MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408 748-3585 ● FAX (510) 489-6372

March 23, 2011

Firetide, Inc.
16795 Lark Ave. Suite 200
Los Gatos, CA 95032

Dear Steve Gu,

Enclosed is the EMC Wireless test report for compliance testing of the Firetide, Inc., Firetide Indoor and Outdoor MIMO Access Points as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Title 47 of the CFR, Part 15, Subpart B, Industry Canada ICES-003 Issue 4 February 2004 for Unintentional Radiators and Part 15.407, Industry Canada 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: (\Firetide, Inc.\EMCS82646-FCC407 Rev. 2)

MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587-3201 ● PHONE (510) 489-6300 ● FAX (510) 489-6372

Electromagnetic Compatibility Criteria
Test Report

for the

Firetide, Inc.
Model Firetide Indoor and Outdoor MIMO Access Points

Tested under
the Certification Rules
contained in
Title 47 of the CFR, Part 15, Subpart B and
ICES-003 Issue 4 February 2004
for Unintentional Radiators
and
Title 47 of the CFR, Part 15.407 and
Industry Canada RSS-210, Issue 7, June 2007
for Intentional Radiators

MET Report: EMCS82646-FCC407 Rev. 2

March 23, 2011

Prepared For:

Firetide, Inc.
16795 Lark Ave. Suite 200
Los Gatos, CA 95032

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

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Industry Canada 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 Parts 15B, 15.407, of the FCC Rules and ICES-003 and RSS-210 of the Industry Canada rules under normal use and maintenance.

Shawn McMillen, Wireless Manager
Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	March 11, 2011	Initial Issue.
1	March 22, 2011	Revised to reflect engineer corrections.
2	March 23, 2011	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**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**microh**enry
µ	**microf**arad
µs	**micros**econds
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Firetide, Inc. Firetide Indoor and Outdoor MIMO Access Points, with the requirements of Part 15, §15.407. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the Firetide Indoor and Outdoor MIMO Access Points. Firetide, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Firetide Indoor and Outdoor MIMO Access Points, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.407, in accordance with Firetide, Inc., purchase order number 2475. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	Industry Canada Reference	Description	Results
15.107	ICES-003 Issue 4 February 2004	Conducted Emissions	Compliant
15.109		Radiated Emissions	Compliant
15.203	RSS-GEN 7.1.4	Antenna Requirements	Compliant
15.205/15.209	2.2	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Compliant
15.207	RSS-GEN 7.2.2; RSS-210 2.2	AC Conducted Emissions 150KHz – 30MHz	Compliant
15.403 (c)	A8.2	26dB Occupied Bandwidth	Compliant
15.407 (a)(1), (2), (3)	A9.2(3)	Conducted Transmitter Output Power	Compliant
15.407 (a)(1), (2), (3), (5)	A9.2(3)	Power Spectral Density	Compliant
15.407 (a)(6)	A8.2	Peak Excursion	Compliant
15.407 (b)(1), (2), (5), (6)	A9.3(4)	Undesirable Emissions	Compliant
15.407(f)	RSS-GEN	RF Exposure	Compliant
15.407(g)	2.1	Frequency Stability	Compliant

Table 1. Executive Summary of EMC Part 15.407 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Firetide, Inc. to perform testing on the Firetide Indoor and Outdoor MIMO Access Points, under Firetide, Inc.'s purchase order number 2475.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Firetide, Inc. Firetide Indoor and Outdoor MIMO Access Points.

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

Model(s) Tested:	Firetide Indoor and Outdoor MIMO Access Points		
Model(s) Covered:	Firetide Indoor and Outdoor MIMO Access Points		
EUT Specifications:	Primary Power: 100- 240VAC, 50Hz and 60Hz		
	FCC ID: REP-F205-1 IC: 4988A-F205		
	Type of Modulations:	OFDM	
	Emission Designators:	802.11a:	19M14D7D
		802.11n 20MHz:	20M25D7D
		802.11n 40MHz:	41M94D7D
	Equipment Code:	NII	
	Peak RF Output Power:	802.11a:	17.24 dBm
		802.11n 20MHz:	17.86 dBm
		802.11n 40MHz:	18.14 dBm
	EUT Frequency Ranges:	5745 MHz – 5805MHz	
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):	March 23, 2011		

Table 2. EUT Summary

B. References

CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
CFR 47, Part 15, Subpart E	Unlicensed National Information Infrastructure Devices (UNII)
RSS-210, Issue 7, June 2007	Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
ICES-003, Issue 4 February 2004	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/NCSL Z540-1-1994	Calibration Laboratories and Measuring and Test Equipment - General Requirements
ANSI/ISO/IEC 17025:2000	General Requirements for the Competence of Testing and Calibration Laboratories

Table 3. References

C. Test Site

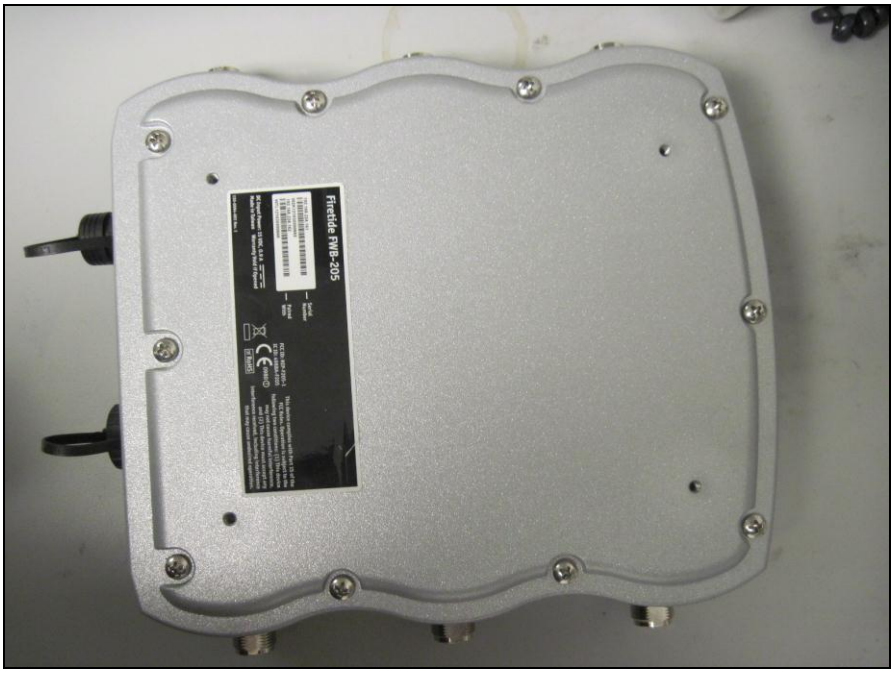
All testing was performed at MET Laboratories, Inc., 3162 Belick Street, Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

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 Firetide, Inc. Firetide Indoor and Outdoor MIMO Access Points, Equipment Under Test (EUT), is an Outdoor MIMO Point to Point Link using Wistron DNMA-H5 mini PCI radios.

Photograph 1. Firetide, Inc. Firetide Indoor and Outdoor MIMO Access Points, Front View



Photograph 2. Firetide, Inc. Firetide Indoor and Outdoor MIMO Access Points, Rear View

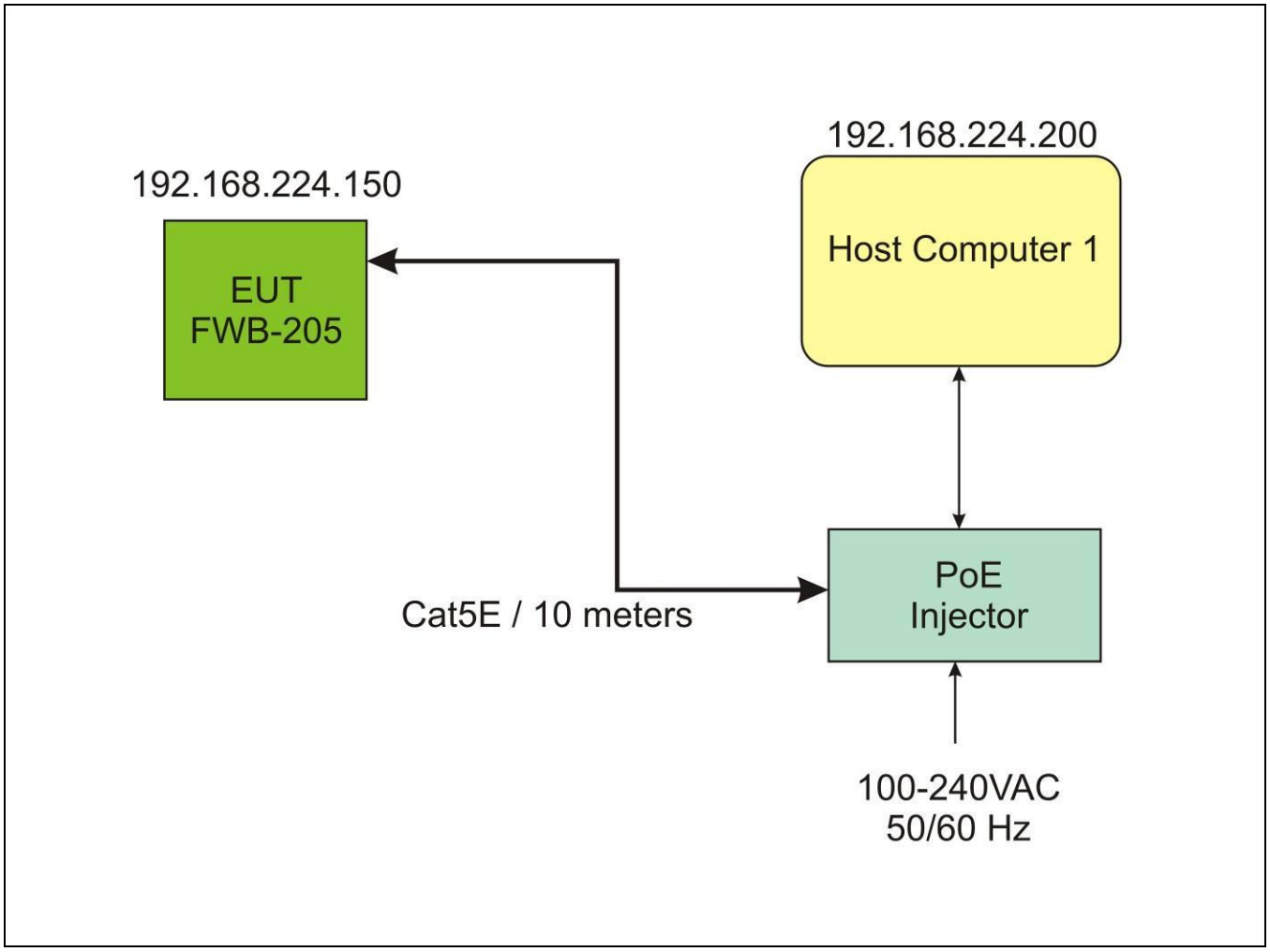


Figure 1. Block Diagram of Test Configuration

E. Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Part Number	Serial Number	Rev. #
A	Firetide PtP Node	FWB-205	FWB-205	WEC071034500414	02
	PoE Injector	Phihong	PoE30U56	P71300187B1	N/A
	DC Adapter	DR-30-15	DR-30-15	RA75144734	N/A

Table 4. Equipment Configuration

F. Support Equipment

Firetide, Inc. supplied support equipment necessary for the operation and testing of the Firetide Indoor and Outdoor MIMO Access Points. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number	Customer Supplied Calibration Data
	Laptop computer	Dell	Vostro 1000	N/A

Table 5. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded (Y/N)	Termination Box ID & Port Name
1	DC Power	DC power input	1	1	N	110-230VAC
2	POE Ethernet IN	IP connection	1	10	N	host computer
3	POE Ethernet OUT	IP connection	1	10	N	FWB-205 Ethernet Port

Table 6. Ports and Cabling Information

H. Mode of Operation

Operation can be monitored using by pinging the EUT or running ART.

I. Method of Monitoring EUT Operation

IP connectivity is maintained with the EUT. If IP connectivity is lost, EUT connectivity shall be re-established upon power up or re-boot.

J. Modifications

a) Modifications to EUT

No modifications were made to the test standard.

b) Modifications to Test Standard

No modifications were made to the test standard.

K. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Firetide, 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.

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 found compliant with the Class A requirement(s) of this section. Measured emissions were below applicable limits.

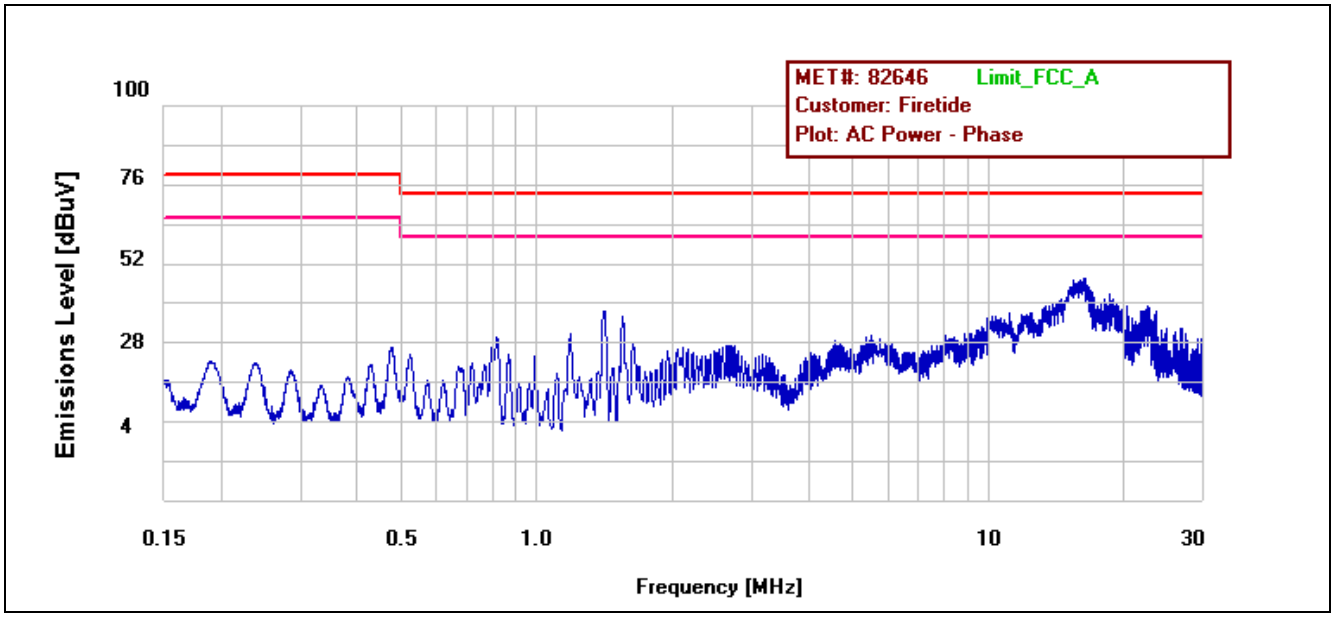
Test Engineer(s): Kenshi Chung

Test Date(s): 09/03/10

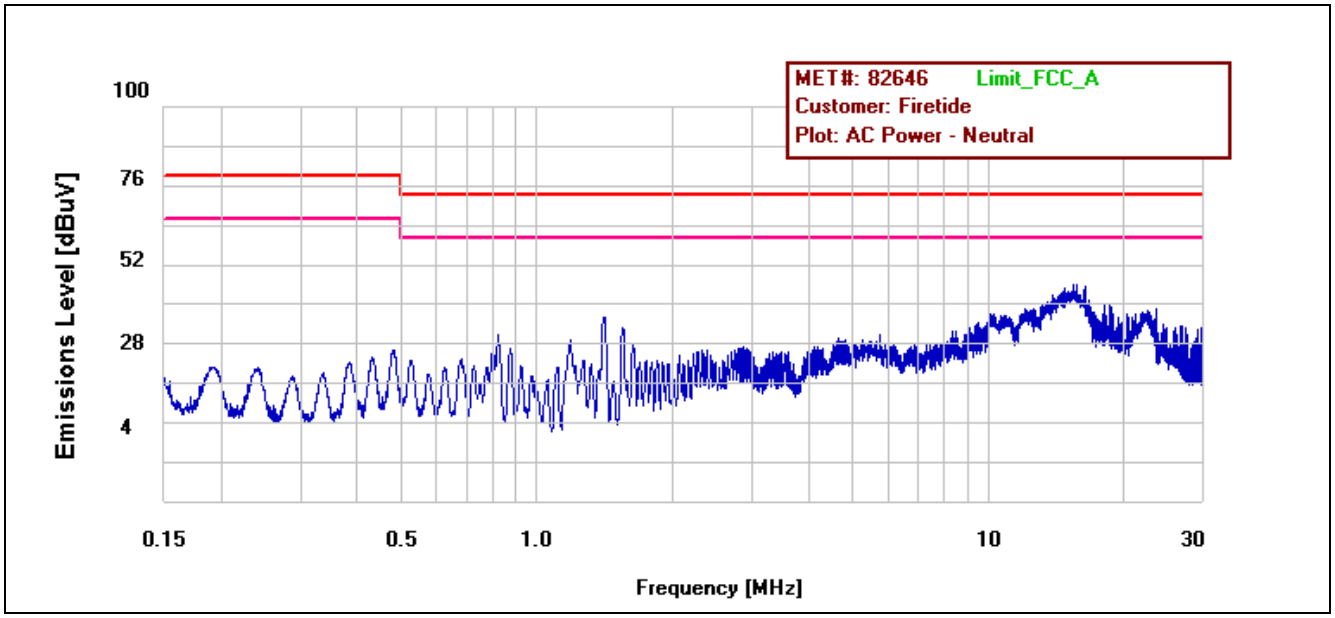
Conducted Emissions - Voltage, AC Power

Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
AC Power - Phase	0.4800	26.58	79	-52.42	Pass	23.06	66	-42.94	Pass
AC Power - Phase	0.8120	24.41	73	-48.59	Pass	19.2	60	-40.8	Pass
AC Power - Phase	1.372	34.07	73	-38.93	Pass	29.34	60	-30.66	Pass
AC Power - Phase	1.5000	32.49	73	-40.51	Pass	27.82	60	-32.18	Pass
AC Power - Phase	16.228	40.19	73	-32.81	Pass	36.03	60	-23.97	Pass
AC Power - Phase	16.168	39.2	73	-33.8	Pass	34.89	60	-25.11	Pass
AC Power - Neutral	0.484	26.1	79	-52.9	Pass	24.77	66	-41.23	Pass
AC Power - Neutral	0.8120	23.81	73	-49.19	Pass	21.34	60	-38.66	Pass
AC Power - Neutral	1.372	34.63	73	-38.37	Pass	30.54	60	-29.46	Pass
AC Power - Neutral	1.5000	32.79	73	-40.21	Pass	29.81	60	-30.19	Pass
AC Power - Neutral	16.228	40.54	73	-32.46	Pass	37.43	60	-22.57	Pass
AC Power - Neutral	15.376	37.89	73	-35.11	Pass	30.15	60	-29.85	Pass

Table 8. Conducted Emissions - Voltage, AC Power, Test Results



Plot 1. Conducted Emission, Phase Line Plot



Plot 2. Conducted Emission, Neutral Line Plot

Photograph 3. Conducted Emissions, Test Setup 1

Photograph 4. Conducted Emissions, Test Setup 2

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 9.

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 9.

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

Test Procedures: The EUT was placed on a 0.8m-high wooden table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 3 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

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

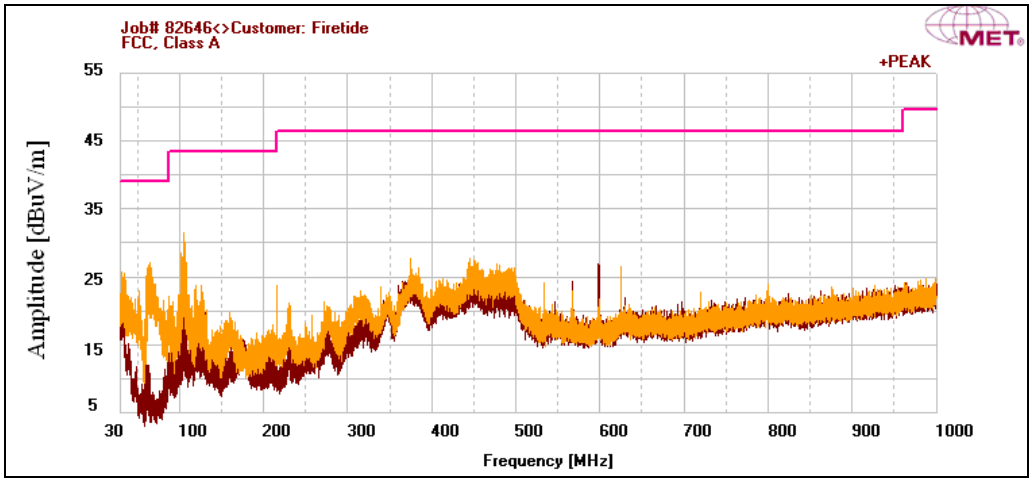
Test Engineer(s): Lionel Gabrillo

Test Date(s): 08/31/10

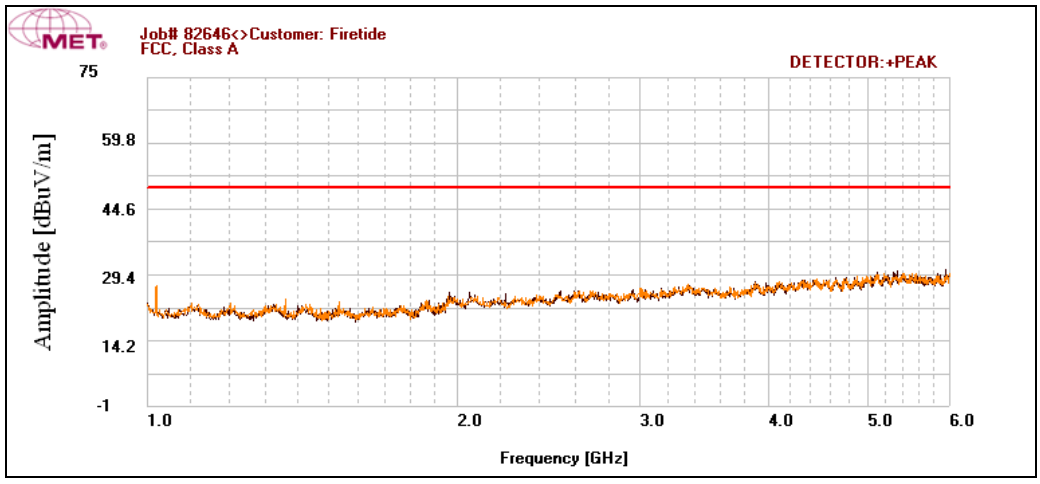
Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
64.76	V	95.7	255.4	60.47	6.3	40	1.239	0	28.009	39	-10.991
106.68	V	143.9	131.9	55.34	11.936	40	1.666	0	28.942	43.5	-14.558
36.12	V	63.4	100.0	42.37	15.152	40	0.955	0	18.477	39	-20.523
447.24	V	190.3	367.1	42.46	16.634	40	3.526	0	22.62	46.4	-23.78
625	V	37.5	100.0	41.44	19.2	40	4.192	0	24.832	46.4	-21.568
600	H	321.1	151.8	43.53	18.4	40	4.061	0	25.991	46.4	-20.409

Table 10. Radiated Emissions, Test Results, FCC Limits



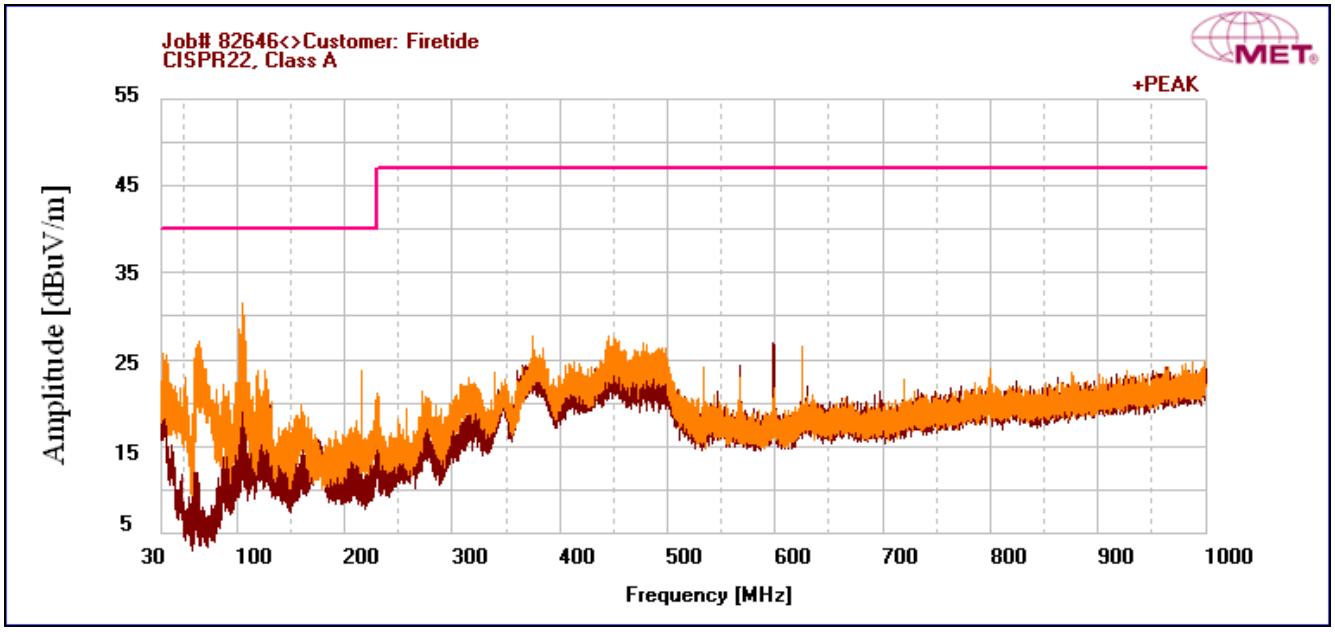
Plot 3. Radiated Emissions, FCC Limits, 30 MHz – 1 GHz



Plot 4. Radiated Emissions, FCC Limits, 1 GHz – 6 GHz

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)
64.76	V	95.7	255.4	60.47	6.3	40	1.239	0	28.009	40	-11.991
106.68	V	143.9	131.9	55.34	11.936	40	1.666	0	28.942	40	-11.058
36.12	V	63.4	100.0	42.37	15.152	40	0.955	0	18.477	40	-21.523
447.24	V	190.3	367.1	42.46	16.634	40	3.526	0	22.62	47	-24.38
625	V	37.5	100.0	41.44	19.2	40	4.192	0	24.832	47	-22.168
600	H	321.1	151.8	43.53	18.4	40	4.061	0	25.991	47	-21.009

Table 11. Radiated Emissions, Test Results, ICES-003 Limits, 30 MHz – 1 GHz



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

Photograph 5 Radiated Emission Test Setup 30 MHz – 1 GHz

Photograph 6. Radiated Emission Test Setup 1 GHz – 6 GHz

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

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

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

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

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

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

Results: The EUT as tested is compliant the criteria of §15.203. The unit will be professionally installed.

Gain/Type	Model	Manufacturer
19dBi Panel (5GHz)	MA-WA55-MIMO	MARS ANTENNAS & RF Systems LTD

Table 12. Antenna Information

Test Engineer(s): Minh Ly

Test Date(s): 09/02/09

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207 Conducted Emissions Limits

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

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

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

Test Procedure: The EUT was placed on a 0.8 m-high wooden table inside a semi-anechoic chamber. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-1992 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 μH LISN as the input transducer to an EMC/field intensity meter.

Test Results: The EUT was found to comply with the requirement(s) of this section. Measured emissions were below applicable limits.

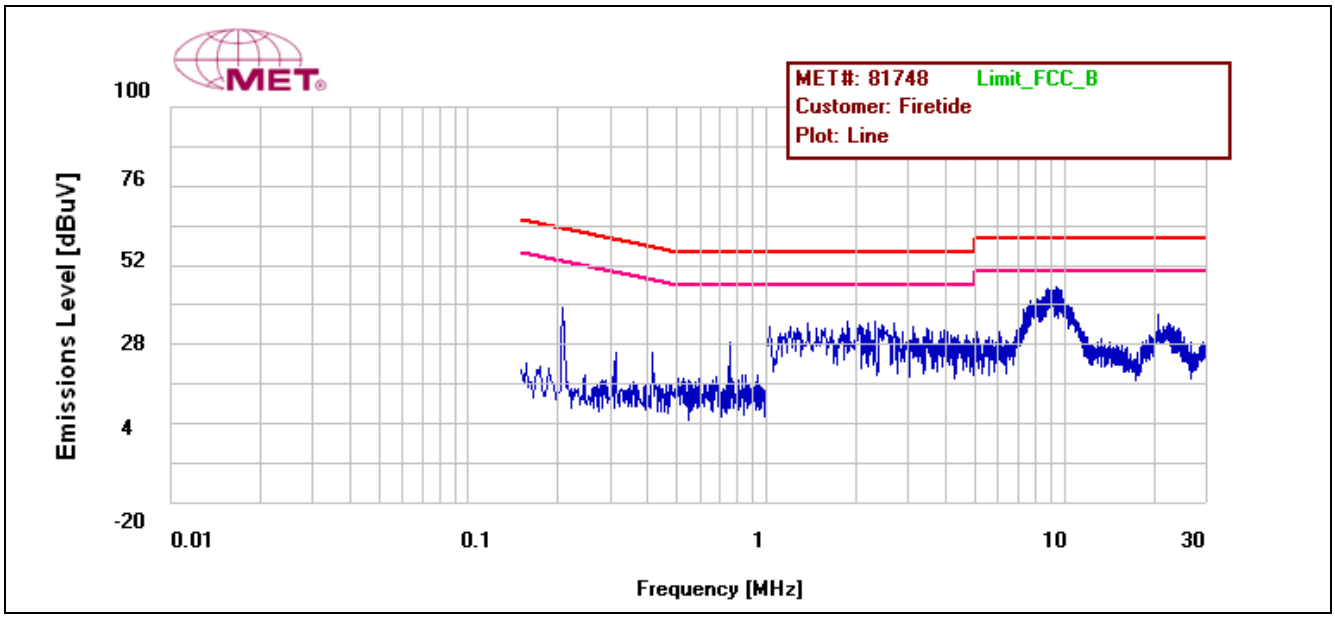
Test Engineer(s): Minh Ly

Test Date(s): 08/17/09

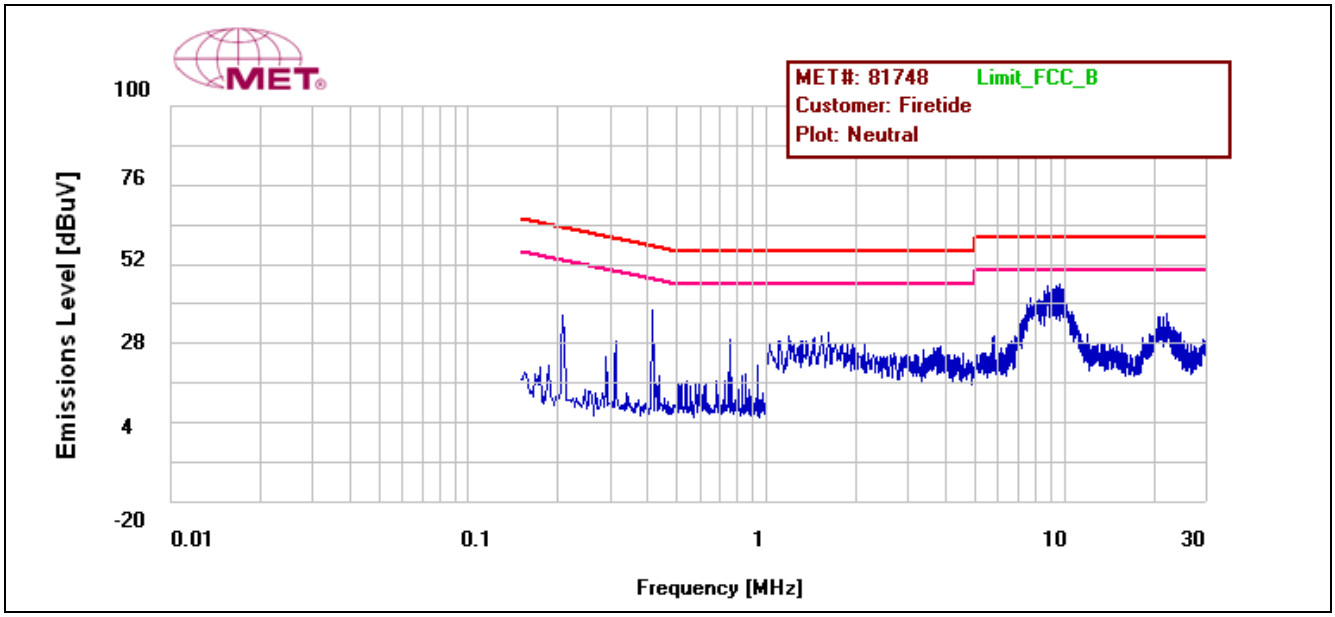
Conducted Emissions - Voltage, AC Power

Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
Line	0.206	38.73	63.372	-24.642	Pass	33.83	53.372	-19.542	Pass
Line	0.76	21.03	56	-34.97	Pass	16.023	46	-29.977	Pass
Line	9.45	37.95	60	-22.05	Pass	31.47	50	-18.53	Pass
Neutral	0.207	36.5	63.332	-26.832	Pass	33.9	53.332	-19.432	Pass
Neutral	0.414	33.77	57.591	-23.821	Pass	32.7	47.591	-14.891	Pass
Neutral	9.117	38.87	60	-21.13	Pass	32.33	50	-17.67	Pass

Table 14. Conducted Emissions - Voltage, AC Power, Test Results



Plot 6. §15.207 Conducted Emissions, Phase Line Plot, Firetide Indoor and Outdoor MIMO Access Points



Plot 7. §15.207 Conducted Emissions, Neutral Line Plot, Firetide Indoor and Outdoor MIMO Access Points

Photograph 7. Conducted Emissions, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 403(c) 26dB Bandwidth

Test Requirements: **§ 15.403 (c):** Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

Test Procedure: The transmitter was set to the mid channel at the highest output power and connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately equal to 1% of the total emission bandwidth, VBW > RBW. The 26 dB Bandwidth was measured and recorded. The measurements were repeated at the low, mid and high channels.

Test Results Equipment complies with § 15.407 (c). The 26 dB Bandwidth was determined from the plots on the following pages.

Test Engineer(s): Anderson Soungpanya

Test Date(s): 12/17/09

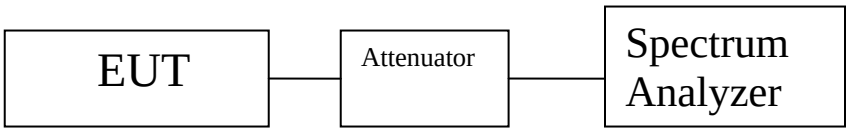


Figure 2. Occupied Bandwidth Test Setup

Occupied Bandwidth, Port 1				
Mode	**Frequency (MHz)**		**Measured 26 dB Bandwidth (MHz)**	**99 % Bandwidth (MHz)**
802.11a	U-NII-3	5745	20.273	16.5735
		5785	21.657	16.4562
		5805	19.885	16.5608
802.11n 20MHz	U-NII-3	5745	19.725	17.7041
		5785	21.948	17.8106
		5805	21.033	17.7358
802.11n 40MHz	U-NII-3	5755	39.494	36.6300
		5795	38.743	35.8859

Table 15. Occupied Bandwidth, Port 1, Test Results

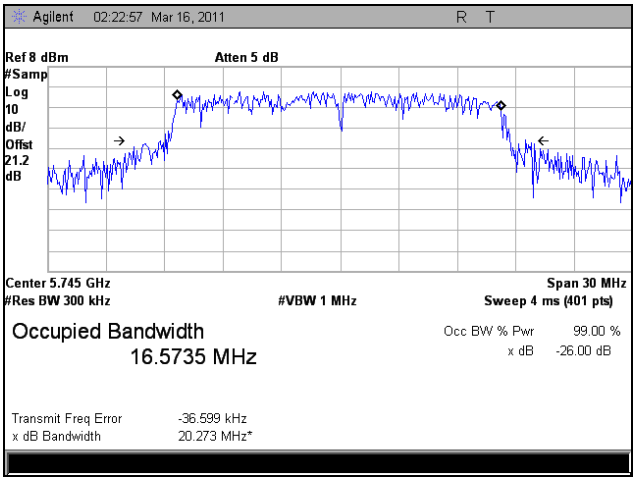
Occupied Bandwidth, Port 2				
Mode	**Frequency (MHz)**		**Measured 26 dB Bandwidth (MHz)**	**99 % Bandwidth (MHz)**
802.11n 20MHz	U-NII-3	5745	24.053	17.6496
		5785	23.064	17.7215
		5805	23.439	17.6999
802.11n 40MHz	U-NII-3	5755	40.954	36.9185
		5795	47.240	36.4790

Table 16. Occupied Bandwidth, Port 2, Test Results

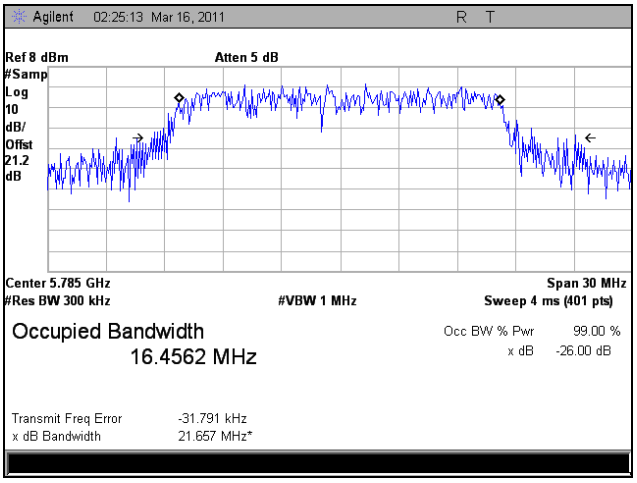
Occupied Bandwidth, Port 3				
Mode	**Frequency (MHz)**		**Measured 26 dB Bandwidth (MHz)**	**99 % Bandwidth (MHz)**
802.11n 20MHz	U-NII-3	5745	21.660	17.5725
		5785	21.974	17.7446
		5805	25.669	17.6767
802.11n 40MHz	U-NII-3	5755	39.689	36.5564
		5795	39.617	36.3996

Table 17. Occupied Bandwidth, Port 3, Test Results

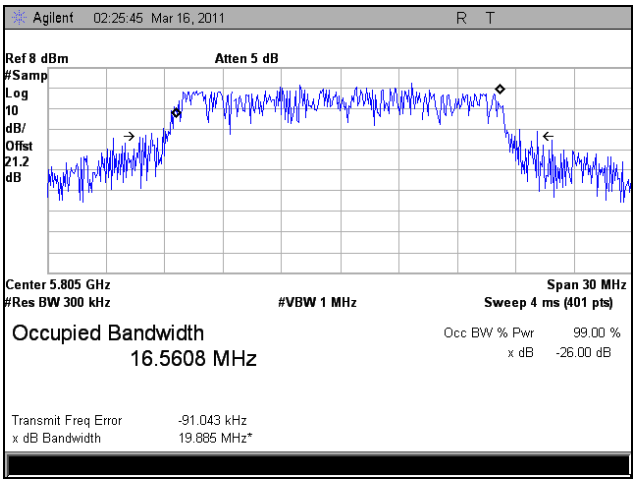
Occupied Bandwidth, Port 1



Plot 8. Occupied Bandwidth, Port 1, 802.11a, 5745 MHz

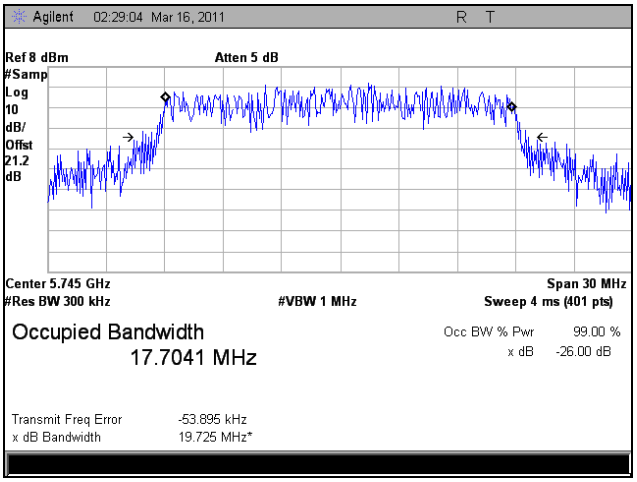


Plot 9. Occupied Bandwidth, Port 1, 802.11a, 5785 MHz

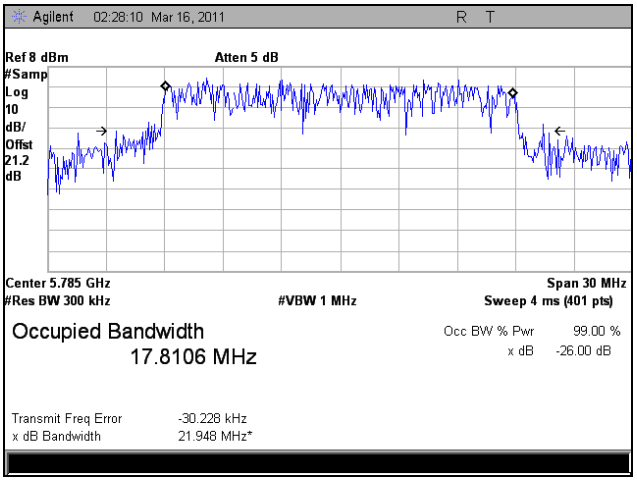


Plot 10. Occupied Bandwidth, Port 1, 802.11a, 5805 MHz

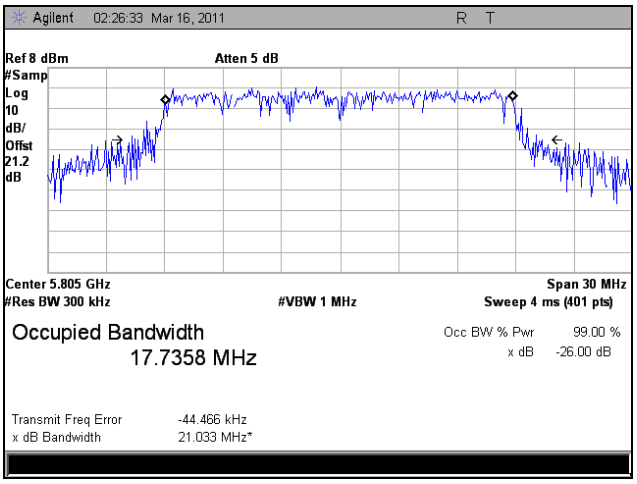
Occupied Bandwidth, Port 1, 802.11n 20MHz



Plot 11. Occupied Bandwidth, Port 1, 802.11n 20MHz, 5745 MHz

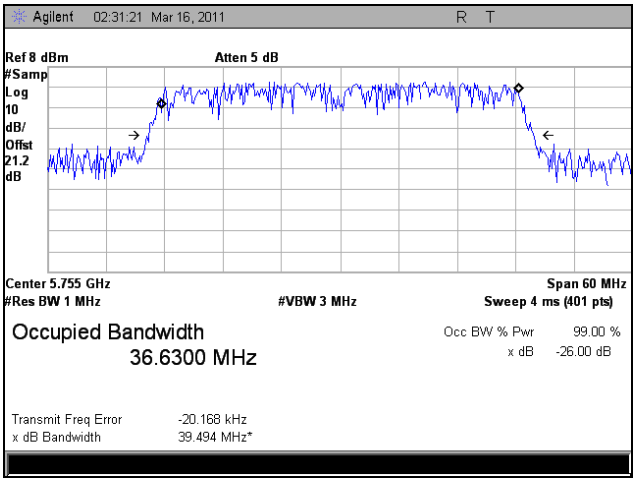


Plot 12. Occupied Bandwidth, Port 1, 802.11n 20MHz, 5785 MHz

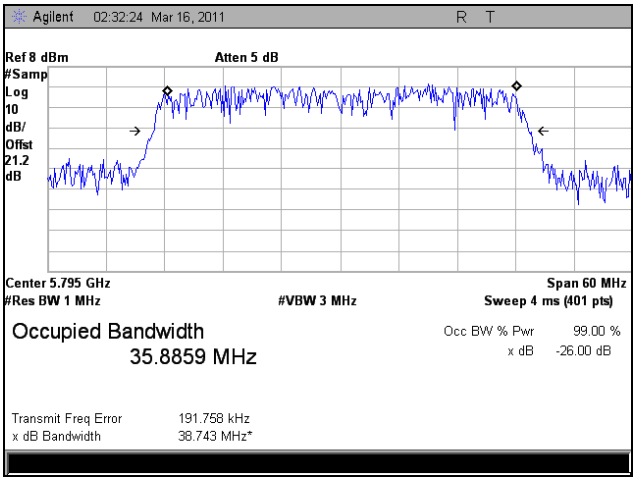


Plot 13. Occupied Bandwidth, Port 1, 802.11n 20MHz, 5805 MHz

Occupied Bandwidth, Port 1, 802.11n 40MHz

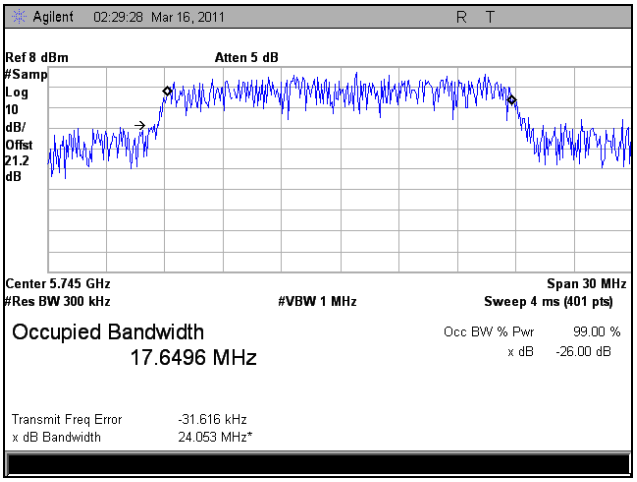


Plot 14. Occupied Bandwidth, Port 1, 802.11n 40MHz, 5755 MHz

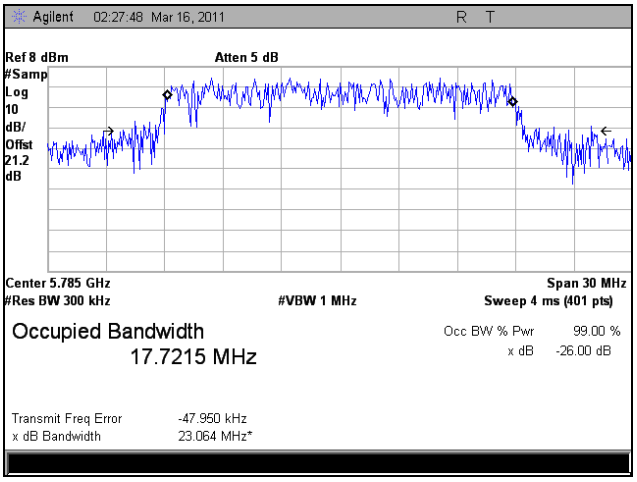


Plot 15. Occupied Bandwidth, Port 1, 802.11n 40MHz, 5795 MHz

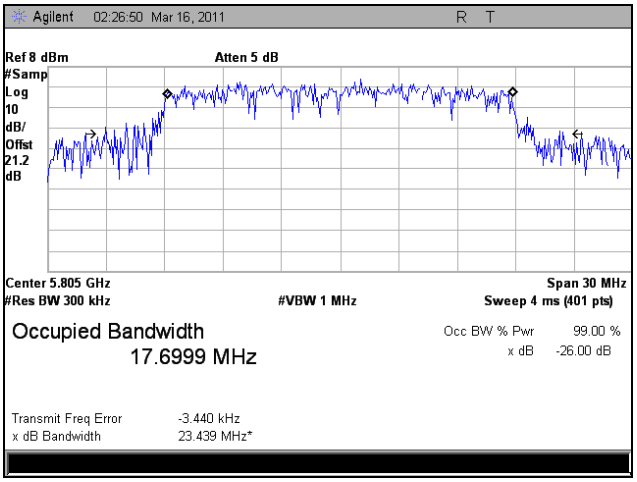
Occupied Bandwidth, Port 2, 802.11n 20MHz



Plot 16. Occupied Bandwidth, Port 2, 802.11n 20MHz, 5745 MHz

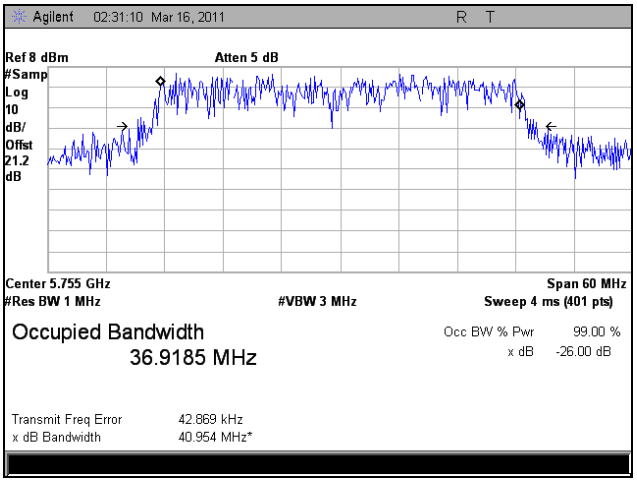


Plot 17. Occupied Bandwidth, Port 2, 802.11n 20MHz, 5785 MHz

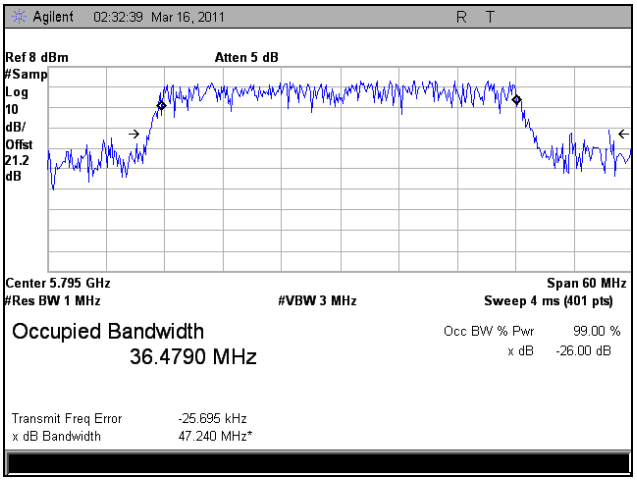


Plot 18. Occupied Bandwidth, Port 2, 802.11n 20MHz, 5805 MHz

Occupied Bandwidth, Port 2, 802.11n 40MHz

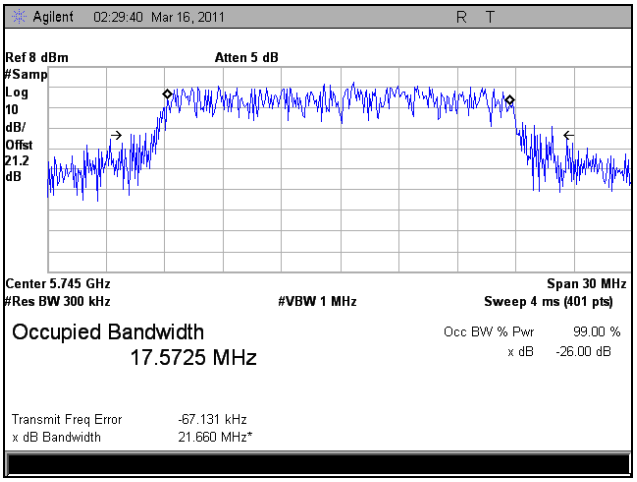


Plot 19. Occupied Bandwidth, Port 2, 802.11n 40MHz, 5755 MHz

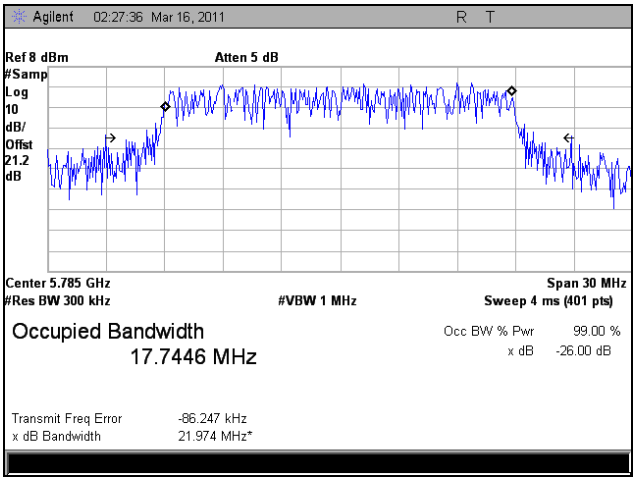


Plot 20. Occupied Bandwidth, Port 2, 802.11n 40MHz, 5795 MHz

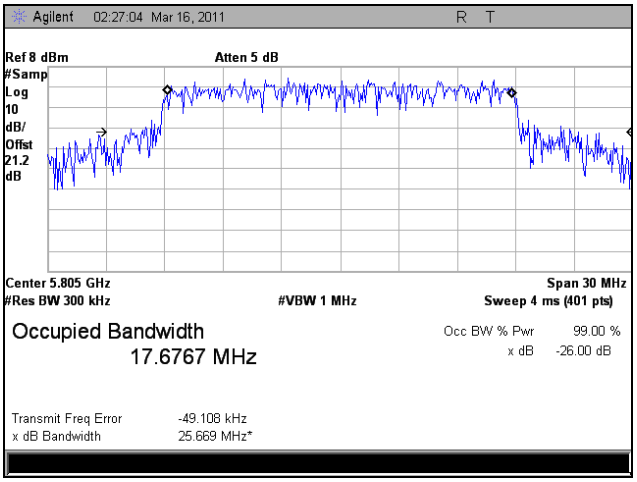
Occupied Bandwidth, Port 3, 802.11n 20MHz



Plot 21. Occupied Bandwidth, Port 3, 802.11n 20MHz, 5745 MHz

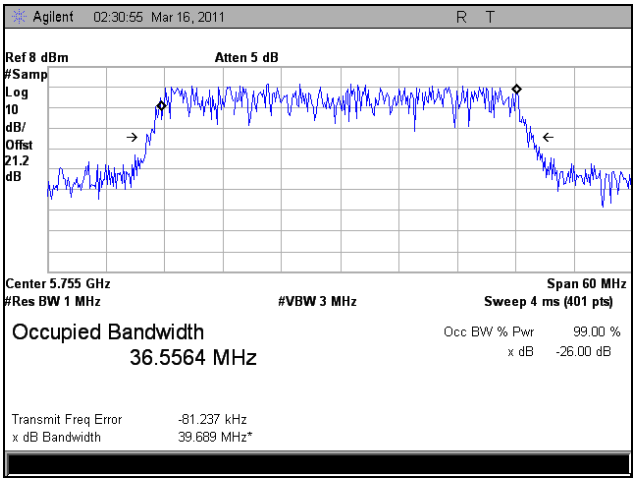


Plot 22. Occupied Bandwidth, Port 3, 802.11n 20MHz, 5785 MHz

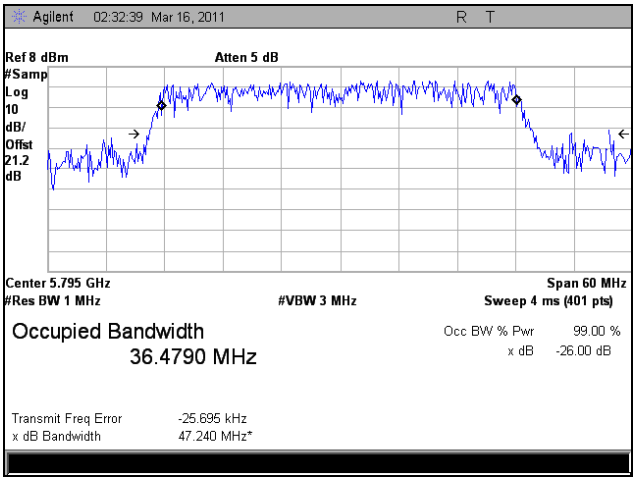


Plot 23. Occupied Bandwidth, Port 3, 802.11n 20MHz, 5805 MHz

Occupied Bandwidth, Port 3, 802.11n 40MHz



Plot 24. Occupied Bandwidth, Port 3, 802.11n 40MHz, 5755 MHz



Plot 25. Occupied Bandwidth, Port 3, 802.11n 40MHz, 5795 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 407(a) (1), (2) RF Power Output

Test Requirements: **§15.407(a) (1), (2):** The maximum output power of the intentional radiator shall not exceed the following:

Digital Transmission Systems (MHz)	Output Limit (mW)
5150-5250	50
5250-5350	250
5470-5725	250
5725-5825	1000

Table 18. Output Power Requirements from §15.407

§15.407(a) (1): For the band 5.15-5.25 GHz the peak transmit power over the frequency band of operation shall not exceed the lesser 50mW or 4dBm + 10logB, where B is the 26-dB emission bandwidth in MHz.

§15.407(a) (2): For the band 5.25-5.35GHz & 5.470-5.72GHz the peak transmit power over the frequency band of operation shall not exceed the lesser of 250mW or 11dBm + 10logB, where B is the 26-dB emission bandwidth in MHz.

§15.407(a) (3): For the band 5.725 – 5.825 GHz the peak transmit power over the frequency band of operation shall not exceed the lesser 1W or 17dBm + 10logB, where B is the 26-dB emission bandwidth in MHz.

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 with the data rate that produced the highest output power.

Test Results: Equipment complies with the Peak Power Output limits of **§ 15.401(a) (3)**.

Test Engineer(s): Anderson Soungpanya

Test Date(s): 12/17/09

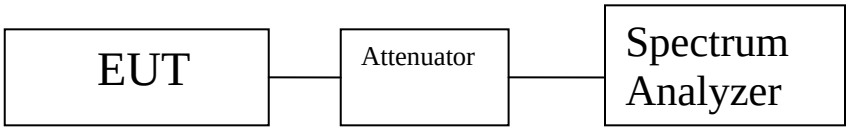


Figure 3. Peak Power Output Test Setup

RF POWER OUTPUT, Port 1			
Mode	**Frequency (MHz)**		**Measured Output Power (dBm)**
802.11a	U-NII-3	5745	17.24
		5785	16.87
		5805	15.93
802.11n 20MHz	U-NII-3	5745	17.24
		5785	17.19
		5805	17.87
802.11n 40MHz	U-NII-3	5755	17.90
		5795	17.82

Table 19. RF Power Output, Test Results, Port 1

RF POWER OUTPUT, Port 2			
Mode	**Frequency (MHz)**		**Measured Output Power (dBm)**
802.11n 20MHz	U-NII-3	5745	15.49
		5785	16.67
		5805	14.80
802.11n 40MHz	U-NII-3	5755	18.14
		5795	17.50

Table 20. RF Power Output, Test Results, Port 2

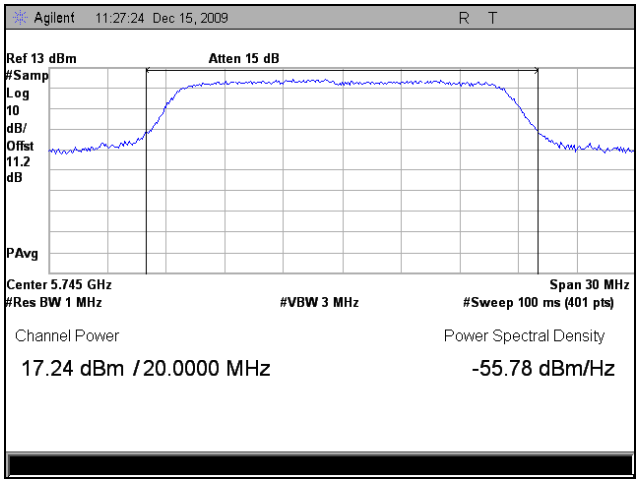
RF POWER OUTPUT, Port 3			
Mode	**Frequency (MHz)**		**Measured Output Power (dBm)**
802.11n 20MHz	U-NII-3	5745	17.24
		5785	17.40
		5805	15.15
802.11n 40MHz	U-NII-3	5755	17.99
		5795	17.51

Table 21. RF Power Output, Test Results, Port 3

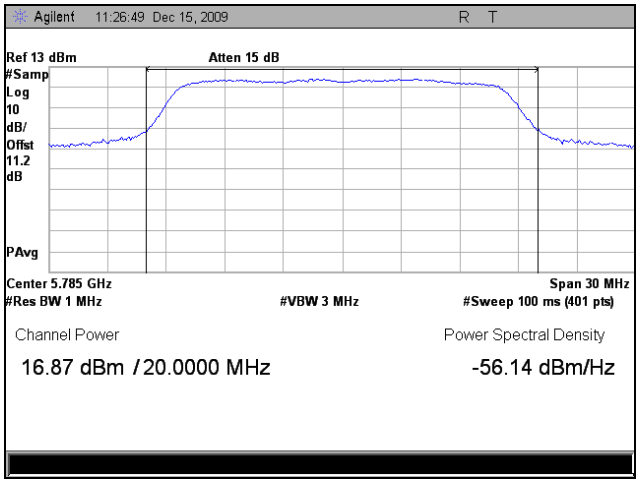
RF POWER OUTPUT, Summed Power						
Mode	**Frequency (MHz)**		**Port 1**	**Port 2**	**Port 3**	**Summed Power (dBm)**
802.11n 20MHz	U-NII-3	5745	17.24	15.49	17.24	21.50
		5785	17.19	16.67	17.40	21.86
		5805	17.87	14.80	15.15	20.94
802.11n 40MHz	U-NII-3	5755	17.90	18.14	17.99	22.78
		5795	17.82	17.50	17.51	22.38

Table 22. RF Power Output, Test Results, Summed Power

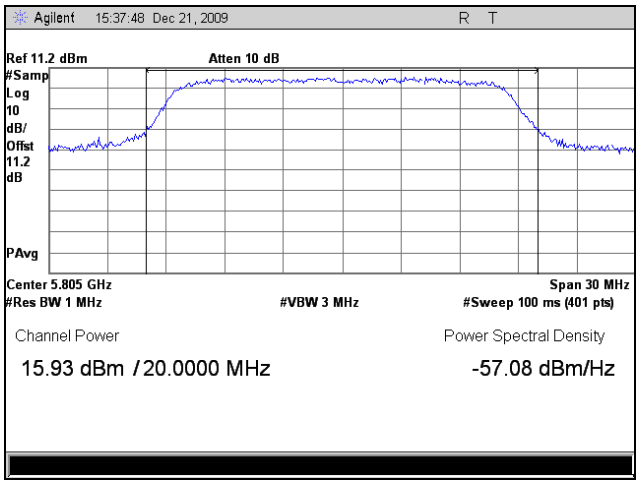
RF Power Output, Port 1 802.11a



Plot 26. RF Power Output, Port 1, 802.11a, 5745 MHz

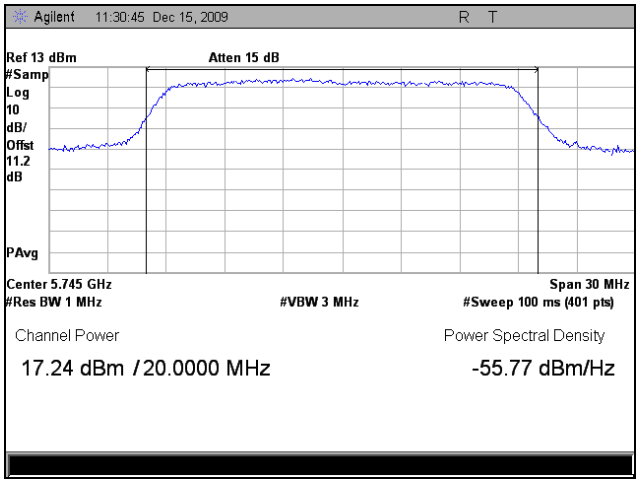


Plot 27. RF Power Output, Port 1, 802.11a, 5785 MHz

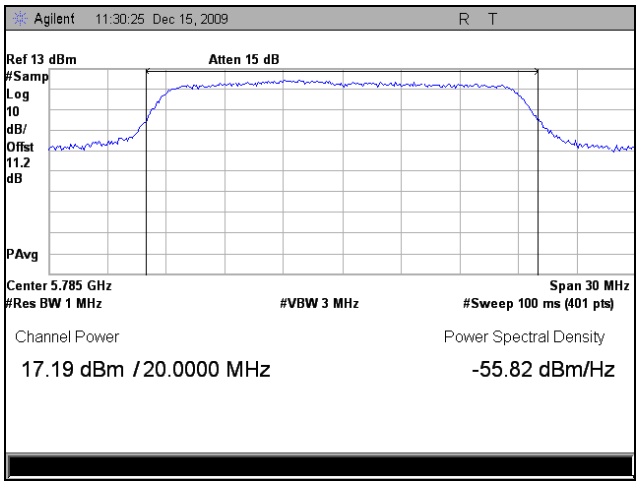


Plot 28. RF Power Output, Port 1, 802.11a, 5805 MHz

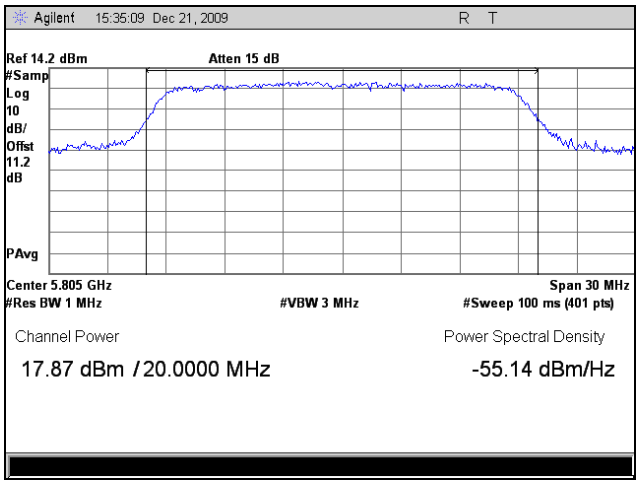
RF Power Output, Port 1, 802.11n 20MHz



Plot 29. RF Power Output, Port 1, 802.11n 20MHz, 5745 MHz

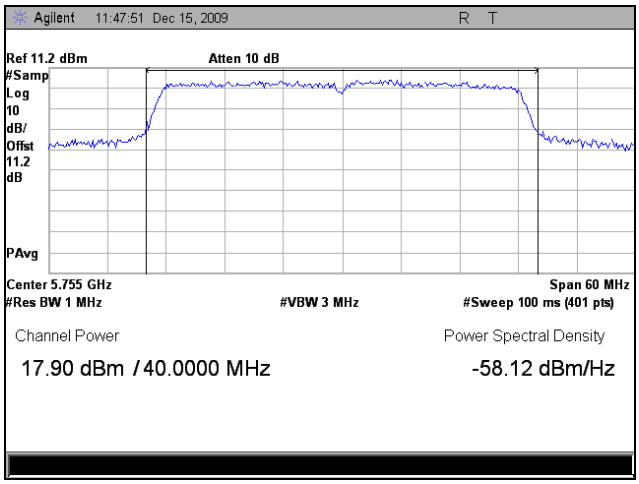


Plot 30. RF Power Output, Port 1, 802.11n 20MHz, 5785 MHz

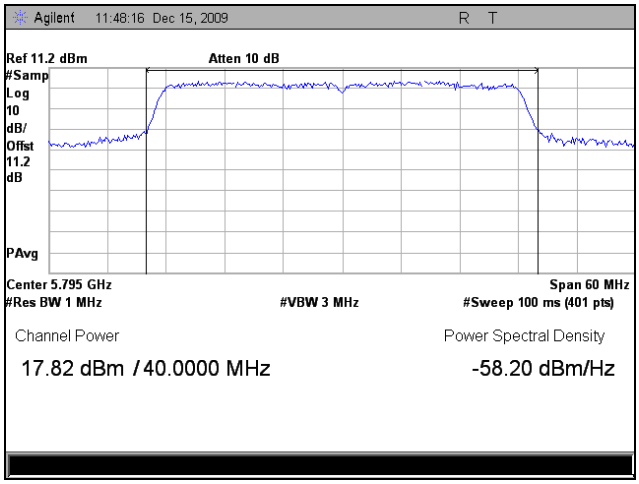


Plot 31. RF Power Output, Port 1, 802.11n 20MHz, 5805 MHz

RF Power Output, Port 1 802.11n 40MHz

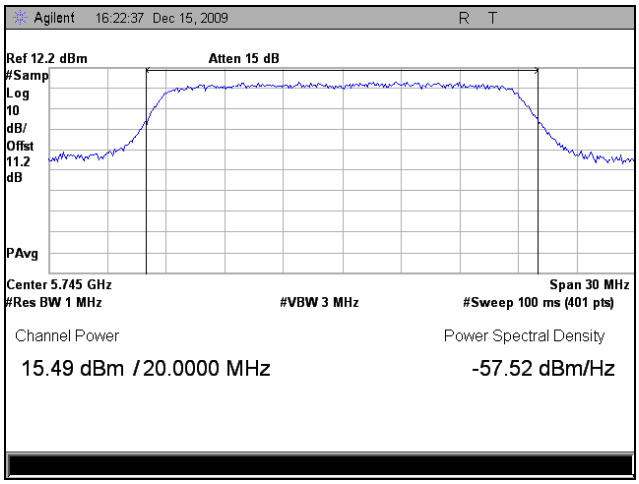


Plot 32. RF Power Output, Port 1, 802.11n 40MHz, 5755 MHz

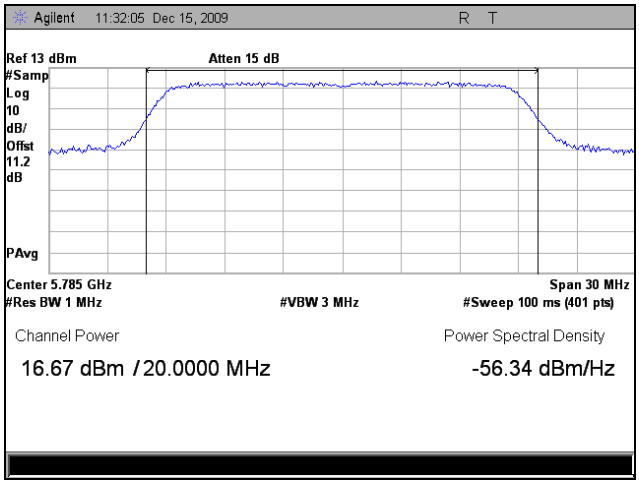


Plot 33. RF Power Output, Port 1, 802.11n 40MHz, 5795 MHz

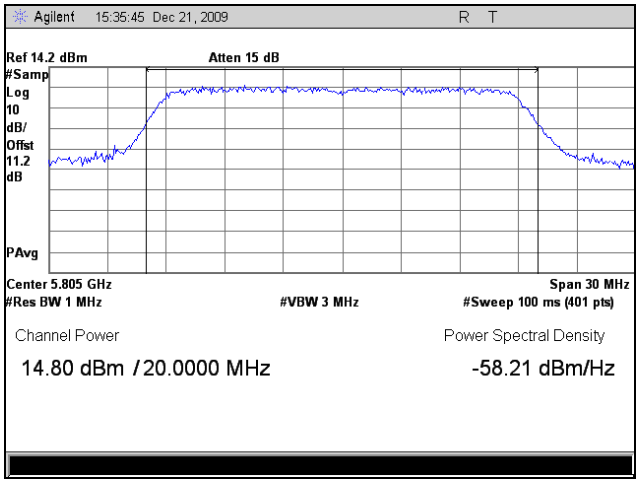
RF Power Output, Port 2, 802.11n 20MHz



Plot 34. RF Power Output, Port 2, 802.11n 20MHz, 5745 MHz

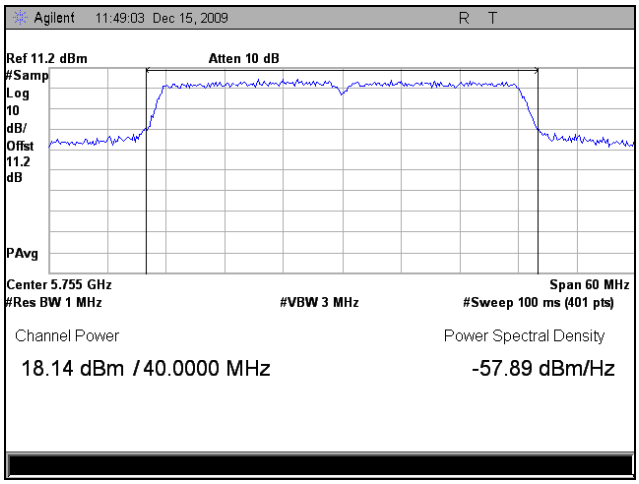


Plot 35. RF Power Output, Port 2, 802.11n 20MHz, 5785 MHz

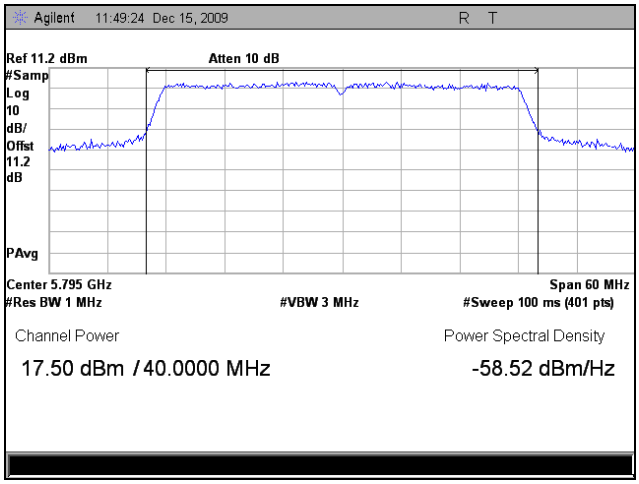


Plot 36. RF Power Output, Port 2, 802.11n 20MHz, 5805 MHz

RF Power Output, Port 2, 802.11n 40MHz

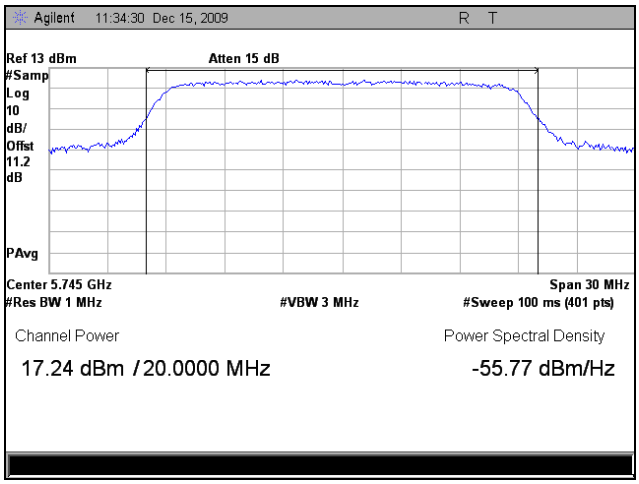


Plot 37. RF Power Output, Port 2, 802.11n 40MHz, 5755 MHz

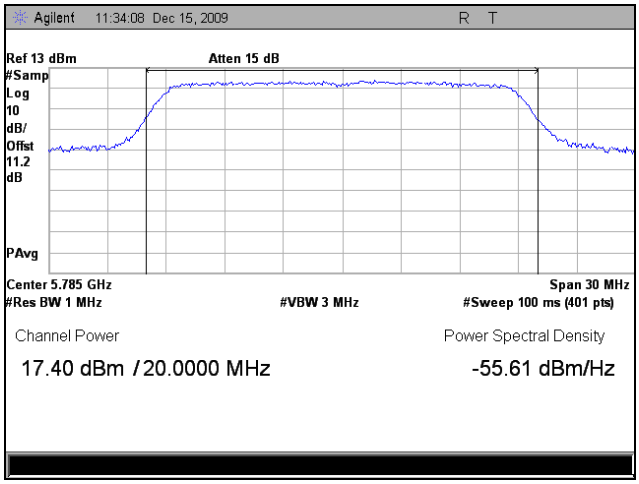


Plot 38. RF Power Output, Port 2, 802.11n 40MHz, 5795 MHz

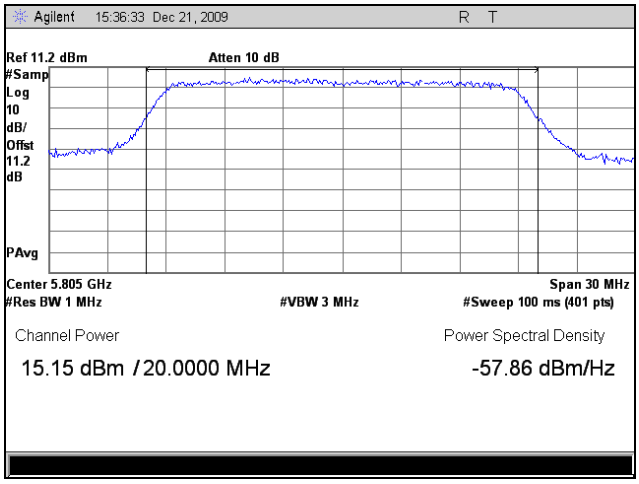
RF Power Output, Port 3, 802.11n 20MHz



Plot 39. RF Power Output, Port 3, 802.11n 20MHz, 5745 MHz

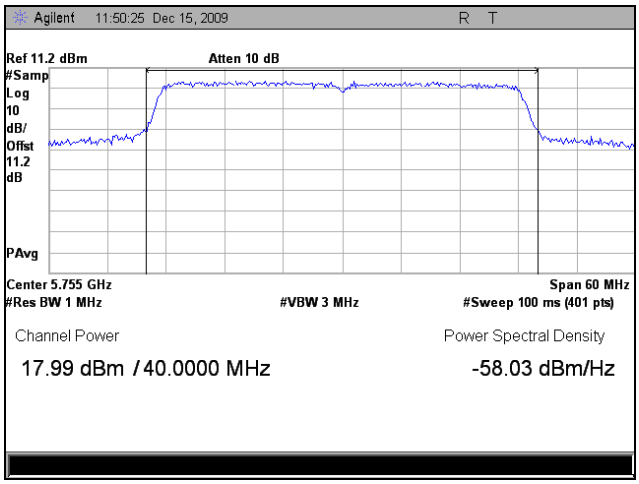


Plot 40. RF Power Output, Port 3, 802.11n 20MHz, 5785 MHz

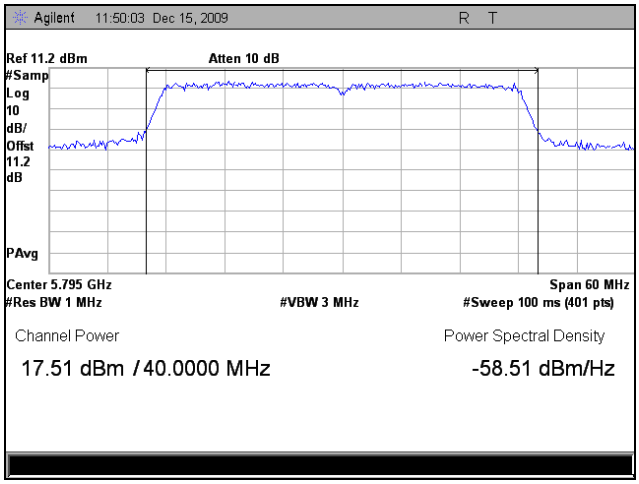


Plot 41. RF Power Output, Port 3, 802.11n 20MHz, 5805 MHz

RF Power Output, Port 3, 802.11n 40MHz



Plot 42. RF Power Output, Port 3, 802.11n 40MHz, 5755 MHz



Plot 43. RF Power Output, Port 3, 802.11n 40MHz, 5795 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(a)(1), (a)(2) Peak Power Spectral Density

Test Requirements: **§ 15.407(a)(3):** For digitally modulated systems, the conducted peak power spectral density from the intentional radiator to the antenna shall not be greater than 17dBm/MHz in the frequency band 5.725 – 5.825GHz.

Test Procedure: The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level on the EUT. The RBW was set to 1MHz and the VBW was set to 3MHz. The combined ports were measured using a splitter/combiner. The method of measurement #2 from the FCC Public Notice CA 02-2138 was used.

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

Test Engineer(s): Anderson Soungpanya

Test Date(s): 12/17/09

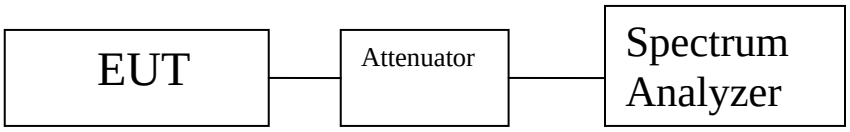


Figure 4. Peak Power Spectral Density Test Setup

Peak Power Spectral Density, Port 1					
Mode	Frequency (MHz)		Measured PPSD (dBm)	Limit (dBm)	Margin (dB)
802.11a	U-NII-3	5745	5.904	17	11.096
		5785	5.613	17	11.387
		5805	5.138	17	11.862
802.11n 20MHz	U-NII-3	5745	6.378	17	10.622
		5785	6.023	17	10.977
		5805	5.405	17	11.595
802.11n 40MHz	U-NII-3	5755	5.09	17	11.91
		5795	3.58	17	13.42

Table 23. Peak Power Spectral Density, Test Results, Port 1

Peak Power Spectral Density, Port 2					
Mode	Frequency (MHz)		Measured PPSD (dBm)	Limit (dBm)	Margin (dB)
802.11n 20MHz	U-NII-3	5745	4.182	17	12.818
		5785	5.788	17	11.212
		5805	4.821	17	12.179
802.11n 40MHz	U-NII-3	5755	3.63	17	13.37
		5795	1.77	17	15.23

Table 24. Peak Power Spectral Density, Test Results, Port 2

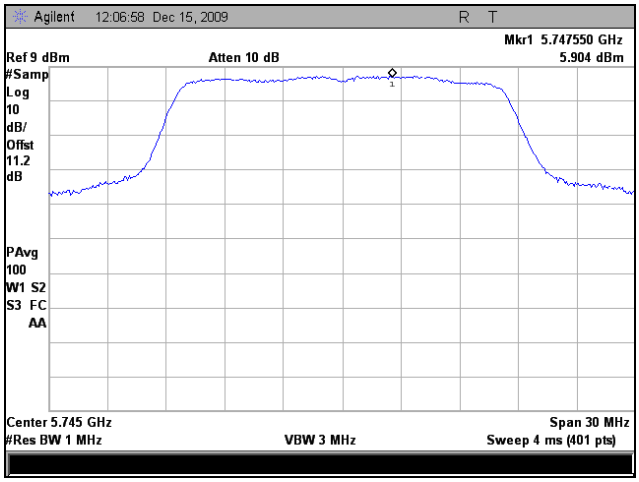
Peak Power Spectral Density, Port 3					
Mode	Frequency (MHz)		Measured PPSD (dBm)	Limit (dBm)	Margin (dB)
802.11n 20MHz	U-NII-3	5745	6.131	17	10.869
		5785	5.768	17	11.232
		5805	5.342	17	11.658
802.11n 40MHz	U-NII-3	5755	2.16	17	14.84
		5795	3.02	17	13.98

Table 25. Peak Power Spectral Density, Test Results, Port 3

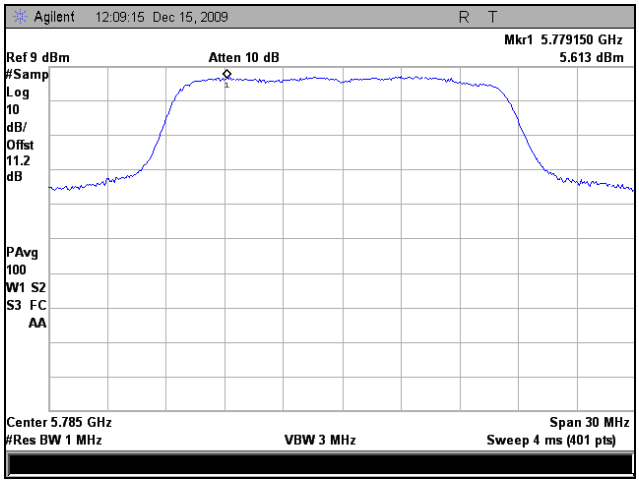
Peak Power Spectral Density, Combined Ports					
Mode	Frequency (MHz)		Measured PPSD (dBm)	Limit (dBm)	Margin (dB)
802.11n 20MHz	U-NII-3	5745	10.06	17	6.94
		5785	9.89	17	7.11
		5805	9.657	17	7.343
802.11n 40MHz	U-NII-3	5755	9.262	17	7.738
		5795	8.545	17	8.455

Table 26. Peak Power Spectral Density, Test Results, Combined Ports

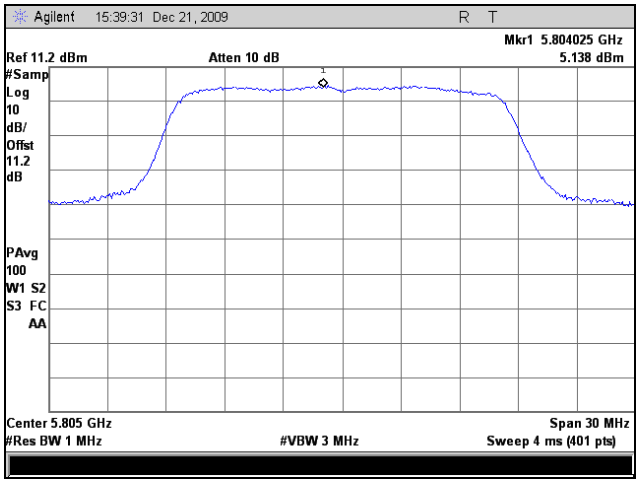
Peak Power Spectral Density, Port 1, 802.11a



Plot 44. PPSD, Port 1, 802.11a, 5745 MHz

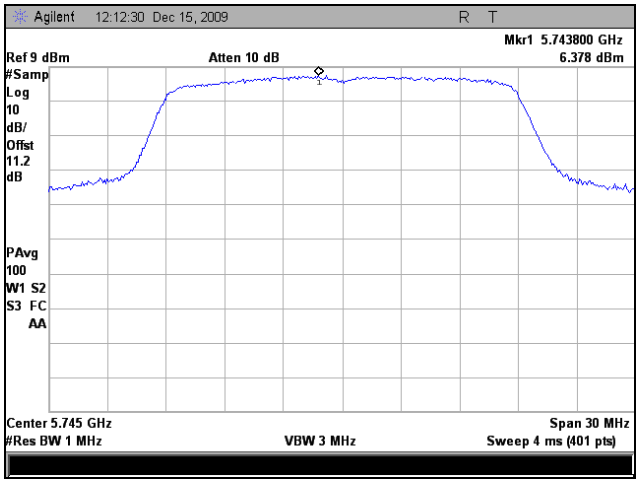


Plot 45. PPSD, Port 1, 802.11a 2, 5785 MHz

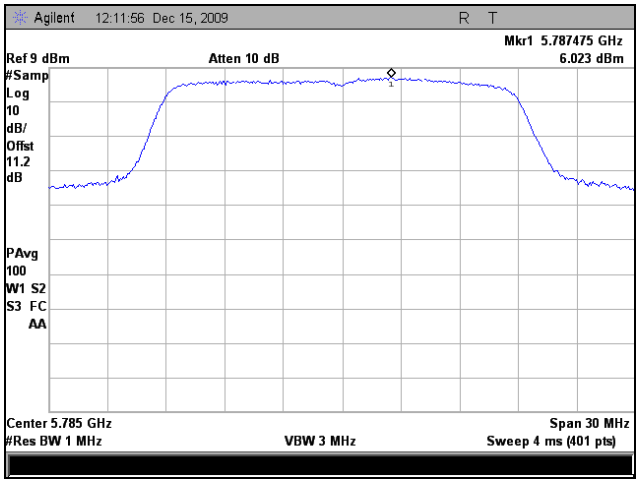


Plot 46. PPSD, Port 1, 802.11a, 5805 MHz

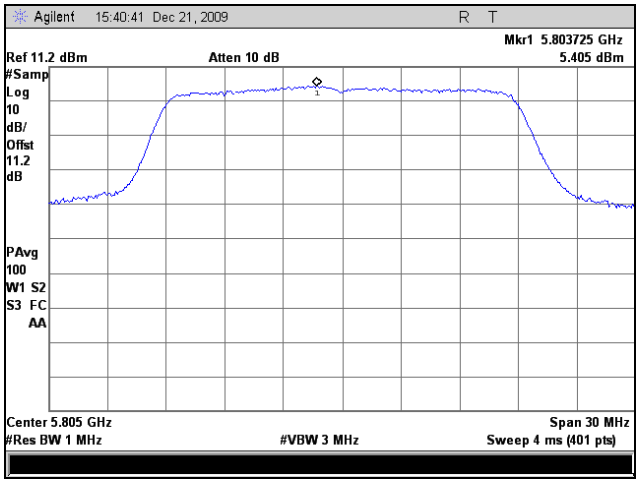
Peak Power Spectral Density, Port 1, 802.11n 20MHz



Plot 47. PPSD, \ Port 1, 802.11an 20MHz, 5745 MHz

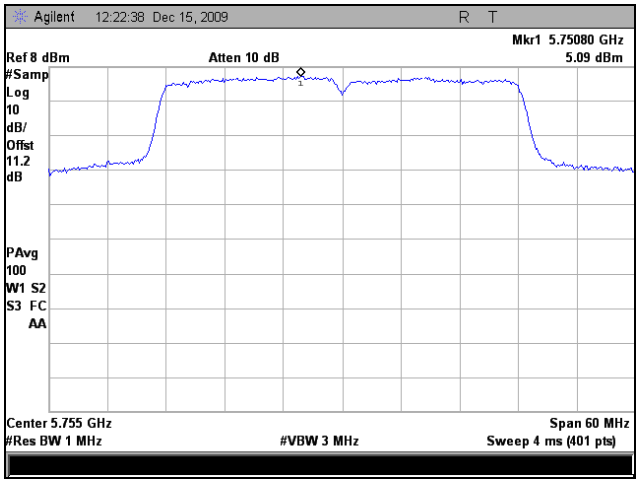


Plot 48. PPSD, Port 1, 802.11an 20MHz, 5785 MHz

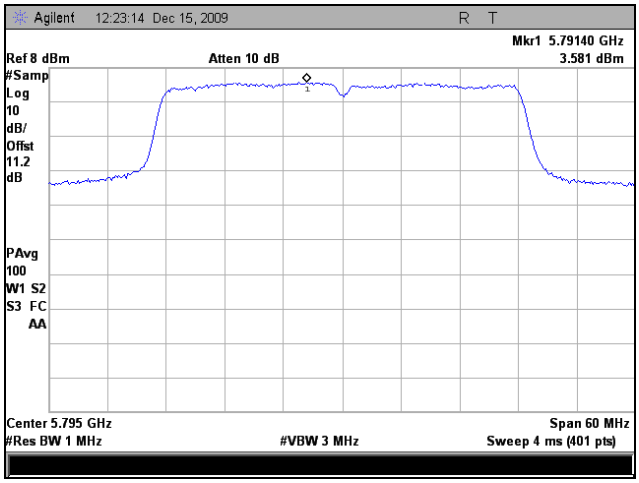


Plot 49. PPSD, Port 1, 802.11an 20MHz, 5805 MHz

Peak Power Spectral Density, Port 1, 802.11n 40MHz

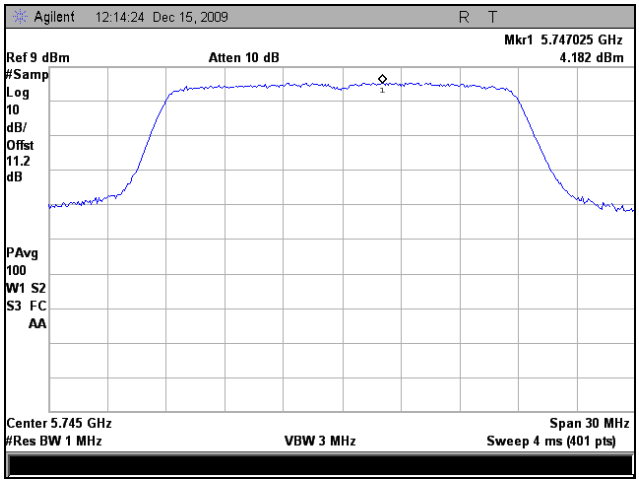


Plot 50. PPSD, Port 1, 802.11n 40MHz, 5755 MHz

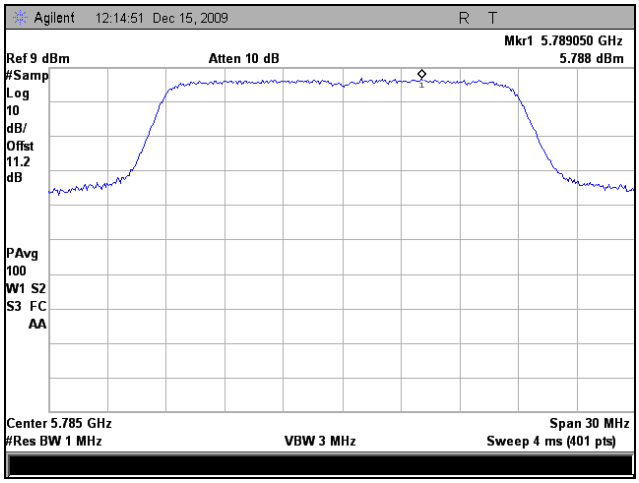


Plot 51. PPSD, Port 1, 802.11n 40MHz, 5795 MHz

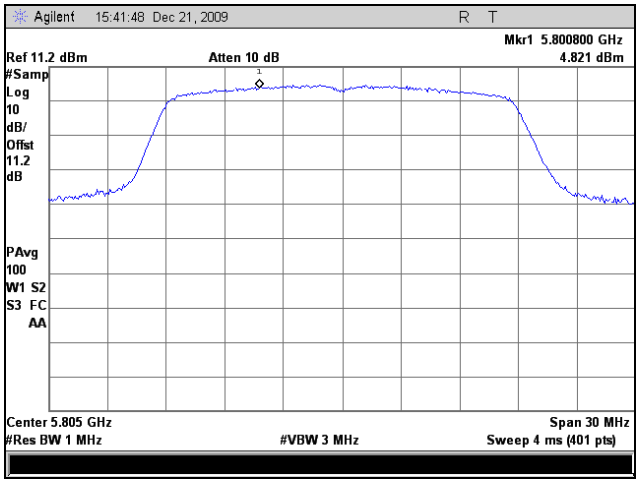
Peak Power Spectral Density, Port 2, 802.11n 20MHz



Plot 52. PPSD, Port 2, 802.11n 20MHz, 5745 MHz

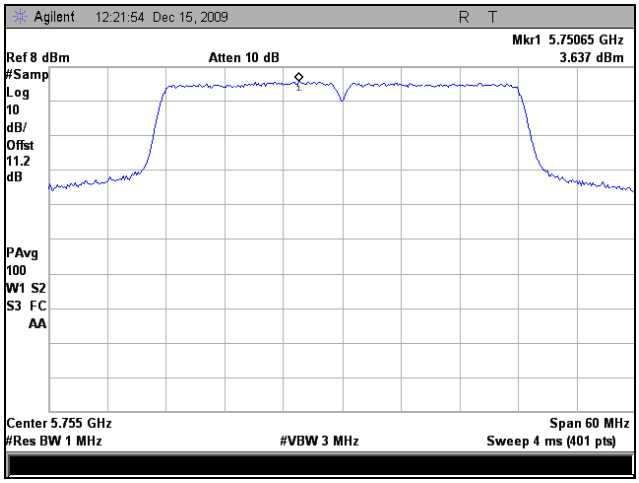


Plot 53. PPSD, Port 2, 802.11n 20MHz, 5785 MHz

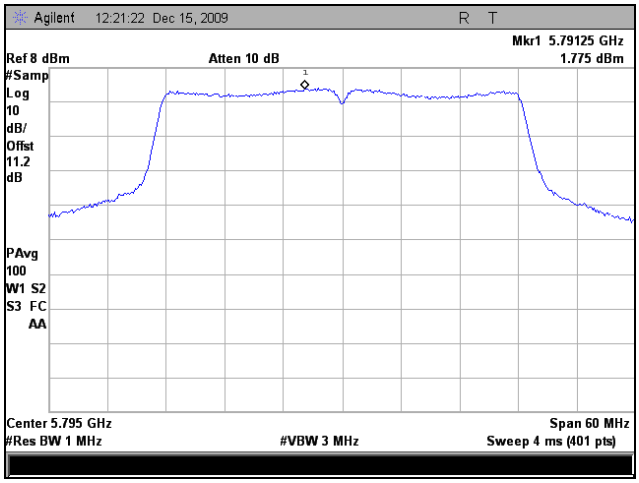


Plot 54. PPSD, Port 2, 802.11n 20MHz, 5805 MHz

Peak Power Spectral Density, Port 2, 802.11n 40MHz

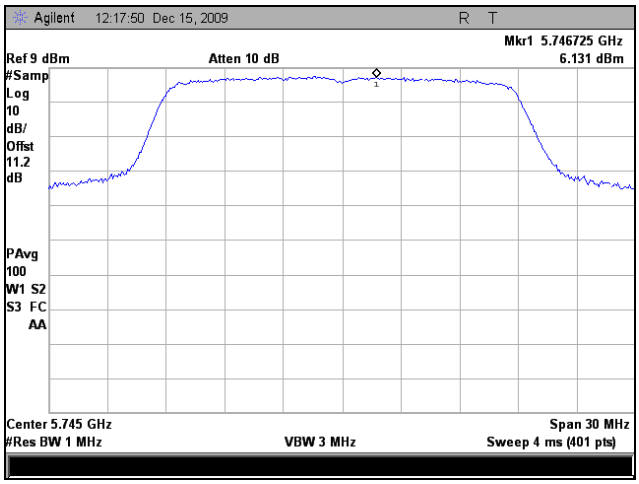


Plot 55. PPSD, Port 2, 802.11n 40MHz, 5755 MHz

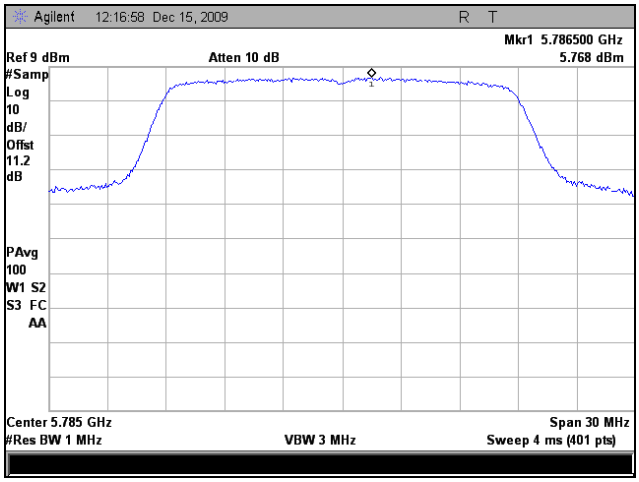


Plot 56. PPSD, Port 2, 802.11n 40MHz, 5795 MHz

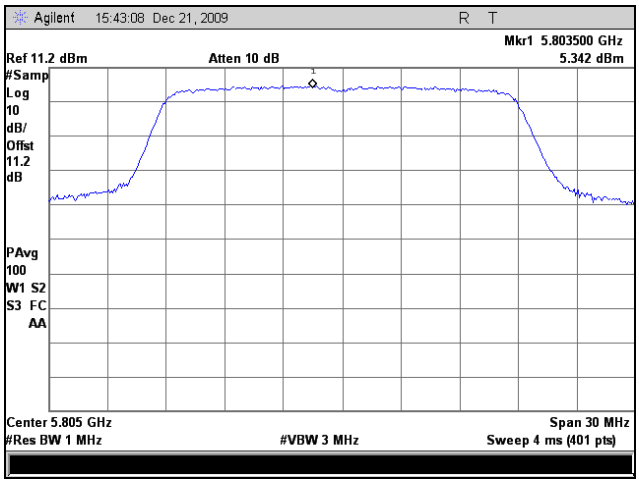
Peak Power Spectral Density, Port 3, 802.11n 20MHz



Plot 57. PPSD, Port 3, 802.11n 20MHz, 5745 MHz

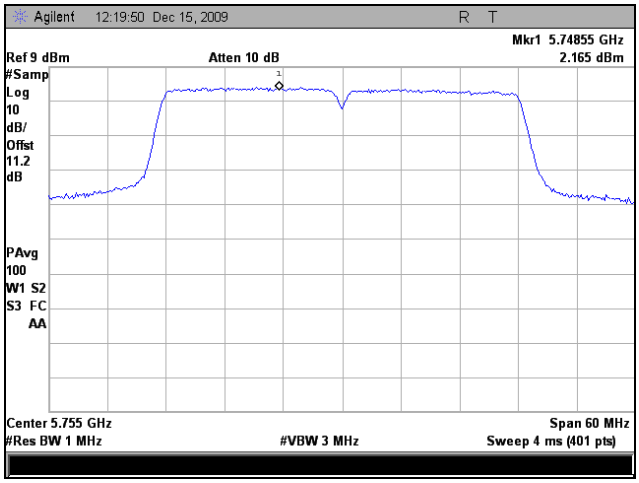


Plot 58. PPSD, Port 3, 802.11n 20MHz, 5785 MHz

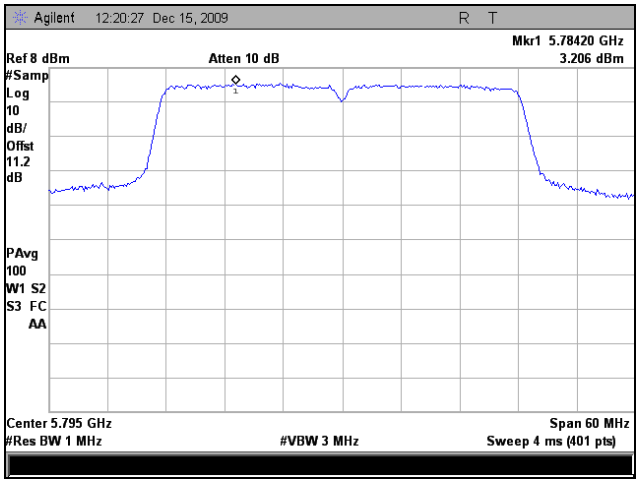


Plot 59. PPSD, Port 3, 802.11n 20MHz, 5805 MHz

Peak Power Spectral Density, Port 3, 802.11n 40MHz

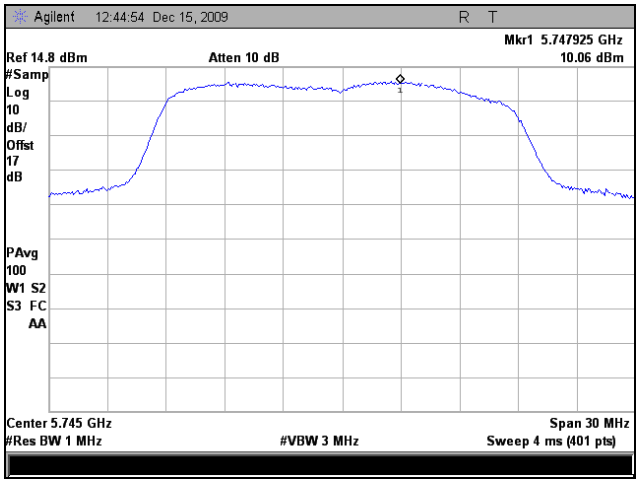


Plot 60. PPSD, Port 3, 802.11n 40MHz, 5755 MHz

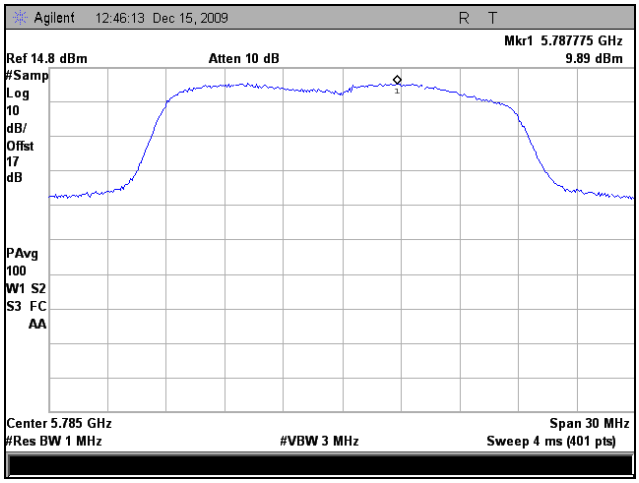


Plot 61. PPSD, Port 3, 802.11n 40MHz, 5795 MHz

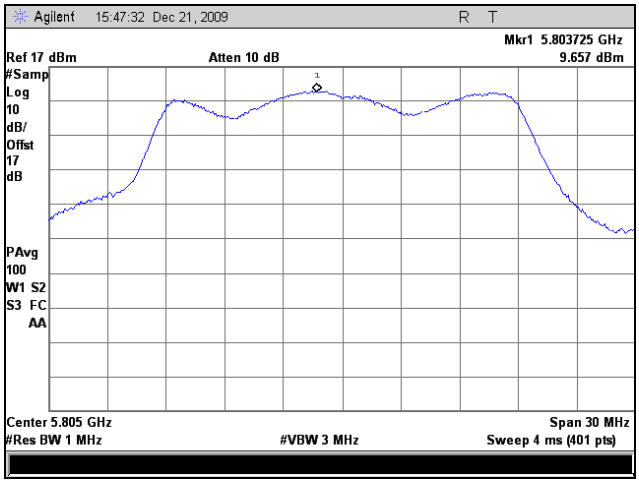
Peak Power Spectral Density, Combined Ports, 802.11n 20MHz



Plot 62. PPSD, Combined Ports, 802.11n 20MHz, 5745 MHz

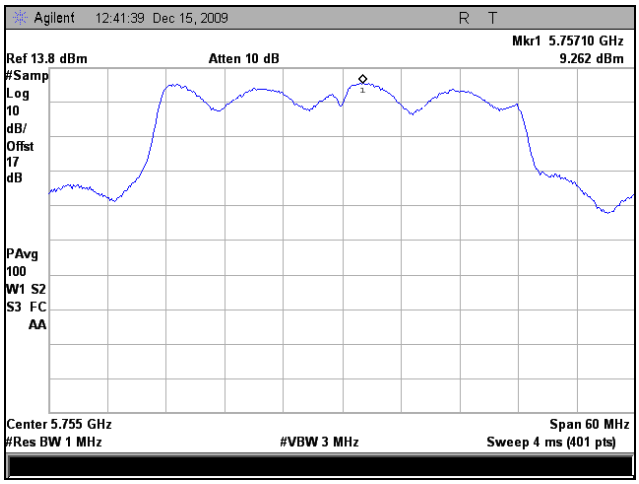


Plot 63. PPSD, Combined Ports, 802.11n 20MHz, 5785 MHz

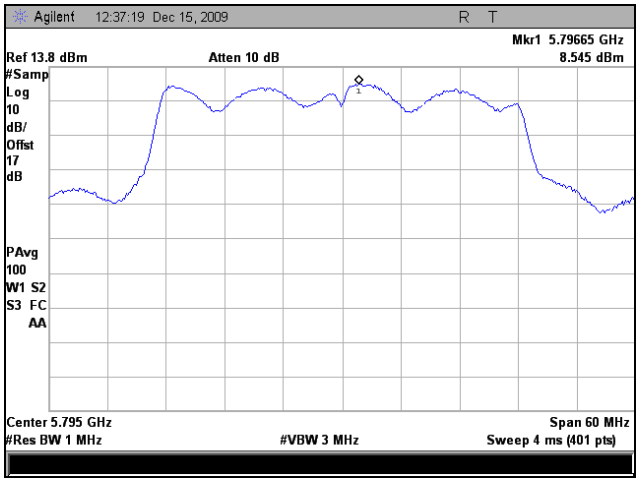


Plot 64. PPSD, Combined Ports, 802.11n 20MHz, 5805 MHz

Peak Power Spectral Density, Combined Ports, 802.11n 40MHz



Plot 65. PPSD, Combined Ports, 802.11n 40MHz, 5755 MHz



Plot 66. PPSD, Combined Ports, 802.11n 40MHz, 5795 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(a)(6) Peak Excursion Ratio

Test Requirements: **§ 15.407(a)(6):** For digitally modulated systems, the peak excursion of the modulation envelope to the peak transmit power shall not exceed 13dB across any 1MHz bandwidth of the emission bandwidth whichever is less.

Test Procedure: The method of measurement #2 from the FCC Public Notice CA 02-2138 was used. The EUT was connected directly to the spectrum analyzer through cabling and attenuation. The 1st trace on the spectrum analyzer was set to RBW=1MHz, VBW=3MHz. The peak detector mode was used and the trace max held. The 2nd trace on the spectrum analyzer was set to a RBW=1MHz, VBW=30 KHz. The detector mode was set to sample detector.

The Peak Excursion Ratio was determined from the difference between the maximum found in each trace.

Test Results: Equipment complies with the peak excursion ratio limits of **§ 15.407(a)(6).** The peak excursion ratio was determined from plots on the following page(s).

Test Engineer(s): Anderson Soungpanya

Test Date(s): 12/17/09

Peak Excursion Ratio, Port 1					
Mode	**Frequency (MHz)**		**Excursion Ratio (dBm)**	**Limit (dBm)**	**Margin (dB)**
802.11a	U-NII-3	5745	9.492	13	3.508
		5785	10.09	13	2.91
		5805	8.461	13	4.539
802.11n 20MHz	U-NII-3	5745	10.24	13	2.76
		5785	10.82	13	2.18
		5805	9.787	13	3.213
802.11n 40MHz	U-NII-3	5755	12.26	13	0.74
		5795	11.42	13	1.58

Table 27. Peak Excursion Ration, Test Results, Port 1

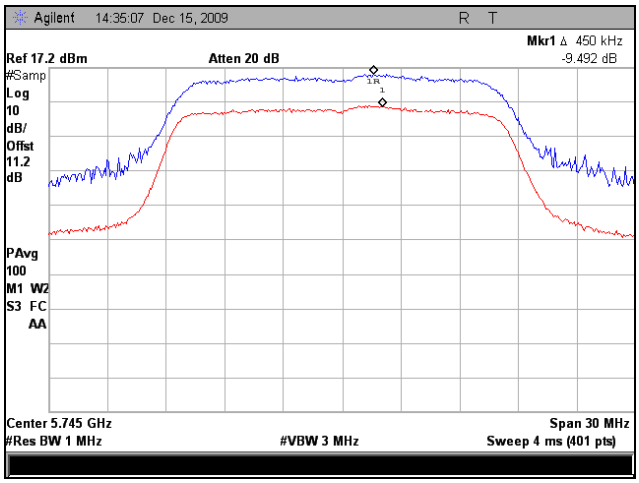
Peak Excursion Ratio, Port 2					
Mode	**Frequency (MHz)**		**Excursion Ratio (dBm)**	**Limit (dBm)**	**Margin (dB)**
802.11n 20MHz	U-NII-3	5745	11.14	13	1.86
		5785	9.76	13	3.24
		5805	10.67	13	2.33
802.11n 40MHz	U-NII-3	5755	11.23	13	1.77
		5795	12.02	13	0.98

Table 28. Peak Excursion Ration, Test Results, Port 2

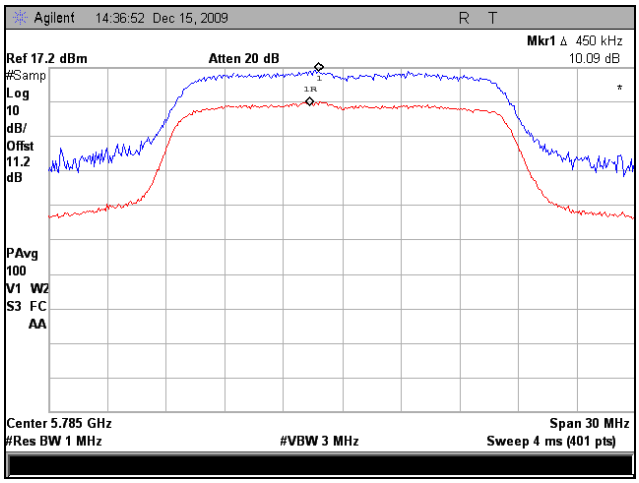
Peak Excursion Ratio, Port 3					
Mode	**Frequency (MHz)**		**Excursion Ratio (dBm)**	**Limit (dBm)**	**Margin (dB)**
802.11n 20MHz	U-NII-3	5745	10.48	13	2.52
		5785	10.59	13	2.41
		5805	10.7	13	2.3
802.11n 40MHz	U-NII-3	5755	12.64	13	0.36
		5795	12.4	13	0.6

Table 29. Peak Excursion Ration, Test Results, Port 3

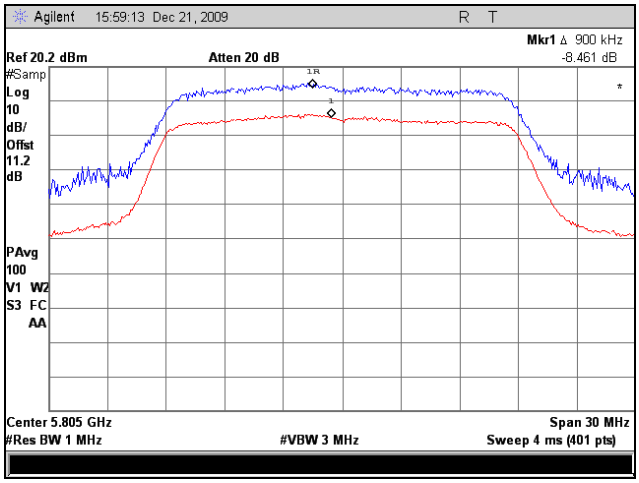
Peak Excursion Ratio, Port 1, 802.11a



Plot 67. Peak Excursion, Port 1, 802.11a, 5745 MHz

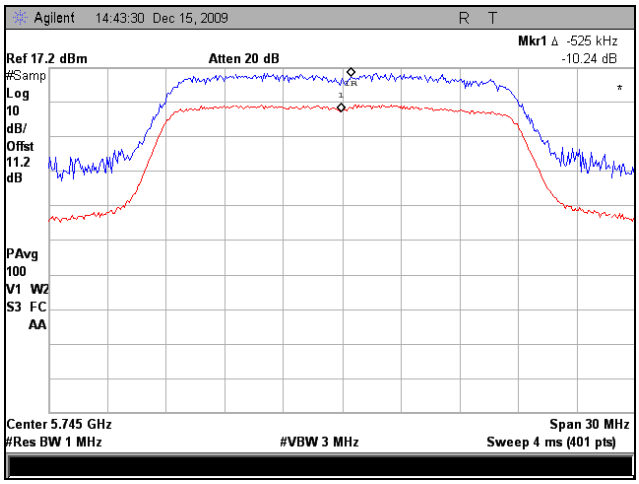


Plot 68. Peak Excursion, Port 1, 802.11a, 5785 MHz

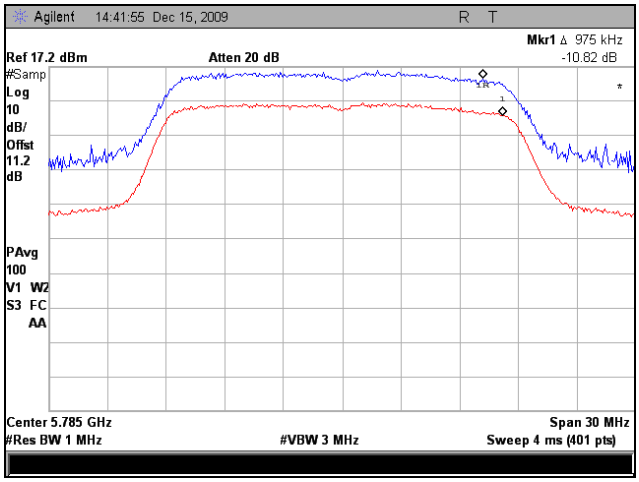


Plot 69. Peak Excursion, Port 1, 802.11a, 5805 MHz

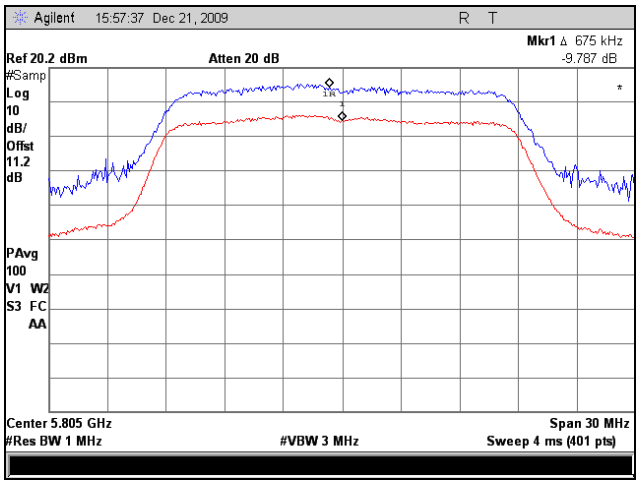
Peak Excursion Ratio, 7200 Outdoor, Port 1, 802.11n 20MHz



Plot 70. Peak Excursion, Port 1, 802.11n 20MHz, 5745 MHz

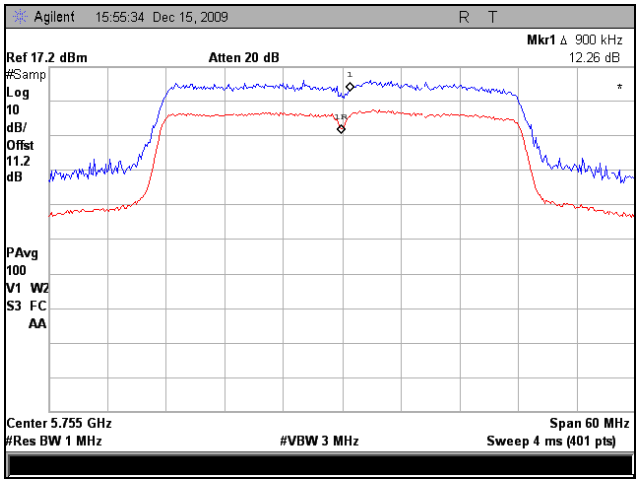


Plot 71. Peak Excursion, Port 1, 802.11n 20MHz, 5785 MHz

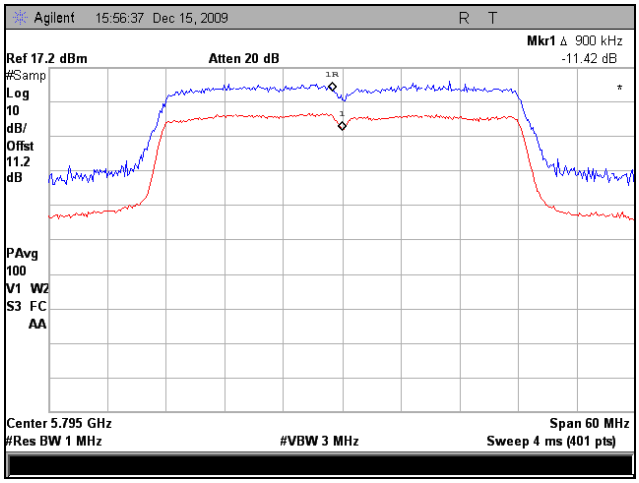


Plot 72. Peak Excursion, Port 1, 802.11n 20MHz, 5805 MHz

Peak Excursion Ratio, Port 1, 802.11n 40MHz

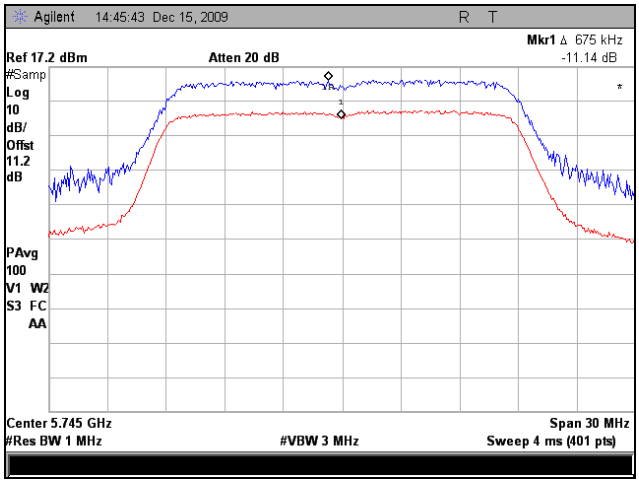


Plot 73. Peak Excursion, Port 1, 802.11n 40MHz, 5755 MHz

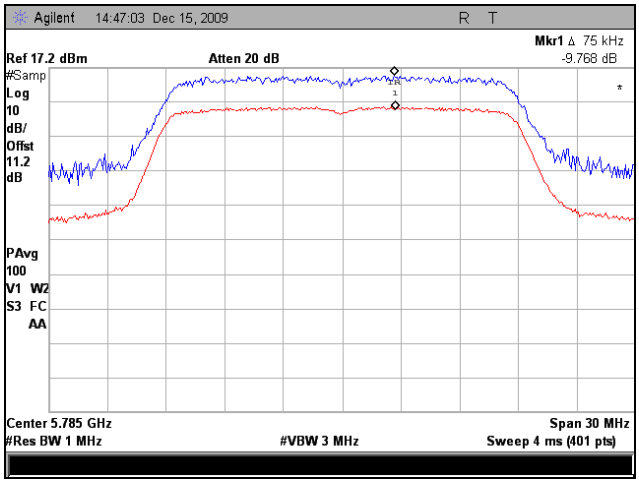


Plot 74. Peak Excursion, Port 1, 802.11n 40MHz, 5795 MHz

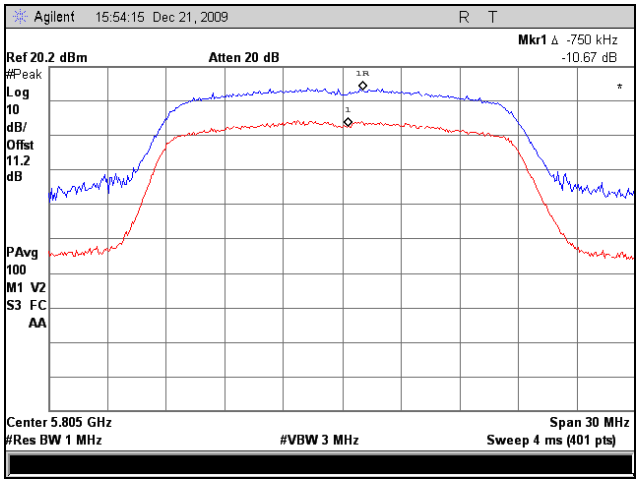
Peak Excursion Ratio, Port 2, 802.11n 20MHz



Plot 75. Peak Excursion, Port 2, 802.11n 20MHz, 5745 MHz

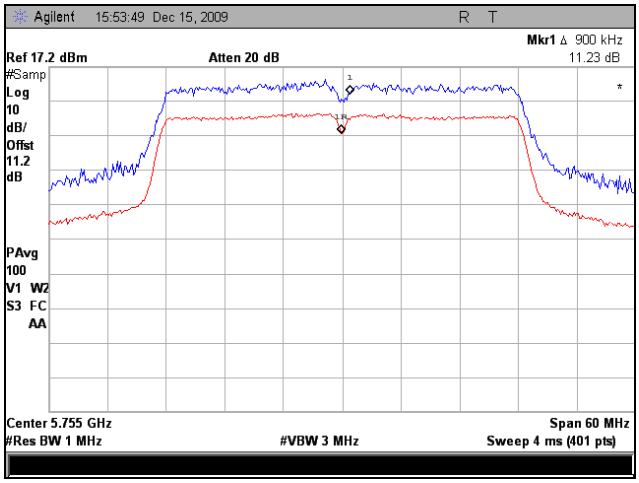


Plot 76. Peak Excursion, Port 2, 802.11n 20MHz, 5785 MHz

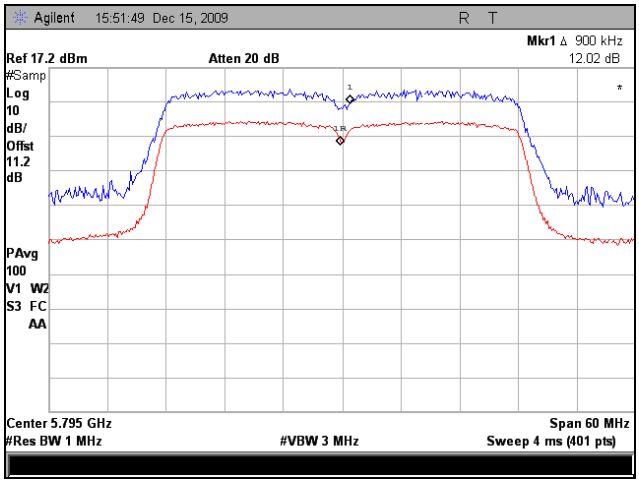


Plot 77. Peak Excursion, Port 2, 802.11n 20MHz, 5805 MHz

Peak Excursion Ratio, Port 2, 802.11n 40MHz

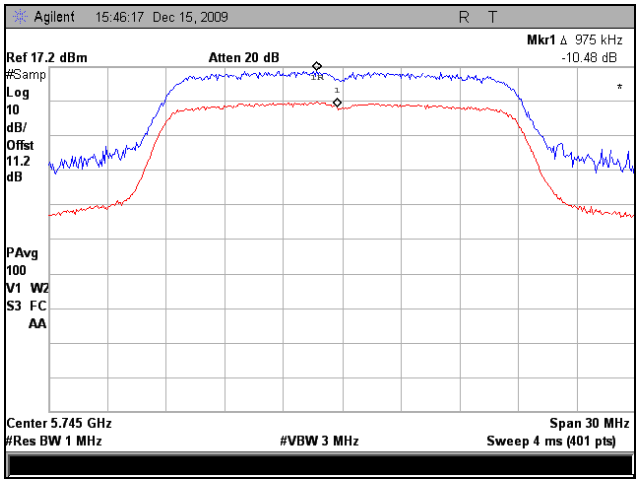


Plot 78. Peak Excursion, Port 2, 802.11n 40MHz, 5755 MHz

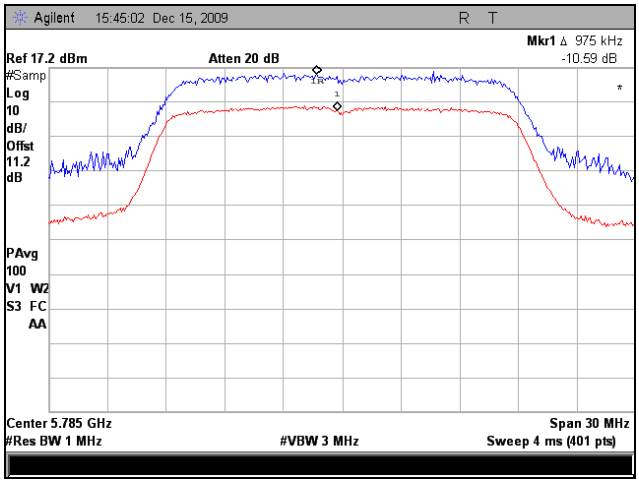


Plot 79. Peak Excursion, Port 2, 802.11n 40MHz, 5795 MHz

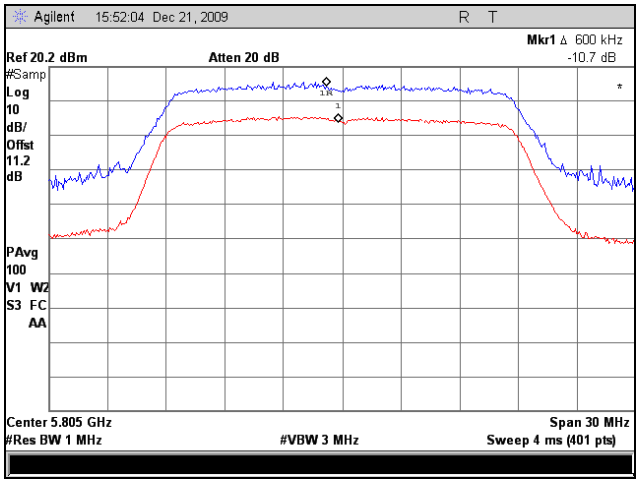
Peak Excursion Ratio, Port 3, 802.11n 20MHz



Plot 80. Peak Excursion, Port 3, 802.11n 20MHz, 5745 MHz

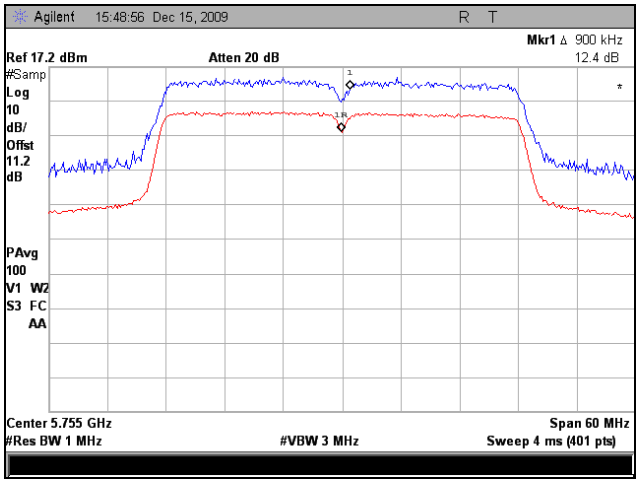


Plot 81. Peak Excursion, Port 3, 802.11n 20MHz, 5785 MHz

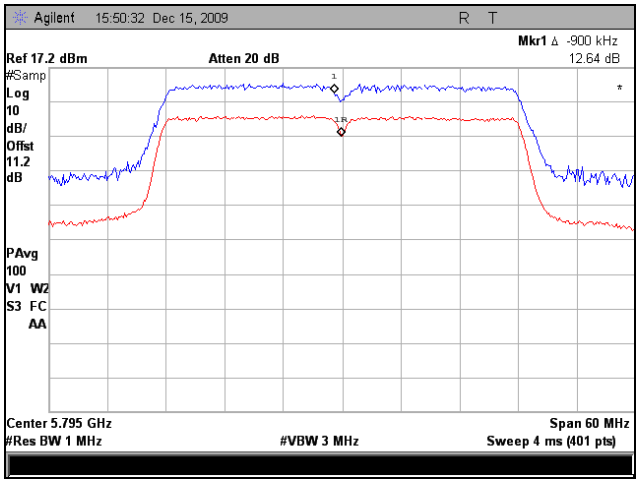


Plot 82. Peak Excursion, Port 3, 802.11n 20MHz, 5805 MHz

Peak Excursion Ratio, Port 3, 802.11n 40MHz



Plot 83. Peak Excursion, Port 3, 802.11n 40MHz, 5755 MHz



Plot 84. Peak Excursion, Port 3, 802.11n 40MHz, 5795 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(b)(1),(2), (5), (6) Undesirable Emissions

Test Requirements: **§ 15.407(b)(1),(2), (5), (6)**; **§15.205:** Emissions outside the frequency band.

§ 15.407(b)(1): In any 1MHz bandwidth outside the frequency band 5.15-5.25GHz in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power shall not exceed -27dBm.

§ 15.407(b)(2): In any 1MHz bandwidth outside the frequency band 5.25-5.35GHz in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power shall not exceed -27dBm.

§ 15.407(b)(4): In any 1MHz bandwidth outside the frequency band 5.725-5.825GHz in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power shall not exceed -17dBm.

§ 15.407(b)(6): 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 30. Restricted Bands of Operation

Test Procedure: The EUT was installed placed on a 0.8m-high wooden table inside a semi-anechoic chamber. The harmonic frequencies the carriers were recorded for reference for final measurements. A receiving horn antenna was placed 3m away from the EUT. Unless otherwise specified, measurements were made using 1MHz RBW & 1MHz VBW for peak measurements and 1MHz RBW & 10Hz VBW for average measurements on a spectrum analyzer.

For each harmonic of the carrier frequency, the turntable was rotated, the positions of the interface cables were varied, and the antenna height was varied between 1 m and 4 m, in order to find the maximum radiated emissions.

The equipment isotropic radiated power (EIRP) at -17dBm/MHz was converted to field strength at 78.26dBuV/m. At the band edge of each band, the EIRP energy measurement is integrated to show the total power over 1MHz.

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

Test Engineer(s): Anderson Soungpanya

Test Date(s): 12/17/09

Electromagnetic Compatibility Criteria for Intentional Radiators

Harmonic Emissions Requirements – Radiated (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)	Distance Correction Factor 1m to 3m (dBuV/m)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.49	V	45.53	34.86	30.43	7.72	-9.54	39.28	Peak	74	-34.72
11.49	V	32.23	34.86	30.43	7.72	-9.54	25.98	Avg.	54	-28.02
17.235	V	45.41	34.01	32.19	10.17	-9.54	44.22	Peak	74	-29.78
17.235	V	31.58	34.01	32.19	10.17	-9.54	30.39	Avg.	54	-23.61

Table 31. Radiated Harmonics, 802.11a, 19 dBi Panel, 5745 MHz

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)	Distance Correction Factor 1m to 3m (dBuV/m)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.57	V	45.29	34.91	30.50	7.63	-9.54	38.97	Peak	74	-35.03
11.57	V	31.29	34.91	30.50	7.63	-9.54	24.97	Avg.	54	-29.03
17.355	V	44.85	33.93	32.15	10.33	-9.54	43.86	Peak	74	-30.14
17.355	V	31.02	33.93	32.15	10.33	-9.54	30.03	Avg.	54	-23.97

Table 32. Radiated Harmonics, 802.11a, 19 dBi Panel, 5785 MHz

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)	Distance Correction Factor 1m to 3m (dBuV/m)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.61	V	47.38	34.93	30.53	7.54	-9.54	40.98	Peak	74	-33.02
11.61	V	33.02	34.93	30.53	7.54	-9.54	26.62	Avg.	54	-27.38
17.415	V	44.11	33.91	32.14	10.42	-9.54	43.23	Peak	74	-30.77
17.415	V	31.93	33.91	32.14	10.42	-9.54	31.05	Avg.	54	-22.95

Table 33. Radiated Harmonics, 802.11a, 19 dBi Panel, 5805 MHz

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

Harmonic Emissions Requirements – Radiated (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)	Distance Correction Factor 1m to 3m (dBuV/m)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.49	V	47.33	34.86	30.43	7.72	-9.54	41.08	Peak	74	-32.92
11.49	V	32.84	34.86	30.43	7.72	-9.54	26.59	Avg.	54	-27.41
17.235	V	45.21	34.01	32.19	10.17	-9.54	44.02	Peak	74	-29.98
17.235	V	31.72	34.01	32.19	10.17	-9.54	30.53	Avg.	54	-23.47

Table 34. Radiated Harmonics, 802.11n 20MHz, 19 dBi Panel, 5745 MHz

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)	Distance Correction Factor 1m to 3m (dBuV/m)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.57	V	45.23	34.91	30.50	7.63	-9.54	38.91	Peak	74	-35.09
11.57	V	32.12	34.91	30.50	7.63	-9.54	25.80	Avg.	54	-28.20
17.355	V	44.45	33.93	32.15	10.33	-9.54	43.46	Peak	74	-30.54
17.355	V	31.74	33.93	32.15	10.33	-9.54	30.75	Avg.	54	-23.25

Table 35. Radiated Harmonics, 802.11n 20MHz, 19 dBi Panel, 5785 MHz

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)	Distance Correction Factor 1m to 3m (dBuV/m)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.61	V	48.49	34.93	30.53	7.54	-9.54	42.09	Peak	74	-31.91
11.61	V	33.34	34.93	30.53	7.54	-9.54	26.94	Avg.	54	-27.06
17.415	V	44.14	33.91	32.14	10.42	-9.54	43.26	Peak	74	-30.74
17.415	V	31.26	33.91	32.14	10.42	-9.54	30.38	Avg.	54	-23.62

Table 36. Radiated Harmonics, 802.11n 20MHz, 19 dBi Panel, 5805 MHz

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

Harmonic Emissions Requirements – Radiated (802.11n 40MHz)

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	Distance Correction Factor 1m to 3m (dBuV/m)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.51	V	45.2	34.88	30.44	7.71	-9.54	38.94	Peak	74	-35.06
11.51	V	31.95	34.88	30.44	7.71	-9.54	25.69	Avg.	54	-28.31
17.265	V	45.92	33.98	32.18	10.21	-9.54	44.78	Peak	74	-29.22
17.265	V	31.57	33.98	32.18	10.21	-9.54	30.43	Avg.	54	-23.57

Table 37. Radiated Harmonics, 802.11n 40MHz, 19 dBi Panel, 5755 MHz

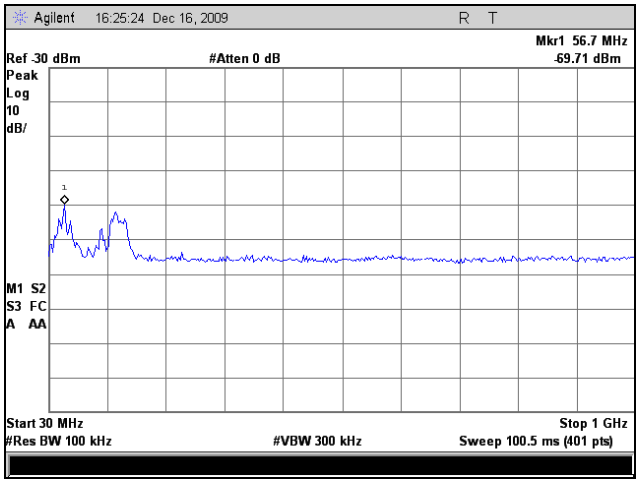
Note: All other emissions were measured at the noise floor of the spectrum analyzer.

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	Distance Correction Factor 1m to 3m (dBuV/m)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.59	V	45.25	34.92	30.51	7.59	-9.54	38.89	Peak	74	-35.11
11.59	V	31.62	34.92	30.51	7.59	-9.54	25.26	Avg.	54	-28.74
17.385	V	44.45	33.92	32.15	10.38	-9.54	43.51	Peak	74	-30.49
17.385	V	31.66	33.92	32.15	10.38	-9.54	30.72	Avg.	54	-23.28

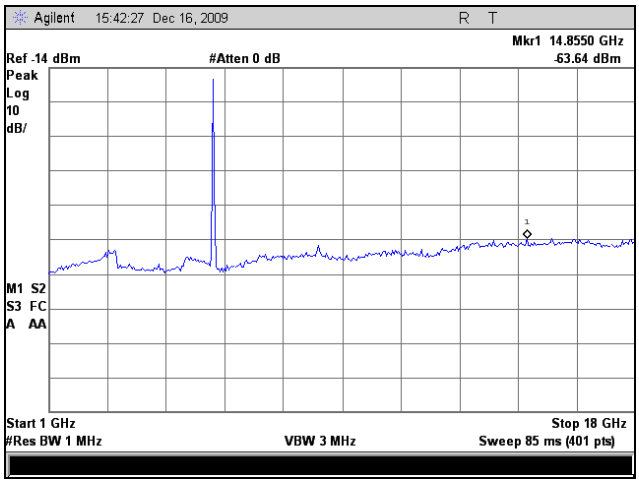
Table 38. Radiated Harmonics, 802.11n 40MHz, 19 dBi Panel, 5795 MHz

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

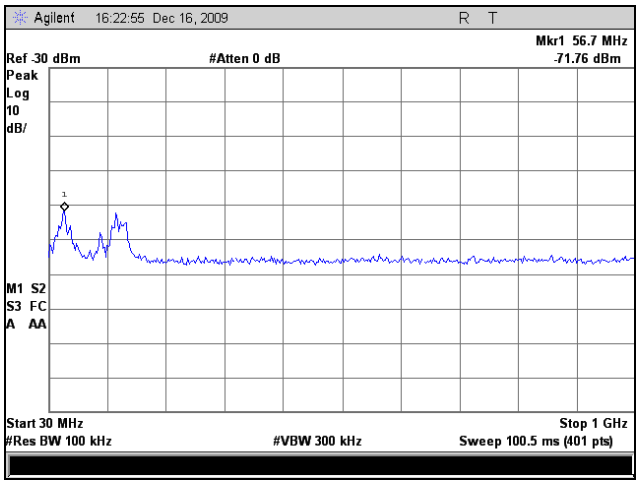
§ 15.209 Radiated Emissions Limits, 802.11a



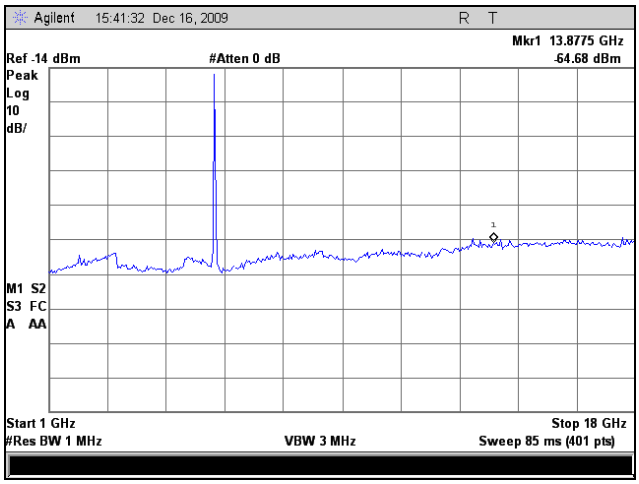
Plot 85. Radiated Spurious, 802.11a, 5745 MHz, 30 MHz – 1 GHz, 19 dBi Panel



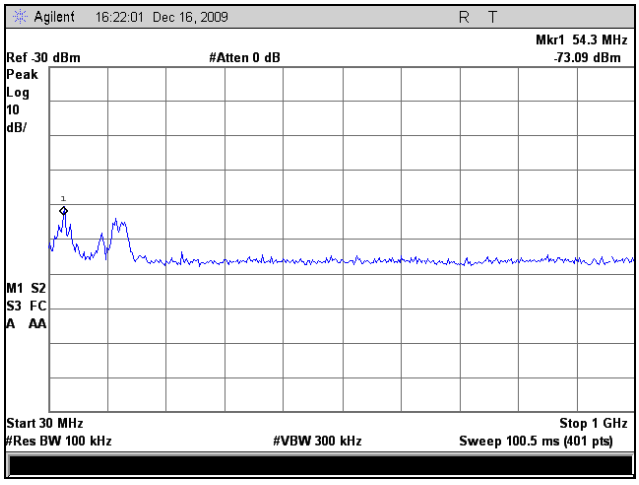
Plot 86. Radiated Spurious, 802.11a, 5745 MHz, 1 GHz – 18 GHz, 19 dBi Panel



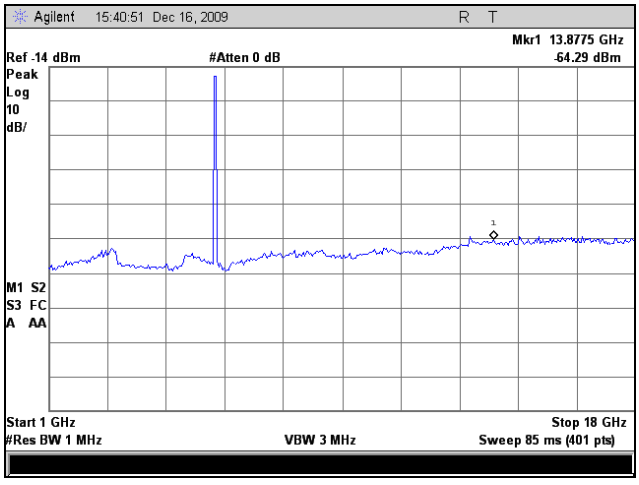
Plot 87. Radiated Spurious, 802.11a, 5785 MHz, 30 MHz – 1 GHz, 19 dBi Panel



Plot 88. Radiated Spurious, 802.11a, 5785 MHz, 1 GHz – 18 GHz, 19 dBi Panel

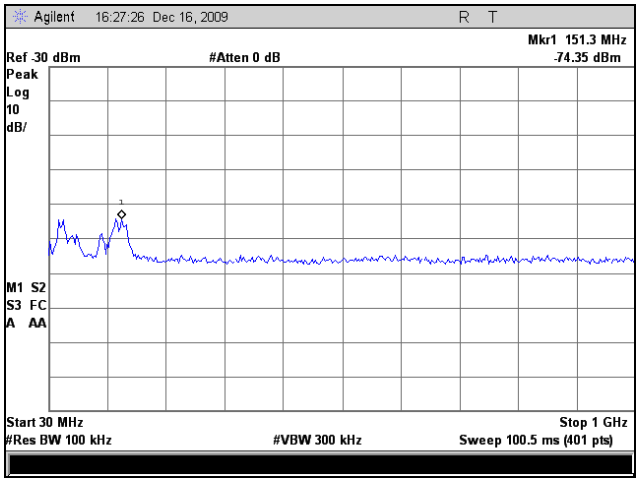


Plot 89. Radiated Spurious, 802.11a, 5805 MHz, 30 MHz – 1 GHz, 19 dBi Panel

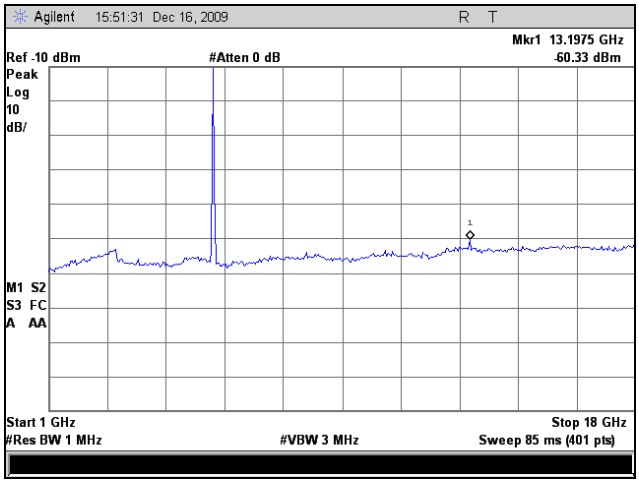


Plot 90. Radiated Spurious, 802.11a, 5805 MHz, 1 GHz – 18 GHz, 19 dBi Panel

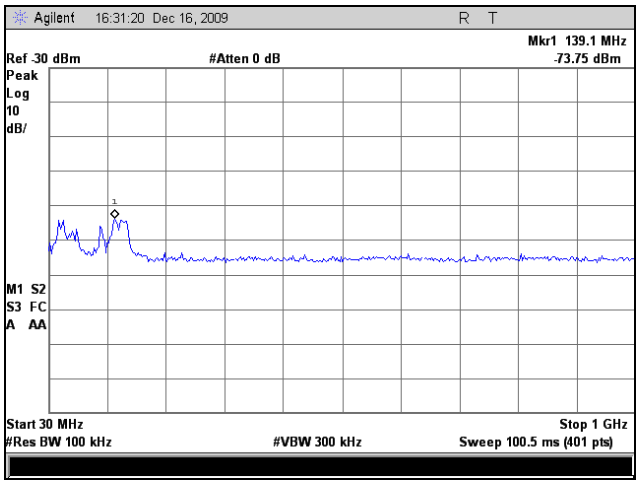
§ 15.209 Radiated Emissions Limits, 802.11n 20MHz



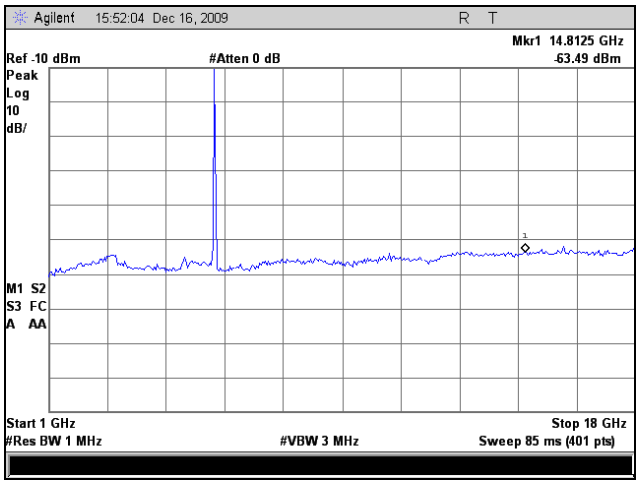
Plot 91. Radiated Spurious, 802.11n 20MHz, 5745 MHz, 30 MHz – 1 GHz, 19 dBi Panel



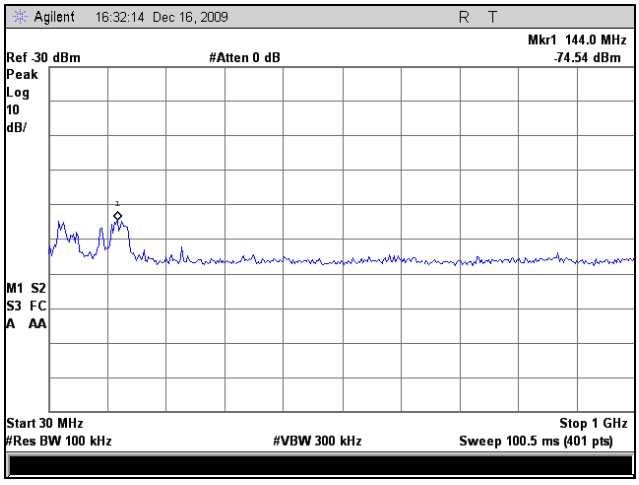
Plot 92. Radiated Spurious, 802.11n 20MHz, 5745 MHz, 1 GHz – 18 GHz, 19 dBi Panel



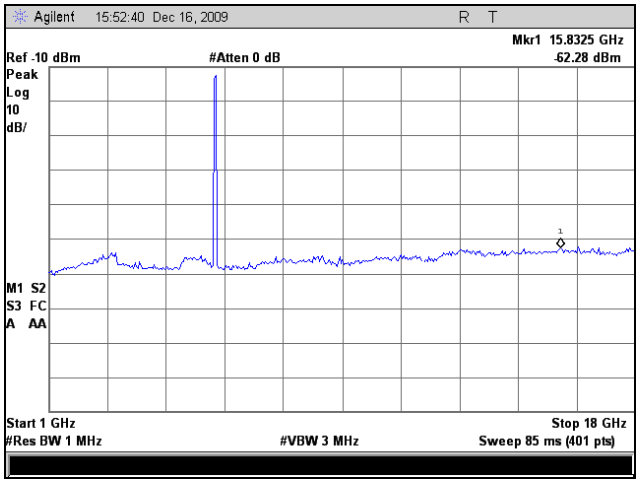
Plot 93. Radiated Spurious, 802.11n 20MHz, 5785 MHz, 30 MHz – 1 GHz, 19 dBi Panel



Plot 94. Radiated Spurious, 802.11n 20MHz, 5785 MHz, 1 GHz – 18 GHz, 19 dBi Panel

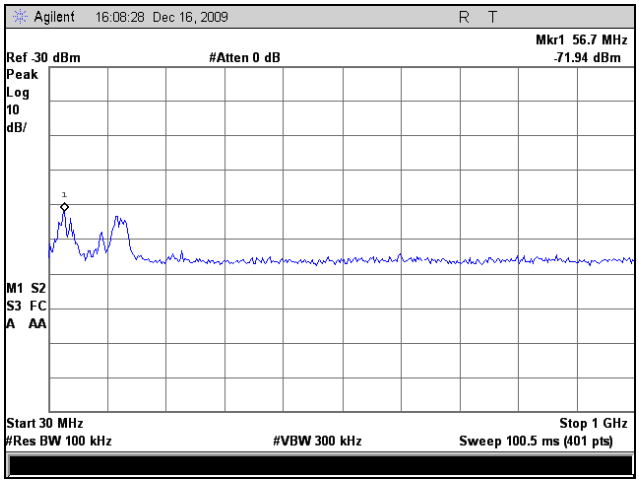


Plot 95. Radiated Spurious, 802.11n 20MHz, 5805 MHz, 30 MHz – 1 GHz, 19 dBi Panel

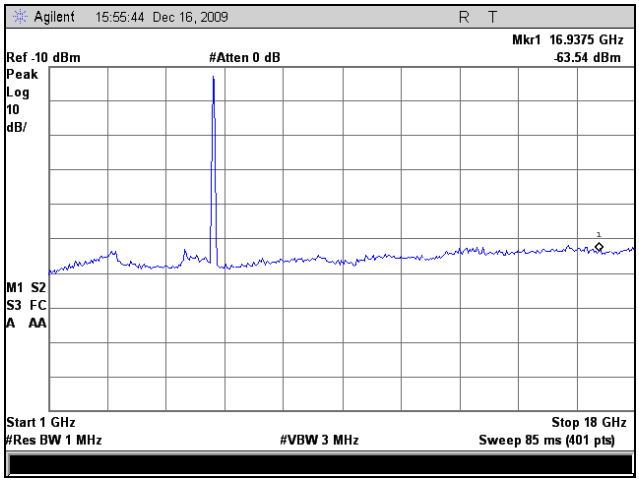


Plot 96. Radiated Spurious, 802.11n 20MHz, 5805 MHz, 1 GHz – 18 GHz, 19 dBi Panel

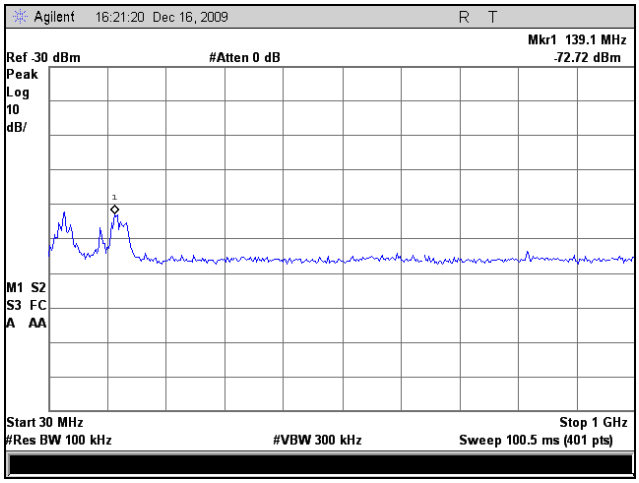
§ 15.209 Radiated Emissions Limits, 802.11n 40MHz



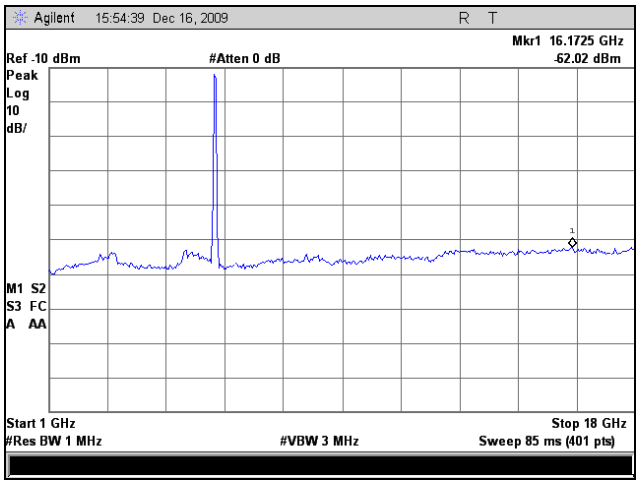
Plot 97. Radiated Spurious, 802.11n 40MHz, 5755 MHz, 30 MHz – 1 GHz, 19 dBi Panel



Plot 98. Radiated Spurious, 802.11n 40MHz, 5755 MHz, 1 GHz – 18 GHz, 19 dBi Panel



Plot 99. Radiated Spurious, 802.11n 40MHz, 5795 MHz, 30 MHz – 1 GHz, 19 dBi Panel



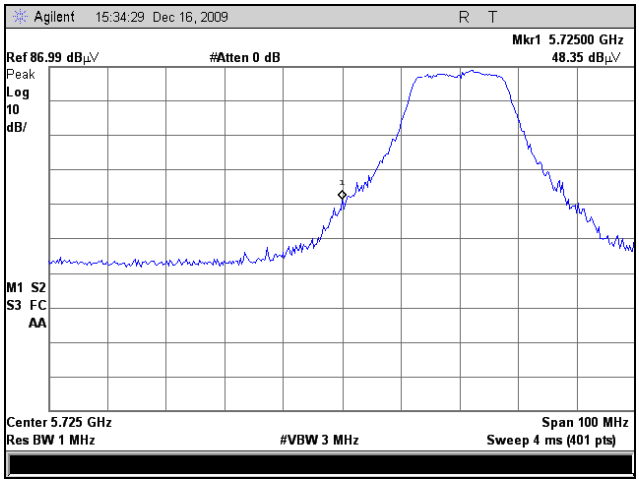
Plot 100. Radiated Spurious, 802.11n 40MHz, 5795 MHz, 1 GHz – 18 GHz, 19 dBi Panel

EIRP

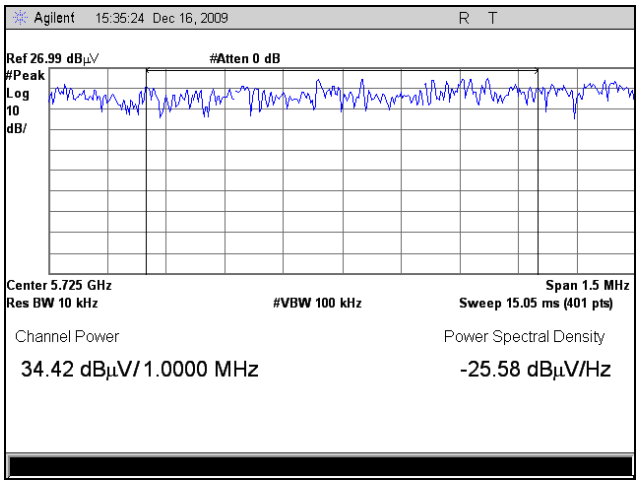
19dBi Panel Antenna								
a mode	**Frequency MHz**	**Uncorrected Peak (dBuV)**	**Cable Loss**	**ACF**	**DCF**	**Corrected**	**Limit (dBuV/m)**	**Margin**
	5745	34.42	7.51	35	9.54	67.39	78.26	-10.87
	5805	32.19	7.83	35	9.54	65.48	78.26	-12.78
HT 20	**Frequency MHz**	**Uncorrected Peak (dBuV)**	**Cable Loss**	**ACF**	**DCF**	**Corrected**	**Limit (dBuV/m)**	**Margin**
	5745	42.28	7.51	35	9.54	75.25	78.26	-3.01
	5805	41.37	7.83	35	9.54	74.66	78.26	-3.6
HT 40	**Frequency MHz**	**Uncorrected Peak (dBuV)**	**Cable Loss**	**ACF**	**DCF**	**Corrected**	**Limit (dBuV/m)**	**Margin**
	5755	43.8	7.51	35	9.54	76.77	78.26	-1.49
	5795	44.13	7.83	35	9.54	77.42	78.26	-0.84

Table 39. EIRP Calculation, 19 dBi Panel

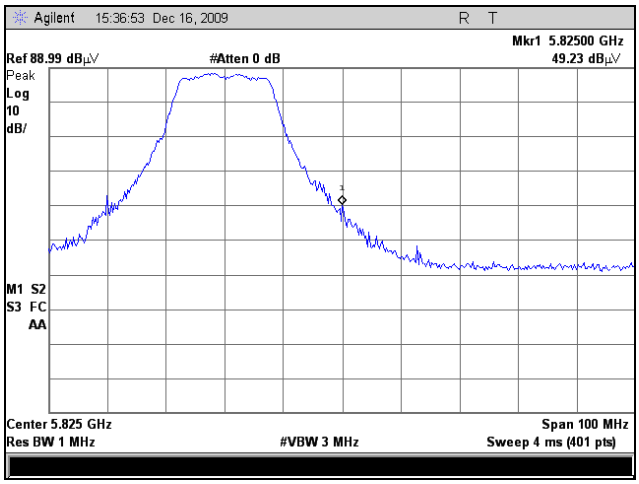
Note: EIRP Limit -17dBm/MHz = 78.26 dBuV/m



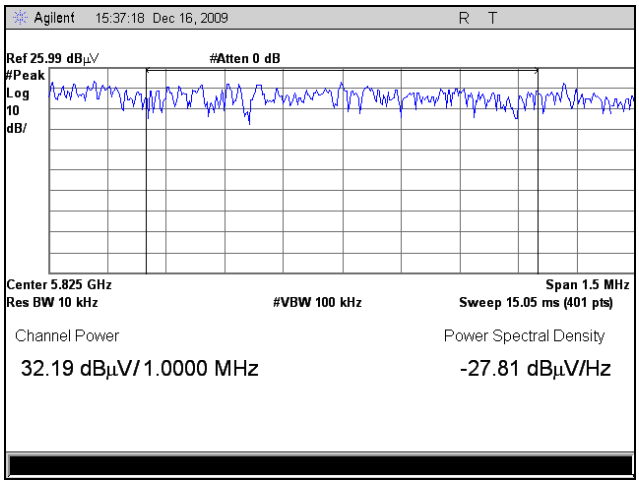
Plot 101. EIRP, 802.11a, Low Channel, 5745 MHz, 19 dBi Panel



Plot 102. EIRP, 802.11a, Low Channel, 5745 MHz Over 1 MHz, 19 dBi Panel

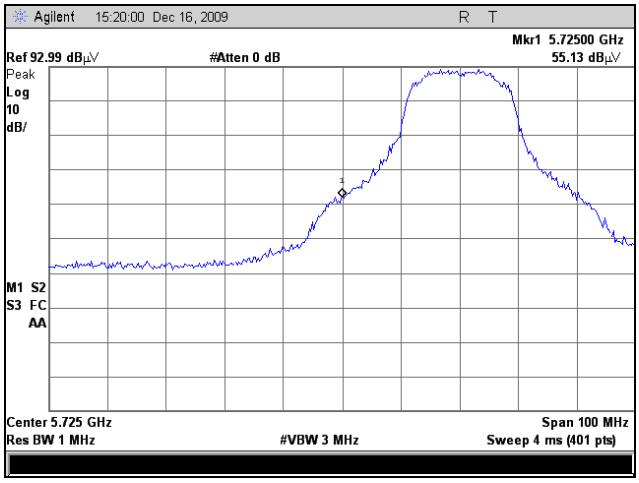


Plot 103. EIRP, 802.11a, High Channel, 5805 MHz, 19 dBi Panel

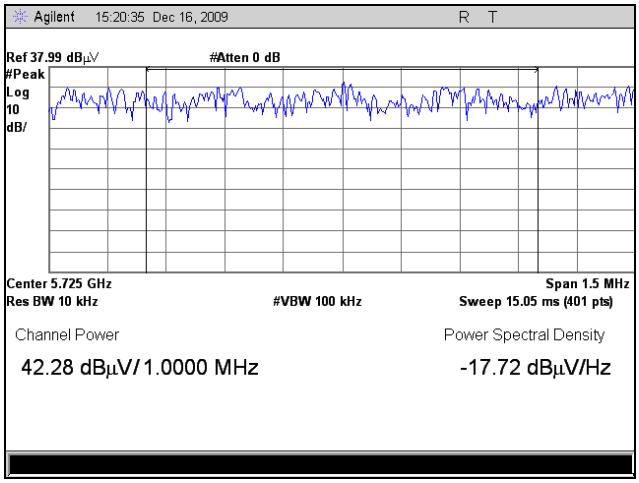


Plot 104. EIRP, 802.11a, High Channel, 5805 MHz Over 1 MHz, 19 dBi Panel

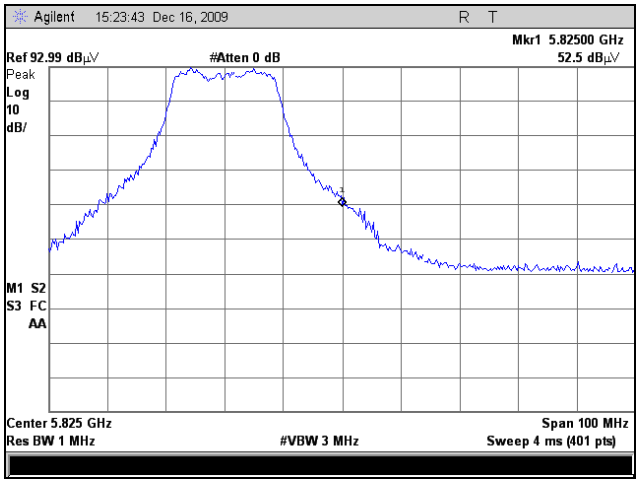
EIRP, 802.11n 20MHz



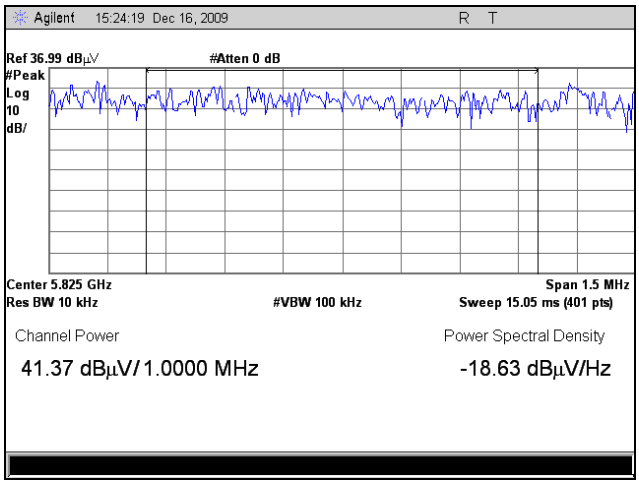
Plot 105. EIRP, 802.11n 20MHz, Low Channel, 5745 MHz, 19 dBi Panel



Plot 106. EIRP, 802.11n 20MHz, Low Channel, 5745 MHz Over 1 MHz, 19 dBi Panel

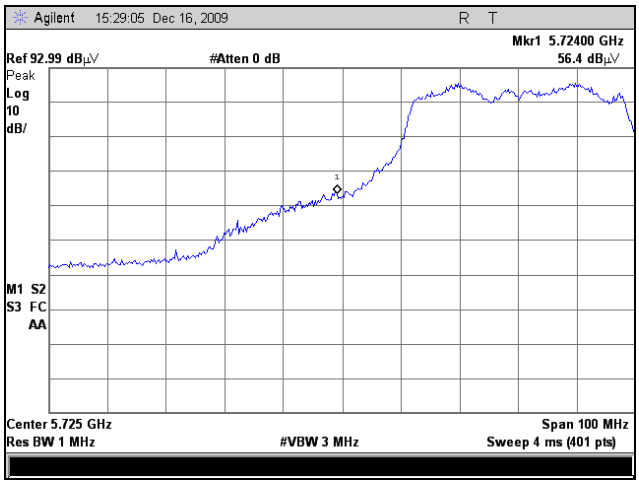


Plot 107. EIRP, 802.11n 20MHz, High Channel, 5805 MHz, 19 dBi Panel

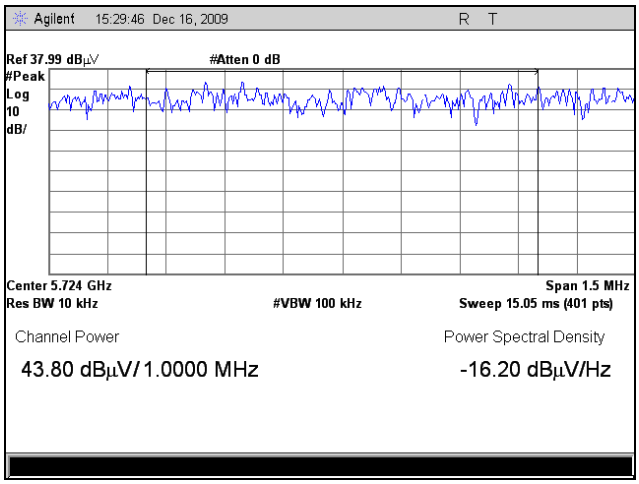


Plot 108. EIRP, 802.11n 20MHz, High Channel, 5805MHz Over 1 MHz, 19 dBi Panel

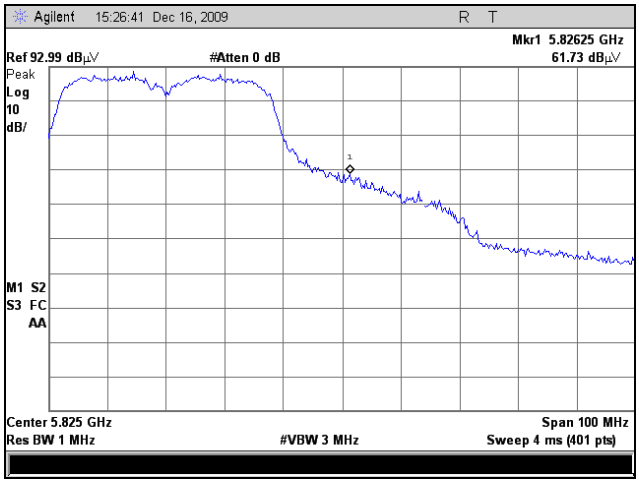
EIRP, 802.11n 40MHz



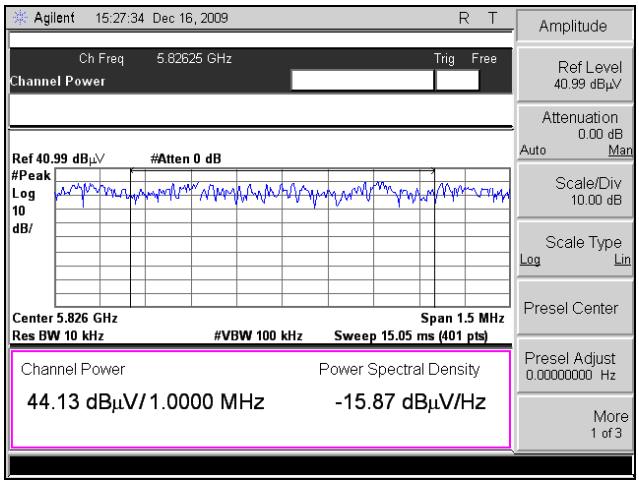
Plot 109. EIRP, 802.11n 40MHz, Low Channel, 5755 MHz, 19 dBi Panel



Plot 110. EIRP, 802.11n 40MHz, Low Channel, 5755 MHz Over 1 MHz, 19 dBi Panel



Plot 111. EIRP, 802.11n 40MHz, High Channel, 5795 MHz, 19 dBi Panel



Plot 112. EIRP, 802.11n 40MHz, High Channel, 5795 MHz Over 1 MHz, 19 dBi Panel

Photograph 8. Test Equipment and Setup for Various Radiated Measurements, 19 dBi Panel

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(f) RF Exposure

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

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

MPE Limit Calculation: EUT's operating frequencies @ 5745-5805MHz; highest conducted power = 22.78dBm (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

EUT maximum antenna gain = **19dBi Panel.**

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 (189.6mW)
G = Antenna Gain (79.432 numeric)

$R = (189.6*79.432 / 4*3.14*1.0)^{1/2} = (15066.07/ 12.56)^{1/2}$ = **34.63cm**

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(g) Frequency Stability

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

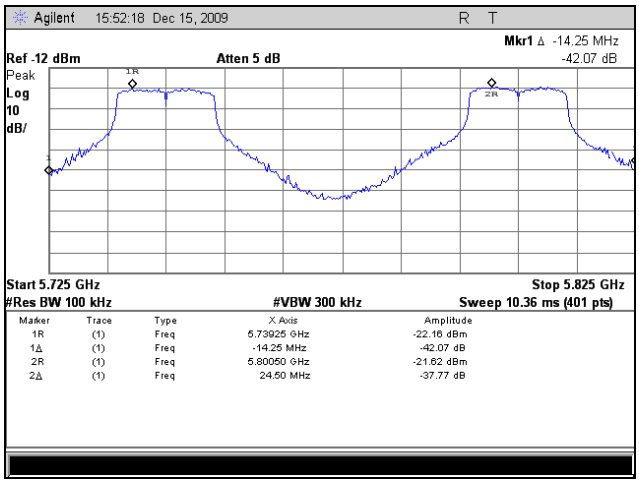
Test Procedure: The EUT was placed in an environmental chamber and the RF port was connected directly to a spectrum analyzer through an attenuator. Depending on which band was being investigated, the EUT was set to transmit at the low, mid, and high with the appropriate power level. If the EUT was capable of transmitting a CW carrier then the spectrum analyzer's frequency counting function was used to measure the actual frequency. If only a modulated carrier was available then the frequency relative to -10dBc above and below the carrier was measured and the carrier frequency was determined using (f1+f2)/2. The frequency of the carrier was measured at normal and extreme conditions with the temperature range of -40°C to +60°C .

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

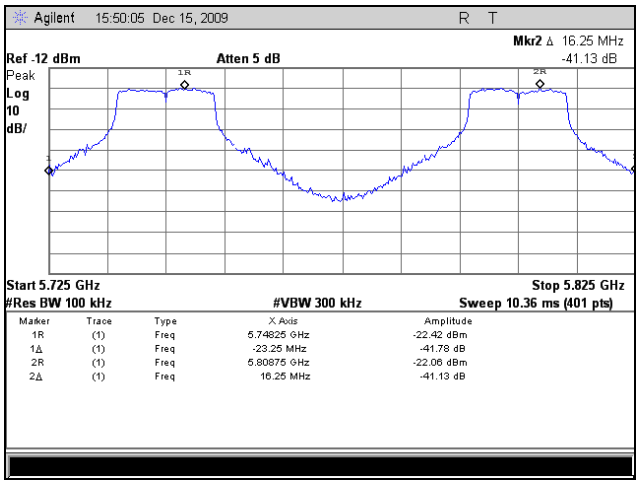
Test Engineer(s): 12/17/09

Test Date(s): Anderson Soungpanya

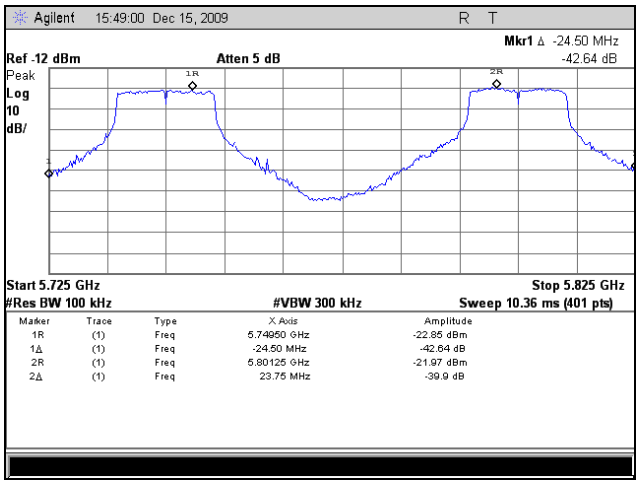
Frequency Stability, 802.11a



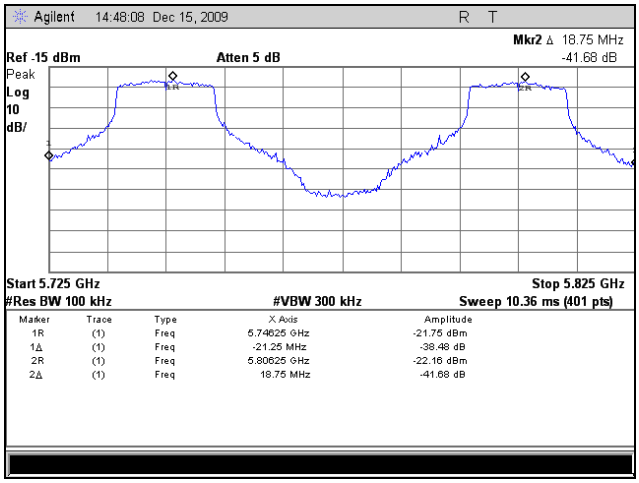
Plot 113. Frequency Stability, 802.11a 20MHz Bandwidth, -40C, 108 VAC



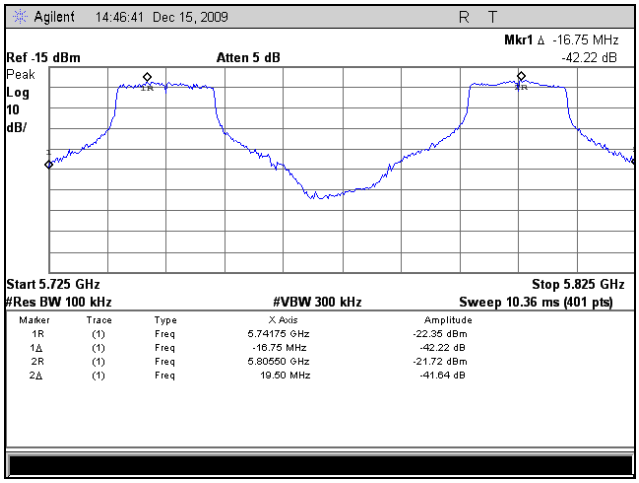
Plot 114. Frequency Stability, 802.11a 20MHz Bandwidth, -40C, 120 VAC



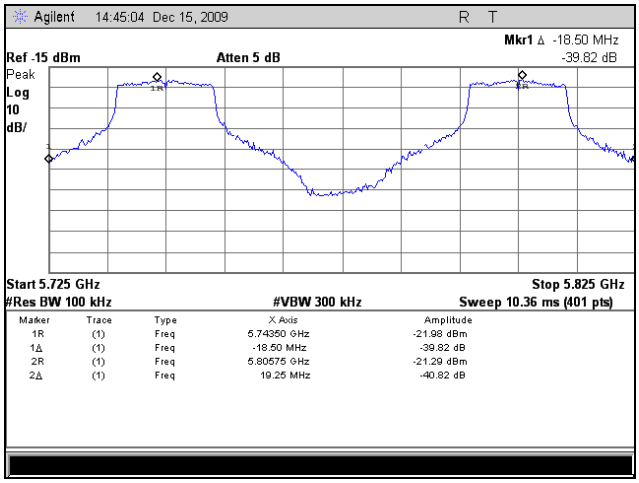
Plot 115. Frequency Stability, 802.11a 20MHz Bandwidth, -40C, 132 VAC



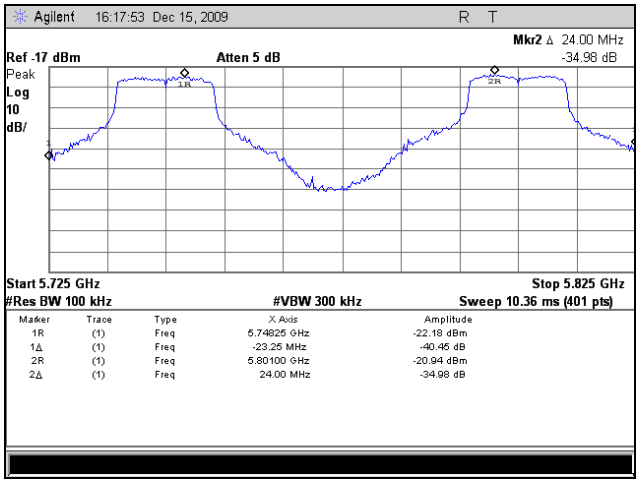
Plot 116. Frequency Stability, 802.11a 20MHz Bandwidth, 20C, 108 VAC



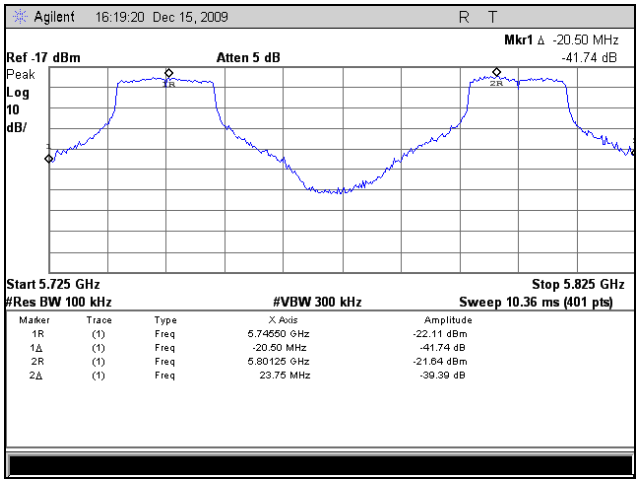
Plot 117. Frequency Stability, 802.11a 20MHz Bandwidth, 20C, 120 VAC



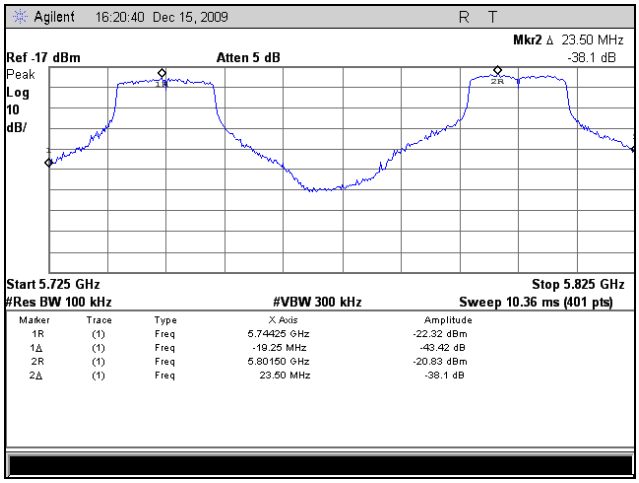
Plot 118. Frequency Stability, 802.11a 20MHz Bandwidth, 20C, 132 VAC



Plot 119. Frequency Stability, 802.11a 20MHz Bandwidth, 60C, 108 VAC

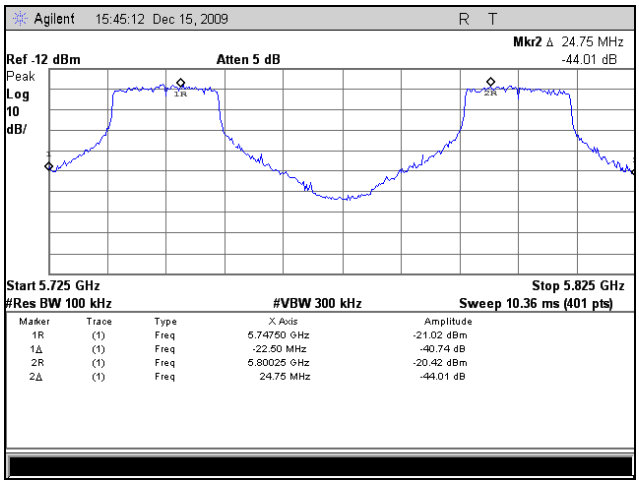


Plot 120. Frequency Stability, 802.11a 20MHz Bandwidth, 60C, 120 VAC

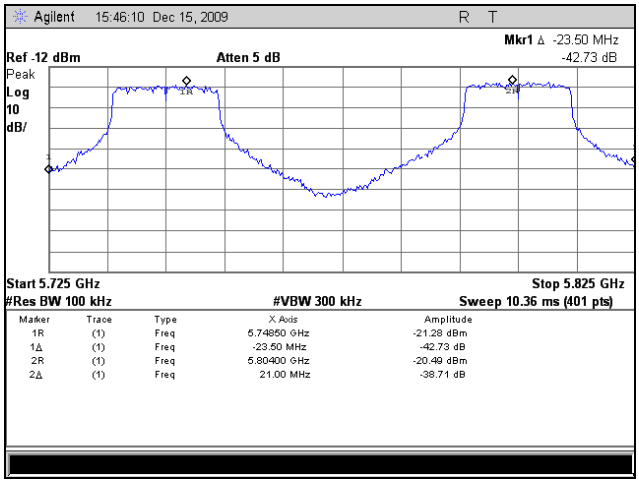


Plot 121. Frequency Stability, 802.11a 20MHz Bandwidth, 60C, 132 VAC

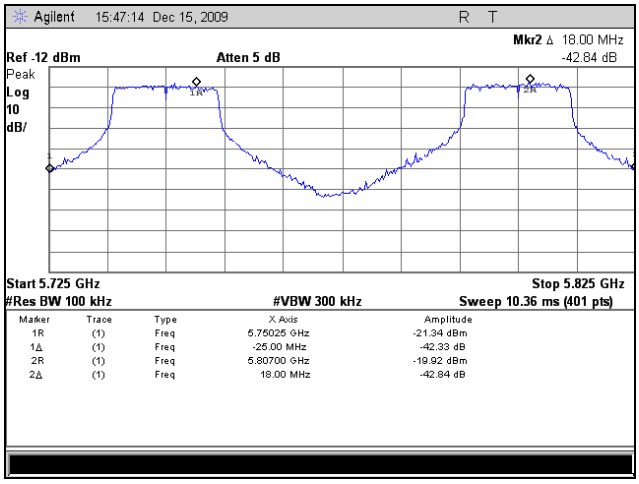
Frequency Stability, 802.11n 20 MHz



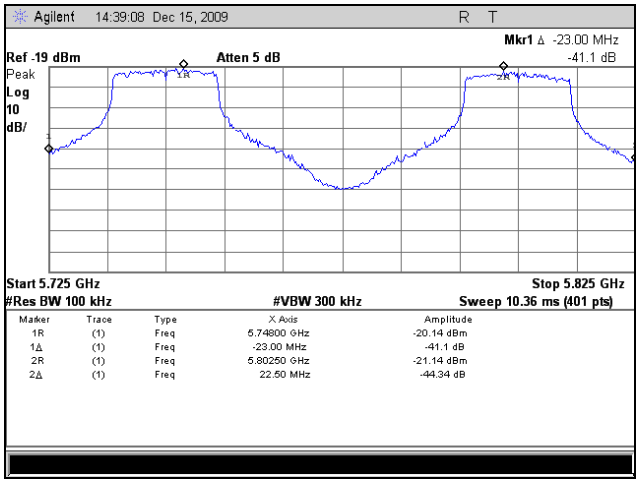
Plot 122. Frequency Stability, 802.11n 20MHz Bandwidth, -40C, 108 VAC



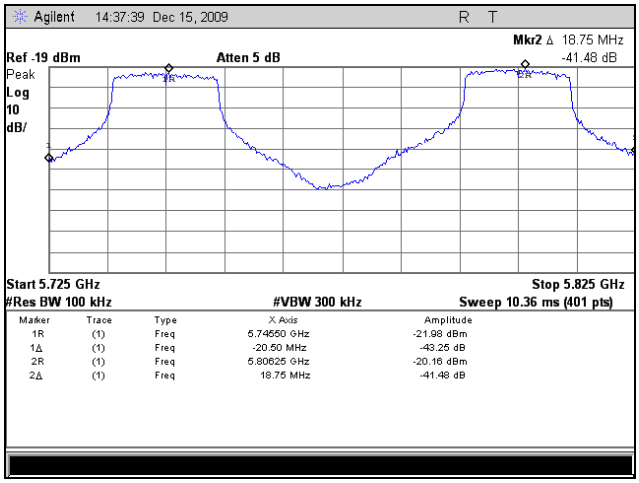
Plot 123. Frequency Stability, 802.11n 20MHz Bandwidth, -40C, 120 VAC



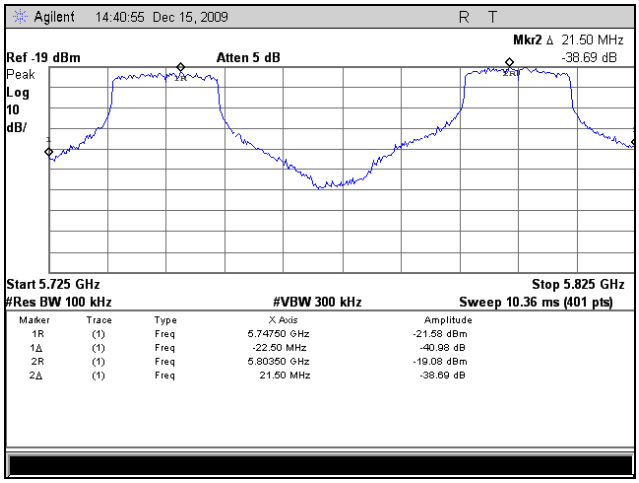
Plot 124. Frequency Stability, 802.11n 20MHz Bandwidth, -40C, 132 VAC



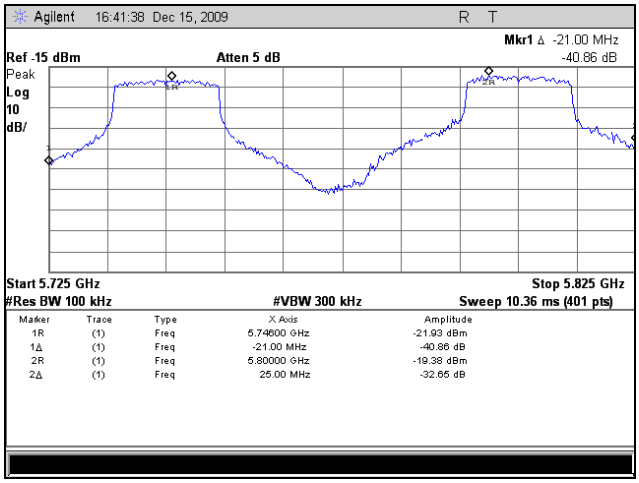
Plot 125. Frequency Stability, 802.11n 20MHz Bandwidth, 20C, 108 VAC



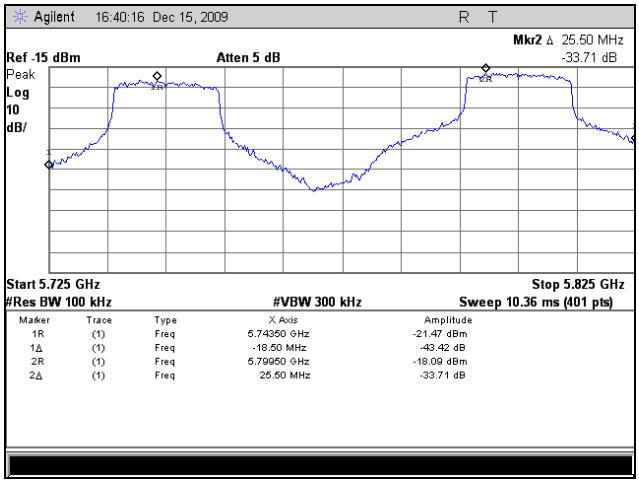
Plot 126. Frequency Stability, 802.11n 20MHz Bandwidth, 20C, 120 VAC



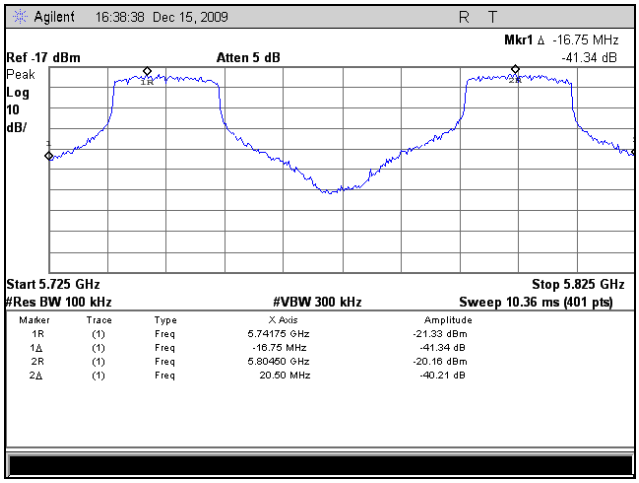
Plot 127. Frequency Stability, 802.11n 20MHz Bandwidth, 20C, 132 VAC



Plot 128. Frequency Stability, 802.11n 20MHz Bandwidth, 60C, 108 VAC

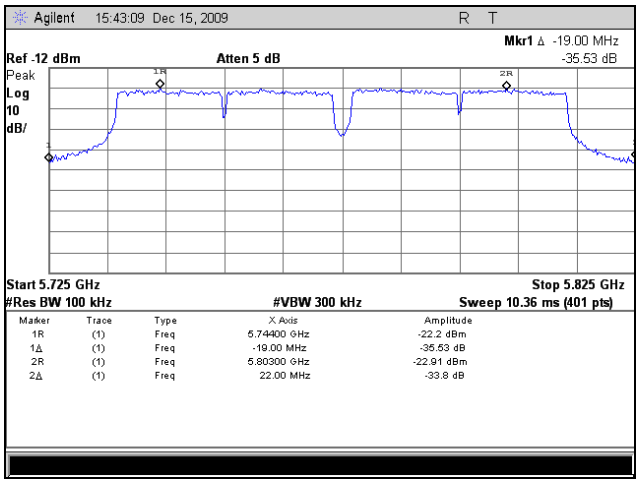


Plot 129. Frequency Stability, 802.11n 20MHz Bandwidth, 60C, 120 VAC

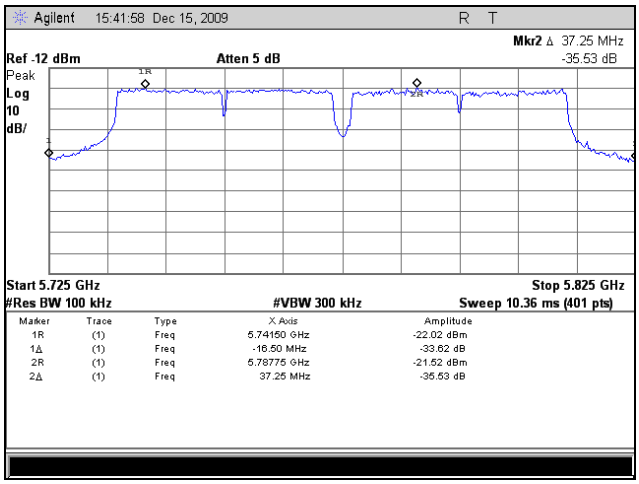


Plot 130. Frequency Stability, 802.11n 20MHz Bandwidth, 60C, 132 VAC

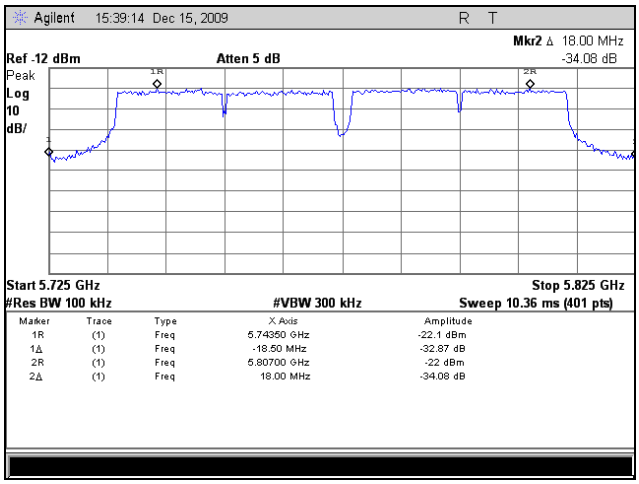
Frequency Stability, 802.11n 40MHz



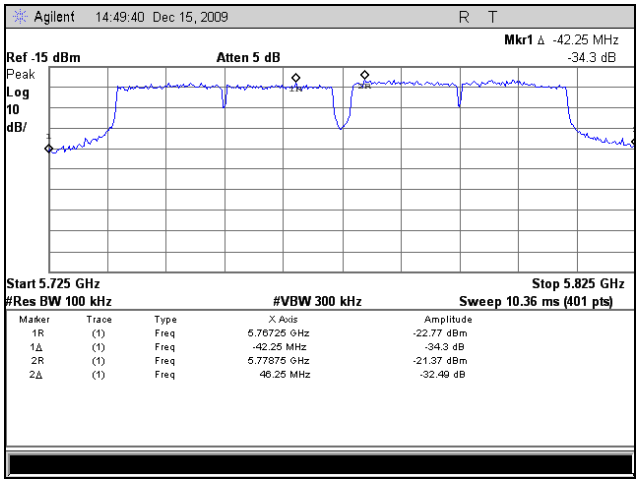
Plot 131. Frequency Stability, 802.11n 40MHz Bandwidth, -40C, 108 VAC



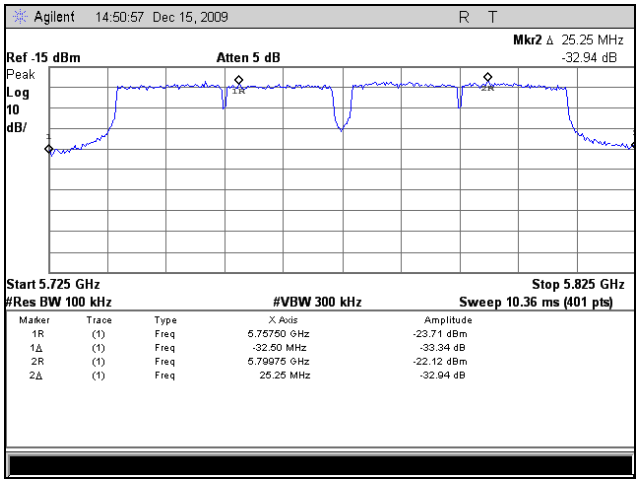
Plot 132. Frequency Stability, 802.11n 40MHz Bandwidth, -40C, 120 VAC



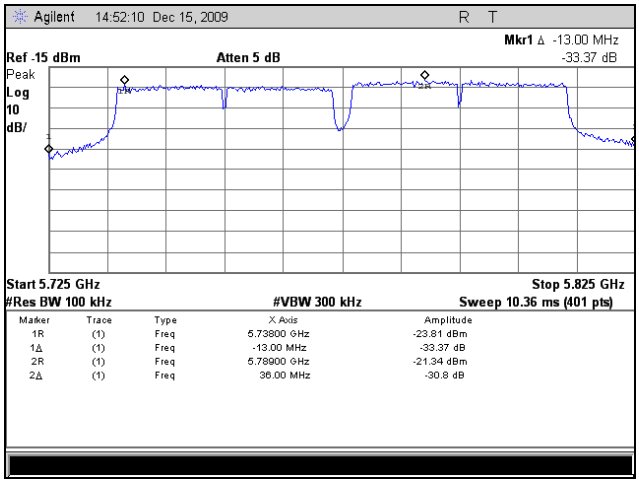
Plot 133. Frequency Stability, 802.11n 40MHz Bandwidth, -40C, 132 VAC



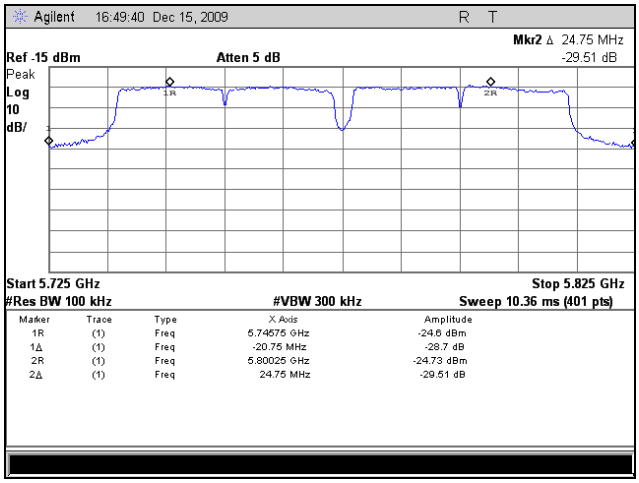
Plot 134. Frequency Stability, 802.11n 40MHz Bandwidth, 20C, 108 VAC



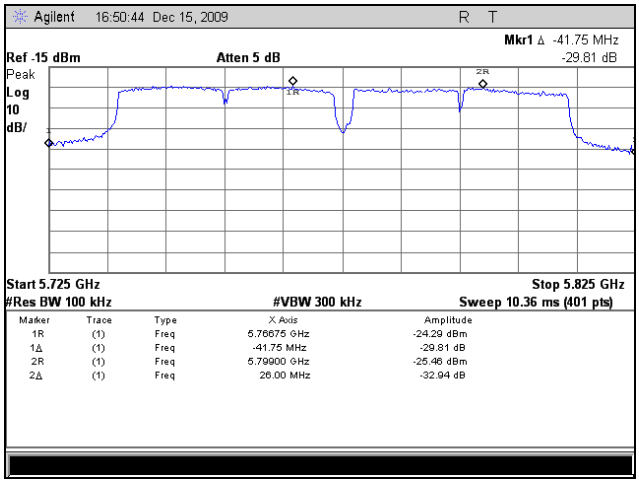
Plot 135. Frequency Stability, 802.11n 40MHz Bandwidth, 20C, 120 VAC



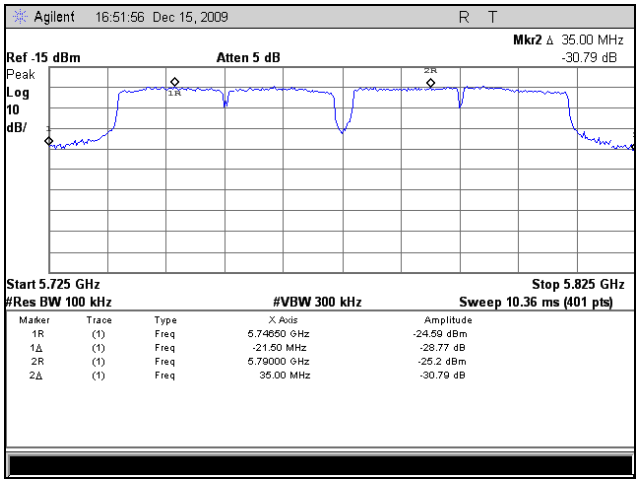
Plot 136. Frequency Stability, 802.11n 40MHz Bandwidth, 20C, 132 VAC



Plot 137. Frequency Stability, 802.11n 40MHz Bandwidth, 60C, 108 VAC



Plot 138. Frequency Stability, 802.11n 40MHz Bandwidth, 60C, 120 VAC



Plot 139. Frequency Stability, 802.11n 40MHz Bandwidth, 60C, 132 VAC

Electromagnetic Compatibility Criteria for Intentional Radiators

RSS-GEN Receiver Spurious Emissions

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 40.

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

Table 40. Spurious Emission Limits for Receivers

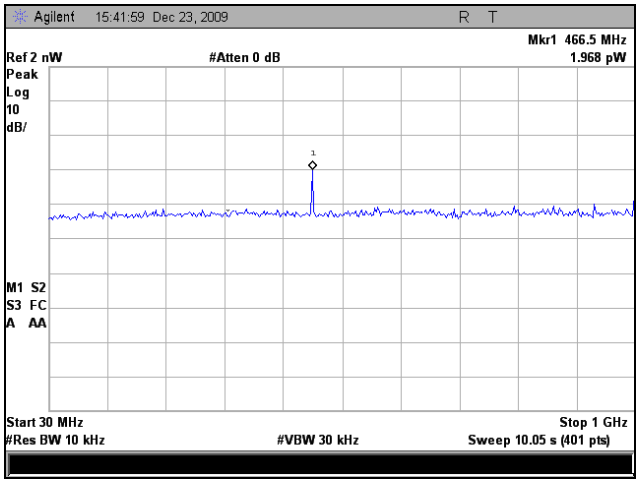
b) If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

Test Procedure: The receiver spurious emissions were tested in compliance with the limits of Table 12. The testing was performed conducted.

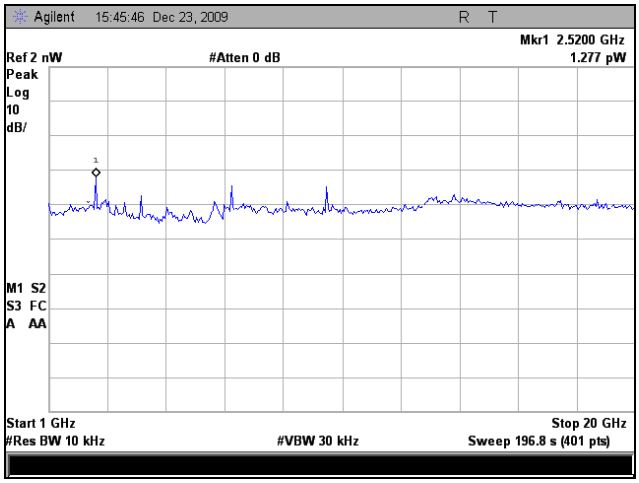
Test Results: The EUT was compliant with the Receiver Spurious Emission limits of this requirement.

Test Engineer(s): Anderson Soungpanya

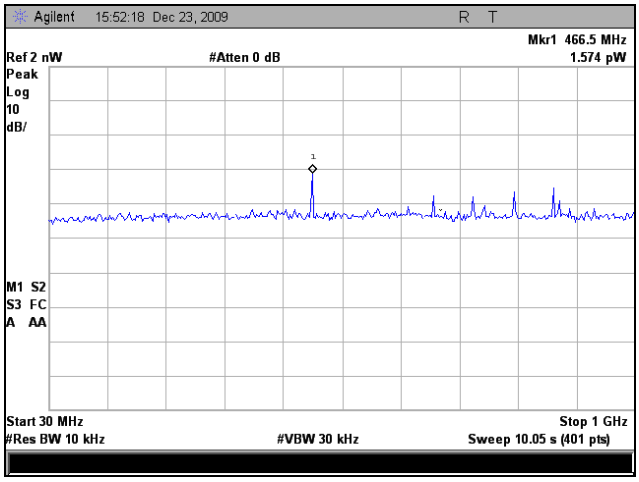
Test Date(s): 09/11/09



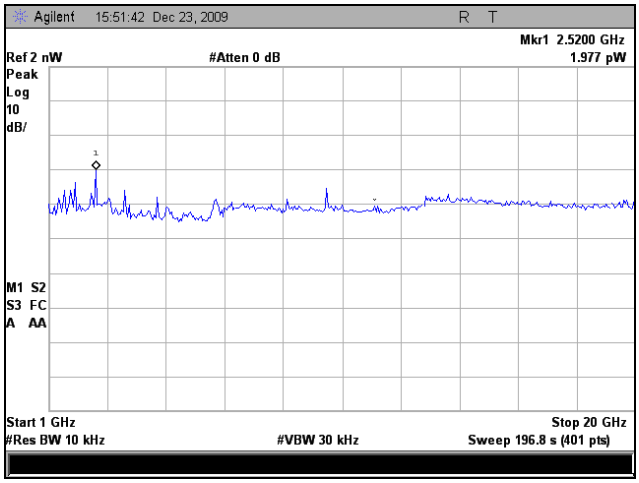
Plot 140. Conducted Receiver Spurious Emissions, Port 1, 30 MHz – 1 GHz



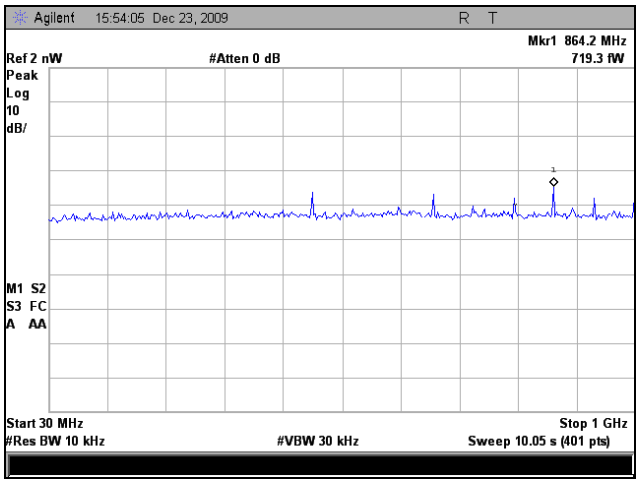
Plot 141. Conducted Receiver Spurious Emissions, Port 1, 1 GHz – 20 GHz



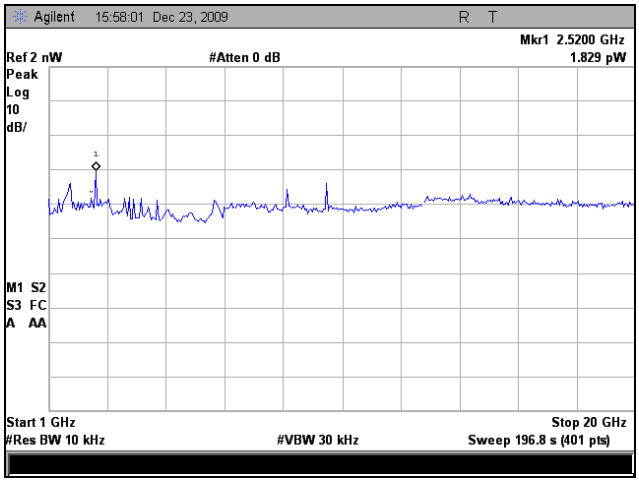
Plot 142. Conducted Receiver Spurious Emissions, Port 2, 30 MHz – 1 GHz



Plot 143. Conducted Receiver Spurious Emissions, Port 2, 1 GHz – 20 GHz



Plot 144. Conducted Receiver Spurious Emissions, Port 3, 30 MHz – 1 GHz



Plot 145. Conducted Receiver Spurious Emissions, Port 3, 1 GHz – 20 GHz

IV. Test Equipment

Test Equipment

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

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2421	EMI RECEIVER	ROHDE&SCHWARZ	ESIB 7	05/27/2009	05/27/2010
1S2121	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	SEE NOTE	
1S2198	HORN ANTENNA	EMCO	3115	09/03/2009	09/03/2010
1S2202	ANTENNA, HORN, 1 METER	EMCO	3116	04/10/2007	04/10/2010
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	
1S2481	CHAMBER, 10 METER	ETS-LINDGREN	DKE 8X8 DBL	12/26/2008	12/26/2009
1S2041	COUPLER, BI DIRECTIONALCOAXIAL	NARDA	N/A	SEE NOTE	
1S2460	ANALYZER, SPECTRUM 9 KHZ-40GHZ	AGILENT	E4407B	04/14/2009	04/14/2010
1S2034	COUPLER, DIRECTIONAL 1-20 GHZ	KRYTAR	101020020	SEE NOTE	
1S2508	LISN	SOLAR ELECTRONICS	9252-50-R24-BNC	06/05/2009	06/05/2010
1S2512	TRANSIENT LIMITER	AGILENT	11947A	SEE NOTE	
1S2520	THERMO-HYGROMETER	FISHER SCIENTIFIC	11-661-7D	11/11/2009	11/11/2010
1S2482	CHAMBER, 5 METER	PANASHIELD	641431	10/16/2009	10/16/2010
1S2108	RECIEVER, EMI, RF FILTER SECTION	HP	85460A	11/10/2009	11/10/2010
1S2399	TURNTABLE CONTROLLER	SUNOL SCIENCE	SC99V	SEE NOTE	
1S2485	BILOG ANTENNA	TESEQ	CBL6112D	03/20/2009	03/20/2010
N/A	2-6GHZ COMBINER	MINI CIRCUITS	ZN4PD-1-63-S+	SEE NOTE	
1S2109	RF FILTER SECTION	HEWLETT PACKARD	85460A	11/10/2009	11/10/2010
1S2041	COUPLER, BI DIRECTIONALCOAXIAL	NARDA	N/A	SEE NOTE	
1S2128	HARMONIC MIXER	HEWLETT PACKARD	11970A	11/22/2008	11/22/2010
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.

V. Certification & User's Manual Information

Certification & User's Manual Information

A. Certification Information

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

§ 2.801 Radio-frequency device defined.

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

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

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

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

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

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

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

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

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

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

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

(i) Compliance testing;

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

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

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

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

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

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

Certification & User's Manual Information

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

§ 2.901 Basis and Purpose

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

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

§ 2.907 Certification.

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

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

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

Certification & User's Manual Information

§ 2.948 Description of measurement facilities.

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

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

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

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

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

Certification & User's Manual Information

Label and User's Manual Information

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

§ 15.19 Labeling requirements.

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

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

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

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

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

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

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

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

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

§ 15.21 Information to user.

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

Verification & User's Manual Information

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

§ 15.105 Information to the user.

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

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

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

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

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

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

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

ICES-003 Procedural & Labeling Requirements

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

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

Procedural Requirements:

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

Section 6.1: A record of the measurements and results, showing the date that the measurements were completed, shall be retained by the manufacturer or importer for a period of at least five years from the date shown in the record and made available for examination on the request of the Minister.

Section 6.2: A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other constraints it is not feasible to affix a label to the apparatus, the notice may be in the form of a statement in the user's manual.

Labeling Requirements:

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

> This Class [2] digital apparatus complies with Canadian ICES-003.
>
> Cet appareil numérique de la classe [1] est conforme à la norme NMB-003 du Canada.

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

End of Report

