**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**
**13301 MCCALLEN PASS ● AUSTIN, TX 78753 ● PHONE (512) 287-2500 ● FAX (512) 287-2513**

February 18, 2013

Amimon
2 Maskit St. Building D, 2nd Floor
Herzelia, Israel 46733

Dear Guy Dar,

Enclosed is the EMC Wireless test report for compliance testing of the Amimon, Falcon RX, Amimon P/N-AMN36254 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 for Unintentional Radiators and Part 15.407 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: (\Amimon\EMC37062B-FCC407 UNII 3)

**MET Laboratories, Inc.** *Safety Certification - EMI - Telecom Environmental Simulation*
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# Electromagnetic Compatibility Criteria
# Test Report

for the

**Amimon**
**Model Falcon RX, Amimon P/N-AMN36254**

**Tested under**
the Certification Rules
contained in
Title 47 of the CFR, Part 15, Subpart B
for Unintentional Radiators
and
Title 47 of the CFR, Part 15.407
for Intentional Radiators

**MET Report: EMC37062B-FCC407**

February 18, 2013

**Prepared For:**

**Amimon**
**2 Maskit St. Building D, 2nd Floor**
**Herzelia, 46733**

**Prepared By:**
**MET Laboratories, Inc.**
914 W. Patapsco Ave
Baltimore, MD 21230

# Electromagnetic Compatibility Criteria
# Test Report

for the

## Amimon
## Model Falcon RX, Amimon P/N-AMN36254

the Certification Rules
contained in
Title 47 of the CFR, Part 15, Subpart B
for Unintentional Radiators
and
Title 47 of the CFR, Part 15.407
for Intentional Radiators

Jeffrey Pratt, 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 under normal use and maintenance.

Asad Bajwa, Director
Electromagnetic Compatibility Lab

  

# Report Status Sheet

| Revision | Report Date | Reason for Revision |
|---|---|---|
| ∅ | February 18, 2013 | Initial Issue. |
| 1 | March 8, 2013 | 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 Amimon Falcon RX, Amimon P/N-AMN36254, 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 Falcon RX, Amimon P/N-AMN36254. Amimon should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Falcon RX, Amimon P/N-AMN36254, 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 Amimon, purchase order number 120291. All tests were conducted using measurement procedure ANSI C63.4-2003.

| FCC Reference | Description | Results |
|---|---|---|
| 15.107 | Conducted Emissions | Compliant |
| 15.109 | Radiated Emissions | Compliant |
| 15.203 | Antenna Requirements | Compliant |
| 15.207 | AC Conducted Emissions 150KHz – 30MHz | Compliant |
| 15.403 (i) | 26dB Occupied Bandwidth | Compliant |
| 15.407 (a)(2) | Conducted Transmitter Output Power | Compliant |
| 15.407 (a)(2) | Power Spectral Density | Compliant |
| 15.407 (a)(6) | Peak Excursion | Compliant |
| 15.407 (b)(2), (3), (5), (6) | Undesirable Emissions (15.205/15.209 - General Field Strength Limits (Restricted Bands and Radiated Emission Limits) | Compliant |
| 15.407(f) | RF Exposure | Compliant |
| 15.407(g) | Frequency Stability | Compliant |

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

# II. Equipment Configuration

# A. Overview

MET Laboratories, Inc. was contracted by Amimon to perform testing on the Falcon RX, Amimon P/N-AMN36254, under Amimon's purchase order number 120291.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Amimon Falcon RX, Amimon P/N-AMN36254.

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

| | | |
|---|---|---|
| **Model(s) Tested:** | Falcon RX, Amimon P/N-AMN36254 | |
| **Model(s) Covered:** | Falcon RX, Amimon P/N-AMN36254 | |
| **]EUT Specifications:** | Primary Power: 120 VAC, 60 Hz | |
| | Secondary Power: 12 VDC | |
| | FCC ID: VQSAMN36254 | |
| | Type of Modulations: | OFDM |
| | Equipment Code: | NII |
| | Peak RF Output Power: | 16.63 dBm |
| | EUT Frequency Ranges: | 5745 – 5805 MHz |
| **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:** | Jeffrey Pratt | |
| **Report Date(s):** | February 18, 2013 | |

**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 |
| **ISO/IEC 17025:2005** | General Requirements for the Competence of Testing and Calibration Laboratories |

**Table 3. References**

## C. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave., Baltimore, MD 21230. 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 3 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 AMN35254/AMN36254 are respectively wireless A/V transmitter/receiver boards, which works at the 5GHz unlicensed band. The device only has one transmit antenna.


**Photograph 1. Amimon Falcon RX, Amimon P/N-AMN36254**

## 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 | Part Number | Serial Number | Revision |
|---|---|---|---|---|---|
| N/A | HD-SDI Wireless Receiver module | AMN36254 | N/A | SDT1260044 | 2.0 |

**Table 4. Equipment Configuration**

## F. Support Equipment

Amimon supplied support equipment necessary for the operation and testing of the Falcon RX, Amimon P/N-AMN36254. All support equipment supplied is listed in the following Support Equipment List.

| Ref. ID | Name / Description | Manufacturer | Model Number |
|---|---|---|---|
| N/A | PC Laptop | | |
| N/A | Debug Board (MAC) | Amimon | AMN043PCB |
| N/A | Debug Board (APP) | Amimon | AMN043PCB |
| N/A | USB-to-Serial Converter (MAC) | ATEN | UC-232A |
| N/A | USB-to-Serial Converter (APP) | ATEN | UC-232A |
| N/A | SDI to HDMI Converter | CYPRESS | CLUX-SDI2SHC |
| N/A | 12V Power Supply | Switching Power Supply | S075AQ12000600 |
| N/A | HDMI Cable | Standard | standard |

**Table 5. Support Equipment**

## G. Ports and Cabling Information

| Ref. ID | Port Name on EUT | Cable Description | Qty. | Length (m) | Shielded (Y/N) | Termination Point |
|---|---|---|---|---|---|---|
| J1 | J1 power supply | XH-4P-with Tin L=200 1007-28# | 1 | 0.2 | N | Power Supply |
| J16 | J16 – SDI out#1 | 75 ohm SDI cable BNC-P to BNC-P | 1 | 3 | Y | HDMI to SDI converter |
| J21 | J21 – MAC | Standard USB able with USB to serial converter | 1 | 2 | Y | PC |
| J20 | J20 – APP | Standard USB able with USB to serial converter | 1 | 2 | Y | PC |
| J15 | J16 – SDI out#2 | 75ohm BNC termination | N/A | N/A | N/A | N/A |

**Table 6. Ports and Cabling Information**

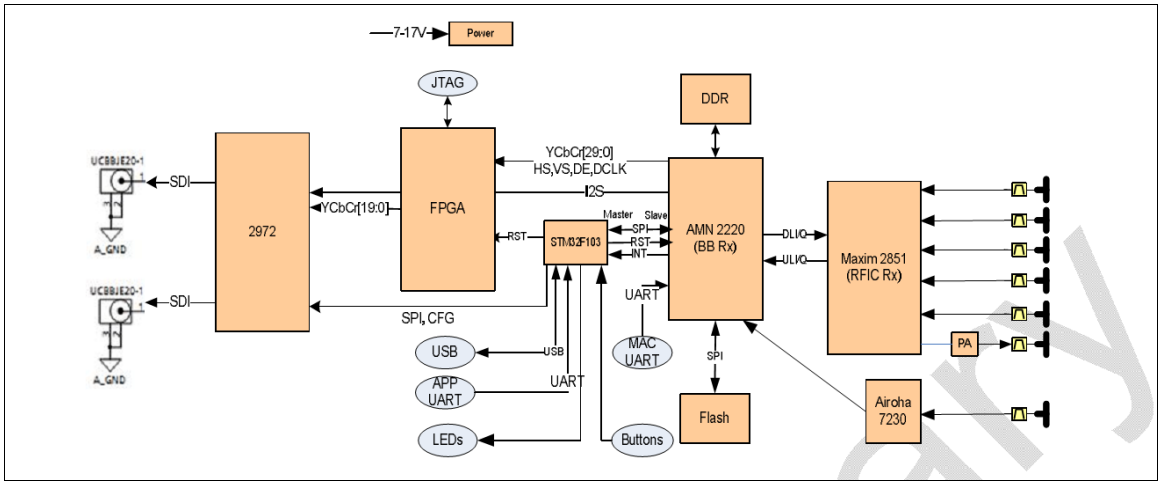



**Figure 1. Block Diagram of Equipment**

## H. Mode of Operation

The AMN36254 WHDI Sink is designed to be at the receiver end of the WHDI downstream. TheAMN36254 receives wireless downstream transmission, demodulates it and regenerates the video, audio and control content transmitted by the AMN15020 WHDI source. The receiver works at the5GHz unlicensed band.
The AMN36254 has a MIMO design of five wireless input channels and one channel output wireless channel, which generates an upstream channel for data content transmissions.
The uncompressed video and audio from the WHDI sink are connected to the Gennum SDI 2972 transmitter with an SDI connector.
The ST STM32F103 application microcontroller controls the SDI transmitter and the AMN2220 baseband receiver using SPI bus. The application microcontroller provides USB device interface through a mini USB connector.

## I. Method of Monitoring EUT Operation

Using AppCom (Amimon designated SW) for commands and LOG.

## 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 Amimon 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 B requirement(s) of this section. Measured emissions were below applicable limits.

**Test Engineer(s):** Zijun Tong

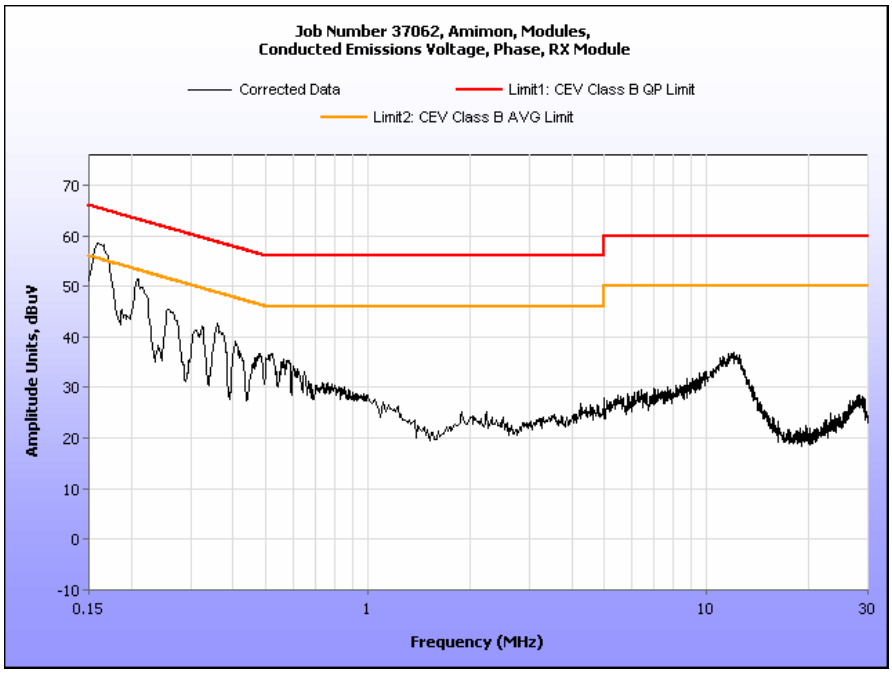
**Test Date(s):** 12/17/12

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

| Frequency (MHz) | Uncorrected Meter Reading (dBuV) QP | Cable Loss (dB) | Corrected Measurement (dBuV) QP | Limit (dBuV) QP | Margin (dB) QP | Uncorrected Meter Reading (dBuV) Avg. | Cable Loss (dB) | Corrected Measurement (dBuV) Avg. | Limit (dBuV) Avg. | Margin (dB) Avg. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.152 | 53.82 | 0 | 53.82 | 65.89 | -12.07 | 35.62 | 0 | 35.62 | 55.89 | -20.27 |
| 0.2009 | 45.65 | 0 | 45.65 | 63.57 | -17.92 | 30.64 | 0 | 30.64 | 53.57 | -22.93 |
| 0.254 | 39.01 | 0 | 39.01 | 61.63 | -22.62 | 24.3 | 0 | 24.3 | 51.63 | -27.33 |
| 0.3211 | 34.93 | 0 | 34.93 | 59.68 | -24.75 | 21.75 | 0 | 21.75 | 49.68 | -27.93 |
| 0.365 | 36.33 | 0 | 36.33 | 58.61 | -22.28 | 26.41 | 0 | 26.41 | 48.61 | -22.2 |
| 0.403 | 33.19 | 0 | 33.19 | 57.79 | -24.6 | 20.52 | 0 | 20.52 | 47.79 | -27.27 |

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



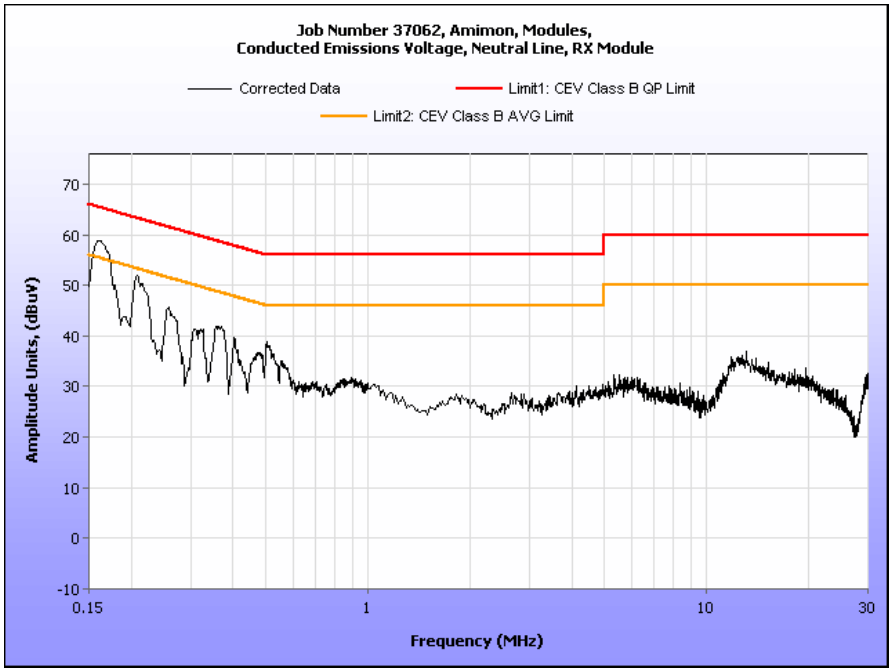

**Plot 1. Conducted Emission, Phase Line Plot**

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

| Frequency (MHz) | Uncorrected Meter Reading (dBuV) QP | Cable Loss (dB) | Corrected Measurement (dBuV) QP | Limit (dBuV) QP | Margin (dB) QP | Uncorrected Meter Reading (dBuV) Avg. | Cable Loss (dB) | Corrected Measurement (dBuV) Avg. | Limit (dBuV) Avg. | Margin (dB) Avg. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.1513 | 52.9 | 0 | 52.9 | 65.93 | -13.03 | 33.37 | 0 | 33.37 | 55.93 | -22.56 |
| 0.2 | 45.22 | 0 | 45.22 | 63.61 | -18.39 | 30.41 | 0 | 30.41 | 53.61 | -23.2 |
| 0.2505 | 37.23 | 0 | 37.23 | 61.74 | -24.51 | 23 | 0 | 23 | 51.74 | -28.74 |
| 0.3166 | 35.99 | 0 | 35.99 | 59.8 | -23.81 | 23.85 | 0 | 23.85 | 49.8 | -25.95 |
| 0.359 | 35.92 | 0 | 35.92 | 58.75 | -22.83 | 23.6 | 0 | 23.6 | 48.75 | -25.15 |
| 0.5025 | 33.64 | 0 | 33.64 | 56 | -22.36 | 21.84 | 0 | 21.84 | 46 | -24.16 |

**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 B requirement(s) of this section. Measured emissions were below applicable limits.

**Test Engineer(s):** Zijun Tong

**Test Date(s):** 12/17/12

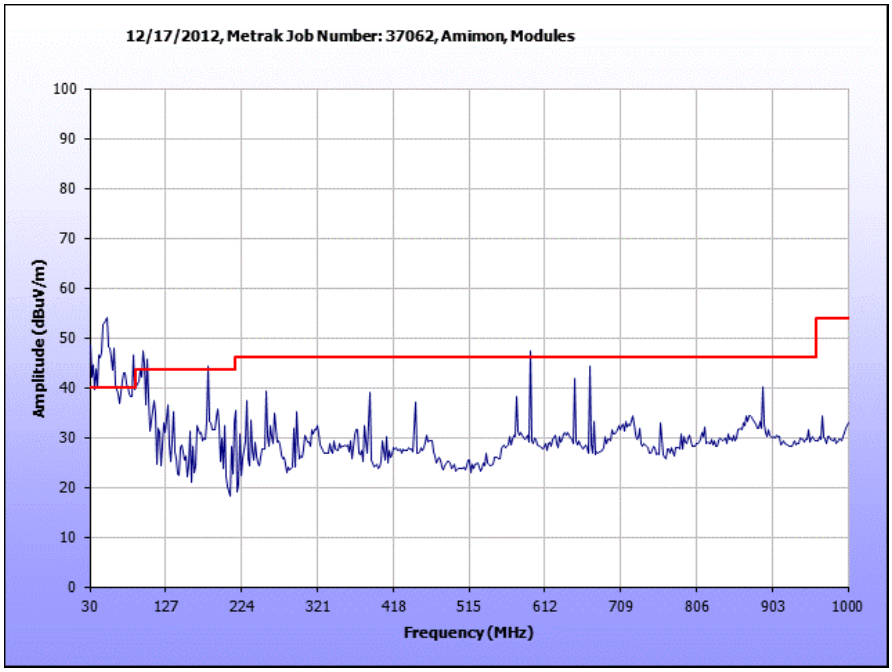
  

## Radiated Emissions Limits Test Results, Class B

| Frequency (MHz) | EUT Azimuth (Degrees) | Antenna Polarity (H/V) | Antenna HEIGHT (m) | Uncorrected Amplitude (dBuV) | Antenna Correction Factor (dB) (+) | Cable Loss (dB) (+) | Distance Correction Factor (dB) (-) | Corrected Amplitude (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 38.376482 | 360 | H | 1.05 | 5.02 | 15.70 | 0.57 | 0.00 | 21.29 | 40.00 | -18.71 |
| 38.376482 | 309 | V | 1.02 | 14.09 | 15.70 | 0.57 | 0.00 | 30.36 | 40.00 | -9.64 |
| 45.04097 | 360 | H | 1.00 | 5.10 | 11.18 | 0.62 | 0.00 | 16.90 | 40.00 | -23.10 |
| 45.04097 | 307 | V | 1.04 | 24.25 | 11.18 | 0.62 | 0.00 | 36.05 | 40.00 | -3.95 |
| 48.095634 | 233 | H | 1.65 | 6.30 | 9.55 | 0.66 | 0.00 | 16.51 | 40.00 | -23.49 |
| 48.095634 | 262 | V | 1.01 | 21.69 | 9.55 | 0.66 | 0.00 | 31.90 | 40.00 | -8.10 |
| 55.646722 | 360 | H | 1.64 | 5.50 | 7.54 | 0.68 | 0.00 | 13.72 | 40.00 | -26.28 |
| 55.646722 | 360 | V | 1.00 | 15.96 | 7.54 | 0.68 | 0.00 | 24.18 | 40.00 | -15.82 |
| 67.040887 | 360 | H | 1.48 | 5.42 | 8.01 | 0.75 | 0.00 | 14.18 | 40.00 | -25.82 |
| 67.040887 | 0 | V | 1.57 | 5.57 | 8.01 | 0.75 | 0.00 | 14.33 | 40.00 | -25.67 |
| 82.386559 | 360 | H | 1.45 | 5.02 | 7.80 | 0.85 | 0.00 | 13.67 | 40.00 | -26.33 |
| 82.386559 | 0 | V | 1.29 | 11.04 | 7.80 | 0.85 | 0.00 | 19.69 | 40.00 | -20.31 |
| 82.585441 | 360 | H | 1.61 | 5.02 | 7.80 | 0.86 | 0.00 | 13.68 | 40.00 | -26.32 |
| 82.585441 | 0 | V | 1.11 | 12.73 | 7.80 | 0.86 | 0.00 | 21.39 | 40.00 | -18.61 |
| 87.995171 | 252 | H | 1.55 | 5.65 | 7.70 | 0.89 | 0.00 | 14.24 | 40.00 | -25.76 |
| 87.995171 | 0 | V | 1.02 | 13.47 | 7.70 | 0.89 | 0.00 | 22.06 | 40.00 | -17.94 |
| 102.70444 | 61 | H | 1.43 | 5.72 | 10.97 | 0.96 | 0.00 | 17.65 | 43.50 | -25.85 |
| 102.70444 | 0 | V | 1.05 | 9.78 | 10.97 | 0.96 | 0.00 | 21.71 | 43.50 | -21.79 |
| 148.48178 | 0 | H | 1.89 | 5.57 | 13.10 | 1.11 | 0.00 | 19.78 | 43.50 | -23.72 |
| 148.48178 | 360 | V | 1.00 | 12.15 | 13.10 | 1.11 | 0.00 | 26.36 | 43.50 | -17.14 |
| 171.31324 | 327 | H | 1.63 | 9.44 | 11.87 | 1.16 | 0.00 | 22.47 | 43.50 | -21.03 |
| 171.31324 | 360 | V | 1.00 | 18.75 | 11.87 | 1.16 | 0.00 | 31.78 | 43.50 | -11.72 |
| 174.50431 | 235 | H | 1.52 | 10.28 | 11.55 | 1.16 | 0.00 | 22.99 | 43.50 | -20.51 |
| 174.50431 | 0 | V | 1.02 | 10.37 | 11.55 | 1.16 | 0.00 | 23.08 | 43.50 | -20.42 |
| 222.73308 | 227 | H | 1.05 | 11.00 | 11.61 | 1.24 | 0.00 | 23.85 | 46.00 | -22.15 |
| 222.73308 | 166 | V | 1.02 | 18.64 | 11.61 | 1.24 | 0.00 | 31.49 | 46.00 | -14.51 |
| 296.98999 | 358 | H | 1.33 | 22.39 | 14.04 | 1.56 | 0.00 | 37.99 | 46.00 | -8.01 |
| 296.98999 | 318 | V | 1.48 | 22.39 | 14.04 | 1.56 | 0.00 | 37.99 | 46.00 | -8.01 |
| 319.78033 | 64 | H | 1.19 | 16.05 | 14.60 | 1.52 | 0.00 | 32.17 | 46.00 | -13.83 |
| 319.78033 | 1 | V | 1.38 | 11.89 | 14.60 | 1.52 | 0.00 | 28.01 | 46.00 | -17.99 |
| 593.98702 | 0 | H | 2.09 | 15.14 | 19.50 | 2.21 | 0.00 | 36.85 | 46.00 | -9.15 |
| 593.98702 | 167 | V | 1.03 | 18.20 | 19.50 | 2.21 | 0.00 | 39.91 | 46.00 | -6.09 |
| 668.23637 | 309 | H | 1.38 | 10.00 | 20.56 | 2.34 | 0.00 | 32.90 | 46.00 | -13.10 |
| 668.23637 | 86 | V | 1.73 | 11.16 | 20.56 | 2.34 | 0.00 | 34.06 | 46.00 | -11.94 |

**Table 11. Radiated Emissions Limits, Test Results**

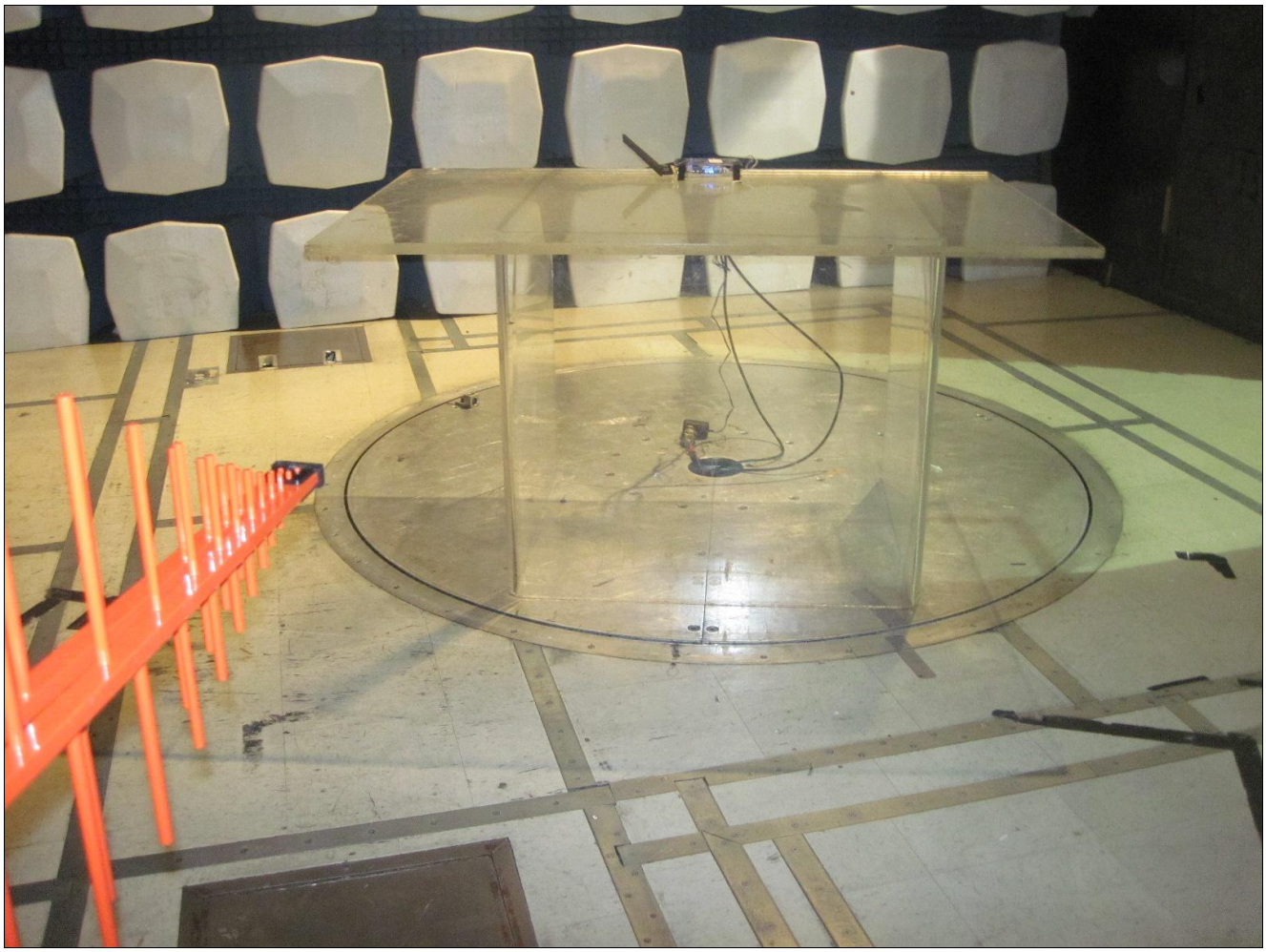
  




**Plot 3. Radiated Emissions, Pre-Scan**

## Radiated Emission Limits Test Setup



**Photograph 3. Radiated Emission, 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 has a unique antenna connector. Therefore, the EUT as tested is compliant with the criteria of §15.203.

| Gain | Type | Manufacturer | Model |
|---|---|---|---|
| 5 dBi | Omni | Laird | RD2458-5-RSMA |
| 2 dBi | Omni | Wanshih | WSS002 |

**Test Engineer(s):** Jeff Pratt

**Test Date(s):** 01/14/2013

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

**Test Procedure:** The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. 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 C63.4-1992 "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.

**Test Results:** The EUT was compliant with the Class B requirement(s) of this section.

**Test Engineer(s):** Jeff Pratt

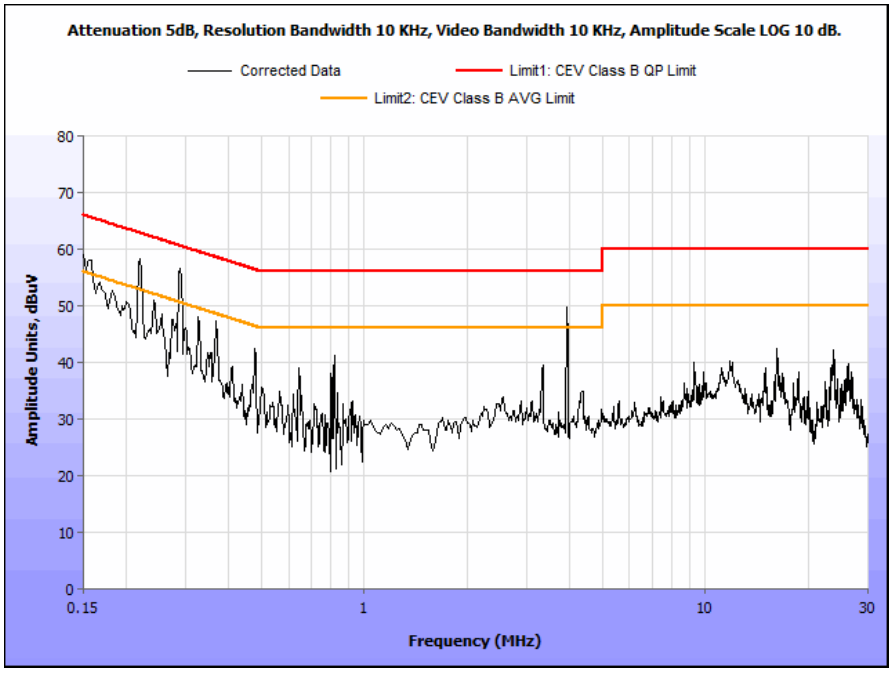
**Test Date(s):** 01/18/13

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

| Frequency (MHz) | Uncorrected Meter Reading (dBuV) QP | Cable Loss (dB) | Corrected Measurement (dBuV) QP | Limit (dBuV) QP | Margin (dB) QP | Uncorrected Meter Reading (dBuV) Avg. | Cable Loss (dB) | Corrected Measurement (dBuV) Avg. | Limit (dBuV) Avg. | Margin (dB) Avg. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.208 | 32.53 | 0 | 32.53 | 63.29 | -30.76 | 19.66 | 0 | 19.66 | 53.29 | -33.63 |
| 0.295 | 25.13 | 0 | 25.13 | 60.38 | -35.25 | 15.99 | 0 | 15.99 | 50.38 | -34.39 |
| 0.722 | 27.6 | 0 | 27.6 | 56 | -28.4 | 25.7 | 0 | 25.7 | 46 | -20.3 |
| 3.321 | 25.98 | 0 | 25.98 | 56 | -30.02 | 19.11 | 0 | 19.11 | 46 | -26.89 |
| 3.927 | 41.44 | 0 | 41.44 | 56 | -14.56 | 17.15 | 0 | 17.15 | 46 | -28.85 |
| 16.24 | 33.65 | 0 | 33.65 | 60 | -26.35 | 27.87 | 0 | 27.87 | 50 | -22.13 |

**Table 13. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)**

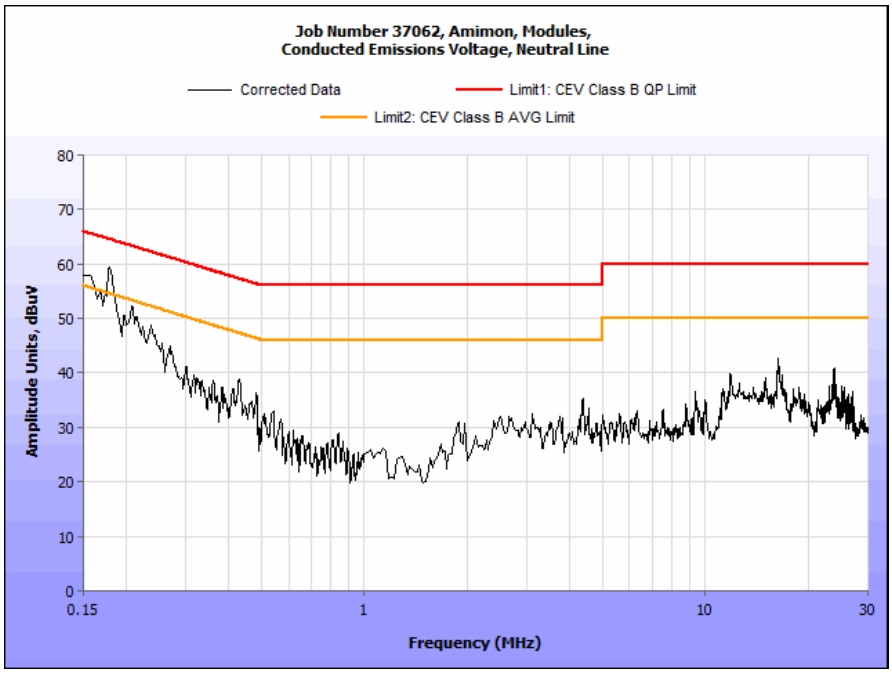



**Plot 4. Conducted Emissions, 15.207, Pre-Scan, Phase Line**

| Frequency (MHz) | Uncorrected Meter Reading (dBuV) QP | Cable Loss (dB) | Corrected Measurement (dBuV) QP | Limit (dBuV) QP | Margin (dB) QP | Uncorrected Meter Reading (dBuV) Avg. | Cable Loss (dB) | Corrected Measurement (dBuV) Avg. | Limit (dBuV) Avg. | Margin (dB) Avg. |
|---|---|---|---|---|---|---|---|---|---|---|
| 4.342 | 28.68 | 0 | 28.68 | 56 | -27.32 | 24.08 | 0 | 24.08 | 46 | -21.92 |
| 11.16 | 31.46 | 0 | 31.46 | 60 | -28.54 | 26.93 | 0 | 26.93 | 50 | -23.07 |
| 11.88 | 33.93 | 0 | 33.93 | 60 | -26.07 | 28.61 | 0 | 28.61 | 50 | -21.39 |
| 16.33 | 34.72 | 0 | 34.72 | 60 | -25.28 | 28.92 | 0 | 28.92 | 50 | -21.08 |
| 23.73 | 34.3 | 0 | 34.3 | 60 | -25.7 | 28.86 | 0 | 28.86 | 50 | -21.14 |
| 26.48 | 24.78 | 0 | 24.78 | 60 | -35.22 | 18.37 | 0 | 18.37 | 50 | -31.63 |

**Table 14. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)**




**Plot 5. Conducted Emissions, 15.207, Pre-Scan, Neutral Line**

## Conducted Emission Limits Test Setup

**Photograph 4. Conducted Emissions, 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):** Jeff Pratt

**Test Date(s):** 01/20/13

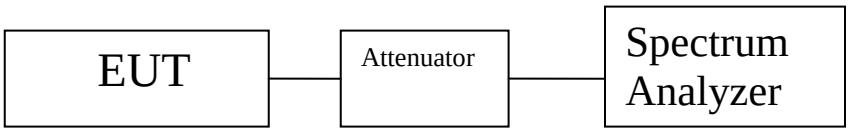
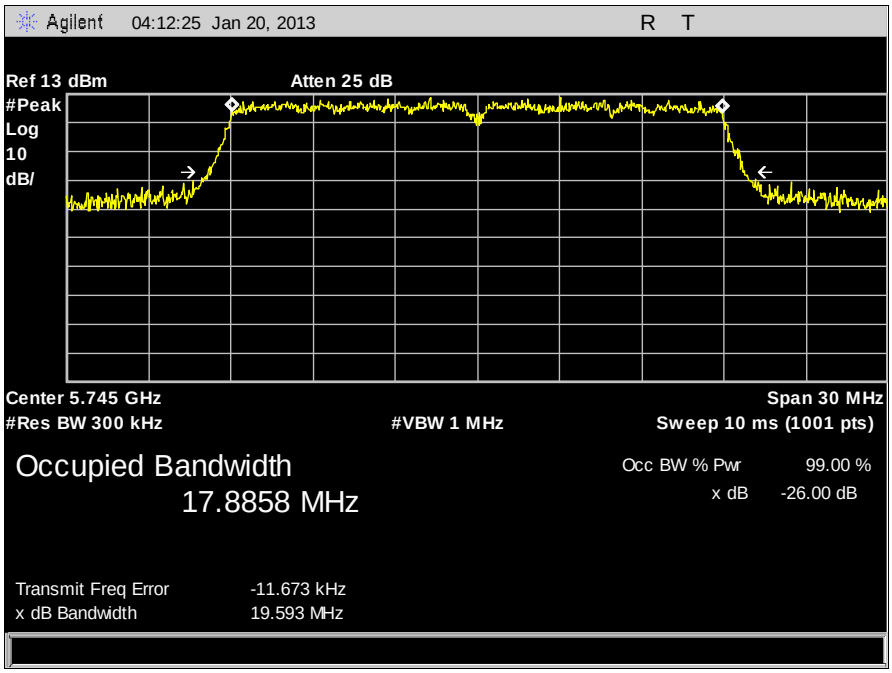


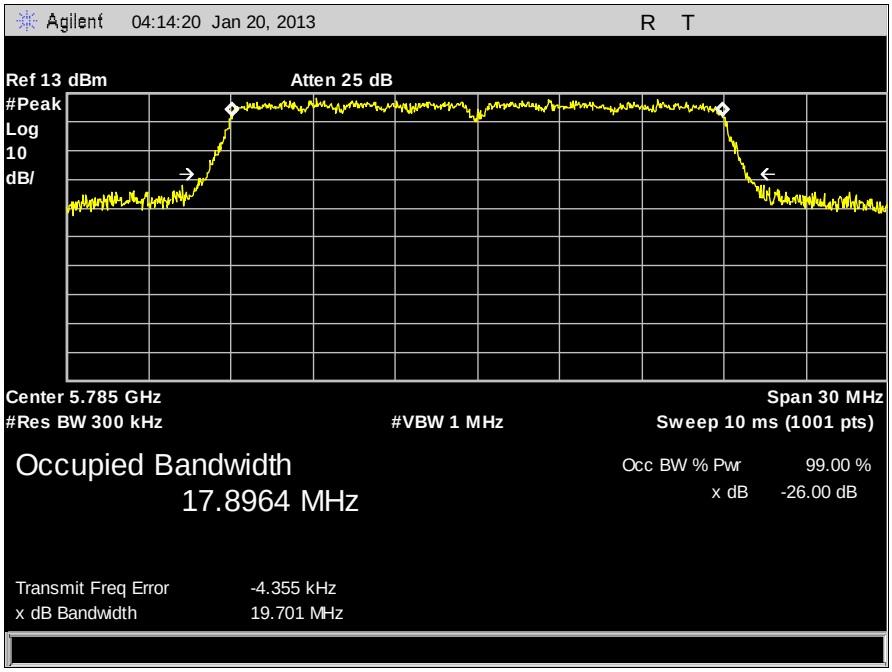

**Figure 2. Occupied Bandwidth, Test Setup**

## Electromagnetic Compatibility Criteria for Intentional Radiators

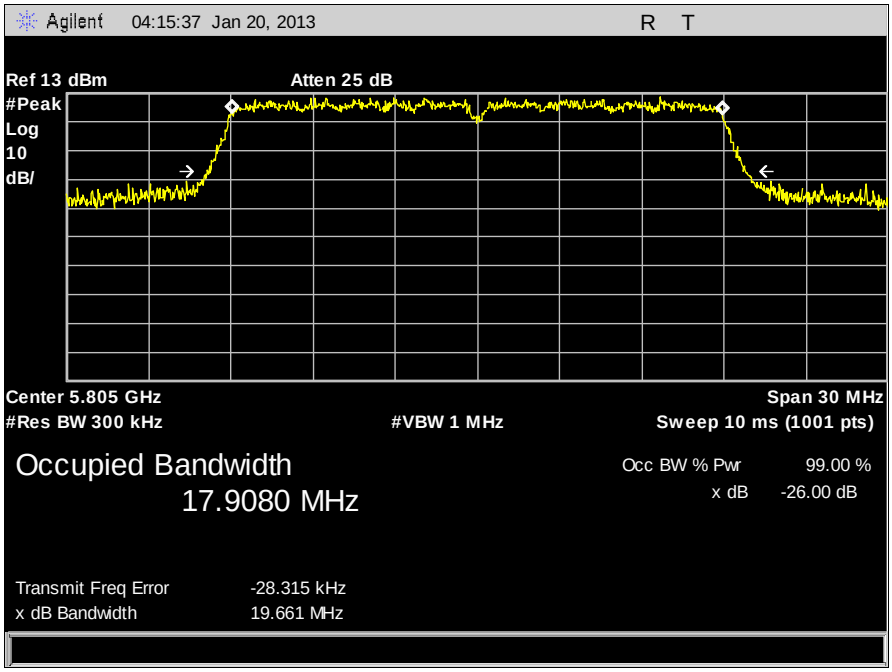



**Plot 6. Occupied Bandwidth, 5745 MHz, 26 dB**

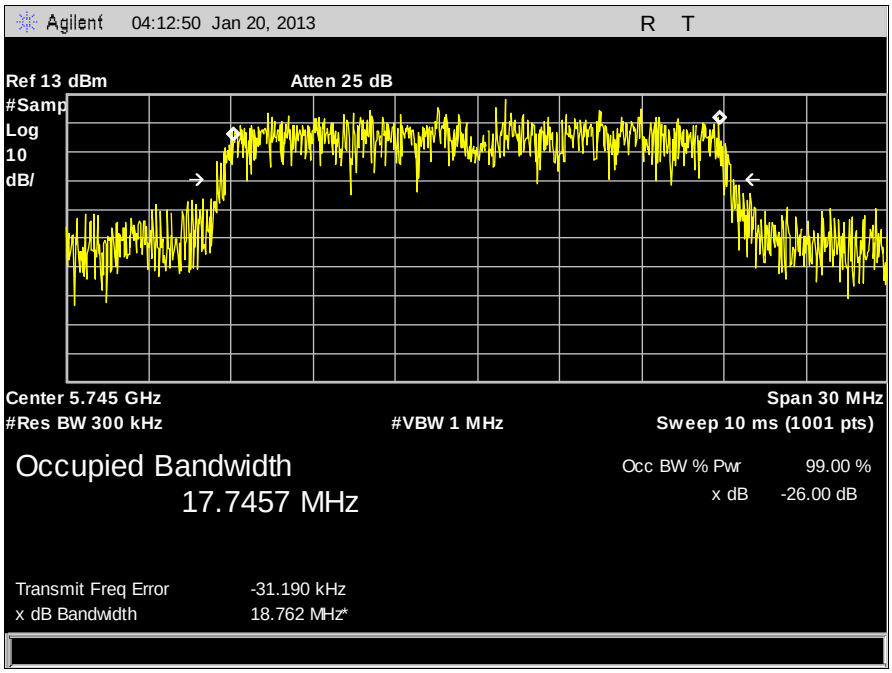



**Plot 7. Occupied Bandwidth, 5785 MHz, 26 dB**

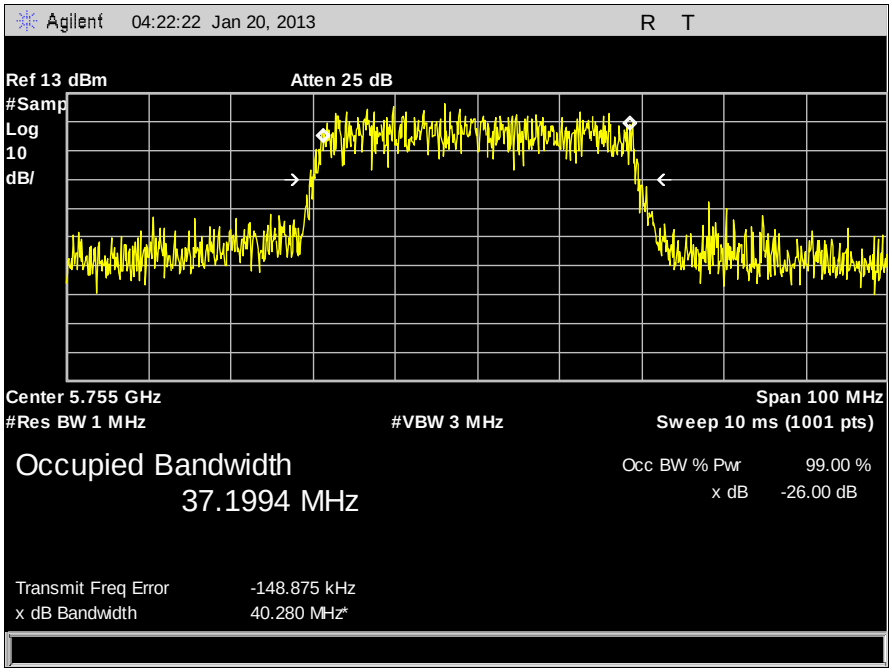



**Plot 8. Occupied Bandwidth, 5805 MHz, 26 dB**

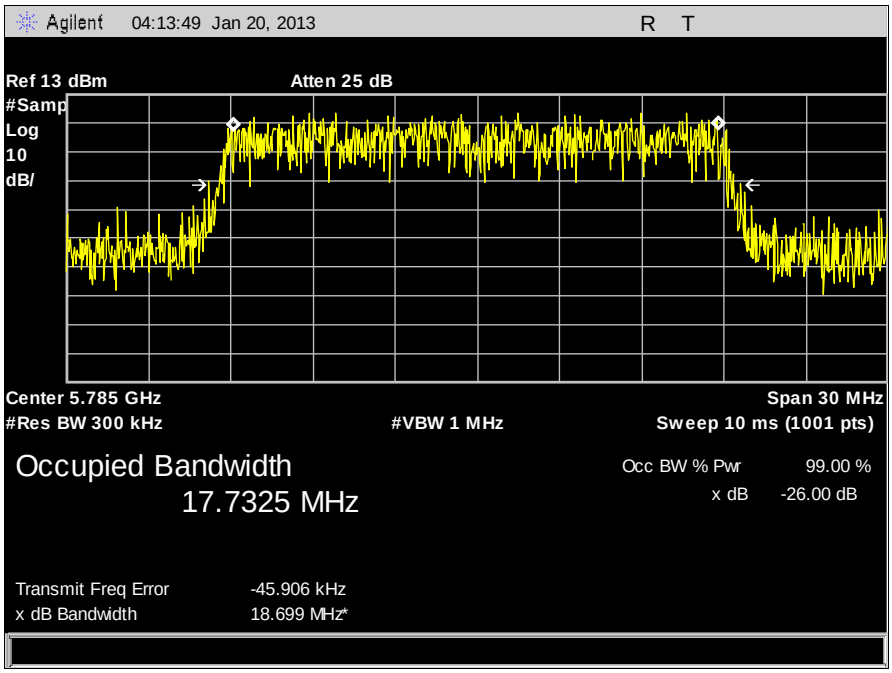



**Plot 9. Occupied Bandwidth, 5745 MHz, 99%**

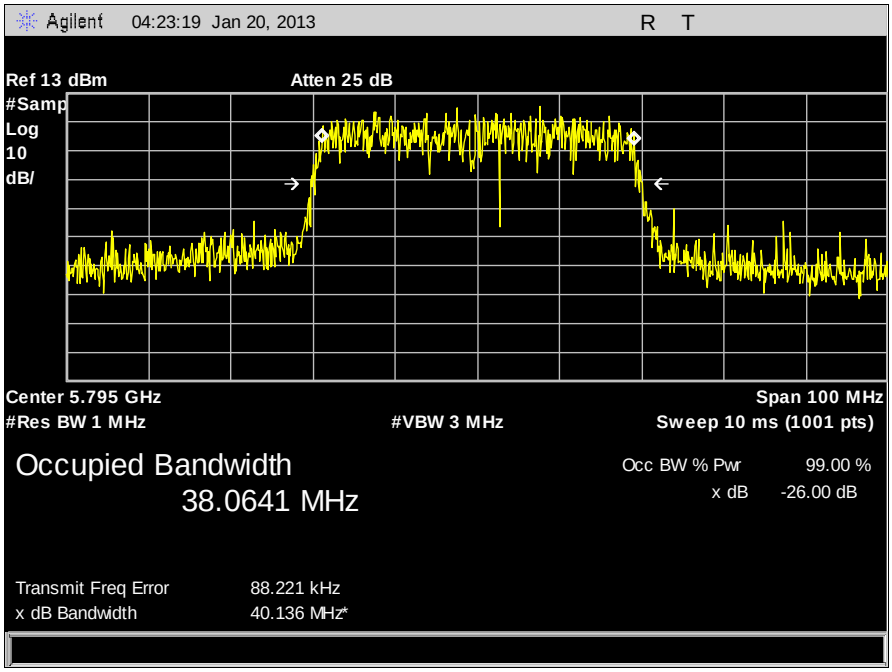



**Plot 10. Occupied Bandwidth, 5755 MHz, 99%**

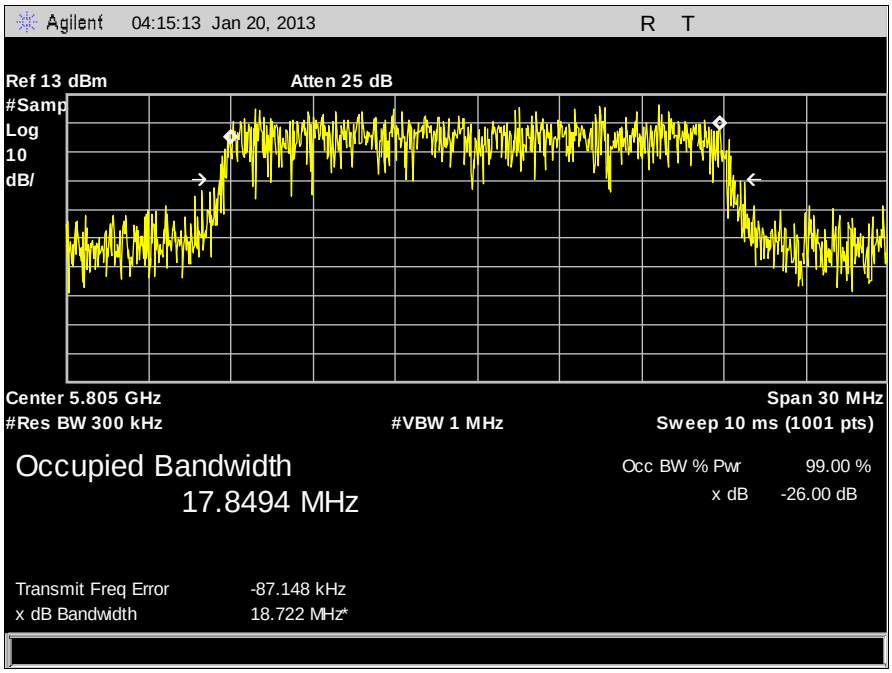



**Plot 11. Occupied Bandwidth, 5785 MHz, 99%**




**Plot 12. Occupied Bandwidth, 5795 MHz, 99%**




**Plot 13. Occupied Bandwidth, 5805 MHz, 99%**

## Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15. 407(a)(3) RF Power Output

**Test Requirements:** **§15.407(a)(3):** The maximum output power of the intentional radiator shall not exceed the following:

**§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.

**Test Procedure:** The EUT was connected to a Spectrum Analyzer. The power was measured on low, mid(where applicable), and high channels.

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

**Test Engineer(s):** Jeff Pratt

**Test Date(s):** 01/20/13

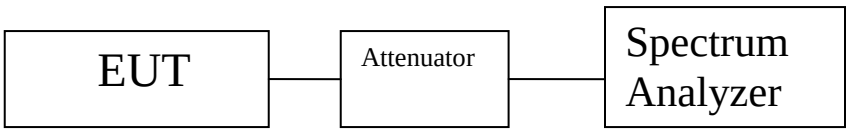
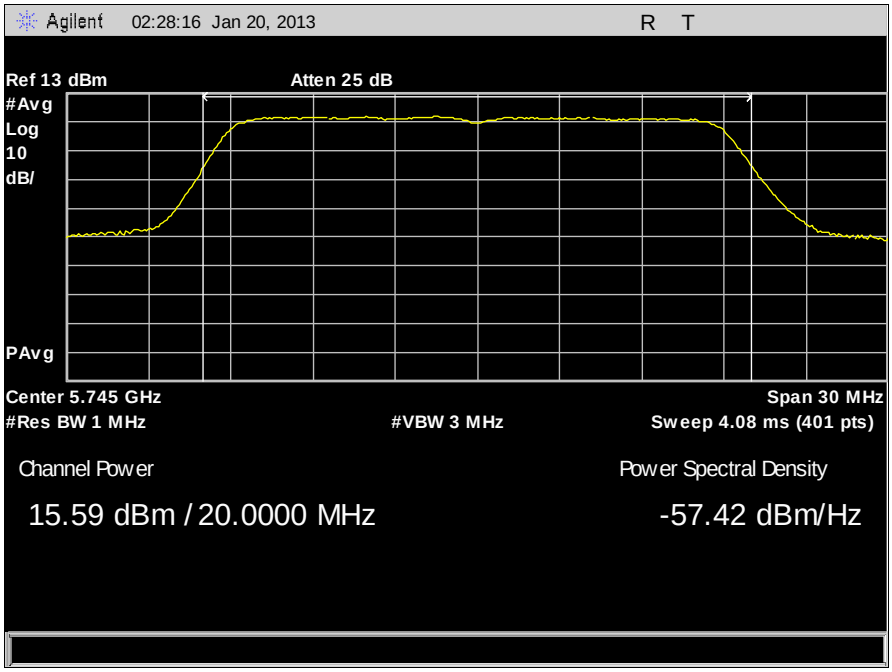


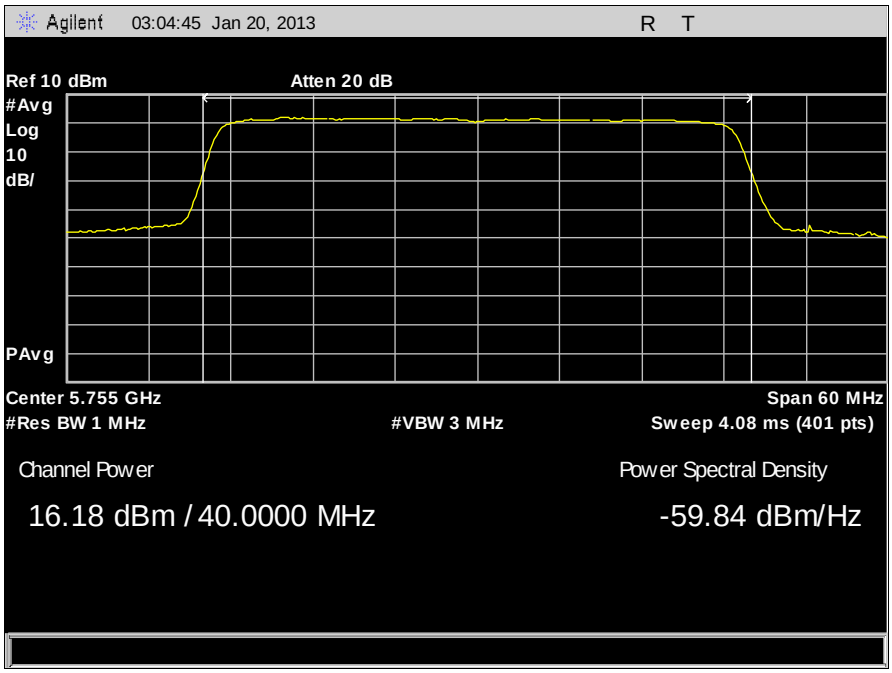

**Figure 3. Power Output Test Setup**

| Frequency (MHz) | Bandwidth | Power (dBm) | Antenna Gain (dBi) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 5745 | 20 MHz | 15.59 | 5 | 30 | -14.41 |
| 5785 | 20 MHz | 15.29 | 5 | 30 | -14.71 |
| 5805 | 20 MHz | 15.97 | 5 | 30 | -14.03 |
| 5755 | 40 MHz | 16.18 | 5 | 30 | -13.82 |
| 5795 | 40 MHz | 16.63 | 5 | 30 | -13.37 |

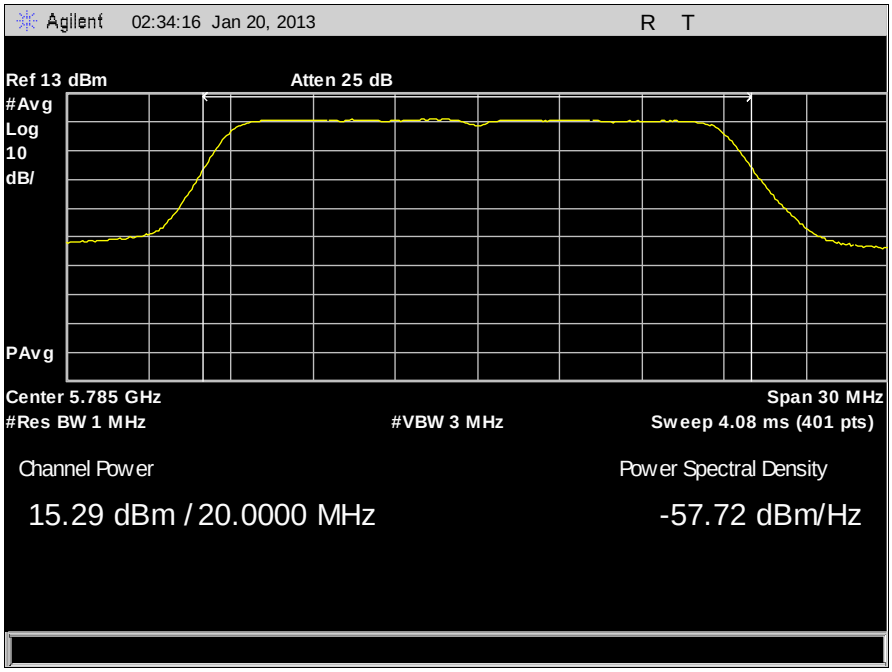



**Plot 14. RF Power Output, 5745 MHz**

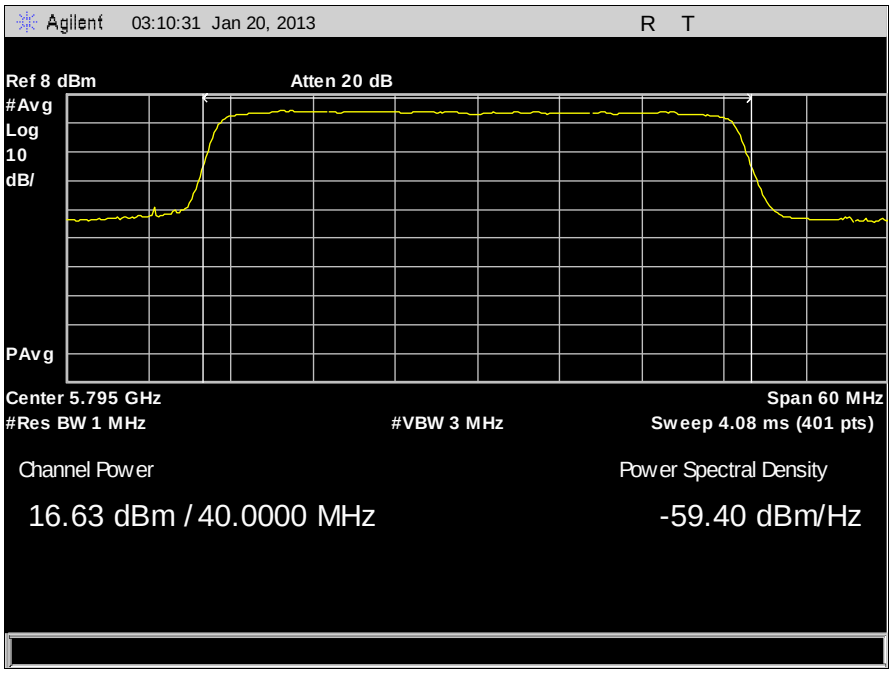



**Plot 15. RF Power Output, 5755 MHz**

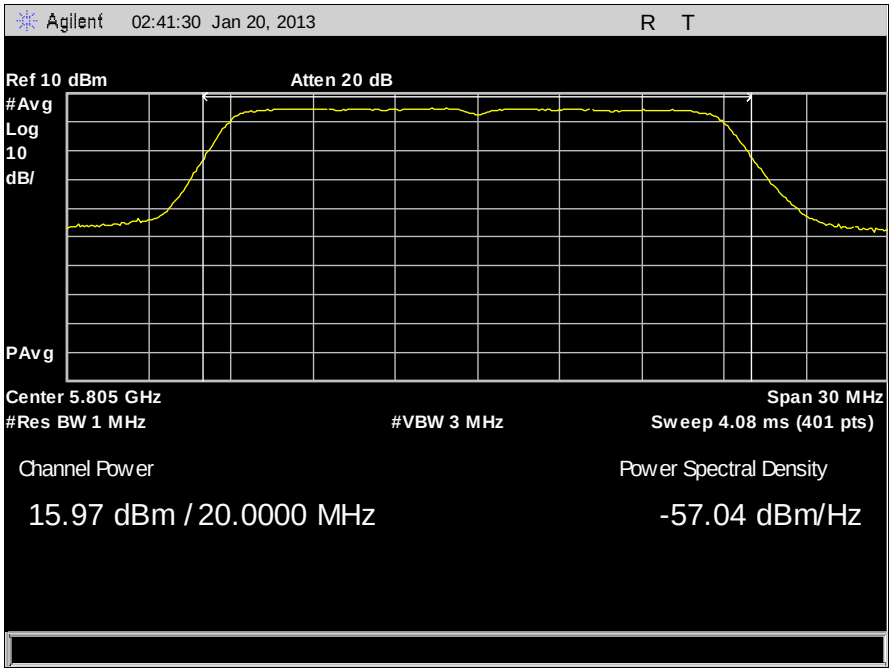



**Plot 16. RF Power Output, 5785 MHz**




**Plot 17. RF Power Output, 5795 MHz**




**Plot 18. RF Power Output, 5805 MHz**

# Electromagnetic Compatibility Criteria for Intentional Radiators

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

**Test Requirements:** **§ 15.407(a)(3):** In addition, the peak power spectral density shall not exceed 17 dBm in any 1 megahertz band.

**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 SA-1 from FCC Publication 789033 was used.

**Test Results:** Equipment was compliant with the peak power spectral density limits of **§ 15.407 (a)(3).** The peak power spectral density was determined from plots on the following page(s).

**Test Engineer(s):** Jeff Pratt

**Test Date(s):** 01/20/13

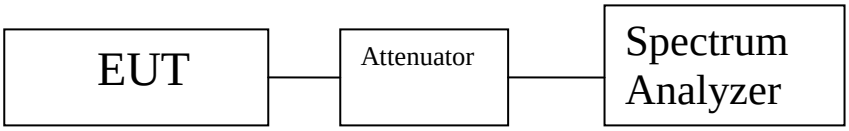
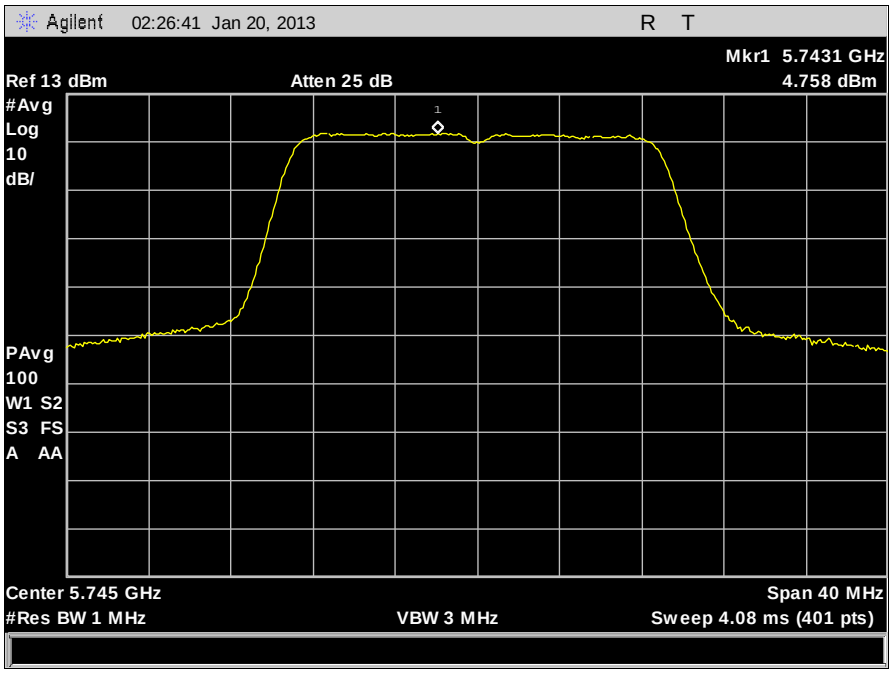



**Figure 4. Power Spectral Density Test Setup**

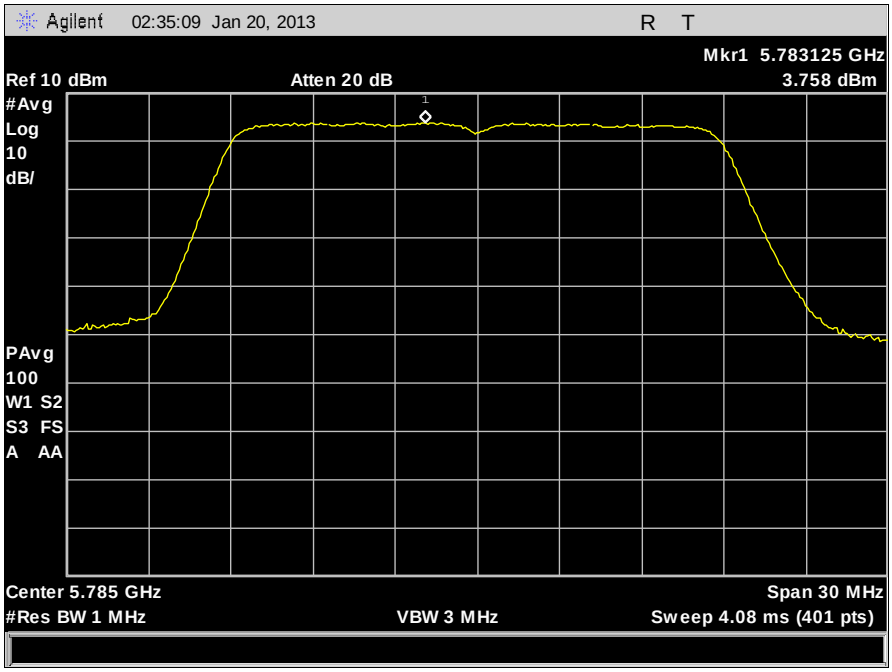
| Frequency (MHz) | Bandwidth | Power Spectral Density (dBm) | Antenna Gain (dBi) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 5745 | 20 MHz | 4.758 | 5 | 17 | -12.242 |
| 5785 | 20 MHz | 3.758 | 5 | 17 | -13.242 |
| 5805 | 20 MHz | 4.896 | 5 | 17 | -12.104 |
| 5755 | 40 MHz | 1.716 | 5 | 17 | -15.284 |
| 5795 | 40 MHz | 2.265 | 5 | 17 | -14.735 |

## Electromagnetic Compatibility Criteria for Intentional Radiators

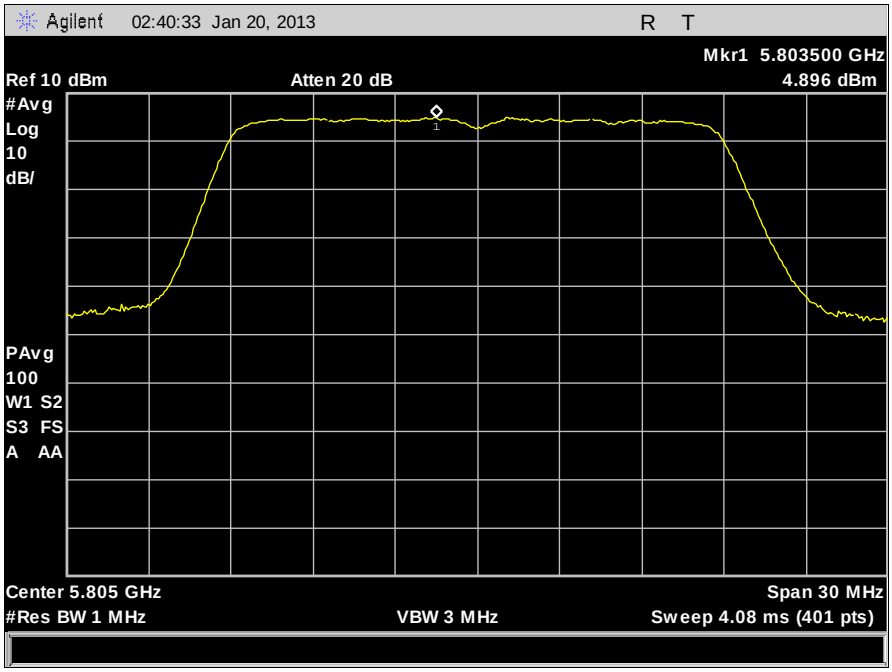



**Plot 19. Power Spectral Density, 5745 MHz**

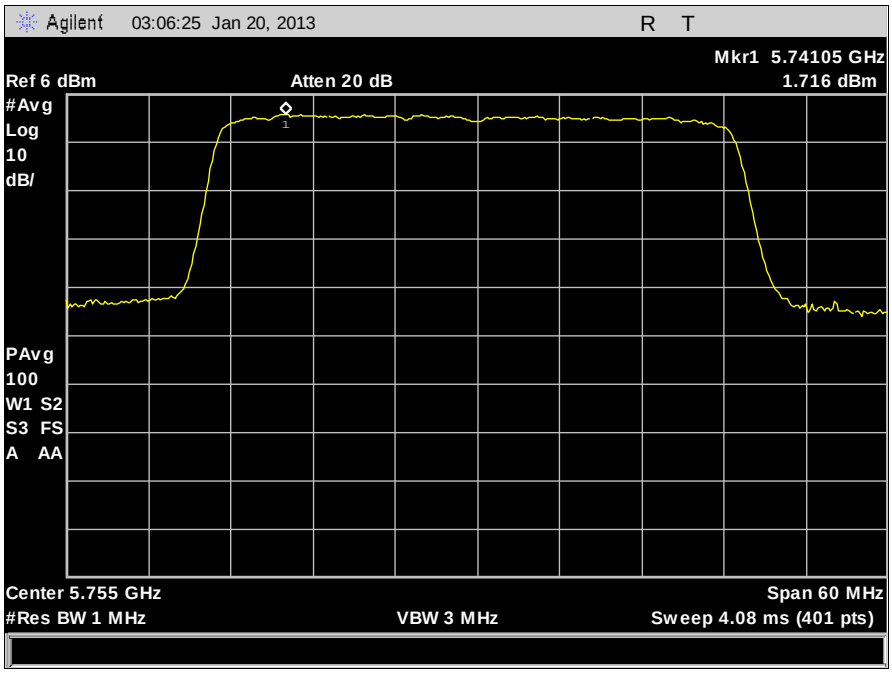



**Plot 20. Power Spectral Density, 5785 MHz**

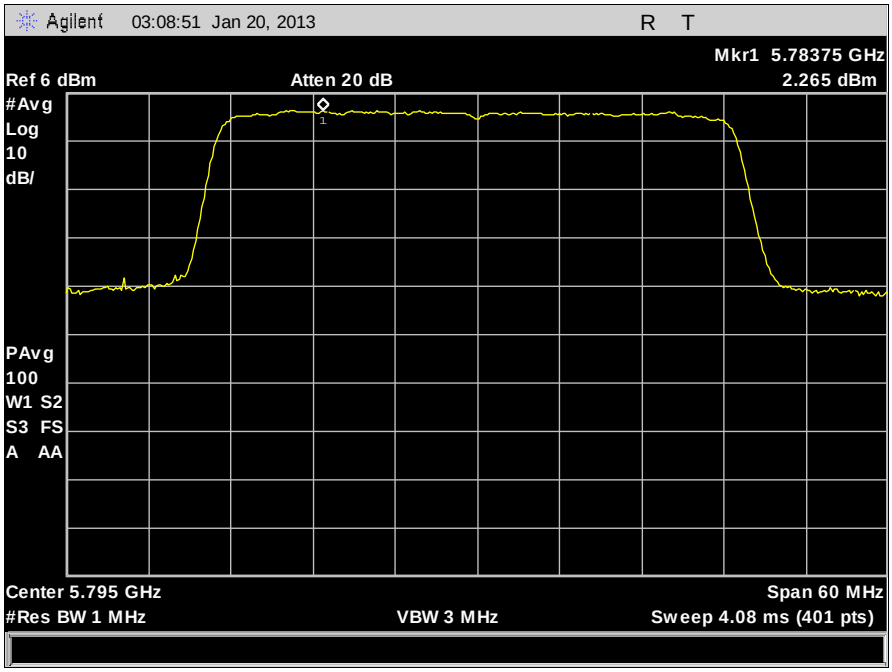



**Plot 21. Power Spectral Density, 5805 MHz**




**Plot 22. Power Spectral Density, 5755 MHz**




**Plot 23. Power Spectral Density, 5795 MHz**

## 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 SA-1 from FCC Publication 789033 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):** Jeff Pratt

**Test Date(s):** 01/20/13

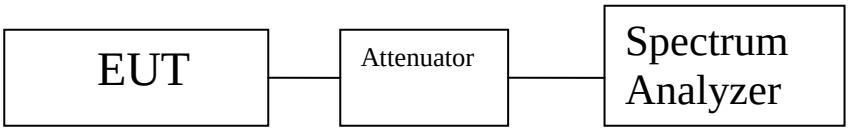
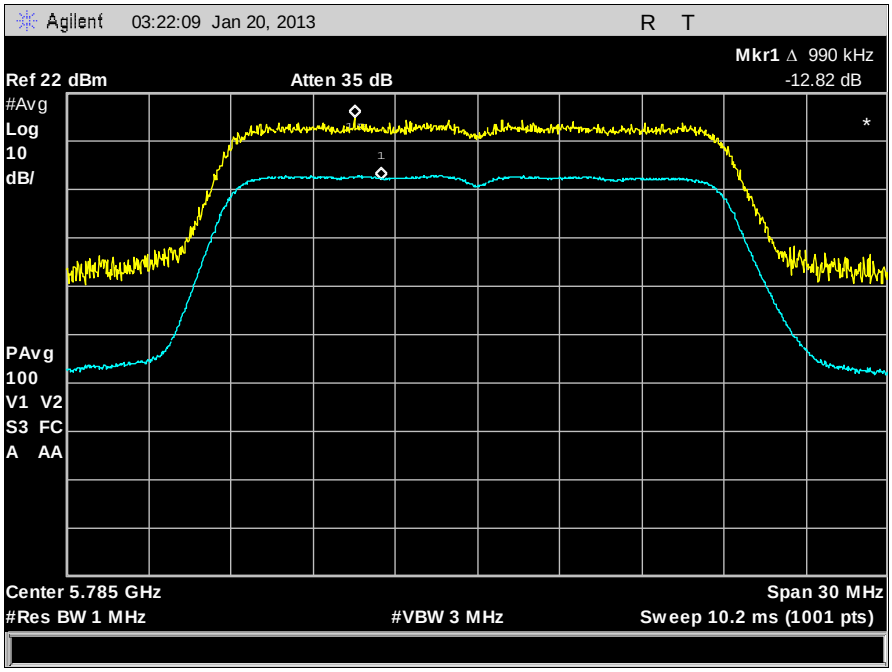
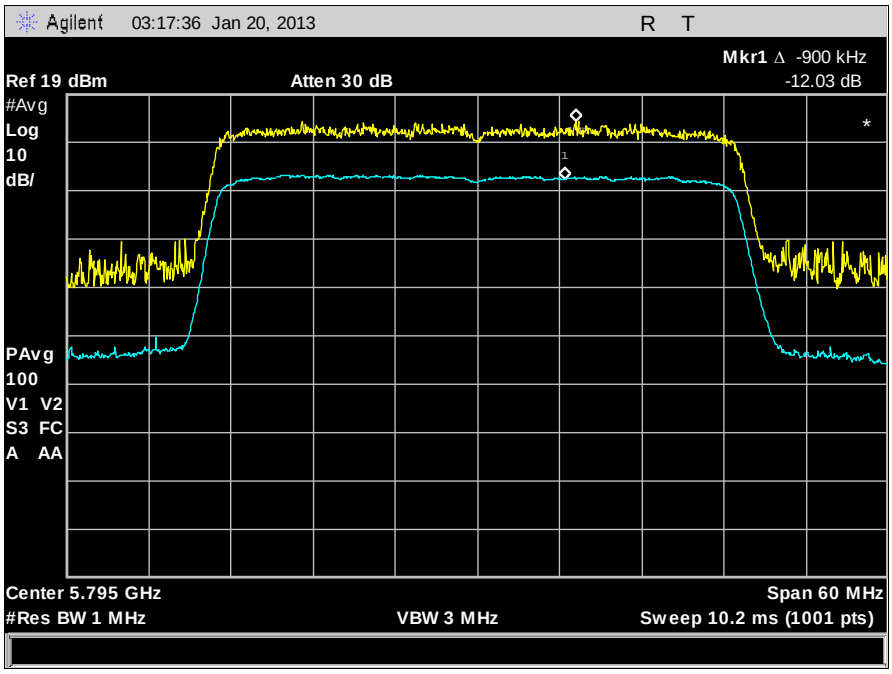



**Figure 5. Peak Excursion Ration Test Setup**




**Plot 24. Peak Excursion Ratio, 5785 MHz, PX**




**Plot 25. Peak Excursion Ratio, 5795 MHz, PX**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.407(b)(4), (6), (7) Undesirable Emissions

**Test Requirements:** **§ 15.407(b)(4), (6), (7)**; **§15.205:** Emissions outside the frequency band.

**§ 15.407(b)(4):** For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions 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 acrylic stand 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

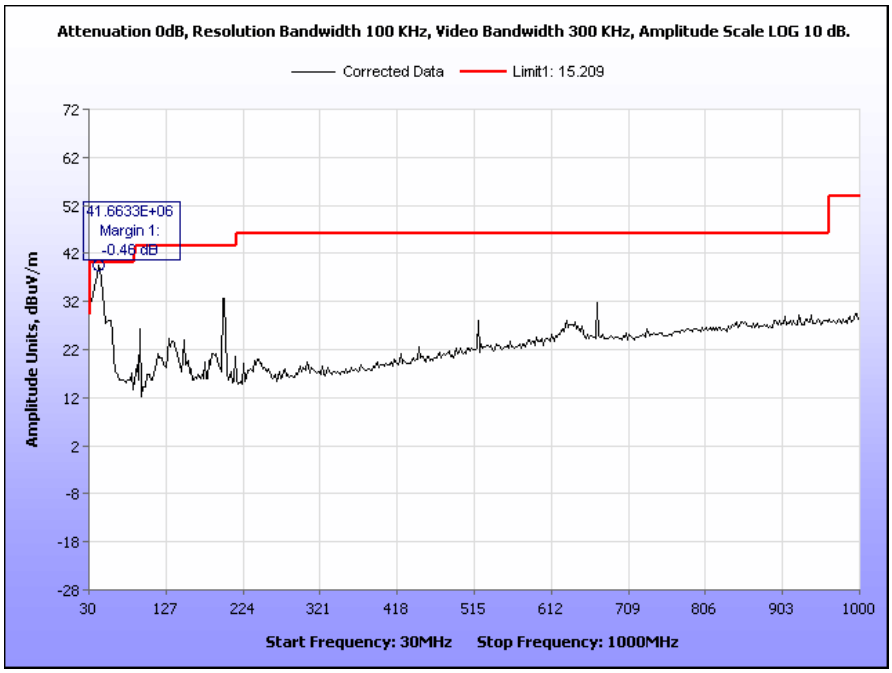
**Test Results:** The EUT was compliant with the Radiated Emission limits for Intentional Radiators. See following pages for detailed test results.

**Test Engineer(s):** Jeff Pratt and Zijun Tong

**Test Date(s):** 12/18/12 – 01/24/13

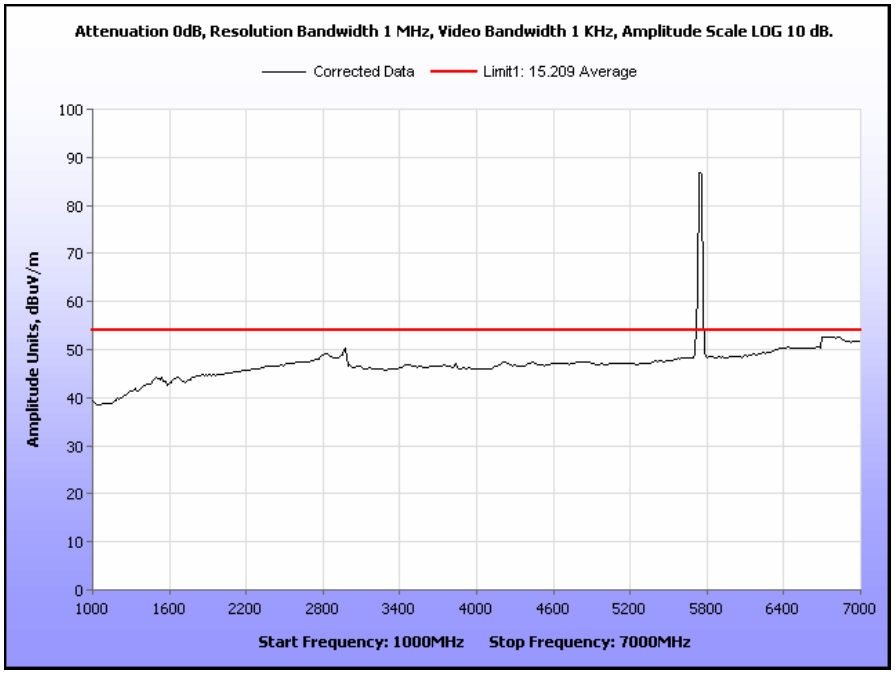
  

## § 15.209 Radiated Emissions Limits



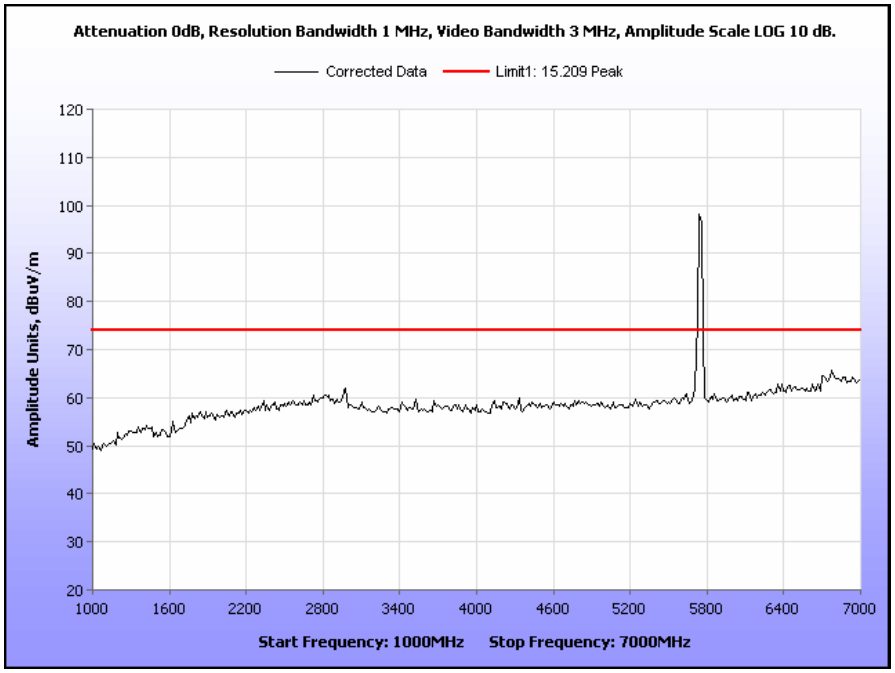

**Plot 26. Radiated Spurious Emissions, 5745 MHz, 20 MHz Channel, Tx Power 20, 30 MHz – 1 GHz**

Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limit of 15.109.

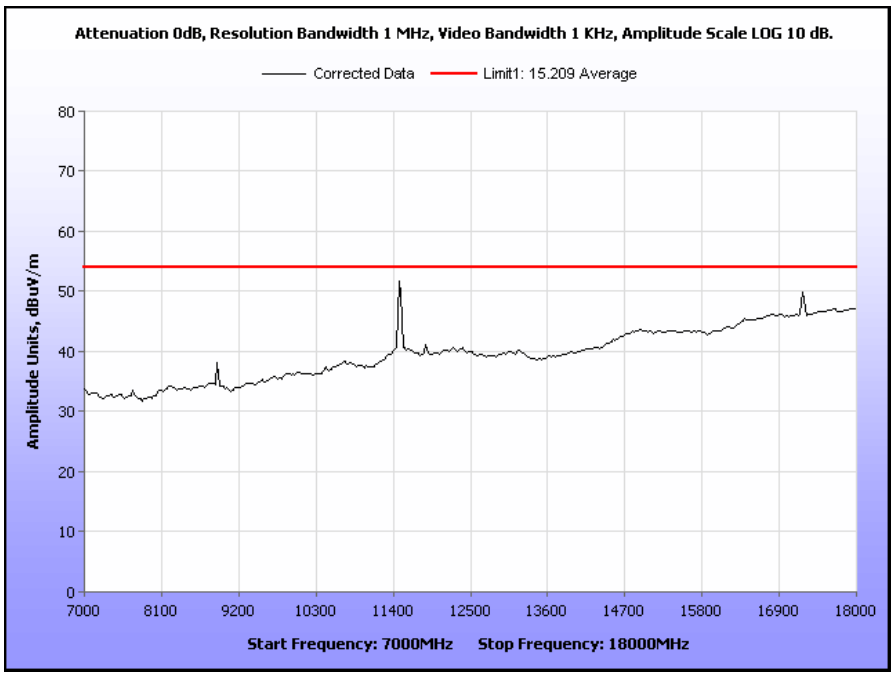



**Plot 27. Radiated Spurious Emissions, 5745 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Average**

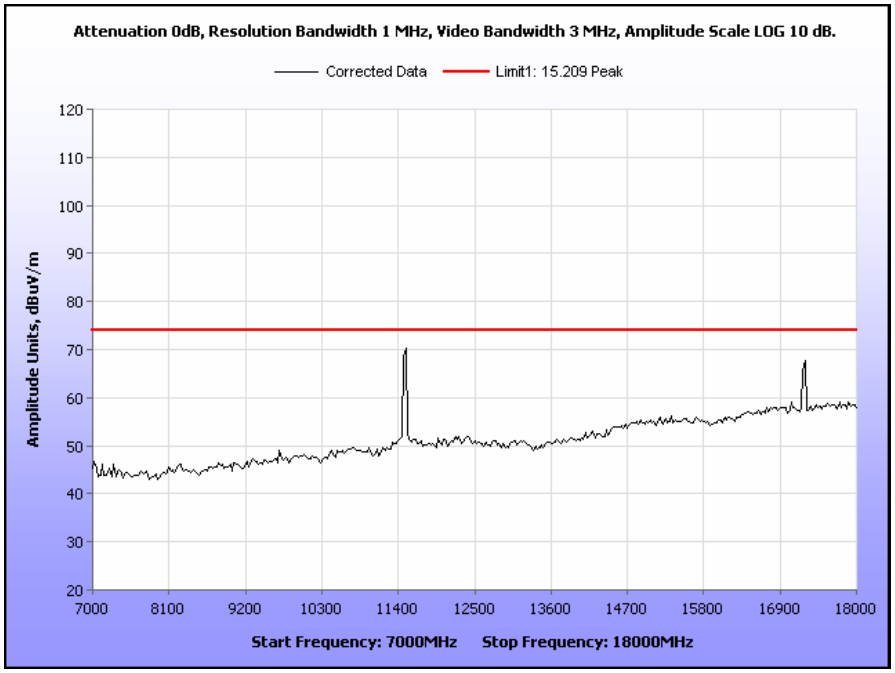



**Plot 28. Radiated Spurious Emissions, 5745 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Peak**

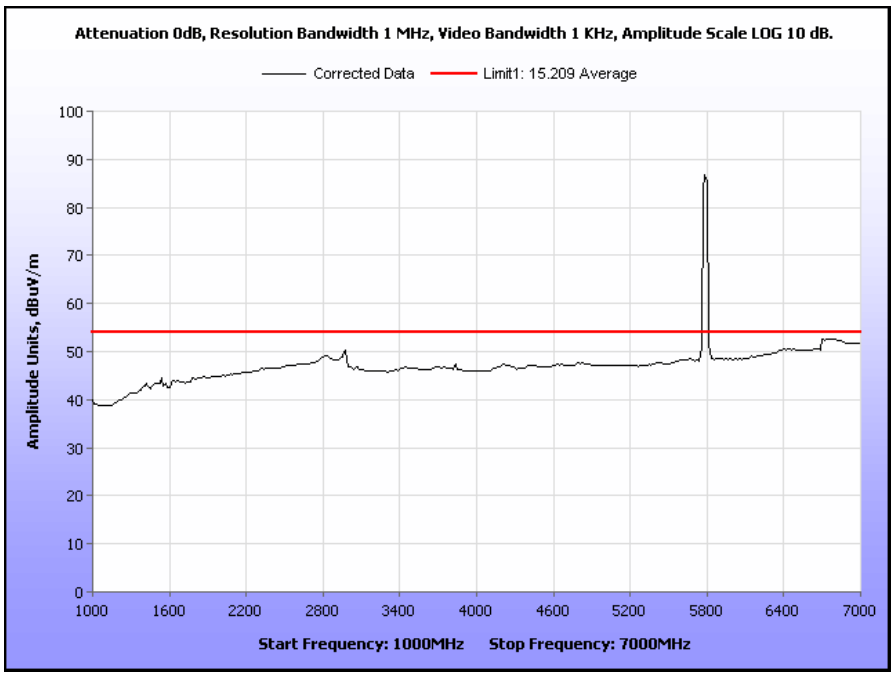



**Plot 29. Radiated Spurious Emissions, 5745 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Average**

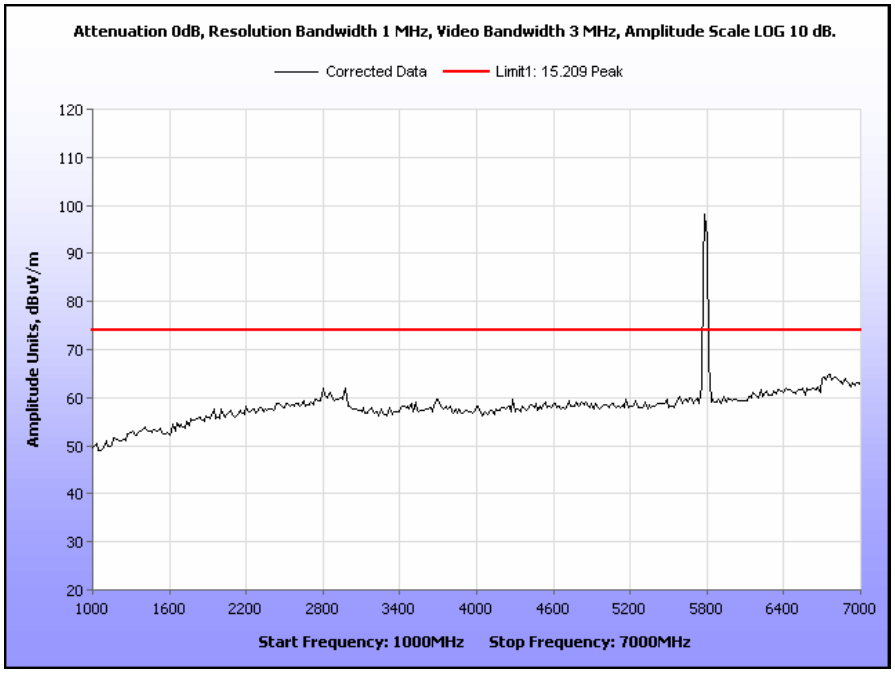



**Plot 30. Radiated Spurious Emissions, 5745 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Peak**

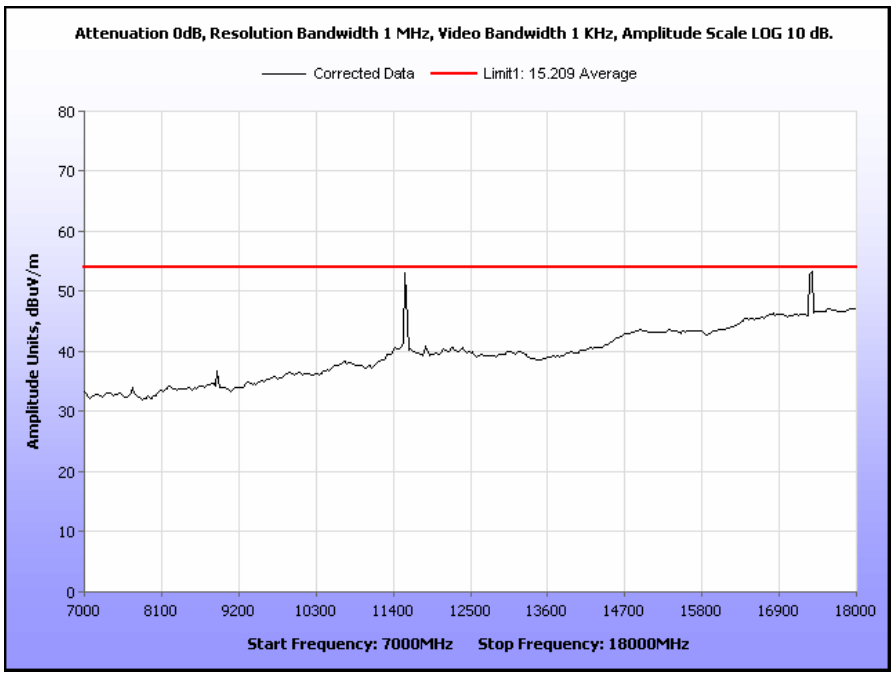



**Plot 31. Radiated Spurious Emissions, 5785 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Average**

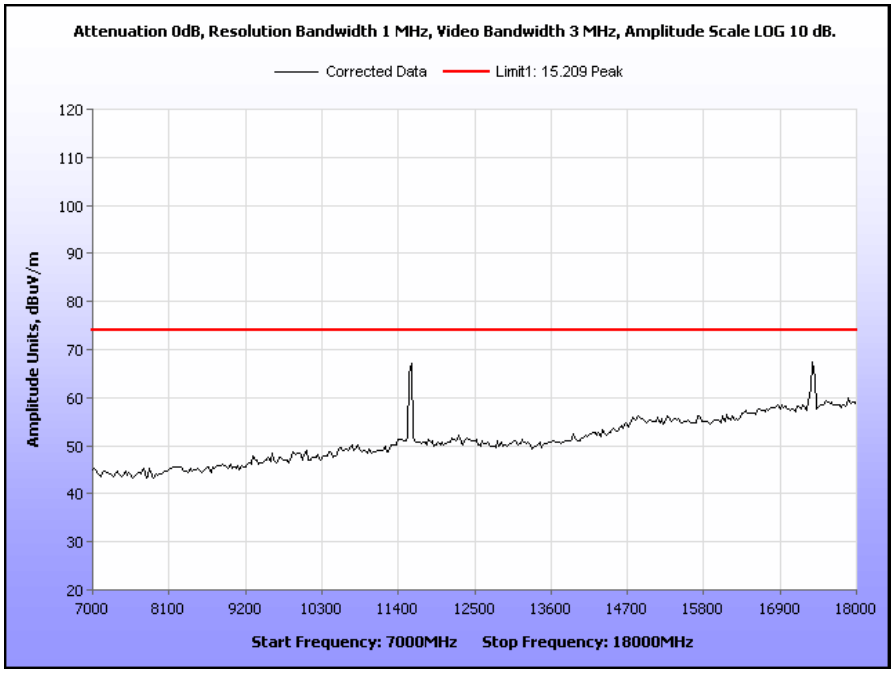



**Plot 32. Radiated Spurious Emissions, 5785 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Peak**

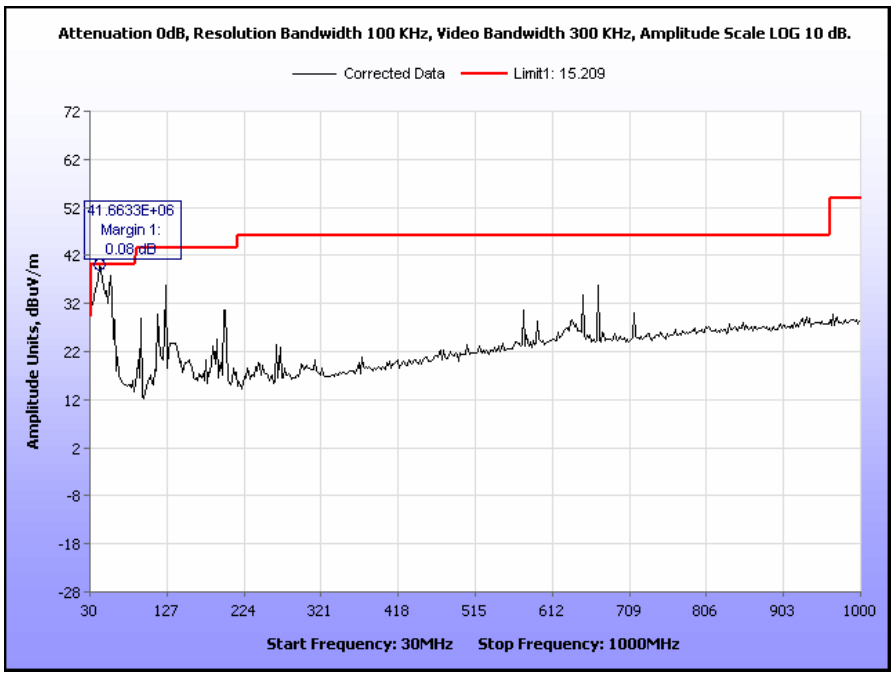



**Plot 33. Radiated Spurious Emissions, 5785 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Average**



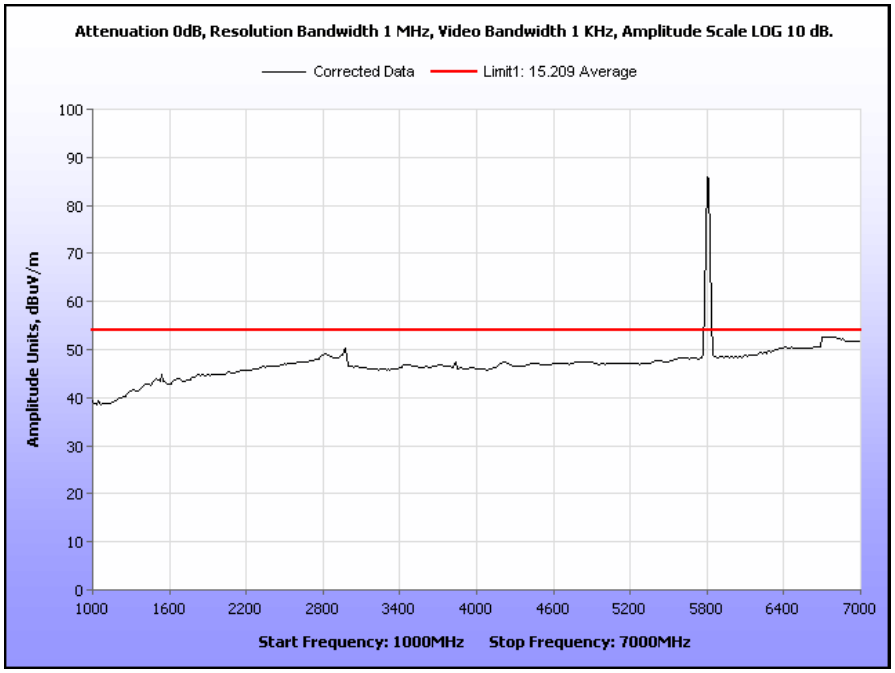

**Plot 34. Radiated Spurious Emissions, 5785 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Peak**



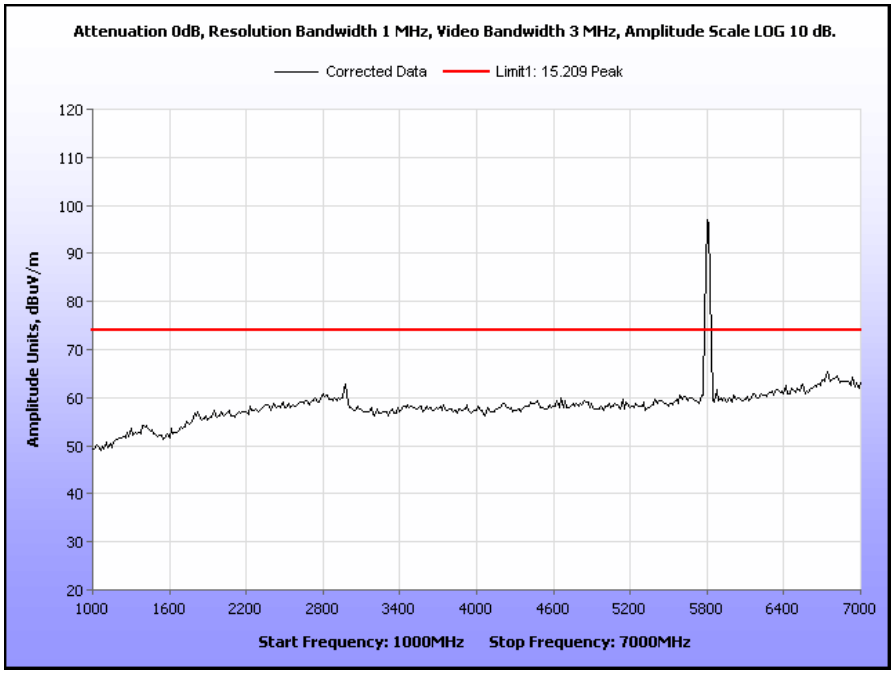

**Plot 35. Radiated Spurious Emissions, 5805 MHz, 20 MHz Channel, Tx Power 20, 30 MHz – 1 GHz**

Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limit of 15.109.

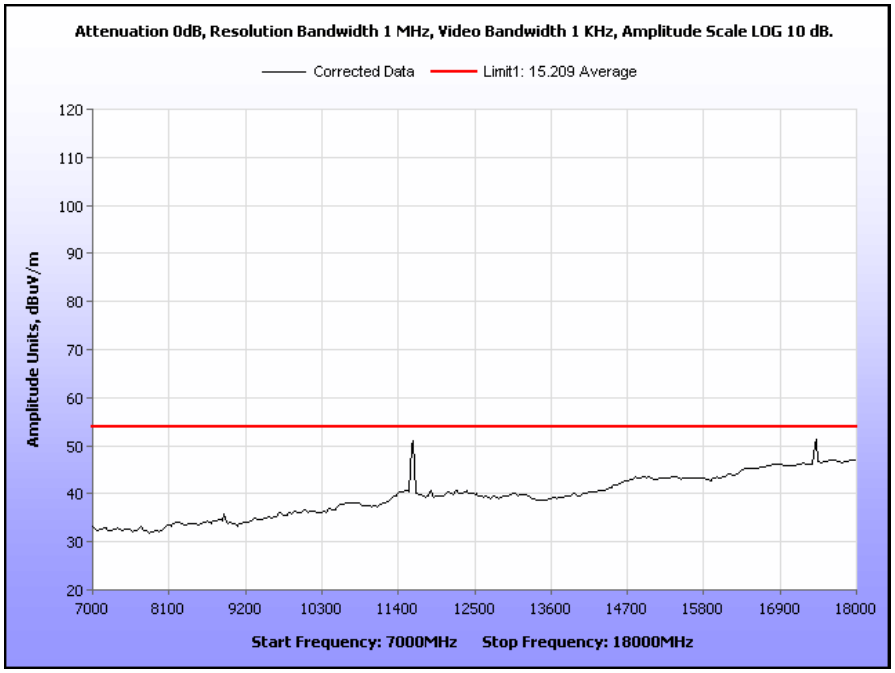



**Plot 36. Radiated Spurious Emissions, 5805 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Average**

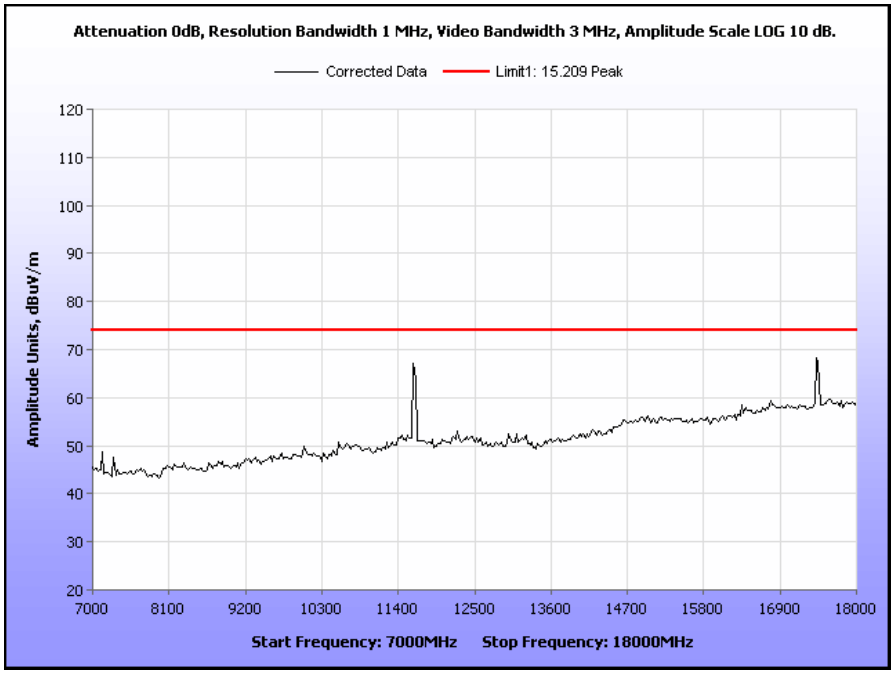



**Plot 37. Radiated Spurious Emissions, 5805 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Peak**

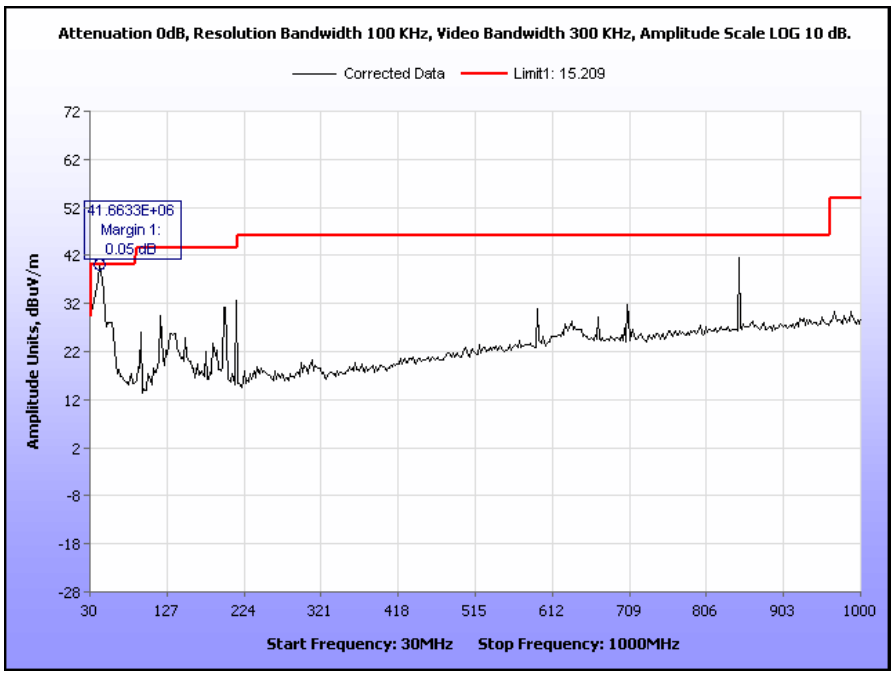



**Plot 38. Radiated Spurious Emissions, 5805 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Average**



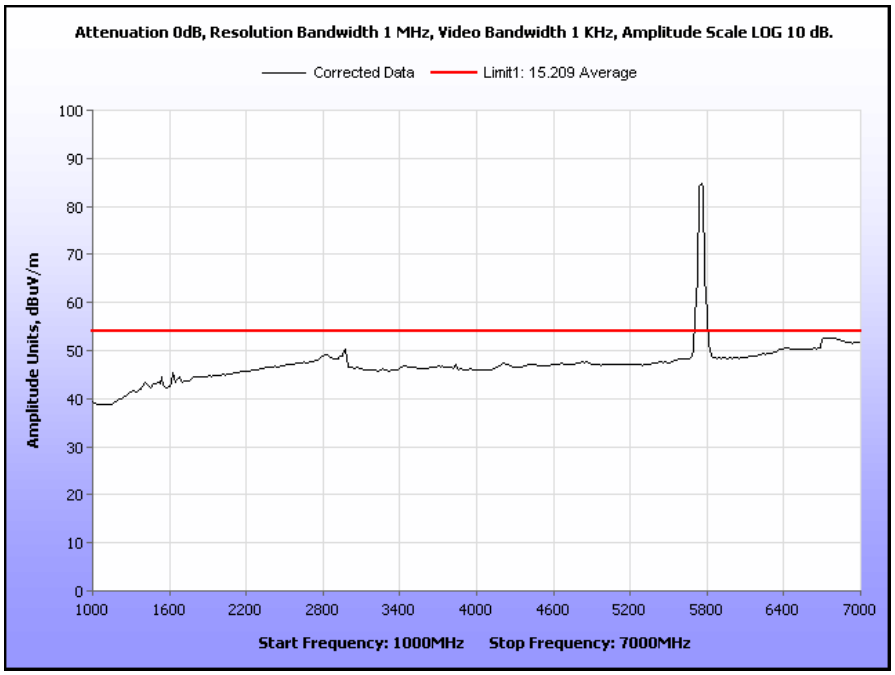

**Plot 39. Radiated Spurious Emissions, 5805 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Peak**



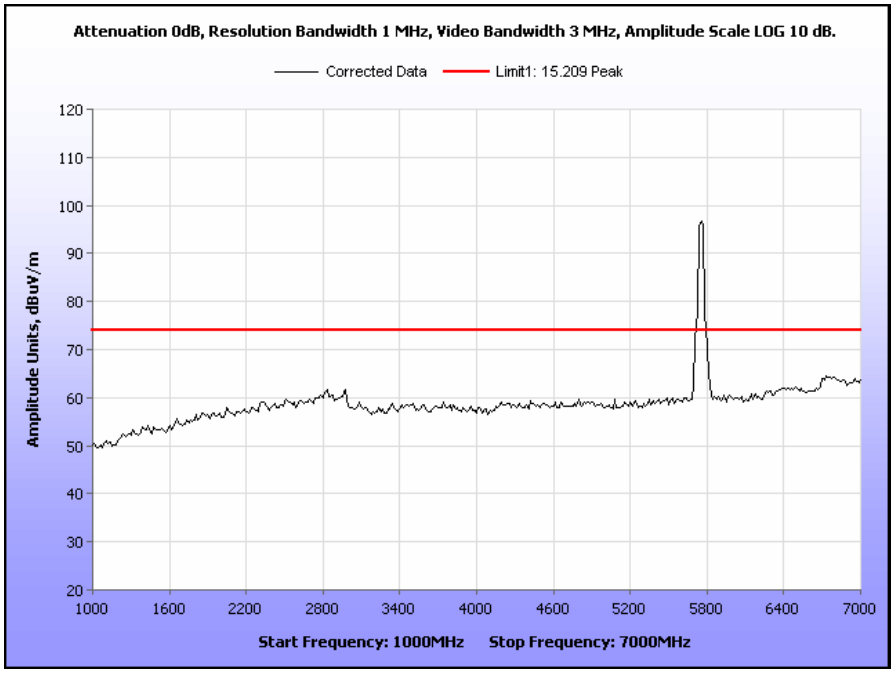

**Plot 40. Radiated Spurious Emissions, 5755 MHz, 40 MHz Channel, Tx Power 20, 30 MHz – 1 GHz**

Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limit of 15.109.

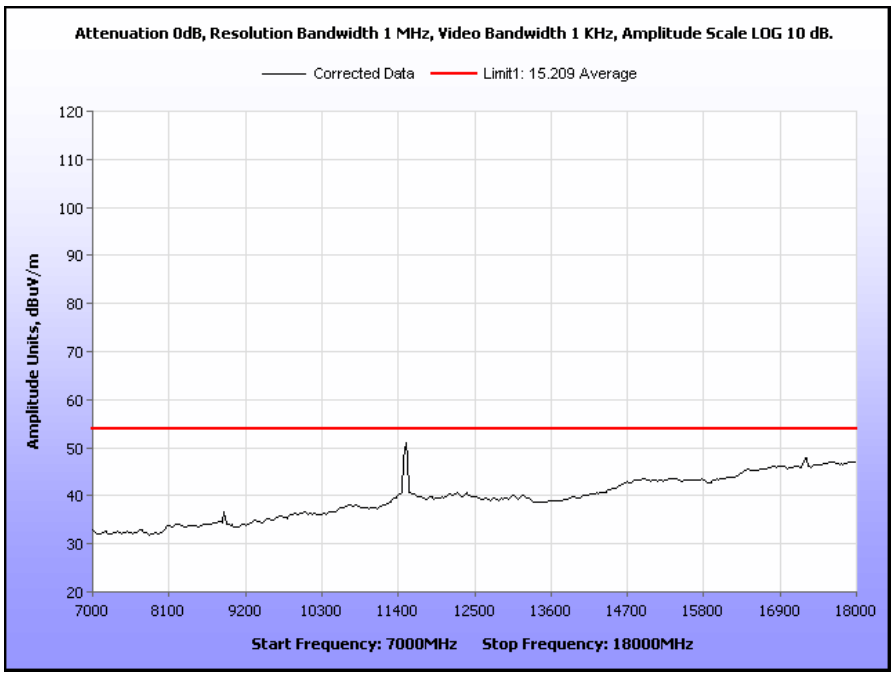



**Plot 41. Radiated Spurious Emissions, 5755 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Average**

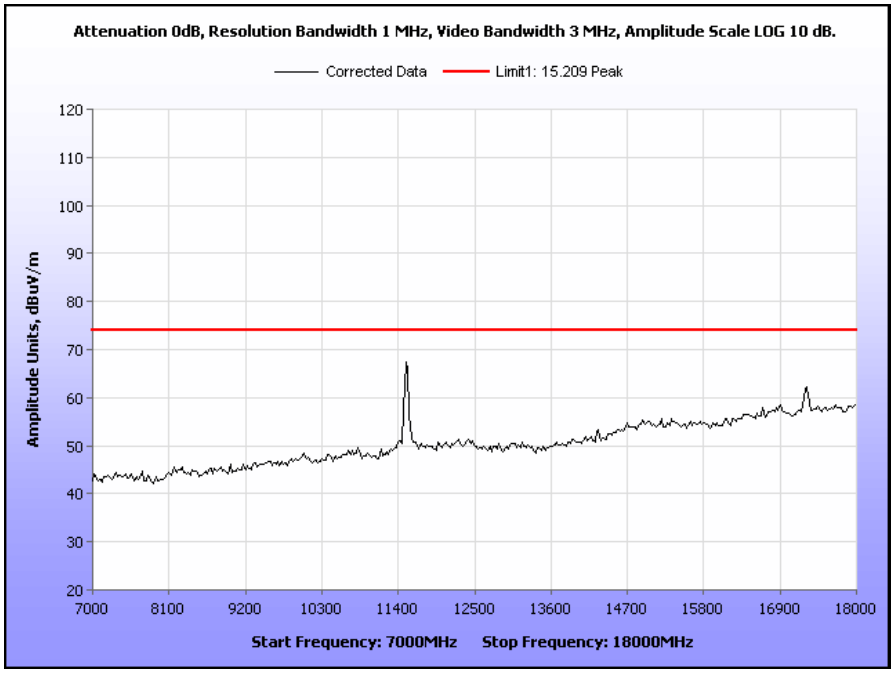



**Plot 42. Radiated Spurious Emissions, 5755 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Peak**

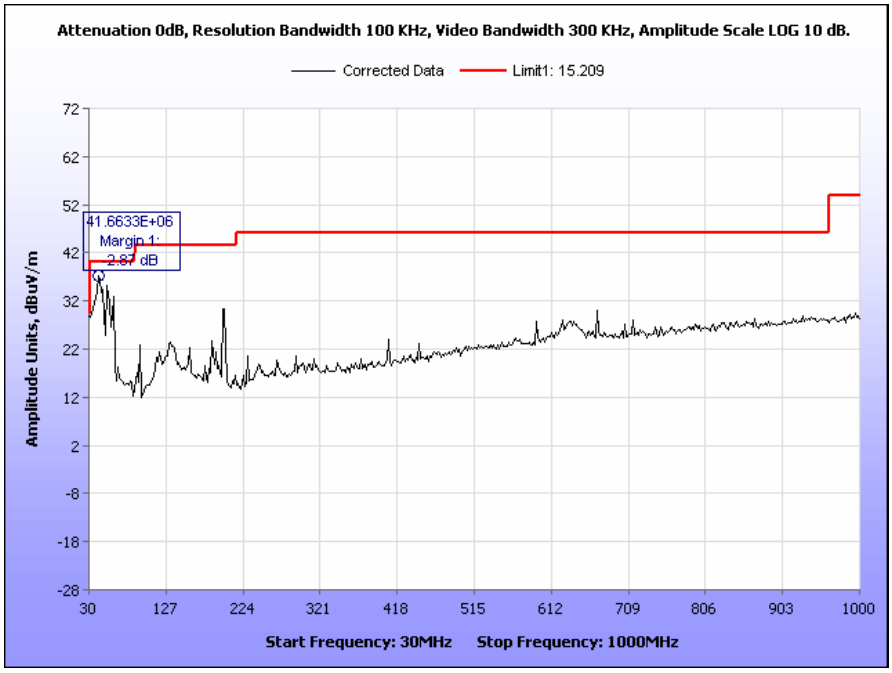



**Plot 43. Radiated Spurious Emissions, 5755 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Average**



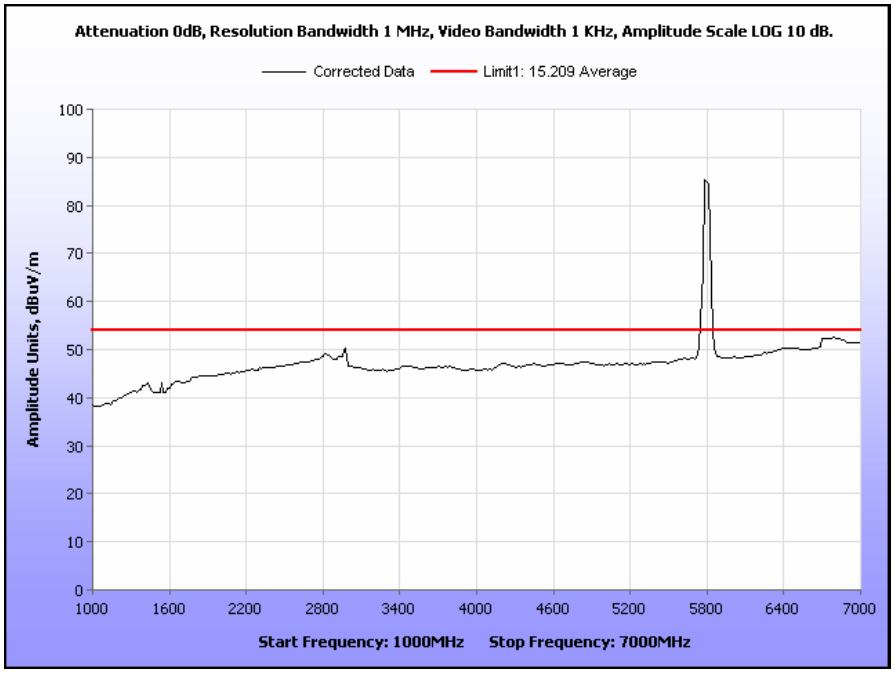

**Plot 44. Radiated Spurious Emissions, 5755 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Peak**



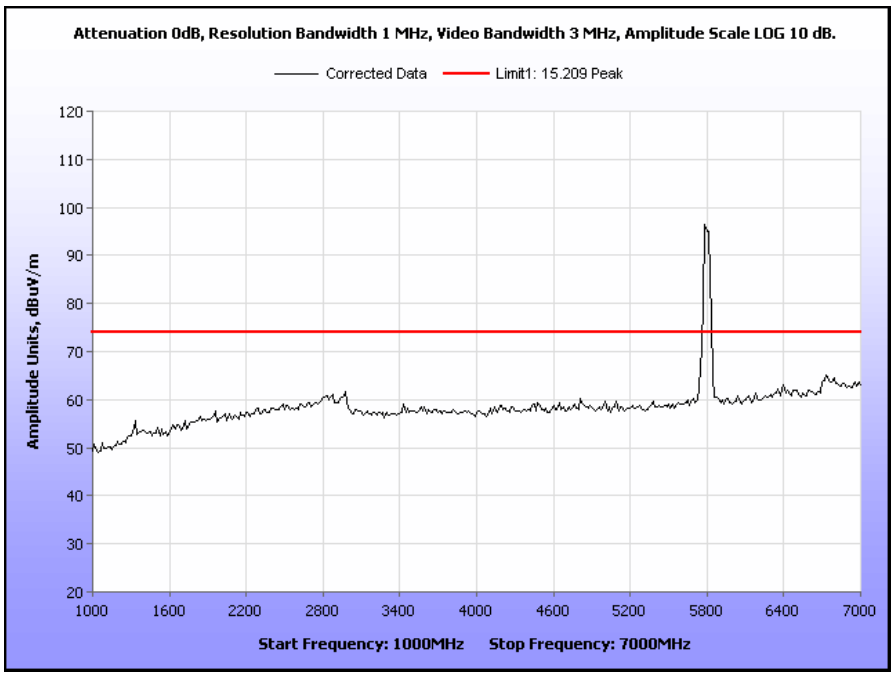

**Plot 45. Radiated Spurious Emissions, 5795 MHz, 40 MHz Channel, Tx Power 20, 30 MHz – 1 GHz**

Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limit of 15.109.

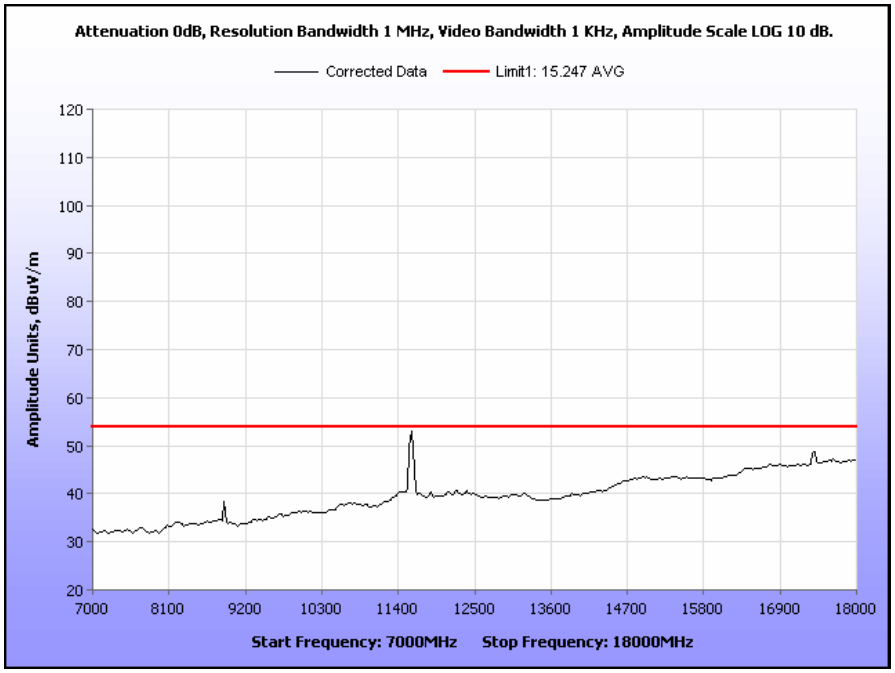



**Plot 46. Radiated Spurious Emissions, 5795 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Average**

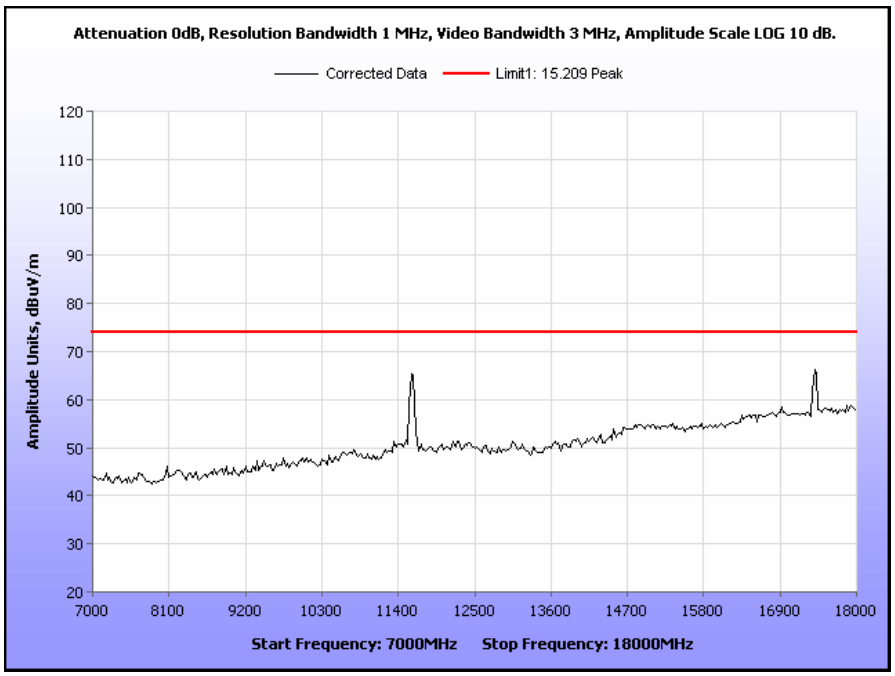



**Plot 47. Radiated Spurious Emissions, 5795 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Peak**

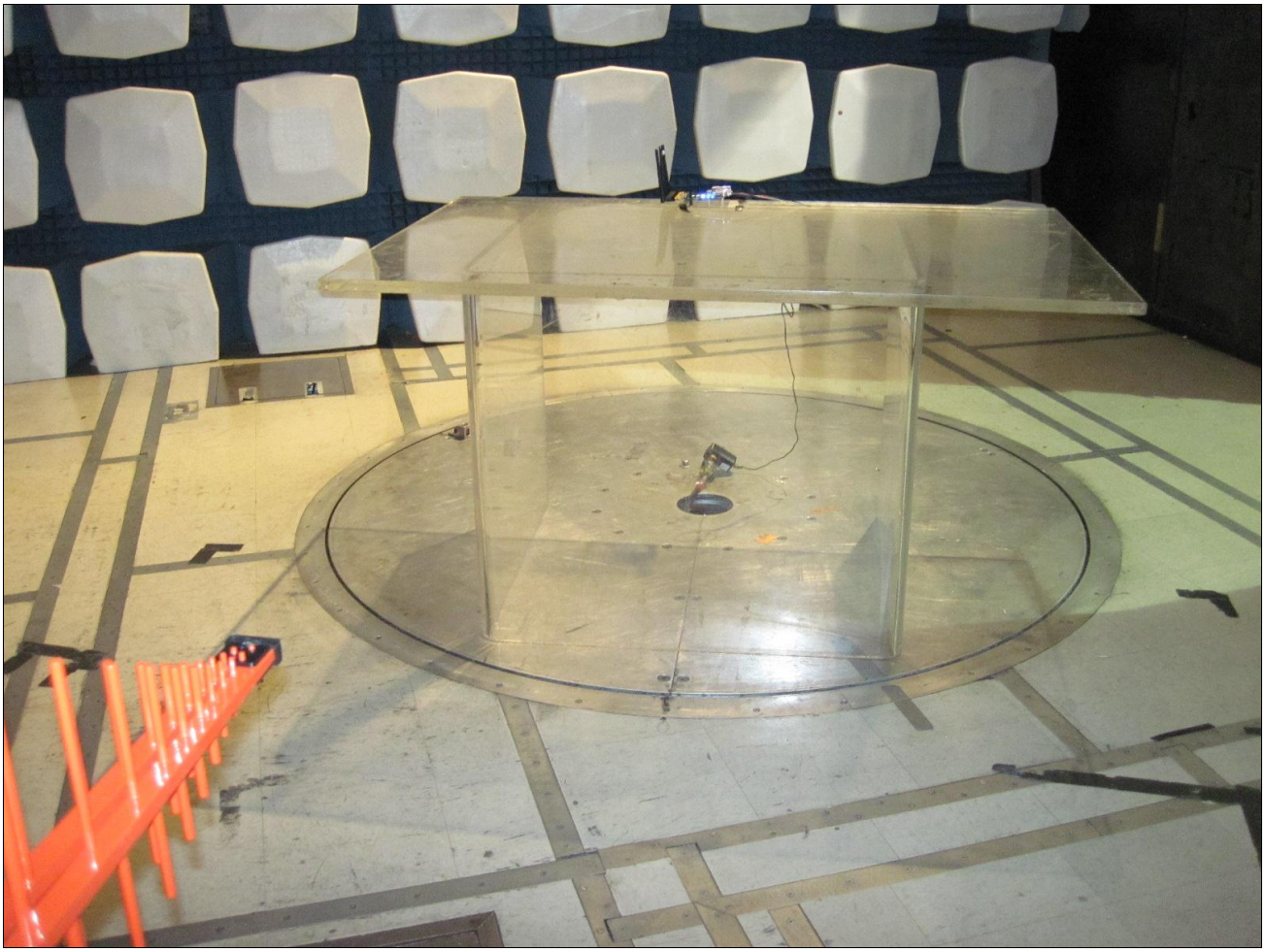



**Plot 48. Radiated Spurious Emissions, 5795 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Average**




**Plot 49. Radiated Spurious Emissions, 5795 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Peak**



**Photograph 5. Radiated Spurious Emissions, Test Setup**

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.407(f) RF Exposure

**RF Exposure Requirements:** **§1.1307(b)(1) and §1.1307(b)(2):** Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

**RF Radiation Exposure Limit:** **§1.1310:** As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

MPE Limit Calculation: EUT's operating frequencies @ 5745-5805MHz; highest conducted power = 16.63 dBm (Avg) therefore, **Limit for Uncontrolled exposure: 1 mW/cm$^2$ or 10 W/m$^2$**

Equation from page 18 of OET 65, Edition 97-01

$S = PG / 4\pi R^2$ or $R = \sqrt{PG / 4\pi S}$

where, S = Power Density (<1 mW/cm$^2$)
P = Power Input to antenna (46.03 mW)
G = Antenna Gain (3.16)
R = Minimum Distance between User and Antenna (20 cm)

$S = (46.03 * 3.16 )/(4*3.14*20^2 ) = 0.029$ mW/cm$^2$

Since S < 1 mW/cm$^2$, the minimum distance (R) is 20cm

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.407(g) Frequency Stability

**Test Requirements:** **§ 15.407(g):** Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

**Test Procedure:** The EUT was connected directly to a spectrum analyzer through an attenuator. The resolution band width of the spectrum analyzer was set to 1 kHz. A reference frequency was found at 20°C with input voltage of 120VAC. The voltage was varied at ambient temperature and the temperature was changed in steps no greater than 10°C. The carrier frequency was recorded in each case and compared to the reference frequency.

**Test Results:** The EUT was compliant with the requirements of **§15.407(g)**.

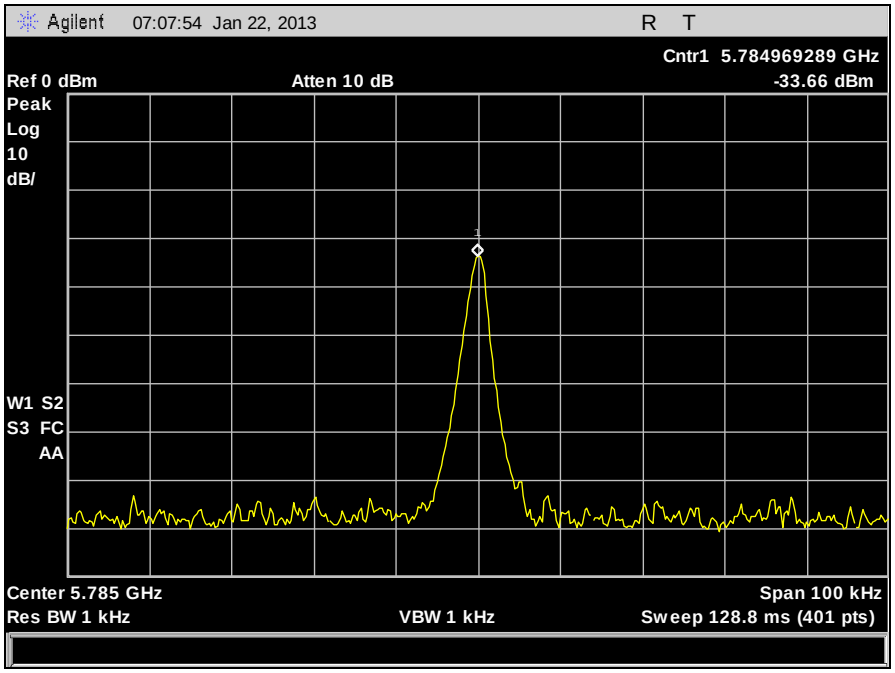
**Test Engineer(s):** Jeff Pratt

**Test Date(s):** 01/22/13

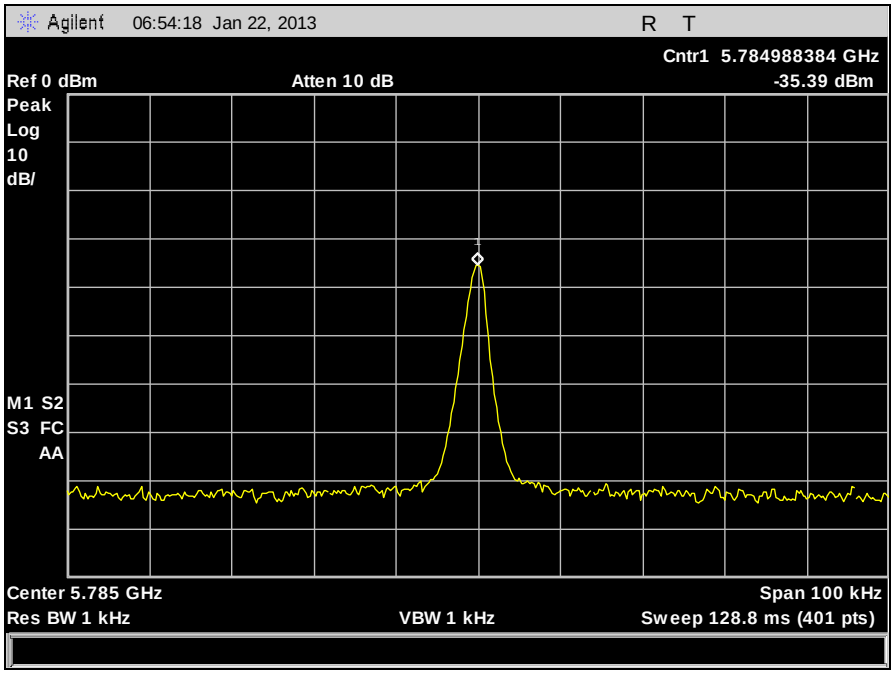
| Frequency | 5785 MHz | UNII3 | |
|---|---|---|---|
| Temperature (C) | Voltage (V) | Center Frequency (MHz) | Drift (PPM) |
| -30 | 120 | 5784.949289 | -2.11082 |
| -20 | 120 | 5784.988384 | 4.647222 |
| -10 | 120 | 5784.995213 | 5.827697 |
| 0 | 120 | 5784.987463 | 4.488016 |
| 10 | 120 | 5784.975523 | 2.424044 |
| 20 | 108 | 5784.96125 | -0.04322 |
| 20 | 120 | 5784.9615 | 0 |
| 20 | 132 | 5784.91873 | -7.39331 |
| 30 | 120 | 5784.94741 | -2.43563 |
| 40 | 120 | 5784.949453 | -2.08247 |
| 50 | 120 | 5784.939092 | -3.87349 |
| 55 | 120 | 5784.91105 | -8.72089 |

**Table 15. Frequency Stability, Test Results**

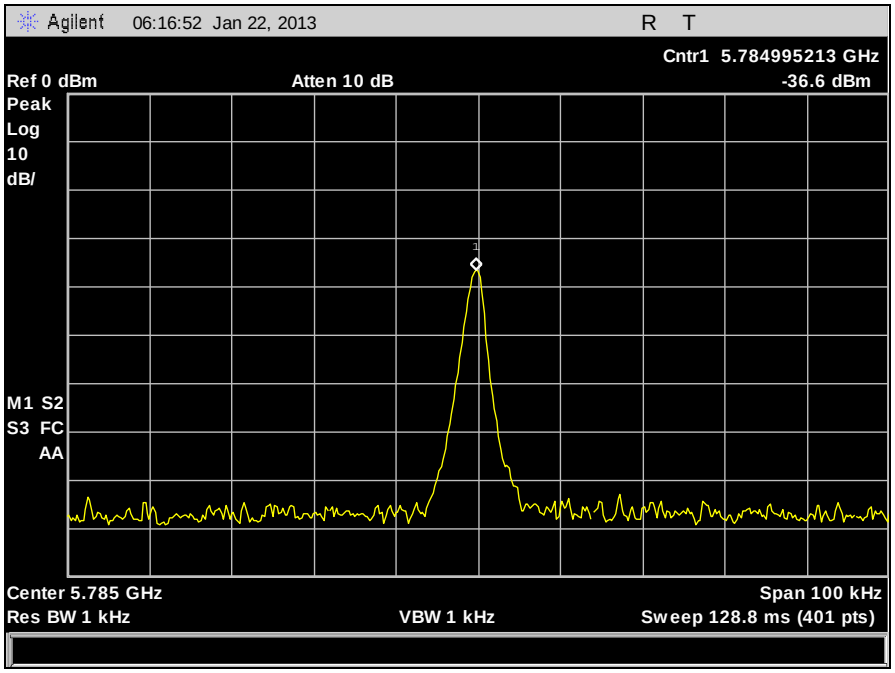



**Plot 50. Frequency Stability, 5785 MHz, -30°C, 120 V**

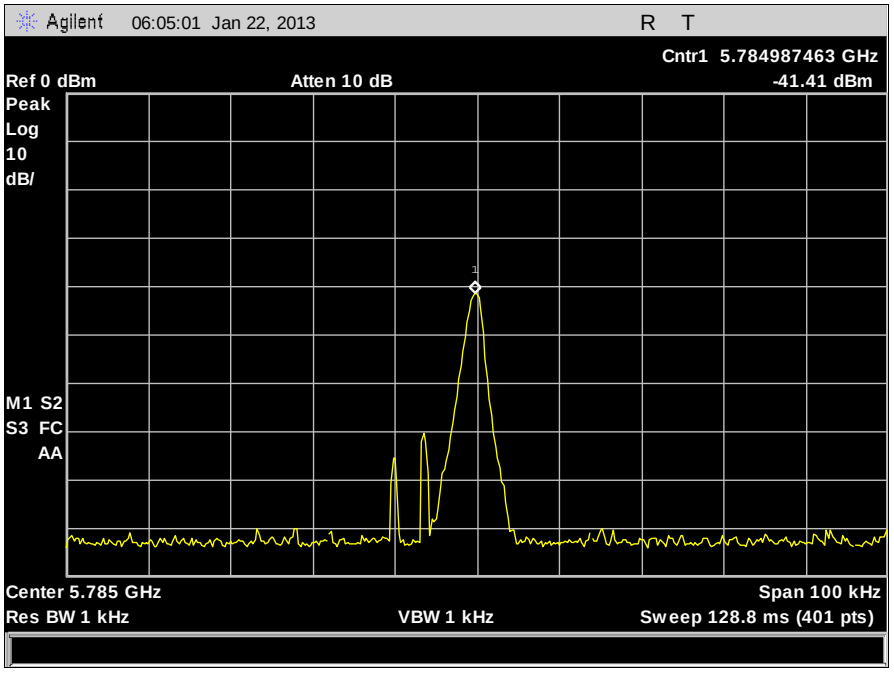



**Plot 51. Frequency Stability, 5785 MHz, -20°C, 120 V**

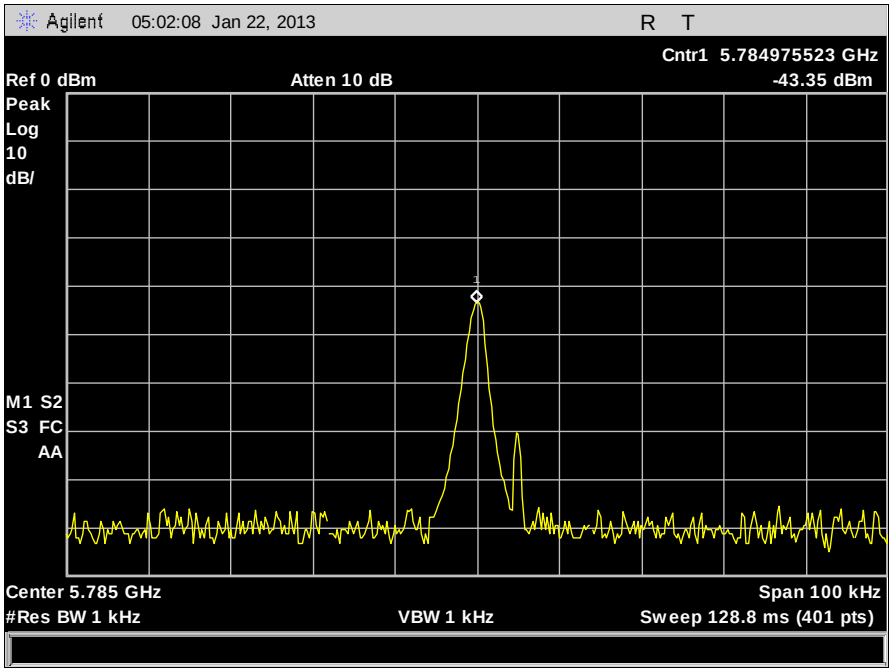



**Plot 52. Frequency Stability, 5785 MHz, -10°C, 120 V**

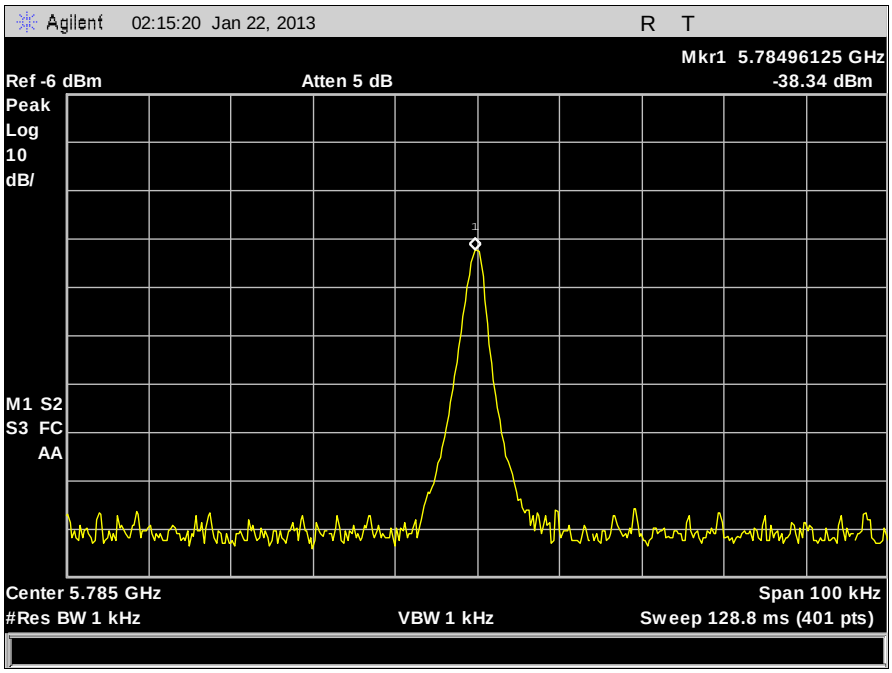



**Plot 53. Frequency Stability, 5785 MHz, 0°C, 120 V**

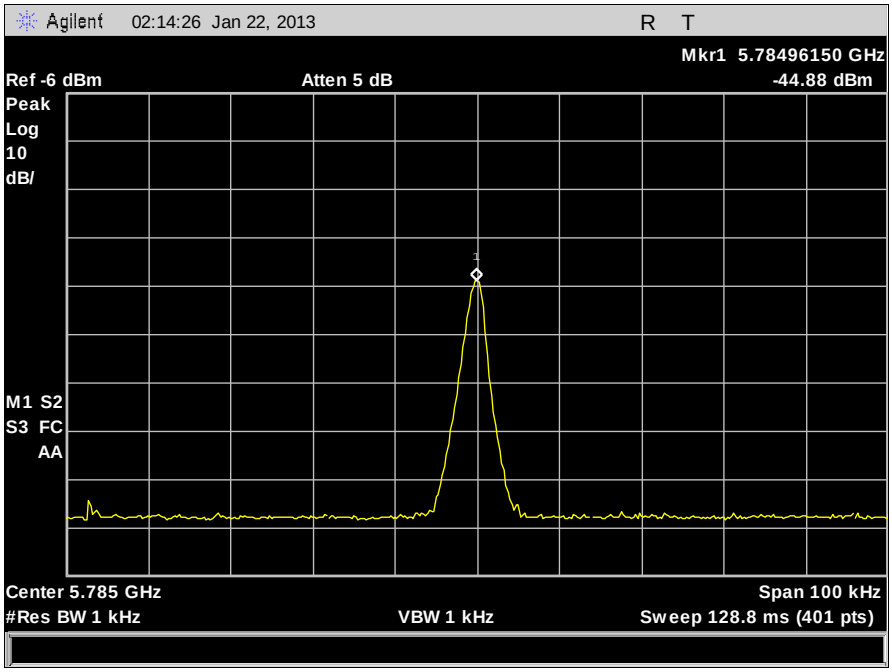



**Plot 54. Frequency Stability, 5785 MHz, 10°C, 120 V**

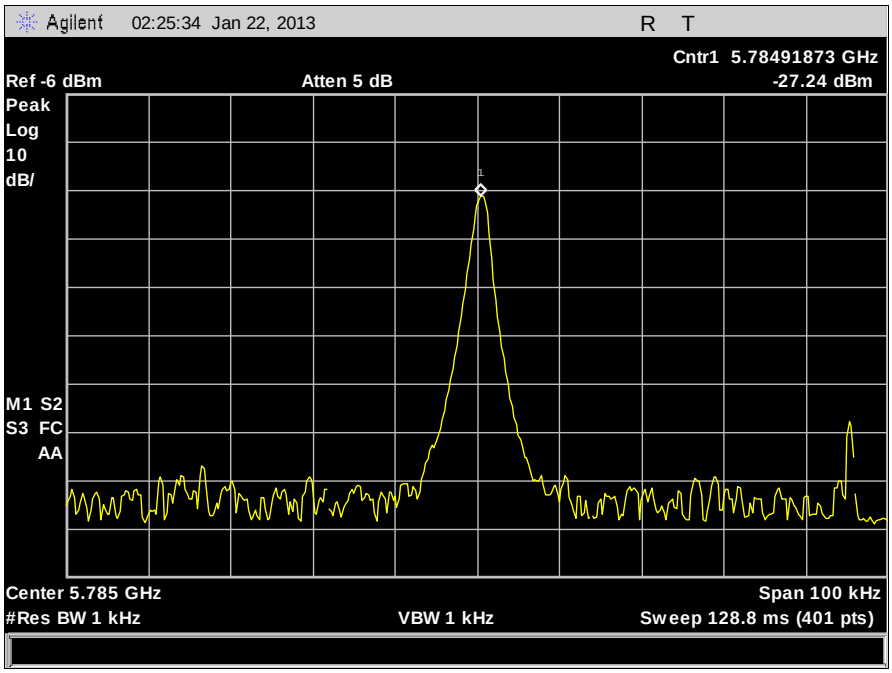



**Plot 55. Frequency Stability, 5785 MHz, 20°C, 108V**

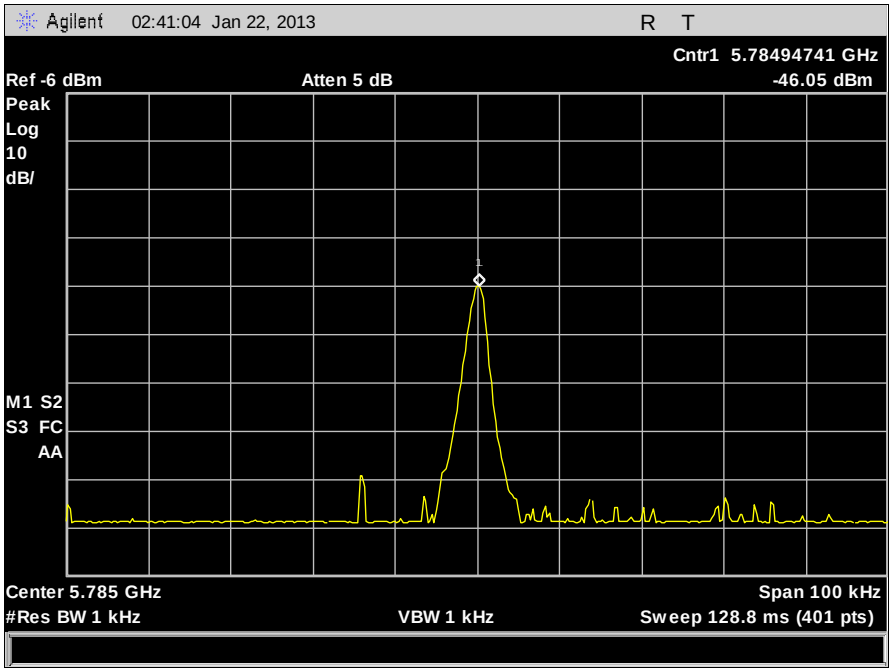



**Plot 56. Frequency Stability, 5785 MHz, 20°C, 120 V**

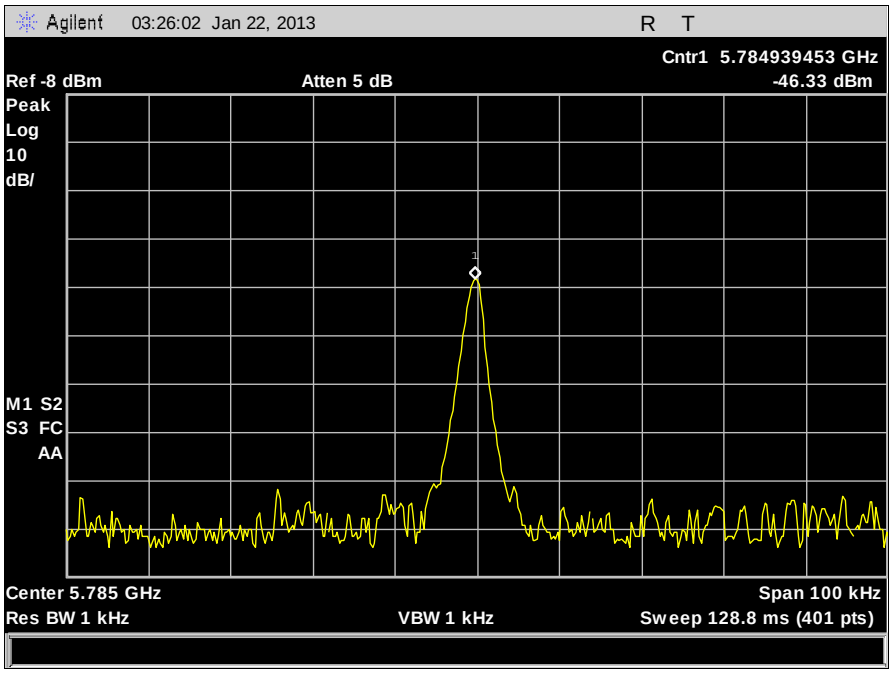



**Plot 57. Frequency Stability, 5785 MHz, 20°C, 132 V**

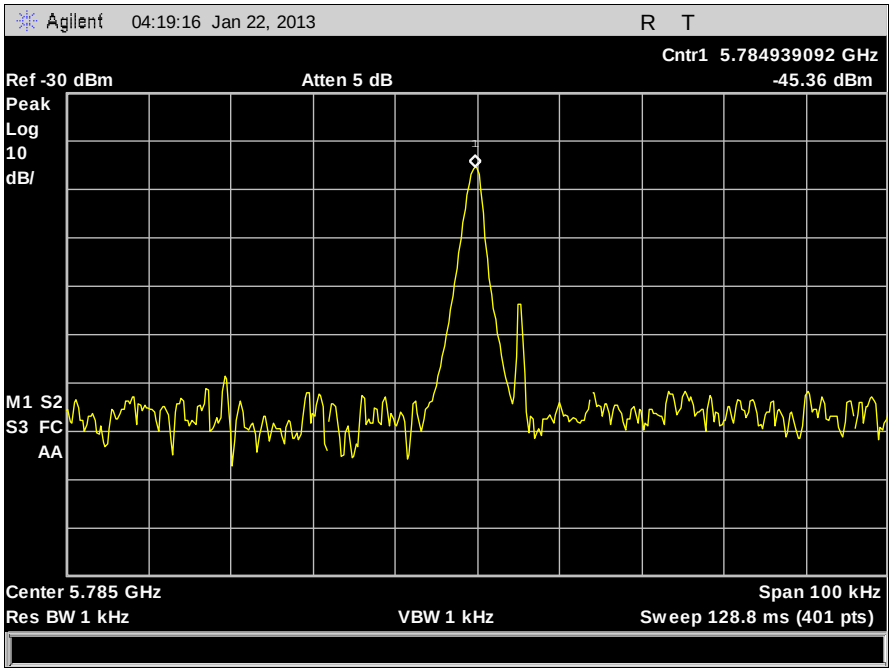



**Plot 58. Frequency Stability, 5785 MHz, 30°C, 120 V**

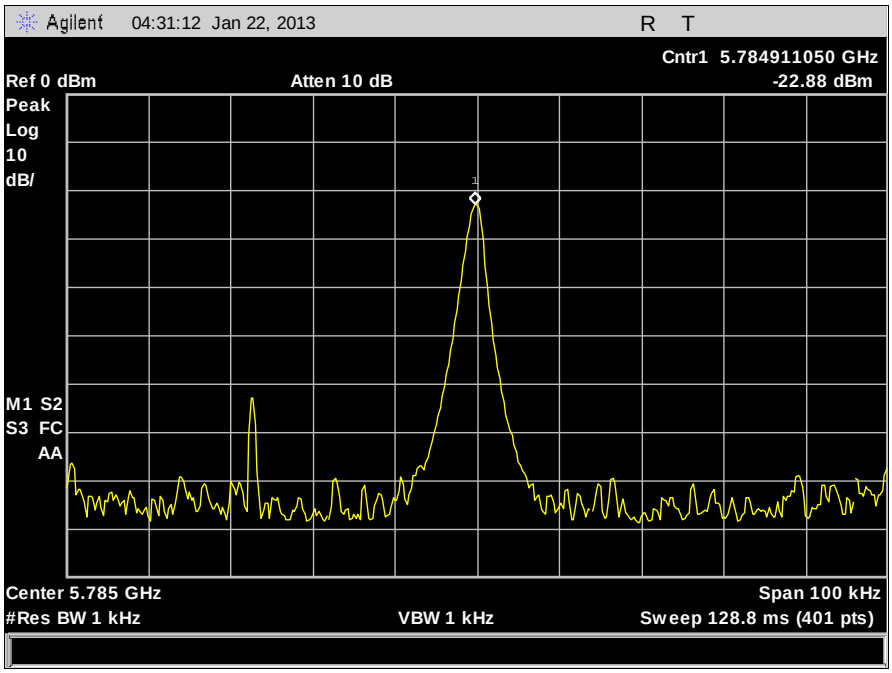



**Plot 59. Frequency Stability, 5785 MHz, 40°C, 120 V**




**Plot 60. Frequency Stability, 5785 MHz, 50°C, 120 V**




**Plot 61. Frequency Stability, 5785 MHz, 55°C, 120 V**

# IV. Test Equipment

## Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2005.

| MET ASSET # | EQUIPMENT | MANUFACTURER | MODEL | LAST CAL DATE | CAL DUE DATE |
|---|---|---|---|---|---|
| 1T4149 | HIGH-FREQUENCY ANECHOIC CHAMBER | RAY-PROOF | 81 | SEE NOTE | |
| 1T4300 | SEMI-ANECHOIC CHAMBER #1 (FCC) | EMC TEST SYSTEMS | NONE | 7/24/2012 | 7/24/2015 |
| 1T4612 | SPECTRUM ANALYZER | AGILENT TECHNOLOGIES | E4407B | 5/23/2012 | 11/23/2013 |
| 1T4409 | EMI RECEIVER | ROHDE & SCHWARZ | ESIB7 | 7/16/2012 | 7/16/2013 |
| 1T4753 | ANTENNA - BILOG | SUNOL SCIENCES | JB6 | 1/5/2012 | 7/5/2013 |
| 1T4505 | TEMPERATURE CHAMBER | TEST EQUITY | 115 | 12/2/2012 | 12/2/2013 |
| 1T4483 | ANTENNA; HORN | ETS-LINDGREN | 3117 | 8/6/2012 | 2/6/2014 |
| 1T2511 | ANTENNA; HORN | EMCO | 3115 | 9/22/2011 | 3/22/2013 |
| 1T4502 | COMB GENERATOR | COM-POWER | CGC-255 | 8/21/2012 | 2/21/2014 |
| 1T4568 | RADIATING NOISE SOURCE | MET LABORATORIES | N/A | SEE NOTE | |
| 1T4791 | THERM./CLOCK/HUMIDITY | CONTROL COMPANY | 06-662-4 | 3/8/2012 | 3/8/2014 |
| 1T4563 | LISN (10 AMP) | SOLAR ELECTRONICS | 9322-50-R-10-BNC | 11/27/2012 | 5/27/2014 |
| 1T2948 | LISN | SOLAR ELECTRONICS | 8028-50-TS-24-BNC | 1/30/2012 | 7/30/2013 |
| 1T4503 | SHIELDED ROOM | UNIVERSAL SHIELDING CORP | N/A | SEE NOTE | |
| 1T4504 | SHIELDED ROOM | UNIVERSAL SHIELDING CORP | N/A | SEE NOTE | |
| 1T4814 | COMB GENERATOR | COM-POWER | CGO-5100 | SEE NOTE | |
| 1T4479 | POWER SUPPLY PROGRAMMABLE | CALIFORNIA INSTRUMENTS | 1501TC | SEE NOTE | |

**Table 16. Test Equipment List**

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

# V. Certification & User's Manual Information

# Certification & User's Manual Information

## A. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

**§ 2.801 Radio-frequency device defined.**

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

(a) The various types of radio communication transmitting devices described throughout this chapter.

*(b) The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.*

(c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.

(d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

**§ 2.803 Marketing of radio frequency devices prior to equipment authorization.**

(a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:

(1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or

(2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.

(d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

(e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:

*(i) Compliance testing;*

(ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or

(v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.

(e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.

(f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

# Certification & User's Manual Information

**The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:**

**§ 2.901 Basis and Purpose**

(a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.[1] *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer*, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.

(b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

**§ 2.907 Certification.**

(a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.

(b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

[1] In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.

# Certification & User's Manual Information

**§ 2.948 Description of measurement facilities.**

(a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.

(1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.

*(i) If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.*

(ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.

(2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

# Certification & User's Manual Information

## Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

**§ 15.19 Labeling requirements.**

*(a) In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:*

(1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

(2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

(3) All other devices shall bear the following statement in a conspicuous location on the device:

*This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.*

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

**§ 15.21 Information to user.**

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## Verification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

**§ 15.105 Information to the user.**

(a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

– Consult the dealer or an experienced radio/TV technician for help.

# End of Report