



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

FOR

802.11 a/b/g MINI PCI MODULE

MODEL NUMBER: PH1117-E & PH12127-E

BRAND NAME: PHILIPS

FCC ID: PUBWCM1010

REPORT NUMBER: 03U2040-1

ISSUE DATE: JUNE 26TH, 2003

Prepared for
**ACCTON AND PHILIPS WIRELESS NETWORKING
1962 ZANKER ROAD
SAN JOSE, CA 95122, U.S.A**

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1. TEST RESULT CERTIFICATION

COMPANY NAME: ACCTON AND PHILIPS WIRELESS NETWORKING
1962 ZANKER ROAD
SAN JOSE, CALIFORNIA 95122 U.S.A

EUT DESCRIPTION: 802.11 a/b/g MINI PCI MODULE

MODEL: PH1117-E & PH12127-E

MODEL DIFFERENCE: The two models are identical. Two model names are for marketing Purposes only.

DATE TESTED: JUNE 9 – JUNE 26, 2003

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

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

Note: This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.

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

Approved & Released For CCS By:

Tested By:



MIKE HECKROTTE
CHIEF ENGINEER
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VEIN TRAN
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. EUT DESCRIPTION

The Philips PH1117-E is a high performance 802.11 a/b/g WLAN client product intended for a laptop application. The difference between PH1117-E and PH12127 is model designation, which is for marketing purposes only.

The EUT uses two Dual Band F Type antennas for diversity operation. Each antenna is mounted in a laptop 15" LCD display. The Main antenna has a gain of +0.46 dBi in the 2.4 - 2.4835 GHz band, and a gain of -0.49 dBi in the 5.725 - 5.850 GHz band. The Auxiliary antenna has a gain of -1.06 dBi in the 2.4 - 2.4835 GHz band, and a gain of -0.12 dBi in the 5.725 - 5.850 GHz band. The peak output power is 20.58 dBm (114 mW) in the 2400 – 2483.5 MHz band and 20.47 dBm (111 mW) in the 5750 – 5825 MHz band.

For test purposes, the EUT is installed on a cardbus to Mini-PCI extender / adapter, which is subsequently installed in a laptop computer equipped with a cardbus slot and the appropriate radio testing software. The antennas are mounted in a separate LCD display.

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

4.1. FACILITIES AND EQUIPMENT

The open area test sites and conducted measurement facilities used to collect the radiated 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."

4.2. TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	 1300
Japan	VCCI	CISPR 22 Two OATS and one conducted Site	 R-1014, R-619, C-640
Norway	NEMKO	EN50081-1, EN50081-2, EN50082-1, EN50082-2, IEC61000-6-1, IEC61000-6-2, EN50083-2, EN50091-2, EN50130-4, EN55011, EN55013, EN55014-1, EN55104, EN55015, EN61547, EN55022, EN55024, EN61000-3-2, EN61000-3-3, EN60945, EN61326-1	 ELA 117
Norway	NEMKO	EN60601-1-2 and IEC 60601-1-2, the Collateral Standards for Electro-Medical Products. MDD, 93/42/EEC, AIMD 90/385/EEC	 ELA-171
Taiwan	BSMI	CNS 13438	 SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	 IC2324 A,B,C, and F

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 EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	2/4/2004
Amplifier 1-26GHz	MITEQ	NSP2600-SP	924341	4/25/2004
Amplifier 1-26GHz	MITEQ	NSP2600-SP	924342	4/25/2004
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	837990	9/6/2003
Line Filter	Lindgren	LMF-3489	497	CNR
LISN, 10 kHz ~ 30 MHz	FCC	50/250-25-2	114	9/6/2003
EMI Test Receiver	R & S	ESHS 20	827129/006	7/17/2004
PSA	AGILENT	E4446A	US42070220	1/13/2004
Peak Power Meter	AGILENT	E4416A	6B41291160	8/9/2003
Power Sensor	AGILENT	E9327A	US40440755	8/9/2003
EMI Test Receiver	HP	8542E	3942A00286	11/20/2003
RF Filter Section	HP	85420E	3705A00256	11/20/2003
Bilog Antenna	ARA	LPB-25201A	1185	3/6/2004
10dB Pad	WEINSCHEL	56-10	K16148	N/A
2.4-2.5 GHz Reject Filter	MICROTRONICS	BRM50702	1	N/A
5.725-5.875 GHz Reject Filter	MICROTRONICS	BRC13192	1	N/A

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Device Type	Manufacturer	Model	Serial Number	FCC ID
LAPTOP	IBM	THINKPAD A-30	N/A	DoC
AC ADAPTER	IBM	02K6744	11302K67442S1	N/A
LCD DISPLAY	N/A	N/A	N/A	N/A

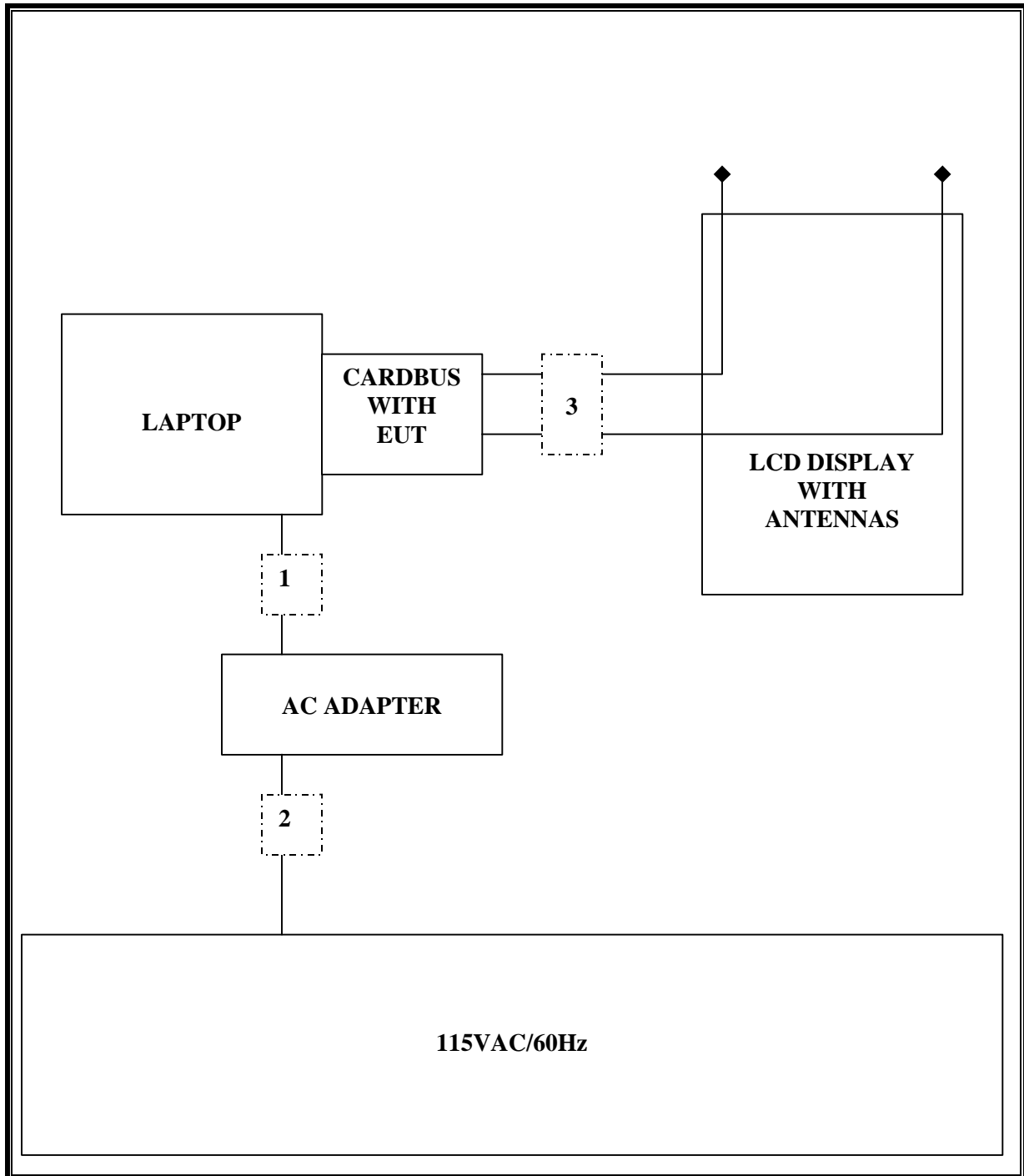
I/O CABLES

Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	PWR	1	DC PWR	UNSHIELDED	1.86M	N/A
2	PWR	1	AC PWR	UNSHIELDED	1.86M	N/A
3	ANTENNA	2	UFL	COAXIAL	0.1M	N/A

TEST SETUP

The EUT is connected to the laptop via a Cardbus-to-MiniPCI adapter / extender and the antennas are mounted within an external LCD laptop display.

SETUP DIAGRAM



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.

2.4 GHZ BAND RESULTS

No non-compliance noted:

802.11b Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2412	11080	500	10580
Middle	2437	12580	500	12080
High	2462	11330	500	10830

802.11g Normal Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2412	16500	500	16000
Middle	2437	16500	500	16000
High	2462	16500	500	16000

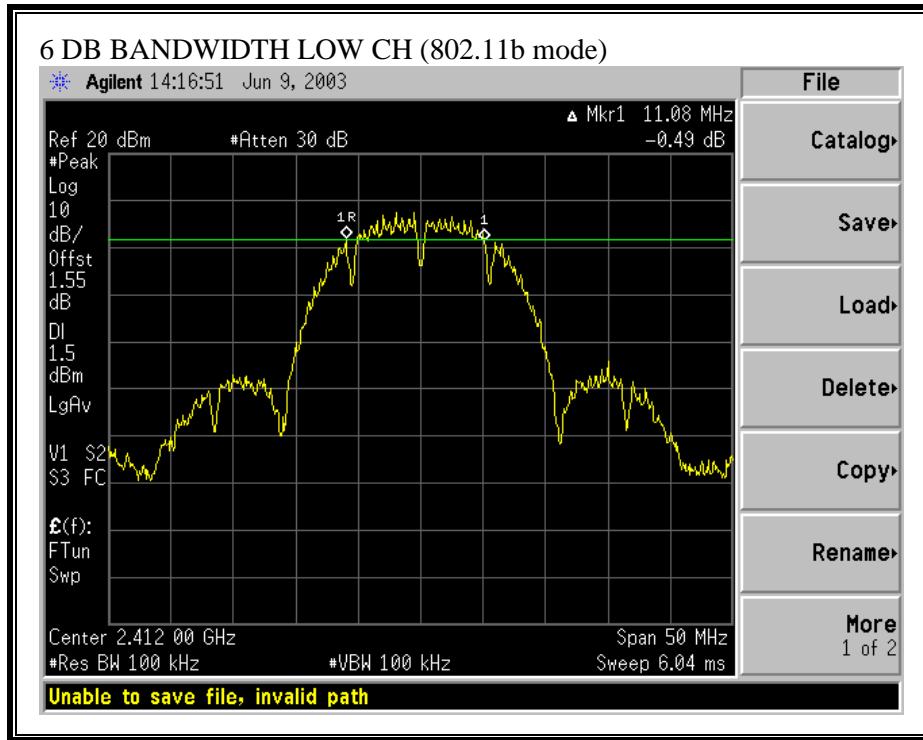
5.8 GHz BAND RESULTS

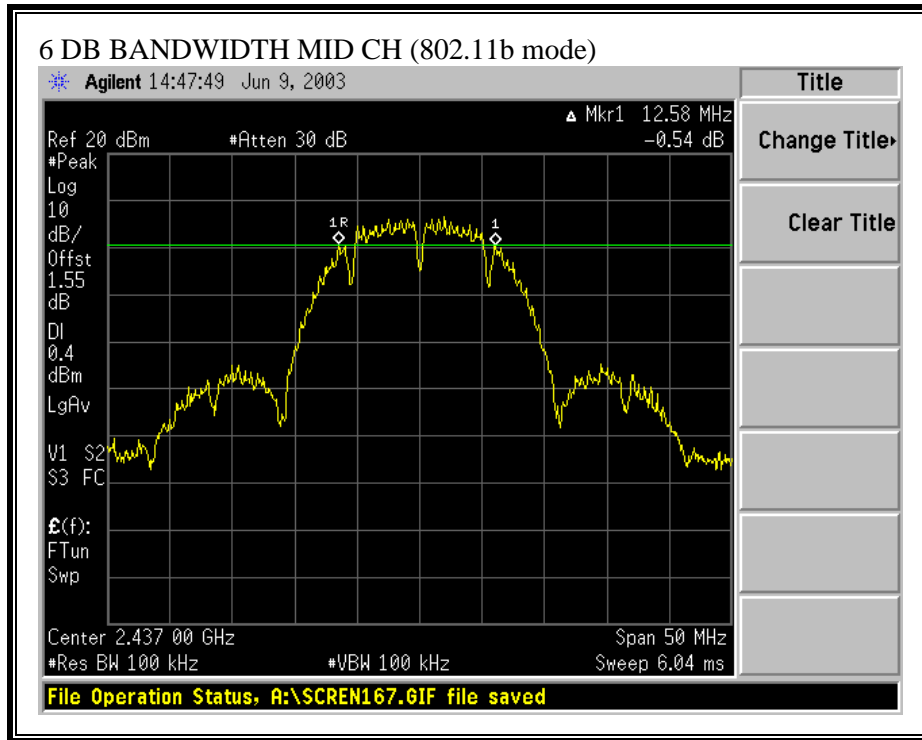
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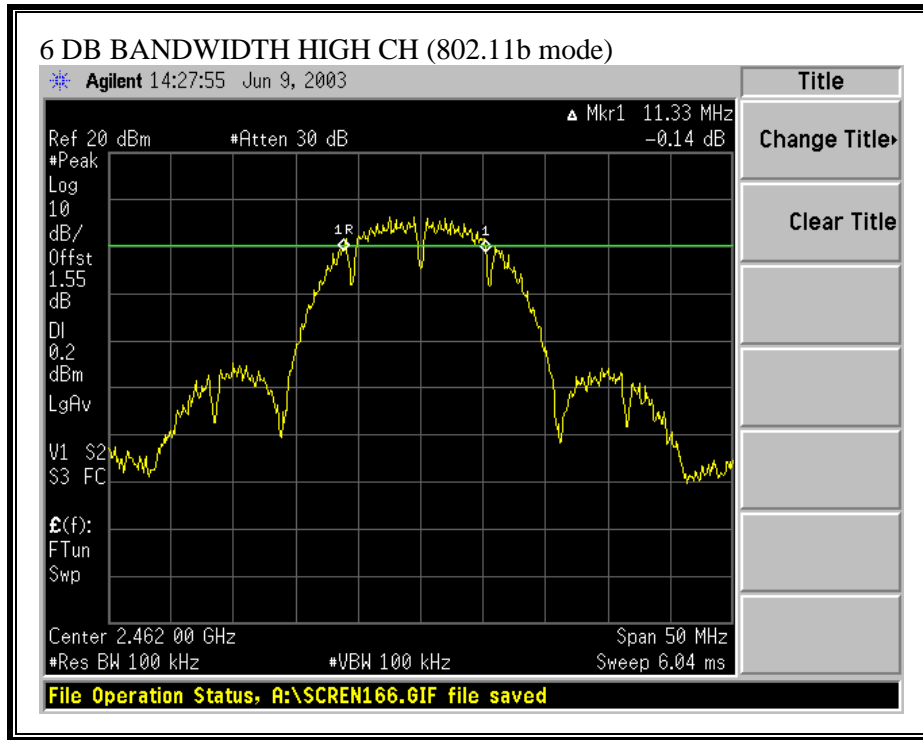
802.11a Normal Mode

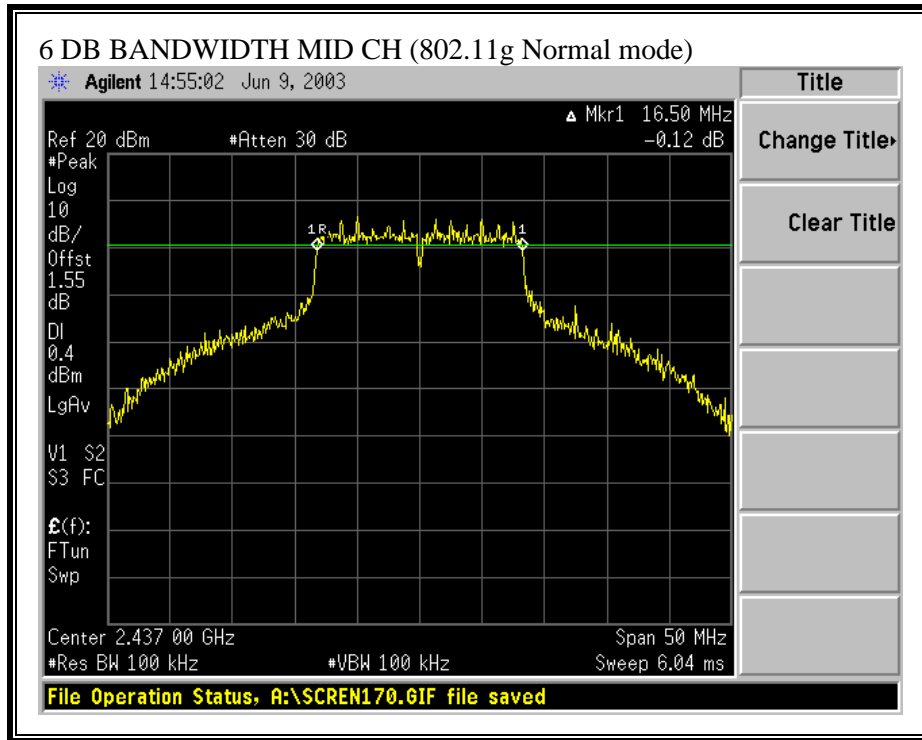
Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	5745	16580	500	16080
Middle	5785	16500	500	16000
High	5825	16500	500	16000

6 DB BANDWIDTH (802.11b MODE)

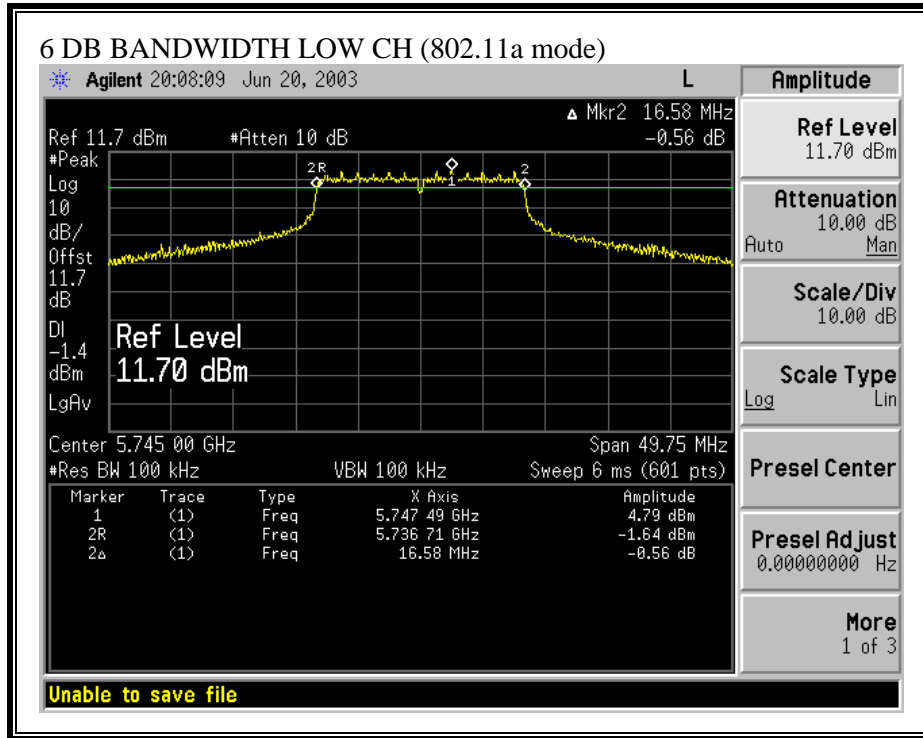


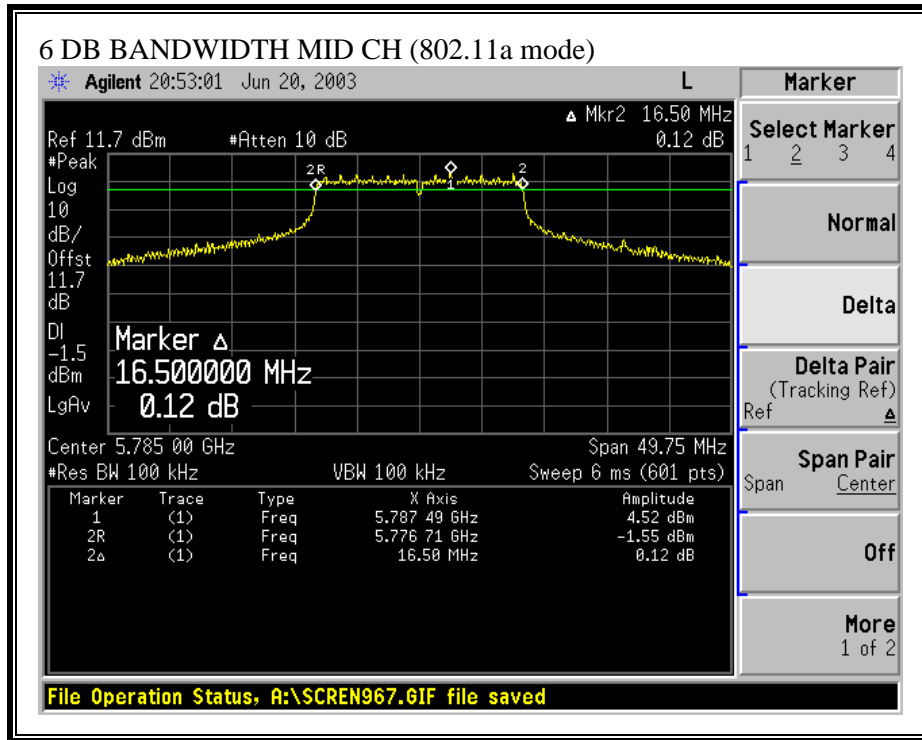


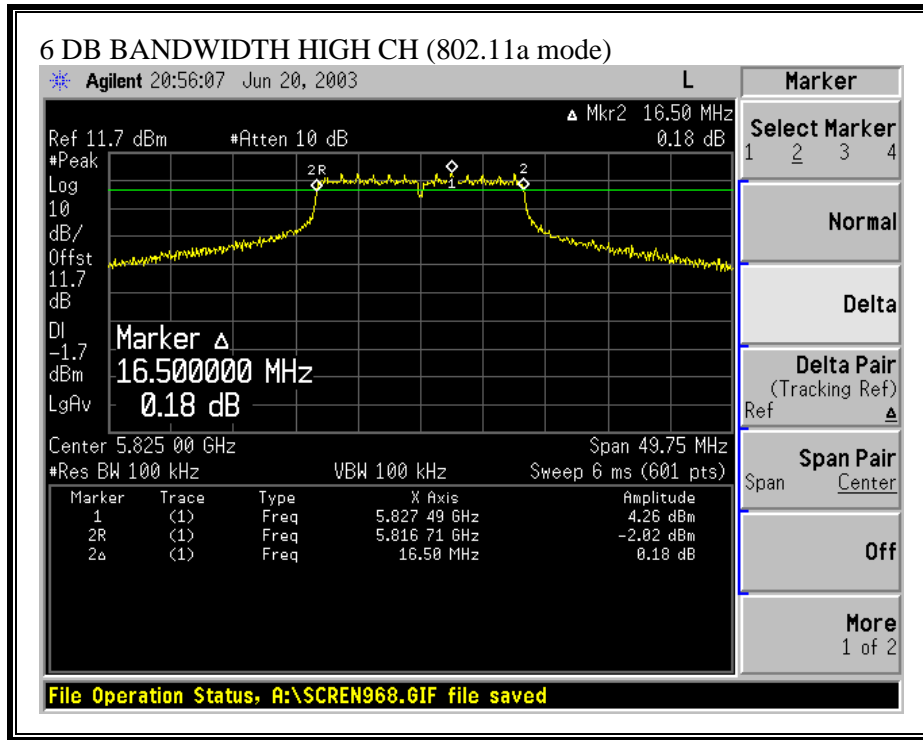




6 DB BANDWIDTH (802.11a MODE)







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	16.0666
Middle	2437	15.5487
High	2462	16.0884

802.11g Normal Mode

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.7215
Middle	2437	16.7106
High	2462	16.7737

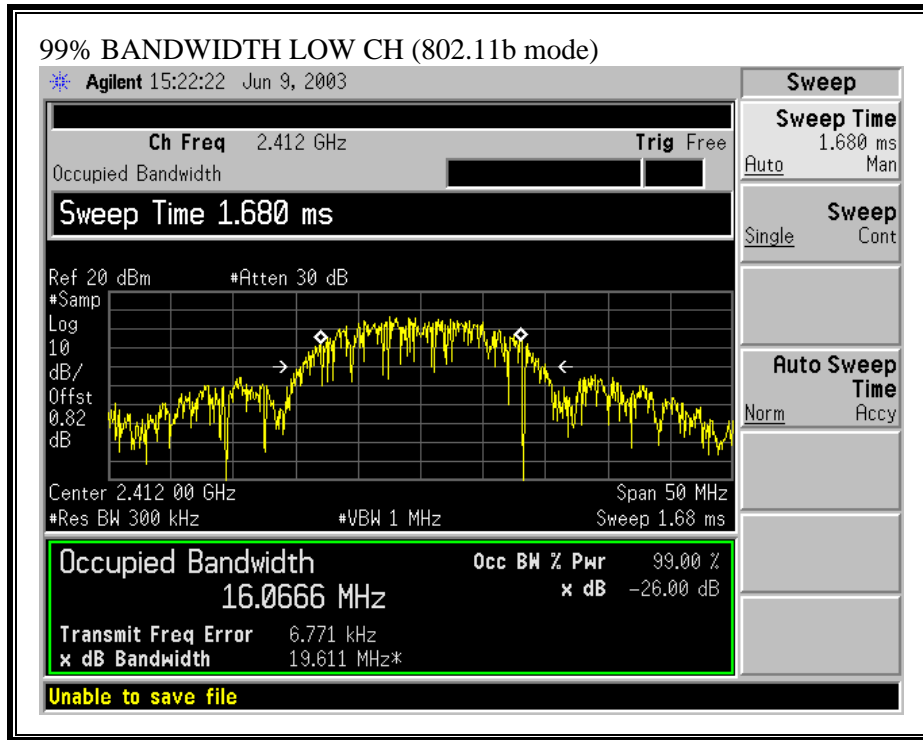
5.8 GHz BAND RESULTS

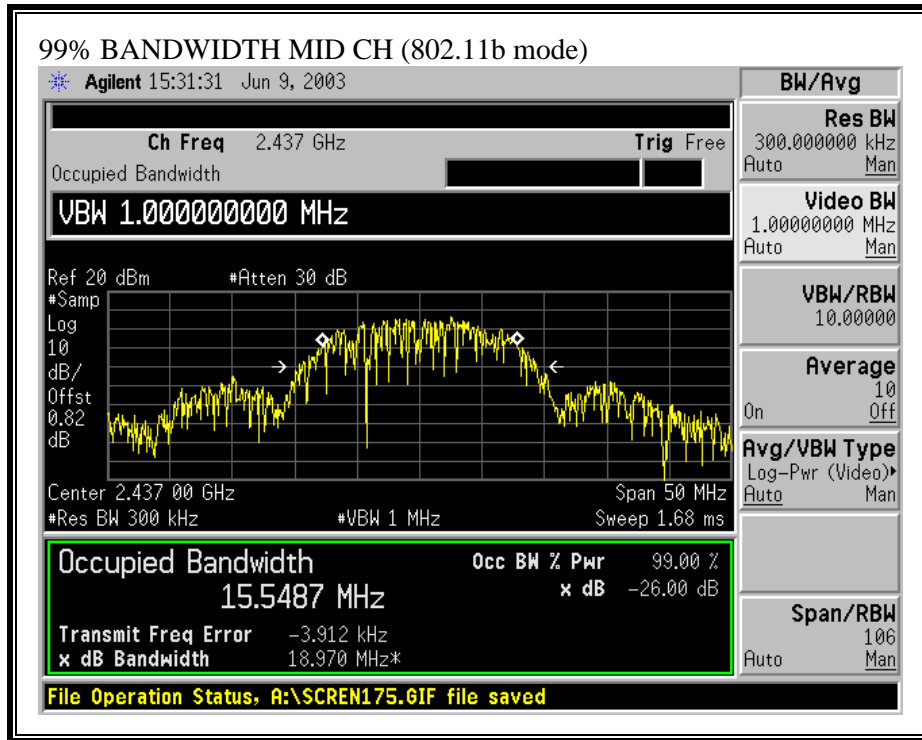
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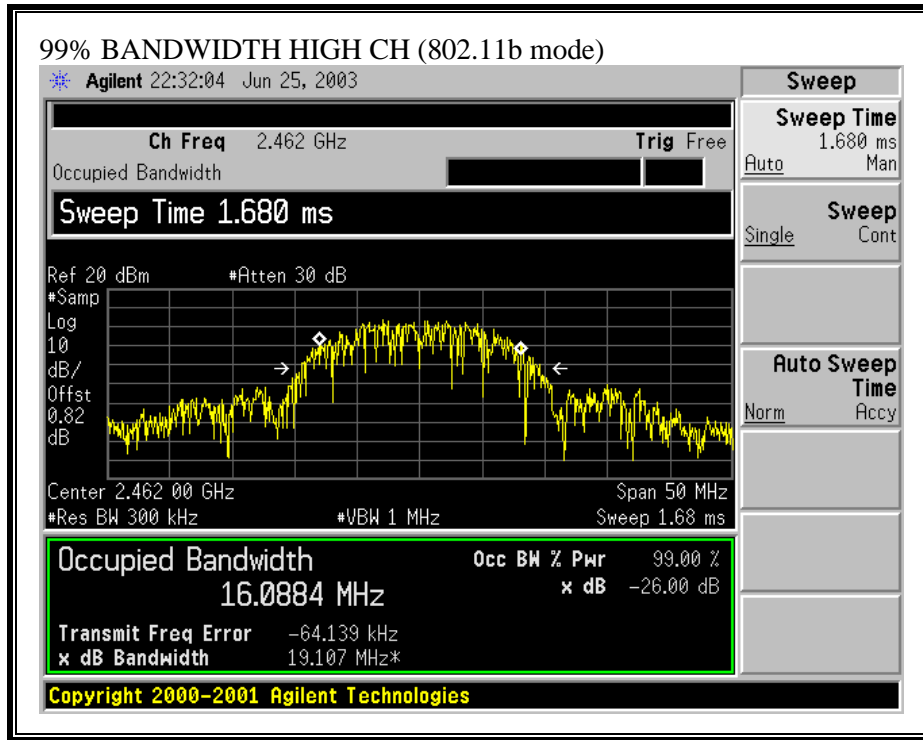
802.11a Normal Mode

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	16.6079
Middle	5785	16.6606
High	5825	16.7230

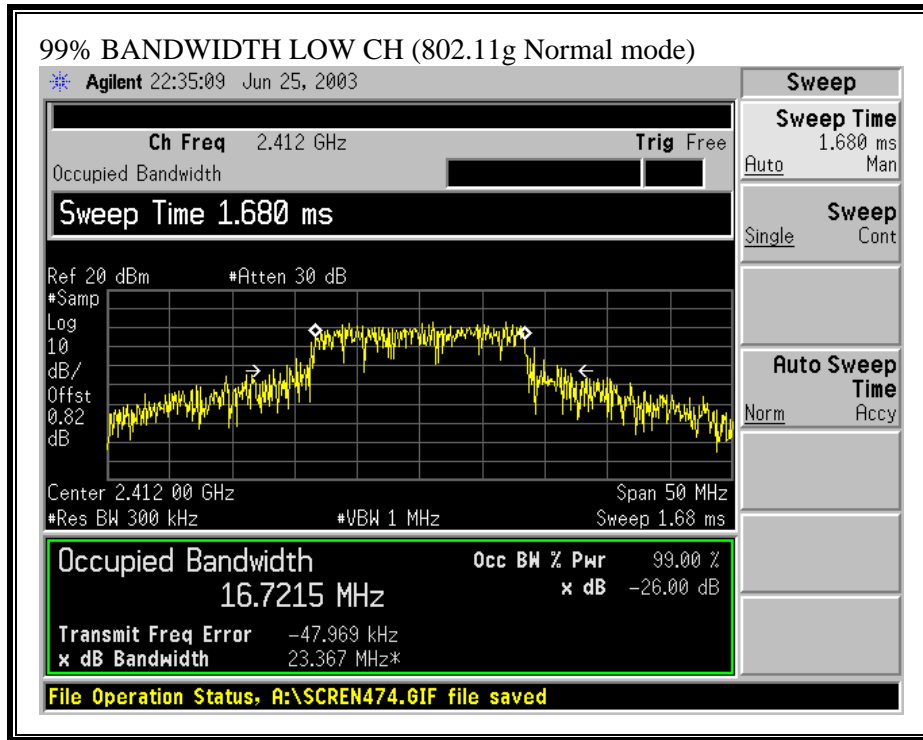
99% BANDWIDTH (802.11b MODE)

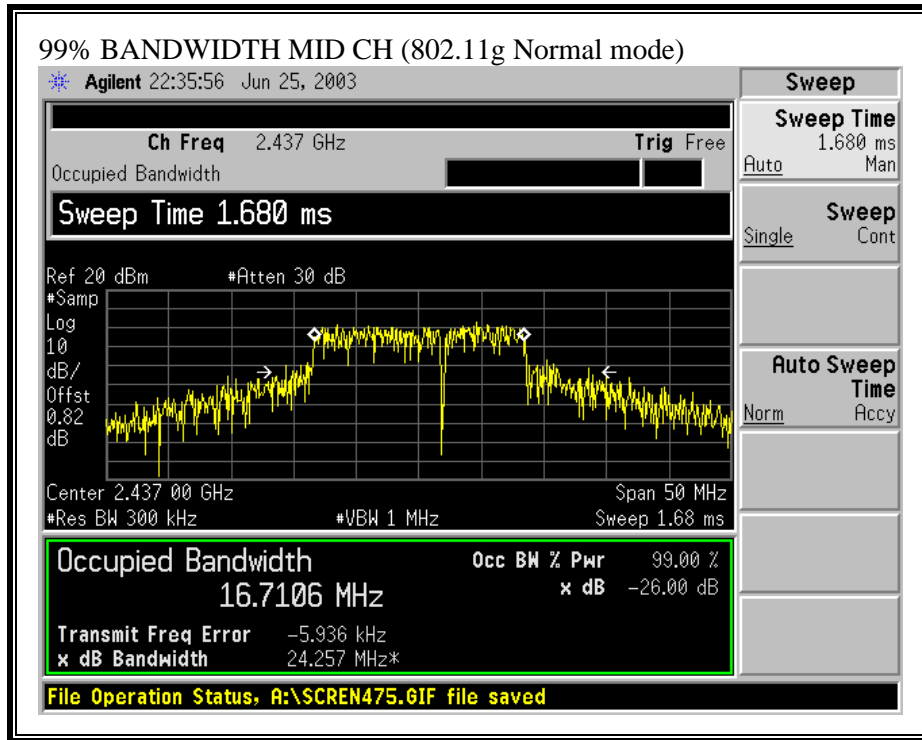


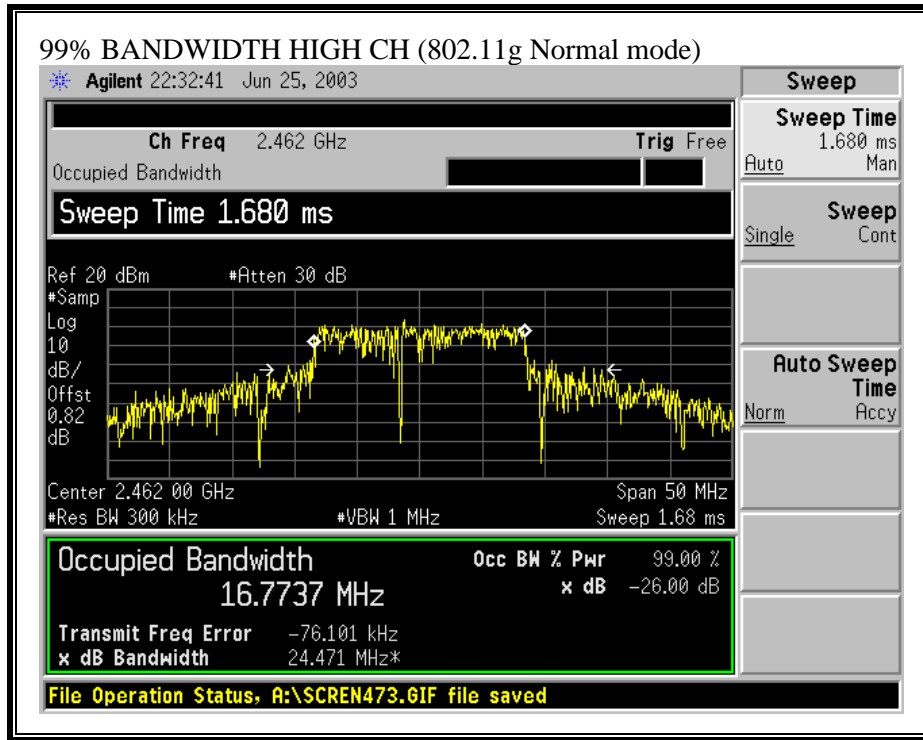




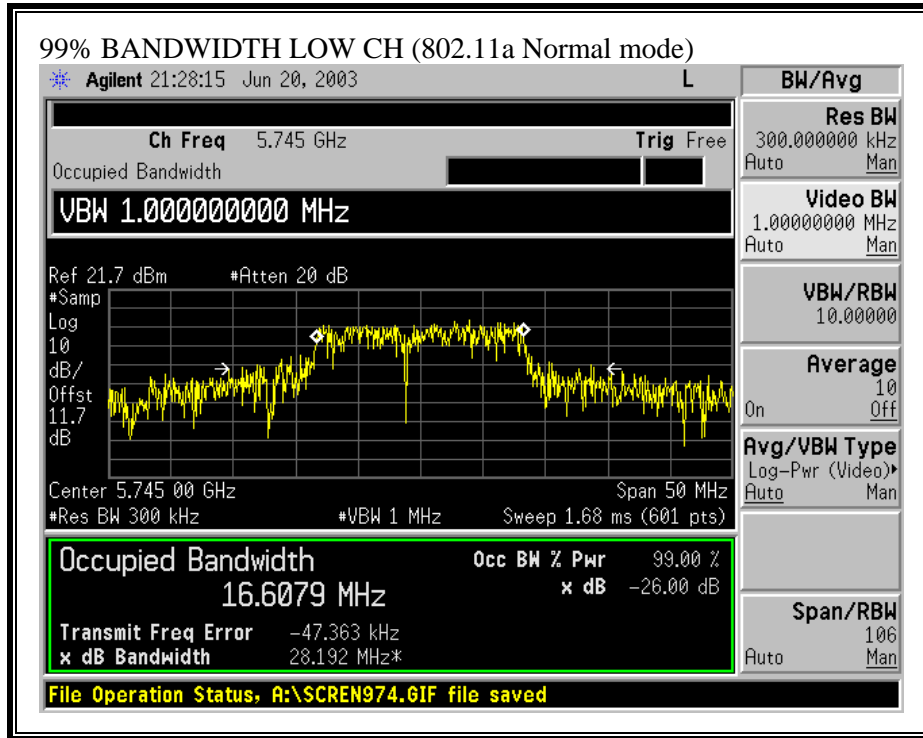
99% BANDWIDTH (802.11g NORMAL MODE)

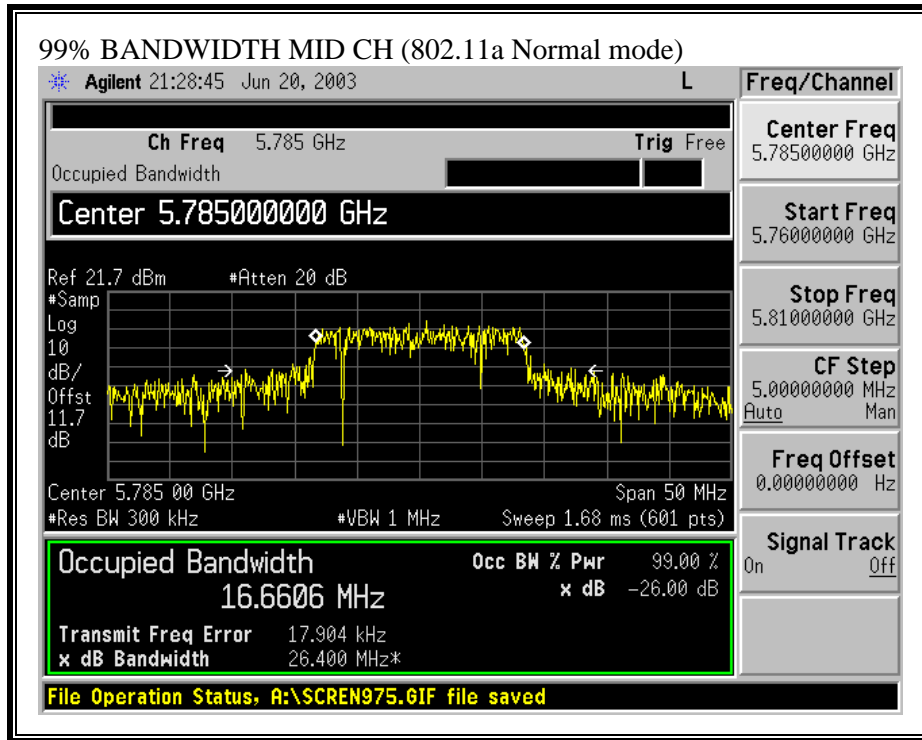


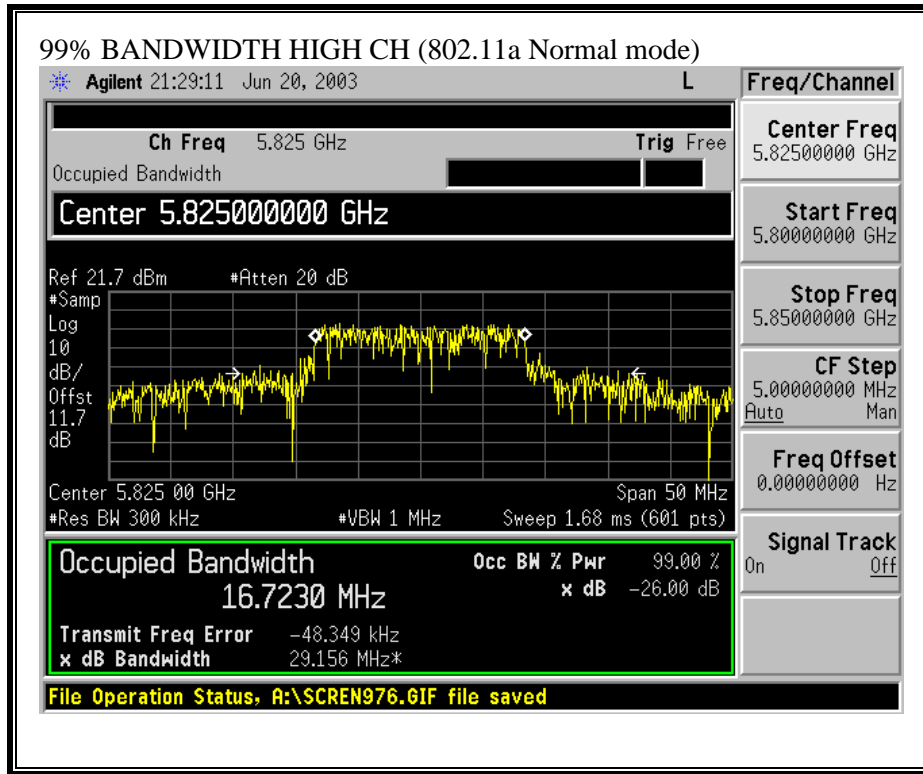




99% BANDWIDTH (802.11a MODE)







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 0.46 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.

2.4 GHZ BAND RESULTS

No non-compliance noted:

802.11b Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	15.88	30	-14.12
Middle	2437	19.33	30	-10.67
High	2462	15.74	30	-14.26

802.11g Normal Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	17.93	30	-12.07
Middle	2437	20.58	30	-9.42
High	2462	17.50	30	-12.50

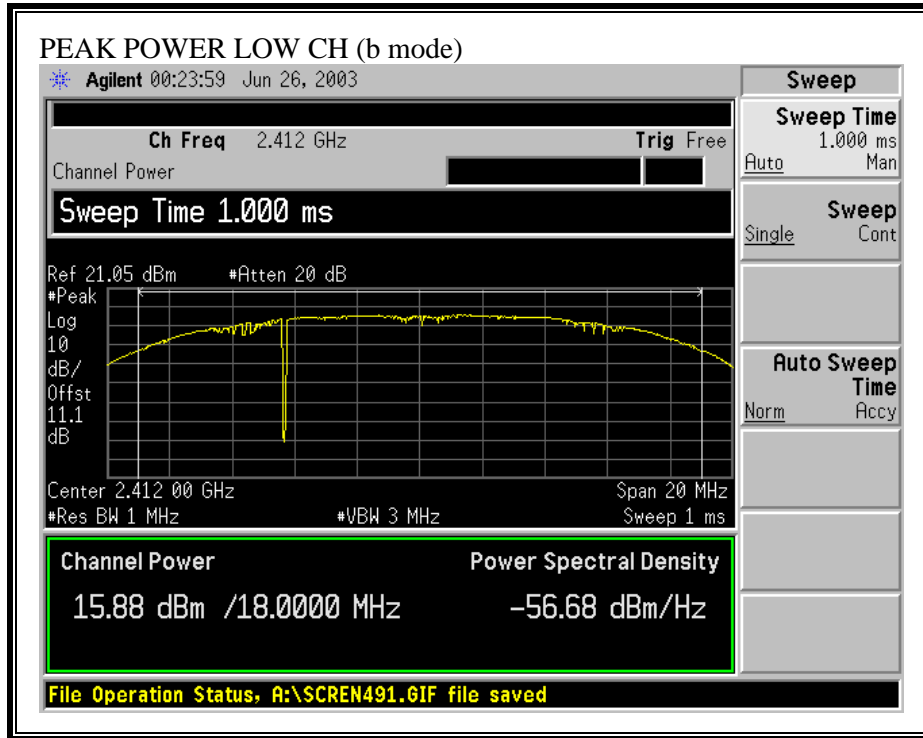
5.8 GHZ BAND RESULTS

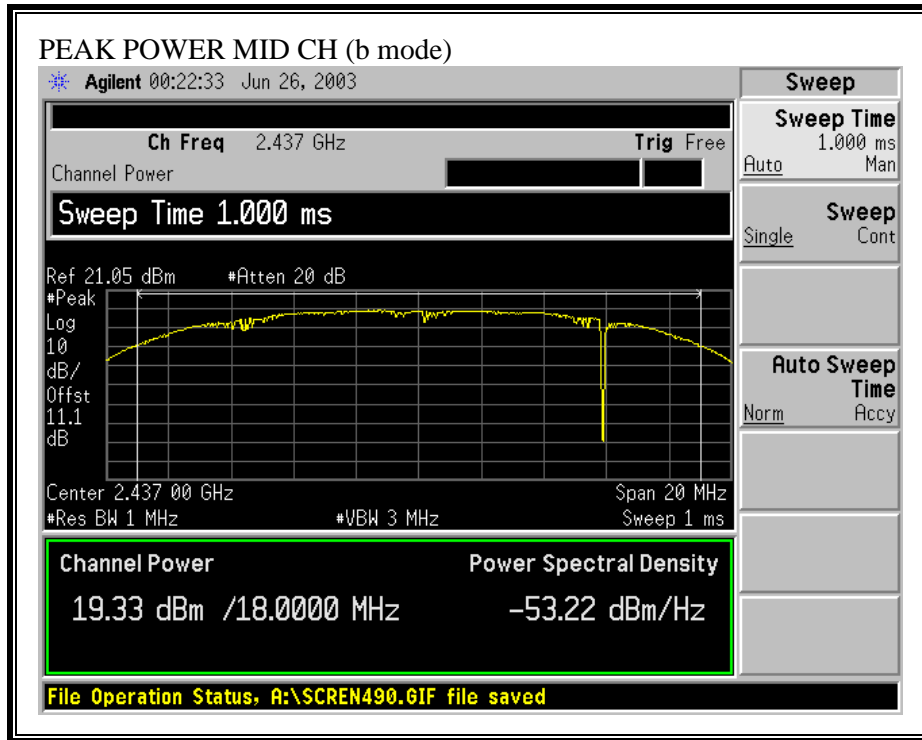
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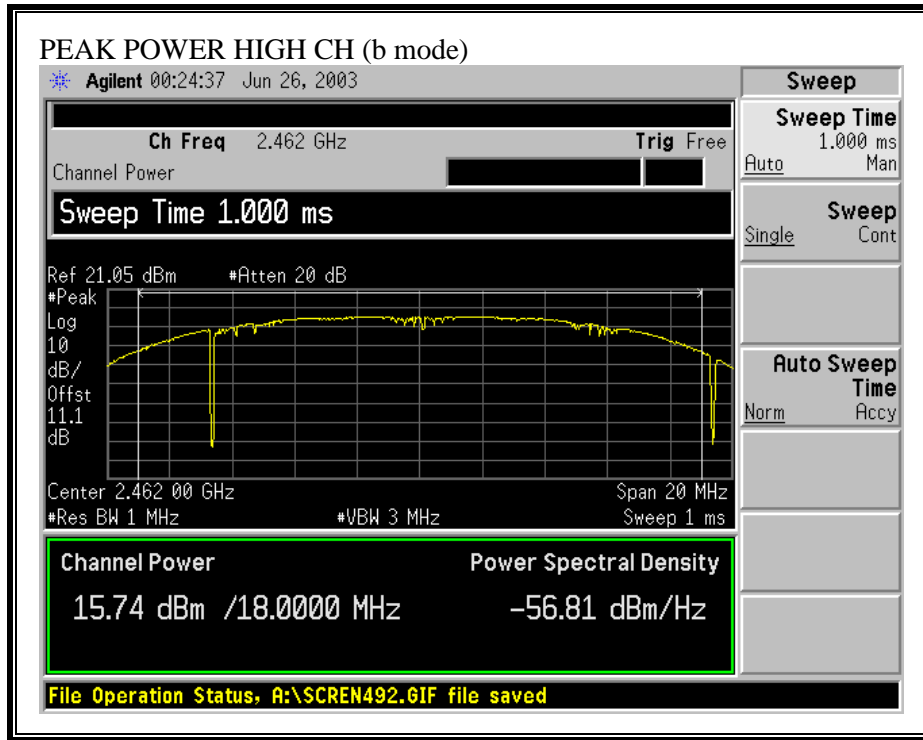
802.11a Normal Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	20.08	30	-9.92
Middle	5785	20.05	30	-9.95
High	5825	20.47	30	-9.53

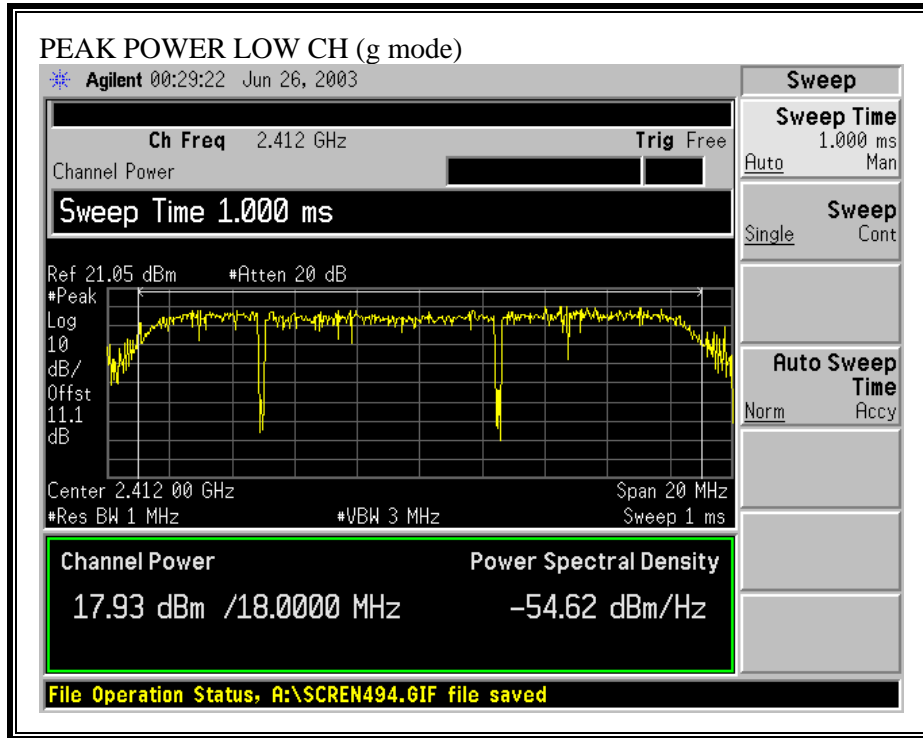
OUTPUT POWER (802.11b MODE)

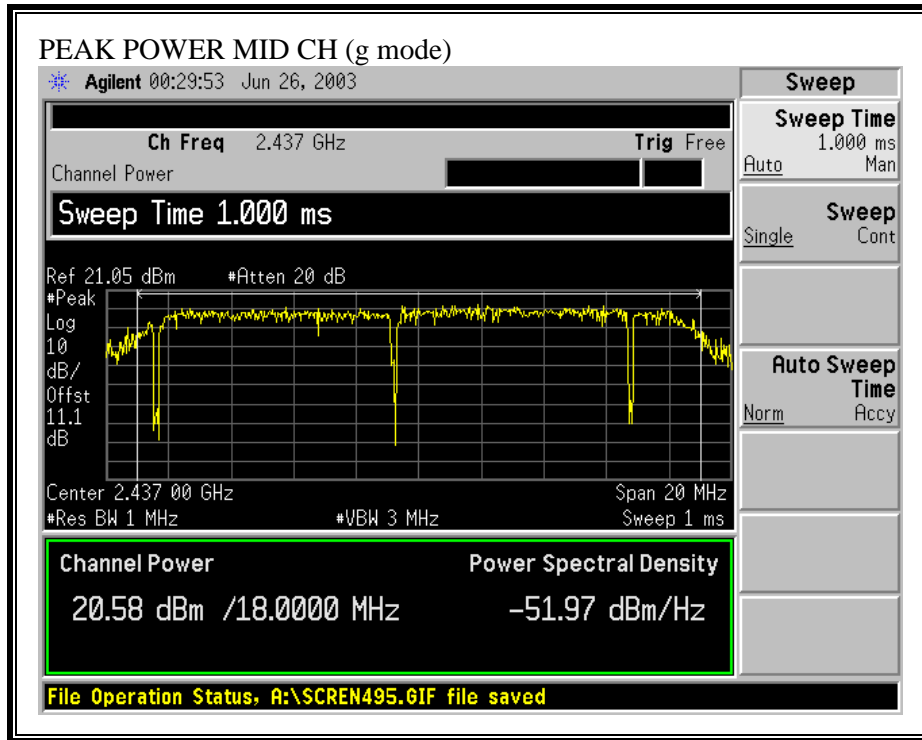


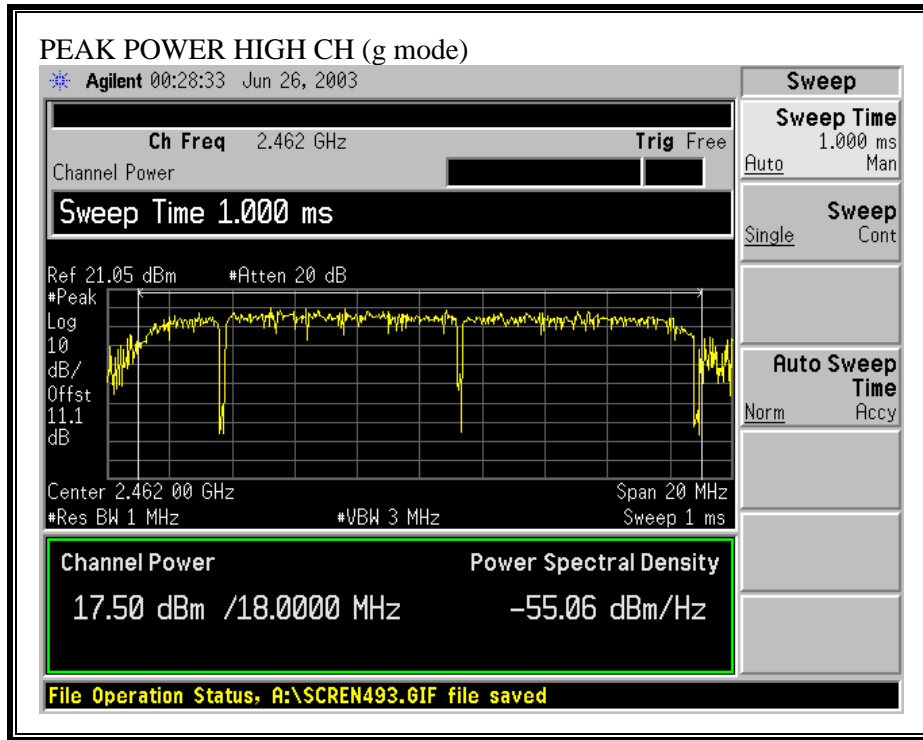




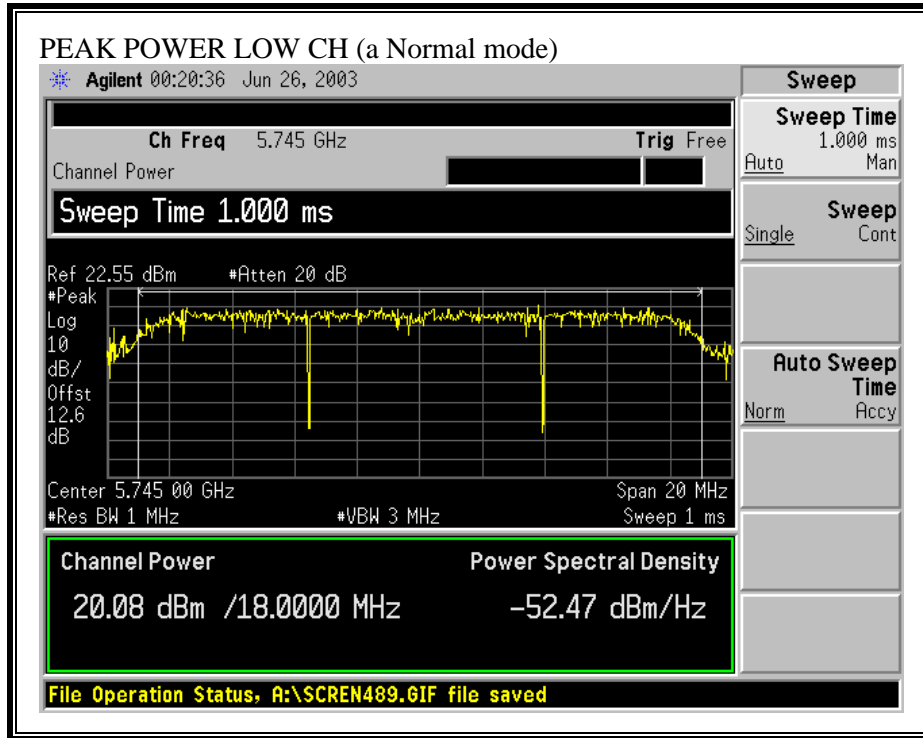
OUTPUT POWER (802.11g NORMAL MODE)

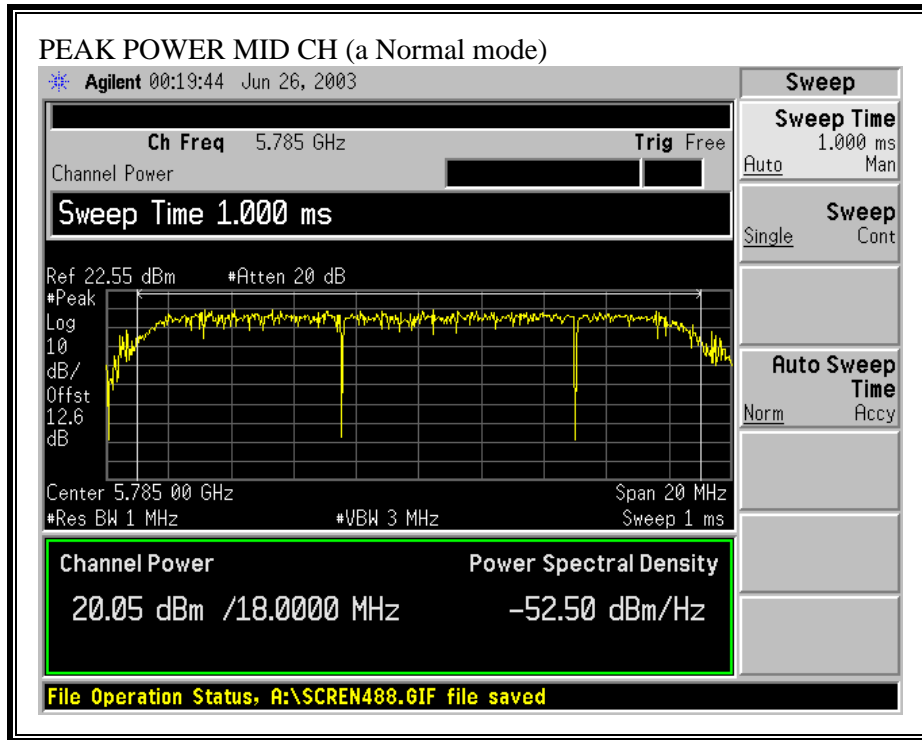


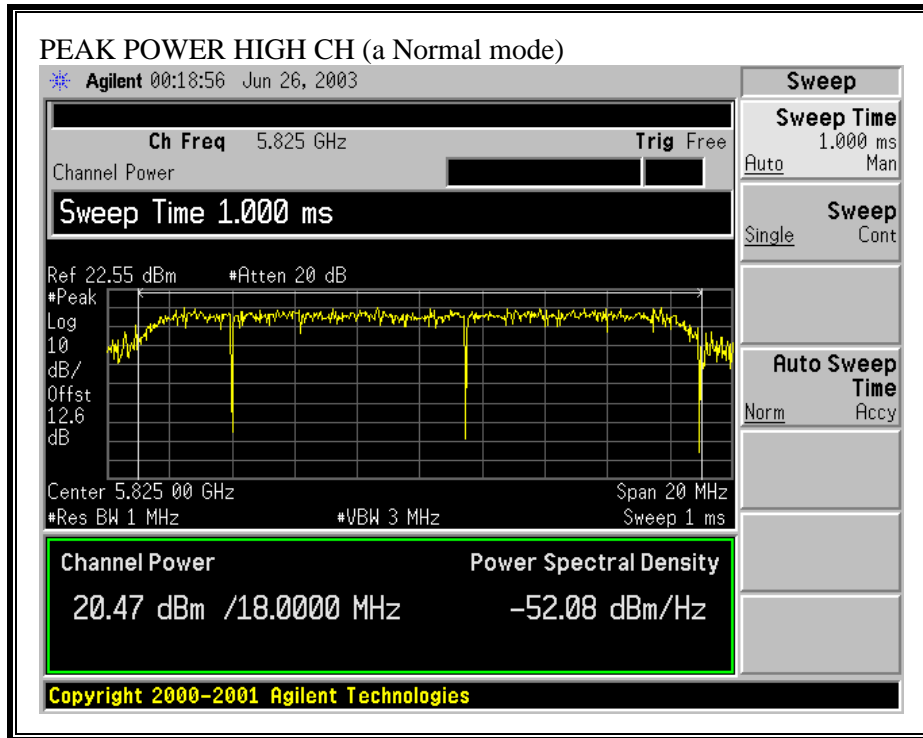




OUTPUT POWER (802.11a NORMAL MODE)







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:

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

yields

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

where

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

2.4 GHz BAND 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	19.33	0.46	2.75
802.11g Normal	1.0	20.58	0.46	3.18

5.8 GHz BAND RESULTS

No non-compliance noted:

Mode	Power Density Limit (mW/cm ²)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
802.11a Normal	1.0	20.08	-0.12	2.81

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.

2.4 GHZ BAND RESULTS

No non-compliance noted:

The cable assembly insertion loss of 11.1 dB (including 10 dB pad and 1.1 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	13.86
Middle	2437	16.91
High	2462	13.90

802.11g Normal Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	2412	14.02
Middle	2437	16.78
High	2462	13.83

5.8 GHZ BAND RESULTS

No non-compliance noted:

The cable assembly insertion loss of 12.6 dB (including 10 dB pad and 2.6 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

802.11a Normal Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	5745	18.01
Middle	5785	17.93
High	5825	17.95

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 \geq 3KHz, 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.

2.4 GHZ BAND RESULTS

No non-compliance noted:

802.11b Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-5.48	8	-13.48
Middle	2437	-7.73	8	-15.73
High	2462	-7.34	8	-15.34

802.11g Normal Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-7.00	8	-15.00
Middle	2437	-7.76	8	-15.76
High	2462	-7.85	8	-15.85

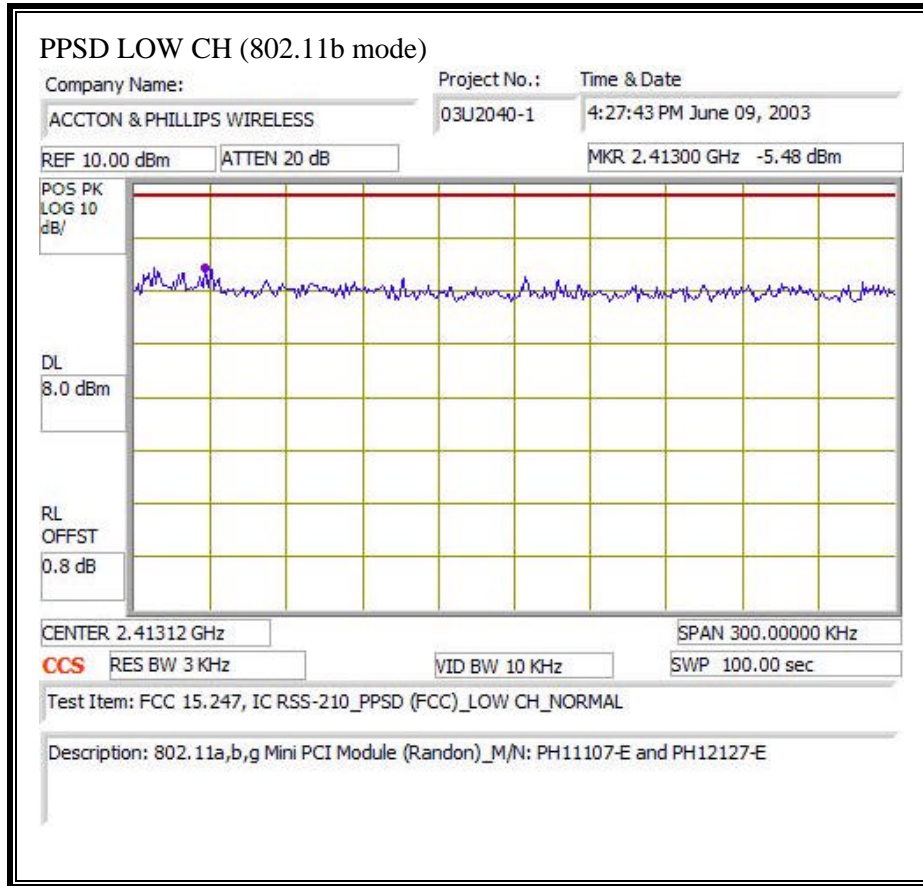
5.8 GHz BAND RESULTS

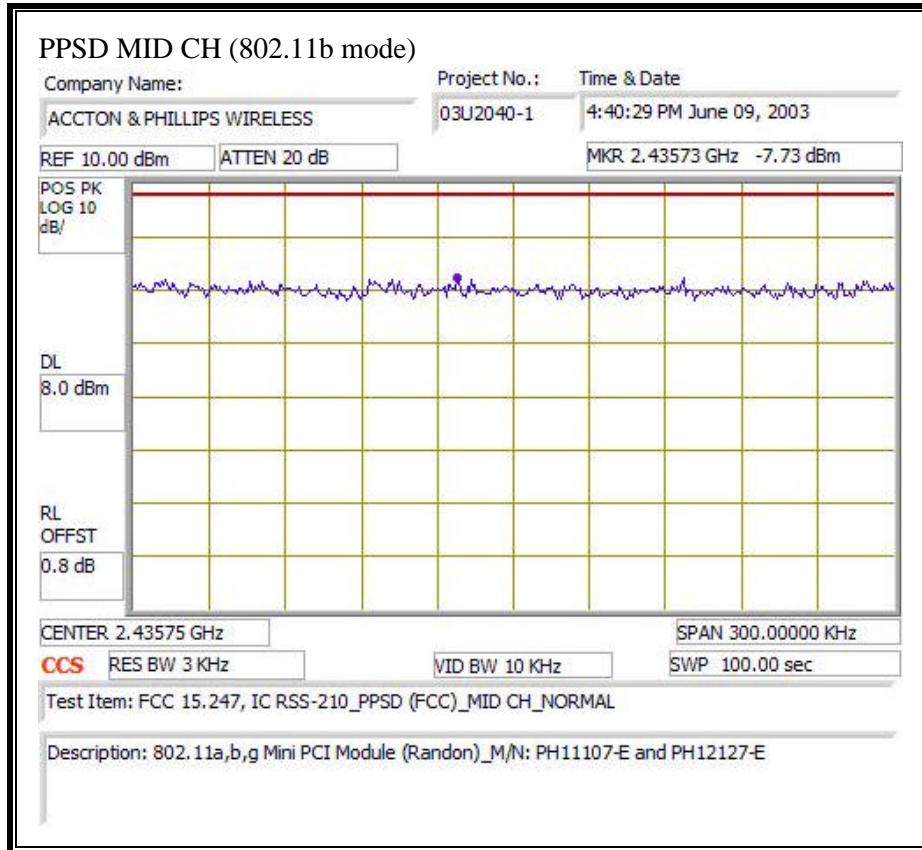
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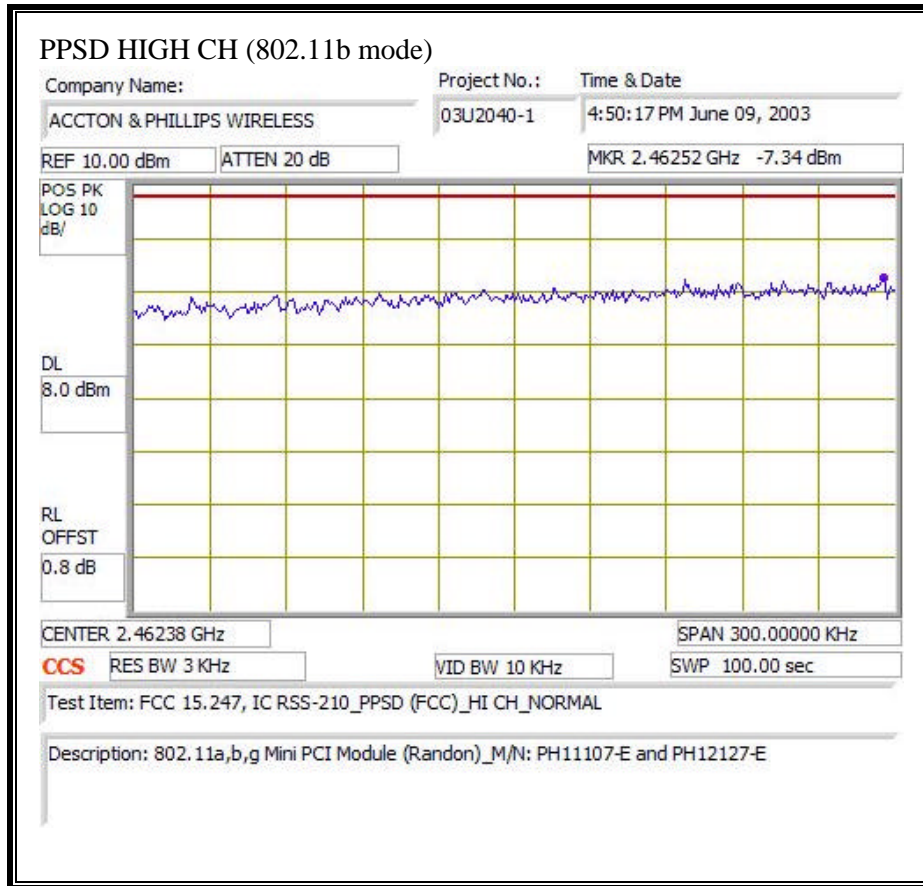
802.11a Normal Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-8.26	8	-16.26
Middle	5785	-8.50	8	-16.50
High	5825	-8.99	8	-16.99

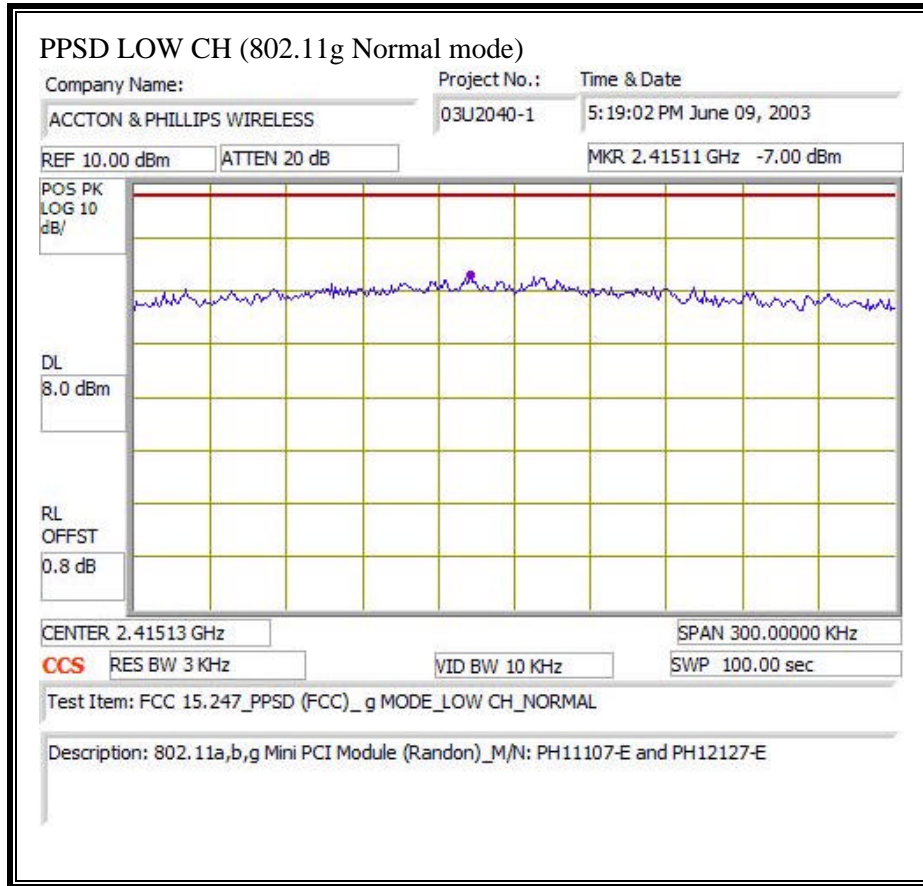
PEAK POWER SPECTRAL DENSITY (802.11b MODE)

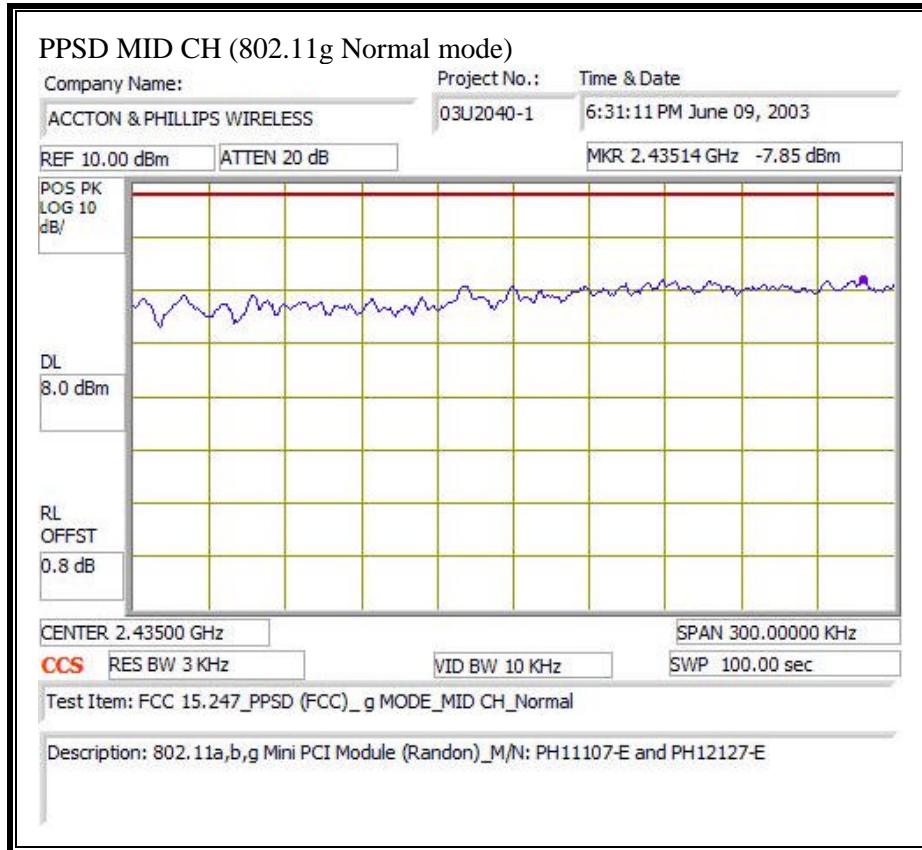


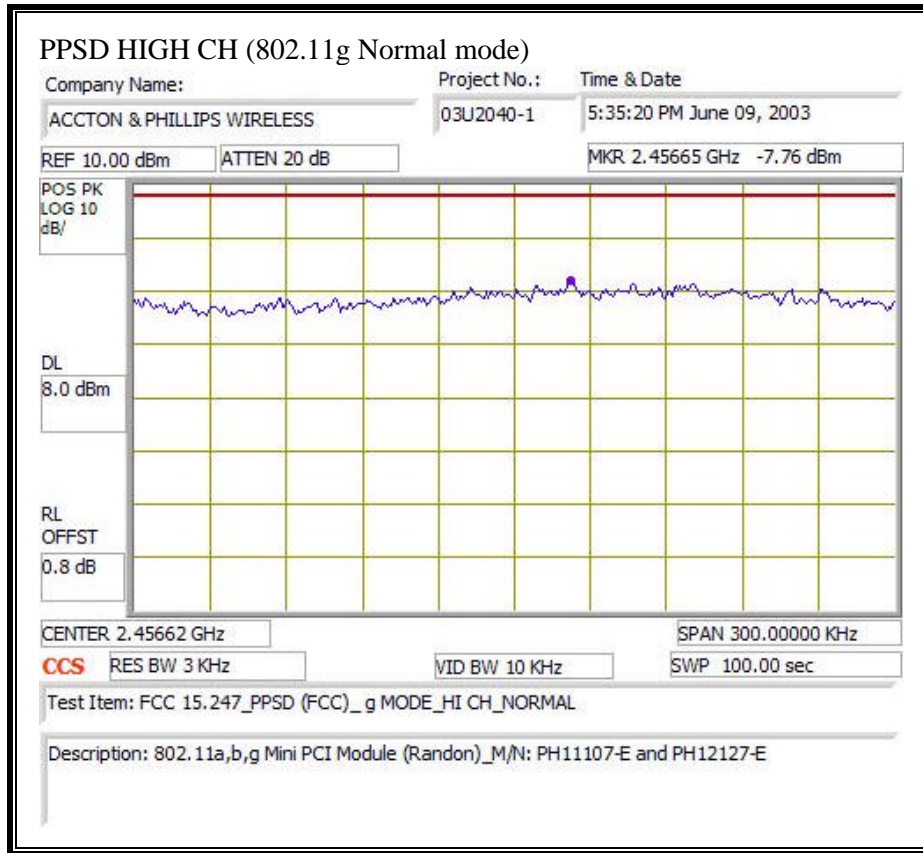




PEAK POWER SPECTRAL DENSITY (802.11g NORMAL MODE)







PEAK POWER SPECTRAL DENSITY (802.11a NORMAL MODE)

