



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

**FOR**

**802.11 b/g COMBO MINI PCI MODULE**

**MODEL NUMBER: PA3299U-1MPC**

**BRAND NAME: TOSHIBA**

**FCC ID: CJ6UPA3299WL**

**REPORT NUMBER: 03U1877-1**

**ISSUE DATE: MAY 30, 2003**

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# 1. TEST RESULT CERTIFICATION

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

**EUT DESCRIPTION:** 802.11 b/g COMBO MINI PCI MODULE

**MODEL:** PA3299U-1MPC

**DATE TESTED:** MAY 6 – MAY 15, 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.

Approved & Released For CCS By:

Tested By:



MIKE HECKROTTE  
CHIEF ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

THANH NGUYEN  
EMC ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

## 2. EUT DESCRIPTION

The EUT is an 802.11b/g WLAN mini PCI module operating in the 2.4-2.4835 GHz band. The EUT has a peak output power of 20.93 dBm (124mW) and highest antenna gain of 4.8 dBi.

Optionally the WLAN may be collocated with a Bluetooth transceiver, FCC ID: CJ6UPA3232BT.

Antennas filed under this report:

Hitachi Cable, Dual Band Film antenna, model: HTL008, antenna gain 4.8dBi;

Hitachi Cable, Wide band film antenna, model: HTL008, antenna gain 4.1 dBi;

Tyco Electronics AMP, Dual band film antenna, TIAN01, antenna gain 1.0dBi.

### **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	6717	2/04/2004
Preamplifier, 1 ~ 26 GHz	Miteq	NSP10023988	646456	4/05/2004
EMI Test Receiver	R & S	ESHS 20	827129/006	4/18/2004
LISN, 10 kHz ~ 30 MHz	<b>FCC</b>	50/250-25-2	114	9/6/2003
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	837990	9/6/2003
Spectrum Analyzer	HP	8593EM	3710A00205	6/11/2003
High Pass Filter 4.57GHz	FSY Microwave	FM-4570-9SS	3	N.C.R
2.4-2.5GHz Reject Filter	MicroTronic	BRM50702	002	N.C.R
Antenna, Bilog	Chase	CBL6112B	2586	3/6/04
Spectrum Analyzer	HP	8564E	3943A01643	7/22/03
Spectrum Analyzer	Agilent	E4446A	US42070220	1/13/04
ERM-P Series Power Meter	Agilent	E4416A	GB41291160	8/9/2003
Peak / Average Power Sensor	Agilent	E9327A	US40440755	9/5/2003



## 6. SETUP OF EQUIPMENT UNDER TEST

### SETUP INFORMATION FOR TESTS

#### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Device Type	Manufacturer	Model	Serial Number	FCC ID
Laptop	Toshiba	PP350E	336946246	DoC
AC Adapter	Toshiba	PA3241U-1ACA	0301A00437226	N/A

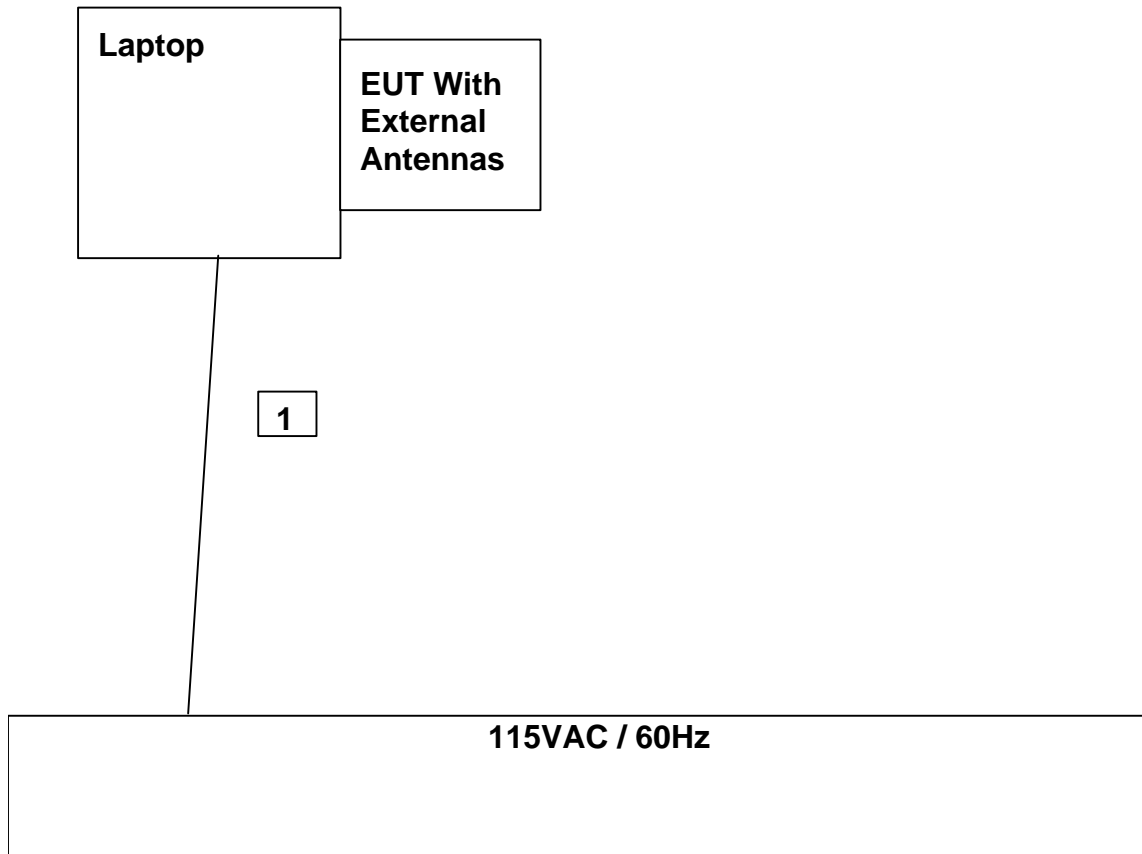
#### I/O CABLES

Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115	Un-shielded	2 m	Laptop cable is integrated with AC Adapter

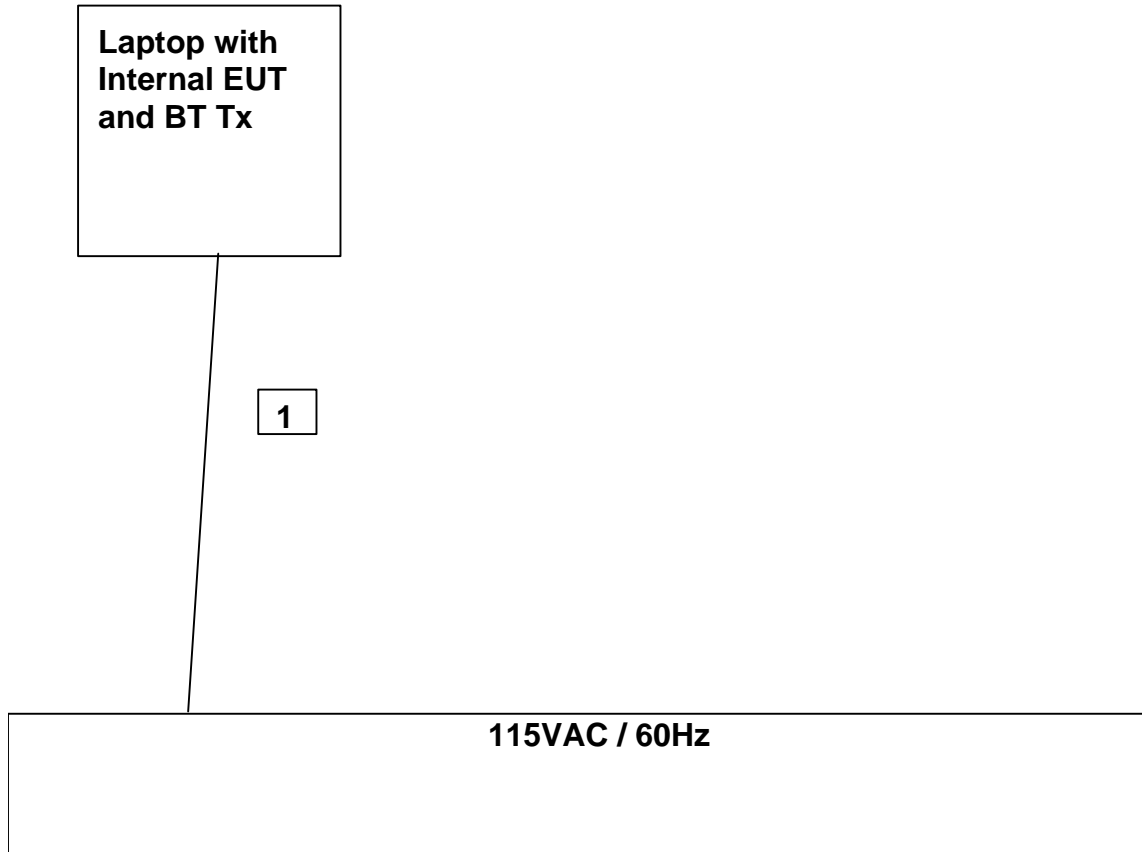
#### TEST SETUP

The EUT is installed in the laptop computer via a PCMCIA extender card.

**SETUP DIAGRAM FOR TRANSMITTER TESTS**



**SETUP DIAGRAM FOR COLOCATION 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	11080	500	10580
Middle	2437	11080	500	10580
High	2462	12000	500	11500

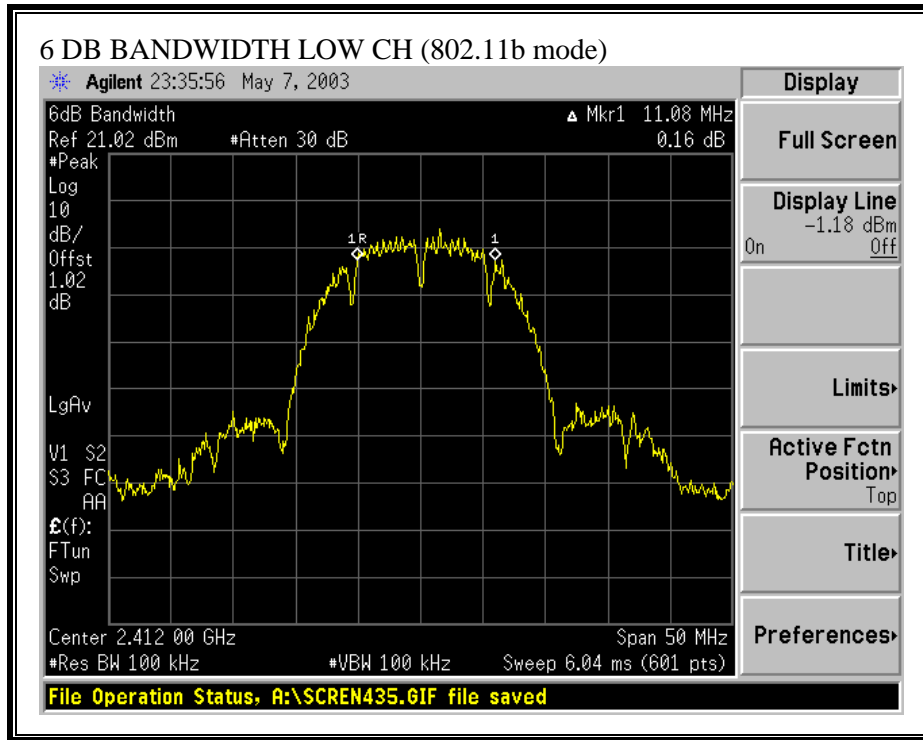
##### 802.11g Normal Mode

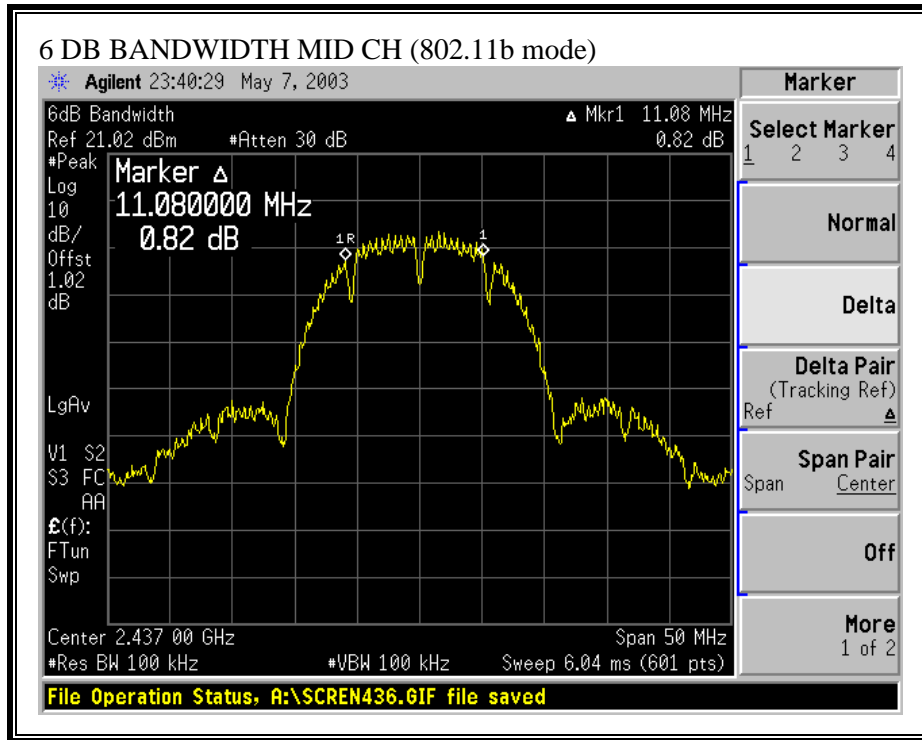
Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2412	16500	500	16000
Middle	2437	16500	500	16000
High	2462	16500	500	16000

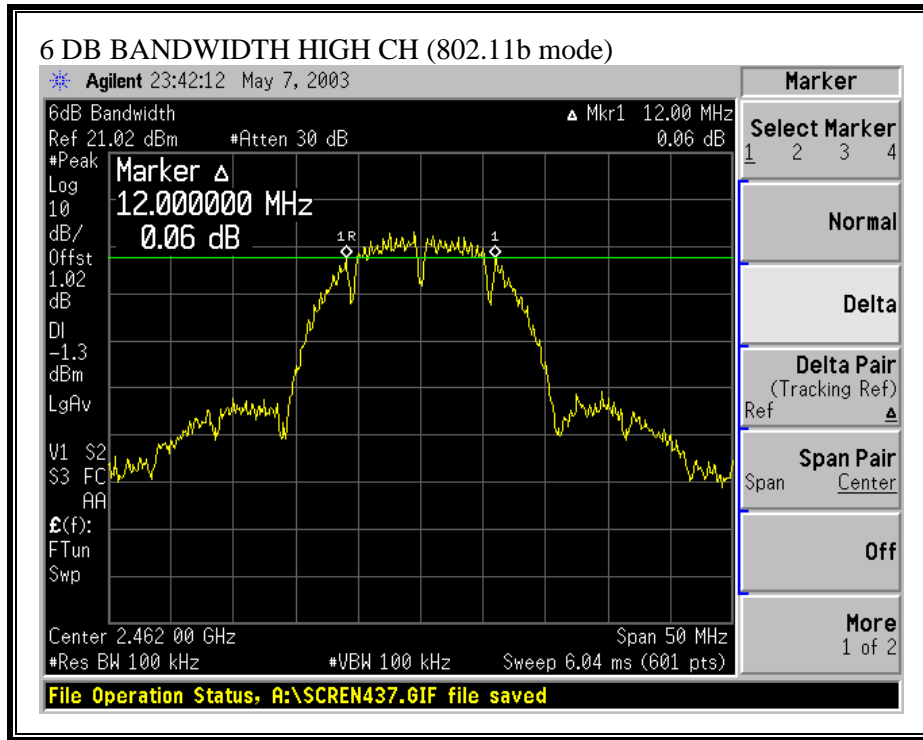
##### 802.11g Turbo Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Middle	2437	32670	500	32170

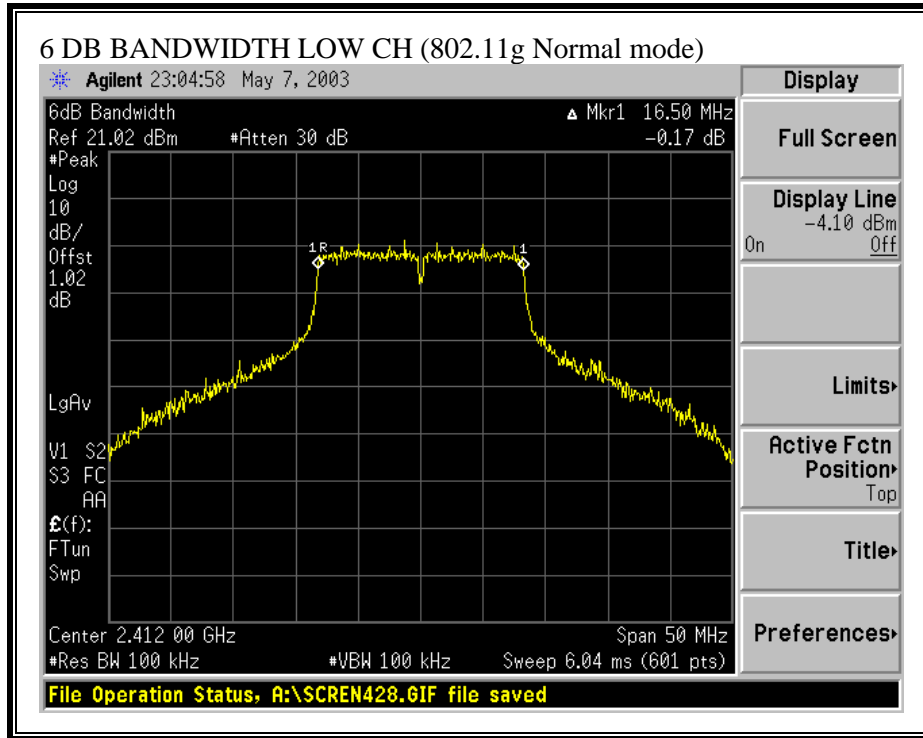
**6 DB BANDWIDTH (802.11b MODE)**



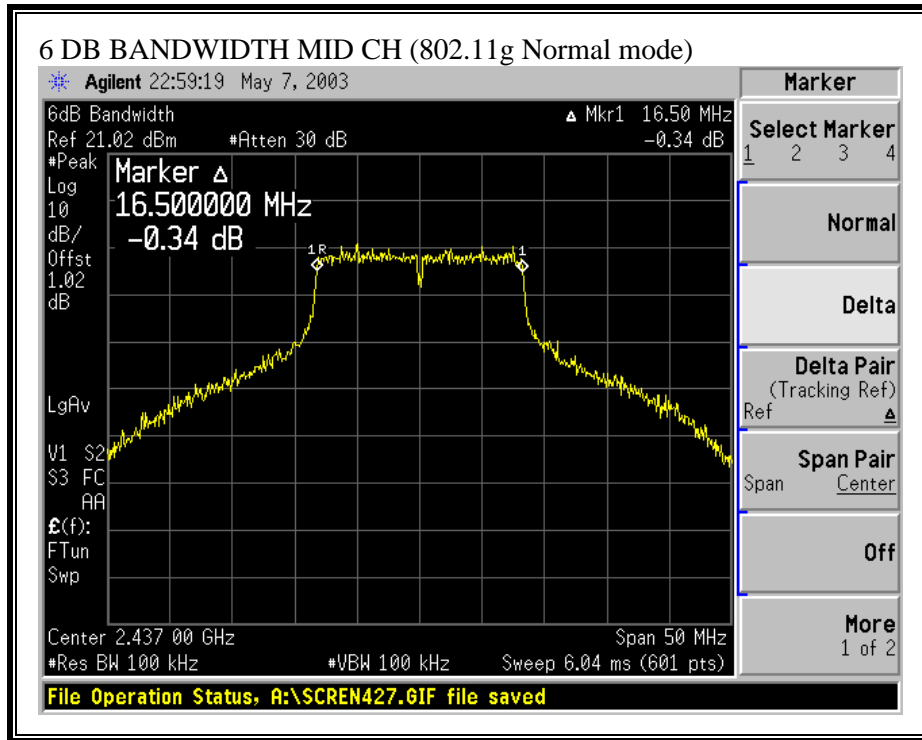


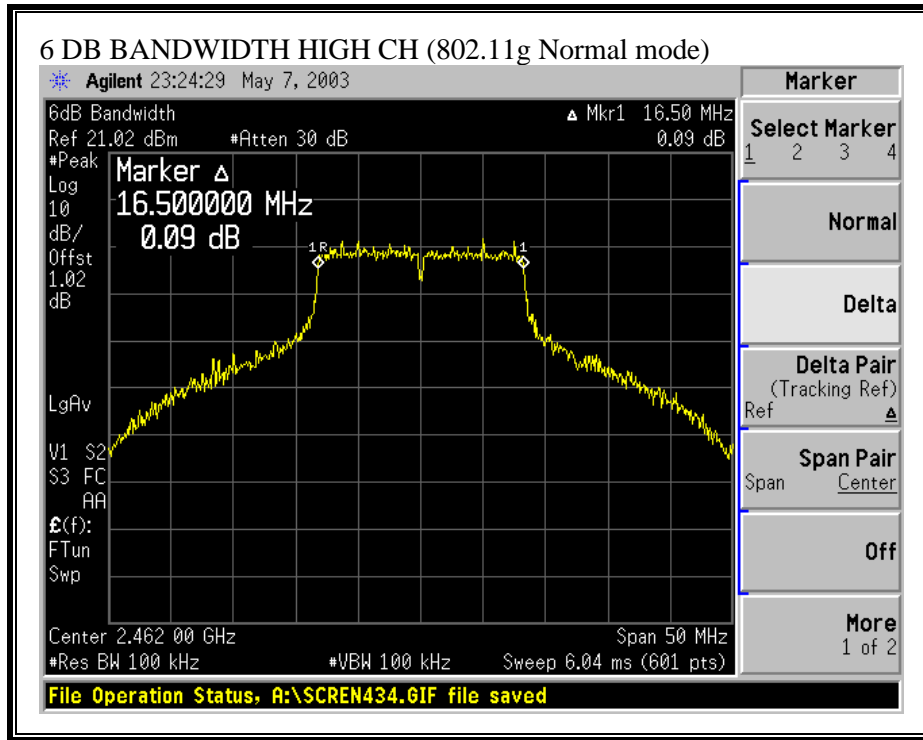


**6 DB BANDWIDTH (802.11g NORMAL MODE)**

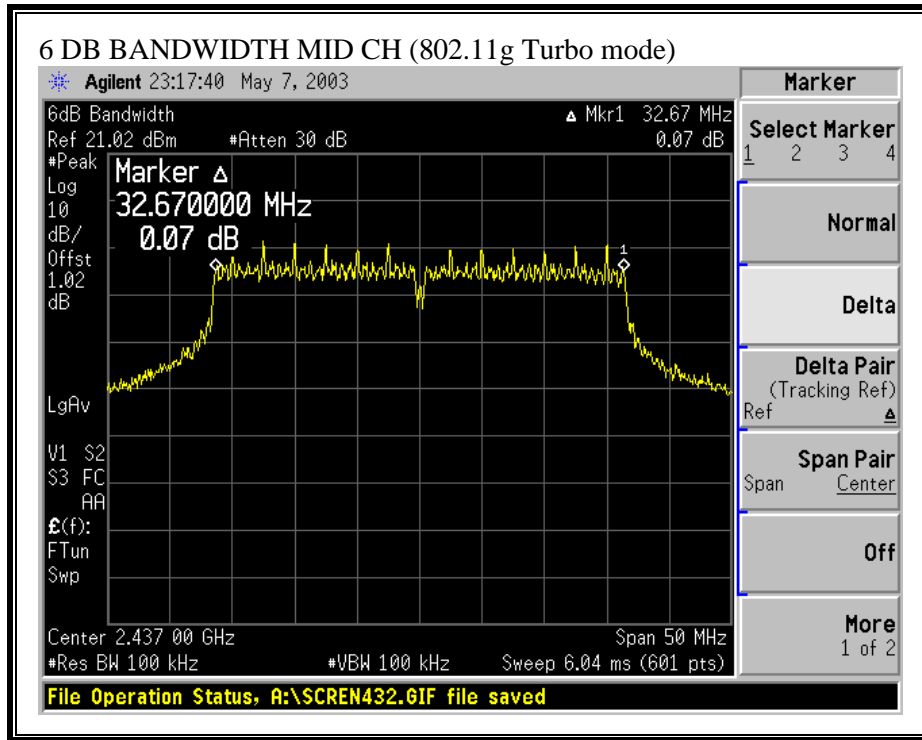








**6 DB BANDWIDTH (802.11g TURBO MODE)**



## 7.2. 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 4.8 dBi, therefore the limit is 30 dBm.

### AVERAGE POWER LIMIT

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter. The power meter is set to simultaneously read peak power and average power.

## **RESULTS**

No non-compliance noted:

The cable assembly insertion loss of 11 dB (including 10 dB pad and 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)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	13.94	16.60	30	-13.40
Middle	2437	13.09	16.36	30	-13.64
High	2462	13.60	16.20	30	-13.80

### 802.11g Normal Mode

Channel	Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	14.30	20.93	30	-9.07
Middle	2437	14.15	20.53	30	-9.47
High	2462	14.23	20.67	30	-9.33

### 802.11g Turbo Mode

Channel	Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Middle	2437	13.89	19.80	30	-10.20

### 7.3. 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 / cm<sup>2</sup>

Substituting the logarithmic form of power and gain using:

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

yields

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

where

- d = MPE distance in cm
- P = Power in dBm
- G = Antenna Gain in dBi
- S = Power Density Limit in mW / cm<sup>2</sup>

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

### **LIMITS**

S = 1.0 mW / cm<sup>2</sup> from 1.1310 Table 1

### **RESULTS**

No non-compliance noted:

Mode	Power Density Limit (mW/cm <sup>2</sup> )	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
802.11b	1.0	16.60	4.80	3.31
802.11g Normal	1.0	20.93	4.80	5.45
802.11g Turbo	1.0	19.80	4.80	4.79

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.

## 7.4. 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.

### RESULTS

No non-compliance noted:

#### 802.11b Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-8.80	8	-16.80
Middle	2437	-9.00	8	-17.00
High	2462	-8.10	8	-16.10

#### 802.11g Normal Mode

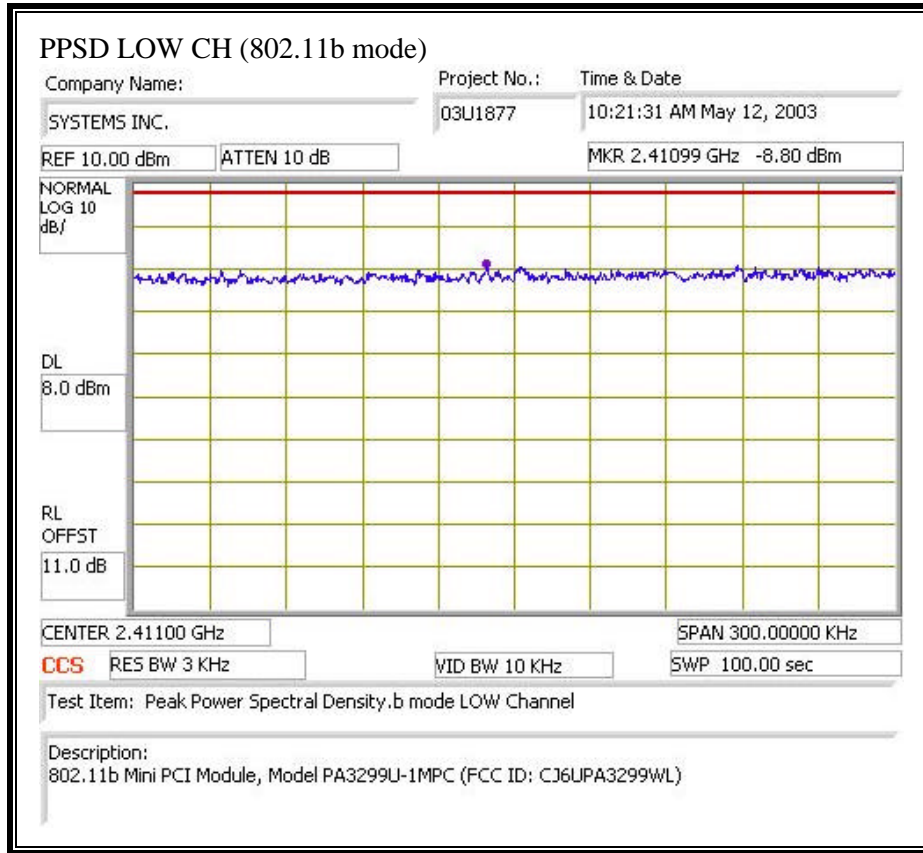
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-9.30	8	-17.30
Middle	2437	-10.20	8	-18.20
High	2462	-9.40	8	-17.40

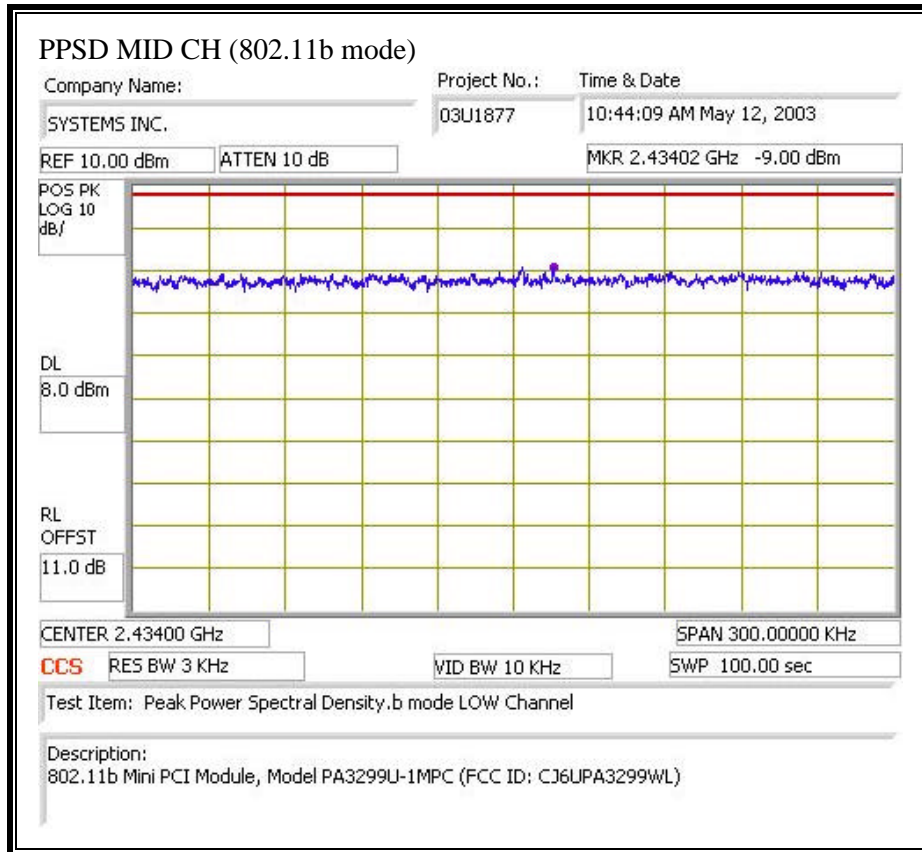
#### 802.11g Turbo Mode

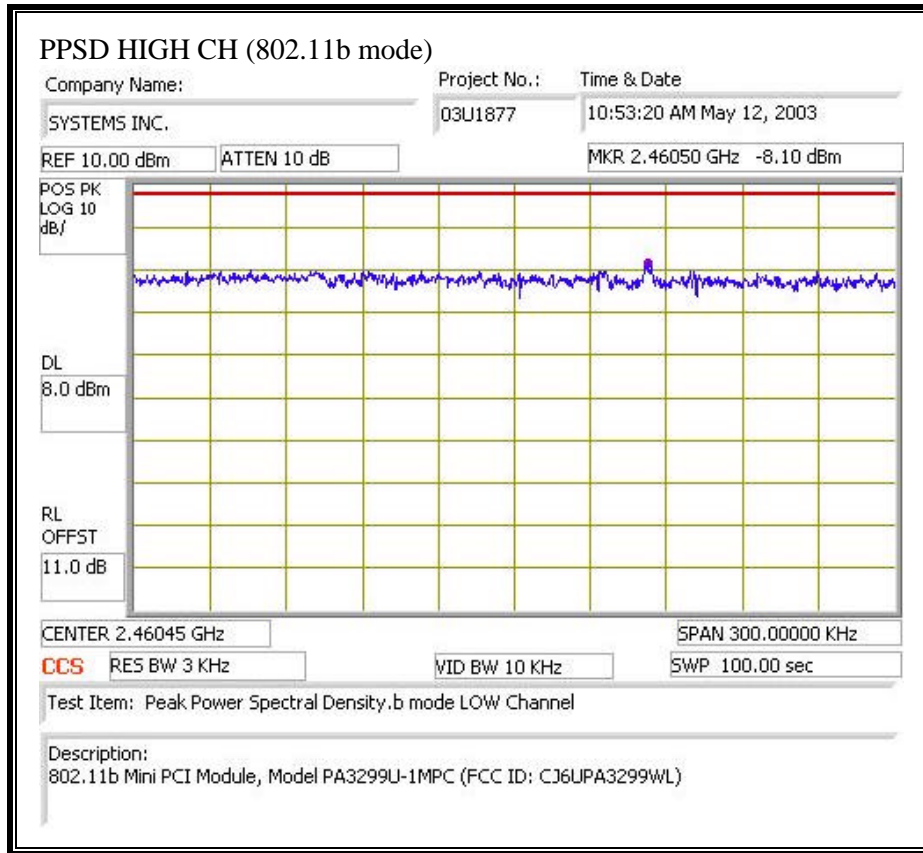
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Middle	2437	-19.70	8	-27.70



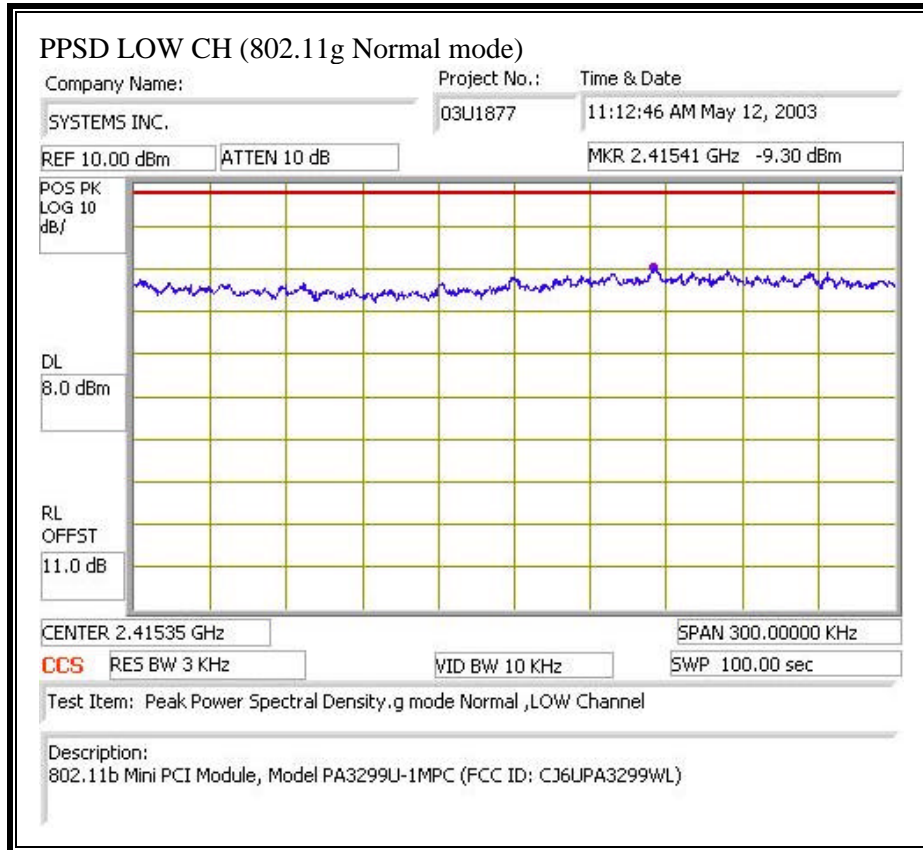
**PEAK POWER SPECTRAL DENSITY (802.11b MODE)**

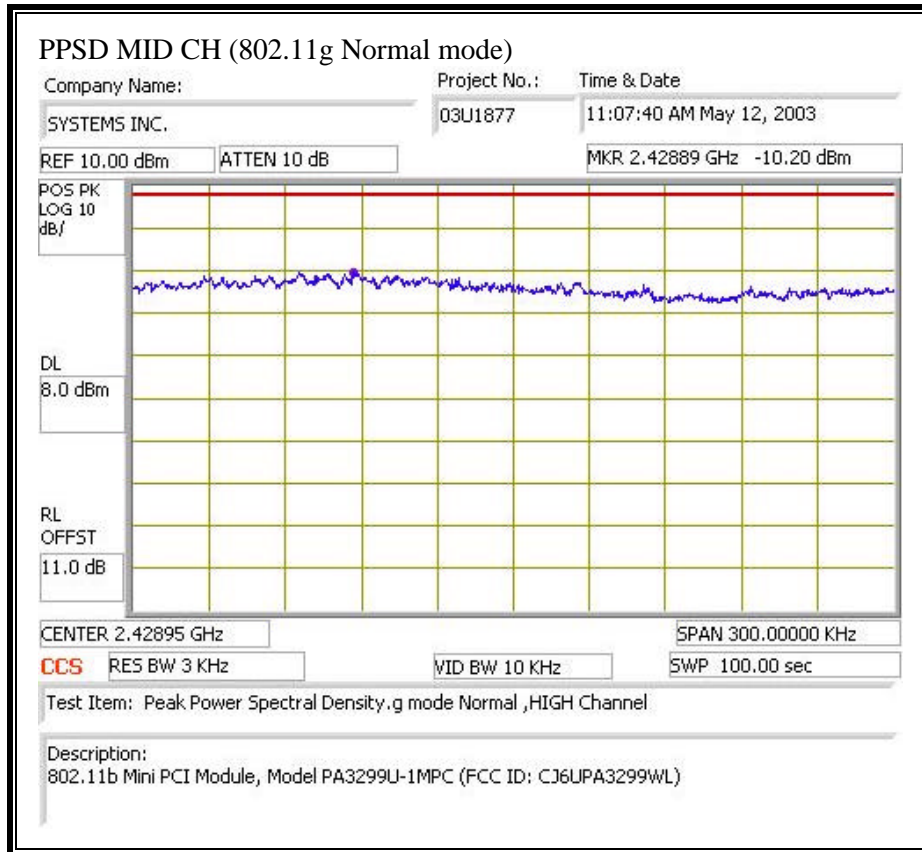


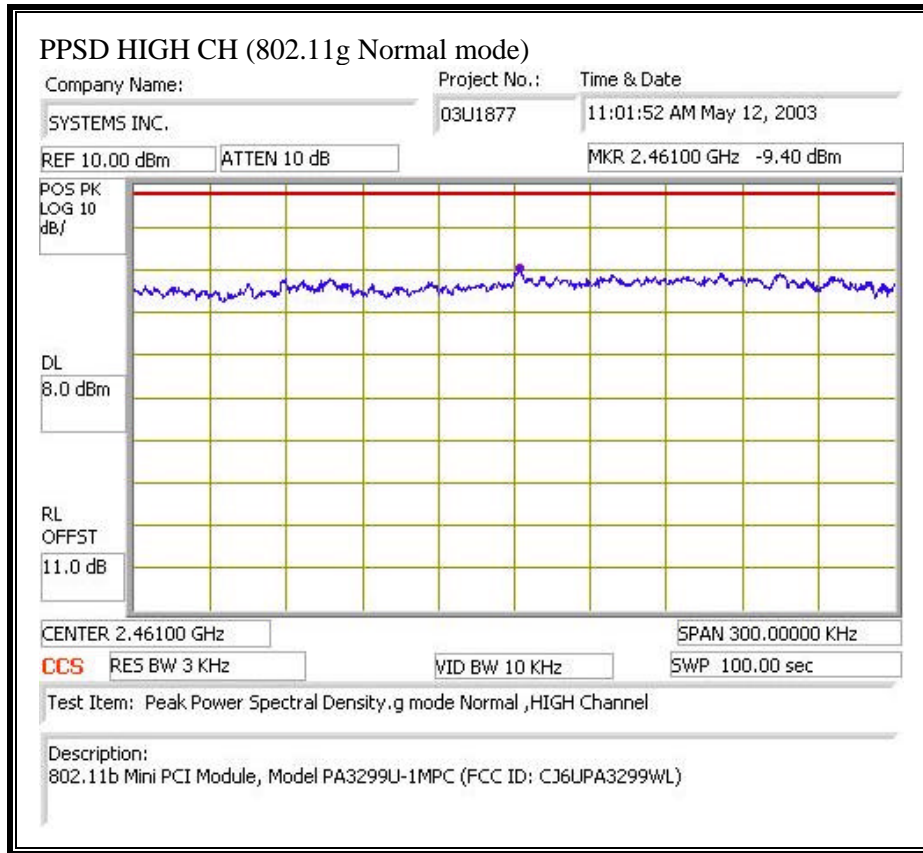




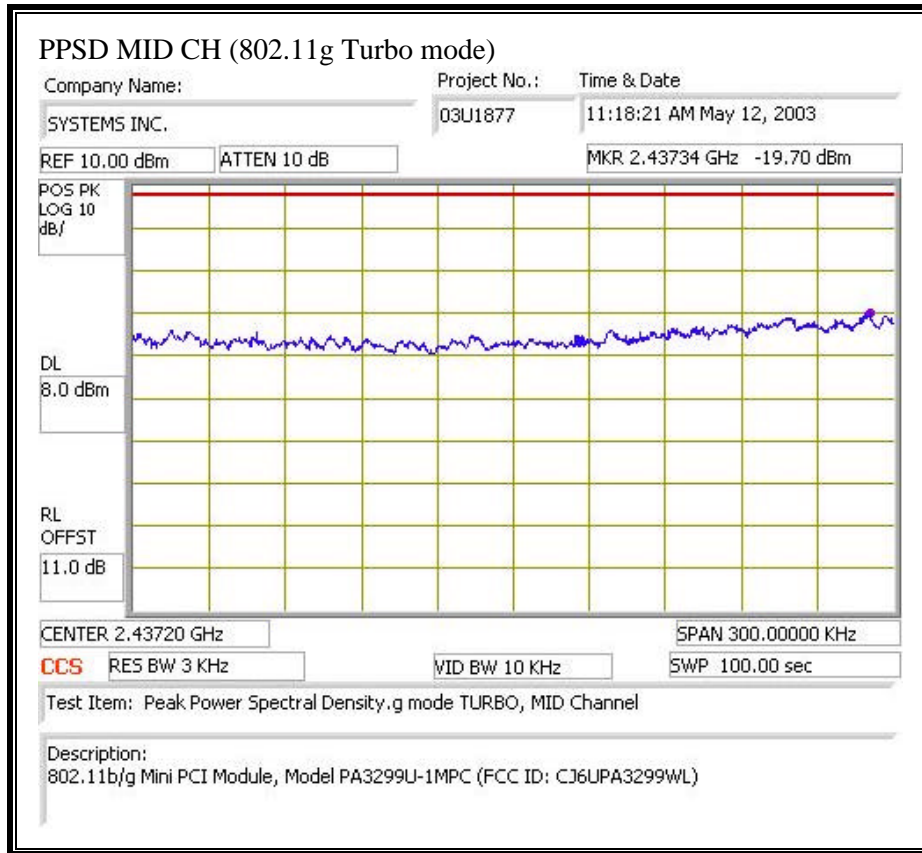
**PEAK POWER SPECTRAL DENSITY (802.11g NORMAL MODE)**







**PEAK POWER SPECTRAL DENSITY (802.11g TURBO MODE)**



## 7.5. 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.

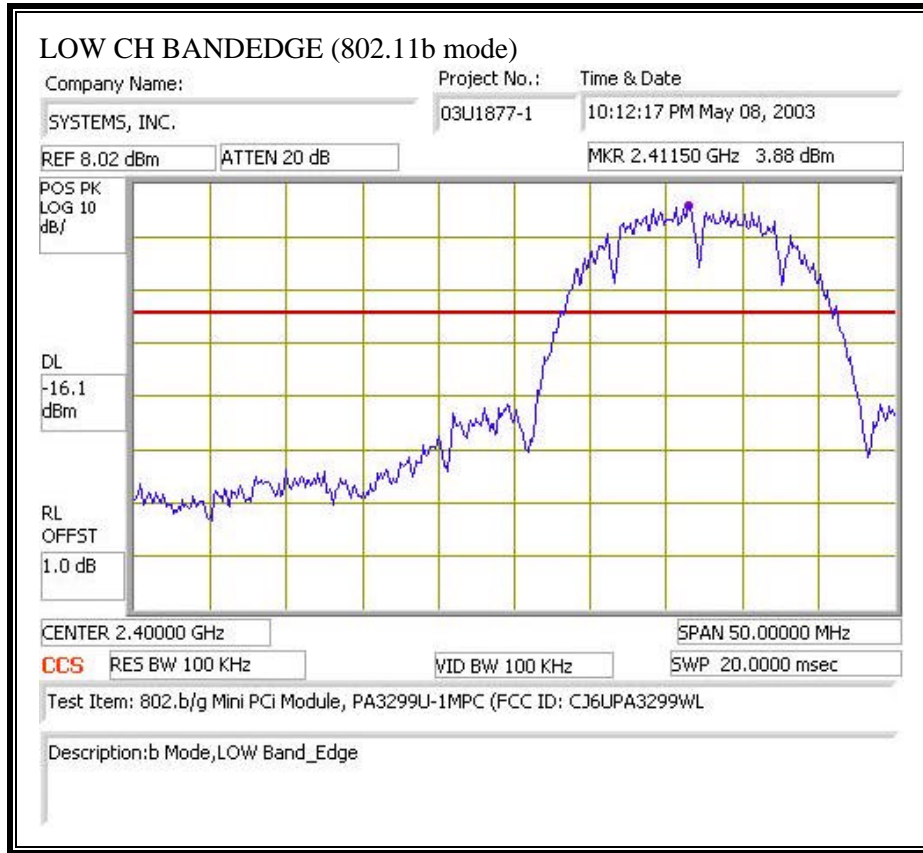
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

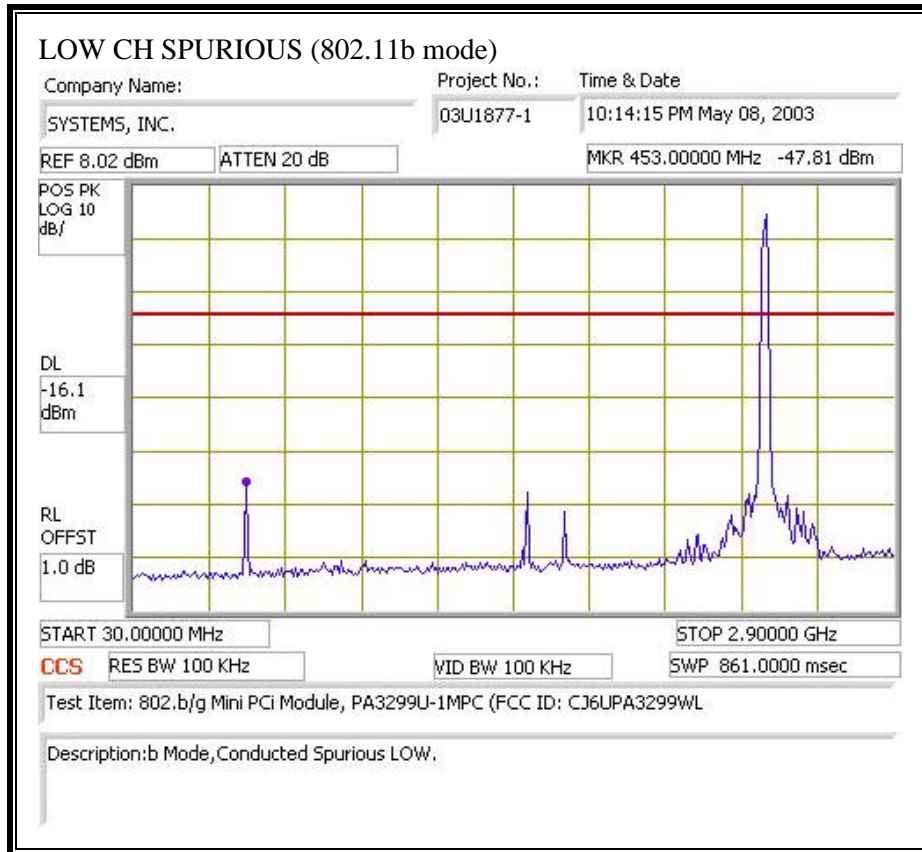
### RESULTS

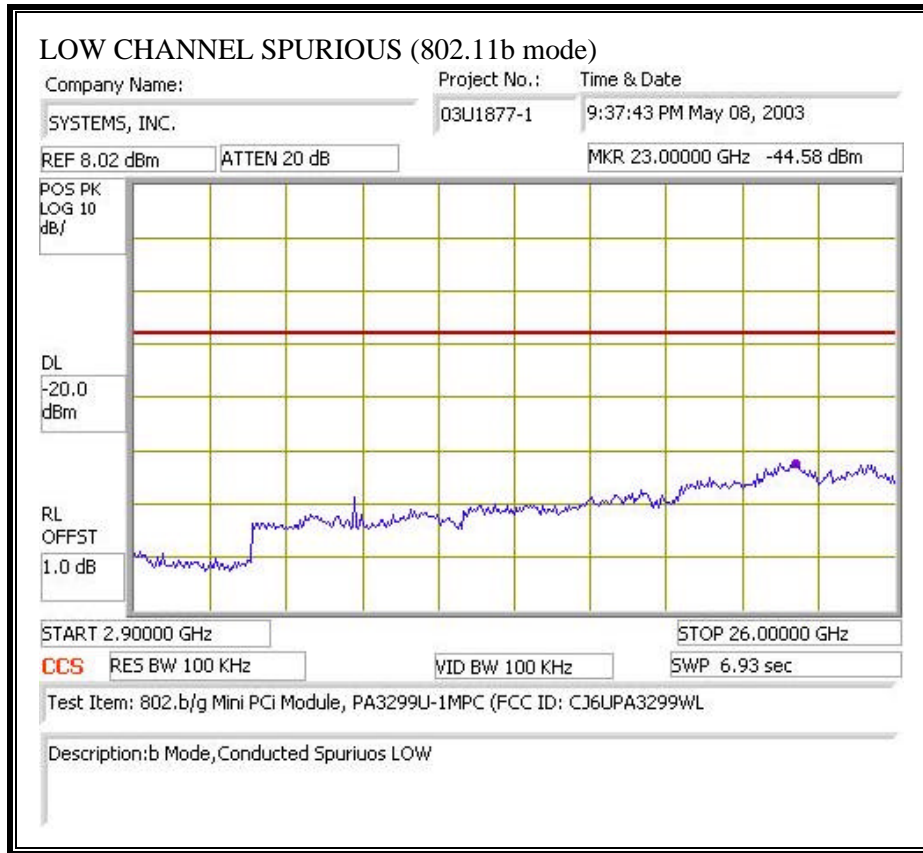
No non-compliance noted:



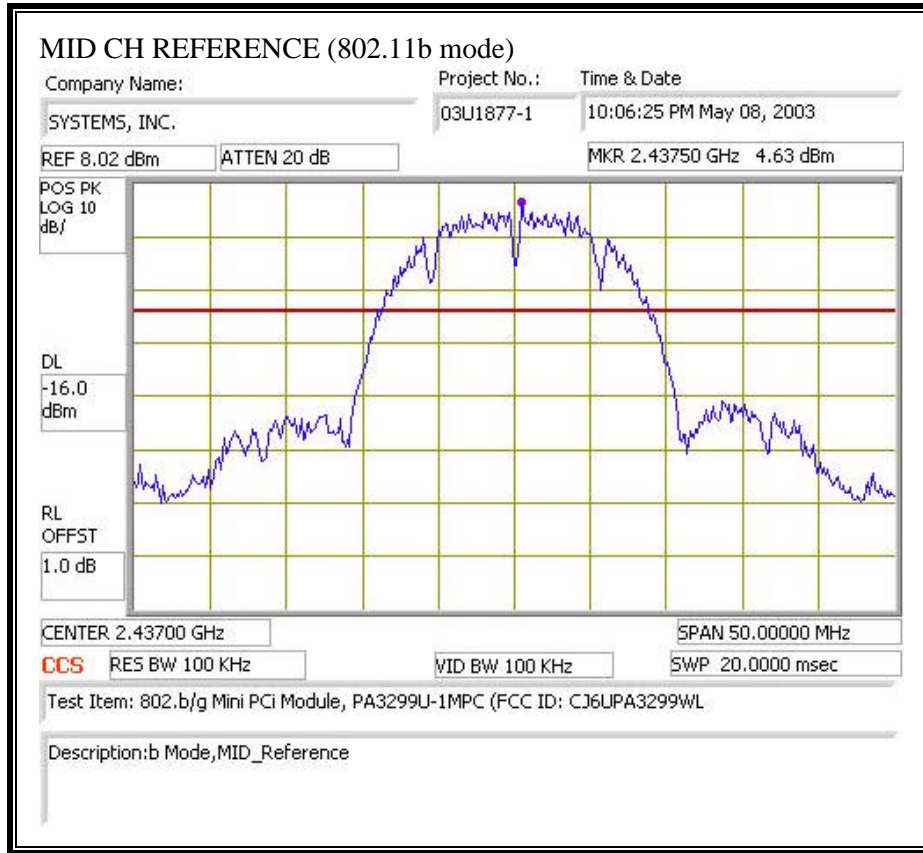
**SPURIOUS EMISSIONS, LOW CHANNEL (802.11b MODE)**

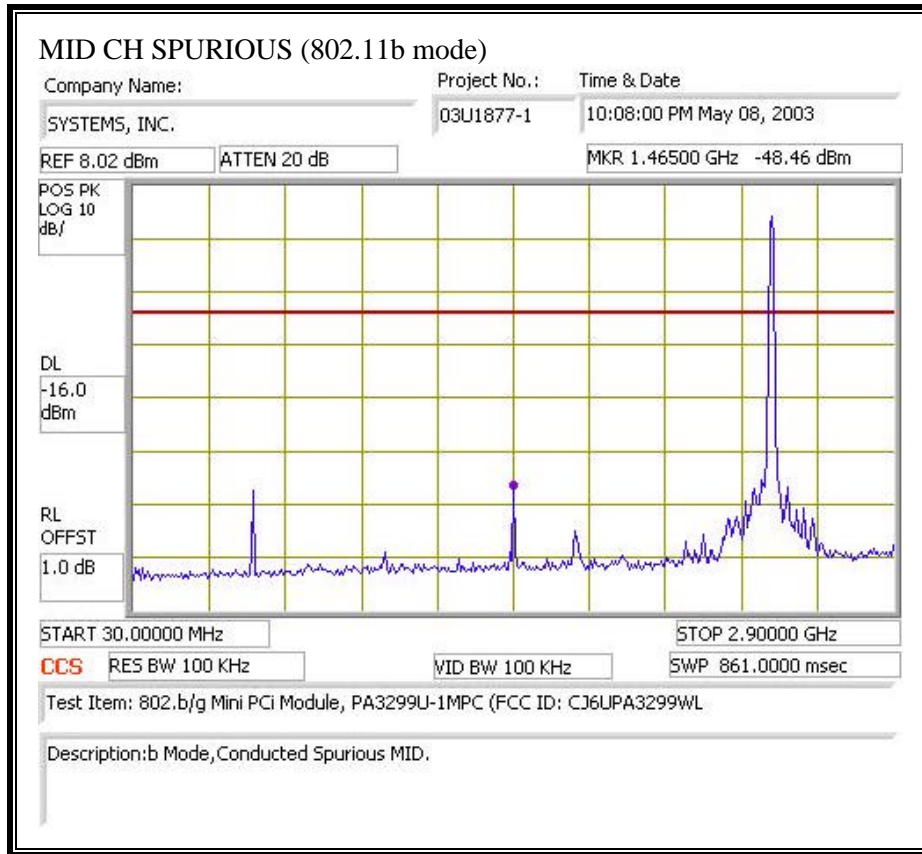


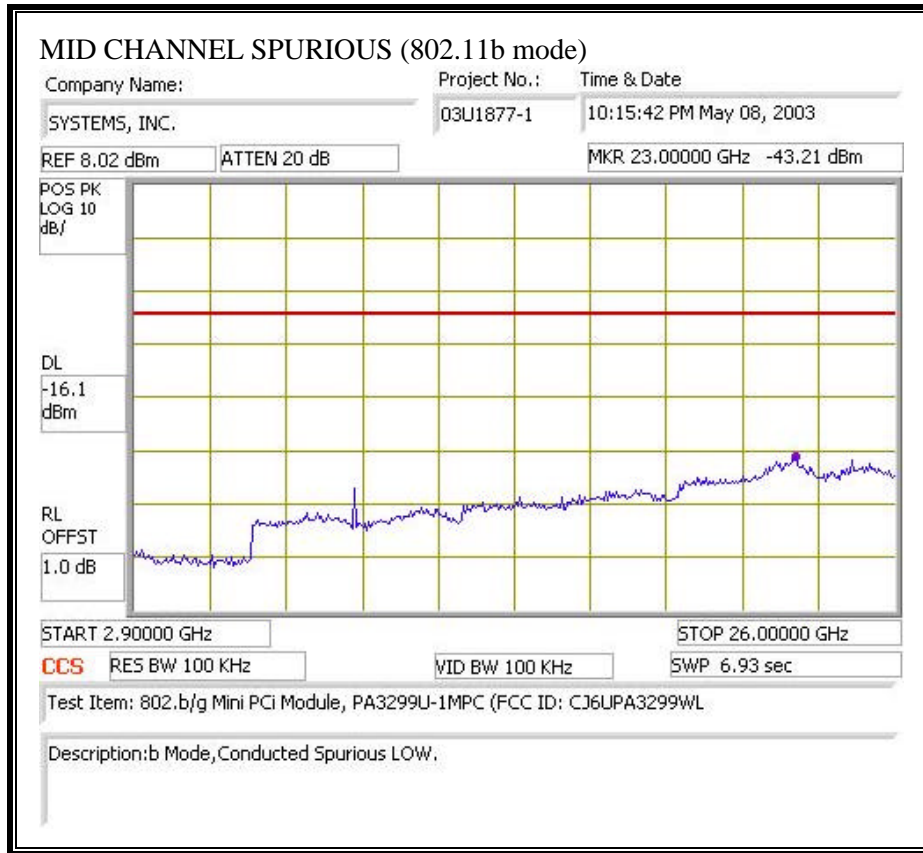




**SPURIOUS EMISSIONS, MID CHANNEL (802.11b MODE)**







**SPURIOUS EMISSIONS, HIGH CHANNEL (802.11b MODE)**

