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August 30, 2010

Apple Inc.
1 Infinite Loop, M/S 26A
Cupertino, CA 95014

Dear Mike Kriege,

Enclosed is the EMC Wireless test report for compliance testing of the Apple Inc., Model A1378 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 Warnell
Documentation Department

Reference: (\Apple Inc.\EMCS82333A-FCC247 Rev. 2)

Electromagnetic Compatibility Criteria
Test Report

for the

Apple Inc.
Model A1378

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: EMCS82333A-FCC247 Rev. 2

August 30, 2010

Prepared For:

Apple Inc.
1 Infinite Loop, M/S 26A
Cupertino, CA 95014

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

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&
15.247 Subpart C & RSS-210, Issue 7, June 2007
for Intentional Radiators

Minh Ly, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules Parts 15B, 15.247 and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210, Issue 7, June 2007 under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	August 25, 2010	Initial Issue.
1	August 25, 2010	Revised to reflect correct customer address.
2	August 30, 2010	Revised to reflect engineer corrections

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List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**er**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**er**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
µF	**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 Apple Inc. Model A1378, 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 Model A1378. Apple Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Model A1378, 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 Apple Inc., purchase order number 0478295456. 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)	ICES-003 Issue 4 February 2004	Conducted Emission Limits for a Class B Digital Device	Compliant
47 CFR Part 15.109 (a)	ICES-003 Issue 4 February 2004	Radiated Emission Limits for a Class B 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 Apple Inc. to perform testing on the Model A1378, under Apple Inc.'s purchase order number 0478295456.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Apple Inc., Model A1378.

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

Model(s) Tested:	Model A1378		
Model(s) Covered:	Model A1378		
EUT Specifications:	Primary Power: 120 VAC, 60 Hz		
	FCC ID: BCGA1378 IC: 579C-A1378		
	Type of Modulations:	DSSS, ODFM	
	Equipment Code:	DTS	
	Peak RF Output Power:	2.4GHz	5GHz
		802.11b: 22.85dBm	802.11a: 25.83dBm
		802.11g: 26.74dBm	802.11n: 26.13dBm
		802.11n: 27.74dBm	
	EUT Frequency Ranges:	2412 – 2462 MHz and 5745 – 5825 MHz	
Analysis:	The results obtained relate only to the item(s) tested.		
Environmental Test Conditions:	Temperature: 15-35º C		
	Relative Humidity: 30-60%		
	Barometric Pressure: 860-1060 mbar		
Evaluated by:	Minh Ly		
Report Date(s):	August 30, 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
ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices

Table 3. References

C. Test Site

All testing was performed at MET Laboratories, Inc., 3162 Belick Street, 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 Model A1378, Equipment Under Test (EUT) for the remainder of this document, is a wireless media client device.

E. Equipment Configuration

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

Ref. ID	Name / Description	Model Number	Serial Number
B	A1378	A1378	PT525669 and PT532993

Table 4. Equipment Configuration

F. Support Equipment

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
A	Insignia LCD TV	Insignia	NS—L19Q-1-0A	V1297JA003853
C	Access Point	Apple	A1354	6F92605BACC
D	Access Point AC Adapter	Apple	A1202	MV92309W1ZBRA
M	Laptop	Apple	Macbook Pro	PT429161

Table 5. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
E	HDMI	HDMI Cable	1	1.5	Y	A
F	Ethernet	Ethernet	1	1	Y	C
G	DC	DC cable	1	3	Y	D
H	Fiber optic Audio	Fiber	1	1.5	N	A
I	USB console	USB	1	1	N	C

Table 6. Ports and Cabling Information

H. Mode of Operation

The device operates using 802.11b, 802.11g, 802.11a and 802.11n (ht20, mcs0-7 only). This device also supports Frequency Hopping Spread Spectrum with GFSK and 8PSK modulations.

I. Modifications

a) Modifications to EUT

Installed a low pass filter in the 2.4GHz path.

b) Modifications to Test Standard

No modifications were made to the test standard.

J. Disposition of EUT

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

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria

§ 15.107 Conducted Emissions Limits

Test Requirement(s):

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

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

15.207(a), Except as shown in paragraphs (b) and (c) of this section*, charging, AC adapters or battery eliminators the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the Table 7, as measured using a 50 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 B requirement(s) of this section. Measured emissions were below applicable limits.

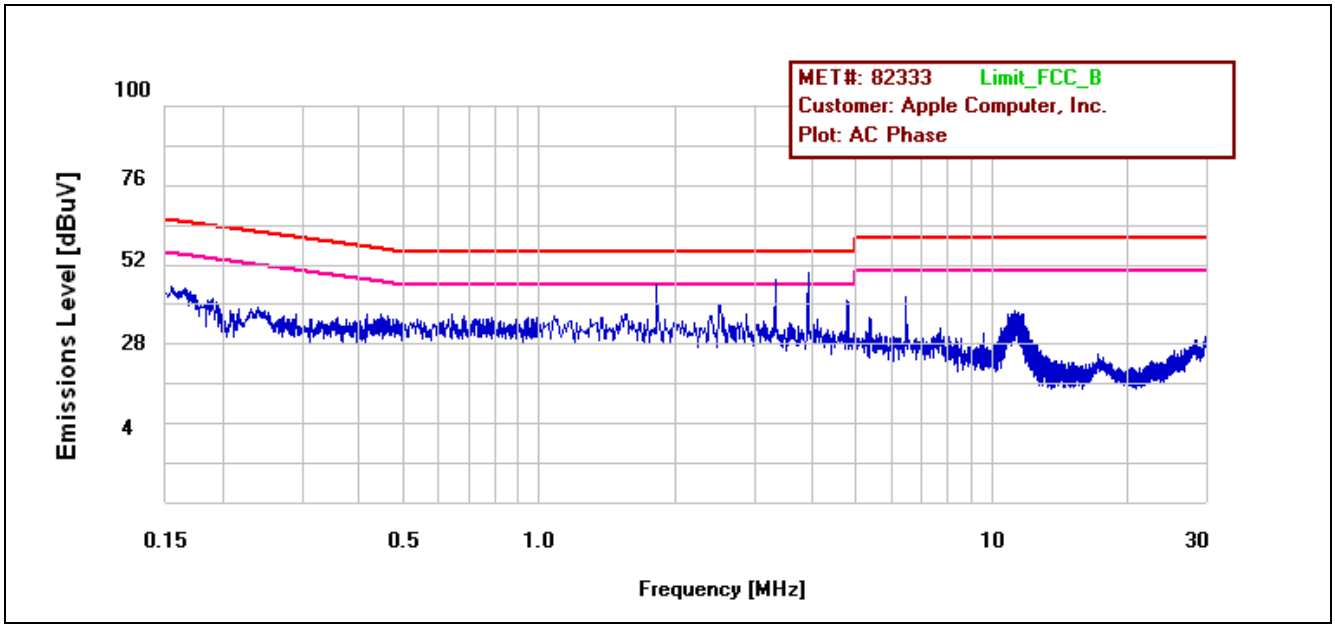
Test Engineer(s): Kenshi Chung

Test Date(s): 06/18/10

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

Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass	Notes
AC Phase	0.5810	36.52	56	-19.48	Pass	20.16	46	-25.84	Pass	Measured emissions are below applicable limits
AC Phase	1.8170	37.66	56	-18.34	Pass	15.02	46	-30.98	Pass	Measured emissions are below applicable limits
AC Phase	2.500	34.12	56	-21.88	Pass	23.33	46	-22.67	Pass	Measured emissions are below applicable limits
AC Phase	3.322	41.57	56	-14.43	Pass	15.62	46	-30.38	Pass	Measured emissions are below applicable limits
AC Phase	3.928	43.28	56	-12.72	Pass	16.31	46	-29.69	Pass	Measured emissions are below applicable limits
AC Phase	4.800	32.92	56	-23.08	Pass	16.1	46	-29.9	Pass	Measured emissions are below applicable limits
AC Phase	6.461	38.51	60	-21.49	Pass	16.54	50	-33.46	Pass	Measured emissions are below applicable limits
AC Phase	11.091	35.73	60	-24.27	Pass	31.15	50	-18.85	Pass	Measured emissions are below applicable limits

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

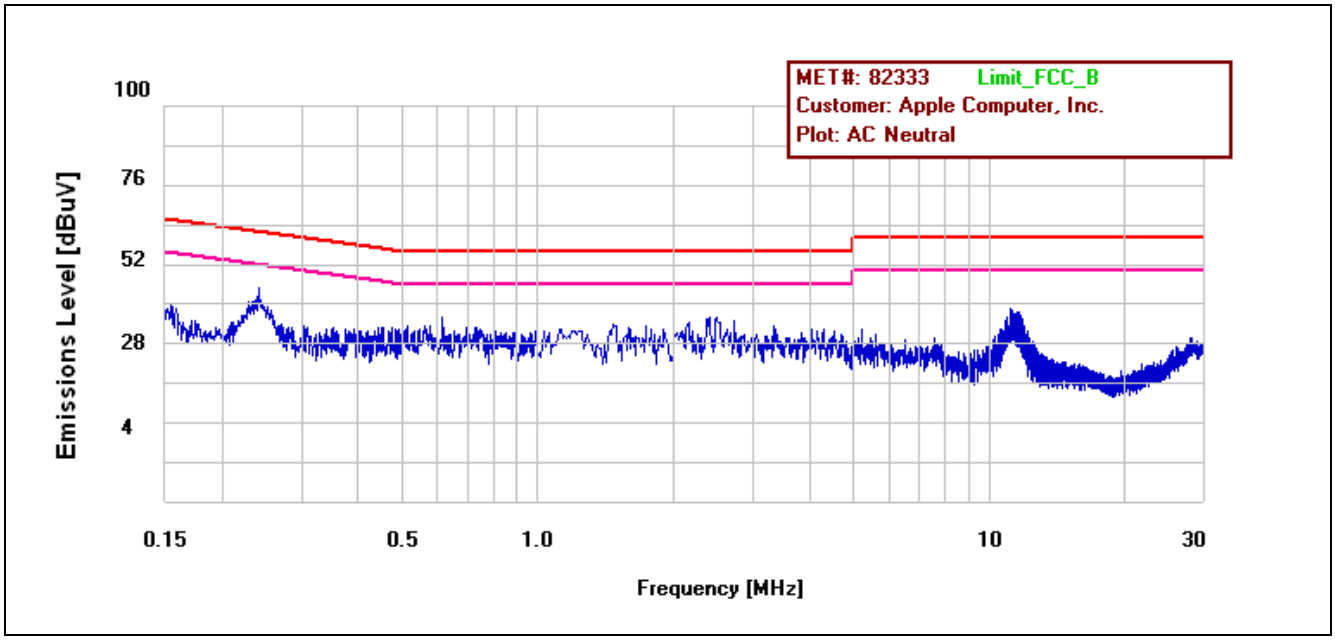


Plot 1. Conducted Emission, Phase Line Plot

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

Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass	Notes
AC Neutral	0.1504	30.91	65.978	-35.068	Pass	16.21	55.978	-39.768	Pass	Measured emissions are below applicable limits
AC Neutral	0.2432	36.98	61.997	-25.017	Pass	25.86	51.997	-26.137	Pass	Measured emissions are below applicable limits
AC Neutral	0.6202	20.98	56	-35.02	Pass	8.185	46	-37.815	Pass	Measured emissions are below applicable limits
AC Neutral	1.3530	20.62	56	-35.38	Pass	7.141	46	-38.859	Pass	Measured emissions are below applicable limits
AC Neutral	2.5130	32.69	56	-23.31	Pass	24.11	46	-21.89	Pass	Measured emissions are below applicable limits
AC Neutral	11.381	28.63	60	-31.37	Pass	21.46	50	-28.54	Pass	Measured emissions are below applicable limits
AC Neutral	0.5810	36.52	56	-19.48	Pass	20.16	46	-25.84	Pass	Measured emissions are below applicable limits

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



Plot 2. Conducted Emission, Neutral Line Plot

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

Test Engineer(s): Minh Ly

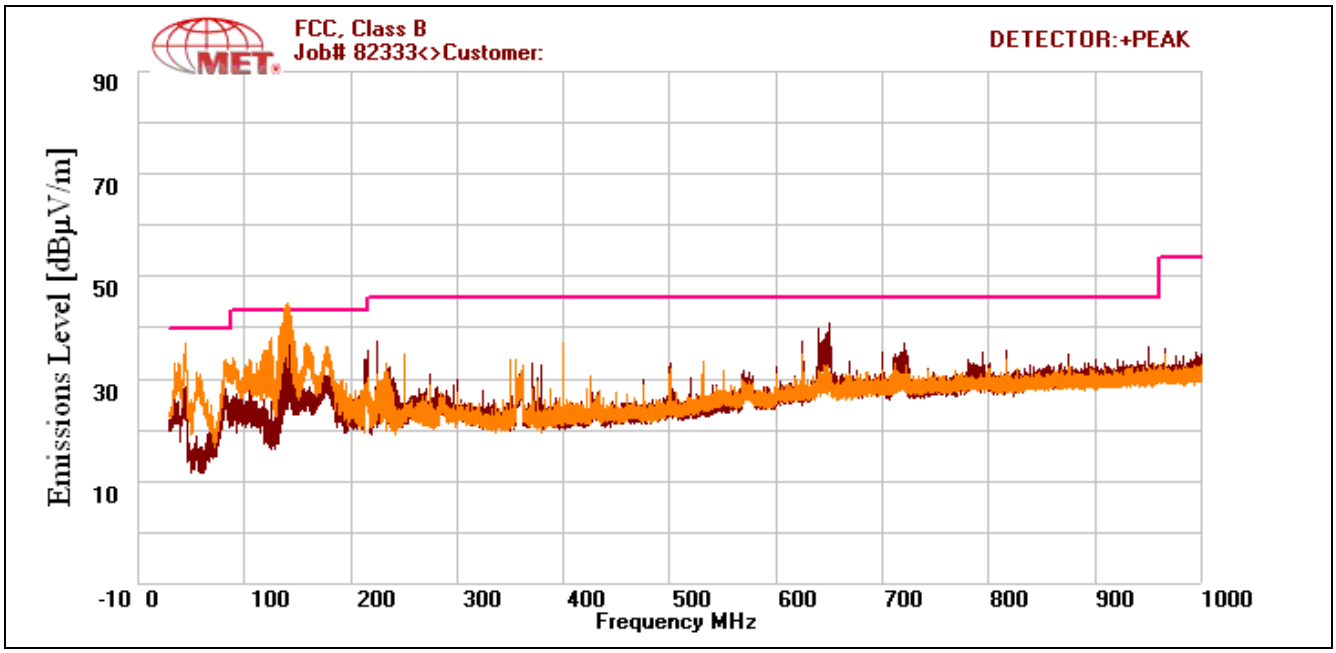
Test Date(s): 06/08/10

Radiated Emissions Limits Test Results, Class B

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
41.72	V	255	100	12.39	11.04	0	1.584	0	25.014	40	-14.986
124.56	V	258	100	13.63	13.318	0	3.11	0	30.058	43.5	-13.442
141.64	V	251	100	22.85	12.269	0	3.291	0	38.41	43.5	-5.09
142	H	166	204	15.79	11.8	0	3.295	0	30.885	43.5	-12.615
225	H	124	100	22.36	10.8	0	3.825	0	36.985	46	-9.015
650.64	H	153	100	8.93	19.687	0	5.464	0	34.081	46	-11.919

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

Note: The EUT was tested at 3 m.



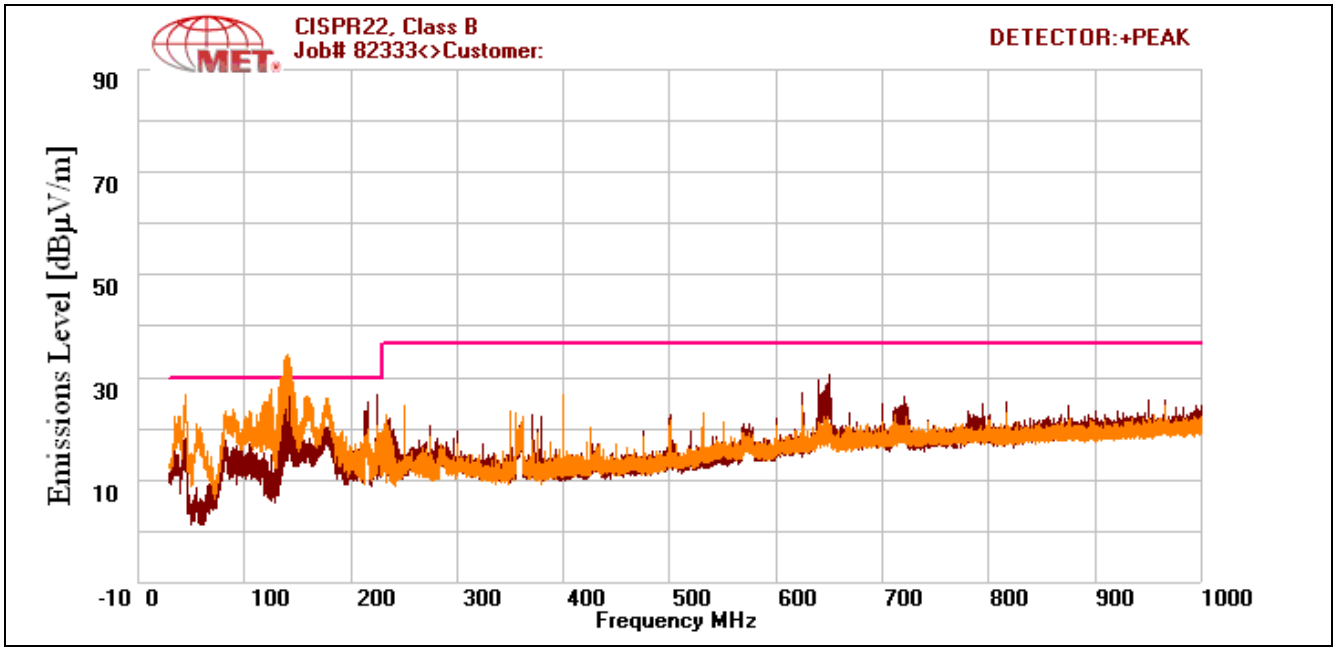
Plot 3. Radiated Emissions, 30 MHz - 1 GHz, FCC Limits

Radiated Emissions Limits Test Results, Class B

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
41.72	V	255	100	12.39	11.04	0	1.584	-10.46	14.554	30	-15.446
124.56	V	258	100	13.63	13.318	0	3.11	-10.46	19.598	30	-10.402
141.64	V	251	100	22.85	12.269	0	3.291	-10.46	27.95	30	-2.05
142	H	166	204	15.79	11.8	0	3.295	-10.46	20.425	30	-9.575
225	H	124	100	22.36	10.8	0	3.825	-10.46	26.525	30	-3.475
650.64	H	153	100	8.93	19.687	0	5.464	-10.46	23.621	37	-13.379

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

Note: The EUT was tested at 3 m.



Plot 4. Radiated Emissions, ICES-003 Limits

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 being a permanently attached integral antenna.

Test Engineer(s): Minh Ly

Test Date(s): 06/02/10

Model	Type	Frequency (MHz)	Gain (dBi)
820-2808	PIFA	2400 - 2483.5	0.49
		5150 – 5250	2.76
		5250 – 5350	2.95
		5470 - 5725	4.09
		5725 - 5850	1.42

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 Σ line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

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

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

Test Procedure: The EUT was placed on a 0.8 m-high wooden table. 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.

Test Results: The EUT was compliant with the requirement(s) of this section. Pre-scans revealed that emissions profiles and amplitudes of emissions were similar when the EUT was transmitting on low, mid and high channels. Therefore, final measurements were taken when the EUT was transmitting on mid channel in HT20 mode (highest power).

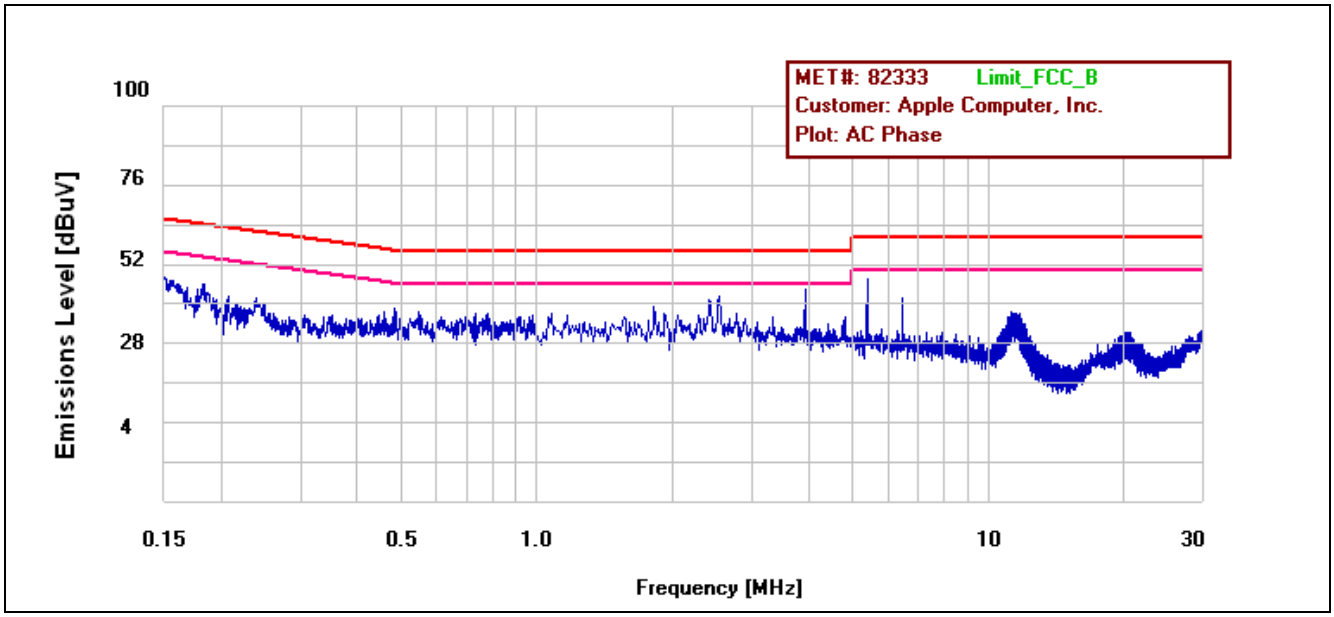
Test Engineer(s): Kenshi Chung

Test Date(s): 06/17/10

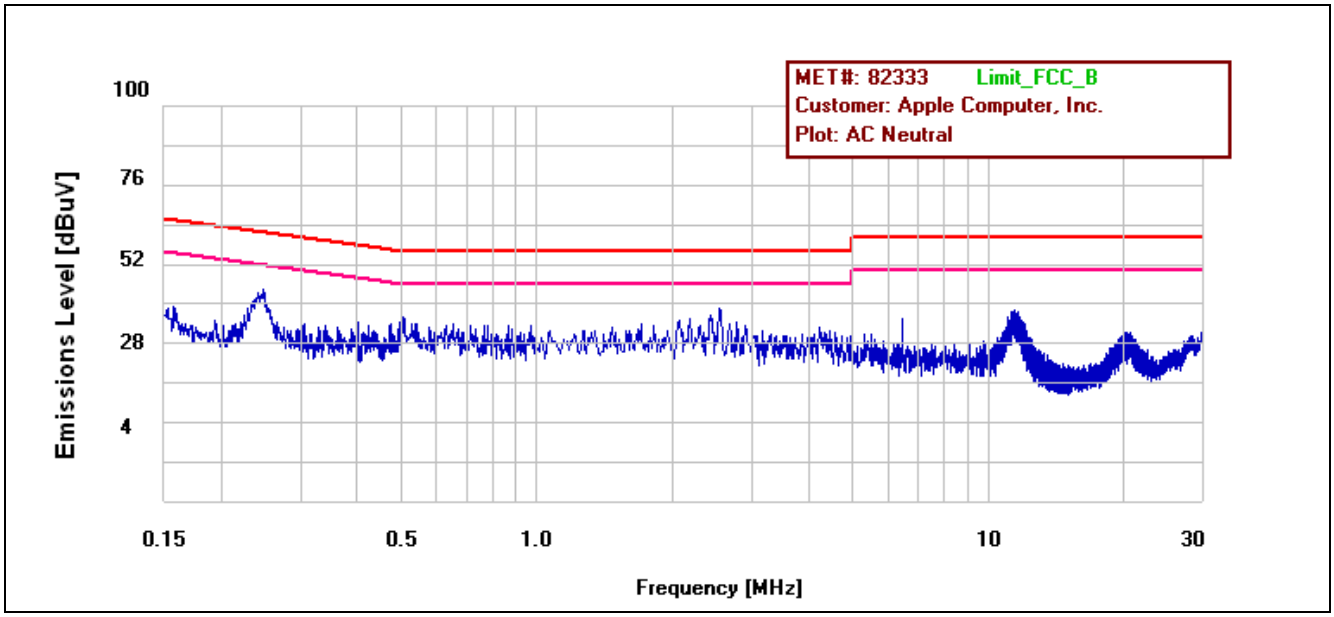
15.207 Conducted Emissions Test Results

Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass	Notes
AC Phase	0.1584	37.21	65.549	-28.339	Pass	20.97	55.549	-34.579	Pass	Measured emission were below applicable limits
AC Phase	1.815	35.01	56	-20.99	Pass	18.02	46	-27.98	Pass	Measured emission were below applicable limits
AC Phase	2.531	37.21	56	-18.79	Pass	26.42	46	-19.58	Pass	Measured emission were below applicable limits
AC Phase	3.928	43.41	56	-12.59	Pass	16.32	46	-29.68	Pass	Measured emission were below applicable limits
AC Phase	5.383	39.29	60	-20.71	Pass	14.23	50	-35.77	Pass	Measured emission were below applicable limits
AC Phase	6.461	38.72	60	-21.28	Pass	15.27	50	-34.73	Pass	Measured emission were below applicable limits
AC Phase	11.291	30.41	60	-29.59	Pass	22.61	50	-27.39	Pass	Measured emission were below applicable limits
Line	**Freq (MHz)**	**QP Amplitude**	**QP Limit**	**Delta**	**Pass**	**Average Amplitude**	**Average Limit**	**Delta**	**Pass**	**Notes**
AC Neutral	0.2448	38.85	61.943	-23.093	Pass	27.34	51.943	-24.603	Pass	Measured emission were below applicable limits
AC Neutral	0.5035	22.26	56	-33.74	Pass	10.89	46	-35.11	Pass	Measured emission were below applicable limits
AC Neutral	2.422	32.16	56	-23.84	Pass	23.31	46	-22.69	Pass	Measured emission were below applicable limits
AC Neutral	5.961	18.53	60	-41.47	Pass	10.11	50	-39.89	Pass	Measured emission were below applicable limits
AC Neutral	11.470	36.39	60	-23.61	Pass	31.94	50	-18.06	Pass	Measured emission were below applicable limits
AC Neutral	29.440	24.07	60	-35.93	Pass	17.66	50	-32.34	Pass	Measured emission were below applicable limits

Table 14. Conducted Emissions, 15.207, Test Results



Plot 5. Conducted Emissions, Phase Line



Plot 6. Conducted Emissions, Neutral Line

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 = 100 kHz for FCC and approximately 1% of the total emission bandwidth for IC. 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): Minh Ly

Test Date(s): 06/09/10

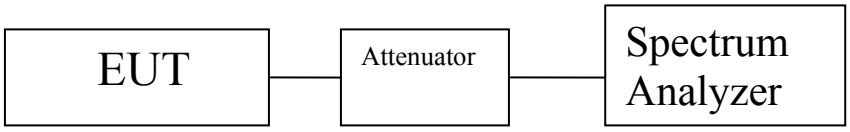


Figure 1. Block Diagram, Occupied Bandwidth Test Setup

Occupied Bandwidth Test Results

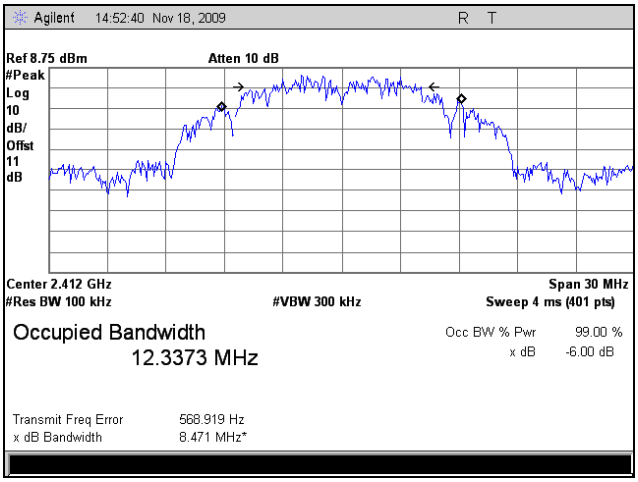
Requirement	Carrier Channel	Frequency (MHz)	Measured 6 dB Bandwidth (MHz)	Measured 99% Bandwidth (MHz)
FCC	802.11b Low	2412	8.471	
	802.11b Mid	2437	7.168	
	802.11b High	2462	6.875	
	802.11g Low	2412	15.001	
	802.11g Mid	2437	16.204	
	802.11g High	2462	16.428	
	802.11n 20MHz Low	2412	17.236	
	802.11n 20MHz Mid	2437	16.984	
	802.11n 20MHz High	2462	15.611	
IC	802.11b Low	2412	7.604	12.304
	802.11b Mid	2437	7.118	12.315
	802.11b High	2462	7.766	12.456
	802.11g Low	2412	16.159	16.406
	802.11g Mid	2437	15.060	16.424
	802.11g High	2462	16.169	16.332
	802.11n 20MHz Low	2412	16.103	17.581
	802.11n 20MHz Mid	2437	16.556	17.576
	802.11n 20MHz High	2462	15.375	17.505

Table 15. Occupied Bandwidth, Test Results, 2.4 GHz

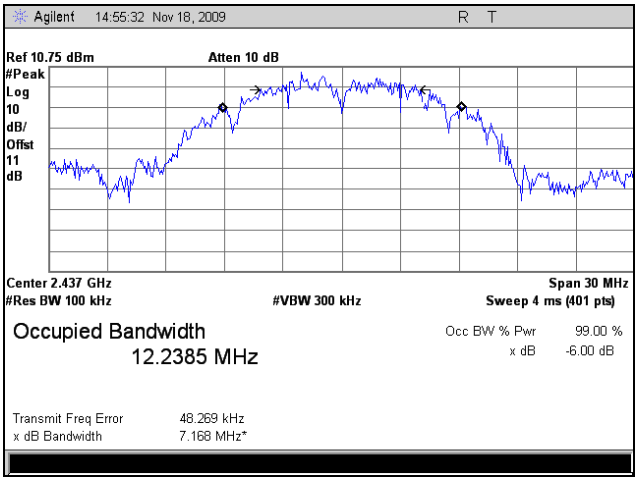
Requirement	Carrier Channel	Frequency (MHz)	Measured 6 dB Bandwidth (MHz)	Measured 99% Bandwidth (MHz)
FCC	802.11a Low	5745	16.331	
	802.11a Mid	5785	15.925	
	802.11a High	5825	14.178	
	802.11n 20MHz Low	5745	16.626	
	802.11n 20MHz Mid	5785	17.599	
	802.11n 20MHz High	5825	17.570	
IC	802.11a Low	5745	15.630	16.388
	802.11a Mid	5785	15.665	16.486
	802.11a High	5825	16.045	16.363
	802.11n 20MHz Low	5745	17.222	17.557
	802.11n 20MHz Mid	5785	14.349	17.696
	802.11n 20MHz High	5825	15.925	17.572

Table 16. Occupied Bandwidth, Test Results, 5.8 GHz

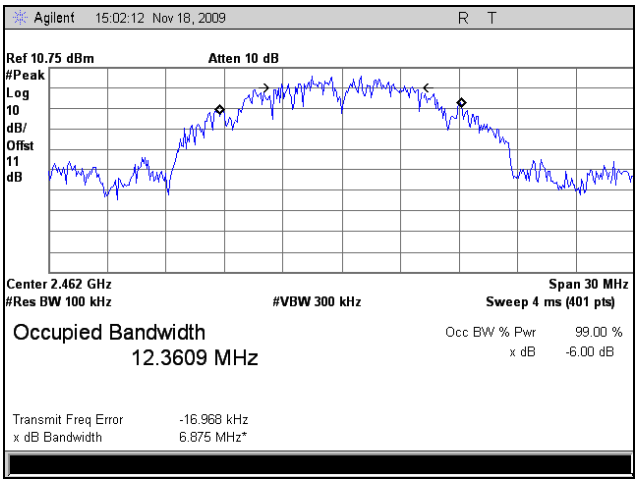
Occupied Bandwidth Test Results



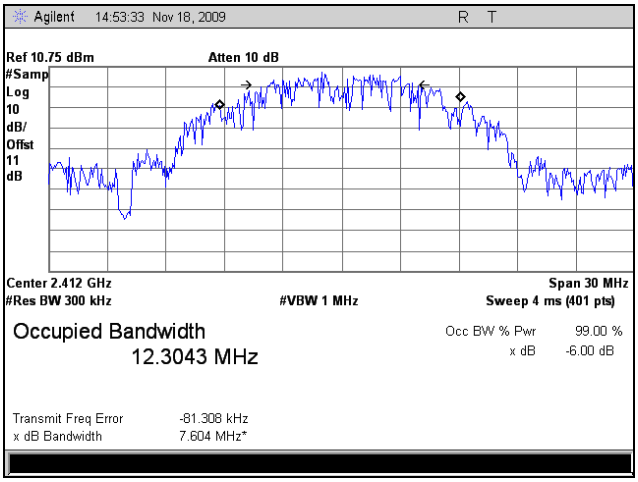
Plot 7. Occupied Bandwidth, Low Channel (2412MHz), 802.11b, 6dB BW



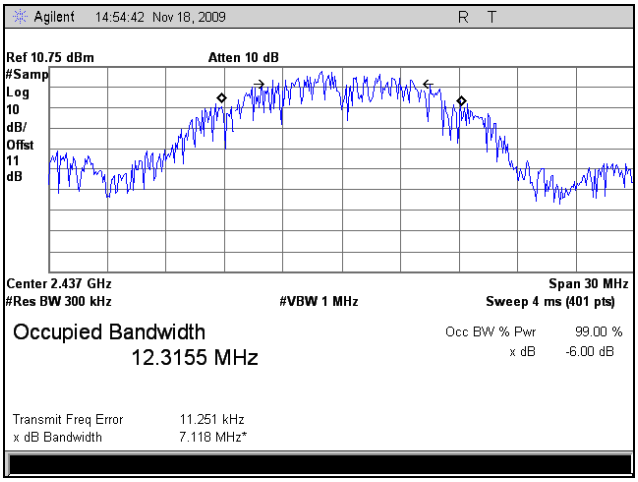
Plot 8. Occupied Bandwidth, Mid Channel (2437MHz), 802.11b, 6dB BW



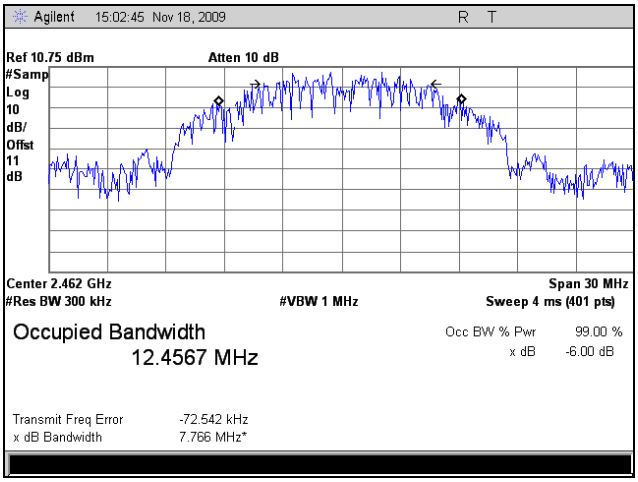
Plot 9. Occupied Bandwidth, High Channel (2462MHz), 802.11b, 6dB BW



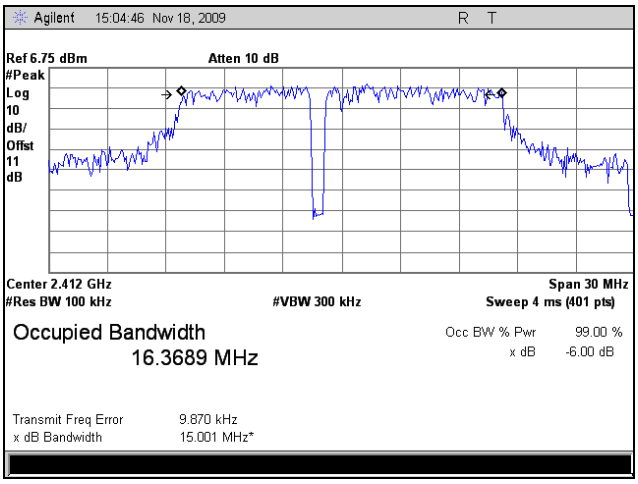
Plot 10. Occupied Bandwidth, Low Channel (2412MHz), 802.11b, 99% BW



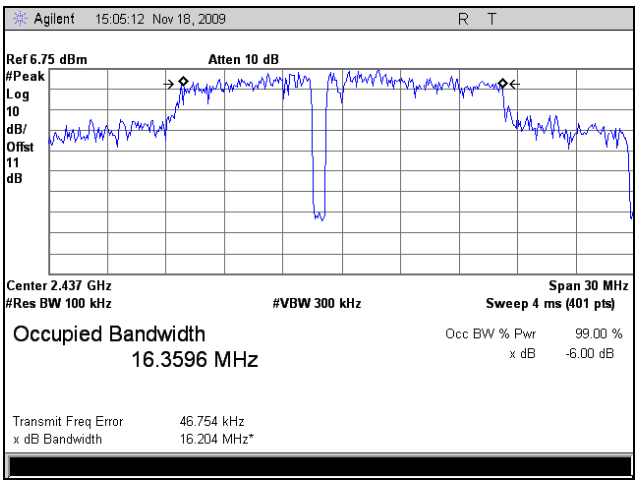
Plot 11. Occupied Bandwidth, Mid Channel (2437MHz), 802.11b, 99% BW



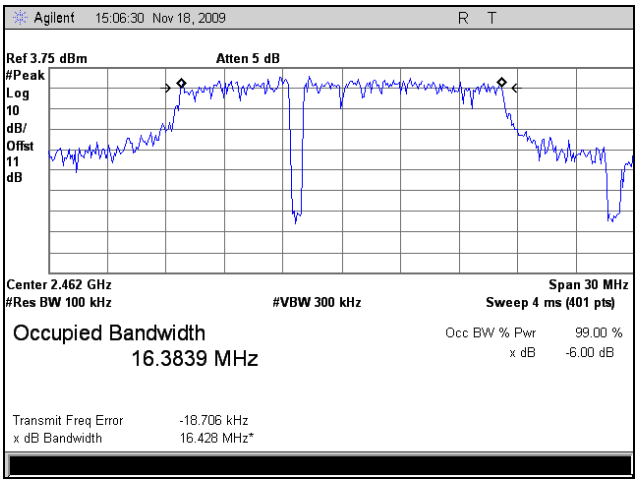
Plot 12. Occupied Bandwidth, High Channel (2462MHz), 802.11b, 99% BW



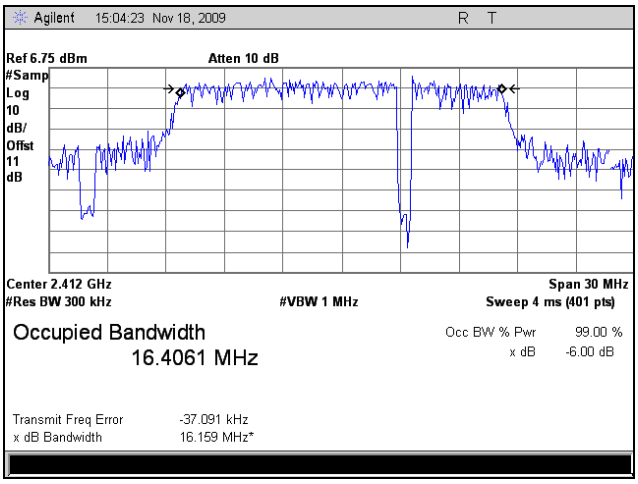
Plot 13. Occupied Bandwidth, Low Channel (2412MHz), 802.11g, 6dB BW



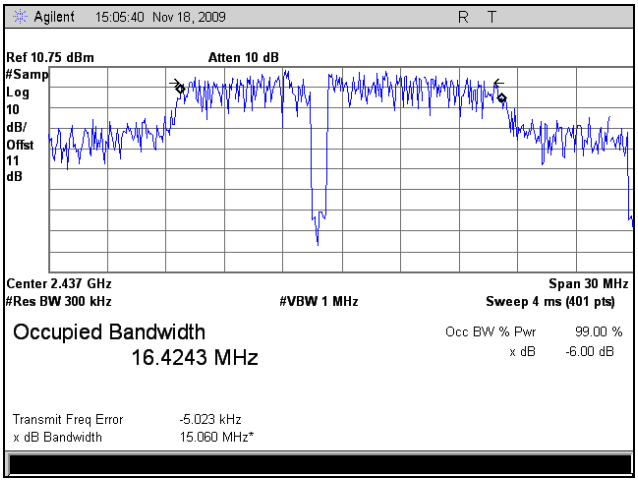
Plot 14. Occupied Bandwidth, Mid Channel (2437MHz), 802.11g, 6dB BW



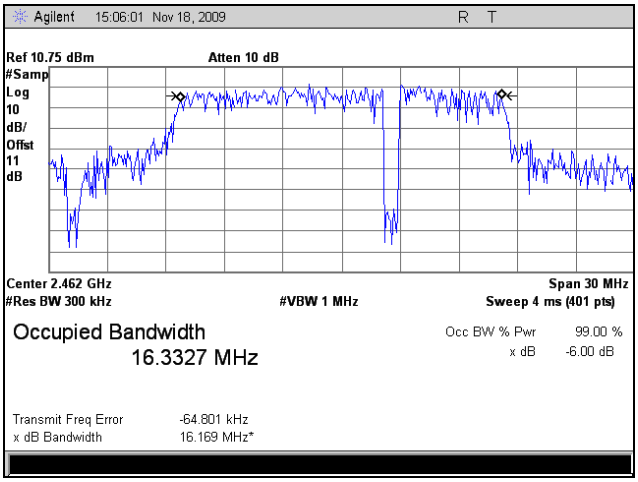
Plot 15. Occupied Bandwidth, High Channel (2462MHz), 802.11g, 6dB BW



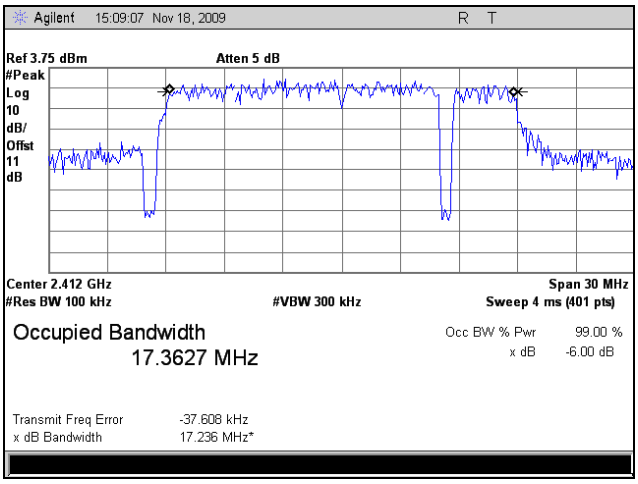
Plot 16. Occupied Bandwidth, Low Channel (2412 MHz), 802.11g, 99% BW



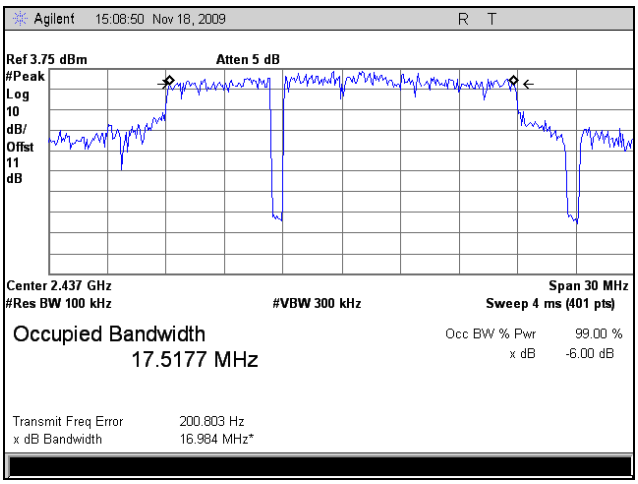
Plot 17. Occupied Bandwidth, Mid Channel (2437 MHz), 802.11g, 99% BW



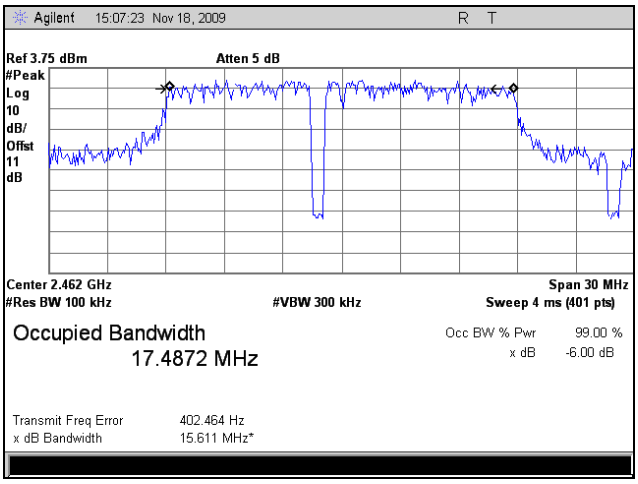
Plot 18. Occupied Bandwidth, High Channel (2462 MHz), 802.11g, 99% BW



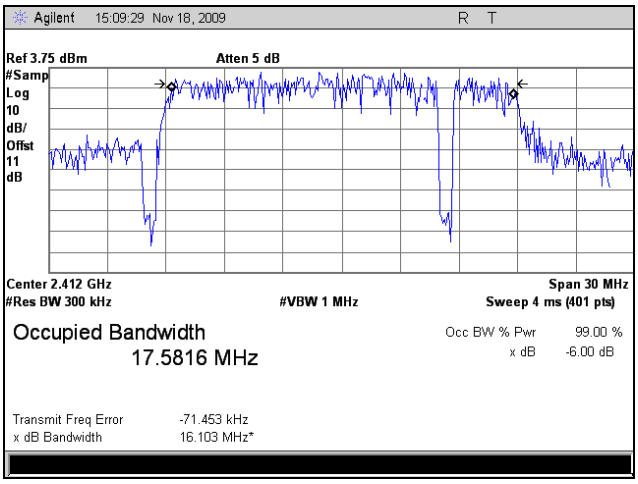
Plot 19. Occupied Bandwidth, Low Channel (2412MHz), 802.11n 20MHz, 6dB BW



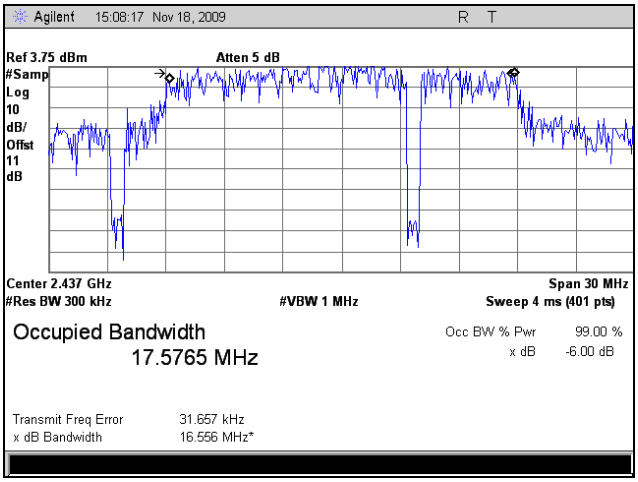
Plot 20. Occupied Bandwidth, Mid Channel (2437MHz), 802.11n 20MHz, 6dB BW



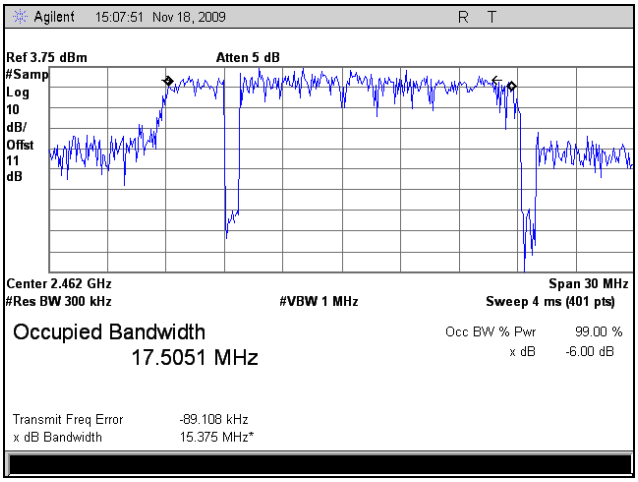
Plot 21. Occupied Bandwidth, High Channel (2462MHz), 802.11n 20MHz, 6dB BW



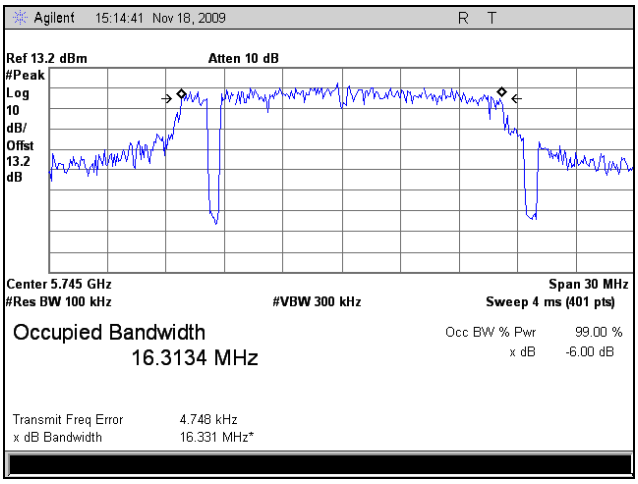
Plot 22. Occupied Bandwidth, Low Channel (2412 MHz), 802.11n 20MHz, 99% BW



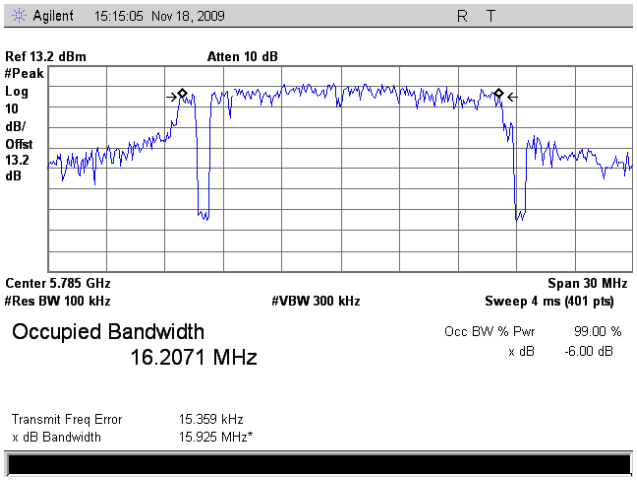
Plot 23. Occupied Bandwidth, Mid Channel (2437 MHz), 802.11n 20MHz, 99% BW



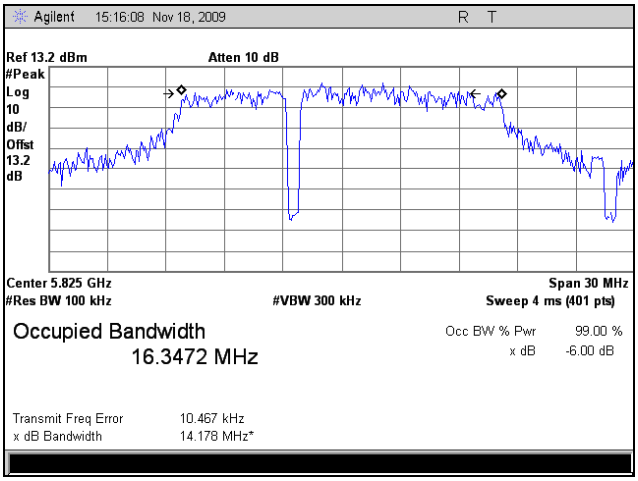
Plot 24. Occupied Bandwidth, High Channel (2462 MHz), 802.11n 20MHz, 99% BW



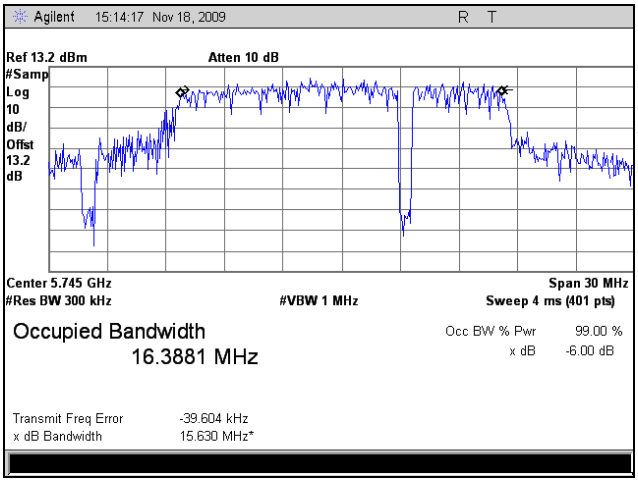
Plot 25. Occupied Bandwidth, Low Channel (5745MHz), 802.11a, 6dB BW



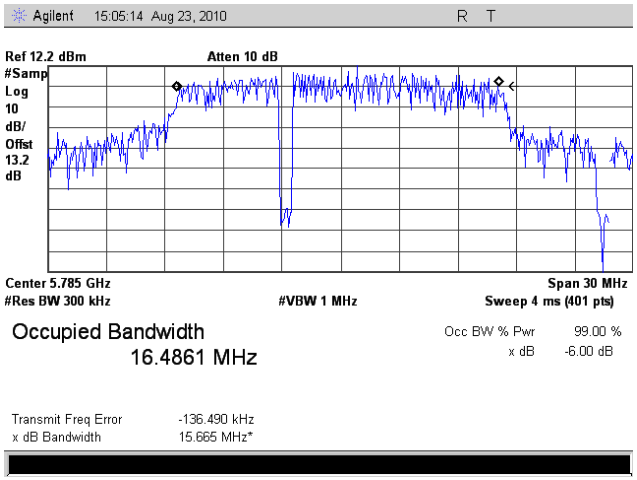
Plot 26. Occupied Bandwidth, Mid Channel (5785MHz), 802.11a, 6dB BW



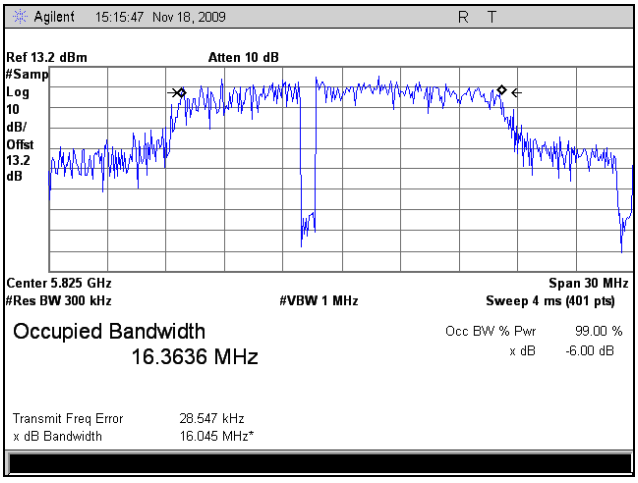
Plot 27. Occupied Bandwidth, High Channel (5825MHz), 802.11a, 6dB BW



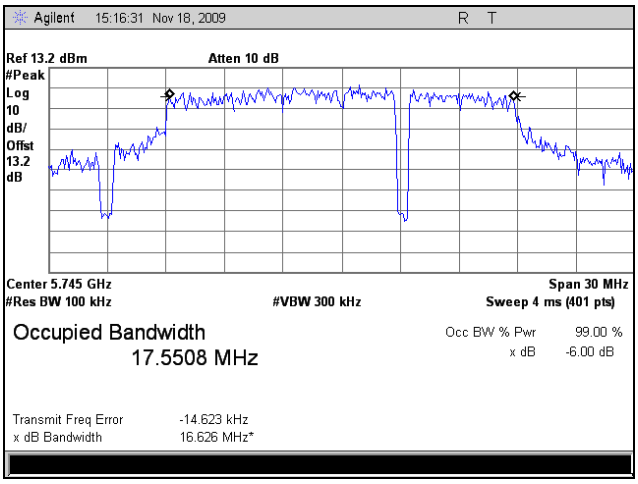
Plot 28. Occupied Bandwidth, Low Channel (5745MHz), 802.11a, 99% BW



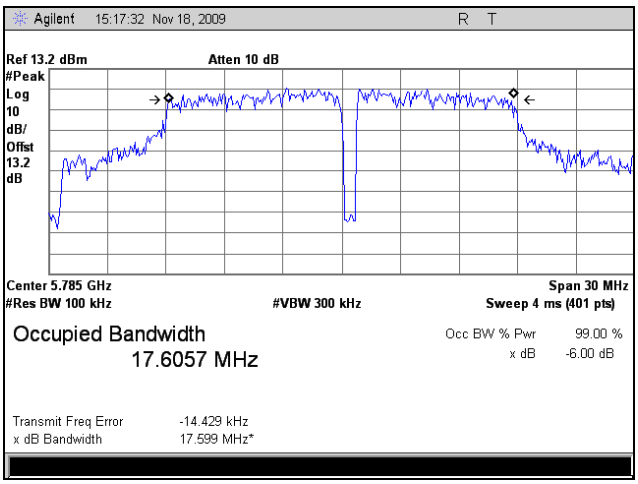
Plot 29. Occupied Bandwidth, Mid Channel (5785MHz), 802.11a, 99% BW



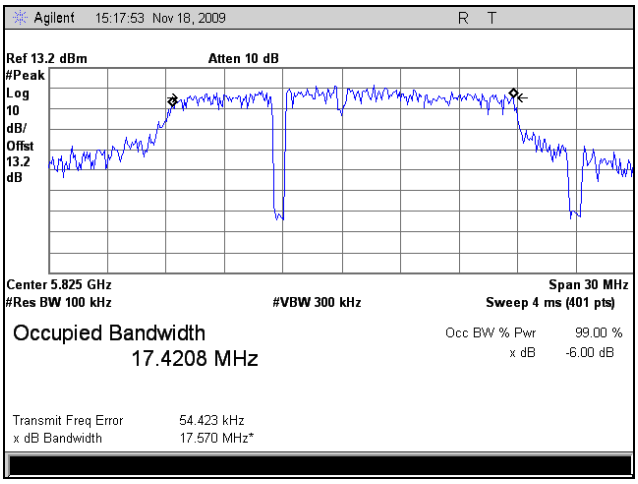
Plot 30. Occupied Bandwidth, High Channel (5825MHz), 802.11a, 99% BW



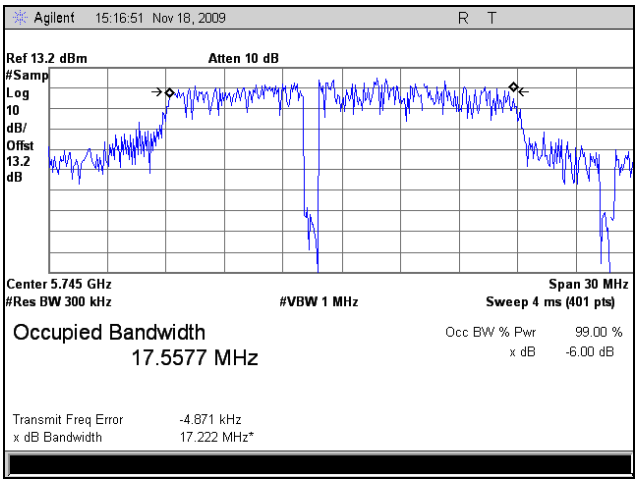
Plot 31. Occupied Bandwidth, Low Channel (5745MHz), 802.11n 20MHz, 6dB BW



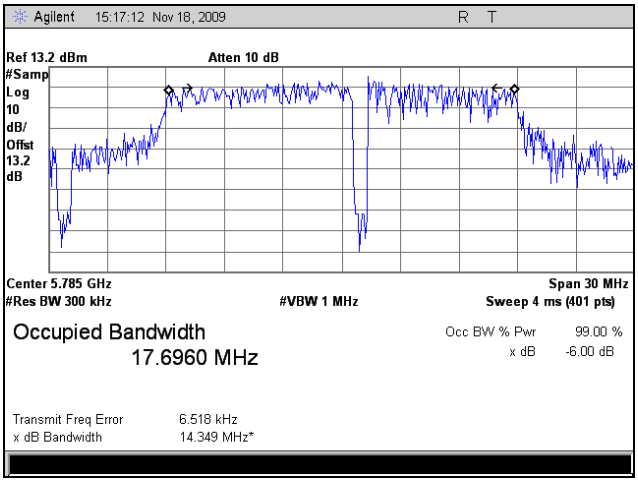
Plot 32. Occupied Bandwidth, Mid Channel (5785MHz), 802.11n 20MHz, 6dB BW



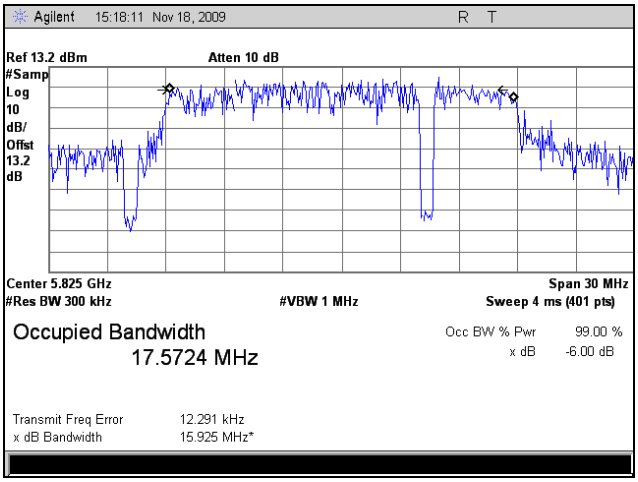
Plot 33. Occupied Bandwidth, High Channel (5825MHz), 802.11n 20MHz, 6dB BW



Plot 34. Occupied Bandwidth, Low Channel (5745 MHz), 802.11n 20MHz, 99% BW



Plot 35. Occupied Bandwidth, Mid Channel (5785 MHz), 802.11n 20MHz, 99% BW



Plot 36. Occupied Bandwidth, High Channel (5825 MHz), 802.11n 20MHz, 99% BW

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 17. 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 17, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

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

Test Engineer(s): Minh Ly

Test Date(s): 06/09/10 and 08/23/10

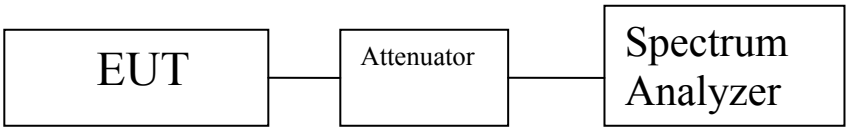


Figure 2. Peak Power Output Test Setup

RF Power Output Test Results

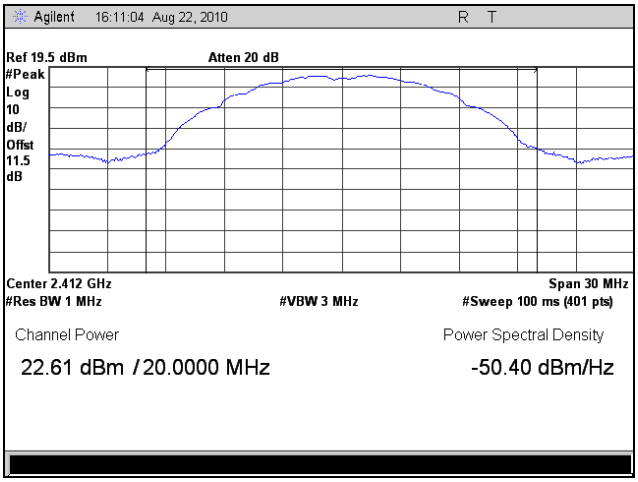
Peak Conducted Output Power		
Carrier Channel	**Frequency (MHz)**	**Measured Peak Output Power dBm**
802.11b Low	2412	22.61
802.11b Mid	2437	22.85
802.11b High	2462	22.79
802.11g Low	2412	20.82
802.11g Mid	2437	26.74
802.11g High	2462	21.51
802.11n 20MHz (CH.1)	2412	19.87
802.11n 20MHz (CH.2)	2417	26.68
802.11n 20MHz (CH.6)	2437	27.74
802.11n 20MHz (CH.10)	2457	25.43
802.11n 20MHz (CH.11)	2462	20.74

Table 18. Peak Conducted Output Power, Test Results. 2.4 GHz

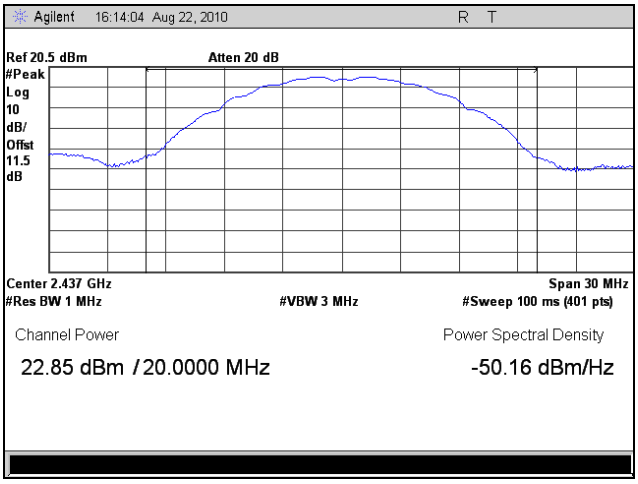
Peak Conducted Output Power		
Carrier Channel	**Frequency (MHz)**	**Measured Peak Output Power dBm**
802.11a Low	5745	25.68
802.11a Mid	5785	25.26
802.11a High	5825	25.83
802.11n 20MHz Low	5745	25.82
802.11n 20MHz Mid	5785	26.13
802.11n 20MHz High	5825	25.92

Table 19. Peak Conducted Output Power, Test Results. 5.8 GHz

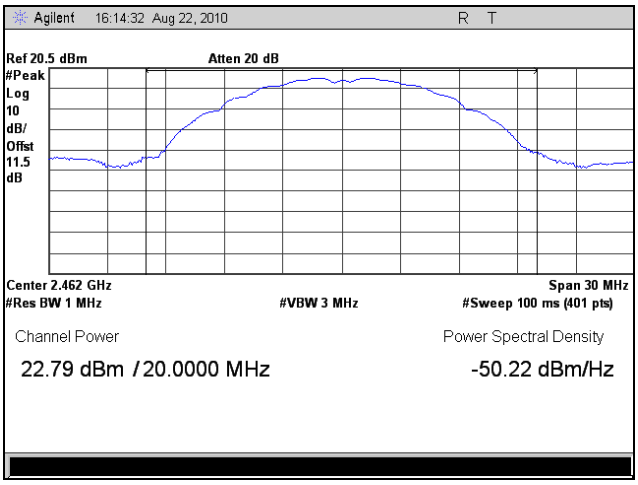
RF Output Power Test Results



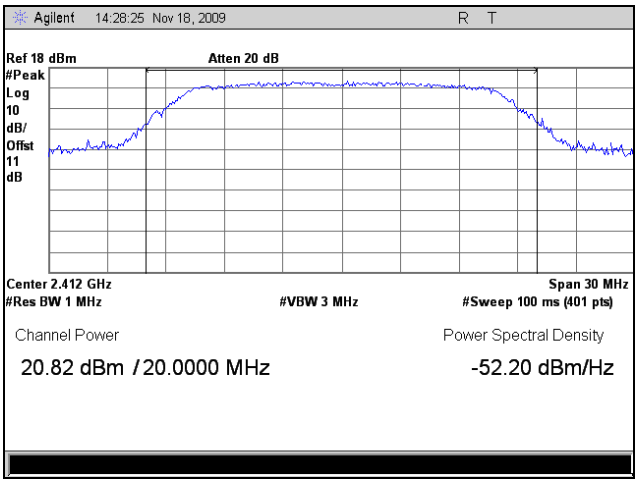
Plot 37. Peak Output Power, Low Channel (2412MHz), 802.11b



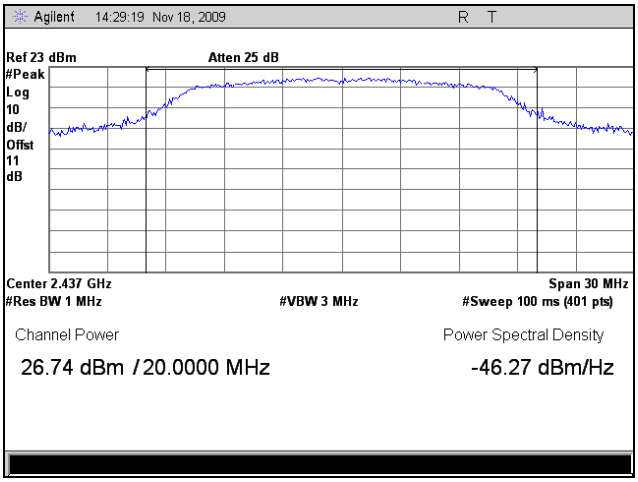
Plot 38. Peak Output Power, Mid Channel (2437MHz), 802.11b



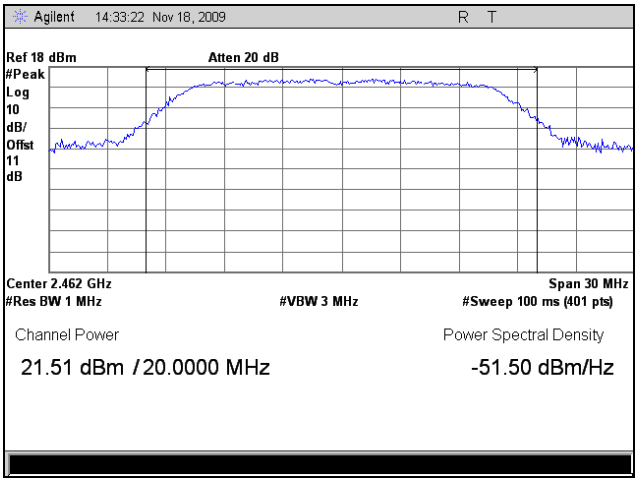
Plot 39. Peak Output Power, High Channel (2462MHz), 802.11b



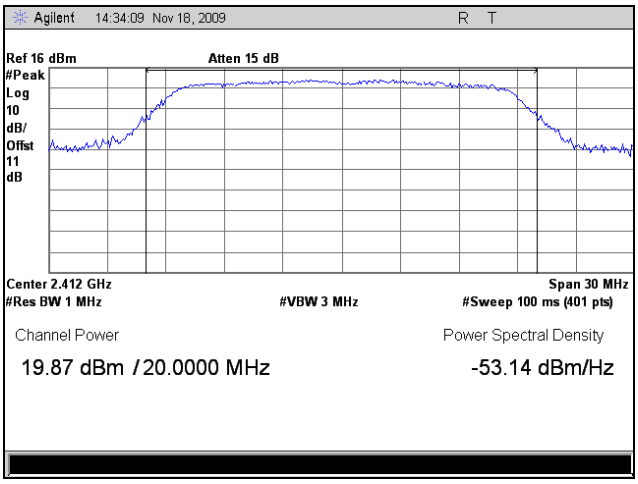
Plot 40. Peak Output Power, Low Channel (2412MHz), 802.11g



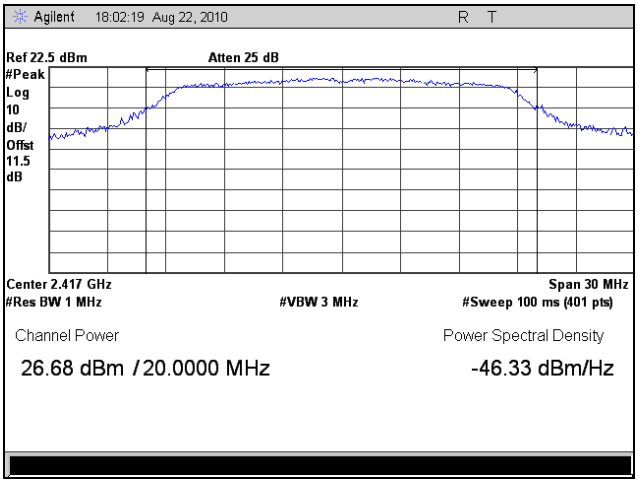
Plot 41. Peak Output Power, Mid Channel (2434MHz), 802.11g



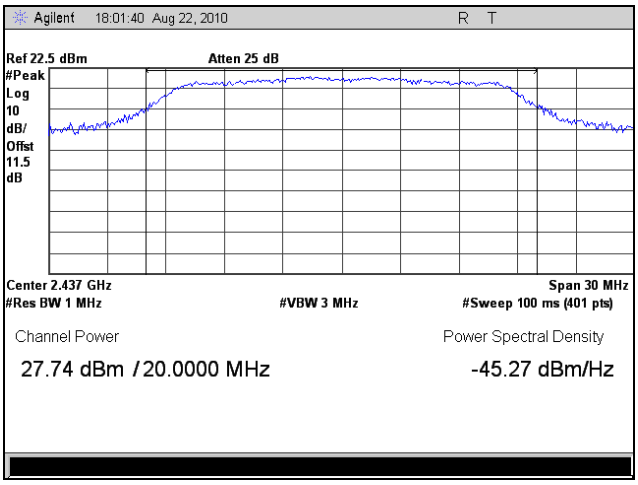
Plot 42. Peak Output Power, High Channel (2462MHz), 802.11g



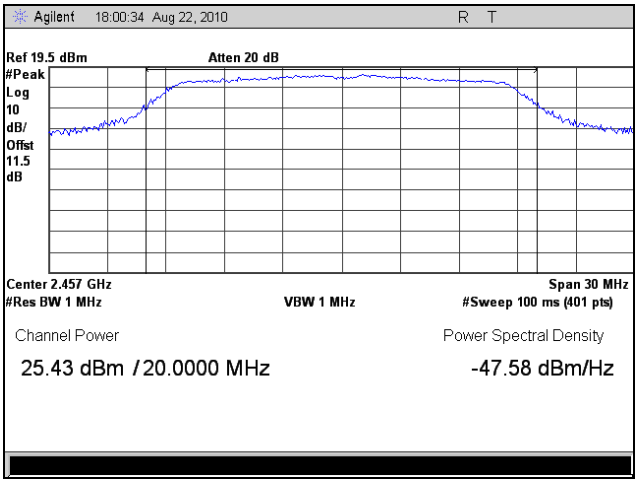
Plot 43. Peak Output Power, Channel 1 (2412MHz), 802.11n 20MHz



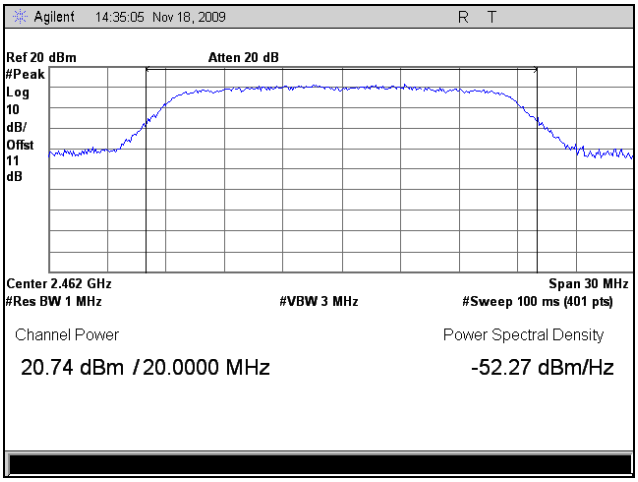
Plot 44. Peak Output Power, Channel 2 (2417MHz), 802.11n 20MHz



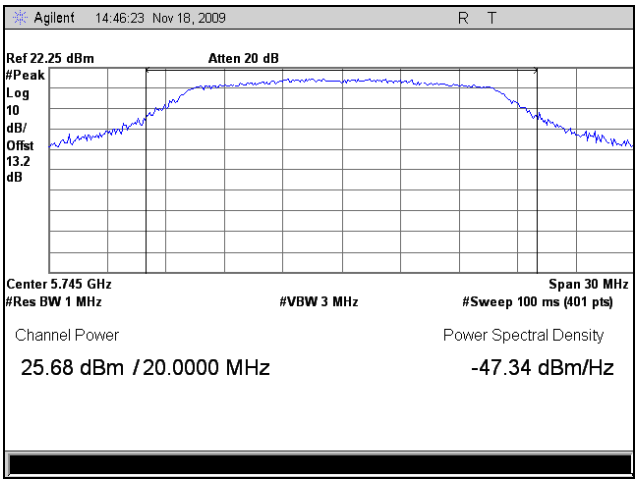
Plot 45. Peak Output Power, Channel 6 (2437MHz), 802.11n 20MHz



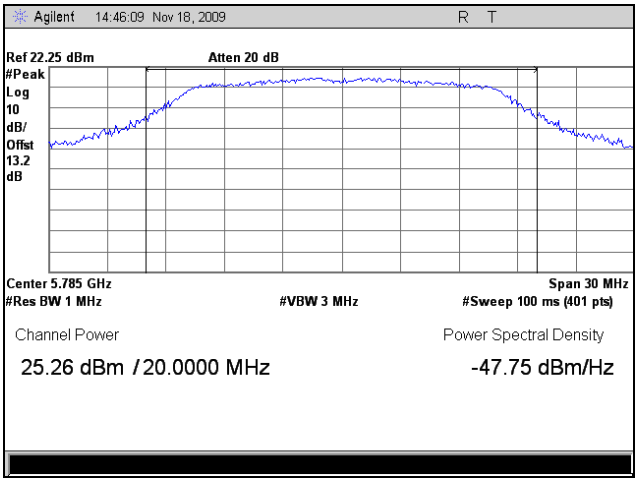
Plot 46. Peak Output Power, Channel 10 (2457MHz), 802.11n 20MHz



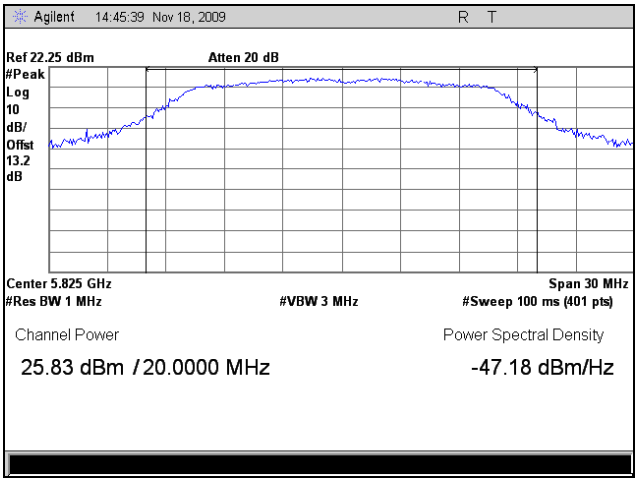
Plot 47. Peak Output Power, Channel 11 (2462MHz), 802.11n 20MHz



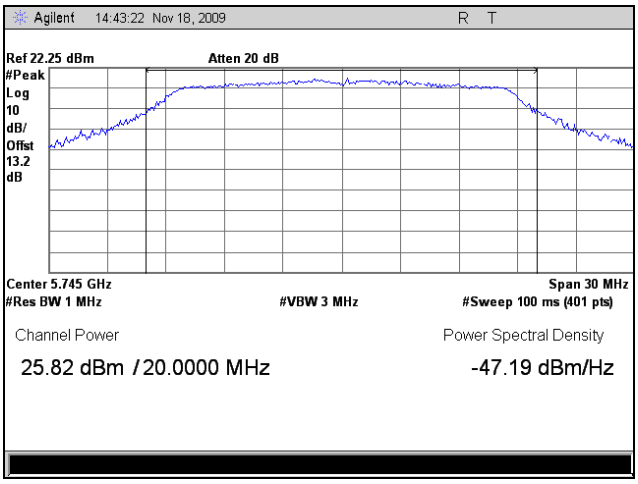
Plot 48. Peak Output Power, Low Channel (5745MHz), 802.11a



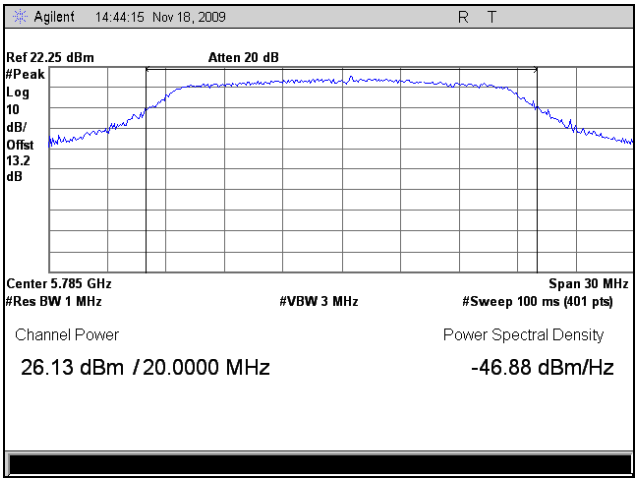
Plot 49. Peak Output Power, Mid Channel (5785MHz), 802.11a



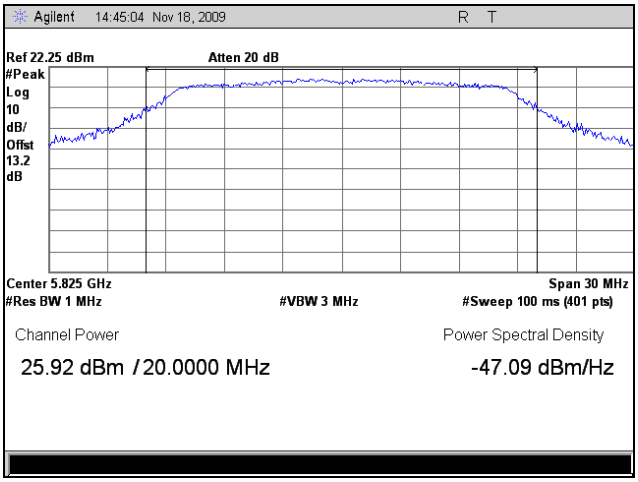
Plot 50. Peak Output Power, High Channel (5825MHz), 802.11a



Plot 51. Peak Output Power, Low Channel (5745MHz), 802.11n 20MHz



Plot 52. Peak Output Power, Mid Channel (5785MHz), 802.11n 20MHz



Plot 53. Peak Output Power, High Channel (5825MHz), 802.11n 20MHz

§ 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 = *27.74dBm* (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

EUT maximum antenna gain = **0.49dBi**

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

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

where, S = Power Density (1 mW/cm^2)
P = Power Input to antenna (650.13mW)
G = Antenna Gain (3.16 numeric)

S = (594.292*1.11 / 4*3.14*20.0^2)= (665.27/ 5024) = **0.132mW/cm^2**@ 20cm separation

MPE Limit Calculation: EUT's operating frequencies @ 5745-5825 MHz; highest conducted power = *26.13dBm* (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

EUT maximum antenna gain = **1.42dBi**

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

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

where, S = Power Density (1 mW/cm^2)
P = Power Input to antenna (905.73mW)
G = Antenna Gain (3.16 numeric)

S = (410.204*1.38 / 4*3.14*20.0^2)= (568.85/ 5024) = **0.11 mW/cm^2**@ 20cm separation

Electromagnetic Compatibility Criteria for Intentional Radiators

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

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

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

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

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

Table 20. Restricted Bands of Operation

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

Test Requirement(s): **§ 15.209 (a):** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 21.

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

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

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

Test Results: The EUT was compliant with the Radiated Spurious Emission limits of **§ 15.247(d)**. No harmonics were detected. There were also no emissions above 18 GHz.

Test Engineer(s): Minh Ly

Test Date(s): 06/02/10 and 08/23/10

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
4.824	H	52.74	34.66	33.94	5.06	57.09	Peak	74	-16.91
4.824	H	49.44	34.66	33.94	5.06	53.79	Avg.	54	-0.21
7.236	H	48.3	35.03	35.62	6.26	55.15	Peak	74	-18.85
7.236	H	35.94	35.03	35.62	6.26	42.79	Avg.	54	-11.21
9.648	H	45.13	35.34	36.62	7.29	53.69	Peak	74	-20.31
9.648	H	31.88	35.34	36.62	7.29	40.44	Avg.	54	-13.56

Table 22. Radiated Harmonics, Low Channel (2412MHz), 802.11b

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
4.874	H	50.31	34.72	33.93	5.06	54.58	Peak	74	-19.42
4.874	H	46.08	34.72	33.93	5.06	50.35	Avg.	54	-3.65
7.311	H	50.08	35.11	35.64	6.33	56.93	Peak	74	-17.07
7.311	H	40.37	35.11	35.64	6.33	47.22	Avg.	54	-6.78
9.748	H	42.99	35.47	36.75	7.42	51.69	Peak	74	-22.31
9.748	H	31.16	35.47	36.75	7.42	39.86	Avg.	54	-14.14

Table 23. Radiated Harmonics, Mid Channel (2437MHz), 802.11b

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
4.924	H	47.09	34.78	33.93	5.06	51.30	Peak	74	-22.70
4.924	H	40.13	34.78	33.93	5.06	44.34	Avg.	54	-9.66
7.386	H	50.62	35.25	35.65	6.38	57.40	Peak	74	-16.60
7.386	H	41.44	35.25	35.65	6.38	48.22	Avg.	54	-5.78
9.848	H	45.38	35.51	36.89	7.54	54.30	Peak	74	-19.70
9.848	H	31.18	35.51	36.89	7.54	40.10	Avg.	54	-13.90

Table 24. Radiated Harmonics, High Channel (2462MHz), 802.11b

*Note: All other emissions were measured at the noise floor of the spectrum analyzer.

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
4.824	H	48.02	34.66	33.94	5.06	52.37	Peak	74	-21.63
4.824	H	32.97	34.66	33.94	5.06	37.32	Avg.	54	-16.68
7.236	H	43.94	35.03	35.62	6.26	50.79	Peak	74	-23.21
7.236	H	30.2	35.03	35.62	6.26	37.05	Avg.	54	-16.95
9.648	H	45.46	35.34	36.62	7.29	54.02	Peak	74	-19.98
9.648	H	31.5	35.34	36.62	7.29	40.06	Avg.	54	-13.94

Table 25. Radiated Harmonics, Low Channel (2412MHz), 802.11g

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
4.874	H	48.16	34.72	33.93	5.06	52.43	Peak	74	-21.57
4.874	H	33.29	34.72	33.93	5.06	37.56	Avg.	54	-16.44
7.311	H	43.84	35.11	35.64	6.33	50.69	Peak	74	-23.31
7.311	H	30.05	35.11	35.64	6.33	36.90	Avg.	54	-17.10
9.748	H	44.7	35.47	36.75	7.42	53.40	Peak	74	-20.60
9.748	H	30.6	35.47	36.75	7.42	39.30	Avg.	54	-14.70

Table 26. Radiated Harmonics, Mid Channel (2437MHz), 802.11g

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
4.924	H	43.85	34.78	33.93	5.06	48.06	Peak	74	-25.94
4.924	H	29.82	34.78	33.93	5.06	34.03	Avg.	54	-19.97
7.386	H	43.57	35.25	35.65	6.38	50.35	Peak	74	-23.65
7.386	H	30.01	35.25	35.65	6.38	36.79	Avg.	54	-17.21
9.848	H	44.5	35.51	36.89	7.54	53.42	Peak	74	-20.58
9.848	H	30.95	35.51	36.89	7.54	39.87	Avg.	54	-14.13

Table 27. Radiated Harmonics, High Channel (2462MHz), 802.11g

*Note: All other emissions were measured at the noise floor of the spectrum analyzer.

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
4.824	H	45.18	34.66	33.94	5.06	49.53	Peak	74	-24.47
4.824	H	32.43	34.66	33.94	5.06	36.78	Avg.	54	-17.22
7.236	H	43.86	35.03	35.62	6.26	50.71	Peak	74	-23.29
7.236	H	30.24	35.03	35.62	6.26	37.09	Avg.	54	-16.91
9.648	H	45.28	35.34	36.62	7.29	53.84	Peak	74	-20.16
9.648	H	31.54	35.34	36.62	7.29	40.10	Avg.	54	-13.90

Table 28. Radiated Harmonics, Channel 1 (2412MHz), 802.11n 20MHz

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
4.834	H	54.22	34.67	33.94	5.06	58.55	Peak	74	-15.45
4.834	H	39.06	34.67	33.94	5.06	43.39	Avg.	54	-10.61
7.251	H	57.05	35.04	35.62	6.27	63.91	Peak	74	-10.09
7.251	H	41.45	35.04	35.62	6.27	48.31	Avg.	54	-5.69
9.668	H	46.07	35.38	36.64	7.31	54.64	Peak	74	-19.36
9.668	H	31.55	35.38	36.64	7.31	40.12	Avg.	54	-13.88

Table 29. Radiated Harmonics, Channel 2 (2417MHz), 802.11n 20MHz

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
4.874	H	52.25	34.72	33.93	5.06	56.52	Peak	74	-17.48
4.874	H	36.98	34.72	33.93	5.06	41.25	Avg.	54	-12.75
7.311	H	58.64	35.11	35.64	6.33	65.49	Peak	74	-8.51
7.311	H	41.8	35.11	35.64	6.33	48.65	Avg.	54	-5.35
9.748	H	45.25	35.47	36.75	7.42	53.95	Peak	74	-20.05
9.748	H	31.17	35.47	36.75	7.42	39.87	Avg.	54	-14.13

Table 30. Radiated Harmonics, Channel 6 (2437MHz), 802.11n 20MHz

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
4.914	H	51.59	34.77	33.93	5.06	55.81	Peak	74	-18.19
4.914	H	36.88	34.77	33.93	5.06	41.10	Avg.	54	-12.90
7.371	H	56.5	35.22	35.65	6.37	63.30	Peak	74	-10.70
7.371	H	41.05	35.22	35.65	6.37	47.85	Avg.	54	-6.15
9.828	H	45.44	35.51	36.86	7.52	54.31	Peak	74	-19.69
9.828	H	30.79	35.51	36.86	7.52	39.66	Avg.	54	-14.34

Table 31. Radiated Harmonics, Channel 10 (2457MHz), 802.11n 20MHz

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
4.924	H	43.76	34.78	33.93	5.06	47.97	Peak	74	-26.03
4.924	H	29.56	34.78	33.93	5.06	33.77	Avg.	54	-20.23
7.386	H	44.61	35.25	35.65	6.38	51.39	Peak	74	-22.61
7.386	H	30.09	35.25	35.65	6.38	36.87	Avg.	54	-17.13
9.848	H	45.37	35.51	36.89	7.54	54.29	Peak	74	-19.71
9.848	H	31.11	35.51	36.89	7.54	40.03	Avg.	54	-13.97

Table 32. Radiated Harmonics, Channel 11 (2462MHz), 802.11n 20MHz

*Note: All other emissions were measured at the noise floor of the spectrum analyzer.

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.49	V	45.07	34.65	38.14	8.11	56.68	Peak	74	-17.32
11.49	V	31.09	34.65	38.14	8.11	42.70	Avg.	54	-11.30

Table 33. Radiated Harmonics, Low Channel (5745MHz), 802.11a

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.57	V	45.82	34.53	38.23	8.28	57.80	Peak	74	-16.20
11.57	V	31.31	34.53	38.23	8.28	43.29	Avg.	54	-10.71

Table 34. Radiated Harmonics, Mid Channel (5785MHz), 802.11a

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.65	V	45.39	34.38	38.32	8.52	57.86	Peak	74	-16.14
11.65	V	31.11	34.38	38.32	8.52	43.58	Avg.	54	-10.42

Table 35. Radiated Harmonics, High Channel (5825MHz), 802.11a

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. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.49	V	44.76	34.65	38.14	8.11	56.37	Peak	74	-17.63
11.49	V	30.55	34.65	38.14	8.11	42.16	Avg.	54	-11.84

Table 36. Radiated Harmonics, Low Channel (5745MHz), 802.11n 20MHz

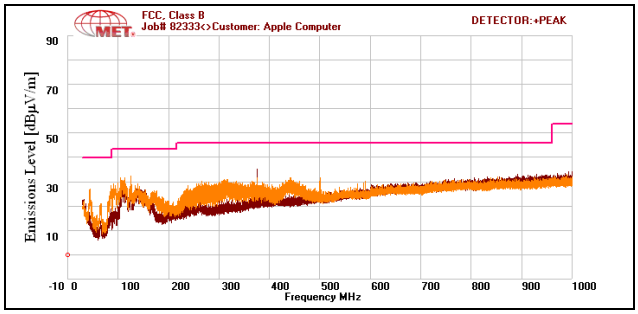
Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.57	V	45.73	34.53	38.23	8.28	57.71	Peak	74	-16.29
11.57	V	31.9	34.53	38.23	8.28	43.88	Avg.	54	-10.12

Table 37. Radiated Harmonics, Mid Channel (5785MHz), 802.11n 20MHz

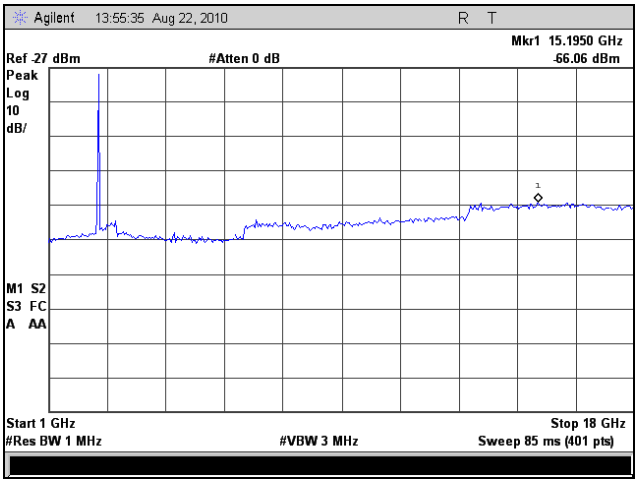
Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.65	V	45.86	34.38	38.32	8.52	58.33	Peak	74	-15.67
11.65	V	30.98	34.38	38.32	8.52	43.45	Avg.	54	-10.55

Table 38. Radiated Harmonics, High Channel (5825MHz), 802.11n 20MHz

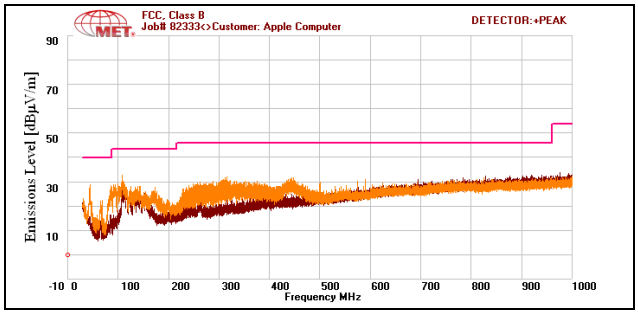
Radiated Spurious Emissions



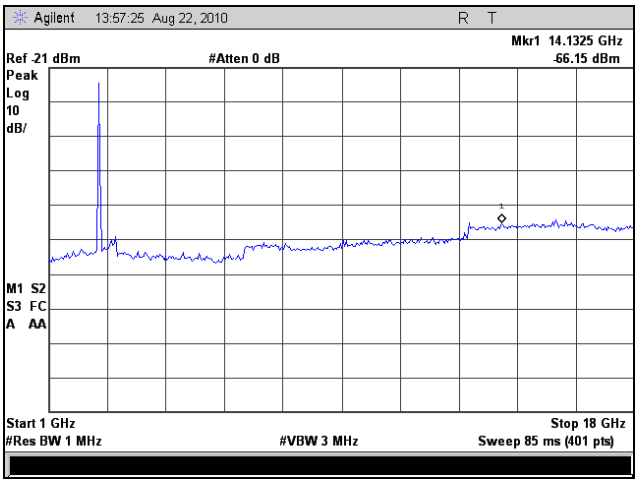
Plot 54. Radiated Spurious Emissions, Low Channel (2412MHz), 802.11b, 30 MHz – 1 GHz



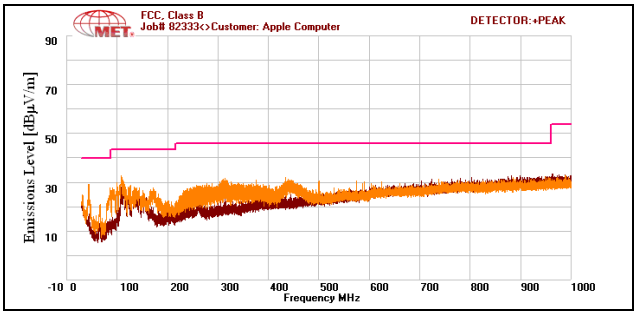
Plot 55. Radiated Spurious Emissions, Low Channel (2412MHz), 802.11b, 1 GHz – 18 GHz



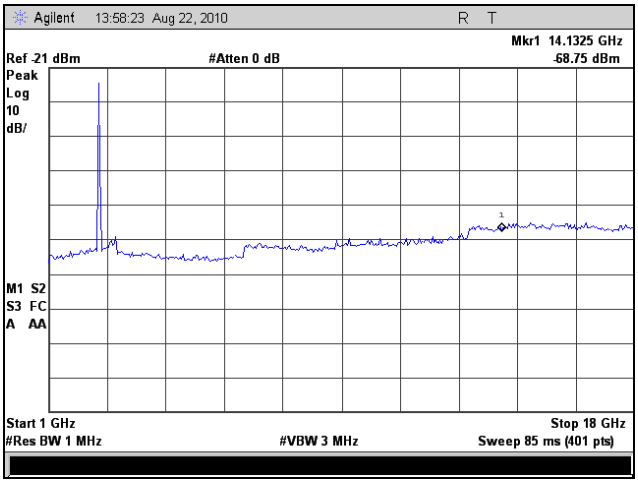
Plot 56. Radiated Spurious Emissions, Mid Channel (2437MHz), 802.11b, 30 MHz – 1 GHz



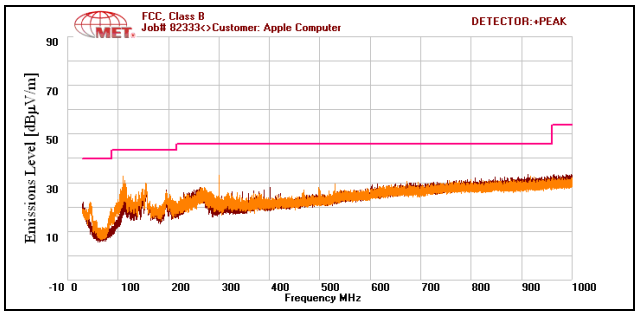
Plot 57. Radiated Spurious Emissions, Mid Channel (2437MHz), 802.11b, 1 GHz – 18 GHz



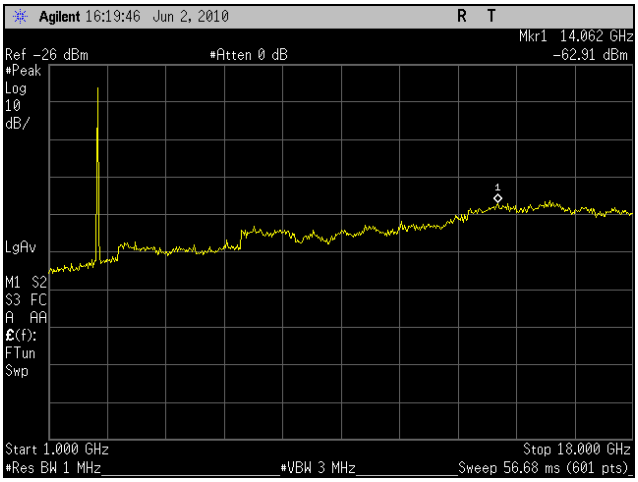
Plot 58. Radiated Spurious Emissions, High Channel (2462MHz), 802.11b, 30 MHz – 1 GHz



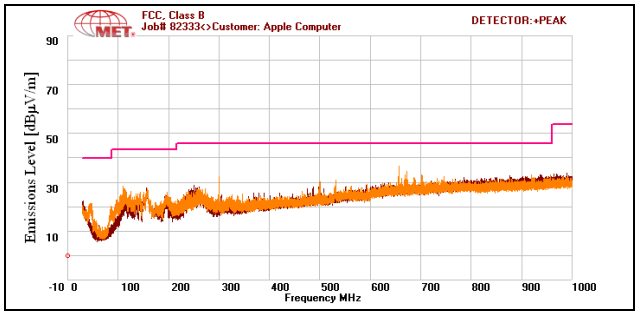
Plot 59. Radiated Spurious Emissions, High Channel (2462MHz), 802.11b, 1 GHz – 18 GHz



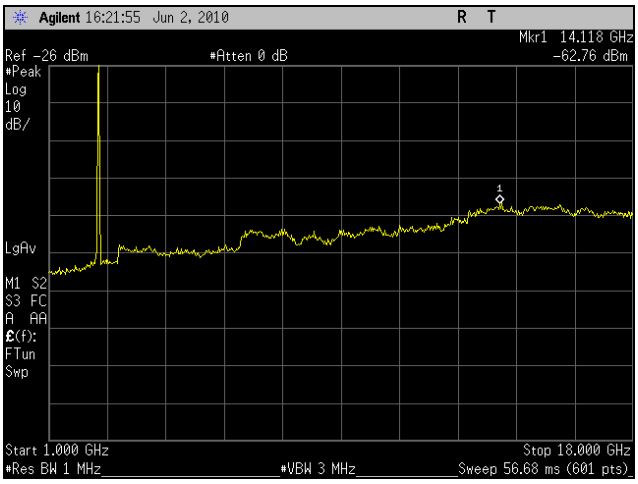
Plot 60. Radiated Spurious Emissions, Low Channel (2412MHz), 802.11g, 30 MHz – 1 GHz



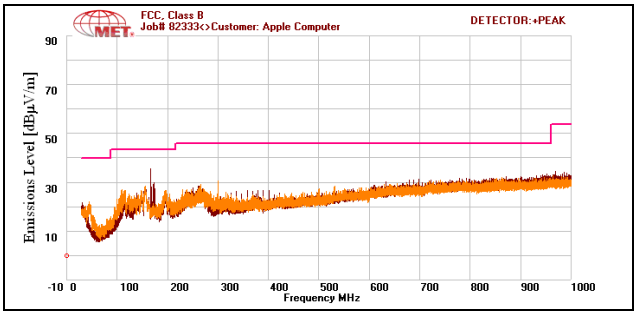
Plot 61. Radiated Spurious Emissions, Low Channel (2412MHz), 802.11g, 1 GHz – 18 GHz



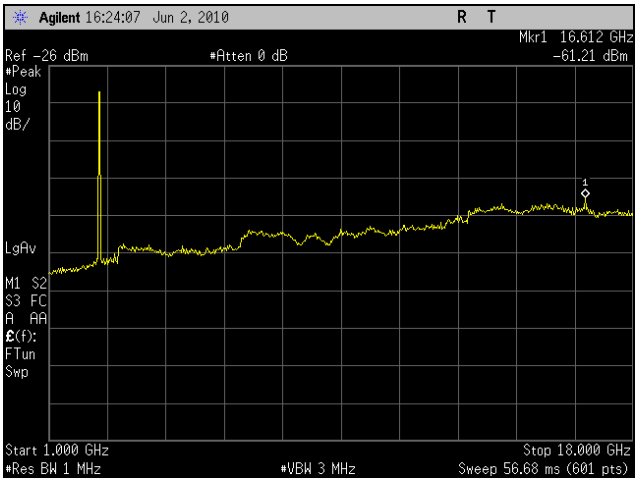
Plot 62. Radiated Spurious Emissions, Mid Channel (2437MHz), 802.11g, 30 MHz – 1 GHz



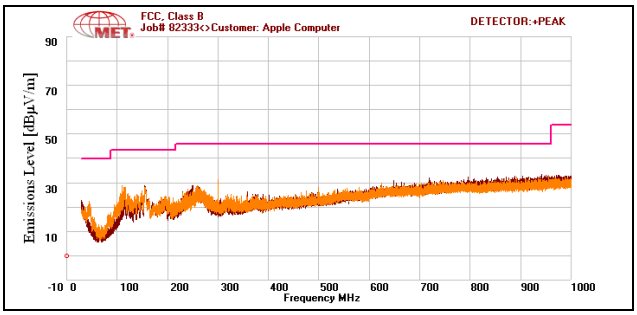
Plot 63. Radiated Spurious Emissions, Mid Channel (2437MHz), 802.11g, 1 GHz – 18 GHz



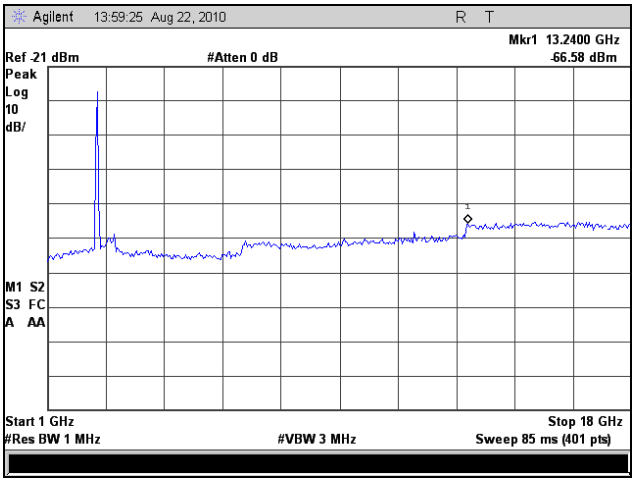
Plot 64. Radiated Spurious Emissions, High Channel (2462MHz), 802.11g, 30 MHz – 1 GHz



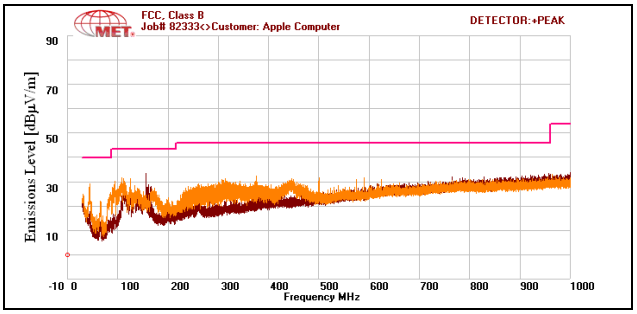
Plot 65. Radiated Spurious Emissions, High Channel (2462MHz), 802.11g, 1 GHz – 18 GHz



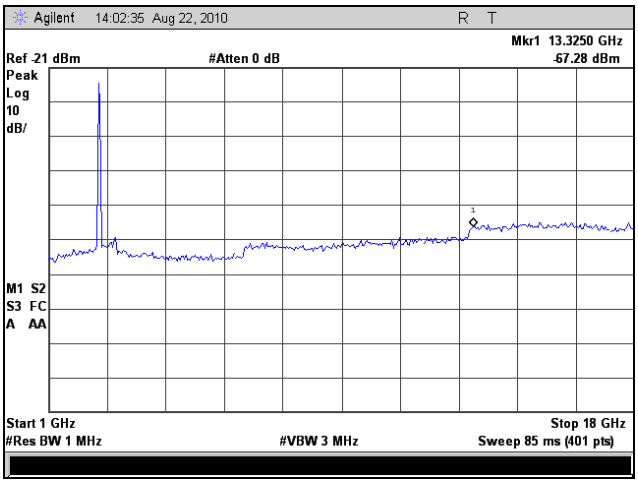
Plot 66. Radiated Spurious Emissions, Channel 1 (2412MHz), 802.11n 20MHz, 30 MHz – 1 GHz



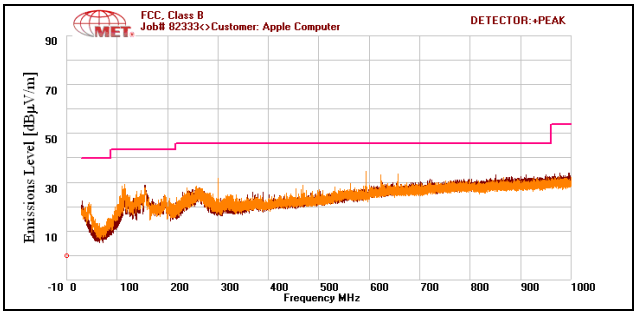
Plot 67. Radiated Spurious Emissions, Channel 1 (2412MHz), 802.11n 20MHz, 1 GHz – 18 GHz



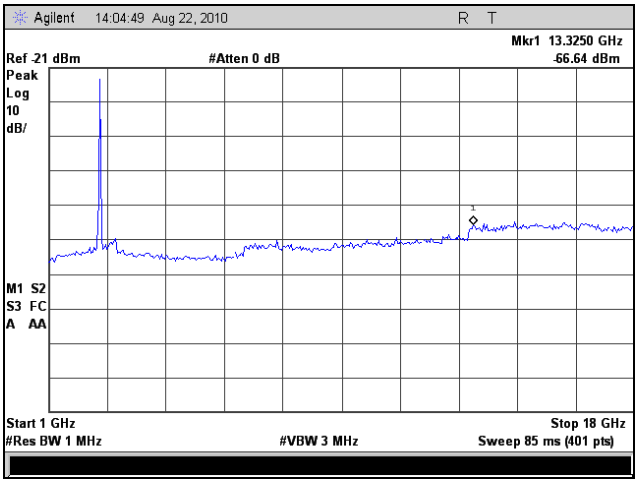
Plot 68. Radiated Spurious Emissions, Channel 6 (2437MHz), 802.11n 20MHz, 30 MHz – 1 GHz



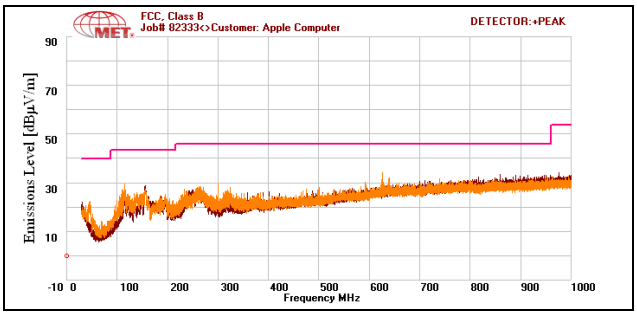
Plot 69. Radiated Spurious Emissions, Channel 6 (2437MHz), 802.11n 20MHz, 1 GHz – 18 GHz



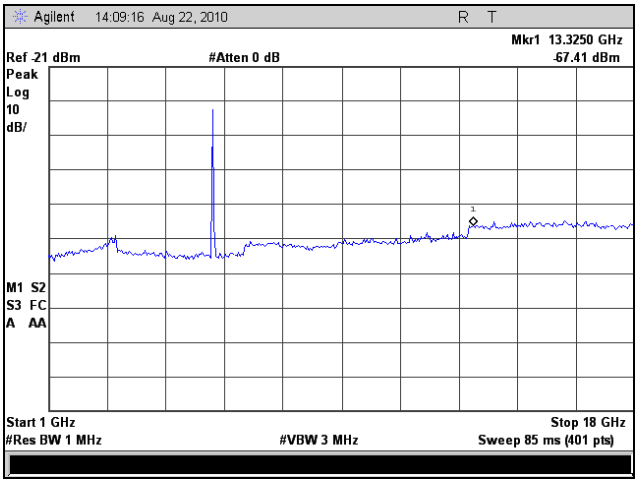
Plot 70. Radiated Spurious Emissions, Channel 11 (2462MHz), 802.11n 20MHz, 30 MHz – 1 GHz



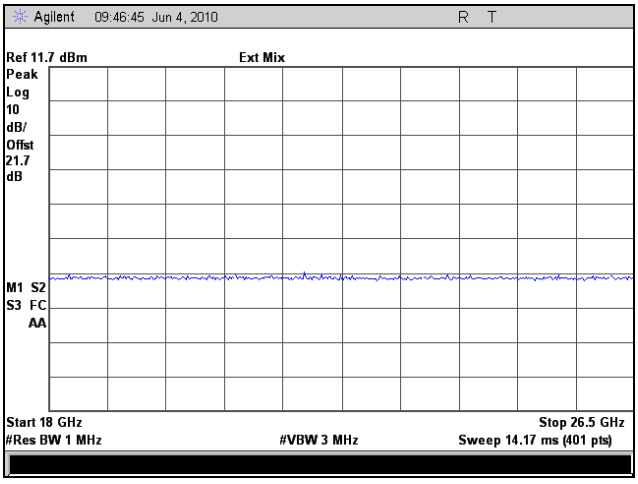
Plot 71. Radiated Spurious Emissions, Channel 11 (2462MHz), 802.11n 20MHz, 1 GHz – 18 GHz



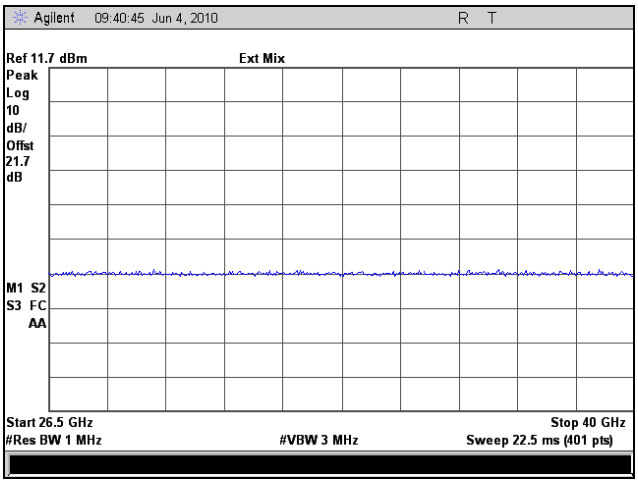
Plot 72. Radiated Spurious Emissions, Low Channel (5745MHz), 802.11a, 30 MHz – 1 GHz



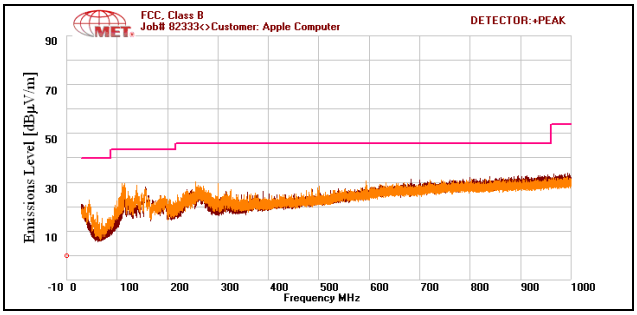
Plot 73. Radiated Spurious Emissions, Low Channel (5745MHz), 802.11a, 1 GHz – 18 GHz



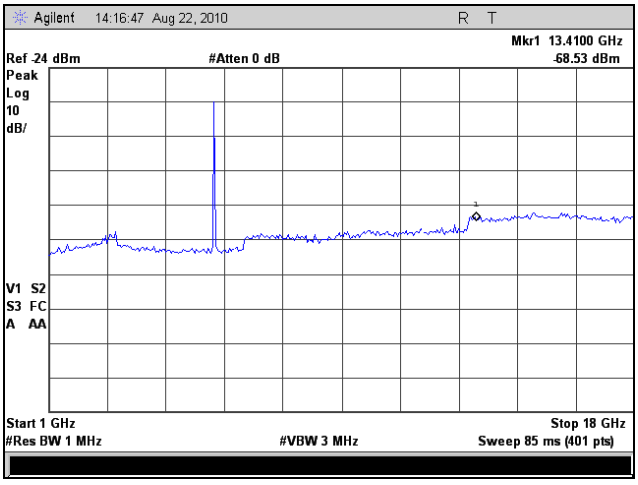
Plot 74. Radiated Spurious Emissions, Low Channel (5745MHz), 802.11a, 18 GHz – 26.5 GHz



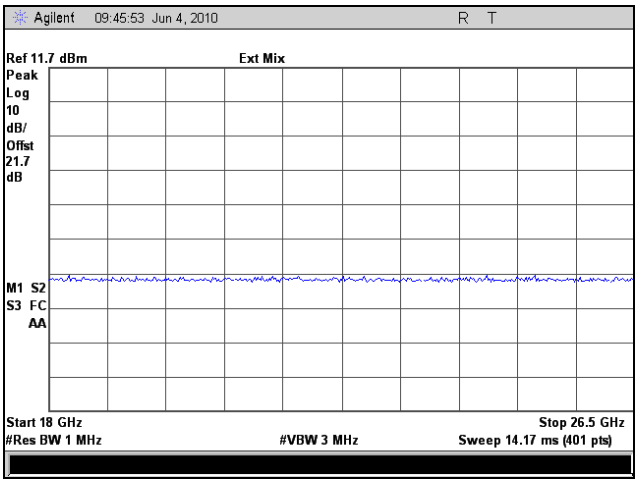
Plot 75. Radiated Spurious Emissions, Low Channel (5745MHz), 802.11a, 26.5 GHz – 40 GHz



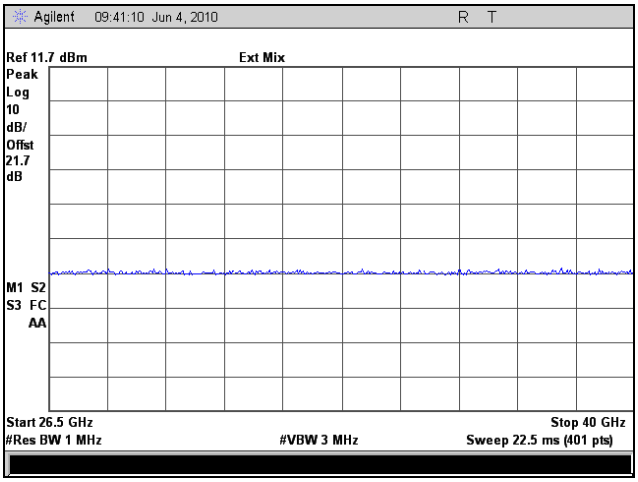
Plot 76. Radiated Spurious Emissions, Mid Channel (5785MHz), 802.11a, 30 MHz – 1 GHz



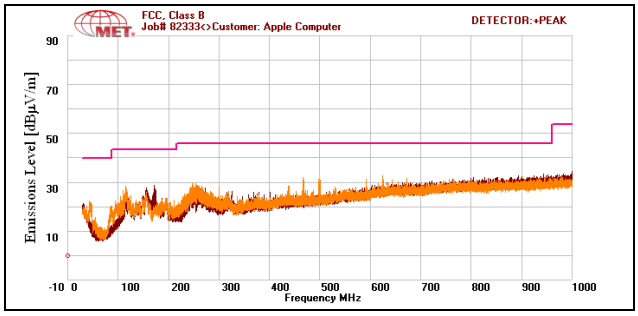
Plot 77. Radiated Spurious Emissions, Mid Channel (5785MHz), 802.11a, 1 GHz – 18 GHz



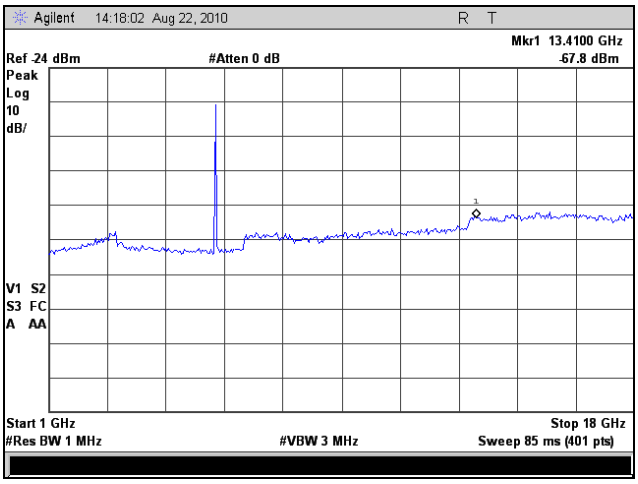
Plot 78. Radiated Spurious Emissions, Mid Channel (5785MHz), 802.11a, 18 GHz – 26.5 GHz



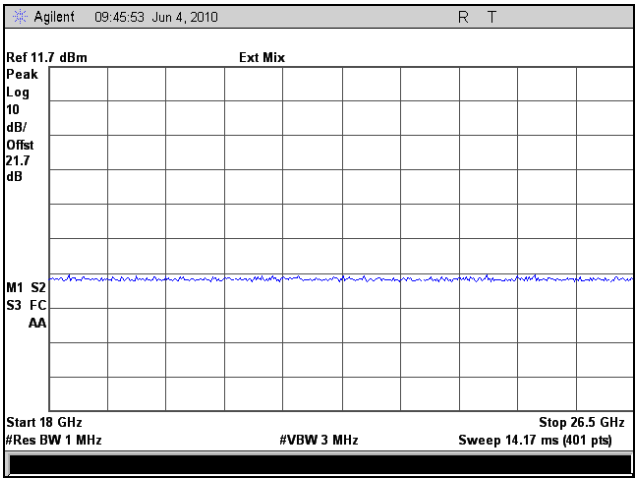
Plot 79. Radiated Spurious Emissions, Mid Channel (5785MHz), 802.11a, 26.5 GHz – 40 GHz



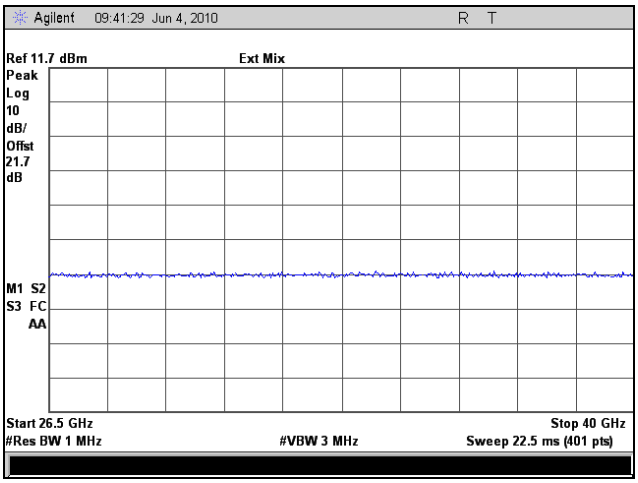
Plot 80. Radiated Spurious Emissions, High Channel (5825MHz), 802.11a, 30 MHz – 1 GHz



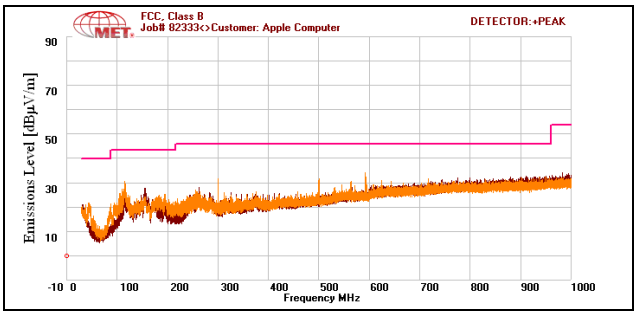
Plot 81. Radiated Spurious Emissions, High Channel (5825MHz), 802.11a, 1 GHz – 18 GHz



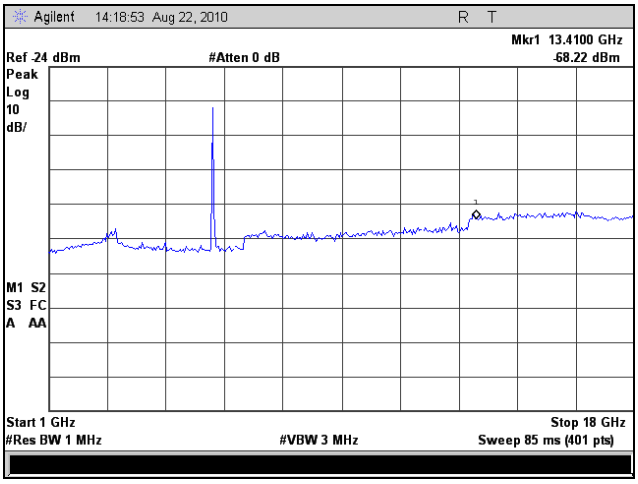
Plot 82. Radiated Spurious Emissions, High Channel (5825MHz), 802.11a, 18 GHz – 26.5 GHz



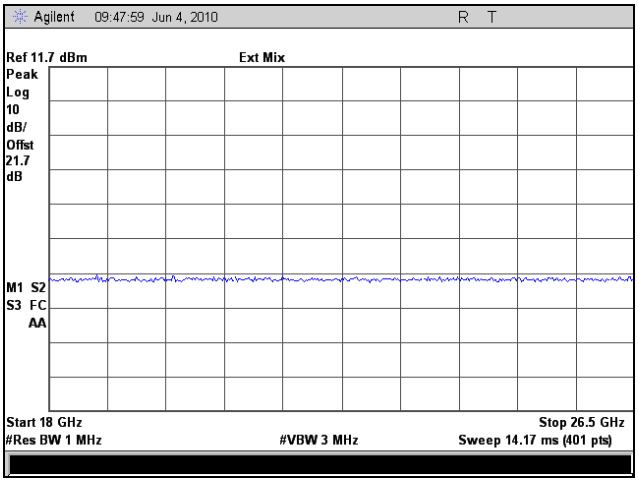
Plot 83. Radiated Spurious Emissions, High Channel (5825MHz), 802.11a, 26.5 GHz – 40 GHz



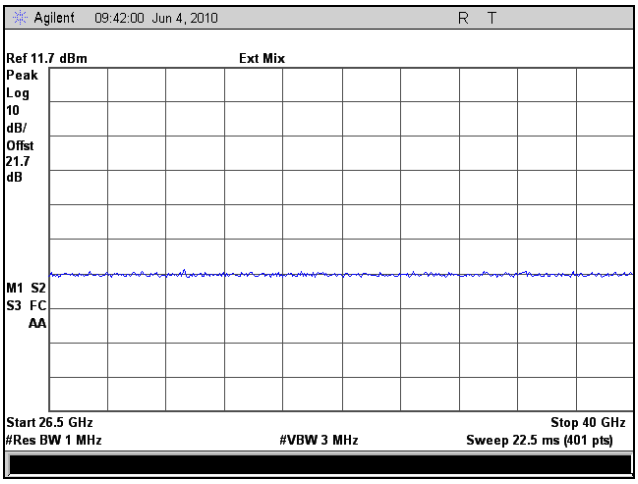
Plot 84. Radiated Spurious Emissions, Low Channel (5745MHz), 802.11n 20MHz, 30 MHz – 1 GHz



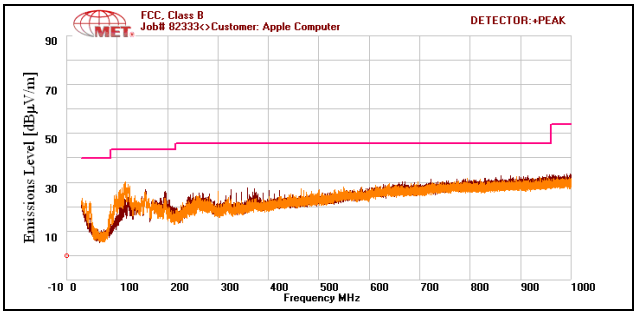
Plot 85. Radiated Spurious Emissions, Low Channel (5745MHz), 802.11n 20MHz, 1 GHz – 18 GHz



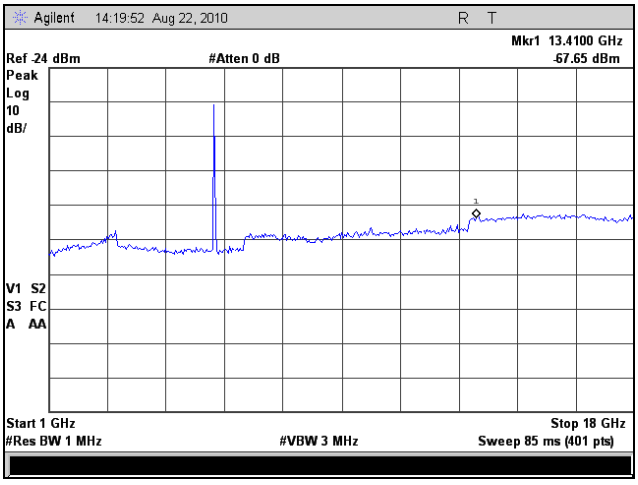
Plot 86. Radiated Spurious Emissions, Low Channel (5745MHz), 802.11n 20MHz, 18 GHz – 26.5 GHz



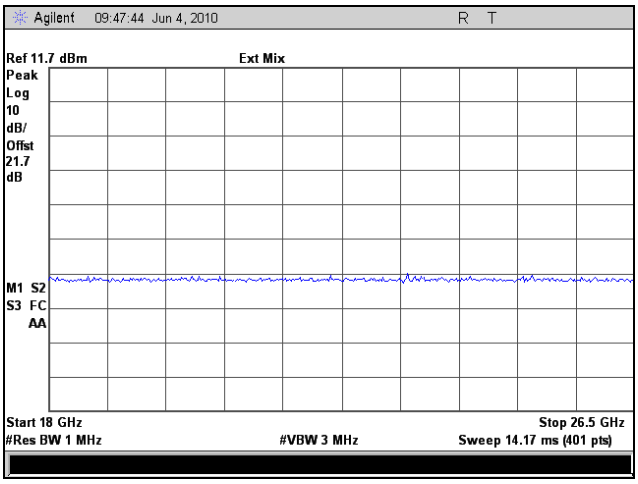
Plot 87. Radiated Spurious Emissions, Low Channel (5745MHz), 802.11n 20MHz, 26.5 GHz – 40 GHz



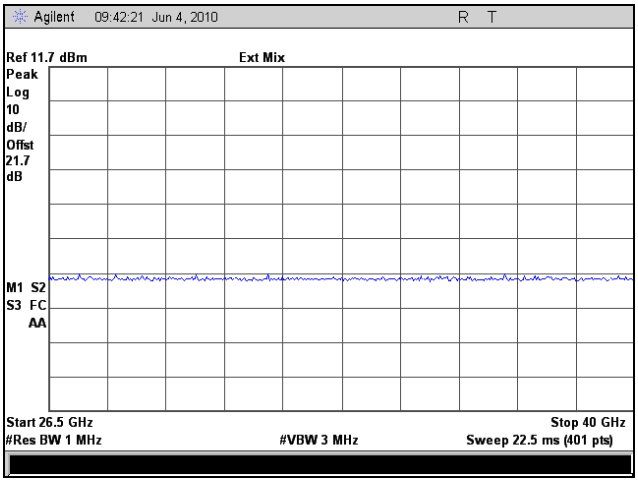
Plot 88. Radiated Spurious Emissions, Mid Channel (5785MHz), 802.11n 20MHz, 30 MHz – 1 GHz



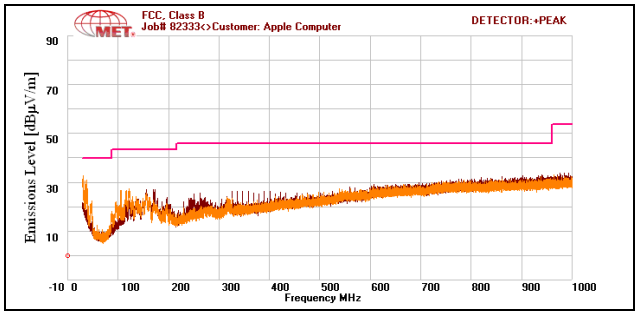
Plot 89. Radiated Spurious Emissions, Mid Channel (5785MHz), 802.11n 20MHz, 1 GHz – 18 GHz



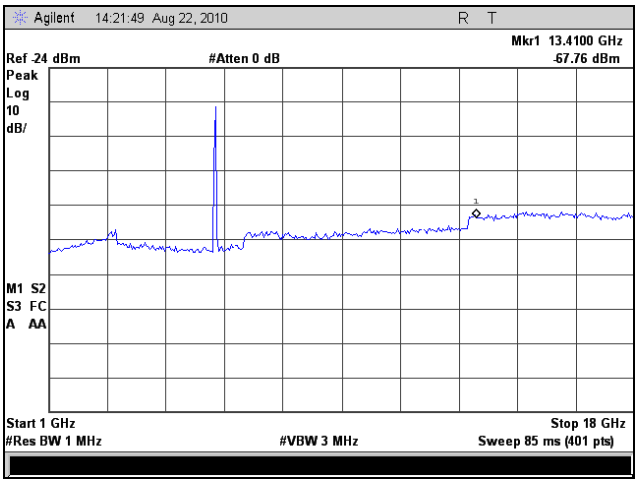
Plot 90. Radiated Spurious Emissions, Mid Channel (5785MHz), 802.11n 20MHz, 18 GHz – 26.5 GHz



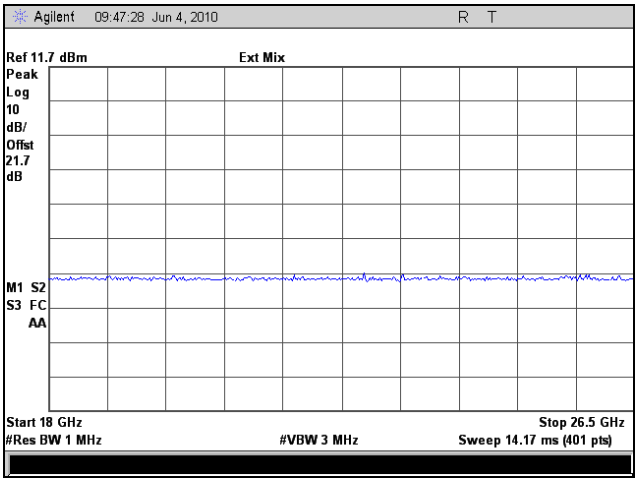
Plot 91. Radiated Spurious Emissions, Mid Channel (5785MHz), 802.11n 20MHz, 26.5 GHz – 40 GHz



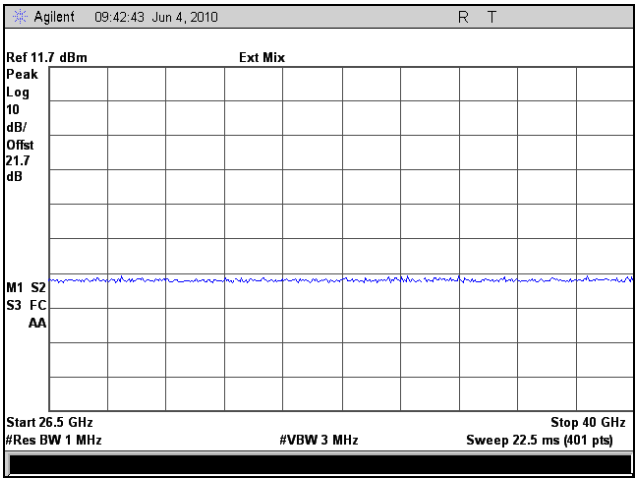
Plot 92. Radiated Spurious Emissions, High Channel (5825MHz), 802.11n 20MHz, 30 MHz – 1 GHz



Plot 93. Radiated Spurious Emissions, High Channel (5825MHz), 802.11n 20MHz, 1 GHz – 18 GHz



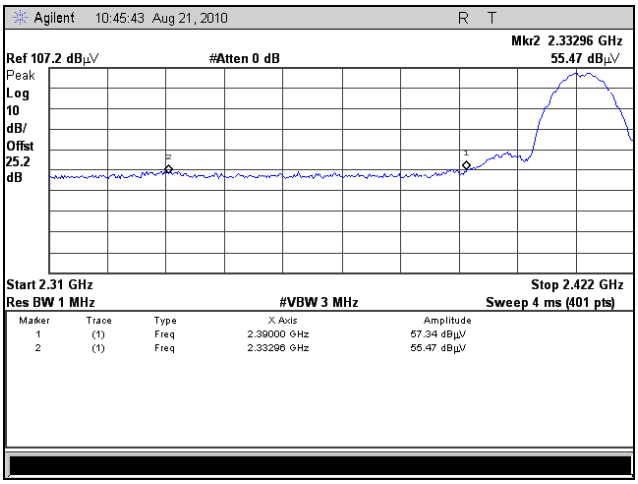
Plot 94. Radiated Spurious Emissions, High Channel (5825MHz), 802.11n 20MHz, 18 GHz – 26.5 GHz



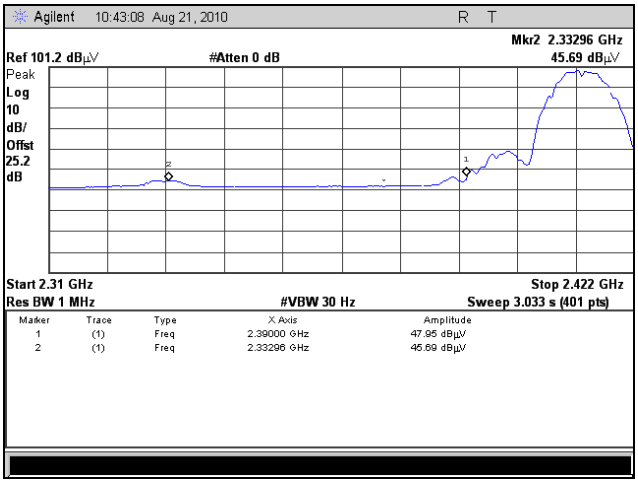
Plot 95. Radiated Spurious Emissions, High Channel (5825MHz), 802.11n 20MHz, 26.5 GHz – 40 GHz

Radiated Band Edge Measurements

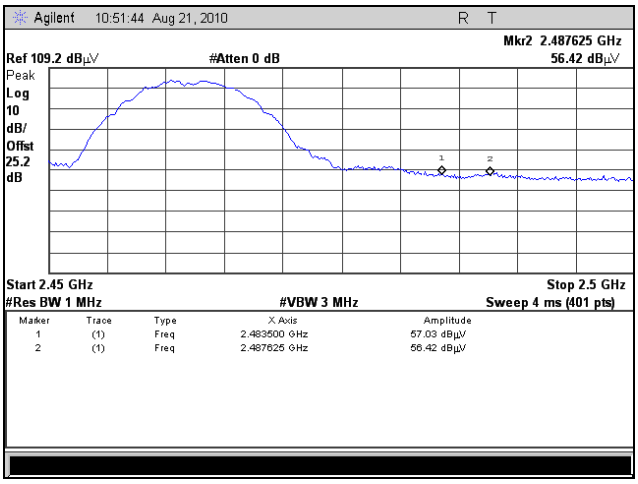
Test Procedures: The transmitter was turned on. Measurements were performed of the low and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor, cable loss and distance and compared to a 3 m limit line.



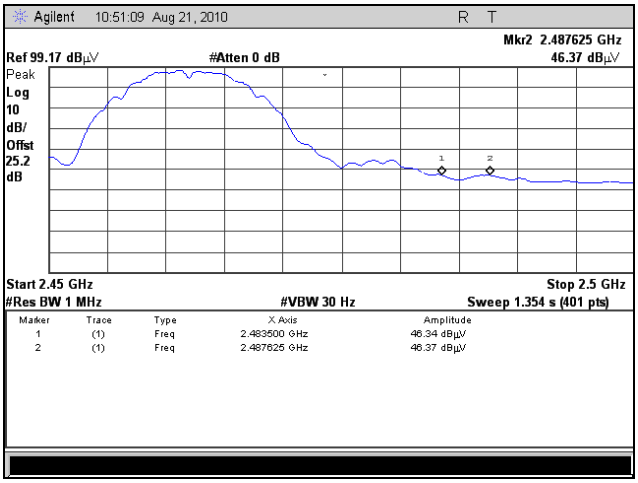
Plot 96. Band Edge, Low Channel (2412MHz), Peak, 802.11b



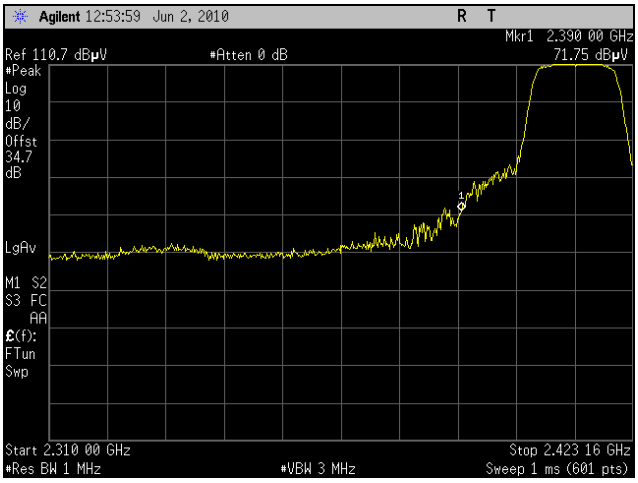
Plot 97. Band Edge, Low Channel (2412MHz), Average, 802.11b



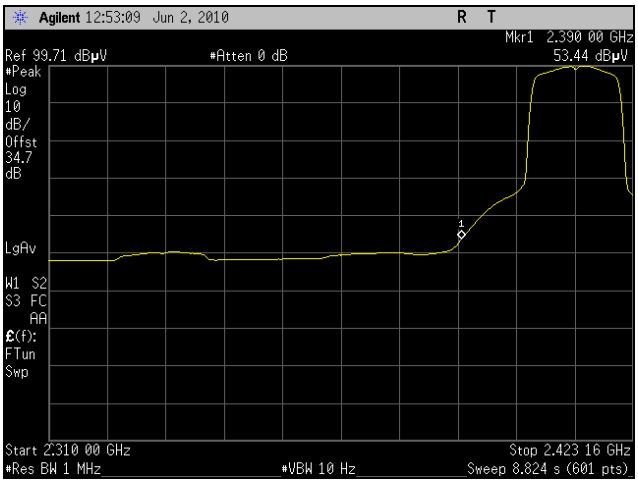
Plot 98. Band Edge, High Channel (2462MHz), Peak, 802.11b



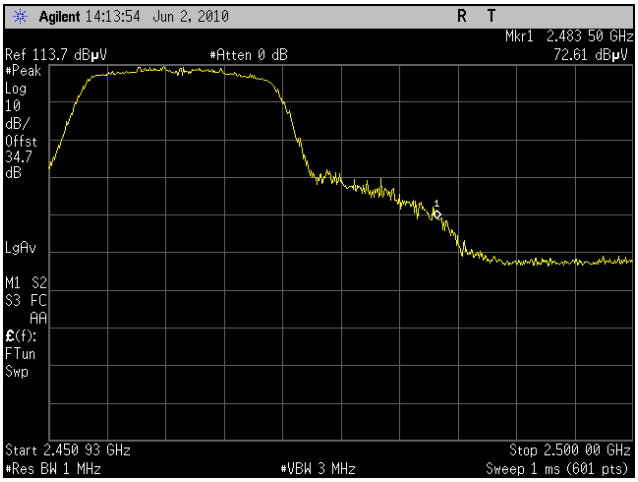
Plot 99. Band Edge, High Channel (2462MHz), Average, 802.11b



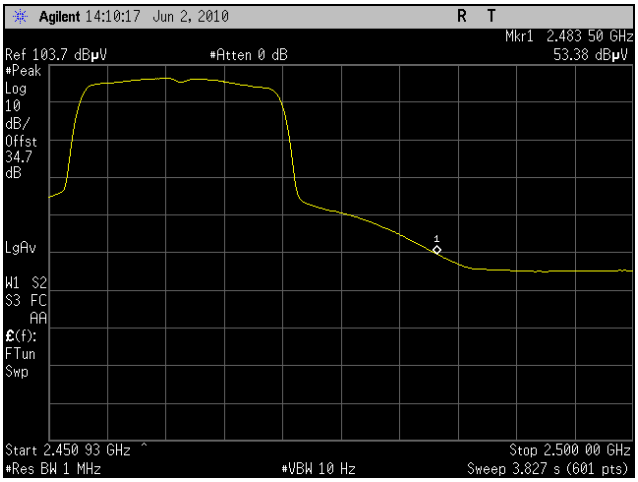
Plot 100. Band Edge, Low Channel (2412MHz), Peak, 802.11g



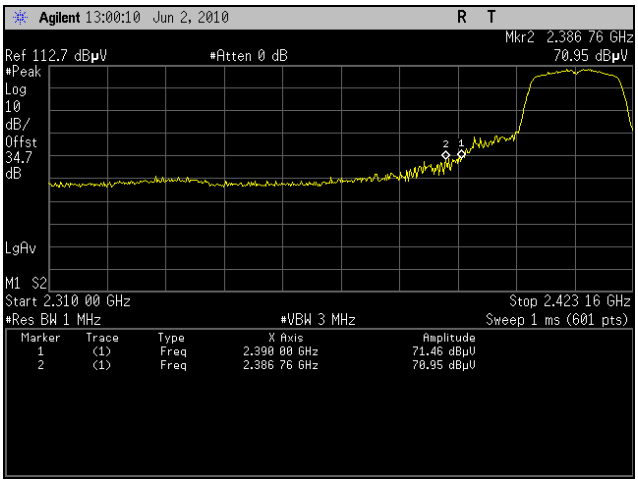
Plot 101. Band Edge, Low Channel (2412MHz), Average, 802.11g



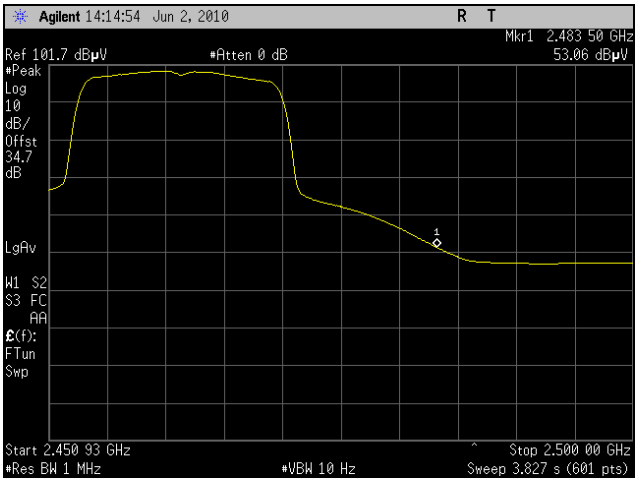
Plot 102. Band Edge, High Channel (2462MHz), Peak, 802.11g



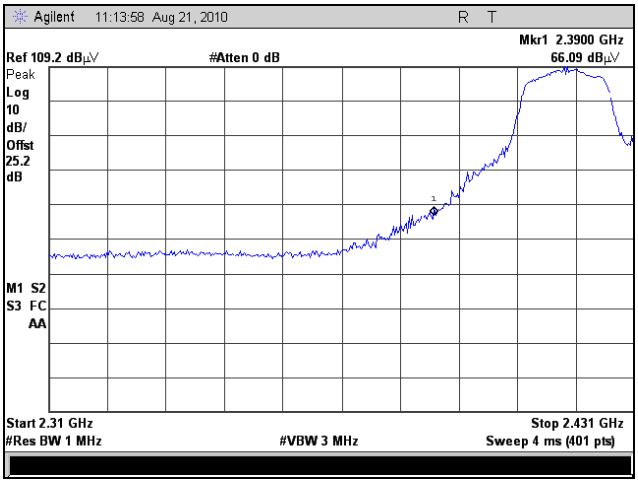
Plot 103. Band Edge, High Channel (2462MHz), Average, 802.11g



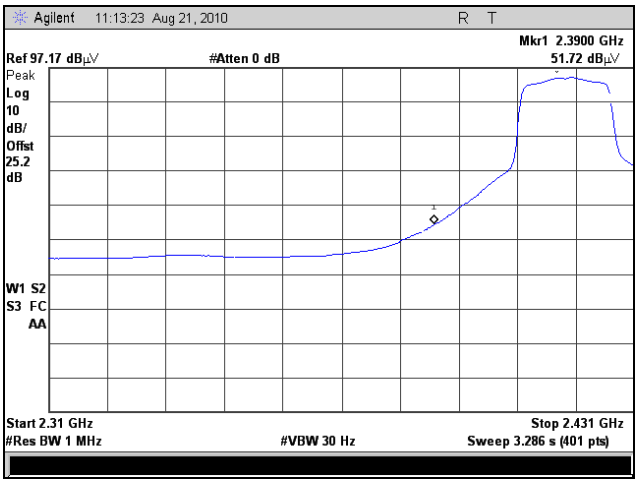
Plot 104. Band Edge, Channel 1 (2412MHz), Peak, 802.11n 20MHz



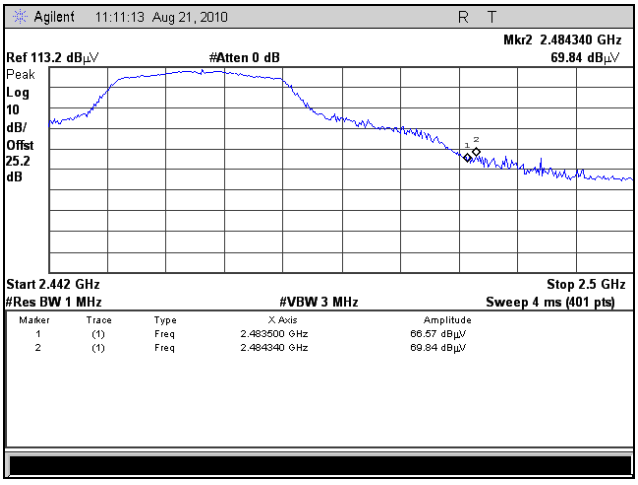
Plot 105. Band Edge, Channel 1 (2412MHz), Average, 802.11n 20MHz



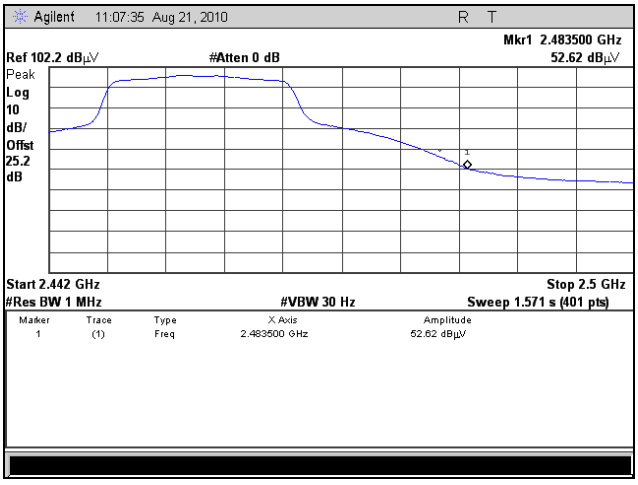
Plot 106. Band Edge, Channel 2 (2417MHz), Peak, 802.11n 20MHz



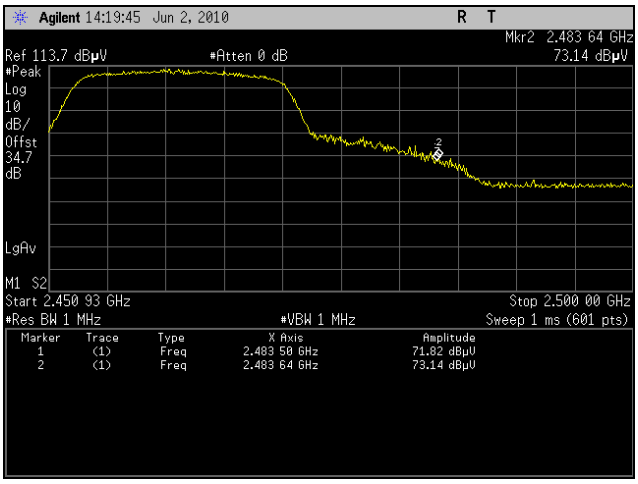
Plot 107. Band Edge, Channel 2 (2417MHz), Average, 802.11n 20MHz



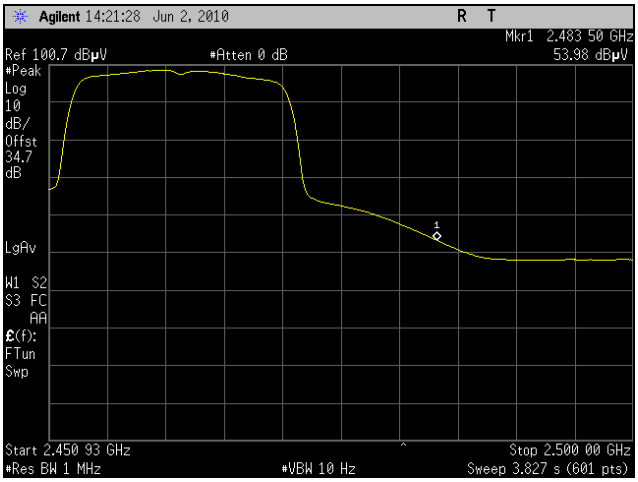
Plot 108. Band Edge, Channel 10 (2457MHz), Peak, 802.11n 20MHz



Plot 109. Band Edge, Channel 10 (2457MHz), Average, 802.11n 20MHz



Plot 110. Band Edge, Channel 11 (2462MHz), Peak, 802.11n 20MHz



Plot 111. Band Edge, Channel 11 (2462MHz), Average, 802.11n 20MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

RSS-GEN Receiver Spurious Emissions Requirements

Test Requirement: 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 39.

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

Table 39. 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 Procedure: The receiver spurious emissions were tested conducted.

Test Results: The EUT was compliant with the Receiver Spurious Emission limits of this requirement.

Test Engineer(s): Minh Ly

Test Date(s): 06/09/10

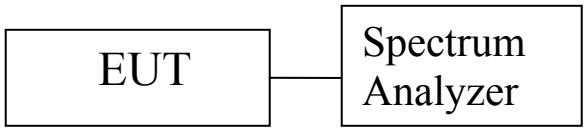
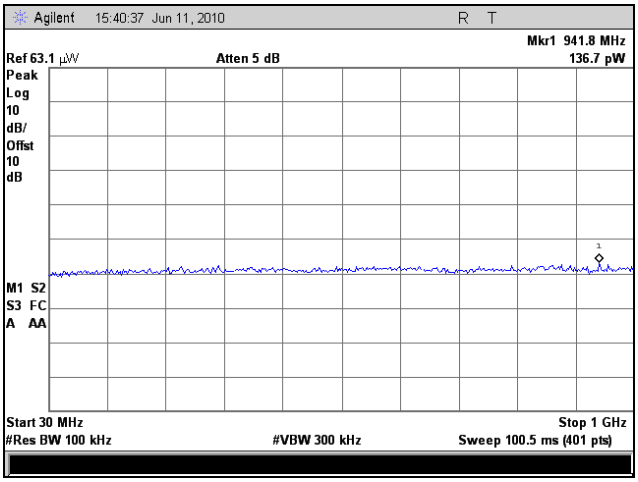
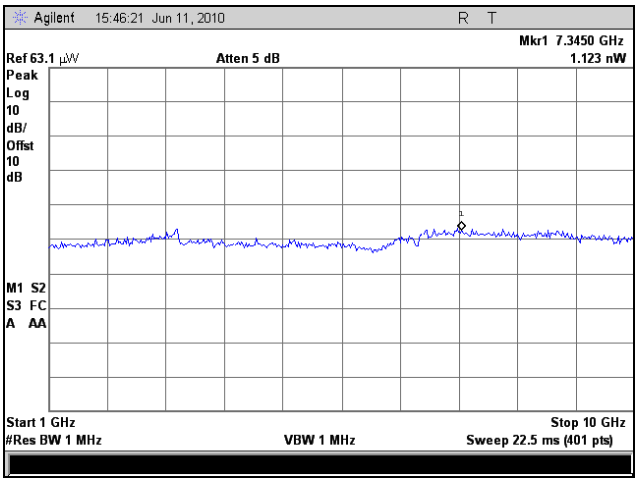


Figure 3. Block Diagram, Conducted Receiver Spurious Emissions Test Setup

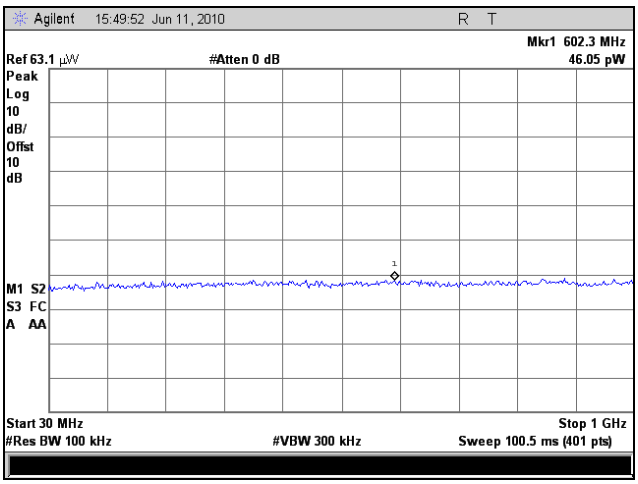
Conducted Receiver Spurious Emissions



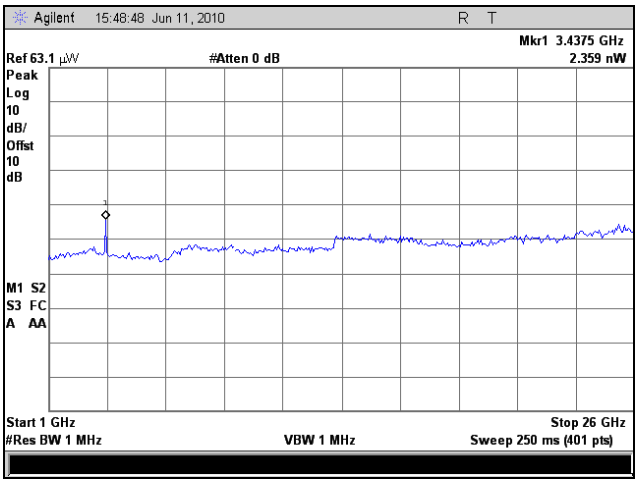
Plot 112. Receiver Spurious Emission, 30 MHz – 1 GHz, 2.4 GHz



Plot 113. Receiver Spurious Emission, 1 GHz – 20 GHz, 2.4 GHz



Plot 114. Receiver Spurious Emission, 30 MHz – 1 GHz, 5.8 GHz



Plot 115. Receiver Spurious Emission, 1 GHz – 18 GHz, 5.8 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.

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): Minh Ly

Test Date(s): 06/14/10

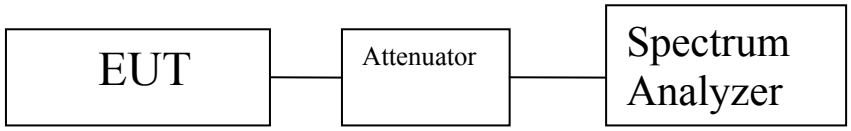
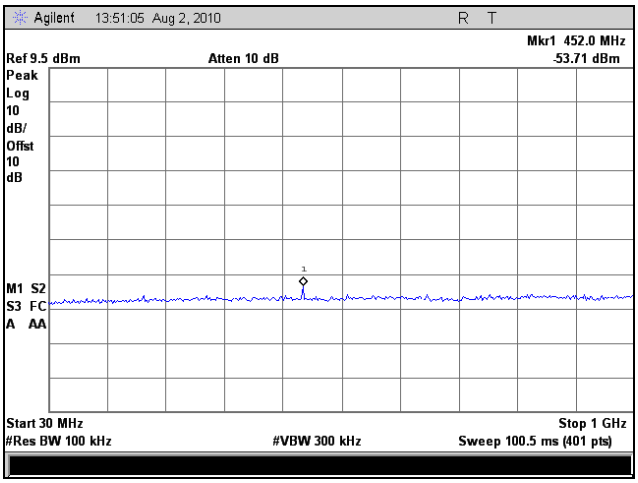
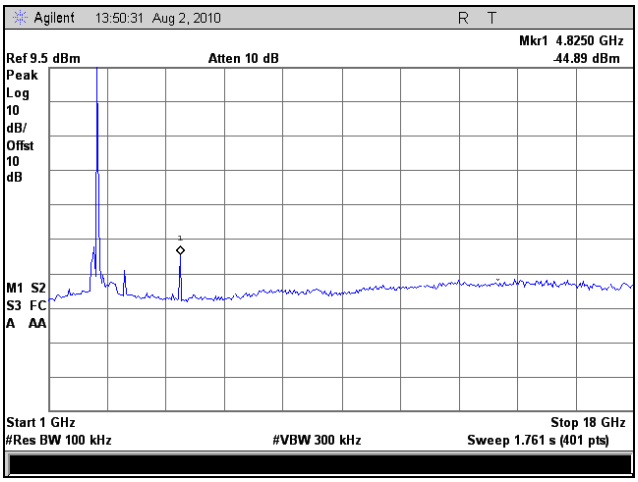


Figure 4. Block Diagram, Conducted Spurious Emissions Test Setup

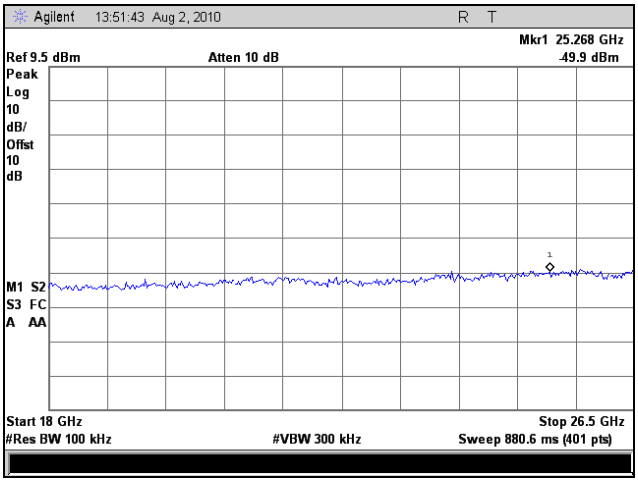
Conducted Spurious Emissions Test Results



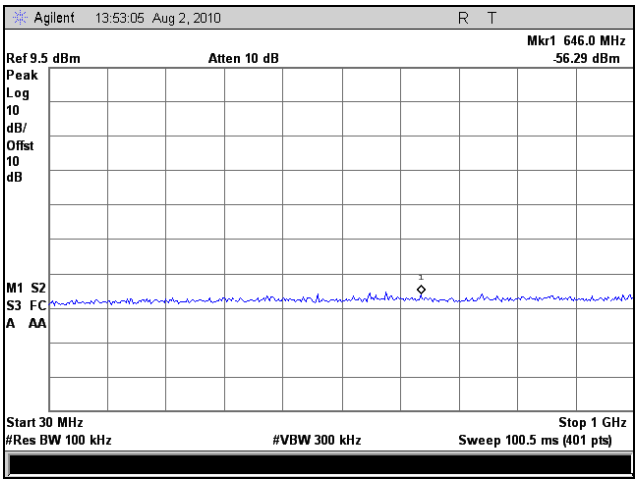
Plot 116. Conducted Emissions, Low Channel (2412MHz), 30 MHz – 1 GHz, 802.11b



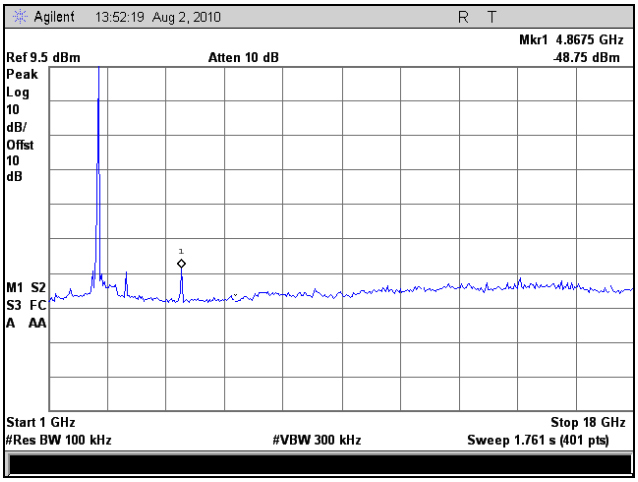
Plot 117. Conducted Emissions, Low Channel (2412MHz), 1 GHz – 18 GHz, 802.11b



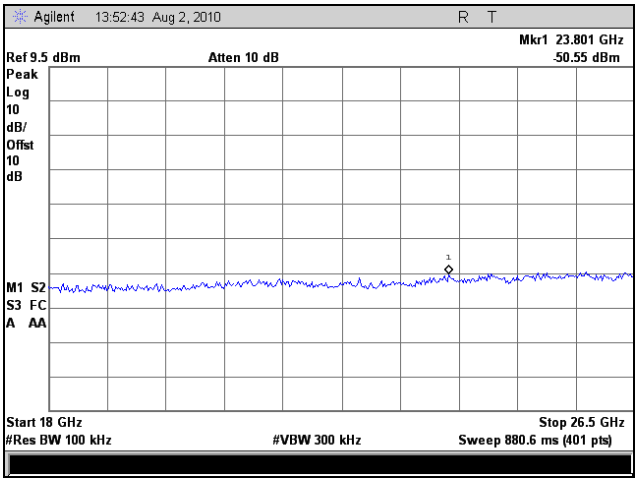
Plot 118. Conducted Emissions, Low Channel (2412MHz), 18 GHz – 26.5 GHz, 802.11b



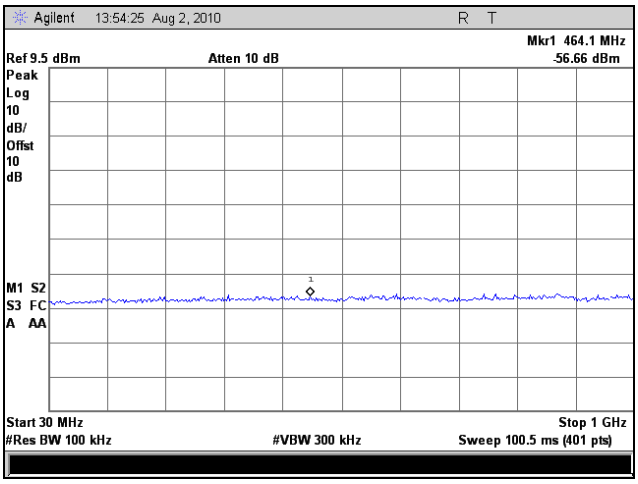
Plot 119. Conducted Emissions, Mid Channel (2437MHz), 30 MHz – 1 GHz, 802.11b



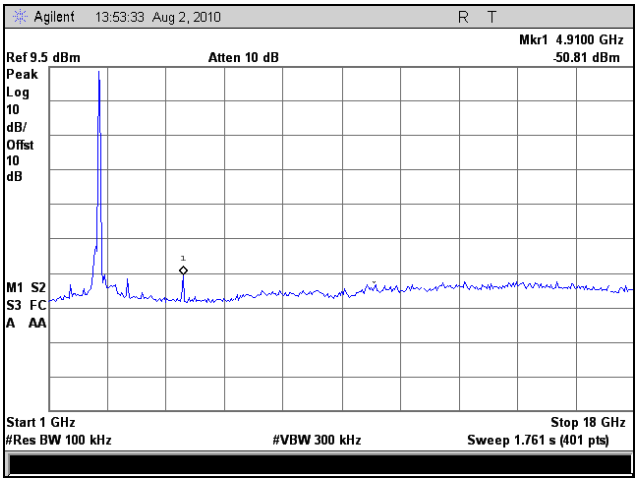
Plot 120. Conducted Emissions, Mid Channel (2437MHz), 1 GHz – 18 GHz, 802.11b



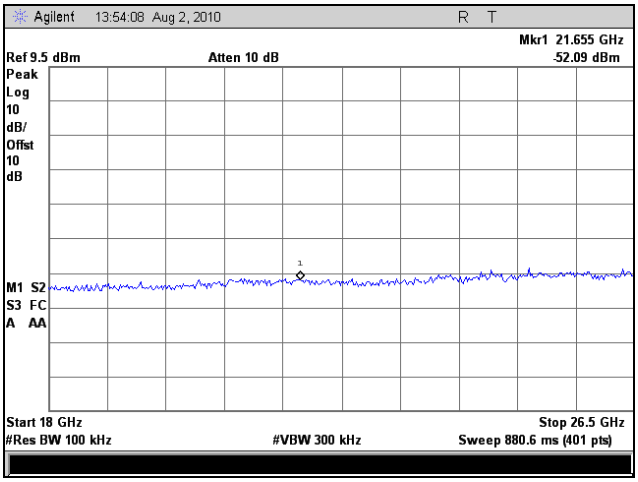
Plot 121. Conducted Emissions, Mid Channel (2437MHz), 18 GHz – 26.5 GHz, 802.11b



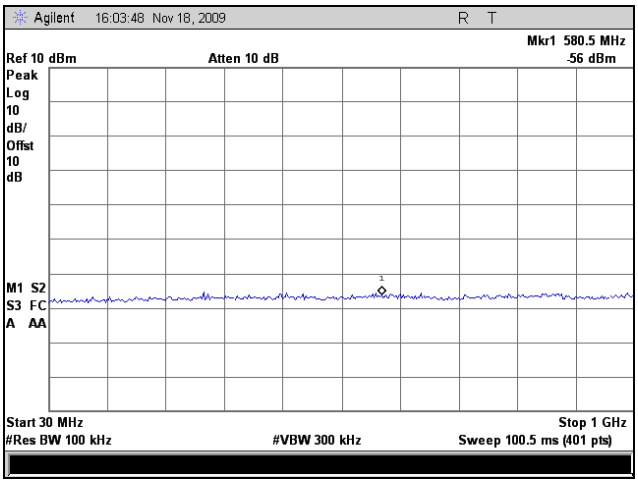
Plot 122. Conducted Emissions, High Channel (2462MHz), 30 MHz – 1 GHz, 802.11b



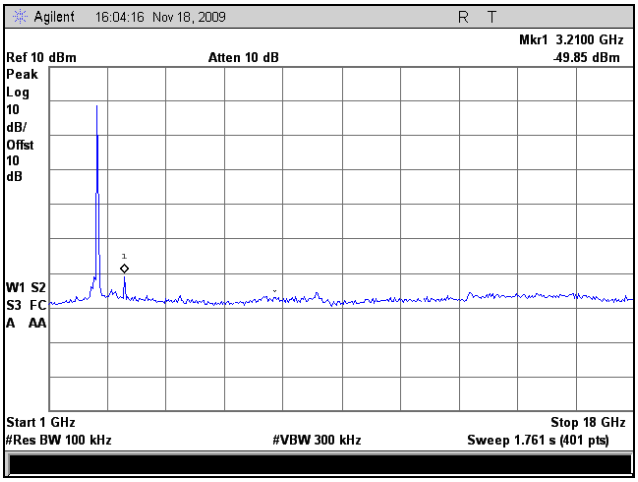
Plot 123. Conducted Emissions, High Channel (2462MHz), 1 GHz – 18 GHz, 802.11b



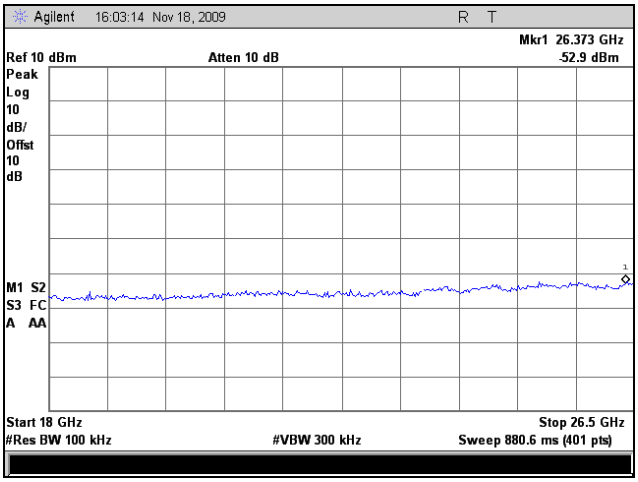
Plot 124. Conducted Emissions, High Channel (2462MHz), 18 GHz – 26.5 GHz, 802.11b



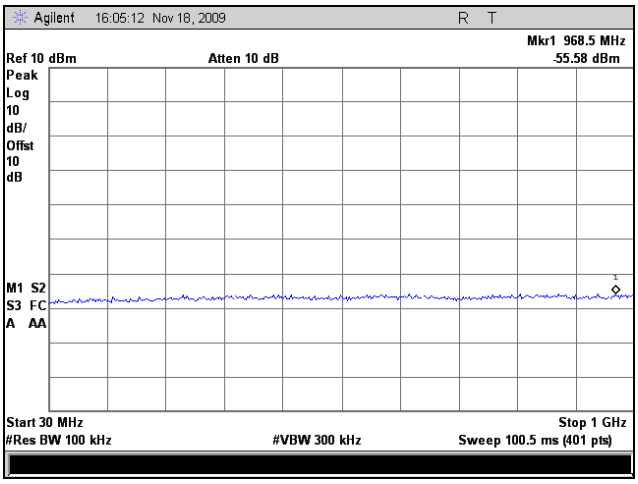
Plot 125. Conducted Emissions, Low Channel (2412MHz), 30 MHz – 1 GHz, 802.11g



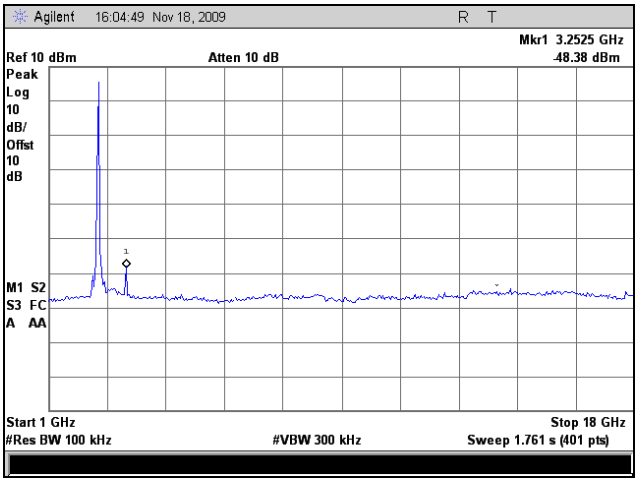
Plot 126. Conducted Emissions, Low Channel (2412MHz), 1 GHz – 18 GHz, 802.11g



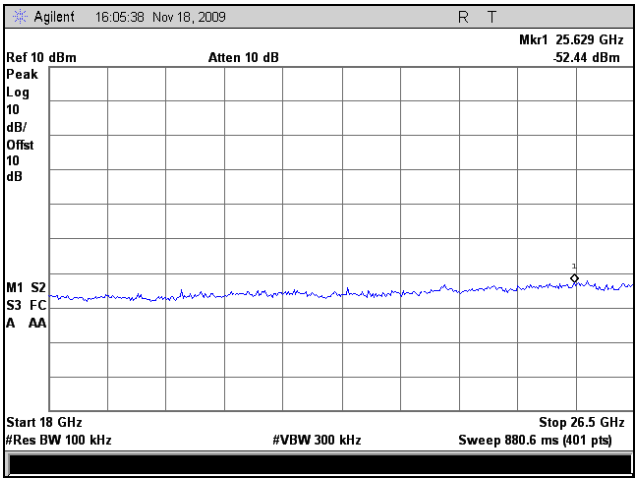
Plot 127. Conducted Emissions, Low Channel (2412MHz), 18 GHz – 26.5 GHz, 802.11g



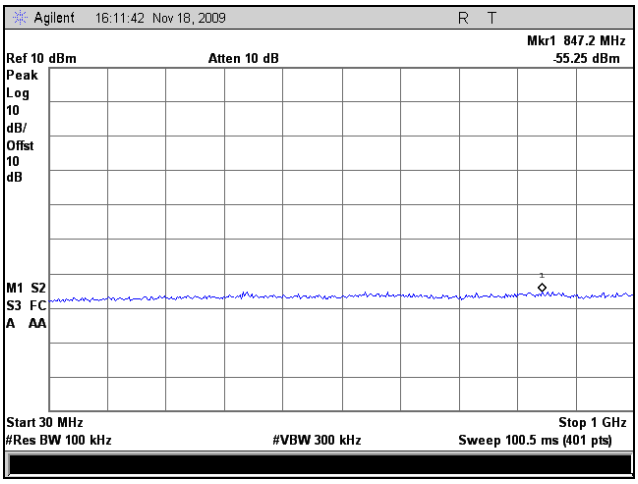
Plot 128. Conducted Emissions, Mid Channel (2437MHz), 30 MHz – 1 GHz, , 802.11g



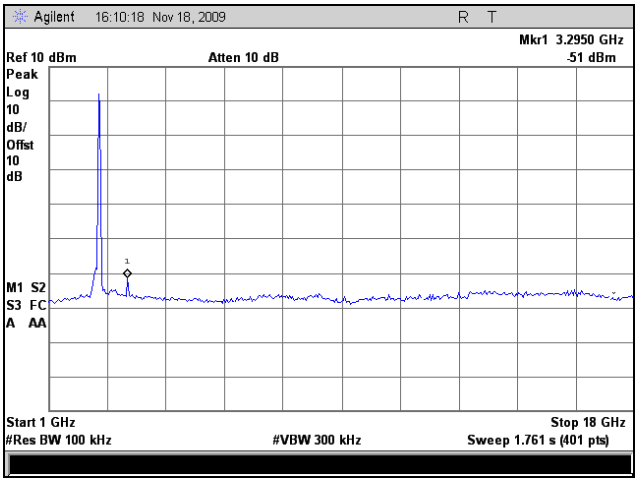
Plot 129. Conducted Emissions, Mid Channel (2437MHz), 1 GHz – 18 GHz, 802.11g



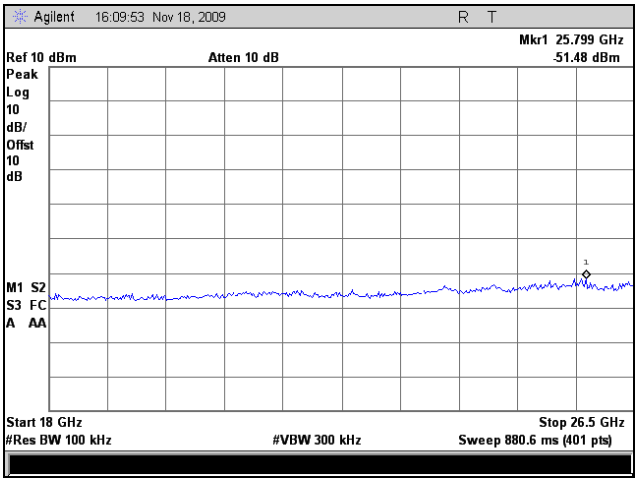
Plot 130. Conducted Emissions, Mid Channel (2437MHz), 18 GHz – 26.5 GHz, 802.11g



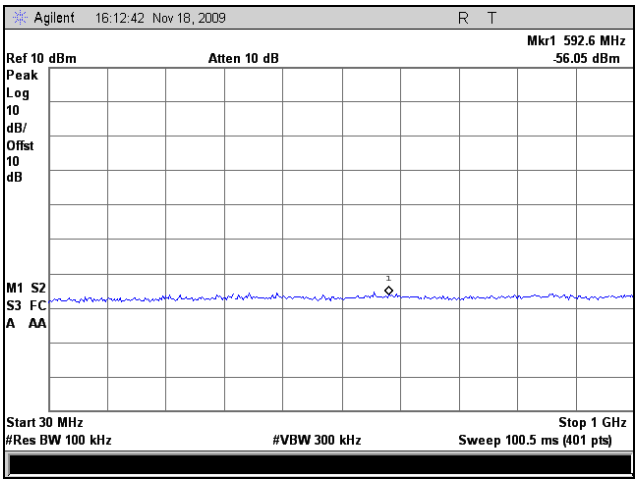
Plot 131. Conducted Emissions, High Channel (2462MHz), 30 MHz – 1 GHz, 802.11g



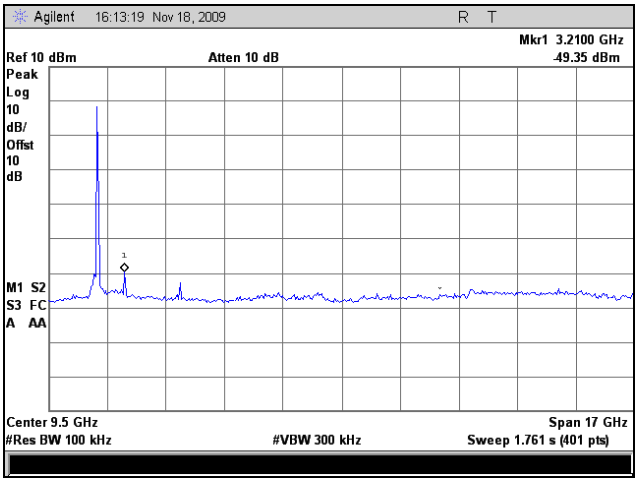
Plot 132. Conducted Emissions, High Channel (2462MHz), 1 GHz – 18 GHz, 802.11g



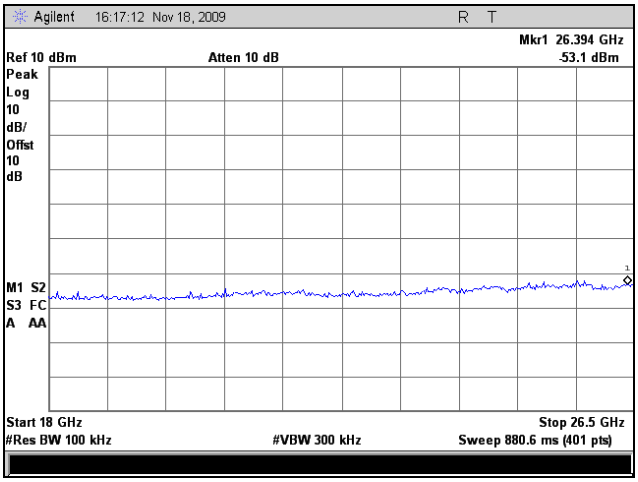
Plot 133. Conducted Emissions, High Channel (2462MHz), 18 GHz – 26.5 GHz, 802.11g



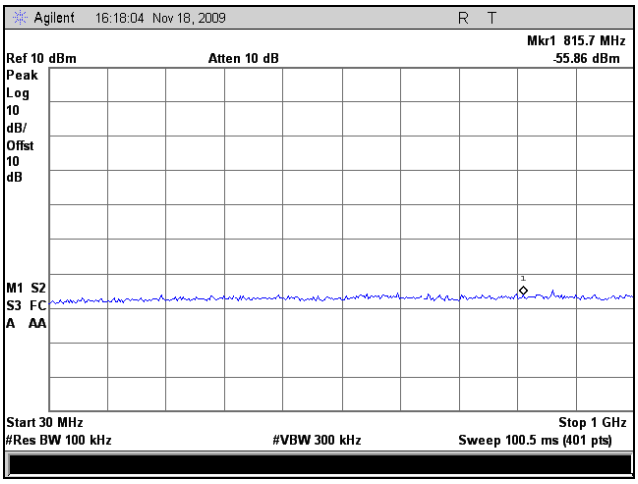
Plot 134. Conducted Emissions, Low Channel (2412MHz), 30 MHz – 1 GHz, 802.11n 20MHz



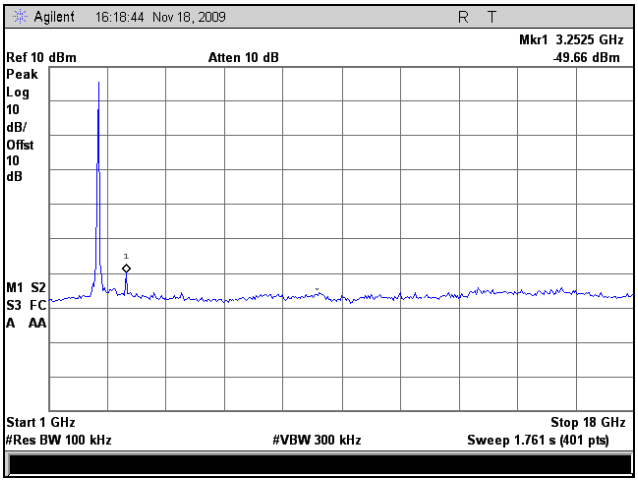
Plot 135. Conducted Emissions, Low Channel (2412MHz), 1 GHz – 18 GHz, 802.11n 20MHz



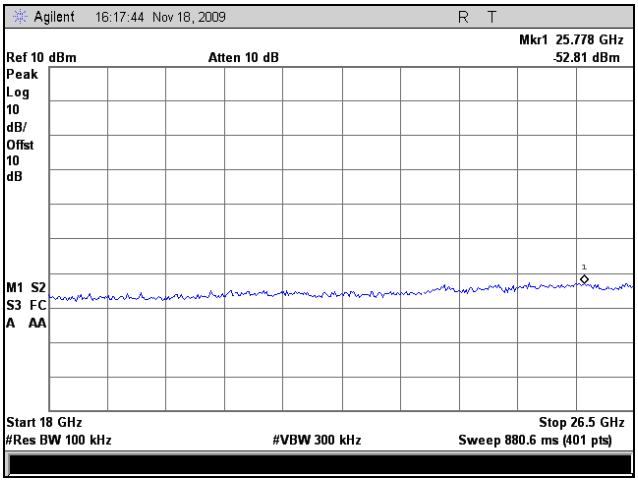
Plot 136. Conducted Emissions, Low Channel (2412MHz), 18 GHz – 26.5 GHz, 802.11n 20MHz



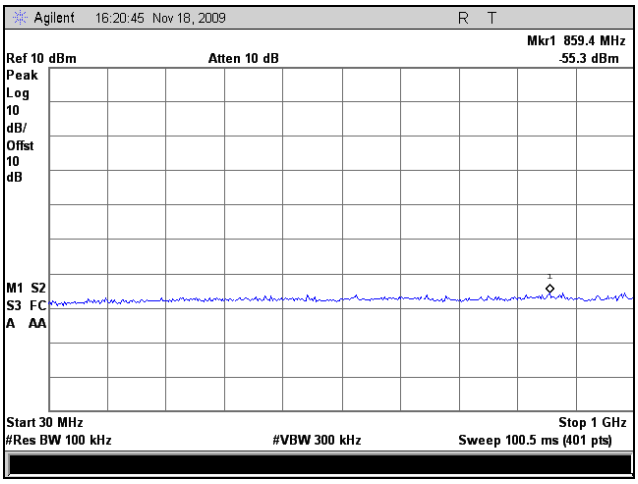
Plot 137. Conducted Emissions, Mid Channel (2437MHz), 30 MHz – 1 GHz, 802.11n 20MHz



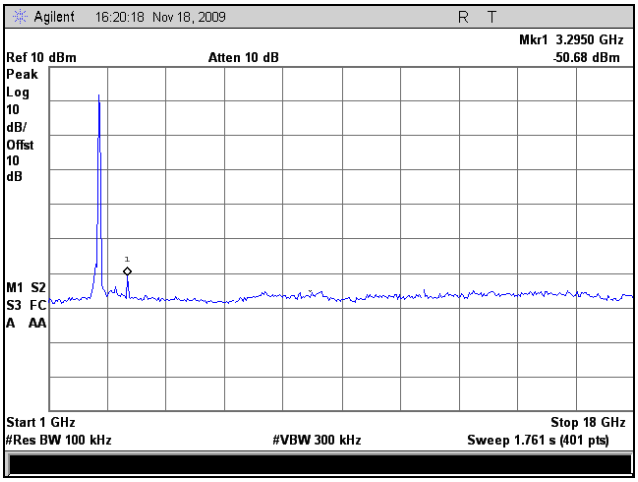
Plot 138. Conducted Emissions, Mid Channel (2437MHz), 1 GHz – 18 GHz, 802.11n 20MHz



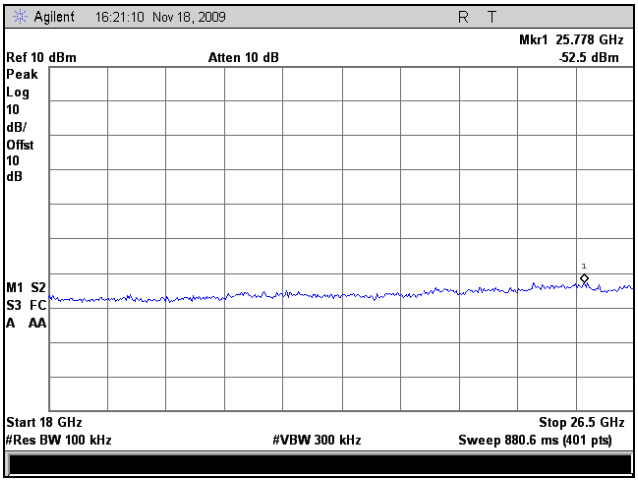
Plot 139. Conducted Emissions, Mid Channel (2437MHz), 18 GHz – 26.5 GHz, 802.11n 20MHz



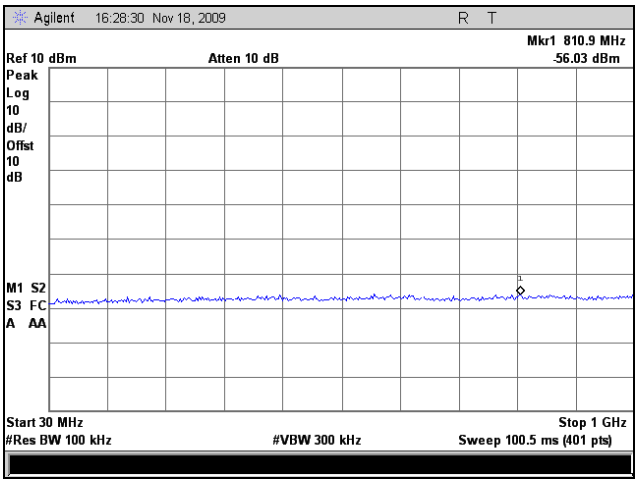
Plot 140. Conducted Emissions, High Channel (2462MHz), 30 MHz – 1 GHz, 802.11n 20MHz



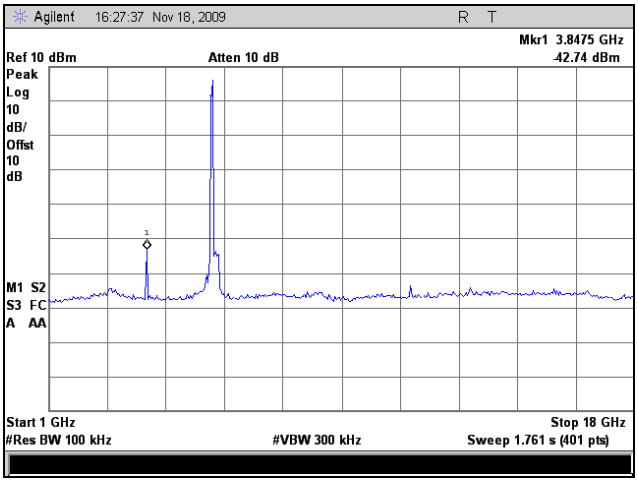
Plot 141. Conducted Emissions, High Channel (2462MHz), 1 GHz – 18 GHz, 802.11n 20MHz



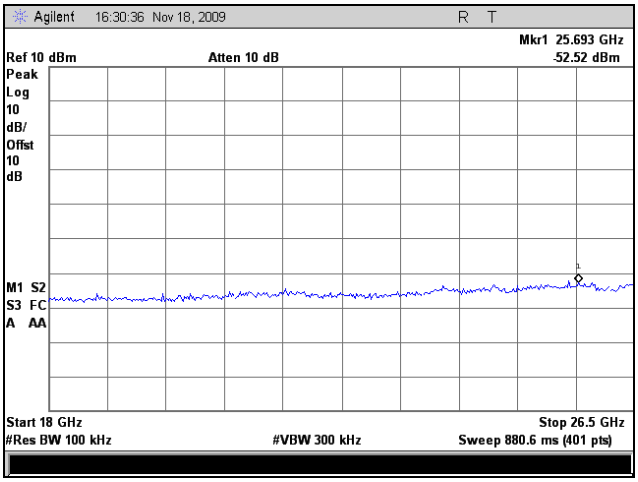
Plot 142. Conducted Emissions, High Channel (2462MHz), 18 GHz – 26.5 GHz, 802.11n 20MHz



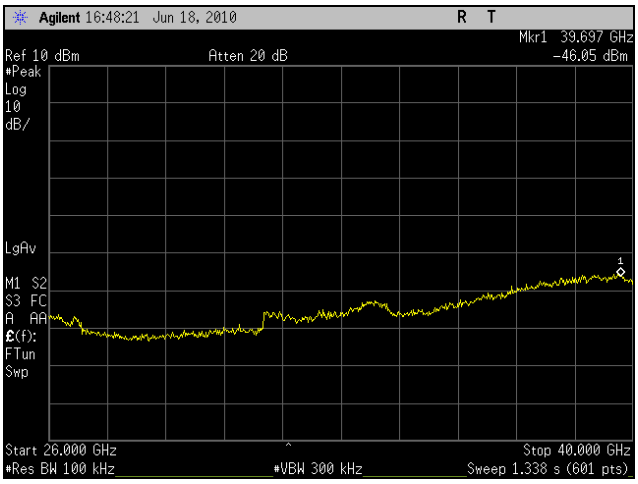
Plot 143. Conducted Emissions, Low Channel (5745MHz), 30 MHz – 1 GHz, 802.11a



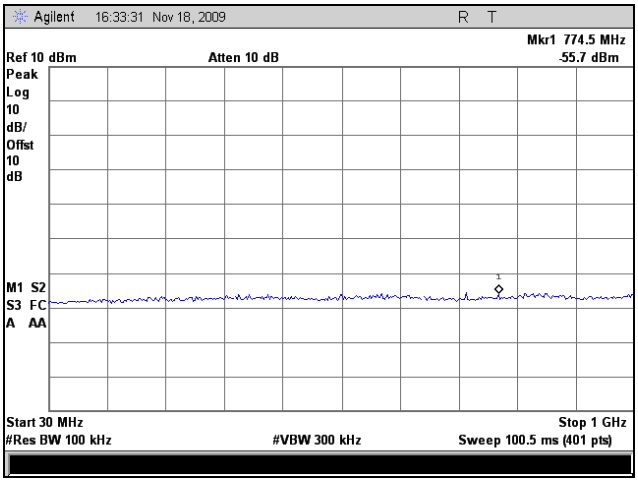
Plot 144. Conducted Emissions, Low Channel (5745MHz), 1 GHz – 18 GHz, 802.11a



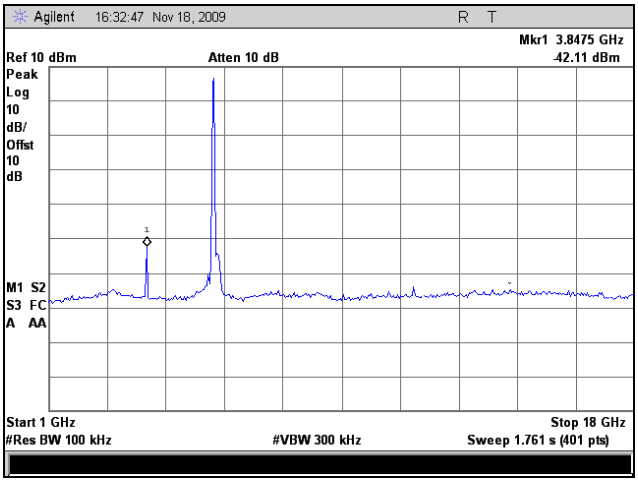
Plot 145. Conducted Emissions, Low Channel (5745MHz), 18 GHz – 26.5 GHz, 802.11a



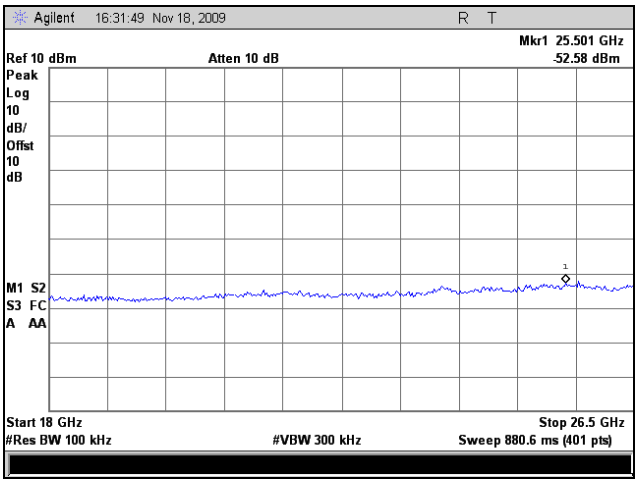
Plot 146. Conducted Emissions, Low Channel (5745MHz), 26 GHz – 40 GHz, 802.11a



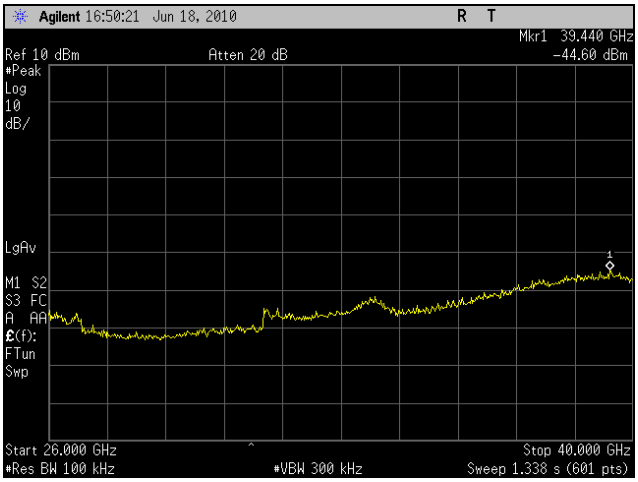
Plot 147. Conducted Emissions, Mid Channel (5785MHz), 30 MHz – 1 GHz, , 802.11a



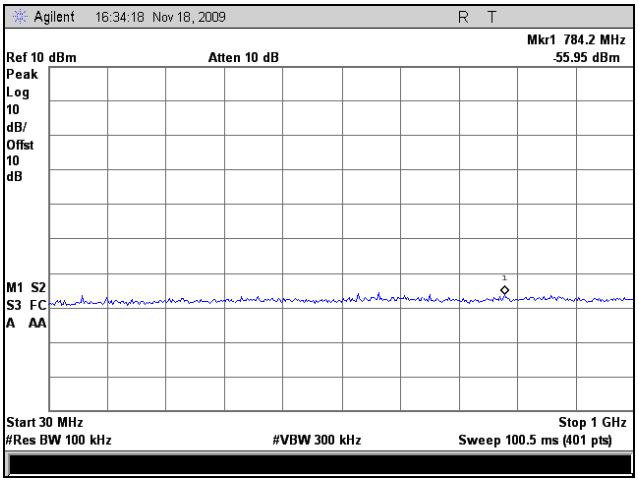
Plot 148. Conducted Emissions, Mid Channel (5785MHz), 1 GHz – 18 GHz, 802.11a



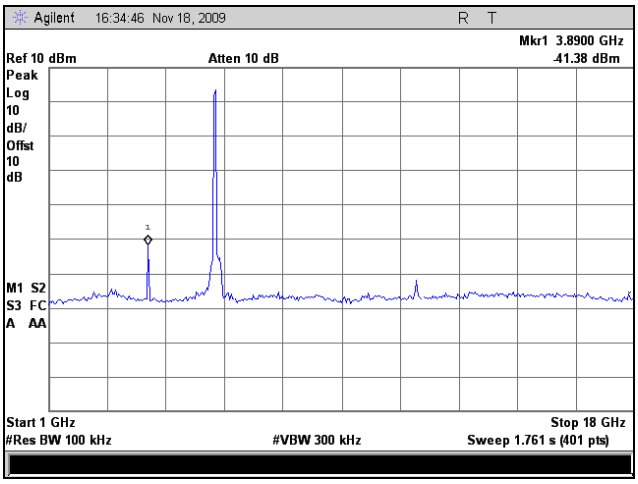
Plot 149. Conducted Emissions, Mid Channel (5785MHz), 18 GHz – 26.5 GHz, 802.11a



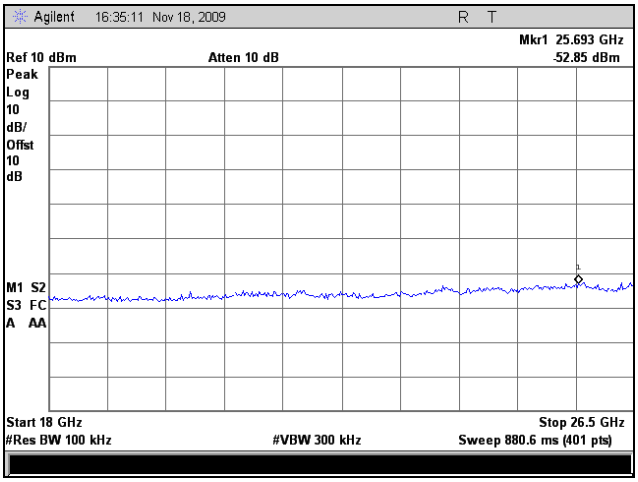
Plot 150. Conducted Emissions, Mid Channel (5785MHz), 26 GHz – 40 GHz, 802.11a



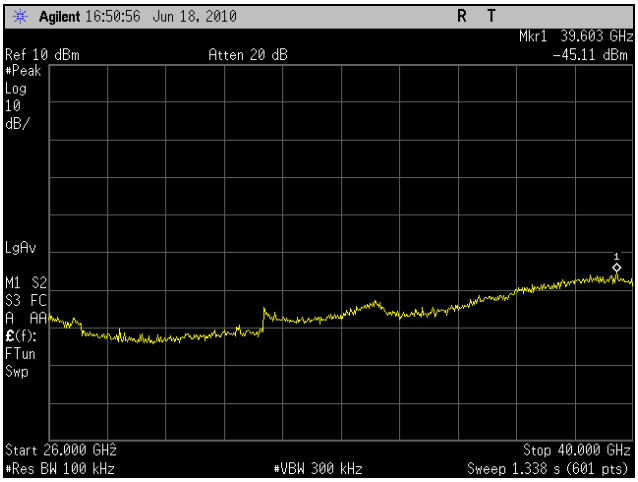
Plot 151. Conducted Emissions, High Channel (5825MHz), 30 MHz – 1 GHz, 802.11a



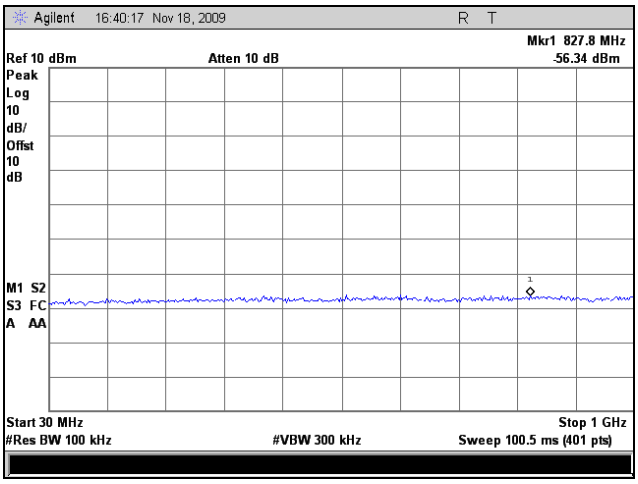
Plot 152. Conducted Emissions, High Channel (5825MHz), 1 GHz – 18 GHz, 802.11a



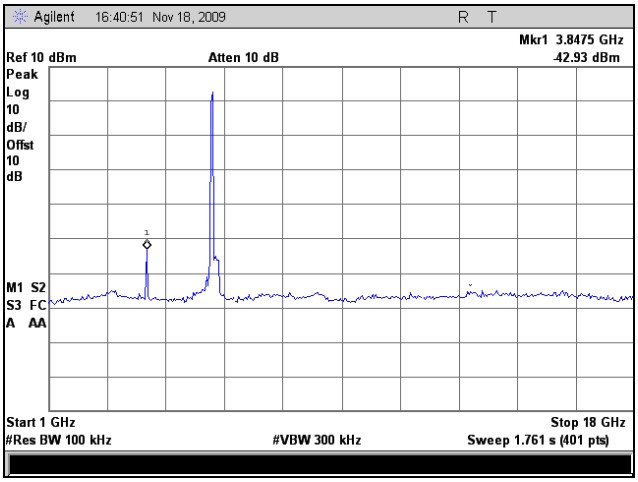
Plot 153. Conducted Emissions, High Channel (5825MHz), 18 GHz – 26.5 GHz, 802.11a



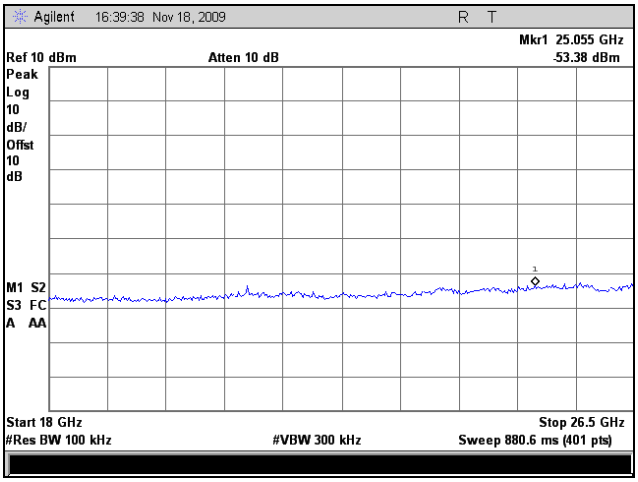
Plot 154. Conducted Emissions, High Channel (5825MHz), 26 GHz – 40 GHz, 802.11a



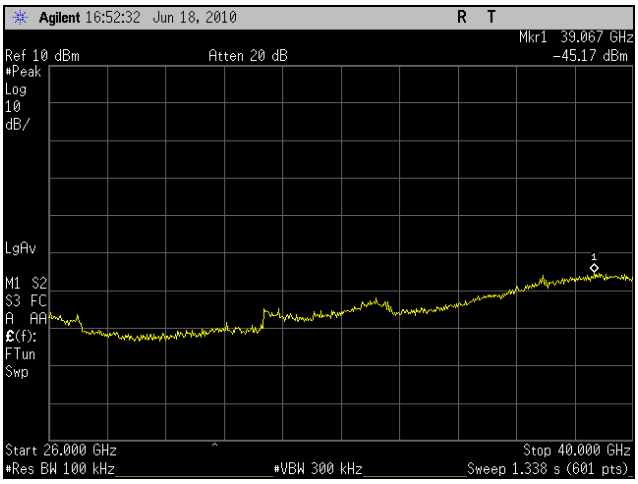
Plot 155. Conducted Emissions, Low Channel (5745MHz), 30 MHz – 1 GHz, 802.11n 20MHz



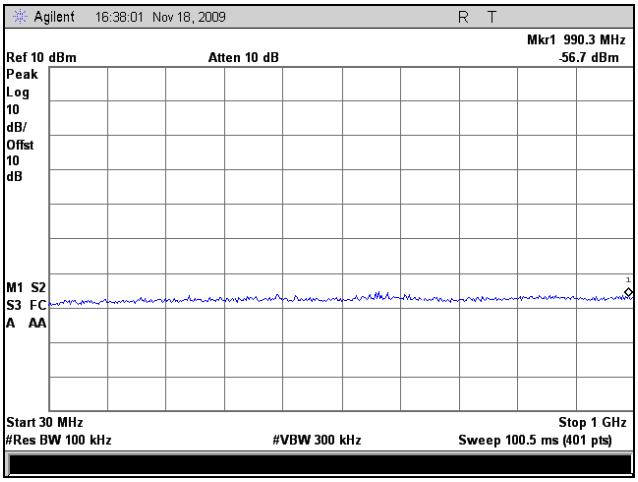
Plot 156. Conducted Emissions, Low Channel (5745MHz), 1 GHz – 18 GHz, 802.11n 20MHz



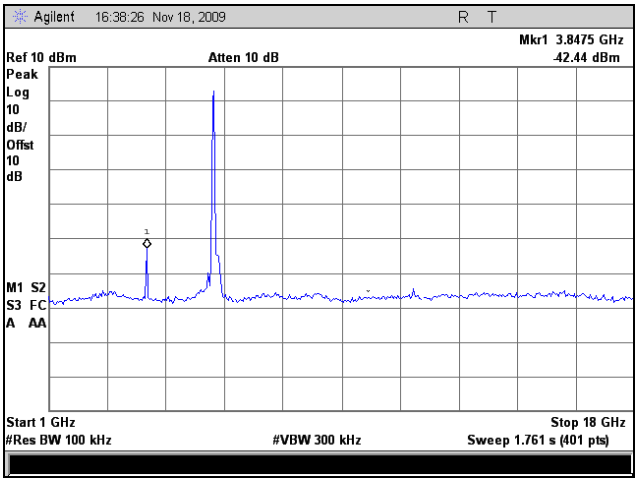
Plot 157. Conducted Emissions, Low Channel (5745MHz), 18 GHz – 26.5 GHz, 802.11n 20MHz



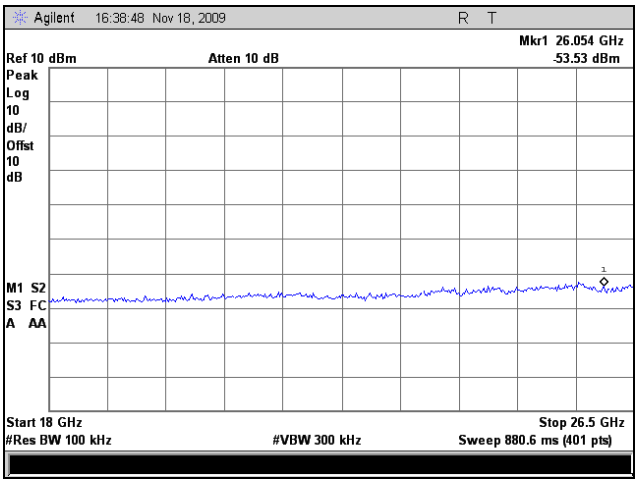
Plot 158. Conducted Emissions, Low Channel (5745MHz), 26 GHz – 40 GHz, 802.11n 20MHz



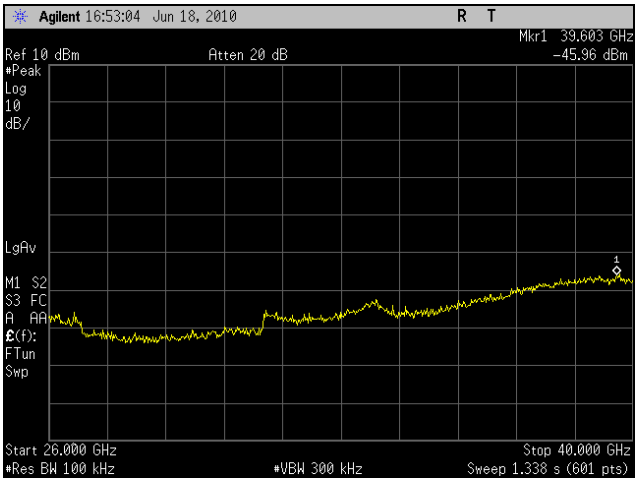
Plot 159. Conducted Emissions, Mid Channel (5785MHz), 30 MHz – 1 GHz, 802.11n 20MHz



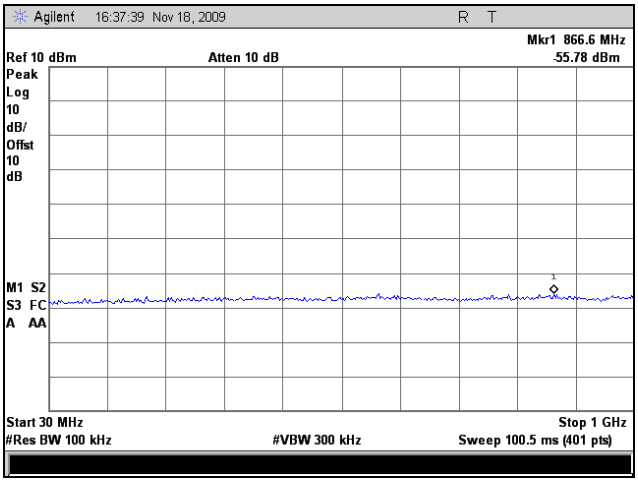
Plot 160. Conducted Emissions, Mid Channel (5785MHz), 1 GHz – 18 GHz, 802.11n 20MHz



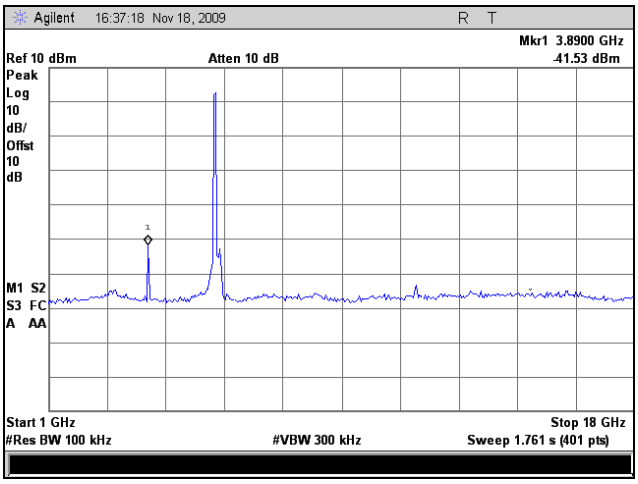
Plot 161. Conducted Emissions, Mid Channel (5785MHz), 18 GHz – 26.5 GHz, 802.11n 20MHz



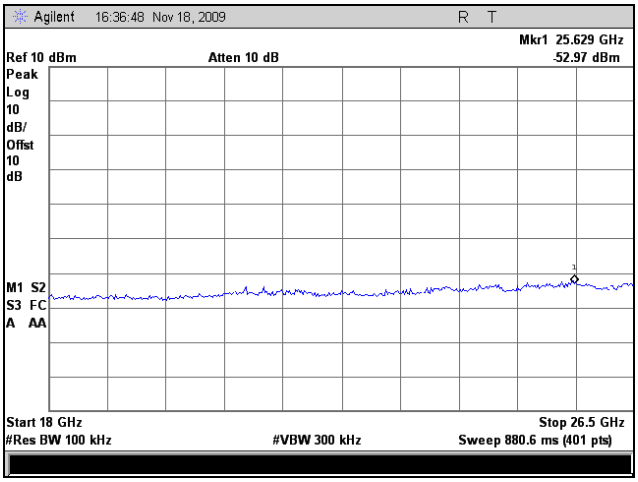
Plot 162. Conducted Emissions, Mid Channel (5785MHz), 26 GHz – 40 GHz, 802.11n 20MHz



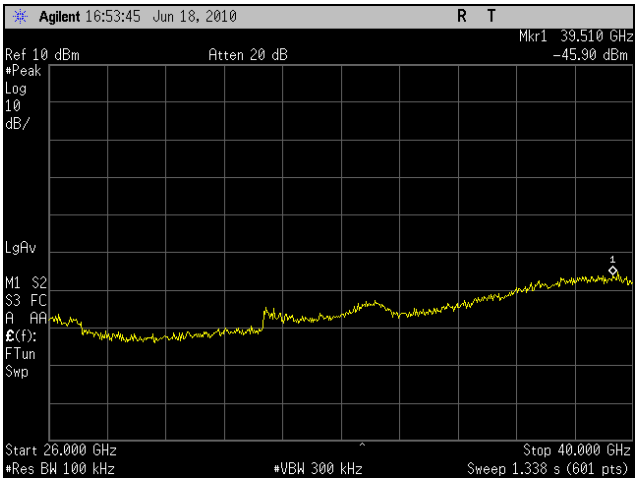
Plot 163. Conducted Emissions, High Channel (5825MHz), 30 MHz – 1 GHz, 802.11n 20MHz



Plot 164. Conducted Emissions, High Channel (5825MHz), 1 GHz – 18 GHz, 802.11n 20MHz

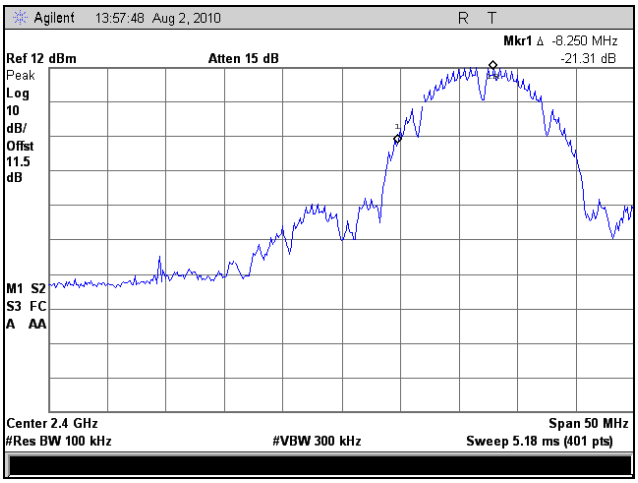


Plot 165. Conducted Emissions, High Channel (5825MHz), 18 GHz – 26.5 GHz, 802.11n 20MHz

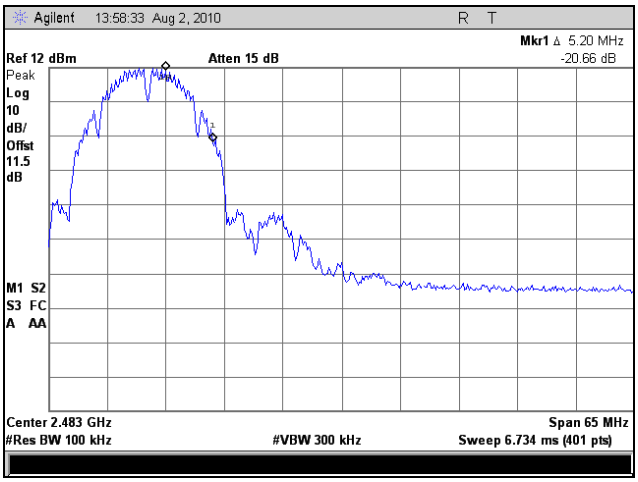


Plot 166. Conducted Emissions, High Channel (5825MHz), 26 GHz – 40 GHz, 802.11n 20MHz

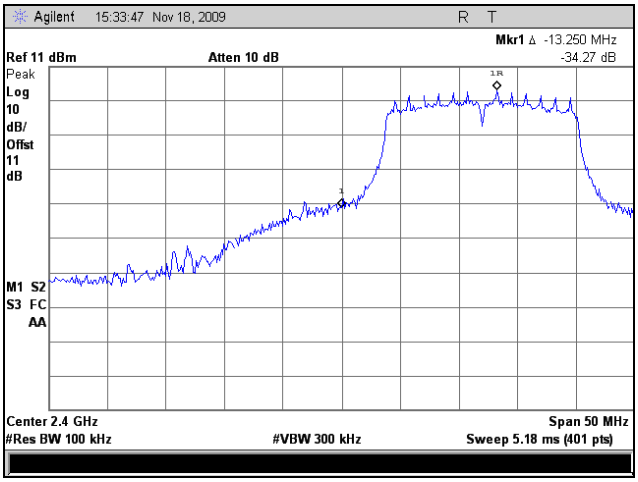
Conducted Band Edge Test Results



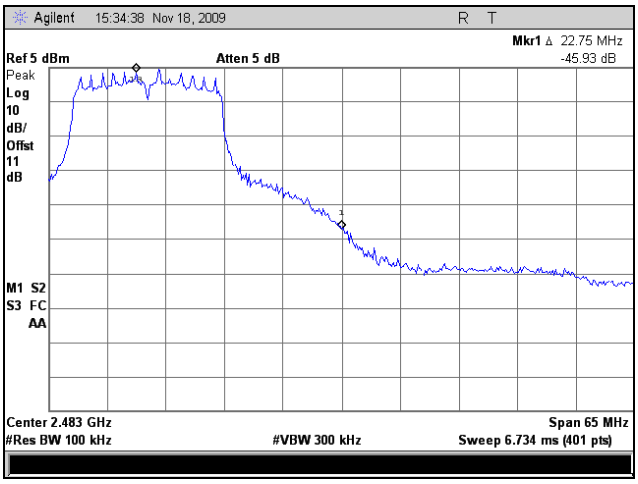
Plot 167. Conducted Band Edge, Low Channel (2412MHz), 802.11b



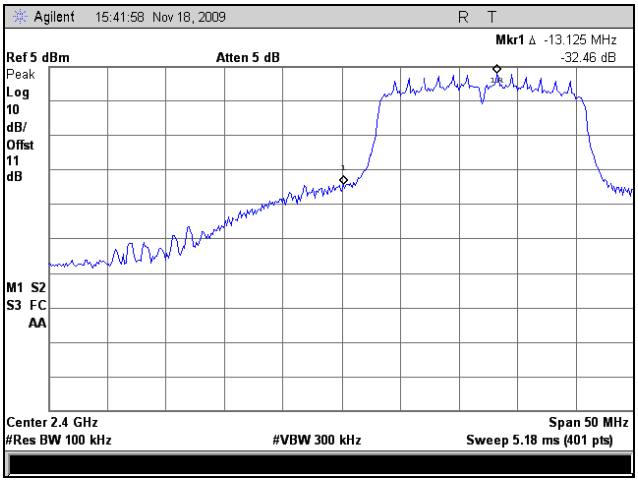
Plot 168. Conducted Band Edge, High Channel (2462MHz), 802.11b



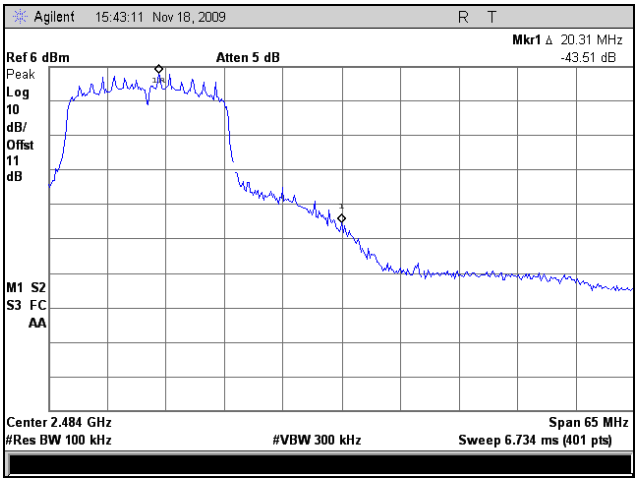
Plot 169. Conducted Band Edge, Low Channel (2412MHz), 802.11g



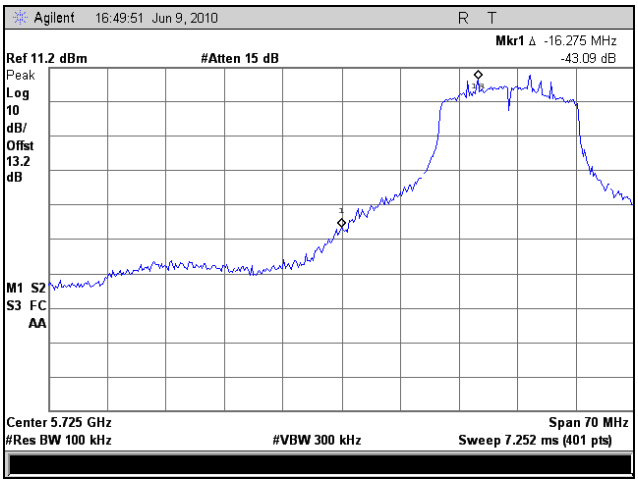
Plot 170. Conducted Band Edge, High Channel (2462MHz), 802.11g



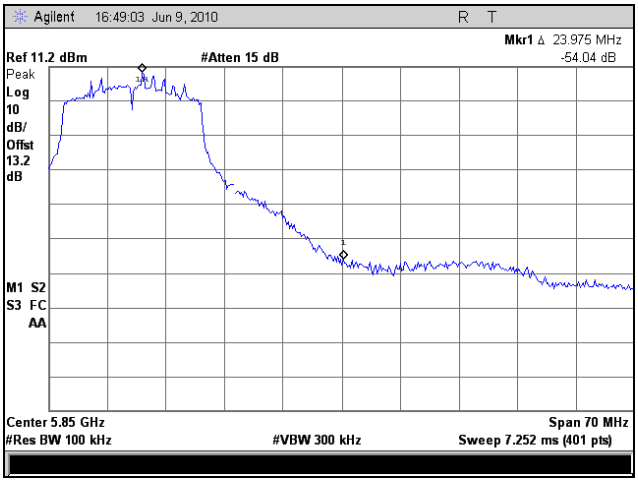
Plot 171. Conducted Band Edge, Low Channel (2412MHz), 802.11n 20MHz



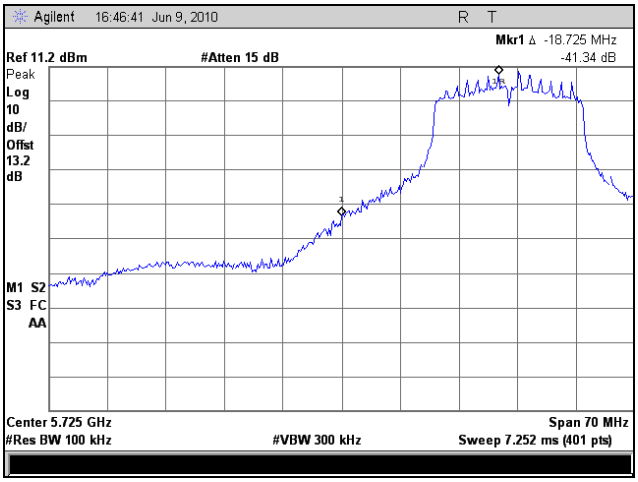
Plot 172. Conducted Band Edge, High Channel (2462MHz), 802.11n 20MHz



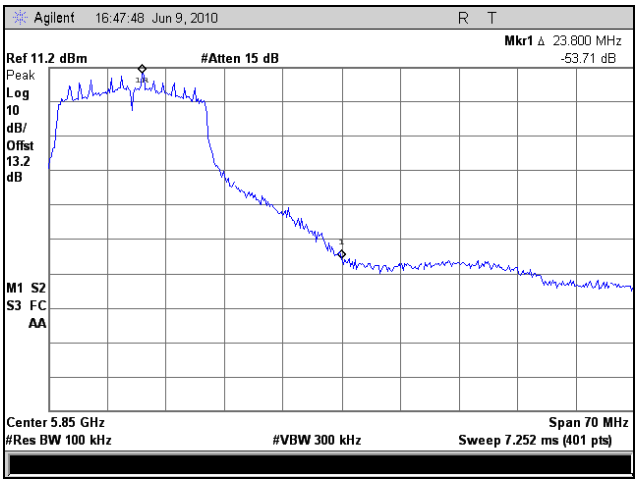
Plot 173. Conducted Band Edge, Low Channel (5745MHz), 802.11a



Plot 174. Conducted Band Edge, High Channel (5825MHz), 802.11a



Plot 175. Conducted Band Edge, Low Channel (5745MHz), 802.11n 20MHz



Plot 176. Conducted Band Edge, High Channel (5825MHz), 802.11n 20MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(e) Peak Power Spectral Density

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

Test Procedure: The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level. The RBW was set to 3 kHz and a VBW set to 9 kHz or greater. The spectrum analyzer was set to an auto sweep time and a peak detector was used. 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: Minh Ly

Test Date: 06/14/10 and 08/23/10

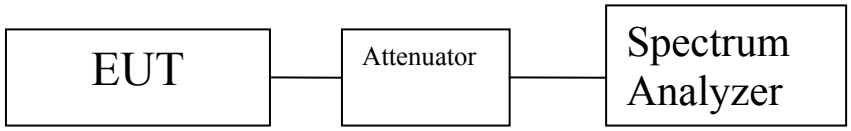
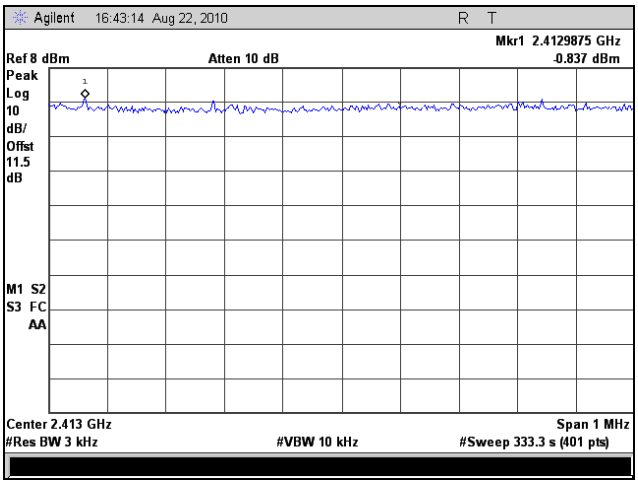


Figure 5. Block Diagram, Peak Power Spectral Density Test Setup

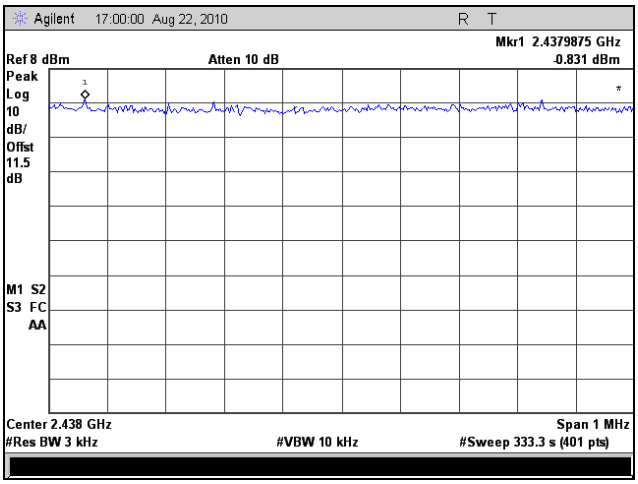
Peak Power Spectral Density				
Carrier Channel	**Frequency (MHz)**	**Measured PPSD (dBm)**	**Limit (dBm)**	**Margin (dB)**
802.11b Low	2412	-0.837	8	-8.837
802.11b Mid	2437	-0.831	8	-8.831
802.11b High	2462	-0.358	8	-8.358
802.11g Low	2412	-11	8	-19.00
802.11g Mid	2437	-4.43	8	-12.43
802.11g High	2462	-9.90	8	-17.90
802.11n 20MHz CH1	2412	-11.3	8	-19.30
802.11n 20MHz CH2	2417	-4.86	8	-12.86
802.11n 20MHz CH6	2437	-3.455	8	-11.455
802.11n 20MHz CH10	2457	-4.937	8	-12.937
802.11n 20MHz CH11	2462	-10.26	8	-18.26
802.11a Low	5745	-5.81	8	-13.81
802.11a Mid	5785	-4.52	8	-12.52
802.11a High	5825	-4.36	8	-12.36
802.11n 20MHz Low	5745	-5.94	8	-13.94
802.11n 20MHz Mid	5785	-6.57	8	-14.57
802.11n 20MHz High	5825	-4.86	8	-12.86

Table 40. Peak Power Spectral Density, Test Results

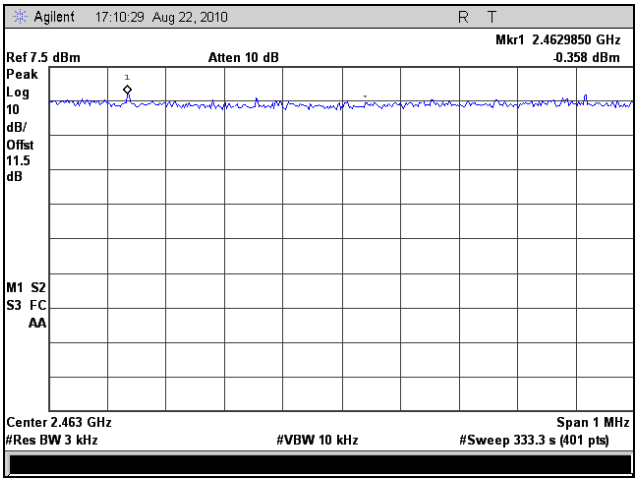
Peak Power Spectral Density



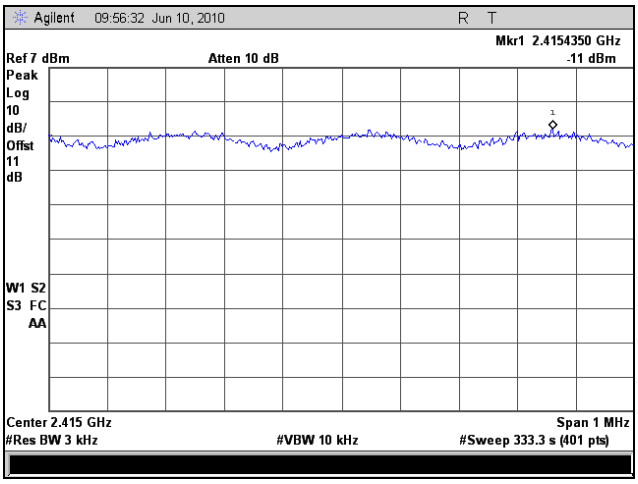
Plot 177. Peak Power Spectral Density, Low Channel (2412MHz), 802.11b



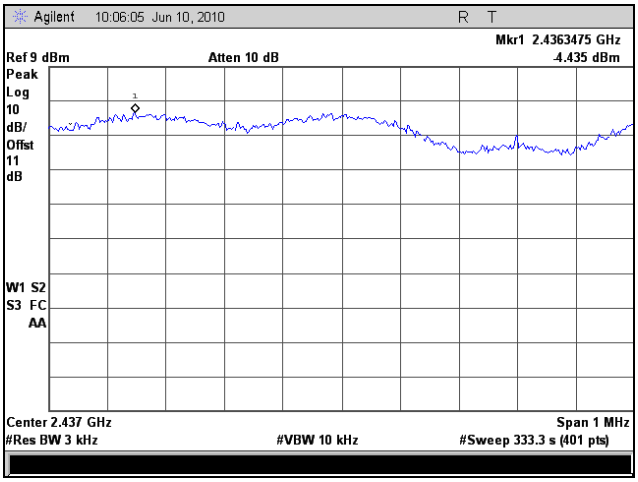
Plot 178. Peak Power Spectral Density, Mid Channel (2437MHz), 802.11b



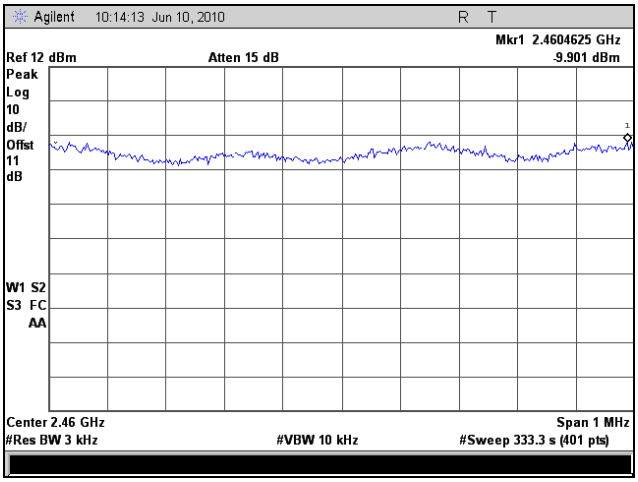
Plot 179. Peak Power Spectral Density, High Channel (2462MHz), 802.11b



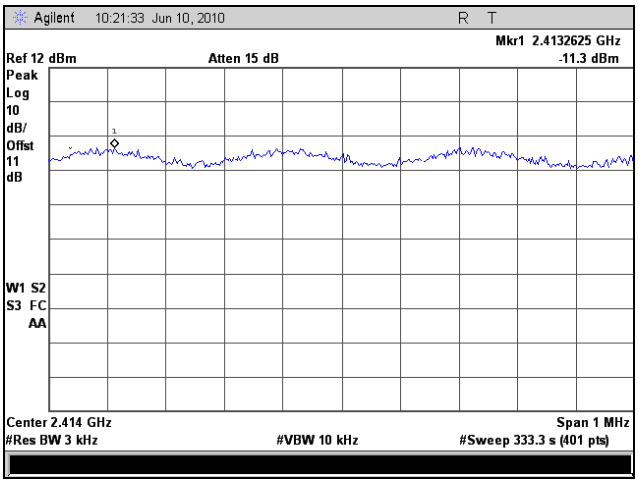
Plot 180. Peak Power Spectral Density, Low Channel (2412MHz), 802.11g



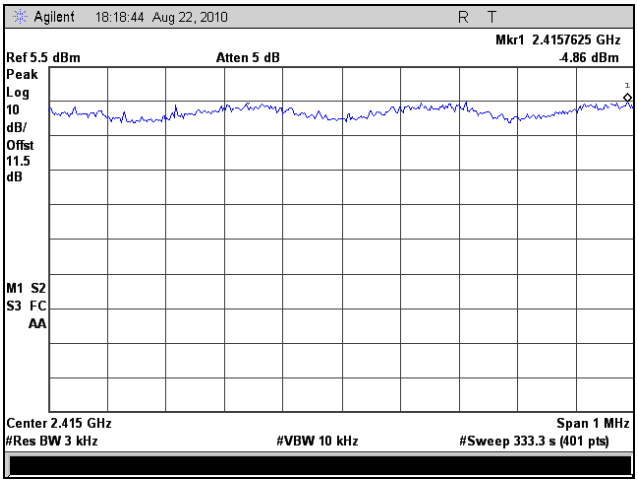
Plot 181. Peak Power Spectral Density, Mid Channel (2437MHz), 802.11g



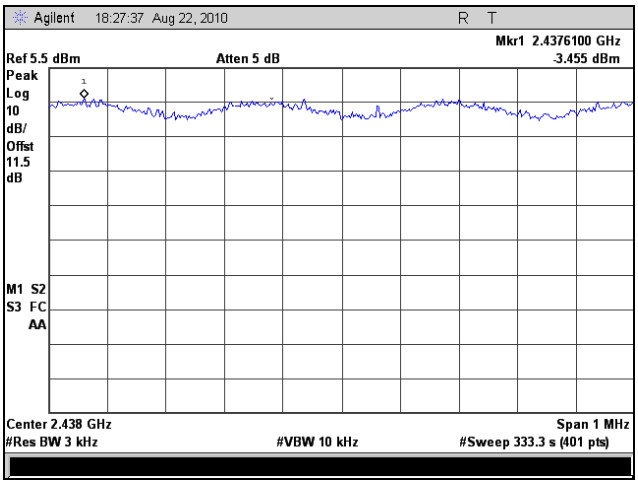
Plot 182. Peak Power Spectral Density, High Channel (2462MHz), 802.11g



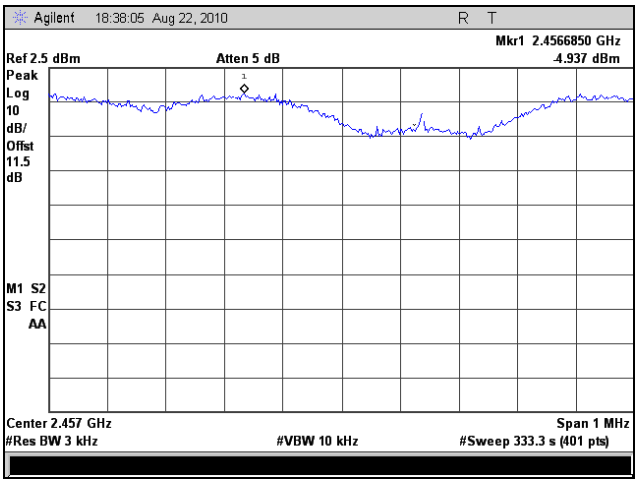
Plot 183. Peak Power Spectral Density, Channel 1 (2412MHz), 802.11n 20MHz



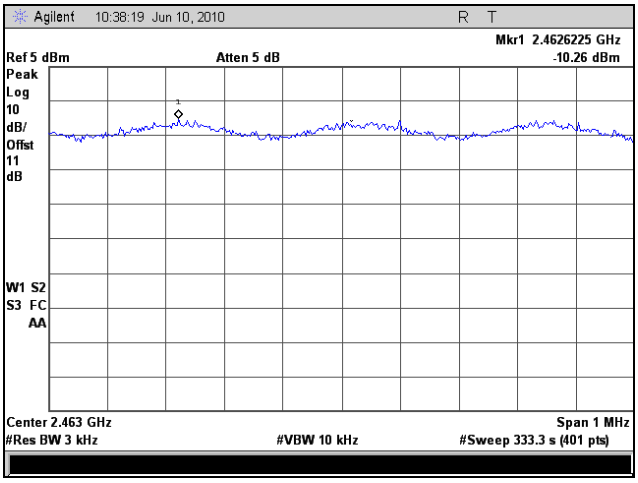
Plot 184. Peak Power Spectral Density, Channel 2 (2417MHz), 802.11n 20MHz



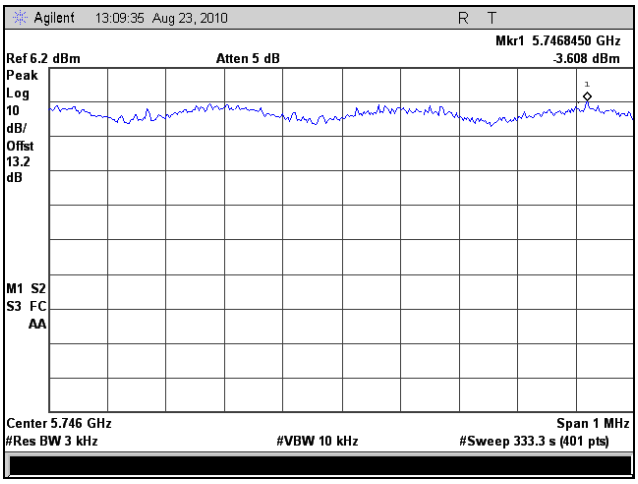
Plot 185. Peak Power Spectral Density, Channel 6 (2437MHz), 802.11n 20MHz



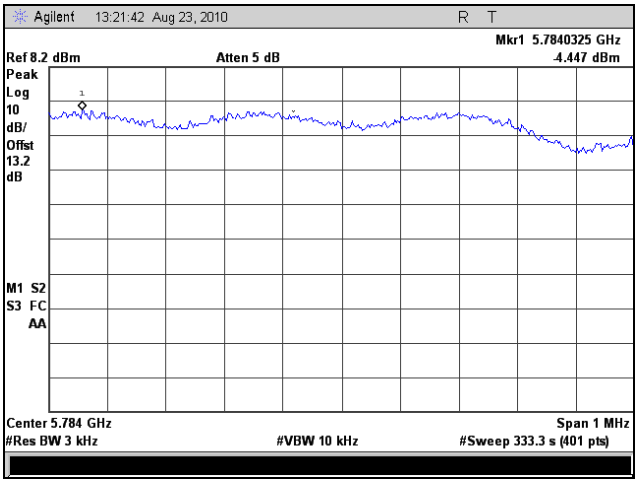
Plot 186. Peak Power Spectral Density, Channel 10 (2457MHz), 802.11n 20MHz



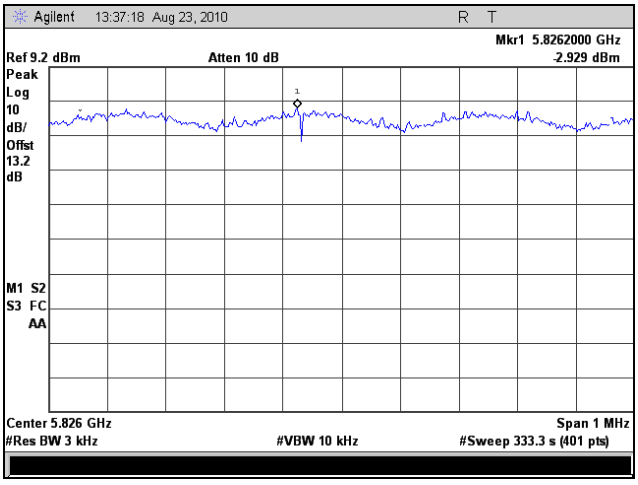
Plot 187. Peak Power Spectral Density, Channel 11 (2462MHz), 802.11n 20MHz



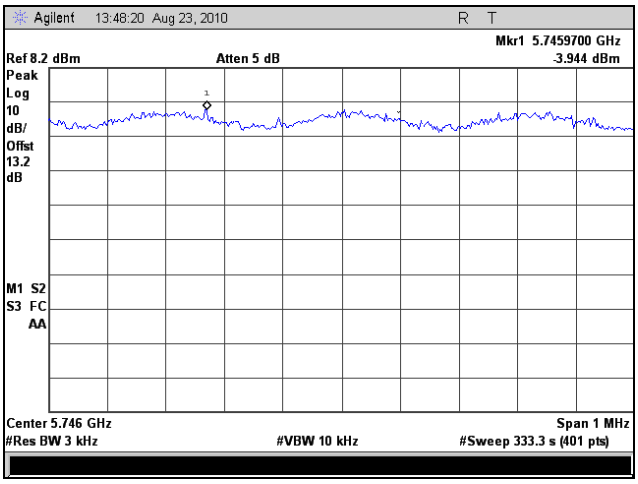
Plot 188. Peak Power Spectral Density, Low Channel (5745MHz), 802.11a



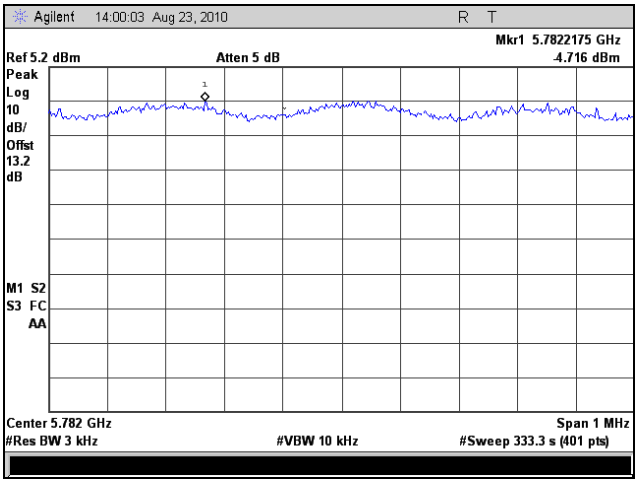
Plot 189. Peak Power Spectral Density, Mid Channel (5785MHz), 802.11a



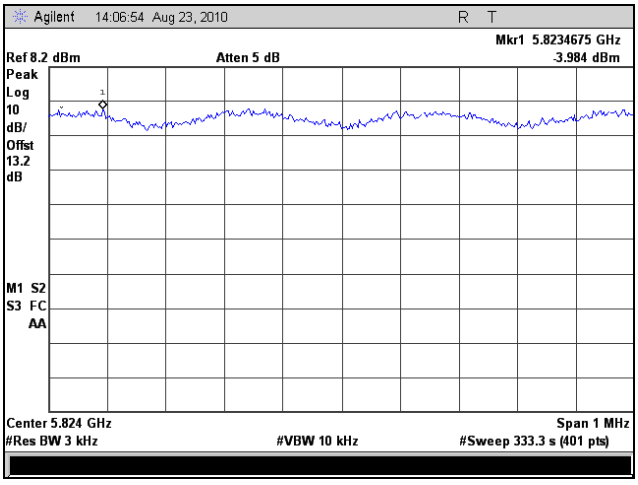
Plot 190. Peak Power Spectral Density, High Channel (5825MHz), 802.11a



Plot 191. Peak Power Spectral Density, Low Channel (5745MHz), 802.11n 20MHz



Plot 192. Peak Power Spectral Density, Mid Channel (5785MHz), 802.11n 20MHz



Plot 193. Peak Power Spectral Density, High Channel (5825MHz), 802.11n 20MHz

V. 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
1S2501	EMI RECEIVER	ROHDE&SCHWARZ	ESU40	06/03/2010	06/03/2011
1S2484	BILOG ANTENNA	TESEQ	CBL6112D	SEE NOTE	
1S2399	TURNNTABLE CONTROLLER	SUNOL SCIENCE	SC99V	NOT REQUIRED	
1S2522	DIGITAL THERMO/HYGROMETER	CONTROL COMPANY	11-661-7D	11/11/2009	11/11/2010
1S2482	5M CHAMBER	PANASHIELD	N/A	10/16/2009	10/16/2010
1S2603	DOUBLE RIDGED WAVEGUIDE HORN	ETS-LINGREN	3117	04/09/2009	04/09/2011
1S2121	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	SEE NOTE	
1S2512	TRANSIENT LIMITER	AGILENT	11947A	SEE NOTE	
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	
1S2034	COUPLER, DIRECTIONAL 1-20 GHZ	KRYTAR	101020020	SEE NOTE	
1S2583	SPECTRUM ANALYZER	AGILENT	E4447A	01/26/2010	01/26/2011
1S2460	ANALYZER, SPECTRUM 9 KHZ-40GHZ	AGILENT	E4407B	07/13/2010	07/213/2011
1S2229	TEMPERATURE CHAMBER	TENNY ENGINEERING	T63C	02/19/2010	02/19/2011
1S2630	TRANSIENT LIMITER	FISCHER CUSTOM COMMUNICATIONS	FCC-450B-2.4-N	01/24/2010	01/24/2011
1S2128	HARMONIC MIXER	HEWLETT PACKARD	11970A	11/22/2008	11/22/2010
1S2501	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU40	06/03/2010	06/03/2011
1S2488	SCREEN ROOM	UNIVERSAL	CUSTOM MADE	01/20/1020	01/20/2011
1S2507	LISN	SOLAR ELECTRONICS	9252-50-R-24-BNC	08/06/2010	08/06/2011
1S2129	HARMONIC MIXER	HEWLETT PACKARD	11970K	11/22/2008	11/22/2010

Table 41. Test Equipment List

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

VI. Certification & User's Manual Information

Certification & User's Manual Information

K. 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

