



## **FCC 47 CFR PART 15 SUBPART E**

### **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**



---

**Note:** This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc. This document may be altered or revised by Compliance Certification Services Inc. personnel only, and shall be noted in the revision section of the document.



## TABLE OF CONTENTS

<b>1. TEST RESULT CERTIFICATION.....</b>	<b>3</b>
<b>2. EUT DESCRIPTION .....</b>	<b>4</b>
<b>3. TEST METHODOLOGY .....</b>	<b>5</b>
3.1 EUT CONFIGURATION .....	5
3.2 EUT EXERCISE .....	5
3.3 GENERAL TEST PROCEDURES .....	5
3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS .....	6
3.5 DESCRIPTION OF TEST MODES .....	6
<b>4. INSTRUMENT CALIBRATION.....</b>	<b>7</b>
<b>5. FACILITIES AND ACCREDITATIONS .....</b>	<b>8</b>
5.1 FACILITIES .....	8
5.2 EQUIPMENT .....	8
5.3 LABORATORY ACCREDITATIONS AND LISTING .....	8
5.4 TABLE OF ACCREDITATIONS AND LISTINGS .....	9
<b>6. SETUP OF EQUIPMENT UNDER TEST .....</b>	<b>10</b>
6.1 SETUP CONFIGURATION OF EUT .....	10
6.2 SUPPORT EQUIPMENT .....	10
<b>7. FCC PART 15 REQUIREMENTS.....</b>	<b>11</b>
7.1 26 DB EMISSION BANDWIDTH.....	11
7.2 PEAK POWER .....	16
7.3 BAND EDGES MEASUREMENT .....	22
7.4 PEAK POWER SPECTRAL DENSITY .....	31
7.5 PEAK EXCURSION.....	36
7.6 RADIO FREQUENCY EXPOSURE.....	41
7.7 RADIATED UNDESIRABLE EMISSION.....	44
7.8 CONDUCTED UNDESIRABLE EMISSION .....	54
7.9 POWERLINE CONDUCTED EMISSIONS .....	58
7.10 TRANSMISSION IN ABSENCE OF DATA .....	61
7.11 FREQUENCY STABILITY.....	61
7.12 ANTENNA REQUIREMENT .....	61
7.13 APPENDIX 1 PHOTOGRAPHS OF TEST SETUP.....	62



## 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 ~ June 07, 2005

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

### We hereby certify that:

Compliance Certification Services Inc. tested the above equipment. 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 conducted and radiated emission limits of FCC Rules Part 15.407.

The test results of this report relate only to the tested sample 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

<b>Product</b>	802.11a/b/g Mini PCI Card
<b>Trade Name</b>	Askey
<b>Model Number</b>	WLL4071
<b>Model Discrepancy</b>	The above model has two types of transmitting mode for sale. (I) With Turbo mode. (II) Without Turbo mode.
<b>Power Supply</b>	Powered from host device
<b>Frequency Range</b>	5.15~5.35 GHz
<b>Transmit Power</b>	17.90 dBm
<b>Modulation Technique</b>	OFDM (QPSK, BPSK, 16-QAM, 64-QAM)
<b>Transmit Data Rate</b>	108, 54, 48, 36, 24, 18, 12, 9, 6 Mbps
<b>Number of Channels</b>	8 Channels
<b>Antenna Specification</b>	Hitachi / HTL017 PIFA Antenna / 1.2 dBi  Hitachi / HTL008 PIFA Antenna / 0.8 dBi  Tyco / TIAN01 PIFA Antenna / 1.6 dBi

### Operation Frequency:

UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII)	
CHANNEL	MHz
1	5180
2	5200
3	5220
4	5240
5	5260
6	5280
7	5300
8	5320

### **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: H8NWLL4071 filing to comply with Section 15.407 of the FCC Part 15, Subpart E Rules.



### **3. TEST METHODOLOGY**

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4. Radiated testing was performed at an antenna to EUT distance 3 meters.

#### **3.1 EUT CONFIGURATION**

The EUT configuration for testing is installed for RF field strength measurement to meet the Commissions requirement, and is operated in a manner intended to generate the maximum emission in a continuous normal application.

#### **3.2 EUT EXERCISE**

The EUT is operated in the engineering mode to fix the Tx frequency for the purposes of measurement.

According to its specifications, the EUT must comply with the requirements of Section 15.407 under the FCC Rules Part 15 Subpart E.

#### **3.3 GENERAL TEST PROCEDURES**

##### **Conducted Emissions**

The EUT is placed on the turntable, which is positioned at 0.8 m above the ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4, the conducted emission from the EUT is measured in the frequency range between 0.15 MHz and 30MHz, using the CISPR Quasi-Peak detector mode.

##### **Radiated Emissions**

The EUT is placed on the turntable, which is 0.8 m above the ground plane. The turntable is then rotated for 360 degrees to determine the proper orientation for the maximum emission level. The EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission level. And, each emission is to be maximized by changing the horizontal and vertical polarization of the receiving antenna. 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
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	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	( <sup>2</sup> )
13.36 - 13.41	322 - 335.4		

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

<sup>2</sup> 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 Tyco (model: TIAN01) 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.

Base mode:

Channel Low (5180MHz), Channel Mid (5260MHz) and Channel High (5320MHz) with 6Mbps data rate were chosen for full testing.

Turbo mode:

Channel Low (5210MHz), Channel Mid (5250MHz) and Channel High (5290MHz) with 12Mbps data rate were 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	 200600-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	 93105, 90471
Japan	VCCI	4 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 300 328-2, 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	 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	 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	 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

Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
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 REQUIREMENTS**

### **7.1 26 dB EMISSION BANDWIDTH**

#### **LIMIT**

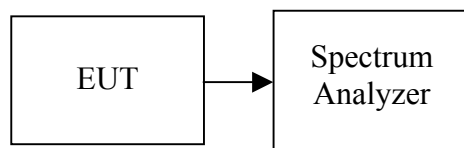
For purposes of this subpart, the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

#### **MEASUREMENT EQUIPMENT USED**

<b>Name of Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Due</b>
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 = 1%EBW, VBW = RBW, Span = 50MHz / 100MHz (Turbo Mode), and Sweep = auto.
- Or Set the spectrum analyzer as RBW > 1%EBW, VBW > RBW, Span >26dB bandwidth (Base Mode) / >26dB bandwidth (Turbo Mode), and Sweep = auto.
4. Mark the peak frequency and -26dB (upper and lower) frequency.
5. Repeat until all the rest channels were investigated.



## **TEST RESULTS**

*No non-compliance noted*

### **Test Data**

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Bandwidth (B) (MHz)</b>
Low	Base mode	5180
Mid		24.3920
High		27.4270
Low	Turbo mode	5320
Mid		26.9730
High		33.7489
Low	Turbo mode	5210
Mid		33.6058
High		33.6546

**Test Plot****IEEE 802.11a Base mode(UNII)****CH Low**

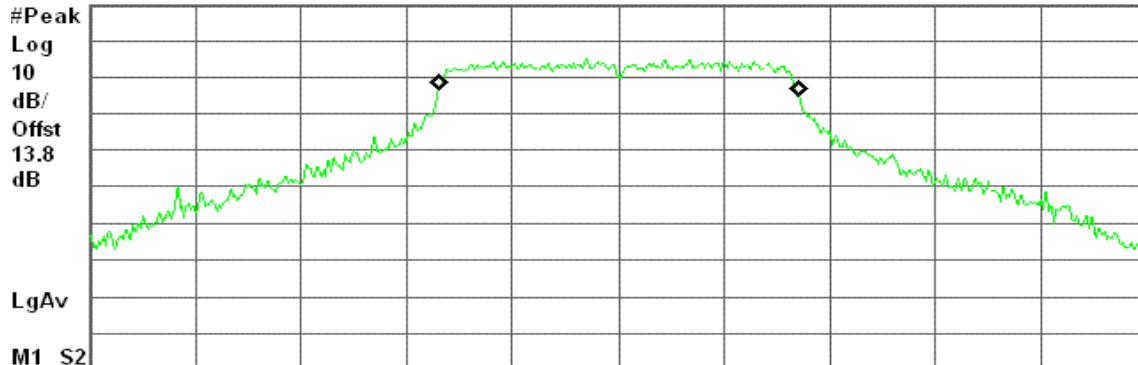
\* Agilent 19:20:52 Mar 28, 2005

R L

26 dB BW, a Mode Low Ch.

Ref 20 dBm

Atten 20 dB



Center 5.180 00 GHz

Span 50 MHz

#Res BW 240 kHz

#VBW 750 kHz

Sweep 1 ms (601 pts)

**Occupied Bandwidth****16.9214 MHz**

Occ BW % Pwr 99.00 %  
x dB -26.00 dB

Transmit Freq Error 23.756 kHz  
x dB Bandwidth 24.392 MHz

**CH Mid**

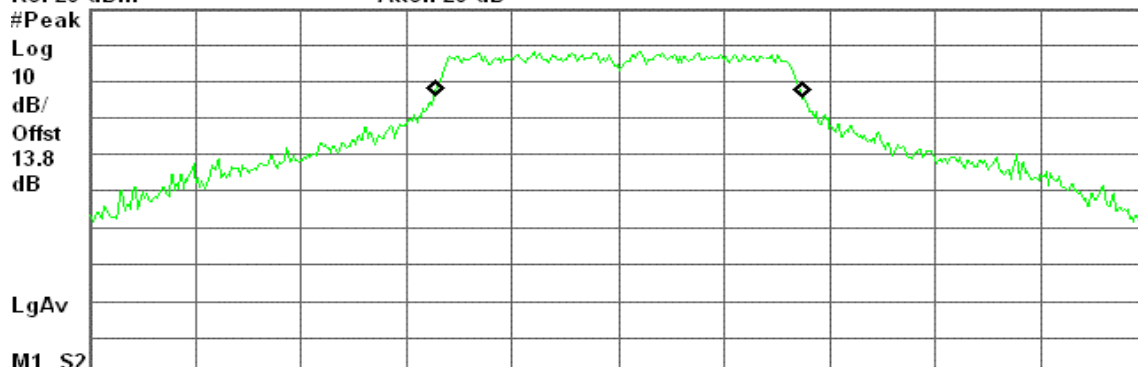
\* Agilent 19:31:10 Mar 28, 2005

R L

26 dB BW, a Mode Mid Ch.

Ref 20 dBm

Atten 20 dB



Center 5.260 00 GHz

Span 50 MHz

#Res BW 270 kHz

#VBW 750 kHz

Sweep 1 ms (601 pts)

**Occupied Bandwidth****17.2869 MHz**

Occ BW % Pwr 99.00 %  
x dB -26.00 dB

Transmit Freq Error 19.657 kHz  
x dB Bandwidth 27.427 MHz

**CH High**

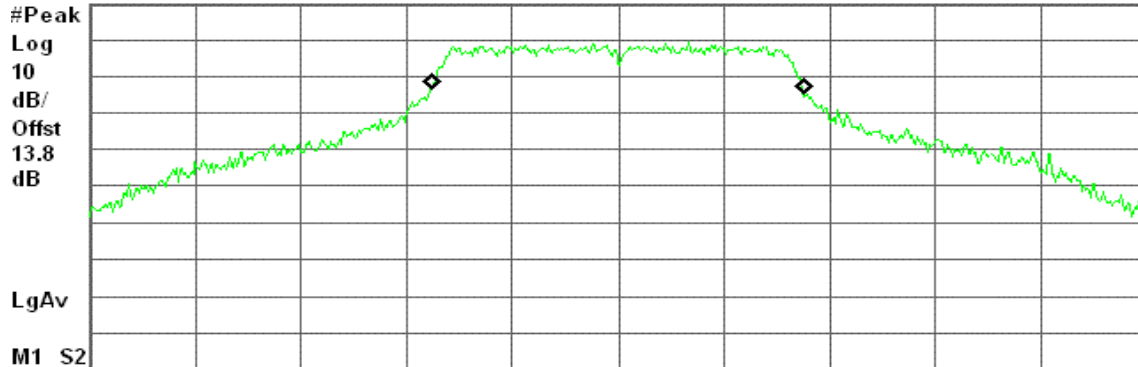
\* Agilent 19:36:05 Mar 28, 2005

R L

26 dB BW, a Mode High Ch.

Ref 20 dBm

Atten 20 dB



Center 5.320 00 GHz

Span 50 MHz

#Res BW 330 kHz

#VBW 1 MHz

Sweep 1 ms (601 pts)

Occupied Bandwidth

17.4768 MHz

Occ BW % Pwr 99.00 %

x dB -26.00 dB

Transmit Freq Error -14.919 kHz

x dB Bandwidth 26.973 MHz

**IEEE 802.11a Turbo mode(UNII)****CH Low**

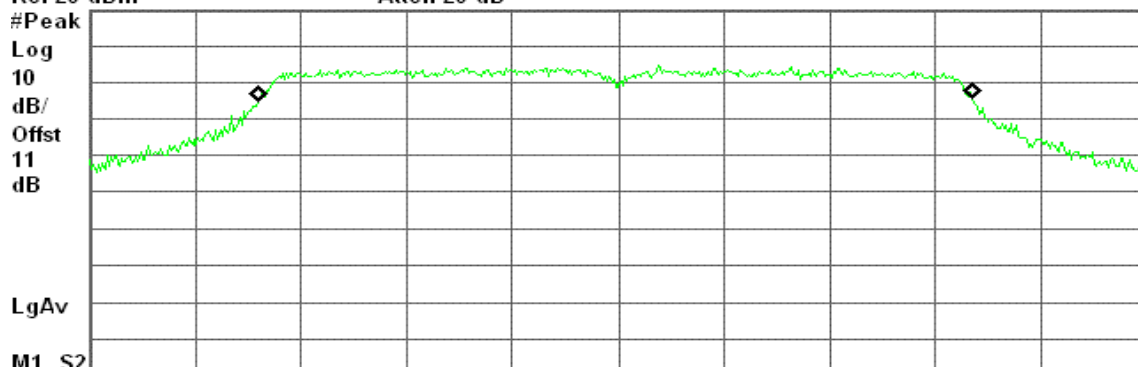
\* Agilent 13:43:18 May 24, 2005

R L

26 dB BW, a Mode Low Ch.

Ref 20 dBm

Atten 20 dB



Center 5.210 00 GHz

Span 50 MHz

#Res BW 560 kHz

#VBW 1.6 MHz

Sweep 1 ms (601 pts)

Occupied Bandwidth

33.7489 MHz

Occ BW % Pwr 99.00 %

x dB -26.00 dB

Transmit Freq Error -106.108 kHz

x dB Bandwidth 49.254 MHz

**CH Mid**

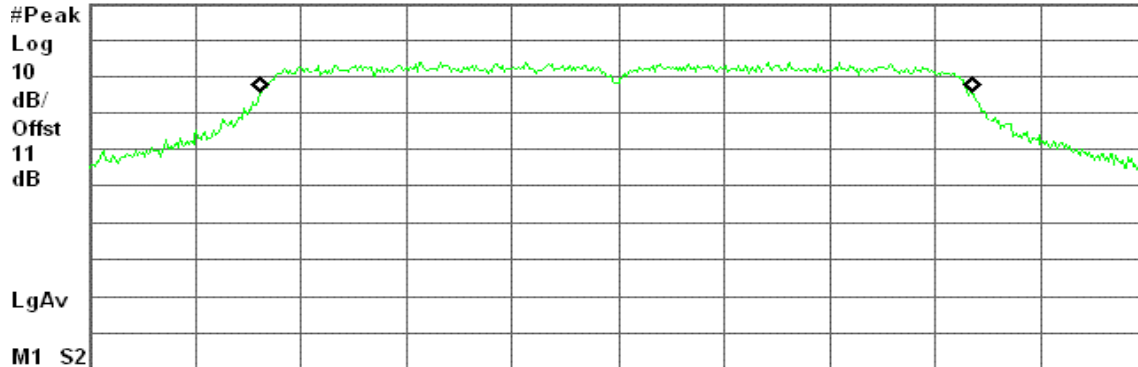
\* Agilent 13:49:59 May 24, 2005

R L

26 dB BW, a Mode Mid Ch.

Ref 20 dBm

Atten 20 dB



Center 5.250 00 GHz

Span 50 MHz

#Res BW 510 kHz

#VBW 1.6 MHz

Sweep 1 ms (601 pts)

Occupied Bandwidth

33.6058 MHz

Occ BW % Pwr 99.00 %

x dB -26.00 dB

Transmit Freq Error

-84.340 kHz

x dB Bandwidth

48.680 MHz

**CH High**

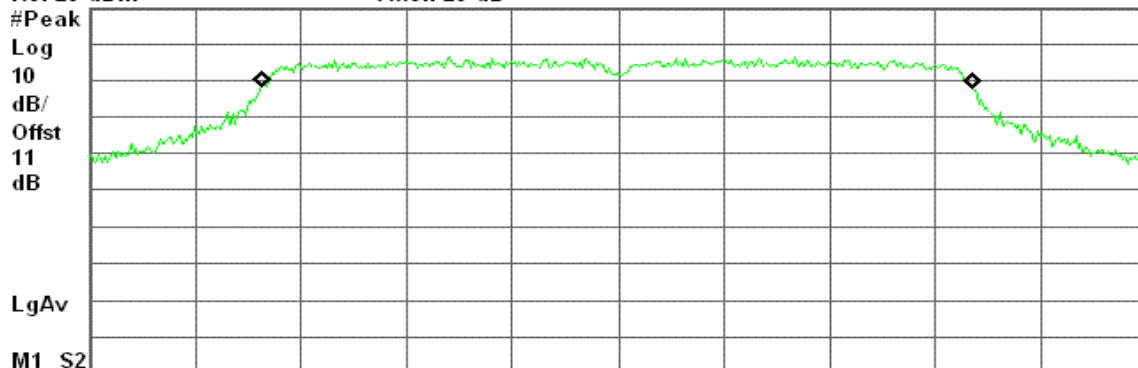
\* Agilent 14:08:43 May 24, 2005

R L

26 dB BW, a Mode High Ch.

Ref 20 dBm

Atten 20 dB



Center 5.290 00 GHz

Span 50 MHz

#Res BW 510 kHz

#VBW 1.6 MHz

Sweep 1 ms (601 pts)

Occupied Bandwidth

33.6546 MHz

Occ BW % Pwr 99.00 %

x dB -26.00 dB

Transmit Freq Error

-47.055 kHz

x dB Bandwidth

48.787 MHz

## 7.2 PEAK POWER

### LIMIT

- For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50mW (17dBm) or  $4\text{dBm} + 10\log B$ , where B is the 26dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4dBm in any 1 MHz band.
- For the band 5.25-5.35 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250mW (24dBm) or  $11\text{dBm} + 10\log B$ , where B is the 26dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 11dBm in any 1 MHz band.

*If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. The peak power shall not exceeded the limit as follows:*

#### **Test mode: IEEE 802.11a Base mode (UNII)**

Frequency (MHz)		Bandwidth (MHz)	4 + 10 Log B or 11 + 10 Log B (dBm)	Power Limit (dBm)
Low	5180	24.392	17.872	17
Mid	5260	27.427	25.382	24
High	5320	26.973	25.309	24

#### **Test mode: IEEE 802.11a Turbo mode (UNII)**

Frequency (MHz)		Bandwidth (MHz)	4 + 10 Log B or 11 + 10 Log B (dBm)	Power Limit (dBm)
Low	5210	33.75	19.28	17
Mid	5250	33.61	26.26	24
High	5290	33.65	26.27	24

(Remark: Maximum antenna gain = 1.2 dBi, therefore there is no reduction due to antenna gain.)



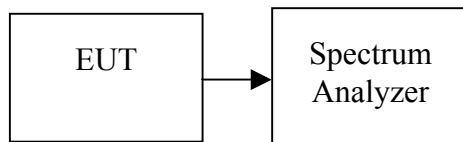
**MEASUREMENT EQUIPMENT USED**

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**

The EUT was connected to a spectrum analyzer through a 50  $\Omega$  RF cable.

**TEST PROCEDURE**

Set span to encompass the entire emission bandwidth (EBW) of the signal.

Set RBW = 1 MHz / Set VBW = 3 MHz.

Use sample detector mode if bin width (i.e., span/number of points in spectrum display) < 0.5 RBW. Otherwise use peak detector mode. Use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at full control power for entire sweep of every sweep. If the device transmits continuously, with no off intervals or reduced power intervals, the trigger may be set to "free run". Trace average 100 traces in power averaging mode. Compute power by integrating the spectrum across the 26 dB EBW of the signal. The integration can be performed using the spectrum analyzer's band power measurement function with band limits set equal to the EBW band edges or by summing power levels in each 1 MHz band in linear power terms. The 1 MHz band power levels to be summed can be obtained by averaging, in linear power terms, power levels in each frequency bin across the 1 MHz.

**TEST RESULTS***No non-compliance noted***Test Data****Test mode: IEEE 802.11a Base mode (UNII)**

Channel	Frequency (MHz)	Reading (dBm)	Cable Loss (dB)	Output Power (dBm)	Limit (dBm)
Low	5180	1.26	13.80	15.06	17
Mid	5260	3.95	13.80	17.75	24
High	5320	4.10	13.80	17.90	24

**Test mode: IEEE 802.11a Turbo mode (UNII)**

Channel	Frequency (MHz)	Reading (dBm)	Cable Loss (dB)	Output Power (dBm)	Limit (dBm)
Low	5210	2.85	11.00	13.85	17
Mid	5250	2.35	11.00	13.35	24
High	5290	4.62	11.00	15.62	24



## Test Plot

### IEEE 802.11a Base mode(UNII)

#### CH Low

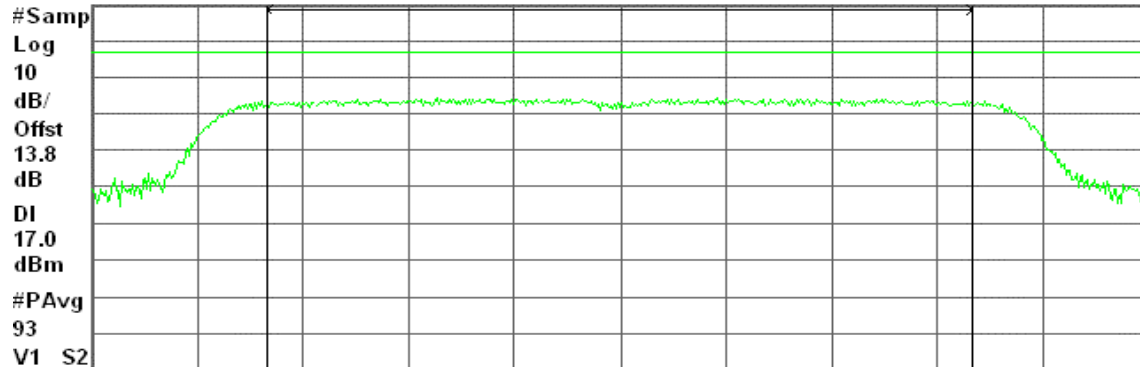
Agilent 19:22:17 Mar 28, 2005

R L

Peak Transmit Power, a Mode Low Ch.

Ref 30 dBm

Atten 30 dB



#Samp

#Res BW 1 MHz

#VBW 3 MHz

Sweep 1 ms (601 pts)

Channel Power

Power Spectral Density

15.06 dBm / 14.7100 MHz

-56.62 dBm/Hz

#### CH Mid

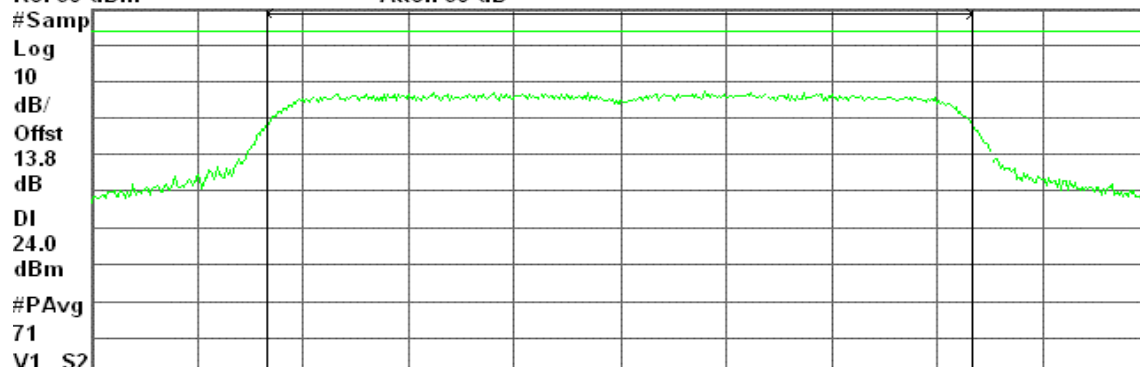
Agilent 19:31:32 Mar 28, 2005

R L

Peak Transmit Power, a Mode Mid Ch.

Ref 30 dBm

Atten 30 dB



#Samp

#Res BW 1 MHz

#VBW 3 MHz

Sweep 1 ms (601 pts)

Channel Power

Power Spectral Density

17.75 dBm / 17.3400 MHz

-54.64 dBm/Hz



## CH High

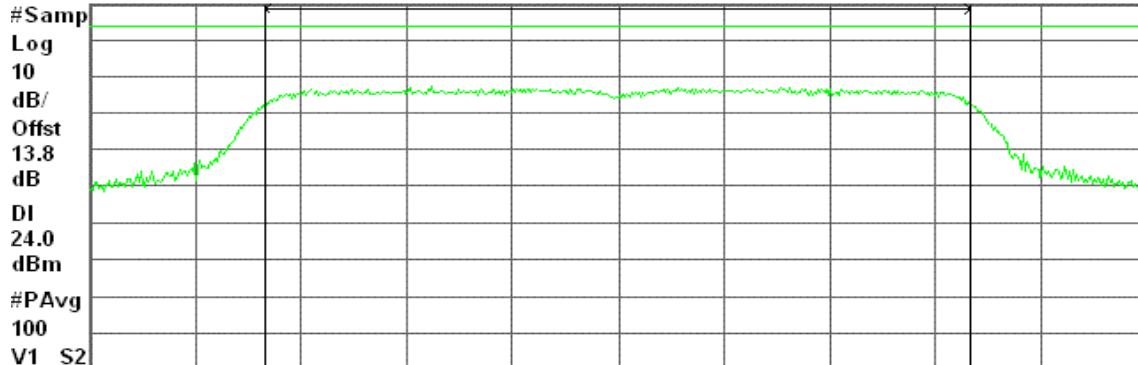
Agilent 19:36:39 Mar 28, 2005

R L

Peak Transmit Power, a Mode High Ch.

Ref 30 dBm

Atten 30 dB



Center 5.320 00 GHz

Span 24.82 MHz

#Res BW 1 MHz

#VBW 3 MHz

Sweep 1 ms (601 pts)

Channel Power

Power Spectral Density

17.90 dBm / 16.5500 MHz

-54.29 dBm/Hz

## IEEE 802.11a Turbo mode(UNII)

### CH Low

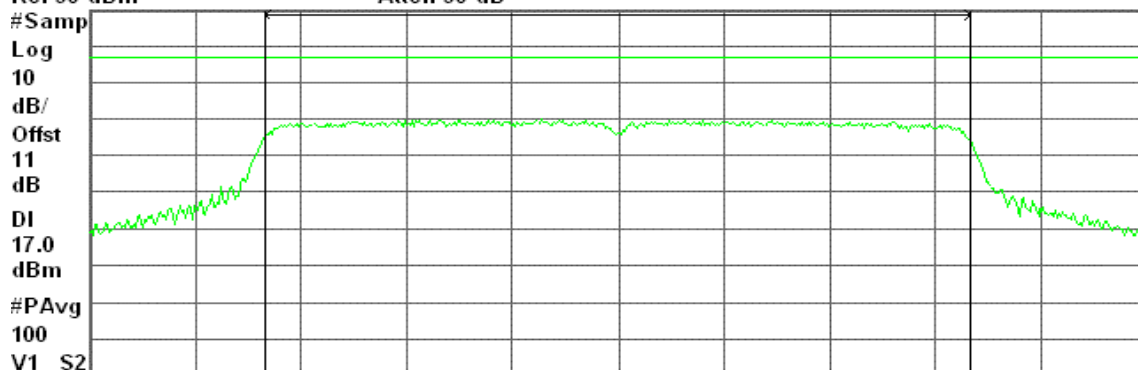
Agilent 13:44:30 May 24, 2005

R L

Peak Transmit Power, a Mode Low Ch.

Ref 30 dBm

Atten 30 dB



Center 5.210 00 GHz

Span 49.88 MHz

#Res BW 1 MHz

#VBW 3 MHz

Sweep 1 ms (601 pts)

Channel Power

Power Spectral Density

13.85 dBm / 33.2500 MHz

-61.37 dBm/Hz



## CH Mid

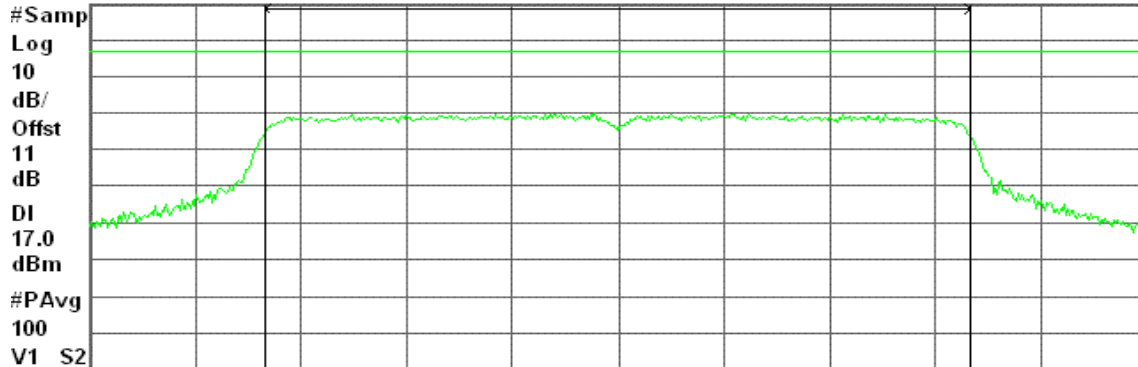
Agilent 13:51:23 May 24, 2005

R L

Peak Transmit Power, a Mode Mid Ch.

Ref 30 dBm

Atten 30 dB



Channel Power

13.35 dBm / 33.2900 MHz

Power Spectral Density

-61.87 dBm/Hz

## CH High

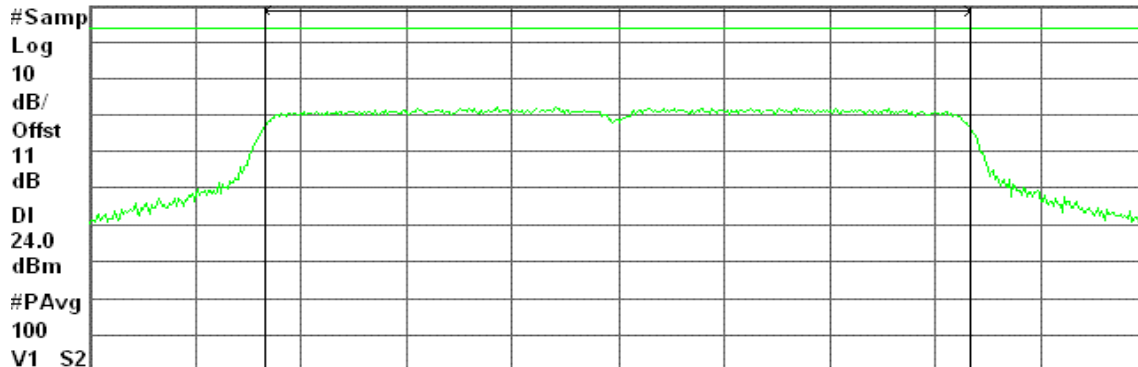
Agilent 14:09:26 May 24, 2005

R L

Peak Transmit Power, a Mode High Ch.

Ref 30 dBm

Atten 30 dB



Channel Power

15.62 dBm / 33.2300 MHz

Power Spectral Density

-59.59 dBm/Hz

## 7.3 BAND EDGES MEASUREMENT

### LIMIT

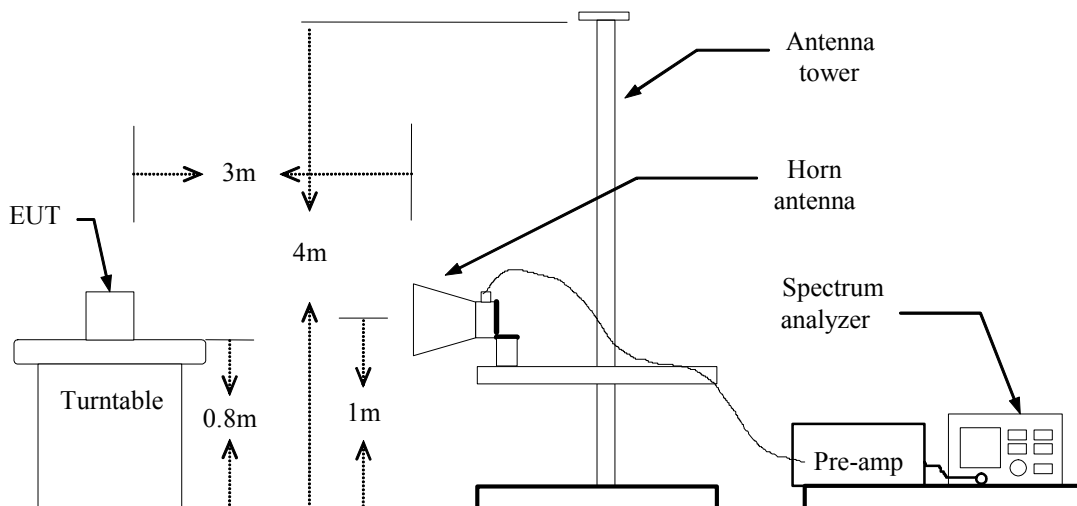
According to §15.407(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	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.

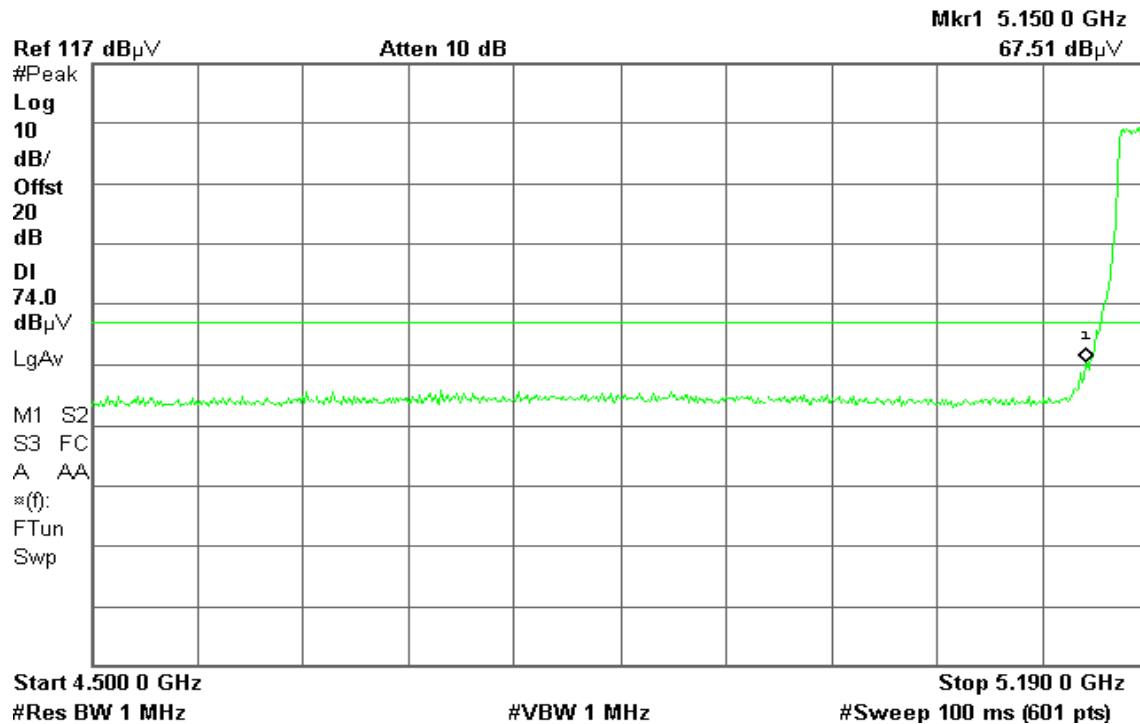
### TEST RESULTS

Refer to attach spectrum analyzer data chart.

**Test Plot****IEEE 802.11a Base mode / CH Low****Detector mode: Peak****Polarity: Vertical**

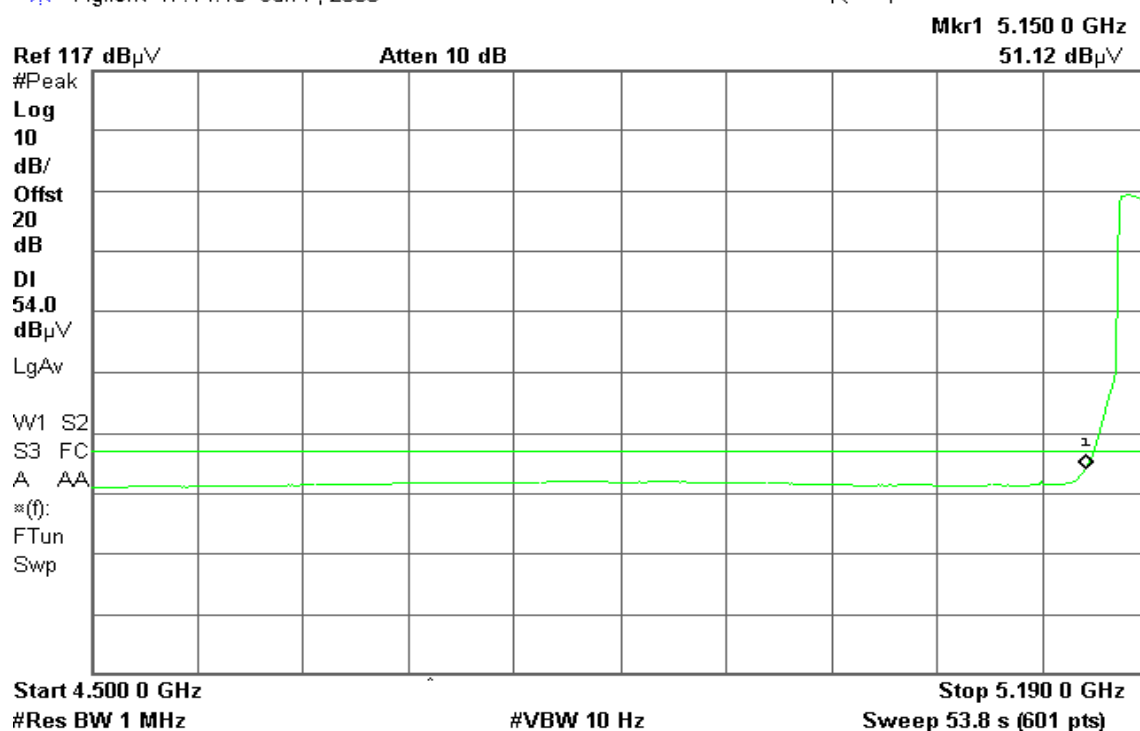
✱ Agilent 17:12:51 Jun 7, 2005

R T

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

✱ Agilent 17:14:15 Jun 7, 2005

R T



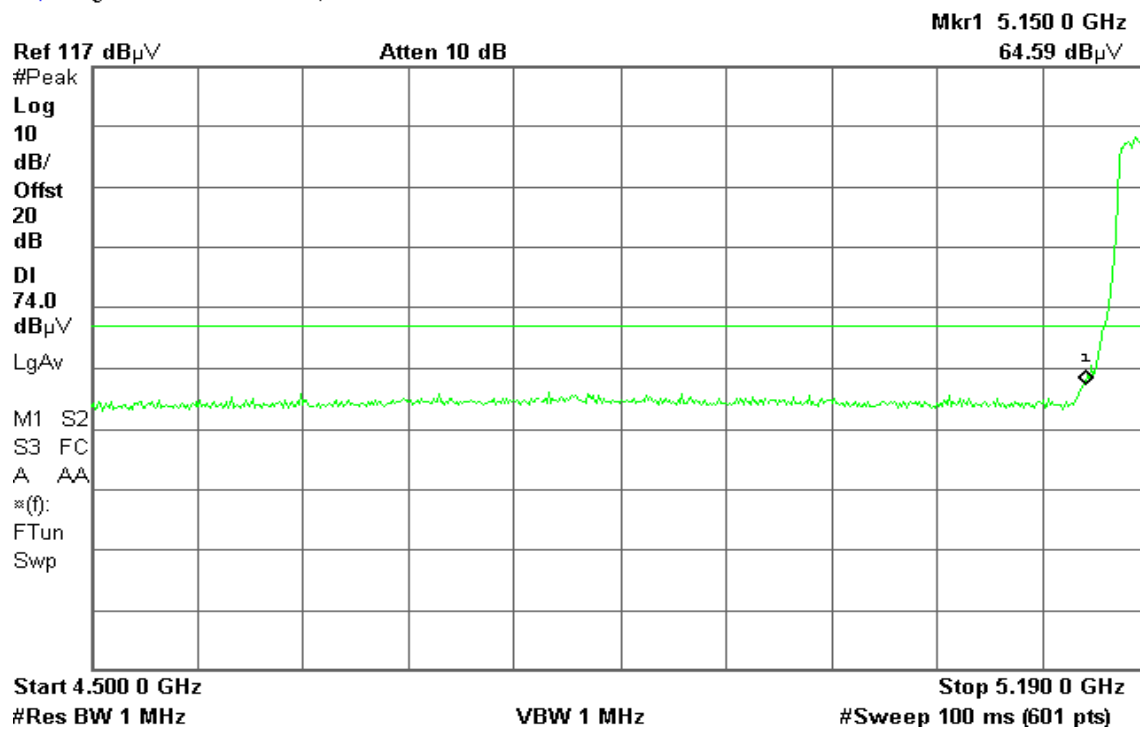


Detector mode: Peak

Polarity: Horizontal

Agilent 17:08:00 Jun 7, 2005

R T

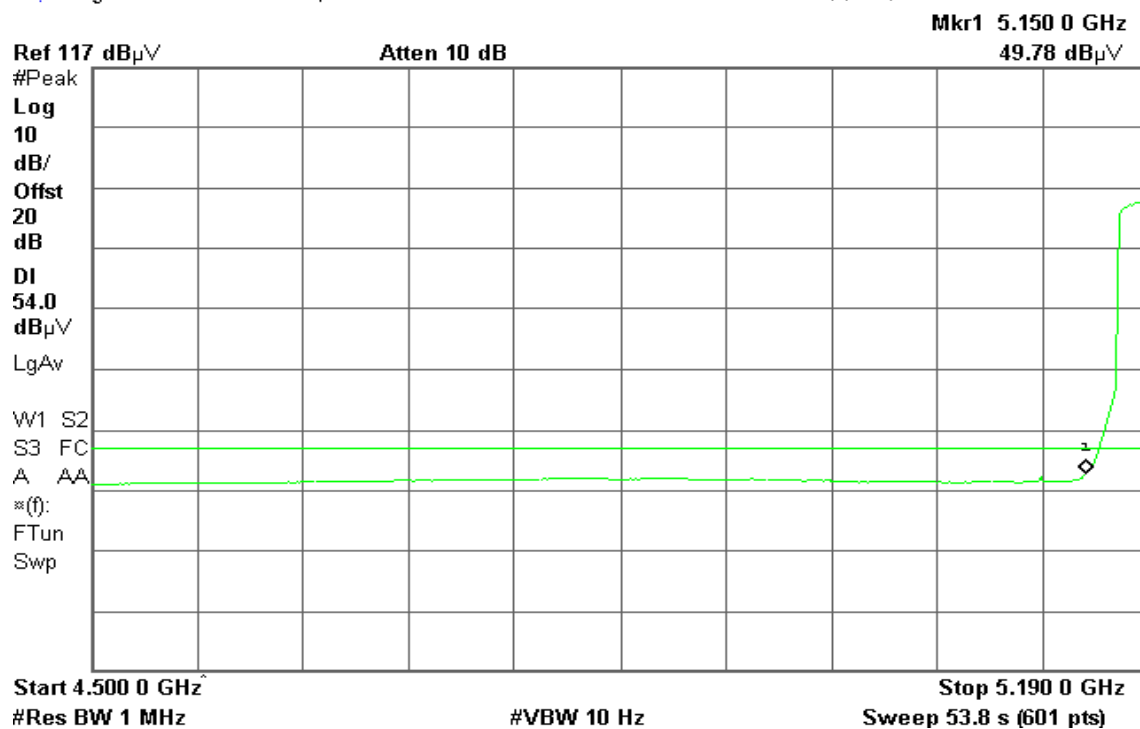


Detector mode: Average

Polarity: Horizontal

Agilent 17:09:24 Jun 7, 2005

R T







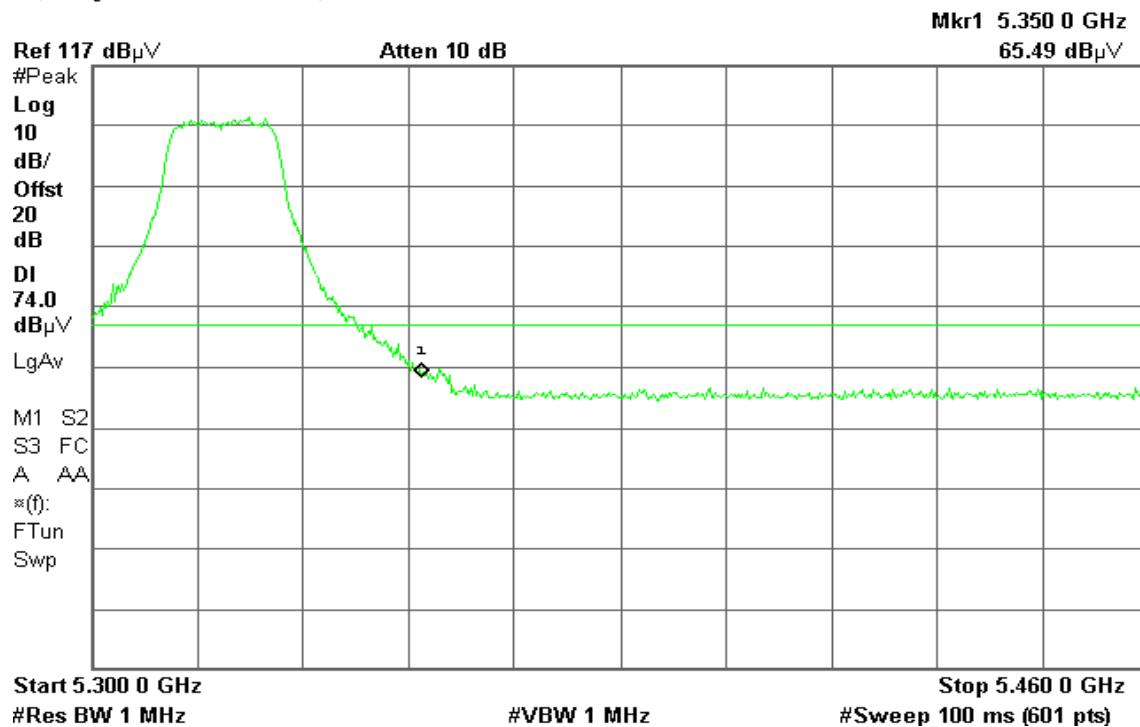
## IEEE 802.11a Base mode / CH High

Detector mode: Peak

Polarity: Vertical

Agilent 17:24:40 Jun 7, 2005

R T

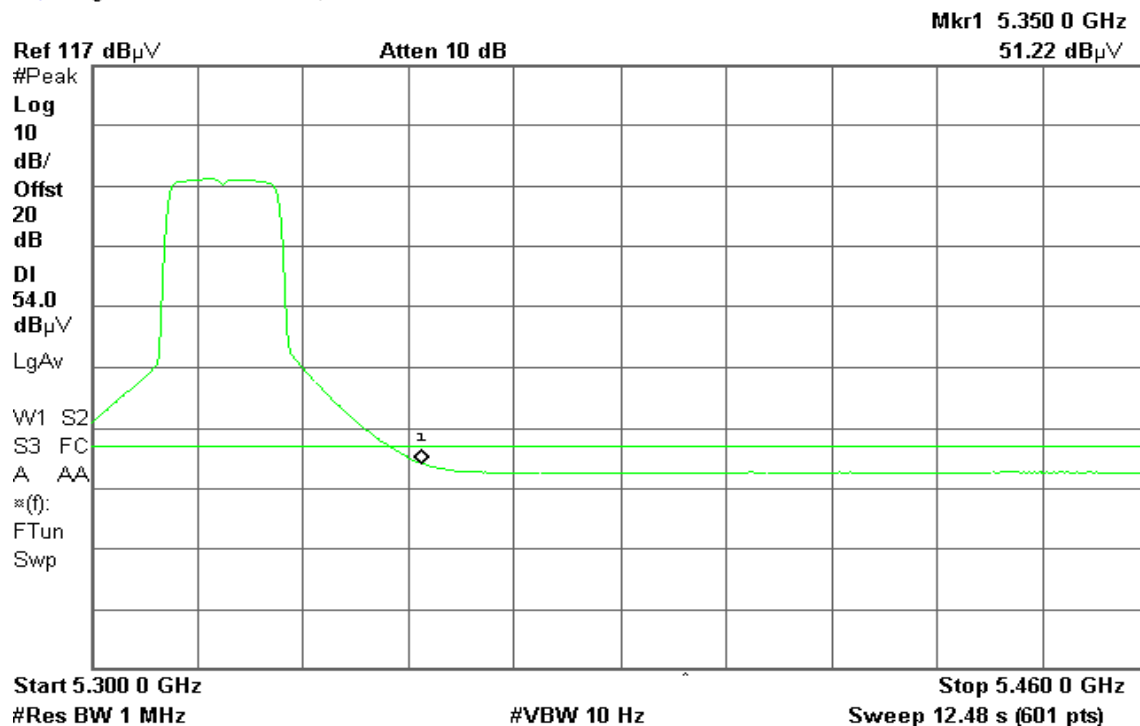


Detector mode: Average

Polarity: Vertical

Agilent 17:25:12 Jun 7, 2005

R T



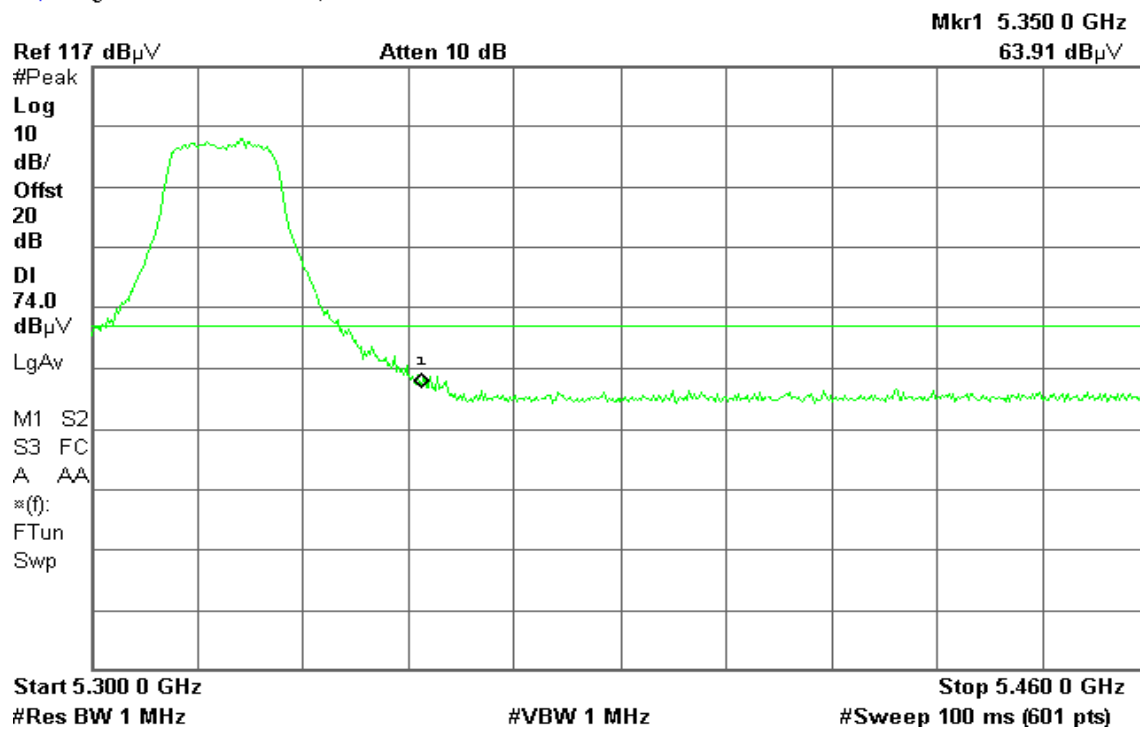


Detector mode: Peak

Polarity: Horizontal

Agilent 17:27:30 Jun 7, 2005

R T

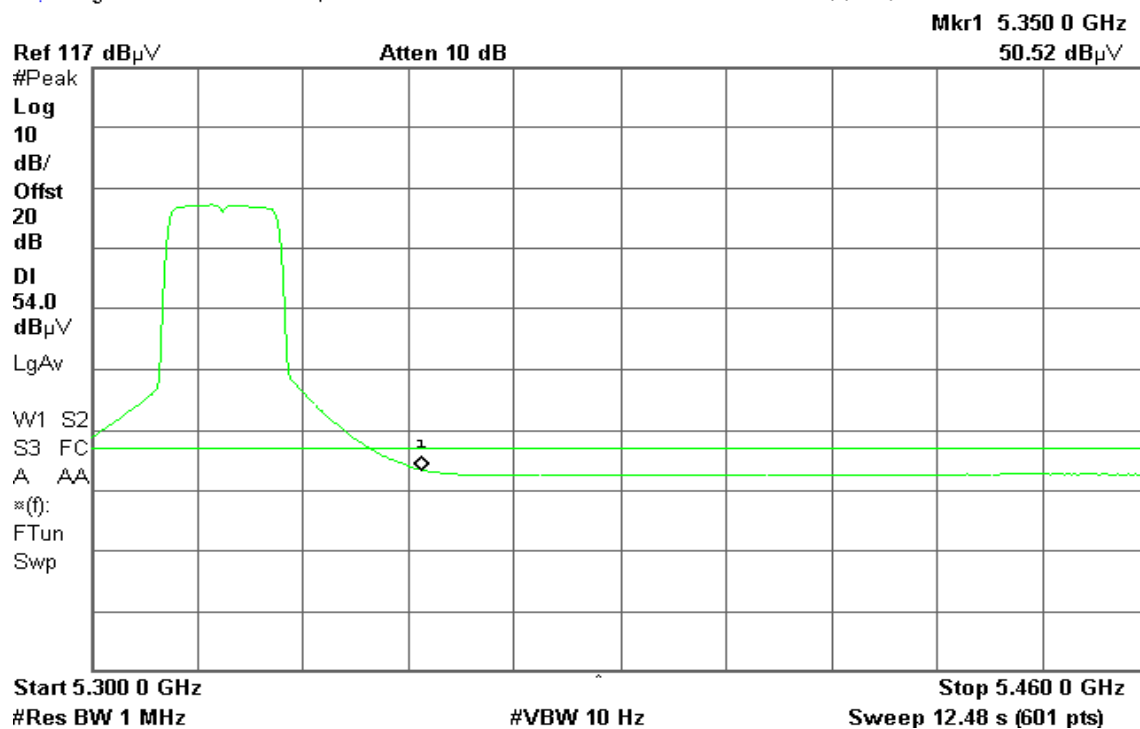


Detector mode: Average

Polarity: Horizontal

Agilent 17:27:58 Jun 7, 2005

R T





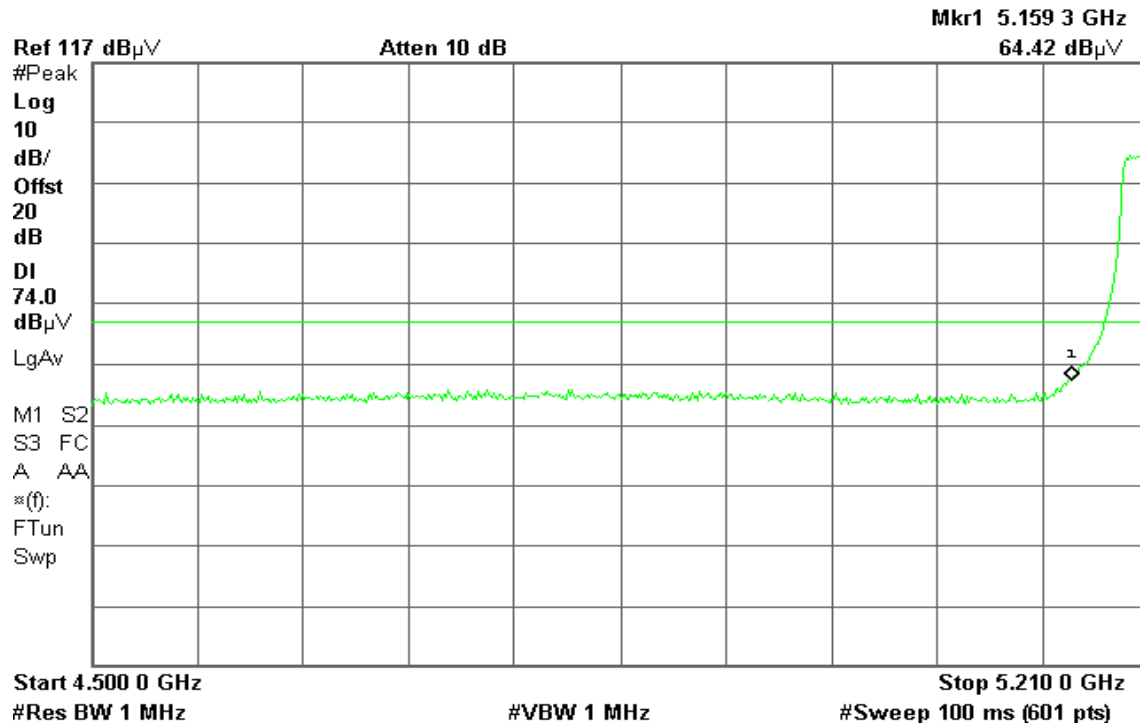
## IEEE 802.11a Turbo mode / CH Low

Detector mode: Peak

Polarity: Vertical

Agilent 17:50:44 Jun 7, 2005

R T

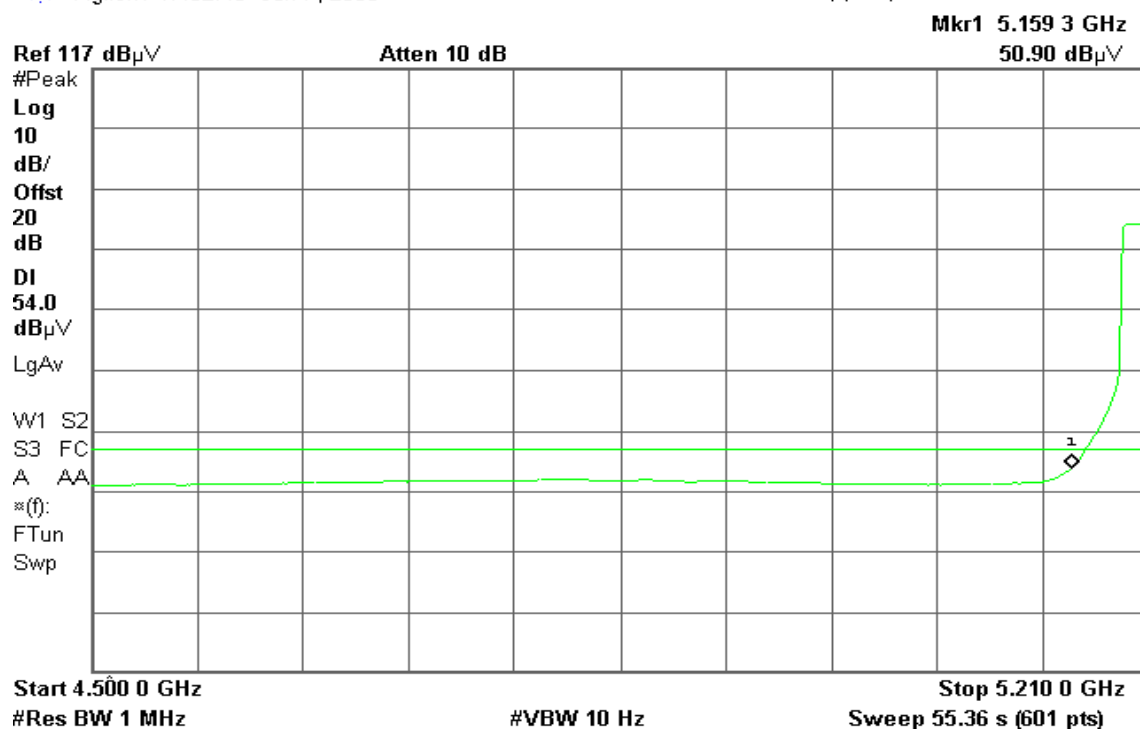


Detector mode: Average

Polarity: Vertical

Agilent 17:52:45 Jun 7, 2005

R T



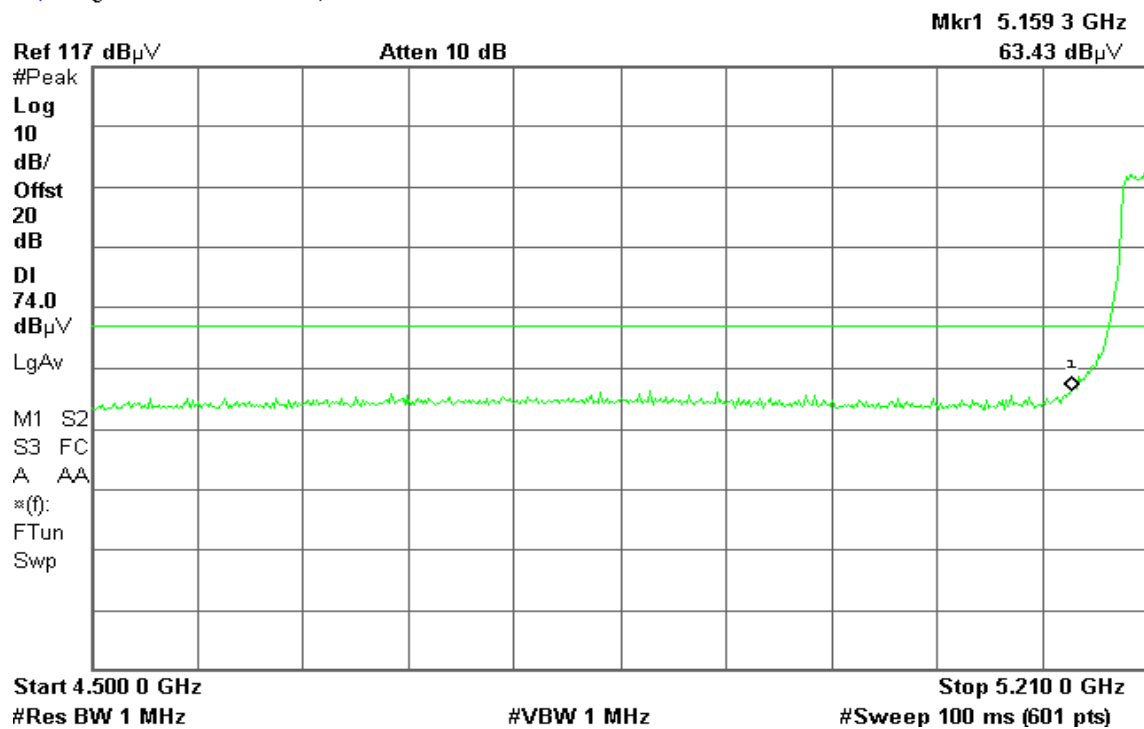


Detector mode: Peak

Polarity: Horizontal

Agilent 17:56:41 Jun 7, 2005

R T

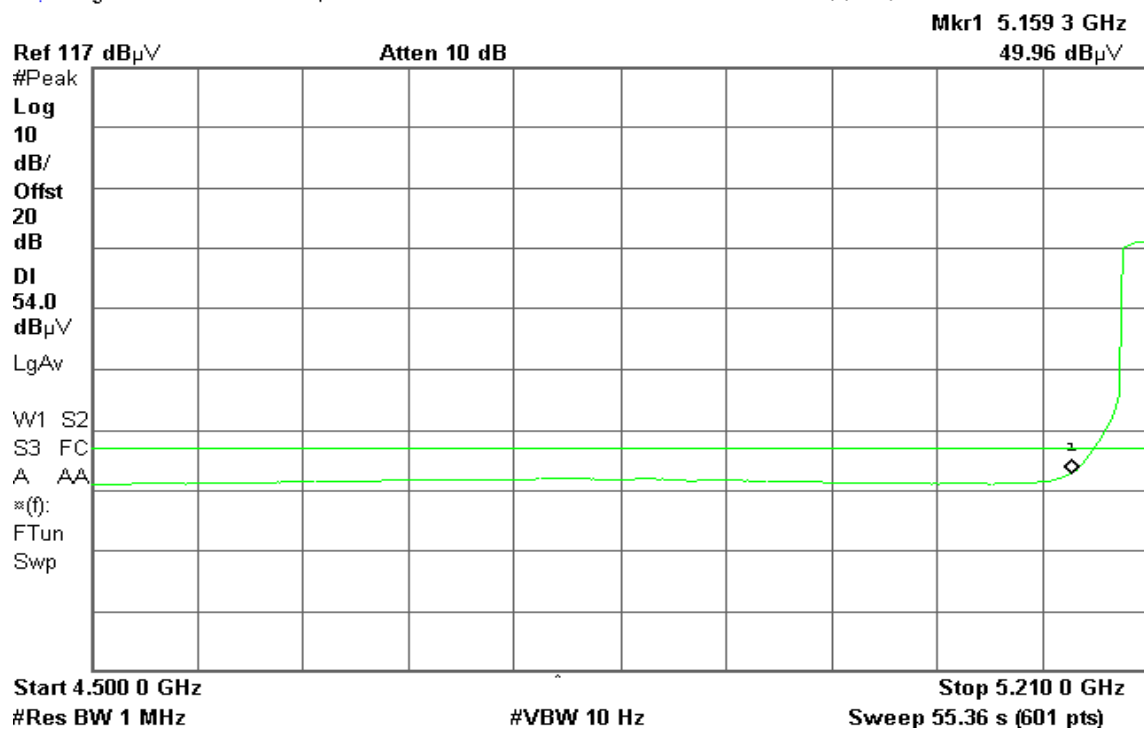


Detector mode: Average

Polarity: Horizontal

Agilent 17:58:21 Jun 7, 2005

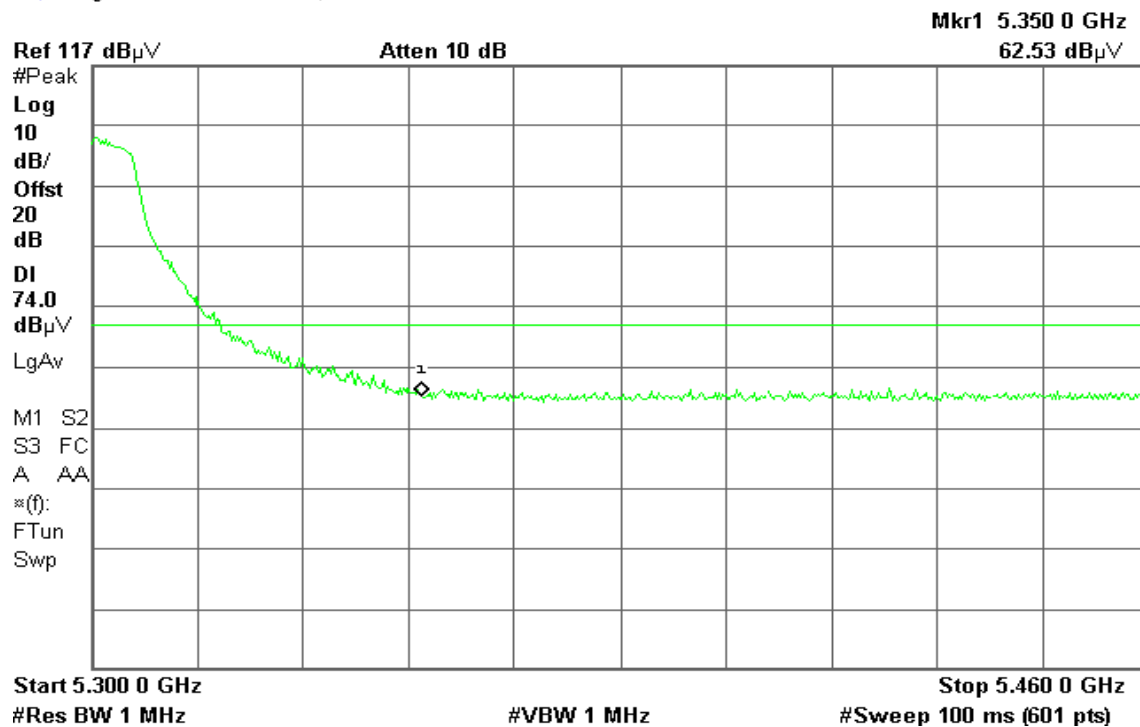
R T



**IEEE 802.11a Turbo mode / CH High****Detector mode: Peak****Polarity: Vertical**

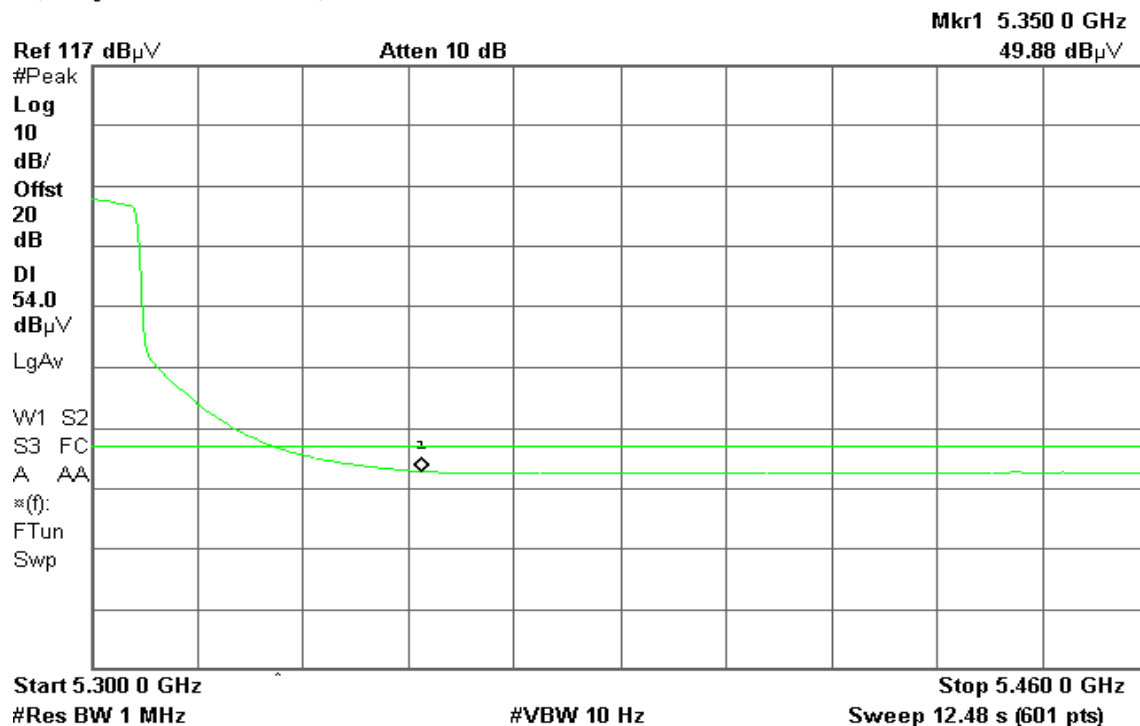
✱ Agilent 17:35:28 Jun 7, 2005

R T

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

✱ Agilent 17:36:04 Jun 7, 2005

R T



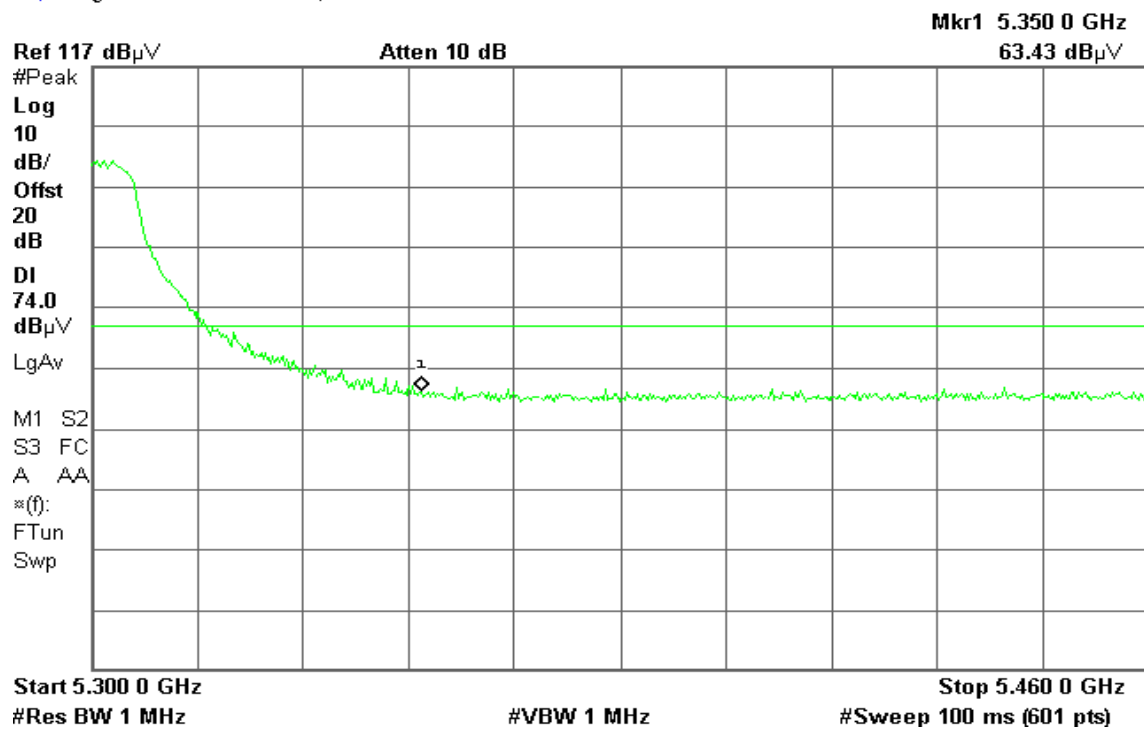


Detector mode: Peak

Polarity: Horizontal

Agilent 17:32:29 Jun 7, 2005

R T

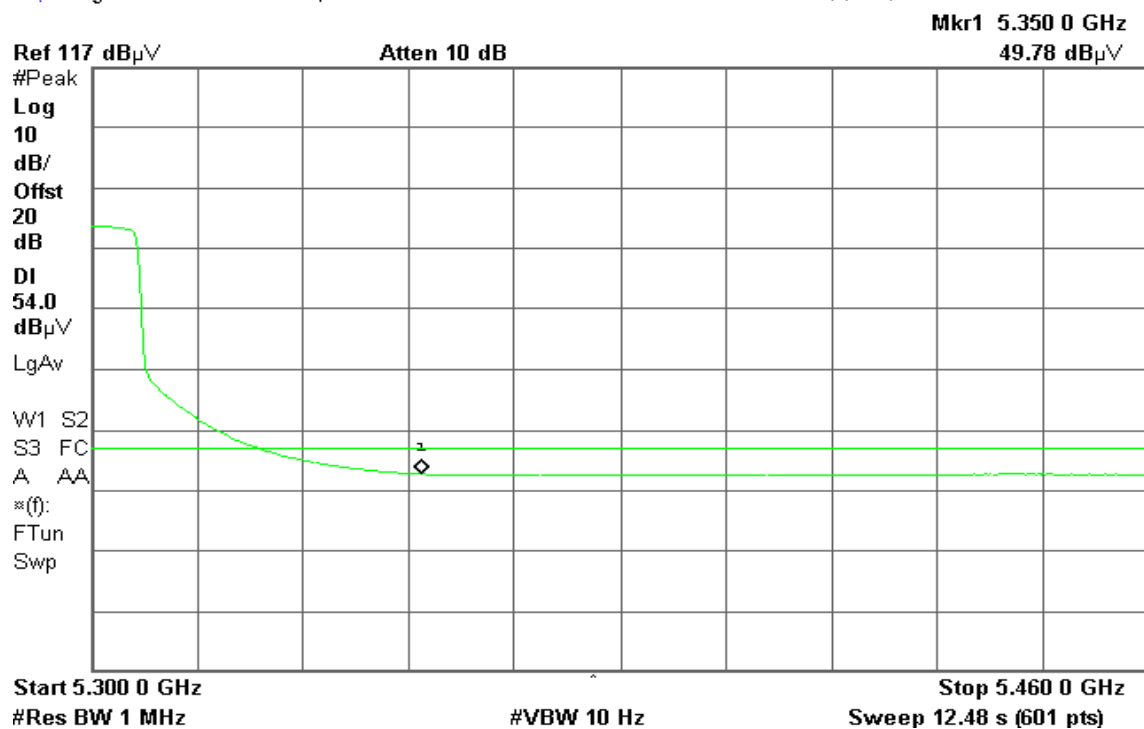


Detector mode: Average

Polarity: Horizontal

Agilent 17:32:59 Jun 7, 2005

R T





## 7.4 PEAK POWER SPECTRAL DENSITY

### LIMIT

- For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4dBm in any 1MHz band.
- For the band 5.25-5.35 GHz, the peak power spectral density shall not exceed 11dBm in any 1MHz band.

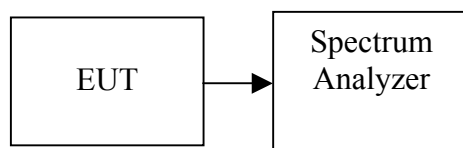
*If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.*

### 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 = 1MHz, VBW = 3MHz, Span = 50MHz, Sweep=Auto.
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****IEEE 802.11a Base mode(UNII)**

Channel	Frequency	Reading (dBm)	Factor (dB)	PPSD (dBm)	Limit (dBm)	Result
Low	5180	-9.945	13.8	3.86	4	PASS
Mid	5260	-6.583	13.8	7.22	11	PASS
High	5320	-6.753	13.8	7.05	11	PASS

**IEEE 802.11a Turbo mode(UNII)**

Channel	Frequency	Reading (dBm)	Factor (dB)	PPSD (dBm)	Limit (dBm)	Result
Low	5210	-10.00	11.00	1.00	4	PASS
Mid	5250	-9.94	11.00	1.06	11	PASS
High	5290	-8.52	11.00	2.49	11	PASS





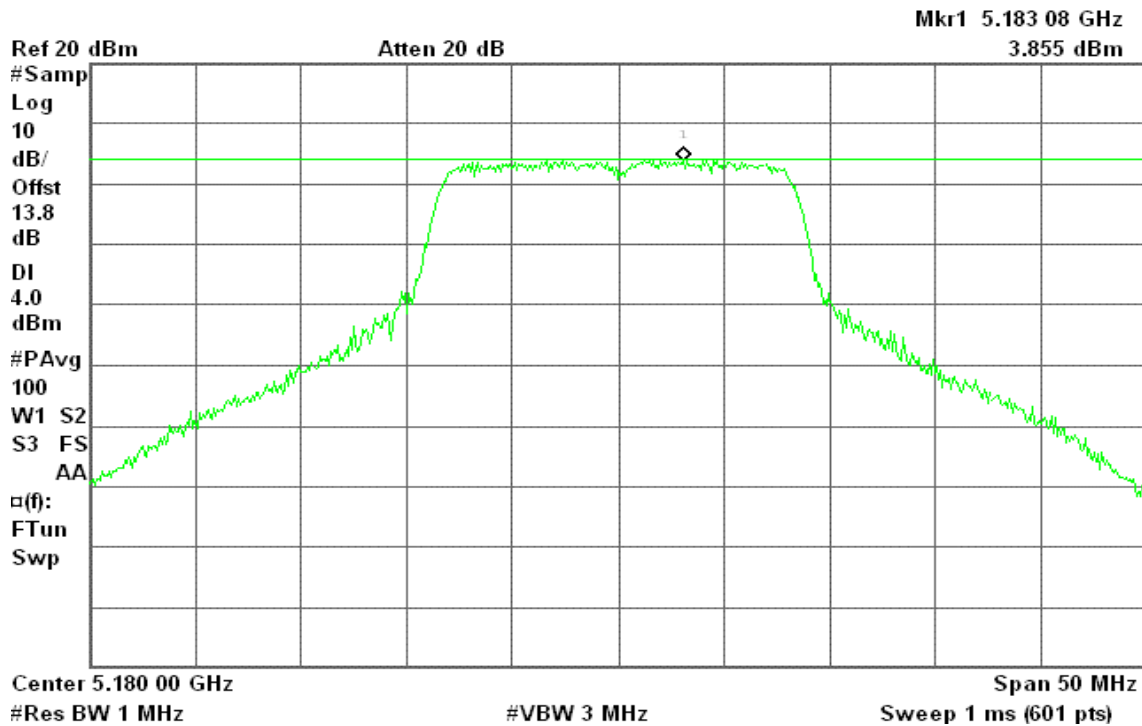
## Test Plot

### IEEE 802.11a Base mode(UNII)

#### CH Low

Agilent 19:27:17 Mar 28, 2005

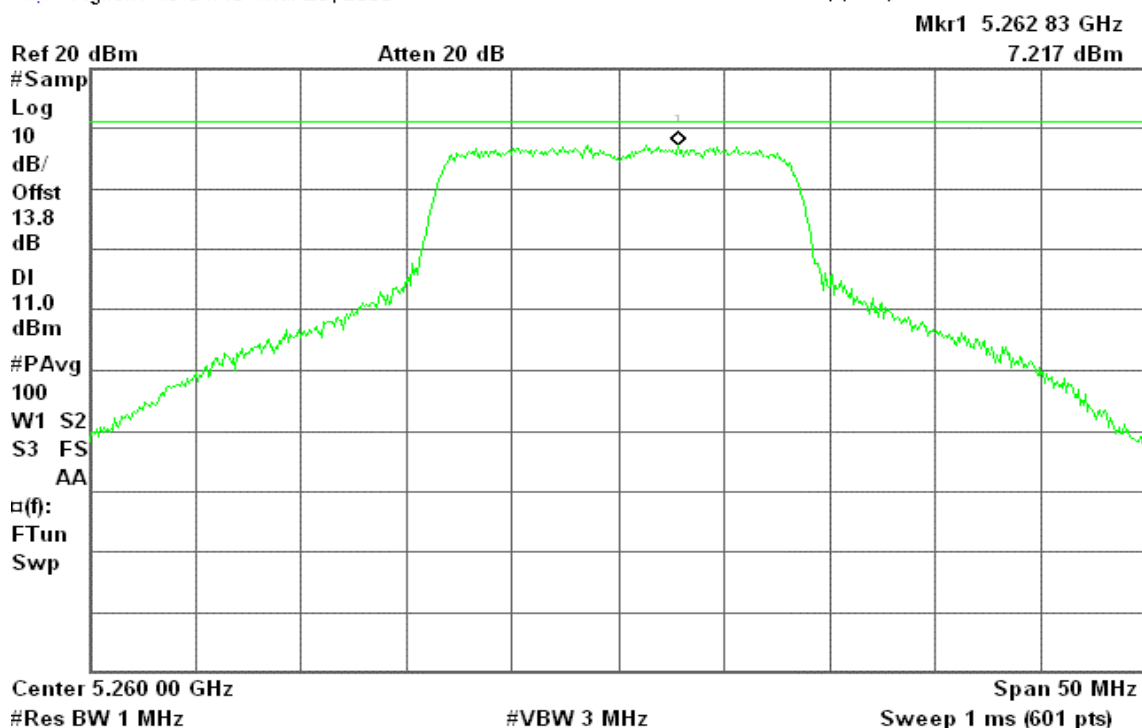
R T



#### CH Mid

Agilent 19:34:46 Mar 28, 2005

R T

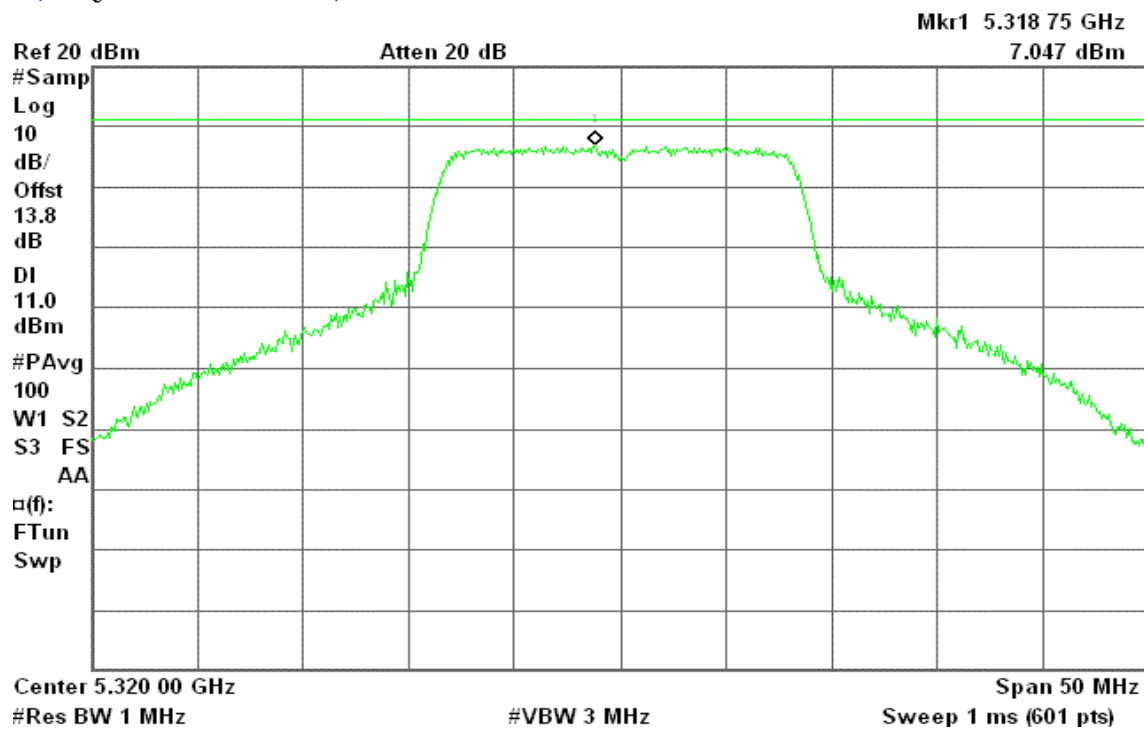




## CH High

Agilent 19:38:51 Mar 28, 2005

R T



## IEEE 802.11a Turbo mode(UNII)

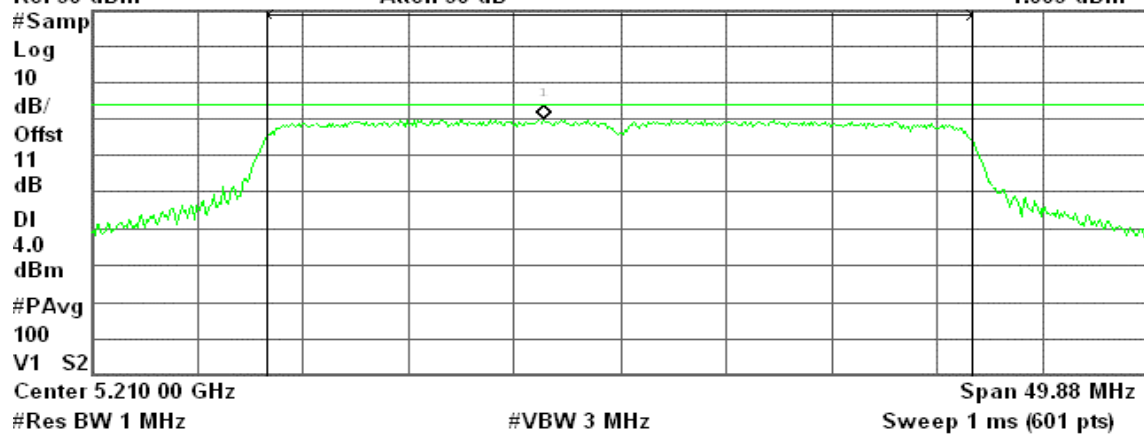
### CH Low

Agilent 13:45:27 May 24, 2005

R L

Peak Power Spectral Density, a Mode Low Ch.

Ref 30 dBm Atten 30 dB Mkr1 5.206 43 GHz 1.003 dBm



Channel Power

13.54 dBm / 33.2500 MHz

Power Spectral Density

-61.67 dBm/Hz



## CH Mid

Agilent 13:52:51 May 24, 2005

R L

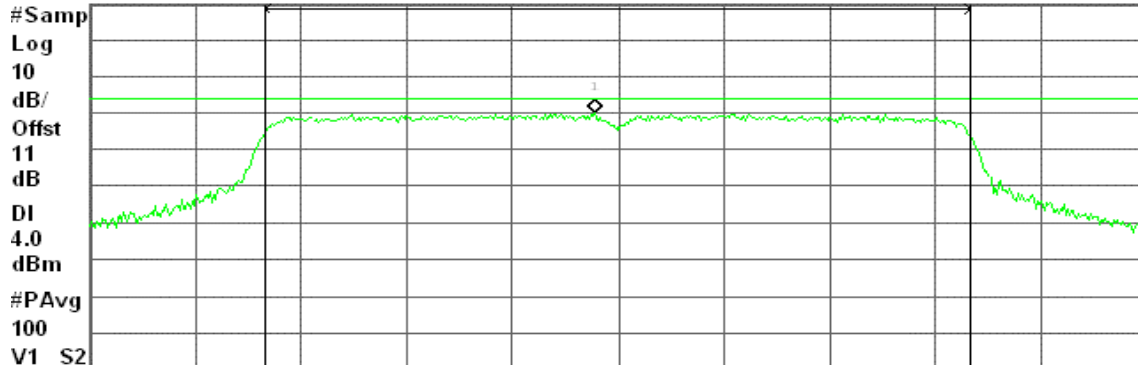
Peak Power Spectral Density, a Mode Mid Ch.

Mkr1 5.248 83 GHz

Ref 30 dBm

Atten 30 dB

1.057 dBm



Center 5.250 00 GHz

Span 49.94 MHz

#Res BW 1 MHz

#VBW 3 MHz

Sweep 1 ms (601 pts)

Channel Power

Power Spectral Density

13.66 dBm / 33.2900 MHz

-61.56 dBm/Hz

## CH High

Agilent 14:09:43 May 24, 2005

R L

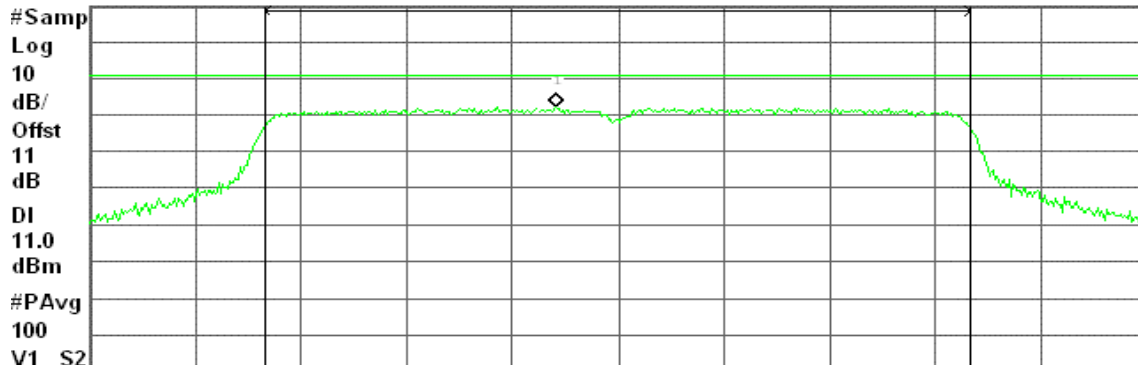
Peak Power Spectral Density, a Mode High Ch.

Mkr1 5.287 09 GHz

Ref 30 dBm

Atten 30 dB

2.485 dBm



Center 5.290 00 GHz

Span 49.84 MHz

#Res BW 1 MHz

#VBW 3 MHz

Sweep 1 ms (601 pts)

Channel Power

Power Spectral Density

15.85 dBm / 33.2300 MHz

-59.37 dBm/Hz



## 7.5 PEAK EXCURSION

### LIMIT

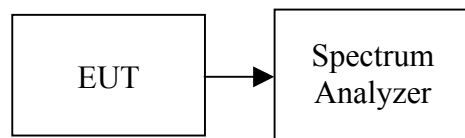
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### 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 test is performed in accordance with <FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices> – Part 15, Subpart E, August 2002.

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to spectrum.
3. Trace A, Set RBW = 1MHz, VBW = 3MHz, Span >26dB bandwidth (Base Mode) / >26dB bandwidth (Turbo Mode), Max. hold.
4. Trace B, Set RBW = 1MHz, VBW = 30kHz, Span >26dB bandwidth (Base Mode) / >26dB bandwidth (Turbo Mode), Max. hold.
5. Delta Mark trace A Maximum frequency and trace B same frequency.
6. Repeat the above procedure until measurements for all frequencies were complete.

**TEST RESULTS***No non-compliance noted***Test Data****IEEE 802.11a Base mode(UNII)**

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5180	10.28	13.00	-2.72	PASS
Mid	5260	9.63	13.00	-3.37	PASS
High	5320	8.92	13.00	-4.08	PASS

**IEEE 802.11a Turbo mode(UNII)**

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5210	9.37	13.00	-3.63	PASS
Mid	5250	10.25	13.00	-2.75	PASS
High	5290	9.60	13.00	-3.40	PASS

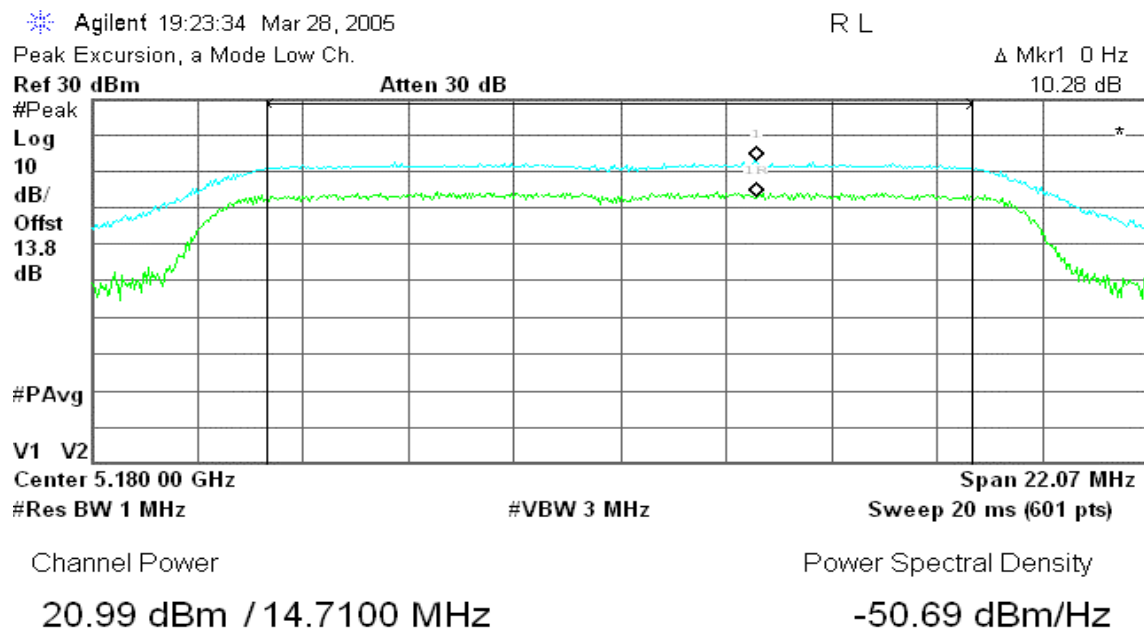
*(Remark: Maximum antenna gain = 1.2 dBi, therefore there is no reduction due to antenna gain.)*



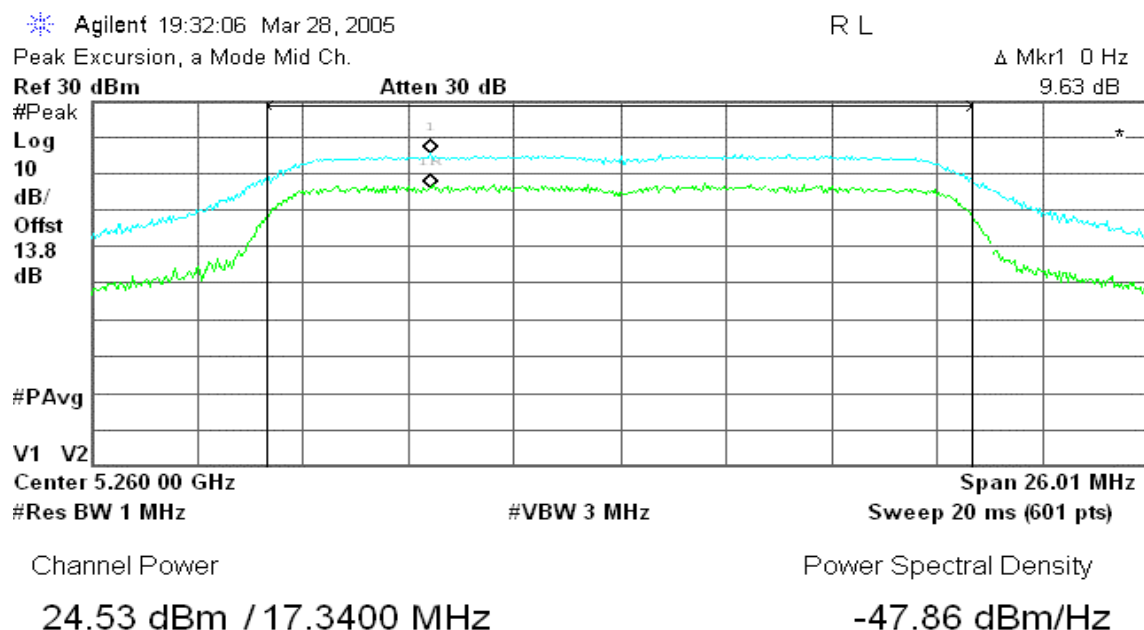
## Test Plot

### IEEE 802.11a Base mode(UNII)

#### CH Low

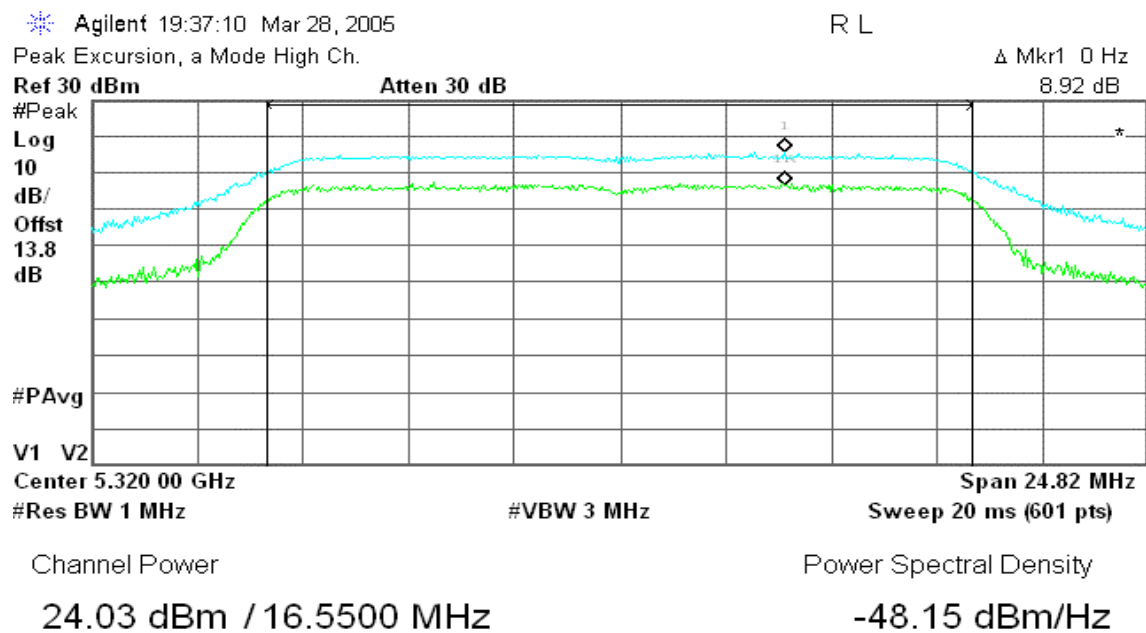


#### CH Mid



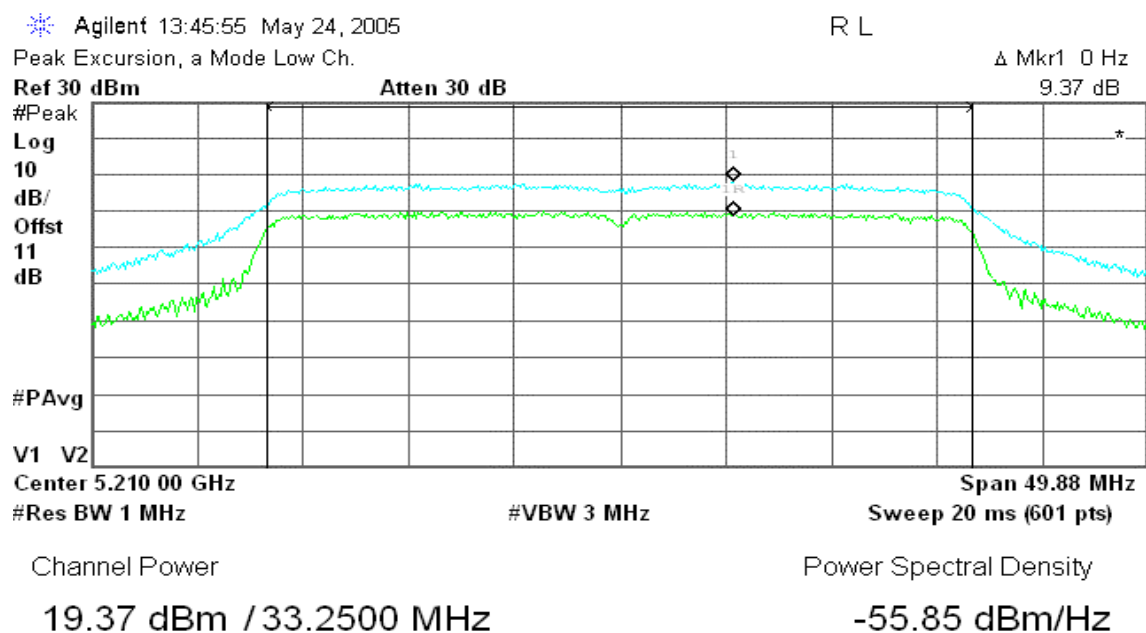


## CH High



## IEEE 802.11a Turbo mode(UNII)

### CH Low





## CH Mid

Agilent 13:53:52 May 24, 2005

R L

Peak Excursion, a Mode Mid Ch.

$\Delta$  Mkr1 0 Hz

Ref 30 dBm

Atten 30 dB

10.25 dB

#Peak

Log

10

dB/

Offst

11

dB

#PAvg

V1 V2

Center 5.250 00 GHz

Span 49.94 MHz

#Res BW 1 MHz

#VBW 3 MHz

Sweep 20 ms (601 pts)

Channel Power

Power Spectral Density

19.39 dBm / 33.2900 MHz

-55.83 dBm/Hz

## CH High

Agilent 14:15:55 May 24, 2005

R L

Peak Excursion, a Mode High Ch.

$\Delta$  Mkr1 0 Hz

Ref 30 dBm

Atten 30 dB

9.60 dB

#Peak

Log

10

dB/

Offst

11

dB

#PAvg

V1 V2

Center 5.290 00 GHz

Span 49.84 MHz

#Res BW 470 kHz

#VBW 4 MHz

Sweep 20 ms (601 pts)

Channel Power

Power Spectral Density

21.02 dBm / 33.2300 MHz

-54.19 dBm/Hz





## 7.6 RADIO FREQUENCY EXPOSURE

### LIMIT

U-NII devices are subject to the radio frequency radiation exposure requirements specified in §1.1307(b), §2.1091 and §2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

### EUT Specification

<b>EUT</b>	802.11a/b/g Mini PCI Card
<b>Frequency band (Operating)</b>	<input type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input checked="" type="checkbox"/> WLAN: 5.15GHz ~ 5.35GHz <input type="checkbox"/> WLAN: 5.725GHz ~ 5.850GHz <input type="checkbox"/> Bluetooth: 2.402 GHz ~ 2.482 GHz <input type="checkbox"/> Others: _____
<b>Device category</b>	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others _____
<b>Exposure classification</b>	General Population/Uncontrolled exposure ( $S=1mW/cm^2$ )
<b>Antenna diversity</b>	<input type="checkbox"/> Single antenna <input type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input checked="" type="checkbox"/> Tx/Rx diversity
<b>Max. output power</b>	Base mode: 17.90 dBm (61.66mW) Turbo mode: 13.85 dBm (24.27mW)
<b>Antenna gain (Max)</b>	1.2 dBi (Numeric gain: 1.32)
<b>Evaluation applied</b>	<input checked="" type="checkbox"/> MPE Evaluation <input type="checkbox"/> SAR Evaluation* <input type="checkbox"/> N/A
<b>Remark:</b> 1. The maximum output power is <u>17.90dBm (61.66mW)</u> at <u>5320MHz</u> (with <u>1.32 numeric antenna gain</u> .) 2. For mobile or fixed location transmitters, no SAR consideration applied. The minimum separation generally be used is at least 20 cm, even if the calculations indicate that the MPE distance would be lesser.	

### TEST RESULTS

No non-compliance noted.

**Calculation**

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

Where  $E$  = Field Strength in Volts / meter

$P$  = Power in Watts

$G$  = Numeric antenna gain

$d$  = Distance in meters

$S$  = Power Density in milliwatts / square centimeter

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

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

Changing to units of mW and cm, using:

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

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

Yields

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

Where  $d$  = distance in cm

$P$  = Power in mW

$G$  = Numeric antenna gain

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

Substituting the logarithmic form of power and gain using:

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

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

Yields

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

**Equation 1**

**Where  $d$  = MPE safe distance in cm**

$P$  = Power in dBm

$G$  = Antenna Gain in dBi

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



### **Maximum Permissible Exposure**

EUT output power = 61.66mW

Antenna Gain = 1.32 mW (Numeric gain)

S = 1.0 mW / cm<sup>2</sup> from 1.1310 Table 1

Substituting these parameters into the above Equation 1:

→ MPE Safe Distance = 2.54 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.)*



## 7.7 RADIATED UNDESIRABLE EMISSION

### LIMIT

For transmitters operating in the 5.15-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm / MHz. Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

The provisions of §15.205 apply to intentional radiators operating under this section. The EUT is set to transmit in a continuous mode.

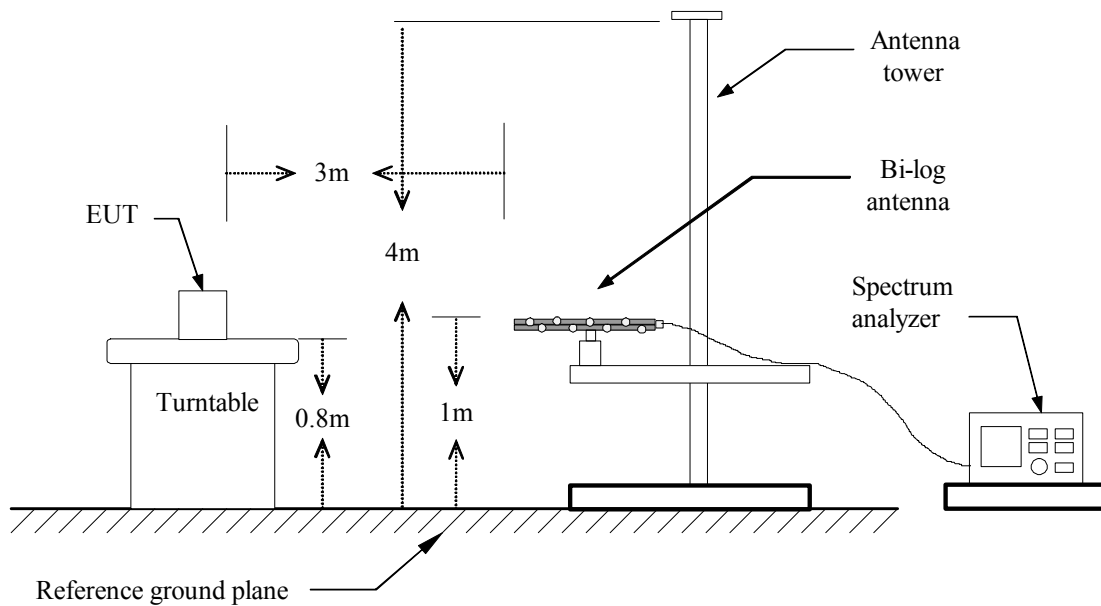
### MEASUREMENT EQUIPMENT USED

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

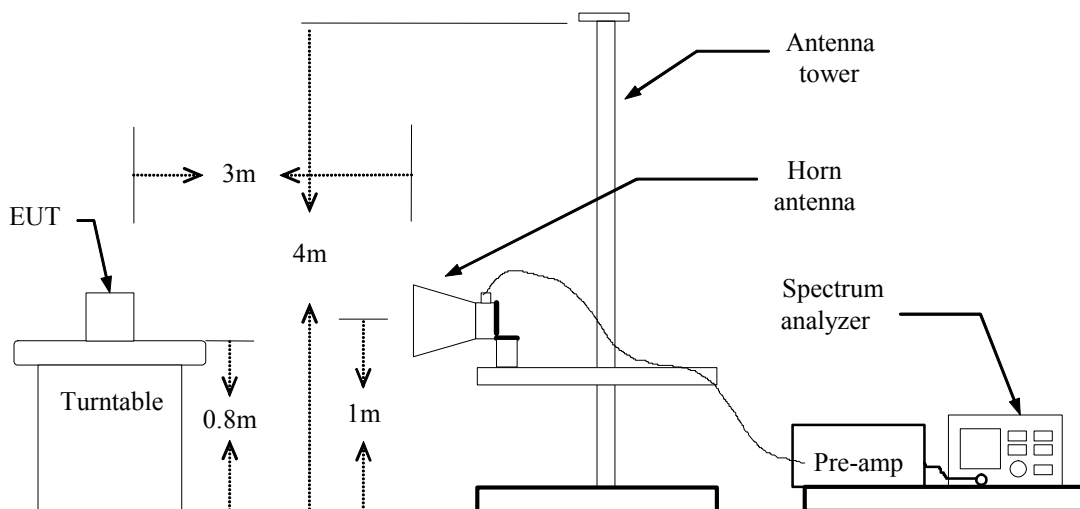
**Remark:** Each piece of equipment is scheduled for calibration once a year.

## 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**Test Date:** May 09, 2005**Temperature:** 25°C**Tested by:** Tom Jen**Humidity:** 55% RH**Polarity:** Ver. / Hor.

<b>Freq. (MHz)</b>	<b>Ant.Pol. H/V</b>	<b>Detector Mode (PK/QP)</b>	<b>Reading (dBuV)</b>	<b>Factor (dB)</b>	<b>Actual FS (dBuV/m)</b>	<b>Limit 3m (dBuV/m)</b>	<b>Safe Margin (dB)</b>
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 802.11a Base mode / CH Low **Test Date:** June 07, 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)				
10360.00	V	50.34	40.49	8.07	58.41	48.56	74.00	54.00	-5.44	AVG
15540.00	V	55.95	45.20	7.03	62.98	52.23	74.00	54.00	-1.77	AVG
N/A										
10360.00	H	48.44	37.27	8.07	56.51	45.34	74.00	54.00	-8.66	AVG
15540.00	H	55.57	44.55	7.03	62.60	51.58	74.00	54.00	-2.42	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 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.



**Operation Mode:** TX / IEEE 802.11a Base mode / CH Mid **Test Date:** June 07, 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)				
10520.00	V	55.85	42.33	8.53	64.38	50.86	74.00	54.00	-3.14	AVG
15780.00	V	53.52	41.62	6.36	59.88	47.98	74.00	54.00	-6.02	AVG
N/A										
10520.00	H	49.27	39.50	8.53	57.80	48.03	74.00	54.00	-5.97	AVG
15780.00	H	54.06	42.81	6.36	60.42	49.17	74.00	54.00	-4.83	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 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11a Base mode / CH High **Test Date:** June 07, 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)				
10640.00	V	55.79	39.51	8.97	64.76	48.48	74.00	54.00	-5.52	AVG
15960.00	V	54.96	41.65	5.85	60.81	47.50	74.00	54.00	-6.50	AVG
N/A										
10640.00	H	50.73	40.00	8.97	59.70	48.97	74.00	54.00	-5.03	AVG
15960.00	H	52.33	41.88	5.85	58.18	47.73	74.00	54.00	-6.27	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 1GHz 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)				
10420.00	V	47.94	37.60	8.23	56.17	45.83	74.00	54.00	-8.17	AVG
15630.00	V	50.37	39.62	6.78	57.15	46.40	74.00	54.00	-7.60	AVG
N/A										
10420.00	H	45.42	35.28	8.23	53.65	43.51	74.00	54.00	-10.49	AVG
15630.00	H	53.22	43.02	6.78	60.00	49.80	74.00	54.00	-4.20	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 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / IEEE 802.11a 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)				
10500.00	V	47.21	37.36	8.45	55.66	45.81	74.00	54.00	-8.19	AVG
15750.00	V	53.85	42.68	6.44	60.29	49.12	74.00	54.00	-4.88	AVG
N/A										
10500.00	H	46.44	36.85	8.45	54.89	45.30	74.00	54.00	-8.70	AVG
15750.00	H	48.91	38.66	6.44	55.35	45.10	74.00	54.00	-8.90	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 1GHz 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)				
10580.00	V	48.40	38.40	8.75	57.15	47.15	74.00	54.00	-6.85	AVG
15870.00	V	54.84	44.01	6.10	60.94	50.11	74.00	54.00	-3.89	AVG
N/A										
10580.00	H	45.91	38.22	8.75	54.66	46.97	74.00	54.00	-7.03	AVG
15870.00	H	50.77	41.17	6.10	56.87	47.27	74.00	54.00	-6.73	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 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.



## 7.8 CONDUCTED UNDESIRABLE EMISSION

### LIMIT

Transmitters operating in the 5.15-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm / MHz. Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

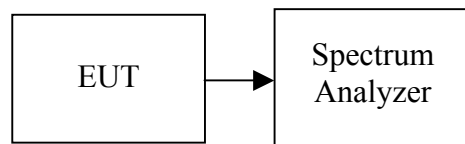
The provisions of §15.205 apply to intentional radiators operating under this section.

### 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

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 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements are made.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

### TEST RESULTS

*No non-compliance noted*

*(Remark: Maximum antenna gain = 1.2 dBi, therefore there is no reduction due to antenna gain.)*

**Test Plot****IEEE 802.11a Base mode (UNII)****CH Low****30MHz ~ 40GHz**

\* Agilent 19:24:11 Mar 28, 2005

L

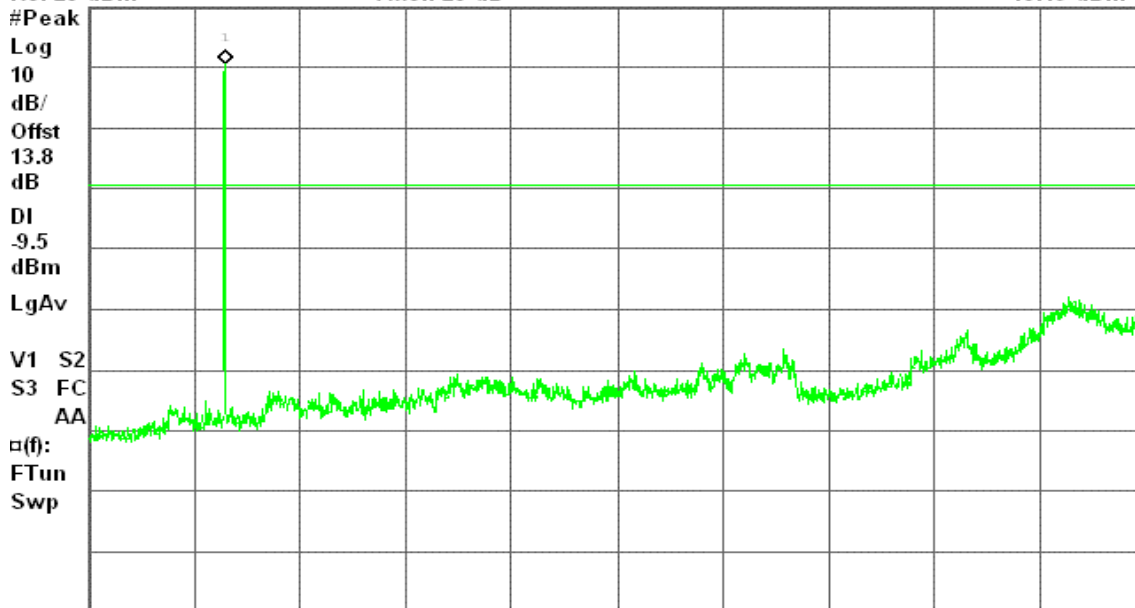
Conducted Spur., a Mode Low Ch.

Mkr1 5.19 GHz

Ref 20 dBm

Atten 20 dB

10.49 dBm



Start 30 MHz

Stop 40.00 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 100 ms (2001 pts)

**CH Mid****30MHz ~ 40GHz**

\* Agilent 19:32:30 Mar 28, 2005

L

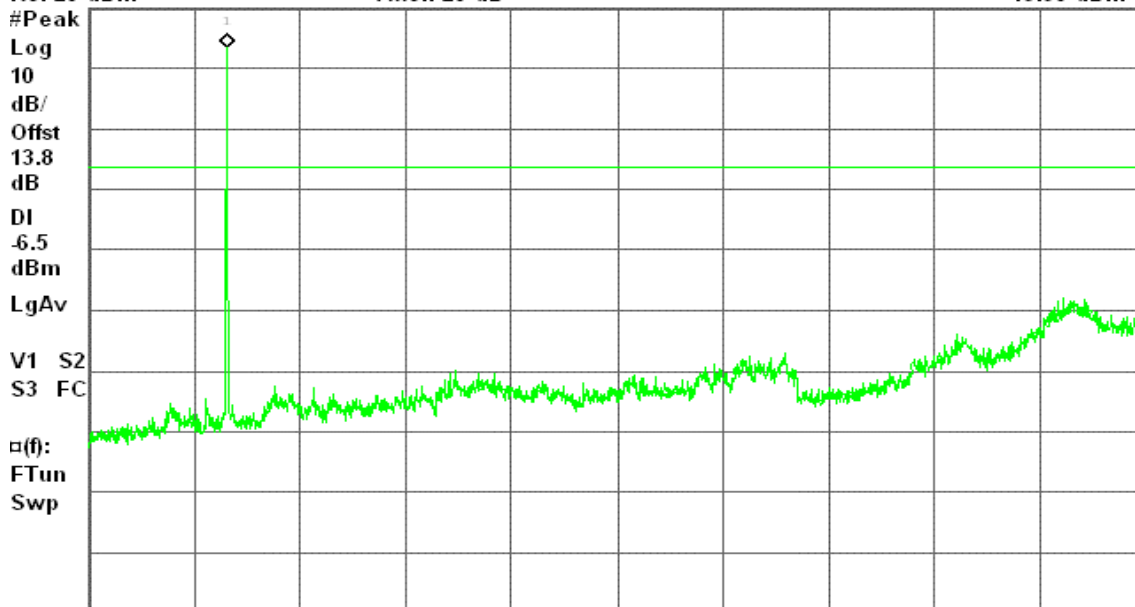
Conducted Spur., a Mode Mid Ch.

Mkr1 5.27 GHz

Ref 20 dBm

Atten 20 dB

13.50 dBm



Start 30 MHz

Stop 40.00 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 100 ms (2001 pts)

**CH High****30MHz ~ 40GHz**

\* Agilent 19:37:36 Mar 28, 2005

R L

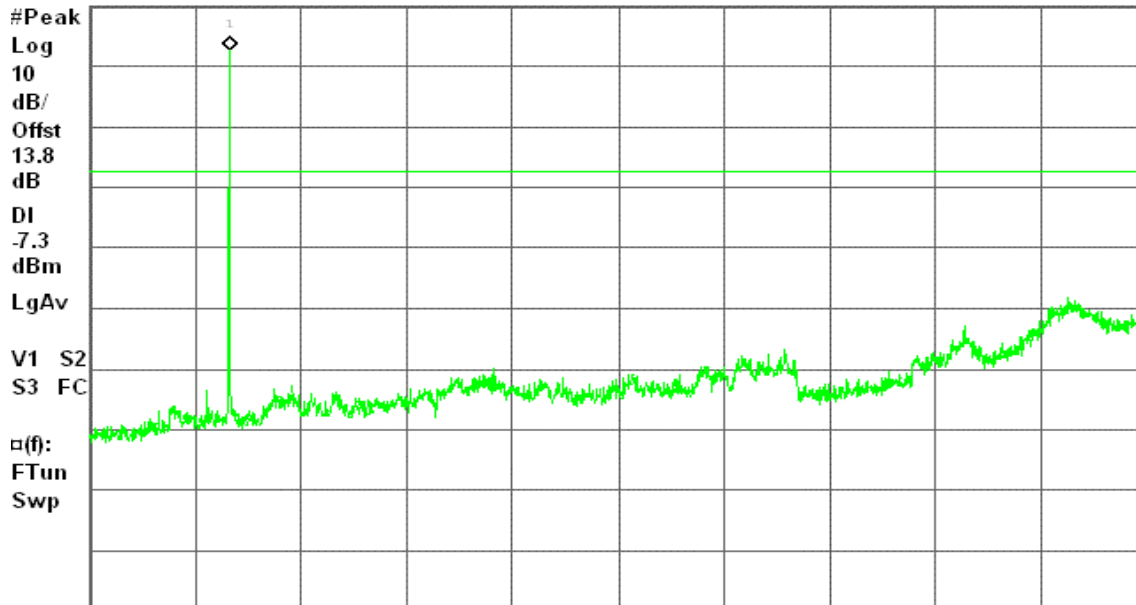
Conducted Spur., a Mode High Ch.

Mkr1 5.33 GHz

Ref 20 dBm

Atten 20 dB

12.70 dBm



Start 30 MHz

Stop 40.00 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 100 ms (2001 pts)

**IEEE 802.11a Turbo mode (UNII)****CH Low****30MHz ~ 40GHz**

\* Agilent 13:46:45 May 24, 2005

T

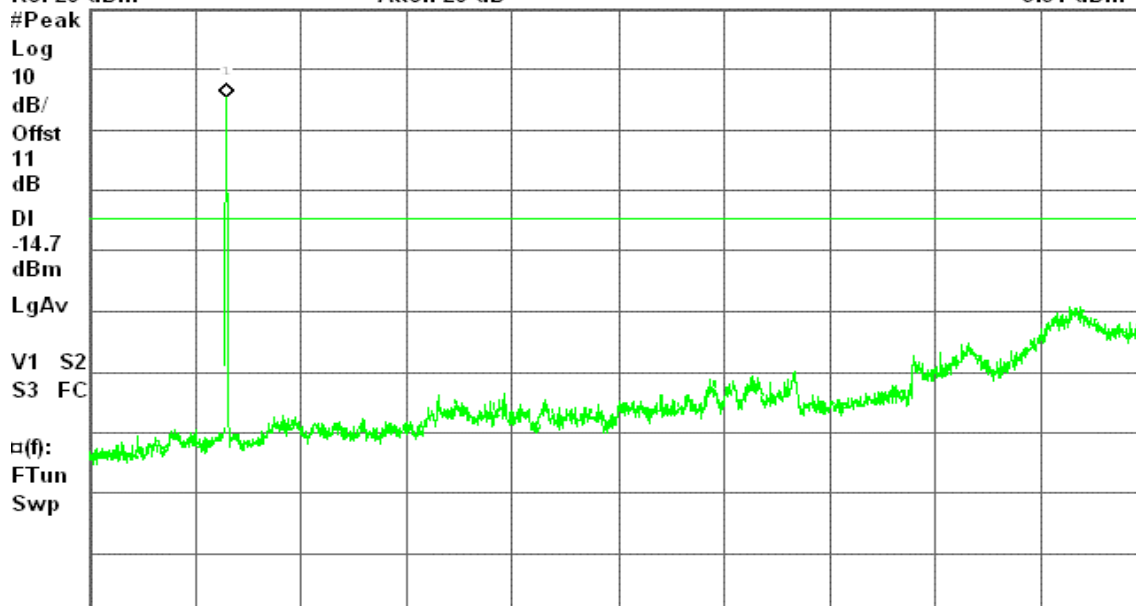
Conducted Spur., a Mode Low Ch.

Mkr1 5.21 GHz

Ref 20 dBm

Atten 20 dB

5.31 dBm



Center 20.02 GHz

Span 39.97 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 100 ms (2001 pts)



**CH Mid****30MHz ~ 40GHz**

\* Agilent 13:54:36 May 24, 2005

L

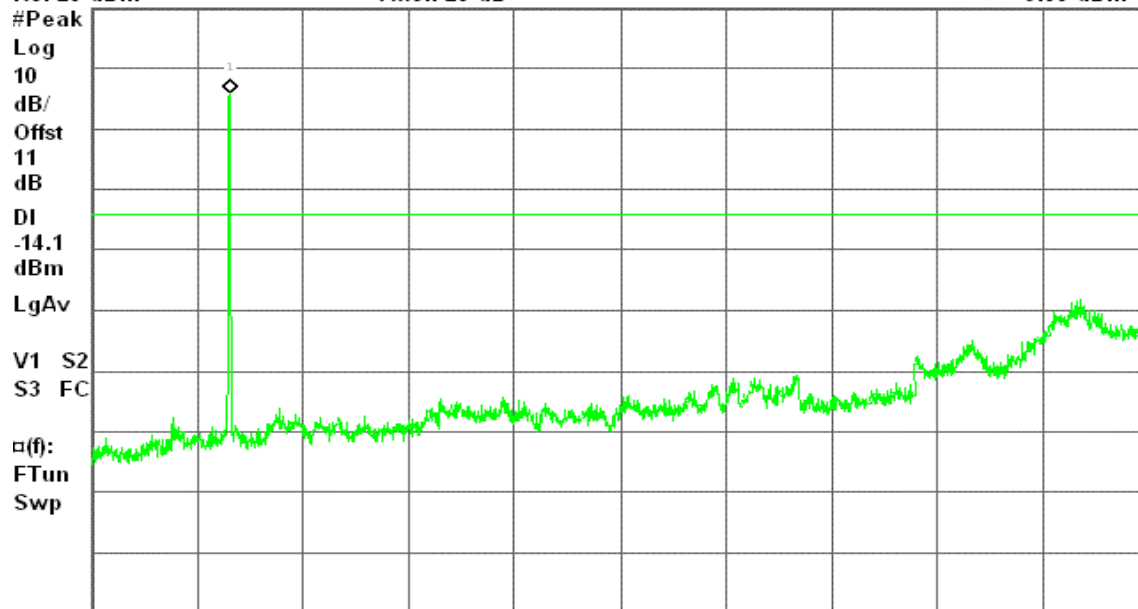
Conducted Spur., a Mode Mid Ch.

Mkr1 5.25 GHz

Ref 20 dBm

Atten 20 dB

5.88 dBm



Center 20.02 GHz

Span 39.97 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 100 ms (2001 pts)

**CH High****30MHz ~ 40GHz**

\* Agilent 14:12:52 May 24, 2005

T

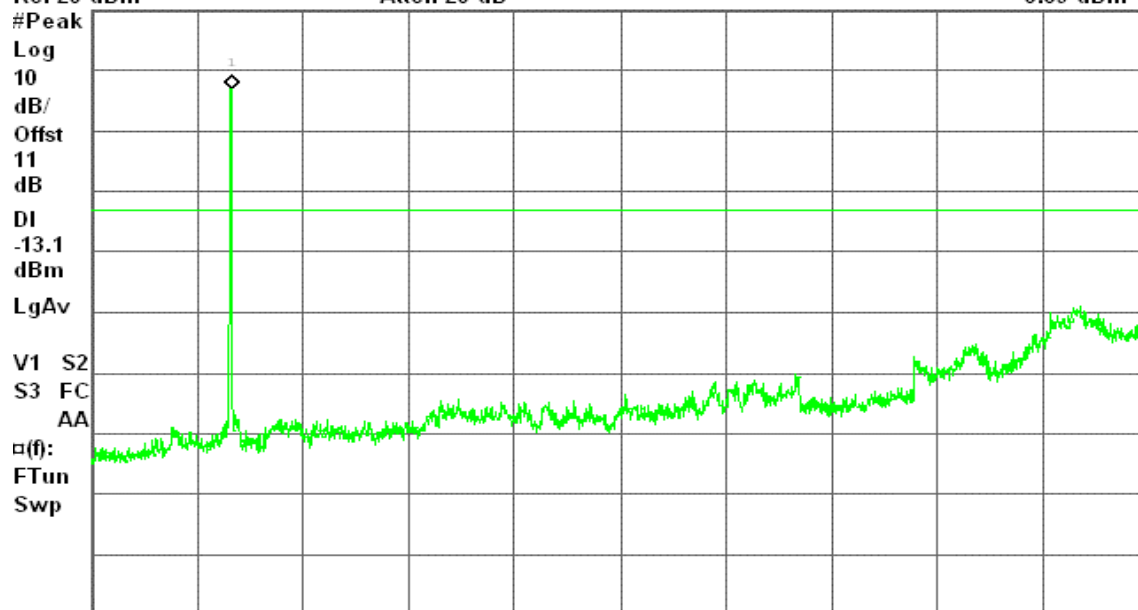
Conducted Spur., a Mode High Ch.

Mkr1 5.31 GHz

Ref 20 dBm

Atten 20 dB

6.89 dBm



Center 20.02 GHz

Span 39.97 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 100 ms (2001 pts)



## 7.9 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 (dB $\mu$ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (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

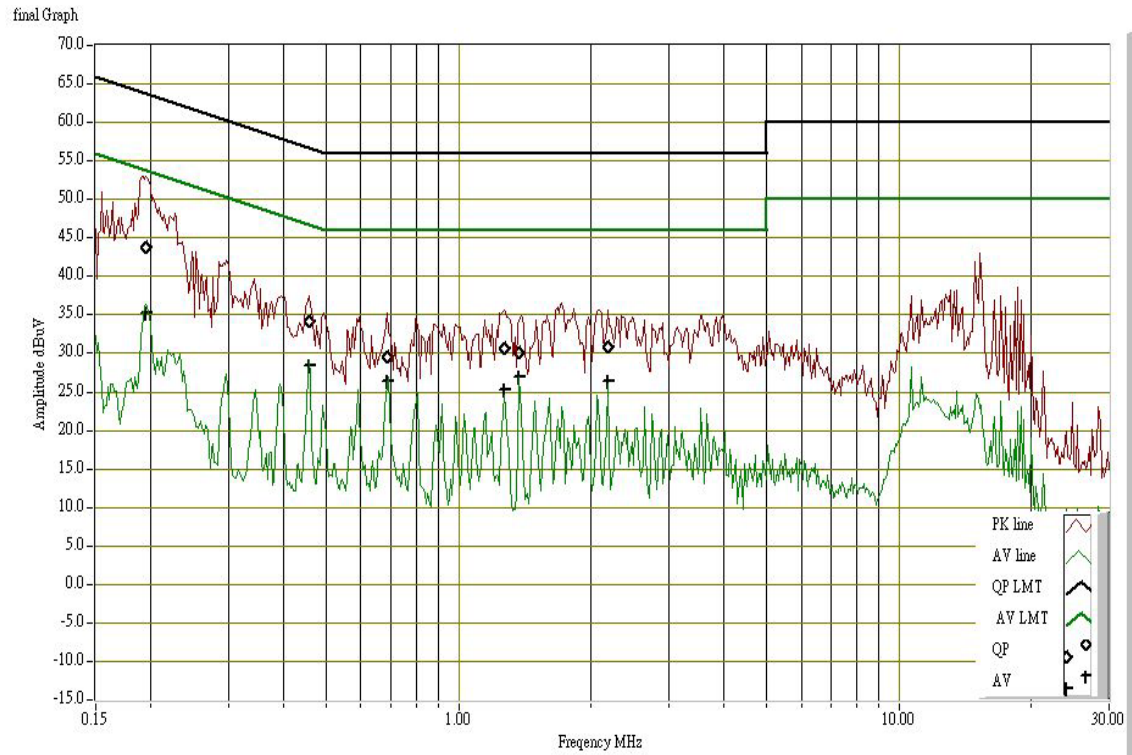
### ***Remark:***

- 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)*

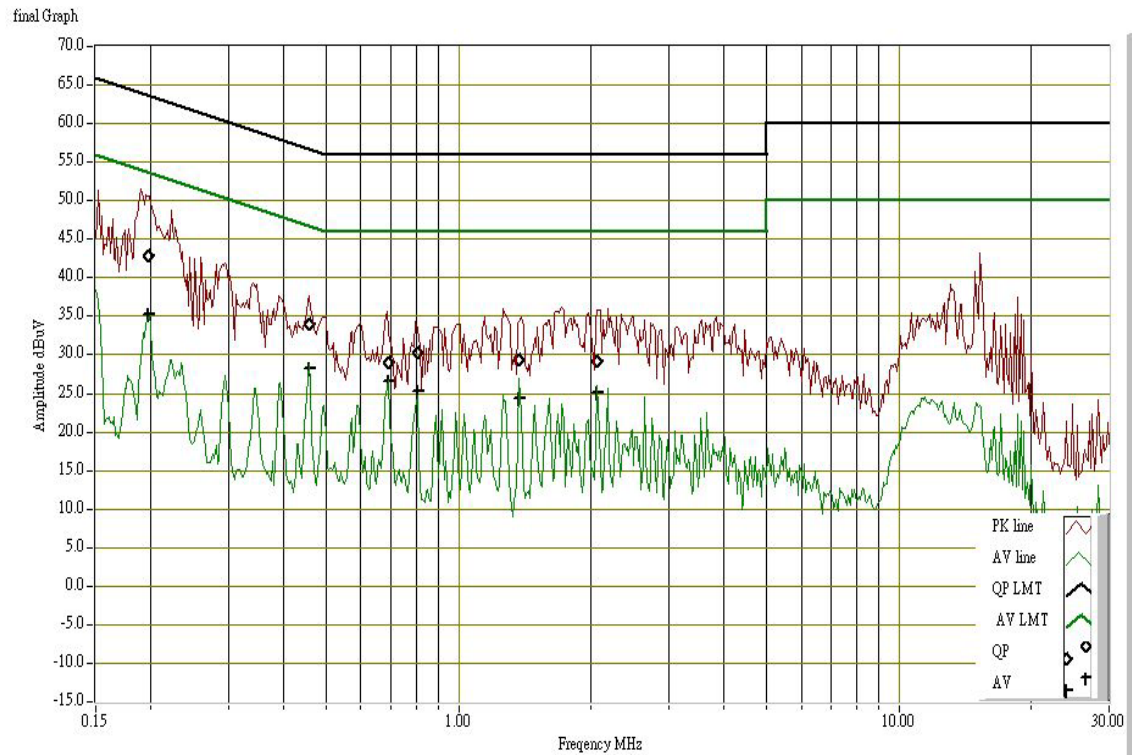


## Test Plots

### Conducted emissions (Line 1)



### Conducted emissions (Line 2)





## 7.10 TRANSMISSION IN ABSENCE OF DATA

### **LIMIT**

The device shall automatically discontinue transmission in case of either absence of information to transmit or operation failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

### **TEST RESULTS**

*No non-compliance noted*

**Remark:** *For the details, refer to the theory of the operation.*

## 7.11 FREQUENCY STABILITY

### **LIMIT**

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the operational description..

### **TEST RESULTS**

*Please refer to the operational description for details.*

**Remark:** *An examination of the band-edge plots shows that the emission will stay within the authorized band over the entire temperature range.*

## 7.12 ANTENNA REQUIREMENT

### **LIMIT**

According to FCC Part 15.407(d), any U-NII device that operates in the 5.15-5.25 GHz band shall use a transmitting antenna that is an integral part of the device.

### **TEST RESULTS**

*No non-compliance noted*

The antenna connector is designed with a unique connector and replacement of it by the user is not considered. For details, refer to the EUT photos.