



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

**TEST REPORT**

**For**

**MiniPCIexpress 802.11 b/g transceiver**

**Model: AR5BHB63  
(Tested inside of Notebook PC, Model No.: ZM1)**

**Trade Name: Atheros**

*Issued to*

**Atheros Communications, Inc.  
5480 Great America Parkway  
Santa Clara CA 95054**

*Issued by*

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

**Applicant:** Atheros Communications, Inc.  
 5480 Great America Parkway  
 Santa Clara CA 95054

**Equipment Under Test:** MiniPCIexpress 802.11 b/g transceiver

**Trade Name:** Atheros

**Model:** AR5BHB63  
 (Tested inside of Notebook PC, Model No.: ZM1)

**Date of Test:** May 8 ~ 14, 2009

| APPLICABLE STANDARDS               |                         |
|------------------------------------|-------------------------|
| STANDARD                           | TEST RESULT             |
| FCC 47 CFR Part 15 Subpart C       | No non-compliance noted |
| Deviation from Applicable Standard |                         |
| N/A                                |                         |

### 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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Gina Lo  
 Section Manager  
 Compliance Certification Services Inc.



## 2. EUT DESCRIPTION

|                                   |                                                                                                                                                                                                                                         |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product</b>                    | MiniPCIexpress 802.11 b/g transceiver                                                                                                                                                                                                   |
| <b>Trade Name</b>                 | Atheros                                                                                                                                                                                                                                 |
| <b>Model Number</b>               | AR5BHB63<br>(Tested inside of Notebook PC, Model No.: ZM1)                                                                                                                                                                              |
| <b>Model Discrepancy</b>          | N/A                                                                                                                                                                                                                                     |
| <b>Power Supply</b>               | VDC from Power Adapter                                                                                                                                                                                                                  |
| <b>Frequency Range</b>            | 2412 ~ 2462 MHz                                                                                                                                                                                                                         |
| <b>Transmit Power</b>             | IEEE 802.11b: 19.12 dBm<br>IEEE 802.11g: 20.77 dBm                                                                                                                                                                                      |
| <b>Modulation Technique</b>       | IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK)<br>IEEE 802.11g: DSSS (CCK, DQPSK, DBPSK) +<br>OFDM (QPSK, BPSK, 16-QAM, 64-QAM)                                                                                                                 |
| <b>Transmit Data Rate</b>         | IEEE 802.11b Mode: 11, 5.5, 2, 1 Mbps<br>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>      | 1. PIFA Antenna / Gain: 3.10 dBi<br>2. PIFA Antenna / Gain: 1.67 dBi                                                                                                                                                                    |
| <b>Class II Permissive Change</b> | 1. Addition of Portable Category Classification.<br>2. This module is designed in 2.4GHz frequency band & the antenna is designed to be dual band which are 2.4GHz & 5GHz, needs to reduce output power to lowdown 2.4GHz 2nd harmonic. |

### 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: **PPD-AR5BHB63** 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: 2003 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: 2003.



### 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: AR5BHB63) 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.

IEEE 802.11b mode:

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

IEEE 802.11g mode:

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

About reduce output power; please see the detail as list below.

#### Test mode: IEEE 802.11b

| Channel | Frequency (MHz) | Original Output Power (dBm) | New Output Power (dBm) | Reduce Output Power (dBm) |
|---------|-----------------|-----------------------------|------------------------|---------------------------|
| Low     | 2412            | 21.80                       | 16.53                  | 5.27                      |
| Mid     | 2437            | 22.71                       | 19.06                  | 3.65                      |
| High    | 2462            | 22.54                       | 19.12                  | 3.42                      |

#### Test mode: IEEE 802.11g

| Channel | Frequency (MHz) | Original Output Power (dBm) | New Output Power (dBm) | Reduce Output Power (dBm) |
|---------|-----------------|-----------------------------|------------------------|---------------------------|
| Low     | 2412            | 22.17                       | 15.80                  | 6.37                      |
| Mid     | 2437            | 22.96                       | 20.77                  | 2.19                      |
| High    | 2462            | 21.36                       | 17.22                  | 4.14                      |



### 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    | 03/05/2010      |

| 3M Semi Anechoic Chamber |                 |                   |                                      |                          |
|--------------------------|-----------------|-------------------|--------------------------------------|--------------------------|
| Name of Equipment        | Manufacturer    | Model             | Serial Number                        | Calibration Due          |
| Spectrum Analyzer        | Agilent         | E4446A            | US42510252                           | 09/10/2009               |
| Test Receiver            | Rohde&Schwarz   | ESCI              | 100064                               | 11/30/2009               |
| Switch Controller        | TRC             | Switch Controller | SC94050010                           | N.C.R.                   |
| 4 Port Switch            | TRC             | 4 Port Switch     | SC94050020                           | N.C.R.                   |
| Loop Antenna             | EMCO            | 6502              | 8905/2356                            | 05/29/2009               |
| Horn-Antenna             | TRC             | HA-0502           | 06                                   | 06/04/2009               |
| Horn-Antenna             | TRC             | HA-0801           | 04                                   | 06/18/2009               |
| Horn-Antenna             | TRC             | HA-1201A          | 01                                   | 10/15/2009               |
| Horn-Antenna             | TRC             | HA-1301A          | 01                                   | 10/15/2009               |
| Bilog- Antenna           | Sunol Sciences  | JB3               | A030205                              | 03/27/2010               |
| 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<br>IC: IC 2324G-1/-2 | 10/17/2010<br>11/04/2010 |
| Test S/W                 | LABVIEW (V 6.1) |                   |                                      |                          |





### 4.3 MEASUREMENT UNCERTAINTY

| PARAMETER                               | UNCERTAINTY |
|-----------------------------------------|-------------|
| 3M Semi Anechoic Chamber / 30MHz ~ 1GHz | +/-3.7046   |
| 3M Semi Anechoic Chamber / Above 1GHz   | +/-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                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <br>FCC MRA: TW1039            |
| Taiwan  | TAF             | LP0002, RTTE01, FCC Method-47 CFR Part 15 Subpart C, D, E, RSS-210, RSS-310<br>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<br>FCC OET Bulletin 65 + Supplement C,<br>EN 50360, EN 50361, EN 50371, RSS 102, EN 50383, EN 50385, EN 50392, IEC 62209, CNS 14958-1, CNS 14959<br>FCC Method -47 CFR Part 15 Subpart B<br>IEC / EN 61000-3-2, IEC / EN 61000-3-3,<br>IEC / EN 61000-4-2/3/4/5/6/8/11 | <br>Testing Laboratory<br>1309 |
| Canada  | Industry Canada | 3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <br>IC 2324G-1<br>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 II 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 |
|-----|-------------|-------|-------|------------|--------|------------|------------|
|     | N/A         | N/A   | N/A   | N/A        | N/A    | N/A        | 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

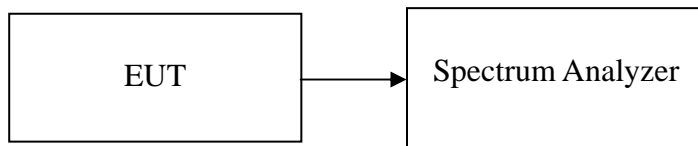
### 7.1 PEAK POWER

#### 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. Peak power is measured using the spectrum analyzer's internal channel power integration function.
2. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

#### TEST RESULTS

*No non-compliance noted.*



**Test Data**

**Test mode: IEEE 802.11b**

| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (W) | Limit (W) | Result |
|---------|-----------------|--------------------|------------------|-----------|--------|
| Low     | 2412            | 16.53              | 0.0450           | 1.00      | PASS   |
| Mid     | 2437            | 19.06              | 0.0805           |           | PASS   |
| High    | 2462            | 19.12              | 0.0817           |           | PASS   |

**Test mode: IEEE 802.11g**

| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (W) | Limit (W) | Result |
|---------|-----------------|--------------------|------------------|-----------|--------|
| Low     | 2412            | 15.80              | 0.0380           | 1.00      | PASS   |
| Mid     | 2437            | 20.77              | 0.1194           |           | PASS   |
| High    | 2462            | 17.22              | 0.0527           |           | PASS   |



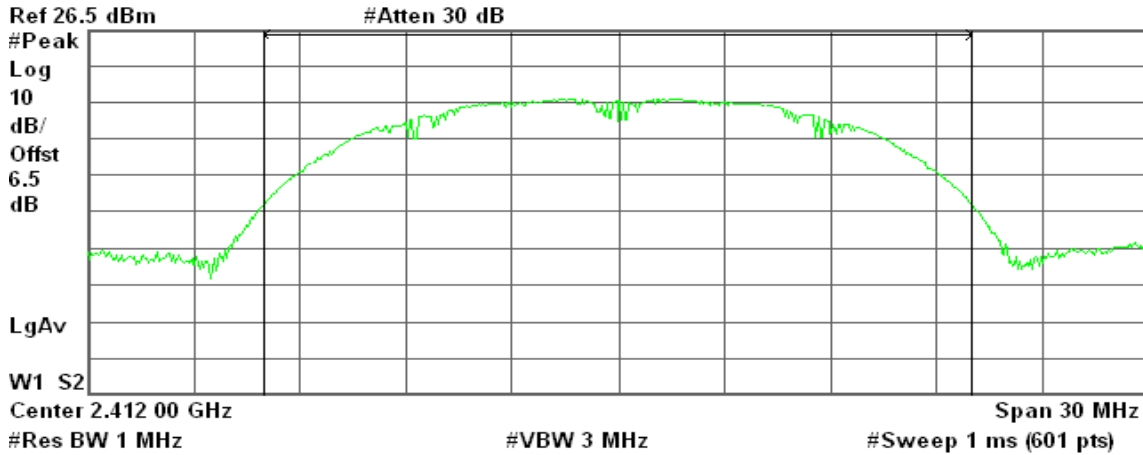
**Test Plot**

**IEEE 802.11b**

**Peak Power (CH Low)**

Agilent 16:43:39 May 14, 2009

R T



Channel Power

16.53 dBm / 20.0000 MHz

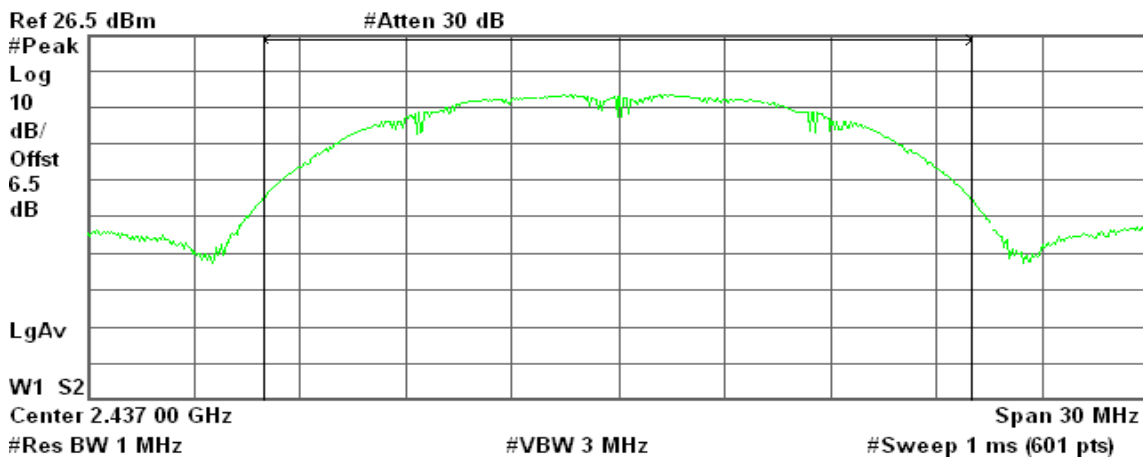
Power Spectral Density

-56.48 dBm/Hz

**Peak Power (CH Mid)**

Agilent 16:44:05 May 14, 2009

R T



Channel Power

19.06 dBm / 20.0000 MHz

Power Spectral Density

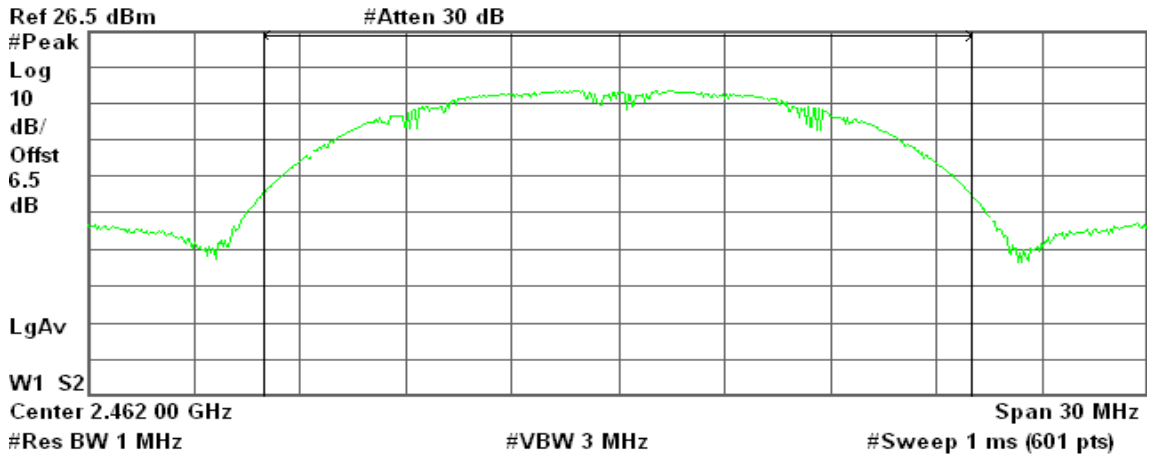
-53.95 dBm/Hz



### Peak Power (CH High)

Agilent 16:44:54 May 14, 2009

R T



Channel Power

19.12 dBm / 20.0000 MHz

Power Spectral Density

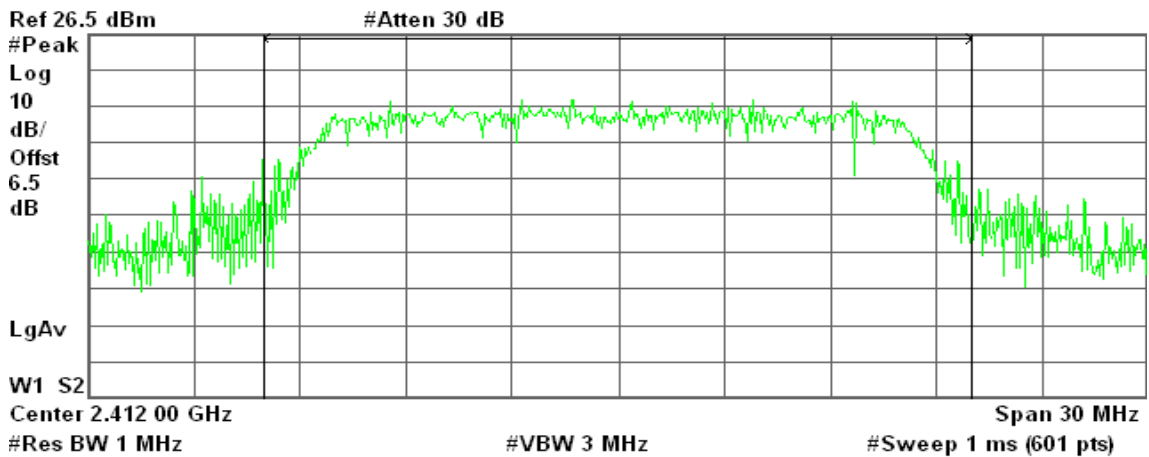
-53.89 dBm/Hz

### IEEE 802.11g

#### Peak Power (CH Low)

Agilent 16:42:41 May 14, 2009

R T



Channel Power

15.80 dBm / 20.0000 MHz

Power Spectral Density

-57.21 dBm/Hz

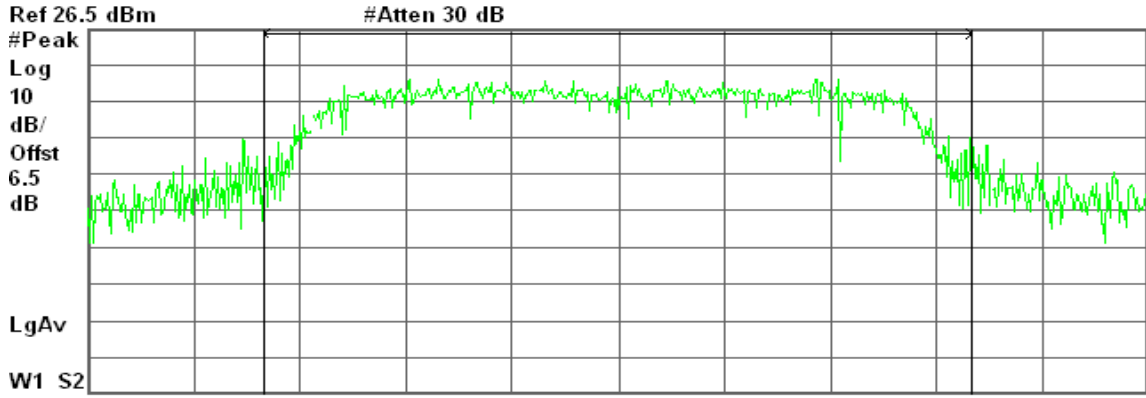




### Peak Power (CH Mid)

Agilent 16:40:55 May 14, 2009

R T



Center 2.437 00 GHz Span 30 MHz  
 #Res BW 1 MHz #VBW 3 MHz #Sweep 1 ms (601 pts)

Channel Power

20.77 dBm / 20.0000 MHz

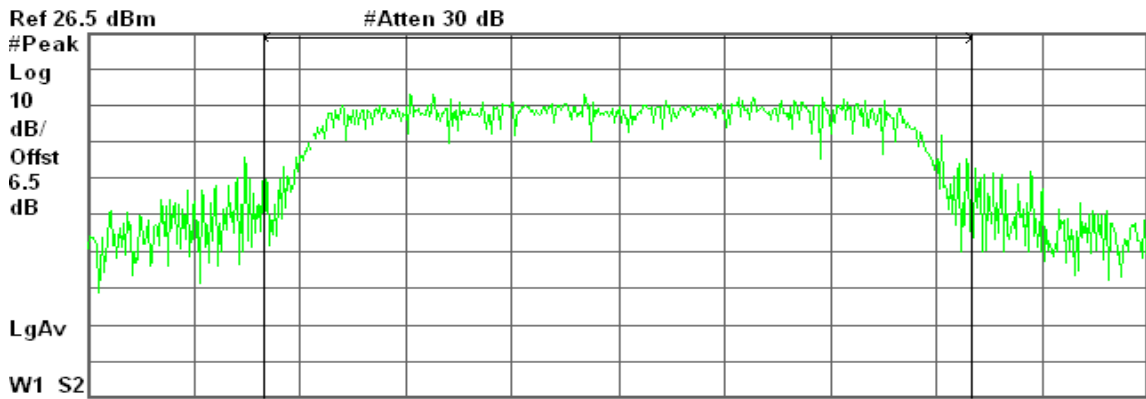
Power Spectral Density

-52.24 dBm/Hz

### Peak Power (CH High)

Agilent 16:42:03 May 14, 2009

R T



Center 2.462 00 GHz Span 30 MHz  
 #Res BW 1 MHz #VBW 3 MHz #Sweep 1 ms (601 pts)

Channel Power

17.22 dBm / 20.0000 MHz

Power Spectral Density

-55.79 dBm/Hz

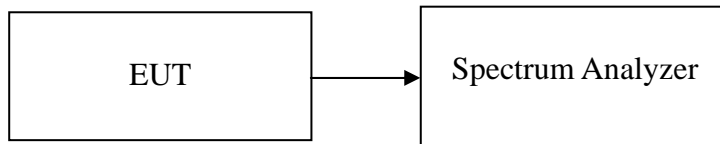


## 7.2 AVERAGE POWER

### LIMIT

None; for reporting purposes only.

### Test Configuration



### TEST PROCEDURE

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

### TEST RESULTS

*No non-compliance noted.*



**Test Data**

**Test mode: IEEE 802.11b mode**

| Channel | Frequency (MHz) | Output Power (dBm) |
|---------|-----------------|--------------------|
| Low     | 2412            | 13.77              |
| Mid     | 2437            | 16.39              |
| High    | 2462            | 16.55              |

**Test mode: IEEE 802.11g mode**

| Channel | Frequency (MHz) | Output Power (dBm) |
|---------|-----------------|--------------------|
| Low     | 2412            | 12.02              |
| Mid     | 2437            | 16.79              |
| High    | 2462            | 13.27              |



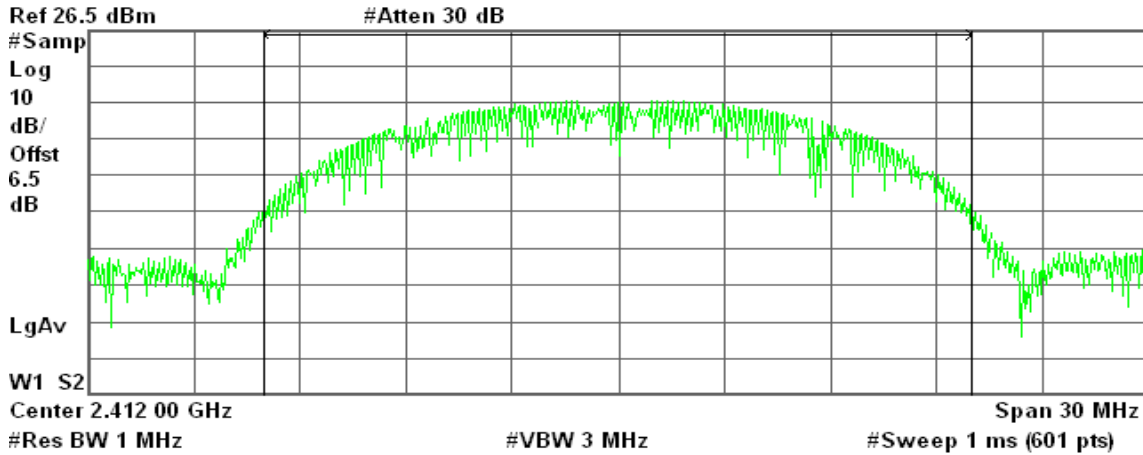
**Test Plot**

**IEEE 802.11b**

**Average Power (CH Low)**

Agilent 16:43:21 May 14, 2009

R T



Channel Power

13.77 dBm / 20.0000 MHz

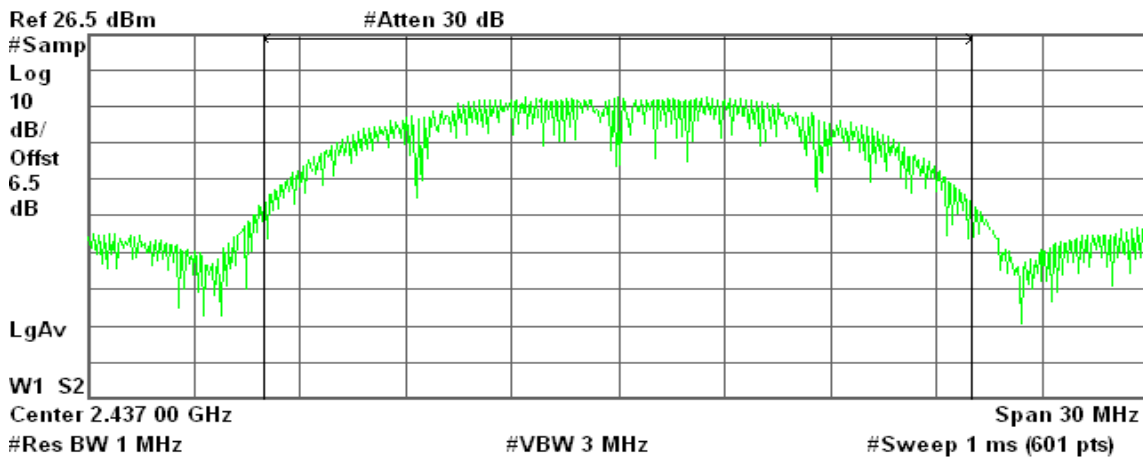
Power Spectral Density

-59.24 dBm/Hz

**Average Power (CH Mid)**

Agilent 16:44:20 May 14, 2009

R T



Channel Power

16.39 dBm / 20.0000 MHz

Power Spectral Density

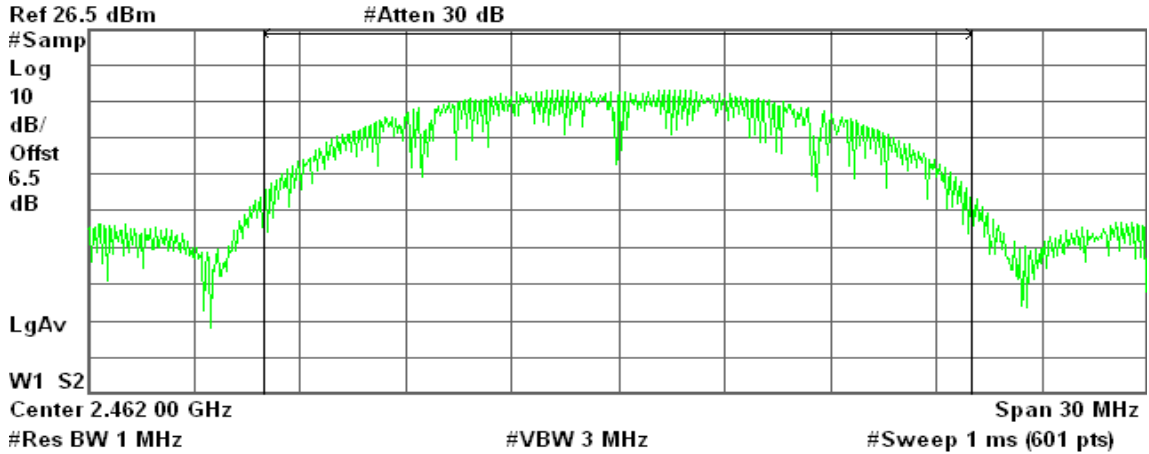
-56.62 dBm/Hz



### Average Power (CH High)

Agilent 16:44:41 May 14, 2009

R T



Channel Power

16.55 dBm / 20.0000 MHz

Power Spectral Density

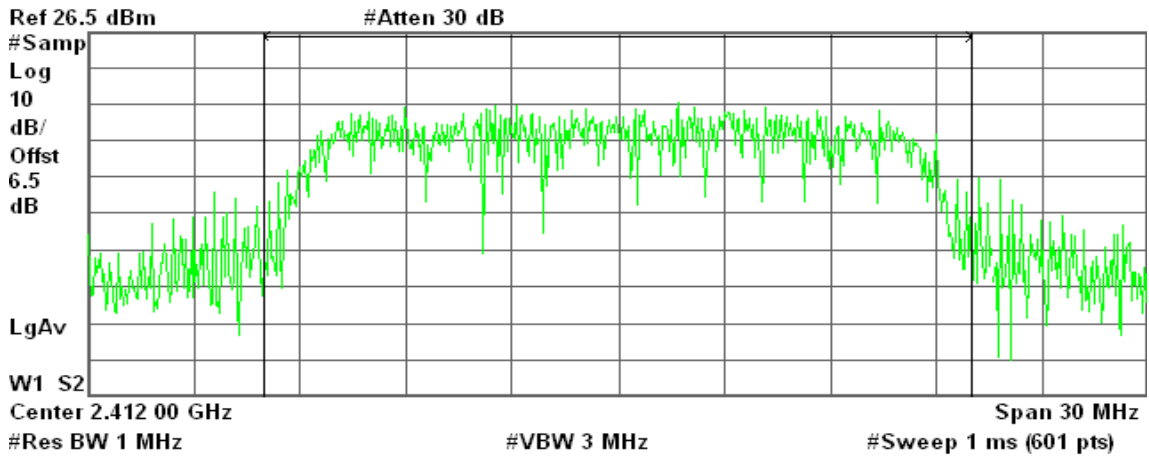
-56.46 dBm/Hz

### IEEE 802.11g

#### Average Power (CH Low)

Agilent 16:42:59 May 14, 2009

R T



Channel Power

12.02 dBm / 20.0000 MHz

Power Spectral Density

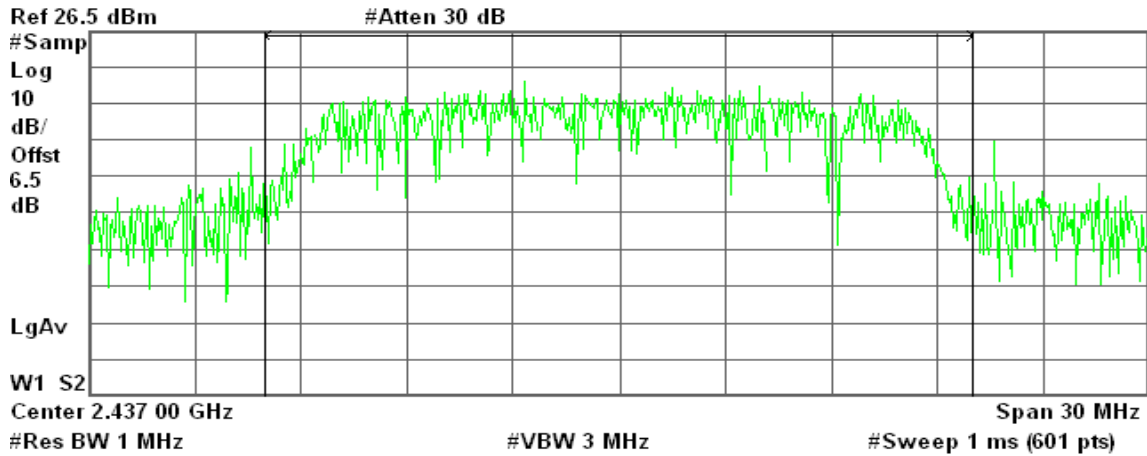
-60.99 dBm/Hz



### Average Power (CH Mid)

Agilent 16:41:17 May 14, 2009

R T



Channel Power

16.79 dBm / 20.0000 MHz

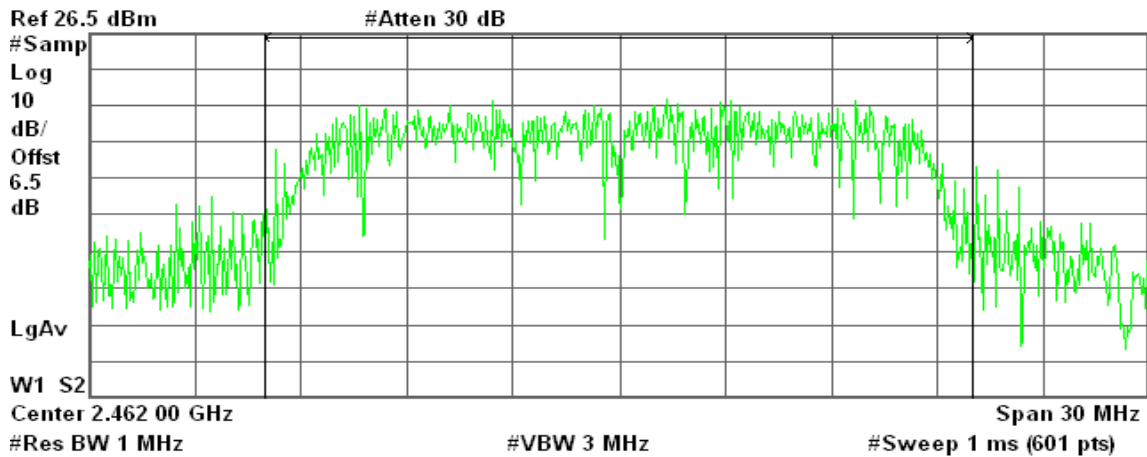
Power Spectral Density

-56.22 dBm/Hz

### Average Power (CH High)

Agilent 16:41:47 May 14, 2009

R T



Channel Power

13.27 dBm / 20.0000 MHz

Power Spectral Density

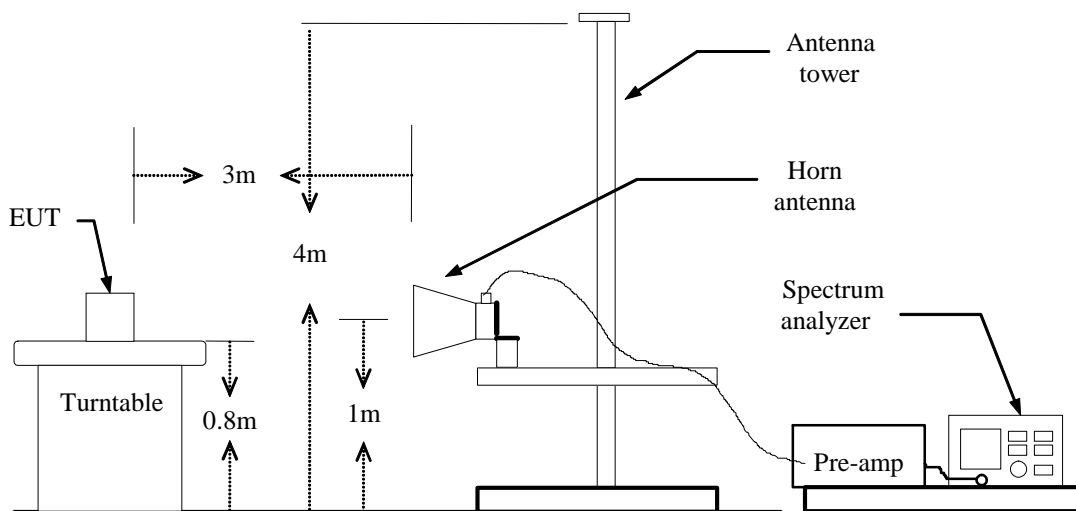
-59.74 dBm/Hz

## 7.3 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

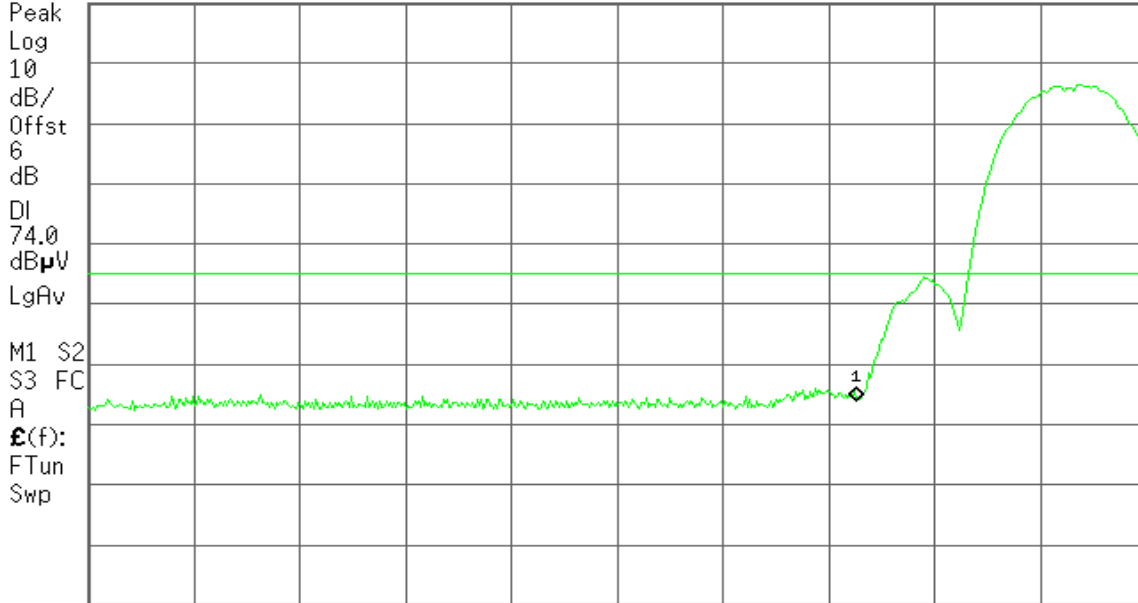
Agilent

R T

Mkr1 2.390 0 GHz  
53.02 dBμV

Ref 119 dBμV

#Atten 16 dB



Start 2.310 0 GHz

Stop 2.420 0 GHz

#Res BW 1 MHz

#VBW 1 MHz

#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Vertical

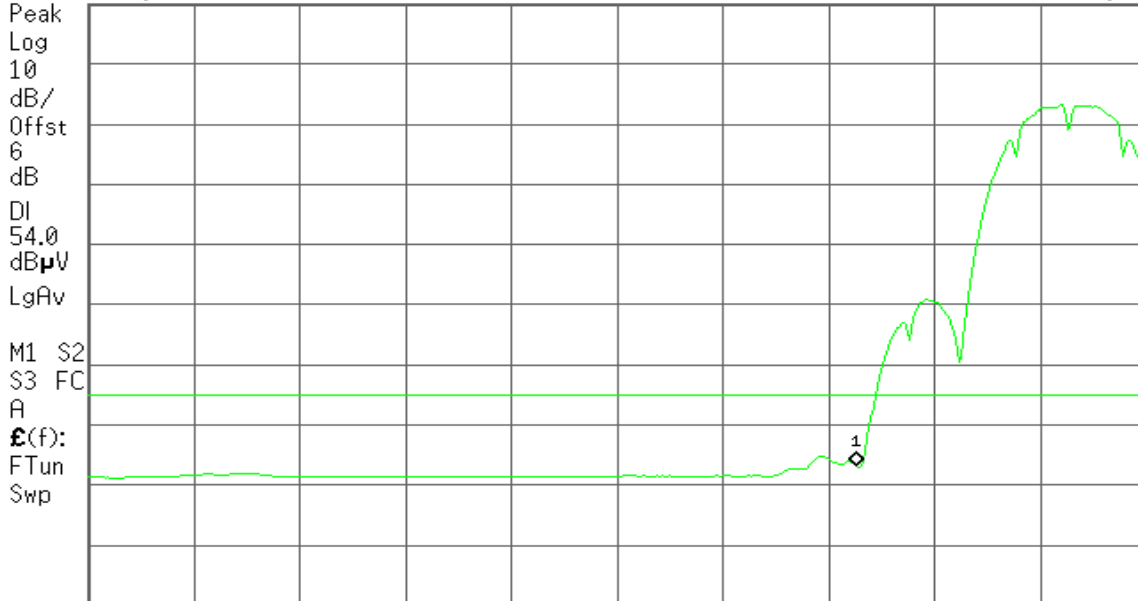
Agilent

R T

Mkr1 2.390 0 GHz  
42.27 dBμV

Ref 119 dBμV

#Atten 16 dB



Start 2.310 0 GHz

Stop 2.420 0 GHz

#Res BW 1 MHz

#VBW 10 Hz

Sweep 8.577 s (601 pts)



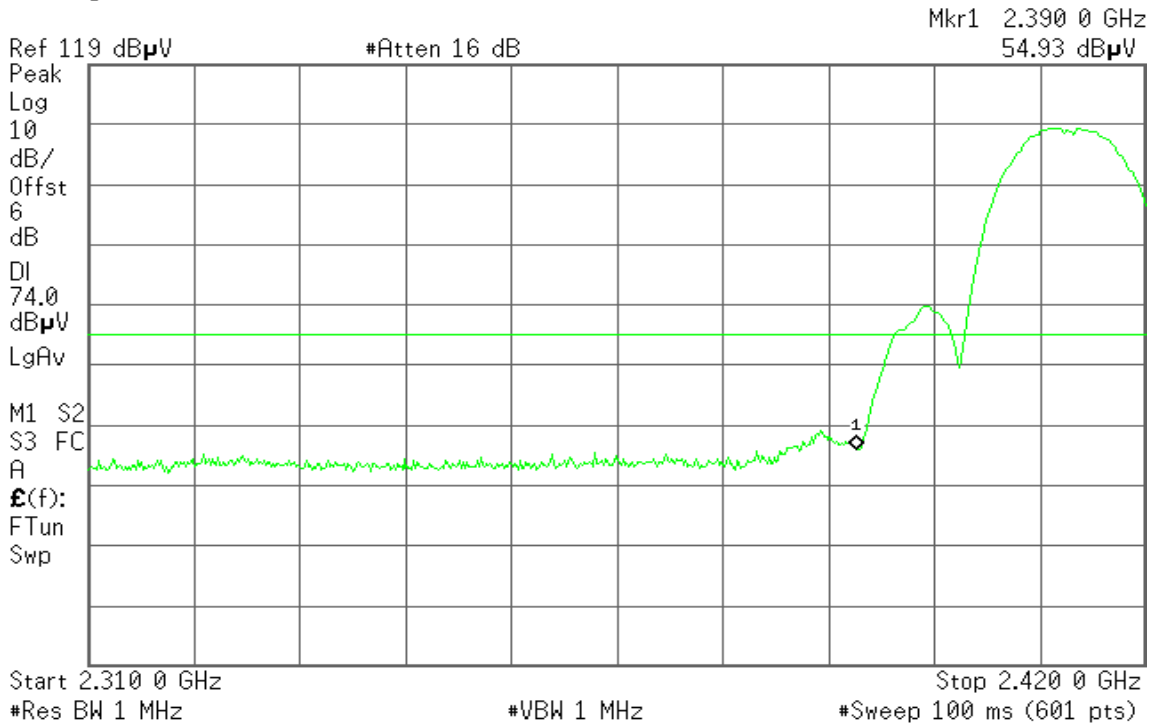


Detector mode: Peak

Polarity: Horizontal

Agilent

R T

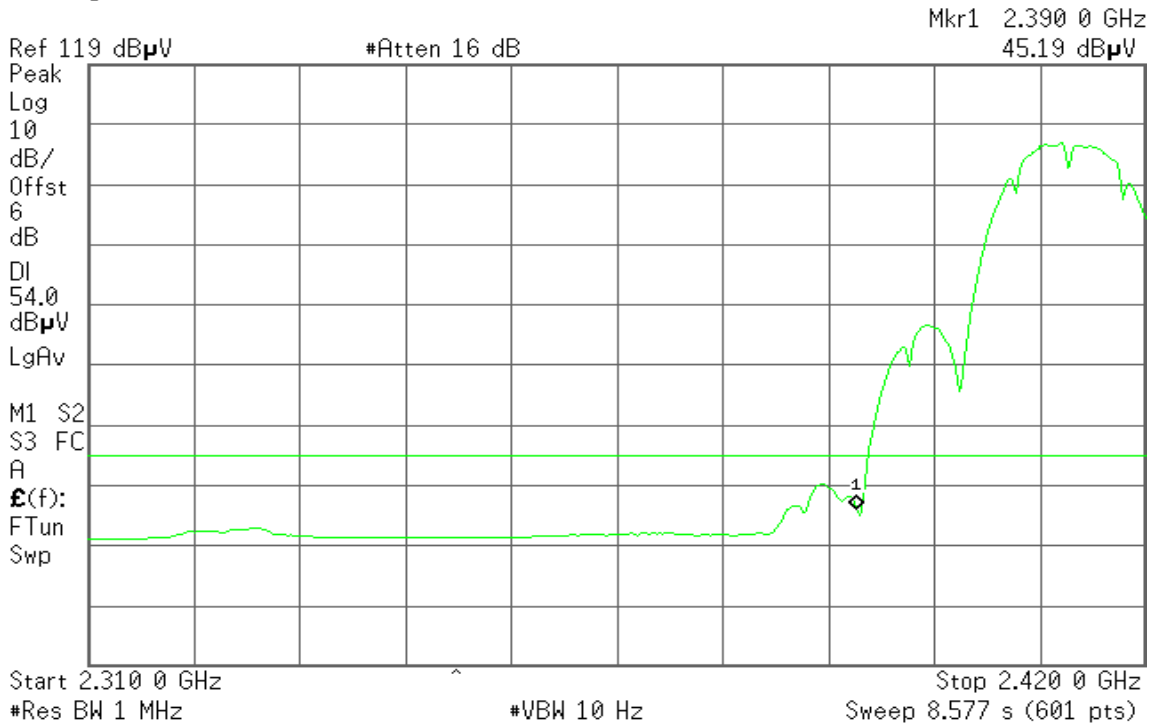


Detector mode: Average

Polarity: Horizontal

Agilent

R T

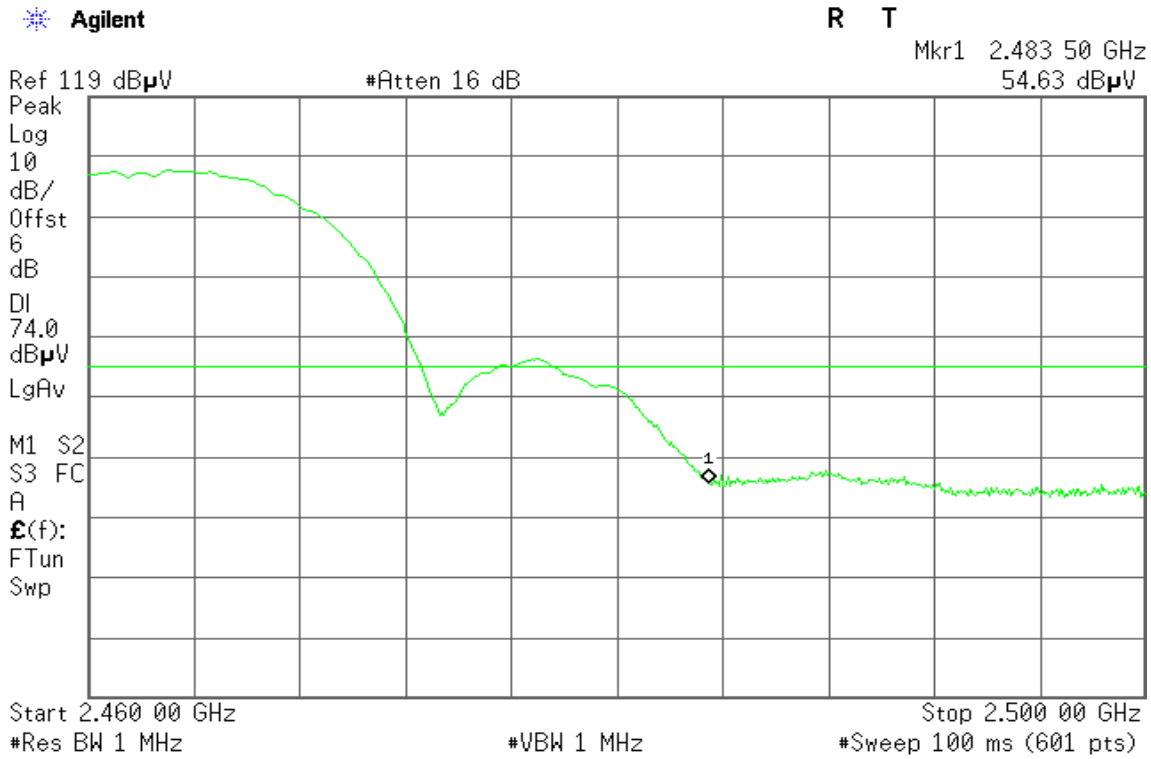




### Band Edges (IEEE 802.11b / CH High)

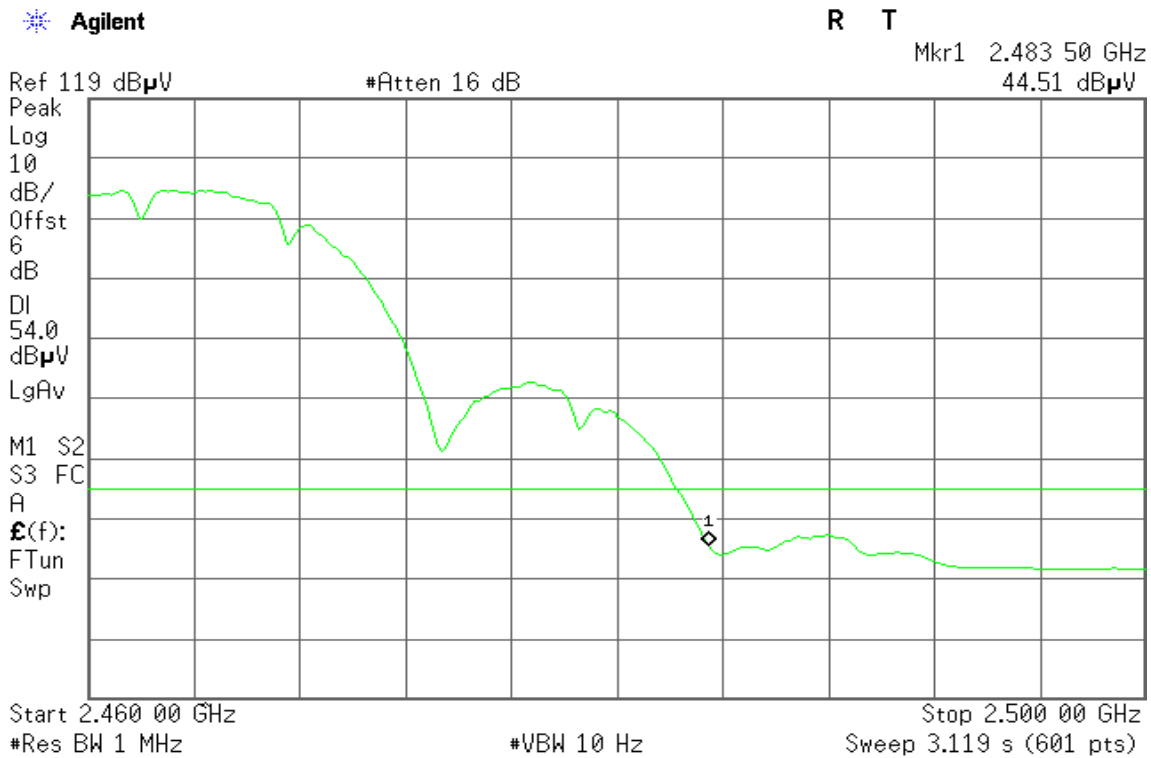
Detector mode: Peak

Polarity: Vertical



Detector mode: Average

Polarity: Vertical





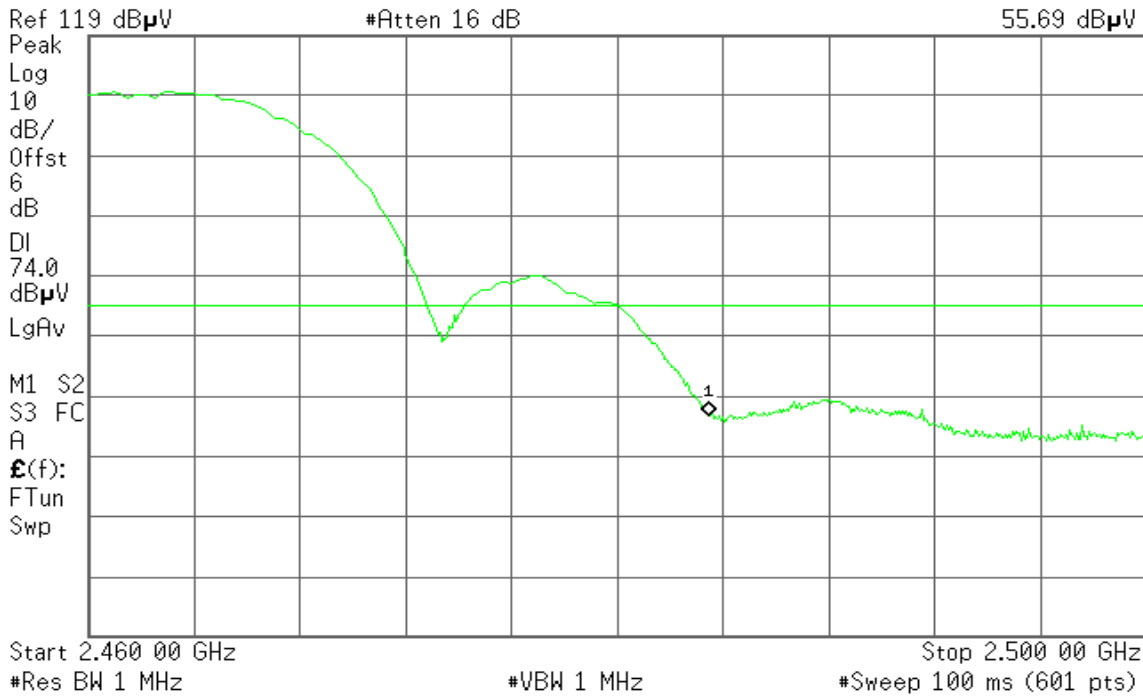
Detector mode: Peak

Polarity: Horizontal

Agilent

R T

Mkr1 2.483 50 GHz  
55.69 dBμV



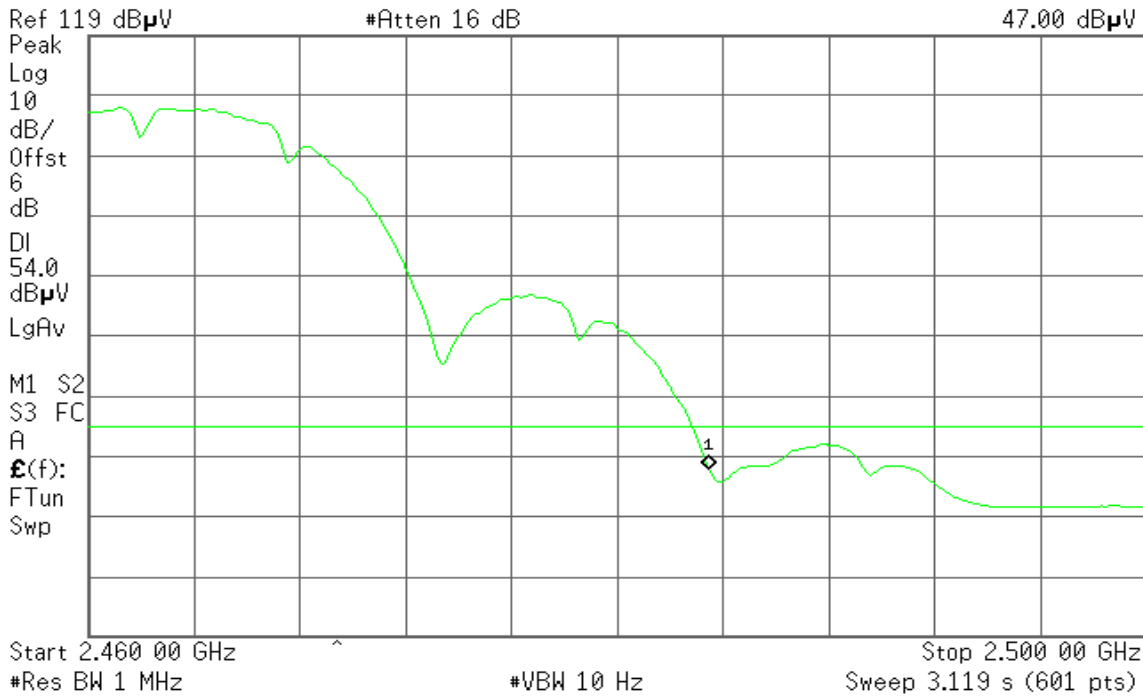
Detector mode: Average

Polarity: Horizontal

Agilent

R T

Mkr1 2.483 50 GHz  
47.00 dBμV





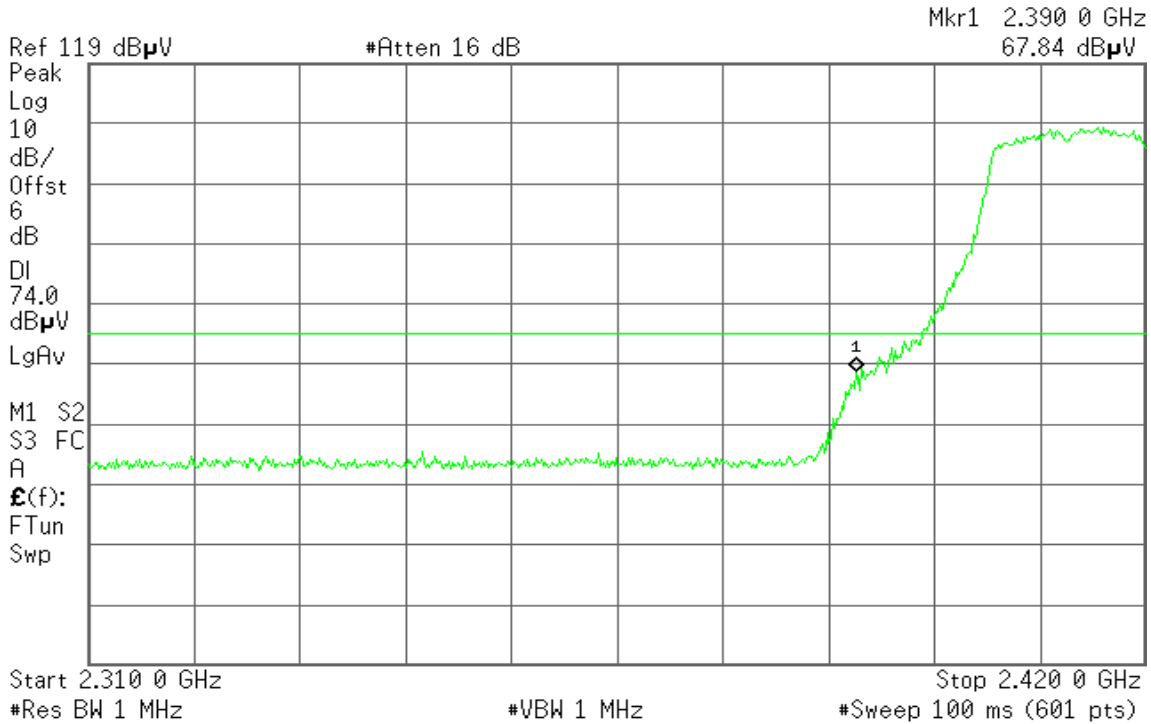
### Band Edges (IEEE 802.11g / CH Low)

Detector mode: Peak

Polarity: Vertical

Agilent

R T

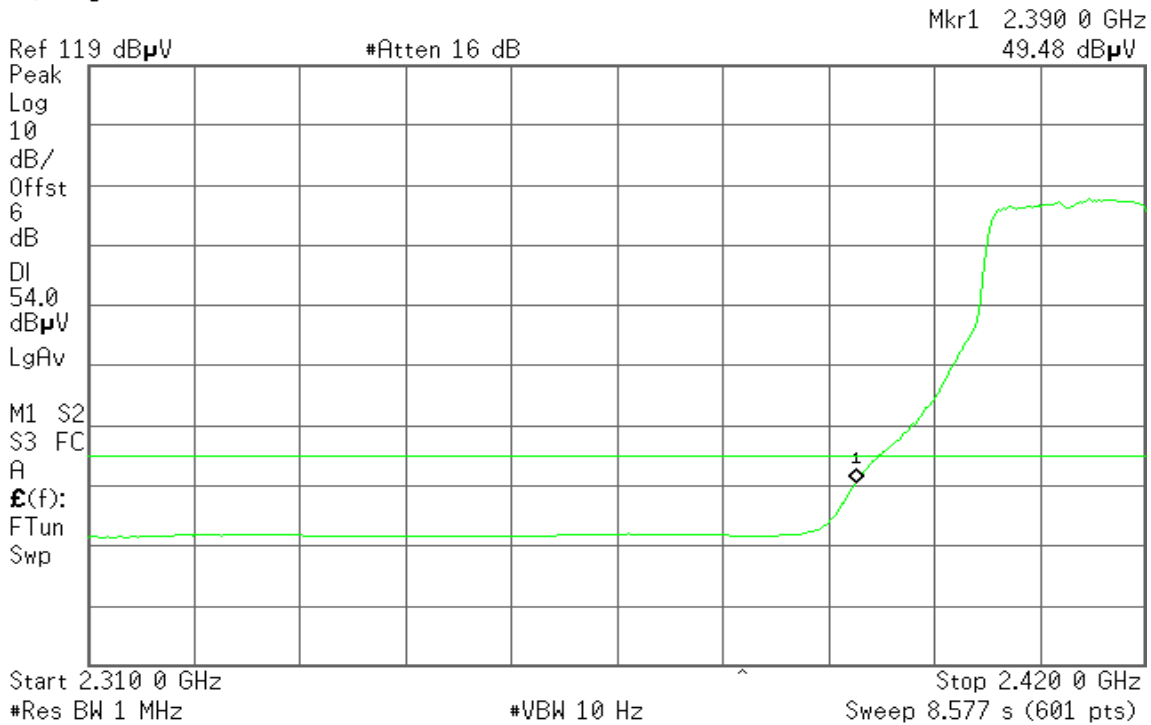


Detector mode: Average

Polarity: Vertical

Agilent

R T



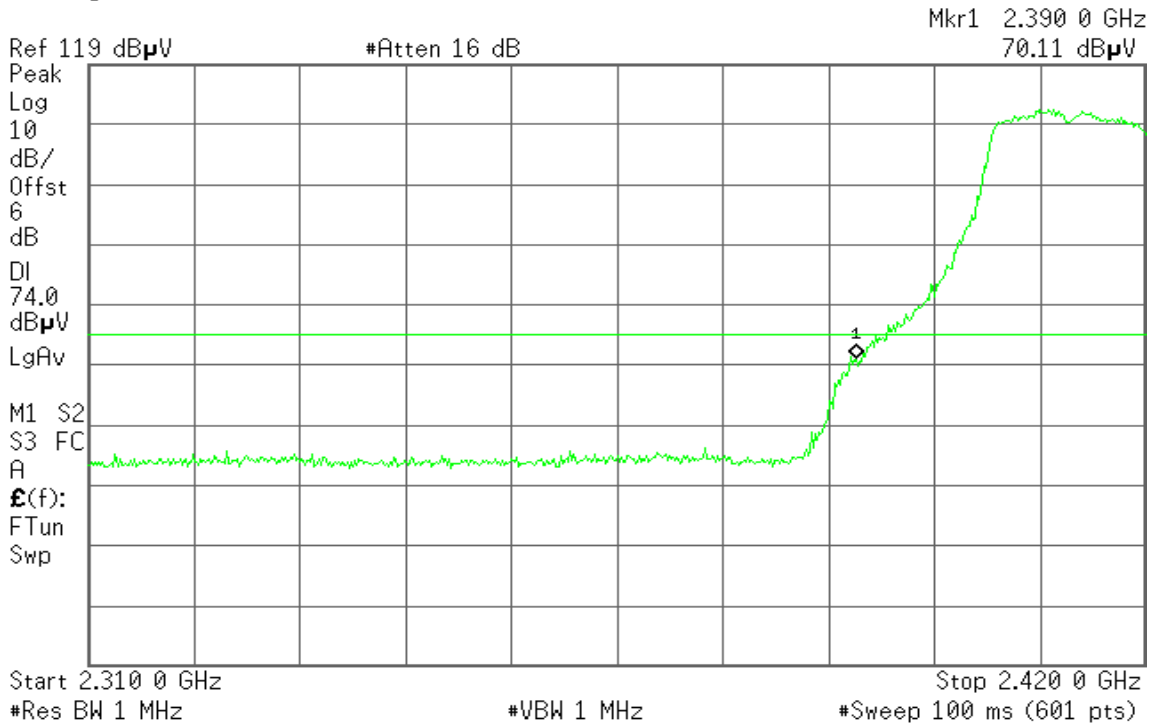


Detector mode: Peak

Polarity: Horizontal

Agilent

R T

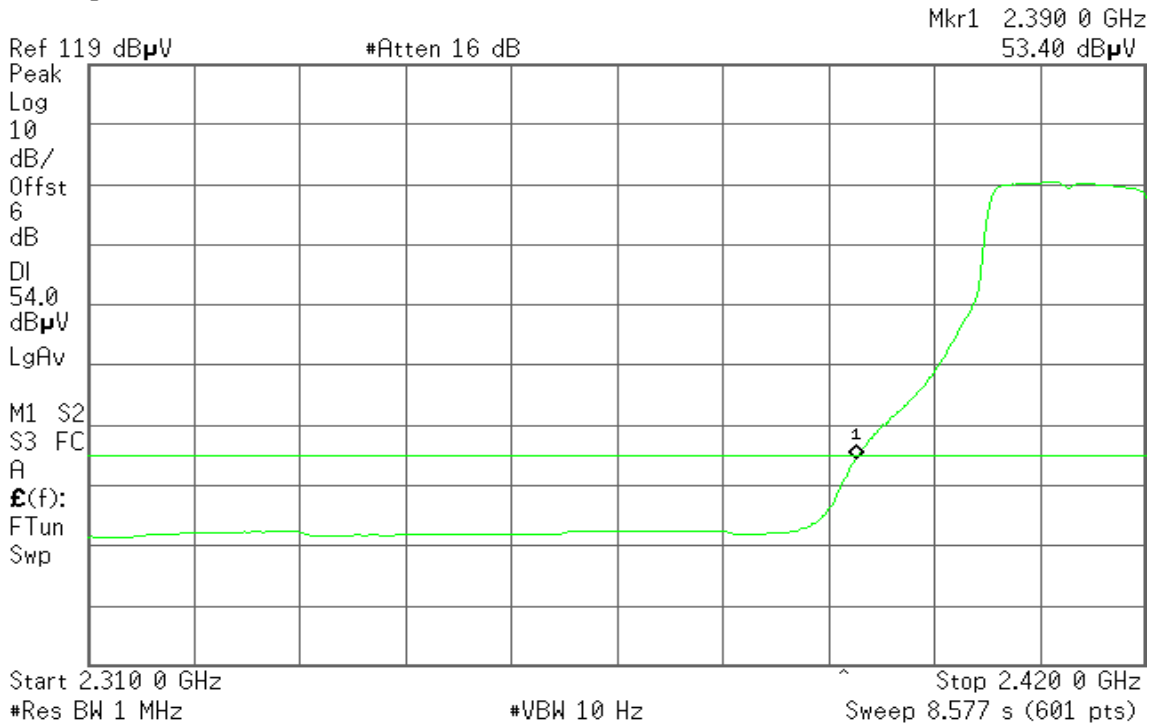


Detector mode: Average

Polarity: Horizontal

Agilent

R T





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

Detector mode: Peak

Polarity: Vertical

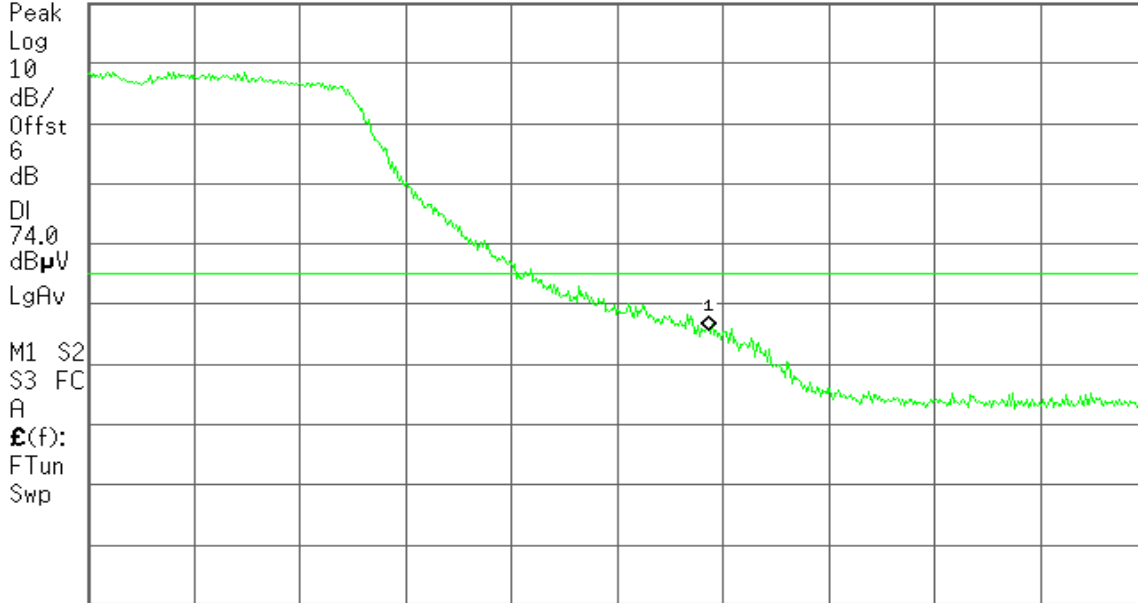
Agilent

R T

Mkr1 2.483 50 GHz  
64.65 dB $\mu$ V

Ref 119 dB $\mu$ V

#Atten 16 dB



Start 2.460 00 GHz

Stop 2.500 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Vertical

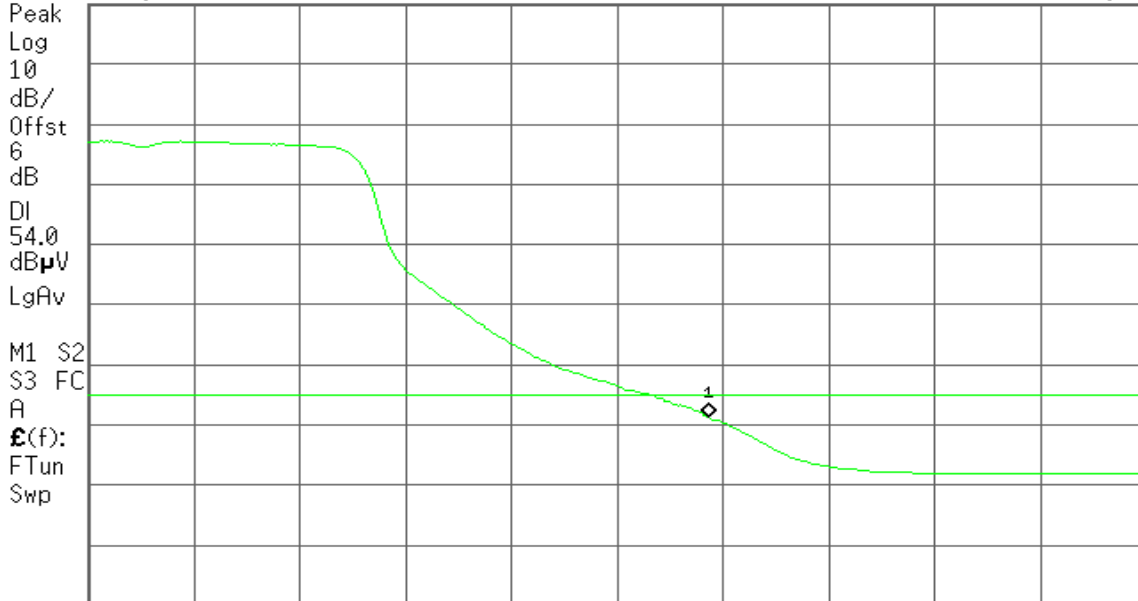
Agilent

R T

Mkr1 2.483 50 GHz  
50.21 dB $\mu$ V

Ref 119 dB $\mu$ V

#Atten 16 dB



Start 2.460 00 GHz

Stop 2.500 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

Sweep 3.119 s (601 pts)



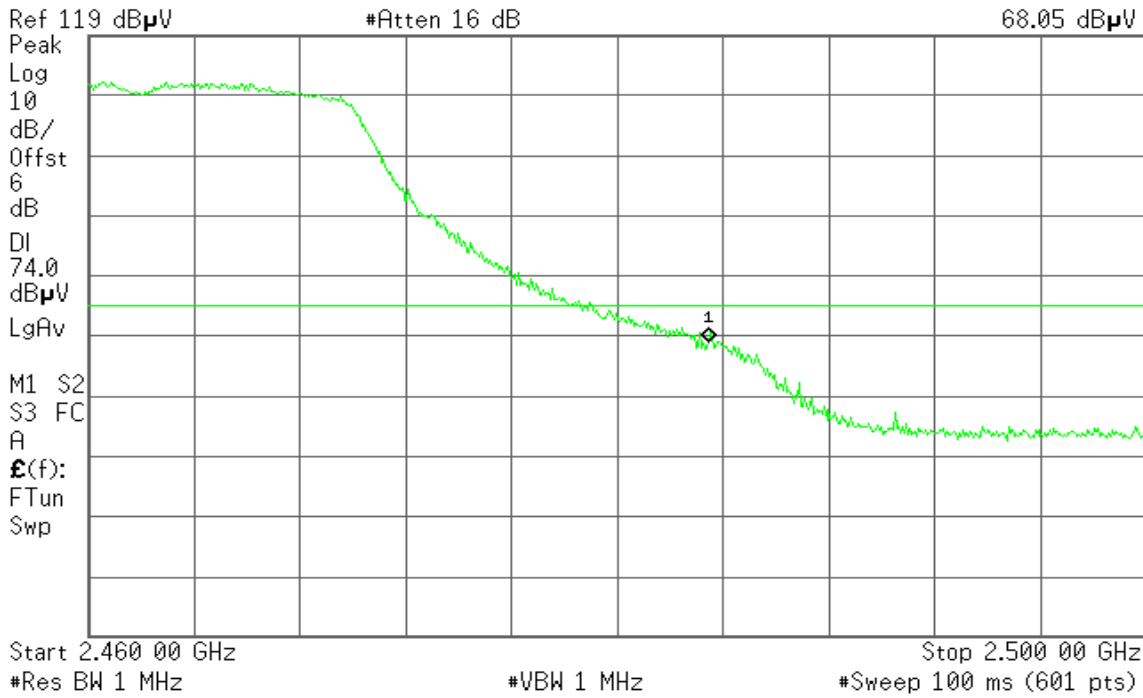
Detector mode: Peak

Polarity: Horizontal

Agilent

R T

Mkr1 2.483 50 GHz  
68.05 dBμV



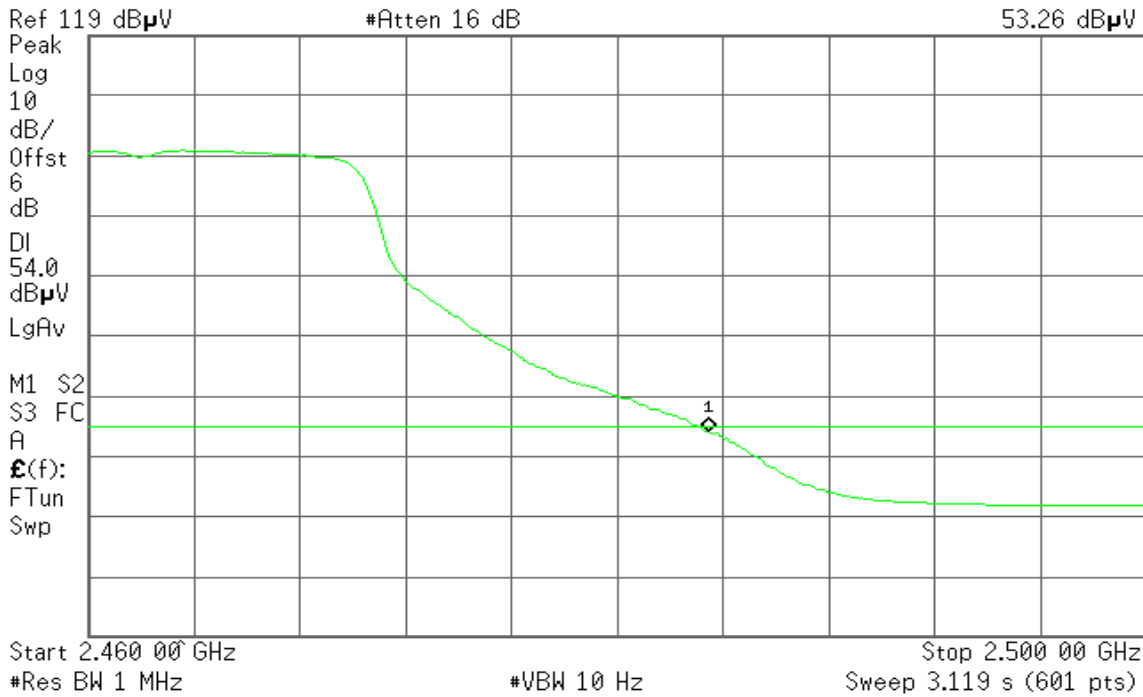
Detector mode: Average

Polarity: Horizontal

Agilent

R T

Mkr1 2.483 50 GHz  
53.26 dBμV





## 7.4 SPURIOUS EMISSIONS

### 7.4.1 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.*

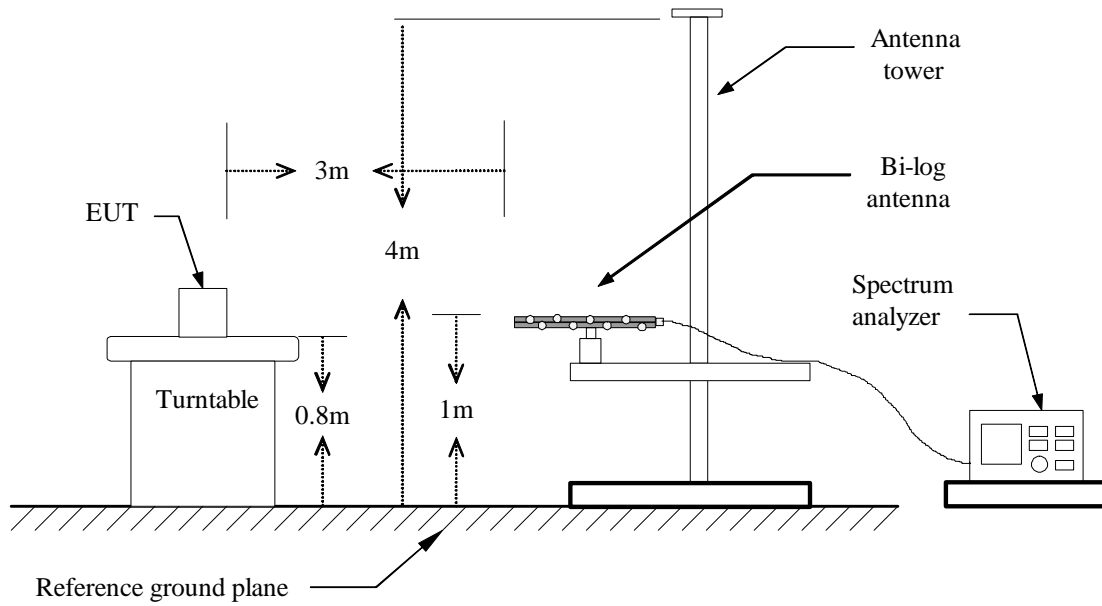
2. In the emission table above, the tighter limit applies at the band edges.

| 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                                             |

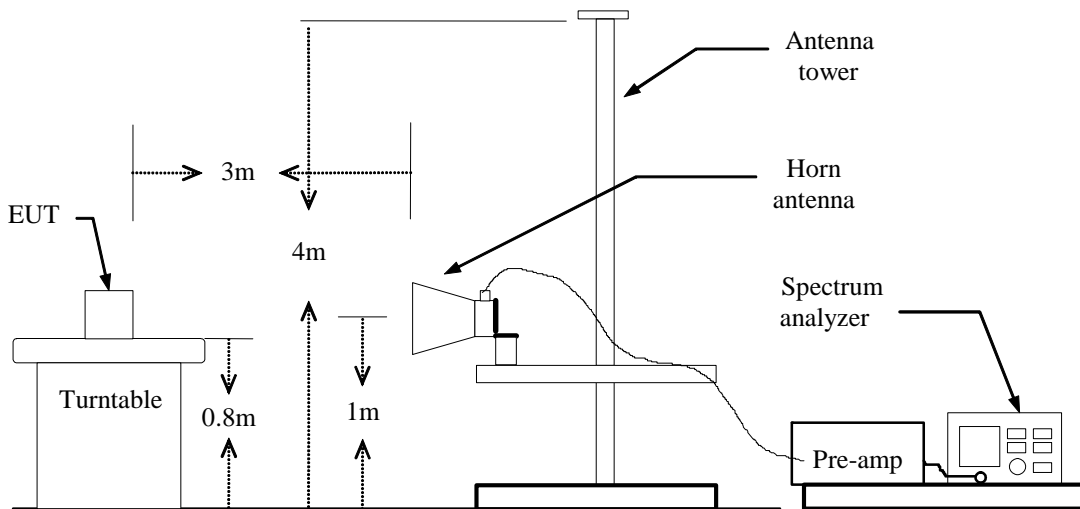


### Test Configuration

#### 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.

**Above 1 GHz****Operation Mode:** IEEE 802.11b / TX / CH Low**Test Date:** May 8, 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 |
|-----------------|-----------------|-----------------------|--------------------------|--------------------------|------------------------|---------------------------|-----------------------|--------------------------|-------------|--------|
| 1383.33         | V               | 55.84                 | ---                      | -7.25                    | 48.59                  | ---                       | 74.00                 | 54.00                    | -5.41       | Peak   |
| 4825.00         | V               | 50.58                 | ---                      | 1.04                     | 51.62                  | ---                       | 74.00                 | 54.00                    | -2.38       | Peak   |
| N/A             |                 |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                 |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                 |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                 |                       |                          |                          |                        |                           |                       |                          |             |        |
| 1520.00         | H               | 55.74                 | ---                      | -6.84                    | 48.90                  | ---                       | 74.00                 | 54.00                    | -5.10       | Peak   |
| 4825.00         | H               | 55.55                 | 51.57                    | 1.04                     | 56.58                  | 52.61                     | 74.00                 | 54.00                    | -1.39       | AVG    |
| N/A             |                 |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                 |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                 |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                 |                       |                          |                          |                        |                           |                       |                          |             |        |

**Remark:**

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



Operation Mode: IEEE 802.11b / TX / CH Mid

Test Date: May 8, 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 |
|-----------------|----------------|-----------------------|--------------------------|--------------------------|------------------------|---------------------------|-----------------------|--------------------------|-------------|--------|
| 1350.00         | V              | 54.80                 | ---                      | -7.31                    | 47.49                  | ---                       | 74.00                 | 54.00                    | -6.51       | Peak   |
| 4875.00         | V              | 53.39                 | 50.19                    | 1.02                     | 54.41                  | 51.21                     | 74.00                 | 54.00                    | -2.79       | AVG    |
| N/A             |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
| 1450.00         | H              | 55.65                 | ---                      | -7.12                    | 48.53                  | ---                       | 74.00                 | 54.00                    | -5.47       | Peak   |
| 4875.00         | H              | 53.84                 | 51.31                    | 1.02                     | 54.87                  | 52.33                     | 74.00                 | 54.00                    | -1.67       | AVG    |
| N/A             |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |

Remark:

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



Operation Mode: IEEE 802.11b / TX / CH High

Test Date: May 8, 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 |
|-----------------|----------------|-----------------------|--------------------------|--------------------------|------------------------|---------------------------|-----------------------|--------------------------|-------------|--------|
| 1400.00         | V              | 55.02                 | ---                      | -7.22                    | 47.80                  | ---                       | 74.00                 | 54.00                    | -6.20       | Peak   |
| 4925.00         | V              | 50.61                 | ---                      | 1.01                     | 51.62                  | ---                       | 74.00                 | 54.00                    | -2.38       | Peak   |
| N/A             |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
| 1400.00         | H              | 56.08                 | ---                      | -7.22                    | 48.87                  | ---                       | 74.00                 | 54.00                    | -5.13       | Peak   |
| 4925.00         | H              | 53.37                 | 50.86                    | 1.01                     | 54.38                  | 51.87                     | 74.00                 | 54.00                    | -2.13       | AVG    |
| N/A             |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |

Remark:

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



Operation Mode: IEEE 802.11g / TX / CH Low

Test Date: May 8, 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 |
|-----------------|----------------|-----------------------|--------------------------|--------------------------|------------------------|---------------------------|-----------------------|--------------------------|-------------|--------|
| 1420.00         | V              | 56.09                 | ---                      | -7.18                    | 48.91                  | ---                       | 74.00                 | 54.00                    | -5.09       | Peak   |
| N/A             |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
| 1436.67         | H              | 55.30                 | ---                      | -7.15                    | 48.15                  | ---                       | 74.00                 | 54.00                    | -5.85       | 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: IEEE 802.11g / TX / CH Mid

Test Date: May 8, 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 |
|-----------------|----------------|-----------------------|--------------------------|--------------------------|------------------------|---------------------------|-----------------------|--------------------------|-------------|--------|
| 1436.67         | V              | 56.25                 | ---                      | -7.15                    | 49.10                  | ---                       | 74.00                 | 54.00                    | -4.90       | Peak   |
| N/A             |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
| 1440.00         | H              | 54.96                 | ---                      | -7.14                    | 47.82                  | ---                       | 74.00                 | 54.00                    | -6.18       | Peak   |
| 4875.00         | H              | 49.92                 | ---                      | 1.02                     | 50.94                  | ---                       | 74.00                 | 54.00                    | -3.06       | 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: IEEE 802.11g / TX / CH High

Test Date: May 8, 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 |
|-----------------|----------------|-----------------------|--------------------------|--------------------------|------------------------|---------------------------|-----------------------|--------------------------|-------------|--------|
| 1396.67         | V              | 55.17                 | ---                      | -7.22                    | 47.95                  | ---                       | 74.00                 | 54.00                    | -6.05       | Peak   |
| N/A             |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
|                 |                |                       |                          |                          |                        |                           |                       |                          |             |        |
| 1473.33         | H              | 55.39                 | ---                      | -7.08                    | 48.31                  | ---                       | 74.00                 | 54.00                    | -5.69       | 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).