FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

802.11a/b/g Mini PCI Card

Model: WLL4071

Trade Name: Askey

Issued to

ASKEY COMPUTER CORP.
10F, No.119, CHIENKANG RD., CHUNG-HO,
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.
TEL: 886-3-324-0332
FAX: 886-3-324-5235

CNLA
0363
ILAC MRA

TABLE OF CONTENTS

1. TEST RESULT CERTIFICATION

Applicant: ASKEY COMPUTER CORP.
10F, No.119, CHIENKANG RD., CHUNG-HO,
TAIPEI, TAIWAN, R.O.C.

Equipment Under Test: 802.11a/b/g Mini PCI Card

Trade Name: Askey

Model: WLL4071

Date of Test: March 22 ~ May 24, 2005

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 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:

Harris W. Lai
Executive Vice President
Compliance Certification Services Inc.

Reviewed by:

Gavin Lim
Section Manager
Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product	802.11a/b/g Mini PCI Card
Trade Name	Askey
Model Number	WLL4071
Model Discrepancy	The above model has two types of transmitting mode for sale. (I) With Turbo mode. (II) Without Turbo mode.
Power Supply	Powered from host device
Frequency Range	IEEE 802.11a Base mode: 5.745~5.825 GHz Turbo mode: 5.760 GHz / 5.800 GHz IEEE 802.11b/g Base mode: 2.412~2.462 GHz IEEE 802.11g Turbo mode: 2.437 GHz
Transmit Power	IEEE 802.11a Base mode: 20.72 dBm Turbo mode: 16.66 dBm IEEE 802.11b Base mode: 21.65 dBm IEEE 802.11g Base mode: 20.51 dBm IEEE 802.11g Turbo mode: 20.92 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: 108, 54, 48, 36, 24, 18, 12, 9, 6 Mbps IEEE 802.11b: 11, 5.5, 2, 1 Mbps IEEE 802.11g: 108, 54, 48, 36, 24, 18, 12, 11, 9, 6, 5.5, 2, 1Mbps
Number of Channels	IEEE 802.11a Base mode: 5 Channels Turbo mode: 2 Channels IEEE 802.11b/g Base mode: 11 Channels IEEE 802.11g Turbo mode: 1 Channel
Antenna Specification	Hitachi / HTL017 / PIFA Antenna IEEE802.11a: 1.0 dBi IEEE802.11b/g: 1.8 dBi Hitachi / HTL008 / PIFA Antenna IEEE802.11a: -2.4 dBi IEEE802.11b/g: 0.2 dBi Tyco / TIAN01 /PIFA Antenna IEEE802.11a: -1.9 dBi IEEE802.11b/g: 1.5 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: H8NWLL4071 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: WLL4071) with Hitachi (model: HTL017) PIFA antenna 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:
Base mode:
Channel Low(5745MHz), Channel Mid(5785MHz) and Channel High(5825MHz) with 6Mbps data rate were chosen for full testing.

Turbo mode:
Channel Low(5760MHz), Channel High(5800MHz) with 12Mbps data rate were chosen for full testing.

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

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

Turbo mode:
Channel Mid(2437MHz) with 12Mbps data rate was chosen for full 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. 81-1, Lane 210, Bade Rd. 2, Luchu Hsiang, Taoyuan Hsien, Taiwan, R.O.C.

☐ No. 199, Chunghsen Road, Hsintien City, Taipei Hsien, 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: 200600-0 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: 93105 and 90471).

5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	NVLAP*	EN 55011, EN 55014-1, AS/NZS 1044, CNS 13783-1, EN 55022, CNS 13438, EN 61000-3-2, EN 61000-3-3, ANSI C63.4, FCC OST/MP-5, AS/NZS CISPR 22, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11	NVLAP® 200600-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	FC 93105, 90471
Japan	VCCI	4 3/10 meter Open Area Test Sites to perform conducted/radiated measurements	VCCI 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 300 328-2, 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	N ELA 124a ELA 124b ELA 124c
Taiwan	CNLA	EN 300 328-1/2, EN 300 220-1/2/3, EN 300 440-1/2, EN 61000-3-2, EN 61000-3-3, 47 CFR FCC Part 15 Subpart C/D/E, EN 55013, CNS 13439, EN 55014-1, CNS 13783-1, EN 55022, CNS 13438, CISPR 22, AS/NZS 3548, EN 61000-4-2/3/4/5/6/8/11, ENV 50204, IEEE Std 1528, FCC OET Bulletin, 65+Supplement C, EN50360, EN50361, EN50371, RSS102	CNLA 0363 ILAC MRA
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	RSS212, Issue 1	Canada IC 3991-3 IC 3991-4

** 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 CONFIGURATION OF EUT

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

6.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1.	Notebook PC	IBM	2672(X31)	99PBTKB	FCC DoC	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core

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

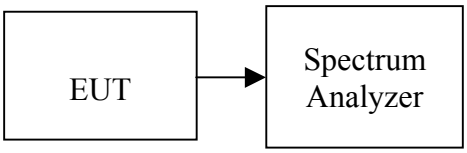
For the direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

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 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 = Base mode: 50MHz / Turbo mode: 50MHz, Sweep = auto.
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 mode

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Low	2412	11420	>500	PASS
Mid	2437	11250		PASS
High	2462	11500		PASS

Test mode: IEEE 802.11g mode

Channel	Frequency (MHz)		Bandwidth (kHz)	Limit (kHz)	Test Result
Low	Base mode	2412	16580	>500	PASS
Mid		2437	16500		PASS
High		2462	16580		PASS
Mid	Turbo mode	2437	32500		PASS

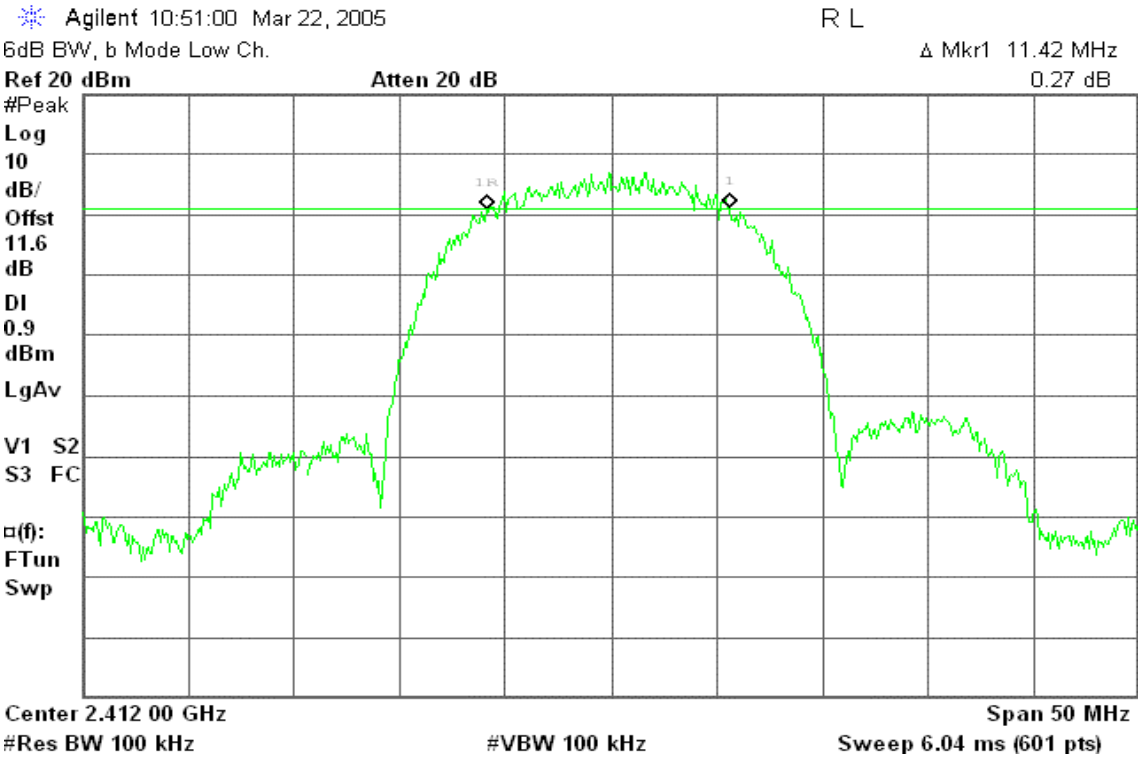
Test mode: IEEE 802.11a mode

Channel	Frequency (MHz)		Bandwidth (kHz)	Limit (kHz)	Test Result
Low	Base mode	5745	16420	>500	PASS
Mid		5785	16500		PASS
High		5825	16500		PASS
Low	Turbo mode	5760	32750		PASS
High		5800	32920		PASS

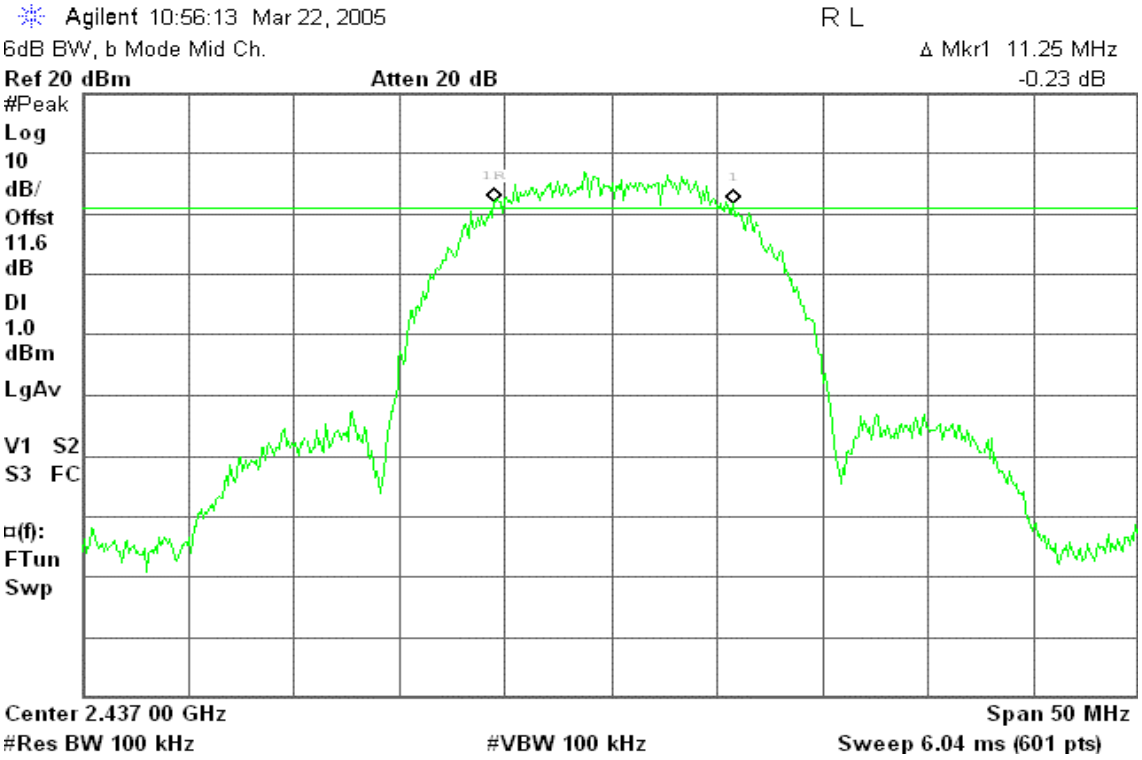
Test Plot

IEEE 802.11b mode

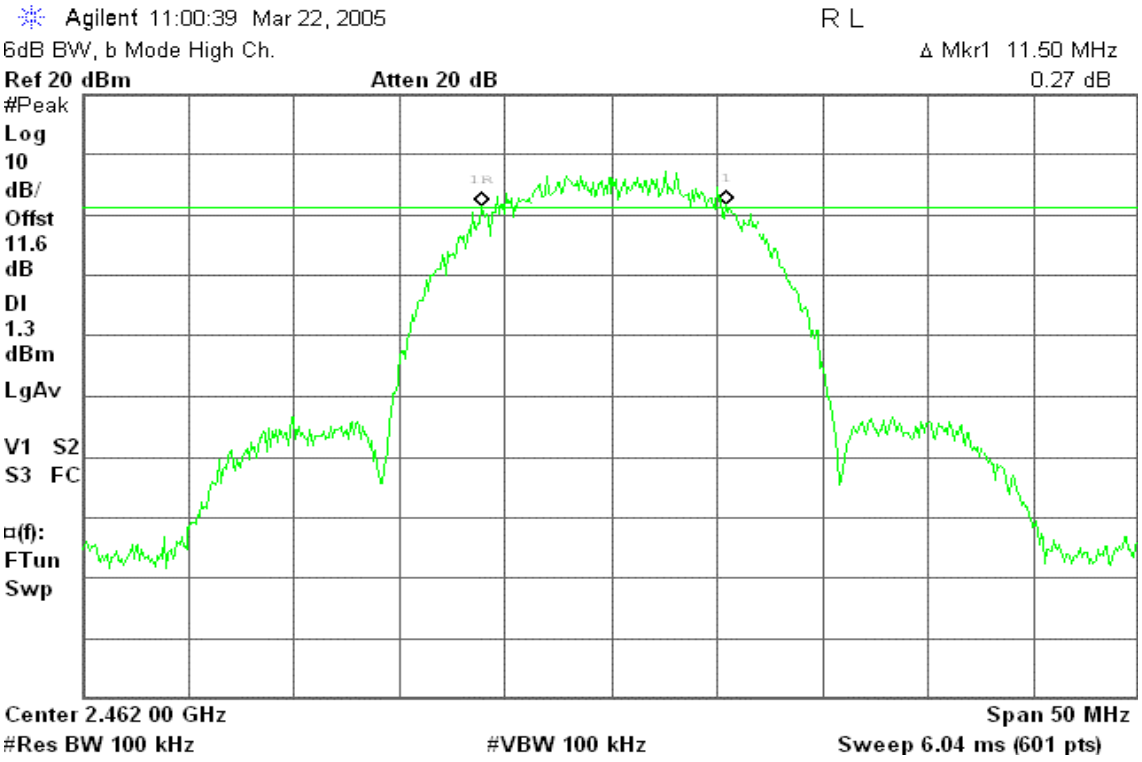
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)

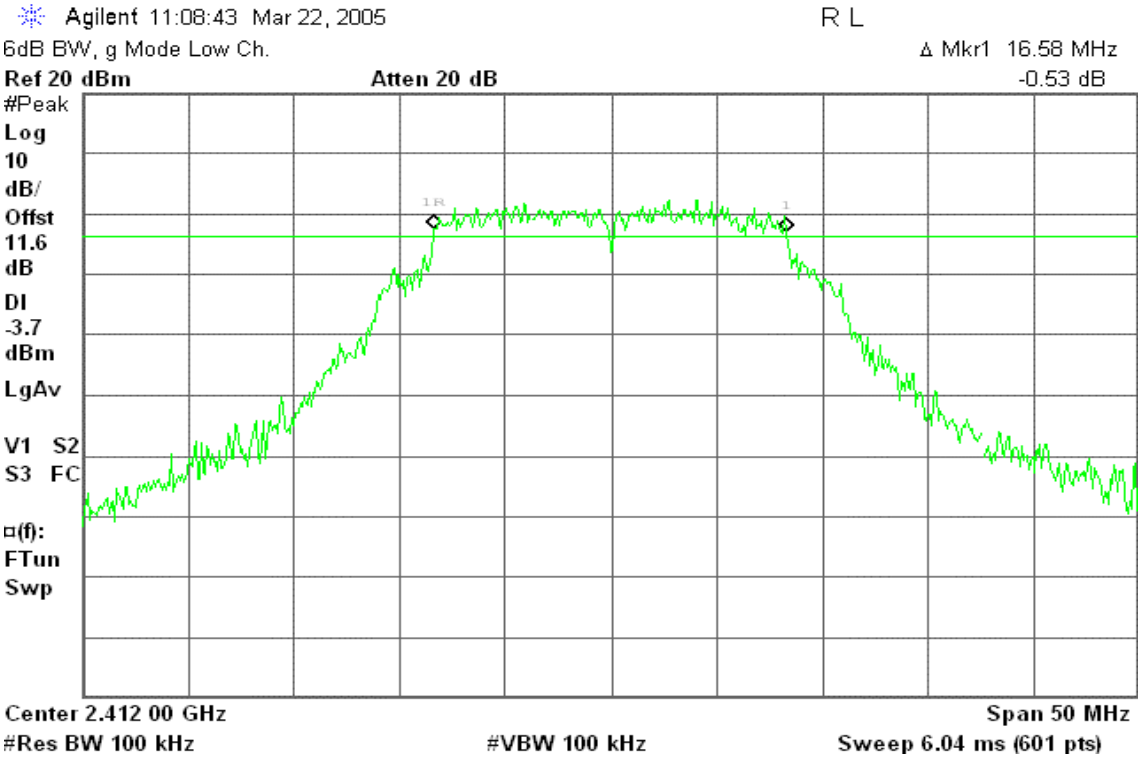


6dB Bandwidth (CH High)

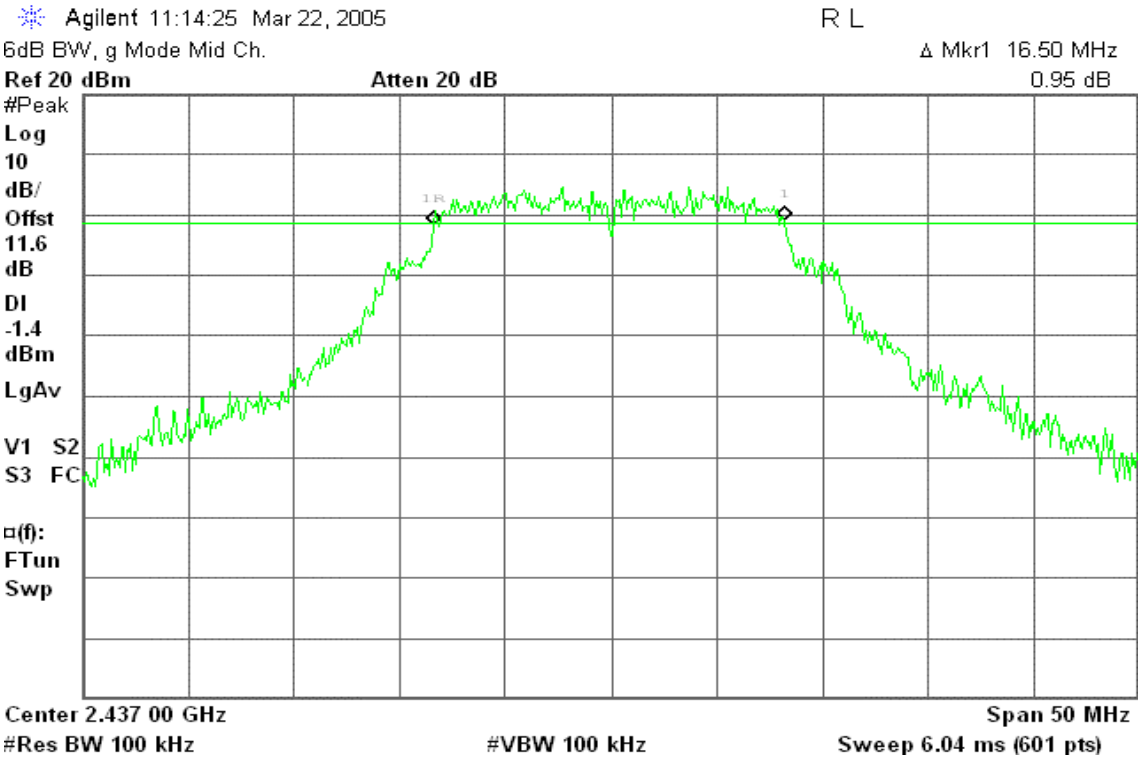


IEEE 802.11g Base mode

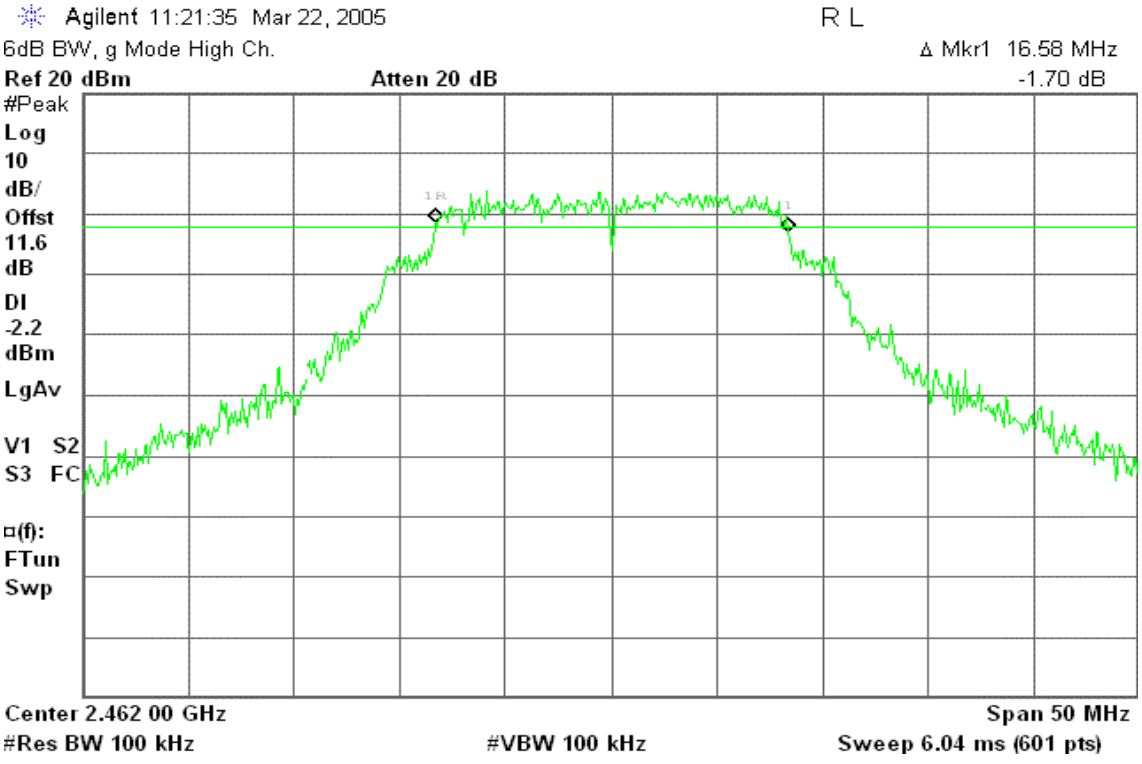
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)

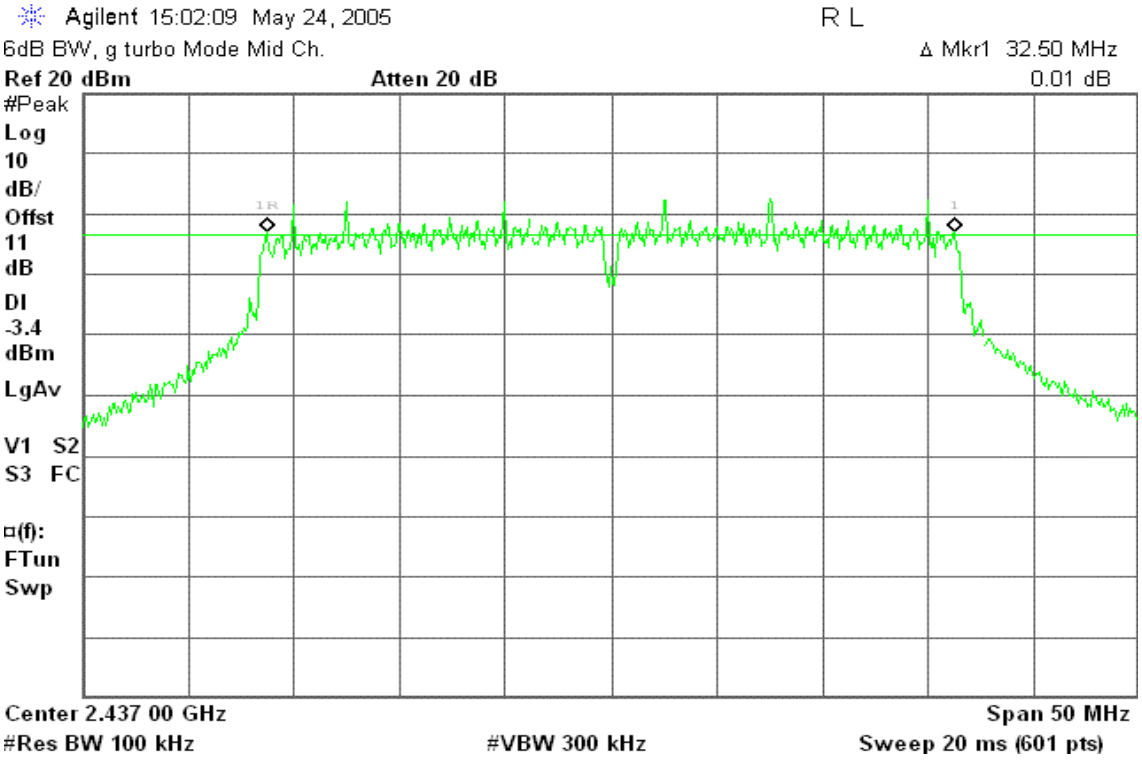


6dB Bandwidth (CH High)



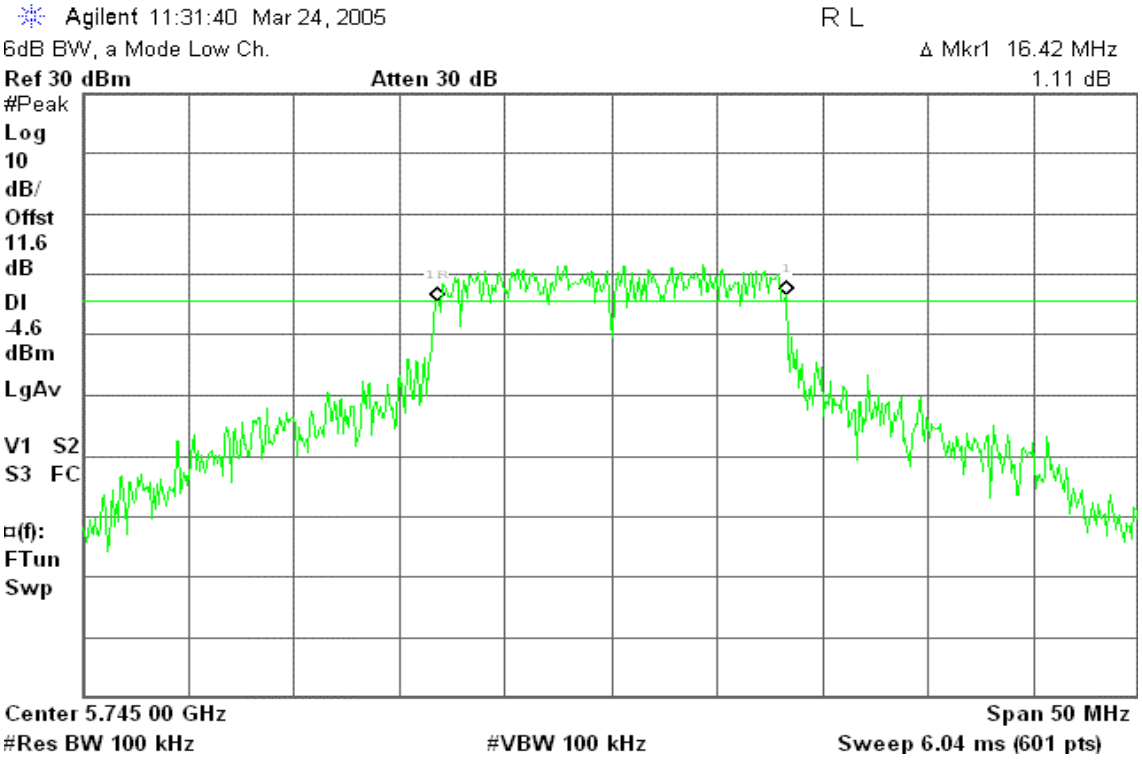
EEE 802.11g Turbo mode

6dB Bandwidth (CH Mid)

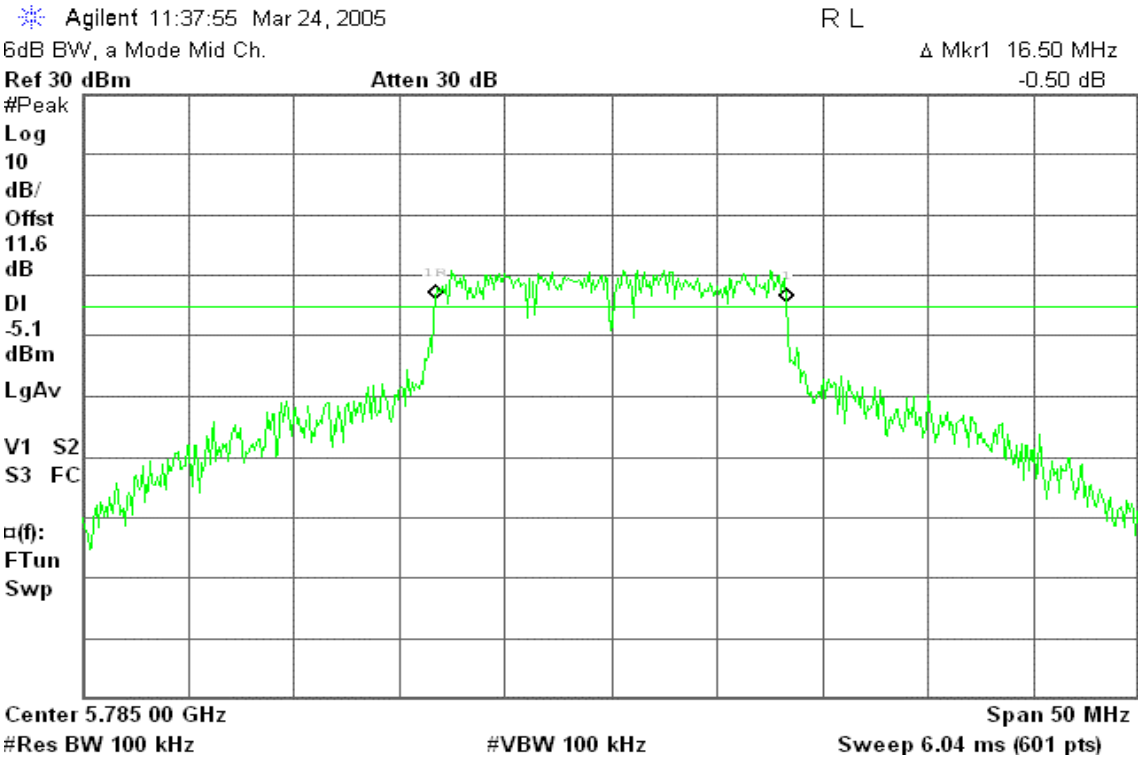


IEEE 802.11a Base mode

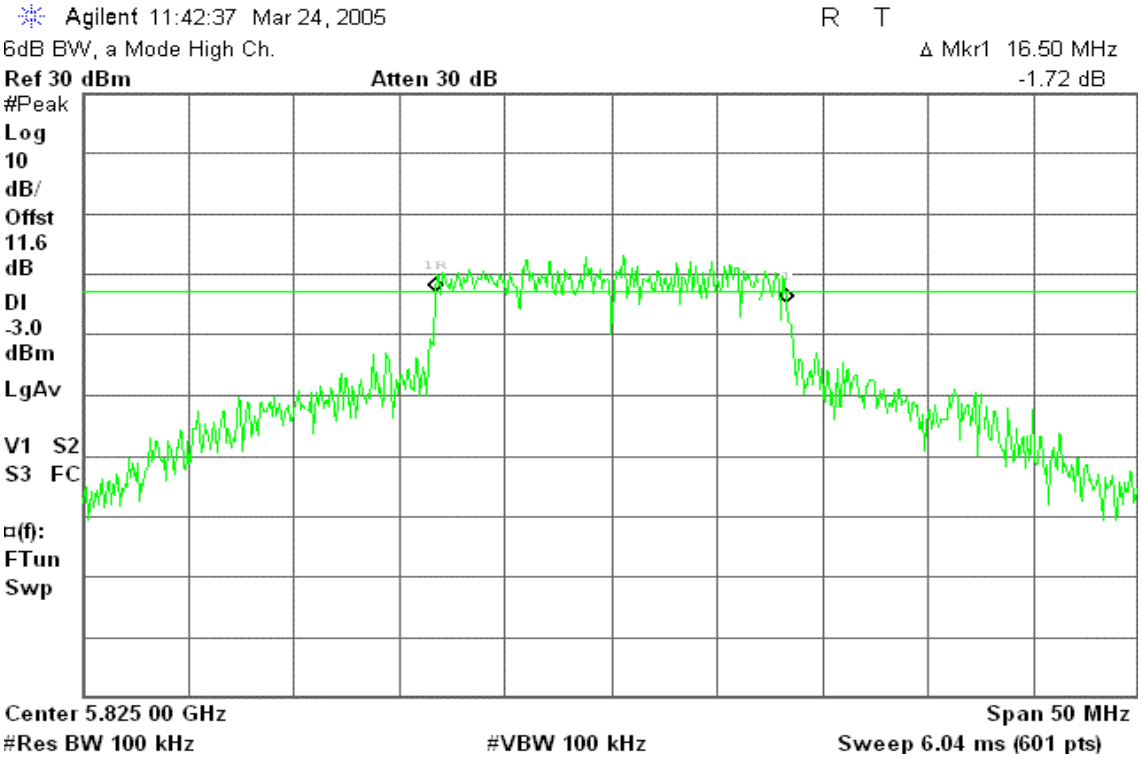
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)

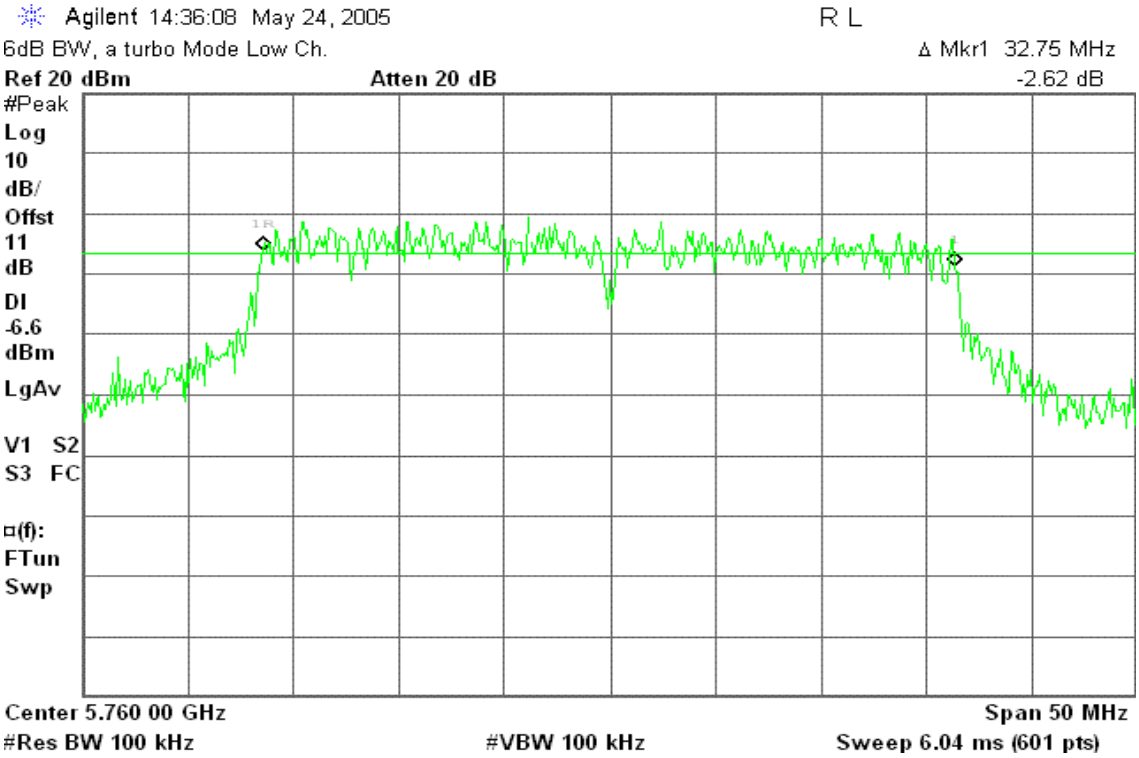


6dB Bandwidth (CH High)

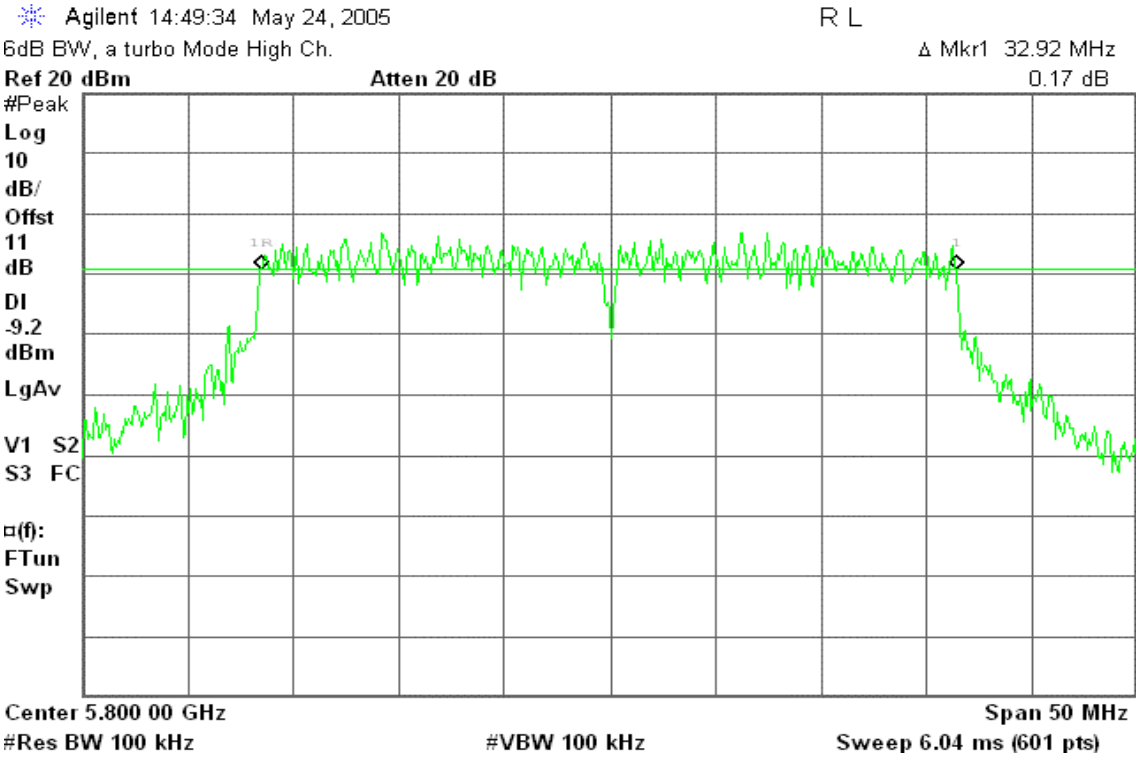


IEEE 802.11a Turbo mode

6dB Bandwidth (CH Low)



6dB Bandwidth (CH High)



7.2 PEAK POWER

LIMIT

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

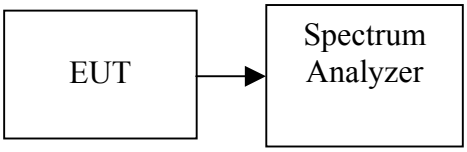
1. For systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 watt.
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional 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	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

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 mode

Channel	Frequency (MHz)	Reading Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2412	10.05	11.6	21.65	0.1462	1	PASS
Mid	2437	9.69	11.6	21.29	0.1346		PASS
High	2462	9.40	11.6	21.00	0.1259		PASS

Test mode: IEEE 802.11g mode

Channel	Frequency (MHz)		Reading Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	Base mode	2412	8.73	11.6	20.33	0.1079	1	PASS
Mid		2437	8.84	11.6	20.44	0.1107		PASS
High		2462	8.91	11.6	20.51	0.1125		PASS
Mid	Turbo mode	2437	9.92	11.0	20.92	0.1236		PASS

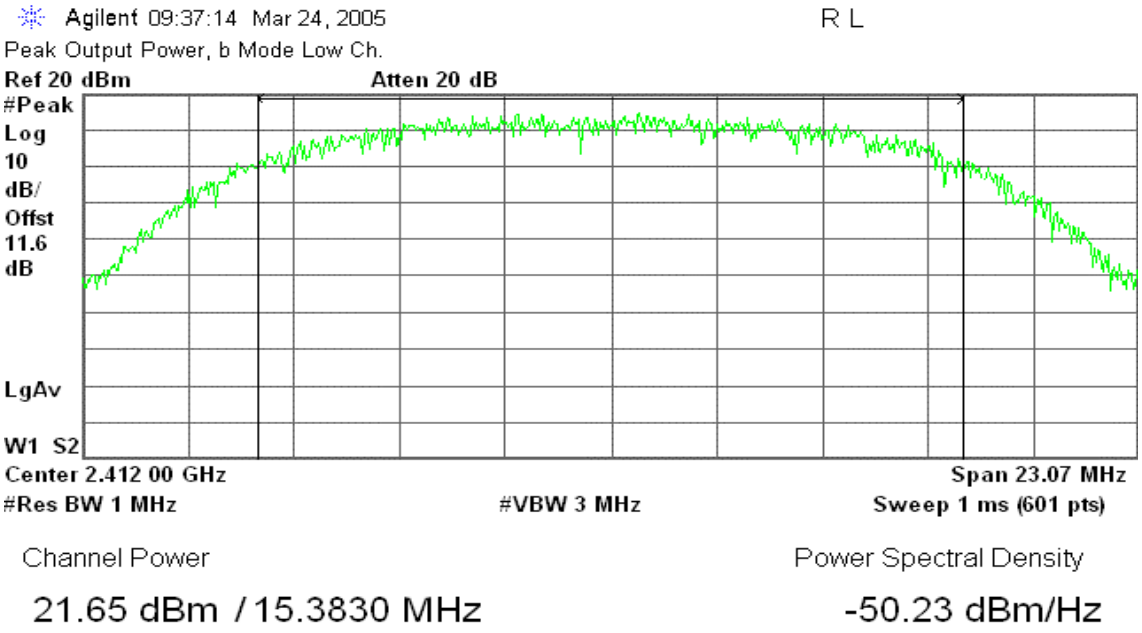
Test mode: IEEE 802.11a mode

Channel	Frequency (MHz)		Reading Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	Base mode	5745	8.99	11.6	20.59	0.1146	1	PASS
Mid		5785	8.65	11.6	20.25	0.1059		PASS
High		5825	9.12	11.6	20.72	0.1180		PASS
Low	Turbo mode	5760	5.60	11.0	16.60	0.0457		PASS
High		5800	5.66	11.0	16.66	0.0463		PASS

Test Plot

IEEE 802.11b Base mode

Peak power (CH Low)



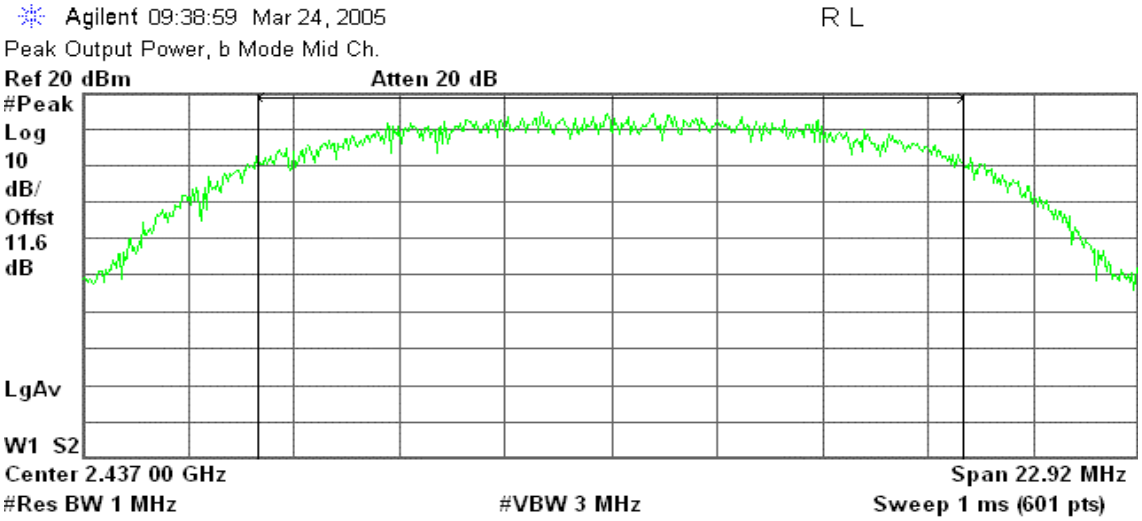
Channel Power

21.65 dBm / 15.3830 MHz

Power Spectral Density

-50.23 dBm/Hz

Peak power (CH Mid)



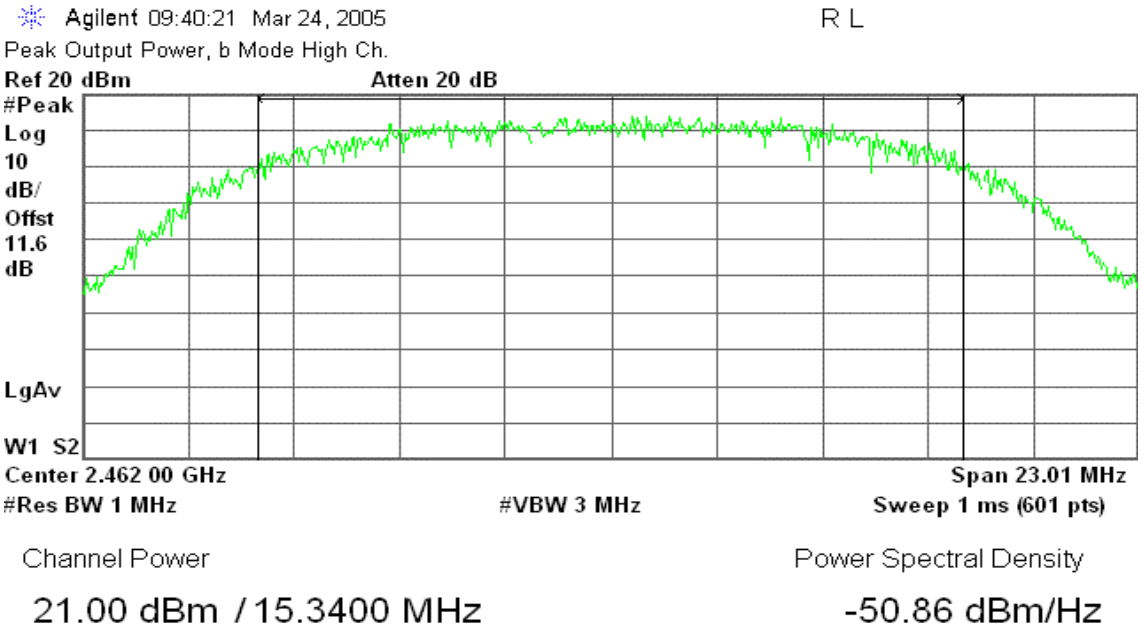
Channel Power

21.29 dBm / 15.2790 MHz

Power Spectral Density

-50.55 dBm/Hz

Peak power (CH High)

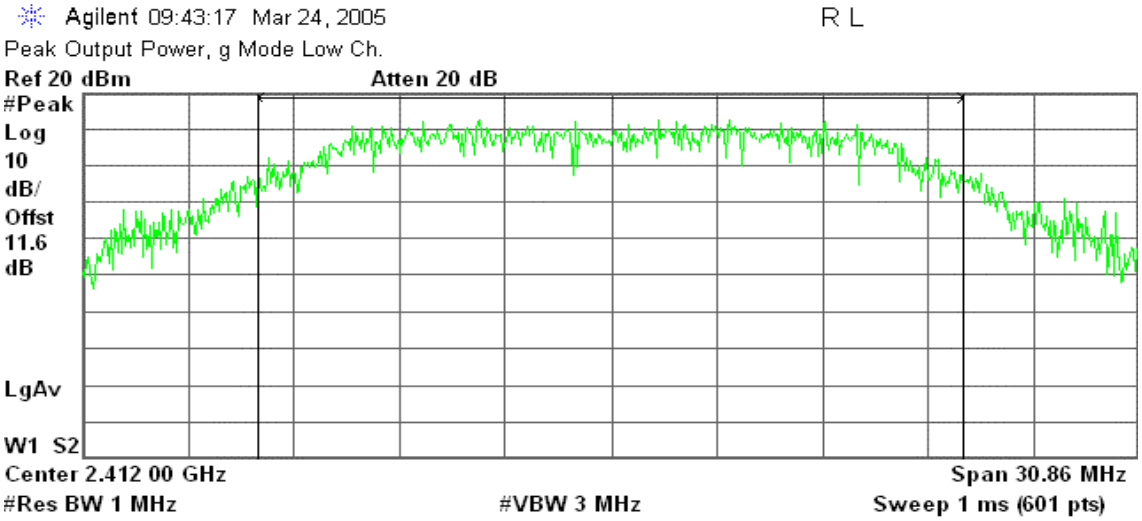


Channel Power
21.00 dBm / 15.3400 MHz

Power Spectral Density
-50.86 dBm/Hz

IEEE 802.11g Base mode

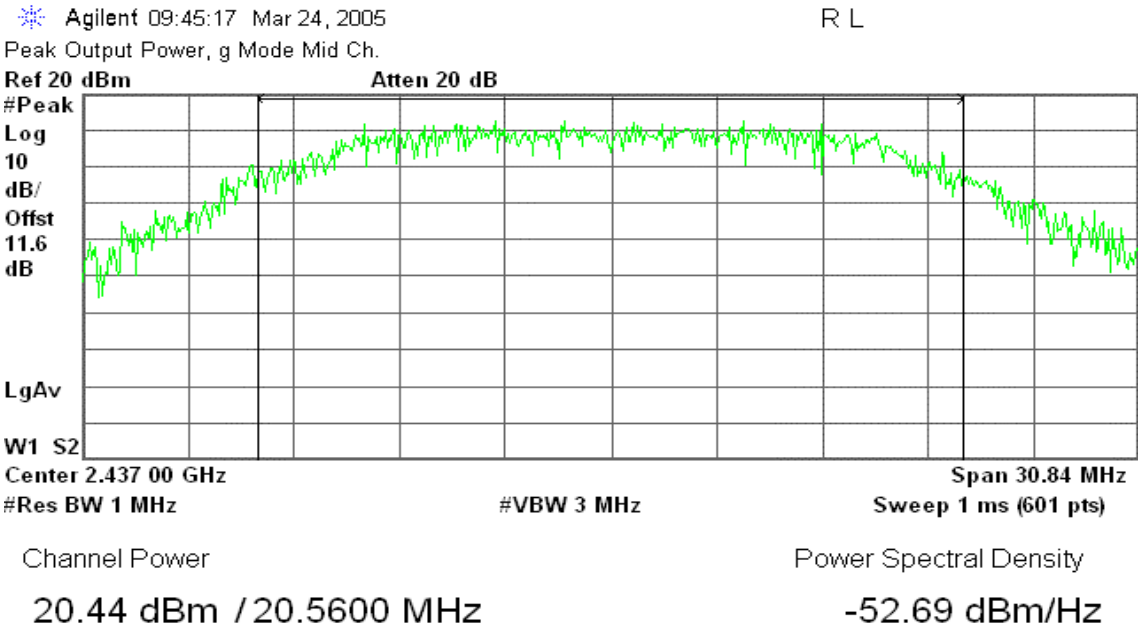
Peak power (CH Low)



Channel Power
20.33 dBm / 20.5740 MHz

Power Spectral Density
-52.80 dBm/Hz

Peak power (CH Mid)



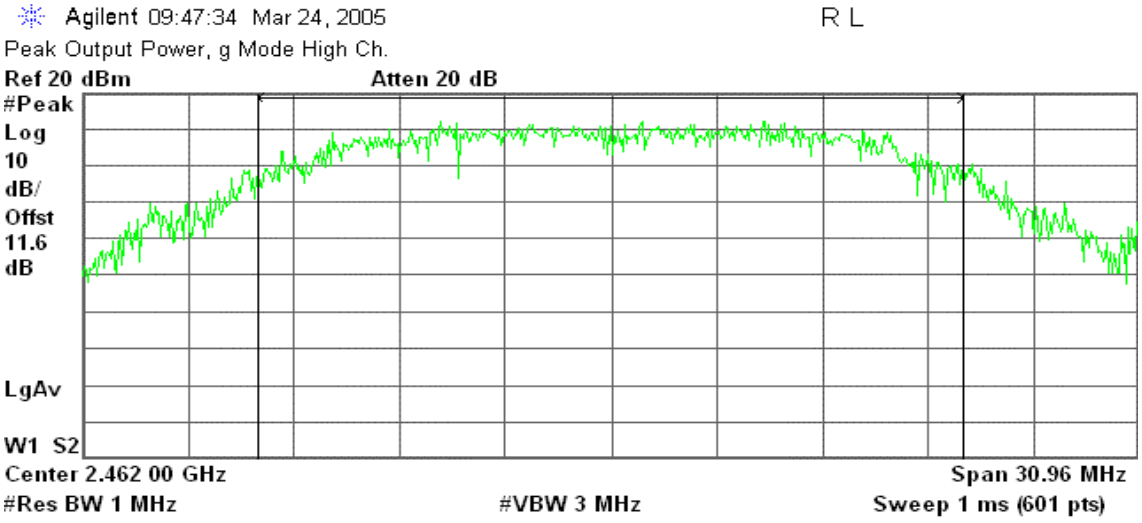
Channel Power

20.44 dBm / 20.5600 MHz

Power Spectral Density

-52.69 dBm/Hz

Peak power (CH High)



Channel Power

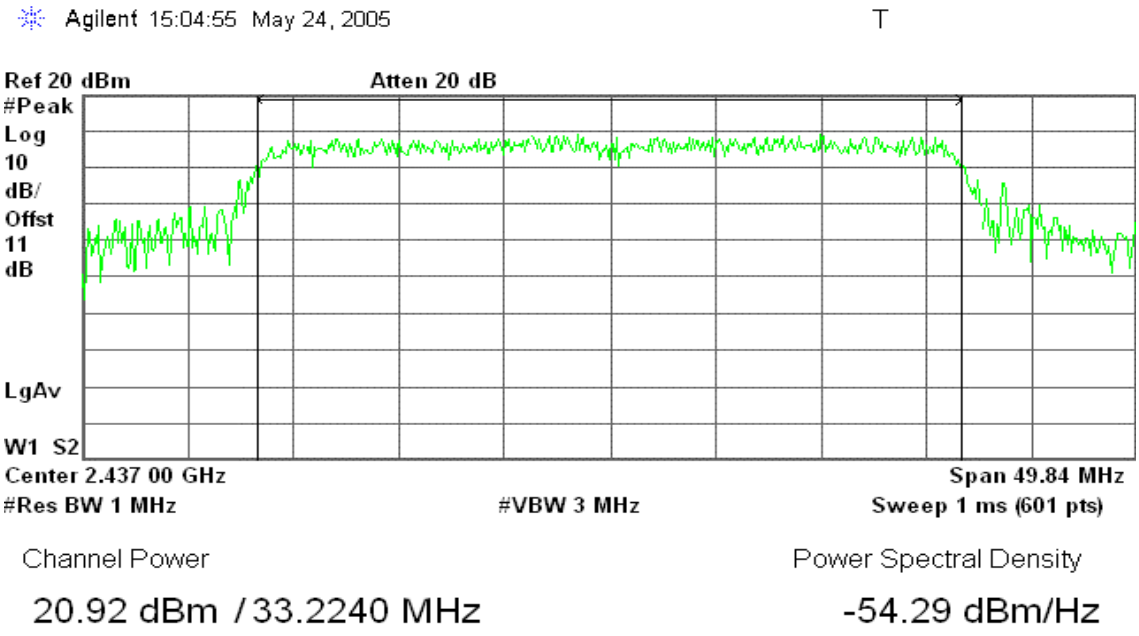
20.51 dBm / 20.6370 MHz

Power Spectral Density

-52.64 dBm/Hz

IEEE 802.11g Turbo mode

Peak power (CH Mid)

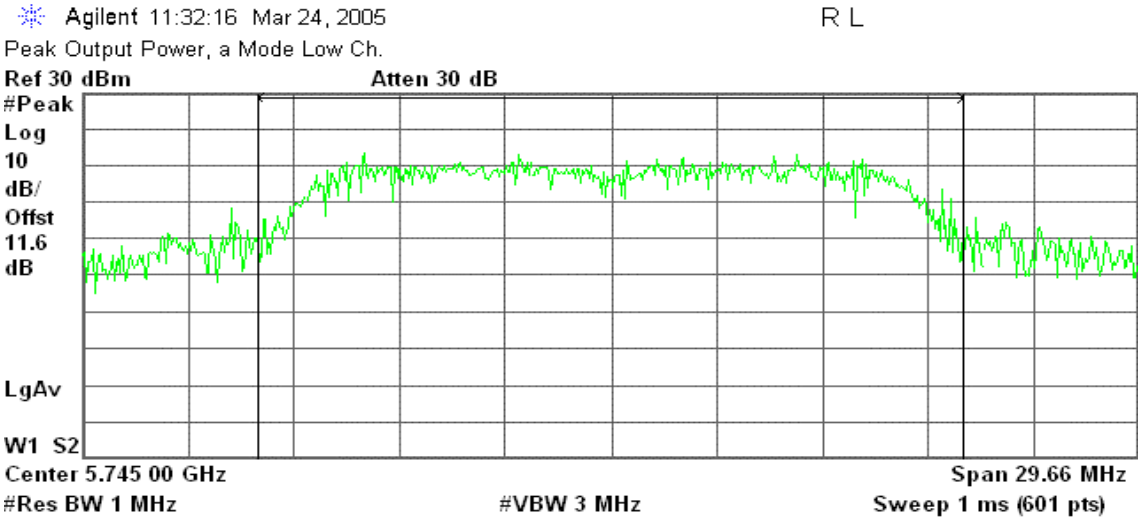


Channel Power
20.92 dBm / 33.2240 MHz

Power Spectral Density
-54.29 dBm/Hz

IEEE 802.11a Base mode

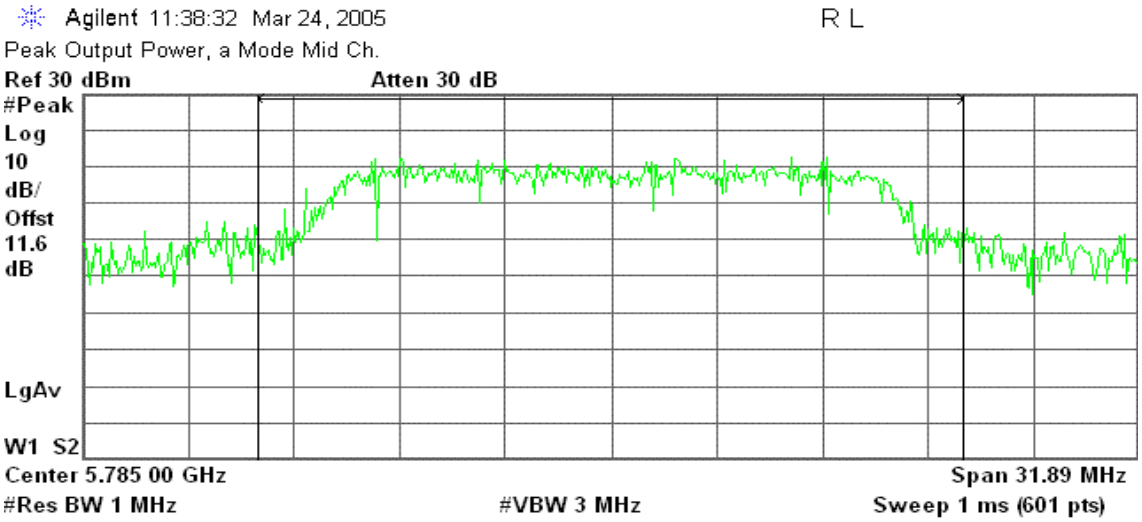
Peak power (CH Low)



Channel Power
20.59 dBm / 19.7760 MHz

Power Spectral Density
-52.37 dBm/Hz

Peak power (CH Mid)



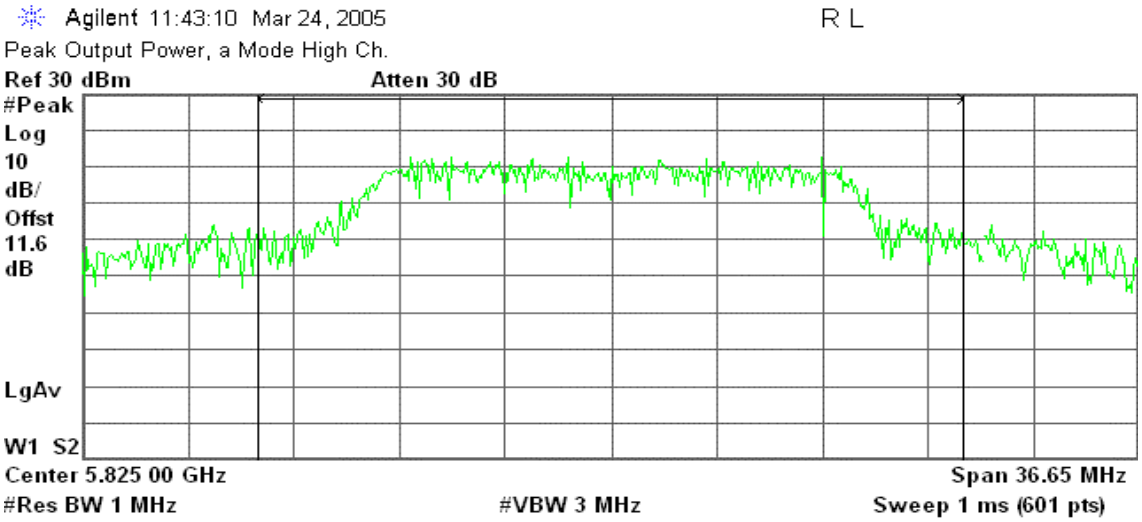
Channel Power

20.25 dBm / 21.2570 MHz

Power Spectral Density

-53.02 dBm/Hz

Peak power (CH High)



Channel Power

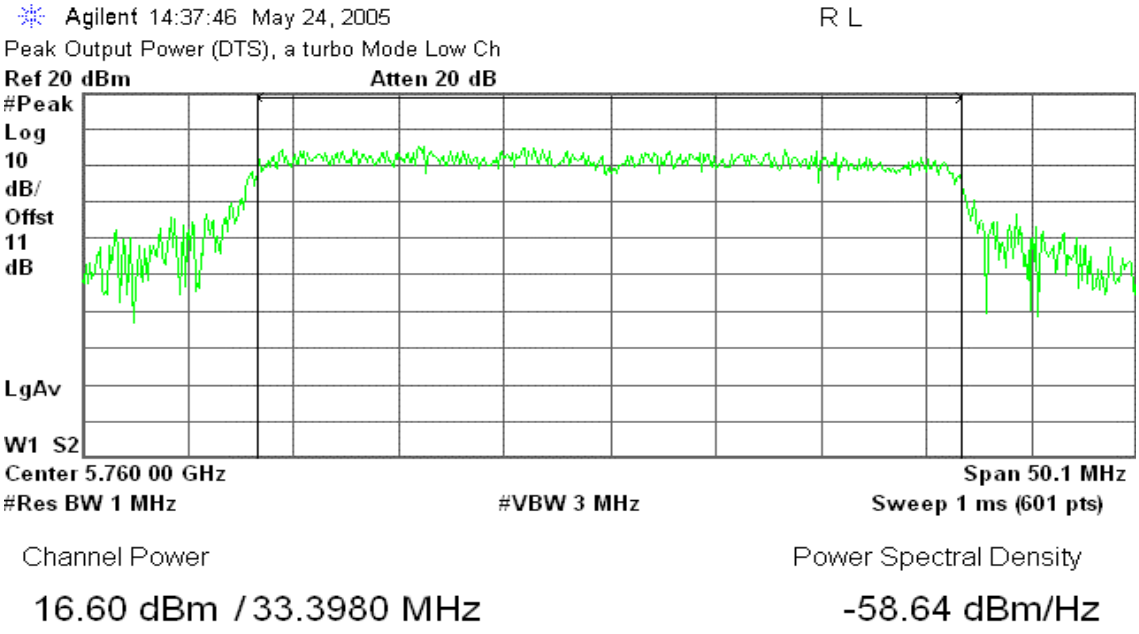
20.72 dBm / 24.4310 MHz

Power Spectral Density

-53.16 dBm/Hz

IEEE 802.11a Turbo mode

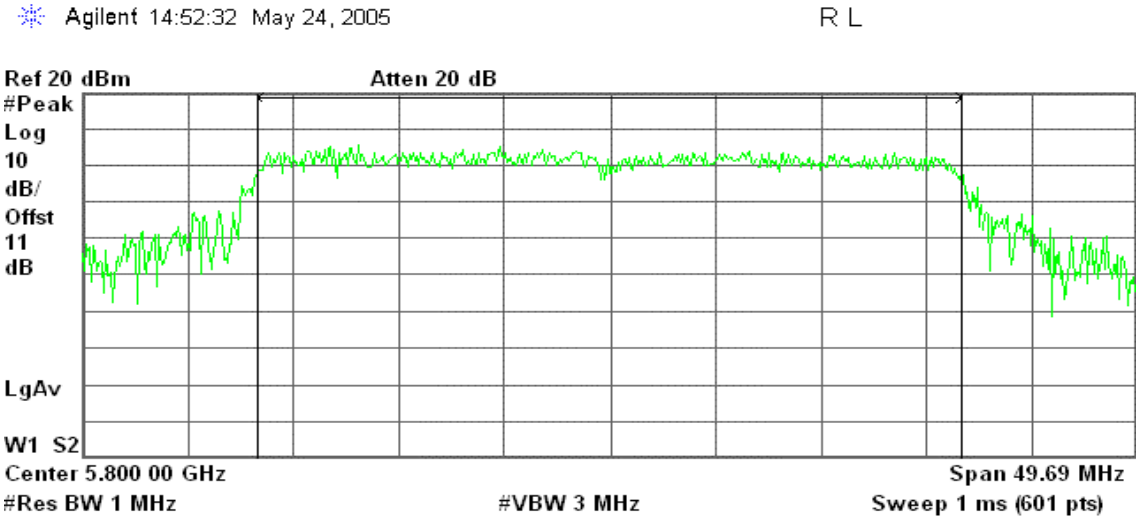
Peak power (CH Low)



Channel Power
16.60 dBm / 33.3980 MHz

Power Spectral Density
-58.64 dBm/Hz

Peak power (CH High)



Channel Power
16.66 dBm / 33.1270 MHz

Power Spectral Density
-58.54 dBm/Hz

7.3 BAND EDGES MEASUREMENT

LIMIT

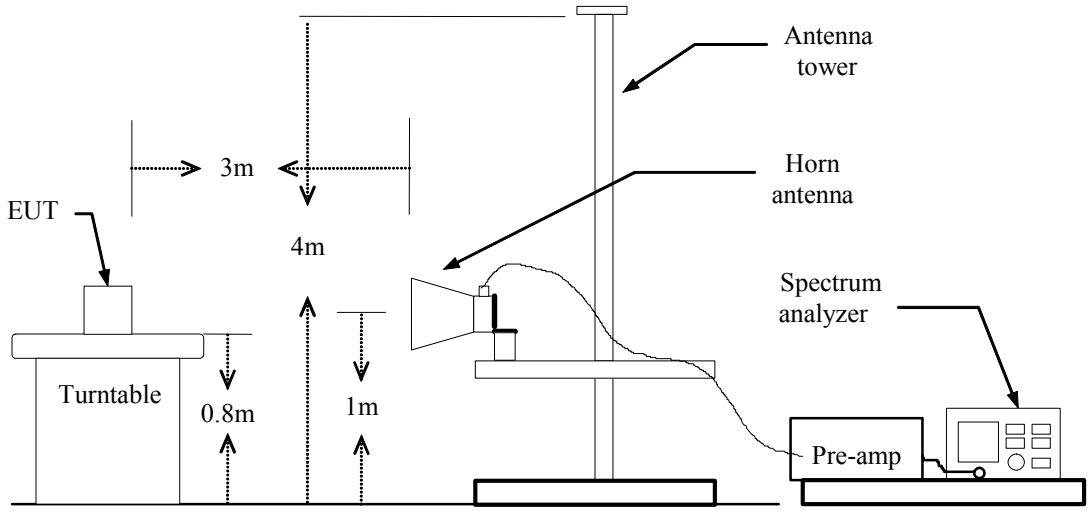
According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains 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 in15.209(a).

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

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

Test Configuration



TEST PROCEDURE

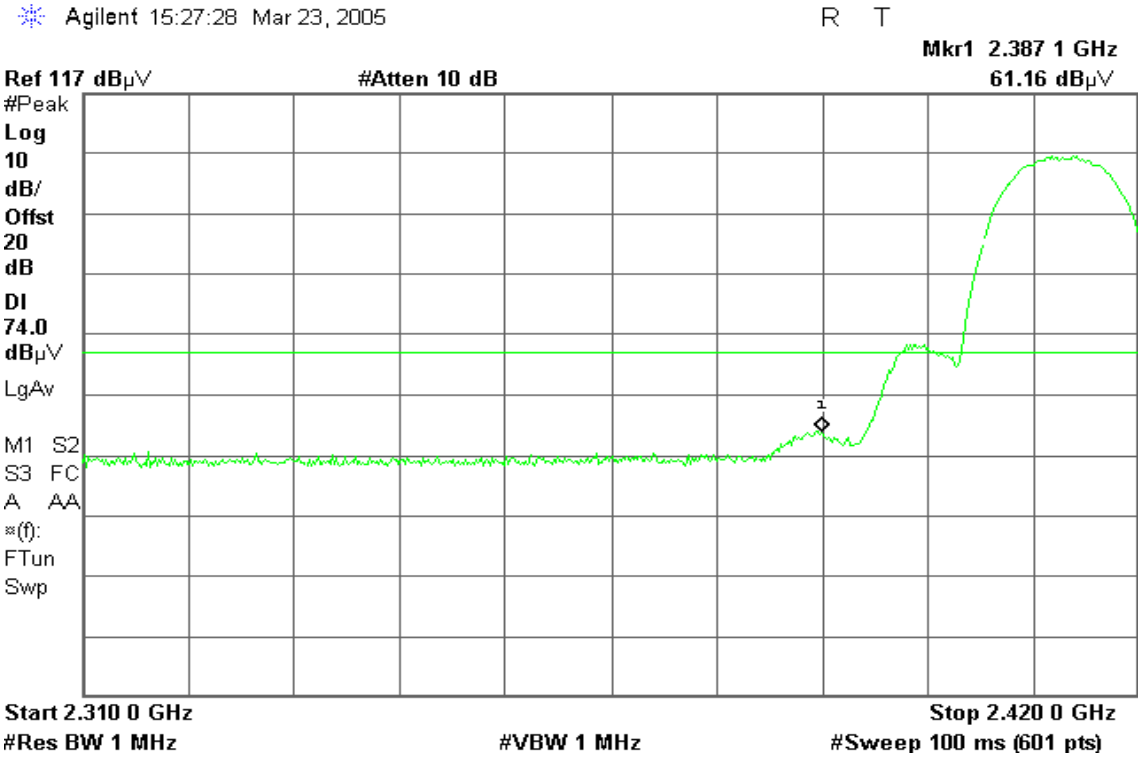
1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the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

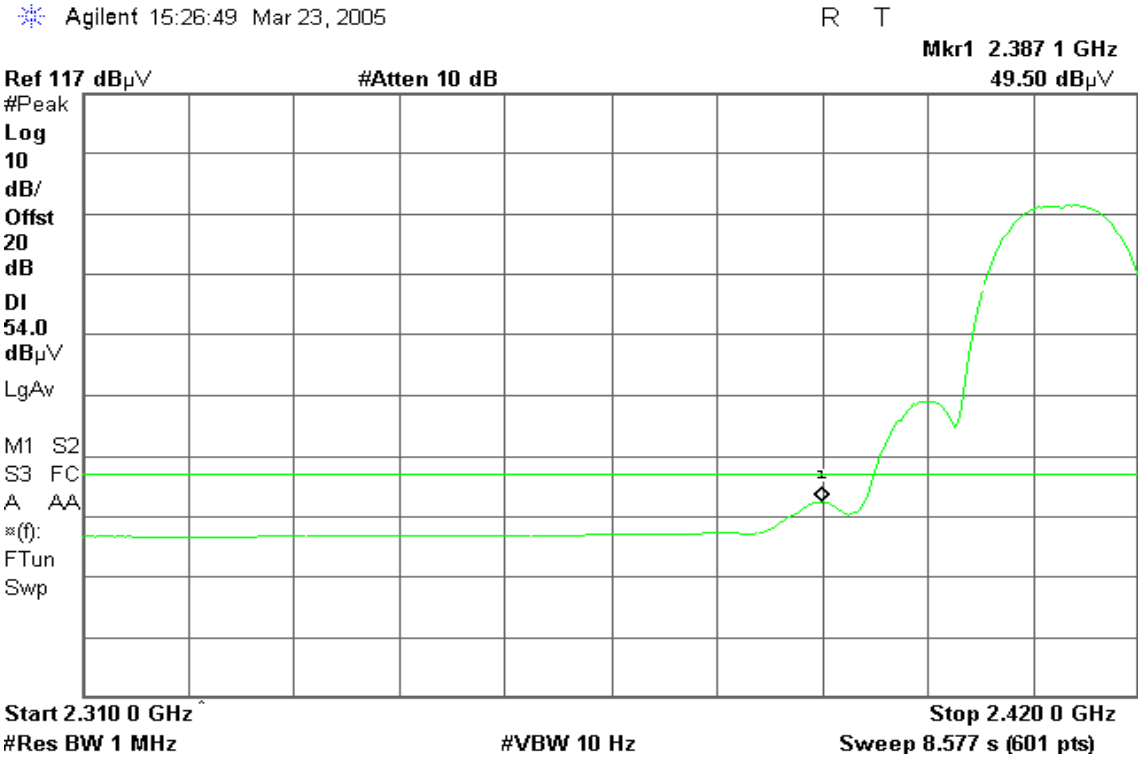
Refer to attach spectrum analyzer data chart.

Band Edges (IEEE 802.11b Base mode / CH Low)

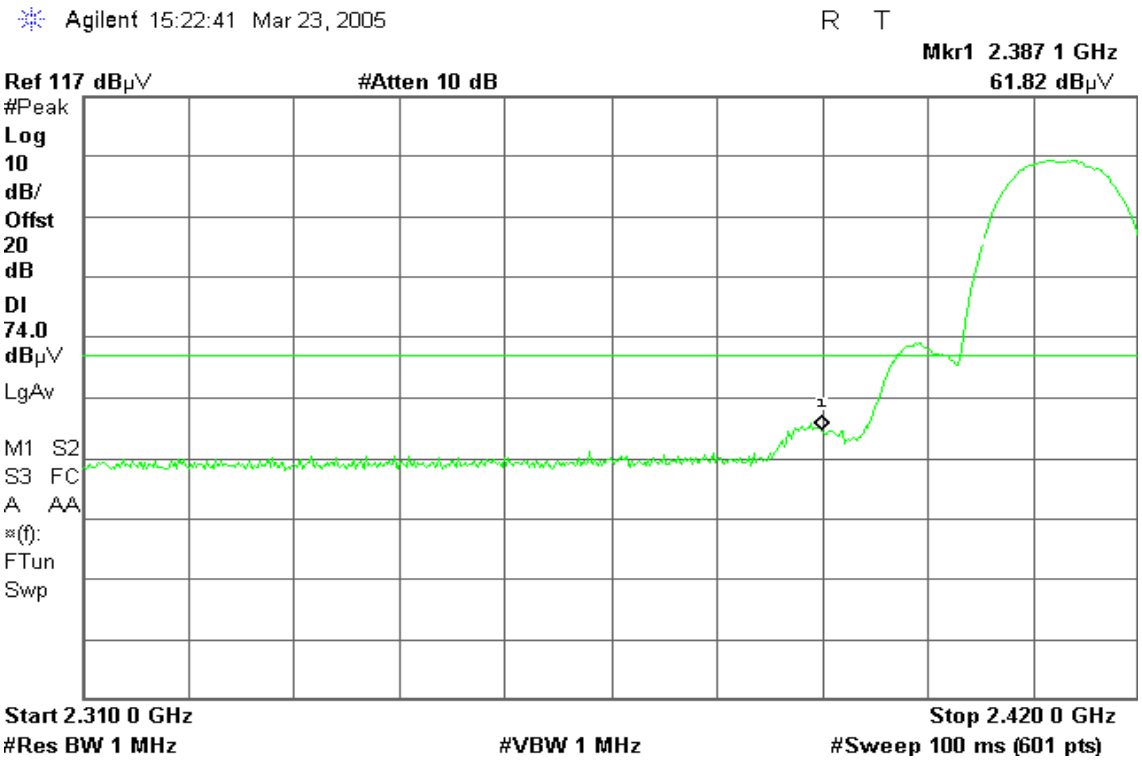
Detector mode: Peak Polarity: Vertical



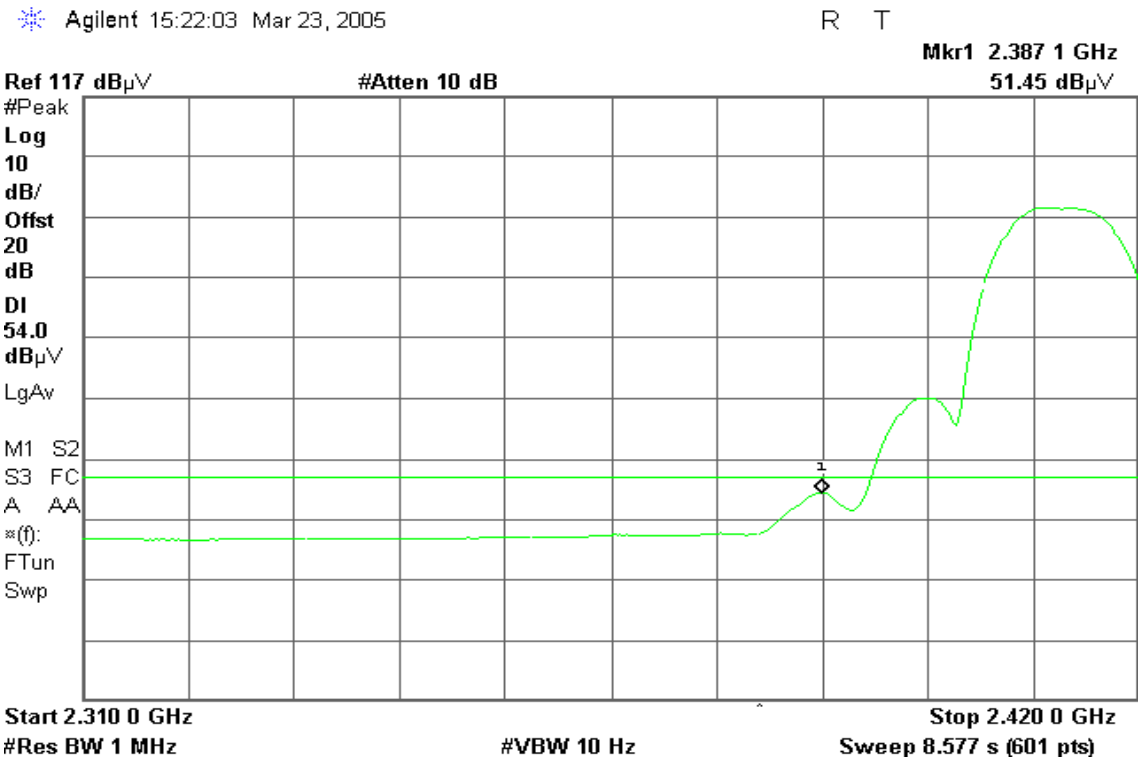
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**

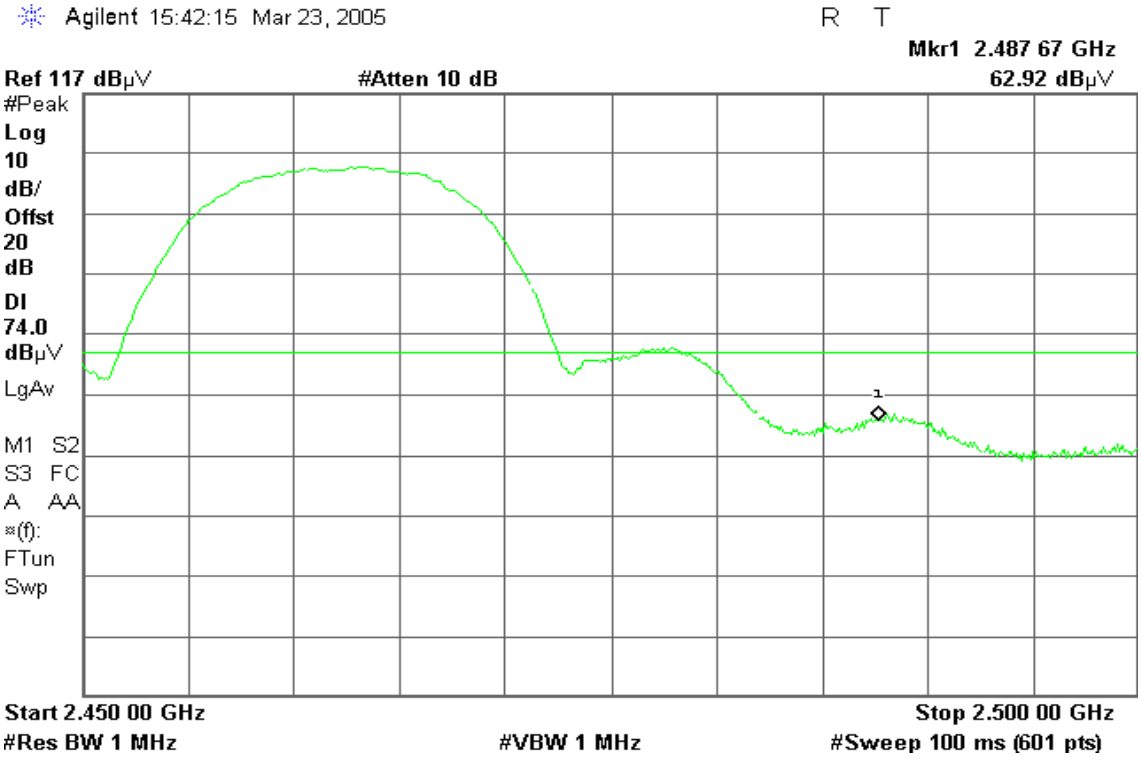


Detector mode: Average **Polarity: Horizontal**

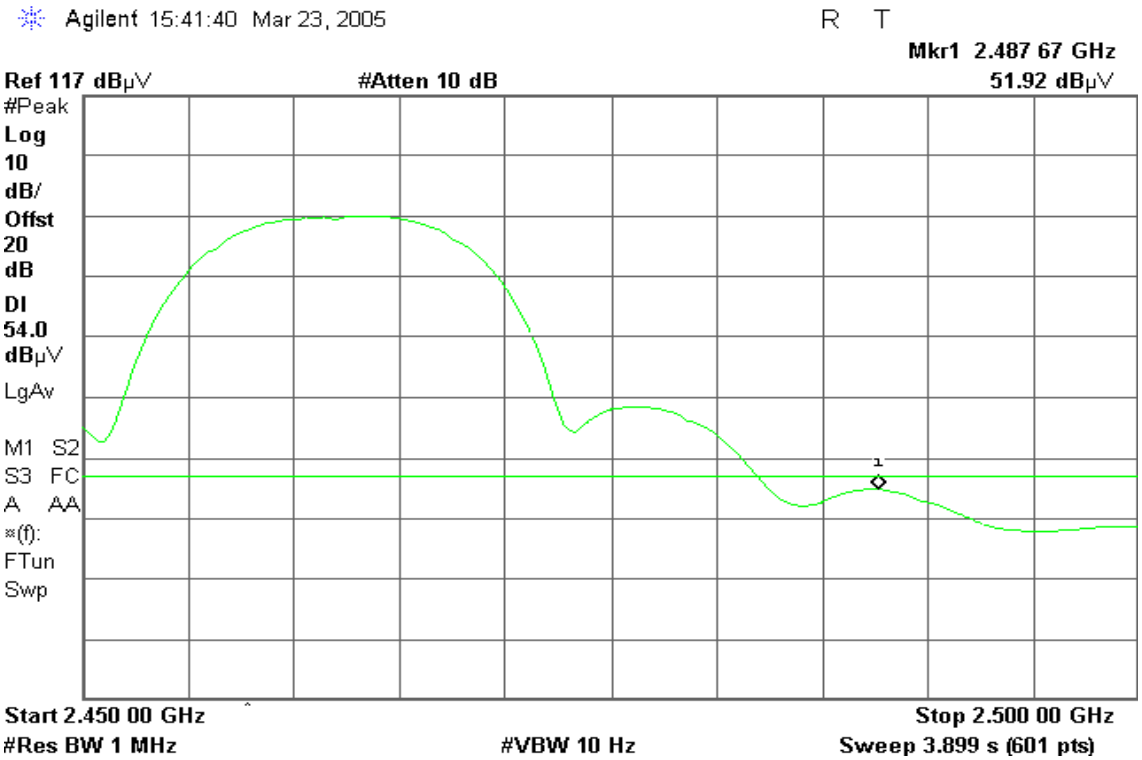


Band Edges (IEEE 802.11b Base mode / CH High)

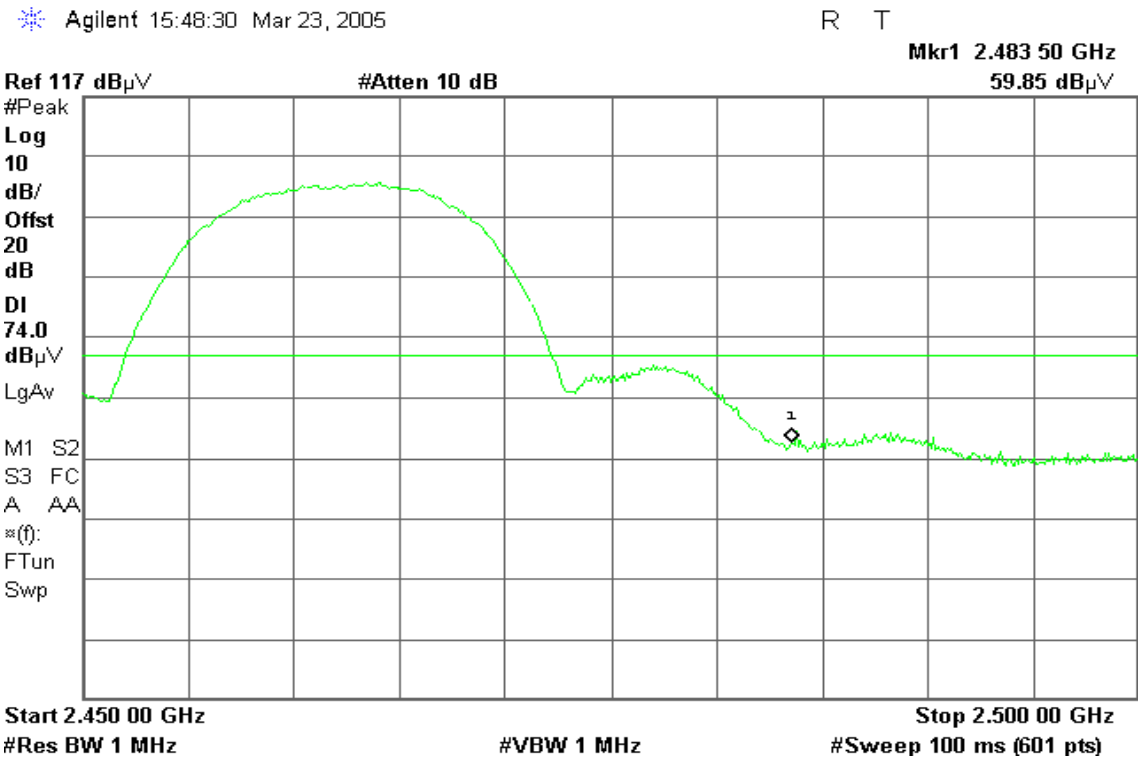
Detector mode: Peak Polarity: Vertical



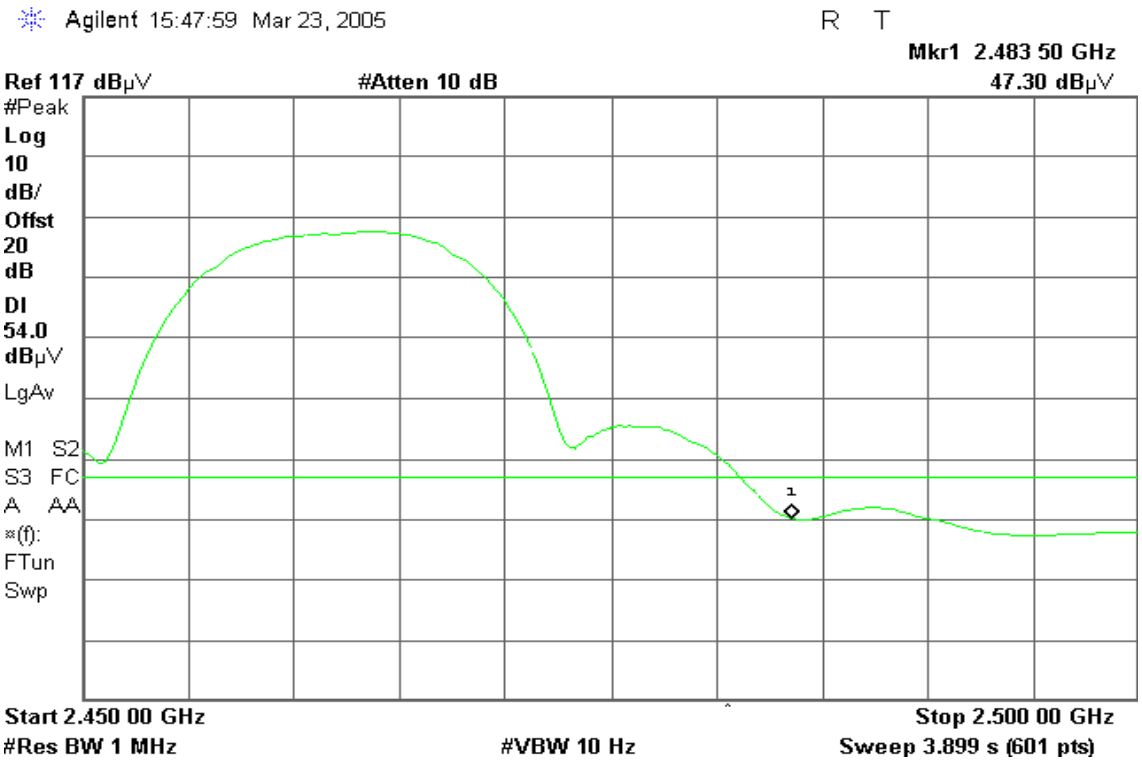
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**

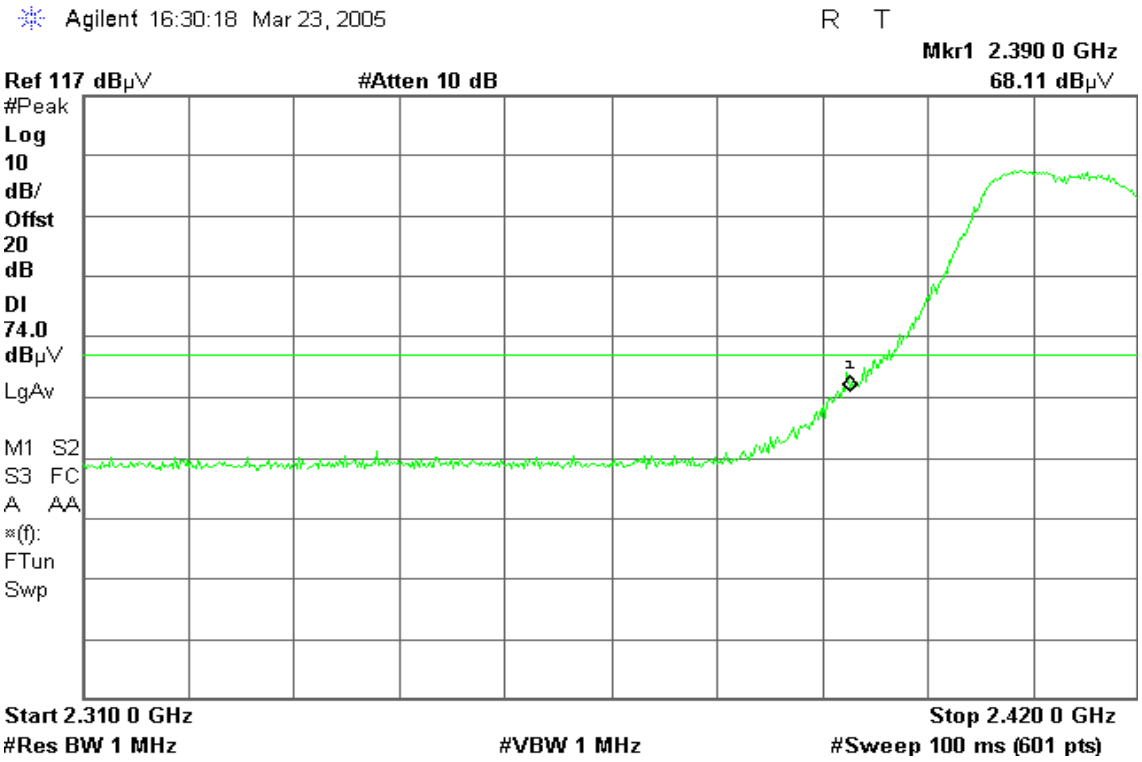


Detector mode: Average **Polarity: Horizontal**

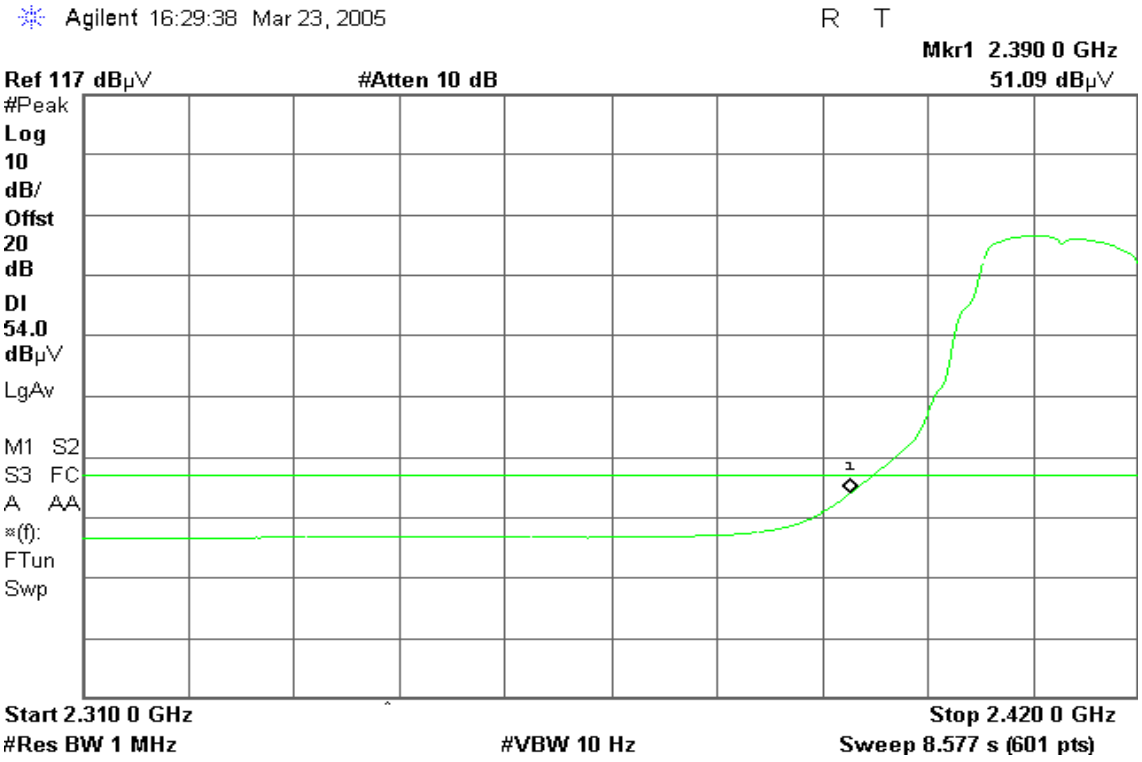


Band Edges (IEEE 802.11g Base mode / CH Low)

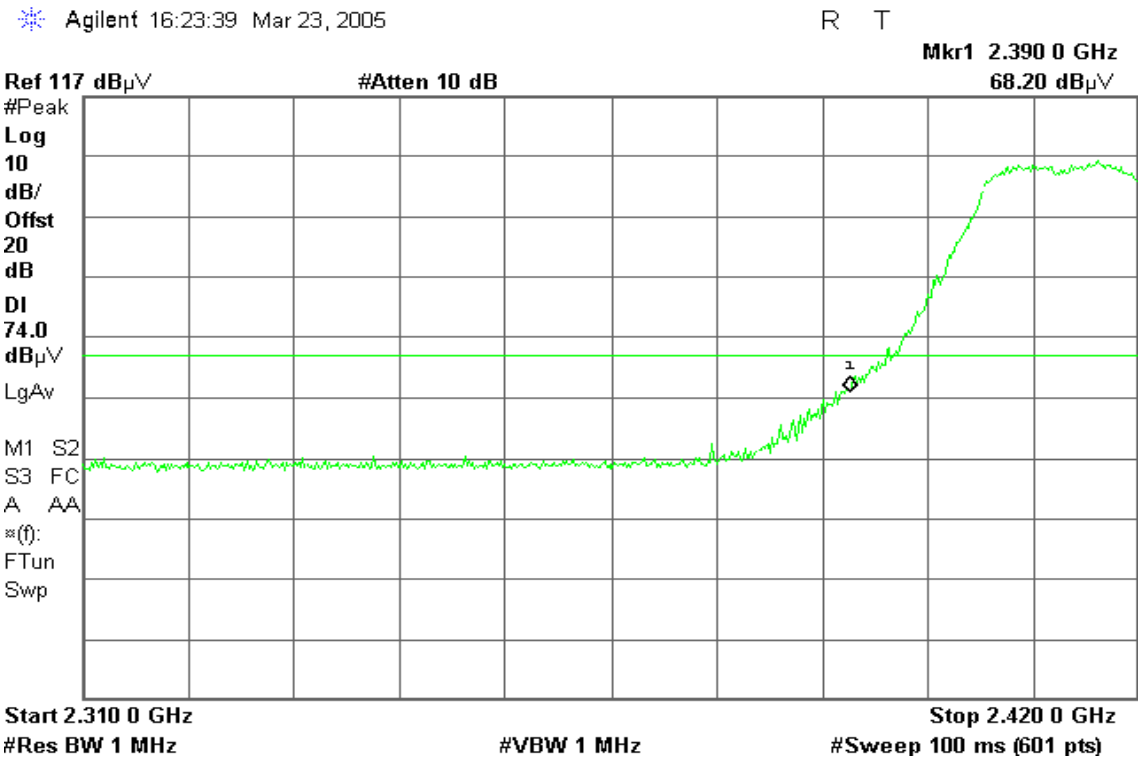
Detector mode: Peak Polarity: Vertical



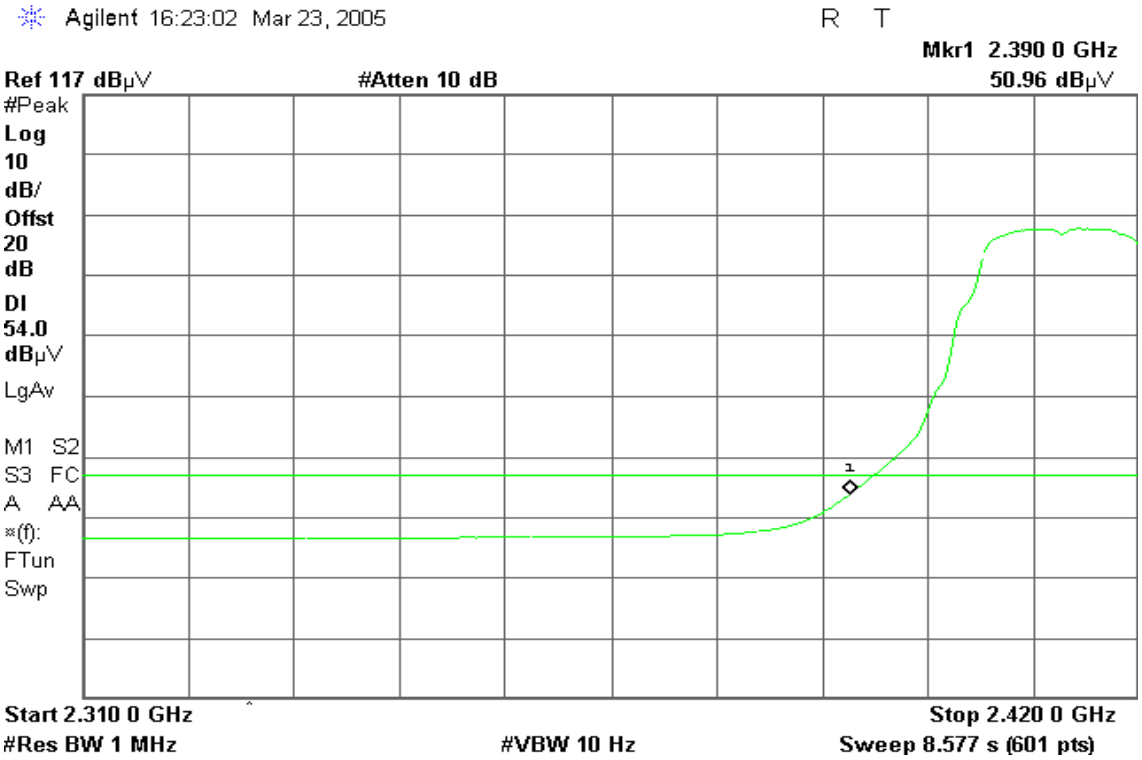
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**

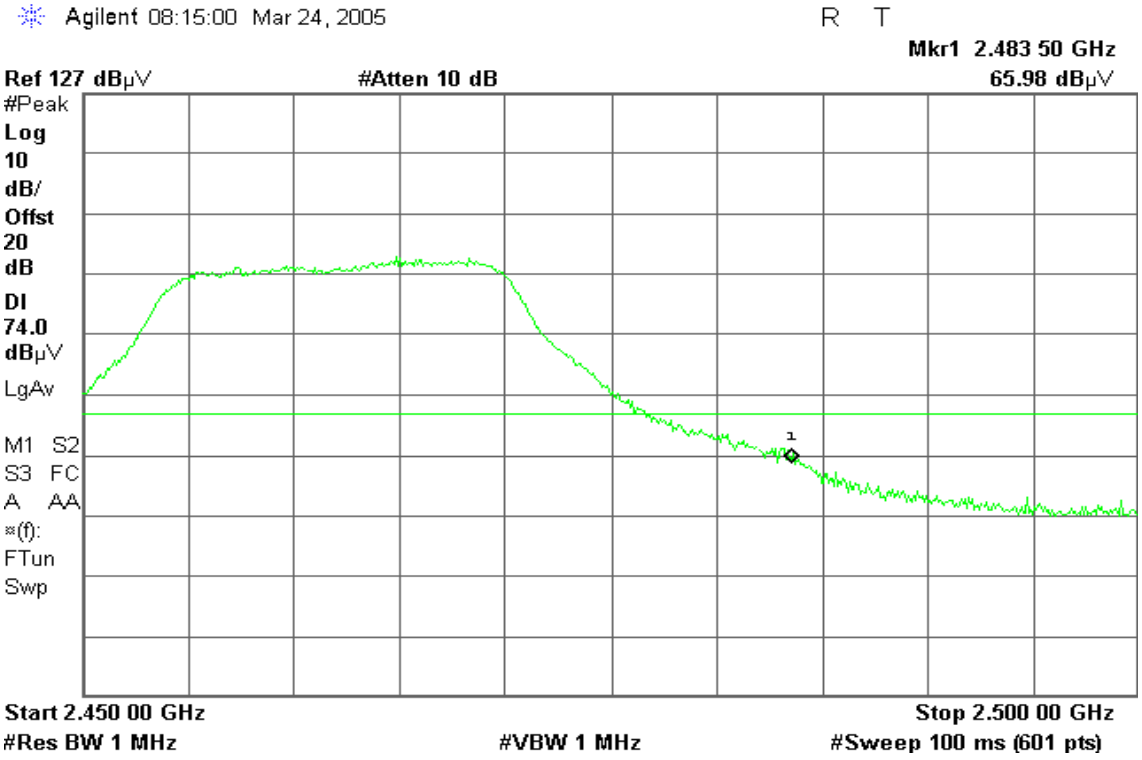


Detector mode: Average **Polarity: Horizontal**

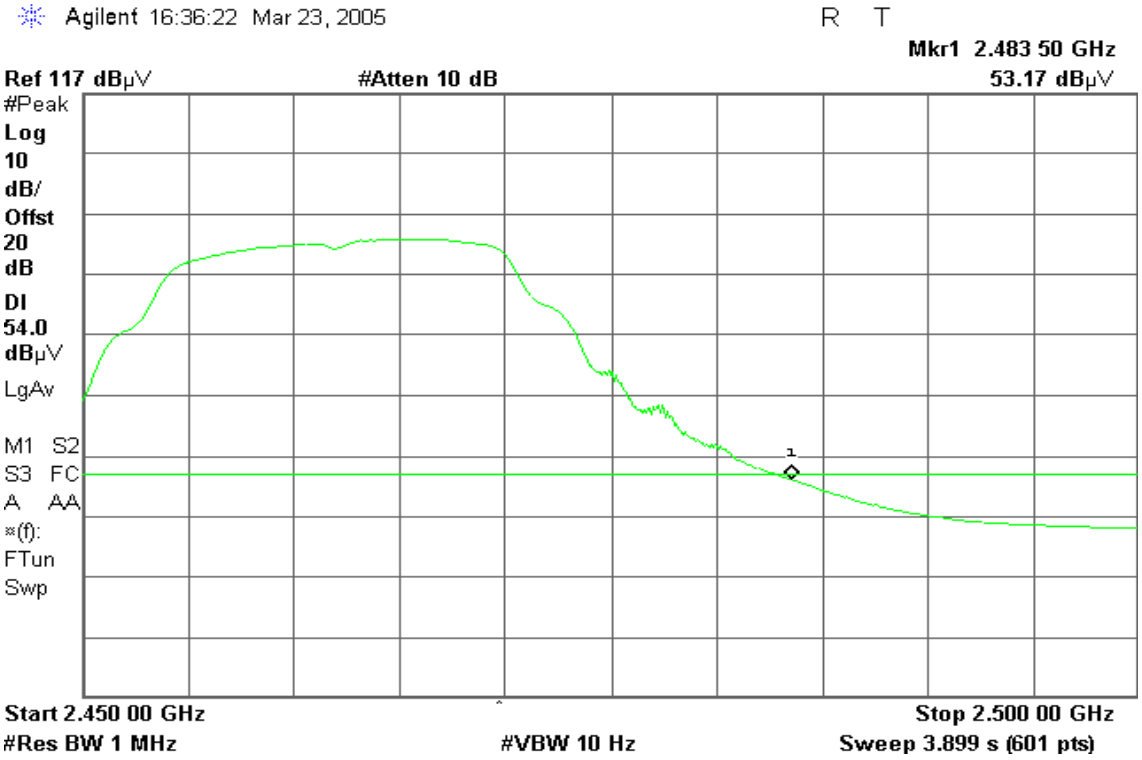


Band Edges (IEEE 802.11g Base mode / CH High)

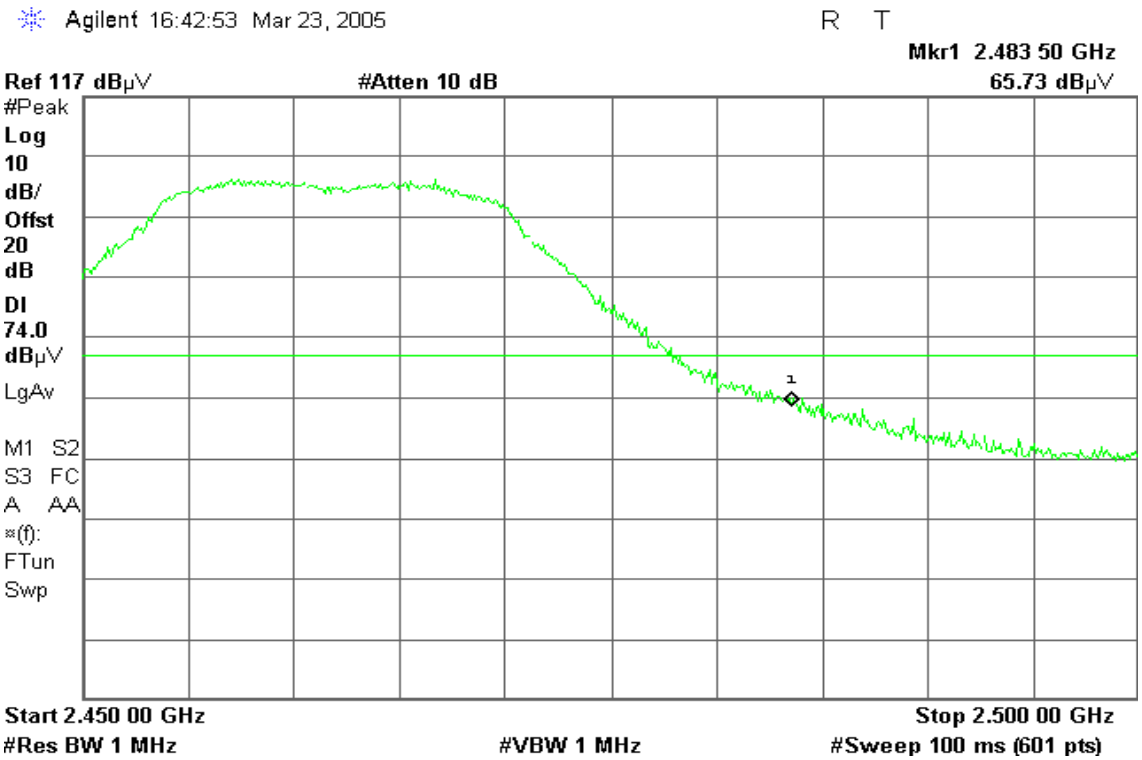
Detector mode: Peak Polarity: Vertical



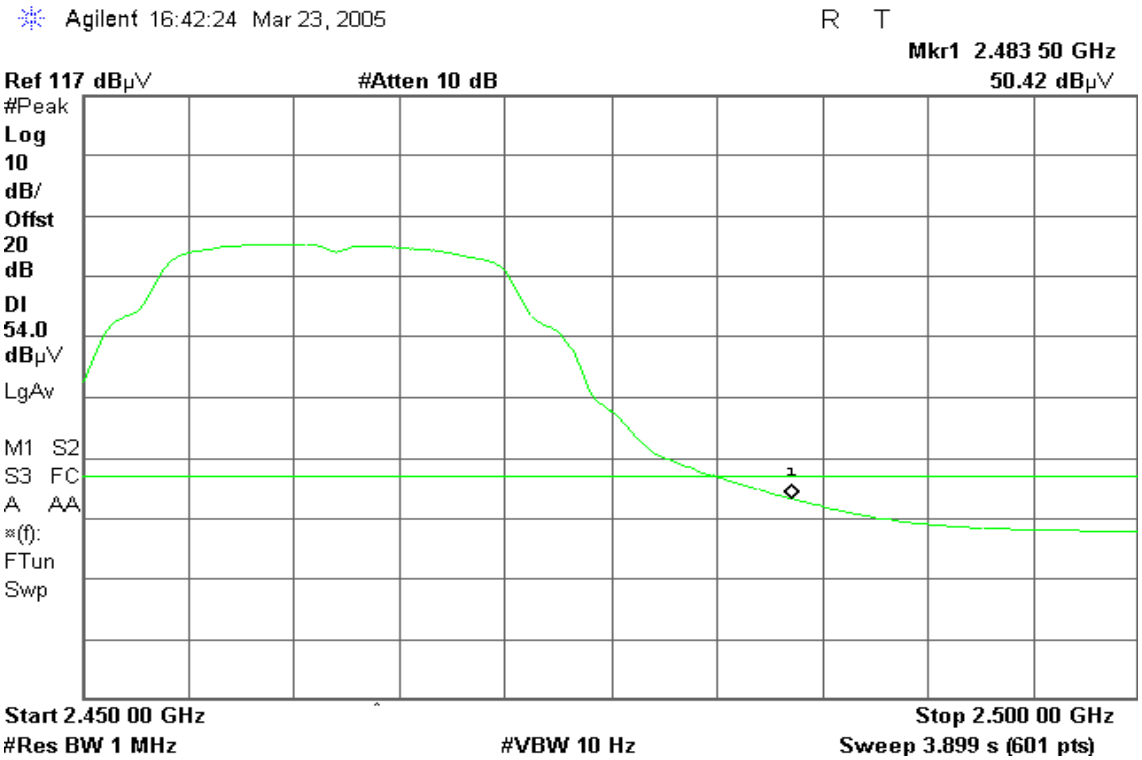
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**

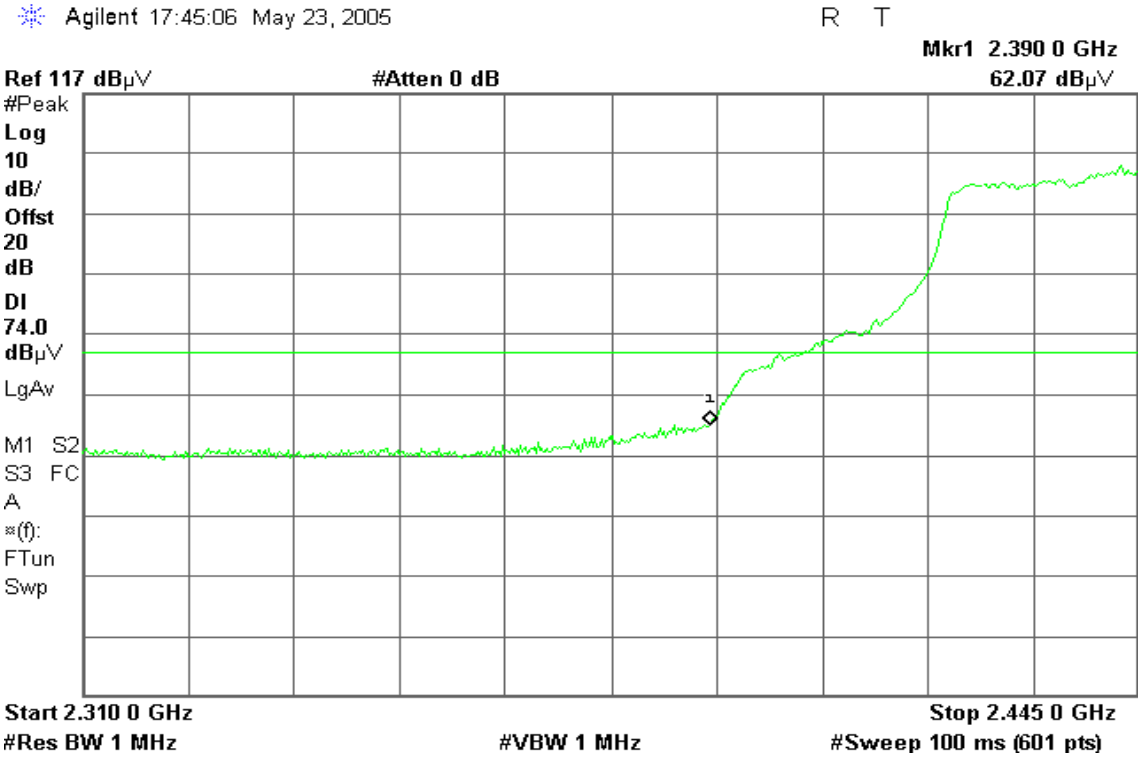


Detector mode: Average **Polarity: Horizontal**

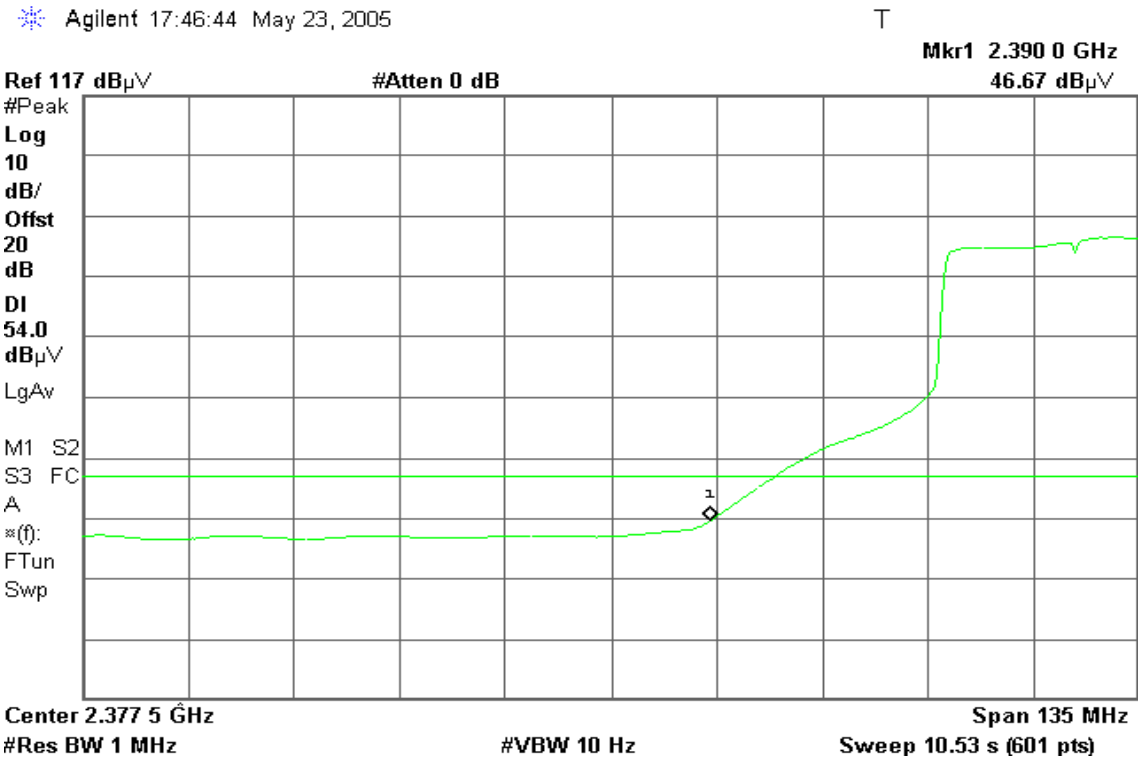


Band Edges (IEEE 802.11g Turbo mode / CH Mid)

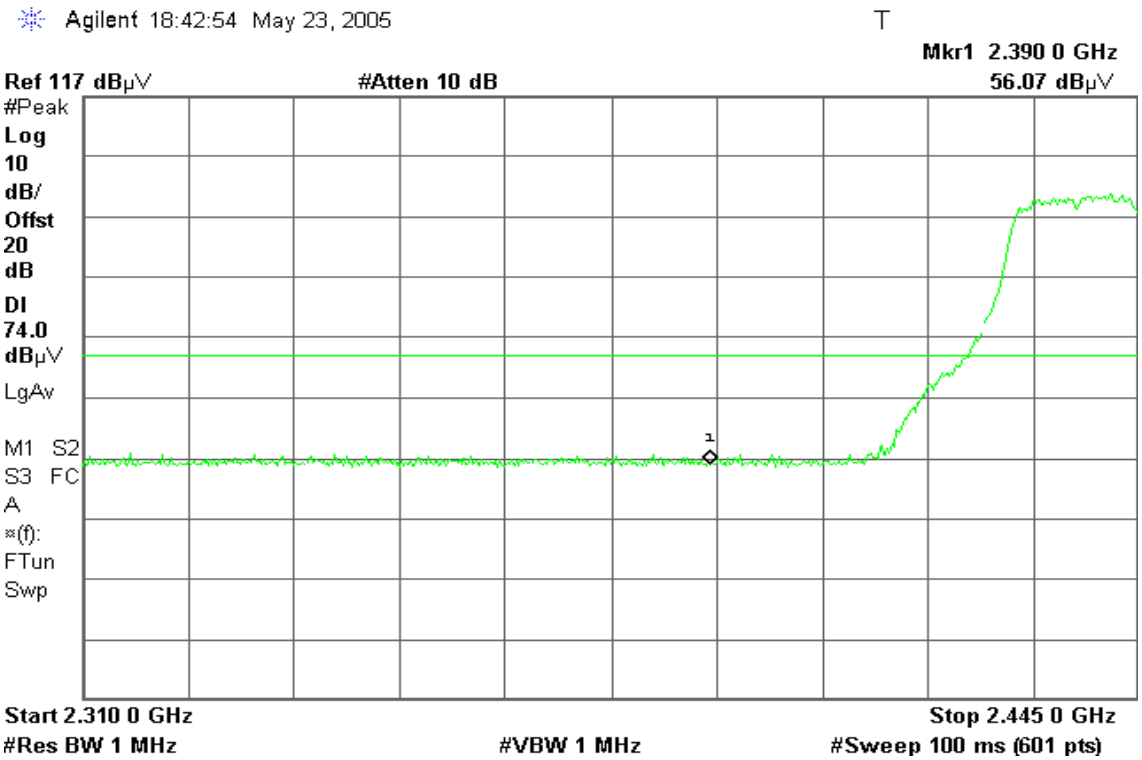
Detector mode: Peak Polarity: Vertical



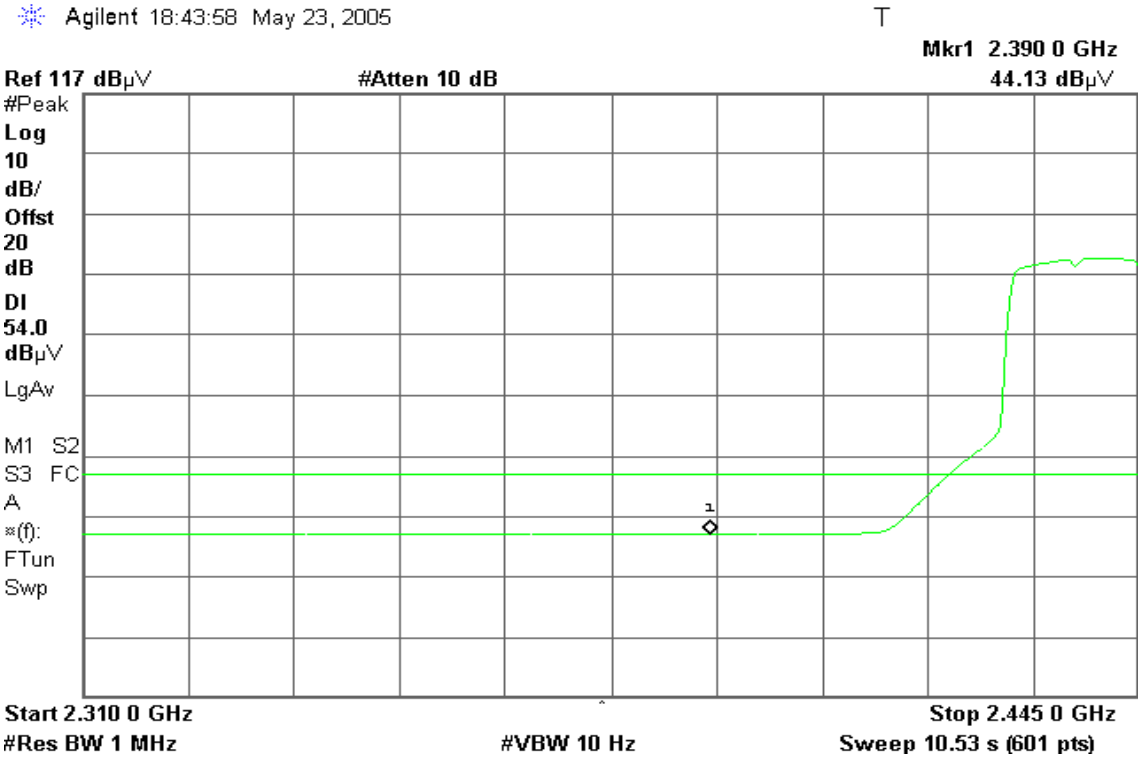
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**

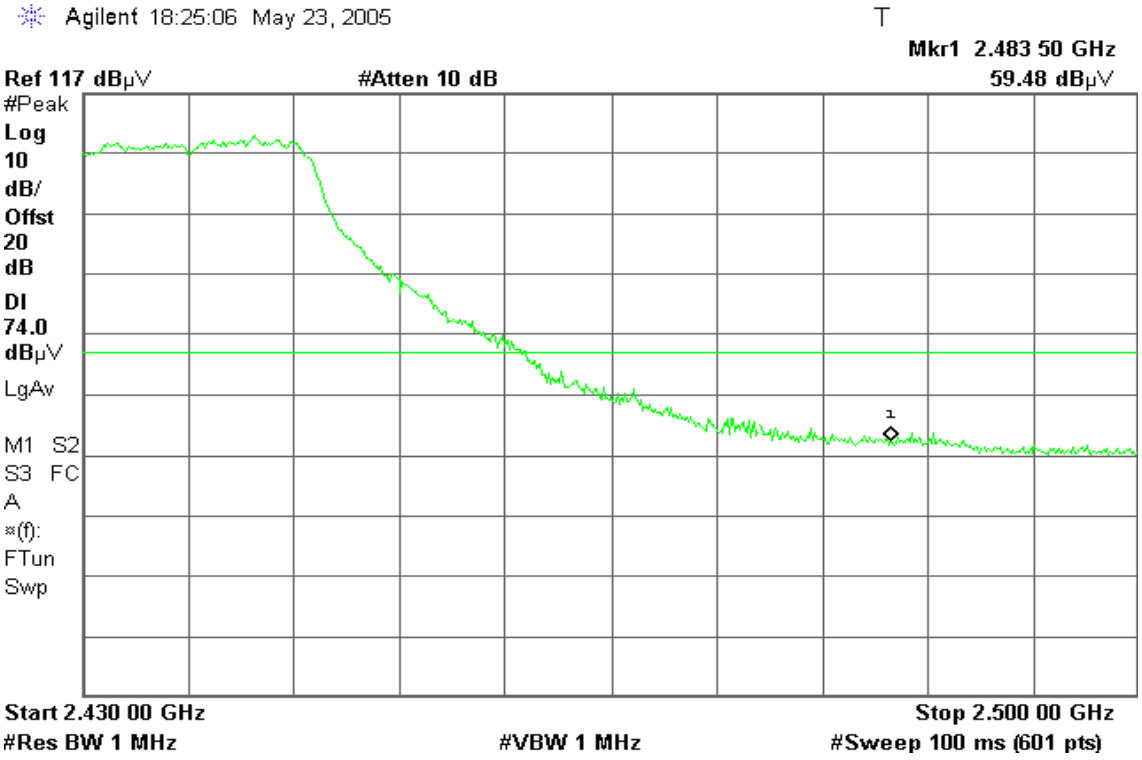


Detector mode: Average **Polarity: Horizontal**

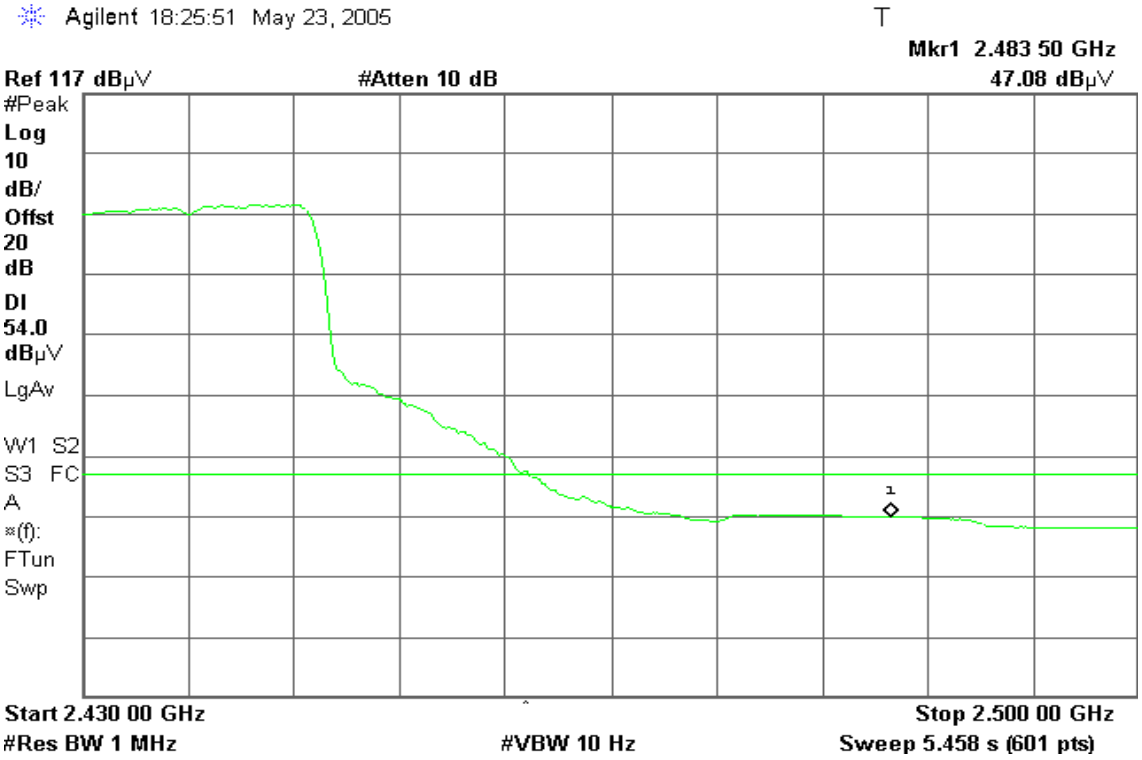


Band Edges (IEEE 802.11g Turbo mode / CH Mid)

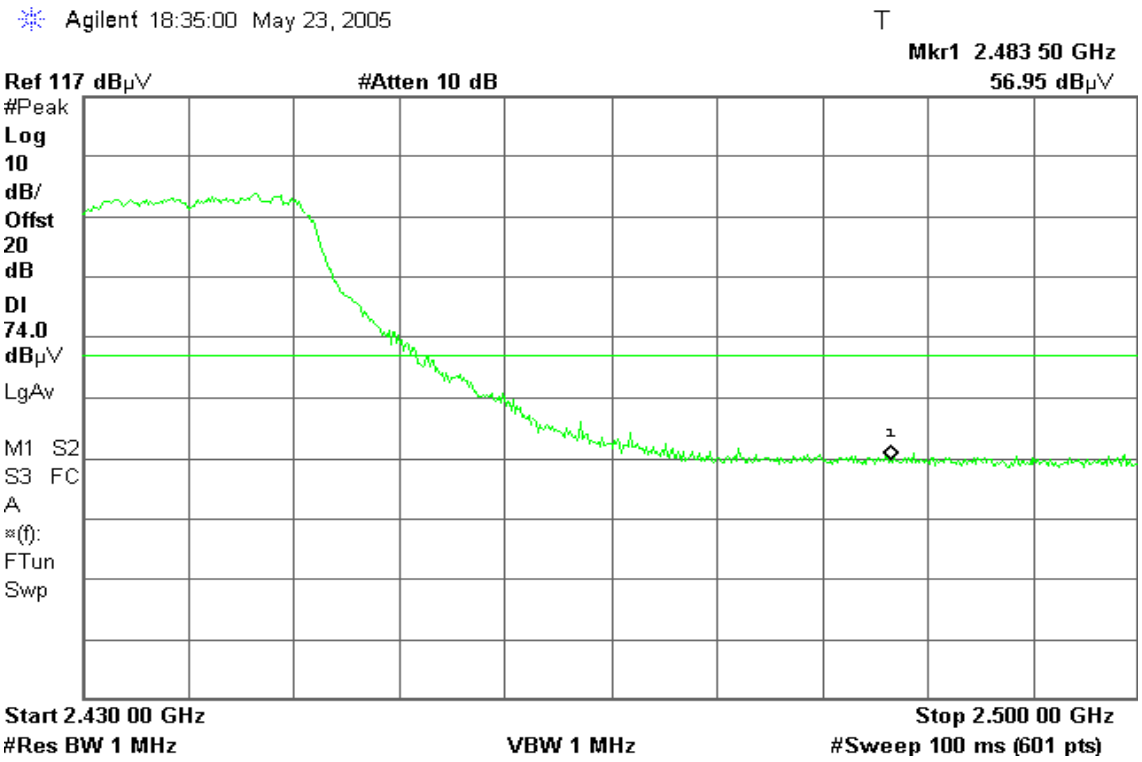
Detector mode: Peak Polarity: Vertical



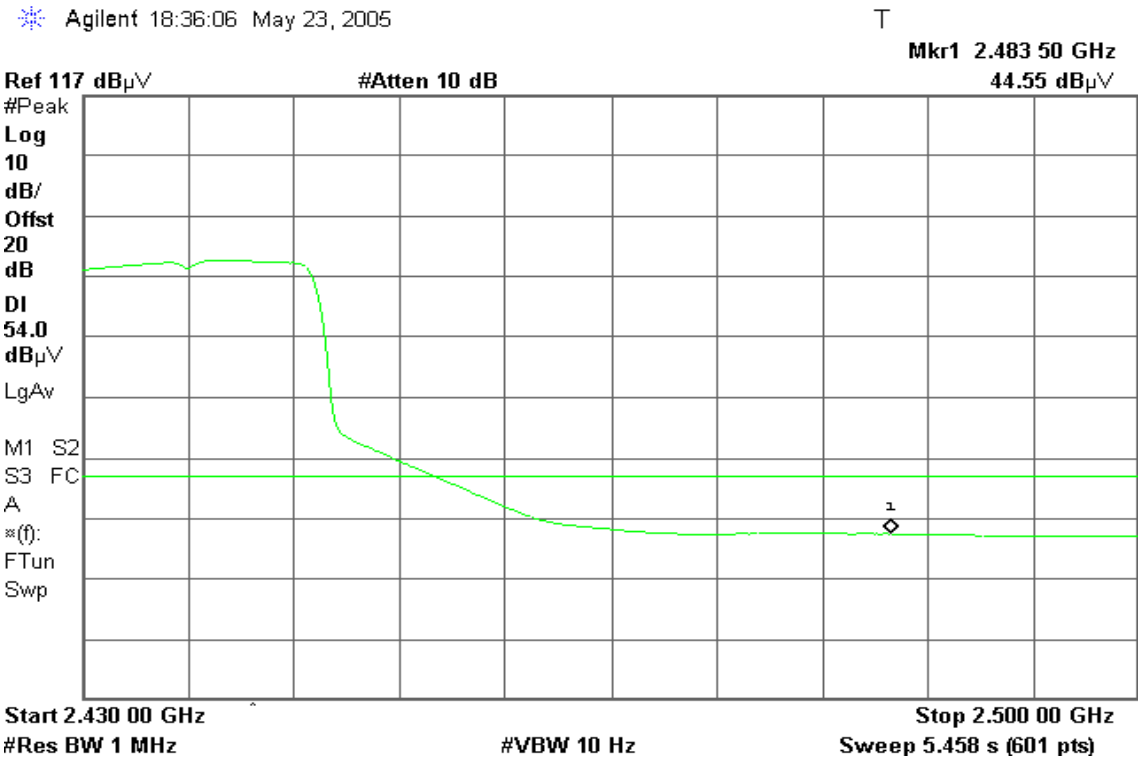
Detector mode: Average Polarity: Vertical



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.

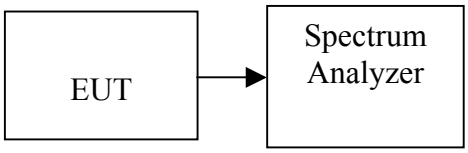
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

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 RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b mode

Channel	Frequency	Reading (dBm)	Factor (dB)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-16.51	11.6	-4.91	8.00	PASS
Mid	2437	-17.08	11.6	-5.48		PASS
High	2462	-18.13	11.6	-6.53		PASS

Test mode: IEEE 802.11g mode

Channel	Frequency		Reading (dBm)	Factor (dB)	PPSD (dBm)	Limit (dBm)	Result
Low	Base mode	2412	-19.88	11.6	-8.28	8.00	PASS
Mid		2437	-18.67	11.6	-7.07		PASS
High		2462	-18.03	11.6	-6.43		PASS
Mid	Turbo mode	2437	-21.40	11.0	-10.40		PASS

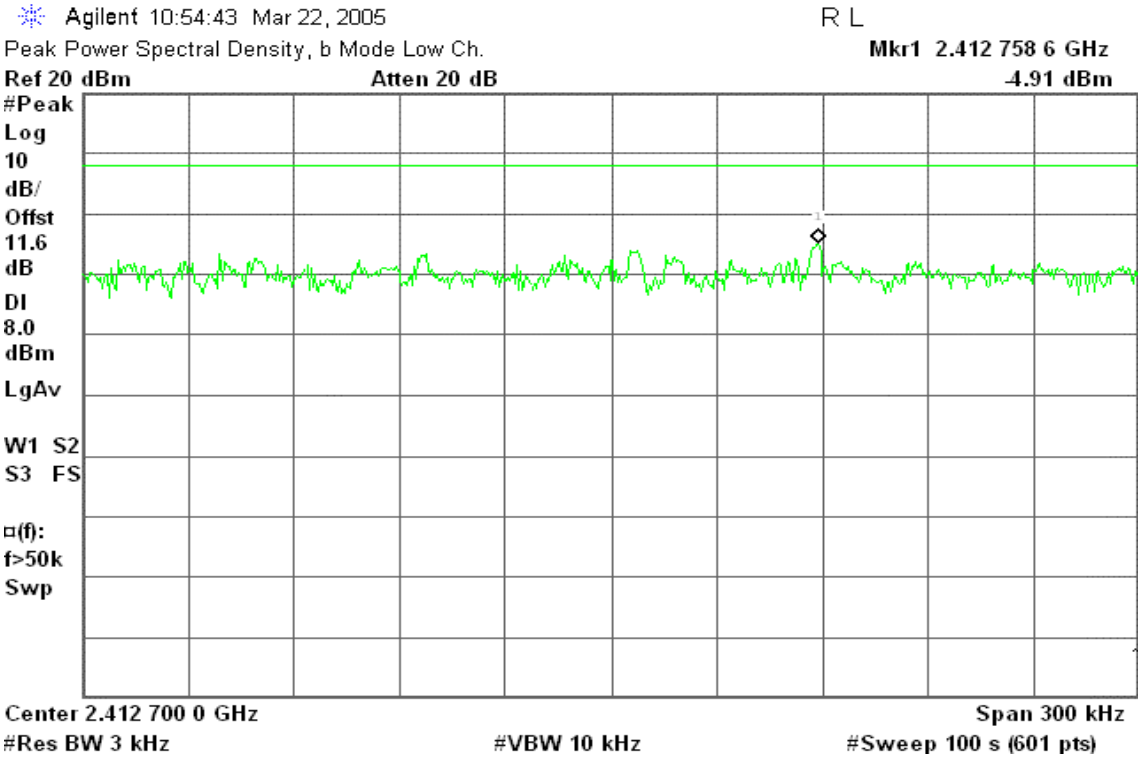
Test mode: IEEE 802.11a mode

Channel	Frequency		Reading (dBm)	Factor (dB)	PPSD (dBm)	Limit (dBm)	Result
Low	Base mode	5745	-19.20	11.6	-7.60	8.00	PASS
Mid		5785	-19.48	11.6	-7.88		PASS
High		5825	-19.29	11.6	-7.69		PASS
Low	Turbo mode	5760	-25.06	11.0	-14.06		PASS
High		5800	-24.91	11.0	-13.91		PASS

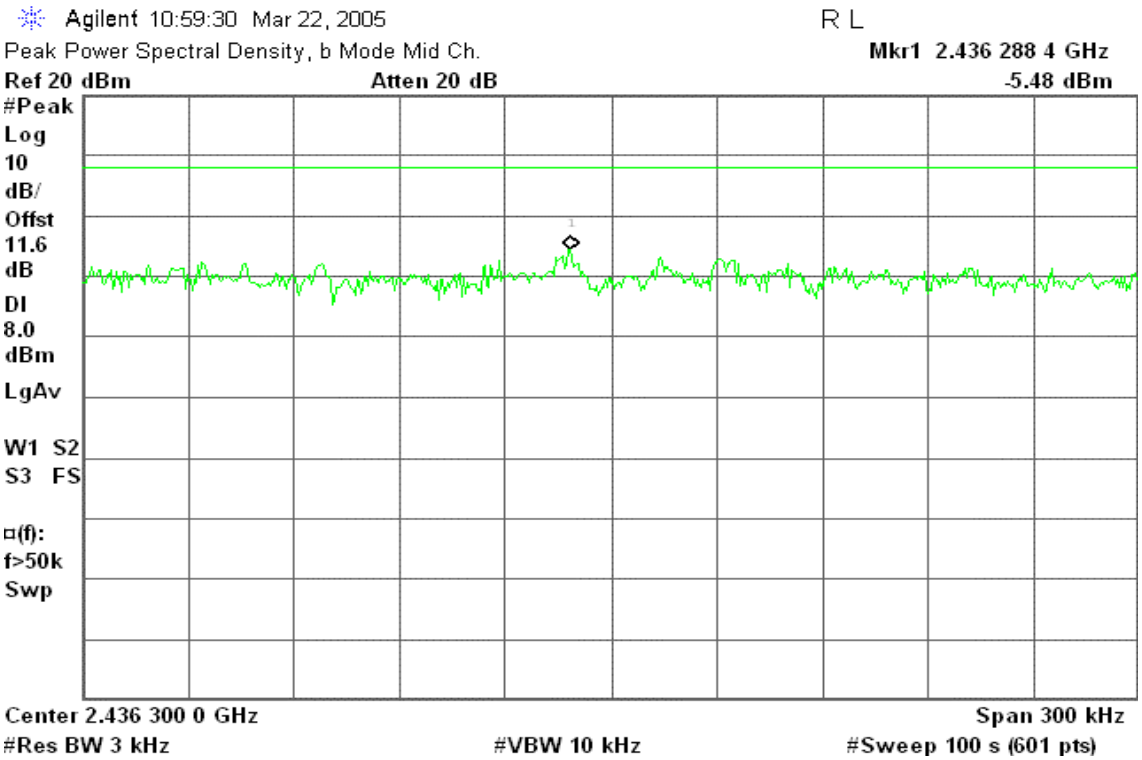
Test Plot

IEEE 802.11b Base mode

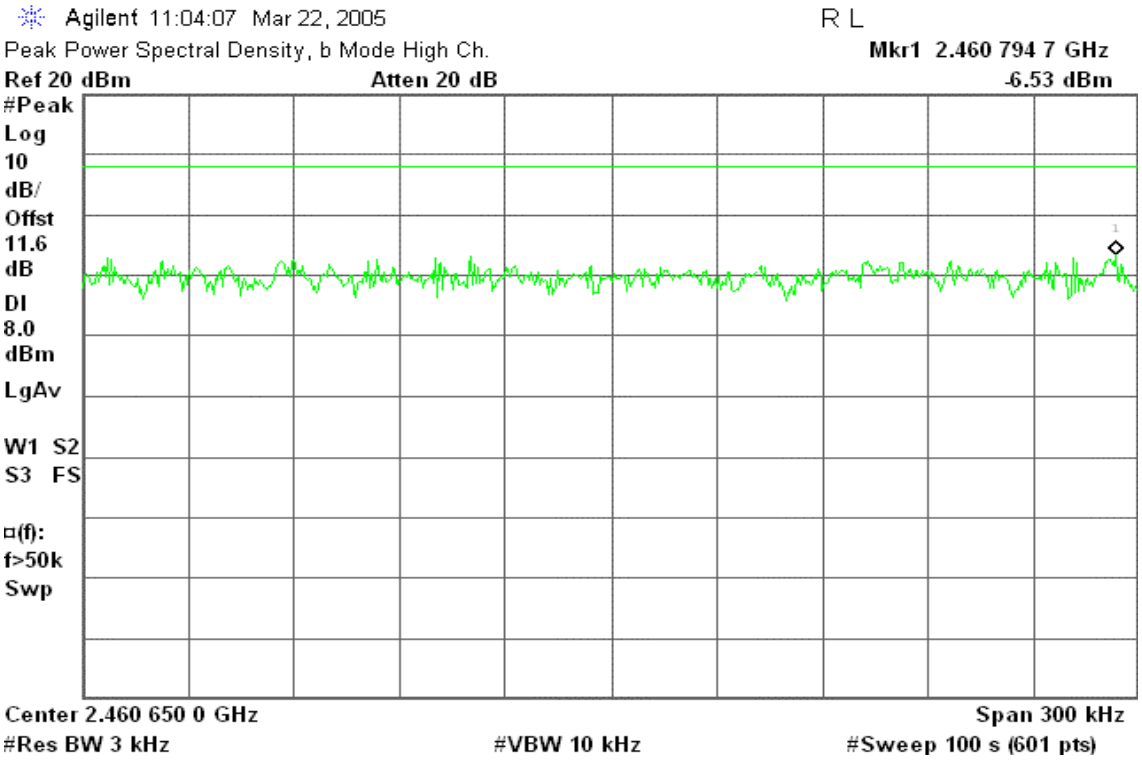
PPSD (CH Low)



PPSD (CH Mid)

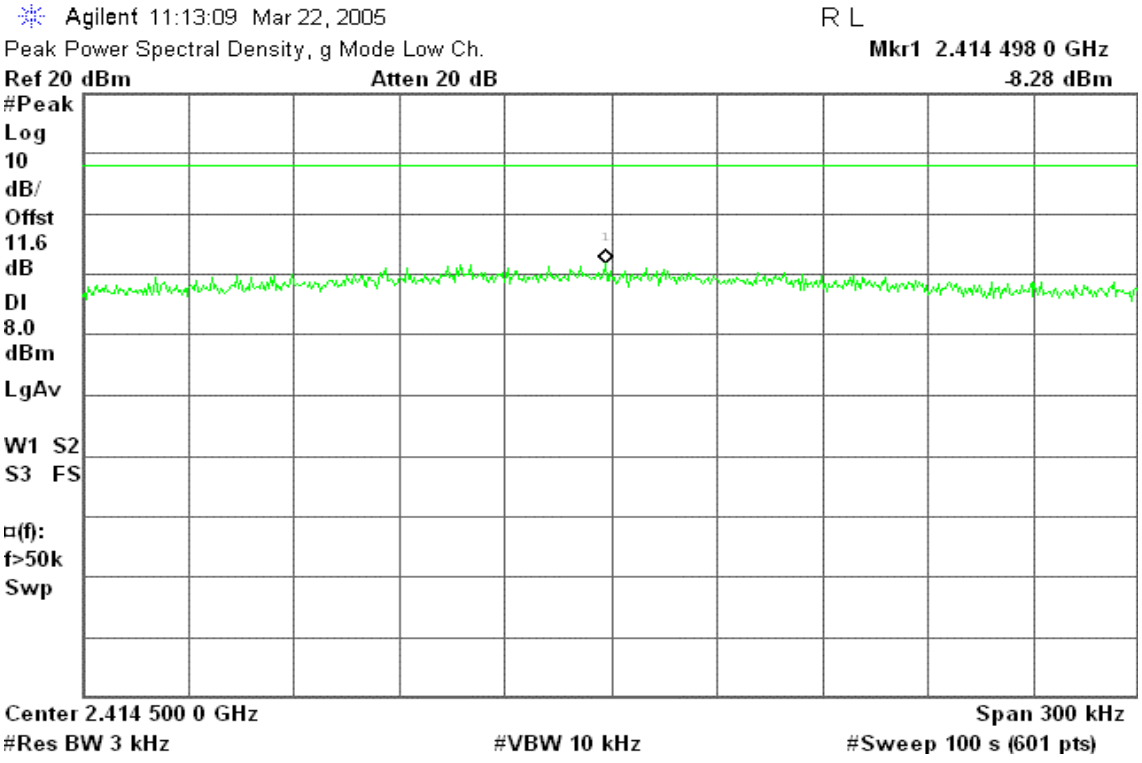


PPSD (CH High)

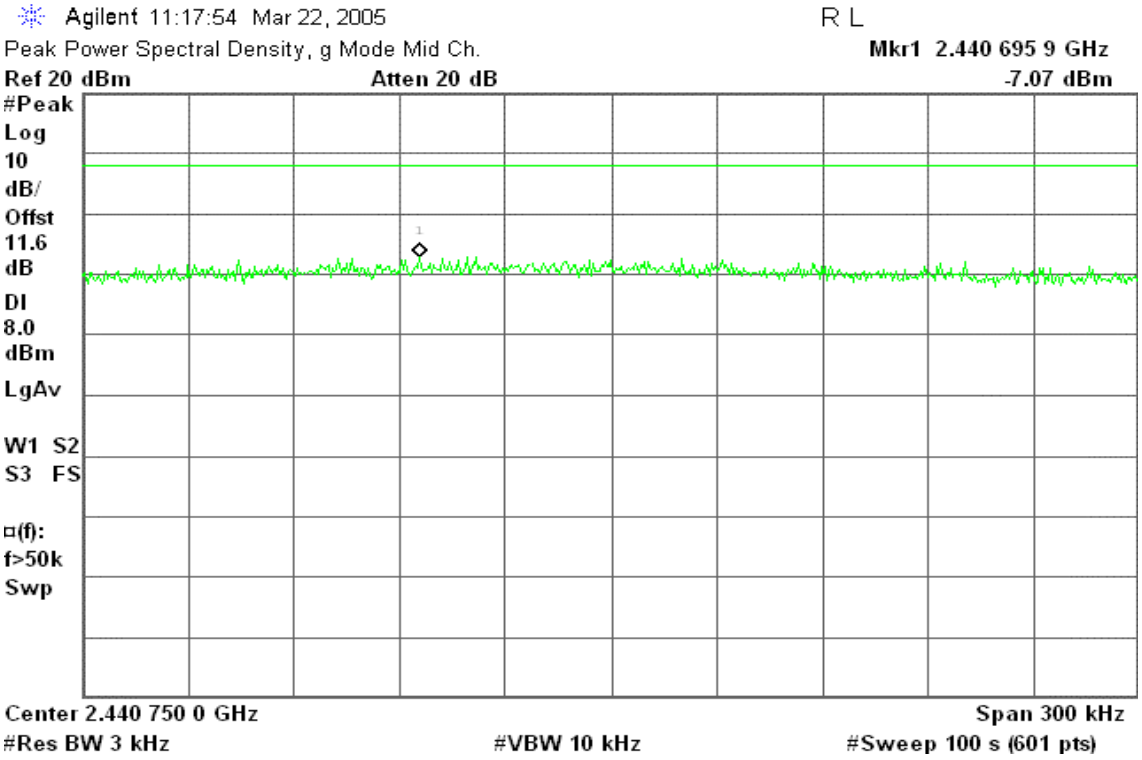


IEEE 802.11g Base mode

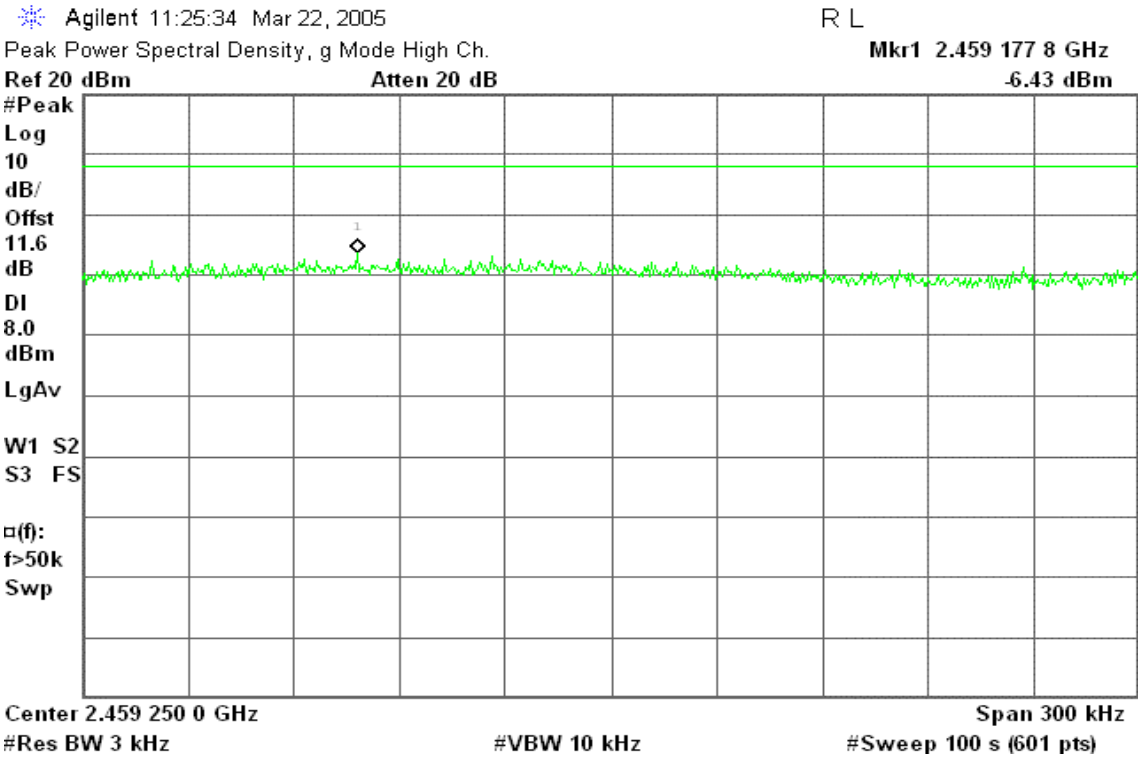
PPSD (CH Low)



PPSD (CH Mid)

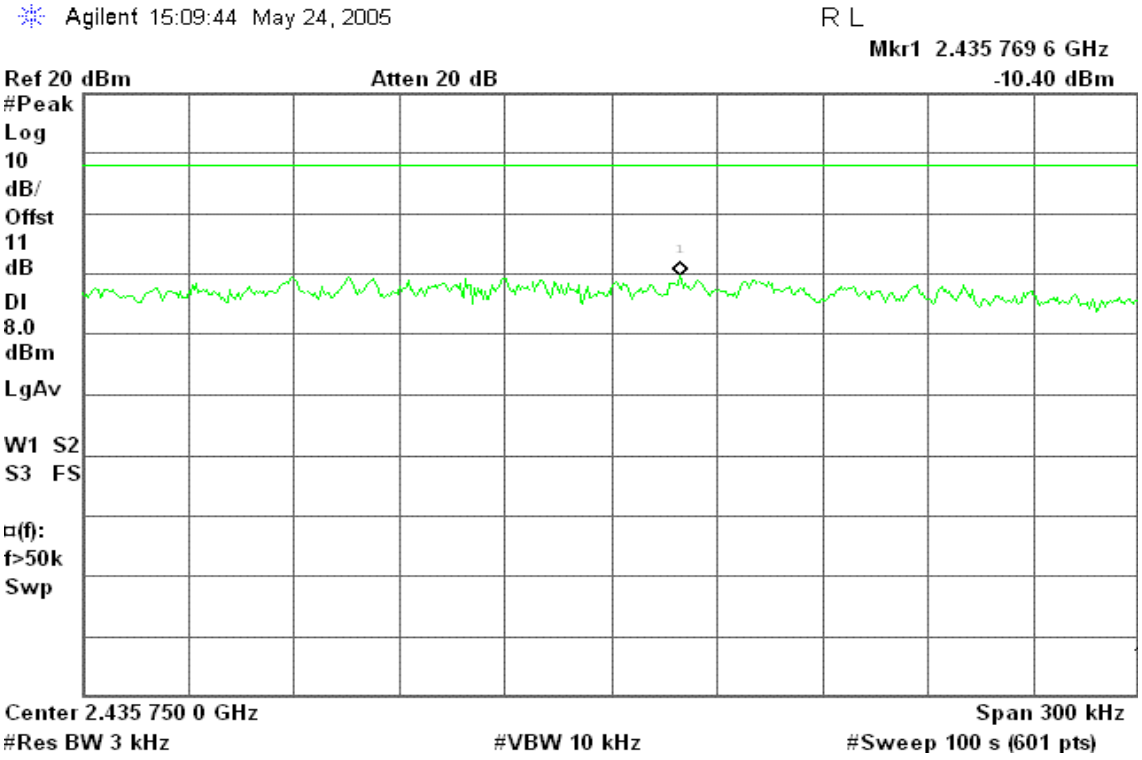


PPSD (CH High)



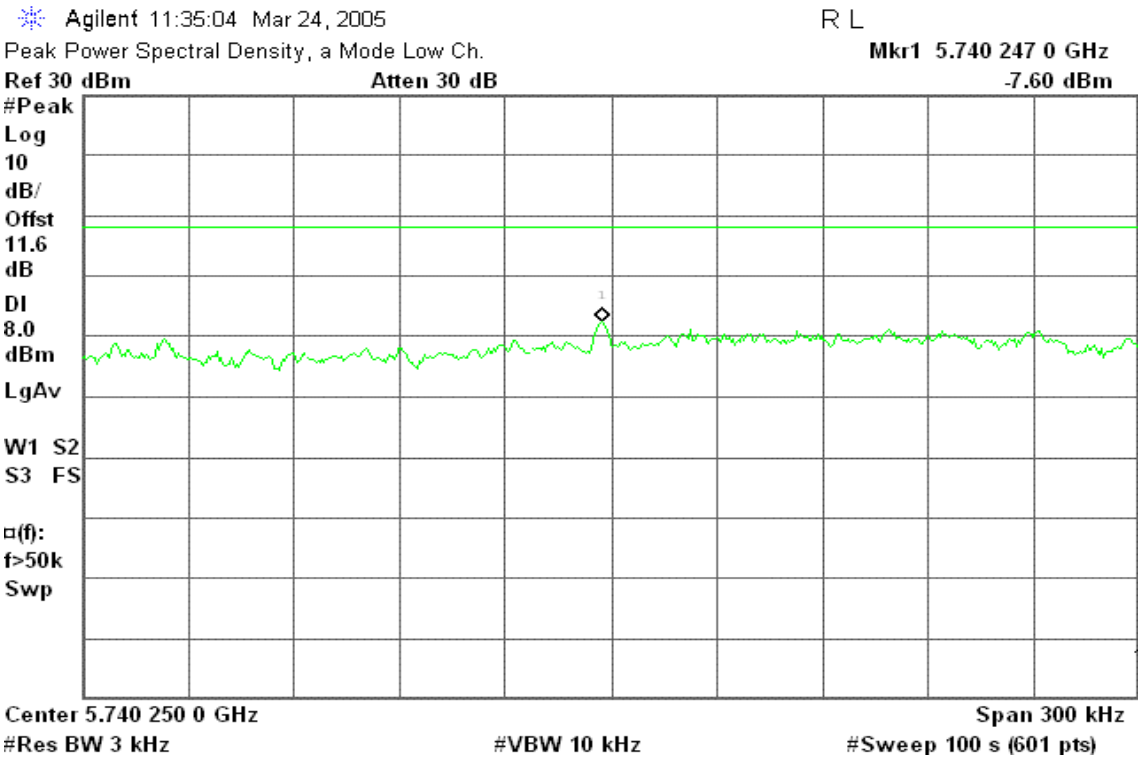
IEEE 802.11g Turbo mode

PPSD (CH Mid)

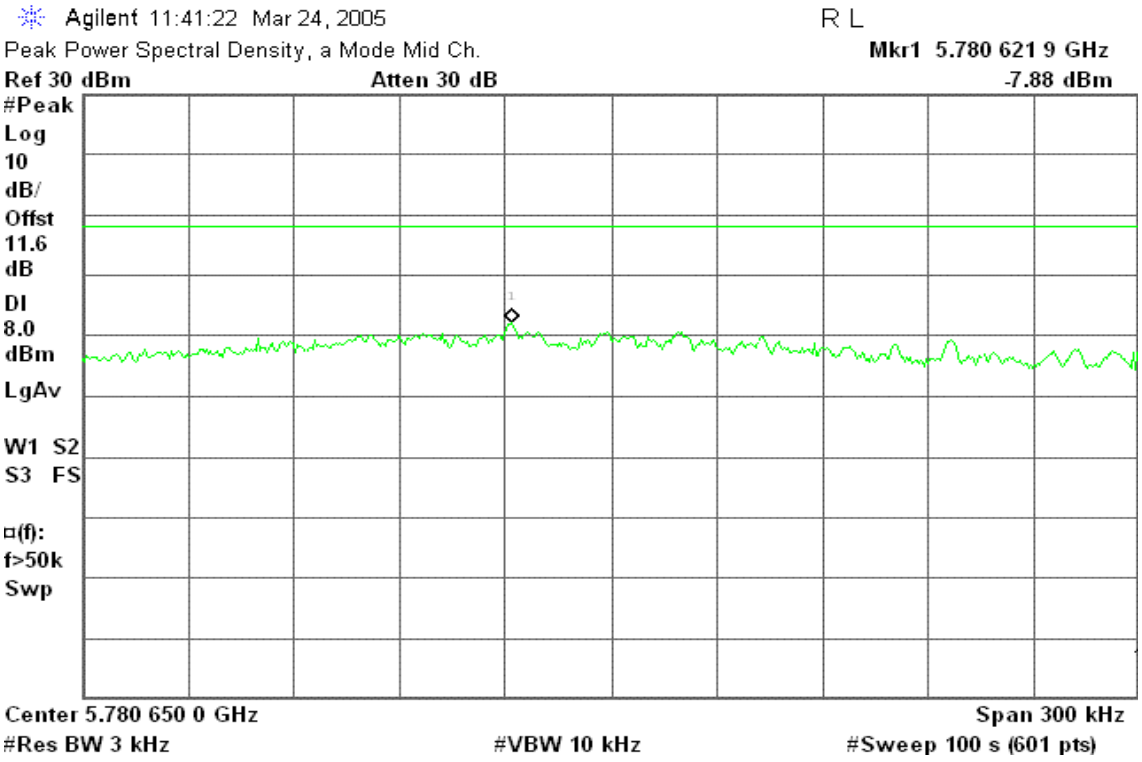


IEEE 802.11a Base mode

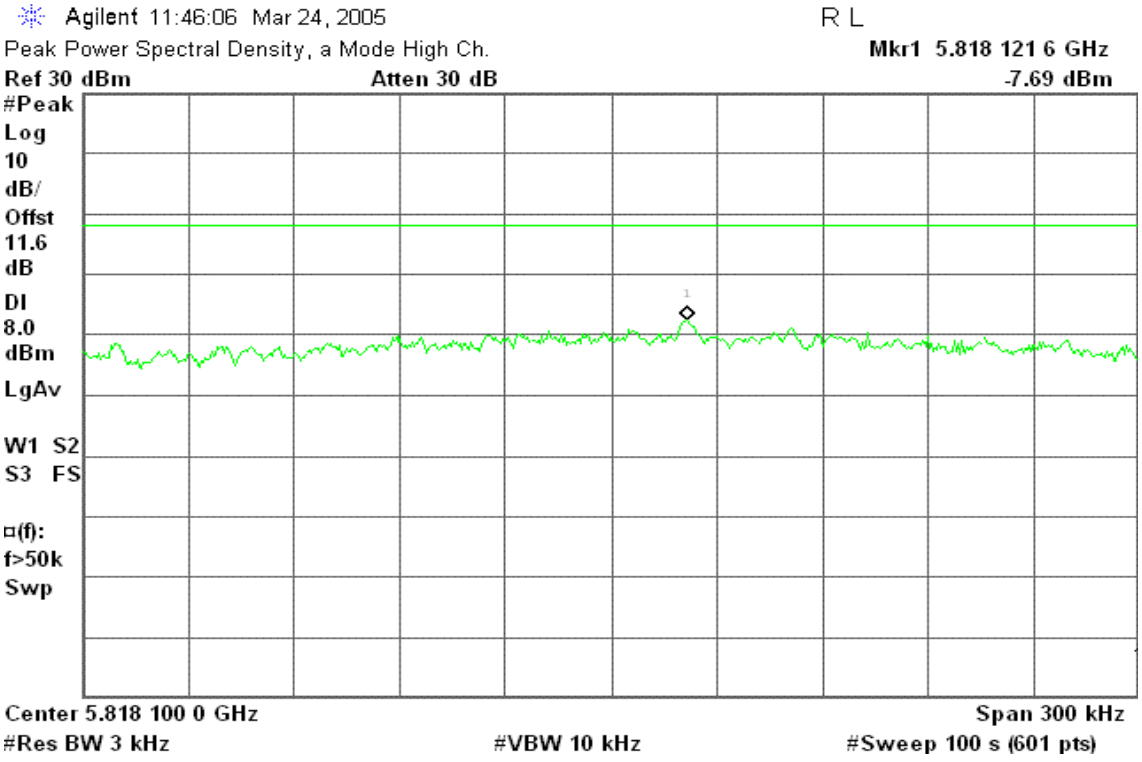
PPSD (CH Low)



PPSD (CH Mid)

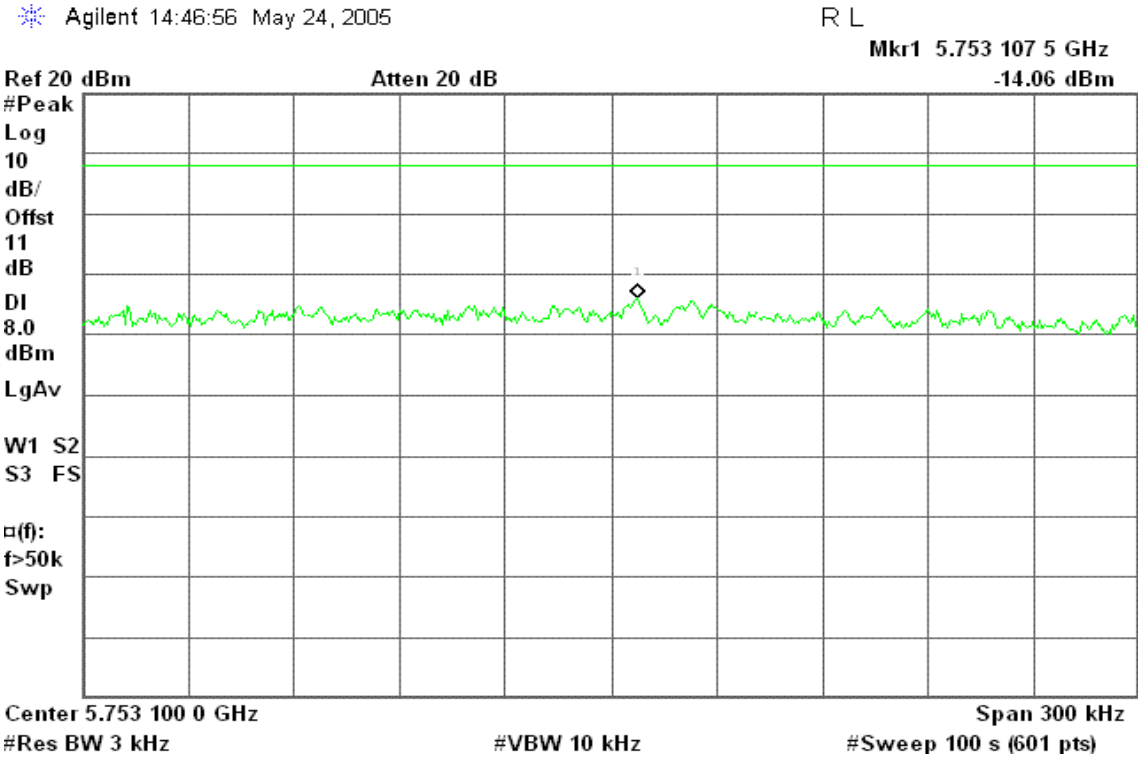


PPSD (CH High)

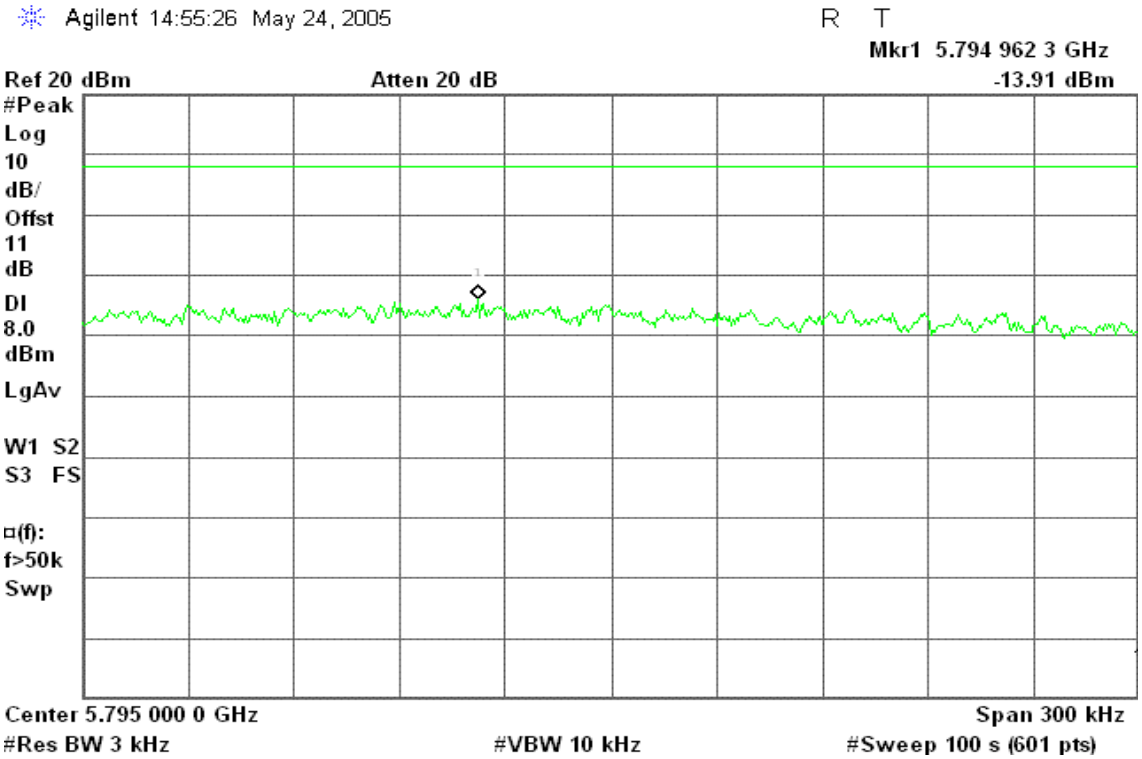


IEEE 802.11a Turbo mode

PPSD (CH Low)



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	802.11a/b/g Mini PCI Card
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/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 Base mode: 20.72 dBm (118.03mW) Turbo: 16.66 dBm (46.34mW) IEEE 802.11b Base mode: 21.65 dBm (146.22mW) IEEE 802.11g Base mode: 20.51 dBm (112.46mW) Turbo: 20.92 dBm (123.59mW)
Antenna gain (Max)	IEEE 802.11a: 1.0 dBi (Numeric gain: 1.26) IEEE 802.11b/g: 1.8 dBi (Numeric gain: 1.51)
Evaluation applied	☒ MPE Evaluation ☐ SAR Evaluation* ☐ N/A
Remark: *1. The maximum output power is 21.65dBm (146.22mW) at 2412MHz (with 1.51 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 (mW) = P (W) / 1000 and
*d (cm) =100 * d (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 / cm^2

Substituting the logarithmic form of power and gain using:
P (mW) = 10 ^ (P (dBm) / 10) and
G (numeric) = 10 ^ (G (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 / cm^2

Maximum Permissible Exposure

IEEE 802.11a:

EUT output power = 118.03mW

Antenna Gain = 1.26 mW (Numeric gain)

S = 1.0 mW / cm^2 from 1.1310 Table 1

Substituting these parameters into the above Equation 1:

→ *MPE Safe Distance = 3.44 cm*

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

IEEE 802.11b/g:

EUT output power = 146.22mW

Antenna Gain = 1.51 mW (Numeric gain)

S = 1.0 mW / cm^2 from 1.1310 Table 1

Substituting these parameters into the above Equation 1:

→ *MPE Safe Distance = 4.19 cm*

(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

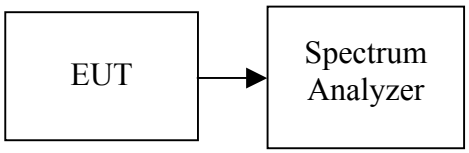
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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	Agilent	E4446A	MY43360131	01/10/2006

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 300 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.

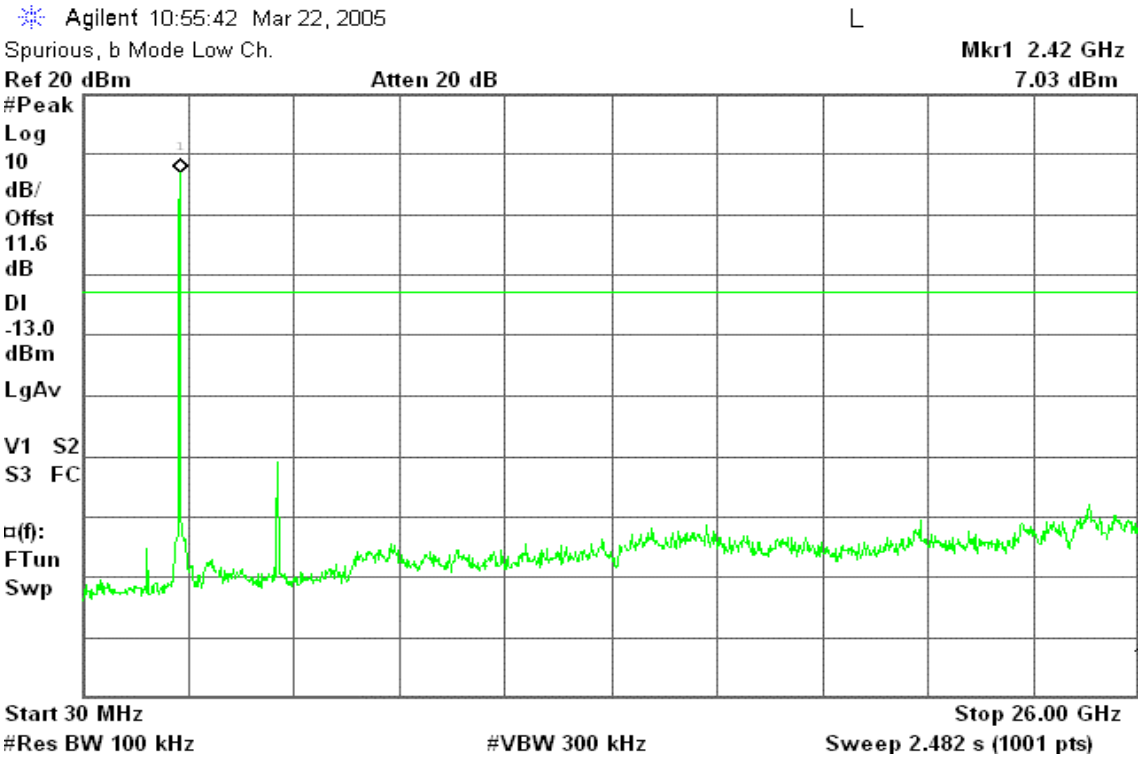
TEST RESULTS

No non-compliance noted.

Test Plot

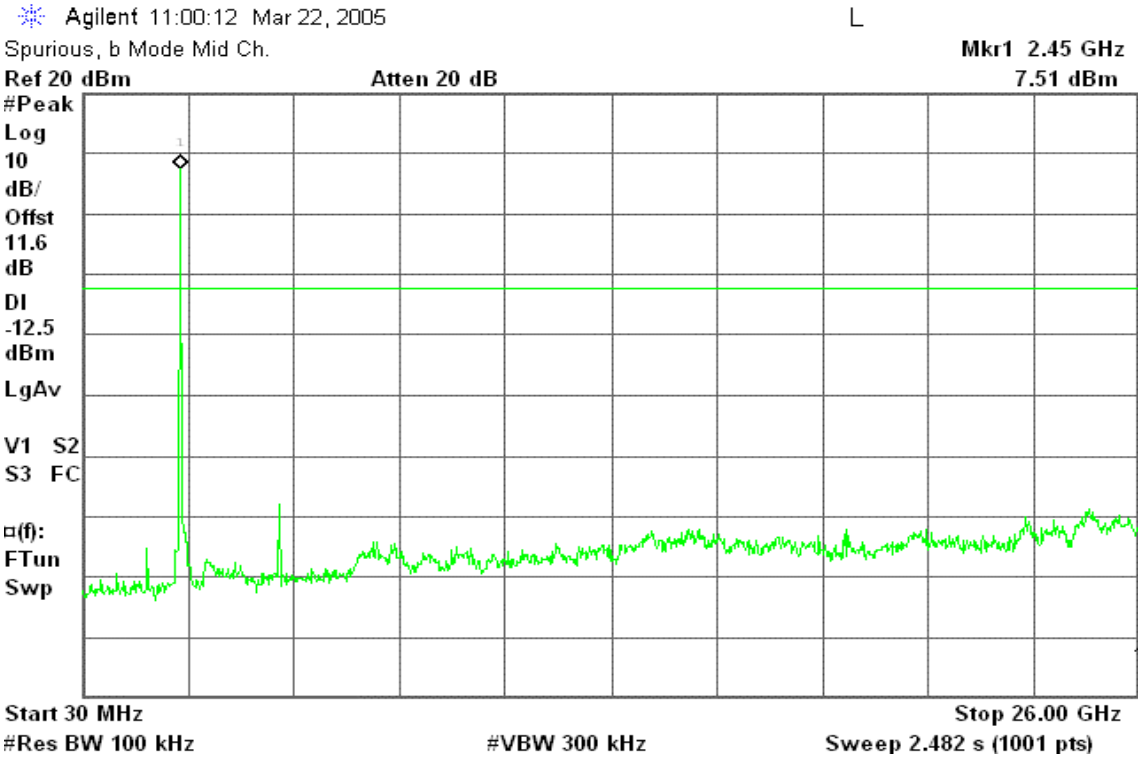
IEEE 802.11b Base mode / CH Low

30MHz ~ 26GHz



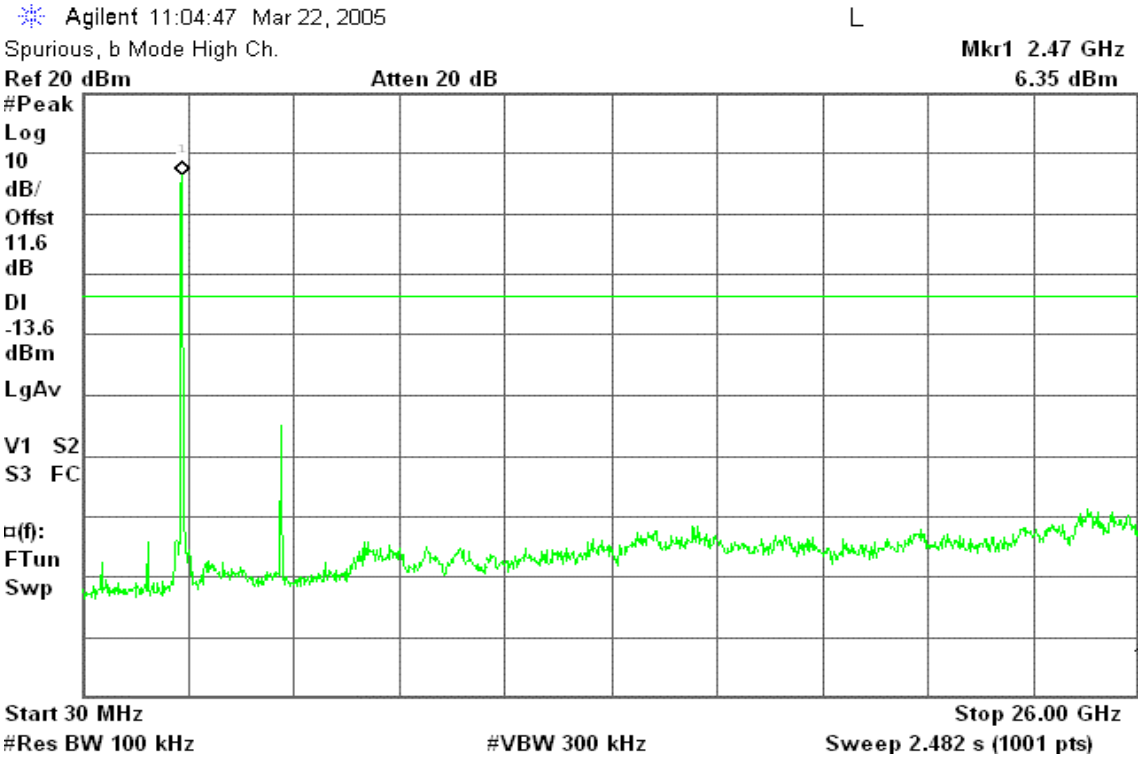
IEEE 802.11b Base mode / CH Mid

30MHz ~ 26GHz



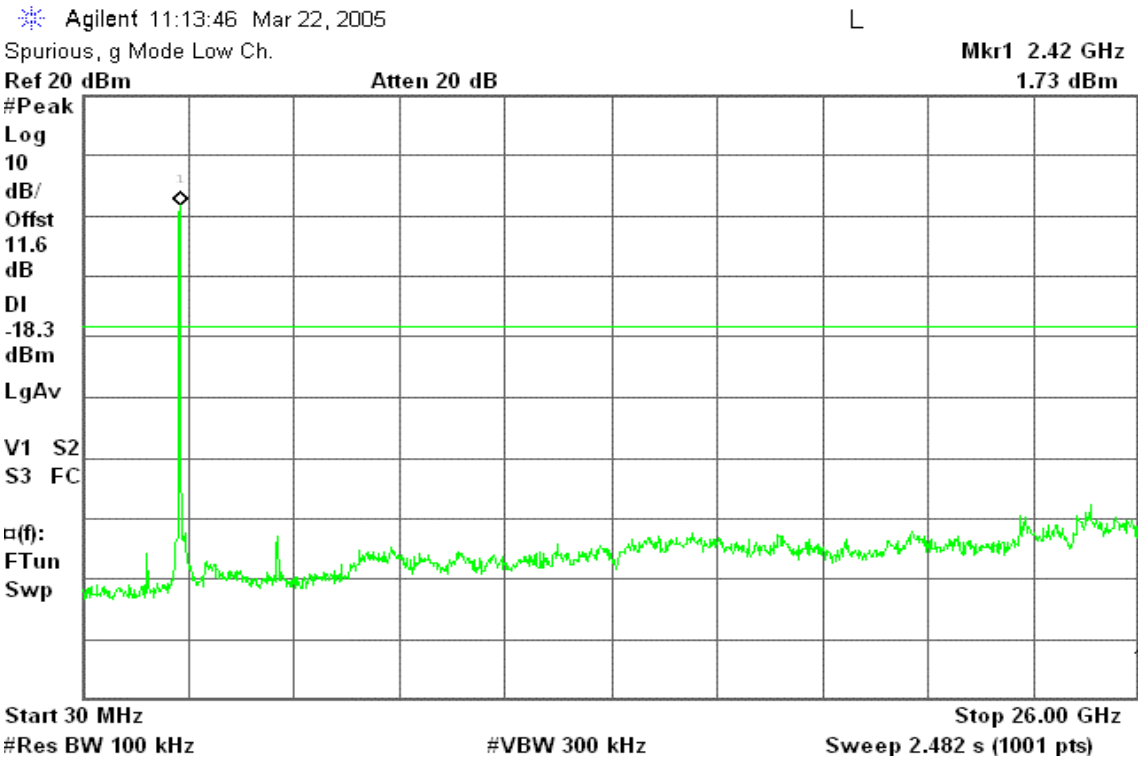
IEEE 802.11b Base mode / CH High

30MHz ~ 26GHz



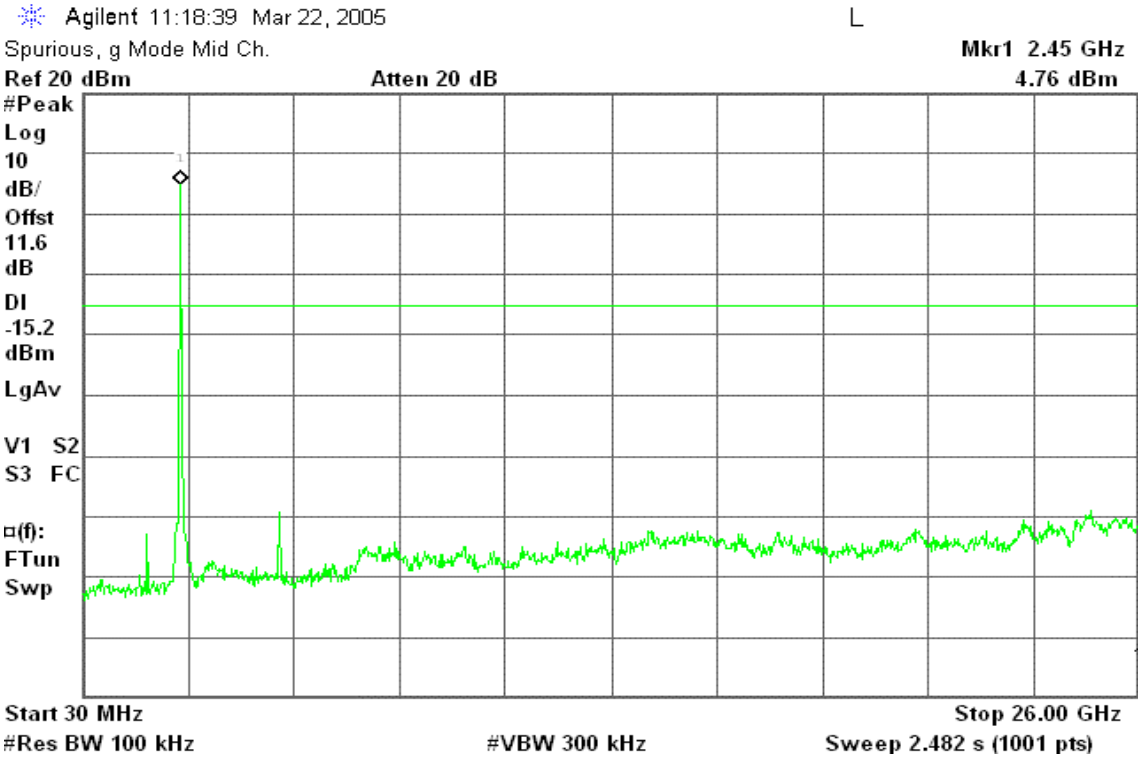
IEEE 802.11g Base mode / CH Low

30MHz ~ 26GHz



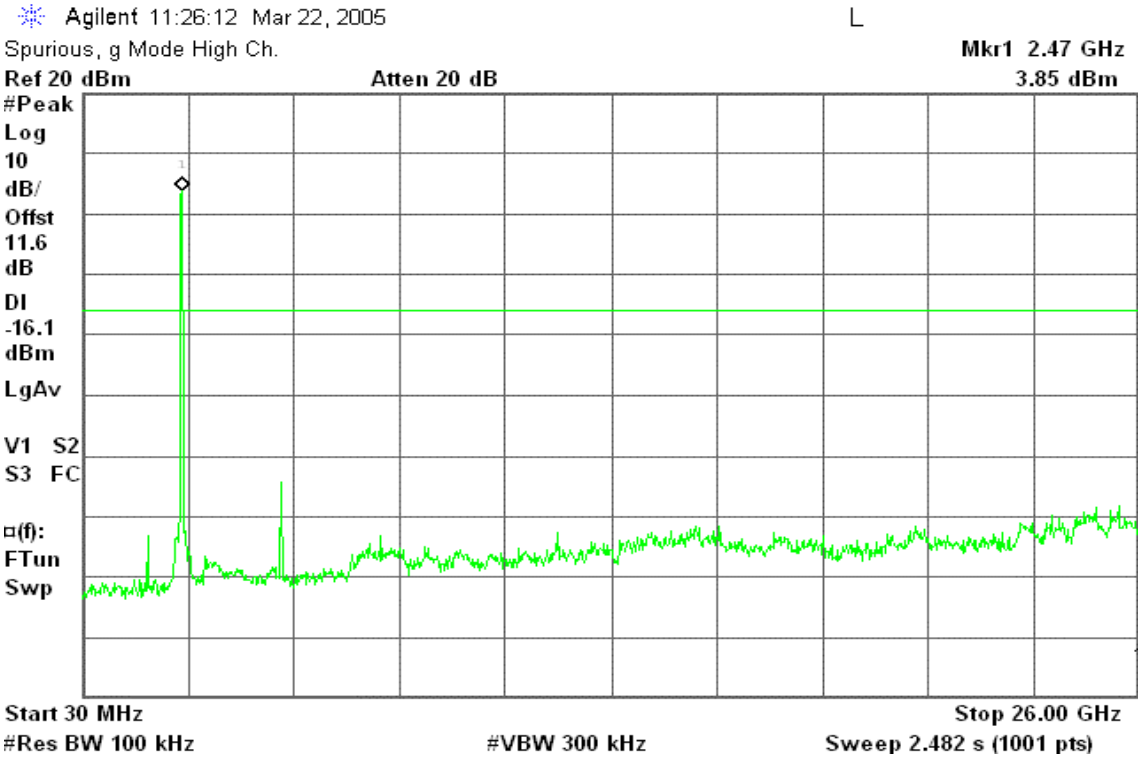
IEEE 802.11g Base mode / CH Mid

30MHz ~ 26GHz



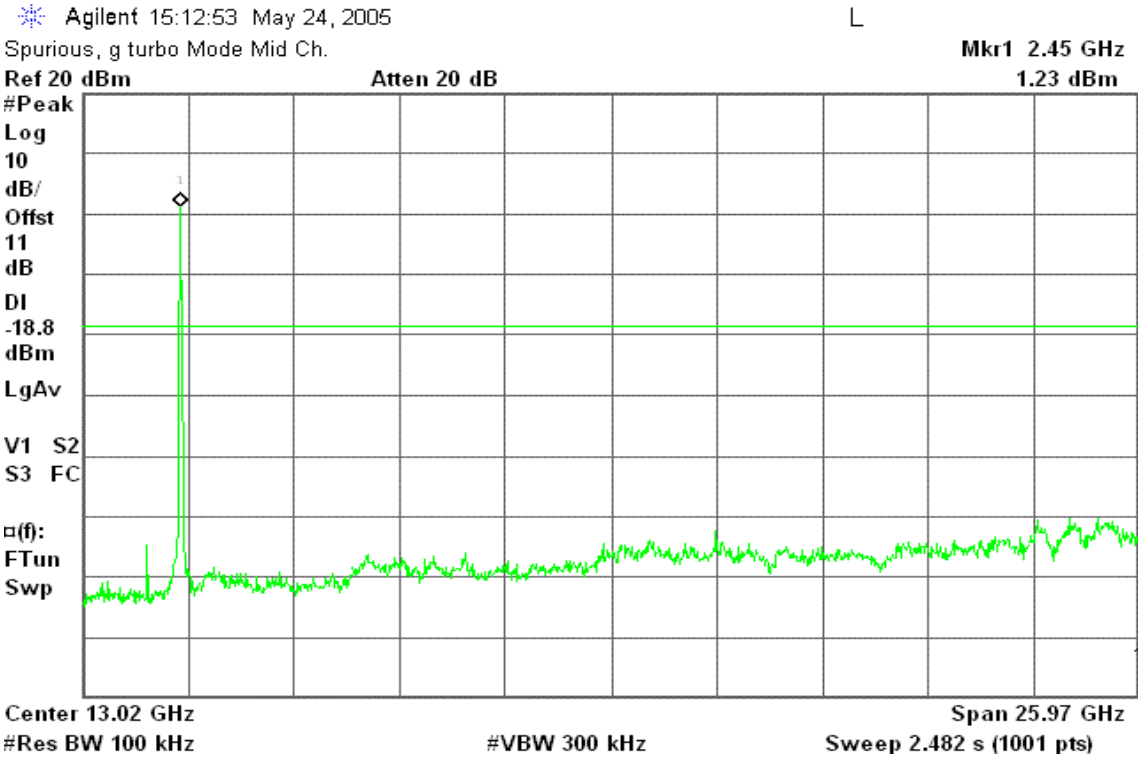
IEEE 802.11g Base mode / CH High

30MHz ~ 26GHz



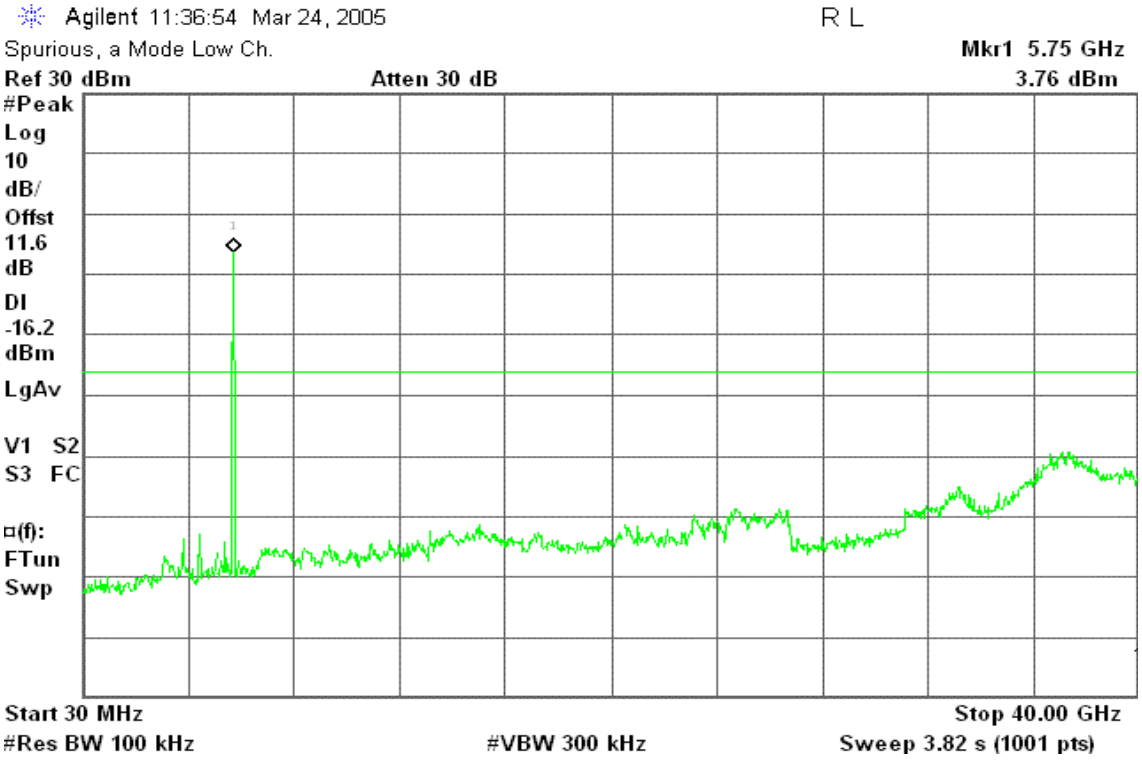
IEEE 802.11g Turbo mode / CH Mid

30MHz ~ 26GHz



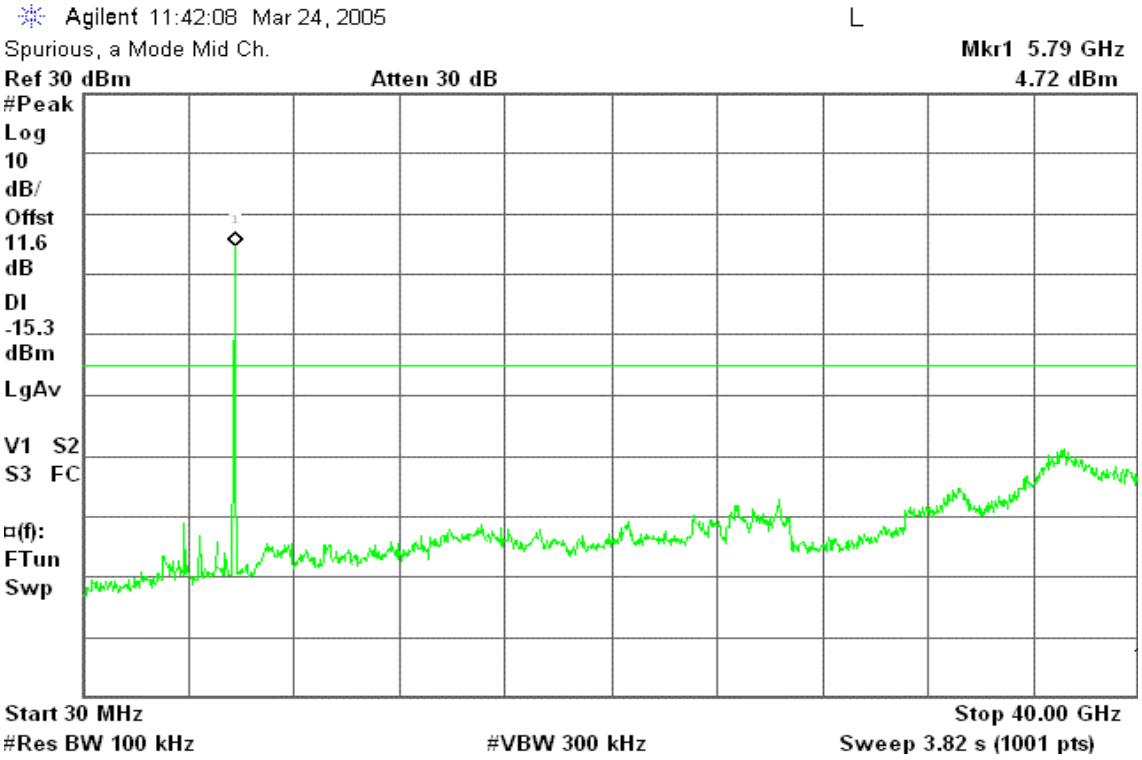
IEEE 802.11a Base mode / CH Low

30MHz ~ 40GHz



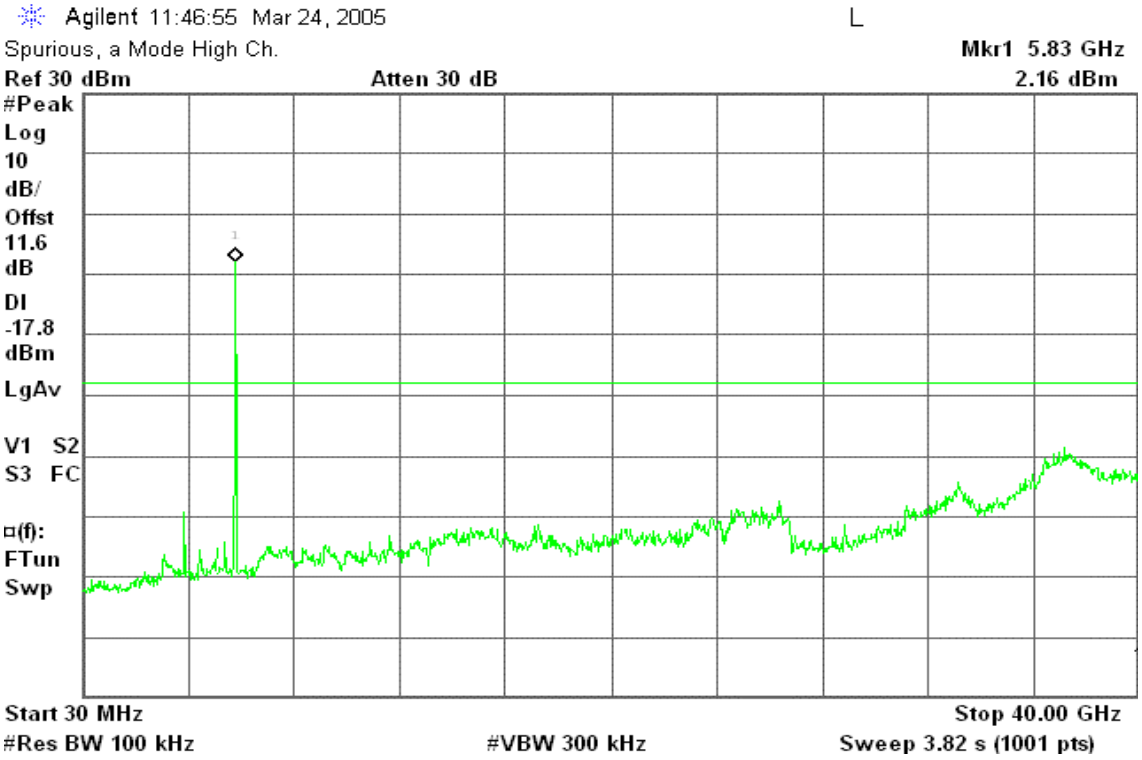
IEEE 802.11a Base mode / CH Mid

30MHz ~ 40GHz



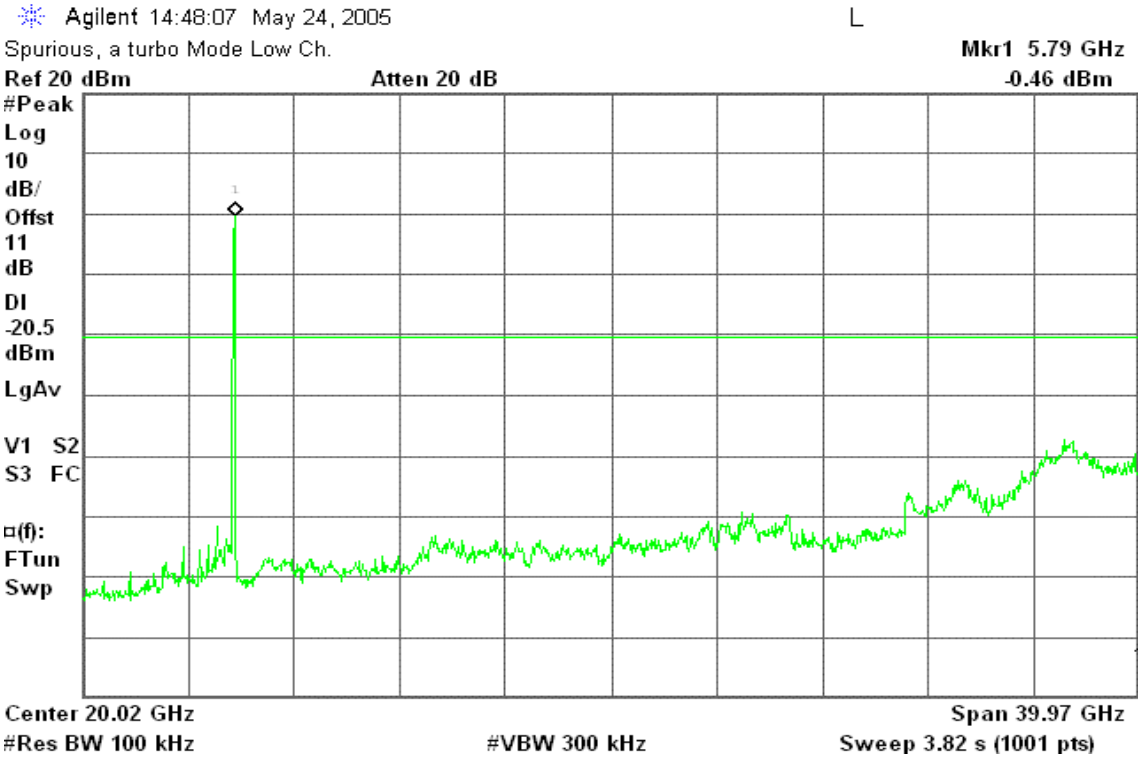
IEEE 802.11a Base mode / CH High

30MHz ~ 40GHz



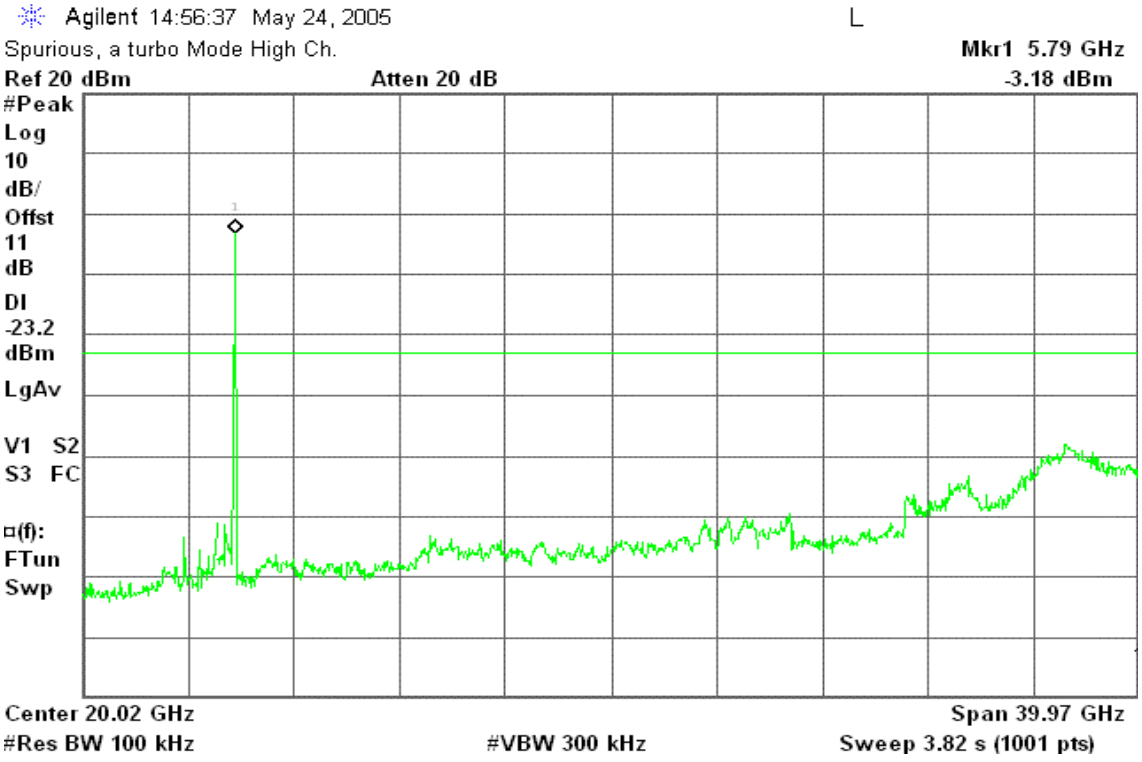
IEEE 802.11a Turbo mode / CH Low

30MHz ~ 40GHz



IEEE 802.11a Turbo mode / 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 (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 (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

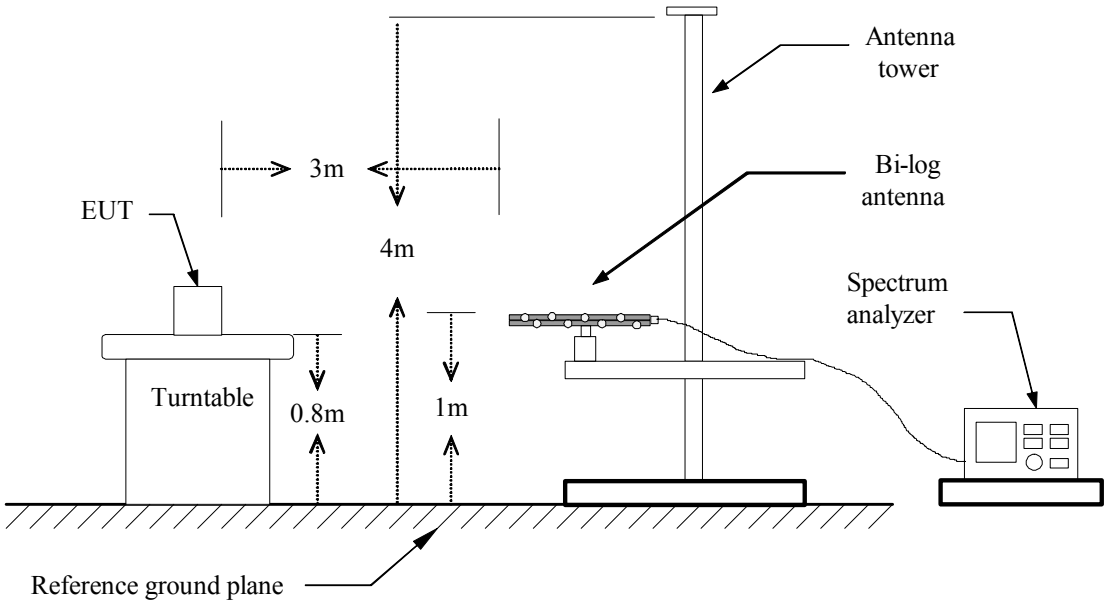
MEASUREMENT EQUIPMENT USED

Open Area Test Site # 3				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI Test Receiver	R&S	ESVS20	838804/004	01/08/2006
Spectrum Analyzer	R&S	FSP30	100112	09/23/2005
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006
Pre-Amplifier	MITEC	AFS42-00102650	924206	N.C.R.
Pre-Amplifier	MITEC	AMF-6F-260400	945377	N.C.R.
Bilog Antenna	SCHWAZBECK	VULB9163	145	07/05/2005
Horn Antenna	EMCO	3115	00022250	04/18/2006
Horn Antenna	EMCO	3116	2487	12/08/2005
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	C&C	N/A	N/A	09/06/2005

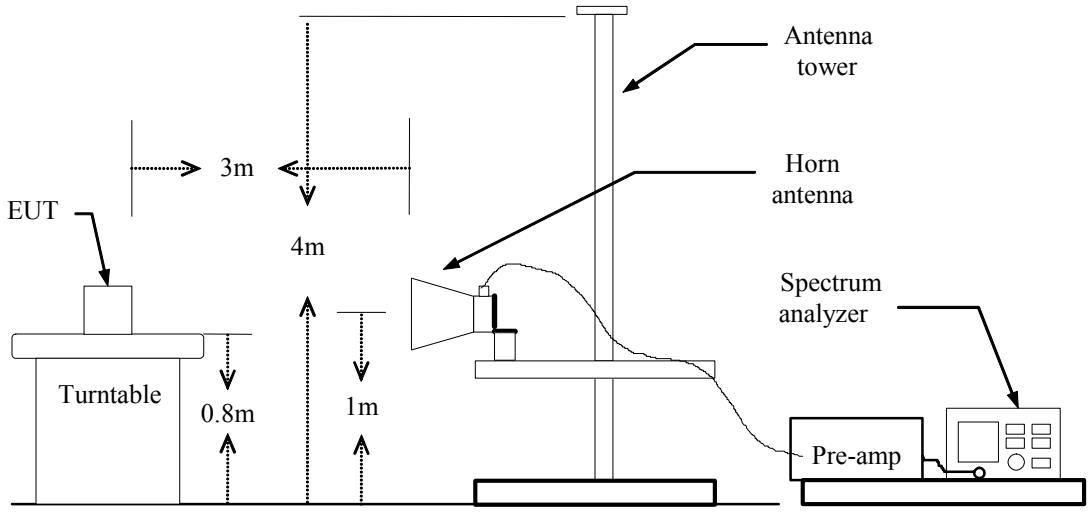
Remark: *Each piece of equipment is scheduled for calibration once a year.*

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: Normal link mode (worst case) **Test Date:** May 09, 2005

Temperature: 25°C **Tested by:** Tom Jen

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

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit 3m (dBuV/m)	Safe Margin (dB)
165.50	V	Peak	21.30	10.30	31.60	43.50	-11.90
269.50	V	Peak	14.50	15.60	30.10	46.00	-15.90
400.30	V	Peak	10.50	20.00	30.50	46.00	-15.50
601.50	V	Peak	11.20	22.10	33.30	46.00	-12.70
666.50	V	Peak	8.40	23.60	32.00	46.00	-14.00
935.00	V	Peak	9.70	27.10	36.80	46.00	-9.20
332.60	H	Peak	18.70	17.00	35.70	46.00	-10.30
366.90	H	Peak	19.60	18.50	38.10	46.00	-7.90
433.50	H	Peak	14.70	19.30	34.00	46.00	-12.00
632.00	H	Peak	10.70	23.00	33.70	46.00	-12.30
702.00	H	Peak	10.10	23.90	34.00	46.00	-12.00
930.00	H	Peak	9.70	27.10	36.80	46.00	-9.20

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 Base mode / CH Low **Test Date:** March 22, 2005

Temperature: 25°C **Tested by:** Tom Jen

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

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4824.00	V	58.52	53.41	-5.47	53.05	47.94	74.00	54.00	-6.06	AVG
7236.00	V	49.14	---	-0.24	48.90	---	74.00	54.00	-5.10	Peak
N/A										
4824.00	H	66.29	53.24	-5.47	60.82	47.77	74.00	54.00	-6.23	AVG
7236.00	H	48.83	---	-0.24	48.59	---	74.00	54.00	-5.41	Peak
N/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 1GH z to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.*

Operation Mode: TX / IEEE 802.11b Base mode / CH Mid **Test Date:** March 22, 2005

Temperature: 25°C **Tested by:** Tom Jen

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

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4874.00	V	63.01	40.66	-5.41	57.60	35.25	74.00	54.00	-18.75	AVG
7311.00	V	49.61	---	-0.08	49.53	---	74.00	54.00	-4.47	Peak
N/A										
4874.00	H	65.25	42.62	-5.41	59.84	37.21	74.00	54.00	-16.79	AVG
7311.00	H	50.68	---	-0.08	50.60	---	74.00	54.00	-3.40	Peak
N/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 1GH z to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.*

Operation Mode: TX / IEEE 802.11b Base mode / CH High **Test Date:** March 22, 2005

Temperature: 25°C **Tested by:** Tom Jen

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

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4924.00	V	63.61	58.01	-5.34	58.27	52.67	74.00	54.00	-1.33	AVG
7386.00	V	50.33	---	0.06	50.39	---	74.00	54.00	-3.61	Peak
N/A										
4924.00	H	65.66	57.22	-5.34	60.32	51.88	74.00	54.00	-2.12	AVG
7386.00	H	49.40	---	0.06	49.46	---	74.00	54.00	-4.54	Peak
N/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 1GH z to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.*

Operation Mode: TX / IEEE 802.11g Base mode / CH Low **Test Date:** March 22, 2005

Temperature: 25°C **Tested by:** Tom Jen

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

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4824.00	V	62.29	45.98	-5.47	56.82	40.51	74.00	54.00	-13.49	AVG
7236.00	V	51.91	---	-0.24	51.67	---	74.00	54.00	-2.33	Peak
N/A										
4824.00	H	62.56	44.20	-5.47	57.09	38.73	74.00	54.00	-15.27	AVG
7236.00	H	52.13	---	-0.24	51.89	---	74.00	54.00	-2.11	Peak
N/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 1GH z to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.*

Operation Mode: TX / IEEE 802.11g Base mode / CH Mid **Test Date:** March 22, 2005

Temperature: 25°C **Tested by:** Tom Jen

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

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4874.00	V	57.42	44.06	-5.41	52.01	38.65	74.00	54.00	-15.35	AVG
7311.00	V	54.08	39.56	-0.08	54.00	39.48	74.00	54.00	-14.52	AVG
N/A										
4874.00	H	61.21	39.63	-5.41	55.80	34.22	74.00	54.00	-19.78	AVG
7311.00	H	50.27	---	-0.08	50.19	---	74.00	54.00	-3.81	Peak
N/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 1GH z to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.*

Operation Mode: TX / IEEE 802.11g Base mode / CH High **Test Date:** March 22, 2005

Temperature: 25°C **Tested by:** Tom Jen

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

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4924.00	V	59.80	46.93	-5.34	54.46	41.59	74.00	54.00	-12.41	AVG
7386.00	V	50.75	---	0.06	50.81	---	74.00	54.00	-3.19	Peak
N/A										
4924.00	H	64.29	48.77	-5.34	58.95	43.43	74.00	54.00	-10.57	AVG
7386.00	H	51.93	---	0.06	51.99	---	74.00	54.00	-2.01	Peak
N/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 1GH z to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.*

Operation Mode: TX / IEEE 802.11g Turbo mode / CH Mid **Test Date:** May 24, 2005

Temperature: 25°C **Tested by:** Tom Jen

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

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1160.00	V	61.81	---	-12.70	49.11	---	74.00	54.00	-4.89	Peak
1597.00	V	60.19	---	-11.12	49.07	---	74.00	54.00	-4.93	Peak
N/A										
1033.00	H	62.21	---	-13.29	48.92	---	74.00	54.00	-5.08	Peak
1097.00	H	60.25	---	-13.02	47.23	---	74.00	54.00	-6.77	Peak
N/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 1GH z to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.*

Operation Mode: TX / IEEE 802.11a Base mode / CH Low **Test Date:** March 22, 2005

Temperature: 25°C **Tested by:** Tom Jen

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

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
11484.00	V	53.48	37.28	9.80	63.28	47.08	74.00	54.00	-6.92	AVG
N/A										
11490.00	H	47.11	32.22	9.79	56.90	42.01	74.00	54.00	-11.99	AVG
N/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 1GH z to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.*

Operation Mode: TX / IEEE 802.11a Base mode / CH Mid **Test Date:** March 22, 2005

Temperature: 25°C **Tested by:** Tom Jen

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

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
11570.00	V	52.36	36.21	9.57	61.93	45.78	74.00	54.00	-8.22	AVG
N/A										
11570.00	H	47.47	31.76	9.57	57.04	41.33	74.00	54.00	-12.67	AVG
N/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 1GH z to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.*

Operation Mode: TX / IEEE 802.11a Base mode / CH High **Test Date:** March 22, 2005

Temperature: 25°C **Tested by:** Tom Jen

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

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
11650.00	V	54.22	38.70	9.32	63.54	48.02	74.00	54.00	-5.98	AVG
N/A										
11652.00	H	48.50	32.33	9.32	57.82	41.65	74.00	54.00	-12.35	AVG
N/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 1GH z to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.*

Operation Mode: TX / IEEE 802.11a Turbo mode / CH Low **Test Date:** May 24, 2005

Temperature: 25°C **Tested by:** Tom Jen

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

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
11509.00	V	48.15	34.45	9.78	57.93	44.23	74.00	54.00	-9.77	AVG
17272.00	V	55.65	40.68	12.13	67.78	52.81	74.00	54.00	-1.19	AVG
N/A										
17272.00	H	56.87	40.88	12.13	69.00	53.01	74.00	54.00	-0.99	AVG
N/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 1GH z to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.*

Operation Mode: TX / IEEE 802.11a Turbo mode / CH High **Test Date:** May 24, 2005

Temperature: 25°C **Tested by:** Tom Jen

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

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
17390.00	V	54.97	39.49	13.07	68.04	52.56	74.00	54.00	-1.44	AVG
N/A										
17405.00	H	59.96	39.88	13.14	73.10	53.02	74.00	54.00	-0.98	AVG
N/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 1GH z to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.*

7.7 POWERLINE 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 (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

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

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI TEST RECEIVER 9kHz-30MHz	ROHDE & SCHWARZ	ESHS30	828144/003	09/24/2005
TWO-LINE V-NETWORK 9kHz-30MHz	SCHAFFNER	NNB41	03/10013	06/11/2005
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	02/17/2006

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:	Normal Link	**Test Date:**	May 04, 2005
Temperature:	25°C	**Tested by:**	Jason Lin
Humidity:	55% RH		

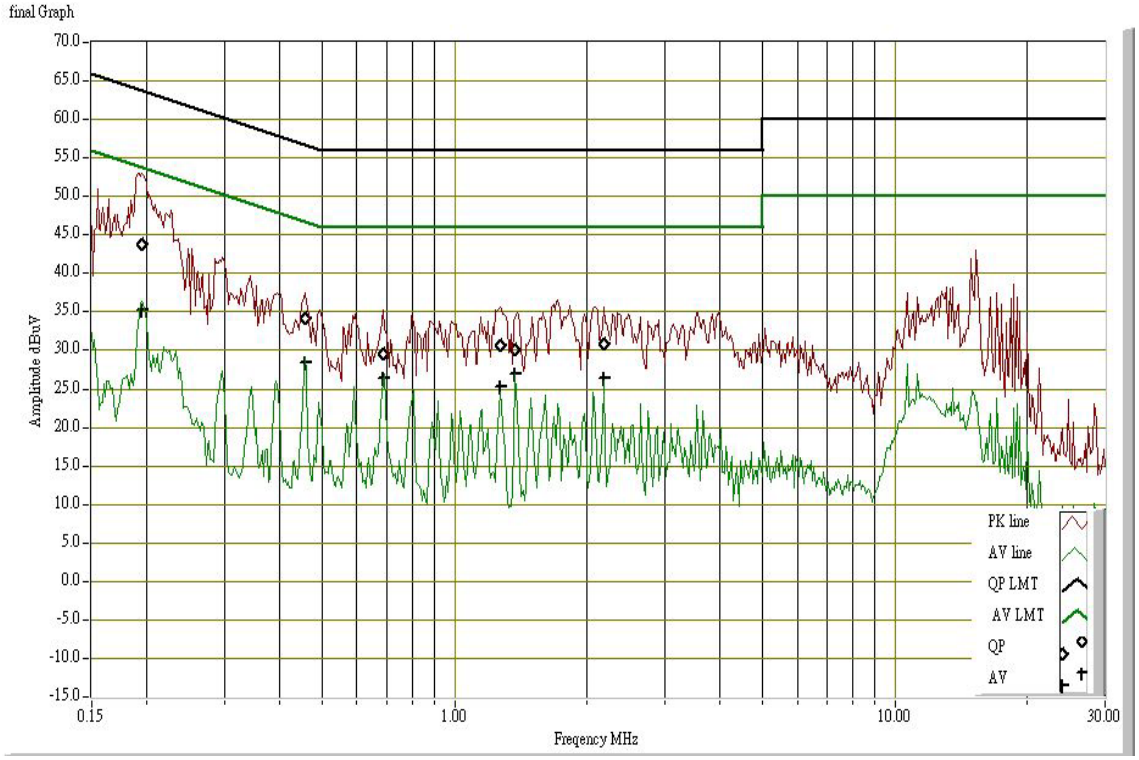
Freq. (MHz)	QP Reading	AV Reading	Corr. factor	QP Result	AV Result	QP Limit	AV Limit	QP Margin	AV Margin	Note
0.195	43.76	35.19	0.11	43.87	35.30	63.82	53.82	-19.95	-18.52	L1
0.458	34.08	28.35	0.10	34.18	28.45	56.73	46.73	-22.55	-18.28	L1
0.687	29.56	26.38	0.10	29.66	26.48	56.00	46.00	-26.34	-19.52	L1
1.269	30.58	25.35	0.10	30.68	25.45	56.00	46.00	-25.32	-20.55	L1
1.374	30.00	26.95	0.10	30.10	27.05	56.00	46.00	-25.90	-18.95	L1
2.182	30.90	26.43	0.10	31.00	26.53	56.00	46.00	-25.00	-19.47	L1
0.197	42.78	35.26	0.11	42.89	35.37	63.74	53.74	-20.85	-18.37	L2
0.458	33.94	28.17	0.10	34.04	28.27	56.73	46.73	-22.69	-18.46	L2
0.693	29.06	26.54	0.10	29.16	26.64	56.00	46.00	-26.84	-19.36	L2
0.806	30.30	25.22	0.10	30.40	25.32	56.00	46.00	-25.60	-20.68	L2
1.374	29.38	24.32	0.10	29.48	24.42	56.00	46.00	-26.52	-21.58	L2
2.064	29.14	25.11	0.10	29.24	25.21	56.00	46.00	-26.76	-20.79	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. *"---" denotes the emission level was or more than 2dB below the Average limit*
4. *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;*
5. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*

Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)