**MET Laboratories, Inc.** *Safety Certification - EMI - Telecom Environmental Simulation*
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April 19, 2016

SMK Electronics Corporation, Japan
5-5, Togoshi 6-chome
Shinagawa-ku, Tokyo 142-8511

Dear Paul Coffey,

Enclosed is the EMC Wireless test report for compliance testing of the SMK Electronics Corporation, Japan, Trinity3 Remote Controller as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15 Subpart C 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: (\SMK Electronics Corporation, Japan\EMCS88363-FCC247 Rev. 1)

# Electromagnetic Compatibility Criteria
# Test Report

for the

**SMK Electronics Corporation, Japan**
**Trinity3 Remote Controller**

**Tested under**
the FCC Certification Rules
contained in
15.247 Subpart C for Intentional Radiators

**MET Report: EMCS88363-FCC247 Rev. 1**

April 19, 2016

**Prepared For:**

**SMK Electronics Corporation, Japan**
**5-5, Togoshi 6-chome**
**Shinagawa-ku, Tokyo 142-8511**

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

# Electromagnetic Compatibility Criteria
# Test Report

for the

## SMK Electronics Corporation, Japan
## Trinity3 Remote Controller

**Tested under**
the FCC Certification Rules
contained in
15.247 Subpart C for Intentional Radiators

Kaushani Dasgupta
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 the FCC Rules Part 15.247 under normal use and maintenance.

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

  

# Report Status Sheet

| Revision | Report Date | Reason for Revision |
|---|---|---|
| ∅ | April 7, 2016 | Initial Issue. |
| 1 | April 19, 2016 | Editorial correction. |

  

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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 |
| **NEBS** | **N**etwork **E**quipment-**B**uilding **S**ystem |
| **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 SMK Electronics Corporation, Japan Trinity3 Remote Controller, with the requirements of Part 15, §15.247. 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 Trinity3 Remote Controller. SMK Electronics Corporation, Japan should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Trinity3 Remote Controller, 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, §15.247, in accordance with SMK Electronics Corporation, Japan, purchase order number FC-23748. All tests were conducted using measurement procedure ANSI C63.4-2014.

| FCC Reference 47 CFR Part 15.247:2005 | Description | Compliance |
|---|---|---|
| Title 47 of the CFR, Part 15 §15.203 | Antenna Requirement | Compliant |
| Title 47 of the CFR, Part 15 §15.207(a) | Conducted Emission Limits | Not Applicable |
| Title 47 of the CFR, Part 15 §15.247(a)(2) | 6dB Occupied Bandwidth | Compliant |
| Title 47 of the CFR, Part 15 §15.247(b) | Peak Power Output | Compliant |
| Title 47 of the CFR, Part 15 §15.247(d); §15.209; §15.205 | Radiated Spurious Emissions Requirements | Compliant |
| Title 47 of the CFR, Part 15 §15.247(d) | RF Conducted Spurious Emissions Requirements | Compliant |
| Title 47 of the CFR, Part 15 §15.247(d) | RF Conducted Band Edge | Compliant |
| Title 47 of the CFR, Part 15; §15.247(e) | Peak Power Spectral Density | Compliant |
| Title 47 of the CFR, Part 15 §15.247(i) | Maximum Permissible Exposure (MPE) | Compliant |

**Table 1. Executive Summary of EMC Part 15.247 ComplianceTesting**

# II. Equipment Configuration

# A. Overview

MET Laboratories, Inc. was contracted by SMK Electronics Corporation, Japan to perform testing on the Trinity3 Remote Controller, under SMK Electronics Corporation, Japan's purchase order number FC-23748.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the SMK Electronics Corporation, Japan, Trinity3 Remote Controller.

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

| | | |
|---|---|---|
| **Model(s) Tested:** | Trinity3 Remote Controller | |
| **Model(s) Covered:** | Trinity3 Remote Controller | |
| **EUT Specifications:** | Primary Power: 3 VDC | |
| | FCC ID: TC2-RCB7 | |
| | Type of Modulations: | OFDM |
| | Equipment Code: | DTS |
| | Peak RF Output Power: | 7.17 dBm |
| | EUT Frequency Ranges: | 2412-2462 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:** | Kaushani Dasgupta | |
| **Report Date(s):** | April 19, 2016 | |

**Table 2. EUT Summary Table**

## B. References

| | |
|---|---|
| **CFR 47, Part 15, Subpart C** | Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies |
| **ANSI C63.4:2014** | 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 |
| **ANSI C63.10-2013** | American National Standard for Testing Unlicensed Wireless Devices |

**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 10 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 Trinity3 Remote Controller, Equipment Under Test (EUT), is a remote control with noise reduction, voice search, headphone and motion capabilities and is used to navigate the Roku set top box using Wi-Fi direct.

## E. Equipment Configuration

| Ref. ID | Name / Description | Model Number | Part Number | Serial Number | Revision |
|---|---|---|---|---|---|
| 1 | Roku RC-TR2 | RC-TR2 | 3226000146 | -- | -- |
| 2 | Roku RC-TR2 | RC-TR2 | 3226000146 | -- | -- |

**Table 4. Equipment Configuration**

## F. Support Equipment

The EUT did not require any support equipment for operation or monitoring.

## G. Mode of Operation

The remote is in production mode.
If the LED on the back next to the batteries is flashing the remote is in pairing mode. It will continue to send pairing signal until a set top box is found to pair with.
Otherwise by pressing a button on the remote it will emit the data corresponding to that button.

## H. Method of Monitoring EUT Operation

The remote is in production mode.
If the LED on the back next to the batteries is flashing the remote is in pairing mode. It will continue to send pairing signal until a set top box is found to pair with.
Otherwise by pressing a button on the remote it will emit the data corresponding to that button.

## I. 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.

## J. Disposition of EUT

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

# III. 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 EUT has integral antenna.

**Test Engineer(s):** Andy Shen

**Test Date(s):** 10/27/14

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.207(a) 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 Σ 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 5. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)**

**Test Results:** The EUT was not applicable with this requirement.

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(a)(2) 6 dB Bandwidth

**Test Requirements:** **§ 15.247(a)(2):** Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

**Test Procedure:** The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately 1% of the total emission bandwidth, VBW > RBW. The 6 dB Bandwidth was measured and recorded. The measurements were performed on the low, mid and high channels.

**Test Results** The EUT was compliant with § 15.247 (a)(2).

The 6 dB Bandwidth was determined from the plots on the following pages.

**Test Engineer(s):** Andy Shen

**Test Date(s):** 10/28/14

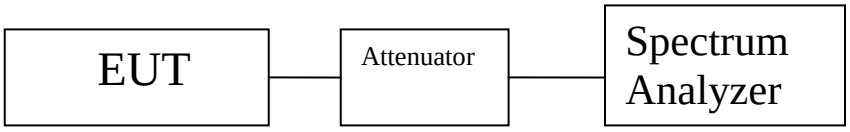



**Figure1. Block Diagram, Occupied Bandwidth Test Setup**

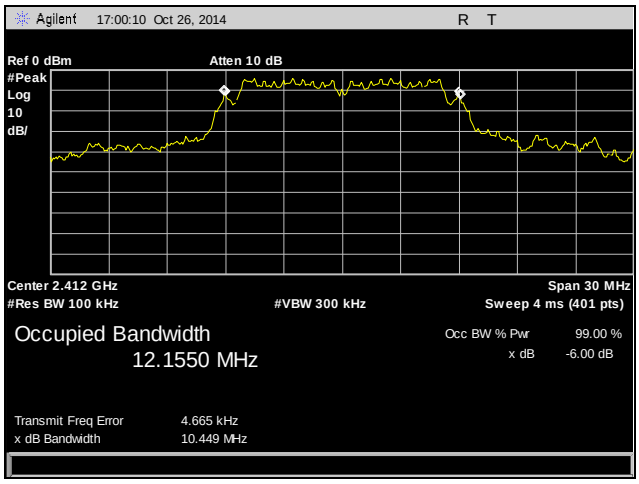
## Occupied Bandwidth Test Results

| Occupied Bandwidth | | | |
|---|---|---|---|
| | **Carrier Channel** | **Frequency (MHz)** | **Measured 6 dB Bandwidth (MHz)** |
| 802.11g | Low | 2412 | 10.449 |
| | Mid | 2437 | 15.802 |
| | High | 2462 | 10.406 |
| 802.11n | Low | 2412 | 15.902 |
| | Mid | 2437 | 15.218 |
| | High | 2462 | 16.063 |

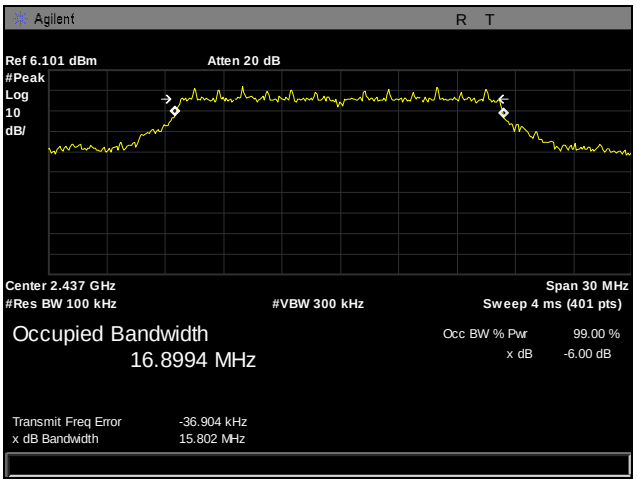
**Table 6. 6 dB Occupied Bandwidth, Test Results**

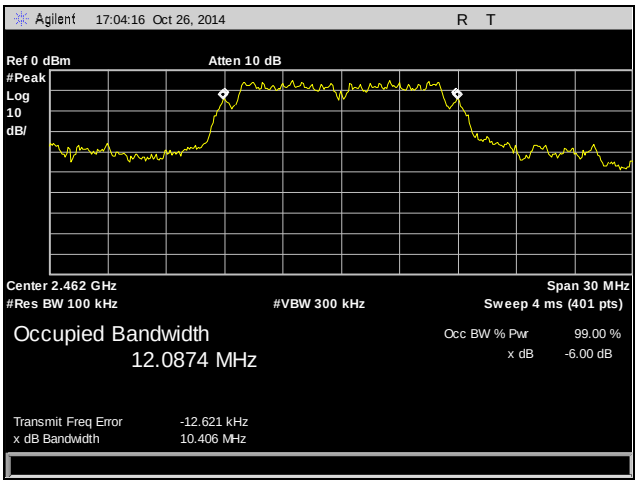
## Occupied Bandwidth Test Results, 802.11g




**Plot 1. Occupied Bandwidth, Low Channel, 2412 MHz, 802.11g**



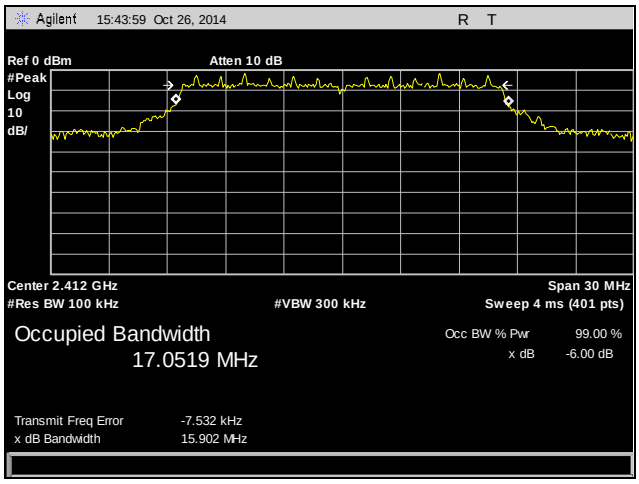

**Plot 2. Occupied Bandwidth, Mid Channel, 2437 MHz, 802.11g**



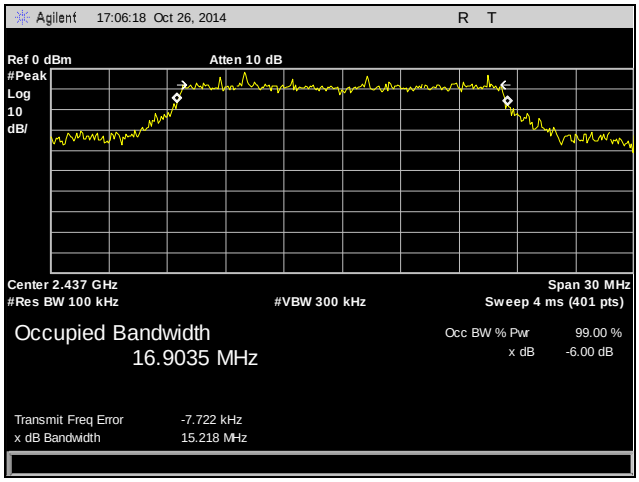

**Plot 3. Occupied Bandwidth, High Channel, 2462 MHz, 802.11g**

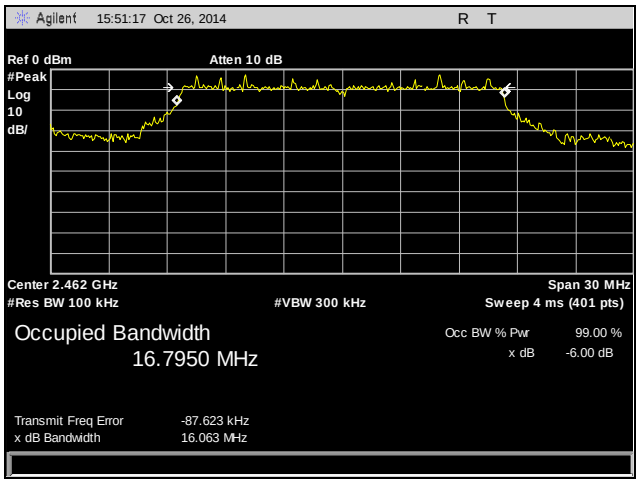
## Occupied Bandwidth Test Results, 802.11n




**Plot 4. Occupied Bandwidth, Low Channel, 2412 MHz, 802.11n**




**Plot 5. Occupied Bandwidth, Mid Channel, 2437 MHz, 802.11n**




**Plot 6. Occupied Bandwidth, High Channel, 2462 MHz, 802.11n**

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.247(b) Peak Power Output

**Test Requirements:** **§15.247(b):** The maximum peak output power of the intentional radiator shall not exceed the following:

| Digital Transmission Systems (MHz) | Output Limit (Watts) |
|---|---|
| 902-928 | 1.000 |
| 2400–2483.5 | 1.000 |
| 5725– 5850 | 1.000 |

**Table 7. Output Power Requirements from §15.247(b)**

**§15.247(b)(4):** if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in the Table 7, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400 – 2483.5 MHz band and using a point to point application may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi without any corresponding reduction in transmitter peak output power.

Fixed, point-to-point operation excludes the use of point-to-multipoint systems, Omni-directional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

**Test Procedure:** The transmitter was connected to a calibrated spectrum analyzer. The EUT was measured at the low, mid and high channels of each band at the maximum power level.

**Test Results:** The EUT was compliant with the Peak Power Output limits of **§15.247(b)**.

**Test Engineer(s):** Andy Shen

**Test Date(s):** 10/28/14

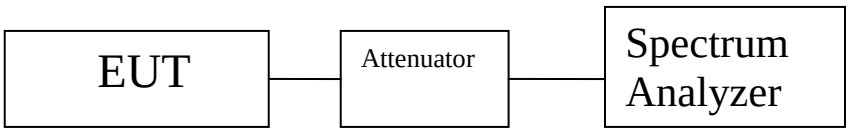



**Figure 1. Peak Power Output Test Setup**

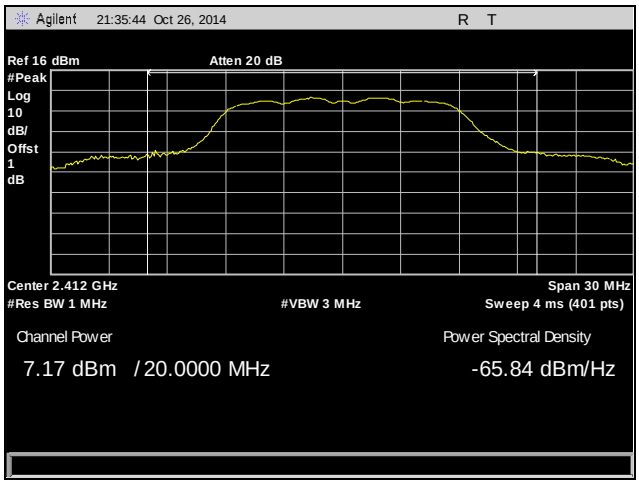
  

## Peak Power Output Test Results

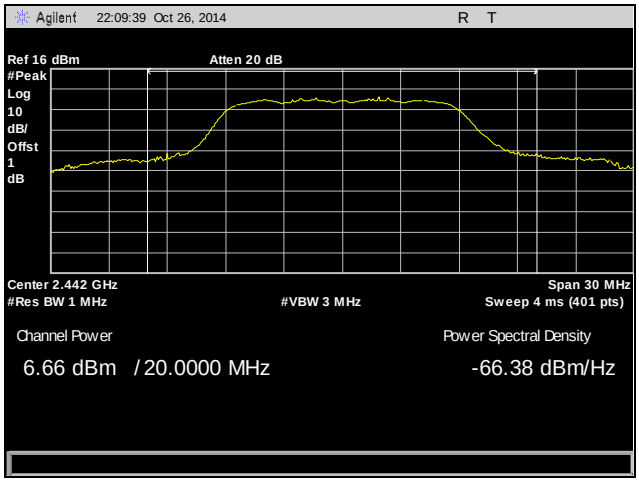
| Frequency (MHz) | Mode | Power (dBm) | Antenna Gain (dBi) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 2412 | 802.11g | 7.17 | 0.00 | 30.00 | -22.83 |
| 2437 | 802.11g | 6.66 | 0.00 | 30.00 | -23.34 |
| 2462 | 802.11g | 6.74 | 0.00 | 30.00 | -23.26 |
| **Frequency (MHz)** | **Mode** | **Power (dBm)** | **Antenna Gain (dBi)** | **Limit (dBm)** | **Margin (dB)** |
| 2412 | 802.11n | 6.12 | 0.00 | 30 | -23.88 |
| 2437 | 802.11n | 5.76 | 0.00 | 30 | -24.24 |
| 2462 | 802.11n | 5.46 | 0.00 | 30 | -24.54 |

**Table 8. Peak Power Output, Test Results**

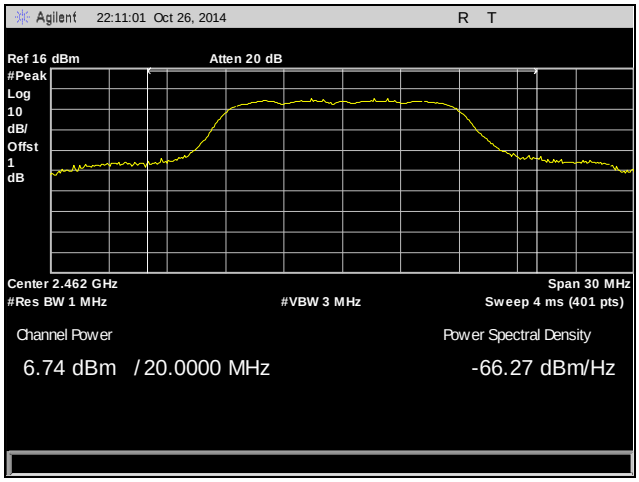
## Peak Power Output Test Results, 802.11g




**Plot 7. Peak Power Output, Low Channel, 2412 MHz, 802.11g**

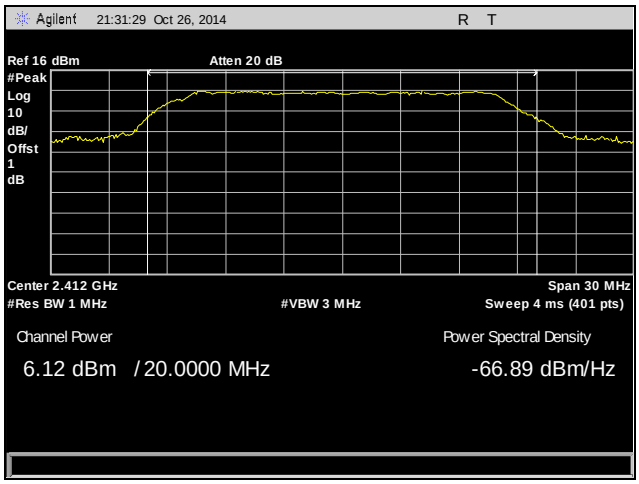



**Plot 8. Peak Power Output, Mid Channel, 2442 MHz, 802.11g**

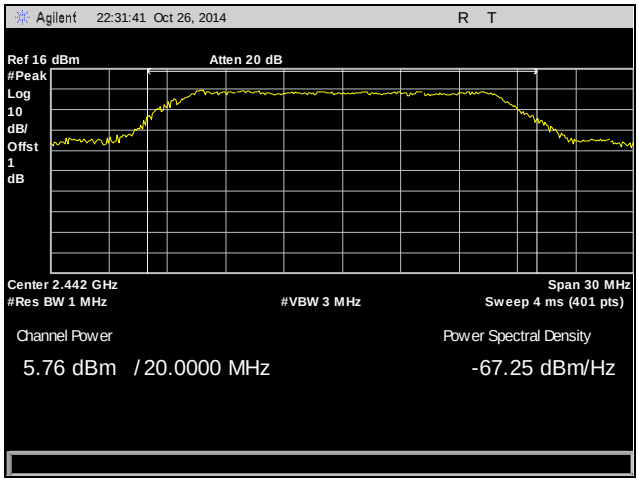



**Plot 9. Peak Power Output, High Channel, 2462 MHz, 802.11g**

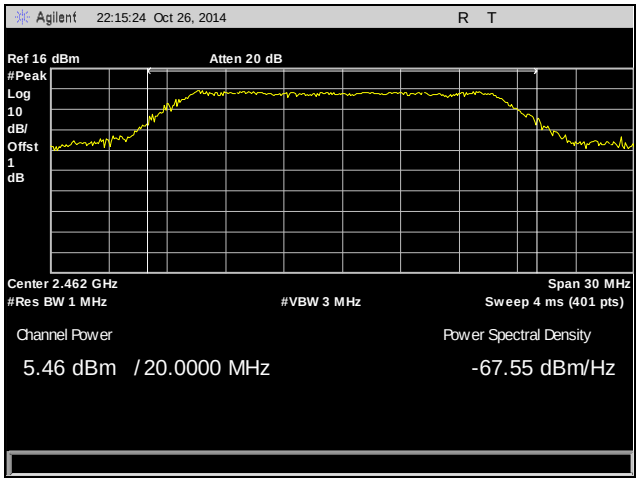
## Peak Power Output Test Results, 802.11n




**Plot 10. Peak Power Output, Low Channel, 2412 MHz, 802.11n**




**Plot 11. Peak Power Output, Mid Channel, 2442 MHz, 802.11n**




**Plot 12. Peak Power Output, High Channel, 2462 MHz, 802.11n**

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.247(d) Radiated Spurious Emissions Requirements and Band Edge

**Test Requirements:** **§15.247(d); §15.205:** Emissions outside the frequency band.

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

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

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090–0.110---------- | 16.42–16.423 | 399.9–410 | 4.5–5.15 |
| [1] 0.495–0.505---------- | 16.69475–16.69525 | 608–614 | 5.35–5.46 |
| 2.1735–2.1905---------- | 16.80425–16.80475 | 960–1240 | 7.25–7.75 |
| 4.125–4.128---------- | 25.5–25.67 | 1300–1427 | 8.025–8.5 |
| 4.17725–4.17775---------- | 37.5–38.25 | 1435–1626.5 | 9.0–9.2 |
| 4.20725–4.20775---------- | 73–74.6 | 1645.5–1646.5 | 9.3–9.5 |
| 6.215–6.218---------- | 74.8–75.2 | 1660–1710 | 10.6–12.7 |
| 6.26775–6.26825---------- | 108–121.94 | 1718.8–1722.2 | 13.25–13.4 |
| 6.31175–6.31225---------- | 123–138 | 2200–2300 | 14.47–14.5 |
| 8.291–8.294---------- | 149.9–150.05 | 2310–2390 | 15.35–16.2 |
| 8.362–8.366---------- | 156.52475–156.52525 | 2483.5–2500 | 17.7–21.4 |
| 8.37625–8.38675---------- | 156.7–156.9 | 2655–2900 | 22.01–23.12 |
| 8.41425–8.41475---------- | 162.0125–167.17 | 3260–3267 | 23.6–24.0 |
| 12.29–12.293---------- | 167.72–173.2 | 3332–3339 | 31.2–31.8 |
| 12.51975–12.52025---------- | 240–285 | 3345.8–3358 36. | 43–36.5 |
| 12.57675–12.57725---------- | 322–335.4 | 3600–4400 | ([2]) |

**Table 9. Restricted Bands of Operation**

[1] Until February 1, 1999, this restricted band shall be 0.490 – 0.510 MHz.
[2] Above 38.6

**Test Requirement(s):** **§ 15.209 (a):** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 10.

| Frequency (MHz) | § 15.209(a),Radiated Emission Limits (dBµV) @ 3m |
|---|---|
| 30 - 88 | 40.00 |
| 88 - 216 | 43.50 |
| 216 - 960 | 46.00 |
| Above 960 | 54.00 |

**Table 10. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)**

**Test Procedures:** The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. A 2.4 GHz notch filter was used to notch out the transmitting frequency. Only noise floor was measured above 18 GHz.

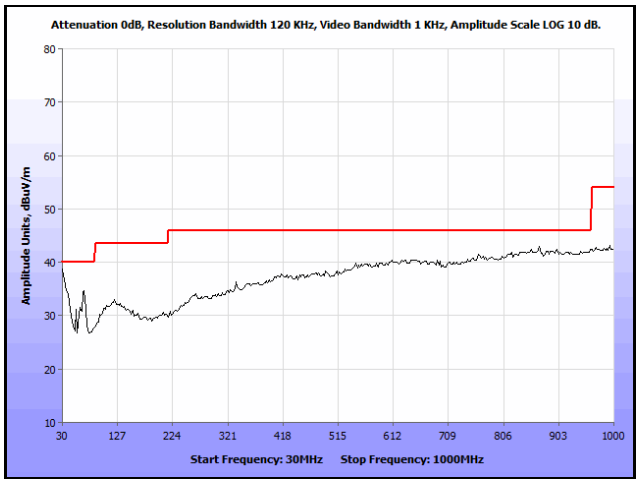
**Test Results:** The EUT was compliant with the Radiated Spurious Emission limits of **§ 15.247(d)**.

**Test Engineer(s):** Andy Shen

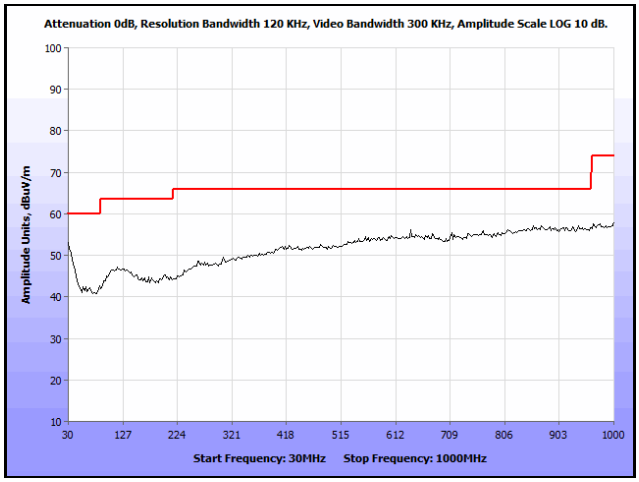
**Test Date(s):** 10/30/14

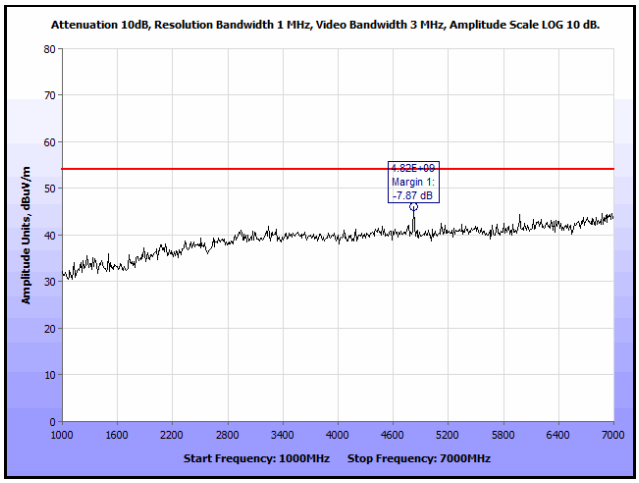
## Radiated Spurious Emissions Test Results, 802.11g




**Plot 13. Radiated Spurious Emissions, Low Channel, 2412 MHz, 802.11g, 30 MHz – 1 GHz, Average**

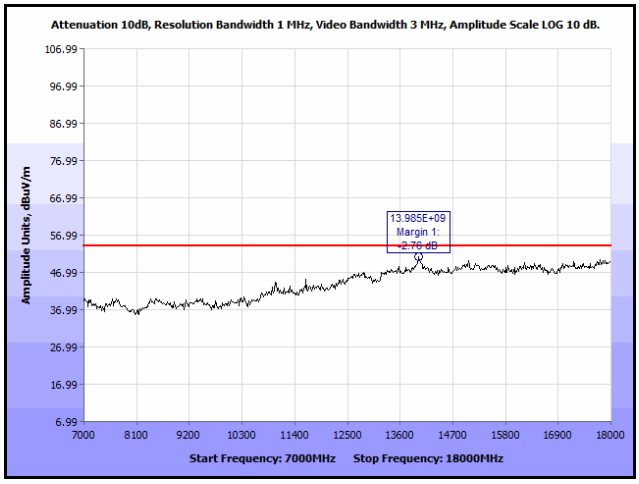



**Plot 14. Radiated Spurious Emissions, Low Channel, 2412 MHz, 802.11g, 30 MHz – 1 GHz, Peak**

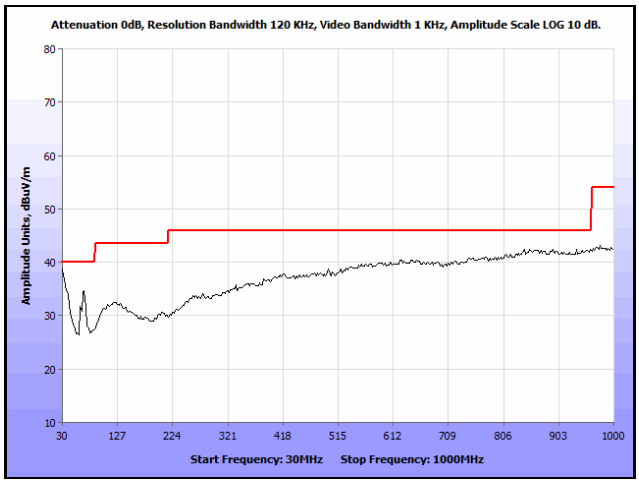



**Plot 15. Radiated Spurious Emissions, Low Channel, 2412 MHz, 802.11g, 1 GHz – 7 GHz, Average**

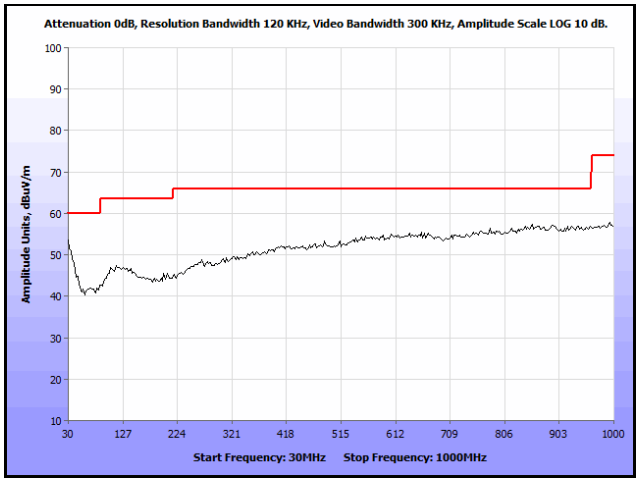
  




**Plot 16. Radiated Spurious Emissions, Low Channel, 2412 MHz, 802.11g, 7 GHz – 18 GHz, Average**

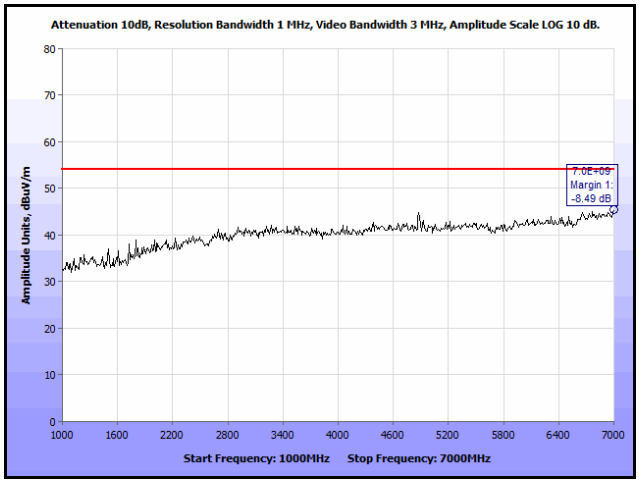



**Plot 17. Radiated Spurious Emissions, Mid Channel, 2442 MHz, 802.11g, 30 MHz – 1 GHz, Average**

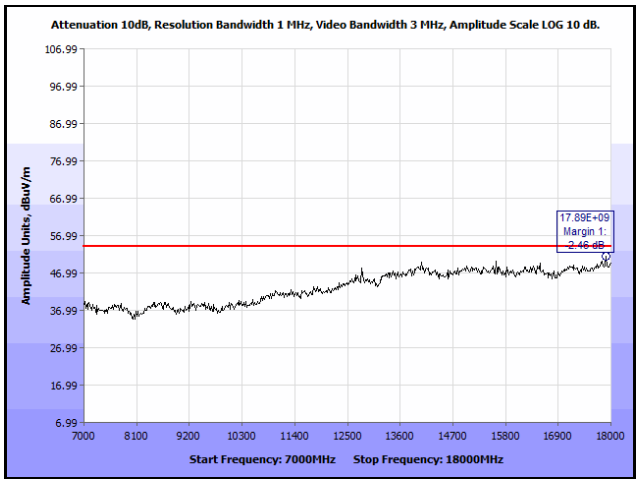



**Plot 18. Radiated Spurious Emissions, Mid Channel, 2442 MHz, 802.11g, 30 MHz – 1 GHz, Peak**

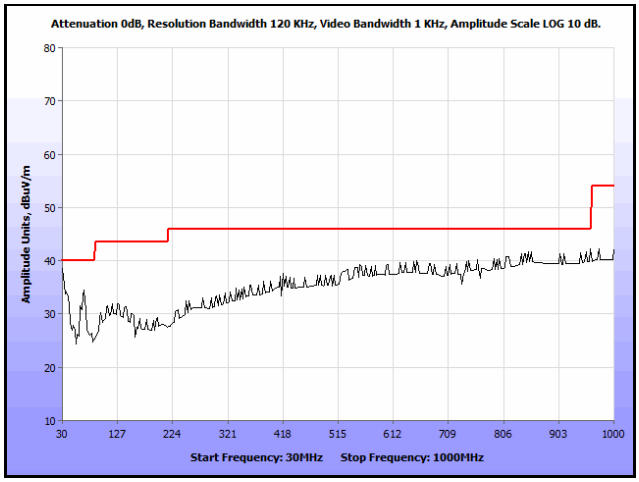
  




**Plot 19. Radiated Spurious Emissions, Mid Channel, 2442 MHz, 802.11g, 1 GHz – 7 GHz, Average**

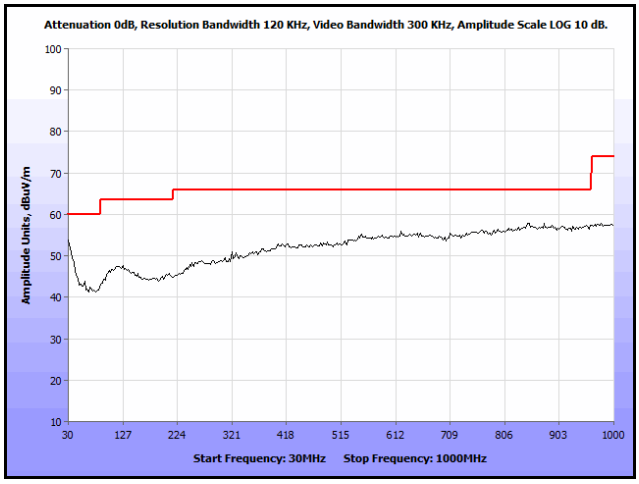



**Plot 20. Radiated Spurious Emissions, Mid Channel, 2442 MHz, 802.11g, 7 GHz – 18 GHz, Average**

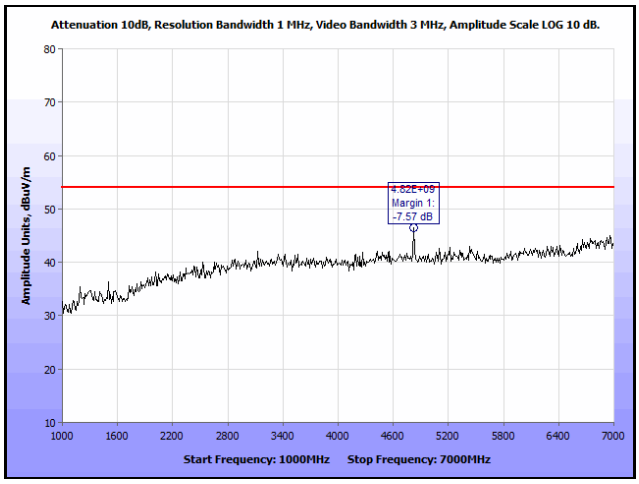



**Plot 21. Radiated Spurious Emissions, High Channel, 2462 MHz, 802.11g, 30 MHz – 1 GHz, Average**

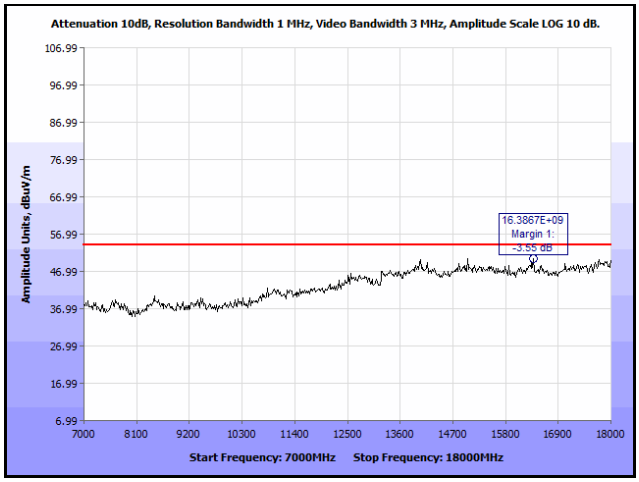
  




**Plot 22. Radiated Spurious Emissions, High Channel, 2462 MHz, 802.11g, 30 MHz – 1 GHz, Peak**



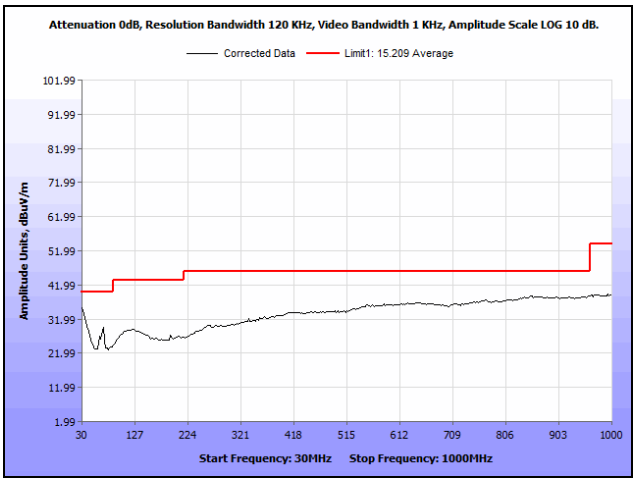

**Plot 23. Radiated Spurious Emissions, High Channel, 2462 MHz, 802.11g, 1 GHz – 7 GHz, Average**



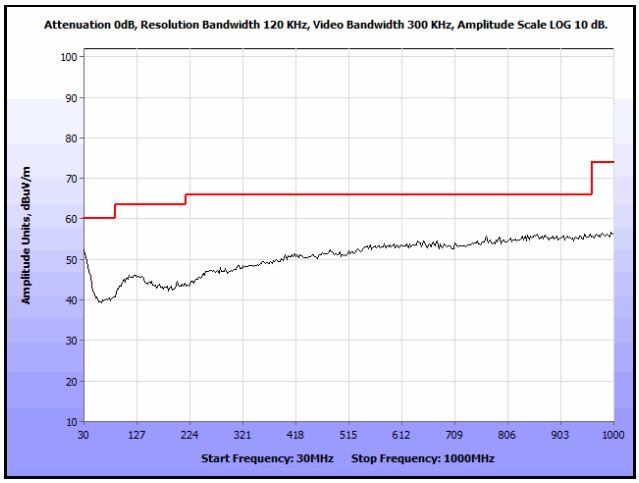

**Plot 24. Radiated Spurious Emissions, High Channel, 2462 MHz, 802.11g, 7 GHz – 18 GHz, Average**

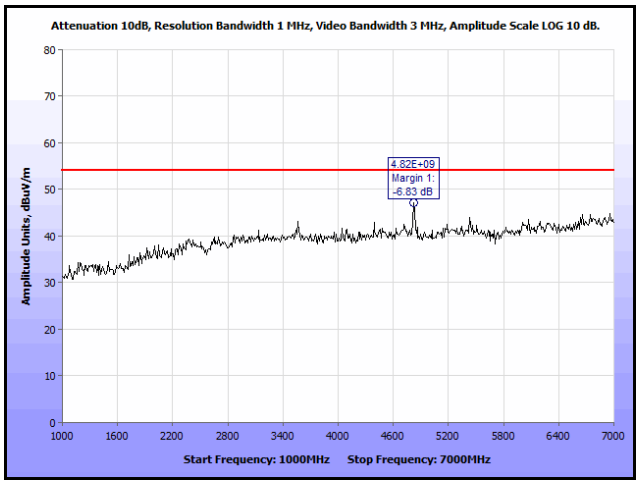
## Radiated Spurious Emissions Test Results, 802.11n




**Plot 25. Radiated Spurious Emissions, Low Channel, 2412 MHz, 802.11n, 30 MHz – 1 GHz, Average**

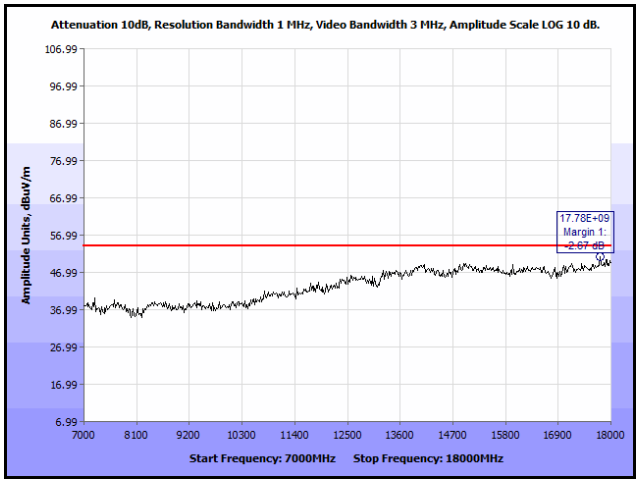



**Plot 26. Radiated Spurious Emissions, Low Channel, 2412 MHz, 802.11n, 30 MHz – 1 GHz, Peak**

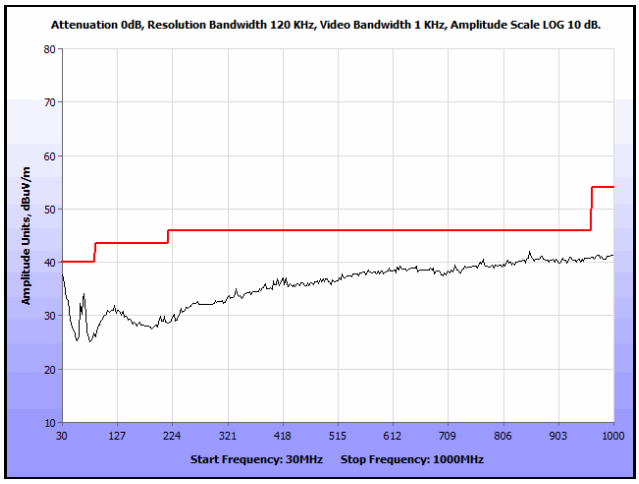



**Plot 27. Radiated Spurious Emissions, Low Channel, 2412 MHz, 802.11n, 1 GHz – 7 GHz, Average**

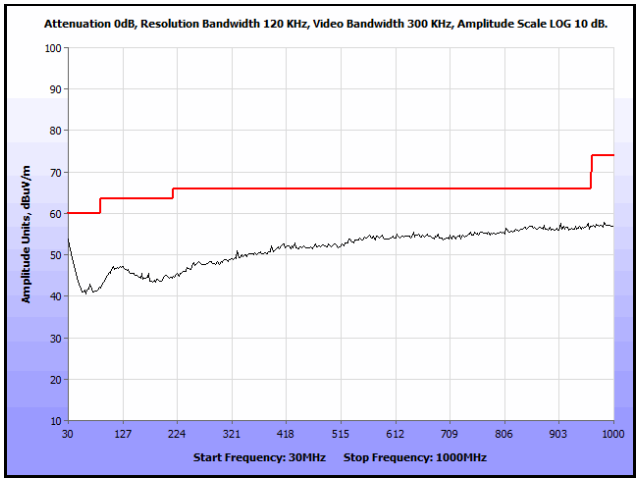
  




**Plot 28. Radiated Spurious Emissions, Low Channel, 2412 MHz, 802.11n, 7 GHz – 18 GHz, Average**

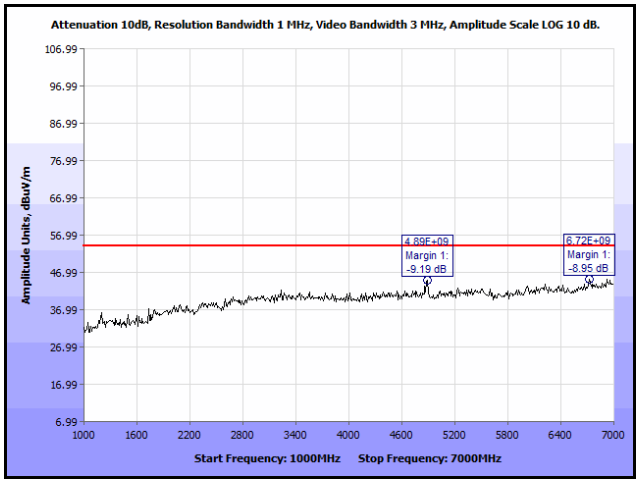



**Plot 29. Radiated Spurious Emissions, Mid Channel, 2442 MHz, 802.11n, 30 MHz – 1 GHz, Average**

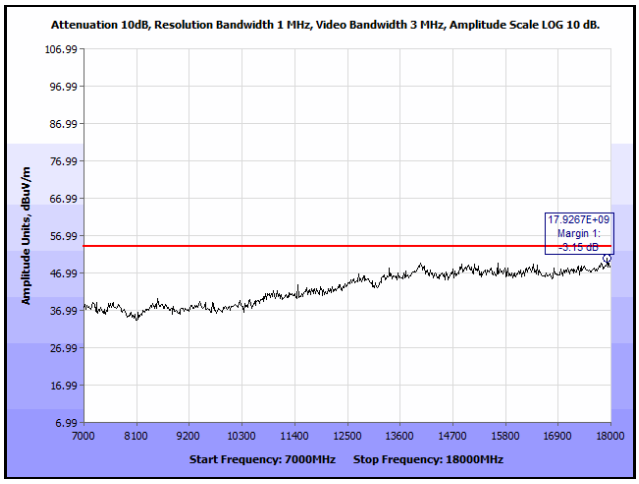



**Plot 30. Radiated Spurious Emissions, Mid Channel, 2442 MHz, 802.11n, 30 MHz – 1 GHz, Peak**

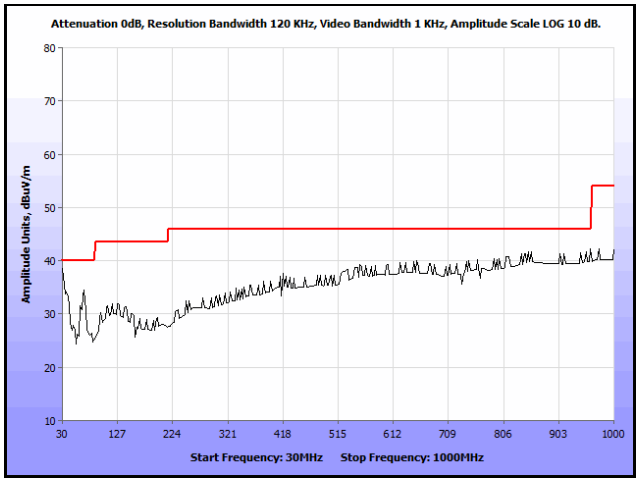
  




**Plot 31. Radiated Spurious Emissions, Mid Channel, 2442 MHz, 802.11n, 1 GHz – 7 GHz, Average**

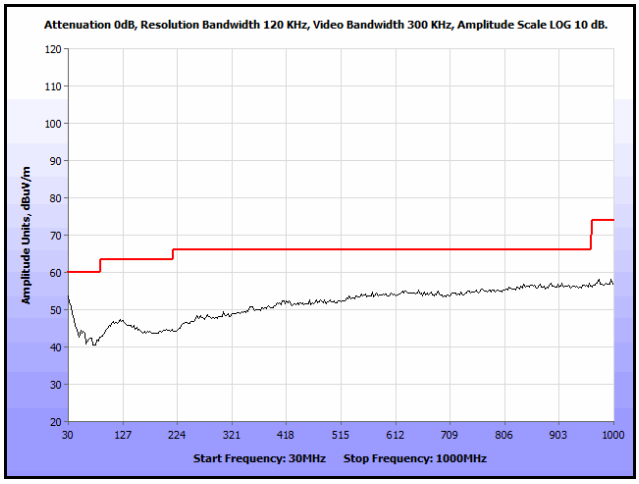



**Plot 32. Radiated Spurious Emissions, Mid Channel, 2442 MHz, 802.11n, 7 GHz – 18 GHz, Average**

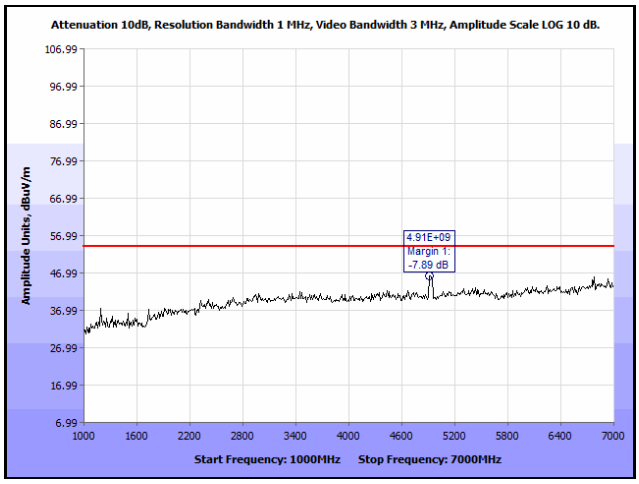



**Plot 33. Radiated Spurious Emissions, High Channel, 2462 MHz, 802.11n, 30 MHz – 1 GHz, Average**

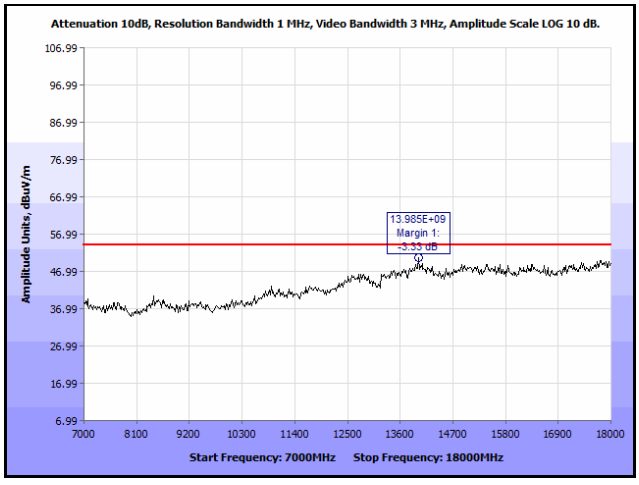
  




**Plot 34. Radiated Spurious Emissions, High Channel, 2462 MHz, 802.11n, 30 MHz – 1 GHz, Peak**




**Plot 35. Radiated Spurious Emissions, High Channel, 2462 MHz, 802.11n, 1 GHz – 7 GHz, Average**



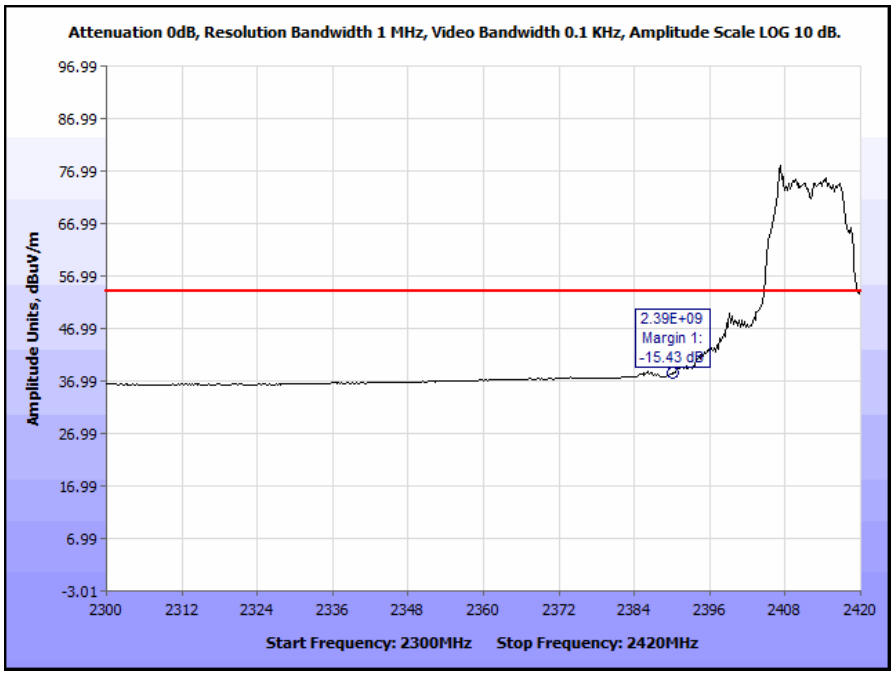

**Plot 36. Radiated Spurious Emissions, High Channel, 2462 MHz, 802.11n, 7 GHz – 18 GHz, Average**

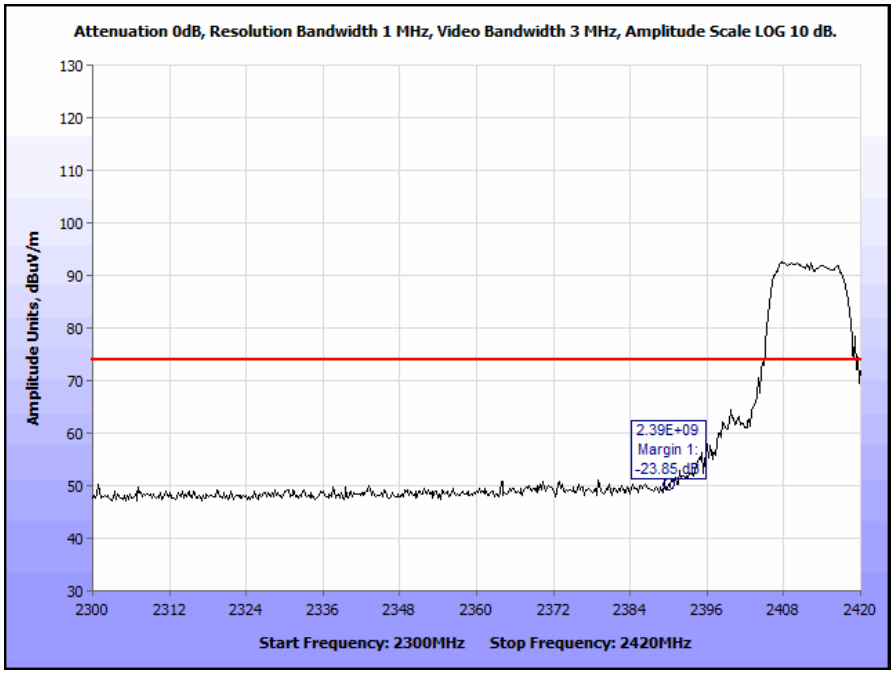
## Radiated Band Edge Measurements

**Test Procedures:** The transmitter was turned on. Measurements were performed of the low and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line.

## Radiated Band Edge Measurements, 802.11g

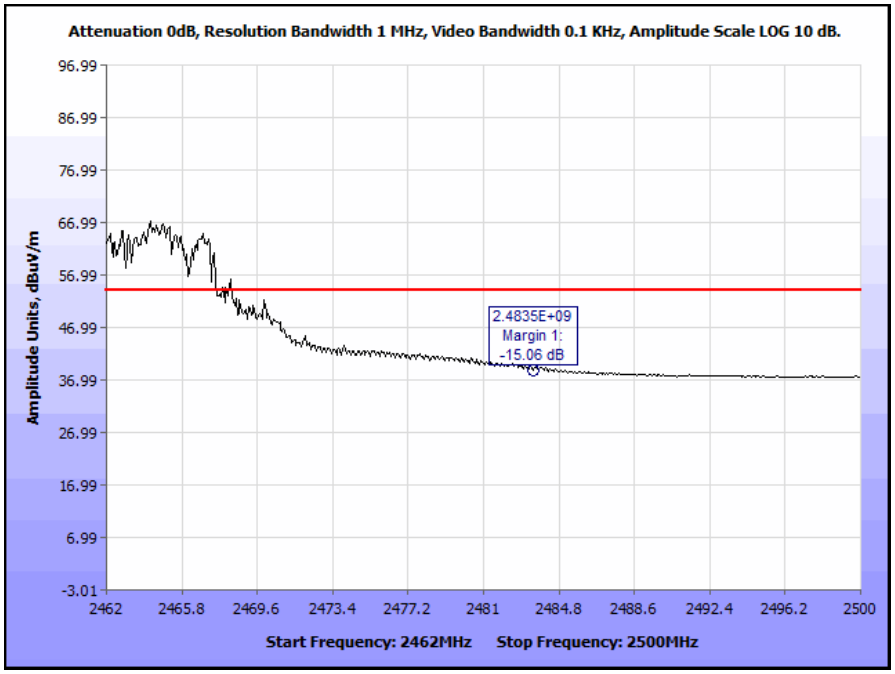



**Plot 37. Radiated Band Edge, 802.11g, Channel 1, Average**

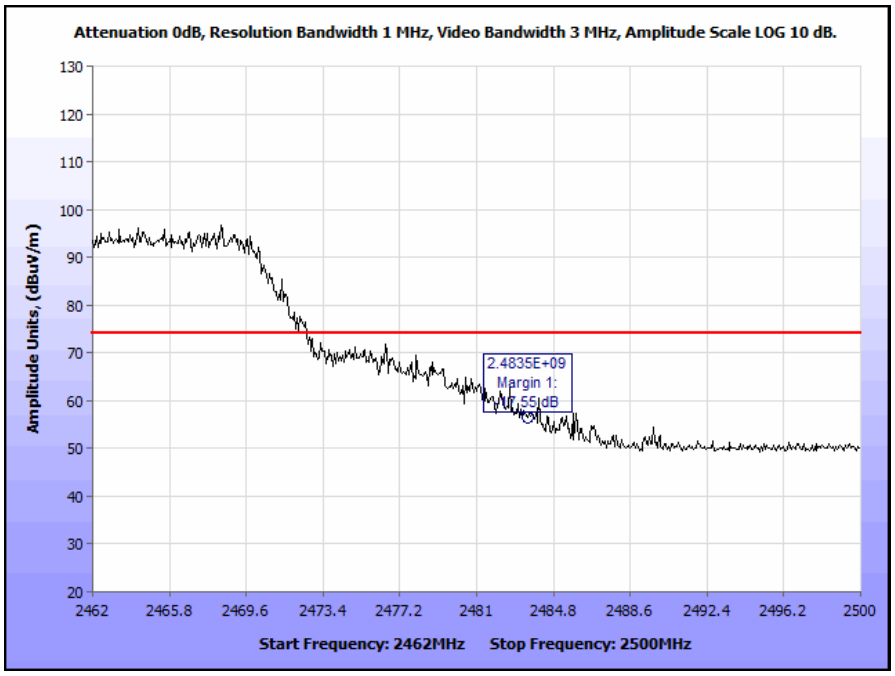



**Plot 38. Radiated Band Edge, 802.11g, Channel 1, Peak**

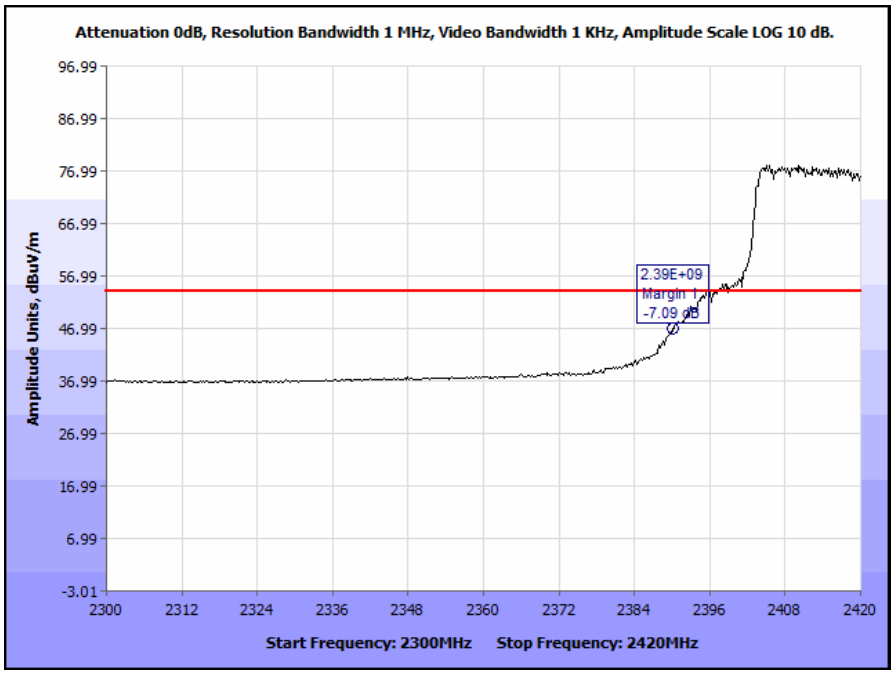



**Plot 39. Radiated Band Edge, 802.11g, Channel 11, Average**

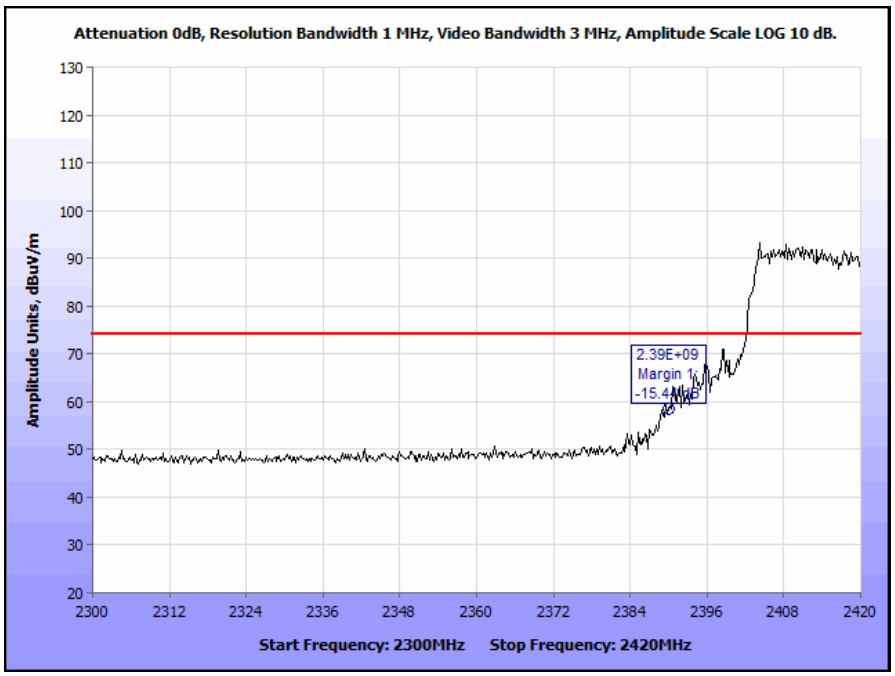



**Plot 40. Radiated Band Edge, 802.11g, Channel 11, Peak**

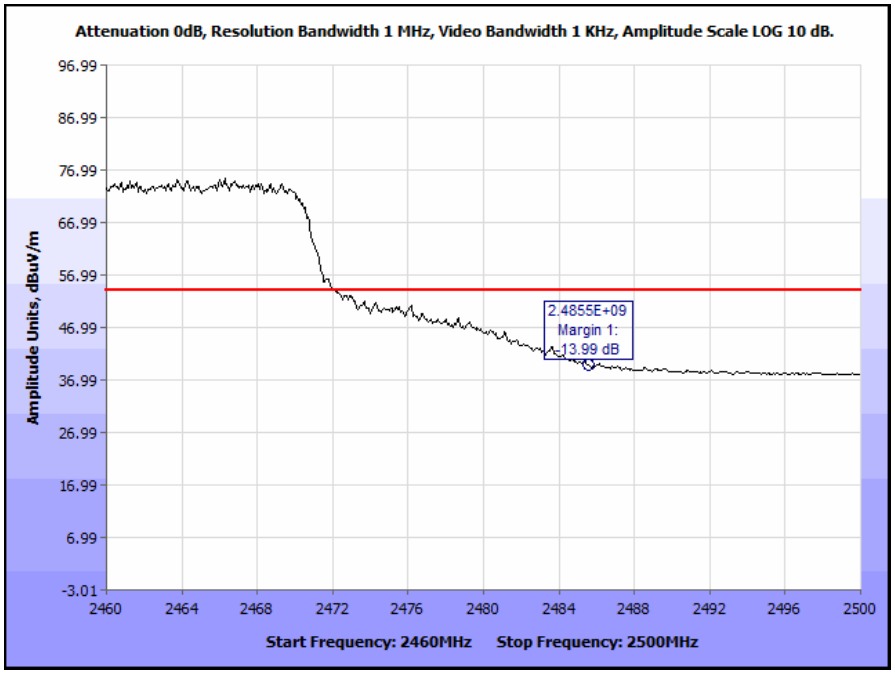
## Radiated Band Edge Measurements, 802.11n



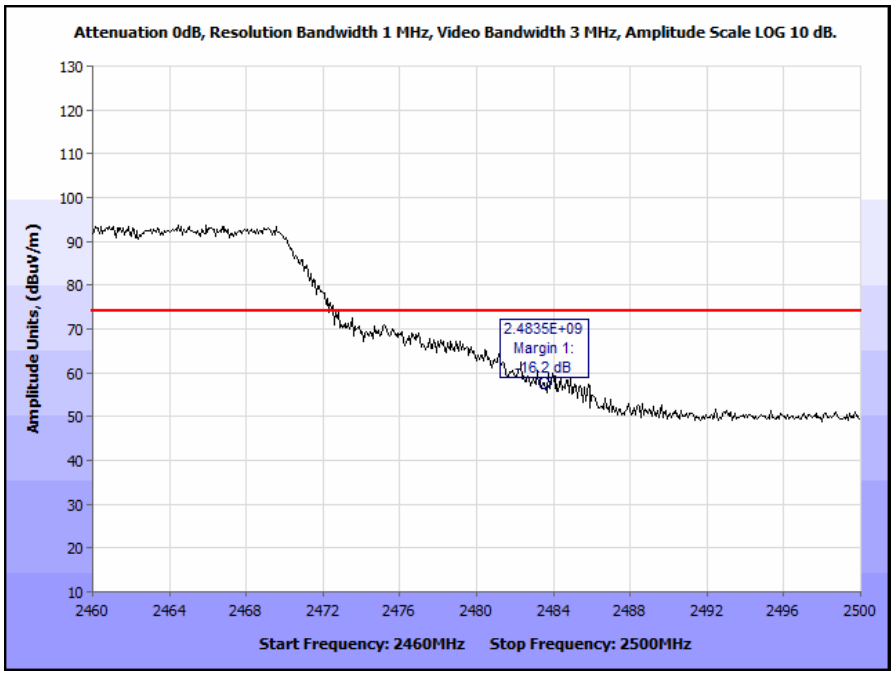

**Plot 41. Radiated Band Edge, 802.11n, Channel 1, Average**




**Plot 42. Radiated Band Edge, 802.11n, Channel 1, Peak**




**Plot 43. Radiated Band Edge, 802.11n, Channel 11, Average**




**Plot 44. Radiated Band Edge, 802.11n, Channel 11, Peak**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(d) RF Conducted Spurious Emissions Requirements and Band Edge

**Test Requirement:** **15.247(d)** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

**Test Procedure:** For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10$^{th}$ harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

See following pages for detailed test results with RF Conducted Spurious Emissions.

**Test Results:** The EUT was compliant with the Conducted Spurious Emission limits of **§15.247(d)**.

**Test Engineer(s):** Andy Shen

**Test Date(s):** 10/30/14

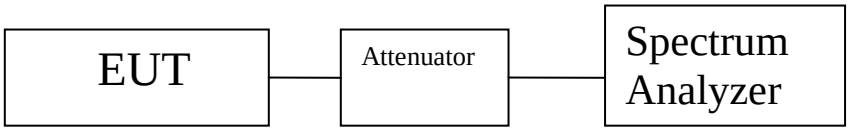
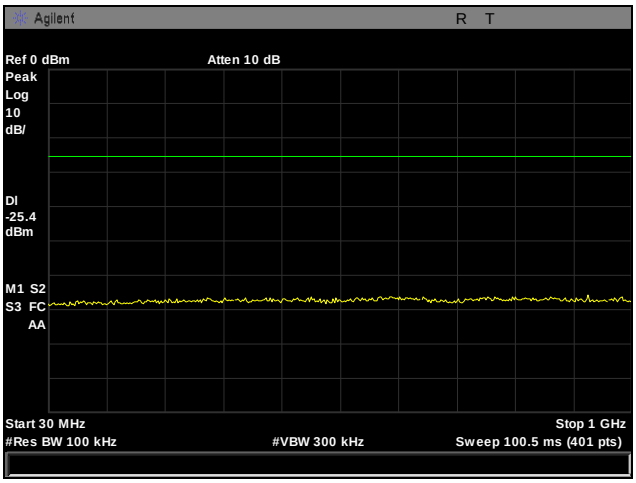


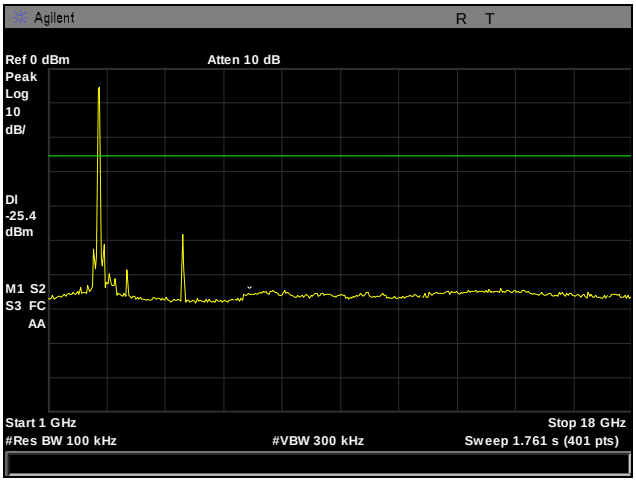

**Figure 2. Block Diagram, Conducted Spurious Emissions Test Setup**

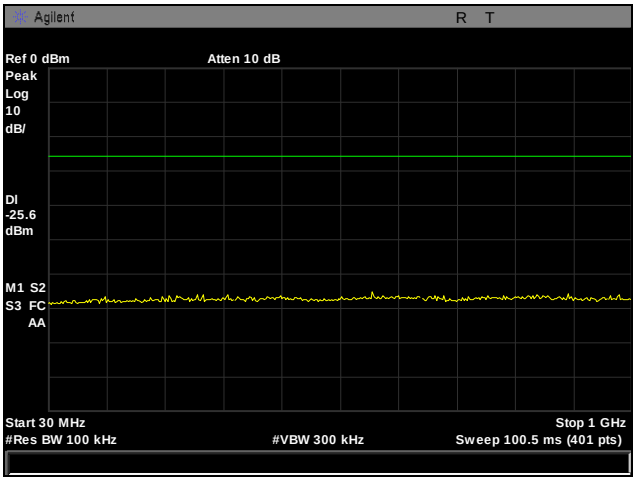
## Conducted Spurious Emissions Test Results, 802.11g




**Plot 45. Conducted Spurious Emissions, Low Channel, 2412 MHz, 802.11g, 30 MHz – 1 GHz**

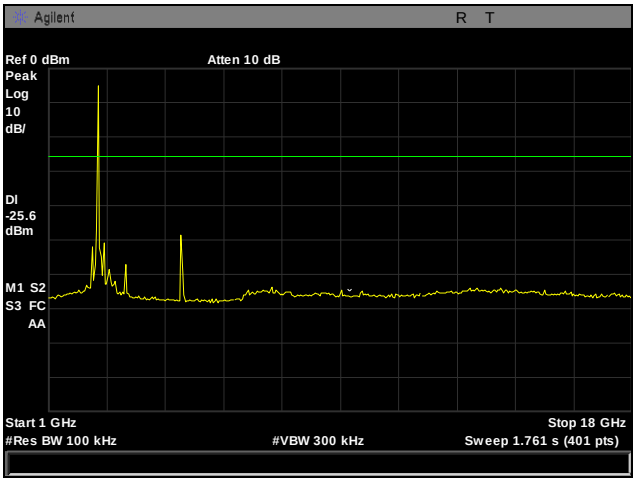



**Plot 46. Conducted Spurious Emissions, Low Channel, 2412 MHz, 802.11g, 1 GHz – 18 GHz**

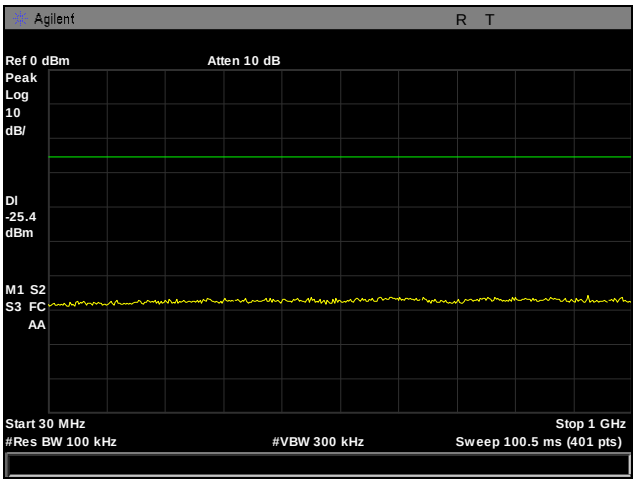



**Plot 47. Conducted Spurious Emissions, Mid Channel, 2442 MHz, 802.11g, 30 MHz – 1 GHz**

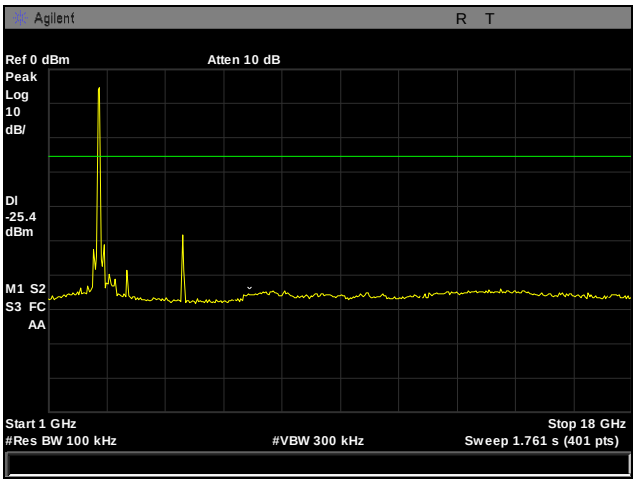
  




**Plot 48. Conducted Spurious Emissions, Mid Channel, 2442 MHz, 802.11g, 1 GHz – 18 GHz**



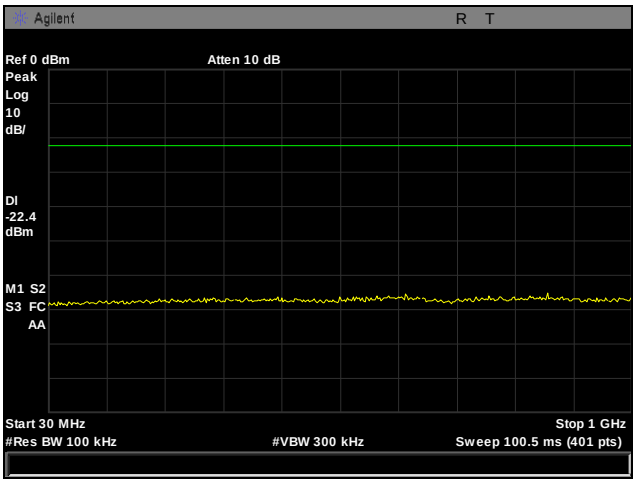

**Plot 49. Conducted Spurious Emissions, High Channel, 2462 MHz, 802.11g, 30 MHz – 1 GHz**



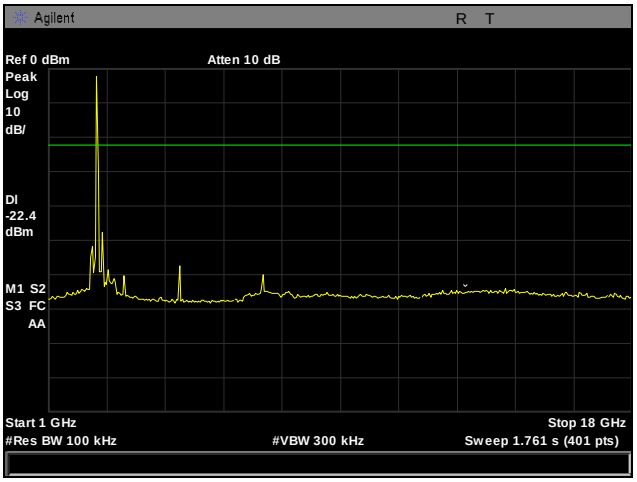

**Plot 50. Conducted Spurious Emissions, High Channel, 2462 MHz, 802.11g, 1 GHz – 18 GHz**

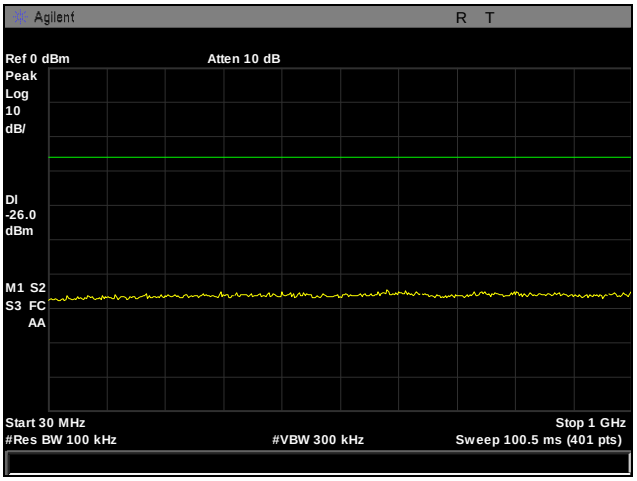
## Conducted Spurious Emissions Test Results, 802.11n



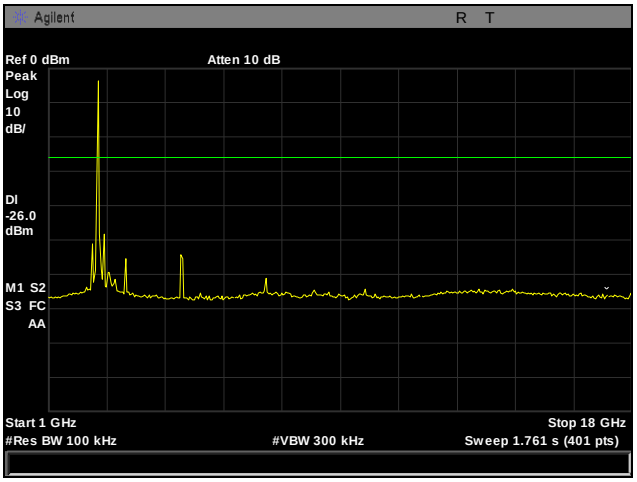

**Plot 51. Conducted Spurious Emissions, Low Channel, 2412 MHz, 802.11n, 30 MHz – 1 GHz**



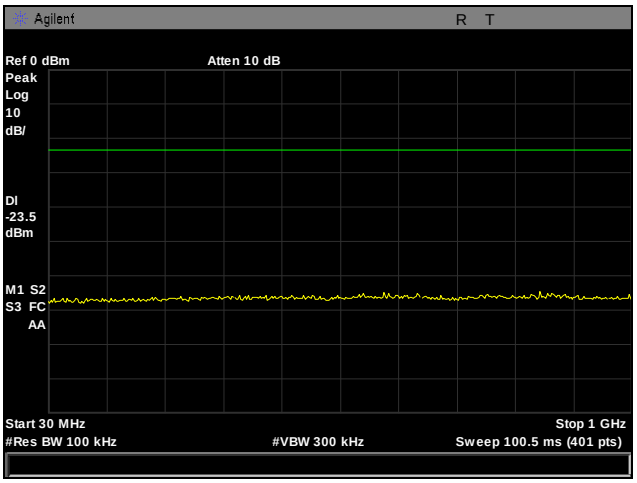

**Plot 52. Conducted Spurious Emissions, Low Channel, 2412 MHz, 802.11n, 1 GHz – 18 GHz**



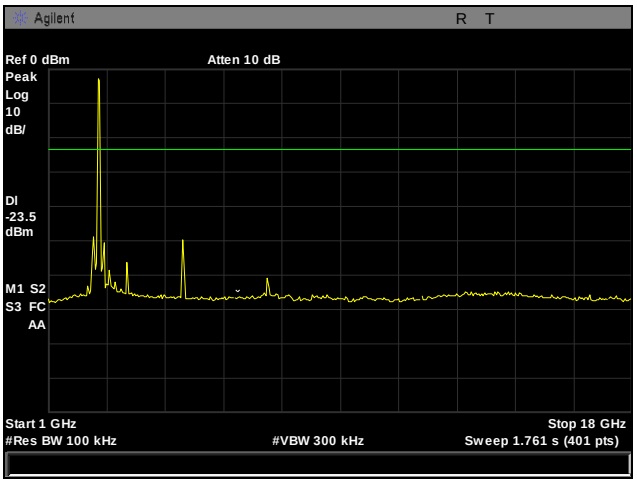

**Plot 53. Conducted Spurious Emissions, Mid Channel, 2442 MHz, 802.11n, 30 MHz – 1 GHz**




**Plot 54. Conducted Spurious Emissions, Mid Channel, 2442 MHz, 802.11n, 1 GHz – 18 GHz**



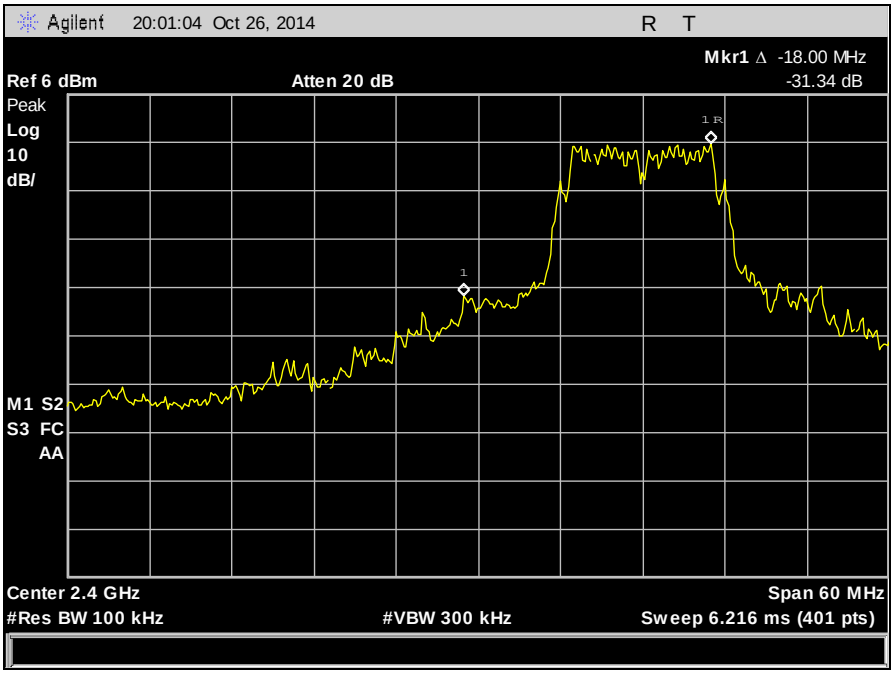

**Plot 55. Conducted Spurious Emissions, High Channel, 2462 MHz, 802.11n, 30 MHz – 1 GHz**



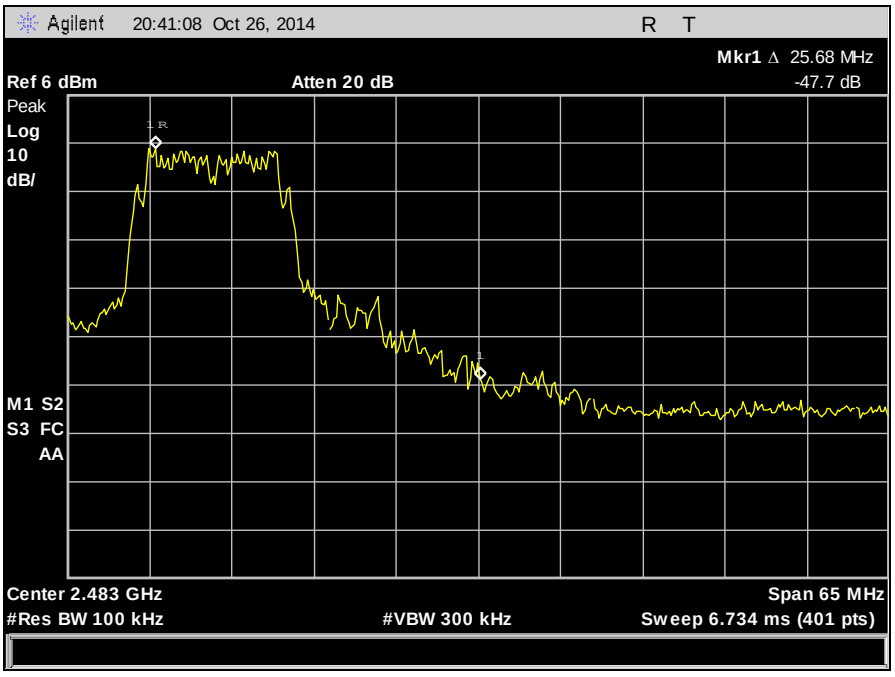

**Plot 56. Conducted Spurious Emissions, High Channel, 2462 MHz, 802.11n, 1 GHz – 18 GHz**

## Conducted Band Edge Test Results, 802.11g

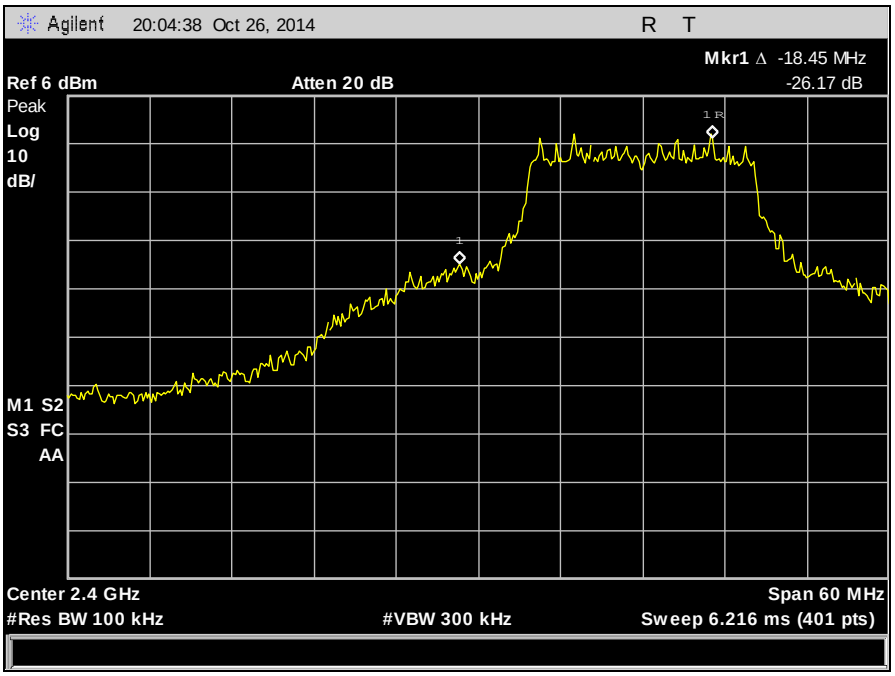



**Plot 57. Conducted Band Edge, Low Channel, 2412 MHz, 802.11g**

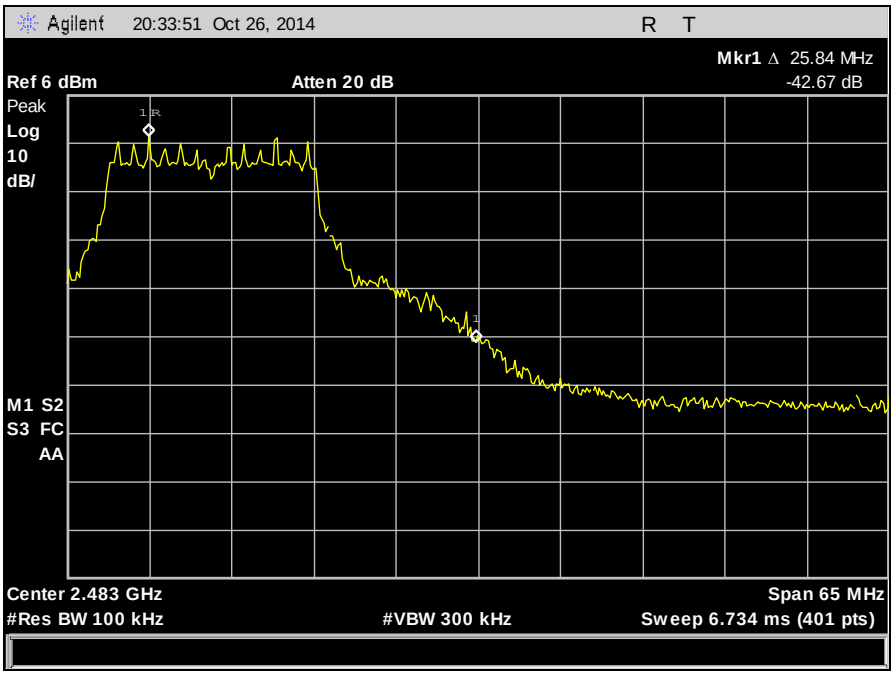



**Plot 58. Conducted Band Edge, High Channel, 2462 MHz, 802.11g**

## Conducted Band Edge Test Results, 802.11n




**Plot 59. Conducted Band Edge, Low Channel, 2412 MHz, 802.11n**




**Plot 60. Conducted Band Edge, High Channel, 2462 MHz, 802.11n**

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(e) Peak Power Spectral Density

**Test Requirements:** **§15.247(e):** For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

**Test Procedure:** The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level. A RBW of 1 MHz and VBW of 3 MHz were used to determine the peak emissions within the band. The Spectrum analyzer was then set to a RBW of 3 kHz and VBW was set to 10 kHz. The SPAN of the analyzer was set to 1 MHz. Measurements were carried out at the low, mid and high channels.

**Test Results:** The EUT was compliant with the peak power spectral density limits of **§ 15.247 (e)**.

The peak power spectral density was determined from plots on the following page(s).

**Test Engineer:** Andy Shen

**Test Date:** 10/30/14

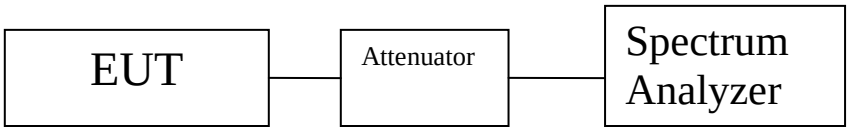
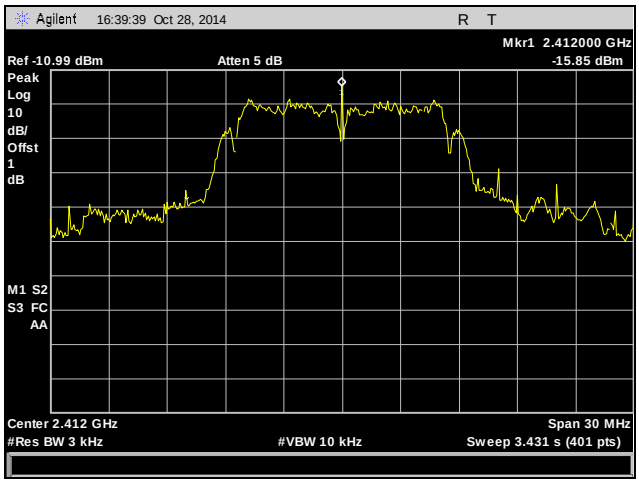


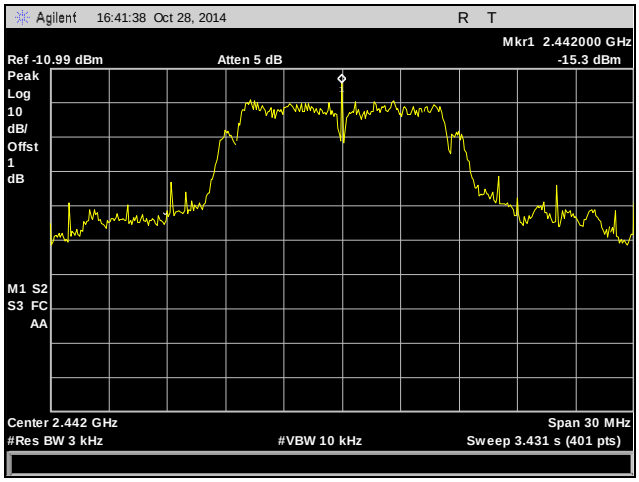

**Figure 3. Block Diagram, Peak Power Spectral Density Test Setup**

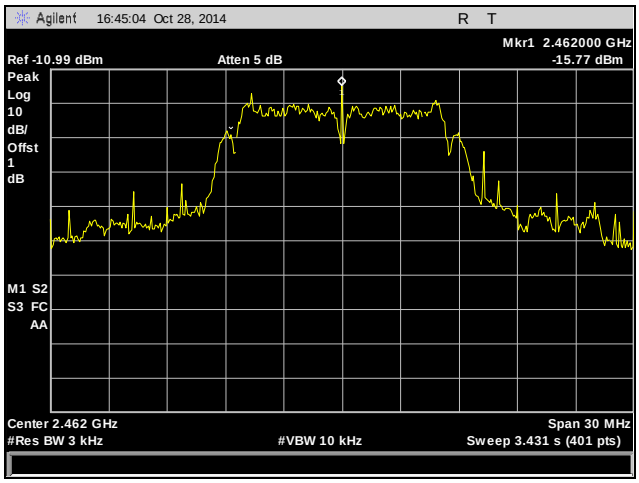
## Peak Power Spectral Density, 802.11g




**Plot 61. Peak Power Spectral Density, Low Channel, 2412 MHz, 802.11g**



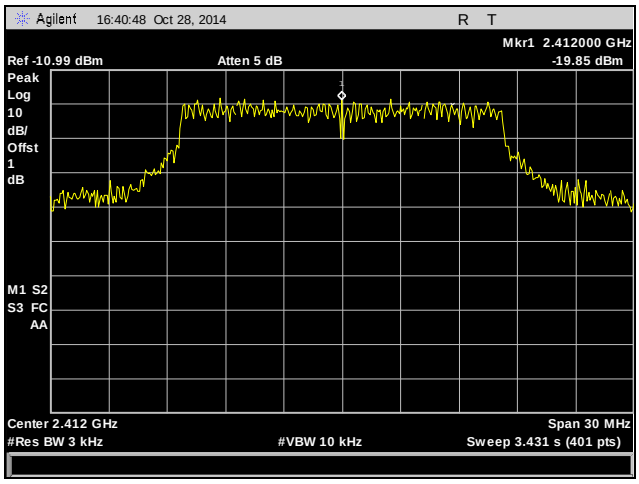

**Plot 62. Peak Power Spectral Density, Mid Channel, 2442 MHz, 802.11g**



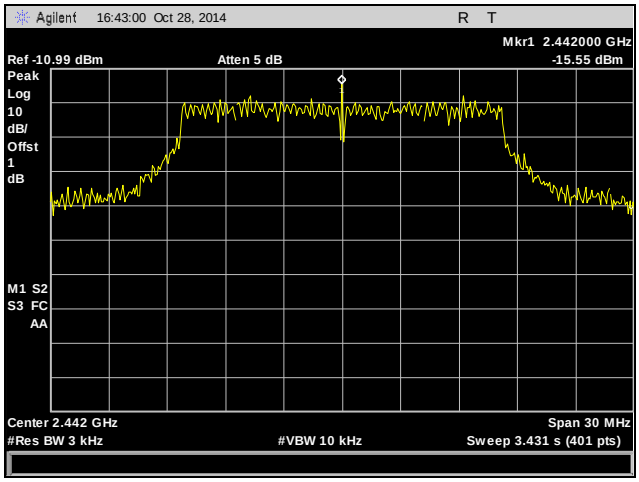

**Plot 63. Peak Power Spectral Density, High Channel, 2462 MHz, 802.11g**

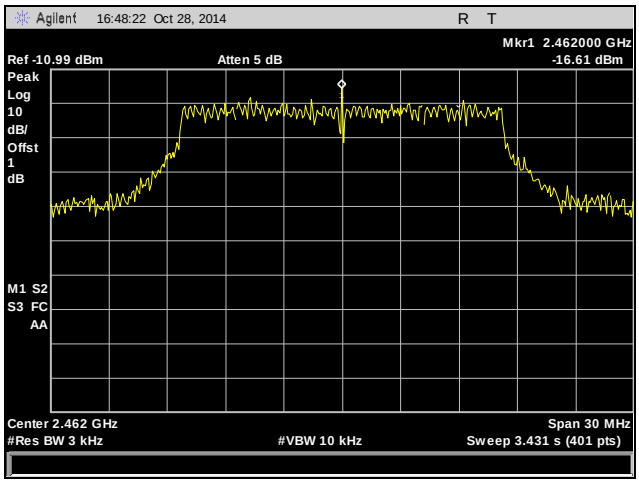
## Peak Power Spectral Density, 802.11n




**Plot 64. Peak Power Spectral Density, Low Channel, 2412 MHz, 802.11n**




**Plot 65. Peak Power Spectral Density, Mid Channel, 2442 MHz, 802.11n**




**Plot 66. Peak Power Spectral Density, High Channel, 2462 MHz, 802.11n**

# Electromagnetic Compatibility Criteria for Intentional Radiators

## § 15.247(i) Maximum Permissible 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.

This is a handheld remote. Per KDB 447498 D01, the SAR exclusion threshold is given by the following formula:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√f(GHz)] ≤ 7.5 for 10-g extremity SAR

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√f(GHz)] = (5.2/5).√2.462 = 1.6, which is less than 7.5.

Therefore, SAR is not required.

# 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 |
|---|---|---|---|---|---|
| 1S2460 | 1-26GHZ SPECTRUM ANALYZER | AGILENT TECHNOLOGIES | E4407B | 2/27/2014 | 8/27/2015 |
| 1S3853 | DIGITAL DC POWER SUPPLY | EXTECH INSTRUMENTS | 382200 | SEE NOTE | |
| 1S2482 | 5 METER CHAMBER (NSA) | PANASHIELD | 5 METER SEMI-ANECHOIC CHAMBER | 9/12/2013 | 3/12/2015 |
| 1S2600 | BILOG ANTENNA | TESEQ | CBL6112D | 8/29/2013 | 8/29/2015 |
| 1S2603 | DOUBLE RIDGED WAVEGUIDE HORN | ETS-LINDGREN | 3117 | 4/24/2013 | 4/24/2015 |
| 1S2421 | EMI TEST RECEIVER | ROHDE & SCHWARZ | ESIB7 | 9/10/2014 | 9/10/2015 |
| 1S3835 | PSA SPECTRUM ANALYZER | AGILENT | E4448A | 9/24/2014 | 9/24/2015 |

**Table 11. 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

## 1. 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 user's 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