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

TEST REPORT

For

ADSL2+ (802.11g)(VPN) Firewall Router

Model : BiPAC 7412GL *R4*

Data Applies To: BiPAC 7402GL *R4* ; BiPAC 7402G *R4* ; BEC 7402GTM *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

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	07/28/2009	Initial Issue	All Page 72	Alex Chiu

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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	：	ADSL2+ (802.11g)(VPN) Firewall Router
Model	：	BiPAC 7412GL *R4*
Data Applies To	：	BiPAC 7402GL *R4* ; BiPAC 7402G *R4* ; BEC 7402GTM *R4*
Tested Date	：	July 03 ~ 24, 2009

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

Approved by:

Alex Chiu
Director

Reviewed by:

Alan Fan
Section Manager

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

Product Name	ADSL2+ (802.11g)(VPN) Firewall Router
Model Number	BiPAC 7412GL *R4*
Data Applies To	BiPAC 7402GL *R4* ; BiPAC 7402G *R4* ; BEC 7402GTM *R4*
Frequency Range	IEEE 802.11b/g : 2412MHz ~ 2462MHz
Transmit Power	IEEE 802.11b : 22.52dBm IEEE 802.11g : 19.76dBm
Channel Spacing	IEEE 802.11b/g : 5MHz
Channel Number	IEEE 802.11b/g : 11 Channels
Transmit Data Rate	IEEE 802.11b : 11, 5.5, 2, 1 Mbps IEEE 802.11g : 54, 48, 36, 24, 18, 12, 9, 6 Mbps
Type of Modulation	IEEE 802.11b : DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g : OFDM (64QAM, 16QAM, QPSK, BPSK)
Frequency Selection	by software / firmware
Antenna Type	Dipole Antenna, Antenna Gain 2dBi
Power Source	12VDC, 1A (From Power Adapter)
I/O Port	ETHERNET (RJ-45) LAN Port × 4、(RJ-11) DSL Port ×1、 USB 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

Model / Different Item	BiPAC 7412GL *R4*	BiPAC 7402GL *R4*	BiPAC 7402G *R4*	BEC 7402GTM *R4*
Trade Name	BILLION	BILLION	BILLION	BEC
External Feature	O	O	O	O
External Color	Blue	Blue	Gray	Black
Housing Drawing	B1	B1	B1	B1
Support 802.11g	O	O	O	O
USB 1.1 Slave	O	X	X	X
Circuits Design	O	O	O	O
Model Module	Flash 4MB SDRAM 16MB	Flash 4MB SDRAM 16MB	Flash 4MB SDRAM 32MB	Flash 4MB SDRAM 16MB
Power Supply	12VDC, 1A	12VDC, 1A	12VDC, 1A	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: BiPAC 7412GL 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 :

Channel	Frequency (MHz)
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. 989-1 Wen Shan Rd., Shang Shan Village,
Qionglin Shiang Hsinchu County 30741, 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: 0240 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by TAF or any agency of the Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: 90585 and 90584).

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	90585, 90584
Taiwan	TAF	FCC Method-47 CFR Part 15 Subpart C,D,E CISPR 11, FCC METHOD-47 CFR Part 18, EN 55011, CNS 13803, CISPR 13, CNS 13439, FCC Method-47 CFR Part 15 Subpart B, CISPR 14-1, EN 55014-1, CNS 13783-1, EN 55015, CNS 14115, CISPR 22, EN 55022, VCCI CNS 13438, EN 61000-4-2/3/4/5/6/8/11	Testing Laboratory 0240
Taiwan	BSMI	CNS 13803, CNS 13438, CNS 13439, CNS 13783-1, CNS 14115	SL2-IS-E-0002 SL2-IN-E-0002 SL2-A1-E-0002 SL2-R1-E-0002 SL2-R2-E-0002 SL2-L1-E-0002

** 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	E2K24BNHM
2	Notebook PC	HP	nx6130	CNU543274R	CNTWM3B2200BGA
3	Notebook PC	LENOVO	7663-AS6	L3F3864	DoC
4	SW HUB	ASUS	GX1008B	90-Q872AN1N0NAMA0-88 QSA1003522	DoC
5	ADSL iDSLAM	ZyXEL	IES-1000	-----	-----

SETUP DIAGRAM FOR TESTS

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

EUT OPERATING CONDITION

For RF :

TX Mode:

1. Set up whole system for test as shown on diagram.
2. Press Reset→Power On
   Run gui_bootsvr.exe(PET2.5.17\ gui_bootsvr.exe)
   GUI BootSever v0.01(Bootserver Core v0.01)
   Select : search MAC address: 0:4:ed:11:f0:57→OK
3. Gui_bootsvr.exe(PET2.5.17\ gui_bootsvr.exe)
   GUI BootSever v0.01(Bootserver Core v0.01)
   Device IP address : 192.168.1.1
   Host IP address : 192.168.1.xxx
   MAC address : 0:4:ed:11:f0:57
   Boot file : F:/EUT driver/Billion Billion /PET2.5.17/7412GLR4_flash_mt_wreset
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=42800 Middle=45000 High=43000
   (2) IEEE 802.11g power level→Low=50600 Middle=52800 High=50800
   Start: Cont.TX

For Normal operating :

1. Setup whole system for test as shown on diagram
2. Notebook PC (1) (2)(3) ping 192.168.1.254 –t to EUT.
3. Notebook PC (2) ping to Notebook PC (3)
4. ADSL iDSLAM Link DSL .
5. Start test.

8. APPLICABLE LIMITS AND TEST RESULTS

8.1 6dB BANDWIDTH

LIMIT

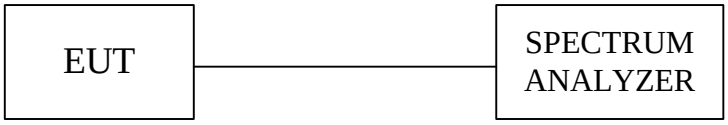
§ 15.207(a) (2) For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

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

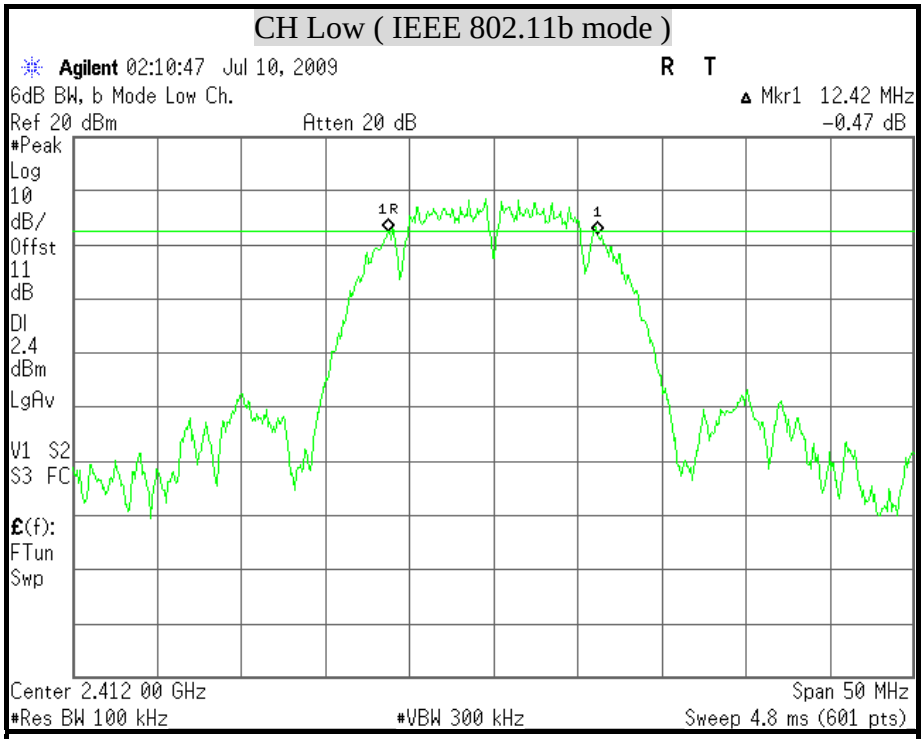
Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	12.42	500	PASS
Middle	2437	12.17	500	PASS
High	2462	12.75	500	PASS

IEEE 802.11g mode

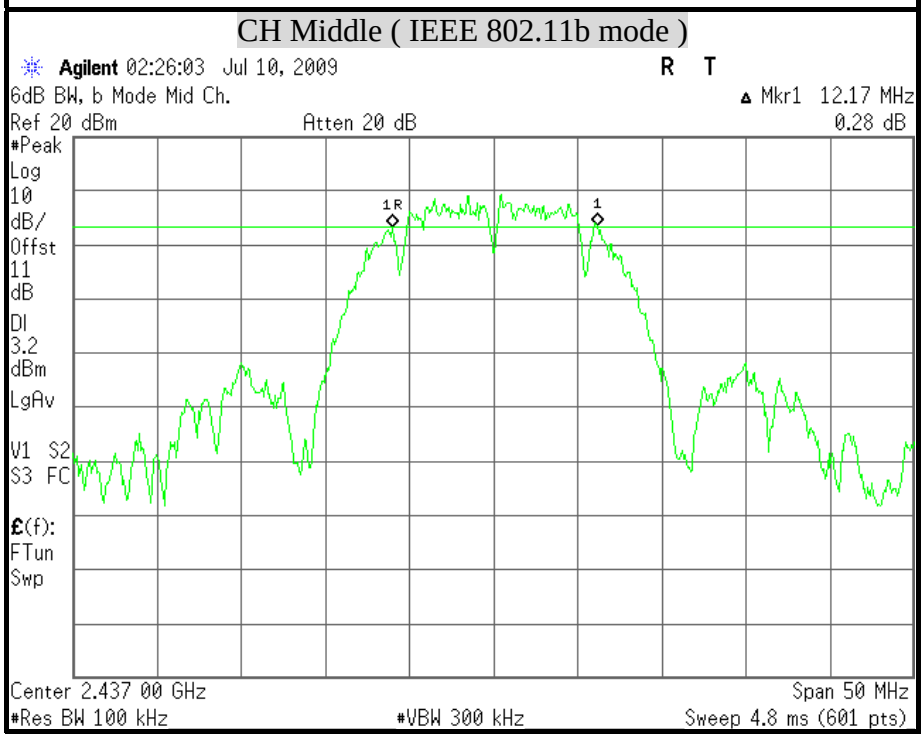
Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	16.58	500	PASS
Middle	2437	16.58	500	PASS
High	2462	16.58	500	PASS

6dB BANDWIDTH (IEEE 802.11b mode)

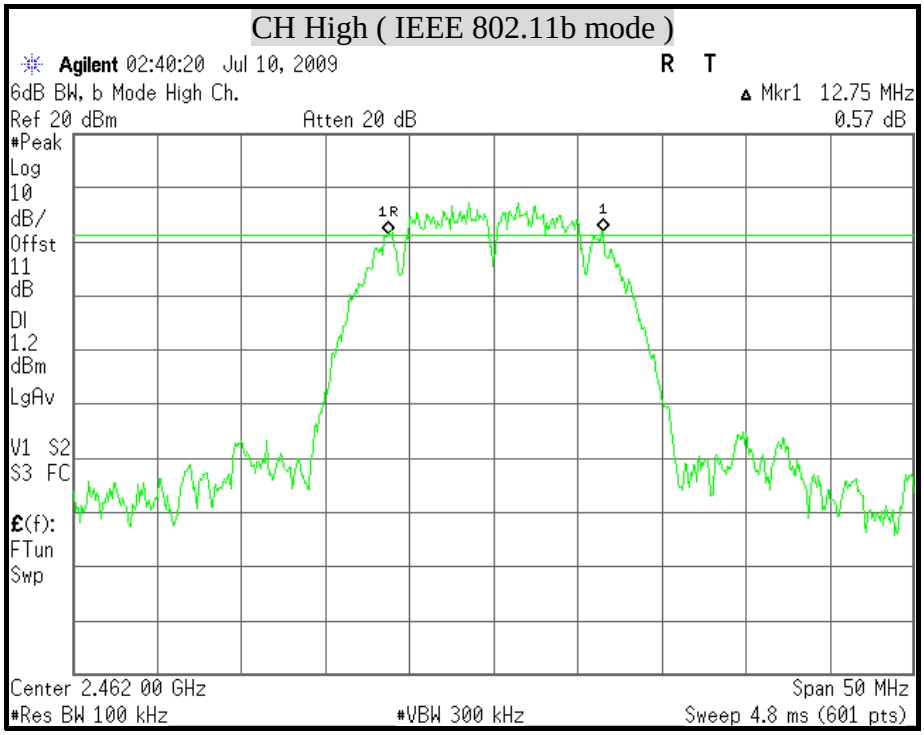
CH Low (IEEE 802.11b mode)



CH Middle (IEEE 802.11b mode)

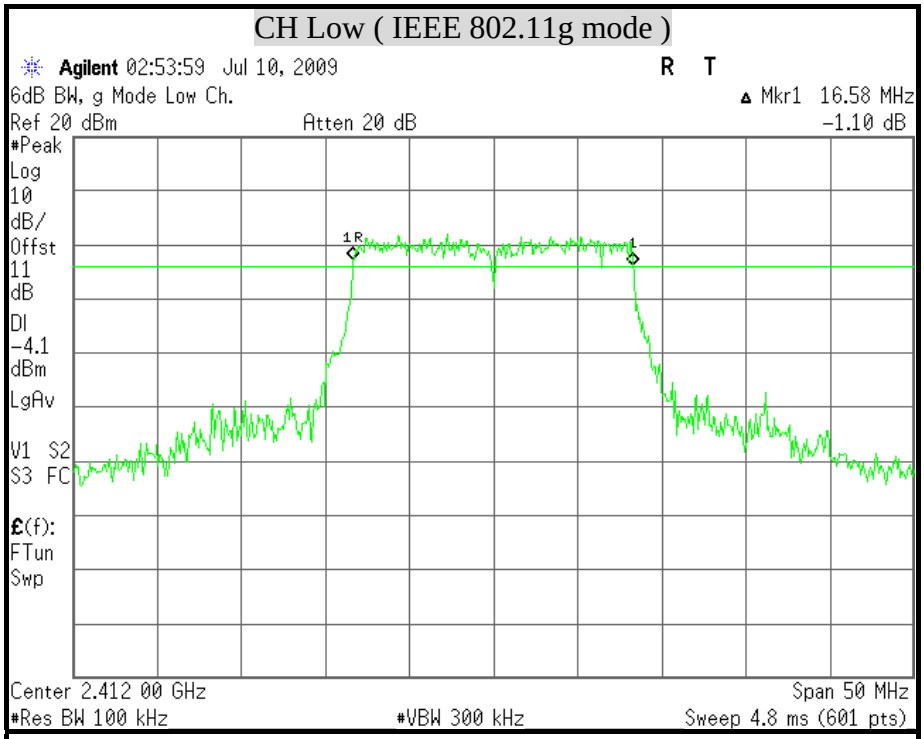


CH High (IEEE 802.11b mode)

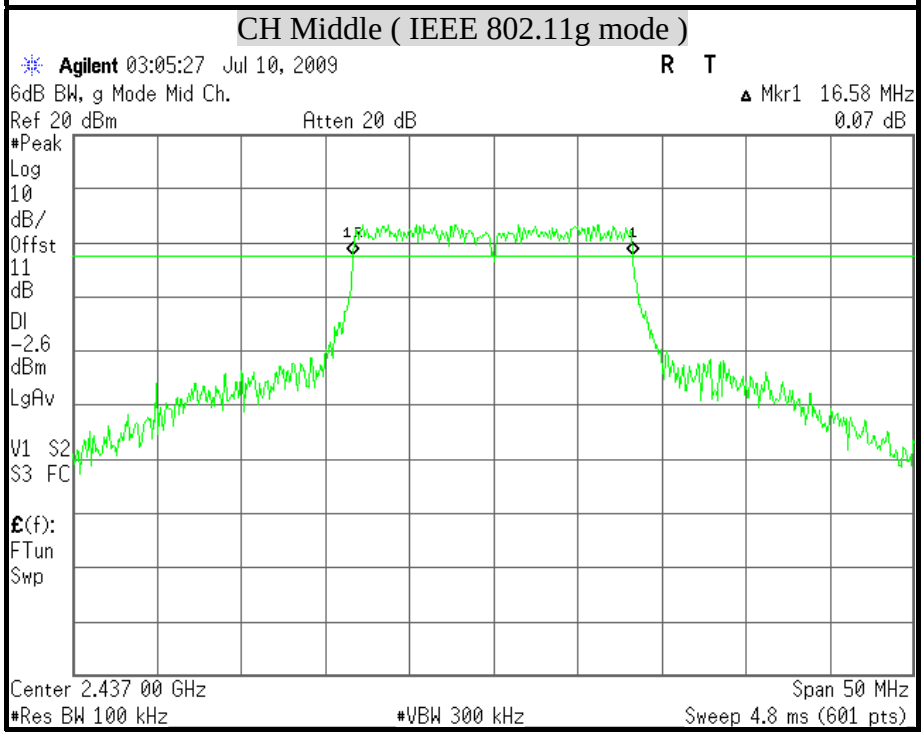


6dB BANDWIDTH (IEEE 802.11g mode)

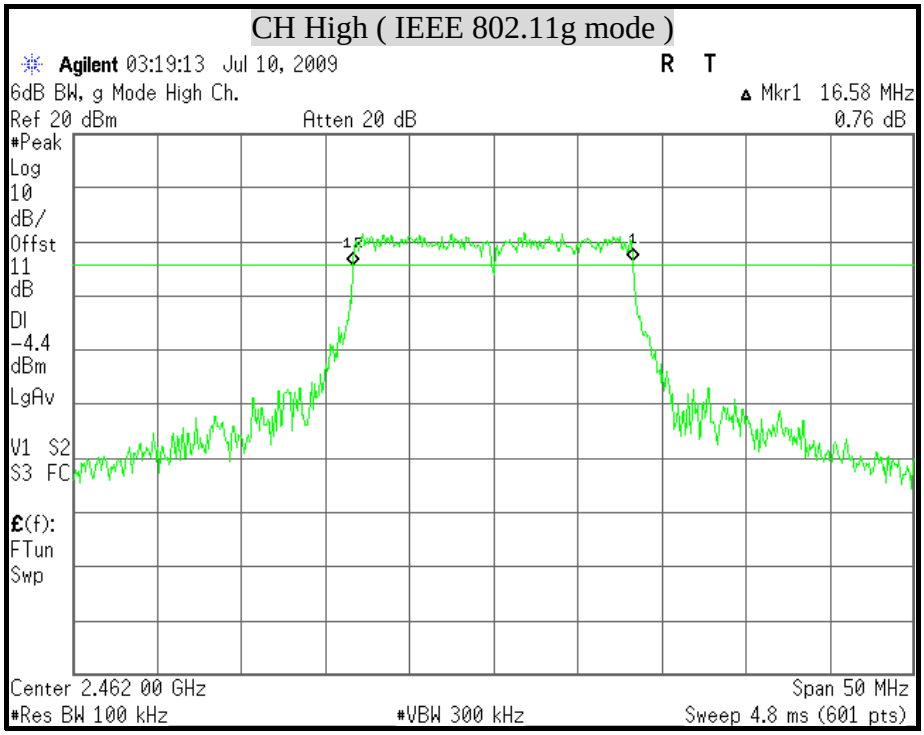
CH Low (IEEE 802.11g mode)



CH Middle (IEEE 802.11g mode)



CH High (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

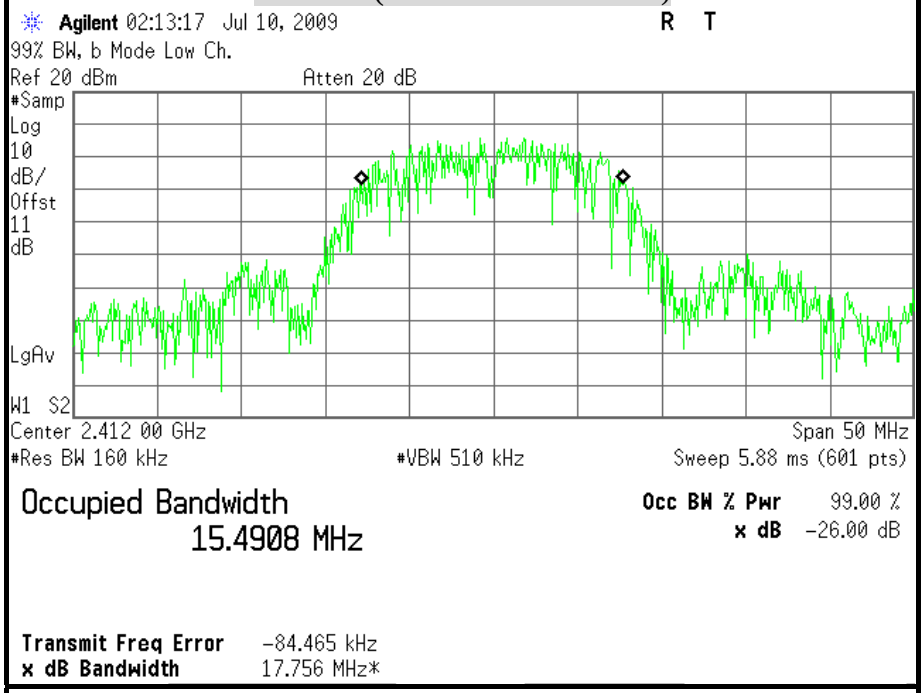
Channel	Channel Frequency (MHz)	99% Occupied power bandwidth (MHz)
Low	2412	15.490
Middle	2437	15.665
High	2462	15.524

IEEE 802.11g mode

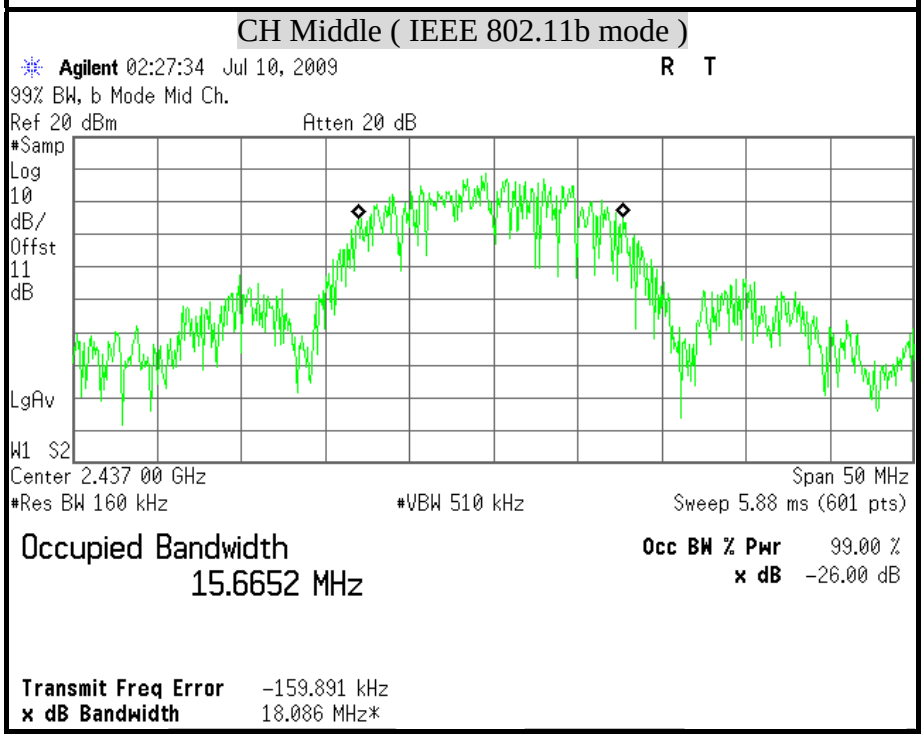
Channel	Channel Frequency (MHz)	99% Occupied power bandwidth (MHz)
Low	2412	16.436
Middle	2437	16.581
High	2462	16.463

99% BANDWIDTH (IEEE 802.11b mode)

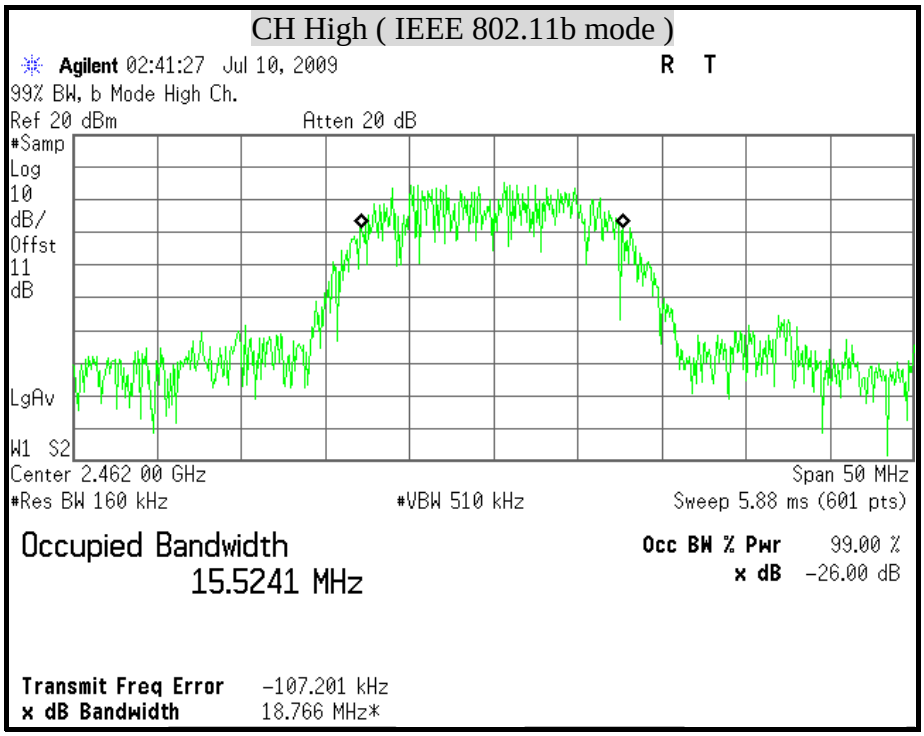
CH Low (IEEE 802.11b mode)



CH Middle (IEEE 802.11b mode)

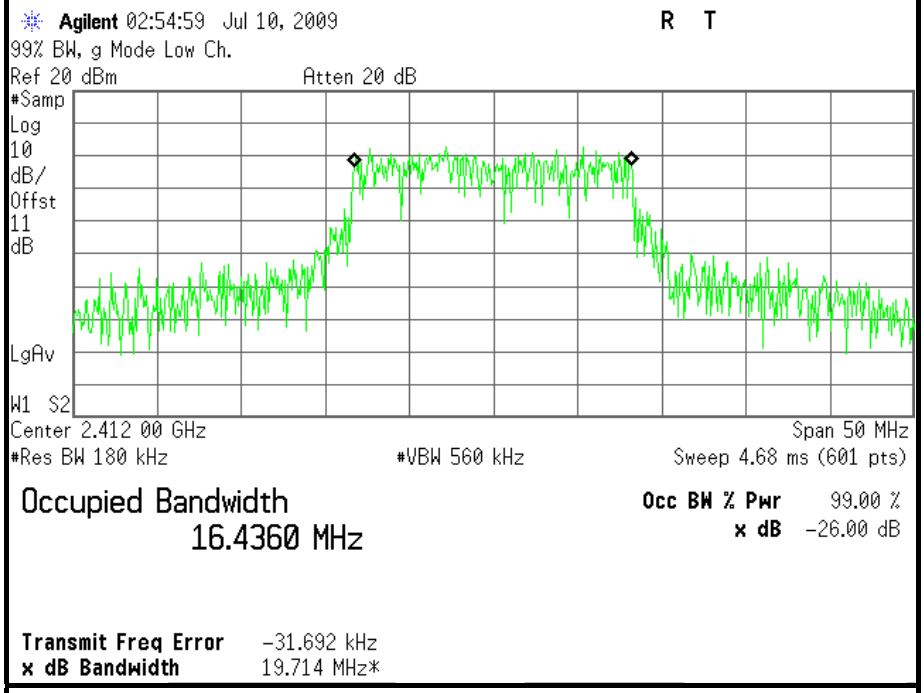


CH High (IEEE 802.11b mode)

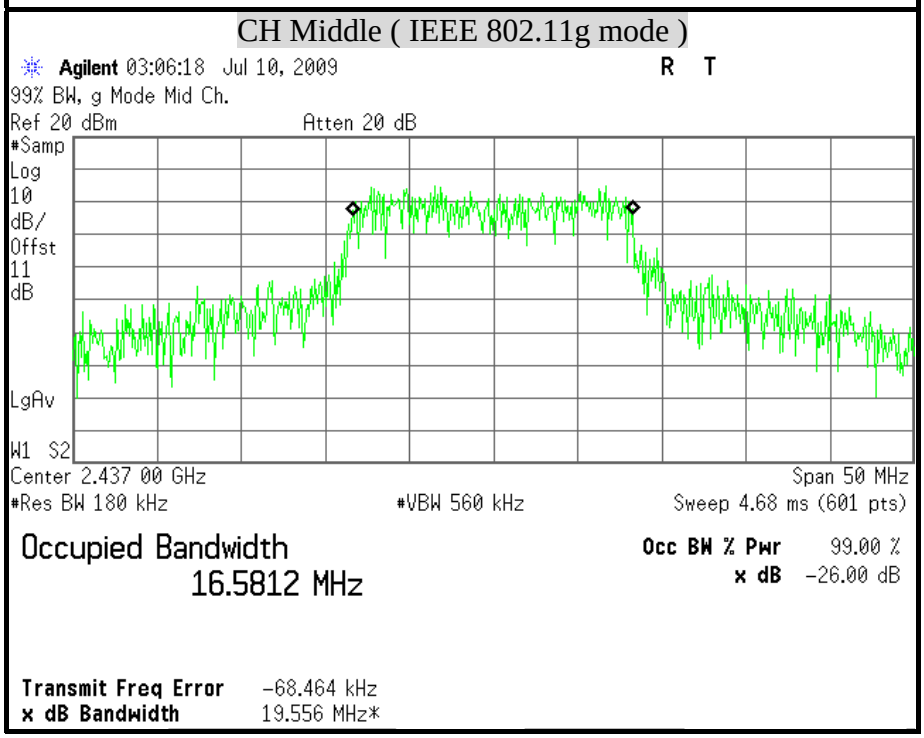


99% BANDWIDTH (IEEE 802.11g mode)

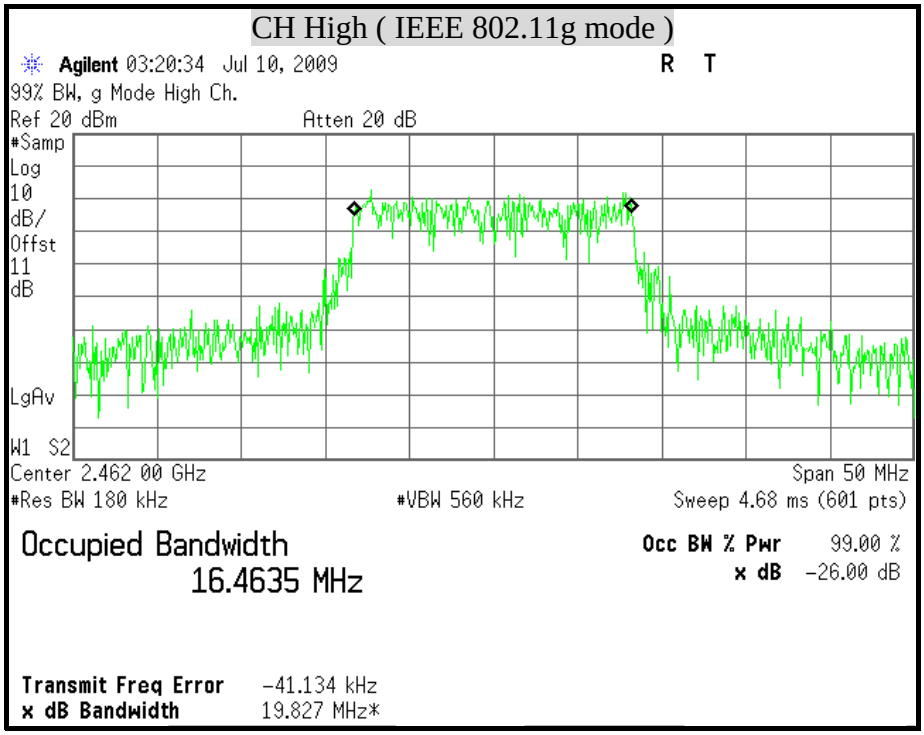
CH Low (IEEE 802.11g mode)



CH Middle (IEEE 802.11g mode)



CH High (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.

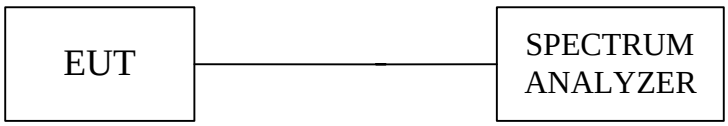
§ 15.247(b) (4) Except as shown in paragraphs (c) of this section , if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2), and (b)(3) of this section , as appropriate, 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	20.58	30	PASS
Middle	2437	22.52	30	PASS
High	2462	20.68	30	PASS

Remark:

1. At finial 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

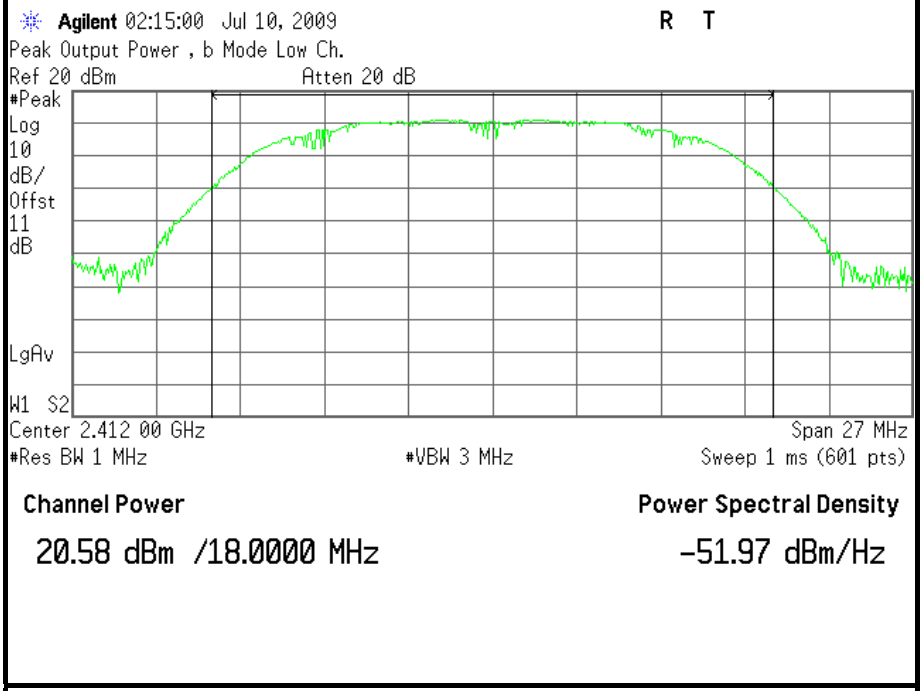
Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2412	17.52	30	PASS
Middle	2437	19.76	30	PASS
High	2462	17.56	30	PASS

Remark:

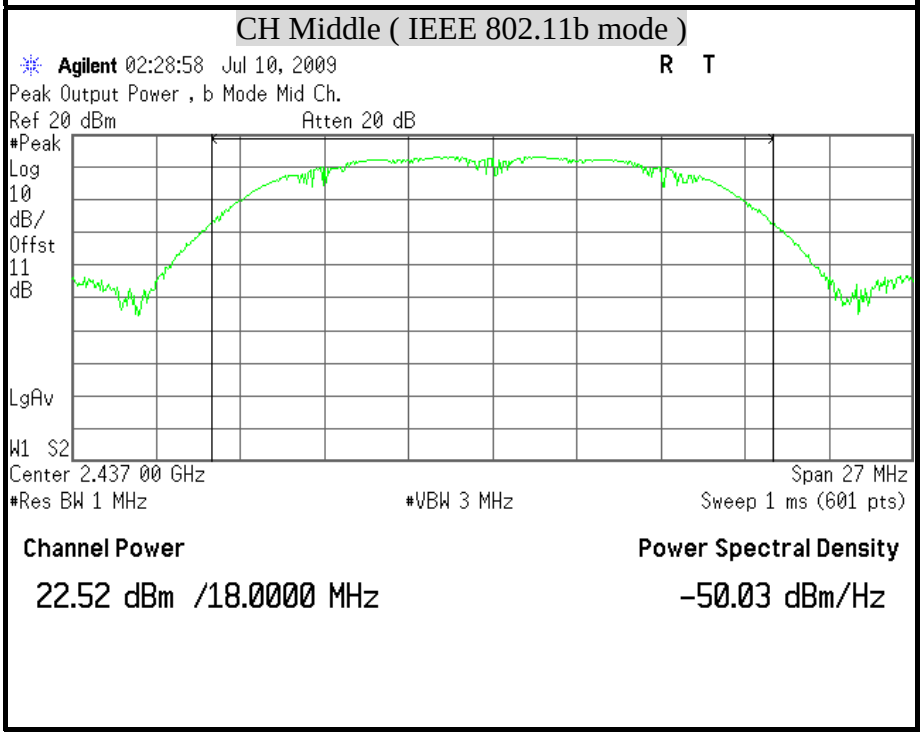
1. At finial test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11dB (including 10 dB pad and 1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

MAXIMUM PEAK OUTPUT POWER (IEEE 802.11b mode)

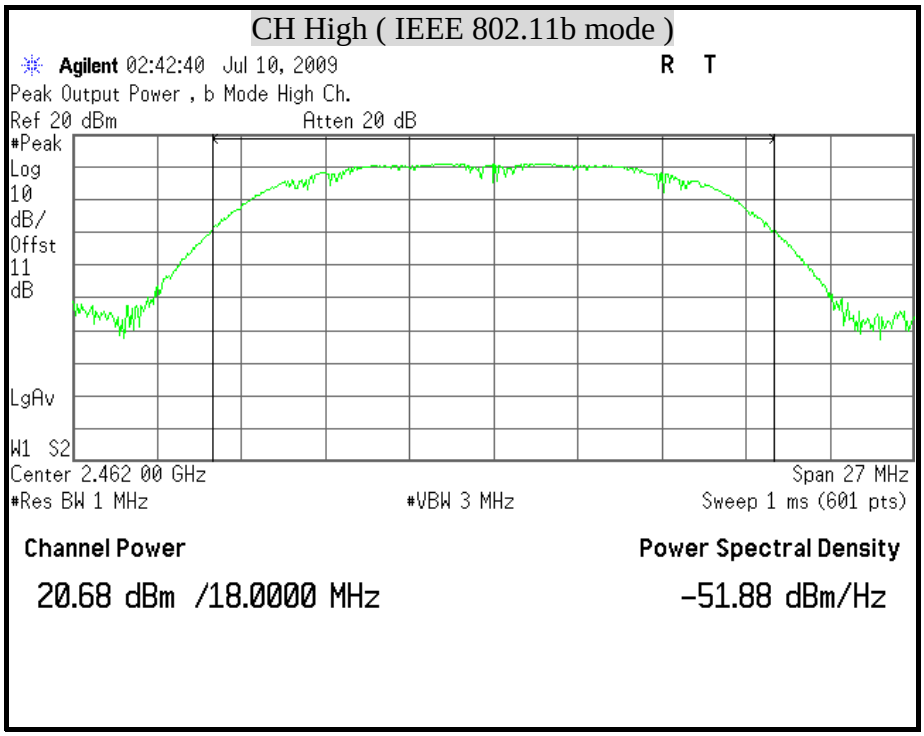
CH Low (IEEE 802.11b mode)



CH Middle (IEEE 802.11b mode)

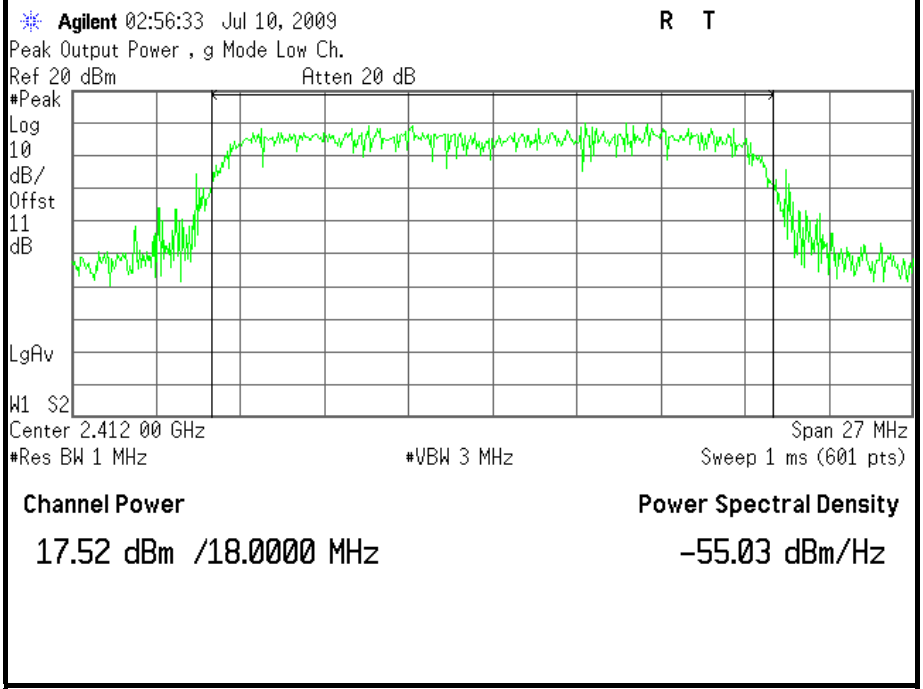


CH High (IEEE 802.11b mode)

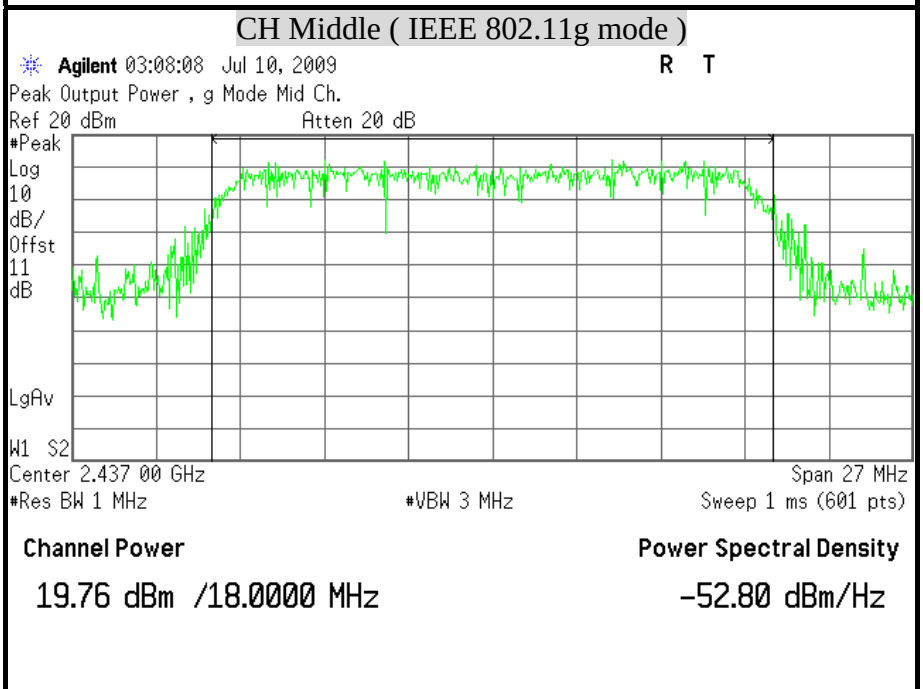


MAXIMUM PEAK OUTPUT POWER (IEEE 802.11g mode)

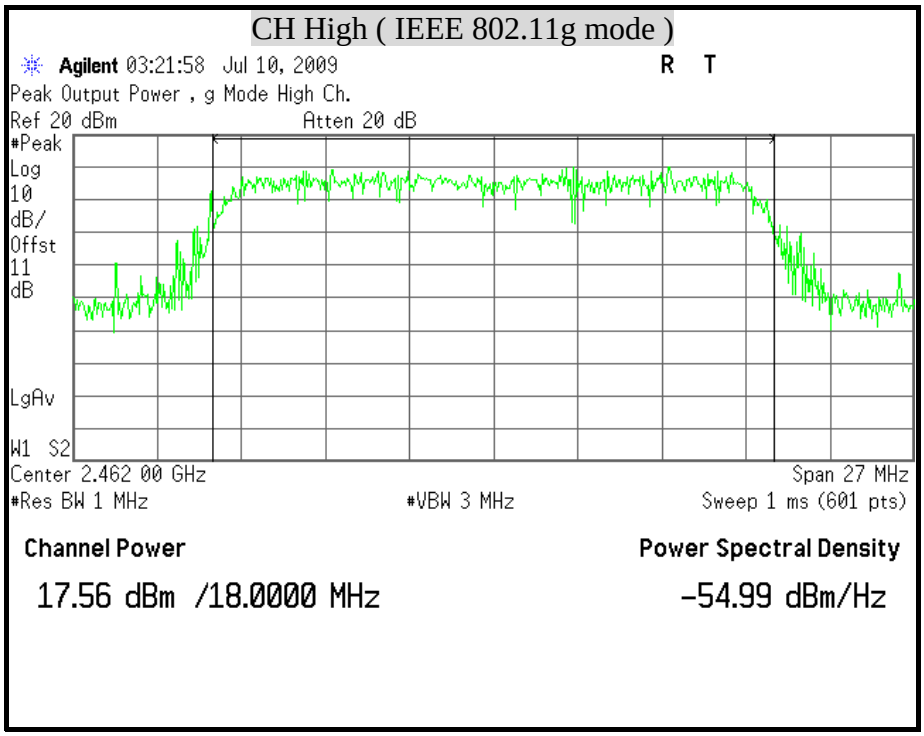
CH Low (IEEE 802.11g mode)



CH Middle (IEEE 802.11g mode)



CH High (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 theenvironment 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^2)	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 $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{3770}$

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 (mW) = P (W) / 1000 and

d (cm) = d(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^2

LIMIT

Power Density Limit, S=1.0mW/cm^2

TEST RESULTS

Mode	Antenna Gain (dBi)	Minimum separation distance (cm)	Output Power (dBm)	Numeric antenna gain (dB)	Power Density Limit (mW/cm^2)	Power Density at 20cm (mW/cm^2)
IEEE 802.11b	2	20.0	22.52	1.58	1.00	0.056327
IEEE 802.11g	2	20.0	19.76	1.58	1.00	0.029835

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

8.5 AVERAGE POWER

LIMIT

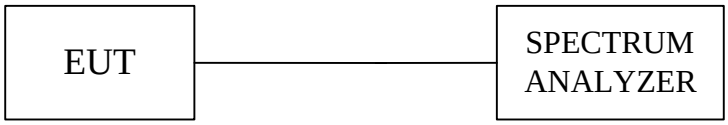
None; for reporting purposes only.

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	18.10
Middle	2437	19.62
High	2462	18.06

Remark:

1. At finial 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	14.21
Middle	2437	16.42
High	2462	14.26

Remark:

1. At finial 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

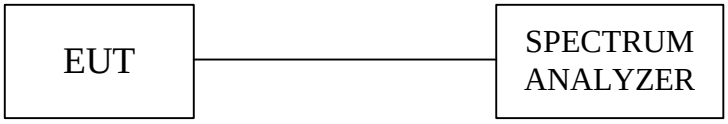
§ 15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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)	Maxmum Limit (dBm)	Pass / Fail
Low	2412	-10.70	8	PASS
Middle	2437	-9.34	8	PASS
High	2462	-11.13	8	PASS

Remark:

1. At finial 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

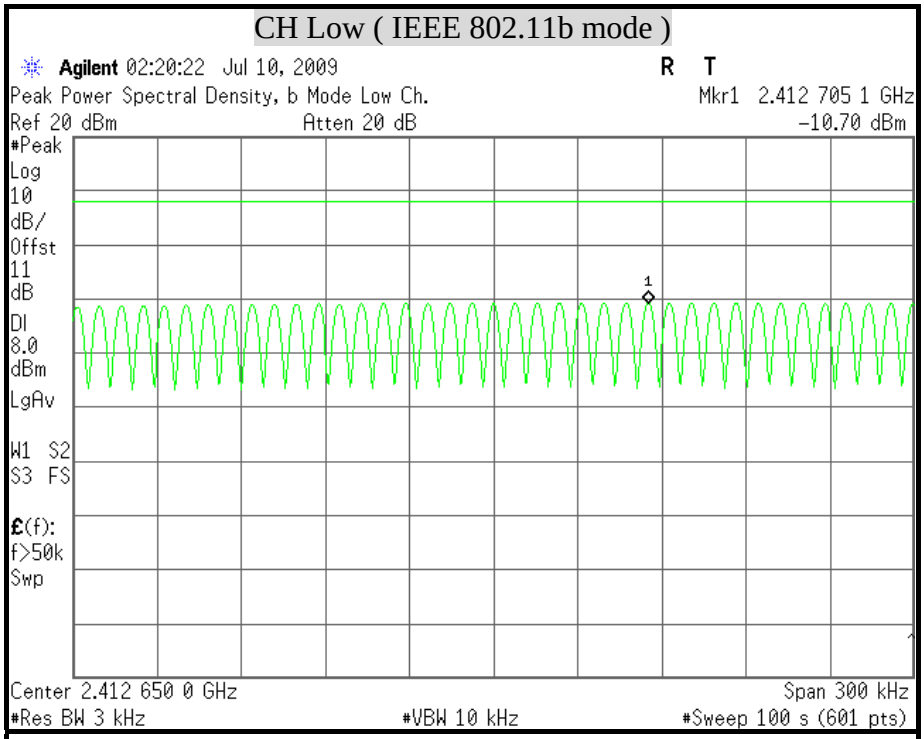
Channel	Channel Frequency (MHz)	Final RF Power Level in 3KHz BW (dBm)	Maxmum Limit (dBm)	Pass / Fail
Low	2412	-11.02	8	PASS
Middle	2437	-9.12	8	PASS
High	2462	-10.77	8	PASS

Remark:

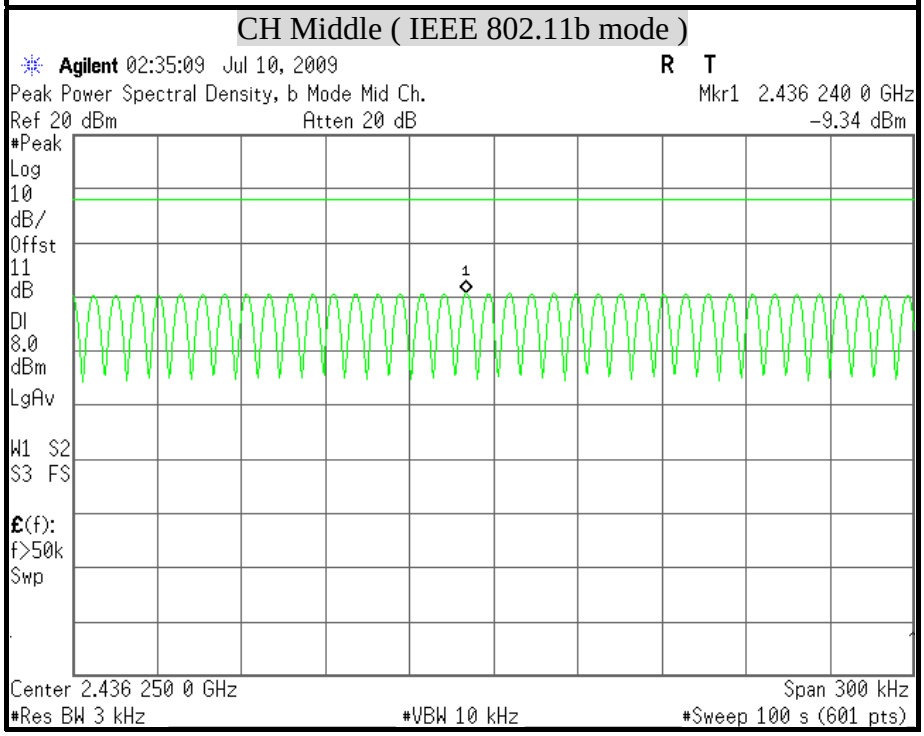
1. At finial test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11dB (including 10 dB pad and 1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

POWER SPECTRAL DENSITY (IEEE 802.11b mode)

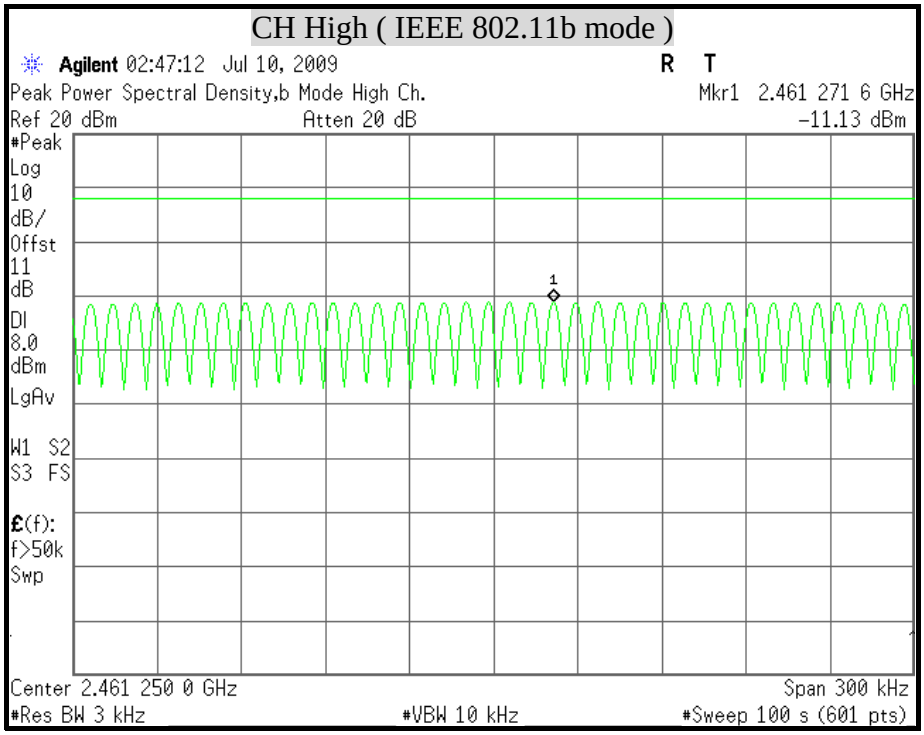
CH Low (IEEE 802.11b mode)



CH Middle (IEEE 802.11b mode)

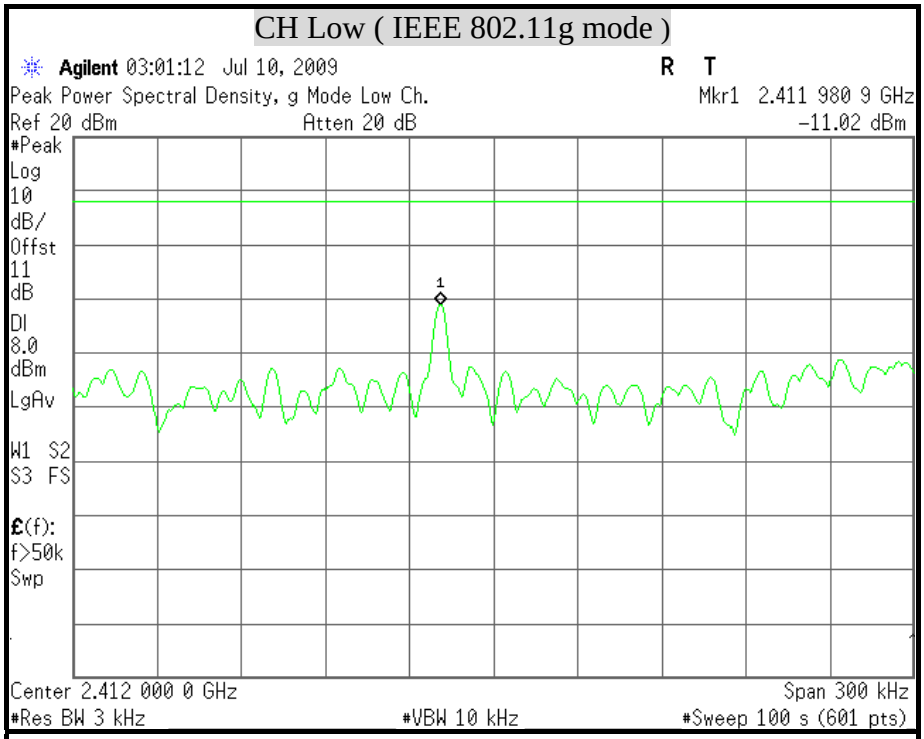


CH High (IEEE 802.11b mode)

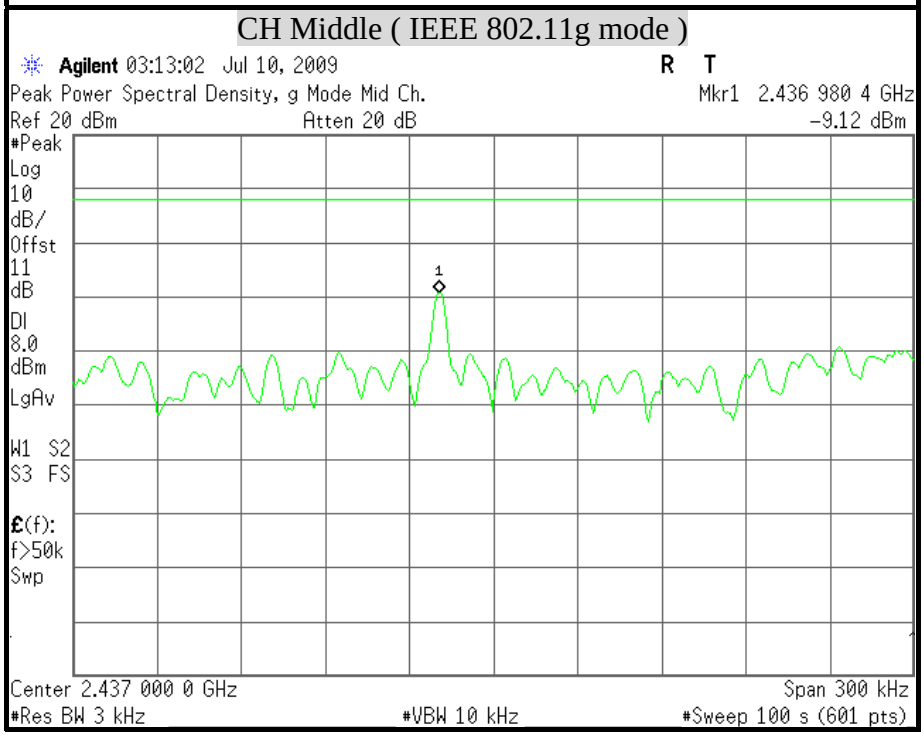


POWER SPECTRAL DENSITY (IEEE 802.11g mode)

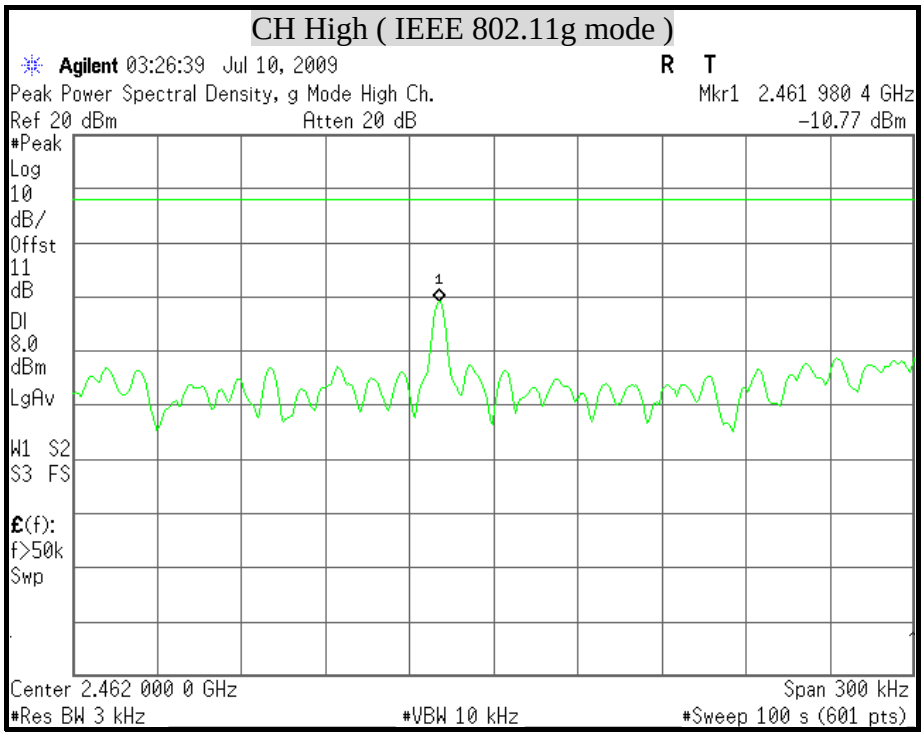
CH Low (IEEE 802.11g mode)



CH Middle (IEEE 802.11g mode)



CH High (IEEE 802.11g mode)



8.7 CONDUCTED SPURIOUS EMISSION

LIMITS

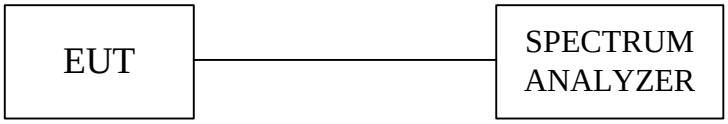
§ 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the and that contains the highest level 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

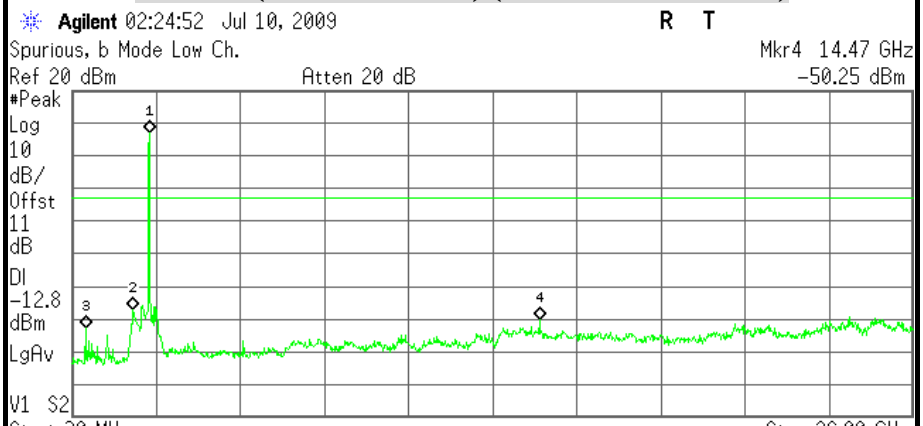


TEST RESULTS

OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

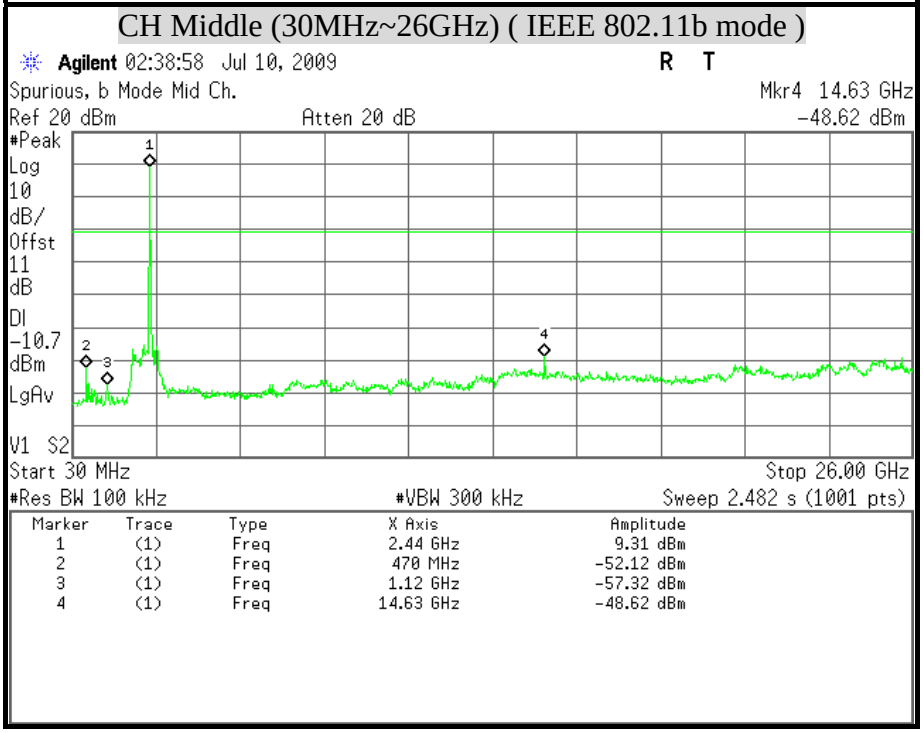
(IEEE 802.11b mode)

CH Low (30MHz~26GHz) (IEEE 802.11b mode)



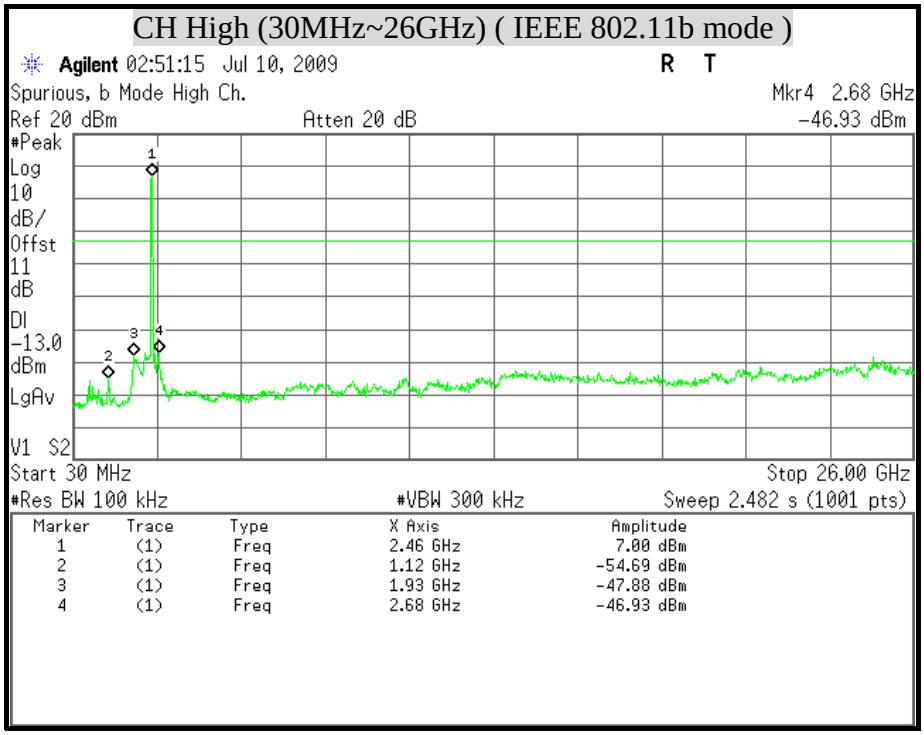
Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.41 GHz	7.19 dBm
2	(1)	Freq	1.93 GHz	-47.18 dBm
3	(1)	Freq	450 MHz	-52.81 dBm
4	(1)	Freq	14.47 GHz	-50.25 dBm

CH Middle (30MHz~26GHz) (IEEE 802.11b mode)



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.44 GHz	9.31 dBm
2	(1)	Freq	470 MHz	-52.12 dBm
3	(1)	Freq	1.12 GHz	-57.32 dBm
4	(1)	Freq	14.63 GHz	-48.62 dBm

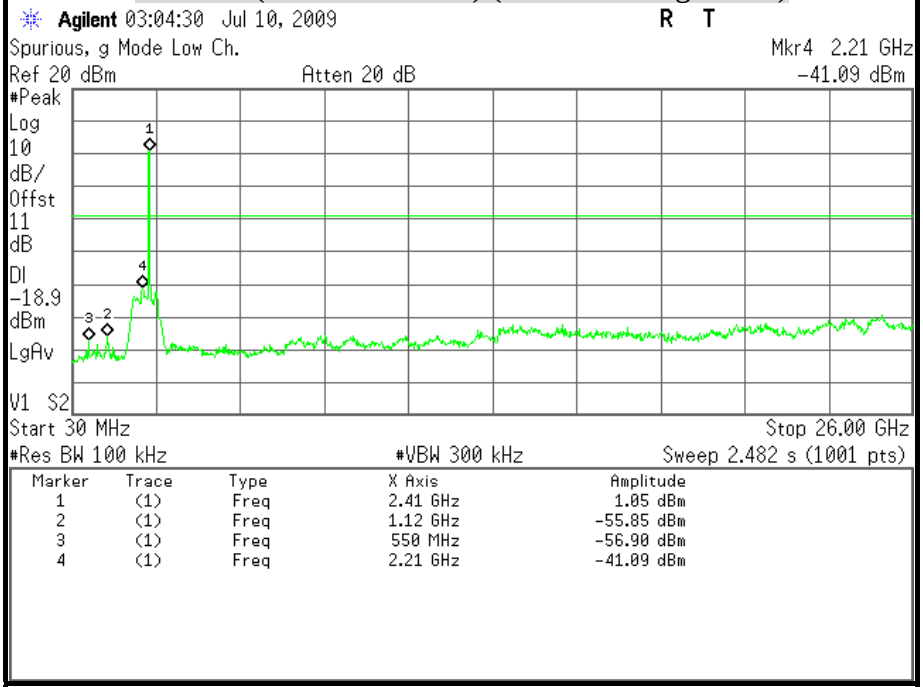
CH High (30MHz~26GHz) (IEEE 802.11b mode)



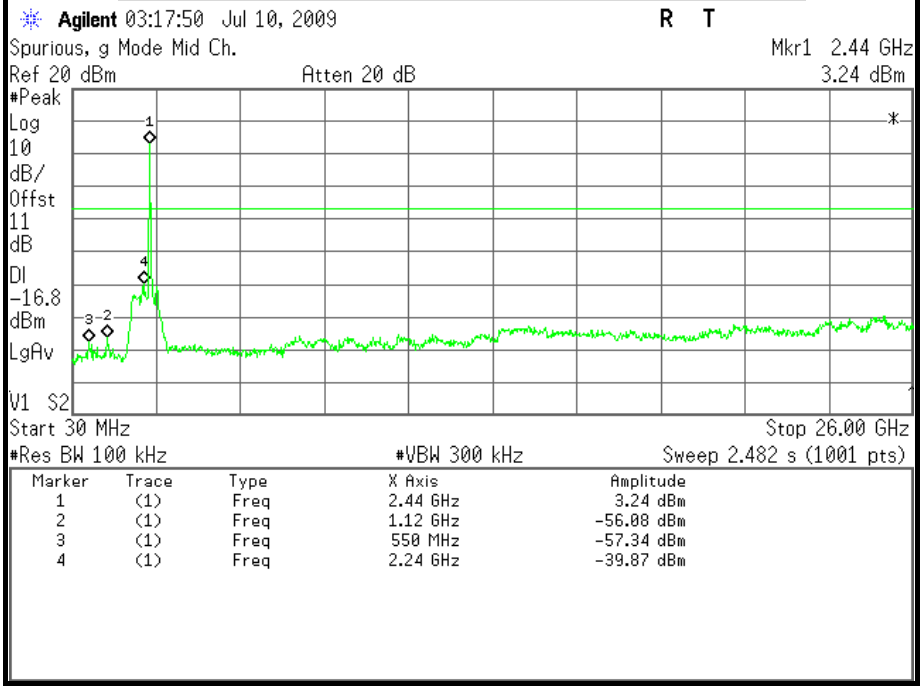
OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

(IEEE 802.11g mode)

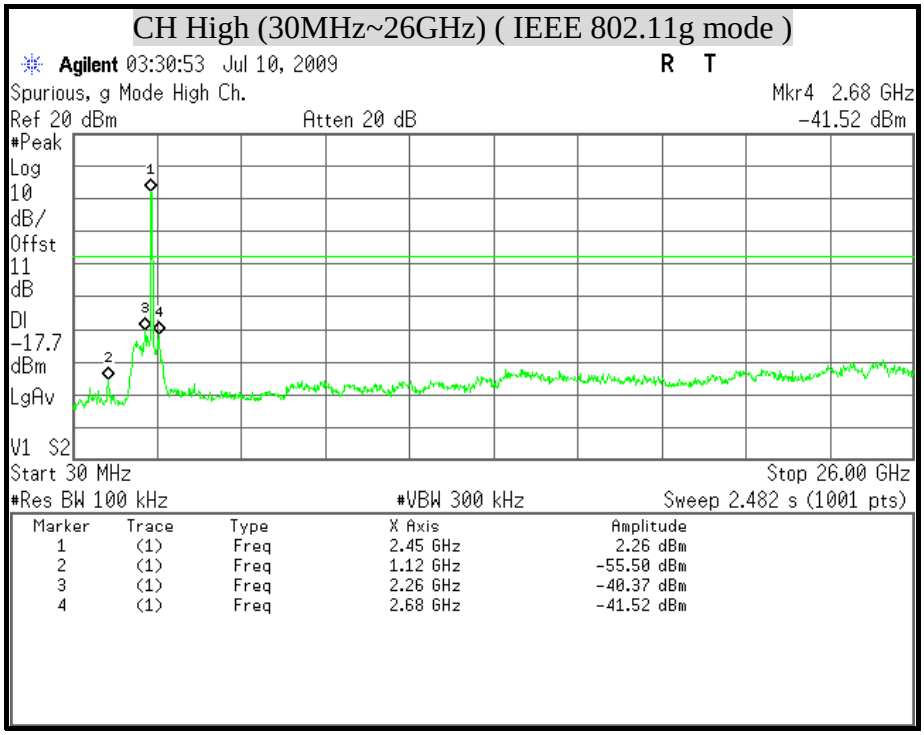
CH Low (30MHz~26GHz) (IEEE 802.11g mode)



CH Middle (30MHz~26GHz) (IEEE 802.11g mode)



CH High (30MHz~26GHz) (IEEE 802.11g mode)



8.8 RADIATED EMISSIONS

8.8.1 TRANSMITTER RADIATED SUPURIOUS EMSSIONS

LIMITS

§ 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 -1710	10.6 -12.7
6.26775 - 6.26825	108 -121.94	1718.8 - 1722.2	13.25 -13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 – 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 -16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3338	36.43 - 36.5
12.57675 - 12.57725	322 -335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown is 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

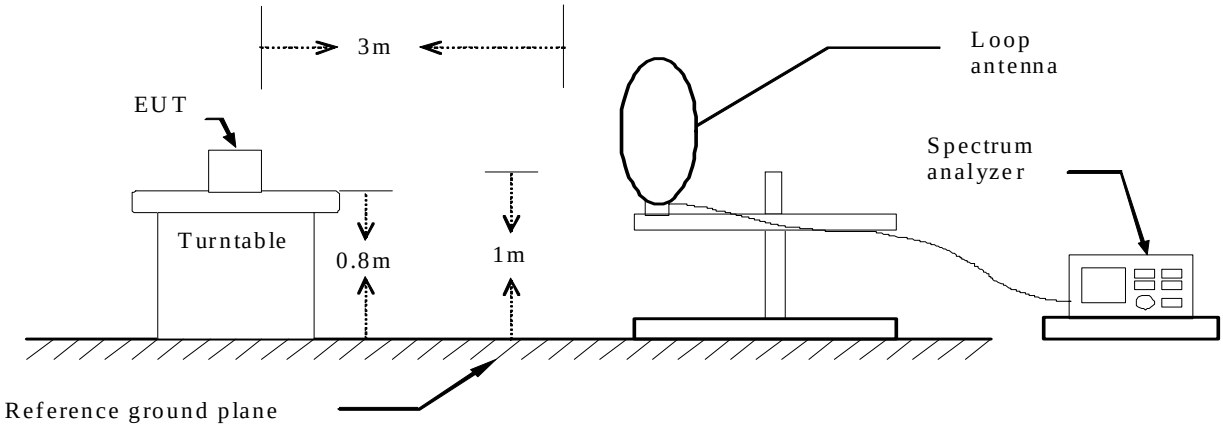
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
SPECTRUM ANALYZER	AGILENT	E4446A	MY46180323	06/09/2010
EMI TEST RECEIVER	R & S	ESCI	100221	05/17/2010
BILOG ANTENNA	SCHWARZBECK	VULB	9168	09/17/2009
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00078732	06/30/2010
PRE-AMPLIFIER	EM	EM30265	07032611	07/14/2010
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.

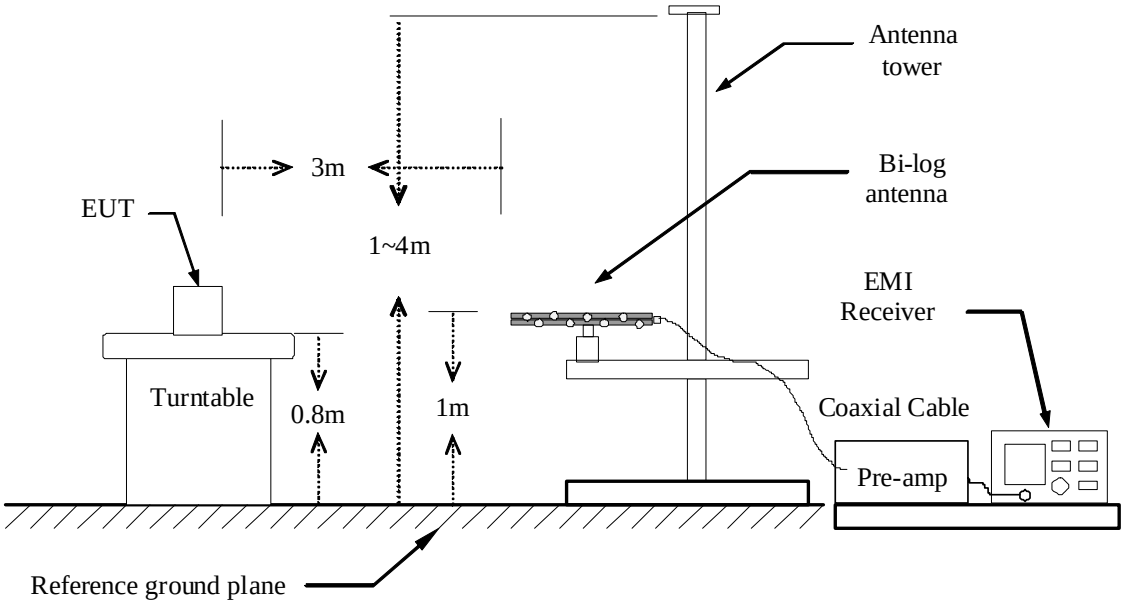
TEST SETUP

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

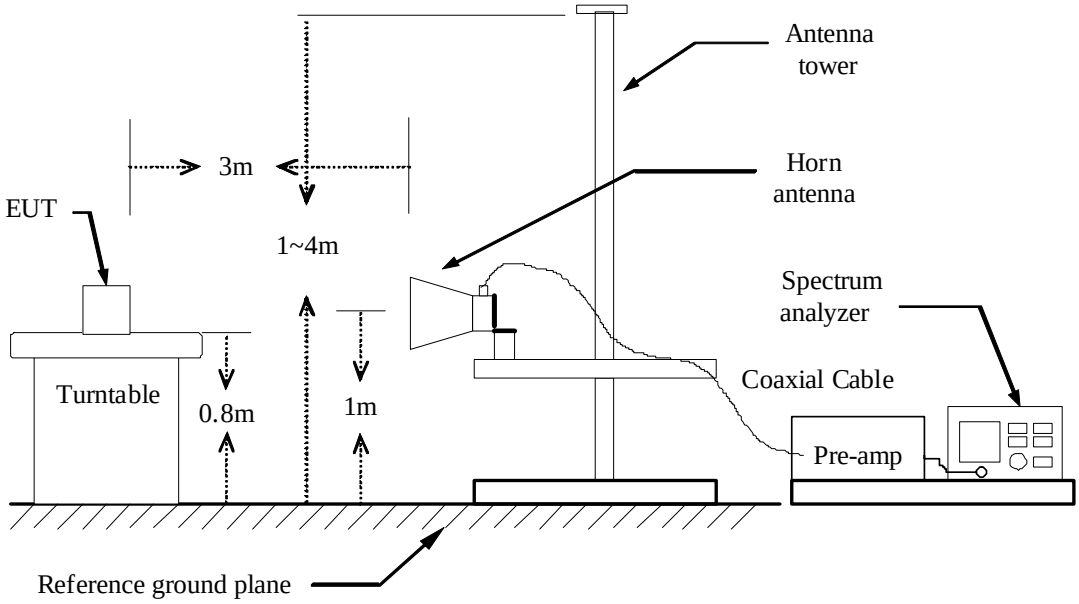
9kHz ~ 30MHz



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. White 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. White 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

BELOW 1 GHz (9kHz ~ 30MHz)

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

BELOW 1 GHz (30MHz ~ 1GHz)

Product Name	ADSL2+ (802.11g)(VPN) Firewall	**Test Date**	2009/07/22
Model	BiPAC 7412GL *R4*	**Test By**	Rick Lin
Test Mode	Normal operating (worst-case)	**TEMP & Humidity**	24.5°C, 46%

Horizontal						
Frequency (MHz)	Reading (dBμV)	Correction Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Remark
131.85	71.37	-33.09	38.28	43.50	-5.22	Peak
159.98	69.39	-31.25	38.14	43.50	-5.36	Peak
263.77	72.18	-30.93	41.25	46.00	-4.75	Peak
527.61	64.34	-25.47	38.87	46.00	-7.13	Peak
659.53	63.51	-23.23	40.28	46.00	-5.72	Peak
792.42	63.23	-21.00	42.23	46.00	-3.77	Peak
924.34	62.19	-19.39	42.79	46.00	-3.21	Peak

Vertical						
Frequency (MHz)	Reading (dBμV)	Correction Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Remark
31.94	67.22	-31.29	35.93	40.00	-4.07	Peak
415.09	66.39	-27.23	39.16	46.00	-6.84	Peak
444.19	66.76	-26.69	40.07	46.00	-5.93	Peak
452.92	66.77	-26.55	40.22	46.00	-5.78	Peak
559.62	66.66	-24.89	41.77	46.00	-4.23	Peak
792.42	61.64	-21.00	40.65	46.00	-5.35	Peak
921.43	63.10	-19.42	43.68	46.00	-2.32	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 (dBuV/m) = Reading (dBuV) + Correction Factor (dB/m)*
5. *Margin (dB) = Remark result (dBuV/m) - Quasi-peak limit (dBuV/m).*

8.8.3 TRANSMITTER RADIATED EMISSION ABOVE 1 GHz

Product Name	ADSL2+ (802.11g)(VPN) Firewall Router	**Test Date**	2009/07/17
Model	BiPAC 7412GL *R4*	**Test By**	Rueyyan Lin
Test Mode	IEEE 802.11b TX (CH Low)	**TEMP & Humidity**	25.3°C, 49%

Horizontal

Frequency (MHz)	Reading-PK (dBµV)	Reading-AV (dBµV)	Correction Factor (dB/m)	Result-PK (dBµV/m)	Result-AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-AV (dBµV/m)	Margin (dB)	Remark
2412.00	109.39	105.37	-8.85	100.53	96.52	---	---	---	Carrier
3097.50	54.32	---	-8.18	46.14	---	74.00	54.00	-7.86	Peak
5032.50	51.57	---	-3.84	47.73	---	74.00	54.00	-6.27	Peak
6517.50	48.70	---	0.48	49.18	---	74.00	54.00	-4.82	Peak
7717.50	47.17	---	2.64	49.82	---	74.00	54.00	-4.18	Peak

Vertical

Frequency (MHz)	Reading-PK (dBµV)	Reading-AV (dBµV)	Correction Factor (dB/m)	Result-PK (dBµV/m)	Result-AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-AV (dBµV/m)	Margin (dB)	Remark
2240.00	68.24	56.42	-9.09	59.15	47.33	74.00	54.00	-6.67	AVG
2414.00	111.98	108.85	-8.85	103.13	100.00	---	---	---	Carrier
2644.00	70.45	57.23	-8.63	61.82	48.60	74.00	54.00	-5.40	AVG
5722.50	50.90	---	-1.75	49.15	---	74.00	54.00	-4.85	Peak
6667.50	48.63	---	0.88	49.51	---	74.00	54.00	-4.49	Peak
9645.00	52.07	46.41	4.63	56.70	51.04	74.00	54.00	-2.96	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)

Product Name	ADSL2+ (802.11g)(VPN) Firewall Router	**Test Date**	2009/07/17
Model	BiPAC 7412GL *R4*	**Test By**	Rueyyan Lin
Test Mode	IEEE 802.11b TX (CH Middle)	**TEMP & Humidity**	25.3°C, 49%

Horizontal

Frequency (MHz)	Reading-PK (dBμV)	Reading-AV (dBμV)	Correction Factor (dB/m)	Result-PK (dBμV/m)	Result-AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-AV (dBμV/m)	Margin (dB)	Remark
2438.00	112.45	109.47	-8.82	103.63	100.65	---	---	---	Carrier
3165.00	52.79	---	-8.05	44.74	---	74.00	54.00	-9.26	Peak
4552.50	50.79	---	-4.20	46.59	---	74.00	54.00	-7.41	Peak
5985.00	49.66	---	-0.83	48.83	---	74.00	54.00	-5.17	Peak
6517.50	48.97	---	0.48	49.45	---	74.00	54.00	-4.55	Peak

Vertical

Frequency (MHz)	Reading-PK (dBμV)	Reading-AV (dBμV)	Correction Factor (dB/m)	Result-PK (dBμV/m)	Result-AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-AV (dBμV/m)	Margin (dB)	Remark
2230.00	70.70	59.19	-9.10	61.60	50.09	74.00	54.00	-3.91	AVG
2434.00	116.85	114.22	-8.82	108.03	105.40	---	---	---	Carrier
2644.00	72.85	60.48	-8.63	64.22	51.85	74.00	54.00	-2.15	AVG
4582.50	51.22	---	-4.19	47.04	---	74.00	54.00	-6.96	Peak
6232.50	49.22	---	-0.22	49.00	---	74.00	54.00	-5.00	Peak
9750.00	53.88	49.92	4.64	58.52	54.56	88.03	85.40	-30.84	20dBc AVG Fundamental

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)

Product Name	ADSL2+ (802.11g)(VPN) Firewall Router	**Test Date**	2009/07/17
Model	BiPAC 7412GL *R4*	**Test By**	Rueyyan Lin
Test Mode	IEEE 802.11b TX (CH High)	**TEMP & Humidity**	25.3°C, 49%

Horizontal

Frequency (MHz)	Reading-PK (dBµV)	Reading-AV (dBµV)	Correction Factor (dB/m)	Result-PK (dBµV/m)	Result-AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-AV (dBµV/m)	Margin (dB)	Remark
2458.00	108.22	105.43	-8.79	99.42	96.64	---	---	---	Carrier
4462.50	50.96	---	-4.40	46.56	---	74.00	54.00	-7.44	Peak
7665.00	47.70	---	2.46	50.15	---	74.00	54.00	-3.85	Peak
8820.00	46.80	---	4.19	50.99	---	74.00	54.00	-3.01	Peak

Vertical

Frequency (MHz)	Reading-PK (dBµV)	Reading-AV (dBµV)	Correction Factor (dB/m)	Result-PK (dBµV/m)	Result-AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-AV (dBµV/m)	Margin (dB)	Remark
1896.00	67.85	57.27	-10.40	57.45	46.87	74.00	54.00	-7.13	AVG
2242.00	71.81	59.85	-9.08	62.73	50.77	74.00	54.00	-3.23	AVG
2460.00	116.58	114.11	-8.79	107.79	105.32	---	---	---	Carrier
2682.00	71.36	58.85	-8.60	62.76	50.25	74.00	54.00	-3.75	AVG
4920.00	51.32	---	-3.98	47.34	---	74.00	54.00	-6.66	Peak
9847.50	52.08	46.15	4.65	56.73	50.80	74.00	54.00	-3.20	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)

Product Name	ADSL2+ (802.11g)(VPN) Firewall Router	**Test Date**	2009/07/17
Model	BiPAC 7412GL *R4*	**Test By**	Rueyyan Lin
Test Mode	IEEE 802.11g TX (CH Low)	**TEMP & Humidity**	25.3°C, 49%

Horizontal									
Frequency (MHz)	Reading-PK (dBμV)	Reading-AV (dBμV)	Correction Factor (dB/m)	Result-PK (dBμV/m)	Result-AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-AV (dBμV/m)	Margin (dB)	Remark
1882.00	68.51	57.18	-10.54	57.97	46.64	74.00	54.00	-7.36	AVG
2418.00	106.39	97.81	-8.85	97.55	88.96	---	---	---	Carrier
3135.00	53.63	---	-8.11	45.52	---	74.00	54.00	-8.48	Peak
4425.00	51.37	---	-4.56	46.81	---	74.00	54.00	-7.19	Peak
5947.50	49.90	---	-0.96	48.94	---	74.00	54.00	-5.06	Peak
7732.50	47.31	---	2.69	50.01	---	74.00	54.00	-3.99	Peak

Vertical									
Frequency (MHz)	Reading-PK (dBμV)	Reading-AV (dBμV)	Correction Factor (dB/m)	Result-PK (dBμV/m)	Result-AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-AV (dBμV/m)	Margin (dB)	Remark
1940.00	69.18	58.51	-9.98	59.20	48.53	74.00	54.00	-5.47	AVG
2246.00	74.45	61.65	-9.08	65.37	52.57	74.00	54.00	-1.43	AVG
2406.00	108.09	100.27	-8.86	99.23	91.41	---	---	---	Carrier
2638.00	73.23	59.91	-8.63	64.60	51.28	74.00	54.00	-2.72	AVG
6525.00	48.67	---	0.50	49.16	---	74.00	54.00	-4.84	Peak
10297.50	49.65	33.82	5.13	54.78	38.95	74.00	54.00	-15.05	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)

Product Name	ADSL2+ (802.11g)(VPN) Firewall Router	**Test Date**	2009/07/17
Model	BiPAC 7412GL *R4*	**Test By**	Rueyyan Lin
Test Mode	IEEE 802.11g TX (CH Middle)	**TEMP & Humidity**	25.3°C, 49%

Horizontal

Frequency (MHz)	Reading-PK (dBμV)	Reading-AV (dBμV)	Correction Factor (dB/m)	Result-PK (dBμV/m)	Result-AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-AV (dBμV/m)	Margin (dB)	Remark
1886.00	70.28	57.64	-10.50	59.78	47.14	74.00	54.00	-6.86	AVG
2442.00	108.69	100.55	-8.81	99.87	91.74	---	---	---	Carrier
3165.00	53.25	---	-8.05	45.20	---	74.00	54.00	-8.80	Peak
5032.50	51.36	---	-3.84	47.52	---	74.00	54.00	-6.48	Peak
6517.50	49.30	---	0.48	49.78	---	74.00	54.00	-4.22	Peak
7762.50	47.43	---	2.80	50.23	---	74.00	54.00	-3.77	Peak

Vertical

Frequency (MHz)	Reading-PK (dBμV)	Reading-AV (dBμV)	Correction Factor (dB/m)	Result-PK (dBμV/m)	Result-AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-AV (dBμV/m)	Margin (dB)	Remark
1892.00	71.55	59.05	-10.44	61.11	48.61	74.00	54.00	-5.39	AVG
2244.00	74.36	61.78	-9.08	65.28	52.70	74.00	54.00	-1.30	AVG
2434.00	113.20	104.61	-8.82	104.37	95.79	---	---	---	Carrier
2650.00	75.41	62.16	-8.62	66.79	53.54	74.00	54.00	-0.46	AVG
6532.50	49.05	---	0.52	49.56	---	74.00	54.00	-4.44	Peak
8407.50	47.27	---	3.87	51.14	---	74.00	54.00	-2.86	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)

Product Name	ADSL2+ (802.11g)(VPN) Firewall Router	**Test Date**	2009/07/17
Model	BiPAC 7412GL *R4*	**Test By**	Rueyyan Lin
Test Mode	IEEE 802.11g TX (CH High)	**TEMP & Humidity**	25.3°C, 49%

Horizontal									
Frequency (MHz)	Reading-PK (dBμV)	Reading-AV (dBμV)	Correction Factor (dB/m)	Result-PK (dBμV/m)	Result-AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-AV (dBμV/m)	Margin (dB)	Remark
1056.00	66.29	---	-15.52	50.77	---	74.00	54.00	-3.23	Peak
1892.00	67.53	56.05	-10.44	57.09	45.61	74.00	54.00	-8.39	AVG
2458.00	104.10	96.93	-8.79	95.31	88.14	---	---	---	Carrier
4537.50	51.16	---	-4.21	46.95	---	74.00	54.00	-7.05	Peak
6690.00	49.14	---	0.94	50.08	---	74.00	54.00	-3.92	Peak
8415.00	46.73	---	3.87	50.60	---	74.00	54.00	-3.40	Peak

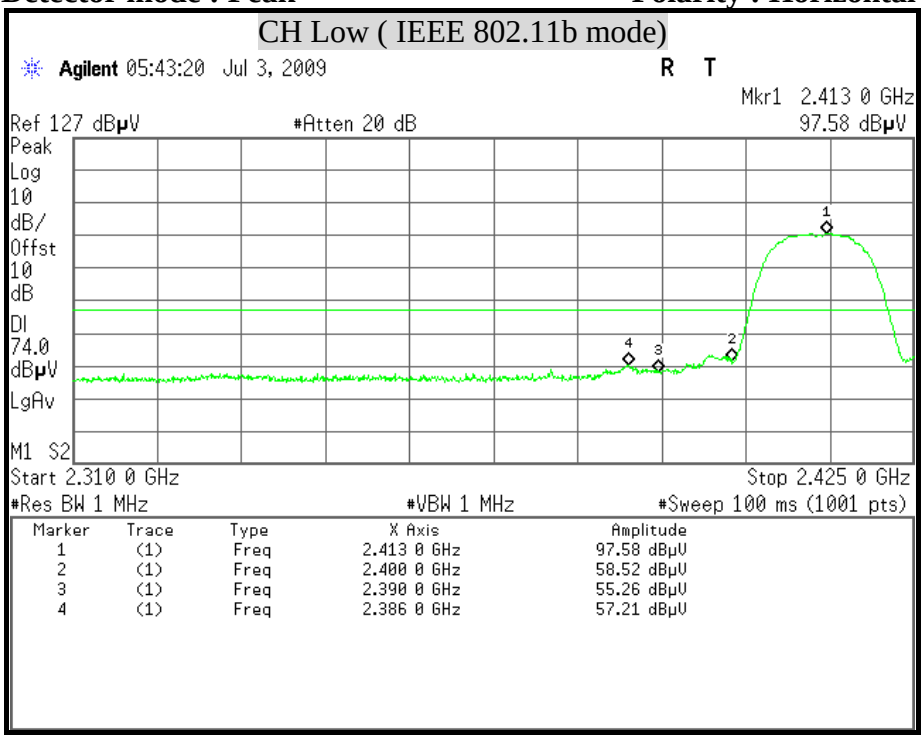
Vertical									
Frequency (MHz)	Reading-PK (dBμV)	Reading-AV (dBμV)	Correction Factor (dB/m)	Result-PK (dBμV/m)	Result-AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-AV (dBμV/m)	Margin (dB)	Remark
1946.00	67.71	56.93	-9.92	57.79	47.01	74.00	54.00	-6.99	AVG
2262.00	69.60	57.19	-9.06	60.54	48.13	74.00	54.00	-5.87	AVG
2456.00	110.40	102.06	-8.80	101.61	93.26	---	---	---	Carrier
5115.00	51.26	---	-3.61	47.65	---	74.00	54.00	-6.35	Peak
6525.00	49.71	---	0.50	50.21	---	74.00	54.00	-3.79	Peak
9150.00	46.76	---	4.42	51.18	---	74.00	54.00	-2.82	Peak

Remark:

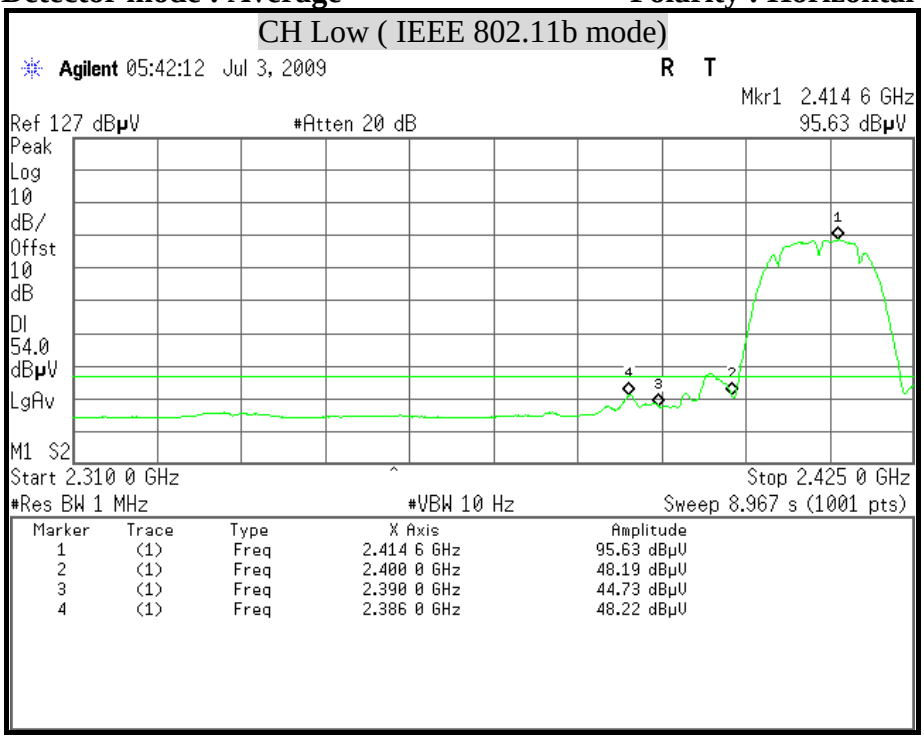
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Average test would be performed if the peak result were greater than the average limit.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions 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

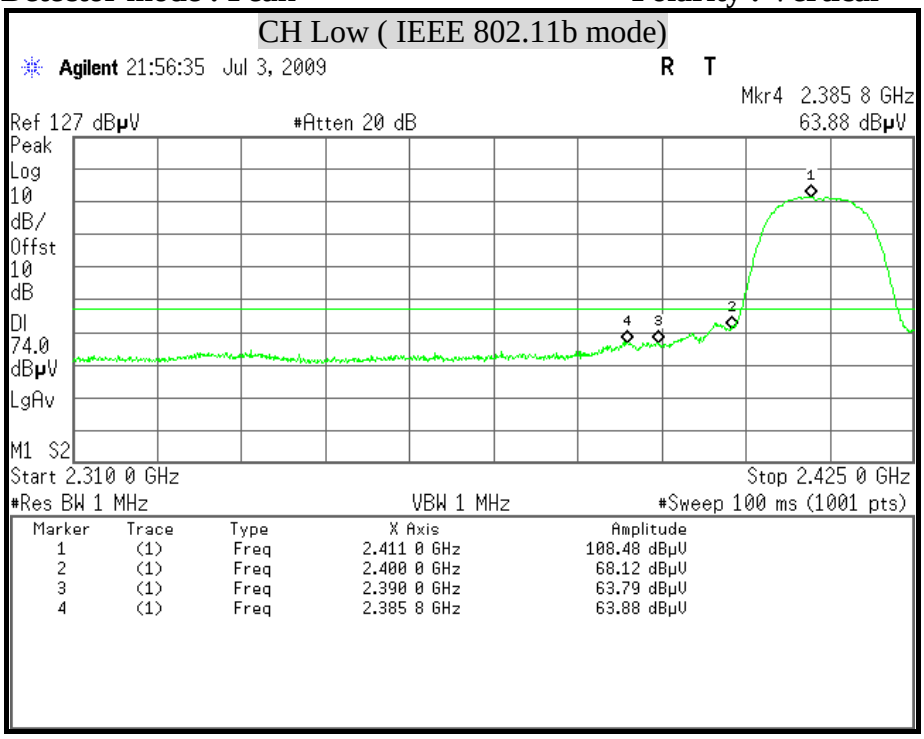
Detector mode : Peak **Polarity : Horizontal**



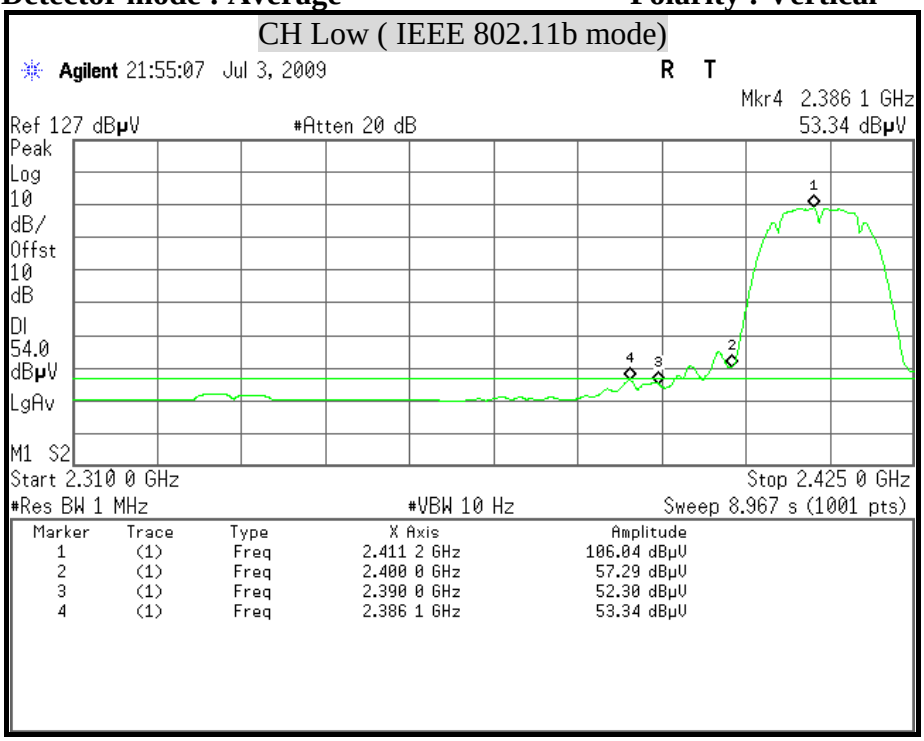
Detector mode : Average **Polarity : Horizontal**



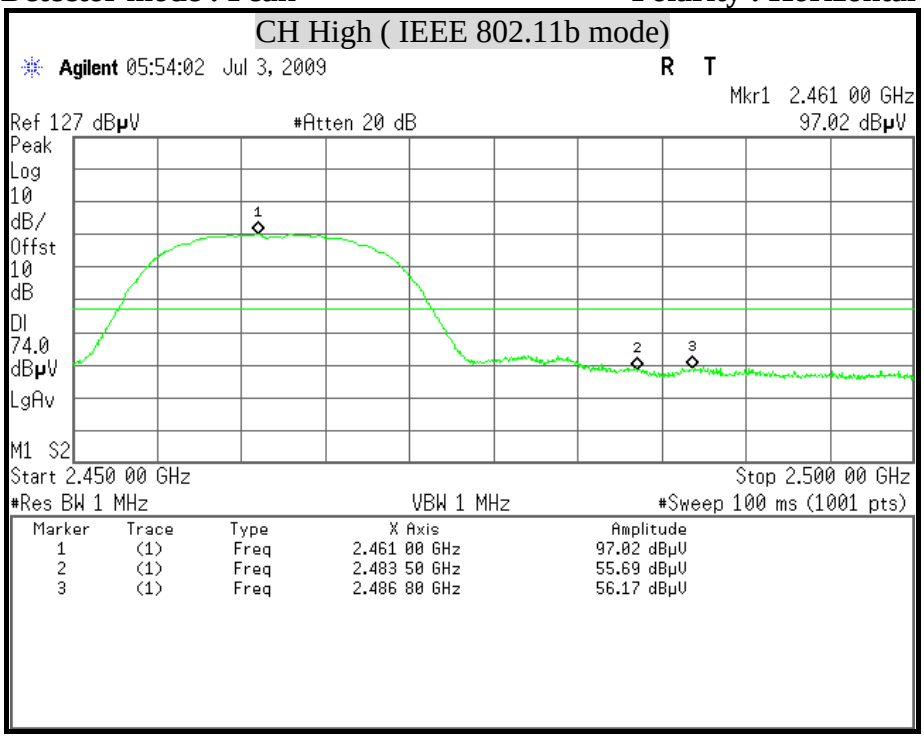
Detector mode : Peak **Polarity : Vertical**



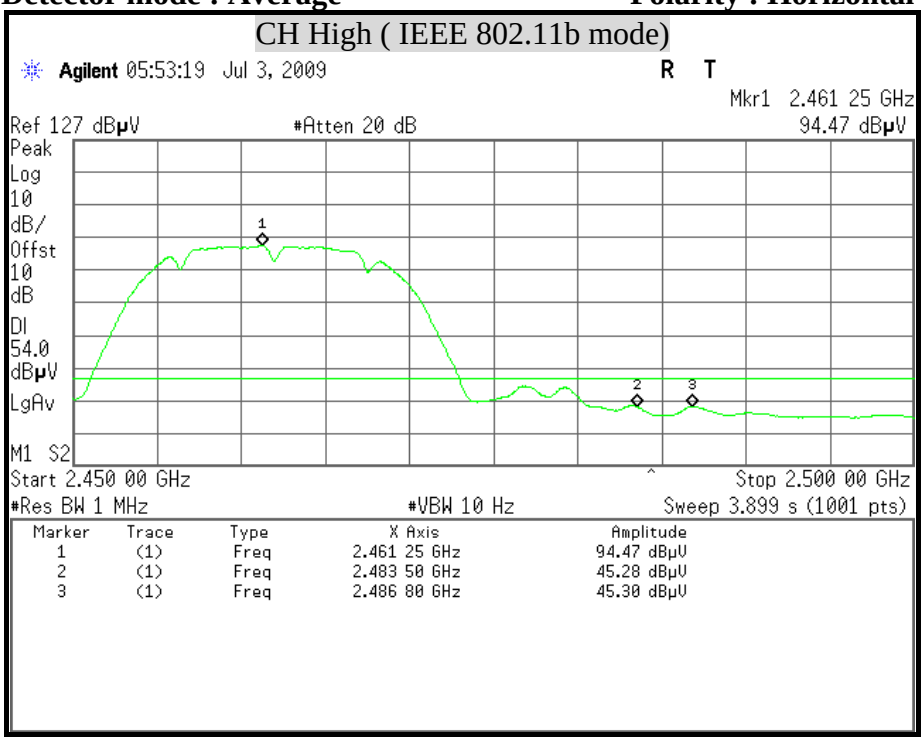
Detector mode : Average **Polarity : Vertical**



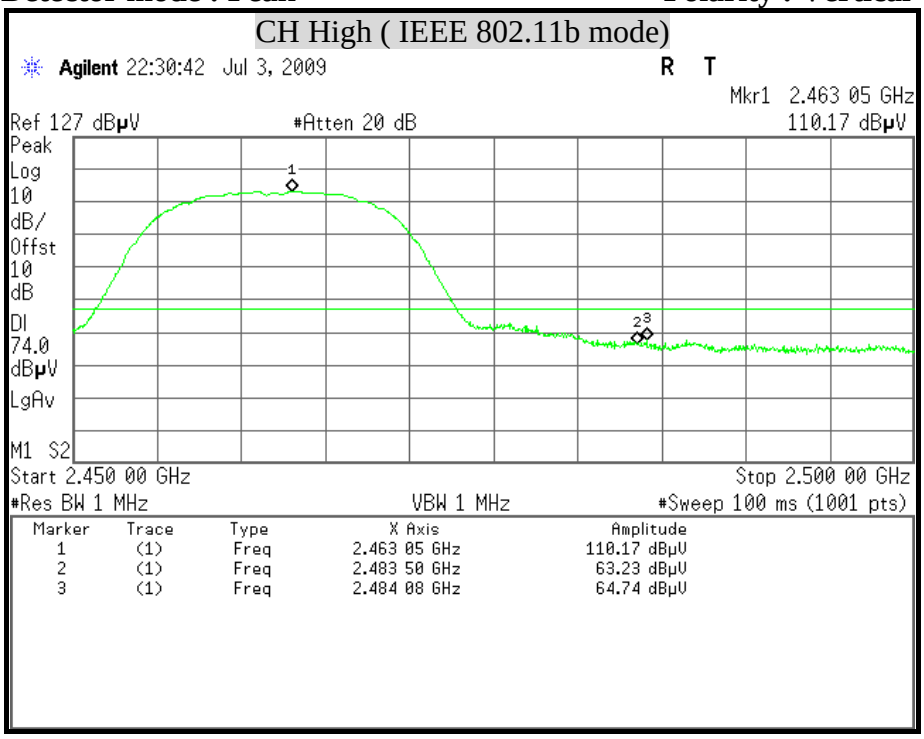
Detector mode : Peak **Polarity : Horizontal**



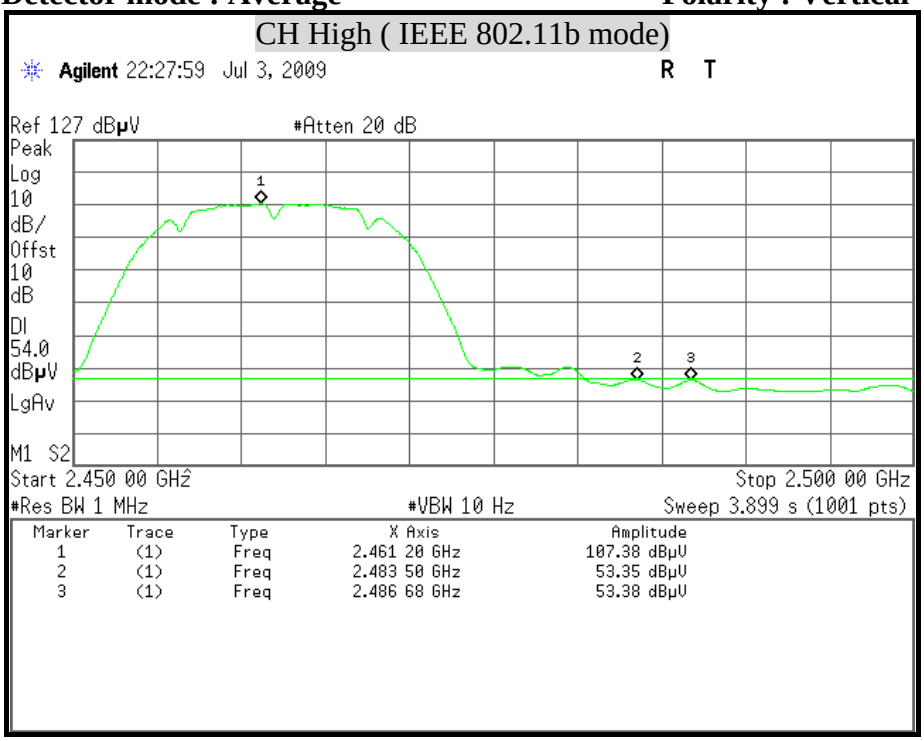
Detector mode : Average **Polarity : Horizontal**



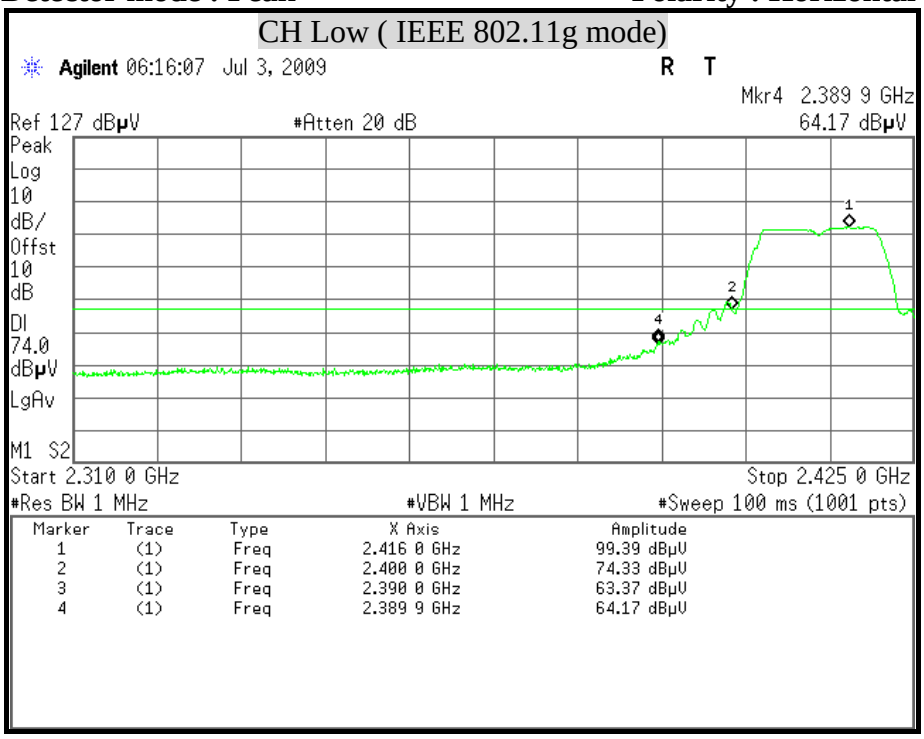
Detector mode : Peak **Polarity : Vertical**



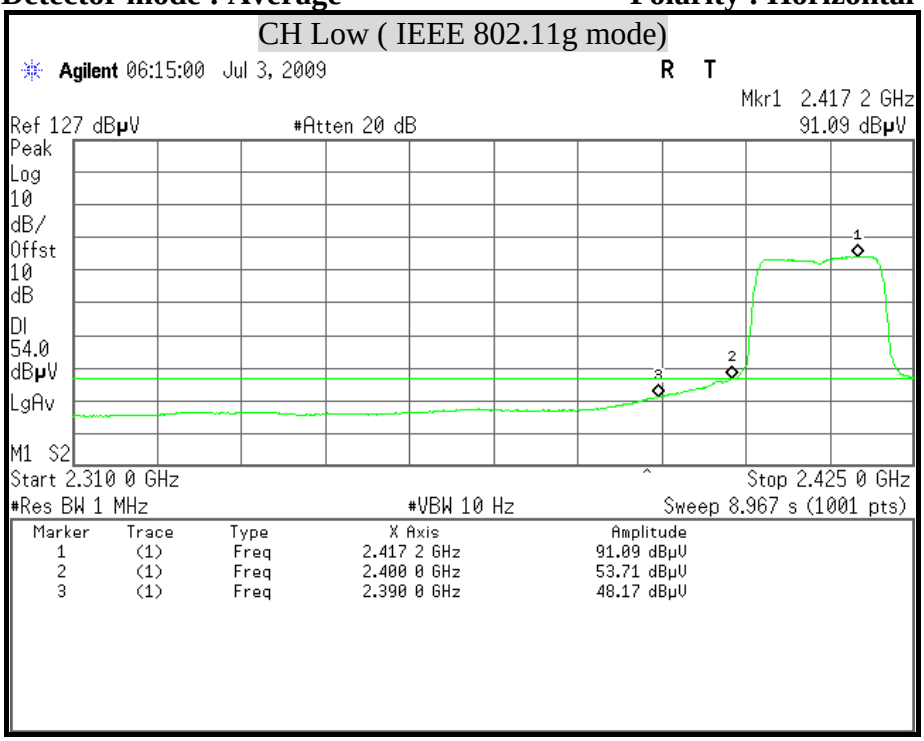
Detector mode : Average **Polarity : Vertical**



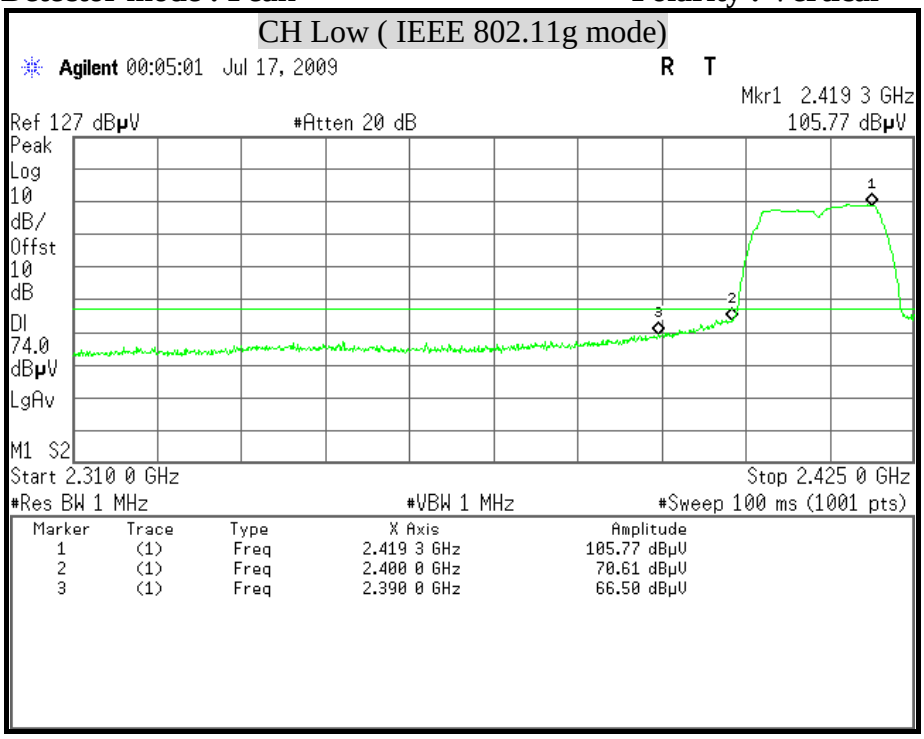
Detector mode : Peak **Polarity : Horizontal**



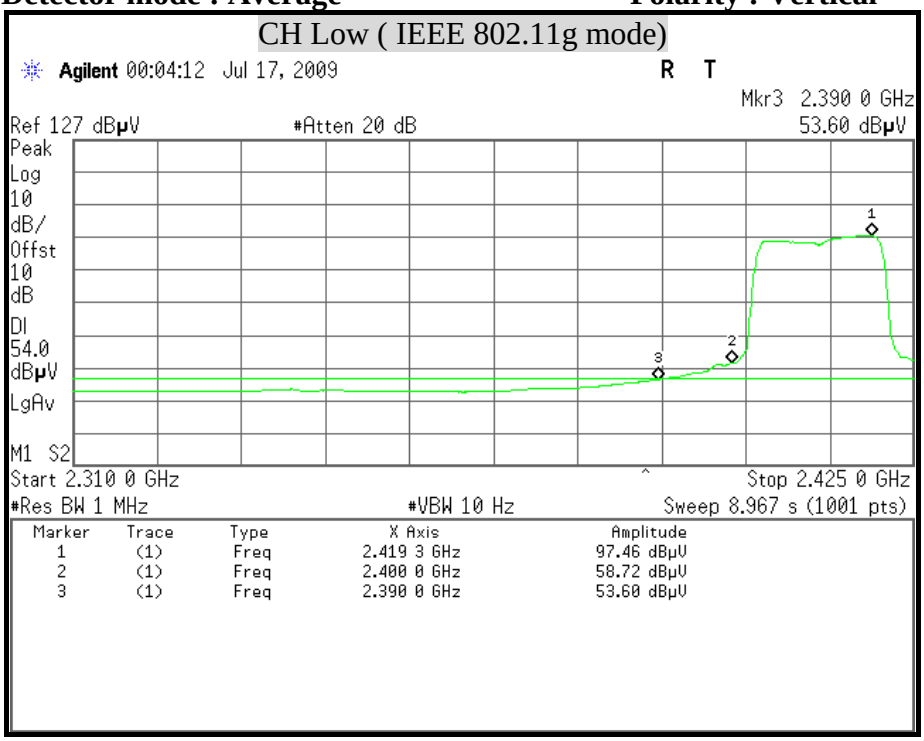
Detector mode : Average **Polarity : Horizontal**



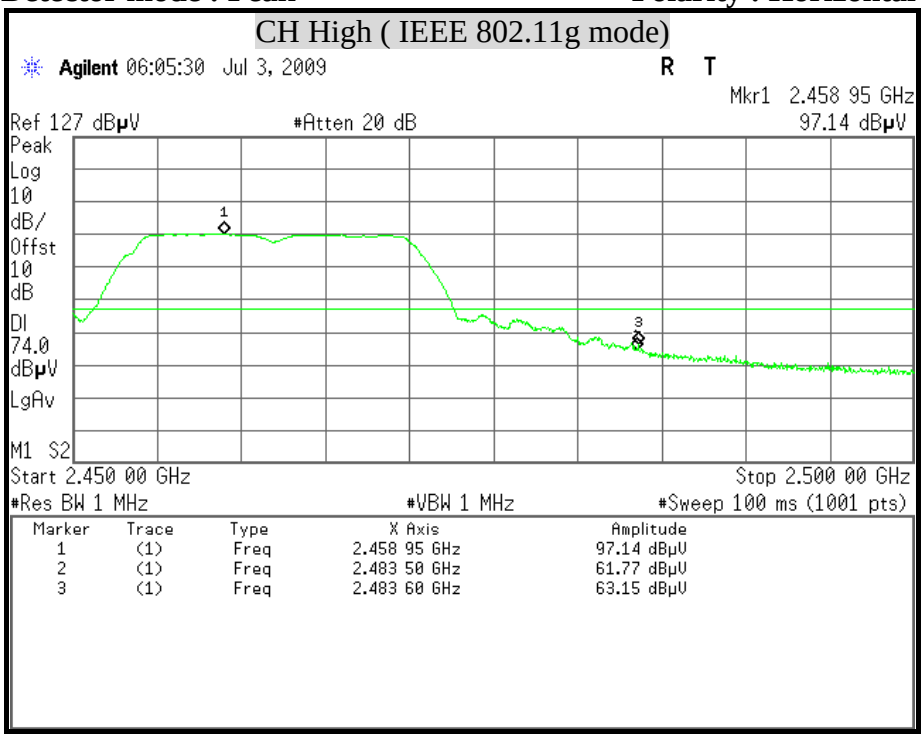
Detector mode : Peak **Polarity : Vertical**



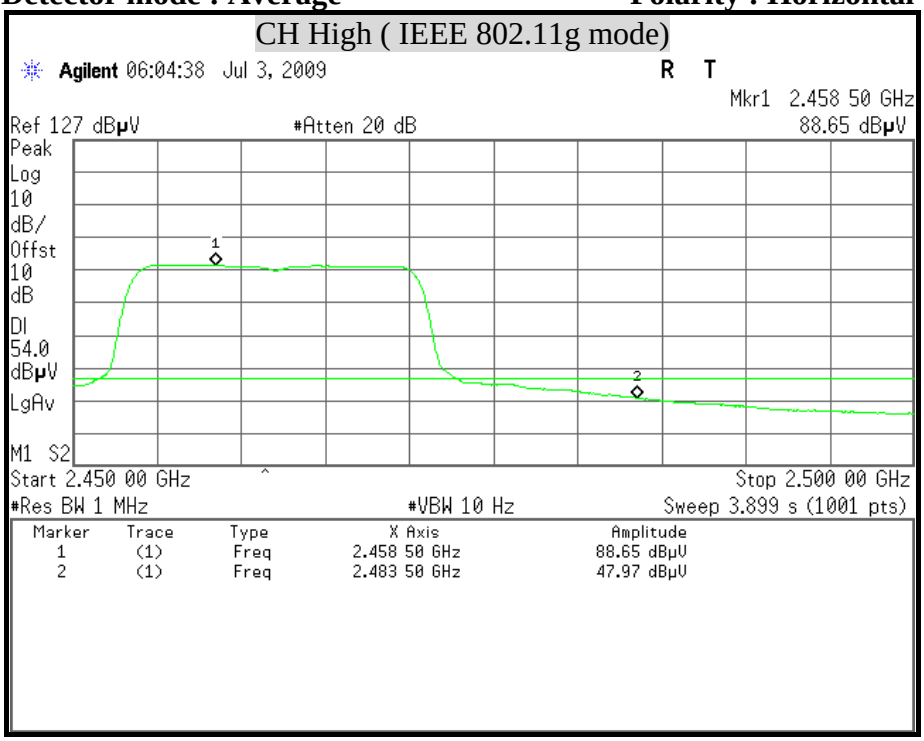
Detector mode : Average **Polarity : Vertical**



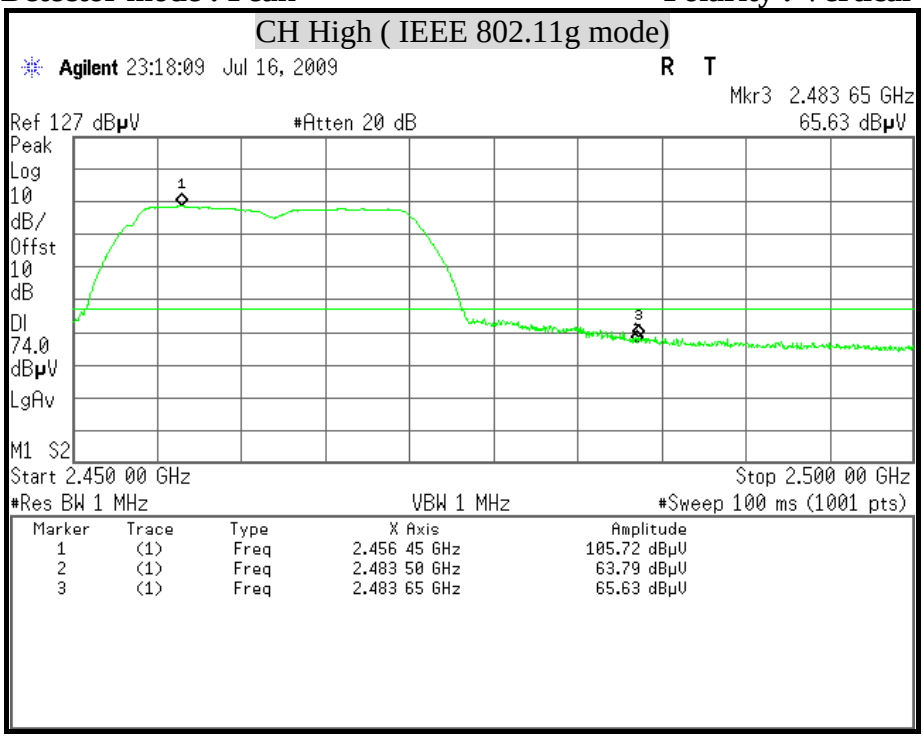
Detector mode : Peak **Polarity : Horizontal**



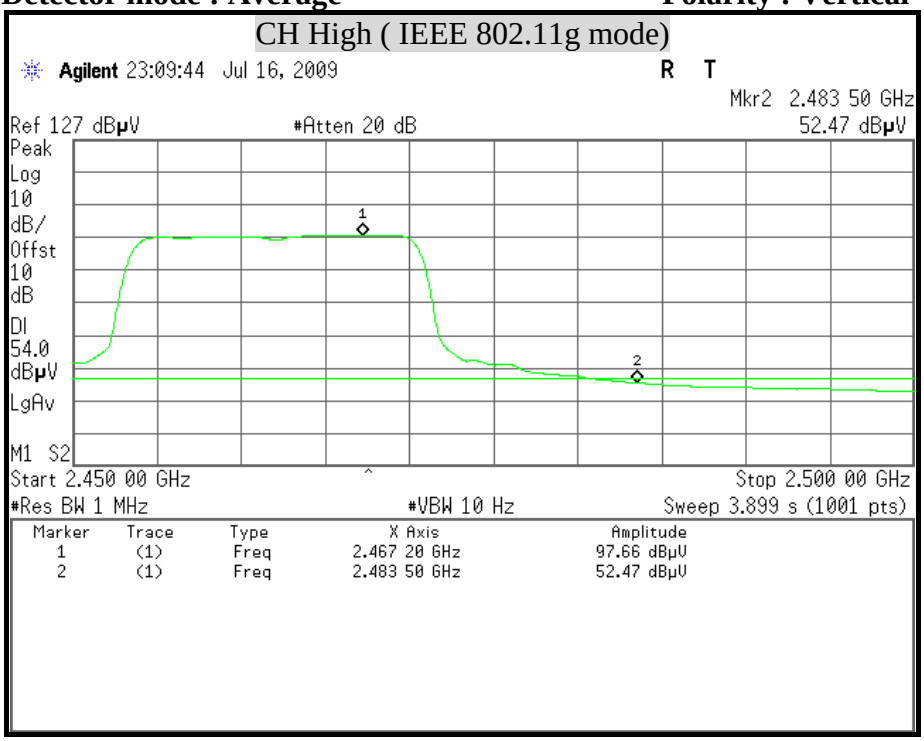
Detector mode : Average **Polarity : Horizontal**



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 μH/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.

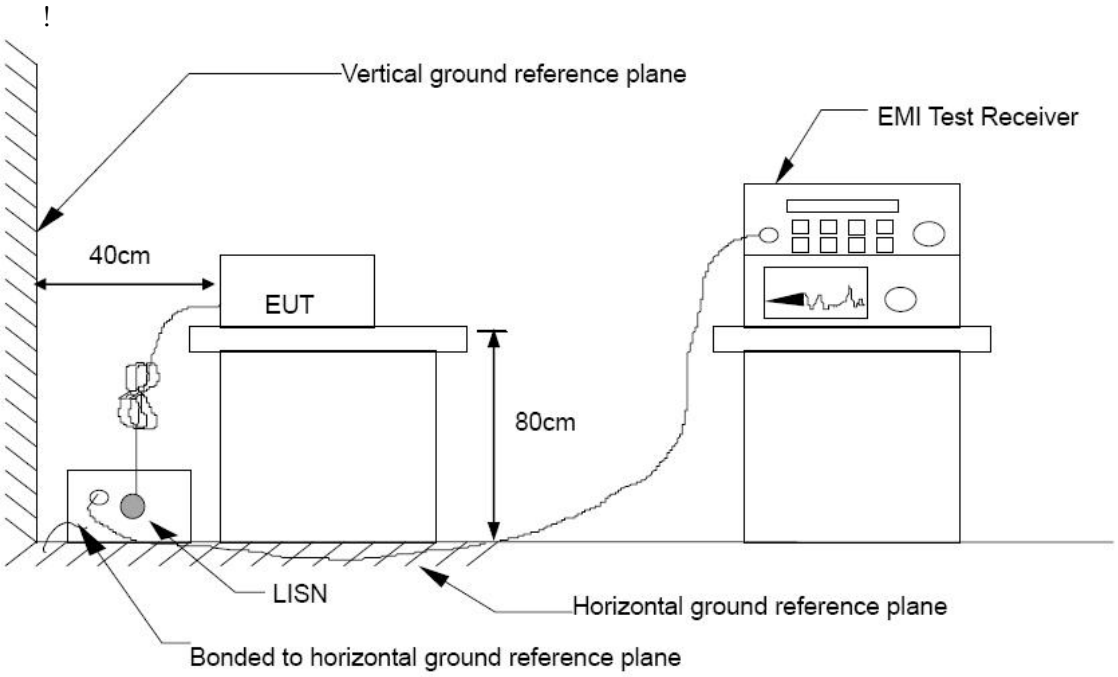
Frequency of Emission (MHz)	Conducted limit (dBμv)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.5 - 5	56	46
5 - 30	60	50

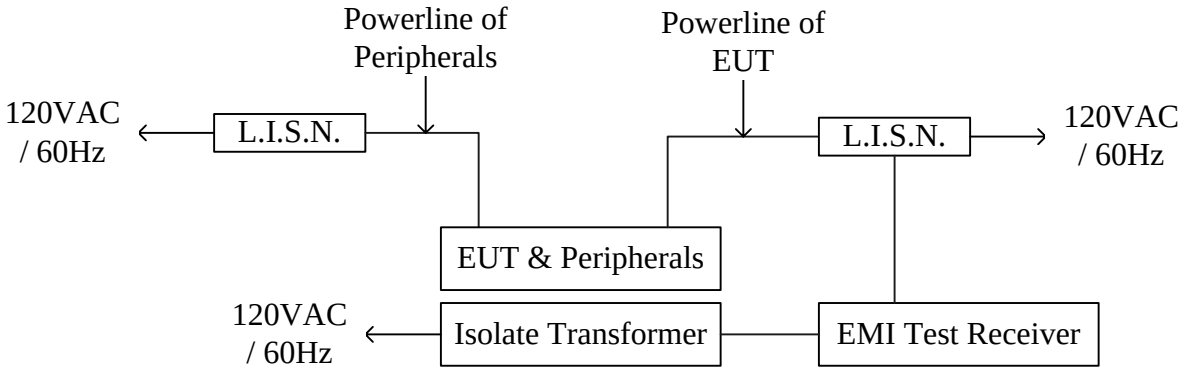
TEST EQUIPMENT

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.

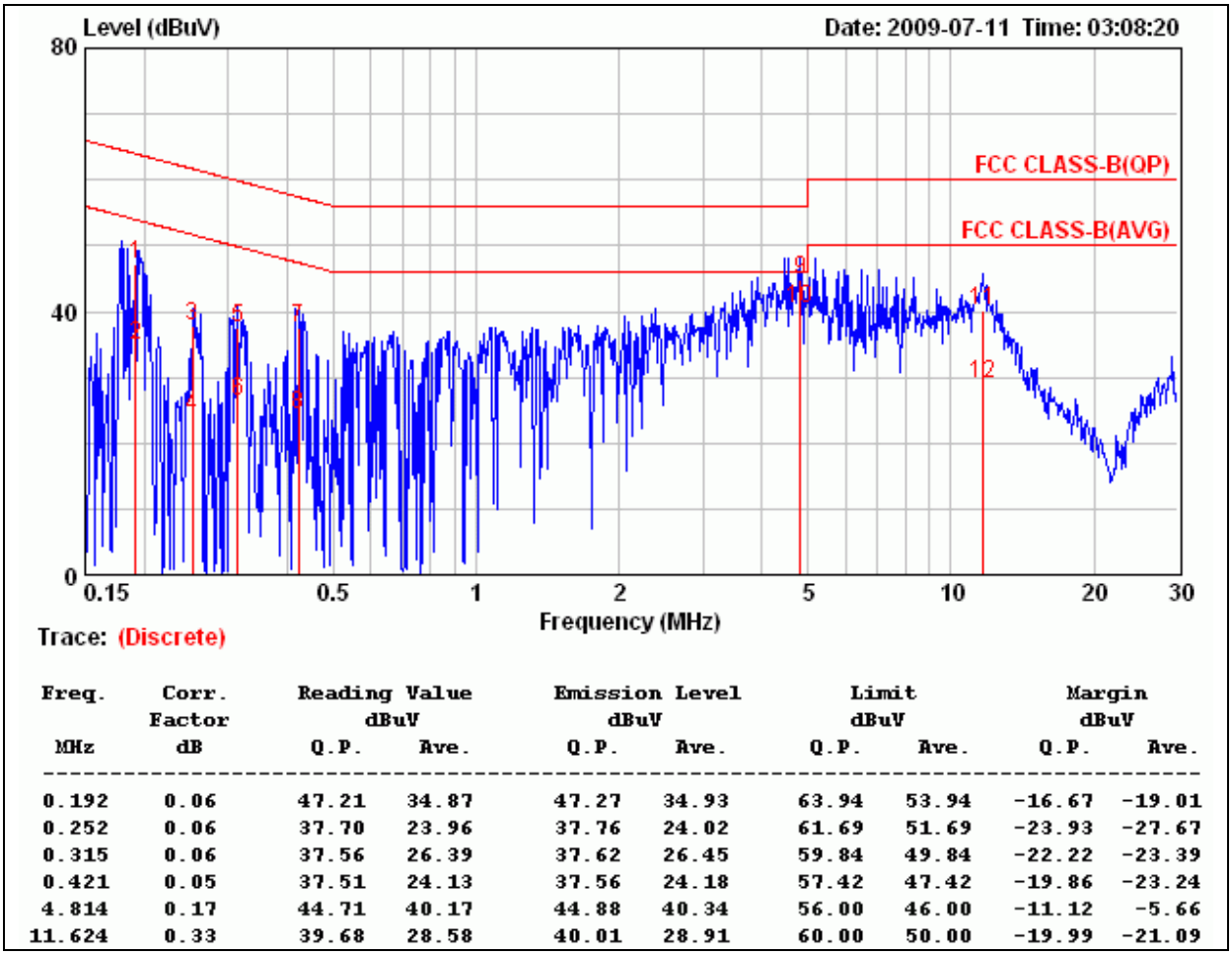
The resolution bandwidth is set to 9 kHz for both quasi-peak detection and average detection measurements.

Line conducted data is recorded for both NEUTRAL and LINE.

TEST RESULTS

Product Name	ADSL2+ (802.11g)(VPN) Firewall Router	Test Date	2009/07/11
Model	BiPAC 7412GL *R4*	Test By	Rueyyan Lin
Test Mode	Normal operating(worst-case)	TEMP & Humidity	20.9°C, 67%

LINE



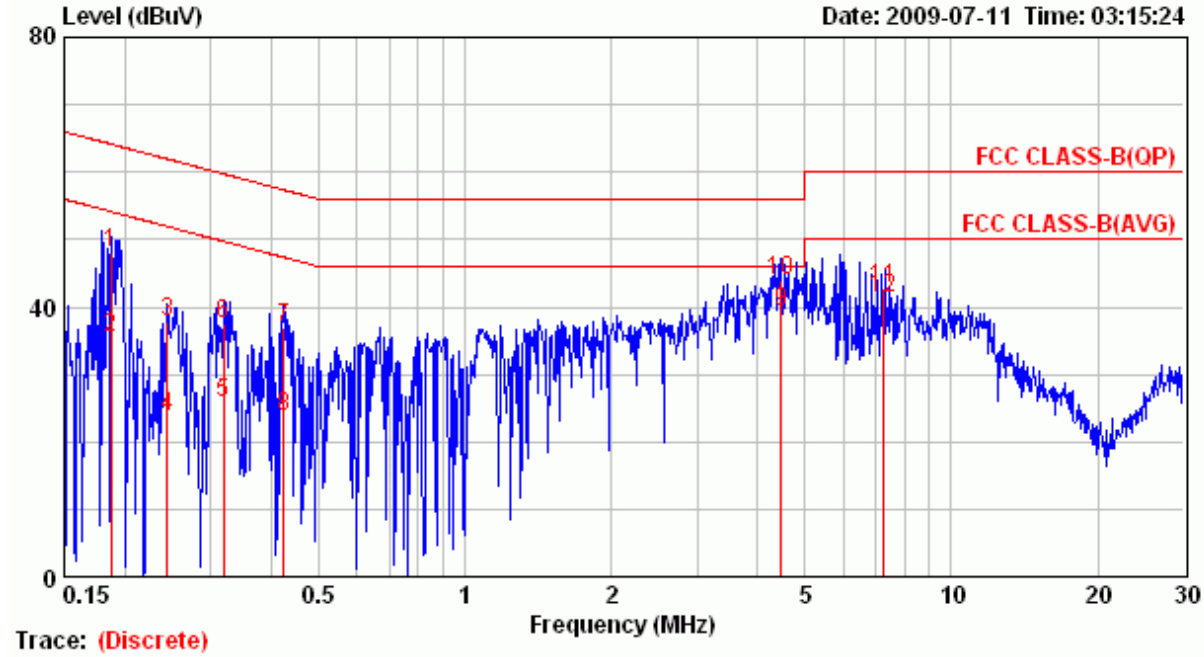
Freq.	Corr. Factor	Reading Value dBuV		Emission Level dBuV		Limit dBuV		Margin dBuV	
MHz	dB	Q.P.	Ave.	Q.P.	Ave.	Q.P.	Ave.	Q.P.	Ave.
0.192	0.06	47.21	34.87	47.27	34.93	63.94	53.94	-16.67	-19.01
0.252	0.06	37.70	23.96	37.76	24.02	61.69	51.69	-23.93	-27.67
0.315	0.06	37.56	26.39	37.62	26.45	59.84	49.84	-22.22	-23.39
0.421	0.05	37.51	24.13	37.56	24.18	57.42	47.42	-19.86	-23.24
4.814	0.17	44.71	40.17	44.88	40.34	56.00	46.00	-11.12	-5.66
11.624	0.33	39.68	28.58	40.01	28.91	60.00	50.00	-19.99	-21.09

Remark:

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

Product Name	ADSL2+ (802.11g)(VPN) Firewall Router	Test Date	2009/07/11
Model	BiPAC 7412GL *R4*	Test By	Rueyyan Lin
Test Mode	Normal operating(worst-case)	TEMP & Humidity	20.9°C, 67%

NEUTRAL



Freq.	Corr. Factor	Reading Value dBuV		Emission Level dBuV		Limit dBuV		Margin dBuV	
MHz	dB	Q.P.	Ave.	Q.P.	Ave.	Q.P.	Ave.	Q.P.	Ave.
0.187	0.06	48.06	35.50	48.12	35.56	64.15	54.15	-16.03	-18.59
0.244	0.06	37.77	23.66	37.83	23.72	61.95	51.95	-24.12	-28.23
0.318	0.06	37.40	25.64	37.46	25.70	59.75	49.75	-22.30	-24.06
0.424	0.05	36.84	23.78	36.89	23.83	57.37	47.37	-20.48	-23.54
4.460	0.16	43.89	38.99	44.05	39.15	56.00	46.00	-11.95	-6.85
7.224	0.23	42.68	41.06	42.91	41.29	60.00	50.00	-17.09	-8.71

Remark:

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