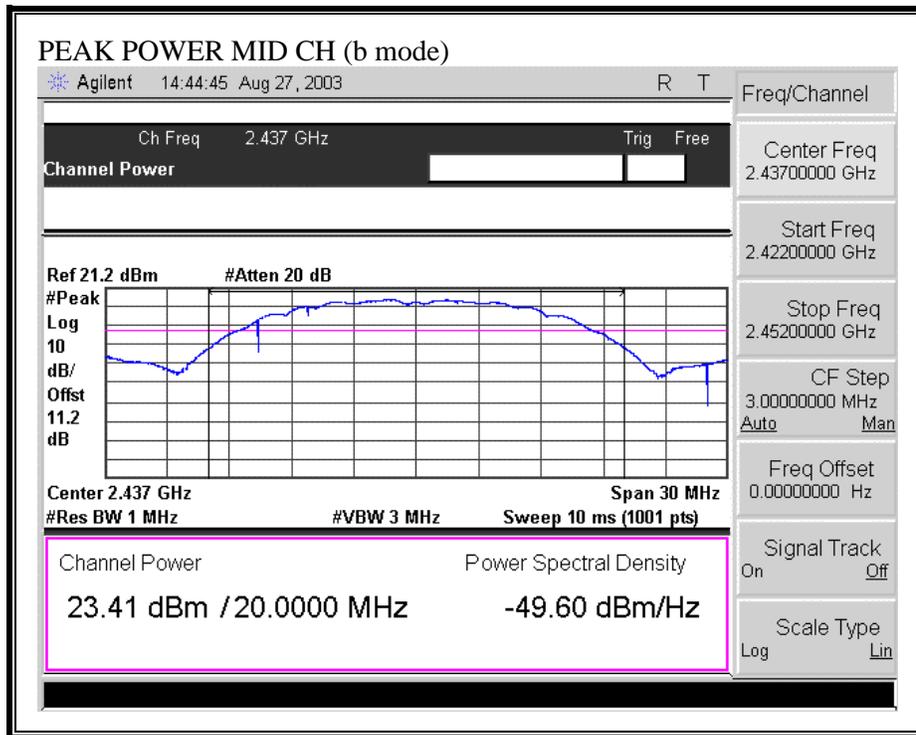
Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	22.24	30	-7.76
Middle	2437	25.25	30	-4.75
High	2462	21.15	30	-8.85

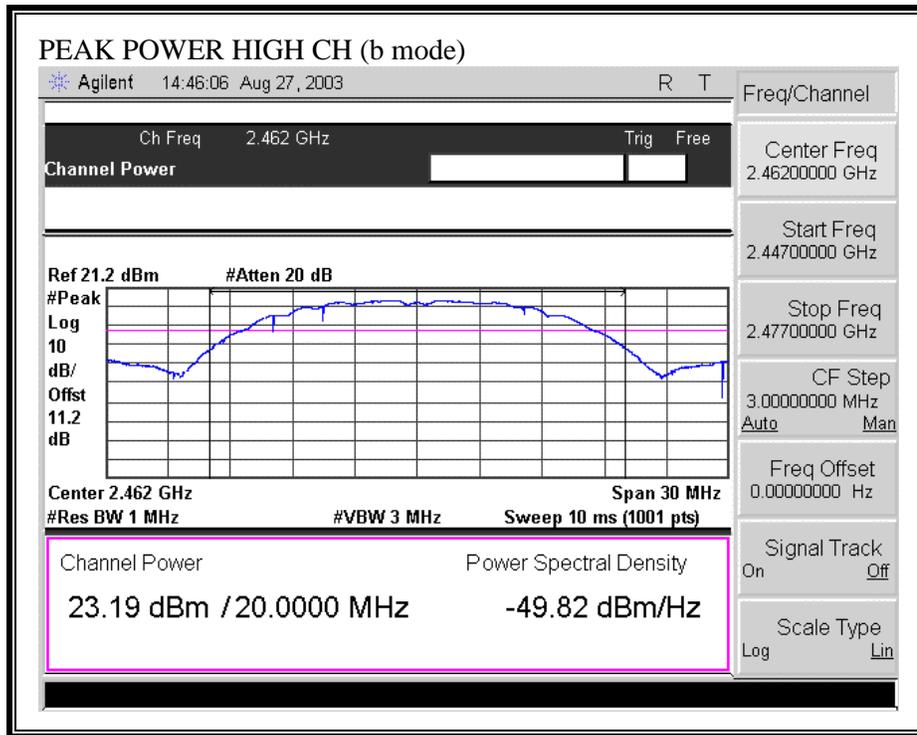
802.11g Turbo Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Middle	2437	23.94	30	-6.06

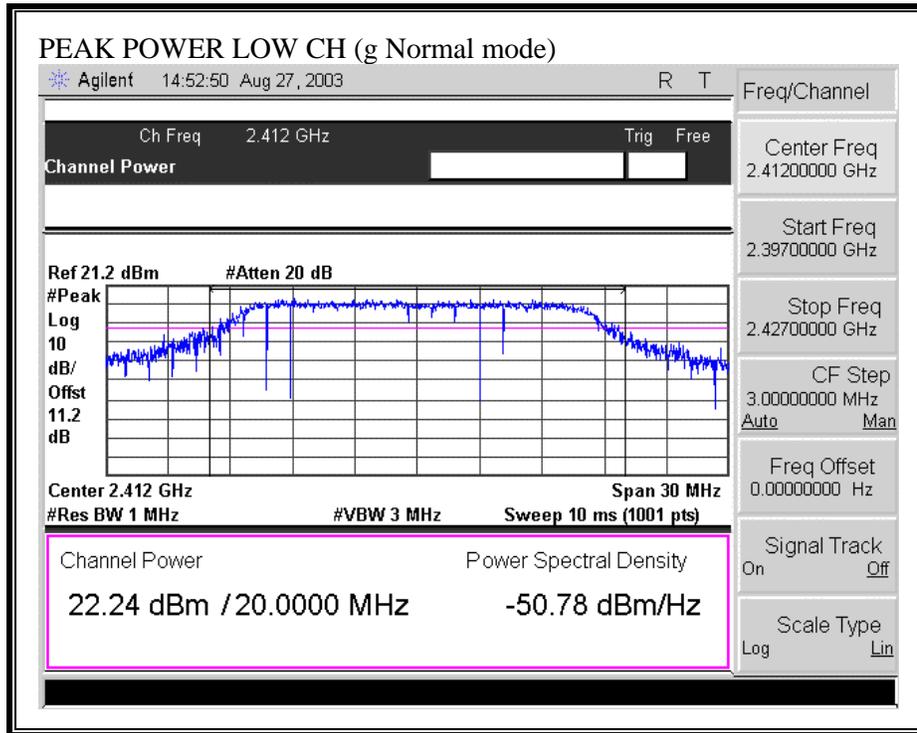
OUTPUT POWER (802.11b MODE)

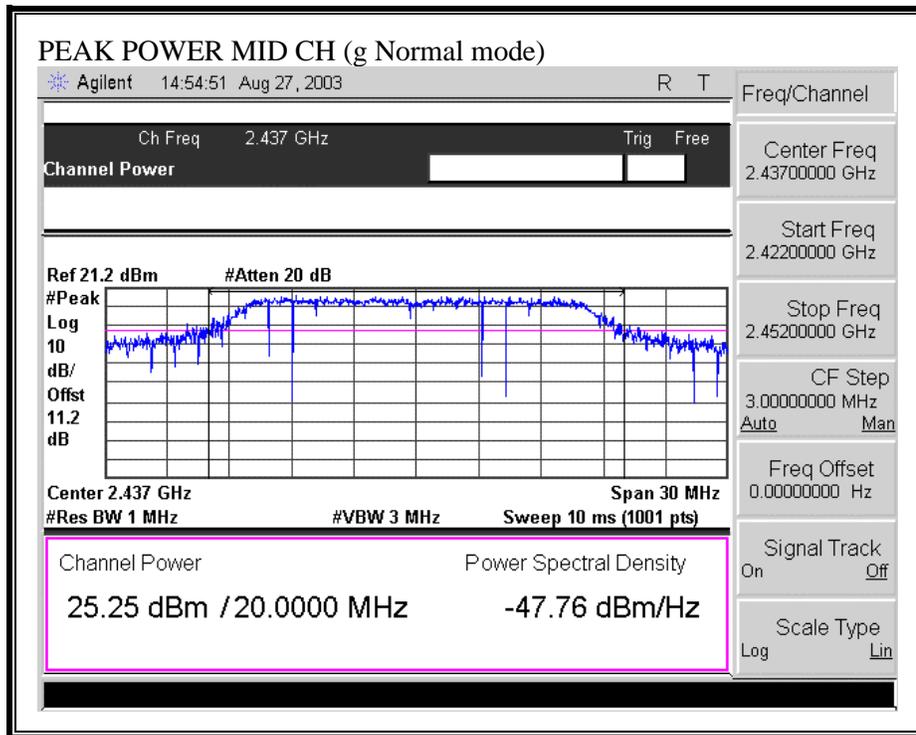


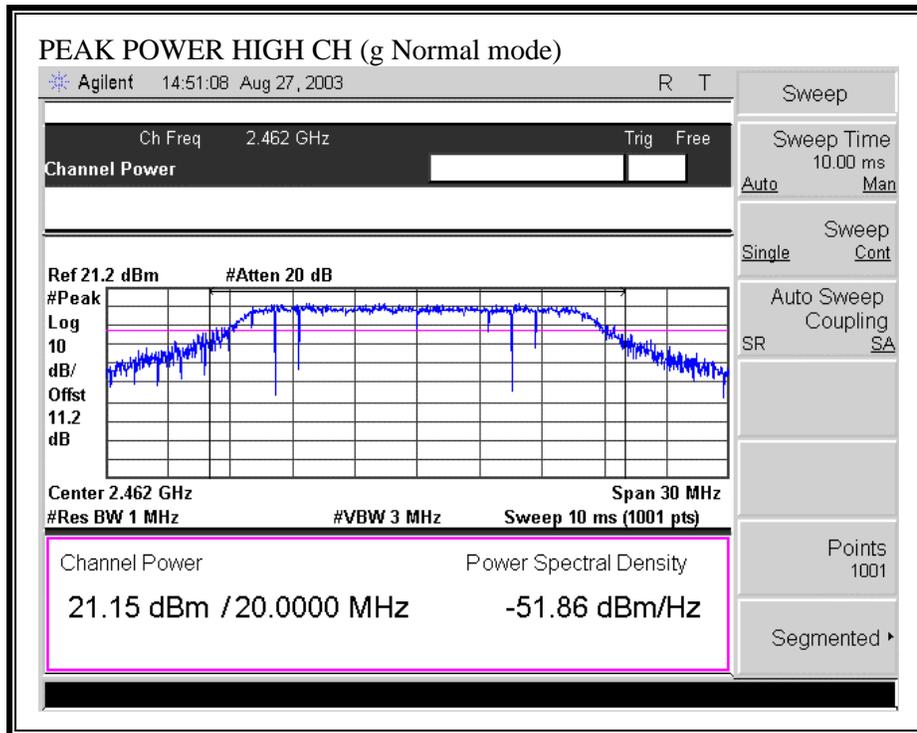




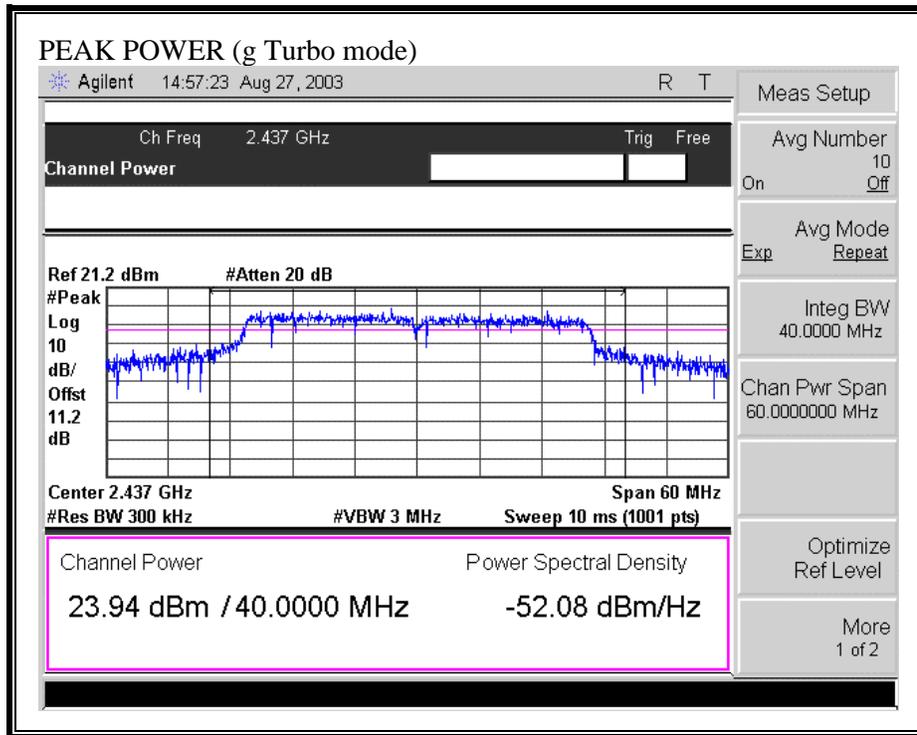
OUTPUT POWER (802.11g NORMAL MODE)







OUTPUT POWER (802.11g TURBO MODE)



7.4. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

§15.247 (b) (5) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See §1.1307(b)(1) of this chapter.

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 mW and 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:

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

yields

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

where

- d = MPE distance in cm
- P = Power in dBm
- G = Antenna Gain in dBi
- S = Power Density Limit in mW / cm²

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

LIMITS

S = 1.0 mW / cm² from 1.1310 Table 1

RESULTS

No non-compliance noted:

Mode	Power Density Limit (mW/cm ²)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
802.11b	1.0	23.41	1.80	5.14
802.11g Normal	1.0	25.25	1.80	6.35
802.11g Turbo	1.0	23.94	1.80	5.46

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.

7.5. 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 dB (including 20 dB pad and 0 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

802.11b Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	2412	20.26
Middle	2437	20.07
High	2462	20.14

802.11g Normal Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	2412	16.91
Middle	2437	20.15
High	2462	15.94

802.11g Turbo Mode

Channel	Frequency (MHz)	Average Power (dBm)
Middle	2437	20.20

7.6. 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 transmitter output is connected to a spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = 3 kHz and VBW > 3 kHz, sweep time = span / 3 kHz, and video averaging is turned off. The PPSD is the highest level found across the emission in any 3 kHz band.

RESULTS

No non-compliance noted:

802.11b Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-2.79	8	-10.79
Middle	2437	-3.30	8	-11.30
High	2462	-2.76	8	-10.76

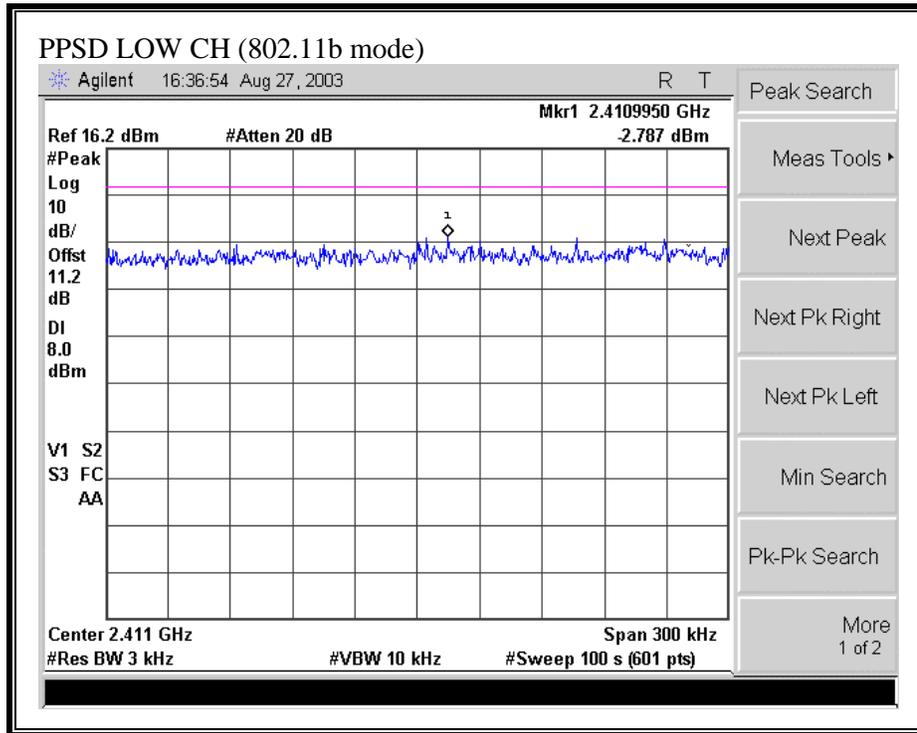
802.11g Normal Mode

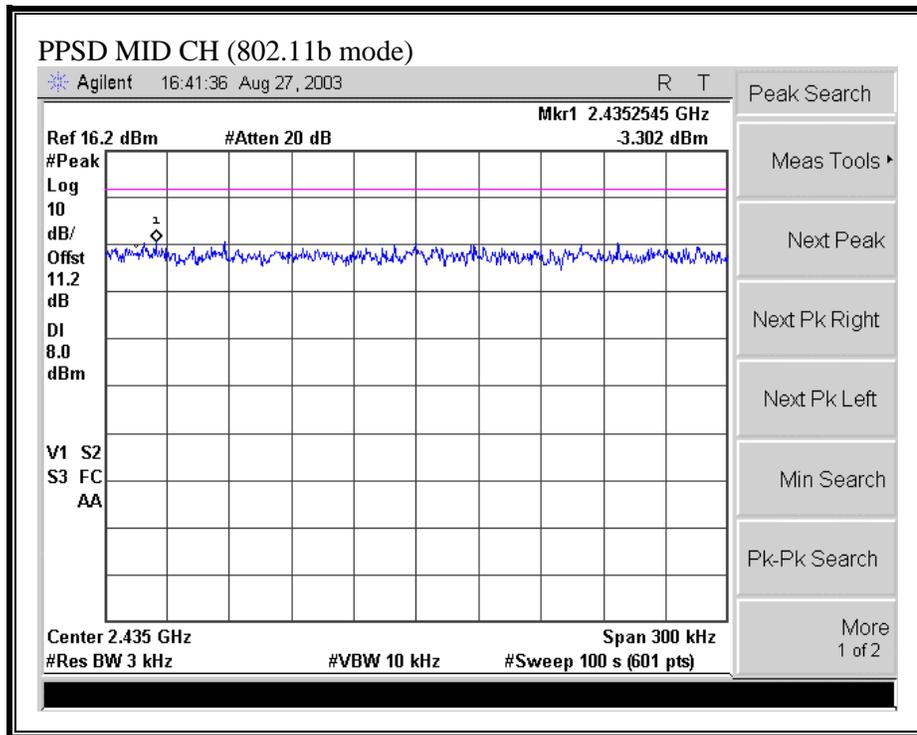
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-7.27	8	-15.27
Middle	2437	-1.32	8	-9.32
High	2462	-7.65	8	-15.65

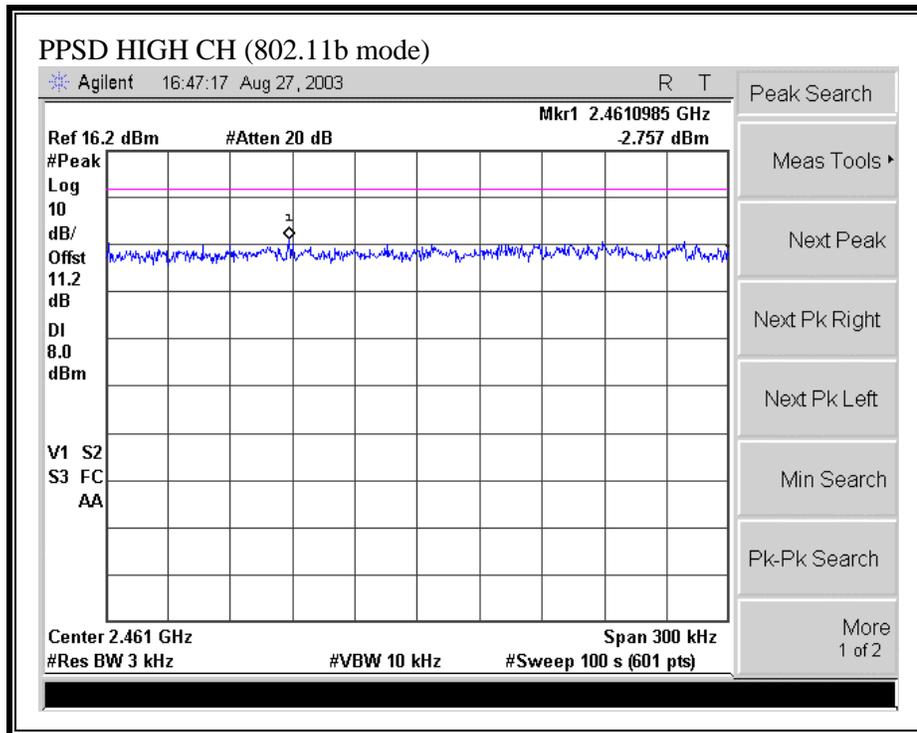
802.11g Turbo Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Middle	2437	-1.75	8	-9.75

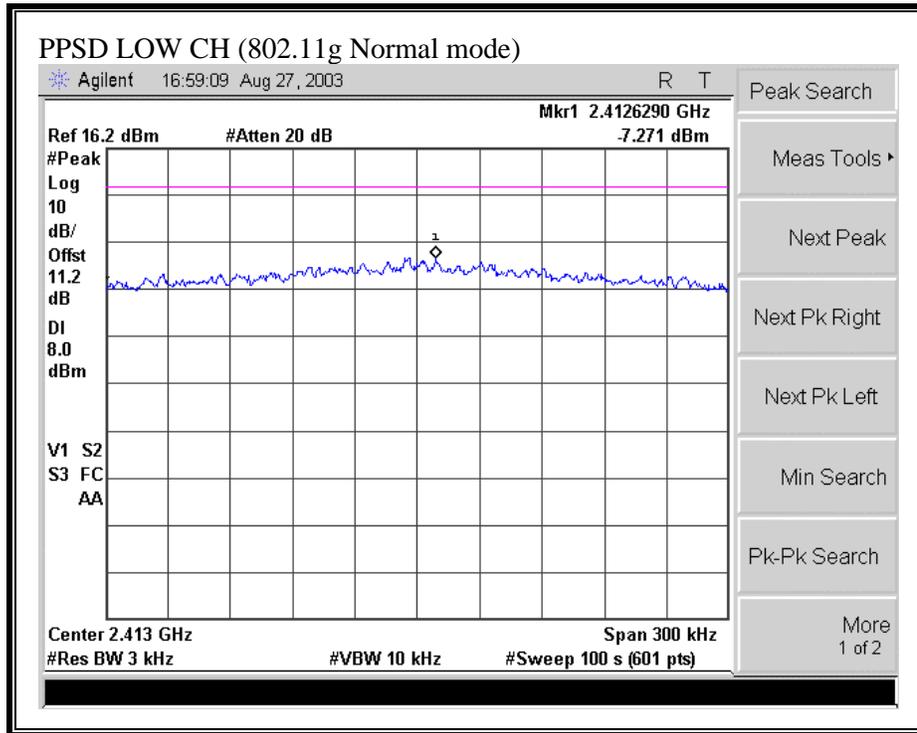
PEAK POWER SPECTRAL DENSITY (802.11b MODE)

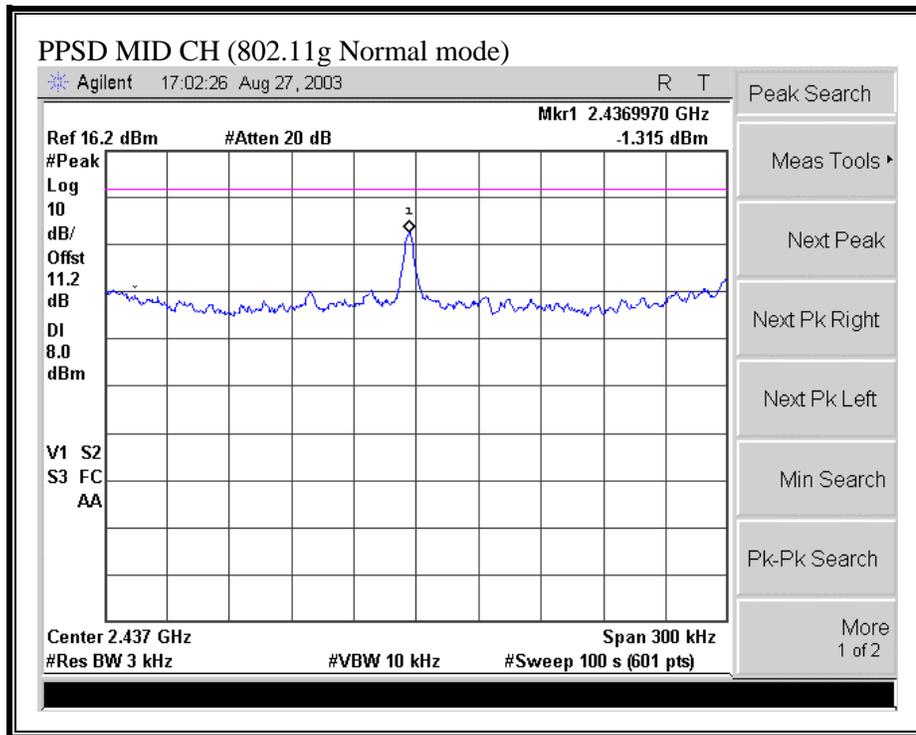


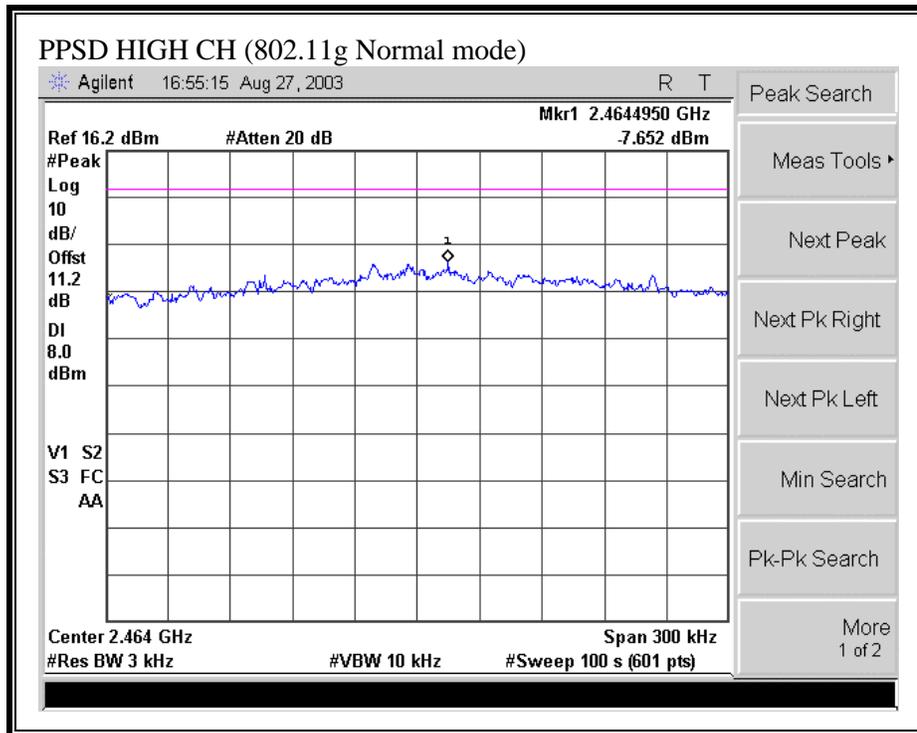




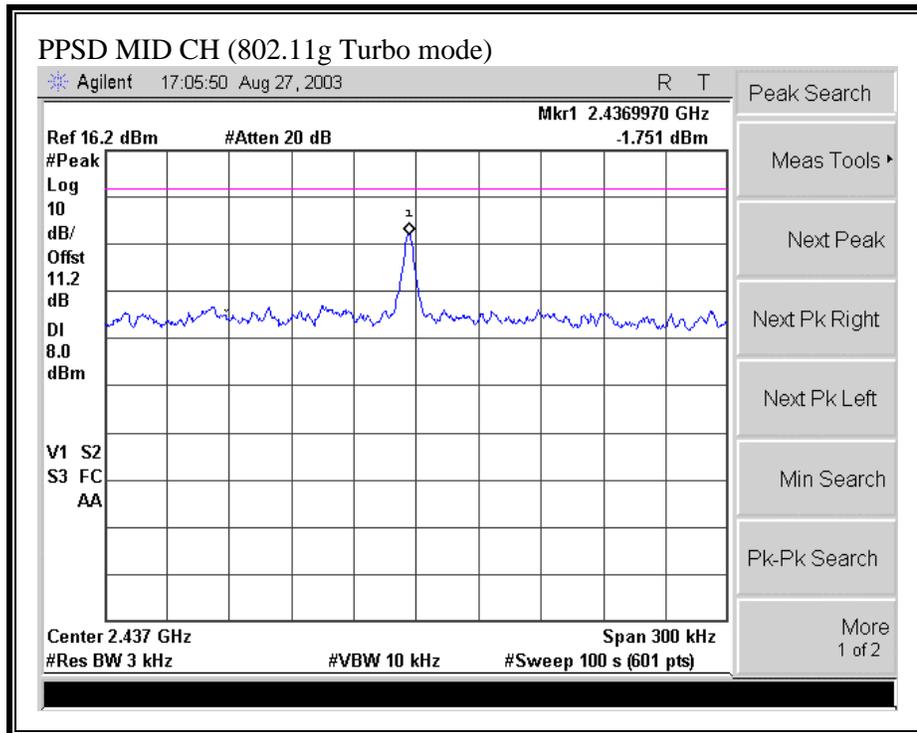
PEAK POWER SPECTRAL DENSITY (802.11g NORMAL MODE)







PEAK POWER SPECTRAL DENSITY (802.11g TURBO MODE)



7.7. 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)).

TEST PROCEDURE

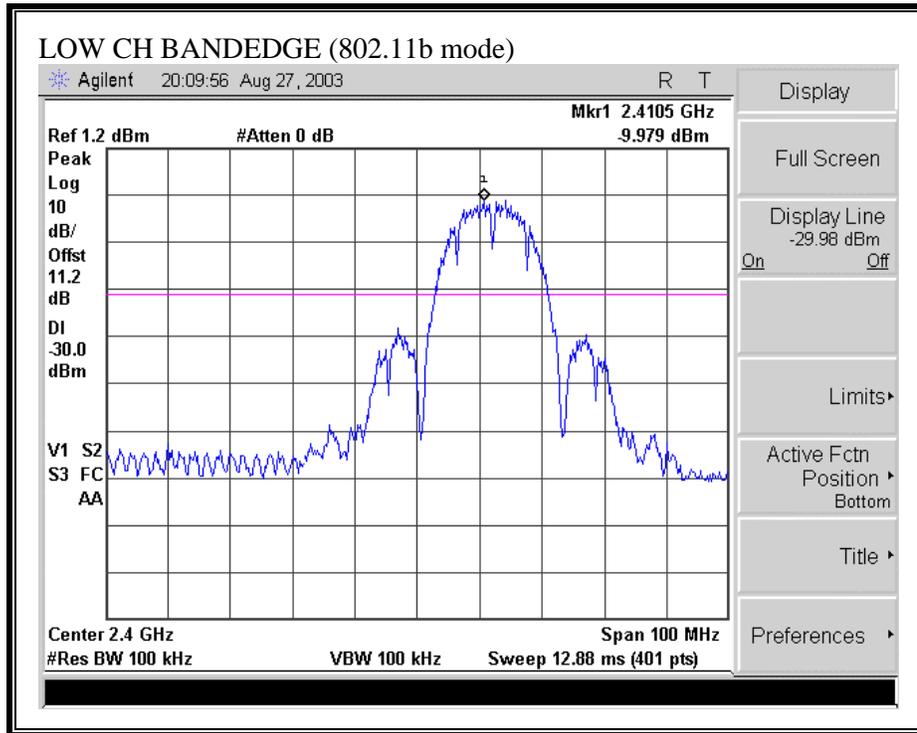
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

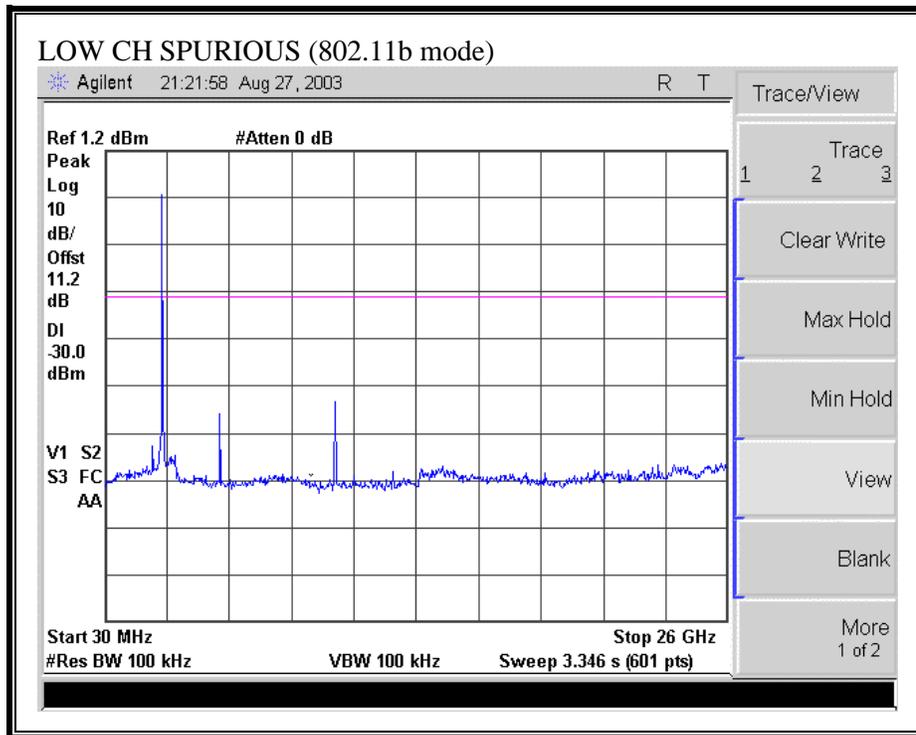
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

No non-compliance noted:

SPURIOUS EMISSIONS, LOW CHANNEL (802.11b MODE)





SPURIOUS EMISSIONS, MID CHANNEL (802.11b MODE)

