



**FCC 47 CFR PART 15 SUBPART C AND ANSI C63.4 : 2003**

**TEST REPORT**

**For**

**VoIP/ (802.11g) ADSL2+ Firewall Router**

**Model : BiPAC 7401VGP R4**

**Data Applies To : BiPAC 7401VGL R4 ; BiPAC 7401VG R4 ; BEC 7401VGP R4  
BEC 7401VGL R4 ; BEC 7401VG R4**

**Issued for**

**Billion Electric Co., Ltd.**

**8F., No. 192, Sec. 2, Chung -Hsing Road, Hsin-Tien City,  
Taipei Hsien, Taiwan, R.O.C.**

**Issued by**

**Compliance Certification Services Inc.  
Tainan Laboratory**

No. 8, Jiu Cheng Ling, Jiaokeng Village, Sinhua  
Township, Tainan Hsien 712, Taiwan R.O.C.

**TEL: 886-6-580-2201**

**FAX: 886-6-580-2202**





## Revision History

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## TABLE OF CONTENTS

TITLE	PAGE NO.
<b>1. TEST REPORT CERTIFICATION.....</b>	<b>4</b>
<b>2. EUT DESCRIPTION.....</b>	<b>5</b>
<b>2.1 DESCRIPTION OF EUT &amp; POWER.....</b>	<b>5</b>
<b>3. DESCRIPTION OF TEST MODES.....</b>	<b>6</b>
<b>4. TEST METHODOLOGY.....</b>	<b>6</b>
<b>5. FACILITIES AND ACCREDITATIONS.....</b>	<b>7</b>
<b>5.1 FACILITIES .....</b>	<b>7</b>
<b>5.2 EQUIPMENT.....</b>	<b>7</b>
<b>5.3 LABORATORY ACCREDITATIONS LISTINGS.....</b>	<b>7</b>
<b>5.4 TABLE OF ACCREDITATIONS AND LISTINGS .....</b>	<b>8</b>
<b>6. CALIBRATION AND UNCERTAINTY.....</b>	<b>9</b>
<b>6.1 MEASURING INSTRUMENT CALIBRATION.....</b>	<b>9</b>
<b>6.2 MEASUREMENT UNCERTAINTY.....</b>	<b>9</b>
<b>7. SETUP OF EQUIPMENT UNDER TEST.....</b>	<b>10-11</b>
<b>8. APPLICABLE LIMITS AND TEST RESULTS .....</b>	<b>12</b>
<b>8.1 6dB BANDWIDTH .....</b>	<b>12-17</b>
<b>8.2 99% BANDWIDTH .....</b>	<b>18-23</b>
<b>8.3 MAXIMUM PEAK OUTPUT POWER .....</b>	<b>24-29</b>
<b>8.4 MAXIMUM PERMISSIBLE EXPOSURE.....</b>	<b>30-31</b>
<b>8.5 AVERAGE POWER.....</b>	<b>32-33</b>
<b>8.6 POWER SPECTRAL DENSITY .....</b>	<b>34-39</b>
<b>8.7 CONDUCTED SPURIOUS EMISSION.....</b>	<b>40-44</b>
<b>8.8 RADIATED EMISSIONS .....</b>	<b>45</b>
<b>8.8.1 TRANSMITTER RADIATED SUPURIOUS EMESSIONS .....</b>	<b>45-48</b>
<b>8.8.2 WORST-CASE RADIATED EMISSION BELOW 1 GHz.....</b>	<b>49</b>
<b>8.8.3 TRANSMITTER RADIATED EMISSION ABOVE 1 GHz.....</b>	<b>50-55</b>
<b>8.8.4 RESTRICTED BAND EDGES .....</b>	<b>56-63</b>
<b>8.9 POWERLINE CONDUCTED EMISSIONS .....</b>	<b>64-67</b>
<b>APPENDIX SETUP PHOTOS.....</b>	<b>68-73</b>



## 1. TEST REPORT CERTIFICATION

**Applicant** : Billion Electric Co., Ltd.

**Address** : 8F., No. 192, Sec. 2, Chung -Hsing Road, Hsin-Tien City, Taipei Hsien, Taiwan, R.O.C.

**Equipment Under Test** : VoIP/ (802.11g) ADSL2+ Firewall Router

**Model** : BiPAC 7401VGP R4

**Data Applies To** : BiPAC 7401VGL R4 ; BiPAC 7401VG R4 ; BEC 7401VGP R4  
BEC 7401VGL R4 ; BEC 7401VG R4

**Tested Date** : June 18 ~ July 07, 2009

APPLICABLE STANDARD	
STANDARD	TEST RESULT
FCC Part 15 Subpart C AND ANSI C63.4:2003	PASS

Approved by:

Jeter Wu  
Section Manager

Reviewed by:

Eric Yang  
Senior Engineer

WE HEREBY CERTIFY THAT: The measurements shown in the attachment were made in accordance with the procedures indicated, and the energy emitted by the equipment was found to be within the limits applicable. We assume full responsibility for the accuracy and completeness of these measurements and vouch for the qualifications of all persons taking them.



## 2. EUT DESCRIPTION

### 2.1 DESCRIPTION OF EUT & POWER

<b>Product Name</b>	VoIP/ (802.11g) ADSL2+ Firewall Router
<b>Model Number</b>	BiPAC 7401VGP R4
<b>Data Applies To</b>	BiPAC 7401VGL R4 ; BiPAC 7401VG R4 ; BEC 7401VGP R4 BEC 7401VGL R4 ; BEC 7401VG R4
<b>Frequency Range</b>	IEEE 802.11b/g : 2412MHz ~ 2462MHz
<b>Transmit Power</b>	IEEE 802.11b : 22.88dBm IEEE 802.11g : 19.48dBm
<b>Channel Spacing</b>	IEEE 802.11b/g : 5MHz
<b>Channel Number</b>	IEEE 802.11b/g : 11 Channels
<b>Transmit Data Rate</b>	IEEE 802.11b : 11, 5.5, 2, 1 Mbps IEEE 802.11g : 54, 48, 36, 24, 18, 12, 9, 6 Mbps
<b>Type of Modulation</b>	IEEE 802.11b : DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g : OFDM (64QAM, 16QAM, QPSK, BPSK)
<b>Frequency Selection</b>	by software / firmware
<b>Antenna Type</b>	Dipole Antenna, Antenna Gain 2dBi
<b>Power Source</b>	12VDC, 1A (From Power Adapter)
<b>I/O Port</b>	ETHERNET (RJ-45) LAN Port × 4、 (RJ-11) TEL Port × 1、 (RJ-11) DSL Port × 1、 (RJ-11) Line Port × 1、 Power port × 1

#### Power Adapter :

No.	Manufacturer	Model No.	Power Input	Power Output
1	EGB	PAW012A12UL	100-240V, 0.5A , 50/60Hz	12VDC, 1.0A

**The difference of the series model**

<b>Model Different Item</b>	BiPAC 7401VGP R4	BiPAC 7401VGL R4	BiPAC 7401VG R4	BEC 7401VGP R4	BEC 7401VGL R4	BEC 7401VG R4
<b>Trade Name</b>	BILLION	BILLION	BILLION	BEC	BEC	BEC
<b>External Feature</b>	O	O	O	O	O	O
<b>External Color</b>	Whit	Whit	Whit	Whit	Whit	Whit
<b>Housing Drawing</b>	D1	D1	D1	D1	D1	D1
<b>Support 802.11g</b>	O	O	O	O	O	O
<b>Circuits Design</b>	O	O	O	O	O	O
<b>Model Module</b>	Flash 4MB SDRAM 32MB					
<b>Power Supply</b>	12VDC, 1A					

Remark : "O" means all the same.

"X" means the difference.

**Remark:**

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: QI3BIL-BiPAC 7401VGP R4 filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.
3. For more details, please refer to the User's manual of the EUT.

### 3. DESCRIPTION OF TEST MODES

#### IEEE 802.11 b, 802.11g

The EUT had been tested under operating condition.

There are three channels have been tested as following :

<b>Channel</b>	<b>Frequency (MHz)</b>
Low	2412
Middle	2437
High	2462

IEEE 802.11b mode : 1Mbps data rate (worst case) were chosen for full testing.

IEEE 802.11g mode : 6Mbps data rate (worst case) were chosen for full testing.

### 4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4:2003 and FCC CRF 47 15.207, 15.209 and 15.247.



## 5. FACILITIES AND ACCREDITATIONS

### 5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

No. 8, Jiu Cheng Ling, Jiaokeng Village, Sinhua Township, Tainan Hsien 712, Taiwan R.O.C.

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 : 2003 and CISPR Publication 22.

### 5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

### 5.3 LABORATORY ACCREDITATIONS LISTINGS

The test facilities used to perform radiated and conducted emissions tests are accredited by Taiwan Accreditation Foundation for the specific scope of accreditation under Lab Code: 1109 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. In addition, the test facilities are listed with Industry Canada, Certification and Engineering Bureau, IC 2324H-1 for OATS -6.



## 5.4 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	 FCC MRA: TW-1037
Japan	VCCI	3/10 meter Open Area Test Sites to perform conducted/radiated measurements	 C-2882 R-2635
Taiwan	TAF	CISPR 11, FCC METHOD-47 CFR Part 18, EN 55011, EN 60601-1-2, CISPR 22, CNS 13438, EN 55022, EN 55024, AS/NZS CISPR 22 CISPR 14, EN 55014-1, EN 55014-2, CNS 13783-1, CISPR 22, CNS 13439, EN 55013, FCC Method-47 CFR Part 15 Subpart B, IC ICES-003, VCCI V-3 & V-4 FCC Method-47 CFR Part 15 Subpart C and ANSI C63.4, LP 0002 EN / IEC 61000-4-2 / -3 / -4 / -5 / -6 / -8 / -11 EN 61000-3-2, EN 61000-3-3 EN 61000-6-3, EN 61000-6-1, AS/NZS 4251.1, EN 61000-6-4, EN 61000-6-2, AS/NZS 4251.2, EN 61204-3, EN 50130-4, EN 62040-2, EN 50371, EN 50385, AS/NZS 4268, ETSI EN 300 386 ETSI EN 300 328, ETSI EN 301 489-1/-3/-9/-17 ETSI EN 301 893, ETSI EN 300 220-2/-1 ETSI EN 300 440-2/-1 ETSI EN 301 357-2/-1 RSS-310, RSS-210 Issue 7, RSS-Gen Issue 2	  Testing Laboratory 1109
Taiwan	BSMI	CNS 13438, CNS 13783-1, CNS13439	 SL2-IN-E-0039 SL2-R1/R2-0039 SL2-A1-E-0039
Canada	Industry Canada	RSS210, Issue 7	

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



## 6. CALIBRATION AND UNCERTAINTY

### 6.1 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.

### 6.2 MEASUREMENT UNCERTAINTY

The following table is for the measurement uncertainty, which is calculated as per the document CISPR 16-4.

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 1000 MHz	+/- 3.2 dB
Radiated Emission, 1 to 26.5GHz	+/- 3.2 dB
Power Line Conducted Emission	+/- 2.1 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



## 7. SETUP OF EQUIPMENT UNDER TEST

### SUPPORT EQUIPMENT

No.	Product	Manufacturer	Model No.	Serial No.	FCC ID
1	Notebook PC	DELL	Latitude D610	CN-0C4708-48643-625 -5565	DoC
2	Notebook PC	HP	nx6130	CNU543274R	DoC
3	SW HUB	ASUS	GX1008B	90-Q872AN1N0NAMA0-8 8QSA1003522	DoC
4	ADSL iDSLAM	TECOM	M801	HIL0017	DOC
5	Telephone	ROMEO	TC-215	20081049	-----

### SETUP DIAGRAM FOR TESTS

EUT & peripherals setup diagram is shown in appendix setup photos.

### EUT OPERATING CONDITION

#### For RF test mode:

##### TX Mode:

1. Set up whole system for test as shown on diagram.
2. Press Reset→Power On

Run gui\_bootsvr.exe(PET2.7.17\ gui\_bootsvr.exe)

GUI BootSever v0.01(Bootserver Core v0.01)

Select : search MAC address: 0:4:ed:22:22:22→OK

3. Gui\_bootsvr.exe(PET2.7.17\ gui\_bootsvr.exe)

GUI BootSever v0.01(Bootserver Core v0.01)

Device IP address : 192.168.1.254

Host IP address : 192.168.1.xxx

MAC address : 0:4:ed:22:22:22

Boot file : F:/EUT driver/Billion Billion/BiPAC 7401VGP R4/BiPAC 7401VGP



4. Run Launch Prism Engineering Tool.exe

Open Adapter (Available Adapters List)

Select :Power Control 0

IEEE 802.11b Rate=1Mbps

IEEE 802.11g Rate=6Mbps

(1) IEEE 802.11b power level → Low=41000 Middle=42000 High=40500

(2) IEEE 802.11g power level → Low=47000 Middle=49000 High=46800

Start: Cont.TX

**For Normal operating :**

1. Setup whole system for test as shown on diagram
2. Notebook PC (1) (2) ping 192.168.1.254 -t to EUT.
3. Notebook PC (1) ping to Notebook PC (2)
4. ADSL iDSLAM Link DSL / LINE link Switchboard .
5. Set telephones on the talking mode .
6. All of the function are under run.
7. Start test.



## 8. APPLICABLE LIMITS AND TEST RESULTS

### 8.1 6dB BANDWIDTH

#### LIMIT

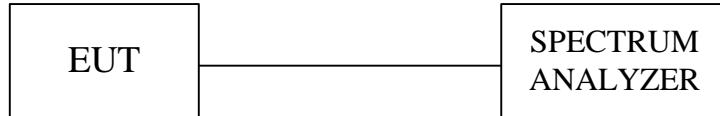
§ 15.207(a) (2) For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

#### TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
SPECTRUM ANALYZER	AGILENT	E4446A	MY43360132	06/09/2010
SPECTRUM ANALYZER	AGILENT	E4446A	MY46180323	05/26/2010

*Remark: Each piece of equipment is scheduled for calibration once a year.*

#### TEST SETUP



#### TEST PROCEDURE

The transmitter output was connected to a spectrum analyzer. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 KHz RBW and 300 KHz VBW. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.



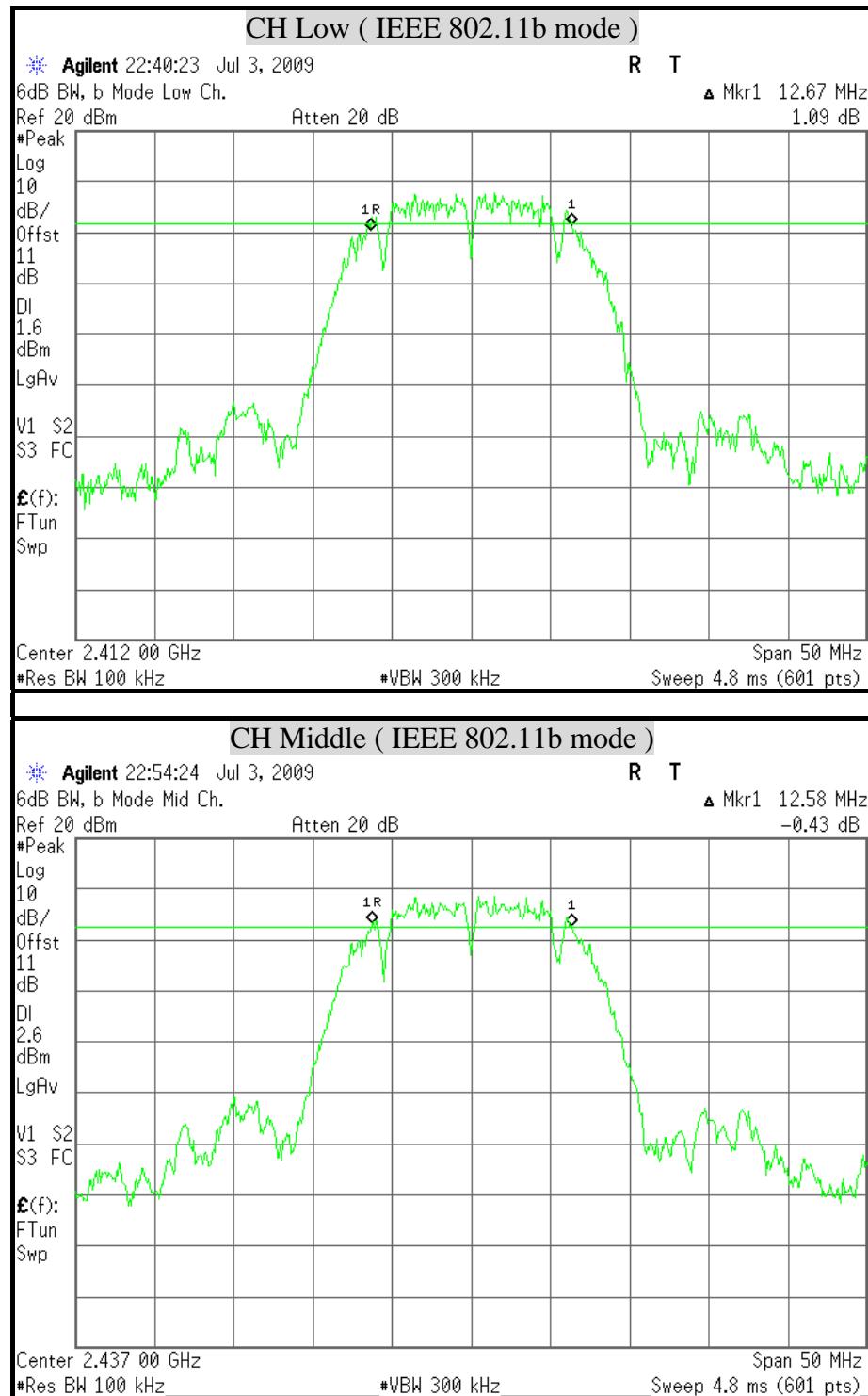
## TEST RESULTS

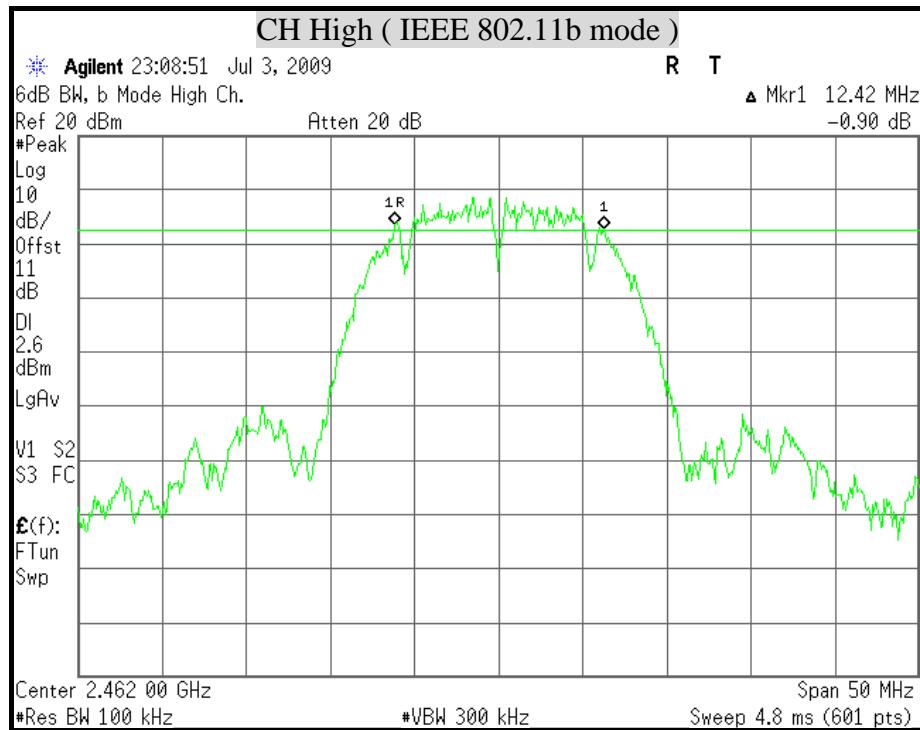
### IEEE 802.11b mode

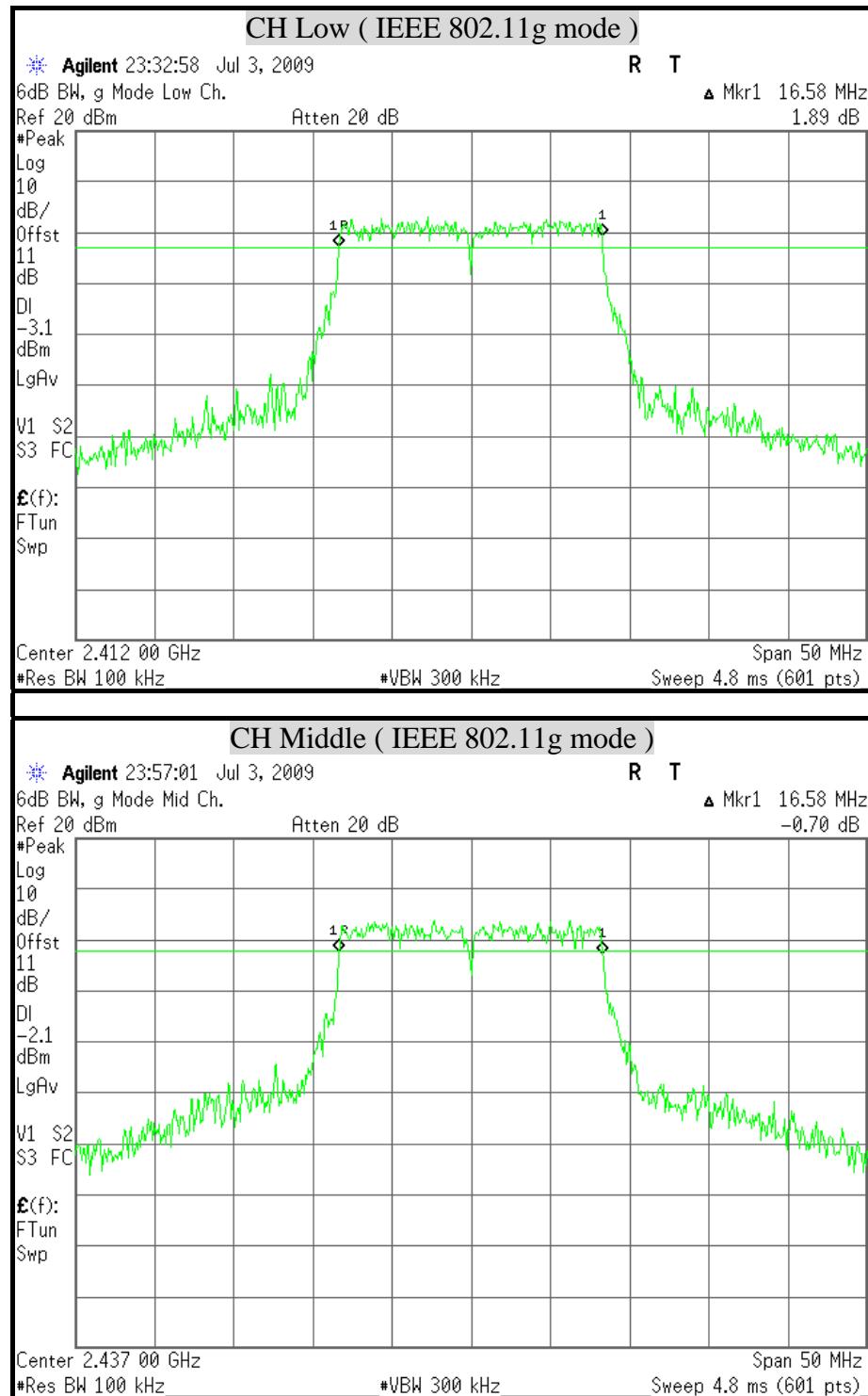
Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	12.67	500	PASS
Middle	2437	12.58	500	PASS
High	2462	12.42	500	PASS

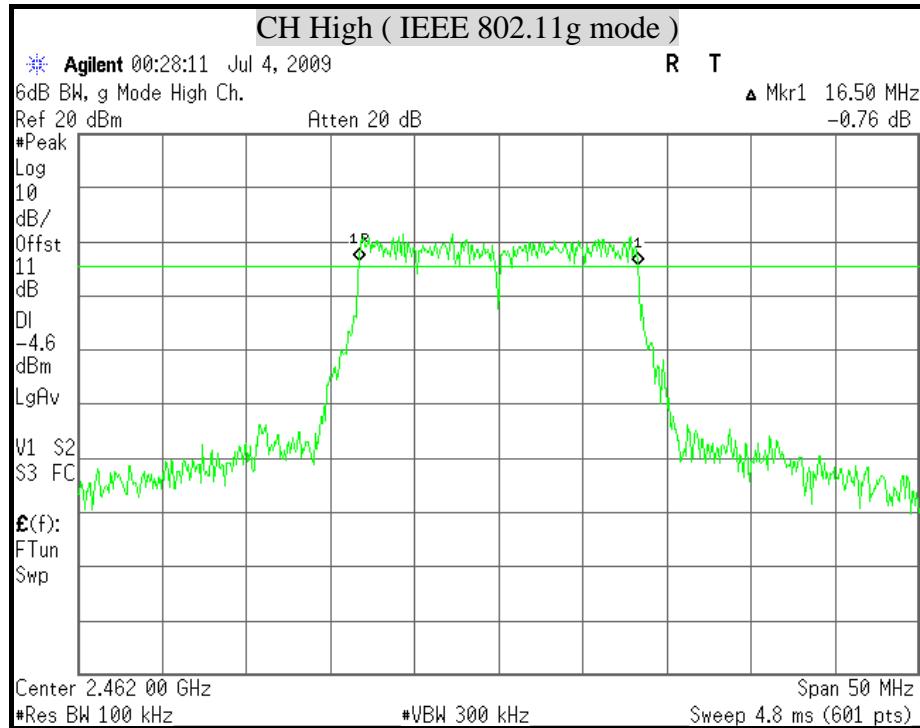
### IEEE 802.11g mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	16.58	500	PASS
Middle	2437	16.58	500	PASS
High	2462	16.50	500	PASS

**6dB BANDWIDTH ( IEEE 802.11b mode )**



**6dB BANDWIDTH ( IEEE 802.11g mode )**





## 8.2 99% BANDWIDTH

### LIMIT

None; for reporting purposes only.

### TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
SPECTRUM ANALYZER	AGILENT	E4446A	MY43360132	06/09/2010
SPECTRUM ANALYZER	AGILENT	E4446A	MY46180323	05/26/2010

*Remark:* Each piece of equipment is scheduled for calibration once a year.

### TEST SETUP



### TEST PROCEDURE

1. The spectrum shall be set as follows :  
Span : The minimum span to fully display the emission and approximately 20dB below peak level.  
RBW : The set to 1% to 3% of the approximate emission width.
2. Compute the combined power of all signal responses contained in the trace by covering all the data points.
3. For 99% occupied BW, place the markers at the frequency at which 0.5% of the power lies to the right of the right marker and 0.5% of the power lies to the left of the left marker.
4. The 99% BW is the bandwidth between the right and left markers.



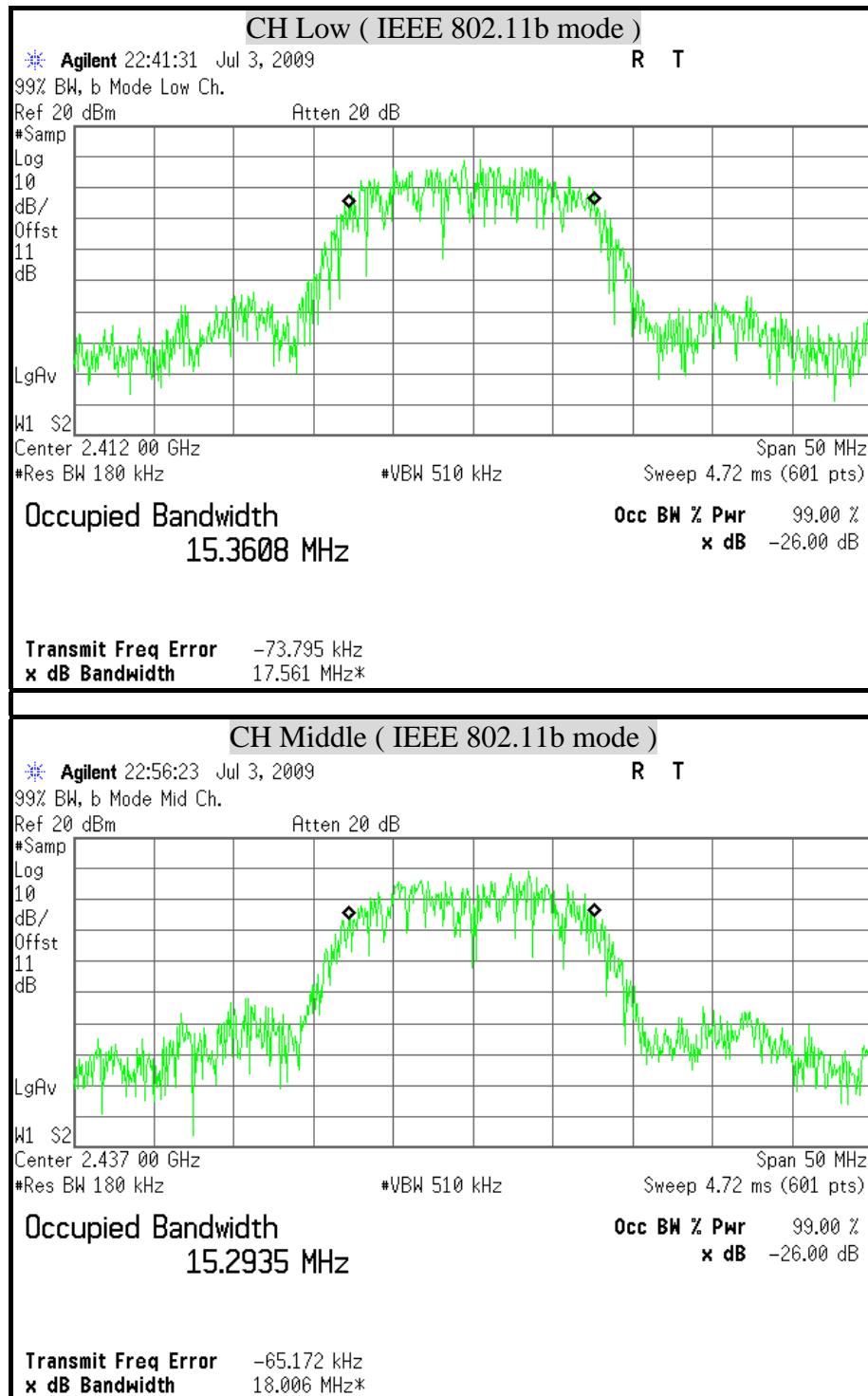
## TEST RESULTS

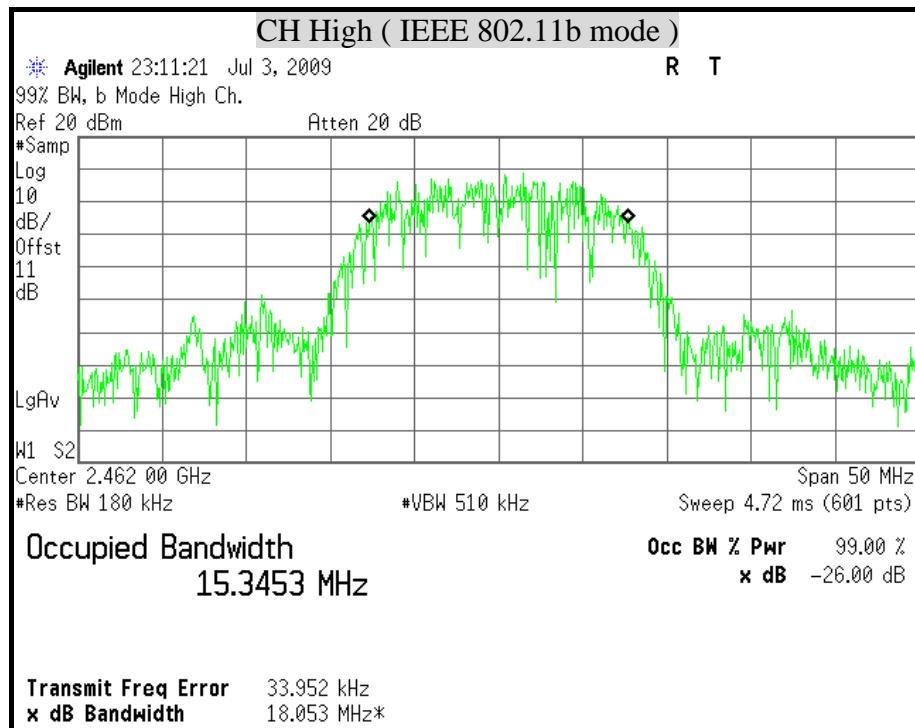
### IEEE 802.11b mode

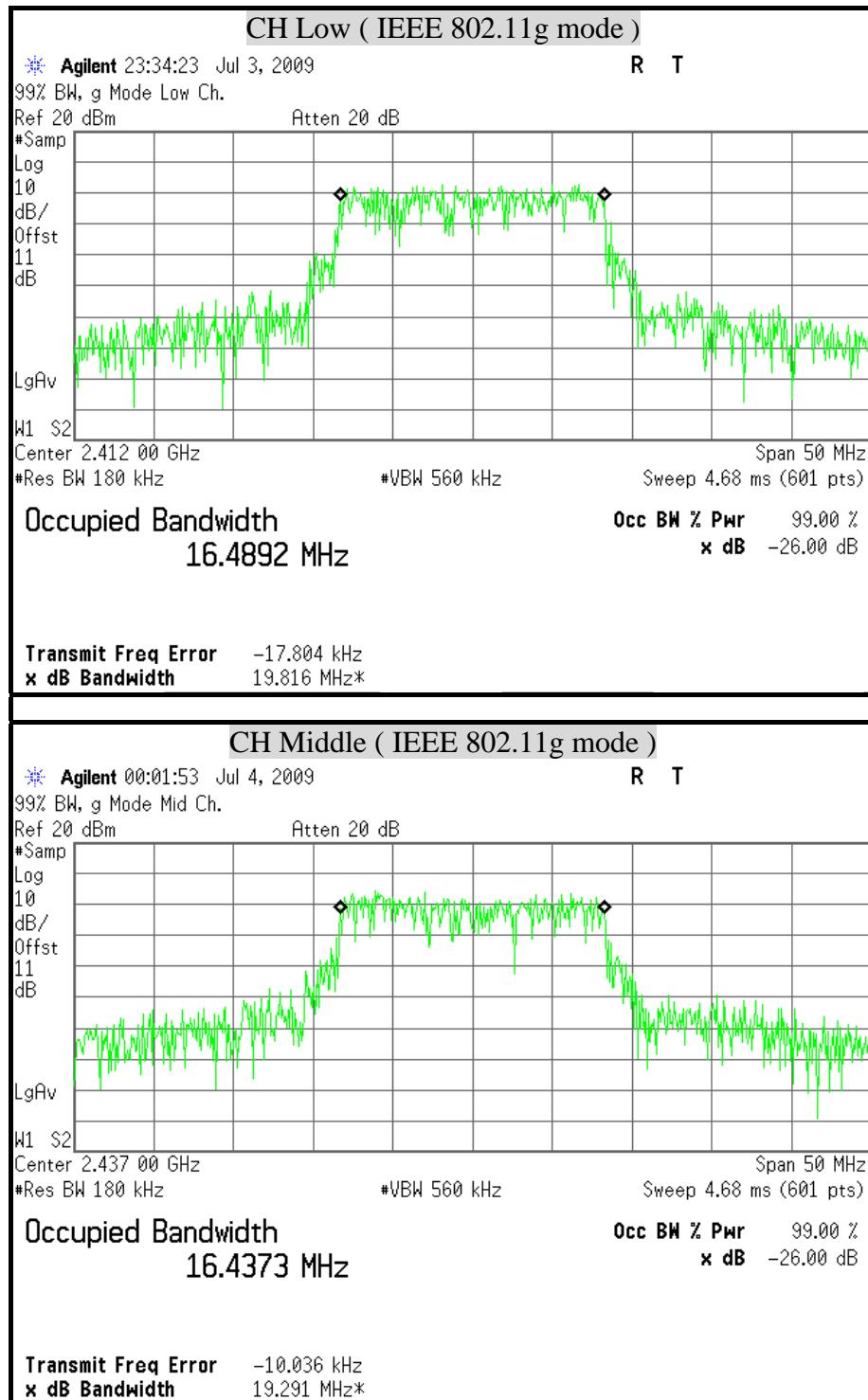
Channel	Channel Frequency (MHz)	99% Occupied power bandwidth (MHz)
Low	2412	15.360
Middle	2437	15.293
High	2462	15.345

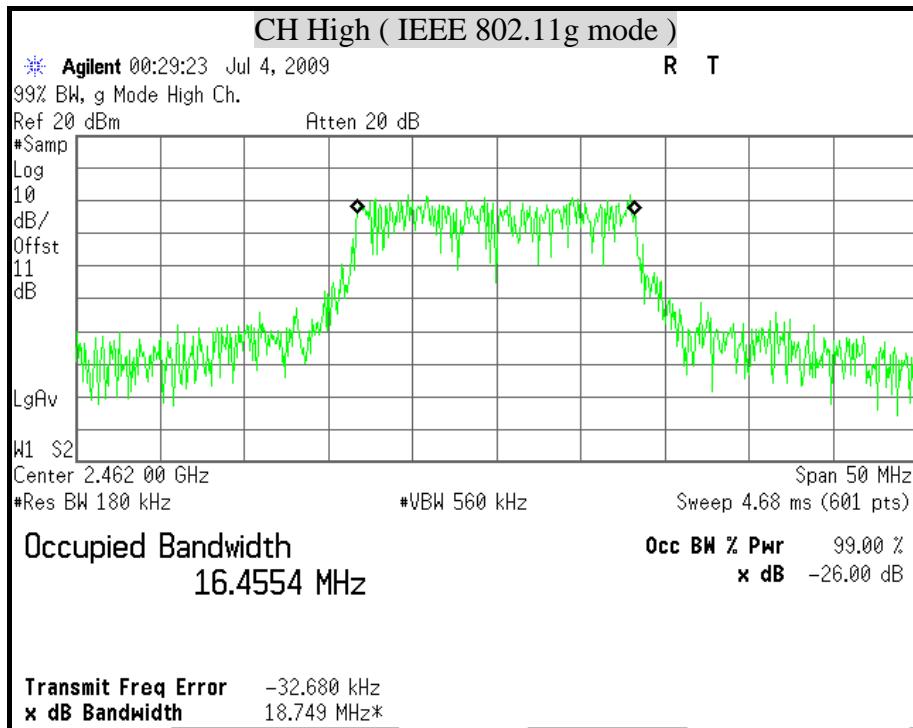
### IEEE 802.11g mode

Channel	Channel Frequency (MHz)	99% Occupied power bandwidth (MHz)
Low	2412	16.489
Middle	2437	16.437
High	2462	16.455

**99% BANDWIDTH ( IEEE 802.11b mode)**



**99% BANDWIDTH ( IEEE 802.11g mode)**



## 8.3 MAXIMUM PEAK OUTPUT 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.

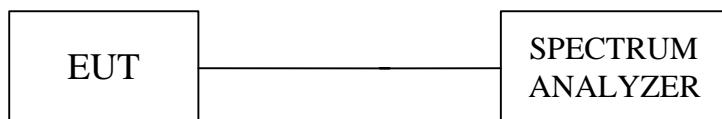
§ 15.247(b) (4) Except as shown in paragraphs (c) of this section , if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2), and (b)(3) of this section , as appropriate,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

### TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
SPECTRUM ANALYZER	AGILENT	E4446A	MY43360132	06/09/2010
SPECTRUM ANALYZER	AGILENT	E4446A	MY46180323	05/26/2010

*Remark: Each piece of equipment is scheduled for calibration once a year.*

### TEST SETUP



### TEST PROCEDURE

1. The spectrum shall be set as follows :  
Span : 1.5 times channel integration bandwidth.  
RBW : 1MHz  
VBW : 3MHz  
Detector : Peak  
Sweep : Single trace
2. Compute the combined power of all signal responses contained in the trace by covering all the data points.
3. For 99% occupied BW, place the markers at the frequency at which 0.5% of the power lies to the right of the right marker and 0.5% of the power lies to the left of the left marker.
4. The peak output power is the channel power integrated over 99% bandwidth.



## TEST RESULTS

### IEEE 802.11b mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2412	21.91	30	PASS
Middle	2437	22.88	30	PASS
High	2462	21.50	30	PASS

**Remark:**

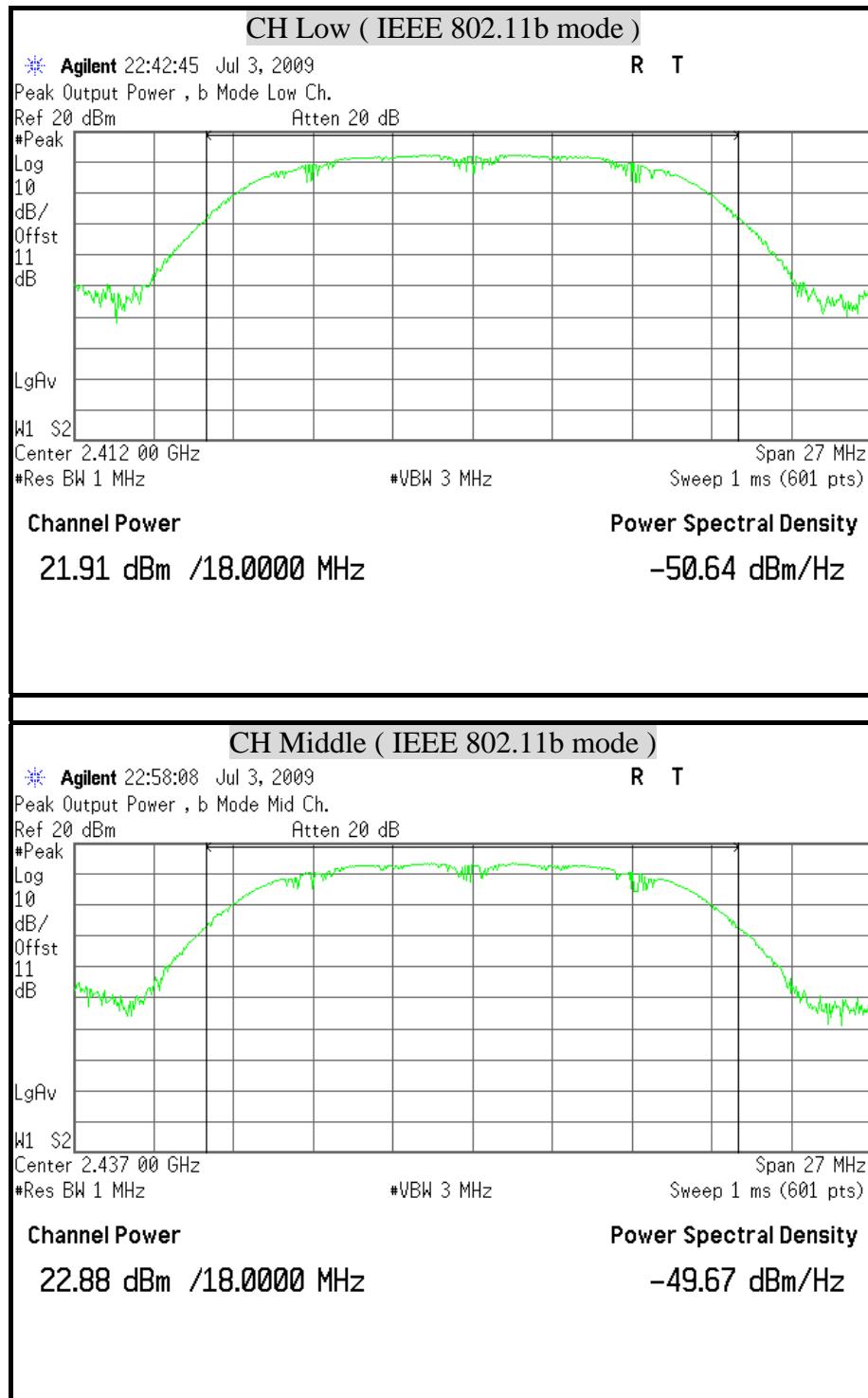
1. At final test to get the worst-case emission at 1Mbps.
2. The cable assembly insertion loss of 11dB (including 10 dB pad and 1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

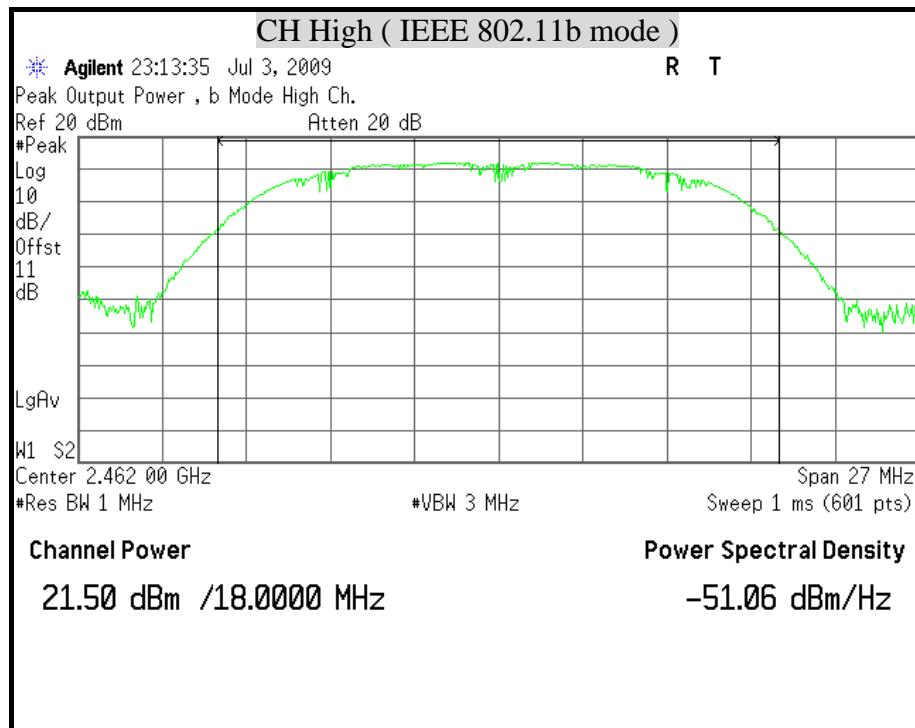
### IEEE 802.11g mode

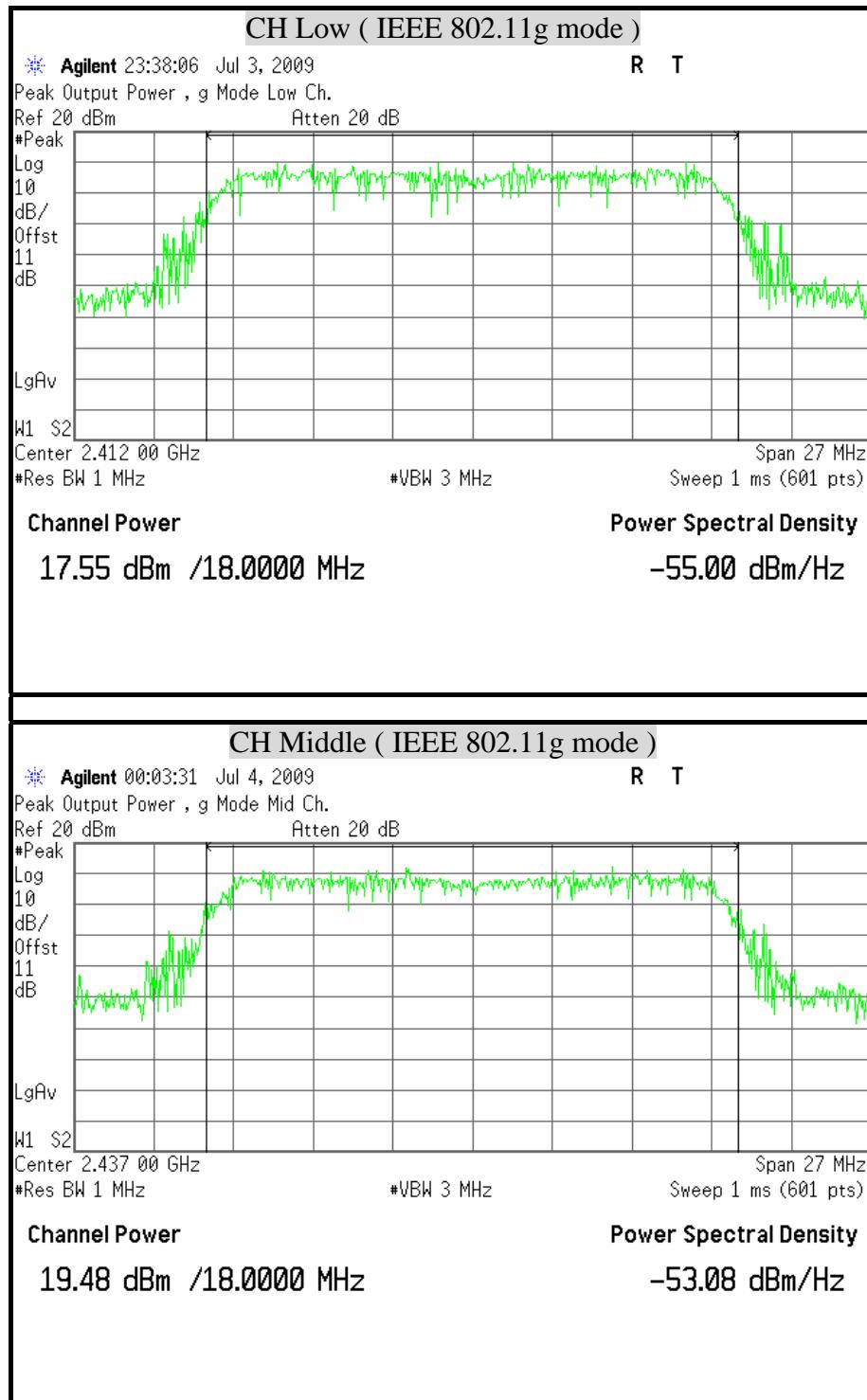
Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2412	17.55	30	PASS
Middle	2437	19.48	30	PASS
High	2462	17.37	30	PASS

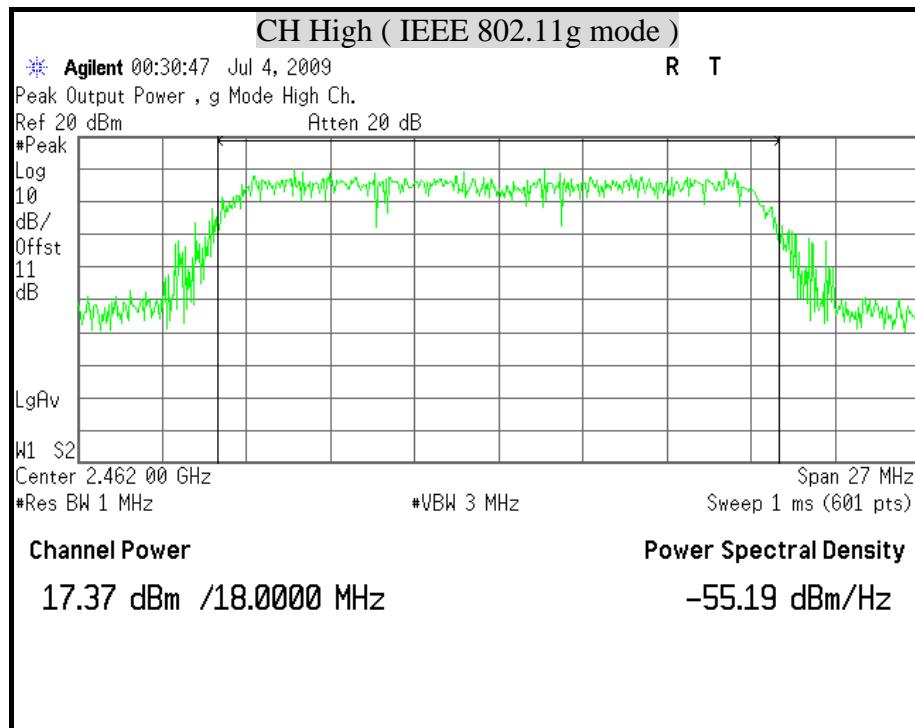
**Remark:**

1. At final test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11dB (including 10 dB pad and 1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

**MAXIMUM PEAK OUTPUT POWER ( IEEE 802.11b mode)**



**MAXIMUM PEAK OUTPUT POWER ( IEEE 802.11g mode)**





## 8.4 MAXIMUM PERMISSIBLE EXPOSURE

According to FCC 1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time
(A) Limits for Occupational / Control Exposures				
300-1,500	--	--	F/300	6
1,500-100,000	--	--	5	6
(B) Limits for General Population / Uncontrol Exposures				
300-1,500	--	--	F/1500	6
1,500-100,000	--	--	1	30

## CALCULATIONS

Given 
$$E = \frac{\sqrt{30 \times P \times G}}{d} \quad \& \quad S = \frac{E^2}{3770}$$

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 re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770 d^2}$$

Changing to units of mW and cm, using:

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

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

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$

Where  $d$  = Distance in cm

$P$  = Power in mW

$G$  = Numeric antenna gain

$S$  = Power density in mW / cm<sup>2</sup>

**LIMIT**Power Density Limit,  $S=1.0\text{mW/cm}^2$ **TEST RESULTS**

Mode	Antenna Gain (dBi)	Minimum separation distance (cm)	Output Power (dBm)	Numeric antenna gain (dB)	Power Density Limit (mW/cm <sup>2</sup> )	Power Density at 20cm (mW/cm <sup>2</sup> )
IEEE 802.11b	2	20.0	22.88	1.58	1.00	0.061196
IEEE 802.11g	2	20.0	19.48	1.58	1.00	0.027972

**Remark:** For mobile or fixed location transmitters, the maximum power density is  $1.0\text{ mW/cm}^2$  even if the calculation indicates that the power density would be larger.



## 8.5 AVERAGE POWER

### LIMIT

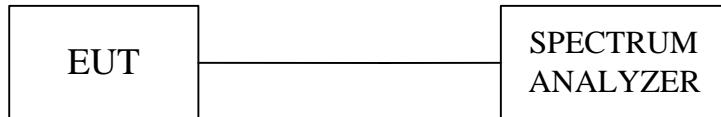
None; for reporting purposes only.

### TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
SPECTRUM ANALYZER	AGILENT	E4446A	MY43360132	06/09/2010
SPECTRUM ANALYZER	AGILENT	E4446A	MY46180323	05/26/2010

*Remark:* Each piece of equipment is scheduled for calibration once a year.

### TEST SETUP



### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer.



## TEST RESULTS

### IEEE 802.11b mode

Channel	Channel Frequency (MHz)	Average Power Output (dBm)
Low	2412	19.20
Middle	2437	20.24
High	2462	18.93

*Remark:*

1. At final test to get the worst-case emission at 1Mbps.
2. The cable assembly insertion loss of 11dB (including 10 dB pad and 1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

### IEEE 802.11g mode

Channel	Channel Frequency (MHz)	Average Power Output (dBm)
Low	2412	14.16
Middle	2437	16.67
High	2462	14.02

*Remark:*

1. At final test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11dB (including 10 dB pad and 1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

## 8.6 POWER SPECTRAL DENSITY

### LIMIT

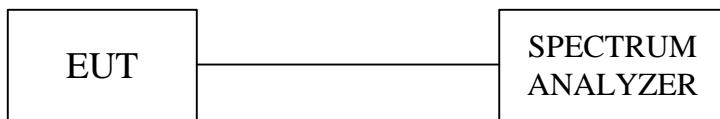
§ 15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
SPECTRUM ANALYZER	AGILENT	E4446A	MY43360132	06/09/2010
SPECTRUM ANALYZER	AGILENT	E4446A	MY46180323	05/26/2010

*Remark: Each piece of equipment is scheduled for calibration once a year.*

### TEST SETUP



### TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer, the bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW = 3KHz and VBW RBW, set sweep time = span / 3KHz.

The power spectral density was measured and recorded.

The sweep time is allowed to be longer than span / 3KHz for a full response of the mixer in the spectrum analyzer.



## **TEST RESULTS**

### **IEEE 802.11b mode**

Channel	Channel Frequency (MHz)	Final RF Power Level in 3KHz BW (dBm)	Maximum Limit (dBm)	Pass / Fail
Low	2412	-9.75	8	PASS
Middle	2437	-9.58	8	PASS
High	2462	-9.75	8	PASS

**Remark:**

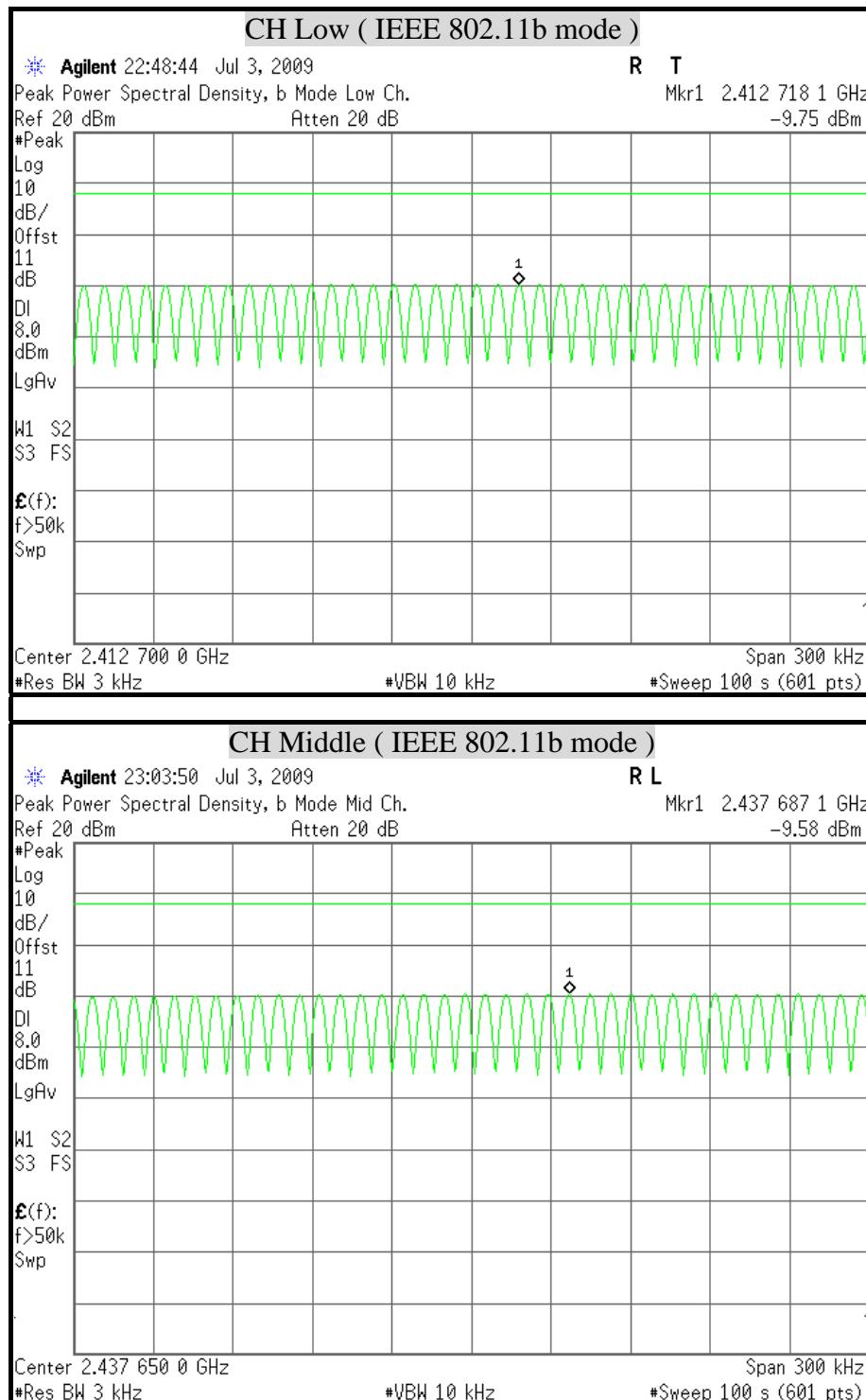
1. At final test to get the worst-case emission at 1Mbps.
2. The cable assembly insertion loss of 11dB (including 10 dB pad and 1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

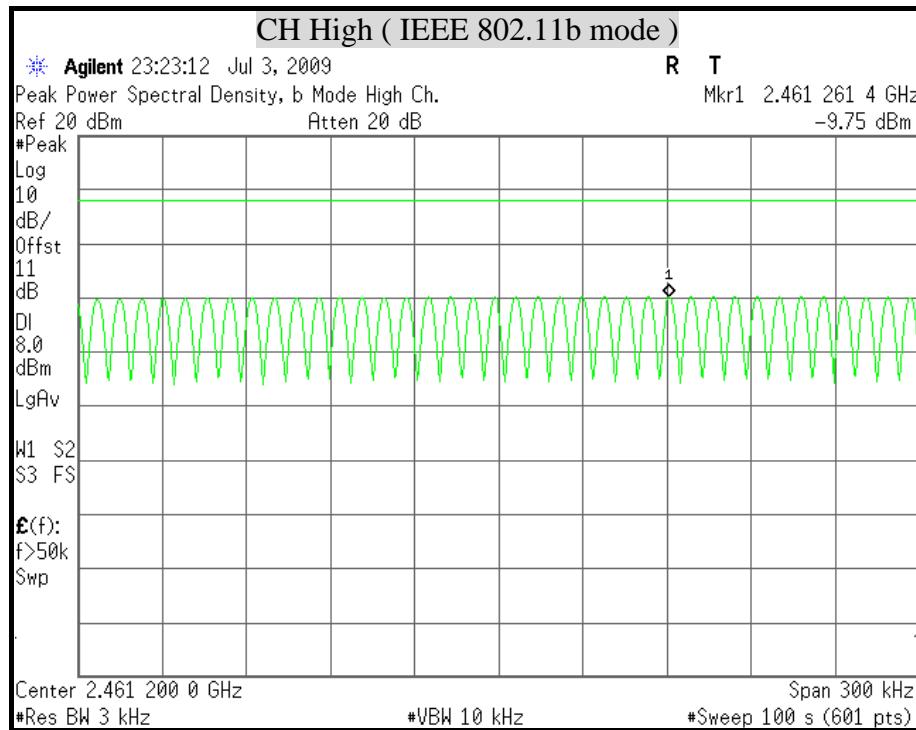
### **IEEE 802.11g mode**

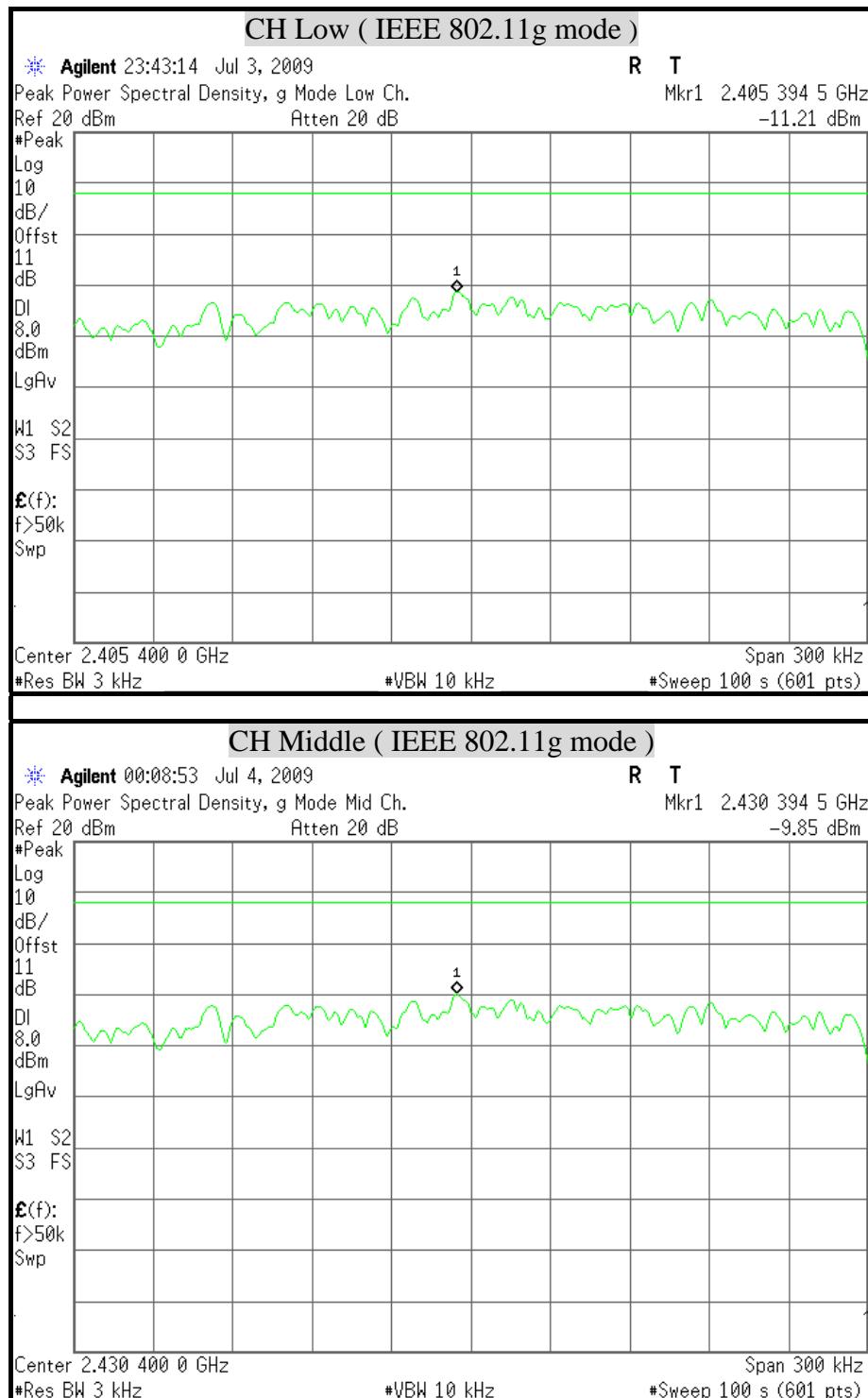
Channel	Channel Frequency (MHz)	Final RF Power Level in 3KHz BW (dBm)	Maximum Limit (dBm)	Pass / Fail
Low	2412	-11.21	8	PASS
Middle	2437	-9.85	8	PASS
High	2462	-12.51	8	PASS

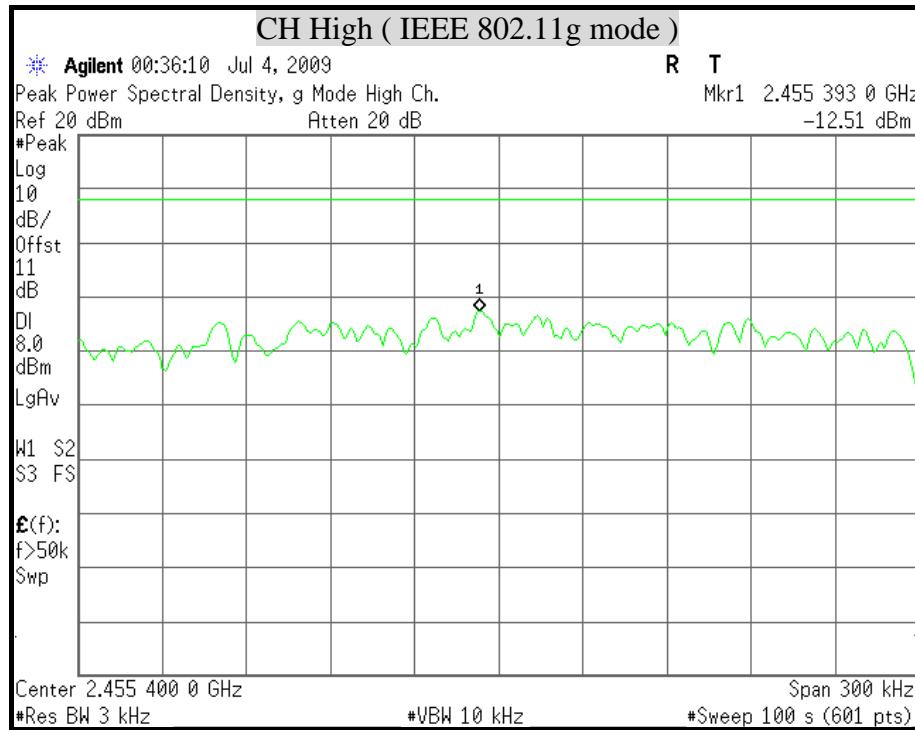
**Remark:**

1. At final test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11dB (including 10 dB pad and 1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

**POWER SPECTRAL DENSITY ( IEEE 802.11b mode)**



**POWER SPECTRAL DENSITY ( IEEE 802.11g mode)**



## 8.7 CONDUCTED SPURIOUS EMISSION

### LIMITS

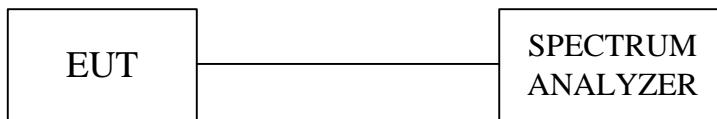
§ 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the and that contains the highest level 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 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

### TEST SETUP

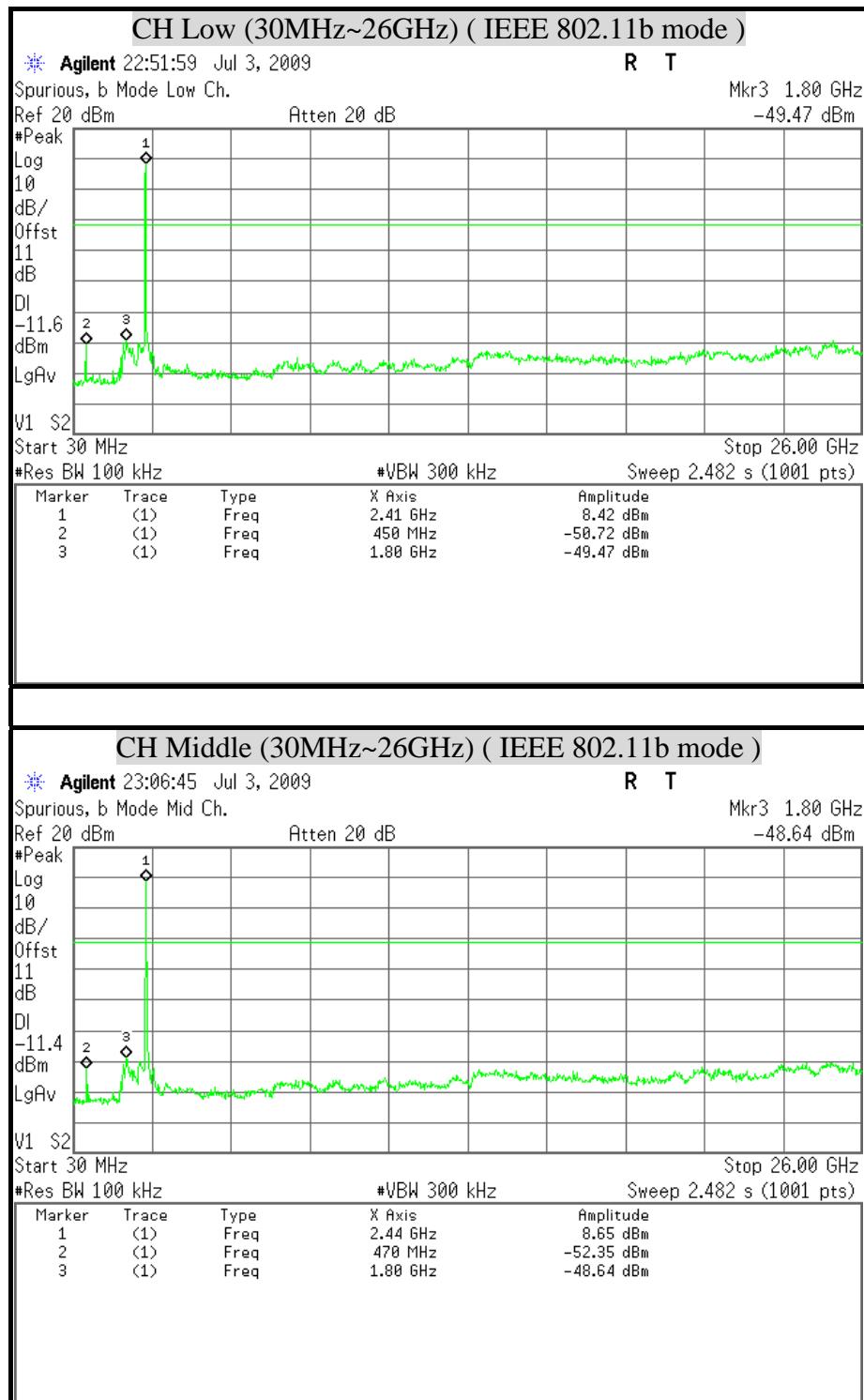


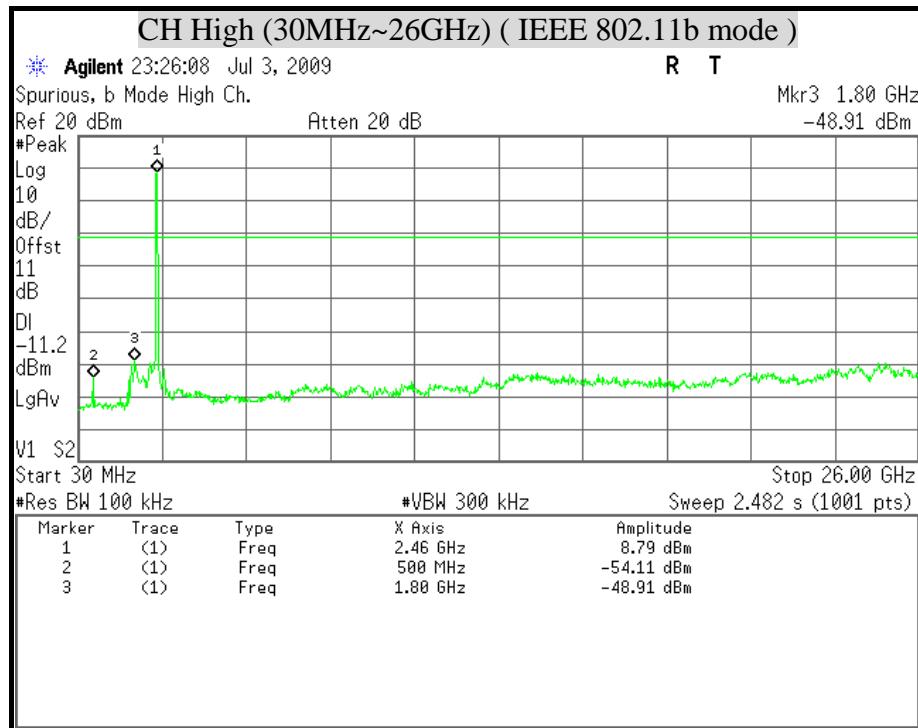


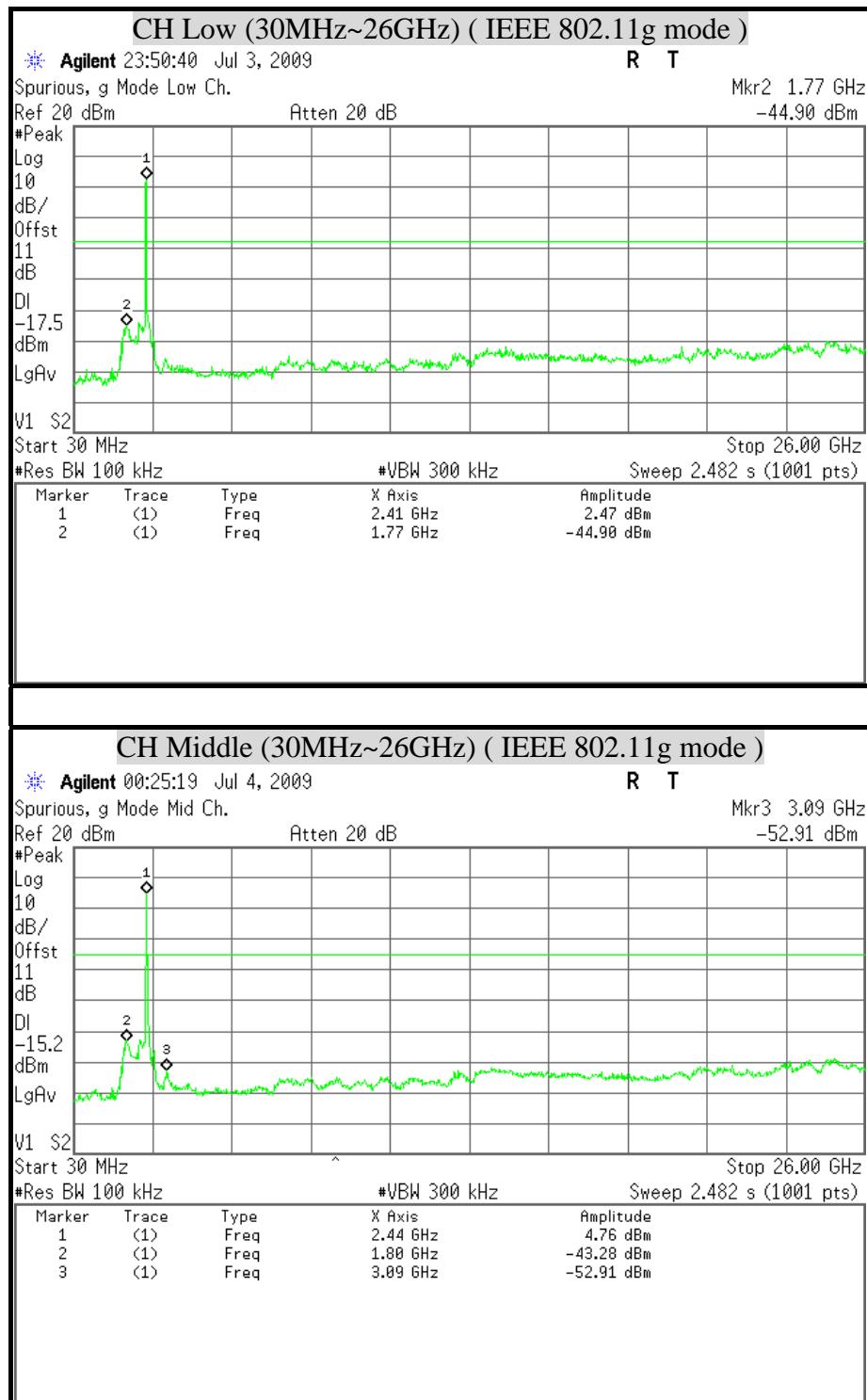
## **TEST RESULTS**

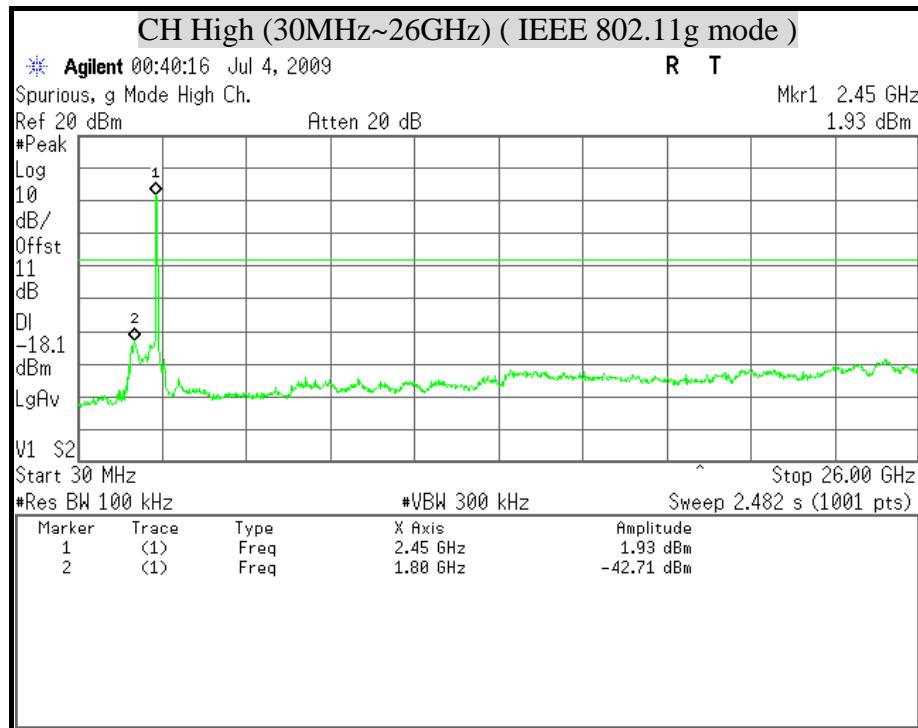
## OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

( IEEE 802.11b mode)





**OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT****( IEEE 802.11g mode)**





## 8.8 RADIATED EMISSIONS

### 8.8.1 TRANSMITTER RADIATED SUPURIOUS 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
<sup>1</sup> 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 - 3338	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41			

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> 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 EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
SPECTRUM ANALYZER	AGILENT	E4446A	MY46180323	06/09/2010
EMI TEST RECEIVER	R & S	ESCI	100211	05/17/2010
BILOG ANTENNA	SCHWARZBECK	VULB	9168	09/17/2009
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00078732	06/30/2010
PRE-AMPLIFIER	EM	EM30265	07032612	05/21/2010
Notch Filters Band Reject	Micro-Tronics	BRM50702-01	009	N.C.R.
RF COAXIAL CABLE	HUBERSUHNER	SUCOFLEX 104PEA	SN31350	07/21/2009
LOOP ANTENNA	EMCO	6502	2356	05/28/2010

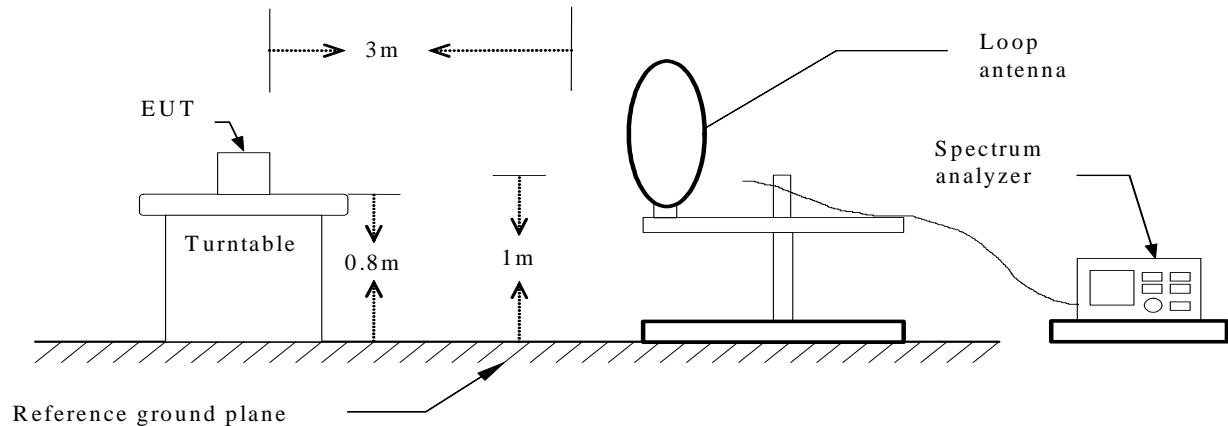
**Remark:** 1. Each piece of equipment is scheduled for calibration once a year.

2. N.C.R = No Calibration Request.

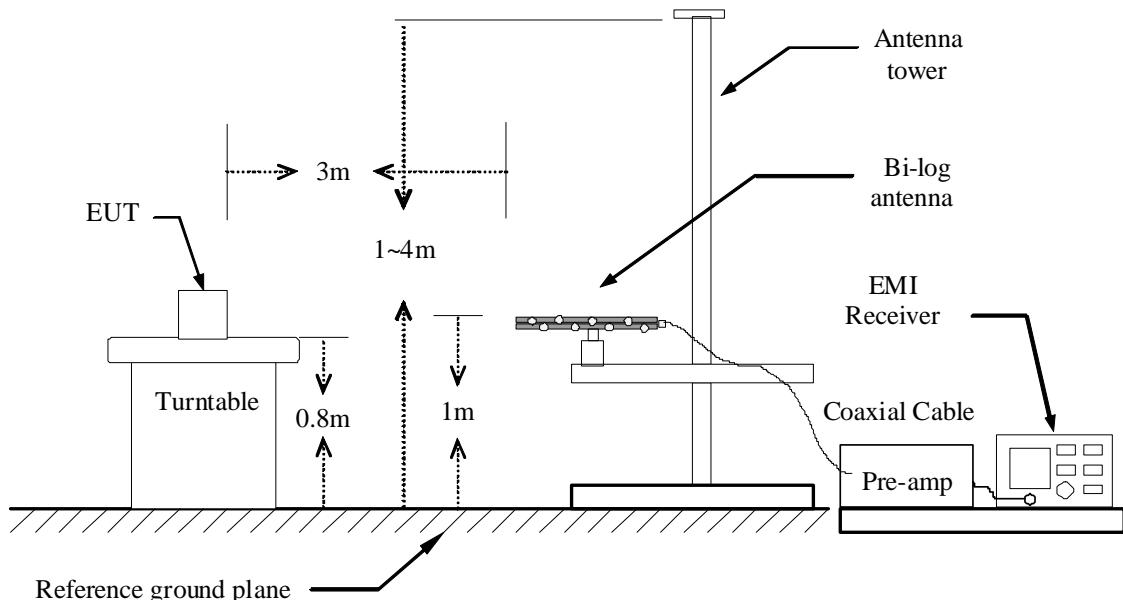
## TEST SETUP

The diagram below shows the test setup that is utilized to make the measurements for emission from below 1GHz.

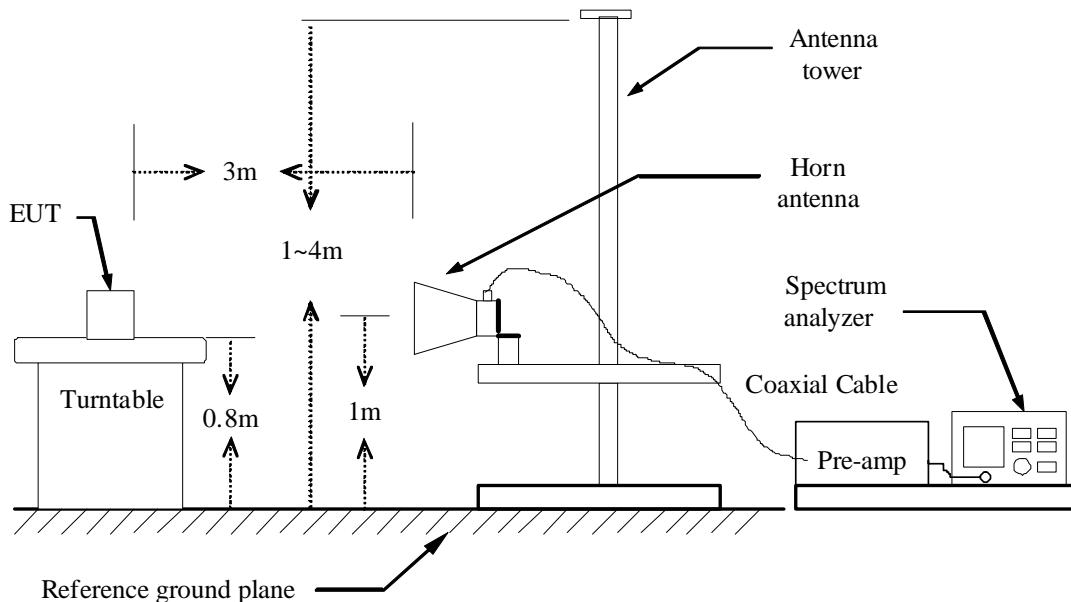
### **9kHz ~ 30MHz**



### **30MHz ~ 1GHz**



The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.



## **TEST PROCEDURE**

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. While measuring the radiated emission below 1GHz, the EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. While measuring the radiated emission above 1GHz, the EUT was set 3 meters away from the interference-receiving antenna
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarization of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

### **Note :**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.

**8.8.2 WORST-CASE RADIATED EMISSION BELOW 1 GHz****BELLOW 1 GHz (9kHz ~ 30MHz)**

No emission found between lowest internal used/generated frequency to 30MHz.

**BELLOW 1 GHz (30MHz ~ 1GHz)**

<b>Product Name</b>	VoIP/ (802.11g) ADSL2+ Firewall	<b>Test Date</b>	2009/07/4
<b>Model</b>	BiPAC 7401VGP R4	<b>Test By</b>	Rueyyan Lin
<b>Test Mode</b>	Normal operating (worst-case)	<b>TEMP &amp; Humidity</b>	23.9°C, 58%

<b>Horizontal</b>						
Frequency (MHz)	Reading (dB $\mu$ V)	Correction Factor (dB/m)	Result (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Remark
141.55	68.49	-31.53	36.95	43.50	-6.55	Peak
263.77	68.99	-29.50	39.49	46.00	-6.51	Peak
282.20	66.19	-28.44	37.75	46.00	-8.25	Peak
395.69	68.30	-27.01	41.30	46.00	-4.70	Peak
408.30	65.06	-26.78	38.28	46.00	-7.72	Peak
515.97	62.85	-24.89	37.96	46.00	-8.04	Peak
527.61	66.90	-24.69	42.21	46.00	-3.79	Peak
659.53	60.54	-22.49	38.05	46.00	-7.95	Peak
792.42	61.78	-20.39	41.39	46.00	-4.61	Peak
924.34	56.29	-18.79	37.51	46.00	-8.49	Peak
<b>Vertical</b>						
Frequency (MHz)	Reading (dB $\mu$ V)	Correction Factor (dB/m)	Result (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Remark
48.43	68.19	-30.25	37.95	40.00	-2.05	Peak
60.07	65.69	-31.65	34.05	40.00	-5.95	Peak
63.95	70.00	-32.21	37.79	40.00	-2.21	QP
70.74	67.56	-33.31	34.25	40.00	-5.75	Peak
131.85	68.43	-32.50	35.93	43.50	-7.57	Peak
141.55	69.15	-31.53	37.61	43.50	-5.89	Peak
176.47	67.61	-31.88	35.74	43.50	-7.76	Peak
282.20	67.11	-28.44	38.67	46.00	-7.33	Peak
792.42	57.44	-20.39	37.04	46.00	-8.96	Peak
924.34	60.20	-18.79	41.41	46.00	-4.59	QP

***Remark:***

1. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit.
2. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
3. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) - PreAmp.Gain (dB)
4. Result (dB $\mu$ V/m) = Reading (dB $\mu$ V) + Correction Factor (dB/m)
5. Margin (dB) = Remark result (dB $\mu$ V/m) - Quasi-peak limit (dB $\mu$ V/m).



### 8.8.3 TRANSMITTER RADIATED EMISSION ABOVE 1 GHz

<b>Product Name</b>	VoIP/ (802.11g) ADSL2+ Firewall Router				<b>Test Date</b>		2009/07/03		
<b>Model</b>	BiPAC 7401VGP R4				<b>Test By</b>		Rueyyan Lin		
<b>Test Mode</b>	IEEE 802.11b TX (CH Low)				<b>TEMP &amp; Humidity</b>	23.9°C, 51%			

Horizontal									
Frequency (MHz)	Reading-PK (dB $\mu$ V)	Reading-AV (dB $\mu$ V)	Correction Factor (dB/m)	Result-PK (dB $\mu$ V/m)	Result-AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Margin (dB)	Remark
2412.00	107.49	105.00	-8.95	98.54	96.05	---	---	---	Carrier
7237.50	56.62	51.44	-0.89	55.73	50.55	74.00	54.00	-3.45	AVG
Vertical									
Frequency (MHz)	Reading-PK (dB $\mu$ V)	Reading-AV (dB $\mu$ V)	Correction Factor (dB/m)	Result-PK (dB $\mu$ V/m)	Result-AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Margin (dB)	Remark
2414.00	111.15	108.64	-8.94	102.21	99.70	---	---	---	Carrier
5752.50	50.01	---	-3.00	47.01	---	74.00	54.00	-6.99	Peak
7237.50	58.62	54.03	-0.89	57.73	53.14	74.00	54.00	-0.86	AVG
7530.00	49.78	---	-0.64	49.15	---	74.00	54.00	-4.85	Peak
9345.00	48.85	---	2.21	51.06	---	74.00	54.00	-2.94	Peak
9645.00	47.21	---	2.51	49.72	---	74.00	54.00	-4.28	Peak

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Average test would be performed if the peak result were greater than the average limit.
3. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
6. Result = Reading + Correction Factor  
Margin = Result - Limit  
Remark Peak = Result(PK) - Limit(AV)  
Remark AVG = Result(AV) - Limit(AV)



<b>Product Name</b>	VoIP/ (802.11g) ADSL2+ Firewall Router				<b>Test Date</b>		2009/07/03		
<b>Model</b>	BiPAC 7401VGP R4				<b>Test By</b>		Rueyyan Lin		
<b>Test Mode</b>	IEEE 802.11b TX (CH Middle)				<b>TEMP &amp; Humidity</b>	23.9°C, 51%			

Horizontal									
Frequency (MHz)	Reading-PK (dB $\mu$ V)	Reading-AV (dB $\mu$ V)	Correction Factor (dB/m)	Result-PK (dB $\mu$ V/m)	Result-AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Margin (dB)	Remark
2438.00	112.13	109.04	-8.92	103.21	100.12	---	---	---	Carrier
7312.50	57.62	52.99	-0.83	56.79	52.16	74.00	54.00	-1.84	AVG
9667.50	47.71	---	2.54	50.25	---	74.00	54.00	-3.75	Peak

Vertical									
Frequency (MHz)	Reading-PK (dB $\mu$ V)	Reading-AV (dB $\mu$ V)	Correction Factor (dB/m)	Result-PK (dB $\mu$ V/m)	Result-AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Margin (dB)	Remark
2434.00	115.24	112.26	-8.92	106.31	103.34	---	---	---	Carrier
7312.50	56.44	50.98	-0.83	55.61	50.15	74.00	54.00	-3.85	AVG

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Average test would be performed if the peak result were greater than the average limit.
3. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
6. Result = Reading + Correction Factor  
Margin = Result - Limit  
Remark Peak = Result(PK) - Limit(AV)  
Remark AVG = Result(AV) - Limit(AV)



<b>Product Name</b>	VoIP/ (802.11g) ADSL2+ Firewall Router		<b>Test Date</b>		2009/07/03	
<b>Model</b>	BiPAC 7401VGP R4		<b>Test By</b>		Rueyyan Lin	
<b>Test Mode</b>	IEEE 802.11b TX (CH High)		<b>TEMP &amp; Humidity</b>		23.9°C, 51%	

Horizontal									
Frequency (MHz)	Reading-PK (dB $\mu$ V)	Reading-AV (dB $\mu$ V)	Correction Factor (dB/m)	Result-PK (dB $\mu$ V/m)	Result-AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Margin (dB)	Remark
2464.00	107.52	104.55	-8.89	98.63	95.66	---	---	---	Carrier
4440.00	51.73	---	-5.54	46.19	---	74.00	54.00	-7.81	Peak
7380.00	48.98	---	-0.79	48.20	---	74.00	54.00	-5.80	Peak

Vertical									
Frequency (MHz)	Reading-PK (dB $\mu$ V)	Reading-AV (dB $\mu$ V)	Correction Factor (dB/m)	Result-PK (dB $\mu$ V/m)	Result-AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Margin (dB)	Remark
2464.00	113.59	110.60	-8.89	104.70	101.71	---	---	---	Carrier
4027.50	51.87	---	-6.58	45.29	---	74.00	54.00	-8.71	Peak
7387.50	48.08	---	-0.78	47.30	---	74.00	54.00	-6.70	Peak

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Average test would be performed if the peak result were greater than the average limit.
3. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

6. Result = Reading + Correction Factor

Margin = Result - Limit

Remark Peak = Result(PK) - Limit(AV)

Remark AVG = Result(AV) - Limit(AV)



<b>Product Name</b>	VoIP/ (802.11g) ADSL2+ Firewall Router		<b>Test Date</b>		2009/07/03	
<b>Model</b>	BiPAC 7401VGP R4		<b>Test By</b>		Rueyyan Lin	
<b>Test Mode</b>	IEEE 802.11g TX (CH Low)		<b>TEMP &amp; Humidity</b>		23.9°C, 51%	

Horizontal									
Frequency (MHz)	Reading-PK (dB $\mu$ V)	Reading-AV (dB $\mu$ V)	Correction Factor (dB/m)	Result-PK (dB $\mu$ V/m)	Result-AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Margin (dB)	Remark
2410.00	106.21	98.46	-8.95	97.26	89.51	---	---	---	Carrier
4627.50	50.11	---	-5.06	45.05	---	74.00	54.00	-8.95	Peak
7237.50	52.50	---	-0.89	51.61	---	74.00	54.00	-2.39	Peak

Vertical									
Frequency (MHz)	Reading-PK (dB $\mu$ V)	Reading-AV (dB $\mu$ V)	Correction Factor (dB/m)	Result-PK (dB $\mu$ V/m)	Result-AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Margin (dB)	Remark
2416.00	110.36	102.25	-8.94	101.42	93.31	---	---	---	Carrier
4447.50	50.80	---	-5.52	45.28	---	74.00	54.00	-8.72	Peak
5422.50	50.42	---	-3.41	47.00	---	74.00	54.00	-7.00	Peak
7230.00	50.72	---	-0.89	49.83	---	74.00	54.00	-4.17	Peak

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Average test would be performed if the peak result were greater than the average limit.
3. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
6. Result = Reading + Correction Factor  
Margin = Result - Limit  
Remark Peak = Result(PK) - Limit(AV)  
Remark AVG = Result(AV) - Limit(AV)



<b>Product Name</b>	VoIP/ (802.11g) ADSL2+ Firewall Router				<b>Test Date</b>		2009/07/03	
<b>Model</b>	BiPAC 7401VGP R4				<b>Test By</b>		Rueyyan Lin	
<b>Test Mode</b>	IEEE 802.11g TX (CH Middle)				<b>TEMP &amp; Humidity</b>	23.9°C, 51%		

Horizontal									
Frequency (MHz)	Reading-PK (dB $\mu$ V)	Reading-AV (dB $\mu$ V)	Correction Factor (dB/m)	Result-PK (dB $\mu$ V/m)	Result-AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Margin (dB)	Remark
2438.00	111.42	103.42	-8.92	102.51	94.50	---	---	---	Carrier
3120.00	51.86	---	-7.94	43.92	---	74.00	54.00	-10.08	Peak
7305.00	52.71	---	-0.84	51.87	---	74.00	54.00	-2.13	Peak
10485.00	48.06	---	3.34	51.40	---	74.00	54.00	-2.60	Peak

Vertical									
Frequency (MHz)	Reading-PK (dB $\mu$ V)	Reading-AV (dB $\mu$ V)	Correction Factor (dB/m)	Result-PK (dB $\mu$ V/m)	Result-AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Margin (dB)	Remark
2430.00	116.05	107.68	-8.93	107.12	98.75	---	---	---	Carrier
3120.00	55.03	---	-7.94	47.10	---	74.00	54.00	-6.90	Peak
7312.50	52.78	---	-0.83	51.95	---	74.00	54.00	-2.05	Peak
10800.00	47.57	---	3.59	51.16	---	74.00	54.00	-2.84	Peak

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Average test would be performed if the peak result were greater than the average limit.
3. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
6. Result = Reading + Correction Factor  
Margin = Result - Limit  
Remark Peak = Result(PK) - Limit(AV)  
Remark AVG = Result(AV) - Limit(AV)



<b>Product Name</b>	VoIP/ (802.11g) ADSL2+ Firewall Router		<b>Test Date</b>	2009/07/03
<b>Model</b>	BiPAC 7401VGP R4		<b>Test By</b>	Rueyyan Lin
<b>Test Mode</b>	IEEE 802.11g TX (CH High)		<b>TEMP &amp; Humidity</b>	23.9°C, 51%

Horizontal									
Frequency (MHz)	Reading-PK (dB $\mu$ V)	Reading-AV (dB $\mu$ V)	Correction Factor (dB/m)	Result-PK (dB $\mu$ V/m)	Result-AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Margin (dB)	Remark
2468.00	105.47	97.48	-8.88	96.58	88.60	---	---	---	Carrier
4155.00	51.45	---	-6.26	45.20	---	74.00	54.00	-8.80	Peak
6660.00	49.49	---	-1.83	47.67	---	74.00	54.00	-6.33	Peak
7380.00	48.08	---	-0.79	47.30	---	74.00	54.00	-6.70	Peak

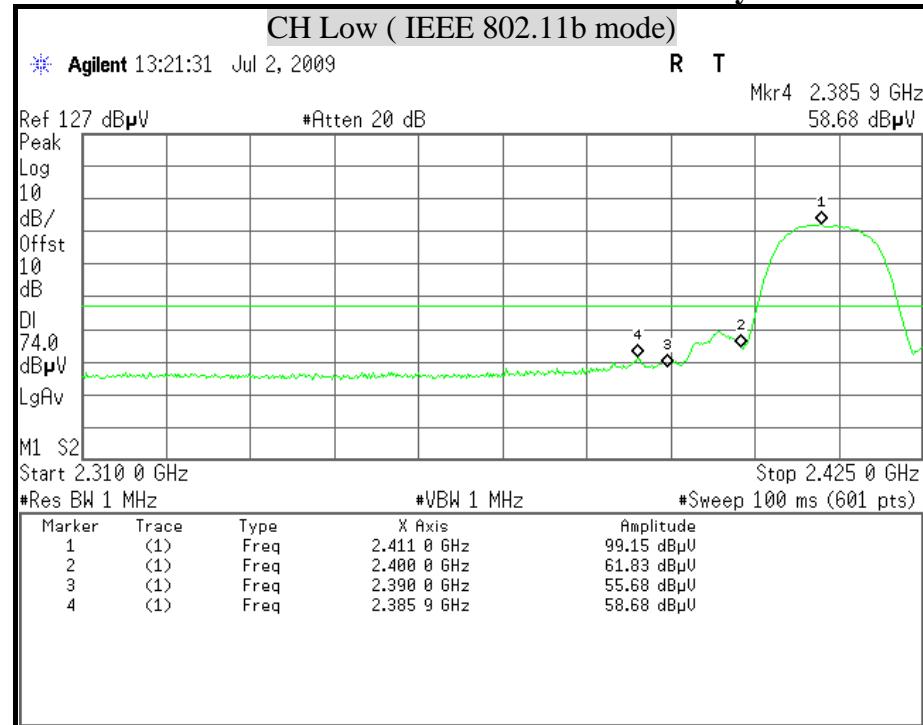
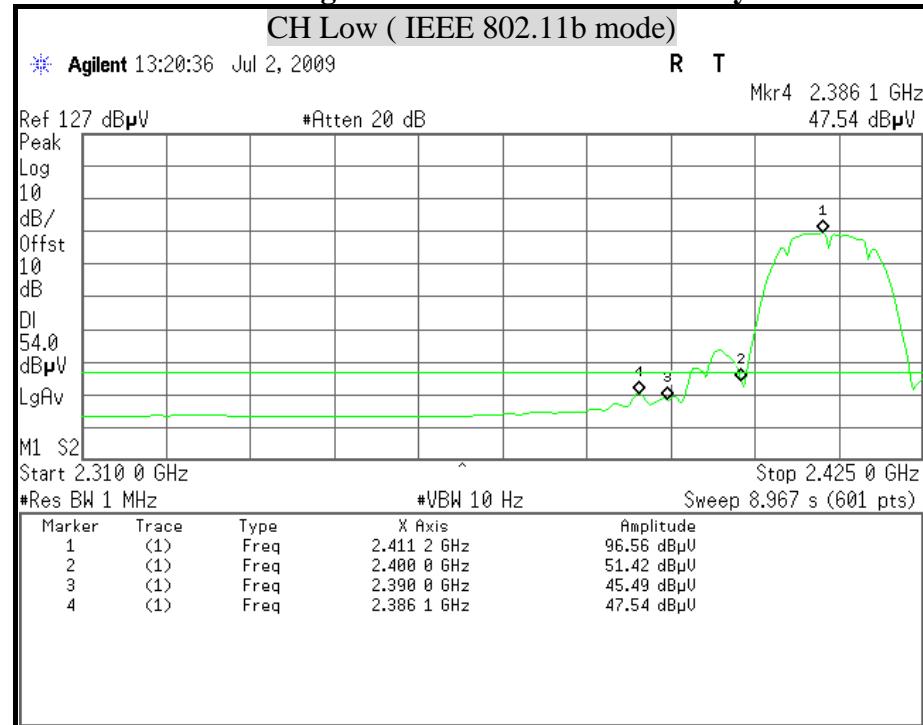
  

Vertical									
Frequency (MHz)	Reading-PK (dB $\mu$ V)	Reading-AV (dB $\mu$ V)	Correction Factor (dB/m)	Result-PK (dB $\mu$ V/m)	Result-AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Margin (dB)	Remark
2466.00	111.82	103.17	-8.89	102.94	94.28	---	---	---	Carrier
6555.00	49.83	---	-2.06	47.76	---	74.00	54.00	-6.24	Peak
8407.50	48.26	---	0.91	49.17	---	74.00	54.00	-4.83	Peak
11452.50	46.35	---	5.58	51.93	---	74.00	54.00	-2.07	Peak

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Average test would be performed if the peak result were greater than the average limit.
3. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
6. Result = Reading + Correction Factor  
Margin = Result - Limit  
Remark Peak = Result(PK) - Limit(AV)  
Remark AVG = Result(AV) - Limit(AV)

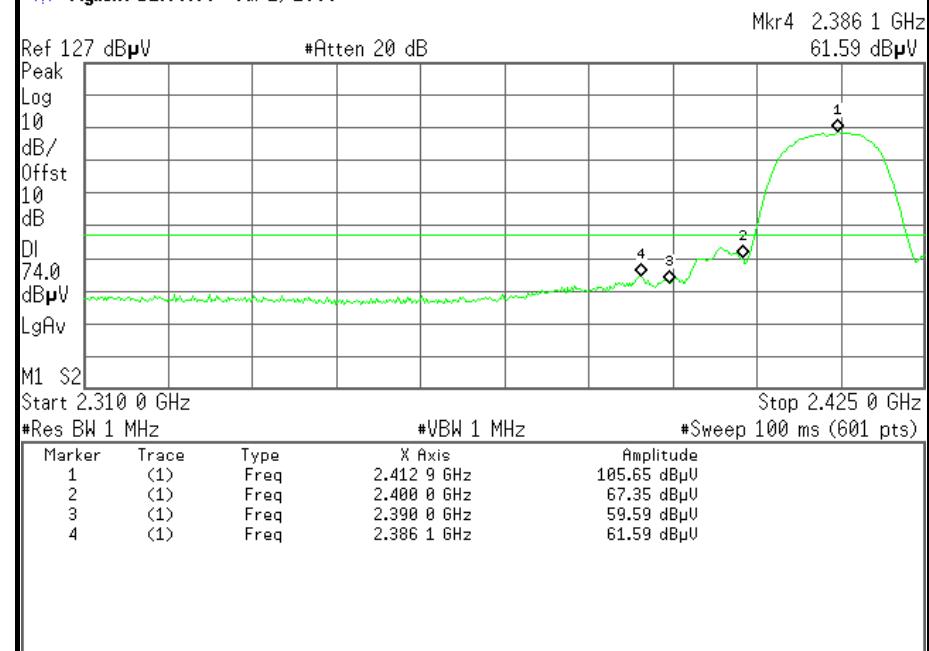
### 8.8.4 RESTRICTED BAND EDGES

**Detector mode : Peak****Polarity : Horizontal****Detector mode : Average****Polarity : Horizontal**

**Detector mode : Peak****Polarity : Vertical**

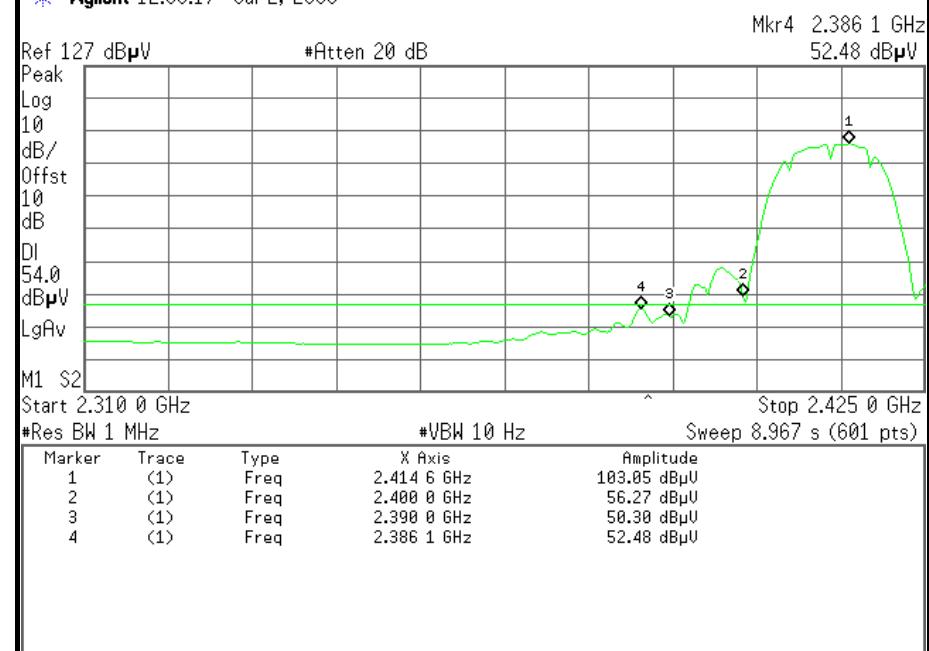
CH Low ( IEEE 802.11b mode)

Agilent 12:09:08 Jul 2, 2009

**Detector mode : Average****Polarity : Vertical**

CH Low ( IEEE 802.11b mode)

Agilent 12:08:17 Jul 2, 2009

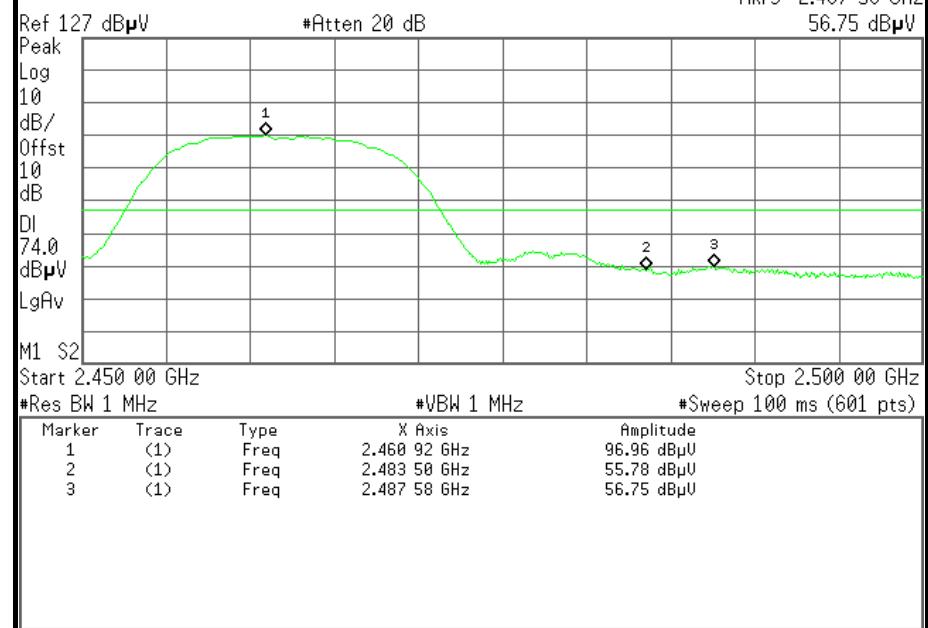


**Detector mode : Peak****Polarity : Horizontal**

CH High ( IEEE 802.11b mode)

Agilent 14:08:01 Jul 2, 2009

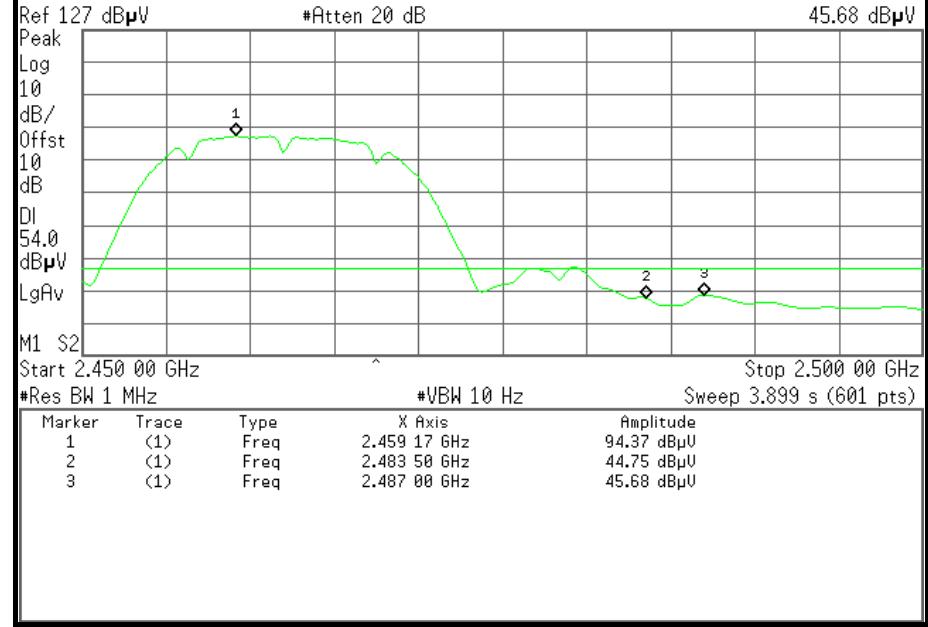
R T

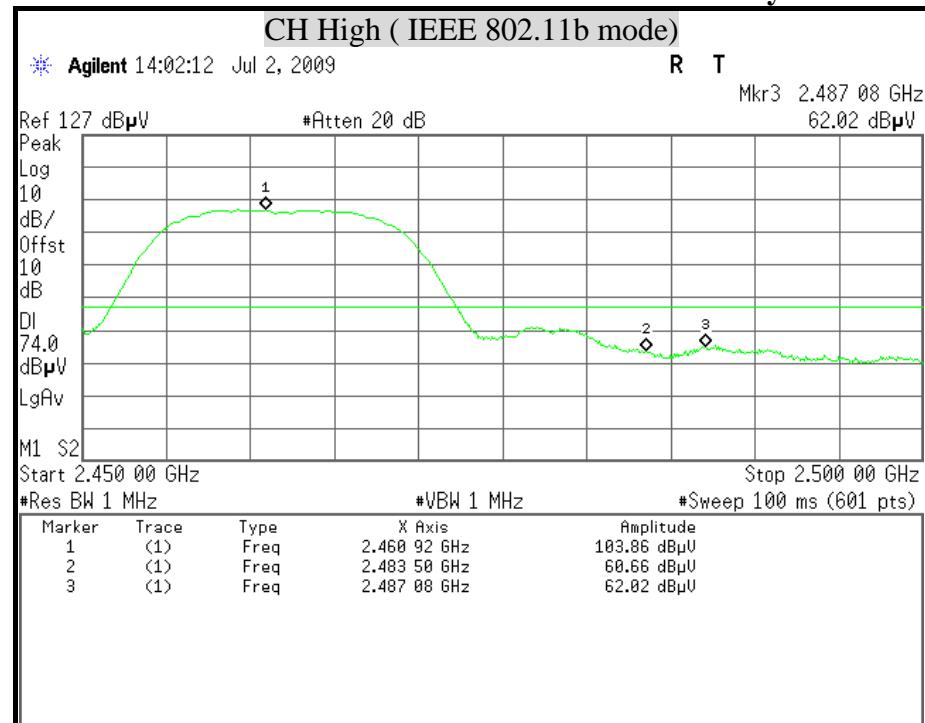
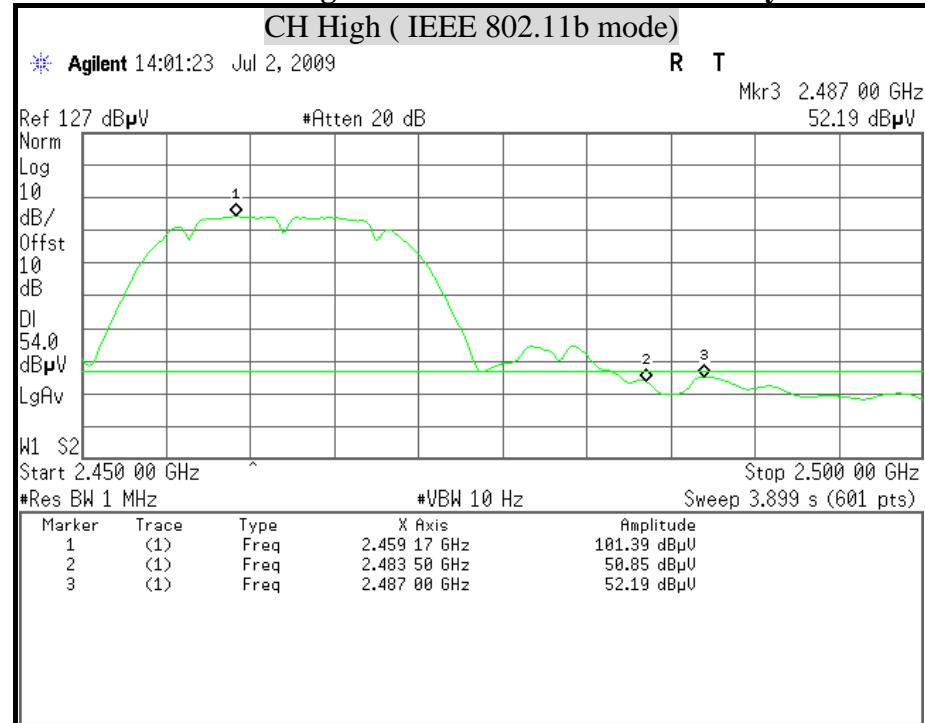
Mkr3 2.487 58 GHz  
56.75 dB $\mu$ V**Detector mode : Average****Polarity : Horizontal**

CH High ( IEEE 802.11b mode)

Agilent 14:06:48 Jul 2, 2009

R T

Mkr3 2.487 00 GHz  
45.68 dB $\mu$ V

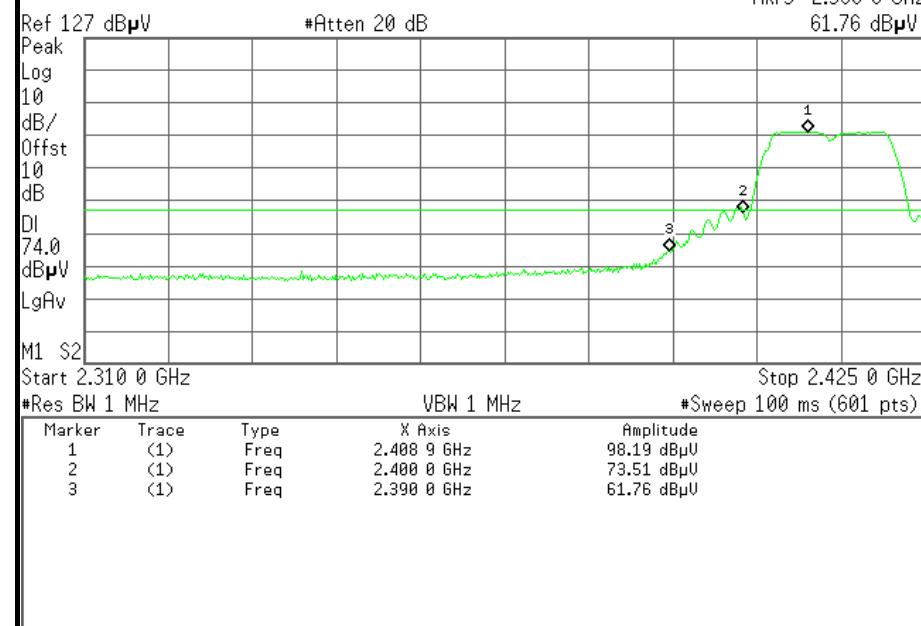
**Detector mode : Peak**
**Polarity : Vertical**

**Detector mode : Average**
**Polarity : Vertical**


**Detector mode : Peak****Polarity : Horizontal**

CH Low ( IEEE 802.11g mode)

Agilent 13:38:06 Jul 2, 2009

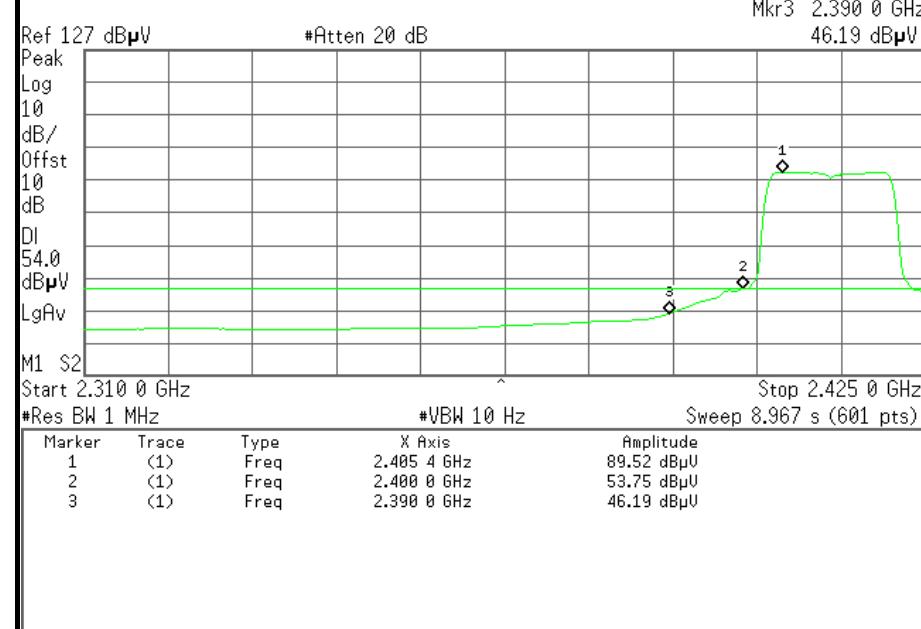
R T

Mkr3 2.390 0 GHz  
61.76 dB $\mu$ V**Detector mode : Average****Polarity : Horizontal**

CH Low ( IEEE 802.11g mode)

Agilent 13:37:38 Jul 2, 2009

R T

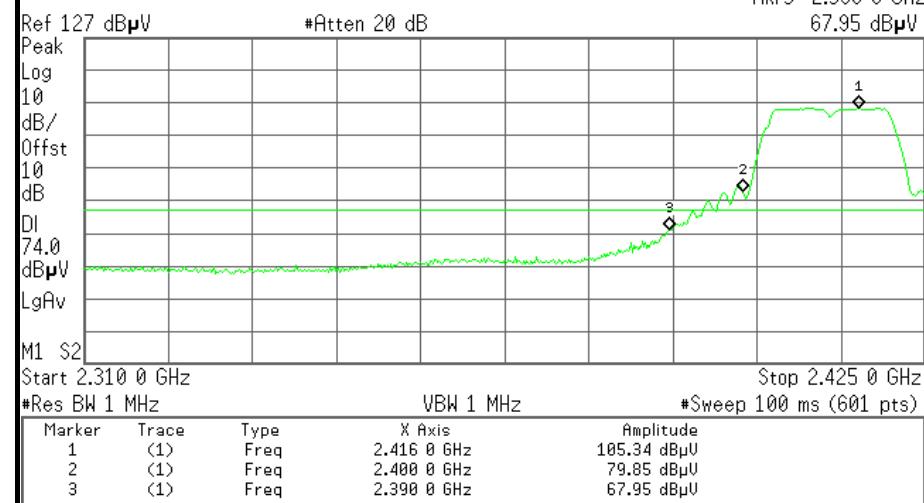
Mkr3 2.390 0 GHz  
46.19 dB $\mu$ V

**Detector mode : Peak****Polarity : Vertical**

CH Low ( IEEE 802.11g mode)

Agilent 13:33:43 Jul 2, 2009

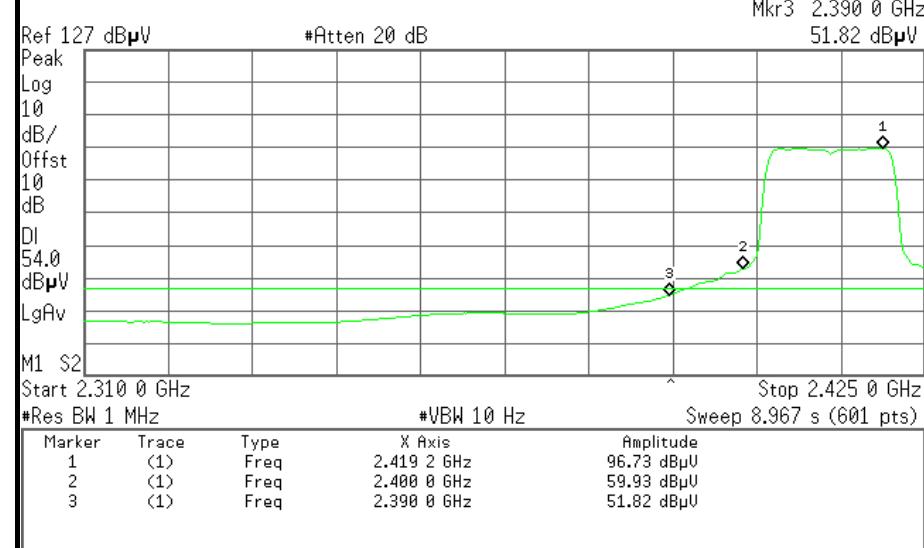
R T

Mkr3 2.390 0 GHz  
67.95 dB $\mu$ V**Detector mode : Average****Polarity : Vertical**

CH Low ( IEEE 802.11g mode)

Agilent 13:31:51 Jul 2, 2009

R T

Mkr3 2.390 0 GHz  
51.82 dB $\mu$ V

**Detector mode : Peak****Polarity : Horizontal**

CH High ( IEEE 802.11g mode)

Agilent 13:54:19 Jul 2, 2009

R T

Mkr3 2.483 67 GHz  
59.78 dB $\mu$ VRef 127 dB $\mu$ V #Atten 20 dB

Peak

Log

10

dB/

0ffst

10

dB

DI

74.0

dB $\mu$ V

LgAv

M1 S2

Start 2.450 00 GHz

Stop 2.500 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

#Sweep 100 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.455 50 GHz	95.00 dB $\mu$ V
2	(1)	Freq	2.483 50 GHz	59.47 dB $\mu$ V
3	(1)	Freq	2.483 67 GHz	59.78 dB $\mu$ V

**Detector mode : Average****Polarity : Horizontal**

CH High ( IEEE 802.11g mode)

Agilent 13:53:27 Jul 2, 2009

R T

Mkr2 2.483 50 GHz  
45.68 dB $\mu$ VRef 127 dB $\mu$ V

#Atten 20 dB

Peak

Log

10

dB/

0ffst

10

dB

DI

54.0

dB $\mu$ V

LgAv

M1 S2

Start 2.450 00 GHz

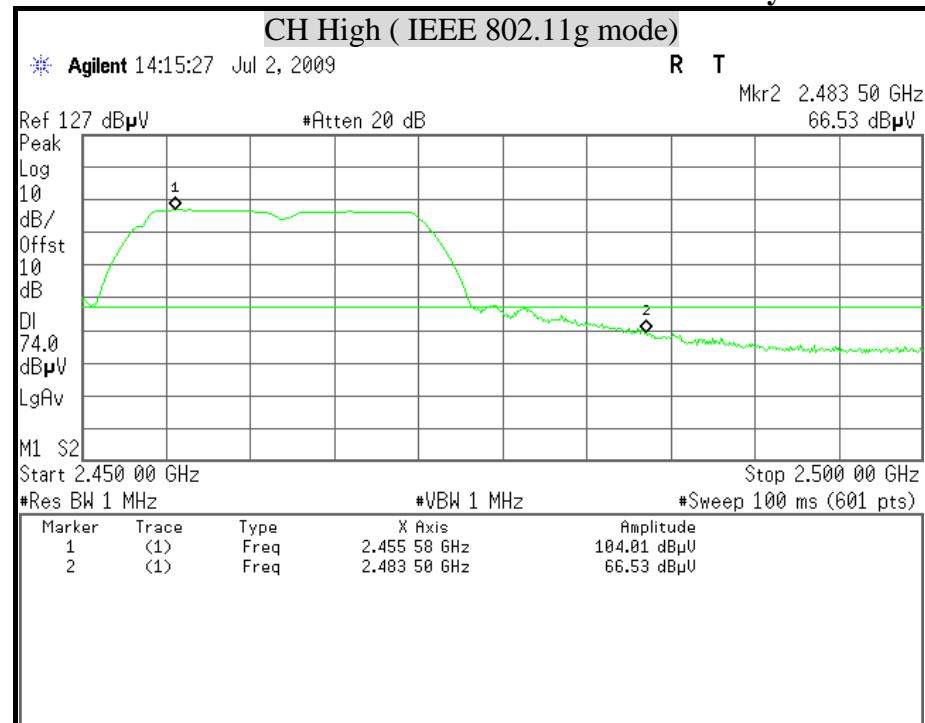
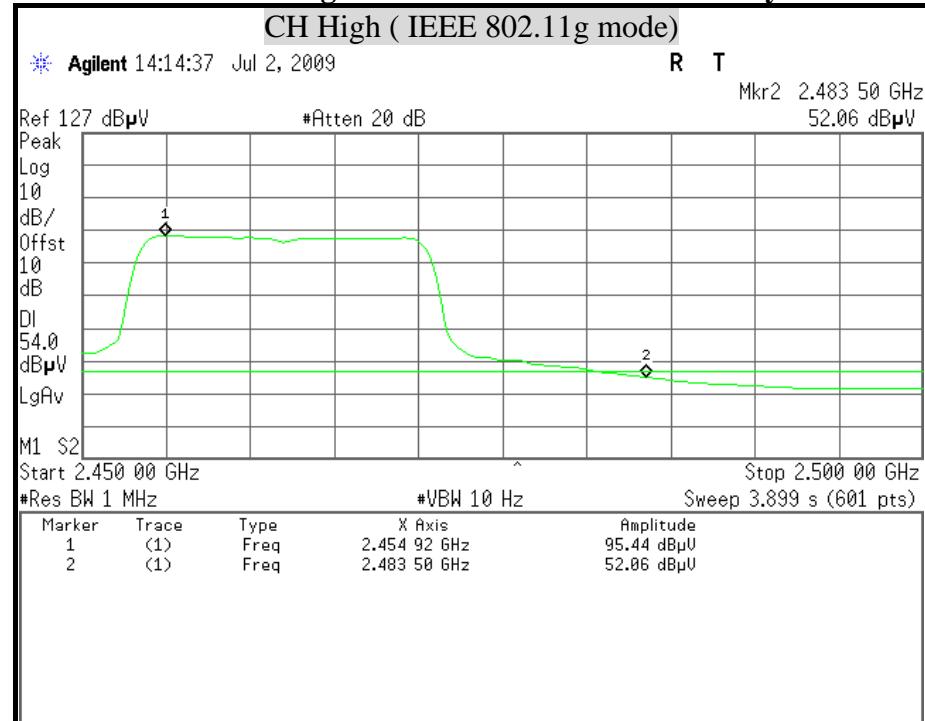
Stop 2.500 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

Sweep 3.899 s (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.454 83 GHz	86.52 dB $\mu$ V
2	(1)	Freq	2.483 50 GHz	45.68 dB $\mu$ V

**Detector mode : Peak****Polarity : Vertical****Detector mode : Average****Polarity : Vertical**



## 8.9 POWERLINE CONDUCTED EMISSIONS

### LIMITS

§ 15.207 (a) Except as shown in paragraph (b) and (c) this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.5 - 5	56	46
5 - 30	60	50

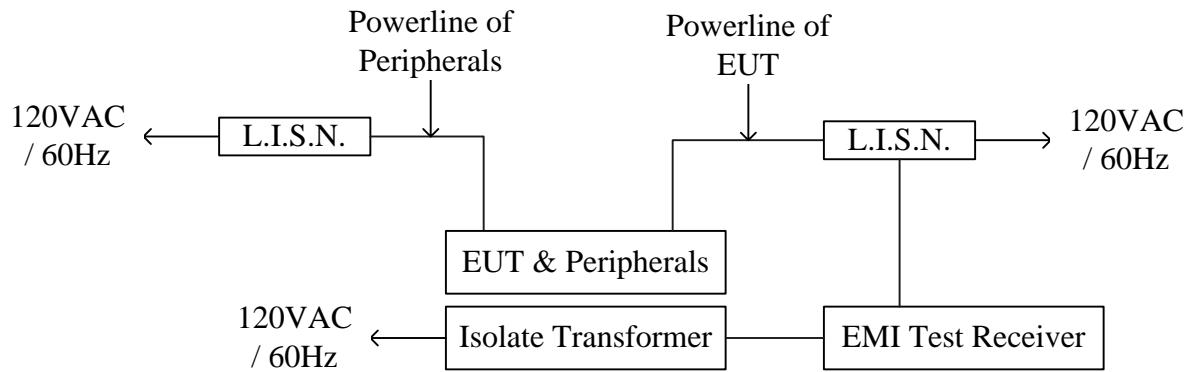
### TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
L.I.S.N	SCHWARZBECK	NSLK 8127	8127-465	08/13/2009
L.I.S.N	SCHWARZBECK	NSLK 8127	8127-473	10/12/2009
TEST RECEIVER	R & S	ESHS30	838550/003	02/02/2010
PULSE LIMIT	R & S	ESH3-Z2	100117	09/23/2009
N TYPE COAXIAL CABLE	BELDEN	8268 M17/164	003	09/13/2009

*Remark:* Each piece of equipment is scheduled for calibration once a year.

## TEST SETUP

!



## TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80cm above the horizontal ground plane. The EUT IS CONFIGURED IN ACCORDANCE WITH ANSI C63.4:2003.

The resolution bandwidth is set to 9 kHz for both quasi-peak detection and average detection measurements.

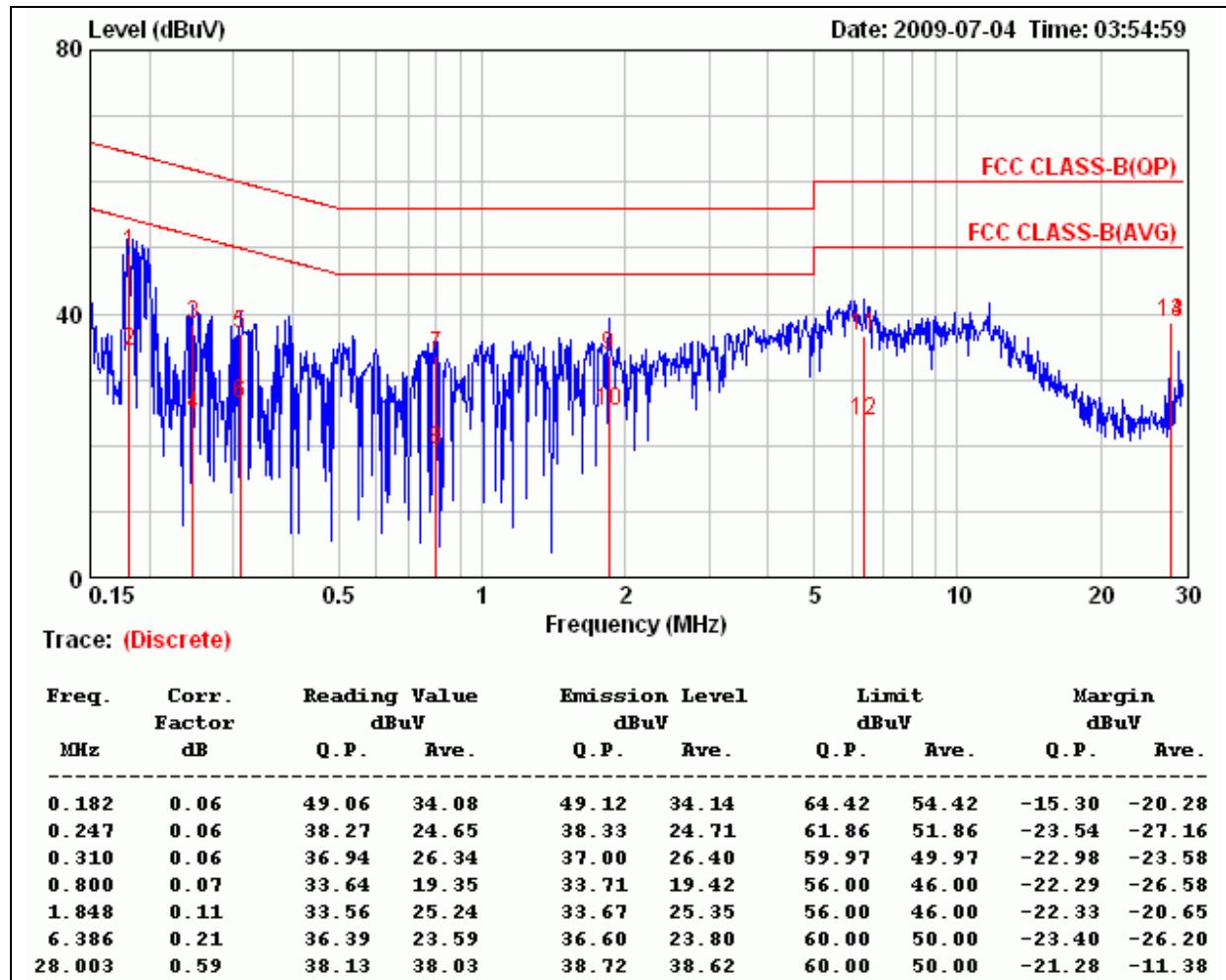
Line conducted data is recorded for both NEUTRAL and LINE.



## TEST RESULTS

<b>Product Name</b>	VoIP/ (802.11g) ADSL2+ Firewall Router	<b>Test Date</b>	2009/07/04
<b>Model</b>	BiPAC 7401VGP R4	<b>Test By</b>	Rueyyan Lin
<b>Test Mode</b>	Normal operating(worst-case)	<b>TEMP &amp; Humidity</b>	20.9°C, 57%

### LINE



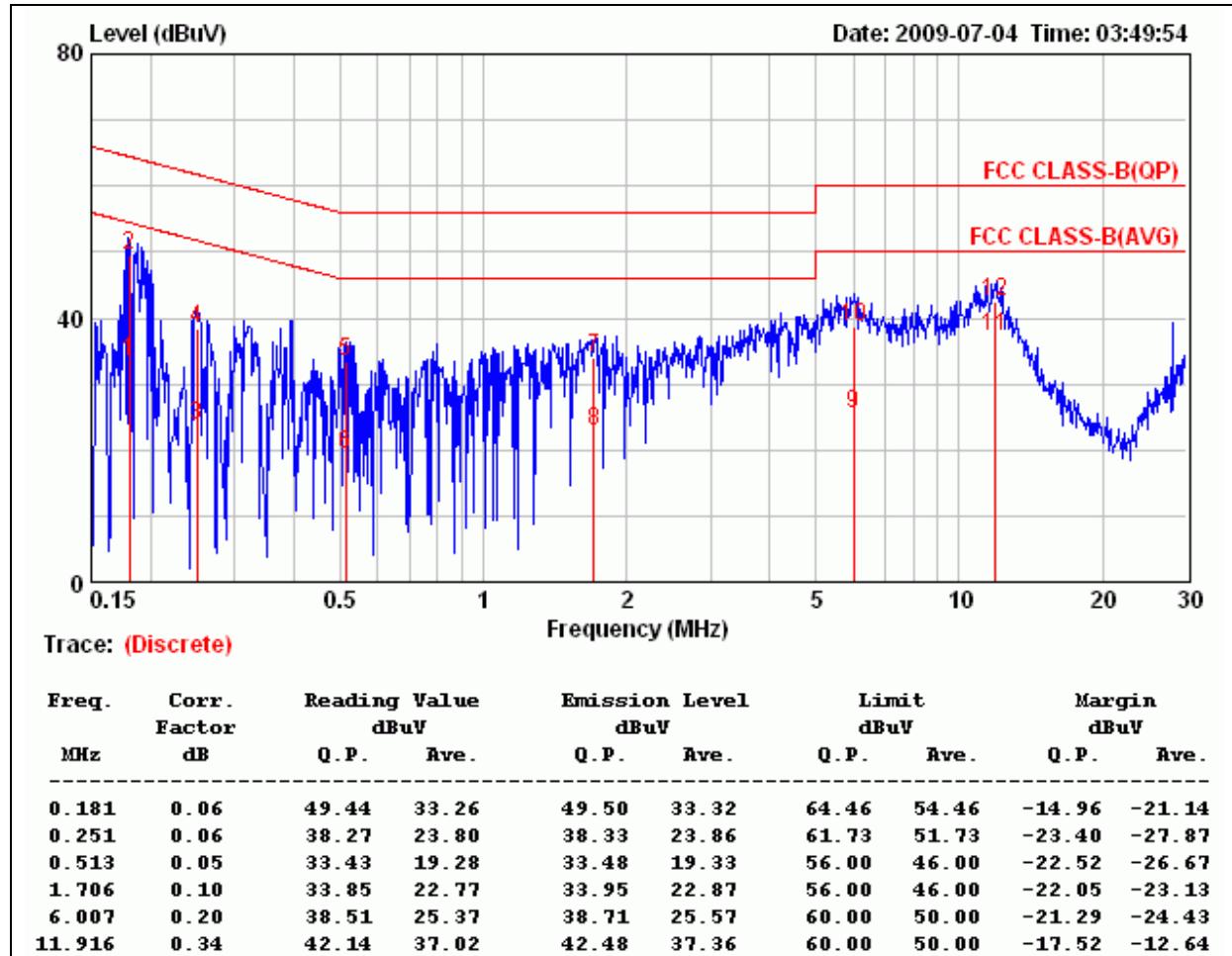
### Remark:

1. Correction Factor = Insertion loss + cable loss
2. Margin value = Emission level – Limit value



<b>Product Name</b>	VoIP/ (802.11g) ADSL2+ Firewall Router	<b>Test Date</b>	2009/07/04
<b>Model</b>	BiPAC 7401VGP R4	<b>Test By</b>	Rueyyan Lin
<b>Test Mode</b>	Normal operating(worst-case)	<b>TEMP &amp; HUMIDITY</b>	20.9°C, 57%

## NEUTRAL

**Remark:**

1. Correction Factor = Insertion loss + cable loss
2. Margin value = Emission level – Limit value