**MET Laboratories, Inc.** *Safety Certification - EMI - Telecom Environmental Simulation*
914 WEST PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230-3432 ● PHONE (410) 354-3300 ● FAX (410) 354-3313
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408 748-3585 ● FAX (510) 489-6372

February 10, 2012

Firetide, Inc.
140 Knowles Drive
Los Gatos, CA 95032

Dear Suresh Kumar,

Enclosed is the EMC Wireless test report for compliance testing of the Firetide, Inc., FT 5900 Wireless Mesh Node as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Title 47 of the CFR, Part 15, Subpart B and ICES-003, Issue 4 February 2004for Unintentional Radiators and Part 15.407 and Industry Canada RSS-210, Annex 9, Issue 8, December 2010 for Intentional Radiators.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\Firetide, Inc.\EMCS33266A-FCC407 Rev. 1)

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# Electromagnetic Compatibility Criteria Test Report

for the

**Firetide, Inc.**
**Model FT 5900 Wireless Mesh Node**

**Tested under**
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class A Digital Devices
&
FCC Part 15.407 & RSS-210, Annex 9
for Intentional Radiators

**MET Report: EMCS33266A-FCC407 Rev. 1**

February 10, 2012

**Prepared For:**

**Firetide, Inc.**
**140 Knowles Drive**
**Los Gatos, CA 95032**

**Prepared By:**
**MET Laboratories, Inc.**
3162 Belick St.
Santa Clara, CA 95054

# Electromagnetic Compatibility Criteria
# Test Report

for the

## Firetide, Inc.
## Model FT 5900 Wireless Mesh Node

**Tested under**
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class A Digital Devices
&
FCC Part 15.407 & RSS-210, Annex 9
for Intentional Radiators

Anderson Soungpanya, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

**Engineering Statement:** The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Parts 15B, 15.407, of the FCC Rules and 407 and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210 Annex 9 under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

  

# Report Status Sheet

| Revision | Report Date | Reason for Revision |
|---|---|---|
| ∅ | January 8, 2012 | Initial Issue. |
| 1 | February 10, 2012 | Revised to reflect engineer corrections. |

  

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# List of Terms and Abbreviations

| | |
|---|---|
| **AC** | **A**lternating **C**urrent |
| **ACF** | **A**ntenna **C**orrection **F**actor |
| **Cal** | **Cal**ibration |
| ***d*** | **M**easurement **D**istance |
| **dB** | **D**eci**b**els |
| **dBµA** | **D**eci**b**els above one **micro**amp |
| **dBµV** | **D**eci**b**els above one **micro**volt |
| **dBµA/m** | **D**eci**b**els above one **micro**amp **per m**eter |
| **dBµV/m** | **D**eci**b**els above one **micro**volt **per m**eter |
| **DC** | **D**irect **C**urrent |
| **E** | **E**lectric Field |
| **DSL** | **D**igital **S**ubscriber **L**ine |
| **ESD** | **E**lectro**s**tatic **D**ischarge |
| **EUT** | **E**quipment **U**nder **T**est |
| ***f*** | **F**requency |
| **FCC** | **F**ederal **C**ommunications **C**ommission |
| **GRP** | **G**round **R**eference **P**lane |
| **H** | Magnetic Field |
| **HCP** | **H**orizontal **C**oupling **P**lane |
| **Hz** | **H**ert**z** |
| **IEC** | **I**nternational **E**lectrotechnical **C**ommission |
| **kHz** | **k**ilo**h**ert**z** |
| **kPa** | **k**ilo**pa**scal |
| **kV** | **k**ilo**v**olt |
| **LISN** | **L**ine **I**mpedance **S**tabilization **N**etwork |
| **MHz** | **M**ega**h**ertz |
| **µH** | **microh**enry |
| **µ** | **microf**arad |
| **µs** | **micros**econds |
| **PRF** | **P**ulse **R**epetition **F**requency |
| **RF** | **R**adio **F**requency |
| **RMS** | **R**oot-**M**ean-**S**quare |
| **TWT** | **T**raveling **W**ave **T**ube |
| **V/m** | **V**olts **per m**eter |
| **VCP** | **V**ertical **C**oupling **P**lane |

# I. Executive Summary

## A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Firetide, Inc. FT 5900 Wireless Mesh Node, with the requirements of Part 15, §15.407. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the FT 5900 Wireless Mesh Node. Firetide, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the FT 5900 Wireless Mesh Node, has been **permanently** discontinued.

## B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.407, in accordance with Firetide, Inc., purchase order number PO-3077. All tests were conducted using measurement procedure ANSI C63.4-2003.

| FCC Reference | Industry Canada Reference | Description | Results |
|---|---|---|---|
| 15.107 | ICES-003 Issue 4 February 2004 | Conducted Emissions | Compliant |
| 15.109 | ICES-003 Issue 4 February 2004 | Radiated Emissions | Compliant |
| 15.203 | RSS-GEN 7.1.4 | Antenna Requirements | Compliant |
| 15.207 | RSS-GEN 7.2.2; RSS-210 2.2 | AC Conducted Emissions 150KHz – 30MHz | Compliant |
| 15.403 (i) | A8.2 | 26dB Occupied Bandwidth | Compliant |
| 15.407 (a)(2) | A9.2(3) | Conducted Transmitter Output Power | Compliant |
| 15.407 (a)(2) | A9.2(3) | Power Spectral Density | Compliant |
| 15.407 (a)(6) | N/A | Peak Excursion | Compliant |
| 15.407 (b)(2), (3), (5), (6) | A9.3(4) | Undesirable Emissions (15.205/15.209 - General Field Strength Limits (Restricted Bands and Radiated Emission Limits) | Compliant |
| 15.407(f) | RSS-GEN | RF Exposure | Compliant |
| 15.407(g) | 2.1 | Frequency Stability | Compliant |
| N/A | RSS-Gen(4.8) | Receiver Spurious Emissions | Compliant |

**Table 1. Executive Summary of EMC Part 15.407 ComplianceTesting**

# II. Equipment Configuration

# A. Overview

MET Laboratories, Inc. was contracted by Firetide, Inc. to perform testing on the FT 5900 Wireless Mesh Node, under Firetide, Inc.'s purchase order number PO-3077.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Firetide, Inc. FT 5900 Wireless Mesh Node.

The results obtained relate only to the item(s) tested.

| | | |
|---|---|---|
| **Model(s) Tested:** | FT 5900 Wireless Mesh Node | |
| **Model(s) Covered:** | FT 5900 Wireless Mesh Node | |
| **EUT Specifications:** | Primary Power: 120 VAC, 60 Hz | |
| | FCC ID: REP-5900-1<br>IC: 4988A-5900 | |
| | Type of Modulations: | OFDM |
| | Equipment Code: | NII |
| | Peak RF Output Power: | 16.86dBm |
| | EUT Frequency Ranges: | 5745 - 5805MHz |
| **Analysis:** | The results obtained relate only to the item(s) tested. | |
| **Environmental Test Conditions:** | Temperature: 15-35º C | |
| | Relative Humidity: 30-60% | |
| | Barometric Pressure: 860-1060 mbar | |
| **Evaluated by:** | Anderson Soungpanya | |
| **Report Date(s):** | February 10, 2012 | |

**Table 2. EUT Summary**

## B. References

| | |
|---|---|
| **CFR 47, Part 15, Subpart B** | Electromagnetic Compatibility: Criteria for Radio Frequency Devices |
| **CFR 47, Part 15, Subpart E** | Unlicensed National Information Infrastructure Devices (UNII) |
| **ANSI C63.4:2003** | Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz |
| **ANSI/NCSL Z540-1-1994** | Calibration Laboratories and Measuring and Test Equipment - General Requirements |
| **ANSI/ISO/IEC 17025:2000** | General Requirements for the Competence of Testing and Calibration Laboratories |

**Table 3. References**

## C. Test Site

All testing was performed at MET Laboratories, Inc., 3162 Belick St., Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 5 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

## D. Description of Test Sample

The Firetide, Inc. FT 5900 Wireless Mesh Node, Equipment Under Test (EUT), provide reliable Ethernet connectivity over a high performance, self-forming wireless mesh backbone. All nodes have an Ethernet port for connecting network devices or other networks to the wireless mesh. 5900 mesh features a dual radio solution with capability of operating in the 900 MHz spectrum on one radio while concurrently operating in the 2.4 GHz, 4.9 GHz (U.S. public safety licensed band) or 5 GHz frequency ranges on the other.

**Photograph 1. Firetide, Inc. FT 5900 Wireless Mesh Node**

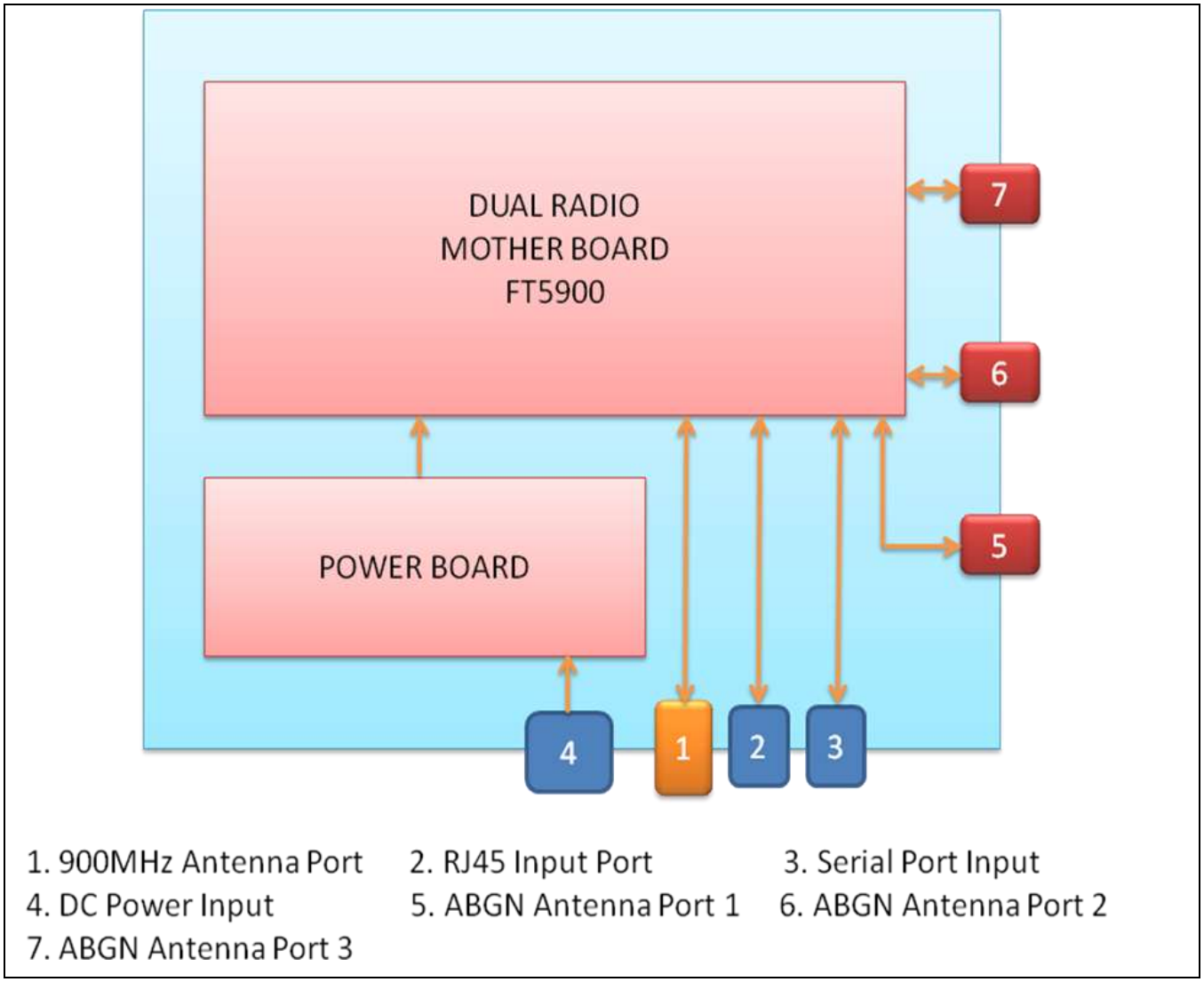



**Figure 1. Block Diagram of Test Configuration**

## E. Equipment Configuration

All cards, racks, etc., incorporated as part of the EUT is included in the following list.

| Ref. ID | Name / Description | Model Number | Serial Number |
|---|---|---|---|
| 1 | Unit Enclosure | -- | -- |
| 2 | DC Power Board | GS260A12 | EB14145528 |
| 3 | Dual Radio Mother Board | FT5900 | -- |
| | 9dBi Omni Antenna (5.8 GHz) | MA-WO55-MIMONHFT9 | 430 |
| | 15dBi Sector Antenna (5.8 GHz) | MA-WE55-MIMOFT15 | 327 |
| | 16dBi Panel Antenna (5.8 GHz) | MA-WD56-DSV16 | 623 |

**Table 4. Equipment Configuration**

## F. Support Equipment

Firetide, Inc. supplied support equipment necessary for the operation and testing of the FT 5900 Wireless Mesh Node. All support equipment supplied is listed in the following Support Equipment List.

| Name / Description | Manufacturer | Model Number | Serial Number |
|---|---|---|---|
| External DC Adapter | Mean Well | GS60A12-P1J | NA |
| Laptop computer | Dell | vostro 1000 | N/A |
| ~~RJ45 Cable~~ | – | – | – |

**Table 5. Support Equipment**

## G. Ports and Cabling Information

| Port name on EUT | Cable Description or reason for no cable | Qty. | Length (m) | Shielded? (Y/N) | Termination Box ID & Port ID |
|---|---|---|---|---|---|
| RJ45 Port | Ethernet Cable | 1 | -- | N | Laptop |
| Serial Port | Serial Cable | 1 | -- | Y | Laptop |
| DC Power Input Port | Power Cable | 1 | -- | Y | DC Adapter |

**Table 6. Ports and Cabling Information**

## H. Mode of Operation

Once the DC power is applied on board LED indicates to mention that the unit is powered on properly. . Proper IP address should be set in the PC prior to the Ethernet cable connection. The Ethernet connectivity needs to be made by connecting an Ethernet cable. Once the connection is established, you can verify this in the PC's LAN connectivity status. Proper IP address should be set in the PC prior to the Ethernet cable connection.

Dual radio mode, both the radios will be enabled.

## I. Method of Monitoring EUT Operation

FT5900 will be used for wireless mesh node application and all the FT5900 nodes connectivity will be monitored using a common server (PC or Laptop). The link connectivity can always be verified using the Firetide provided Software which will run on server PC or Laptop. If some connectivity is broken then we can verify this with Firetide software running on the server then we can take necessary action accordingly.

## J. Modifications

### a) Modifications to EUT

No modifications were made to the EUT.

### b) Modifications to Test Standard

No modifications were made to the test standard.

## K. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Firetide, Inc. upon completion of testing.

# III. Electromagnetic Compatibility Criteria for Unintentional Radiators

## Electromagnetic Compatibility Criteria

### § 15.107 Conducted Emissions Limits

**Test Requirement(s):**

**15.107 (a)** Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

**15.107 (b)** For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

| Frequency range (MHz) | Class A Conducted Limits (dBµV) | | *Class B Conducted Limits (dBµV) | |
|---|---|---|---|---|
| | Quasi-Peak | Average | Quasi-Peak | Average |
| * 0.15- 0.45 | 79 | 66 | 66 - 56 | 56 - 46 |
| 0.45 - 0.5 | 79 | 66 | 56 | 46 |
| 0.5 - 30 | 73 | 60 | 60 | 50 |
| Note 1 — The lower limit shall apply at the transition frequencies.<br>Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.<br>* -- Limits per Subsection 15.207(a). | | | | |

**Table 7. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(a) (b) and 15.207(a)**

**Test Results:** The EUT was compliant with the Class A requirement(s) of this section. Measured emissions were below applicable limits.

**Test Engineer(s):** Anderson Soungpanya

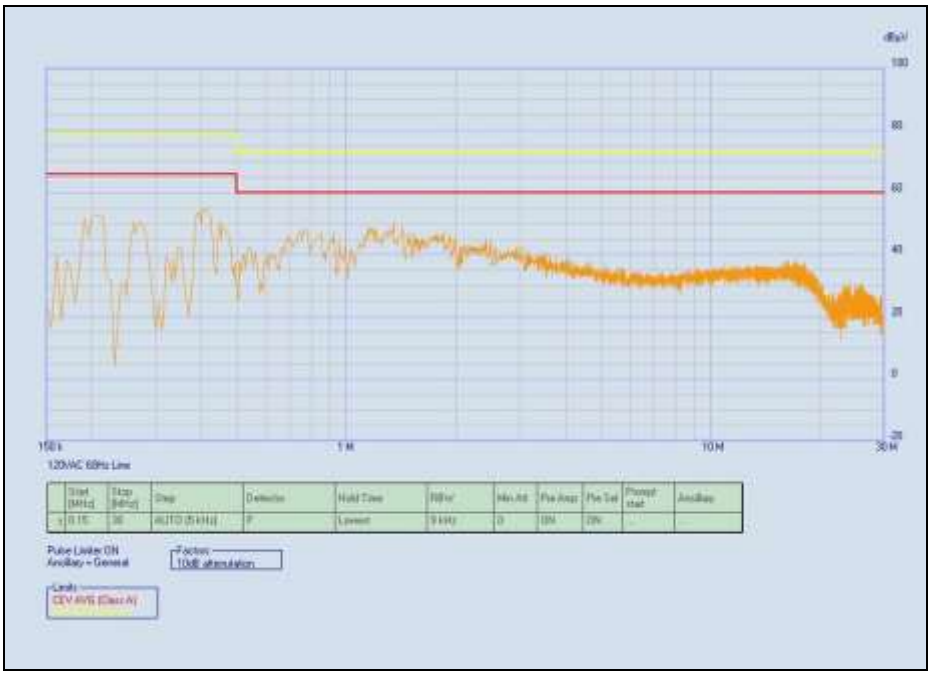
**Test Date(s):** 11/10/11

## Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)

| Line | Freq. (MHz) | QP Amplitude | QP Limit | Delta | Pass | Average Amplitude | Average Limit | Delta | Pass |
|---|---|---|---|---|---|---|---|---|---|
| 120VAC Line 60Hz | 0.19 | 49.43 | 79 | -29.57 | Pass | 32.49 | 66 | -33.51 | Pass |
| 120VAC Line 60Hz | 0.27 | 47.93 | 79 | -31.07 | Pass | 35.37 | 66 | -30.63 | Pass |
| 120VAC Line 60Hz | 0.395 | 51.59 | 79 | -27.41 | Pass | 35.38 | 66 | -30.62 | Pass |
| 120VAC Line 60Hz | 0.415 | 52.52 | 79 | -26.48 | Pass | 36.21 | 66 | -29.79 | Pass |
| 120VAC Line 60Hz | 1.35 | 47.36 | 73 | -25.64 | Pass | 34.56 | 60 | -25.44 | Pass |

**Table 8. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)**



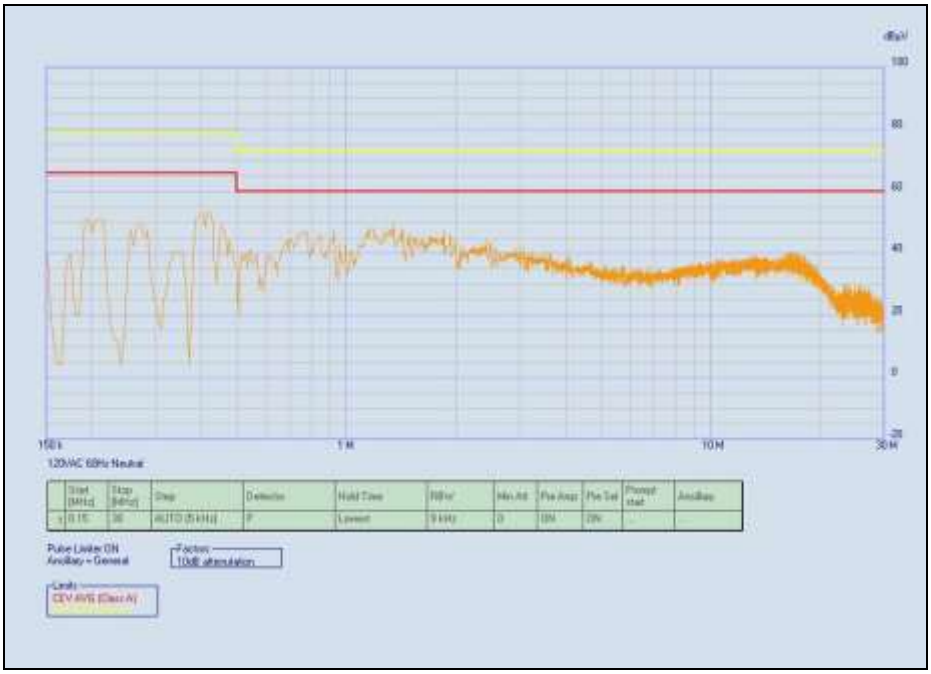
**Plot 1. Conducted Emission, Phase Line Plot**

## Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)

| Line | Freq. (MHz) | QP Amplitude | QP Limit | Delta | Pass | Average Amplitude | Average Limit | Delta | Pass |
|---|---|---|---|---|---|---|---|---|---|
| 120VAC Neutral 60Hz | 0.195 | 39.87 | 79 | -39.13 | Pass | 28.27 | 66 | -37.73 | Pass |
| 120VAC Neutral 60Hz | 0.27 | 46.89 | 79 | -32.11 | Pass | 35.1 | 66 | -30.9 | Pass |
| 120VAC Neutral 60Hz | 0.405 | 51.45 | 79 | -27.55 | Pass | 35.68 | 66 | -30.32 | Pass |
| 120VAC Neutral 60Hz | 0.42 | 51.42 | 79 | -27.58 | Pass | 34.44 | 66 | -31.56 | Pass |
| 120VAC Neutral 60Hz | 0.455 | 46.93 | 79 | -32.07 | Pass | 29.56 | 66 | -36.44 | Pass |
| 120VAC Neutral 60Hz | 1.35 | 44.87 | 73 | -28.13 | Pass | 36.44 | 60 | -23.56 | Pass |

**Table 9. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)**



**Plot 2. Conducted Emission, Neutral Line Plot**

## Conducted Emission Limits Test Setup

**Photograph 2. Conducted Emissions, Test Setup**

## Radiated Emission Limits

### § 15.109 Radiated Emissions Limits

**Test Requirement(s):** **15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 10.

**15.109 (b)** The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the Class A limits expressed in Table 10.

| Frequency (MHz) | Field Strength (dBµV/m) | |
|---|---|---|
| | §15.109 (b), Class A Limit (dBµV) @ 10m | §15.109 (a),Class B Limit (dBµV) @ 3m |
| 30 - 88 | 39.00 | 40.00 |
| 88 - 216 | 43.50 | 43.50 |
| 216 - 960 | 46.40 | 46.00 |
| Above 960 | 49.50 | 54.00 |

**Table 10. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)**

**Test Procedures:** The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 3 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

**Test Results:** The EUT was compliant with the Class A requirement(s) of this section. Measured emissions were below applicable limits.

**Test Engineer(s):** Lionel Gabrillo

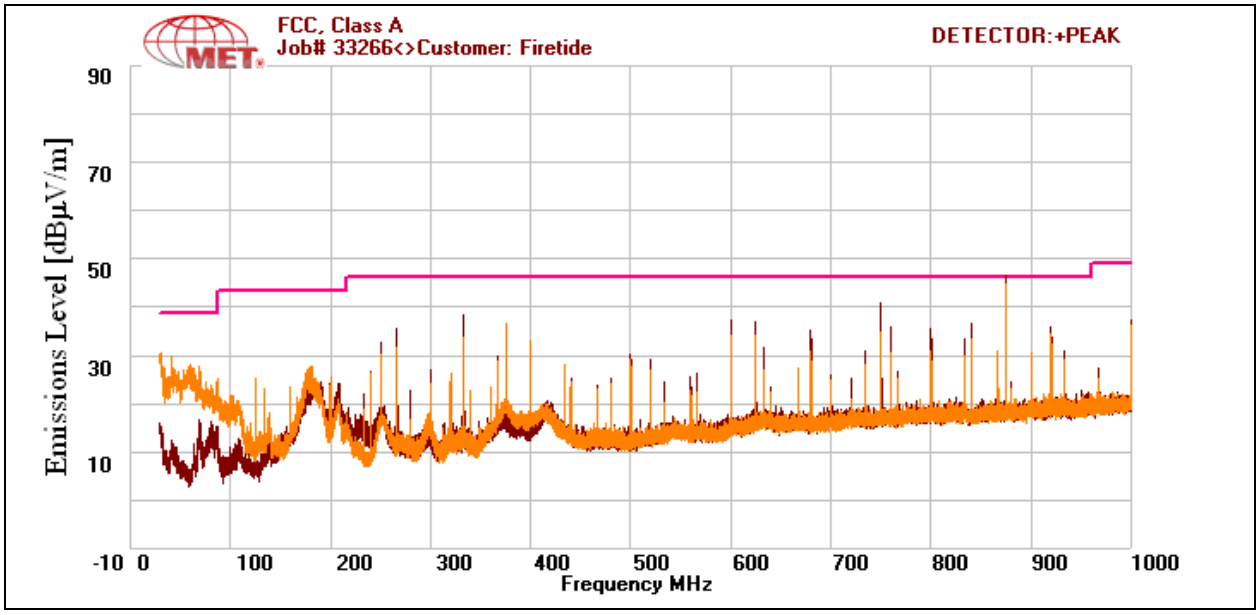
**Test Date(s):** 11/23/11

## Radiated Emissions Limits Test Results, Class A

| Frequency (MHz) | Antenna Polarity | EUT Azimuth (Degrees) | Antenna Height (cm) | Uncorrected Amplitude (dBuV) | ACF (dB/m) | Pre Amp Gain (dB) | CBL (dB) | DCF (dB) | Corrected Amplitude (dBuV) | Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 875 | V | 203.0 | 108.23 | 28.46 | 20.1 | 0 | 6.455 | -10.46 | 44.555 | 46.4 | -1.845 |
| 875 | H | 33.0 | 120.41 | 29.32 | 20.1 | 0 | 6.455 | -10.46 | 45.415 | 46.4 | -0.984 |
| 750 | H | 6.0 | 158.29 | 27.54 | 19.3 | 0 | 5.985 | -10.46 | 42.365 | 46.4 | -4.035 |
| 333.32 | H | 209.0 | 100.76 | 31.44 | 13.766 | 0 | 3.763 | -10.46 | 38.509 | 46.4 | -7.891 |
| 625 | H | 186.0 | 171.94 | 23.46 | 19.2 | 0 | 5.32 | -10.46 | 37.52 | 46.4 | -8.88 |
| 45.28 | V | 266.0 | 100.0 | 13.07 | 10.132 | 0 | 1.685 | -10.46 | 14.427 | 39 | -24.573 |

**Table 11. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz, FCC Limits**

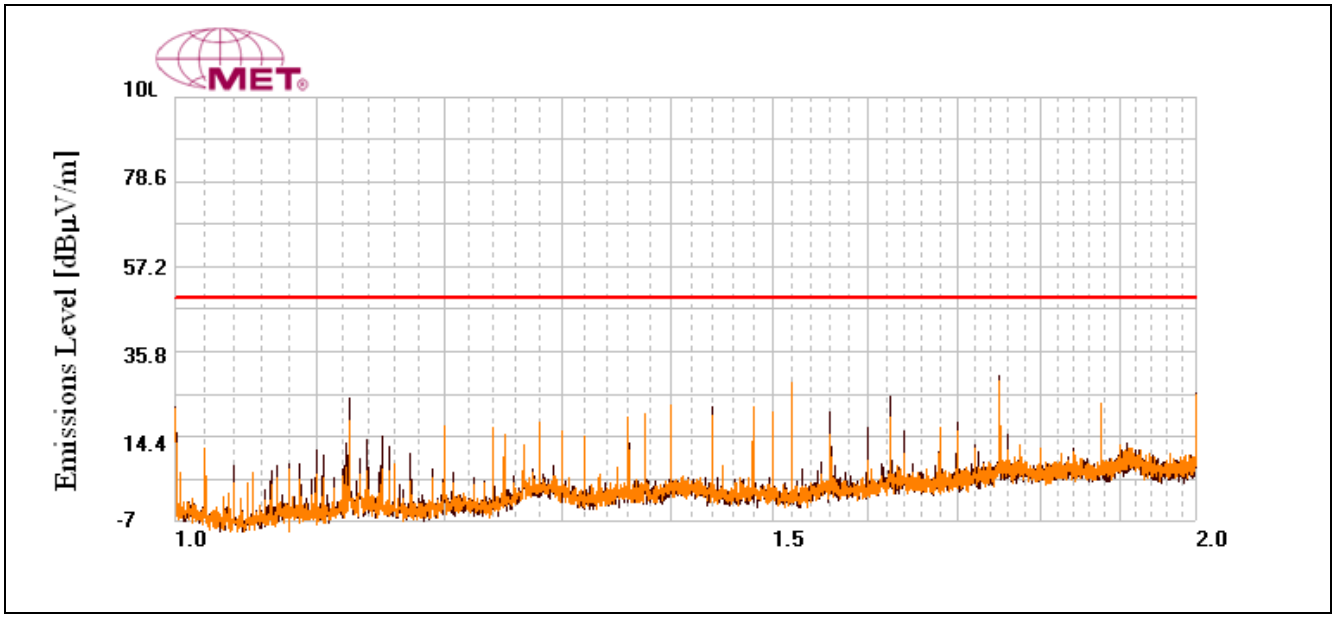



**Plot 3. Radiated Emissions, 30 MHz - 1 GHz, FCC Limits**

| Frequency (MHz) | Antenna Polarity | EUT Azimuth (Degrees) | Antenna Height (cm) | Uncorrected Amplitude (dBuV) | ACF (dB/m) | Pre Amp Gain (dB) | CBL (dB) | DCF (dB) | Corrected Amplitude (dBuV) | Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1750 | H | 224.0 | 101.0 | 78.57 | 29.307 | 75.575 | 9.73 | -10.46 | 31.572 | 49.5 | -17.928 |
| 1520 | V | 257.0 | 102.94 | 86.14 | 28.396 | 75.856 | 9.086 | -10.46 | 37.306 | 49.5 | -12.194 |

**Table 12. Radiated Emissions Limits, Test Results, 1 GHz – 2 GHz, FCC Limits**



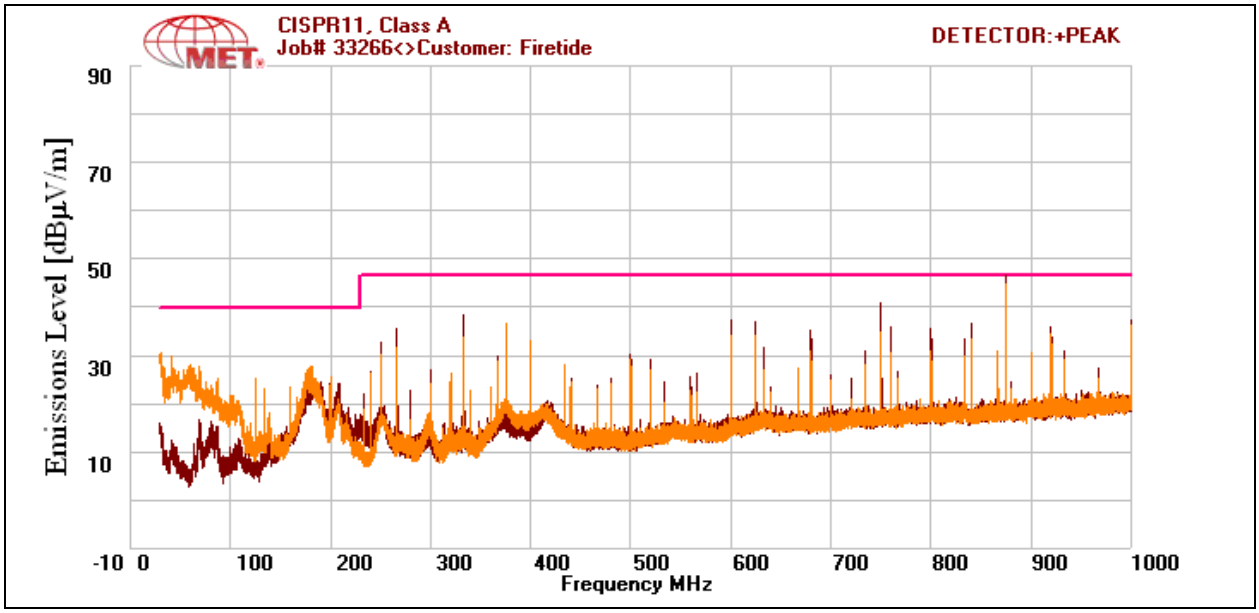

**Plot 4. Radiated Emissions, 1 GHz - 2 GHz, FCC Limits**

## Radiated Emissions Limits Test Results, Class A

| Frequency (MHz) | Antenna Polarity | EUT Azimuth (Degrees) | Antenna Height (cm) | Uncorrected Amplitude (dBuV) | ACF (dB/m) | Pre Amp Gain (dB) | CBL (dB) | DCF (dB) | Corrected Amplitude (dBuV) | Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 875 | V | 203.0 | 108.23 | 28.46 | 20.1 | 0 | 6.455 | -10.46 | 44.555 | 47 | -2.445 |
| 875 | H | 33.0 | 120.41 | 29.32 | 20.1 | 0 | 6.455 | -10.46 | 45.415 | 47 | -1.585 |
| 750 | H | 6.0 | 158.29 | 27.54 | 19.3 | 0 | 5.985 | -10.46 | 42.365 | 47 | -4.635 |
| 333.32 | H | 209.0 | 100.76 | 31.44 | 13.766 | 0 | 3.763 | -10.46 | 38.509 | 47 | -8.491 |
| 625 | H | 186.0 | 171.94 | 23.46 | 19.2 | 0 | 5.32 | -10.46 | 37.52 | 47 | -9.48 |
| 45.28 | V | 266.0 | 100.0 | 13.07 | 10.132 | 0 | 1.685 | -10.46 | 14.427 | 40 | -25.573 |

**Table 13. Radiated Emissions Limits, Test Results, ICES-003 Limits**




**Plot 5. Radiated Emissions, ICES-003 Limits**

## Radiated Emission Limits Test Setup

**Photograph 3. Radiated Emission, 30MHz – 1GHz, Test Setup**

**Photograph 4. Radiated Emission, 1GHz – 2GHz, Test Setup**

# IV. Electromagnetic Compatibility Criteria for Intentional Radiators

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.203 Antenna Requirement

**Test Requirement:** **§ 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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

a.) Antenna must be permanently attached to the unit.

b.) Antenna must use a unique type of connector to attach to the EUT.

c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

**Results:** The EUT as tested is compliant the criteria of §15.203. The device is professionally installed.

**Test Engineer(s):** Anderson Soungpanya

**Test Date(s):** 11/07/11

| Gain | Type | Model | Manufacturer |
|---|---|---|---|
| 9dBi | Omni | MA-WO55-MIMONHFT9 | Mars Antennas |
| 15 dBi | Sector | MA-WE55-MIMOFT15 | Mars Antennas |
| 16 dBi | Panel | MA-WD56-DSV16 | Mars Antennas |

**Table 14. Antenna List**

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.207 Conducted Emissions Limits

**Test Requirement(s):** **§ 15.207 (a):** For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency range (MHz) | § 15.207(a), Conducted Limit (dBμV) | |
|---|---|---|
| | Quasi-Peak | Average |
| * 0.15- 0.45 | 66 - 56 | 56 - 46 |
| 0.45 - 0.5 | 56 | 46 |
| 0.5 - 30 | 60 | 50 |

**Table 15. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)**

**Test Procedure:** The EUT was placed on a 0.8 m-high wooden table inside a screen room. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-2003 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 μH LISN as the input transducer to an EMC/field intensity meter. For the purpose of this testing, the transmitter was turned on. Scans were performed with the transmitter on.

**Test Results:** The EUT was compliant with this requirement. Measured emissions were below applicable limits.

**Test Engineer(s):** Anderson Soungpanya

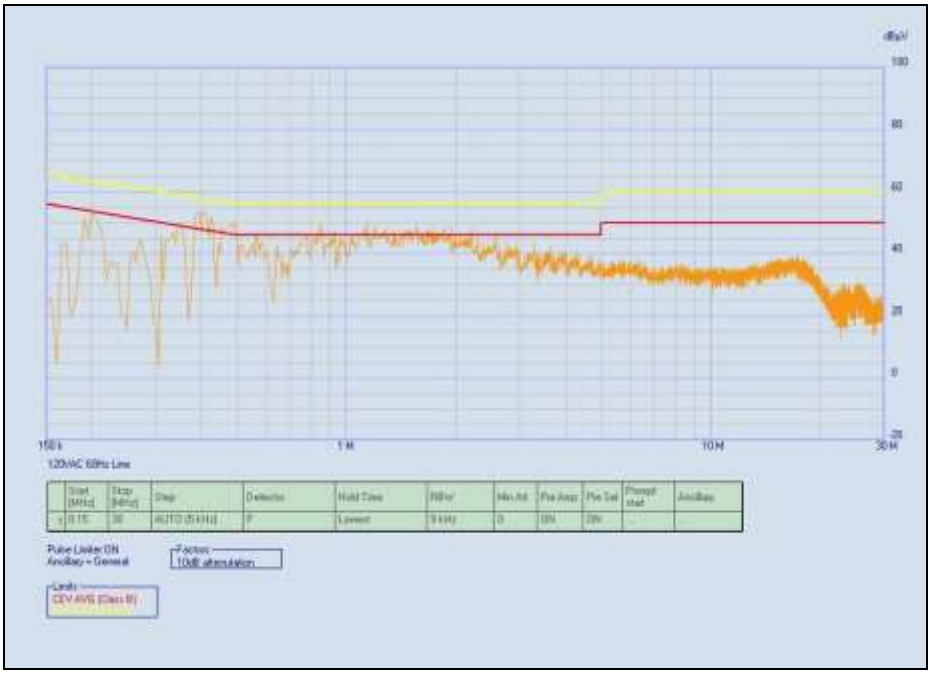
**Test Date(s):** 11/10/11

## 15.207(a) Conducted Emissions Test Results, 5.8 GHz

| Line | Freq. (MHz) | QP Amplitude | QP Limit | Delta | Pass | Average Amplitude | Average Limit | Delta | Pass |
|---|---|---|---|---|---|---|---|---|---|
| 120VAC Line 60Hz | .200 | 49.89 | 63.617 | -13.727 | Pass | 39.77 | 53.617 | -13.847 | Pass |
| 120VAC Line 60Hz | .405 | 50.8 | 57.773 | -6.973 | Pass | 35.55 | 47.773 | -12.223 | Pass |
| 120VAC Line 60Hz | .495 | 47.14 | 56.086 | -8.946 | Pass | 29.44 | 46.086 | -16.646 | Pass |
| 120VAC Line 60Hz | .855 | 46.06 | 56 | -9.94 | Pass | 29.65 | 46 | -16.35 | Pass |
| 120VAC Line 60Hz | .925 | 43.88 | 56 | -12.12 | Pass | 29.36 | 46 | -16.64 | Pass |
| 120VAC Line 60Hz | 1.14 | 46.4 | 56 | -9.6 | Pass | 29.96 | 46 | -16.04 | Pass |
| 120VAC Line 60Hz | 1.20 | 43.73 | 56 | -12.27 | Pass | 29.48 | 46 | -16.52 | Pass |
| 120VAC Line 60Hz | 1.57 | 46.42 | 56 | -9.58 | Pass | 33.71 | 46 | -12.29 | Pass |
| 120VAC Line 60Hz | 2.21 | 44.22 | 56 | -11.78 | Pass | 33.24 | 46 | -12.76 | Pass |
| 120VAC Line 60Hz | 2.56 | 42.54 | 56 | -13.46 | Pass | 33.66 | 46 | -12.34 | Pass |

**Table 16. Conducted Emissions, 15.207(a), Phase Line, Test Results, 5.8 GHz**



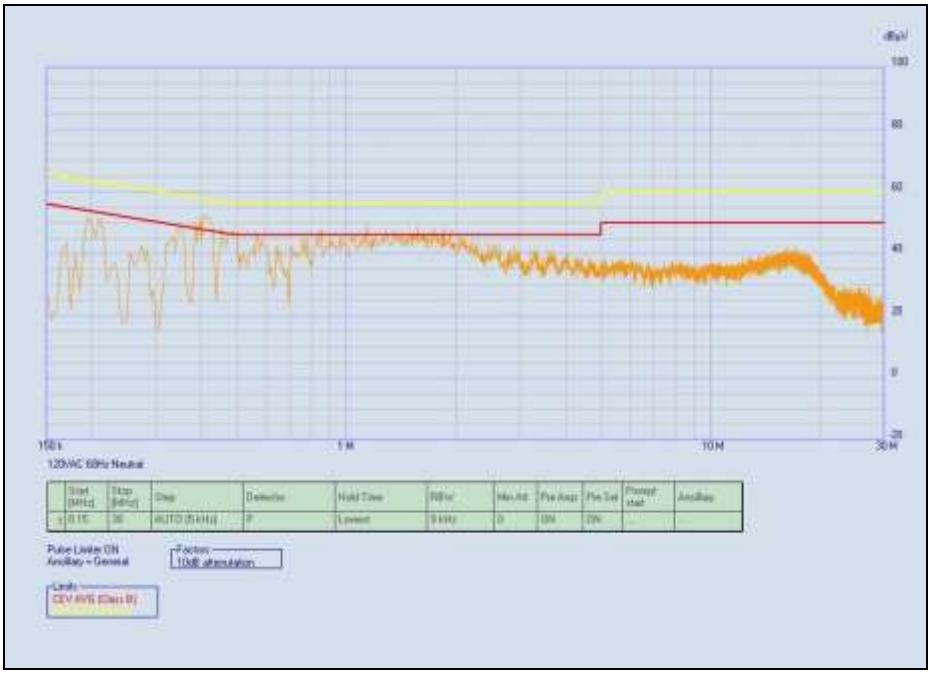
**Plot 6. Conducted Emissions, 15.207(a), Phase Line, 5.8 GHz**

## 15.207(a) Conducted Emissions Test Results, 5.8 GHz

| Line | Freq. (MHz) | QP Amplitude | QP Limit | Delta | Pass | Average Amplitude | Average Limit | Delta | Pass |
|---|---|---|---|---|---|---|---|---|---|
| 120VAC Neutral 60Hz | .195 | 49.23 | 63.827 | -14.597 | Pass | 35.66 | 53.827 | -18.167 | Pass |
| 120VAC Neutral 60Hz | .210 | 48.59 | 63.213 | -14.623 | Pass | 36.21 | 53.213 | -17.003 | Pass |
| 120VAC Neutral 60Hz | .350 | 46.4 | 58.982 | -12.582 | Pass | 30.12 | 48.982 | -18.862 | Pass |
| 120VAC Neutral 60Hz | .410 | 49.66 | 57.671 | -8.011 | Pass | 34.09 | 47.671 | -13.581 | Pass |
| 120VAC Neutral 60Hz | .570 | 42.55 | 56 | -13.45 | Pass | 23.56 | 46 | -22.44 | Pass |
| 120VAC Neutral 60Hz | 1.14 | 45.3 | 56 | -10.7 | Pass | 28.61 | 46 | -17.39 | Pass |
| 120VAC Neutral 60Hz | 1.57 | 45.56 | 56 | -10.44 | Pass | 32.12 | 46 | -13.88 | Pass |
| 120VAC Neutral 60Hz | 1.85 | 44.99 | 56 | -11.01 | Pass | 34.67 | 46 | -11.33 | Pass |

**Table 17. Conducted Emissions, 15.207(a), Neutral Line, Test Results, 5.8 GHz**



**Plot 7. Conducted Emissions, 15.207(a), Neutral Line, 5.8 GHz**

## 15.207(a) Conducted Emissions Test Setup

**Photograph 5. Conducted Emissions, 15.207(a), Test Setup**

## Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15. 403(c) 26dB Bandwidth

**Test Requirements:** **§ 15.403 (i):** For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

**Test Procedure:** The transmitter was set to both operating frequencies at the highest output power and connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately equal to 1% of the total emission bandwidth, VBW > RBW. The 26 dB Bandwidth was measured and recorded.

**Test Results** The 26 dB Bandwidth was compliant with the requirements of this section and was determined from the plots on the following pages.

**Test Engineer(s):** Lionel Gabrillo

**Test Date(s):** 11/02/11

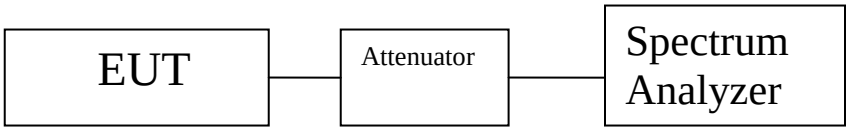



**Figure 2. Occupied Bandwidth, Test Setup**

| Mode | Channel | Frequency | 26 dB Bandwidth (MHz) |
|---|---|---|---|
| 802.11a | Low | 5745 | 18.866 |
| | Mid | 5785 | 19.131 |
| | High | 5805 | 19.135 |
| 802.11n 5 MHz Port 1 | Low | 5745 | 4.770 |
| | Mid | 5785 | 4.808 |
| | High | 5805 | 4.862 |
| 802.11n 5 MHz Port 2 | Low | 5745 | 4.788 |
| | Mid | 5785 | 5.689 |
| | High | 5805 | 4.859 |
| 802.11n 5 MHz Port 3 | Low | 5745 | 4.948 |
| | Mid | 5785 | 4.808 |
| | High | 5805 | 5.582 |
| 802.11n 10 MHz Port 1 | Low | 5745 | 9.598 |
| | Mid | 5785 | 9.623 |
| | High | 5805 | 9.657 |
| 802.11n 10 MHz Port 2 | Low | 5745 | 9.645 |
| | Mid | 5785 | 10.468 |
| | High | 5805 | 9.643 |
| 802.11n 10 MHz Port 3 | Low | 5745 | 9.860 |
| | Mid | 5785 | 9.777 |
| | High | 5805 | 9.852 |
| 802.11n 20 MHz Port 1 | Low | 5745 | 20.272 |
| | Mid | 5785 | 20.335 |
| | High | 5805 | 20.234 |
| 802.11n 20 MHz Port 2 | Low | 5745 | 24.475 |
| | Mid | 5785 | 23.147 |
| | High | 5805 | 20.225 |
| 802.11n 20 MHz Port 3 | Low | 5745 | 20.182 |
| | Mid | 5785 | 19.939 |
| | High | 5805 | 20.064 |
| 802.11n 40 MHz Port 1 | Low | 5755 | 42.485 |
| | High | 5795 | 42.198 |
| 802.11n 40 MHz Port 2 | Low | 5755 | 41.880 |
| | High | 5795 | 41.816 |
| 802.11n 40 MHz Port 3 | Low | 5755 | 41.611 |
| | High | 5795 | 41.594 |

**Table 18. 26 dB Occupied Bandwidth, Test Results**

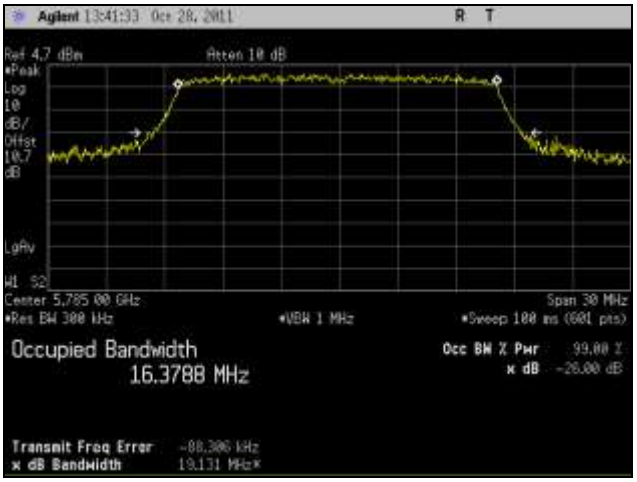
| Mode | Channel | Frequency | 99% Bandwidth (MHz) |
|---|---|---|---|
| 802.11a | Low | 5745 | 16.3852 |
| | Mid | 5785 | 16.4171 |
| | High | 5805 | 16.3377 |
| 802.11n 5 MHz Port 1 | Low | 5745 | 4.1250 |
| | Mid | 5785 | 4.1258 |
| | High | 5805 | 4.1480 |
| 802.11n 5 MHz Port 2 | Low | 5745 | 4.1460 |
| | Mid | 5785 | 4.1377 |
| | High | 5805 | 4.1333 |
| 802.11n 5 MHz Port 3 | Low | 5745 | 4.1320 |
| | Mid | 5785 | 4.1390 |
| | High | 5805 | 4.1346 |
| 802.11n 10 MHz Port 1 | Low | 5745 | 8.2288 |
| | Mid | 5785 | 8.2083 |
| | High | 5805 | 8.2064 |
| 802.11n 10 MHz Port 2 | Low | 5745 | 8.2380 |
| | Mid | 5785 | 8.2321 |
| | High | 5805 | 8.2450 |
| 802.11n 10 MHz Port 3 | Low | 5745 | 8.2612 |
| | Mid | 5785 | 8.2061 |
| | High | 5805 | 8.2424 |
| 802.11n 20 MHz Port 1 | Low | 5745 | 17.6210 |
| | Mid | 5785 | 17.5993 |
| | High | 5805 | 17.6806 |
| 802.11n 20 MHz Port 2 | Low | 5745 | 17.6826 |
| | Mid | 5785 | 17.5574 |
| | High | 5805 | 17.6039 |
| 802.11n 20 MHz Port 3 | Low | 5745 | 17.5965 |
| | Mid | 5785 | 17.4794 |
| | High | 5805 | 17.6374 |
| 802.11n 40 MHz Port 1 | Low | 5755 | 36.3262 |
| | High | 5795 | 36.2227 |
| 802.11n 40 MHz Port 2 | Low | 5755 | 36.6902 |
| | High | 5795 | 36.5990 |
| 802.11n 40 MHz Port 3 | Low | 5755 | 36.5266 |
| | High | 5795 | 36.5303 |

**Table 19. 99% Occupied Bandwidth, Test Results**

## 26 dB Occupied Bandwidth, 802.11a


**Plot 8. 26 dB Occupied Bandwidth, Low Channel, 802.11a**



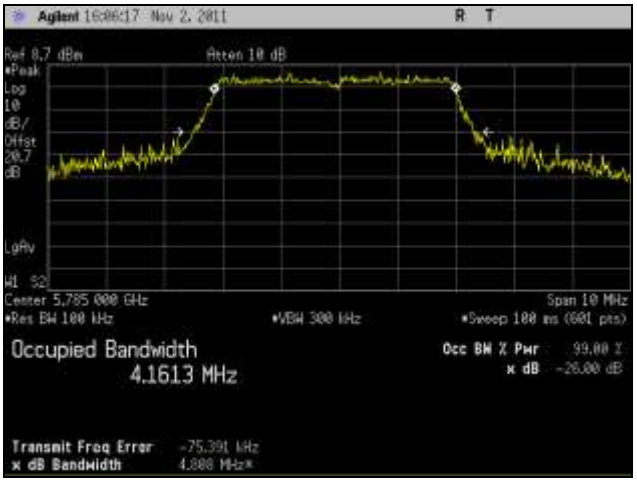

**Plot 9. 26 dB Occupied Bandwidth, Mid Channel, 802.11a**


**Plot 10. 26 dB Occupied Bandwidth, High Channel, 802.11a**

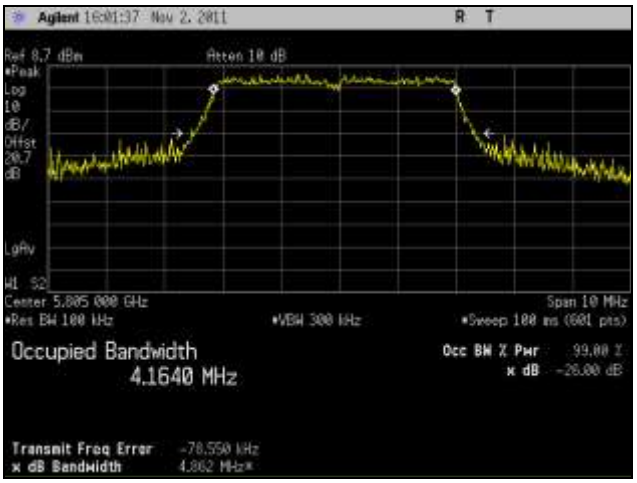
  

## 26 dB Occupied Bandwidth, 802.11n 5 MHz, Port 1


**Plot 11. 26 dB Occupied Bandwidth, Low Channel, 802.11n 5 MHz, Port 1**




**Plot 12. 26 dB Occupied Bandwidth, Mid Channel, 802.11n 5 MHz, Port 1**



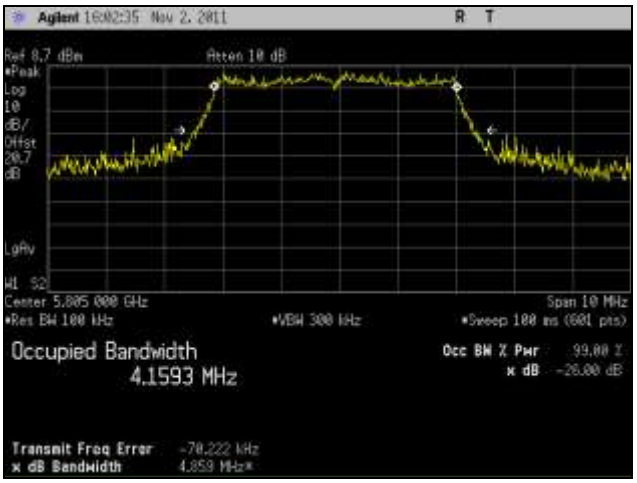

**Plot 13. 26 dB Occupied Bandwidth, High Channel, 802.11n 5 MHz, Port 1**

## 26 dB Occupied Bandwidth, 802.11n 5 MHz, Port 2


**Plot 14. 26 dB Occupied Bandwidth, Low Channel, 802.11n 5 MHz, Port 2**


**Plot 15. 26 dB Occupied Bandwidth, Mid Channel, 802.11n 5 MHz, Port 2**




**Plot 16. 26 dB Occupied Bandwidth, High Channel, 802.11n 5 MHz, Port 2**

## 26 dB Occupied Bandwidth, 802.11n 5 MHz, Port 3


**Plot 17. 26 dB Occupied Bandwidth, Low Channel, 802.11n 5 MHz, Port 3**


**Plot 18. 26 dB Occupied Bandwidth, Mid Channel, 802.11n 5 MHz, Port 3**


**Plot 19. 26 dB Occupied Bandwidth, High Channel, 802.11n 5 MHz, Port 3**

## 26 dB Occupied Bandwidth, 802.11n 10 MHz, Port 1

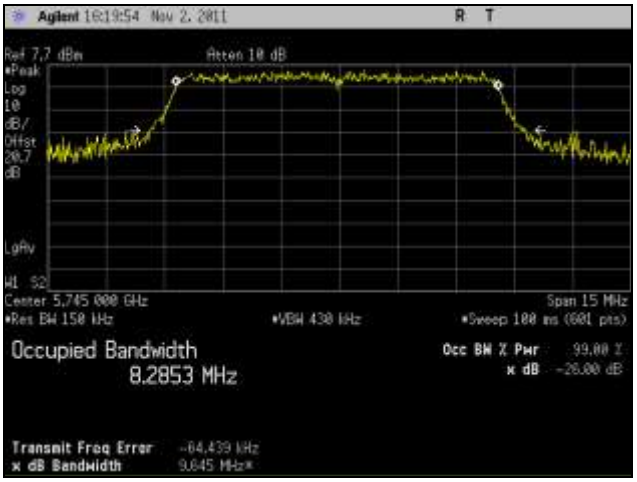

**Plot 20. 26 dB Occupied Bandwidth, Low Channel, 802.11n 10 MHz, Port 1**


**Plot 21. 26 dB Occupied Bandwidth, Mid Channel, 802.11n 10 MHz, Port 1**


**Plot 22. 26 dB Occupied Bandwidth, High Channel, 802.11n 10 MHz, Port 1**

## 26 dB Occupied Bandwidth, 802.11n 10 MHz, Port 2




**Plot 23. 26 dB Occupied Bandwidth, Low Channel, 802.11n 10 MHz, Port 2**


**Plot 24. 26 dB Occupied Bandwidth, Mid Channel, 802.11n 10 MHz, Port 2**


**Plot 25. 26 dB Occupied Bandwidth, High Channel, 802.11n 10 MHz, Port 2**

## 26 dB Occupied Bandwidth, 802.11n 10 MHz, Port 3


**Plot 26. 26 dB Occupied Bandwidth, Low Channel, 802.11n 10 MHz, Port 3**

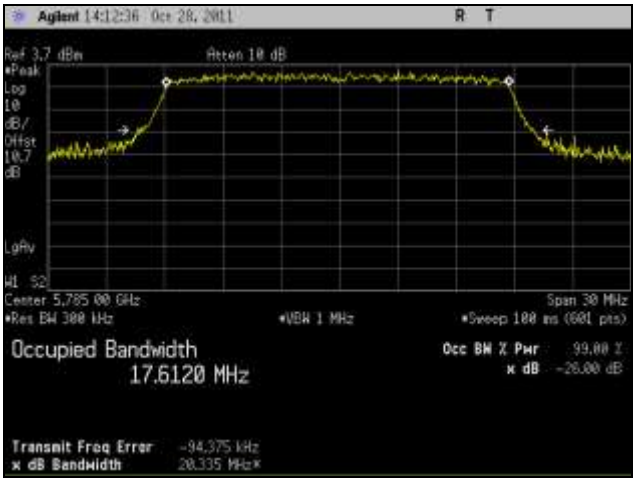

**Plot 27. 26 dB Occupied Bandwidth, Mid Channel, 802.11n 10 MHz, Port 3**


**Plot 28. 26 dB Occupied Bandwidth, High Channel, 802.11n 10 MHz, Port 3**

## 26 dB Occupied Bandwidth, 802.11n 20 MHz, Port 1


**Plot 29. 26 dB Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 1**



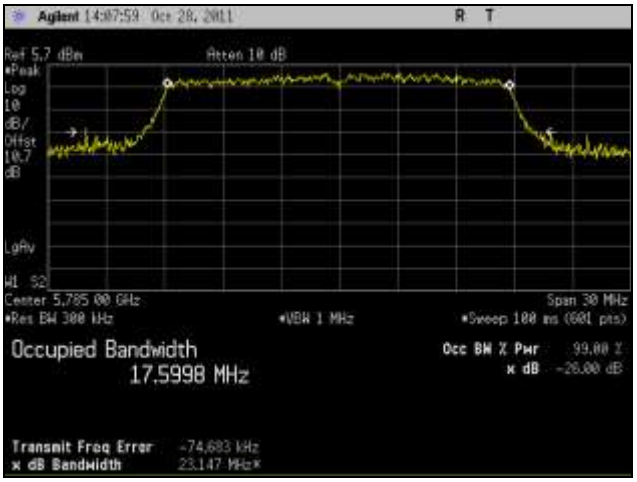

**Plot 30. 26 dB Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 1**


**Plot 31. 26 dB Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 1**

## 26 dB Occupied Bandwidth, 802.11n 20 MHz, Port 2


**Plot 32. 26 dB Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 2**



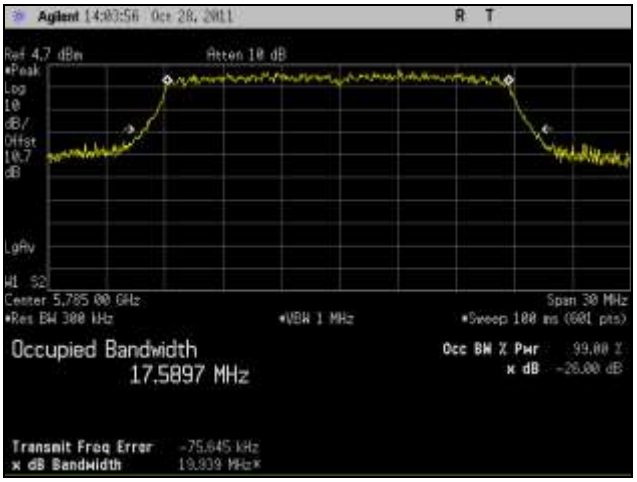

**Plot 33. 26 dB Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 2**


**Plot 34. 26 dB Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 2**

## 26 dB Occupied Bandwidth, 802.11n 20 MHz, Port 3


**Plot 35. 26 dB Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 3**

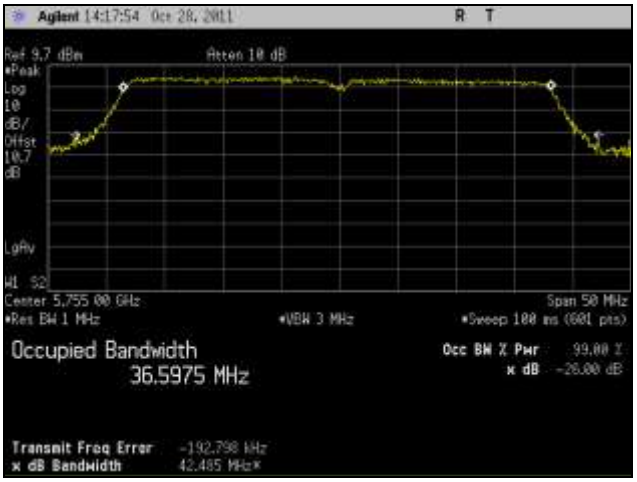



**Plot 36. 26 dB Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 3**

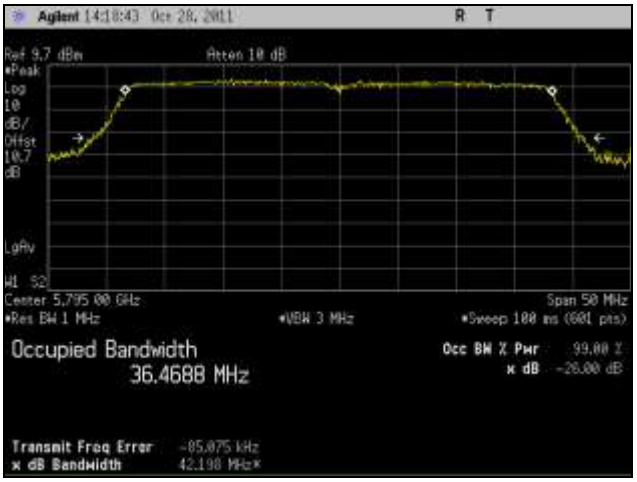

**Plot 37. 26 dB Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 3**

## 26 dB Occupied Bandwidth, 802.11n 40 MHz, Port 1



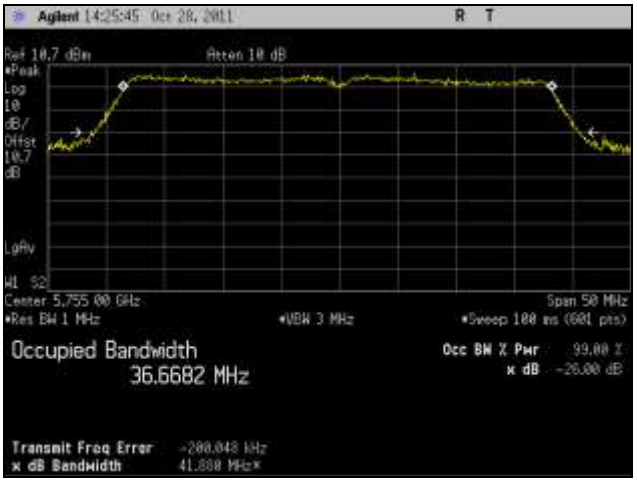

**Plot 38. 26 dB Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 1**




**Plot 39. 26 dB Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 1**

## 26 dB Occupied Bandwidth, 802.11n 40 MHz, Port 2

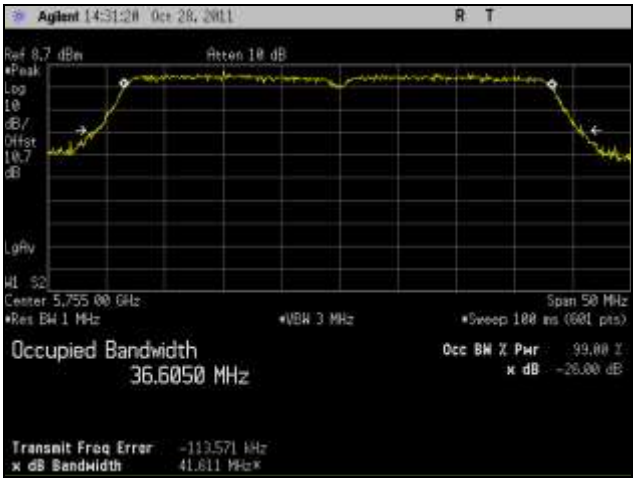



**Plot 40. 26 dB Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 2**

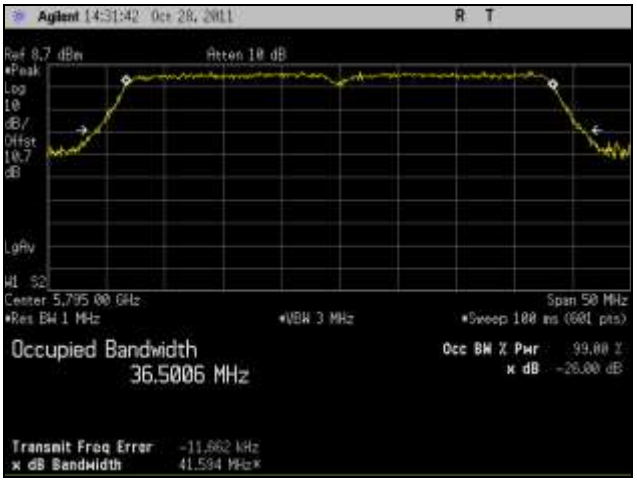

**Plot 41. 26 dB Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 2**

## 26 dB Occupied Bandwidth, 802.11n 40 MHz, Port 3



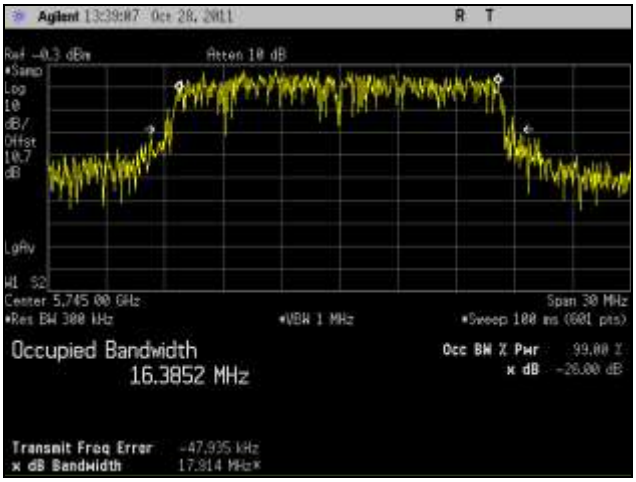

**Plot 42. 26 dB Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 3**



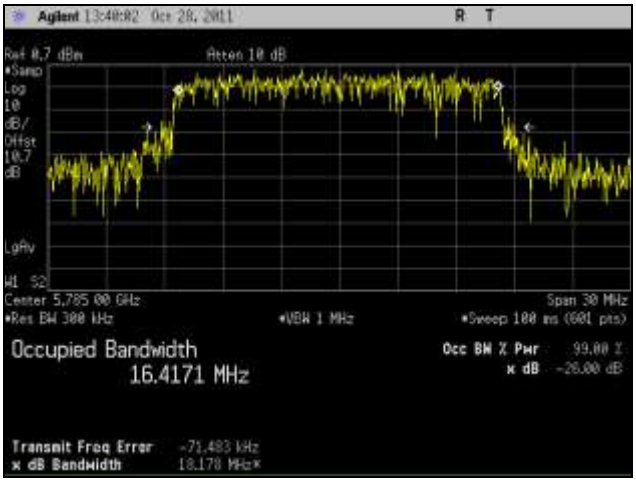

**Plot 43. 26 dB Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 3**

## 99% Occupied Bandwidth, 802.11a




**Plot 44. 99% Occupied Bandwidth, Low Channel, 802.11a**




**Plot 45. 99% Occupied Bandwidth, Mid Channel, 802.11a**

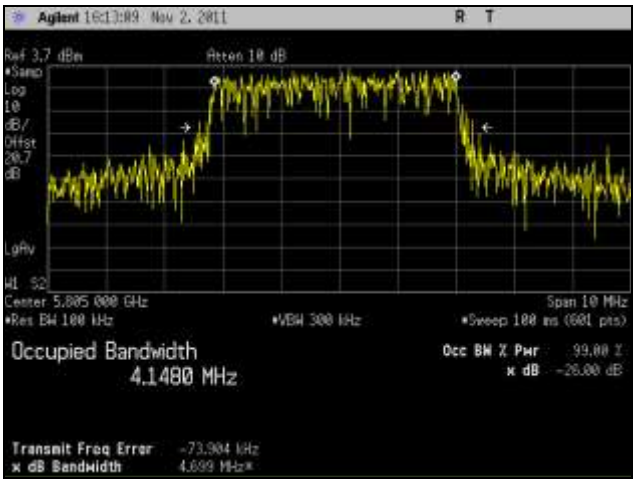

**Plot 46. 99% Occupied Bandwidth, High Channel, 802.11a**

## 99% Occupied Bandwidth, 802.11n 5 MHz, Port 1


**Plot 47. 99% Occupied Bandwidth, Low Channel, 802.11n 5 MHz, Port 1**


**Plot 48. 99% Occupied Bandwidth, Mid Channel, 802.11n 5 MHz, Port 1**




**Plot 49. 99% Occupied Bandwidth, High Channel, 802.11n 5 MHz, Port 1**

## 99% Occupied Bandwidth, 802.11n 5 MHz, Port 2


**Plot 50. 99% Occupied Bandwidth, Low Channel, 802.11n 5 MHz, Port 2**


**Plot 51. 99% Occupied Bandwidth, Mid Channel, 802.11n 5 MHz, Port 2**


**Plot 52. 99% Occupied Bandwidth, High Channel, 802.11n 5 MHz, Port 2**

## 99% Occupied Bandwidth, 802.11n 5 MHz, Port 3


**Plot 53. 99% Occupied Bandwidth, Low Channel, 802.11n 5 MHz, Port 3**


**Plot 54. 99% Occupied Bandwidth, Mid Channel, 802.11n 5 MHz, Port 3**


**Plot 55. 99% Occupied Bandwidth, High Channel, 802.11n 5 MHz, Port 3**

## 99% Occupied Bandwidth, 802.11n 10 MHz, Port 1


**Plot 56. 99% Occupied Bandwidth, Low Channel, 802.11n 10 MHz, Port 1**


**Plot 57. 99% Occupied Bandwidth, Mid Channel, 802.11n 10 MHz, Port 1**


**Plot 58. 99% Occupied Bandwidth, High Channel, 802.11n 10 MHz, Port 1**

## 99% Occupied Bandwidth, 802.11n 10 MHz, Port 2


**Plot 59. 99% Occupied Bandwidth, Low Channel, 802.11n 10 MHz, Port 2**


**Plot 60. 99% Occupied Bandwidth, Mid Channel, 802.11n 10 MHz, Port 2**


**Plot 61. 99% Occupied Bandwidth, High Channel, 802.11n 10 MHz, Port 2**

## 99% Occupied Bandwidth, 802.11n 10 MHz, Port 3


**Plot 62. 99% Occupied Bandwidth, Low Channel, 802.11n 10 MHz, Port 3**


**Plot 63. 99% Occupied Bandwidth, Mid Channel, 802.11n 10 MHz, Port 3**


**Plot 64. 99% Occupied Bandwidth, High Channel, 802.11n 10 MHz, Port 3**

## 99% Occupied Bandwidth, 802.11n 20 MHz, Port 1


**Plot 65. 99% Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 1**


**Plot 66. 99% Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 1**


**Plot 67. 99% Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 1**

## 99% Occupied Bandwidth, 802.11n 20 MHz, Port 2


**Plot 68. 99% Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 2**


**Plot 69. 99% Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 2**


**Plot 70. 99% Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 2**

## 99% Occupied Bandwidth, 802.11n 20 MHz, Port 3

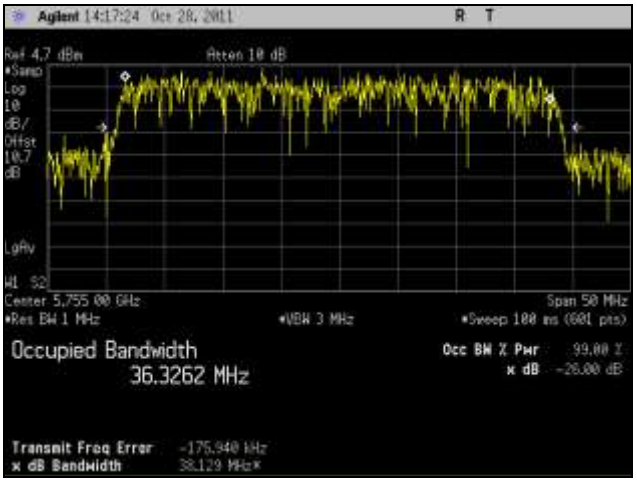

**Plot 71. 99% Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 3**


**Plot 72. 99% Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 3**


**Plot 73. 99% Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 3**

## 99% Occupied Bandwidth, 802.11n 40 MHz, Port 1




**Plot 74. 99% Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 1**


**Plot 75. 99% Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 1**

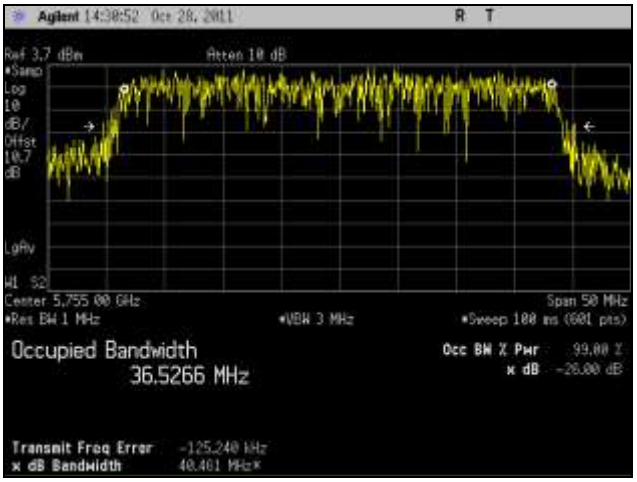
## 99% Occupied Bandwidth, 802.11n 40 MHz, Port 2


**Plot 76. 99% Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 2**


**Plot 77. 99% Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 2**

## 99% Occupied Bandwidth, 802.11n 40 MHz, Port 3




**Plot 78. 99% Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 3**


**Plot 79. 99% Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 3**

## Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15. 407(a)(2)(3) RF Power Output

**Test Requirements:** **§15.407(a)(2):** The maximum output power of the intentional radiator shall not exceed the following:

**§15.407(a) (2):** For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10log B, where B is the 26 dB emission bandwidth in megahertz.

**§15.407(a) (3):** For the band 5.725-5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or 17 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without an corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Note to paragraph (a)(3): The Commission strongly recommends that parties employing U-NII devices to provide critical communications services should determine if there are any nearby Government radar systems that could affect their operation.

**Test Procedure:** The EUT was connected to a Spectrum Analyzer through a 20dB attenuator. The EUT was measured at the low, mid and high channels of each band at the maximum power level.

**Test Results:** Equipment was compliant with the Peak Power Output limits of **§ 15.401(a)(2)**.

**Test Engineer(s):** Lionel Gabrillo

**Test Date(s):** 12/19/11

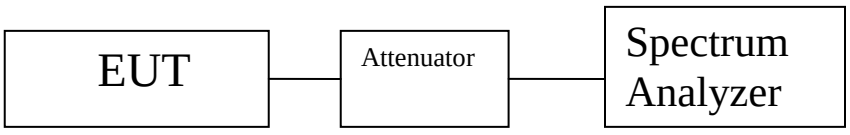


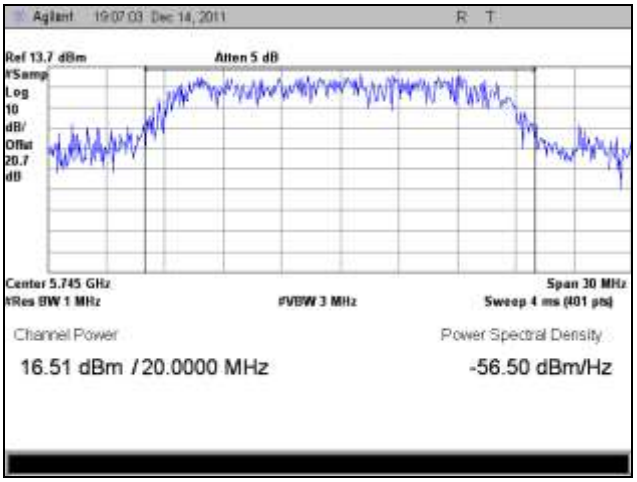

**Figure 3. Power Output Test Setup**

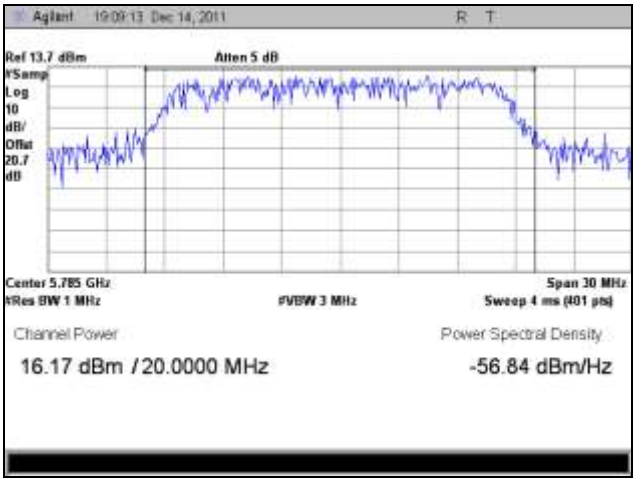
| Mode | Channel | Frequency (MHz) | Conducted power (dBm) Port 1 | Conducted power (dBm) Port 2 | Conducted power (dBm) Port 3 | Conducted power (dBm) Combined | Limit (dBm) |
|---|---|---|---|---|---|---|---|
| 802.11a | Low | 5745 | 16.51 | -- | -- | -- | 26.82 |
| | Mid | 5785 | 16.17 | -- | -- | -- | 26.82 |
| | High | 5805 | 15.97 | -- | -- | -- | 26.82 |
| 802.11n 5 MHz | Low | 5745 | 14.71 | 14.29 | 14.44 | 19.255 | 21.55 |
| | Mid | 5785 | 14.32 | 13.62 | 14.37 | 18.888 | 21.55 |
| | High | 5805 | 14.51 | 13.88 | 13.89 | 18.875 | 21.55 |
| 802.11n 10 MHz | Low | 5745 | 10.97 | 13.37 | 12.81 | 17.270 | 24.20 |
| | Mid | 5785 | 11.55 | 13.73 | 10.38 | 16.885 | 24.20 |
| | High | 5805 | 10.13 | 13.61 | 12.17 | 16.968 | 24.20 |
| 802.11n 20 MHz | Low | 5745 | 14.50 | 14.98 | 13.56 | 19.157 | 27.88 |
| | Mid | 5785 | 12.62 | 15.03 | 14.01 | 18.768 | 27.88 |
| | High | 5805 | 13.28 | 14.97 | 12.84 | 18.568 | 27.88 |
| 802.11n 40 MHz | Low | 5755 | 14.25 | 16.86 | 14.75 | 20.211 | 30.00 |
| | High | 5795 | 13.52 | 15.94 | 13.07 | 19.140 | 30.00 |

**Table 20. RF Power Output, Test Results**

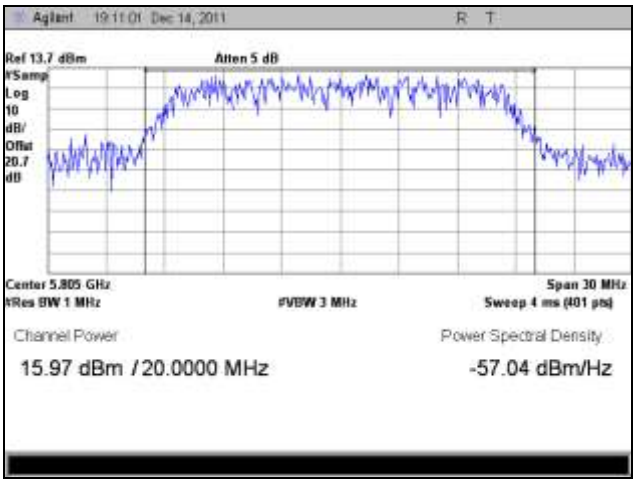
## RF Power Output, 802.11a




**Plot 80. RF Power Output, Low Channel, 802.11a**



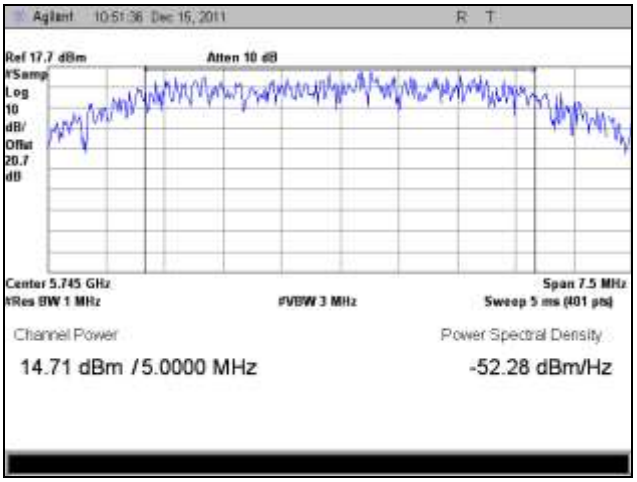

**Plot 81. RF Power Output, Mid Channel, 802.11a**



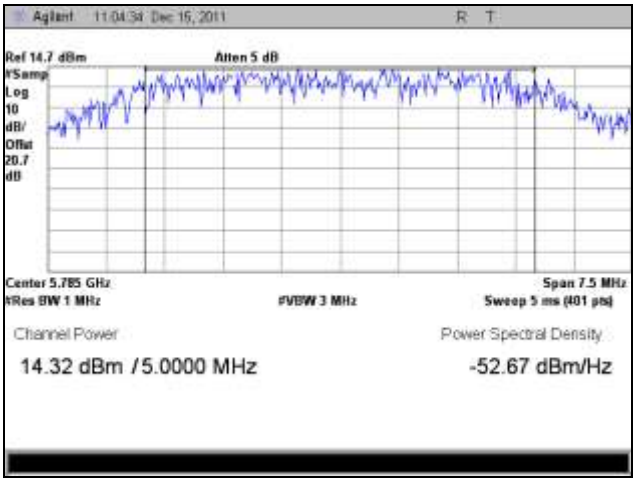

**Plot 82. RF Power Output, High Channel, 802.11a**

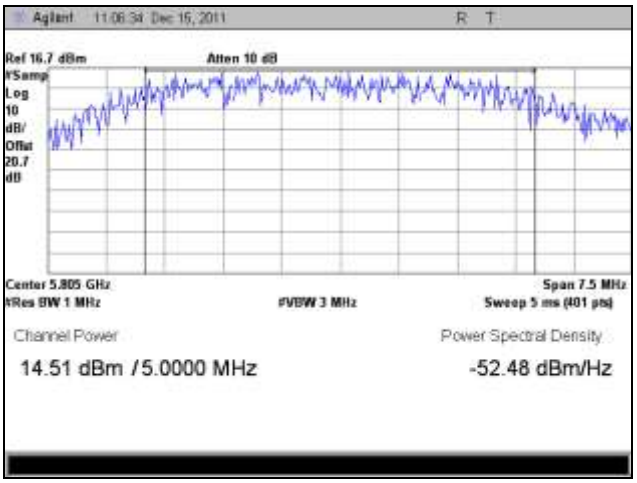
## RF Power Output, 802.11n 5 MHz Port 1




**Plot 83. RF Power Output, Low Channel, 802.11n 5 MHz Port 1**



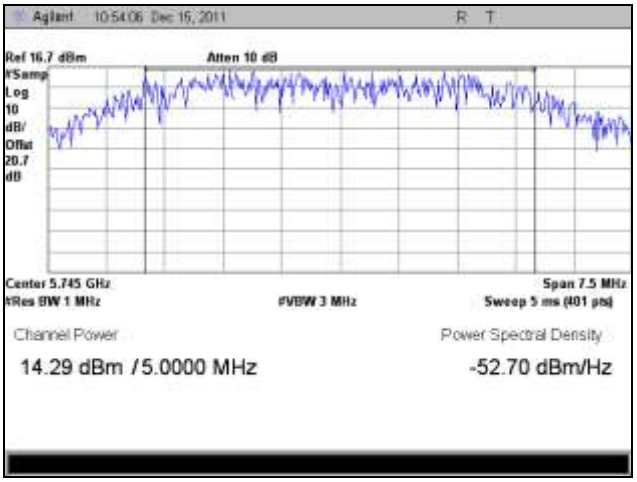

**Plot 84. RF Power Output, Mid Channel, 802.11n 5 MHz Port 1**



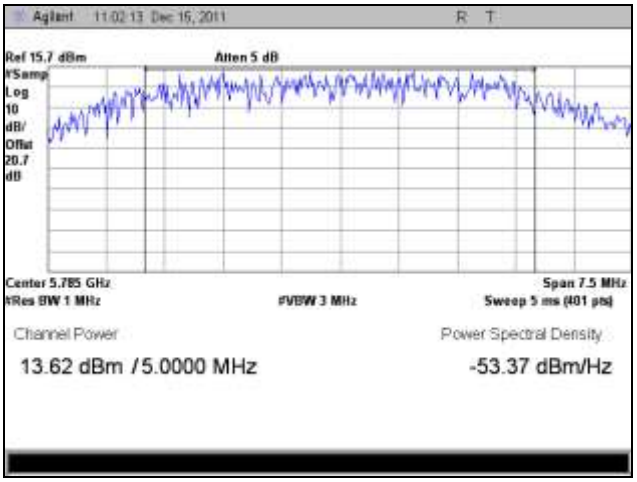

**Plot 85. RF Power Output, High Channel, 802.11n 5 MHz Port 1**

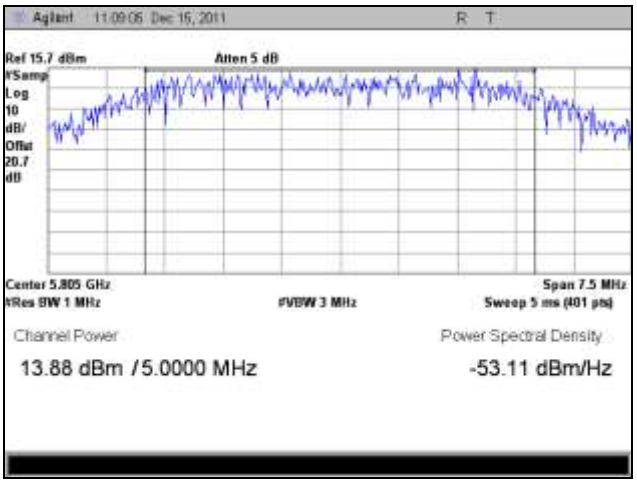
## RF Power Output, 802.11n 5 MHz Port 2




**Plot 86. RF Power Output, Low Channel, 802.11n 5 MHz Port 2**



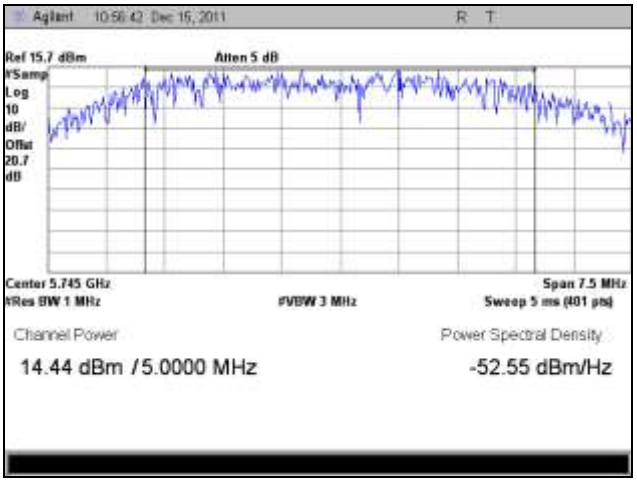

**Plot 87. RF Power Output, Mid Channel, 802.11n 5 MHz Port 2**



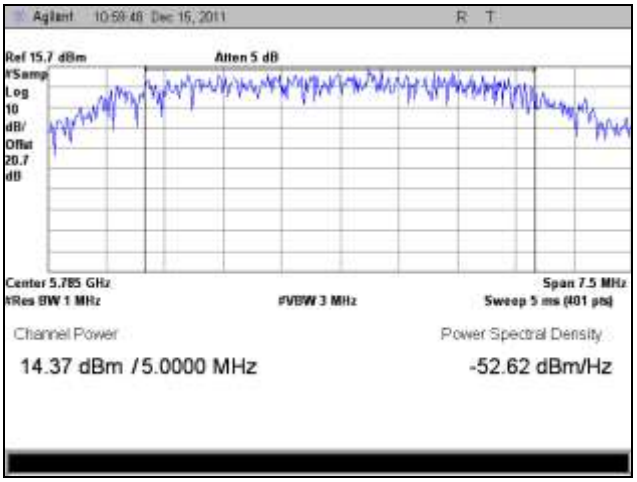

**Plot 88. RF Power Output, High Channel, 802.11n 5 MHz Port 2**

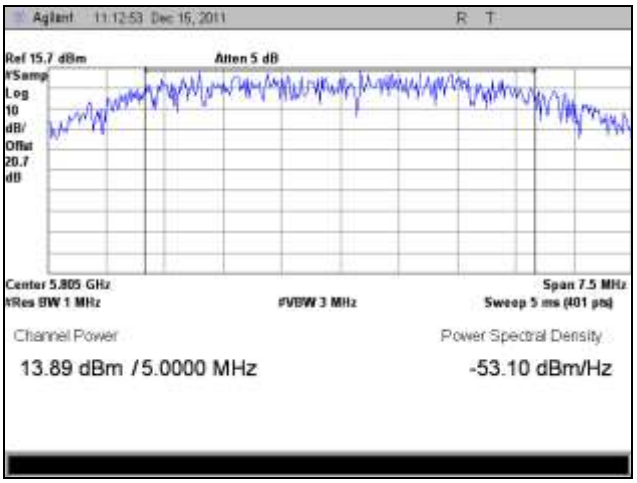
## RF Power Output, 802.11n 5 MHz Port 3




**Plot 89. RF Power Output, Low Channel, 802.11n 5 MHz Port 3**




**Plot 90. RF Power Output, Mid Channel, 802.11n 5 MHz Port 3**




**Plot 91. RF Power Output, High Channel, 802.11n 5 MHz Port 3**

## RF Power Output, 802.11n 10 MHz Port 1


**Plot 92. RF Power Output, Low Channel, 802.11n 10 MHz Port 1**


**Plot 93. RF Power Output, Mid Channel, 802.11n 10 MHz Port 1**


**Plot 94. RF Power Output, High Channel, 802.11n 10 MHz Port 1**

## RF Power Output, 802.11n 10 MHz Port 2


**Plot 95. RF Power Output, Low Channel, 802.11n 10 MHz Port 2**


**Plot 96. RF Power Output, Mid Channel, 802.11n 10 MHz Port 2**


**Plot 97. RF Power Output, High Channel, 802.11n 10 MHz Port 2**

## RF Power Output, 802.11n 10 MHz Port 3


**Plot 98. RF Power Output, Low Channel, 802.11n 10 MHz Port 3**


**Plot 99. RF Power Output, Mid Channel, 802.11n 10 MHz Port 3**


**Plot 100. RF Power Output, High Channel, 802.11n 10 MHz Port 3**

## RF Power Output, 802.11n 20 MHz Port 1


**Plot 101. RF Power Output, Low Channel, 802.11n 20 MHz Port 1**


**Plot 102. RF Power Output, Mid Channel, 802.11n 20 MHz Port 1**


**Plot 103. RF Power Output, High Channel, 802.11n 20 MHz Port 1**

## RF Power Output, 802.11n 20 MHz Port 2


**Plot 104. RF Power Output, Low Channel, 802.11n 20 MHz Port 2**


**Plot 105. RF Power Output, Mid Channel, 802.11n 20 MHz Port 2**


**Plot 106. RF Power Output, High Channel, 802.11n 20 MHz Port 2**

## RF Power Output, 802.11n 20 MHz Port 3

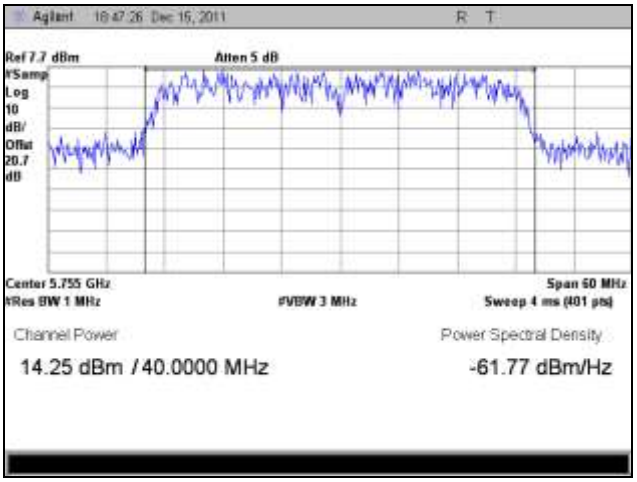

**Plot 107. RF Power Output, Low Channel, 802.11n 20 MHz Port 3**


**Plot 108. RF Power Output, Mid Channel, 802.11n 20 MHz Port 3**

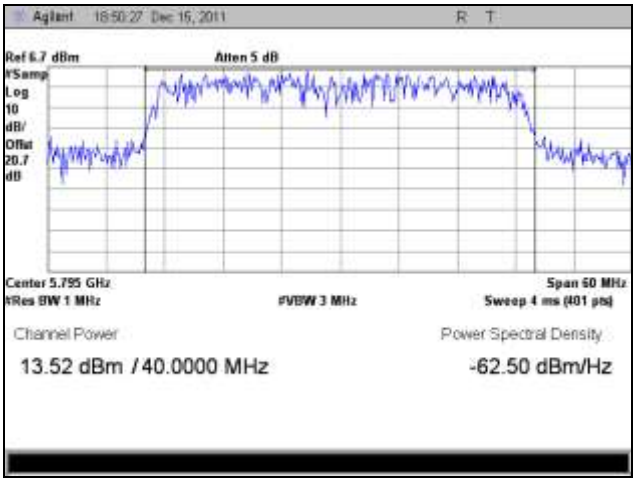

**Plot 109. RF Power Output, High Channel, 802.11n 20 MHz Port 3**

## RF Power Output, 802.11n 40 MHz Port 1



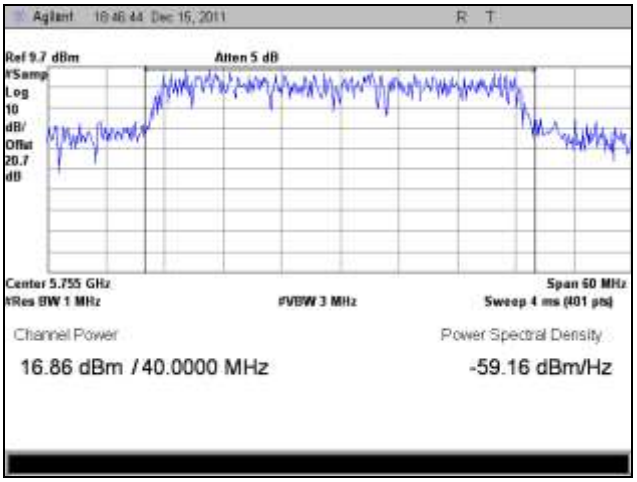

**Plot 110. RF Power Output, Low Channel, 802.11n 40 MHz Port 1**



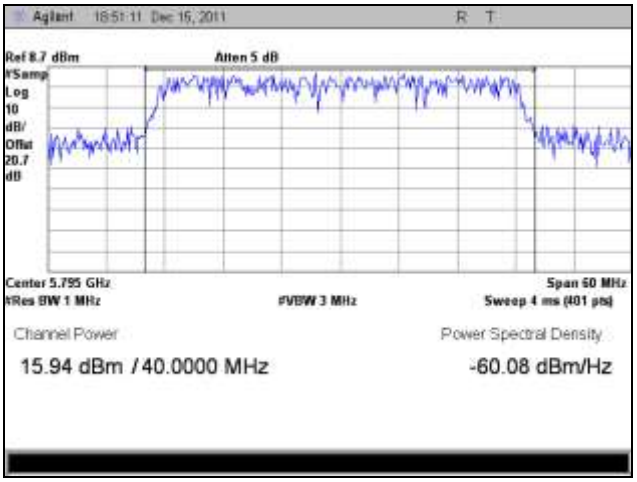

**Plot 111. RF Power Output, High Channel, 802.11n 40 MHz Port 1**

## RF Power Output, 802.11n 40 MHz Port 2



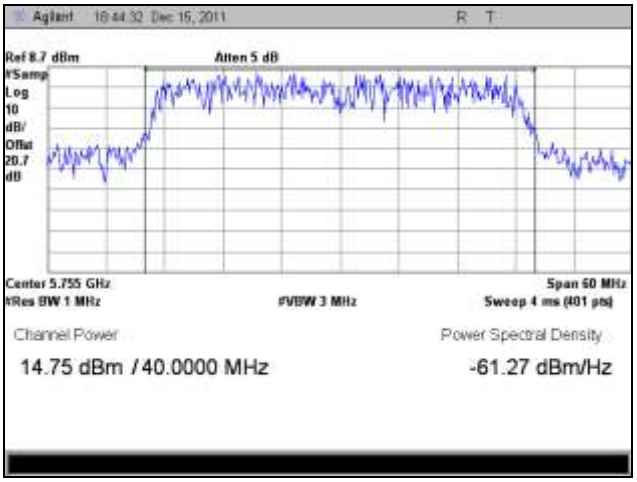

**Plot 112. RF Power Output, Low Channel, 802.11n 40 MHz Port 2**



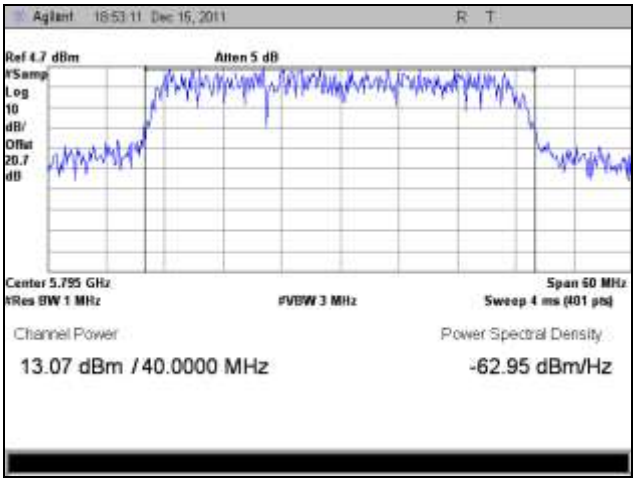

**Plot 113. RF Power Output, High Channel, 802.11n 40 MHz Port 2**

## RF Power Output, 802.11n 40 MHz Port 3




**Plot 114. RF Power Output, Low Channel, 802.11n 40 MHz Port 3**




**Plot 115. RF Power Output, High Channel, 802.11n 40 MHz Port 3**

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.407(a)(3) Peak Power Spectral Density

**Test Requirements:** **§ 15.407(a)(3):** The peak power spectral density shall not exceed 17 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, Omni directional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

**Test Procedure:** The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level on the EUT. The RBW was set to 1MHz and the VBW was set to 3MHz. The method of measurement from the FCC Publication 789033 D01 UNII General Test Procedures v01 was used.

**Test Results:** Equipment was compliant with the peak power spectral density limits of **§ 15.407 (a)(2).** The peak power spectral density was determined from plots on the following page(s).

**Test Engineer(s):** Lionel Gabrillo

**Test Date(s):** 12/19/11

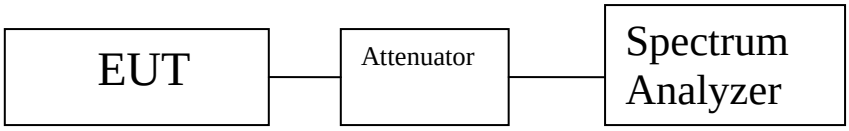



**Figure 4. Power Spectral Density Test Setup**

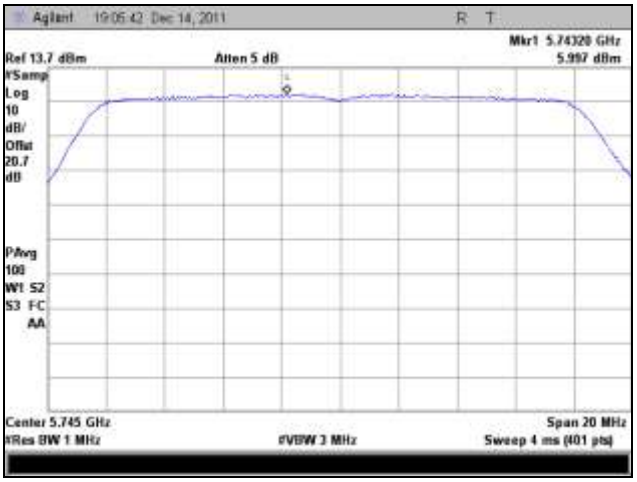
  

| Mode | Frequency (MHz) | PSD (dBm) Port 1 | PSD (dBm) Port 2 | PSD (dBm) Port 3 | Sum (mW) | Sum (dBm) | Limit (dBm) | Delta |
|---|---|---|---|---|---|---|---|---|
| 802.11a | 5745 | 5.997 | - | - | - | - | 14 | -8.003 |
| | 5785 | 5.270 | - | - | - | - | 14 | -8.730 |
| | 5805 | 5.154 | - | - | - | - | 14 | -8.846 |
| 802.11n 5 MHz | 5745 | 8.786 | 9.048 | 8.881 | 23.322 | 13.678 | 14 | -0.322 |
| | 5785 | 8.921 | 8.482 | 8.888 | 22.591 | 13.539 | 14 | -0.460 |
| | 5805 | 8.876 | 8.192 | 8.810 | 21.918 | 13.408 | 14 | -0.592 |
| 802.11n 10MHz | 5745 | 8.162 | 8.229 | 8.229 | 19.852 | 12.978 | 14 | -1.022 |
| | 5785 | 7.515 | 8.421 | 8.421 | 19.547 | 12.911 | 14 | -1.089 |
| | 5805 | 8.098 | 8.103 | 8.103 | 19.376 | 12.873 | 14 | -1.127 |
| 802.11n 20MHz | 5745 | 5.143 | 5.524 | 5.072 | 10.051 | 10.022 | 14 | -3.978 |
| | 5785 | 6.757 | 8.938 | 8.684 | 19.956 | 13.001 | 14 | -0.999 |
| | 5805 | 5.41 | 5.382 | 4.773 | 9.930 | 9.969 | 14 | -4.031 |
| 802.11n 40MHz | 5755 | -0.043 | 2.679 | 0.308 | 3.917 | 5.929 | 14 | -8.071 |
| | 5795 | -0.692 | 1.727 | -1.103 | 3.117 | 4.937 | 14 | -9.063 |

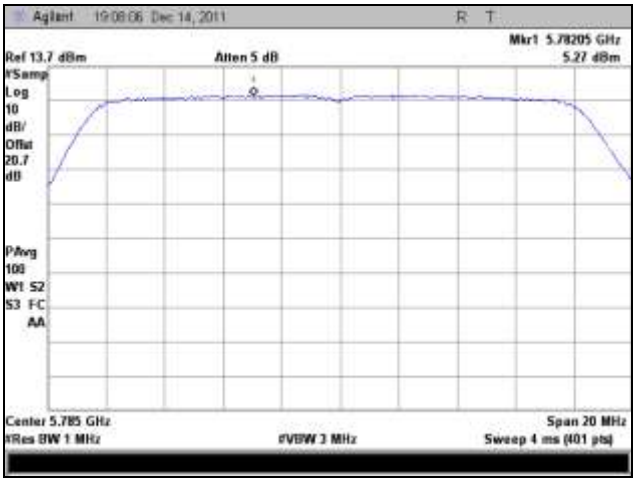
**Table 21. Power Spectral Density, Test Results**

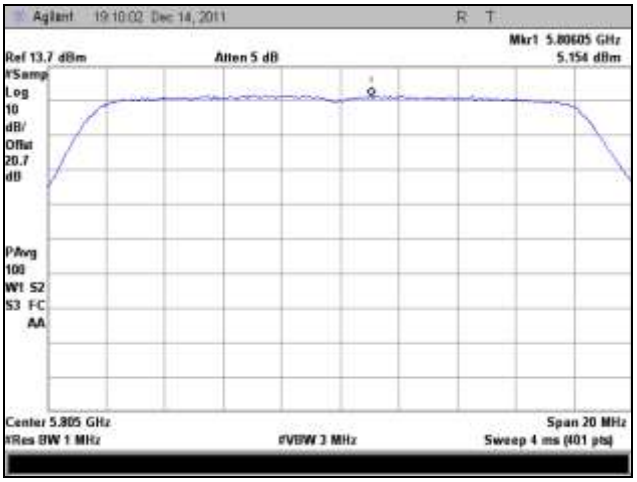
## Power Spectral Density, 802.11a




**Plot 116. Power Spectral Density, Low Channel, 802.11a**



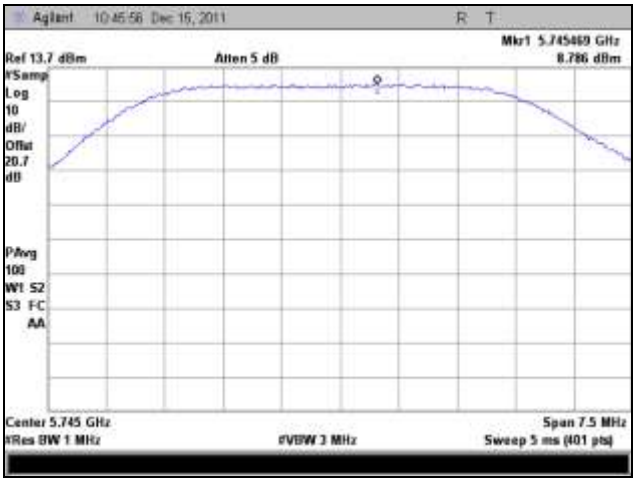

**Plot 117. Power Spectral Density, Mid Channel, 802.11a**



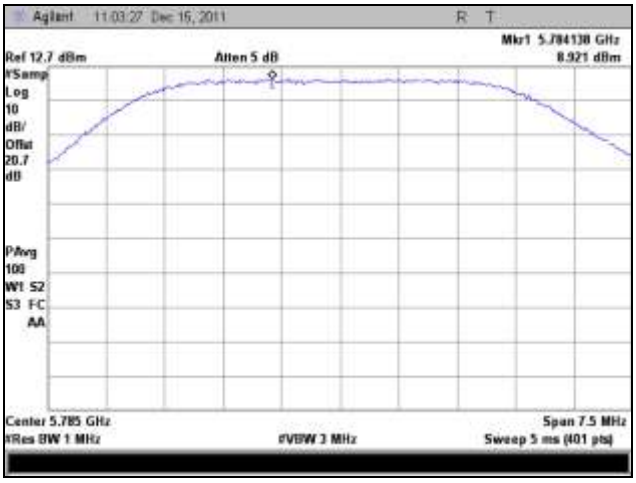

**Plot 118. Power Spectral Density, High Channel, 802.11a**

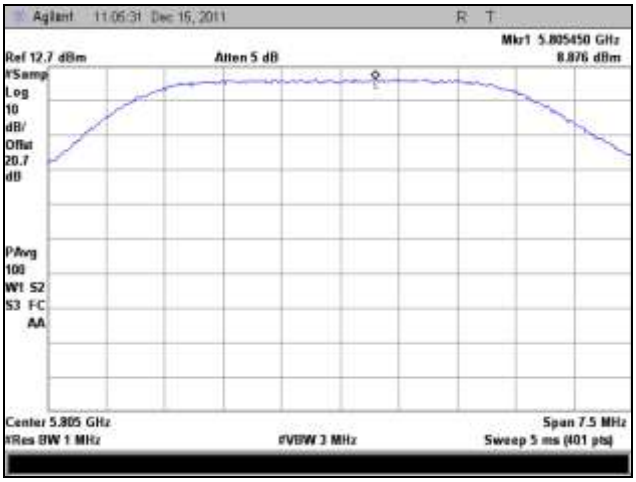
## Power Spectral Density, 802.11n 5 MHz, Port 1




**Plot 119. Power Spectral Density, Low Channel, 802.11n 5 MHz, Port 1**



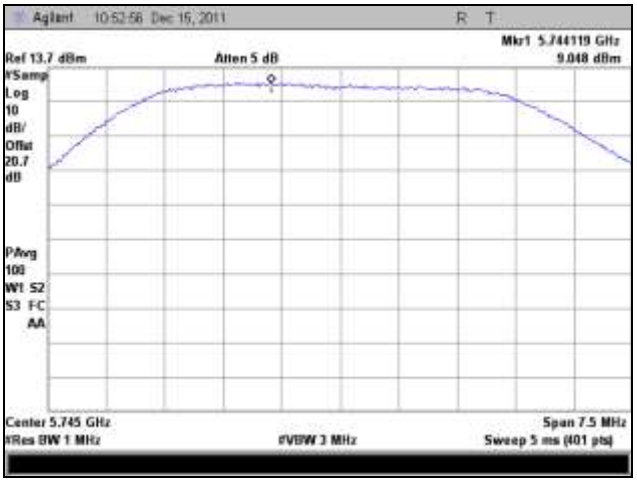

**Plot 120. Power Spectral Density, Mid Channel, 802.11n 5 MHz, Port 1**



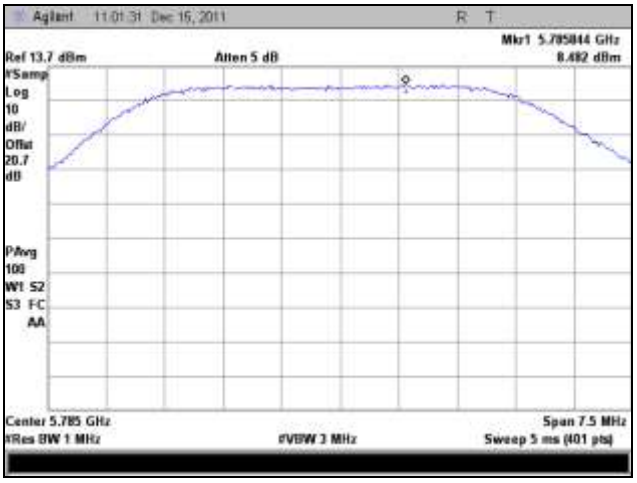

**Plot 121. Power Spectral Density, High Channel, 802.11n 5 MHz, Port 1**

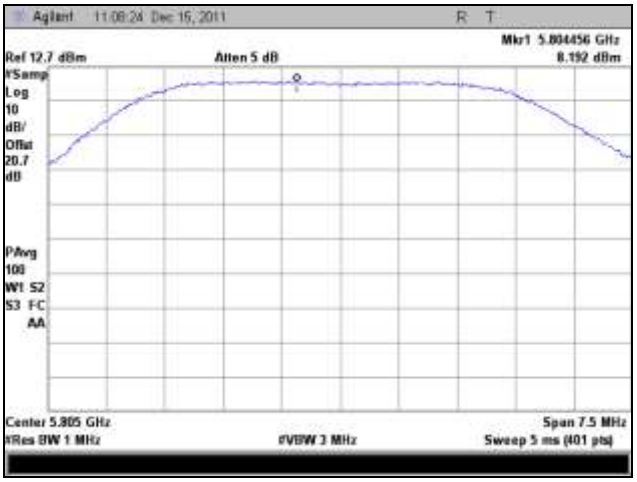
## Power Spectral Density, 802.11n 5 MHz, Port 2




**Plot 122. Power Spectral Density, Low Channel, 802.11n 5 MHz, Port 2**



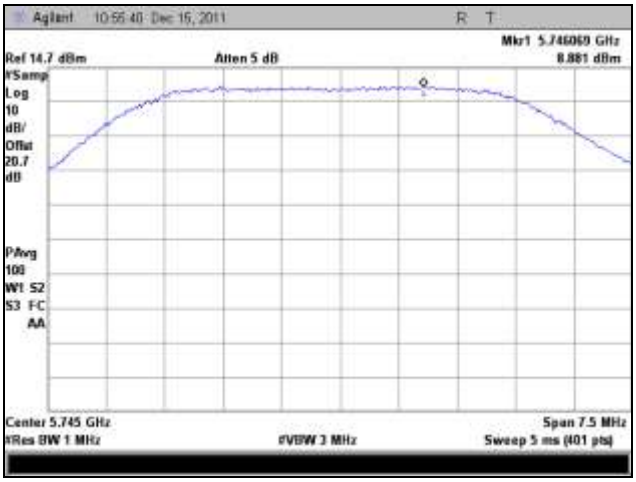

**Plot 123. Power Spectral Density, Mid Channel, 802.11n 5 MHz, Port 2**



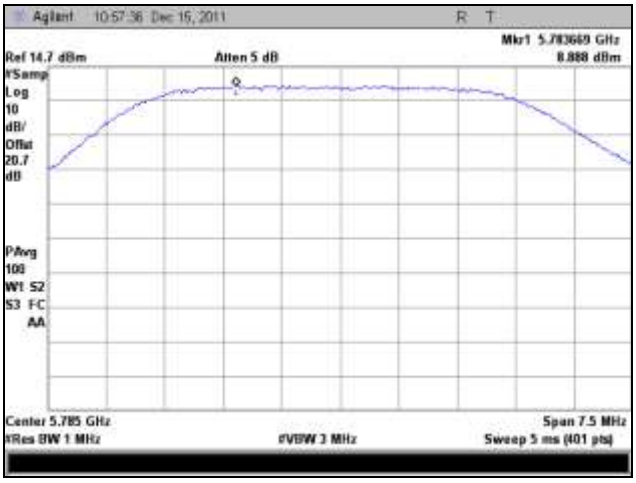

**Plot 124. Power Spectral Density, High Channel, 802.11n 5 MHz, Port 2**

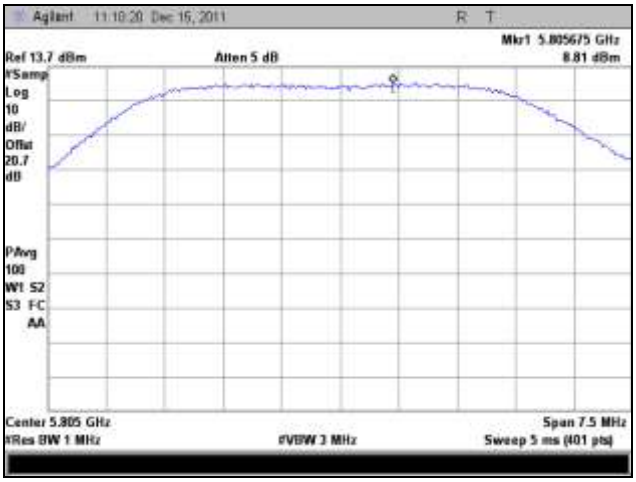
## Power Spectral Density, 802.11n 5 MHz, Port 3




**Plot 125. Power Spectral Density, Low Channel, 802.11n 5 MHz, Port 3**



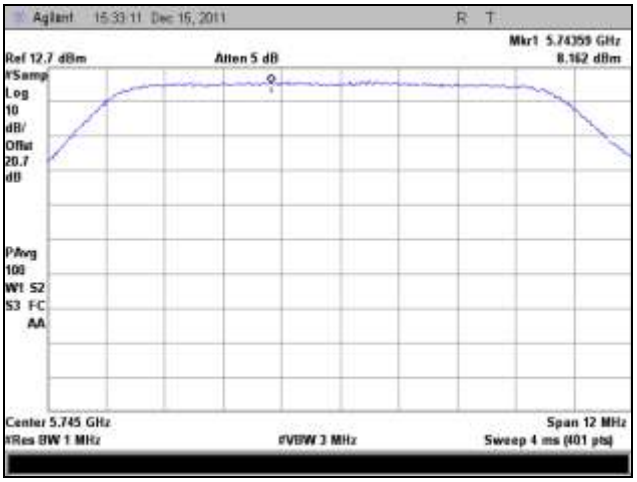

**Plot 126. Power Spectral Density, Mid Channel, 802.11n 5 MHz, Port 3**



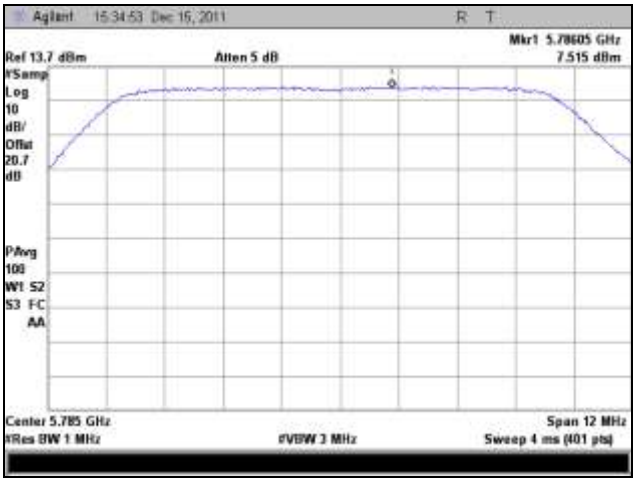

**Plot 127. Power Spectral Density, High Channel, 802.11n 5 MHz, Port 3**

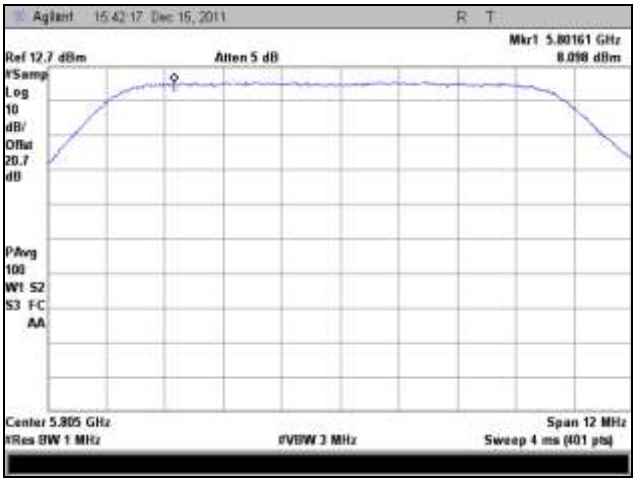
## Power Spectral Density, 802.11n 10 MHz, Port 1




**Plot 128. Power Spectral Density, Low Channel, 802.11n 10 MHz, Port 1**



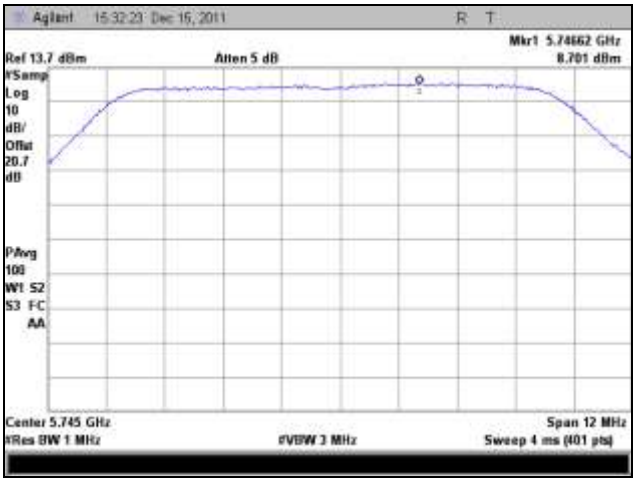

**Plot 129. Power Spectral Density, Mid Channel, 802.11n 10 MHz, Port 1**



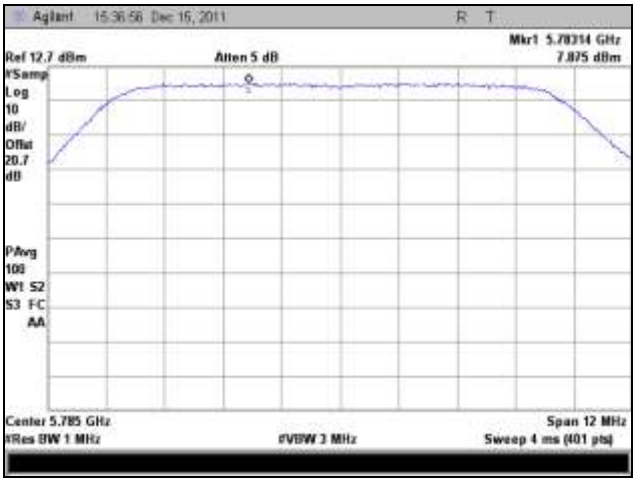

**Plot 130. Power Spectral Density, High Channel, 802.11n 10 MHz, Port 1**

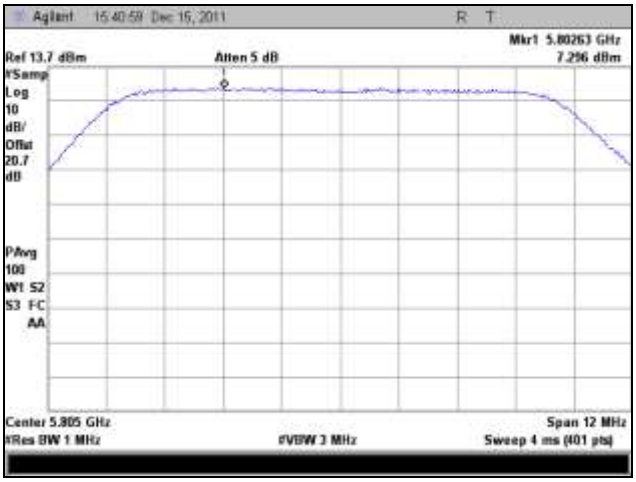
## Power Spectral Density, 802.11n 10 MHz, Port 2




**Plot 131. Power Spectral Density, Low Channel, 802.11n 10 MHz, Port 2**



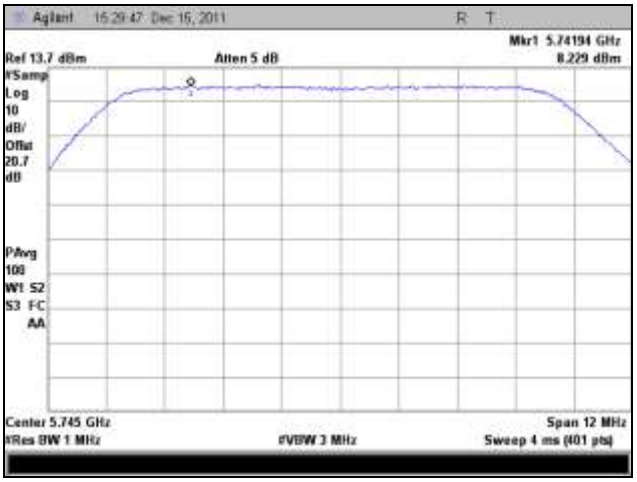

**Plot 132. Power Spectral Density, Mid Channel, 802.11n 10 MHz, Port 2**



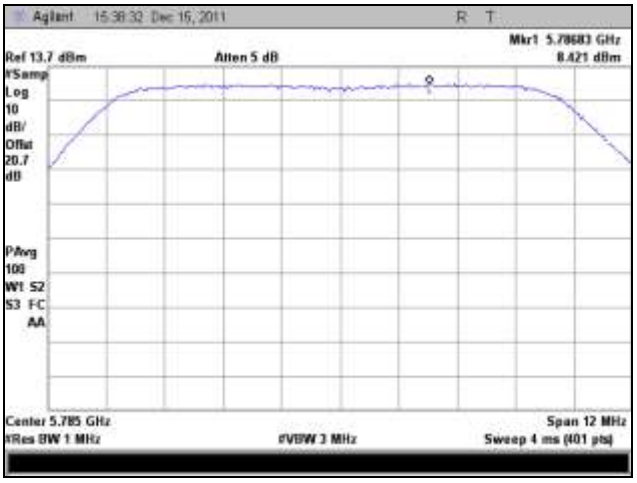

**Plot 133. Power Spectral Density, High Channel, 802.11n 10 MHz, Port 2**

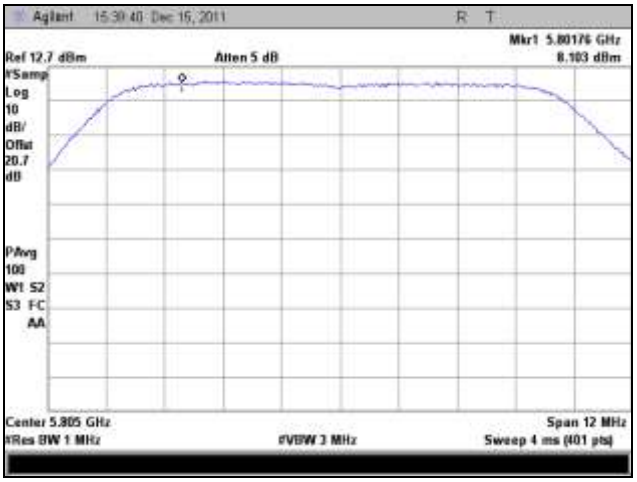
## Power Spectral Density, 802.11n 10 MHz, Port 3




**Plot 134. Power Spectral Density, Low Channel, 802.11n 10 MHz, Port 3**



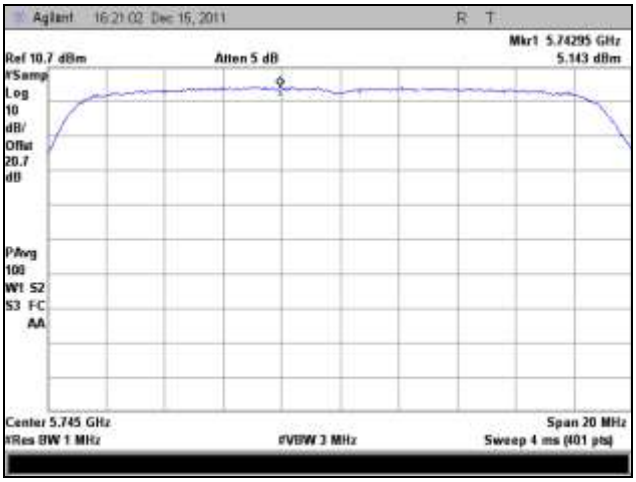

**Plot 135. Power Spectral Density, Mid Channel, 802.11n 10 MHz, Port 3**



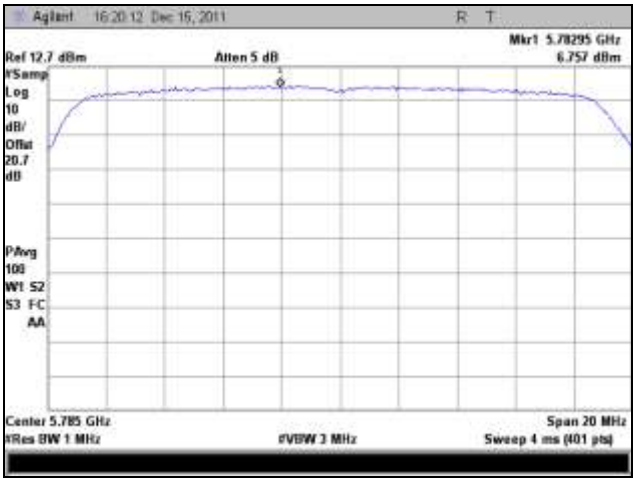

**Plot 136. Power Spectral Density, High Channel, 802.11n 10 MHz, Port 3**

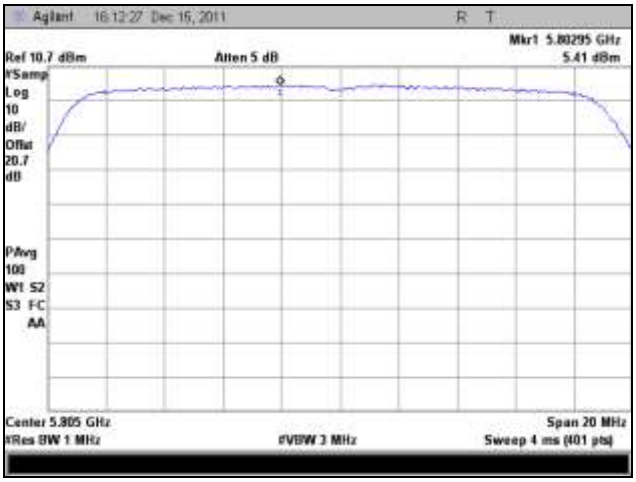
## Power Spectral Density, 802.11n 20 MHz, Port 1




**Plot 137. Power Spectral Density, Low Channel, 802.11n 20 MHz, Port 1**



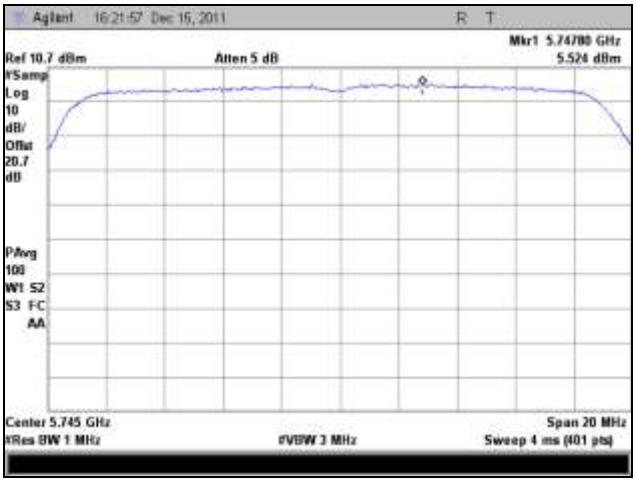

**Plot 138. Power Spectral Density, Mid Channel, 802.11n 20 MHz, Port 1**



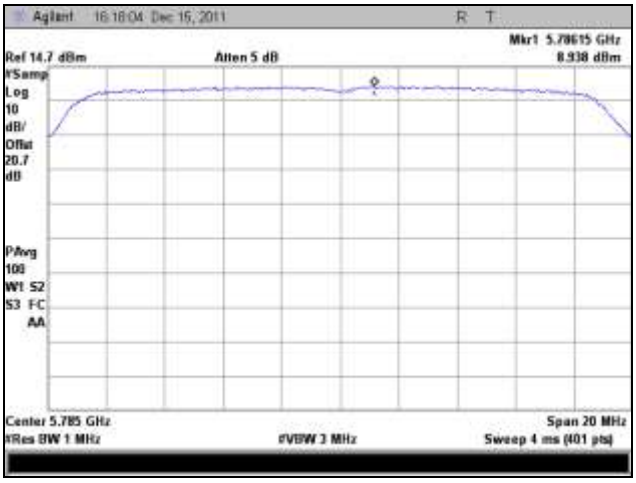

**Plot 139. Power Spectral Density, High Channel, 802.11n 20 MHz, Port 1**

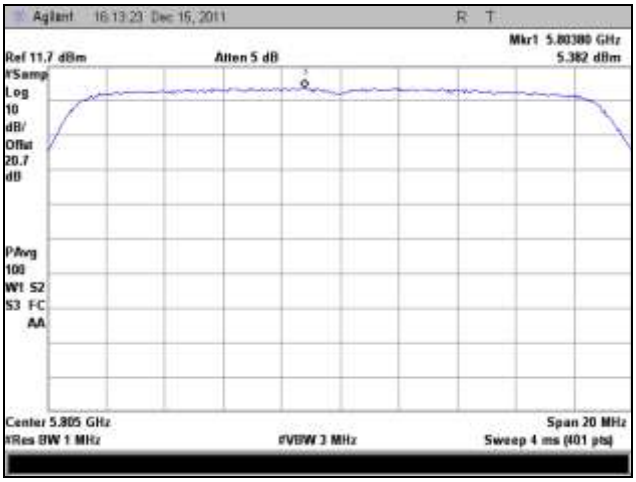
## Power Spectral Density, 802.11n 20 MHz, Port 2




**Plot 140. Power Spectral Density, Low Channel, 802.11n 20 MHz, Port 2**



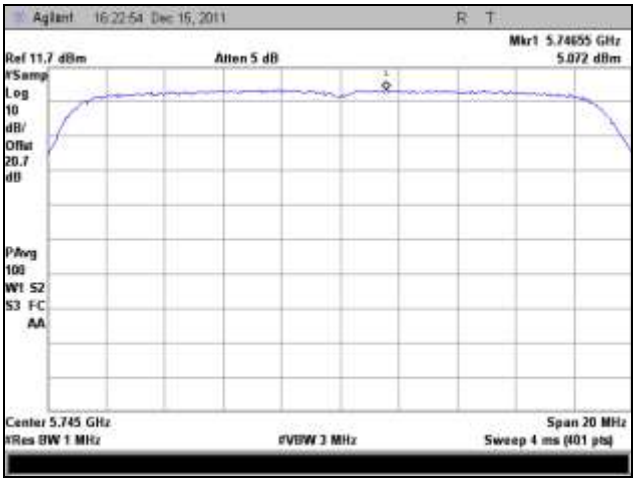

**Plot 141. Power Spectral Density, Mid Channel, 802.11n 20 MHz, Port 2**



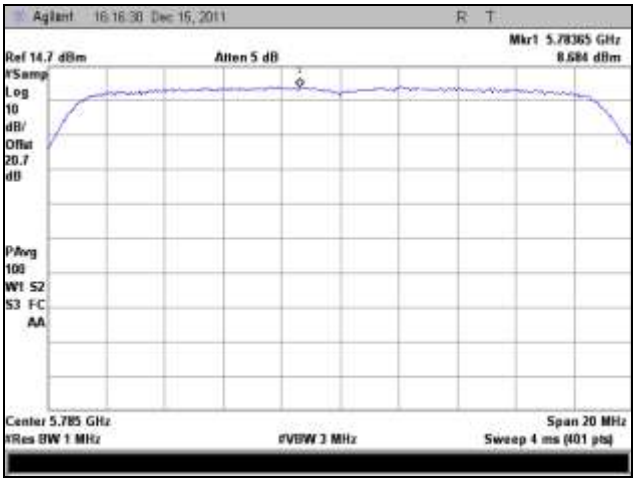

**Plot 142. Power Spectral Density, High Channel, 802.11n 20 MHz, Port 2**

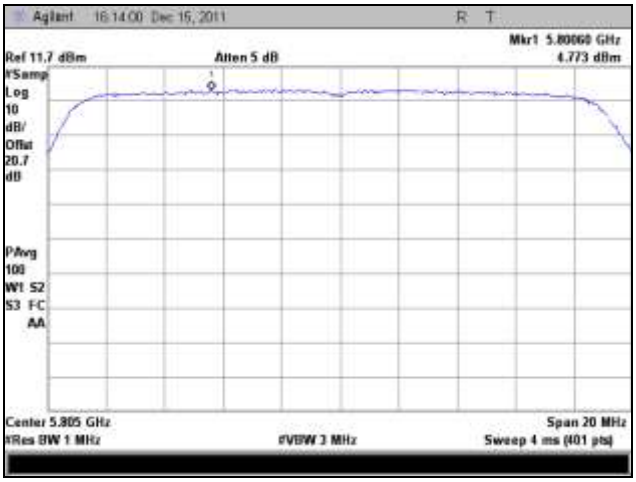
## Power Spectral Density, 802.11n 20 MHz, Port 3




**Plot 143. Power Spectral Density, Low Channel, 802.11n 20 MHz, Port 3**



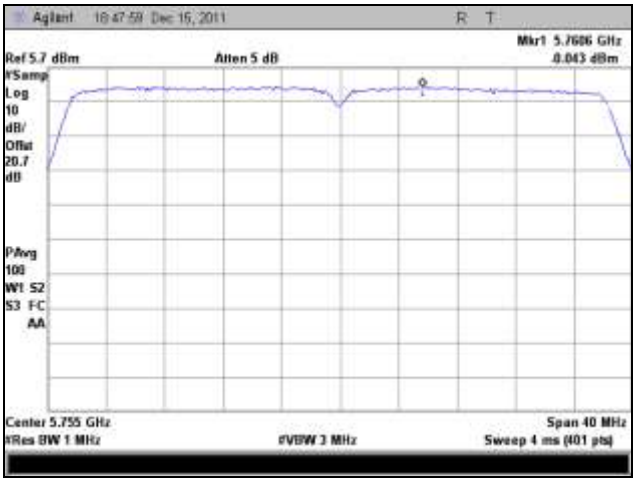

**Plot 144. Power Spectral Density, Mid Channel, 802.11n 20 MHz, Port 3**



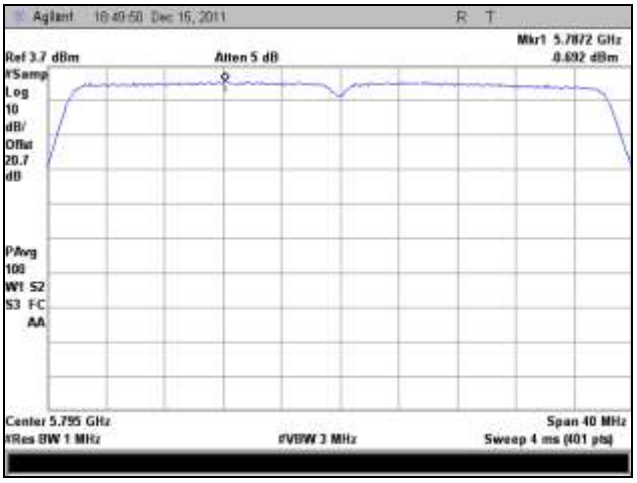

**Plot 145. Power Spectral Density, High Channel, 802.11n 20 MHz, Port 3**

## Power Spectral Density, 802.11n 40 MHz, Port 1



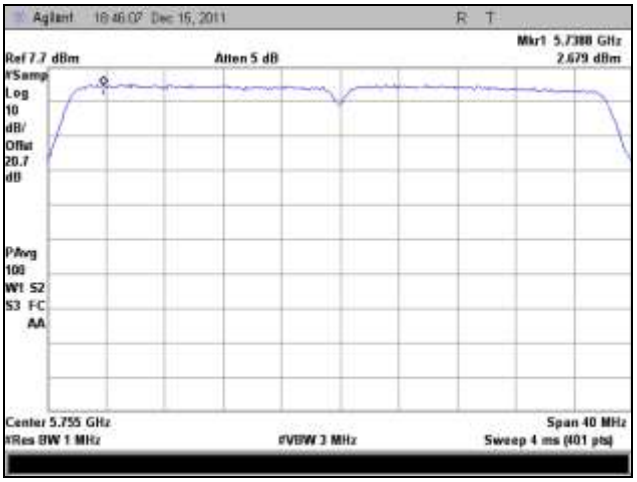

**Plot 146. Power Spectral Density, Low Channel, 802.11n 40 MHz, Port 1**



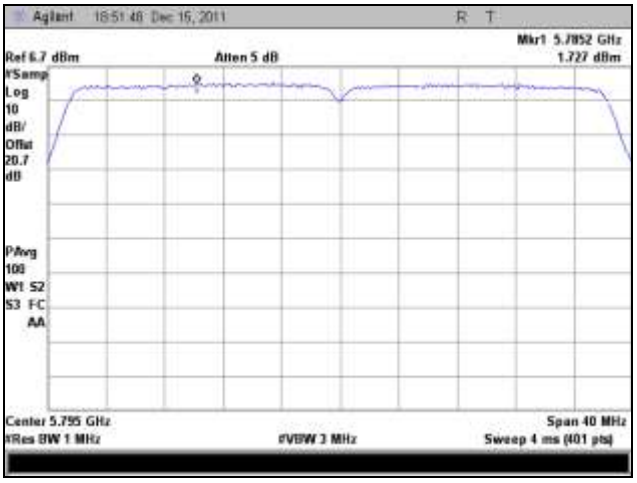

**Plot 147. Power Spectral Density, High Channel, 802.11n 40 MHz, Port 1**

## Power Spectral Density, 802.11n 40 MHz, Port 2



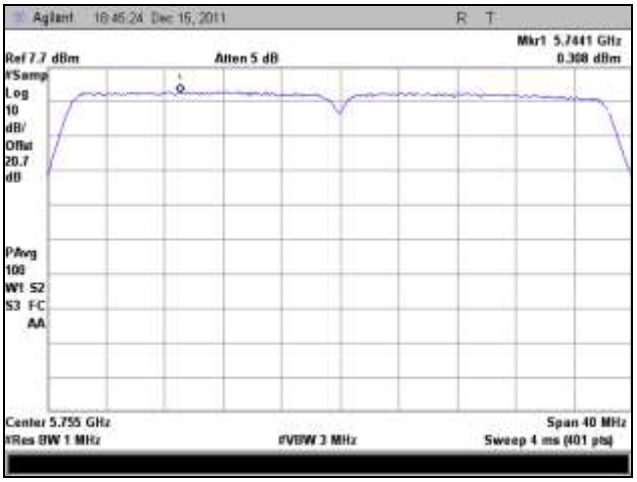

**Plot 148. Power Spectral Density, Low Channel, 802.11n 40 MHz, Port 2**



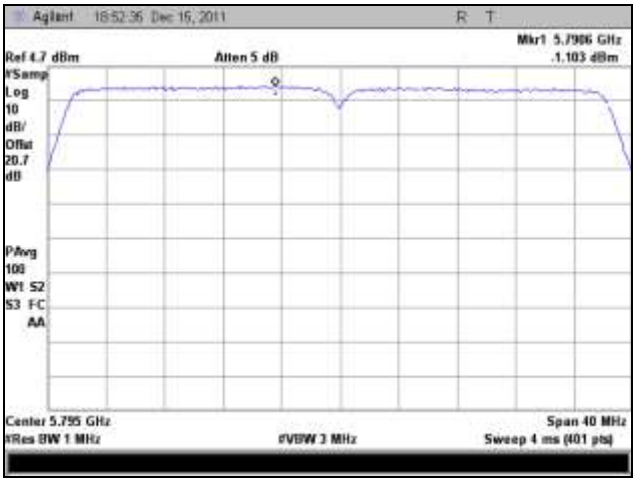

**Plot 149. Power Spectral Density, High Channel, 802.11n 40 MHz, Port 2**

## Power Spectral Density, 802.11n 40 MHz, Port 3




**Plot 150. Power Spectral Density, Low Channel, 802.11n 40 MHz, Port 3**




**Plot 151. Power Spectral Density, High Channel, 802.11n 40 MHz, Port 3**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.407(a)(6) Peak Excursion Ratio

**Test Requirements:** **§ 15.407(a)(6):** The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**Test Procedure:** The EUT was connected directly to the spectrum analyzer through cabling and attenuation. The 1st trace on the spectrum analyzer was set to RBW=1MHz, VBW=3MHz. The peak detector mode was used and the trace max held. The 2nd trace on the spectrum analyzer was set according to measurement method #SA-1 from the FCC Publication 789033 D01 UNII General Test Procedures v01 for making conducted power measurements.

**Test Results:** Equipment was compliant with the peak excursion ratio limits of **§ 15.407(a)(6).** The peak excursion ratio was determined from plots on the following page(s).

**Test Engineer(s):** Lionel Gabrillo

**Test Date(s):** 11/02/11

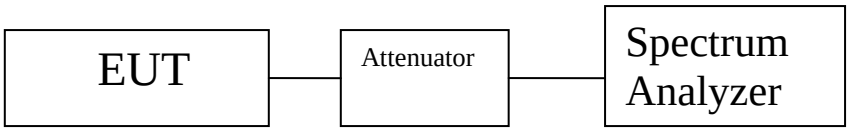
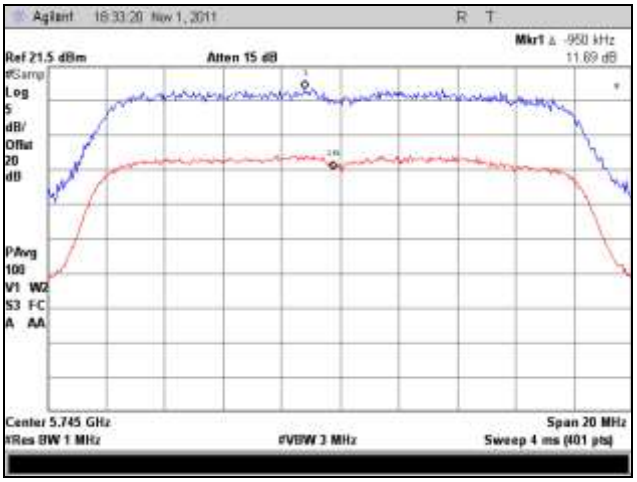


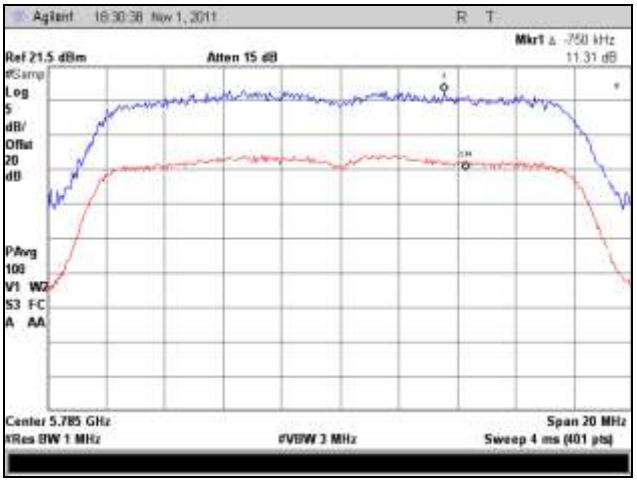

**Figure 5. Peak Excursion Ration Test Setup**

## Peak Excursion Ratio, 802.11a




**Plot 152. Peak Excursion Ratio, Low Channel, 802.11a**

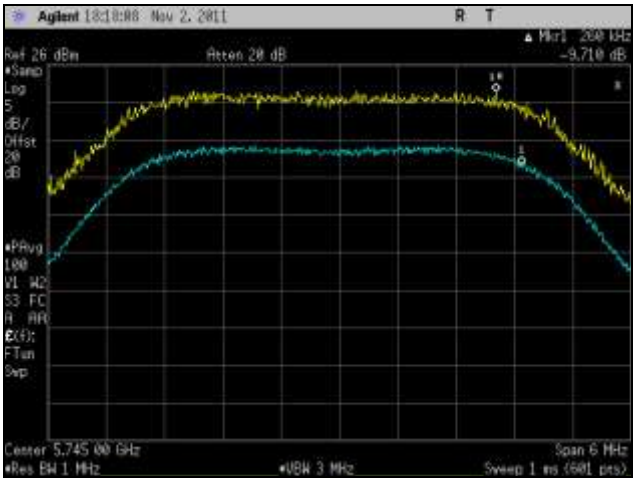



**Plot 153. Peak Excursion Ratio, Mid Channel, 802.11a**

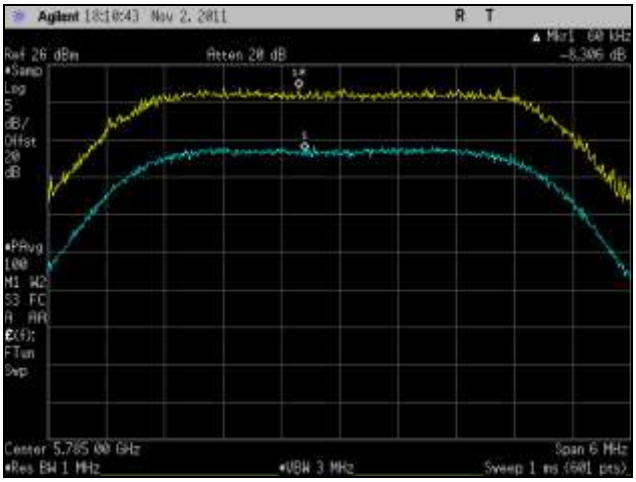

**Plot 154. Peak Excursion Ratio, High Channel, 802.11a**

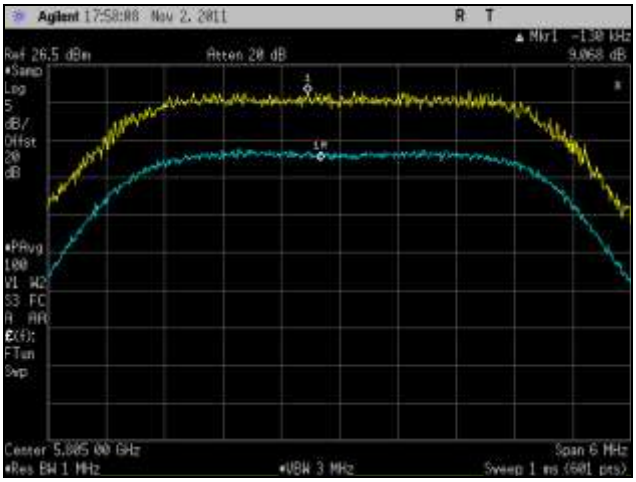
## Peak Excursion Ratio, 802.11n 5 MHz, Port 1




**Plot 155. Peak Excursion Ratio, Low Channel, 802.11n 5 MHz, Port 1**



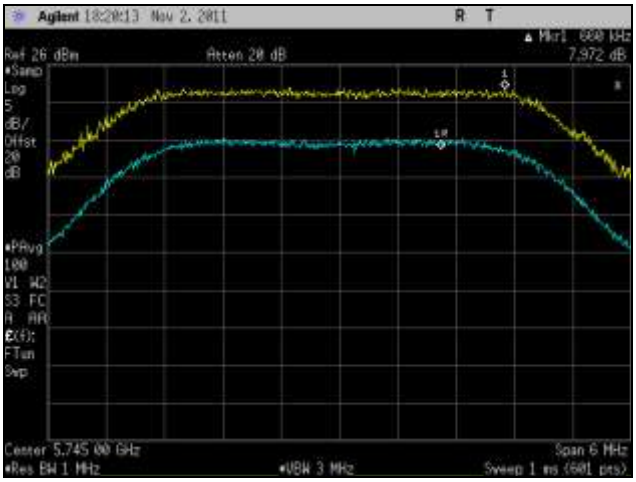

**Plot 156. Peak Excursion Ratio, Mid Channel, 802.11n 5 MHz, Port 1**



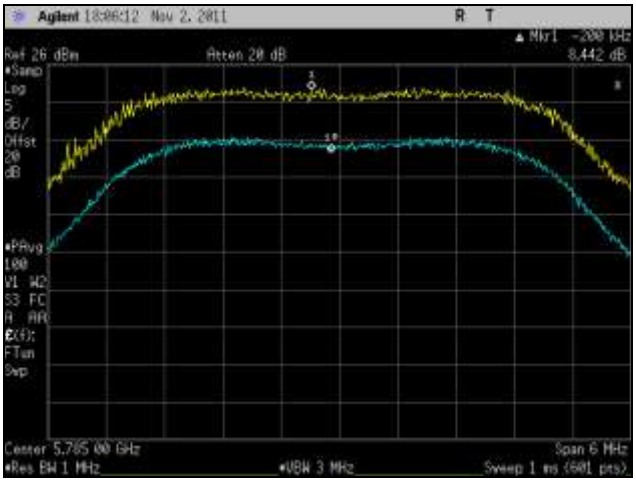

**Plot 157. Peak Excursion Ratio, High Channel, 802.11n 5 MHz, Port 1**

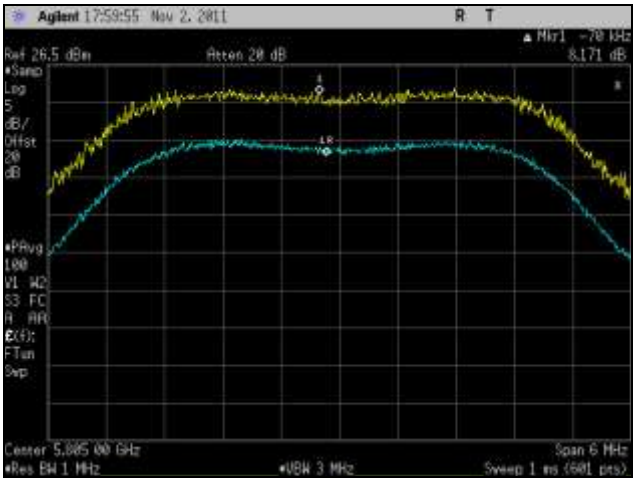
## Peak Excursion Ratio, 802.11n 5 MHz, Port 2




**Plot 158. Peak Excursion Ratio, Low Channel, 802.11n 5 MHz, Port 2**



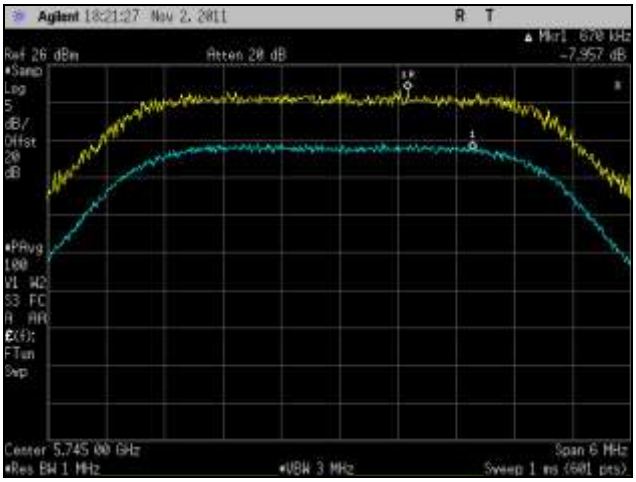

**Plot 159. Peak Excursion Ratio, Mid Channel, 802.11n 5 MHz, Port 2**



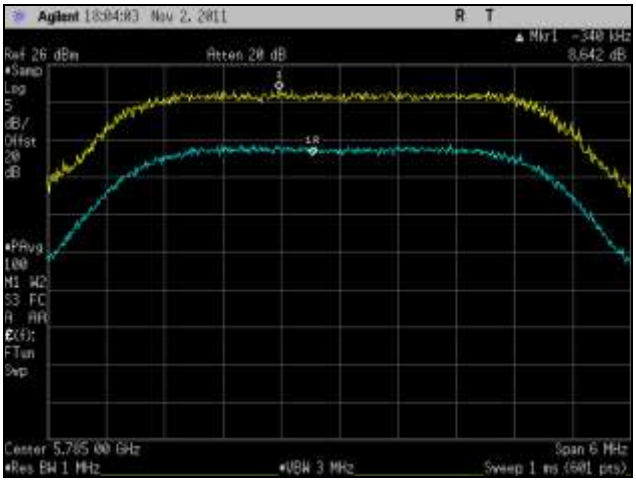

**Plot 160. Peak Excursion Ratio, High Channel, 802.11n 5 MHz, Port 2**

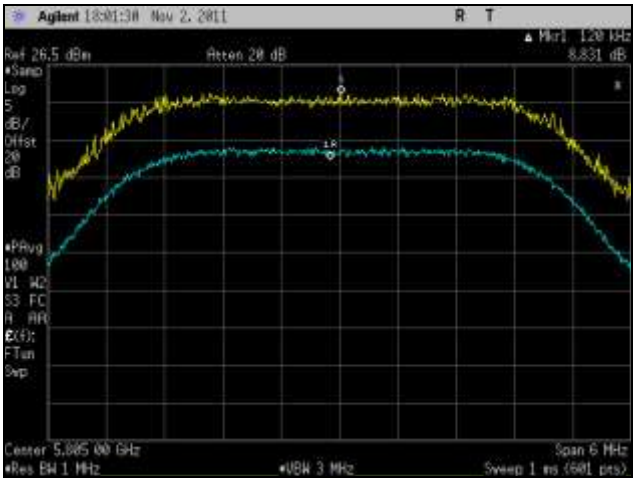
## Peak Excursion Ratio, 802.11n 5 MHz, Port 3




**Plot 161. Peak Excursion Ratio, Low Channel, 802.11n 5 MHz, Port 3**



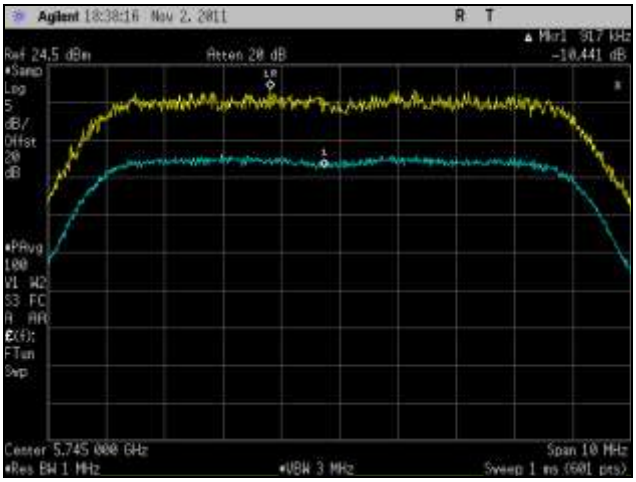

**Plot 162. Peak Excursion Ratio, Mid Channel, 802.11n 5 MHz, Port 3**



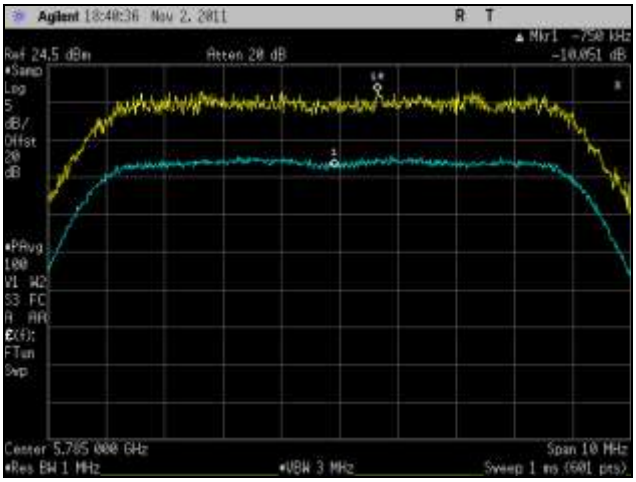

**Plot 163. Peak Excursion Ratio, High Channel, 802.11n 5 MHz, Port 3**

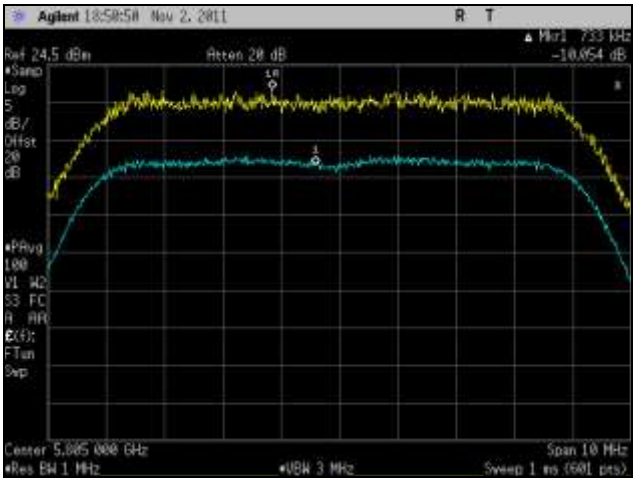
## Peak Excursion Ratio, 802.11n 10 MHz, Port 1




**Plot 164. Peak Excursion Ratio, Low Channel, 802.11n 10 MHz, Port 1**



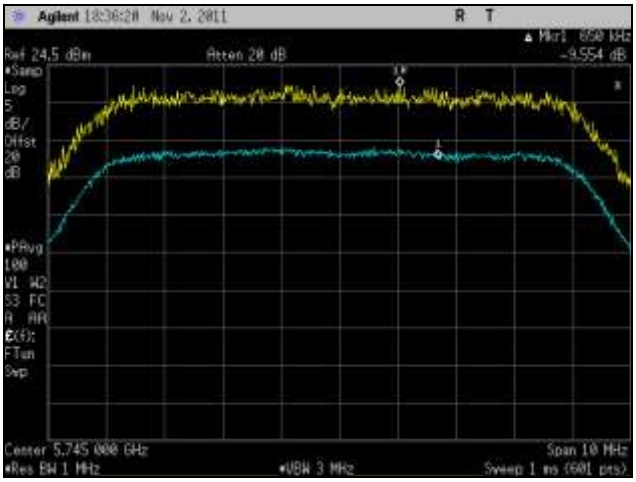

**Plot 165. Peak Excursion Ratio, Mid Channel, 802.11n 10 MHz, Port 1**



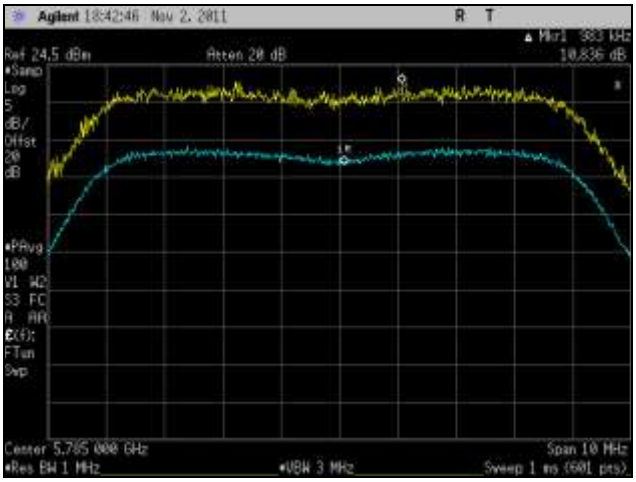

**Plot 166. Peak Excursion Ratio, High Channel, 802.11n 10 MHz, Port 1**

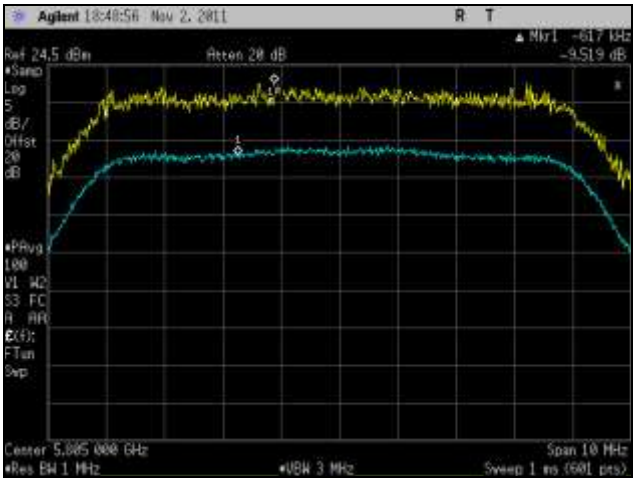
## Peak Excursion Ratio, 802.11n 10 MHz, Port 2




**Plot 167. Peak Excursion Ratio, Low Channel, 802.11n 10 MHz, Port 2**



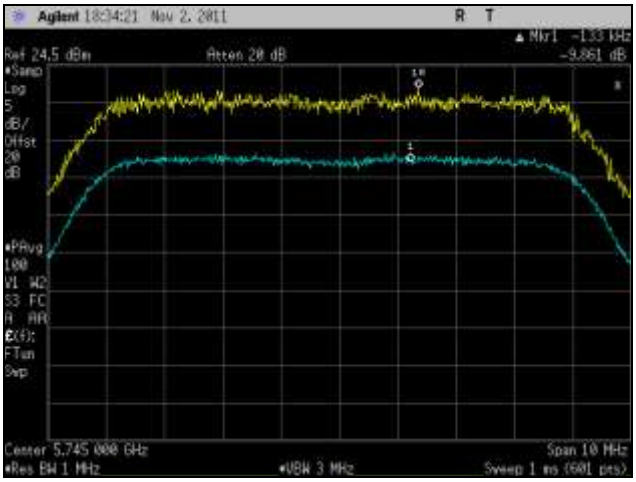

**Plot 168. Peak Excursion Ratio, Mid Channel, 802.11n 10 MHz, Port 2**



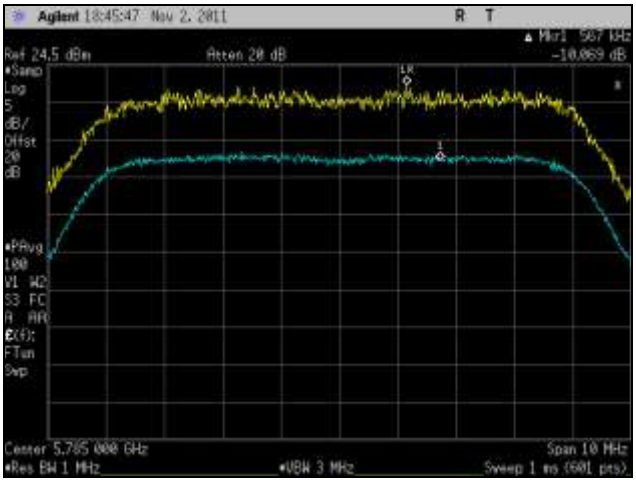

**Plot 169. Peak Excursion Ratio, High Channel, 802.11n 10 MHz, Port 2**

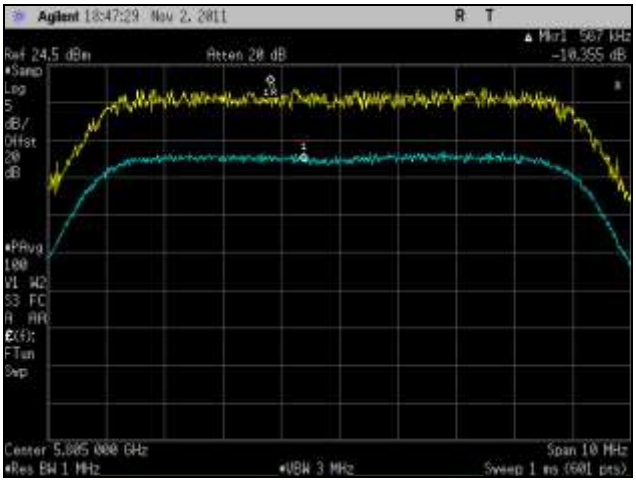
## Peak Excursion Ratio, 802.11n 10 MHz, Port 3




**Plot 170. Peak Excursion Ratio, Low Channel, 802.11n 10 MHz, Port 3**



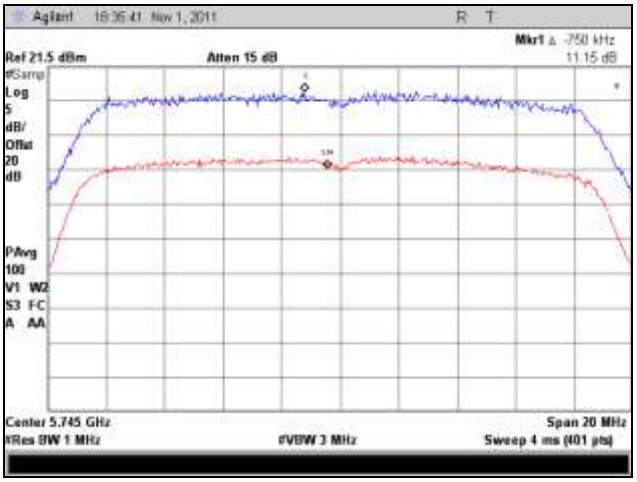

**Plot 171. Peak Excursion Ratio, Mid Channel, 802.11n 10 MHz, Port 3**



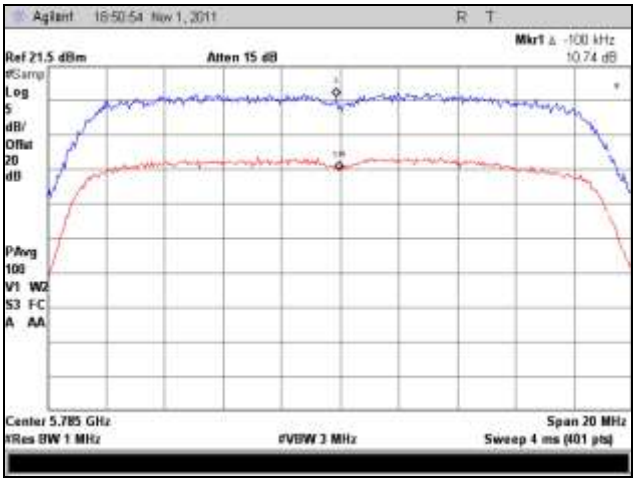

**Plot 172. Peak Excursion Ratio, High Channel, 802.11n 10 MHz, Port 3**

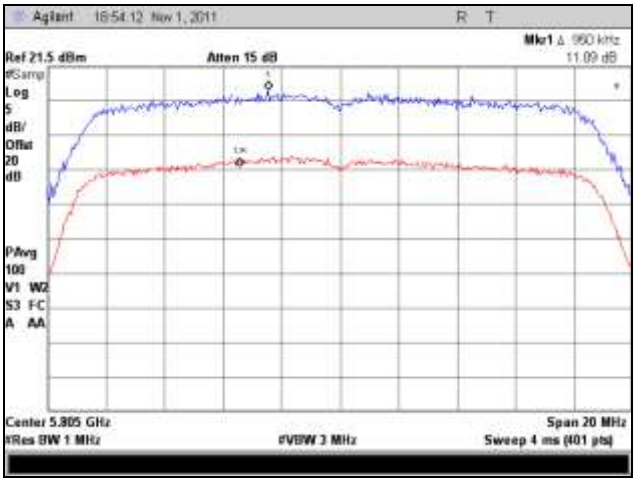
## Peak Excursion Ratio, 802.11n 20 MHz, Port 1




**Plot 173. Peak Excursion Ratio, Low Channel, 802.11n 20 MHz, Port 1**



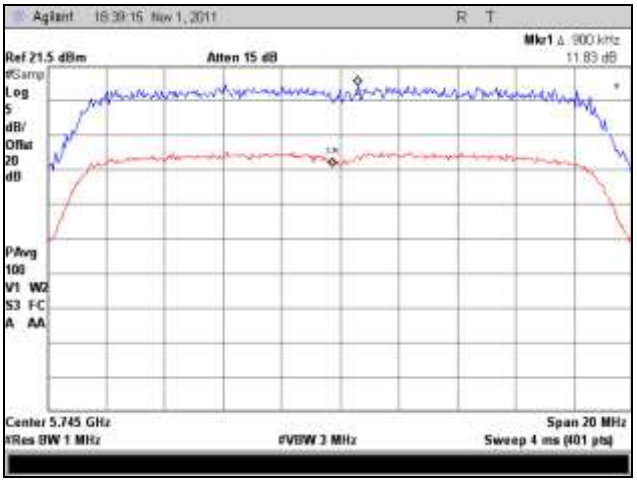

**Plot 174. Peak Excursion Ratio, Mid Channel, 802.11n 20 MHz, Port 1**



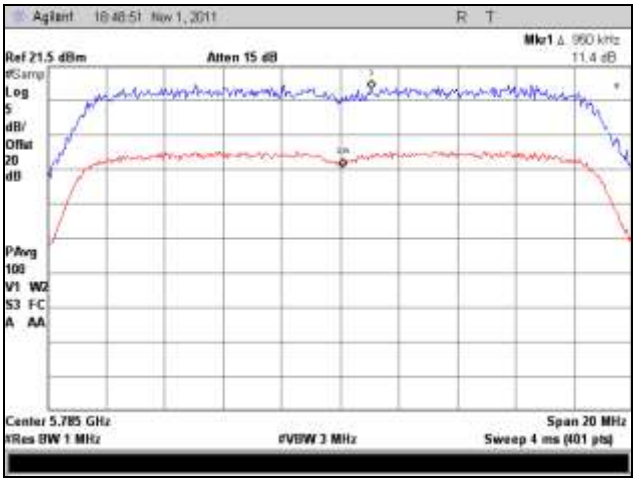

**Plot 175. Peak Excursion Ratio, High Channel, 802.11n 20 MHz, Port 1**

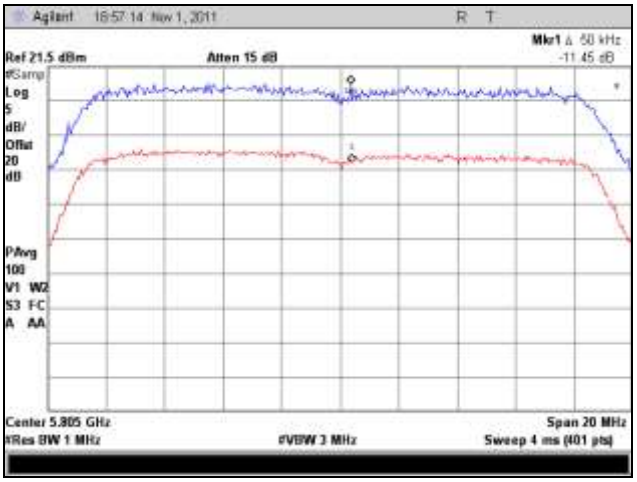
## Peak Excursion Ratio, 802.11n 20 MHz, Port 2




**Plot 176. Peak Excursion Ratio, Low Channel, 802.11n 20 MHz, Port 2**



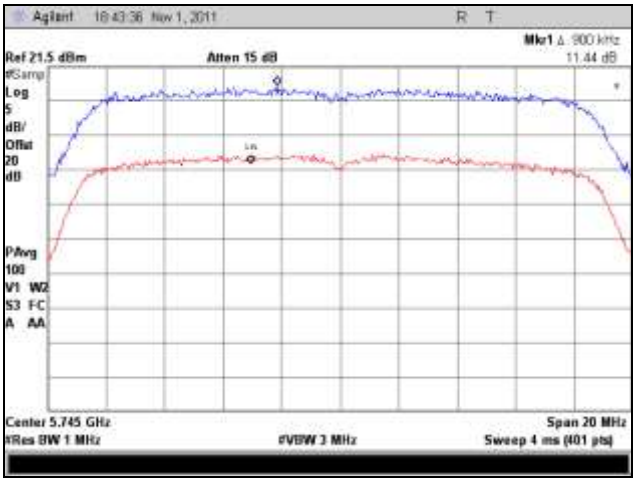

**Plot 177. Peak Excursion Ratio, Mid Channel, 802.11n 20 MHz, Port 2**



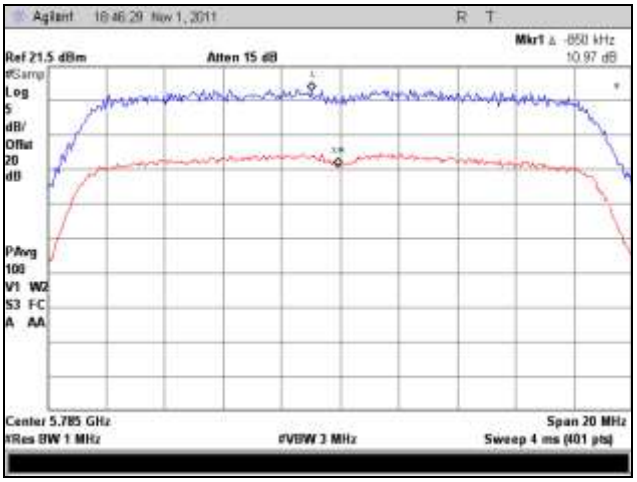

**Plot 178. Peak Excursion Ratio, High Channel, 802.11n 20 MHz, Port 2**

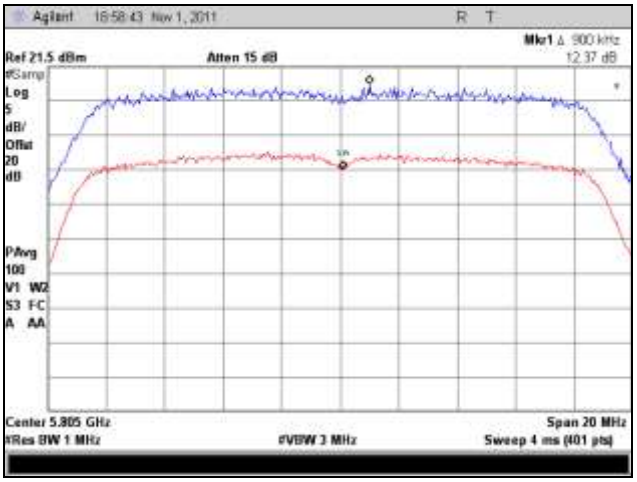
## Peak Excursion Ratio, 802.11n 20 MHz, Port 3




**Plot 179. Peak Excursion Ratio, Low Channel, 802.11n 20 MHz, Port 3**



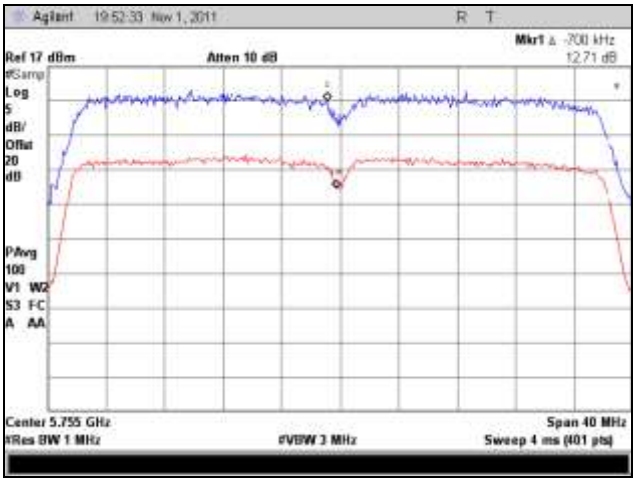

**Plot 180. Peak Excursion Ratio, Mid Channel, 802.11n 20 MHz, Port 3**



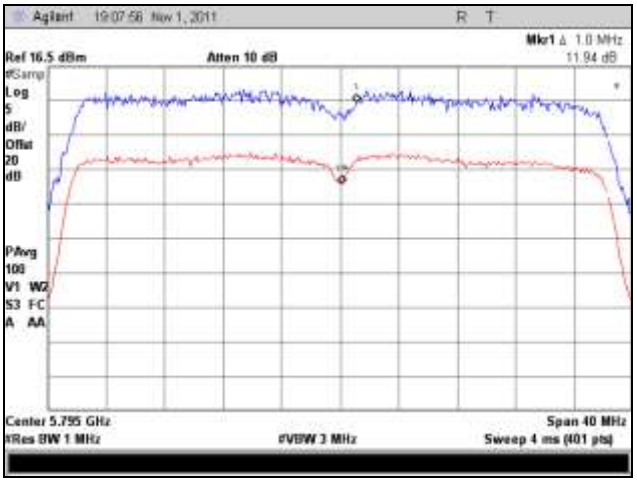

**Plot 181. Peak Excursion Ratio, High Channel, 802.11n 20 MHz, Port 3**

## Peak Excursion Ratio, 802.11n 40 MHz, Port 2



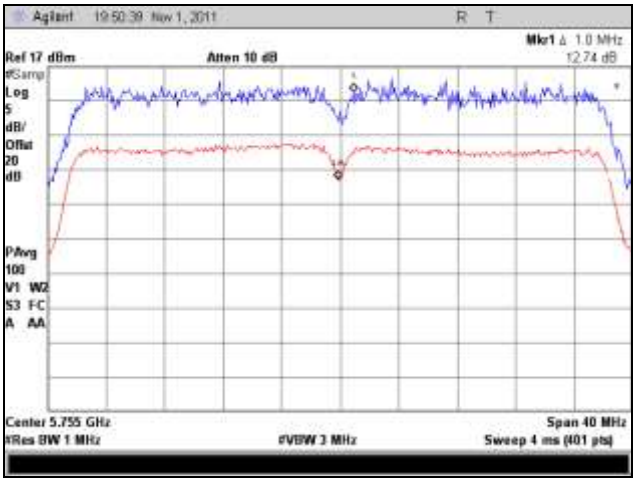

**Plot 182. Peak Excursion Ratio, Low Channel, 802.11n 40 MHz, Port 2**



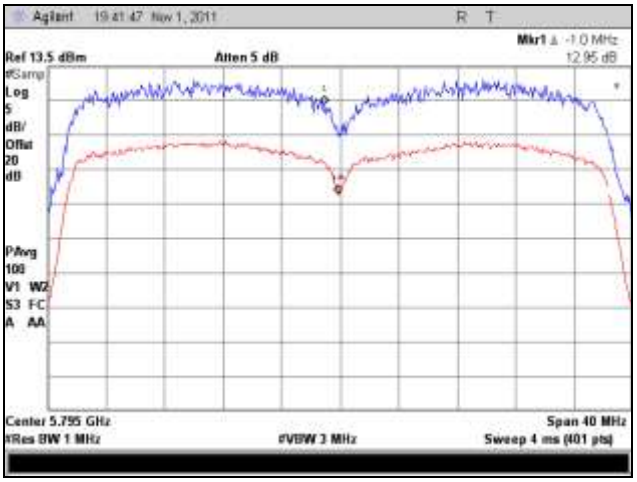

**Plot 183. Peak Excursion Ratio, High Channel, 802.11n 40 MHz, Port 2**

## Peak Excursion Ratio, 802.11n 40 MHz, Port 2



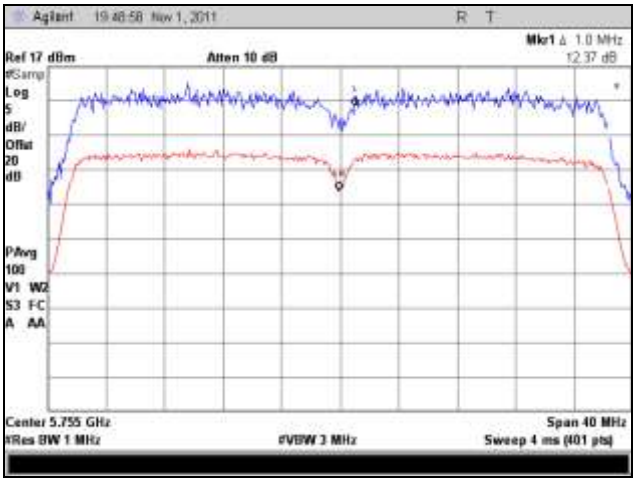

**Plot 184. Peak Excursion Ratio, Low Channel, 802.11n 40 MHz, Port 2**



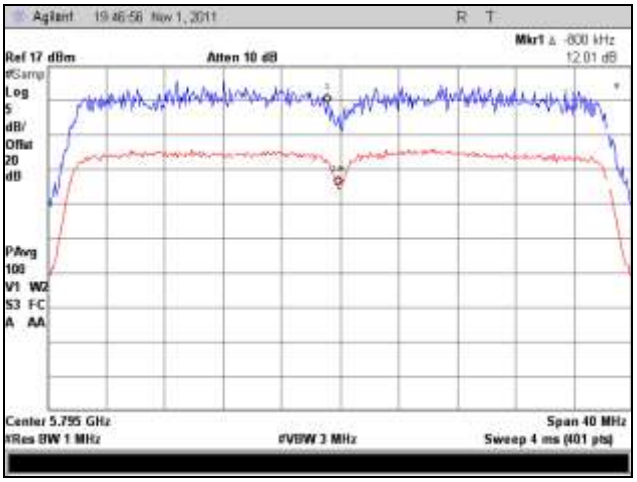

**Plot 185. Peak Excursion Ratio, High Channel, 802.11n 40 MHz, Port 2**

## Peak Excursion Ratio, 802.11n 40 MHz, Port 3




**Plot 186. Peak Excursion Ratio, Low Channel, 802.11n 40 MHz, Port 3**




**Plot 187. Peak Excursion Ratio, High Channel, 802.11n 40 MHz, Port 3**

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.407(b)(2), (3), (6), (7) Undesirable Emissions

**Test Requirements:** **§ 15.407(b)(2), (3), (6), (7)**; **§15.205:** Emissions outside the frequency band.

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

**§ 15.407(b)(3):** For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz**.**

**§ 15.407(b)(6):** Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Section 15.207.

**§ 15.407(b)(7):** The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

**Test Procedure:** The transmitter was placed on an 80cm wooden table inside in a semi-anechoic chamber. Measurements were performed with the EUT rotated 360 degrees and varying the adjustable antenna mast height to determine worst case orientation for maximum emissions.

For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

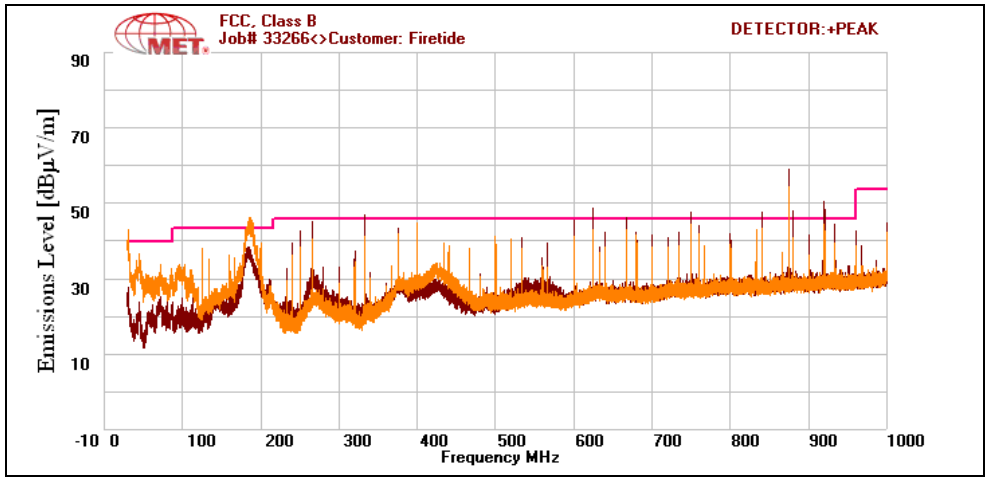
For measurements above 1 GHz, measurements were made with a Peak detector with 1 MHz resolution bandwidth. Where the spurious emissions fell into a restricted band, measurements were also made with an average detector to make sure they complied with 15.209 limits. Emissions were explored up to 40 GHz.
The equation, **EIRP= E + 20 log D – 104.8** was used to convert an EIRP limit to a field strength limit.
E = field strength (dBUv/m)
D = Reference measurement distance

**Test Results:** The EUT was compliant with the Radiated Emission limits for Intentional Radiators. See following pages for detailed test results.

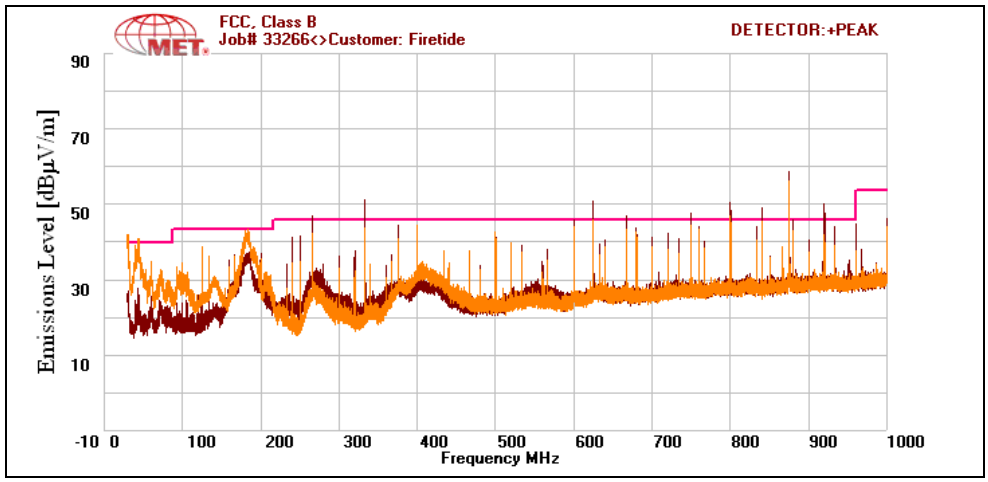
**Test Engineer(s):** Lionel Gabrillo

**Test Date(s):** 12/09/11

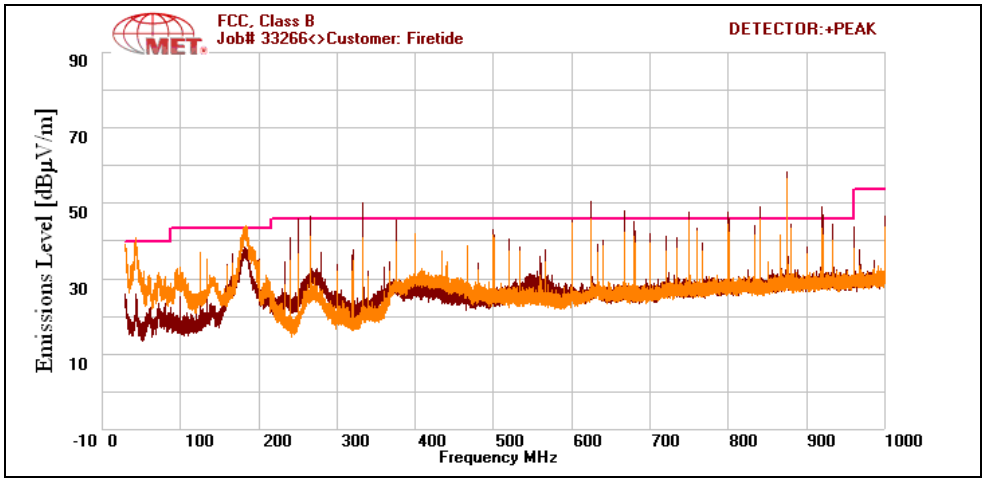
  




**Plot 188. Radiated Spurs, 802.11a, Radio Off, 9 dBi Omni**



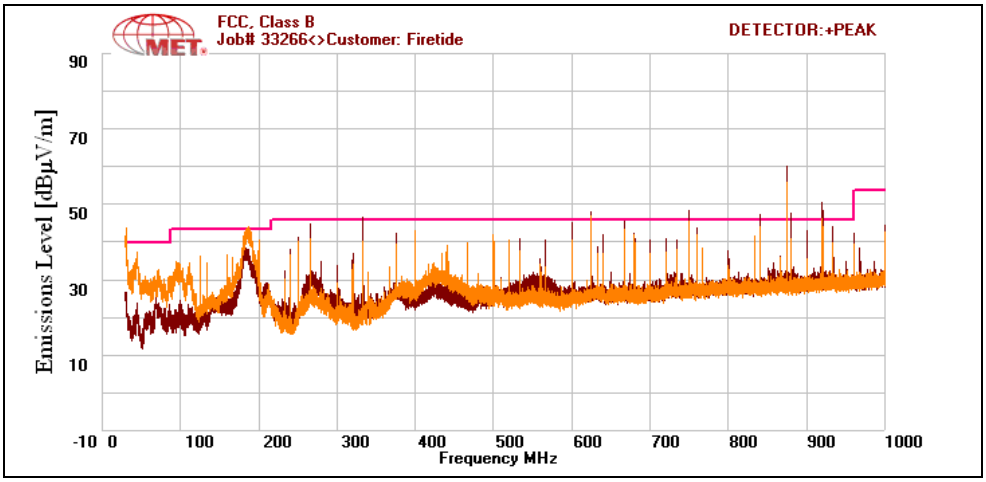

**Plot 189. Radiated Spurs, 802.11a, Radio Off, 15 dBi Sector**



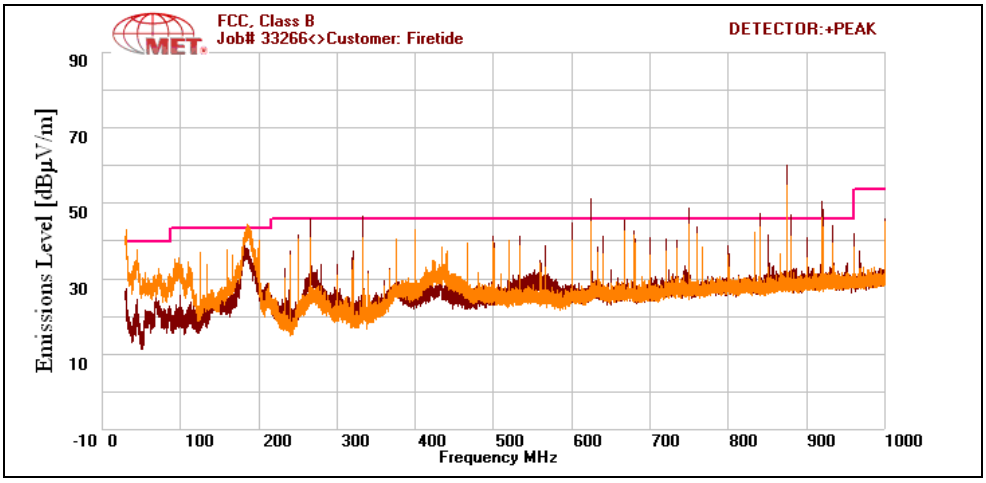

**Plot 190. Radiated Spurs, 802.11a, Radio Off, 16 dBi Panel**

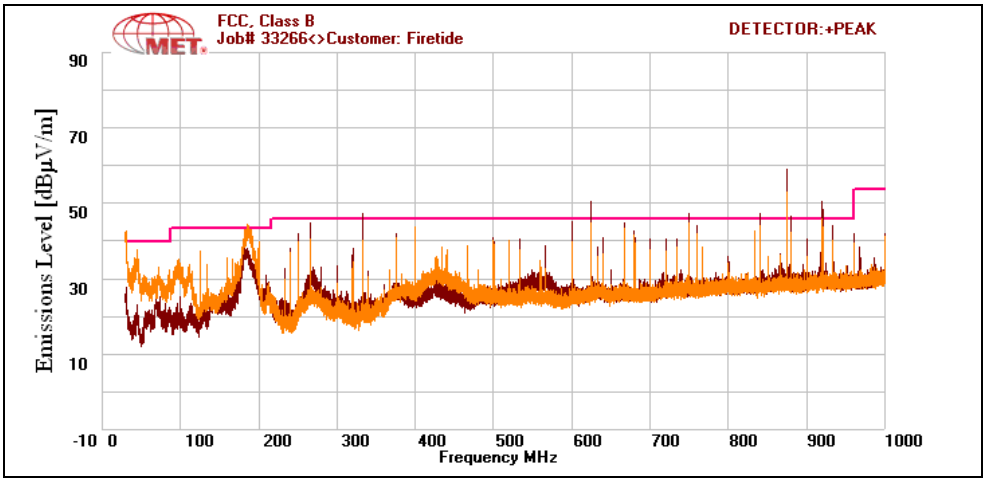
## Radiated Spurious Emissions, 802.11a, 9 dBi Omni




**Plot 191. Radiated Spurs, Low Channel, 802.11a, 9 dBi Omni**



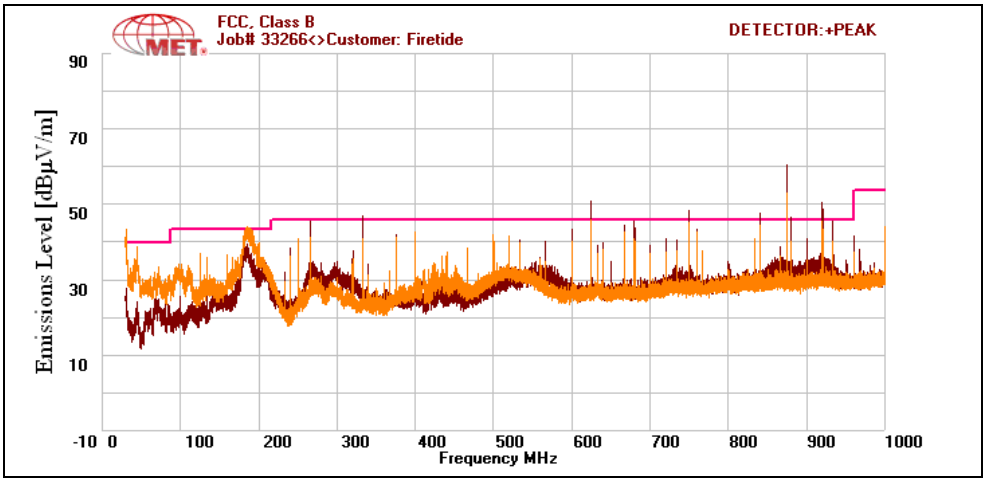

**Plot 192. Radiated Spurs, Mid Channel, 802.11a, 9 dBi Omni**



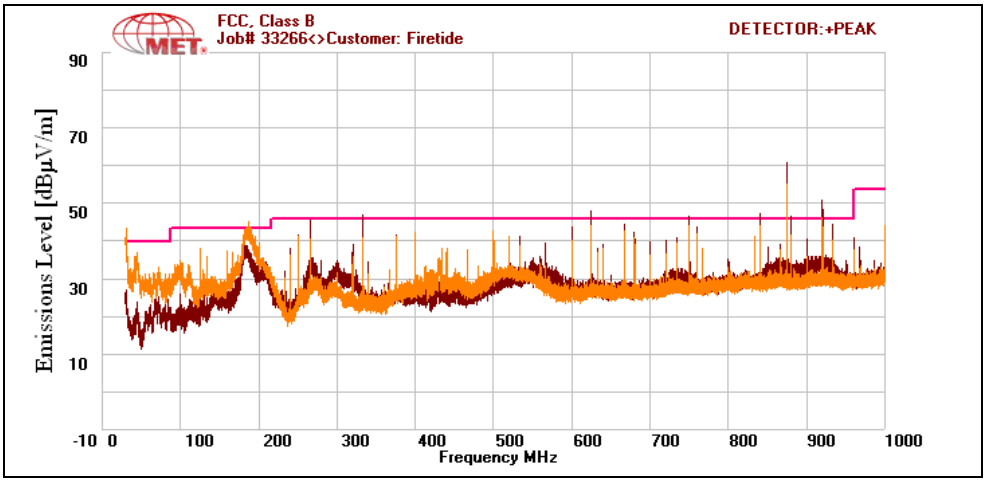

**Plot 193. Radiated Spurs, High Channel, 802.11a, 9 dBi Omni**

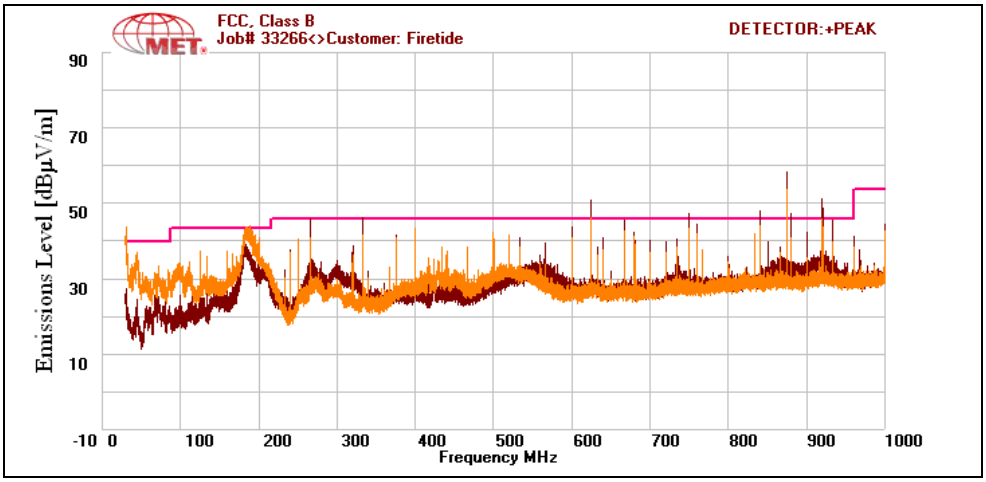
## Radiated Spurious Emissions, 802.11n 5 MHz, 9 dBi Omni




**Plot 194. Radiated Spurs, Low Channel, 802.11n 5 MHz, 9 dBi Omni**



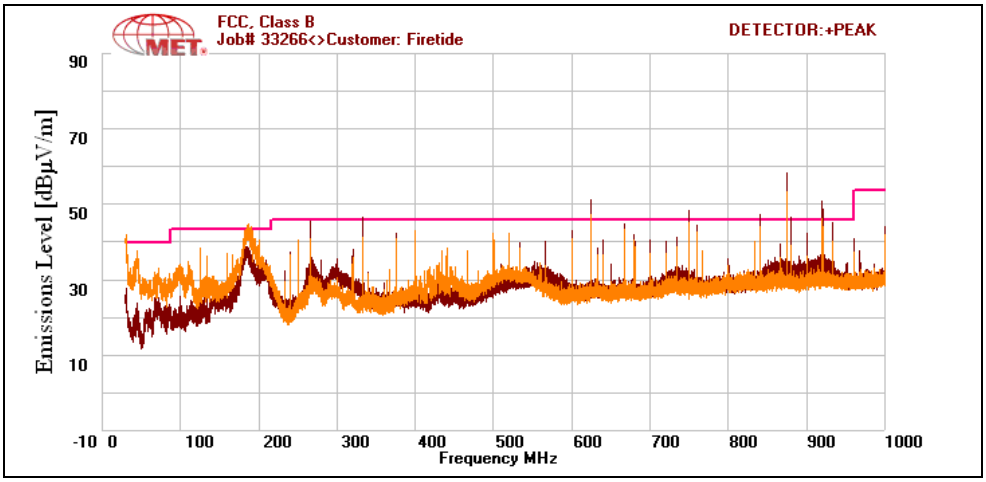

**Plot 195. Radiated Spurs, Mid Channel, 802.11n 5 MHz, 9 dBi Omni**



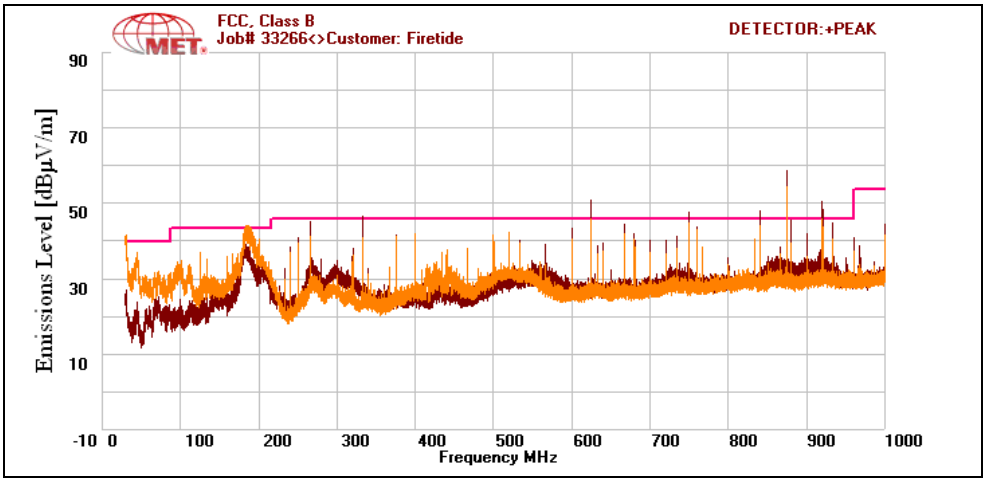

**Plot 196. Radiated Spurs, High Channel, 802.11n 5 MHz, 9 dBi Omni**

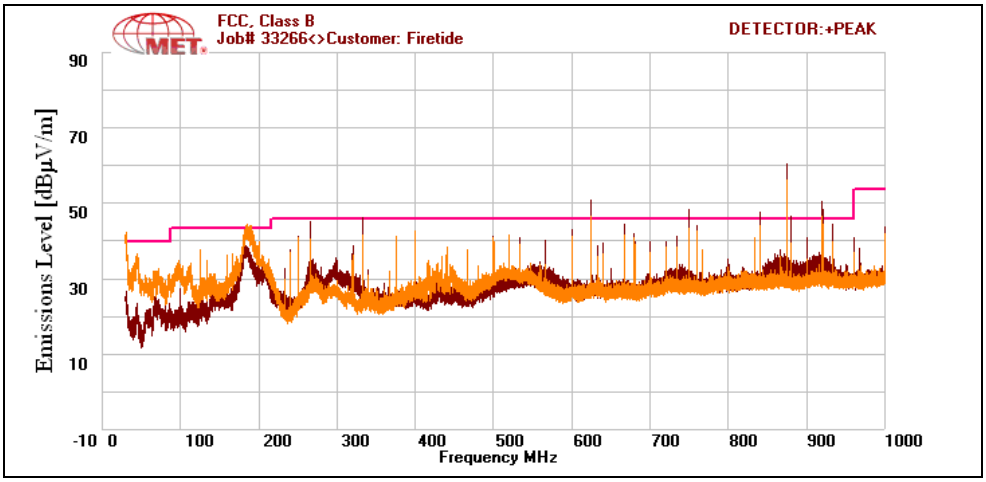
## Radiated Spurious Emissions, 802.11n 10 MHz, 9 dBi Omni




**Plot 197. Radiated Spurs, Low Channel, 802.11n 10 MHz, 9 dBi Omni**



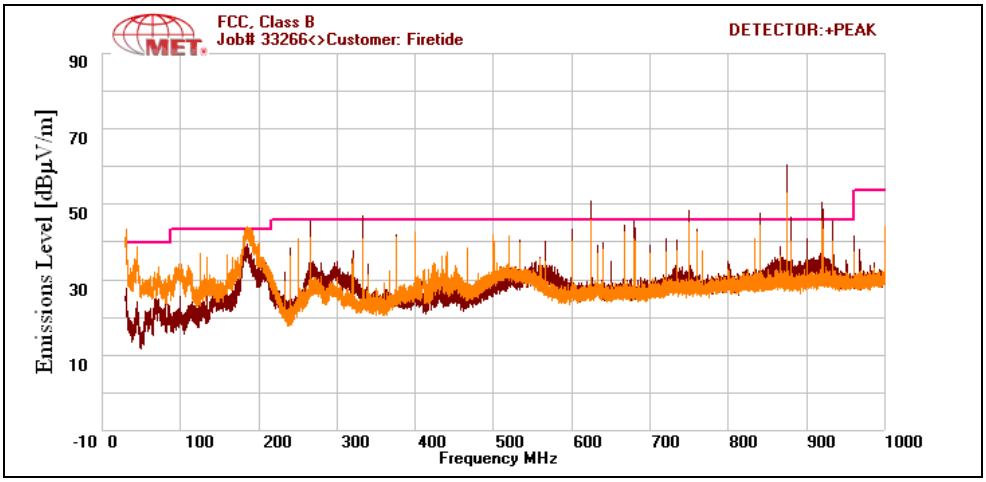

**Plot 198. Radiated Spurs, Mid Channel, 802.11n 10 MHz, 9 dBi Omni**



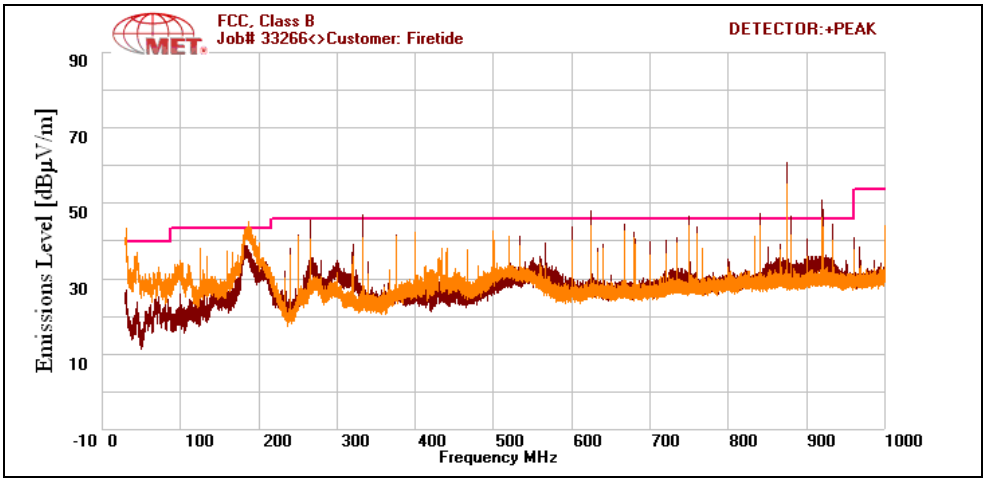

**Plot 199. Radiated Spurs, High Channel, 802.11n 10 MHz, 9 dBi Omni**

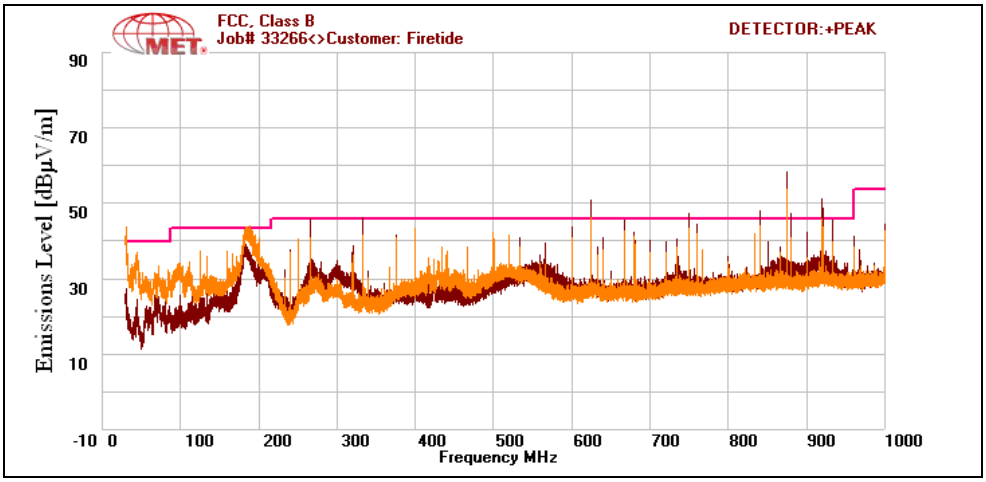
## Radiated Spurious Emissions, 802.11n 20 MHz, 9 dBi Omni




**Plot 200. Radiated Spurs, Low Channel, 802.11n 20 MHz, 9 dBi Omni**



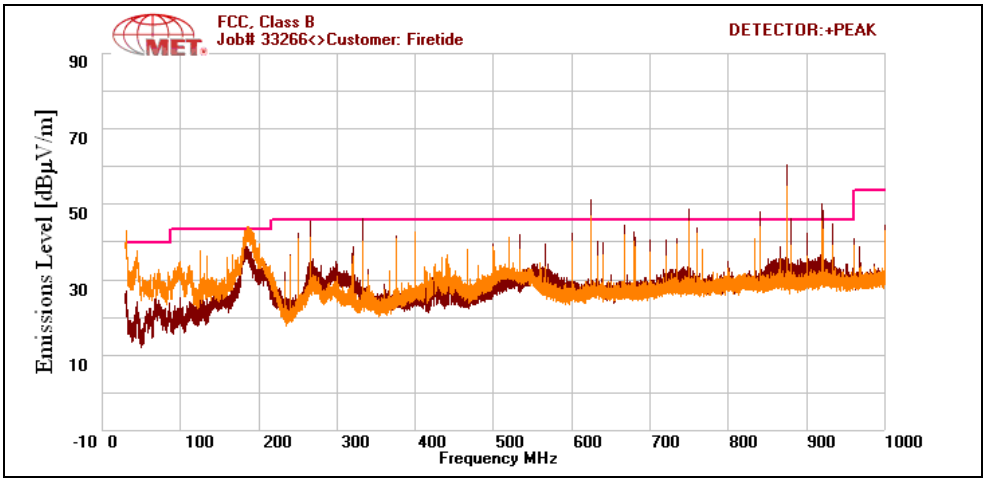

**Plot 201. Radiated Spurs, Mid Channel, 802.11n 20 MHz, 9 dBi Omni**



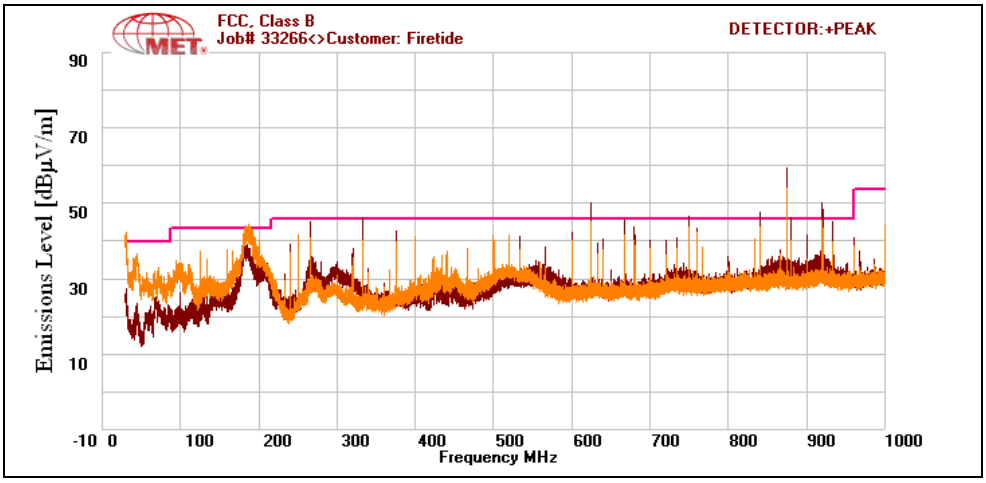

**Plot 202. Radiated Spurs, High Channel, 802.11n 20 MHz, 9 dBi Omni**

## Radiated Spurious Emissions, 802.11n 40 MHz, 9 dBi Omni

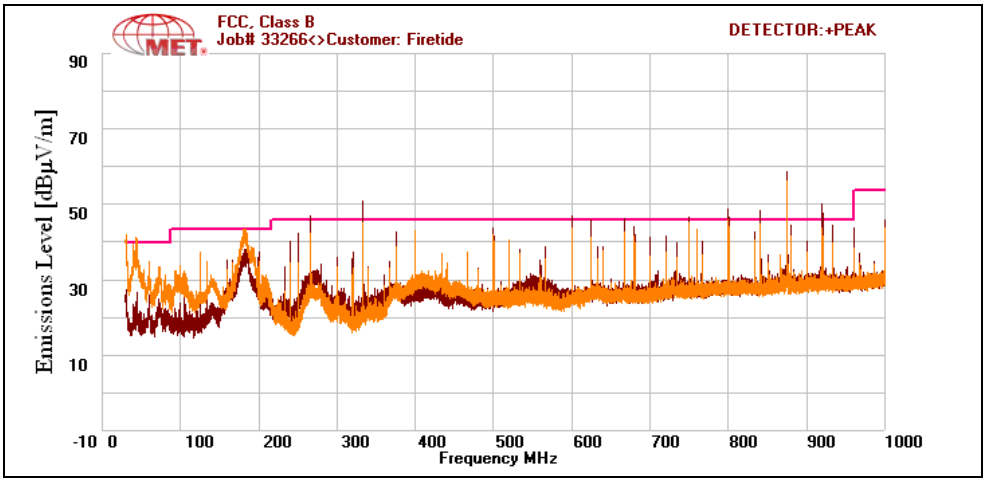



**Plot 203. Radiated Spurs, Low Channel, 802.11n 40 MHz, 9 dBi Omni**

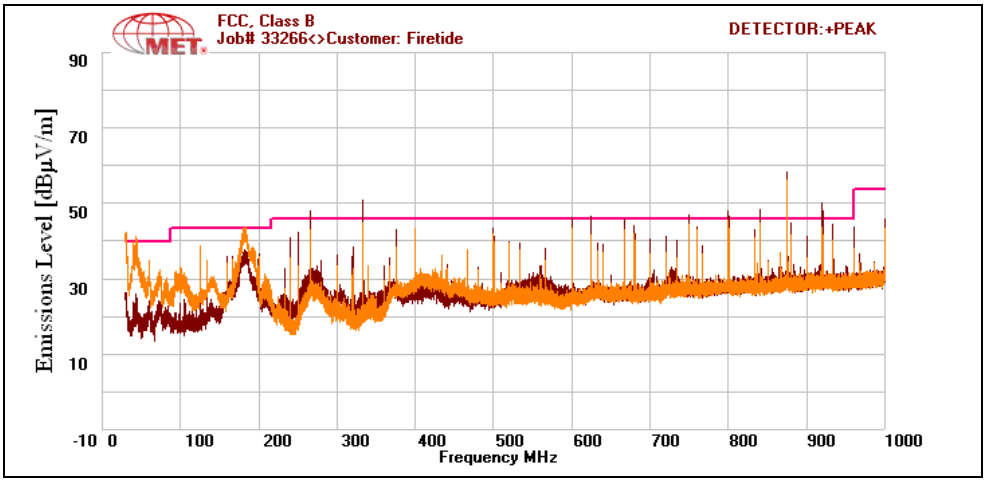



**Plot 204. Radiated Spurs, High Channel, 802.11n 40 MHz, 9 dBi Omni**

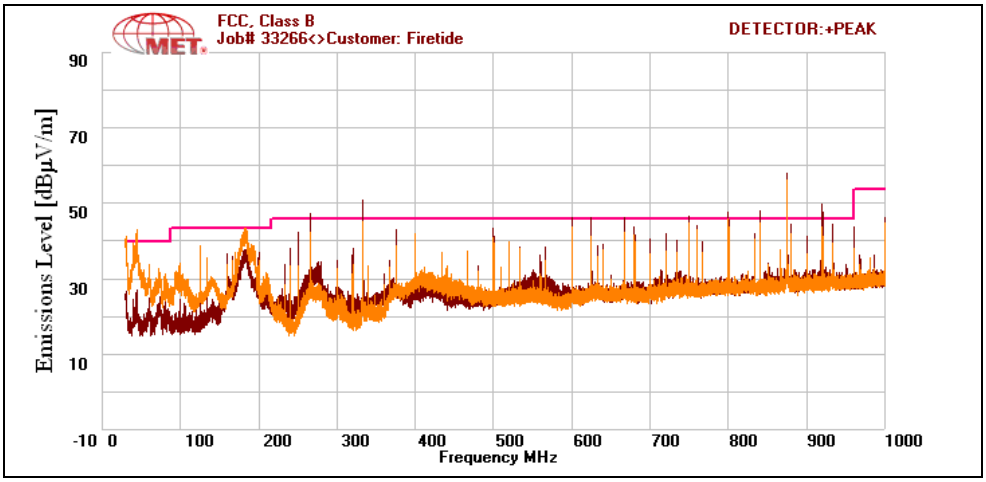
## Radiated Spurious Emissions, 802.11a, 15 dBi Sector




**Plot 205. Radiated Spurs, Low Channel, 802.11a, 15 dBi Sector**



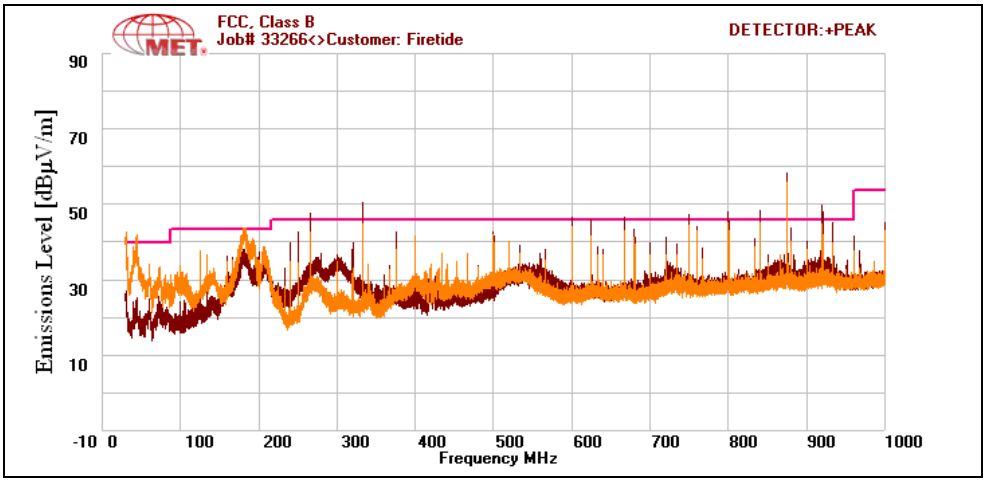

**Plot 206. Radiated Spurs, Mid Channel, 802.11a, 15 dBi Sector**



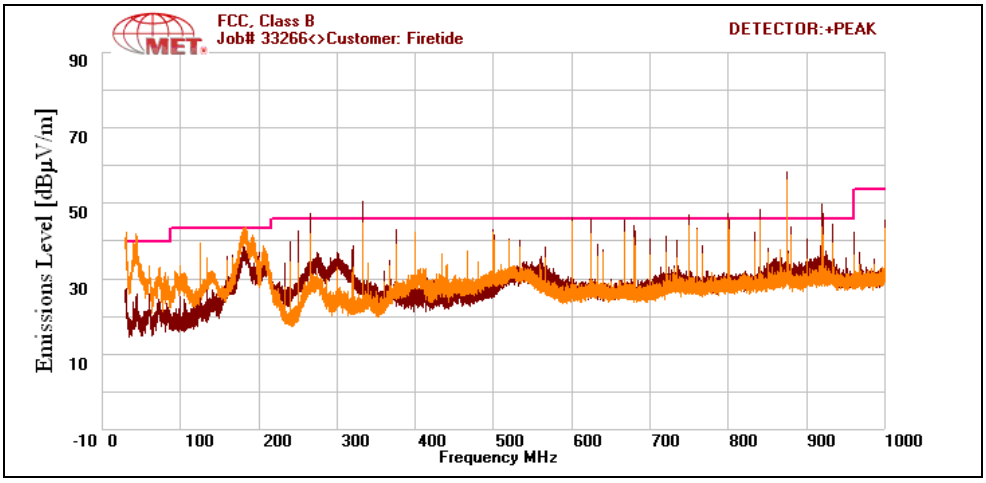

**Plot 207. Radiated Spurs, High Channel, 802.11a, 15 dBi Sector**

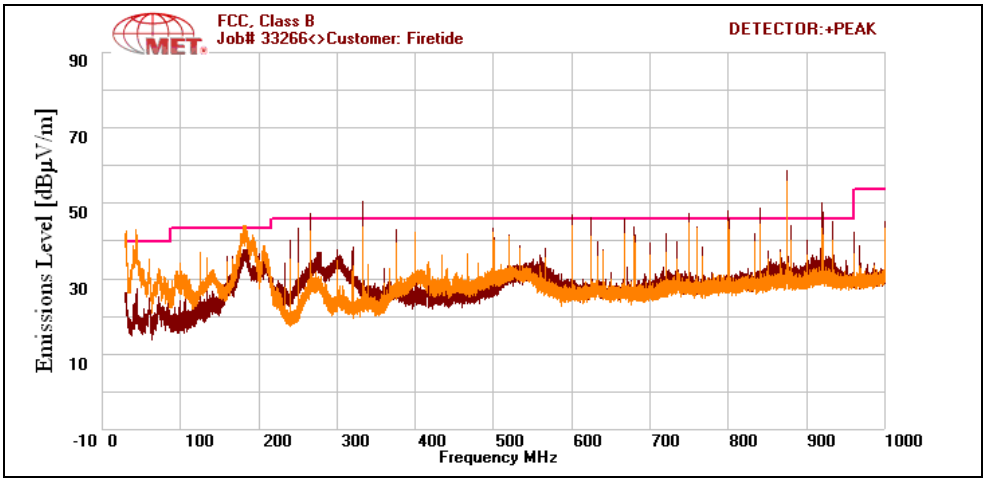
## Radiated Spurious Emissions, 802.11n 5 MHz, 15 dBi Sector




**Plot 208. Radiated Spurs, Low Channel, 802.11n 5 MHz, 15 dBi Sector**



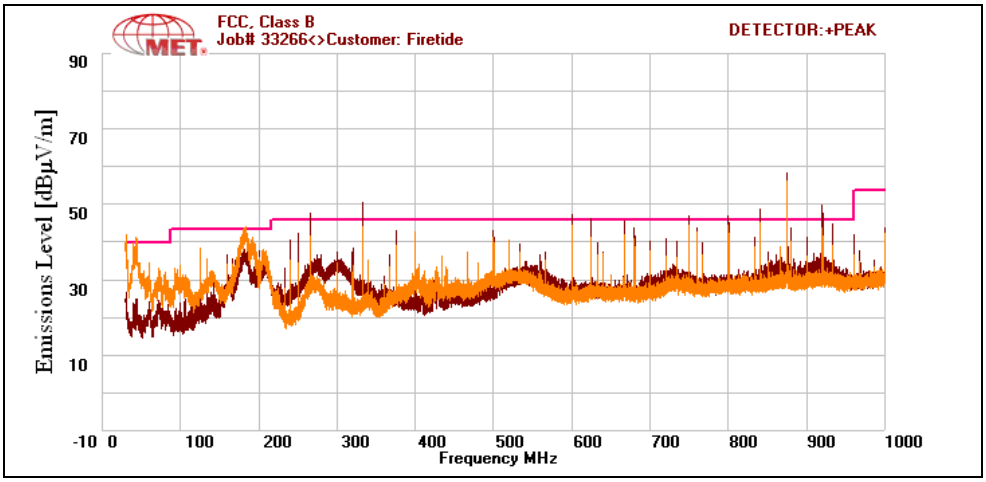

**Plot 209. Radiated Spurs, Mid Channel, 802.11n 5 MHz, 15 dBi Sector**



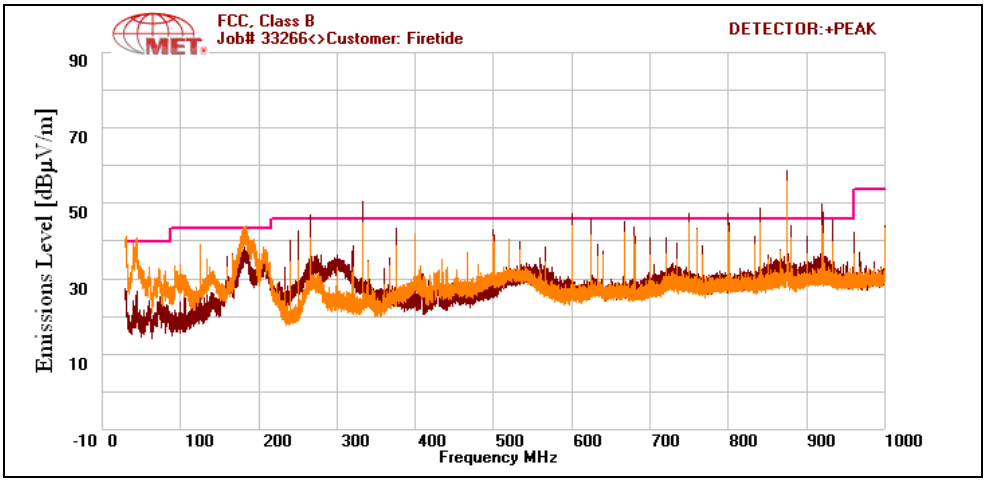

**Plot 210. Radiated Spurs, High Channel, 802.11n 5 MHz, 15 dBi Sector**

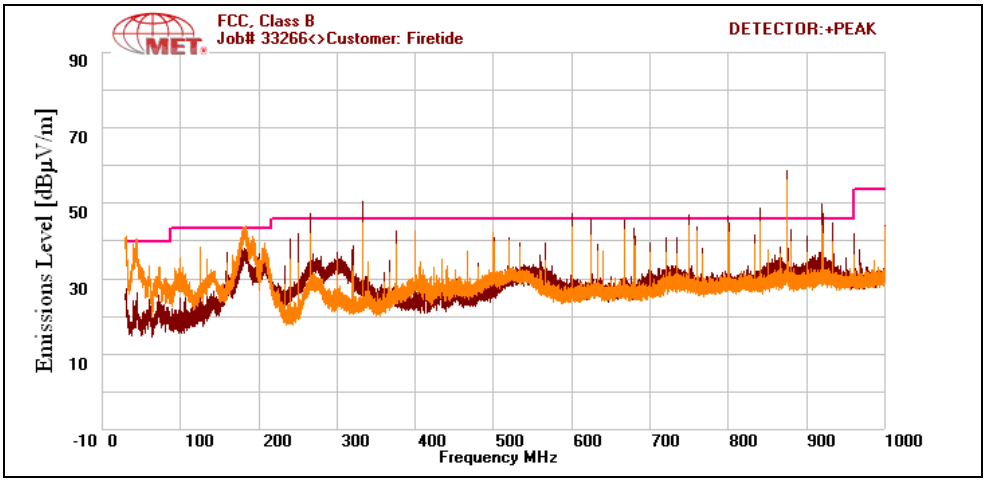
## Radiated Spurious Emissions, 802.11n 10 MHz, 15 dBi Sector




**Plot 211. Radiated Spurs, Low Channel, 802.11n 10 MHz, 15 dBi Sector**



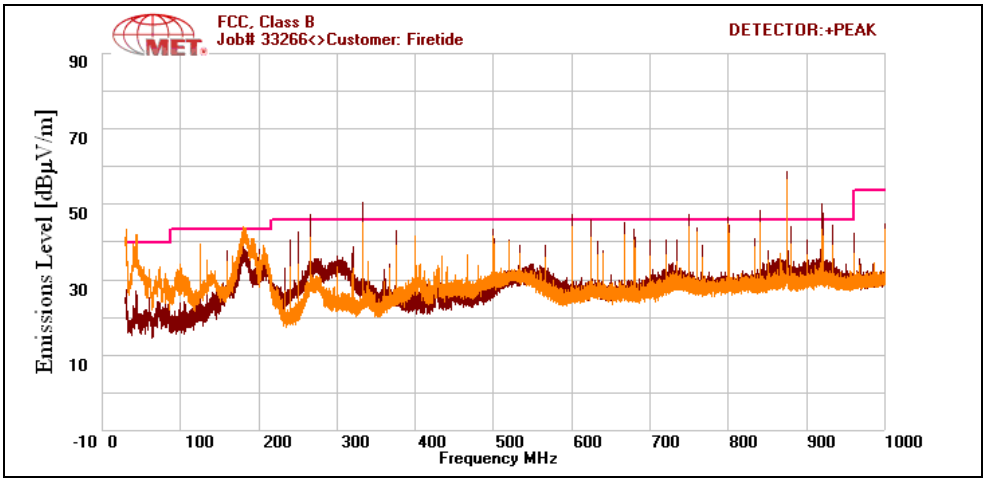

**Plot 212. Radiated Spurs, Mid Channel, 802.11n 10 MHz, 15 dBi Sector**



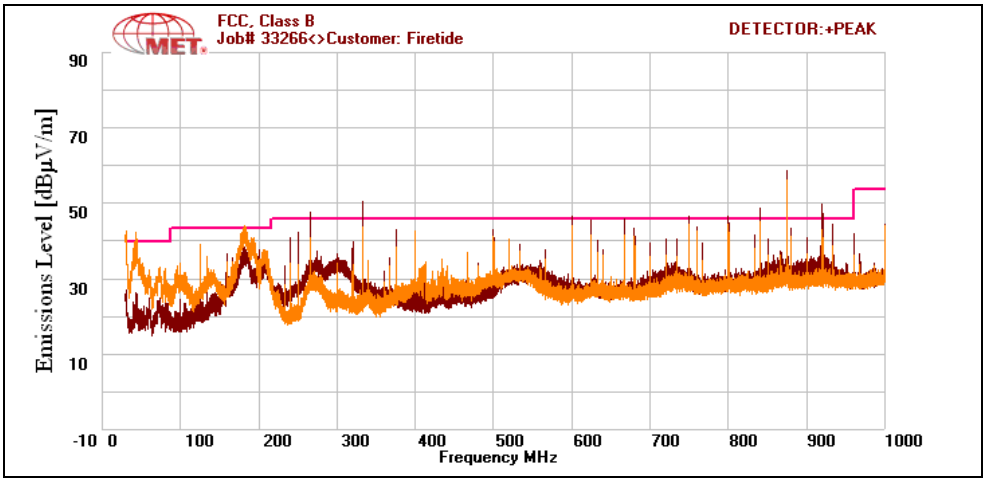

**Plot 213. Radiated Spurs, High Channel, 802.11n 10 MHz, 15 dBi Sector**

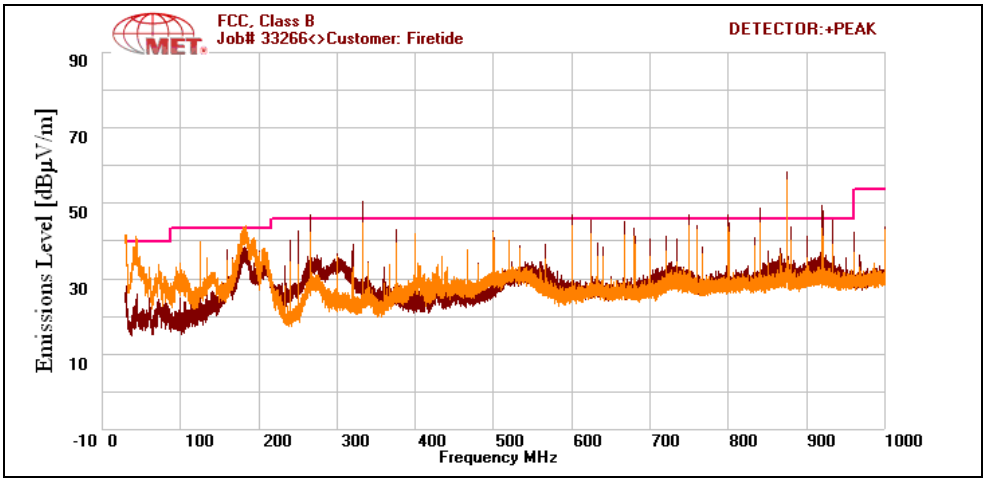
## Radiated Spurious Emissions, 802.11n 20 MHz, 15 dBi Sector




**Plot 214. Radiated Spurs, Low Channel, 802.11n 20 MHz, 15 dBi Sector**




**Plot 215. Radiated Spurs, Mid Channel, 802.11n 20 MHz, 15 dBi Sector**




**Plot 216. Radiated Spurs, High Channel, 802.11n 20 MHz, 15 dBi Sector**