MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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March 1, 2010

Ubiquiti Networks
91 E. Tasman
San Jose, CA 95134

Dear Robert Pera,

Enclosed is the EMC Wireless test report for compliance testing of the Ubiquiti Networks, B2L 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 7, June 2007 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 Sanchez
Documentation Department

Reference: (\Ubiquiti Networks\EMCS82103-FCC247_Rev2)

Electromagnetic Compatibility Criteria
Test Report

for the

Ubiquiti Networks
B2L

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 7, June 2007
for Intentional Radiators

MET Report: EMCS82103-FCC247_Rev2

March 1, 2010

Prepared For:

Ubiquiti Networks
91 E. Tasman
San Jose, CA 95134

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

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for Intentional Radiators

Anderson Soungpanya, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Sanchez
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 7, June 2007 under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	January 28, 2010	Initial Issue.
1	February 5, 2010	Final Issue
2	February 9, 2010	Revised RF Output Power & Spectral Density Procedures
3	March 1, 2010	Revision 2 – Add Omni Antenna

Table of Contents

List of Tables

List of Plots

List of Figures

List of Photographs

List of Terms and Abbreviations

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

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Ubiquiti Networks B2L, 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 B2L. Ubiquiti Networks should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the B2L, 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, purchase order number US090038. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference 47 CFR Part 15.247:2005	**IC Reference** RSS-210 Issue 7: 2007	**Description**	**Compliance**
47 CFR Part 15.107 (a)	RSS-210 Issue 7: 2007	Conducted Emission Limits for a Class A Digital Device	Compliant
47 CFR Part 15.109 (a)	RSS-210 Issue 7: 2007	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-210(7.2.2)	Conducted Emission Voltage	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(1)	RSS-210(A8.1)	Occupied Bandwidth	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	RSS-210(A8.4)	RF Output Power	Compliant
Title 47 of the CFR, Part 15 §15.209, §15.247(d)	RSS-210(A8.5)	Radiated Spurious Emissions	Compliant
Title 47 of the CFR, Part 15 §15.205	RSS-210(A8.5)	Emissions at Restricted Band	Compliant
Title 47 of the CFR, Part 15 §15.209, §15.247(d)	RSS-210(A8.5)	Conducted Spurious Emissions	Compliant
Title 47 of the CFR, Part 15; §15.247(e)	RSS-210(A8.3)	Power Spectral Density	Compliant
Title 47 of the CFR, Part 15 §15.247(i)	RSS-Gen(5.5)	Maximum Permissible Exposure	Compliant
N/A	RSS-Gen(4.8)	Receiver Spurious Emissions	Compliant

Table 1. Executive Summary of EMC Part 15.247 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Ubiquiti Networks to perform testing on the B2L, under Ubiquiti Networks's purchase order number US090038.

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, B2L.

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

Model(s) Tested:	B2L	
Model(s) Covered:	B2L	
EUT Specifications:	Primary Power: PoE, 15V, 0.5A	
	FCC ID: SWX-B2L IC: 6545A-B2L	
	Type of Modulations:	OFDM, DSSS
	Equipment Code:	DTS
	Peak RF Output Power:	29.96dBm (0.990W) Omni Antenna 17.93dBm (0.062W) Grid Antenna
	EUT Frequency Ranges:	2412-2462MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35º C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Anderson Soungpanya & Minh Ly	
Report Date(s):	February 9, 2010	

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
RSS-210, Issue 7, June 2007	Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
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

Table 3. References

C. Test Site

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

Radiated Emissions measurements were performed in a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Description of Test Sample

The Ubiquiti Networks B2L, Equipment Under Test (EUT), is a high performance 802.11b/g outdoor point to point Radio specifically designed for optimized performance at 2.4GHz.

Photograph 1. Ubiquiti Networks, Model B2L

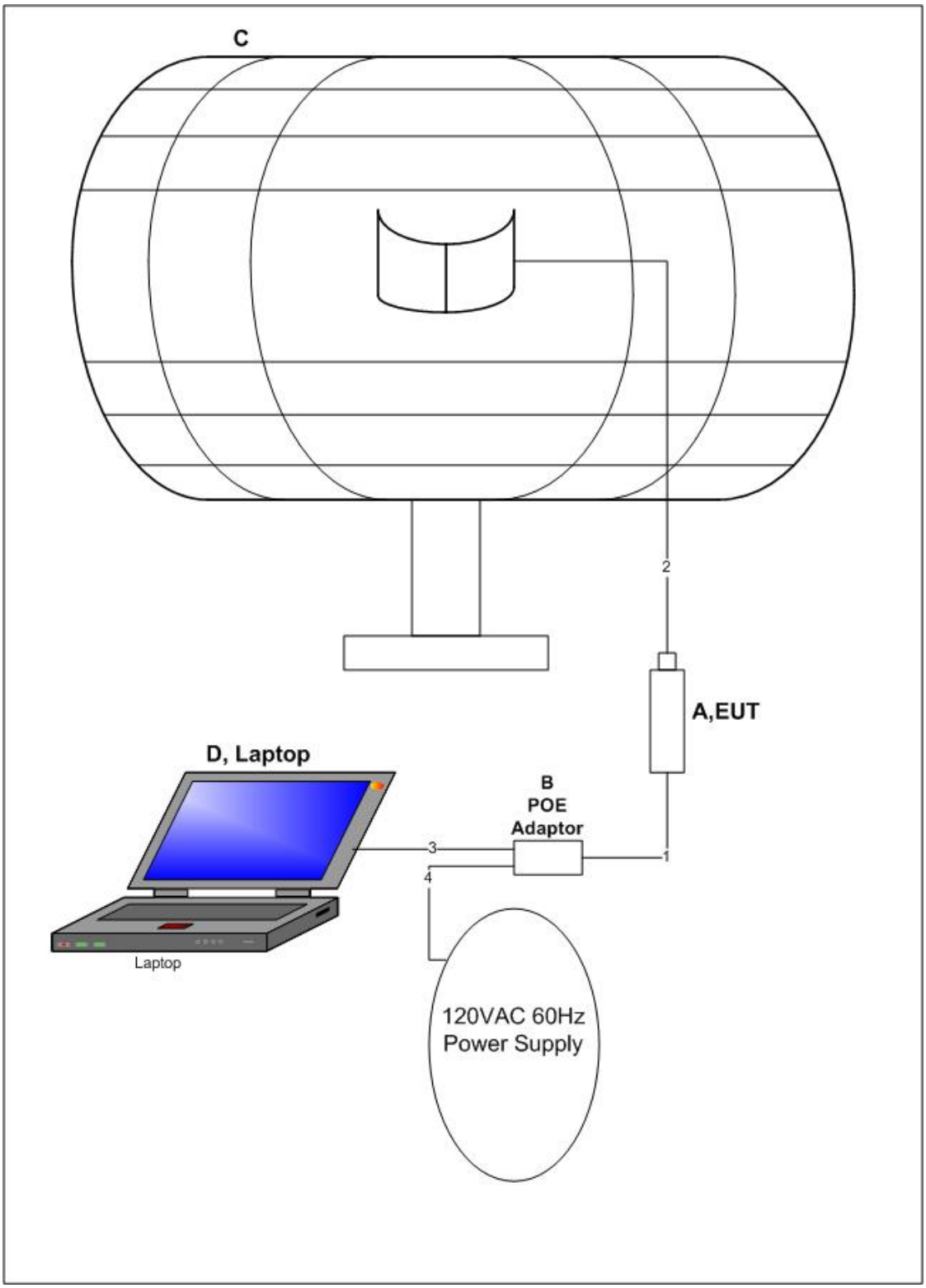


Figure 1. Block Diagram of Test Configuration (24dBi Grid Antenna)

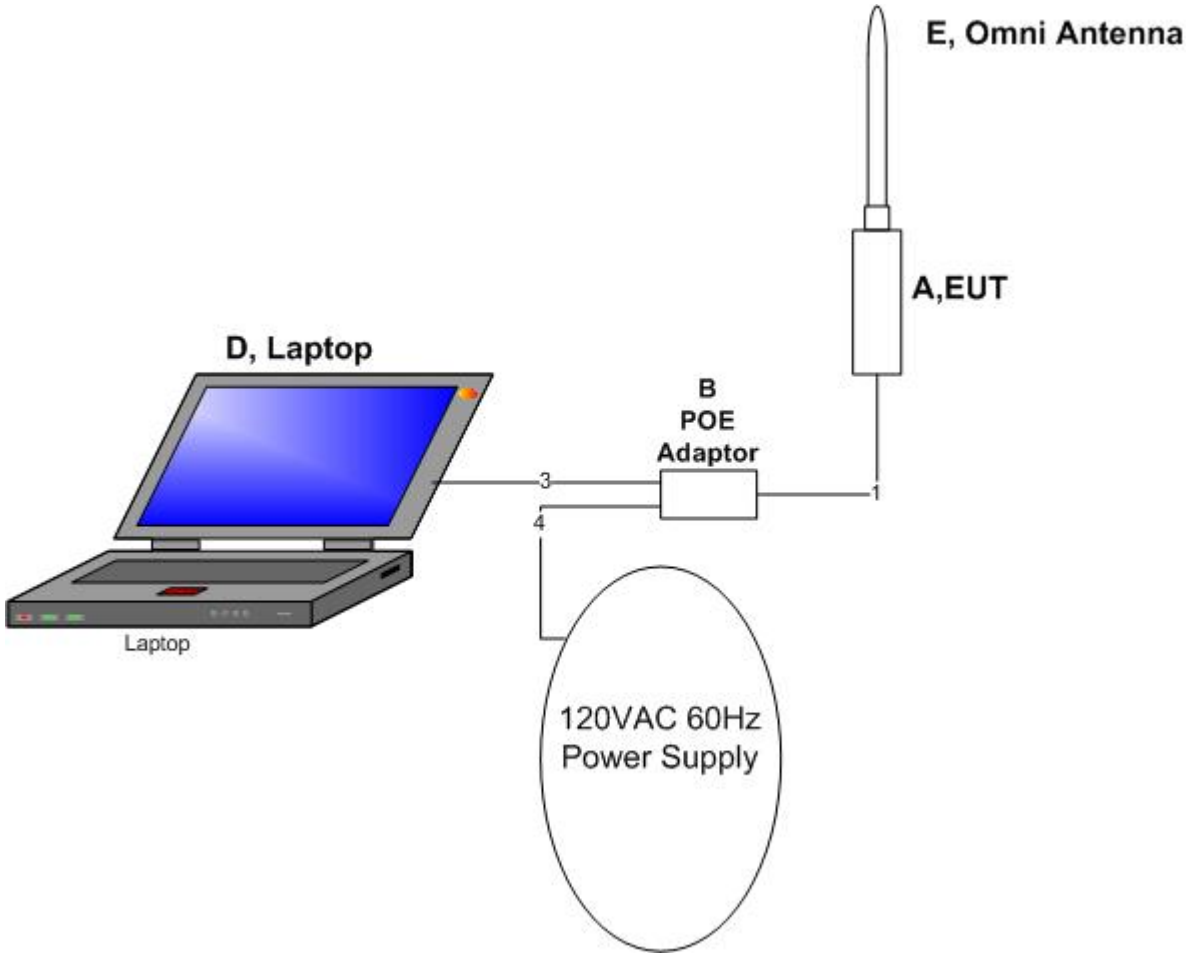


Figure 2. Block Diagram of Test Configuration (6dBi Omni Antenna)

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	Serial Number
A	B2L	B2L	00156DF0607B
B	Power Supply (POE)	UBI-POE-15-8	0908-0012285
C	24dBi Grid	ANT2400D24A	080627554
E	6dBi Omni	O-2G-6	-

Table 4. Equipment Configuration

E. 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
D	Laptop	Dell	Vostro 1510

Table 5. Support Equipment

F. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded (Y/N)	Termination Box ID & Port Name
1	A,EUT	CAT 5E	1	1	Y	B, POE
2	A,EUT	RF Cable from Antenna	1	0.5	N	C or E
3	B	CAT 5E	1	1	Y	D
4	B	Power Cable	1	.5	N	120VAC Power Supply

Table 6. Ports and Cabling Information

Mode of Operation

The EUT operates in OFDM & DSSS modes.

G. Method of Monitoring EUT Operation

A Spectrum Analyzer and a Power Meter was use to monitor the EUT's transmitter channel and power output.

H. 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.

I. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Ubiquiti Networks 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 µH/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 (dBµV)		*Class B Conducted Limits (dBµV)	
	Quasi-Peak	Average	Quasi-Peak	Average
* 0.15- 0.45	79	66	66 – 56	56 – 46
0.45 – 0.5	79	66	56	46
0.5 – 30	73	60	60	50
Note 1 — The lower limit shall apply at the transition frequencies. 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.

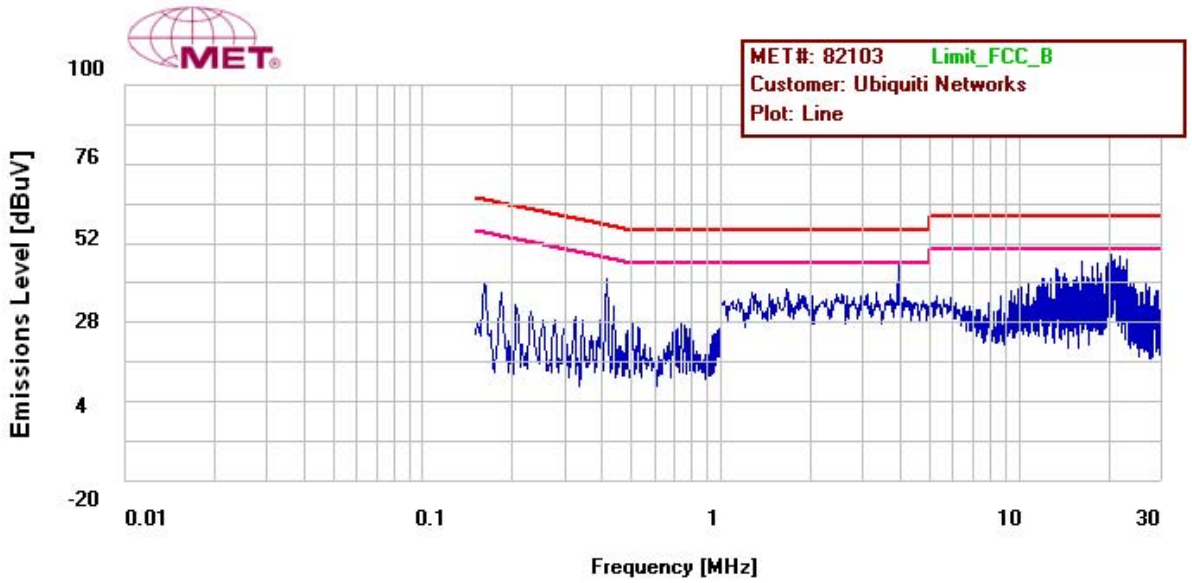
Test Engineer(s): Minh Ly

Test Date(s): 01/12/10

Conducted Emissions – Voltage, AC Power, Phase Line (120V/60Hz)

Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
0.414	40.55	57.591	-17.041	Pass	35.8	47.591	-11.791	Pass
3.92	33.21	56	-22.79	Pass	20.64	46	-25.36	Pass
20.26	47.65	60	-12.35	Pass	41.52	50	-8.48	Pass

Table 8. Conducted Emissions – Voltage, AC Power, Phase Line (120V/60Hz)

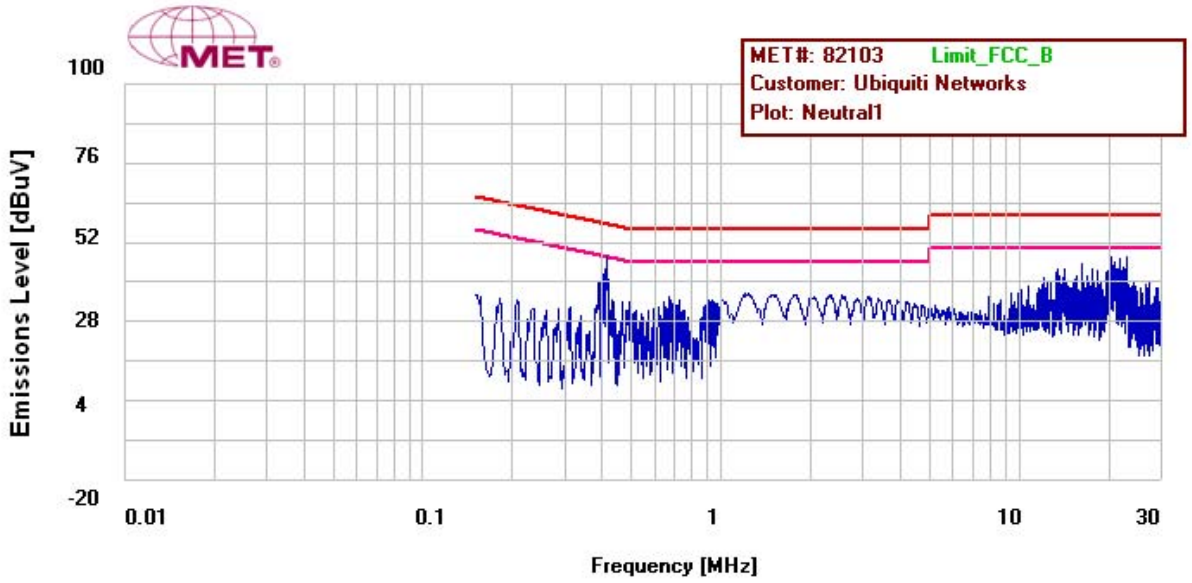


Plot 1. Conducted Emission, Phase Line Plot

Conducted Emissions – Voltage, AC Power, Neutral Line (120V/60Hz)

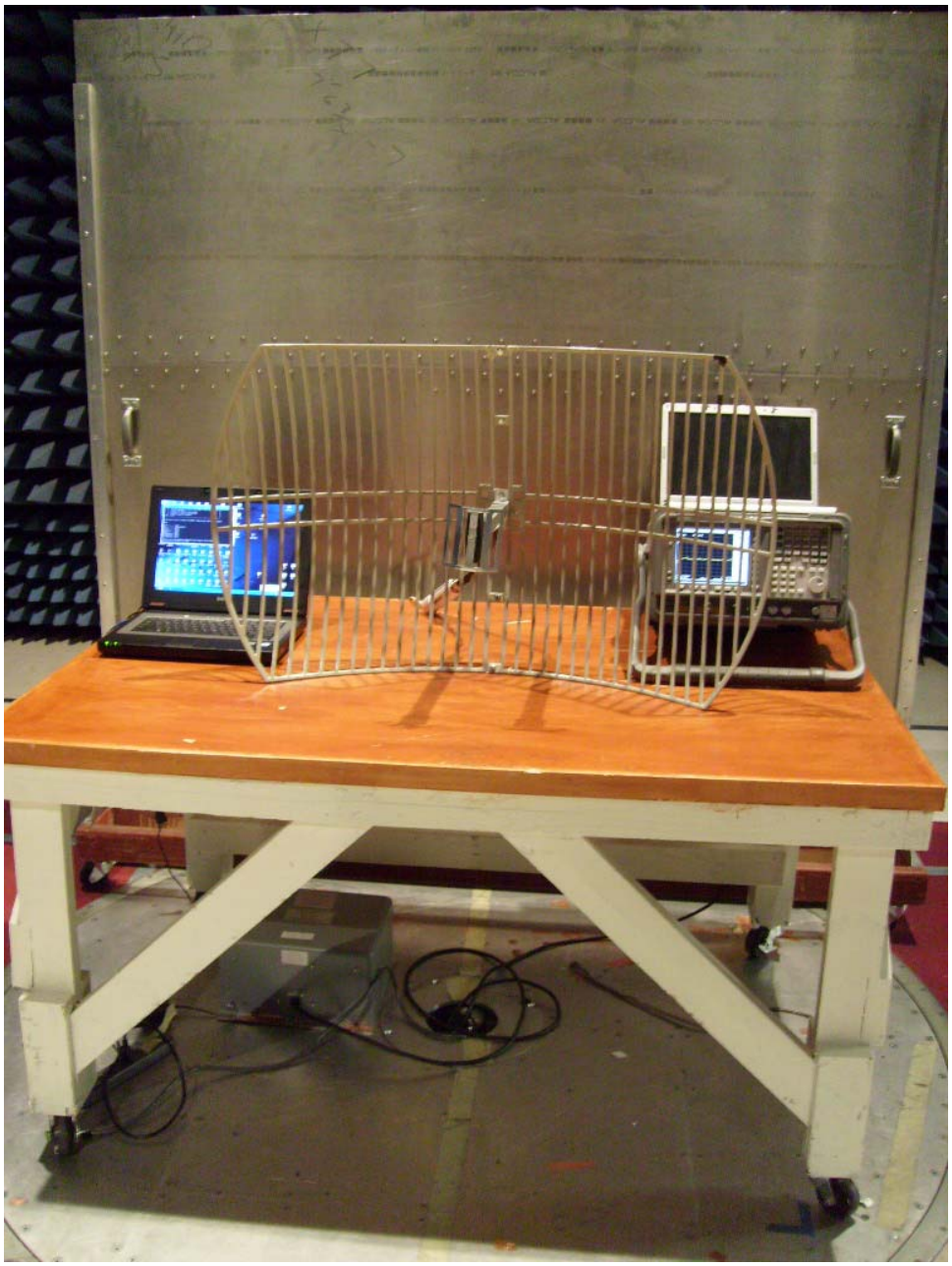
Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
0.414	47.01	57.591	-10.581	Pass	42.94	47.591	-4.651	Pass
16.23	44.83	60	-15.17	Pass	41.51	50	-8.49	Pass
20.26	46.4	60	-13.6	Pass	41.22	50	-8.78	Pass

Table 9. Conducted Emissions – Voltage, AC Power, Neutral Line (120V/60Hz)



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 3m 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.

Test Engineer(s): Minh Ly

Test Date(s): 1/12/10

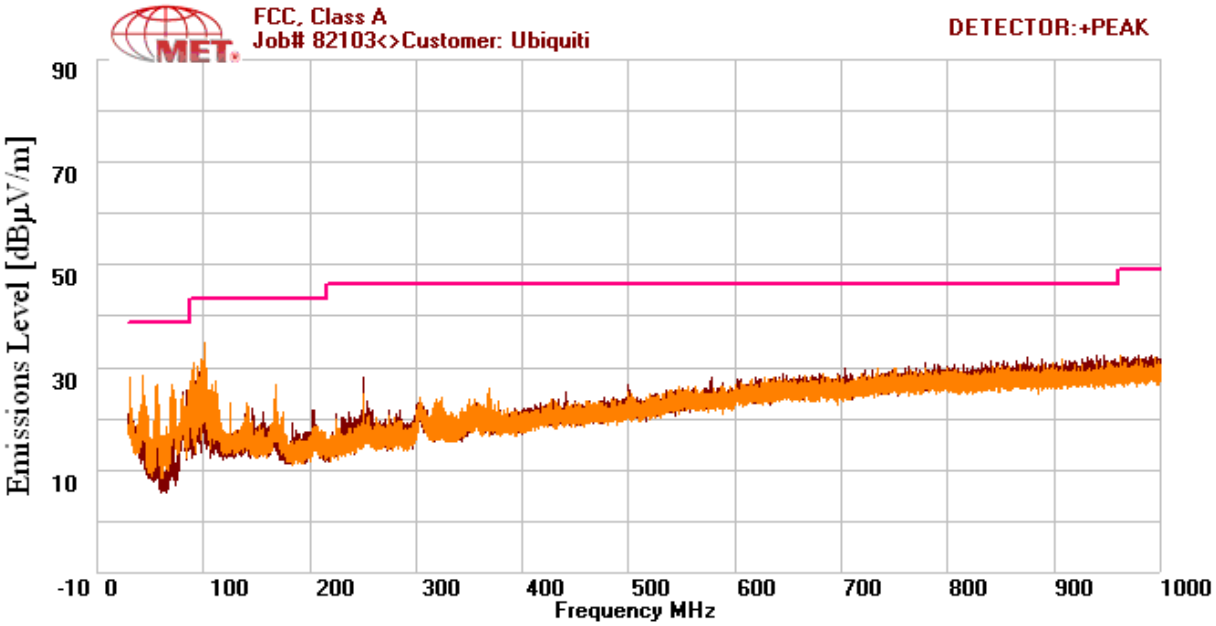
Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBµV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBµV)	Limit (dBµV)	Margin (dB)
30.64	V	262	99.94	22.415	17.38	0	1.268	-10.46	30.603	39	-8.397
43.8	V	188	100	27.03	10.08	0	1.643	-10.46	28.293	39	-10.707
56.56	V	359	100	26.98	7.2	0	1.949	-10.46	25.669	39	-13.331
98.42	H	81	169	29.35	10.784	0	2.816	-10.46	32.49	43.5	-11.01
101.89	V	234	100	29.95	12.7	0	2.87	-10.46	35.06	43.5	-8.44
101.89	V	231	100	29.89	12.7	0	2.87	-10.46	35	43.5	-8.5
2000	V	0	100	64.68	30.988	75.27	10.43	-10.46	20.368	49.5	-29.132
2000	H	0	100	65.62	30.988	75.27	10.43	-10.46	21.308	49.5	-28.192

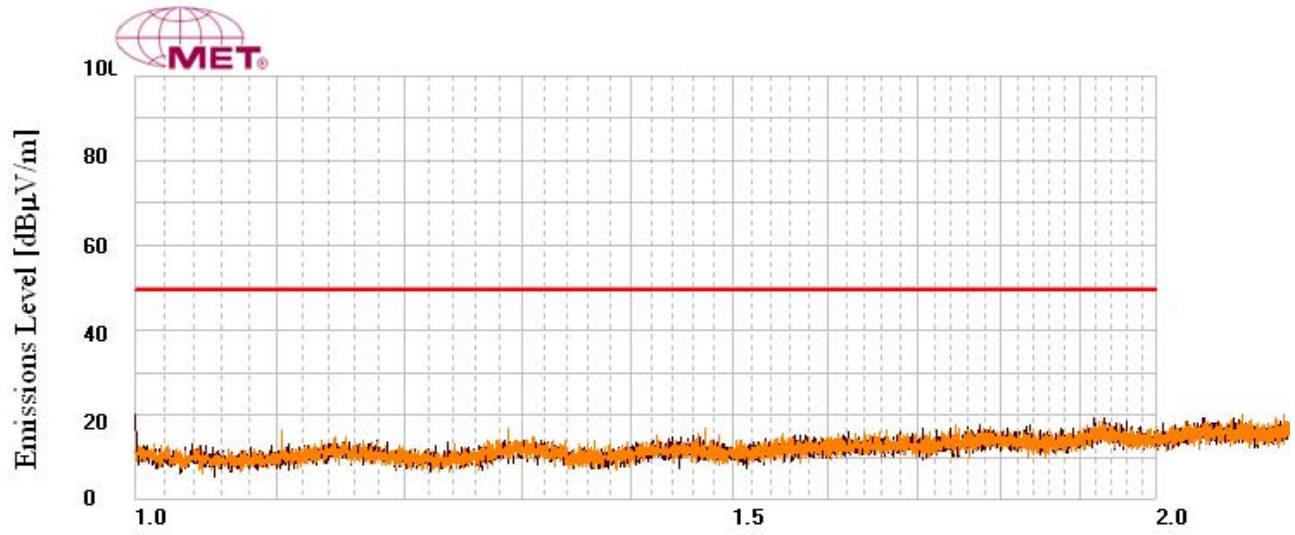
Table 11. Radiated Emissions Limits, Test Results, FCC Limits

Note 1: The EUT was tested at 3 m.

Radiated Emissions Limits Test Results, Class A



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



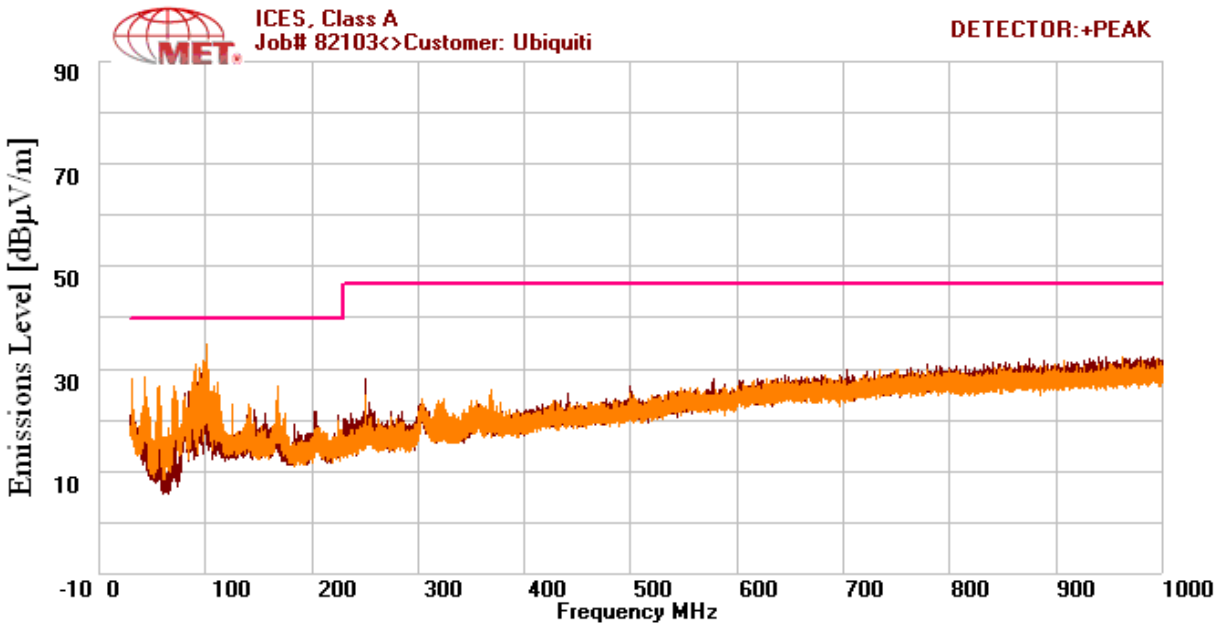
Plot 4. Radiated Emissions, above 1GHz FCC Limits

Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBµV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBµV)	Limit (dBµV)	Margin (dB)
101.89	V	234	100	29.95	12.7	0	2.87	-10.46	35.06	40	-4.94
30.64	V	262	99.94	22.415	17.38	0	1.268	-10.46	30.603	40	-9.397
43.8	V	188	100	27.03	10.08	0	1.643	-10.46	28.293	40	-11.707
56.56	V	359	100	26.98	7.2	0	1.949	-10.46	25.669	40	-14.331
101.89	V	231	100	29.89	12.7	0	2.87	-10.46	35	40	-5
98.42	H	81	169	29.35	10.784	0	2.816	-10.46	32.49	40	-7.51

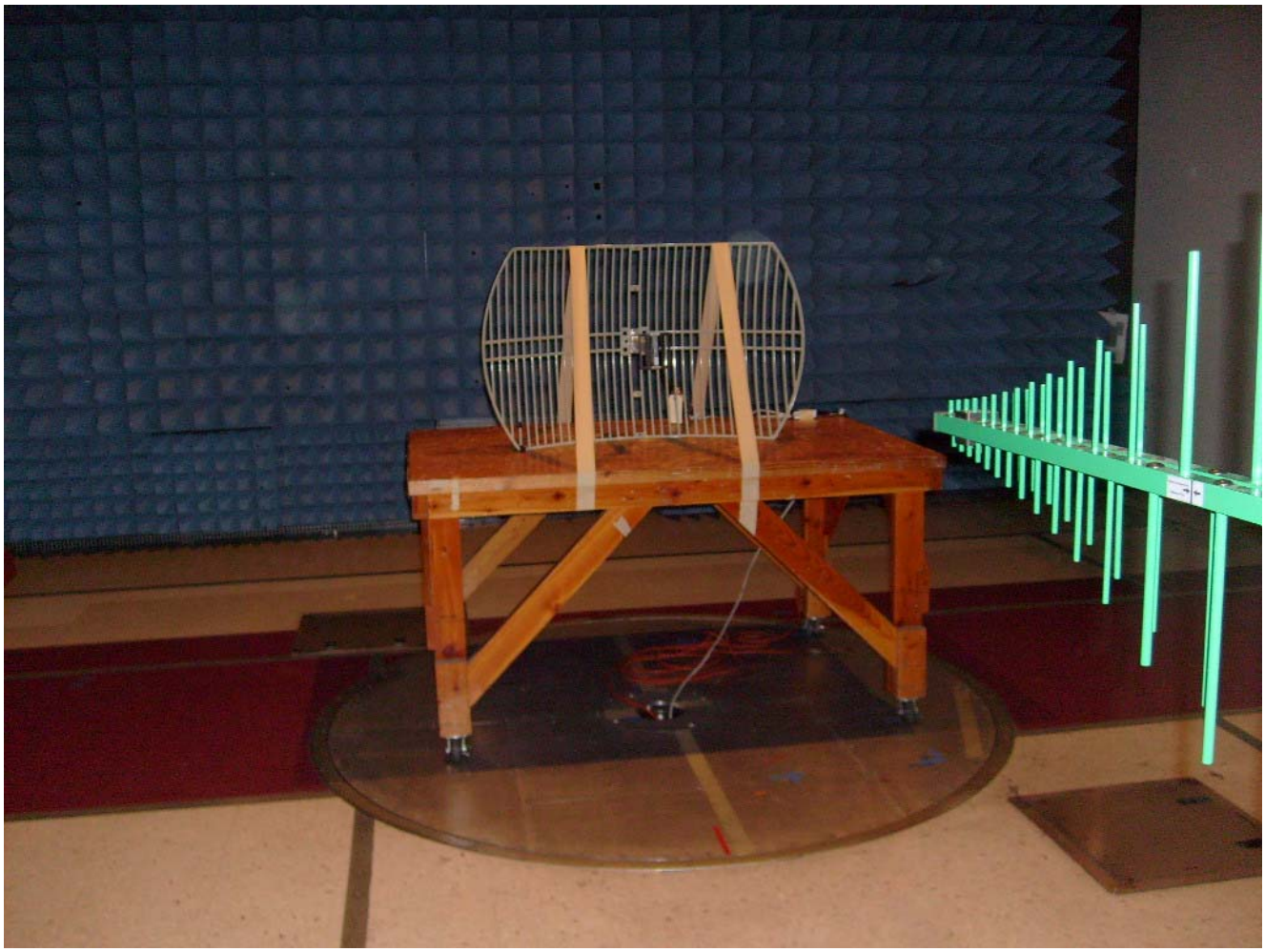
Table 12. Radiated Emissions Limits, Test Results, ICES-003 Limits

Note 1: The EUT was tested at 3 m.



Plot 5. Radiated Emissions, 30MHz – 1GHz, ICES-003 Limits

Radiated Emission Limits Test Setup



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

Radiated Emission Limits Test Setup

Photograph 4. Radiated Emission, above 1GHz Test Setup

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

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

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

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

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

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

Results: The EUT as tested is compliant the criteria of §15.203 by virtue of criteria C.

Test Engineer(s): Anderson Soungpanya

Test Date(s): 01/12/10

Gain	Type	Model	Manufacturer
24dBi	Grid	AG-2G-24	Ubiquiti Networks
6dBi	Omni	O-2G-6	Ubiquiti Networks

Table 13. Antenna List

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207 Conducted Emissions Limits

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

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

Table 14. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

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

Test Results: The EUT was compliant with this requirement.

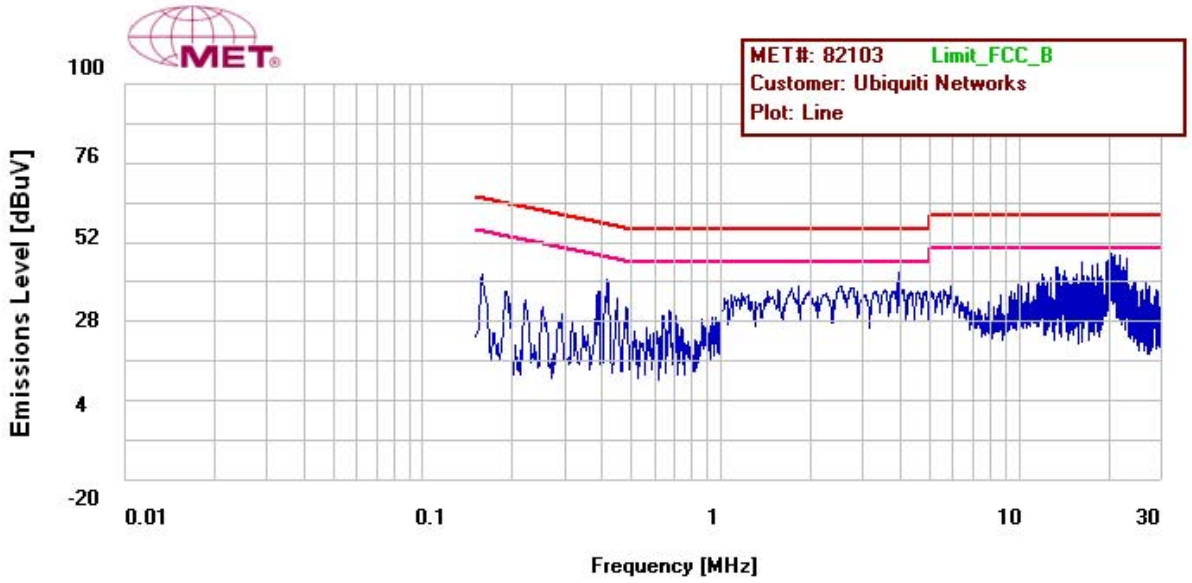
Test Engineer(s): Minh Ly

Test Date(s): 01/12/10

15.207 Conducted Emissions Test Results

Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
0.416	40.5	57.551	-17.051	Pass	34.23	47.551	-13.321	Pass
3.93	28.34	56	-27.66	Pass	12.75	46	-33.25	Pass
20.26	47.68	60	-12.32	Pass	41.72	50	-8.28	Pass

Table 15. Conducted Emissions, 15.207, Phase Line, Test Results

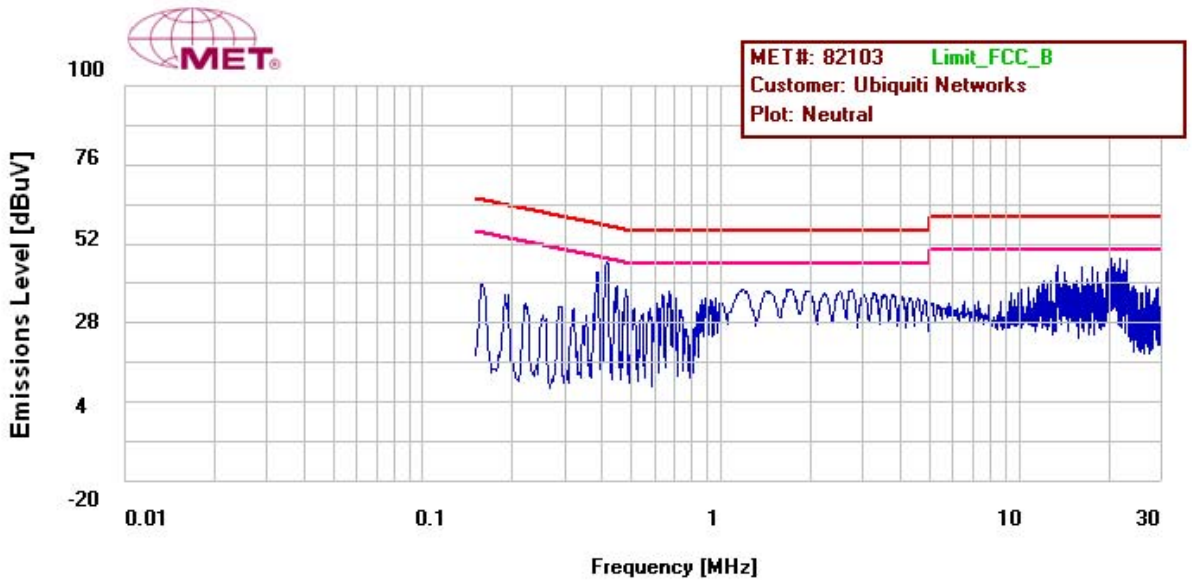


Plot 6. Conducted Emissions, Phase Line

15.207 Conducted Emissions Test Results

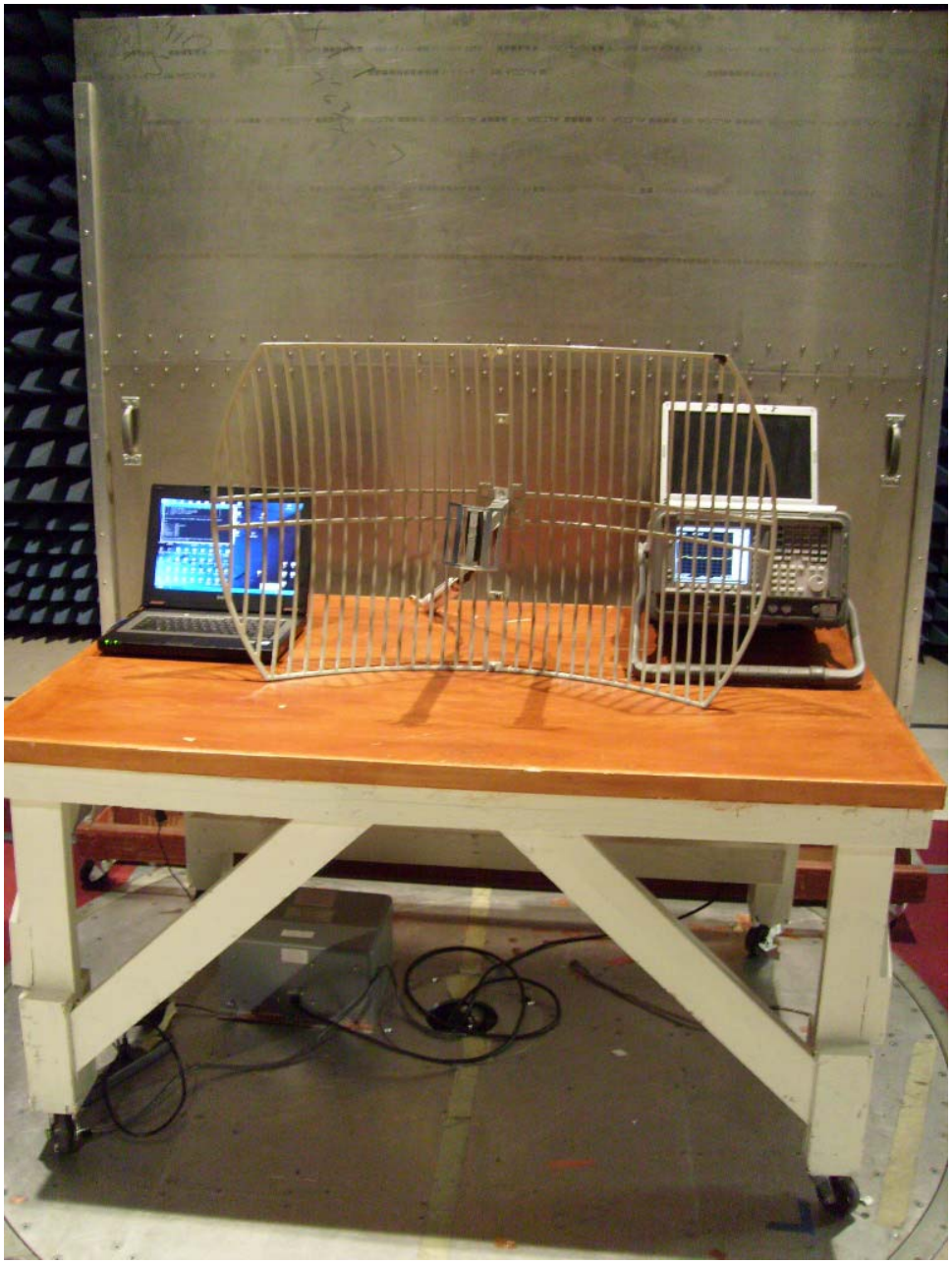
Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
0.413	46.31	57.611	-11.301	Pass	42.47	47.611	-5.141	Pass
21.66	46.6	60	-13.4	Pass	43.27	50	-6.73	Pass
21.91	44.17	60	-15.83	Pass	41.04	50	-8.96	Pass

Table 16. Conducted Emissions, 15.207, Neutral Line, Test Results



Plot 7. Conducted Emissions, Neutral Line,

15.207 Conducted Emissions Test Setup Photograph



Photograph 5. Conducted Emissions, 15.207, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a) 6 dB and 99% Bandwidth

Test Requirements: **§ 15.247(a):** 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).

The 6 dB and 99% Bandwidth was determined from the plots on the following pages.

Test Engineer(s): Anderson Soungpanya & Minh Ly

Test Date(s): 01/12/10 & 2/19/10

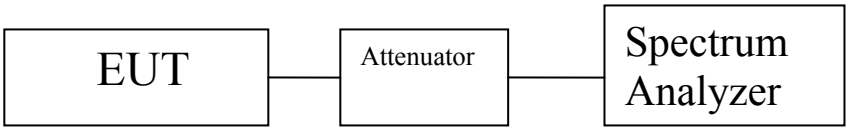


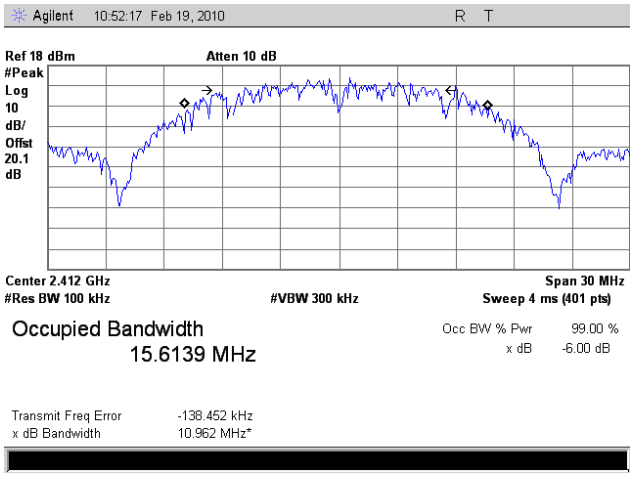
Figure 3. Block Diagram, Occupied Bandwidth Test Setup

Occupied Bandwidth Test Results

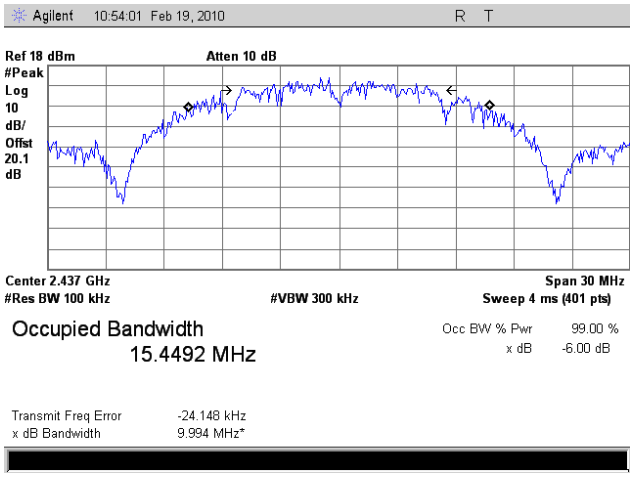
Occupied Bandwidth 802.11b Mode			
Carrier Channel	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**	**Measured 99% Bandwidth (MHz)**
Low	2412	10.96	15.92
Mid	2437	9.99	15.73
High	2462	9.84	15.97
Occupied Bandwidth 802.11g Mode			
Carrier Channel	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**	**Measured 99% Bandwidth (MHz)**
Low	2412	16.16	16.53
Mid	2437	16.25	16.56
High	2462	16.39	16.62

Table 17. Occupied Bandwidth Test Results, 802.11b/g Modes

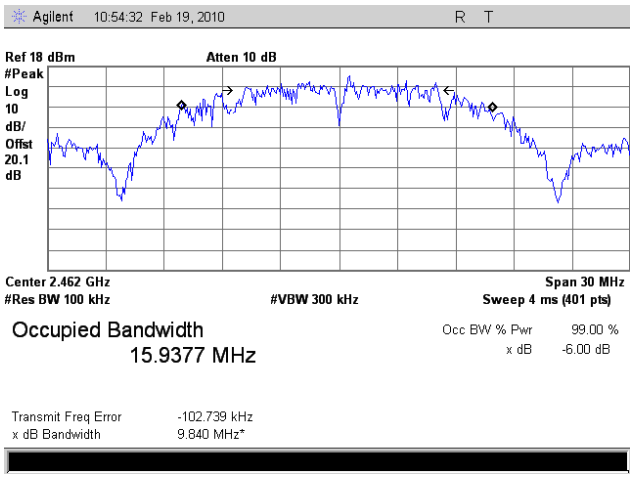
Occupied Bandwidth Test Results – 802.11b Mode



Plot 8. 6 dB Occupied Band Width, 802.11b Mode , Low Channel

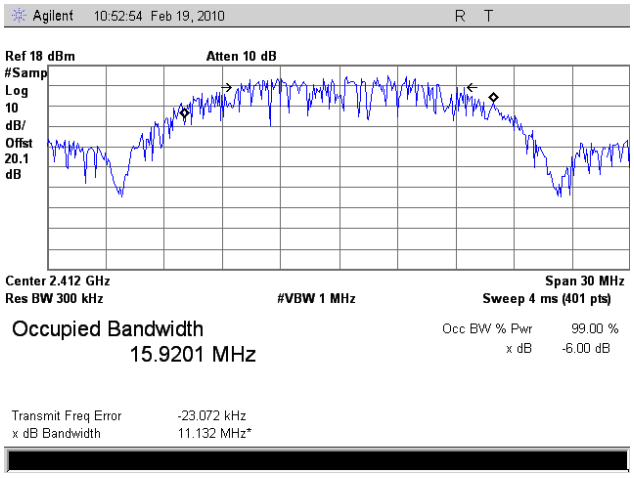


Plot 9. 6 dB Occupied Band Width, 802.11b Mode, Mid Channel

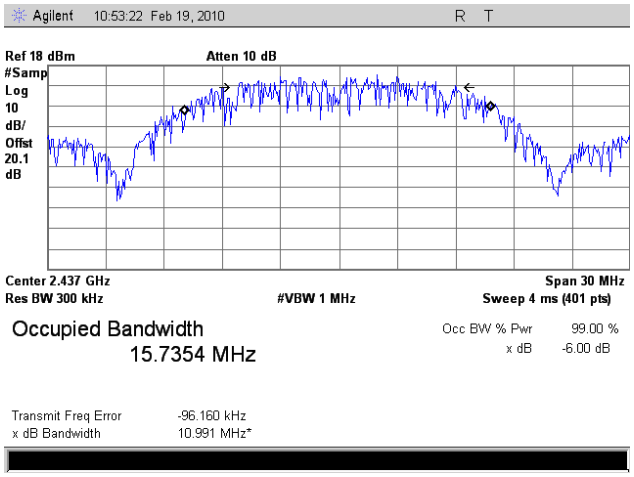


Plot 10. 6 dB Occupied Band Width, 802.11b Mode, High Channel

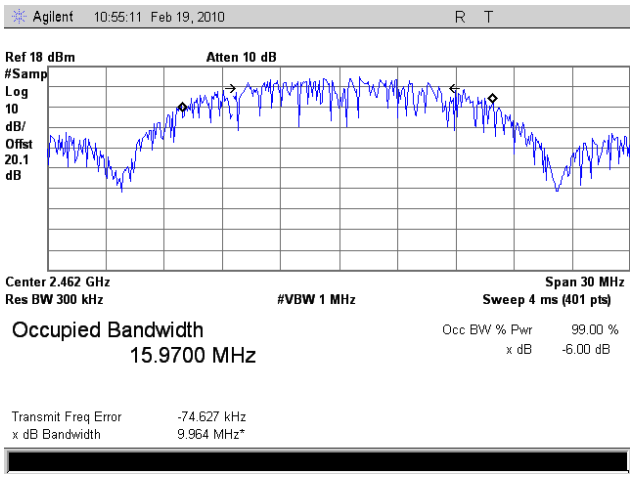
Occupied Bandwidth Test Results – 802.11b Mode



Plot 11. 99 %Occupied Band Width, 802.11b Mode, Low Channel

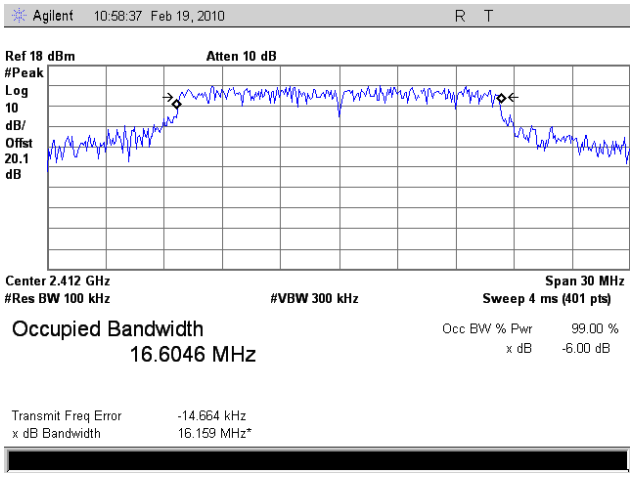


Plot 12. 99%Occupied Band Width, 802.11b Mode, Mid Channel

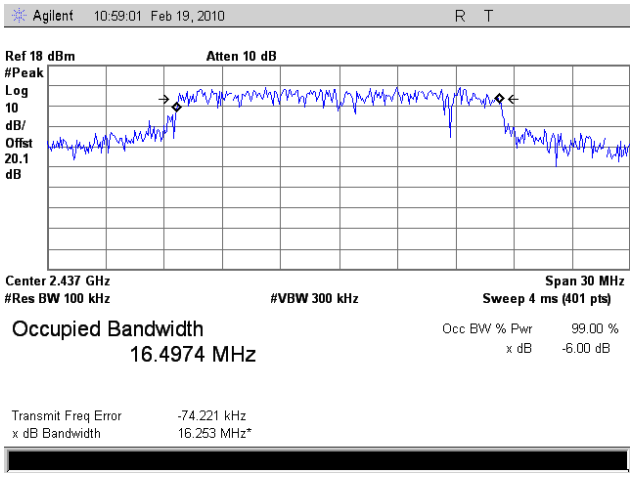


Plot 13. 99 % Occupied Band Width, 802.11b Mode, High Channel

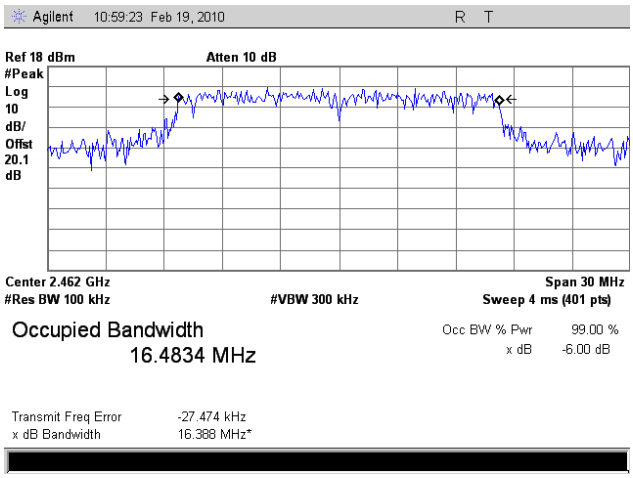
Occupied Bandwidth Test Results – 802.11g Mode



Plot 14. 6 dB Occupied Band Width, 802.11g Mode , Low Channel

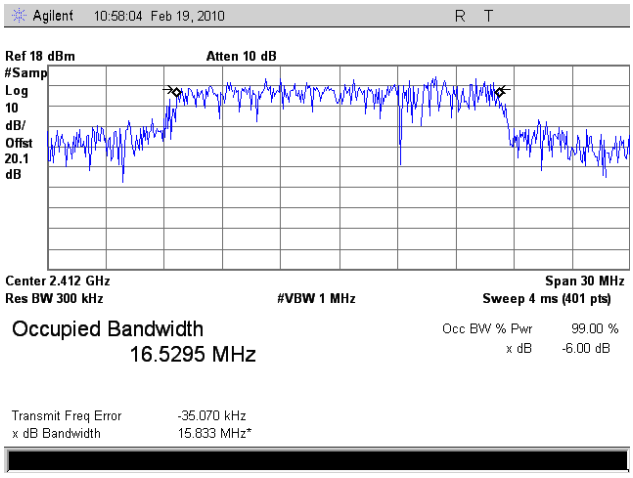


Plot 15. 6 dB Occupied Band Width, 802.11g Mode, Mid Channel

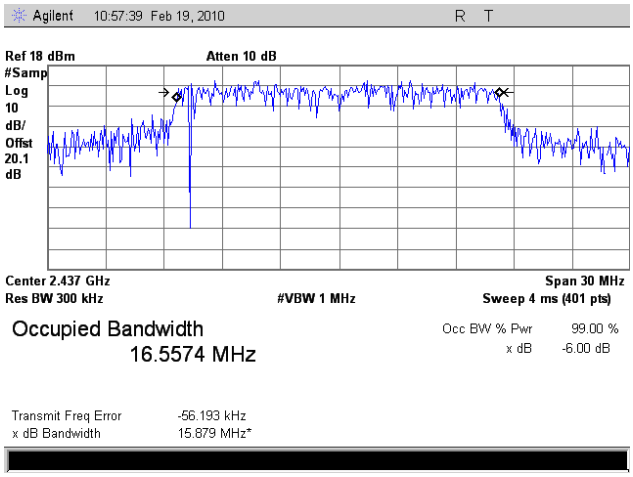


Plot 16. 6 dB Occupied Band Width, 802.11g Mode, High Channel

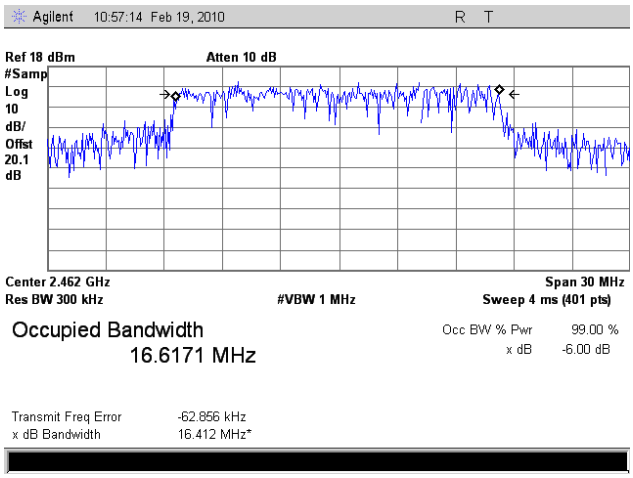
Occupied Bandwidth Test Results – 802.11g Mode



Plot 17. 99 %Occupied Band Width, 802.11g Mode, Low Channel



Plot 18. 99%Occupied Band Width, 802.11g Mode, Mid Channel



Plot 19. 99 % Occupied Band Width, 802.11g Mode, High Channel

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output and RF Exposure

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

§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.

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. Since the EUT is deploying a point to point system with a 24 dBi Grid Antenna the peak output power limit was reduced in accordance to §15.247(c) to 24 dBm when the 24 dBi Grid Antenna.

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

Test Engineer(s): Anderson Soungpanya & Minh Ly

Test Date(s): 01/12/10 & 2/19/10

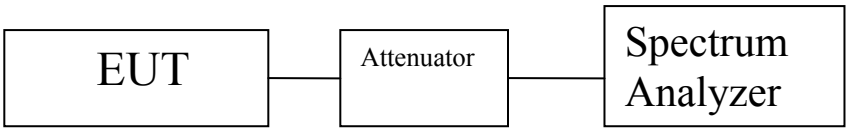


Figure 4. Block Diagram, Peak Power Output Test Setup

RF Output Power Test Results

802.11b Mode			
Carrier Channel	**Frequency (MHz)**	**Measured Peak Output Power (dBm)**	**Measured Peak Output Power (Watts)**
1	2412	23.54	0.225
2	2417	24.82	0.303
6	2437	26.59	0.456
10	2457	22.81	0.190
11	2462	22.38	0.172
802.11g Mode			
Carrier Channel	**Frequency (MHz)**	**Measured Peak Output Power (dBm)**	**Measured Peak Output Power (Watts)**
1	2412	25.40	0.346
2	2417	27.81	0.603
6	2437	29.96	0.990
10	2457	27.40	0.549
11	2462	23.59	0.228

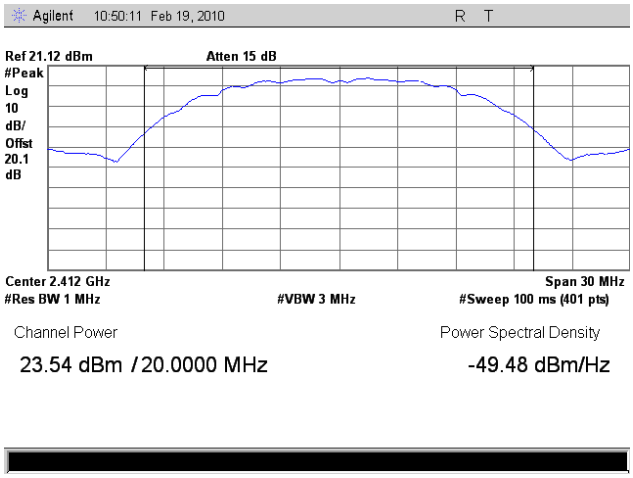
Table 19. RF Output Power Test Results, 802.11b/g Modes, 6dBi Omni Antenna

RF Output Power Test Results

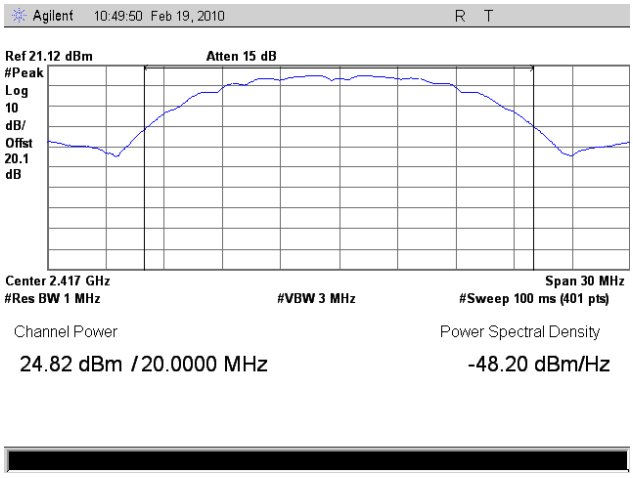
802.11b Mode			
Carrier Channel	**Frequency (MHz)**	**Measured Peak Output Power (dBm)**	**Measured Peak Output Power (Watts)**
1	2412	12.70	0.018
2	2417	15.13	0.032
3	2422	16.93	0.049
4	2427	16.87	0.048
5	2432	16.73	0.047
6	2437	16.62	0.045
7	2442	16.50	0.044
8	2447	16.39	0.043
9	2452	16.30	0.042
10	2457	13.41	0.021
11	2462	16.12	0.040
802.11g Mode			
Carrier Channel	**Frequency (MHz)**	**Measured Peak Output Power (dBm)**	**Measured Peak Output Power (Watts)**
1	2412	10.97	0.012
2	2417	16.20	0.041
3	2422	16.98	0.049
4	2427	17.93	0.062
5	2432	17.69	0.058
6	2437	17.54	0.056
7	2442	17.43	0.055
8	2447	17.20	0.052
9	2452	17.10	0.051
10	2457	17.04	0.050
11	2462	10.35	0.010

Table 20. RF Output Power Test Results, 802.11b/g Modes, 24dBi Grid Antenna

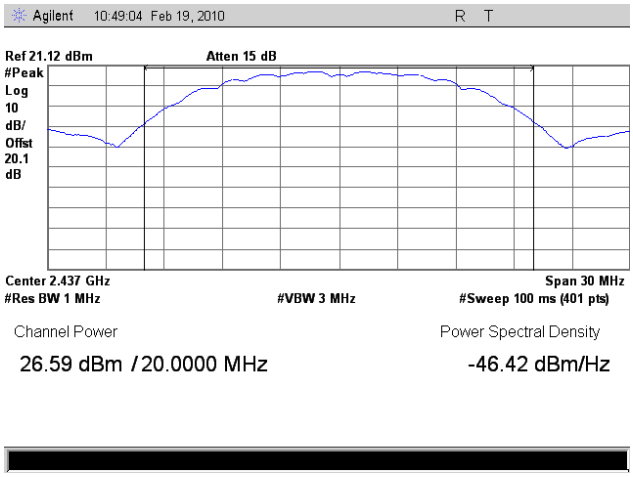
RF Output Power Test Results – 802.11bMode (6dBi Omni Antenna)



Plot 20. Peak Output Power, Channel 1, 802.11b Mode (6dBi Omni Antenna)

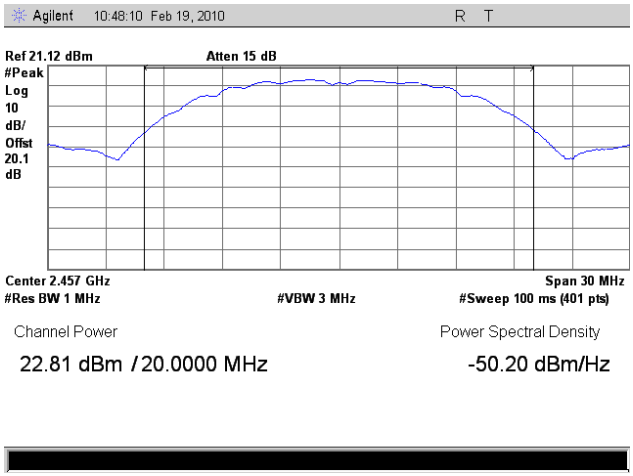


Plot 21. Peak Output Power, Channel 2, 802.11b Mode (6dBi Omni Antenna)

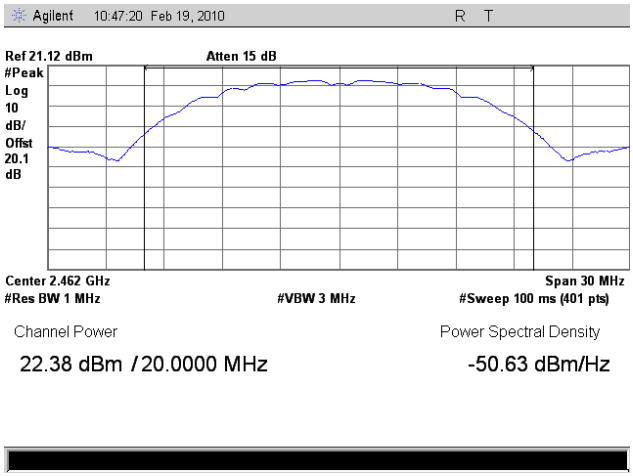


Plot 22. Peak Output Power, Channel 6, 802.11b Mode (6dBi Omni Antenna)

RF Output Power Test Results – 802.11bMode (6dBi Omni Antenna)

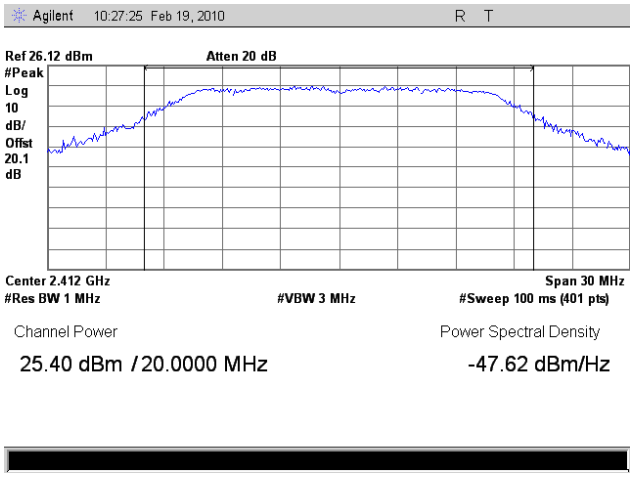


Plot 23. Peak Output Power, Channel 10, 802.11b Mode (6dBi Omni Antenna)

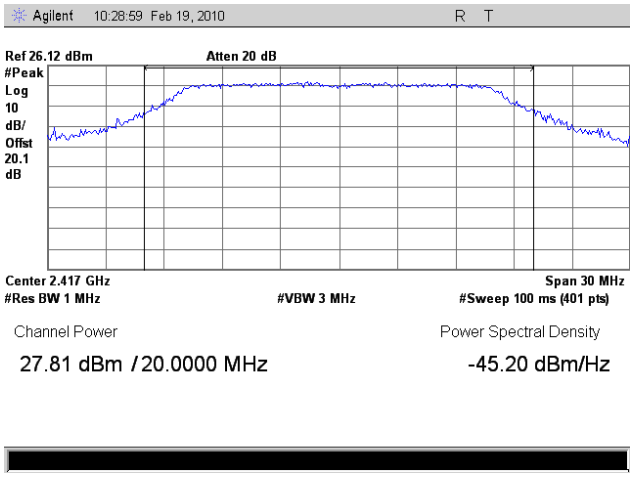


Plot 24. Peak Output Power, Channel 11, 802.11b Mode (6dBi Omni Antenna)

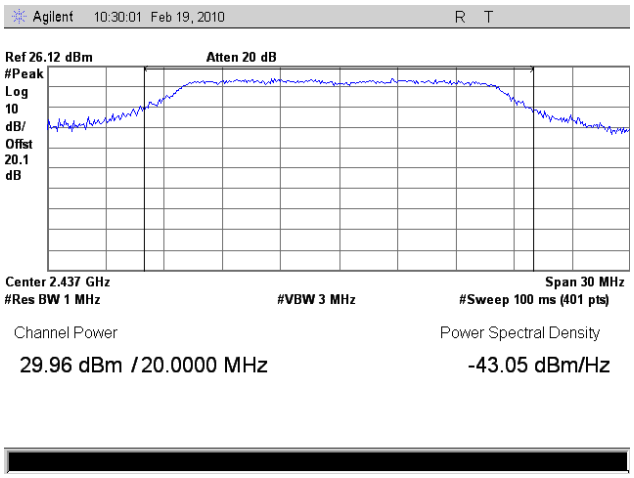
RF Output Power Test Results – 802.11gMode (6dBi Omni Antenna)



Plot 25. Peak Output Power, Channel 1, 802.11g Mode (6dBi Omni Antenna)

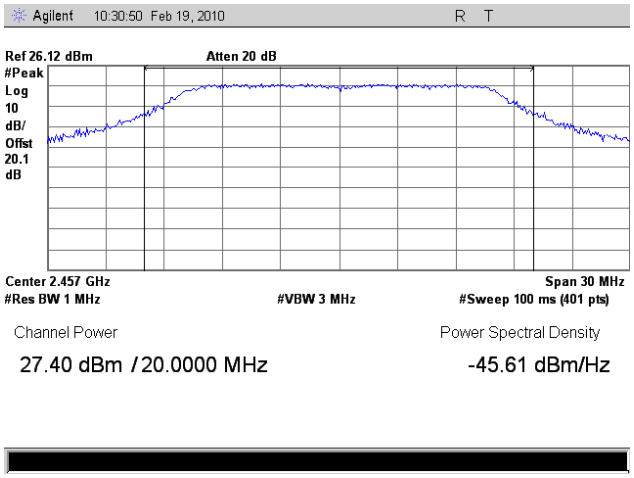


Plot 26. Peak Output Power, Channel 2, 802.11g Mode (6dBi Omni Antenna)

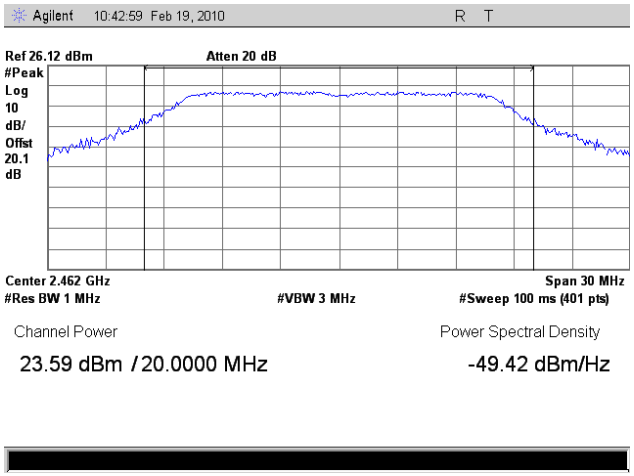


Plot 27. Peak Output Power, Channel 6, 802.11g Mode (6dBi Omni Antenna)

RF Output Power Test Results – 802.11gMode (6dBi Omni Antenna)

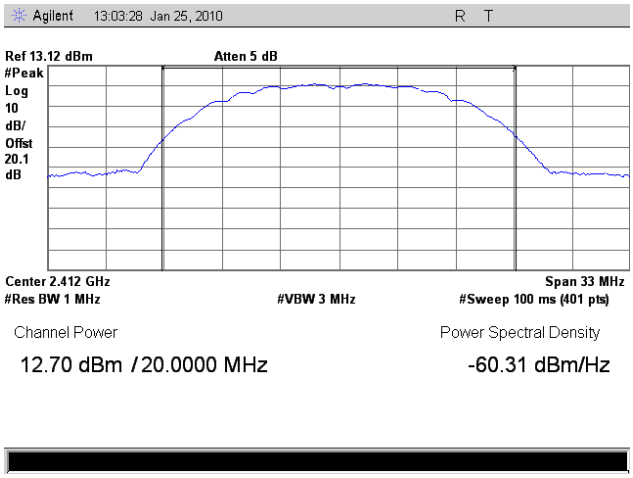


Plot 28. Peak Output Power, Channel 10, 802.11g Mode (6dBi Omni Antenna)

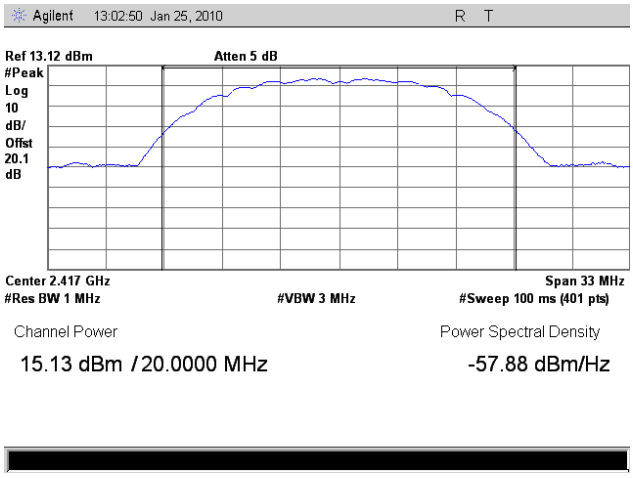


Plot 29. Peak Output Power, Channel 11, 802.11g Mode (6dBi Omni Antenna)

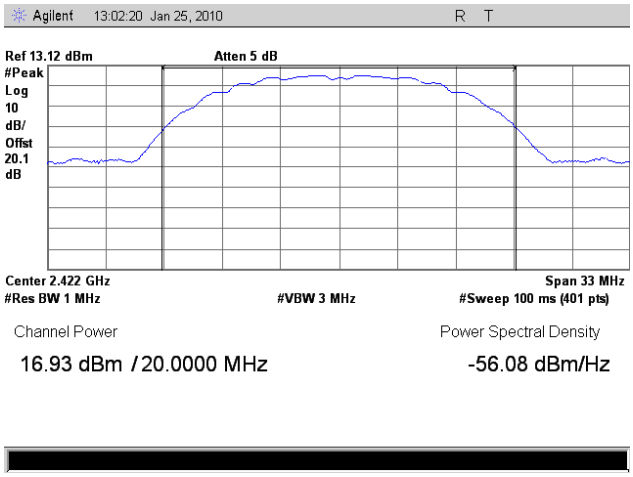
RF Output Power Test Results – 802.11bMode (24dBi Grid Antenna)



Plot 30. Peak Output Power, Channel 1, 802.11b Mode (24dBi Grid Antenna)

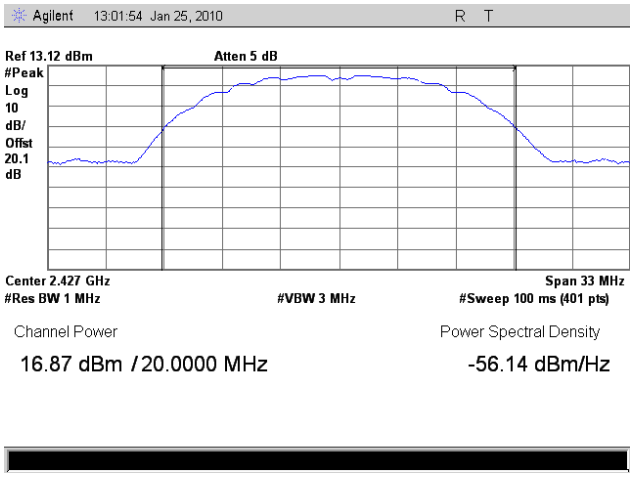


Plot 31. Peak Output Power, Channel 2, 802.11b Mode (24dBi Grid Antenna)

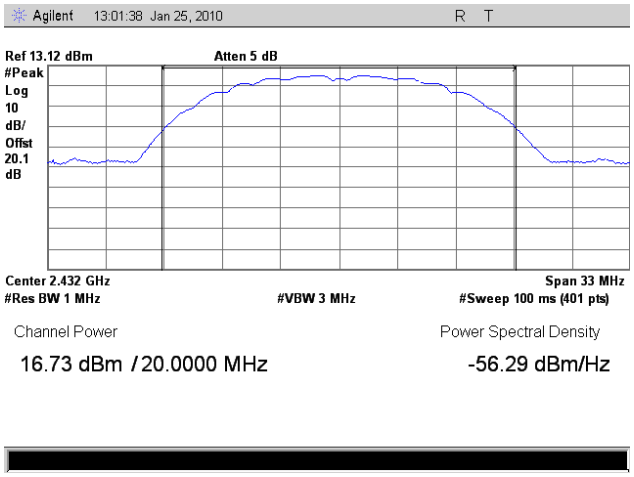


Plot 32. Peak Output Power, Channel 3, 802.11b Mode (24dBi Grid Antenna)

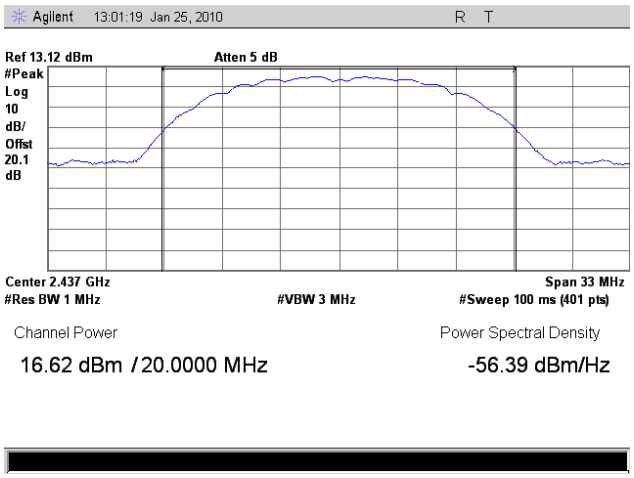
RF Output Power Test Results – 802.11bMode



Plot 33. Peak Output Power, Channel 4, 802.11b Mode (24dBi Grid Antenna)

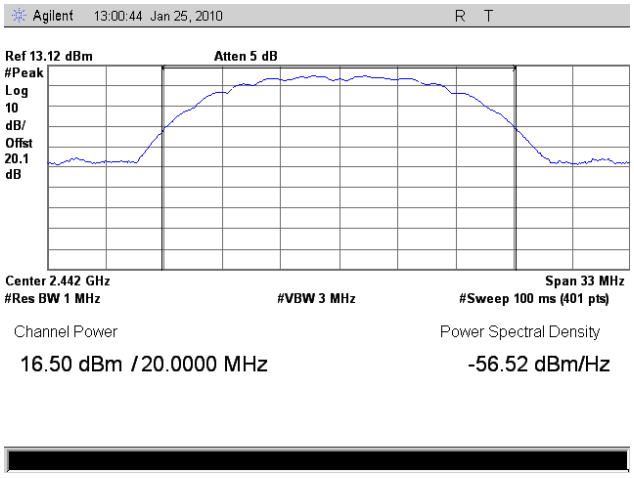


Plot 34. Peak Output Power, Channel 5, 802.11b Mode (24dBi Grid Antenna)

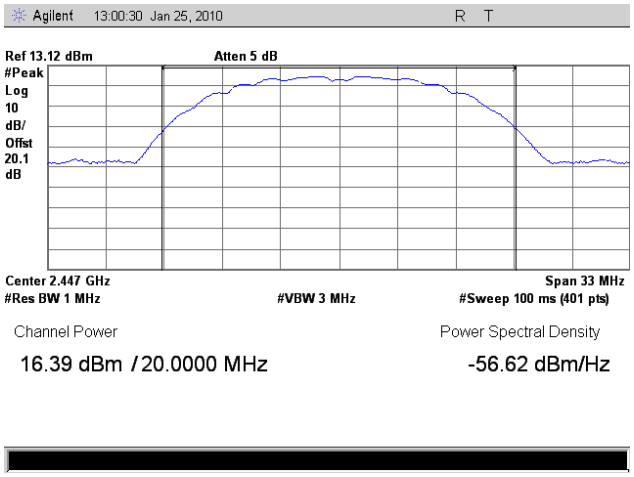


Plot 35. Peak Output Power, Channel 6, 802.11b Mode (24dBi Grid Antenna)

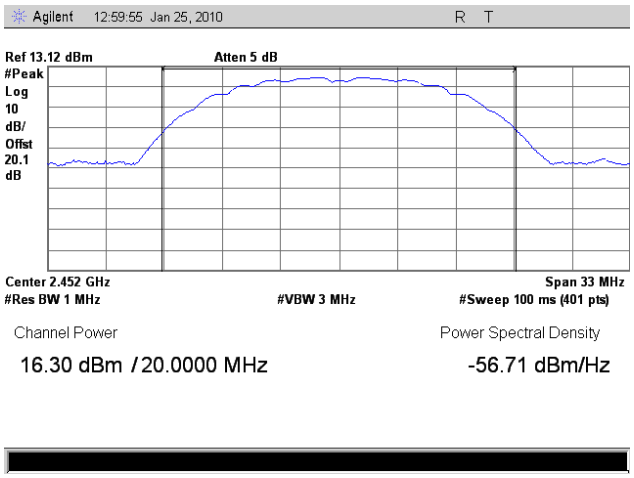
RF Output Power Test Results – 802.11bMode



Plot 36. Peak Output Power, Channel 7, 802.11b Mode (24dBi Grid Antenna)

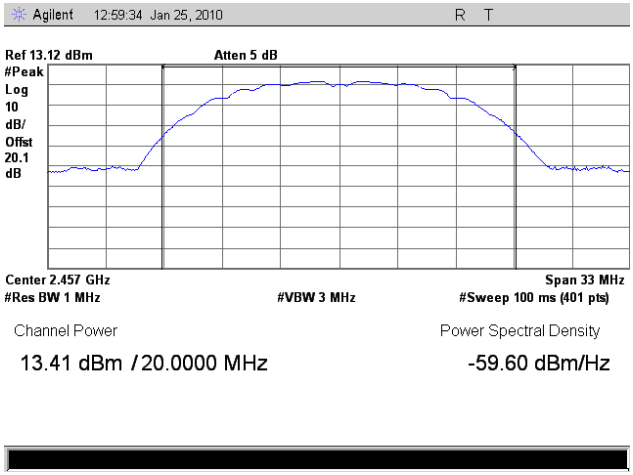


Plot 37. Peak Output Power, Channel 8, 802.11b Mode (24dBi Grid Antenna)

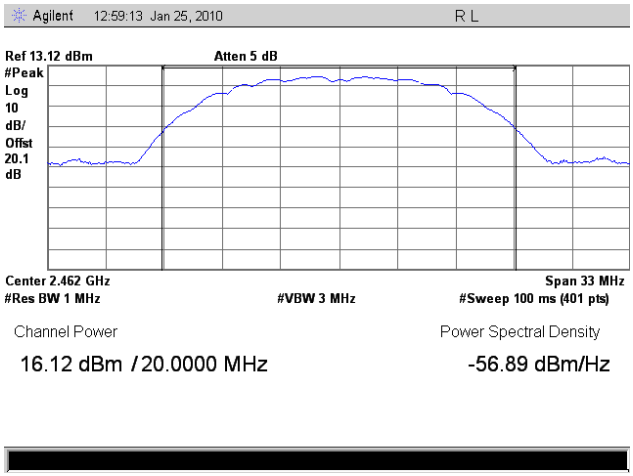


Plot 38. Peak Output Power, Channel 9, 802.11b Mode (24dBi Grid Antenna)

RF Output Power Test Results – 802.11bMode

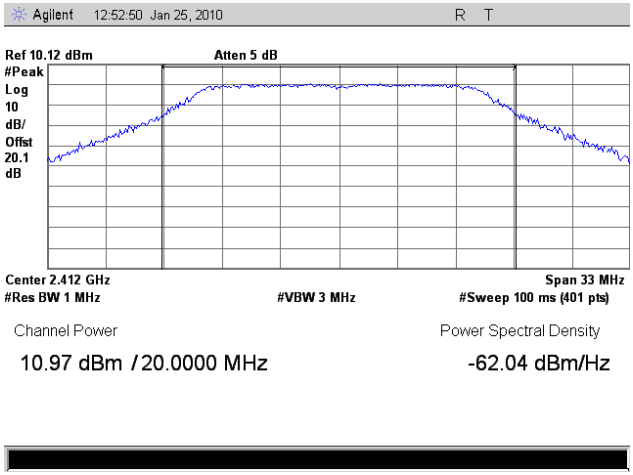


Plot 39. Peak Output Power, Channel 10, 802.11b Mode (24dBi Grid Antenna)

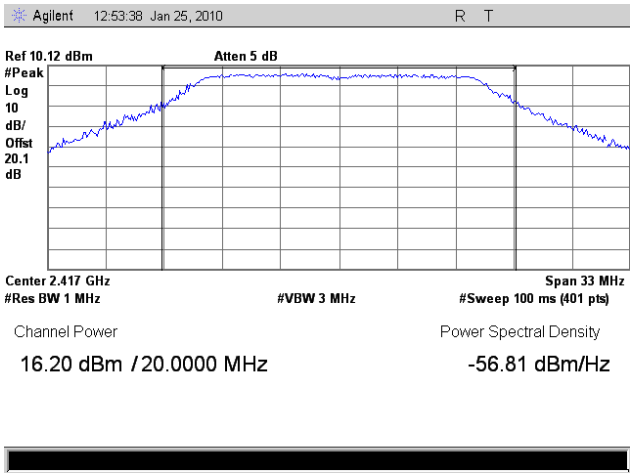


Plot 40. Peak Output Power, Channel 11, 802.11b Mode (24dBi Grid Antenna)

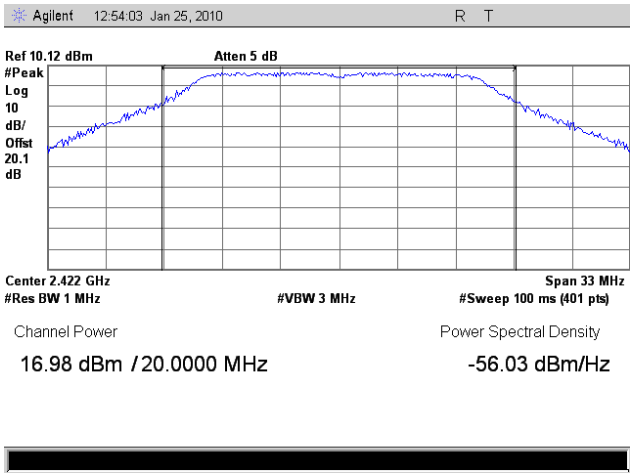
RF Output Power Test Results – 802.11g Mode



Plot 41. Peak Output Power, Channel 1, 802.11g Mode (24dBi Grid Antenna)

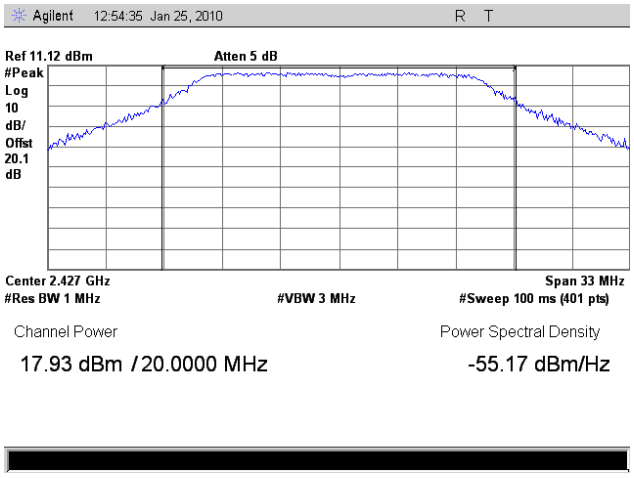


Plot 42. Peak Output Power, Channel 2, 802.11g Mode (24dBi Grid Antenna)

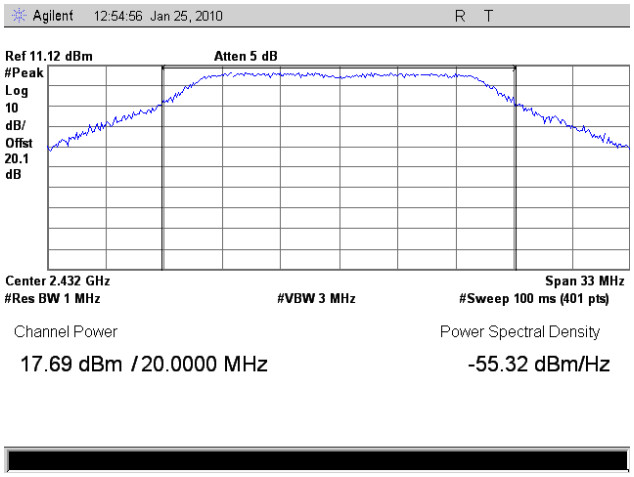


Plot 43. Peak Output Power, Channel 3, 802.11g Mode (24dBi Grid Antenna)

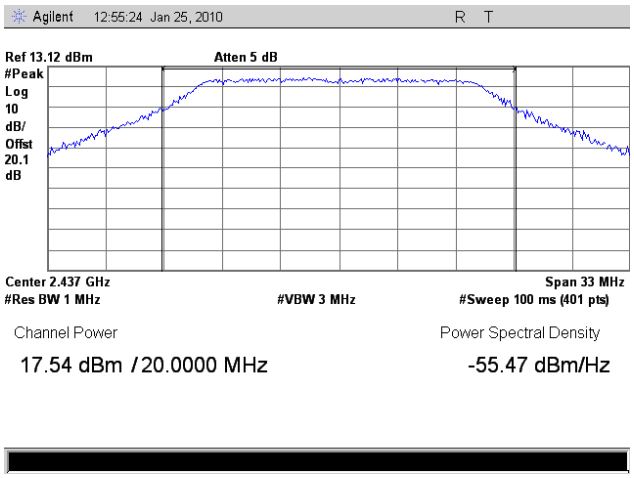
RF Output Power Test Results – 802.11g Mode



Plot 44. Peak Output Power, Channel 4, 802.11g Mode (24dBi Grid Antenna)

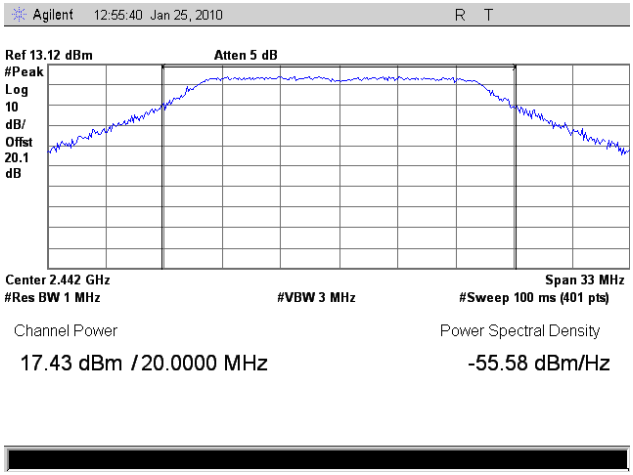


Plot 45. Peak Output Power, Channel 5, 802.11g Mode (24dBi Grid Antenna)

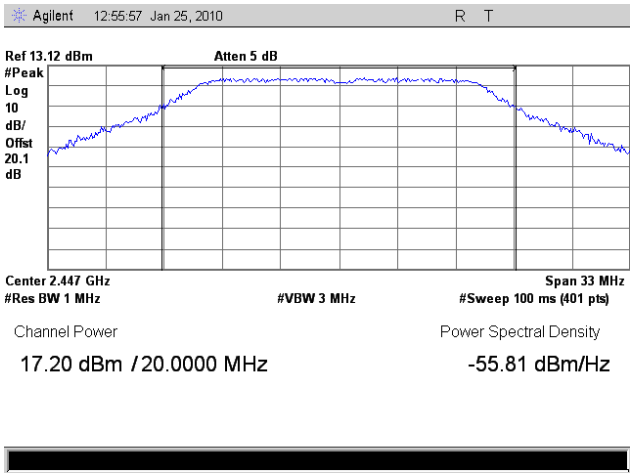


Plot 46. Peak Output Power, Channel 6, 802.11g Mode (24dBi Grid Antenna)

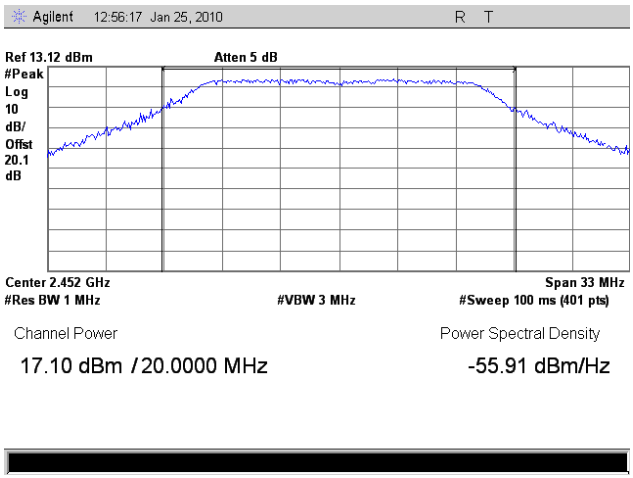
RF Output Power Test Results – 802.11g Mode



Plot 47. Peak Output Power, Channel 7, 802.11g Mode (24dBi Grid Antenna)

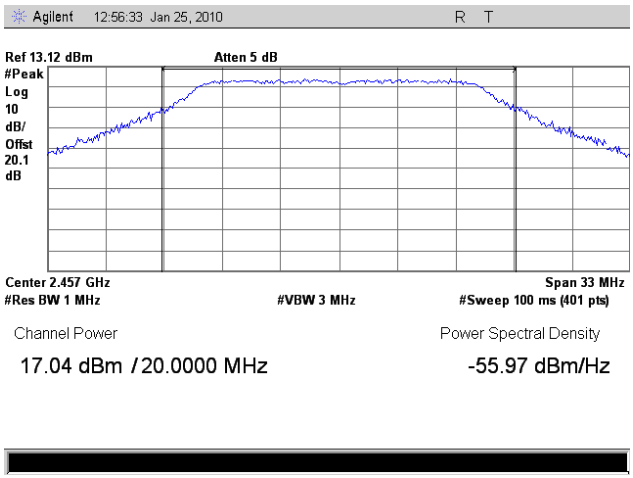


Plot 48. Peak Output Power, Channel 8, 802.11g Mode (24dBi Grid Antenna)

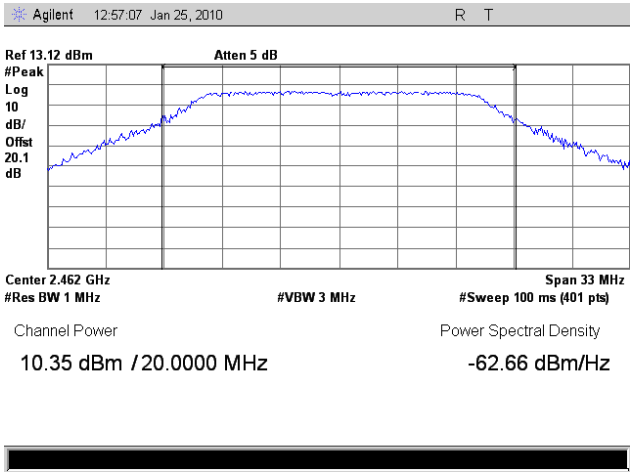


Plot 49. Peak Output Power, Channel 9, 802.11g Mode (24dBi Grid Antenna)

RF Output Power Test Results – 802.11g Mode



Plot 50. Peak Output Power, Channel 10, 802.11g Mode (24dBi Grid Antenna)



Plot 51. Peak Output Power, Channel 11, 802.11g Mode (24dBi Grid Antenna)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) RF Exposure

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

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

MPE Limit Calculation: EUT's operating frequencies @ 2412-2462 MHz; highest conducted power = *29.96dBm* (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

EUT maximum antenna gain = **6dBi Omni**

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/cm^2)
P = Power Input to antenna (990.83mW)
G = Antenna Gain (3.98 numeric)

$S = (990.83*3.98/ 4*3.14*20.0^2) = (3944.573 / 5024) =$ **0.785mW/cm^2** @ 20cm separation

MPE Limit Calculation: EUT's operating frequencies @ 2412-2462 MHz; highest conducted power = *17.93dBm* (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

EUT maximum antenna gain = **24dBi Grid**

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/cm^2)
P = Power Input to antenna (62.08mW)
G = Antenna Gain (251.18 numeric)

$R = (62.08*251.18/ 4*3.14*1.0)^{1/2} = (15595.53 / 12.56)^{1/2} =$ **35.23cm**

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 21. 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 22.

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

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

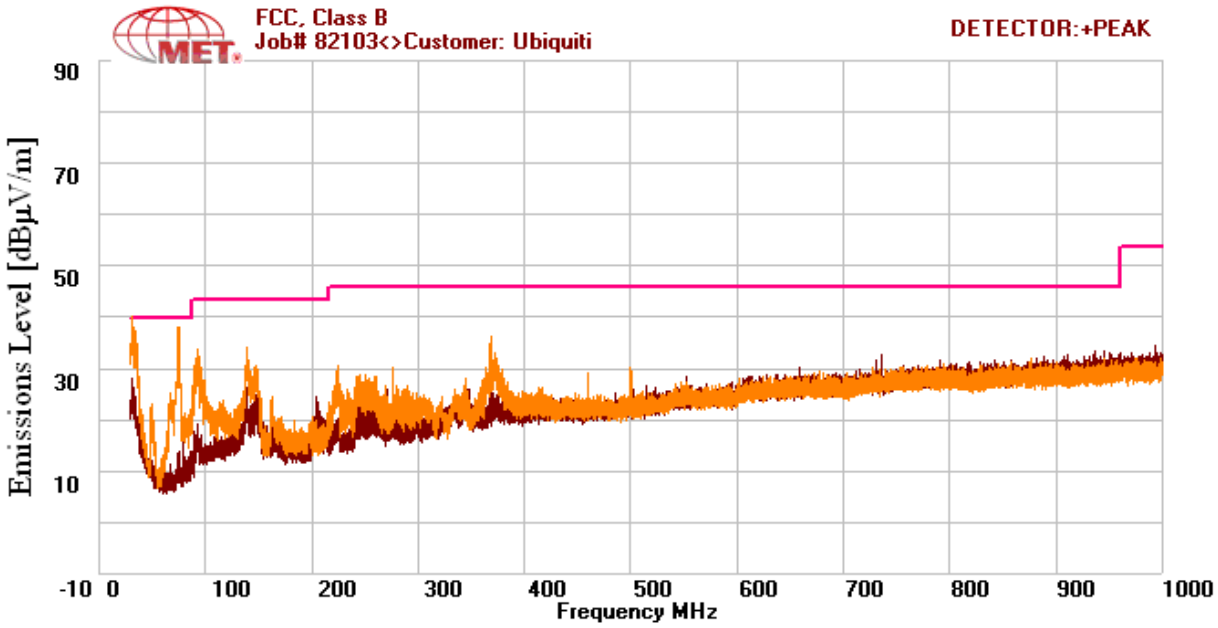
The highest emissions test results were submitted for 30 MHz – 1GHz. The highest emission measurements were found on the mid channel due to the use of a highest output power. See plots below for details.

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

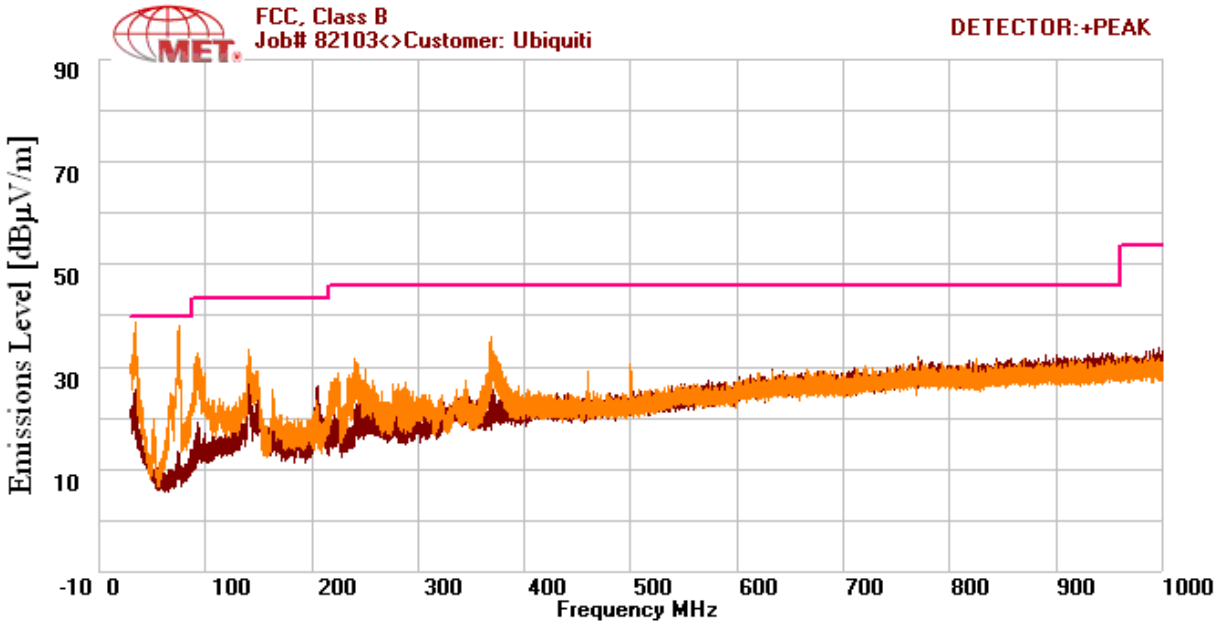
Test Engineer(s): Anderson Soungpanya & Minh Ly

Test Date(s): 01/12/10 & 02/19/10

15.209 Radiated Emissions Limits Test Results



Plot 52. 15.209 Radiated Emissions Plot, 6 dBi Omni Antenna



Plot 53. 15.209 Radiated Emissions Plot, 24 dBi Grid Antenna

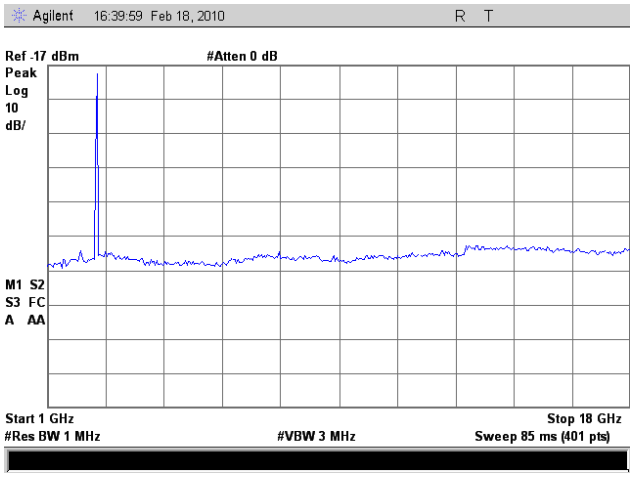
Note: The plots above show the highest out of band emissions found for each mode, channel and configuration.

Harmonic Emissions Requirements – Radiated (802.11b Mode) 6dBi Omni Antenna

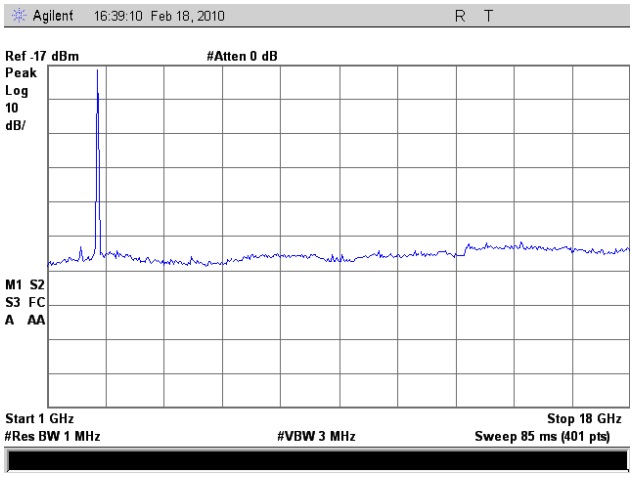
Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg)	P.Amp (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBµV/m)	Limit Detector Peak / Avg	Limit @ 3 m (dBµV/m)	Delta (dB)
4.824	V	49.51	34.76	33.95	4.37	53.07	Peak	74	-20.93
4.824	V	43.98	34.76	33.95	4.37	47.54	Avg	54	-6.46
7.236	V	46.19	35.01	35.62	5.59	52.39	Peak	74	-21.61
7.236	V	35.36	35.01	35.62	5.59	41.56	Avg	54	-12.44
9.648	V	48.21	35.58	36.61	6.25	55.50	Peak	74	-18.50
9.648	V	40.39	35.58	36.61	6.25	47.68	Avg	54	-6.32
12.06	V	43.21	35.00	38.76	6.60	53.56	Peak	74	-20.44
12.06	V	30.74	35.00	38.76	6.60	41.09	Avg	54	-12.91
Low Channel 2412MHz									
Freq. (GHz)	**Antenna Polarity (H/V)**	**Raw Amp. @ 3 m (Peak) / (Avg)**	**P.Amp (dB)**	**Ant. Cor. Factor (dB/m)**	**Cable Loss (dB)**	**EUT Field Strength Final Amp. (dBµV/m)**	**Limit Detector Peak / Avg**	**Limit @ 3 m (dBµV/m)**	**Delta (dB)**
4.874	V	50.44	34.74	33.94	4.41	54.05	Peak	74	-19.95
4.874	V	46.43	34.74	33.94	4.41	50.04	Avg	54	-3.96
7.311	V	45.31	35.02	35.64	5.93	51.86	Peak	74	-22.14
7.311	V	33.94	35.02	35.64	5.93	40.49	Avg	54	-13.51
9.748	V	47.67	35.55	36.75	6.29	55.16	Peak	74	-18.84
9.748	V	40.47	35.55	36.75	6.29	47.96	Avg	54	-6.04
12.185	V	43.17	34.94	38.83	6.89	53.95	Peak	74	-20.05
12.185	V	30.21	34.94	38.83	6.89	40.99	Avg	54	-13.01
Mid Channel 2437MHz									
Freq. (GHz)	**Antenna Polarity (H/V)**	**Raw Amp. @ 3 m (Peak) / (Avg)**	**P.Amp (dB)**	**Ant. Cor. Factor (dB/m)**	**Cable Loss (dB)**	**EUT Field Strength Final Amp. (dBµV/m)**	**Limit Detector Peak / Avg**	**Limit @ 3 m (dBµV/m)**	**Delta (dB)**
4.924	V	50.99	34.73	33.94	4.46	54.66	Peak	74	-19.34
4.924	V	48.25	34.73	33.94	4.46	51.92	Avg	54	-2.08
7.386	V	49.54	35.05	35.65	6.24	56.38	Peak	74	-17.62
7.386	V	40.75	35.05	35.65	6.24	47.59	Avg	54	-6.41
9.848	V	48.7	35.54	36.89	6.33	56.38	Peak	74	-17.62
9.848	V	42.48	35.54	36.89	6.33	50.16	Avg	54	-3.84
12.31	V	44.21	34.83	38.89	7.31	55.58	Peak	74	-18.42
12.31	V	30.11	34.83	38.89	7.31	41.48	Avg	54	-12.52
High Channel 2462MHz									

Table 23. Radiated Harmonic Emissions, 802.11b Mode (6dBi Omni Antenna)

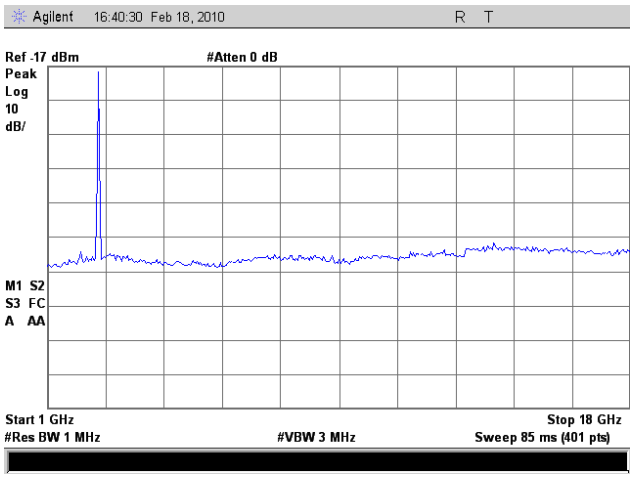
Radiated Spurious Emissions Test Results (6dBi Omni Antenna)



Plot 54. Radiated Spurious Emissions, Low Channel, 802.11b Mode (6dBi Omni Antenna)



Plot 55. Radiated Spurious Emissions, Mid Channel, 802.11b Mode (6dBi Omni Antenna)



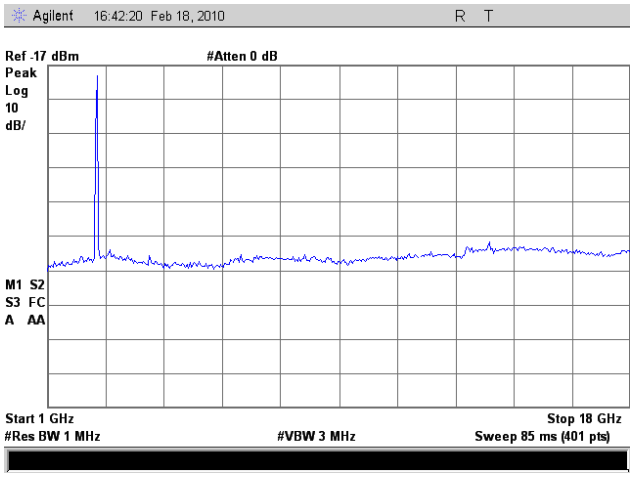
Plot 56. Radiated Spurious Emissions, High Channel, 802.11b Mode (6dBi Omni Antenna)

Harmonic Emissions Requirements – Radiated (802.11g Mode) 6dBi Omni Antenna

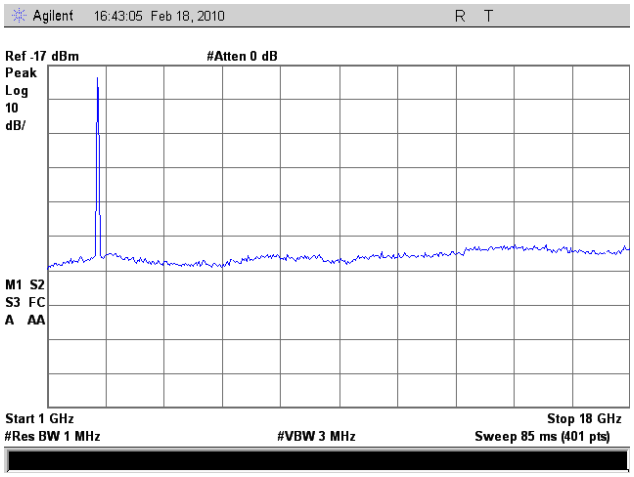
Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg)	P.Amp (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBµV/m)	Limit Detector Peak / Avg	Limit @ 3 m (dBµV/m)	Delta (dB)
4.824	V	46.72	34.76	33.95	4.37	50.28	Peak	74	-23.72
4.824	V	32.78	34.76	33.95	4.37	36.34	Avg	54	-17.66
7.236	V	42.03	35.01	35.62	5.59	48.23	Peak	74	-25.77
7.236	V	34.05	35.01	35.62	5.59	40.25	Avg	54	-13.75
9.648	V	44.32	35.58	36.61	6.25	51.61	Peak	74	-22.39
9.648	V	30.21	35.58	36.61	6.25	37.50	Avg	54	-16.50
Low Channel 2412MHz									
Freq. (GHz)	**Antenna Polarity (H/V)**	**Raw Amp. @ 3 m (Peak) / (Avg)**	**P.Amp (dB)**	**Ant. Cor. Factor (dB/m)**	**Cable Loss (dB)**	**EUT Field Strength Final Amp. (dBµV/m)**	**Limit Detector Peak / Avg**	**Limit @ 3 m (dBµV/m)**	**Delta (dB)**
4.874	V	46.25	34.74	33.94	4.41	49.86	Peak	74	-24.14
4.874	V	33.75	34.74	33.94	4.41	37.36	Avg	54	-16.64
7.311	V	47.06	35.02	35.64	5.93	53.61	Peak	74	-20.39
7.311	V	33.58	35.02	35.64	5.93	40.13	Avg	54	-13.87
9.748	V	44.27	35.55	36.75	6.29	51.76	Peak	74	-22.24
9.748	V	30.74	35.55	36.75	6.29	38.23	Avg	54	-15.77
Mid Channel 2437MHz									
Freq. (GHz)	**Antenna Polarity (H/V)**	**Raw Amp. @ 3 m (Peak) / (Avg)**	**P.Amp (dB)**	**Ant. Cor. Factor (dB/m)**	**Cable Loss (dB)**	**EUT Field Strength Final Amp. (dBµV/m)**	**Limit Detector Peak / Avg**	**Limit @ 3 m (dBµV/m)**	**Delta (dB)**
4.924	V	49.45	34.73	33.94	4.46	53.12	Peak	74	-20.88
4.924	V	35.34	34.73	33.94	4.46	39.01	Avg	54	-14.99
7.386	V	46.35	35.05	35.65	6.24	53.19	Peak	74	-20.81
7.386	V	33.19	35.05	35.65	6.24	40.03	Avg	54	-13.97
9.848	V	44.74	35.54	36.89	6.33	52.42	Peak	74	-21.58
9.848	V	30.81	35.54	36.89	6.33	38.49	Avg	54	-15.51
High Channel 2462MHz									

Table 24. Radiated Harmonic Emissions, 802.11g Mode (6dBi Omni Antenna)

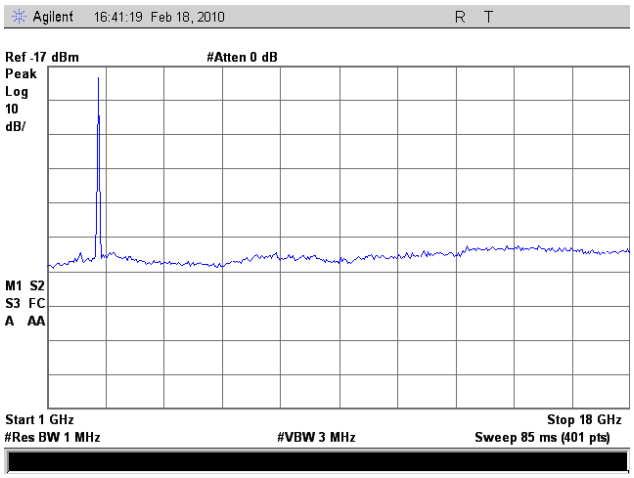
Radiated Spurious Emissions Test Results (6dBi Omni Antenna)



Plot 57. Radiated Spurious Emissions, Low Channel, 802.11g Mode (6dBi Omni Antenna)



Plot 58. Radiated Spurious Emissions, Mid Channel, 802.11g Mode (6dBi Omni Antenna)



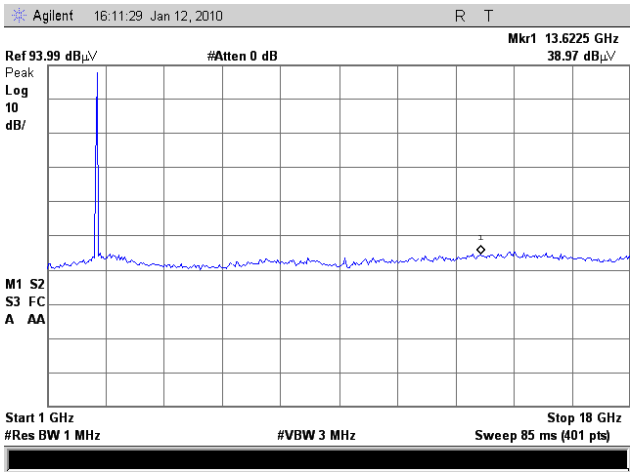
Plot 59. Radiated Spurious Emissions, High Channel, 802.11g Mode (6dBi Omni Antenna)

Harmonic Emissions Requirements – Radiated (802.11b Mode) 24dBi Grid Antenna

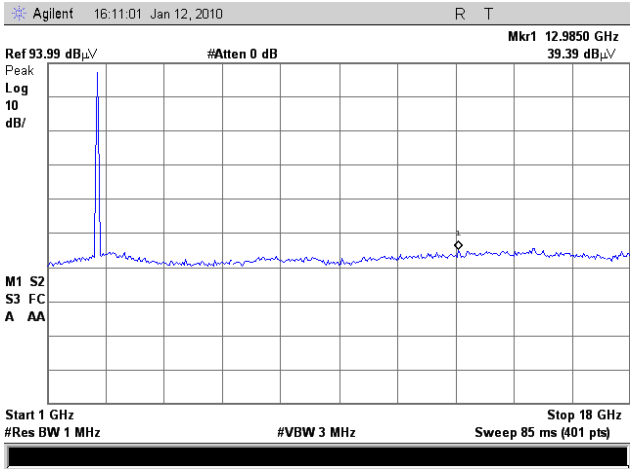
Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg)	P.Amp (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBµV/m)	Limit Detector Peak / Avg	Limit @ 3 m (dBµV/m)	Delta (dB)
4.824	V	48.96	34.76	33.95	4.37	52.52	Peak	74	-21.48
4.824	V	41.27	34.76	33.95	4.37	44.83	Avg	54	-9.17
7.236	V	45.21	35.01	35.62	5.59	51.41	Peak	74	-22.59
7.236	V	30.69	35.01	35.62	5.59	36.89	Avg	54	-17.11
9.648	V	45.74	35.58	36.61	6.25	53.03	Peak	74	-20.97
9.648	V	31.21	35.58	36.61	6.25	38.50	Avg	54	-15.50
Low Channel 2412MHz									
Freq. (GHz)	**Antenna Polarity (H/V)**	**Raw Amp. @ 3 m (Peak) / (Avg)**	**P.Amp (dB)**	**Ant. Cor. Factor (dB/m)**	**Cable Loss (dB)**	**EUT Field Strength Final Amp. (dBµV/m)**	**Limit Detector Peak / Avg**	**Limit @ 3 m (dBµV/m)**	**Delta (dB)**
4.874	V	48.46	34.74	33.94	4.41	52.07	Peak	74	-21.93
4.874	V	41.34	34.74	33.94	4.41	44.95	Avg	54	-9.05
7.311	V	43.8	35.02	35.64	5.93	50.35	Peak	74	-23.65
7.311	V	30.59	35.02	35.64	5.93	37.14	Avg	54	-16.86
9.748	V	45.35	35.55	36.75	6.29	52.84	Peak	74	-21.16
9.748	V	31.24	35.55	36.75	6.29	38.73	Avg	54	-15.27
Mid Channel 2437MHz									
Freq. (GHz)	**Antenna Polarity (H/V)**	**Raw Amp. @ 3 m (Peak) / (Avg)**	**P.Amp (dB)**	**Ant. Cor. Factor (dB/m)**	**Cable Loss (dB)**	**EUT Field Strength Final Amp. (dBµV/m)**	**Limit Detector Peak / Avg**	**Limit @ 3 m (dBµV/m)**	**Delta (dB)**
4.924	V	46.55	34.73	33.94	4.46	50.22	Peak	74	-23.78
4.924	V	38.73	34.73	33.94	4.46	42.40	Avg	54	-11.60
7.386	V	43.66	35.05	35.65	6.24	50.50	Peak	74	-23.50
7.386	V	30.17	35.05	35.65	6.24	37.01	Avg	54	-16.99
9.848	V	44.84	35.54	36.89	6.33	52.52	Peak	74	-21.48
9.848	V	30.66	35.54	36.89	6.33	38.34	Avg	54	-15.66
High Channel 2462MHz									

Table 25. Radiated Harmonic Emissions, 802.11b Mode (24dBi Grid Antenna)

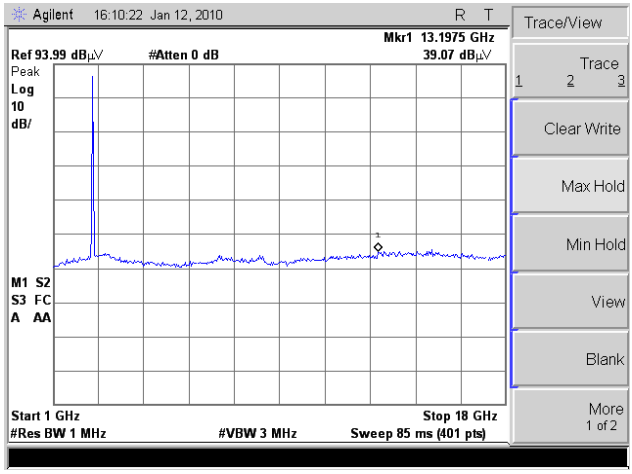
Radiated Spurious Emissions Test Results (24dBi Grid Antenna)



Plot 60. Radiated Spurious Emissions, Low Channel, 802.11b Mode (24dBi Grid Antenna)



Plot 61. Radiated Spurious Emissions, Mid Channel, 802.11b Mode (24dBi Grid Antenna)



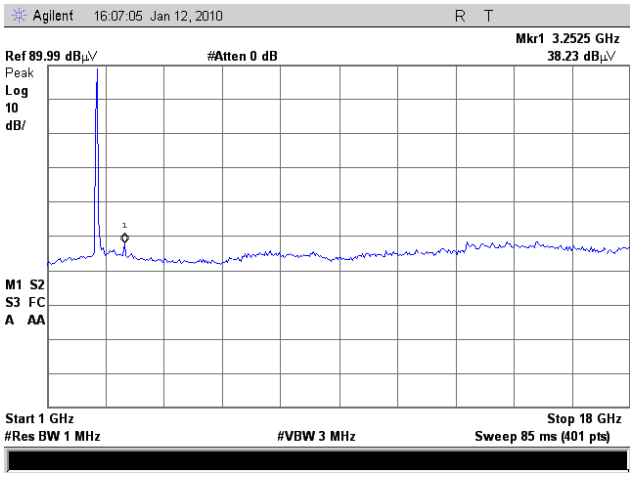
Plot 62. Radiated Spurious Emissions, High Channel, 802.11b Mode (24dBi Grid Antenna)

Harmonic Emissions Requirements – Radiated (802.11g Mode) 24dBi Grid Antenna

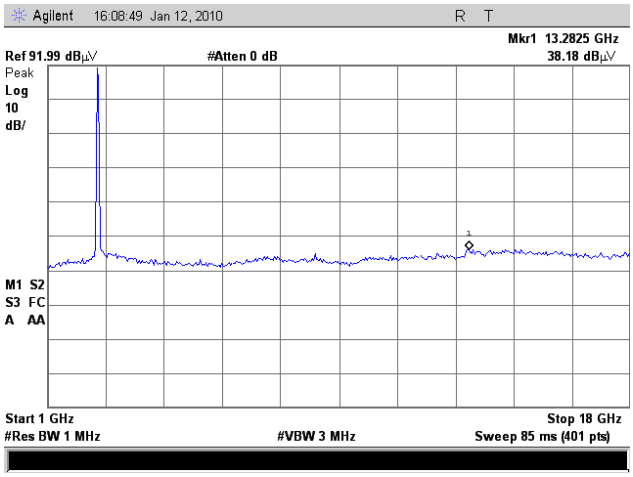
Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg)	P.Amp (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBµV/m)	Limit Detector Peak / Avg	Limit @ 3 m (dBµV/m)	Delta (dB)
4.824	V	44.52	34.76	33.95	4.37	48.08	Peak	74	-25.92
4.824	V	31.02	34.76	33.95	4.37	34.58	Avg	54	-19.42
7.236	V	43.77	35.01	35.62	5.59	49.97	Peak	74	-24.03
7.236	V	30.43	35.01	35.62	5.59	36.63	Avg	54	-17.37
9.648	V	43.15	35.58	36.61	6.25	50.44	Peak	74	-23.56
9.648	V	30.47	35.58	36.61	6.25	37.76	Avg	54	-16.24
Low Channel 2412MHz									
Freq. (GHz)	**Antenna Polarity (H/V)**	**Raw Amp. @ 3 m (Peak) / (Avg)**	**P.Amp (dB)**	**Ant. Cor. Factor (dB/m)**	**Cable Loss (dB)**	**EUT Field Strength Final Amp. (dBµV/m)**	**Limit Detector Peak / Avg**	**Limit @ 3 m (dBµV/m)**	**Delta (dB)**
4.874	V	43.08	34.74	33.94	4.41	46.69	Peak	74	-27.31
4.874	V	29.98	34.74	33.94	4.41	33.59	Avg	54	-20.41
7.311	V	43.67	35.02	35.64	5.93	50.22	Peak	74	-23.78
7.311	V	30.38	35.02	35.64	5.93	36.93	Avg	54	-17.07
9.748	V	44.98	35.55	36.75	6.29	52.47	Peak	74	-21.53
9.748	V	31.29	35.55	36.75	6.29	38.78	Avg	54	-15.22
Mid Channel 2437MHz									
Freq. (GHz)	**Antenna Polarity (H/V)**	**Raw Amp. @ 3 m (Peak) / (Avg)**	**P.Amp (dB)**	**Ant. Cor. Factor (dB/m)**	**Cable Loss (dB)**	**EUT Field Strength Final Amp. (dBµV/m)**	**Limit Detector Peak / Avg**	**Limit @ 3 m (dBµV/m)**	**Delta (dB)**
4.924	V	43.74	34.73	33.94	4.46	47.41	Peak	74	-26.59
4.924	V	29.69	34.73	33.94	4.46	33.36	Avg	54	-20.64
7.386	V	43.97	35.05	35.65	6.24	50.81	Peak	74	-23.19
7.386	V	30.33	35.05	35.65	6.24	37.17	Avg	54	-16.83
9.848	V	45.49	35.54	36.89	6.33	53.17	Peak	74	-20.83
9.848	V	30.87	35.54	36.89	6.33	38.55	Avg	54	-15.45
High Channel 2462MHz									

Table 26. Radiated Harmonic Emissions, 802.11g Mode (24dBi Grid Antenna)

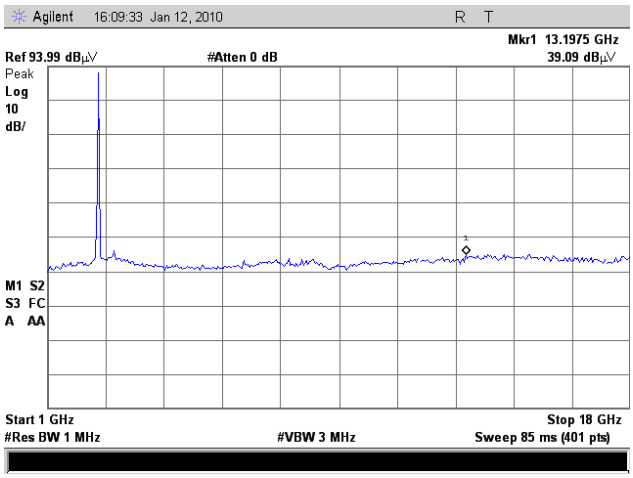
Radiated Spurious Emissions Test Results (24dBi Grid Antenna)



Plot 63. Radiated Spurious Emissions, Low Channel, 802.11g Mode (24dBi Grid Antenna)

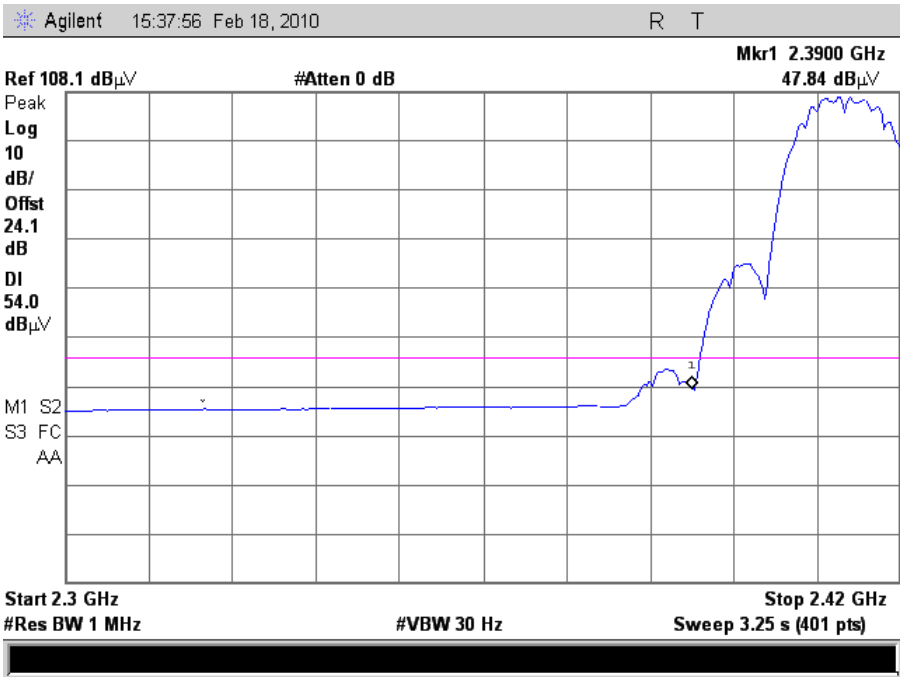


Plot 64. Radiated Spurious Emissions, Mid Channel, 802.11g Mode (24dBi Grid Antenna)

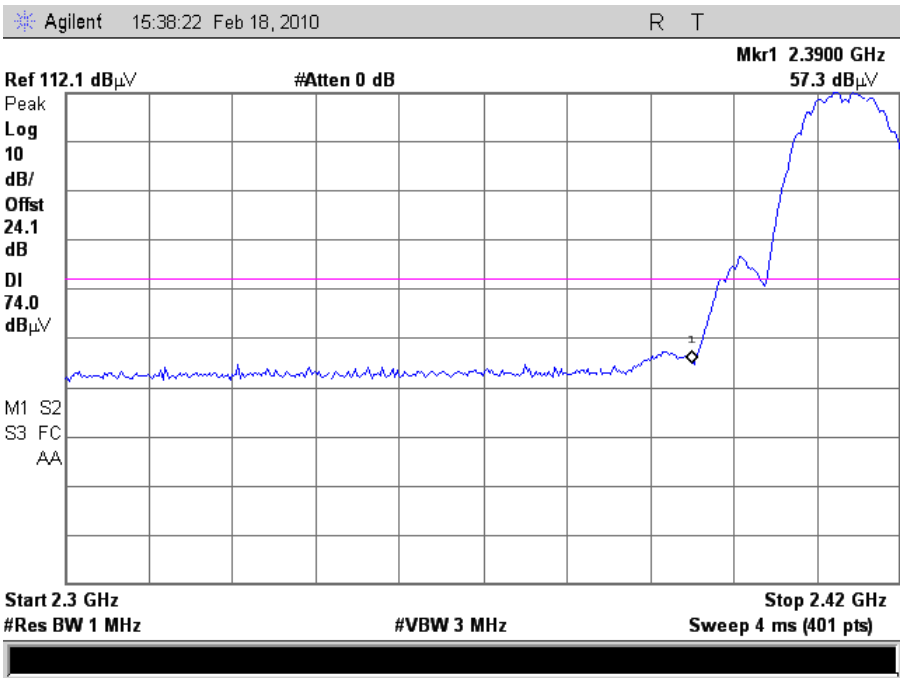


Plot 65. Radiated Spurious Emissions, High Channel, 802.11g Mode (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode (6dBi Omni Antenna)

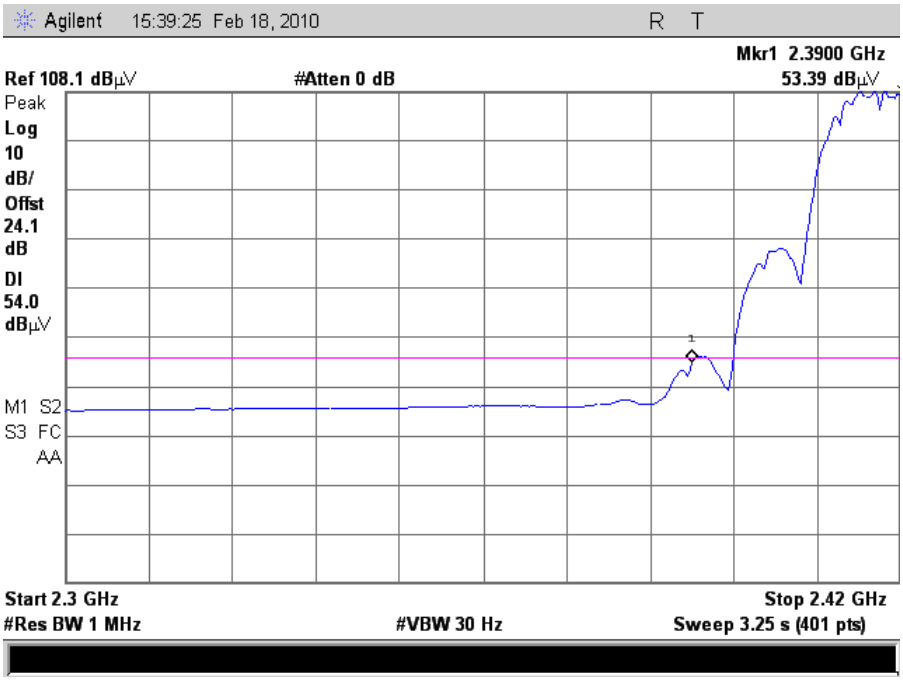


Plot 66. 802.11b Lower Band Edge, Channel 1, Average (6dBi Omni Antenna)

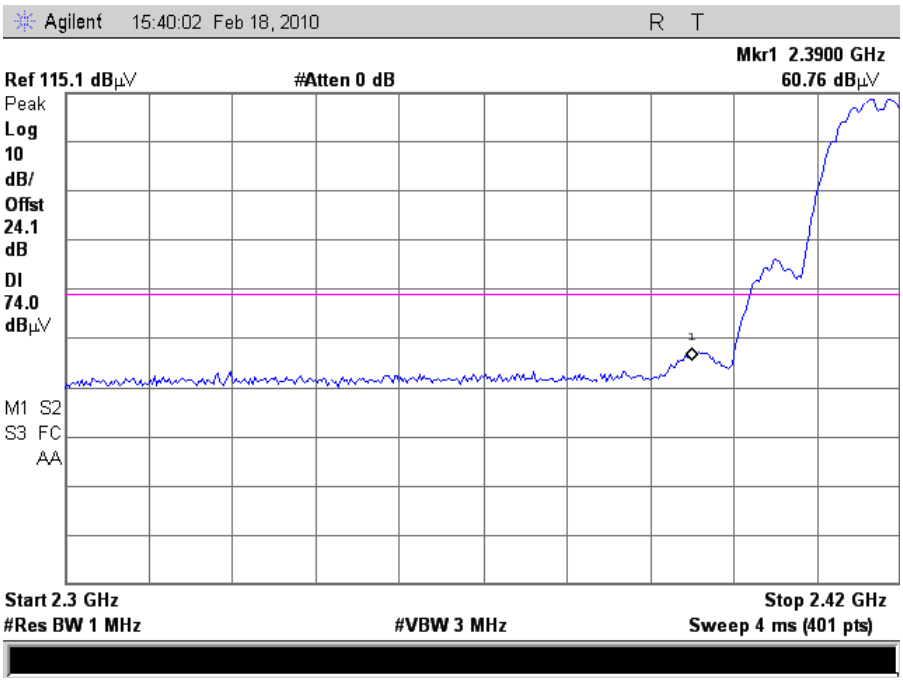


Plot 67. 802.11b Lower Band Edge, Channel 1, Peak (6dBi Omni Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode (6dBi Omni Antenna)

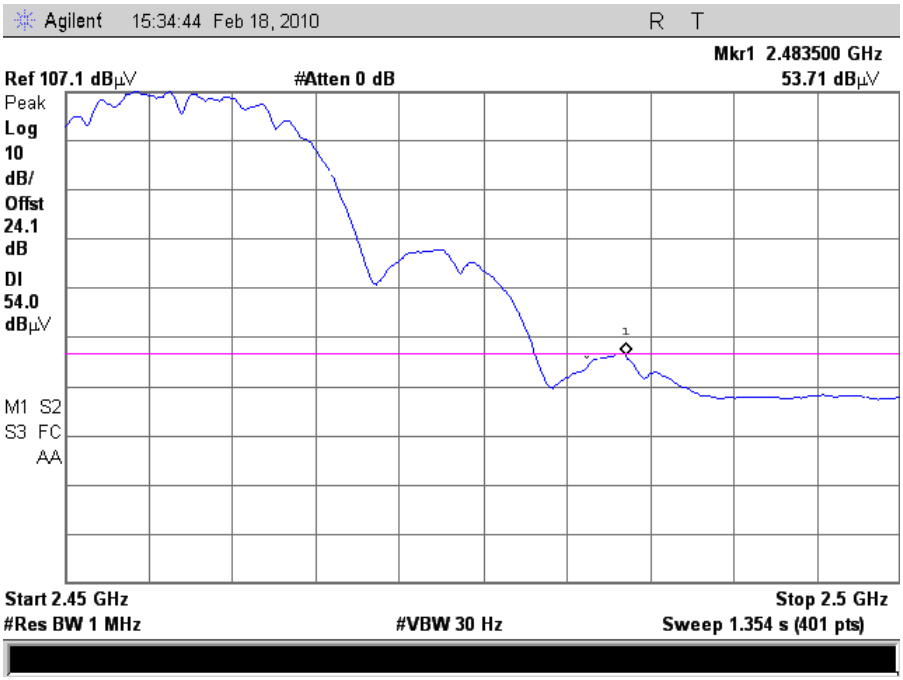


Plot 68. 802.11b Lower Band Edge, Channel 2, Average (6dBi Omni Antenna)

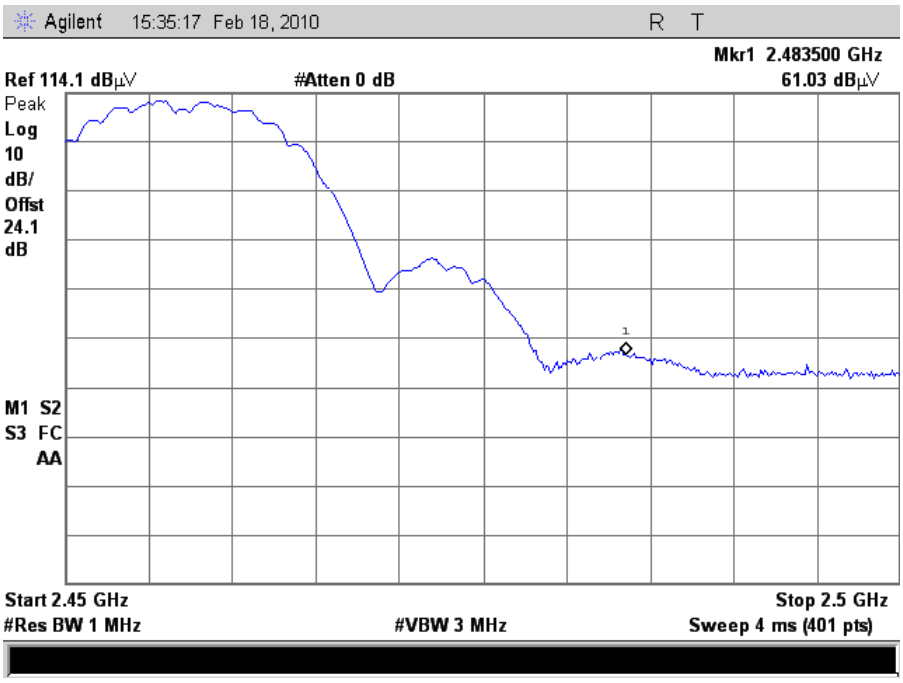


Plot 69. 802.11b Lower Band Edge, Channel 2, Peak (6dBi Omni Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode (6dBi Omni Antenna)

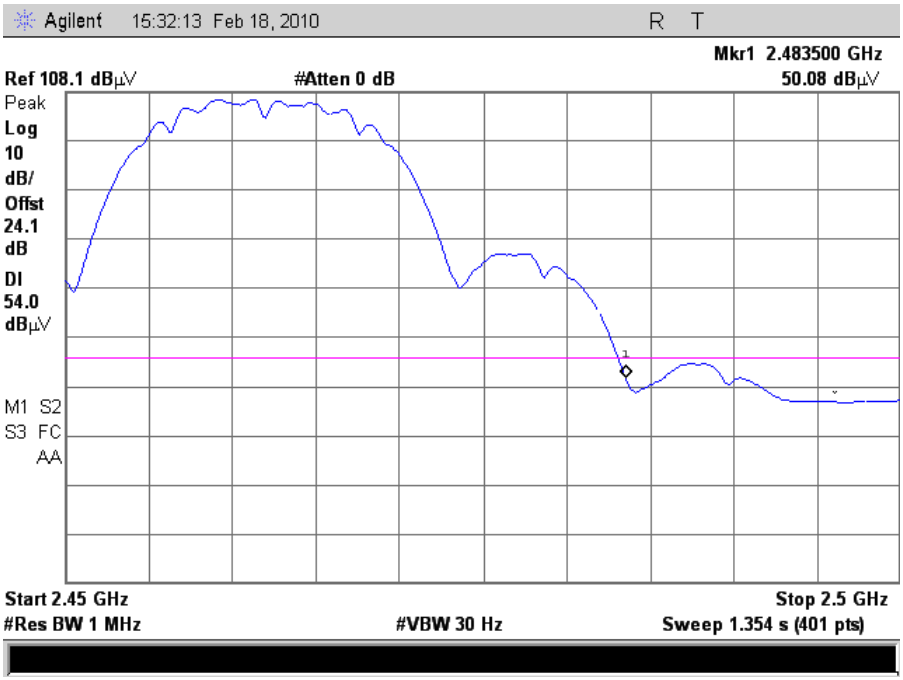


Plot 70. 802.11b Higher Band Edge, Channel 10, Average (6dBi Omni Antenna)

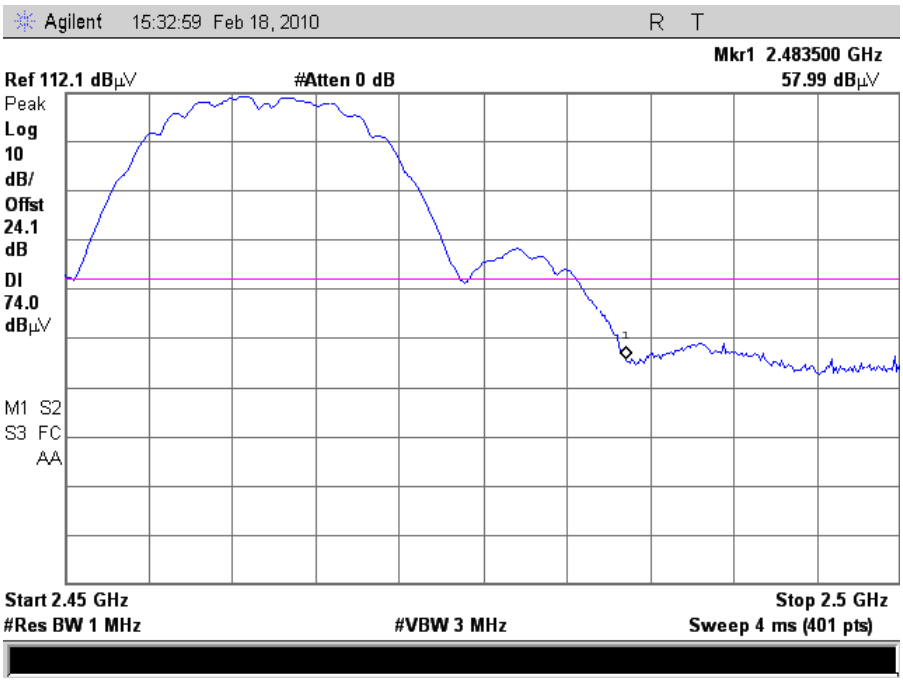


Plot 71. 802.11b Higher Band Edge, Channel 10, Peak (6dBi Omni Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode (6dBi Omni Antenna)

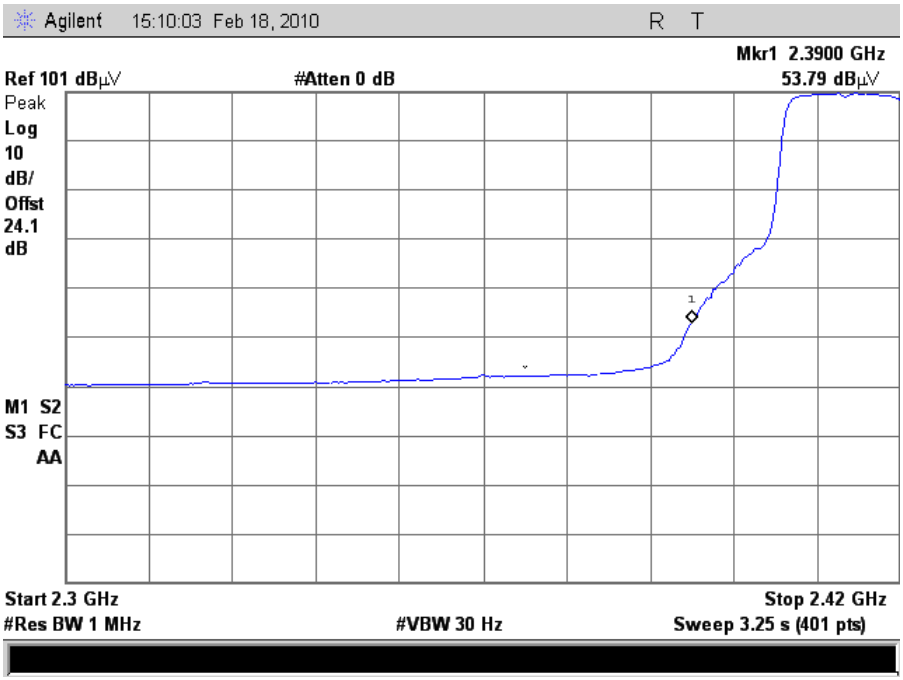


Plot 72. 802.11b Higher Band Edge, Channel 11, Average (6dBi Omni Antenna)

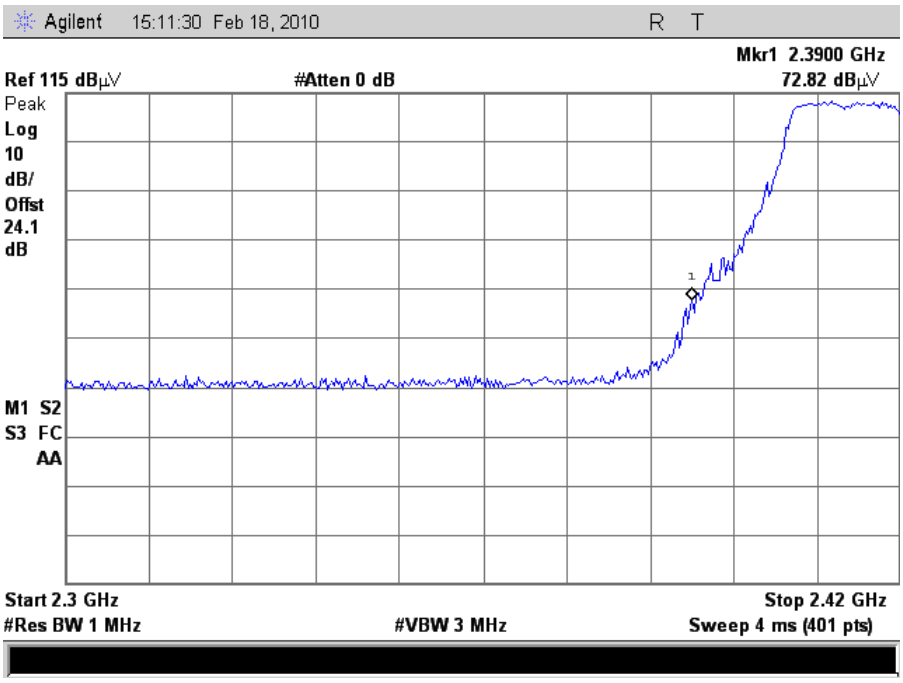


Plot 73. 802.11b Higher Band Edge, Channel 11, Peak (6dBi Omni Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode (6dBi Omni Antenna)

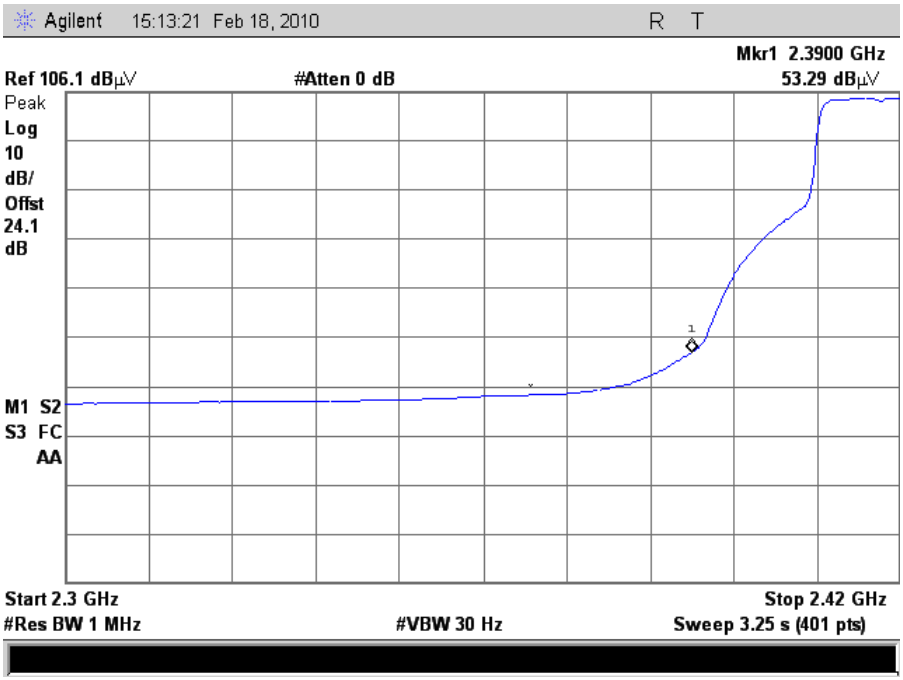


Plot 74. 802.11g Lower Band Edge, Channel 1, Average (6dBi Omni Antenna)

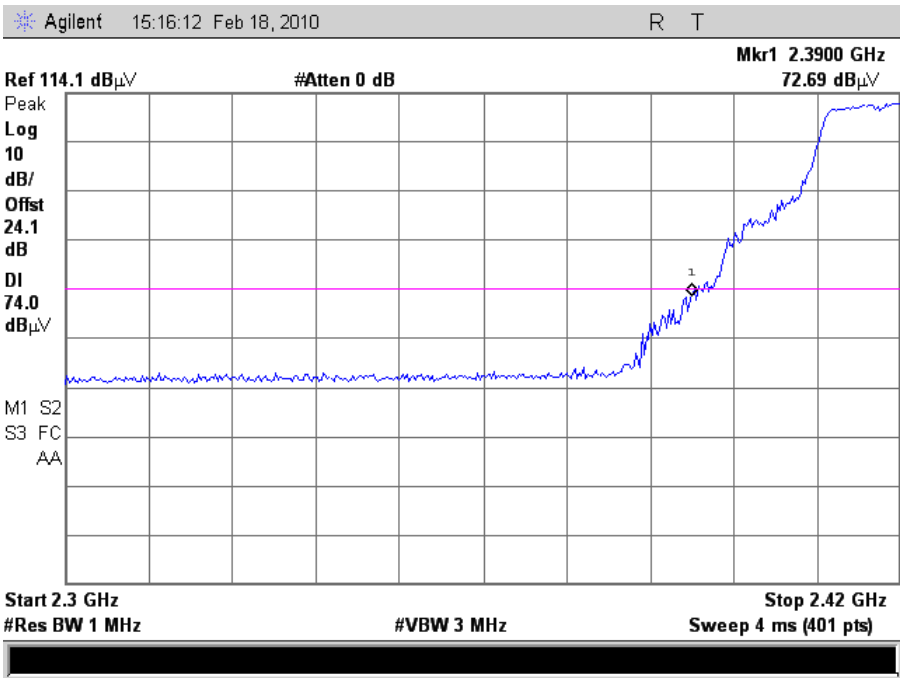


Plot 75. 802.11g Lower Band Edge, Channel 1, Peak (6dBi Omni Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode (6dBi Omni Antenna)

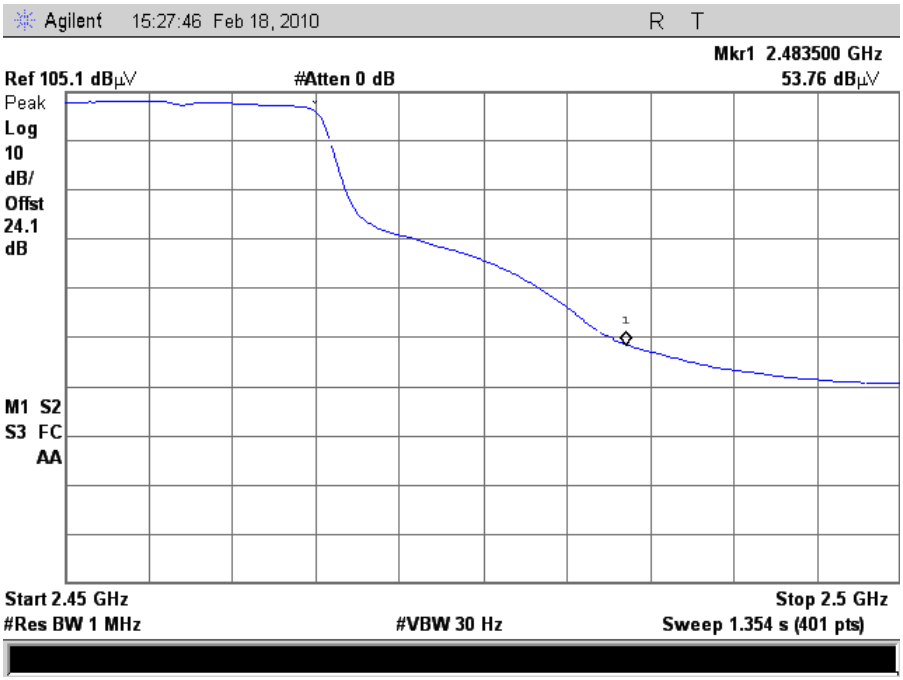


Plot 76. 802.11g Lower Band Edge, Channel 2, Average (6dBi Omni Antenna)

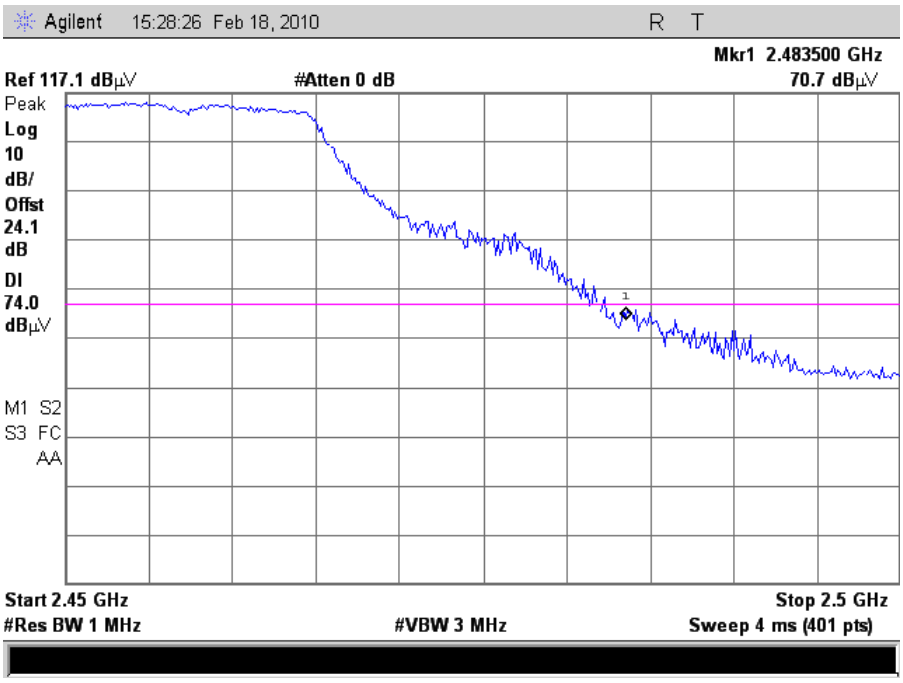


Plot 77. 802.11g Lower Band Edge, Channel 2, Peak (6dBi Omni Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode (6dBi Omni Antenna)

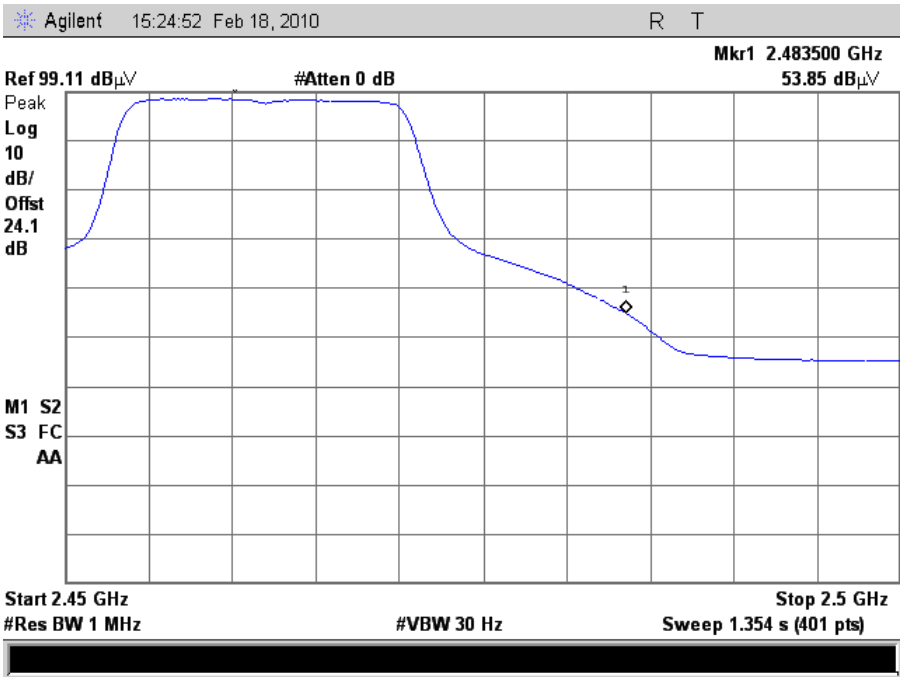


Plot 78. 802.11g Upper Band Edge, Channel 10, Average (6dBi Omni Antenna)

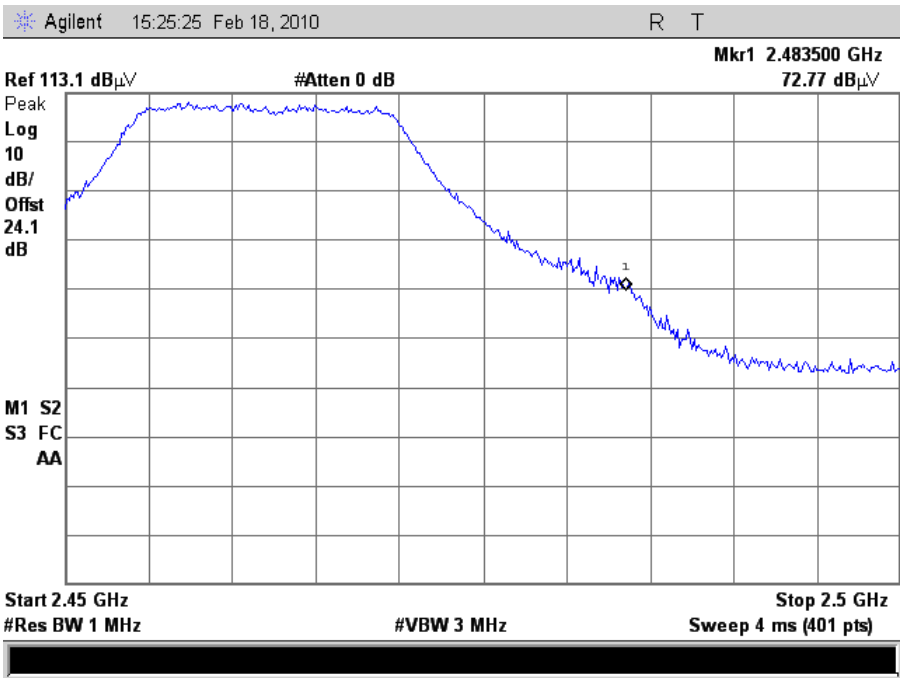


Plot 79. 802.11g Upper Band Edge, Channel 10, Peak (6dBi Omni Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode (6dBi Omni Antenna)

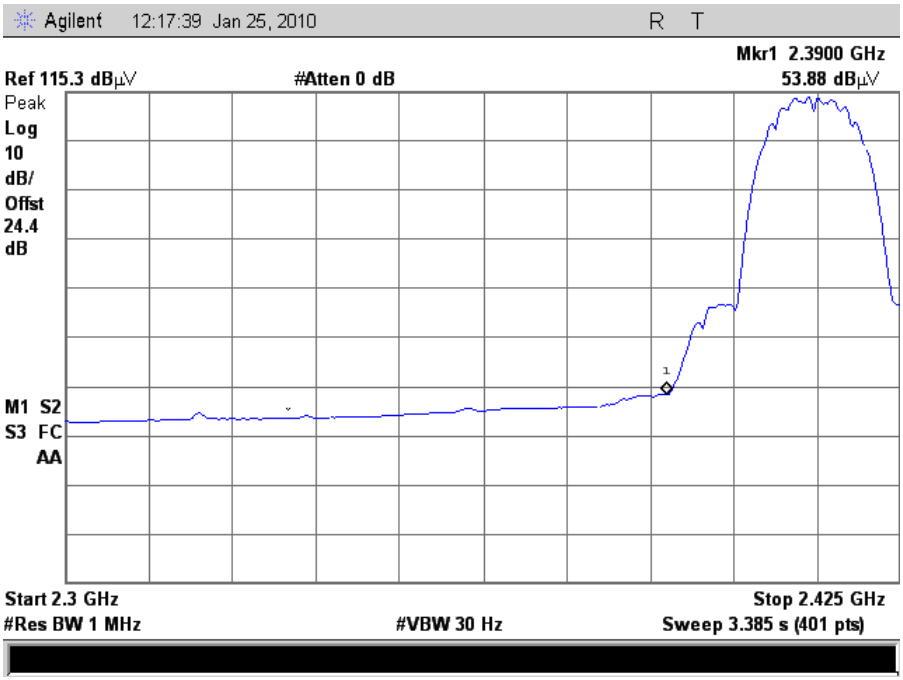


Plot 80. 802.11g Upper Band Edge, Channel 11, Average (6dBi Omni Antenna)

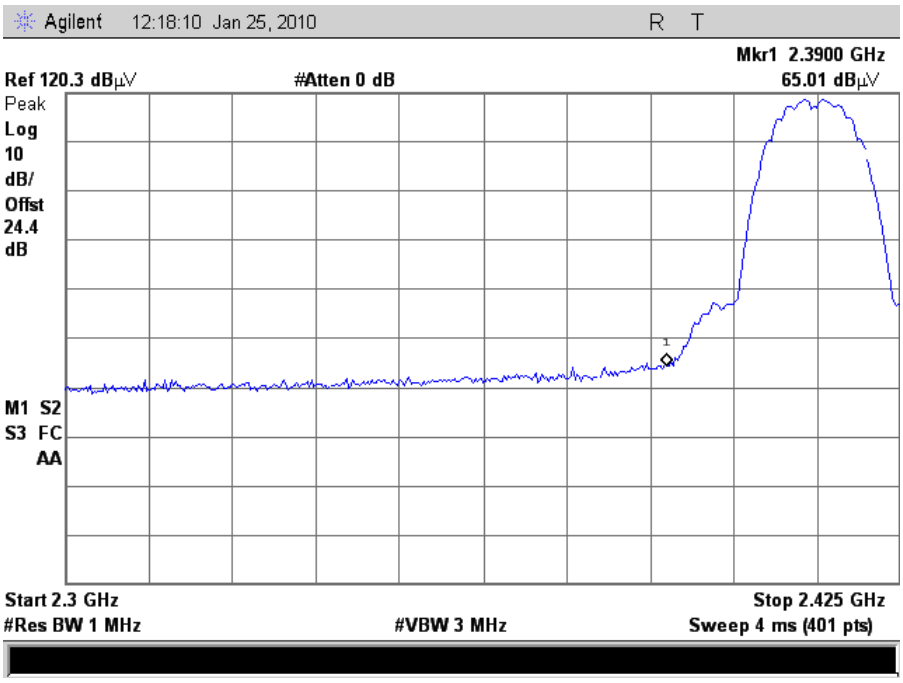


Plot 81. 802.11g Upper Band Edge, Channel 11, Peak (6dBi Omni Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode (24dBi Grid Antenna)

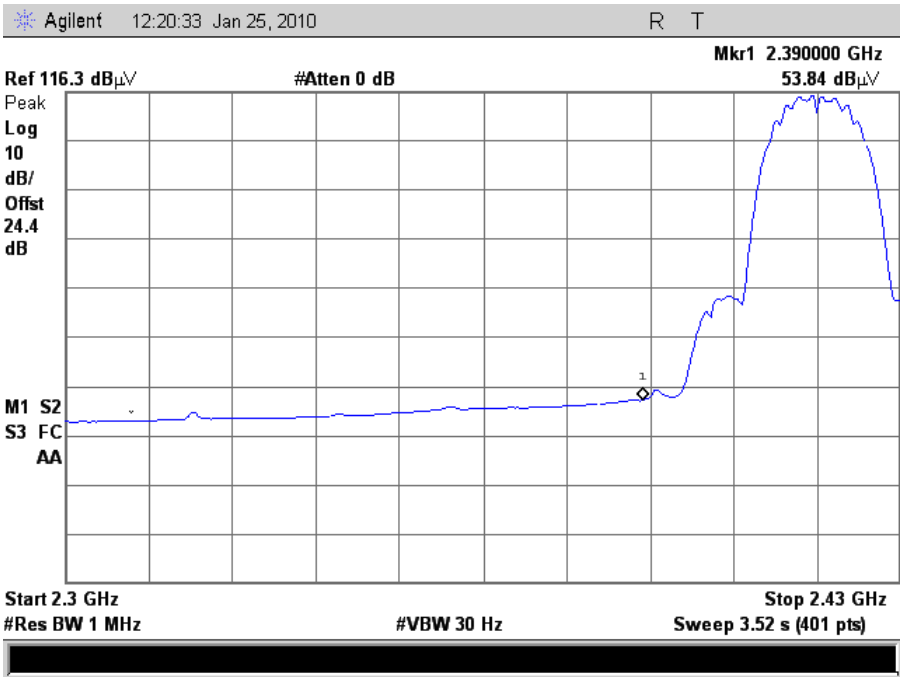


Plot 82. 802.11b Lower Band Edge, Channel 1, Average (24dBi Grid Antenna)

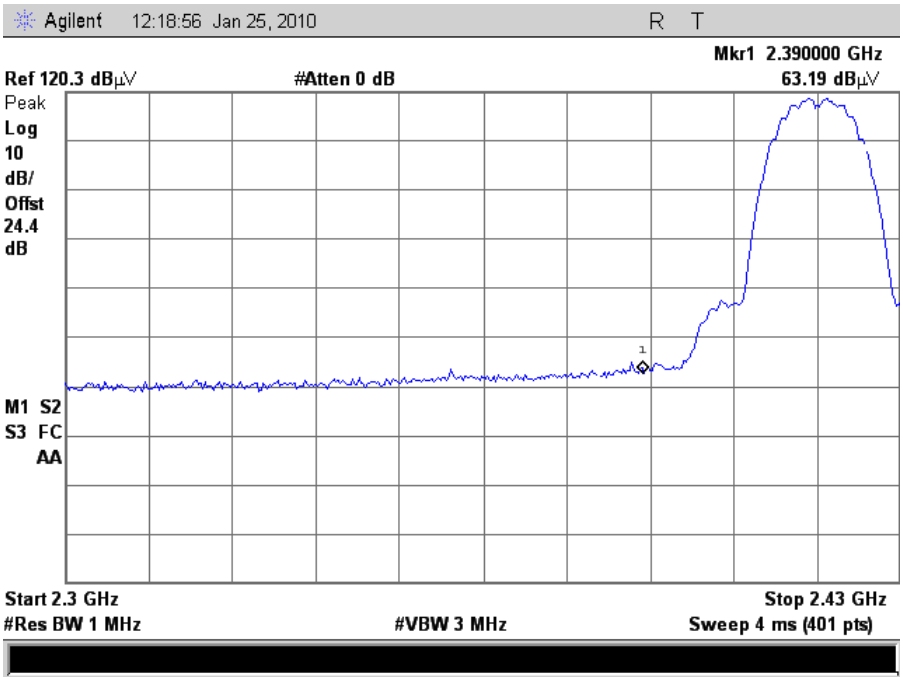


Plot 83. 802.11b Lower Band Edge, Channel 1, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode

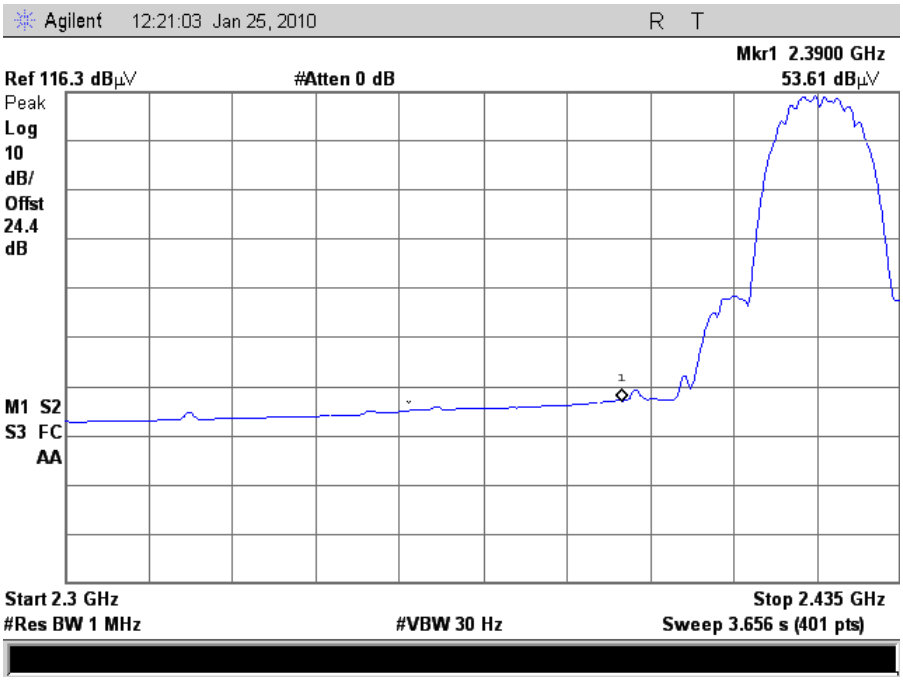


Plot 84. 802.11b Lower Band Edge, Channel 2, Average (24dBi Grid Antenna)

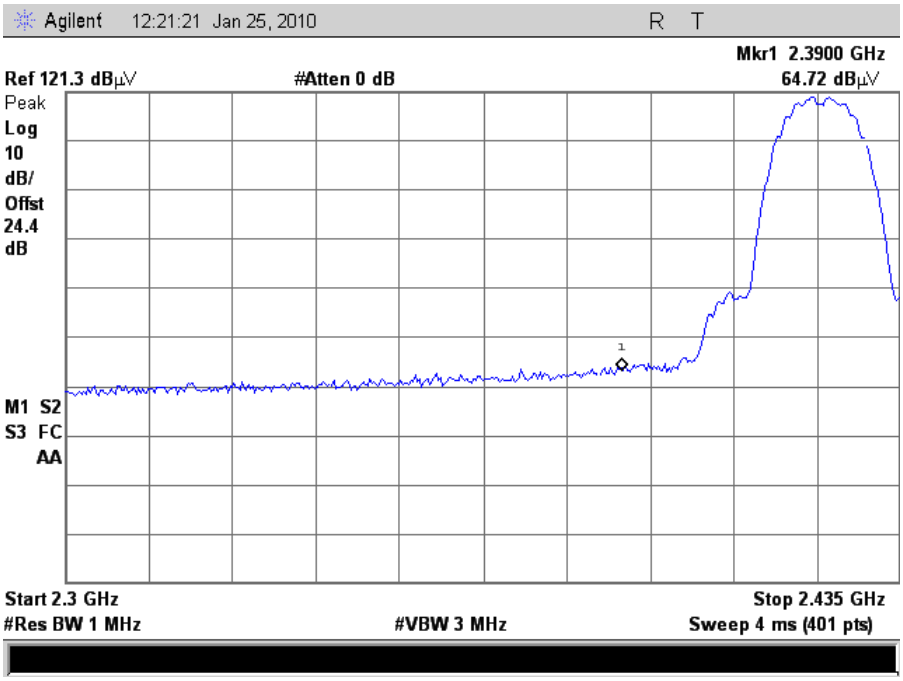


Plot 85. 802.11b Lower Band Edge, Channel 2, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode

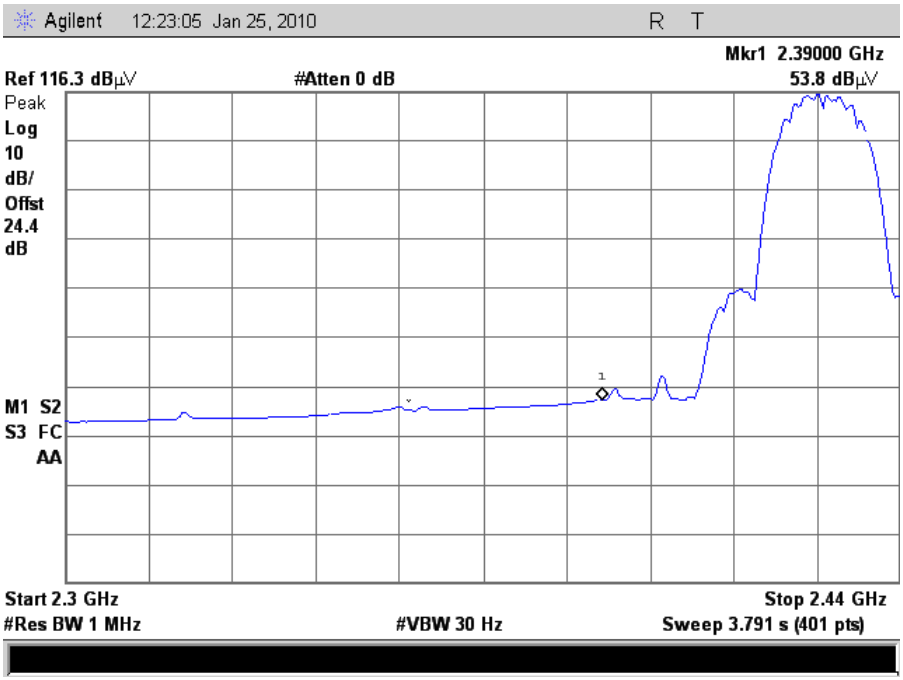


Plot 86. 802.11b Lower Band Edge, Channel 3, Average (24dBi Grid Antenna)

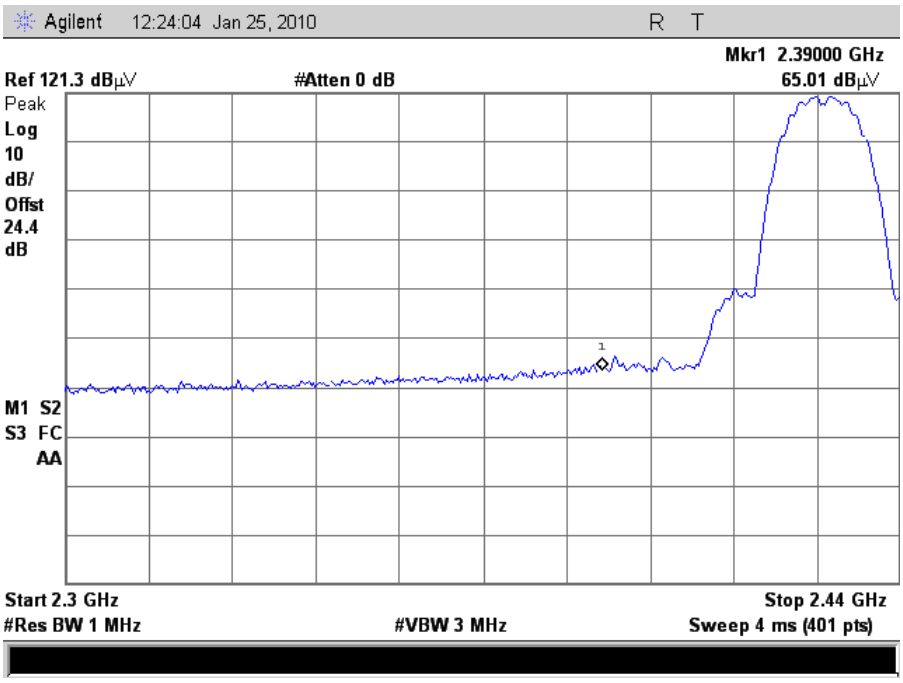


Plot 87. 802.11b Lower Band Edge, Channel 3, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode

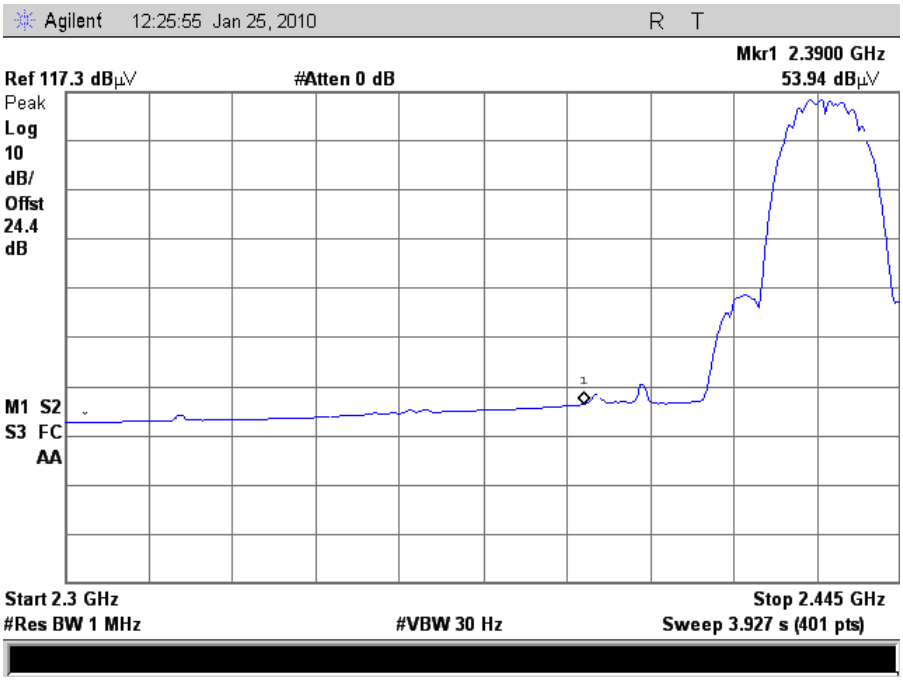


Plot 88. 802.11b Lower Band Edge, Channel 4, Average (24dBi Grid Antenna)

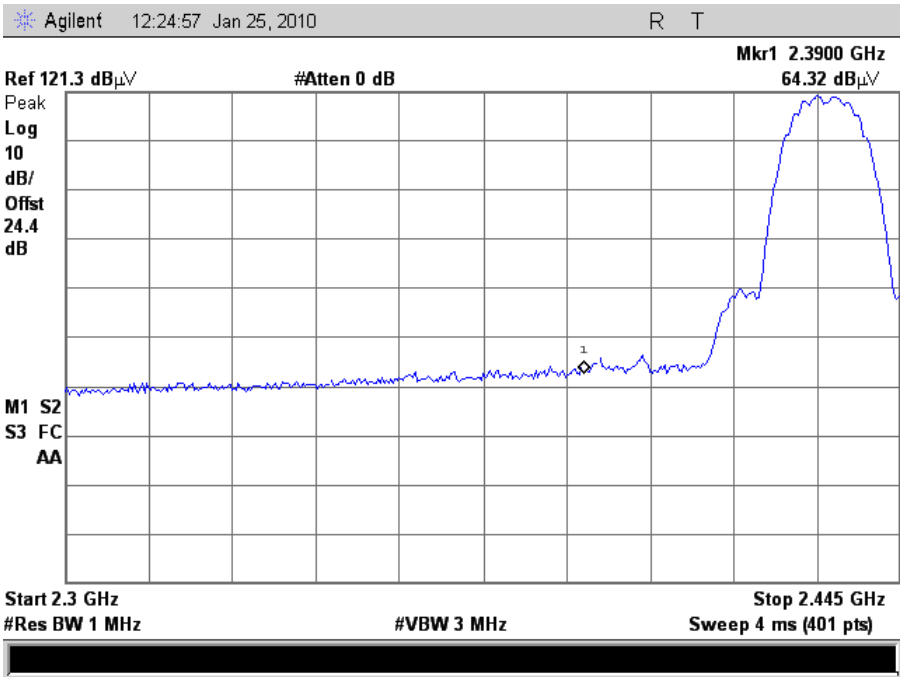


Plot 89. 802.11b Lower Band Edge, Channel 4, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode

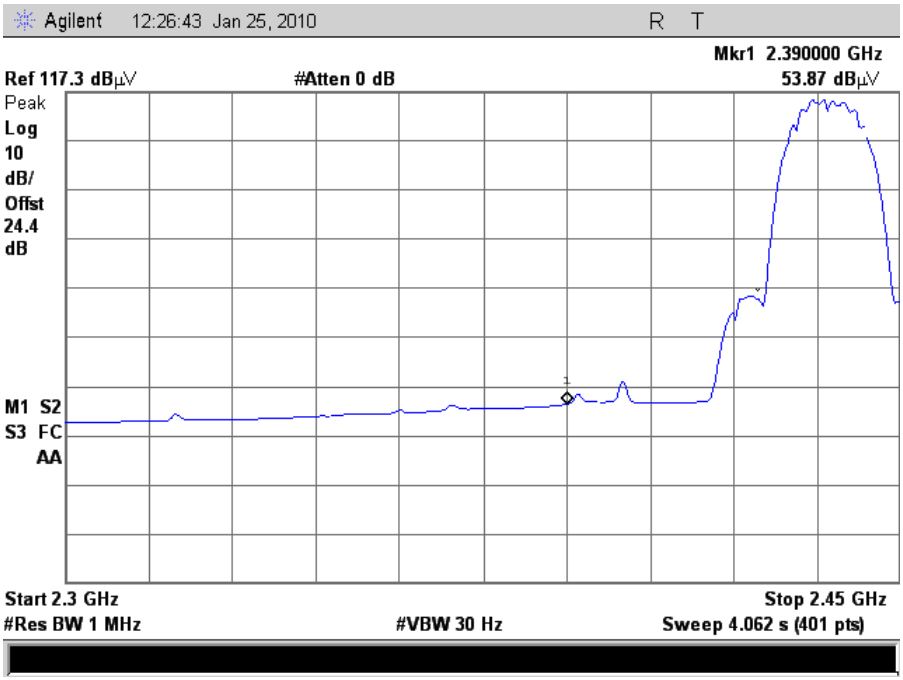


Plot 90. 802.11b Lower Band Edge, Channel 5, Average (24dBi Grid Antenna)

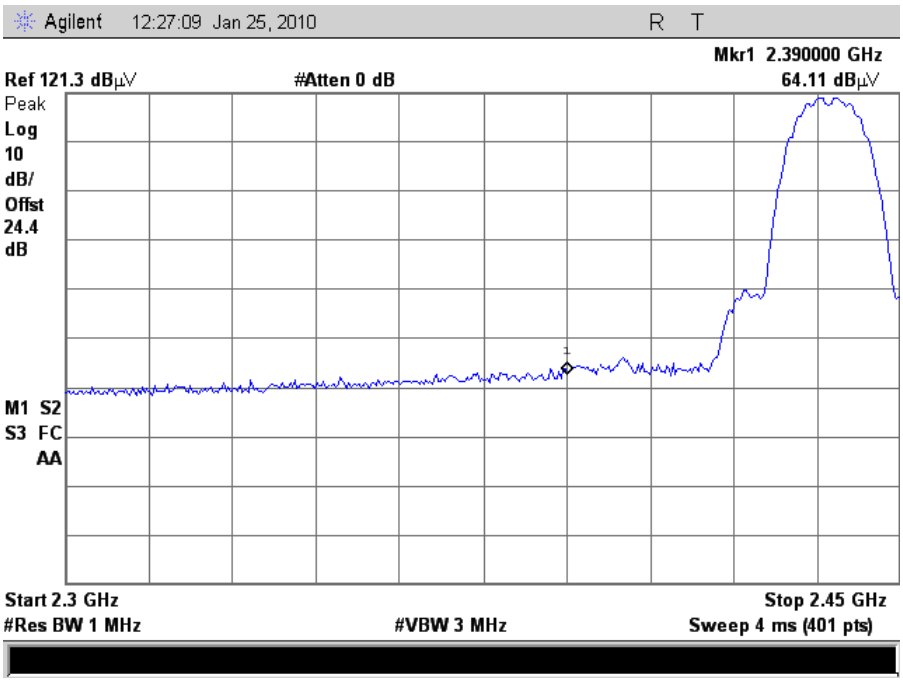


Plot 91. 802.11b Lower Band Edge, Channel 5, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode

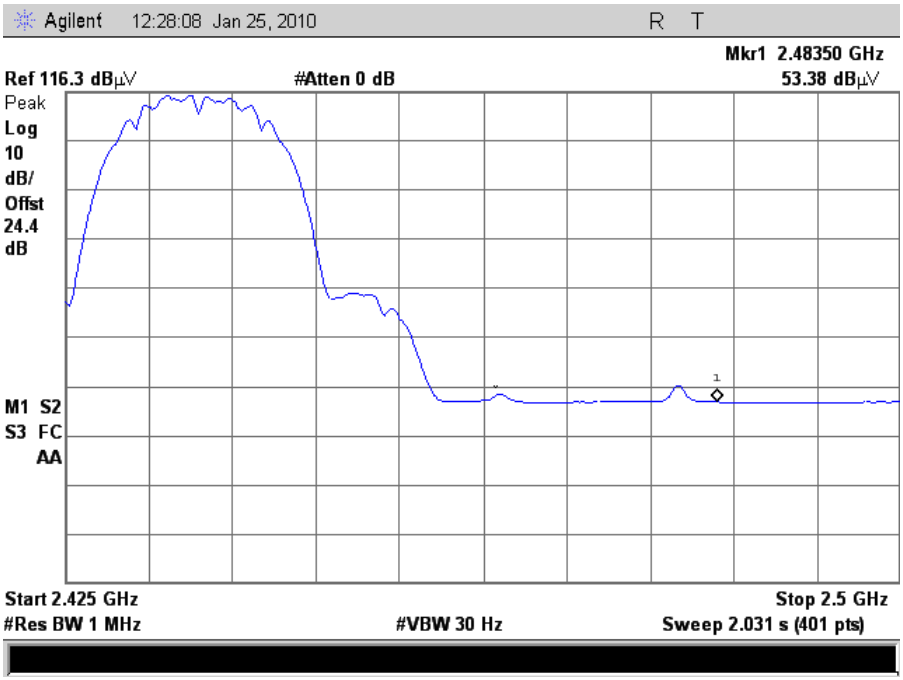


Plot 92. 802.11b Lower Band Edge, Channel 6, Average (24dBi Grid Antenna)

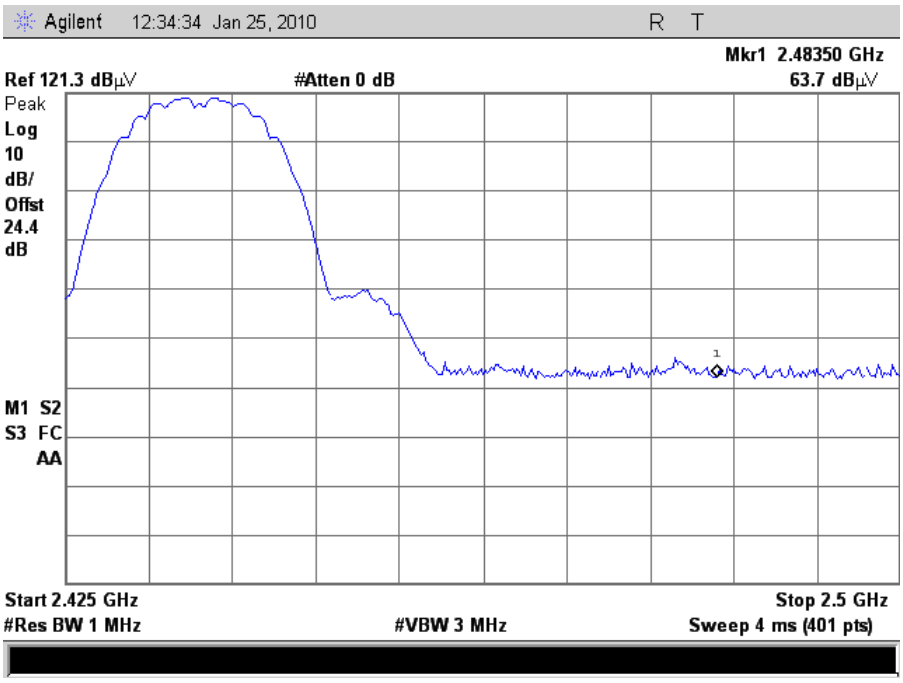


Plot 93. 802.11b Lower Band Edge, Channel 6, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode

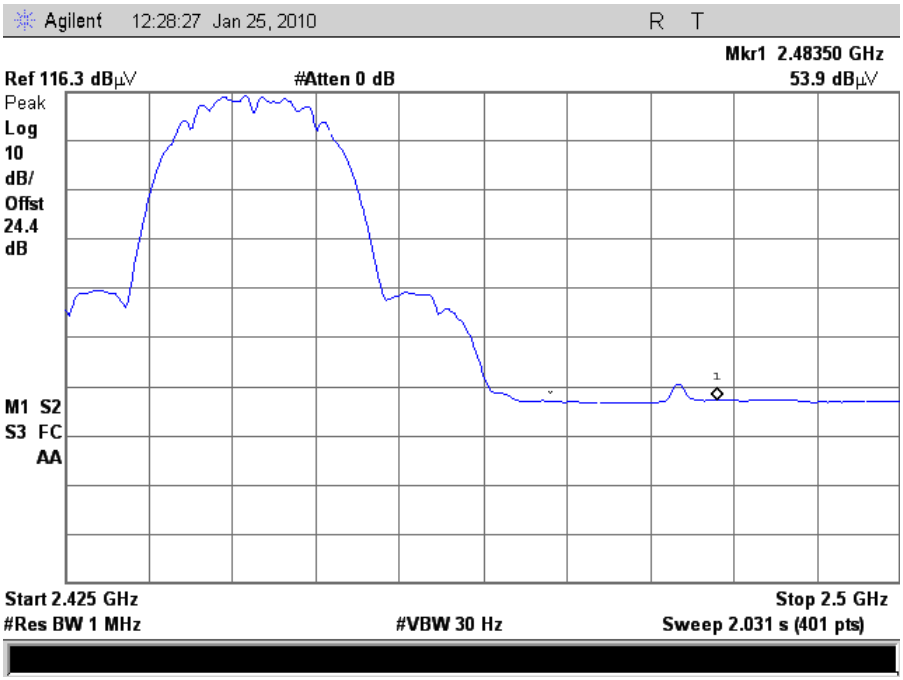


Plot 94. 802.11b Upper Band Edge, Channel 6, Average (24dBi Grid Antenna)

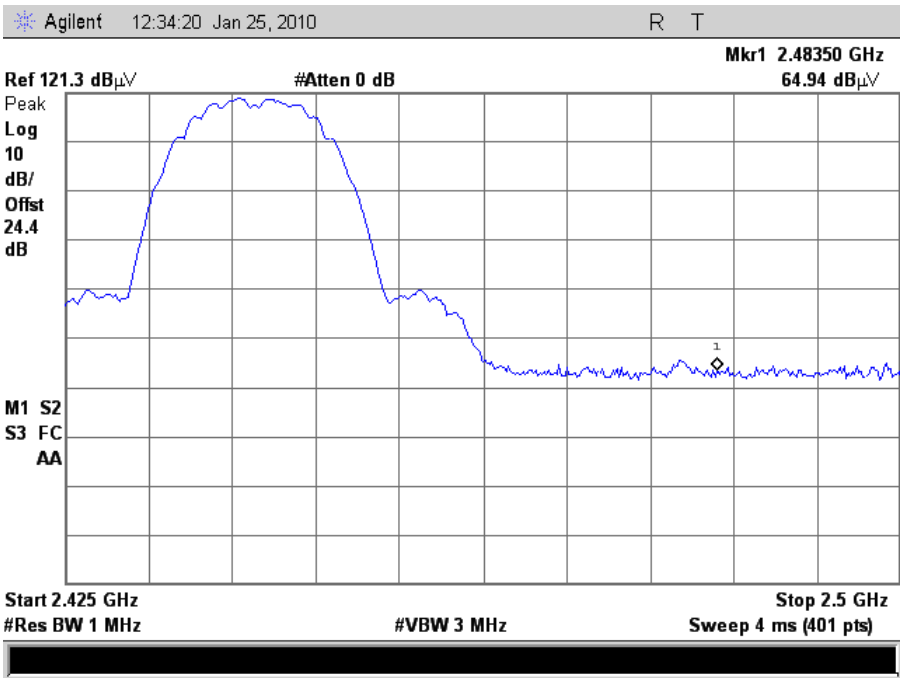


Plot 95. 802.11b Upper Band Edge, Channel 6, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode

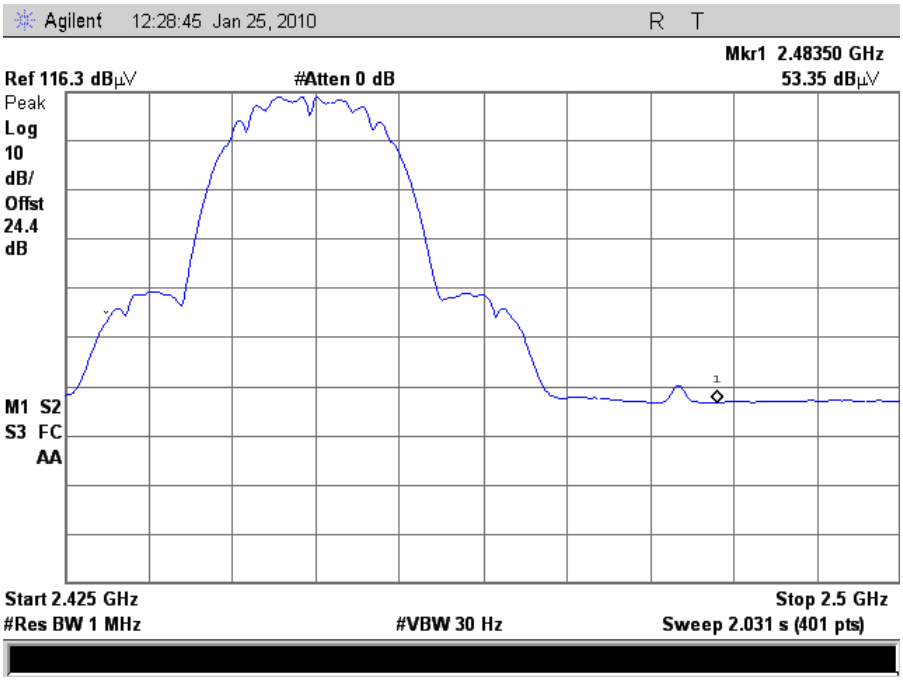


Plot 96. 802.11b Upper Band Edge, Channel 7, Average (24dBi Grid Antenna)

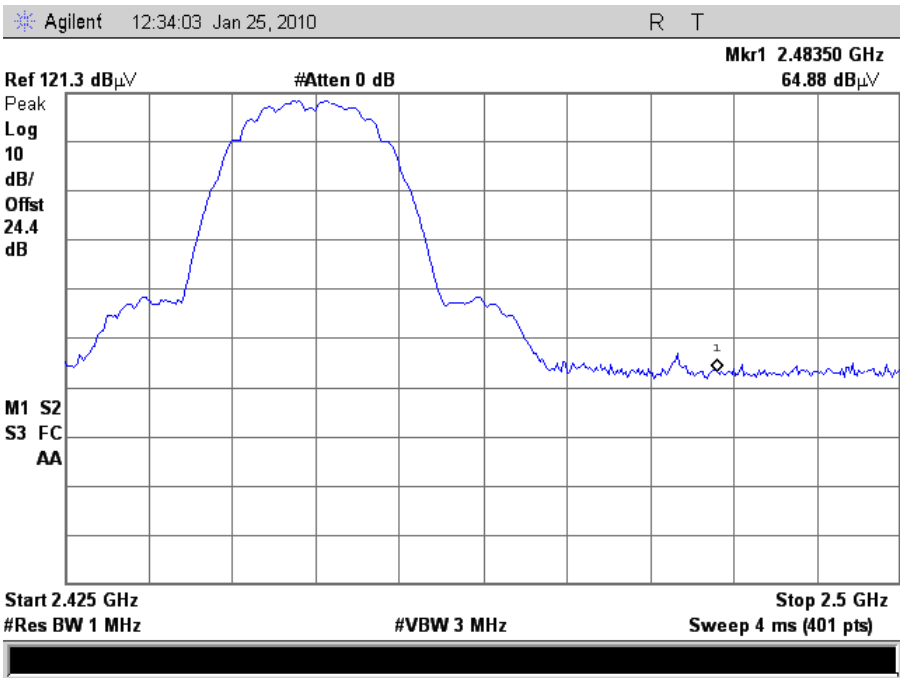


Plot 97. 802.11b Upper Band Edge, Channel 7, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode

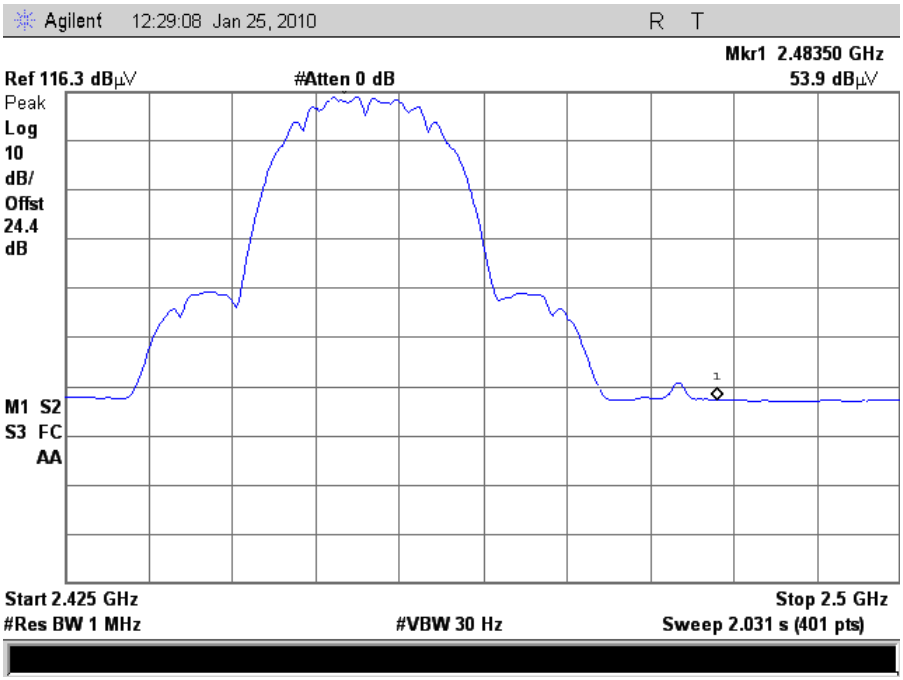


Plot 98. 802.11b Upper Band Edge, Channel 8, Average (24dBi Grid Antenna)

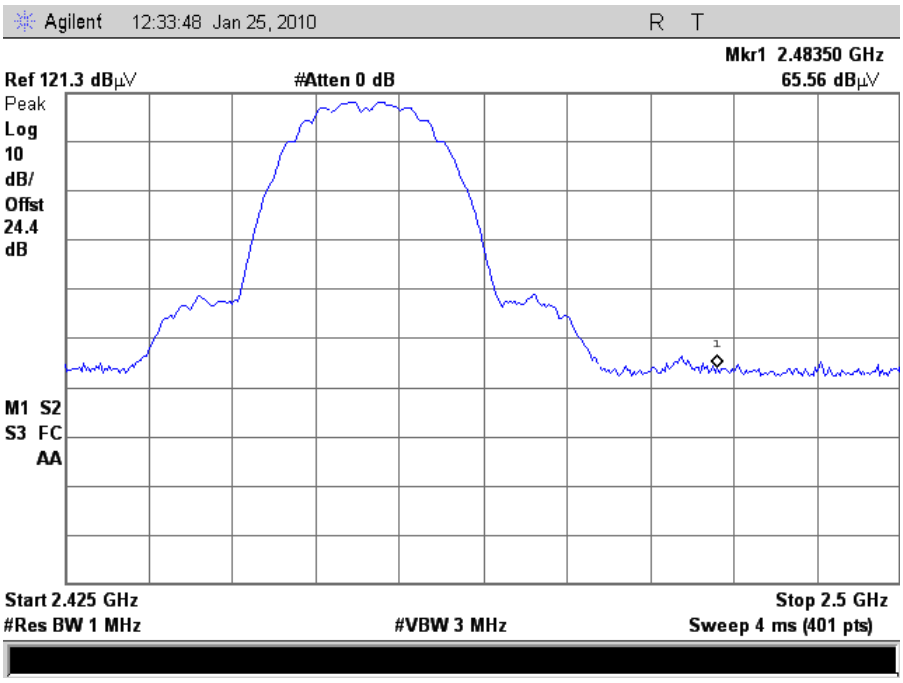


Plot 99. 802.11b Upper Band Edge, Channel 8, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode

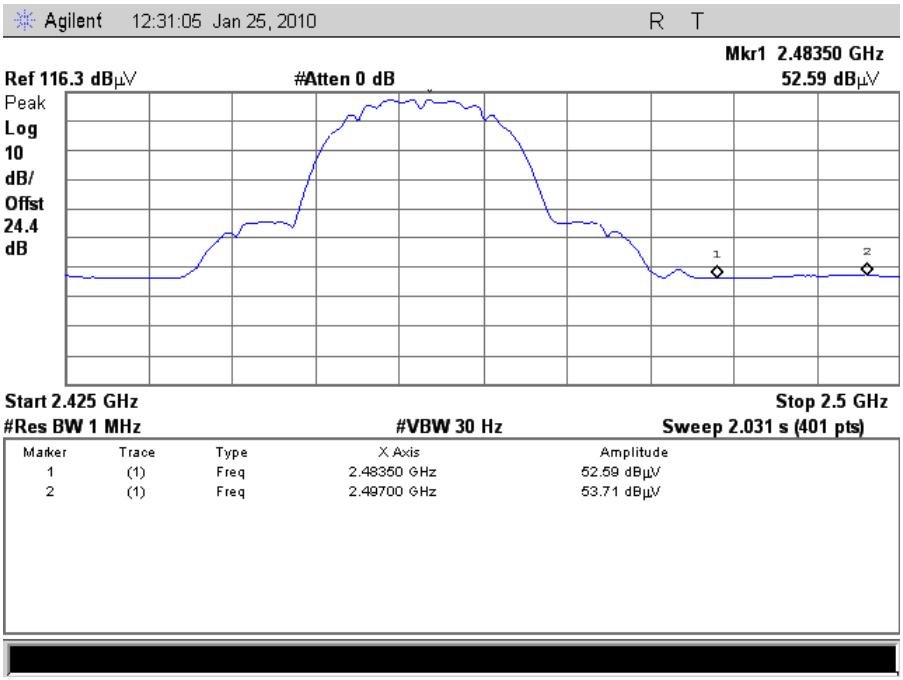


Plot 100. 802.11b Upper Band Edge, Channel 9, Average (24dBi Grid Antenna)

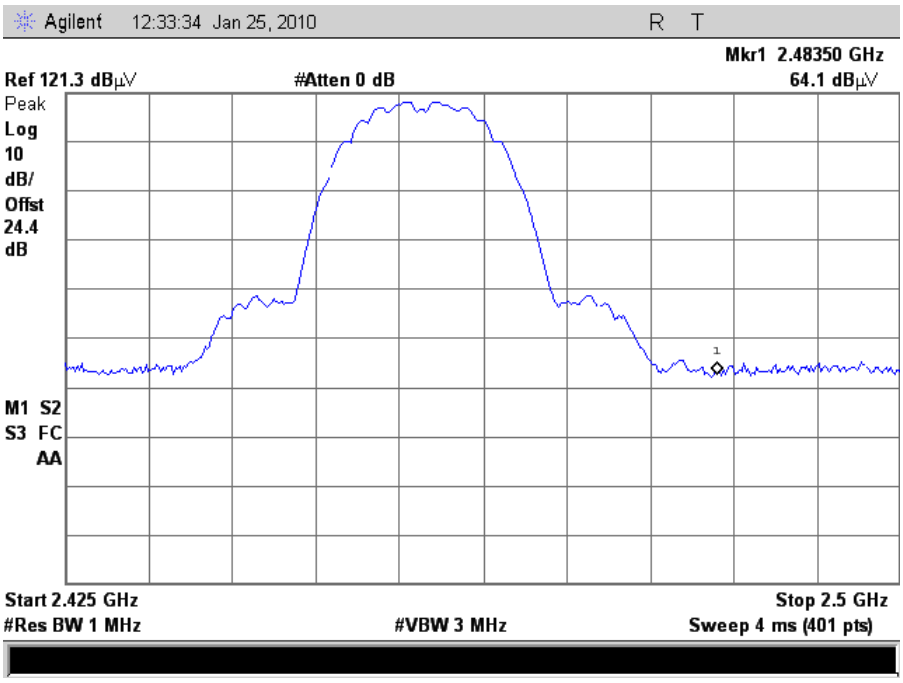


Plot 101. 802.11b Upper Band Edge, Channel 9, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode

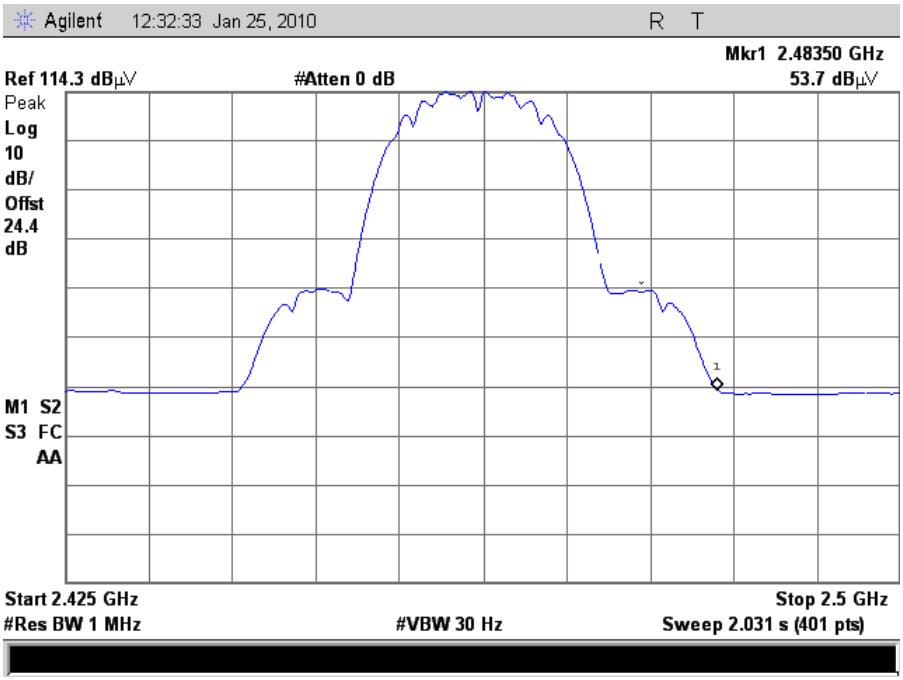


Plot 102. 802.11b Upper Band Edge, Channel 10, Average (24dBi Grid Antenna)

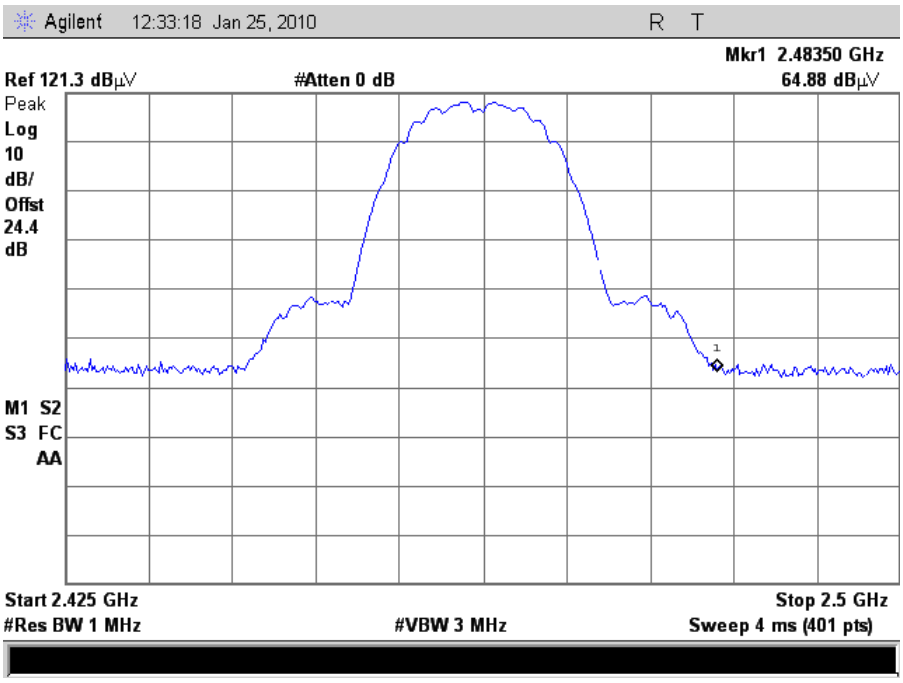


Plot 103. 802.11b Upper Band Edge, Channel 10, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11b Mode

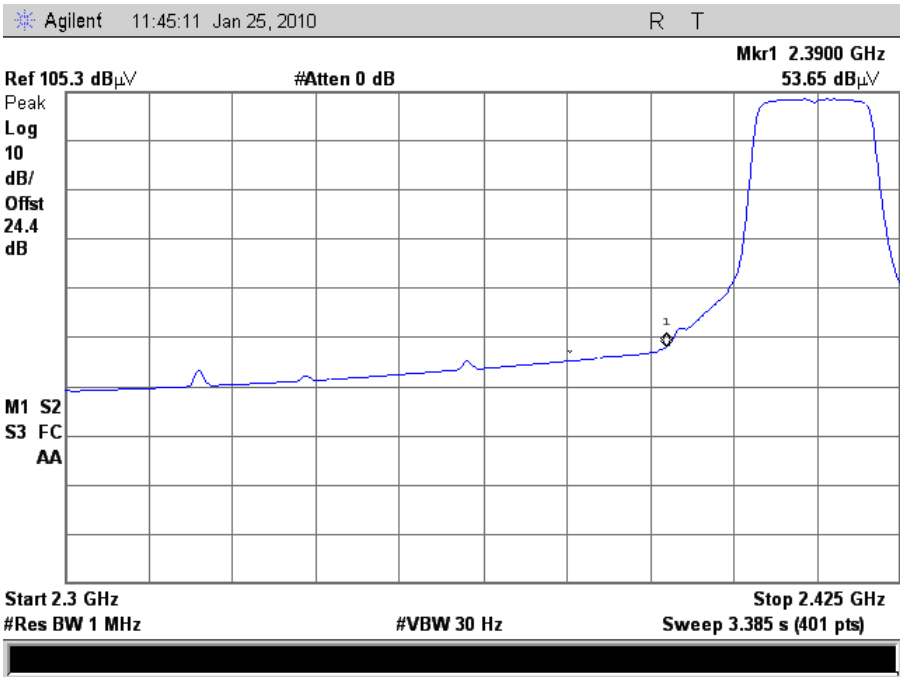


Plot 104. 802.11b Upper Band Edge, Channel 11, Average (24dBi Grid Antenna)

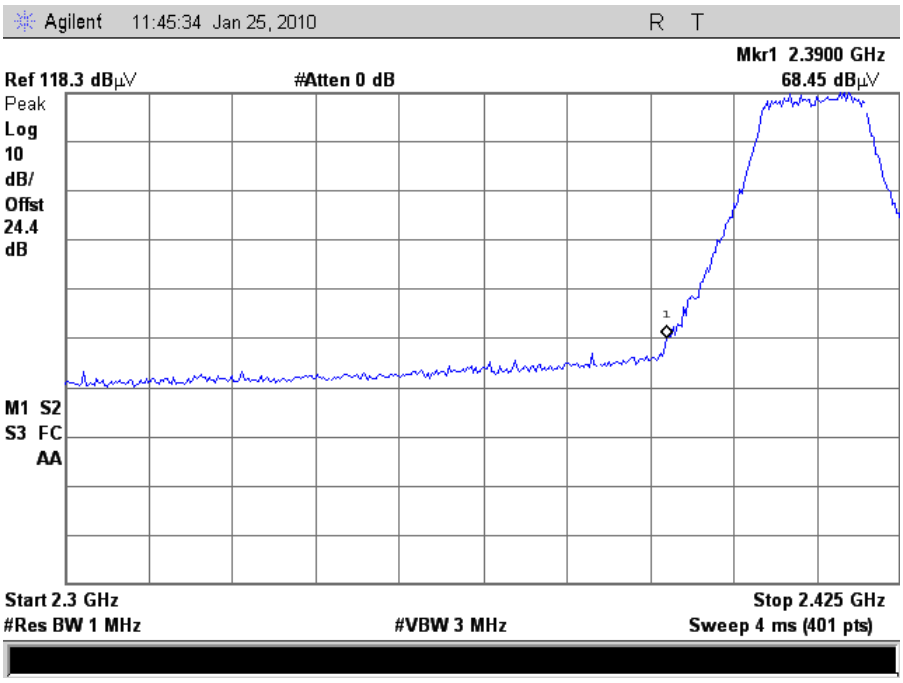


Plot 105. 802.11b Upper Band Edge, Channel 11, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode

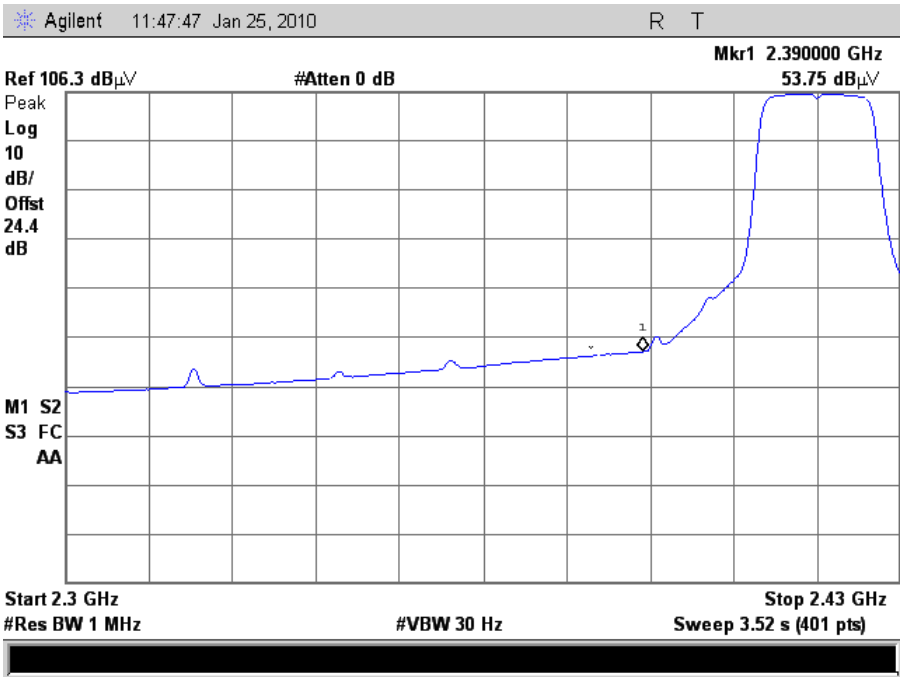


Plot 106. 802.11g Lower Band Edge, Channel 1, Average (24dBi Grid Antenna)

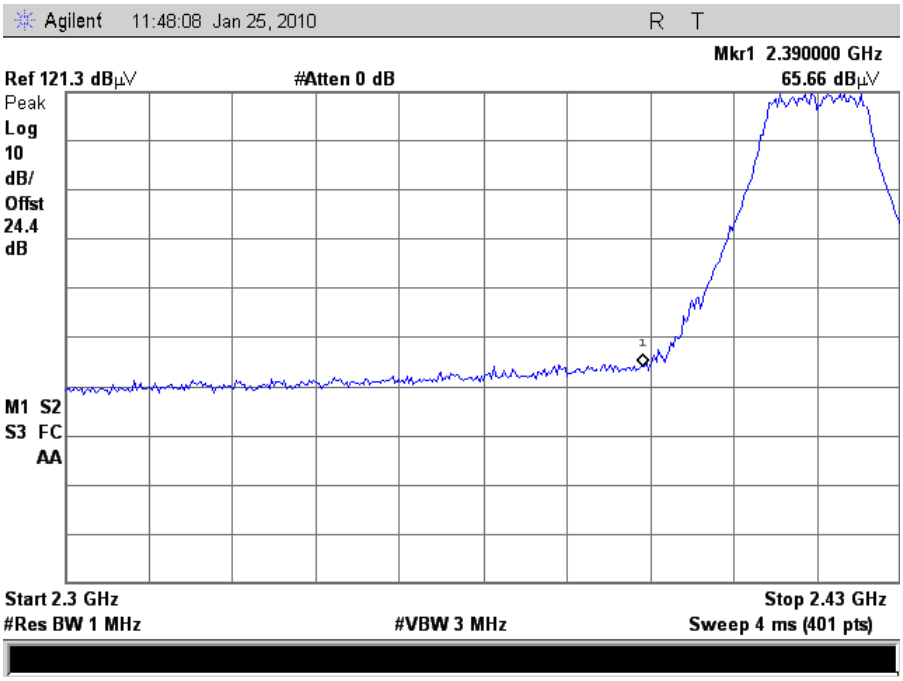


Plot 107. 802.11g Lower Band Edge, Channel 1, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode

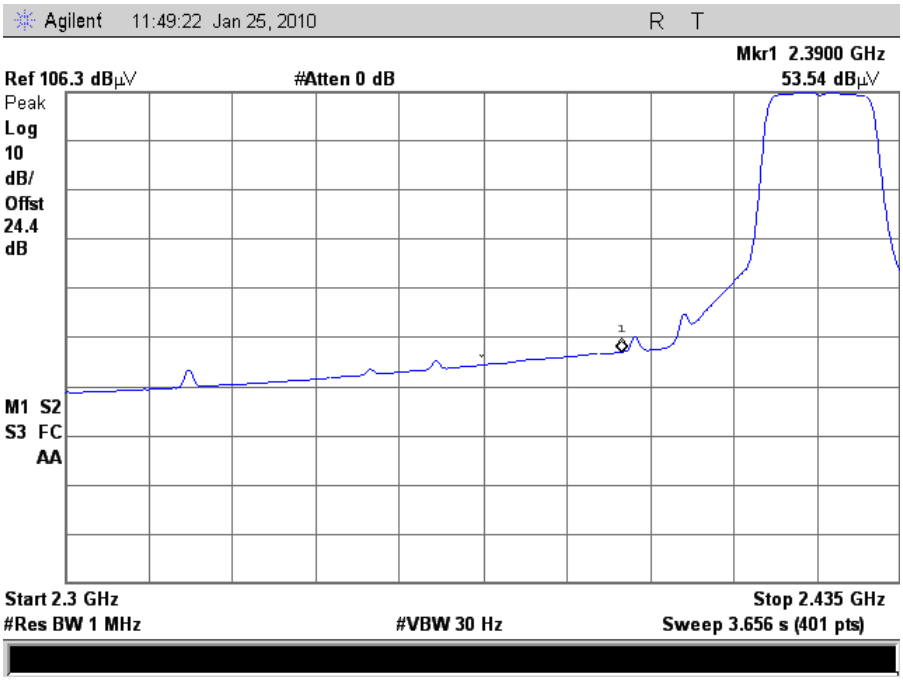


Plot 108. 802.11g Lower Band Edge, Channel 2, Average (24dBi Grid Antenna)

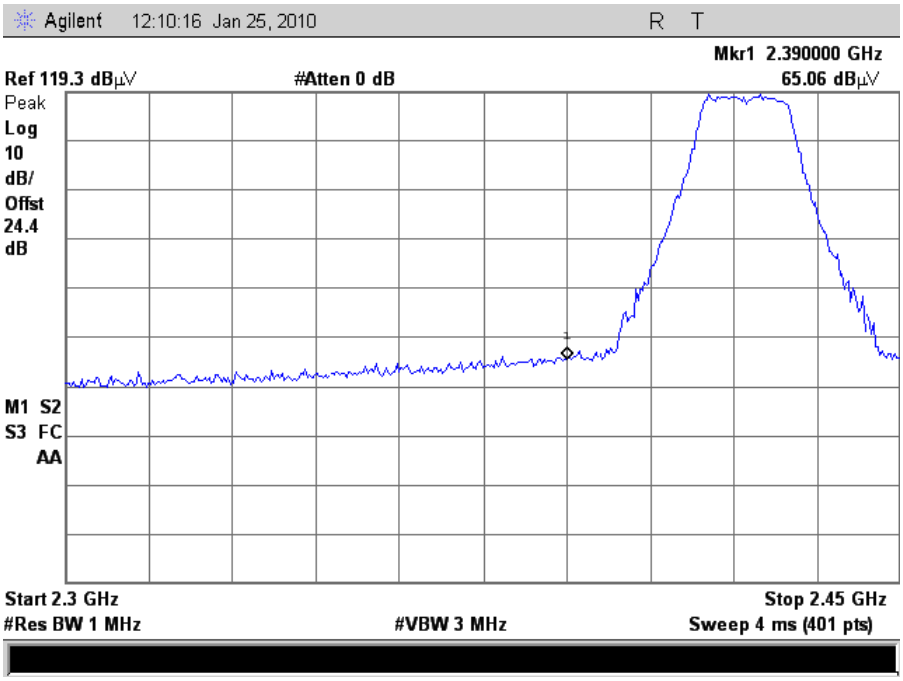


Plot 109. 802.11g Lower Band Edge, Channel 2, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode

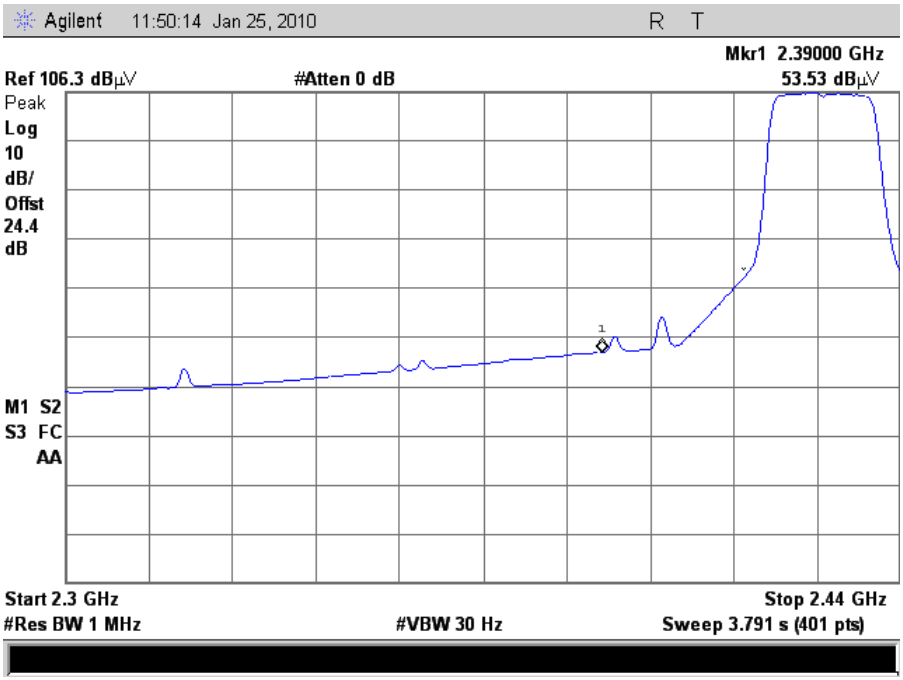


Plot 110. 802.11g Lower Band Edge, Channel 3, Average (24dBi Grid Antenna)

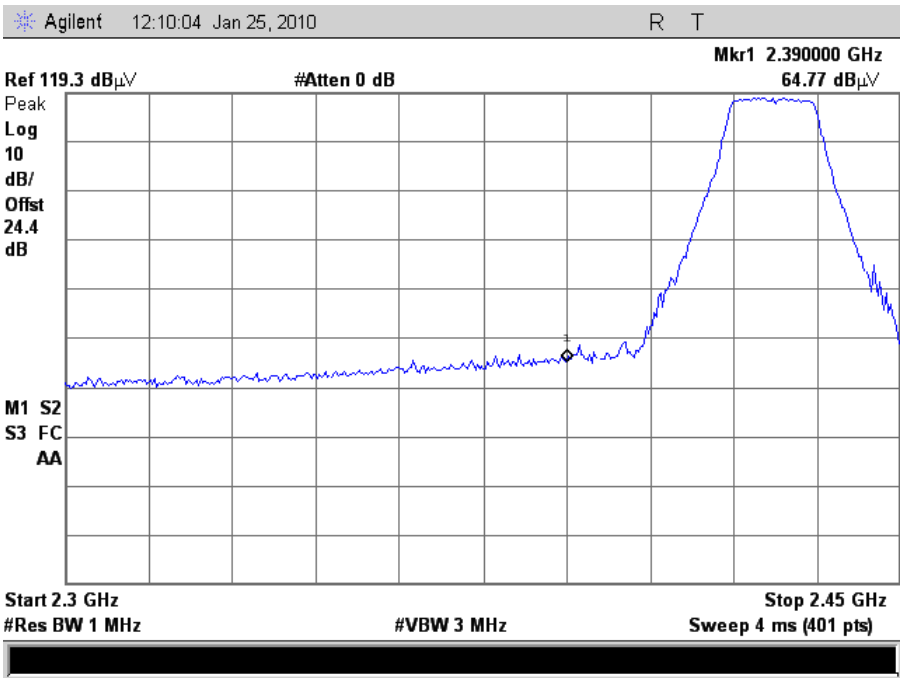


Plot 111. 802.11g Lower Band Edge, Channel 3, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode

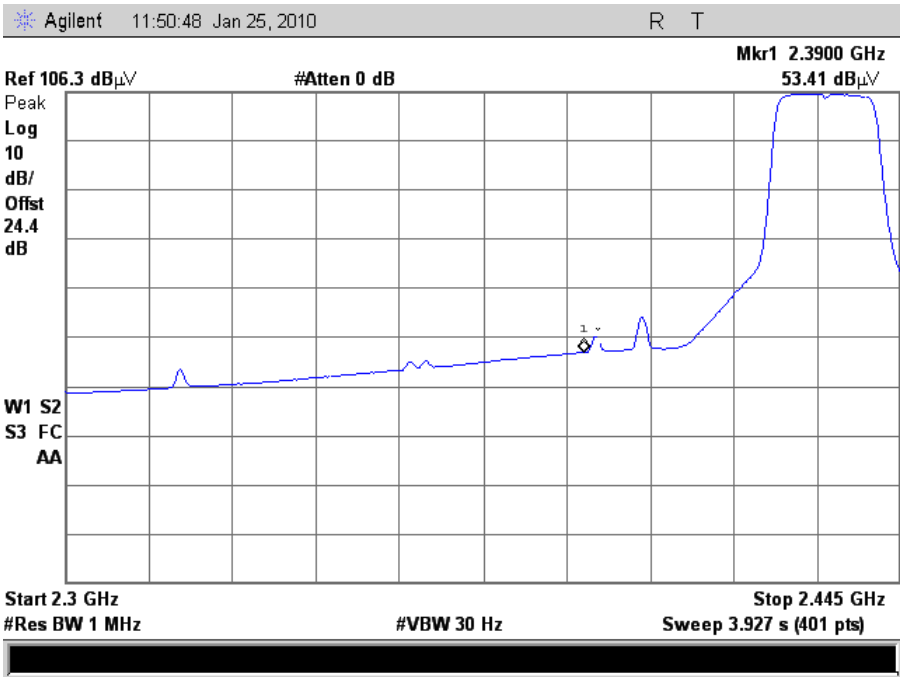


Plot 112. 802.11g Lower Band Edge, Channel 4, Average (24dBi Grid Antenna)

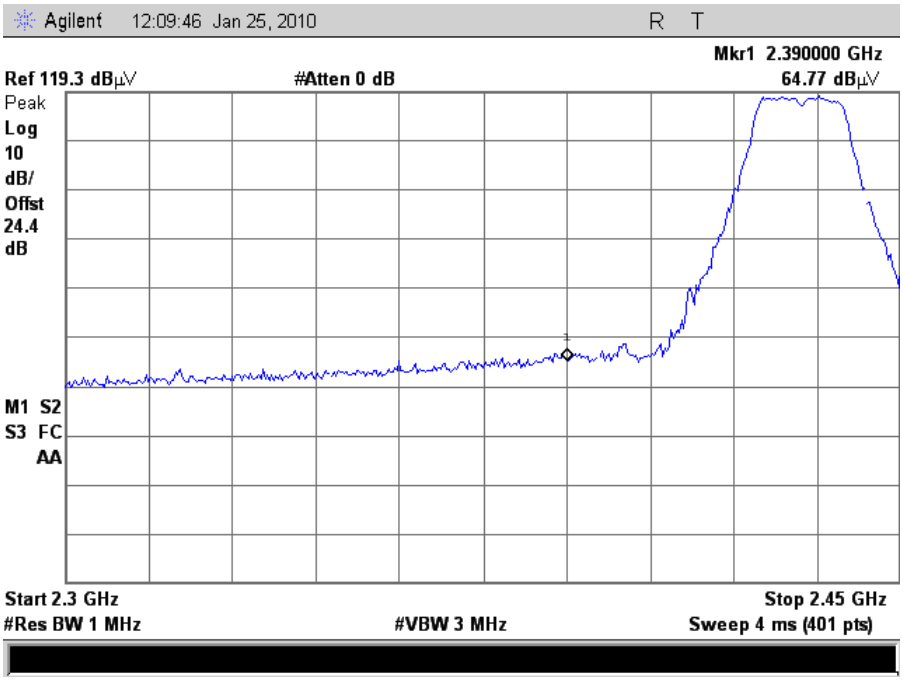


Plot 113. 802.11g Lower Band Edge, Channel 4, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode

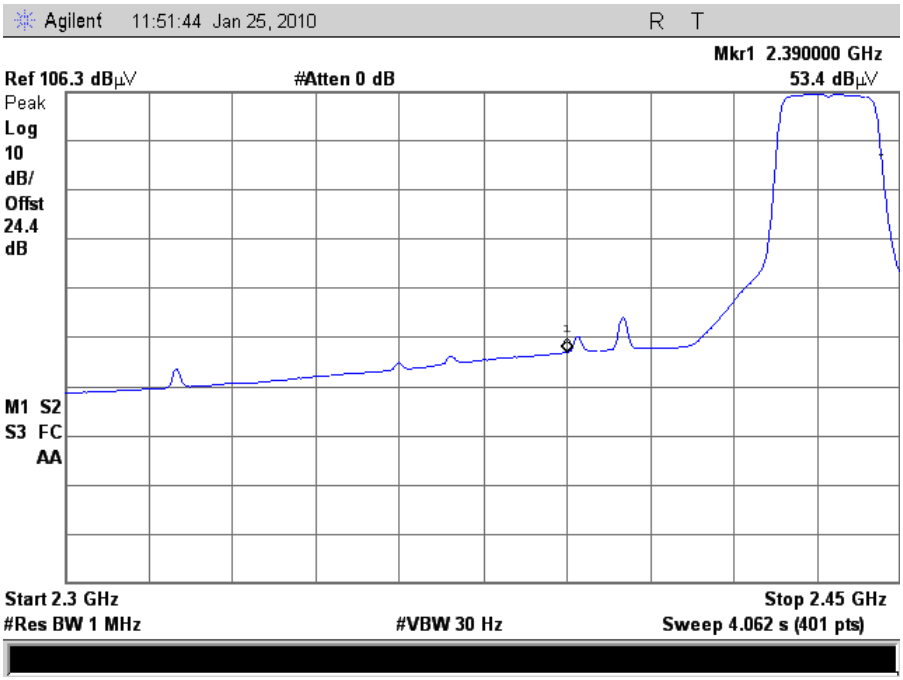


Plot 114. 802.11g Lower Band Edge, Channel 5, Average (24dBi Grid Antenna)

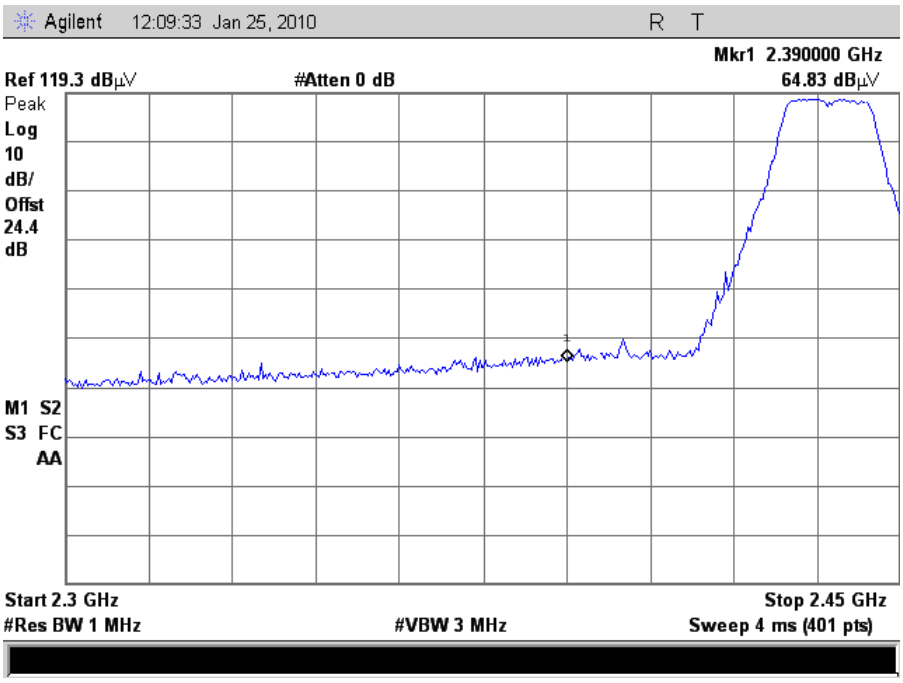


Plot 115. 802.11g Lower Band Edge, Channel 5, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode

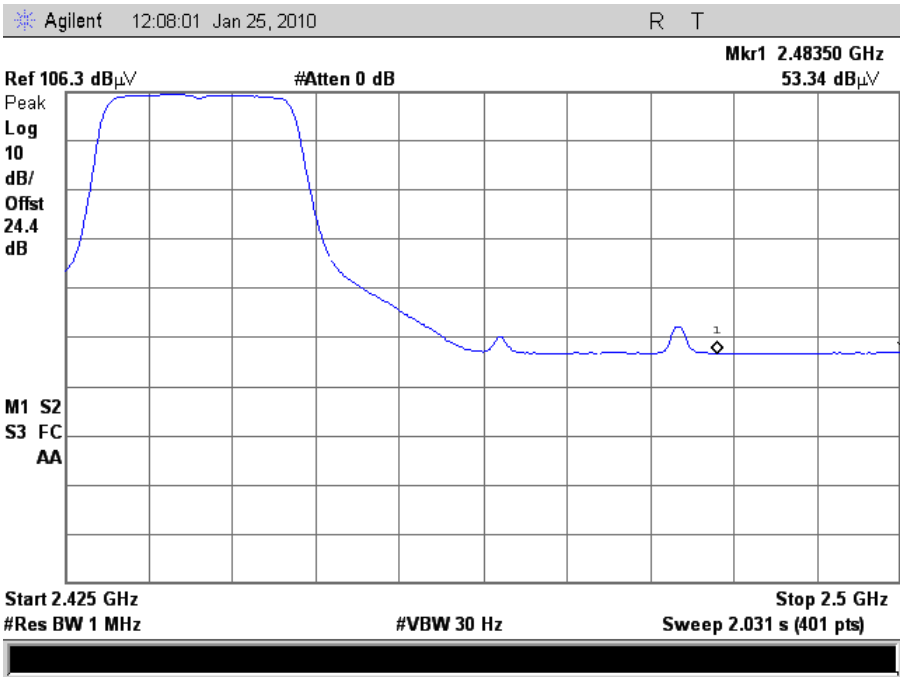


Plot 116. 802.11g Lower Band Edge, Channel 6, Average (24dBi Grid Antenna)

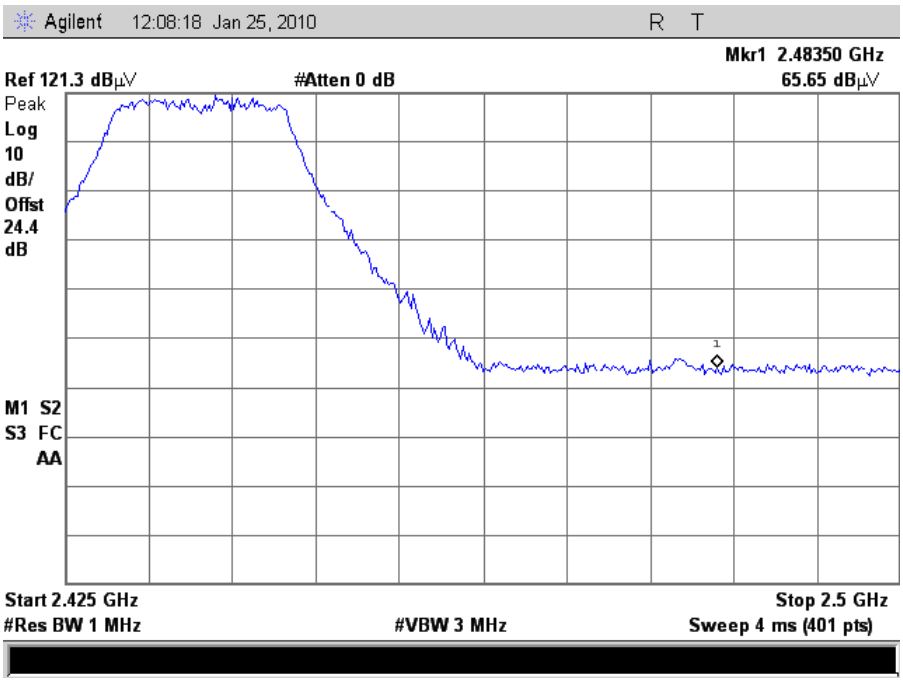


Plot 117. 802.11g Lower Band Edge, Channel 6, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode

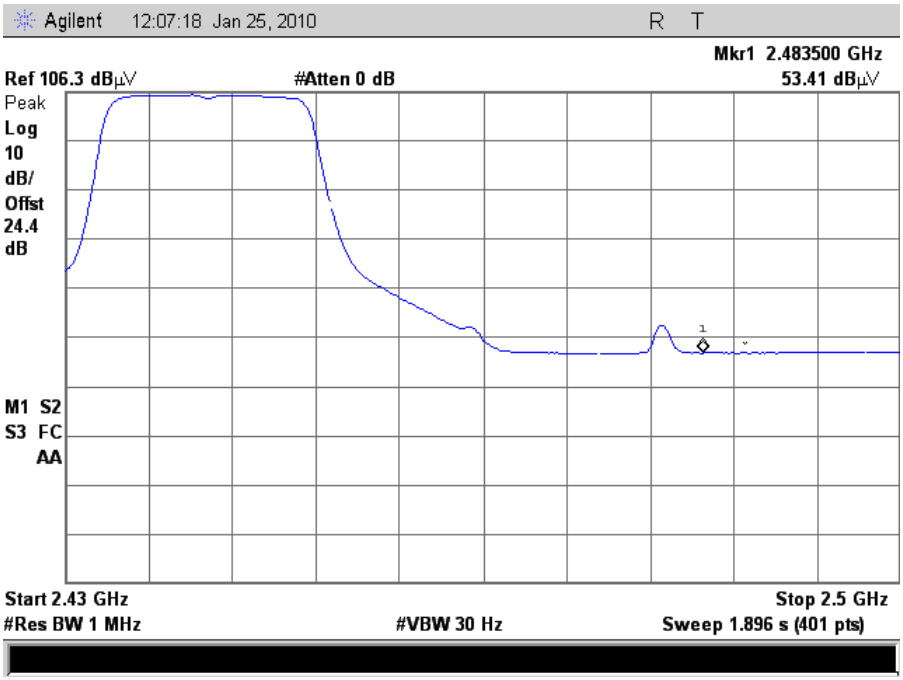


Plot 118. 802.11g Upper Band Edge, Channel 6, Average (24dBi Grid Antenna)

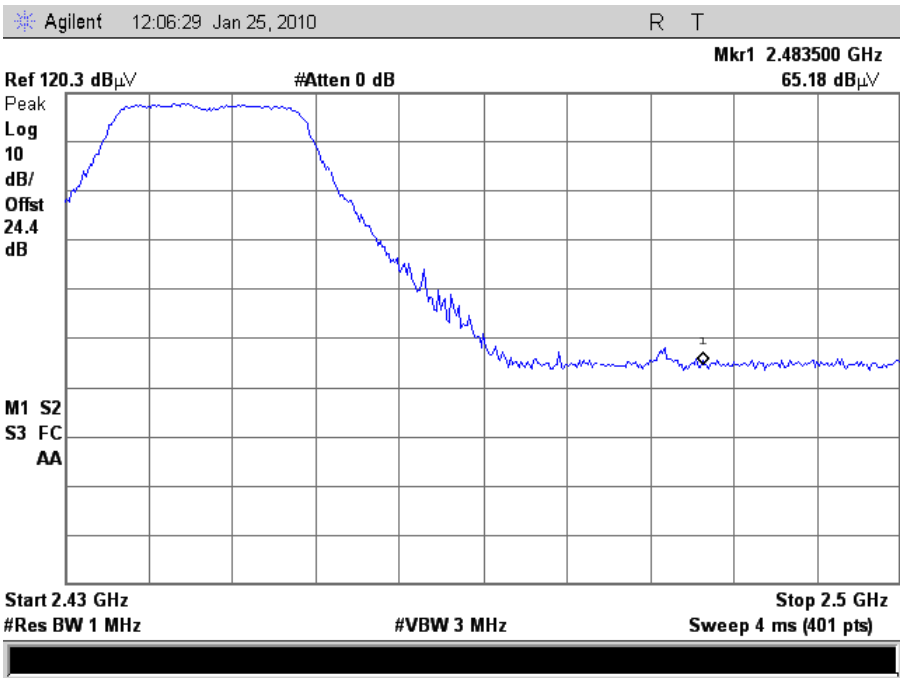


Plot 119. 802.11g Upper Band Edge, Channel 6, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode

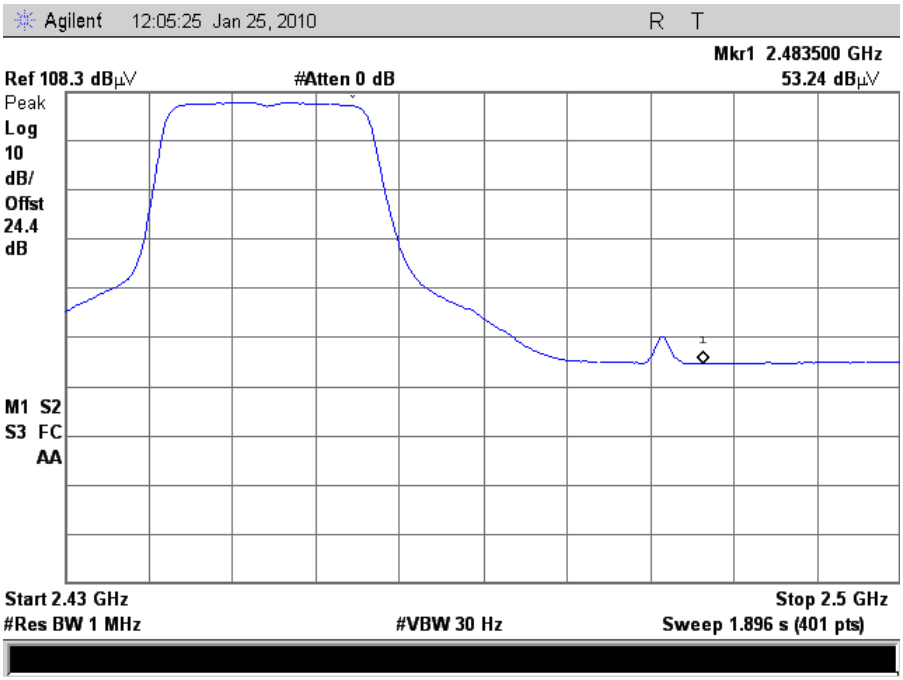


Plot 120. 802.11g Upper Band Edge, Channel 7, Average (24dBi Grid Antenna)

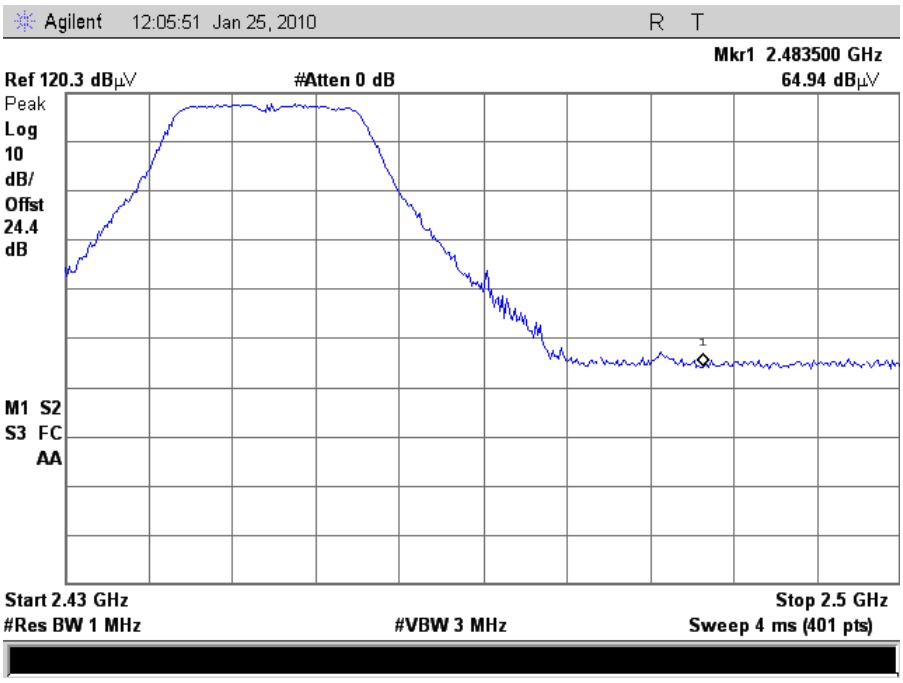


Plot 121. 802.11g Upper Band Edge, Channel 7, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode

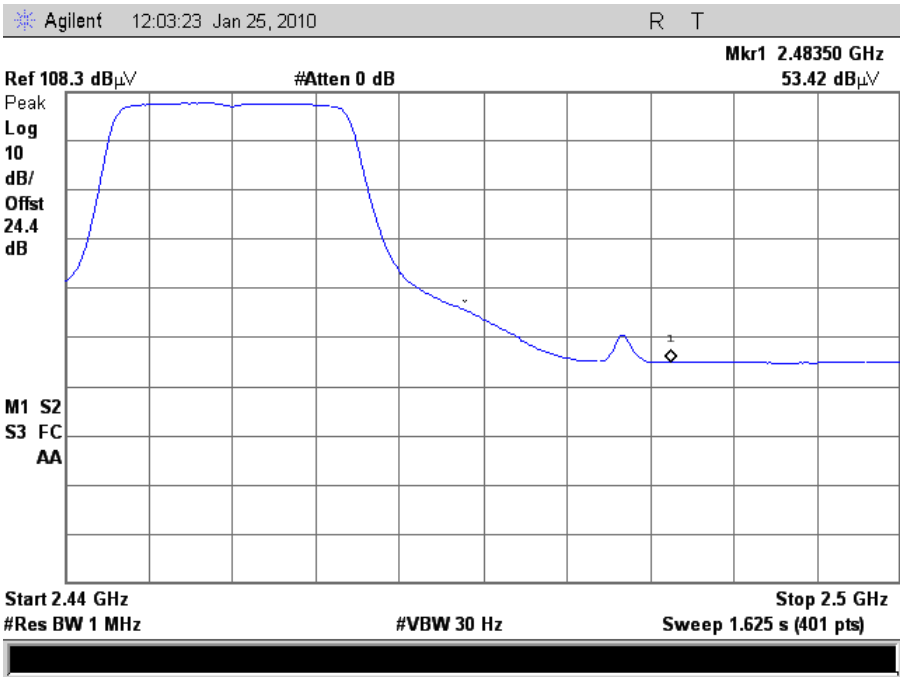


Plot 122. 802.11g Upper Band Edge, Channel 8, Average (24dBi Grid Antenna)

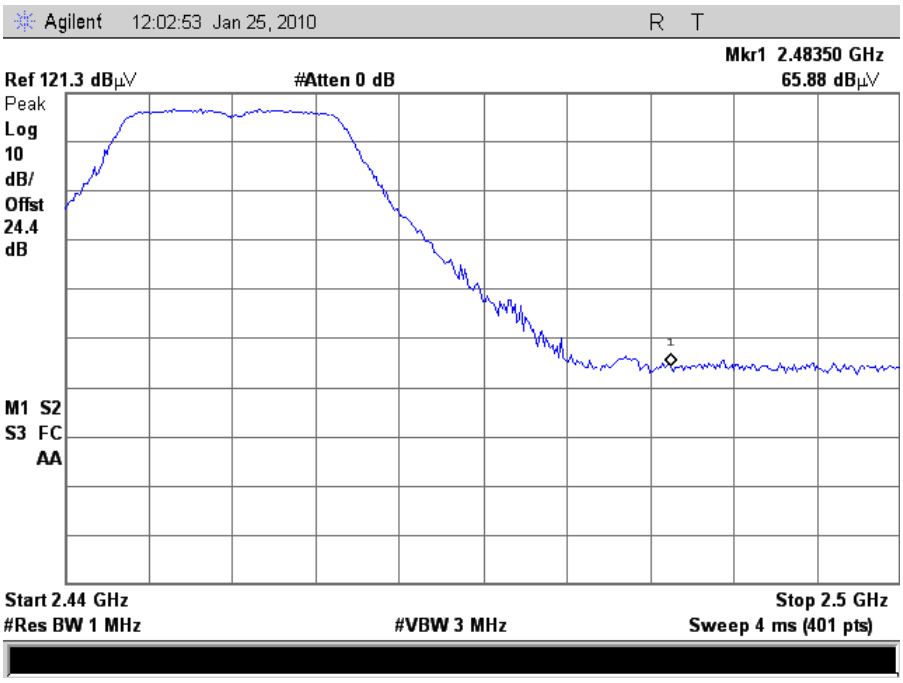


Plot 123. 802.11g Upper Band Edge, Channel 8, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode

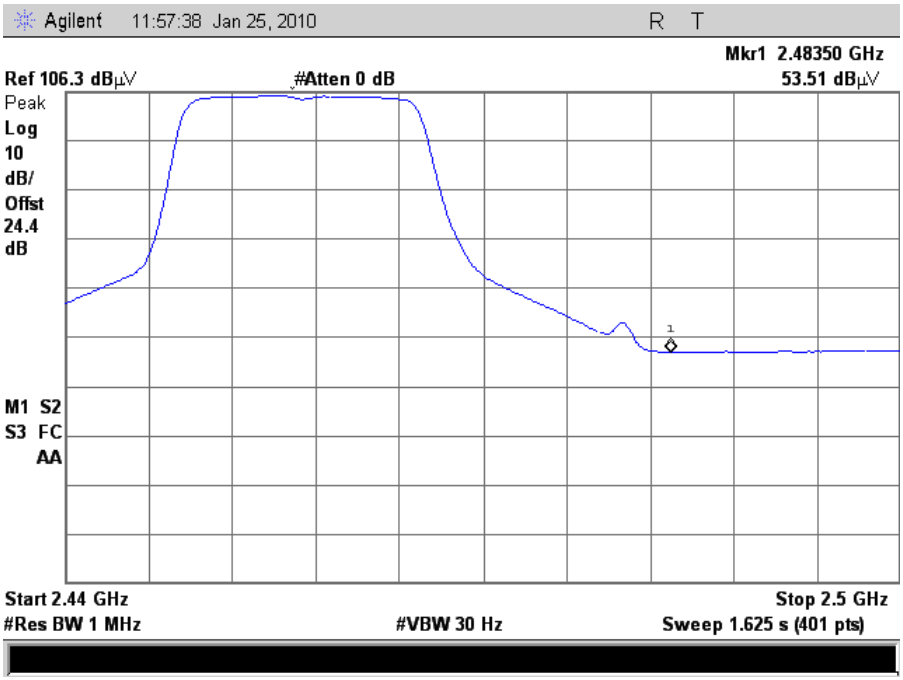


Plot 124. 802.11g Upper Band Edge, Channel 9, Average (24dBi Grid Antenna)

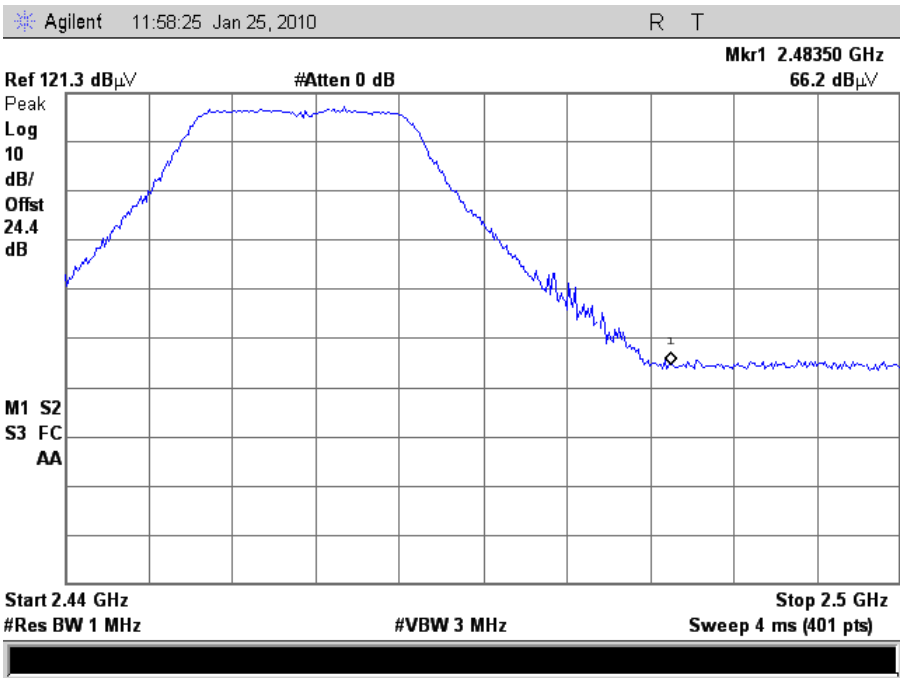


Plot 125. 802.11g Upper Band Edge, Channel 9, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode

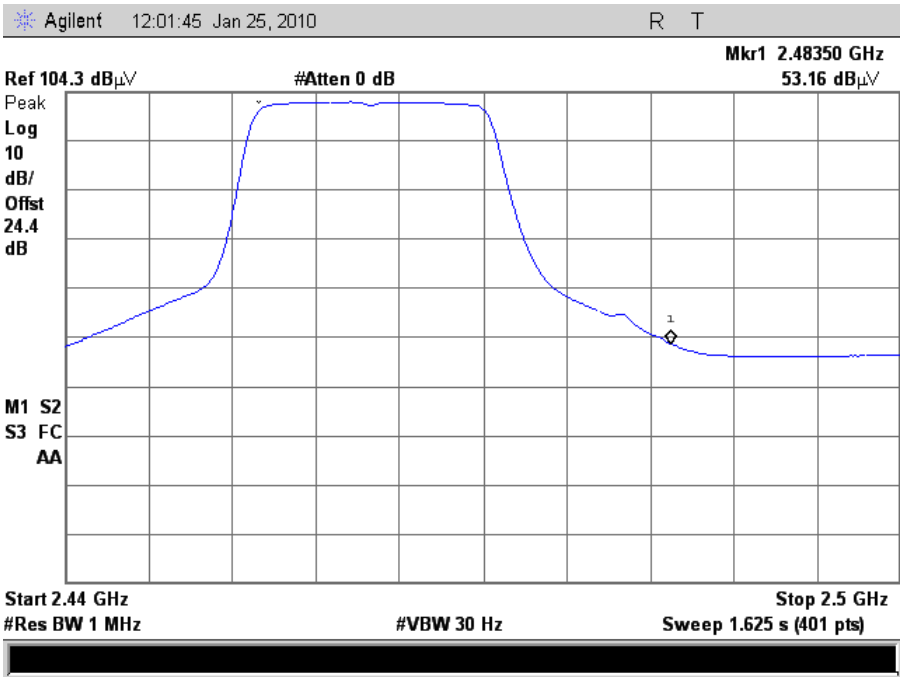


Plot 126. 802.11g Upper Band Edge, Channel 10, Average (24dBi Grid Antenna)

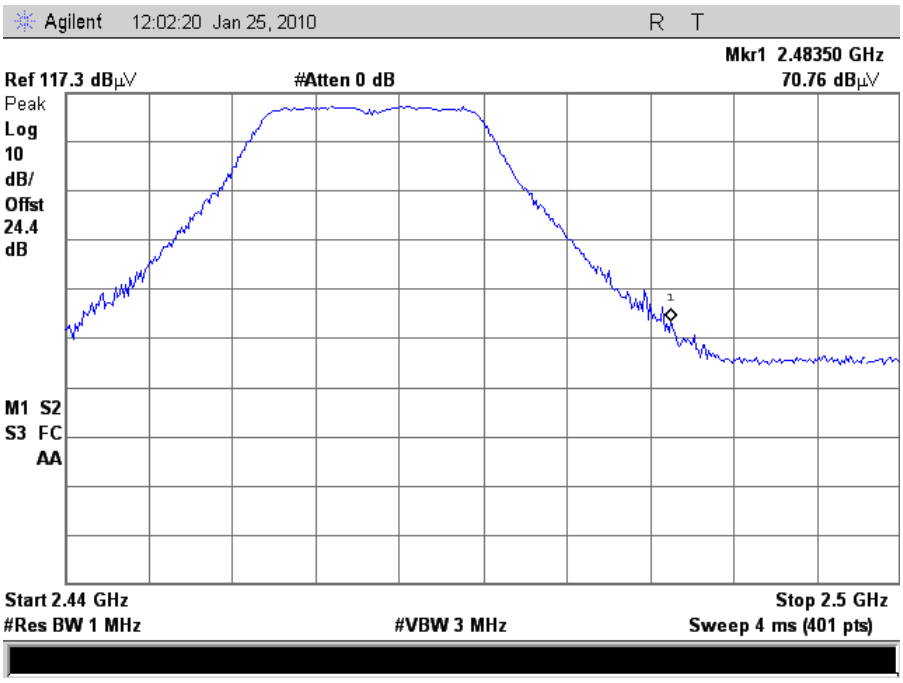


Plot 127. 802.11g Upper Band Edge, Channel 10, Peak (24dBi Grid Antenna)

Radiated Band Edge Measurements Test Results – 802.11g Mode

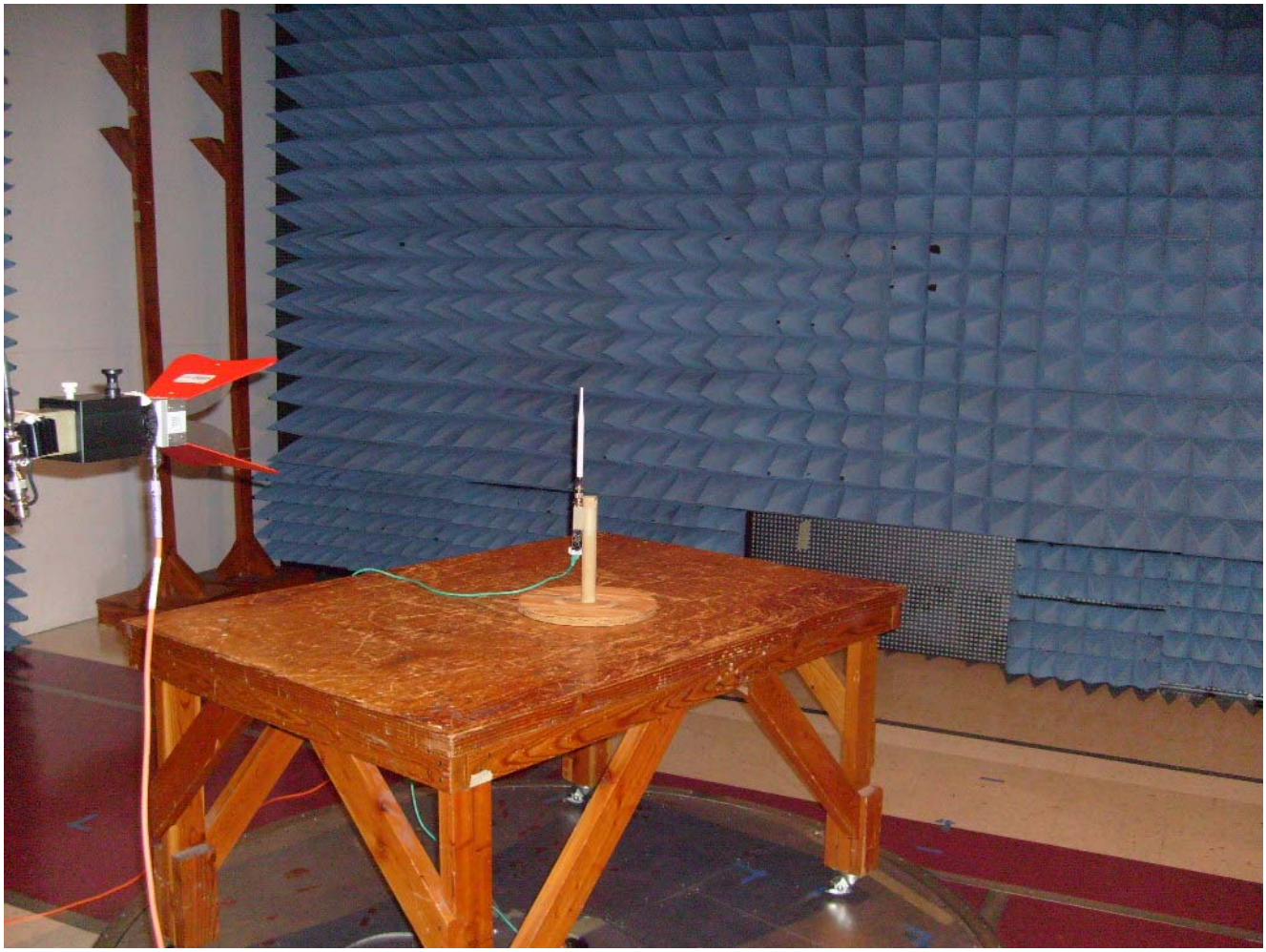


Plot 128. 802.11g Upper Band Edge, Channel 11, Average (24dBi Grid Antenna)



Plot 129. 802.11g Upper Band Edge, Channel 11, Peak (24dBi Grid Antenna)

Radiated Measurements Test Photographs



Photograph 6. Radiated Spurious Emission, 1m Test Setup (6dBi Omni Antenna)

Radiated Measurements Test Photographs

Photograph 7. Radiated Spurious Emission, 3m Test Setup (6dBi Omni Antenna)

Radiated Measurements Test Photographs

Photograph 8. Radiated Spurious Emission, Test Setup (24dBi Grid Antenna)

Radiated Measurements Test Photographs

Photograph 9. Radiated Spurious Emission, Test Setup (24dBi Grid Antenna)

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 27.

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

Table 27. 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 1 MHz resolution was used for measurements done above 1 GHz. All plots are corrected for cable loss.

Test Results: Equipment complies with the Receiver Spurious Emissions Requirements of RSS-GEN.

Test Engineer(s): Minh Ly

Test Date(s): 01/05/10 & 2/19/10

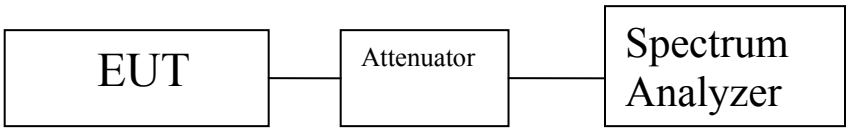
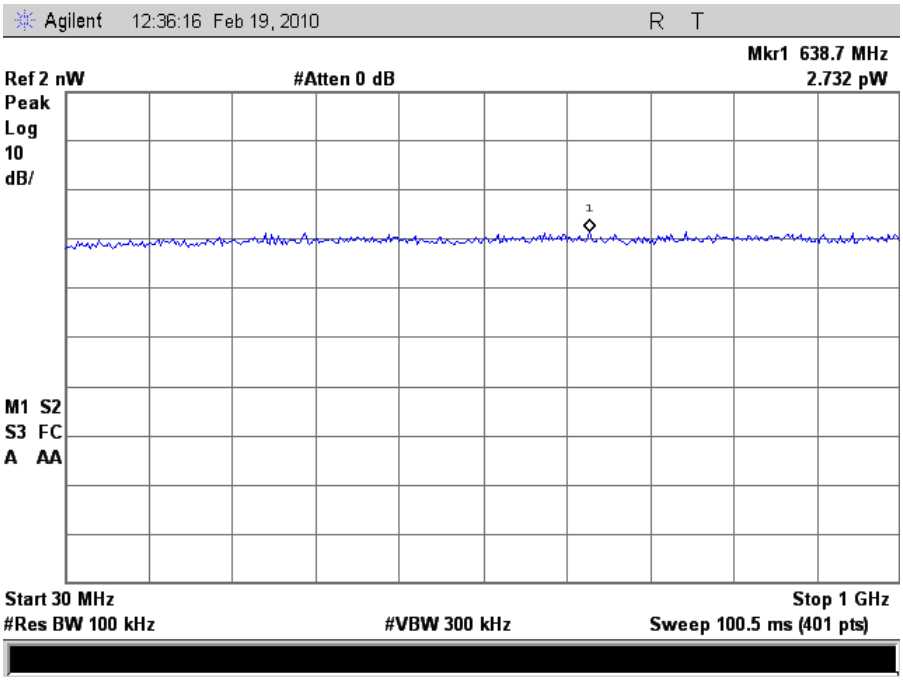
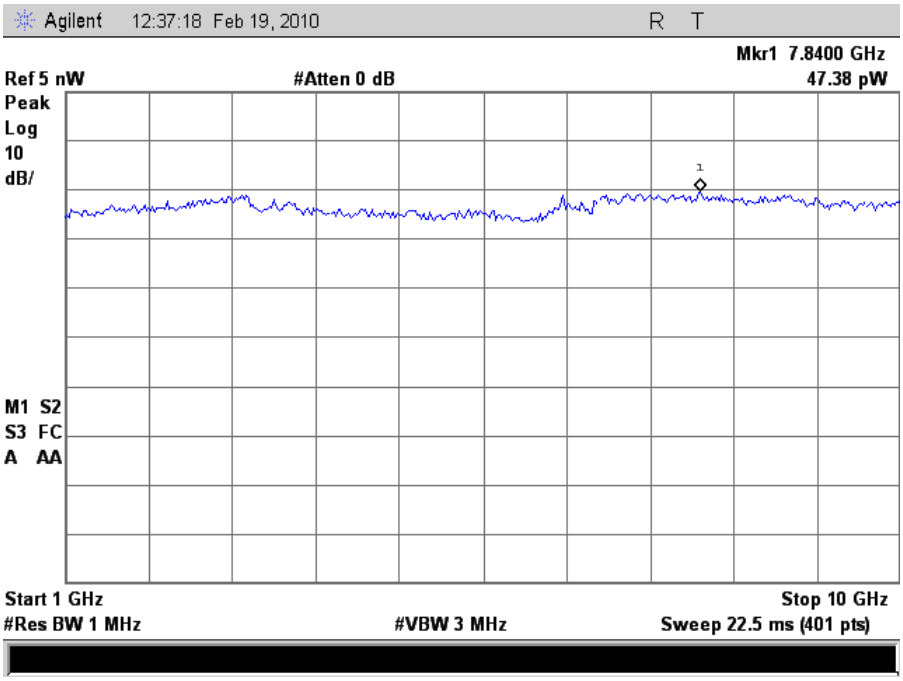


Figure 5. Block Diagram, Conducted Receiver Spurious Emissions Test Setup

Receiver Spurious Emissions (6dBi Omni Antenna)



Plot 130. Conducted Receiver Spurious Emission, 30MHz – 1GHz



Plot 131. Conducted Receiver Spurious Emission, 1 GHz – 10 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 leas 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.

A conducted version of the EUT was provided with an N connector at the antenna port. The spectrum analyzer was set to a 100 kHz resolution bandwidth and 300 kHz video bandwidth. Measurements were taken at antenna port. Plots are corrected for external attenuation 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)**.

Test Engineer(s): Anderson Soungpanya & Minh Ly

Test Date(s): 01/12/10, 01/13/10 & 2/19/10

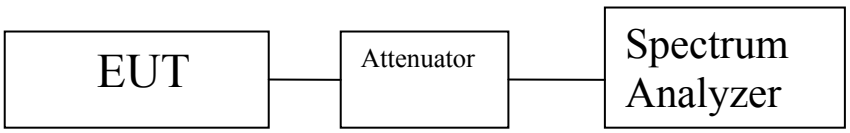
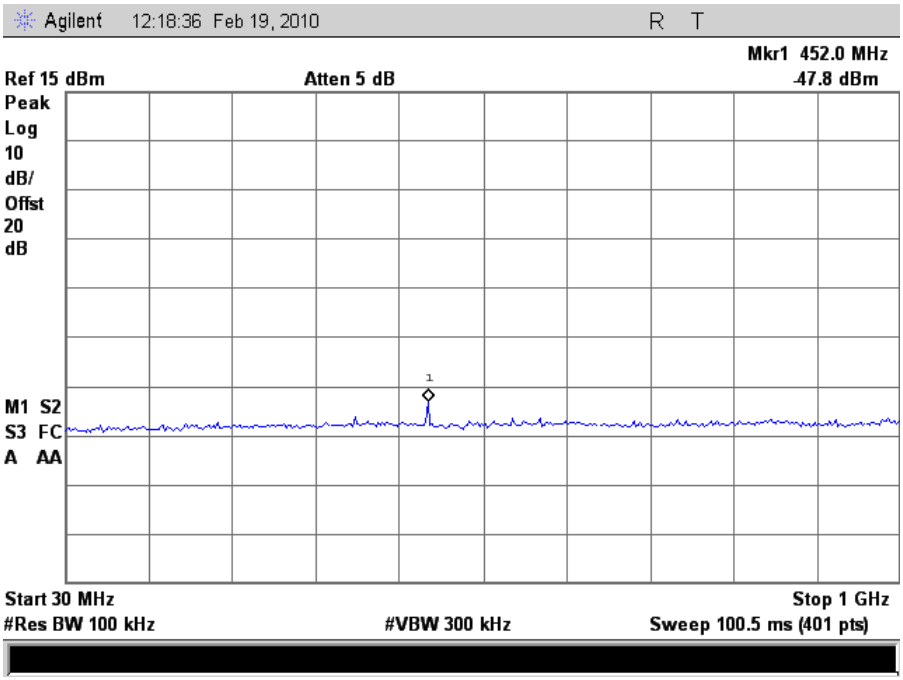
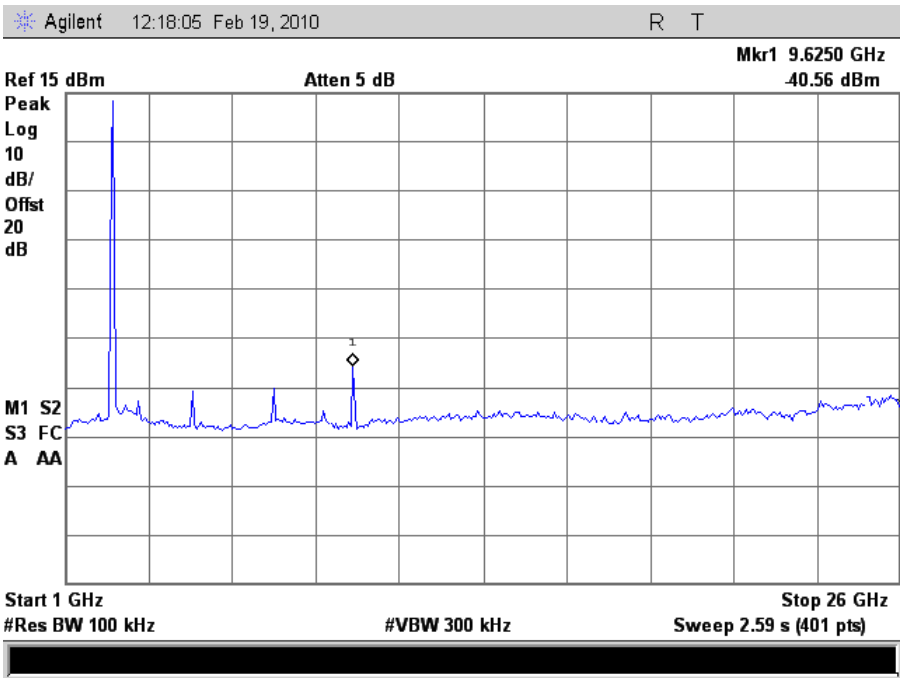


Figure 6. Block Diagram, Conducted Spurious Emissions Test Setup

RF Conducted Spurious Emissions Test Results – 802.11b Mode

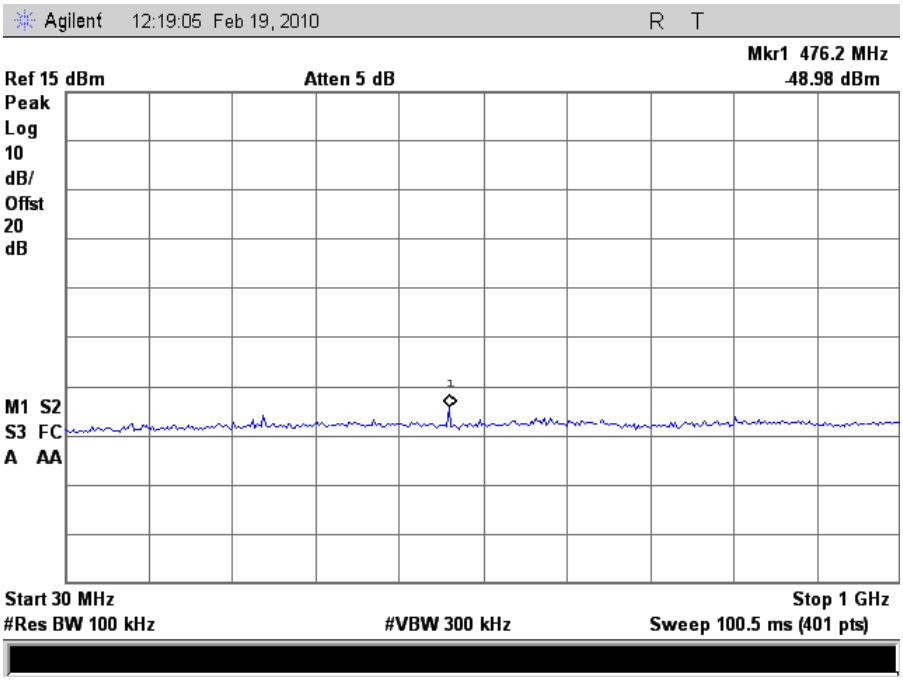


Plot 132. Conducted Emissions, 802.11b Low Channel, 30 MHz – 1 GHz

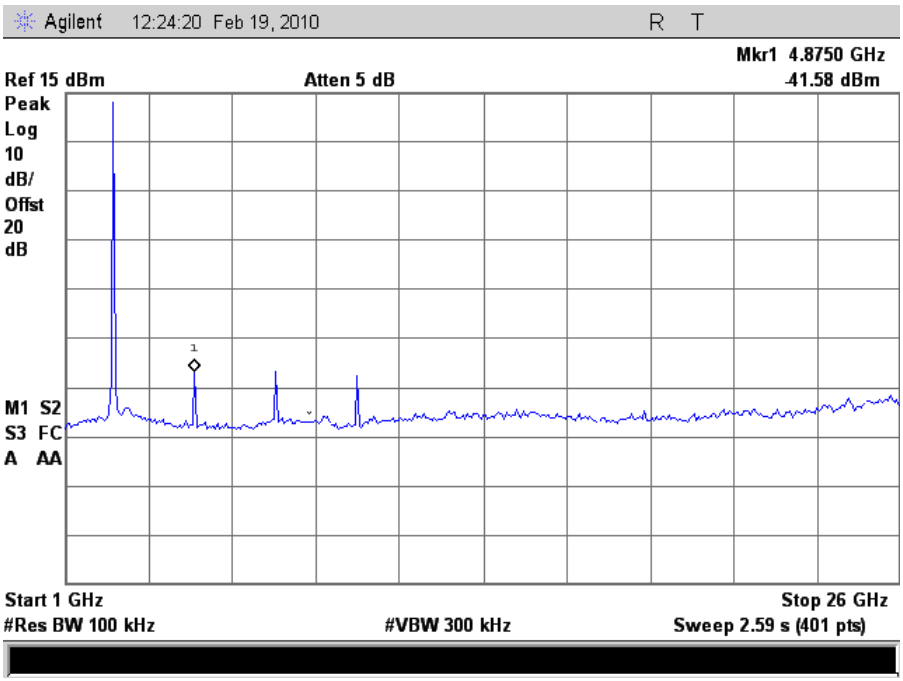


Plot 133. Conducted Emissions, 802.11b Low Channel, 1 GHz – 26 GHz

RF Conducted Spurious Emissions Test Results – 802.11b Mode

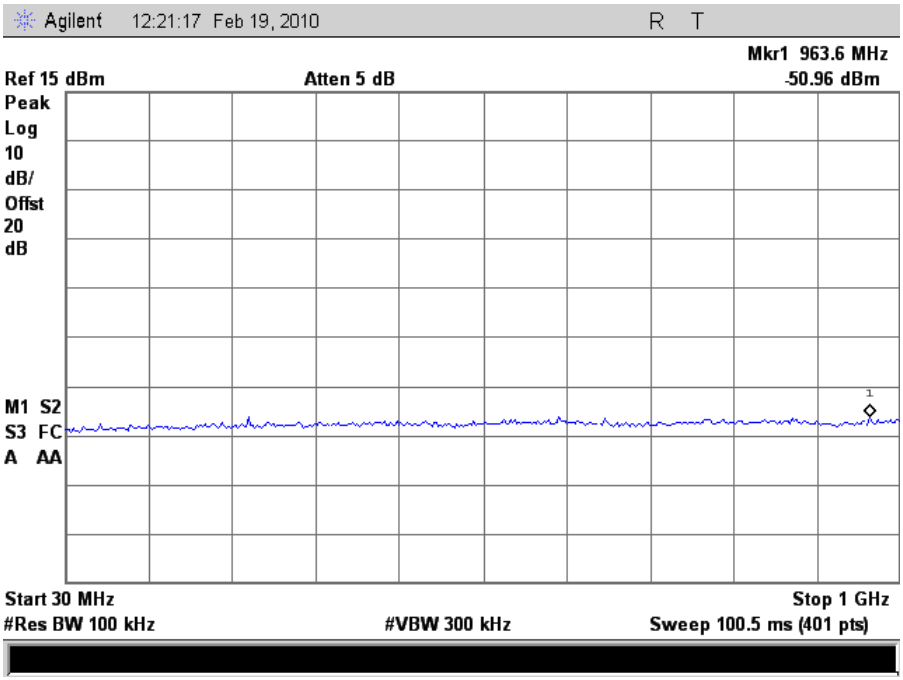


Plot 134. Conducted Emissions, 802.11b Mid Channel, 30 MHz – 1 GHz

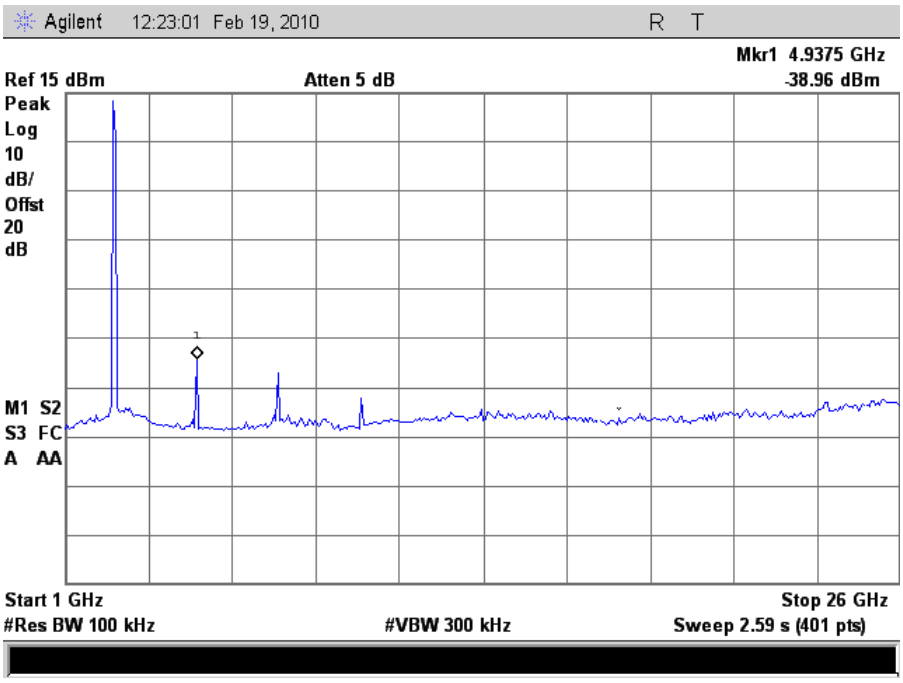


Plot 135. Conducted Emissions, 802.11b Mid Channel, 1 GHz – 26 GHz

RF Conducted Spurious Emissions Test Results – 802.11b Mode

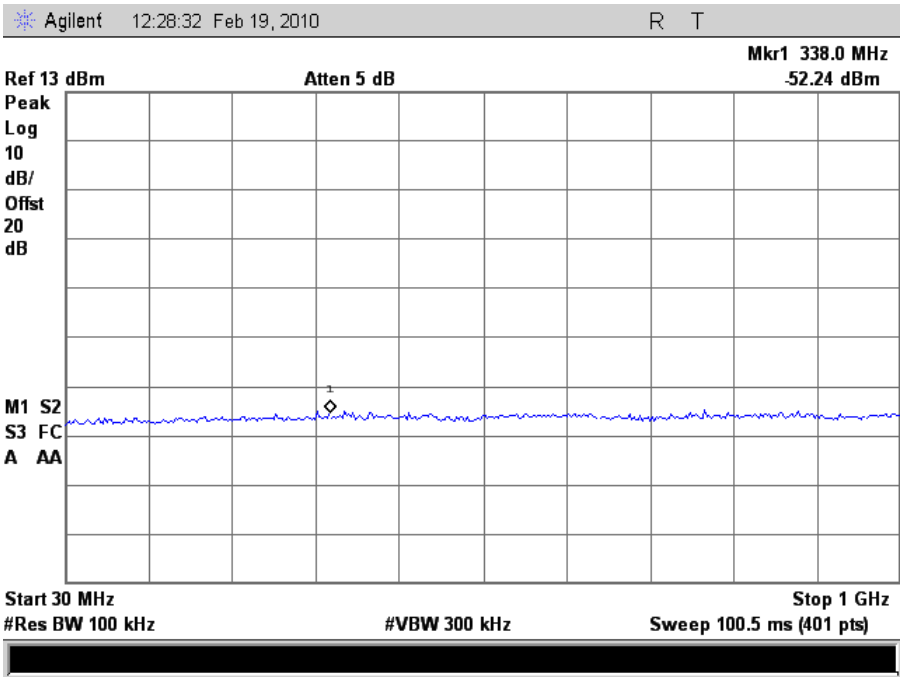


Plot 136. Conducted Emissions, 802.11b High Channel, 30 MHz – 1 GHz

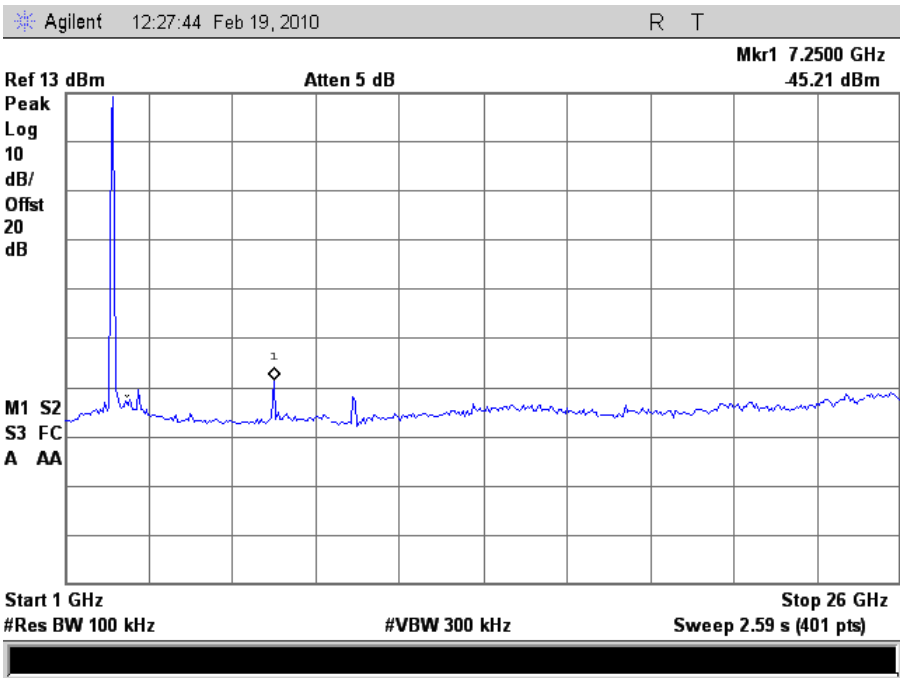


Plot 137. Conducted Emissions, 802.11b High Channel, 1 GHz – 26 GHz

RF Conducted Spurious Emissions Test Results – 802.11g Mode

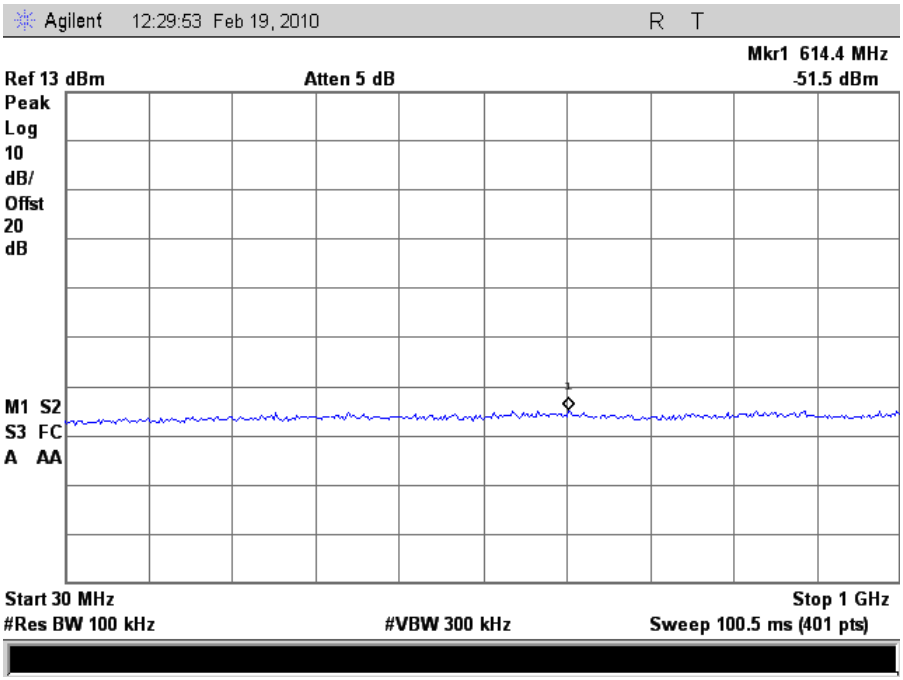


Plot 138. Conducted Emissions, 802.11g Low Channel, 30 MHz – 1 GHz

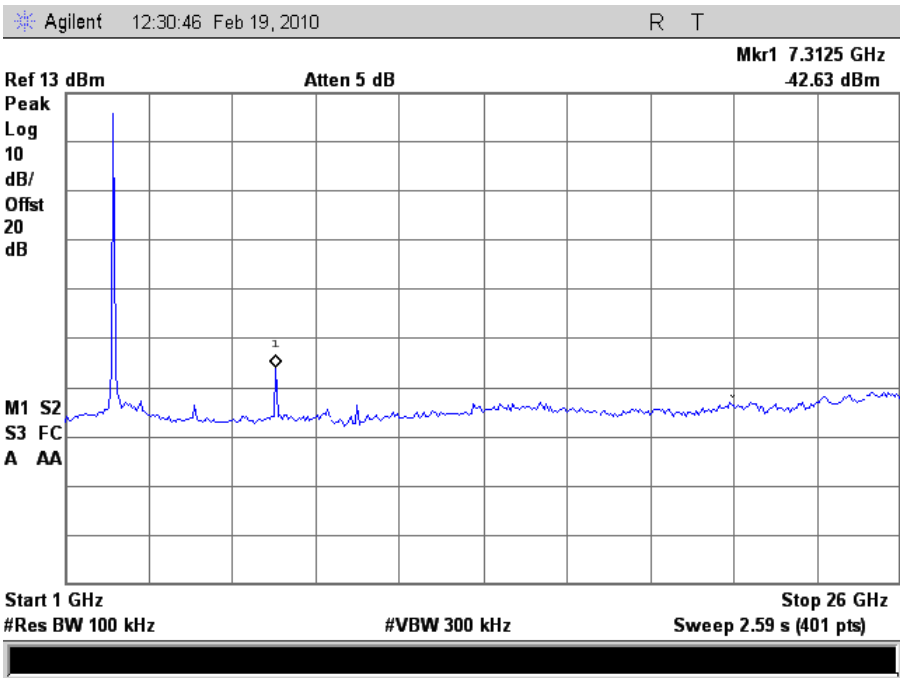


Plot 139. Conducted Emissions, 802.11g Low Channel, 1 GHz – 26 GHz

RF Conducted Spurious Emissions Test Results – 802.11g Mode

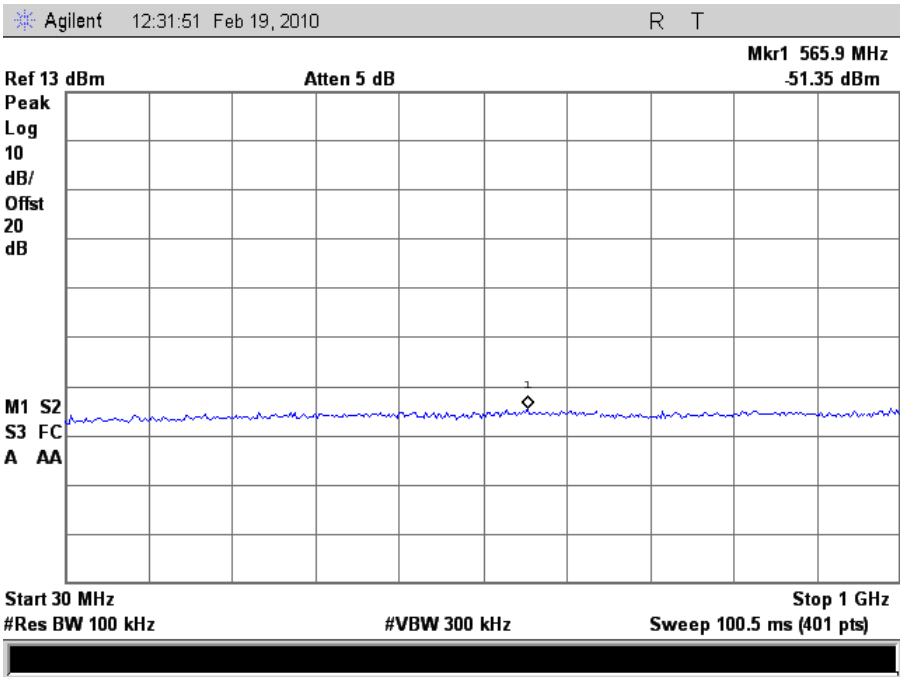


Plot 140. Conducted Emissions, 802.11g Mid Channel, 30 MHz – 1 GHz

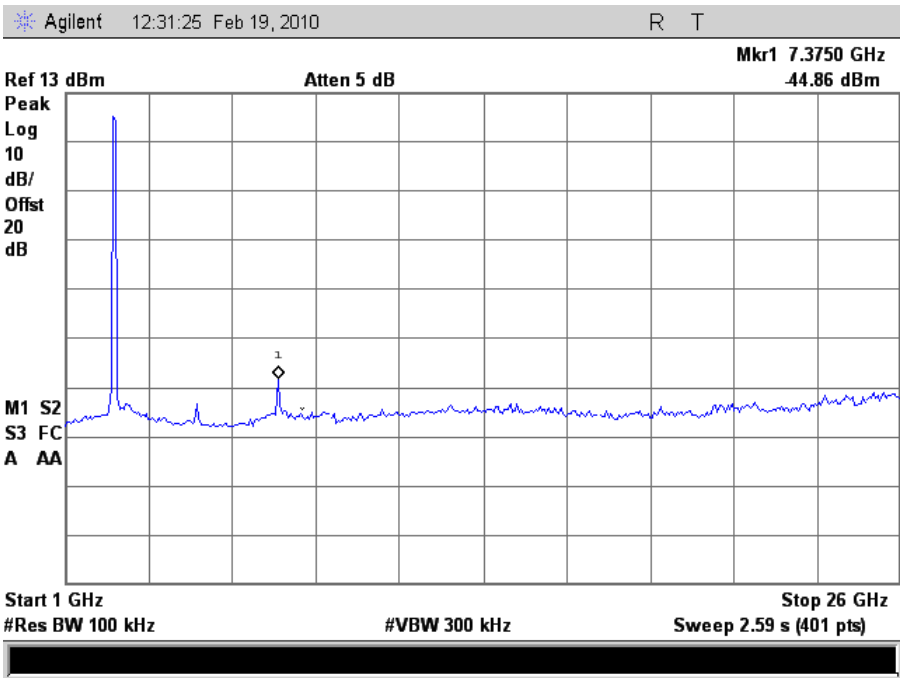


Plot 141. Conducted Emissions, 802.11g Mid Channel, 1 GHz – 26 GHz

RF Conducted Spurious Emissions Test Results – 802.11g Mode

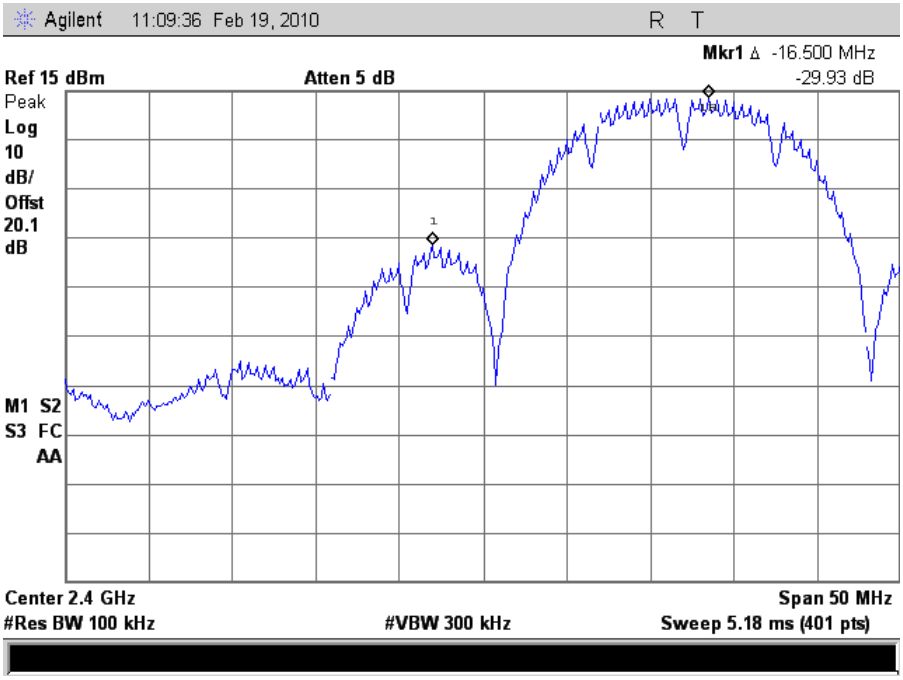


Plot 142. Conducted Emissions, 802.11g High Channel, 30 MHz – 1 GHz

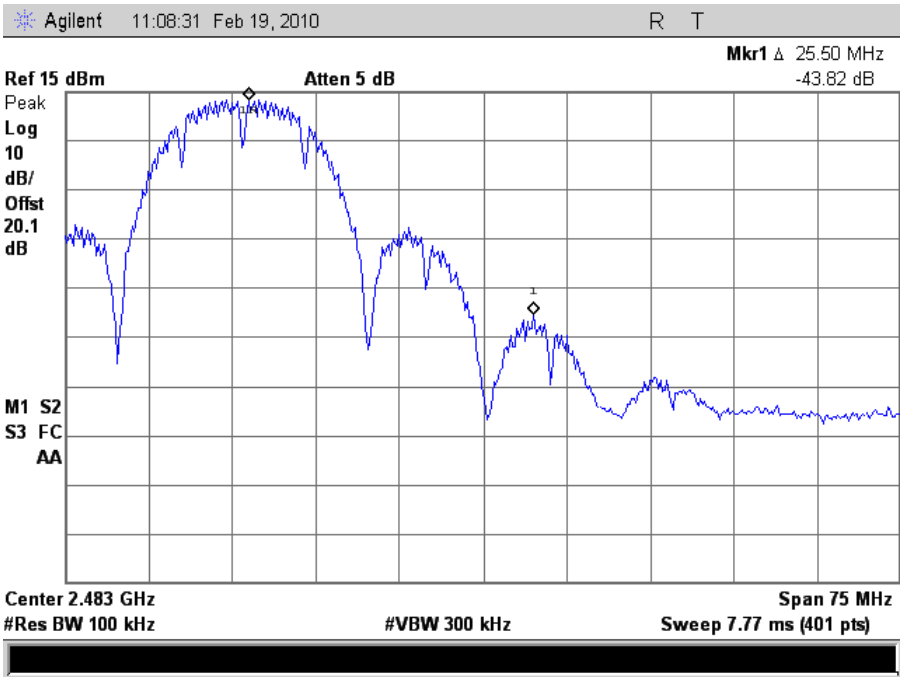


Plot 143. Conducted Emissions, 802.11g High Channel, 1 GHz – 26 GHz

Conducted Band Edge Test Results – 802.11b Mode

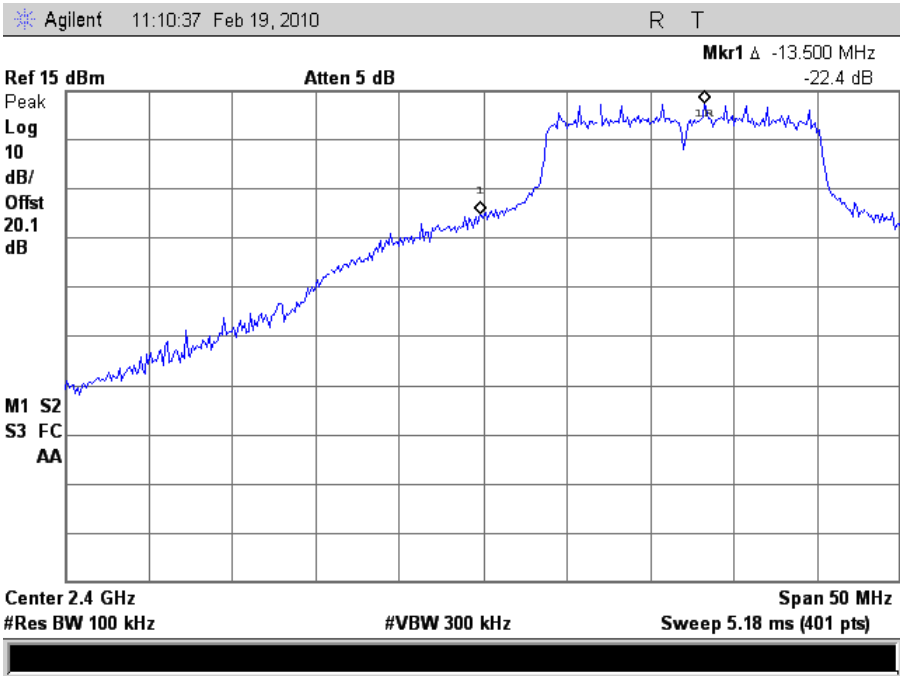


Plot 144. Lower Conducted Band Edge, 802.11b

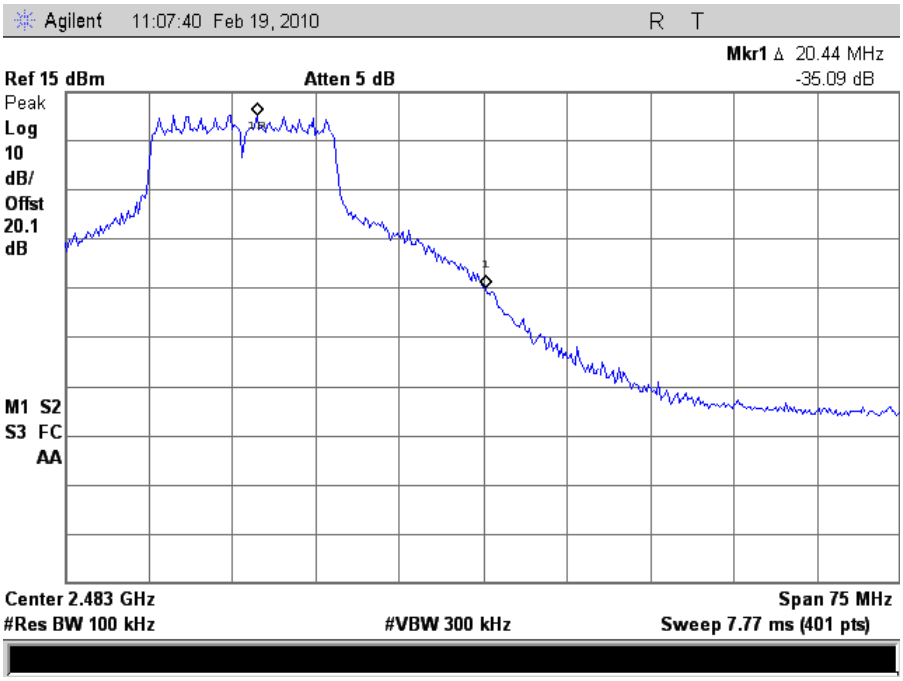


Plot 145. Upper Conducted Band Edge, 802.11b

Conducted Band Edge Test Results – 802.11g Mode



Plot 146. Lower Conducted Band Edge, 802.11g



Plot 147. Upper Conducted Band Edge, 802.11g

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. This power spectral density shall be determined in accordance with the provisions of §15.247(b).

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(s): Anderson Soungpanya & Minh Ly

Test Date: 01/12/10 & 2/19/10

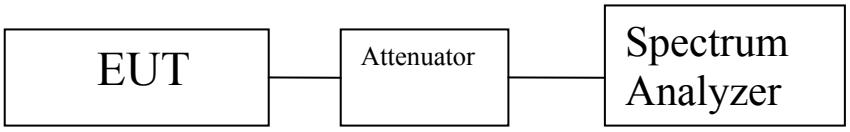


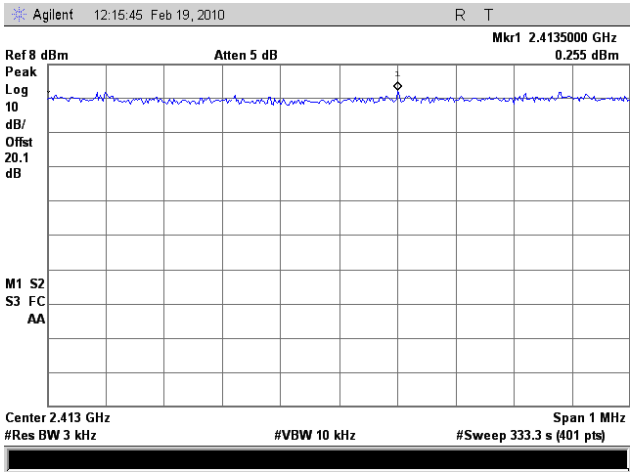
Figure 7. Block Diagram, Peak Power Spectral Density Test Setup

Peak Power Spectral Density Test Results

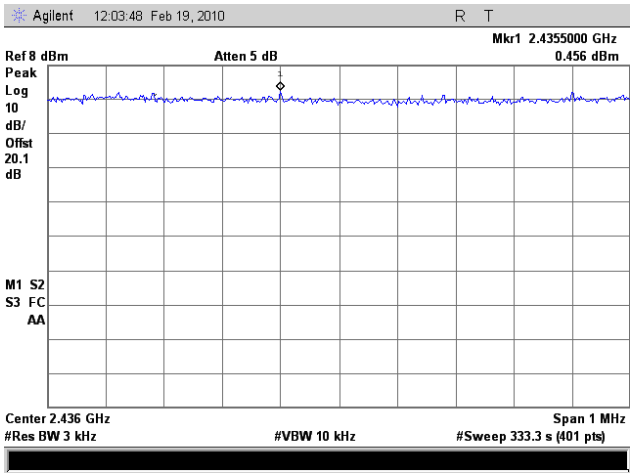
802.11b Mode				
Carrier Channel	**Frequency (MHz)**	**Measured PPSD (dBm)**	**Limit (dBm)**	**Margin (dB)**
Low	2412	0.255	8	7.745
Mid	2437	0.456	8	7.544
High	2462	0.141	8	7.859
802.11g Mode				
Carrier Channel	**Frequency (MHz)**	**Measured PPSD (dBm)**	**Limit (dBm)**	**Margin (dB)**
Low	2412	-0.685	8	8.685
Mid	2437	-1.236	8	9.236
High	2462	-2.826	8	10.826

Table 28. Peak Power Spectral Density 802.11b/g Modes Test Results

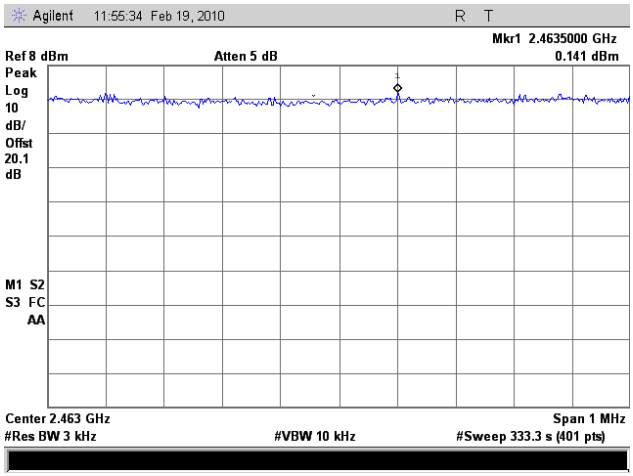
Peak Power Spectral Density Test Results 802.11b Mode



Plot 148. Peak Power Spectral Density, 802.11b Mode, Low Channel

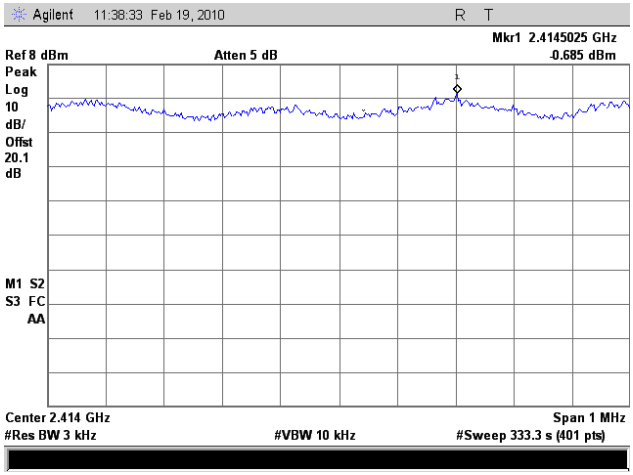


Plot 149. Peak Power Spectral Density, 802.11b Mode, Mid Channel

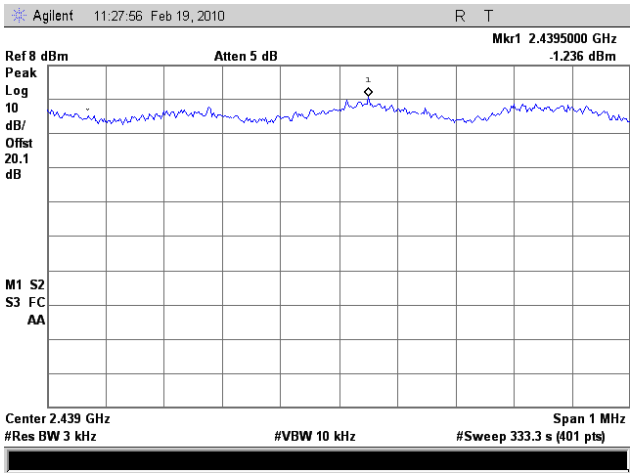


Plot 150. Peak Power Spectral Density, 802.11b Mode, High Channel

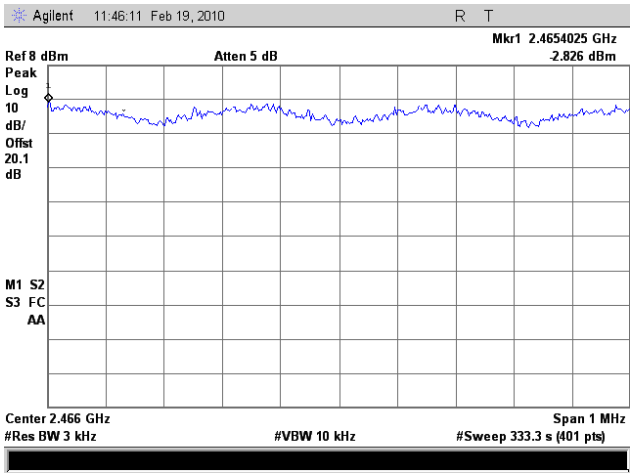
Peak Power Spectral Density Test Results 802.11g Mode



Plot 151. Peak Power Spectral Density, 802.11g Mode, Low Channel



Plot 152. Peak Power Spectral Density, 802.11g Mode, Mid Channel



Plot 153. Peak Power Spectral Density, 802.11g Mode, High Channel

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
1S2421	EMI RECEIVER	ROHDE&SCHWARZ	ESIB 7	05/27/2009	05/27/2010
1S2121	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	SEE NOTE	
1S2501	EMI RECEIVER	Rohde & Schwarz	ESU40	4/27/2009	4/27/2010
1S2198	HORN ANTENNA	EMCO	3115	09/03/2009	09/03/2010
1S2202	HORN ANTENNA	EMCO	3116	4/10/2007	4/10/2010
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	
1S2041	COUPLER, BI DIRECTIONALCOAXIAL	NARDA	N/A	SEE NOTE	
1S2460	ANALYZER, SPECTRUM 9 KHZ-40GHZ	AGILENT	E4407B	04/14/2009	04/14/2010
1S508	LISN	SOLAR ELECTRONICS	9252-50-R24-BNC	06/05/2009	06/05/2010
1S2512	TRANSIENT LIMITER	AGILENT	11947A	SEE NOTE	
1S2482	CHAMBER, 5 METER	PANASHIELD	641431	10/16/2009	10/16/2010
1S2108	RECIEVER, EMI, RF FILTER SECTION	HP	85460A	11/10/2009	11/10/2010
1S2399	TURNTABLE CONTROLLER	SUNOL SCIENCE	SC99V	SEE NOTE	
1S2485	BILOG ANTENNA	TESEQ	CBL6112D	03/20/2009	03/20/2010

Table 29. Test Equipment List

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

V. Certification & User's Manual Information

Certification & User's Manual Information

A. Certification Information

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

§ 2.801 Radio-frequency device defined.

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

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

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

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

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

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

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

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

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

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

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

(i) Compliance testing;

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

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

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

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

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

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

Certification & User's Manual Information

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

§ 2.901 Basis and Purpose

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

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

§ 2.907 Certification.

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

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

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

Certification & User's Manual Information

§ 2.948 Description of measurement facilities.

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

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

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

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

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

Certification & User's Manual Information

Label and User's Manual Information

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

§ 15.19 Labeling requirements.

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

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

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

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

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

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

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

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

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

§ 15.21 Information to user.

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

Verification & User's Manual Information

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

§ 15.105 Information to the user.

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

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

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

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

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

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

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

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

