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October 20, 2011

Ubiquiti Networks, Inc.
91 E. Tasman
San Jose, CA 95134

Dear Jennifer Sanchez,

Enclosed is the EMC Wireless test report for compliance testing of the Ubiquiti Networks, Inc., AirRouterHP as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B, ICES-003, Issue 4 February 2004 for a Class A Digital Device and FCC Part 15 Subpart C, RSS-210, Issue 8, Dec. 2010 for Intentional Radiators.

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

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\Ubiquiti Networks, Inc.\EMCS32997-FCC247)

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Electromagnetic Compatibility Criteria Test Report

for the

**Ubiquiti Networks, Inc.
AirRouterHP**

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class A Digital Devices
&
15.247 Subpart C & RSS-210, Issue 8, Dec. 2010
for Intentional Radiators

MET Report: EMCS32997-FCC247

October 20, 2011

Prepared For:

**Ubiquiti Networks, Inc.
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San Jose, CA 95134**

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for Intentional Radiators



Lionel Gabrillo, 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 Parts 15B, 15.247 and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210, Issue 8, Dec. 2010 under normal use and maintenance.



Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	October 20, 2011	Initial Issue.

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List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
<i>d</i>	Measurement Distance
dB	Decibels
dBμA	Decibels above one microamp
dBμV	Decibels above one microvolt
dBμA/m	Decibels above one microamp per meter
dBμV/m	Decibels above one microvolt per meter
DC	Direct Current
E	Electric Field
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
EUT	Equipment Under Test
<i>f</i>	Frequency
FCC	Federal Communications Commission
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	Kilohertz
kPa	Kilopascal
kV	Kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μH	Microhenry
μ	Microfarad
μs	Microseconds
NEBS	Network Equipment-Building System
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
TWT	Traveling Wave Tube
V/m	Volts per meter
VCP	Vertical Coupling Plane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Ubiquiti Networks, Inc. AirRouterHP, 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 AirRouterHP. Ubiquiti Networks, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the AirRouterHP, 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 Ubiquiti Networks, Inc., purchase order number US100230. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference 47 CFR Part 15.247:2005	IC Reference RSS-210 Issue 8: 2010; RSS-GEN Issue 3: 2010	Description	Compliance
47 CFR Part 15.107 (a)	ICES-003 Issue 4 February 2004	Conducted Emission Limits for a Class A Digital Device	Compliant
47 CFR Part 15.109 (a)	ICES-003 Issue 4 February 2004	Radiated Emission Limits for a Class A Digital Device	Compliant
Title 47 of the CFR, Part 15 §15.203	N/A	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	RSS-GEN (7.2.4)	Conducted Emission Limits	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(2)	RSS-Gen(4.6)	6dB Occupied Bandwidth	Compliant
		99% Occupied Bandwidth	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	RSS-210(A8.4)	Peak Power Output	Compliant
Title 47 of the CFR, Part 15 §15.247(d); §15.209; §15.205	RSS-210(A8.5)	Radiated Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RSS-210(A8.5)	RF Conducted Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RSS-210(A8.5)	RF Conducted Band Edge	Compliant
Title 47 of the CFR, Part 15; §15.247(e)	RSS-210(A8.2)	Peak Power Spectral Density	Compliant
Title 47 of the CFR, Part 15 §15.247(i)	RSS-Gen(5.6)	Maximum Permissible Exposure (MPE)	Compliant
N/A	RSS-Gen(4.10)	Receiver Spurious Emissions	Compliant

Table 1. Executive Summary of EMC Part 15.247 Compliance Testing

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Ubiquiti Networks, Inc. to perform testing on the AirRouterHP, under Ubiquiti Networks, Inc.'s purchase order number US100230.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Ubiquiti Networks, Inc., AirRouterHP.

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

Model(s) Tested:	AirRouterHP	
Model(s) Covered:	AirRouterHP	
EUT Specifications:	Primary Power: 120 VAC, 60 Hz	
	FCC ID: SWX-ARHP IC: 6545A-ARHP	
	Type of Modulations:	OFDM
	Equipment Code:	DTS
	Peak RF Output Power:	802.11b – 25.53 dBm 802.11g – 28.84 dBm 802.11n 20 MHz – 28.06 dBm 802.11n 40 MHz – 20.69 dBm
	EUT Frequency Ranges:	2412 – 2462 MHz and 2422 – 2452 MHz
	99% Occupied Bandwidth:	802.11b – 16.0253 MHz 802.11g – 16.7577 MHz 802.11n 20 MHz – 18.0579 MHz 802.11n 40 MHz – 36.8624
	Antenna:	5dBi Dipole Reverse SMA Connector
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35° C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Lionel Gabrillo	
Report Date(s):	October 20, 2011	

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
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
RSS-210, Issue 8, Dec. 2010	Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
RSS-GEN, Issue 3, Dec. 2010	General Requirements and Information for the Certification of Radio Apparatus
ICES-003, Issue 4 February 2004	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/NCSL Z540-1-1994	Calibration Laboratories and Measuring and Test Equipment - General Requirements
ANSI/ISO/IEC 17025:2000	General Requirements for the Competence of Testing and Calibration Laboratories
ANSI C63.10-2009	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 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 Ubiquiti Networks, Inc. AirRouterHP, Equipment Under Test (EUT), is a 2400MHz 802.11b/g/n Radio.



Photograph 1. Ubiquiti Networks, Inc. AirRouterHP

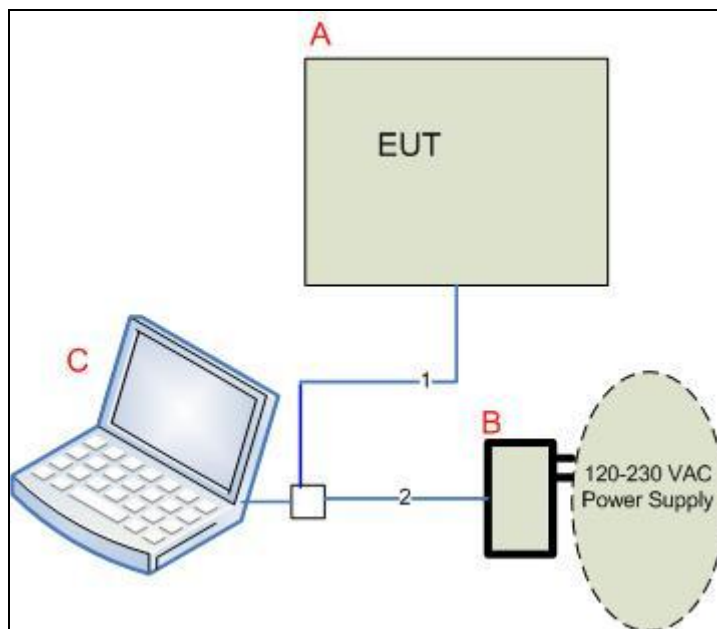


Figure 1. Block Diagram of Test Configuration

E. Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. 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
A	2400MHz Radio	AirRouterHP	NA	1129C00272222A234
B	Poe Adapter	GFP121T-050200-1	NA	1002-0010465

Table 4. Equipment Configuration

F. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number
C	Laptop	Dell	Vostro 1000

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
1	A, Ethernet	Ethernet	1	2	Y	C
2	A, Power Input	2 Conductor DC Cable	1	1	N	B, 100-240VAC 50/60Hz

Table 6. Ports and Cabling Information

H. Mode of Operation

Using Atheros Radio Test Software.

I. Method of Monitoring EUT Operation

Ping Times out and doesn't return. Unit locks up requires power down is a fail.

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 Ubiquiti Networks, Inc. upon completion of testing.

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria

§ 15.107 Conducted Emissions Limits

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

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

15.207(a), Except as shown in paragraphs (b) and (c) of this section*, charging, AC adapters or battery eliminators 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 the Table 7, as measured using a 50 μ H/50 ohms 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 frequencies ranges.

Frequency range (MHz)	Class A Conducted Limits (dB μ V)		*Class B Conducted Limits (dB μ V)	
	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. Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz. * -- Limits per Subsection 15.207(a).				

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

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

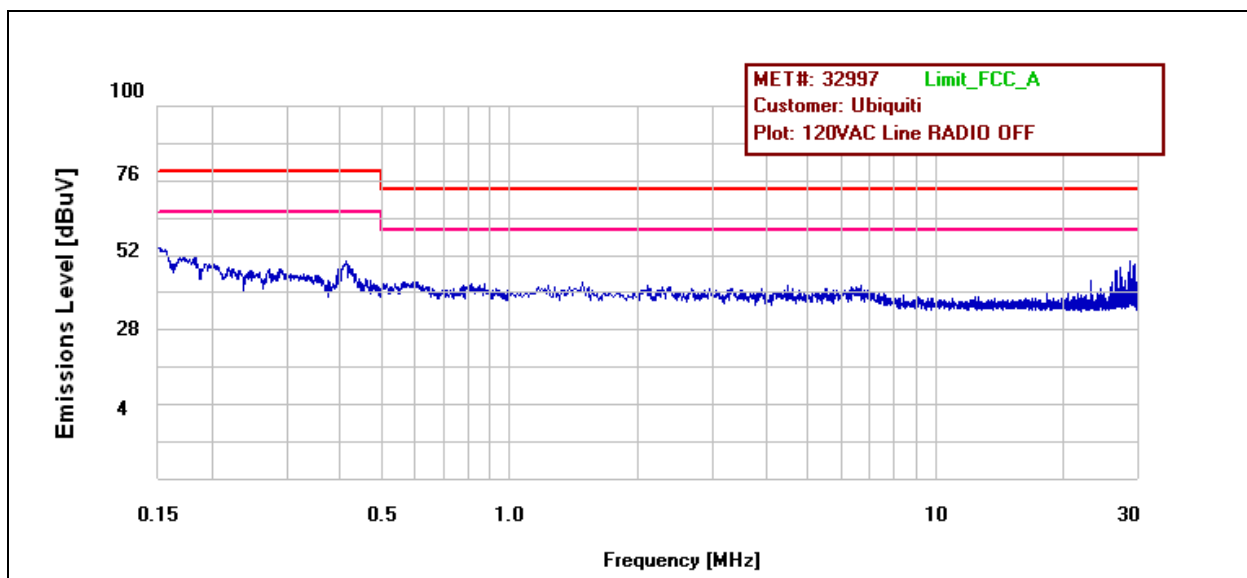
Test Engineer(s): Lionel Gabrillo

Test Date(s): 09/30/11

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

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
120VAC Line RADIO OFF	0.1819	45.72	79	-33.28	Pass	33.34	66	-32.66	Pass
120VAC Line RADIO OFF	0.410	45.8	79	-33.2	Pass	34.47	66	-31.53	Pass
120VAC Line RADIO OFF	28.69	48.15	73	-24.85	Pass	42.24	60	-17.76	Pass

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

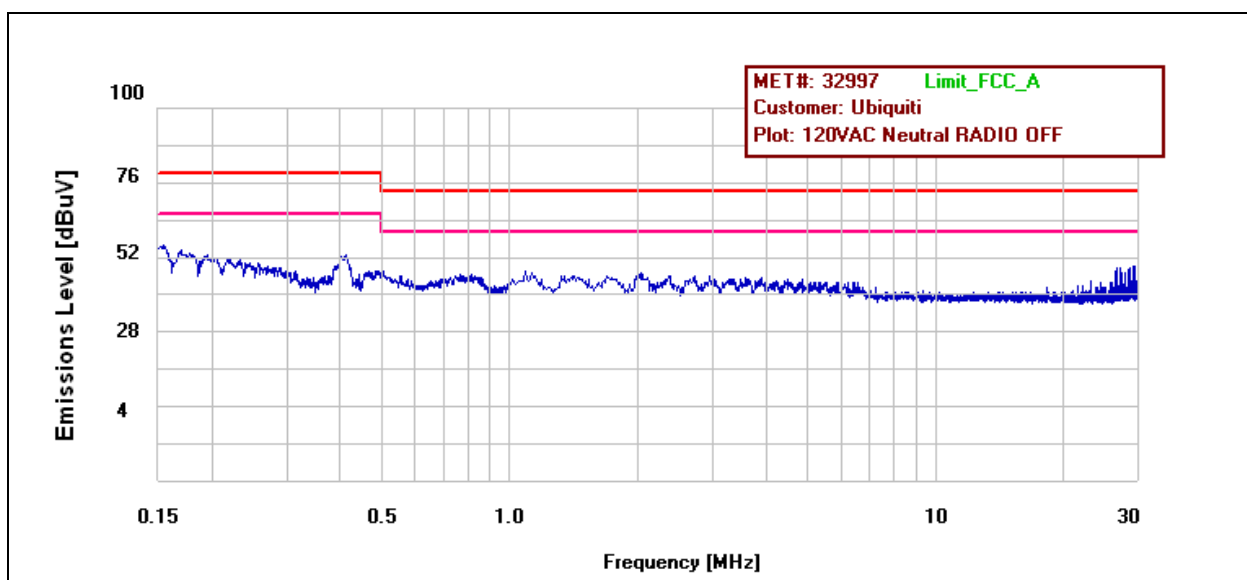


Plot 1. Conducted Emission, Phase Line Plot

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

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
120VAC Neutral RADIO OFF	0.1702	50.03	79	-28.97	Pass	36.9	66	-29.1	Pass
120VAC Neutral RADIO OFF	0.4115	49.56	79	-29.44	Pass	41.18	66	-24.82	Pass
120VAC Neutral RADIO OFF	29.24	47.23	73	-25.77	Pass	43.92	60	-16.08	Pass

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



Plot 2. Conducted Emission, Neutral Line Plot

Conducted Emission Limits Test Setup



Photograph 2. Conducted Emissions, Test Setup

Radiated Emission Limits

§ 15.109 Radiated Emissions Limits

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

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

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

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

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

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

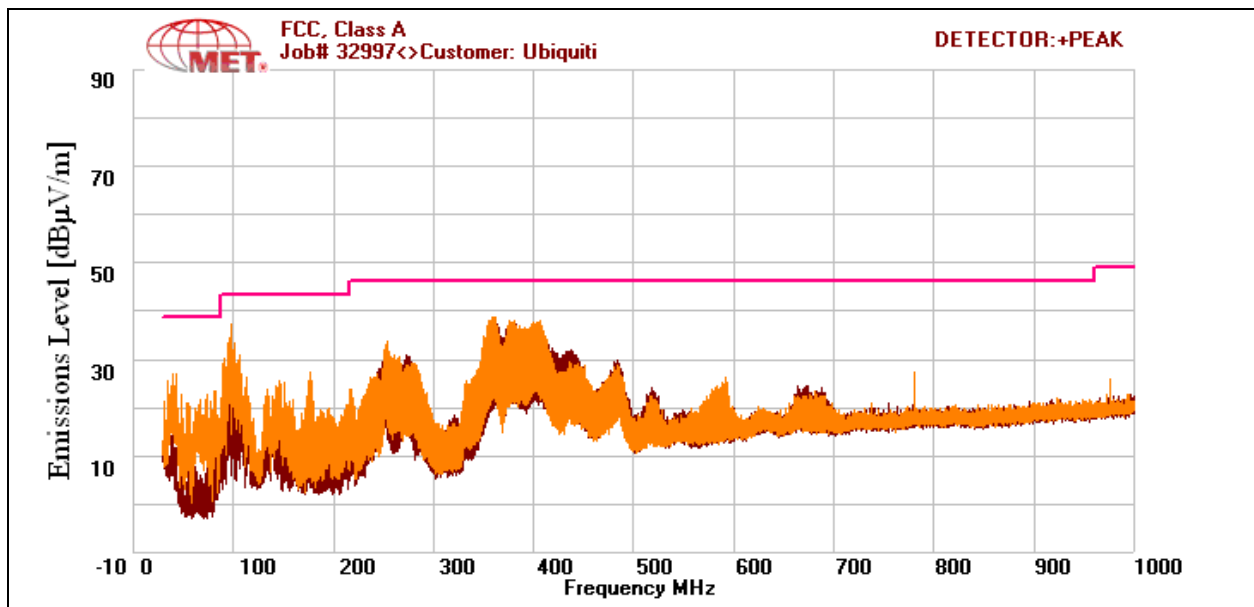
Test Engineer(s): Lionel Gabrillo

Test Date(s): 09/30/11

Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
98.44	V	310.0	100.0	33.84	10.732	0	2.816	-10.46	36.928	43.5	-6.572
43.52	V	210.0	101.5	25.32	10.936	0	1.635	-10.46	27.431	39	-11.569
253.12	V	218.0	100.11	28.64	12.412	0	3.729	-10.46	34.321	46.4	-12.079
360.88	V	181.0	104.23	31.71	14.318	0	3.923	-10.46	39.491	46.4	-6.909
380.16	V	9.0	106.82	29.83	15.194	0	4.035	-10.46	38.599	46.4	-7.801
358.8	H	204.0	119.0	29.88	14.324	0	3.911	-10.46	37.655	46.4	-8.745

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

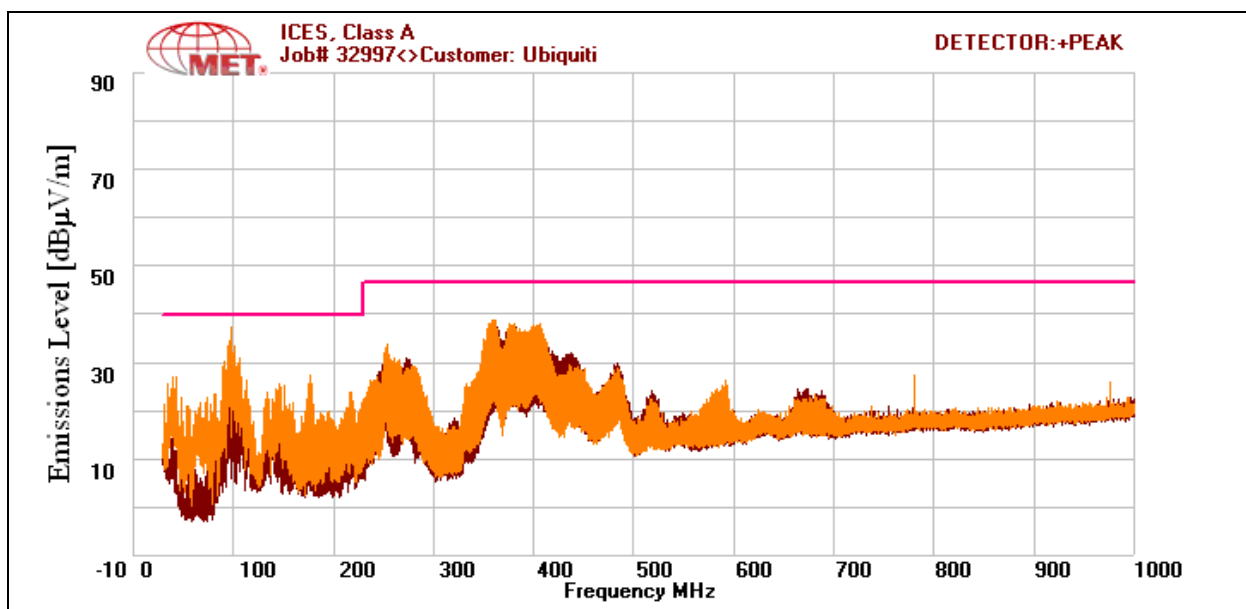


Plot 3. Radiated Emissions, 30 MHz - 1 GHz, FCC Limits

Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
98.44	V	310.0	100.0	33.84	10.732	0	2.816	-10.46	36.928	40	-3.072
43.52	V	210.0	101.5	25.32	10.936	0	1.635	-10.46	27.431	40	-12.569
253.12	V	218.0	100.11	28.64	12.412	0	3.729	-10.46	34.321	47	-12.679
360.88	V	181.0	104.23	31.71	14.318	0	3.923	-10.46	39.491	47	-7.509
380.16	V	9.0	106.82	29.83	15.194	0	4.035	-10.46	38.599	47	-8.401
358.8	H	204.0	119.0	29.88	14.324	0	3.911	-10.46	37.655	47	-9.345

Table 12. Radiated Emissions Limits, Test Results, ICES-003 Limits



Plot 4. Radiated Emissions, ICES-003 Limits

Radiated Emission Limits Test Setup



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



IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

Test Requirement: § 15.203: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

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

- a.) Antenna must be permanently attached to the unit.
- b.) Antenna must use a unique type of connector to attach to the EUT.
- c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Results: The EUT as tested is compliant the criteria of §15.203. The EUT antenna uses a unique type of connector. The antenna is a 5 dBi Dipole antenna, manufactured by Ubiquiti Networks.

Test Engineer(s): Lionel Gabrillo

Test Date(s): 10/04/11

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 μ H/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 (dB μ V)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 13. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Procedure: The EUT was placed on a 0.8 m-high wooden table inside a 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 μ H Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-2003 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω /50 μ H LISN as the input transducer to an EMC/field intensity meter. For the purpose of this testing, the transmitter was turned on. Scans were performed with the transmitter on.

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

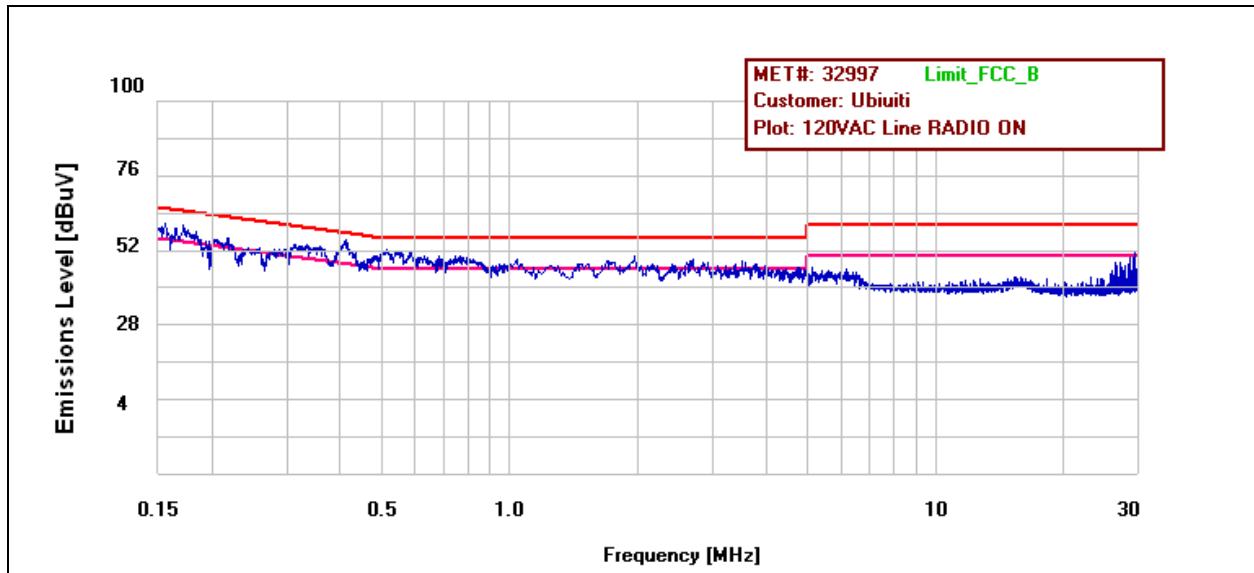
Test Engineer(s): Lionel Gabrillo

Test Date(s): 09/30/11

15.207(a) Conducted Emissions Test Results

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
120VAC Line RADIO ON	28.69	47.61	60	-12.39	Pass	42.81	50	-7.19	Pass
120VAC Line RADIO ON	29.29	49.31	60	-10.69	Pass	46.98	50	-3.02	Pass
120VAC Line RADIO ON	1.756	42.59	56	-13.41	Pass	33.52	46	-12.48	Pass
120VAC Line RADIO ON	0.1762	52.96	64.667	-11.707	Pass	39.46	54.667	-15.207	Pass
120VAC Line RADIO ON	0.5112	47.47	56	-8.53	Pass	35.56	46	-10.44	Pass

Table 14. Conducted Emissions, 15.207(a), Phase Line, Test Results

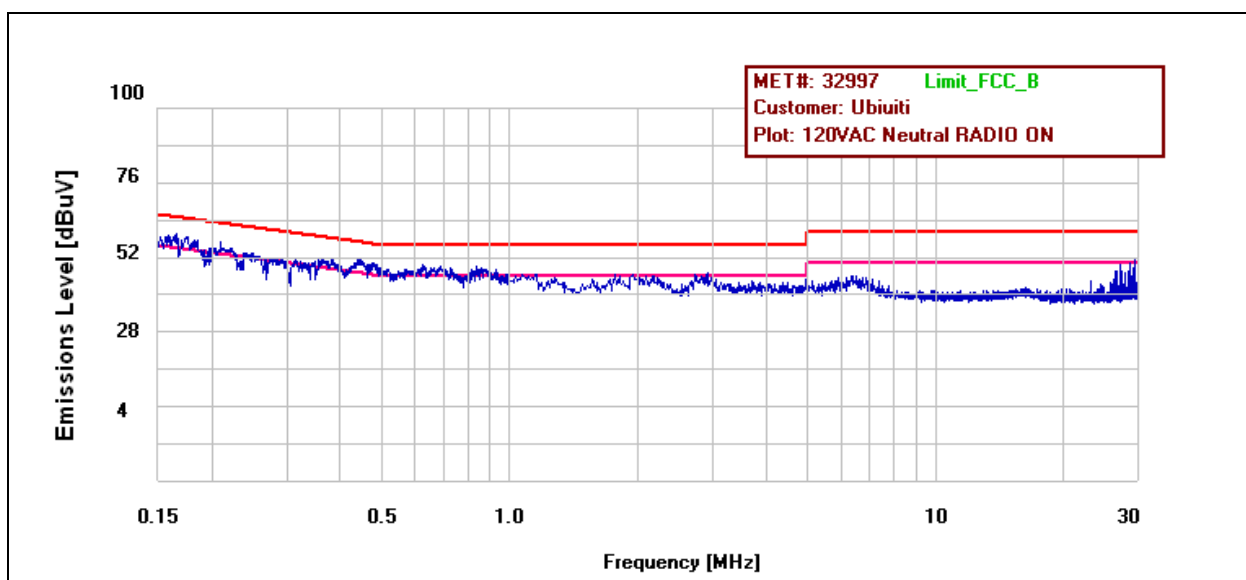


Plot 5. Conducted Emissions, 15.207(a), Phase Line

15.207(a) Conducted Emissions Test Results

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
120VAC Neutral RADIO ON	0.165	48.56	65.211	-16.651	Pass	33.42	55.211	-21.791	Pass
120VAC Neutral RADIO ON	0.4475	46.47	56.946	-10.476	Pass	32.69	46.946	-14.256	Pass
120VAC Neutral RADIO ON	0.6125	43.43	56	-12.57	Pass	31.63	46	-14.37	Pass
120VAC Neutral RADIO ON	1.089	40.52	56	-15.48	Pass	30.34	46	-15.66	Pass
120VAC Neutral RADIO ON	29.31	48.35	60	-11.65	Pass	44.31	50	-5.69	Pass

Table 15. Conducted Emissions, 15.207(a), Neutral Line, Test Results



Plot 6. Conducted Emissions, 15.207(a), Neutral Line

15.207(a) Conducted Emissions Test Setup Photo



Photograph 4. Conducted Emissions, 15.207(a), Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a)(2) 6 dB and 99% 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 and 99% Bandwidth was determined from the plots on the following pages.

Test Engineer(s): Lionel Gabrillo

Test Date(s): 09/21/11

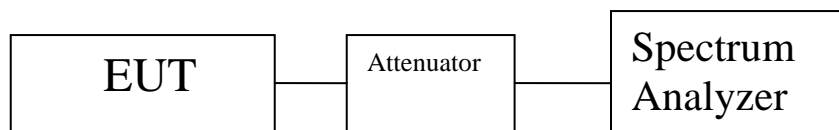


Figure 2. Block Diagram, Occupied Bandwidth Test Setup

Occupied Bandwidth Test Results

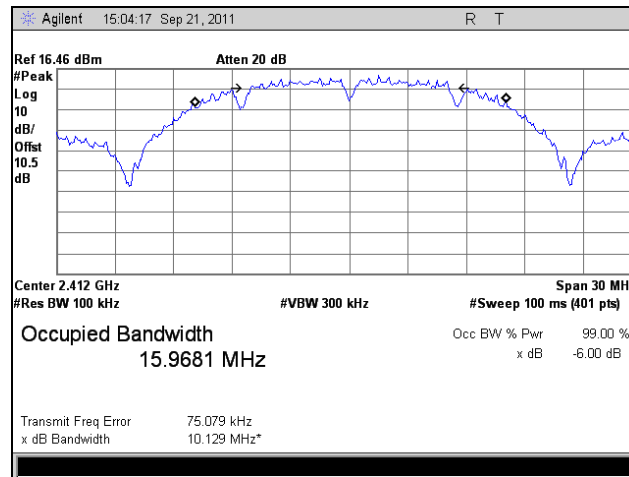
Occupied Bandwidth			
Mode	Carrier Channel	Frequency (MHz)	Measured 6 dB Bandwidth (MHz)
802.11b	Low	2412	10.129
	Mid	2437	10.183
	High	2462	11.132
802.11g	Low	2412	16.571
	Mid	2437	16.599
	High	2462	16.386
802.11b 20 MHz	Low	2412	17.645
	Mid	2437	17.673
	High	2462	17.666
802.11b 40 MHz	Low	2422	36.462
	Mid	2437	36.388
	High	2452	36.115

Table 16. 6 dB Occupied Bandwidth, Test Results

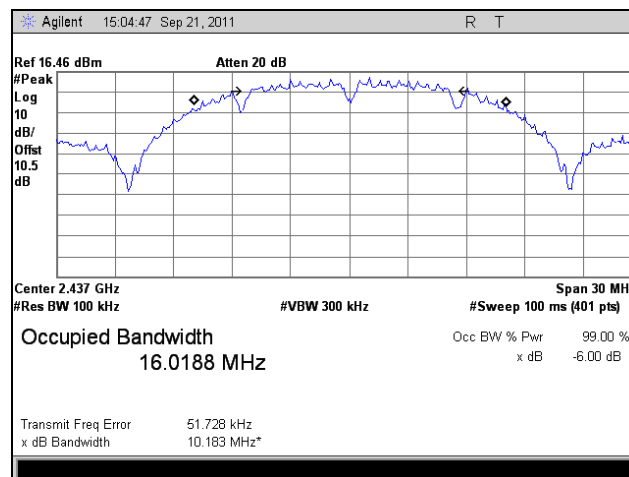
Occupied Bandwidth			
Mode	Carrier Channel	Frequency (MHz)	Measured 99% Bandwidth (MHz)
802.11b	Low	2412	16.0253
	Mid	2437	15.7106
	High	2462	15.8851
802.11g	Low	2412	16.7577
	Mid	2437	16.5958
	High	2462	16.6526
802.11b 20 MHz	Low	2412	17.9202
	Mid	2437	17.7440
	High	2462	18.0579
802.11b 40 MHz	Low	2422	36.8624
	Mid	2437	36.6760
	High	2452	36.5042

Table 17. 99% Occupied Bandwidth, Test Results

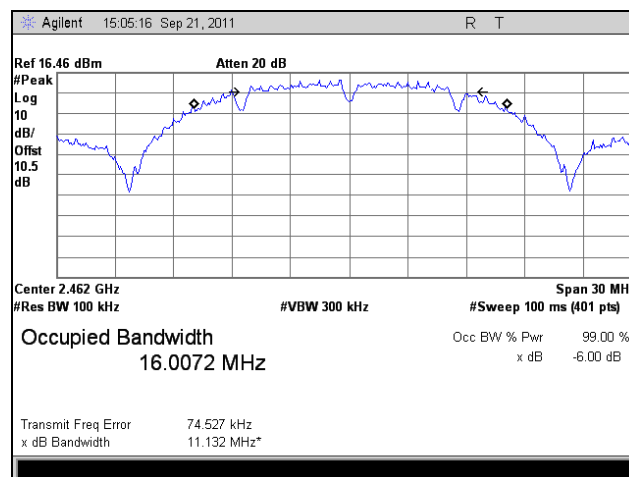
6 dB Occupied Bandwidth Test Results, 802.11b



Plot 7. 6 dB Occupied Bandwidth, Low Channel, 802.11b

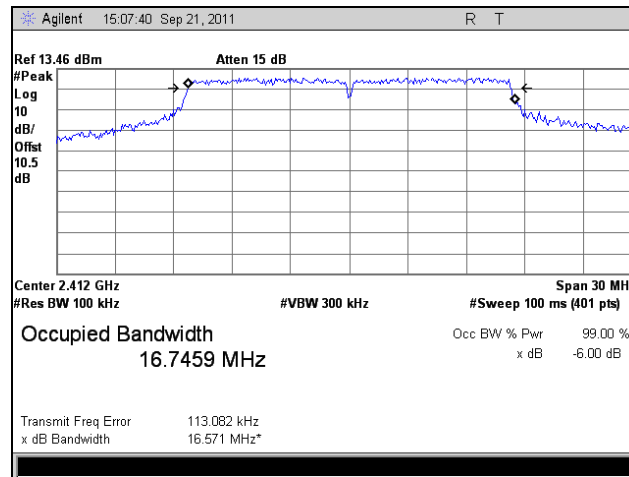


Plot 8. 6 dB Occupied Bandwidth, Mid Channel, 802.11b

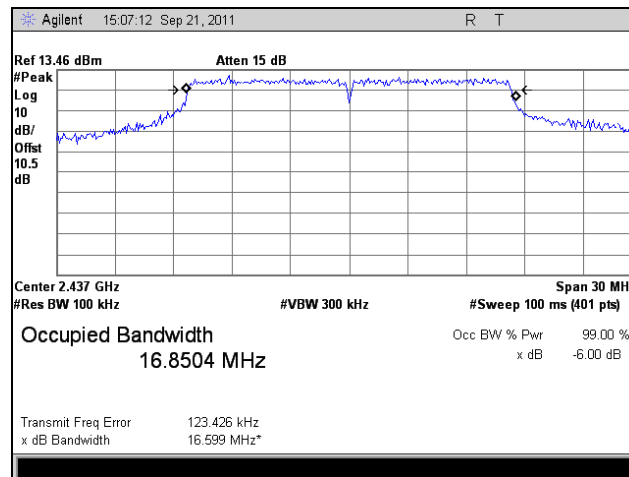


Plot 9. 6 dB Occupied Bandwidth, High Channel, 802.11b

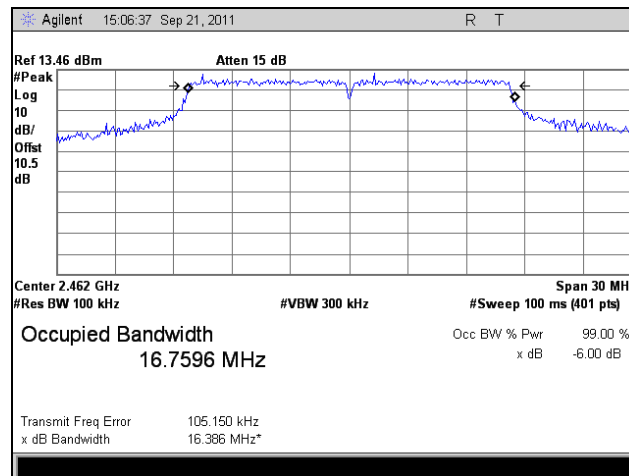
6 dB Occupied Bandwidth Test Results, 802.11g



Plot 10. 6 dB Occupied Bandwidth, Low Channel, 802.11g

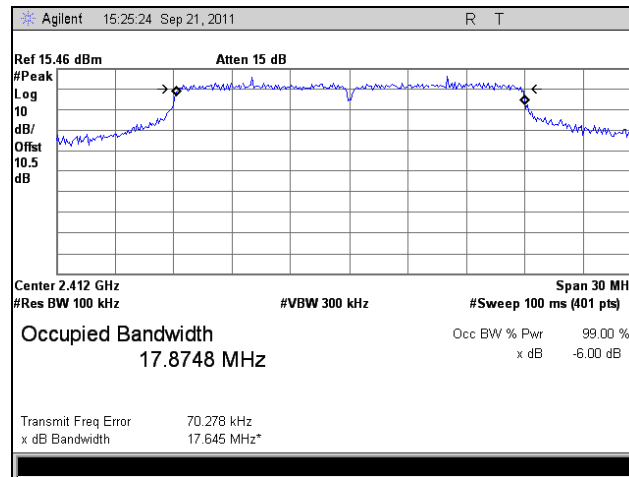


Plot 11. 6 dB Occupied Bandwidth, Mid Channel, 802.11g

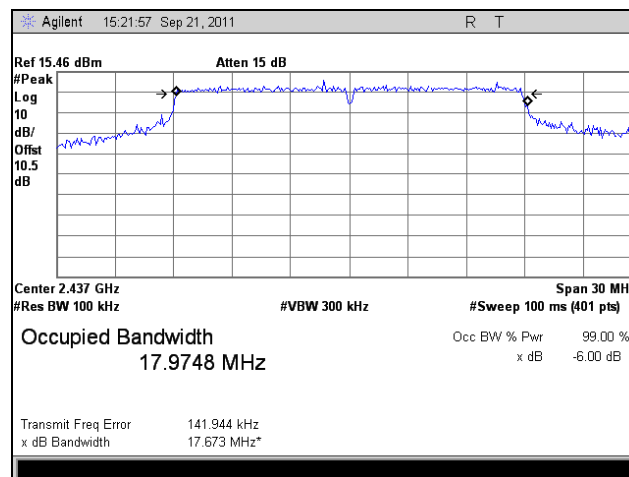


Plot 12. 6 dB Occupied Bandwidth, High Channel, 802.11g

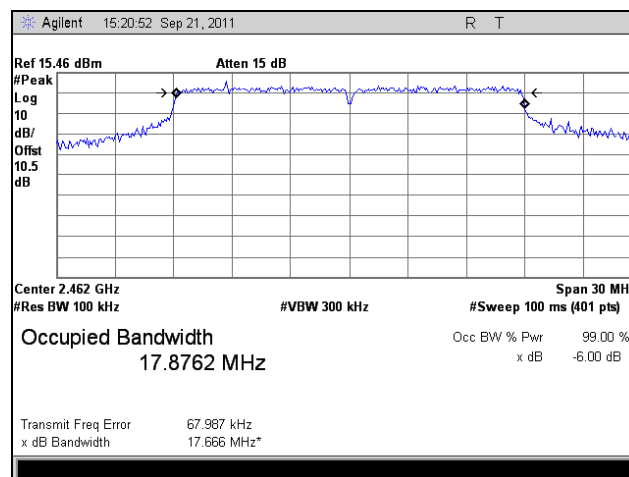
6 dB Occupied Bandwidth Test Results, 802.11n 20 MHz



Plot 13. 6 dB Occupied Bandwidth, Low Channel, 802.11n 20 MHz

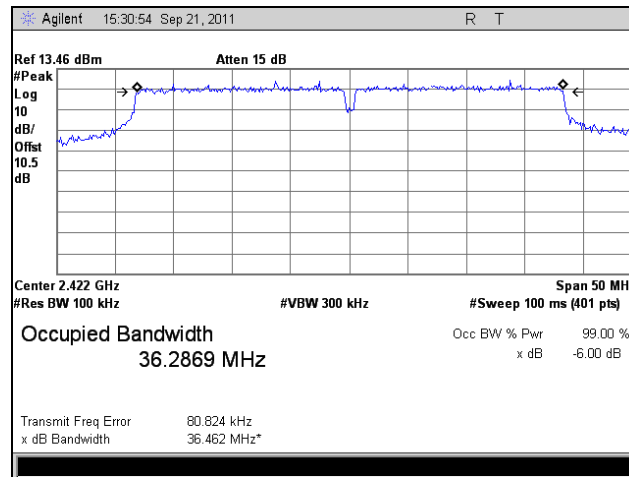


Plot 14. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 20 MHz

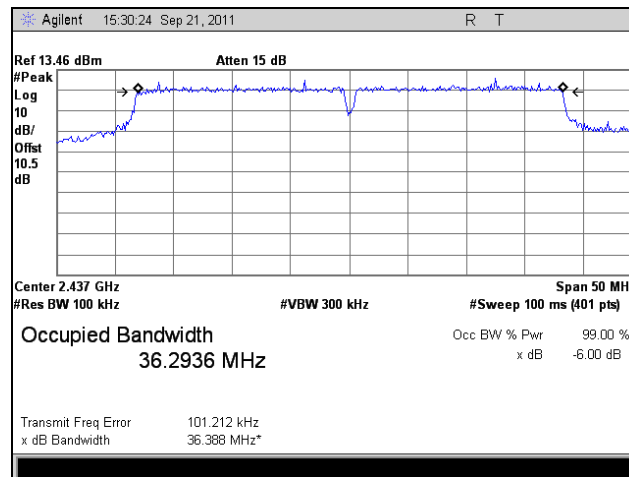


Plot 15. 6 dB Occupied Bandwidth, High Channel, 802.11n 20 MHz

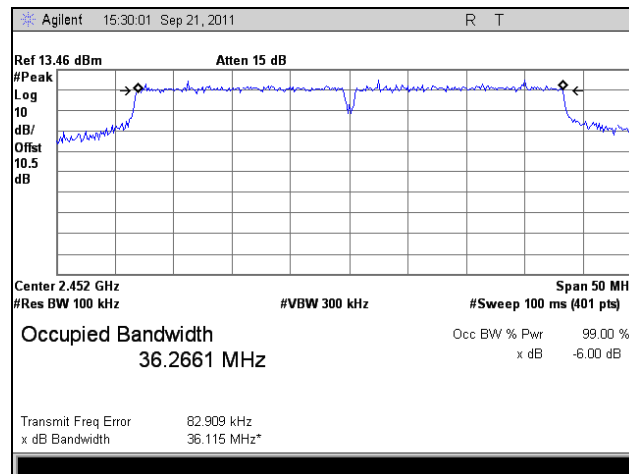
6 dB Occupied Bandwidth Test Results, 802.11n 40 MHz



Plot 16. 6 dB Occupied Bandwidth, Low Channel, 802.11n 40 MHz

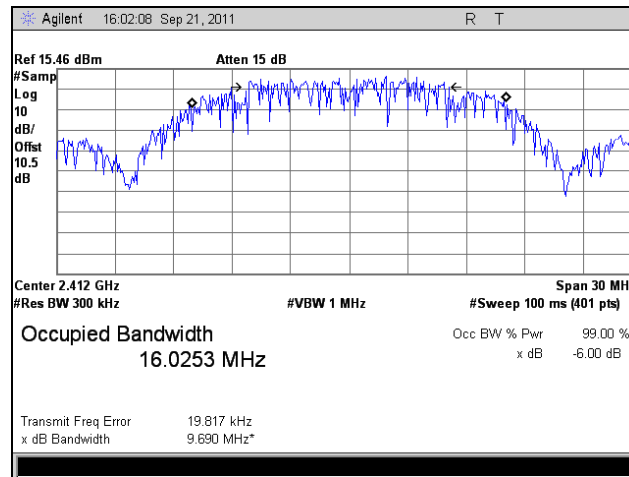


Plot 17. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 40 MHz

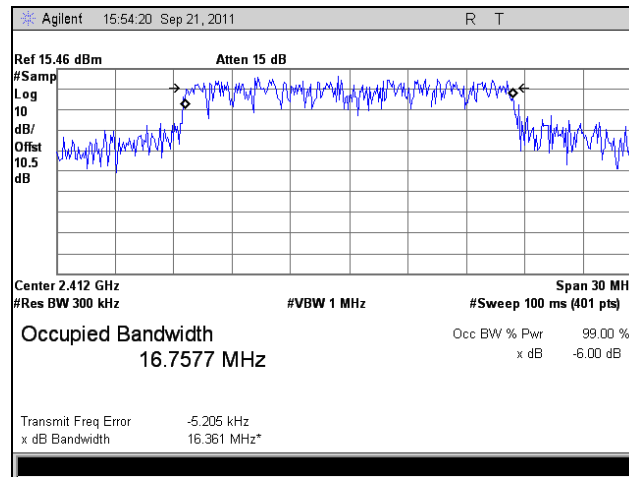


Plot 18. 6 dB Occupied Bandwidth, High Channel, 802.11n 40 MHz

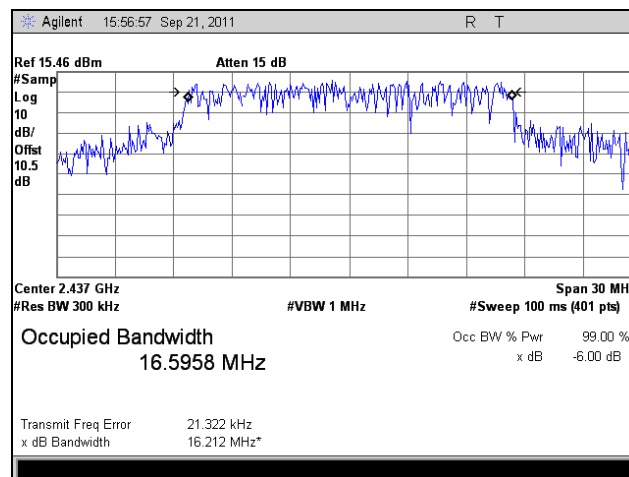
99% Occupied Bandwidth Test Results, 802.11b



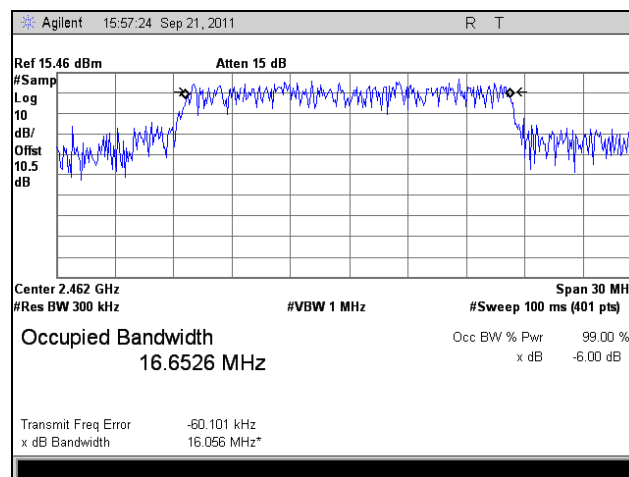
99% Occupied Bandwidth Test Results, 802.11g



Plot 22. 99% Occupied Bandwidth, Low Channel, 802.11g

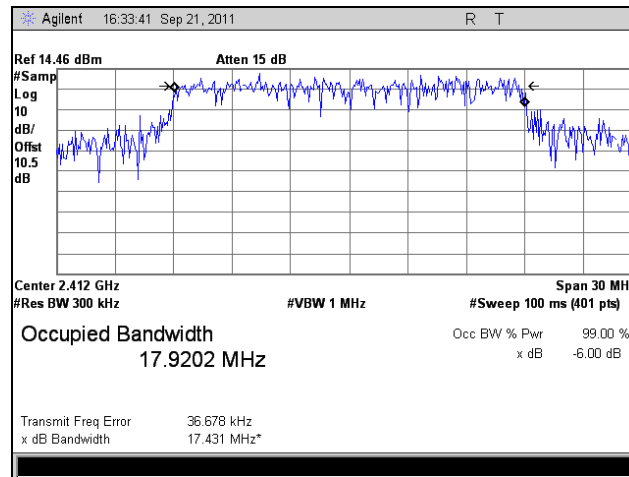


Plot 23. 99% Occupied Bandwidth, Mid Channel, 802.11g

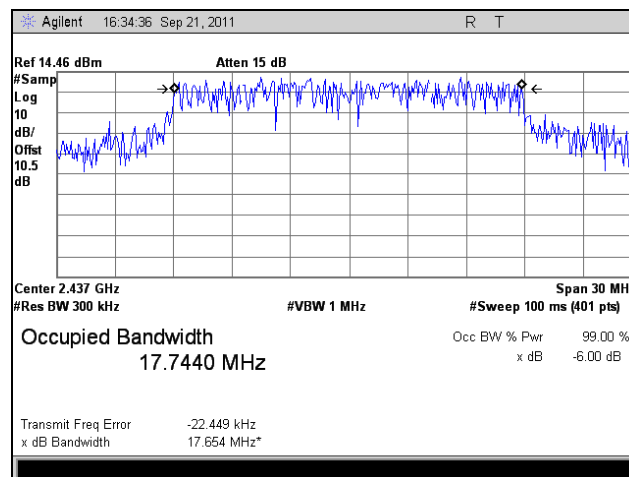


Plot 24. 99% Occupied Bandwidth, High Channel, 802.11g

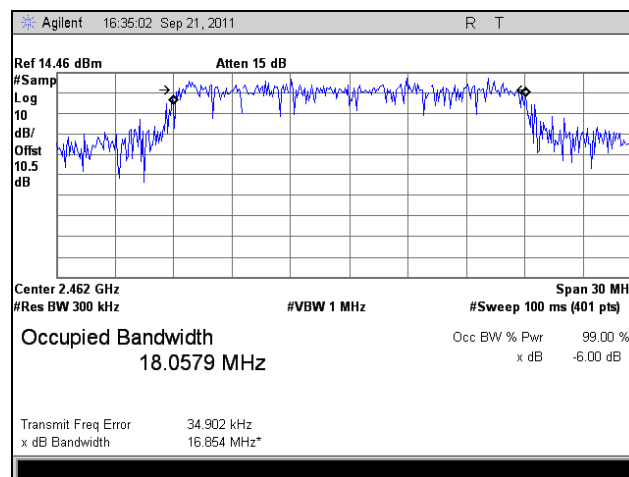
99% Occupied Bandwidth Test Results, 802.11n 20 MHz



Plot 25. 99% Occupied Bandwidth, Low Channel, 802.11n 20 MHz

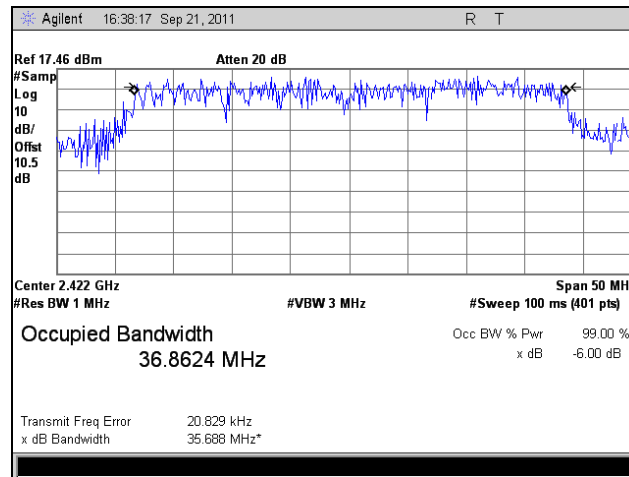


Plot 26. 99% Occupied Bandwidth, Mid Channel, 802.11n 20 MHz

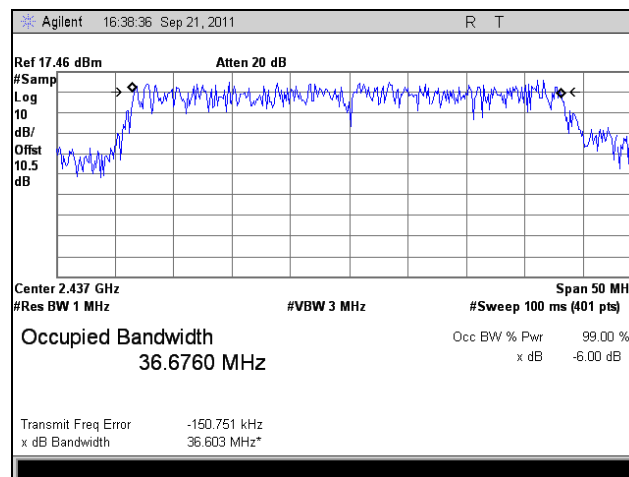


Plot 27. 99% Occupied Bandwidth, High Channel, 802.11n 20 MHz

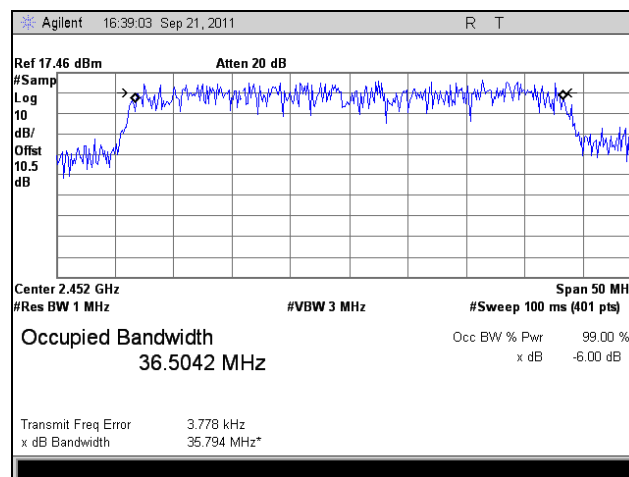
99% Occupied Bandwidth Test Results, 802.11n 40 MHz



Plot 28. 99% Occupied Bandwidth, Low Channel, 802.11n 40 MHz



Plot 29. 99% Occupied Bandwidth, Mid Channel, 802.11n 40 MHz



Plot 30. 99% Occupied Bandwidth, High Channel, 802.11n 40 MHz

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 18. Output Power Requirements from §15.247(b)

§15.247(c): 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 18, 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 6 dBi 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): Lionel Gabrillo

Test Date(s): 09/22/11 – 09/30/11

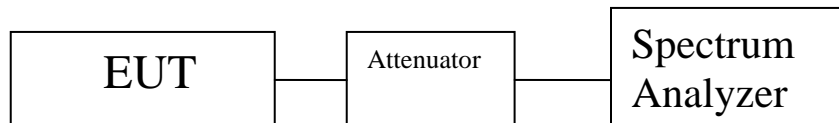


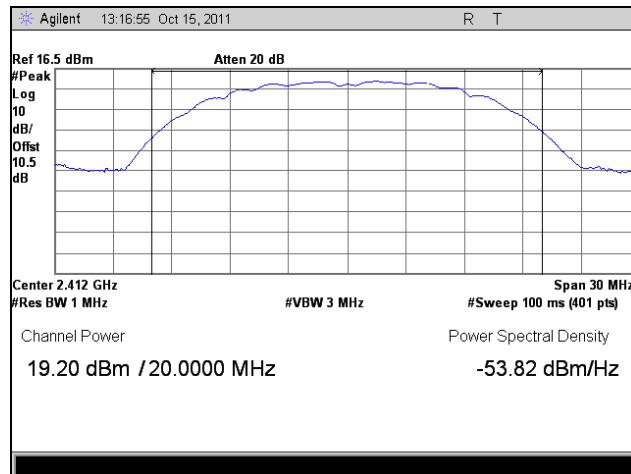
Figure 3. Peak Power Output Test Setup

Peak Power Output Test Results

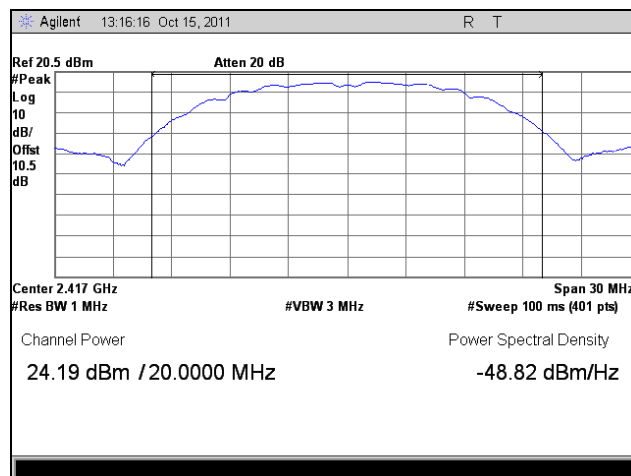
Peak Conducted Output Power		
Mode	Frequency (MHz)	Measured Peak Output Power dBm
802.11b	2412	19.20
	2417	24.19
	2422	25.53
	2437	25.13
	2442	24.24
	2447	20.18
	2452	19.43
	2457	17.11
	2462	16.23
802.11g	2412	24.06
	2417	28.54
	2437	28.77
	2422	28.84
	2447	27.23
	2452	24.87
	2457	24.58
	2462	22.05
802.11n 20 MHz	2412	22.73
	2417	28.06
	2437	28.01
	2442	28.00
	2447	26.94
	2452	24.62
	2457	23.15
	2462	17.76
802.11n 40 MHz	2422	19.63
	2437	20.69
	2442	17.26
	2447	14.42
	2452	13.87

Table 19. Peak Power Output, Test Results

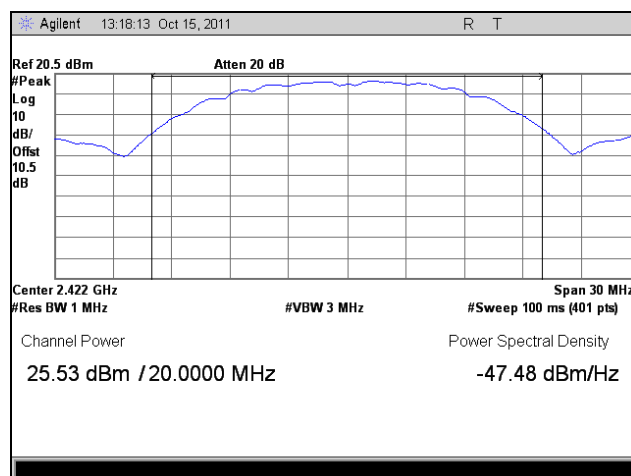
Peak Power Output Test Results, 802.11b



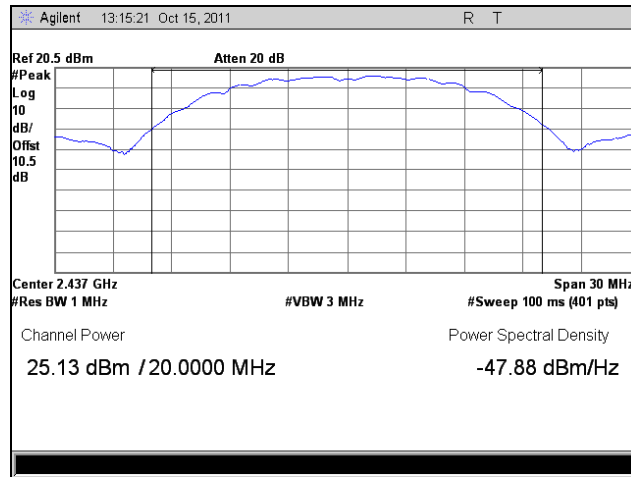
Plot 31. Peak Power Output, 802.11b, 2412 MHz, Low Channel



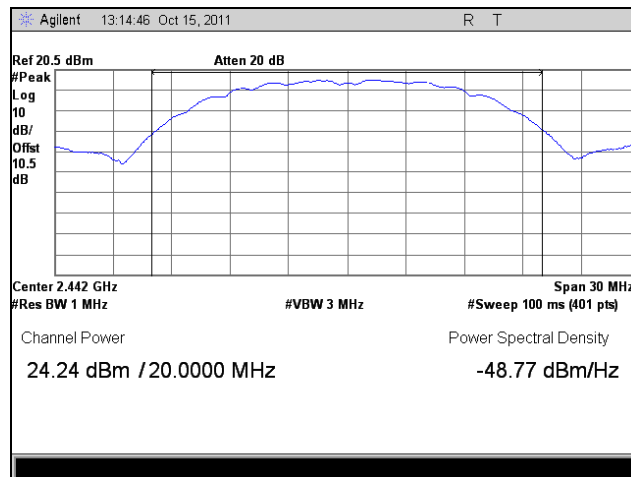
Plot 32. Peak Power Output, 802.11b, 2417 MHz



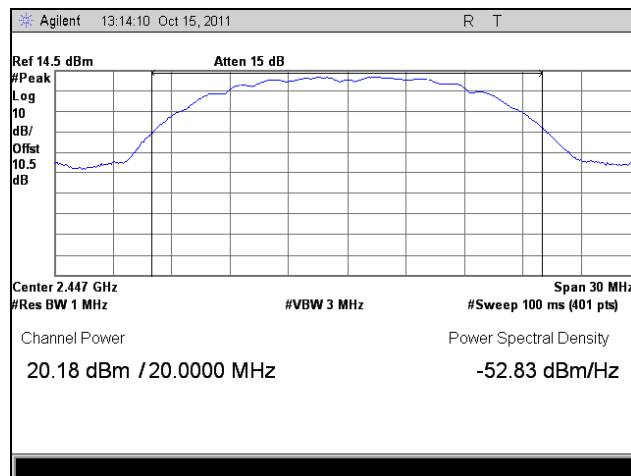
Plot 33. Peak Power Output, 802.11b, 2422 MHz



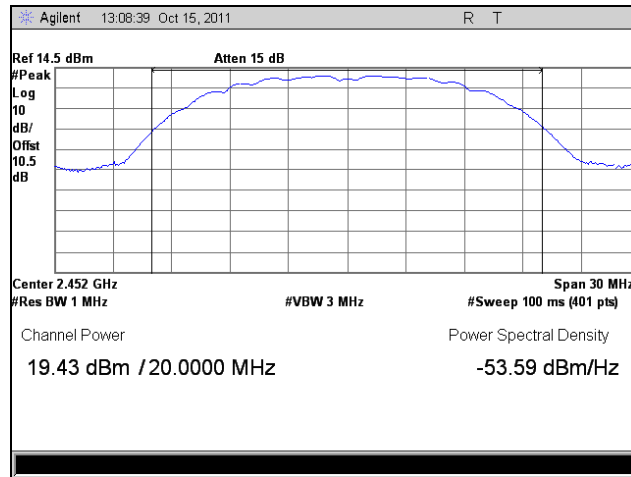
Plot 34. Peak Power Output, 802.11b, 2437 MHz, Mid Channel



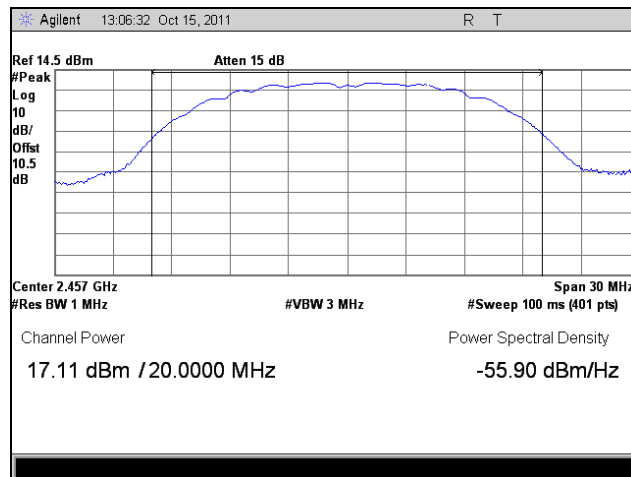
Plot 35. Peak Power Output, 802.11b, 2442 MHz



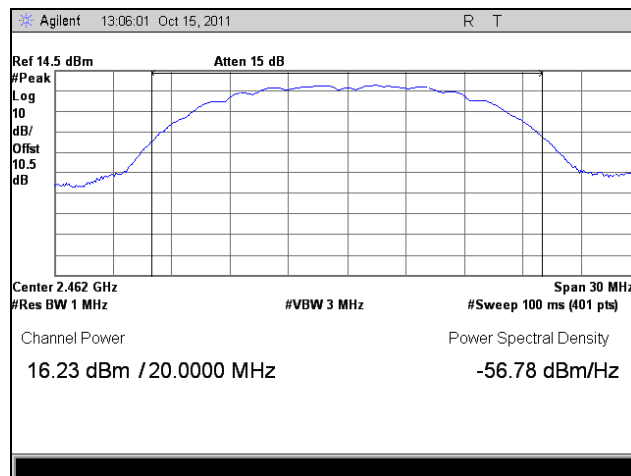
Plot 36. Peak Power Output, 802.11b, 2447 MHz



Plot 37. Peak Power Output, 802.11b, 2452 MHz

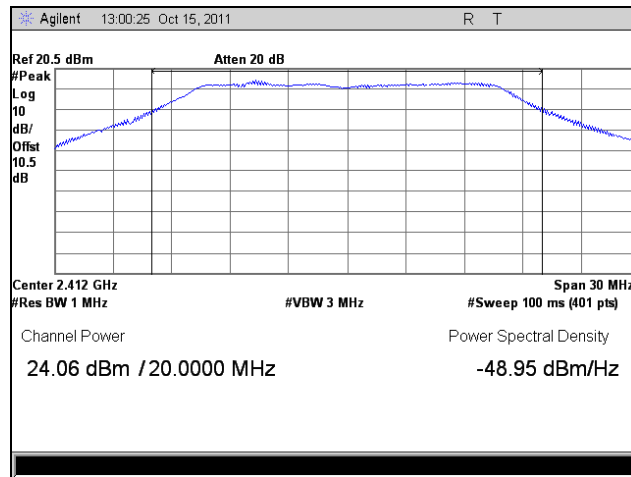


Plot 38. Peak Power Output, 802.11b, 2457 MHz

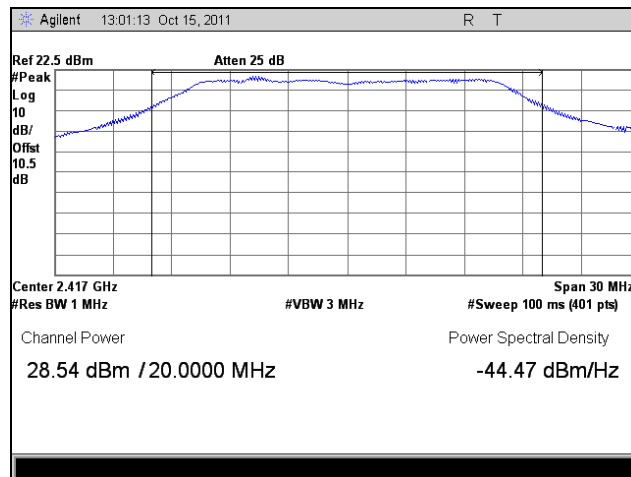


Plot 39. Peak Power Output, 802.11b, 2462 MHz, High Channel

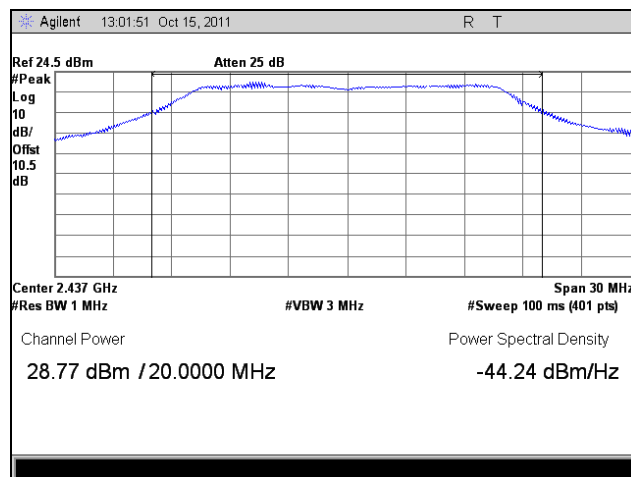
Peak Power Output Test Results, 802.11g



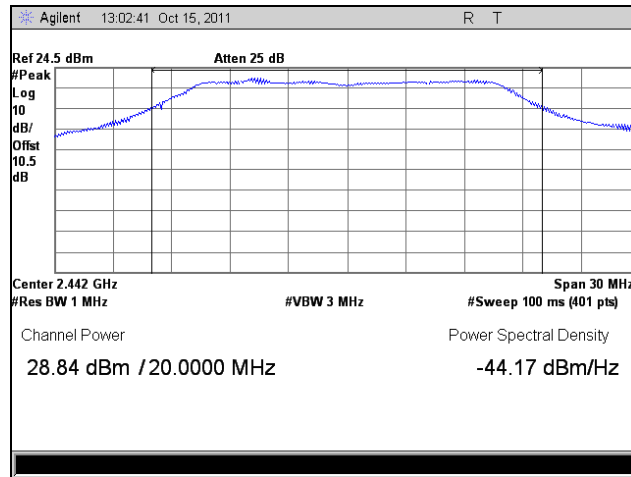
Plot 40. Peak Power Output, 802.11g, 2412 MHz, Low Channel



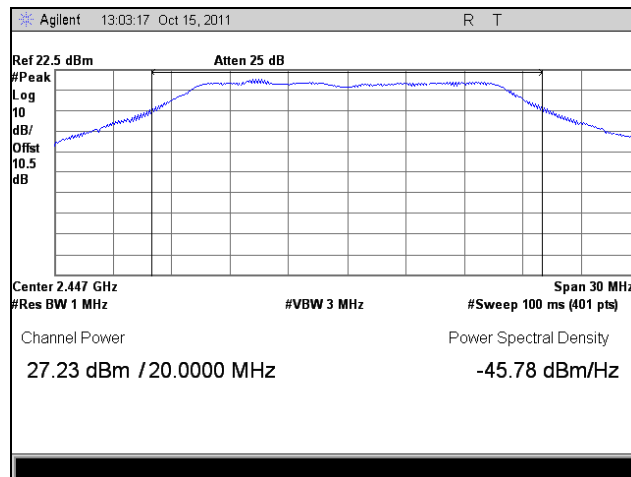
Plot 41. Peak Power Output, 802.11g, 2417 MHz



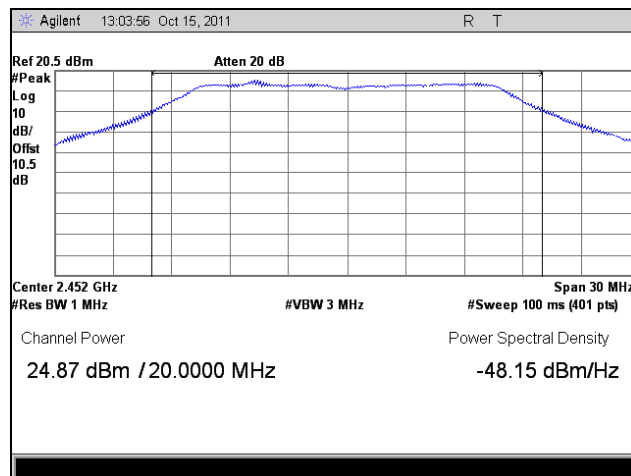
Plot 42. Peak Power Output, 802.11g, 2437 MHz, Mid Channel



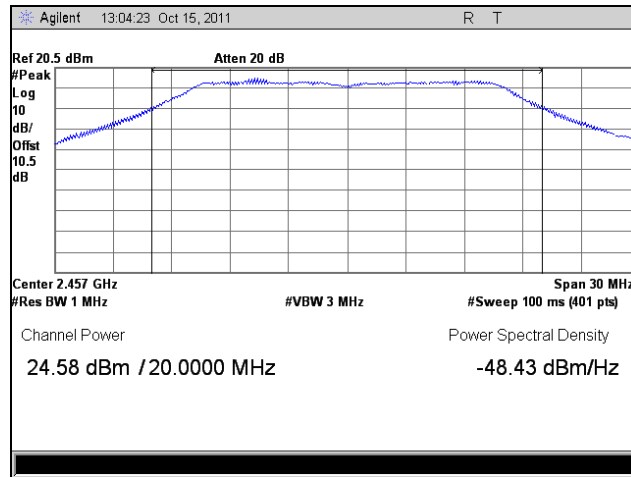
Plot 43. Peak Power Output, 802.11g, 2442 MHz



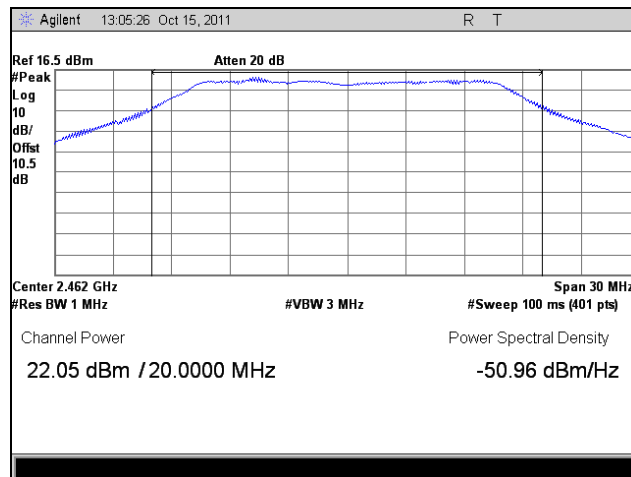
Plot 44. Peak Power Output, 802.11g, 2447 MHz



Plot 45. Peak Power Output, 802.11g, 2452 MHz

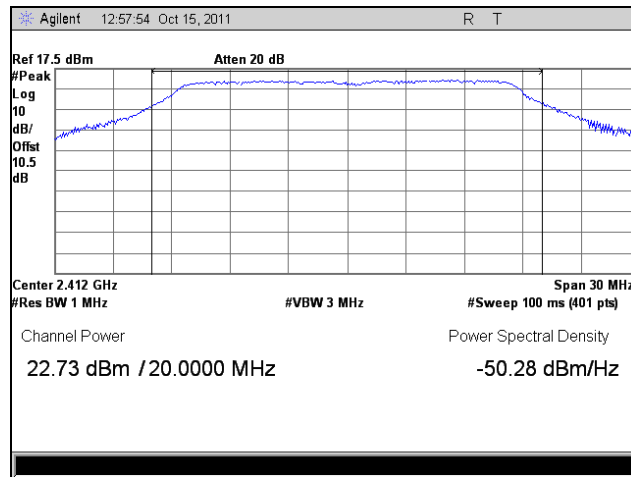


Plot 46. Peak Power Output, 802.11g, 2457 MHz

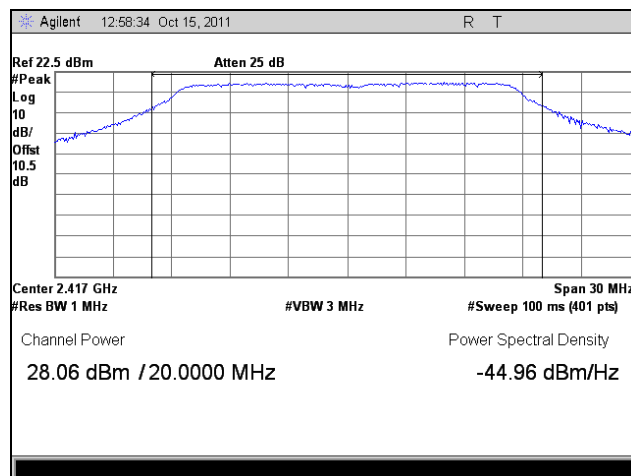


Plot 47. Peak Power Output, 802.11g, 2462 MHz, High Channel

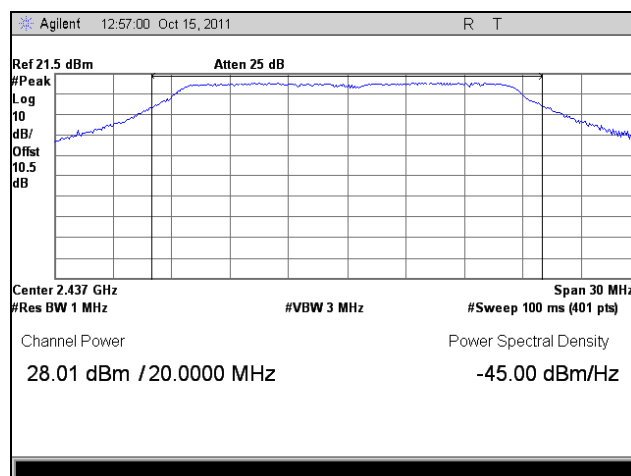
Peak Power Output Test Results, 802.11n 20 MHz



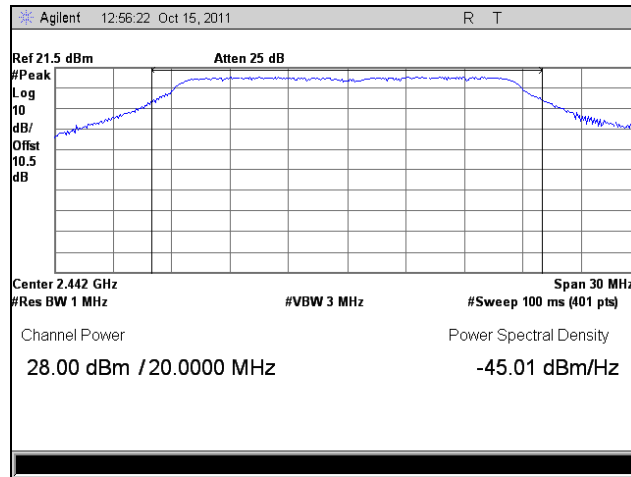
Plot 48. Peak Power Output, 802.11n 20 MHz, 2412 MHz, Low Channel



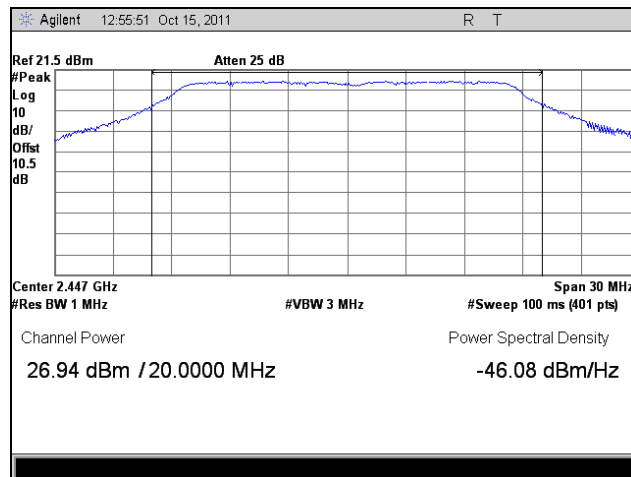
Plot 49. Peak Power Output, 802.11n 20 MHz, 2417 MHz



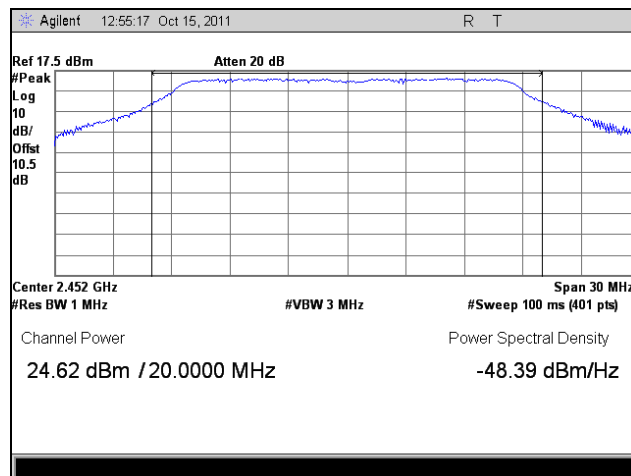
Plot 50. Peak Power Output, 802.11n 20 MHz, 2437 MHz, Mid Channel



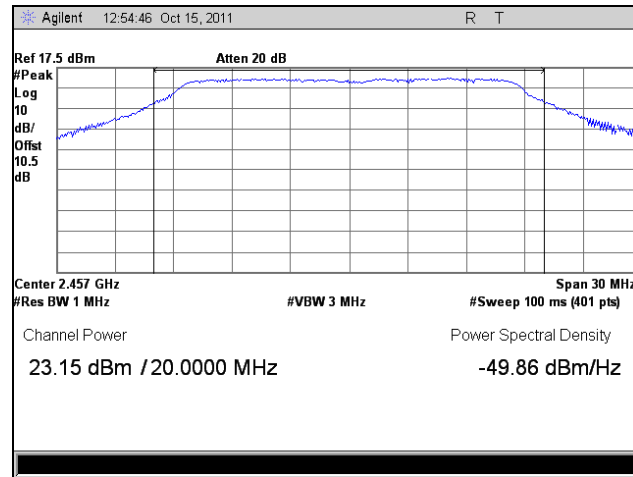
Plot 51. Peak Power Output, 802.11n 20 MHz, 2442 MHz



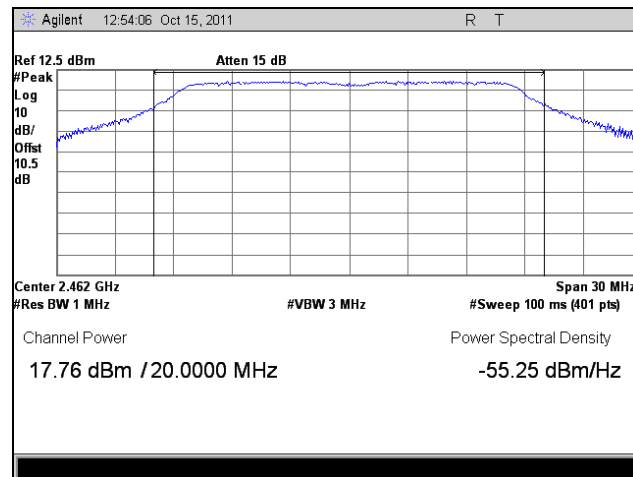
Plot 52. Peak Power Output, 802.11n 20 MHz, 2447 MHz



Plot 53. Peak Power Output, 802.11n 20 MHz, 2452 MHz

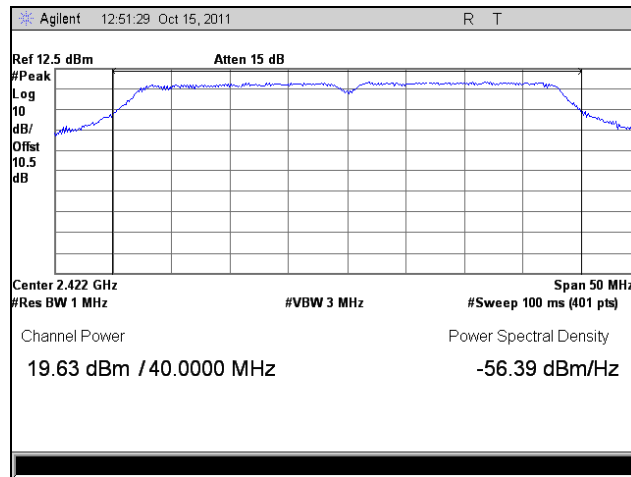


Plot 54. Peak Power Output, 802.11n 20 MHz, 2457 MHz

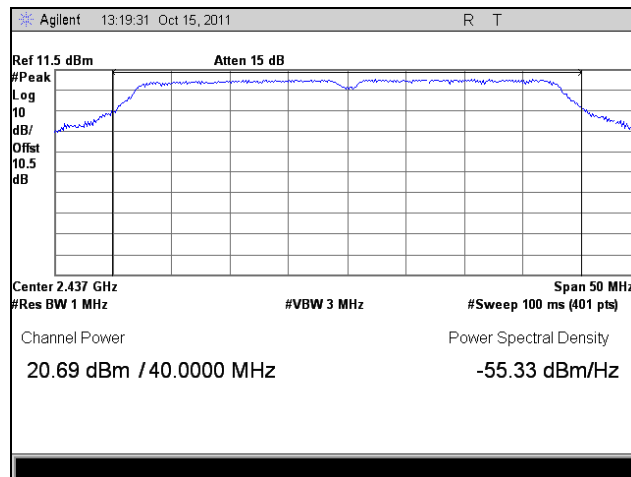


Plot 55. Peak Power Output, 802.11n 20 MHz, 2462 MHz, High Channel

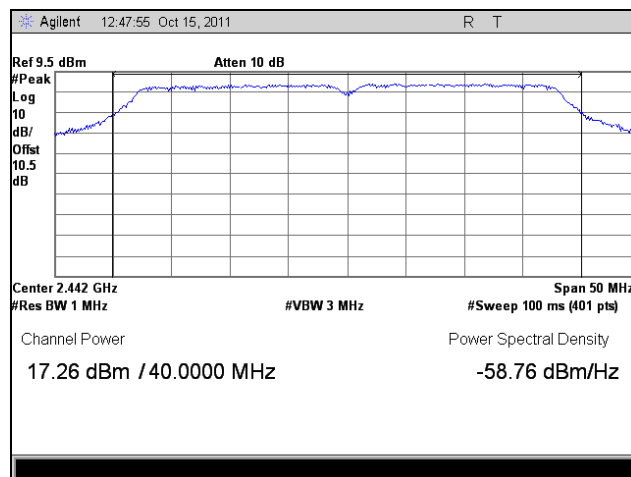
Peak Power Output Test Results, 802.11n 40 MHz



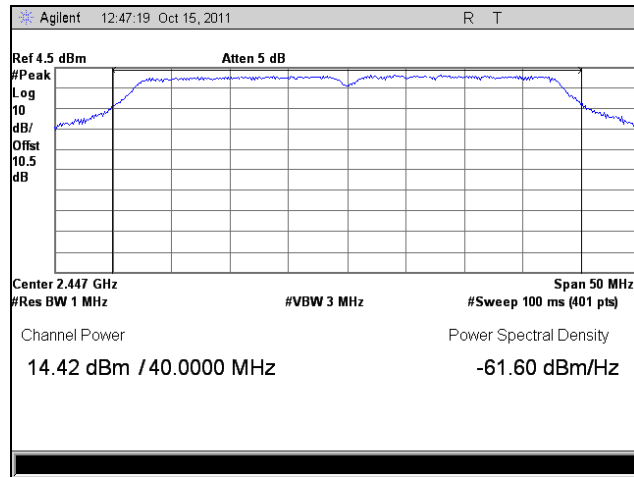
Plot 56. Peak Power Output, 802.11n 40 MHz, 2422 MHz, Low Channel



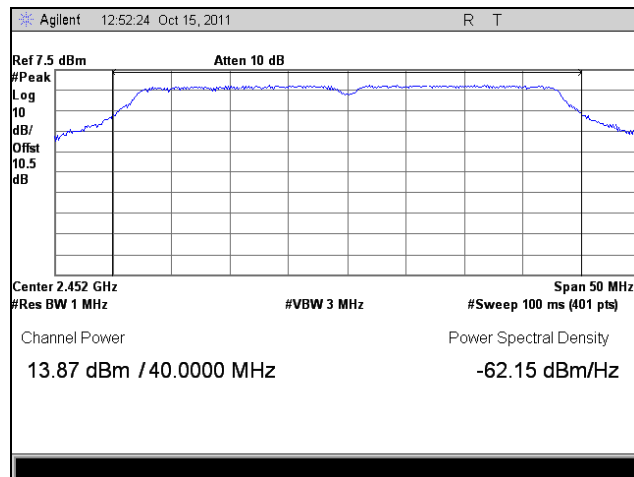
Plot 57. Peak Power Output, 802.11n 40 MHz, 2437 MHz, Mid Channel



Plot 58. Peak Power Output, 802.11n 40 MHz, 2442 MHz



Plot 59. Peak Power Output, 802.11n 40 MHz, 2447 MHz



Plot 60. Peak Power Output, 802.11n 40 MHz, 2452 MHz, High Channel

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 20. 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 21.

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 21. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)

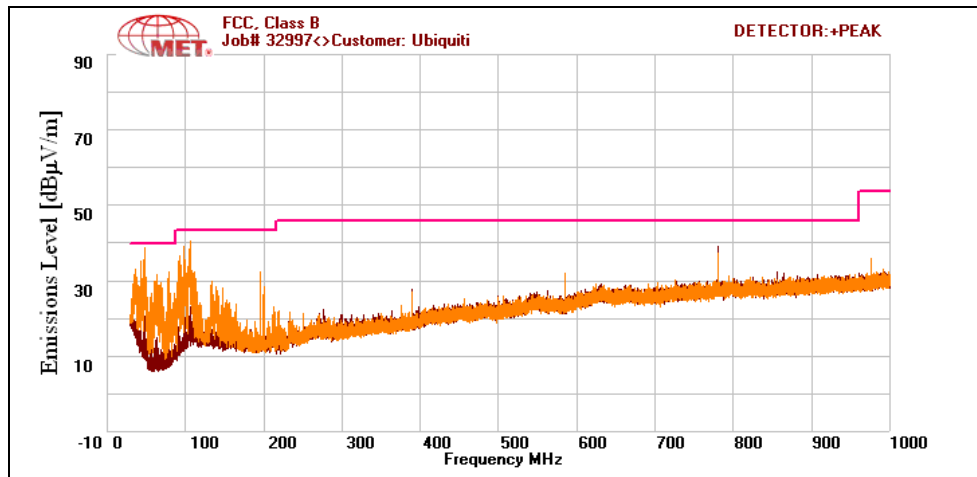
Test Procedures: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Radiated Spurious measurements were performed at 1m distance. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Only noise floor was measured above 18 GHz.

Test Results: The EUT was compliant with the Radiated Spurious Emission limits of § 15.247(d). Measured emissions were below applicable limits.

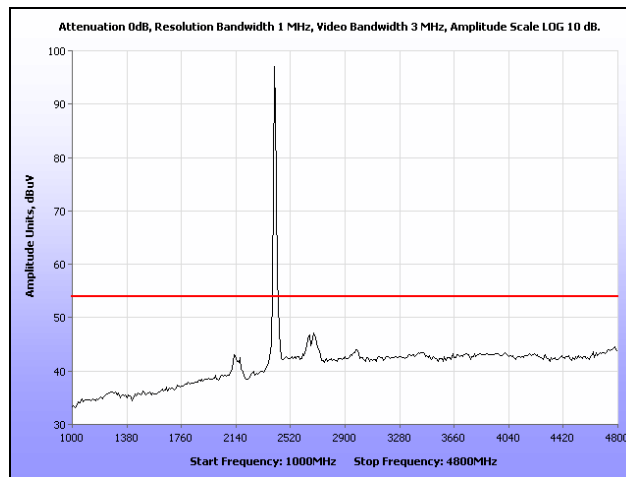
Test Engineer(s): Lionel Gabrillo

Test Date(s): 09/30/11

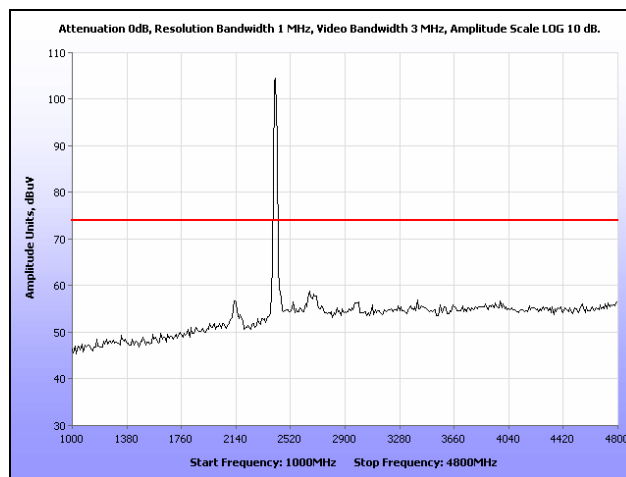
Radiated Spurious Emissions Test Results, 802.11b



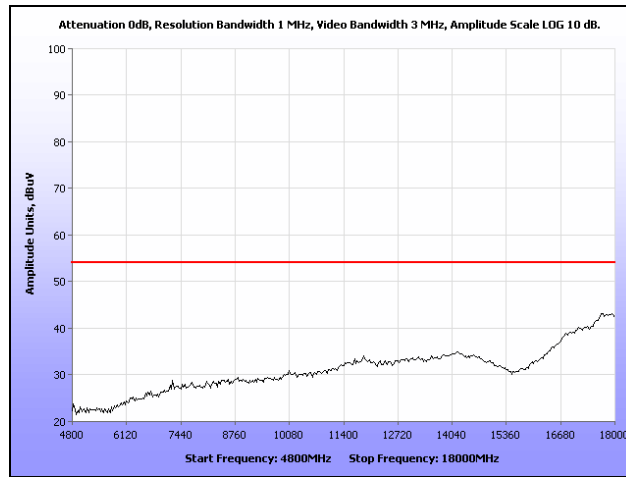
Plot 61. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11b



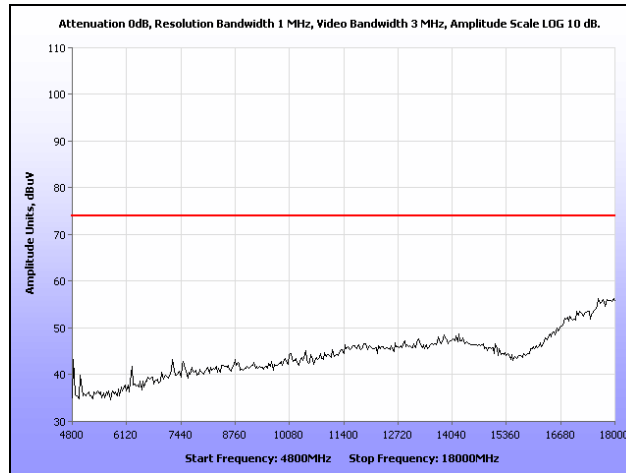
Plot 62. Radiated Spurious Emissions, Low Channel, 1 GHz – 4.8 GHz, Average, 802.11b



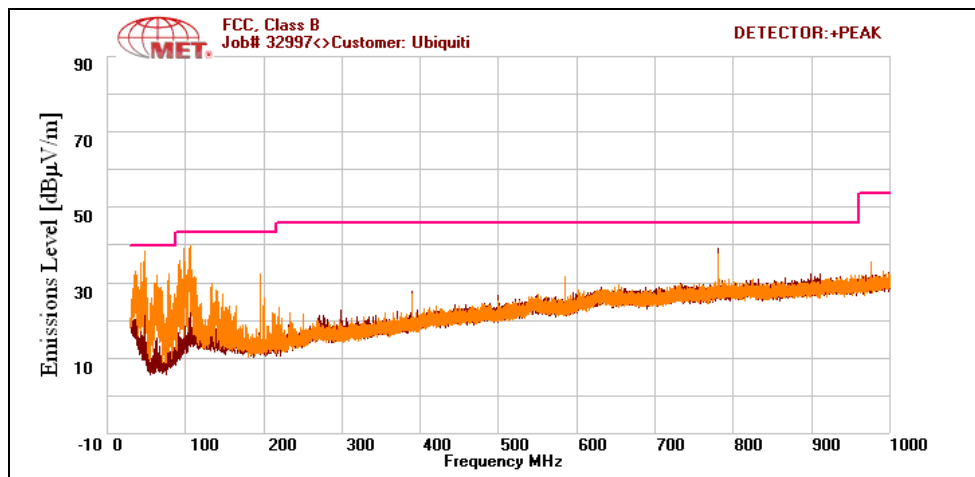
Plot 63. Radiated Spurious Emissions, Low Channel, 1 GHz – 4.8 GHz, Peak, 802.11b



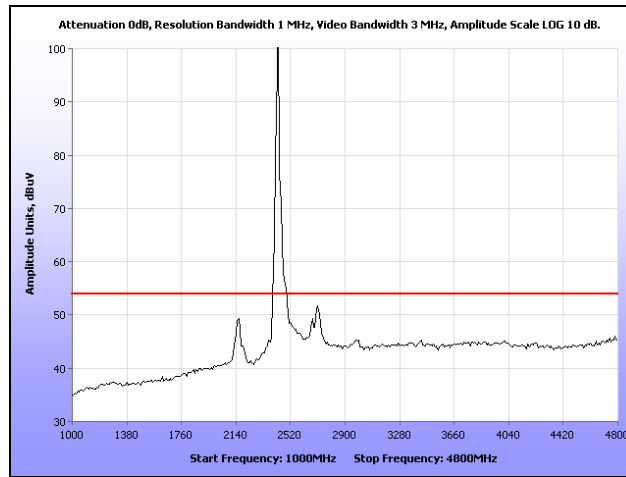
Plot 64. Radiated Spurious Emissions, Low Channel, 4.8 GHz – 18 GHz, Average, 802.11b



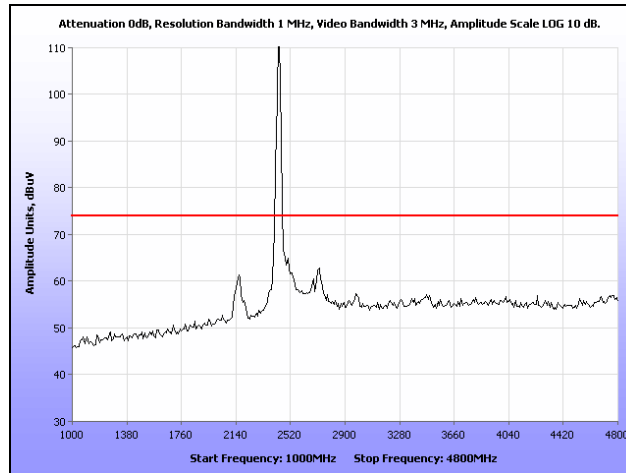
Plot 65. Radiated Spurious Emissions, Low Channel, 4.8 GHz – 18 GHz, Peak, 802.11b



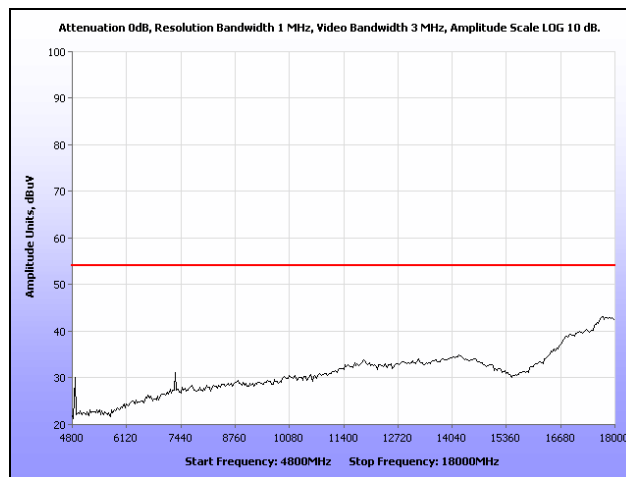
Plot 66. Radiated Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 802.11b



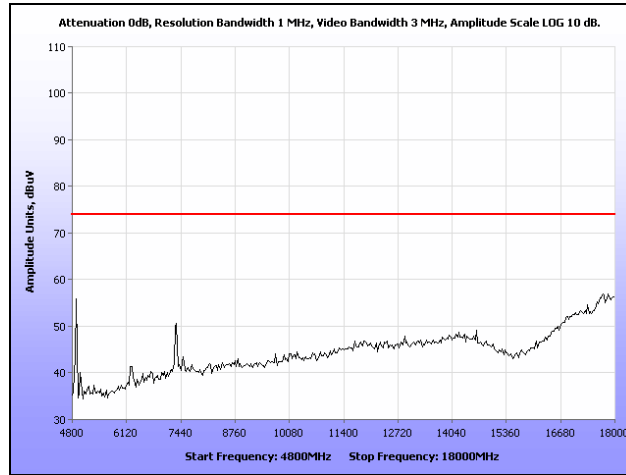
Plot 67. Radiated Spurious Emissions, Mid Channel, 1 GHz – 4.8 GHz, Average, 802.11b



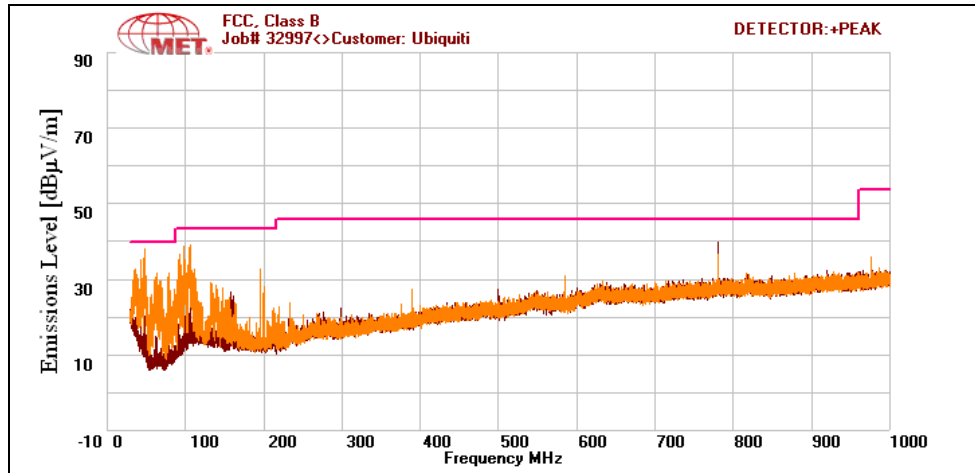
Plot 68. Radiated Spurious Emissions, Mid Channel, 1 GHz – 4.8 GHz, Peak, 802.11b



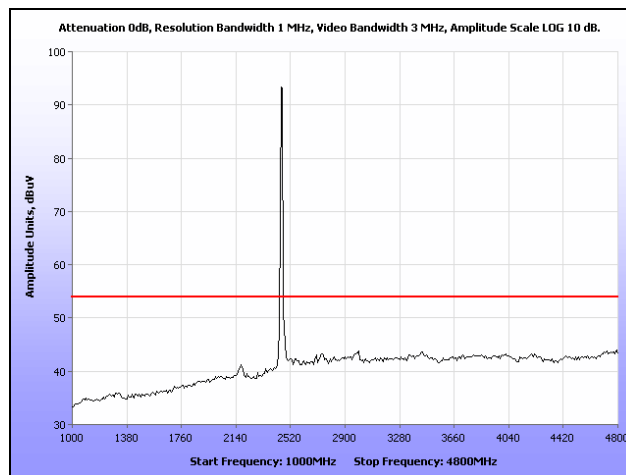
Plot 69. Radiated Spurious Emissions, Mid Channel, 4.8 GHz – 18 GHz, Average, 802.11b



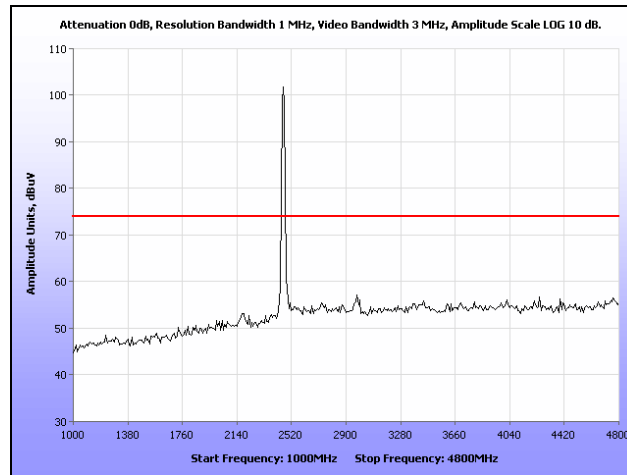
Plot 70. Radiated Spurious Emissions, Mid Channel, 4.8 GHz – 18 GHz, Peak, 802.11b



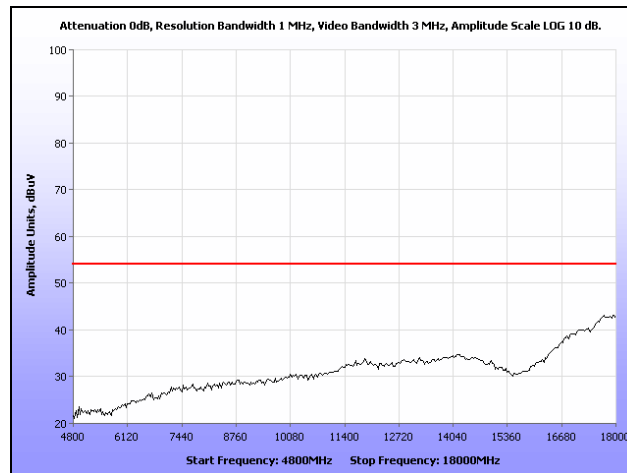
Plot 71. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11b



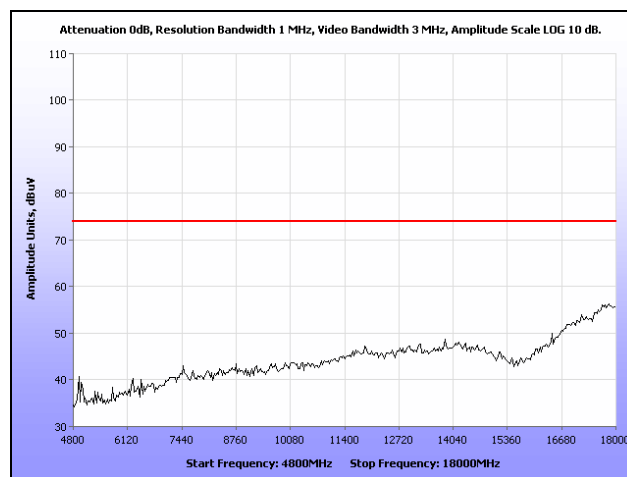
Plot 72. Radiated Spurious Emissions, High Channel, 1 GHz – 4.8 GHz, Average, 802.11b



Plot 73. Radiated Spurious Emissions, High Channel, 1 GHz – 4.8 GHz, Peak, 802.11b

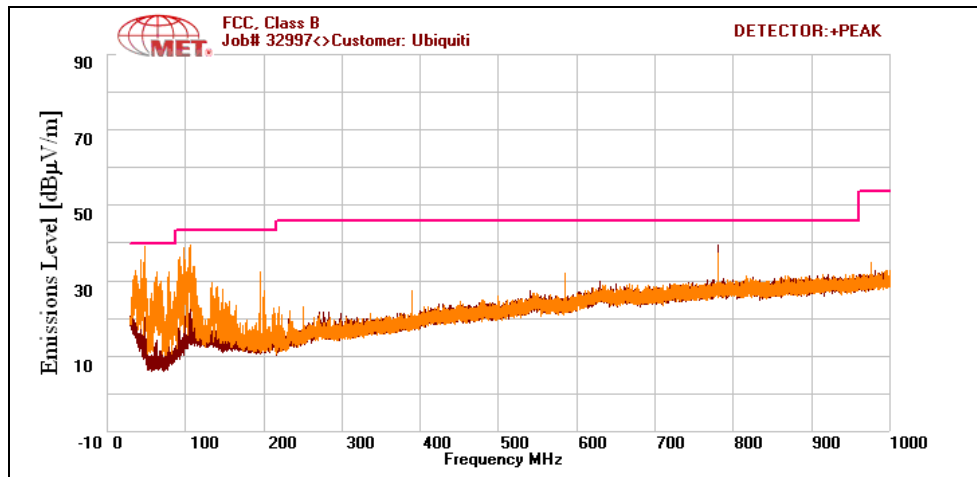


Plot 74. Radiated Spurious Emissions, High Channel, 4.8 GHz – 18 GHz, Average, 802.11b

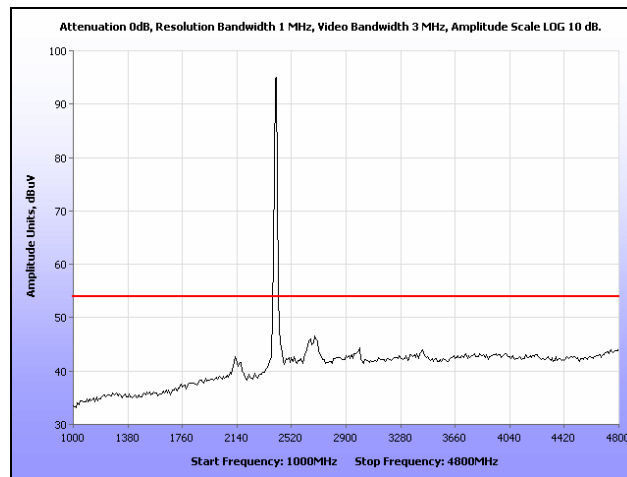


Plot 75. Radiated Spurious Emissions, High Channel, 4.8 GHz – 18 GHz, Peak, 802.11b

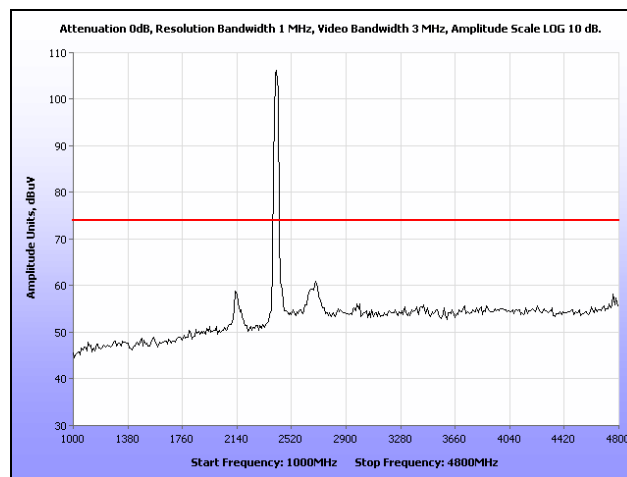
Radiated Spurious Emissions Test Results, 802.11g



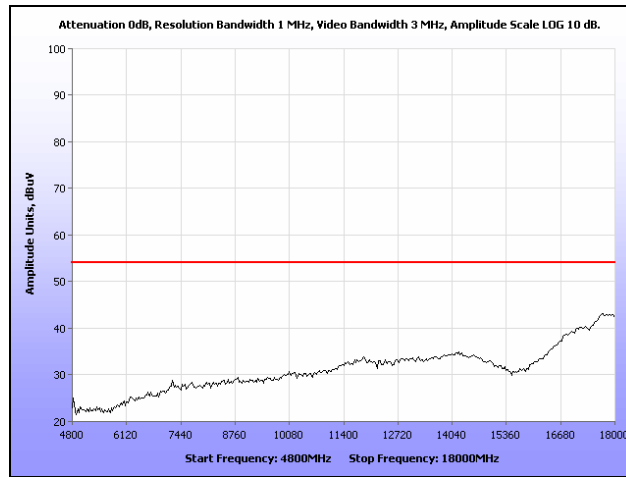
Plot 76. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11g



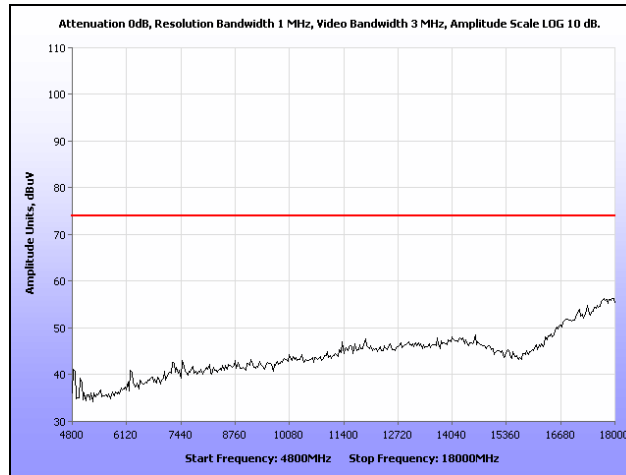
Plot 77. Radiated Spurious Emissions, Low Channel, 1 GHz – 4.8 GHz, Average, 802.11g



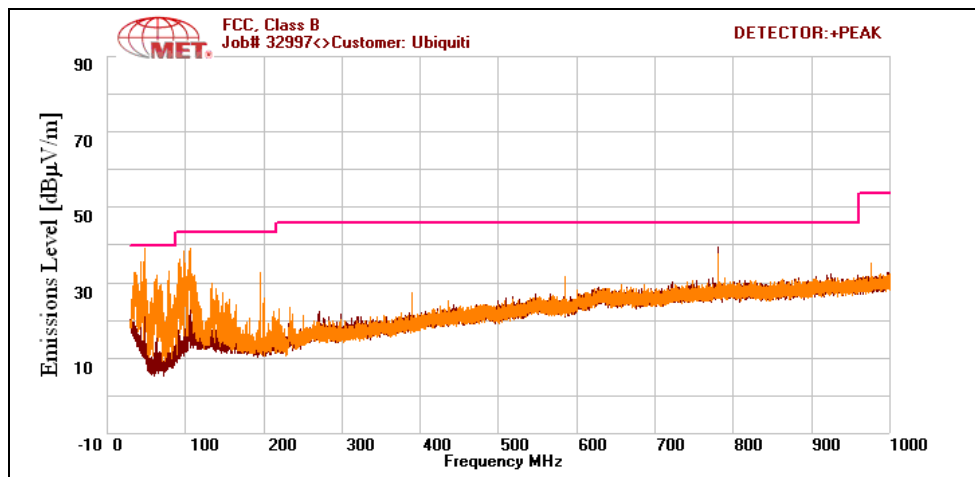
Plot 78. Radiated Spurious Emissions, Low Channel, 1 GHz – 4.8 GHz, Peak, 802.11g



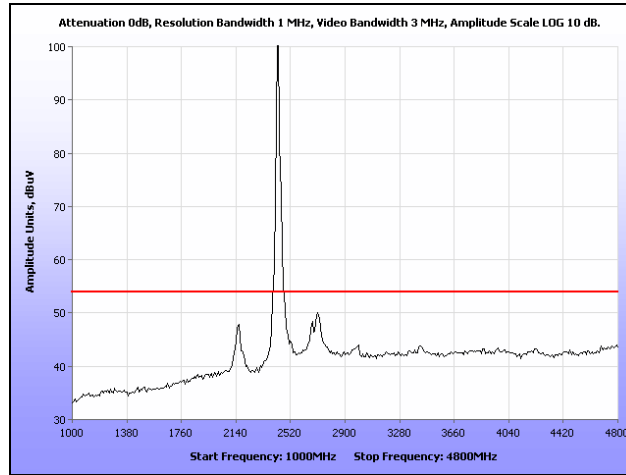
Plot 79. Radiated Spurious Emissions, Low Channel, 4.8 GHz – 18 GHz, Average, 802.11g



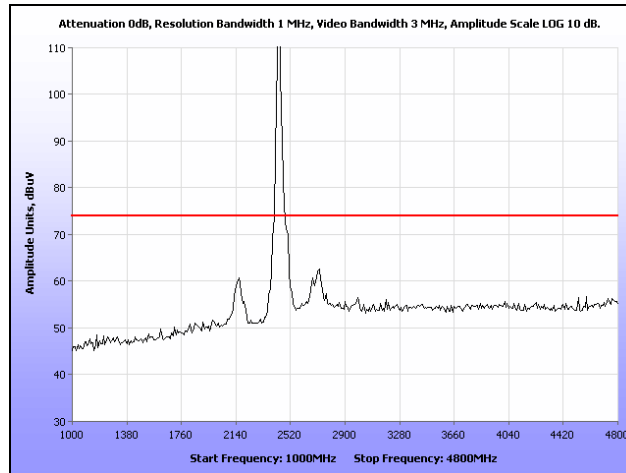
Plot 80. Radiated Spurious Emissions, Low Channel, 4.8 GHz – 18 GHz, Peak, 802.11g



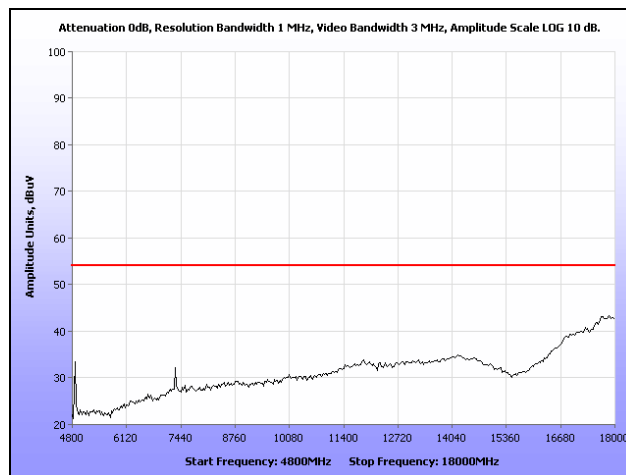
Plot 81. Radiated Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 802.11g



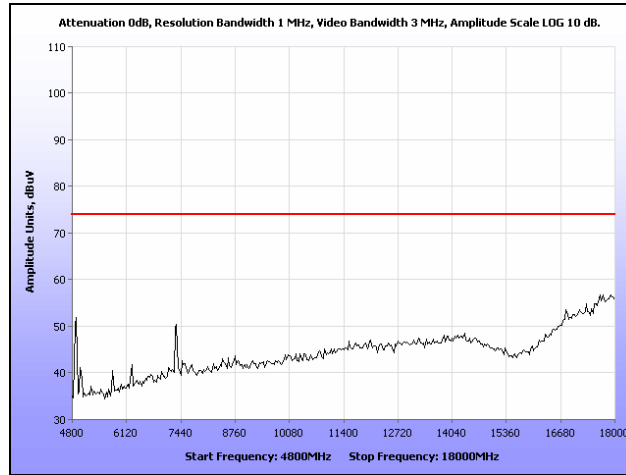
Plot 82. Radiated Spurious Emissions, Mid Channel, 1 GHz – 4.8 GHz, Average, 802.11g



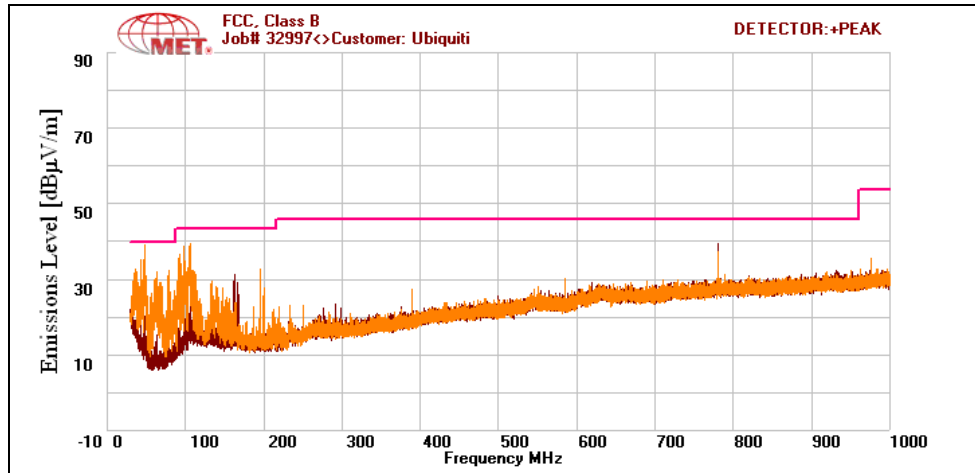
Plot 83. Radiated Spurious Emissions, Mid Channel, 1 GHz – 4.8 GHz, Peak, 802.11g



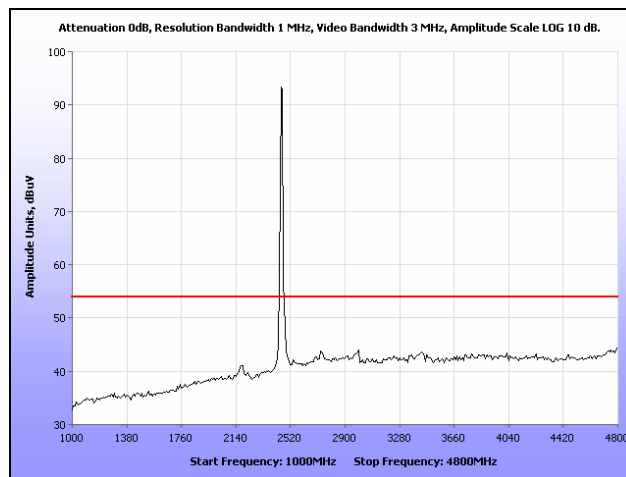
Plot 84. Radiated Spurious Emissions, Mid Channel, 4.8 GHz – 18 GHz, Average, 802.11g



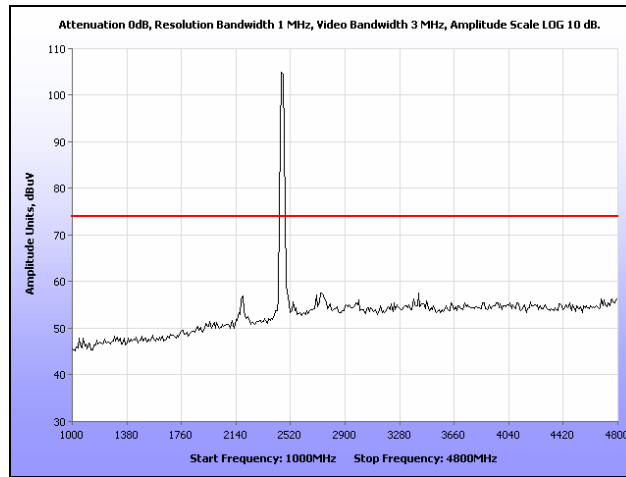
Plot 85. Radiated Spurious Emissions, Low Channel, 4.8 GHz – 18 GHz, Peak, 802.11g



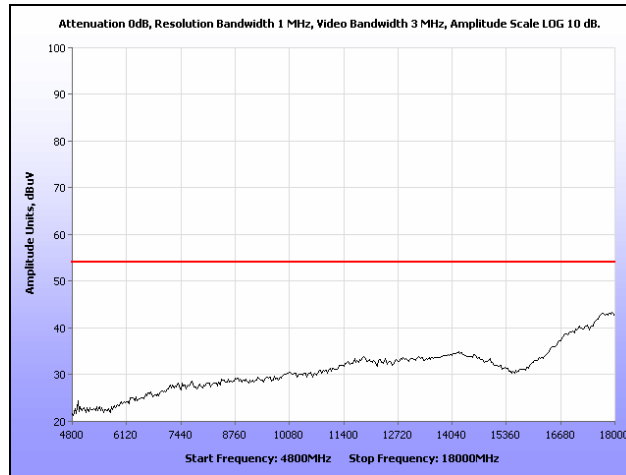
Plot 86. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11g



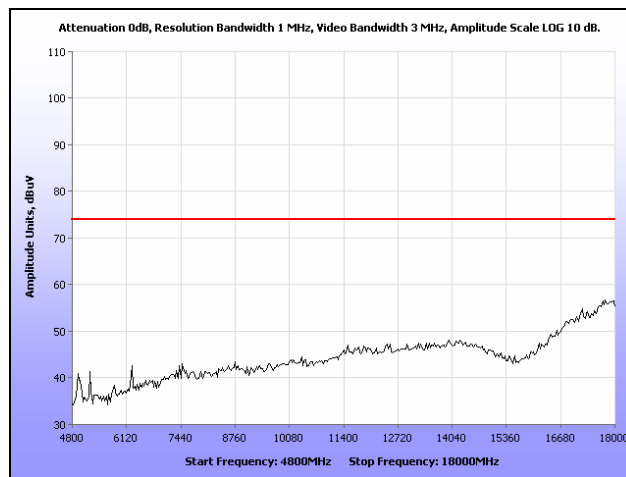
Plot 87. Radiated Spurious Emissions, High Channel, 1 GHz – 4.8 GHz, Average, 802.11g



Plot 88. Radiated Spurious Emissions, High Channel, 1 GHz – 4.8 GHz, Peak, 802.11g

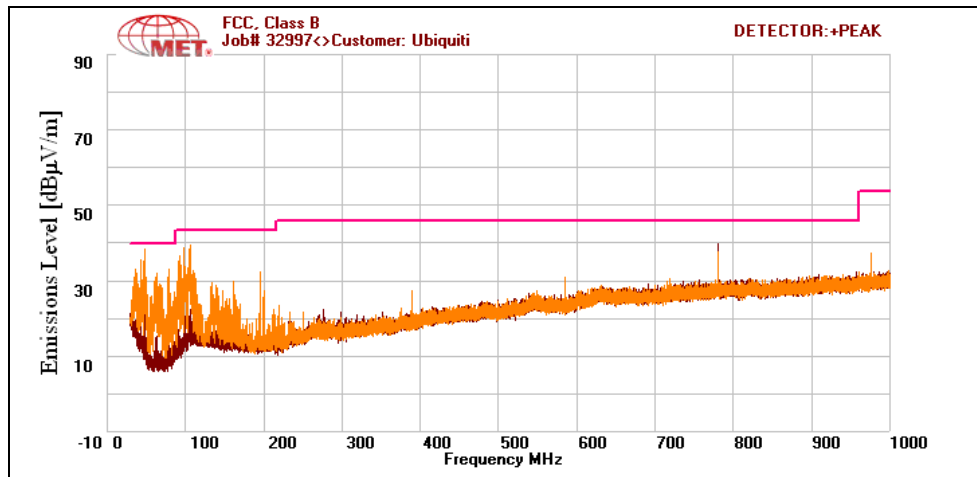


Plot 89. Radiated Spurious Emissions, High Channel, 4.8 GHz – 18 GHz, Average, 802.11g

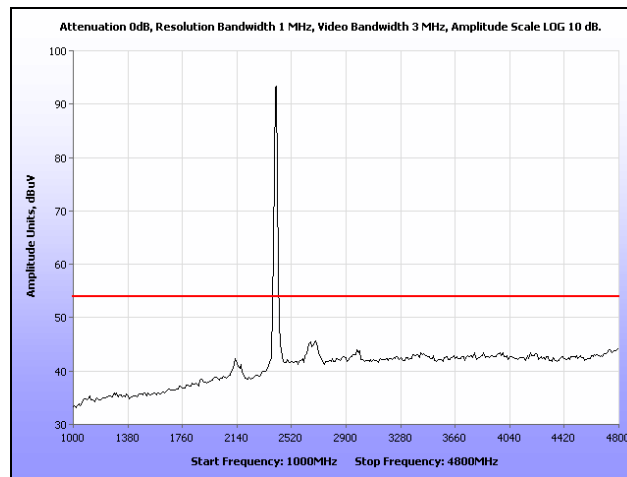


Plot 90. Radiated Spurious Emissions, High Channel, 4.8 GHz – 18 GHz, Peak, 802.11g

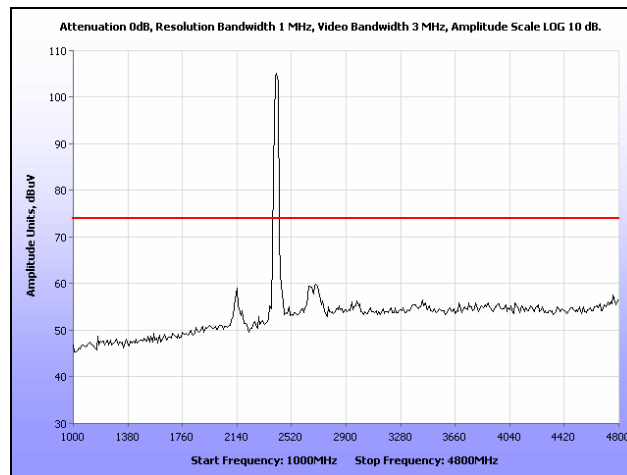
Radiated Spurious Emissions Test Results, 802.11n 20 MHz



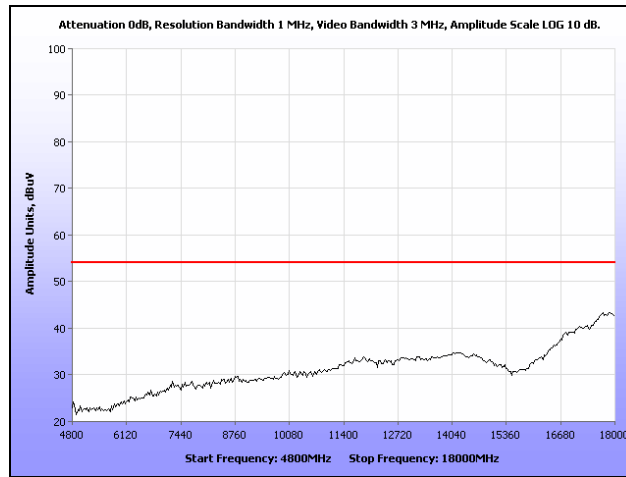
Plot 91. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11n 20 MHz



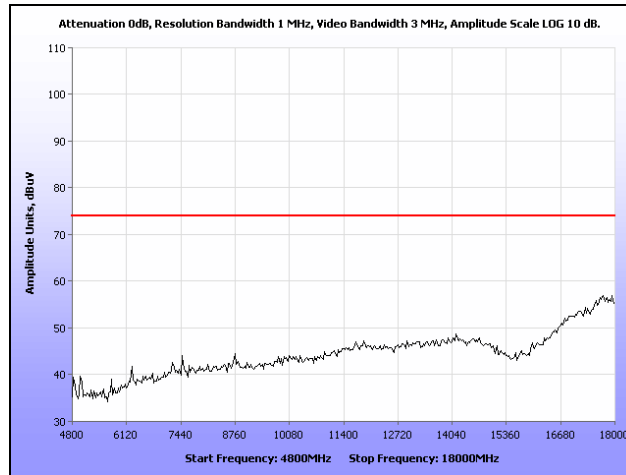
Plot 92. Radiated Spurious Emissions, Low Channel, 1 GHz – 4.8 GHz, Average, 802.11n 20 MHz



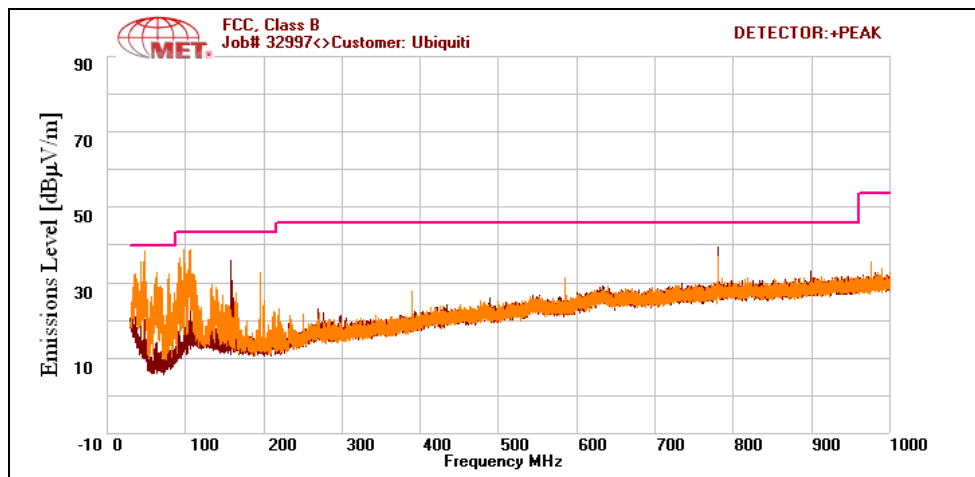
Plot 93. Radiated Spurious Emissions, Low Channel, 1 GHz – 4.8 GHz, Peak, 802.11n 20 MHz



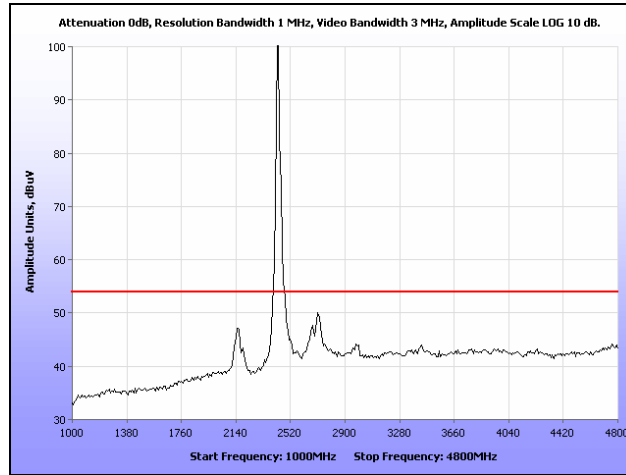
Plot 94. Radiated Spurious Emissions, Low Channel, 4.8 GHz – 18 GHz, Average, 802.11n 20 MHz



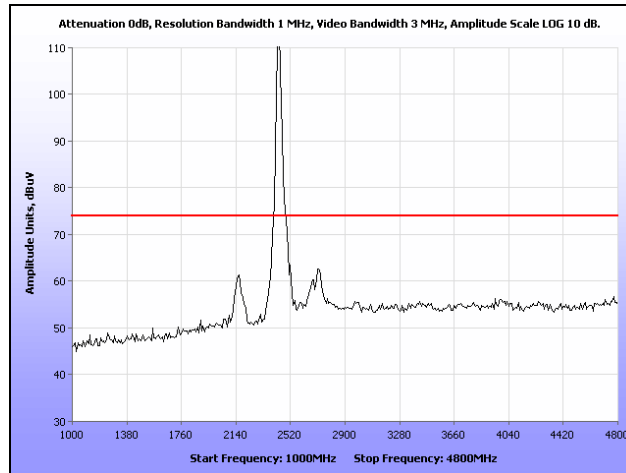
Plot 95. Radiated Spurious Emissions, Low Channel, 4.8 GHz – 18 GHz, Peak, 802.11n 20 MHz



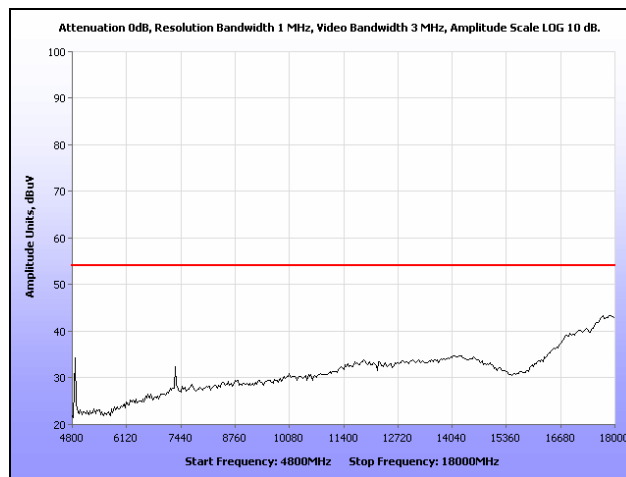
Plot 96. Radiated Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 802.11n 20 MHz



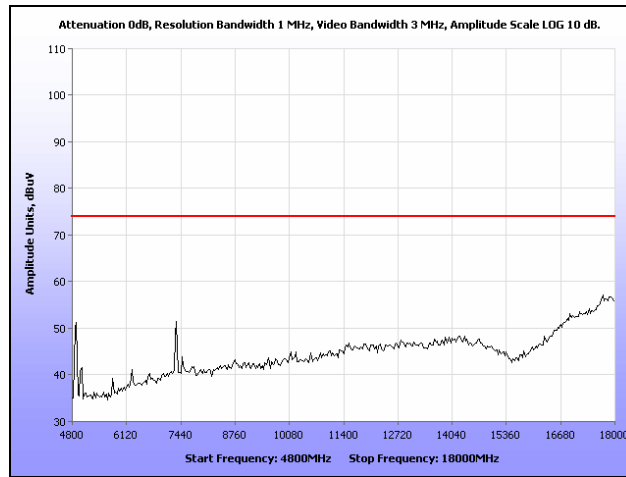
Plot 97. Radiated Spurious Emissions, Mid Channel, 1 GHz – 4.8 GHz, Average, 802.11n 20 MHz



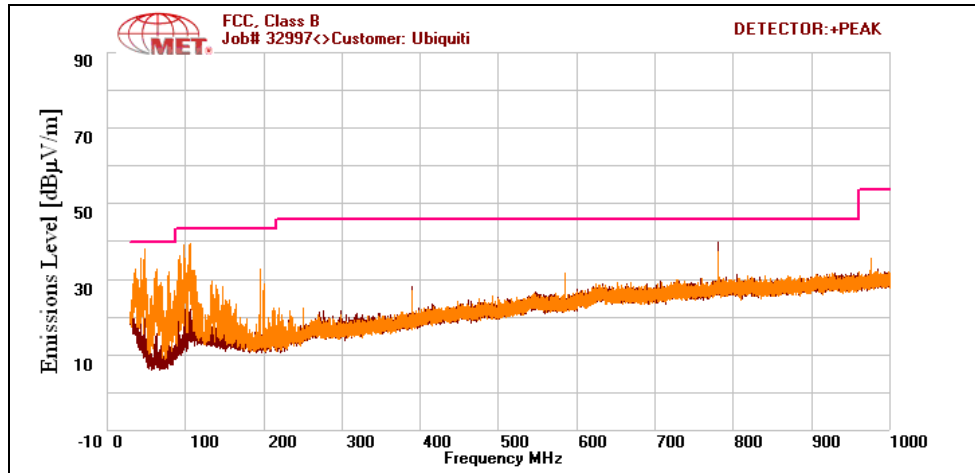
Plot 98. Radiated Spurious Emissions, Mid Channel, 1 GHz – 4.8 GHz, Peak, 802.11n 20 MHz



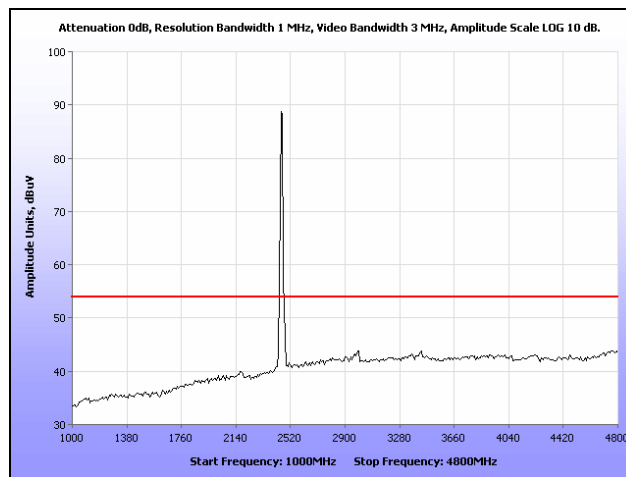
Plot 99. Radiated Spurious Emissions, Mid Channel, 4.8 GHz – 18 GHz, Average, 802.11n 20 MHz



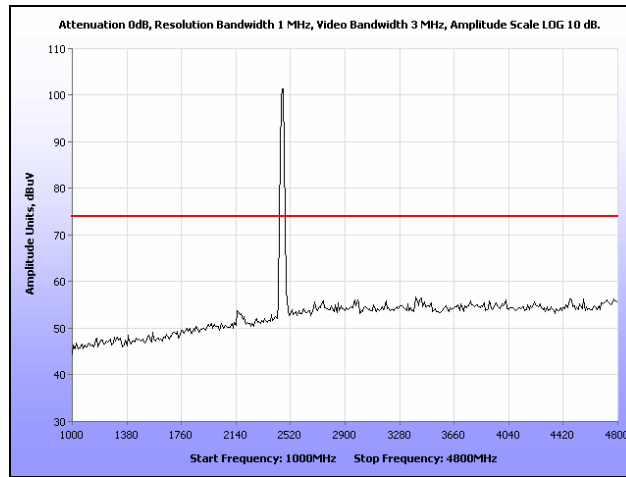
Plot 100. Radiated Spurious Emissions, Mid Channel, 4.8 GHz – 18 GHz, Peak, 802.11n 20 MHz



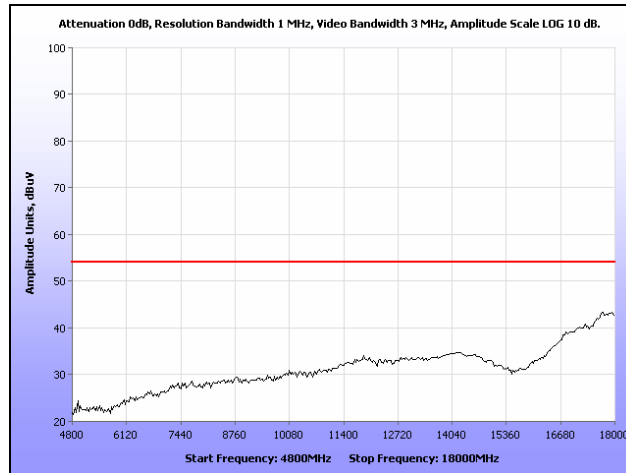
Plot 101. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11n 20 MHz



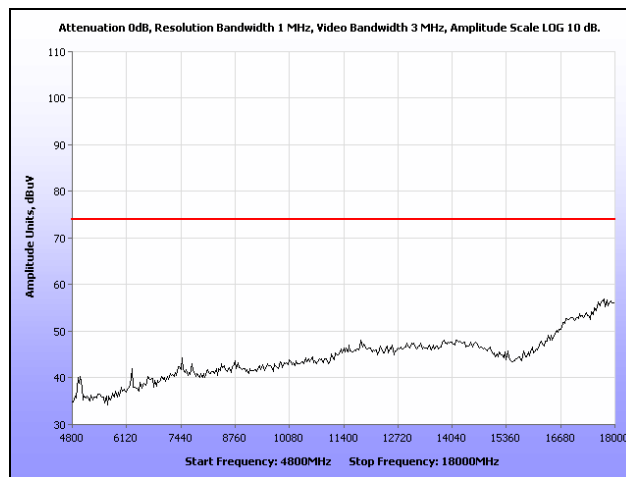
Plot 102. Radiated Spurious Emissions, High Channel, 1 GHz – 4.8 GHz, Average, 802.11n 20 MHz



Plot 103. Radiated Spurious Emissions, High Channel, 1 GHz – 4.8 GHz, Peak, 802.11n 20 MHz

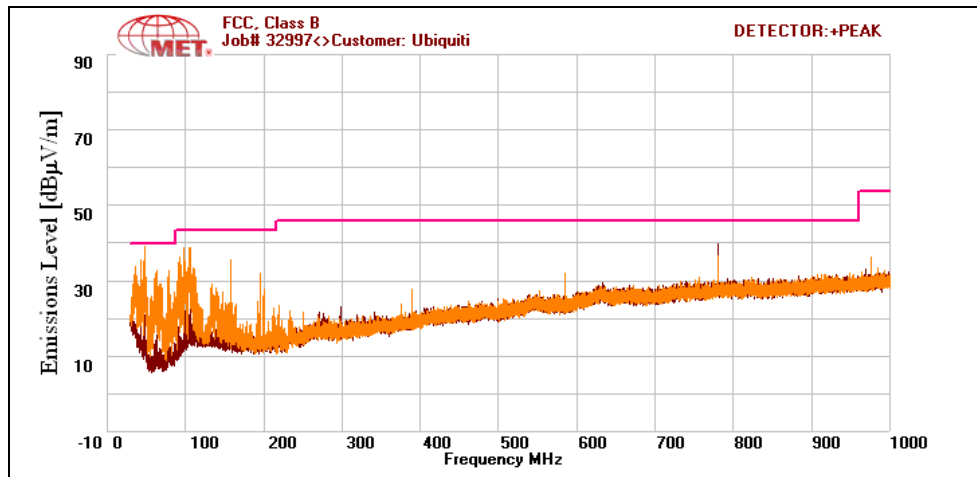


Plot 104. Radiated Spurious Emissions, High Channel, 4.8 GHz – 18 GHz, Average, 802.11n 20 MHz

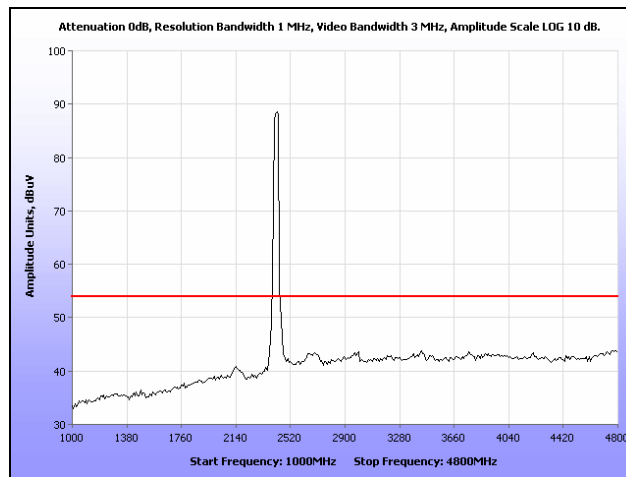


Plot 105. Radiated Spurious Emissions, High Channel, 4.8 GHz – 18 GHz, Peak, 802.11n 20 MHz

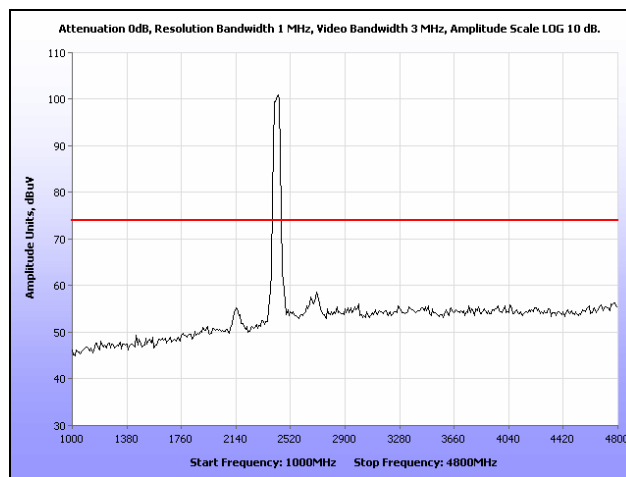
Radiated Spurious Emissions Test Results, 802.11n 40 MHz



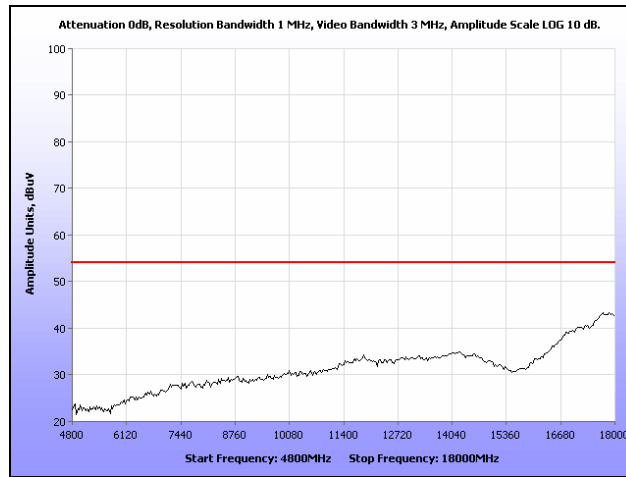
Plot 106. Radiated Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11n 40 MHz



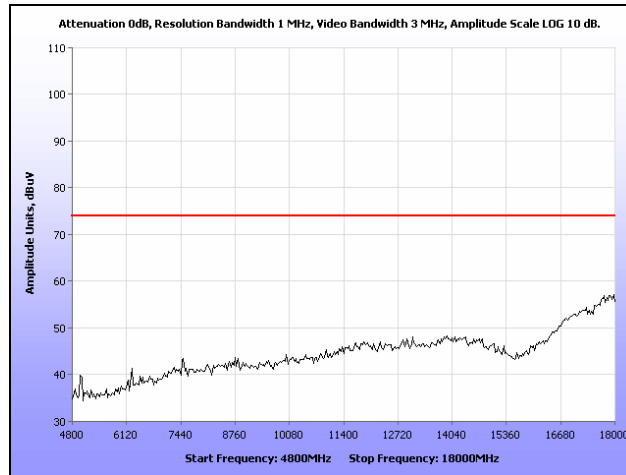
Plot 107. Radiated Spurious Emissions, Low Channel, 1 GHz – 4.8 GHz, Average, 802.11n 40 MHz



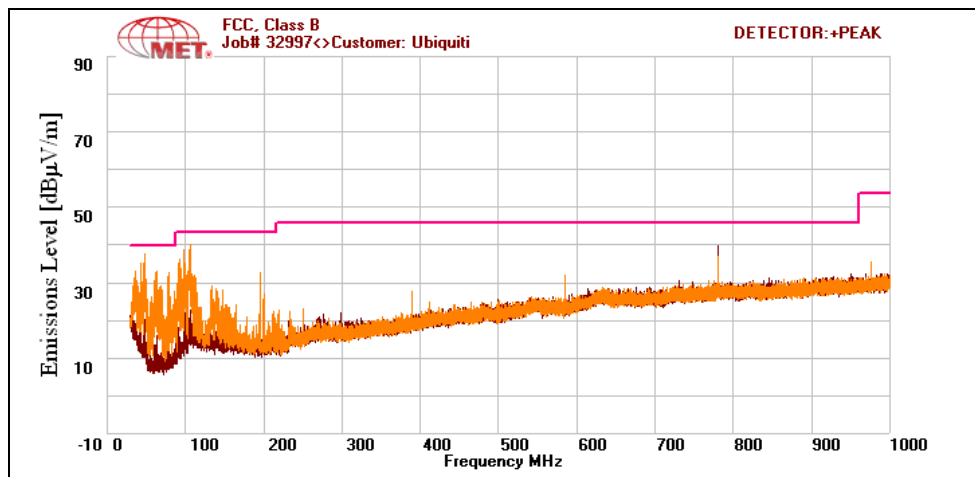
Plot 108. Radiated Spurious Emissions, Low Channel, 1 GHz – 4.8 GHz, Peak, 802.11n 40 MHz



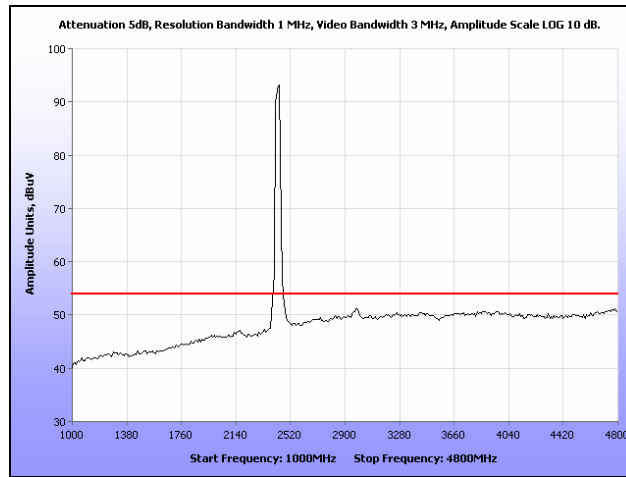
Plot 109. Radiated Spurious Emissions, Low Channel, 4.8 GHz – 18 GHz, Average, 802.11n 40 MHz



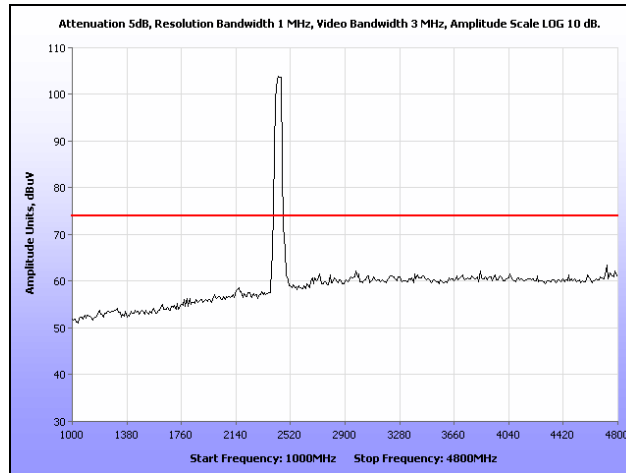
Plot 110. Radiated Spurious Emissions, Low Channel, 4.8 GHz – 18 GHz, Peak, 802.11n 40 MHz



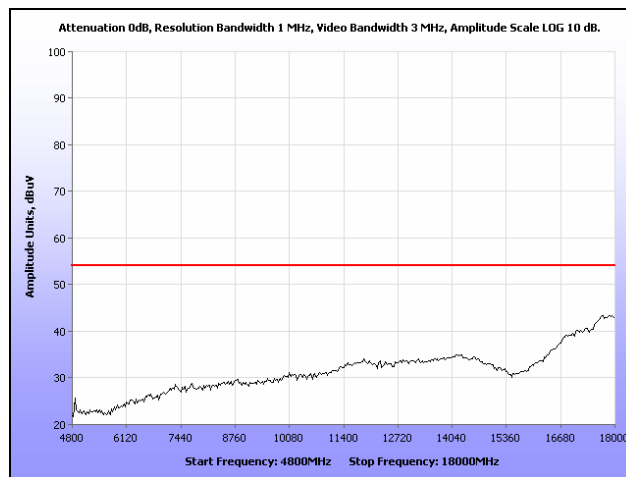
Plot 111. Radiated Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 802.11n 40 MHz



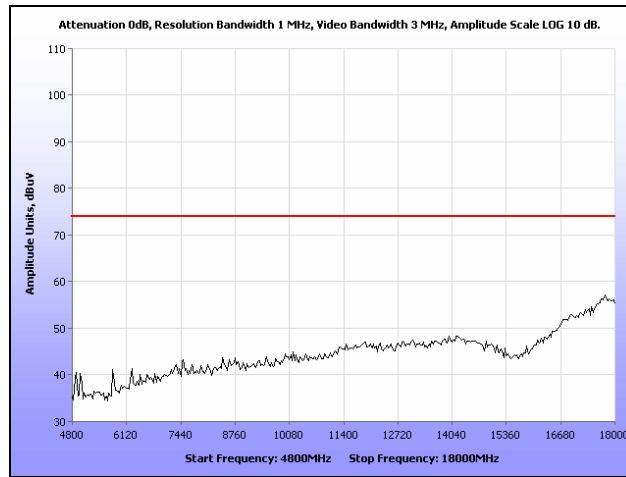
Plot 112. Radiated Spurious Emissions, Mid Channel, 1 GHz – 4.8 GHz, Average, 802.11n 40 MHz



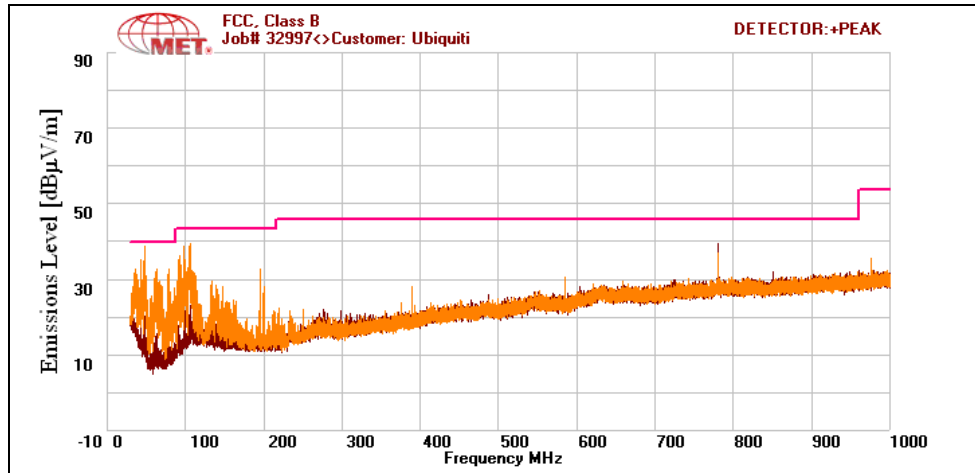
Plot 113. Radiated Spurious Emissions, Mid Channel, 1 GHz – 4.8 GHz, Peak, 802.11n 40 MHz



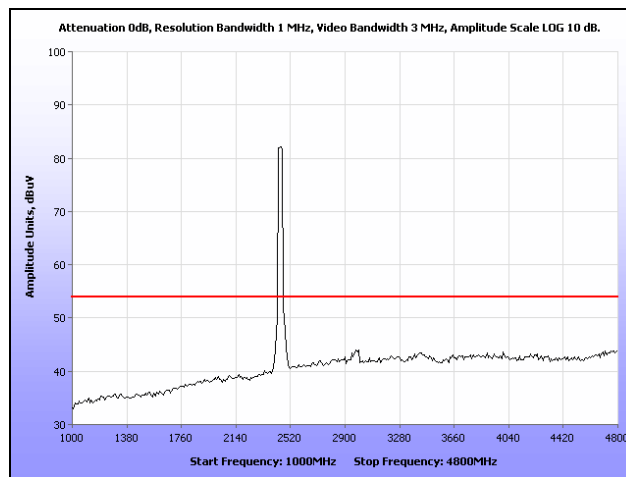
Plot 114. Radiated Spurious Emissions, Mid Channel, 4.8 GHz – 18 GHz, Average, 802.11n 40 MHz



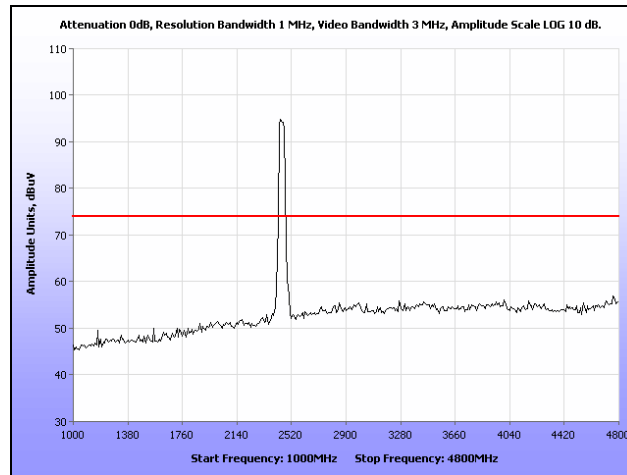
Plot 115. Radiated Spurious Emissions, Mid Channel, 4.8 GHz – 18 GHz, Peak, 802.11n 40 MHz



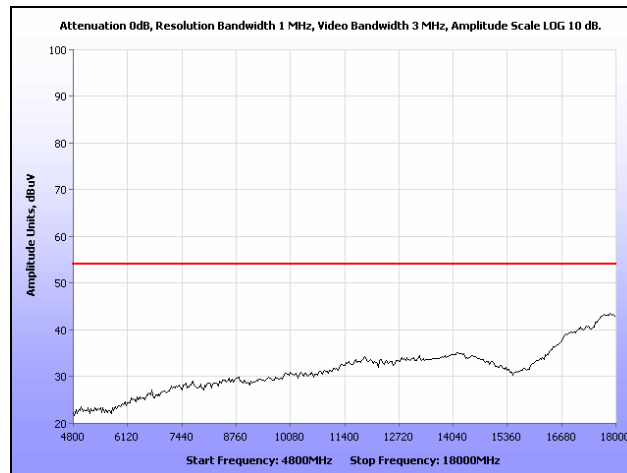
Plot 116. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11n 40 MHz



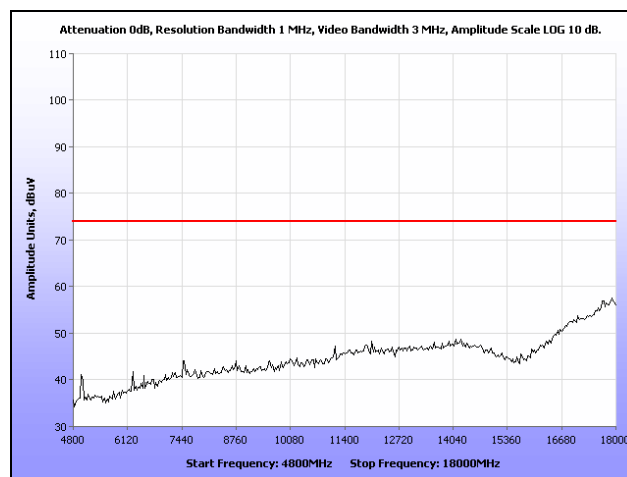
Plot 117. Radiated Spurious Emissions, High Channel, 1 GHz – 4.8 GHz, Average, 802.11n 40 MHz



Plot 118. Radiated Spurious Emissions, High Channel, 1 GHz – 4.8 GHz, Peak, 802.11n 40 MHz



Plot 119. Radiated Spurious Emissions, High Channel, 4.8 GHz – 18 GHz, Average, 802.11n 40 MHz

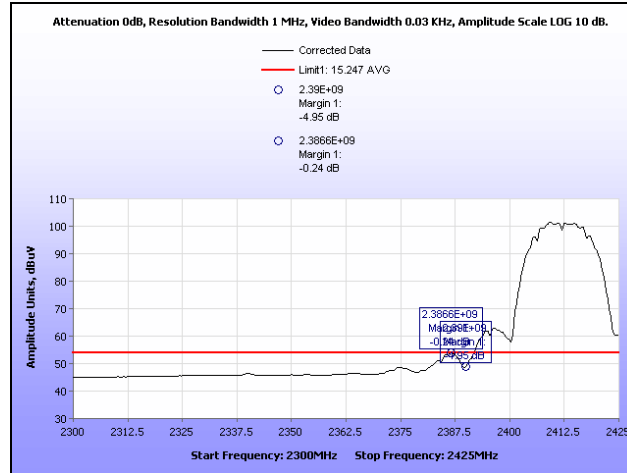


Plot 120. Radiated Spurious Emissions, High Channel, 4.8 GHz – 18 GHz, Peak, 802.11n 40 MHz

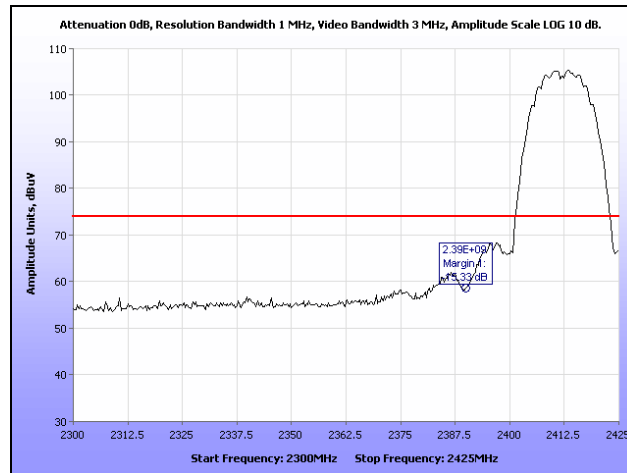
Radiated Band Edge Measurements

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. Radiated Band Edge measurements were performed at 1m distance. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line.

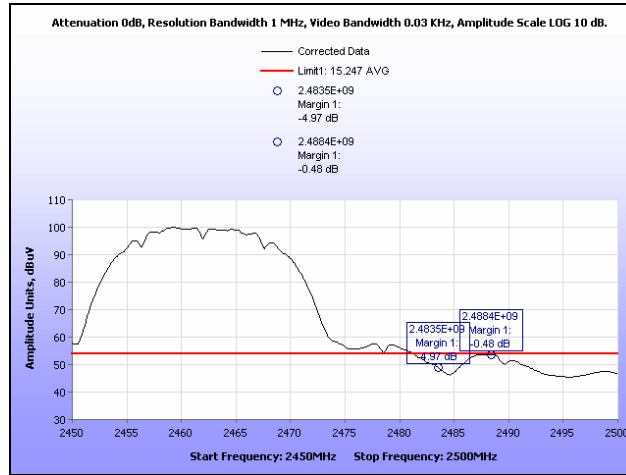
Radiated Band Edge Measurements, 802.11b



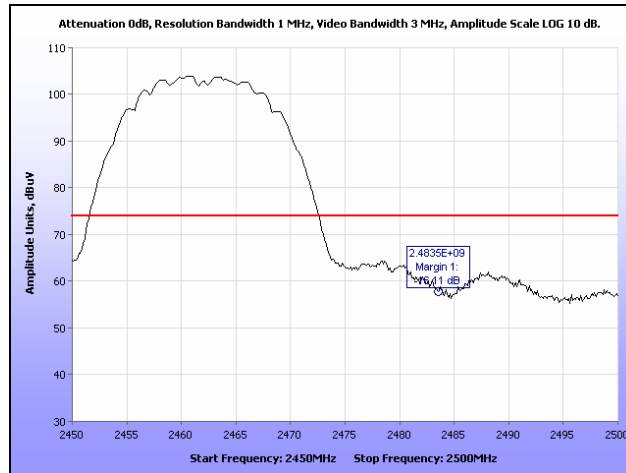
Plot 121. Radiated Restricted Band Edge, Low Channel, Average, 802.11b



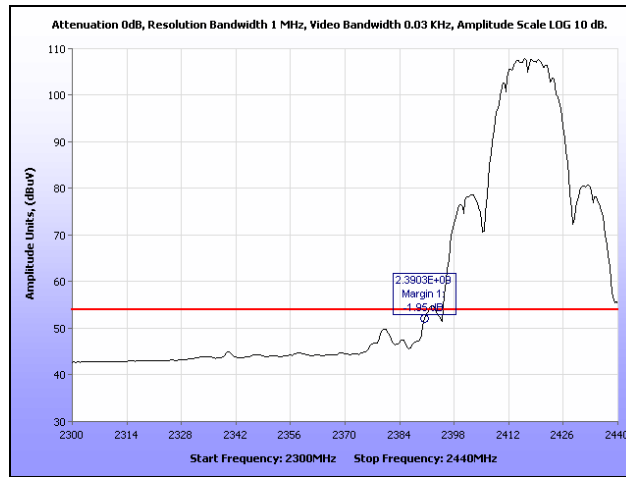
Plot 122. Radiated Restricted Band Edge, Low Channel, Peak, 802.11b



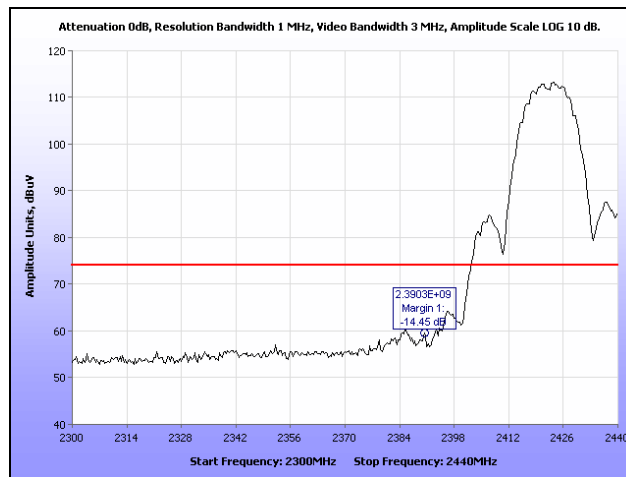
Plot 123. Radiated Restricted Band Edge, High Channel, Average, 802.11b



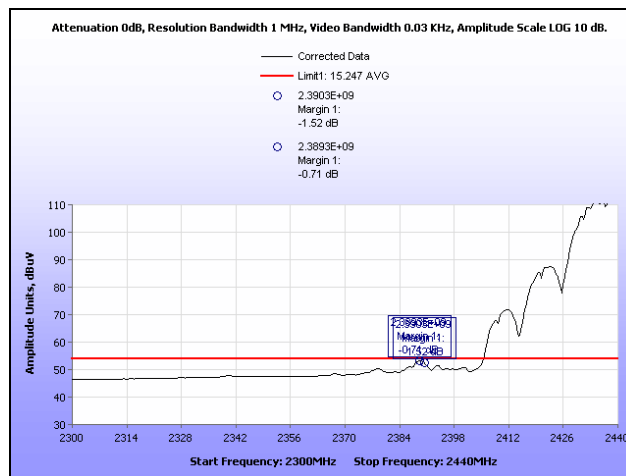
Plot 124. Radiated Restricted Band Edge, High Channel, Peak, 802.11b



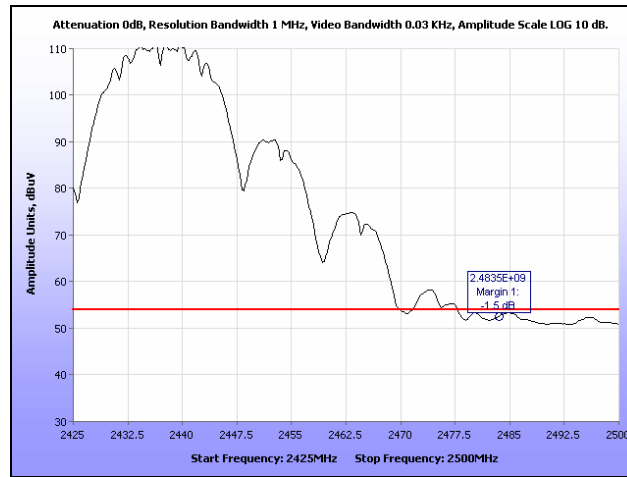
Plot 125. Restricted Band, 802.11b, 2417 MHz, Average, Low Band



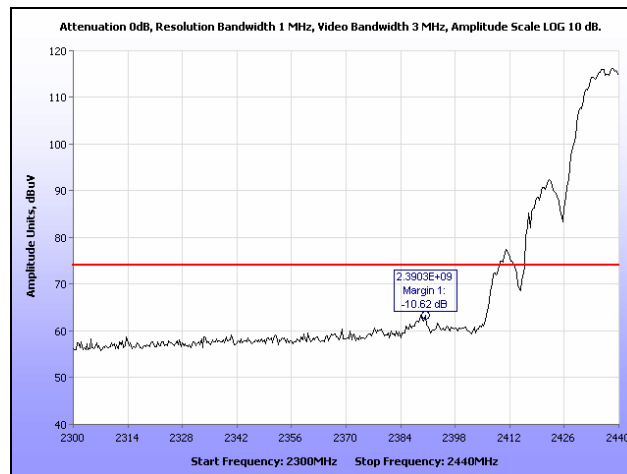
Plot 126. Restricted Band, 802.11b, 2417 MHz, Peak, Low Band



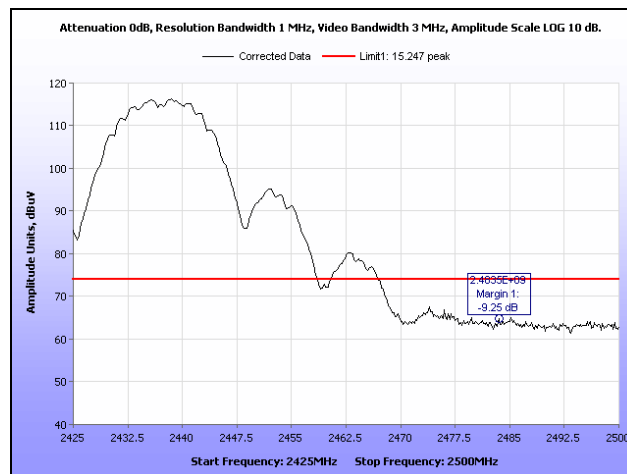
Plot 127. Restricted Band, 802.11b, 2437 MHz, Average, Low Band



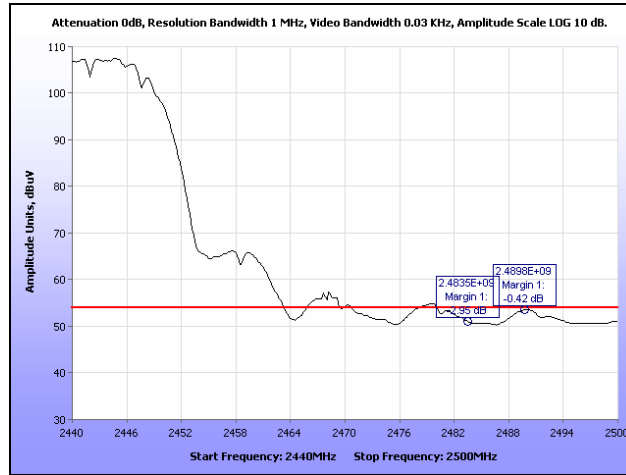
Plot 128. Restricted Band, 802.11b, 2437 MHz, Average, High Band



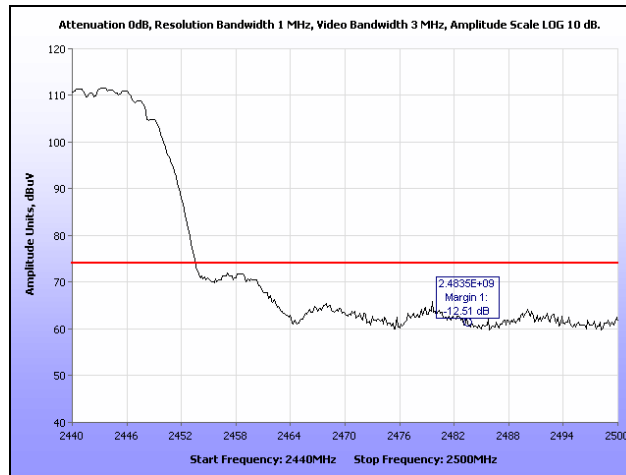
Plot 129. Restricted Band, 802.11b, 2437 MHz, Peak, Low Band



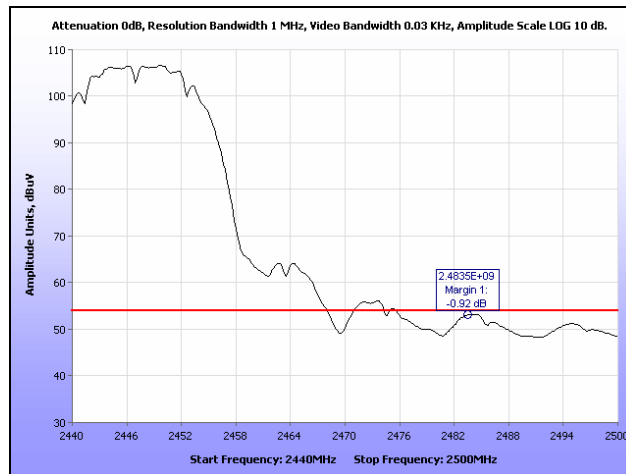
Plot 130. Restricted Band, 802.11b, 2437 MHz, Peak, High Band



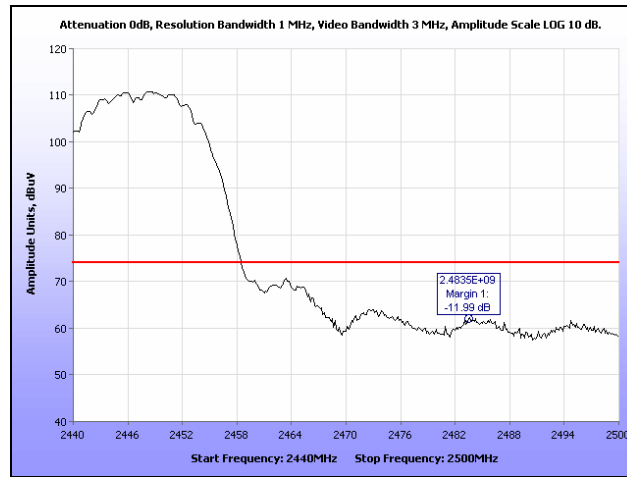
Plot 131. Restricted Band, 802.11b, 2442 MHz, Average, High Band



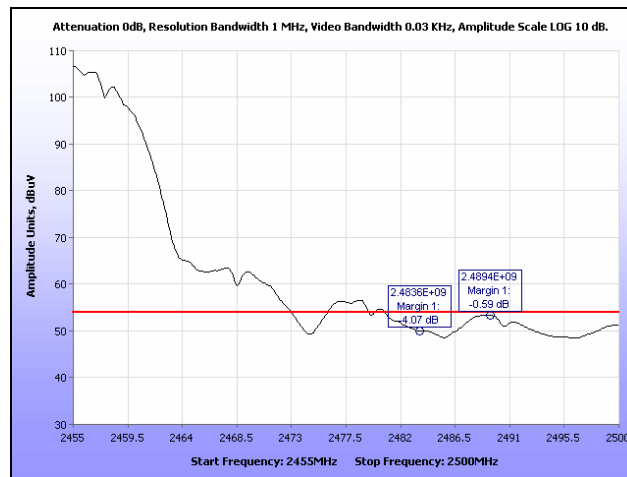
Plot 132. Restricted Band, 802.11b, 2442 MHz, Peak, High Band



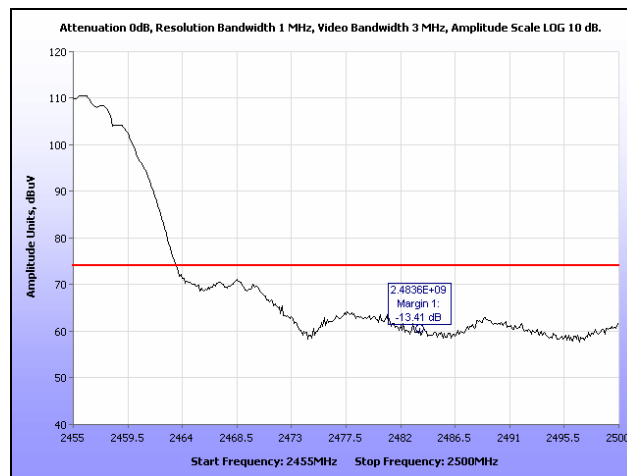
Plot 133. Restricted Band, 802.11b, 2447 MHz, Average, High Band



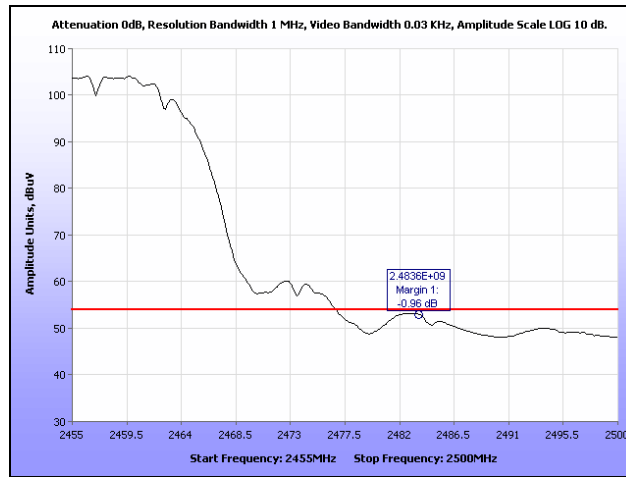
Plot 134. Restricted Band, 802.11b, 2447 MHz, Peak, High Band



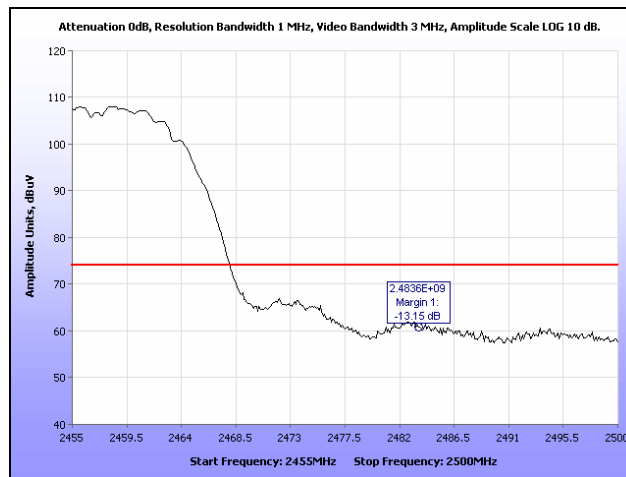
Plot 135. Restricted Band, 802.11b, 2452 MHz, Average, High Band



Plot 136. Restricted Band, 802.11b, 2452 MHz, Peak, High Band

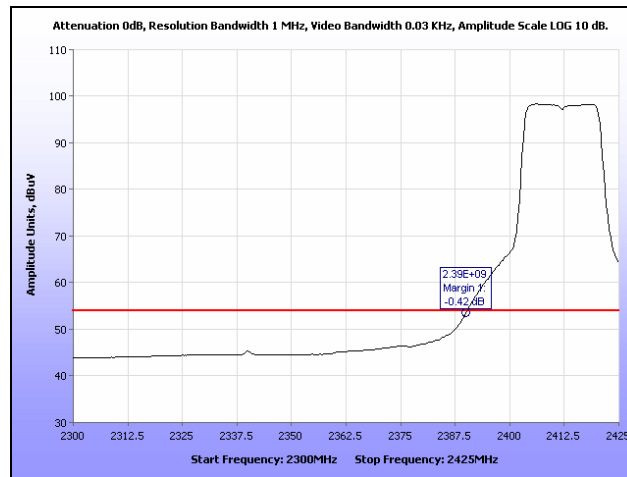


Plot 137. Restricted Band, 802.11b, 2457 MHz, Average, High Band

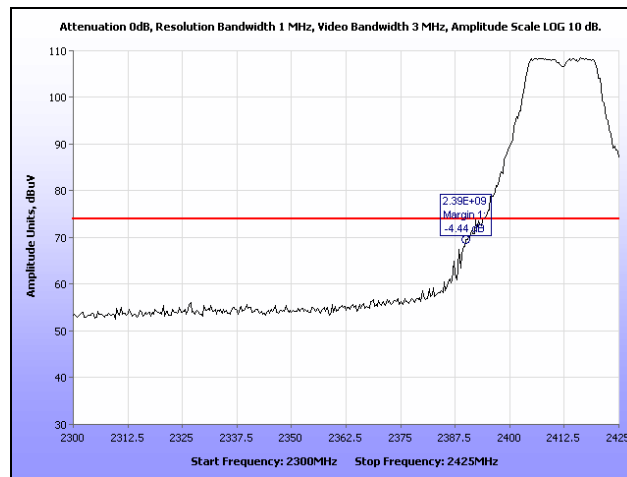


Plot 138. Restricted Band, 802.11b, 2457 MHz, Peak, High Band

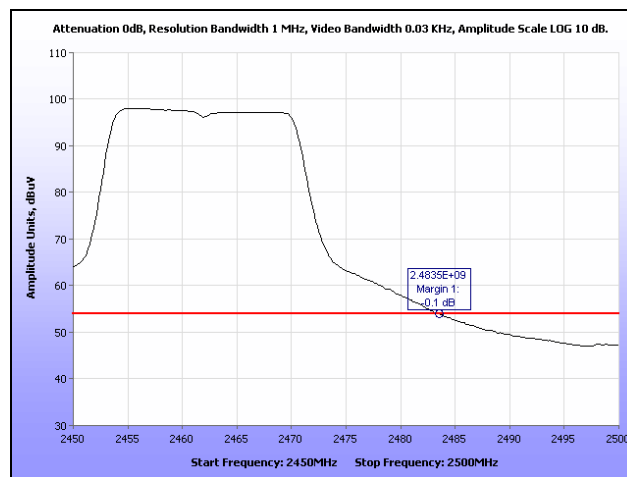
Radiated Band Edge Measurements, 802.11g



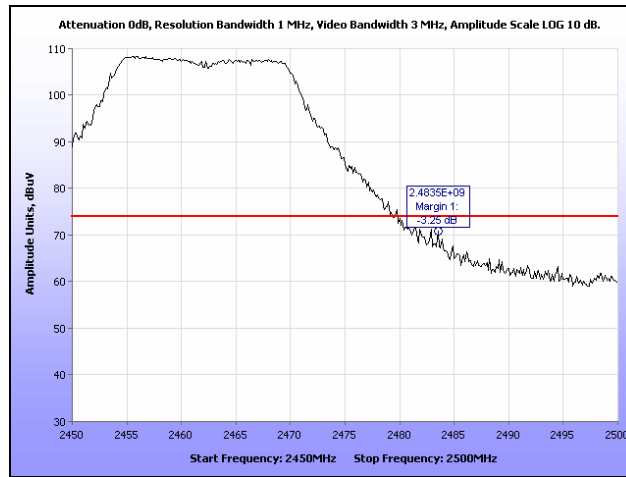
Plot 139. Radiated Restricted Band Edge, Low Channel, Average, 802.11g



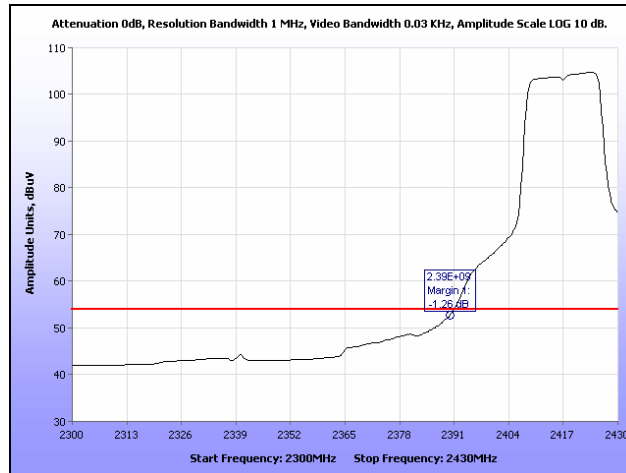
Plot 140. Radiated Restricted Band Edge, Low Channel, Peak, 802.11g



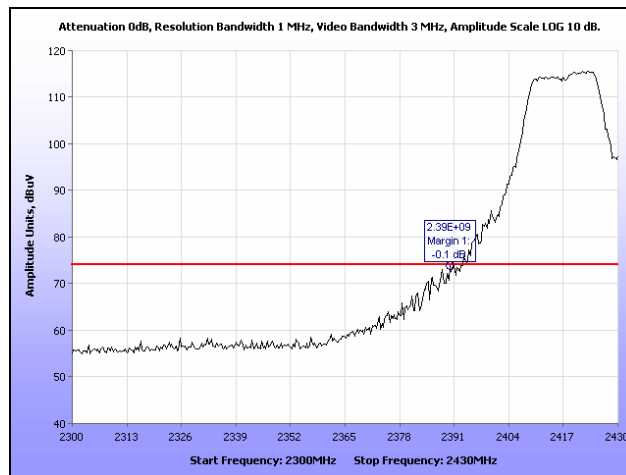
Plot 141. Radiated Restricted Band Edge, High Channel, Average, 802.11g



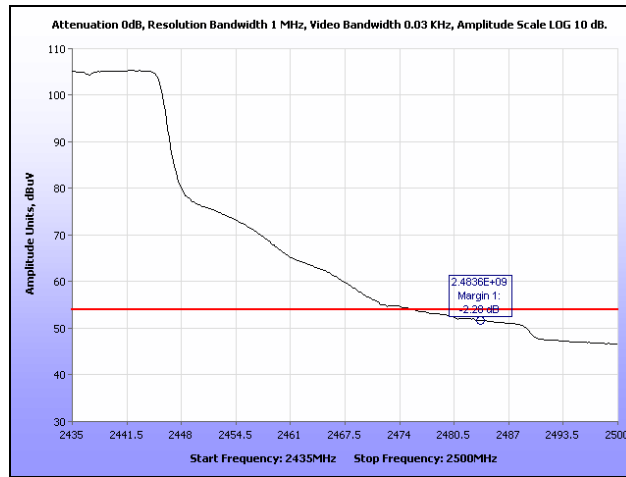
Plot 142. Radiated Restricted Band Edge, High Channel, Peak, 802.11g



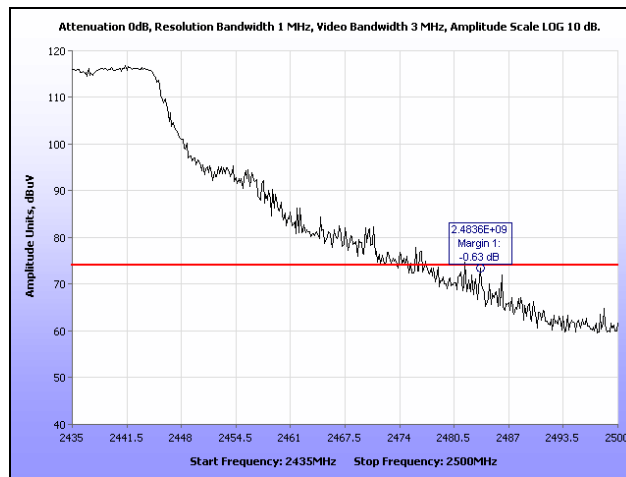
Plot 143. Restricted Band, 802.11g, 2417 MHz, Average, Low Band



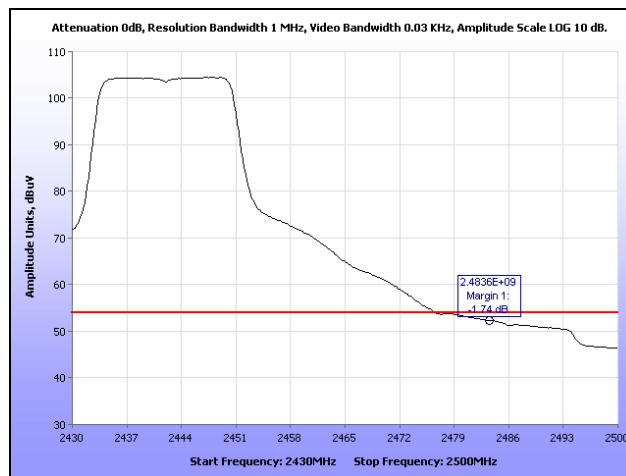
Plot 144. Restricted Band, 802.11g, 2417 MHz, Peak, Low Band



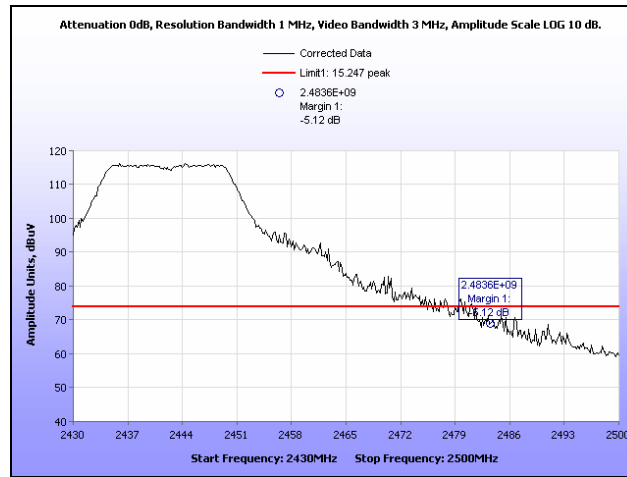
Plot 145. Restricted Band, 802.11g, 2437 MHz, Average, High Band



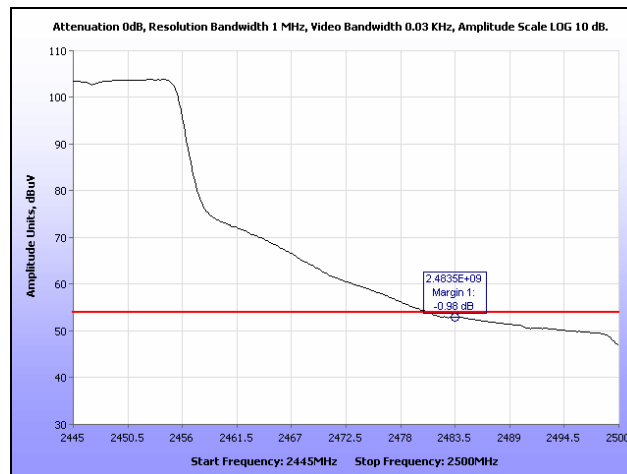
Plot 146. Restricted Band, 802.11g, 2437 MHz, Peak, High Band



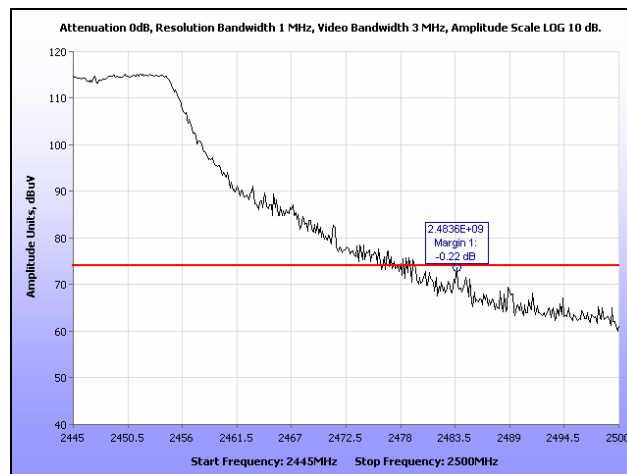
Plot 147. Restricted Band, 802.11g, 2442 MHz, Average, High Band



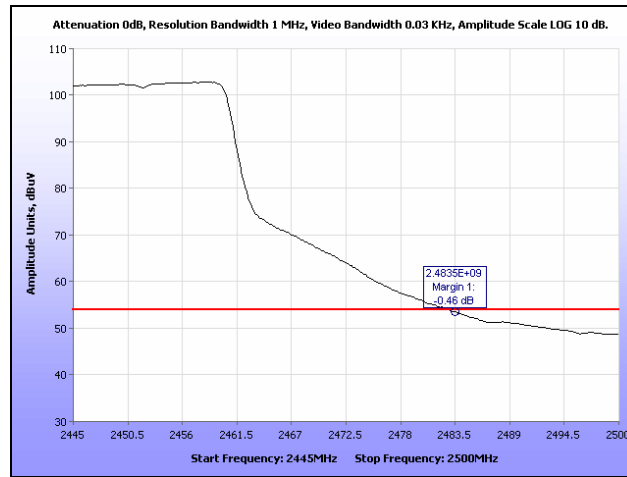
Plot 148. Restricted Band, 802.11g, 2442 MHz, Peak, High Band



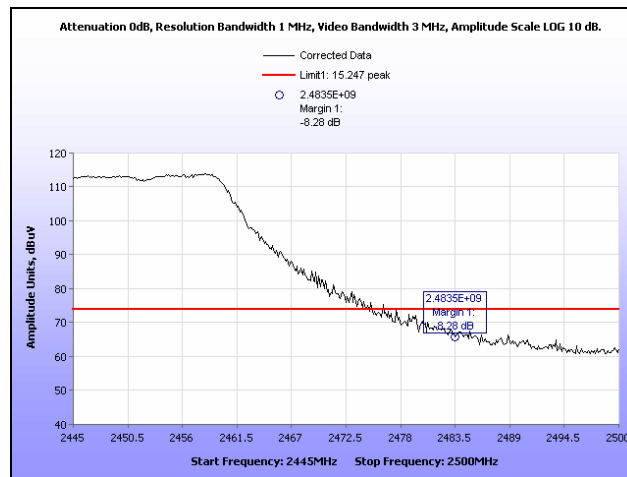
Plot 149. Restricted Band, 802.11g, 2447 MHz, Average, High Band



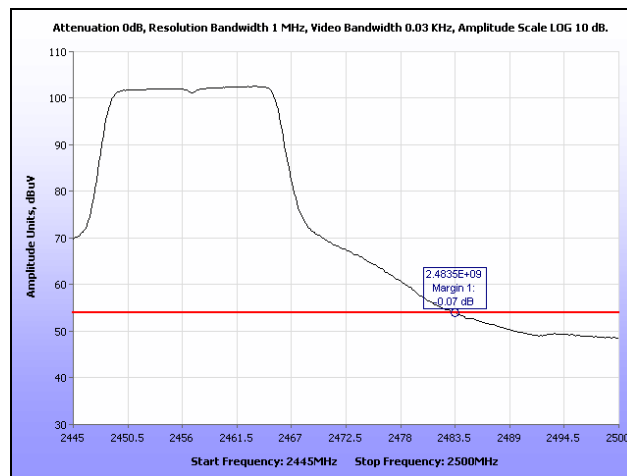
Plot 150. Restricted Band, 802.11g, 2447 MHz, Peak, High Band



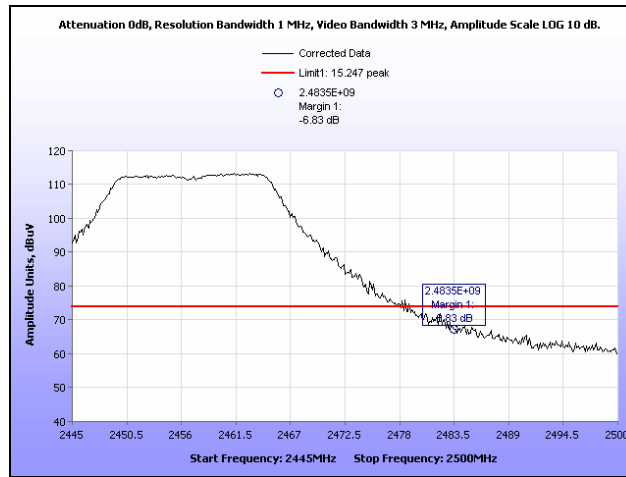
Plot 151. Restricted Band, 802.11g, 2452 MHz, Average, High Band



Plot 152. Restricted Band, 802.11g, 2452 MHz, Peak, High Band

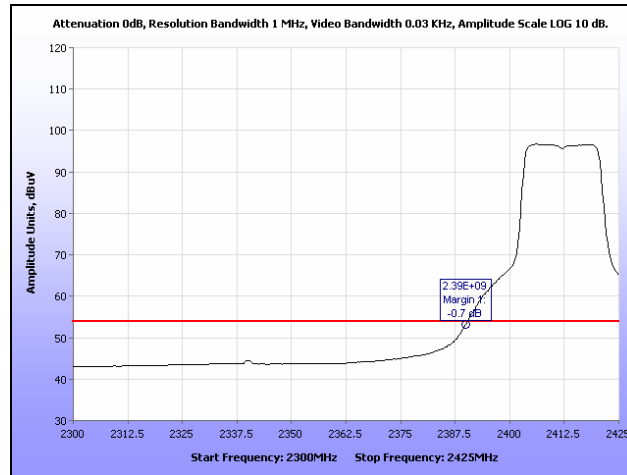


Plot 153. Restricted Band, 802.11g, 2457 MHz, Average, High Band

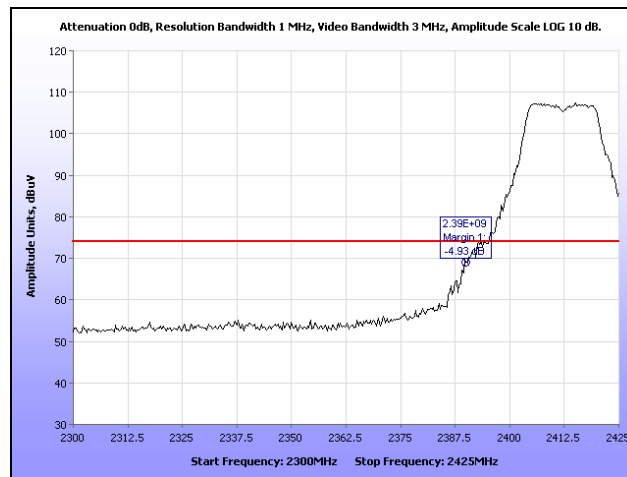


Plot 154. Restricted Band, 802.11g, 2457 MHz, Peak, High Band

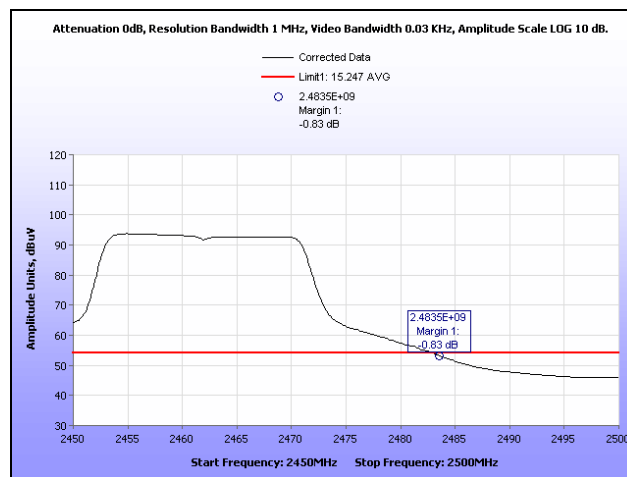
Radiated Band Edge Measurements, 802.11n 20 MHz



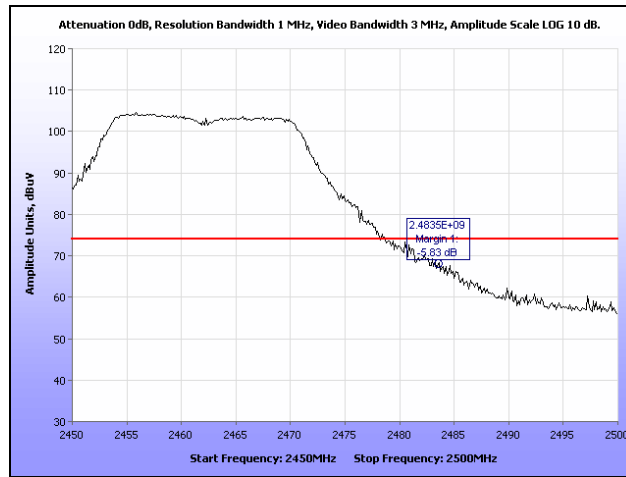
Plot 155. Radiated Restricted Band Edge, Low Channel, Average, 802.11n 20 MHz



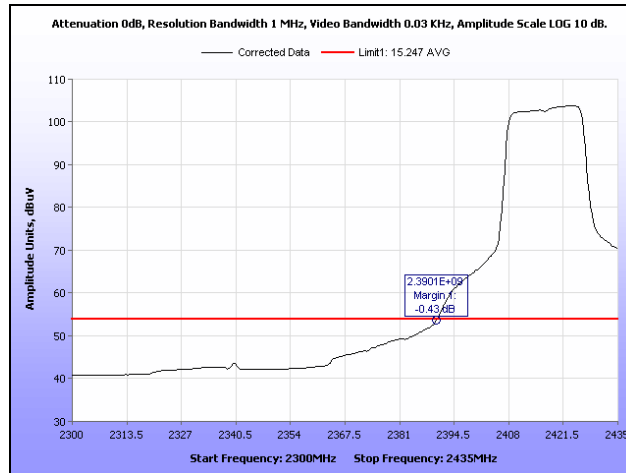
Plot 156. Radiated Restricted Band Edge, Low Channel, Peak, 802.11n 20 MHz



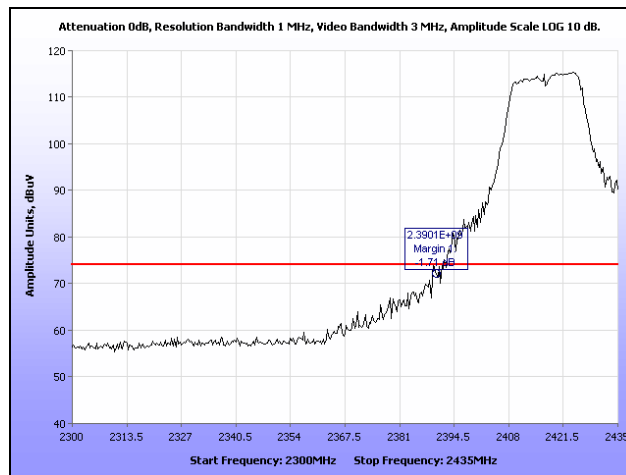
Plot 157. Radiated Restricted Band Edge, High Channel, Average, 802.11n 20 MHz



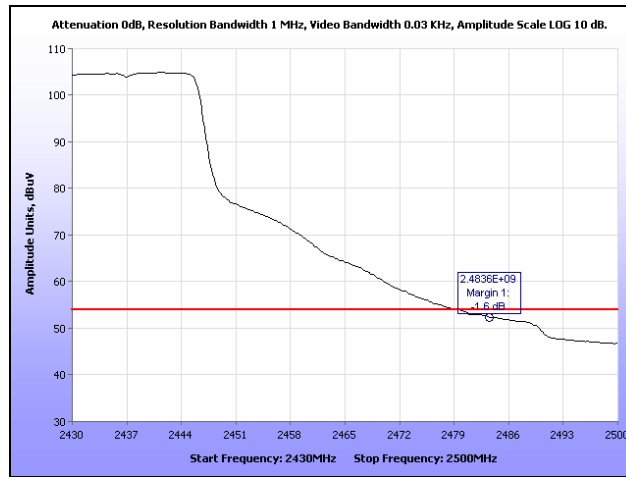
Plot 158. Radiated Restricted Band Edge, High Channel, Peak, 802.11n 20 MHz



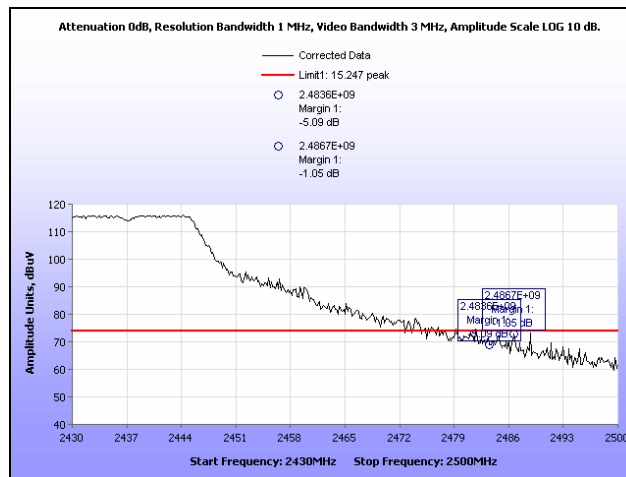
Plot 159. Restricted Band, 802.11n 20 MHz, 2417 MHz, Average, Low Band



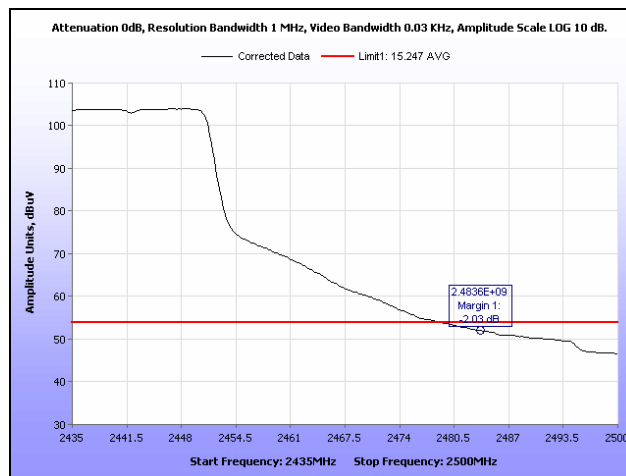
Plot 160. Restricted Band, 802.11n 20 MHz, 2417 MHz, Peak, Low Band



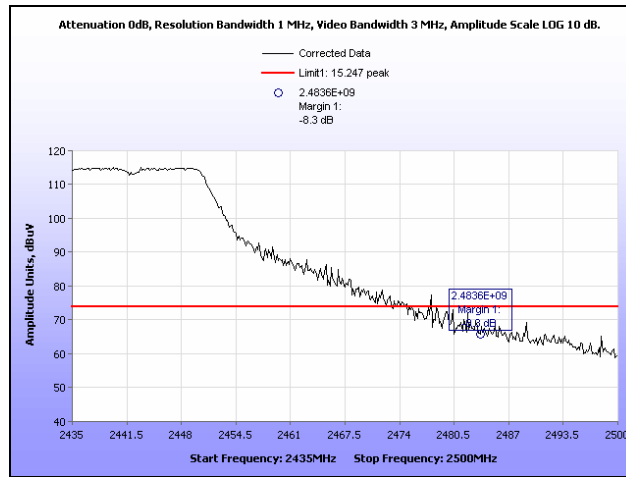
Plot 161. Restricted Band, 802.11n 20 MHz, 2437 MHz, Average, High Band



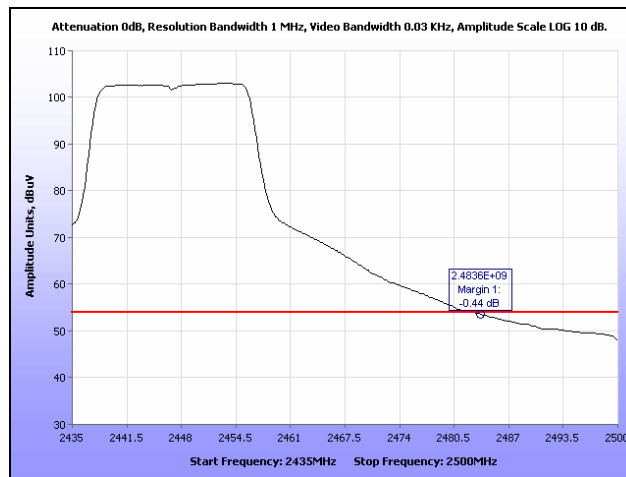
Plot 162. Restricted Band, 802.11n 20 MHz, 2437 MHz, Peak, High Band



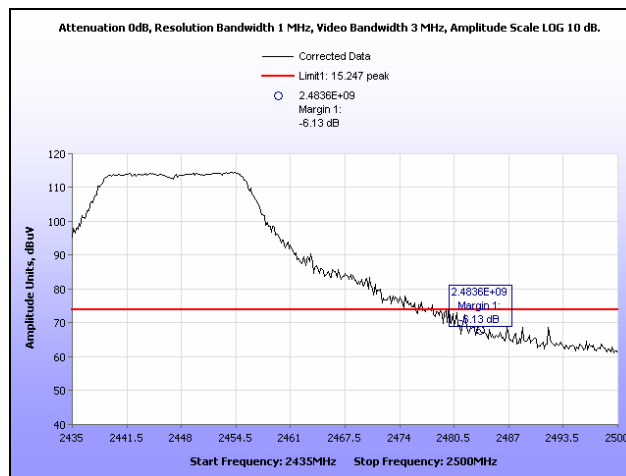
Plot 163. Restricted Band, 802.11n 20 MHz, 2442 MHz, Average, High Band



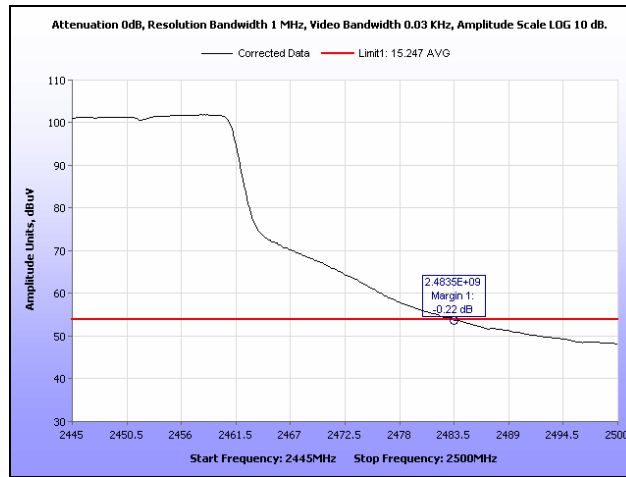
Plot 164. Restricted Band, 802.11n 20 MHz, 2442 MHz, Peak, High Band



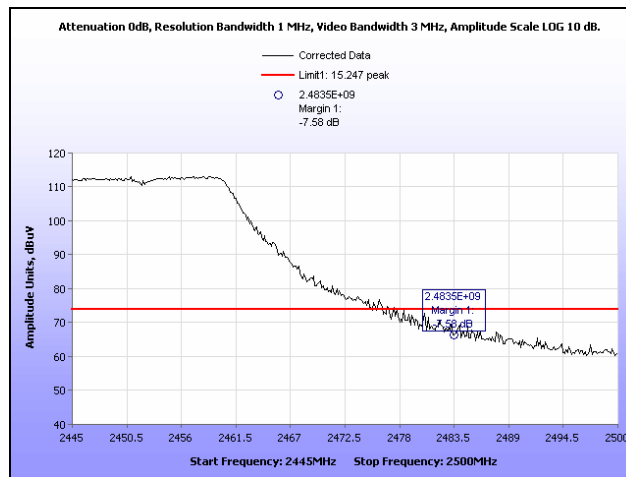
Plot 165. Restricted Band, 802.11n 20 MHz, 2447 MHz, Average, High Band



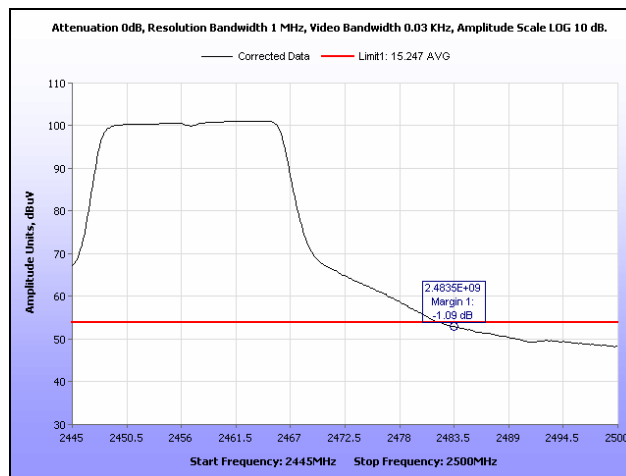
Plot 166. Restricted Band, 802.11n 20 MHz, 2447 MHz, Peak, High Band



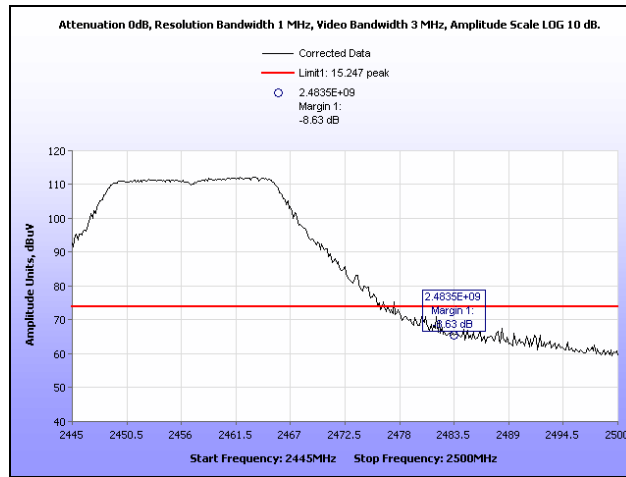
Plot 167. Restricted Band, 802.11n 20 MHz, 2452 MHz, Average, High Band



Plot 168. Restricted Band, 802.11n 20 MHz, 2452 MHz, Peak, High Band

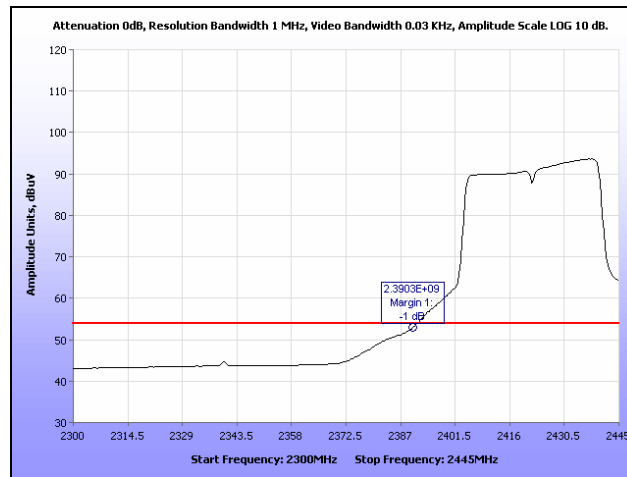


Plot 169. Restricted Band, 802.11n 20 MHz, 2457 MHz, Average, High Band

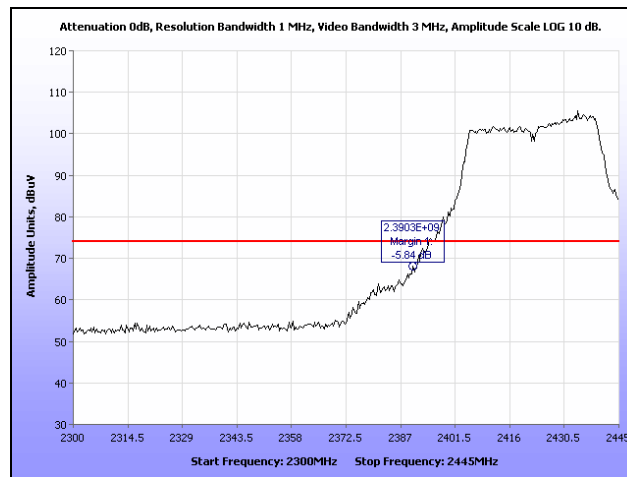


Plot 170. Restricted Band, 802.11n 20 MHz, 2457 MHz, Peak, High Band

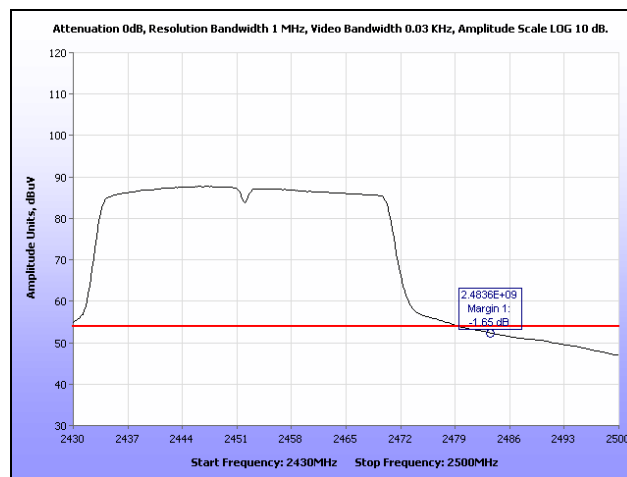
Radiated Band Edge Measurements, 802.11n 40 MHz



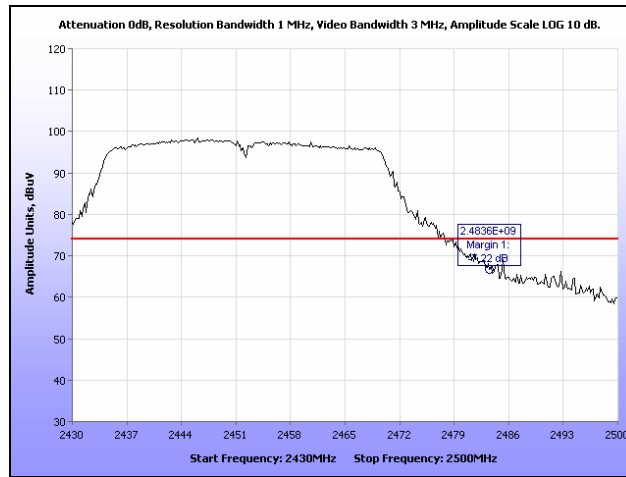
Plot 171. Radiated Restricted Band Edge, Low Channel, Average, 802.11n 40 MHz



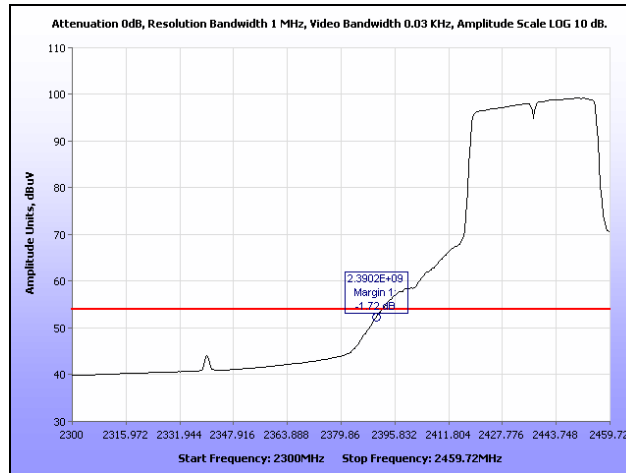
Plot 172. Radiated Restricted Band Edge, Low Channel, Peak, 802.11n 40 MHz



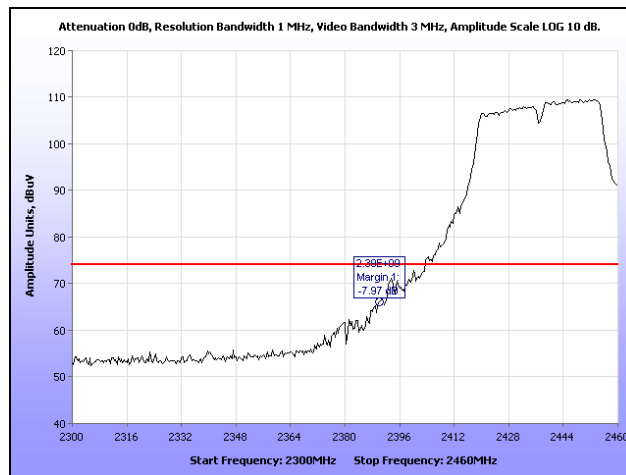
Plot 173. Radiated Restricted Band Edge, High Channel, Average, 802.11n 40 MHz



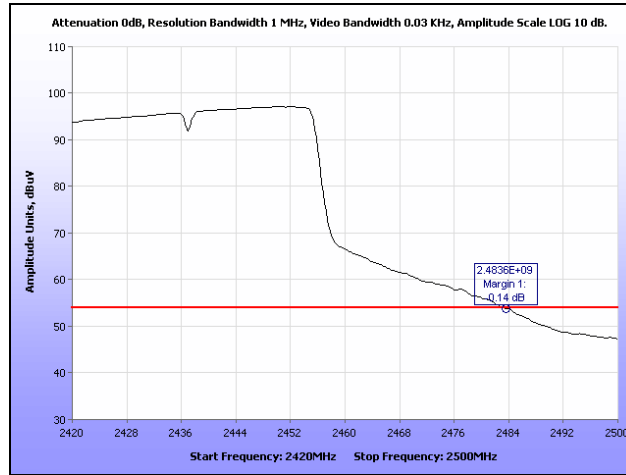
Plot 174. Radiated Restricted Band Edge, High Channel, Peak, 802.11n 40 MHz



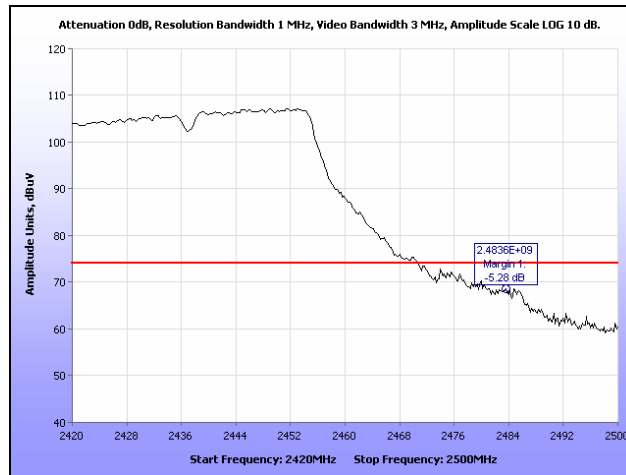
Plot 175. Restricted Band, 802.11n 40 MHz, 2437 MHz, Average, Low Band



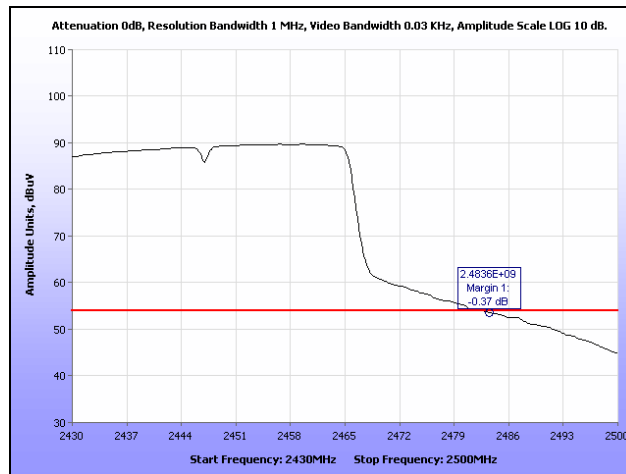
Plot 176. Restricted Band, 802.11n 40 MHz, 2437 MHz, Peak, Low Band



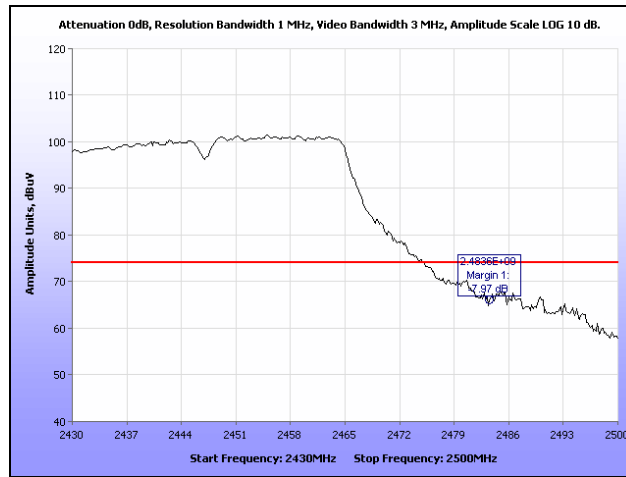
Plot 177. Restricted Band, 802.11n 40 MHz, 2437 MHz, Average, High Band



Plot 178. Restricted Band, 802.11n 40 MHz, 2437 MHz, Peak, High Band

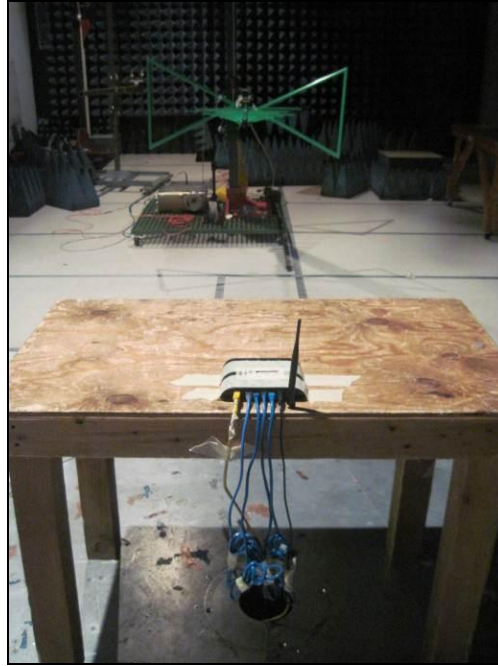


Plot 179. Restricted Band, 802.11n 40 MHz, 2447 MHz, Average, High Band



Plot 180. Restricted Band, 802.11n 40 MHz, 2447 MHz, Peak, High Band

Radiated Spurious Emissions Test Setup



Photograph 5. Radiated Spurious Emissions, Test Setup, 30 MHz – 1 GHz



Photograph 6. Radiated Spurious Emissions, Test Setup, 1 GHz – 18 GHz

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 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

Since the EUT had an integral antenna, conducted measurements could not be performed. Measurements needed to be taken radiated. An antenna was located 3 m away from the EUT and plots were taken. The EUT was rotated through all three orthogonal axes. The plots were corrected for both antenna correction factor and cable loss.

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)**. Measured emissions were below applicable limits.

Test Engineer(s): Lionel Gabrillo

Test Date(s): 09/30/11

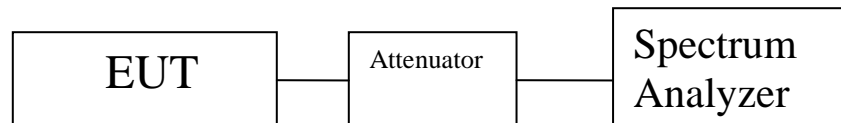
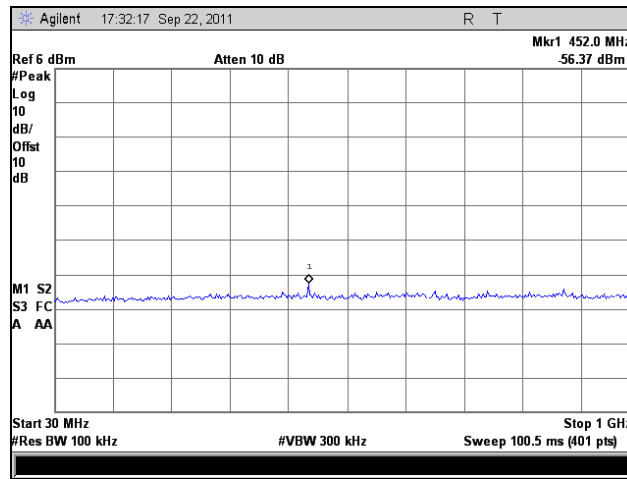
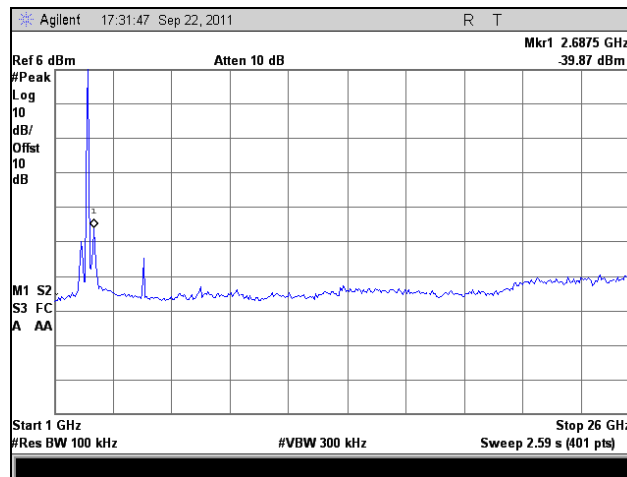


Figure 4. Block Diagram, Conducted Spurious Emissions Test Setup

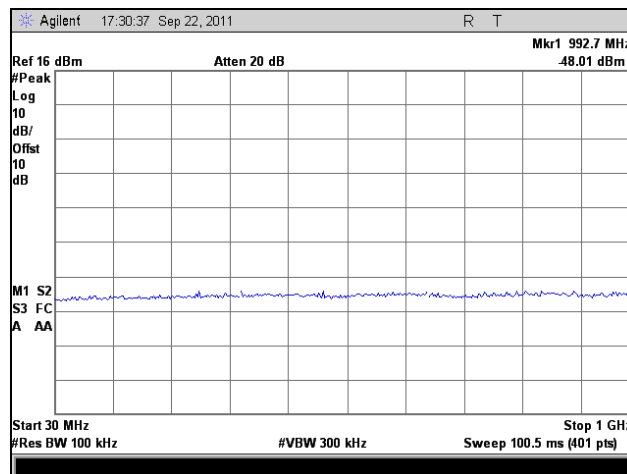
Conducted Spurious Emissions Test Results, 802.11b



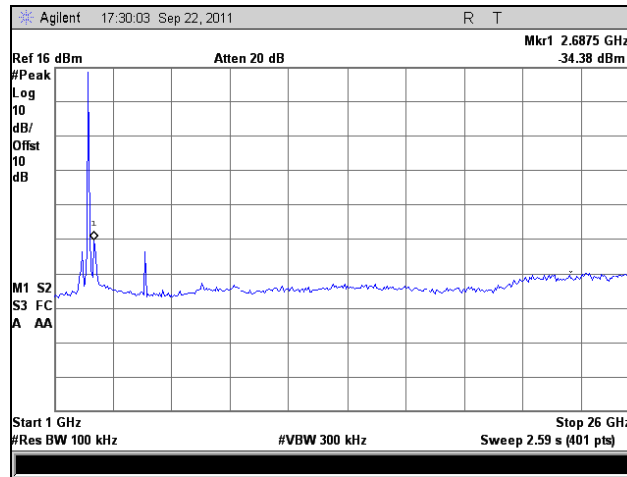
Plot 181. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11b



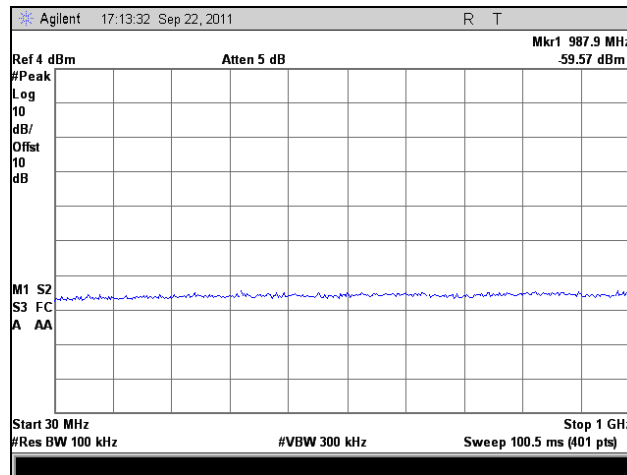
Plot 182. Conducted Spurious Emissions, Low Channel, 1 GHz – 26 GHz, 802.11b



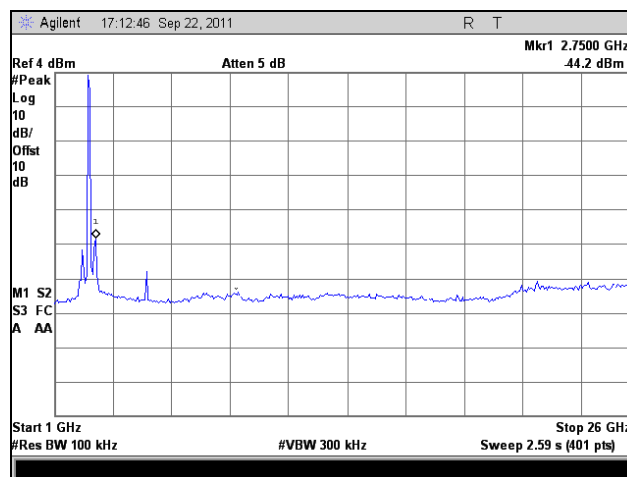
Plot 183. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 802.11b



Plot 184. Conducted Spurious Emissions, Mid Channel, 1 GHz – 26 GHz, 802.11b

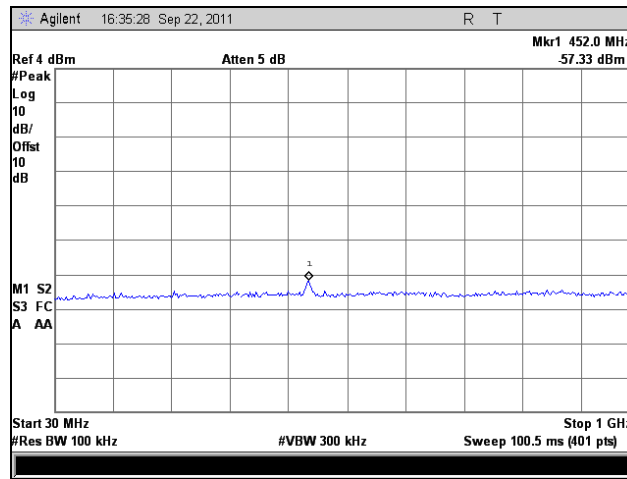


Plot 185. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11b

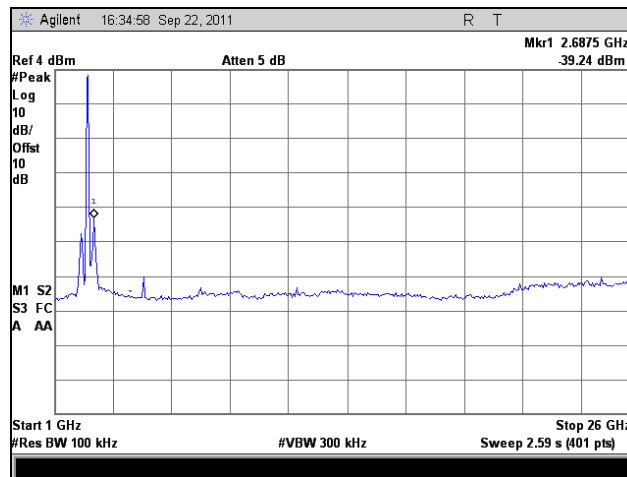


Plot 186. Conducted Spurious Emissions, High Channel, 1 GHz – 26 GHz, 802.11b

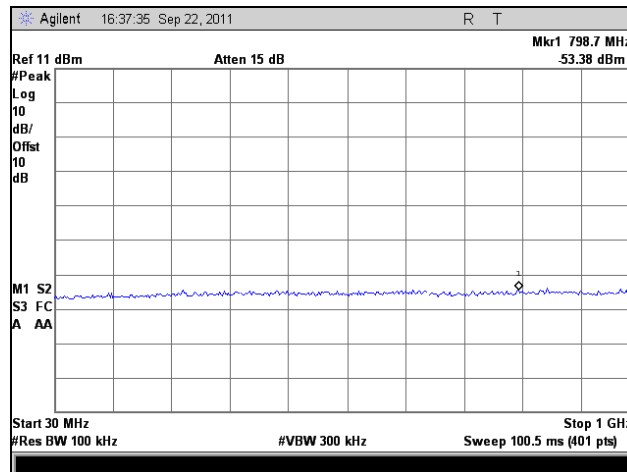
Conducted Spurious Emissions Test Results, 802.11g



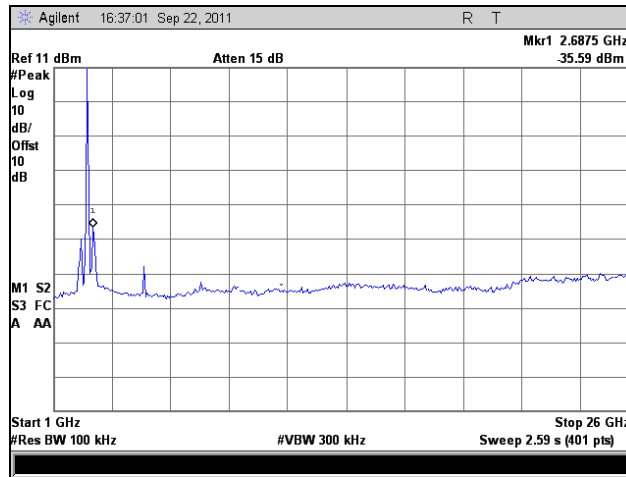
Plot 187. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11g



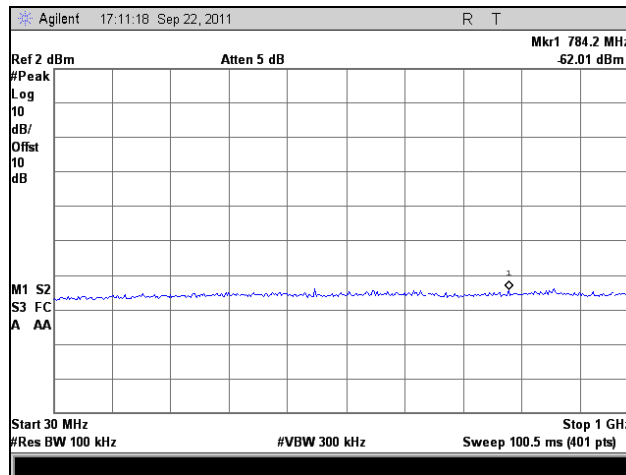
Plot 188. Conducted Spurious Emissions, Low Channel, 1 GHz – 26 GHz, 802.11g



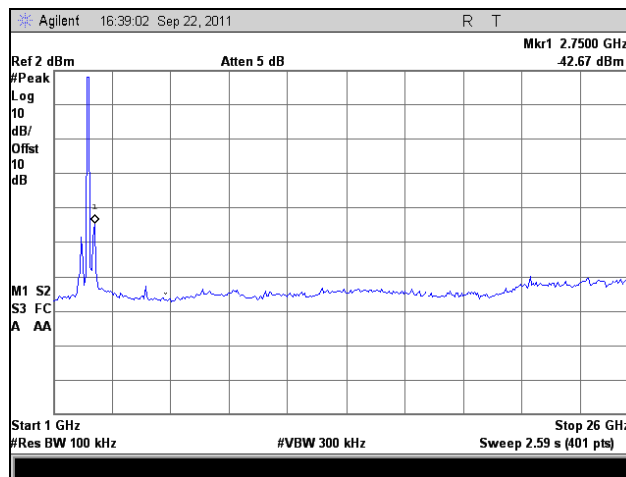
Plot 189. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 802.11g



Plot 190. Conducted Spurious Emissions, Mid Channel, 1 GHz – 26 GHz, 802.11g

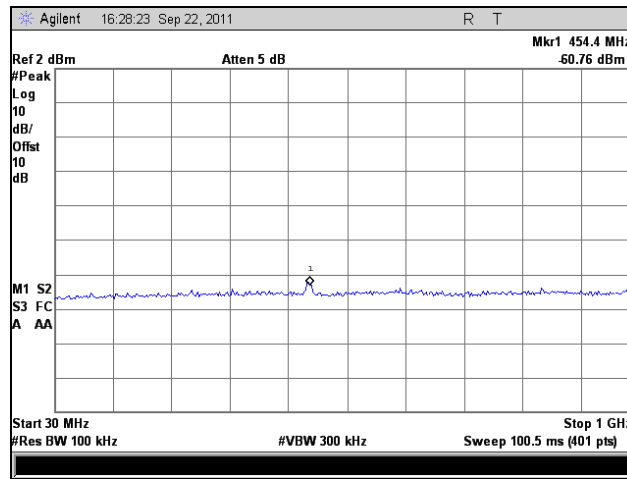


Plot 191. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11g

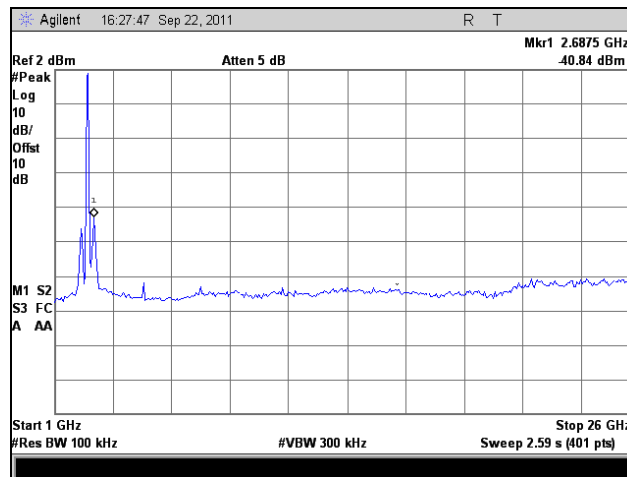


Plot 192. Conducted Spurious Emissions, High Channel, 1 GHz – 26 GHz, 802.11g

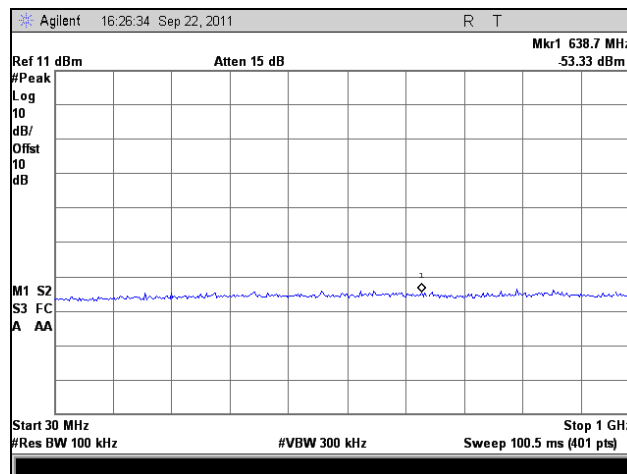
Conducted Spurious Emissions Test Results, 802.11n 20 MHz



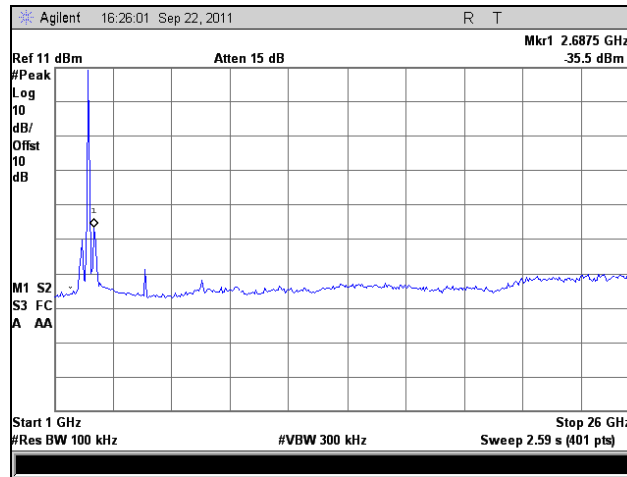
Plot 193. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11n 20 MHz



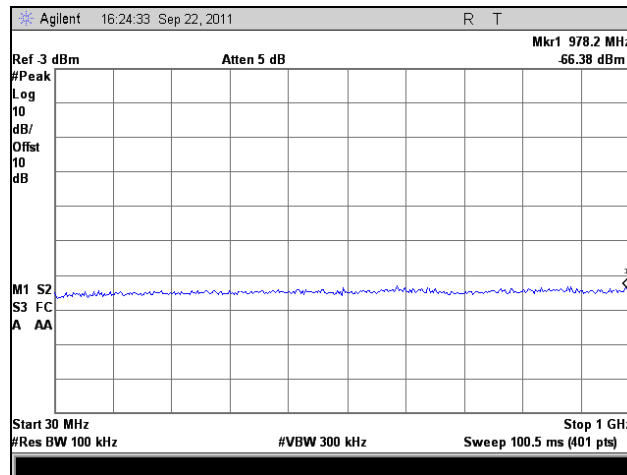
Plot 194. Conducted Spurious Emissions, Low Channel, 1 GHz – 26 GHz, 802.11n 20 MHz



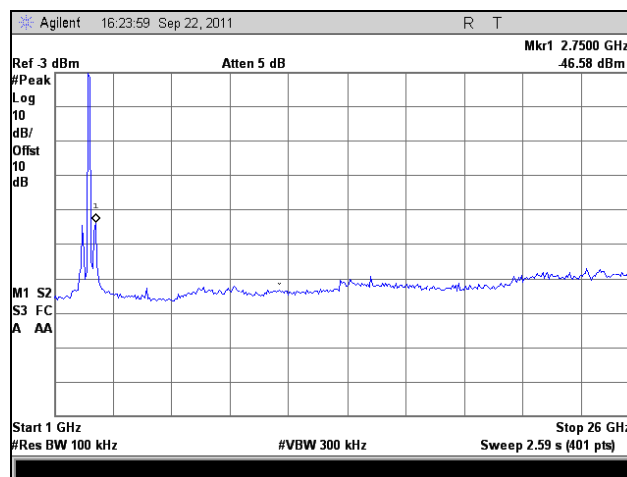
Plot 195. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 802.11n 20 MHz



Plot 196. Conducted Spurious Emissions, Mid Channel, 1 GHz – 26 GHz, 802.11n 20 MHz

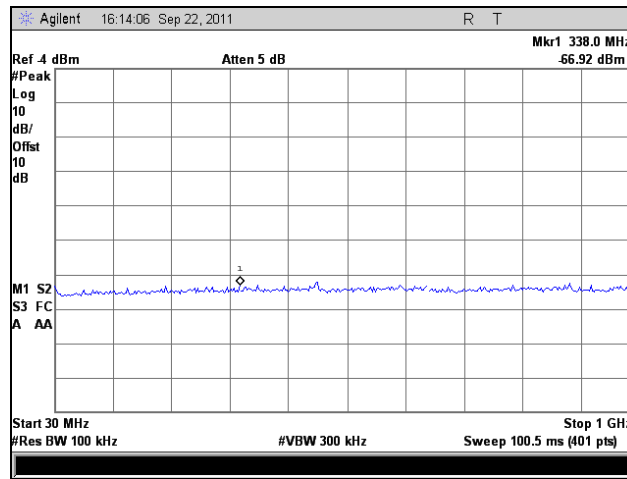


Plot 197. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11n 20 MHz

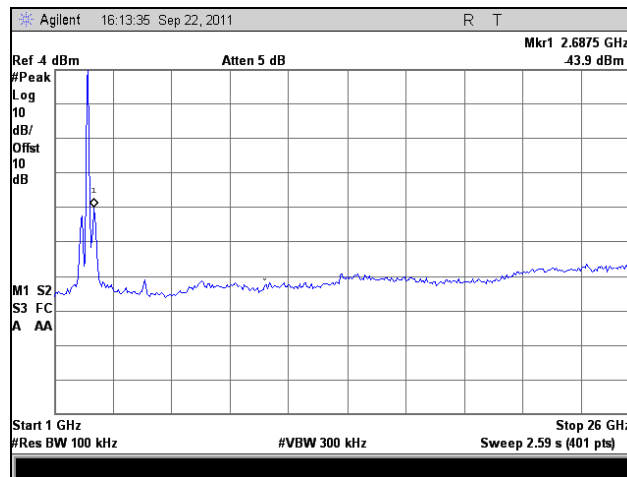


Plot 198. Conducted Spurious Emissions, High Channel, 1 GHz – 26 GHz, 802.11n 20 MHz

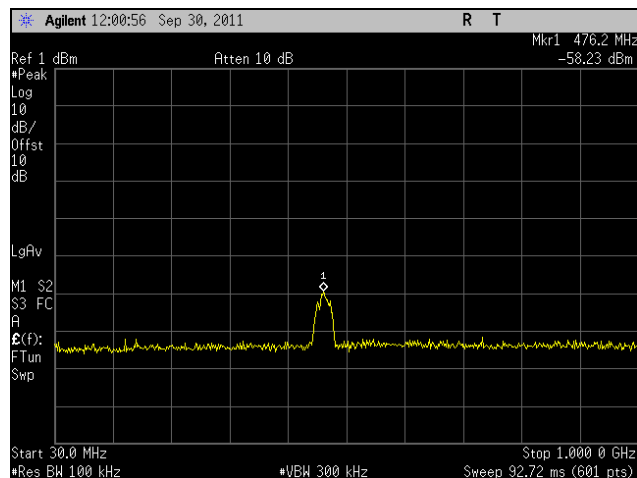
Conducted Spurious Emissions Test Results, 802.11n 40 MHz



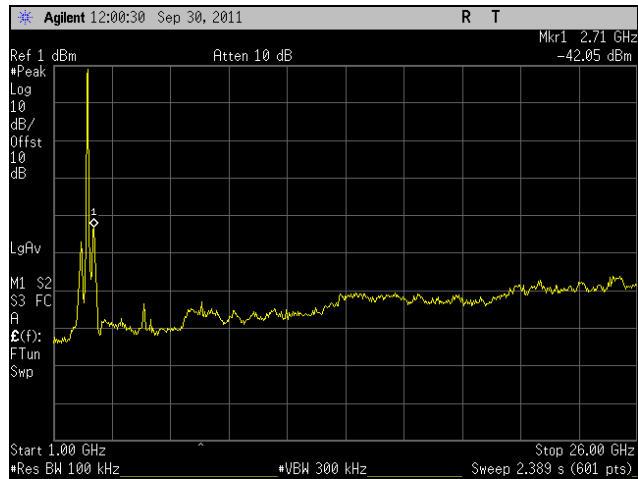
Plot 199. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 802.11n 40 MHz



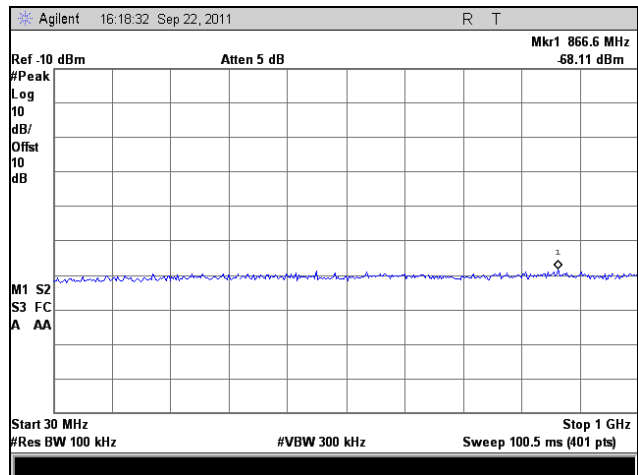
Plot 200. Conducted Spurious Emissions, Low Channel, 1 GHz – 26 GHz, 802.11n 40 MHz



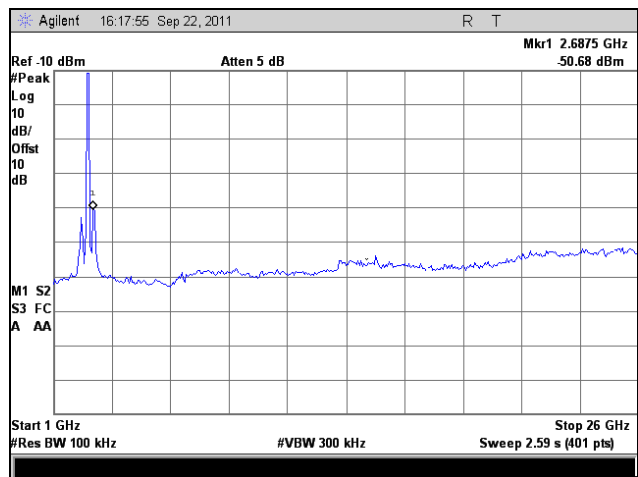
Plot 201. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 802.11n 40 MHz



Plot 202. Conducted Spurious Emissions, Mid Channel, 1 GHz – 26 GHz, 802.11n 40 MHz

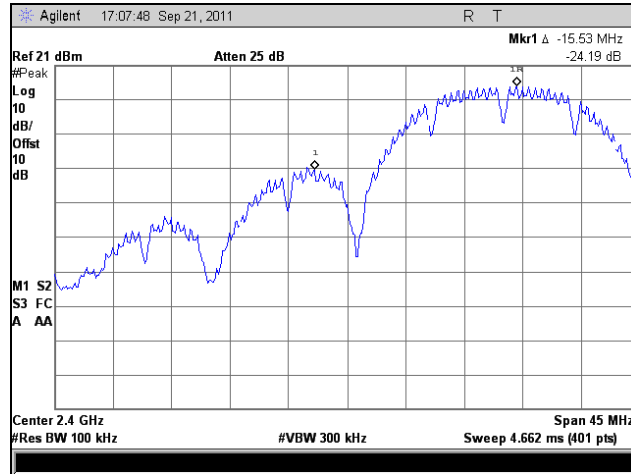


Plot 203. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 802.11n 40 MHz

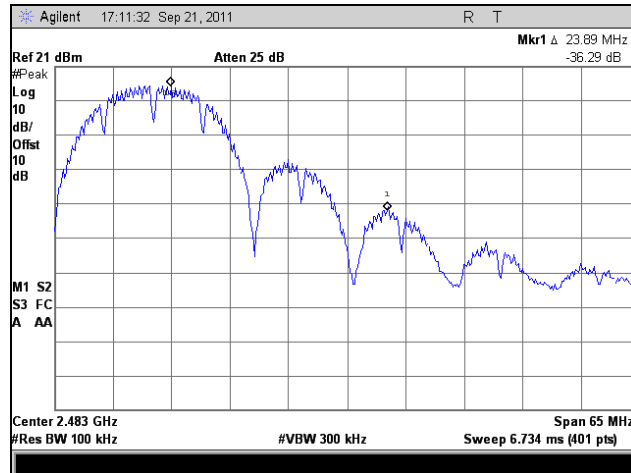


Plot 204. Conducted Spurious Emissions, High Channel, 1 GHz – 26 GHz, 802.11n 40 MHz

Conducted Band Edge Test Results, 802.11b

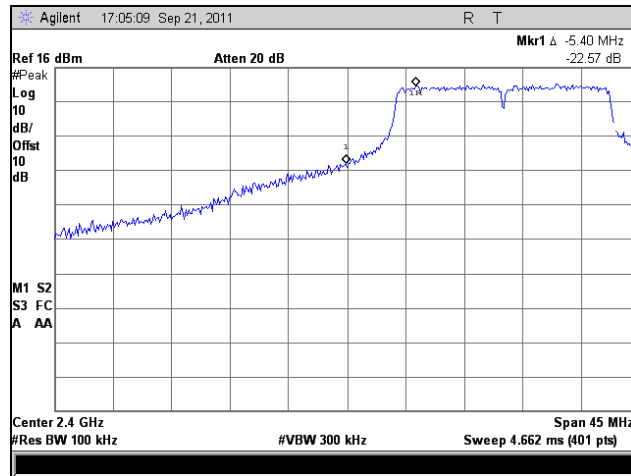


Plot 205. Conducted Band Edge, Low Channel, 802.11b

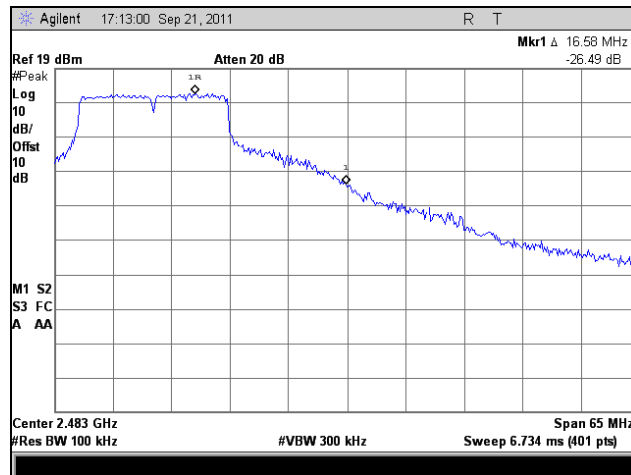


Plot 206. Conducted Band Edge, High Channel, 802.11b

Conducted Band Edge Test Results, 802.11g

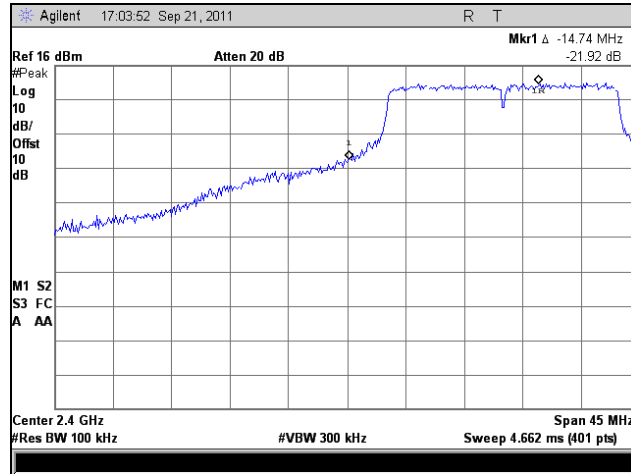


Plot 207. Conducted Band Edge, Low Channel, 802.11g

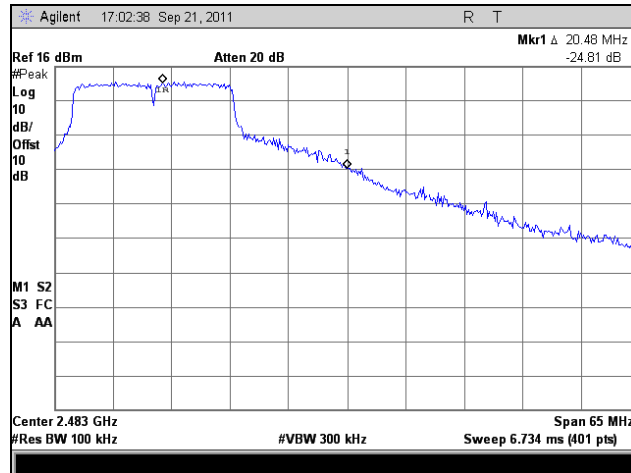


Plot 208. Conducted Band Edge, High Channel, 802.11g

Conducted Band Edge Test Results, 802.11n 20 MHz

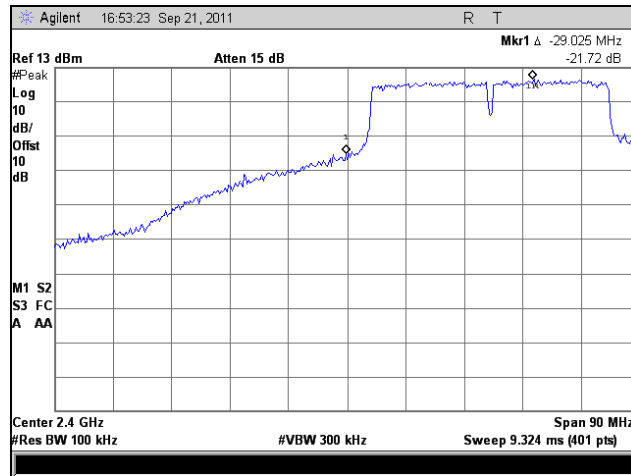


Plot 209. Conducted Band Edge, Low Channel, 802.11n 20 MHz

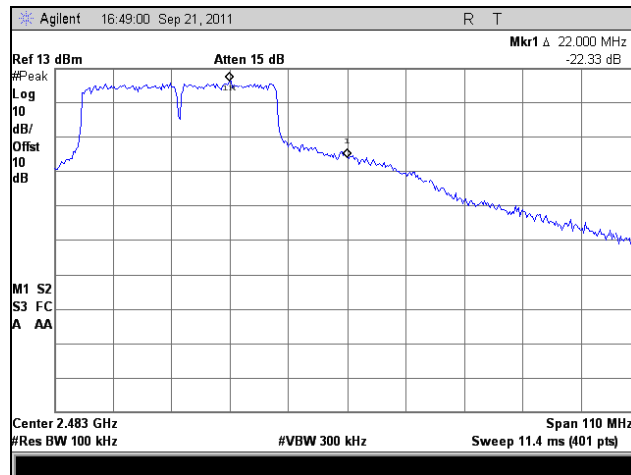


Plot 210. Conducted Band Edge, High Channel, 802.11n 20 MHz

Conducted Band Edge Test Results, 802.11n 40 MHz



Plot 211. Conducted Band Edge, Low Channel, 802.11n 40 MHz



Plot 212. Conducted Band Edge, High Channel, 802.11n 40 MHz

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 with a 333.3 second sweep. 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: Lionel Gabrillo

Test Date: 09/30/11

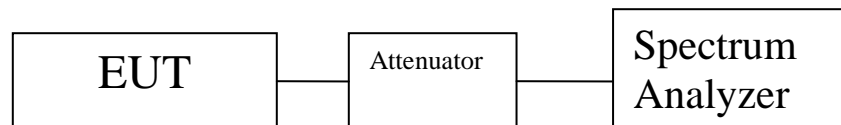


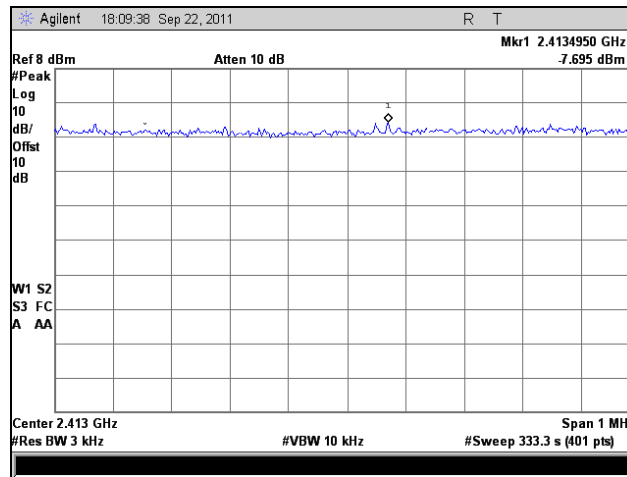
Figure 5. Block Diagram, Peak Power Spectral Density Test Setup

Peak Power Spectral Density Test Results

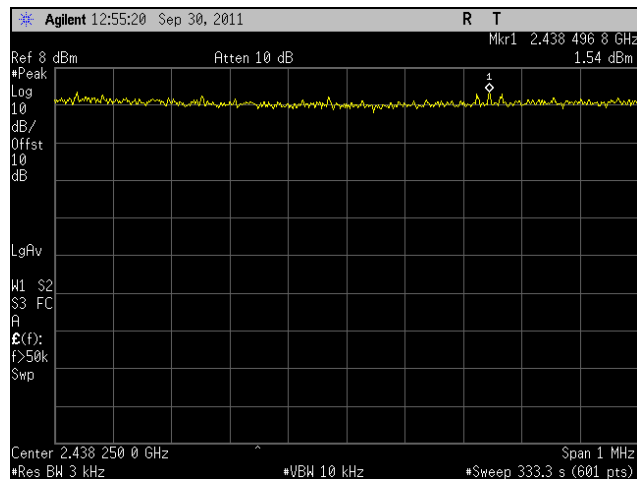
Peak Power Spectral Density					
Mode	Carrier Channel	Frequency (MHz)	Measured PPSD (dBm)	Limit (dBm)	Margin (dB)
802.11b	Low	2412	-7.695	8	-15.695
	Mid	2437	1.54	8	-6.46
	High	2462	-9.847	8	-17.847
802.11g	Low	2412	-8.208	8	-16.208
	Mid	2437	-1.09	8	-9.09
	High	2462	-9.835	8	-17.835
802.11n 20 MHz	Low	2412	-9.362	8	-17.362
	Mid	2437	-0.67	8	-8.67
	High	2462	-14.33	8	-22.33
802.11n 40 MHz	Low	2422	-13.8	8	-21.8
	Mid	2437	-10.23	8	-18.23
	High	2452	-19.53	8	-27.53

Table 22. Peak Power Spectral Density, Test Results

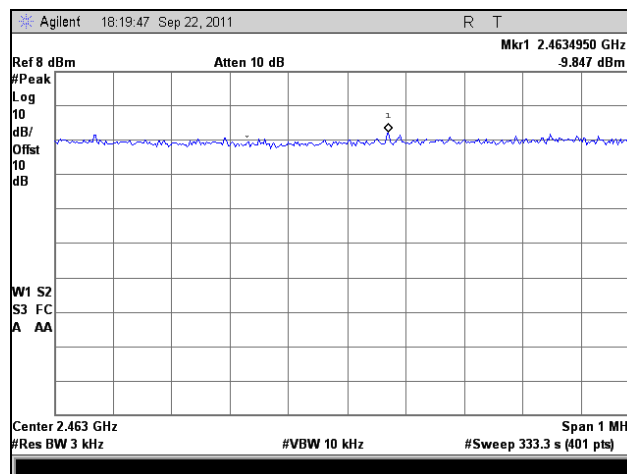
Peak Power Spectral Density, 802.11b



Plot 213. Peak Power Spectral Density, Low Channel, 802.11b

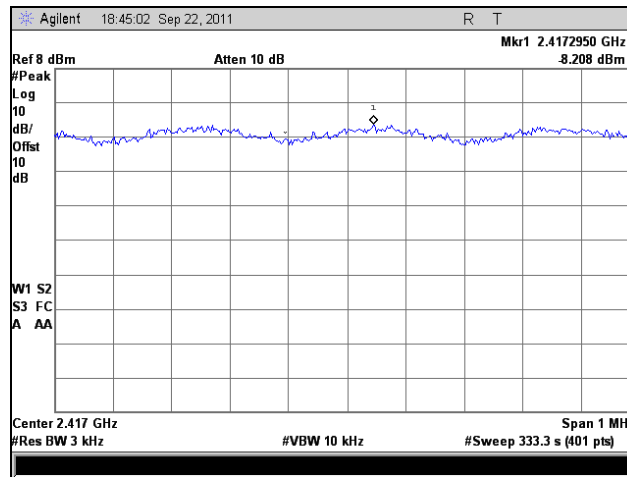


Plot 214. Peak Power Spectral Density, Mid Channel, 802.11b

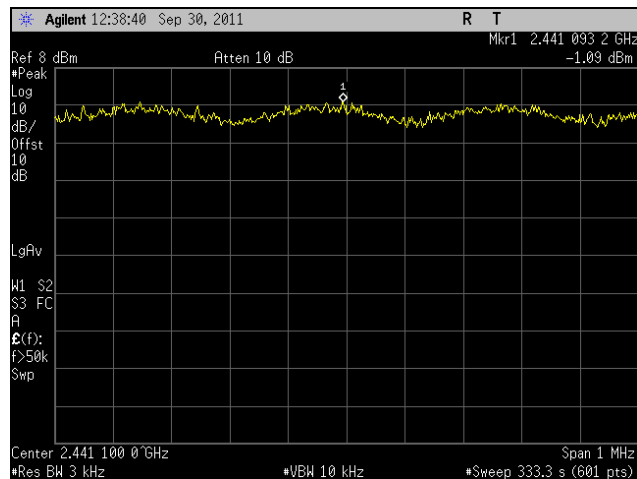


Plot 215. Peak Power Spectral Density, High Channel, 802.11b

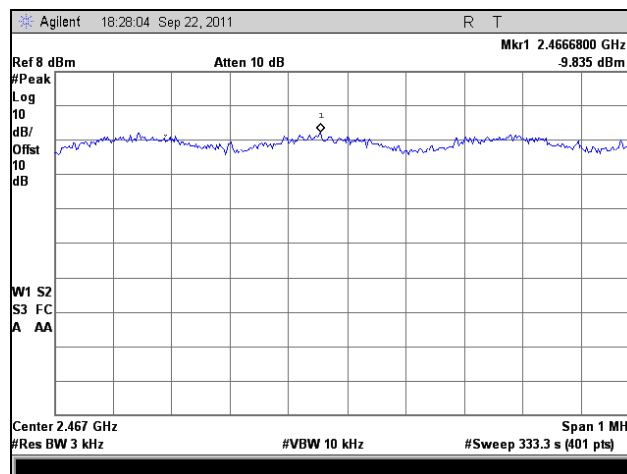
Peak Power Spectral Density, 802.11g



Plot 216. Peak Power Spectral Density, Low Channel, 802.11g

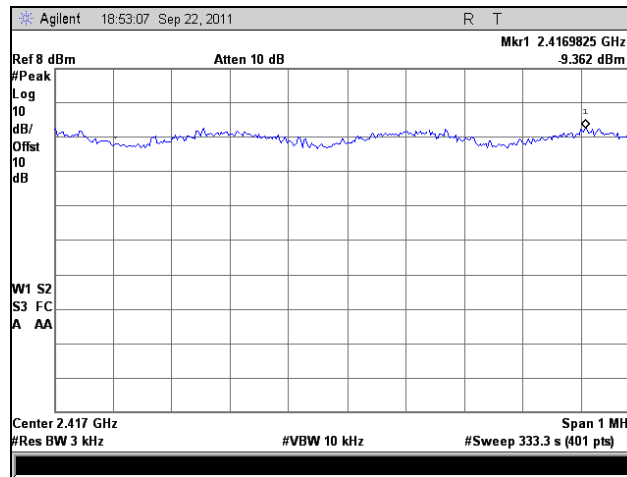


Plot 217. Peak Power Spectral Density, Mid Channel, 802.11g

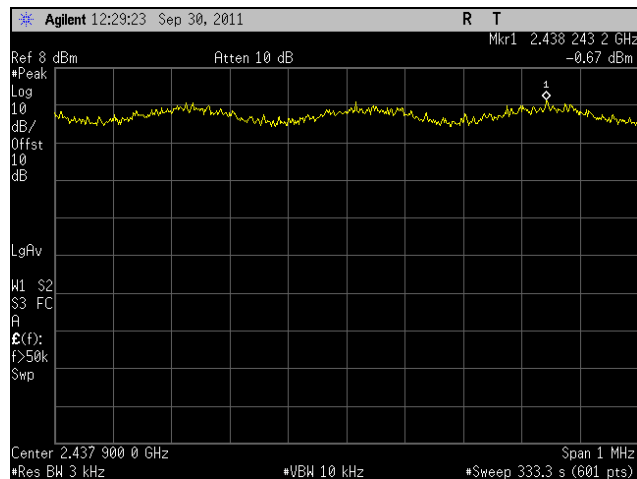


Plot 218. Peak Power Spectral Density, High Channel, 802.11g

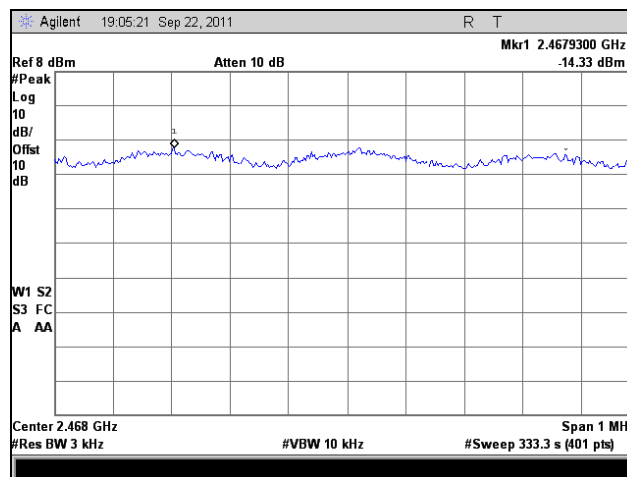
Peak Power Spectral Density, 802.11n 20 MHz



Plot 219. Peak Power Spectral Density, Low Channel, 802.11n 20 MHz

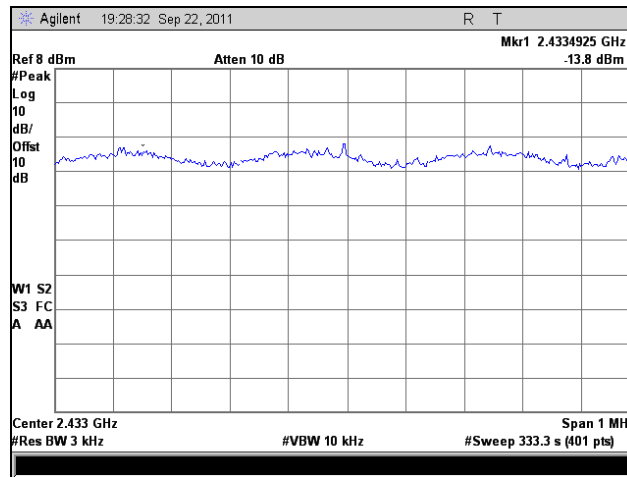


Plot 220. Peak Power Spectral Density, Mid Channel, 802.11n 20 MHz

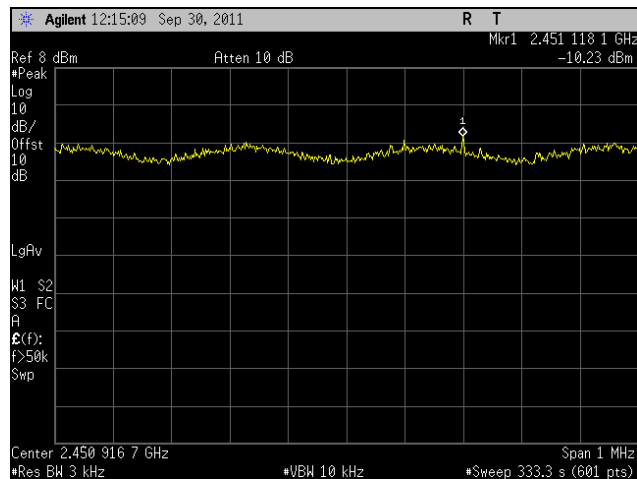


Plot 221. Peak Power Spectral Density, High Channel, 802.11n 20 MHz

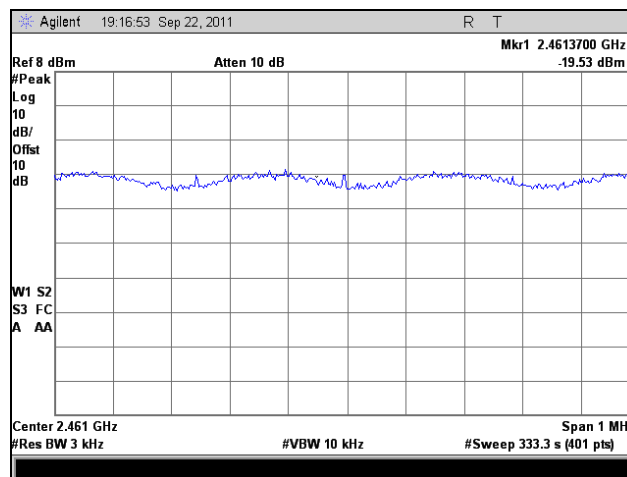
Peak Power Spectral Density, 802.11n 40 MHz



Plot 222. Peak Power Spectral Density, Low Channel, 802.11n 40 MHz



Plot 223. Peak Power Spectral Density, Mid Channel, 802.11n 40 MHz



Plot 224. Peak Power Spectral Density, High Channel, 802.11n 40 MHz

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.

MPE Limit Calculation: EUT's operating frequencies @ 2400-2483.5 MHz; highest conducted power = 28.84 dBm (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm² or 10 W/m²**

EUT maximum antenna gain = 5 dBi.

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

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

where, S = Power Density (1 mW/cm²)
P = Power Input to antenna (765.60mW)
G = Antenna Gain (3.162 numeric)
R = Minimum Distance between User and Antenna (20 cm)

$$S = (765.60 \times 3.162) / (4 \times 3.14 \times 20^2) = 2420.83 / 5024 = 0.482 \text{ mW/cm}^2$$

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

Electromagnetic Compatibility Criteria for Intentional Radiators

RSS-GEN Receiver Spurious Emissions Requirements

Test Requirements: The following receiver spurious emission limits shall be complied with:

- (a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 23.

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

Table 23. Spurious Emission Limits for Receivers

- (b) If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

Test Procedures: The EUT was programmed for receive mode only. Conducted measurements were taken at the antenna port of the EUT. 100 kHz resolution bandwidth was used from 30 MHz - 1 GHz and 300 kHz resolution was used for measurements done above 1 GHz. All plots are corrected for cable loss.

Test Results: Equipment is compliant with the Receiver Spurious Emissions Requirements of RSS-GEN. Measured emissions were below applicable limits.

Test Engineer(s): Lionel Gabrillo

Test Date(s): 09/30/11

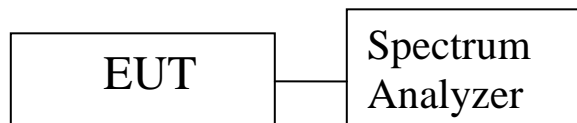
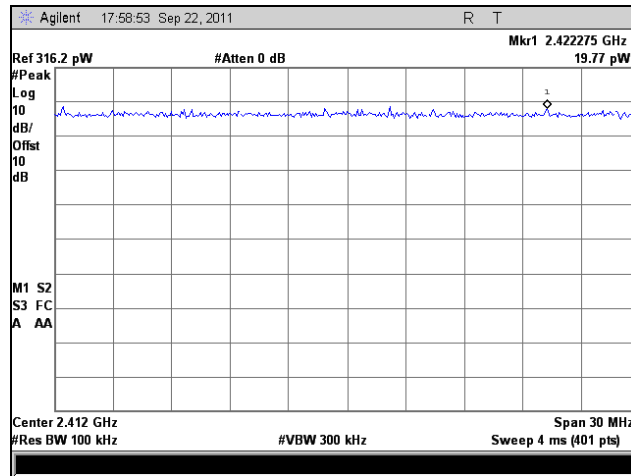
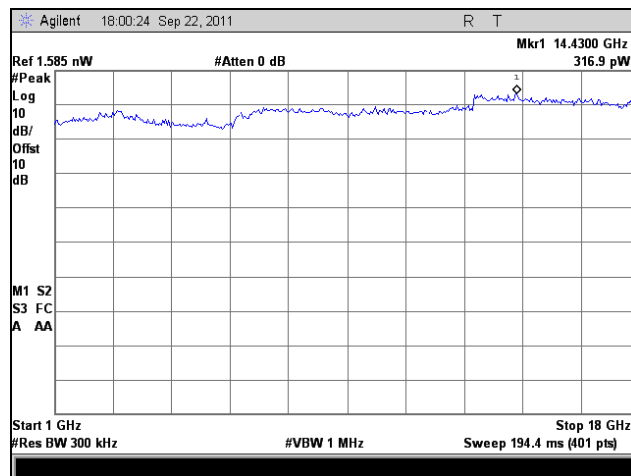


Figure 6. Block Diagram, Conducted Receiver Spurious Emissions Test Setup

Conducted Receiver Spurious Emissions



Plot 225. Receiver Spurious Emission, 30 MHz – 1 GHz



Plot 226. Receiver Spurious Emission, 1 GHz – 18 GHz

IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2607	SPECTRUM ANALYZER ESA-E	AGILENT/HP	E4407B	8/9/2011	8/9/2012
1S2691	DUAL-LINE V-LISN	TESEQ	NNB-51	3/31/2011	3/31/2012
1S2633	TRANSIENT LIMITER	FISCHER CUSTOM COMMUNICATIONS INC.	FCC-450B-2.4-N	2/18/2011	2/18/2012
1S2399	TURNTABLE CONTROLLER	SUNOL SCIENCE	SC99V	NO CALIBRATION REQUIRED	
1S2501	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU40	06/09/2011	06/09/2012
1S2482	5 METER CHAMBER	PANASHIELD	641431	11/13/2010	11/13/2011
1S2460	SPECTRUM ANALYZER	AGILENT	E4407B	7/12/2011	7/12/2012
1S2583	SPECTRUM ANALYZER	AGILENT/HP	E4447A	3/18/2011	3/18/2012
1S2600	BILOG ANTENNA	TESEQ	CBL6112D	4/14/2010	4/14/2013
1S2501	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU40	06/09/2011	06/09/2012
1S2198	HORN ANTENNA	EMCO	3115	9/29/2011	9/29/2012
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13147	SEE NOTE	
1S2521	THERMO-HYGROMETER	FISHER SCIENTIFIC	11-661-7D	12/2/2009	12/2/2011
1S2523	PREAMP (1-26.5GHZ)	AGILENT	8449B	SEE NOTE	

Table 24. 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.

ICES-003 Procedural & Labeling Requirements

From the Industry Canada Electromagnetic Compatibility Advisory Bulletin entitled, "Implementation and Interpretation of the Interference-Causing Equipment Standard for Digital Apparatus, ICES-003" (EMCAB-3, Issue 2, July 1995):

"At present, CISPR 22: 2002 and ICES technical requirements are essentially equivalent. Therefore, if you have CISPR 22: 2002 approval by meeting CISPR Publication 22, the only additional requirements are: to attach a note to the report of the test results for compliance, indicating that these results are deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations; to maintain these records on file for the requisite five year period; and to provide the device with a notice of compliance in accordance with ICES-003."

Procedural Requirements:

According to Industry Canada's Interference Causing Equipment Standard for Digital Apparatus ICES-003 Issue 4, February 2004:

- Section 6.1: A record of the measurements and results, showing the date that the measurements were completed, shall be retained by the manufacturer or importer for a period of at least five years from the date shown in the record and made available for examination on the request of the Minister.
- Section 6.2: A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other constraints it is not feasible to affix a label to the apparatus, the notice may be in the form of a statement in the user's manual.

Labeling Requirements:

The suggested text for the notice, in English and in French, is provided below, from the Annex of ICES-003:

This Class [²] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [¹] est conforme à la norme NMB-003 du Canada.

² Insert either A or B but not both as appropriate for the equipment requirements.

End of Report