



FCC 47 CFR PART 15 Subpart B & Subpart C

TEST REPORT

For

802.11g Wireless Firewall Router

Model : P-320W

Trade Name: ZyXEL P-320W

Issued to

ZyXEL Communications Corporation
No. 6 Innovation Road II, Science Park, Hsin-Chu, Taiwan

Issued by

Compliance Certification Services Inc.
No. 8, Jiu Ceng Ling, Jiaokeng Village, Sinhua
Township, Tainan Hsien 712, Taiwan R.O.C.
TEL: 886-6-580-2201
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1. TEST RESULT CERTIFICATION

Applicant : ZyXEL Communications Corporation
Address : No. 6 Innovation Road II, Science Park, Hsin-Chu, Taiwan
Equipment Under Test : 802.11g Wireless Firewall Router
Model : P-320W
Trade Name : ZyXEL P-320W
Date of Test : October 05 ~ October 17, 2005

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart B & Subpart C	No non-compliance noted

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Reviewed by:

 Oct. 19, 2005

Alex Chiu
Manager
Compliance Certification Services Inc.



 Oct. 19, 2005

Jeter Wu
Section Manager
Compliance Certification Services Inc.



2. EUT DESCRIPTION

Product	802.11g Wireless Firewall Router
Model Number	P-320W
Brand Name	ZyXEL P-320W
Model Discrepancy	N/A
Power Supply	AC 12V
Adapter	Global AM-121000A I/P: 120V/60Hz O/P: AC12V/1A Cable: 1.8M
Frequency Range	2412 ~ 2462 MHz
Transmit Power	IEEE802.11b mode: 19.18 dBm IEEE802.11g mode: 18.58dBm
Modulation Technique	IEEE802.11b: DSSS IEEE802.11g: OFDM
Transmit Data Rate	IEEE802.11b: 11Mbps(CCK) with fall back rates of 5.5, 2, and 1Mbps IEEE802.11g: 54Mbps with fall back rates of 48/36/24/18/12/9/6 Mbps (OFDM)
Number of Channels	11 Channels
Antenna Specification	Dipole Antenna 1.8 dBi

Remark: The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer. This submittal(s) (test report) is intended for FCC ID: **I88P320W** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.



3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4.



3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

- (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 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	(²)
13.36 - 13.41	322 - 335.4		

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

² Above 38.6

- (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.



3.5 DESCRIPTION OF TEST MODES

The EUT (Model: P-320W) have been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

There are two sources of power adapters: Delta / ADP-10SB and Delta / ADP-10ZB. After verified, the worst data of radiated spurious emission recorded in the test report is Delta / ADP-10SB.

After verification, all tests carried out are with the worst-case test modes as shown below except radiated spurious emission below 1GHz's worst case is in normal link mode.

IEEE802.11b: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 11Mbps higher data rate were chosen for the final testing.

IEEE802.11g: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 54Mbps higher data rate were chosen for the final testing.

4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.



5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

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

☒ No. 8, Jiu Ceng 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 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 pre-selectors 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 AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code: 200627-0 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 NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (Registration no: **228014, 781908**).

5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	NVLAP	EN 55014-1, CNS 13783-1, AS/NZS CISPR 14.1, IEC/CISPR 14-1, IEC/CISPR 22, CNS 13438, IEC 61000-3-2, IEC 61000-3-3, AS/NZS 61000.3.3, ANSI C63.4, AS/NZS CISPR 22, VCCI, IEC/CISPR 24, IEC 61000-4-2/4/5/6/8/11	 NVLAP LAB CODE 200627-0 200627-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	 228014, 781908
Japan	VCCI	3/10 meter Open Area Test Sites and conducted test sites to perform radiated/conducted measurements	VCCI R-1989 C-2142
Taiwan	CNLA	CISPR 11 FCC METHOD-47 CFR Part 18 EN 55011 CNS 13803, CISPR 14 EN 55014 CNS 13783-1, CISPR 22 EN 55022 VCCI FCC Method-47 CFR Part 15 Subpart B CNS 13438	 1109 ILAC MRA
Taiwan	BSMI	CNS 13438, CNS 13783-1, CNS 13803	 SL2-IS-E-0039 SL2-IN-E-0039 SL2-A1-E-0039

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



6. SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATIONS OF EUT

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

6.2 SUPPORT EQUIPMENT

No.	Product	Manufacturer	Model No.	FCC ID	Signal cable
1	Note Book	HP	CNC 6000	CNTPP2090	N/A
2	HUB	LEMEL	LM-S5M4C	DoC	N/A
2	Note Book	IBM	ThinkPad2888	DoC	N/A

Remark:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.



7. FCC PART 15.247 REQUIREMENTS

7.1 6dB BANDWIDTH

Limit

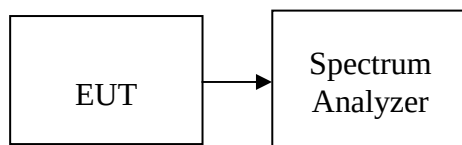
For the direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

Measurement Equipment Used

Name of Equipment	Manufacturer	Model	Serial Number	Date of Calibration
SPECTRUM ANALYZER	R&S	FSEM	829054/017	Mar. 18, 2005

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

Test Configuration



Test Procedure

1. Turn on PC and run test program.
2. Setup EUT in test mode.
3. Start test.

**Test Results**

No non-compliance noted

Test Data**Test mode: IEEE 802.11b**

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
Low	2412	12124	>500	PASS
Mid	2437	11873		PASS
High	2462	11923		PASS

Test mode: IEEE 802.11g

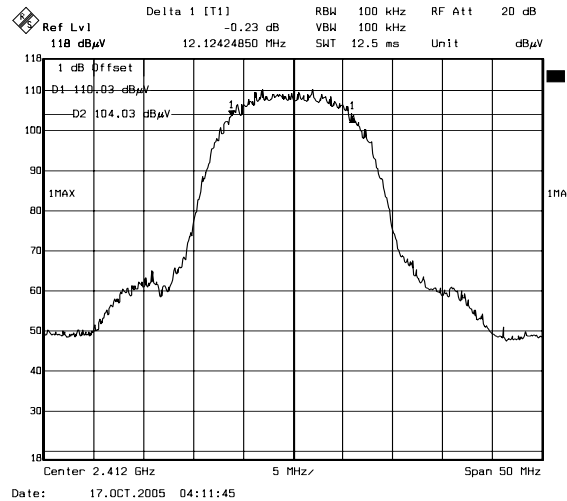
Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
Low	2412	16533	>500	PASS
Mid	2437	16533		PASS
High	2462	16583		PASS



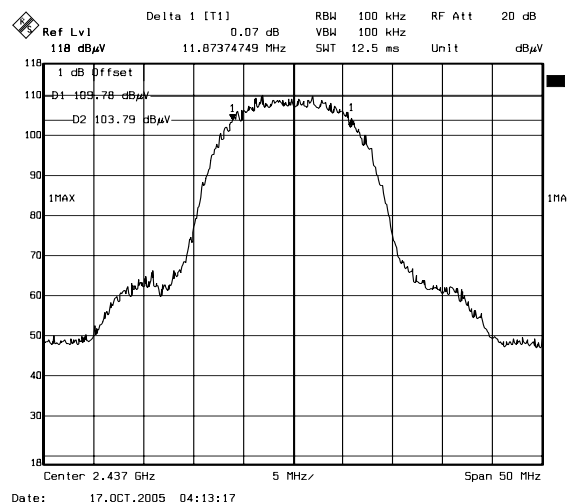
Test Plot

IEEE 802.11b mode

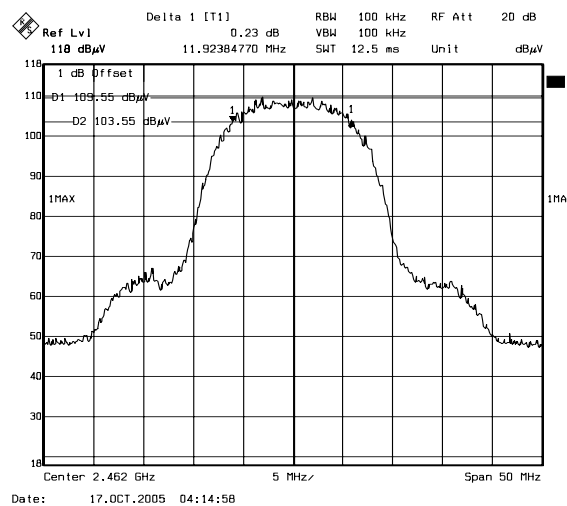
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)



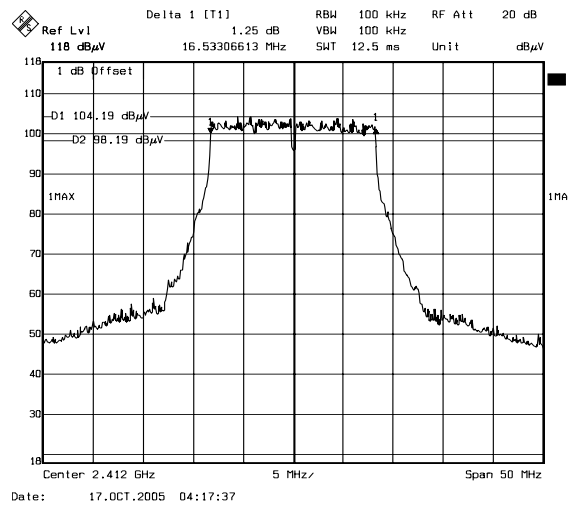
6dB Bandwidth (CH High)



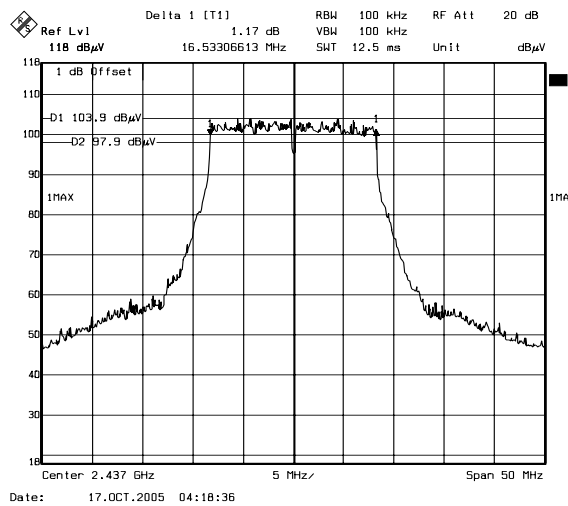


IEEE 802.11g mode

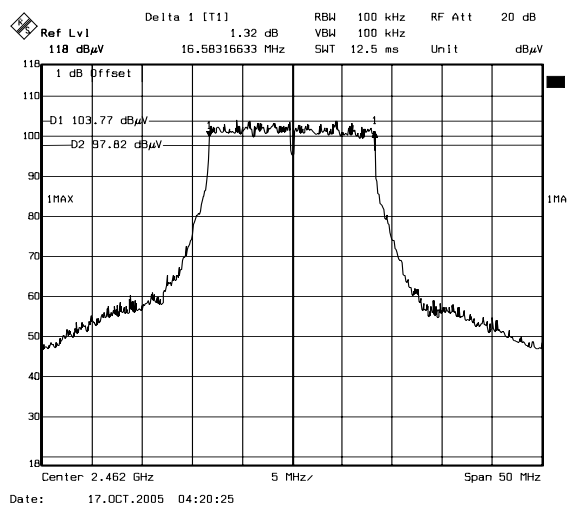
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)



6dB Bandwidth (CH High)





7.2 PEAK POWER

Limit

The maximum peak output power of the intentional radiator shall not exceed the following:

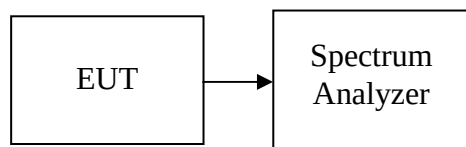
1. For systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 watt.
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Measurement Equipment Used

Name of Equipment	Manufacturer	Model	Serial Number	Date of Calibration
SPECTRUM ANALYZER	R&S	FSEM	829054/017	Mar. 18, 2005

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

Test Configuration



Test Procedure

The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the peak power detection.

**Test Results***No non-compliance noted***Test Data****Test mode: IEEE 802.11b**

Channel	Frequency (MHz)	Reading Power(dBm)	Factor (dB)	Output Power(dBm)	Output Power(W)	Limit(W)	Result
Low	2412	18.18	1	19.18	0.08279	1	PASS
Mid	2437	18.15	1	19.15	0.08222		PASS
High	2462	18.09	1	19.09	0.08110		PASS

Test mode: IEEE 802.11g

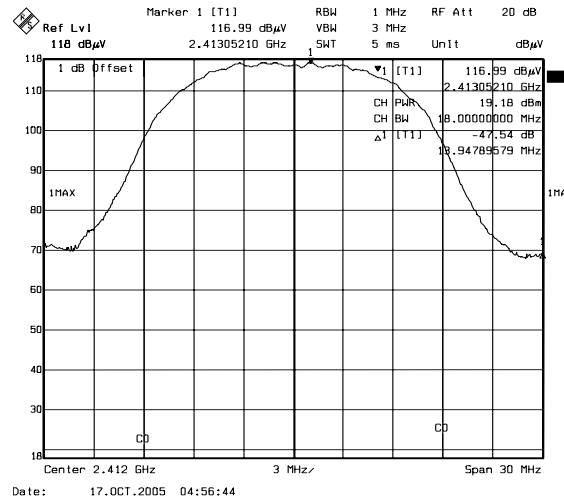
Channel	Frequency (MHz)	Reading Power(dBm)	Factor (dB)	Output Power(dBm)	Output Power(W)	Limit(W)	Result
Low	2412	17.58	1	18.58	0.07211	1	PASS
Mid	2437	17.22	1	18.22	0.06637		PASS
High	2462	17.09	1	18.09	0.06442		PASS



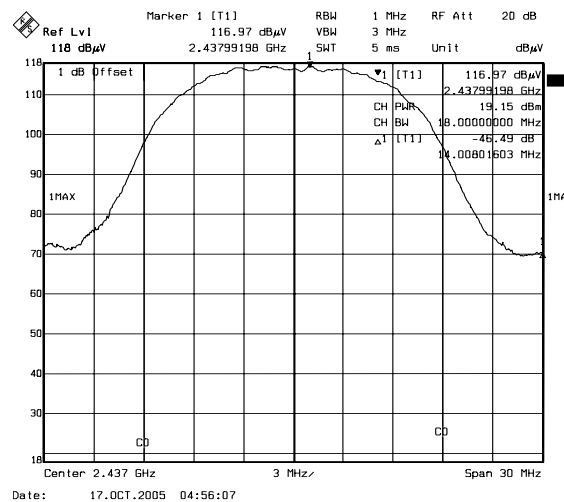
Test Plot

IEEE 802.11b mode

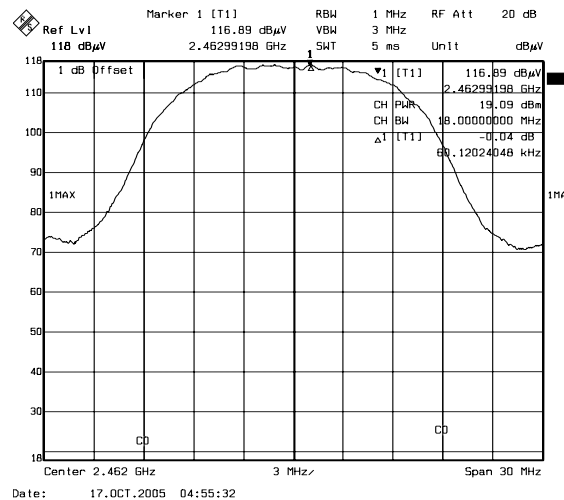
Peak power (CH Low)



Peak power (CH Mid)



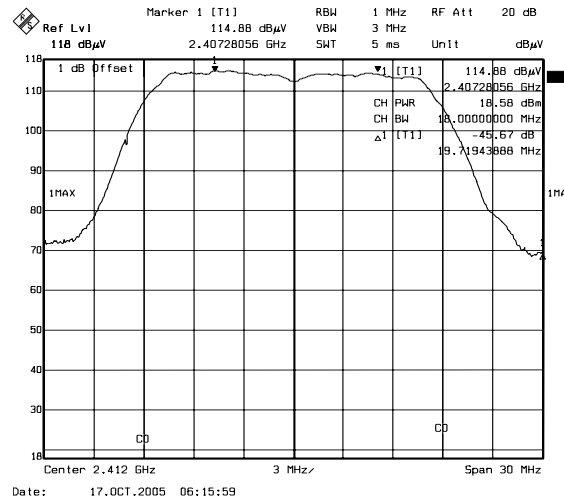
Peak power (CH High)



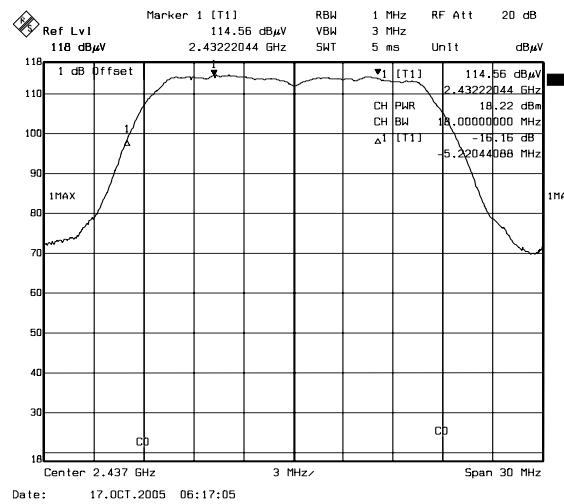


IEEE 802.11g mode

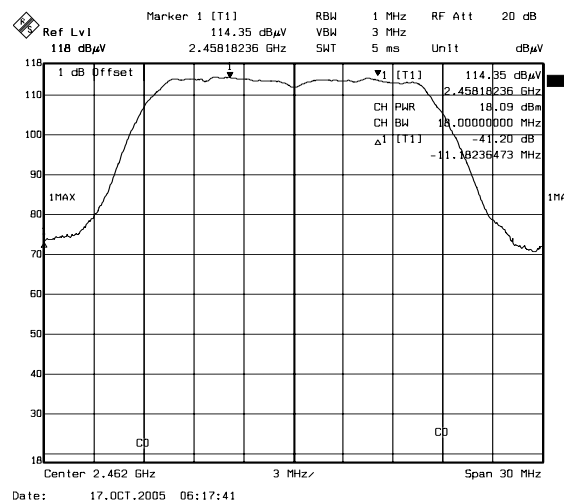
Peak power (CH Low)



Peak power (CH Mid)



Peak power (CH High)



7.3 BAND EDGES MEASUREMENT

Limit

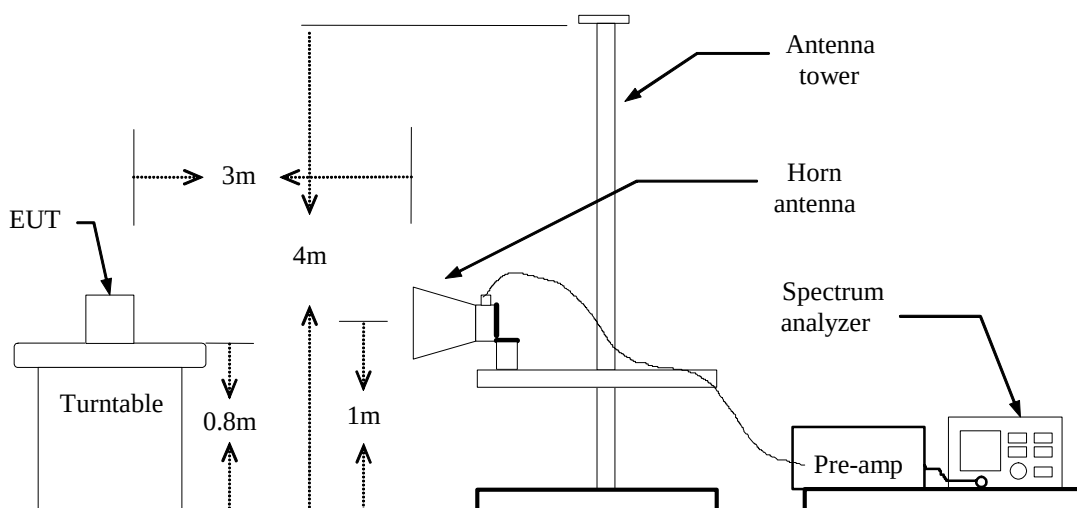
According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. 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).

Measurement Equipment Used

Name of Equipment	Manufacturer	Model	Serial Number	Date of Calibration
SPECTRUM ANALYZER	R&S	FSEM	830270/015	Mar. 18, 2005

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

Test Configuration



Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
 - (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

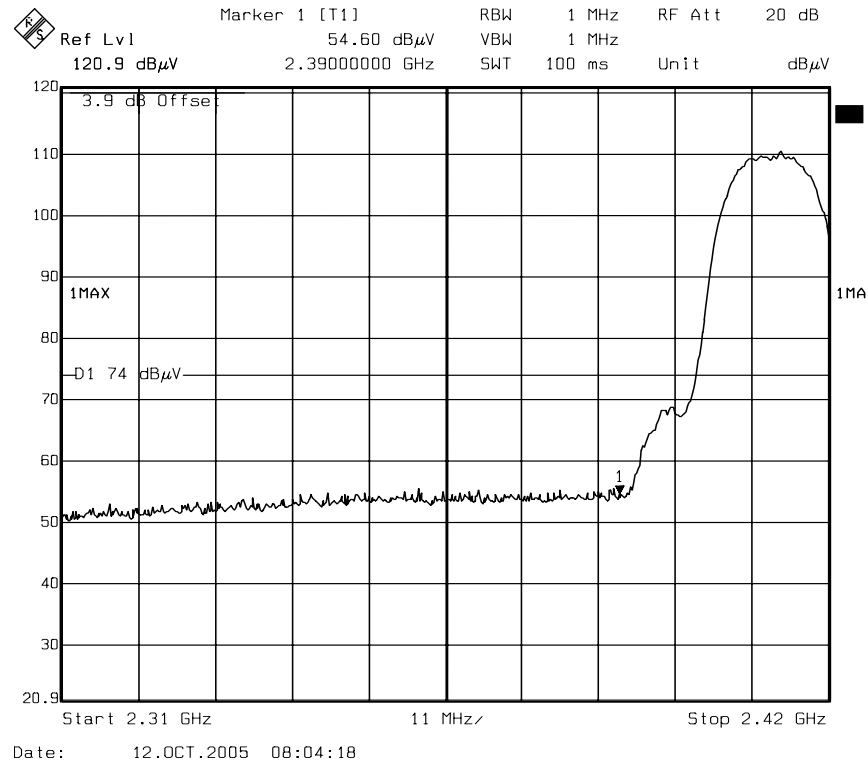
Test Results

Refer to attach spectrum analyzer data chart.

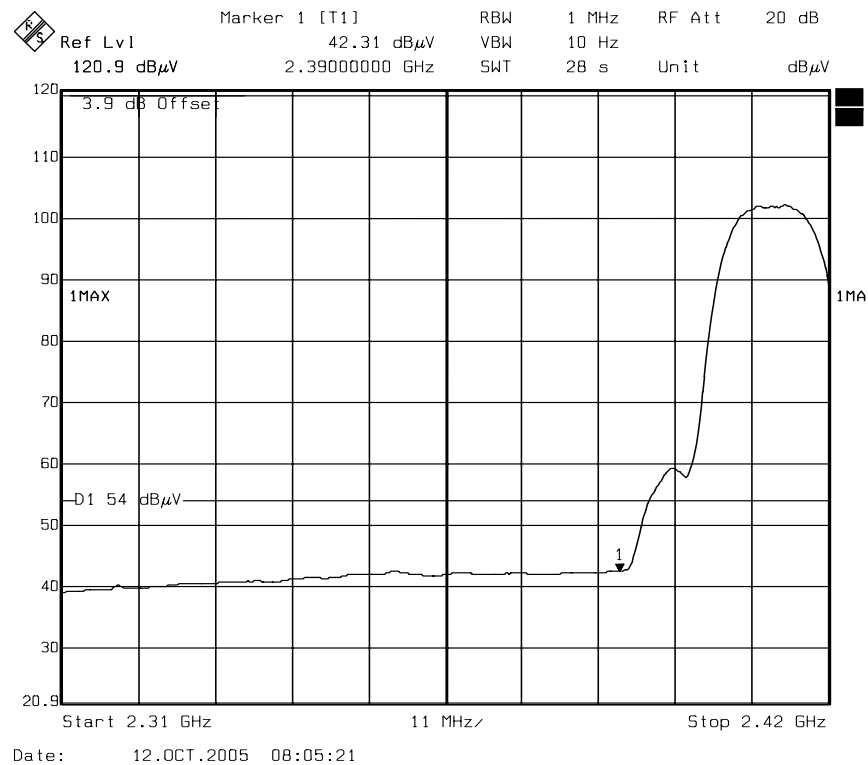


Band Edges (IEEE 802.11b mode / CH Low)

Detector mode: Peak Polarity: Vertical

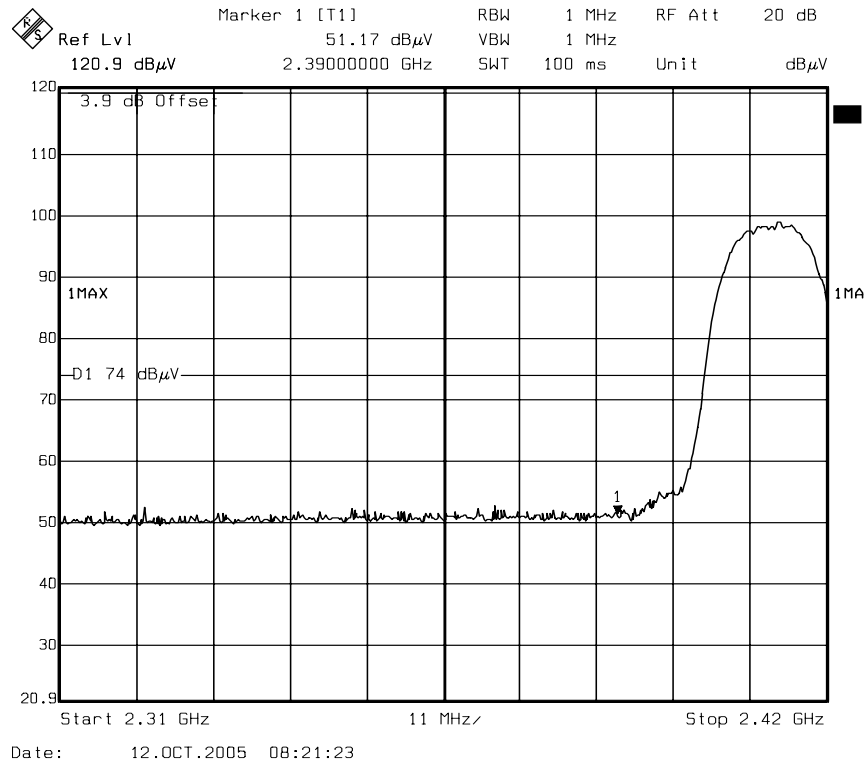


Detector mode: Average Polarity: Vertical

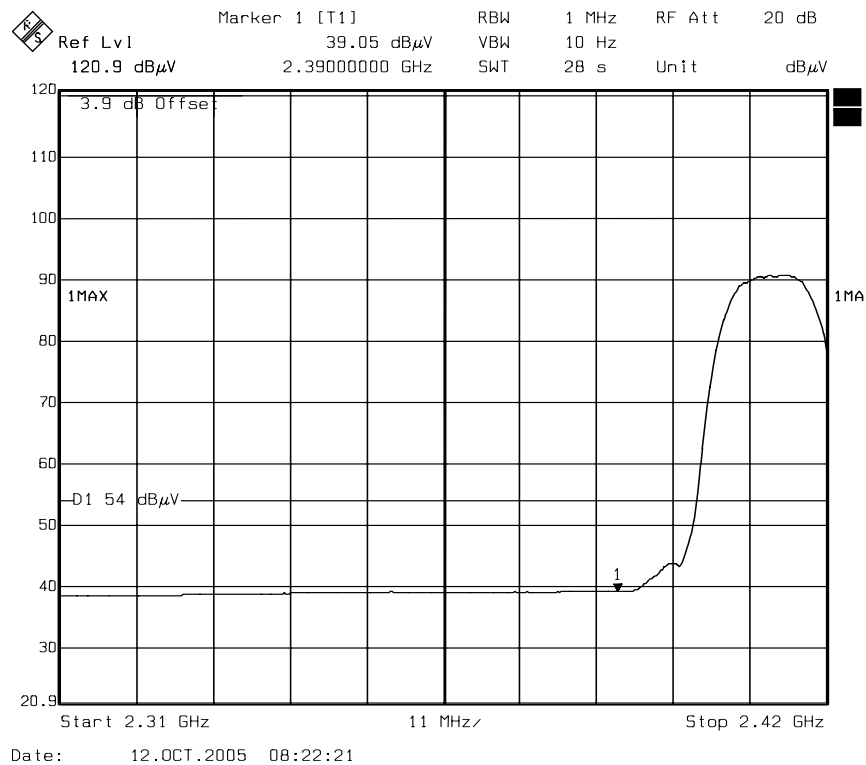




Detector mode: Peak Polarity: Horizontal



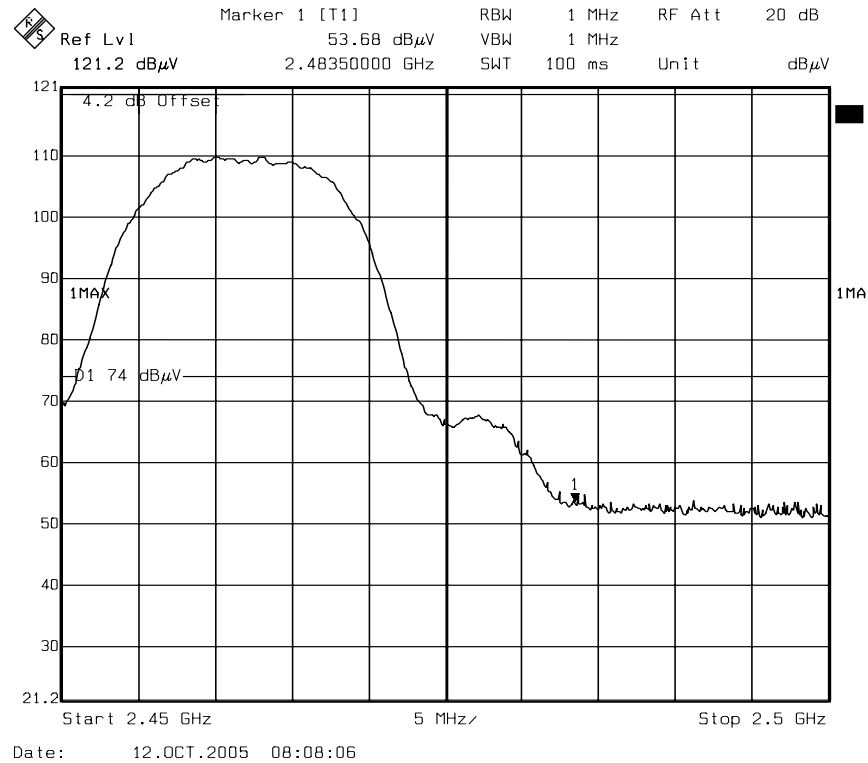
Detector mode: Average Polarity: Horizontal



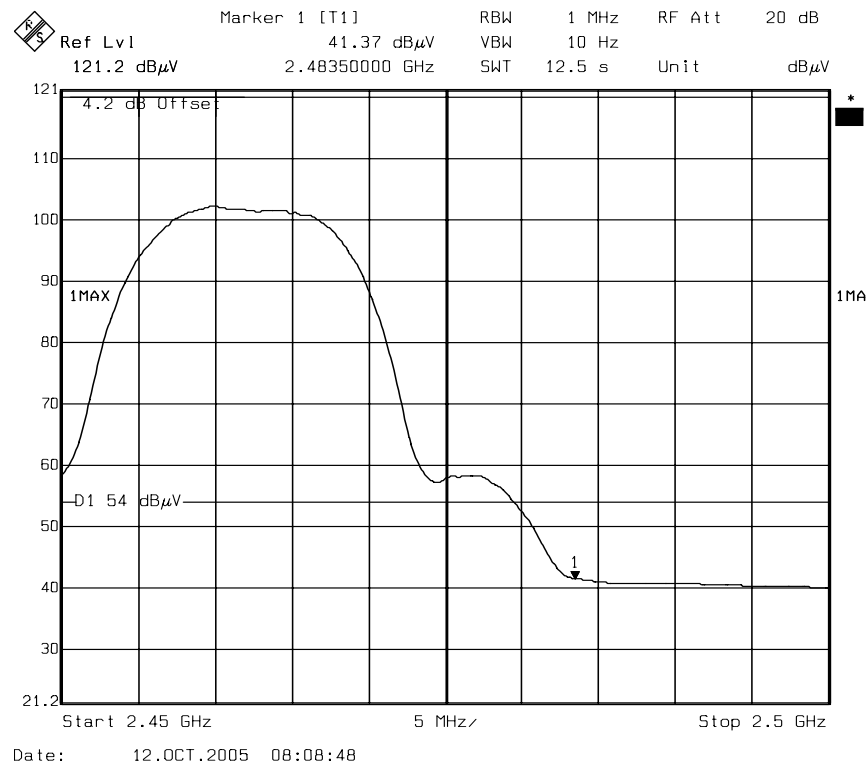


Band Edges (IEEE 802.11b mode / CH High)

Detector mode: Peak Polarity: Vertical

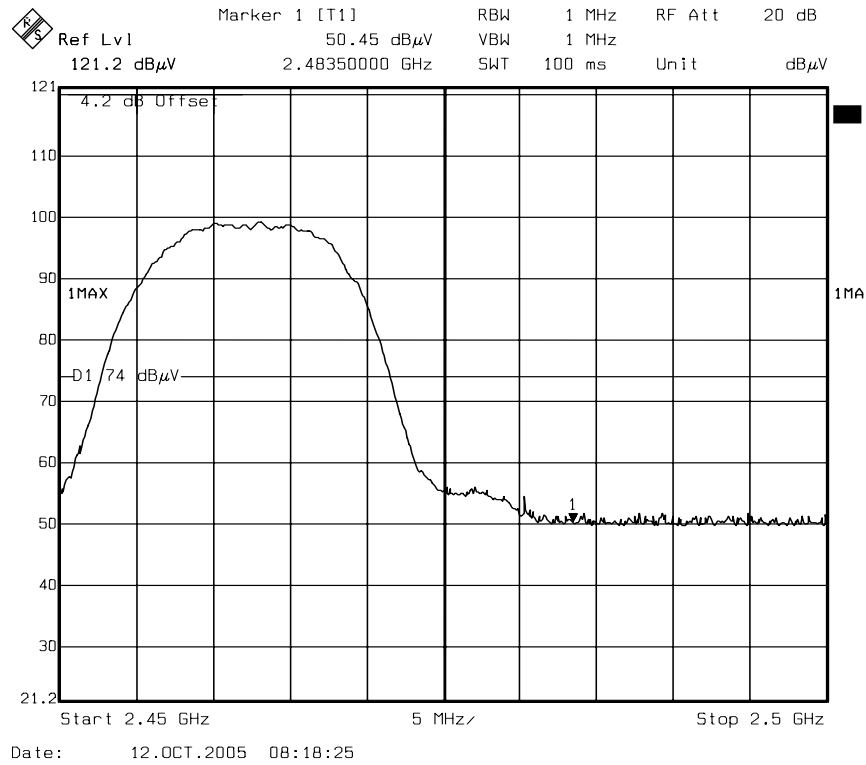


Detector mode: Average Polarity: Vertical

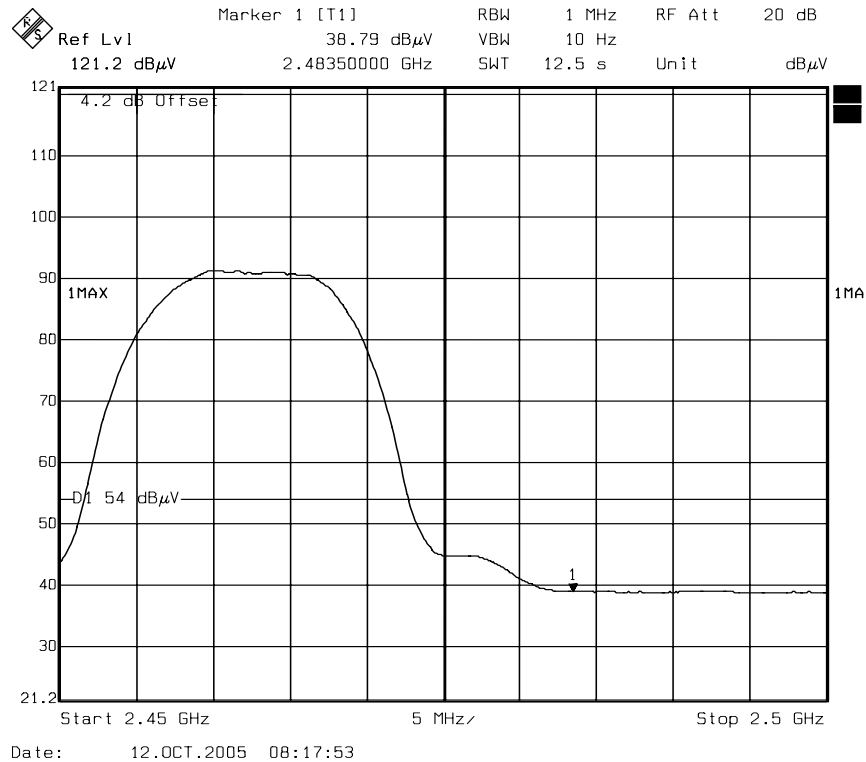




Detector mode: Peak Polarity: Horizontal



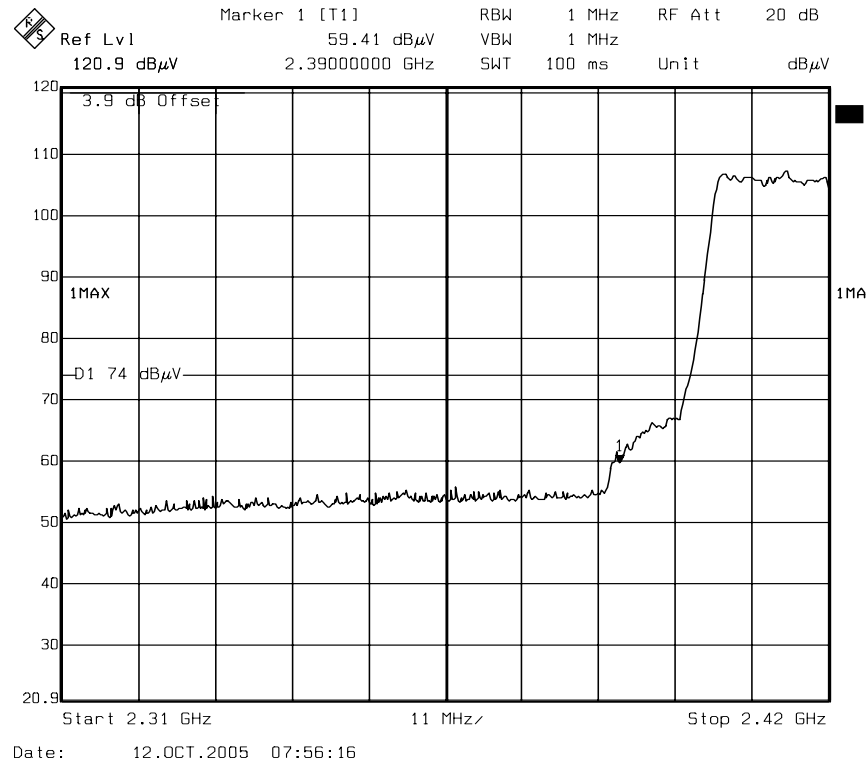
Detector mode: Average Polarity: Horizontal



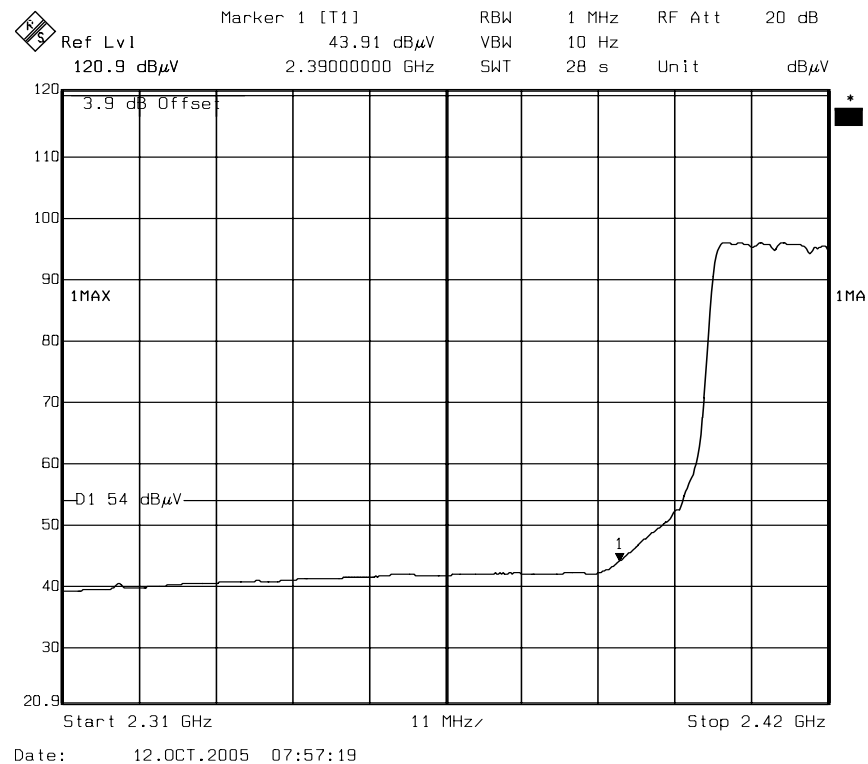


Band Edges (IEEE 802.11g mode / CH Low)

Detector mode: Peak Polarity: Vertical

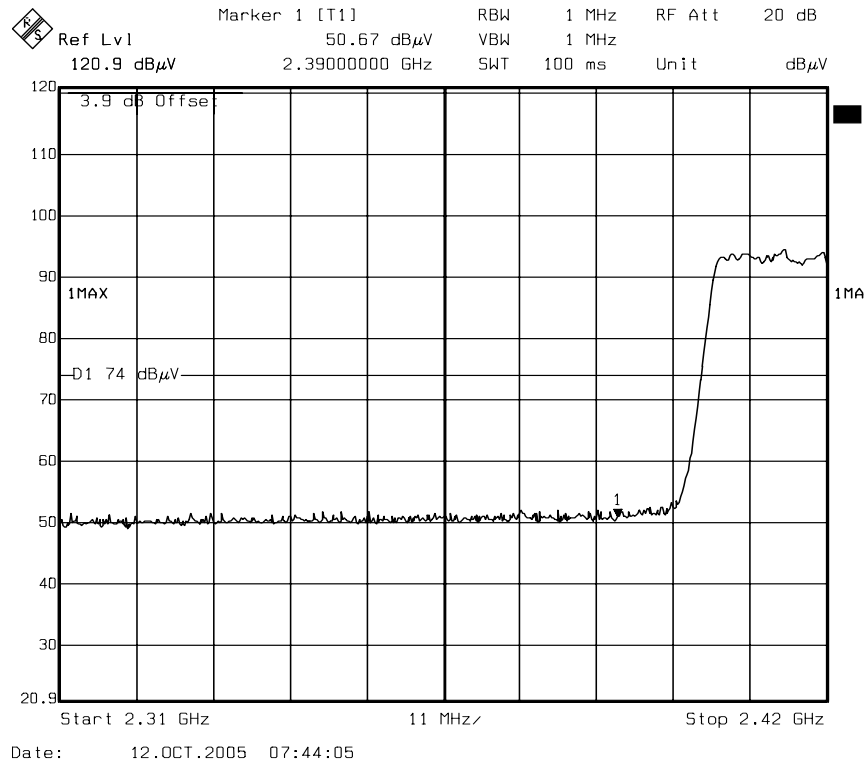


Detector mode: Average Polarity: Vertical

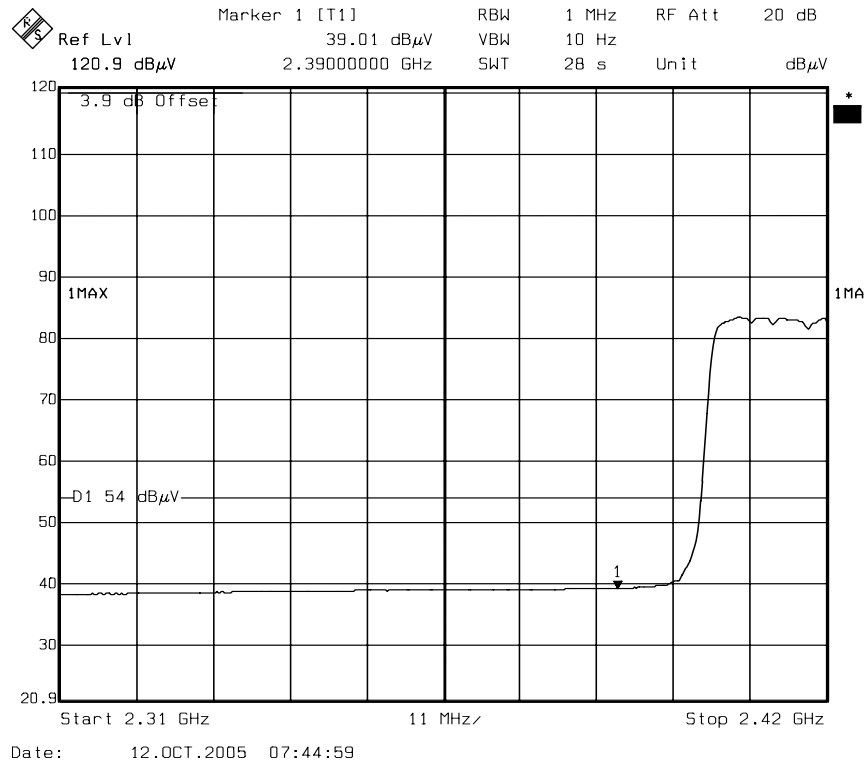




Detector mode: Peak Polarity: Horizontal



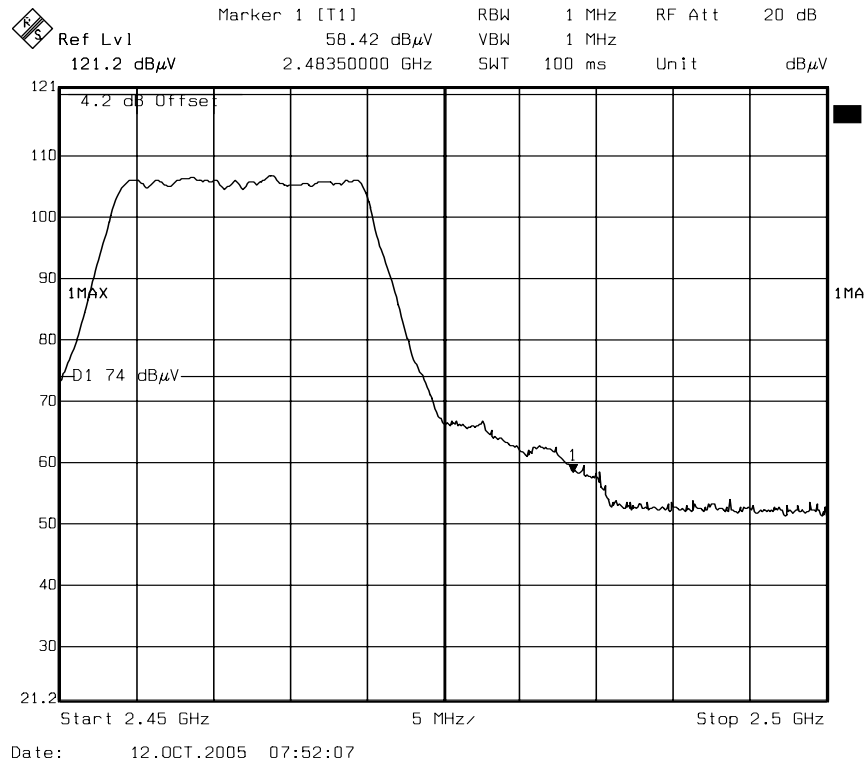
Detector mode: Average Polarity: Horizontal



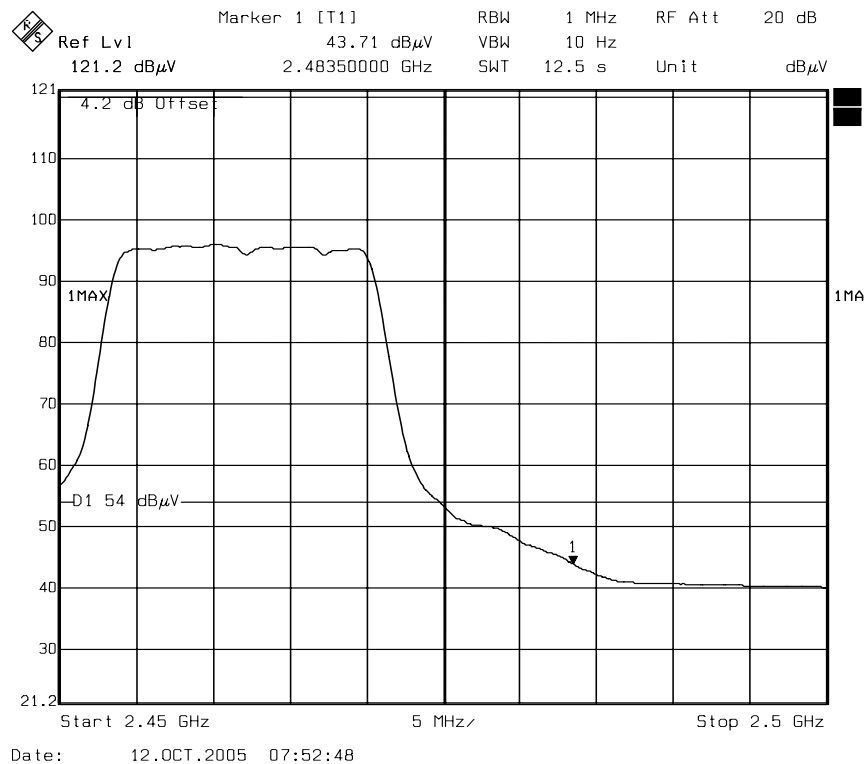


Band Edges (IEEE 802.11g mode / CH High)

Detector mode: Peak Polarity: Vertical

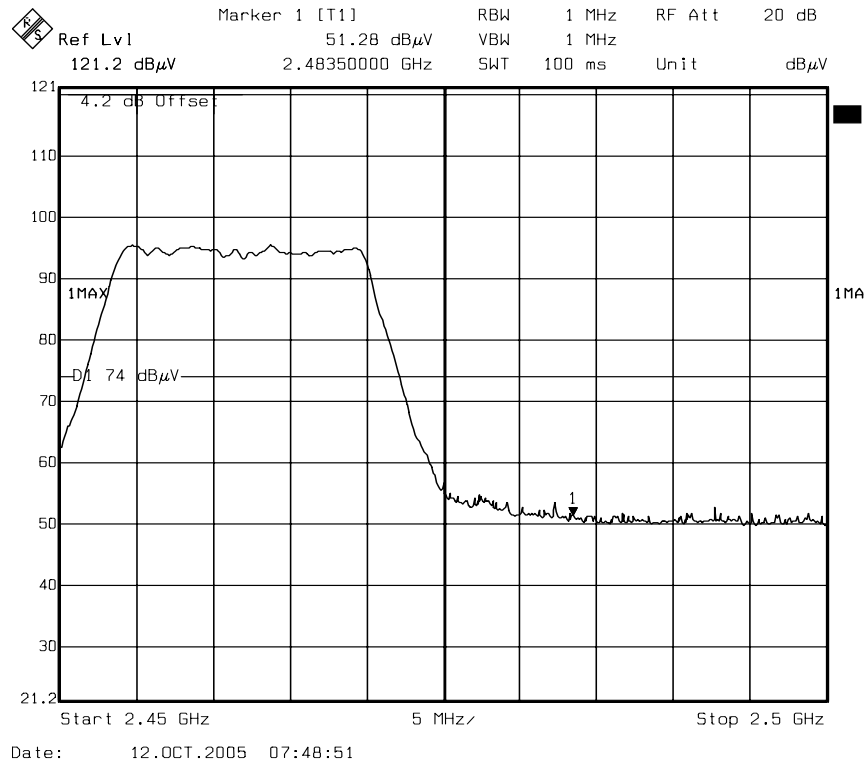


Detector mode: Average Polarity: Vertical

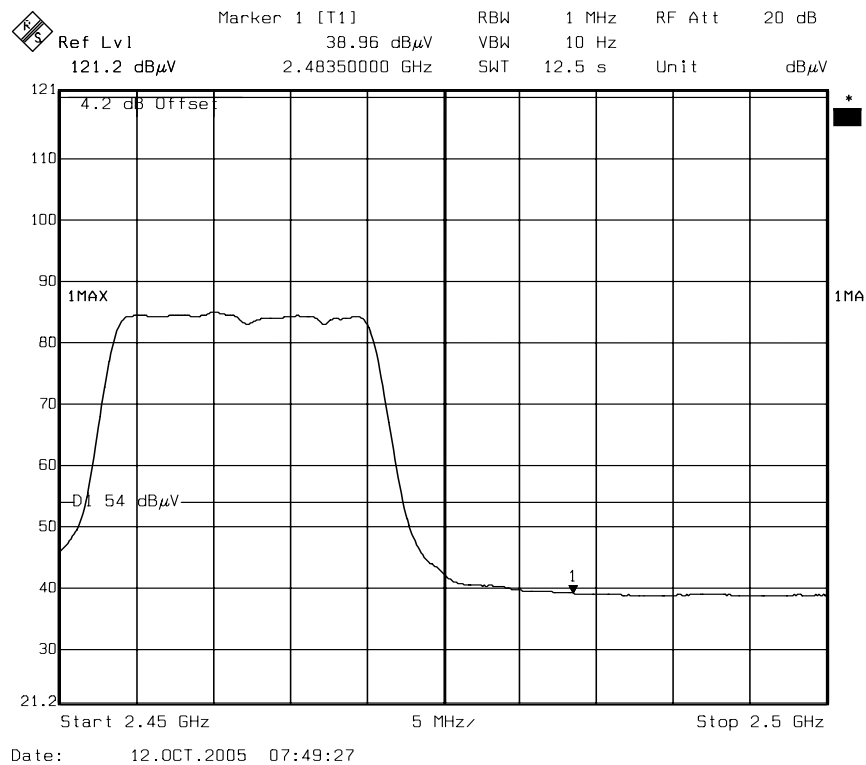




Detector mode: Peak Polarity: Horizontal



Detector mode: Average Polarity: Horizontal





7.4 PEAK POWER SPECTRAL DENSITY

Limit

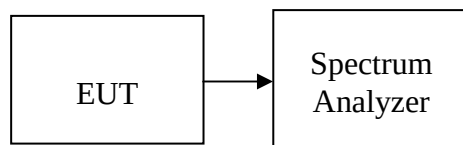
1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

Measurement Equipment Used

Name of Equipment	Manufacturer	Model	Serial Number	Date of Calibration
SPECTRUM ANALYZER	R&S	FSEM	829054/017	Mar. 18, 2005

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

Test Configuration



Test Procedure

1. Place the EUT on the table and set it in transmitting mode.
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 300kHz, Sweep=100s
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

**Test Resultes***No non-compliance noted***Test Data****Test mode: IEEE 802.11b**

Channel	Frequency (MHz)	Reading Power(dBm)	Factor (dB)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-12.30	1	-11.30	8	PASS
Mid	2437	-12.31	1	-11.31		PASS
High	2462	-11.80	1	-10.80		PASS

Test mode: IEEE 802.11g

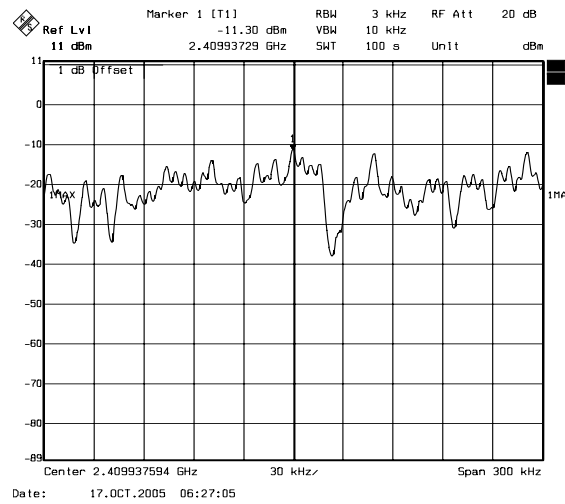
Channel	Frequency (MHz)	Reading Power(dBm)	Factor (dB)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-19.02	1	-18.02	8	PASS
Mid	2437	-18.93	1	-17.93		PASS
High	2462	-19.79	1	-18.79		PASS



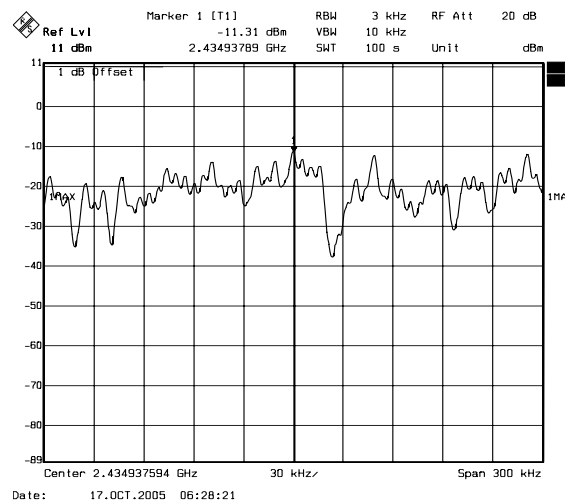
Test Plot

IEEE 802.11b mode

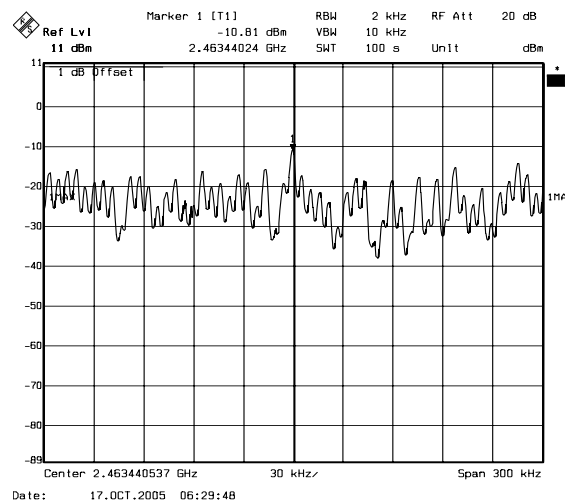
PPSD (CH Low)



PPSD (CH Mid)



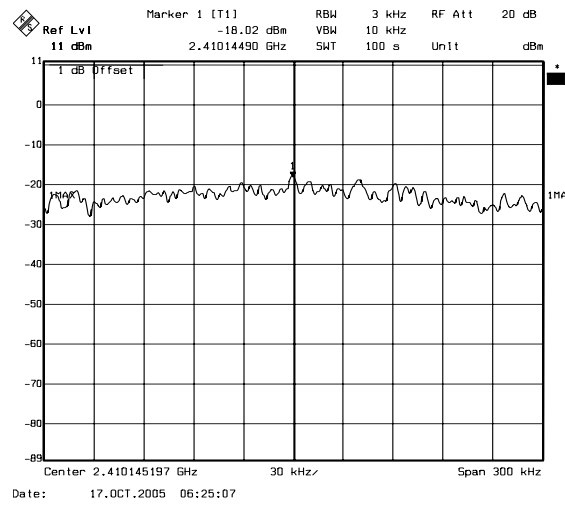
PPSD (CH High)



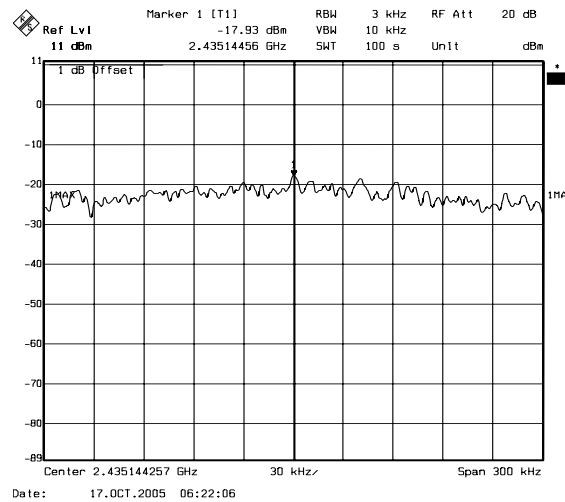


IEEE 802.11g mode

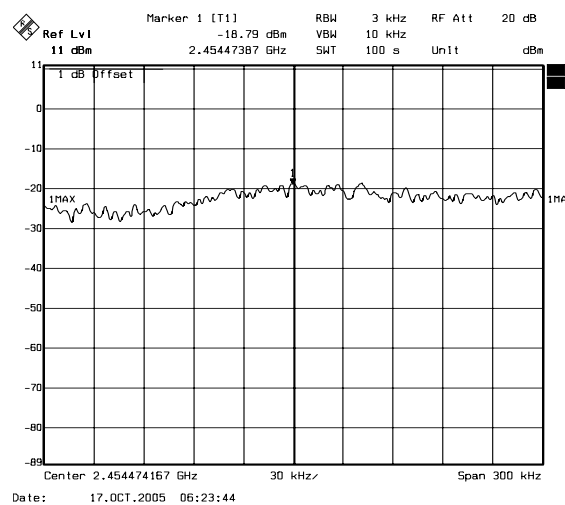
PPSD (CH Low)



PPSD (CH Mid)



PPSD (CH High)





7.5 Radio frequency exposure

Limit

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

EUT Specification

EUT	802.11g Wireless Firewall Router
Frequency band (Operating)	☒ WLAN: 2.412GHz ~ 2.462GHz ☐ WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz ☐ WLAN: 5.745GHz ~ 5.825GHz ☐ Others
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm ²) ☒ General Population/Uncontrolled exposure (S=1mW/cm ²)
Antenna diversity	☒ Single antenna ☐ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☒ Tx/Rx diversity
Max. output power	19.18 dBm (82.794mW)
Antenna gain (Max)	1.8 dBi (Numeric gain: 1.513)
Evaluation applied	☒ MPE Evaluation ☐ SAR Evaluation

Remark:

1. The maximum output power is 19.18 dBm (82.794mW) at 2412MHz (with 1.513 numeric antenna gain.)
2. DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.
3. For mobile or fixed location transmitters, no SAR consideration applied. The minimum separation generally be used is at least 20 cm, even if the calculations indicate that the MPE distance would be lesser.

Test Results

No non-compliance noted.

**Calculation**

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

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:

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

Changing to units of mW and cm, using:

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

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

Yields

$$d = 100 \times \sqrt{\frac{30 \times (P / 1000) \times G}{3770 \times S}} = 0.282 \times \sqrt{\frac{P \times G}{S}}$$

Where d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW / cm²

Substituting the logarithmic form of power and gain using:

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

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

Yields

$$d = 0.282 \times \frac{10^{(P+G)/20}}{\sqrt{20}}$$

Equation 1

Where d = MPE safe distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW / cm²



Maximum Permissible Exposure (2.4 GHz Band)

EUT output power = 82.794mW

Antenna Gain = 1.513(Numeric gain)

S = 1.0 mW / cm² from 1.1310 Table 1

Substituting these parameters into the above Equation 1:

→ MPE Safe Distance = 3.187cm

(For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.)



7.6 SPURIOUS EMISSIONS

7.6.1 CONDUCTED MEASUREMENT

Limit

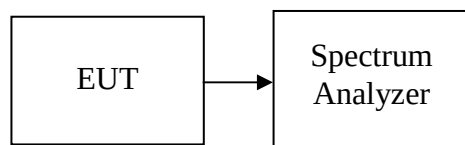
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Measurement Equipment Used

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
SPECTRUM ANALYZER	R&S	FSEM	830270/015	Mar. 18, 2005

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

Test Configuration



Test Procedure

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 100 KHz.

Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

Test Results

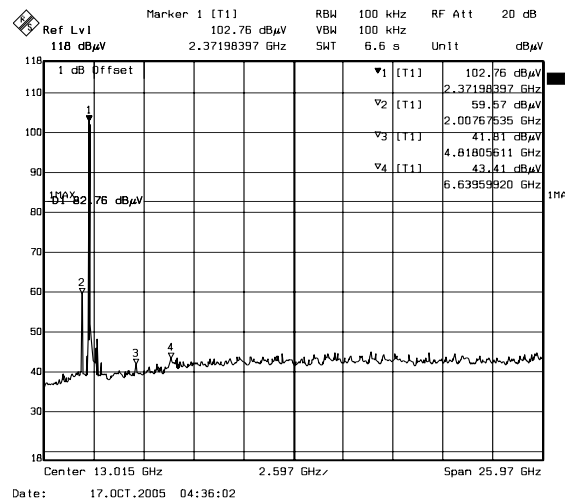
No non-compliance noted



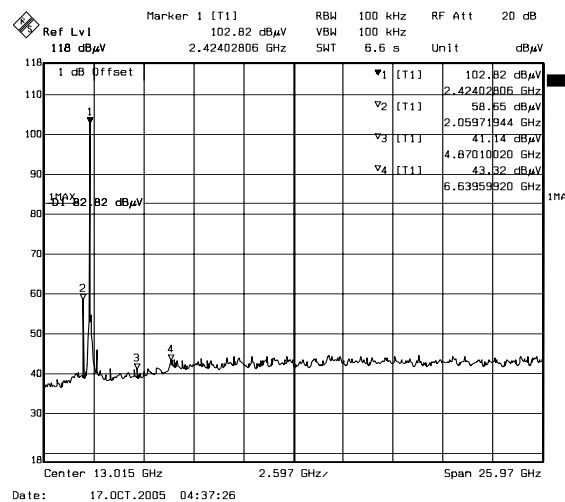
Test Plot

IEEE 802.11b mode

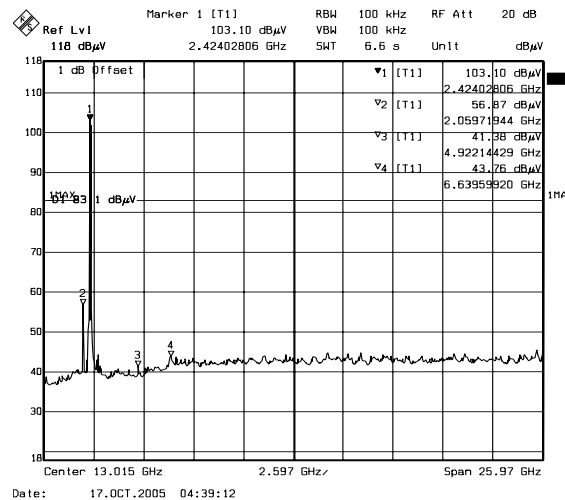
CH Low



CH Mid



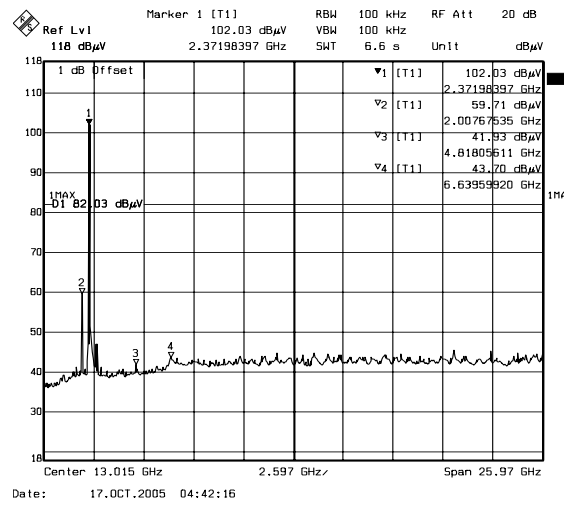
CH High



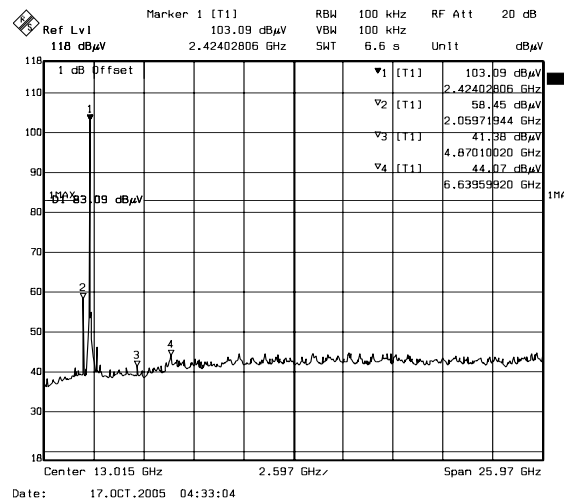


IEEE 802.11g mode

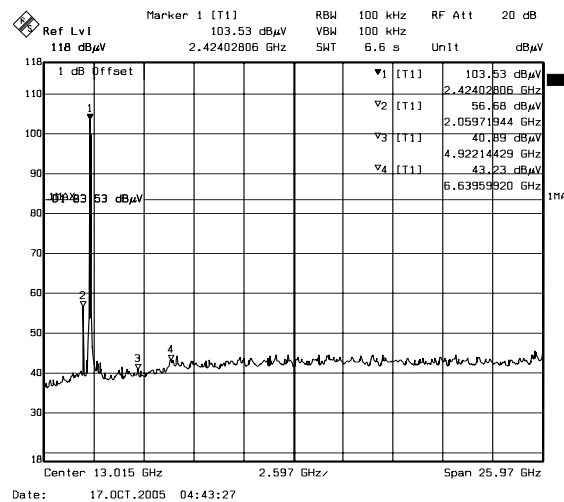
CH Low



CH Mid



CH High





7.6.2 RADIATED EMISSIONS

Limit

1. 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 (mV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

Remark: 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.

2. In the above emission table, the tighter limit applies at the band edges.

Frequency (Hz)	Field Strength (μ V/m at 3-meter)	Field Strength (dB μ V/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

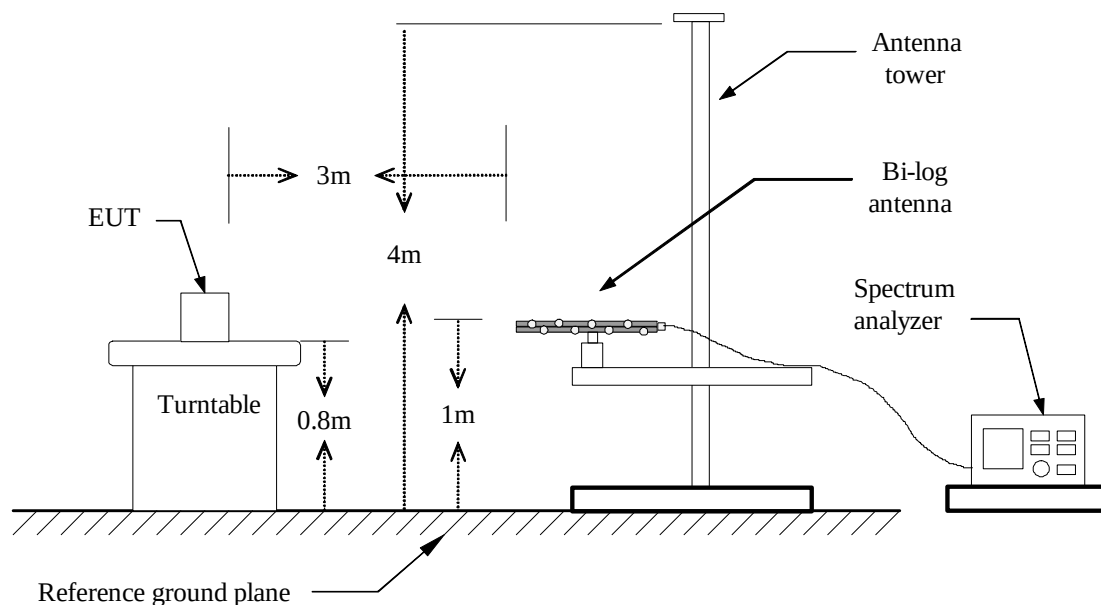
Measurement Equipment Used

Open Area Test Site # 6				
Name of Equipment	Manufacturer	Model	Serial Number	Date of Calibration
O.A.T.S	-----	-----	No.6	SEP. 12, 2005
EMI RECEIVER	R&S	ESVS10	833206/012	FEB. 24, 2005
Spectrum Analyzer	R&S	FSEM	829054/017	MAR. 18, 2005
BI-LOG ANTENNA	CHASE	CBL6112B	2563	FEB. 16, 2005
Horn Antenna	Com-Power	AH-118	071033	AUG. 09, 2005
18G Cable	SMA	SUCOFLEX104(1M)	001	MAR. 22, 2005
Pre-Amplifier	HP	8447F	2727A02227	MAR. 03, 2005
Signal Generator	HP	8673C	2938A00663	FEB. 02, 2005
RF SWITCH	-----	ERS-180A	-----	JAN. 31, 2005
POWER METER	IFR	8541C	1835448	APR. 07, 2005

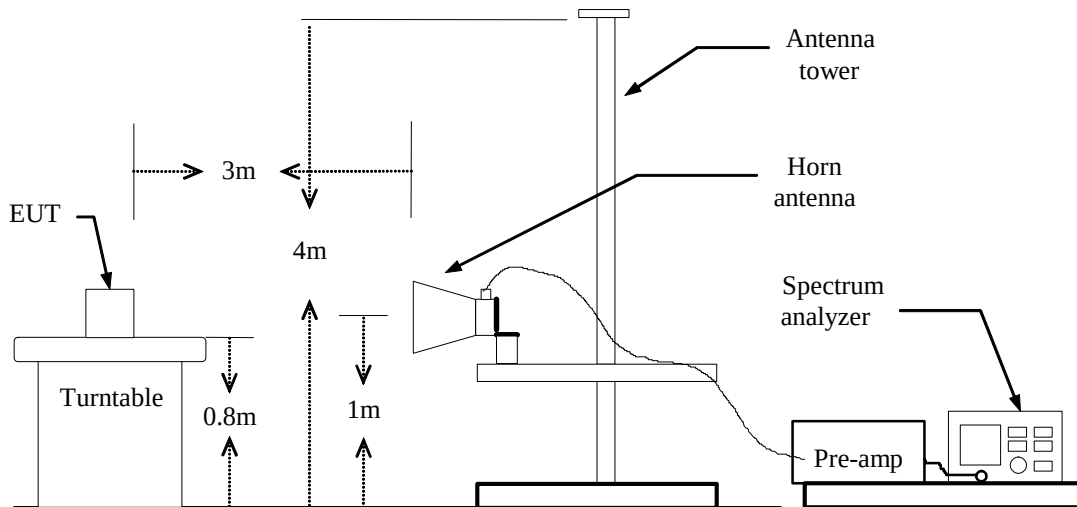
Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration

Below 1 GHz



Above 1 GHz



Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

Below 1GHz:

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz:

(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO

7. Repeat above procedures until the measurements for all frequencies are complete.

**Test Results****Below 1 GHz****Operation Mode:** P-320W**Test Date:** Oct. 17, 2005**Temperature:** 28.9°C**Tested by:** Jerry Chang**Humidity:** 67% RH**Polarity:** Horizontal; Vertical

Freq- Uency	Meter Reading at 3 m(dB μ V/M)	Antenna Factor	Cable Loss	Limits	Emission Level at 3 m(dB μ V/M)	Detector Mode	Margin
(MHz)	Horizontal	(dB)	(dB)	(dB μ V/M)	Horizontal	PK/QP	(dB)
151.51	7.10	10.87	1.18	43.50	19.15	QP	-24.35
200.00	15.70	9.98	1.24	43.50	26.92	QP	-16.58
300.00	9.50	13.73	1.60	46.00	24.83	QP	-21.17
499.99	11.00	17.63	2.60	46.00	31.23	QP	-14.77
799.99	9.30	21.13	3.50	46.00	33.93	QP	-12.07
900.01	3.40	22.02	3.80	46.00	29.22	QP	-16.78
1000.00	4.10	23.17	4.10	54.00	31.37	QP	-22.63

Freq- Uency	Meter Reading at 3 m(dB μ V/M)	Antenna Factor	Cable Loss	Limits	Emission Level at 3 m(dB μ V/M)	Detector Mode	Margin
(MHz)	Vertical	(dB)	(dB)	(dB μ V/M)	Vertical	PK/QP	(dB)
151.53	9.10	10.87	1.18	43.50	21.14	QP	-22.36
199.99	22.60	9.98	1.24	43.50	33.82	QP	-9.68
299.99	13.10	13.73	1.60	46.00	28.43	QP	-17.57
500.01	13.50	17.63	2.60	46.00	33.73	QP	-12.27
800.00	7.20	21.13	3.50	46.00	31.83	QP	-14.17
899.99	5.40	22.02	3.80	46.00	31.22	QP	-14.78
999.98	6.20	23.17	4.10	54.00	33.47	QP	-20.53

Remark:

1. Measuring frequencies from 30 MHz to the 1GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak detector mode.
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. The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.

**Above 1 GHz****Operation Mode:** TX / IEEE 802.11b mode / CH Low**Test Date:** Oct. 11, 2005**Temperature:** 29.3°C**Tested by:** Jerry Chang**Humidity:** 72 % RH**Polarity:** Horizontal; Vertical

TX / IEEE 802.11b mode / CH Low					Measurement Distance at 3m			Horizontal polarity		
	Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	2413.01	95.39	29.83	6.01	31.86	1.25	100.61	Fundamental Frequency		P
	2413.01	88.20	29.83	6.01	31.86	1.25	93.42			A
	2037.96	46.73	29.08	5.56	31.91	1.06	50.52	80.61	-30.09	P
	2037.96	42.50	29.08	5.56	31.91	1.06	46.29	73.42	-27.13	A
*	4823.87	40.71	33.65	8.29	32.80	0.69	50.54	74.00	-23.46	P
*	4823.87	28.28	33.65	8.29	32.80	0.69	38.11	54.00	-15.89	A
	N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
	N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

	TX / IEEE 802.11b mode / CH Low				Measurement Distance at 3m			Vertical polarity		
	Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	2412.99	106.08	29.83	6.01	31.86	0.00	110.05	Fundamental Frequency		P
	2412.99	99.25	29.83	6.01	31.86	0.00	103.22			A
	2037.99	45.73	29.08	5.56	31.91	1.06	49.52	90.05	-40.54	P
	2037.99	40.99	29.08	5.56	31.91	1.06	44.78	83.22	-38.45	A
*	4824.10	40.99	33.65	8.29	32.80	0.69	50.83	74.00	-23.17	P
*	4824.10	28.67	33.65	8.29	32.80	0.69	38.51	54.00	-15.49	A
	N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
	N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, b. Sweep time = Auto.
5. Remark “*” means the Restricted band.

**Operation Mode:** TX / IEEE 802.11b mode / CH Mid**Test Date:** Oct. 11, 2005**Temperature:** 29.3°C**Tested by:** Jerry Chang**Humidity:** 72 % RH**Polarity:** Horizontal; Vertical

	TX / IEEE 802.11b mode / CH Mid				Measurement Distance at 3m			Horizontal polarity		
	Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	2435.10	95.49	29.87	6.03	31.86	0.00	99.53	Fundamental Frequency		P
	2435.10	89.09	29.87	6.03	31.86	0.00	93.13			A
	2062.95	47.63	29.13	5.59	31.90	1.07	51.51	79.53	-28.02	P
	2062.95	43.78	29.13	5.59	31.90	1.07	47.66	73.13	-25.47	A
*	4874.15	40.35	33.75	8.34	32.81	0.71	50.34	74.00	-23.66	P
*	4874.15	28.28	33.75	8.34	32.81	0.71	38.27	54.00	-15.73	A
	N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
	N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

	TX / IEEE 802.11b mode / CH Mid				Measurement Distance at 3m			Vertical polarity		
	Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	2437.99	105.99	29.88	6.04	31.86	0.00	110.04	Fundamental Frequency		P
	2437.99	99.30	29.88	6.04	31.86	0.00	103.35			A
	2062.73	47.24	29.13	5.59	31.90	1.07	51.12	90.04	-38.92	P
	2062.73	43.37	29.13	5.59	31.90	1.07	47.25	83.35	-36.10	A
*	4874.47	41.43	33.75	8.34	32.81	0.71	51.42	74.00	-22.58	P
*	4874.47	28.68	33.75	8.34	32.81	0.71	38.67	54.00	-15.33	A
	N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
	N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, b. Sweep time = Auto.
5. Remark “*” means the Restricted band.

**Operation Mode:** TX / IEEE 802.11b mode / CH High**Test Date:** Oct. 11, 2005**Temperature:** 29.3°C**Tested by:** Jerry Chang**Humidity:** 72 % RH**Polarity:** Horizontal; Vertical

	TX / IEEE 802.11b mode / CH High				Measurement Distance at 3m			Horizontal polarity		
	Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	2463.05	95.43	29.93	6.07	31.85	0.00	99.57	Fundamental Frequency		P
	2463.33	88.67	29.93	6.07	31.85	0.00	92.81			A
	2087.92	46.30	29.18	5.62	31.90	1.08	50.28	79.57	-29.29	P
	2087.92	42.02	29.18	5.62	31.90	1.08	46.00	72.81	-26.81	A
*	4924.92	40.52	33.85	8.39	32.83	0.73	50.66	74.00	-23.34	P
*	4924.92	28.27	33.85	8.39	32.83	0.73	38.41	54.00	-15.59	A
	N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
	N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

	TX / IEEE 802.11b mode / CH High				Measurement Distance at 3m			Vertical polarity		
	Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	2601.06	105.40	30.00	6.22	31.88	0.00	109.74	Fundamental Frequency		P
	2601.06	98.75	30.00	6.22	31.88	0.00	103.09			A
	2087.94	44.96	29.18	5.62	31.90	1.08	48.94	89.74	-40.81	P
	2087.94	37.69	29.18	5.62	31.90	1.08	41.67	83.09	-41.43	A
*	4923.90	39.92	33.85	8.39	32.83	0.73	50.06	74.00	-23.94	P
*	4923.90	28.82	33.85	8.39	32.83	0.73	38.96	54.00	-15.04	A
	N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
	N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, b. Sweep time = Auto.
5. Remark “*” means the Restricted band.

**Operation Mode:** TX / IEEE 802.11g mode / CH Low**Test Date:** Oct. 11, 2005**Temperature:** 29.3°C**Tested by:** Jerry Chang**Humidity:** 72 % RH**Polarity:** Horizontal; Vertical

TX / IEEE 802.11g mode / CH Low					Measurement Distance at 3m			Horizontal polarity		
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark	
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)	
2414.97	91.86	29.83	6.01	31.86	1.25	97.09	Fundamental Frequency		P	
2414.97	82.80	29.83	6.01	31.86	1.25	88.03			A	
2037.99	45.78	29.08	5.56	31.91	1.06	49.57	77.09	-27.52	P	
2037.99	41.08	29.08	5.56	31.91	1.06	44.87	68.03	-23.16	A	
* 4823.14	40.99	33.65	8.29	32.80	0.69	50.82	74.00	-23.18	P	
* 4823.14	28.67	33.65	8.29	32.80	0.69	38.50	54.00	-15.50	A	
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P	
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A	

TX / IEEE 802.11g mode / CH Low					Measurement Distance at 3m			Vertical polarity		
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark	
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)	
2046.37	101.72	29.09	5.57	31.90	0.00	104.47	Fundamental Frequency		P	
2046.37	92.73	29.09	5.57	31.90	0.00	95.48			A	
2437.81	45.84	29.88	6.04	31.86	1.26	51.15	84.47	-33.32	P	
2437.81	40.90	29.88	6.04	31.86	1.26	46.21	75.48	-29.27	A	
* 4824.04	39.82	33.65	8.29	32.80	0.69	49.66	74.00	-24.34	P	
* 4824.04	28.28	33.65	8.29	32.80	0.69	38.12	54.00	-15.88	A	
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P	
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A	

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, b. Sweep time = Auto.
5. Remark “*” means the Restricted band.

**Operation Mode:** TX / IEEE 802.11g mode / CH Mid**Test Date:** Oct. 11, 2005**Temperature:** 29.3°C**Tested by:** Jerry Chang**Humidity:** 72 % RH**Polarity:** Horizontal; Vertical

TX / IEEE 802.11g mode / CH Mid					Measurement Distance at 3m Horizontal polarity					
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark	
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)	
2429.87	92.55	29.86	6.03	31.86	0.00	96.58	Fundamental Frequency		P	
2429.87	83.49	29.86	6.03	31.86	0.00	87.52			A	
2062.94	47.58	29.13	5.59	31.90	1.07	51.46	76.58	-25.12	P	
2062.94	43.71	29.13	5.59	31.90	1.07	47.59	67.52	-19.93	A	
* 4873.68	40.99	33.75	8.34	32.81	0.71	50.98	74.00	-23.02	P	
* 4873.68	28.67	33.75	8.34	32.81	0.71	38.66	54.00	-15.34	A	
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P	
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A	

TX / IEEE 802.11g mode / CH Mid					Measurement Distance at 3m Vertical polarity					
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark	
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)	
2433.72	102.01	29.87	6.03	31.86	0.00	106.05	Fundamental Frequency		P	
2433.72	93.51	29.87	6.03	31.86	0.00	97.55			A	
2063.11	47.80	29.13	5.59	31.90	1.07	51.68	86.05	-34.37	P	
2063.11	42.80	29.13	5.59	31.90	1.07	46.68	77.55	-30.87	A	
* 4873.93	39.82	33.75	8.34	32.81	0.71	49.81	74.00	-24.19	P	
* 4873.93	28.67	33.75	8.34	32.81	0.71	38.66	54.00	-15.34	A	
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P	
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A	

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, b. Sweep time = Auto.
5. Remark “*” means the Restricted band.

**Operation Mode:** TX / IEEE 802.11g mode / CH High**Test Date:** Oct. 11, 2005**Temperature:** 29.3°C**Tested by:** Jerry Chang**Humidity:** 72 % RH**Polarity:** Horizontal; Vertical

TX / IEEE 802.11g mode / CH High					Measurement Distance at 3m Horizontal polarity					
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark	
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)	
2464.97	92.29	29.93	6.07	31.85	0.00	96.43	Fundamental Frequency		P	
2464.97	83.15	29.93	6.07	31.85	0.00	87.29			A	
2087.79	46.44	29.18	5.62	31.90	1.08	50.42	76.43	-26.02	P	
2087.79	41.35	29.18	5.62	31.90	1.08	45.33	67.29	-21.97	A	
* 4924.04	40.52	33.85	8.39	32.83	0.73	50.66	74.00	-23.34	P	
* 4924.04	28.28	33.85	8.39	32.83	0.73	38.42	54.00	-15.58	A	
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P	
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A	

TX / IEEE 802.11g mode / CH High					Measurement Distance at 3m Vertical polarity					
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark	
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)	
2458.72	102.32	29.92	6.06	31.85	0.00	106.44	Fundamental Frequency		P	
2458.72	93.32	29.92	6.06	31.85	0.00	97.44			A	
2087.87	44.96	29.18	5.62	31.90	1.08	48.94	86.44	-37.51	P	
2087.87	39.60	29.18	5.62	31.90	1.08	43.58	77.44	-33.87	A	
* 4924.15	40.52	33.85	8.39	32.83	0.73	50.66	74.00	-23.34	P	
* 4924.15	28.29	33.85	8.39	32.83	0.73	38.43	54.00	-15.57	A	
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P	
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A	

Remark:

- Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
- Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- Spectrum setting:
 - Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.
- Remark “*” means the Restricted band.

**Operation Mode:** RX / IEEE 802.11b mode / CH Low**Test Date:** Oct. 11, 2005**Temperature:** 29.3°C**Tested by:** Jerry Chang**Humidity:** 72 % RH**Polarity:** Horizontal; Vertical

RX / IEEE 802.11b mode / CH Low				Measurement Distance at 3m				Horizontal polarity	
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
2038.03	46.55	29.08	5.56	31.91	1.06	50.34	74	-23.66	P
2038.03	42.57	29.08	5.56	31.91	1.06	46.36	54	-7.64	A
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

RX / IEEE 802.11b mode / CH Low				Measurement Distance at 3m				Vertical polarity	
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
2038.06	45.68	29.08	5.56	31.91	1.06	49.47	74	-24.53	P
2038.06	41.02	29.08	5.56	31.91	1.06	44.81	54	-9.19	A
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, b. Sweep time = Auto.
5. Remark “*” means the Restricted band.

**Operation Mode:** RX / IEEE 802.11b mode / CH Mid**Test Date:** Oct. 11, 2005**Temperature:** 29.3°C**Tested by:** Jerry Chang**Humidity:** 72 % RH**Polarity:** Horizontal; Vertical

RX / IEEE 802.11b mode / CH Mid				Measurement Distance at 3m				Horizontal polarity	
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
2063.02	47.63	29.13	5.59	31.90	1.07	51.51	74	-22.49	P
2063.02	43.52	29.13	5.59	31.90	1.07	47.40	54	-6.60	A
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

RX / IEEE 802.11b mode / CH Mid				Measurement Distance at 3m				Vertical polarity	
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
2062.98	47.52	29.13	5.59	31.90	1.07	51.40	74	-22.60	P
2062.98	43.03	29.13	5.59	31.90	1.07	46.91	54	-7.09	A
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, b. Sweep time = Auto.
5. Remark “*” means the Restricted band.

**Operation Mode:** RX / IEEE 802.11b mode / CH High**Test Date:** Oct. 11, 2005**Temperature:** 29.3°C**Tested by:** Jerry Chang**Humidity:** 72 % RH**Polarity:** Horizontal; Vertical

RX / IEEE 802.11b mode / CH High				Measurement Distance at 3m				Horizontal polarity	
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
2087.87	45.86	29.18	5.62	31.90	1.08	49.84	74	-24.16	P
2087.87	41.23	29.18	5.62	31.90	1.08	45.21	54	-8.79	A
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

RX / IEEE 802.11b mode / CH High				Measurement Distance at 3m				Vertical polarity	
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
2087.96	45.48	29.18	5.62	31.90	1.08	49.46	74	-24.54	P
2087.96	40.09	29.18	5.62	31.90	1.08	44.07	54	-9.93	A
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, b. Sweep time = Auto.
5. Remark " *" means the Restricted band.

**Operation Mode:** RX / IEEE 802.11g mode / CH Low**Test Date:** Oct. 11, 2005**Temperature:** 29.3°C**Tested by:** Jerry Chang**Humidity:** 72 % RH**Polarity:** Horizontal; Vertical

RX / IEEE 802.11g mode / CH Low				Measurement Distance at 3m				Horizontal polarity	
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
2038.01	46.68	29.08	5.56	31.91	1.06	50.47	74	-23.53	P
2038.01	42.72	29.08	5.56	31.91	1.06	46.51	54	-7.49	A
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

RX / IEEE 802.11g mode / CH Low				Measurement Distance at 3m				Vertical polarity	
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
2037.91	45.78	29.08	5.56	31.91	1.06	49.56	74	-24.44	P
2037.91	40.90	29.08	5.56	31.91	1.06	44.68	54	-9.32	A
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, b. Sweep time = Auto.
5. Remark “*” means the Restricted band.

**Operation Mode:** RX / IEEE 802.11g mode / CH Mid**Test Date:** Oct. 11, 2005**Temperature:** 29.3°C**Tested by:** Jerry Chang**Humidity:** 72 % RH**Polarity:** Horizontal; Vertical

RX / IEEE 802.11g mode / CH Mid				Measurement Distance at 3m				Horizontal polarity	
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
2062.97	47.46	29.13	5.59	31.90	1.07	51.34	74	-22.66	P
2062.97	43.51	29.13	5.59	31.90	1.07	47.39	54	-6.61	A
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

RX / IEEE 802.11g mode / CH Mid				Measurement Distance at 3m				Vertical polarity	
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
2062.94	47.46	29.13	5.59	31.90	1.07	51.34	74	-22.66	P
2062.94	42.95	29.13	5.59	31.90	1.07	46.83	54	-7.17	A
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, b. Sweep time = Auto.
5. Remark “*” means the Restricted band.

**Operation Mode:** RX / IEEE 802.11g mode / CH High**Test Date:** Oct. 11, 2005**Temperature:** 29.3°C**Tested by:** Jerry Chang**Humidity:** 72 % RH**Polarity:** Horizontal; Vertical

RX / IEEE 802.11g mode / CH High				Measurement Distance at 3m				Horizontal polarity	
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
2087.82	45.82	29.18	5.62	31.90	1.08	49.80	74	-24.20	P
2087.82	41.52	29.18	5.62	31.90	1.08	45.50	54	-8.50	A
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

RX / IEEE 802.11g mode / CH High				Measurement Distance at 3m				Vertical polarity	
Freq.	Reading	AF	Closs	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dBμV)	(dBμV)	(dB)	(dB)	dB	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
2088.05	45.24	29.18	5.62	31.90	1.08	49.22	74	-24.78	P
2088.05	39.82	29.18	5.62	31.90	1.08	43.80	54	-10.20	A
N/A	-----	-----	-----	-----	-----	-----	-----	-----	P
N/A	-----	-----	-----	-----	-----	-----	-----	-----	A

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, b. Sweep time = Auto.
5. Remark “*” means the Restricted band.



7.7 POWER LINE CONDUCTED EMISSIONS

Limit

For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (*Live Line* and *Neutral Line*) and ground at the power terminals.

Measurement Equipment Used

Name of Equipment	Manufacturer	Model	Serial Number	Date of Calibration
SCHWARZBECK L.I.S.N.	-----	NNLK 8121	8121-446	SEP. 29, 2005 For Insertion loss
			8121-308	DEC. 09, 2004 For Insertion loss
TEST RECEIVER	R&S	ESCS 30	100348	JUN. 16, 2005
TYPE N COAXIAL CABLE	-----	-----	-----	FEB. 26, 2005

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

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

Test Procedure

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.



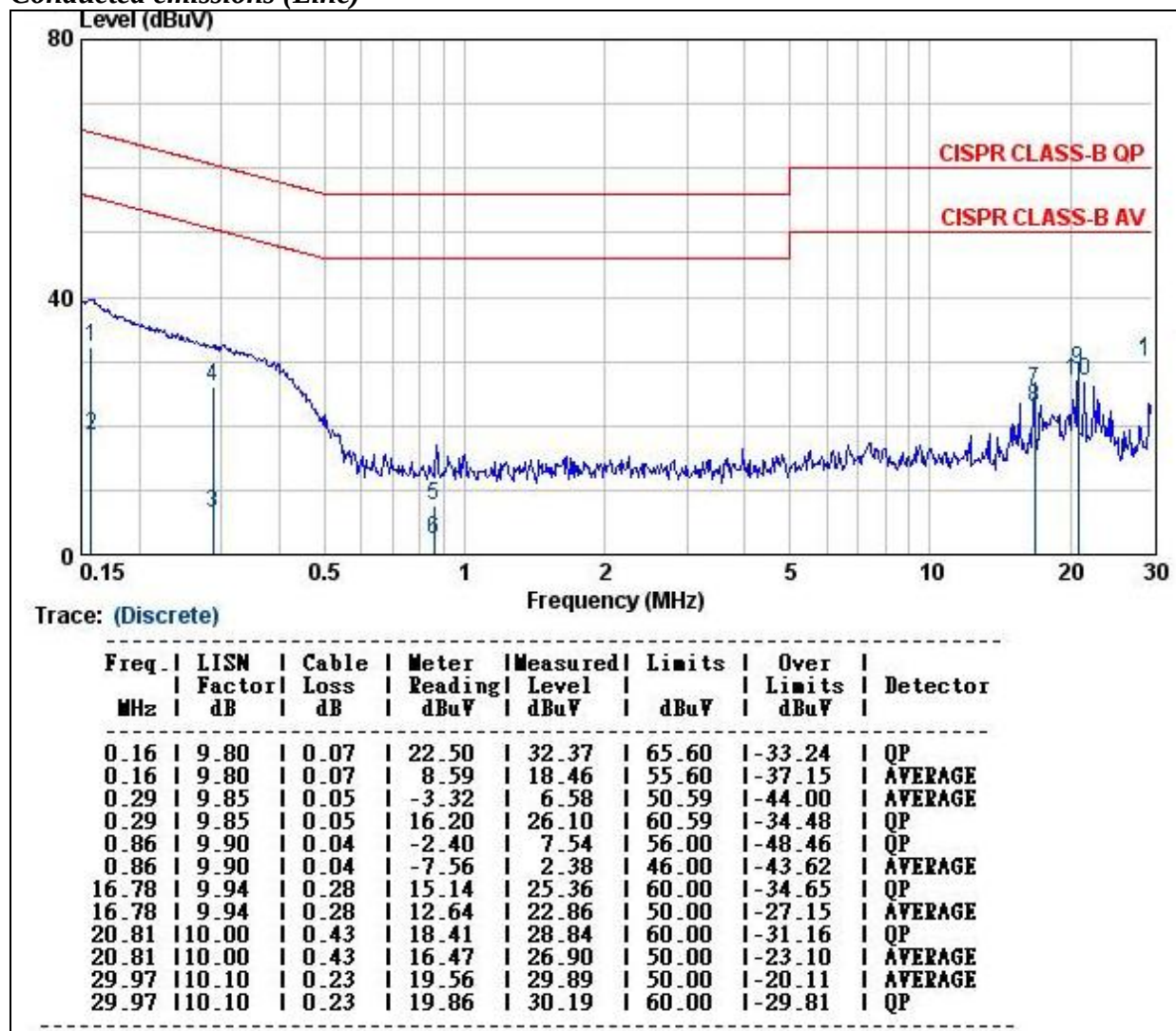
Test Results

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Test Data

Operation Mode: TX + RX mode **Test Date:** Oct. 05, 2005
Temperature: 25.8°C **Humidity:** 55% RH
Tested by: Boy Wu **Test Mode:** Data Transmit

Conducted emissions (Line)



Remark:

- 1 Measuring frequencies from 0.15 MHz to 30MHz.
- 2 The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.
- 3 The IF bandwidth of SPA between 0.15MHz to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz;
- 4 a. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB)
b. Over Limit value (dB) = Level (dBuV) – Limit Line (dBuV)



Operation Mode: TX + RX mode

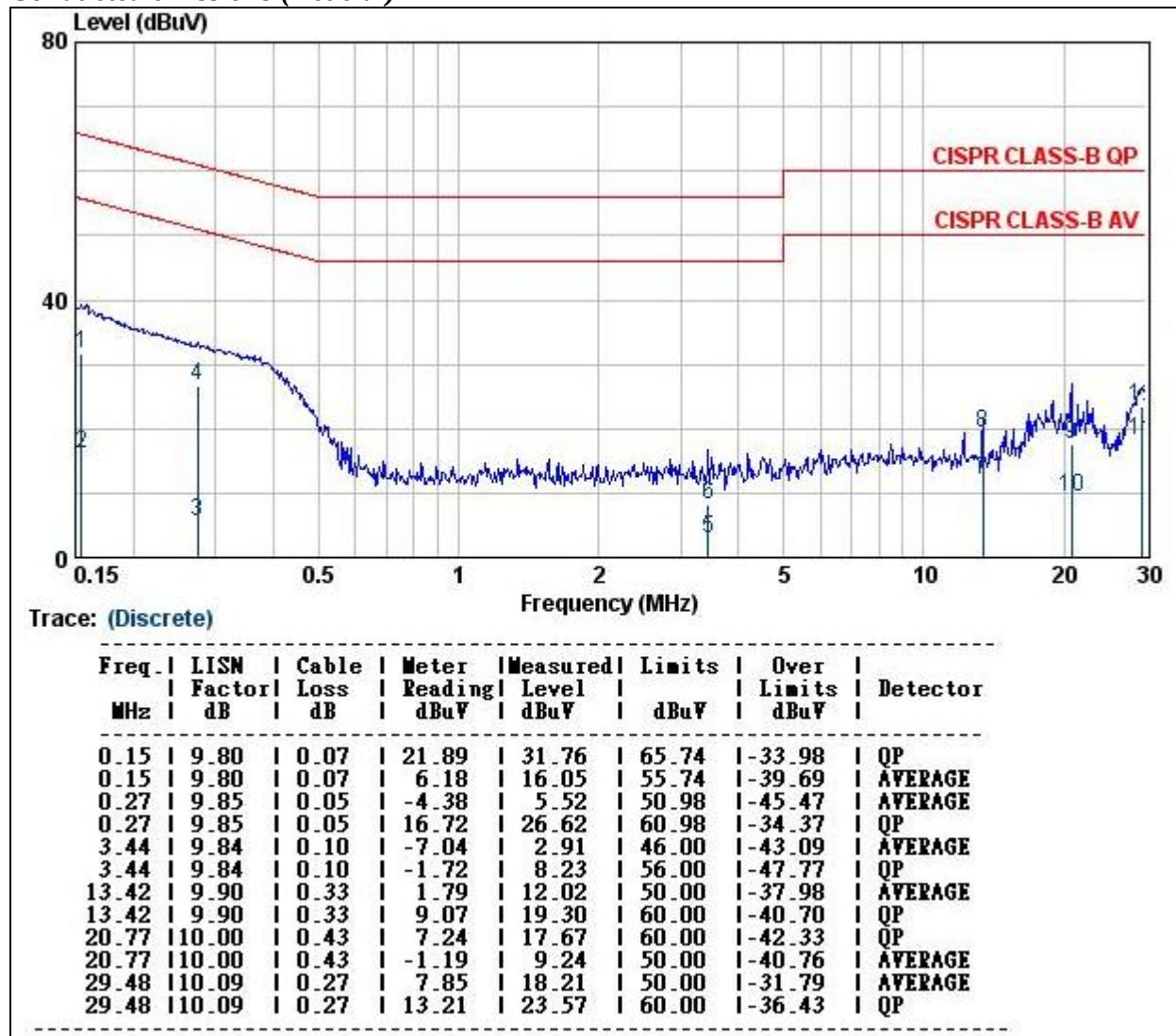
Test Date: Oct. 05, 2005

Temperature: 25.8°C

Humidity: 55% RH

Tested by: Boy Wu

Test Mode: Data Transmit

Conducted emissions (Neutral)**Remark:**

- 1 Measuring frequencies from 0.15 MHz to 30MHz.
- 2 The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.
- 3 The IF bandwidth of SPA between 0.15MHz to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz;
- 4 a. Level (dBUV) = Read Level (dBUV) + LISN Factor (dB) + Cable Loss (dB)
b. Over Limit value (dB) = Level (dBUV) – Limit Line (dBUV)

8. APPENDIX 1 PHOTOGRAPHS OF TEST SETUP

Radiated Emission Set up Photos



Conducted Emission Set Up Photos

