



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

### **TEST REPORT**

**For**

**IEEE 802.11a/b/g Wireless Mini-PCI Adapter**

**Model: NMP-8602(FCC)PLUS, EMP-8602(FCC)PLUS**

**Trade Name: SENAO**

*Issued to*

**SENAO INTERNATIONAL CO., LTD.  
No.500, Fusing 3 RD., Hwa-Ya Technical Park,  
Kuei-Shan Hsiang, Taoyuan County 333, Taiwan, R.O.C.**

*Issued by*



**Compliance Certification Services Inc.  
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## 1. TEST RESULT CERTIFICATION

**Applicant:** SENAO INTERNATIONAL CO., LTD.  
No.500, Fusing 3 RD., Hwa-Ya Technical Park,  
Kuei-Shan Hsiang, Taoyuan County 333, Taiwan, R.O.C.

**Equipment Under Test:** IEEE 802.11a/b/g Wireless Mini-PCI Adapter

**Trade Name:** SENAO

**Model:** NMP-8602(FCC)PLUS, EMP-8602(FCC)PLUS

**Date of Test:** November 21, 2005 ~ January 22, 2006

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: 2003 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:*

*Reviewed by:*

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Gavin Lim  
Section Manager  
Compliance Certification Services Inc.

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Amanda Wu  
Section Manager  
Compliance Certification Services Inc.



## 2. EUT DESCRIPTION

<b>Product</b>	IEEE 802.11a/b/g Wireless Mini-PCI Adapter
<b>Trade Name</b>	SENAO
<b>Model Number</b>	NMP-8602(FCC)PLUS, EMP-8602(FCC)PLUS
<b>Model Discrepancy</b>	All the specification and layout are identical except they come with different model numbers for marketing purpose.
<b>Power Supply</b>	Powered from host device.
<b>Frequency Range</b>	5.15~5.35 GHz
<b>Transmit Power</b>	17.06 dBm
<b>Modulation Technique</b>	OFDM (QPSK, BPSK, 16-QAM, 64-QAM)
<b>Transmit Data Rate</b>	54, 48, 36, 24, 18, 12, 9, 6 Mbps
<b>Number of Channels</b>	8 Channels
<b>Antenna Specification</b>	Antenna Type: Dipole Antenna Antenna Gain: 1.5dBi

### Operation Frequency:

UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII)	
CHANNEL	MHz
36	5180
40	5200
44	5220
48	5240
52	5260
56	5280
60	5300
64	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: NI3-MP86005001 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: NMP-8602(FCC)PLUS) 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.

Channel Low (5180MHz), Channel Mid (5260MHz) and Channel High (5320MHz) with 54Mbps data rate were chosen for full testing.



## 4. INSTRUMENT CALIBRATION

### 4.1 MEASURING INSTRUMENT CALIBRATION

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

### 4.2 MEASUREMENT EQUIPMENT USED

#### Equipment Used for Emissions Measurement

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

Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2007

Open Area Test Site # 3				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESVS20	838804/004	01/08/2007
Spectrum Analyzer	R&S	FSP30	100112	09/23/2006
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2007
Pre-Amplifier	MITEC	AFS42-00102650	924206	N.C.R.
Pre-Amplifier	MITEC	AMF-6F-260400	945377	N.C.R.
Bilog Antenna	SCHWAZBECK	VULB9163	145	07/05/2006
Horn Antenna	EMCO	3115	00022250	04/18/2006
Horn Antenna	EMCO	3116	2487	12/08/2006
Turn Table	EMCO	2081-1.21	9709-1885	N.C.R.
Antenna Tower	EMCO	2075-2	9707-2060	N.C.R.
Controller	EMCO	2090	9709-1256	N.C.R.
RF Switch	ANRITSU	MP59B	M53867	N.C.R.
Site NSA	C&C	N/A	N/A	09/06/2006

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

Powerline Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI TEST RECEIVER 9kHz-30MHz	ROHDE & SCHWARZ	ESHS30	828144/003	09/24/2006
TWO-LINE V-NETWORK 9kHz-30MHz	SCHAFFNER	NNB41	03/10013	06/11/2006
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	02/17/2006
Test S/W	LABVIEW (V 6.1)			

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



## **5. FACILITIES AND ACCREDITATIONS**

### **5.1 FACILITIES**

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

☐ No. 199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.

Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No. No.11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan

Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☒ No.81-1, Lane 210, Bade 2nd Rd., Luchu Hsiang, Taoyuan Hsien 338, Taiwan

Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

### **5.2 EQUIPMENT**

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.








Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."



### 5.3 TABLE OF ACCREDITATIONS AND LISTINGS

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

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



## 6. SETUP OF EQUIPMENT UNDER TEST

### 6.1 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	WLAN: ANO20030400LEG Bluetooth: ANO20020100MTN	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
2.	Super a/g 108Mbps Wireless Lan Router (Remote)	PLANEX	BLW-04SAG	40DDA0421	SJ9-BLW54SAG	N/A	Unshielded, 1.8m

**Remark:**

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



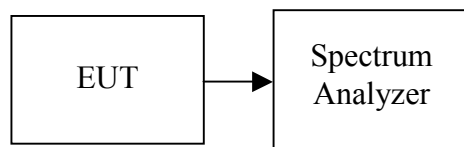
## 7 FCC PART 15 REQUIREMENTS

### 6.3 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.

#### 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, 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

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	23.041
Mid	5260	24.714
High	5320	24.229



## Test Plot

### CH Low

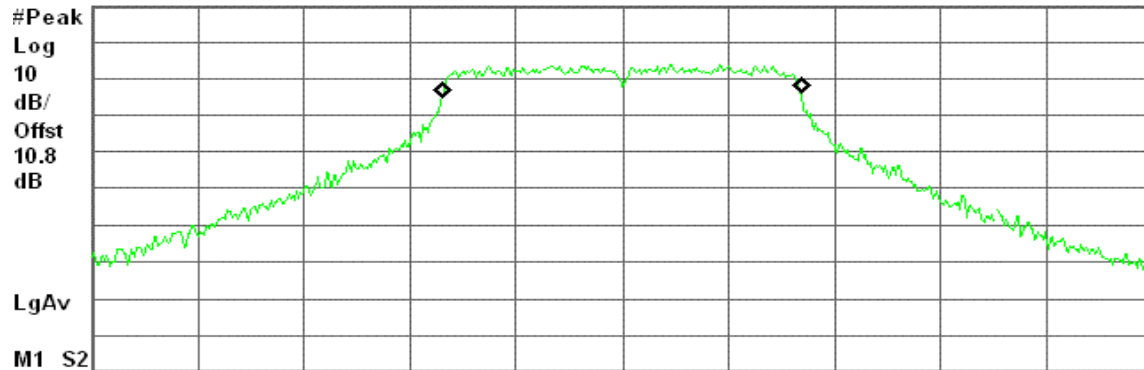
Agilent 13:24:43 Jan 22, 2006

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

16.7837 MHz

Occ BW % Pwr 99.00 %

x dB -26.00 dB

Transmit Freq Error

-8.824 kHz

x dB Bandwidth

23.041 MHz

### CH Mid

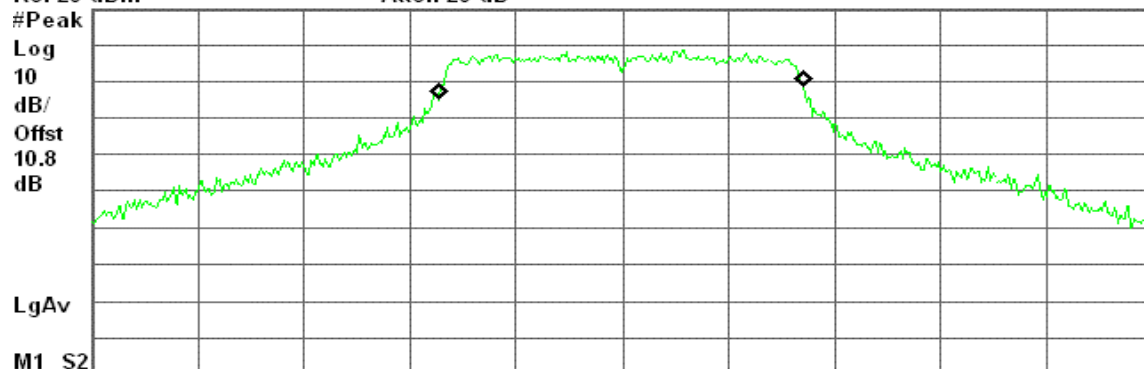
Agilent 13:28:02 Jan 22, 2006

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 820 kHz

Sweep 1 ms (601 pts)

Occupied Bandwidth

17.1179 MHz

Occ BW % Pwr 99.00 %

x dB -26.00 dB

Transmit Freq Error

-48.024 kHz

x dB Bandwidth

24.714 MHz



## CH High

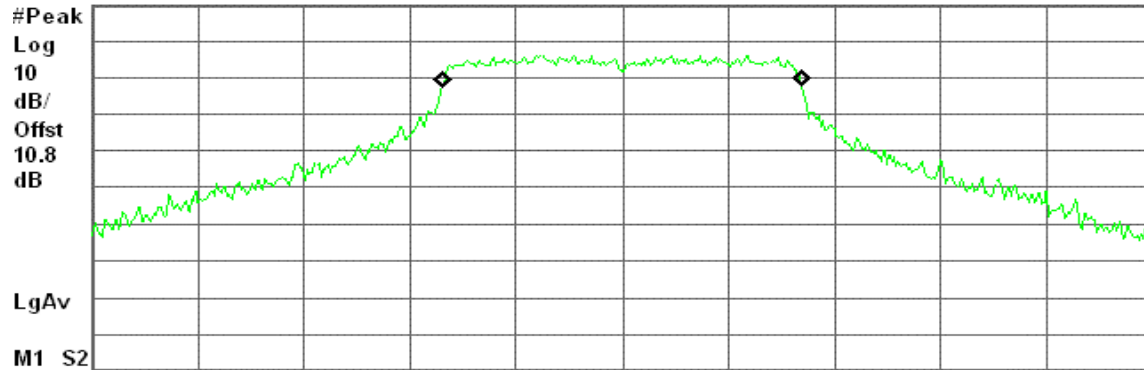
Agilent 13:31:30 Jan 22, 2006

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 240 kHz

#VBW 750 kHz

Sweep 1 ms (601 pts)

Occupied Bandwidth

16.8499 MHz

Occ BW % Pwr 99.00 %  
x dB -26.00 dB

Transmit Freq Error -10.868 kHz  
x dB Bandwidth 24.229 MHz



## 6.4 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:*

### Specified Limit of the Peak Power

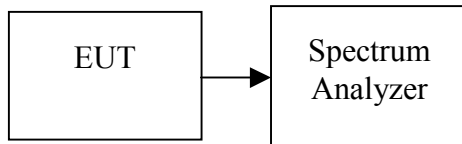
Channel	Frequency (MHz)	26 dB Bandwidth (B) (MHz)	10 Log B (dB)	4 + 10 Log B or 11 + 10 Log B (dBm)	Power Limit (dBm)
Low	5180	23.041	13.63	17.63	17.00
Mid	5260	24.714	13.93	24.93	24.00
High	5320	24.229	13.84	24.84	24.00

*(Remark: Maximum antenna gain = 1.5dBi, therefore there is no reduction due to antenna gain.)*



### **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**

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)
Low	5180	13.98	17.00
Mid	5260	17.06	24.00
High	5320	16.50	24.00

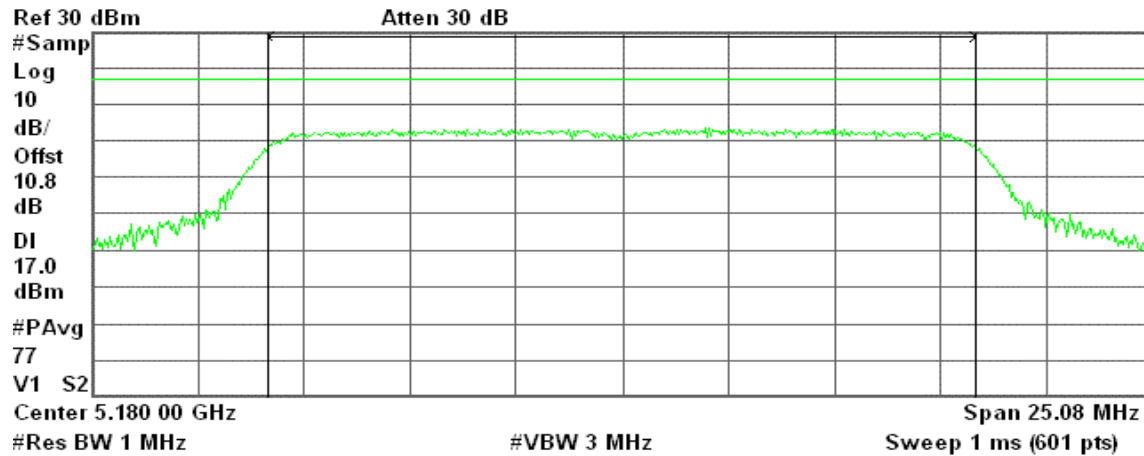


## Test Plot

### CH Low

Agilent 13:25:14 Jan 22, 2006  
Peak Transmit Power, a Mode Low Ch.

R L



Channel Power

13.98 dBm / 16.7200 MHz

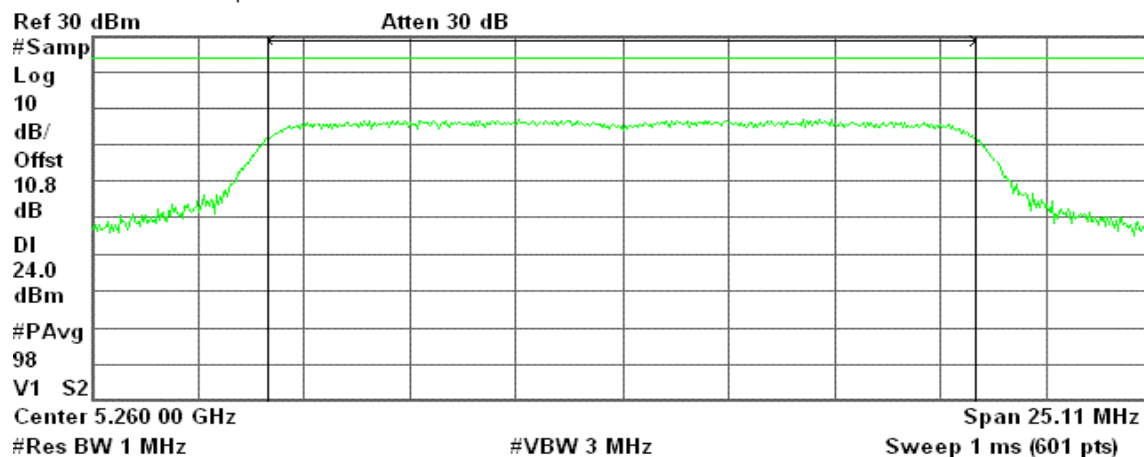
Power Spectral Density

-58.25 dBm/Hz

### CH Mid

Agilent 13:28:34 Jan 22, 2006  
Peak Transmit Power, a Mode Mid Ch.

R L



Channel Power

17.06 dBm / 16.7400 MHz

Power Spectral Density

-55.18 dBm/Hz





## CH High

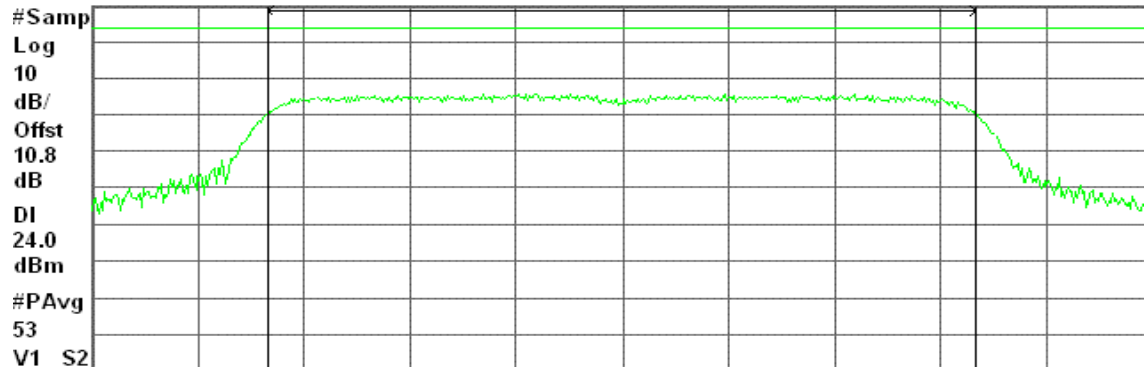
Agilent 13:31:57 Jan 22, 2006

R L

Peak Transmit Power, a Mode High Ch.

Ref 30 dBm

Atten 30 dB



Channel Power

16.50 dBm / 16.7600 MHz

Power Spectral Density

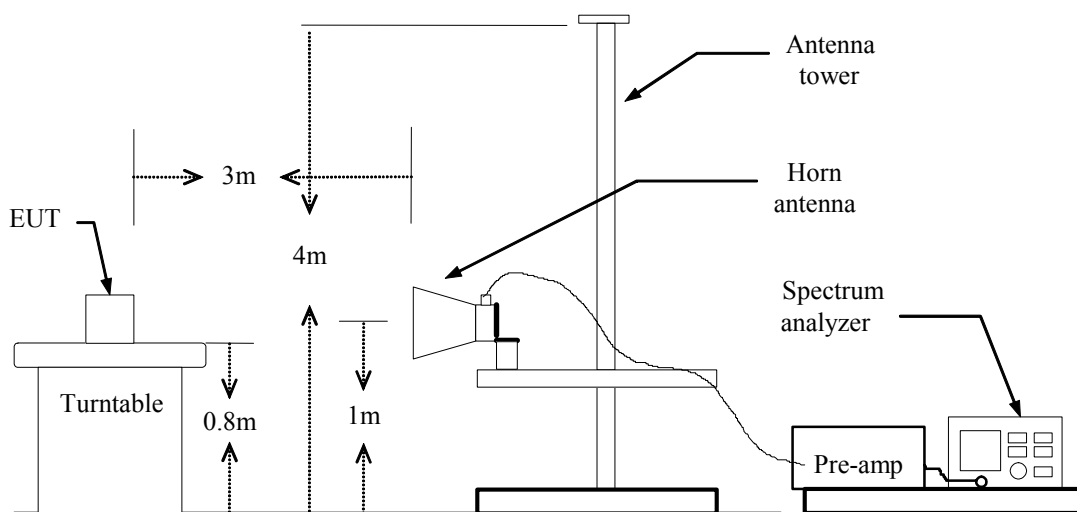
-55.74 dBm/Hz

## 6.5 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).

### Test Configuration



### TEST PROCEDURE

3. The EUT is placed on a turntable, which is 0.8m above the ground plane.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
6. 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
7. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

### TEST RESULTS

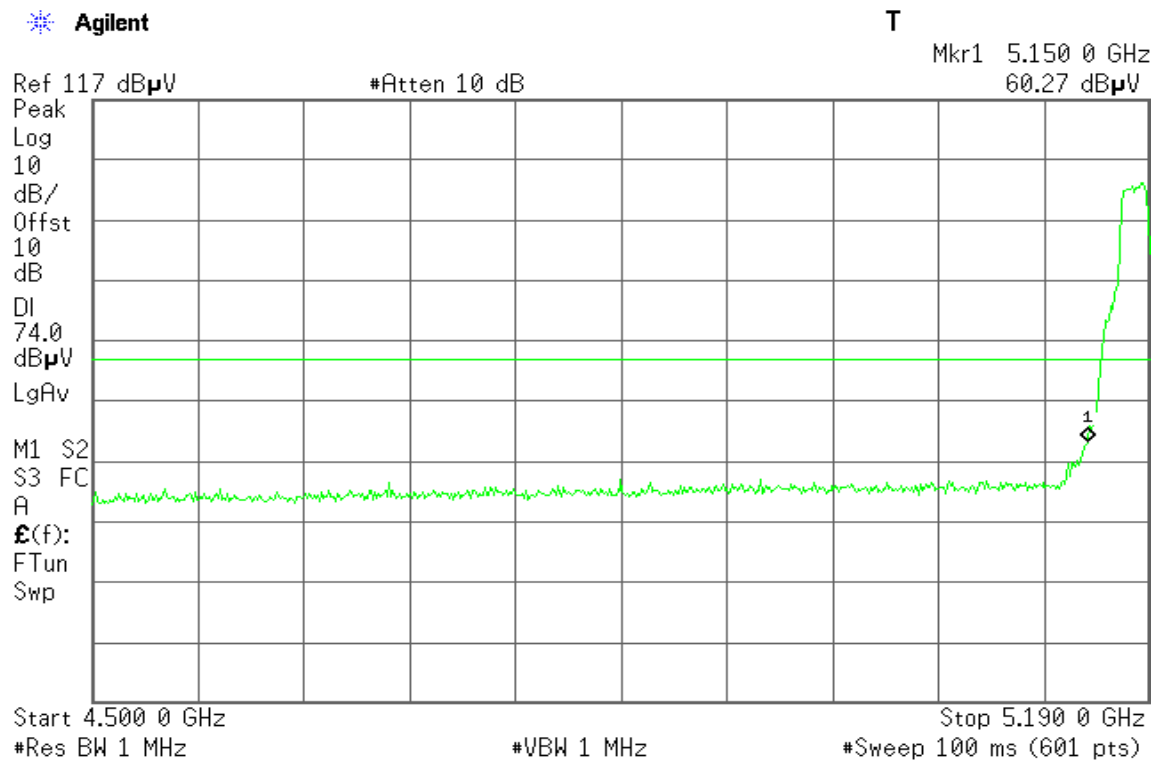
Refer to attach spectrum analyzer data chart.



## Band Edges (CH Low)

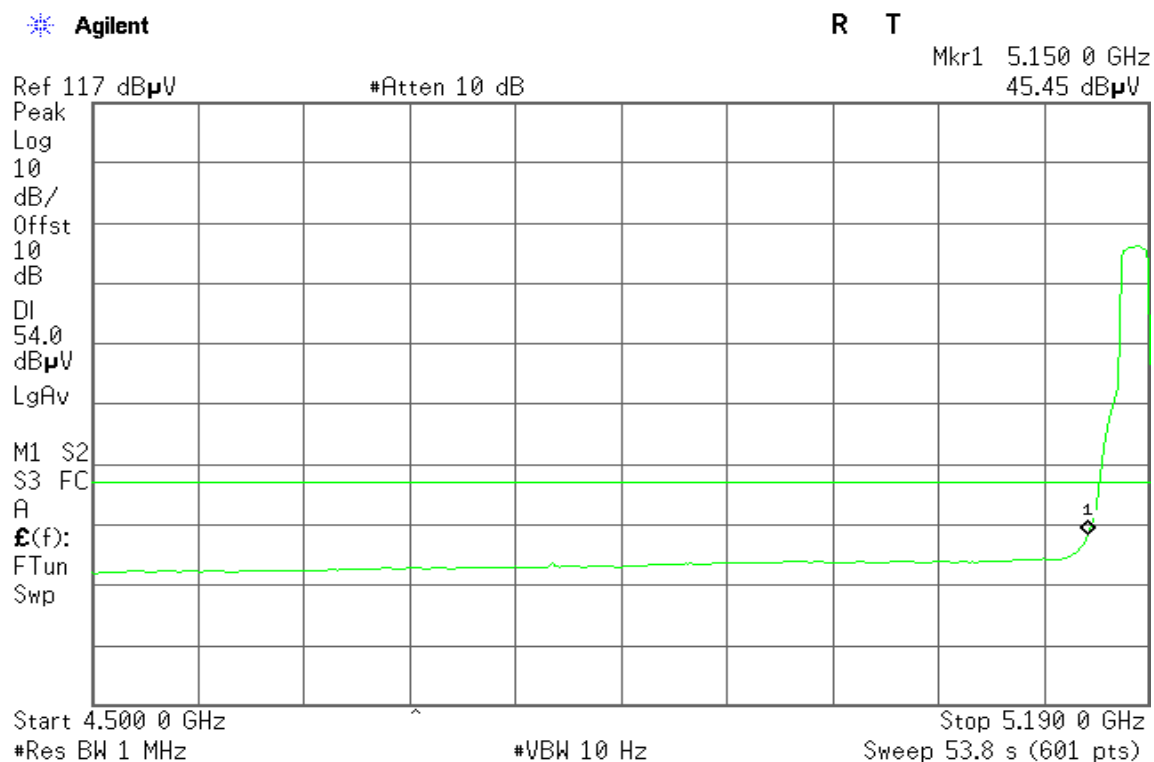
Detector mode: Peak

Polarity: Vertical



Detector mode: Average

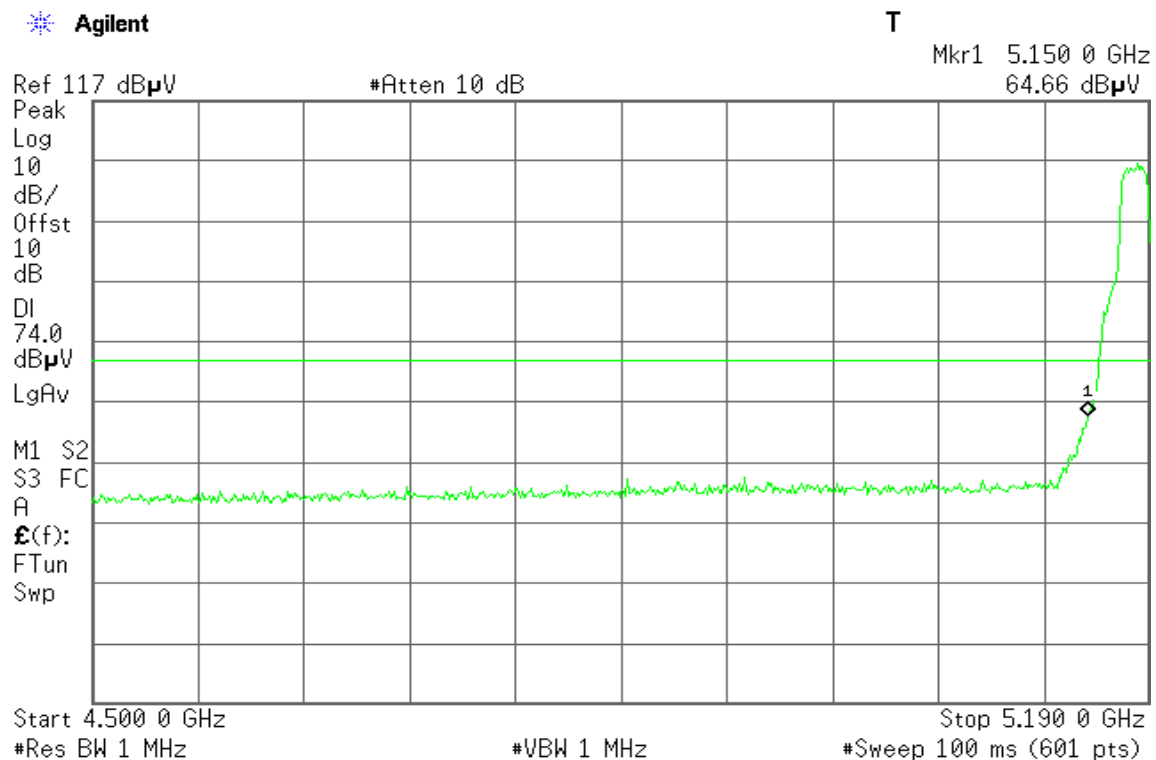
Polarity: Vertical





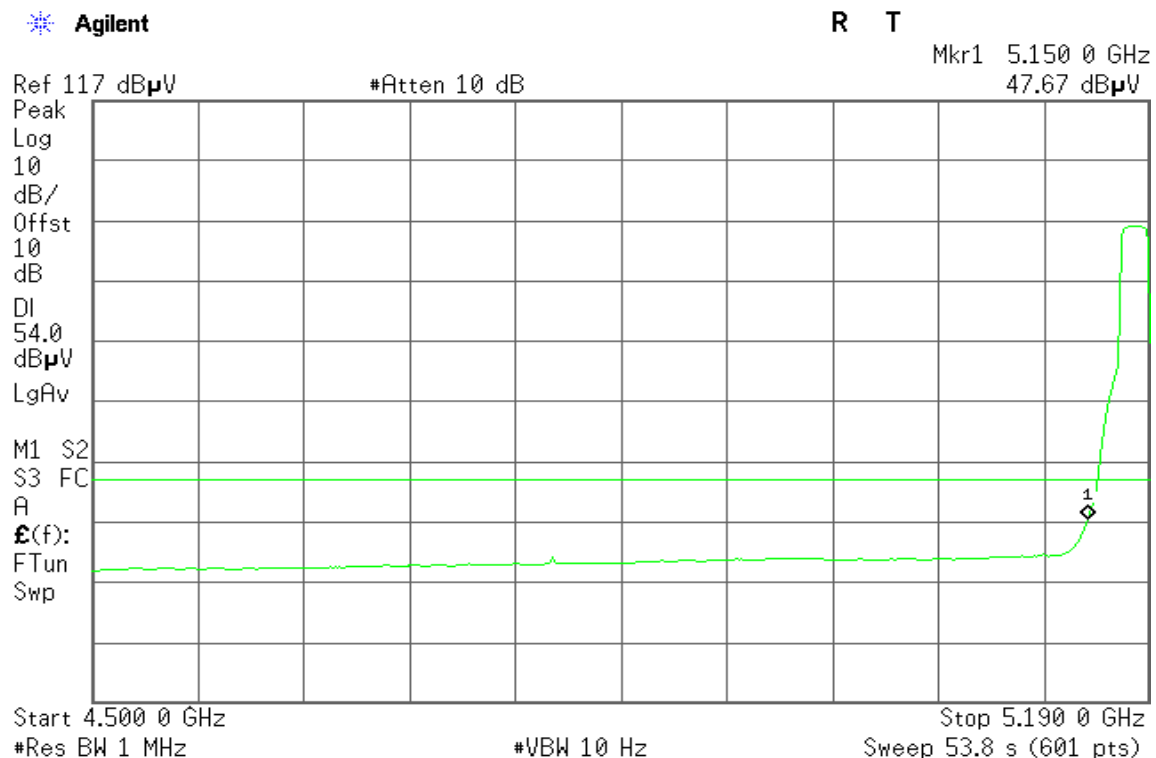
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

Polarity: Horizontal

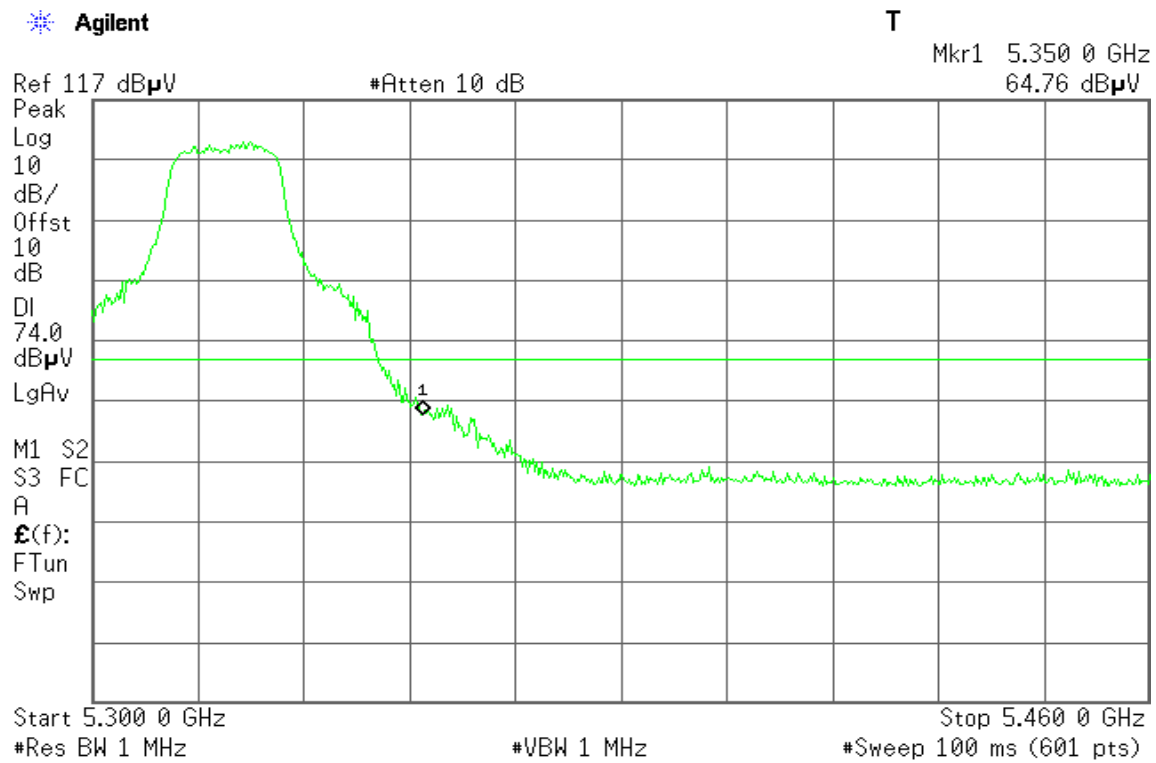




## Band Edges (CH High)

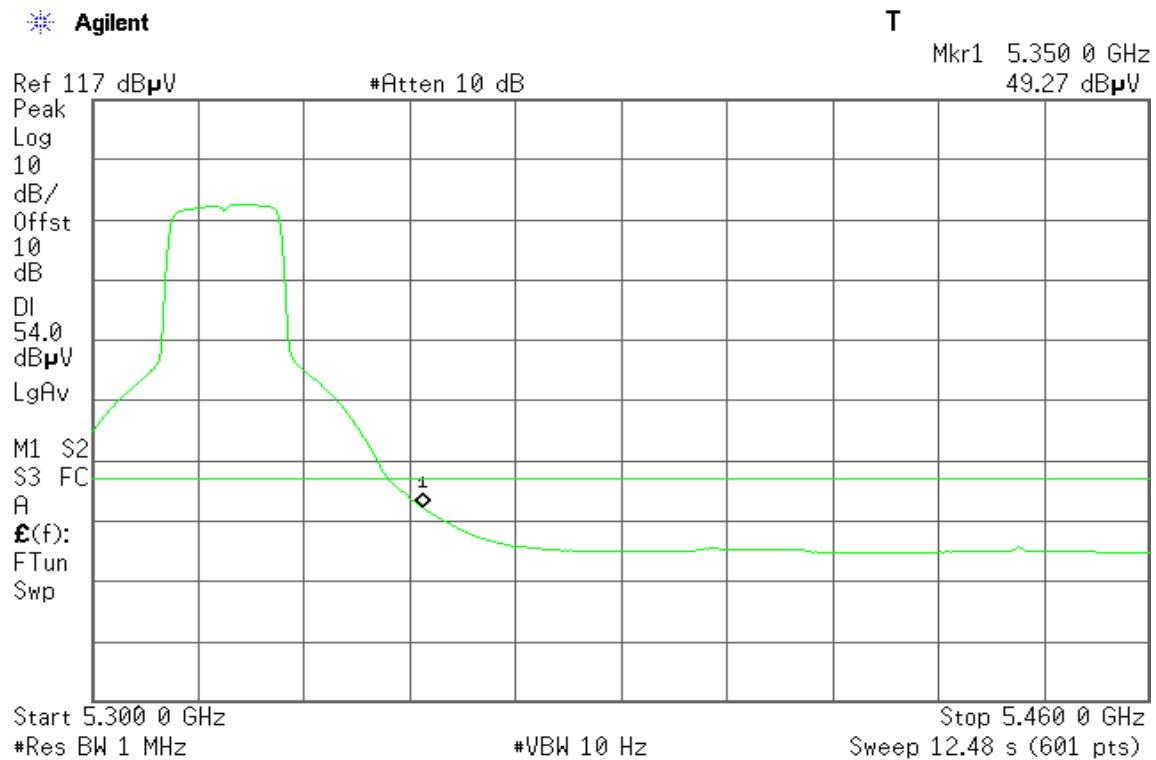
Detector mode: Peak

Polarity: Vertical



Detector mode: Average

Polarity: Vertical





Detector mode: Peak

Polarity: Horizontal

Agilent

R T

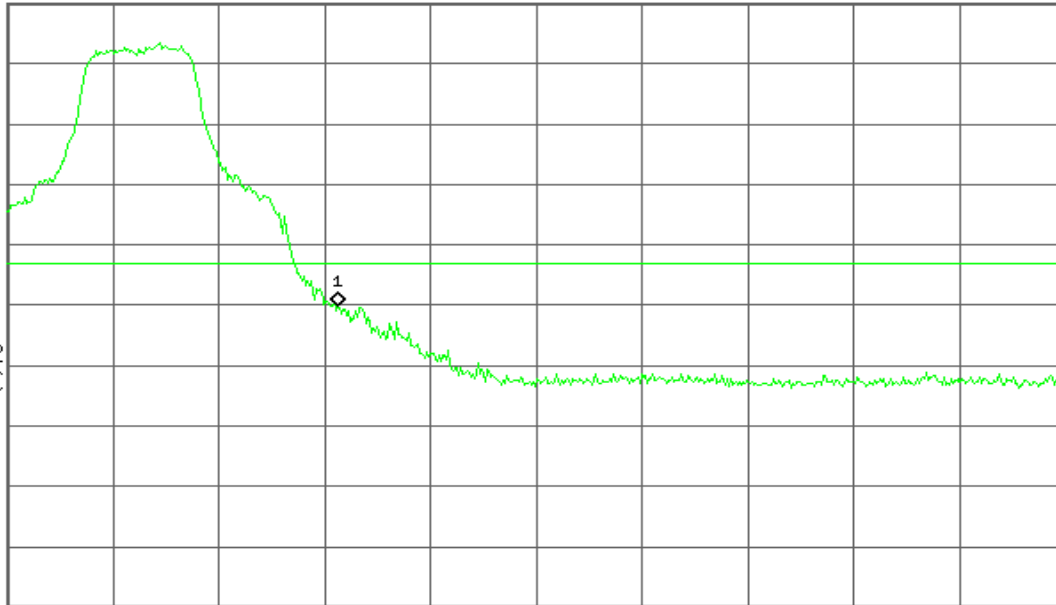
Mkr1 5.350 0 GHz  
66.91 dB $\mu$ V

Ref 117 dB $\mu$ V

#Atten 10 dB

Peak  
Log  
10  
dB/  
Offst  
10  
dB  
DI  
74.0  
dB $\mu$ V  
LgAv

M1 S2  
S3 FC  
A  
£(f):  
FTun  
Swp



Start 5.300 0 GHz

#Res BW 1 MHz

#VBW 1 MHz

Stop 5.460 0 GHz

#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Horizontal

Agilent

T

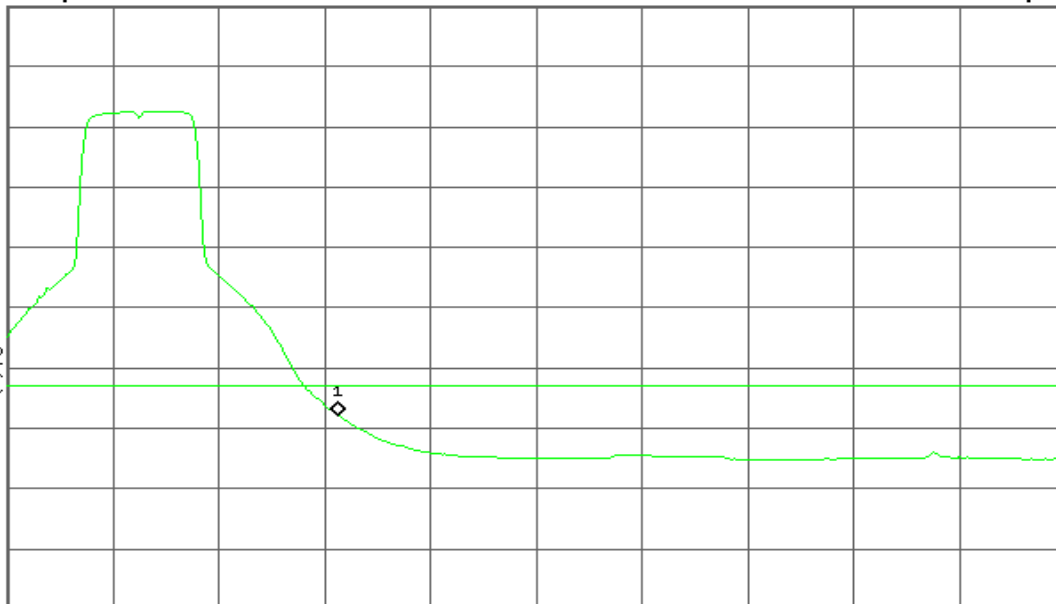
Mkr1 5.350 0 GHz  
49.22 dB $\mu$ V

Ref 117 dB $\mu$ V

#Atten 10 dB

Peak  
Log  
10  
dB/  
Offst  
10  
dB  
DI  
54.0  
dB $\mu$ V  
LgAv

M1 S2  
S3 FC  
A  
£(f):  
FTun  
Swp



Start 5.300 0 GHz

#Res BW 1 MHz

#VBW 10 Hz

Stop 5.460 0 GHz

Sweep 12.48 s (601 pts)



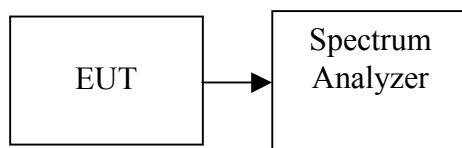
## 6.6 PEAK POWER SPECTRAL DENSITY

### 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.*

### 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 = Auto, Sweep=1ms
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

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)	Result
Low	5180	3.67	4.00	-0.33	PASS
Mid	5260	7.01	11.00	-3.99	PASS
High	5320	5.80	11.00	-5.20	PASS

*(Remark: Maximum antenna gain = 1.5dBi, therefore there is no reduction due to antenna gain.)*



## Test Plot

### CH Low

Agilent 13:25:26 Jan 22, 2006

Peak Power Spectral Density, a Mode Low Ch.

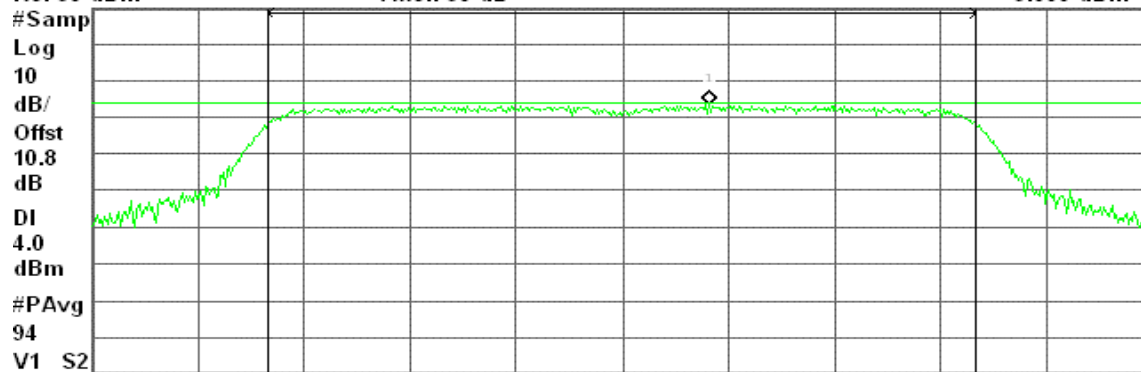
Ref 30 dBm

Atten 30 dB

R L

Mkr1 5.182 05 GHz

3.666 dBm



Center 5.180 00 GHz

Span 25.08 MHz

#Res BW 1 MHz

#VBW 3 MHz

Sweep 1 ms (601 pts)

Channel Power

Power Spectral Density

13.84 dBm / 16.7200 MHz

-58.40 dBm/Hz

### CH Mid

Agilent 13:28:46 Jan 22, 2006

Peak Power Spectral Density, a Mode Mid Ch.

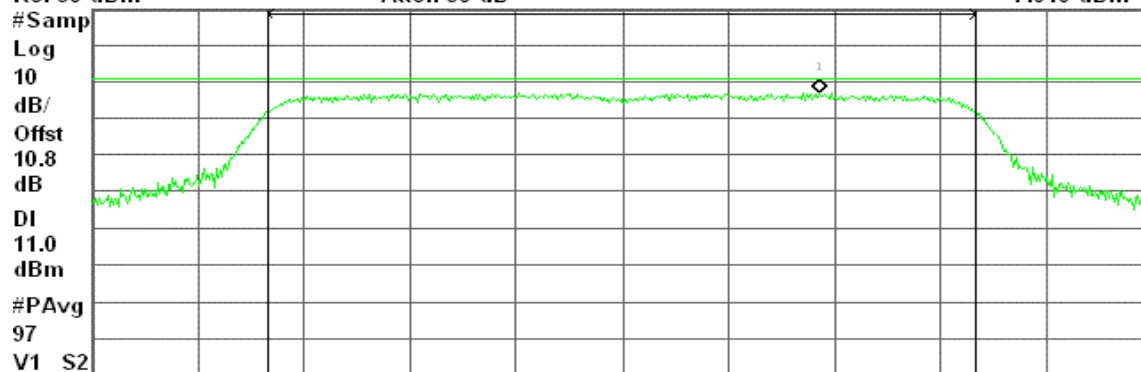
Ref 30 dBm

Atten 30 dB

R L

Mkr1 5.264 65 GHz

7.010 dBm



Center 5.260 00 GHz

Span 25.11 MHz

#Res BW 1 MHz

#VBW 3 MHz

Sweep 1 ms (601 pts)

Channel Power

Power Spectral Density

16.96 dBm / 16.7400 MHz

-55.28 dBm/Hz





## CH High

Agilent 13:32:11 Jan 22, 2006

R L

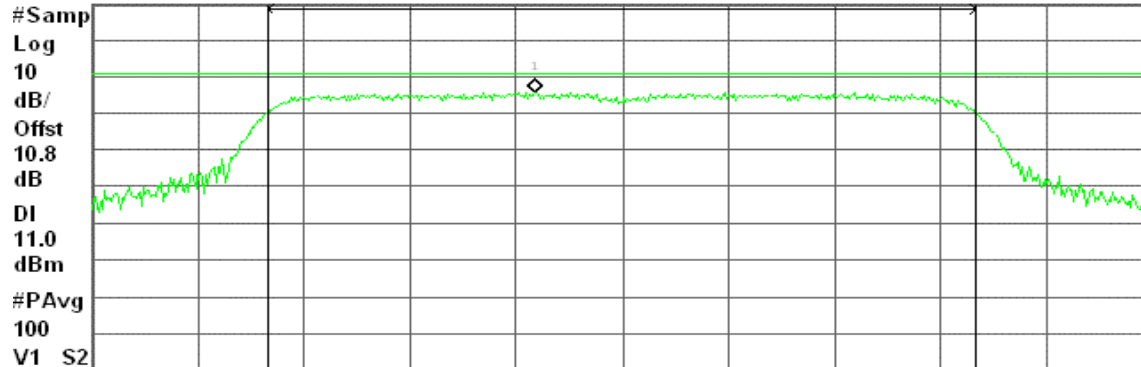
Peak Power Spectral Density, a Mode High Ch.

Mkr1 5.317 95 GHz

Ref 30 dBm

Atten 30 dB

5.804 dBm



Center 5.320 00 GHz

Span 25.14 MHz

#Res BW 1 MHz

#VBW 3 MHz

Sweep 1 ms (601 pts)

Channel Power

Power Spectral Density

16.44 dBm / 16.7600 MHz

-55.80 dBm/Hz

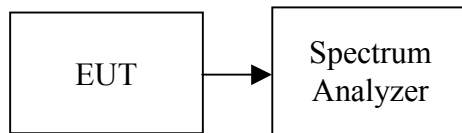


## 6.7 PEAK EXCURSION

### 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.

### 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, Max. hold.
4. Delta Mark trace A Maximum frequency and trace B same frequency.
5. Repeat the above procedure until measurements for all frequencies were complete.

### TEST RESULTS

*No non-compliance noted*

#### Test Data

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
Low	5180	9.73	13.00	-3.27	PASS
Mid	5260	10.74	13.00	-2.26	PASS
High	5320	11.20	13.00	-1.80	PASS



## Test Plot

### CH Low

Agilent 13:25:49 Jan 22, 2006

R L

Peak Excursion, a Mode Low Ch.

$\Delta$  Mkr1 0 Hz

Ref 30 dBm

Atten 30 dB

9.73 dB

#Peak

Log

10

dB/

Offst

10.8

dB

#PAvg

V1 V2

Center 5.180 00 GHz

Span 25.08 MHz

#Res BW 1 MHz

#VBW 3 MHz

Sweep 20 ms (601 pts)

Channel Power

Power Spectral Density

20.60 dBm / 16.7200 MHz

-51.64 dBm/Hz

### CH Mid

Agilent 13:29:07 Jan 22, 2006

R L

Peak Excursion, a Mode Mid Ch.

$\Delta$  Mkr1 0 Hz

Ref 30 dBm

Atten 30 dB

10.74 dB

#Peak

Log

10

dB/

Offst

10.8

dB

#PAvg

V1 V2

Center 5.260 00 GHz

Span 25.11 MHz

#Res BW 1 MHz

#VBW 3 MHz

Sweep 20 ms (601 pts)

Channel Power

Power Spectral Density

23.99 dBm / 16.7400 MHz

-48.25 dBm/Hz



## CH High

Agilent 13:32:32 Jan 22, 2006

R L

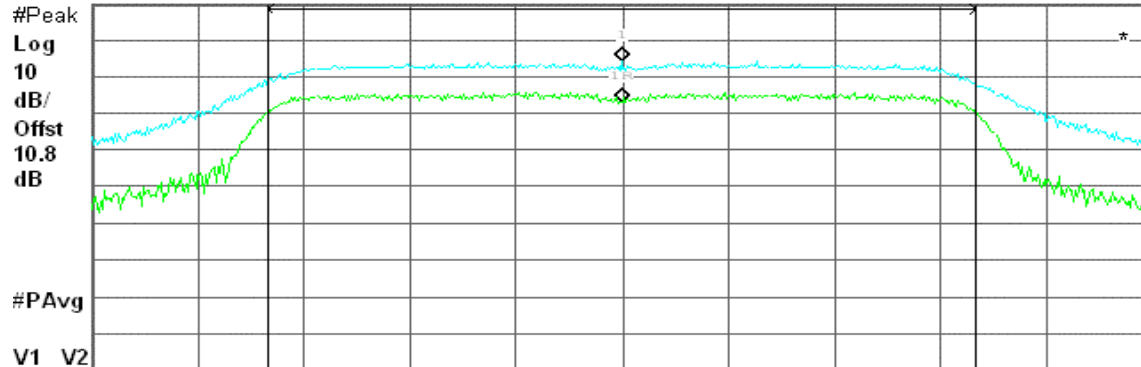
Peak Excursion, a Mode High Ch.

$\Delta$  Mkr1 0 Hz

Ref 30 dBm

Atten 30 dB

11.20 dB



#PAvg

Center 5.320 00 GHz  
#Res BW 1 MHz

#VBW 3 MHz

Span 25.14 MHz  
Sweep 20 ms (601 pts)

Channel Power

Power Spectral Density

22.83 dBm / 16.7600 MHz

-49.41 dBm/Hz

## 6.8 RADIATED UNDESIRABLE EMISSION

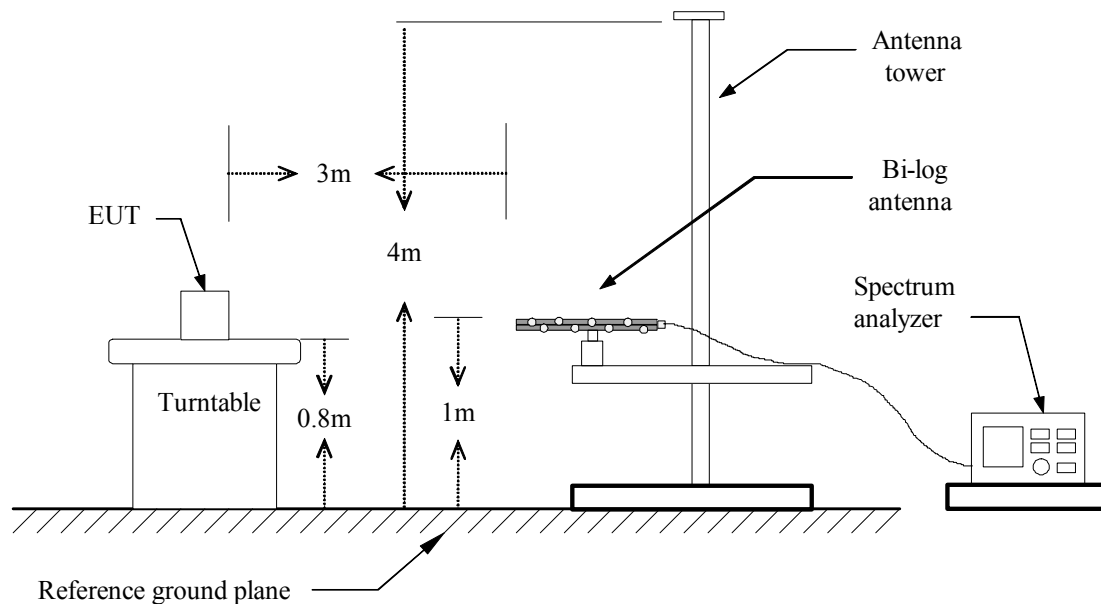
### LIMIT

According to 15.407(b),

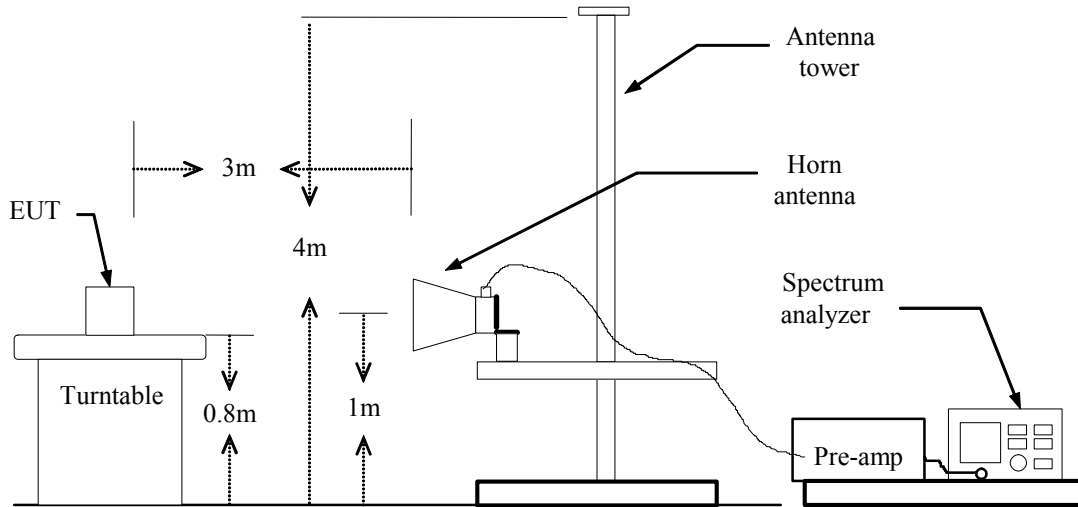
- (1) For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.
- (2) For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

### 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:** March 10, 2006**Temperature:** 26°C**Tested by:** Ryan Chen**Humidity:** 55% RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (QP) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (QP) (dBuV/m)	Limit (QP) (dBuV/m)	Margin (dB)	Remark
136.42	V	21.37	---	9.88	31.25	---	43.50	-12.25	Peak
265.79	V	19.70	---	14.25	33.95	---	46.00	-12.05	Peak
366.41	V	14.76	---	16.73	31.49	---	46.00	-14.51	Peak
554.67	V	12.12	---	20.42	32.54	---	46.00	-13.46	Peak
643.10	V	8.81	---	21.68	30.49	---	46.00	-15.51	Peak
806.46	V	8.35	---	23.54	31.89	---	46.00	-14.11	Peak
145.46	H	23.81	---	9.68	33.49	---	43.50	-10.01	Peak
274.94	H	21.82	---	14.42	36.24	---	46.00	-9.76	Peak
349.15	H	20.75	---	16.36	37.11	---	46.00	-8.89	Peak
455.97	H	17.72	---	18.22	35.94	---	46.00	-10.06	Peak
598.16	H	11.25	---	21.31	32.56	---	46.00	-13.44	Peak
715.38	H	12.89	---	22.33	35.22	---	46.00	-10.78	Peak

***Remark:***

- Measuring frequencies from 30 MHz to the 1GHz.*
- Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.*
- Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.*
- 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.*
- Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
- Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).*

**Above 1 GHz****Operation Mode:** Tx / IEEE 802.11a mode / CH Low**Test Date:** January 16, 2006**Temperature:** 24°C**Tested by:** Eric Cheng**Humidity:** 60% RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1198.33	V	52.03	---	-6.88	45.15	---	74.00	54.00	-8.85	Peak
15550.00	V	65.69	---	-17.68	48.01	---	74.00	54.00	-5.99	Peak
N/A										
1198.33	H	50.05	---	-6.88	43.18	---	74.00	54.00	-10.82	Peak
15550.00	H	64.40	---	-17.68	46.71	---	74.00	54.00	-7.29	Peak
N/A										

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).



**Operation Mode:** Tx / IEEE 802.11a mode / CH Mid**Test Date:** January 16, 2006**Temperature:** 24°C**Tested by:** Eric Cheng**Humidity:** 60% RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1490.00	V	51.08	---	-7.02	44.06	---	74.00	54.00	-9.94	Peak
N/A										
1490.00	H	46.61	---	-7.02	39.60	---	74.00	54.00	-14.40	Peak
N/A										

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Operation Mode:** Tx / IEEE 802.11a mode / CH High**Test Date:** January 16, 2006**Temperature:** 24°C**Tested by:** Eric Cheng**Humidity:** 60% RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1198.33	V	51.40	---	-6.88	44.53	---	74.00	54.00	-9.47	Peak
10633.33	V	88.92	75.71	-22.99	65.93	52.72	74.00	54.00	-1.28	Average
N/A										
10650.00	H	91.57	75.74	-22.97	68.60	52.77	74.00	54.00	-1.23	Average
N/A										

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).



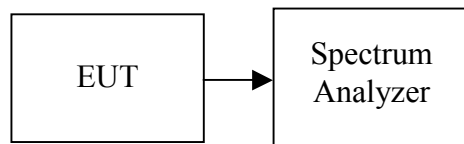
## 6.9 CONDUCTED UNDESIRABLE EMISSION

### 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.

### 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*



## Test Plot

### CH Low

#### 30MHz ~ 40GHz

Agilent 13:26:43 Jan 22, 2006

T

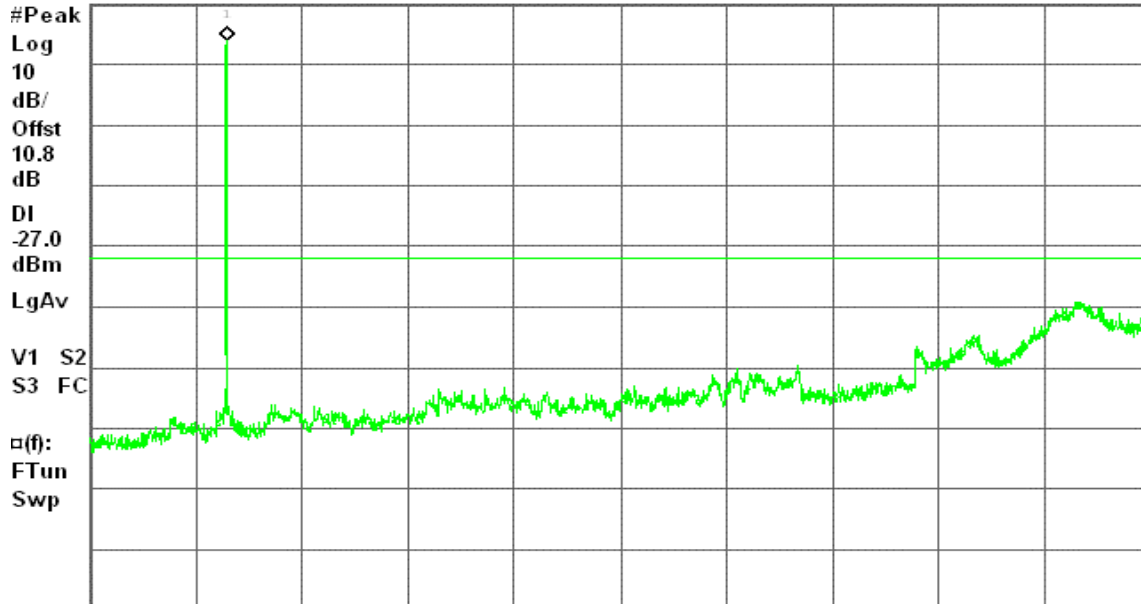
Conducted Spur., a Mode Low Ch.

Mkr1 5.19 GHz

Ref 15 dBm

#Atten 16 dB

9.06 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 13:30:09 Jan 22, 2006

L

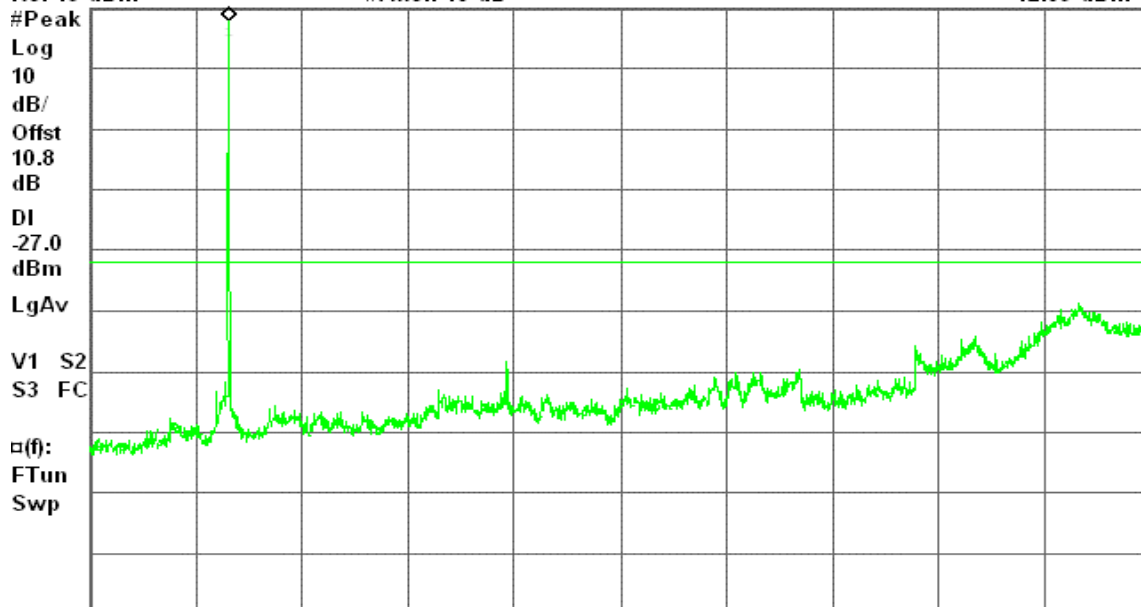
Conducted Spur., a Mode Mid Ch.

Mkr1 5.27 GHz

Ref 15 dBm

#Atten 16 dB

12.89 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 13:33:12 Jan 22, 2006

L

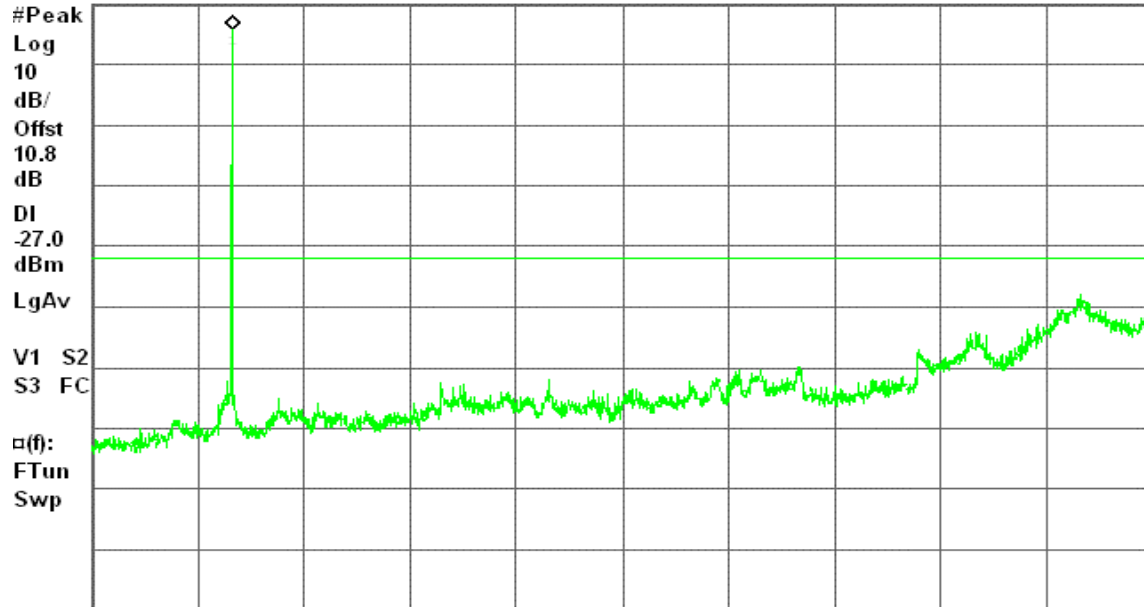
Conducted Spur., a Mode High Ch.

Mkr1 5.33 GHz

Ref 15 dBm

#Atten 16 dB

10.86 dBm



Center 20.02 GHz

Span 39.97 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 100 ms (2001 pts)



## 6.10 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.

### 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:** November 23, 2005  
**Temperature:** 25°C      **Tested by:** Rex Lai  
**Humidity:** 55% RH

Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB)	QP Result (dBuV)	AV Result (dBuV)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.191	47.820	43.570	0.118	47.938	43.688	63.993	53.993	-16.055	-10.305	L1
0.252	39.210	35.030	0.100	39.310	35.130	61.691	51.691	-22.381	-16.561	L1
0.317	32.840	30.250	0.100	32.940	30.350	59.785	49.785	-26.845	-19.435	L1
0.443	30.770	29.730	0.100	30.870	29.830	57.005	47.005	-26.135	-17.175	L1
0.572	29.500	29.100	0.100	29.600	29.200	56.000	46.000	-26.400	-16.800	L1
15.248	26.030	22.560	0.820	26.850	23.380	60.000	50.000	-33.150	-26.620	L1
0.189	45.790	41.610	0.122	45.912	41.732	64.080	54.080	-18.168	-12.348	L2
0.254	36.410	33.200	0.100	36.510	33.300	61.625	51.625	-25.115	-18.325	L2
0.381	28.190	24.330	0.100	28.290	24.430	58.258	48.258	-29.968	-23.828	L2
0.440	30.000	29.000	0.100	30.100	29.100	57.062	47.062	-26.962	-17.962	L2
0.568	29.220	29.270	0.100	29.320	29.370	56.000	46.000	-26.680	-16.630	L2
15.006	24.800	21.130	0.800	25.600	21.930	60.000	50.000	-34.400	-28.070	L2

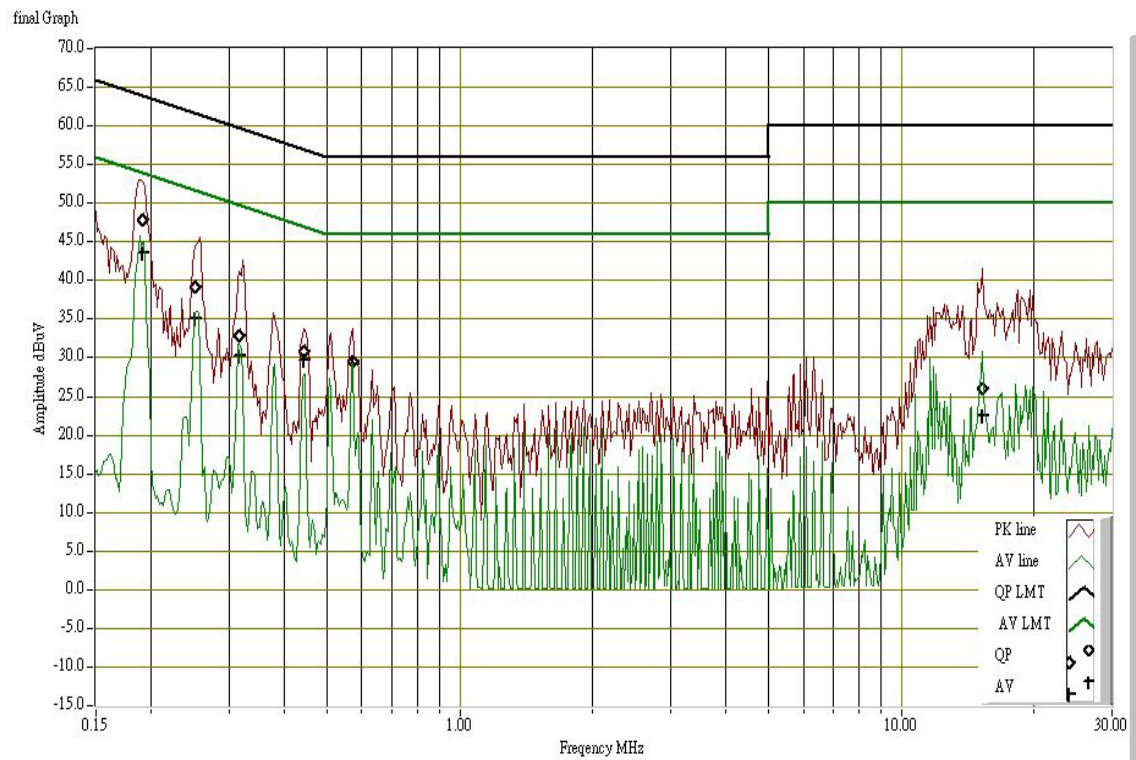
**Remark:**

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

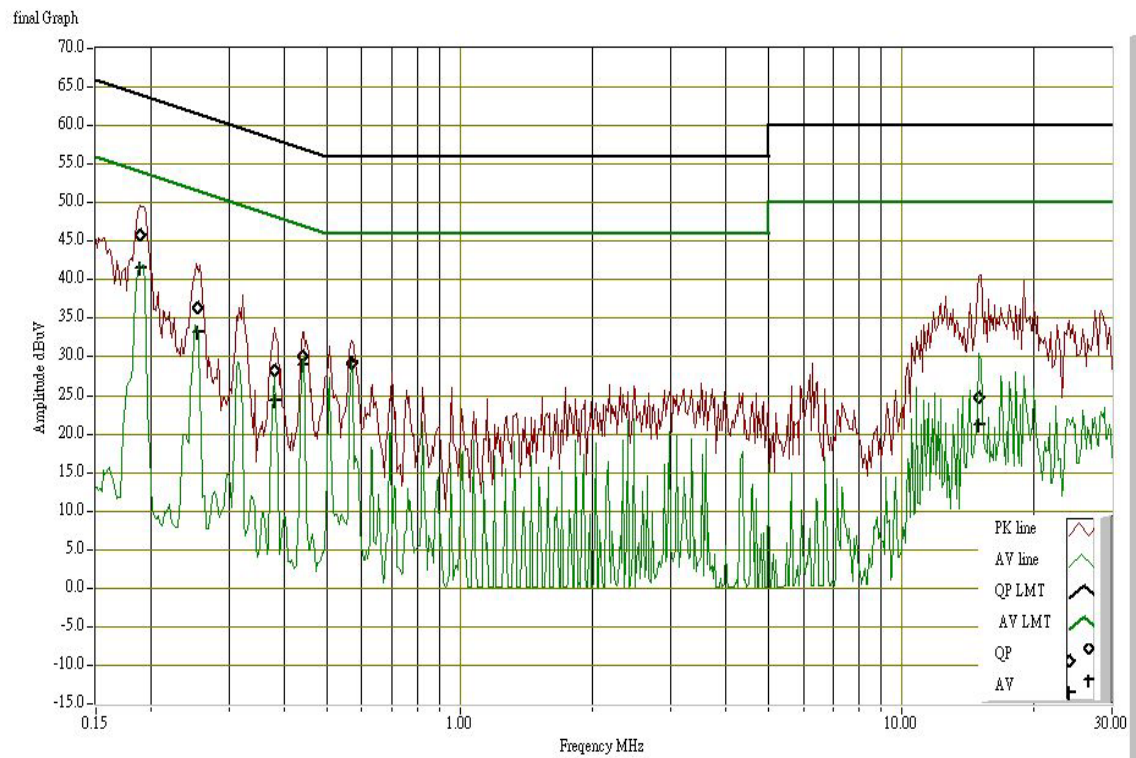


## Test Plots

### Conducted emissions (Line 1)



### Conducted emissions (Line 2)







## 6.11 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

Please refer to the operational description for details.

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

## 6.12 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 user's manual.

### 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.*