OKFCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Shuttle XPC (Wireless 802.11a+b+g)

Trade Name: Shuttle

Model: Xyy0yy (y=0~9)

Issued to

UNIWILL COMPUTER CORP.
3F, No.43, Wu Chiuan Rd, Wu Cu Ind., Park,
Taipei, Taiwan, R.O.C.

Issued by

Compliance Certification Services Inc.
No. 81-1, Lane 210, Bade Rd. 2, Luchu Hsiang,
Taoyuan Hsien, (338) Taiwan, R.O.C.
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ACCREDITED
No. 0824-01

TAF
Testing Laboratory
0363

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1. TEST RESULT CERTIFICATION

Applicant:	UNIWILL COMPUTER CORP. 3F, No.43, Wu Chiuan Rd., Wu Cu Ind, Park, Taipei, Taiwan, R.O.C.
Equipment Under Test:	Shuttle XPC (Wireless 802.11a+b+g)
Trade Name:	Shuttle
Model:	Xyy0yy (y=0~9)
Date of Test:	March 20 ~ April 25, 2006

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 15 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: 2003 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:

Gavin Lim
Section Manager
Compliance Certification Services Inc.

Reviewed by:

Amanda Wu
Section Manager
Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product	Shuttle XPC (Wireless 802.11a+b+g)
Trade Name	Shuttle
Model	Xyy0yy (y=0~9)
Model Discrepancy	1. All the specification and layout are identical except they come with different model numbers. 2. "y" could be 0-9 to denote different color of enclosure.
Power Supply	LI SHIN INTERNATIONAL ENTERPRISE CORP. / 0227A20120 I/P: AC 100-240V, 2.0A, 50-60Hz O/P: DC 20V, 6.0A
Frequency Range	IEEE 802.11a: 5.745~5.825 GHz IEEE 802.11b/g: 2.412~2.462 GHz
Transmit Power	IEEE 802.11a: 15.84 dBm IEEE 802.11b: 16.32 dBm IEEE 802.11g: 16.07 dBm
Modulation Technique	IEEE 802.11a: OFDM (QPSK, BPSK, 16-QAM, 64-QAM) IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: DSSS (CCK, DQPSK, DBPSK) + OFDM (QPSK, BPSK, 16-QAM, 64-QAM)
Transmit Data Rate	IEEE 802.11a: 54, 48, 36, 24, 18, 12, 9, 6 Mbps IEEE 802.11b: 11, 5.5, 2, 1 Mbps IEEE 802.11g: 54, 48, 36, 24, 18, 12, 11, 9, 6, 5.5, 2, 1Mbps
Number of Channels	IEEE 802.11a: 5 Channels IEEE 802.11b/g: 11 Channels
Antenna Specification	IEEE 802.11a: PCB antenna / Gain: 1.91 dBi IEEE 802.11b/g: PCB antenna / Gain: 0.56 dBi

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: **SAZ-3945ABGXPCIA** 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.

3.1EUT 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.

3.2EUT 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.

3.3GENERAL 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.

3.4FCC 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 - 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 - 3358	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

(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.

3.5DESCRIPTION OF TEST MODES

The EUT (model: Xyy0yy (y=0~9)) had been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only.

IEEE802.11a:
Channel Low(5745MHz), Channel Mid(5785MHz) and Channel High(5825MHz) with 6Mbps data rate were chosen for full testing.

IEEE802.11b:
Channel Low(2412MHz), Channel Mid(2437MHz) and Channel High(2462MHz) with 1Mbps data rate were chosen for full testing.

IEEE802.11g:
Channel Low(2412MHz), Channel Mid(2437MHz) and Channel High(2462MHz) with 6Mbps data rate were chosen for full testing.

4. INSTRUMENT CALIBRATION

4.1MEASURING 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.

4.2MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

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

Conducted Emissions Test Site				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/18/2007

Open Area Test Site # 3				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI Test Receiver	R&S	ESVS20	838804/004	01/18/2007
Spectrum Analyzer	R&S	FSP30	100112	09/12/2006
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/18/2007
Pre-Amplifier	MITEC	AFS42-00102650	924206	N.C.R.
Pre-Amplifier	MITEC	AMF-6F-260400	945377	N.C.R.
Bilog Antenna	SCHWAZBECK	VULB9163	145	07/05/2006
Horn Antenna	EMCO	3115	00022250	04/16/2007
Horn-Antenna	TRC	HA-1201A	02	07/04/2006
Horn-Antenna	TRC	HA-1301A	02	07/04/2006
Turn Table	EMCO	2081-1.21	9709-1885	N.C.R.
Antenna Tower	EMCO	2075-2	9707-2060	N.C.R.
Controller	EMCO	2090	9709-1256	N.C.R.
RF Switch	ANRITSU	MP59B	M53867	N.C.R.
Site NSA	CCS	N/A	N/A	09/06/2006
Test S/W	LABVIEW (V 6.1)			

Remark: *The measurement uncertainty is less than +/- 2.16dB, which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.*

Powerline Conducted Emissions Test Site				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI TEST RECEIVER 9kHz-30MHz	ROHDE & SCHWARZ	ESHS30	828144/003	09/27/2006
TWO-LINE V-NETWORK 9kHz-30MHz	SCHAFFNER	NNB41	03/10013	06/12/2006
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	03/20/2007
Test S/W	LABVIEW (V 6.1)			

Remark: *The measurement uncertainty is less than +/- 2.81dB, which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.*

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

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

☐ No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No.11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☒ No.81-1, Lane 210, Bade 2nd Rd., Luchu Hsiang, Taoyuan Hsien 338, Taiwan
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

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.”

5.3TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	A2LA	EN 55011, EN 55014-1/2, CISPR 11, CISPR 14-1/2, EN 55022, EN 55015, CISPR 22, CISPR 15, AS/NZS 3548, VCCI V3 (2001), CFR 47, FCC Part 15/18, CNS 13783-1, CNS 13439, CNS 13438, CNS 13803, CNS 14115, EN 55024, IEC 801-2, IEC 801-3, IEC 801-4, IEC/EN 61000-3-2, EIC/EN 61000-3-3, IEC/EN 61000-4-2/3/4/5/6/8/11, EN 50081-1/ EN 61000-6-3, EN 50081-2/EN 61000-6-4, EN 50081-2/EN 61000-6-1: 2001	ACCREDITED 0824-01
USA	FCC	3/10 meter Open Area Test Sites (93105, 90471) / 3M Semi Anechoic Chamber (965860) to perform FCC Part 15/18 measurements	93105, 90471 965860
Japan	VCCI	3/10 meter Open Area Test Sites to perform conducted/radiated measurements	R-393/1066/725/879 C-402/747/912
Norway	NEMKO	EN 50081-1/2, EN 50082-1/2, IEC 61000-6-1/2, EN 50091-2, EN 50130-4, EN 55011, EN 55013, EN 55014-1/2, EN 55015, EN 55022, EN 55024, EN 61000-3-2/3, EN 61326-1, IEC 61000-4-2/3/4/5/6/8/11, EN 60601-1-2, EN 300 328, EN 300 422-2, EN 301 419-1, EN 301 489-01/03/07/08/09/17, EN 301 419-2/3, EN 300 454-2, EN 301 357-2	ELA 124a ELA 124b ELA 124c
Taiwan	TAF	EN 300 328, EN 300 220-1, EN 300 220-2, EN 300 220-3, 47 CFR FCC Part 15 Subpart C, EN 61000-3-2, EN 61000-3-3, CNS 13439, CNS 13783-1, CNS 14115, CNS 13438, AS/NZS CISPR 22, CNS 13022-1, IEC 61000-4-2/3/4/5/6/8/11, CNS 13022-2/3	Testing Laboratory 0363
Taiwan	BSMI	CNS 13438, CNS 13783-1, CNS 13439, CNS 14115	SL2-IS-E-0014 SL2-IN-E-0014 SL2-A1-E-0014 SL2-R1-E-0014 SL2-R2-E-0014 SL2-L1-E-0014
Canada	Industry Canada	3/10 meter Open Area Test Sites (IC 3991-3, IC 3991-4) / 3M Semi Anechoic Chamber (IC 6106) to perform RSS 212 Issue 1	IC 3991-3 IC 3991-4 IC 6106

** No part of this report may be used to claim or imply product endorsement by A2LA or any agency of the US Government.*

6. SETUP OF EQUIPMENT UNDER TEST

6.1SETUP CONFIGURATION OF EUT

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

6.2SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1.	LCD Monitor	LG	L1740PQ	503KGXA2K858	BEJL17NU	Unshielded, 1.8m With 2 cores	Unshielded, 1.8m
2.	USB Keyboard	Compaq	KU-9978	B463AOAGALT097	FCC DoC	Shielded, 1.8m	N/A
3.	USB Mouse	HP	MO19UCA	20440964	FCC DoC	Shielded, 1.8m	N/A
4.	USB 2.0 External HDD	TeraSyS	F12-U	A0100214-31d0014	FCC DoC	Shielded, 1.8m	Shielded, 1.8m
5.	USB 2.0 External HDD	TeraSyS	F12-U	A0100214-31d0028	FCC DoC	Shielded, 1.8m	Shielded, 1.8m
6.	USB 2.0 External HDD	TeraSyS	F12-U	A0100214-2Bq0039	FCC DoC	Shielded, 1.8m	Shielded, 1.8m
7.	USB 2.0 & 1394 External HDD	TeraSyS	F12-UF(COMBO)	A0100215-420014	FCC DoC	Shielded, 1.8m	Shielded, 1.8m
8.	Walkman	Panasonic	RQ-L10	HB004471	FCC DoC	Unshielded, 1.8m	N/A
9.	Headset	LABTEC	980180-0121	N/A	FCC DoC	Unshielded, 1.8m	N/A
10.	Super a/g 108Mbps Wireless Lan Router (Remote)	PLANEX	BLW-04SAG	40DDA0421	SJ9-BLW54SAG	N/A	Unshielded, 1.8m

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.*

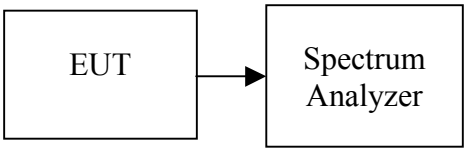
7. FCC PART 15.247 REQUIREMENTS

7.16dB BANDWIDTH

LIMIT

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 100kHz, VBW = RBW, Span = 50MHz
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
Low	2412	8670	>500	PASS
Mid	2437	9080		PASS
High	2462	8500		PASS

Test mode: IEEE 802.11g

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
Low	2412	16500	>500	PASS
Mid	2437	16670		PASS
High	2462	16420		PASS

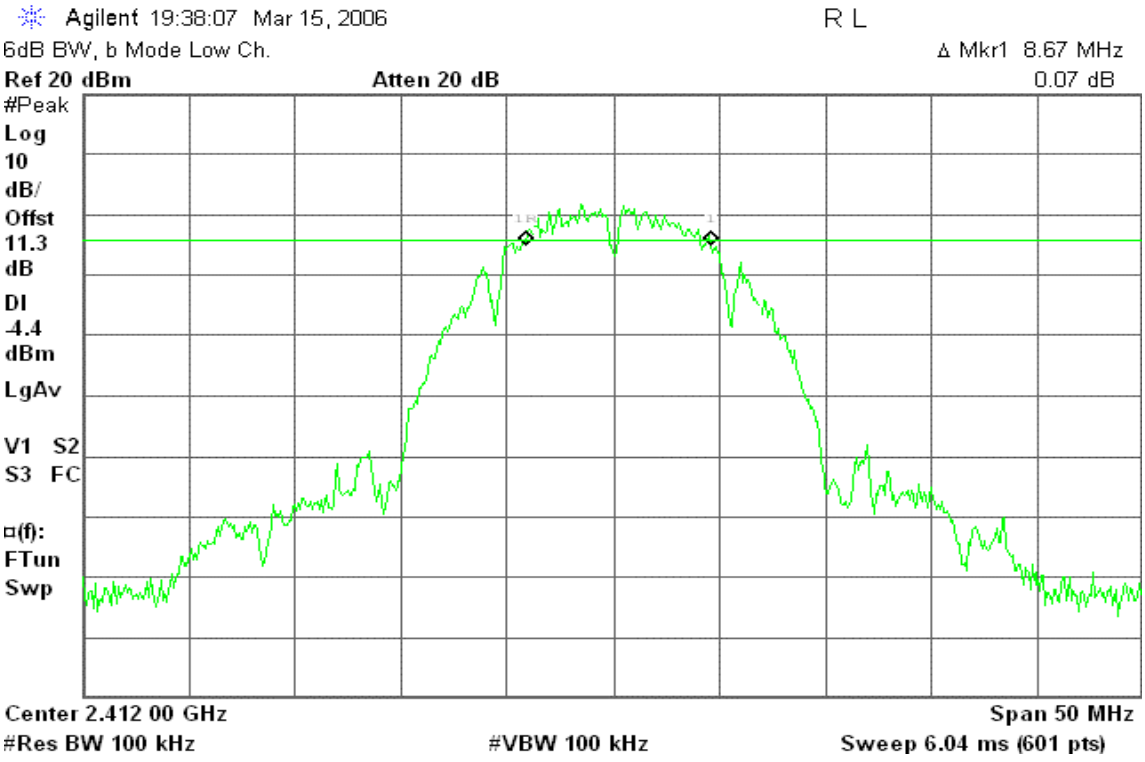
Test mode: IEEE 802.11a

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
Low	5745	16500	>500	PASS
Mid	5785	16330		PASS
High	5825	16500		PASS

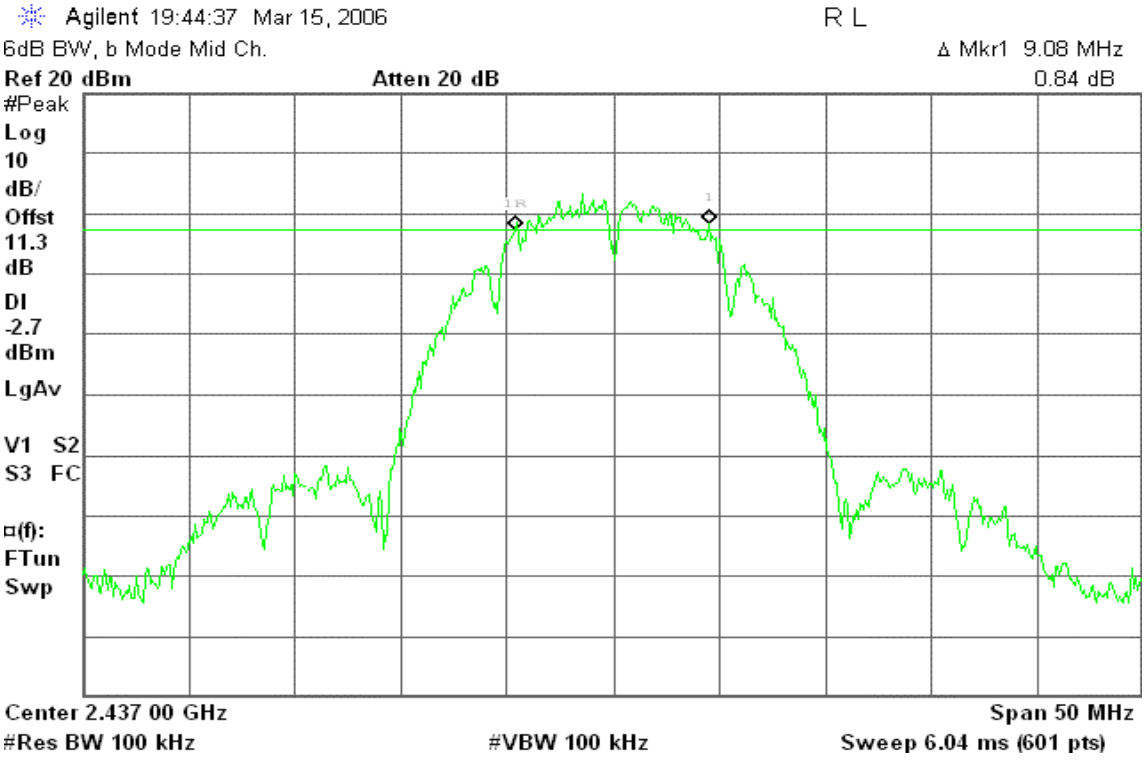
Test Plot

IEEE 802.11b

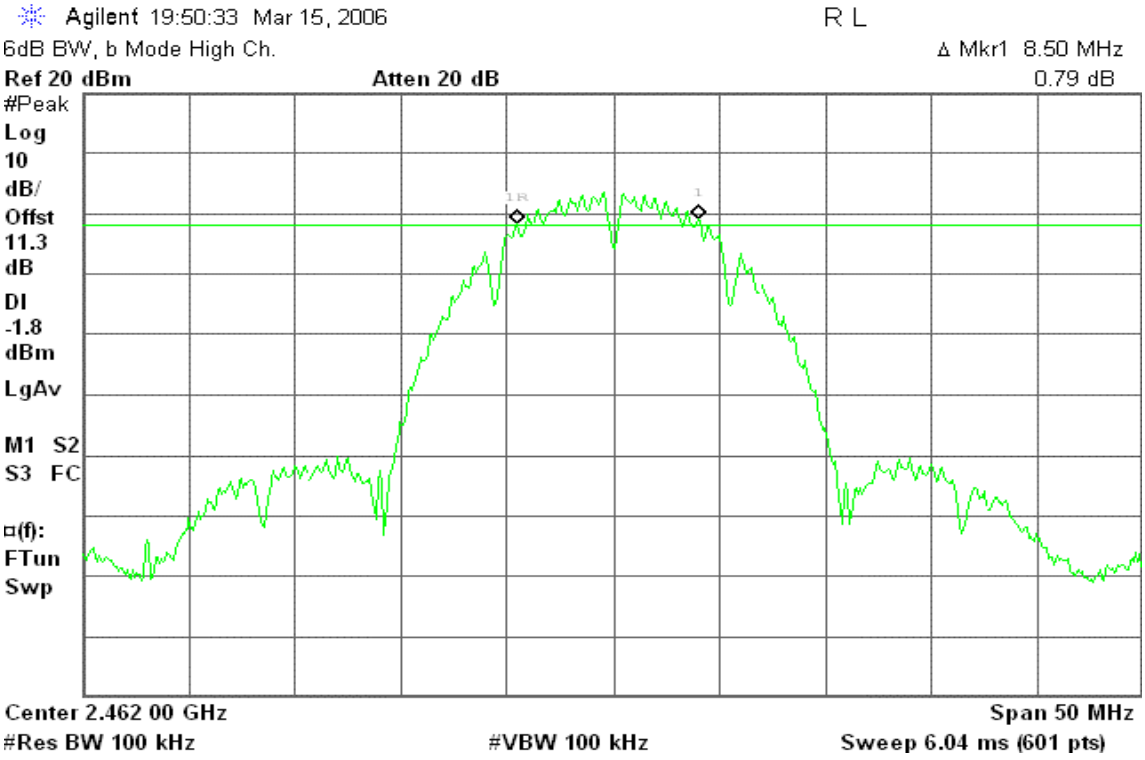
CH Low



CH Mid

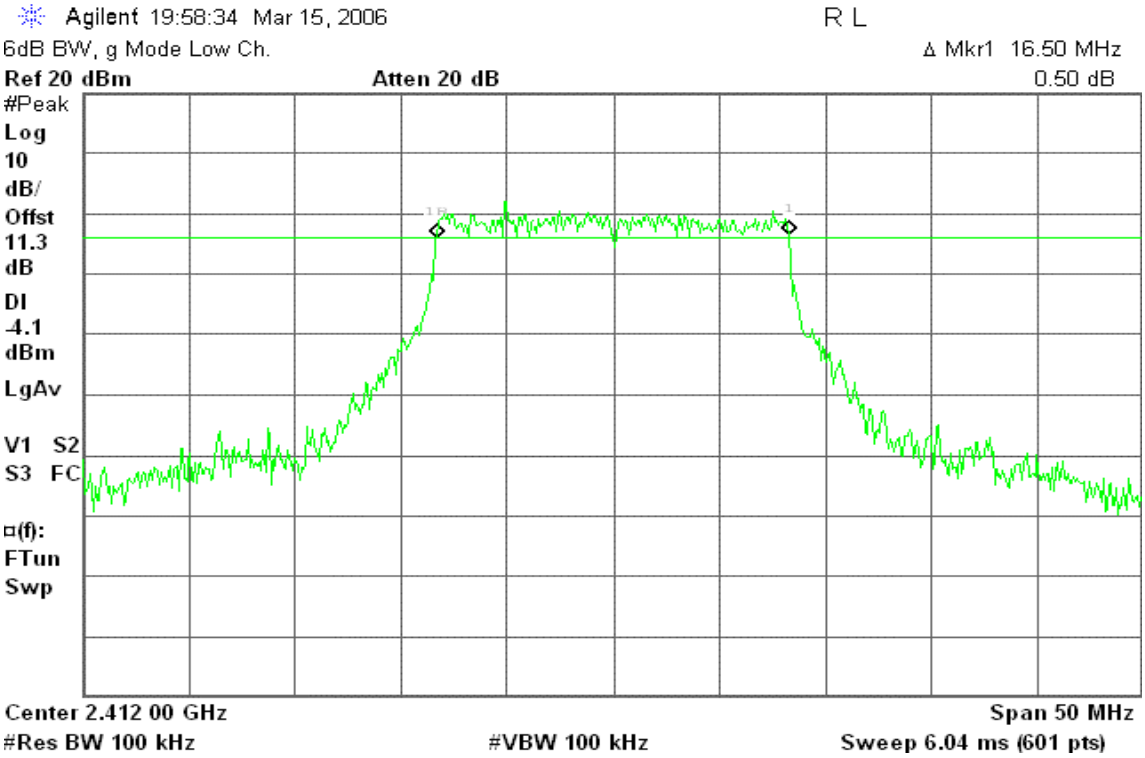


CH High

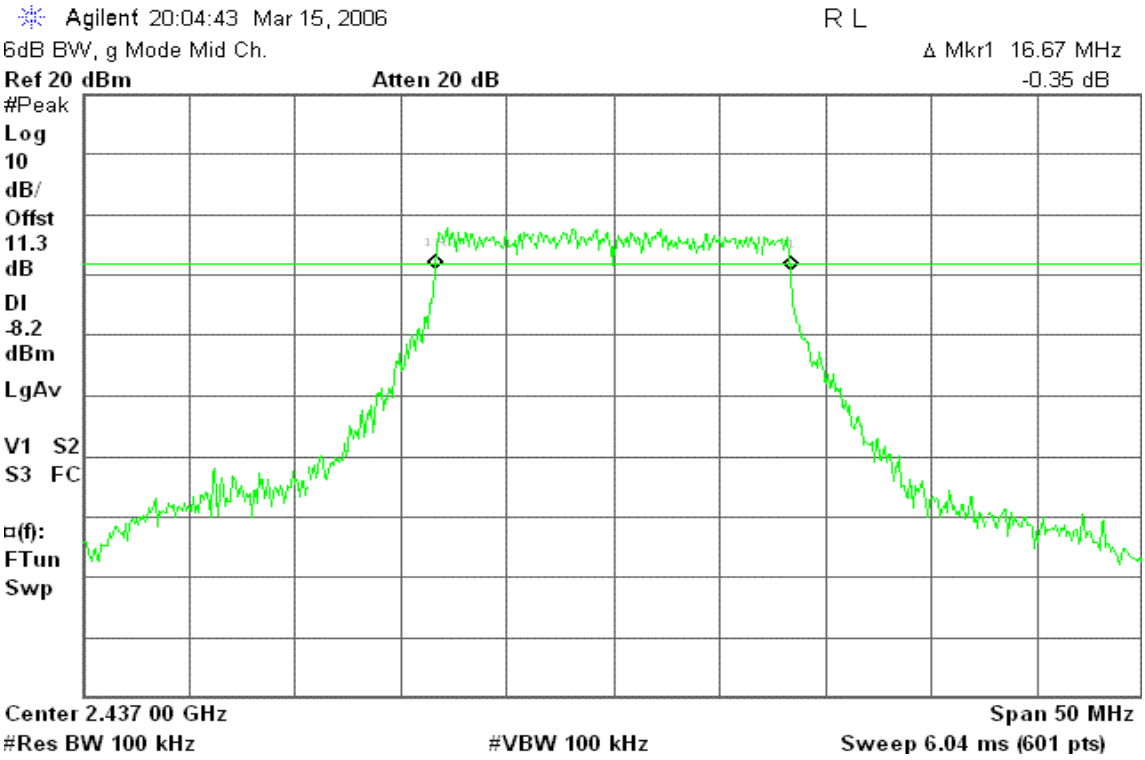


IEEE 802.11g

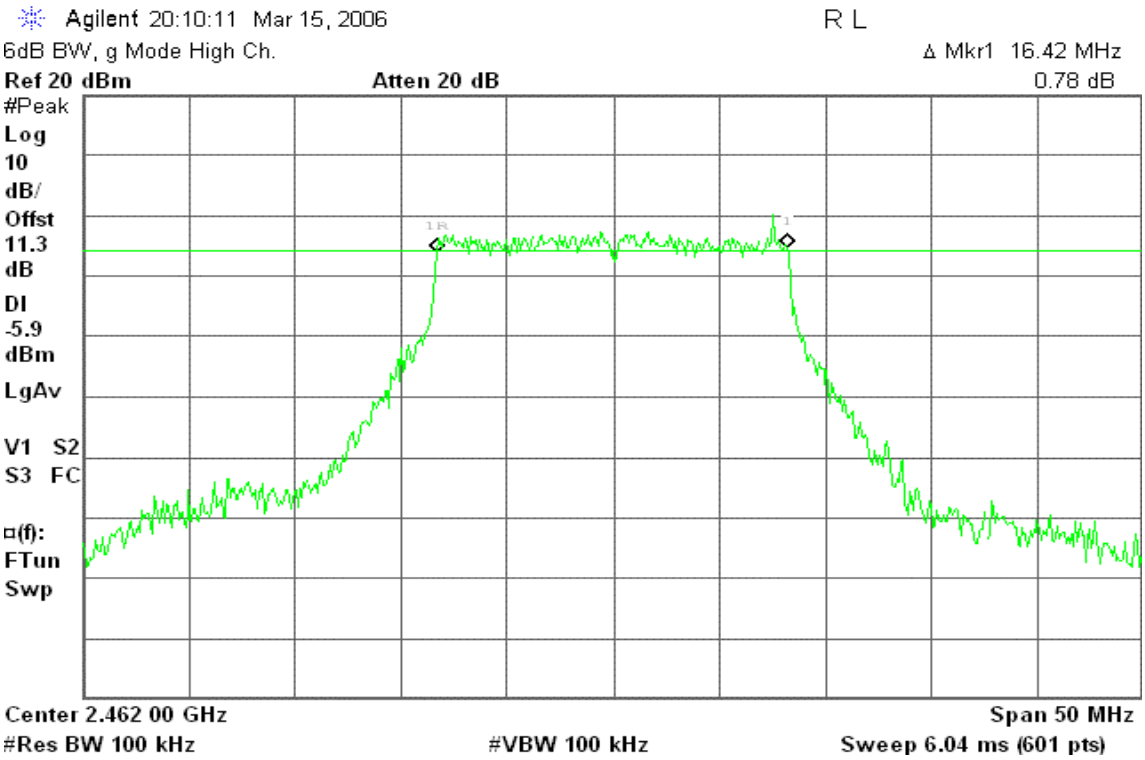
CH Low



CH Mid

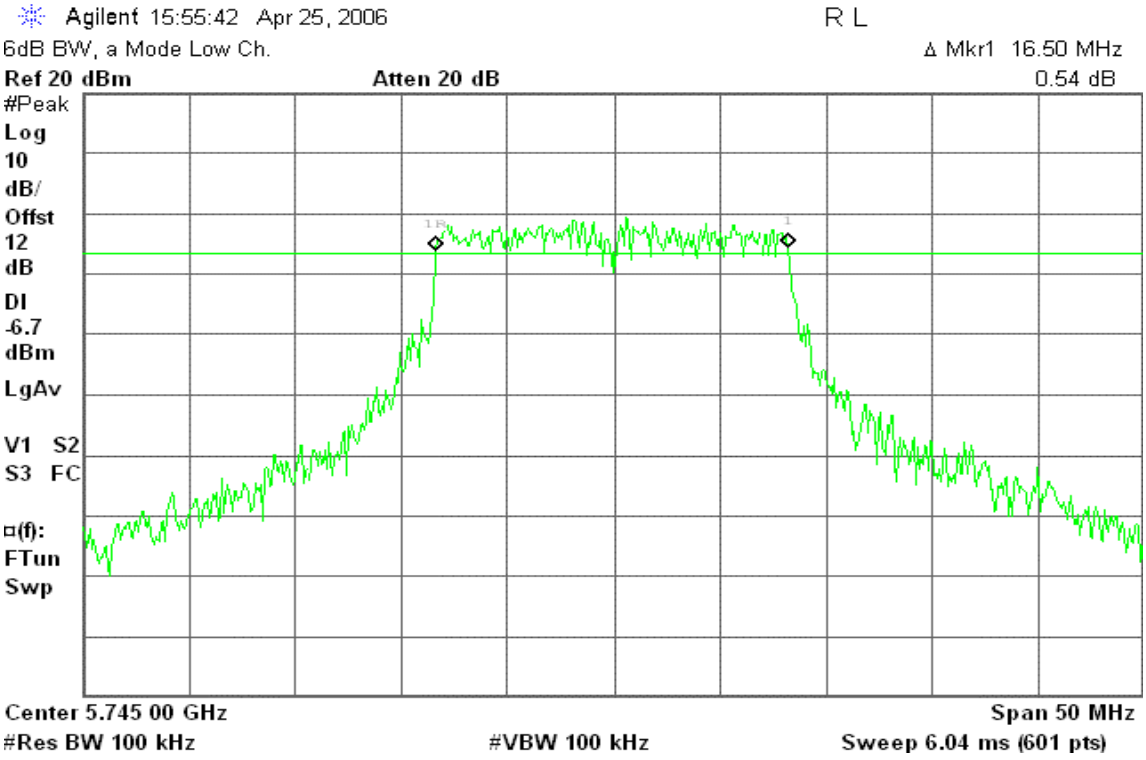


CH High

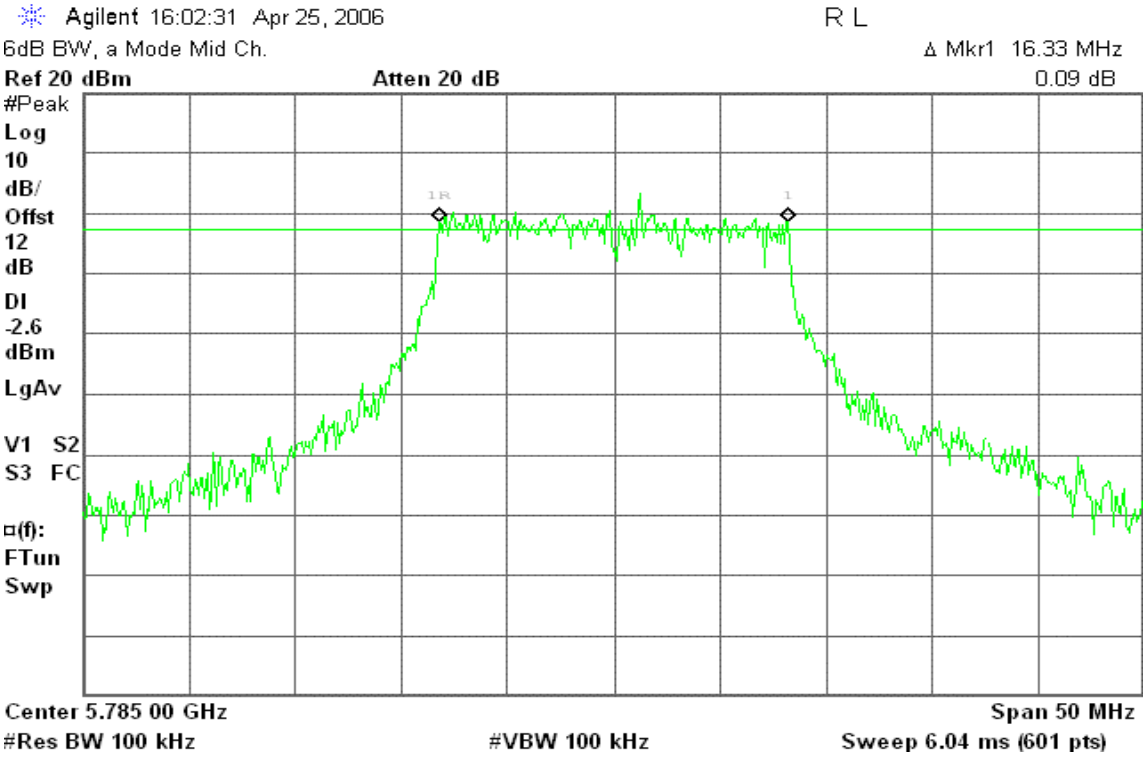


IEEE 802.11a

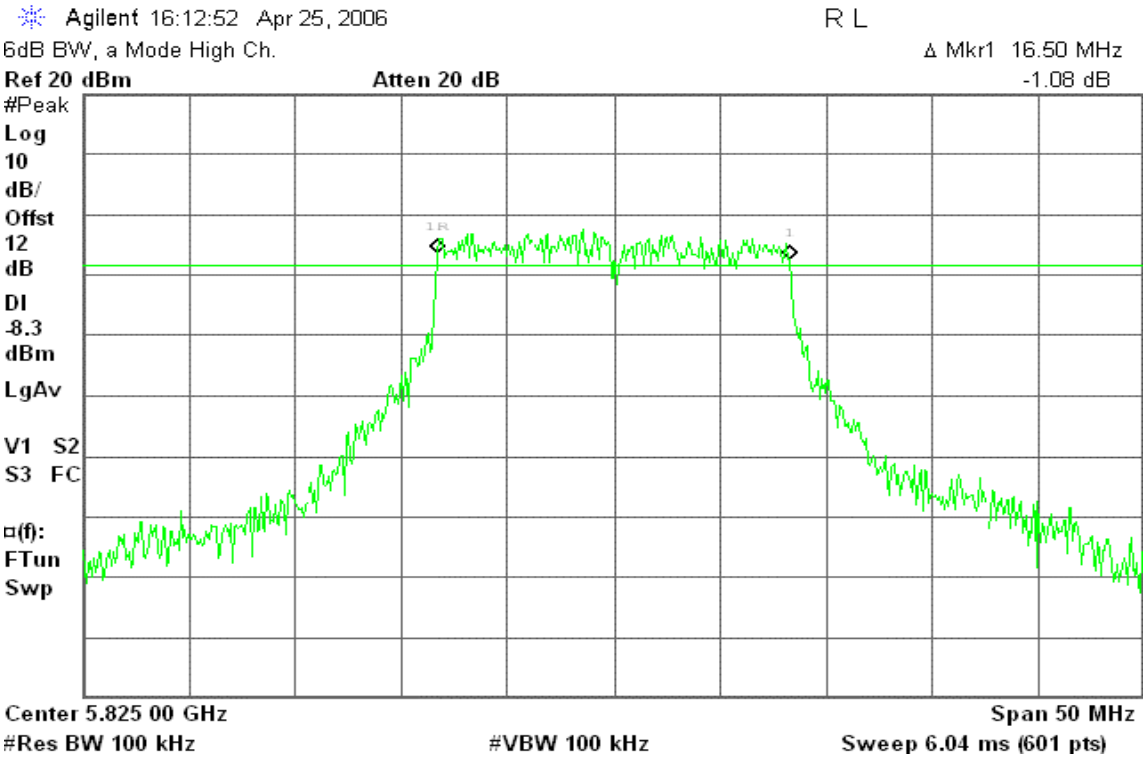
CH Low



CH Mid



CH High


Agilent 16:12:52 Apr 25, 2006
R L
6dB BW, a Mode High Ch.
Δ Mkr1 16.50 MHz
Ref 20 dBm
Atten 20 dB
-1.08 dB
#Peak
Log
10
dB/
Offst
12
dB
Dl
-8.3
dBm
LgAv
V1 S2
S3 FC
¤(f):
FTun
Swp
Center 5.825 00 GHz
Span 50 MHz
#Res BW 100 kHz
#VBW 100 kHz
Sweep 6.04 ms (601 pts)

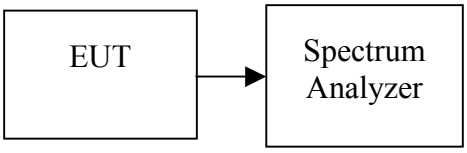
7.2PEAK POWER

LIMIT

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

1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (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 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)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2412	16.01	0.0399	1	PASS
Mid	2437	16.32	0.0429		PASS
High	2462	15.19	0.0330		PASS

Test mode: IEEE 802.11g

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2412	15.72	0.0373	1	PASS
Mid	2437	16.07	0.0405		PASS
High	2462	15.67	0.0369		PASS

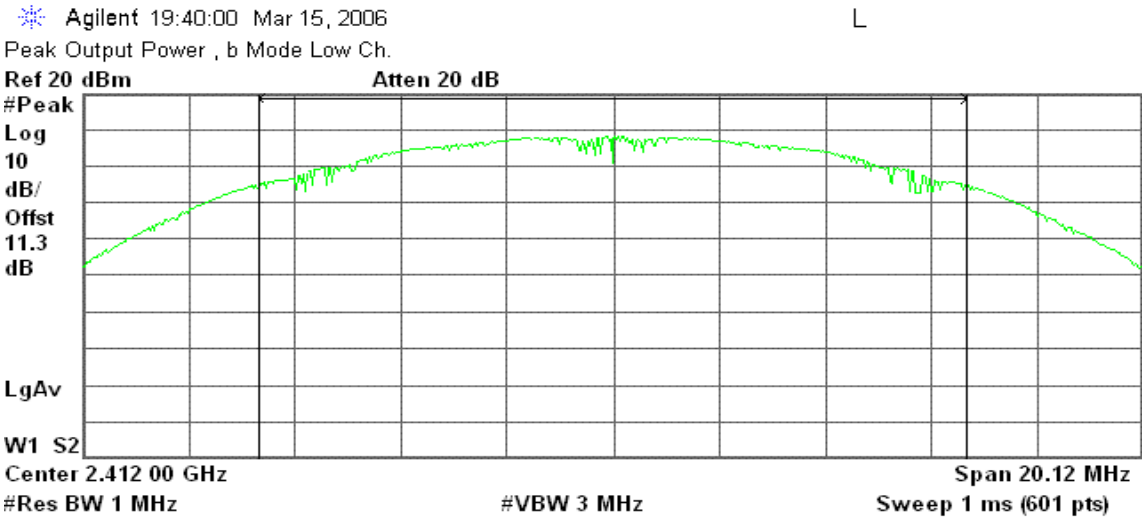
Test mode: IEEE 802.11a

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	5745	15.24	0.0334	1	PASS
Mid	5785	14.98	0.0315		PASS
High	5825	15.84	0.0384		PASS

Test Plot

IEEE 802.11b

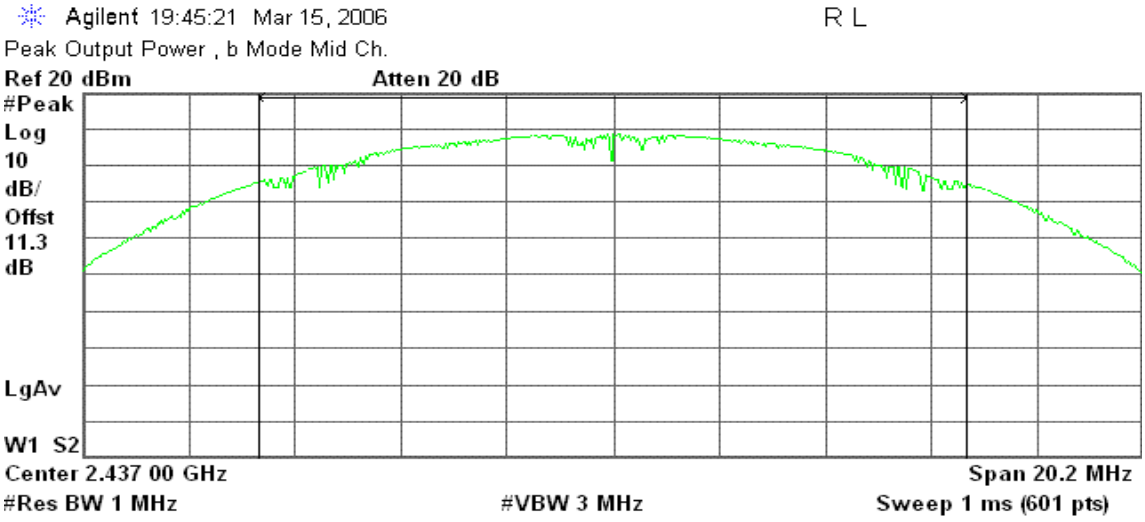
CH Low



Channel Power
16.01 dBm / 13.4130 MHz

Power Spectral Density
-55.27 dBm/Hz

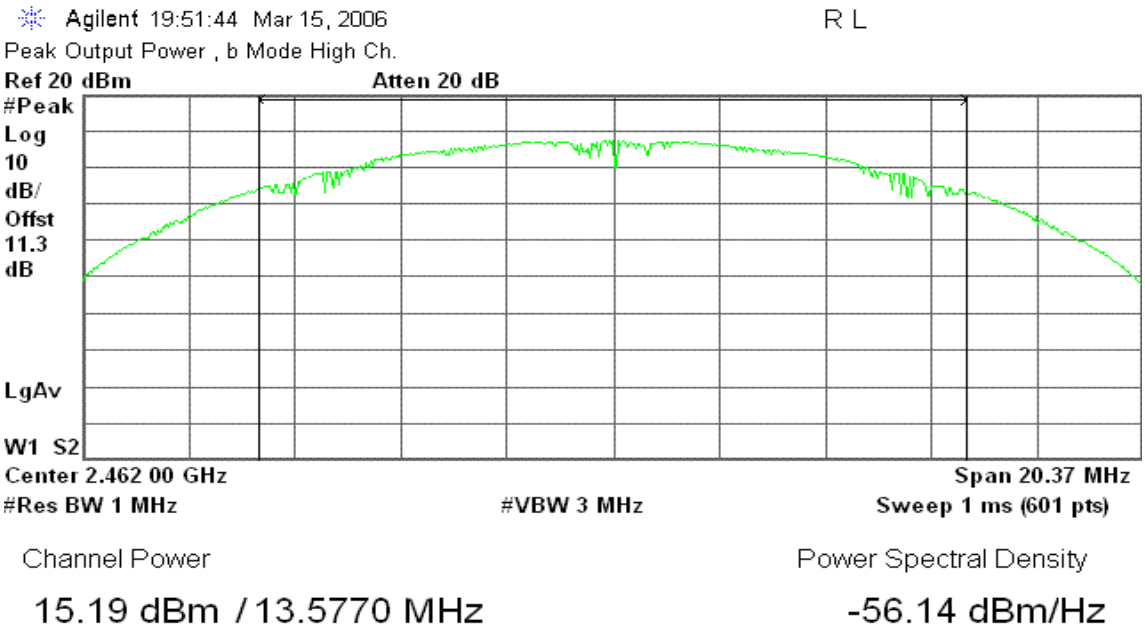
CH Mid



Channel Power
16.32 dBm / 13.4640 MHz

Power Spectral Density
-54.97 dBm/Hz

CH High

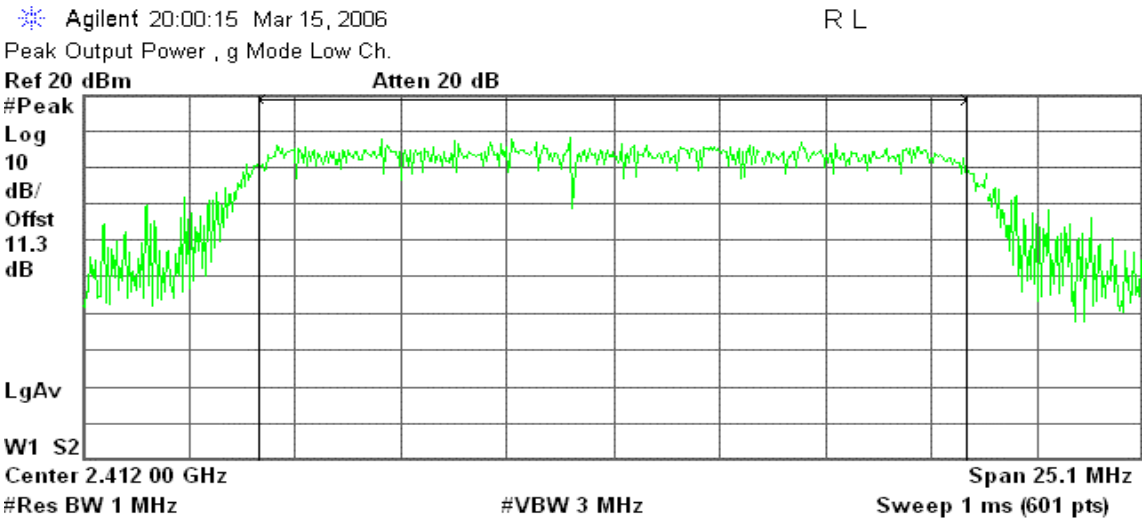


Channel Power
15.19 dBm / 13.5770 MHz

Power Spectral Density
-56.14 dBm/Hz

IEEE 802.11g

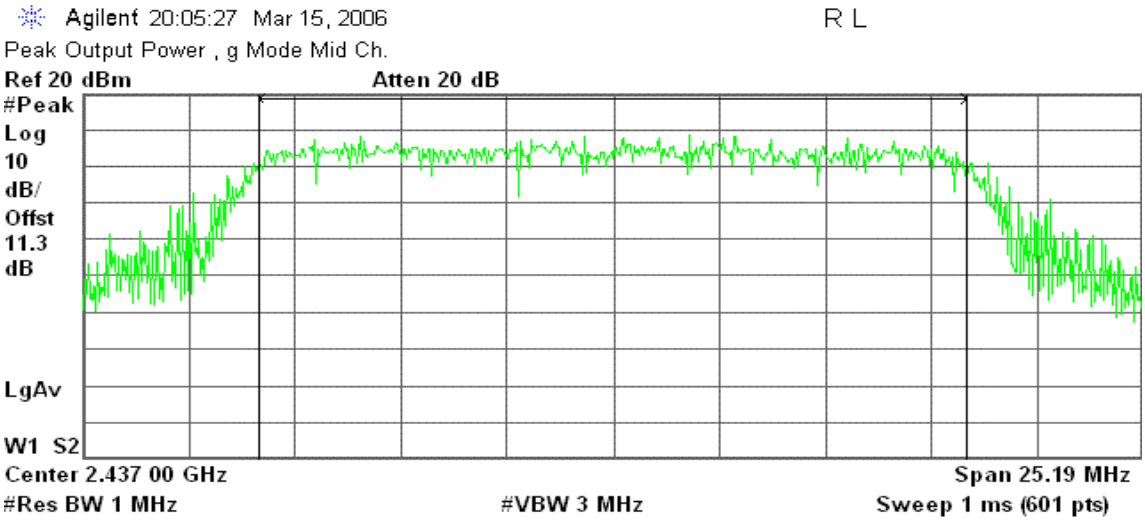
CH Low



Channel Power
15.72 dBm / 16.7330 MHz

Power Spectral Density
-56.51 dBm/Hz

CH Mid



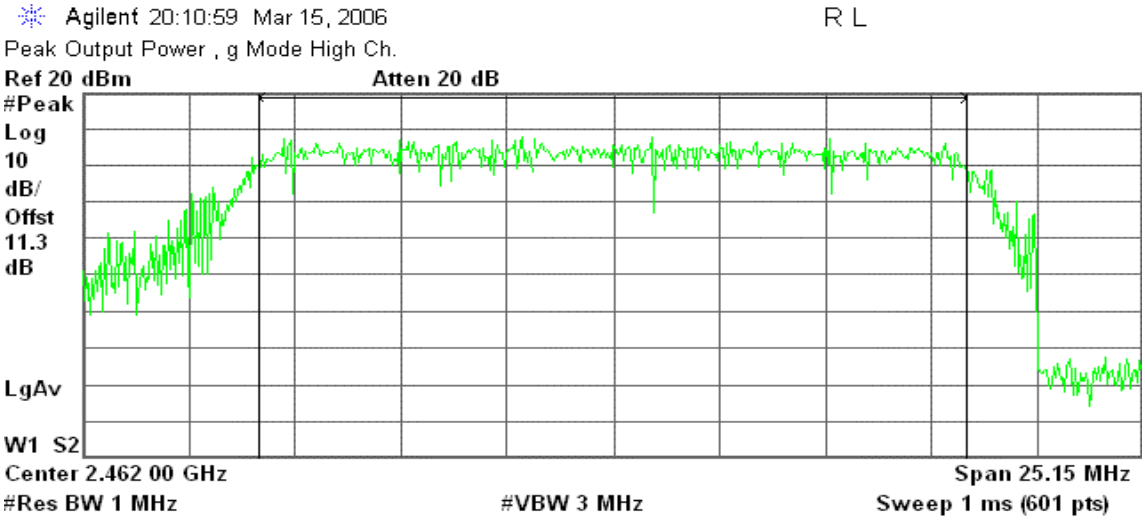
Channel Power

16.07 dBm / 16.7940 MHz

Power Spectral Density

-56.18 dBm/Hz

CH High



Channel Power

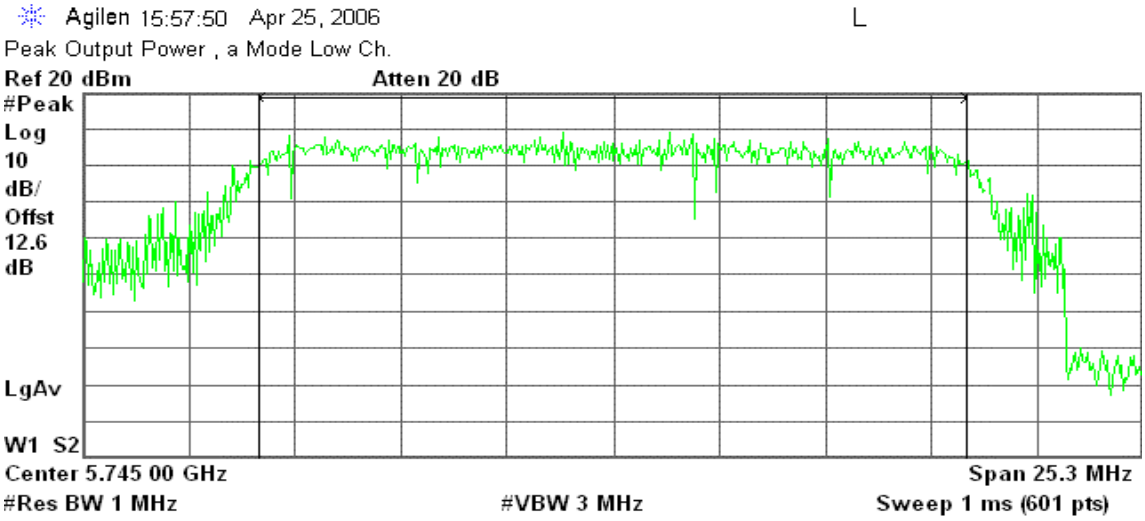
15.67 dBm / 16.7660 MHz

Power Spectral Density

-56.57 dBm/Hz

IEEE 802.11a

CH Low



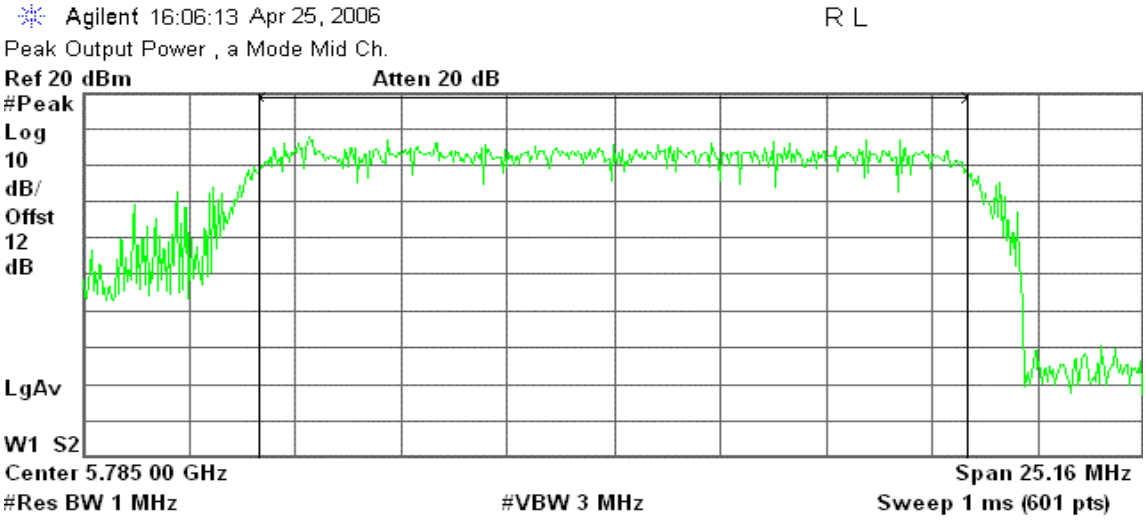
Channel Power

15.24 dBm / 16.8640 MHz

Power Spectral Density

-56.03 dBm/Hz

CH Mid



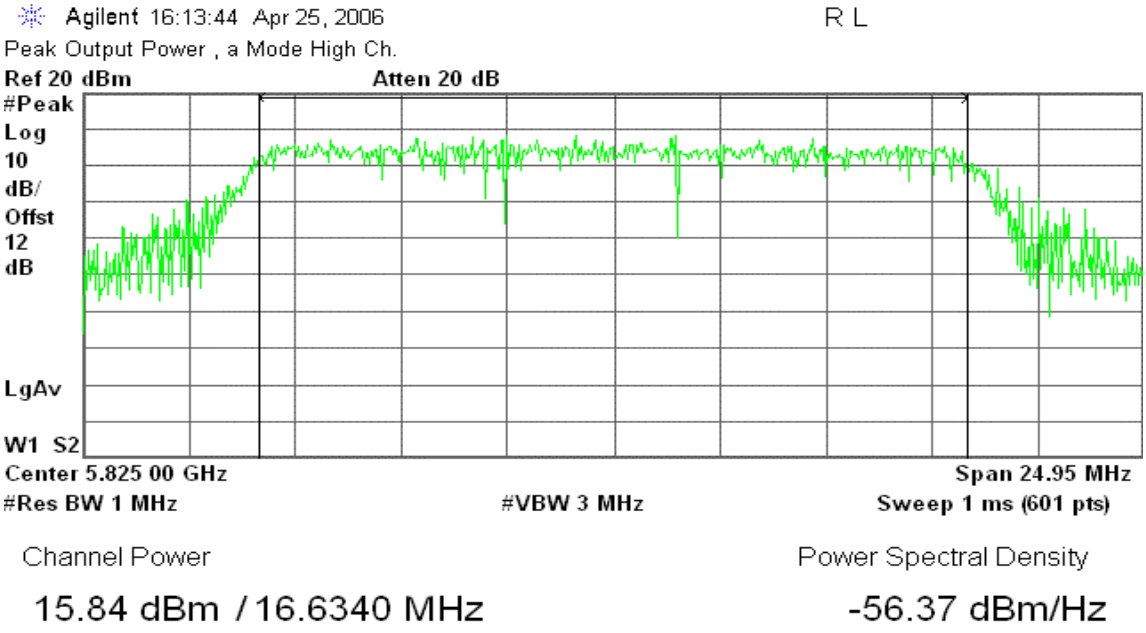
Channel Power

14.98 dBm / 16.7760 MHz

Power Spectral Density

-57.27 dBm/Hz

CH High



Channel Power

15.84 dBm / 16.6340 MHz

Power Spectral Density

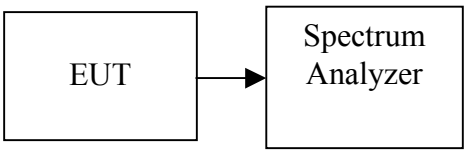
-56.37 dBm/Hz

7.3AVERAGE POWER

LIMIT

None; for reporting purposes only.

Test Configuration



TEST PROCEDURE

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

TEST RESULTS

No non-compliance noted.

Test Data

Test mode: IEEE 802.11b

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2412	13.45	0.0221
Mid	2437	13.81	0.0240
High	2462	12.49	0.0177

Test mode: IEEE 802.11g

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2412	12.53	0.0179
Mid	2437	12.77	0.0189
High	2462	12.21	0.0166

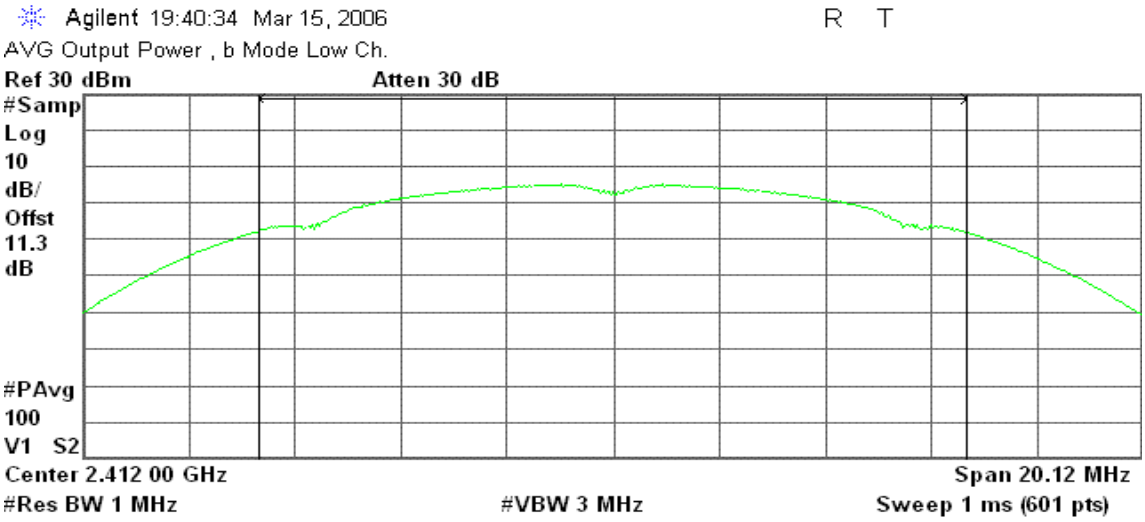
Test mode: IEEE 802.11a

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	5745	13.42	0.0220
Mid	5785	11.75	0.0150
High	5825	12.23	0.0167

Test Plot

IEEE 802.11b

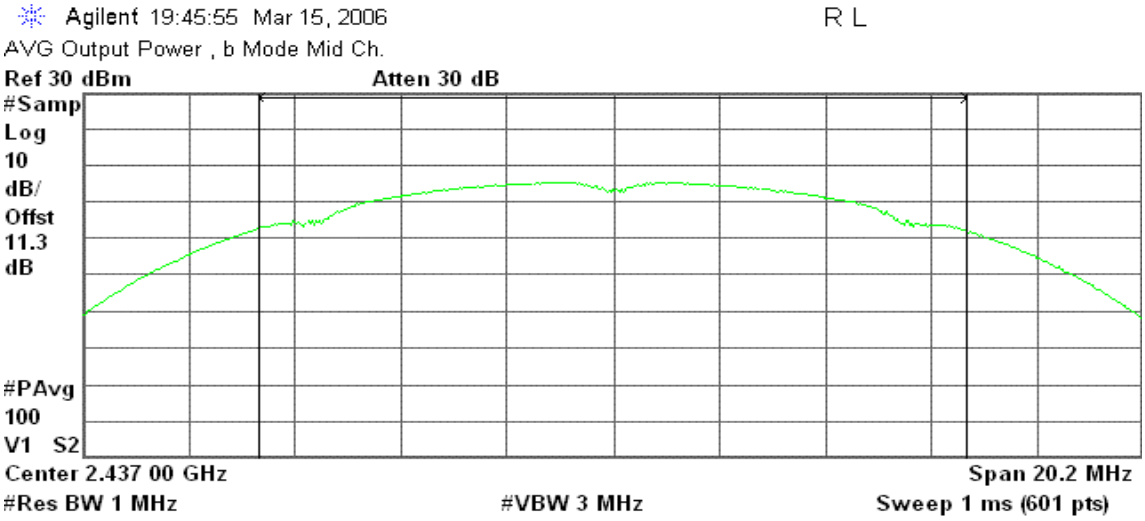
CH Low



Channel Power
13.45 dBm / 13.4130 MHz

Power Spectral Density
-57.83 dBm/Hz

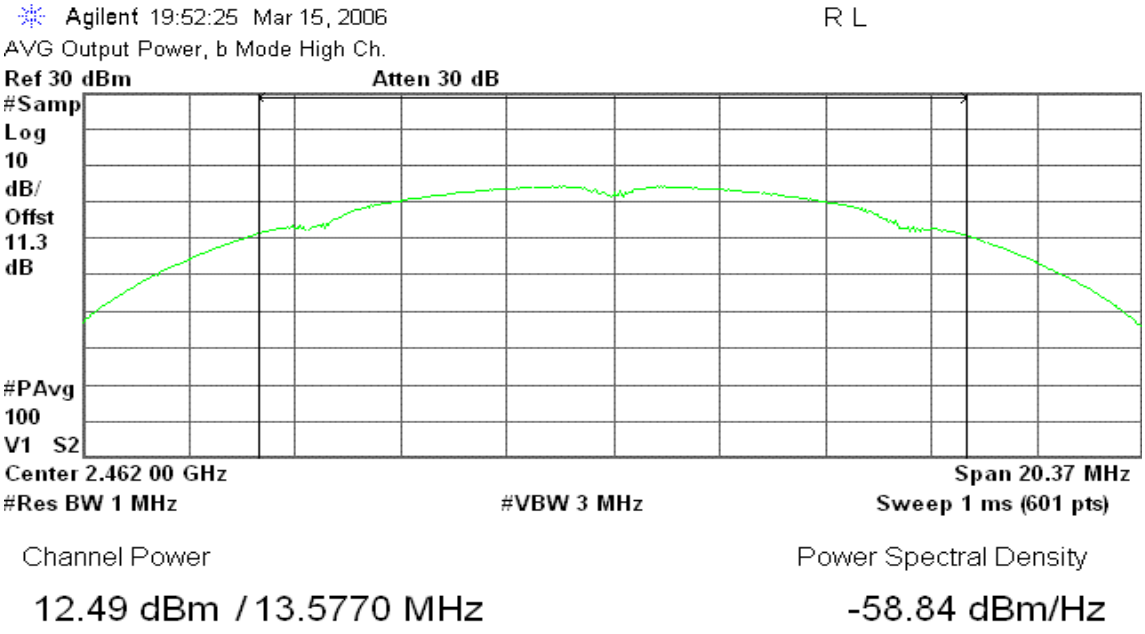
CH Mid



Channel Power
13.81 dBm / 13.4640 MHz

Power Spectral Density
-57.48 dBm/Hz

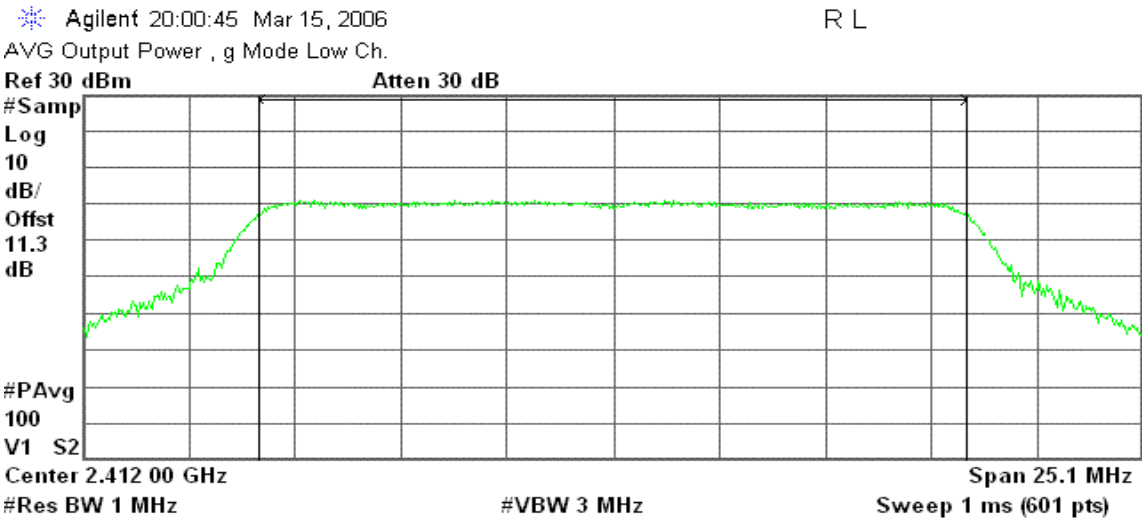
CH High



Channel Power	Power Spectral Density
12.49 dBm / 13.5770 MHz	-58.84 dBm/Hz

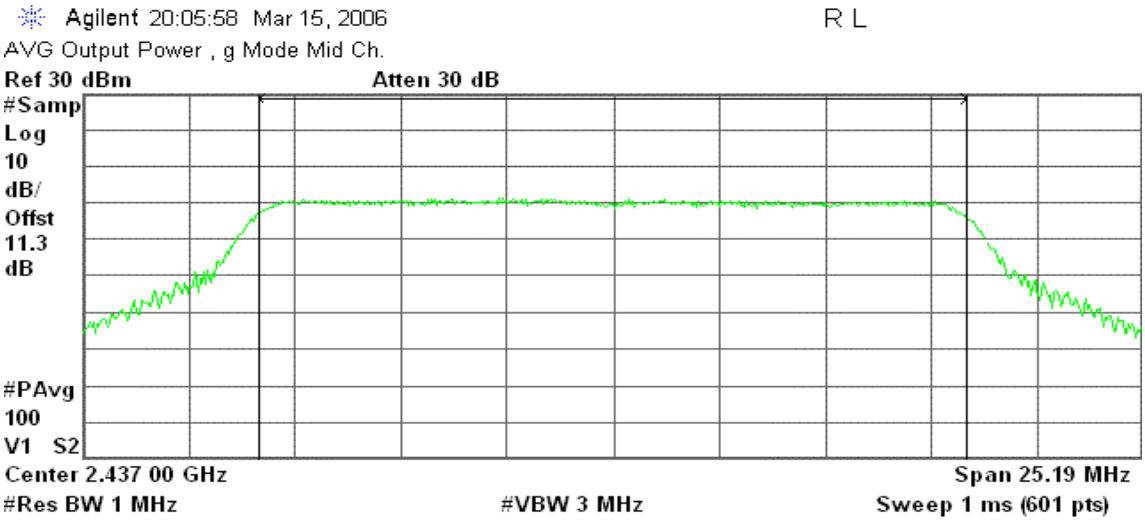
IEEE 802.11g

CH Low



Channel Power	Power Spectral Density
12.53 dBm / 16.7330 MHz	-59.70 dBm/Hz

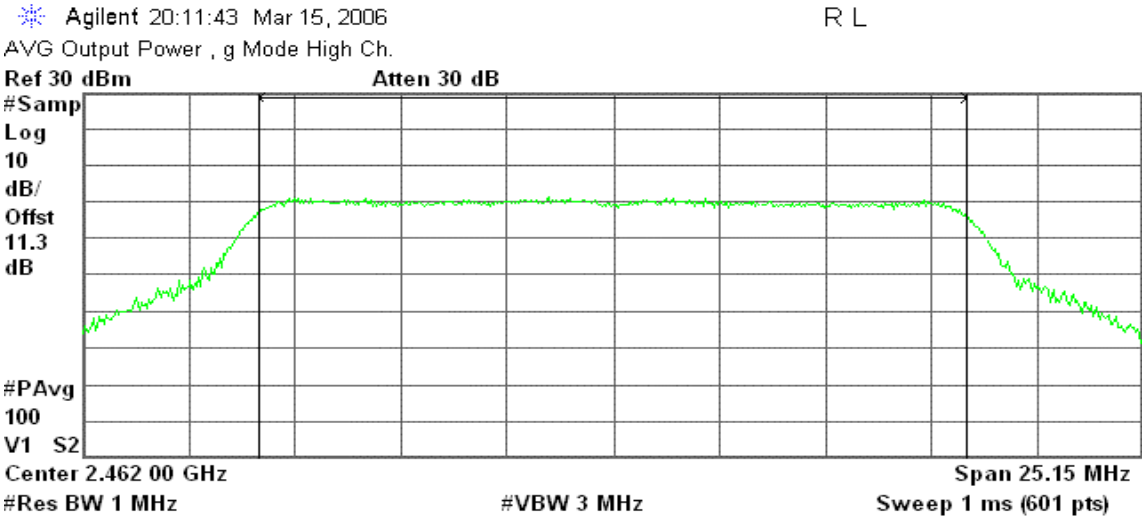
CH Mid



Channel Power
12.77 dBm / 16.7940 MHz

Power Spectral Density
-59.48 dBm/Hz

CH High

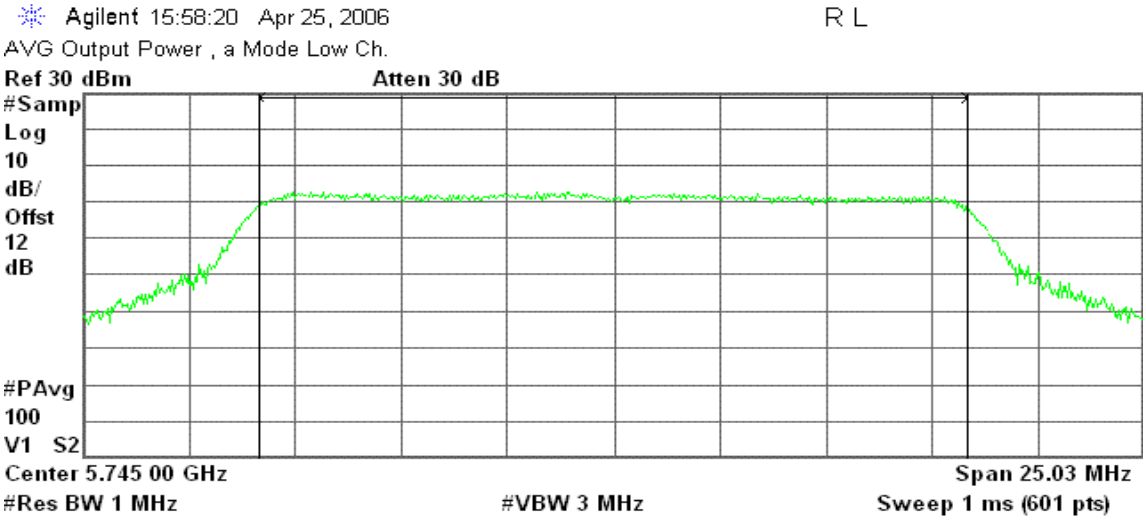


Channel Power
12.21 dBm / 16.7660 MHz

Power Spectral Density
-60.03 dBm/Hz

IEEE 802.11a

CH Low



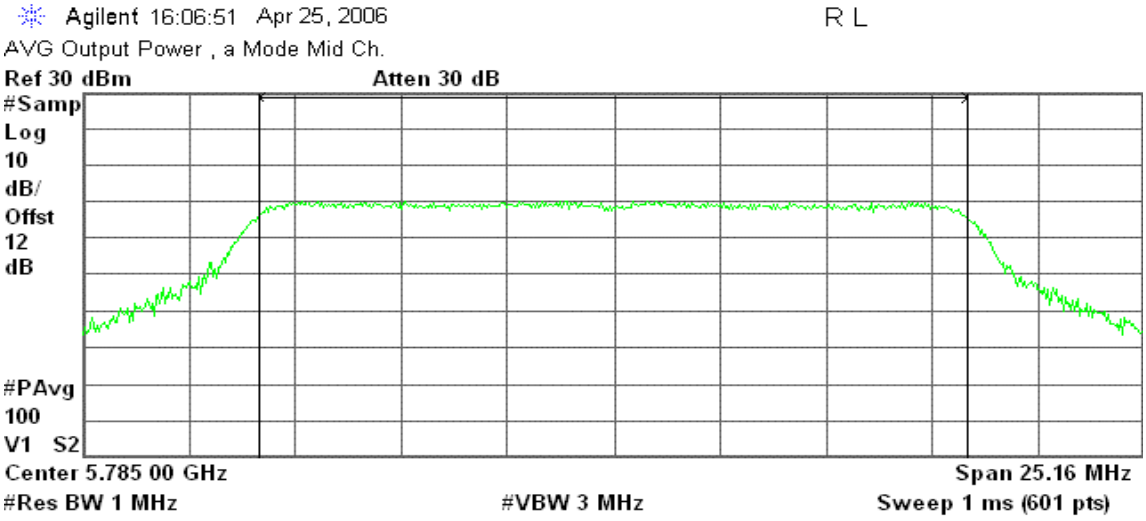
Channel Power

13.42 dBm / 16.6880 MHz

Power Spectral Density

-58.80 dBm/Hz

CH Mid



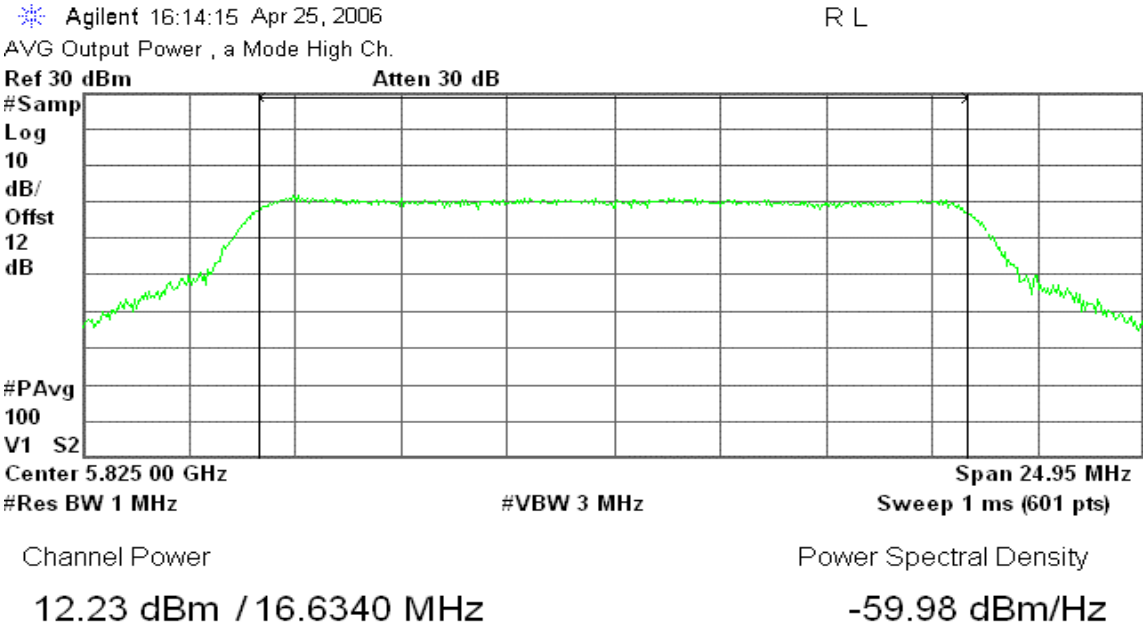
Channel Power

11.75 dBm / 16.7760 MHz

Power Spectral Density

-60.49 dBm/Hz

CH High



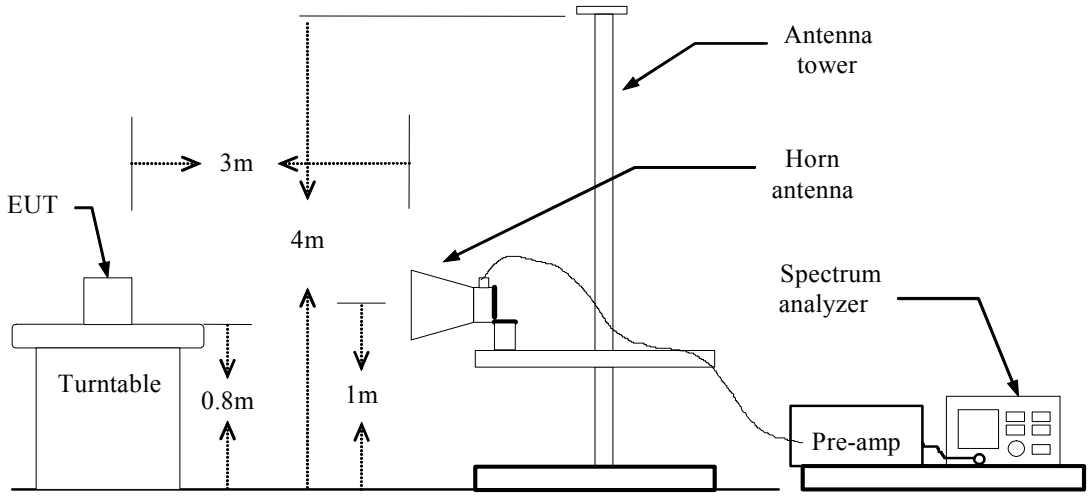
Channel Power	Power Spectral Density
12.23 dBm / 16.6340 MHz	-59.98 dBm/Hz

7.4BAND EDGES MEASUREMENT

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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. 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 Section 15.205(c)).

Test Configuration



TEST PROCEDURE

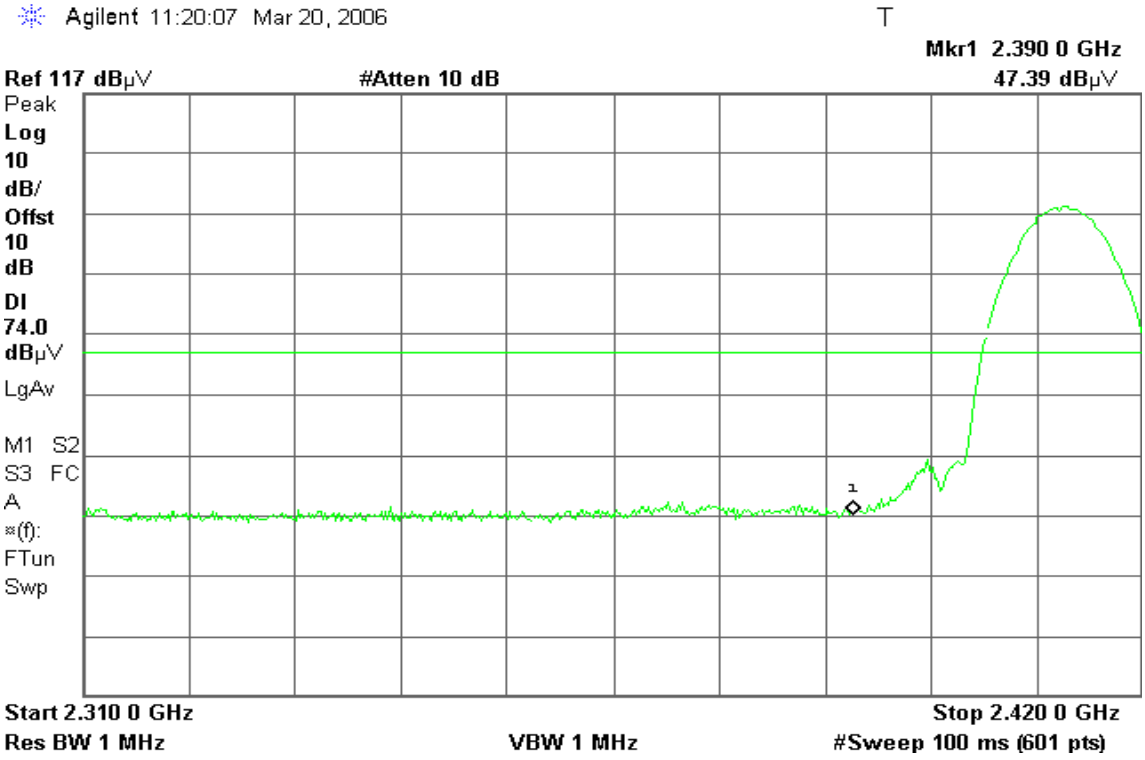
1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the 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

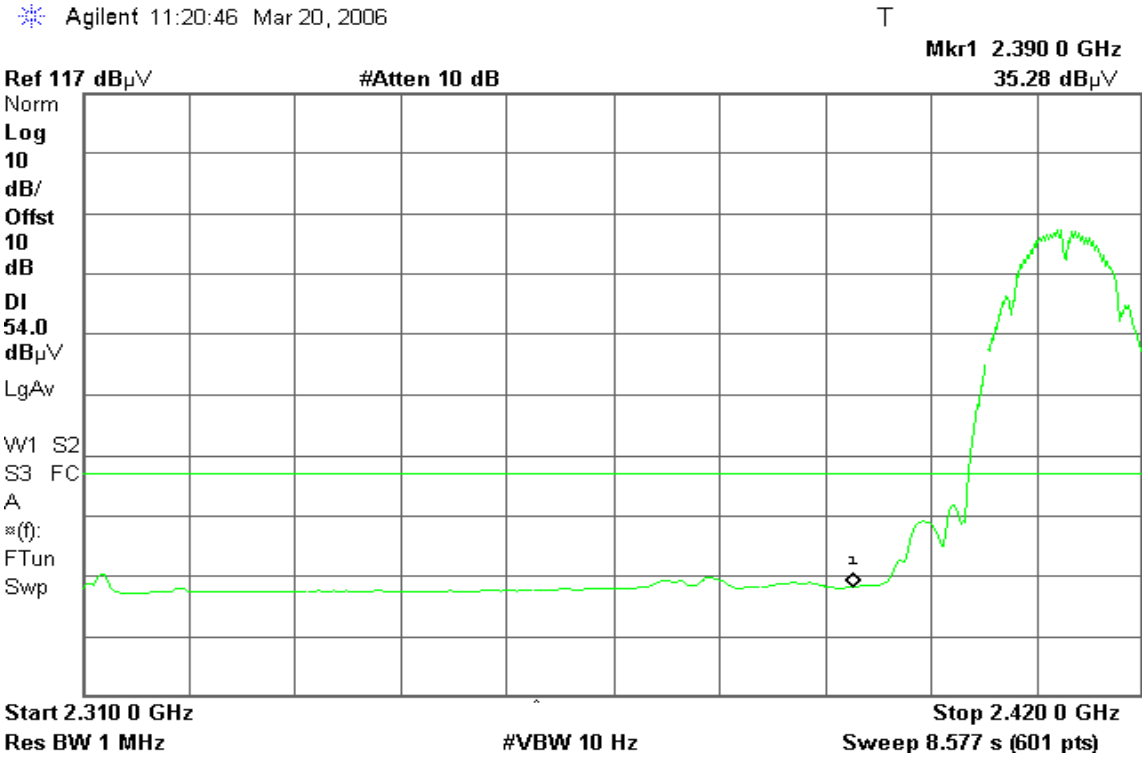
Refer to attach spectrum analyzer data chart.

Band Edges (IEEE 802.11b / CH Low)

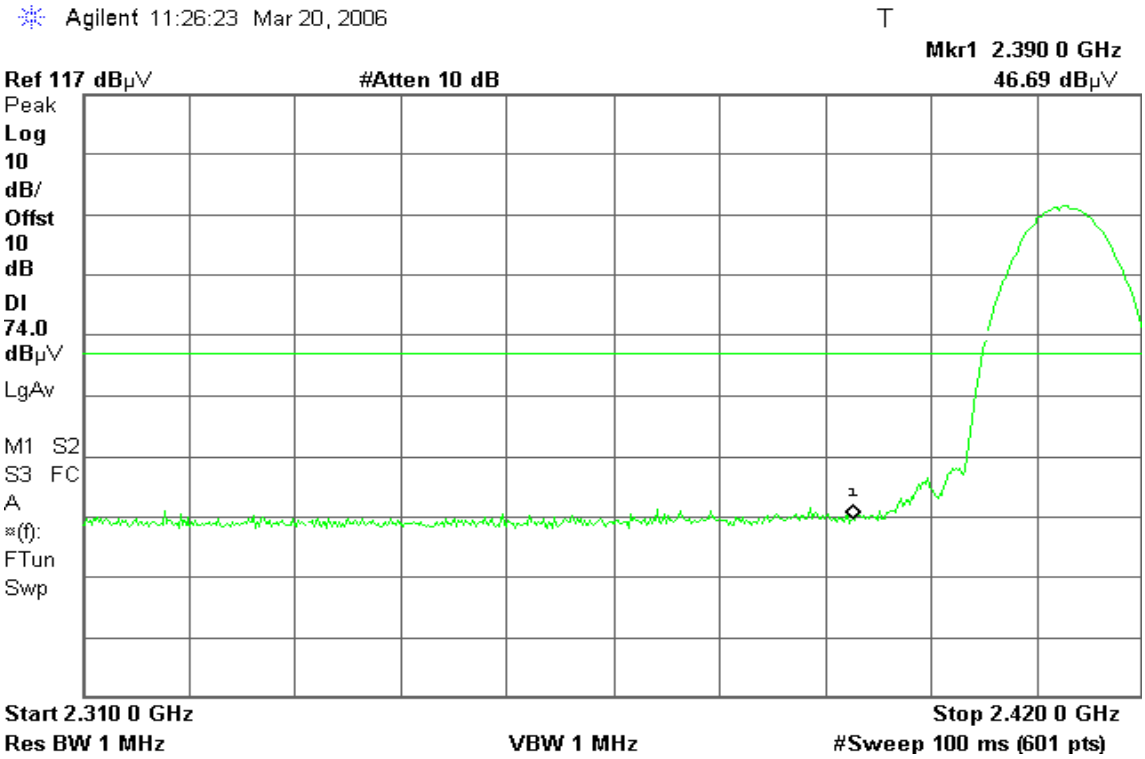
Detector mode: Peak Polarity: Vertical



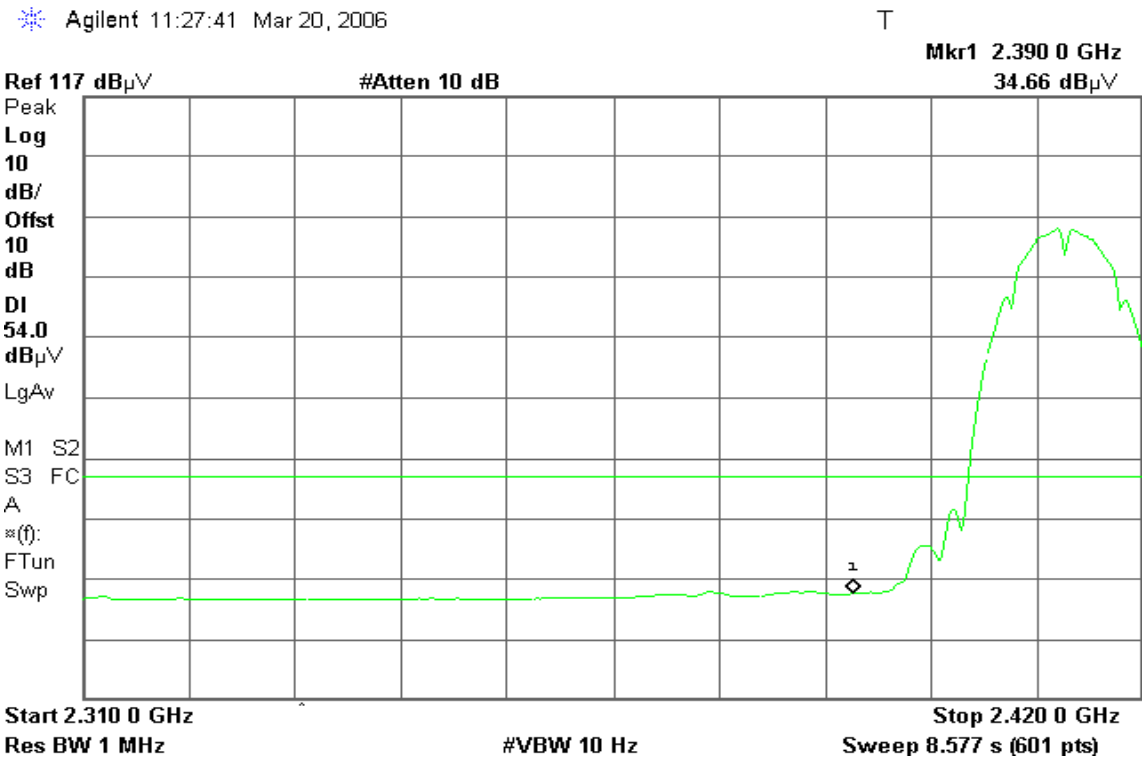
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**

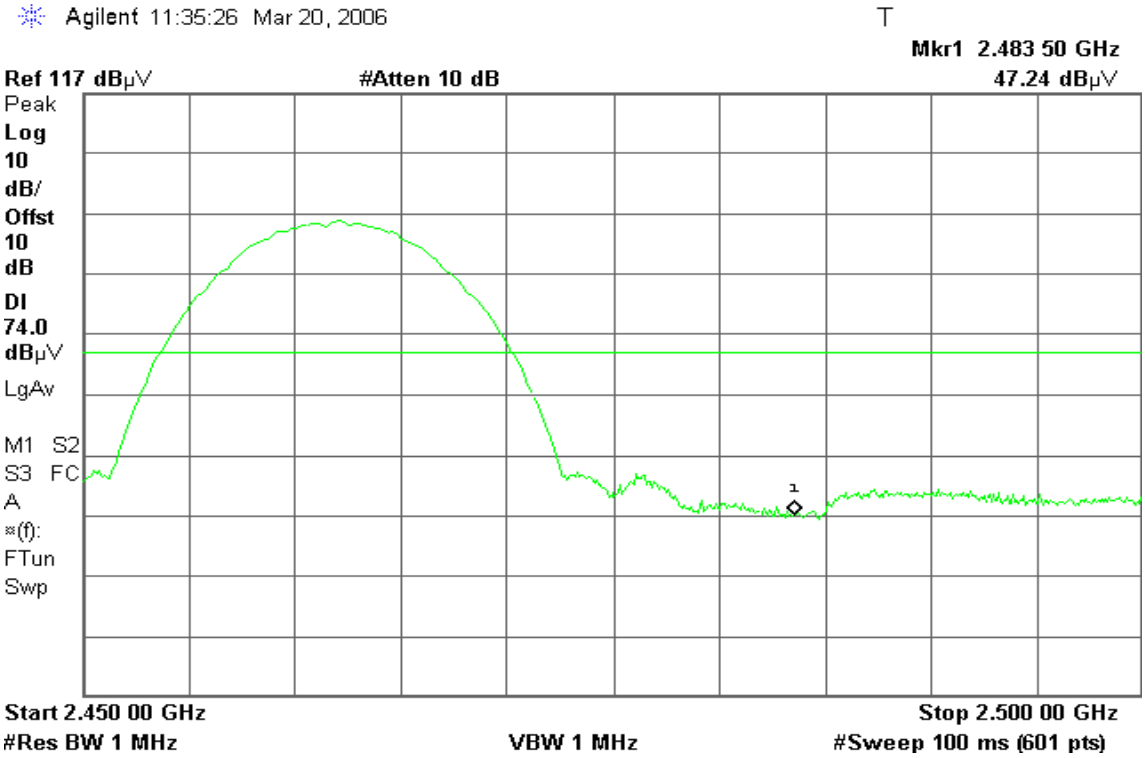


Detector mode: Average **Polarity: Horizontal**

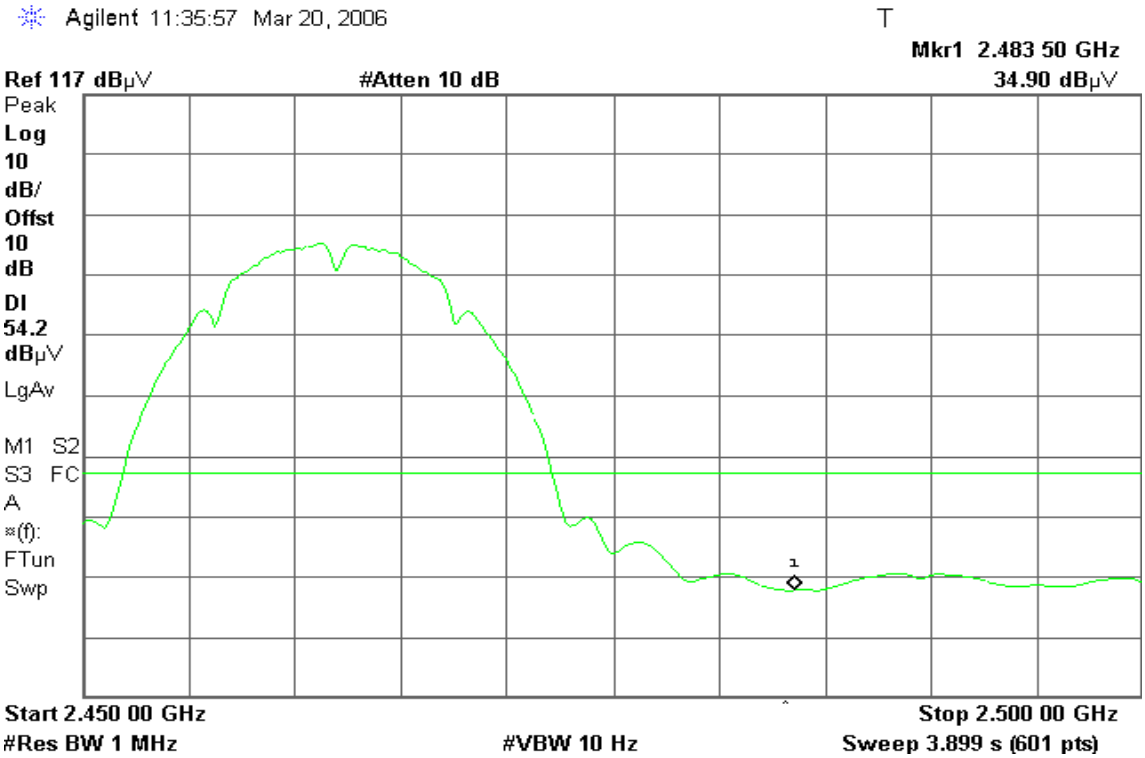


Band Edges (IEEE 802.11b / CH High)

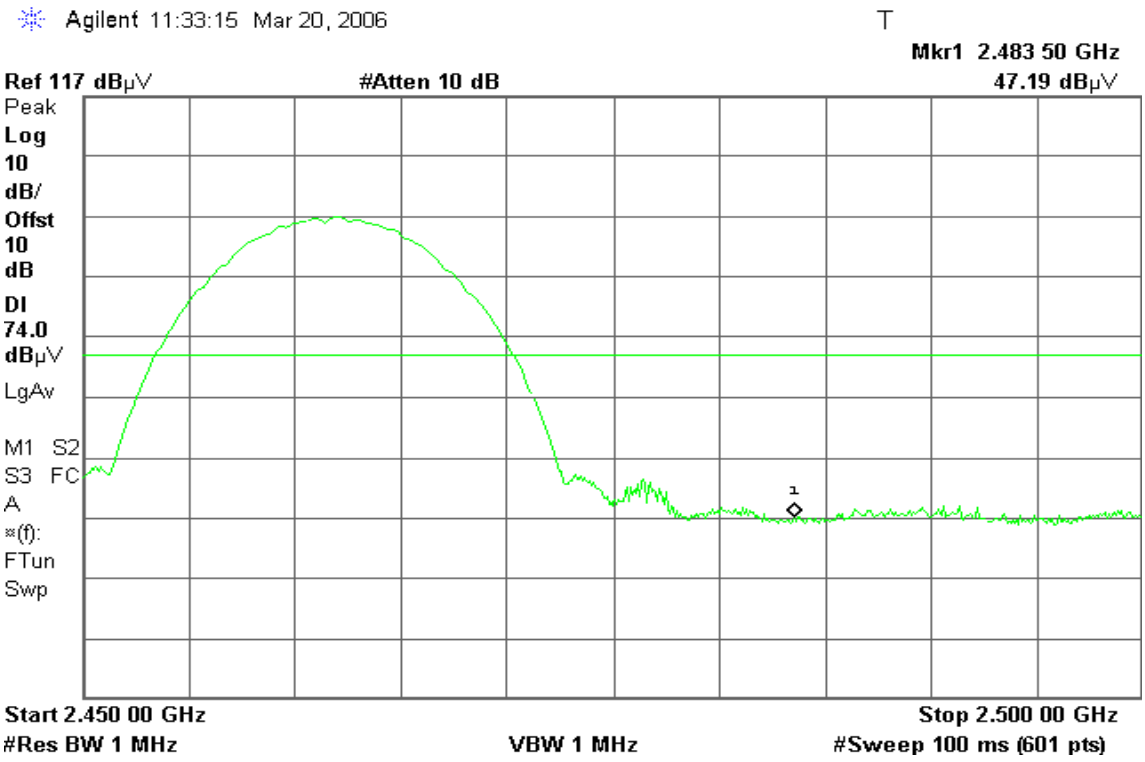
Detector mode: Peak Polarity: Vertical



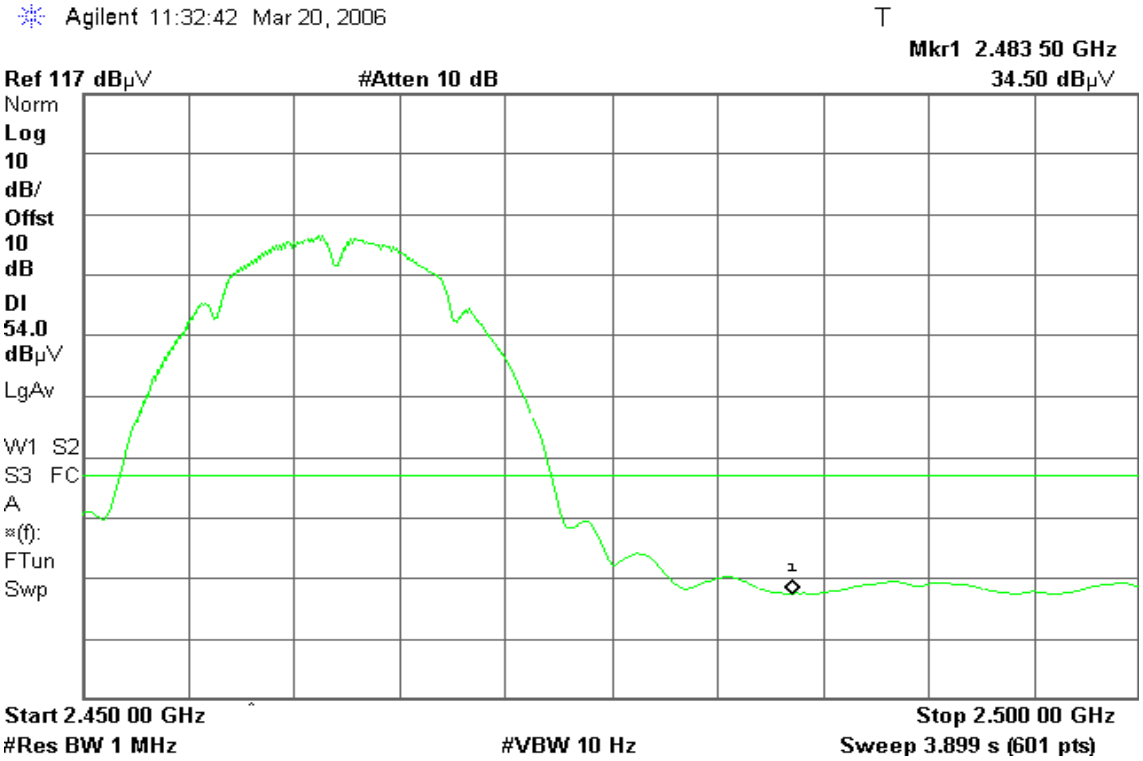
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**

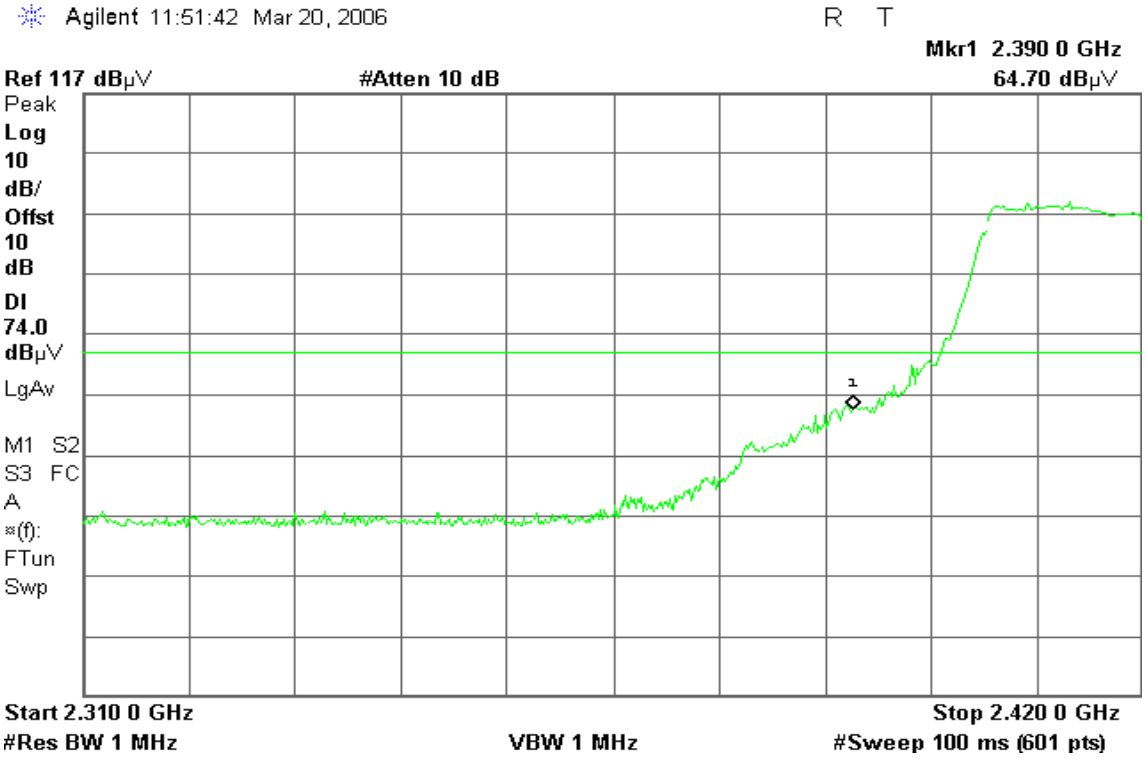


Detector mode: Average **Polarity: Horizontal**

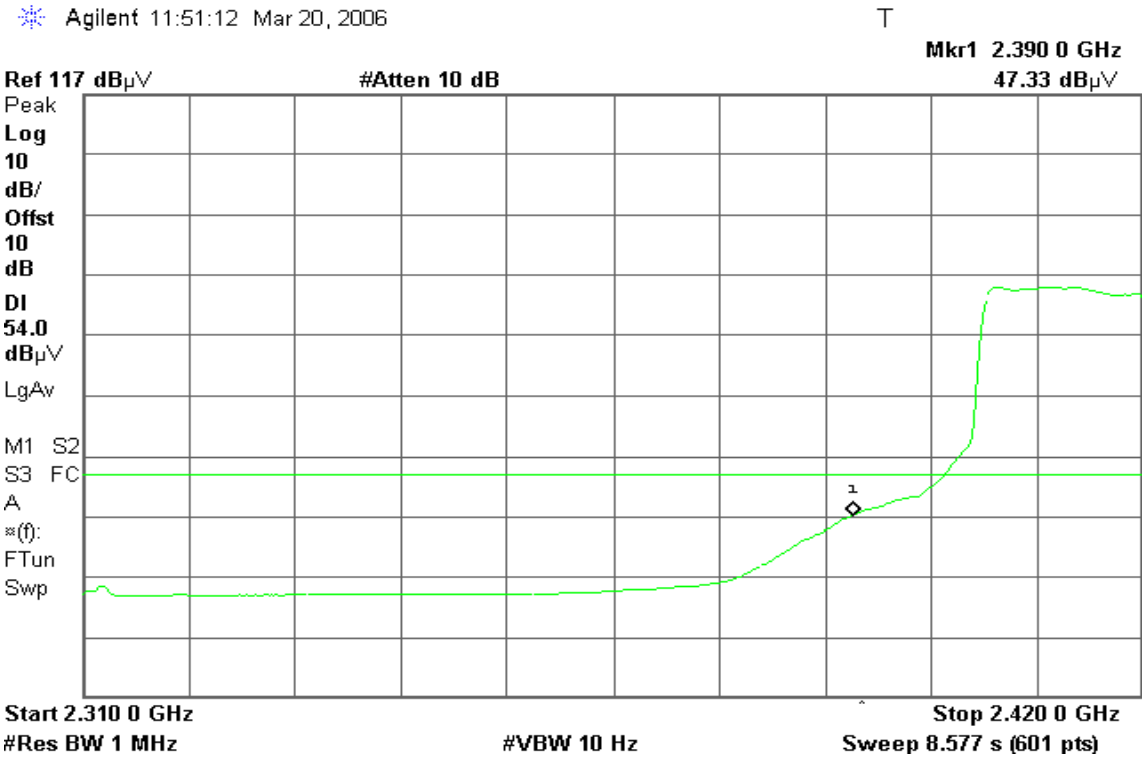


Band Edges (IEEE 802.11g / CH Low)

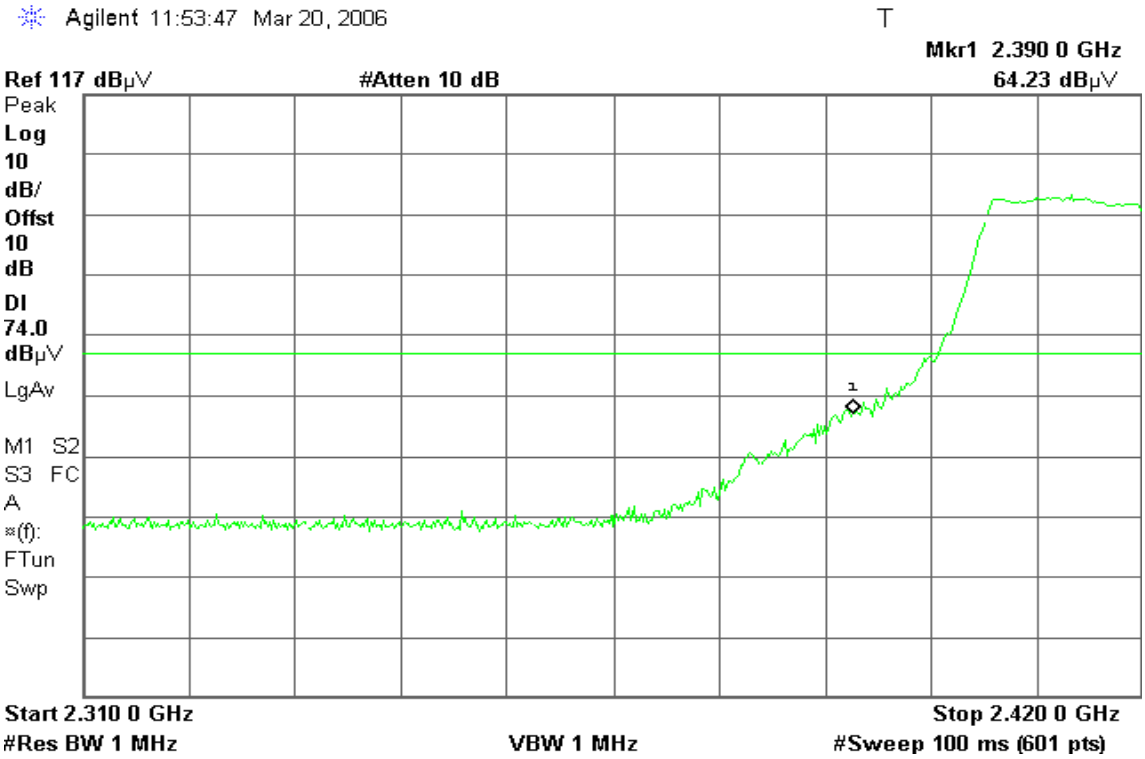
Detector mode: Peak Polarity: Vertical



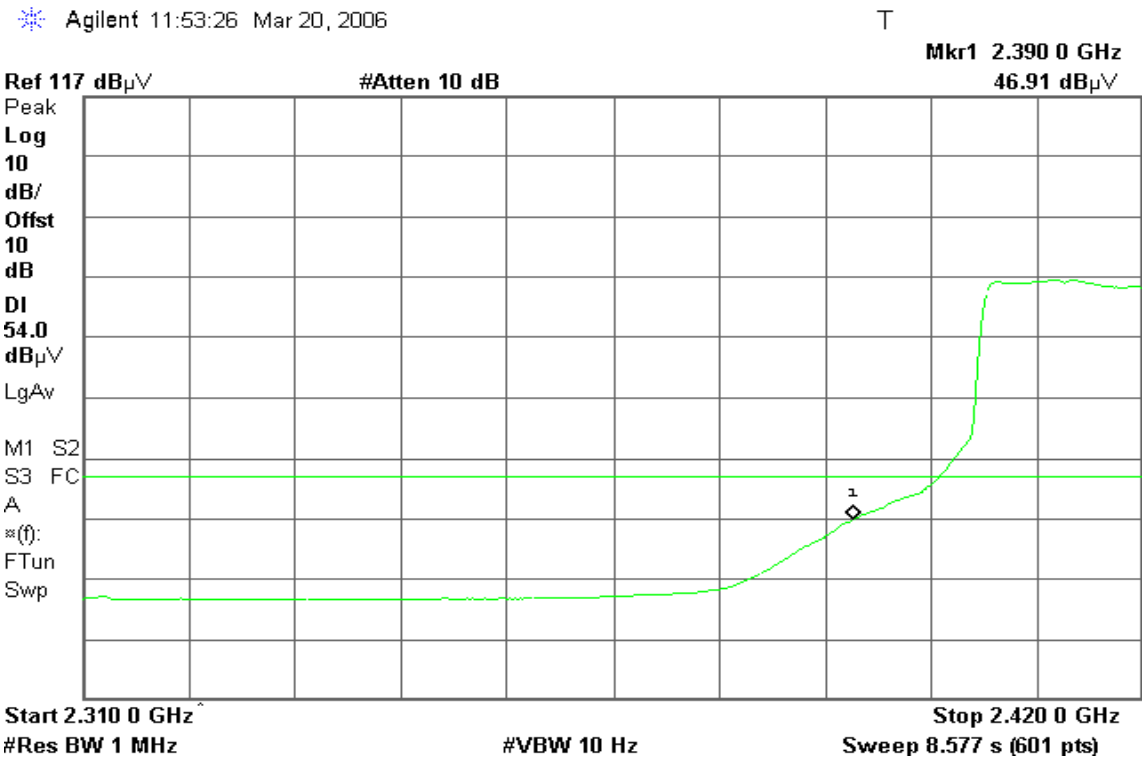
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**

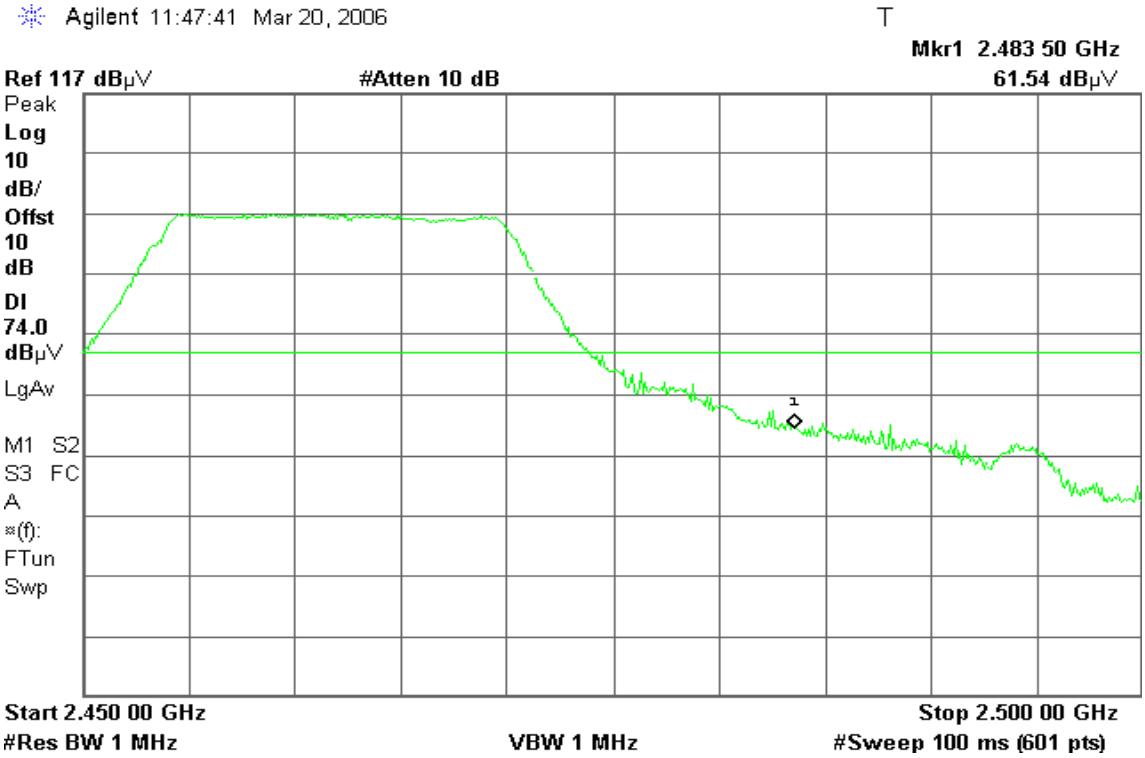


Detector mode: Average **Polarity: Horizontal**

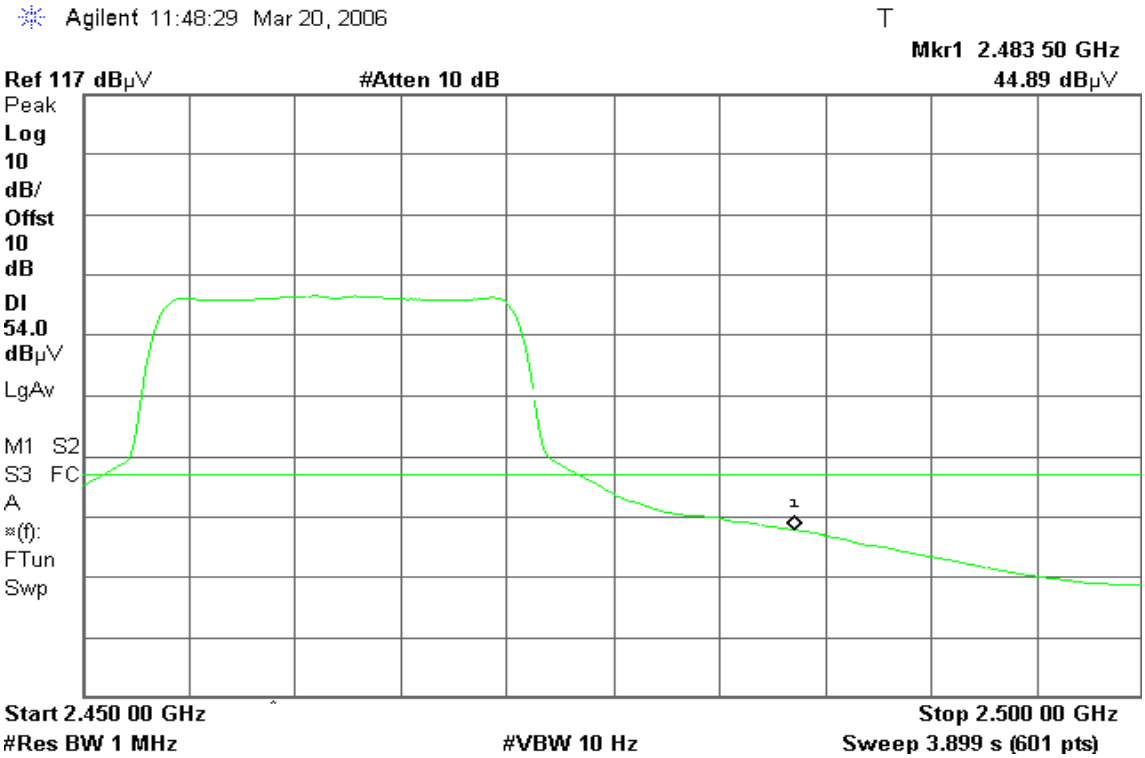


Band Edges (IEEE 802.11g / CH High)

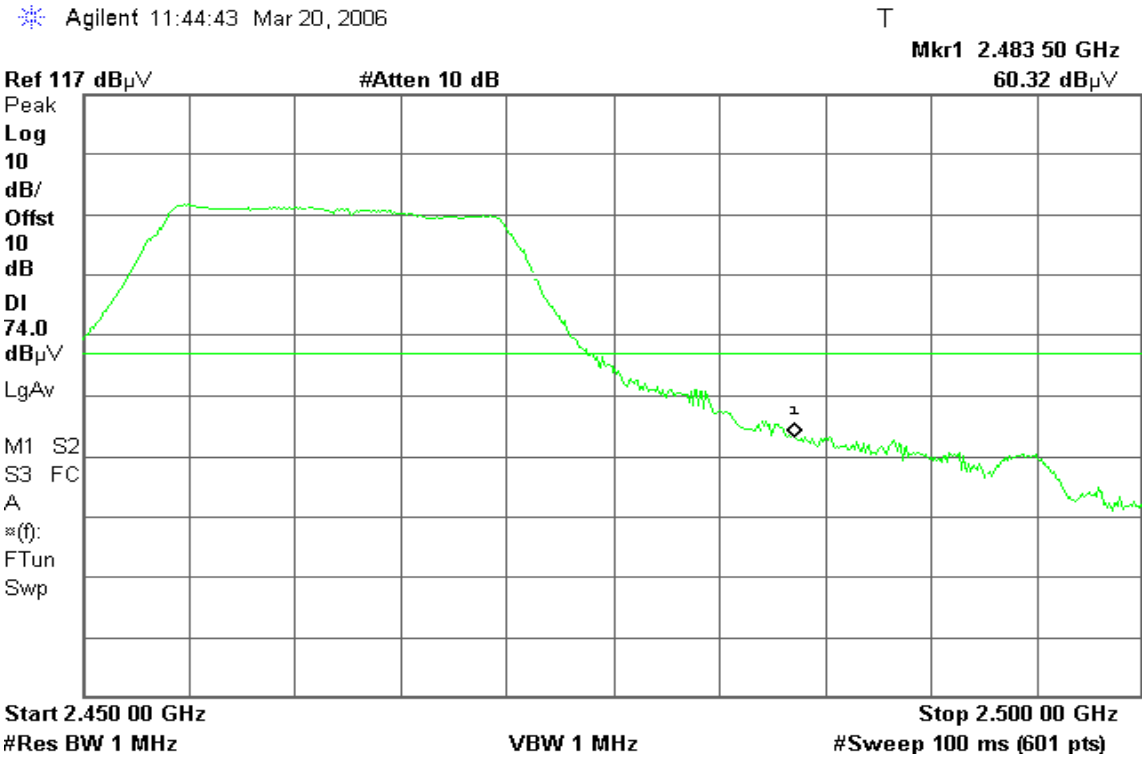
Detector mode: Peak Polarity: Vertical



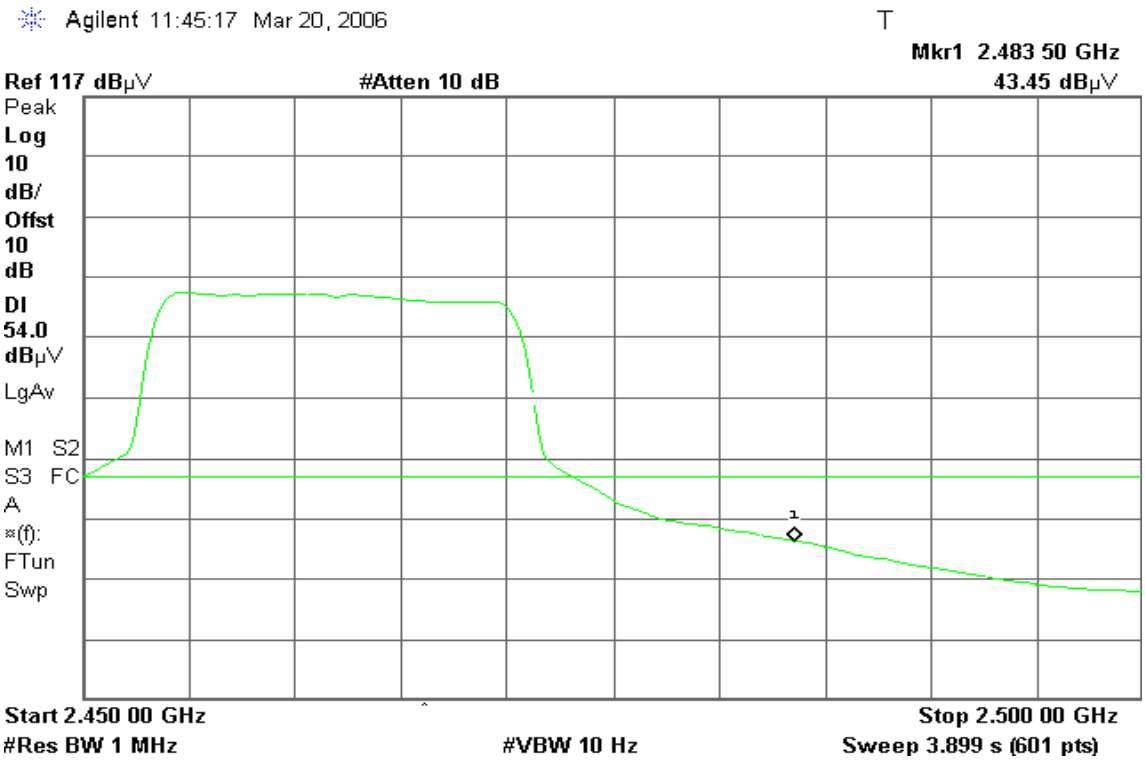
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**

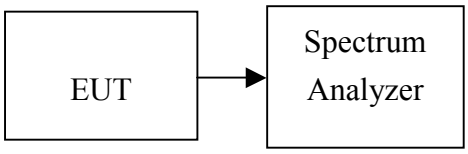


7.5PEAK POWER SPECTRAL DENSITY

LIMIT

1. According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
2. According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

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 RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-12.40	8.00	PASS
Mid	2437	-11.18		PASS
High	2462	-12.81		PASS

Test mode: IEEE 802.11g

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-8.63	8.00	PASS
Mid	2437	-8.63		PASS
High	2462	-8.84		PASS

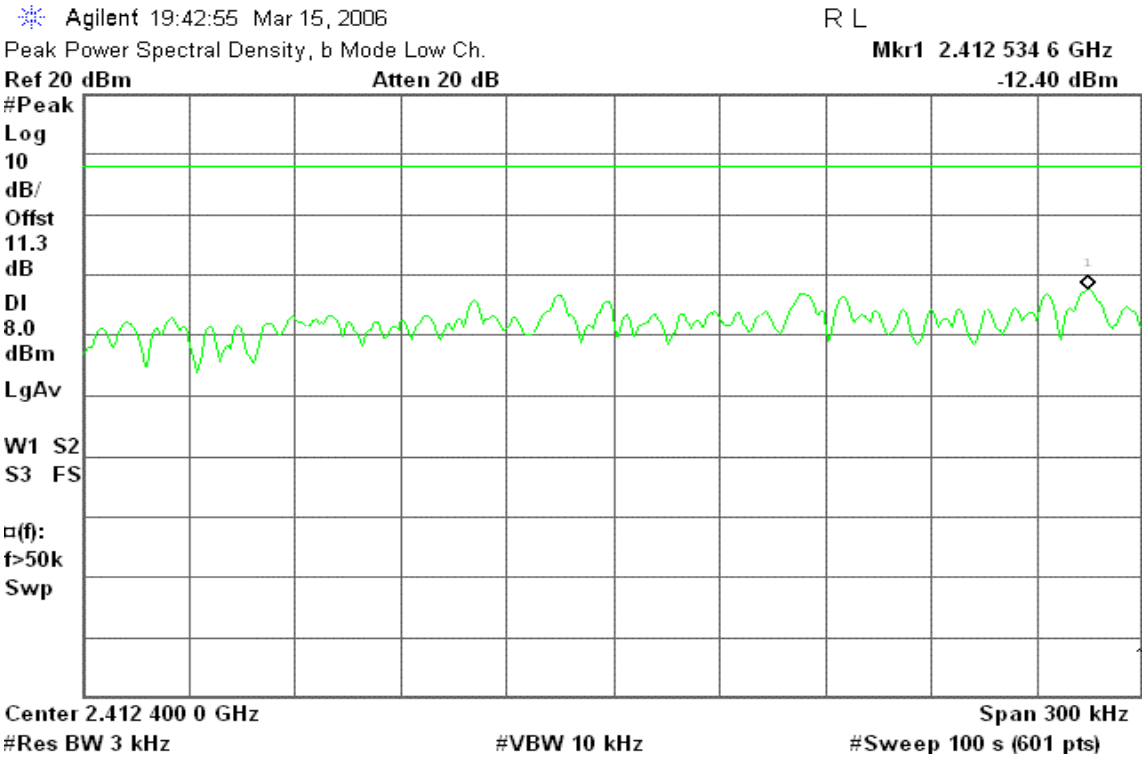
Test mode: IEEE 802.11a

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	5745	-8.62	8.00	PASS
Mid	5785	-9.57		PASS
High	5825	-9.00		PASS

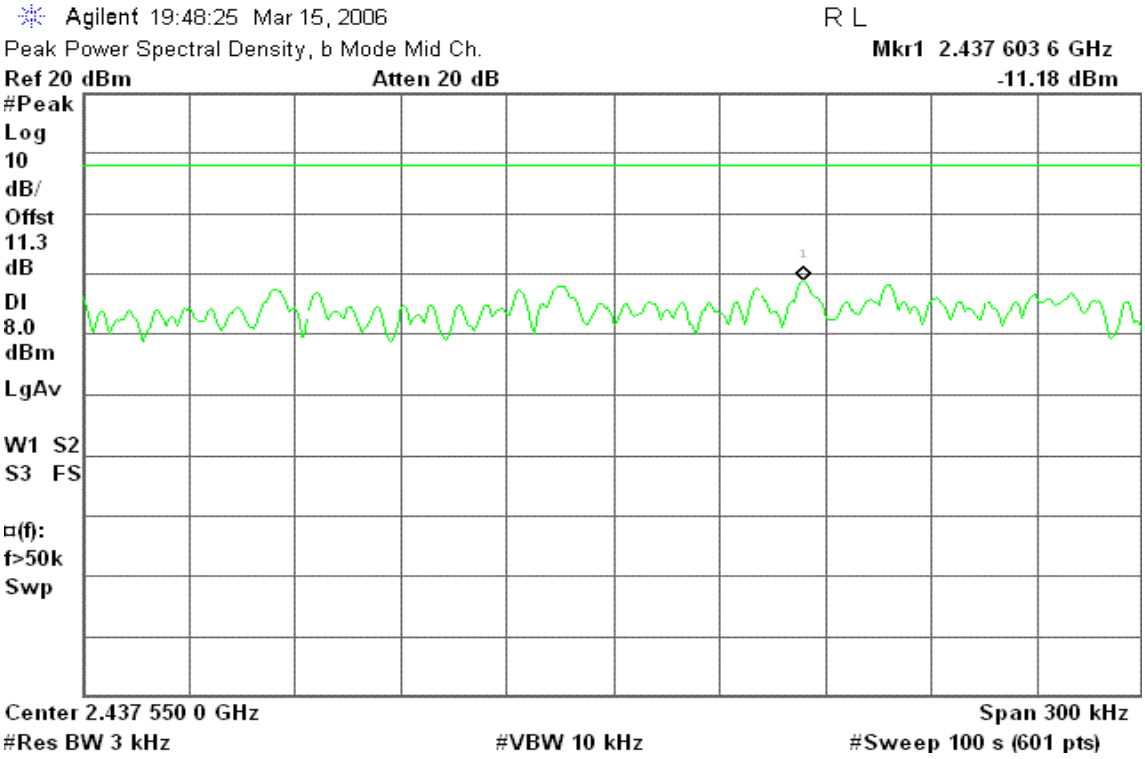
Test Plot

IEEE 802.11b

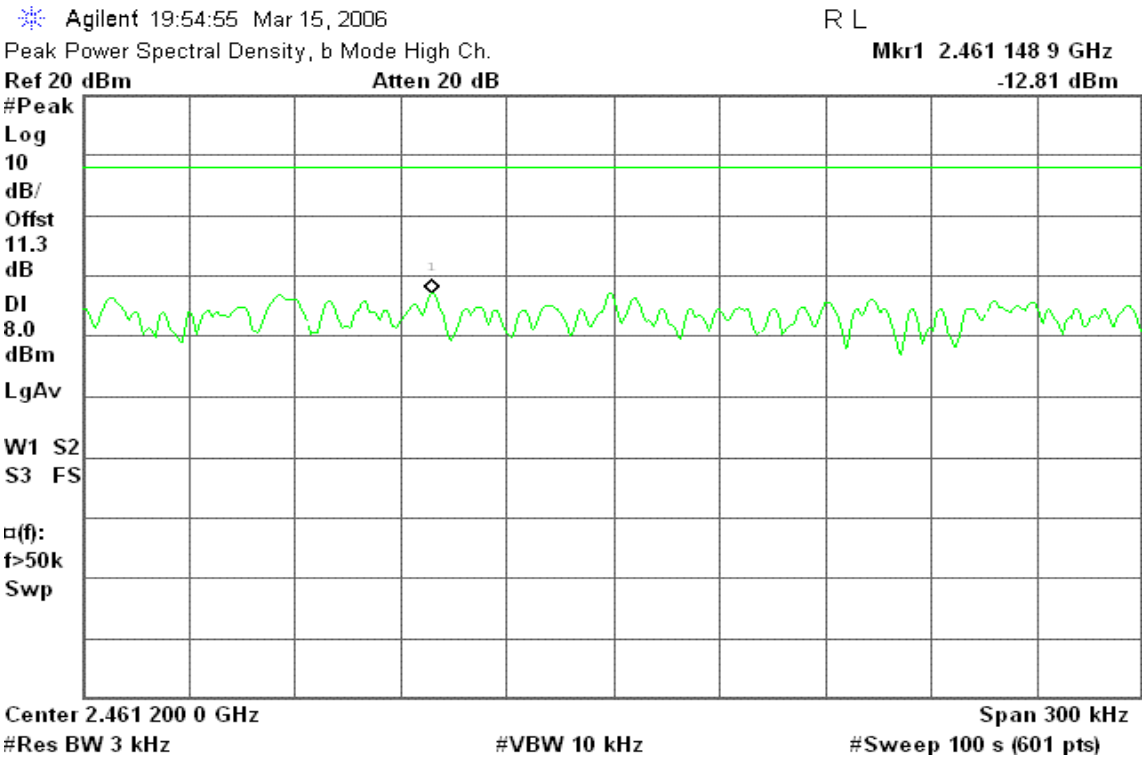
CH Low



CH Mid

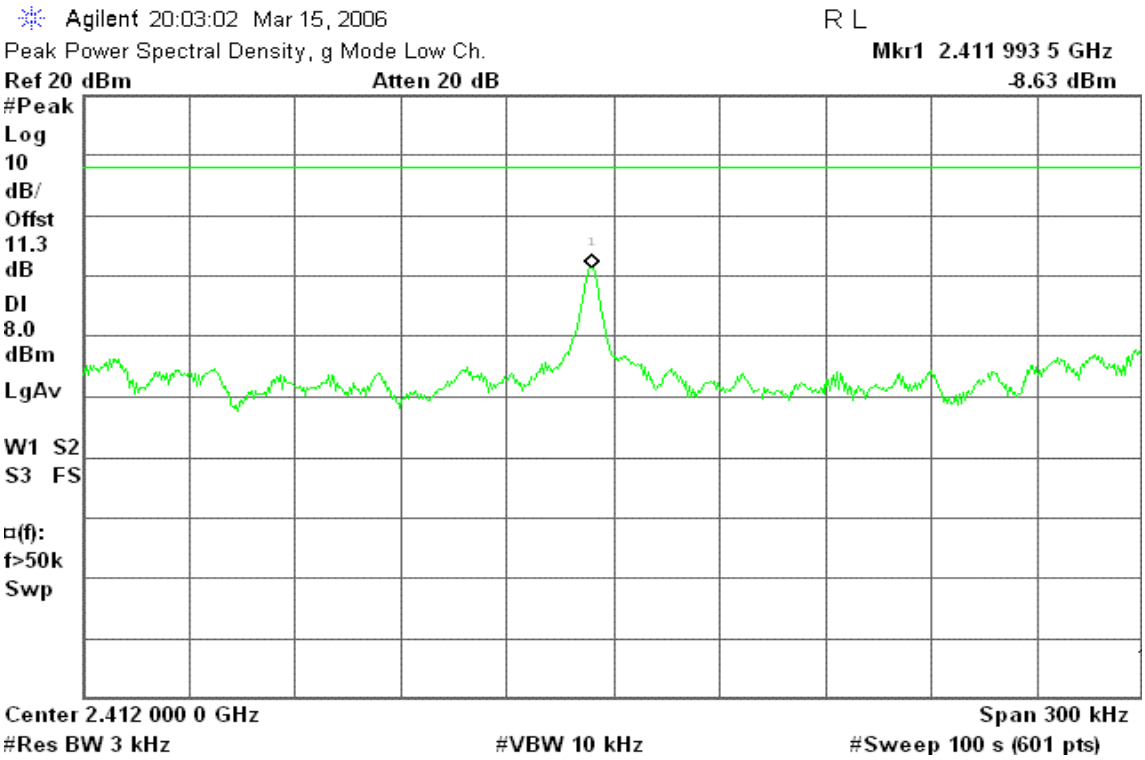


CH High

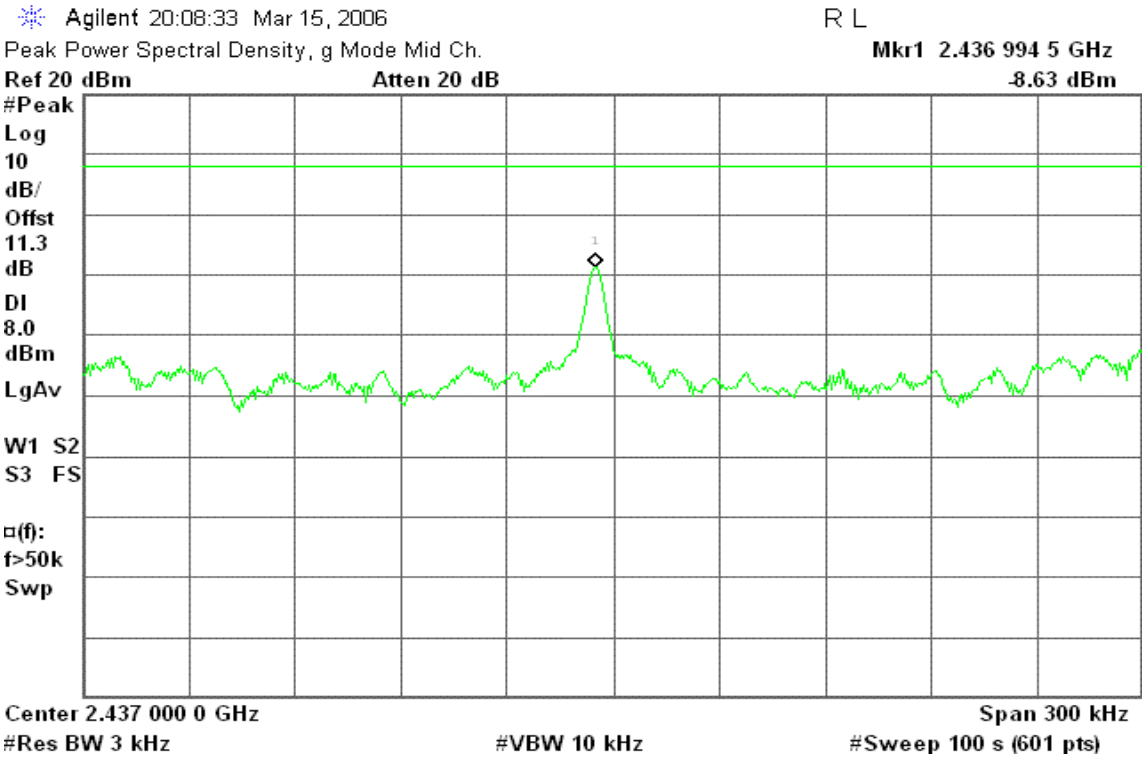


IEEE 802.11g

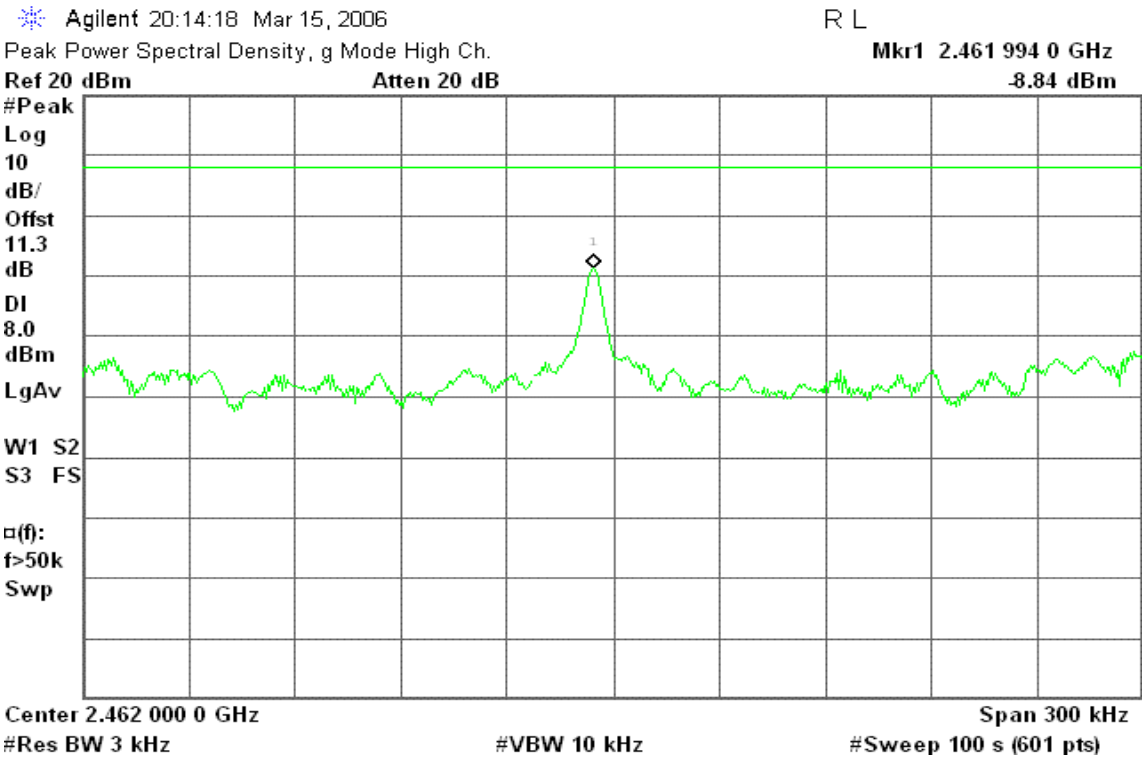
CH Low



CH Mid

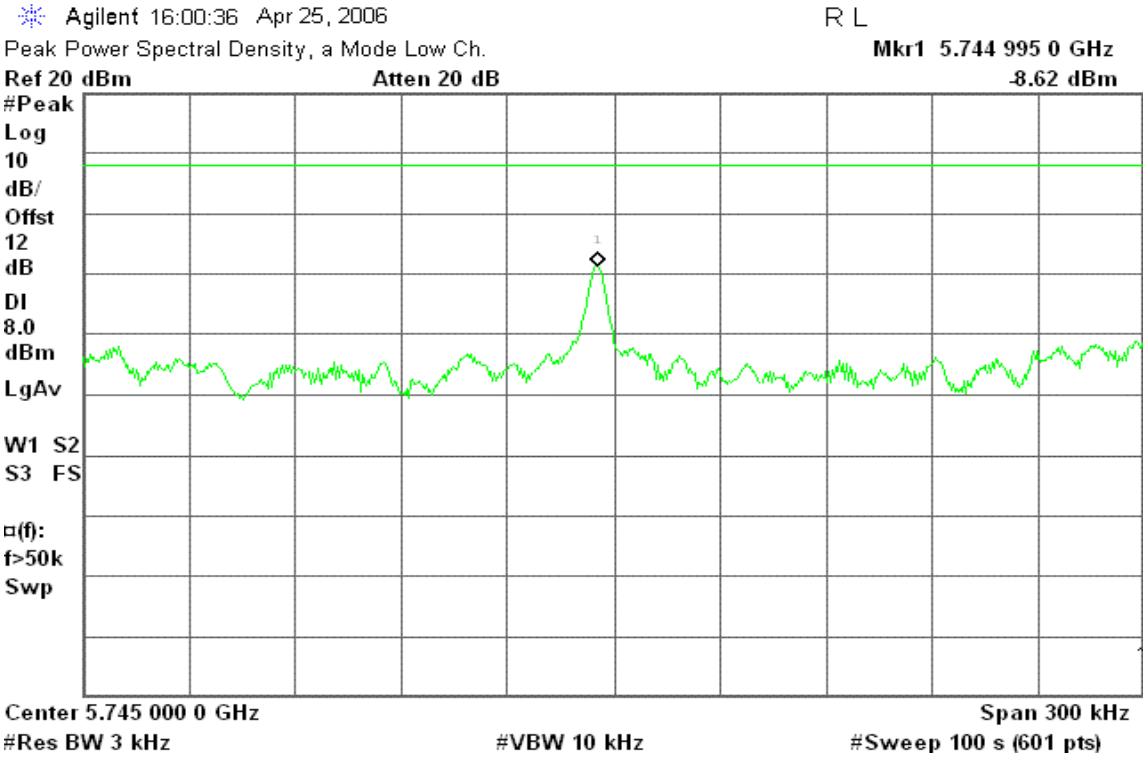


CH High

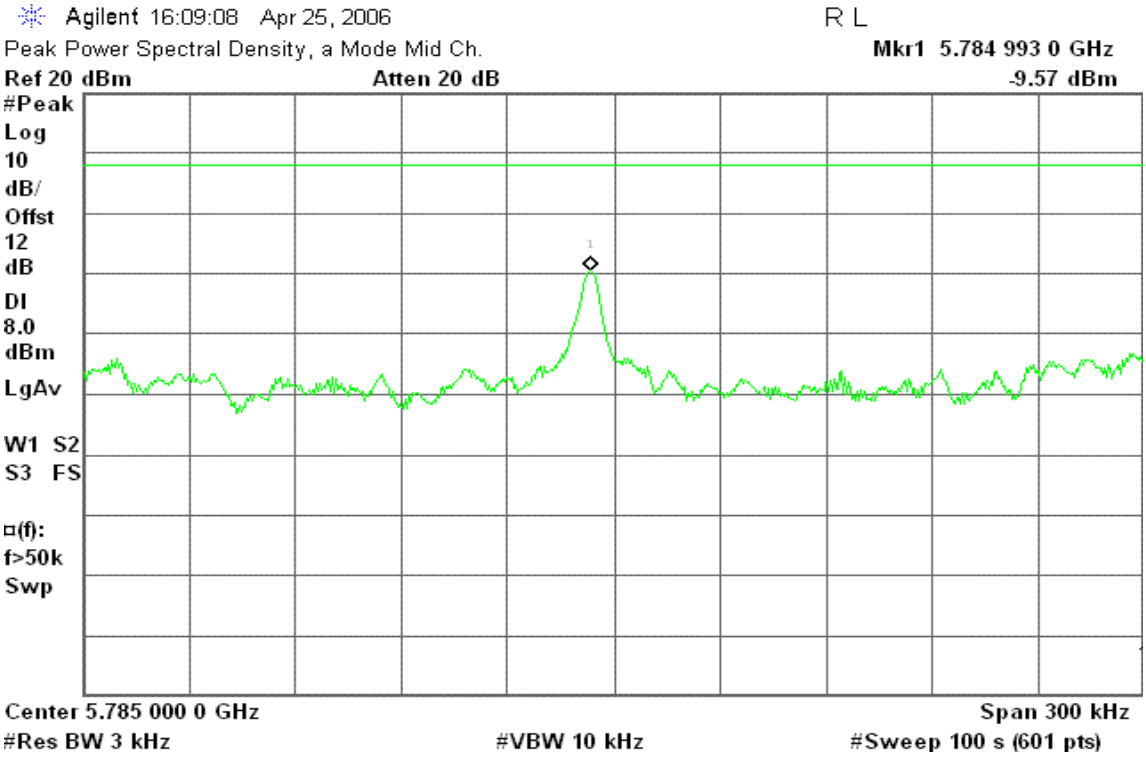


IEEE 802.11a

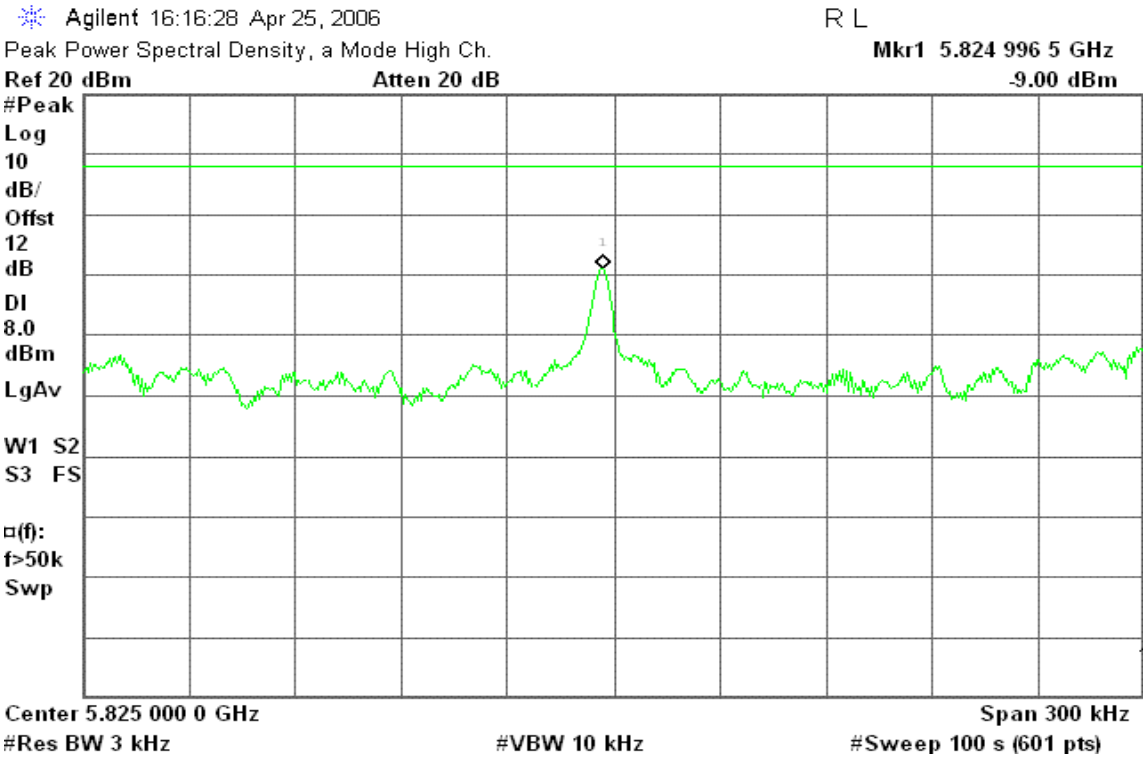
CH Low



CH Mid



CH High


Agilent 16:16:28 Apr 25, 2006
R L
Peak Power Spectral Density, a Mode High Ch.
Mkr1 5.824 996 5 GHz
Ref 20 dBm
Atten 20 dB
-9.00 dBm
#Peak
Log
10
dB/
Offst
12
dB
Dl
8.0
dBm
LgAv
W1 S2
S3 FS
¤(f):
f>50k
Swp
Center 5.825 000 0 GHz
Span 300 kHz
#Res BW 3 kHz
#VBW 10 kHz
#Sweep 100 s (601 pts)

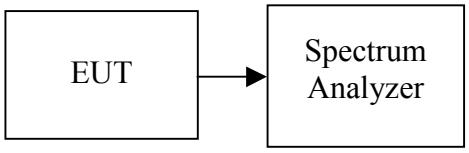
7.6SPURIOUS EMISSIONS

7.6.1 Conducted Measurement

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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. 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 Section 15.205(c)).

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 for IEEE802.11b/g, 30MHz to 40GHz range for IEEE802.11a with the transmitter set to the lowest, middle, and highest channels.

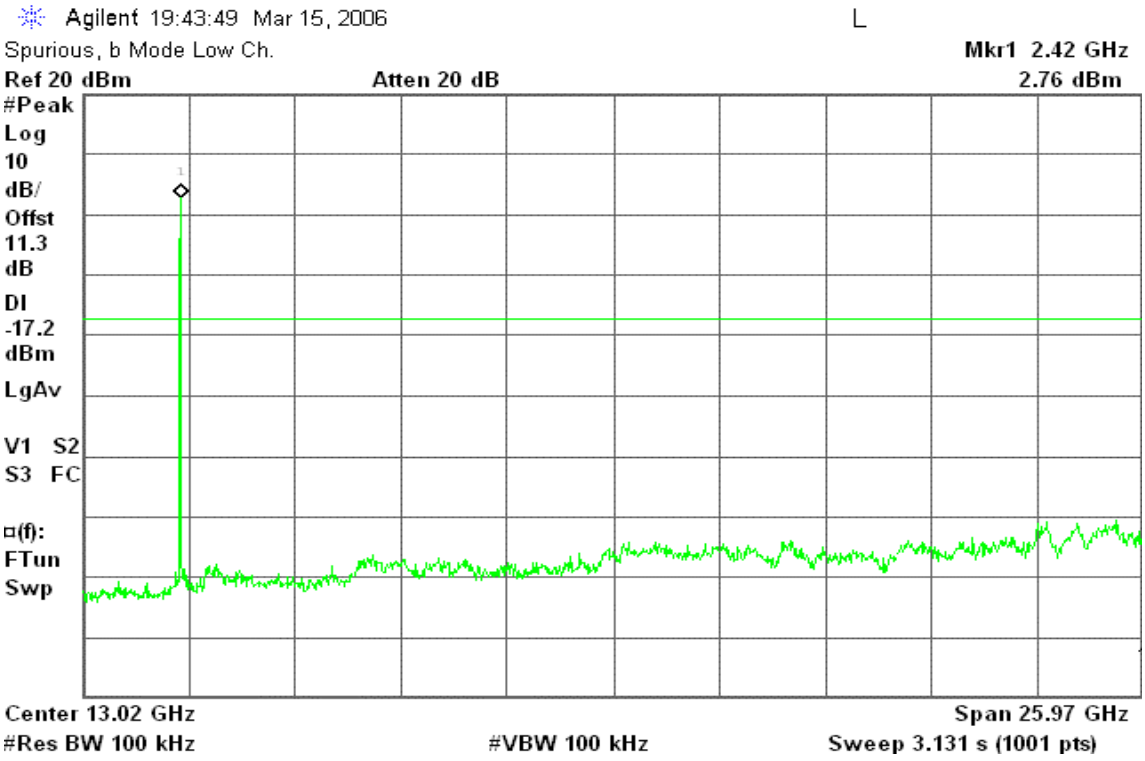
TEST RESULTS

No non-compliance noted.

Test Plot

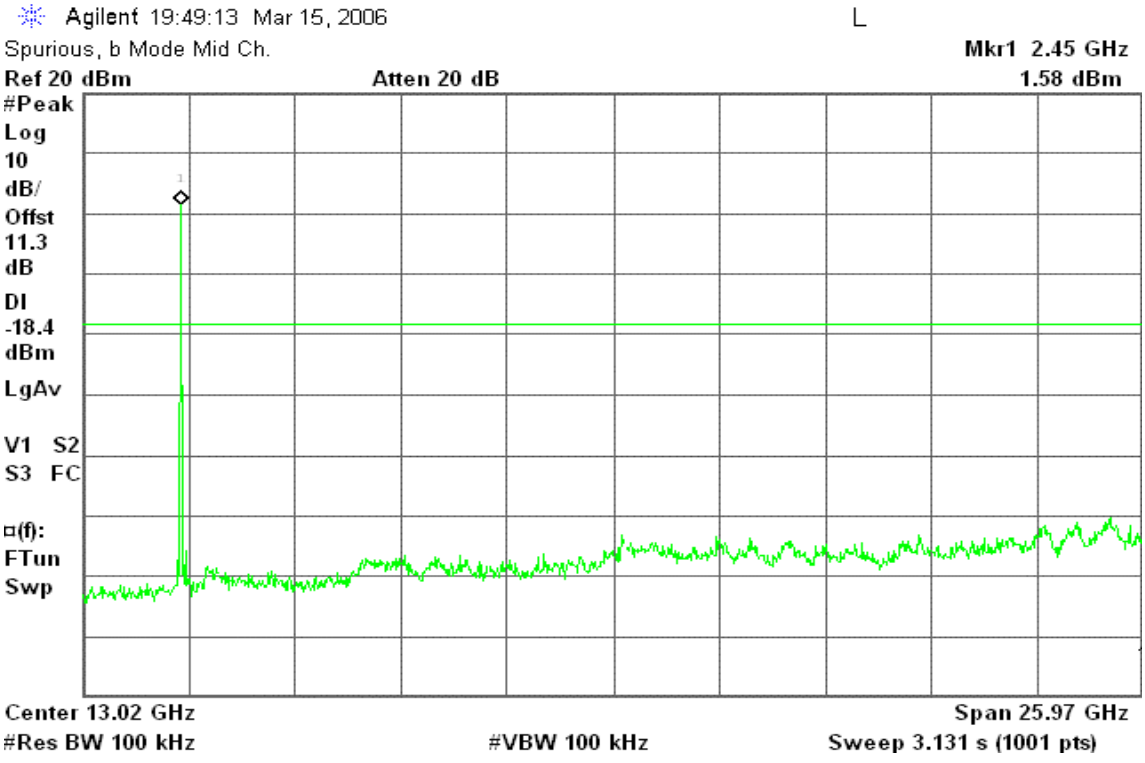
IEEE 802.11b / CH Low

30MHz ~ 26GHz



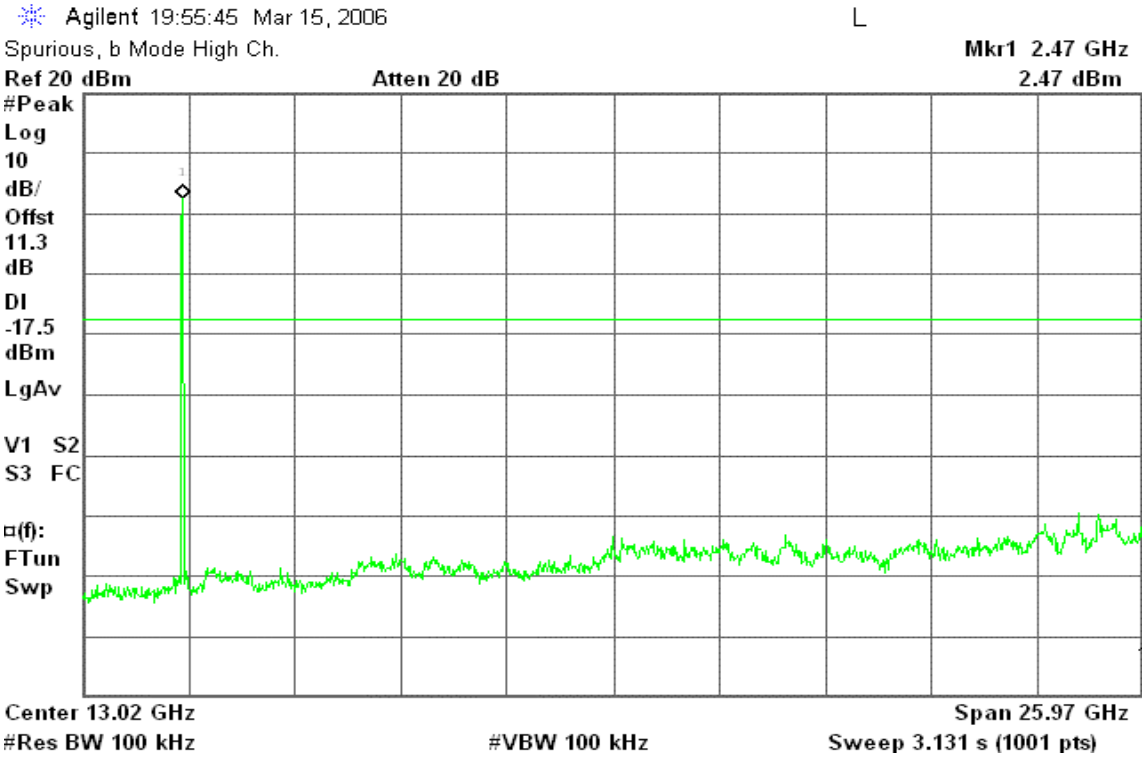
IEEE 802.11b / CH Mid

30MHz ~ 26GHz



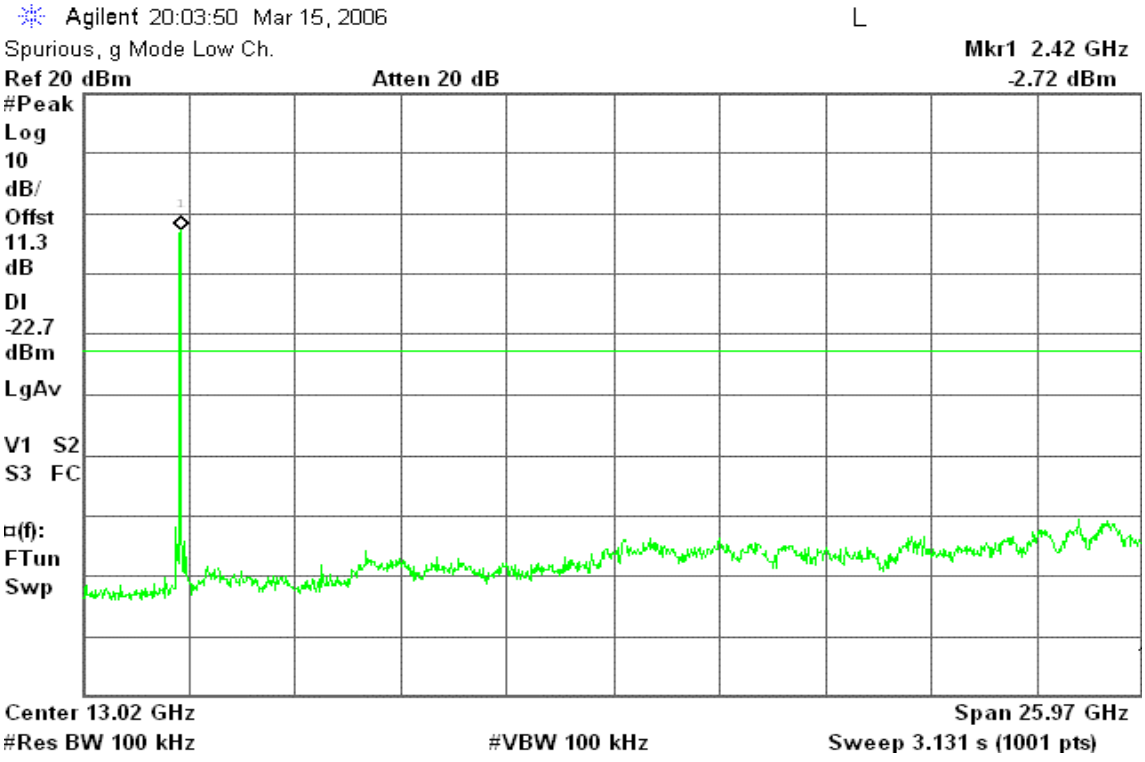
IEEE 802.11b / CH High

30MHz ~ 26GHz



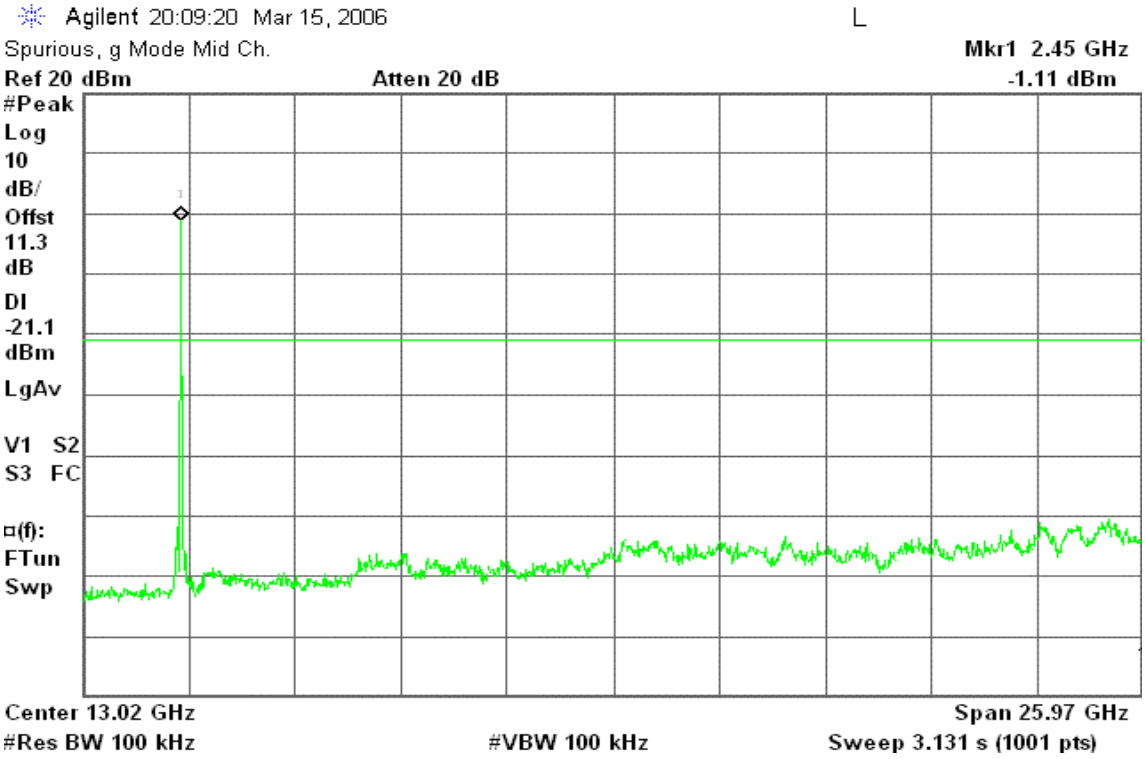
IEEE 802.11g / CH Low

30MHz ~ 26GHz



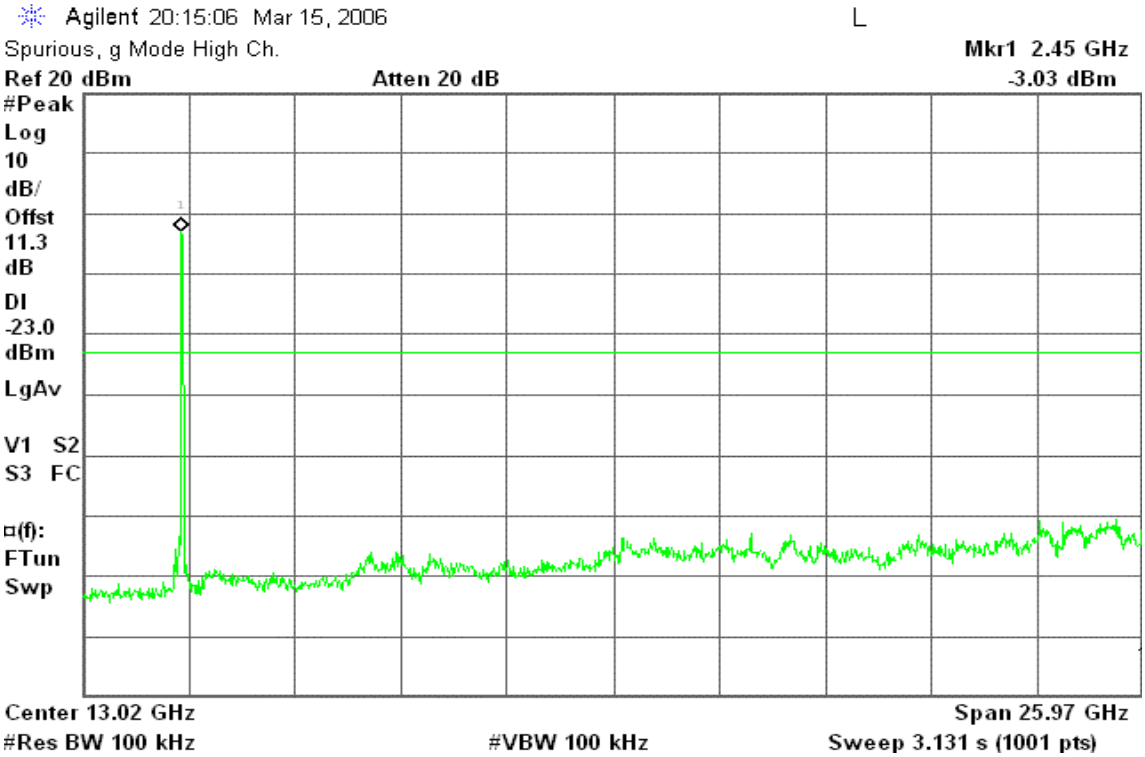
IEEE 802.11g / CH Mid

30MHz ~ 26GHz



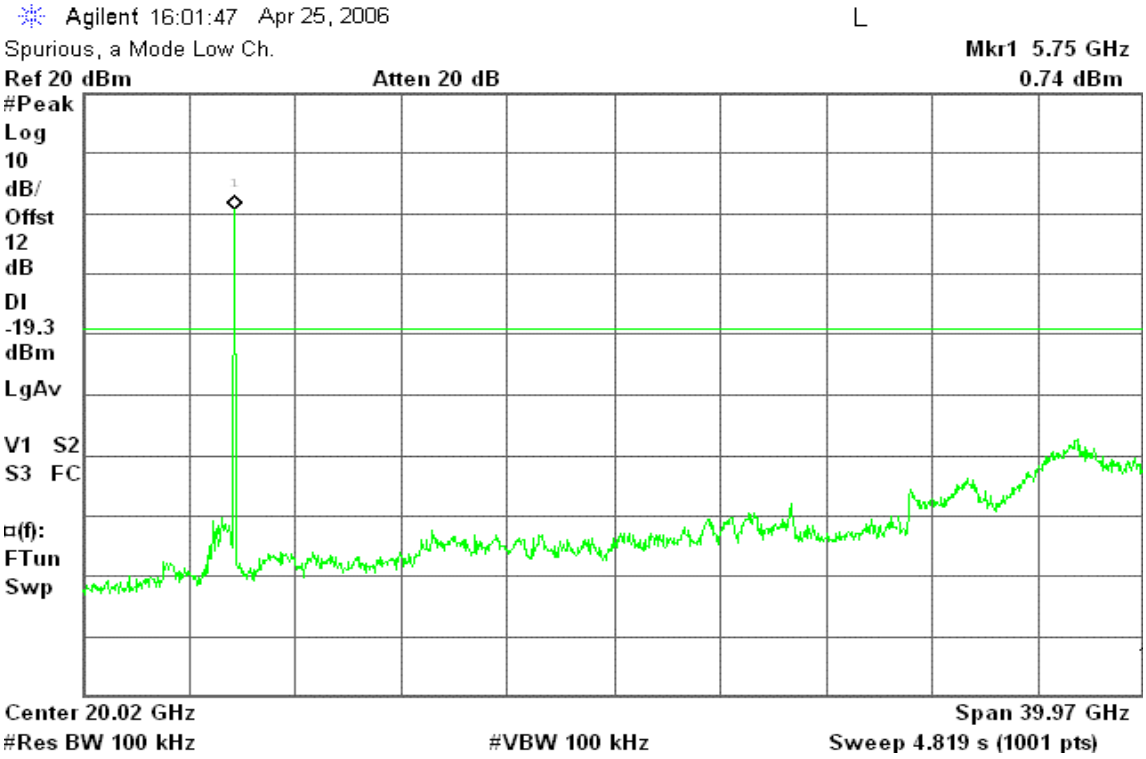
IEEE 802.11g / CH High

30MHz ~ 26GHz



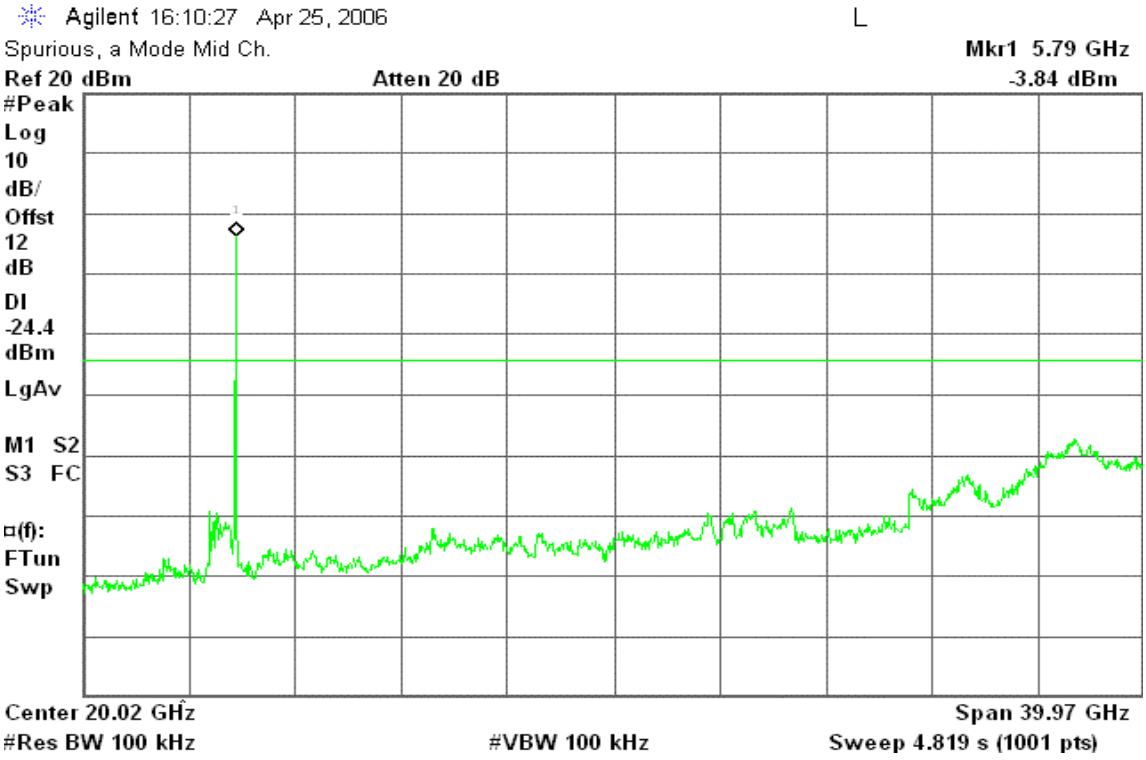
IEEE 802.11a / CH Low

30MHz ~ 40GHz



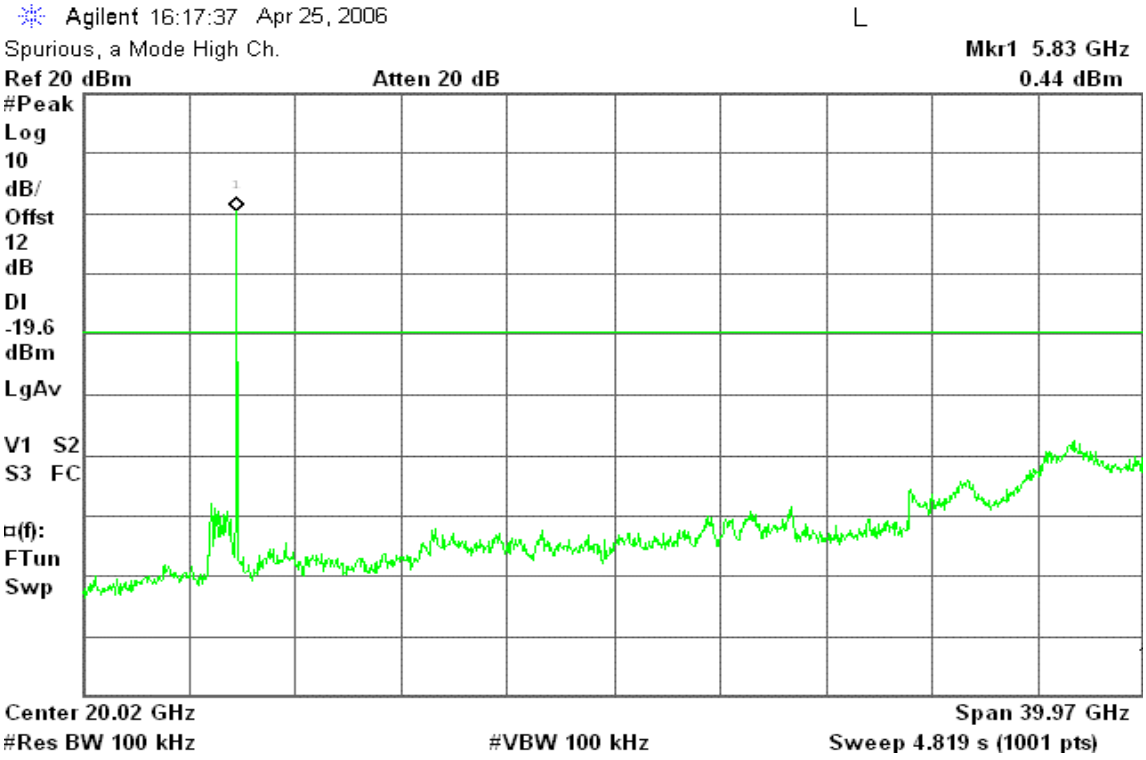
IEEE 802.11a / CH Mid

30MHz ~ 40GHz



IEEE 802.11a / CH High

30MHz ~ 40GHz



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

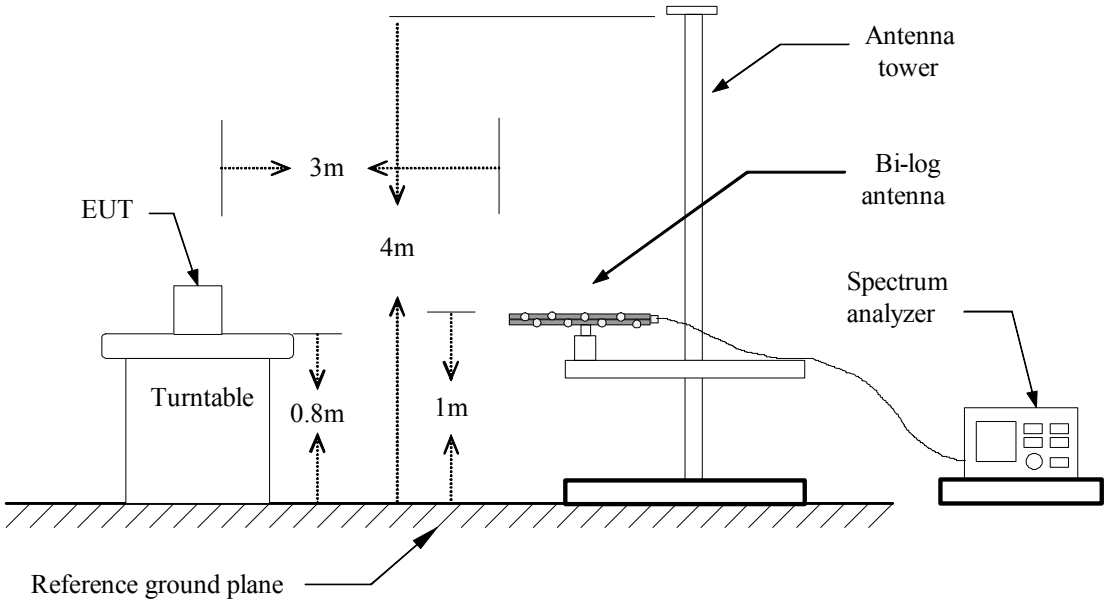
Remark: *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

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

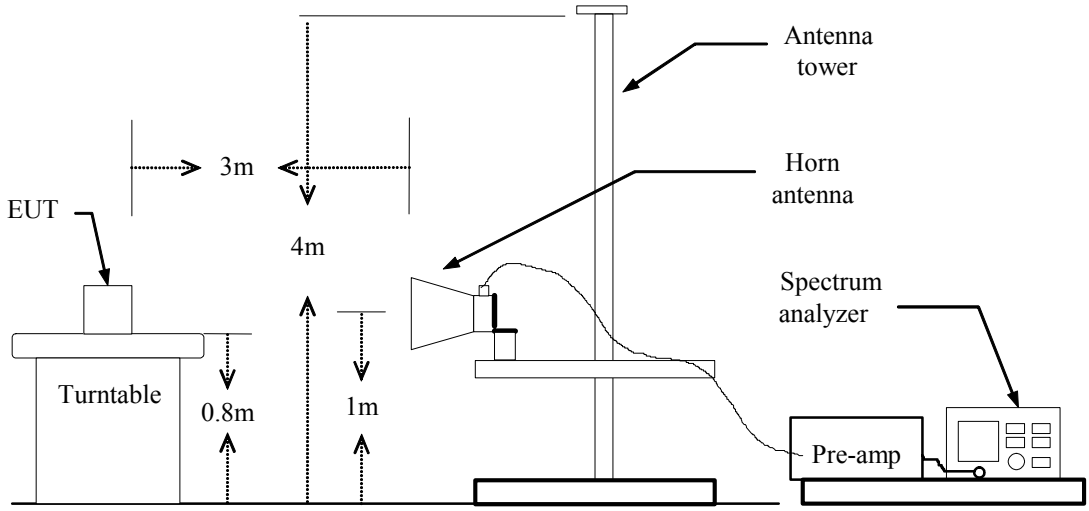
Frequency (MHz)	Field Strength (μV/m at 3-meter)	Field Strength (dBμV/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

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: Normal Link **Test Date:** April 26, 2006

Temperature: 26°C **Tested by:** Ryan Chen

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (QP) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (QP) (dBuV/m)	Limit (QP) (dBuV/m)	Margin (dB)	Remark
344.08	V	9.61	---	17.66	27.27	---	46.00	-18.73	Peak
539.68	V	1.76	---	21.69	23.45	---	46.00	-22.55	Peak
639.00	V	1.19	---	21.62	22.81	---	46.00	-23.19	Peak
680.85	V	8.02	---	22.93	30.95	---	46.00	-15.05	Peak
739.60	V	2.39	---	23.80	26.20	---	46.00	-19.80	Peak
838.43	V	3.60	---	24.15	27.75	---	46.00	-18.25	Peak
345.63	H	7.66	---	17.70	25.36	---	46.00	-20.64	Peak
397.85	H	10.28	---	18.38	28.66	---	46.00	-17.34	Peak
539.69	H	3.68	---	21.69	25.37	---	46.00	-20.63	Peak
589.49	H	4.51	---	22.65	27.16	---	46.00	-18.84	Peak
637.14	H	3.97	---	21.68	25.65	---	46.00	-20.35	Peak
738.97	H	5.53	---	23.80	29.33	---	46.00	-16.67	Peak

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/quasi-peak detector mode.*
3. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.*
4. *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.*
5. *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.*
6. *Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).*

Above 1 GHz

Operation Mode: Tx / IEEE 802.11b / CH Low **Test Date:** March 20, 2006

Temperature: 24°C **Tested by:** Rex Lai

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1690.00	V	54.91	---	-12.78	42.14	---	74.00	54.00	-11.86	Peak
2493.33	V	54.01	---	-10.28	43.73	---	74.00	54.00	-10.27	Peak
3000.00	V	53.99	---	-9.64	44.35	---	74.00	54.00	-9.65	Peak
4825.00	V	47.94	---	-7.80	40.15	---	74.00	54.00	-13.85	Peak
9650.00	V	39.66	---	-0.85	38.81	---	74.00	54.00	-15.19	Peak
18000.00	V	36.85	---	1.07	37.92	---	74.00	54.00	-16.08	Peak
1040.00	H	57.47	---	-14.83	42.64	---	74.00	54.00	-11.36	Peak
1430.00	H	60.41	---	-14.06	46.36	---	74.00	54.00	-7.64	Peak
1626.67	H	56.89	---	-13.16	43.73	---	74.00	54.00	-10.27	Peak
1950.00	H	54.94	---	-11.21	43.73	---	74.00	54.00	-10.27	Peak
3000.00	H	48.30	---	-9.64	38.66	---	74.00	54.00	-15.34	Peak
4825.00	H	47.78	---	-7.80	39.98	---	74.00	54.00	-14.02	Peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *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.*
5. *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.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: Tx / IEEE 802.11b / CH Mid **Test Date:** March 20, 2006

Temperature: 24°C **Tested by:** Rex Lai

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1300.00	V	55.45	---	-14.32	41.14	---	74.00	54.00	-12.86	Peak
3000.00	V	56.98	---	-9.64	47.34	---	74.00	54.00	-6.66	Peak
3000.00	V	54.31	---	-9.64	44.67	---	74.00	54.00	-9.33	Peak
4500.00	V	44.90	---	-7.86	37.04	---	74.00	54.00	-16.96	Peak
9750.00	V	47.08	---	-0.68	46.40	---	74.00	54.00	-7.60	Peak
12183.33	V	41.32	---	-0.41	40.91	---	74.00	54.00	-13.09	Peak
1430.00	H	58.88	---	-14.06	44.82	---	74.00	54.00	-9.18	Peak
1560.00	H	57.78	---	-13.56	44.22	---	74.00	54.00	-9.78	Peak
1626.67	H	56.53	---	-13.16	43.38	---	74.00	54.00	-10.62	Peak
4875.00	H	47.72	---	-7.79	39.93	---	74.00	54.00	-14.07	Peak
9750.00	H	41.11	---	-0.68	40.43	---	74.00	54.00	-13.57	Peak
13150.00	H	42.24	---	-1.06	41.18	---	74.00	54.00	-12.82	Peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *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.*
5. *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.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: Tx / IEEE 802.11b / CH High **Test Date:** March 20, 2006

Temperature: 24°C **Tested by:** Rex Lai

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
3000.00	V	57.28	---	-9.64	47.64	---	74.00	54.00	-6.36	Peak
3000.00	V	54.16	---	-9.64	44.52	---	74.00	54.00	-9.48	Peak
7383.33	V	46.31	---	-5.59	40.73	---	74.00	54.00	-13.27	Peak
9850.00	V	45.40	---	-0.51	44.89	---	74.00	54.00	-9.11	Peak
12316.67	V	43.48	---	-0.48	43.00	---	74.00	54.00	-11.00	Peak
N/A										
1430.00	H	57.35	---	-14.06	43.29	---	74.00	54.00	-10.71	Peak
1626.67	H	56.47	---	-13.16	43.31	---	74.00	54.00	-10.69	Peak
3000.00	H	49.08	---	-9.64	39.44	---	74.00	54.00	-14.56	Peak
4925.00	H	48.58	---	-7.78	40.80	---	74.00	54.00	-13.20	Peak
9850.00	H	40.90	---	-0.51	40.39	---	74.00	54.00	-13.61	Peak
N//A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *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.*
5. *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.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: Tx / IEEE 802.11g / CH Low **Test Date:** March 20, 2006

Temperature: 24°C **Tested by:** Rex Lai

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1300.00	V	55.85	---	-14.32	41.54	---	74.00	54.00	-12.46	Peak
3000.00	V	56.06	---	-9.64	46.42	---	74.00	54.00	-7.58	Peak
3000.00	V	54.98	---	-9.64	45.34	---	74.00	54.00	-8.66	Peak
4500.00	V	46.34	---	-7.86	38.48	---	74.00	54.00	-15.52	Peak
N/A										
1430.00	H	58.84	---	-14.06	44.78	---	74.00	54.00	-9.22	Peak
1560.00	H	57.71	---	-13.56	44.15	---	74.00	54.00	-9.85	Peak
3000.00	H	48.23	---	-9.64	38.59	---	74.00	54.00	-15.41	Peak
17083.33	H	41.47	---	0.44	41.90	---	74.00	54.00	-12.10	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *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.*
5. *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.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: Tx / IEEE 802.11g / CH Mid **Test Date:** March 20, 2006

Temperature: 24°C **Tested by:** Rex Lai

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1300.00	V	56.49	---	-14.32	42.17	---	74.00	54.00	-11.83	Peak
3000.00	V	55.58	---	-9.64	45.94	---	74.00	54.00	-8.06	Peak
3000.00	V	53.86	---	-9.64	44.22	---	74.00	54.00	-9.78	Peak
N/A										
1430.00	H	58.12	---	-14.06	44.06	---	74.00	54.00	-9.94	Peak
1560.00	H	56.93	---	-13.56	43.37	---	74.00	54.00	-10.63	Peak
1950.00	H	55.29	---	-11.21	44.08	---	74.00	54.00	-9.92	Peak
3000.00	H	48.44	---	-9.64	38.80	---	74.00	54.00	-15.20	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *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.*
5. *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.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: Tx / IEEE 802.11g / CH High **Test Date:** March 20, 2006

Temperature: 24°C **Tested by:** Rex Lai

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1300.00	V	55.72	---	-14.32	41.40	---	74.00	54.00	-12.60	Peak
3000.00	V	55.76	---	-9.64	46.12	---	74.00	54.00	-7.88	Peak
3000.00	V	54.23	---	-9.64	44.59	---	74.00	54.00	-9.41	Peak
7391.67	V	45.14	---	-5.58	39.56	---	74.00	54.00	-14.44	Peak
9850.00	V	39.93	---	-0.51	39.42	---	74.00	54.00	-14.58	Peak
12316.67	V	42.79	---	-0.48	42.32	---	74.00	54.00	-11.68	Peak
1430.00	H	57.24	---	-14.06	43.19	---	74.00	54.00	-10.81	Peak
1560.00	H	57.44	---	-13.56	43.88	---	74.00	54.00	-10.12	Peak
3000.00	H	48.19	---	-9.64	38.55	---	74.00	54.00	-15.45	Peak
4925.00	H	45.39	---	-7.78	37.61	---	74.00	54.00	-16.39	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *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.*
5. *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.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: Tx / IEEE 802.11a / CH Low **Test Date:** March 20, 2006

Temperature: 24°C **Tested by:** Rex Lai

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
2995.00	V	55.29	---	-9.65	45.65	---	74.00	54.00	-8.35	Peak
13116.67	V	41.45	---	-0.96	40.49	---	74.00	54.00	-13.51	Peak
17233.33	V	41.36	---	0.34	41.69	---	74.00	54.00	-12.31	Peak
N/A										
1560.00	H	57.12	---	-13.56	43.56	---	74.00	54.00	-10.44	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *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.*
5. *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.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: Tx / IEEE 802.11a / CH Mid **Test Date:** March 20, 2006

Temperature: 24°C **Tested by:** Rex Lai

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
2995.00	V	54.59	---	-9.65	44.94	---	74.00	54.00	-9.06	Peak
4826.67	V	57.06	---	-7.79	49.27	---	74.00	54.00	-4.73	Peak
N/A										
4815.00	H	59.53	---	-7.80	51.73	---	74.00	54.00	-2.27	Peak
5421.67	H	58.44	---	-7.41	51.03	---	74.00	54.00	-2.97	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *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.*
5. *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.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: Tx / IEEE 802.11a / CH High **Test Date:** March 20, 2006

Temperature: 24°C **Tested by:** Rex Lai

Humidity: 55% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
2995.00	V	56.22	---	-9.65	46.58	---	74.00	54.00	-7.42	Peak
4850.00	V	57.72	---	-7.79	49.93	---	74.00	54.00	-4.07	Peak
11650.00	V	43.66	---	0.04	43.69	---	74.00	54.00	-10.31	Peak
17466.67	V	43.97	---	0.18	44.15	---	74.00	54.00	-9.85	Peak
N/A										
4850.00	H	63.70	57.67	-7.79	55.91	49.88	74.00	54.00	-4.12	AVG
5468.33	H	62.56	50.89	-7.38	55.18	43.51	74.00	54.00	-10.49	AVG
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *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.*
5. *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.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

7.7POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of 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 Range (MHz)	Limits (dBμV)	
	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

***** *Decreases with the logarithm of the frequency.*

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:	Normal Link	**Test Date:**	March 28, 2006
Temperature:	25°C	**Tested by:**	Ivan Tsai
Humidity:	55% RH		

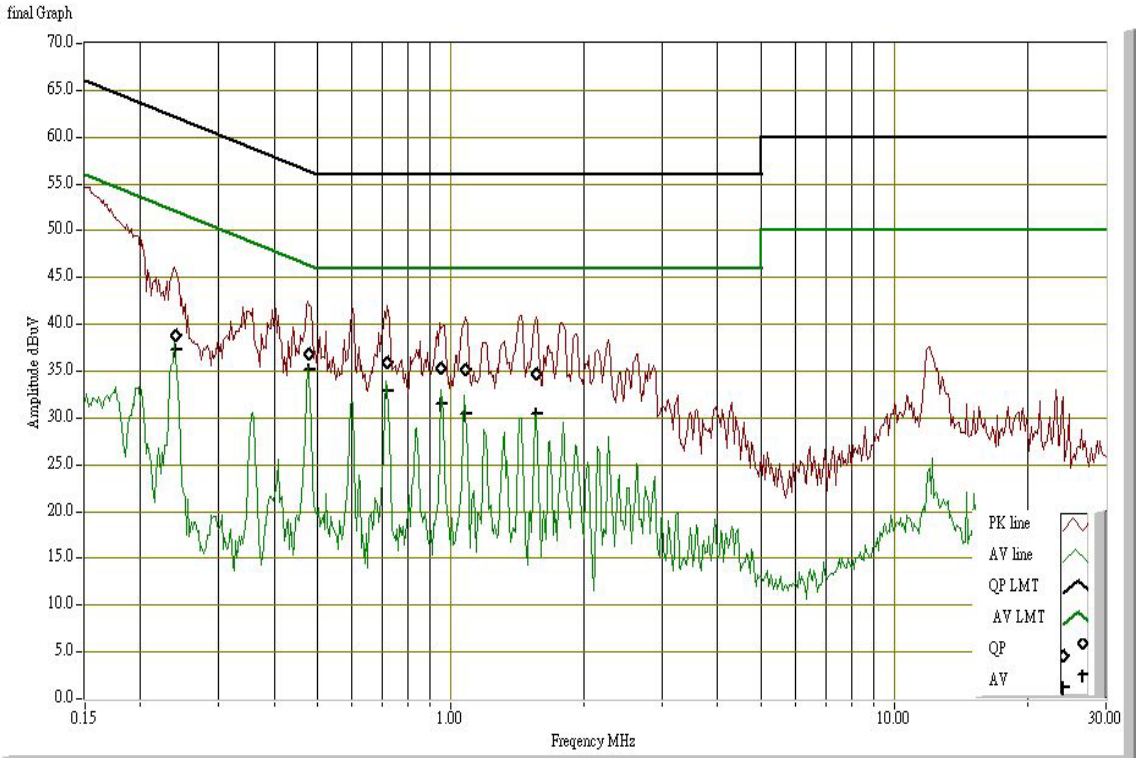
Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB)	QP Result (dBuV)	AV Result (dBuV)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.240	38.830	37.250	0.100	38.930	37.350	62.103	52.103	-23.173	-14.753	L1
0.478	36.760	35.180	0.100	36.860	35.280	56.371	46.371	-19.511	-11.091	L1
0.721	35.950	32.840	0.100	36.050	32.940	56.000	46.000	-19.950	-13.060	L1
0.953	35.370	31.530	0.100	35.470	31.630	56.000	46.000	-20.530	-14.370	L1
1.082	35.200	30.490	0.100	35.300	30.590	56.000	46.000	-20.700	-15.410	L1
1.561	34.710	30.360	0.100	34.810	30.460	56.000	46.000	-21.190	-15.540	L1
0.238	38.910	37.820	0.100	39.010	37.920	62.166	52.166	-23.156	-14.246	L2
0.476	36.840	35.340	0.100	36.940	35.440	56.409	46.409	-19.469	-10.969	L2
0.595	34.520	32.440	0.100	34.620	32.540	56.000	46.000	-21.380	-13.460	L2
0.715	36.660	34.300	0.100	36.760	34.400	56.000	46.000	-19.240	-11.600	L2
0.945	33.370	28.140	0.100	33.470	28.240	56.000	46.000	-22.530	-17.760	L2
1.082	35.140	30.490	0.100	35.240	30.590	56.000	46.000	-20.760	-15.410	L2

Remark:

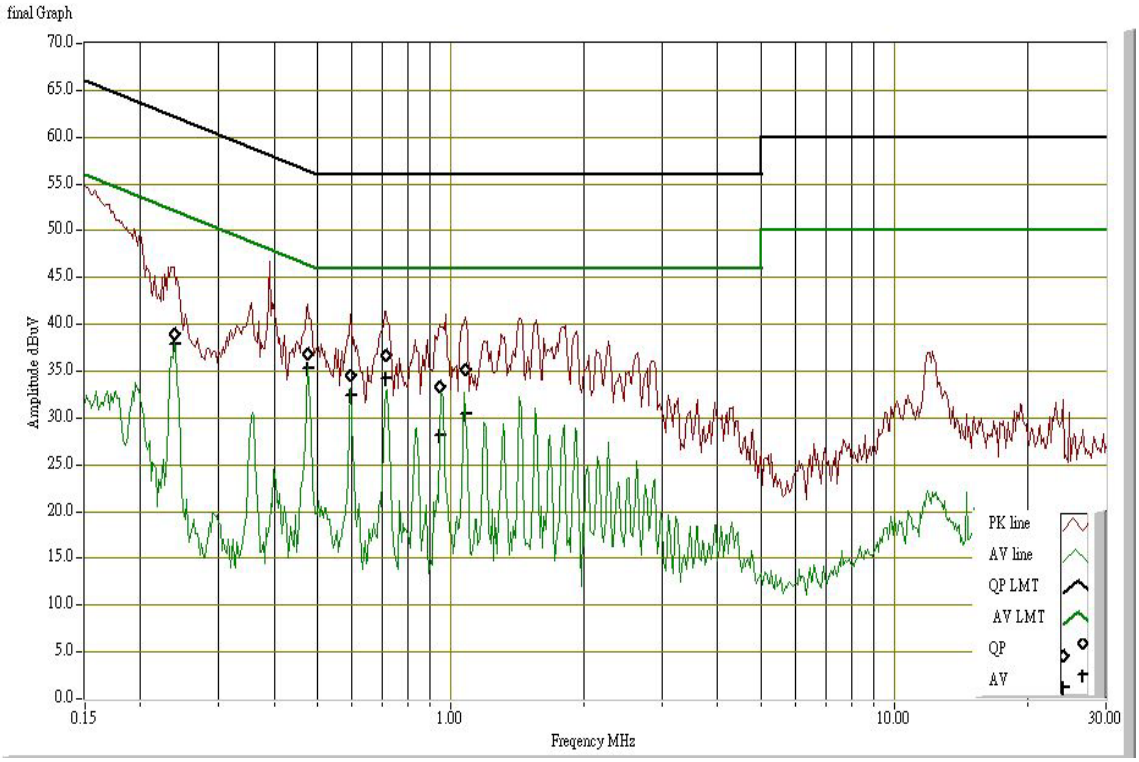
1. *Measuring frequencies from 0.15 MHz to 30MHz.*
2. *The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.*
3. *The IF bandwidth of SPA between 0.15MHz to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz.*
4. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*

Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)



APPENDIX I
RADIO FREQUENCY EXPOSURE

LIMIT

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

EUT Specification

EUT	Shuttle XPC (Wireless 802.11a+b+g)
Frequency band (Operating)	☒ WLAN: 2.412GHz ~ 2.462GHz ☐ WLAN: 5.725GHz ~ 5.850GHz ☐ WLAN: 5.15GHz ~ 5.35GHz ☐ Others: _____
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm2) ☒ General Population/Uncontrolled exposure (S=1mW/cm2)
Antenna diversity	☐ Single antenna ☒ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☒ Tx/Rx diversity
Max. output power	IEEE 802.11b: 16.32 dBm (42.85mW) IEEE 802.11g: 16.07 dBm (40.46mW)
Antenna gain (Max)	0.56 dBi (Numeric gain: 1.14)
Evaluation applied	☒ MPE Evaluation ☐ SAR Evaluation ☐ N/A
Remark: *1. The maximum output power is 16.32dBm (42.85mW) at 2437MHz (with 1.14 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 maximum power density is 1.0 mW/cm^2 even if the calculation indicates that the power density would be larger.*	

TEST RESULTS

No non-compliance noted.

Calculation

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

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$ ***Equation 1***

Where *d = Distance in cm*
P = Power in mW
G = Numeric antenna gain
S = Power density in mW / cm^2

Maximum Permissible Exposure

EUT output power = 42.85mW

Numeric Antenna gain = 1.14

Substituting the MPE safe distance using d = 20 cm into Equation 1:

Yields

$$S = 0.000199 \times P \times G$$

Where *P = Power in mW*
G = Numeric antenna gain
S = Power density in mW / cm^2

→ Power density = 0.0097 mW / cm2

(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.)

EUT	Shuttle XPC (Wireless 802.11a+b+g)
Frequency band (Operating)	☐ WLAN: 2.412GHz ~ 2.462GHz ☒ WLAN: 5.725GHz ~ 5.850GHz ☐ WLAN: 5.15GHz ~ 5.35GHz ☐ Others: _____
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm2) ☒ General Population/Uncontrolled exposure (S=1mW/cm2)
Antenna diversity	☐ Single antenna ☒ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☒ Tx/Rx diversity
Max. output power	IEEE 802.11a: 15.84 dBm (38.37mW)
Antenna gain (Max)	1.91 dBi (Numeric gain: 1.55)
Evaluation applied	☒ MPE Evaluation* ☐ SAR Evaluation ☐ N/A
Remark: *1. The maximum output power is 15.84dBm (38.37mW) at 5825MHz (with 1.55 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 maximum power density is 1.0 mW/cm^2 even if the calculation indicates that the power density would be larger.*	

TEST RESULTS

No non-compliance noted.

Calculation

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

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$ ***Equation 1***

Where *d = Distance in cm*

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

Maximum Permissible Exposure

EUT output power = 38.37mW

Numeric Antenna gain = 1.55

Substituting the MPE safe distance using d = 20 cm into Equation 1:

Yields

$$S = 0.000199 \times P \times G$$

Where *P = Power in mW*

G = Numeric antenna gain

S = Power density in mW / cm²

→ Power density = 0.0118 mW / cm²

(For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm² even if the calculation indicates that the power density would be larger.)