World Standardization Certification &Testing CO.,LTD
World Standardization Safety and EMC Testing Centre

# FCC 47 CFR PART 15 SUBPART C

# TEST REPORT

## Report Number: WSCT09030045E-RF

## For

## WIRELESS NETWORK CAMERA

## Model: CM-IP700

## Trade Name: Astak

*Prepared for*

**Astak , Inc**
**1911 Hartog Dr. San Jose, CA95131**

*Prepared by*

**WORLD STANDARDIZATION CERTIFICATION & TESTING CO., LTD.**
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# 1. TEST CERTIFICATION

**Applicant:** Astak, Inc
1911 Hartog Dr. San Jose, CA95131

**Equipment Under Test:** WIRELESS NETWORK CAMERA

**Trade Name:** Astak

**Model:** CM-IP700

**Date of Test:** March 02~20, 2009

| APPLICABLE STANDARDS | | | |
|---|---|---|---|
| **Standard** | **Test Type** | **Standard** | **Test Type** |
| 15.247(a)(2) | 6dB Bandwidth Measurement | 15.247(e) | Peak Power Spectral Density |
| 15.247(b)(3)<br>15.247(b)(4) | Peak Power Measurement | 15.247(d)<br>15.209(a) | Spurious Emissions<br>● Conducted Measurement<br>● Radiated Emissions |
| 15.247(d) | Band Edges Measurement | 15.207(a) | Power Line Conducted Emissions |

| Deviation from Applicable Standard |
|---|
| None |

The above equipment was tested by World Standardization Certification& Testing CO., LTD. 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.

***Tested By:*** Cheney Chen ***Date:*** ***2009-03-20***
***(Cheney Chen)***

***Check By:*** Joe Lin ***Date:*** ***2009-03-20***
***(Joe Lin)***

***Approved By:*** Sula Huang ***Date:*** ***2009-03-20***
***(Sula Huang)***

# 2. TEST RESULT SUMMARY

| APPLICABLE STANDARDS | | | |
|---|---|---|---|
| **Standard** | **Test Type** | **Result** | **Remark** |
| 15.247(a)(2) | 6dB Bandwidth Measurement | Pass | Meet the requirement of limit. |
| 15.247(b)(3)<br>15.247(b)(4) | Peak Power Measurement | Pass | Meet the requirement of limit. |
| 15.247(d) | Band Edges Measurement | Pass | Meet the requirement of limit. |
| 15.247(e) | Peak Power Spectral Density | Pass | Meet the requirement of limit. |
| 15.247(d)<br>15.209(a) | Spurious Emissions<br>● Conducted Measurement<br>● Radiated Emissions | Pass | Meet the requirement of limit. |
| 15.207(a) | Power line Conducted Emissions | Pass | Meet the requirement of limit. |

Note: 1. The test result judgment is decided by the limit of test standard
2. The information of measurement uncertainty is available upon the customer's request.

# 3. EUT DESCRIPTION

| | |
|---|---|
| **Product** | WIRELESS NETWORK CAMERA |
| **Trade Name** | Astak |
| **Model Number** | CM-IP700 |
| **Model Difference** | N/A |
| **Power Supply** | DC 12V Powered by switching adapter<br>(Switching Adapter)Model number: SAP-18W01-12 12012 US<br>INPUT: 100-240V~50-60Hz max. 0.6A<br>OUTPUT: DC 12V, 1.0A |
| **Frequency Range** | 802.11b mode: 2412 ~ 2462 MHz<br>802.11g mode: 2412 ~ 2462 MHz |
| **Transmit Power** | 802.11b mode: 14.42dBm<br>802.11g mode: 15.59 dBm |
| **Modulation Technique** | 802.11b: DSSS (CCK; DQPSK; DBPSK)<br>802.11g: OFDM |
| **Transmit Data Rate** | IEEE 802.11b: 11, 5.5, 2, 1 Mbps<br>IEEE 802.11g: 54, 48, 36, 24,18, 12, 9, 6Mbps |
| **Number of Channels** | 13 Channels |
| **Antenna Specification** | RF Antenna Assembly ; Gain: 2 dBi (Max) |

***Note:*** *This submittal(s) (test report) comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.*

# 4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4: 2003 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

## 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.

## 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.

## 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.

## FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

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

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 – 0.110 | 16.42 – 16.423 | 399.9 – 410 | 4.5 – 5.15 |
| [1]0.495 – 0.505 | 16.69475 – 16.69525 | 608 – 614 | 5.35 – 5.46 |
| 2.1735 – 2.1905 | 16.80425 – 16.80475 | 960 – 1240 | 7.25 – 7.75 |
| 4.125 – 4.128 | 25.5 – 25.67 | 1300 – 1427 | 8.025 – 8.5 |
| 2. 17725 – 4.17775 | 37.5 – 38.25 | 1435 – 1626.5 | 9.0 – 9.2 |
| 2. 20725 – 4.20775 | 73 – 74.6 | 1645.5 – 1646.5 | 9.3 – 9.5 |
| 6.215 – 6.218 | 74.8 – 75.2 | 1660 – 1710 | 10.6 – 12.7 |
| 6.26775 – 6.26825 | 108 – 121.94 | 1718.8 – 1722.2 | 13.25 – 13.4 |
| 6.31175 – 6.31225 | 123 – 138 | 2200 – 2300 | 14.47 – 14.5 |
| 8.291 – 8.294 | 149.9 – 150.05 | 2310 – 2390 | 15.35 – 16.2 |
| 8.362 – 8.366 | 156.52475 – | 2483.5 – 2500 | 17.7 – 21.4 |
| 8.37625 – 8.38675 | 156.52525 | 2655 – 2900 | 22.01 – 23.12 |
| 8.41425 – 8.41475 | 156.7 – 156.9 | 3260 – 3267 | 23.6 – 24.0 |
| 12.29 – 12.293 | 162.0125 – 167.17 | 3332 – 3339 | 31.2 – 31.8 |
| 12.51975 – 12.52025 | 167.72 – 173.2 | 3345.8 – 3358 | 36.43 – 36.5 |
| 12.57675 – 12.57725 | 240 – 285 | 3600 – 4400 | ([2]) |
| 13.36 – 13.41 | 322 – 335.4 | | |

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

## DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

IEEE802.11b: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 1Mbps highest data rate (worst case) are chosen for the final testing.

IEEE802.11g: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 6Mbps data rate (the worst case) are chosen for the final testing.

# 5. 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.

# 6. FACILITIES AND ACCREDITATIONS

## FACILITIES

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

1-2/F, Dachong Science&Technology Building,No.28 of Tonggu Road,Nanshan District, ShenZhen.PRC.

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4: 2003 and CISPR Publication 22.

## 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.”

## LABORATORY ACCREDITATIONS AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by FCC. Oct 06.2007. The certificate registration number is 276008 to perform Electromagnetic Interference tests according to FCC PART 15 and CISPR 22 requirements.

# 7. SETUP OF EQUIPMENT UNDER TEST

## SETUP CONFIGURATION OF EUT

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

## SUPPORT EQUIPMENT

| No | Equipment | Model | Serial No. | FCC ID | Trade Name | Data Cable | Power Cord |
|---|---|---|---|---|---|---|---|
| 1. | PC | dx2700 | N/A | DoC | HP | Shielded 1.5m | Unshielded 1.8m |
| 2. | LCD MONITOR | L1706v | N/A | DoC | HP | shielded 1. 5m | Unshielded 1. 8m |
| 3. | Keyboard | KB-0623 | 08G00704325D | DoC | LENOVO | N/A | Unshielded 1.8m |
| 4. | Mouse | N/A | N/A | DoC | LENOVO | N/A | Unshielded 1.8m |

***Notes:***

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.*

# 8. FCC PART 15.247 REQUIREMENTS

## 6dB BANDWIDTH

## LIMIT

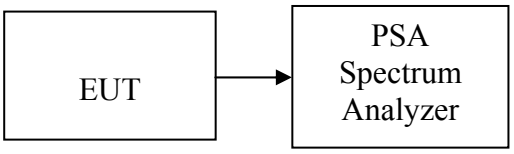
For the direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

## MEASUREMENT EQUIPMENT USED

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| PSA Spectrum Analyzer | Agilent | E4446A | US44300399 | 02/16/2010 |

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

**Test Configuration**




## TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 100kHz, VBW = RBW, Span = 20MHz, Sweep = auto.
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

## TEST RESULTS

*No non-compliance noted*

**Test Data**

**Test mode: IEEE 802.11b**

| Channel | Frequency (MHz) | Bandwidth (kHz) | Limit (kHz) | Margin (kHz) |
|---|---|---|---|---|
| Low | 2412 | 9570 | >500 | PASS |
| Mid | 2437 | 9170 | | PASS |
| High | 2462 | 10100 | | PASS |

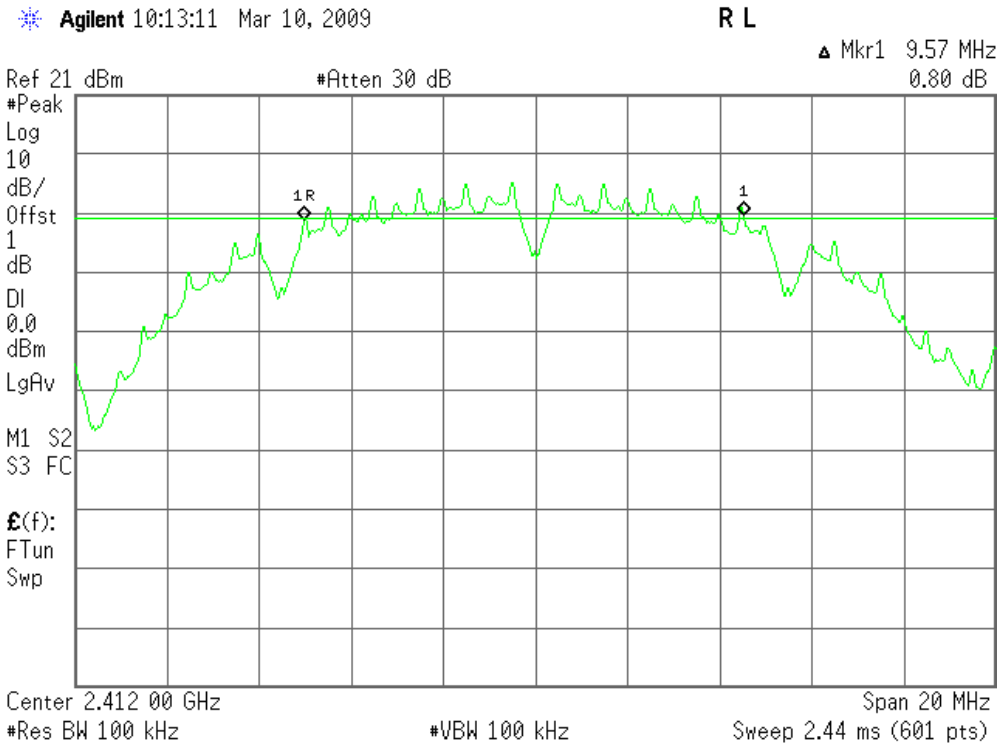
**Test mode: IEEE 802.11g**

| Channel | Frequency (MHz) | Bandwidth (kHz) | Limit (kHz) | Margin (kHz) |
|---|---|---|---|---|
| Low | 2412 | 16370 | >500 | PASS |
| Mid | 2437 | 15930 | | PASS |
| High | 2462 | 16100 | | PASS |

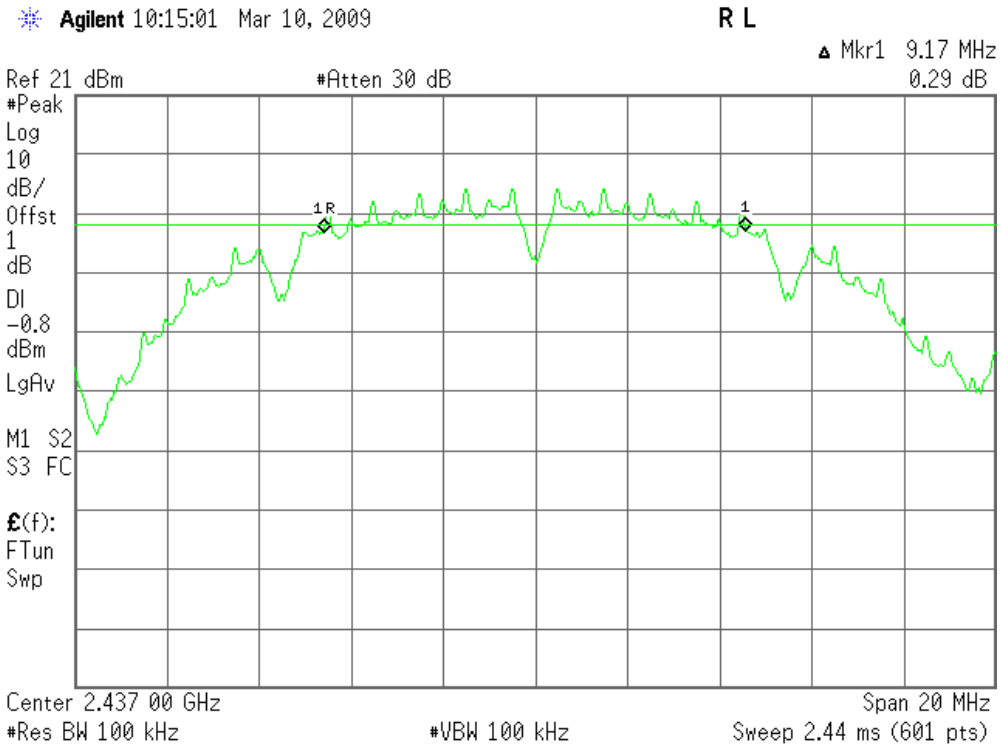
## Test Plot

## 802.11b mode

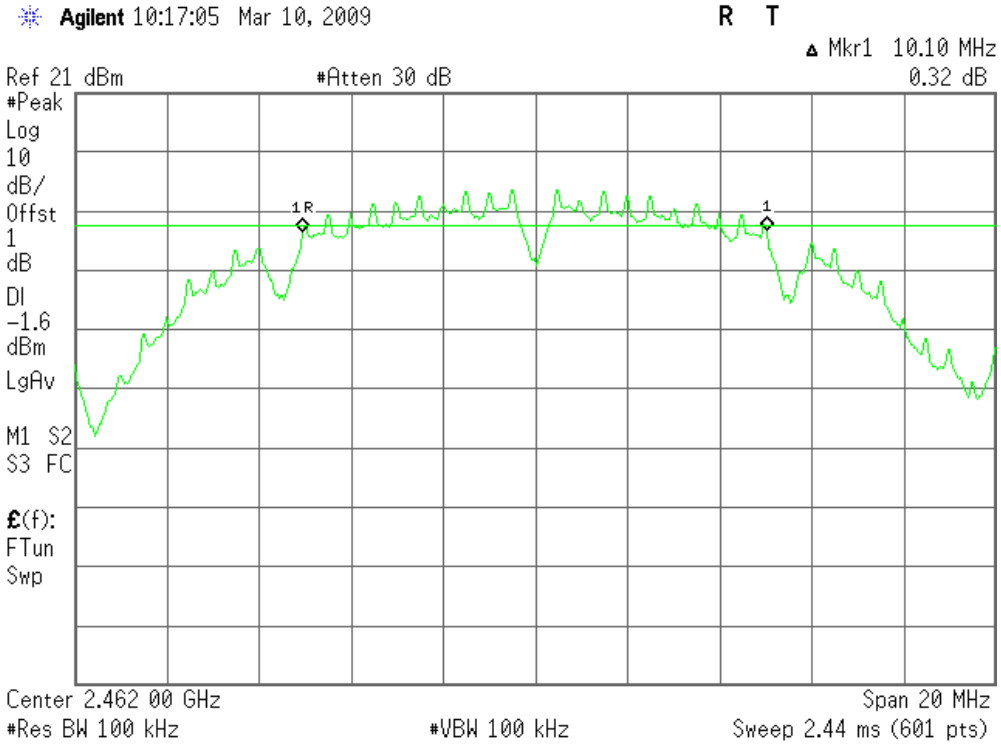
### 6dB Bandwidth (CH Low)




### 6dB Bandwidth (CH Mid)

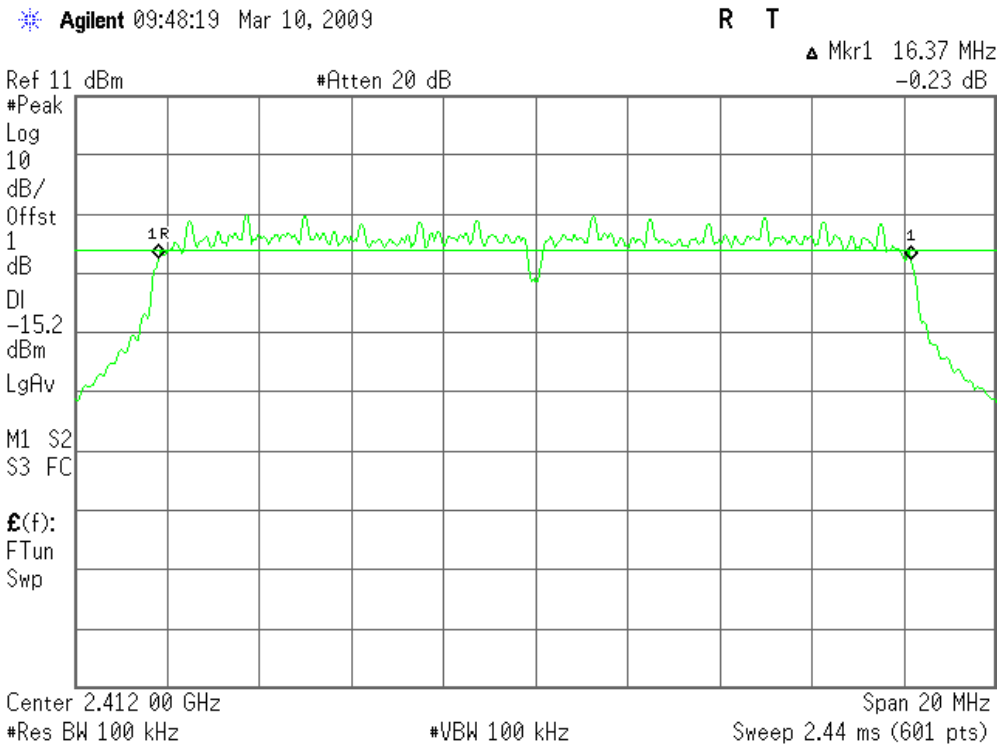


## 6dB Bandwidth (CH High)

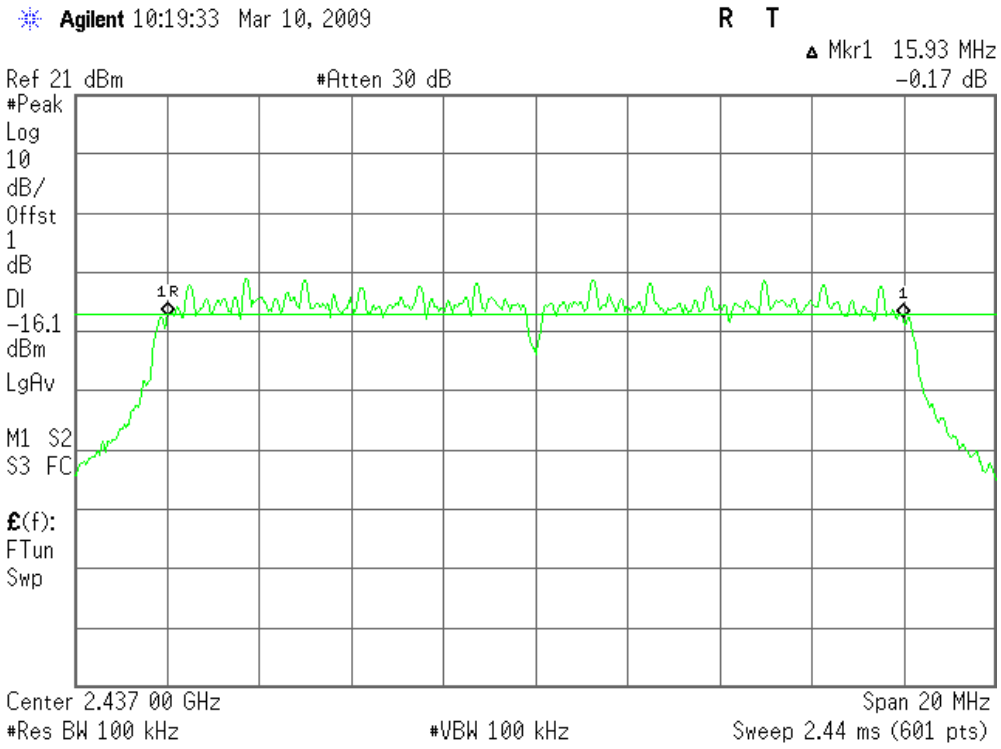


## 802.11g mode

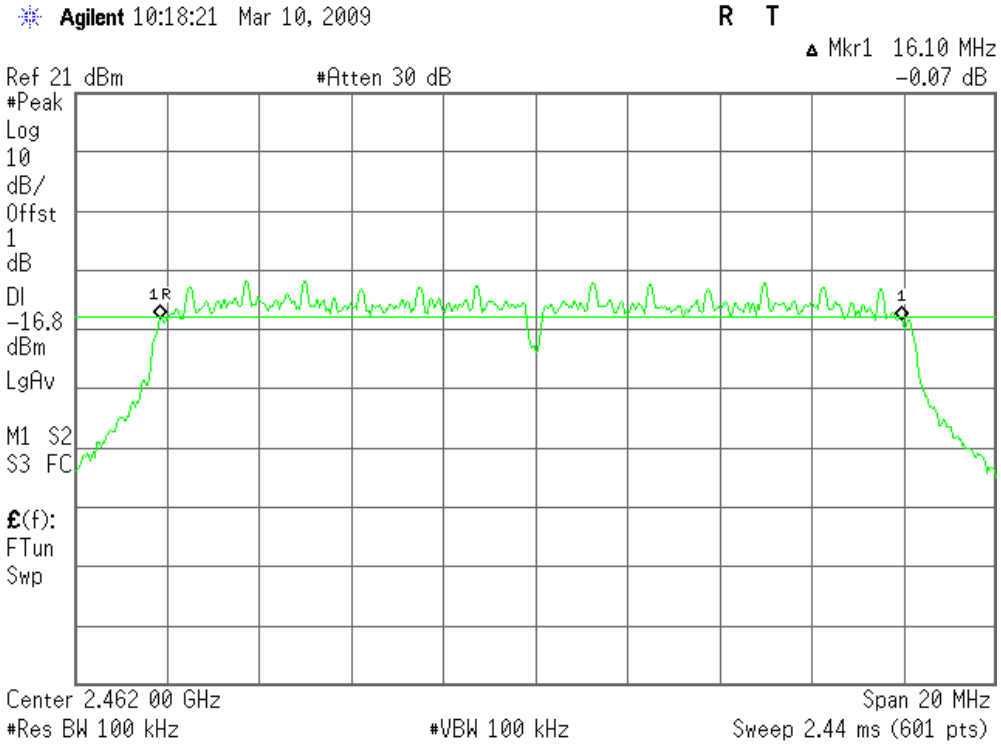
### 6dB Bandwidth (CH Low)




### 6dB Bandwidth (CH Mid)



## 6dB Bandwidth (CH High)



## PEAK POWER

## LIMIT

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

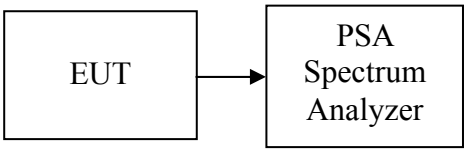
1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains 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.

## MEASUREMENT EQUIPMENT USED

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| PSA Spectrum Analyzer | Agilent | E4446A | US44300399 | 02/16/2010 |

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

### Test Configuration




## TEST PROCEDURE

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

## TEST RESULTS

*No non-compliance noted*

**Test Data**

**Test mode: IEEE 802.11b**

| Channel | Frequency (MHz) | Output (dBm) | Factor (dB) | Output Power (dBm) | Output Power (W) | Limit (W) | Result |
|---|---|---|---|---|---|---|---|
| Low | 2412 | 13.29 | 1.00 | 14.29 | 0.02685 | 1 | PASS |
| Mid | 2437 | 13.42 | 1.00 | 14.42 | 0.02767 | 1 | PASS |
| High | 2462 | 12.67 | 1.00 | 13.67 | 0.02328 | 1 | PASS |

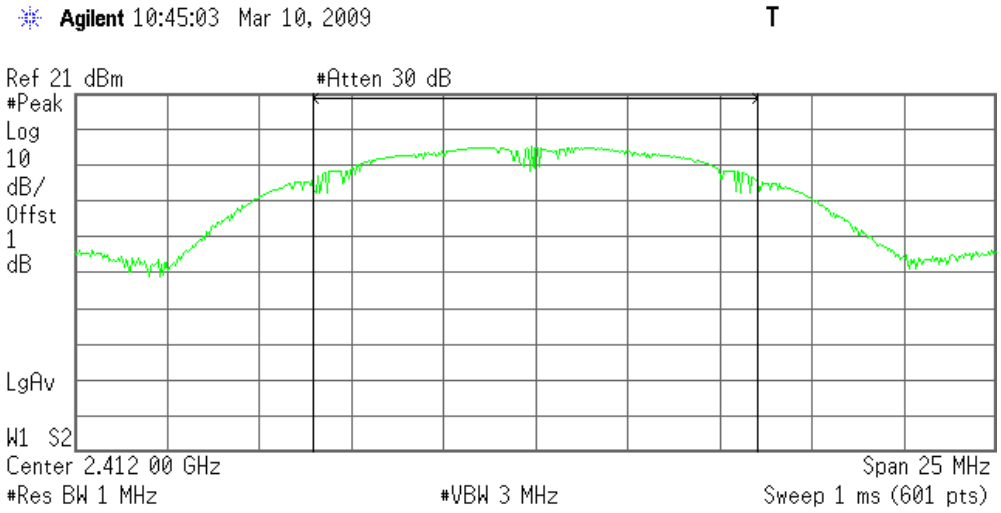
**Test mode: IEEE 802.11g**

| Channel | Frequency (MHz) | Output (dBm) | Factor (dB) | Output Power (dBm) | Output Power (W) | Limit (W) | Result |
|---|---|---|---|---|---|---|---|
| Low | 2412 | 14.59 | 1.00 | 15.59 | 0.03622 | 1 | PASS |
| Mid | 2437 | 13.56 | 1.00 | 14.56 | 0.02858 | 1 | PASS |
| High | 2462 | 12.72 | 1.00 | 13.72 | 0.02355 | 1 | PASS |

**Test Plot**

**802.11b mode**

**Peak power (CH Low)**



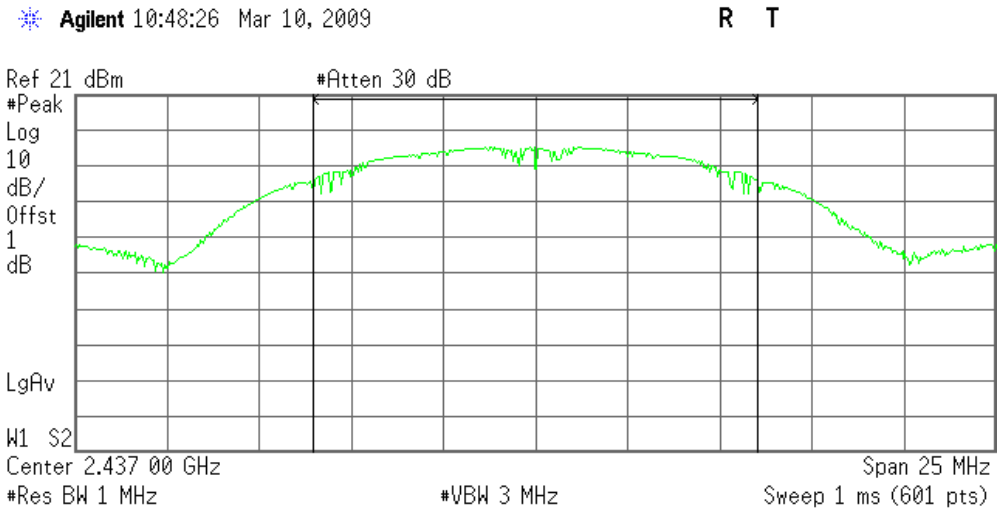

Channel Power

14.29 dBm /12.0000 MHz

Power Spectral Density

-56.50 dBm/Hz

**Peak power (CH Mid)**



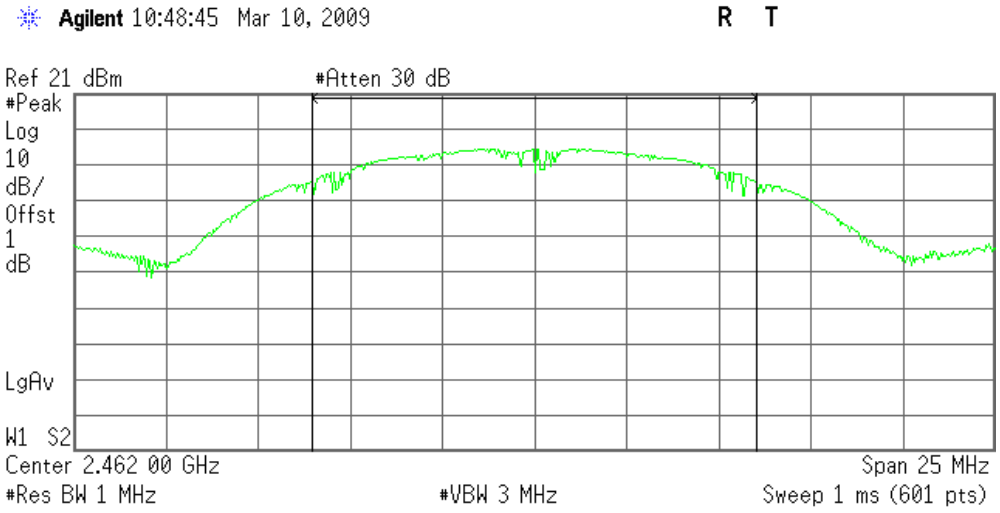

Channel Power

14.42 dBm /12.0000 MHz

Power Spectral Density

-56.37 dBm/Hz

**Peak power (CH High)**




**Channel Power**

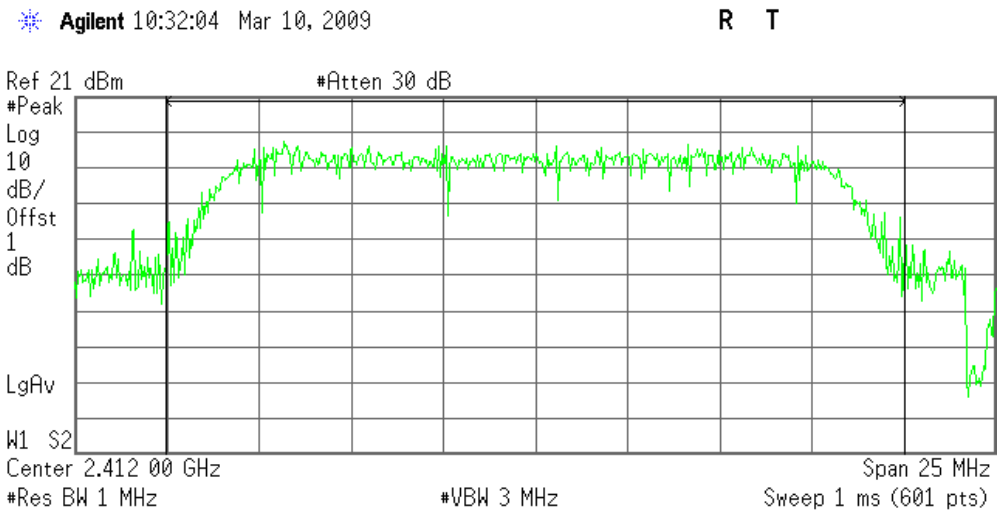
13.67 dBm /12.0000 MHz

**Power Spectral Density**

-57.12 dBm/Hz

## 802.11g mode

### Peak power (CH Low)



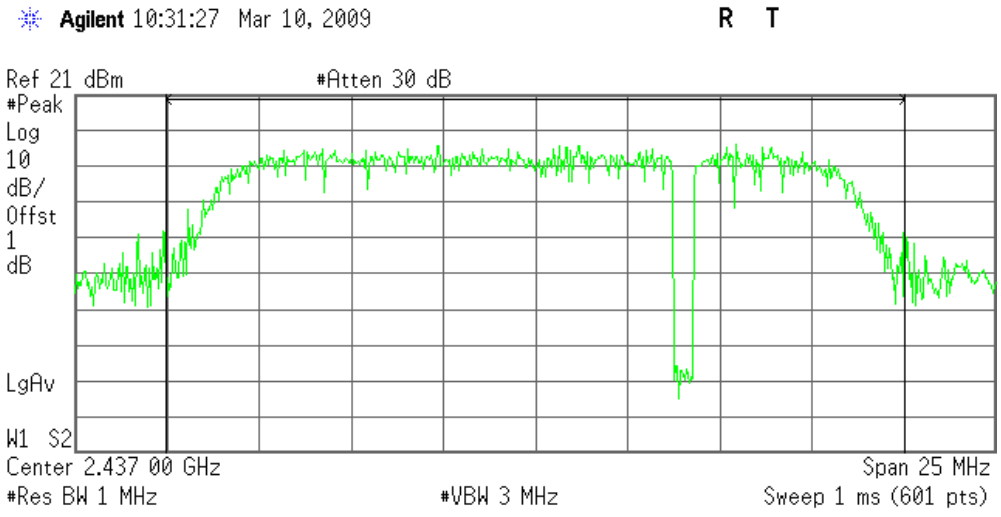

**Channel Power**

15.59 dBm /20.0000 MHz

**Power Spectral Density**

-57.42 dBm/Hz

### Peak power (CH Mid)



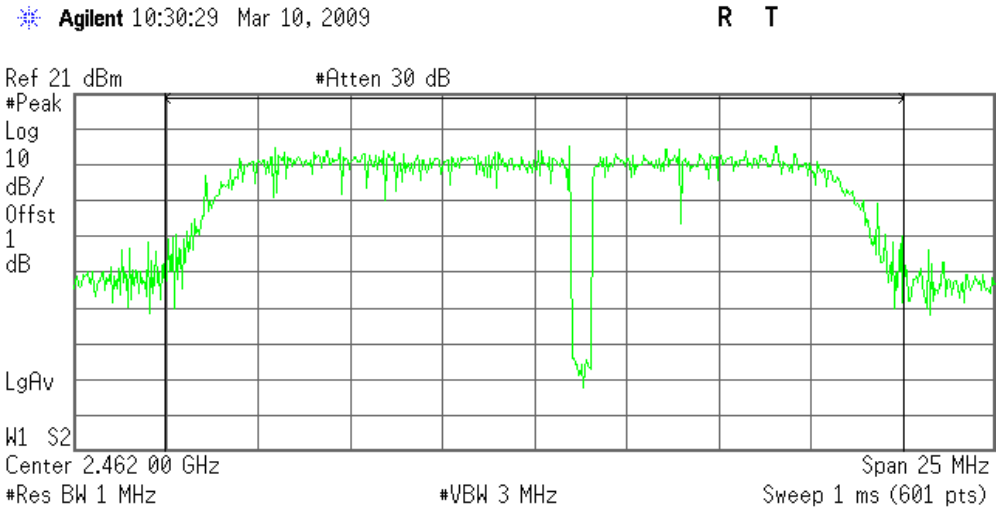

**Channel Power**

14.56 dBm /20.0000 MHz

**Power Spectral Density**

-58.45 dBm/Hz

**Peak power (CH High)**




**Channel Power**

13.72 dBm /20.0000 MHz

**Power Spectral Density**

-59.29 dBm/Hz

## BAND EDGES MEASUREMENT

## LIMIT

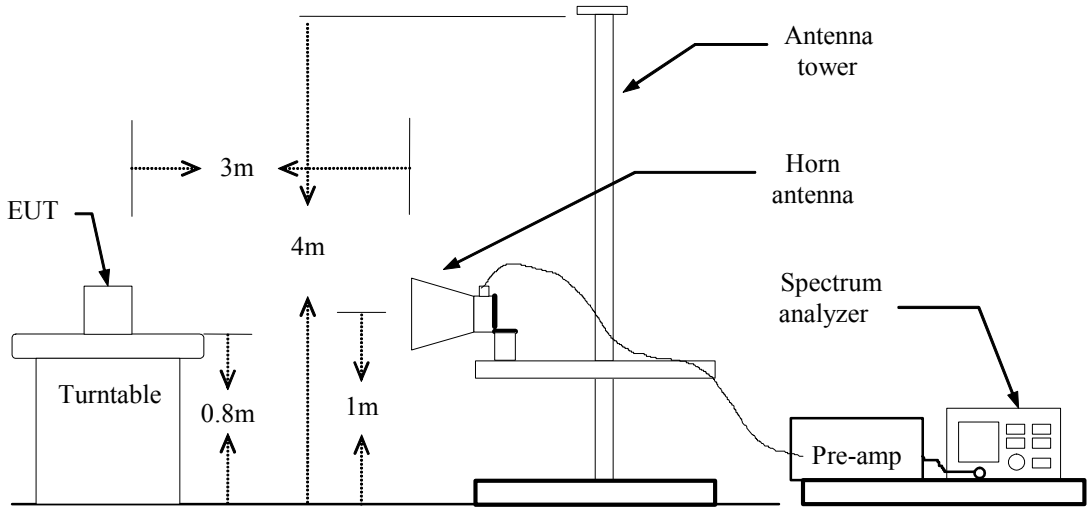
According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in15.209(a).

## MEASUREMENT EQUIPMENT USED

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| PSA Spectrum Analyzer | Agilent | E4446A | US44300399 | 02/16/2010 |

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

### Test Configuration




## TEST PROCEDURE

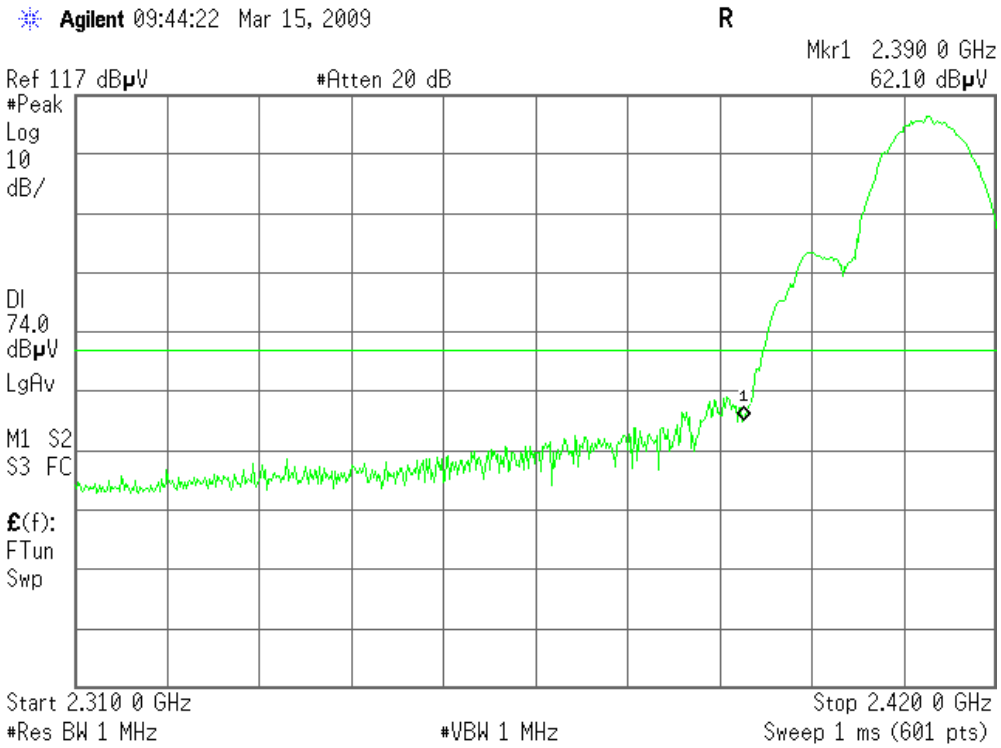
1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the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

## TEST RESULTS

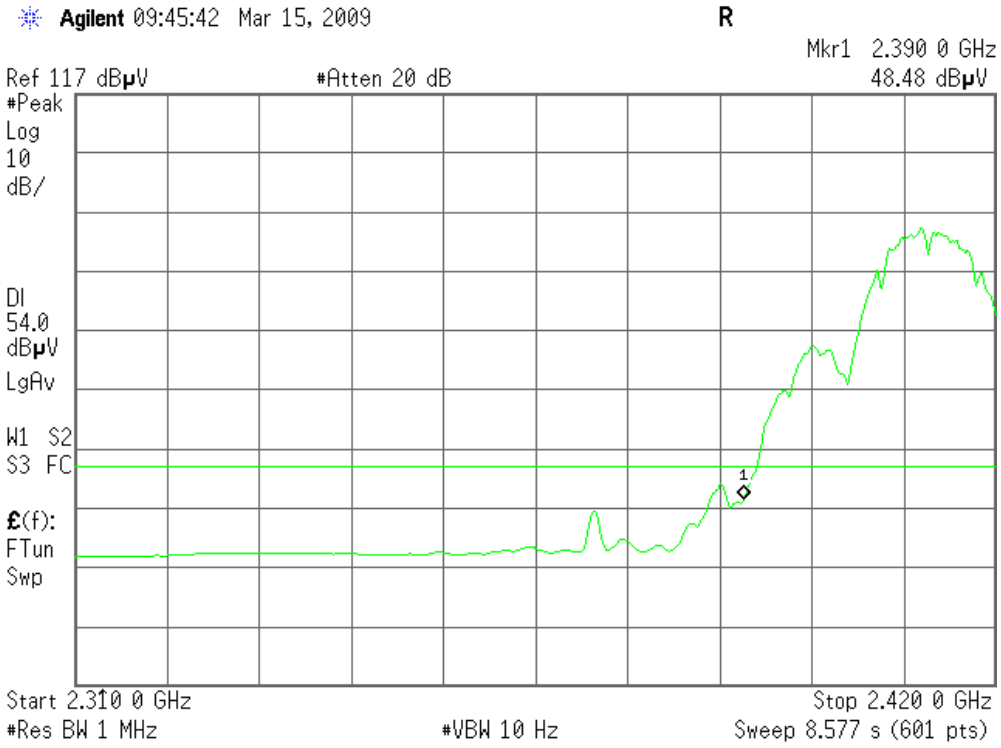
Refer to attach spectrum analyzer data chart.

## Band Edges (802.11b / CH Low)

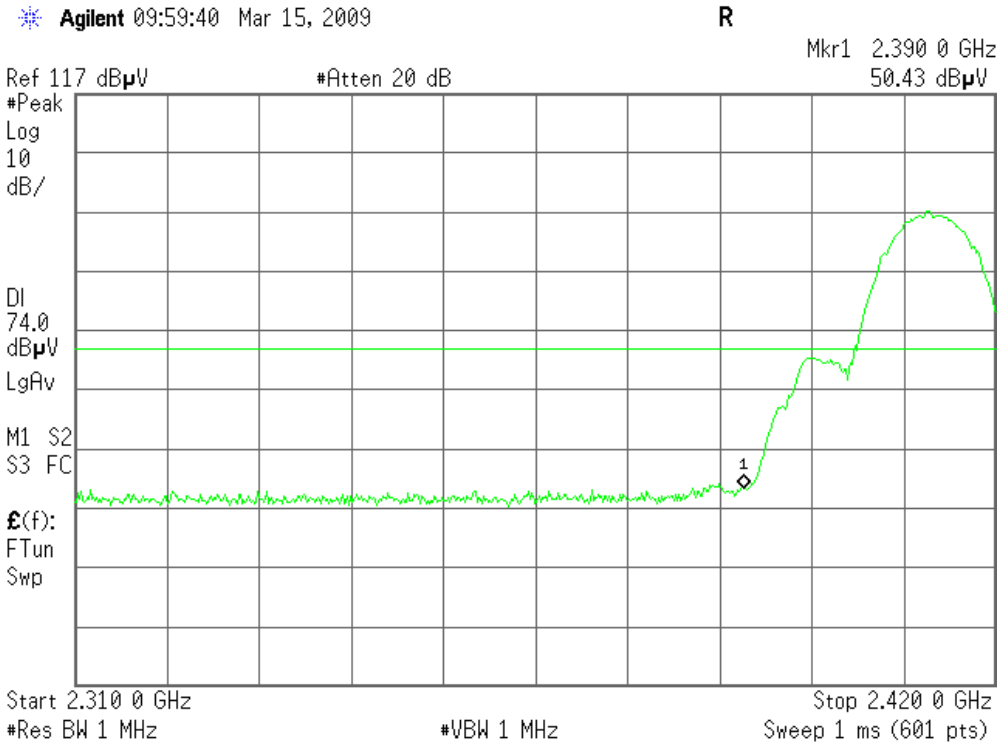
**Detector mode: Peak** **Polarity: Vertical**



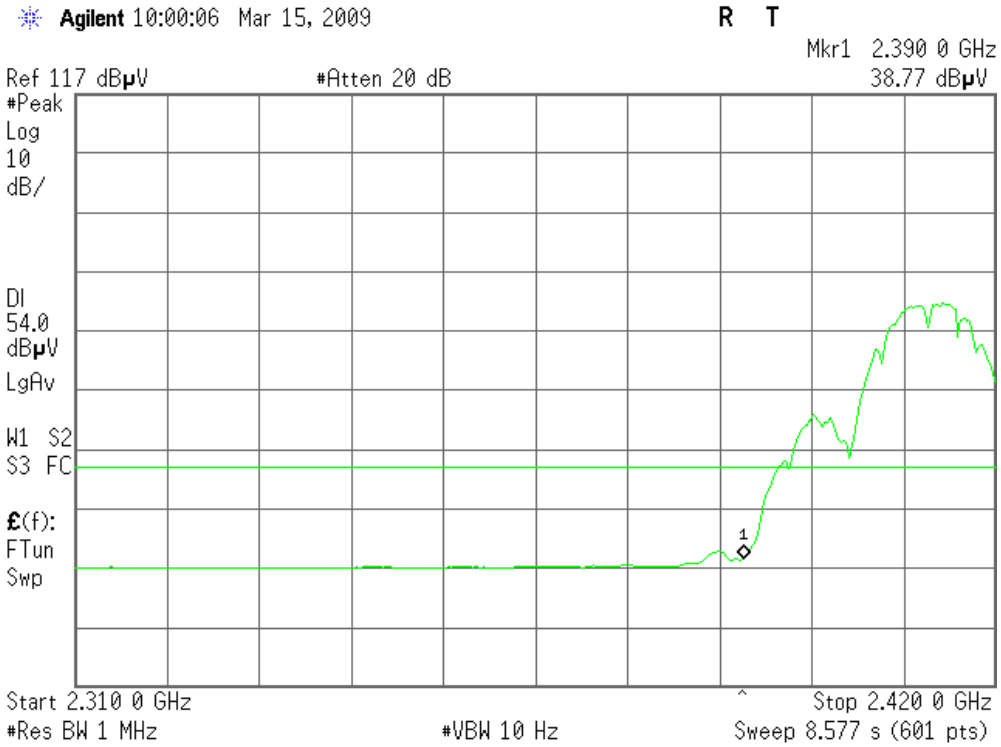

**Detector mode: Average** **Polarity: Vertical**



**Detector mode: Peak** **Polarity: Horizontal**

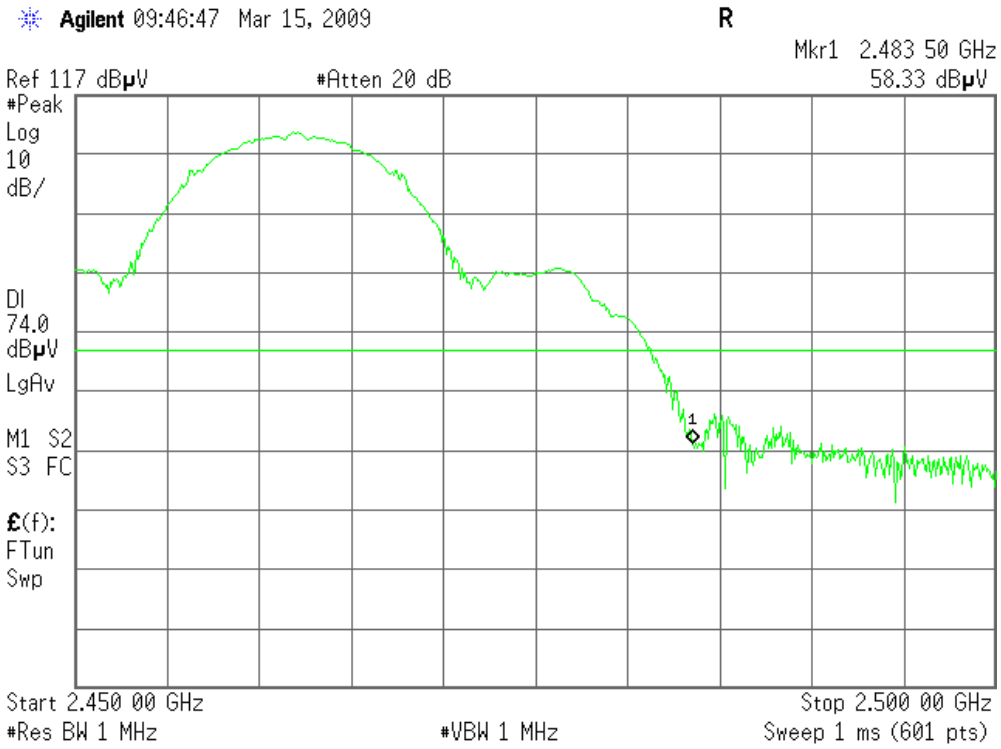



**Detector mode: Average** **Polarity: Horizontal**

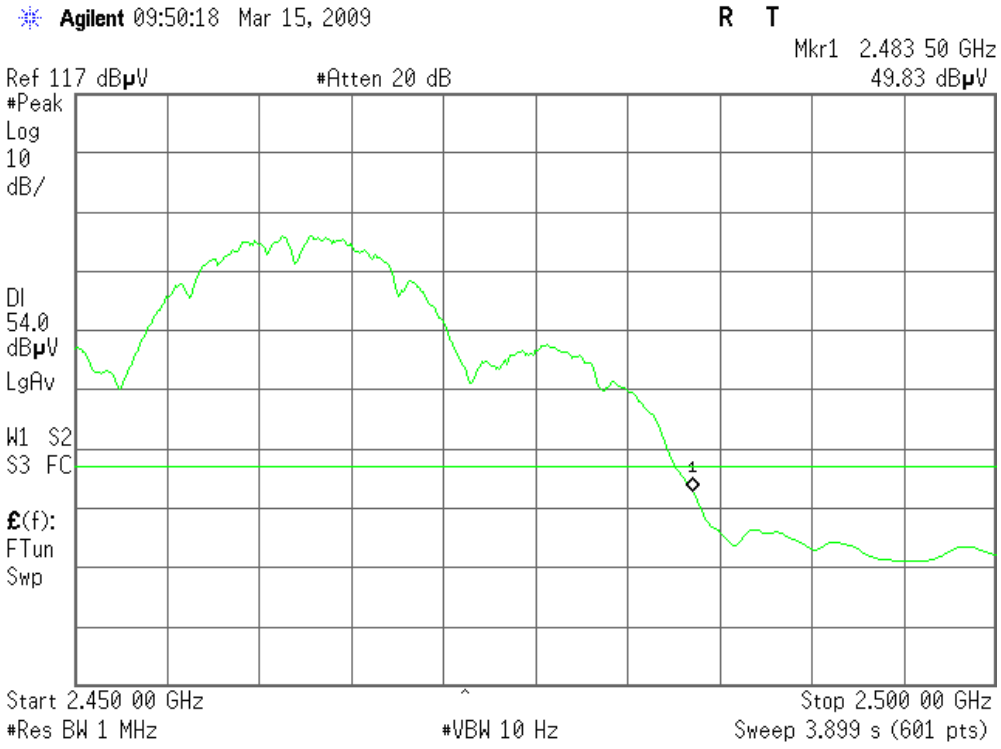


## Band Edges (802.11b / CH High)

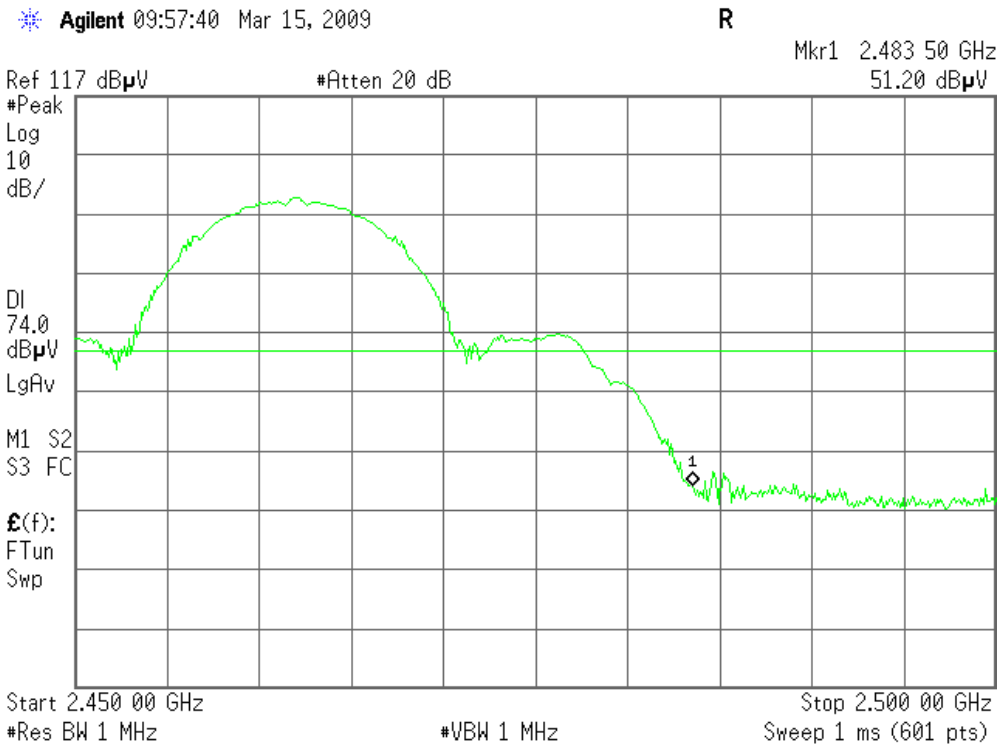
**Detector mode: Peak** **Polarity: Vertical**



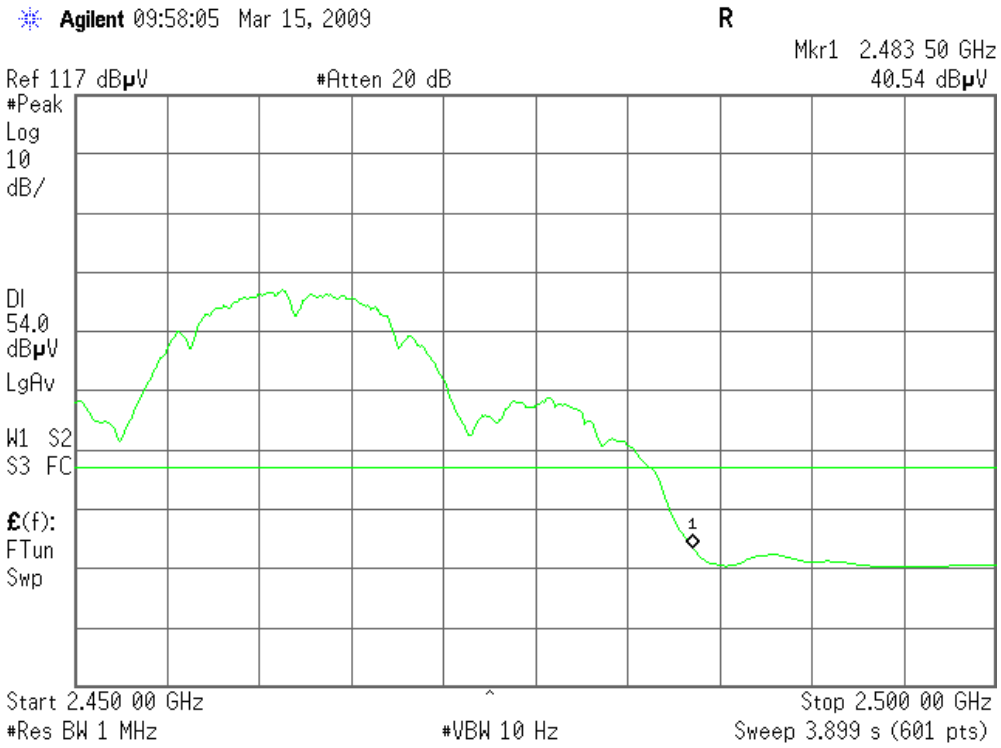

**Detector mode: Average** **Polarity: Vertical**



**Detector mode: Peak** **Polarity: Horizontal**

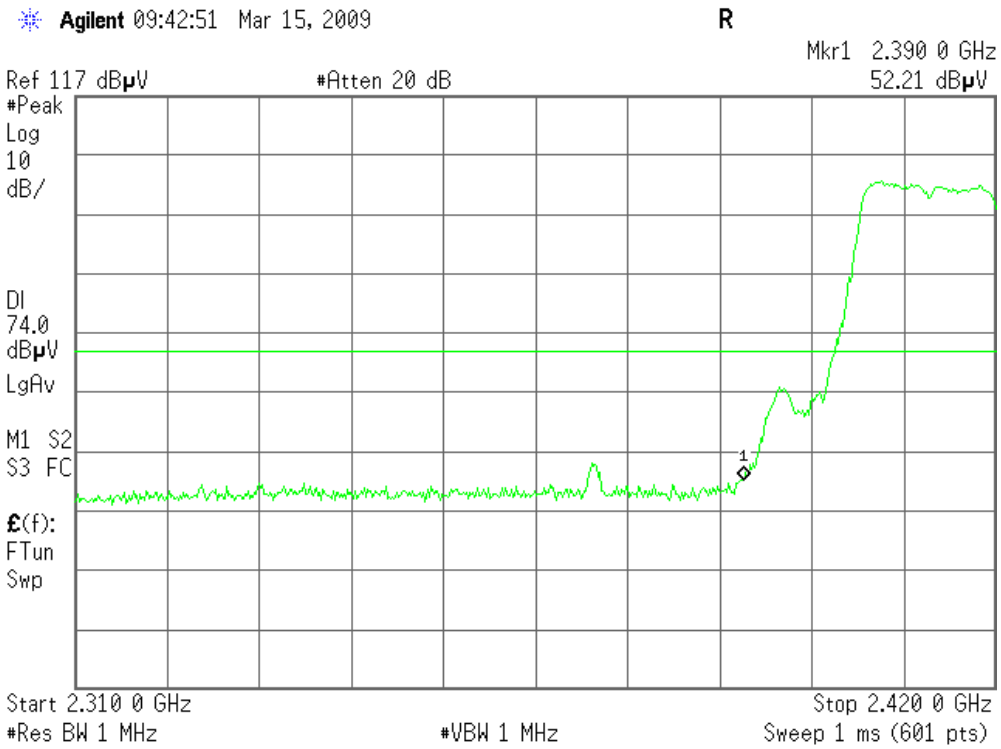



**Detector mode: Average** **Polarity: Horizontal**

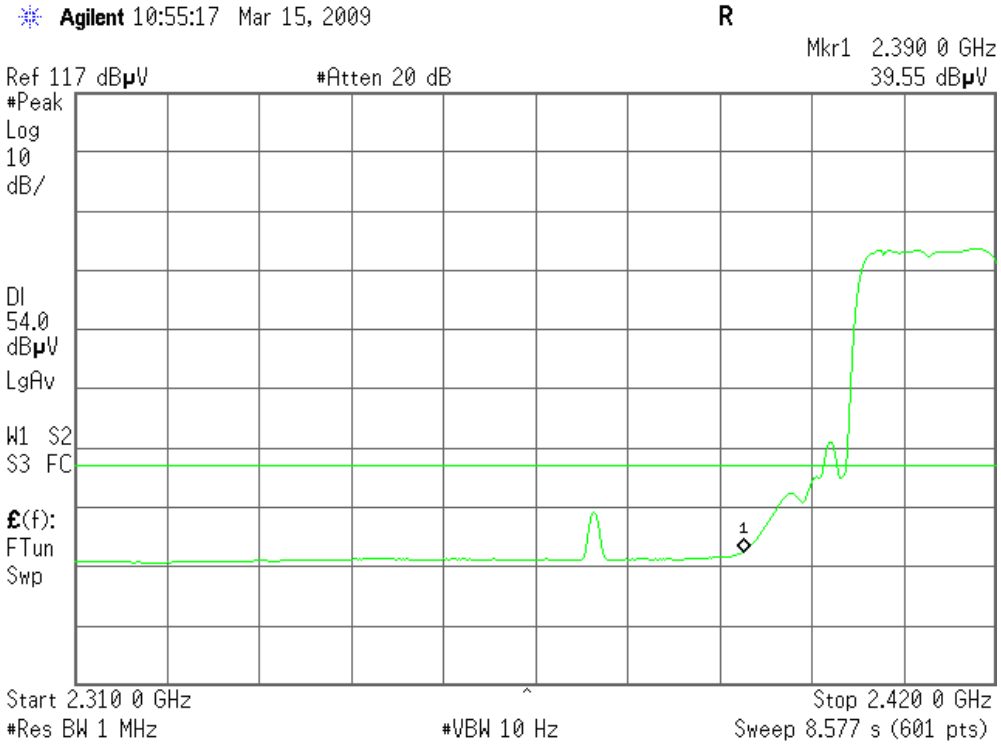


## Band Edges (802.11g / CH Low)

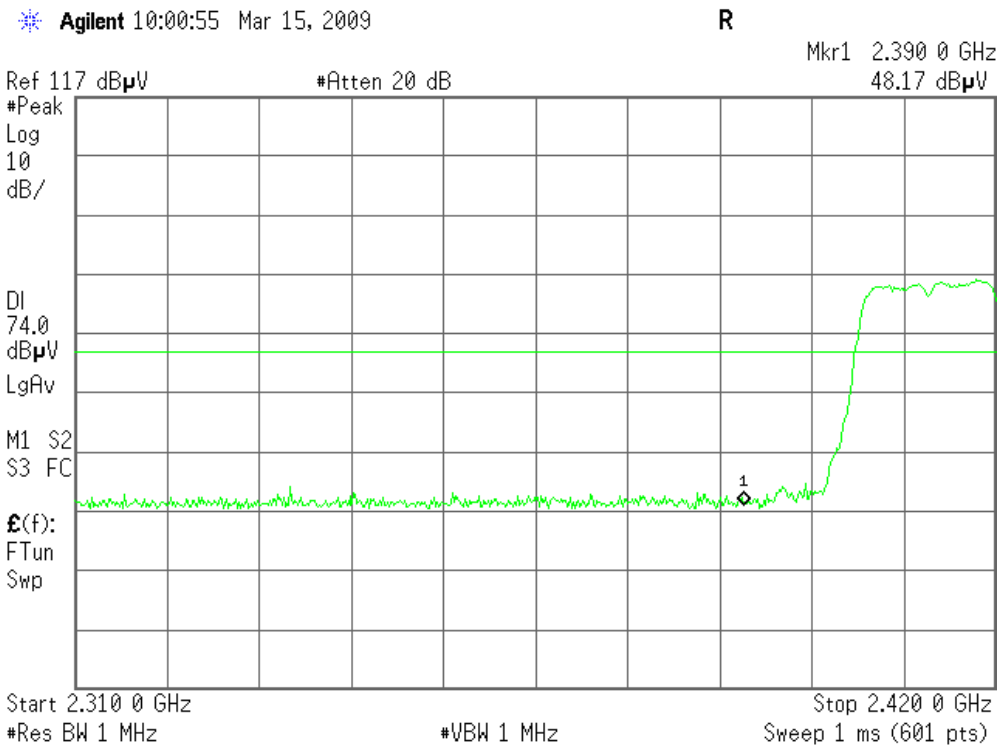
**Detector mode: Peak** **Polarity: Vertical**



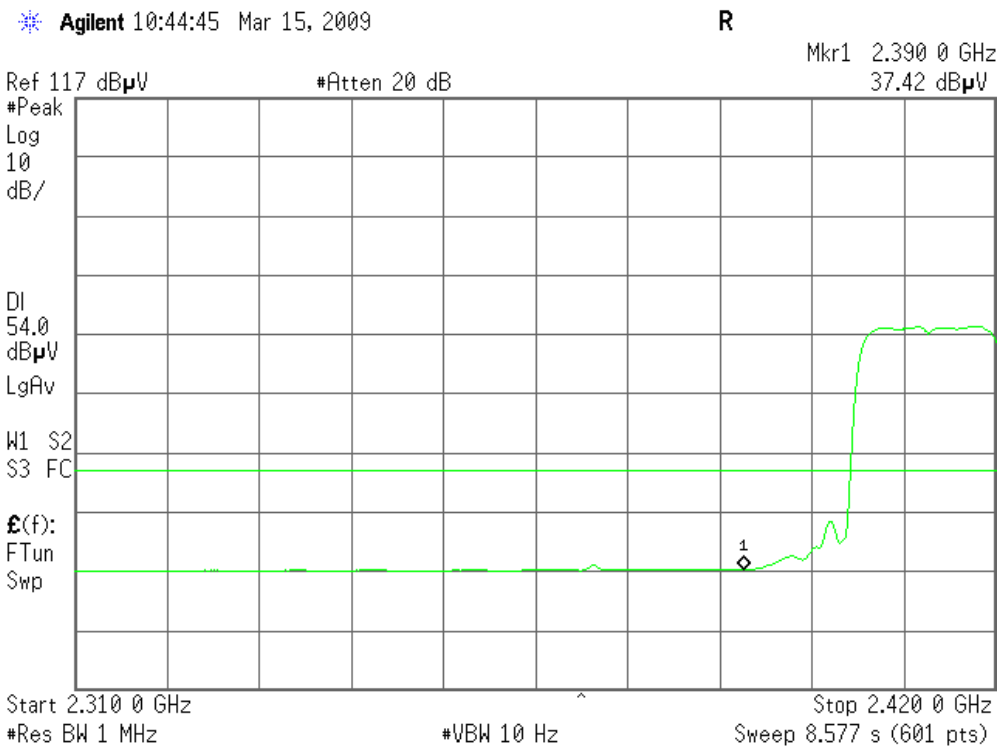

**Detector mode: Average** **Polarity: Vertical**



**Detector mode: Peak** **Polarity: Horizontal**

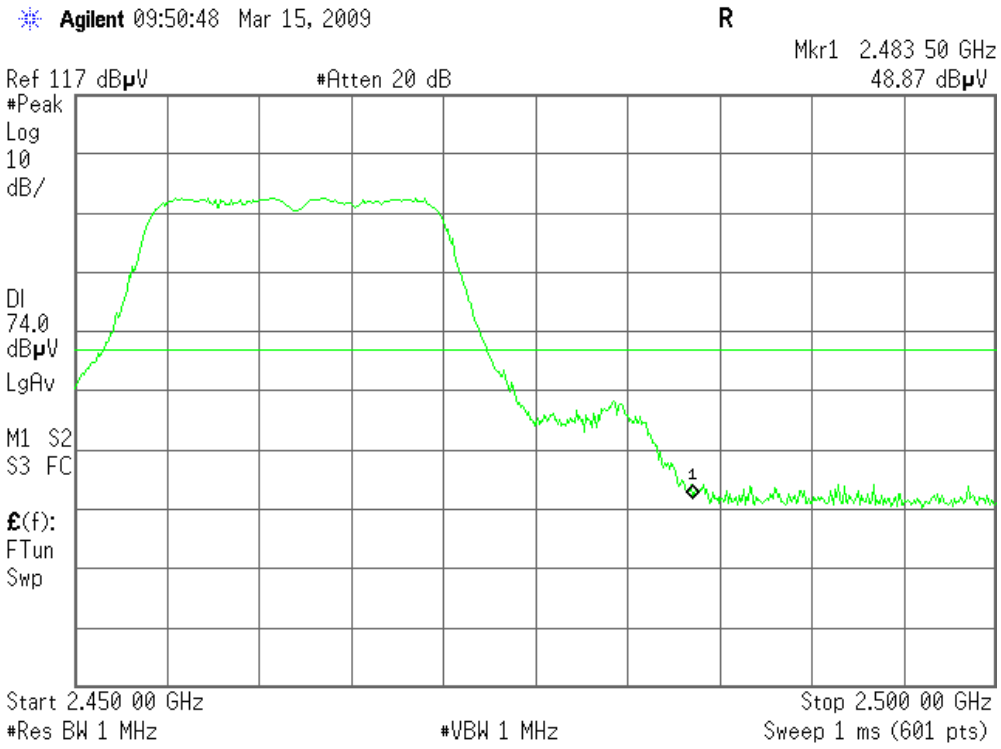



**Detector mode: Average** **Polarity: Horizontal**

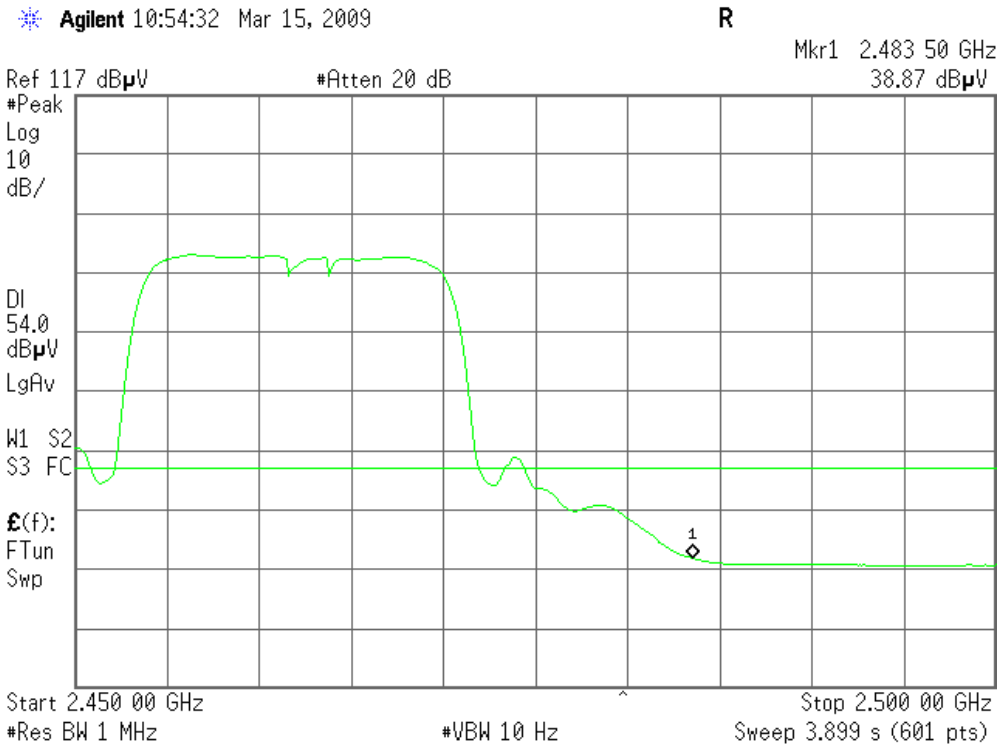


## Band Edges (802.11g / CH High)

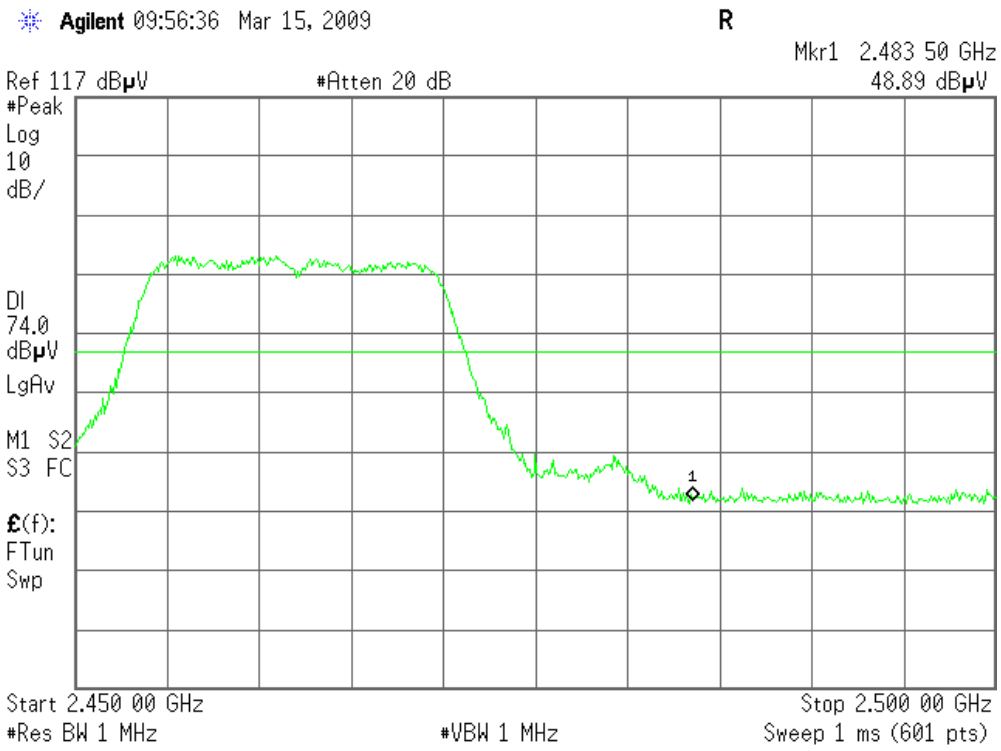
**Detector mode: Peak** **Polarity: Vertical**



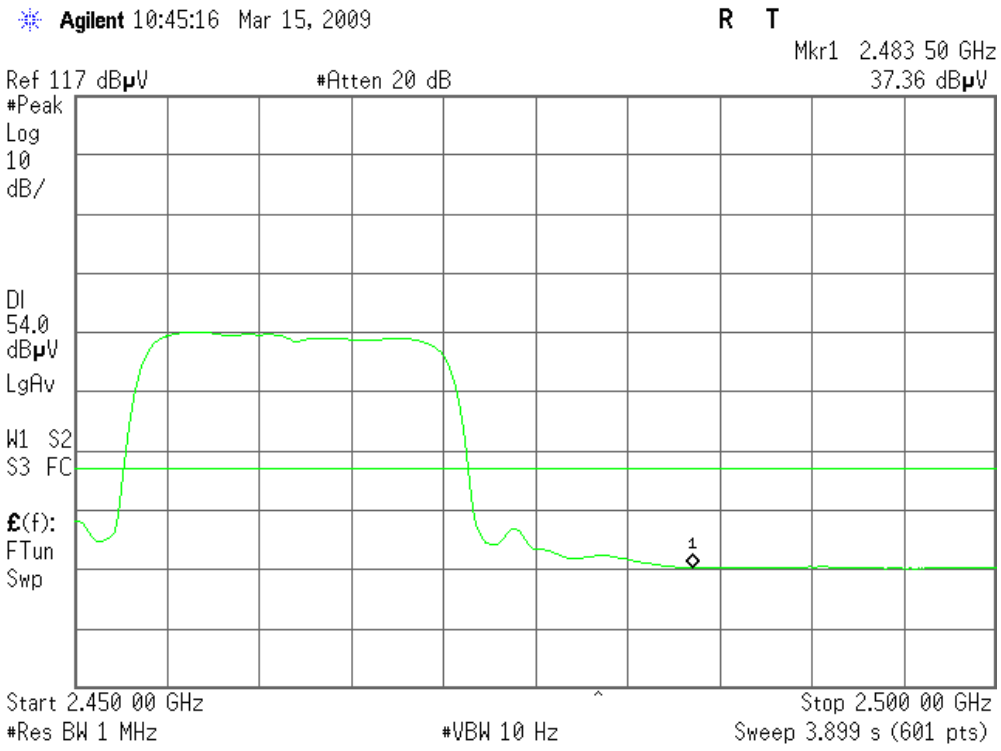

**Detector mode: Average** **Polarity: Vertical**



**Detector mode: Peak** **Polarity: Horizontal**




**Detector mode: Average** **Polarity: Horizontal**



# PEAK POWER SPECTRAL DENSITY

## LIMIT

1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

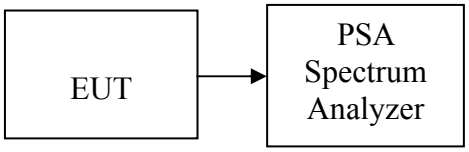
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

## MEASUREMENT EQUIPMENT USED

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| PSA Spectrum Analyzer | Agilent | E4446A | US44300399 | 02/16/2010 |

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

**Test Configuration**




## TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
   Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

2. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 300kHz, Sweep=100s

3. Record the max. reading.

4. Repeat the above procedure until the measurements for all frequencies are completed.

## TEST RESULTS

*No non-compliance noted*

**Test Data**

**Test mode: IEEE 802.11b**

| Channel | Frequency | Reading (dBm) | Factor (dB) | PPSD (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|
| Low | 2412 | -11.93 | 1.00 | -10.93 | 8.00 | PASS |
| Mid | 2437 | 0.06 | 1.00 | 1.06 | | PASS |
| High | 2462 | 1.50 | 1.00 | 2.50 | | PASS |

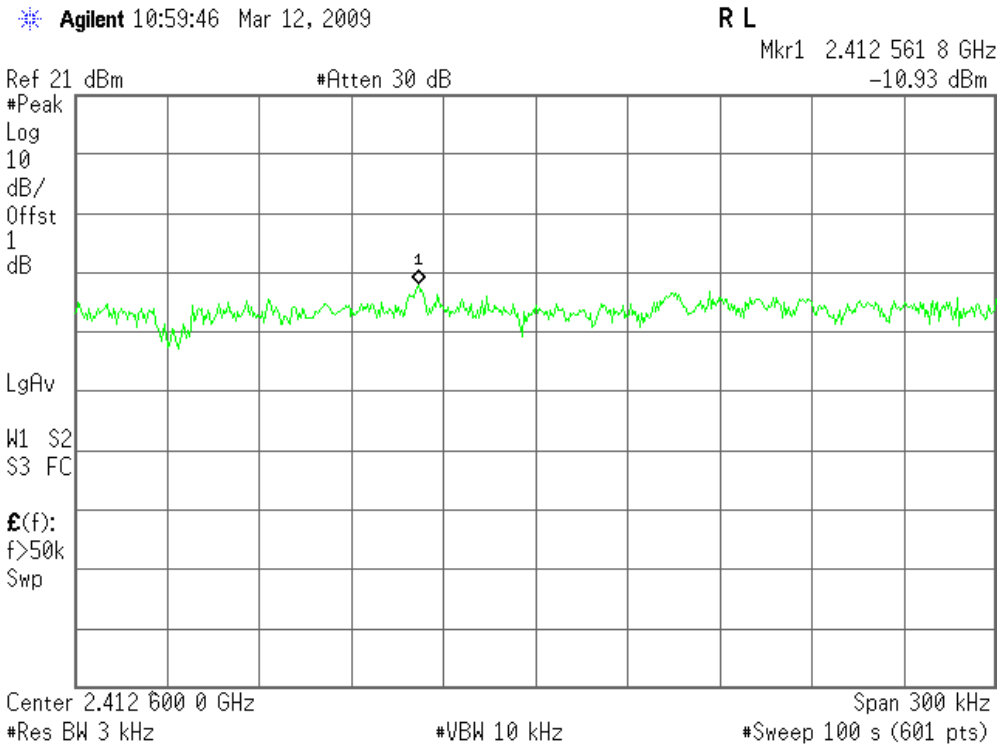
**Test mode: IEEE 802.11g**

| Channel | Frequency | Reading (dBm) | Factor (dB) | PPSD (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|
| Low | 2412 | -18.26 | 1.00 | -17.26 | 8.00 | PASS |
| Mid | 2437 | -20.19 | 1.00 | -19.19 | | PASS |
| High | 2462 | -20.94 | 1.00 | -19.94 | | PASS |

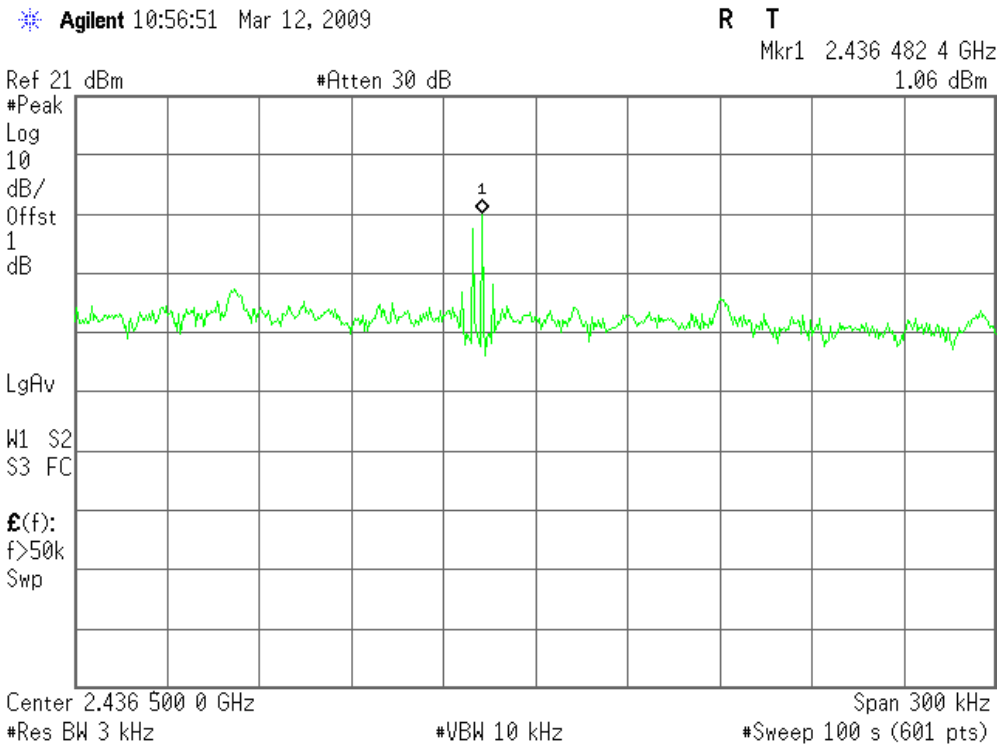
## Test Plot

## 802.11b mode

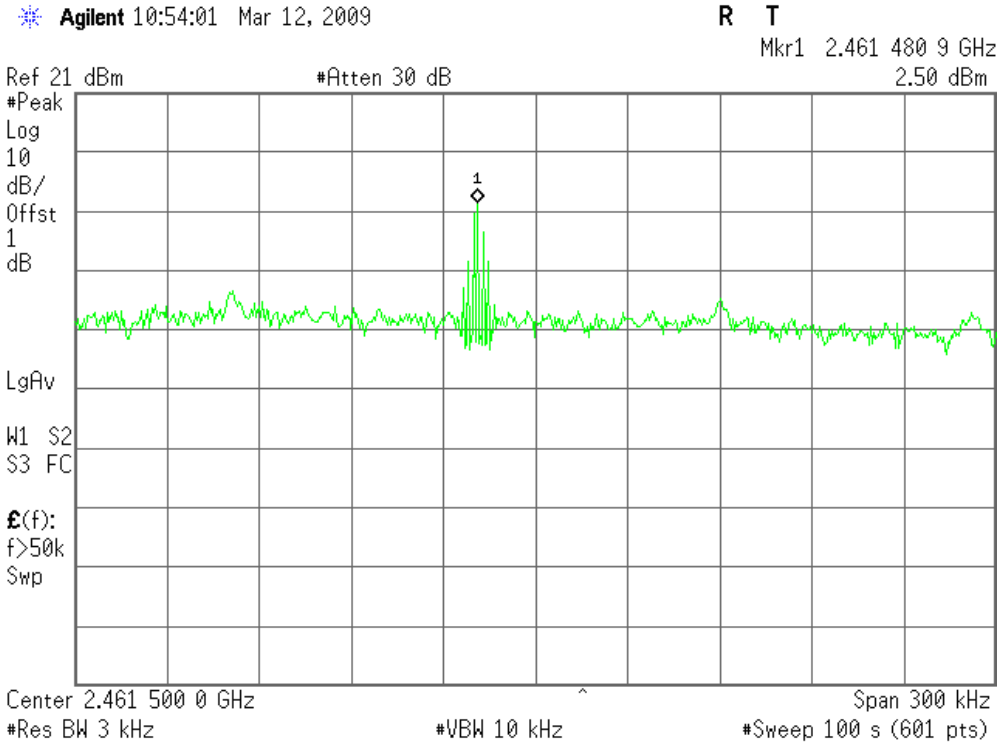
### PPSD (CH Low)




### PPSD (CH Mid)

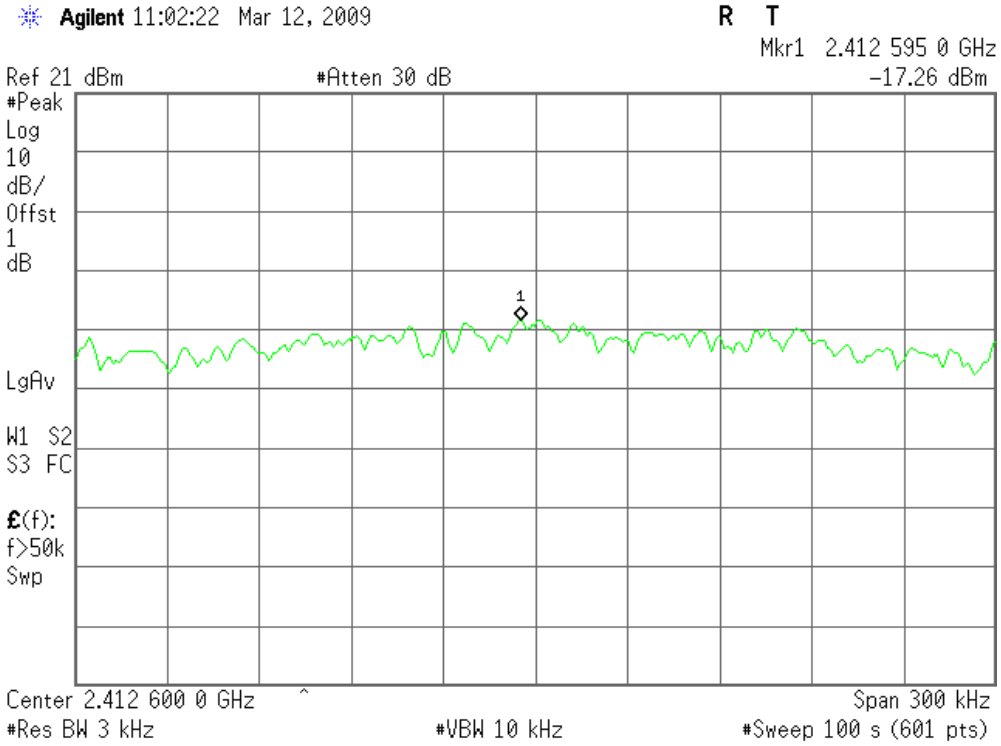


**PPSD (CH High)**

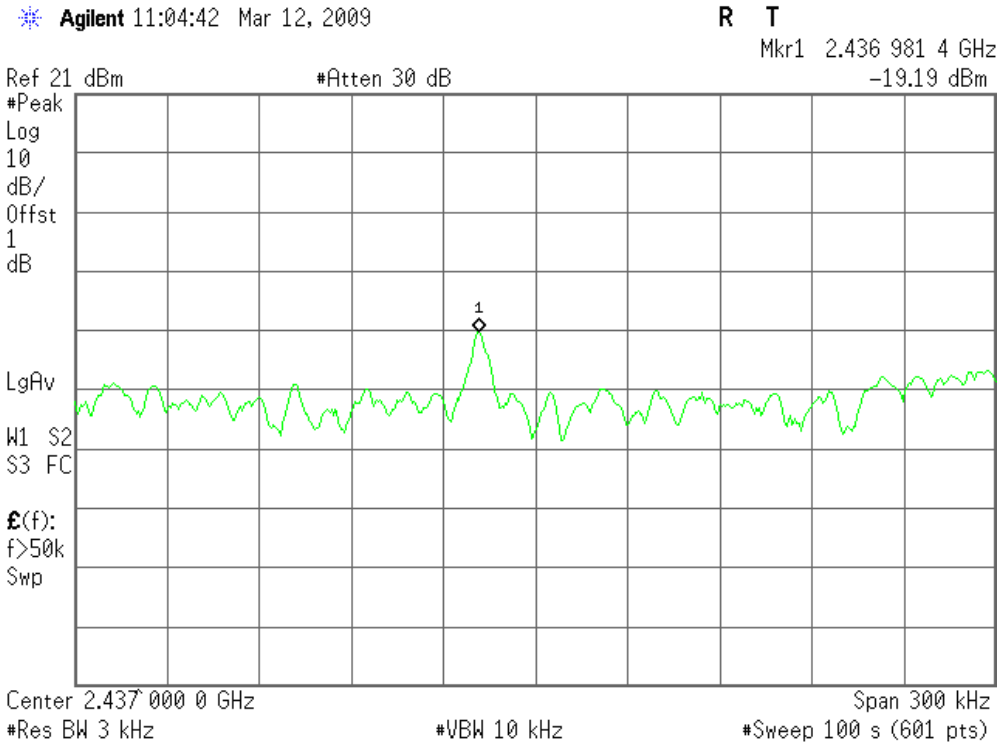

Agilent 10:54:01 Mar 12, 2009
R T
Mkr1 2.461 480 9 GHz
Ref 21 dBm
#Atten 30 dB
2.50 dBm
#Peak
Log
10
dB/
Offst
1
dB
1
LgAv
W1 S2
S3 FC
£(f):
f>50k
Swp
Center 2.461 500 0 GHz
Span 300 kHz
#Res BW 3 kHz
#VBW 10 kHz
#Sweep 100 s (601 pts)

## 802.11g mode

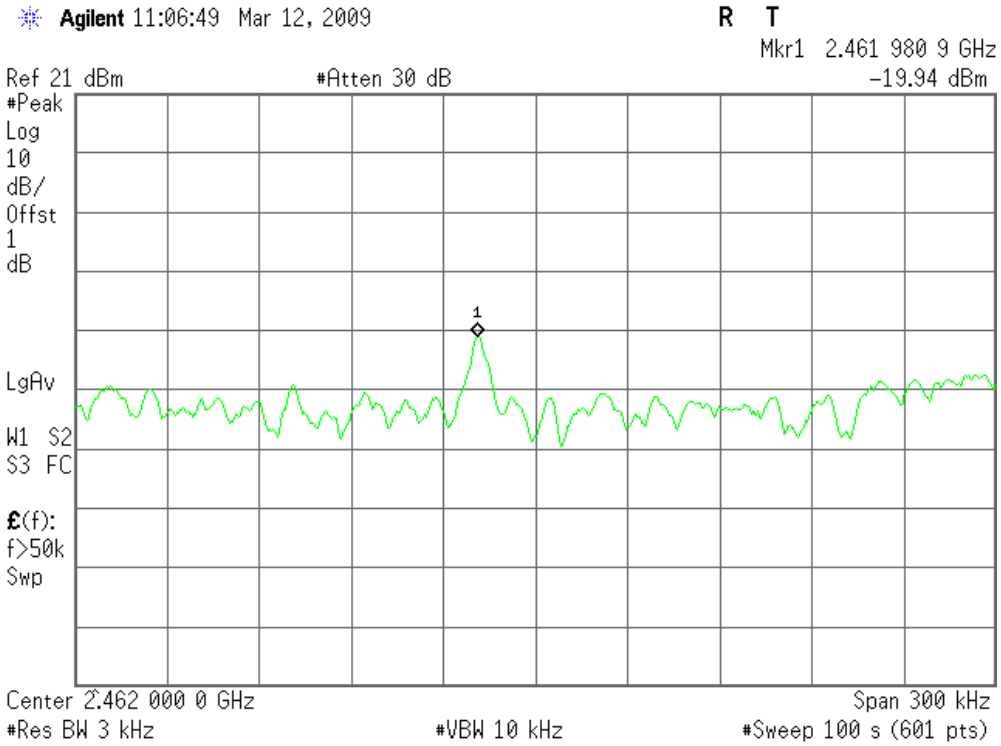
### PPSD (CH Low)




### PPSD (CH Mid)



**PPSD (CH High)**


Agilent 11:06:49 Mar 12, 2009
R T
Mkr1 2.461 980 9 GHz
Ref 21 dBm
#Atten 30 dB
-19.94 dBm
#Peak
Log
10
dB/
Offst
1
dB
1
LgAv
W1 S2
S3 FC
£(f):
f>50k
Swp
Center 2.462 000 0 GHz
Span 300 kHz
#Res BW 3 kHz
#VBW 10 kHz
#Sweep 100 s (601 pts)

## SPURIOUS EMISSIONS

### 7.6.1 Conducted Measurement

## LIMIT

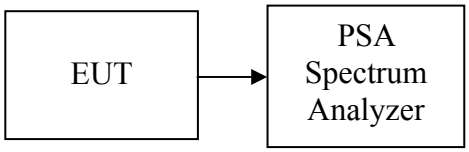
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

## MEASUREMENT EQUIPMENT USED

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| PSA Spectrum Analyzer | Agilent | E4446A | US44300399 | 02/16/2010 |

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

**Test Configuration**




## TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 100 KHz.

Measurements are made over the 30MHz to 26GHzrange with the transmitter set to the lowest, middle, and highest channels.

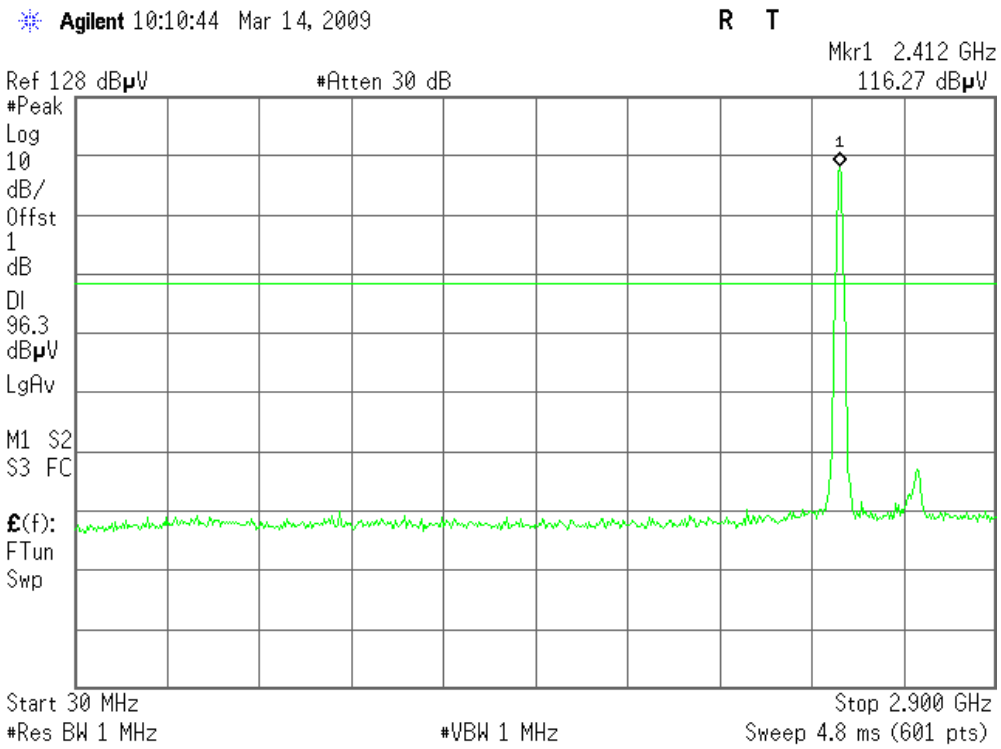
## TEST RESULTS

*No non-compliance noted*

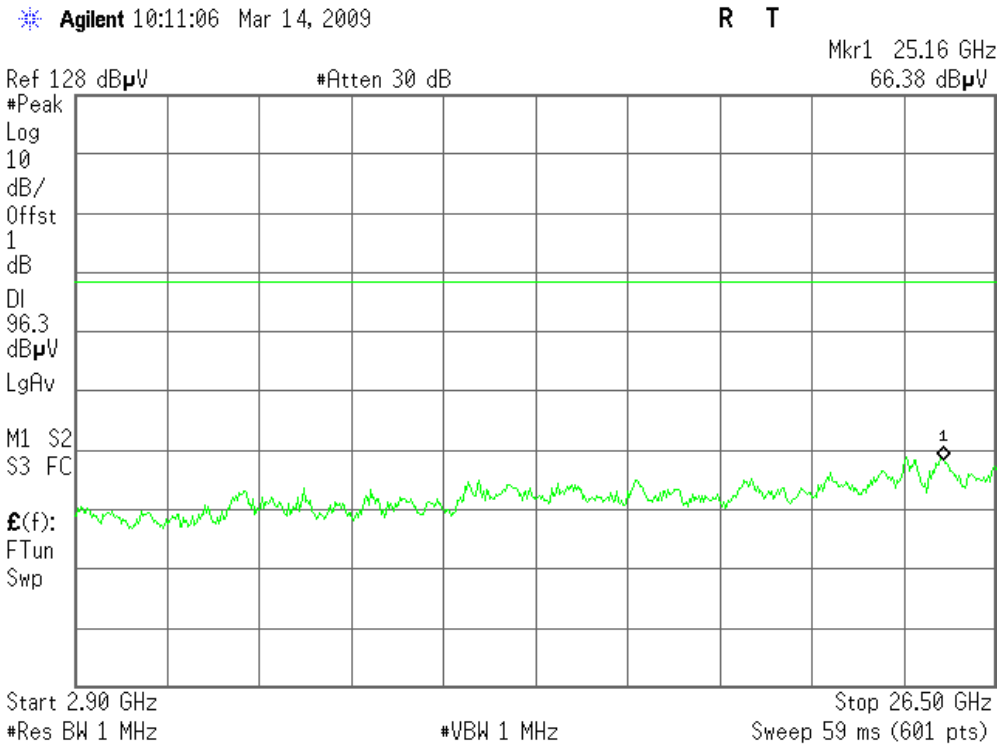
## Test Plot

### IEEE 802.11b / CH Low

**30MHz ~ 2.9GHz**

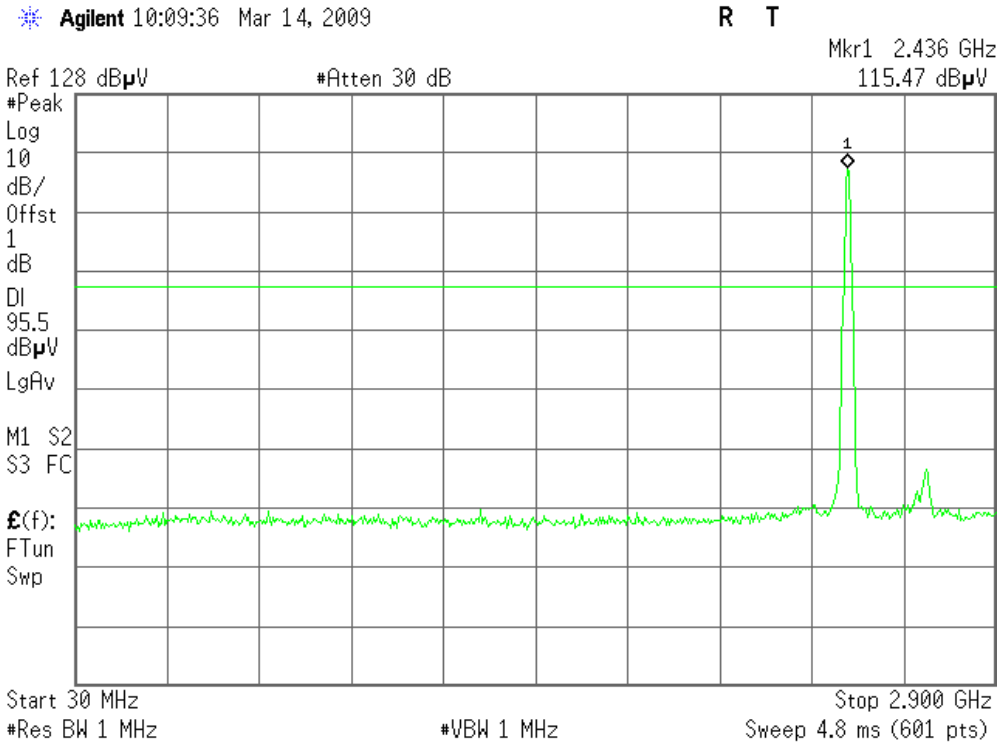



**2.9GHz ~ 26.5GHz**

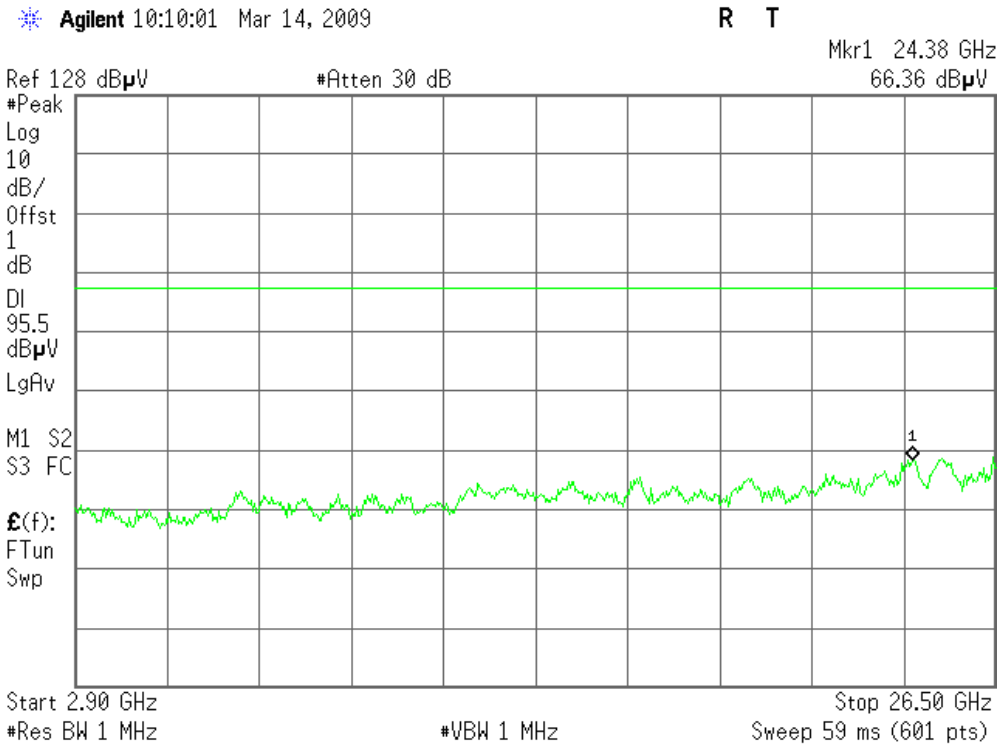


## IEEE 802.11b / CH Mid

### 30MHz ~ 2.9GHz

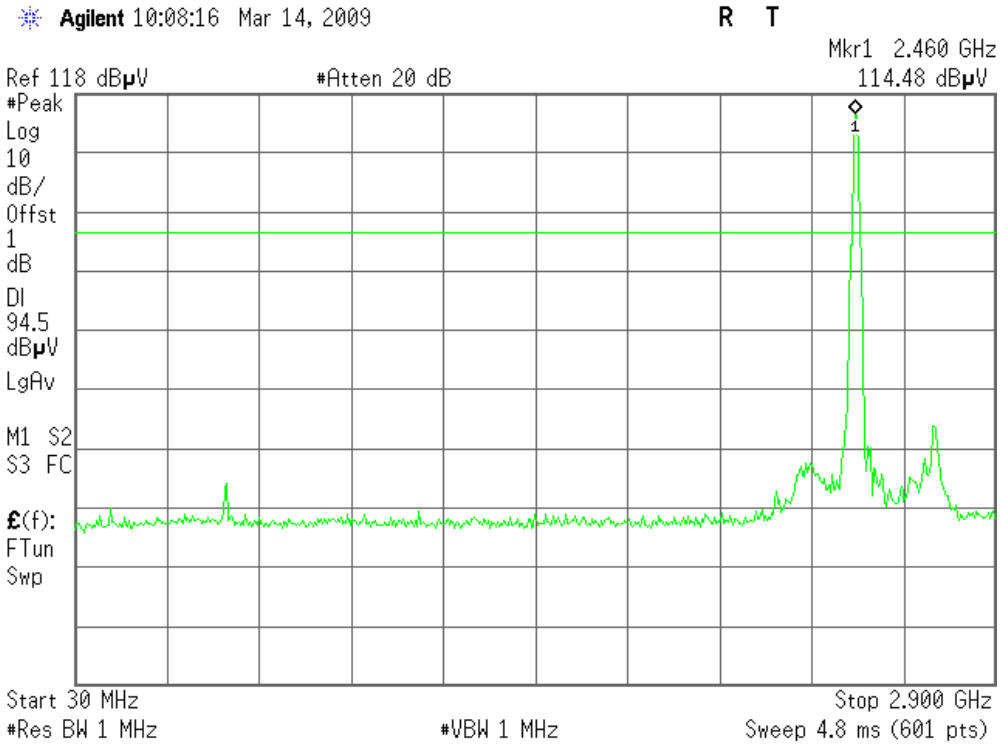



### 2.9GHz ~ 26.5GHz

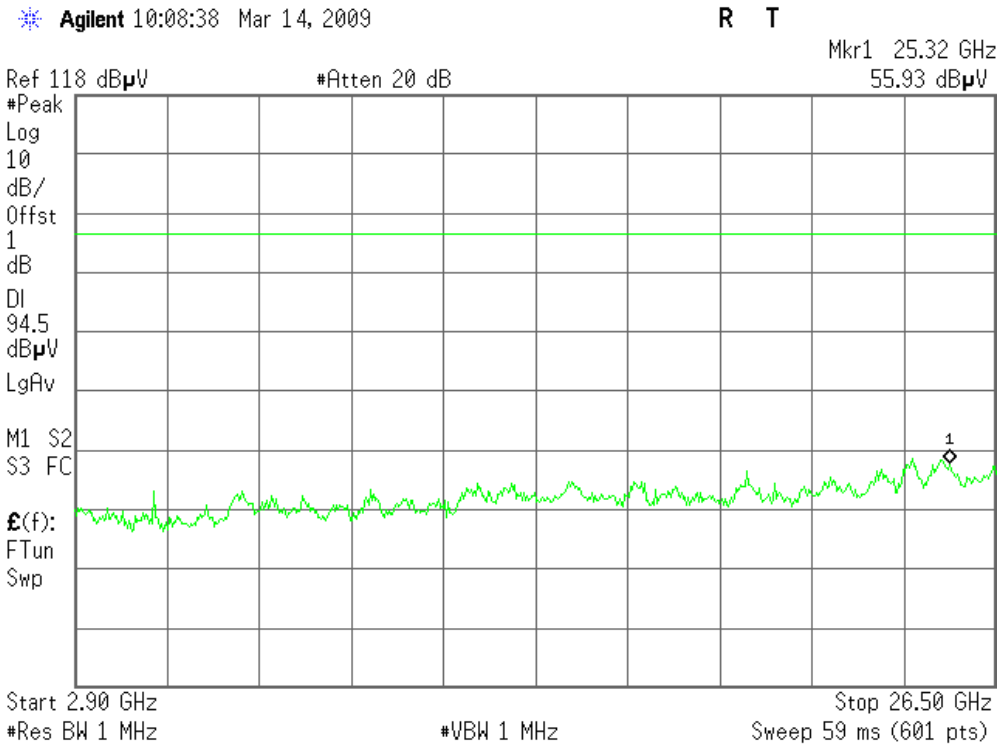


## IEEE 802.11b / CH High

### 30MHz ~ 2.9GHz

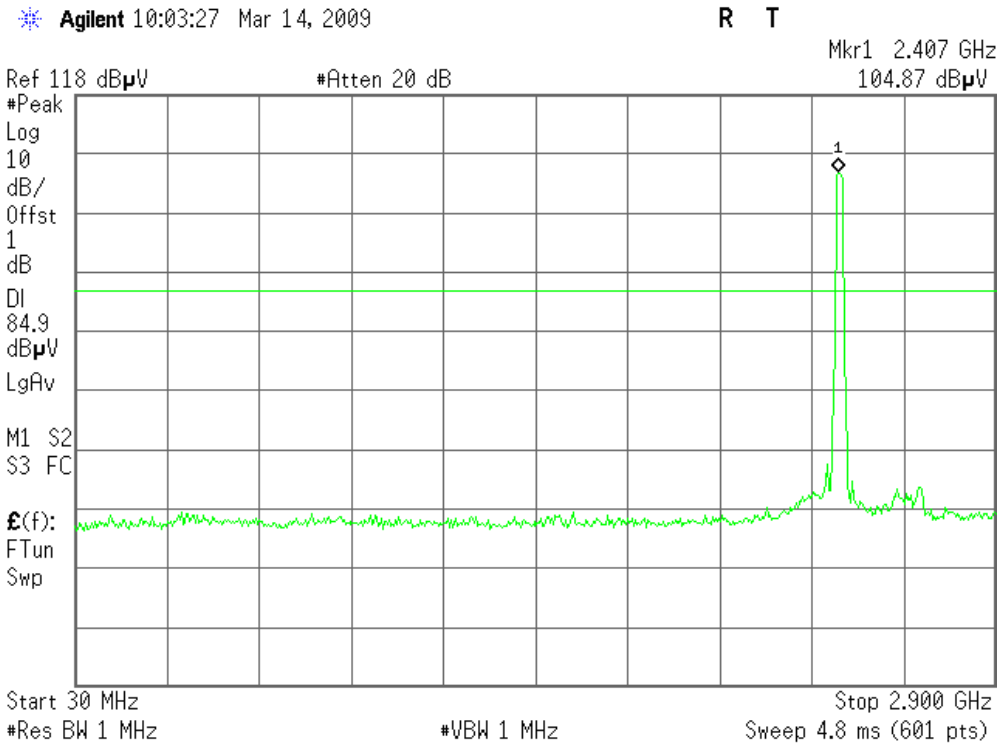



### 2.9GHz ~ 26.5GHz

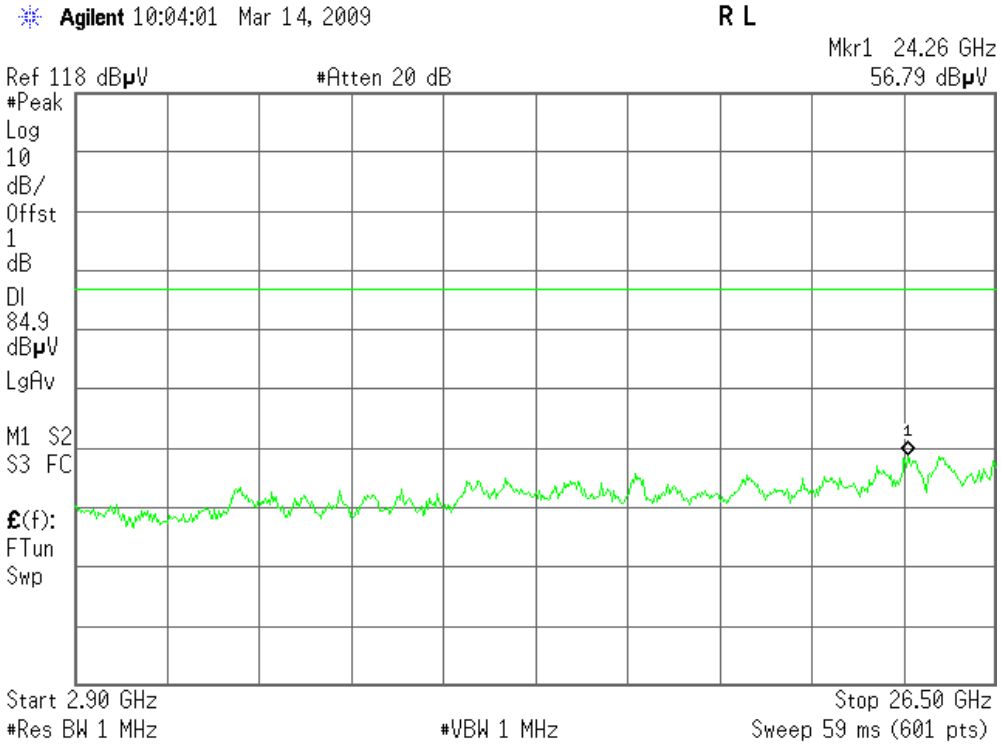


## IEEE 802.11g / CH Low

### 30MHz ~ 2.9GHz

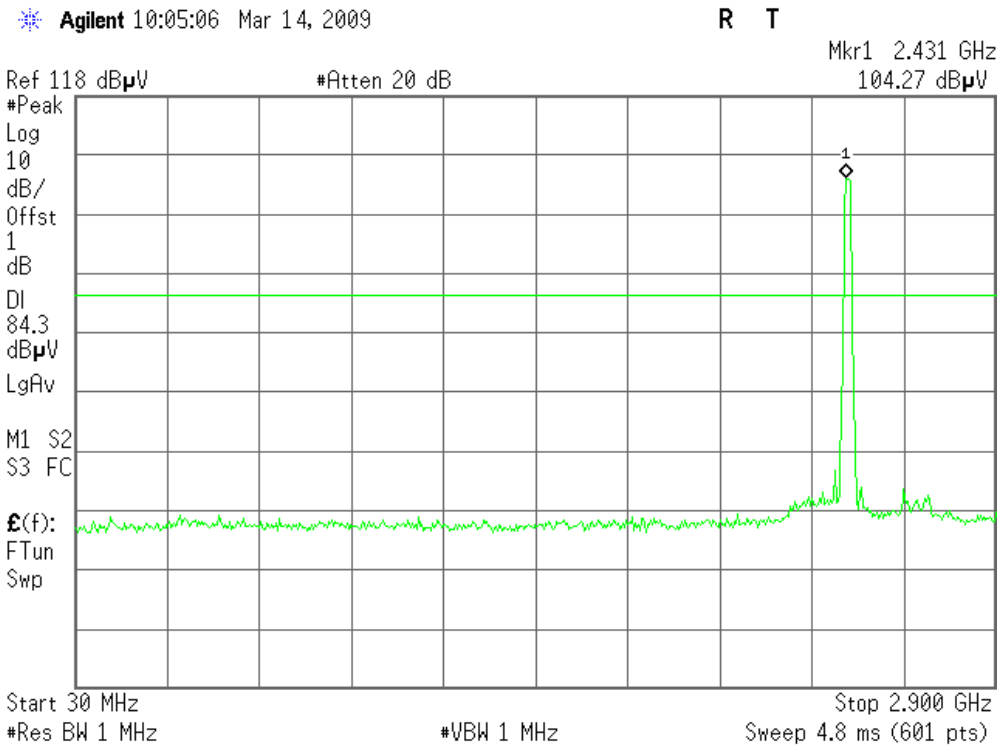



### 2.9GHz ~ 26.5GHz

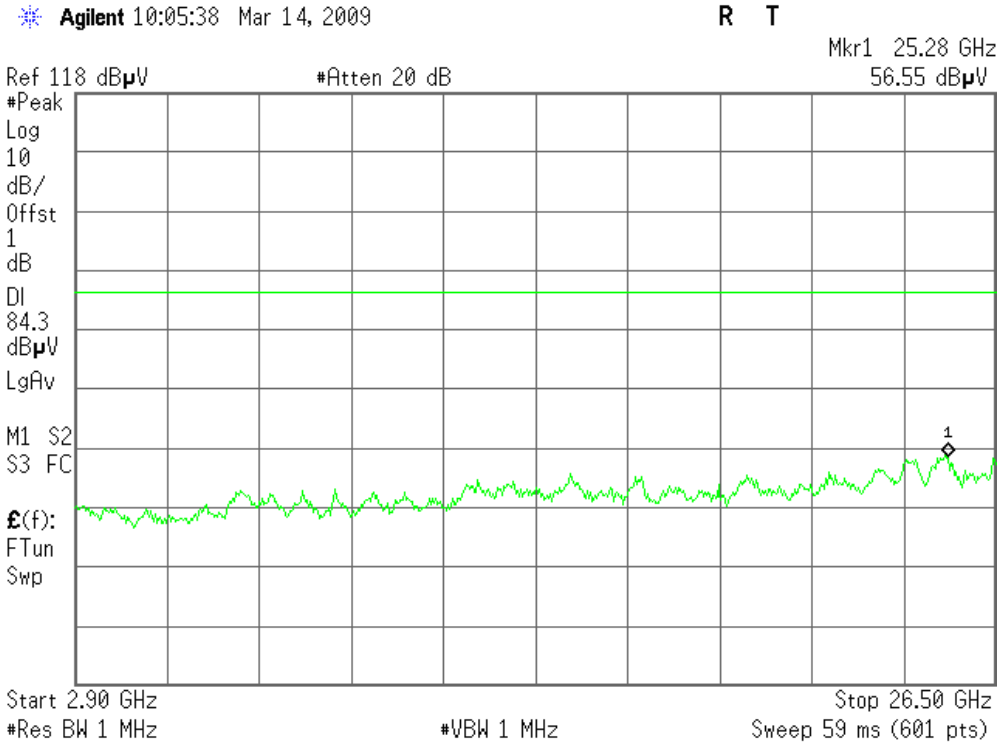


## IEEE 802.11g / CH Mid

### 30MHz ~ 2.9GHz

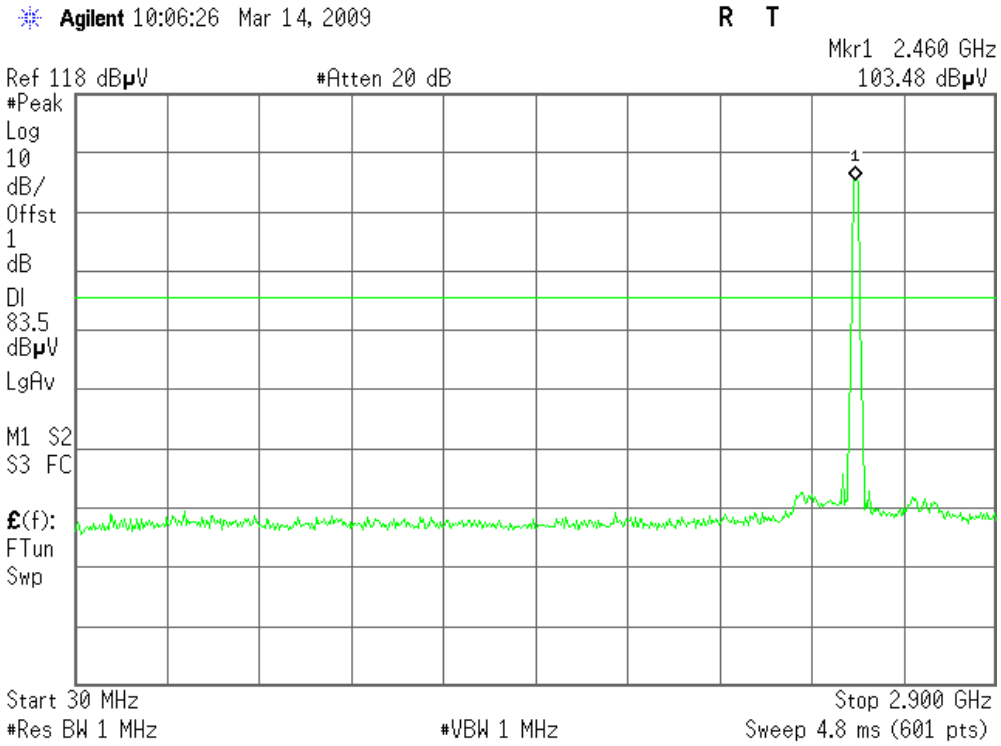



### 2.9GHz ~ 26.5GHz

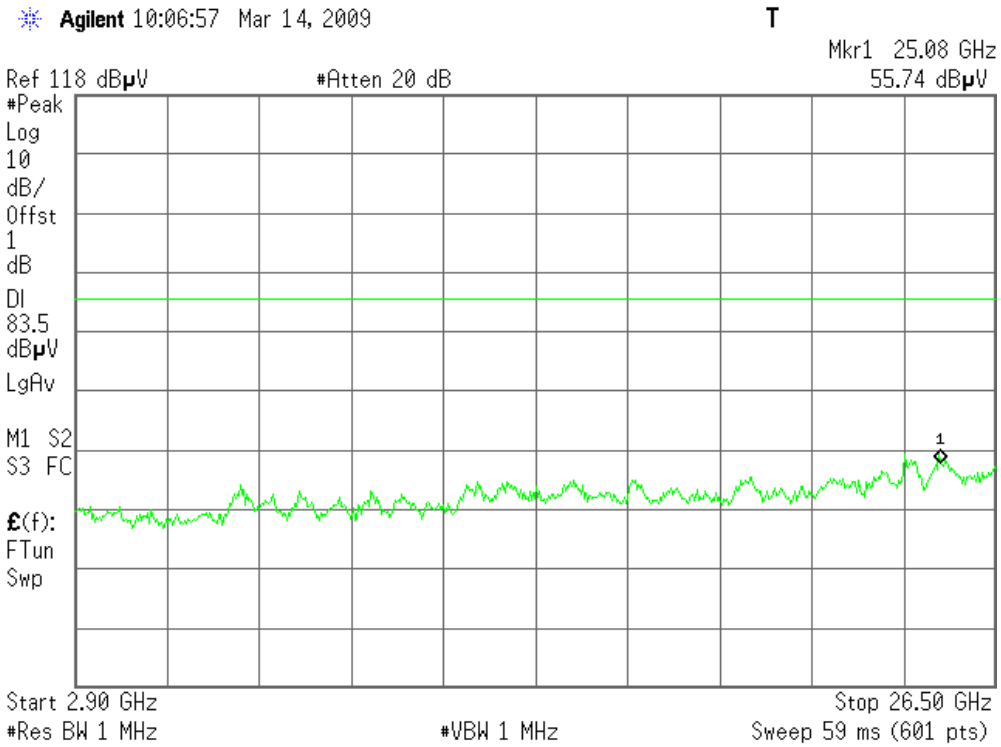


## IEEE 802.11g / CH High

### 30MHz ~ 2.9GHz




### 2.9GHz ~ 26.5GHz



## 7.6.2 Radiated Emissions

**LIMIT**

1. Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field Strength (mV/m) | Measurement Distance (m) |
|---|---|---|
| 30-88 | 100* | 3 |
| 88-216 | 150* | 3 |
| 216-960 | 200* | 3 |
| Above 960 | 500 | 3 |

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

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

| Frequency (Hz) | Field Strength (μV/m at 3-meter) | Field Strength (dBμV/m at 3-meter) |
|---|---|---|
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500 | 54 |

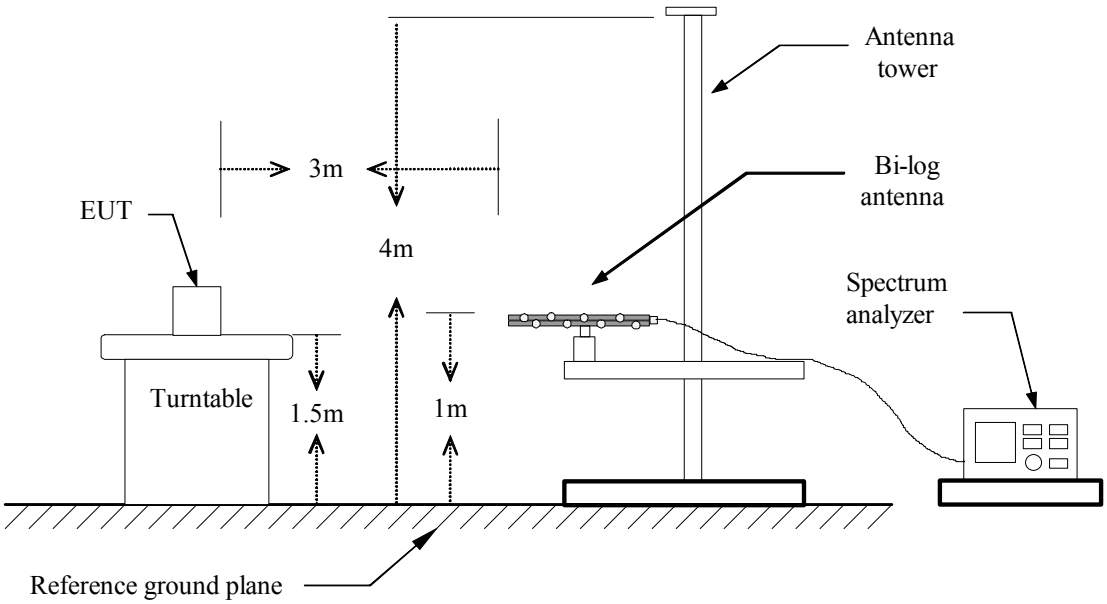
# MEASUREMENT EQUIPMENT USED

| 966 CHAMBER | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| PSA Spectrum Analyzer | Agilent | E4446A | US44300399 | 02/16/2010 |
| EMI Test Receiver | R&S | ESCI | 100005 | 06/23/2009 |
| Pre Amplifier | HP | HP8447E | 2945A02715 | 06/15/2009 |
| Pre Amplifier | Agilent | 8449B | N/A | 06/04/2009 |
| Bilog Antenna | SUNOL Sciences | JB3 | A021907 | 06/10/2009 |
| Horn Antenna | TRC | N/A | N/A | 06/10/2009 |
| Turn Table | CCS | 2081-1.21 | N/A | N.C.R |
| Antenna Tower | CT | N/A | N/A | N.C.R |
| Controller | CCS | N/A | N/A | N.C.R |
| RF Comm. Test set | HP | 8920B | US36142090 | N.C.R |
| Site NSA | C&C | N/A | N/A | 06/09/2009 |

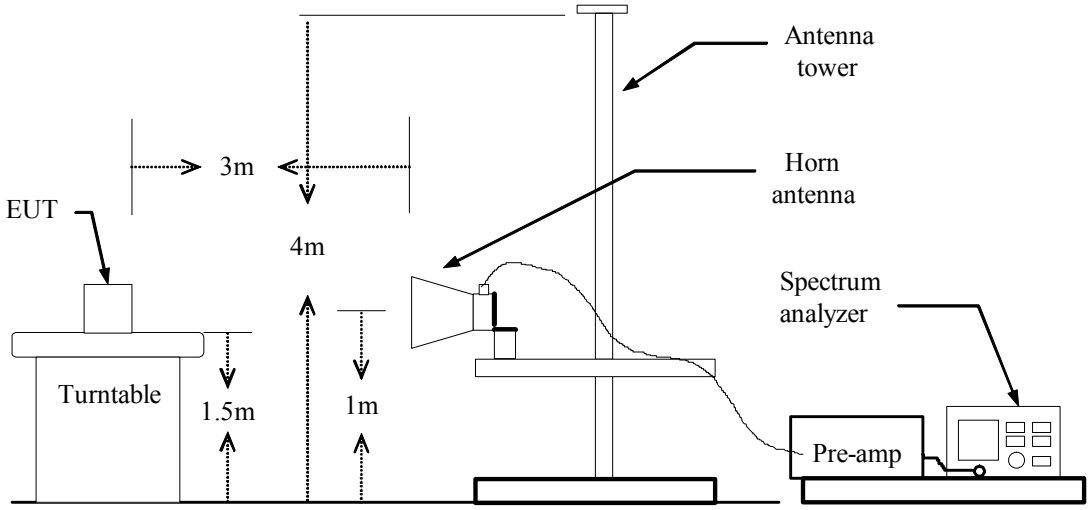
***Remark:*** *Each piece of equipment is scheduled for calibration once a year.*

## Test Configuration

### Below 1 GHz



**Above 1 GHz**




## TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

# TEST RESULTS

## Below 1 GHz

**(These results were the worst case of Low,Mid and High channels tested.)**

**Operation Mode:** TX / IEEE 802.11b / CH Low **Test Date:** March 20, 2009

**Temperature:** 25°C **Tested by:** Cheney

**Humidity:** 60 % RH **Polarity:** Ver. / Hor.

| Freq. (MHz) | Ant.Pol. H/V | Detector Mode (PK/QP) | Reading (dBuV) | Factor (dB) | Actual FS (dBuV/m) | Limit 3m (dBuV/m) | Safe Margin (dB) |
|---|---|---|---|---|---|---|---|
| 40.417 | V | QP | 40.76 | -2.23 | 38.53 | 40.00 | -1.47 |
| 47.159 | V | QP | 47.68 | -9.07 | 38.61 | 40.00 | -1.39 |
| 216.024 | V | QP | 51.60 | -6.93 | 44.67 | 46.00 | -1.33 |
| 270.300 | V | QP | 46.62 | -2.13 | 44.49 | 46.00 | -1.51 |
| 369.404 | V | QP | 45.40 | -0.94 | 44.46 | 46.00 | -1.54 |
| 406.088 | V | QP | 43.58 | 0.90 | 44.48 | 46.00 | -1.52 |
| | | | | | | | |
| 122.834 | H | QP | 46.72 | -4.59 | 42.13 | 43.50 | -1.37 |
| 189.074 | H | QP | 49.43 | -7.32 | 42.11 | 43.50 | -1.39 |
| 216.024 | H | QP | 51.46 | -6.57 | 44.89 | 46.00 | -1.11 |
| 270.374 | H | QP | 47.61 | -3.33 | 44.28 | 46.00 | -1.72 |
| 351.707 | H | QP | 47.48 | -2.84 | 44.62 | 46.00 | -1.36 |
| 378.584 | H | QP | 47.23 | -2.75 | 44.48 | 46.00 | -1.52 |

***Notes:***

1. *Measuring frequencies from 30 MHz to the 1GHz.*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/Quasi-peak detector mode.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.*

**Operation Mode:** TX / IEEE 802.11b / CH Mid
**Test Date:** March 15, 2009
**Temperature:** 25°C
**Tested by:** Cheney
**Humidity:** 60 % RH
**Polarity:** Ver. / Hor.

| Freq. (MHz) | Ant.Pol. H/V | Detector Mode (PK/QP) | Reading (dBuV) | Factor (dB) | Actual FS (dBuV/m) | Limit 3m (dBuV/m) | Safe Margin (dB) |
|---|---|---|---|---|---|---|---|
| 47.159 | V | QP | 40.58 | -2.23 | 38.35 | 40.00 | -1.65 |
| 162.041 | V | QP | 48.23 | -5.92 | 42.31 | 43.50 | -1.19 |
| 189.074 | V | QP | 49.26 | -6.97 | 42.29 | 43.50 | -1.21 |
| 270.300 | V | QP | 46.40 | -2.13 | 44.27 | 46.00 | -1.73 |
| 369.404 | V | QP | 45.24 | -0.94 | 44.30 | 46.00 | -1.70 |
| 459.114 | V | QP | 44.79 | -0.50 | 44.29 | 46.00 | -1.71 |
| 114.916 | H | QP | 47.05 | -4.83 | 42.22 | 43.50 | -1.28 |
| 189.074 | H | QP | 49.78 | -7.32 | 42.46 | 43.50 | -1.04 |
| 216.024 | H | QP | 51.21 | -6.57 | 44.64 | 46.00 | -1.36 |
| 270.374 | H | QP | 47.61 | -3.33 | 44.28 | 46.00 | -1.72 |
| 351.707 | H | QP | 47.46 | -2.84 | 44.62 | 46.00 | -1.38 |
| 369.404 | H | QP | 47.62 | -2.68 | 44.94 | 46.00 | -1.06 |

***Notes:***

1. *Measuring frequencies from 30 MHz to the 1GHz.*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/Quasi-peak detector mode.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.*

**Operation Mode:** TX / IEEE 802.11b / CH High **Test Date:** March 20, 2009

**Temperature:** 25°C **Tested by:** Cheney

**Humidity:** 60 % RH **Polarity:** Ver. / Hor.

| Freq. (MHz) | Ant.Pol. H/V | Detector Mode (PK/QP) | Reading (dBuV) | Factor (dB) | Actual FS (dBuV/m) | Limit 3m (dBuV/m) | Safe Margin (dB) |
|---|---|---|---|---|---|---|---|
| 40.417 | V | QP | 40.65 | -2.23 | 38.42 | 40.00 | -1.58 |
| 47.159 | V | QP | 47.74 | -9.07 | 38.67 | 40.00 | -1.33 |
| 189.074 | V | QP | 49.19 | -6.97 | 42.22 | 43.50 | -1.28 |
| 270.374 | V | QP | 46.52 | -2.13 | 44.39 | 46.00 | -1.61 |
| 369.404 | V | QP | 45.32 | -0.94 | 44.38 | 46.00 | -1.62 |
| 406.088 | V | QP | 43.60 | 0.90 | 44.50 | 46.00 | -1.50 |
| 122.834 | H | QP | 46.56 | -4.59 | 41.97 | 43.50 | -1.53 |
| 189.074 | H | QP | 49.65 | -7.32 | 42.33 | 43.50 | -1.17 |
| 216.024 | H | QP | 51.25 | -6.57 | 44.68 | 46.00 | -1.32 |
| 270.374 | H | QP | 47.58 | -3.33 | 44.25 | 46.00 | -1.75 |
| 369.404 | H | QP | 47.49 | -2.68 | 44.81 | 46.00 | -1.19 |
| 378.584 | H | QP | 47.45 | -2.75 | 44.70 | 46.00 | -1.30 |

***Notes:***

1. *Measuring frequencies from 30 MHz to the 1GHz.*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/Quasi-peak detector mode.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.*

**Operation Mode:** TX / IEEE 802.11g / CH Low
**Test Date:** March 20, 2009
**Temperature:** 25°C
**Tested by:** Cheney
**Humidity:** 60 % RH
**Polarity:** Ver. / Hor.

| Freq. (MHz) | Ant.Pol. H/V | Detector Mode (PK/QP) | Reading (dBuV) | Factor (dB) | Actual FS (dBuV/m) | Limit 3m (dBuV/m) | Safe Margin (dB) |
|---|---|---|---|---|---|---|---|
| 40.417 | V | QP | 41.11 | -2.23 | 38.88 | 40.00 | -1.12 |
| 47.159 | V | QP | 48.04 | -9.07 | 38.97 | 40.00 | -1.03 |
| 189.074 | V | QP | 49.21 | -6.97 | 42.24 | 43.50 | -1.26 |
| 216.024 | V | QP | 51.65 | -6.93 | 44.72 | 46.00 | -1.28 |
| 369.404 | V | QP | 45.68 | -0.94 | 44.74 | 46.00 | -1.26 |
| 406.088 | V | QP | 43.59 | 0.90 | 44.49 | 46.00 | -1.51 |
| 122.834 | H | QP | 46.67 | -4.59 | 42.08 | 43.50 | -1.42 |
| 189.074 | H | QP | 49.31 | -7.32 | 41.99 | 43.50 | -1.51 |
| 216.024 | H | QP | 51.37 | -6.57 | 44.80 | 46.00 | -1.20 |
| 270.374 | H | QP | 48.15 | -3.33 | 44.82 | 46.00 | -1.18 |
| 351.707 | H | QP | 47.51 | -2.84 | 44.67 | 46.00 | -1.33 |
| 378.584 | H | QP | 47.21 | -2.75 | 44.46 | 46.00 | -1.54 |

***Notes:***

1. *Measuring frequencies from 30 MHz to the 1GHz.*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/Quasi-peak detector mode.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.*

**Operation Mode:** TX / IEEE 802.11g / CH Mid
**Test Date:** March 20, 2009
**Temperature:** 25°C
**Tested by:** Cheney
**Humidity:** 60 % RH
**Polarity:** Ver. / Hor.

| Freq. (MHz) | Ant.Pol. H/V | Detector Mode (PK/QP) | Reading (dBuV) | Factor (dB) | Actual FS (dBuV/m) | Limit 3m (dBuV/m) | Safe Margin (dB) |
|---|---|---|---|---|---|---|---|
| 40.417 | V | QP | 40.65 | -2.23 | 38.42 | 40.00 | -1.58 |
| 47.159 | V | QP | 47.86 | -9.07 | 38.79 | 40.00 | -1.21 |
| 216.024 | V | QP | 49.00 | -6.93 | 42.07 | 43.50 | -1.43 |
| 270.300 | V | QP | 46.52 | -2.13 | 44.39 | 46.00 | -1.61 |
| 369.404 | V | QP | 45.37 | -0.94 | 44.43 | 46.00 | -1.57 |
| 459.114 | V | QP | 44.95 | -0.50 | 44.45 | 46.00 | -1.55 |
| 122.834 | H | QP | 46.72 | -4.59 | 42.13 | 43.50 | -1.37 |
| 189.074 | H | QP | 49.57 | -7.32 | 42.25 | 43.50 | -1.25 |
| 216.024 | H | QP | 51.13 | -6.57 | 44.56 | 46.00 | -1.44 |
| 270.374 | H | QP | 47.77 | -3.33 | 44.44 | 46.00 | -1.56 |
| 351.707 | H | QP | 47.41 | -2.84 | 44.57 | 46.00 | -1.43 |
| 378.584 | H | QP | 47.65 | -2.75 | 44.81 | 46.00 | -1.19 |

***Notes:***

1. *Measuring frequencies from 30 MHz to the 1GHz.*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/Quasi-peak detector mode.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.*

**Operation Mode:** TX / IEEE 802.11g / CH High
**Test Date:** March 20, 2009
**Temperature:** 25°C
**Tested by:** Cheney
**Humidity:** 60 % RH
**Polarity:** Ver. / Hor.

| Freq. (MHz) | Ant.Pol. H/V | Detector Mode (PK/QP) | Reading (dBuV) | Factor (dB) | Actual FS (dBuV/m) | Limit 3m (dBuV/m) | Safe Margin (dB) |
|---|---|---|---|---|---|---|---|
| 40.417 | V | QP | 40.77 | -2.23 | 38.54 | 40.00 | -1.46 |
| 53.881 | V | QP | 50.60 | -12.03 | 38.57 | 40.00 | -1.43 |
| 122.034 | V | QP | 51.06 | -8.75 | 43.31 | 43.50 | -1.19 |
| 270.374 | V | QP | 46.50 | -2.13 | 44.37 | 46.00 | -1.63 |
| 369.404 | V | QP | 45.37 | -0.94 | 44.43 | 46.00 | -1.57 |
| 406.088 | V | QP | 43.88 | 0.90 | 44.78 | 46.00 | -1.22 |
| 122.834 | H | QP | 46.55 | -4.59 | 41.96 | 43.50 | -1.54 |
| 189.074 | H | QP | 49.66 | -7.32 | 42.34 | 43.50 | -1.16 |
| 216.024 | H | QP | 51.20 | -6.57 | 44.63 | 46.00 | -1.37 |
| 270.374 | H | QP | 47.74 | -3.33 | 44.41 | 46.00 | -1.59 |
| 369.404 | H | QP | 47.47 | -2.68 | 44.79 | 46.00 | -1.21 |
| 378.584 | H | QP | 47.51 | -2.75 | 44.76 | 46.00 | -1.24 |

***Notes:***

1. *Measuring frequencies from 30 MHz to the 1GHz.*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/Quasi-peak detector mode.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.*

**Above 1 GHz**

**Operation Mode:** TX / IEEE 802.11b / CH Low **Test Date:** March 15, 2009

**Temperature:** 25°C **Tested by:** Cheney

**Humidity:** 60 % RH **Polarity:** Ver. / Hor.

| Freq. (MHz) | Ant. Pol H/V | Peak Reading (dBuV) | AV Reading (dBuV) | Ant. / CL CF (dB) | Actual Fs | | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Peak (dBuV/m) | AV (dBuV/m) | | | | |
| 1296.66 | V | 59.83 | --- | -10.54 | 49.29 | --- | 74.00 | 54.00 | -4.71 | Peak |
| 1800.00 | V | 56.57 | --- | -8.24 | 48.33 | --- | 74.00 | 54.00 | -5.67 | Peak |
| 2040.00 | V | 57.15 | --- | -7.30 | 49.85 | --- | 74.00 | 54.00 | -4.15 | Peak |
| 4825.00 | V | 52.60 | --- | 0.68 | 53.28 | --- | 74.00 | 54.00 | -0.72 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 1240.00 | H | 51.19 | --- | -10.85 | 40.34 | --- | 74.00 | 54.00 | -13.66 | Peak |
| 1296.66 | H | 51.05 | --- | -10.54 | 40.51 | --- | 74.00 | 54.00 | -13.49 | Peak |
| 1616.66 | H | 49.96 | --- | -8.96 | 41.00 | --- | 74.00 | 54.00 | -13.00 | Peak |
| 4825.00 | H | 53.10 | 50.77 | 0.68 | 53.78 | 51.45 | 74.00 | 54.00 | -2.55 | AVG. |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |

***Notes:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
3. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.*
4. *Spectrum setting:*
   a. *Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.*
   b. *AV Setting 1GH z- 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.*

**Operation Mode:** TX / IEEE 802.11b / CH Mid **Test Date:** March 15, 2009

**Temperature:** 25°C **Tested by:** Cheney

**Humidity:** 60 % RH **Polarity:** Ver. / Hor.

| Freq. (MHz) | Ant. Pol H/V | Peak Reading (dBuV) | AV Reading (dBuV) | Ant. / CL CF (dB) | Actual Fs | | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Peak (dBuV/m) | AV (dBuV/m) | | | | |
| 1296.66 | V | 59.66 | --- | -10.54 | 49.12 | --- | 74.00 | 54.00 | -4.88 | Peak |
| 2150.00 | V | 57.75 | --- | -6.87 | 50.88 | --- | 74.00 | 54.00 | -3.12 | Peak |
| 2296.66 | V | 58.11 | --- | -6.29 | 51.82 | --- | 74.00 | 54.00 | -2.18 | Peak |
| 4875.00 | V | 53.09 | 52.15 | 0.77 | 53.86 | 52.92 | 74.00 | 54.00 | -1.08 | AVG. |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 1213.33 | H | 51.88 | --- | -11.00 | 40.88 | --- | 74.00 | 54.00 | -13.12 | Peak |
| 1296.66 | H | 52.50 | --- | -10.54 | 41.96 | --- | 74.00 | 54.00 | -12.04 | Peak |
| 1726.66 | H | 49.78 | --- | -8.53 | 41.25 | --- | 74.00 | 54.00 | -12.75 | Peak |
| 4875.00 | H | 54.34 | 51.08 | 0.77 | 55.11 | 51.85 | 74.00 | 54.00 | -2.15 | AVG. |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |

***Notes:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
3. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.*
4. *Spectrum setting:*
   a. *Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.*
   b. *AV Setting 1GH z- 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.*

**Operation Mode:** TX / IEEE 802.11b / CH High **Test Date:** March 15, 2009

**Temperature:** 25°C **Tested by:** Cheney

**Humidity:** 60 % RH **Polarity:** Ver. / Hor.

| Freq. (MHz) | Ant. Pol H/V | Peak Reading (dBuV) | AV Reading (dBuV) | Ant. / CL CF (dB) | Actual Fs | | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Peak (dBuV/m) | AV (dBuV/m) | | | | |
| 1296.66 | V | 57.37 | --- | -10.54 | 46.83 | --- | 74.00 | 54.00 | -7.17 | Peak |
| 1876.66 | V | 51.60 | --- | -7.94 | 43.66 | --- | 74.00 | 54.00 | -10.34 | Peak |
| 2710.00 | V | 51.85 | --- | -4.90 | 46.95 | --- | 74.00 | 54.00 | -7.05 | Peak |
| 4925.00 | V | 52.85 | 51.16 | 0.85 | 53.70 | 52.01 | 74.00 | 54.00 | -1.99 | AVG. |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 1216.66 | H | 51.47 | --- | -10.98 | 40.49 | --- | 74.00 | 54.00 | -13.51 | Peak |
| 1266.66 | H | 51.51 | --- | -10.70 | 40.81 | --- | 74.00 | 54.00 | -13.19 | Peak |
| 1293.33 | H | 52.12 | --- | -10.56 | 41.56 | --- | 74.00 | 54.00 | -12.44 | Peak |
| 4925.00 | H | 54.27 | 51.96 | 0.85 | 55.12 | 52.81 | 74.00 | 54.00 | -1.19 | AVG. |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |

***Notes:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
3. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.*
4. *Spectrum setting:*
   a. *Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.*
   b. *AV Setting 1GH z- 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.*

**Operation Mode:** TX / IEEE 802.11g / CH Low **Test Date:** March 15, 2009

**Temperature:** 25°C **Tested by:** Cheney

**Humidity:** 60 % RH **Polarity:** Ver. / Hor.

| Freq. (MHz) | Ant. Pol H/V | Peak Reading (dBuV) | AV Reading (dBuV) | Ant. / CL CF (dB) | Actual Fs | | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Peak (dBuV/m) | AV (dBuV/m) | | | | |
| 1216.66 | V | 53.50 | --- | -10.98 | 42.52 | --- | 74.00 | 54.00 | -11.48 | Peak |
| 1243.33 | V | 53.89 | --- | -10.83 | 43.06 | --- | 74.00 | 54.00 | -10.94 | Peak |
| 1296.66 | V | 54.71 | --- | -10.54 | 44.17 | --- | 74.00 | 54.00 | -9.83 | Peak |
| 4875.00 | V | 46.10 | --- | 0.77 | 46.87 | --- | 74.00 | 54.00 | -7.13 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 1243.33 | H | 51.32 | --- | -10.83 | 40.49 | --- | 74.00 | 54.00 | -13.51 | Peak |
| 1296.66 | H | 53.34 | --- | -10.54 | 42.80 | --- | 74.00 | 54.00 | -11.20 | Peak |
| 1726.66 | H | 50.21 | --- | -8.53 | 41.68 | --- | 74.00 | 54.00 | -12.32 | Peak |
| 4883.33 | H | 46.64 | --- | 0.78 | 47.42 | --- | 74.00 | 54.00 | -6.58 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |

***Notes:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
3. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.*
4. *Spectrum setting:*
   a. *Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.*
   b. *AV Setting 1GH z- 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.*

**Operation Mode:** TX / IEEE 802.11g / CH Mid
**Test Date:** March 15, 2009
**Temperature:** 25°C
**Tested by:** Cheney
**Humidity:** 60 % RH
**Polarity:** Ver. / Hor.

| Freq. (MHz) | Ant. Pol H/V | Peak Reading (dBuV) | AV Reading (dBuV) | Ant. / CL CF (dB) | Actual Fs | | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Peak (dBuV/m) | AV (dBuV/m) | | | | |
| 1243.33 | V | 56.93 | --- | -10.83 | 46.10 | --- | 74.00 | 54.00 | -7.90 | Peak |
| 1293.33 | V | 54.72 | --- | -10.56 | 44.16 | --- | 74.00 | 54.00 | -9.84 | Peak |
| 1620.00 | V | 51.80 | --- | -8.95 | 42.85 | --- | 74.00 | 54.00 | -11.15 | Peak |
| 4891.66 | V | 46.24 | --- | 0.79 | 47.03 | --- | 74.00 | 54.00 | -6.97 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 1243.33 | H | 51.49 | --- | -10.83 | 40.66 | --- | 74.00 | 54.00 | -13.34 | Peak |
| 1293.33 | H | 51.36 | --- | -10.56 | 40.80 | --- | 74.00 | 54.00 | -13.20 | Peak |
| 1623.33 | H | 49.87 | --- | -8.94 | 40.93 | --- | 74.00 | 54.00 | -13.07 | Peak |
| 4883.33 | H | 45.53 | --- | 0.78 | 46.31 | --- | 74.00 | 54.00 | -7.69 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |

***Notes:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
3. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.*
4. *Spectrum setting:*
   a. *Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.*
   b. *AV Setting 1GH z- 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.*

**Operation Mode:** TX / IEEE 802.11g / CH High **Test Date:** March 15, 2009

**Temperature:** 25°C **Tested by:** Cheney

**Humidity:** 60 % RH **Polarity:** Ver. / Hor.

| Freq. (MHz) | Ant. Pol H/V | Peak Reading (dBuV) | AV Reading (dBuV) | Ant. / CL CF (dB) | Actual Fs | | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Peak (dBuV/m) | AV (dBuV/m) | | | | |
| 1236.66 | V | 56.13 | --- | -10.87 | 45.26 | --- | 74.00 | 54.00 | -8.74 | Peak |
| 1296.66 | V | 55.71 | --- | -10.54 | 45.17 | --- | 74.00 | 54.00 | -8.83 | Peak |
| 1726.66 | V | 51.72 | --- | -8.53 | 43.19 | --- | 74.00 | 54.00 | -10.81 | Peak |
| 4916.66 | V | 45.95 | --- | 0.84 | 46.79 | --- | 74.00 | 54.00 | -7.21 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 1023.33 | H | 52.20 | --- | -12.04 | 40.16 | --- | 74.00 | 54.00 | -13.84 | Peak |
| 1080.00 | H | 52.26 | --- | -11.73 | 40.53 | --- | 74.00 | 54.00 | -13.47 | Peak |
| 1293.33 | H | 52.21 | --- | -10.56 | 41.65 | --- | 74.00 | 54.00 | -12.35 | Peak |
| 4933.33 | H | 46.42 | --- | 0.87 | 47.29 | --- | 74.00 | 54.00 | -6.71 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |

***Notes:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
3. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.*
4. *Spectrum setting:*
   *a. Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.*
   *b. AV Setting 1GH z- 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.*

## POWERLINE CONDUCTED EMISSIONS

## LIMIT

For an intentional radiator which is designed to be connected to the public utility (AC) power Line, the radio frequency voltage that is conducted back onto the AC power Line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases Linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

| Frequency Range (MHz) | Limits (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

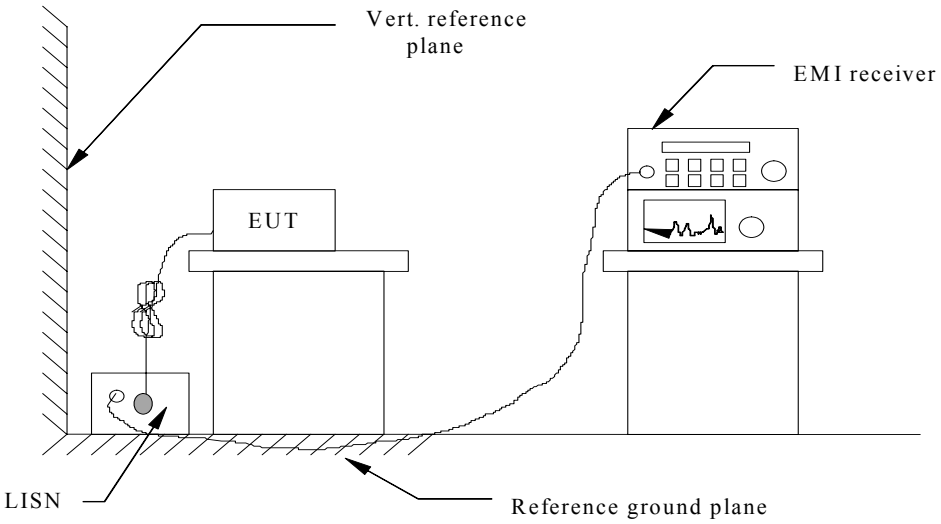
Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power Line (LINE and NEUTRAL) and ground at the power terminals.

## MEASUREMENT EQUIPMENT USED

| Conducted Emission Test Site Shielding Room 743 | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| EMI Test Receiver | R&S | ESCI | 100005 | 06/23/2009 |
| LISN | AFJ | LS16 | 16010222119 | 04/02/2009 |
| LISN | Meestec | AN3016 | 04/10040 | 04/02/2009 |

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

**Test Configuration**




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

## TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

## TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

**Test Data**

| | |
|---|---|
| **Test Mode:** Normal link | **Location:** Shielding Room743 |
| **Model Name:** CM-IP700 | **Test Date:**March 15, 2009 |
| **Tested by:** Cheney | **Test Results:** Passed |

(The chart below shows the highest readings taken from the final data)

| FREQ MHz | PEAK RAW dBuV | Q.P. RAW dBuV | AVG RAW dBuV | Q.P. Limit dBuV | AVG Limit dBuV | Q.P. Margin dB | AVG Margin dB | NOTE |
|---|---|---|---|---|---|---|---|---|
| 0.309 | 60.44 | 58.66 | 49.32 | 61.45 | 51.45 | -2.79 | -2.13 | L1 |
| 0.510 | 56.99 | 53.24 | 43.69 | 56.00 | 46.00 | -2.76 | -2.31 | L1 |
| 0.839 | 57.67 | 53.55 | 43.75 | 56.00 | 46.00 | -2.45 | -2.25 | L1 |
| 0.950 | 55.84 | 52.55 | 37.54 | 56.00 | 46.00 | -3.45 | -8.46 | L1 |
| 1.043 | 53.72 | 50.99 | 41.89 | 56.00 | 46.00 | -5.01 | -4.11 | L1 |
| 3.426 | 53.46 | 50.95 | 34.61 | 56.00 | 46.00 | -5.05 | -11.39 | L1 |
| | | | | | | | | |
| 0.309 | 60.90 | 58.47 | 48.77 | 61.45 | 51.45 | -2.98 | -2.68 | L2 |
| 0.514 | 55.71 | 53.53 | 42.62 | 56.00 | 46.00 | -2.47 | -3.38 | L2 |
| 0.839 | 56.74 | 52.16 | 42.36 | 56.00 | 46.00 | -3.84 | -3.64 | L2 |
| 0.970 | 54.33 | 51.58 | 38.60 | 56.00 | 46.00 | -4.42 | -7.40 | L2 |
| 1.039 | 53.00 | 50.42 | 41.02 | 56.00 | 46.00 | -5.58 | -4.98 | L2 |
| 1.569 | 51.25 | 47.34 | 37.92 | 56.00 | 46.00 | -8.66 | -8.08 | L2 |

***Remark:***

1. *The measuring frequencies range between 0.15 MHz and 30 MHz.*
2. *The emissions measured in the frequency range between 0.15 MHz and 30MHz were made with an instrument using Quasi-peak detector and Average detector.*
3. *"---" denotes the emission level was or more than 2dB below the Average limit, and no re-check was made.*
4. *The IF bandwidth of SPA between 0.15MHz and 30MHz was 10KHz. The IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz.*
5. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*

***Note:***

*Freq.* = *Emission frequency in KHz*

*Factor (dB)* = *cable loss + Insertion loss of LISN+ Insertion loss of TRANSIENT LIMITER (The TRANSIENT LIMITER included 10 dB ATTENUATION)*

*Amptd dBuV* = *Uncorrected Analyzer/Receiver reading + cable loss + Insertion loss of LISN+ Insertion loss of TRANSIENT LIMITER,*

*if it > 0.5 dB*

*Limit dBuV* = *Limit stated in standard*

*Margin dB* = *Reading in reference to limit*

## Calculation Formula

*Margin (dB) = Amptd (dBuV) – Limit (dBuV)*

**Common Mode Conducted Emission**

*Not applicable*

# RADIO FREQUENCY EXPOSURE

## LIMIT

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See §15.247(b)(4) and §1.1307(b)(1) of this chapter.

**EUT Specification**

| | |
|---|---|
| **EUT** | CM-IP700 |
| **Frequency band (Operating)** | ☒ WLAN: 2.412GHz ~ 2.462GHz<br>☐ WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz<br>☐ WLAN: 5.745GHz ~ 5825GHz<br>☐ Others ____ |
| **Device category** | ☐ Portable (<20cm separation)<br>☒ Mobile (>20cm separation)<br>☐ Others _____ |
| **Exposure classification** | ☐ Occupational/Controlled exposure *(S = 5mW/cm$^2$)*<br>☒ General Population/Uncontrolled exposure *(S=1mW/cm$^2$)* |
| **Antenna diversity** | ☐ Single antenna<br>☒ Multiple antennas<br>☐ Tx diversity<br>☐ Rx diversity<br>☒ Tx/Rx diversity |
| **Max. output power** | 15.59 dBm (36.22mW) |
| **Antenna gain (Max)** | 2dBi (Numeric gain: 1.58) |
| **Evaluation applied** | ☒ MPE Evaluation<br>☐ SAR Evaluation |

***Note:***

1. *The maximum output power is 15.59 dBm (36.22mW) at 2412MHz (with 1.58 numeric antenna gain.)*
2. *For mobile or fixed location transmitters, no SAR consideration applied. The minimum separation generally be used is at least 20 cm, even if the calculations indicate that the MPE distance would be lesser.*

## TEST RESULTS

*No non-compliance noted.*

**Calculation**

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

*Where* *E = Field Strength in Volts / meter*
*P = Power in Watts*
*G=Numeric antenna gain*
*d=Distance in meters*
*S=Power Density in milliwatts / square centimeter*

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

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

Changing to units of mW and cm, using:

*P (mW) = P (W) / 1000 and*

*d (cm) =100 * d (m)*

Yields

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

*Where* *d = distance in cm*
*P = Power in mW*
*G = Numeric antenna gain*
*S = Power Density in mW / cm^2*

Substituting the logarithmic form of power and gain using:

*P (mW) = 10 ^ (P (dBm) / 10) and*

*G (numeric) = 10 ^ (G (dBi) / 10)*

Yields

$$d = 0.282 \times \frac{10^{(P+G)/20}}{\sqrt{20}}$$ ***Equation 1***

*Where* *d = MPE safe distance in cm*
*P = Power in dBm*
*G = Antenna Gain in dBi*
*S = Power Density Limit in mW / cm^2*

**Maximum Permissible Exposure (2.4 GHz Band)**

S = Maximum power density ($mW/cm^2$)

P = Power input to the antenna (mW). = 36.22

G = Numeric power gain of the antenna = 1.58

R = Distance to the center of the radiation of the antenna (20cm = limit for MPE) = 20cm

The maximum permissible exposure (MPE) for the general population is 1.00 $mW/cm^2$.

$(36.22* 1.58 ) / ( 4\pi * 20^2 ) = 0.0114$ $mW/cm^2$

The power density at 20cm does not exceed the 1 $mW/cm^2$ limit. Therefore, the exposure condition is compliant with FCC rules.