# FCC Part 15C

# Measurement and Test Report

**For**

# Compex Systems Pte Ltd

**135 Joo Seng Road, #08-01 PM Industrial Building Singapore 368363**

## FCC ID: TK4-10-WLE200NX

| **Report Concerns:** Original Report | **Equipment Type:** Wireless-A/B/G/N Network Mini PCIe Adapter |
|---|---|
| **Model:** | WLE200NX |
| **Report No.:** | STR10098029I-1 |
| **Test Date:** | 2010-09-06 to 2010-10-12 |
| **Issue Date:** | 2010-10-14 |
| **Tested By:** | Seven Song / Engineer |
| **Reviewed By:** | Lahm Peng / EMC Manager |
| **Approved & Authorized By:** | Jandy so / PSQ Manager |
| **Prepared By:** | **SEM.Test Compliance Service Co., Ltd**<br>3/F, Jinbao Commerce Building, Xin'an Fanshen Road,<br>Bao'an District, Shenzhen, P.R.C.（518101）<br>Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: www.semtest.com.cn |

Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by SEM.Test Compliance Service Co., Ltd.

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# 1. GENERAL INFORMATION

## 1.1 Product Description for Equipment Under Test (EUT)

### Client Information

| | |
|---|---|
| Applicant: | Compex Systems Pte Ltd |
| Address of applicant: | 135 Joo Seng Road, #08-01 PM Industrial Building<br>Singapore 368363 |
| Manufacturer: | Compex Systems Pte Ltd |
| Address of manufacturer: | 135 Joo Seng Road, #08-01 PM Industrial Building<br>Singapore 368363 |

### General Description of E.U.T

| Items | Description |
|---|---|
| EUT Description: | Wireless-A/B/G/N Network Mini PCIe Adapter |
| Trade Name: | COMPEX |
| Model No.: | WLE200NX |
| Rated Voltage: | DC 3.3V |
| RF Output Power | Max. 26.12dBm (Conducted Power) for 2.4GHz<br>Max. 26.04dBm (Conducted Power) for 5.8GHz |
| Frequency range: | 2412~2462MHz for 802.11b/g/n(HT20)<br>2422~2452MHz for 802.11n(HT40)<br>5745~5825MHz for 802.11a/n<br>5755~5795MHz for 802.11n(HT40) |
| Antenna Gain: | Max. 2dBi for 2.4GHz, Max. 7.3dBi for 5.8GHz |
| Type of Antenna: | 10.6cm |
| Type of Antenna: | Detachable Antenna |
| Size: | 5.0X2.8X0.3cm |

*Note: The test data is gathered from a production sample, provided by the manufacture.*

## 1.2 Test Standards

The following report is prepared on behalf of the Compex Systems Pte Ltd in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

**Maintenance of compliance** is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

## 1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted with Low Channel, Middle Channel and High Channel, accordingly in reference to the Operating Instructions.

## 1.4 Test Facility

- **FCC – Registration No.: 994117**
  SEM.Test Compliance Services Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 994117.

- **Industry Canada (IC) Registration No.: 7673A**
  The 3m Semi-anechoic chamber of SEM.Test Compliance Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 7673A.

## 1.5 EUT Exercise Software

The EUT exercise program used during the testing was designed to exercise the system components.

## 1.6 Accessories Equipment List and Details

| Description | Manufacturer | Model | Serial Number |
|---|---|---|---|
| Notebook | ASUS | X50 | / |

## 1.7 EUT Cable List and Details

| Cable Description | Length (M) | Shielded/Unshielded | With Core/Without Core |
|---|---|---|---|
| / | / | / | / |
| / | / | / | / |

# 2. SUMMARY OF TEST RESULTS

| FCC RULES | DESCRIPTION OF TEST | RESULT |
|---|---|---|
| § 15.203; § 15.247(c)(1)(i) | Antenna Requirement | Compliant |
| § 15.207 | Conducted Emission | Compliant |
| § 15.247(e) | Power Spectral Density | Compliant |
| § 15.247(a)(2) | 6 dB Bandwidth | Compliant |
| § 15.247(b)(3) | Power Output | Compliant |
| § 15.209(a)(d) | Radiated Emission | Compliant |
| § 15.247(d) | Band edge | Compliant |

# 3. CONDUCTED EMISSIONS

## 3.1 Measurement Uncertainty

Base on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is ± 2.88 dB.

## 3.2 Test Equipment List and Details

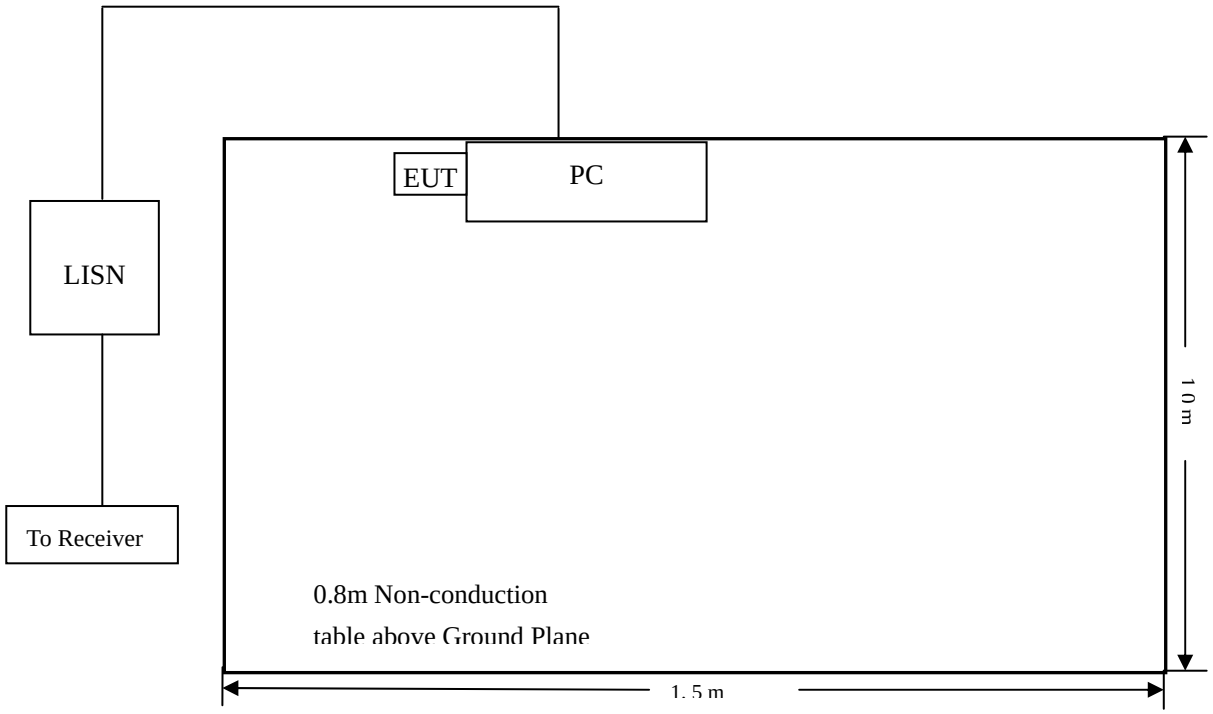
| Description | Manufacturer | Model | Serial Number | Cal. Date | Due. Date |
|---|---|---|---|---|---|
| EMI Test Receiver | Rohde & Schwarz | ESPI | 101611 | 2010-08-12 | 2011-08-11 |
| L.I.S.N | Schwarz beck | NSLK8126 | 8126-224 | 2010-08-12 | 2011-08-11 |
| Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 100911 | 2010-08-12 | 2011-08-11 |

**Statement of Traceability:** All calibrations have been performed per the NVLAP requirements traceable to the NIST.

## 3.3 Test Procedure

Test is conducting under the description of ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

## 3.4 Basic Test Setup Block Diagram



## 3.5 Environmental Conditions

| | |
|---|---|
| Temperature: | 20° C |
| Relative Humidity: | 52% |
| ATM Pressure: | 1011 mbar |

## 3.6 Summary of Test Results/Plots

According to the data in section 3.7, the EUT complied with the FCC 15.207 Conducted margin for a Class B device, with the *worst* margin reading of:

**-5.0 dBμV** at **0.158 MHz** in the **Neutral QP** Detector, 0.15-30MHz

## 3.7 Conducted Emissions Test Data

| LINE CONDUCTED EMISSIONS | | | | FCC 15.207 | |
|---|---|---|---|---|---|
| Frequency | Amplitude | Detector | Phase | Limit | Margin |
| MHz | dBμV | QP/Ave/Pk | Line/Neutral | dBμV | dB |
| 0.158 | 60.55 | QP | Neutral | 65.57 | -5.0 |
| 0.166 | 56.60 | QP | Line | 65.16 | -8.6 |
| 0.158 | 44.74 | Ave | Neutral | 55.57 | -10.8 |
| 0.238 | 49.26 | QP | Line | 62.17 | -12.9 |
| 0.162 | 41.55 | Ave | Line | 55.36 | -13.8 |
| 0.242 | 46.09 | QP | Neutral | 62.03 | -15.9 |
| 0.694 | 39.91 | QP | Line | 56 | -16.1 |
| 22.582 | 41.54 | QP | Line | 60 | -18.5 |

***Plot of Conducted Emissions Test Data***

*Conducted Disturbance*

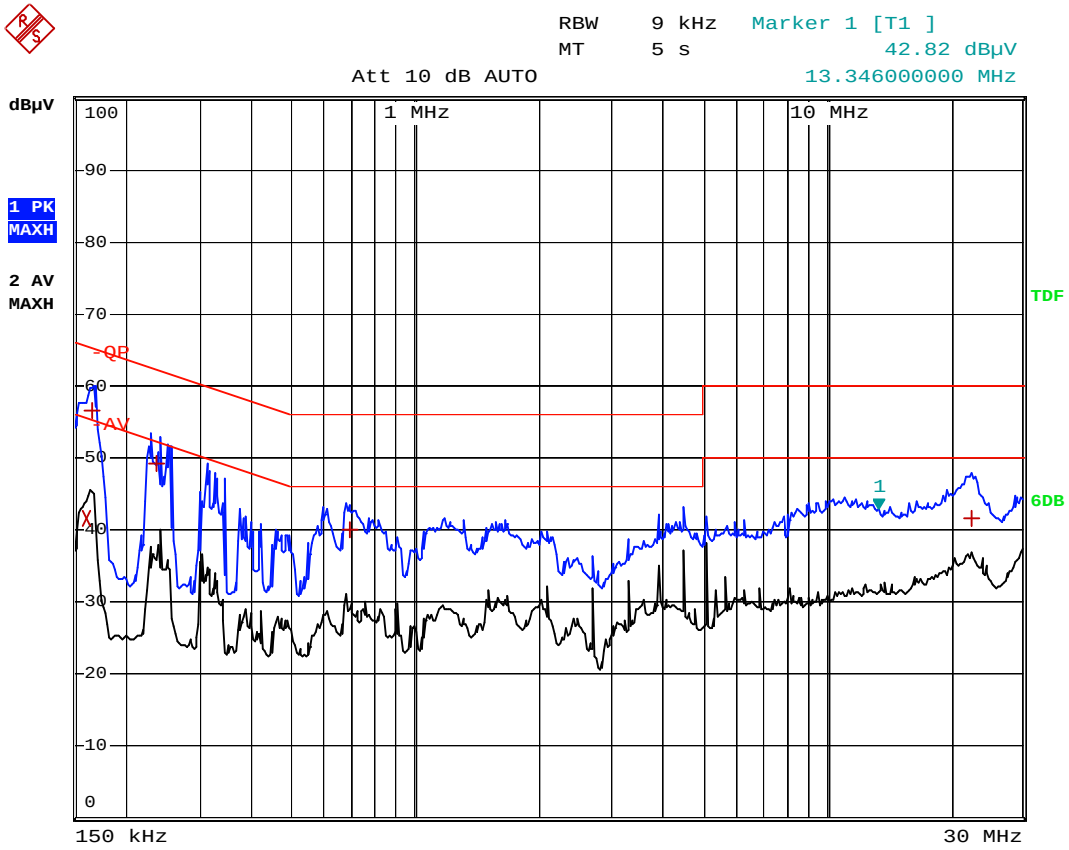
*EUT: Wireless-A/B/G/N Network Mini PCIe Adapter*

*M/N: WLE200NX*

*Operating Condition: Transmitting*

*Test Specification: L*

*Comment: AC 120V/60Hz*



***Plot of Conducted Emissions Test Data***

*Conducted Disturbance*

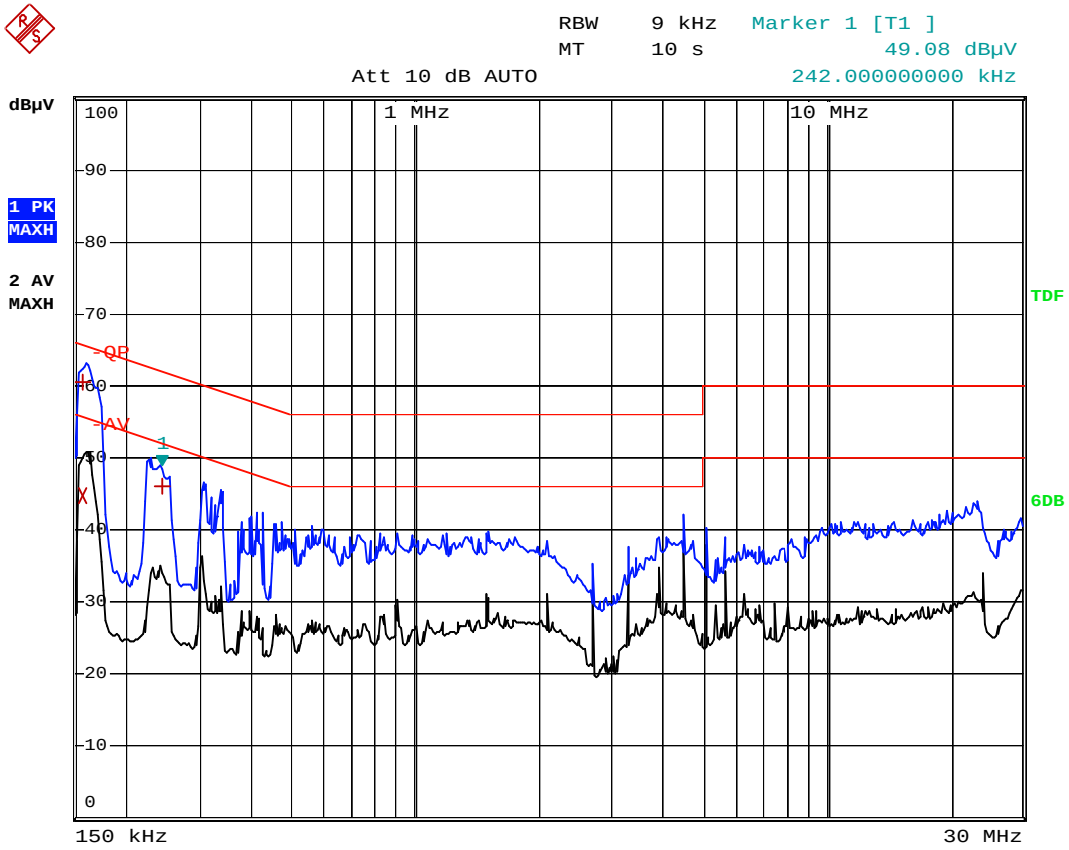
*EUT: Wireless-A/B/G/N Network Mini PCIe Adapter*

*M/N: WLE200NX*

*Operating Condition: Transmitting*

*Test Specification: N*

*Comment: AC 120V/60Hz*



# 4. §15.203 - ANTENNA REQUIREMENT

## 4.1 Standard Applicable

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

## 4.2 Test Result

This product has an unique and detachable antenna, fulfill the requirement of this section.

# 5. POWER SPECTRAL DENSITY

## 5.1 Standard Applicable

According to 15.247(a)(1)(iii), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

## 5.2 Test Equipment List and Details

| Description | Manufacturer | Model | Serial Number | Cal. Date | Due. Date |
|---|---|---|---|---|---|
| Spectrum Analyzer | Agilent | E4402B | US41192821 | 2010-08-12 | 2011-08-11 |
| Spectrum Analyzer | R&S | FSP | 836079/035 | 2010-04-16 | 2011-04-15 |
| Attenuator | ATTEN | ATS100-6-20 | DC-6GHz | 2010-08-12 | 2011-08-11 |

**Statement of Traceability:** All calibrations have been performed per the NVLAP requirements traceable to the NIST.

## 5.3 Test Procedure

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer via a RF combiner.
2. Set center frequency of spectrum analyzer = operating frequency.
3. Set the spectrum analyzer as RBW = 3kHz, VBW = 10KHz.
4. Repeat above procedures until all frequency measured was complete.

## 5.4 Environmental Conditions

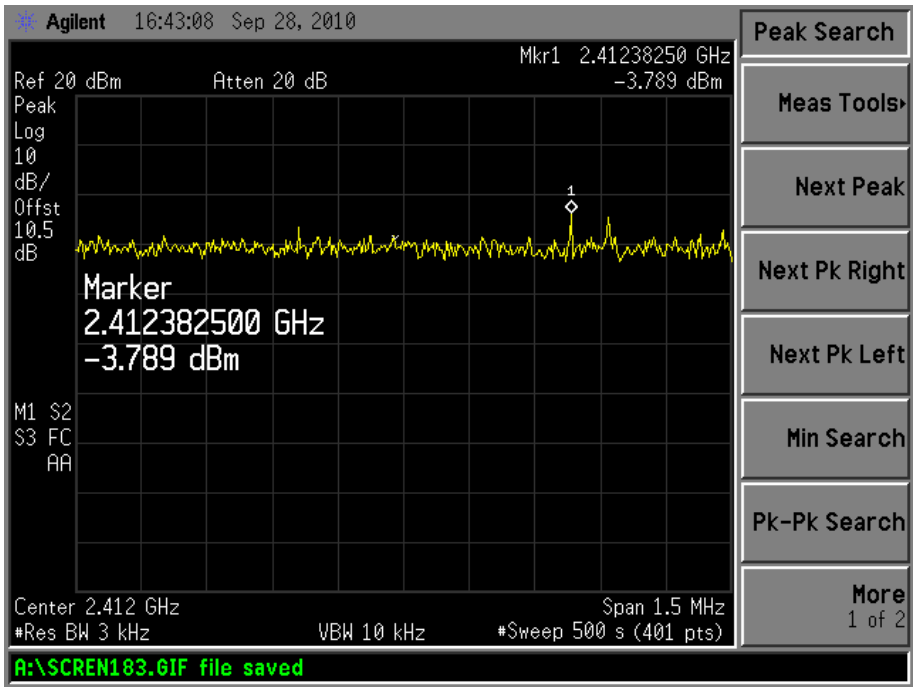
| | |
|---|---|
| Temperature: | 20° C |
| Relative Humidity: | 54% |
| ATM Pressure: | 1011 mbar |

## 5.5 Summary of Test Results/Plots

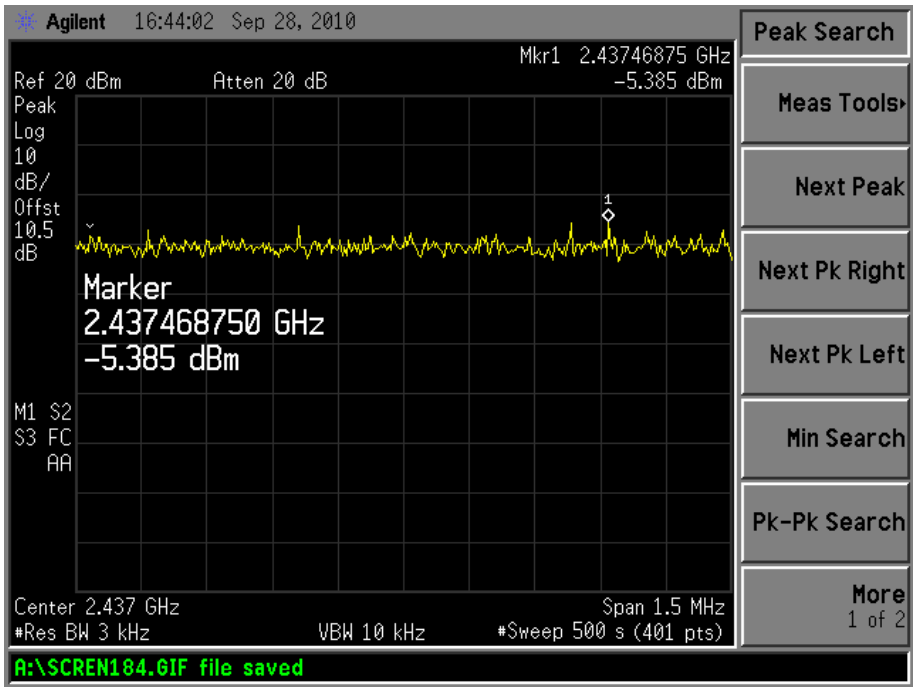
| Test mode | Test channel | Reading with combiner dBm/3kHz | Limit dBm/3kHz |
|---|---|---|---|
| 802.11b | Low channel (2412MHz) | -3.789 | 8 |
| | Middle channel (2437MHz) | -5.385 | 8 |
| | High channel (2462MHz) | -4.374 | 8 |
| 802.11g | Low channel (2412MHz) | -7.987 | 8 |
| | Middle channel (2437MHz) | -8.183 | 8 |
| | High channel (2462MHz) | -7.094 | 8 |
| 802.11n (HT20) | Low channel (2412MHz) | -6.771 | 8 |
| | Middle channel (2437MHz) | -8.823 | 8 |
| | High channel (2462MHz) | -7.200 | 8 |
| 802.11n (HT40) | Low channel (2422MHz) | -12.99 | 8 |
| | Middle channel (2437MHz) | -12.15 | 8 |
| | High channel (2452MHz) | -12.40 | 8 |
| 802.11a | Low channel (5745MHz) | -14.51 | 8 |
| | Middle channel (5785MHz) | -12.72 | 8 |
| | High channel (5825MHz) | -13.44 | 8 |
| 802.11n (HT20) | Low channel (5745MHz) | -10.50 | 8 |
| | Middle channel (5785MHz) | -11.10 | 8 |
| | High channel (5825MHz) | -13.12 | 8 |
| 802.11n (HT40) | Low channel (5755MHz) | -14.02 | 8 |
| | Middle channel (5775MHz) | -9.86 | 8 |
| | High channel (5795MHz) | -11.66 | 8 |

**For 802.11b**

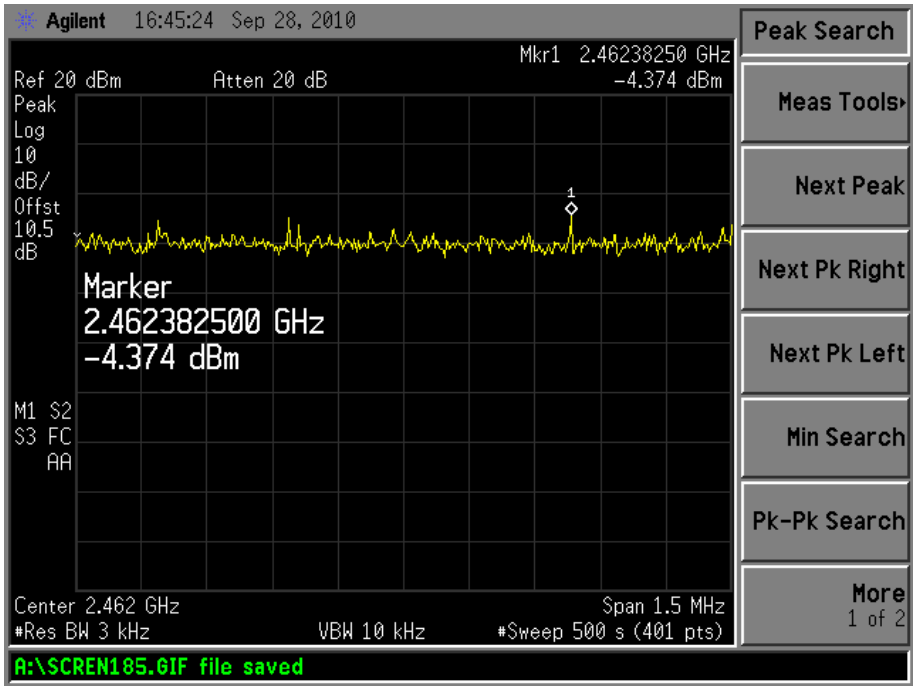
Low Channel:




Middle Channel:

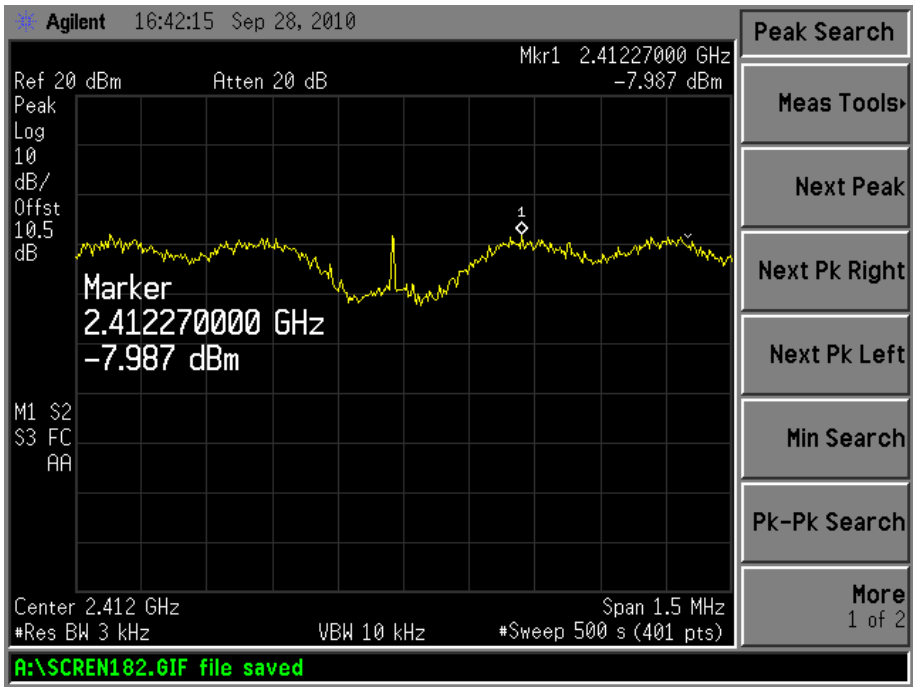


High Channel:

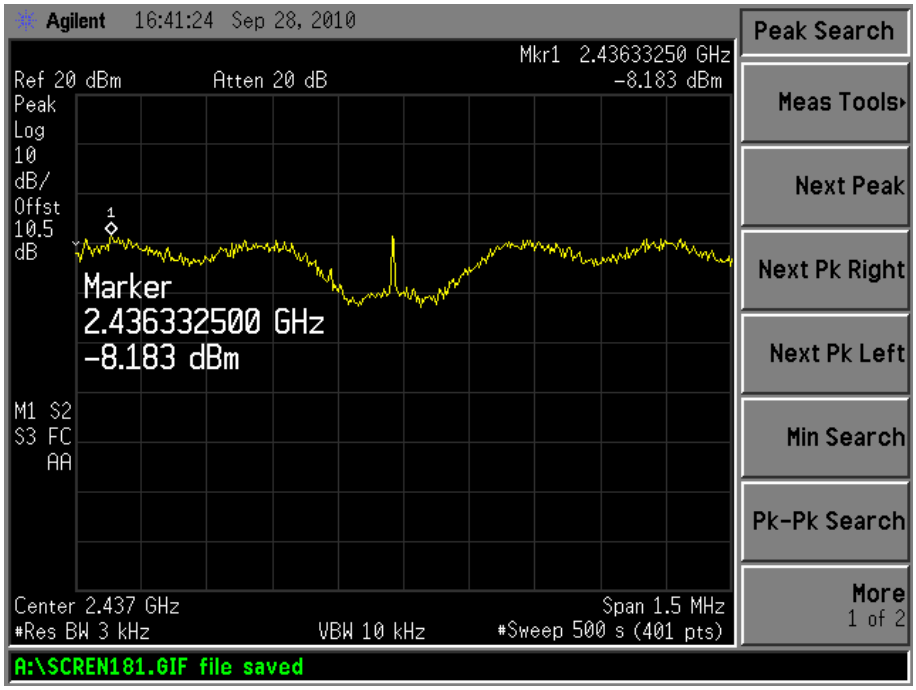



**For 802.11g**

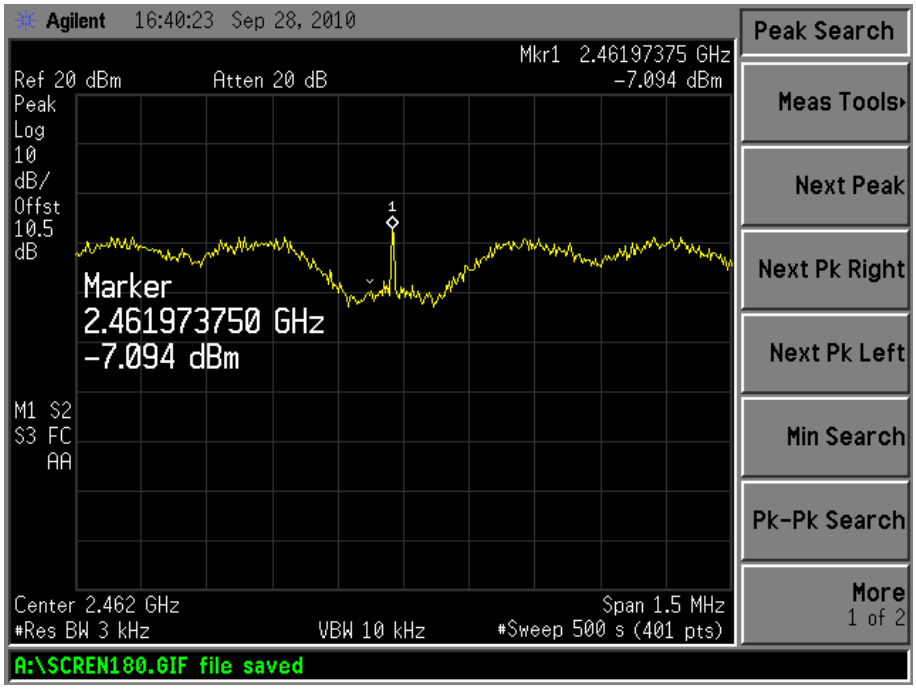
Low Channel:



Middle Channel:

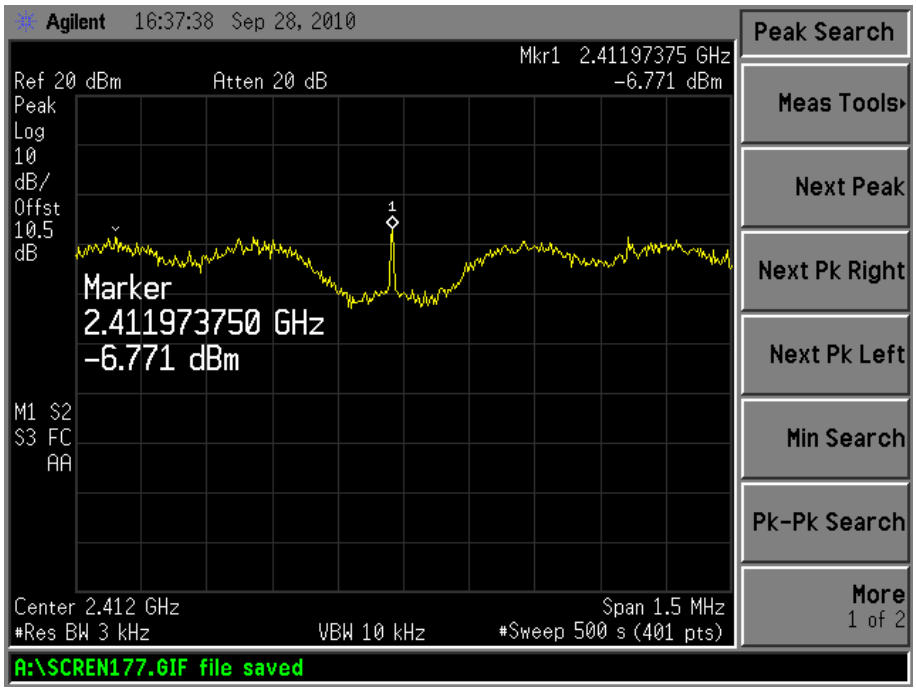



High Channel:

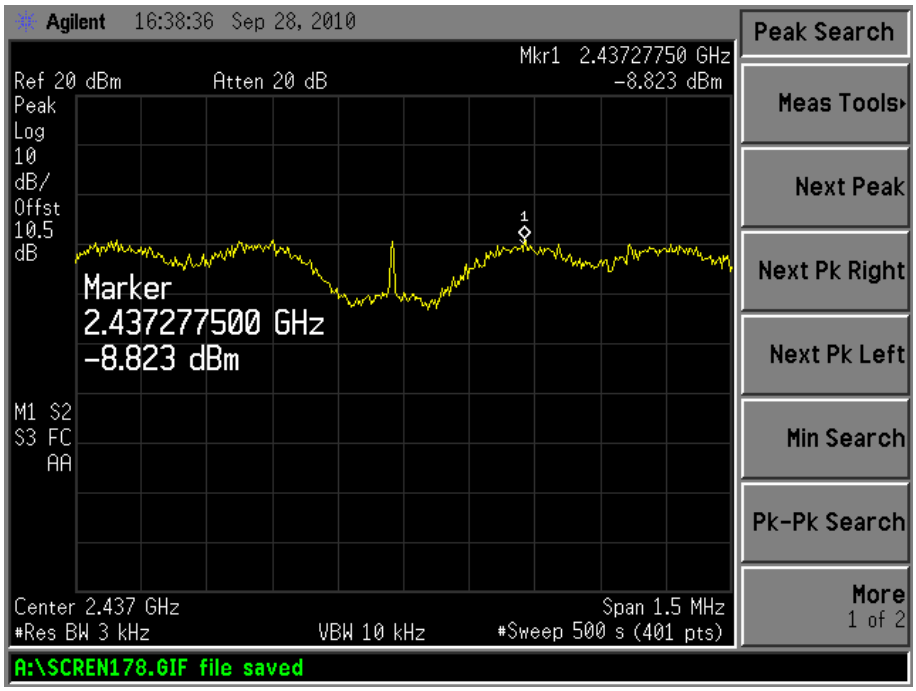


**For 802.11n HT20**

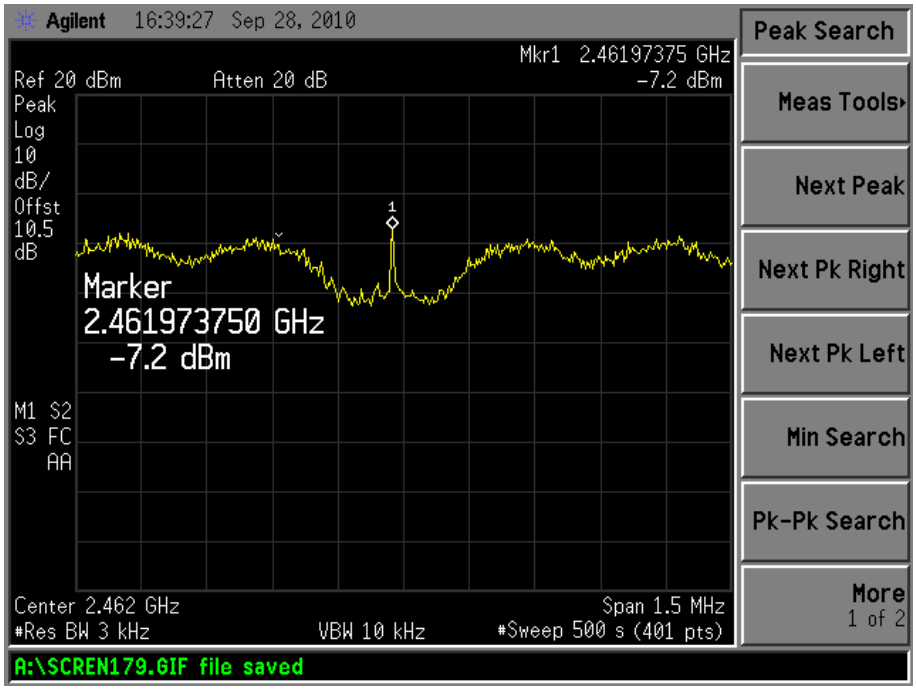
Low Channel:




Middle Channel:

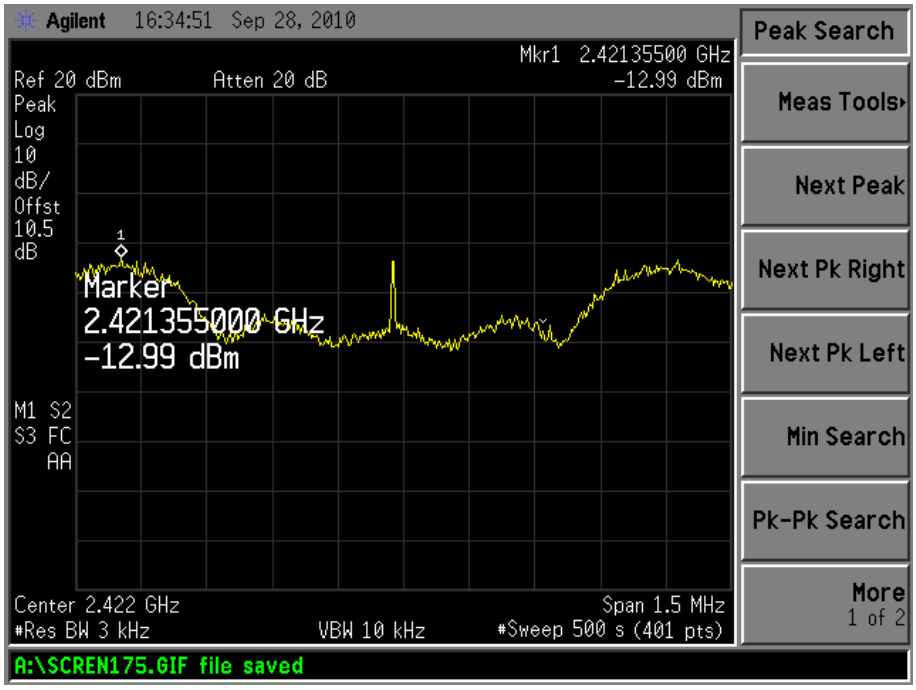


High Channel:

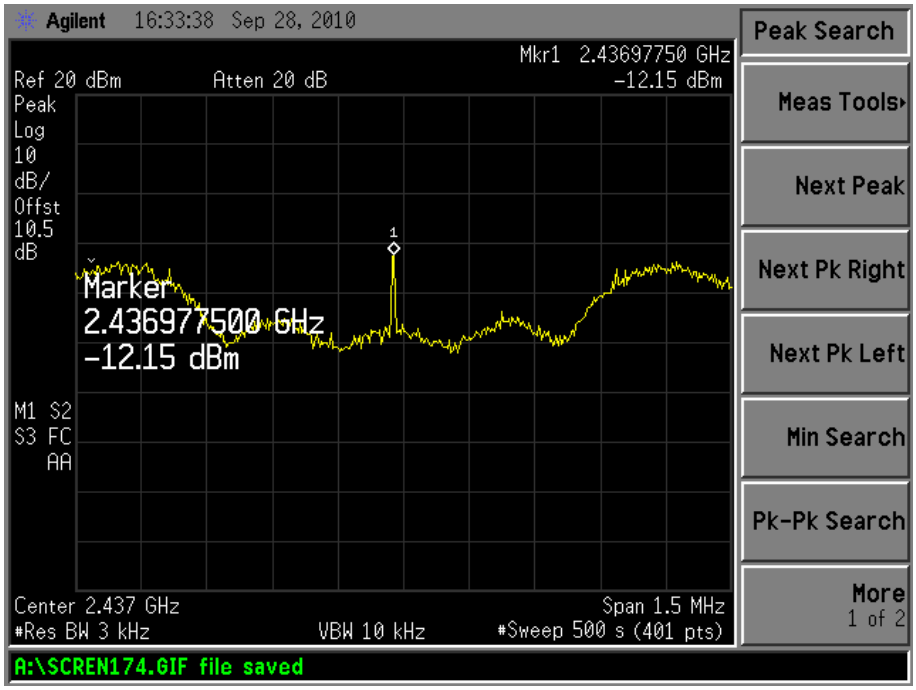



**For 802.11n HT40**

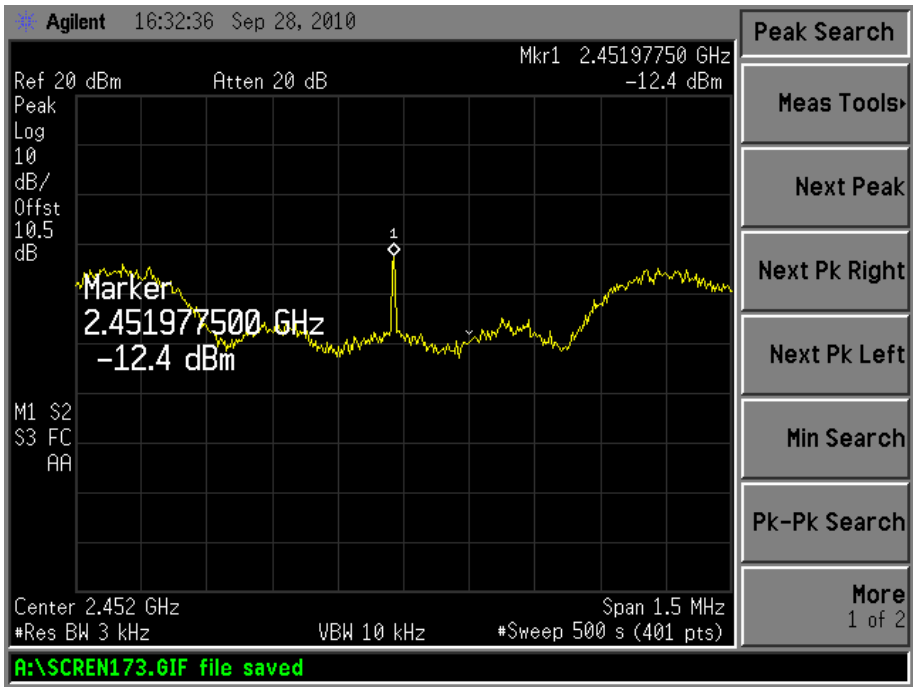
Low Channel:



Middle Channel:

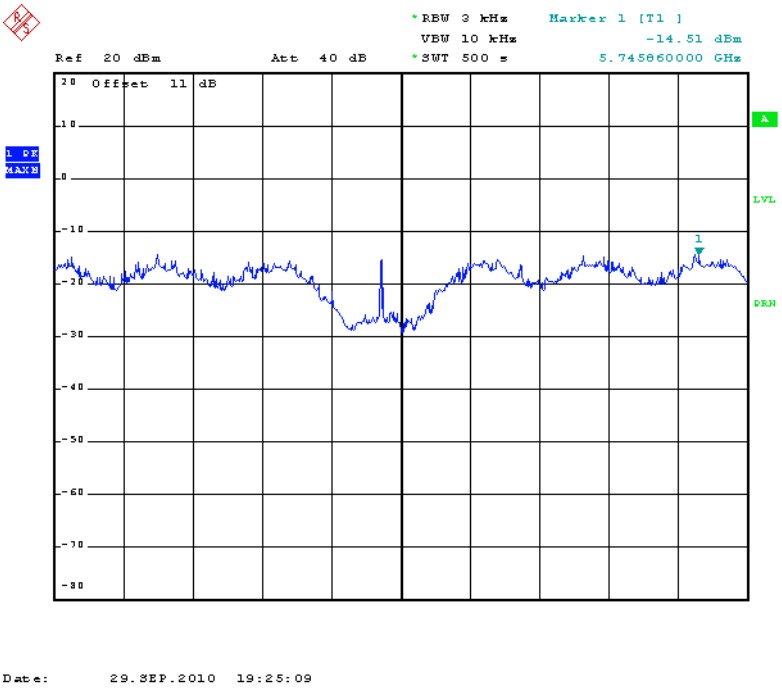



High Channel:

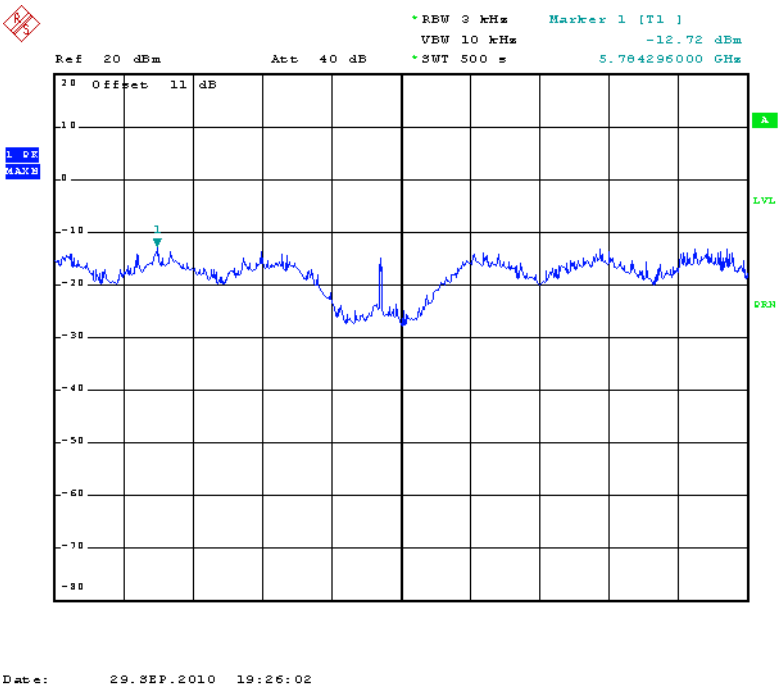


**For 802.11a**

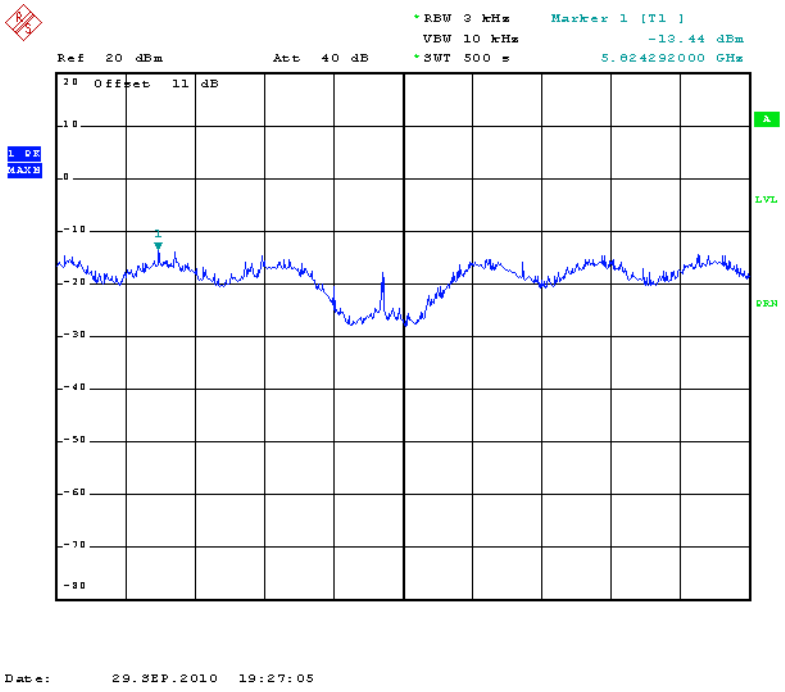
Low Channel:




Middle Channel:

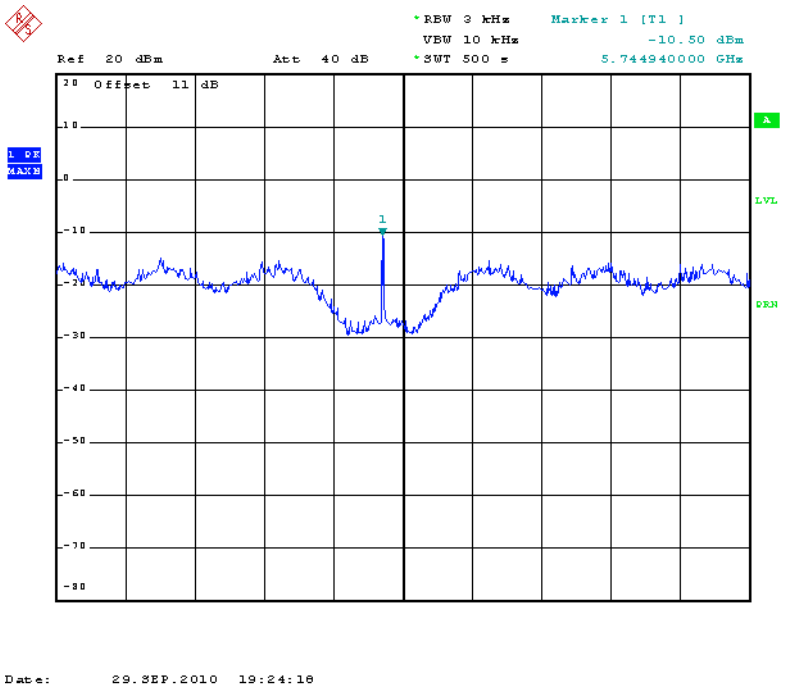


High Channel:

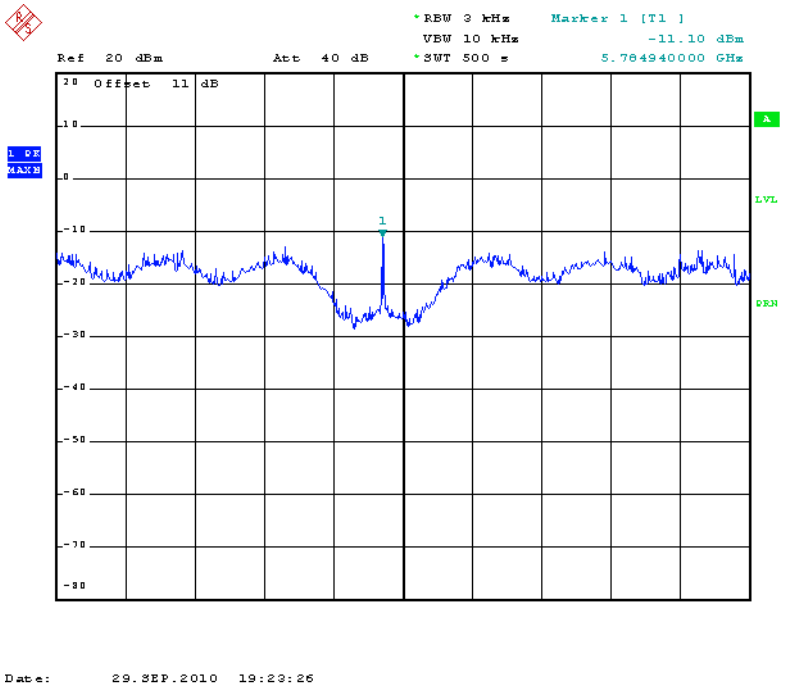



## For 802.11n HT20 5.8G

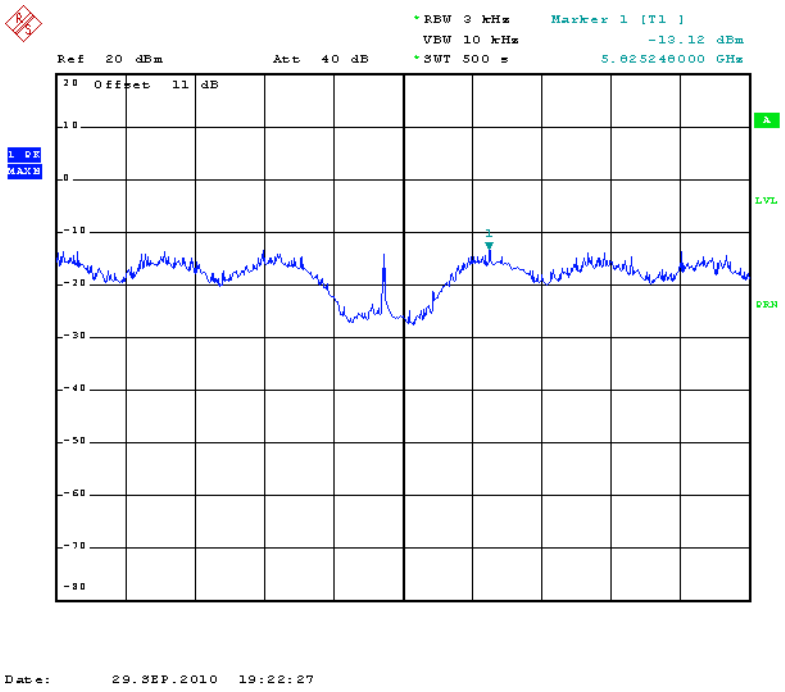
Low Channel:



Middle Channel:

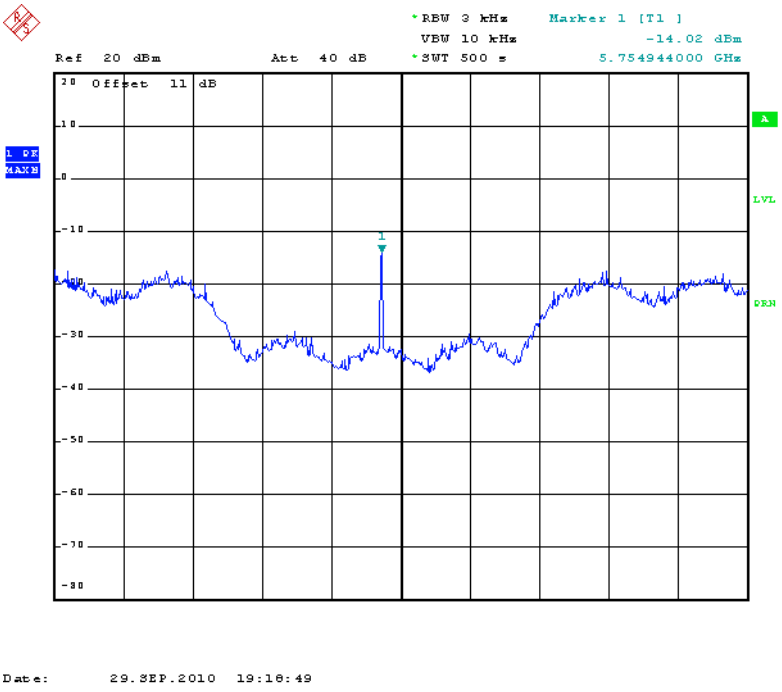



High Channel:

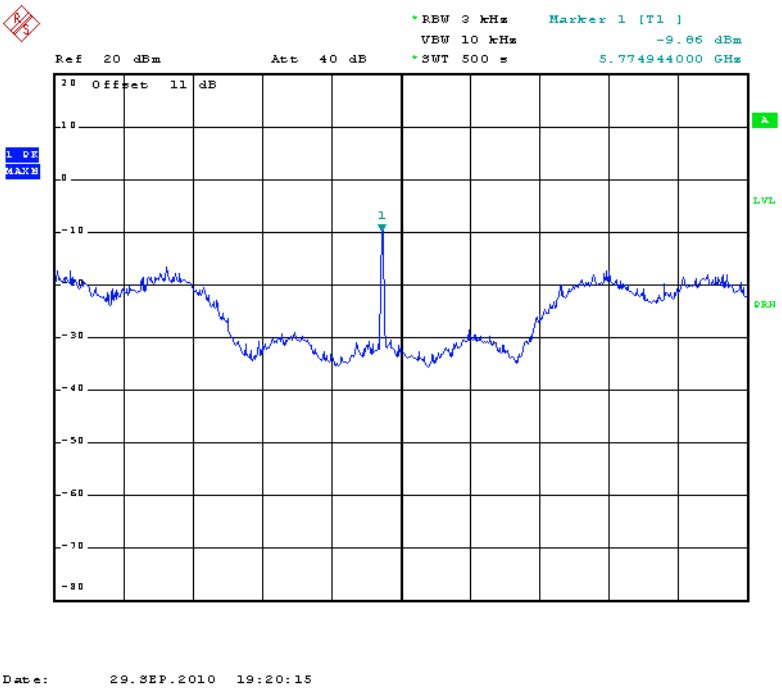


**For 802.11b**

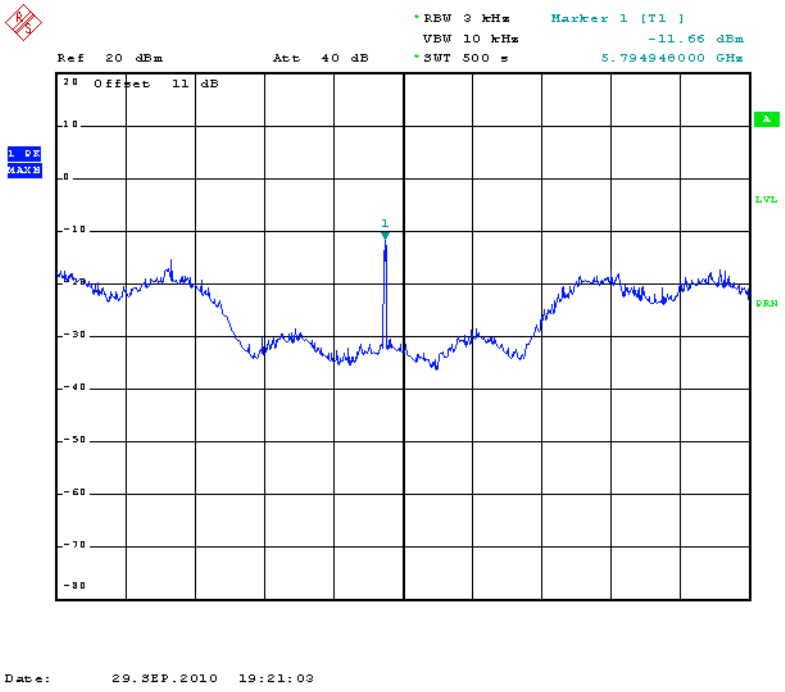
Low Channel:




Middle Channel:



High Channel:



# 6. 6-dB BANDWIDTH

## 6.1 Standard Applicable

According to 15.247(a)(2). Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

## 6.2 Test Equipment List and Details

| Description | Manufacturer | Model | Serial Number | Cal. Date | Due. Date |
|---|---|---|---|---|---|
| Spectrum Analyzer | Agilent | E4402B | US41192821 | 2010-08-12 | 2011-08-11 |
| Spectrum Analyzer | R&S | FSP | 836079/035 | 2010-04-16 | 2011-04-15 |
| Attenuator | ATTEN | ATS100-6-20 | DC-6GHz | 2010-08-12 | 2011-08-11 |

**Statement of Traceability:** All calibrations have been performed per the NVLAP requirements traceable to the NIST.

## 6.3 Test Procedure

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set center frequency of spectrum analyzer = operating frequency.
3. The spectrum analyzer as RBW=300KHz (1 % of Bandwidth.), Sweep=auto
4. Mark the peak frequency and –6dB (upper and lower) frequency.

## 6.4 Environmental Conditions

| | |
|---|---|
| Temperature: | 24° C |
| Relative Humidity: | 53% |
| ATM Pressure: | 1018 mbar |

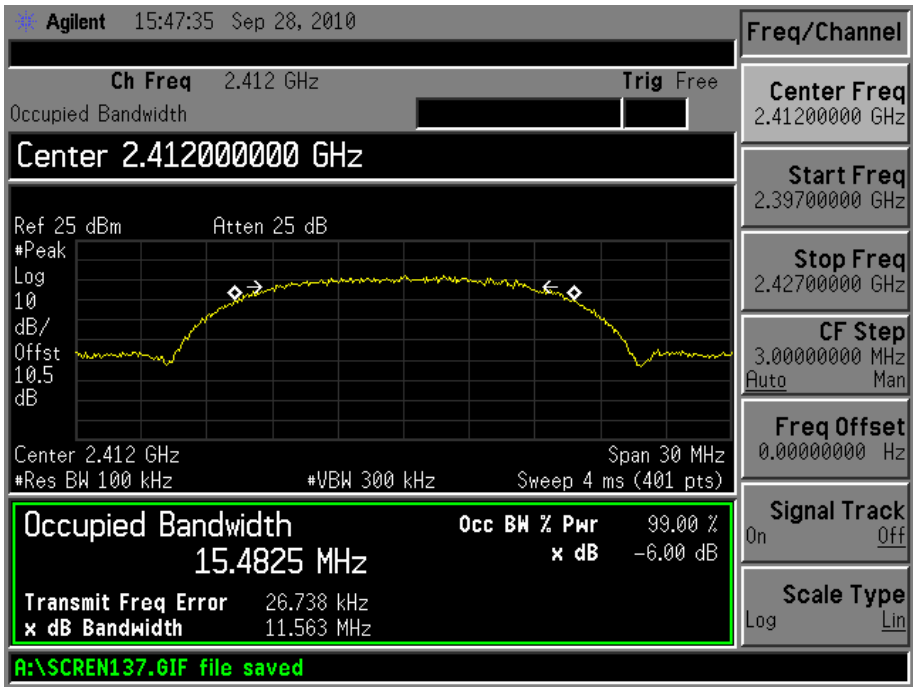
## 6.5 Summary of Test Results/Plots

*Chain 0:*

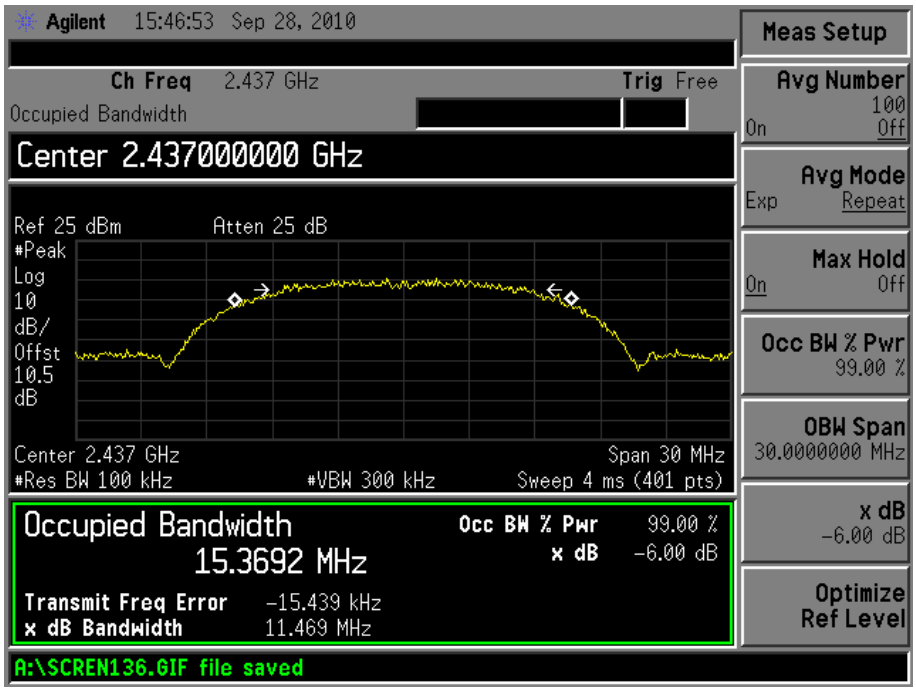
| Test mode | Frequency MHz | 6 dB Bandwidth kHz | Limit kHz |
|---|---|---|---|
| 802.11b | 2412 | 11563 | 500 |
| | 2437 | 11469 | 500 |
| | 2462 | 11699 | 500 |
| 802.11g | 2412 | 16599 | 500 |
| | 2437 | 16464 | 500 |
| | 2462 | 16546 | 500 |
| 802.11n HT20 | 2412 | 17798 | 500 |
| | 2437 | 17794 | 500 |
| | 2462 | 17822 | 500 |
| 802.11n HT40 | 2422 | 36537 | 500 |
| | 2437 | 36449 | 500 |
| | 2452 | 36441 | 500 |
| 802.11a | 5745 | 16680 | 500 |
| | 5785 | 16620 | 500 |
| | 5825 | 16620 | 500 |
| 802.11n HT20 | 5745 | 17880 | 500 |
| | 5785 | 17940 | 500 |
| | 5825 | 17880 | 500 |
| 802.11n HT40 | 5755 | 36700 | 500 |
| | 5785 | 36700 | 500 |
| | 5795 | 36800 | 500 |

**For 802.11b**

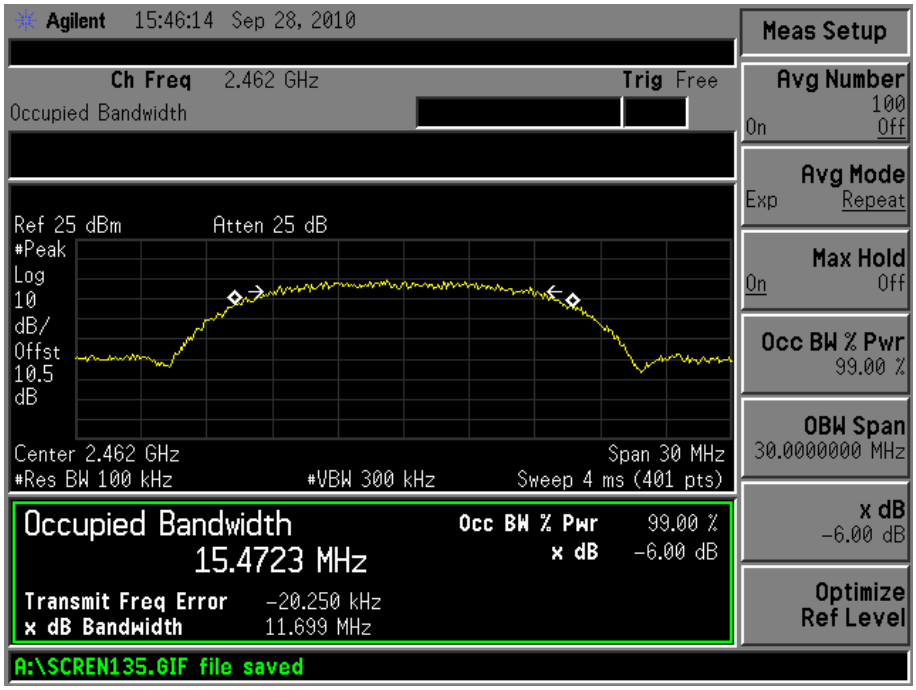
Low Channel:




Mid Channel:

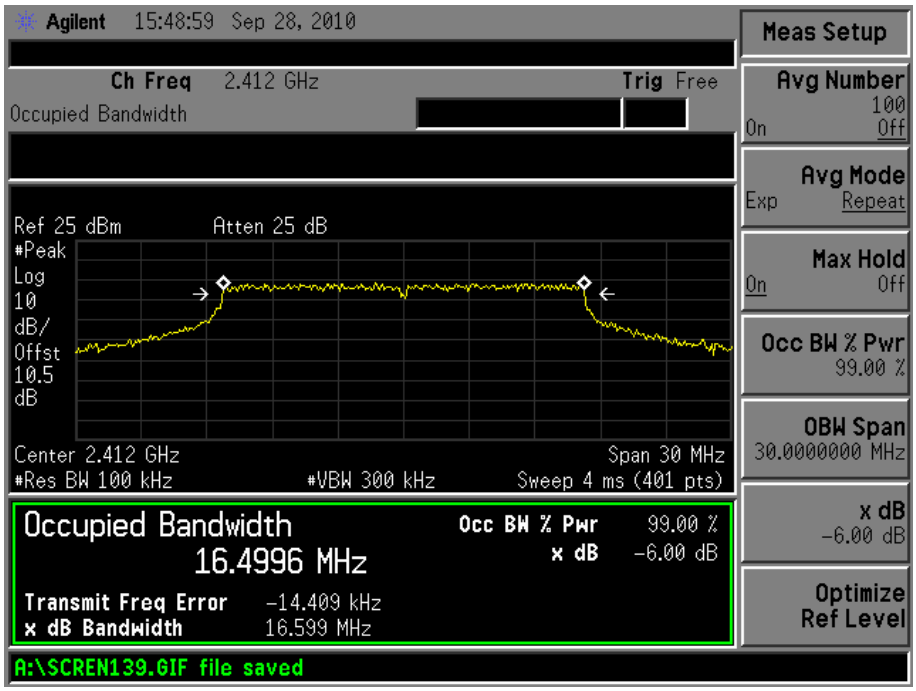


High Channel:

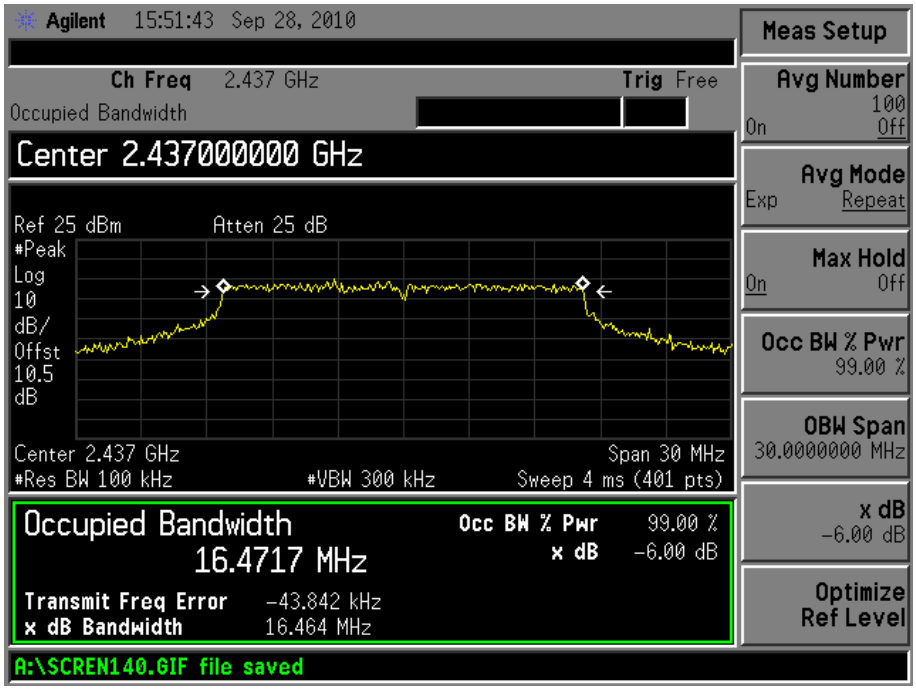



**For 802.11g**

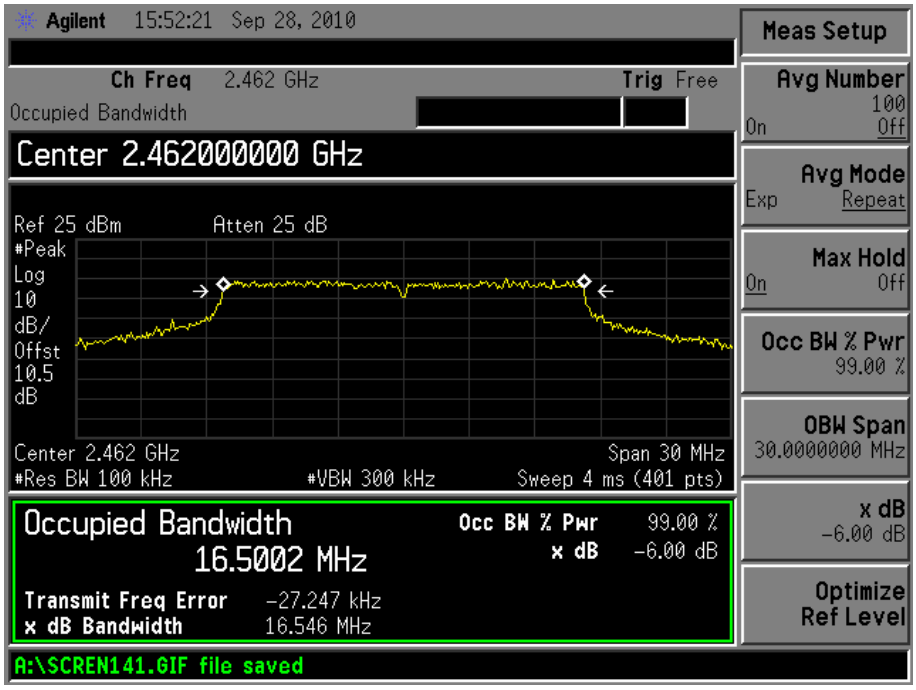
Low Channel:



Mid Channel:

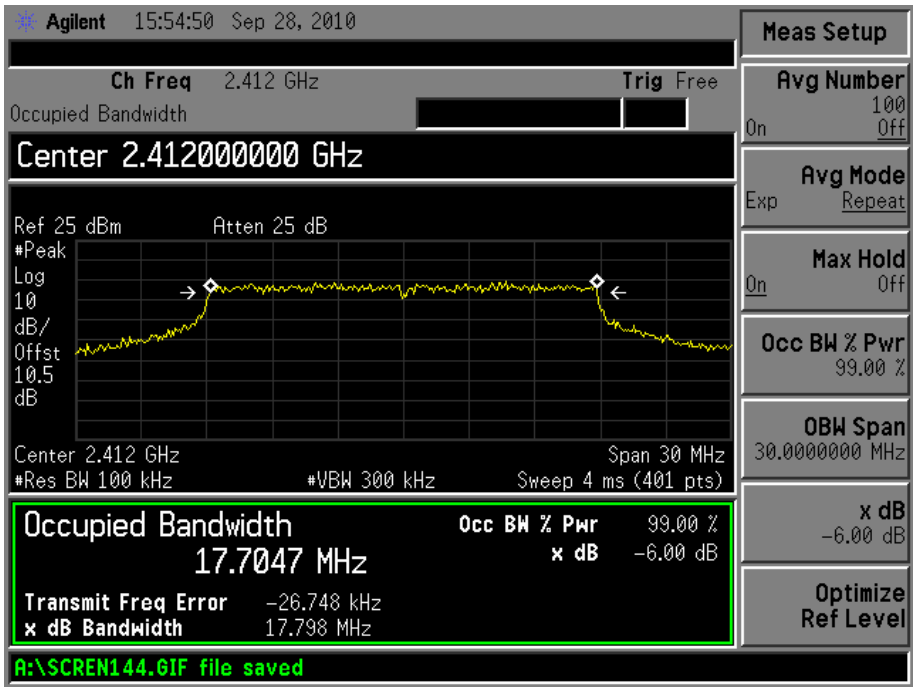



High Channel:

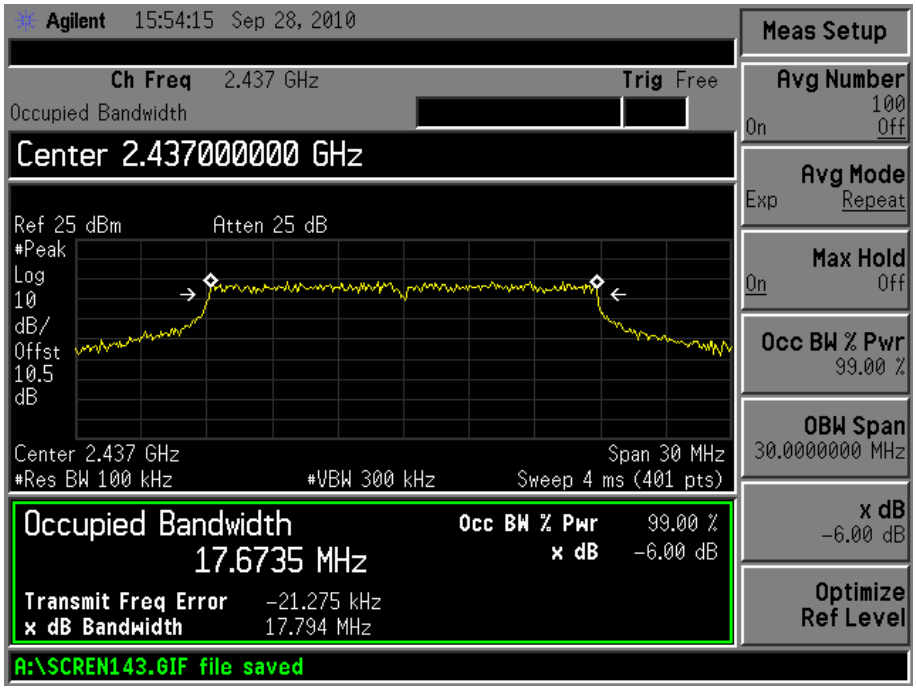


**For 802.11n HT20**

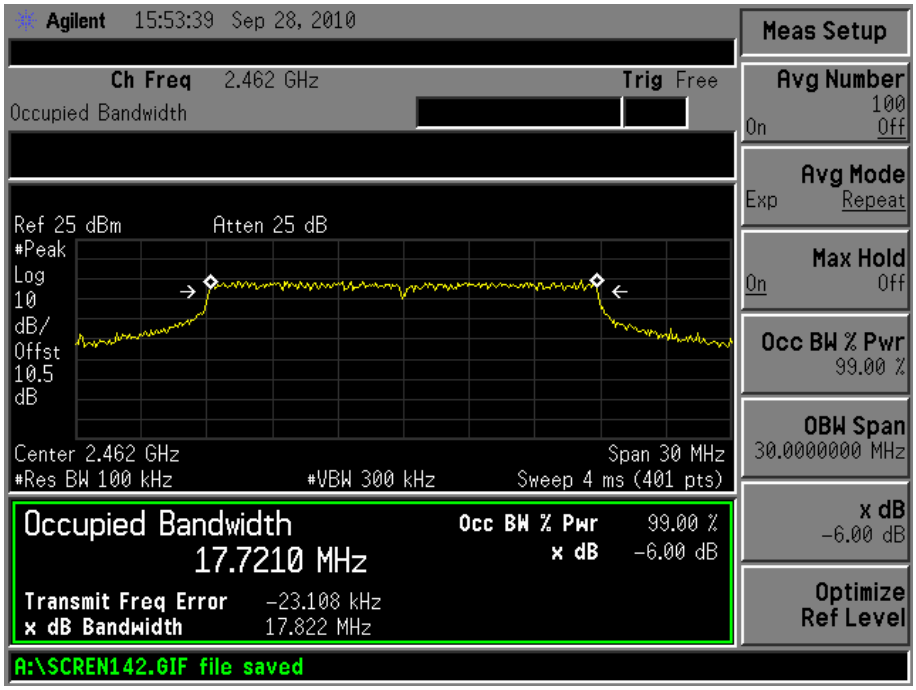
Low Channel:




Mid Channel:

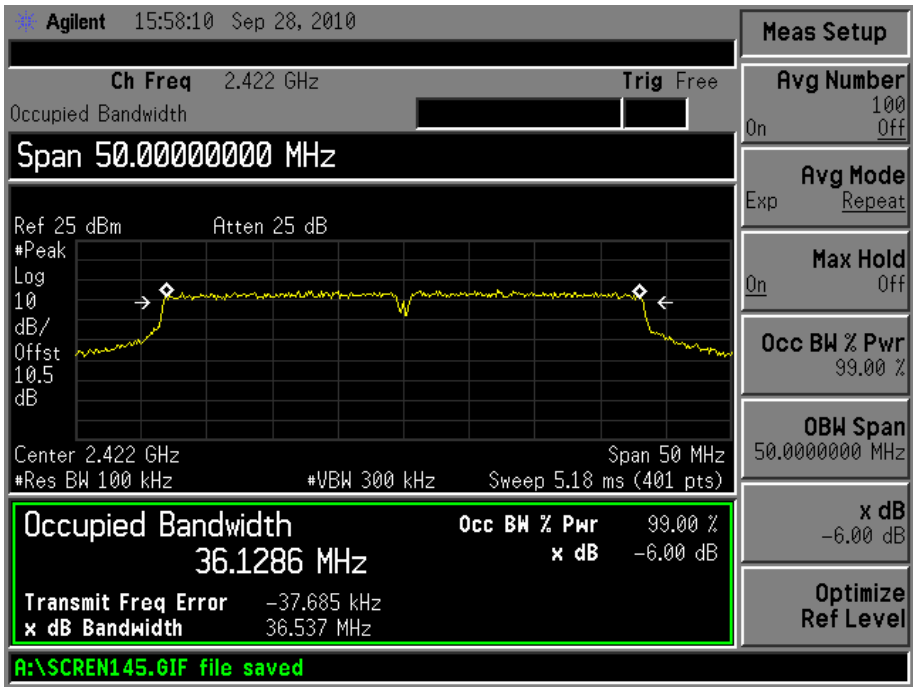


High Channel:

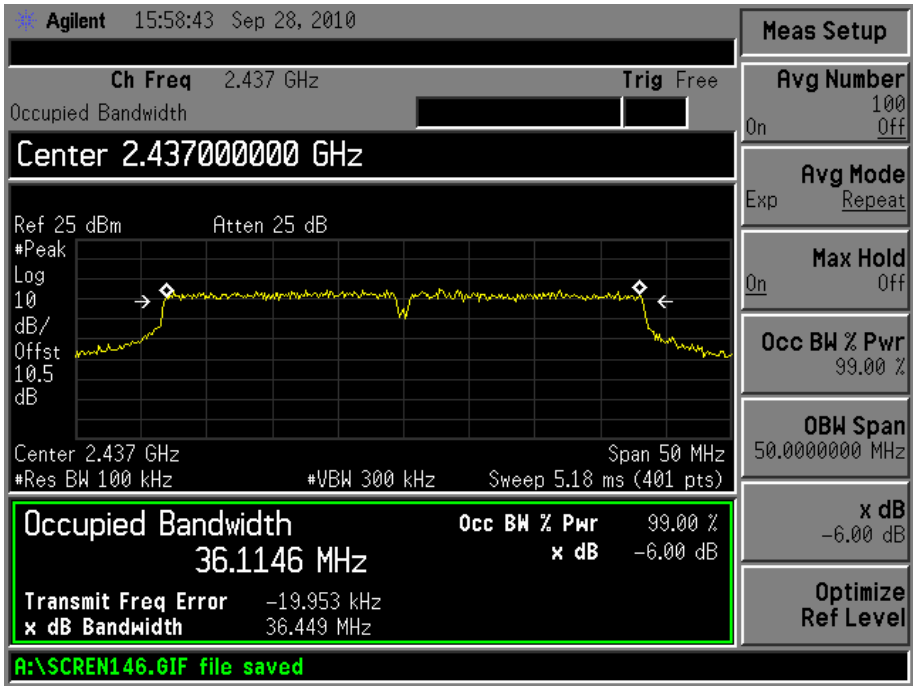



**For 802.11n HT40**

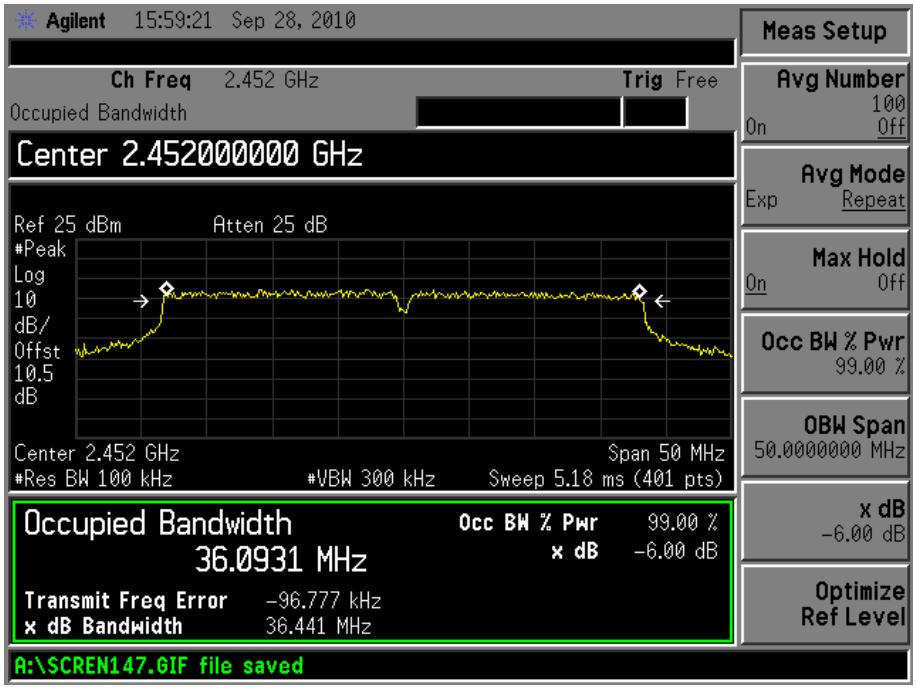
Low Channel:



Mid Channel:

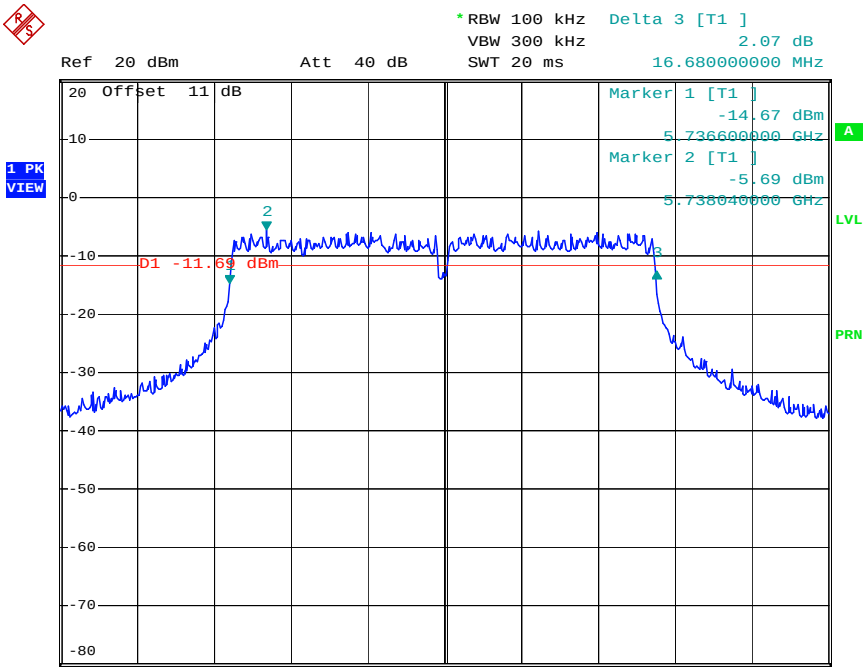



High Channel:

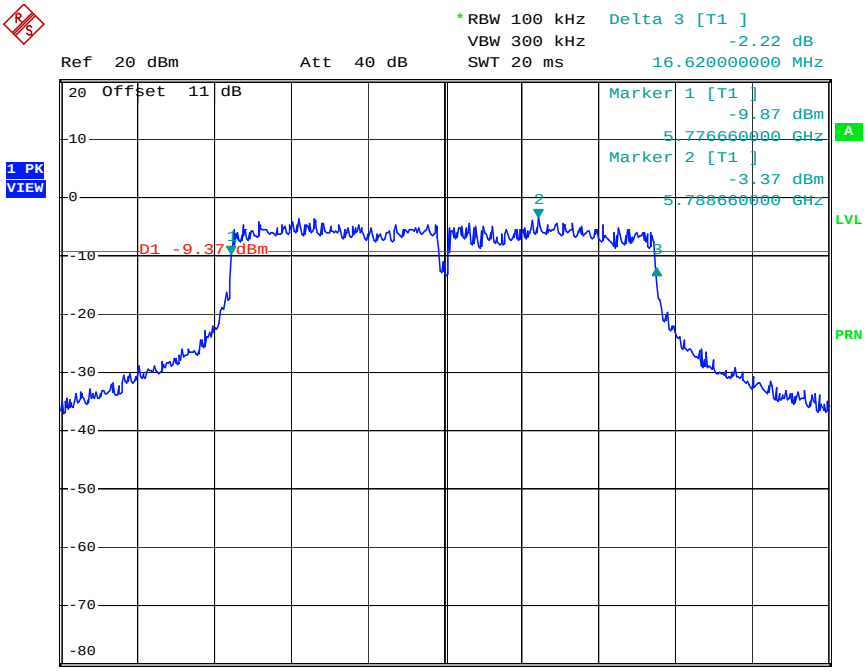


## For 802.11a

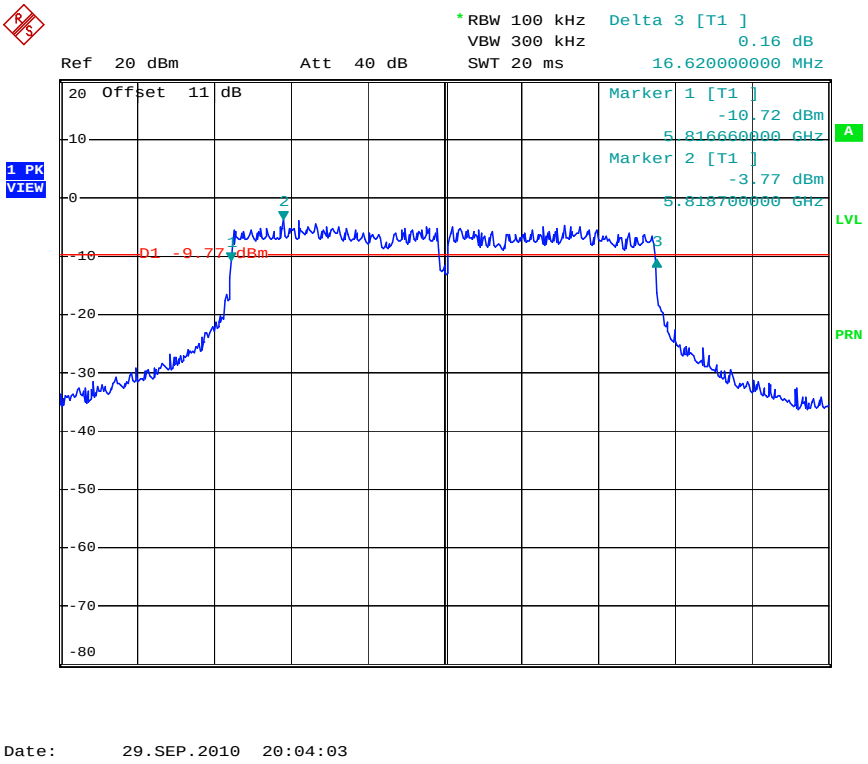
Low Channel:




Mid Channel:

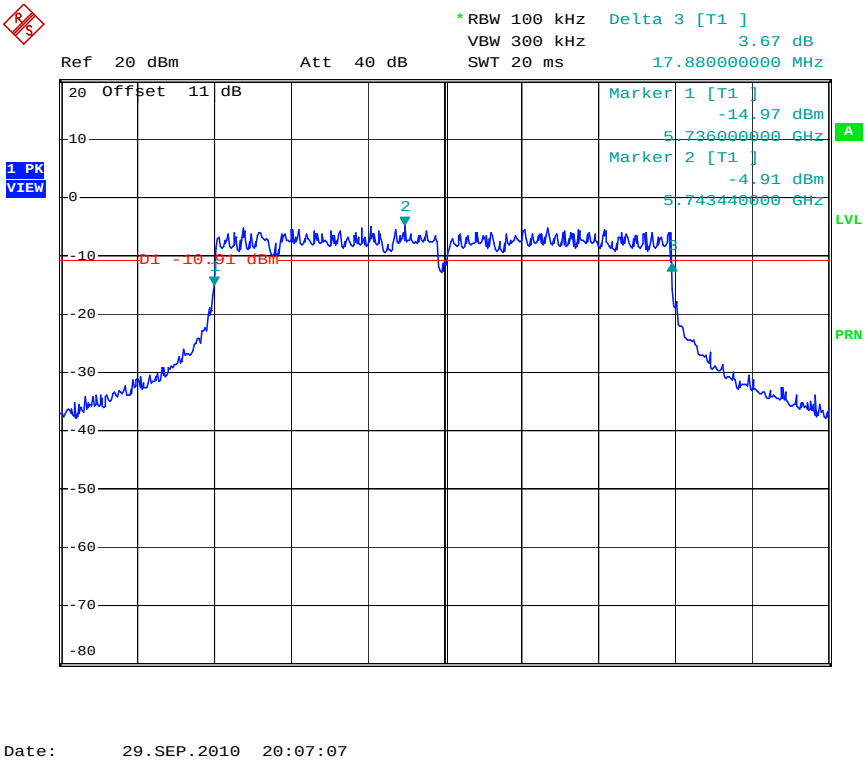


High Channel:

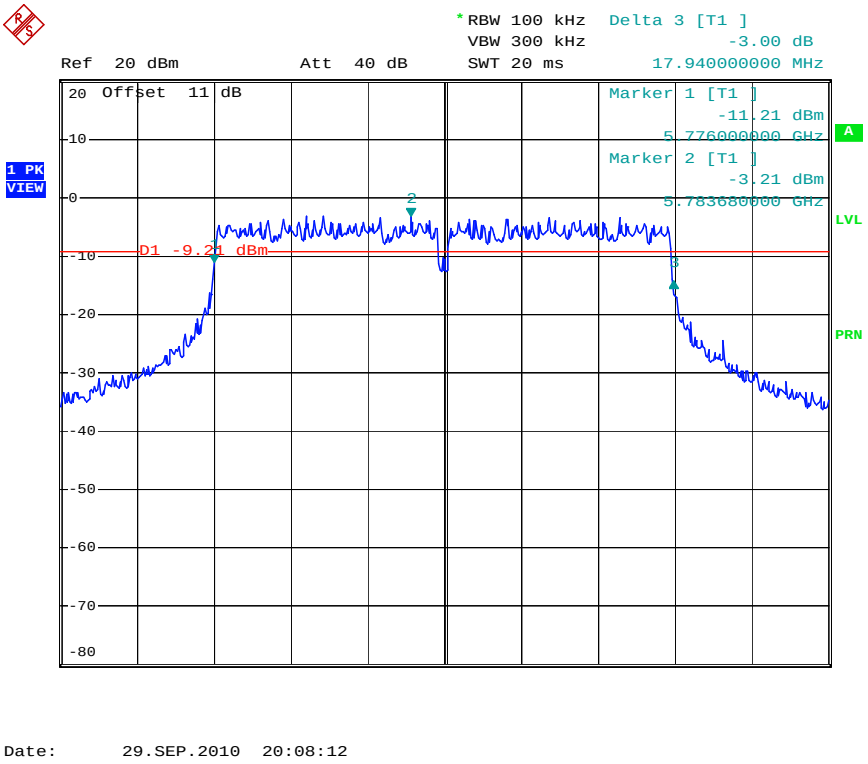



## For 802.11n HT20 5.8G

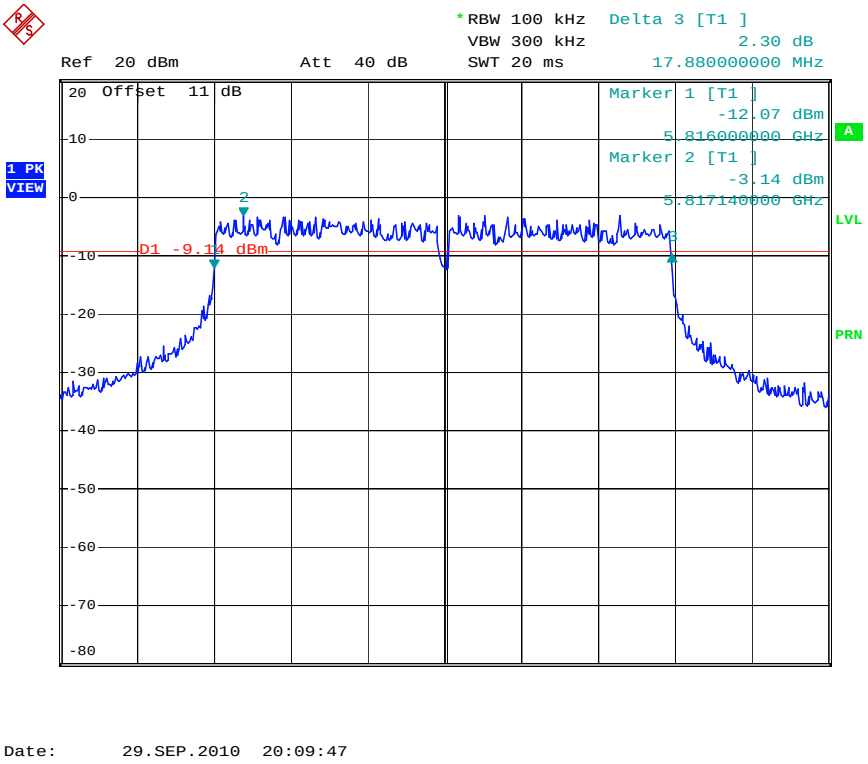
Low Channel:



Mid Channel:

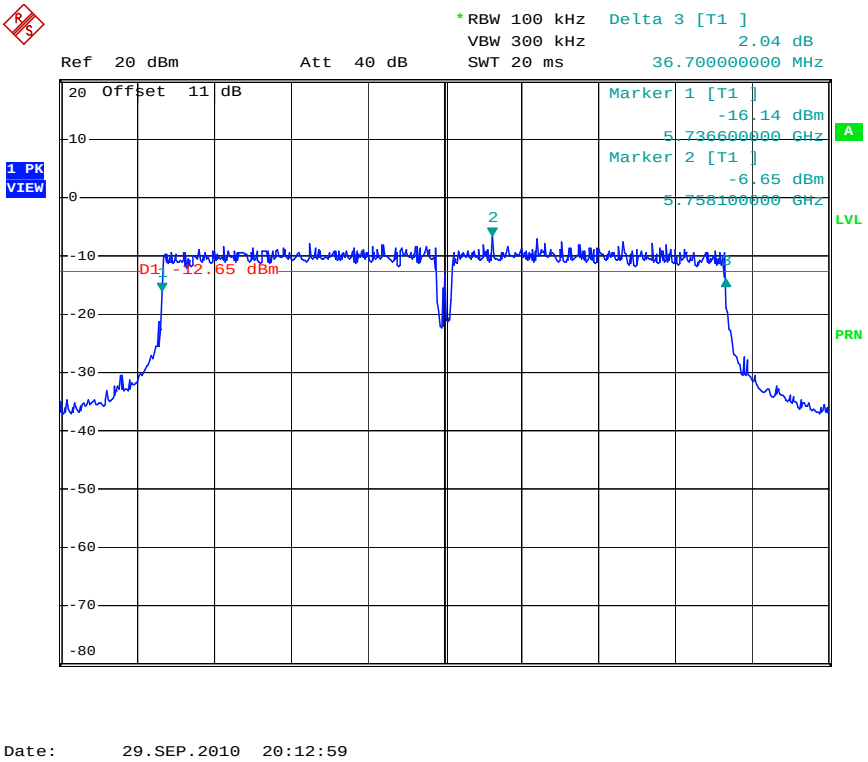



High Channel:

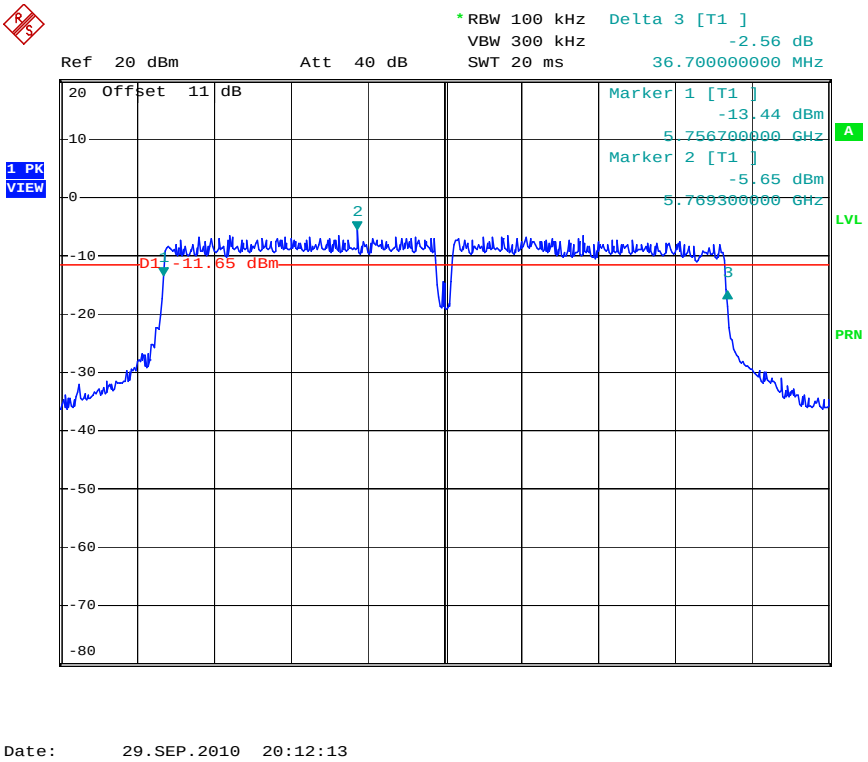


## For 802.11n HT40 5.8G

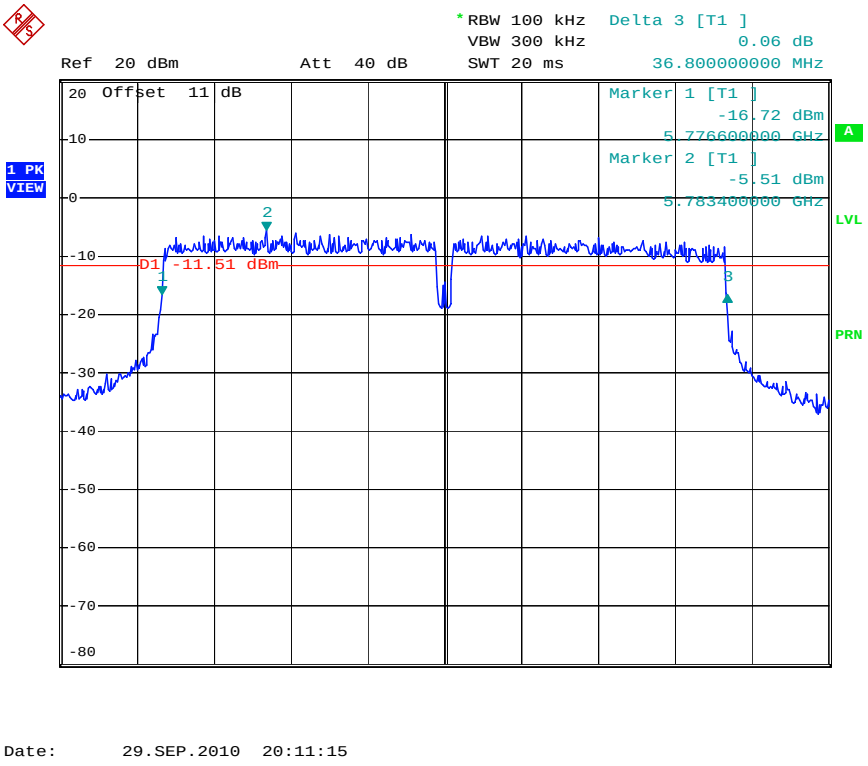
Low Channel:




Mid Channel:



High Channel:



# 7. POWER OUTPUT

## 7.1 Standard Applicable

According to 15.247(b)(3). For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

## 7.2 Test Equipment List and Details

| Description | Manufacturer | Model | Serial Number | Cal. Date | Due. Date |
|---|---|---|---|---|---|
| Spectrum Analyzer | Agilent | E4402B | US41192821 | 2010-08-12 | 2011-08-11 |
| Spectrum Analyzer | R&S | FSP | 836079/035 | 2010-04-16 | 2011-04-15 |
| Attenuator | ATTEN | ATS100-6-20 | DC-6GHz | 2010-08-12 | 2011-08-11 |

**Statement of Traceability:** All calibrations have been performed per the NVLAP requirements traceable to the NIST.

## 7.3 Test Procedure

According to section 15.247(b)-power output of the KDB-558074 (2005), the method #1 of the power output option2 was used, the following is the measurement procedure.

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

2. Set RBW = 1 MHz, Set VBW $\geqslant$ 3 MHz.

4. Use sample detector mode if bin width (i.e., span/number of points in spectrum display) < 0.5 RBW. Otherwise use peak detector mode.

5. Use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at full control power for entire sweep of every sweep. If the device transmits continuously, with no off intervals or reduced power intervals, the trigger may be set to “free run”.

6. Trace average 100 traces in power averaging mode.

7. Compute power by integrating the spectrum across the 26 dB EBW of the signal. The integration can be performed using the spectrum analyzer’s band power measurement function with band limits set equal to the EBW band edges.

## 7.4 Environmental Conditions

| | |
|---|---|
| Temperature: | 21° C |
| Relative Humidity: | 55% |
| ATM Pressure: | 1011 mbar |

## 7.5 Summary of Test Results/Plots

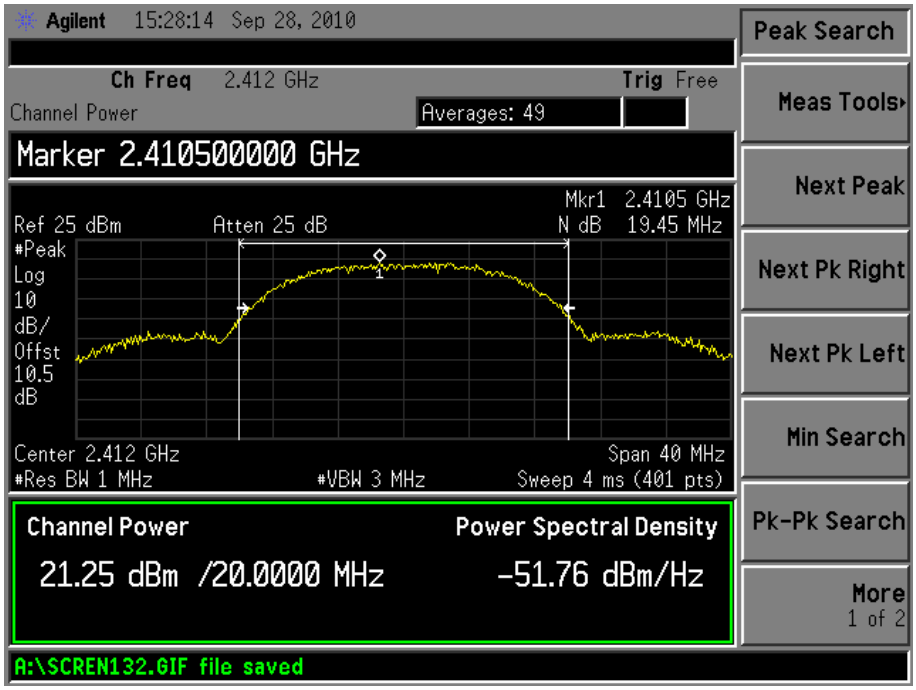
| Test mode | Frequency MHz | Chain 0 dBm | Chain 1 dBm | Total Power dBm | Total Power mW | Limit mW |
|---|---|---|---|---|---|---|
| 802.11b | 2412 | 21.25 | 21.70 | 24.49 | 281.26 | 1000 |
| | 2437 | 21.31 | 21.26 | 24.30 | 268.87 | 1000 |
| | 2462 | 21.22 | 21.07 | 24.16 | 260.37 | 1000 |
| 802.11g | 2412 | 23.21 | 23.01 | 26.12 | 409.40 | 1000 |
| | 2437 | 22.27 | 21.98 | 25.14 | 326.42 | 1000 |
| | 2462 | 22.73 | 22.89 | 25.82 | 382.04 | 1000 |
| 802.11n HT20 | 2412 | 21.94 | 23.04 | 25.54 | 357.69 | 1000 |
| | 2437 | 22.25 | 22.73 | 25.51 | 355.38 | 1000 |
| | 2462 | 22.73 | 22.32 | 25.54 | 358.11 | 1000 |
| 802.11n HT40 | 2422 | 20.96 | 20.37 | 23.69 | 233.63 | 1000 |
| | 2437 | 20.74 | 19.91 | 23.36 | 216.53 | 1000 |
| | 2452 | 20.03 | 20.07 | 23.06 | 202.32 | 1000 |
| 802.11a | 5745 | 20.34 | 20.88 | 23.63 | 230.61 | 741.3* |
| | 5785 | 23.11 | 22.95 | 26.04 | 401.89 | 741.3* |
| | 5825 | 22.23 | 22.54 | 25.40 | 346.58 | 741.3* |
| 802.11n HT20 | 5745 | 21.89 | 22.14 | 25.03 | 318.21 | 741.3* |
| | 5785 | 22.50 | 22.78 | 25.65 | 367.50 | 741.3* |
| | 5825 | 22.90 | 22.46 | 25.70 | 371.18 | 741.3* |
| 802.11n HT40 | 5755 | 21.73 | 21.55 | 24.65 | 291.83 | 741.3* |
| | 5785 | 21.27 | 21.36 | 24.33 | 270.74 | 741.3* |
| | 5795 | 22.31 | 21.89 | 25.12 | 324.74 | 741.3* |

*: Limit = 30dBm – (Antenna Gian – 6dBi), Antenna Gain = 7.3dBi, so Limit = 28.7dBm = 741.3mW

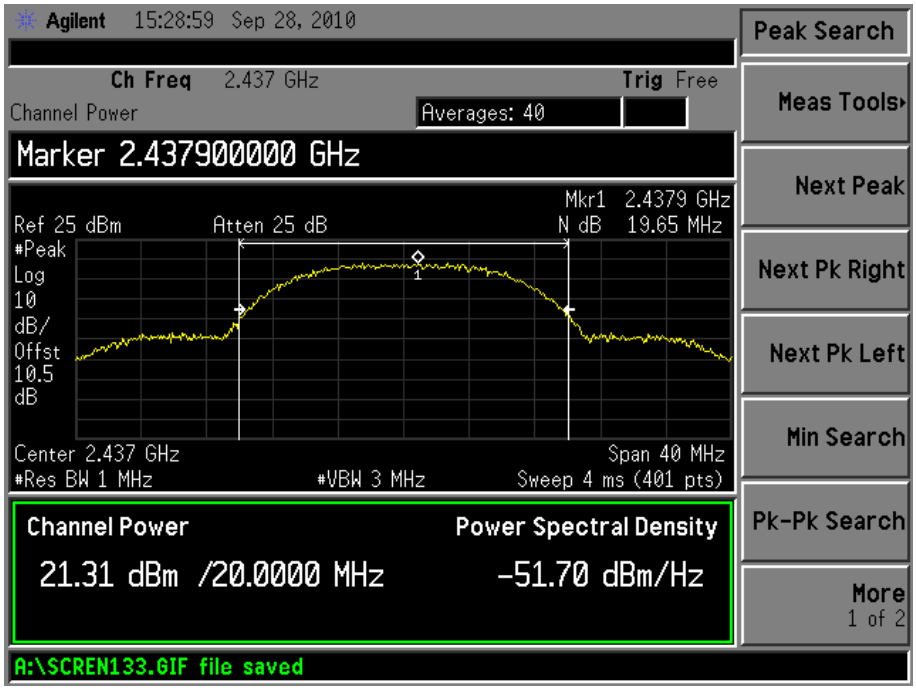
**Chain 0**

**For 802.11b**

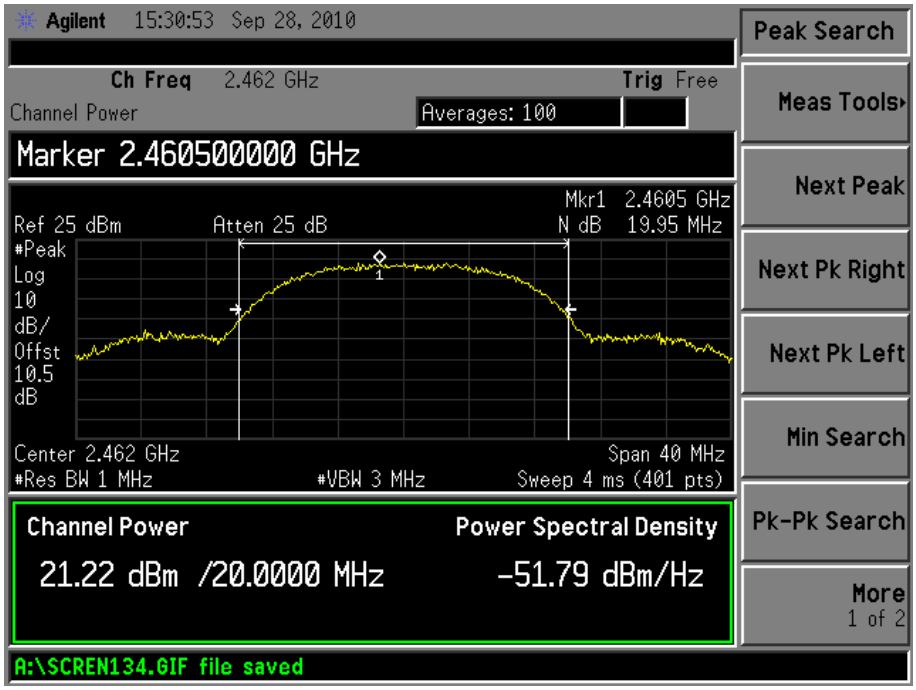
Low Channel:




Middle Channel:

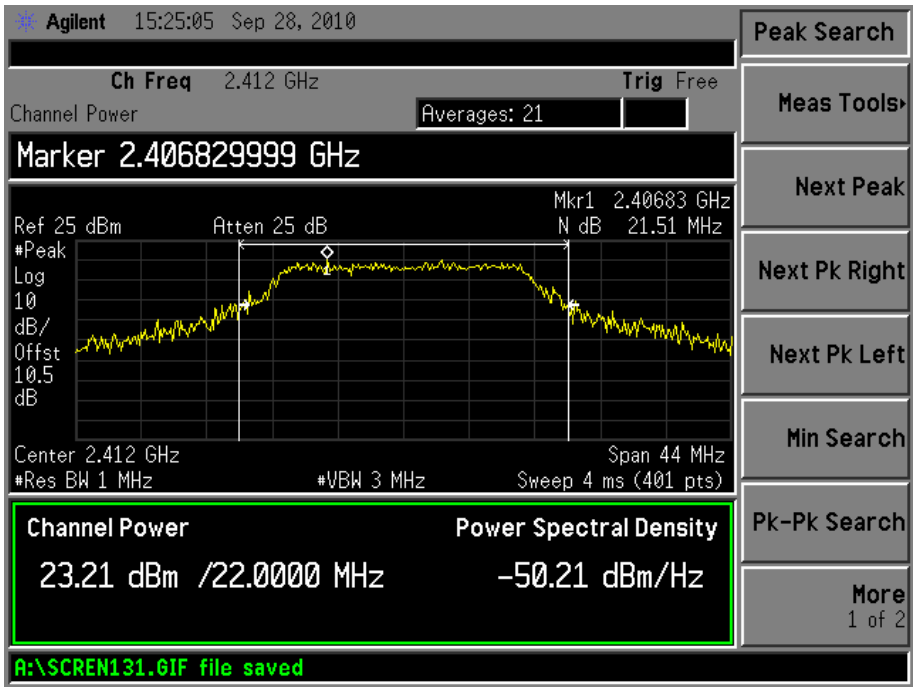


High Channel:

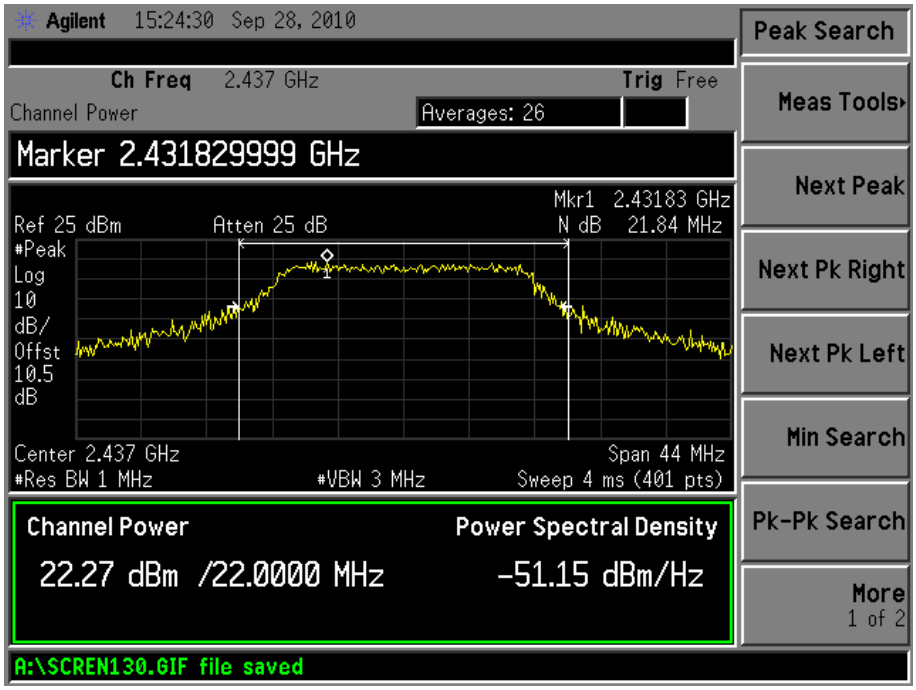



**For 802.11g**

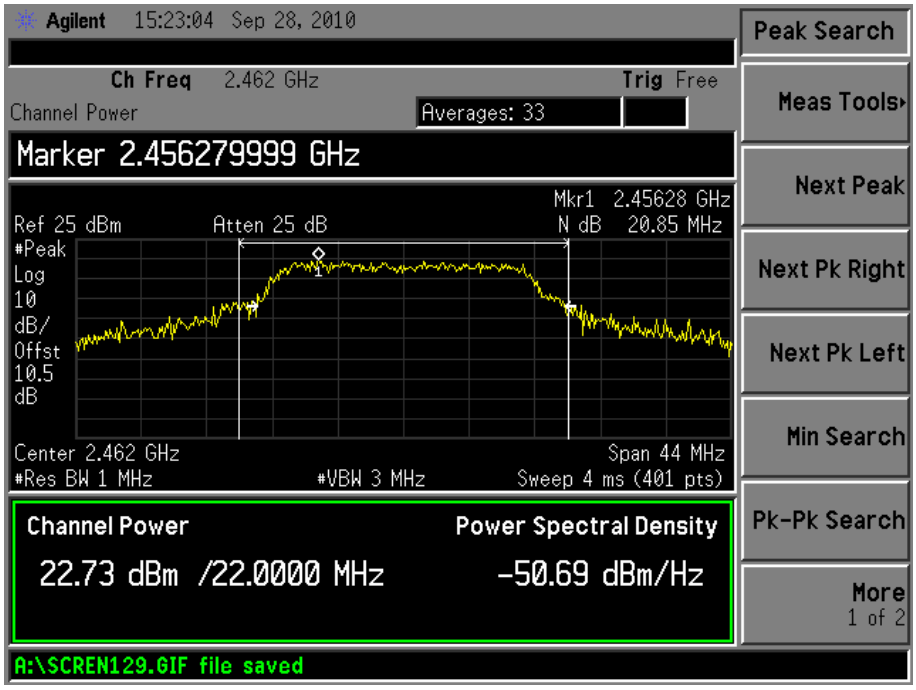
Low Channel:



Middle Channel:

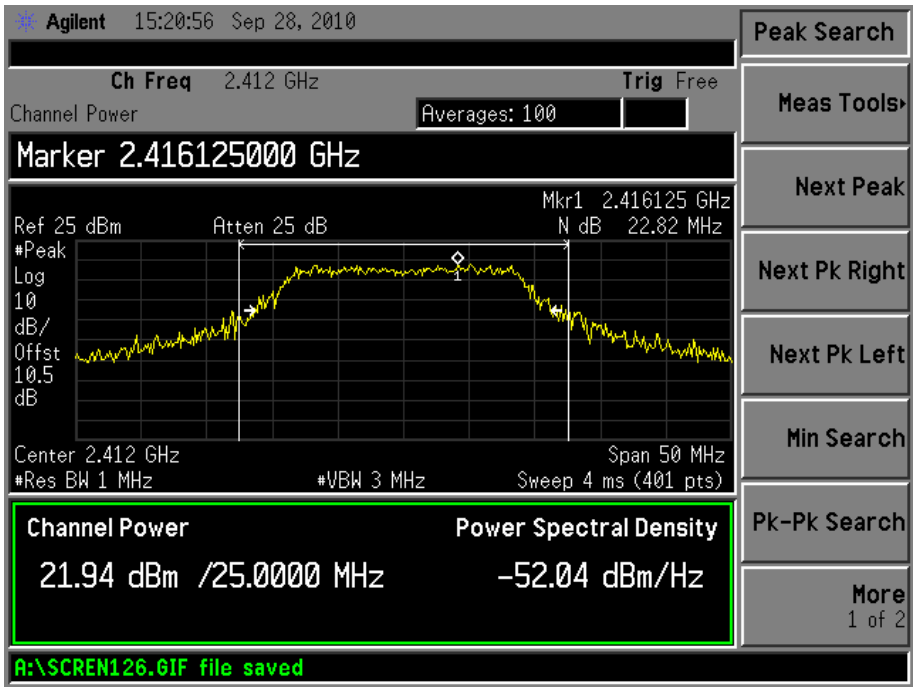



High Channel:

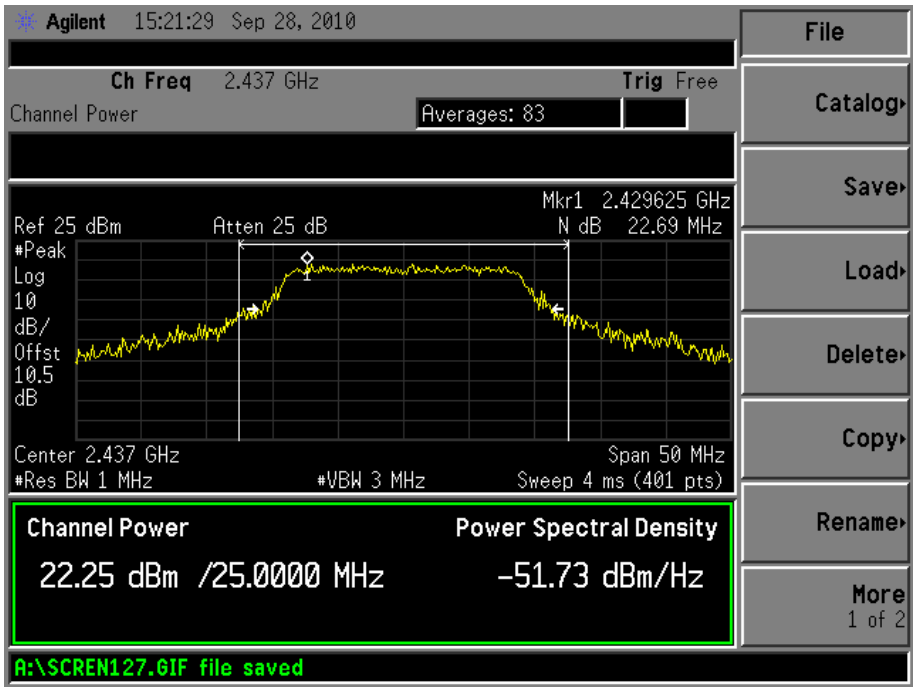


**For 802.11n HT20**

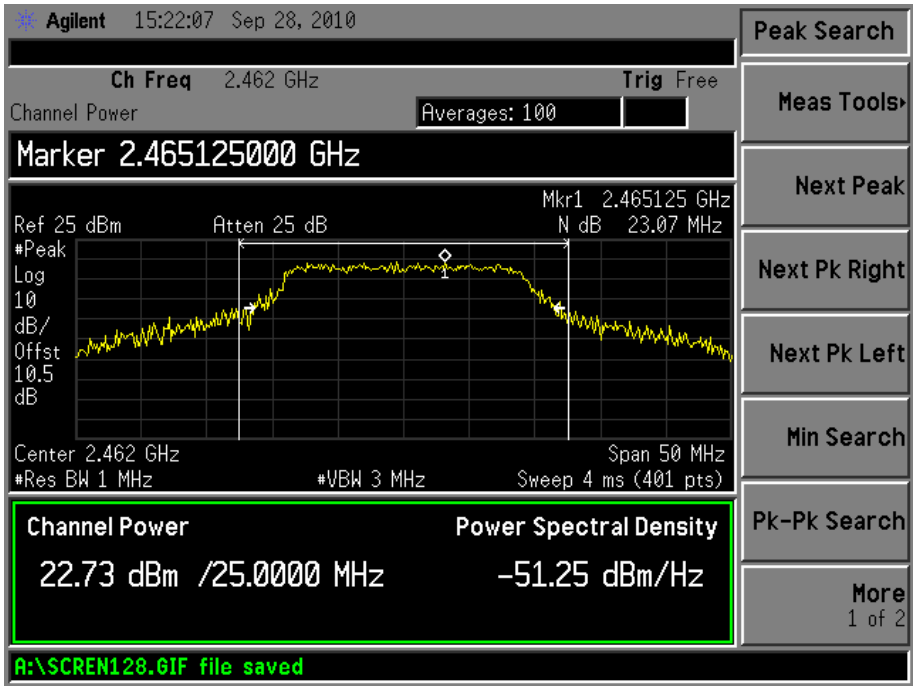
Low Channel:




Middle Channel:

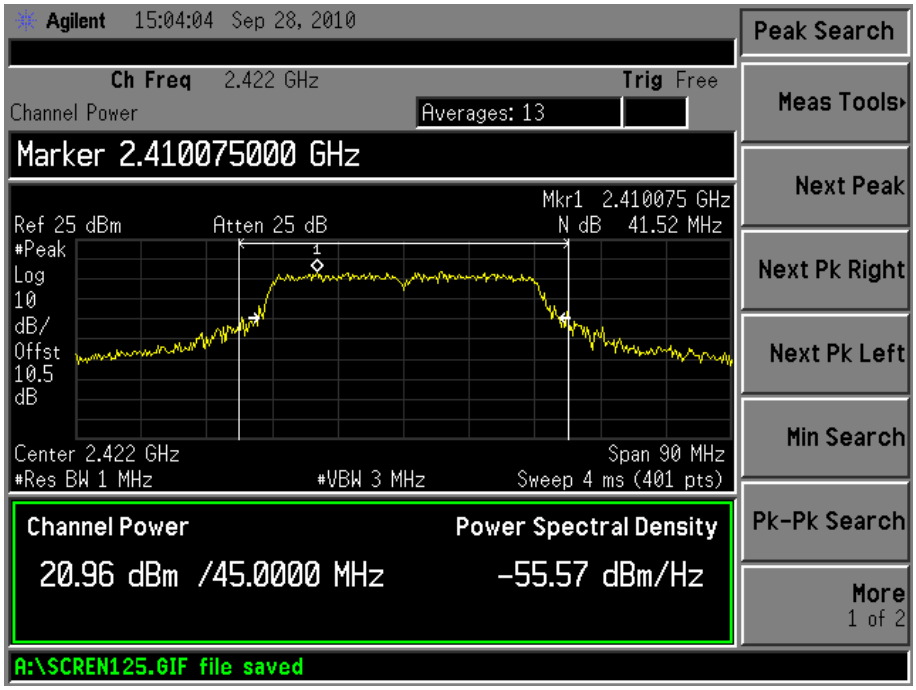


High Channel:

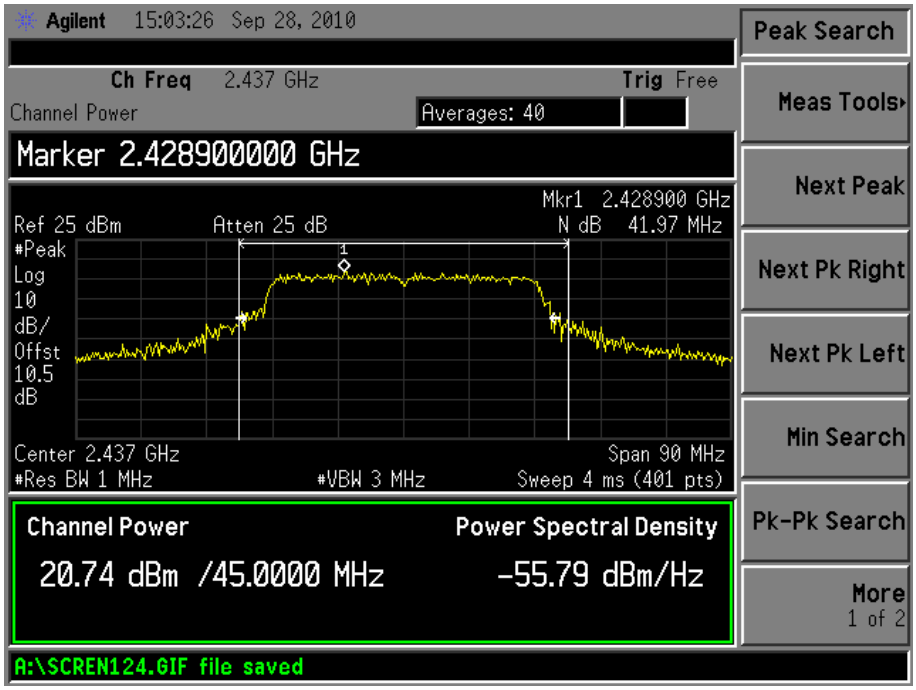



**For 802.11n HT40**

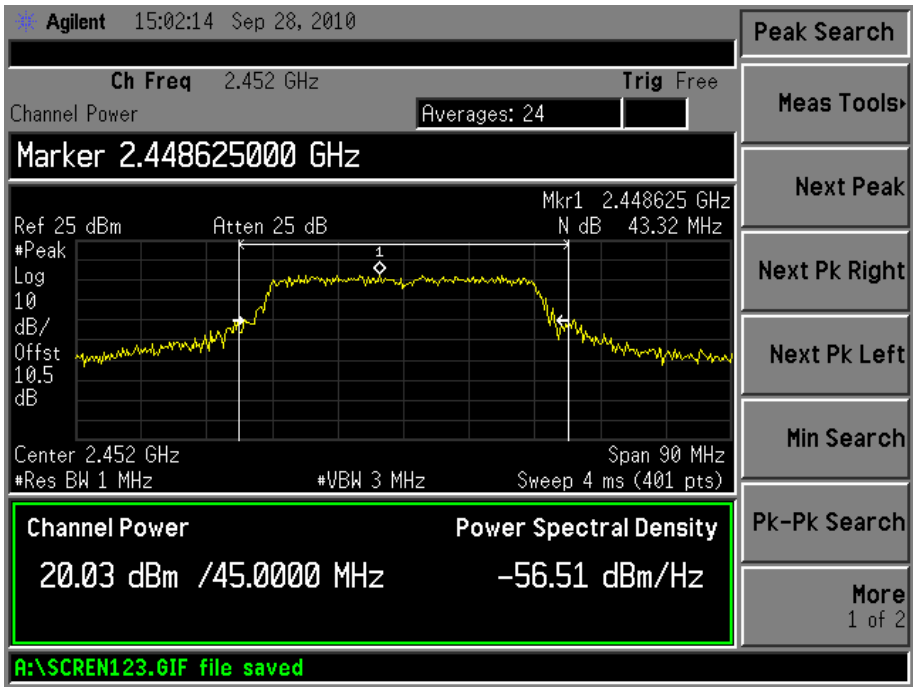
Low Channel:



Middle Channel:



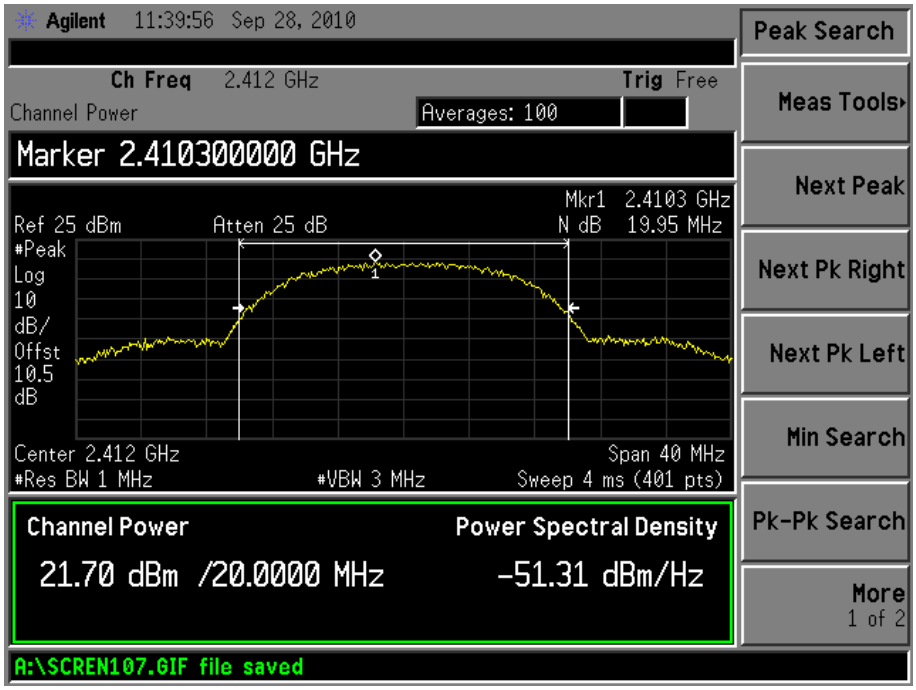

High Channel:



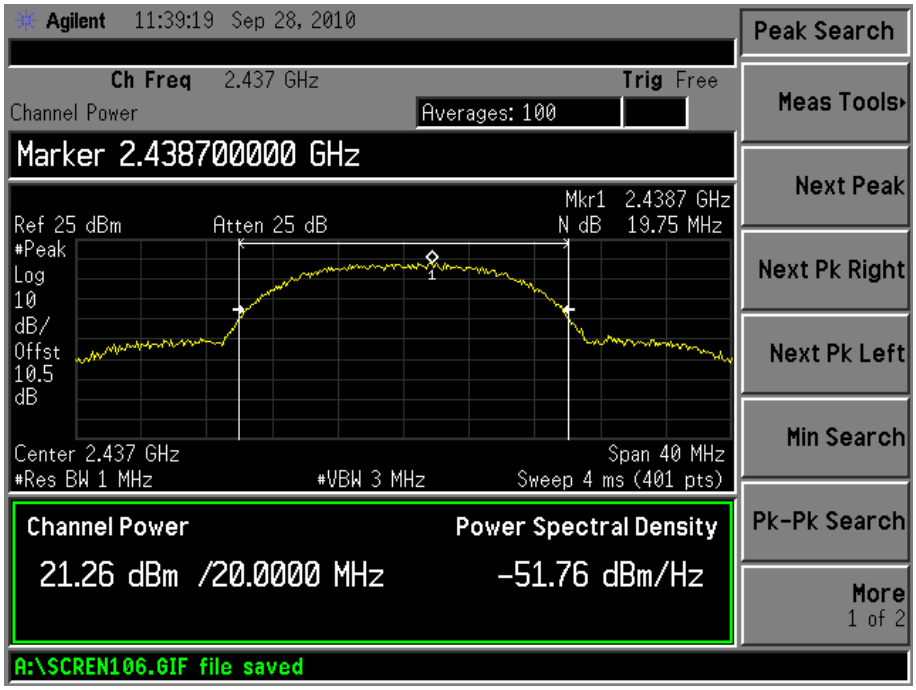
**Chain 1**

**For 802.11b**

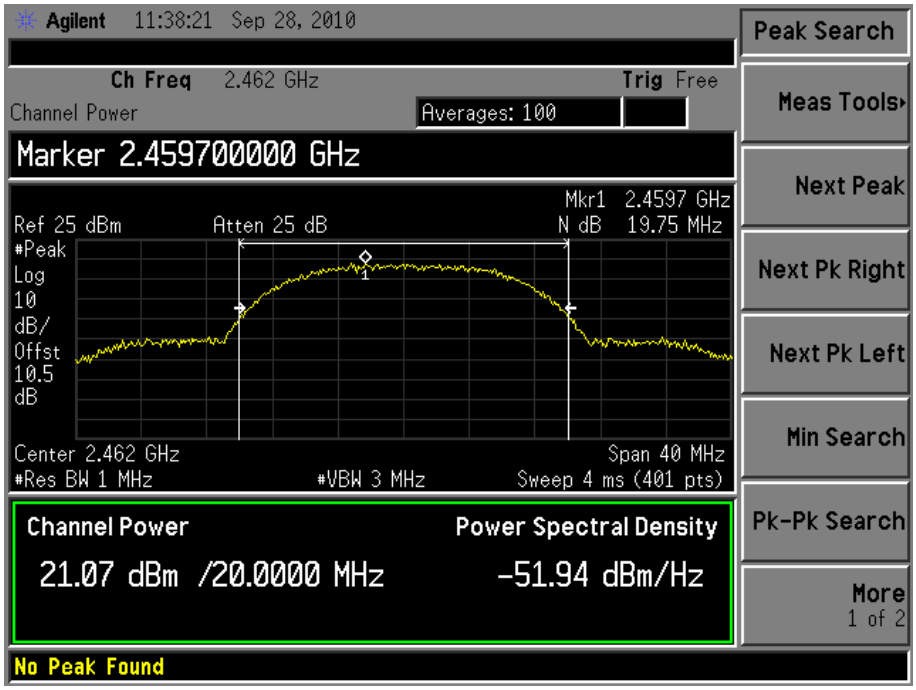
Low Channel:




Middle Channel:

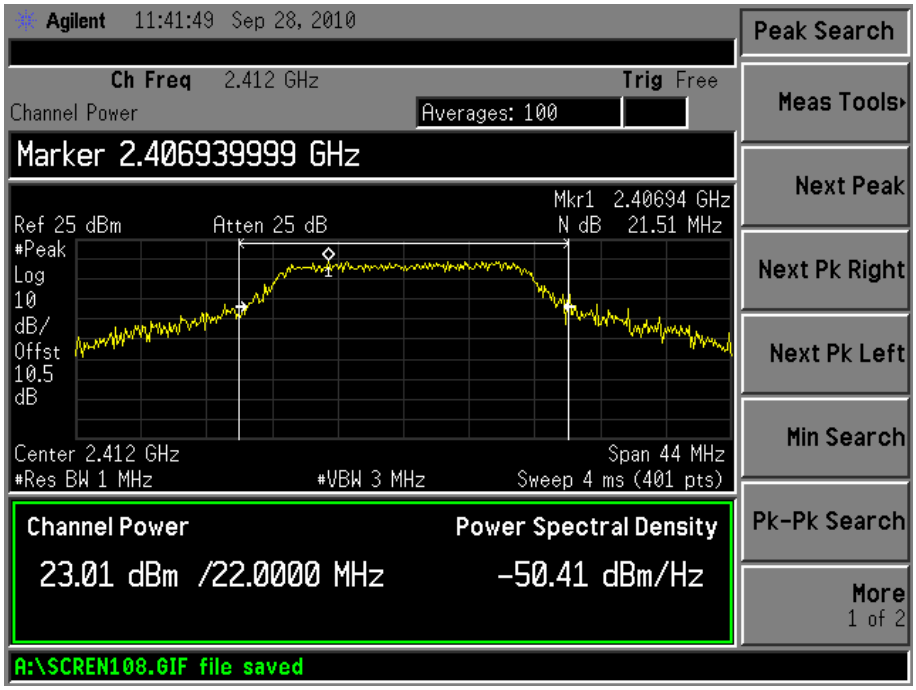


High Channel:

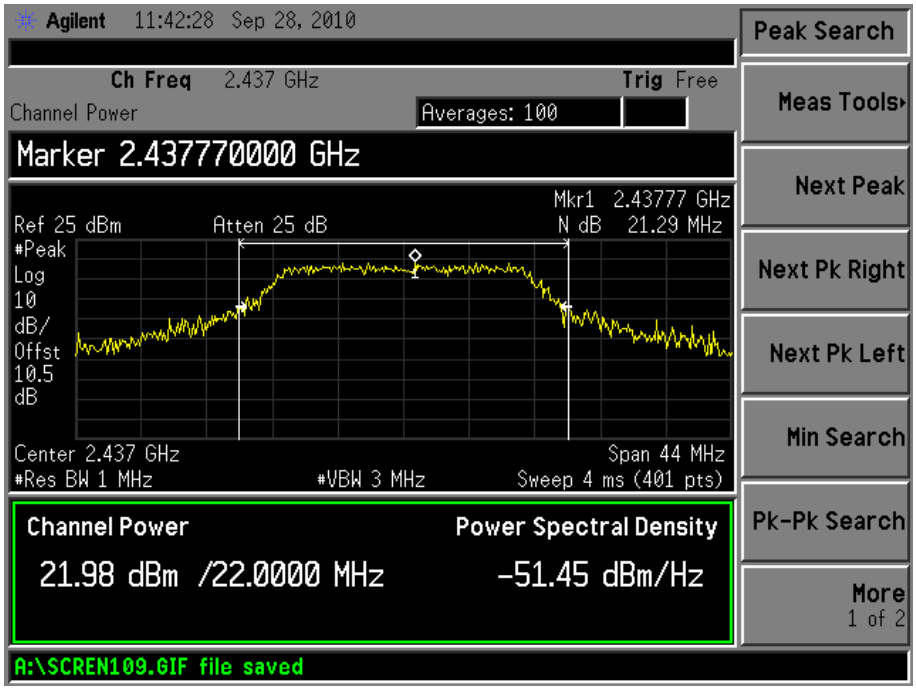



**For 802.11g**

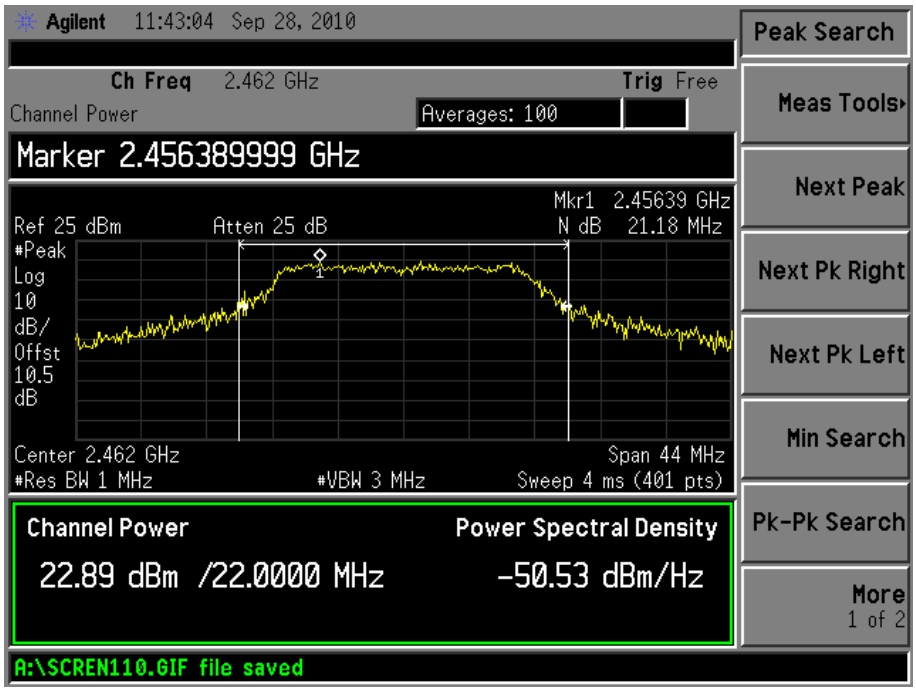
Low Channel:



Middle Channel:

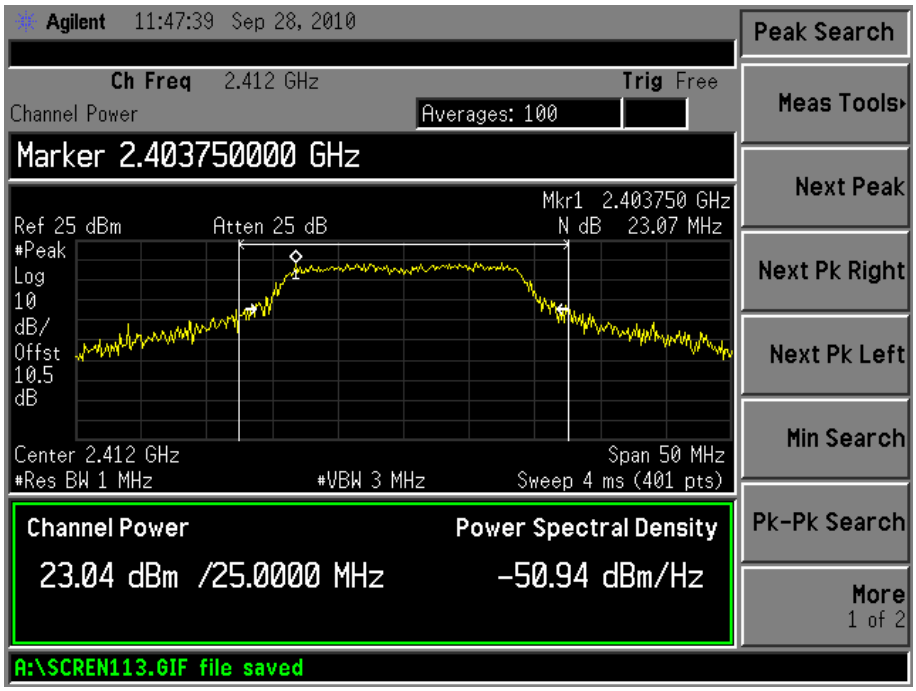



High Channel:

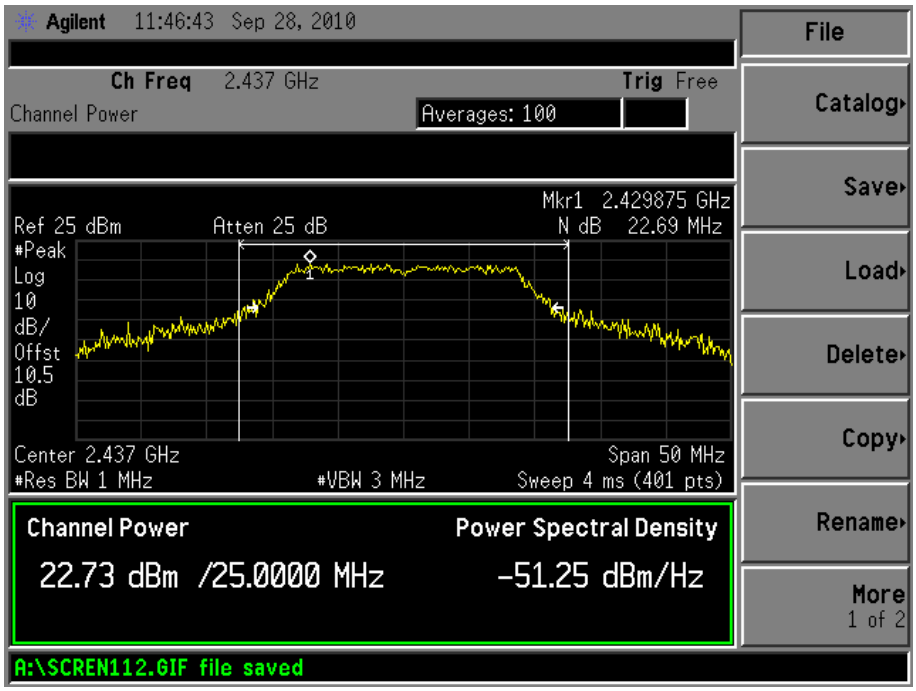


**For 802.11n HT20**

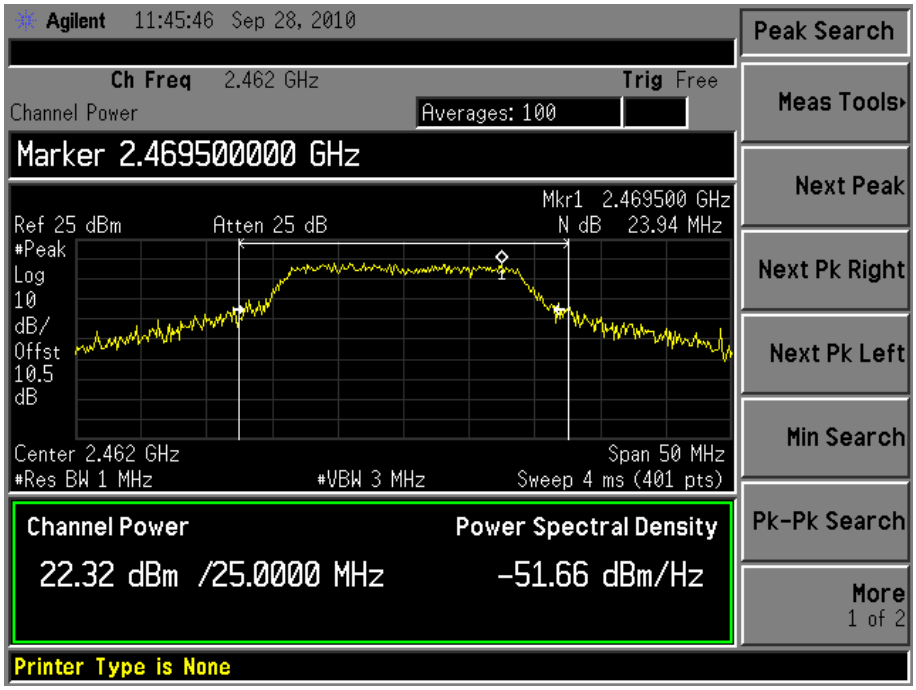
Low Channel:




Middle Channel:

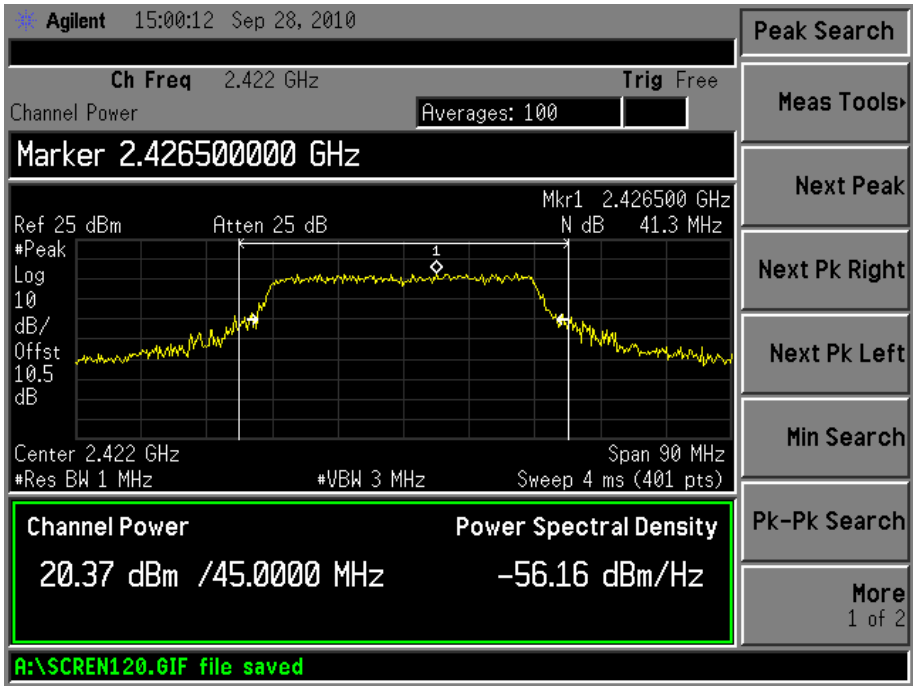


High Channel:

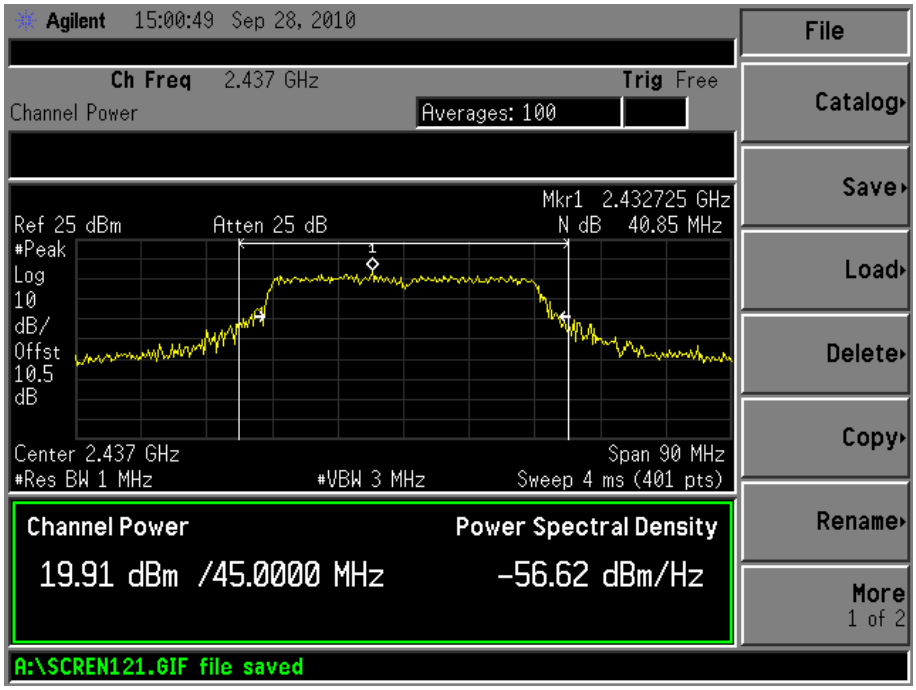



**For 802.11n HT40**

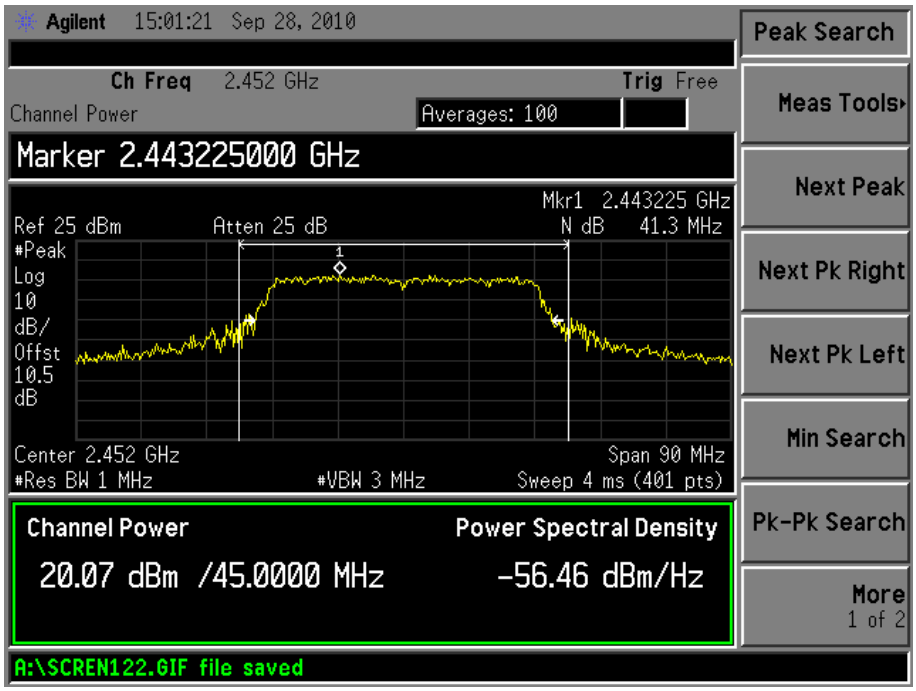
Low Channel:



Middle Channel:




High Channel:



# 8. FIELD STRENGTH OF SPURIOUS EMISSIONS

## 8.1 Measurement Uncertainty

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ±5.10 dB.

## 8.2 Standard Applicable

According to §15.247(c), 15.205 15.209(b) &15.35 (b), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Section 15.209:
30 - 88 MHz 40 dBuV/m @3M
88 -216 MHz 43.5 dBuV/m @3M
216 -960 MHz 46 dBuV/m @3M
Above 960 MHz 54dBuV/m @3M

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

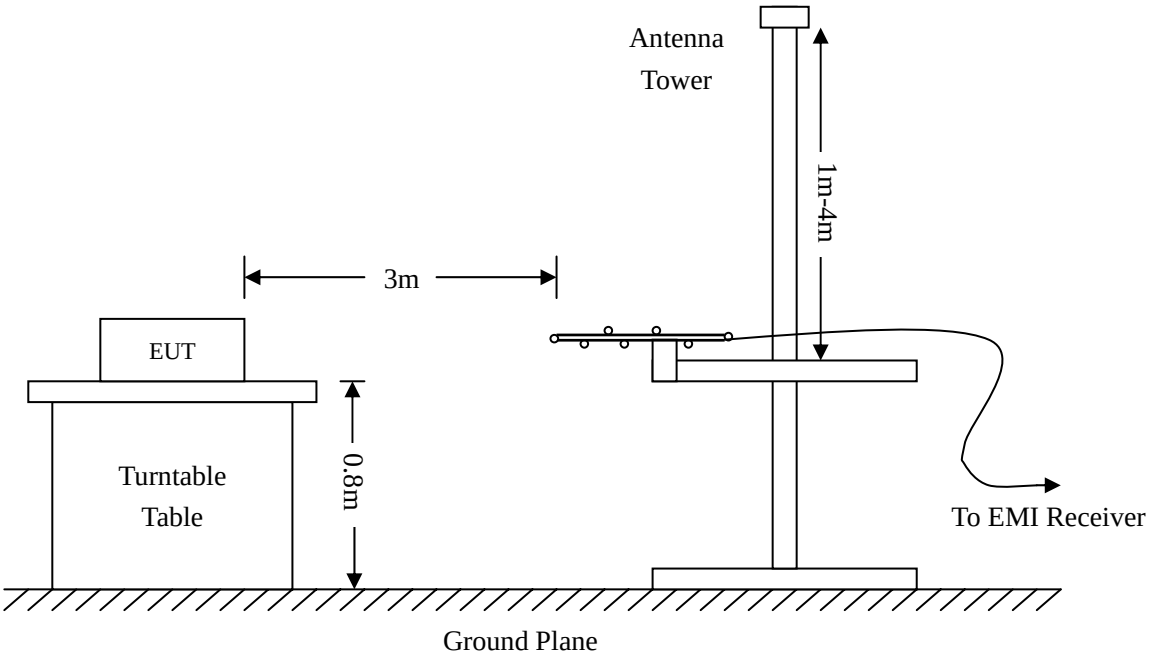
Emissions that fall in the restricted bands (15.205) must be less than 54dBuV/m otherwise the spurious and harmonics must be attenuated by at least 20dB.

## 8.3 Test Equipment List and Details

| Description | Manufacturer | Model | Serial Number | Cal. Date | Due. Date |
|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSP | 836079/035 | 2010-04-16 | 2011-04-15 |
| EMI Test Receiver | R&S | ESVB | 825471/005 | 2010-08-12 | 2011-08-11 |
| Positioning Controller | C&C | CC-C-1F | N/A | 2010-08-12 | 2011-08-11 |
| RF Switch | EM | EMSW18 | SW060023 | 2010-08-12 | 2011-08-11 |
| Pre-amplifier | Agilent | 8447F | 3113A06717 | 2010-08-12 | 2011-08-11 |
| Pre-amplifier | Compliance Direction | PAP-0118 | 24002 | 2010-08-12 | 2011-08-11 |
| Trilog Broadband Antenna | SCHWARZBECK | VULB9163 | 9163-333 | 2010-07-21 | 2011-07-20 |
| Horn Antenna | ETS | 3117 | 00086197 | 2010-07-21 | 2011-07-20 |

## 8.4 Test Procedure

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.




## 8.5 Test Receiver Setup

During the radiated emission test for above 1GHz, the test receiver was set with the following configurations:

For peak detector:
RBW = 1000kHz, VBW = 3000kHz, Sweep Time = Auto

For average detector:
RBW = 1000kHz, VBW = 10Hz, Sweep Time = Auto

## 8.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – Ampl. Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – FCC Part 15 Limit

## 8.7 Environmental Conditions

| | |
|---|---|
| Temperature: | 22° C |
| Relative Humidity: | 52% |
| ATM Pressure: | 1012 mbar |

## 8.8 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst margin of:

**-4.5 dBμV** at **4824.0 MHz** in the **Vertical** polarization, **Average** detector, **Transmitting 802.11b Low Channel** test mode, **30 MHz to 25 GHz, 3Meters**

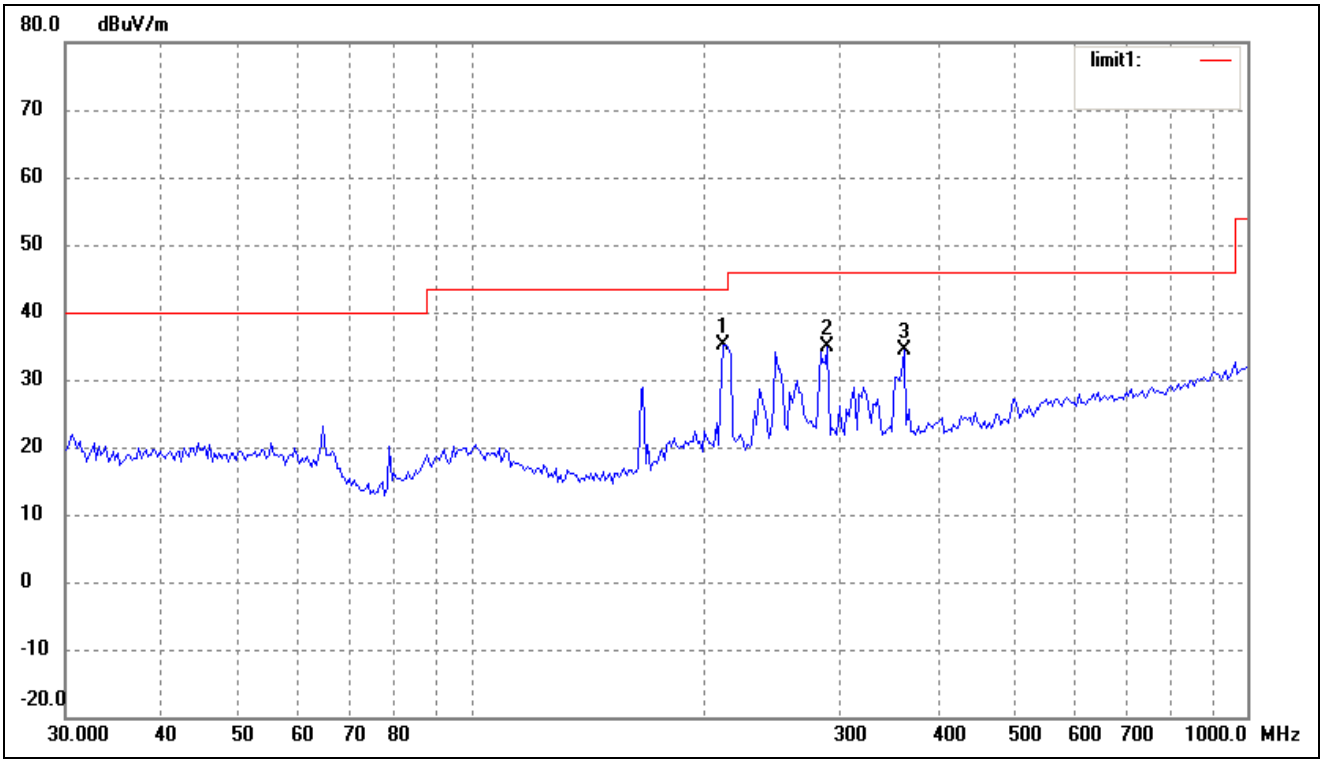
***Note:*** *this EUT was tested in 3 orthogonal positions and the worst case position data was reported.*

*Test Result/Plots:*

*Spurious Emission From 30 MHz to 1 GHz*

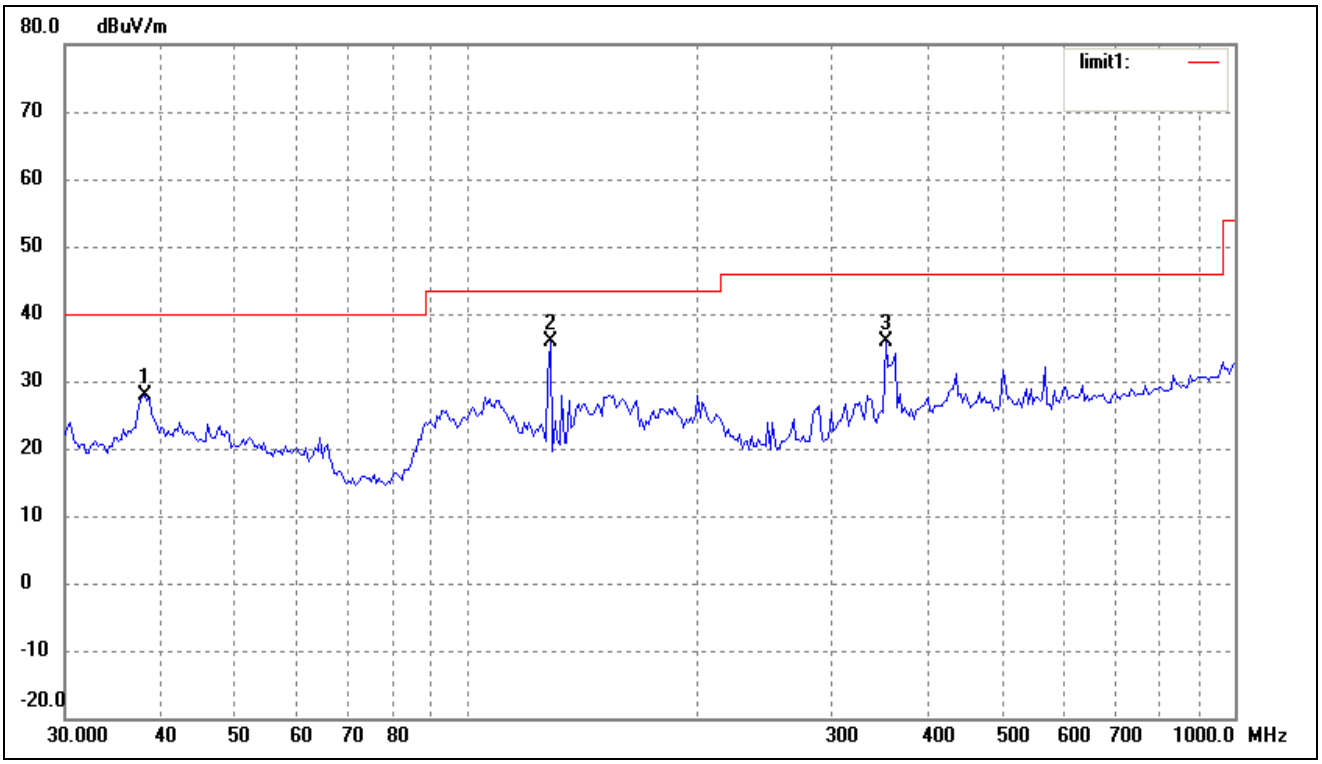
*Test mode: Transmitting (802.11b)*

*Horizontal:*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 211.6112 | 29.00 | 6.06 | 35.06 | 43.50 | -8.44 | 360 | 100 | peak |
| 2 | 288.2840 | 26.44 | 8.54 | 34.98 | 46.00 | -11.02 | 360 | 100 | peak |
| 3 | 360.9775 | 24.74 | 9.66 | 34.40 | 46.00 | -11.60 | 360 | 100 | peak |

*Vertical:*

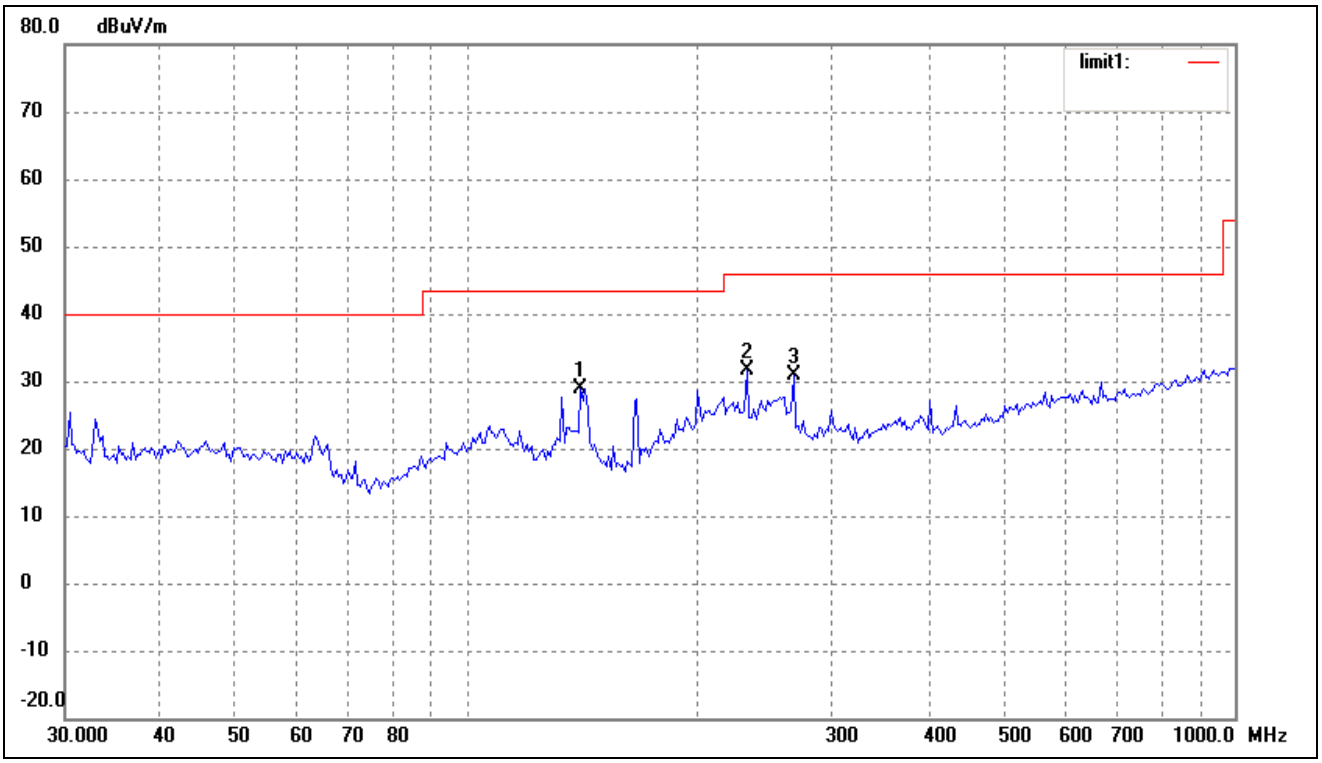



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 38.0965 | 20.40 | 7.42 | 27.82 | 40.00 | -12.18 | 360 | 100 | peak |
| 2 | 128.4862 | 31.87 | 4.06 | 35.93 | 43.50 | -7.57 | 360 | 100 | peak |
| 3 | 350.9722 | 26.52 | 9.46 | 35.98 | 46.00 | -10.02 | 360 | 100 | peak |

*Spurious Emission From 30 MHz to 1 GHz*

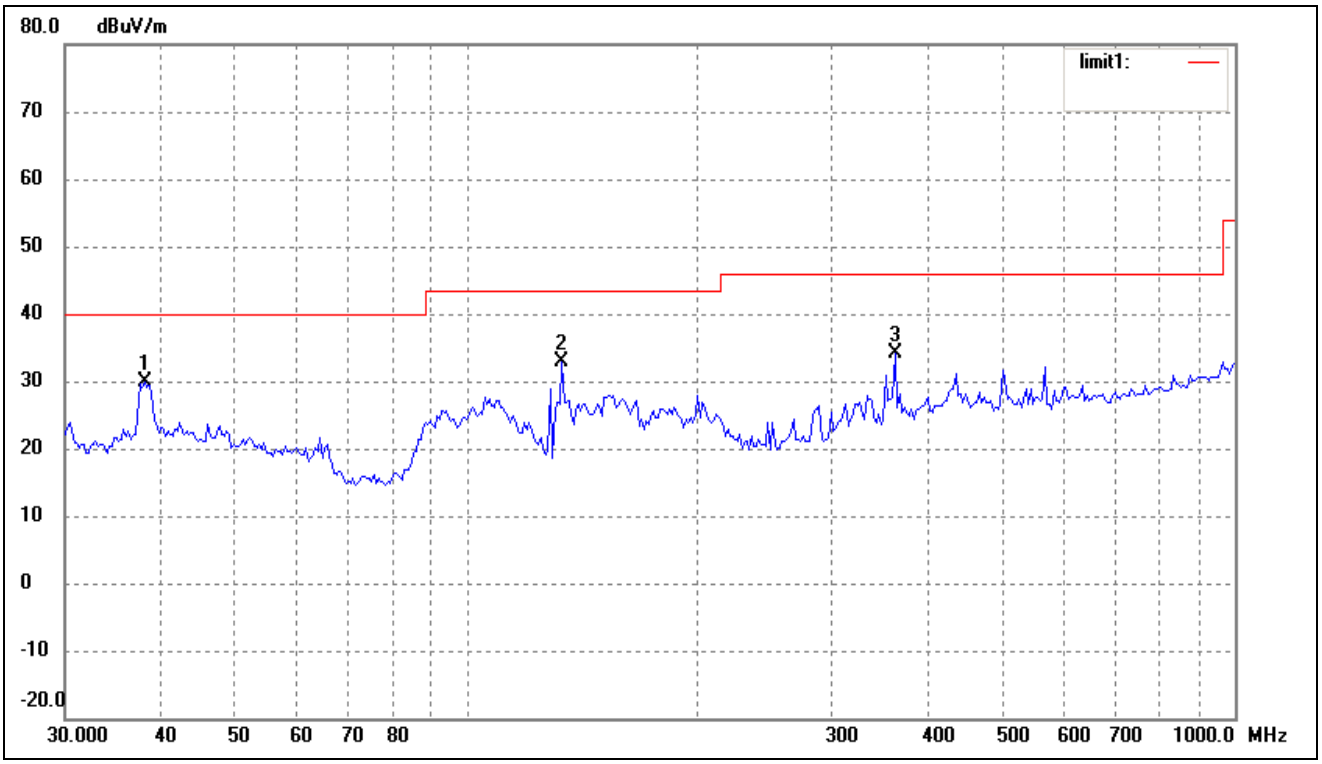
*Test mode: Transmitting (802.11g)*

*Horizontal:*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 140.7767 | 25.74 | 3.23 | 28.97 | 43.50 | -14.53 | 360 | 100 | peak |
| 2 | 231.8531 | 24.70 | 6.99 | 31.69 | 46.00 | -14.31 | 360 | 100 | peak |
| 3 | 266.8395 | 22.71 | 8.11 | 30.82 | 46.00 | -15.18 | 360 | 100 | peak |

*Vertical:*

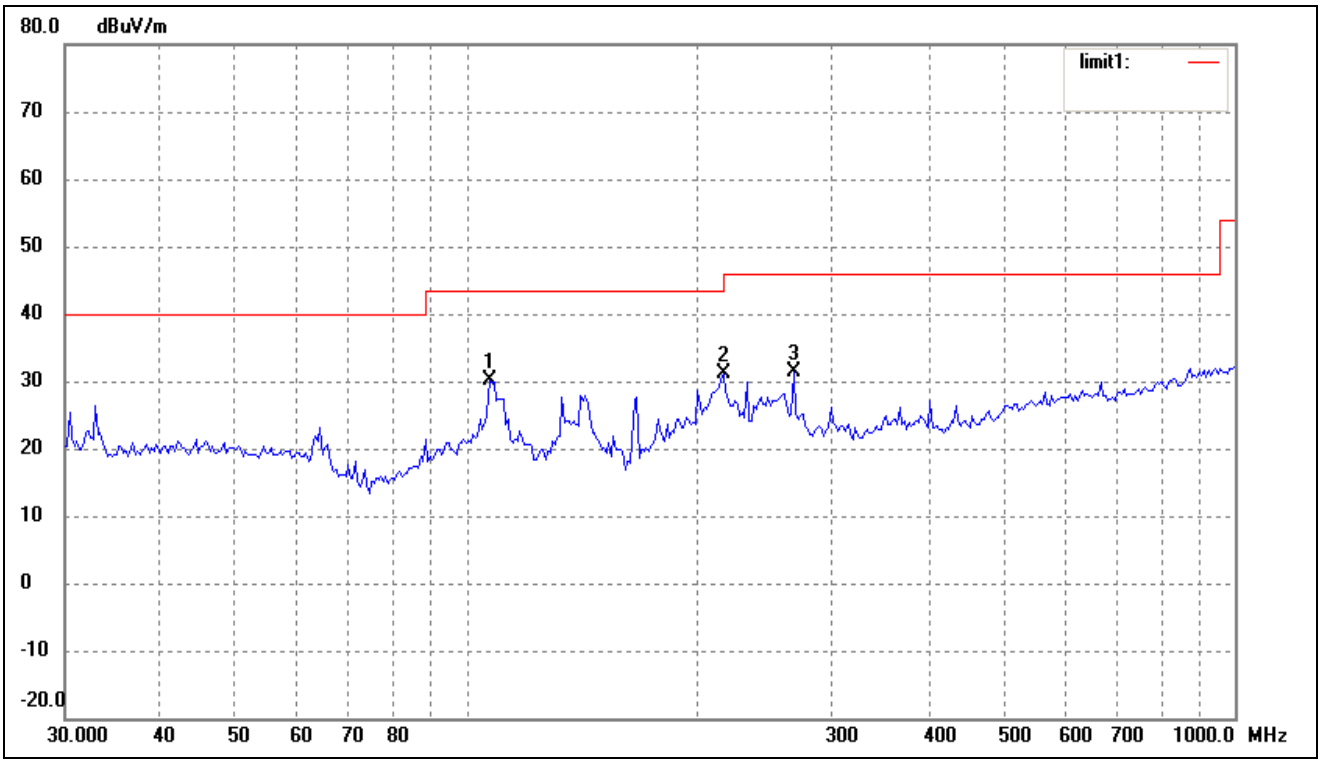



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 38.0965 | 22.40 | 7.42 | 29.82 | 40.00 | -10.18 | 360 | 100 | peak |
| 2 | 133.0809 | 29.12 | 3.66 | 32.78 | 43.50 | -10.72 | 360 | 100 | peak |
| 3 | 360.9775 | 24.51 | 9.66 | 34.17 | 46.00 | -11.83 | 360 | 100 | peak |

*Spurious Emission From 30 MHz to 1 GHz*

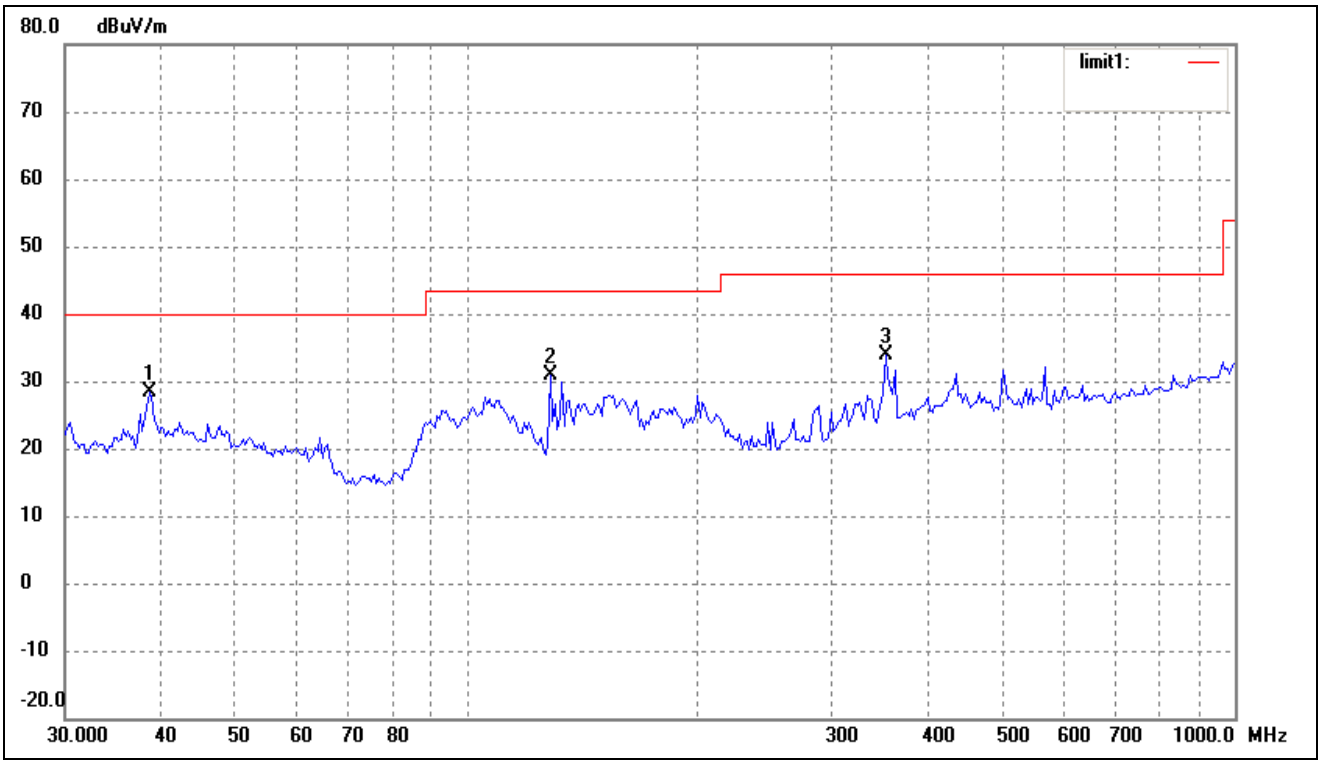
*Test mode: Transmitting (802.11n HT20)*

*Horizontal:*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 107.0306 | 22.88 | 7.20 | 30.08 | 43.50 | -13.42 | 360 | 100 | peak |
| 2 | 216.1197 | 24.90 | 6.21 | 31.11 | 46.00 | -14.89 | 360 | 100 | peak |
| 3 | 266.8395 | 23.22 | 8.11 | 31.33 | 46.00 | -14.67 | 360 | 100 | peak |

*Vertical:*

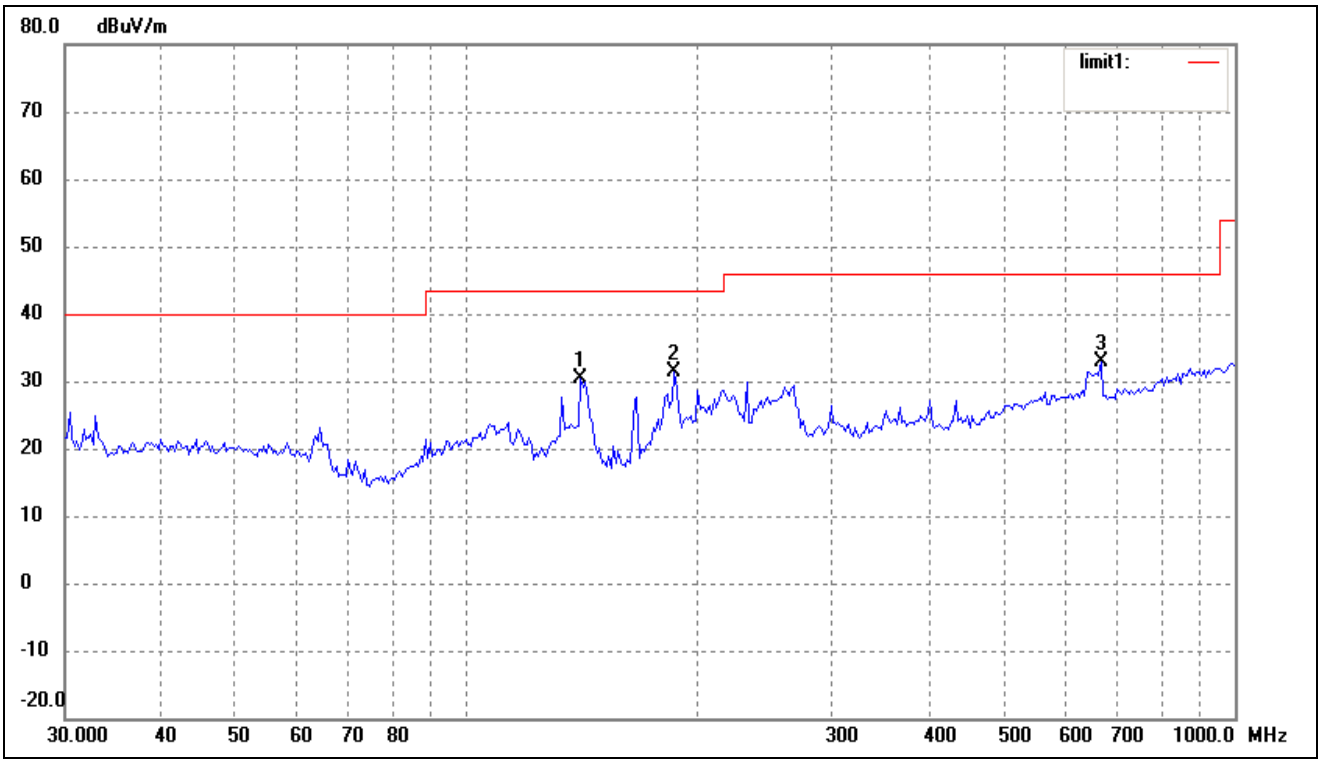



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 38.6357 | 20.92 | 7.57 | 28.49 | 40.00 | -11.51 | 360 | 100 | peak |
| 2 | 128.4862 | 26.87 | 4.06 | 30.93 | 43.50 | -12.57 | 360 | 100 | peak |
| 3 | 350.9722 | 24.52 | 9.46 | 33.98 | 46.00 | -12.02 | 360 | 100 | peak |

*Spurious Emission From 30 MHz to 1 GHz*

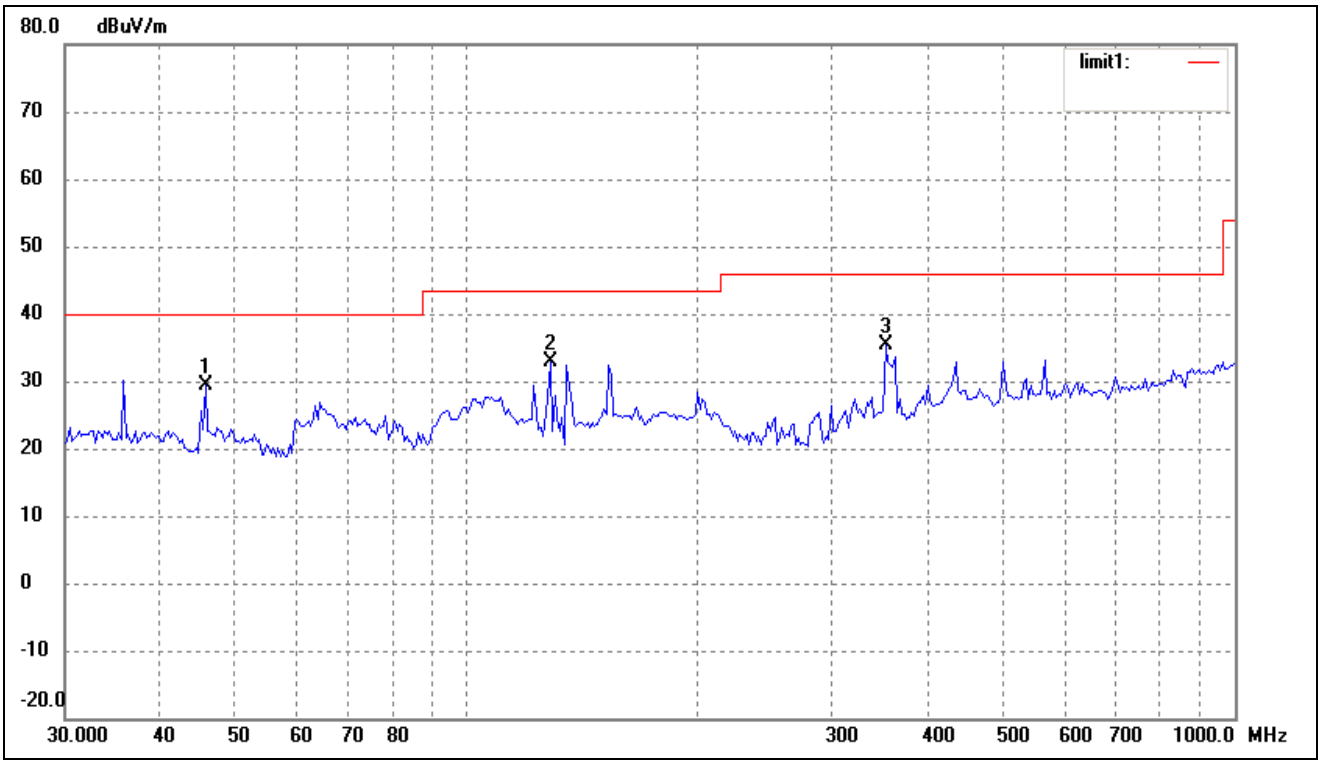
*Test mode: Transmitting (802.11n HT40)*

*Horizontal:*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 140.7767 | 27.25 | 3.23 | 30.48 | 43.50 | -13.02 | 360 | 100 | peak |
| 2 | 186.4684 | 25.96 | 5.35 | 31.31 | 43.50 | -12.19 | 360 | 100 | peak |
| 3 | 669.9523 | 18.38 | 14.40 | 32.78 | 46.00 | -13.22 | 360 | 100 | peak |

*Vertical:*

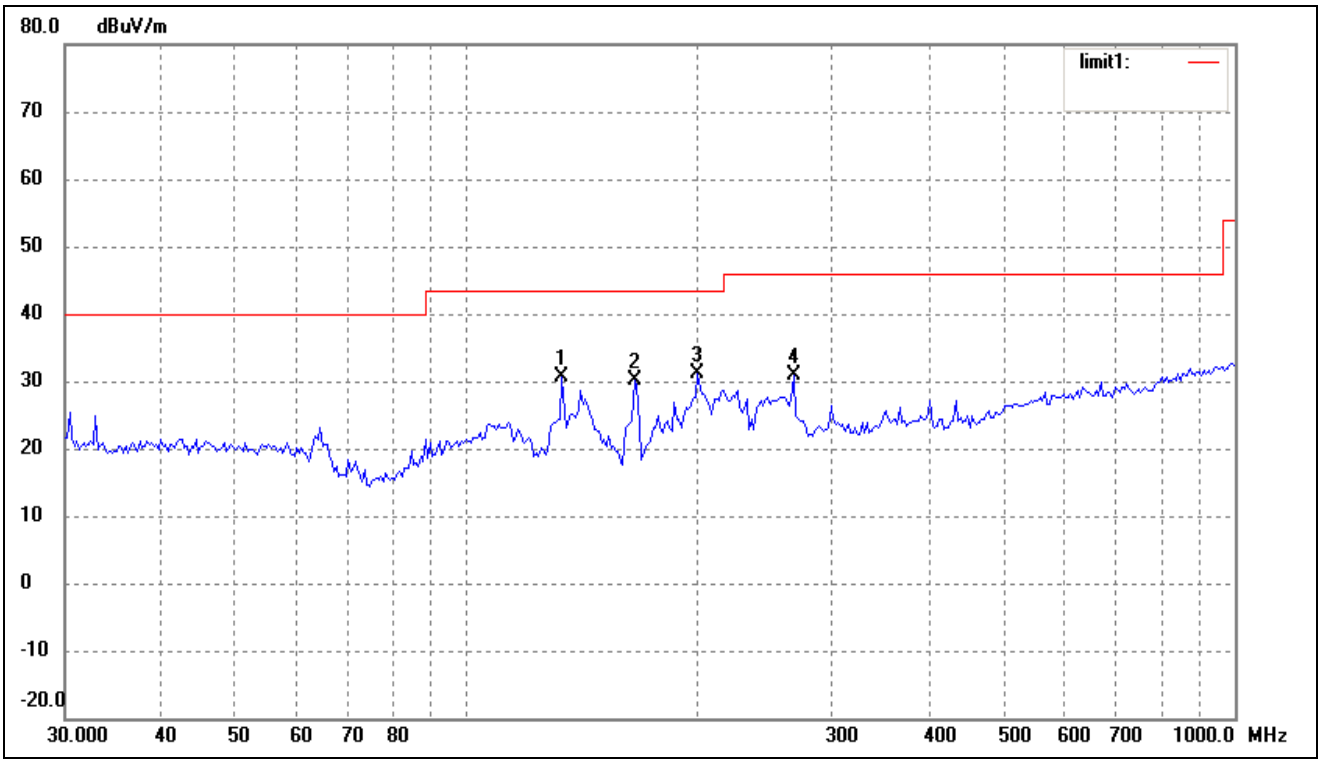



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 45.7333 | 21.32 | 7.95 | 29.27 | 40.00 | -10.73 | 360 | 100 | peak |
| 2 | 128.4862 | 28.87 | 4.06 | 32.93 | 43.50 | -10.57 | 360 | 100 | peak |
| 3 | 350.9722 | 26.02 | 9.46 | 35.48 | 46.00 | -10.52 | 360 | 100 | peak |

*Spurious Emission From 30 MHz to 1 GHz*

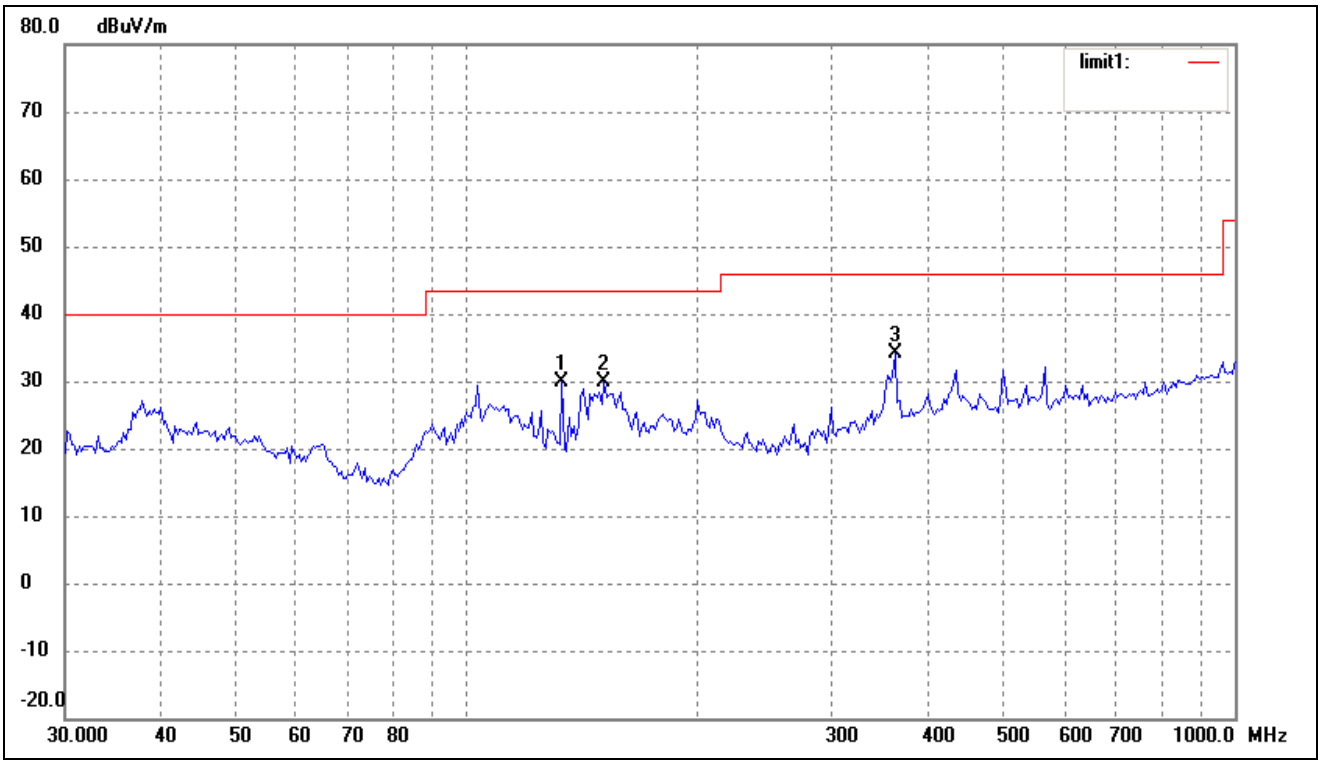
*Test mode: Transmitting (802.11a)*

*Horizontal:*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 133.0809 | 27.05 | 3.66 | 30.71 | 43.50 | -12.79 | 360 | 100 | peak |
| 2 | 165.4716 | 26.27 | 3.92 | 30.19 | 43.50 | -13.31 | 360 | 100 | peak |
| 3 | 200.0432 | 25.52 | 5.68 | 31.20 | 43.50 | -12.30 | 360 | 100 | peak |
| 4 | 266.8395 | 22.81 | 8.11 | 30.92 | 46.00 | -15.08 | 360 | 100 | peak |

*Vertical:*

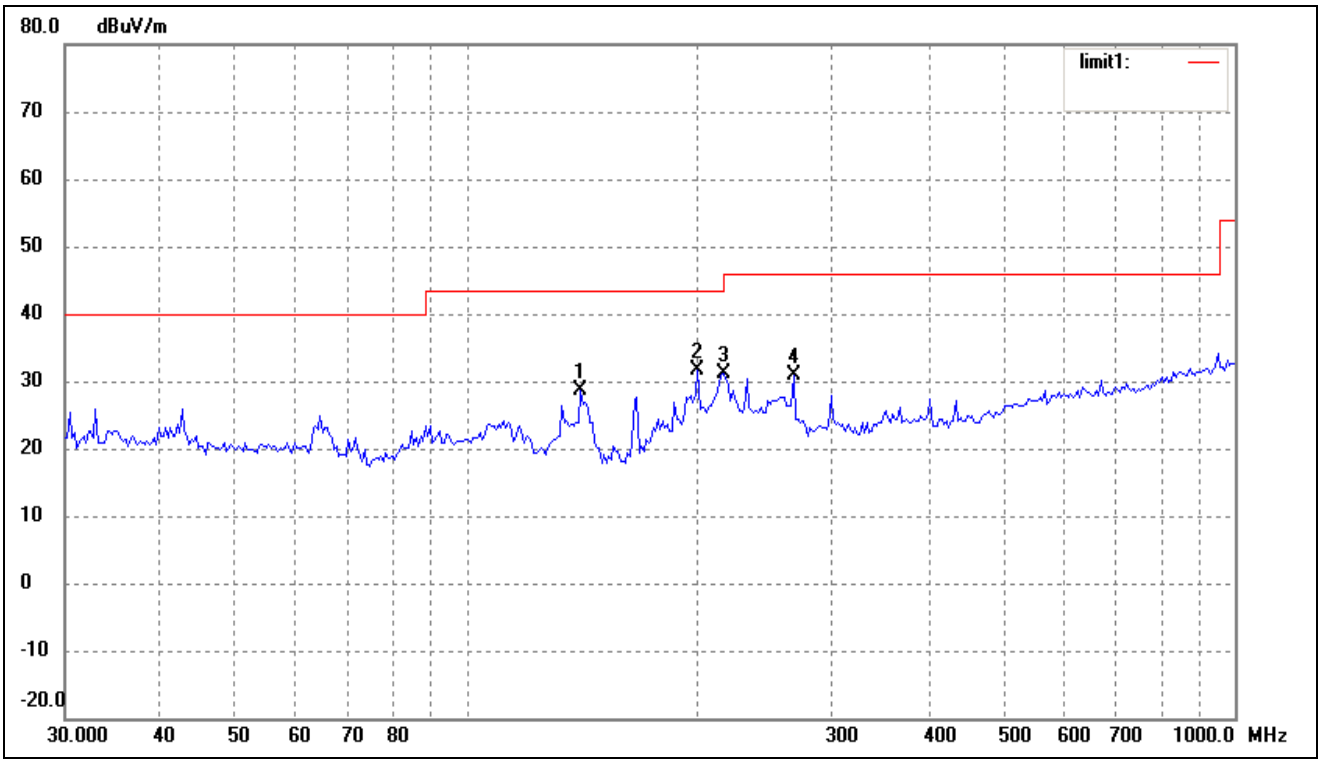



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 133.0809 | 26.22 | 3.66 | 29.88 | 43.50 | -13.62 | 360 | 100 | peak |
| 2 | 151.0252 | 26.59 | 3.35 | 29.94 | 43.50 | -13.56 | 360 | 100 | peak |
| 3 | 360.9775 | 24.55 | 9.66 | 34.21 | 46.00 | -11.79 | 360 | 100 | peak |

*Spurious Emission From 30 MHz to 1 GHz*

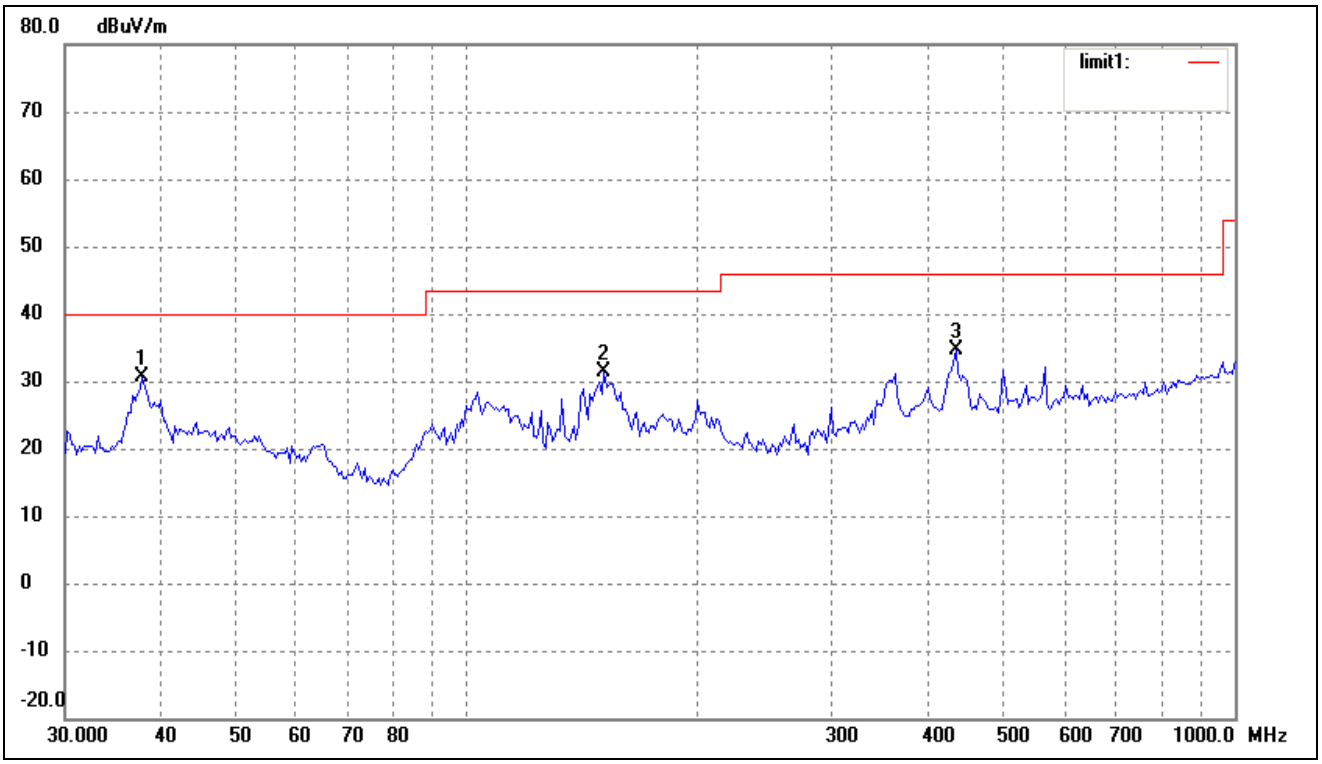
*Test mode: Transmitting (802.11n HT20, 5.8G)*

*Horizontal:*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 140.7767 | 25.39 | 3.23 | 28.62 | 43.50 | -14.88 | 360 | 100 | peak |
| 2 | 200.0432 | 26.02 | 5.68 | 31.70 | 43.50 | -11.80 | 360 | 100 | peak |
| 3 | 216.1197 | 24.90 | 6.21 | 31.11 | 46.00 | -14.89 | 360 | 100 | peak |
| 4 | 266.8395 | 22.81 | 8.11 | 30.92 | 46.00 | -15.08 | 360 | 100 | peak |

*Vertical:*

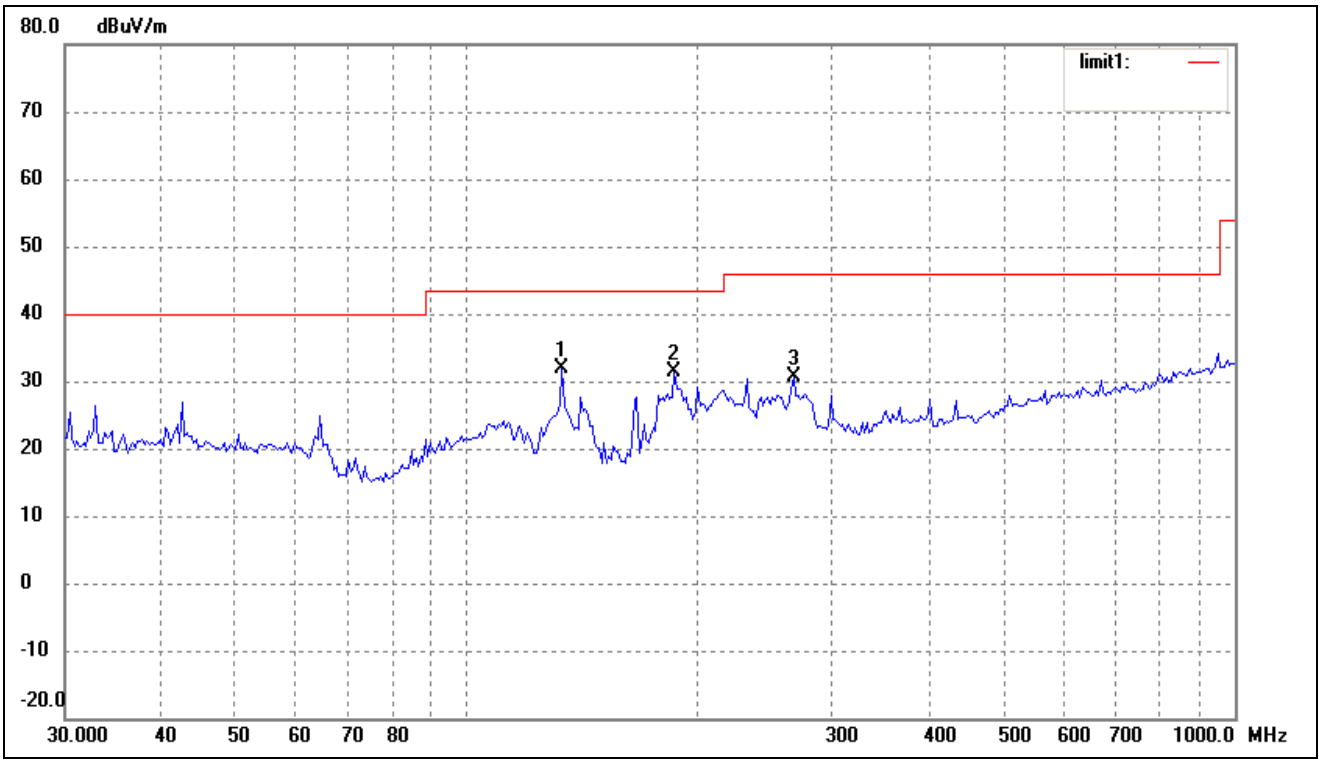



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 37.8297 | 23.32 | 7.35 | 30.67 | 40.00 | -9.33 | 360 | 100 | peak |
| 2 | 151.0252 | 28.09 | 3.35 | 31.44 | 43.50 | -12.06 | 360 | 100 | peak |
| 3 | 433.3397 | 24.15 | 10.54 | 34.69 | 46.00 | -11.31 | 360 | 100 | peak |

*Spurious Emission From 30 MHz to 1 GHz*

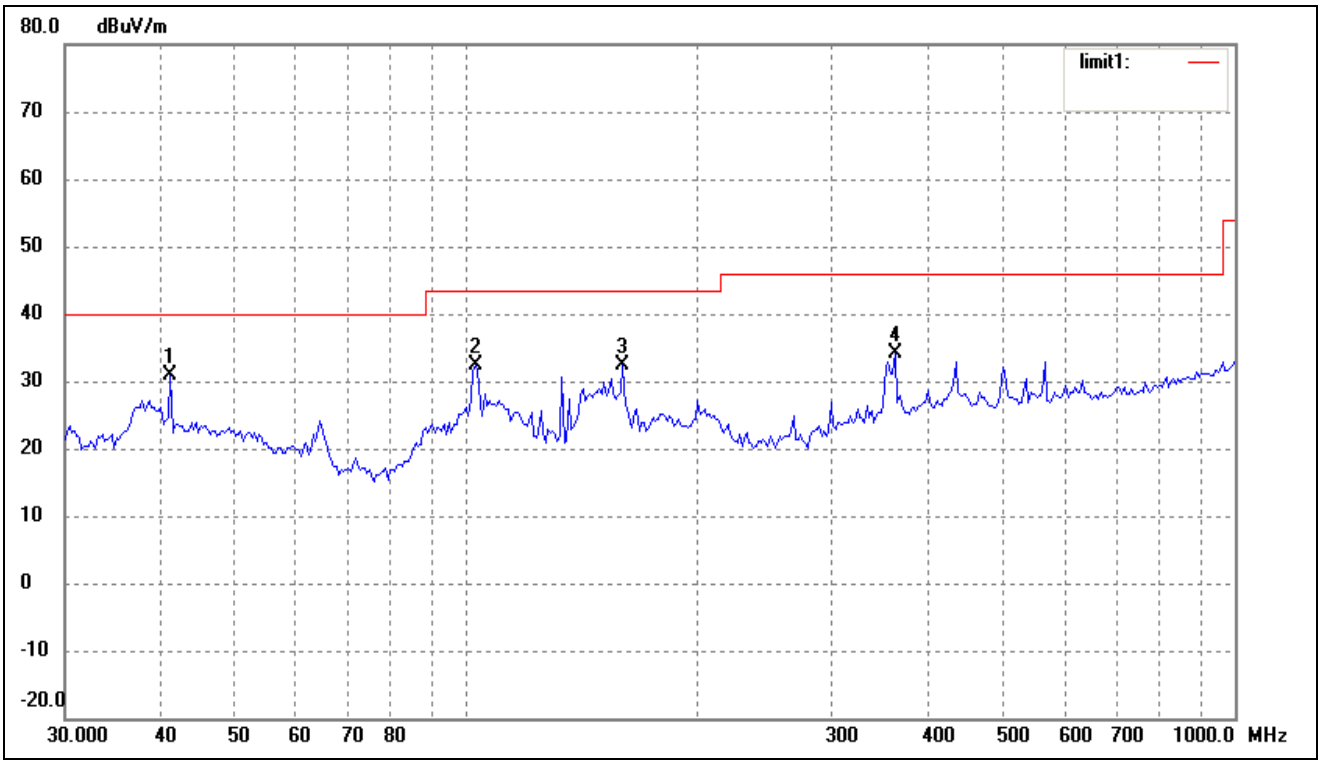
*Test mode: Transmitting (802.11n HT40, 5.8G)*

*Horizontal:*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 133.0809 | 28.13 | 3.66 | 31.79 | 43.50 | -11.71 | 360 | 100 | peak |
| 2 | 186.4684 | 25.96 | 5.35 | 31.31 | 43.50 | -12.19 | 360 | 100 | peak |
| 3 | 266.8395 | 22.44 | 8.11 | 30.55 | 46.00 | -15.45 | 360 | 100 | peak |

*Vertical:*




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 41.1581 | 23.03 | 7.94 | 30.97 | 40.00 | -9.03 | 360 | 100 | peak |
| 2 | 102.6117 | 24.88 | 7.58 | 32.46 | 43.50 | -11.04 | 360 | 100 | peak |
| 3 | 159.7586 | 28.64 | 3.73 | 32.37 | 43.50 | -11.13 | 360 | 100 | peak |
| 4 | 360.9775 | 24.55 | 9.66 | 34.21 | 46.00 | -11.79 | 360 | 100 | peak |

*Spurious Emission above 1GHz*

*Test Mode: Transmitting (802.11b)*

| Frequency MHz | Detector | Meter Reading dBuV | Direction Degree | Polar H / V | Antenna Loss dB | Cable loss dB | Amplifier dB | Correction Amplitude dBuV/m | Limit dBuV/m | Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1G to 25GHz) | | | | | | | | | | |
| 4824.0 | PK | 55.0 | 90 | V | 34.1 | 5.2 | 33.0 | 61.3 | 74 | -12.7 |
| 7236.0 | PK | 48.5 | 270 | V | 37.4 | 6.1 | 33.5 | 58.5 | 74 | -15.5 |
| 7236.0 | PK | 44.5 | 180 | H | 37.4 | 6.1 | 33.5 | 54.5 | 74 | -19.5 |
| 4824.0 | PK | 51.9 | 45 | H | 34.1 | 5.2 | 33.0 | 58.2 | 74 | -15.8 |
| 4824.0 | AV | 43.2 | 270 | V | 34.1 | 5.2 | 33.0 | 49.5 | 54 | -4.5 |
| 7236.0 | AV | 37.7 | 90 | V | 37.4 | 6.1 | 33.5 | 47.7 | 54 | -6.3 |
| 7236.0 | AV | 36.3 | 45 | H | 37.4 | 6.1 | 33.5 | 46.3 | 54 | -7.7 |
| 4824.0 | AV | 40.1 | 60 | H | 34.1 | 5.2 | 33.0 | 46.4 | 54 | -7.6 |
| Middle Channel (1G to 25GHz) | | | | | | | | | | |
| 7311.0 | PK | 51.5 | 45 | V | 37.4 | 6.1 | 33.5 | 61.5 | 74 | -12.5 |
| 4874.0 | PK | 56.0 | 270 | V | 34.1 | 5.2 | 33.0 | 62.3 | 74 | -11.7 |
| 7311.0 | PK | 49.6 | 45 | H | 37.4 | 6.1 | 33.5 | 59.6 | 74 | -14.4 |
| 4874.0 | PK | 52.0 | 180 | H | 34.1 | 5.2 | 33.0 | 58.3 | 74 | -15.7 |
| 7311.0 | AV | 38.4 | 270 | V | 37.4 | 6.1 | 33.5 | 48.4 | 54 | -5.6 |
| 4874.0 | AV | 42.0 | 90 | V | 34.1 | 5.2 | 33.0 | 48.3 | 54 | -5.7 |
| 7311.0 | AV | 35.7 | 60 | H | 37.4 | 6.1 | 33.5 | 45.7 | 54 | -8.3 |
| 4874.0 | AV | 39.5 | 45 | H | 34.1 | 5.2 | 33.0 | 45.8 | 54 | -8.2 |
| High Channel (1G to 25GHz) | | | | | | | | | | |
| 4924.0 | PK | 54.6 | 270 | V | 34.1 | 5.2 | 33.0 | 60.9 | 74 | -13.1 |
| 7386.0 | PK | 49.4 | 45 | V | 37.4 | 6.1 | 33.5 | 59.4 | 74 | -14.6 |
| 4924.0 | PK | 52.1 | 180 | H | 34.1 | 5.2 | 33.0 | 58.4 | 74 | -15.6 |
| 7386.0 | PK | 47.4 | 45 | H | 37.4 | 6.1 | 33.5 | 57.4 | 74 | -16.6 |
| 4924.0 | AV | 41.4 | 90 | V | 34.1 | 5.2 | 33.0 | 47.7 | 54 | -6.3 |
| 7386.0 | AV | 35.8 | 270 | V | 37.4 | 6.1 | 33.5 | 45.8 | 54 | -8.2 |
| 4924.0 | AV | 40.0 | 60 | H | 34.1 | 5.2 | 33.0 | 46.3 | 54 | -7.7 |
| 7386.0 | AV | 34.0 | 60 | H | 37.4 | 6.1 | 33.5 | 44.0 | 54 | -10.0 |

*Note: Testing is carried out with frequency rang 30MHz to the tenth harmonics, which above 5$^{th}$ Harmonics is close to the noise base even antenna close up to 1meter distance according the measurement of ANSI C63.4.*

*Spurious Emission Above 1GHz*

*Test Mode: Transmitting (802.11g)*

| Frequency MHz | Detector | Meter Reading dBuV | Direction Degree | Polar H / V | Antenna Loss dB | Cable loss dB | Amplifier dB | Correction Amplitude dBuV/m | Limit dBuV/m | Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1G to 25GHz) | | | | | | | | | | |
| 4824.0 | PK | 52.0 | 90 | V | 34.1 | 5.2 | 33.0 | 58.3 | 74 | -15.7 |
| 7236.0 | PK | 45.5 | 270 | V | 37.4 | 6.1 | 33.5 | 55.5 | 74 | -18.5 |
| 7236.0 | PK | 45.7 | 180 | H | 37.4 | 6.1 | 33.5 | 55.7 | 74 | -18.3 |
| 4824.0 | PK | 50.8 | 45 | H | 34.1 | 5.2 | 33.0 | 57.1 | 74 | -16.9 |
| 4824.0 | AV | 41.1 | 270 | V | 34.1 | 5.2 | 33.0 | 47.4 | 54 | -6.6 |
| 7236.0 | AV | 36.6 | 90 | V | 37.4 | 6.1 | 33.5 | 46.6 | 54 | -7.4 |
| 7236.0 | AV | 35.5 | 45 | H | 37.4 | 6.1 | 33.5 | 45.5 | 54 | -8.5 |
| 4824.0 | AV | 41.0 | 60 | H | 34.1 | 5.2 | 33.0 | 47.3 | 54 | -6.7 |
| Middle Channel (1G to 25GHz) | | | | | | | | | | |
| 7311.0 | PK | 48.8 | 45 | V | 37.4 | 6.1 | 33.5 | 58.8 | 74 | -15.2 |
| 4874.0 | PK | 49.9 | 270 | V | 34.1 | 5.2 | 33.0 | 56.2 | 74 | -17.8 |
| 7311.0 | PK | 46.0 | 45 | H | 37.4 | 6.1 | 33.5 | 56.0 | 74 | -18.0 |
| 4874.0 | PK | 51.0 | 180 | H | 34.1 | 5.2 | 33.0 | 57.3 | 74 | -16.7 |
| 7311.0 | AV | 37.6 | 270 | V | 37.4 | 6.1 | 33.5 | 47.6 | 54 | -6.4 |
| 4874.0 | AV | 42.2 | 90 | V | 34.1 | 5.2 | 33.0 | 48.5 | 54 | -5.5 |
| 7311.0 | AV | 36.4 | 60 | H | 37.4 | 6.1 | 33.5 | 46.4 | 54 | -7.6 |
| 4874.0 | AV | 41.3 | 45 | H | 34.1 | 5.2 | 33.0 | 47.6 | 54 | -6.4 |
| High Channel (1G to 25GHz) | | | | | | | | | | |
| 4924.0 | PK | 53.3 | 270 | V | 34.1 | 5.2 | 33.0 | 59.6 | 74 | -14.4 |
| 7386.0 | PK | 44.1 | 45 | V | 37.4 | 6.1 | 33.5 | 54.1 | 74 | -19.9 |
| 4924.0 | PK | 50.4 | 180 | H | 34.1 | 5.2 | 33.0 | 56.7 | 74 | -17.3 |
| 7386.0 | PK | 43.3 | 45 | H | 37.4 | 6.1 | 33.5 | 53.3 | 74 | -20.7 |
| 4924.0 | AV | 42.0 | 90 | V | 34.1 | 5.2 | 33.0 | 48.3 | 54 | -5.7 |
| 7386.0 | AV | 36.2 | 270 | V | 37.4 | 6.1 | 33.5 | 46.2 | 54 | -7.8 |
| 4924.0 | AV | 40.1 | 60 | H | 34.1 | 5.2 | 33.0 | 46.4 | 54 | -7.6 |
| 7386.0 | AV | 35.3 | 60 | H | 37.4 | 6.1 | 33.5 | 45.3 | 54 | -8.7 |

*Spurious Emission Above 1GHz*

*Test Mode: Transmitting (802.11n HT20)*

| Frequency MHz | Detector | Meter Reading dBuV | Direction Degree | Polar H / V | Antenna Loss dB | Cable loss dB | Amplifier dB | Correction Amplitude dBuV/m | Limit dBuV/m | Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1G to 25GHz) | | | | | | | | | | |
| 4824.0 | PK | 54.0 | 90 | V | 34.1 | 5.2 | 33.0 | 60.3 | 74 | -13.7 |
| 7236.0 | PK | 48.6 | 270 | V | 37.4 | 6.1 | 33.5 | 58.6 | 74 | -15.4 |
| 7236.0 | PK | 49.4 | 180 | H | 37.4 | 6.1 | 33.5 | 59.4 | 74 | -14.6 |
| 4824.0 | PK | 52.9 | 45 | H | 34.1 | 5.2 | 33.0 | 59.2 | 74 | -14.8 |
| 4824.0 | AV | 43.1 | 270 | V | 34.1 | 5.2 | 33.0 | 49.4 | 54 | -4.6 |
| 7236.0 | AV | 37.6 | 90 | V | 37.4 | 6.1 | 33.5 | 47.6 | 54 | -6.4 |
| 7236.0 | AV | 36.2 | 45 | H | 37.4 | 6.1 | 33.5 | 46.2 | 54 | -7.8 |
| 4824.0 | AV | 41.2 | 60 | H | 34.1 | 5.2 | 33.0 | 47.5 | 54 | -6.5 |
| Middle Channel (1G to 25GHz) | | | | | | | | | | |
| 7311.0 | PK | 50.4 | 45 | V | 37.4 | 6.1 | 33.5 | 60.4 | 74 | -13.6 |
| 4874.0 | PK | 54.9 | 270 | V | 34.1 | 5.2 | 33.0 | 61.2 | 74 | -12.8 |
| 7311.0 | PK | 49.4 | 45 | H | 37.4 | 6.1 | 33.5 | 59.4 | 74 | -14.6 |
| 4874.0 | PK | 52.3 | 180 | H | 34.1 | 5.2 | 33.0 | 58.6 | 74 | -15.4 |
| 7311.0 | AV | 38.5 | 270 | V | 37.4 | 6.1 | 33.5 | 48.5 | 54 | -5.5 |
| 4874.0 | AV | 41.0 | 90 | V | 34.1 | 5.2 | 33.0 | 47.3 | 54 | -6.7 |
| 7311.0 | AV | 36.4 | 60 | H | 37.4 | 6.1 | 33.5 | 46.4 | 54 | -7.6 |
| 4874.0 | AV | 40.4 | 45 | H | 34.1 | 5.2 | 33.0 | 46.7 | 54 | -7.3 |
| High Channel (1G to 25GHz) | | | | | | | | | | |
| 4924.0 | PK | 54.9 | 270 | V | 34.1 | 5.2 | 33.0 | 61.2 | 74 | -12.8 |
| 7386.0 | PK | 49.0 | 45 | V | 37.4 | 6.1 | 33.5 | 59.0 | 74 | -15.0 |
| 4924.0 | PK | 54.0 | 180 | H | 34.1 | 5.2 | 33.0 | 60.3 | 74 | -13.7 |
| 7386.0 | PK | 49.2 | 45 | H | 37.4 | 6.1 | 33.5 | 59.2 | 74 | -14.8 |
| 4924.0 | AV | 42.2 | 90 | V | 34.1 | 5.2 | 33.0 | 48.5 | 54 | -5.5 |
| 7386.0 | AV | 36.4 | 270 | V | 37.4 | 6.1 | 33.5 | 46.4 | 54 | -7.6 |
| 4924.0 | AV | 40.3 | 60 | H | 34.1 | 5.2 | 33.0 | 46.6 | 54 | -7.4 |
| 7386.0 | AV | 37.3 | 60 | H | 37.4 | 6.1 | 33.5 | 47.3 | 54 | -6.7 |

*Spurious Emission Above 1GHz*

*Test Mode: Transmitting (802.11n HT40)*

| Frequency MHz | Detector | Meter Reading dBuV | Direction Degree | Polar H / V | Antenna Loss dB | Cable loss dB | Amplifier dB | Correction Amplitude dBuV/m | Limit dBuV/m | Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (1G to 25GHz) | | | | | | | | | | |
| 4824.0 | PK | 52.0 | 90 | V | 34.1 | 5.2 | 33.0 | 58.3 | 74 | -15.7 |
| 7236.0 | PK | 47.4 | 270 | V | 37.4 | 6.1 | 33.5 | 57.4 | 74 | -16.6 |
| 7236.0 | PK | 49.3 | 180 | H | 37.4 | 6.1 | 33.5 | 59.3 | 74 | -14.7 |
| 4824.0 | PK | 52.9 | 45 | H | 34.1 | 5.2 | 33.0 | 59.2 | 74 | -14.8 |
| 4824.0 | AV | 43.1 | 270 | V | 34.1 | 5.2 | 33.0 | 49.4 | 54 | -4.6 |
| 7236.0 | AV | 36.5 | 90 | V | 37.4 | 6.1 | 33.5 | 46.5 | 54 | -7.5 |
| 7236.0 | AV | 36.2 | 45 | H | 37.4 | 6.1 | 33.5 | 46.2 | 54 | -7.8 |
| 4824.0 | AV | 38.5 | 60 | H | 34.1 | 5.2 | 33.0 | 44.8 | 54 | -9.2 |
| Middle Channel (1G to 25GHz) | | | | | | | | | | |
| 7311.0 | PK | 49.7 | 45 | V | 37.4 | 6.1 | 33.5 | 59.7 | 74 | -14.3 |
| 4874.0 | PK | 54.0 | 270 | V | 34.1 | 5.2 | 33.0 | 60.3 | 74 | -13.7 |
| 7311.0 | PK | 44.9 | 45 | H | 37.4 | 6.1 | 33.5 | 54.9 | 74 | -19.1 |
| 4874.0 | PK | 50.4 | 180 | H | 34.1 | 5.2 | 33.0 | 56.7 | 74 | -17.3 |
| 7311.0 | AV | 34.5 | 270 | V | 37.4 | 6.1 | 33.5 | 44.5 | 54 | -9.5 |
| 4874.0 | AV | 38.4 | 90 | V | 34.1 | 5.2 | 33.0 | 44.7 | 54 | -9.3 |
| 7311.0 | AV | 32.6 | 60 | H | 37.4 | 6.1 | 33.5 | 42.6 | 54 | -11.4 |
| 4874.0 | AV | 36.4 | 45 | H | 34.1 | 5.2 | 33.0 | 42.7 | 54 | -11.3 |
| High Channel (1G to 25GHz) | | | | | | | | | | |
| 4924.0 | PK | 53.8 | 270 | V | 34.1 | 5.2 | 33.0 | 60.1 | 74 | -13.9 |
| 7386.0 | PK | 49.0 | 45 | V | 37.4 | 6.1 | 33.5 | 59.0 | 74 | -15.0 |
| 4924.0 | PK | 50.1 | 180 | H | 34.1 | 5.2 | 33.0 | 56.4 | 74 | -17.6 |
| 7386.0 | PK | 45.6 | 45 | H | 37.4 | 6.1 | 33.5 | 55.6 | 74 | -18.4 |
| 4924.0 | AV | 40.1 | 90 | V | 34.1 | 5.2 | 33.0 | 46.4 | 54 | -7.6 |
| 7386.0 | AV | 35.7 | 270 | V | 37.4 | 6.1 | 33.5 | 45.7 | 54 | -8.3 |
| 4924.0 | AV | 37.5 | 60 | H | 34.1 | 5.2 | 33.0 | 43.8 | 54 | -10.2 |
| 7386.0 | AV | 33.2 | 60 | H | 37.4 | 6.1 | 33.5 | 43.2 | 54 | -10.8 |

*Spurious Emission Above 1GHz*

*Test Mode: Transmitting (802.11a 5.8G)*

| Frequency MHz | Detector | Meter Reading dBuV | Direction Degree | Polar H / V | Antenna Loss dB | Cable loss dB | Amplifier dB | Correction Amplitude dBuV/m | Limit dBuV/m | Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (5745MHz) | | | | | | | | | | |
| 11490 | PK | 53.7 | 360 | V | 39.1 | 10.2 | 40.5 | 62.5 | 74 | -11.5 |
| 11490 | PK | 52.0 | 360 | H | 39.1 | 10.2 | 40.5 | 60.8 | 74 | -13.2 |
| 11490 | AV | 37.5 | 360 | V | 39.1 | 10.2 | 40.5 | 46.3 | 54 | -7.7 |
| 11490 | AV | 36.4 | 360 | H | 39.1 | 10.2 | 40.5 | 45.2 | 54 | -8.8 |
| Middle Channel (5785MHz) | | | | | | | | | | |
| 11570 | PK | 54.0 | 360 | V | 39.1 | 10.2 | 40.5 | 62.8 | 74 | -11.2 |
| 11570 | PK | 52.4 | 360 | H | 39.1 | 10.2 | 40.5 | 61.2 | 74 | -12.8 |
| 11570 | AV | 37.2 | 360 | V | 39.1 | 10.2 | 40.5 | 46.0 | 54 | -8.0 |
| 11570 | AV | 36.3 | 360 | H | 39.1 | 10.2 | 40.5 | 45.1 | 54 | -8.9 |
| High Channel (5825MHz) | | | | | | | | | | |
| 11650 | PK | 54.3 | 360 | V | 39.1 | 10.2 | 40.5 | 63.1 | 74 | -10.9 |
| 11650 | PK | 51.5 | 360 | H | 39.1 | 10.2 | 40.5 | 60.3 | 74 | -13.7 |
| 11650 | AV | 36.9 | 360 | V | 39.1 | 10.2 | 40.5 | 45.7 | 54 | -8.3 |
| 11650 | AV | 35.5 | 360 | H | 39.1 | 10.2 | 40.5 | 44.3 | 54 | -9.7 |

*Test Mode: Transmitting (802.11n HT20 5.8G)*

| Frequency MHz | Detector | Meter Reading dBuV | Direction Degree | Polar H / V | Antenna Loss dB | Cable loss dB | Amplifier dB | Correction Amplitude dBuV/m | Limit dBuV/m | Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (5745MHz) | | | | | | | | | | |
| 11490 | PK | 53.7 | 360 | V | 39.1 | 10.2 | 40.5 | 62.5 | 74 | -11.5 |
| 11490 | PK | 52.7 | 360 | H | 39.1 | 10.2 | 40.5 | 61.5 | 74 | -12.5 |
| 11490 | AV | 36.5 | 360 | V | 39.1 | 10.2 | 40.5 | 45.3 | 54 | -8.7 |
| 11490 | AV | 36.1 | 360 | H | 39.1 | 10.2 | 40.5 | 44.9 | 54 | -9.1 |
| Middle Channel (5785MHz) | | | | | | | | | | |
| 11570 | PK | 54.2 | 360 | V | 39.1 | 10.2 | 40.5 | 63.0 | 74 | -11.0 |
| 11570 | PK | 53.6 | 360 | H | 39.1 | 10.2 | 40.5 | 62.4 | 74 | -11.6 |
| 11570 | AV | 36.7 | 360 | V | 39.1 | 10.2 | 40.5 | 45.5 | 54 | -8.5 |
| 11570 | AV | 35.4 | 360 | H | 39.1 | 10.2 | 40.5 | 44.2 | 54 | -9.8 |
| High Channel (5825MHz) | | | | | | | | | | |
| 11650 | PK | 53.6 | 360 | V | 39.1 | 10.2 | 40.5 | 62.4 | 74 | -11.6 |
| 11650 | PK | 54.1 | 360 | H | 39.1 | 10.2 | 40.5 | 62.9 | 74 | -11.1 |
| 11650 | AV | 37.5 | 360 | V | 39.1 | 10.2 | 40.5 | 46.3 | 54 | -7.7 |
| 11650 | AV | 36.6 | 360 | H | 39.1 | 10.2 | 40.5 | 45.4 | 54 | -8.6 |

*Test Mode: Transmitting (802.11n HT40 5.8G)*

| Frequency MHz | Detector | Meter Reading dBuV | Direction Degree | Polar H / V | Antenna Loss dB | Cable loss dB | Amplifier dB | Correction Amplitude dBuV/m | Limit dBuV/m | Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (5755MHz) | | | | | | | | | | |
| 11510 | PK | 51.5 | 360 | V | 39.1 | 10.2 | 40.5 | 60.3 | 74 | -13.7 |
| 11510 | PK | 50.6 | 360 | H | 39.1 | 10.2 | 40.5 | 59.4 | 74 | -14.6 |
| 11510 | AV | 35.0 | 360 | V | 39.1 | 10.2 | 40.5 | 43.8 | 54 | -10.2 |
| 11510 | AV | 34.4 | 360 | H | 39.1 | 10.2 | 40.5 | 43.2 | 54 | -10.8 |
| Middle Channel (5775MHz) | | | | | | | | | | |
| 11550 | PK | 52.5 | 360 | V | 39.1 | 10.2 | 40.5 | 61.3 | 74 | -12.7 |
| 11550 | PK | 51.0 | 360 | V | 39.1 | 10.2 | 40.5 | 59.8 | 74 | -14.2 |
| 11550 | AV | 35.5 | 360 | H | 39.1 | 10.2 | 40.5 | 44.3 | 54 | -9.7 |
| 11550 | AV | 34.9 | 360 | H | 39.1 | 10.2 | 40.5 | 43.7 | 54 | -10.3 |
| High Channel (5795MHz) | | | | | | | | | | |
| 11590 | PK | 52.1 | 360 | V | 39.1 | 10.2 | 40.5 | 60.9 | 74 | -13.1 |
| 11590 | PK | 51.7 | 360 | V | 39.1 | 10.2 | 40.5 | 60.5 | 74 | -13.5 |
| 11590 | AV | 35.5 | 360 | H | 39.1 | 10.2 | 40.5 | 44.3 | 54 | -9.7 |
| 11590 | AV | 35.0 | 360 | H | 39.1 | 10.2 | 40.5 | 43.8 | 54 | -10.2 |

*Note: Testing is carried out with frequency rang 30MHz to the tenth harmonics, which above 5$^{th}$ Harmonics is close to the noise base even antenna close up to 1meter distance according the measurement of ANSI C63.4.*

# 9. BANDEDGE EMISSIONS

## 9.1 Standard Applicable

According to §15.247 (d) 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, provided the transmitter demonstrates compliance with the peak conducted power limits.

## 9.2 Test Equipment List and Details

| Description | Manufacturer | Model | Serial Number | Cal. Date | Due. Date |
|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSP | 836079/035 | 2010-04-16 | 2011-04-15 |
| EMI Test Receiver | R&S | ESVB | 825471/005 | 2010-08-12 | 2011-08-11 |
| Positioning Controller | C&C | CC-C-1F | N/A | 2010-08-12 | 2011-08-11 |
| RF Switch | EM | EMSW18 | SW060023 | 2010-08-12 | 2011-08-11 |
| Pre-amplifier | Agilent | 8447F | 3113A06717 | 2010-08-12 | 2011-08-11 |
| Pre-amplifier | Compliance Direction | PAP-0118 | 24002 | 2010-08-12 | 2011-08-11 |
| Trilog Broadband Antenna | SCHWARZBECK | VULB9163 | 9163-333 | 2010-07-21 | 2011-07-20 |
| Horn Antenna | ETS | 3117 | 00086197 | 2010-07-21 | 2011-07-20 |

## 9.3 Test Procedure

1. 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, VBW=100KHz, Span=50MHz, Sweep = auto
3. Set the Lowest and Highest Transmitting Channel, observed the outside band of 2400MHz to 2438.5MHz, then mark the higher-level emission for comparing with the FCC rules.

## 9.4 Test Receiver Setup

During the radiated emission test for above 1GHz, the test receiver was set with the following configurations:

For peak detector:
RBW = 1000kHz, VBW = 3000kHz, Sweep Time = Auto

For average detector:
RBW = 1000kHz, VBW = 10Hz, Sweep Time = Auto

## 9.5 Environmental Conditions

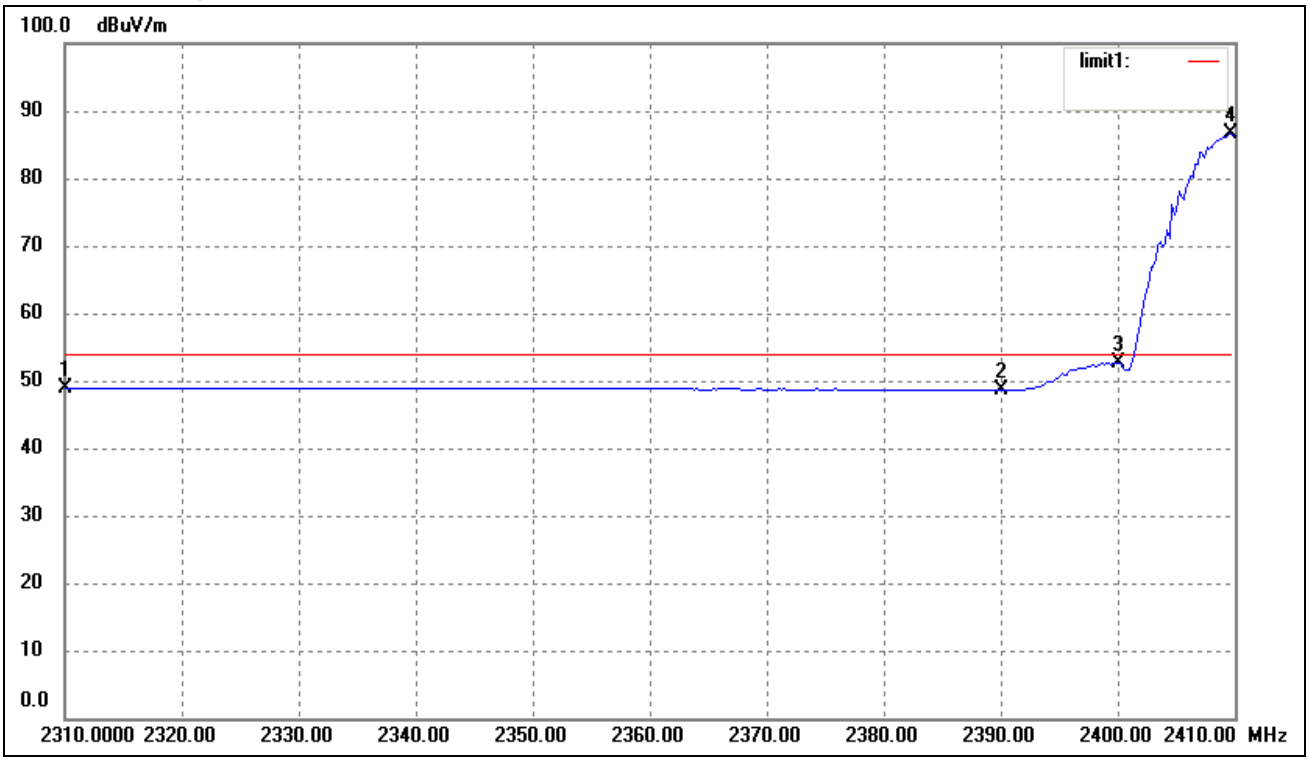
| | |
|---|---|
| Temperature: | 21° C |
| Relative Humidity: | 54% |
| ATM Pressure: | 1011 mbar |

## 9.6 Summary of Test Results/Plots

| Test mode | Frequency MHz | Limit dBuV /dB | Result |
|---|---|---|---|
| 802.11b | 2310~2390.00 | <54dBuv | Pass |
| | 2400.00 | >20dB ATT | Pass |
| | 2483.50~2500 | <54dBuv | Pass |
| 802.11g | 2310~2390.00 | <54dBuv | Pass |
| | 2400.00 | >20dB ATT | Pass |
| | 2483.50~2500 | <54dBuv | Pass |
| 802.11n HT20 | 2310~2390.00 | <54dBuv | Pass |
| | 2400.00 | >20dB ATT | Pass |
| | 2483.50~2500 | <54dBuv | Pass |
| 802.11n HT40 | 2310~2390.00 | <54dBuv | Pass |
| | 2400.00 | >20dB ATT | Pass |
| | 2483.50~2500 | <54dBuv | Pass |
| 802.11a | 5350~5460 | <54dBuv | Pass |
| | 5725 | >20dB ATT | Pass |
| | 5850 | >20dB ATT | Pass |
| 802.11n HT20 | 5350~5460 | <54dBuv | Pass |
| | 5725 | >20dB ATT | Pass |
| | 5850 | >20dB ATT | Pass |
| 802.11n HT40 | 5350~5460 | <54dBuv | Pass |
| | 5725 | >20dB ATT | Pass |
| | 5850 | >20dB ATT | Pass |

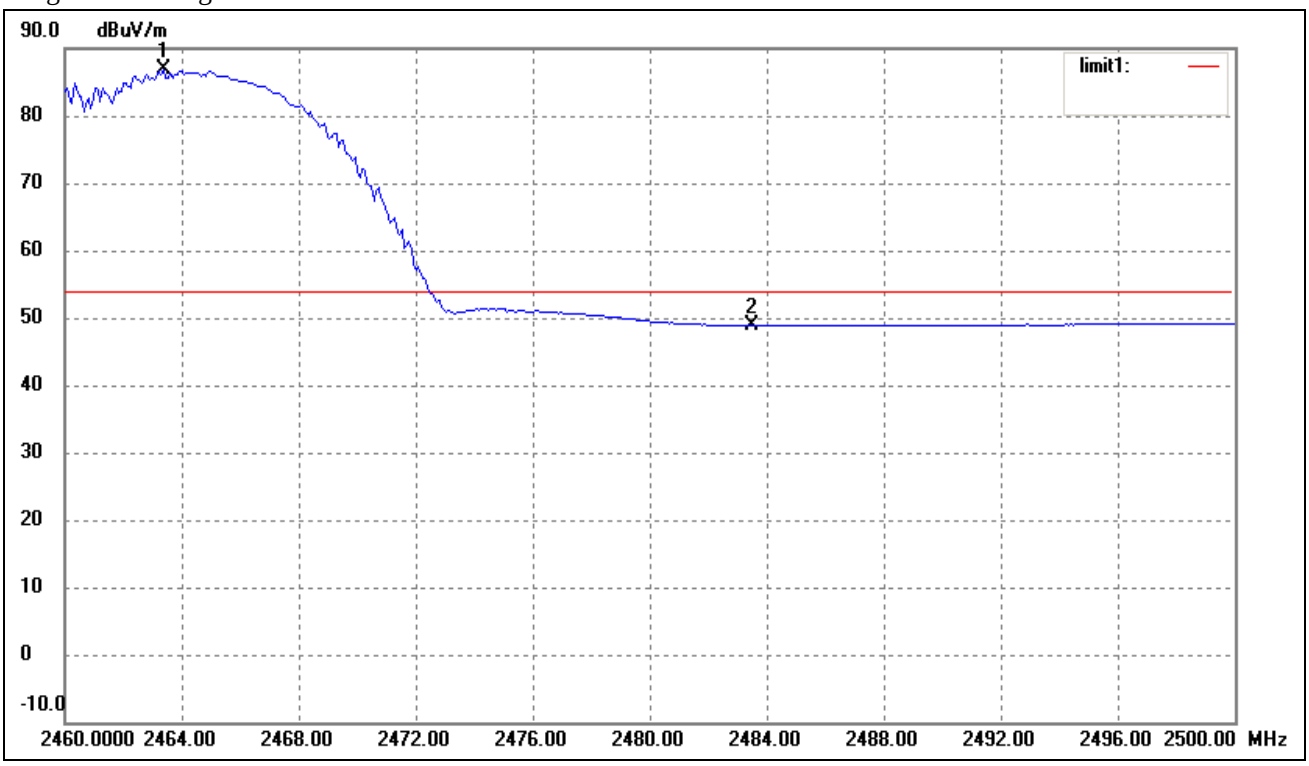
## For 802.11b

Lowest Bandedge




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 2310.000 | 12.38 | 36.49 | 48.87 | 54.00 | -5.13 | 360 | 100 | Ave |
| | 2310.000 | 24.84 | 36.49 | 61.33 | 74.00 | -12.67 | 360 | 100 | Peak |
| 2 | 2390.000 | 11.99 | 36.67 | 48.66 | 54.00 | -5.34 | 360 | 100 | Ave |
| | 2390.000 | 24.11 | 36.67 | 60.78 | 74.00 | -13.22 | 360 | 100 | Peak |
| 3 | 2400.000 | 16.00 | 36.69 | 52.69 | / | / | 360 | 100 | Ave |
| 4 | 2409.600 | 49.86 | 36.72 | 86.58 | / | / | 360 | 100 | Ave |

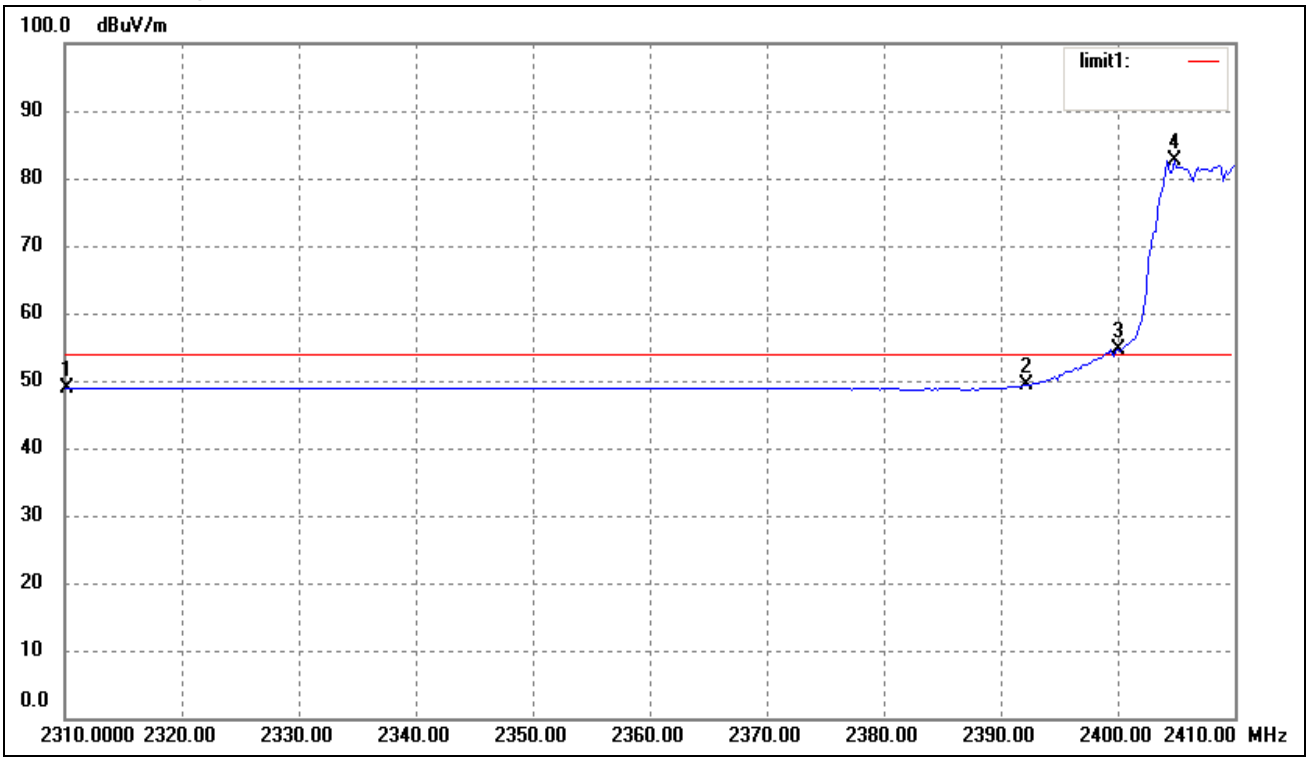
Highest Bandedge




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 2463.360 | 50.13 | 36.84 | 86.97 | / | / | 360 | 100 | Ave |
| 2 | 2483.500 | 12.02 | 36.88 | 48.90 | 54.00 | -5.10 | 360 | 100 | Ave |
| | 2483.500 | 21.68 | 36.88 | 58.56 | 74.00 | -15.44 | 360 | 100 | peak |

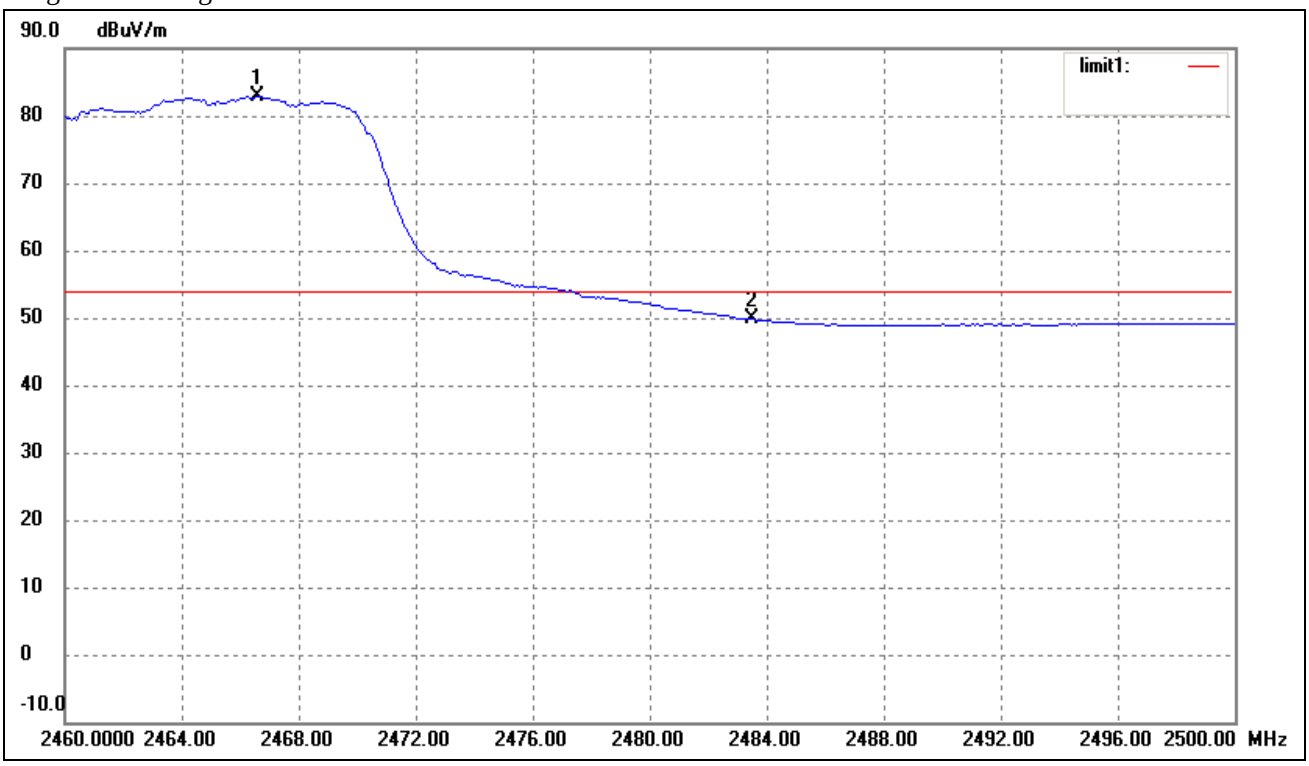
## For 802.11g

Lowest Bandedge




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 2310.200 | 12.43 | 36.49 | 48.92 | 54.00 | -5.08 | 360 | 100 | Ave |
| | 2310.200 | 23.39 | 36.49 | 59.88 | 74.00 | -14.12 | 360 | 100 | Peak |
| 2 | 2392.200 | 12.68 | 36.68 | 49.36 | 54.00 | -4.64 | 360 | 100 | Ave |
| | 2392.200 | 22.69 | 36.68 | 59.37 | 74.00 | -14.63 | 360 | 100 | Peak |
| 3 | 2400.000 | 17.85 | 36.69 | 54.54 | / | / | 360 | 100 | Ave |
| 4 | 2404.800 | 45.88 | 36.71 | 82.59 | / | / | 360 | 100 | Ave |

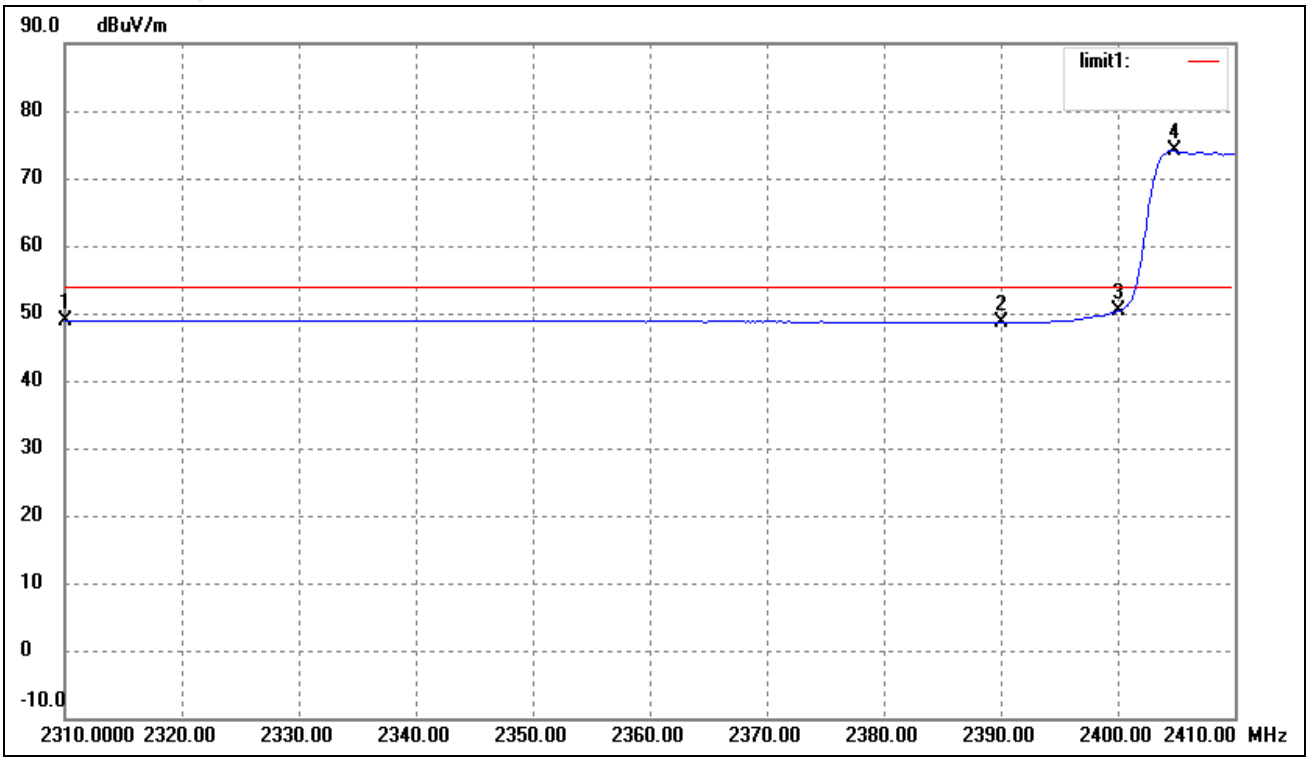
Highest Bandedge




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 2466.560 | 45.94 | 36.85 | 82.79 | / | / | 360 | 100 | Ave |
| 2 | 2483.500 | 12.96 | 36.88 | 49.84 | 54.00 | -4.16 | 360 | 100 | Ave |
| | 2483.500 | 24.65 | 36.88 | 61.53 | 74.00 | -12.47 | 360 | 100 | Peak |

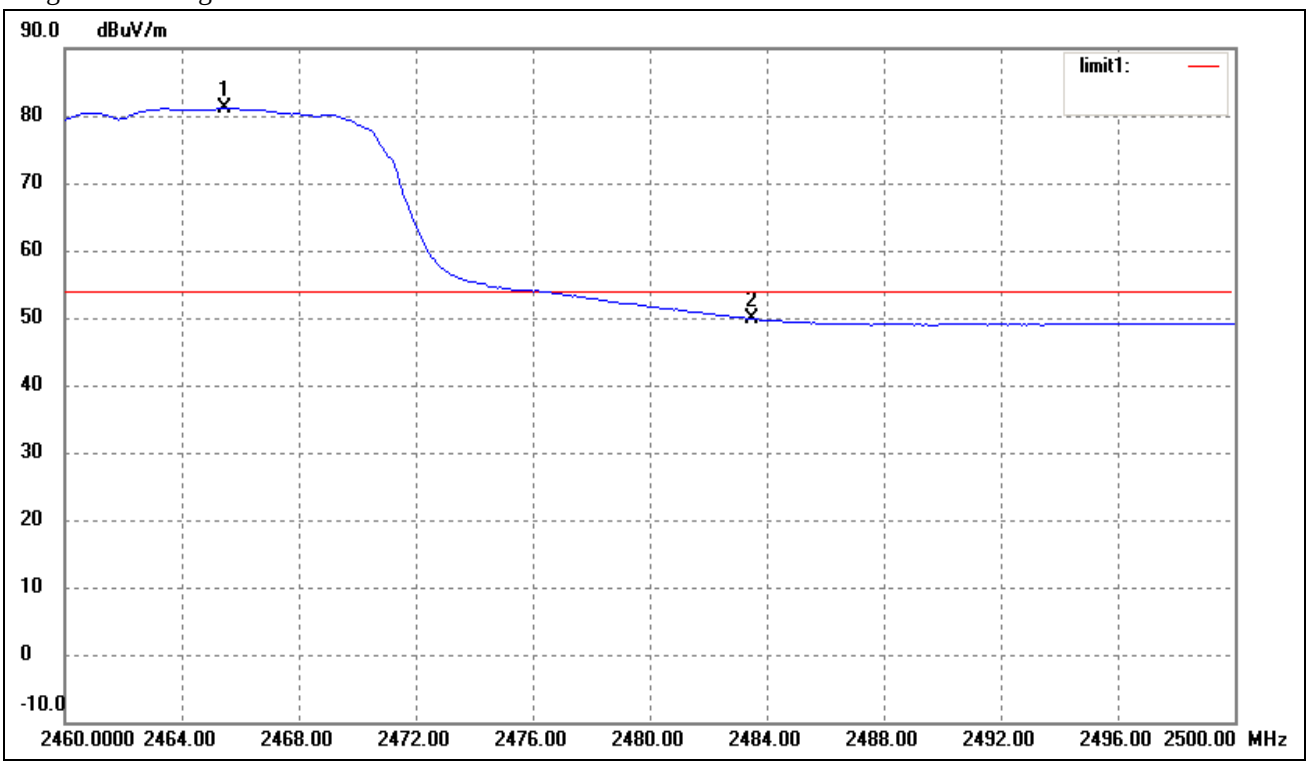
## For 802.11n HT20

Lowest Bandedge




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 2310.000 | 12.40 | 36.49 | 48.89 | 54.00 | -5.11 | 360 | 100 | Ave |
| | 2310.000 | 25.84 | 36.49 | 62.33 | 74.00 | -11.67 | 360 | 100 | Peak |
| 2 | 2390.000 | 12.00 | 36.67 | 48.67 | 54.00 | -5.33 | 360 | 100 | Ave |
| | 2390.000 | 23.45 | 36.67 | 60.12 | 74.00 | -13.88 | 360 | 100 | Peak |
| 3 | 2400.000 | 13.69 | 36.69 | 50.38 | / | / | 360 | 100 | Ave |
| 4 | 2404.800 | 37.38 | 36.71 | 74.09 | / | / | 360 | 100 | Ave |

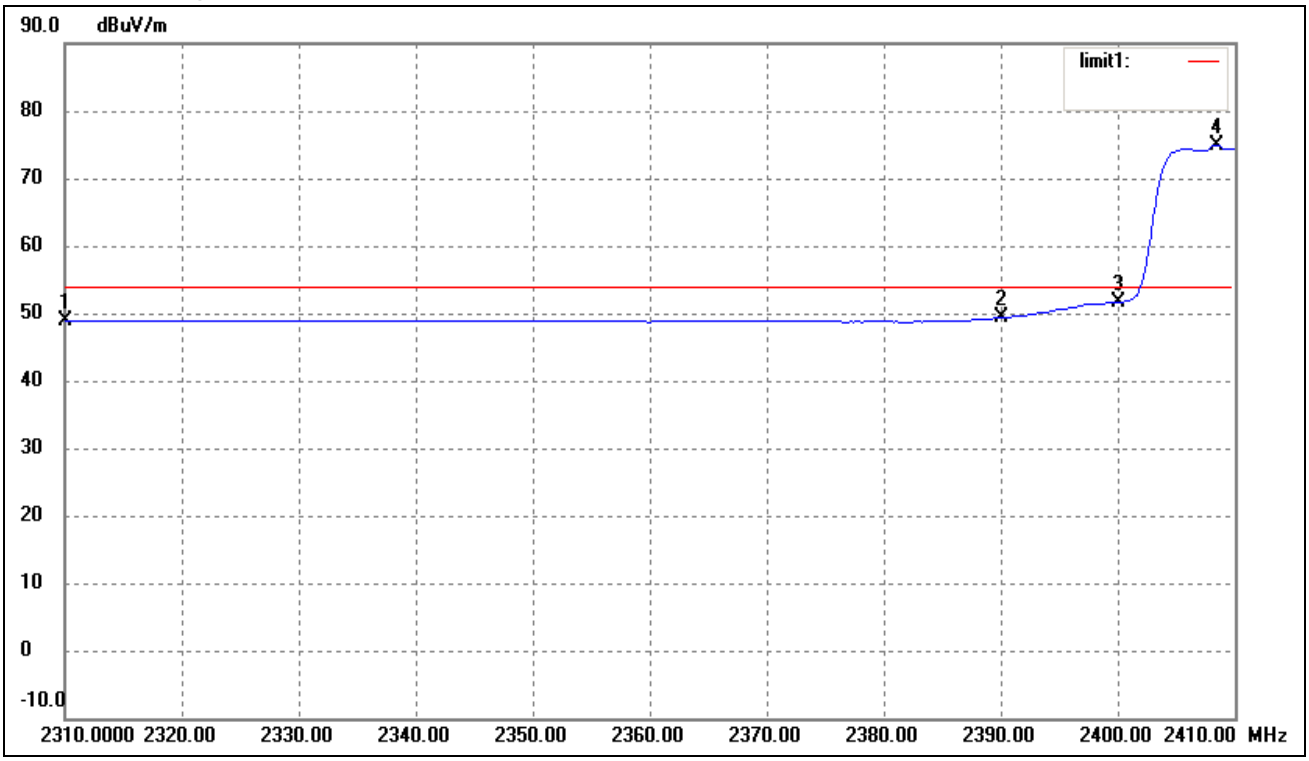
Highest Bandedge




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 2465.440 | 44.25 | 36.84 | 81.09 | / | / | 360 | 100 | Ave |
| 2 | 2483.500 | 12.96 | 36.88 | 49.84 | 54.00 | -4.16 | 360 | 100 | Ave |
| | 2483.500 | 23.35 | 36.88 | 60.23 | 74.00 | -13.77 | 360 | 100 | Peak |

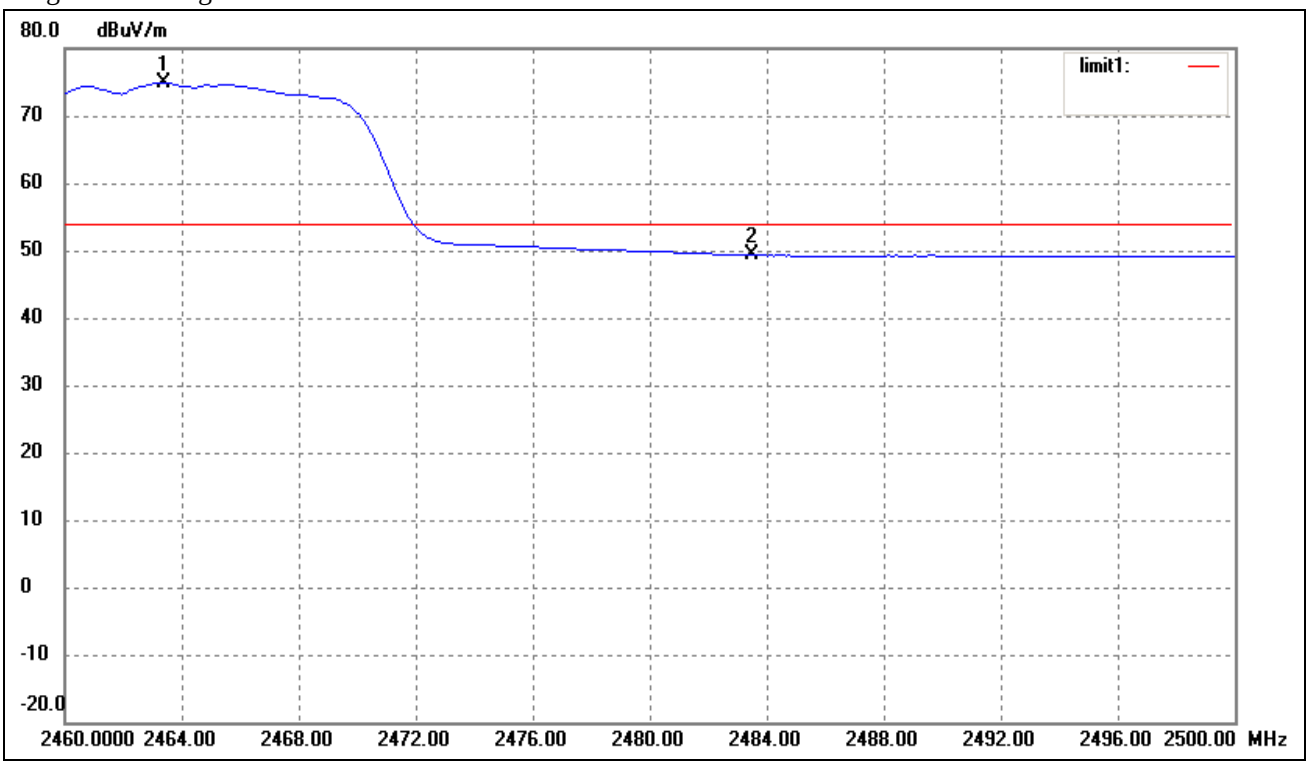
## For 802.11n HT40

Lowest Bandedge




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 2310.000 | 12.37 | 36.49 | 48.86 | 54.00 | -5.14 | 360 | 100 | Ave |
| | 2310.000 | 22.95 | 36.49 | 59.44 | 74.00 | -14.56 | 360 | 100 | peak |
| 2 | 2390.000 | 12.67 | 36.67 | 49.34 | 54.00 | -4.66 | 360 | 100 | Ave |
| | 2390.000 | 23.00 | 36.67 | 59.67 | 74.00 | -14.33 | 360 | 100 | peak |
| 3 | 2400.000 | 14.95 | 36.69 | 51.64 | / | / | 360 | 100 | Ave |
| 4 | 2408.400 | 38.25 | 36.71 | 74.96 | / | / | 360 | 100 | Ave |

Highest Bandedge




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (° ) | (cm) | |
| 1 | 2463.360 | 38.12 | 36.84 | 74.96 | / | / | 360 | 100 | Ave |
| 2 | 2483.500 | 12.46 | 36.88 | 49.34 | 54.00 | -4.66 | 360 | 100 | Ave |
| | 2483.500 | 24.34 | 36.88 | 61.22 | 74.00 | -12.78 | 360 | 100 | Peak |

******* END OF REPORT *******