



**FCC 47 CFR PART 15 SUBPART C  
(Class II Permissive Change)**

**TEST REPORT**

**For**

**IEEE802.11b/g +Bluetooth 2.0+EDR and GPS Mini Card (Tested inside of  
Notebook PC, Model NP-Q1EX)**

**Model: MM230-M, MM210-M**

**Trade Name: CyberTAN**

*Issued to*

**CyberTAN Technology, Inc.  
99 Park Avenue III, Hsinchu Science Park,  
Hsinchu 300, Taiwan, R.O.C.**

*Issued by*



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## 1. TEST RESULT CERTIFICATION

**Applicant:** CyberTAN Technology, Inc.  
99 Park Avenue III, Hsinchu Science Park,  
Hsinchu 300, Taiwan, R.O.C.

**Equipment Under Test:** IEEE802.11b/g +Bluetooth 2.0+EDR and GPS Mini Card (Tested  
inside of Notebook PC, Model NP-Q1EX)

**Trade Name:** CyberTAN

**Model:** MM230-M, MM210-M

**Date of Test:** January 5 ~ 20, 2009

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C	No non-compliance noted
Deviation from Applicable Standard	
None	

### We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in **ANSI C63.4: 2003** and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

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

*Approved by:*

*Reviewed by:*

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Rex Lai  
Section Manager  
Compliance Certification Services Inc.

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Amanda Wu  
Section Manager  
Compliance Certification Services Inc.



## 2. EUT DESCRIPTION

<b>Product</b>	IEEE802.11b/g +Bluetooth 2.0+EDR and GPS Mini Card (Tested inside of Notebook PC, Model NP-Q1EX)			
<b>Trade Name</b>	CyberTAN			
<b>Model Number</b>	MM230-M, MM210-M			
<b>Model Discrepancy</b>	<b>Model</b>	<b>WLAN Function</b>	<b>Bluetooth Function</b>	<b>GPS Function</b>
	MM230-M	Yes	Yes	Yes
	MM210-M	Yes	Yes	No
<b>Power Supply</b>	1. Model: ADP-40MH AB I/P: 100-240VAC, 50-60Hz, 1.2A O/P: 19V, 2.1A 2. Rechargeable Battery: Model: AA-PB0UC4B Rating: 7.4VDC, 4000mAh			
<b>Frequency Range</b>	2412 ~ 2462 MHz			
<b>Transmit Power Listed in the Grant as below (FCC ID: N89-MM230M)</b>	0.0627W			
<b>Modulation Technique</b>	IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: DSSS (CCK, DQPSK, DBPSK) + OFDM (QPSK, BPSK, 16-QAM, 64-QAM)			
<b>Transmit Data Rate</b>	IEEE 802.11b Mode: 11, 5.5, 2, 1 Mbps IEEE 802.11g Mode: 54, 48, 36, 24, 18, 12, 11, 9, 6, 5.5, 2, 1Mbps			
<b>Number of Channels</b>	11 Channels			
<b>Antenna Specification</b>	Gain: 0.47 dBi			
<b>Antenna Designation</b>	PIFA Antenna			
<b>Class II Permissive Change</b>	The major change filed under this application is: 1. Addition of Portable Category Classification. 2. Add same type lower gain antenna of the EUT.			

**Remark:**

1. The sample selected for test was production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: **N89-MM230M** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.



### **3. TEST METHODOLOGY**

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CFR 47 Part 15.207, 15.209 and 15.247.

#### **3.1 EUT CONFIGURATION**

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

#### **3.2 EUT EXERCISE**

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

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

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

##### **Conducted Emissions**

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

##### **Radiated Emissions**

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



### 3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

- (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<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**

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

The EUT (model: MM230-M) had been tested under operating condition.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

IEEE 802.11b mode:

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

IEEE 802.11g mode:

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

The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.



## 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	02/24/2009

3M Semi Anechoic Chamber				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US42510252	10/07/2009
Test Receiver	Rohde&Schwarz	ESCI	100064	11/29/2009
Switch Controller	TRC	Switch Controller	SC94050010	05/03/2009
4 Port Switch	TRC	4 Port Switch	SC94050020	05/03/2009
Horn-Antenna	TRC	HA-0502	06	06/04/2009
Horn-Antenna	TRC	HA-0801	04	10/20/2009
Horn-Antenna	TRC	HA-1201A	01	10/15/2009
Horn-Antenna	TRC	HA-1301A	01	10/15/2009
Bilog- Antenna	Sunol Sciences	JB3	A030205	03/28/2009
Turn Table	Max-Full	MFT-120S	T120S940302	N.C.R.
Antenna Tower	Max-Full	MFA-430	A440940302	N.C.R.
Controller	Max-Full	MF-CM886	CC-C-1F-13	N.C.R.
Site NSA	CCS	N/A	FCC MRA: TW1039 IC: IC 2324G-1/-2	10/17/2010 11/04/2010
Test S/W	LABVIEW (V 6.1)			

Powerline Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver 9kHz-30MHz	Rohde & Schwarz	ESHS30	828144/003	11/18/2009
Two-Line V-Network 9kHz-30MHz	Schaffner	NNB41	03/10013	06/11/2009
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	04/09/2009
Test S/W	LABVIEW (V 6.1)			





### 4.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission	+/- 2.81
3M Semi Anechoic Chamber / 30MHz ~ 1GHz	+/-3.7046
3M Semi Anechoic Chamber / 1GHz Above	+/-3.0958

**Remark:** This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .



## **5. FACILITIES AND ACCREDITATIONS**

### **5.1 FACILITIES**

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

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

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

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

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

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

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

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

### **5.2 EQUIPMENT**




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

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

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

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

### 5.3 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3M Semi Anechoic Chamber (FCC MRA: TW1039) to perform FCC Part 15 measurements	 FCC MRA: TW1039
Taiwan	TAF	LP0002, RTTE01, FCC Method-47 CFR Part 15 Subpart C, D, E, RSS-210, RSS-310 IDA TS SRD, AS/NZS 4268, AS/NZS 4771, TS 12.1 & 12.2, ETSI EN 300 440-1, ETSI EN 300 440-2, ETSI EN 300 328, ETSI EN 300 220-1, ETSI EN 300 220-2, ETSI EN 301 893, ETSI EN 301 489-1/3/7/17 FCC OET Bulletin 65 + Supplement C, EN 50360, EN 50361, EN 50371, RSS 102, EN 50383, EN 50385, EN 50392, IEC 62209, CNS 14958-1, CNS 14959 FCC Method -47 CFR Part 15 Subpart B IEC / EN 61000-3-2, IEC / EN 61000-3-3, IEC / EN 61000-4-2/3/4/5/6/8/11	 Testing Laboratory 1309
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 & IC 2324G-2) to perform	 IC 2324G-1 IC 2324G-2

\* 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 I 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.	USB Keyboard	DELL	Sk-8115	N/A	FCC DoC	Shielded, 1.8m	N/A
2.	USB Mouse	Logitech	M-BB48	LZE01360732	FCC DoC	Shielded, 1.8m	N/A
3.	USB Mouse	DELL	MO56UC	E1G01GBO	FCC DoC	Shielded, 1.8m	N/A
4.	Multimedia Earphone	Ergotech	ET-E220	N/A	FCC DoC	Unshielded, 1.8m*2	N/A

**Remark:**

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



## 7. FCC PART 15.247 REQUIREMENTS

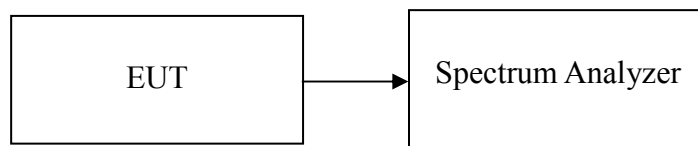
### 7.1 PEAK POWER

#### LIMIT

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

1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### Test Configuration



#### TEST PROCEDURE

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz.
3. Set VBW  $\geq$  3 MHz.
4. Use sample detector mode if bin width (i.e., span/number of points in spectrum display)  $<$  0.5 RBW. Otherwise use peak detector mode.
5. 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.
6. Trace average 100 traces in power averaging mode.
7. 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 mode: IEEE 802.11b**

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2412	17.59	0.0574	1.00	PASS
Mid	2437	15.07	0.0321		PASS
High	2462	14.78	0.0301		PASS

**Test mode: IEEE 802.11g**

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2412	17.76	0.0597	1.00	PASS
Mid	2437	17.57	0.0571		PASS
High	2462	17.50	0.0562		PASS



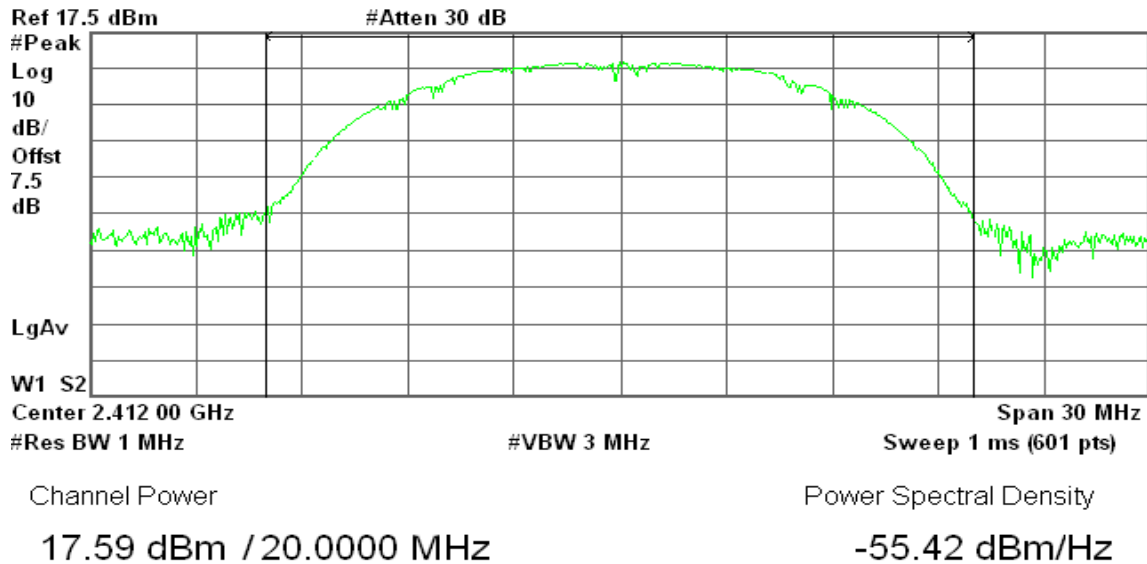
## Test Plot

### IEEE 802.11b

#### Peak Power (CH Low)

Agilent 12:04:20 Jan 21, 2009

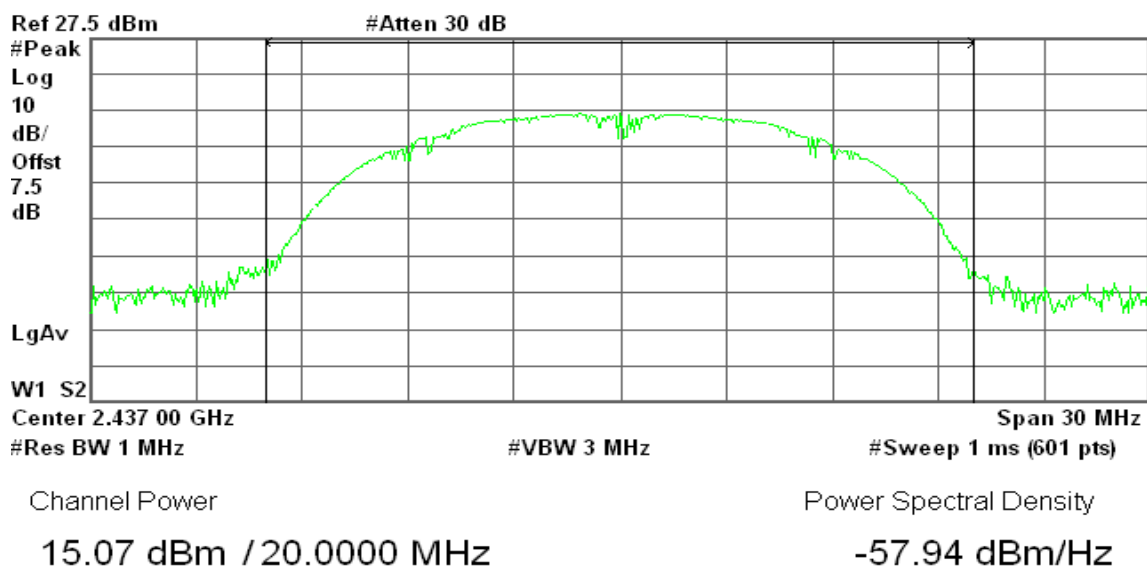
R T



#### Peak Power (CH Mid)

Agilent 10:53:40 Jan 21, 2009

R T

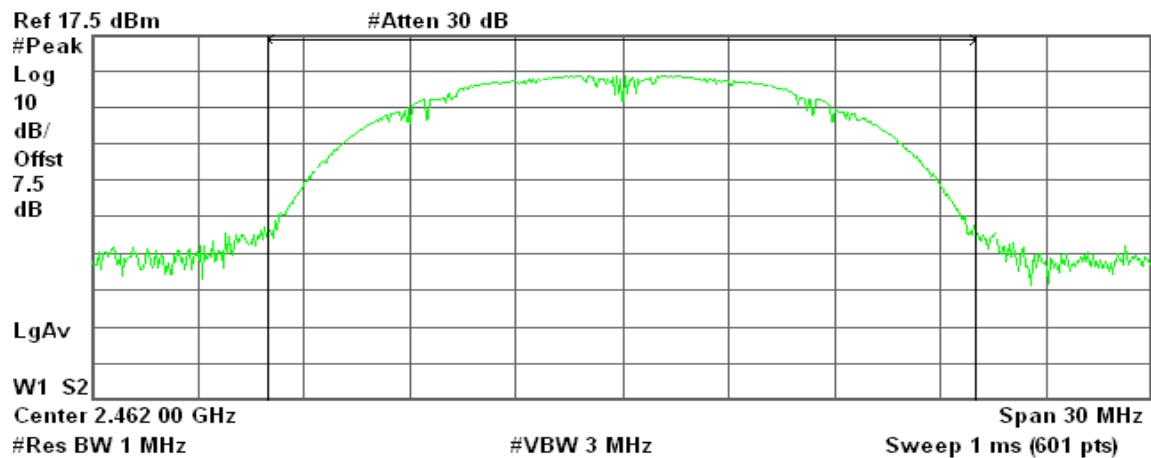




## Peak Power (CH High)

Agilent 12:07:17 Jan 21, 2009

R T



Channel Power

14.78 dBm / 20.0000 MHz

Power Spectral Density

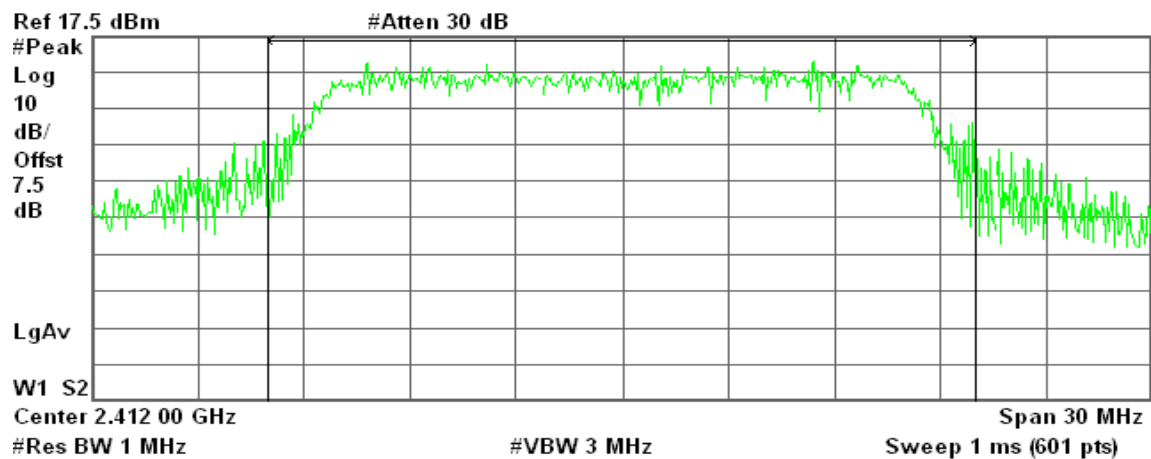
-58.23 dBm/Hz

## IEEE 802.11g

### Peak Power (CH Low)

Agilent 12:50:05 Jan 21, 2009

R T



Channel Power

17.76 dBm / 20.0000 MHz

Power Spectral Density

-55.25 dBm/Hz

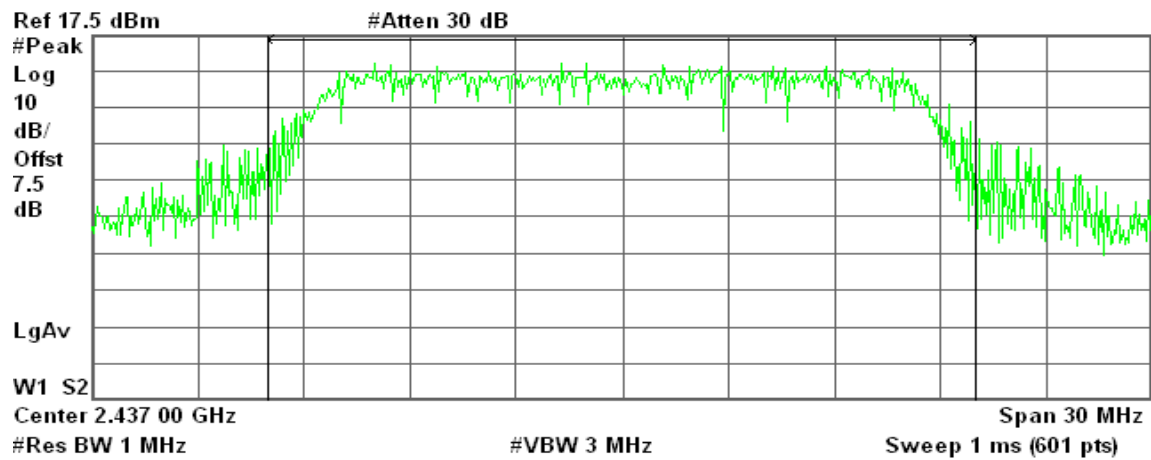




## Peak Power (CH Mid)

Agilent 12:57:13 Jan 21, 2009

R T



Channel Power

17.57 dBm / 20.0000 MHz

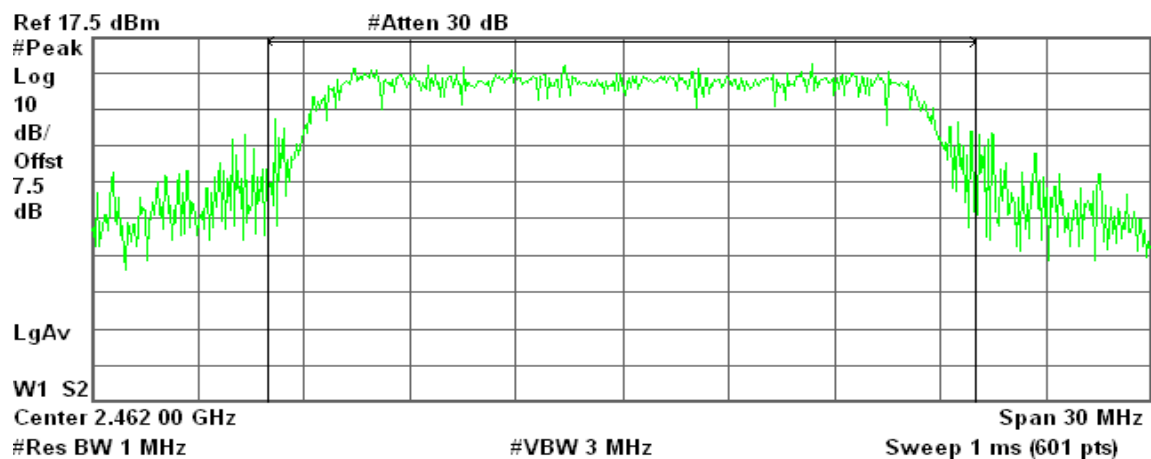
Power Spectral Density

-55.44 dBm/Hz

## Peak Power (CH High)

Agilent 13:42:05 Jan 21, 2009

R T



Channel Power

17.50 dBm / 20.0000 MHz

Power Spectral Density

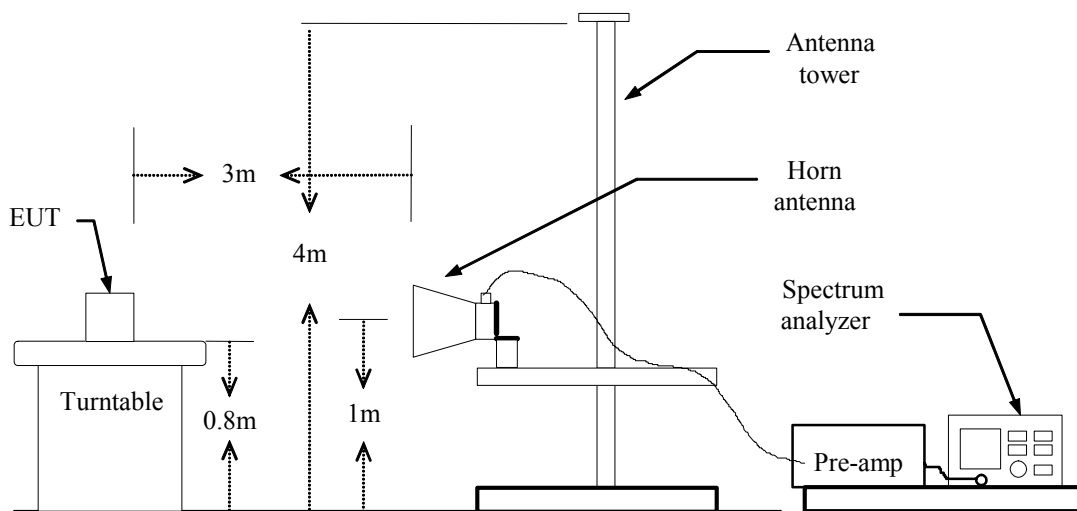
-55.51 dBm/Hz

## 7.2 BAND EDGES MEASUREMENT

### LIMIT

According to §15.247(d), 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

### Test Configuration



### TEST PROCEDURE

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

### TEST RESULTS

Refer to attach spectrum analyzer data chart.



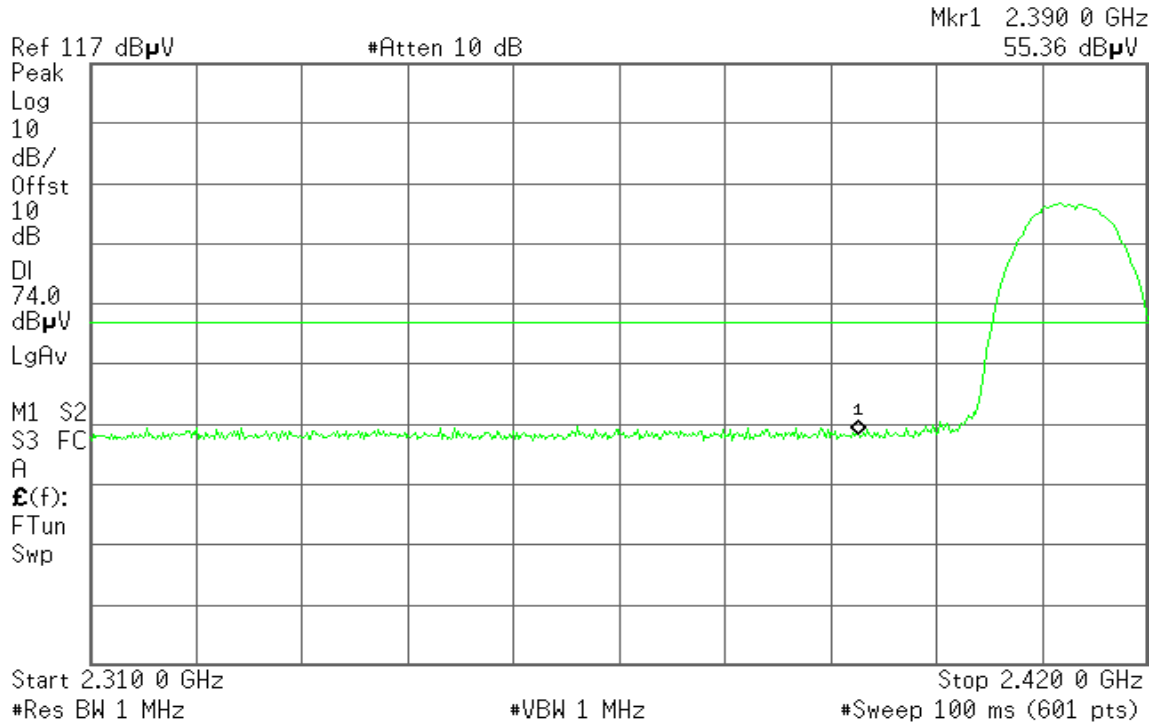
## Band Edges (IEEE 802.11b / CH Low)

Detector mode: Peak

Polarity: Vertical

Agilent 16:47:04 Jan 5, 2009

R T

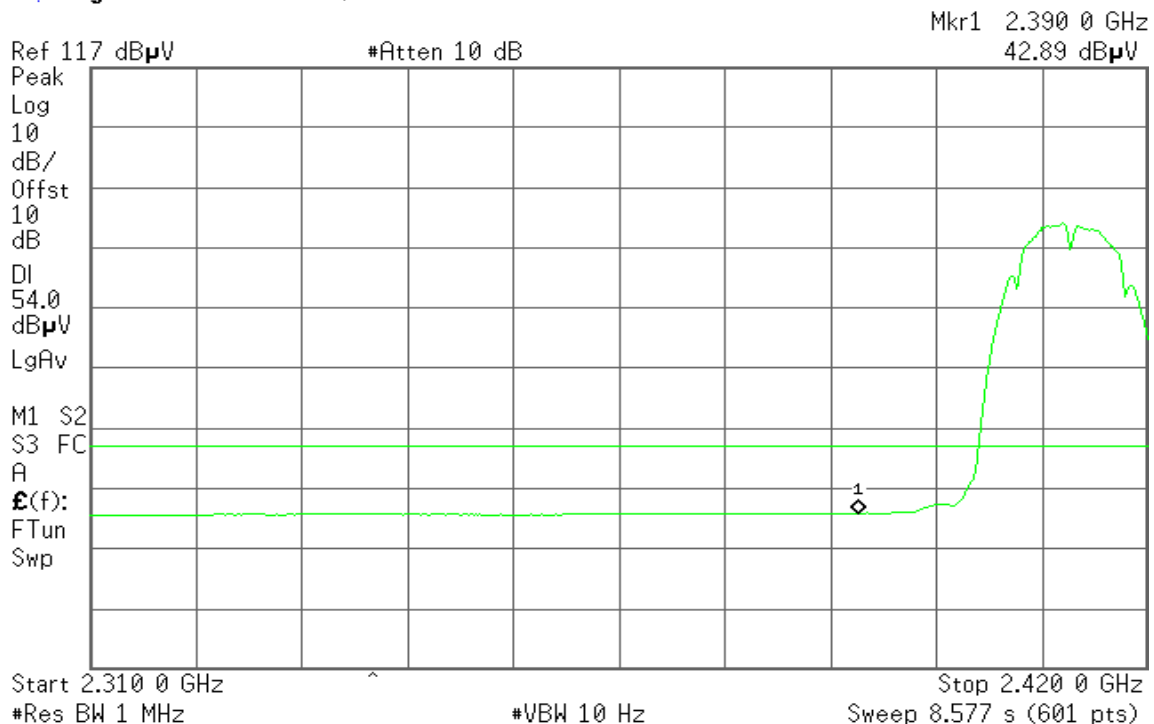


Detector mode: Average

Polarity: Vertical

Agilent 16:47:26 Jan 5, 2009

R T



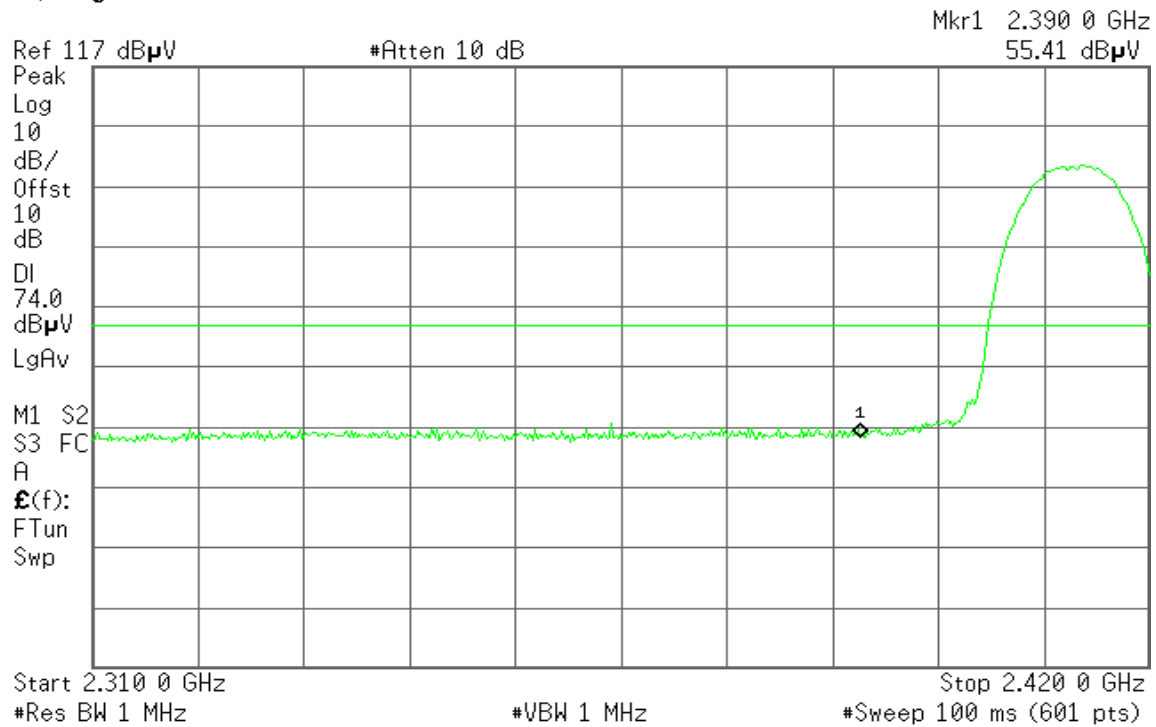


Detector mode: Peak

Polarity: Horizontal

\* Agilent 16:45:05 Jan 5, 2009

R T

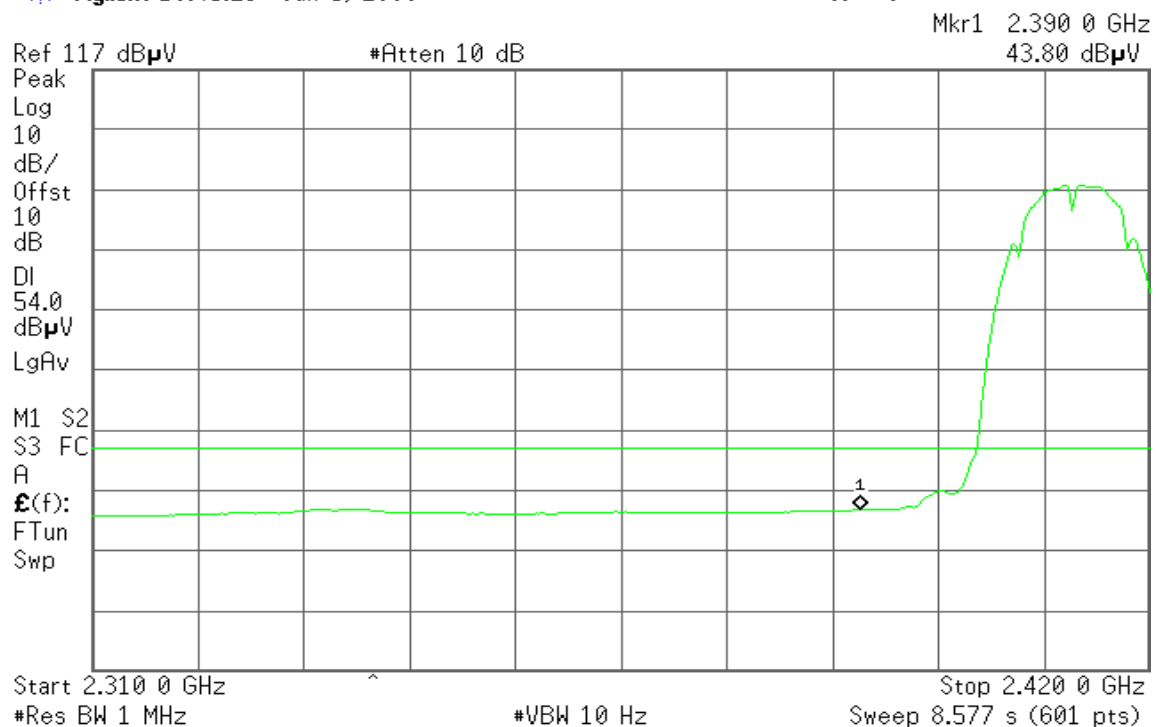


Detector mode: Average

Polarity: Horizontal

\* Agilent 16:45:23 Jan 5, 2009

R T





## Band Edges (IEEE 802.11b / CH High)

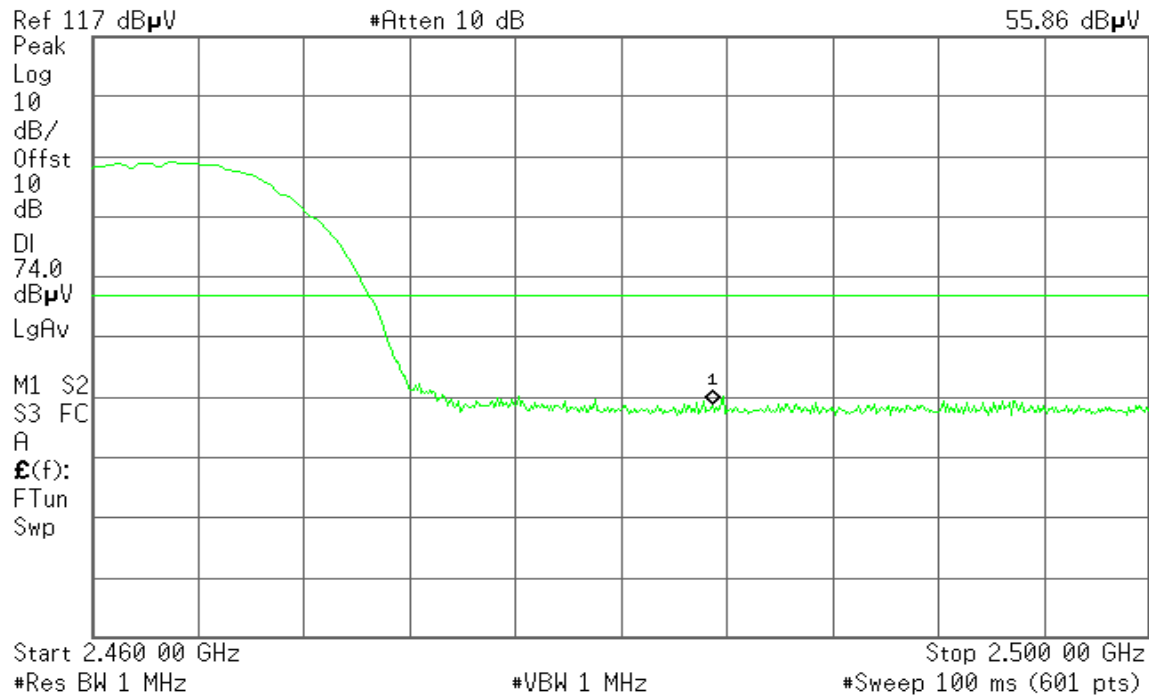
Detector mode: Peak

Polarity: Vertical

Agilent 16:36:23 Jan 5, 2009

R T

Mkr1 2.483 50 GHz  
55.86 dB $\mu$ V



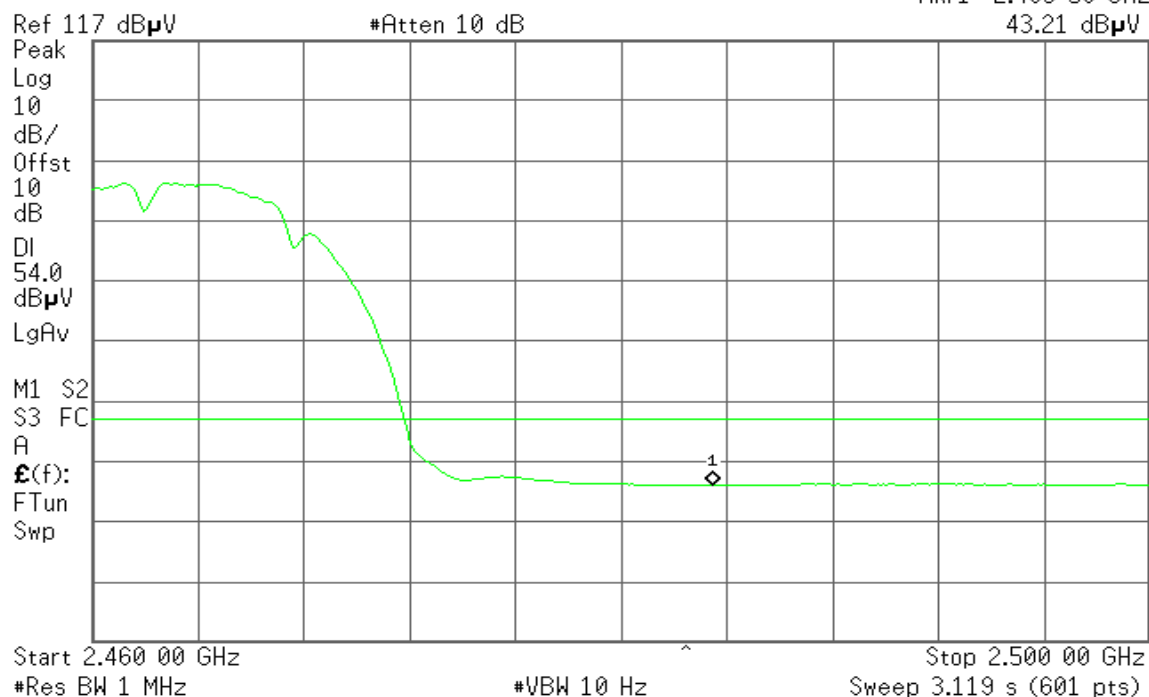
Detector mode: Average

Polarity: Vertical

Agilent 16:36:35 Jan 5, 2009

R T

Mkr1 2.483 50 GHz  
43.21 dB $\mu$ V





Detector mode: Peak

Polarity: Horizontal

Agilent 16:24:47 Jan 5, 2009

R T

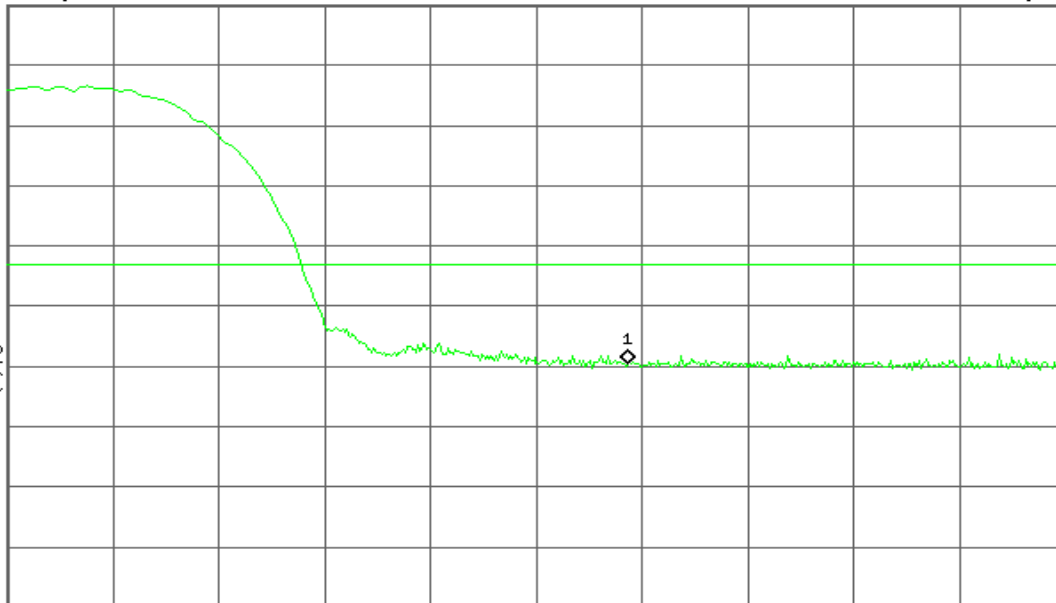
Mkr1 2.483 50 GHz  
57.59 dB $\mu$ V

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 2.460 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

Stop 2.500 00 GHz

#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Horizontal

Agilent 16:25:00 Jan 5, 2009

R T

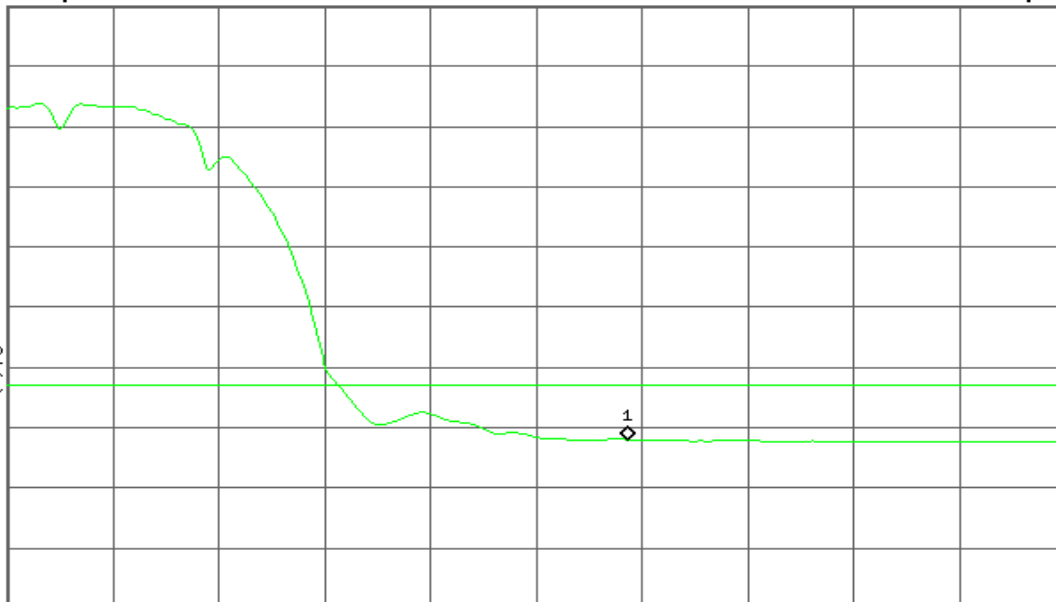
Mkr1 2.483 50 GHz  
45.00 dB $\mu$ V

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 2.460 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

Stop 2.500 00 GHz

Sweep 3.119 s (601 pts)



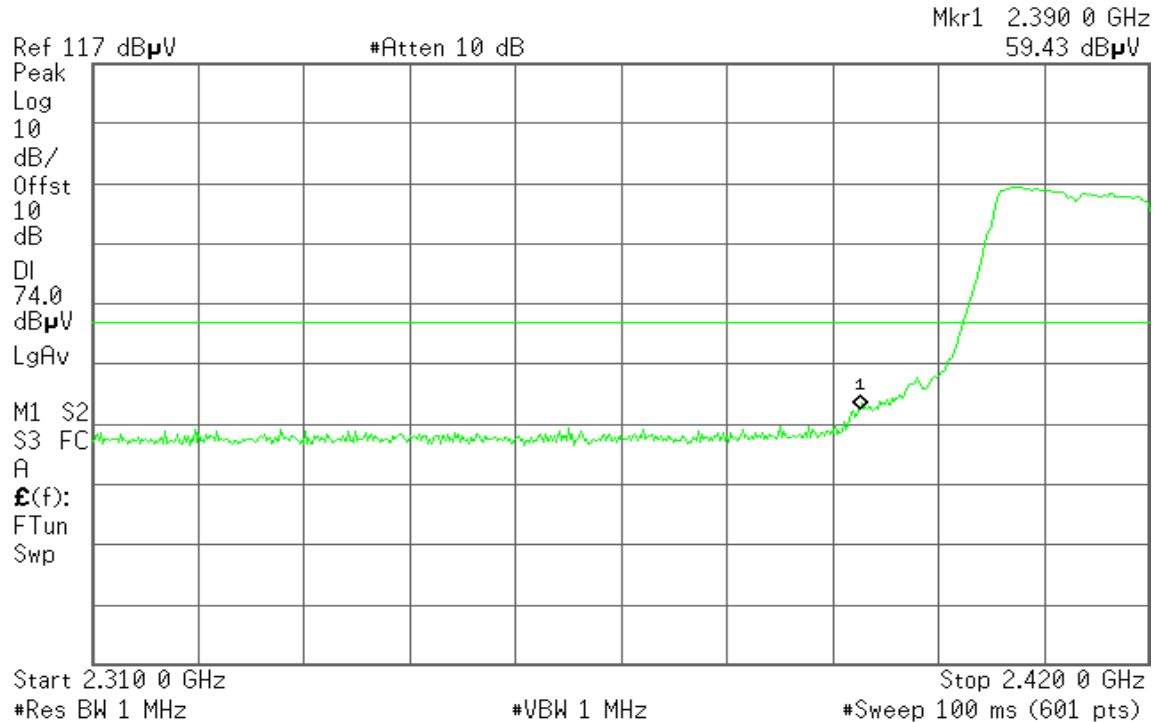
## Band Edges (IEEE 802.11g / CH Low)

Detector mode: Peak

Polarity: Vertical

Agilent 16:48:57 Jan 5, 2009

R T

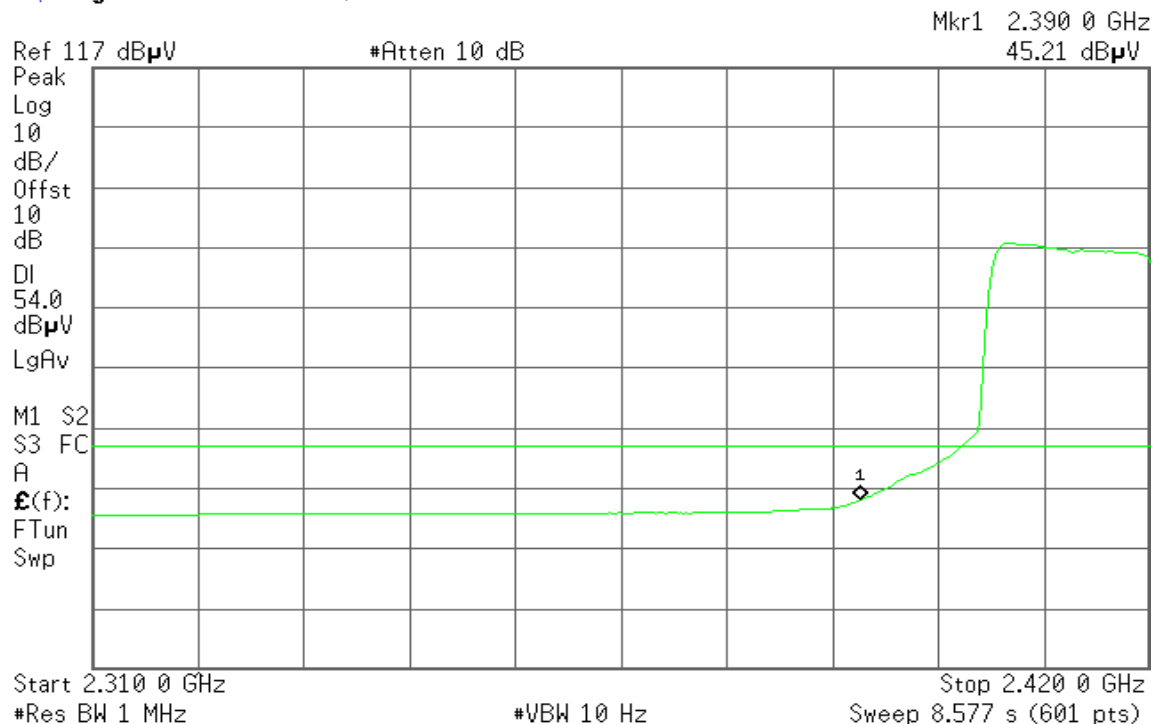


Detector mode: Average

Polarity: Vertical

Agilent 16:48:45 Jan 5, 2009

R T



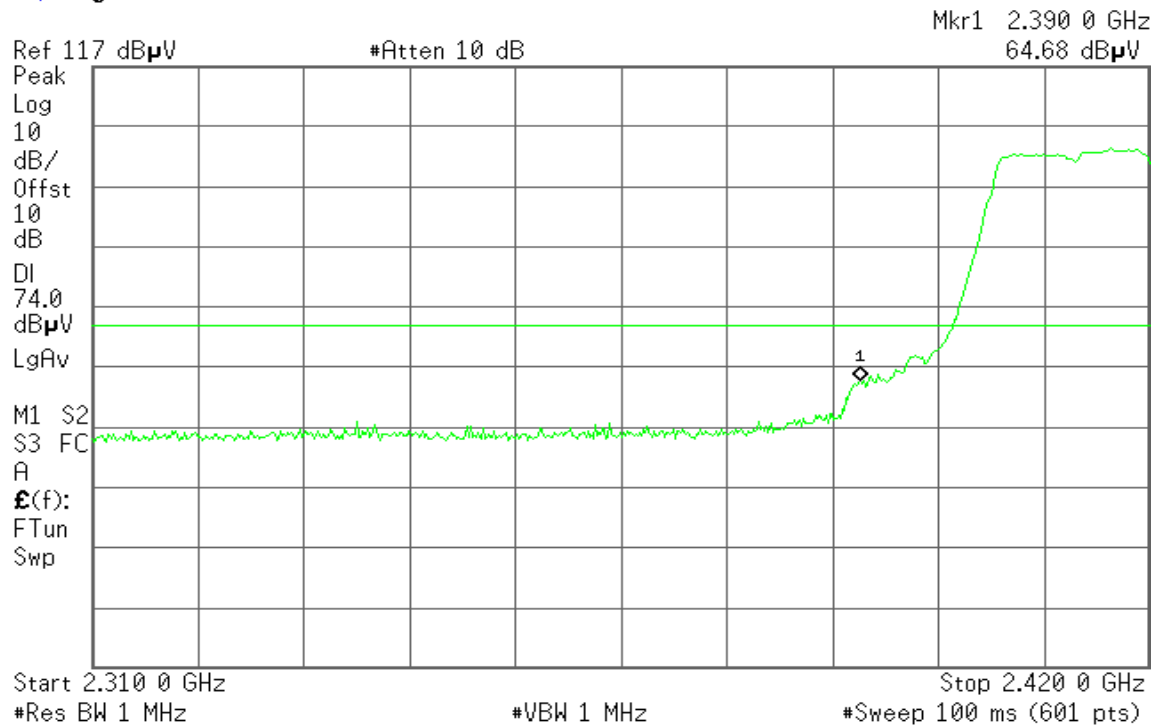


**Detector mode: Peak**

**Polarity: Horizontal**

\* Agilent 16:49:22 Jan 5, 2009

R T

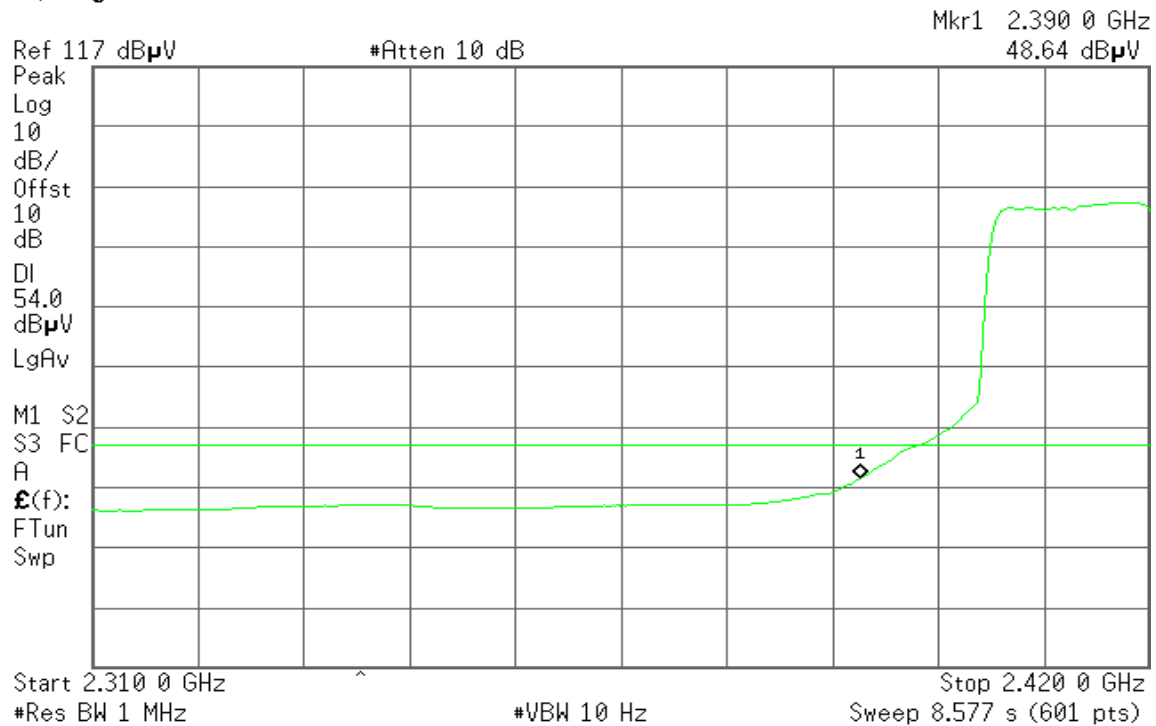


**Detector mode: Average**

**Polarity: Horizontal**

\* Agilent 16:49:39 Jan 5, 2009

R T







## Band Edges (IEEE 802.11g / CH High)

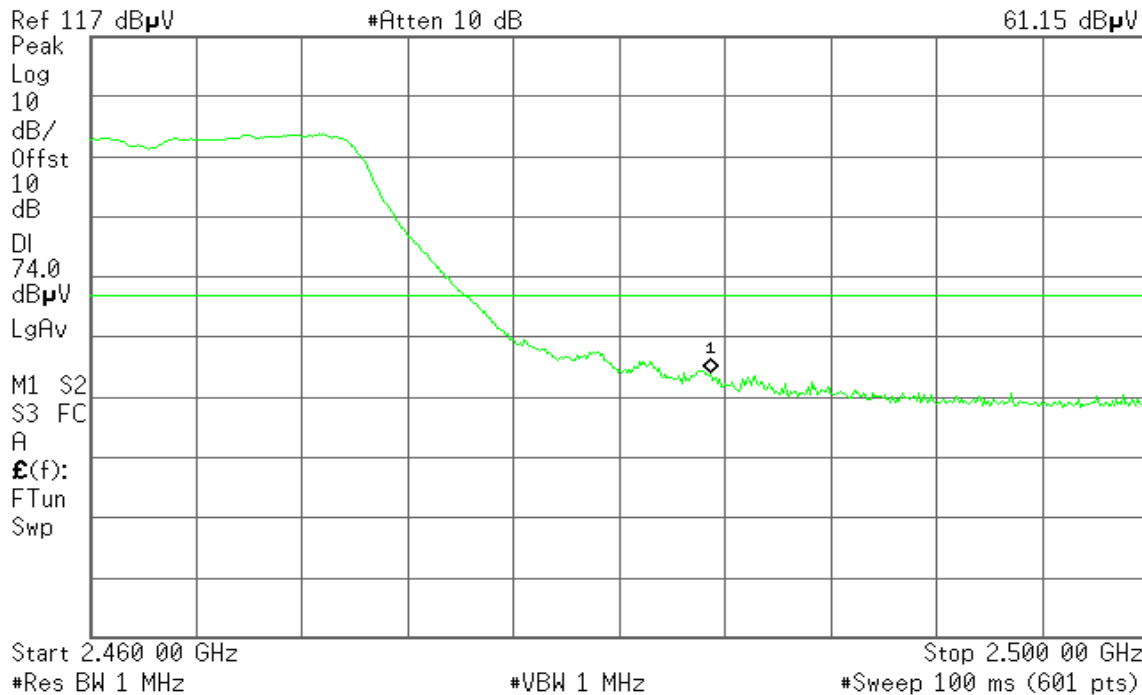
Detector mode: Peak

Polarity: Vertical

Agilent 16:29:56 Jan 5, 2009

R T

Mkr1 2.483 50 GHz  
61.15 dB $\mu$ V



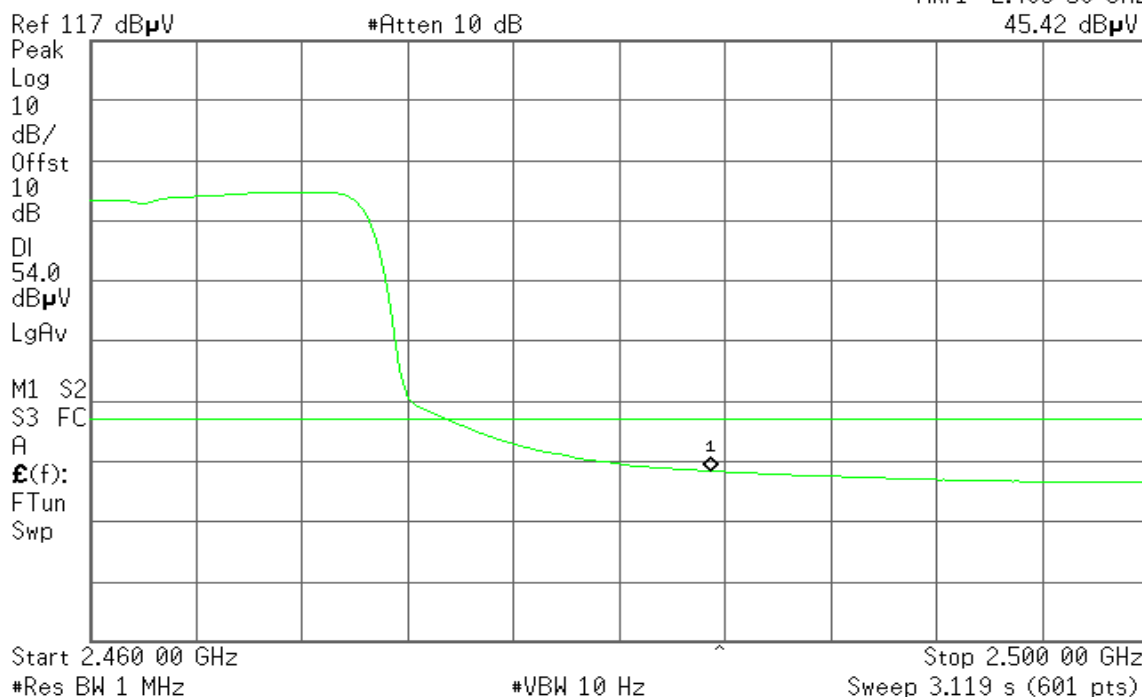
Detector mode: Average

Polarity: Vertical

Agilent 16:30:10 Jan 5, 2009

R T

Mkr1 2.483 50 GHz  
45.42 dB $\mu$ V





Detector mode: Peak

Polarity: Horizontal

Agilent 16:28:11 Jan 5, 2009

R T

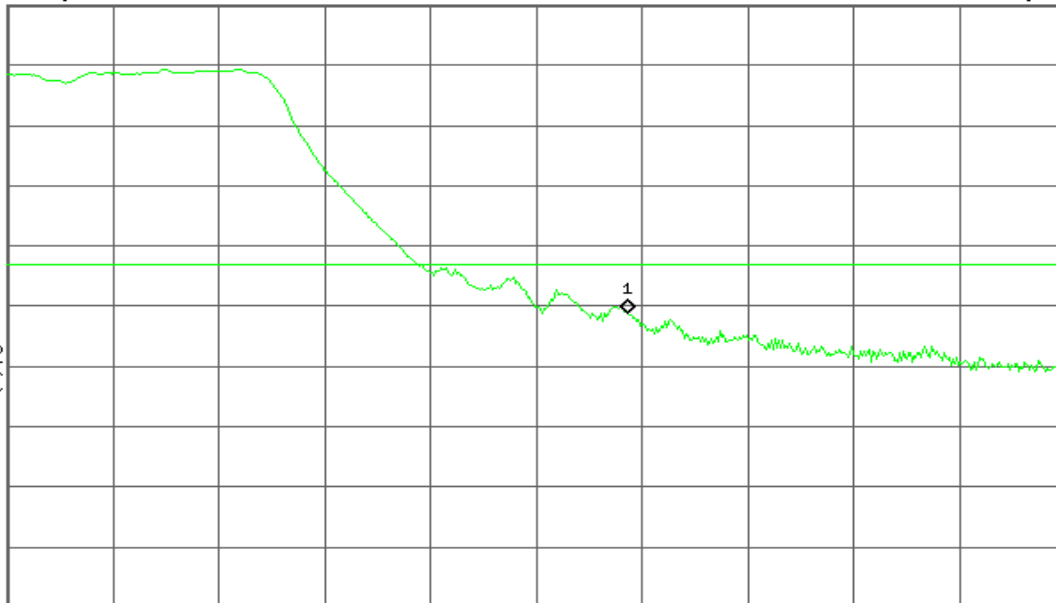
Mkr1 2.483 50 GHz  
65.85 dB $\mu$ V

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 2.460 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

Stop 2.500 00 GHz

#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Horizontal

Agilent 16:27:55 Jan 5, 2009

R T

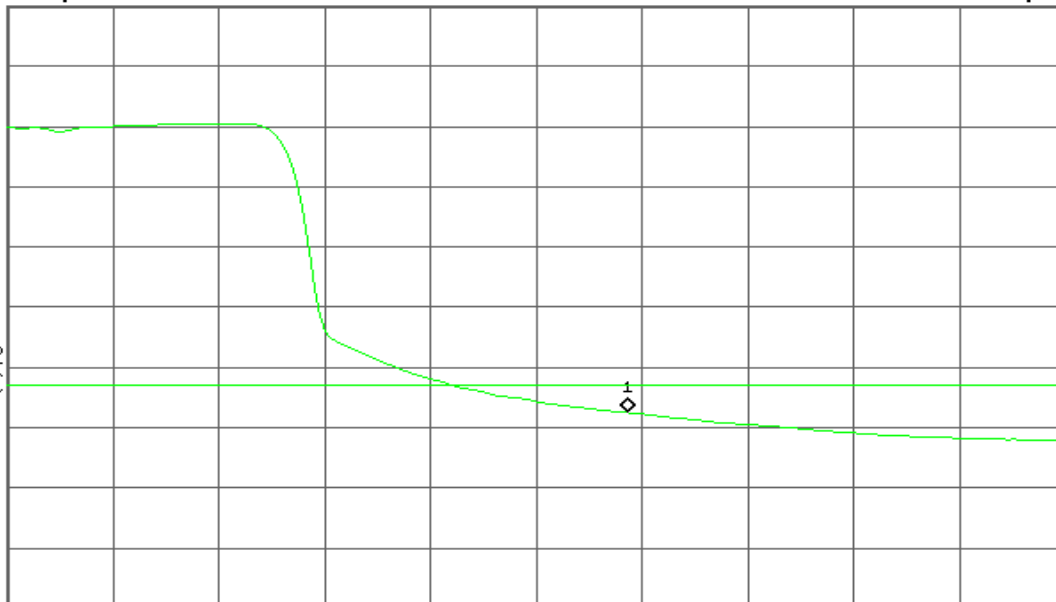
Mkr1 2.483 50 GHz  
49.52 dB $\mu$ V

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 2.460 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

Stop 2.500 00 GHz

Sweep 3.119 s (601 pts)



## 7.3 SPURIOUS EMISSIONS

### Radiated Emissions

#### LIMIT

1. According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength ( $\mu\text{V/m}$ )	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

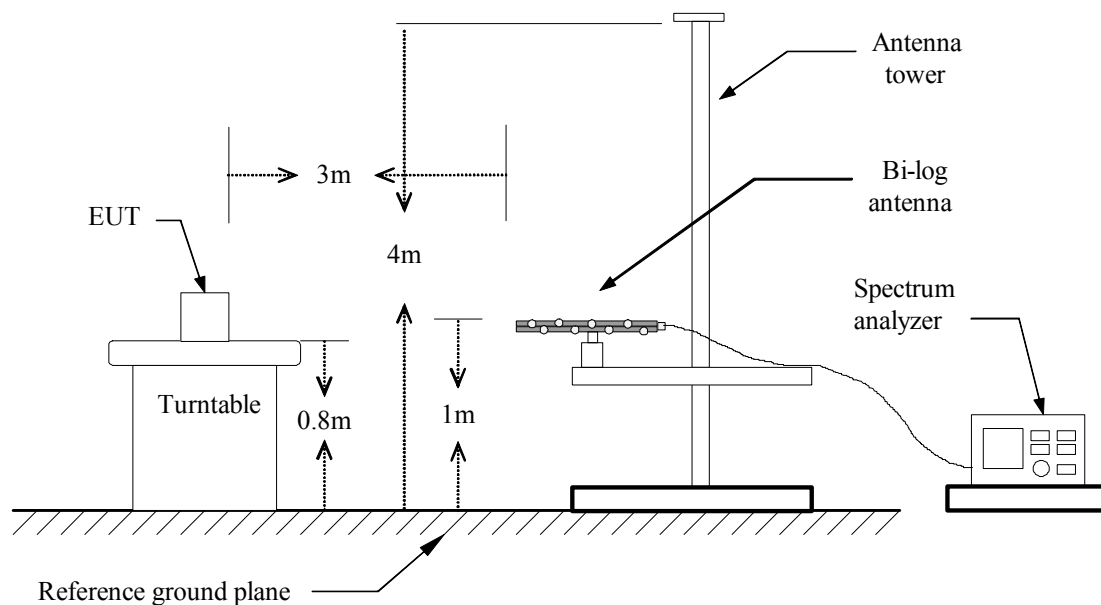
**Remark:** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections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

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

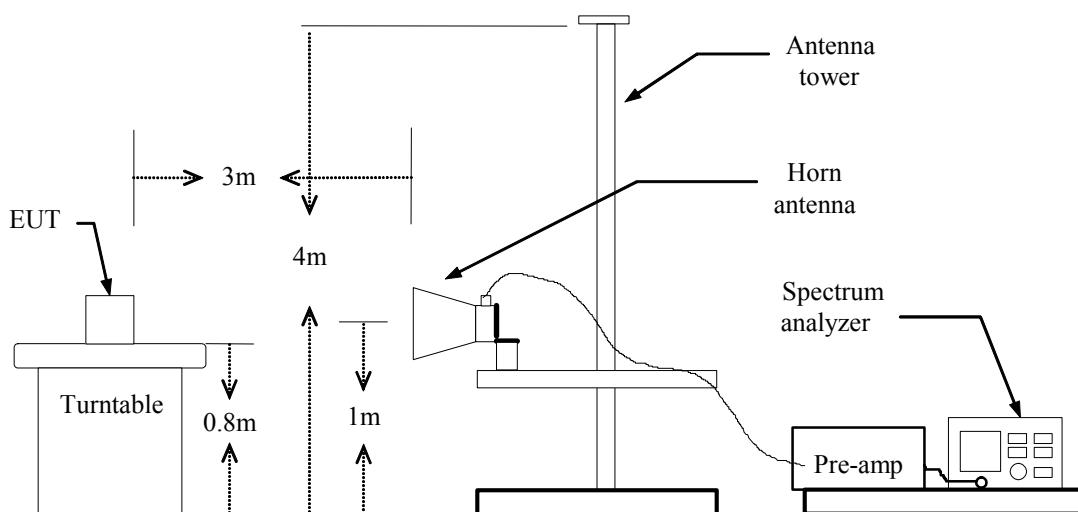
Frequency (MHz)	Field Strength ( $\mu\text{V/m}$ at 3-meter)	Field Strength (dB $\mu\text{V/m}$ at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

## Test Configuration

### Below 1 GHz



### Above 1 GHz





## **TEST PROCEDURE**

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:  
Below 1GHz:  
RBW=100kHz / VBW=300kHz / Sweep=AUTO  
Above 1GHz:  
(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO  
(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

**Below 1 GHz****Operation Mode:** Normal Link**Test Date:** January 5, 2009**Temperature:** 23°C**Tested by:** Mimic Yang**Humidity:** 53% RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
36.47	V	41.61	-6.33	35.28	40.00	-4.72	QP
47.78	V	44.90	-12.40	32.50	40.00	-7.50	QP
177.12	V	41.80	-10.85	30.96	43.50	-12.54	Peak
245.02	V	40.70	-9.80	30.91	46.00	-15.09	Peak
466.50	V	36.34	-5.12	31.22	46.00	-14.78	Peak
599.07	V	35.19	-2.48	32.71	46.00	-13.29	Peak
109.22	H	43.85	-11.16	32.69	43.50	-10.81	Peak
138.32	H	42.30	-8.85	33.45	43.50	-10.05	Peak
175.50	H	45.45	-10.79	34.66	43.50	-8.84	Peak
236.93	H	46.81	-9.89	36.93	46.00	-9.07	Peak
527.93	H	38.87	-3.48	35.39	46.00	-10.61	Peak
799.53	H	36.58	0.42	36.99	46.00	-9.01	Peak

***Remark:***

- 1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)*
- 2. Measuring frequencies from 30 MHz to the 1GHz.*
- 3. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.*
- 4. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.*
- 5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
- 6. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).*

**Above 1 GHz****Operation Mode:** IEEE 802.11b / TX / CH Low**Test Date:** January 5, 2009**Temperature:** 23°C**Tested by:** Mimic Yang**Humidity:** 53 % 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
1223.33	V	59.25	---	-9.01	50.23	---	74.00	54.00	-3.77	Peak
N/A										
1223.33	H	59.42	---	-9.01	50.41	---	74.00	54.00	-3.59	Peak
N/A										

**Remark:**

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)
2. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
4. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
5. 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.
6. 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.
7. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Operation Mode:** IEEE 802.11b / TX / CH Mid**Test Date:** January 5, 2009**Temperature:** 23°C**Tested by:** Mimic Yang**Humidity:** 53 % 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
1263.33	V	59.88	---	-8.92	50.96	---	74.00	54.00	-3.04	Peak
N/A										
1263.33	H	59.58	---	-8.92	50.66	---	74.00	54.00	-3.34	Peak
N/A										

**Remark:**

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)
2. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
4. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
5. 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.
6. 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.
7. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).



**Operation Mode:** IEEE 802.11b / TX / CH High**Test Date:** January 5, 2009**Temperature:** 23°C**Tested by:** Mimic Yang**Humidity:** 53 % 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
1270.00	V	59.39	---	-8.90	50.49	---	74.00	54.00	-3.51	Peak
N/A										
1230.00	H	58.90	---	-9.00	49.91	---	74.00	54.00	-4.09	Peak
N/A										

**Remark:**

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)
2. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
4. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
5. 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.
6. 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.
7. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Operation Mode:** IEEE 802.11g / TX / CH Low**Test Date:** January 5, 2009**Temperature:** 23°C**Tested by:** Mimic Yang**Humidity:** 53 % 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
1230.00	V	59.35	---	-9.00	50.35	---	74.00	54.00	-3.65	Peak
N/A										
1253.33	H	59.58	---	-8.94	50.63	---	74.00	54.00	-3.37	Peak
N/A										

**Remark:**

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)
2. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
4. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
5. 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.
6. 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.
7. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Operation Mode:** IEEE 802.11g / TX / CH Mid**Test Date:** January 5, 2009**Temperature:** 23°C**Tested by:** Mimic Yang**Humidity:** 53 % 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
1243.33	V	59.48	---	-8.97	50.52	---	74.00	54.00	-3.48	Peak
N/A										
1226.67	H	59.89	---	-9.01	50.88	---	74.00	54.00	-3.12	Peak
N/A										

**Remark:**

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)
2. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
4. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
5. 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.
6. 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.
7. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Operation Mode:** IEEE 802.11g / TX / CH High**Test Date:** January 5, 2009**Temperature:** 23°C**Tested by:** Mimic Yang**Humidity:** 53 % 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
1373.33	V	60.01	---	-8.66	51.35	---	74.00	54.00	-2.65	Peak
N/A										
1266.67	H	59.34	---	-8.91	50.43	---	74.00	54.00	-3.57	Peak
N/A										

**Remark:**

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)
2. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
4. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
5. 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.
6. 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.
7. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).



## 7.4 POWERLINE CONDUCTED EMISSIONS

### **LIMIT**

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (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

### **Test Configuration**

See test photographs attached in Appendix II 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:** January 20, 2009

**Temperature:** 22°C

**Tested by:** Leo Shi

**Humidity:** 45% RH

Frequency (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
0.2000	48.14	39.24	0.16	48.30	39.40	63.61	53.61	-15.31	-14.21	L1
0.2650	44.67	41.07	0.13	44.80	41.20	61.27	51.27	-16.47	-10.07	L1
0.3350	42.50	34.50	0.10	42.60	34.60	59.33	49.33	-16.73	-14.73	L1
0.4038	45.53	43.03	0.07	45.60	43.10	57.77	47.77	-12.17	-4.67	L1
0.5350	41.07	39.67	0.03	41.10	39.70	56.00	46.00	-14.90	-6.30	L1
3.3650	35.68	30.58	0.12	35.80	30.70	56.00	46.00	-20.20	-15.30	L1
0.1516	41.61	20.41	0.19	41.80	20.60	65.91	55.91	-24.11	-35.31	L2
0.2000	48.25	39.45	0.15	48.40	39.60	63.61	53.61	-15.21	-14.01	L2
0.2700	44.28	41.68	0.12	44.40	41.80	61.12	51.12	-16.72	-9.32	L2
0.4000	45.23	43.33	0.07	45.30	43.40	57.85	47.85	-12.55	-4.45	L2
0.5350	41.07	39.97	0.03	41.10	40.00	56.00	46.00	-14.90	-6.00	L2
30.0000	40.57	39.77	1.03	41.60	40.80	60.00	50.00	-18.40	-9.20	L2

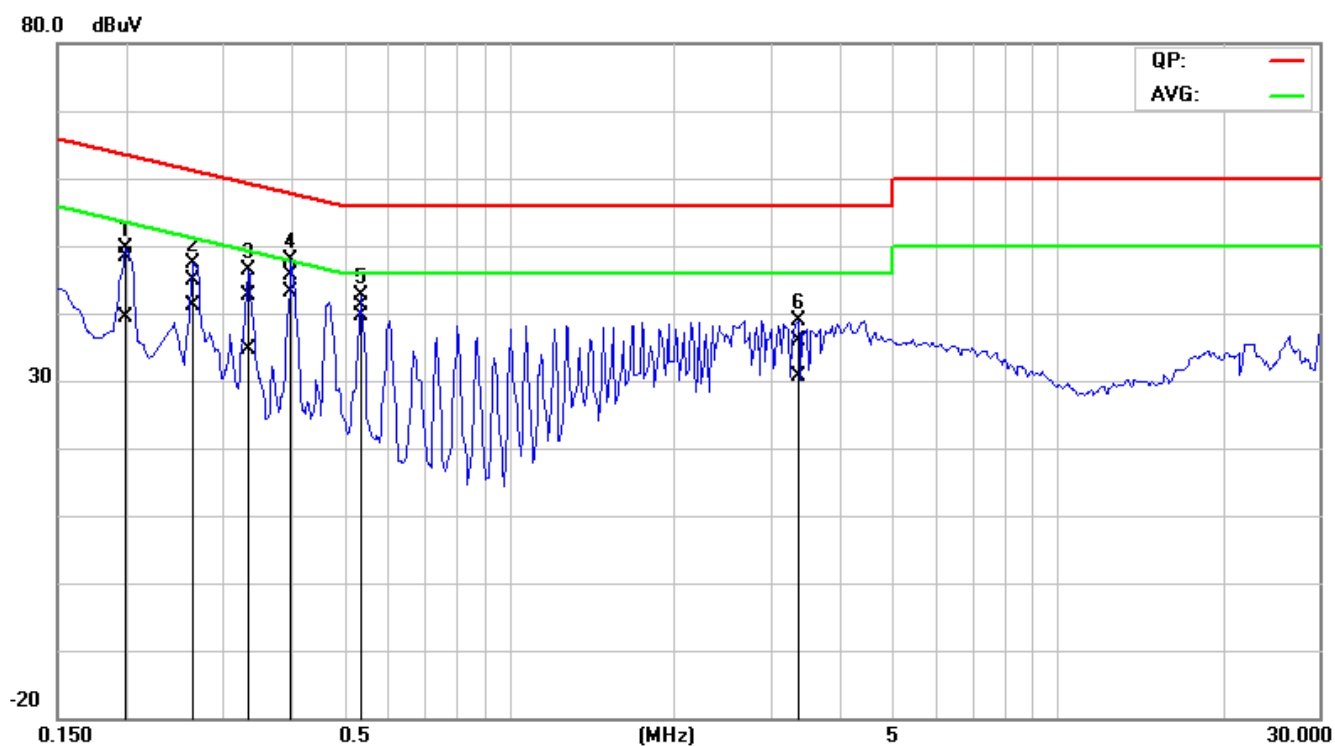
### Remark:

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)

