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April 4, 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 – DFS Rev. 1)

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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 – DFS Rev. 1

April 4, 2011

Prepared For:

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Prepared By:
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and
Title 47 of the CFR, Part 15.407 and
Industry Canada RSS-210, Issue 7, June 2007
for Intentional Radiators

Minh Ly, Project Engineer
Electromagnetic Compatibility Lab

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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 2, 2011	Initial Issue.
1	April 4, 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**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilovolt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**micro**henry
µ	**micro**farad
µs	**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 2790. 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
15.407 (h)(1)	A9.4	Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS)	Compliant
15.407 (h)(2)	A9.4	Channel Availability Check Time	Compliant
15.407 (h)(2)(ii)	A9.4	Channel Move Time and Channel Closing Time	Compliant
15.407 (h)(2)(iii)	A9.4	Non-Occupancy Period	Compliant
15.407 (h)(2)(iv)	A9.4	Radar Detection Function of Dynamic Frequency Selection (DFS)	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 2790.

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:	FWB-205		
Model(s) Covered:	Firetide Indoor and Outdoor MIMO Access Points		
EUT Specifications:	Primary Power: 115 VAC		
	FCC ID: REP-F205-1 IC: 4988A-F205		
	Type of Modulations:	OFDM	
	Emission Designators:	D7D	
	Equipment Code:	NII	
	Peak RF Output Power:	**MHz**	**Power**
		5260-5320	17.43 dBm
		5270-5310	18.05 dBm
		5500-5700	17.79 dBm
		5510-5690	18.10 dBm
	EUT Frequency Ranges:	5260 – 5320MHz; 5270-5310MHz 5500 – 5580MHz, 5660-5700MHz; 5510-5550MHz, 5670-5690MHz	
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):	April 4, 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 License-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

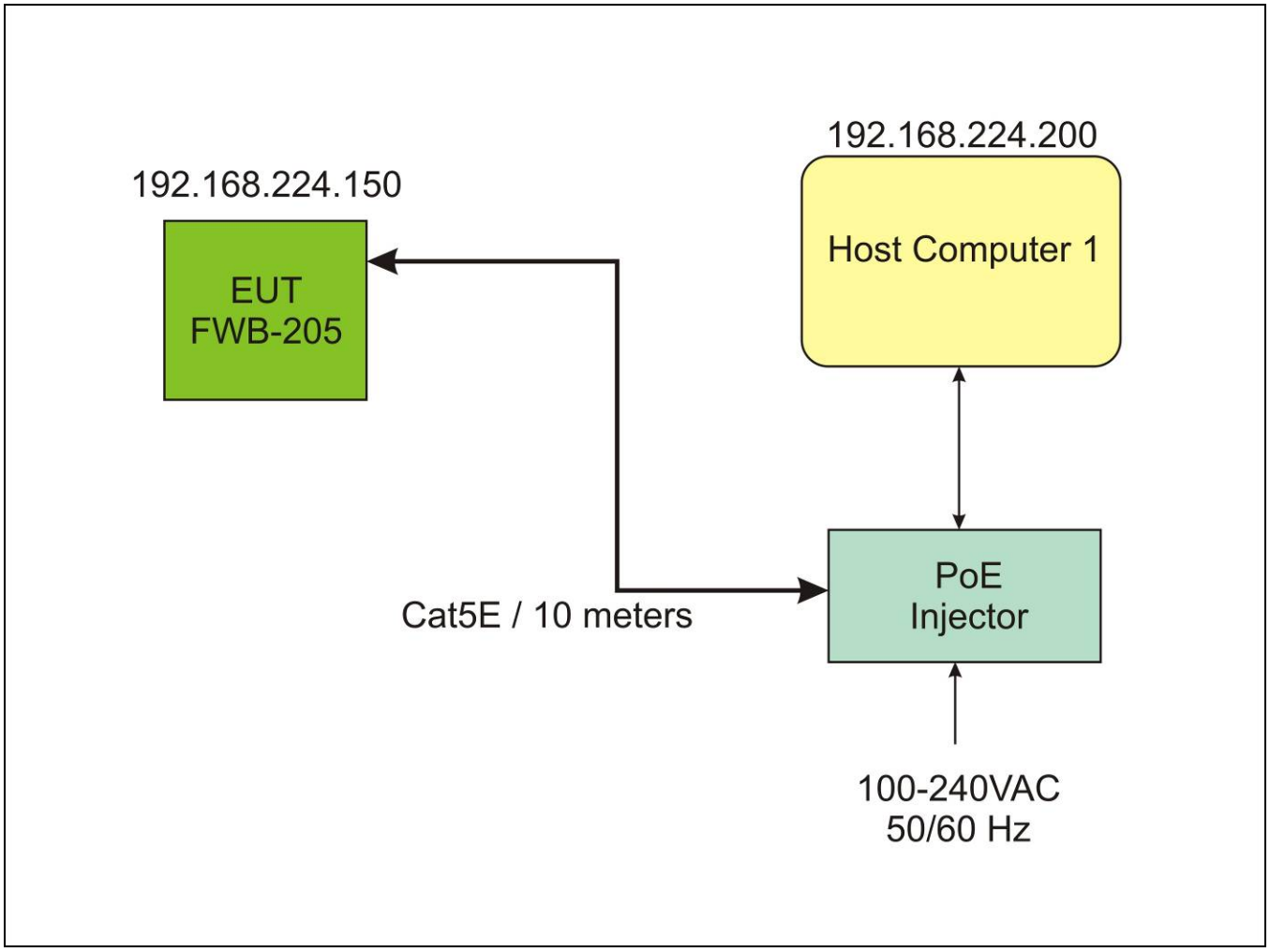


Figure 1. Block Diagram of Test Configuration

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.

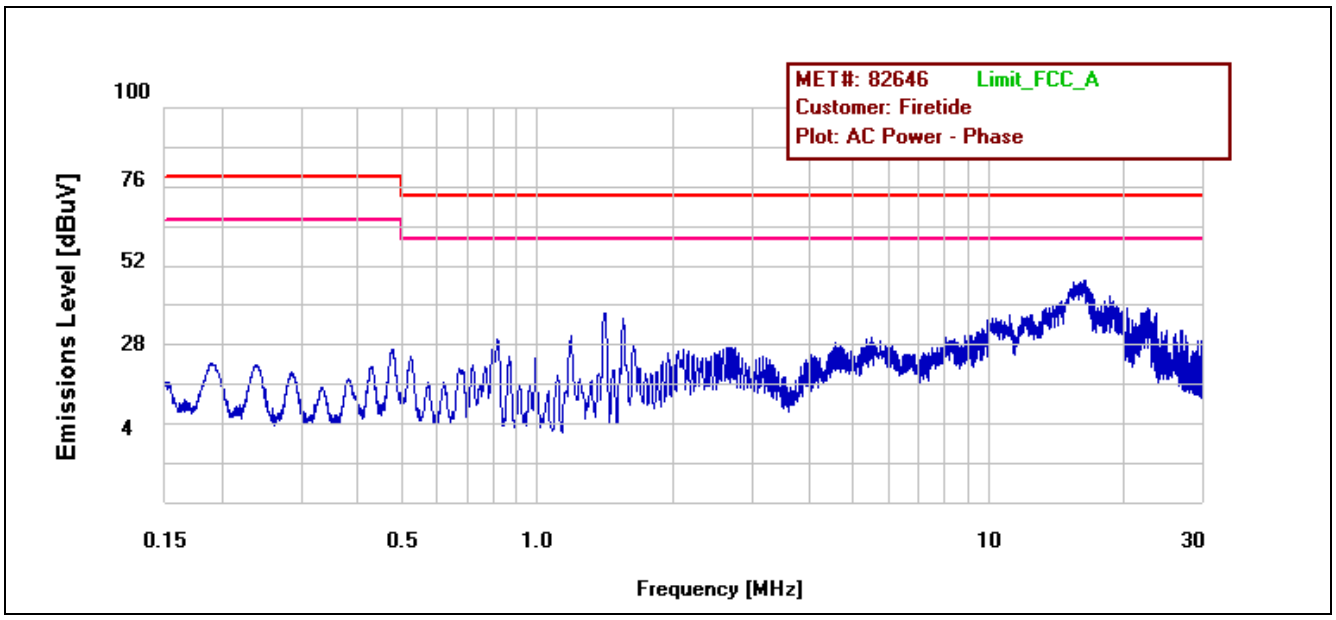
Test Engineer(s): Kenshi Chung

Test Date(s): 09/03/10

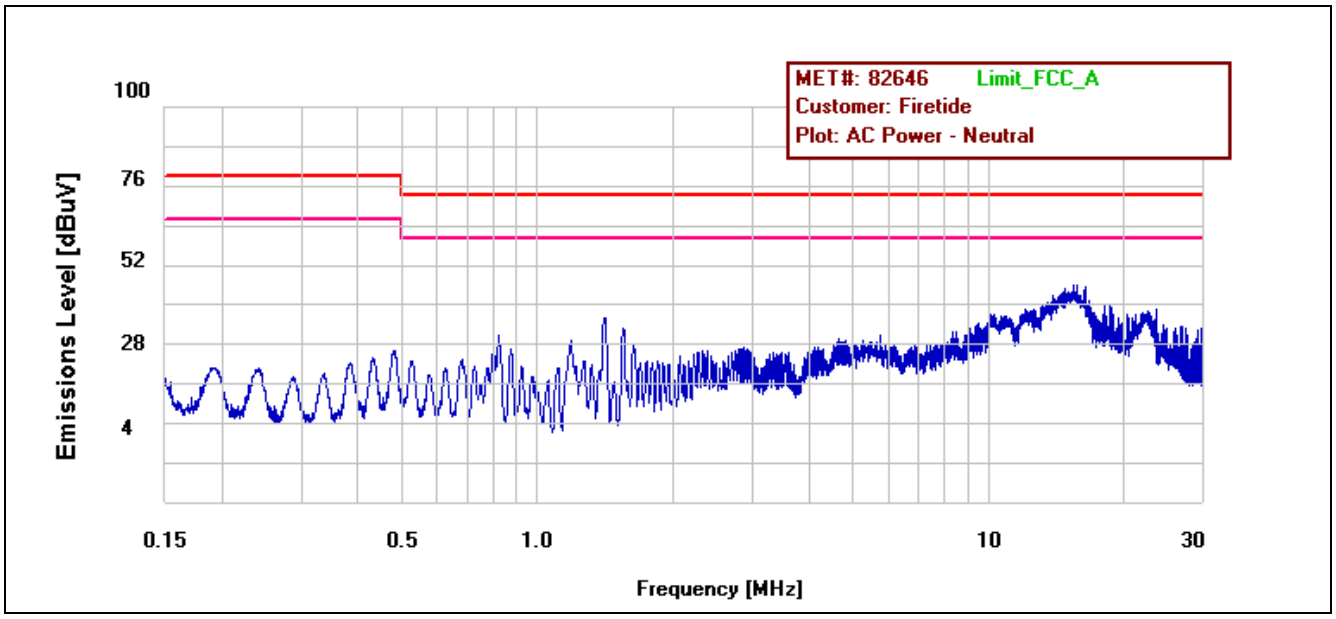
Conducted Emissions - Voltage, AC Power

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

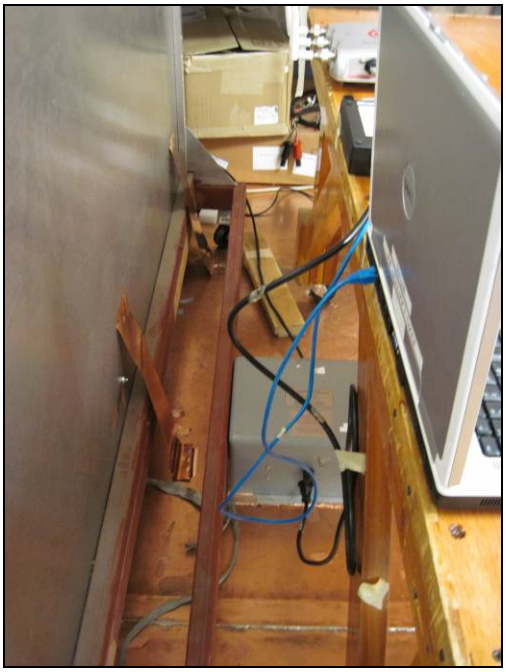


Plot 1. Conducted Emission, Phase Line Plot



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.

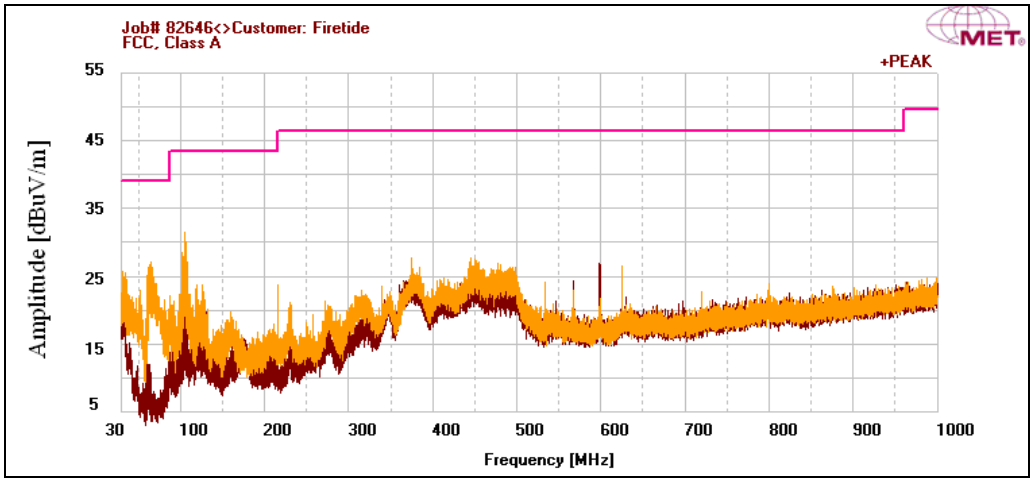
Test Engineer(s): Lionel Gabrillo

Test Date(s): 08/31/10

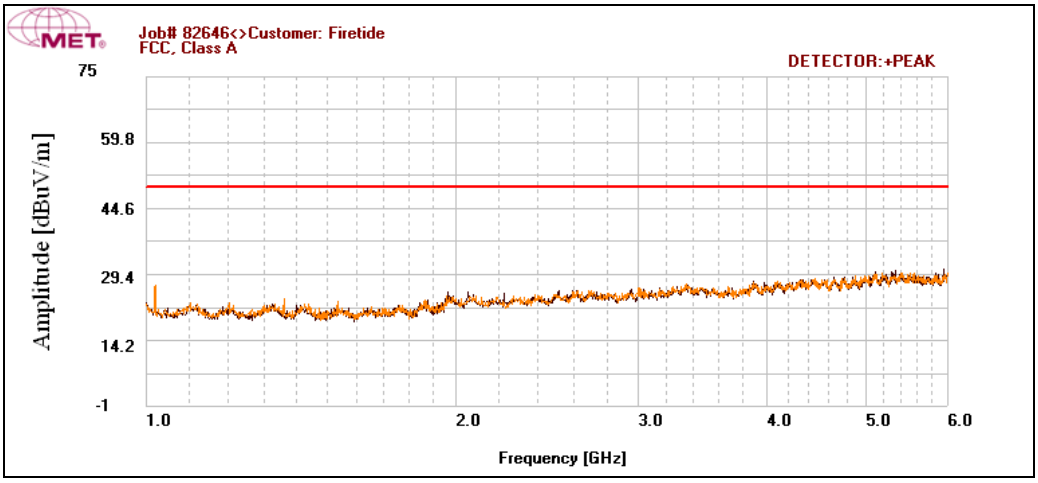
Radiated Emissions Limits Test Results, Class A

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



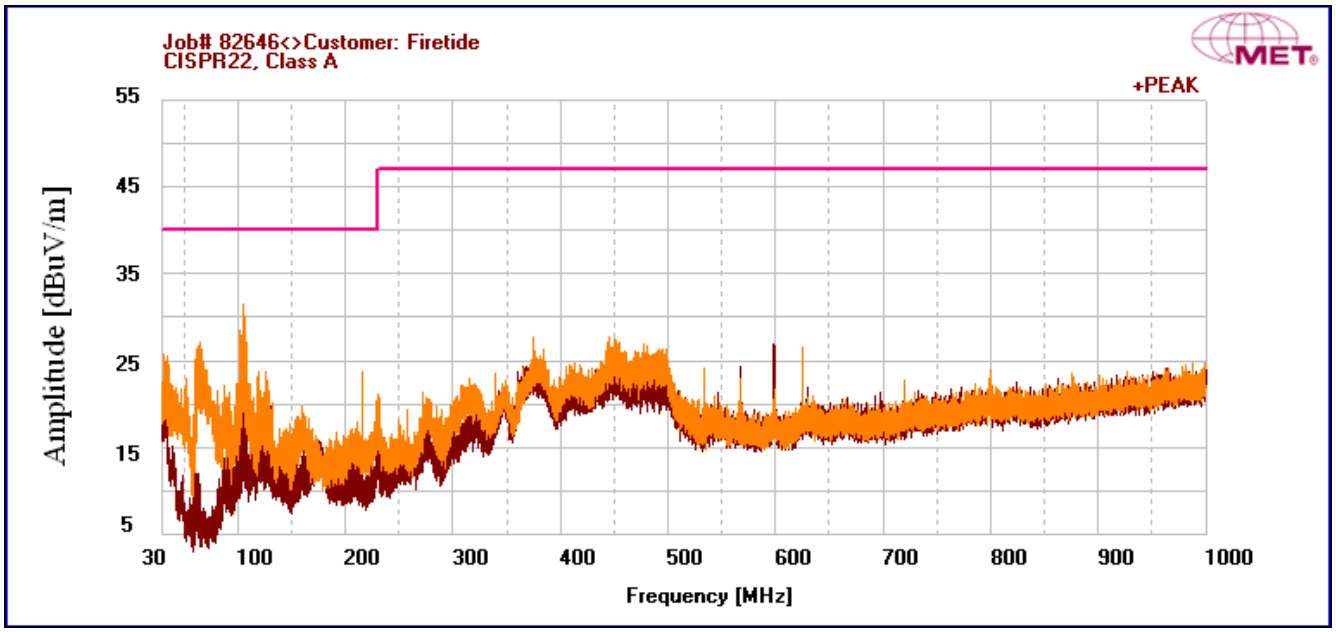
Plot 3. Radiated Emissions, FCC Limits, 30 MHz – 1 GHz



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
5dBi Omni	C812-510012-A	Wha Yu
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.

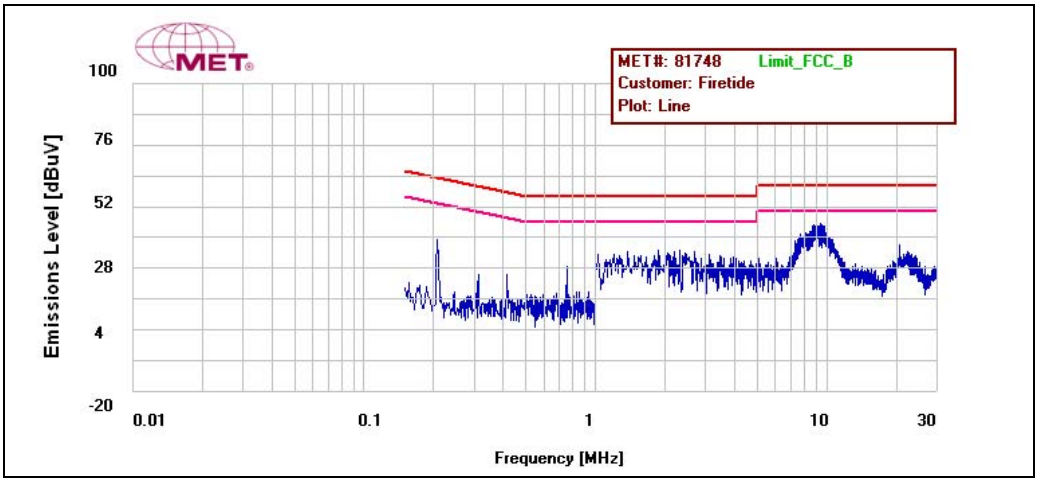
Test Engineer(s): Minh Ly

Test Date(s): 08/17/09

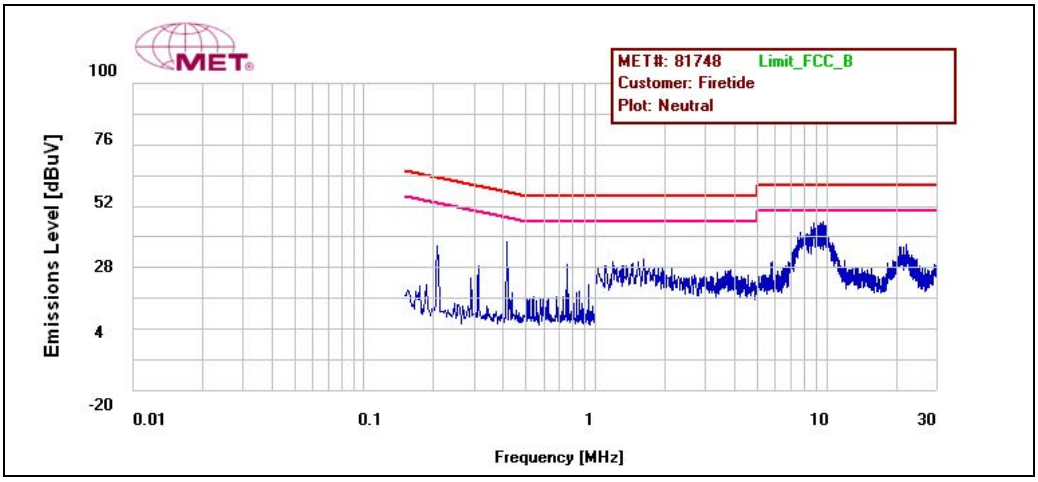
Conducted Emissions - Voltage, AC Power

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 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): Minh Ly

Test Date(s): 07/28/09 – 08/11/09

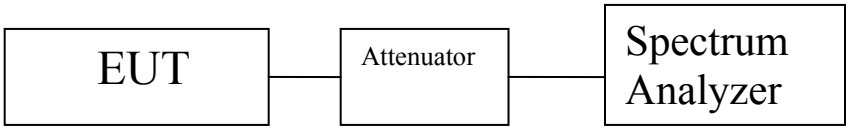


Figure 2. Occupied Bandwidth Test Setup

Occupied Bandwidth, Port 1			
Mode	**Frequency (MHz)**	**Measured 26 dB Bandwidth (MHz)**	**99 % Bandwidth (MHz)**
802.11a	5260	16.6051	16.2574
	5320	16.5974	16.4561
	5500	16.8858	16.2905
	5580	16.5369	16.4007
	5700	16.5889	16.3513
802.11n 20MHz	5260	17.8775	17.6328
	5320	17.7002	17.5481
	5500	17.7966	17.6993
	5580	17.6172	17.4919
	5700	17.7173	17.3338
802.11n 40MHz	5270	36.9057	36.7638
	5310	36.9001	36.6566
	5510	36.6398	36.4100
	5550	36.5579	36.5839
	5670	36.6412	36.6333

Table 15. Occupied Bandwidth, Port 1, Test Results

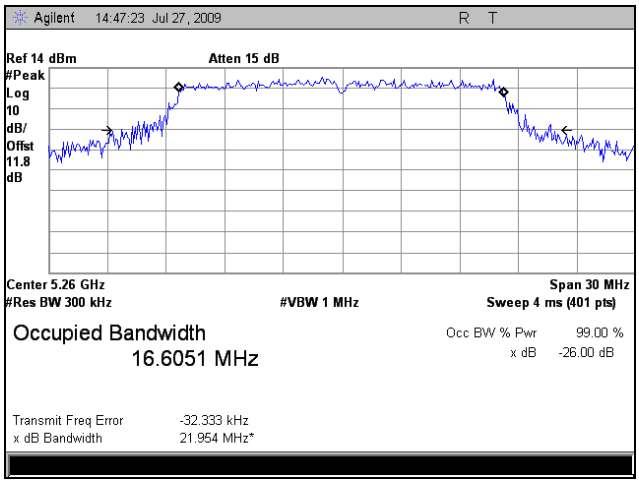
Occupied Bandwidth, Port 2			
Mode	**Frequency (MHz)**	**Measured 26 dB Bandwidth (MHz)**	**99 % Bandwidth (MHz)**
802.11n 20MHz	5260	17.7306	17.5789
	5320	17.7836	17.6254
	5500	17.8179	17.5414
	5580	17.5533	17.6765
	5700	17.6525	17.5882
802.11n 40MHz	5270	36.8372	36.6803
	5310	36.7184	36.2819
	5510	36.8367	36.5567
	5550	36.7273	36.4103
	5670	36.7982	36.7017

Table 16. Occupied Bandwidth, Port 2, Test Results

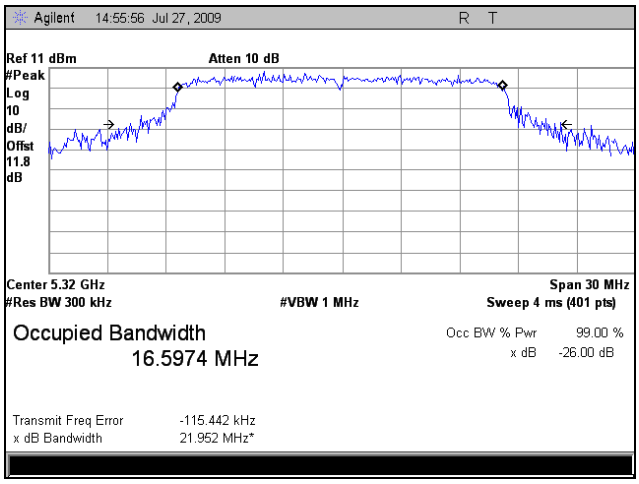
Occupied Bandwidth, Port 3			
Mode	**Frequency (MHz)**	**Measured 26 dB Bandwidth (MHz)**	**99 % Bandwidth (MHz)**
802.11n 20MHz	5260	17.8378	17.6291
	5320	17.7333	17.5672
	5500	17.7594	17.5506
	5580	17.6137	17.5337
	5700	17.8288	17.5724
802.11n 40MHz	5270	36.8721	36.2576
	5310	36.8101	36.8722
	5510	37.0056	36.8653
	5550	36.5107	36.6691
	5670	36.9159	36.4767

Table 17. Occupied Bandwidth, Port 3, Test Results

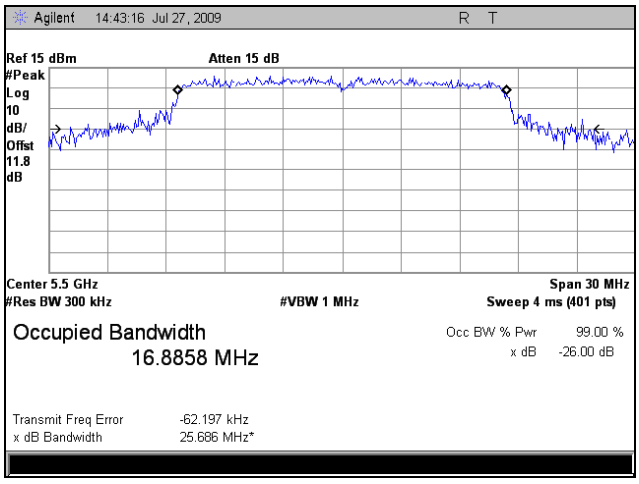
6 dB Occupied Bandwidth, Port 1



Plot 8. 6 dB Occupied Bandwidth, Port 1, 802.11a, 5260 MHz

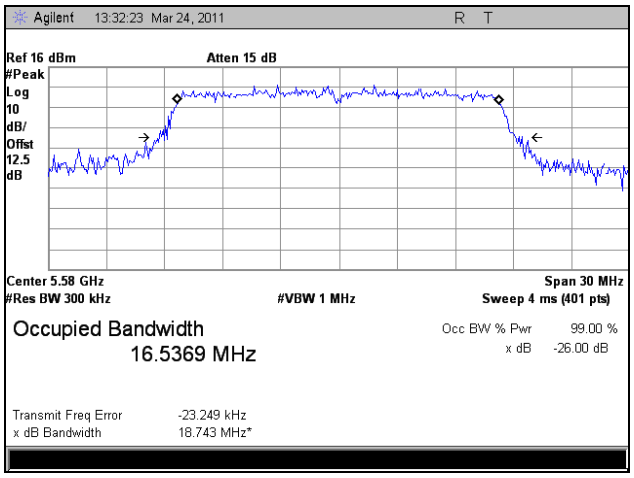


Plot 9. 6 dB Occupied Bandwidth, Port 1, 802.11a, 5320 MHz

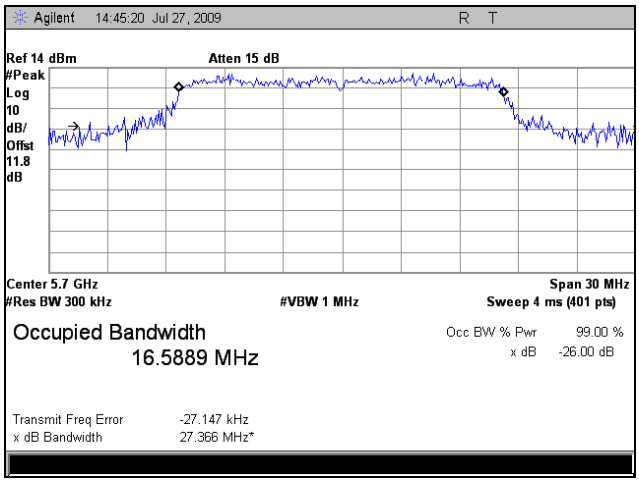


Plot 10. 6 dB Occupied Bandwidth, Port 1, 802.11a, 5500 MHz

6 dB Occupied Bandwidth, Port 1

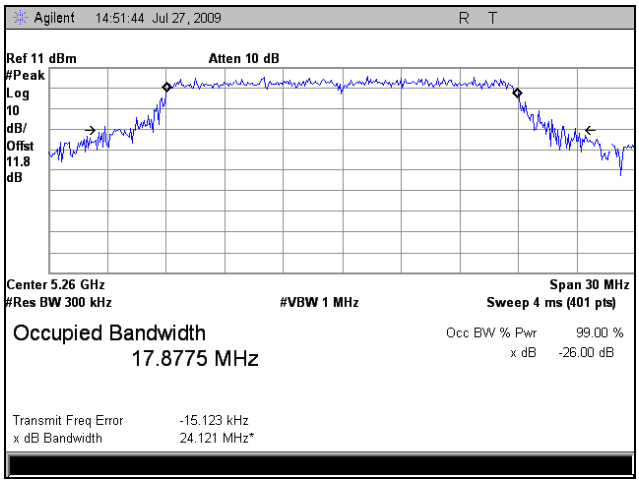


Plot 11. 6 dB Occupied Bandwidth, Port 1, 802.11a, 5580 MHz

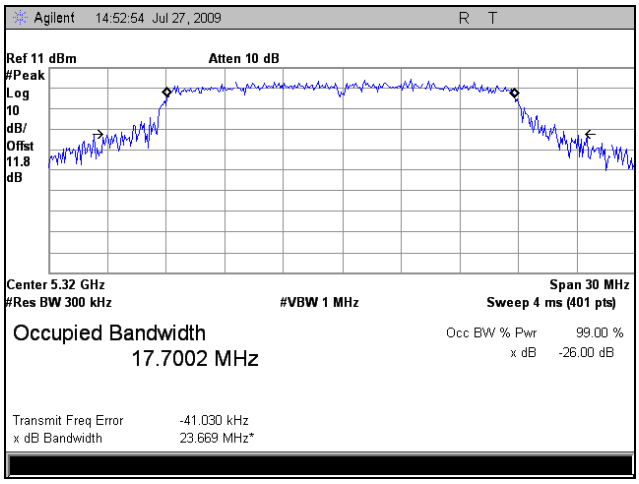


Plot 12. 6 dB Occupied Bandwidth, Port 1, 802.11a, 5700 MHz

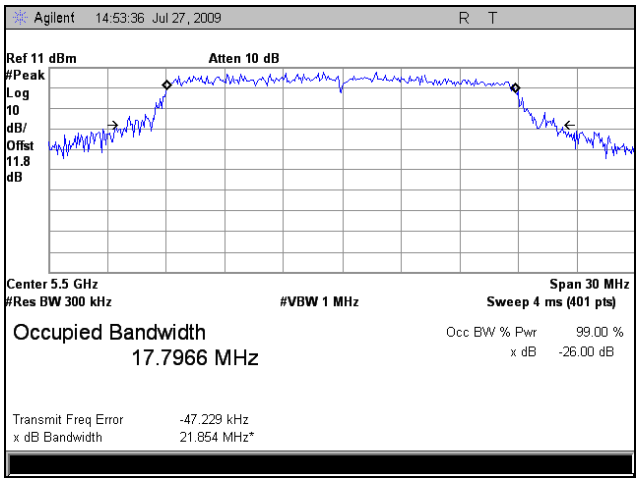
6 dB Occupied Bandwidth, Port 1, 802.11n 20MHz



Plot 13. 6 dB Occupied Bandwidth, Port 1, 802.11n 20MHz, 5260 MHz

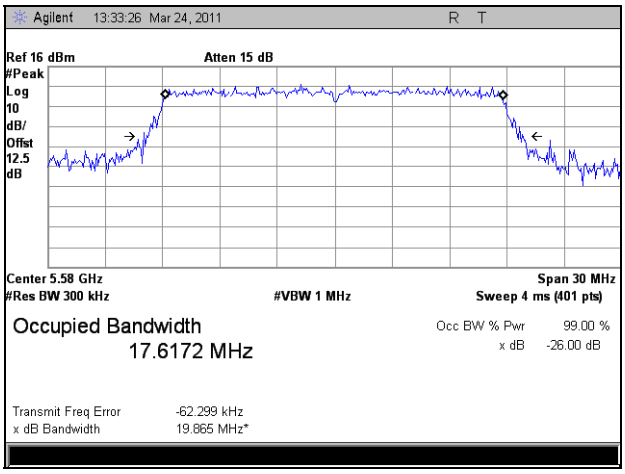


Plot 14. 6 dB Occupied Bandwidth, Port 1, 802.11n 20MHz, 5320 MHz

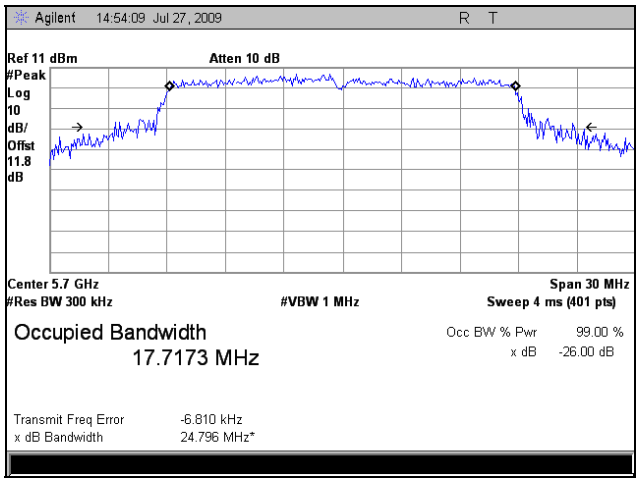


Plot 15. 6 dB Occupied Bandwidth, Port 1, 802.11n 20MHz, 5500 MHz

6 dB Occupied Bandwidth, Port 1, 802.11n 20MHz

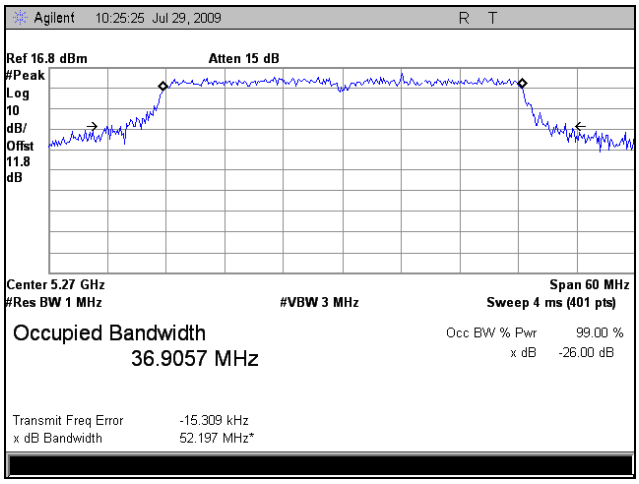


Plot 16. 6 dB Occupied Bandwidth, Port 1, 802.11n 20MHz, 5580 MHz

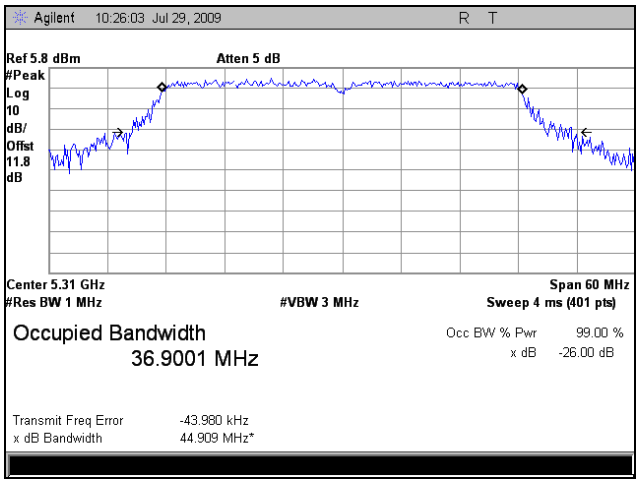


Plot 17. 6 dB Occupied Bandwidth, Port 1, 802.11n 20MHz, 5700 MHz

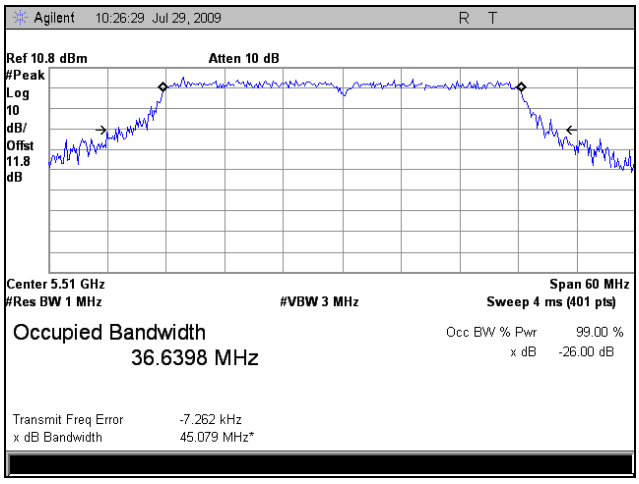
6 dB Occupied Bandwidth, Port 1, 802.11n 40MHz



Plot 18. 6 dB Occupied Bandwidth, Port 1, 802.11n 40MHz, 5270 MHz

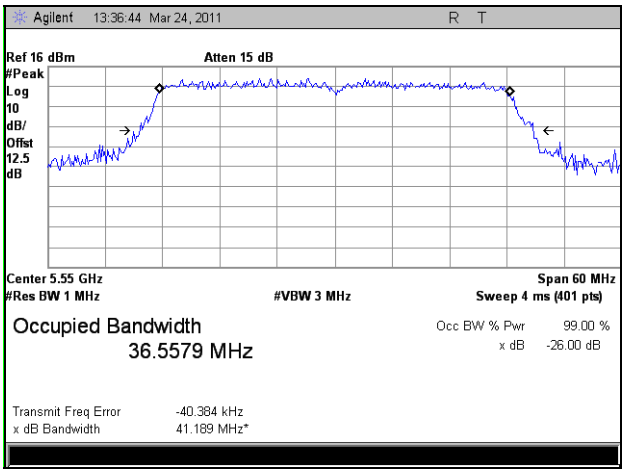


Plot 19. 6 dB Occupied Bandwidth, Port 1, 802.11n 40MHz, 5310 MHz

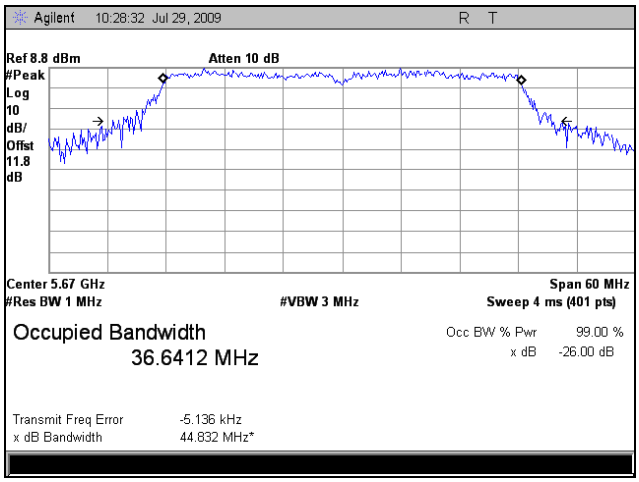


Plot 20. 6 dB Occupied Bandwidth, Port 1, 802.11n 40MHz, 5510 MHz

6 dB Occupied Bandwidth, Port 1, 802.11n 40MHz

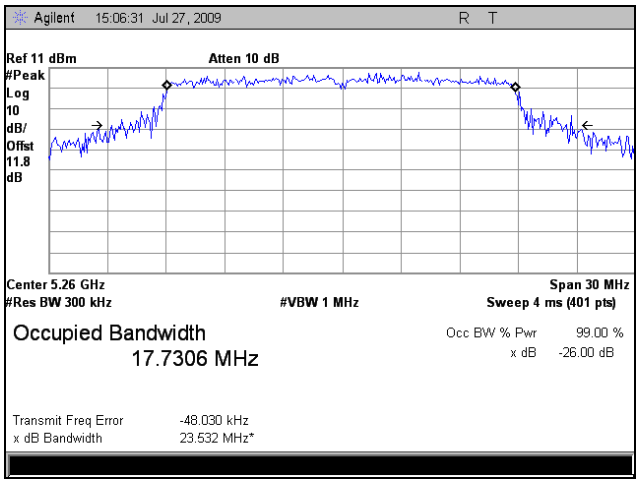


Plot 21. 6 dB Occupied Bandwidth, Port 1, 802.11n 40MHz, 5550 MHz

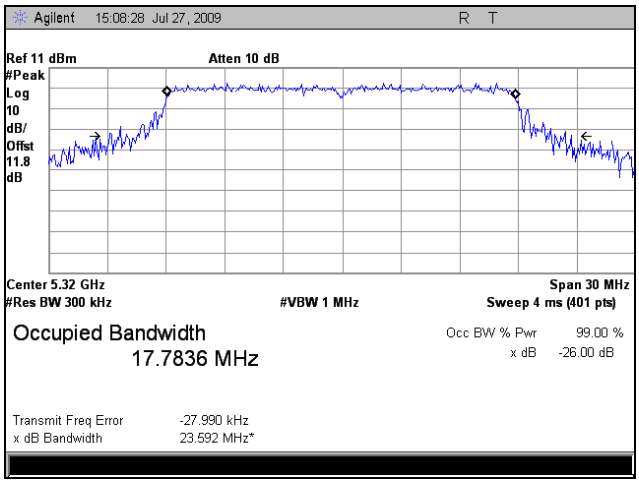


Plot 22. 6 dB Occupied Bandwidth, Port 1, 802.11n 40MHz, 5670 MHz

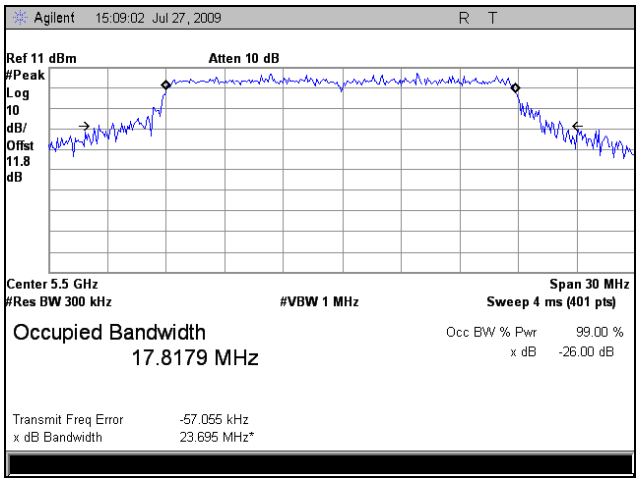
6 dB Occupied Bandwidth, Port 2, 802.11n 20MHz



Plot 23. 6 dB Occupied Bandwidth, Port 2, 802.11n 20MHz, 5260 MHz

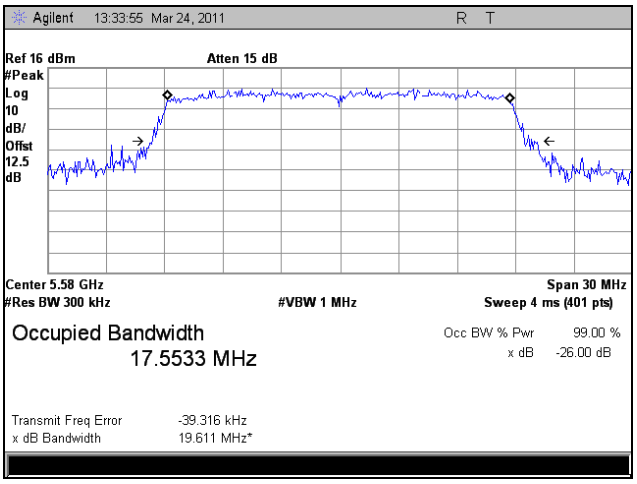


Plot 24. 6 dB Occupied Bandwidth, Port 2, 802.11n 20MHz, 5320 MHz

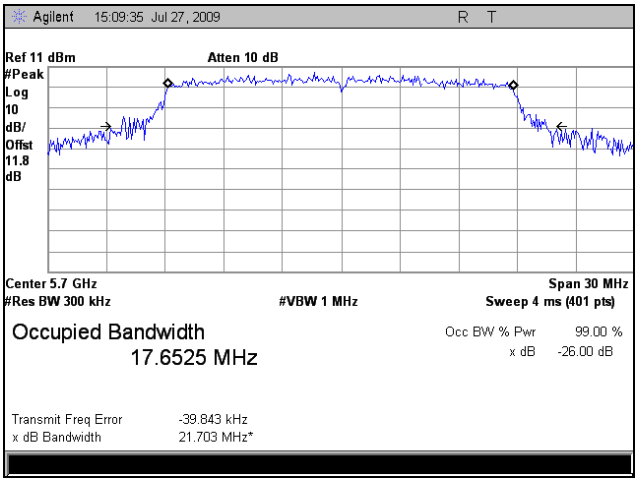


Plot 25. 6 dB Occupied Bandwidth, Port 2, 802.11n 20MHz, 5500 MHz

6 dB Occupied Bandwidth, Port 2, 802.11n 20MHz

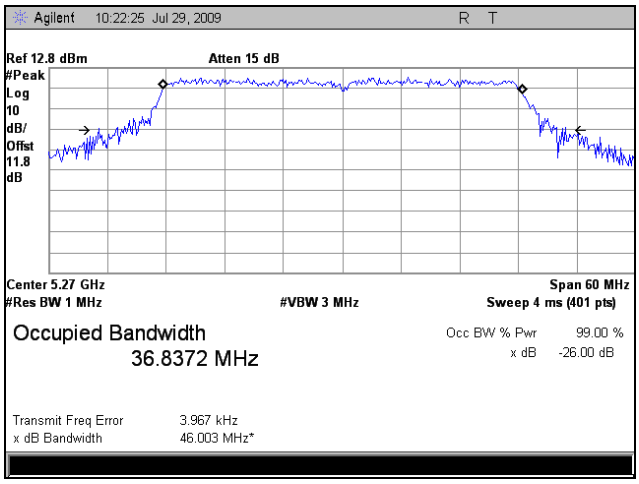


Plot 26. 6 dB Occupied Bandwidth, Port 2, 802.11n 20MHz, 5580 MHz

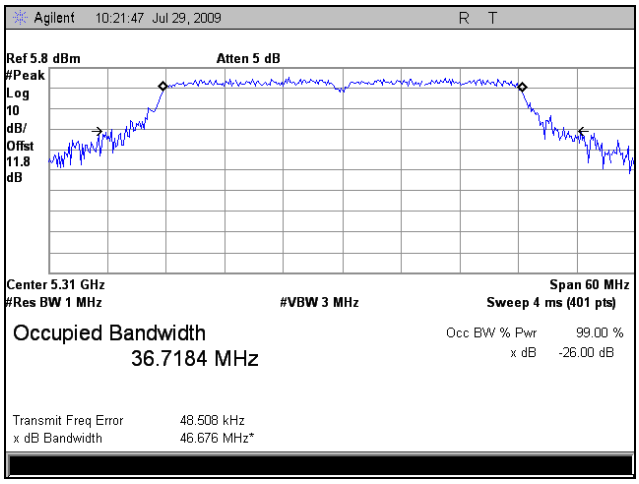


Plot 27. 6 dB Occupied Bandwidth, Port 2, 802.11n 20MHz, 5700 MHz

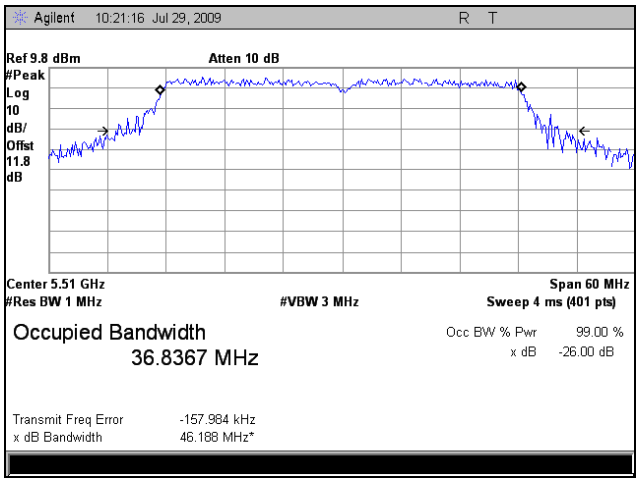
6 dB Occupied Bandwidth, Port 2, 802.11n 40MHz



Plot 28. 6 dB Occupied Bandwidth, Port 2, 802.11n 40MHz, 5270 MHz

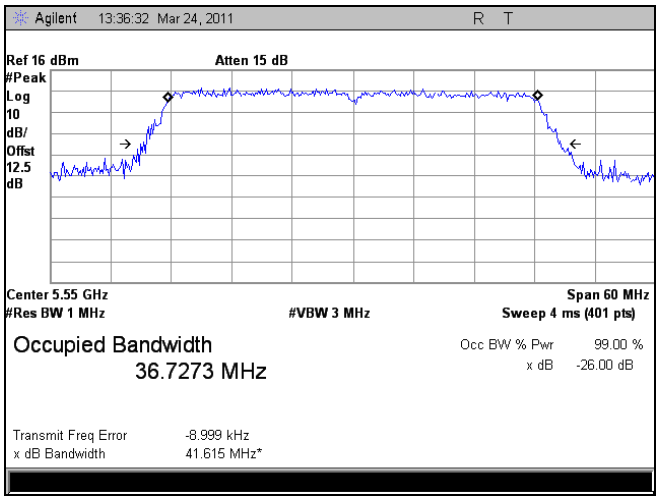


Plot 29. 6 dB Occupied Bandwidth, Port 2, 802.11n 40MHz, 5310 MHz

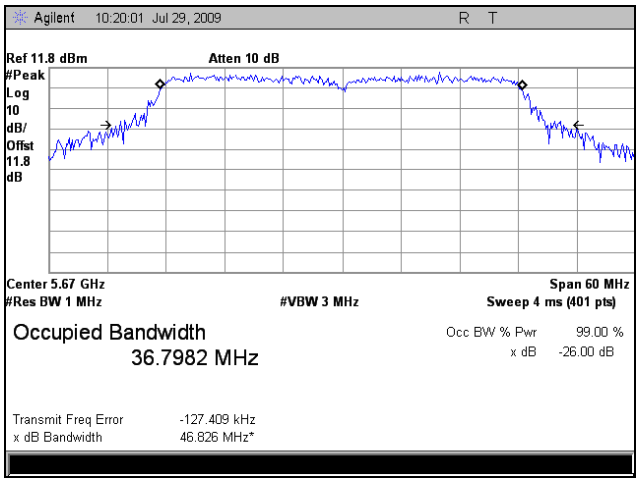


Plot 30. 6 dB Occupied Bandwidth, Port 2, 802.11n 40MHz, 5510 MHz

6 dB Occupied Bandwidth, Port 2, 802.11n 40MHz

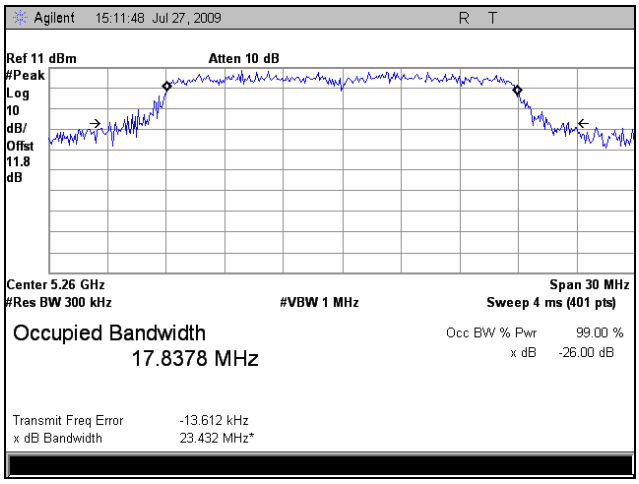


Plot 31. 6 dB Occupied Bandwidth, Port 2, 802.11n 40MHz, 5550 MHz

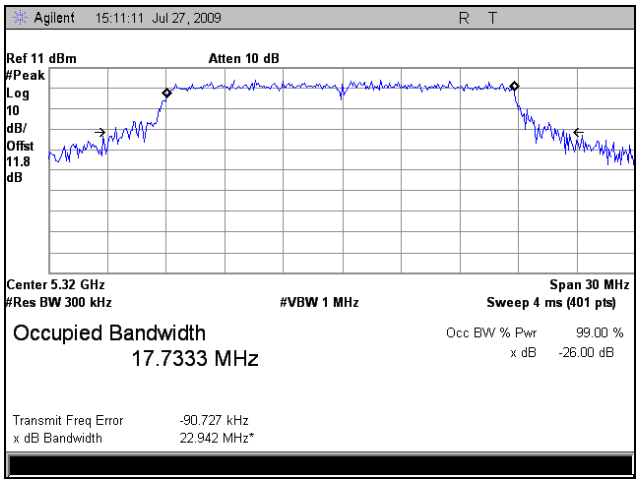


Plot 32. 6 dB Occupied Bandwidth, Port 2, 802.11n 40MHz, 5670 MHz

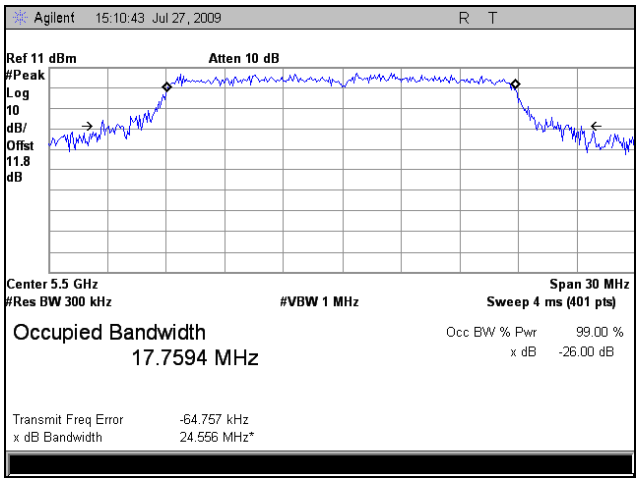
6 dB Occupied Bandwidth, Port 3, 802.11n 20MHz



Plot 33. 6 dB Occupied Bandwidth, Port 3, 802.11n 20MHz, 5260 MHz

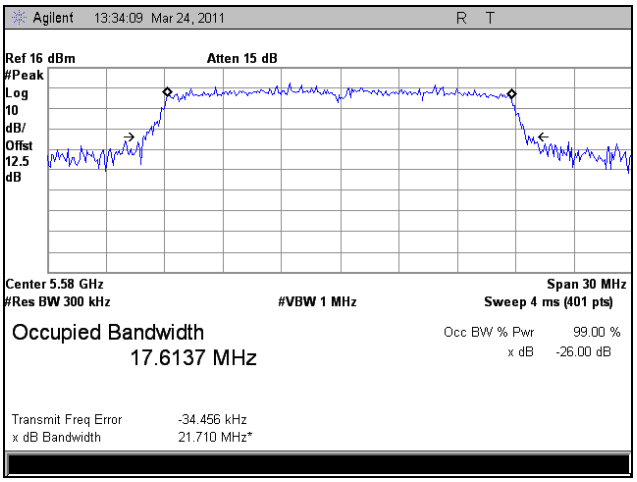


Plot 34. 6 dB Occupied Bandwidth, Port 3, 802.11n 20MHz, 5320 MHz

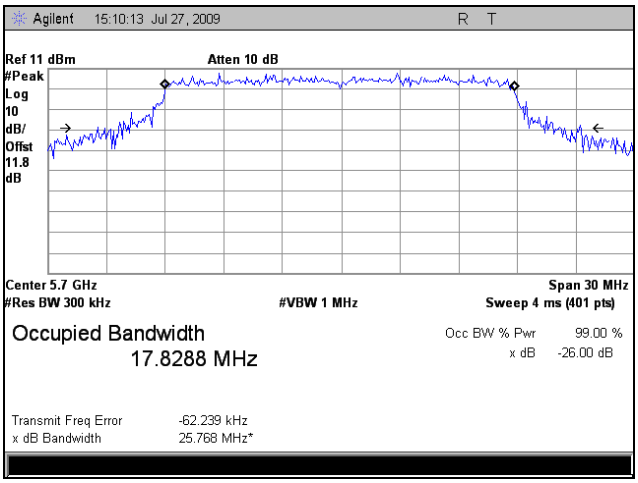


Plot 35. 6 dB Occupied Bandwidth, Port 3, 802.11n 20MHz, 5500 MHz

6 dB Occupied Bandwidth, Port 3, 802.11n 20MHz

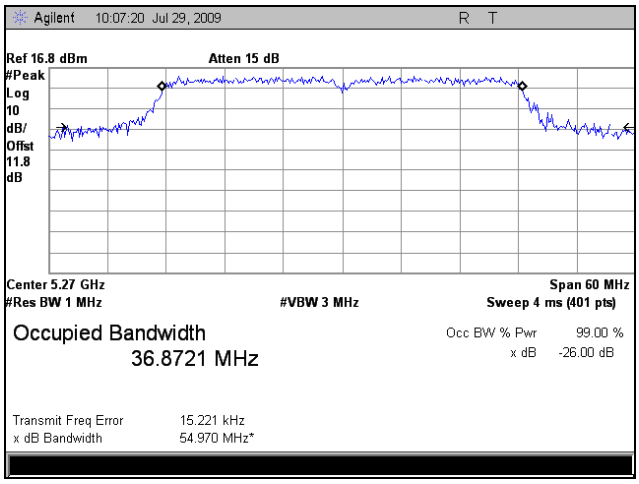


Plot 36. 6 dB Occupied Bandwidth, Port 3, 802.11n 20MHz, 5580 MHz

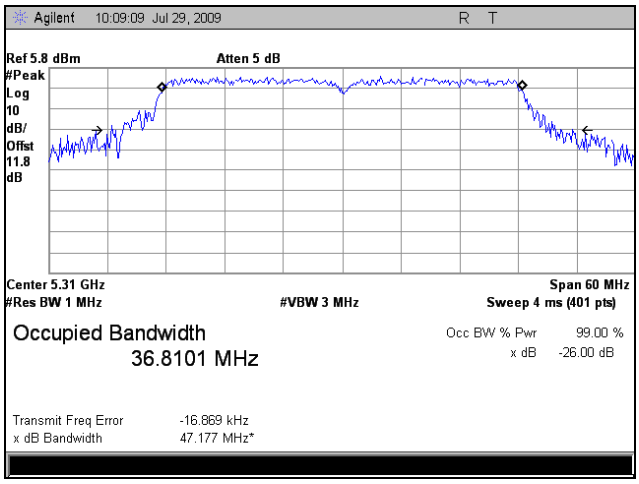


Plot 37. 6 dB Occupied Bandwidth, Port 3, 802.11n 20MHz, 5700 MHz

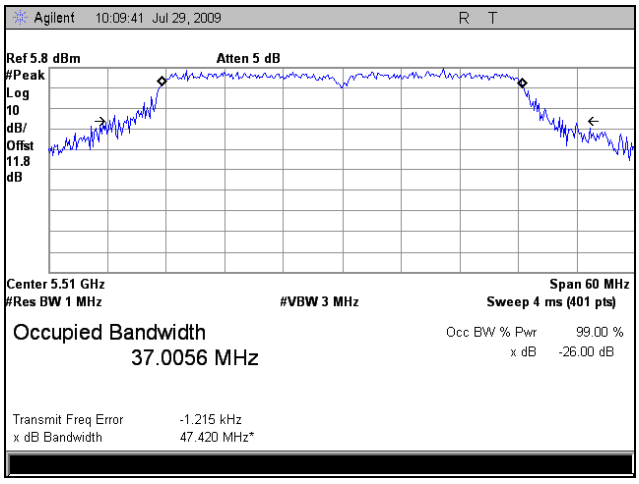
6 dB Occupied Bandwidth, Port 3, 802.11n 40MHz



Plot 38. 6 dB Occupied Bandwidth, Port 3, 802.11n 40MHz, 5270 MHz

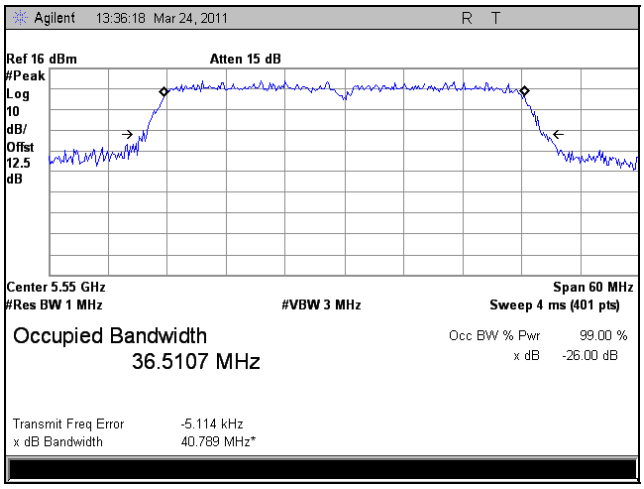


Plot 39. 6 dB Occupied Bandwidth, Port 3, 802.11n 40MHz, 5310 MHz

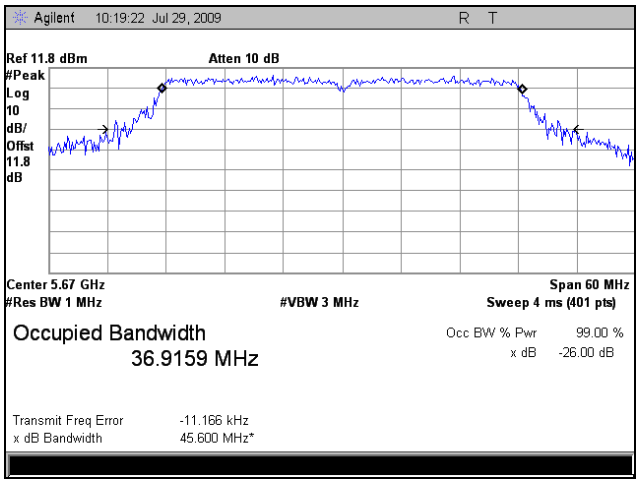


Plot 40. 6 dB Occupied Bandwidth, Port 3, 802.11n 40MHz, 5510 MHz

6 dB Occupied Bandwidth, Port 3, 802.11n 40MHz

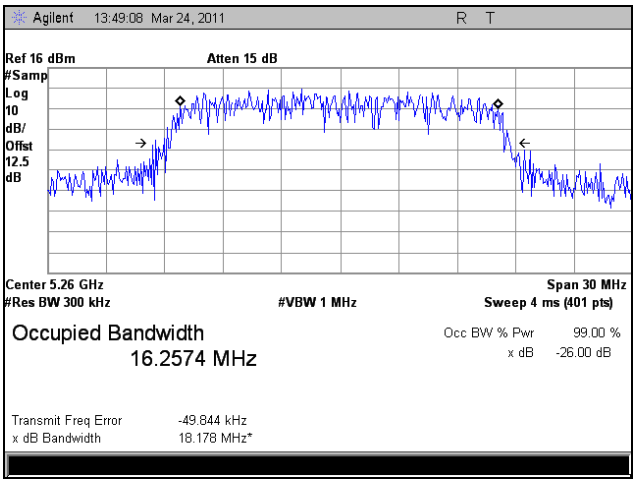


Plot 41. 6 dB Occupied Bandwidth, Port 3, 802.11n 40MHz, 5550 MHz

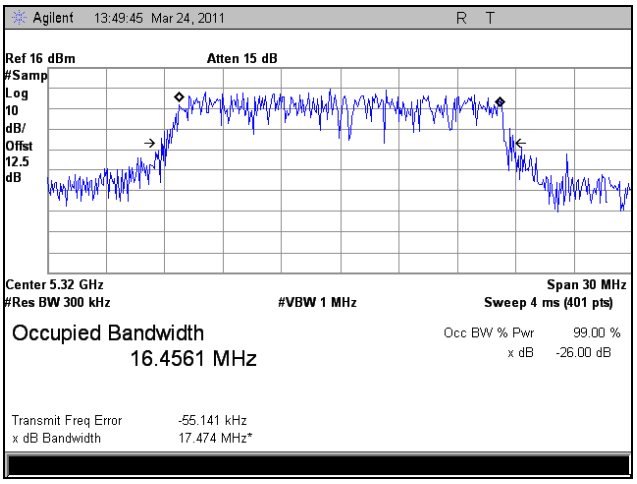


Plot 42. 6 dB Occupied Bandwidth, Port 3, 802.11n 40MHz, 5670 MHz

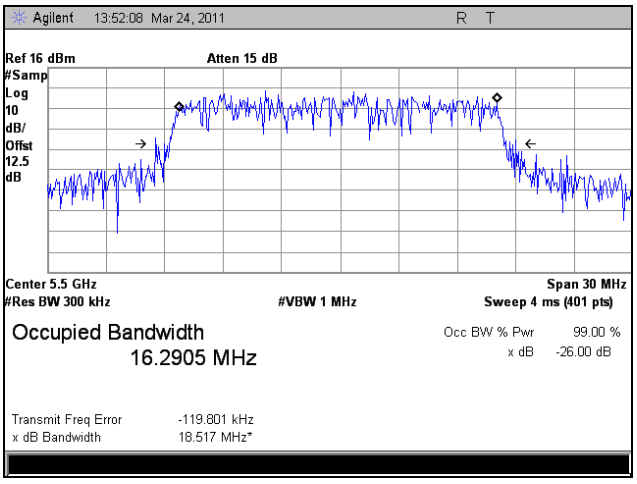
99% Occupied Bandwidth, Port 1



Plot 43. 99% Occupied Bandwidth, Port 1, 802.11a, 5260 MHz

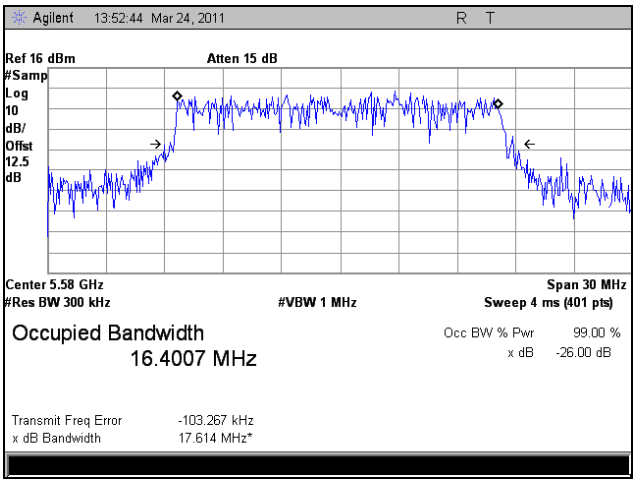


Plot 44. 99% Occupied Bandwidth, Port 1, 802.11a, 5320 MHz

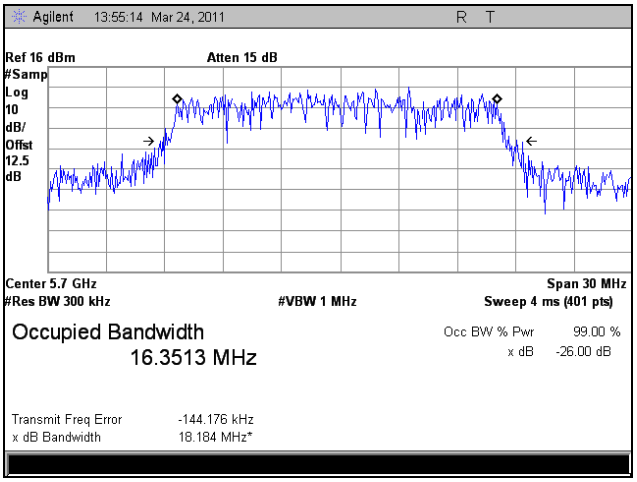


Plot 45. 99% Occupied Bandwidth, Port 1, 802.11a, 5500 MHz

99% Occupied Bandwidth, Port 1

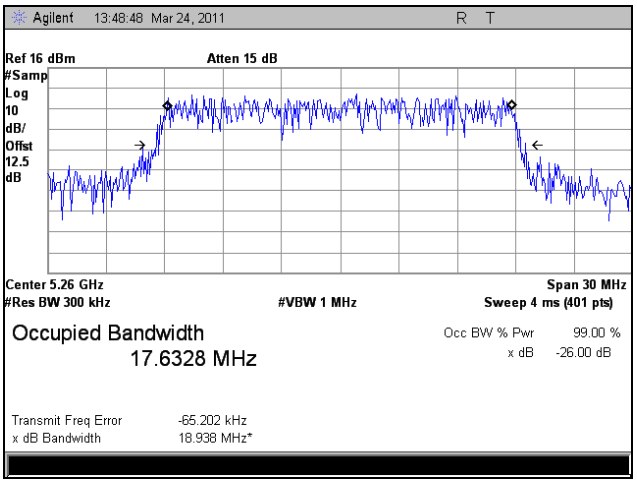


Plot 46. 99% Occupied Bandwidth, Port 1, 802.11a, 5580 MHz

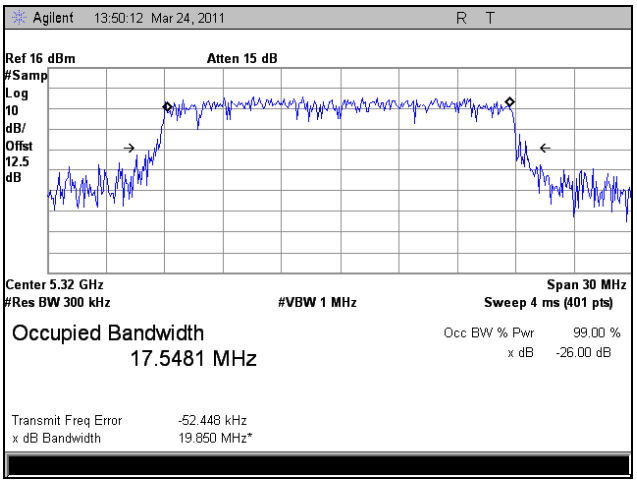


Plot 47. 99% Occupied Bandwidth, Port 1, 802.11a, 5700 MHz

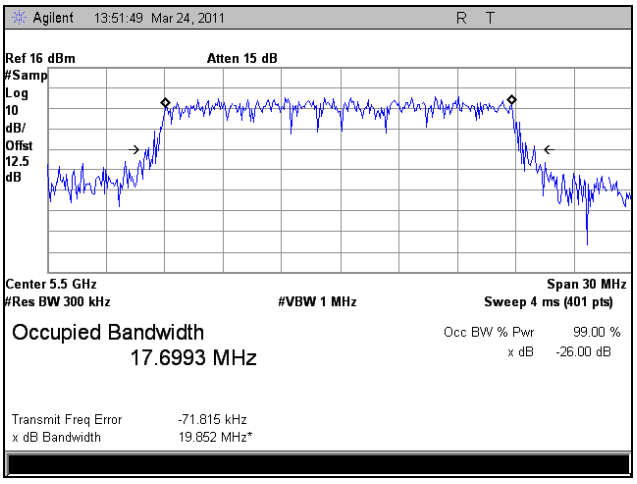
99% Occupied Bandwidth, Port 1, 802.11n 20MHz



Plot 48. 99% Occupied Bandwidth, Port 1, 802.11n 20MHz, 5260 MHz

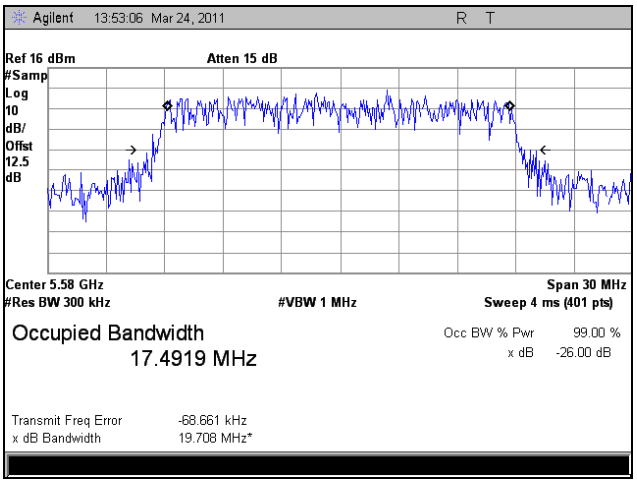


Plot 49. 99% Occupied Bandwidth, Port 1, 802.11n 20MHz, 5320 MHz

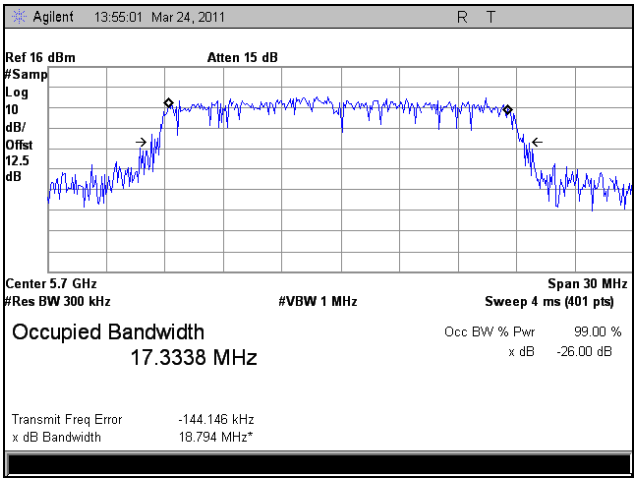


Plot 50. 99% Occupied Bandwidth, Port 1, 802.11n 20MHz, 5500 MHz

99% Occupied Bandwidth, Port 1, 802.11n 20MHz

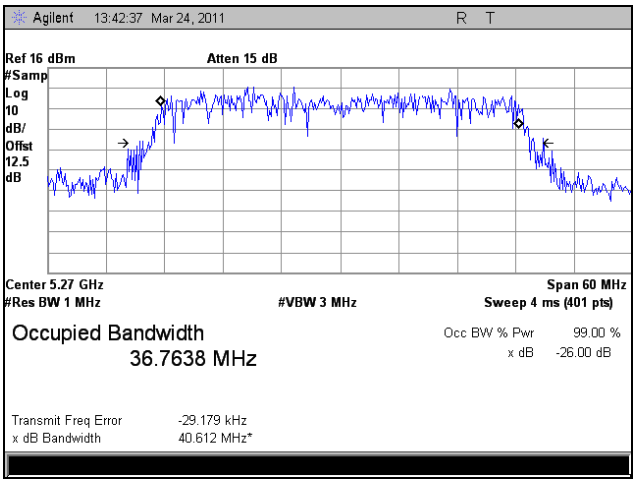


Plot 51. 99% Occupied Bandwidth, Port 1, 802.11n 20MHz, 5580 MHz

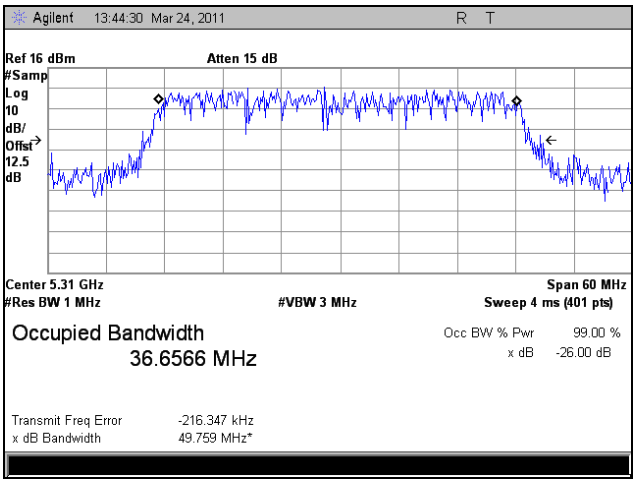


Plot 52. 99% Occupied Bandwidth, Port 1, 802.11n 20MHz, 5700 MHz

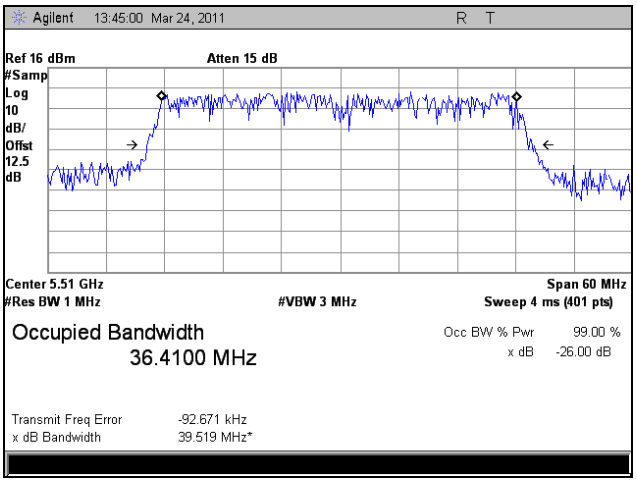
99% Occupied Bandwidth, Port 1, 802.11n 40MHz



Plot 53. 99% Occupied Bandwidth, Port 1, 802.11n 40MHz, 5270 MHz

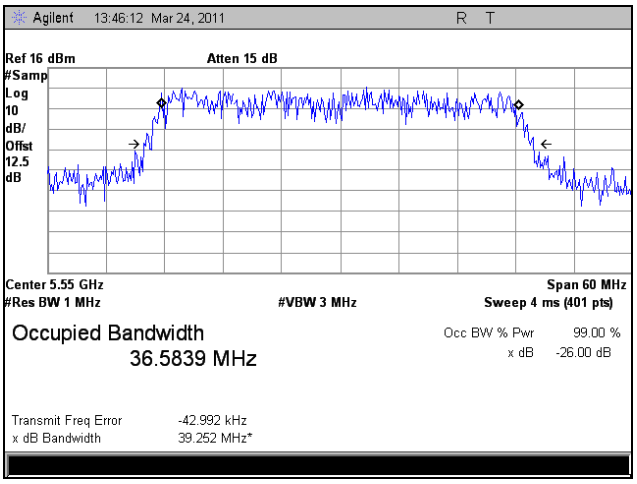


Plot 54. 99% Occupied Bandwidth, Port 1, 802.11n 40MHz, 5310 MHz

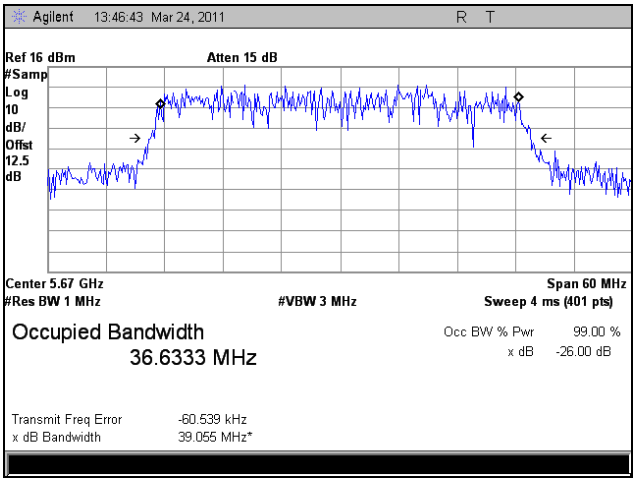


Plot 55. 99% Occupied Bandwidth, Port 1, 802.11n 40MHz, 5510 MHz

99% Occupied Bandwidth, Port 1, 802.11n 40MHz

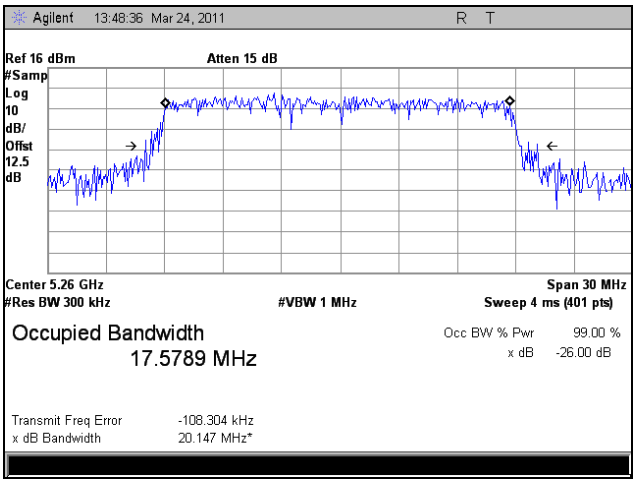


Plot 56. 99% Occupied Bandwidth, Port 1, 802.11n 40MHz, 5550 MHz

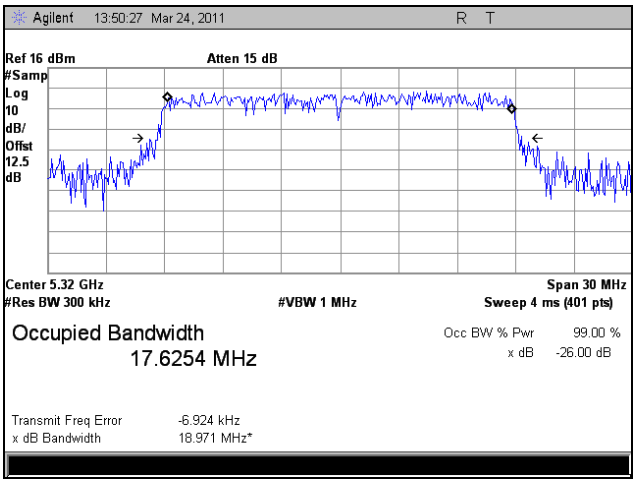


Plot 57. 99% Occupied Bandwidth, Port 1, 802.11n 40MHz, 5670 MHz

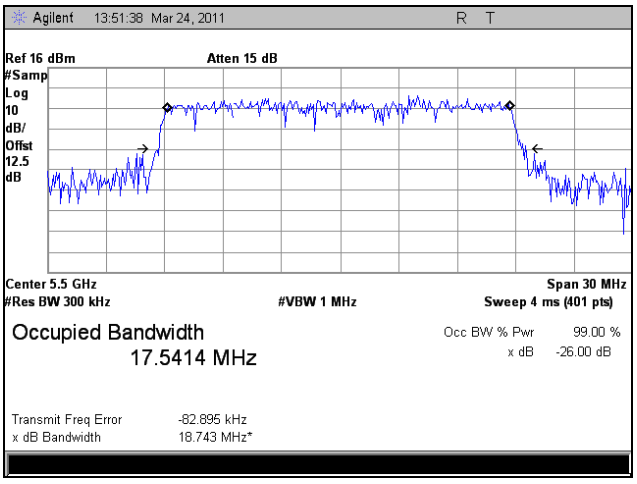
99% Occupied Bandwidth, Port 2, 802.11n 20MHz



Plot 58. 99% Occupied Bandwidth, Port 2, 802.11n 20MHz, 5260 MHz

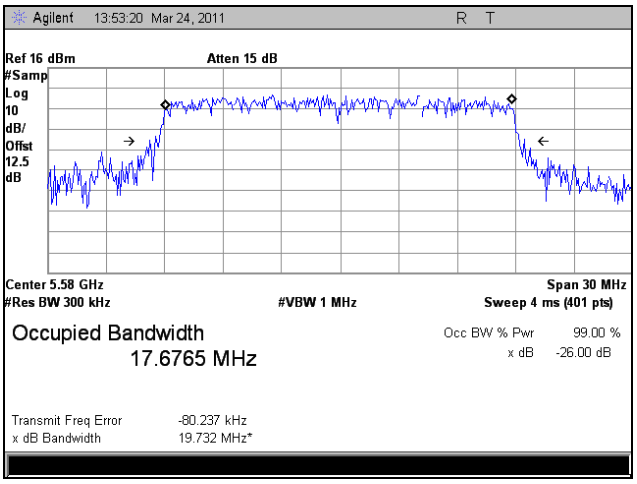


Plot 59. 99% Occupied Bandwidth, Port 2, 802.11n 20MHz, 5320 MHz

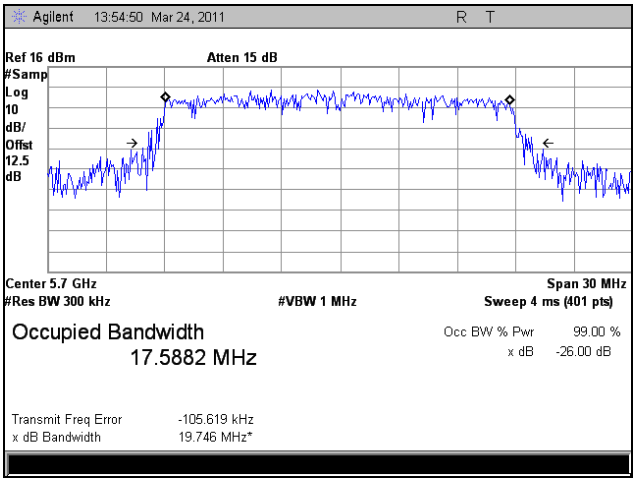


Plot 60. 99% Occupied Bandwidth, Port 2, 802.11n 20MHz, 5500 MHz

99% Occupied Bandwidth, Port 2, 802.11n 20MHz

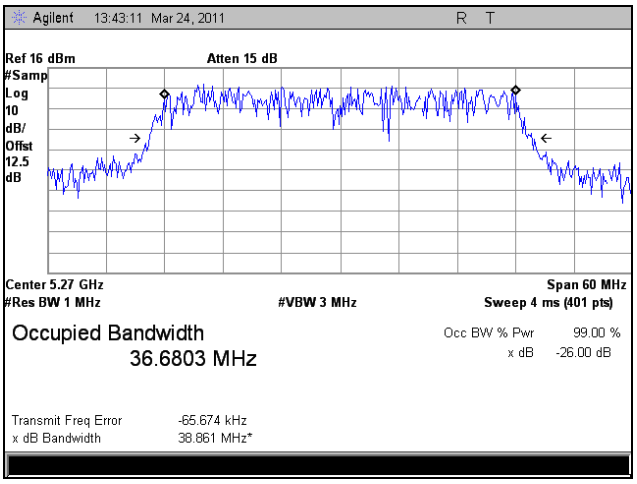


Plot 61. 99% Occupied Bandwidth, Port 2, 802.11n 20MHz, 5580 MHz

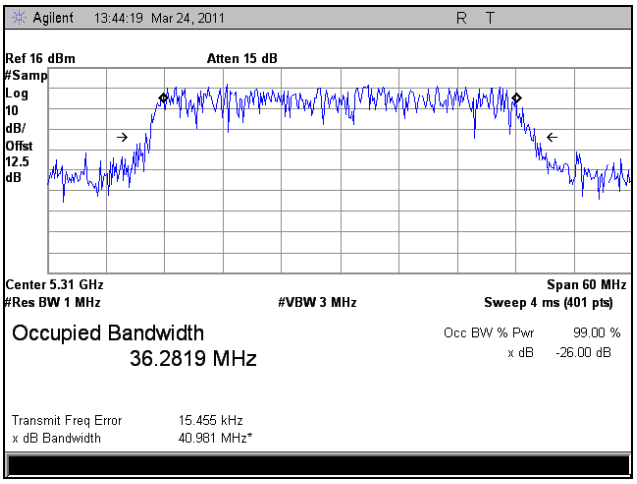


Plot 62. 99% Occupied Bandwidth, Port 2, 802.11n 20MHz, 5700 MHz

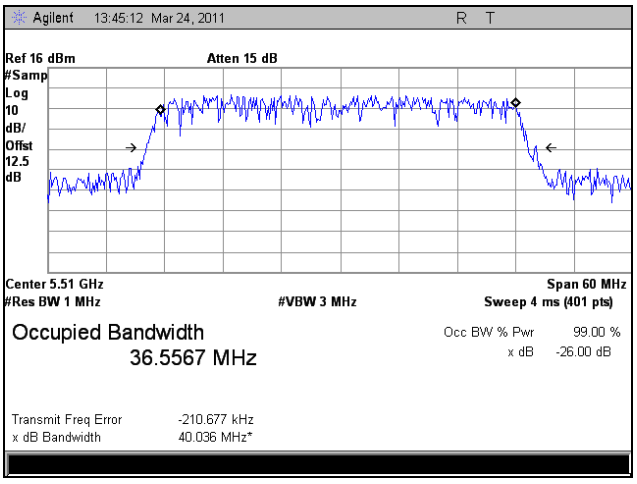
99% Occupied Bandwidth, Port 2, 802.11n 40MHz



Plot 63. 99% Occupied Bandwidth, Port 2, 802.11n 40MHz, 5270 MHz

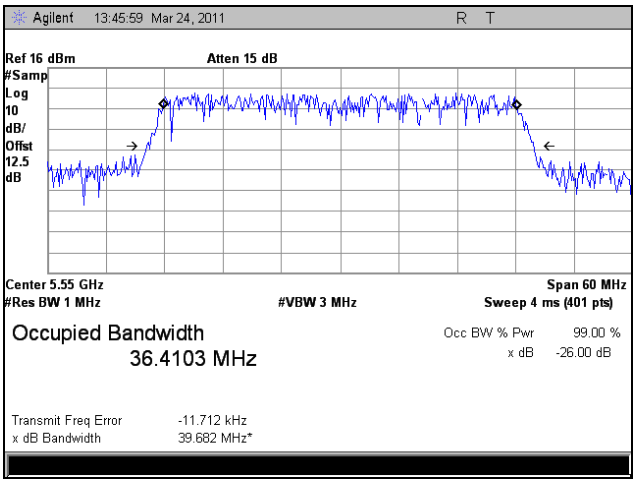


Plot 64. 99% Occupied Bandwidth, Port 2, 802.11n 40MHz, 5310 MHz

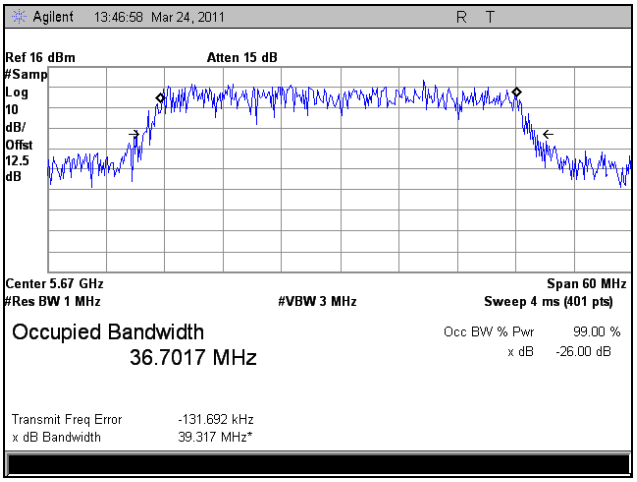


Plot 65. 99% Occupied Bandwidth, Port 2, 802.11n 40MHz, 5510 MHz

99% Occupied Bandwidth, Port 2, 802.11n 40MHz

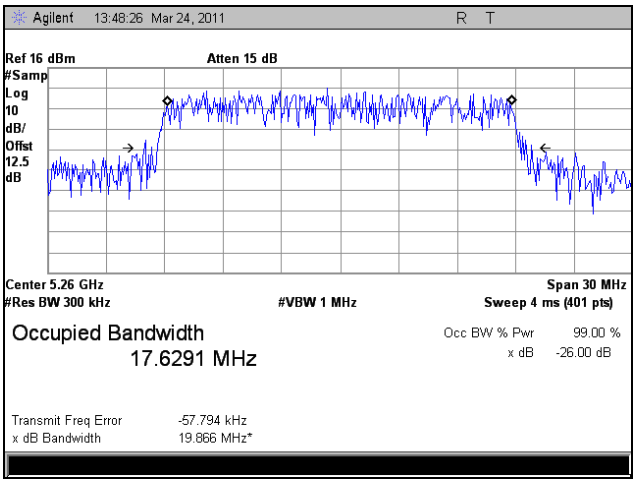


Plot 66. 99% Occupied Bandwidth, Port 2, 802.11n 40MHz, 5550 MHz

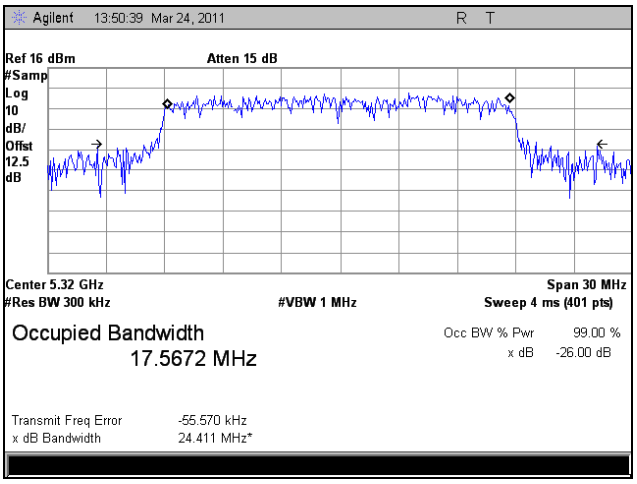


Plot 67. 99% Occupied Bandwidth, Port 2, 802.11n 40MHz, 5670 MHz

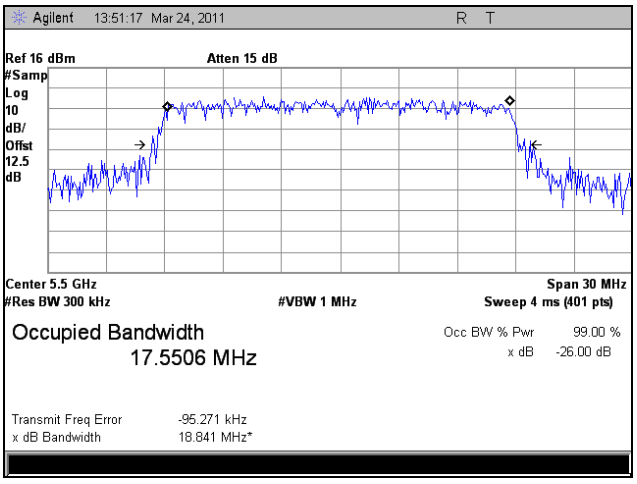
99% Occupied Bandwidth, Port 3, 802.11n 20MHz



Plot 68. 99% Occupied Bandwidth, Port 3, 802.11n 20MHz, 5260 MHz

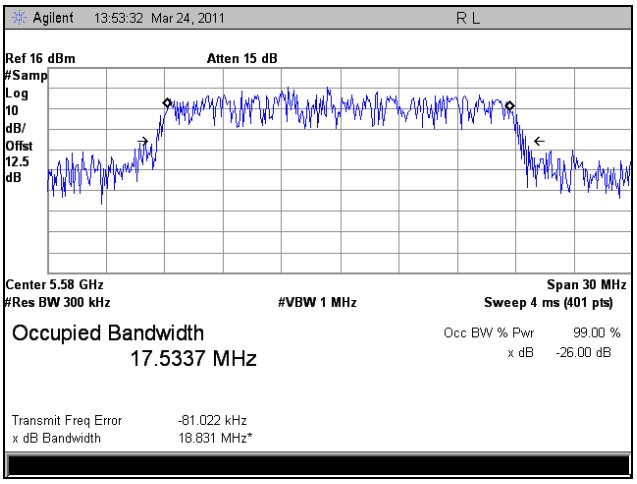


Plot 69. 99% Occupied Bandwidth, Port 3, 802.11n 20MHz, 5320 MHz

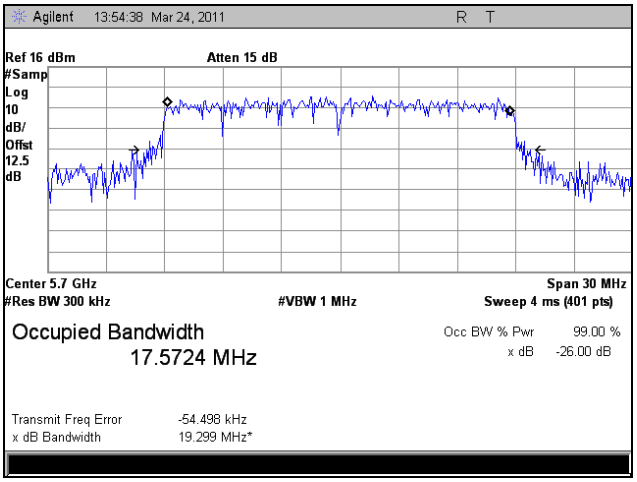


Plot 70. 99% Occupied Bandwidth, Port 3, 802.11n 20MHz, 5500 MHz

99% Occupied Bandwidth, Port 3, 802.11n 20MHz

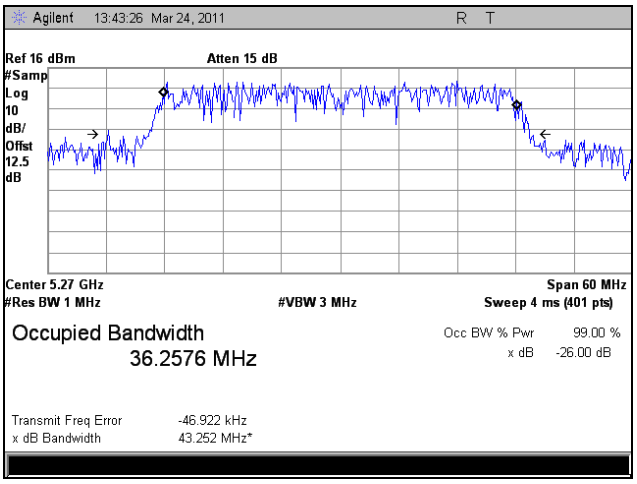


Plot 71. 99% Occupied Bandwidth, Port 3, 802.11n 20MHz, 5580 MHz

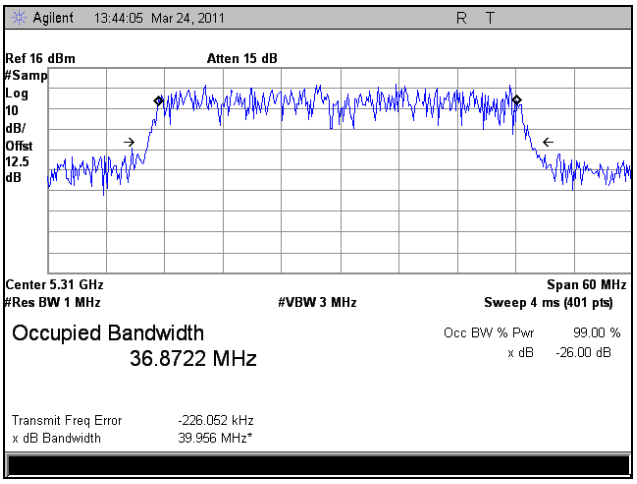


Plot 72. 99% Occupied Bandwidth, Port 3, 802.11n 20MHz, 5700 MHz

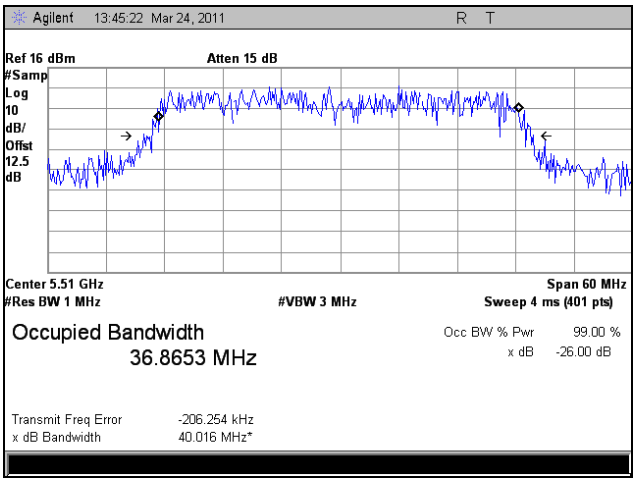
99% Occupied Bandwidth, Port 3, 802.11n 40MHz



Plot 73. 99% Occupied Bandwidth, Port 3, 802.11n 40MHz, 5270 MHz

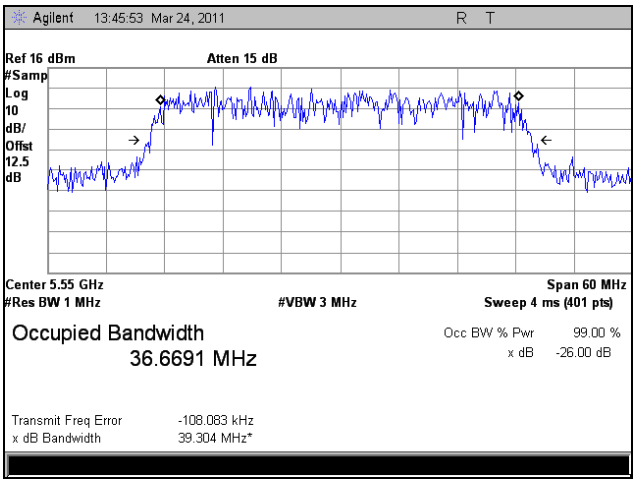


Plot 74. 99% Occupied Bandwidth, Port 3, 802.11n 40MHz, 5310 MHz

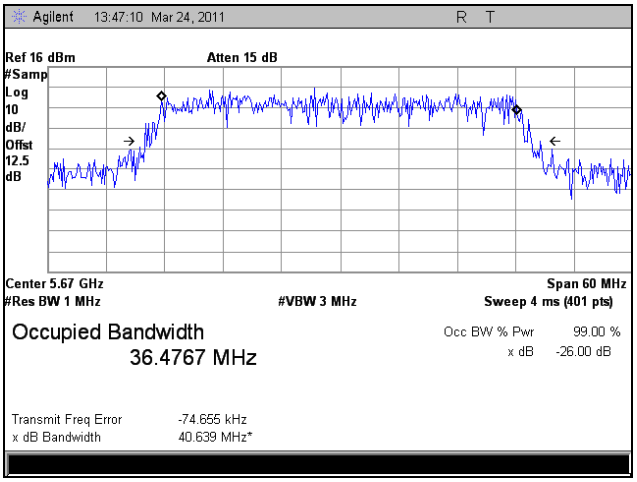


Plot 75. 99% Occupied Bandwidth, Port 3, 802.11n 40MHz, 5510 MHz

99% Occupied Bandwidth, Port 3, 802.11n 40MHz



Plot 76. 99% Occupied Bandwidth, Port 3, 802.11n 40MHz, 5550 MHz



Plot 77. 99% Occupied Bandwidth, Port 3, 802.11n 40MHz, 5670 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

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.

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) (2)**

Test Engineer(s): Minh Ly

Test Date(s): 07/28/09 - 08/11/09

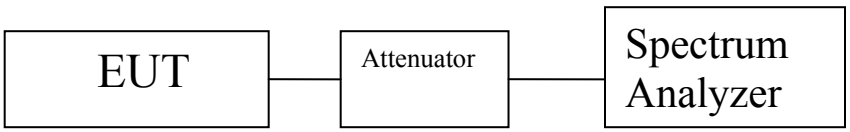


Figure 3. Peak Power Output Test Setup

5 dBi Omni Antenna (802.11a)			
Mode	**Frequency (MHz)**		**Measured Output Power (dBm)**
802.11a	UNII-2 Lower Band	5260	17.33
		5320	17.42
	UNII-2 Upper Band	5500	17.38
		5580	17.31
		5700	17.24

5 dBi Omni Antenna (802.11n)						
Mode	**Frequency (MHz)**		**Port 1**	**Port 2**	**Port 3**	**Summed Power (dBm)**
802.11n 20MHz	UNII-2 Lower Band	5260	13.43	13.55	12.90	18.07
		5320	13.06	11.83	12.99	17.43
	UNII-2 Upper Band	5500	13.18	12.11	13.27	17.65
		5580	12.83	12.83	13.38	17.79
		5700	12.90	12.80	13.12	17.71
802.11n 40MHz	UNII-2 Lower Band	5270	13.29	13.30	13.25	18.05
		5310	6.35	7.01	7.22	11.65
	UNII-2 Upper Band	5510	10.13	10.40	10.30	15.05
		5550	13.41	13.04	13.52	18.10
		5670	8.54	10.82	10.37	14.78

Table 19. RF Power Output, 5 dBi Omni

19 dBi Panel Antenna (802.11a)			
Mode	**Frequency (MHz)**		**Measured Output Power (dBm)**
802.11a	UNII-2 Lower Band	5260	10.31
		5320	10.14
	UNII-2 Upper Band	5500	10.41
		5580	10.45
		5700	10.22

19 dBi Panel Antenna (802.11n)						
Mode	**Frequency (MHz)**		**Port 1**	**Port 2**	**Port 3**	**Summed Power (dBm)**
802.11n 20MHz	UNII-2 Lower Band	5260	5.92	5.35	5.48	10.19
		5320	6.10	5.45	5.83	10.40
	UNII-2 Upper Band	5500	6.02	5.75	5.55	10.38
		5580	6.22	5.92	5.05	10.35
		5700	5.87	5.30	5.57	10.19
802.11n 40MHz	UNII-2 Lower Band	5270	5.02	5.06	5.05	9.67
		5310	5.64	5.34	5.80	10.20
	UNII-2 Upper Band	5510	5.22	5.02	5.18	9.76
		5550	5.23	5.71	5.73	10.17
		5670	4.94	5.23	5.02	9.68

Table 19. RF Power Output, 19 dBi Panel

Electromagnetic Compatibility Criteria for Intentional Radiators

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

Test Requirements: **§ 15.407(a)(1), (a)(2):** For digitally modulated systems, the conducted peak power spectral density from the intentional radiator to the antenna shall not be greater than 4dBm/MHz in the frequency band 5.15-5.25 GHz and 11dBm/MHz in the frequency band 5.25-5.35GHz.

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 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)(1), (a)(2).** The peak power spectral density was determined from plots on the following page(s).

Test Engineer(s): Minh Ly

Test Date(s): 07/28/09 – 08/11/09

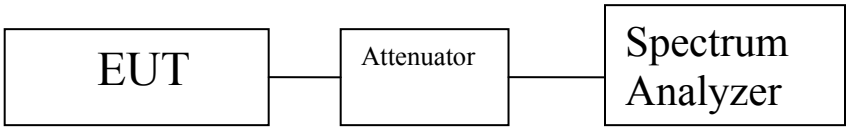


Figure 4. Peak Power Spectral Density Test Setup

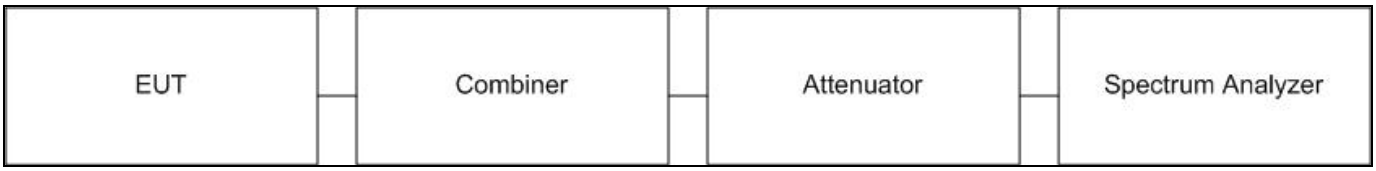


Figure 5. Peak Power Spectral Density Test Setup, Combined Ports

Power Spectral Density			
Mode	**Frequency (MHz)**		**Measured Power Spectral Density (dBm)**
802.11a	UNII-2 Lower Band	5260	4.24
		5320	4.19
	UNII-2 Upper Band	5500	6.22
		5580	6.32
		5700	6.12

Table 20. Power Spectral Density, 802.11a, Test Results

Power Spectral Density						
Mode	**Frequency (MHz)**		**Port 1**	**Port 2**	**Port 3**	**Combined Ports**
802.11n 20MHz	UNII-2 Lower Band	5260	3.13	4.30	4.23	5.63
		5320	3.37	2.18	2.16	4.33
	UNII-2 Upper Band	5500	6.02	3.90	4.05	5.62
		5580	5.94	3.99	4.27	5.66
		5700	6.08	4.27	4.03	5.41
802.11n 40MHz	UNII-2 Lower Band	5270	3.76	3.20	2.15	5.51
		5310	-5.39	-4.89	-5.50	-0.45
	UNII-2 Upper Band	5510	-2.94	-2.96	-2.99	1.14
		5550	2.73	3.49	3.74	5.09
		5670	-1.51	0.75	-0.10	2.76

Table 21. Power Spectral Density, 802.11n, Test Results, Port 1-3 & Combined

Power Spectral Density			
Mode	**Frequency (MHz)**		**Measured Power Spectral Density (dBm)**
802.11a	UNII-2 Lower Band	5260	-3.48
		5320	-3.90
	UNII-2 Upper Band	5500	-3.44
		5580	-4.53
		5700	-4.94

Table 22. Power Spectral Density, 802.11a, Test Results 19dBi

Power Spectral Density						
Mode	**Frequency (MHz)**		**Port 1**	**Port 2**	**Port 3**	**Combined Ports**
802.11n 20MHz	UNII-2 Lower Band	5260	-5.24	-5.84	-7.56	-4.30
		5320	-9.32	-5.12	-7.76	-3.49
	UNII-2 Upper Band	5500	-6.44	-6.24	-9.40	-2.36
		5580	-4.48	-5.04	-4.92	-4.63
		5700	-3.72	-7.36	-9.28	-3.37
802.11n 40MHz	UNII-2 Lower Band	5270	-9.96	-7.83	-9.74	-7.73
		5310	-7.74	-8.08	-9.06	-6.28
	UNII-2 Upper Band	5510	-7.44	-5.92	-8.4	-4.25
		5550	-9.71	-9.92	-8.67	-8.33
		5670	-8.67	-9.48	-6.75	-6.07

Table 23. Power Spectral Density, 802.11n, Test Results, Port 1-3 & Combined 19dBi

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): Minh Ly

Test Date(s): 07/28/09 - 08/11/09

Firetide Indoor and Outdoor MIMO Access Points, Port 1				
Mode	**Frequency (MHz)**	**Excursion Ratio (dBm)**	**Limit (dBm)**	**Margin (dB)**
802.11a	5260	9.087	13	3.913
	5320	9.009	13	3.991
	5500	9.613	13	3.387
	5580	11.37	13	1.63
	5700	9.827	13	3.173
802.11n 20MHz	5260	10.32	13	2.68
	5320	11.53	13	1.47
	5500	10.65	13	2.35
	5580	10.26	13	2.74
	5700	10.79	13	2.21
802.11n 40MHz	5270	12.71	13	0.29
	5310	12.65	13	0.35
	5510	12.59	13	0.41
	5550	10.68	13	2.32
	5670	11.73	13	1.27

Table 24. Peak Excursion Ration, Test Results, Port 1

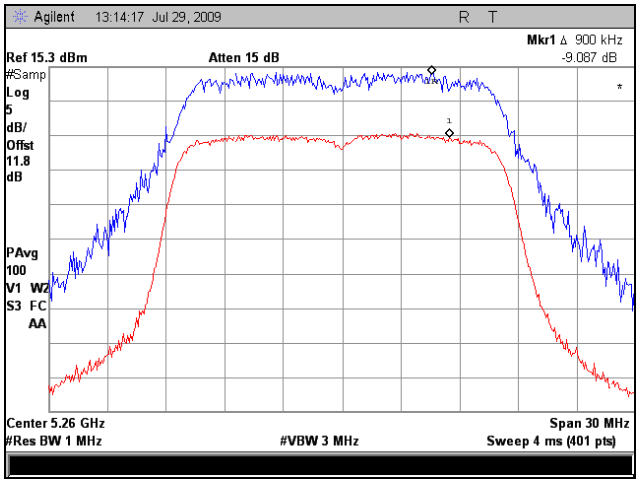
Firetide Indoor and Outdoor MIMO Access Points, Port 2				
Mode	**Frequency (MHz)**	**Excursion Ratio (dBm)**	**Limit (dBm)**	**Margin (dB)**
802.11n 20MHz	5260	10.33	13	2.67
	5320	9.634	13	3.366
	5500	11.02	13	1.98
	5580	11.27	13	1.73
	5700	10.63	13	2.37
802.11n 40MHz	5270	12.95	13	0.05
	5310	11.98	13	1.02
	5510	11.73	13	1.27
	5550	10.52	13	2.48
	5670	9.8	13	3.2

Table 25. Peak Excursion Ration, Test Results, Port 2

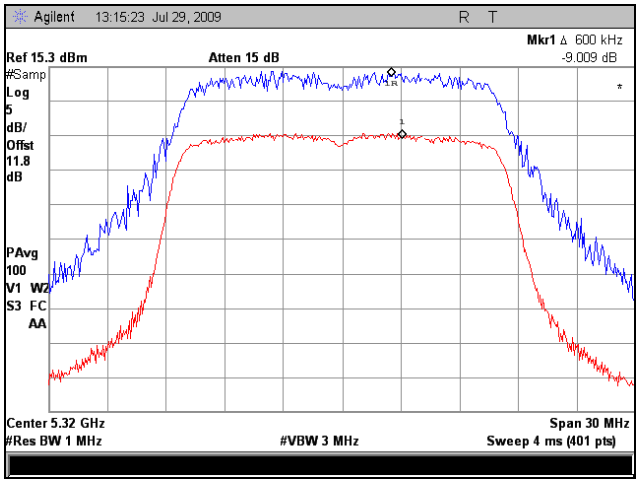
Firetide Indoor and Outdoor MIMO Access Points, Port 3				
Mode	**Frequency (MHz)**	**Excursion Ratio (dBm)**	**Limit (dBm)**	**Margin (dB)**
802.11n 20MHz	5260	11.96	13	1.04
	5320	9.529	13	3.471
	5500	10.11	13	2.89
	5580	10.24	13	2.76
	5700	8.677	13	4.323
802.11n 40MHz	5270	12.86	13	0.14
	5310	12.17	13	0.83
	5510	12.6	13	0.4
	5550	11.2	13	1.8
	5670	12	13	1

Table 26. Peak Excursion Ration, Test Results, Port 3

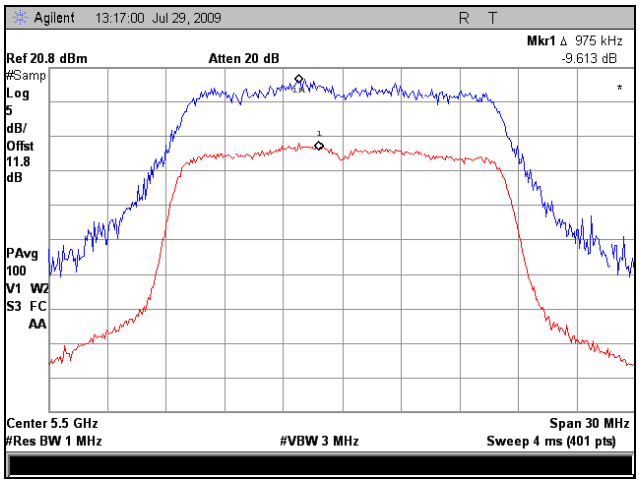
Peak Excursion Ratio, Port 1, 802.11a



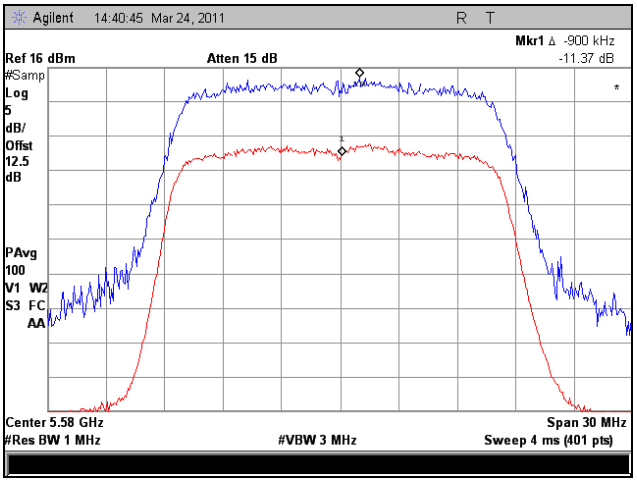
Plot 78. Peak Excursion, Port 1, 802.11a, 5260 MHz



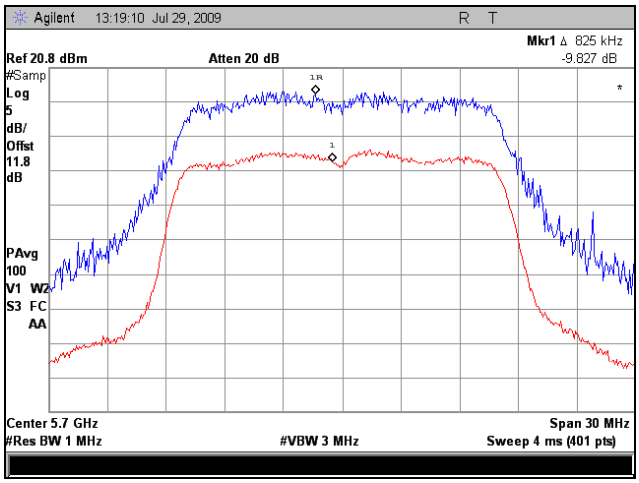
Plot 79. Peak Excursion, Port 1, 802.11a, 5320 MHz



Plot 80. Peak Excursion, Port 1, 802.11a, 5500 MHz

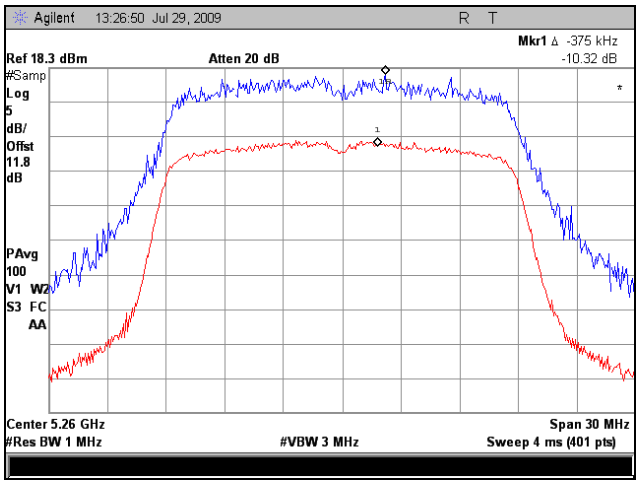


Plot 81. Peak Excursion, Port 1, 802.11a, 5800 MHz

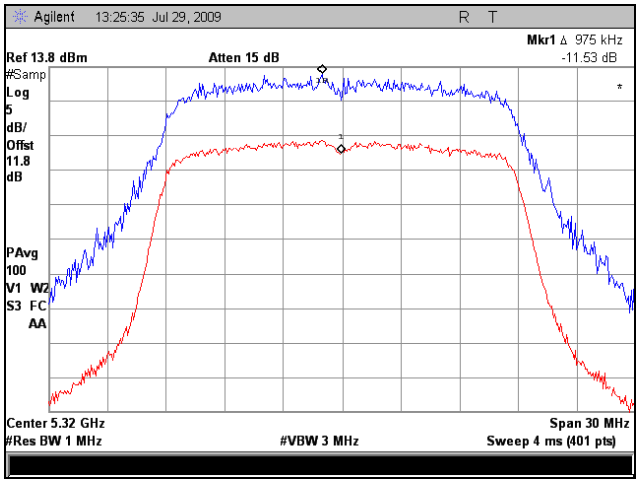


Plot 82. Peak Excursion, Port 1, 802.11a, 5700 MHz

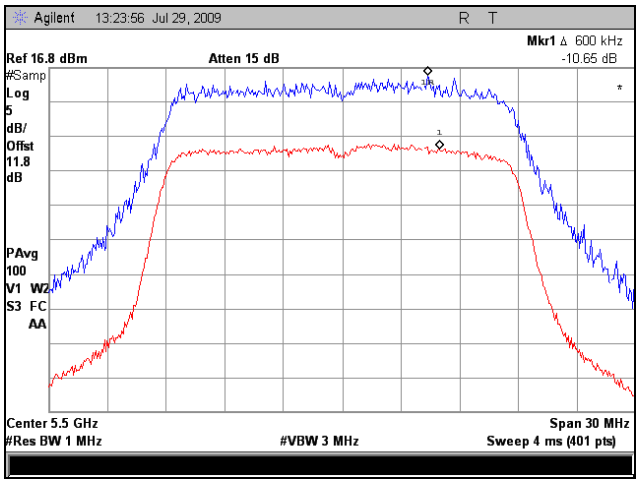
Peak Excursion Ratio, 7200 Outdoor, Port 1, 802.11n 20MHz



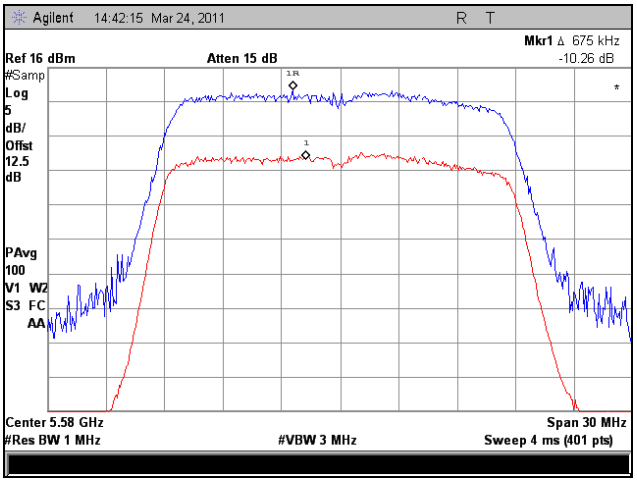
Plot 83. Peak Excursion, Port 1, 802.11n 20MHz, 5260 MHz



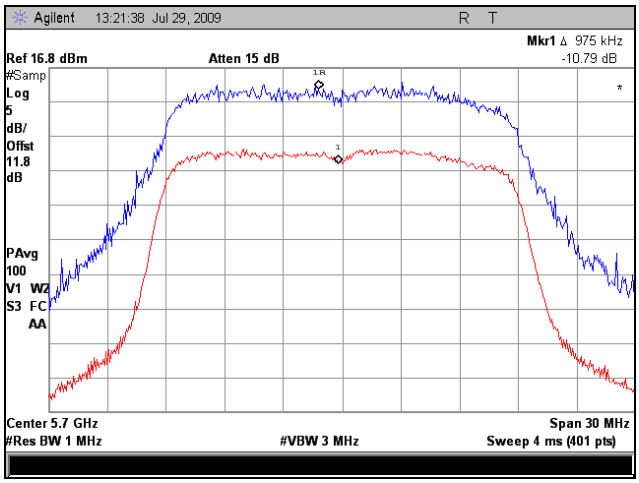
Plot 84. Peak Excursion, Port 1, 802.11n 20MHz, 5320 MHz



Plot 85. Peak Excursion, Port 1, 802.11n 20MHz, 5500 MHz

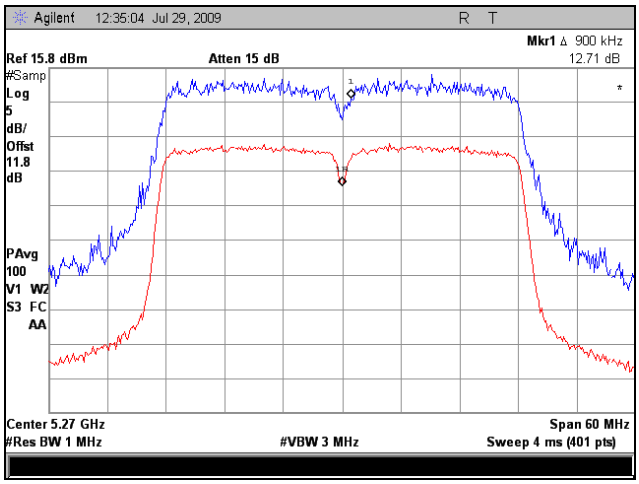


Plot 86. Peak Excursion, Port 1, 802.11n 20MHz, 5600 MHz

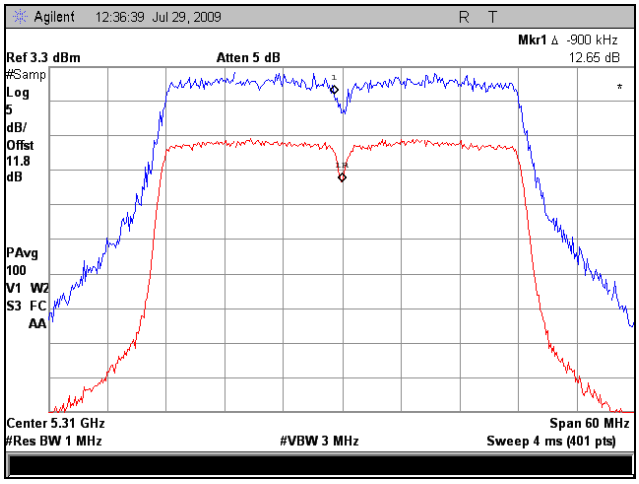


Plot 87. Peak Excursion, Port 1, 802.11n 20MHz, 5700 MHz

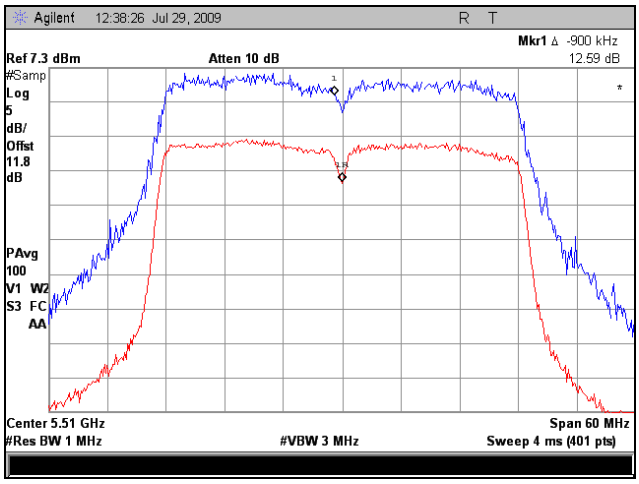
Peak Excursion Ratio, Port 1, 802.11n 40MHz



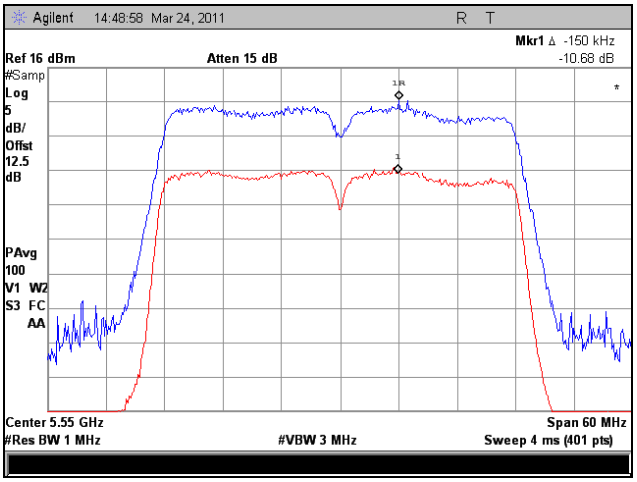
Plot 88. Peak Excursion, Port 1, 802.11n 40MHz, 5270 MHz



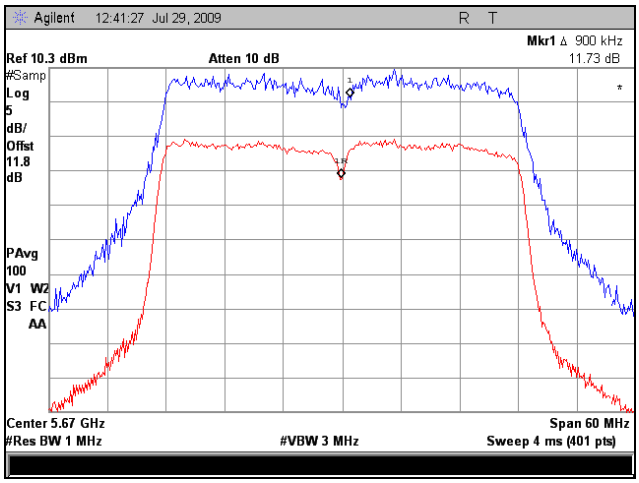
Plot 89. Peak Excursion, Port 1, 802.11n 40MHz, 5310 MHz



Plot 90. Peak Excursion, Port 1, 802.11n 40MHz, 5510 MHz

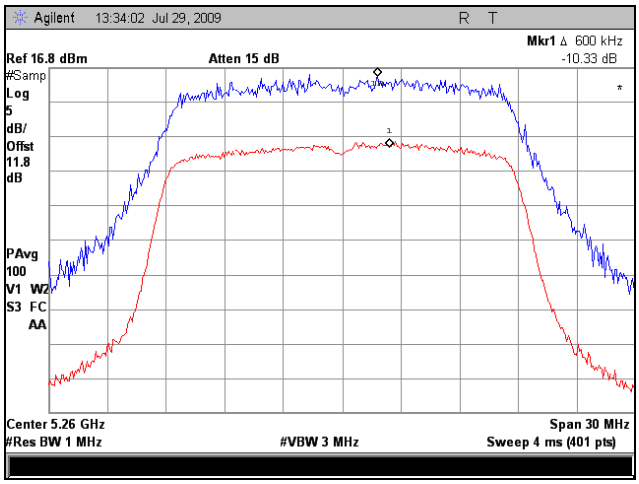


Plot 91. Peak Excursion, Port 1, 802.11n 40MHz, 5550 MHz

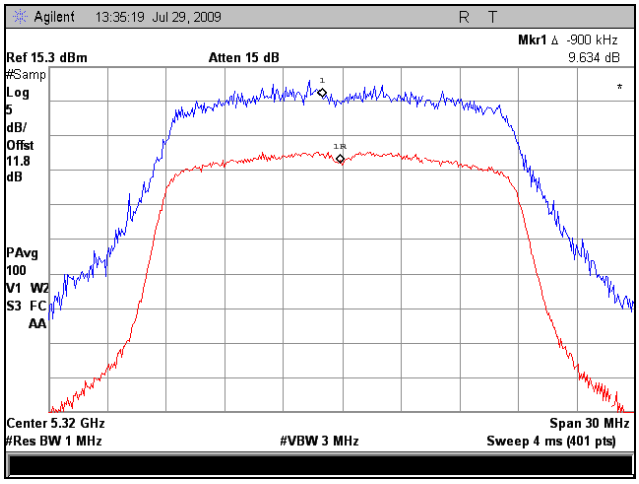


Plot 92. Peak Excursion Ratio, Port 1, 802.11n 40MHz, 5670 MHz

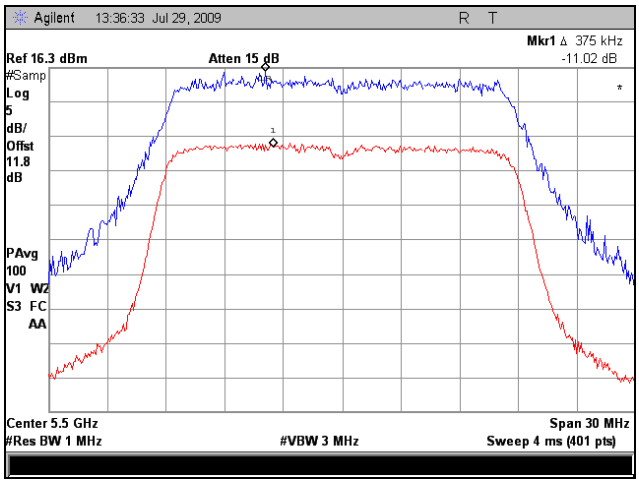
Peak Excursion Ratio, Port 2, 802.11n 20MHz



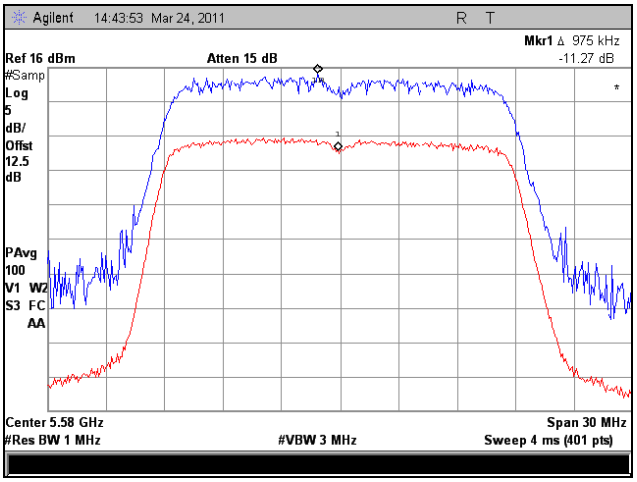
Plot 93. Peak Excursion, Port 2, 802.11n 20MHz, 5260 MHz



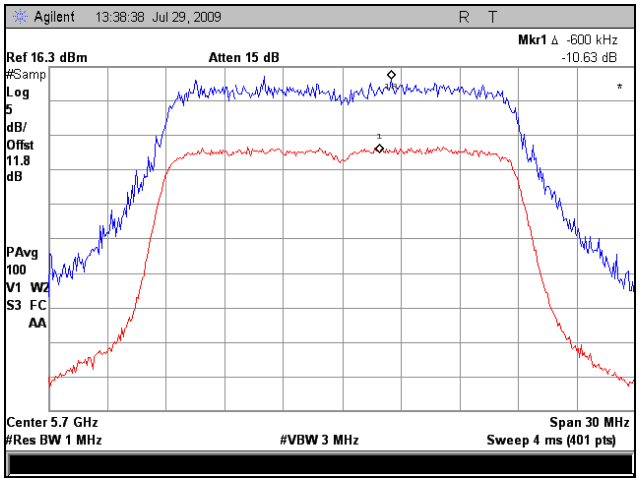
Plot 94. Peak Excursion, Port 2, 802.11n 20MHz, 5320 MHz



Plot 95. Peak Excursion, Port 2, 802.11n 20MHz, 5500 MHz

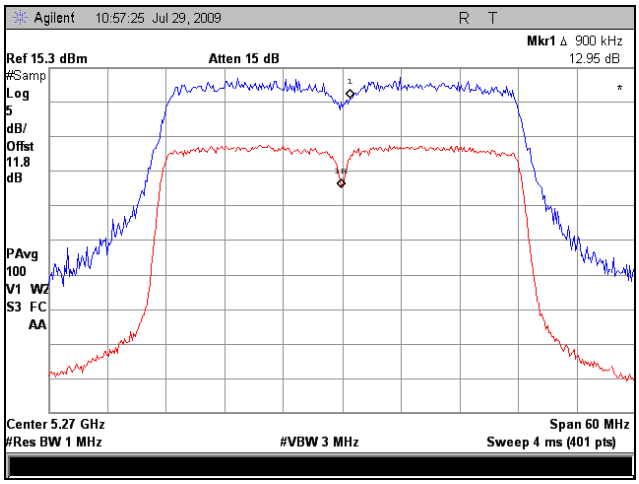


Plot 96. Peak Excursion, Port 2, 802.11n 20MHz, 5800 MHz

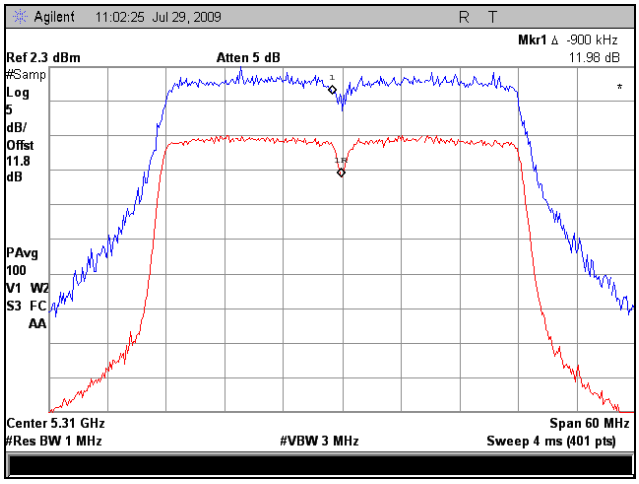


Plot 97. Peak Excursion Ratio, Port 2, 802.11n 20MHz, 5700 MHz

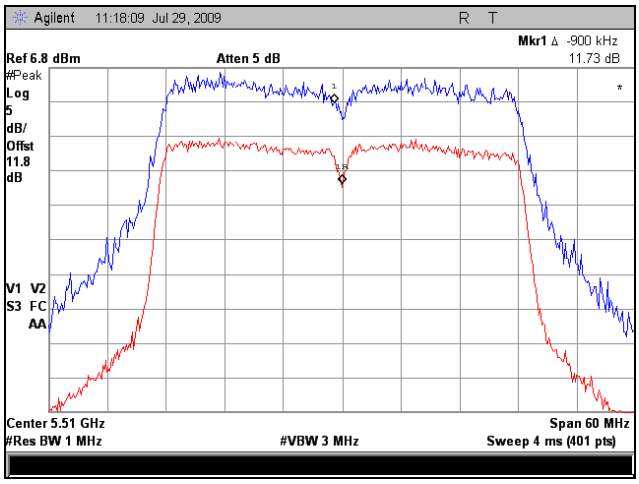
Peak Excursion Ratio, Port 2, 802.11n 40MHz



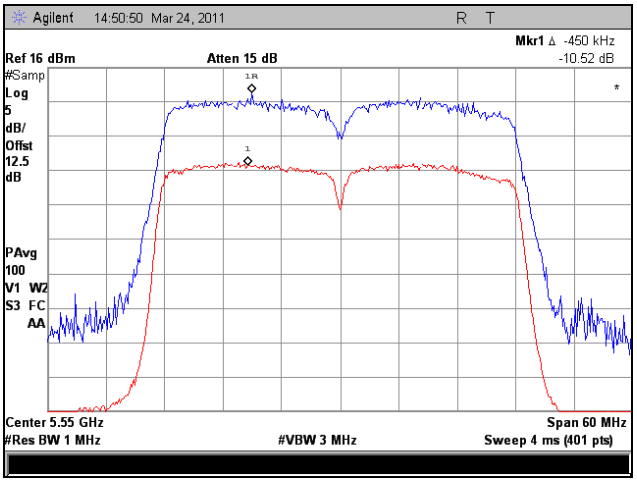
Plot 98. Peak Excursion, Port 2, 802.11n 40MHz, 5270 MHz



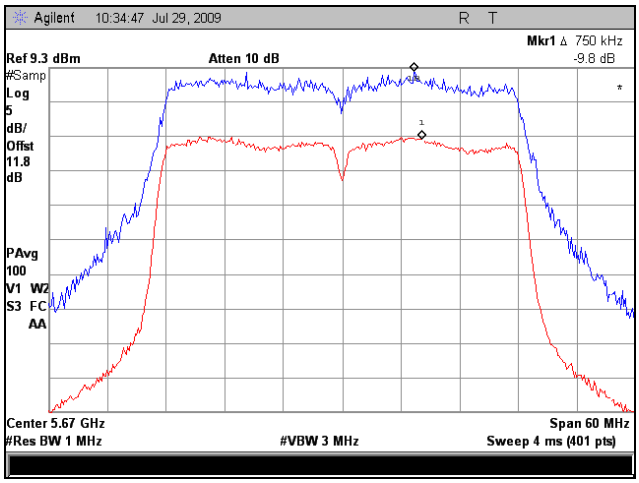
Plot 99. Peak Excursion, Port 2, 802.11n 40MHz, 5310 MHz



Plot 100. Peak Excursion, Port 2, 802.11n 40MHz, 5510 MHz

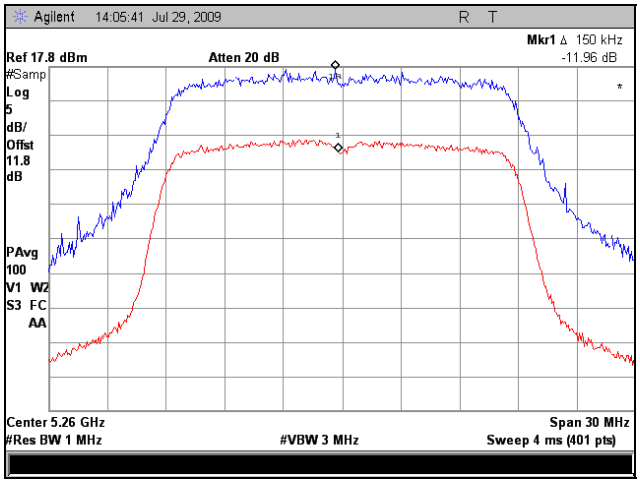


Plot 101. Peak Excursion, Port 2, 802.11n 40MHz, 5550 MHz

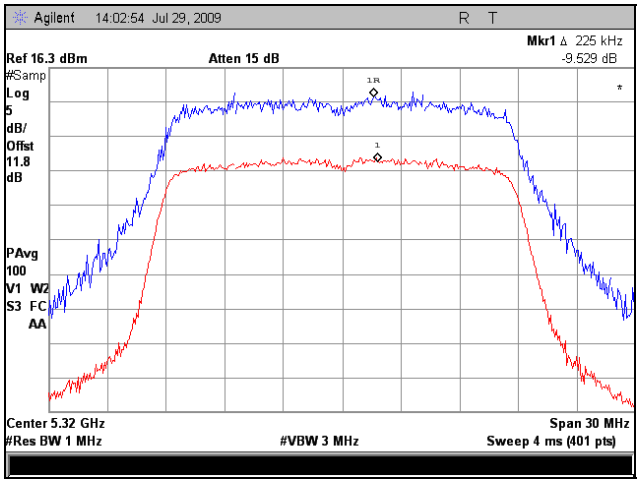


Plot 102. Peak Excursion, Port 2, 802.11n 40MHz, 5670 MHz

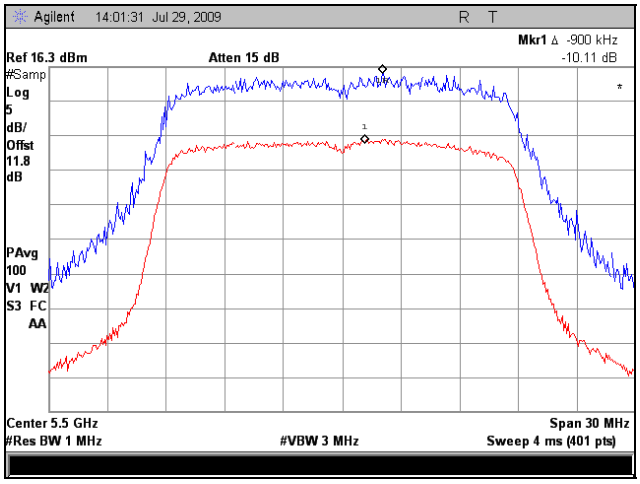
Peak Excursion Ratio, Port 3, 802.11n 20MHz



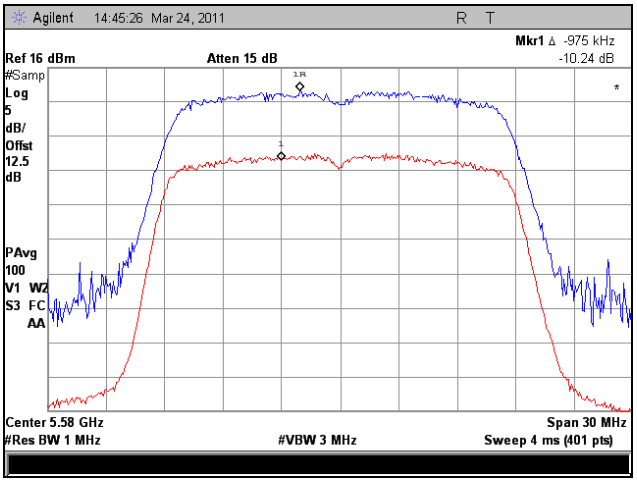
Plot 103. Peak Excursion, Port 3, 802.11n 20MHz, 5260 MHz



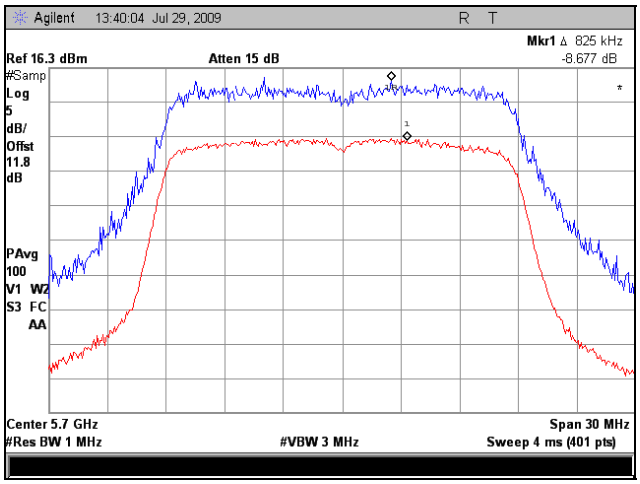
Plot 104. Peak Excursion, Port 3, 802.11n 20MHz, 5320 MHz



Plot 105. Peak Excursion, Port 3, 802.11n 20MHz, 5500 MHz

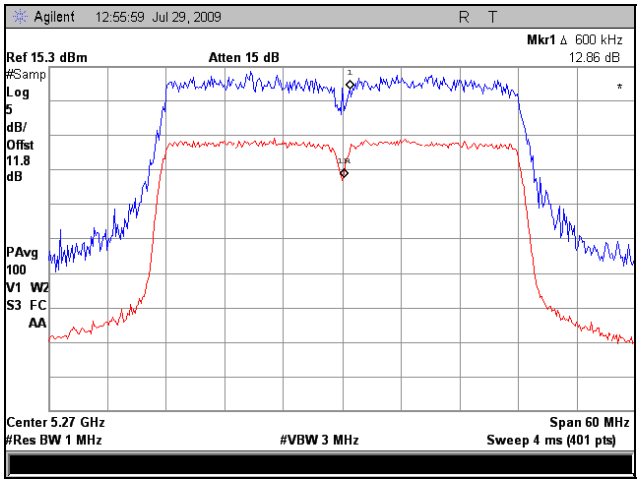


Plot 106. Peak Excursion, Port 3, 802.11n 20MHz, 5800 MHz

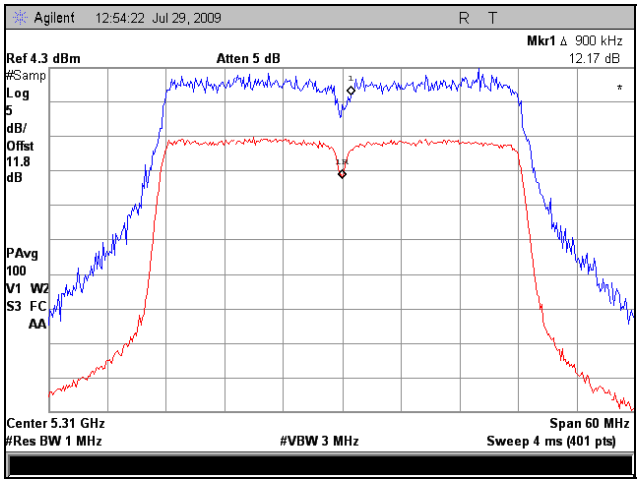


Plot 107. Peak Excursion Ratio, Port 3, 802.11n 20MHz, 5700 MHz

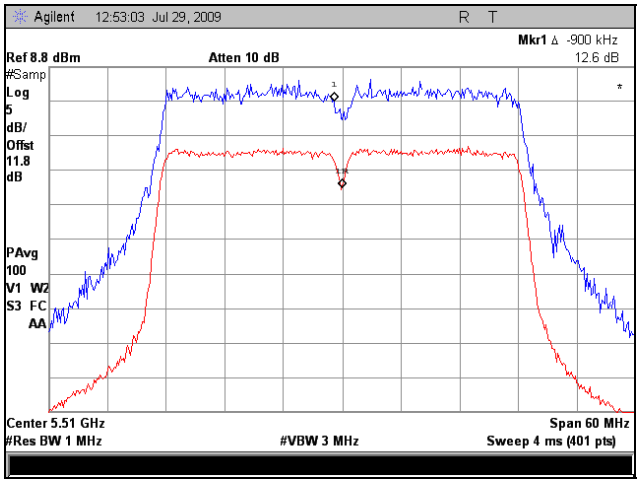
Peak Excursion Ratio, Port 3, 802.11n 40MHz



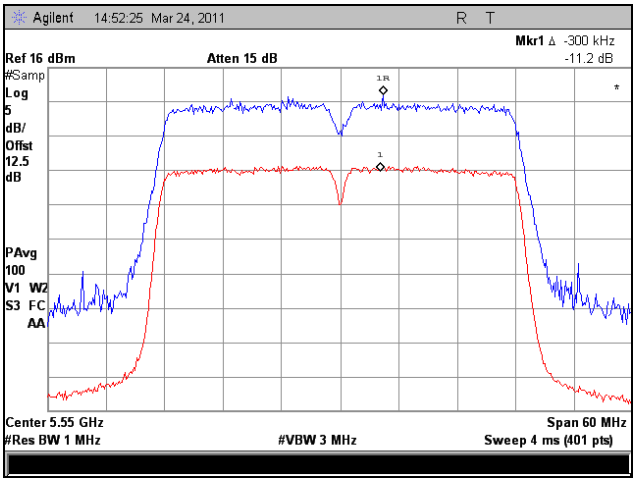
Plot 108. Peak Excursion, Port 3, 802.11n 40MHz, 5270 MHz



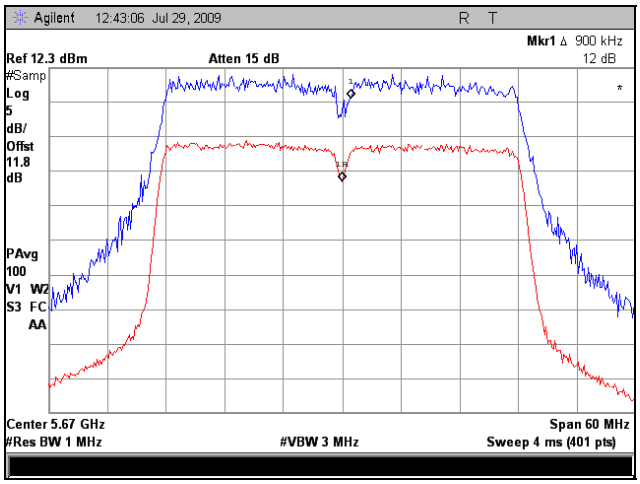
Plot 109. Peak Excursion, Port 3, 802.11n 40MHz, 5310 MHz



Plot 110. Peak Excursion, Port 3, 802.11n 40MHz, 5510 MHz



Plot 111. Peak Excursion, Port 3, 802.11n 40MHz, 5550 MHz



Plot 112. Peak Excursion, Port 3, 802.11n 40MHz, 5670 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)(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 27. 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 -27dBm/MHz was converted to field strength at 68.23dBuV/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): Minh Ly

Test Date(s): 07/28/09 - 08/11/09

Harmonic Emissions Requirements – Radiated, 802.11a, (5dBi Omni Antenna)

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp. (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
10.52	V	45.77	35.19	38.21	6.84	55.63	Peak	74	-18.37
10.52	V	33.41	35.19	38.21	6.84	43.27	Avg.	54	-10.73
15.78	V	44.97	34.97	37.68	8.86	56.55	Peak	74	-17.45
15.78	V	32..41	34.97	37.68	8.86	43.99	Avg.	54	-10.01

Table 28. Radiated Harmonics, 802.11a, 5 dBi Omni, 5260 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
10.64	V	50.07	35.03	38.29	6.83	60.16	Peak	74	-13.84
10.64	V	39.24	35.03	38.29	6.83	49.33	Avg.	54	-4.67
15.96	V	44.3	35.09	37.68	8.87	55.76	Peak	74	-18.24
15.96	V	31.43	35.09	37.68	8.87	42.89	Avg.	54	-11.11

Table 29. Radiated Harmonics, 802.11a, 5 dBi Omni, 5320 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11	V	44.41	34.81	38.70	6.98	55.28	Peak	74	-18.72
11	V	30.33	34.81	38.70	6.98	41.20	Avg.	54	-12.80
16.5	V	44.61	34.60	38.80	9.70	58.51	Peak	74	-15.49
16.5	V	30.91	34.60	38.80	9.70	44.81	Avg.	54	-9.19

Table 30. Radiated Harmonics, 802.11a, 5 dBi Omni, 5500 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.16	V	45.41	34.77	39.04	7.22	56.90	Peak	74	-17.10
11.16	V	30.38	34.77	39.04	7.22	41.87	Avg	54	-12.13
16.74	V	45.04	34.38	40.29	9.69	60.64	Peak	74	-13.36
16.74	V	30.75	34.38	40.29	9.69	46.35	Avg	54	-7.65

Table 31. Radiated Harmonics, 802.11a, 5 dBi Omni, 5580 MHz

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

Harmonic Emissions Requirements – Radiated, 802.11a (5dBi Omni Antenna)

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp. (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.4	V	43.41	34.81	39.63	7.63	55.86	Peak	74	-18.14
11.4	V	33.27	34.81	39.63	7.63	45.72	Avg.	54	-8.28
17.1	V	44.7	34.15	42.41	9.77	62.73	Peak	74	-11.27
17.1	V	30.18	34.15	42.41	9.77	48.21	Avg.	54	-5.79

Table 32. Radiated Harmonics, 802.11a, 5 dBi Omni, 5700 MHz

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

Harmonic Emissions Requirements – Radiated, 802.11n 20MHz (5 dBi Omni Antenna)

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp. (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
10.52	V	46.44	35.19	38.21	6.84	56.30	Peak	74	-17.70
10.52	V	31.01	35.19	38.21	6.84	40.87	Avg.	54	-13.13
15.78	V	46.01	34.97	37.68	8.86	57.59	Peak	74	-16.41
15.78	V	32.79	34.97	37.68	8.86	44.37	Avg.	54	-9.63

Table 33. Radiated Harmonics, 802.11n 20MHz, 5 dBi Omni, 5260 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
10.64	V	49.96	35.03	38.29	6.83	60.05	Peak	74	-13.95
10.64	V	37.59	35.03	38.29	6.83	47.68	Avg.	54	-6.32
15.96	V	45.23	35.09	37.68	8.87	56.69	Peak	74	-17.31
15.96	V	32.92	35.09	37.68	8.87	44.38	Avg.	54	-9.62

Table 34. Radiated Harmonics, 802.11n 20MHz, 5 dBi Omni, 5320 MHz

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

Harmonic Emissions Requirements – Radiated, 802.11n 20MHz (5 dBi Omni Antenna)

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp. (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11	V	44.05	34.81	38.70	6.98	54.92	Peak	74	-19.08
11	V	31.19	34.81	38.70	6.98	42.06	Avg.	54	-11.94
16.5	V	45.88	34.60	38.80	9.70	59.78	Peak	74	-14.22
16.5	V	30.84	34.60	38.80	9.70	44.74	Avg.	54	-9.26

Table 35. Radiated Harmonics, 802.11n 20MHz, 5 dBi Omni, 5500 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.16	V	45.1	34.77	39.04	7.22	56.59	Peak	74	-17.41
11.16	V	30.04	34.77	39.04	7.22	41.53	Avg	54	-12.47
16.74	V	44.39	34.38	40.29	9.69	59.99	Peak	74	-14.01
16.74	V	32.24	34.38	40.29	9.69	47.84	Avg	54	-6.16

Table 36. Radiated Harmonics, 802.11n 20MHz, 5 dBi Omni, 5580 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.4	V	46.04	34.81	39.63	7.63	58.49	Peak	74	-15.51
11.4	V	31.76	34.81	39.63	7.63	44.21	Avg.	54	-9.79
17.1	V	44.71	34.15	42.41	9.77	62.74	Peak	74	-11.26
17.1	V	32.72	34.15	42.41	9.77	50.75	Avg.	54	-3.25

Table 37. Radiated Harmonics, 802.11n 20MHz, 5 dBi Omni, 5700 MHz

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

Harmonic Emissions Requirements – Radiated, 802.11n 40MHz (5dBi Omni Antenna)

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp. (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
10.54	V	44.39	35.16	38.22	6.83	54.28	Peak	74	-19.72
10.54	V	30.52	35.16	38.22	6.83	40.41	Avg.	54	-13.59
15.81	V	45.51	34.99	37.67	8.85	57.05	Peak	74	-16.95
15.81	V	32.39	34.99	37.67	8.85	43.93	Avg.	54	-10.07

Table 38. Radiated Harmonics, 802.11n 40MHz, 5 dBi Omni, 5270 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
10.62	V	48.5	35.06	38.27	6.83	58.54	Peak	74	-15.46
10.62	V	34.55	35.06	38.27	6.83	44.59	Avg.	54	-9.41
15.93	V	44.46	35.07	37.67	8.86	55.91	Peak	74	-18.09
15.93	V	32.27	35.07	37.67	8.86	43.72	Avg.	54	-10.28

Table 39. Radiated Harmonics, 802.11n 40MHz, 5 dBi Omni, 5310 MHz

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

Harmonic Emissions Requirements – Radiated, 802.11n 40MHz (5dBi Omni Antenna)

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp. (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.02	V	45.02	34.80	38.73	7.00	55.95	Peak	74	-18.05
11.02	V	31.09	34.80	38.73	7.00	42.02	Avg.	54	-11.98
16.53	V	43.69	34.55	38.94	9.72	57.79	Peak	74	-16.21
16.53	V	30.96	34.55	38.94	9.72	45.06	Avg.	54	-8.94

Table 40. Radiated Harmonics, 802.11n 40MHz, 5 dBi Omni, 5510 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.1	V	44.27	34.78	38.90	7.11	55.50	Peak	74	-18.50
11.1	V	30.1	34.78	38.90	7.11	41.33	Avg	54	-12.67
16.65	V	46.58	34.43	39.65	9.72	61.53	Peak	74	-12.47
16.65	V	32.47	34.43	39.65	9.72	47.42	Avg	54	-6.58

Table 41. Radiated Harmonics, 802.11n 40MHz, 5 dBi Omni, 5550 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.34	V	44.78	34.78	39.50	7.56	57.05	Peak	74	-16.95
11.34	V	31.98	34.78	39.50	7.56	44.25	Avg.	54	-9.75
17.01	V	43.4	34.24	42.05	9.68	60.89	Peak	74	-13.11
17.01	V	31.11	34.24	42.05	9.68	48.60	Avg.	54	-5.40

Table 42. Radiated Harmonics, 802.11n 40MHz, 5 dBi Omni, 5670 MHz

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

Harmonic Emissions Requirements – Radiated, 802.11a (19dBi Panel Antenna)

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp. (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
10.52	V	44.52	35.19	38.21	6.84	54.38	Peak	74	-19.62
10.52	V	30.81	35.19	38.21	6.84	40.67	Avg.	54	-13.33
15.78	V	44.7	34.97	37.68	8.86	56.28	Peak	74	-17.72
15.78	V	32.27	34.97	37.68	8.86	43.85	Avg.	54	-10.15

Table 43. Radiated Harmonics, 802.11a, 19 dBi Panel, 5260 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
10.64	V	50	35.03	38.29	6.83	60.09	Peak	74	-13.91
10.64	V	38.06	35.03	38.29	6.83	48.15	Avg.	54	-5.85
15.96	V	44.6	35.09	37.68	8.87	56.06	Peak	74	-17.94
15.96	V	31.77	35.09	37.68	8.87	43.23	Avg.	54	-10.77

Table 44. Radiated Harmonics, 802.11a, 19 dBi Panel, 5320 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11	V	43.83	34.81	38.70	6.98	54.70	Peak	74	-19.30
11	V	31.55	34.81	38.70	6.98	42.42	Avg.	54	-11.58
16.5	V	45.44	34.60	38.80	9.70	59.34	Peak	74	-14.66
16.5	V	31.58	34.60	38.80	9.70	45.48	Avg.	54	-8.52

Table 45. Radiated Harmonics, 802.11a, 19 dBi Panel, 5500 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.16	V	45.12	34.77	39.04	7.22	56.61	Peak	74	-17.39
11.16	V	33.52	34.77	39.04	7.22	45.01	Avg	54	-8.99
16.74	V	45.65	34.38	40.29	9.69	61.25	Peak	74	-12.75
16.74	V	31.52	34.38	40.29	9.69	47.12	Avg	54	-6.88

Table 46. Radiated Harmonics, 802.11a, 19 dBi Panel, 5580 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.4	V	47.42	34.81	39.63	7.63	59.87	Peak	74	-14.13
11.4	V	31.72	34.81	39.63	7.63	44.17	Avg.	54	-9.83
17.1	V	45.42	34.15	42.41	9.77	63.45	Peak	74	-10.55
17.1	V	30.62	34.15	42.41	9.77	48.65	Avg.	54	-5.35

Table 47. Radiated Harmonics, 802.11a, 19 dBi Panel, 5700 MHz

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

Harmonic Emissions Requirements – Radiated, 802.11n 20MHz (19dBi Panel Antenna)

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp. (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
10.52	V	45.37	35.19	38.21	6.84	55.23	Peak	74	-18.77
10.52	V	35.22	35.19	38.21	6.84	45.08	Avg.	54	-8.92
15.78	V	48.09	34.97	37.68	8.86	59.67	Peak	74	-14.33
15.78	V	33.41	34.97	37.68	8.86	44.99	Avg.	54	-9.01

Table 48. Radiated Harmonics, 802.11n 20MHz, 19 dBi Panel, 5260 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
10.64	V	48.99	35.03	38.29	6.83	59.08	Peak	74	-14.92
10.64	V	35.77	35.03	38.29	6.83	45.86	Avg.	54	-8.14
15.96	V	44.88	35.09	37.68	8.87	56.34	Peak	74	-17.66
15.96	V	32.98	35.09	37.68	8.87	44.44	Avg.	54	-9.56

Table 49. Radiated Harmonics, 802.11n 20MHz, 19 dBi Panel, 5320 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11	V	45.93	34.81	38.70	6.98	56.80	Peak	74	-17.20
11	V	30.47	34.81	38.70	6.98	41.34	Avg.	54	-12.66
16.5	V	47.04	34.60	38.80	9.70	60.94	Peak	74	-13.06
16.5	V	35.65	34.60	38.80	9.70	49.55	Avg.	54	-4.45

Table 50. Radiated Harmonics, 802.11n 20MHz, 19 dBi Panel, 5500 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.16	V	45.94	34.77	39.04	7.22	57.43	Peak	74	-16.57
11.16	V	33.4	34.77	39.04	7.22	44.89	Avg	54	-9.11
16.74	V	46.89	34.38	40.29	9.69	62.49	Peak	74	-11.51
16.74	V	33.28	34.38	40.29	9.69	48.88	Avg	54	-5.12

Table 51. Radiated Harmonics, 802.11n 20MHz, 19 dBi Panel, 5580 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.4	V	45.52	34.81	39.63	7.63	57.97	Peak	74	-16.03
11.4	V	34.2	34.81	39.63	7.63	46.65	Avg.	54	-7.35
17.1	V	45.12	34.15	42.41	9.77	63.15	Peak	74	-10.85
17.1	V	30.63	34.15	42.41	9.77	48.66	Avg.	54	-5.34

Table 52. Radiated Harmonics, 802.11n 20MHz, 19 dBi Panel, 5700 MHz

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

Harmonic Emissions Requirements – Radiated, 802.11n 40MHz (19dBi Panel Antenna)

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp. (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
10.54	V	44.29	35.16	38.22	6.83	54.18	Peak	74	-19.82
10.54	V	34.06	35.16	38.22	6.83	43.95	Avg.	54	-10.05
15.81	V	45.29	34.99	37.67	8.85	56.83	Peak	74	-17.17
15.81	V	32.3	34.99	37.67	8.85	43.84	Avg.	54	-10.16

Table 53. Radiated Harmonics, 802.11n 40MHz, 19 dBi Panel, 5270 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
10.62	V	47.11	35.06	38.27	6.83	57.15	Peak	74	-16.85
10.62	V	34.53	35.06	38.27	6.83	44.57	Avg.	54	-9.43
15.93	V	44.63	35.07	37.67	8.86	56.08	Peak	74	-17.92
15.93	V	31.72	35.07	37.67	8.86	43.17	Avg.	54	-10.83

Table 54. Radiated Harmonics, 802.11n 40MHz, 19 dBi Panel, 5310 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.02	V	43.13	34.80	38.73	7.00	54.06	Peak	74	-19.94
11.02	V	30.57	34.80	38.73	7.00	41.50	Avg.	54	-12.50
16.53	V	43.63	34.55	38.94	9.72	57.73	Peak	74	-16.27
16.53	V	31.37	34.55	38.94	9.72	45.47	Avg.	54	-8.53

Table 55. Radiated Harmonics, 802.11n 40MHz, 19 dBi Panel, 5510 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)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.1	V	44.89	34.78	38.90	7.11	56.12	Peak	74	-17.88
11.1	V	31.29	34.78	38.90	7.11	42.52	Avg	54	-11.48
16.65	V	46.82	34.43	39.65	9.72	61.77	Peak	74	-12.23
16.65	V	32.92	34.43	39.65	9.72	47.87	Avg	54	-6.13

Table 56. Radiated Harmonics, 802.11n 40MHz, 19 dBi Panel, 5550 MHz

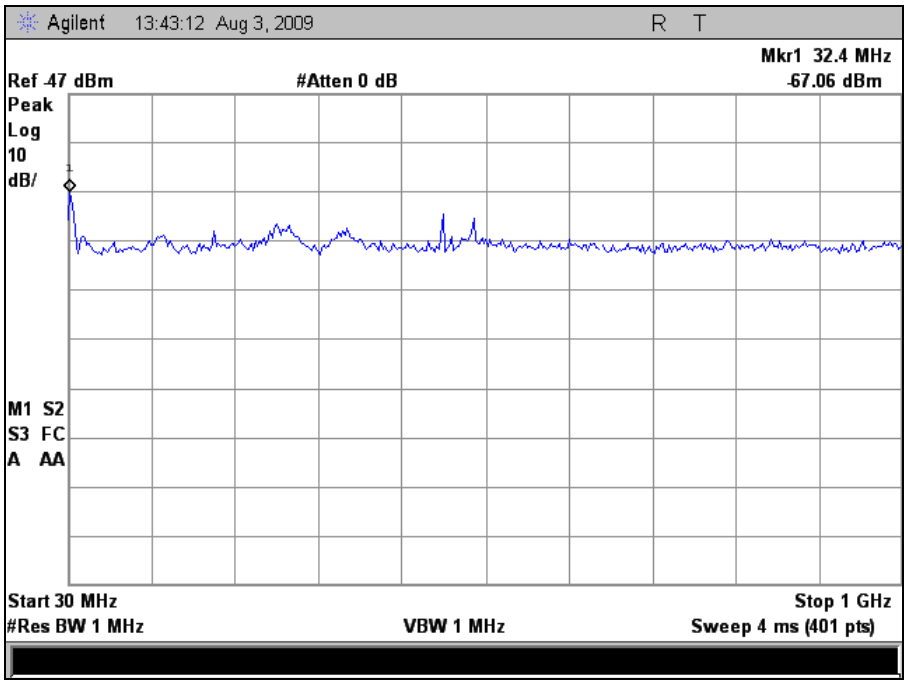
Note: All other emissions were measured at the noise floor of the spectrum analyzer.

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp. (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
11.34	V	44.62	34.78	39.50	7.56	56.89	Peak	74	-17.11
11.34	V	32.29	34.78	39.50	7.56	44.56	Avg.	54	-9.44
17.01	V	43.31	34.24	42.05	9.68	60.80	Peak	74	-13.20
17.01	V	30.98	34.24	42.05	9.68	48.47	Avg.	54	-5.53

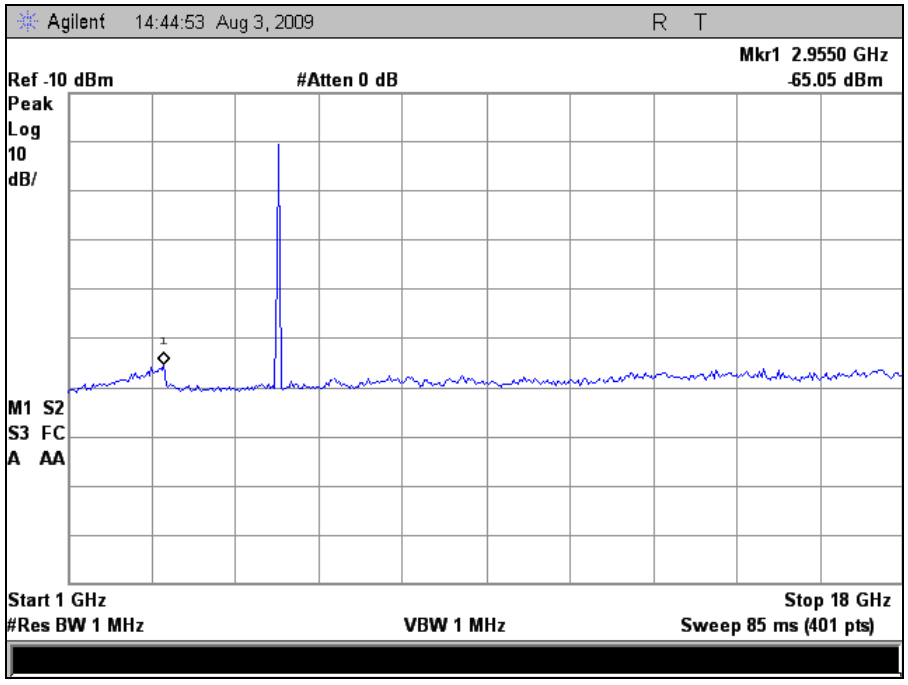
Table 57. Radiated Harmonics, 802.11n 40MHz, 19 dBi Panel, 5670 MHz

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

Radiated Spurious Emissions Test Results, 802.11a (5dBi Omni Antenna)

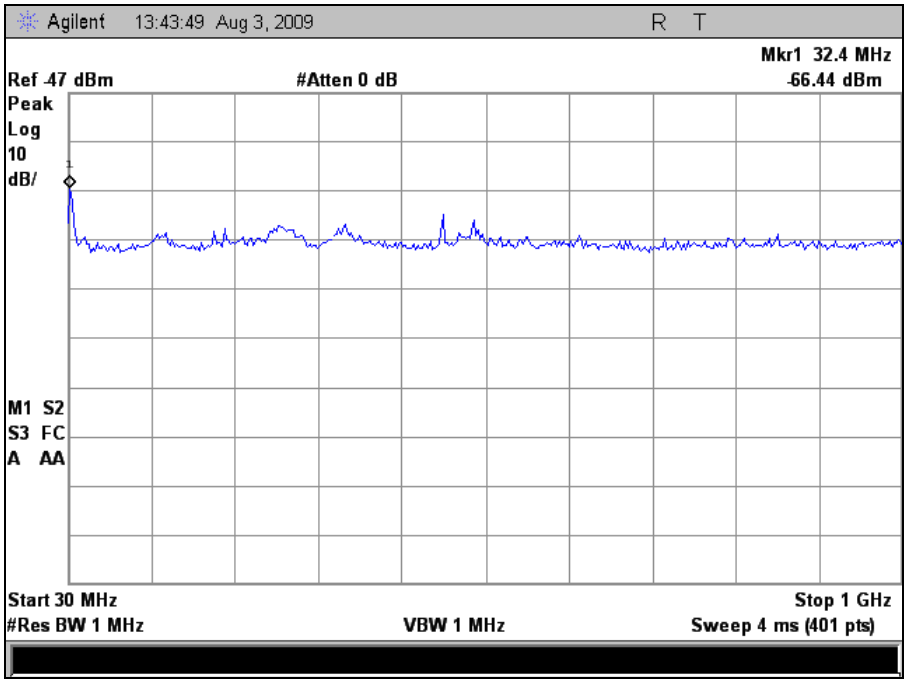


Plot 113. Radiated Spurious, 802.11a, 5260 MHz, 30 MHz – 1 GHz, 5 dBi Omni

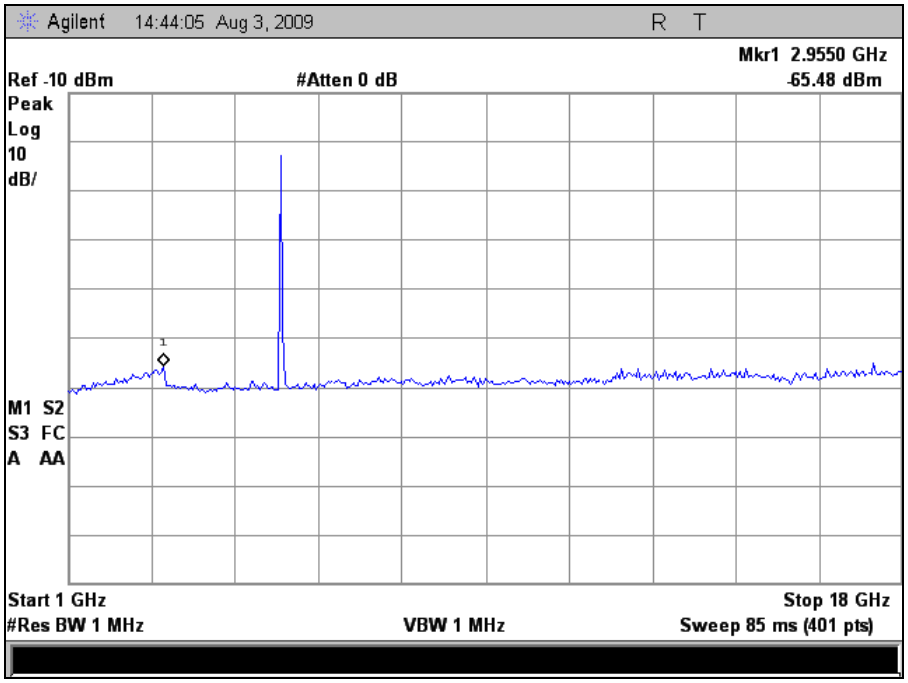


Plot 114. Radiated Spurious, 802.11a, 5260 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11a (5dBi Omni Antenna)

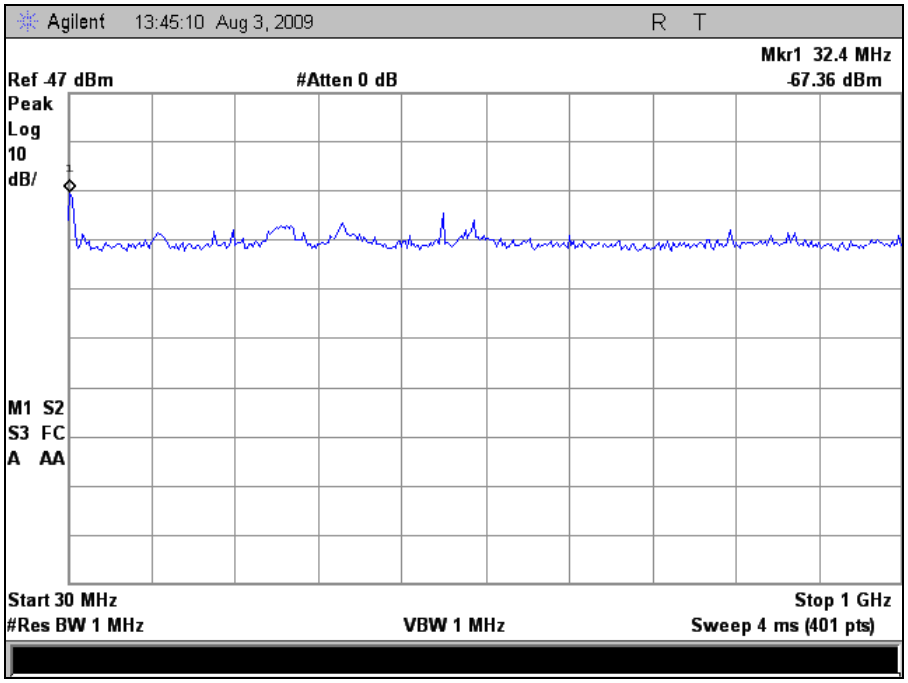


Plot 115. Radiated Spurious, 802.11a, 5320 MHz, 30 MHz – 1 GHz, 5 dBi Omni

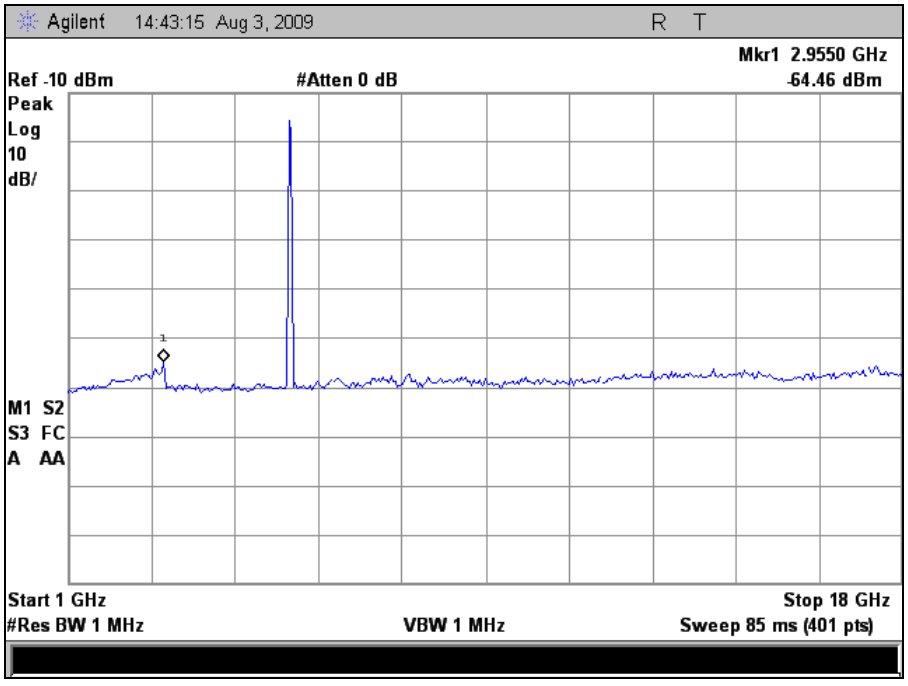


Plot 116. Radiated Spurious, 802.11a, 5320 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11a (5dBi Omni Antenna)

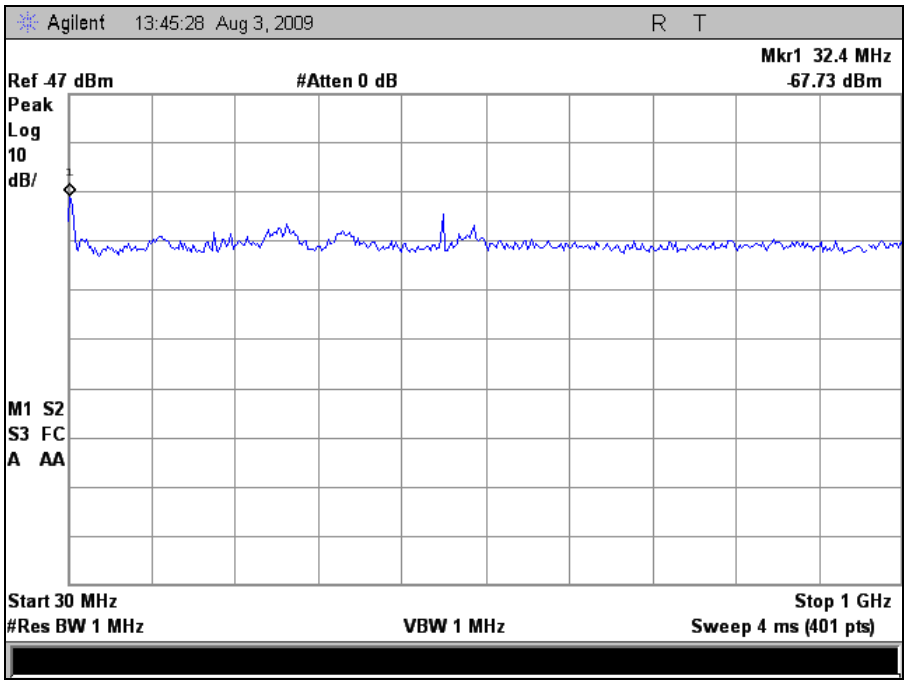


Plot 117. Radiated Spurious, 802.11a, 5500 MHz, 30 MHz – 1 GHz, 5 dBi Omni

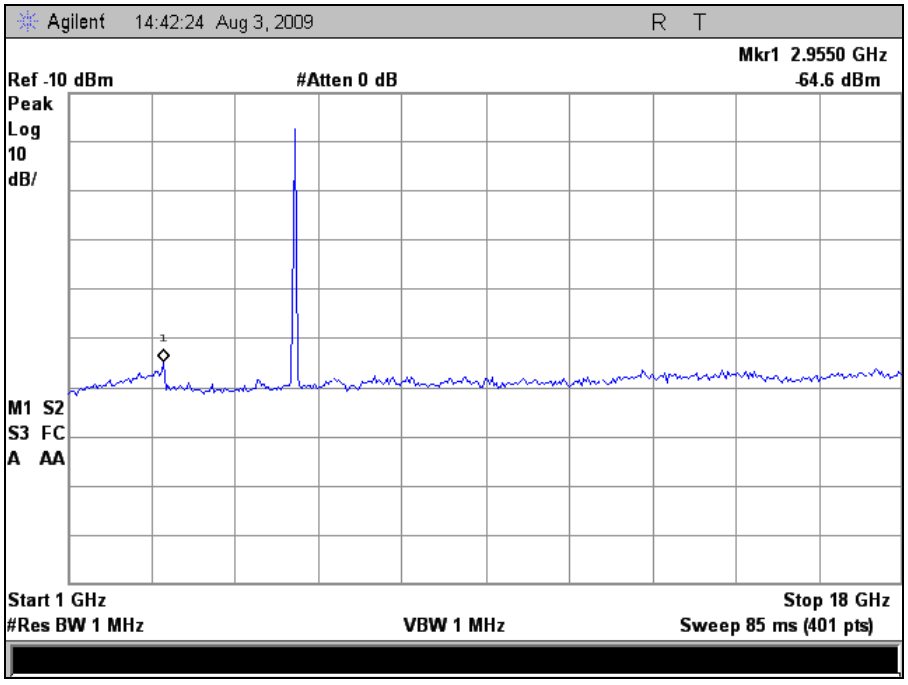


Plot 118. Radiated Spurious, 802.11a, 5500 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11a (5dBi Omni Antenna)

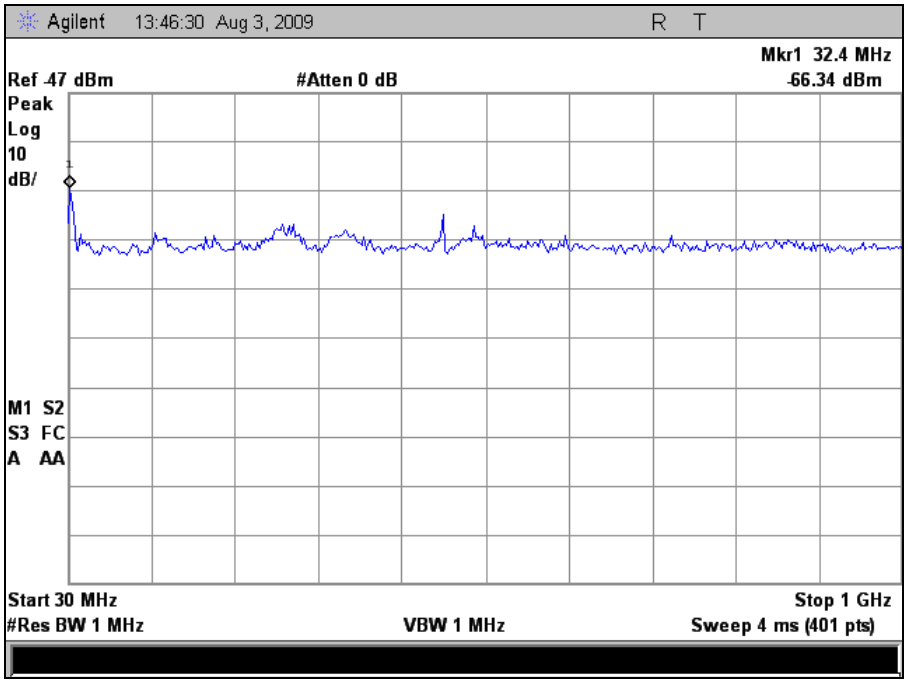


Plot 119. Radiated Spurious, 802.11a, 5580 MHz, 30 MHz – 1 GHz, 5 dBi Omni

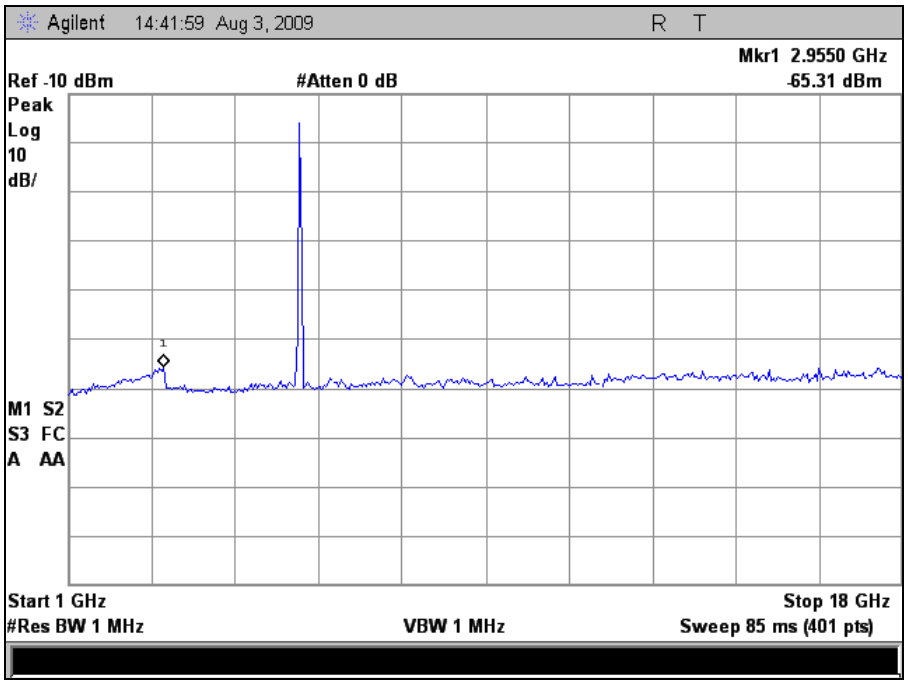


Plot 120 Radiated Spurious, 802.11a, 5580 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11a (5dBi Omni Antenna)

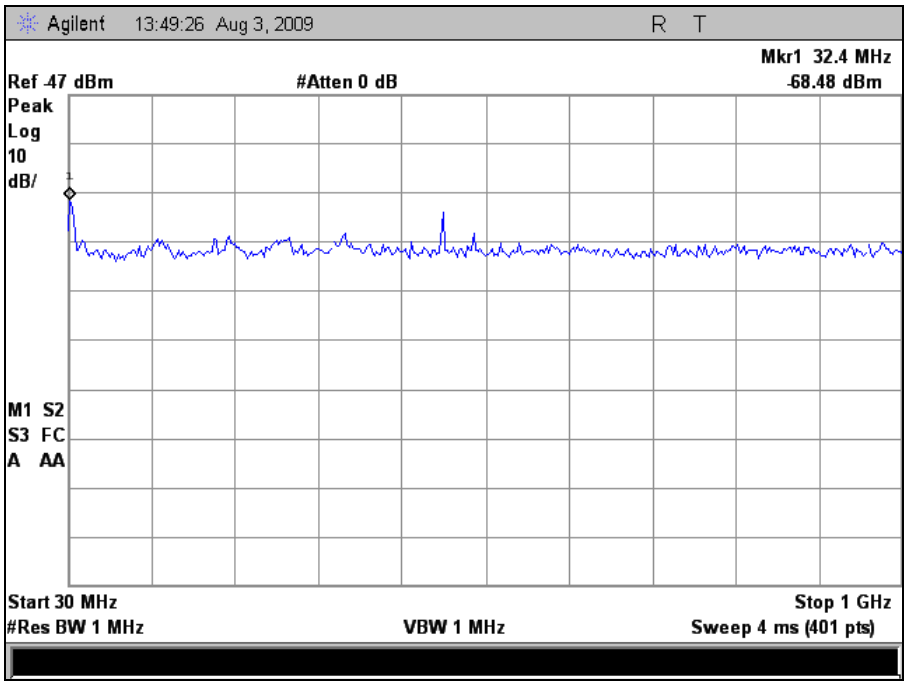


Plot 121. Radiated Spurious, 802.11a, 5700 MHz, 30 MHz – 1 GHz, 5 dBi Omni

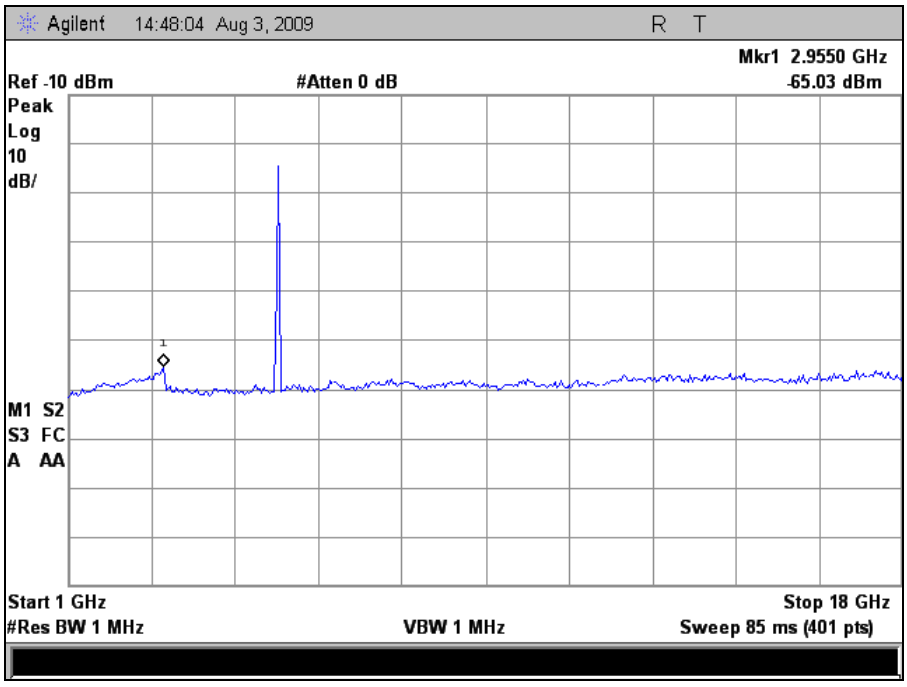


Plot 122. Radiated Spurious, 802.11a, 5700 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11n 20MHz (5dBi Omni Antenna)

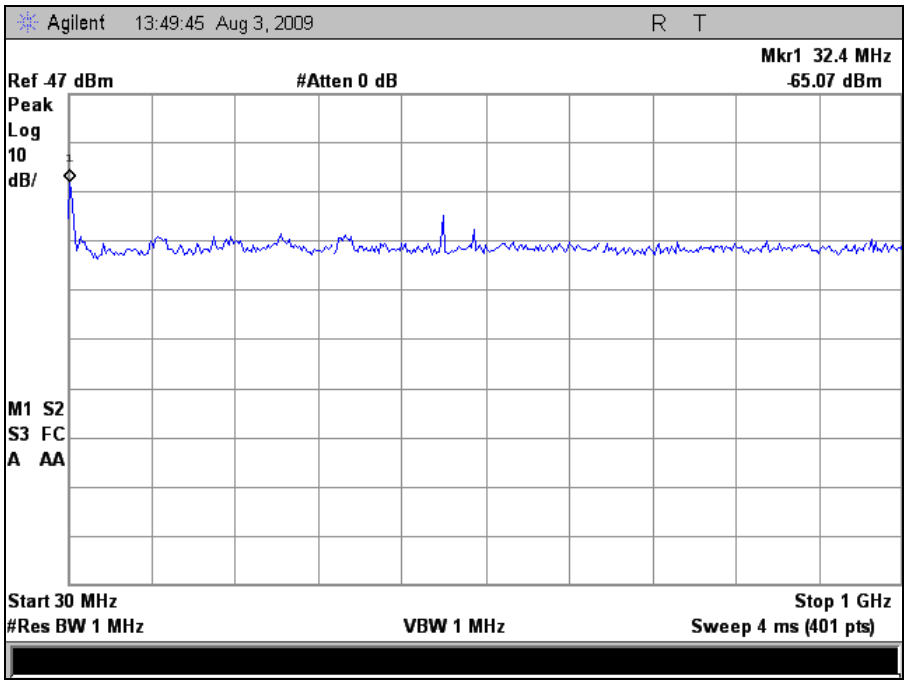


Plot 123. Radiated Spurious, 802.11n 20MHz, 5260 MHz, 30 MHz – 1 GHz, 5 dBi Omni

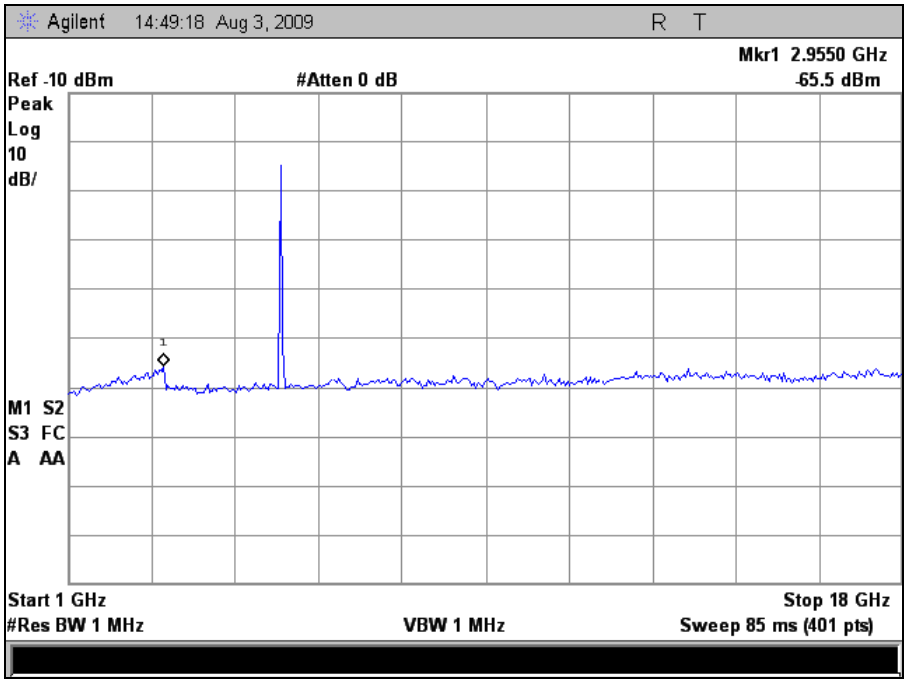


Plot 124. Radiated Spurious, 802.11n 20MHz, 5260 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11n 20MHz (5dBi Omni Antenna)

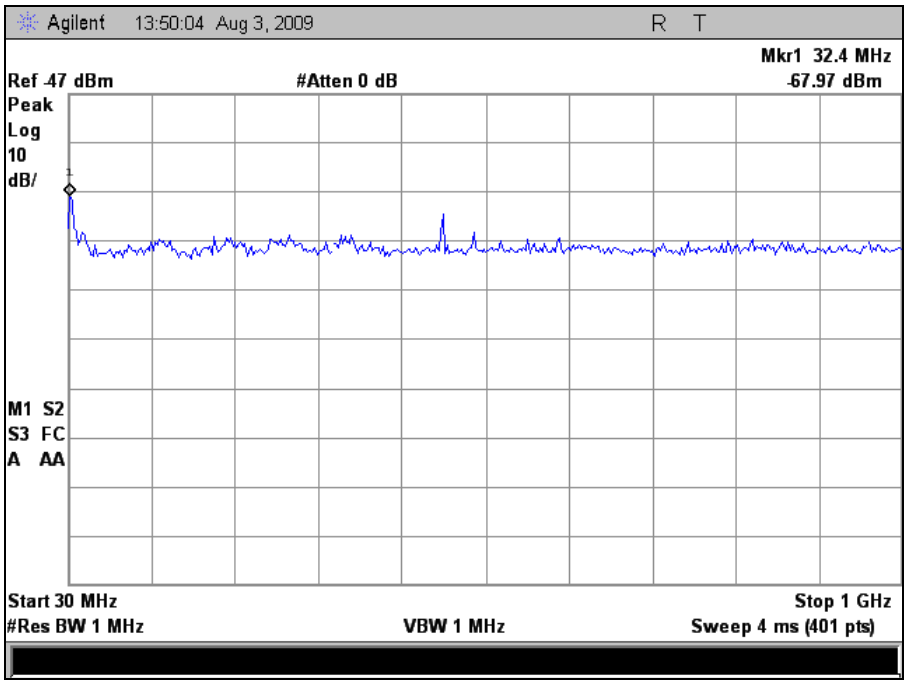


Plot 125. Radiated Spurious, 802.11n 20MHz, 5320 MHz, 30 MHz – 1 GHz, 5 dBi Omni

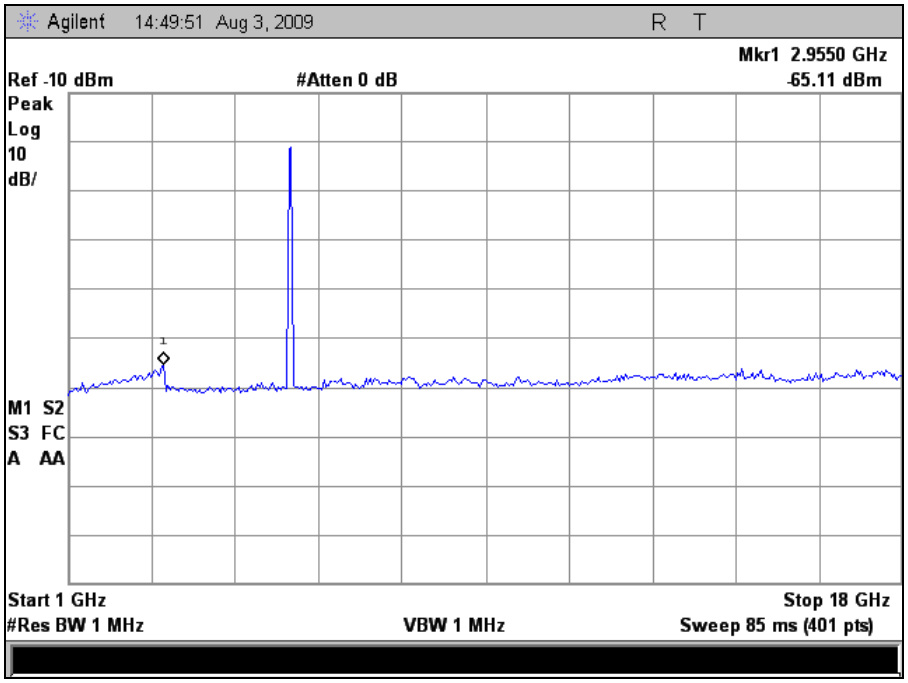


Plot 126. Radiated Spurious, 802.11n 20MHz, 5320 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11n 20MHz (5dBi Omni Antenna)

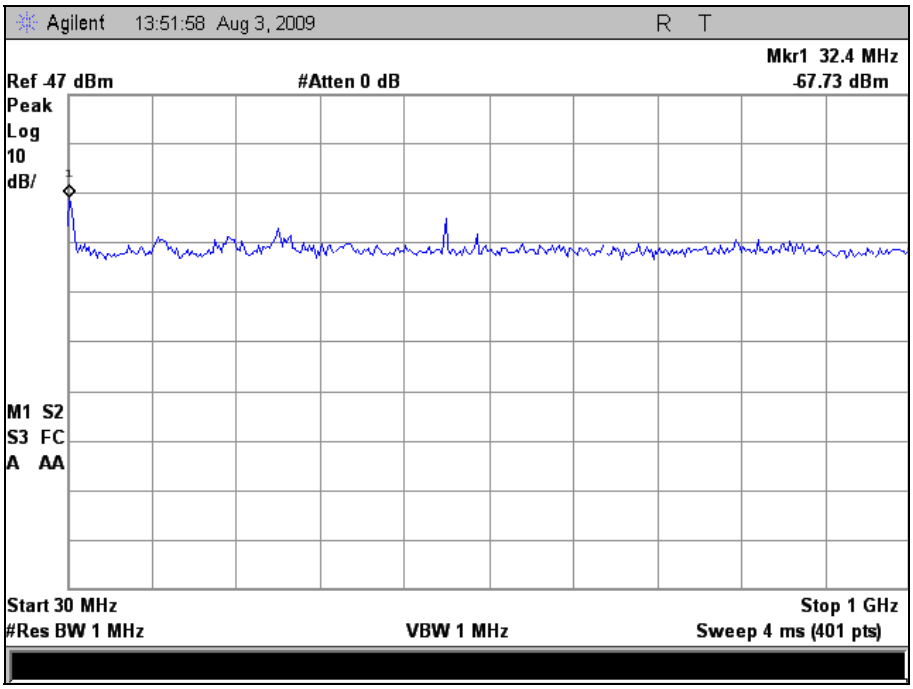


Plot 127. Radiated Spurious, 802.11n 20MHz, 5500 MHz, 30 MHz – 1 GHz, 5 dBi Omni

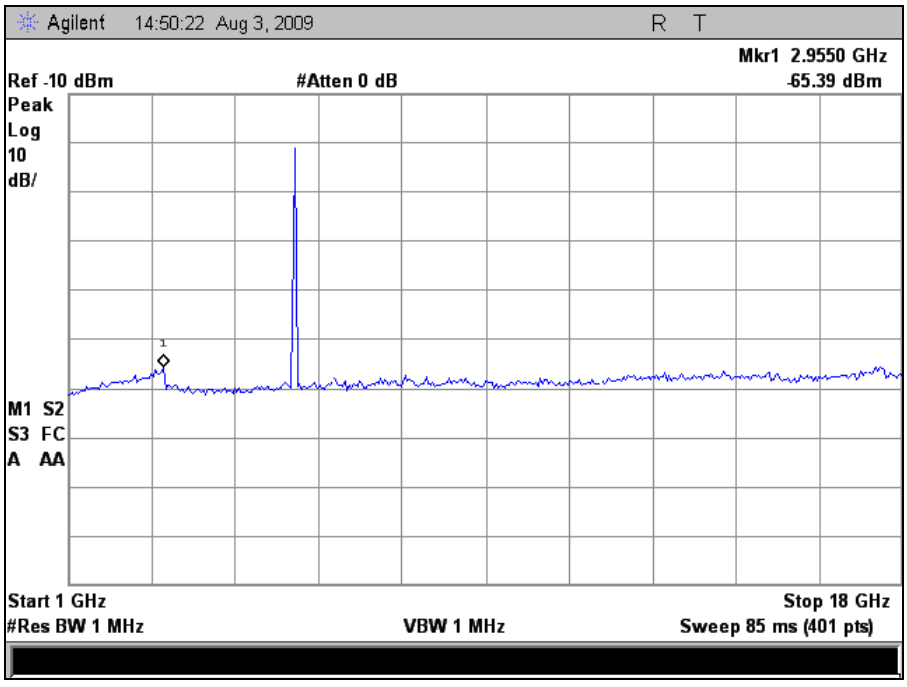


Plot 128. Radiated Spurious, 802.11n 20MHz, 5500 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11n 20MHz (5dBi Omni Antenna)

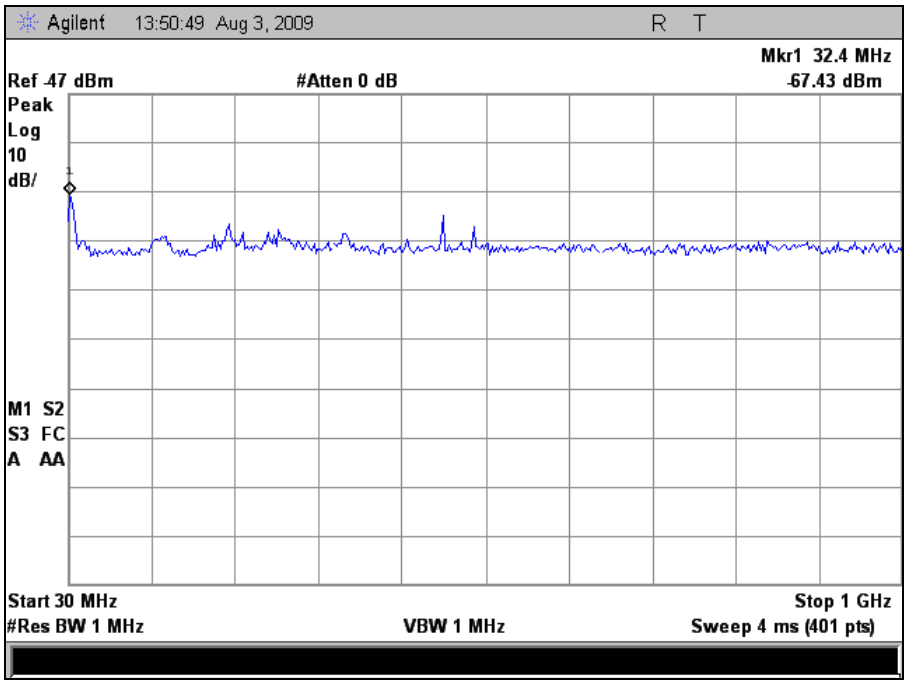


Plot 129. Radiated Spurious, 802.11n 20MHz, 5580 MHz, 30 MHz – 1 GHz, 5 dBi Omni

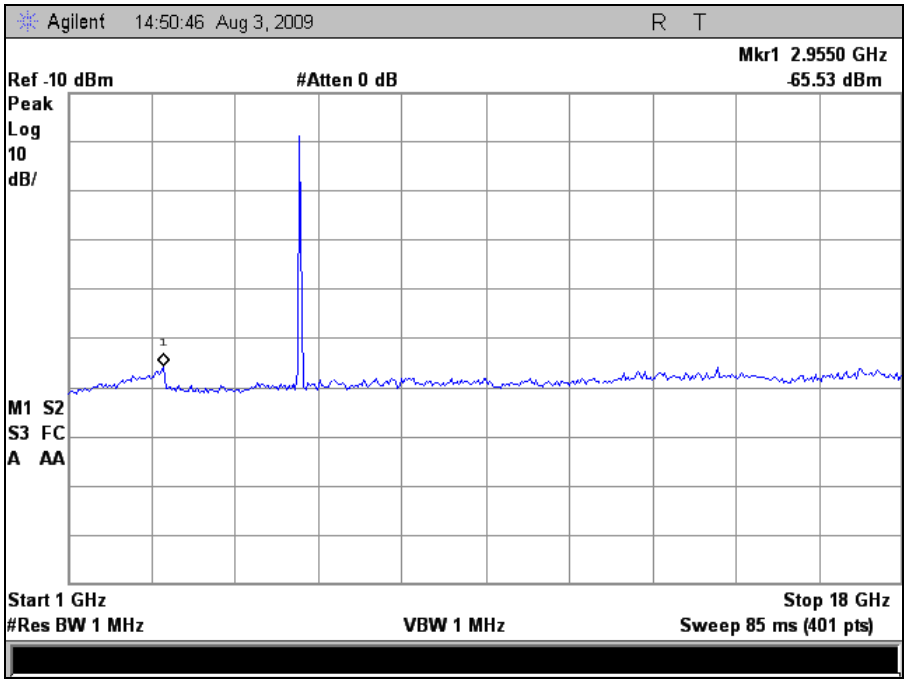


Plot 130. Radiated Spurious, 802.11n 20MHz, 5580 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11n 20MHz (5dBi Omni Antenna)

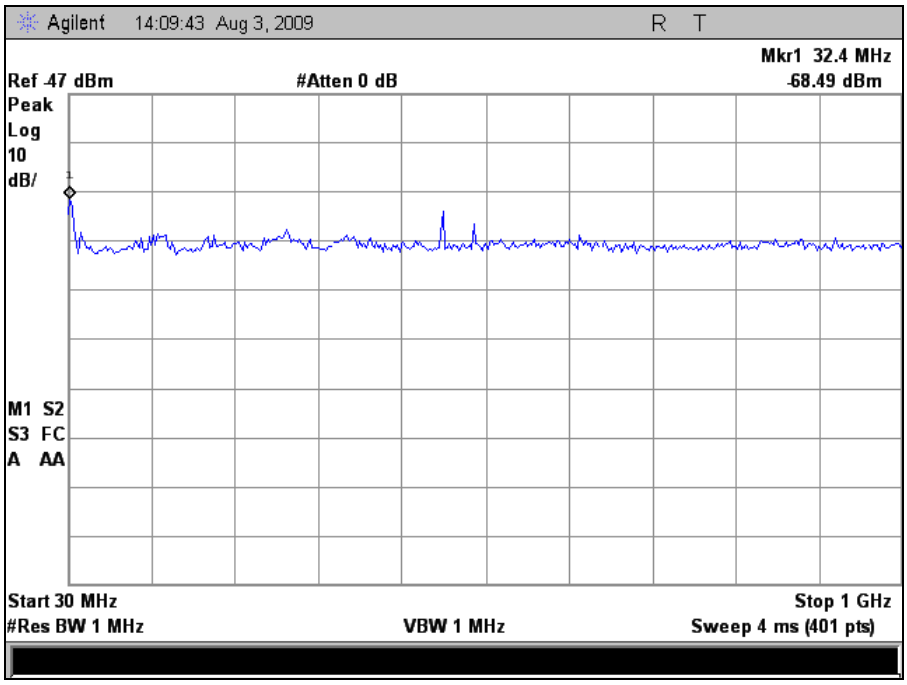


Plot 131. Radiated Spurious, 802.11n 20MHz, 5700 MHz, 30 MHz – 1 GHz, 5 dBi Omni

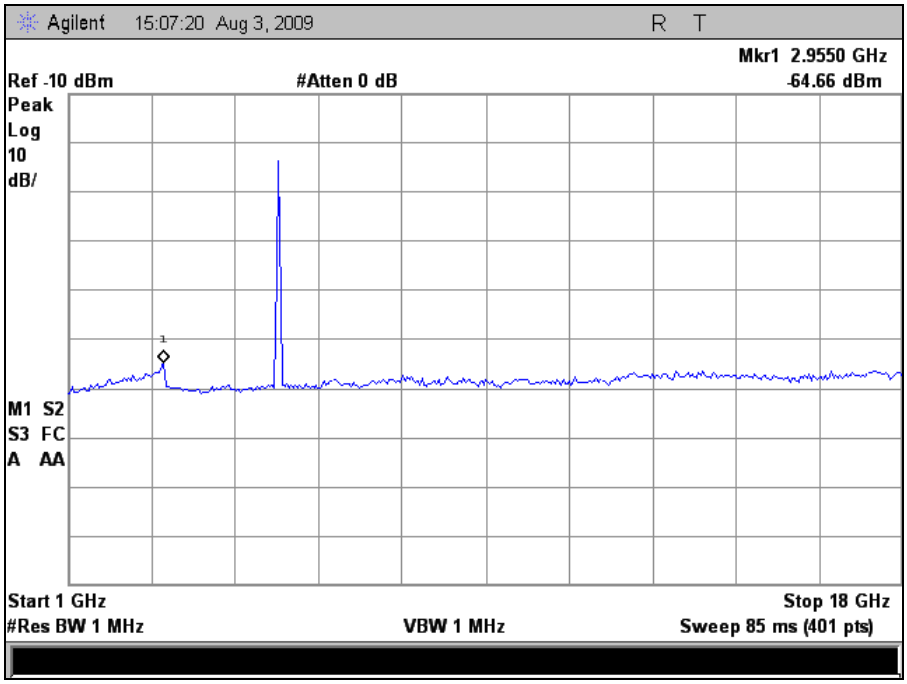


Plot 132. Radiated Spurious, 802.11n 20MHz, 5700 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11n 40MHz (5dBi Omni Antenna)

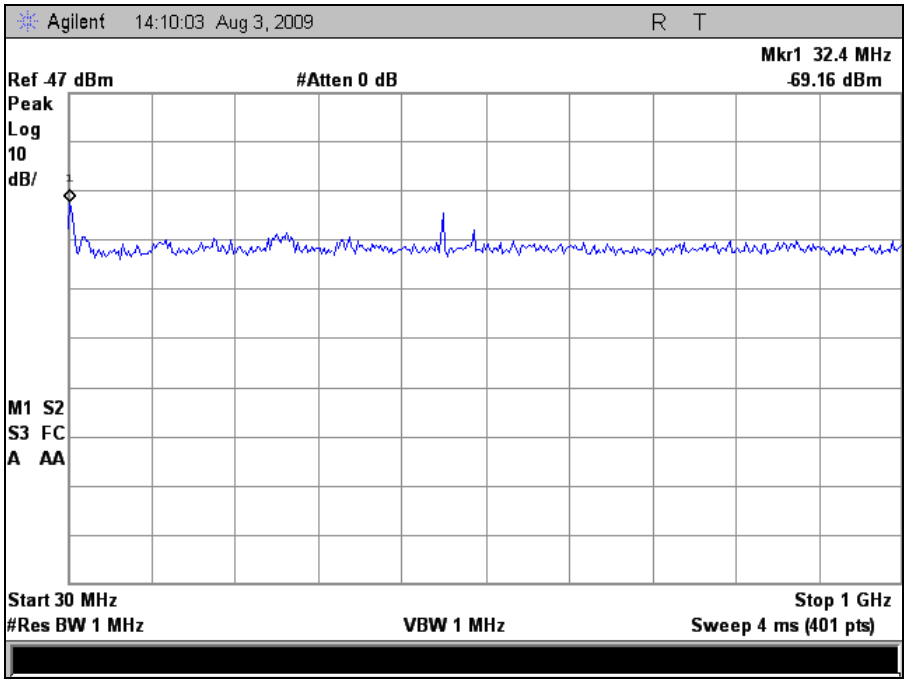


Plot 133. Radiated Spurious, 802.11n 40MHz, 5270 MHz, 30 MHz – 1 GHz, 5 dBi Omni

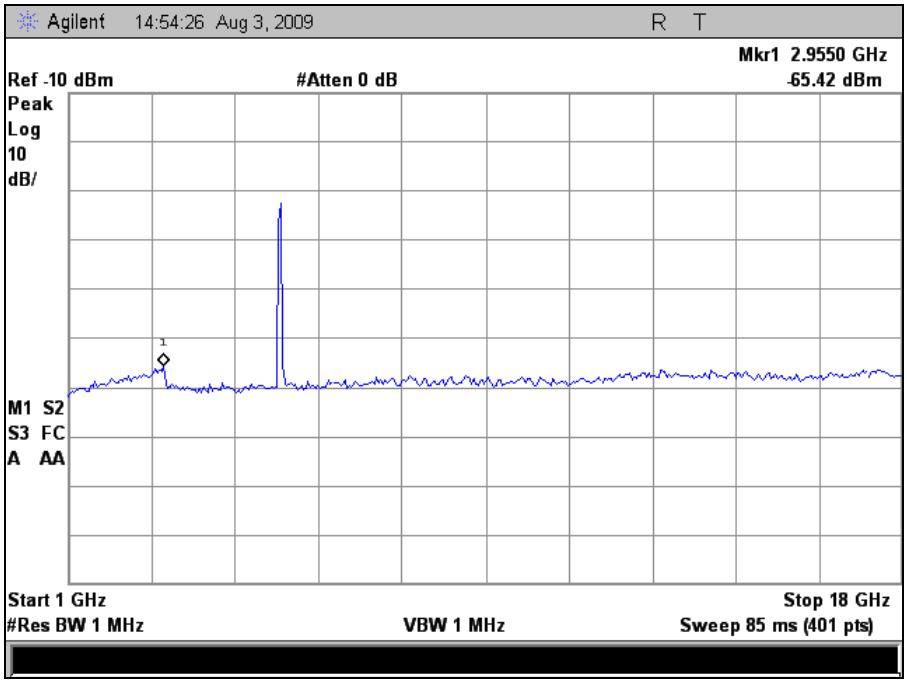


Plot 134. Radiated Spurious, 802.11n 40MHz, 5270 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11n 40MHz (5dBi Omni Antenna)

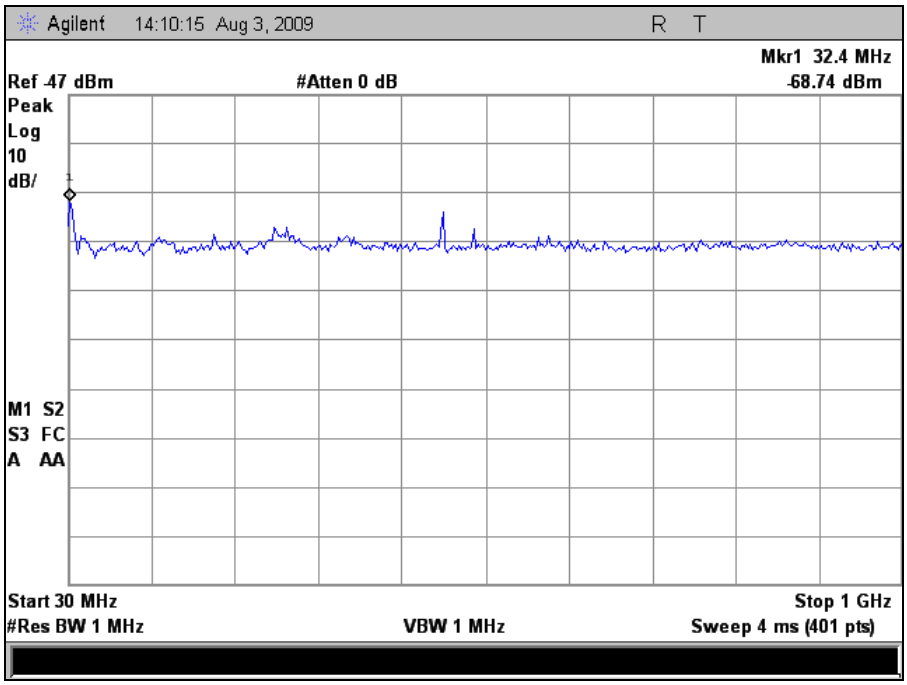


Plot 135. Radiated Spurious, 802.11n 40MHz, 5310 MHz, 30 MHz – 1 GHz, 5 dBi Omni

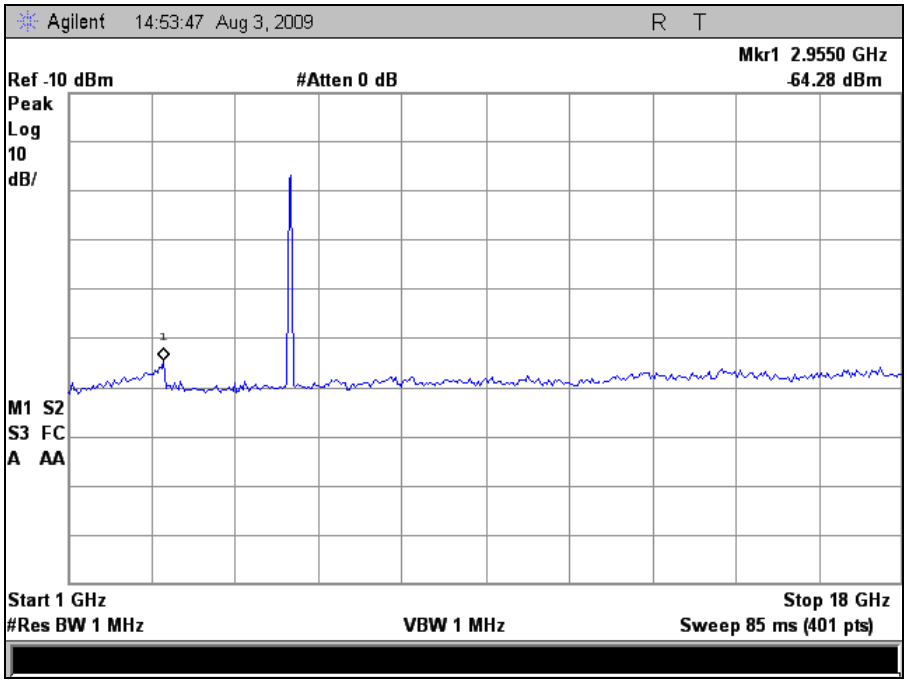


Plot 136. Radiated Spurious, 802.11n 40MHz, 5310 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11n 40MHz (5dBi Omni Antenna)

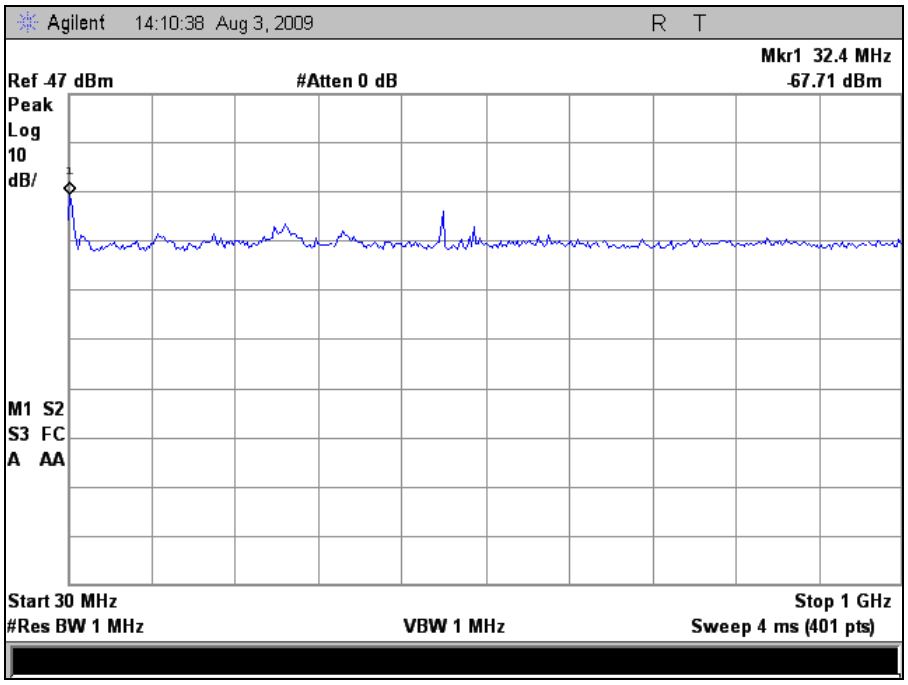


Plot 137. Radiated Spurious, 802.11n 40MHz, 5510 MHz, 30 MHz – 1 GHz, 5 dBi Omni

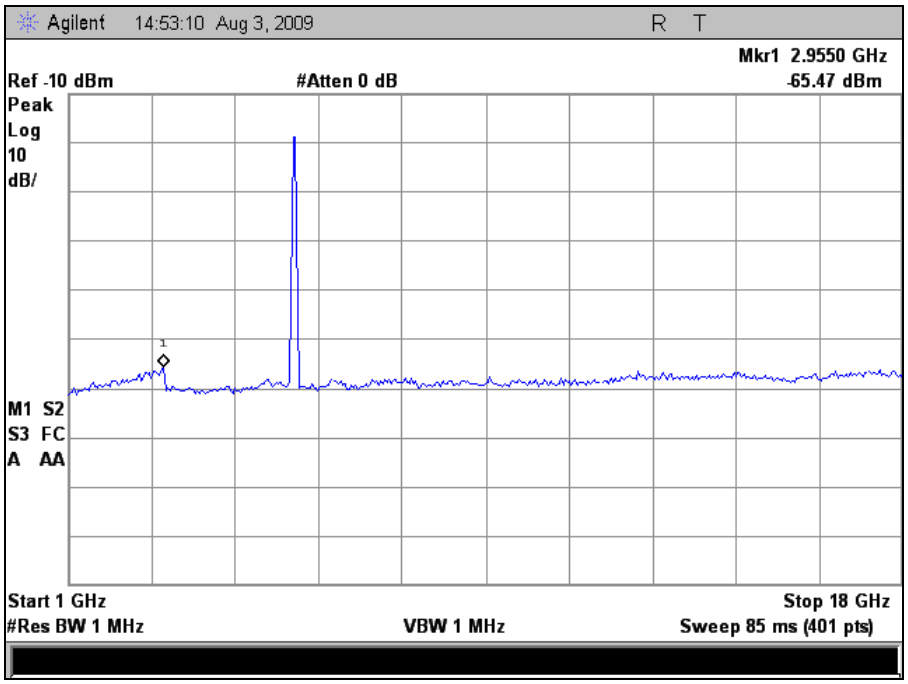


Plot 138. Radiated Spurious, 802.11n 40MHz, 5510 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11n 40MHz (5dBi Omni Antenna)

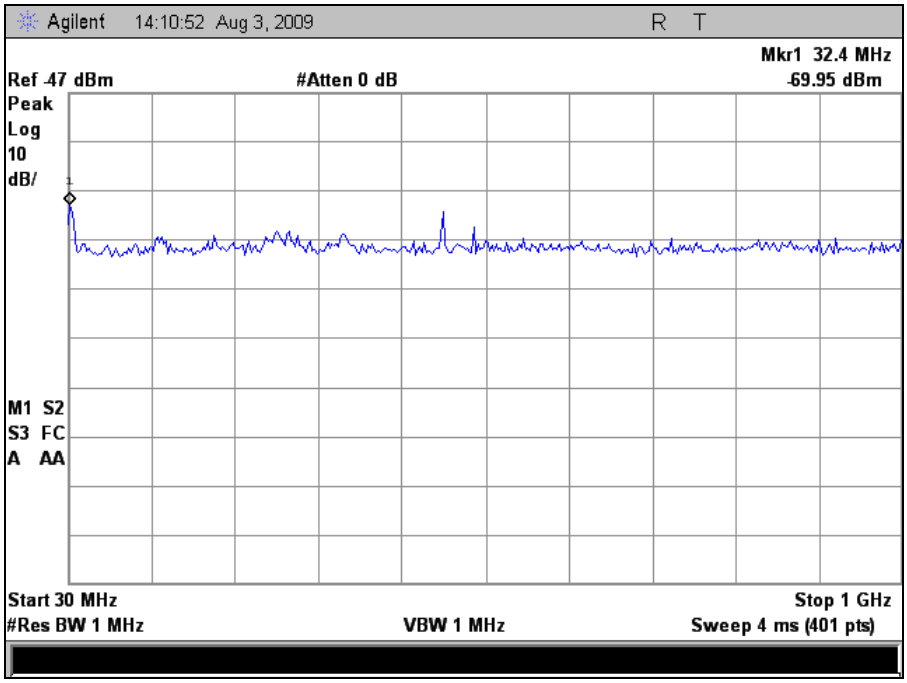


Plot 139. Radiated Spurious, 802.11n 40MHz, 5550 MHz, 30 MHz – 1 GHz, 5 dBi Omni

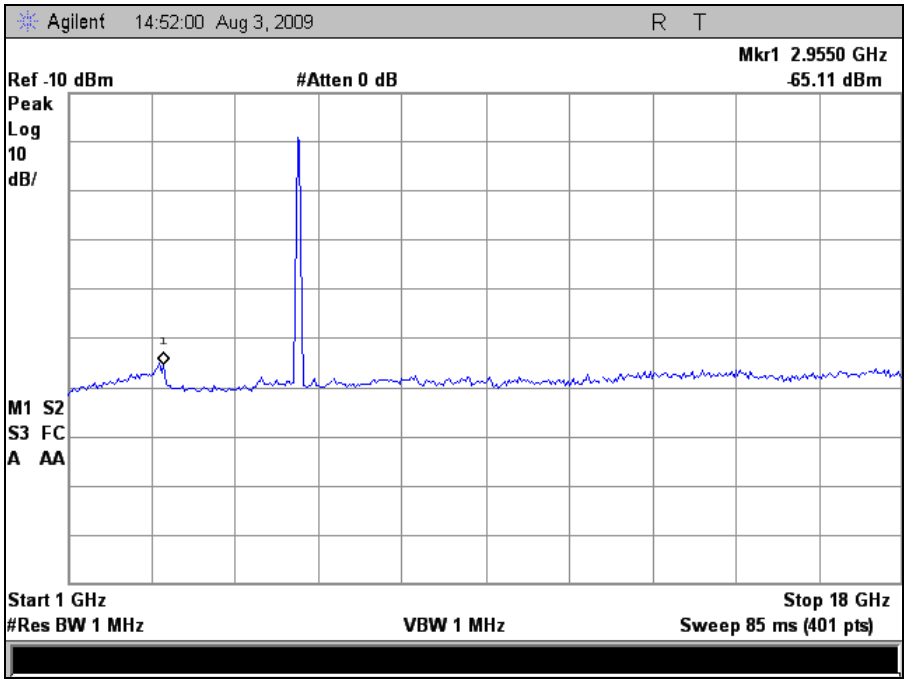


Plot 140. Radiated Spurious, 802.11n 40MHz, 5550 MHz, 1 GHz – 18 GHz, 5 dBi Omni

Radiated Spurious Emissions Test Results, 802.11n 40MHz (5dBi Omni Antenna)

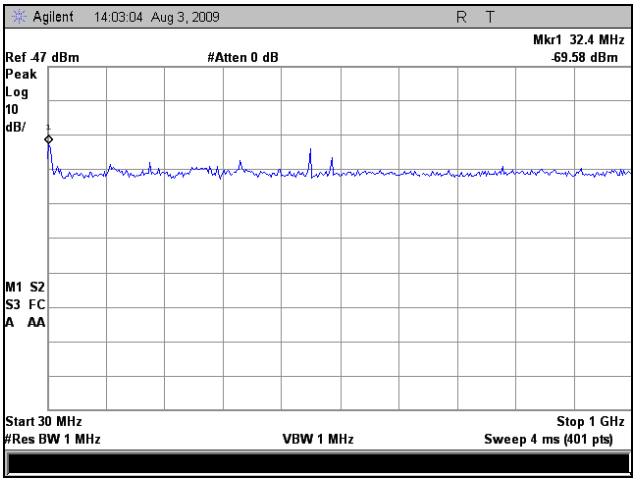


Plot 141. Radiated Spurious, 802.11n 40MHz, 5670 MHz, 30 MHz – 1 GHz, 5 dBi Omni

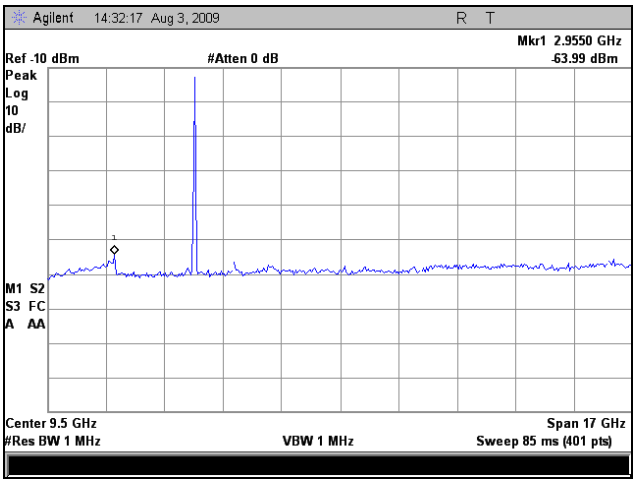


Plot 142. Radiated Spurious, 802.11n 40MHz, 5670 MHz, 1 GHz – 18 GHz, 5 dBi Omni

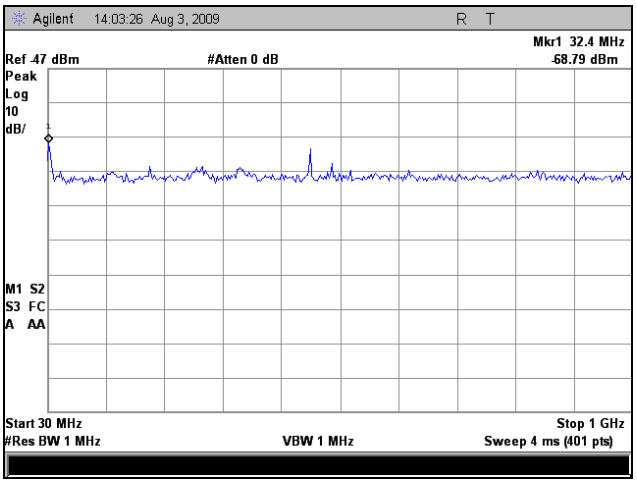
Radiated Spurious Emissions Test Results, 802.11a (19 dBi Panel Antenna)



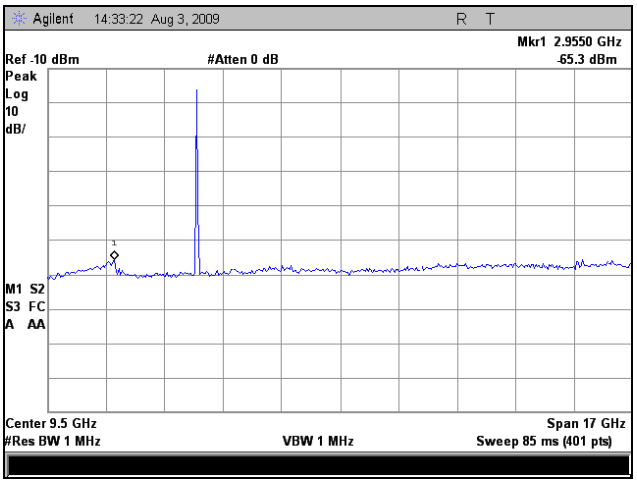
Plot 143. Radiated Spurious, 802.11a, 5260 MHz, 30 MHz – 1 GHz, 19 dBi Panel



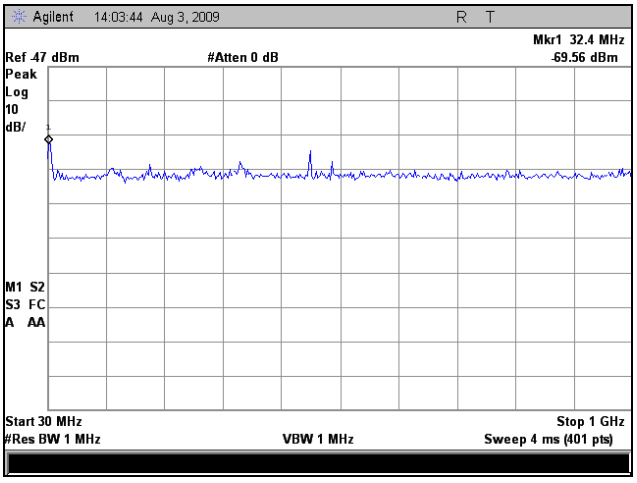
Plot 144. Radiated Spurious, 802.11a, 5260 MHz, 1 GHz – 18 GHz, 19 dBi Panel



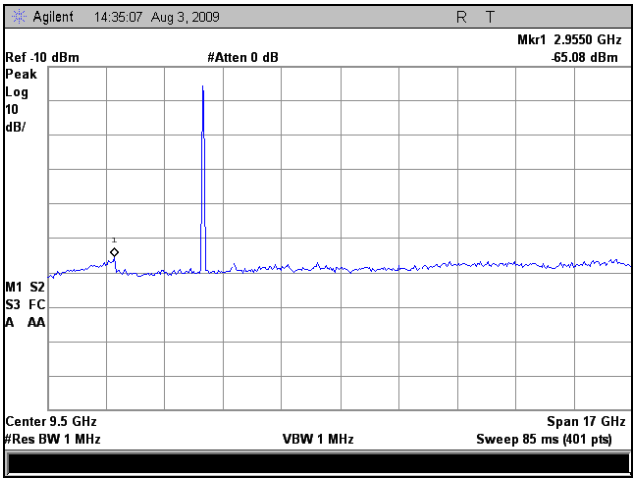
Plot 145. Radiated Spurious, 802.11a, 5320 MHz, 30 MHz – 1 GHz, 19 dBi Panel



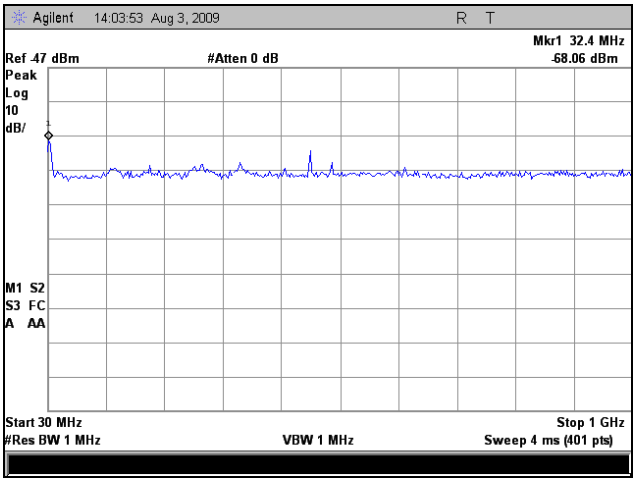
Plot 146. Radiated Spurious, 802.11a, 5320 MHz, 1 GHz – 18 GHz, 19 dBi Panel



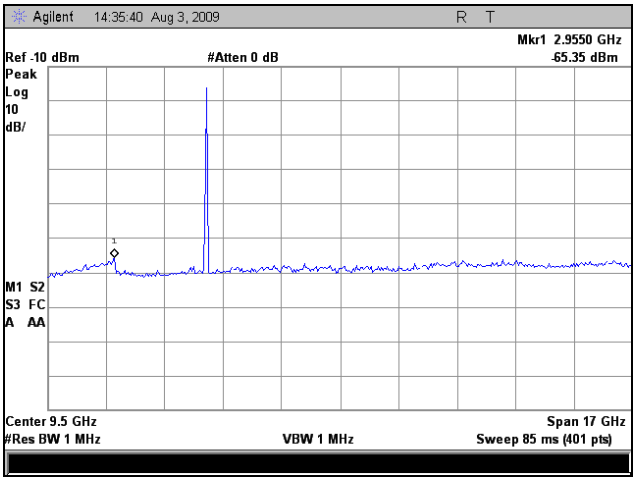
Plot 147. Radiated Spurious, 802.11a, 5500 MHz, 30 MHz – 1 GHz, 19 dBi Panel



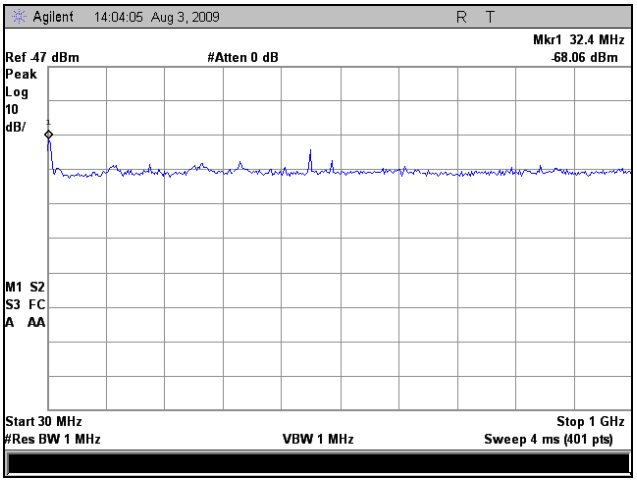
Plot 148. Radiated Spurious, 802.11a, 5500 MHz, 1 GHz – 18 GHz, 19 dBi Panel



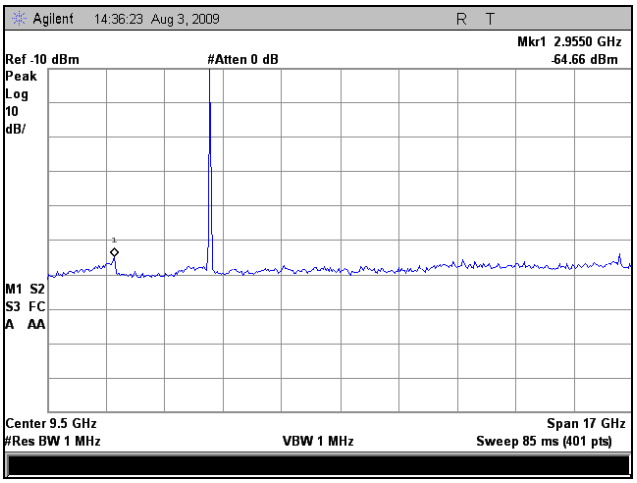
Plot 149. Radiated Spurious, 802.11a, 5580 MHz, 30 MHz – 1 GHz, 19 dBi Panel



Plot 150. Radiated Spurious, 802.11a, 5580 MHz, 1 GHz – 18 GHz, 19 dBi Panel

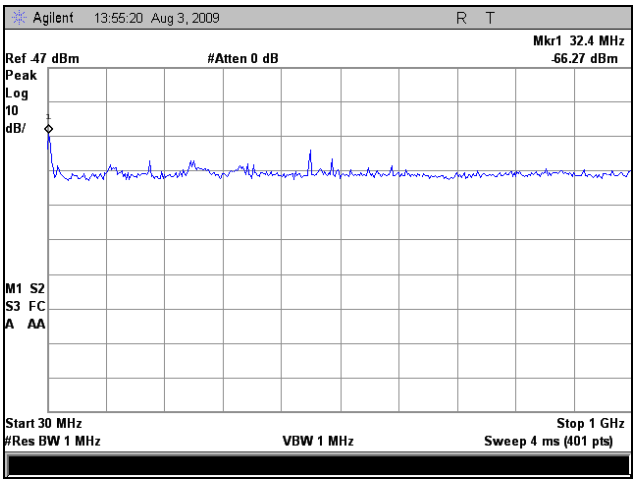


Plot 151. Radiated Spurious, 802.11a, 5700 MHz, 30 MHz – 1 GHz, 19 dBi Panel

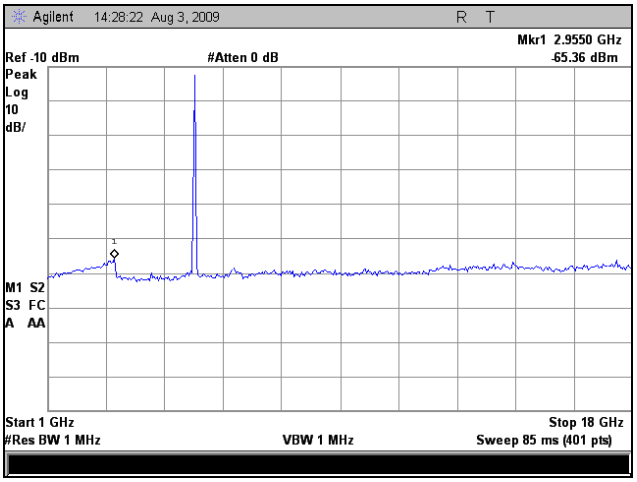


Plot 152. Radiated Spurious, 802.11a, 5700 MHz, 1 GHz – 18 GHz, 19 dBi Panel

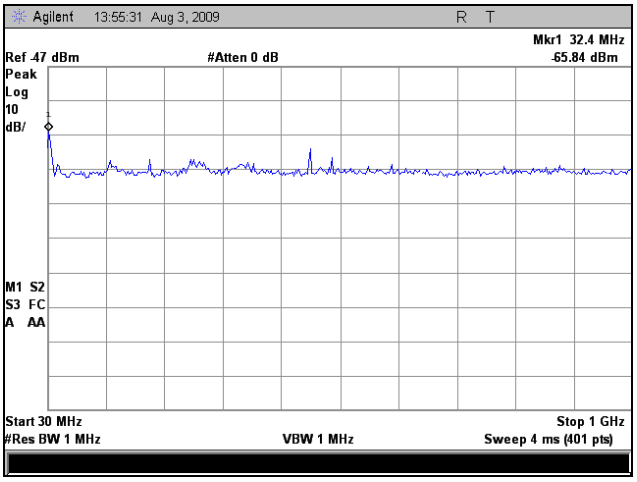
Radiated Spurious Emissions Test Results, 802.11n 20MHz (19dBi Panel Antenna)



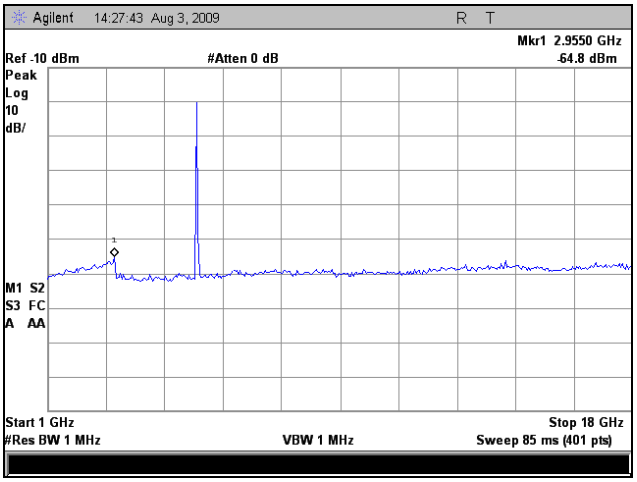
Plot 153. Radiated Spurious, 802.11n 20MHz, 5260 MHz, 30 MHz – 1 GHz, 19 dBi Panel



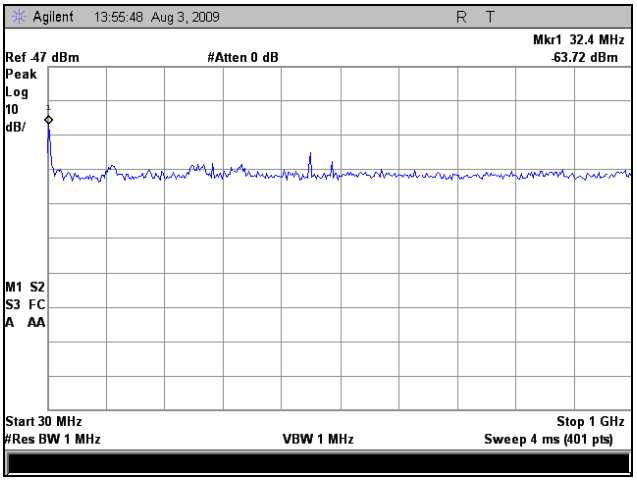
Plot 154. Radiated Spurious, 802.11n 20MHz, 5260 MHz, 1 GHz – 18 GHz, 19 dBi Panel



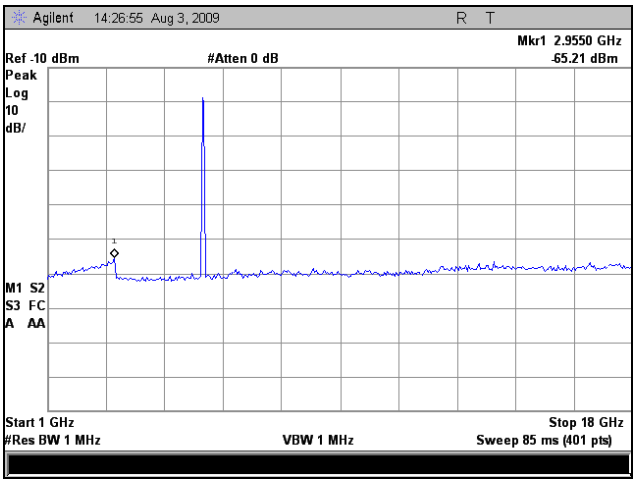
Plot 155. Radiated Spurious, 802.11n 20MHz, 5320 MHz, 30 MHz – 1 GHz, 19 dBi Panel



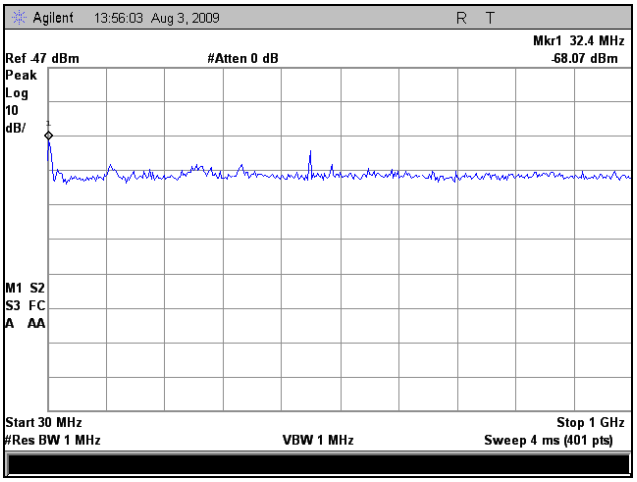
Plot 156. Radiated Spurious, 802.11n 20MHz, 5320 MHz, 1 GHz – 18 GHz, 19 dBi Panel



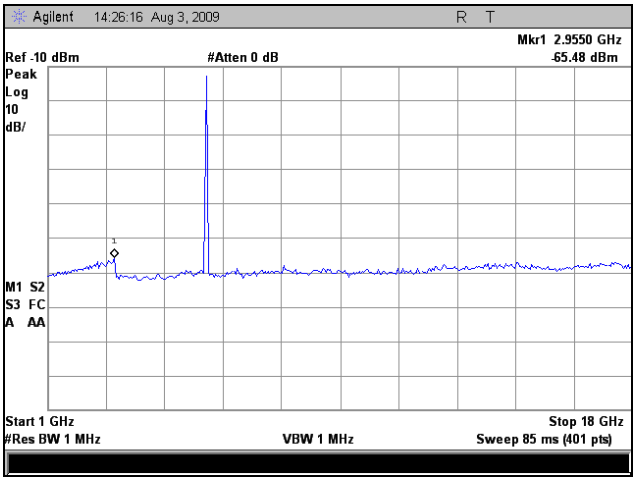
Plot 157. Radiated Spurious, 802.11n 20MHz, 5500 MHz, 30 MHz – 1 GHz, 19 dBi Panel



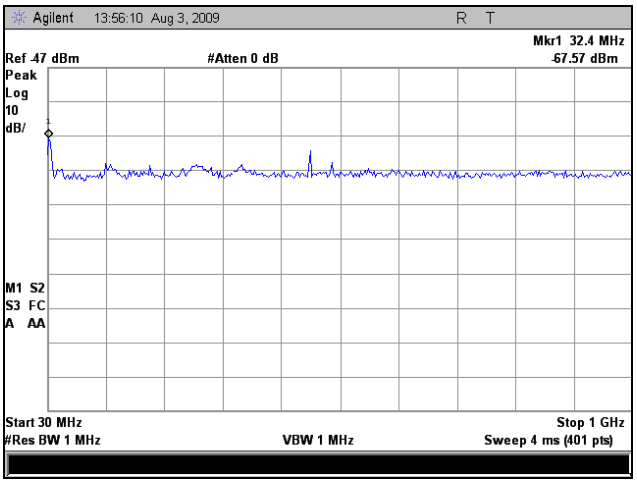
Plot 158. Radiated Spurious, 802.11n 20MHz, 5500 MHz, 1 GHz – 18 GHz, 19 dBi Panel



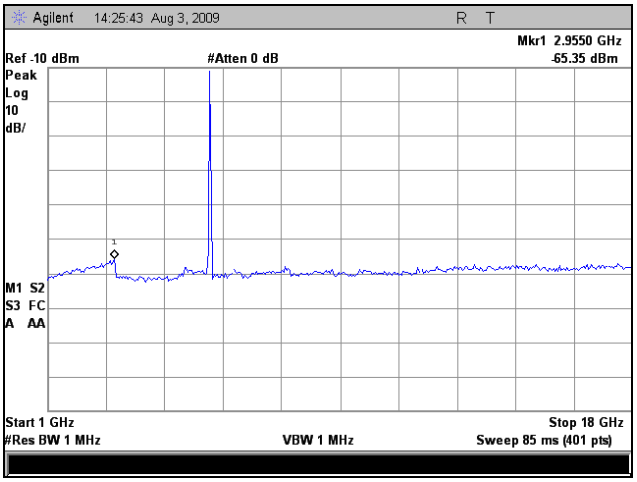
Plot 159. Radiated Spurious, 802.11n 20MHz, 5580 MHz, 30 MHz – 1 GHz, 19 dBi Panel



Plot 160. Radiated Spurious, 802.11n 20MHz, 5580 MHz, 1 GHz – 18 GHz, 19 dBi Panel

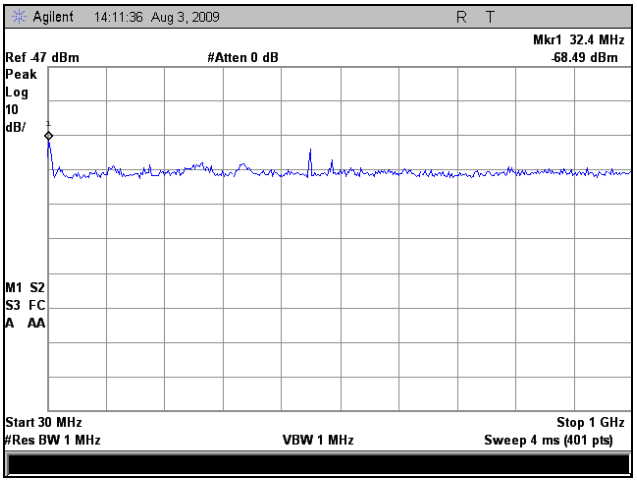


Plot 161. Radiated Spurious, 802.11n 20MHz, 5700 MHz, 30 MHz – 1 GHz, 19 dBi Panel

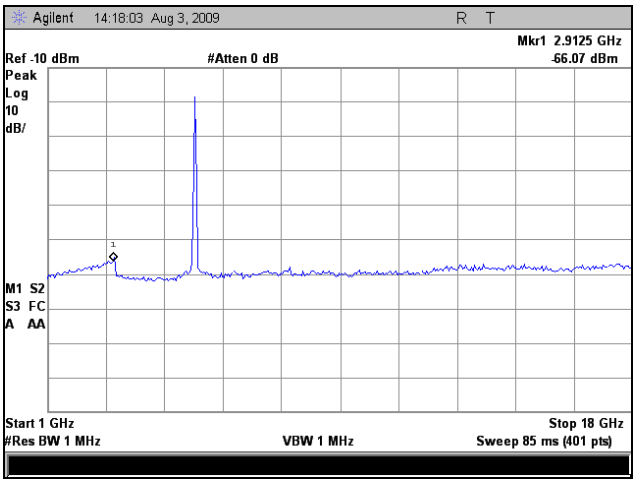


Plot 162. Radiated Spurious, 802.11n 20MHz, 5700 MHz, 1 GHz – 18 GHz, 19 dBi Panel

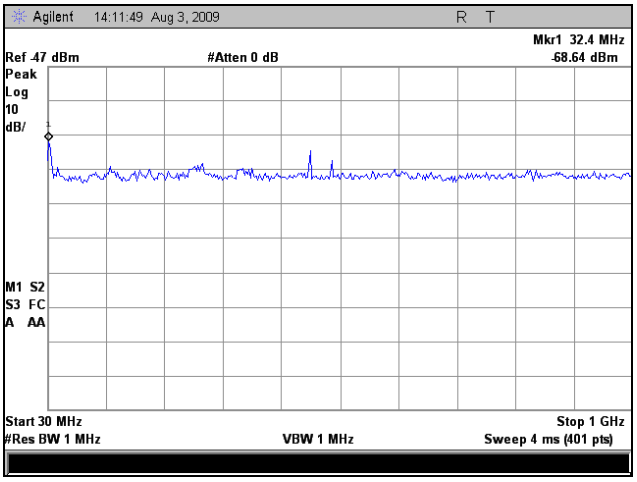
Radiated Spurious Emissions Test Results, 802.11n 40MHz (19dBi Panel Antenna)



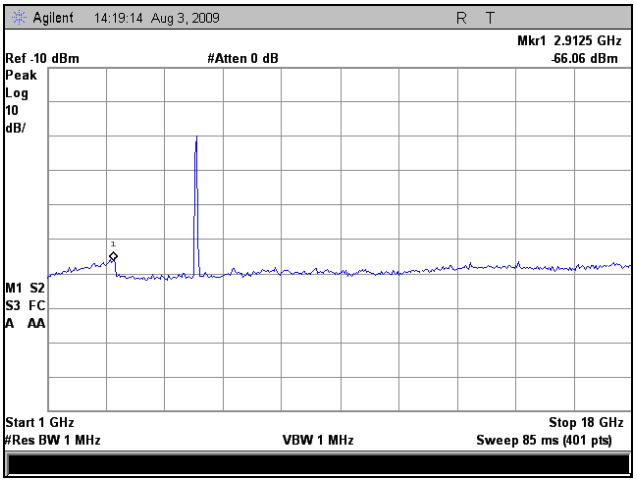
Plot 163. Radiated Spurious, 802.11n 40MHz, 5270 MHz, 30 MHz – 1 GHz, 19 dBi Panel



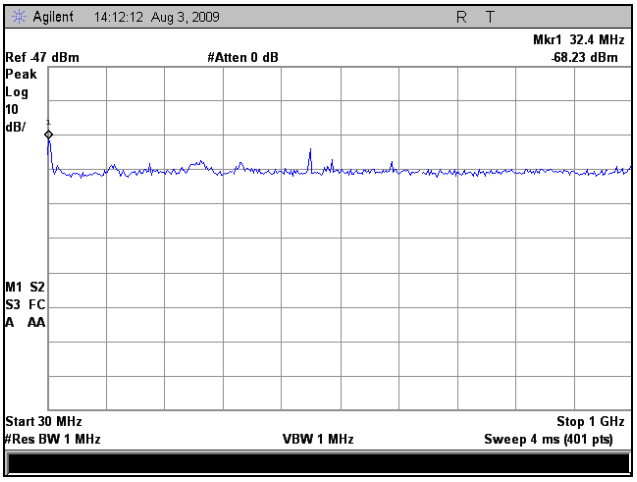
Plot 164. Radiated Spurious, 802.11n 40MHz, 5270 MHz, 1 GHz – 18 GHz, 19 dBi Panel



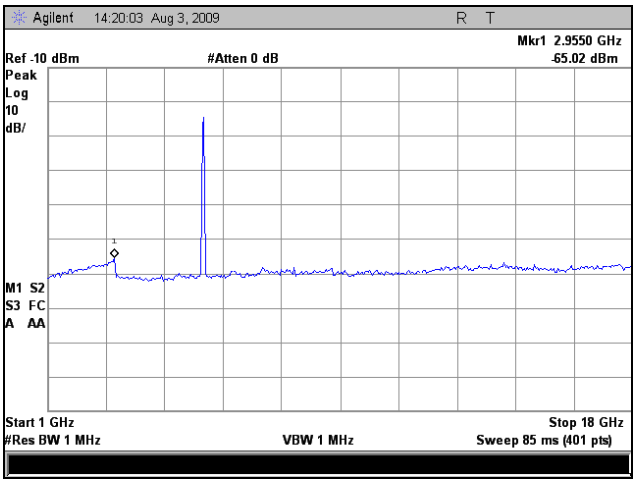
Plot 165. Radiated Spurious, 802.11n 40MHz, 5310 MHz, 30 MHz – 1 GHz, 19 dBi Panel



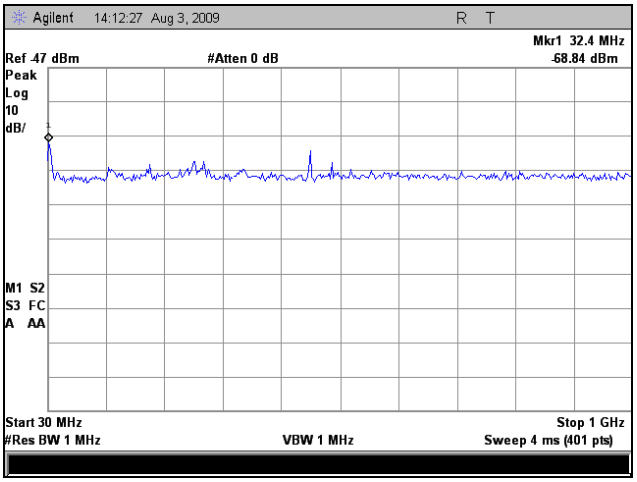
Plot 166. Radiated Spurious, 802.11n 40MHz, 5310 MHz, 1 GHz – 18 GHz, 19 dBi Panel



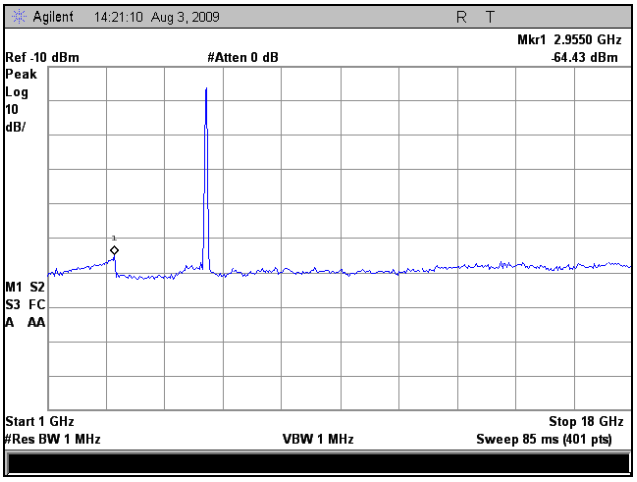
Plot 167. Radiated Spurious, 802.11n 40MHz, 5510 MHz, 30 MHz – 1 GHz, 19 dBi Panel



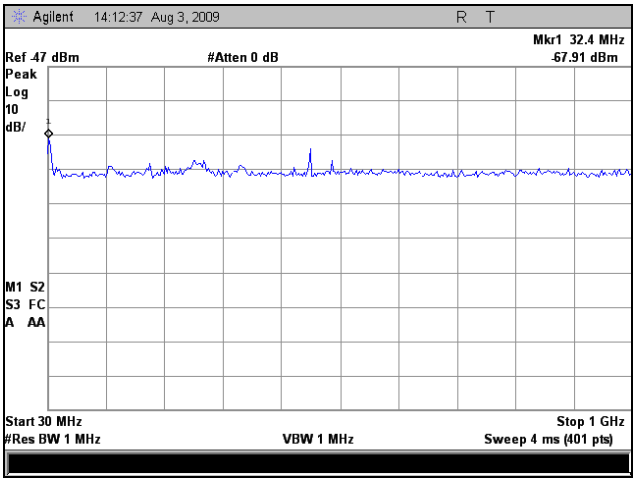
Plot 168. Radiated Spurious, 802.11n 40MHz, 5510 MHz, 1 GHz – 18 GHz, 19 dBi Panel



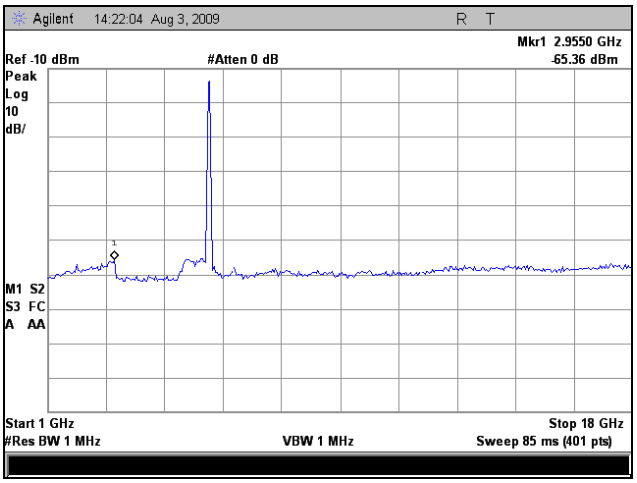
Plot 169. Radiated Spurious, 802.11n 40MHz, 5550 MHz, 30 MHz – 1 GHz, 19 dBi Panel



Plot 170. Radiated Spurious, 802.11n 40MHz, 5550 MHz, 1 GHz – 18 GHz, 19 dBi Panel



Plot 171. Radiated Spurious, 802.11n 40MHz, 5670 MHz, 30 MHz – 1 GHz, 19 dBi Panel



Plot 172. Radiated Spurious, 802.11n 40MHz, 5670 MHz, 1 GHz – 18 GHz, 19 dBi Panel

EIRP

5dBi Omni Antenna								
802.11a	Band Edge Freq.	Uncorrected Peak (dBuV)	Cable Loss	ACF	DCF	Corrected	Limit (dBuV/m)	Margin
	5350 MHz	21.22	7.03	35	9.54	53.71	68.23	-14.52
	5470 MHz	26.19	7.03	35	9.54	58.68	68.23	-9.55
	5725 MHz	32.2	7.5	35	9.54	65.16	68.23	-3.07
802.11n 20MHz	Band Edge Freq.	Uncorrected Peak (dBuV)	Cable Lost	ACF	DCF	Corrected	Limit (dBuV/m)	Margin
	5350 MHz	21.33	7.03	35	9.54	53.82	68.23	-14.41
	5470 MHz	26.95	7.03	35	9.54	59.44	68.23	-8.79
	5725 MHz	32.73	7.5	35	9.54	65.69	68.23	-2.54
802.11n 40MHz	Band Edge Freq.	Uncorrected Peak (dBuV)	Cable Lost	ACF	DCF	Corrected	Limit (dBuV/m))	Margin
	5350 MHz	20.94	7.03	35	9.54	53.43	68.23	-14.8
	5470 MHz	25.91	7.03	35	9.54	58.4	68.23	-9.83
	5725 MHz	34.19	7.5	35	9.54	67.15	68.23	-1.08

Table 58. EIRP Calculation, 5 dBi Omni

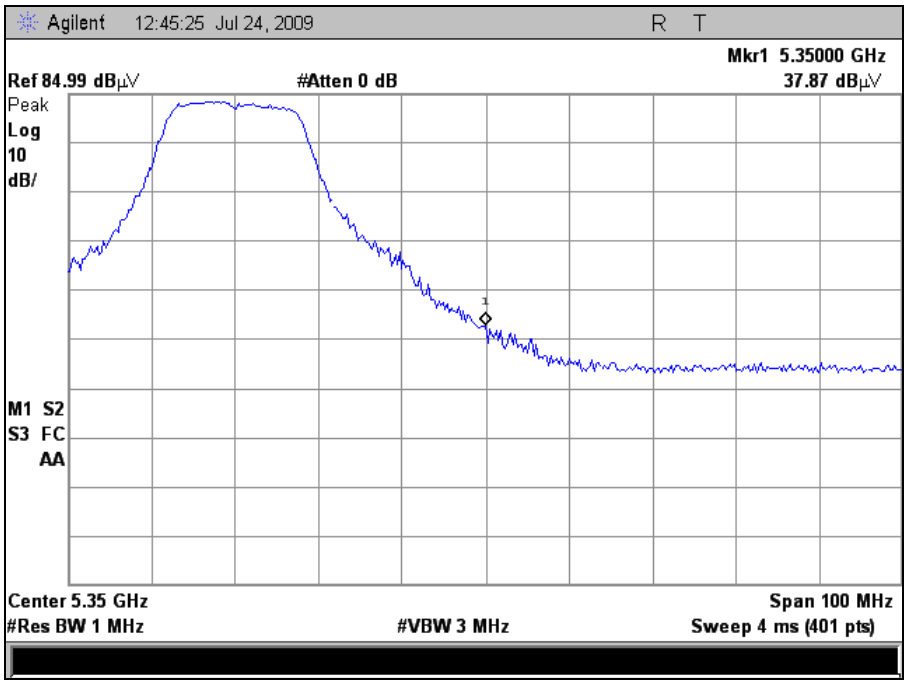
Note: EIRP Limit -27dBm/MHz = 68.23dBuV/m

19dBi Panel Antenna								
802.11a	Band Edge Freq.	Uncorrected Peak (dBuV)	Cable Loss	ACF	DCF	Corrected	Limit (dBuV/m)	Margin
	5350 MHz	20.09	7.03	35	9.54	52.58	68.23	-15.65
	5470 MHz	21.92	7.03	35	9.54	54.41	68.23	-13.82
	5725 MHz	33.2	7.5	35	9.54	66.16	68.23	-2.07
802.11n 20MHz	5350 MHz	19.03	7.03	35	9.54	51.52	68.23	-16.71
	5470 MHz	23.2	7.03	35	9.54	55.69	68.23	-12.54
	5725 MHz	34.25	7.5	35	9.54	67.21	68.23	-1.02
802.11n 40MHz	5350 MHz	20.83	7.03	35	9.54	53.32	68.23	-14.91
	5470 MHz	27.54	7.03	35	9.54	60.03	68.23	-8.2
	5725 MHz	34.83	7.5	35	9.54	67.79	68.23	-0.44

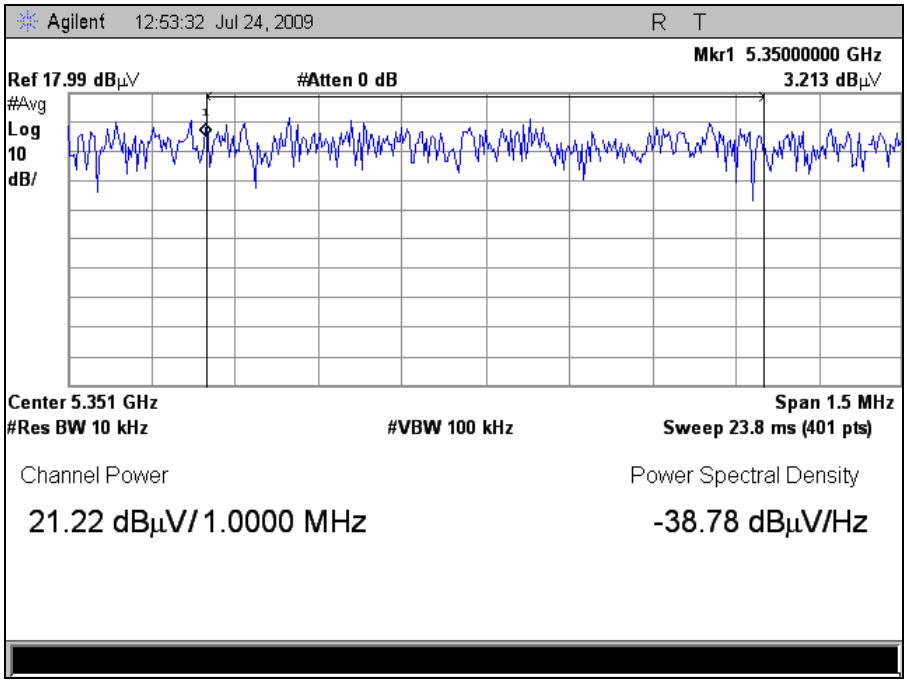
Table 59. EIRP Calculation, 19 dBi Panel

Note: EIRP Limit -27dBm/MHz = 68.23dBuV/m

EIRP, 802.11a (5 dBi Omni)

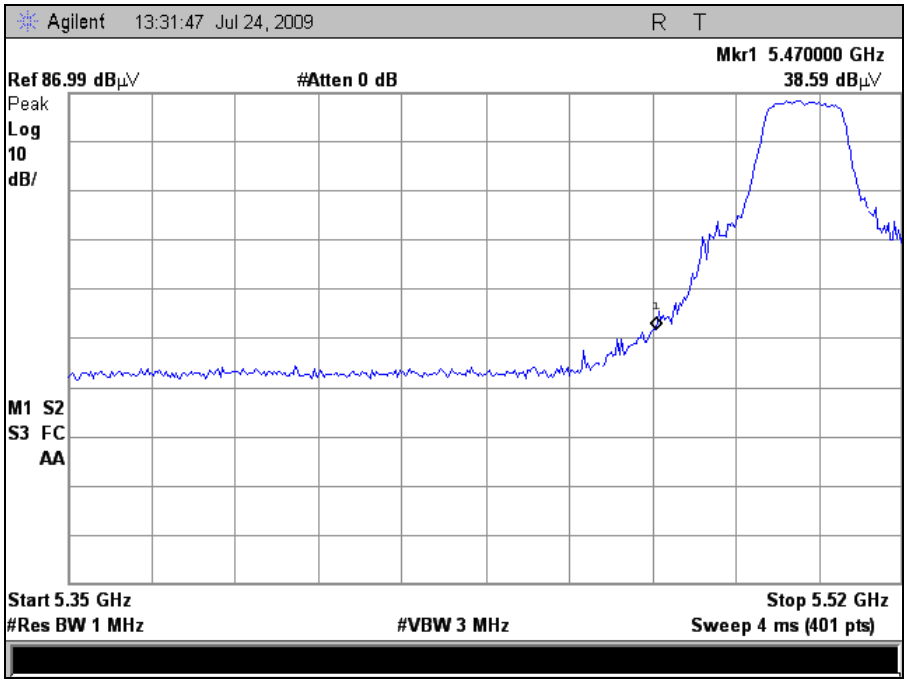


Plot 173. EIRP, Port 1, 802.11a, 5350 MHz Peak, 5 dBi Omni

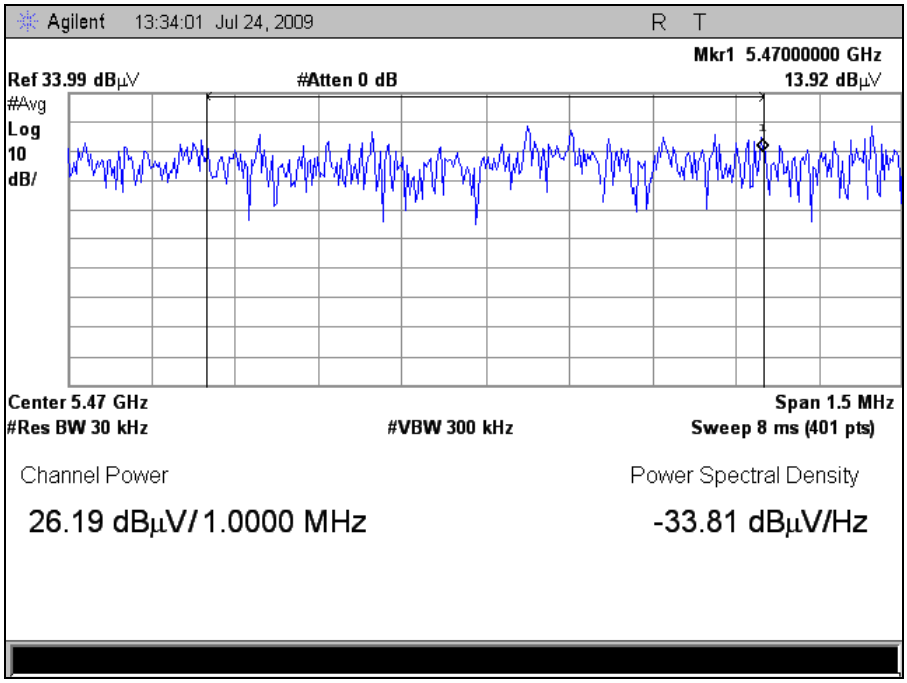


Plot 174. EIRP, Port 1, 802.11a, 5350 MHz Over 1 MHz, 5 dBi Omni

EIRP, 802.11a (5 dBi Omni)

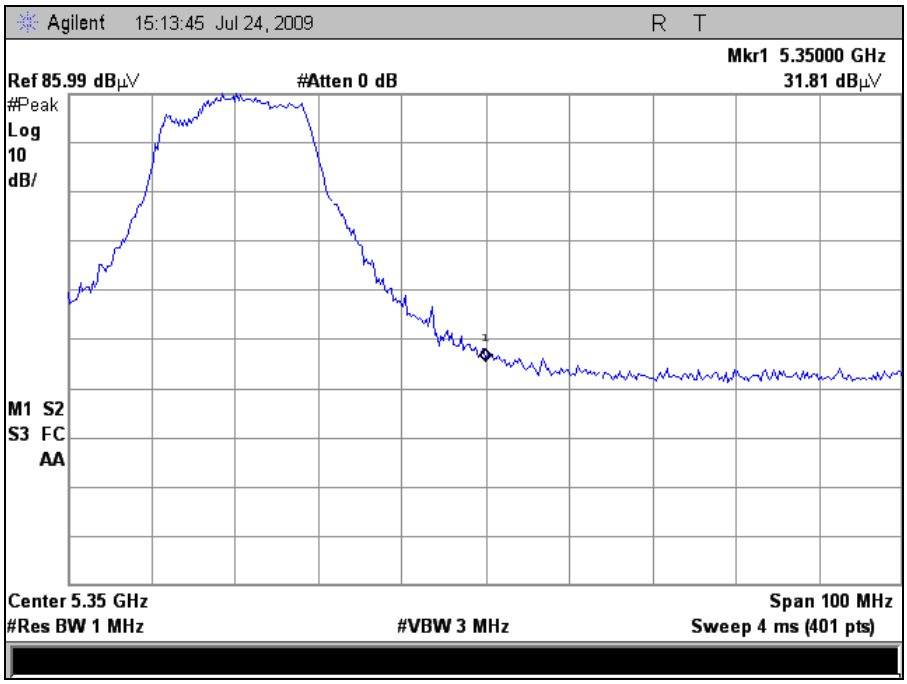


Plot 175. EIRP, Port 1, 802.11a, 5470 MHz Peak, 5 dBi Omni

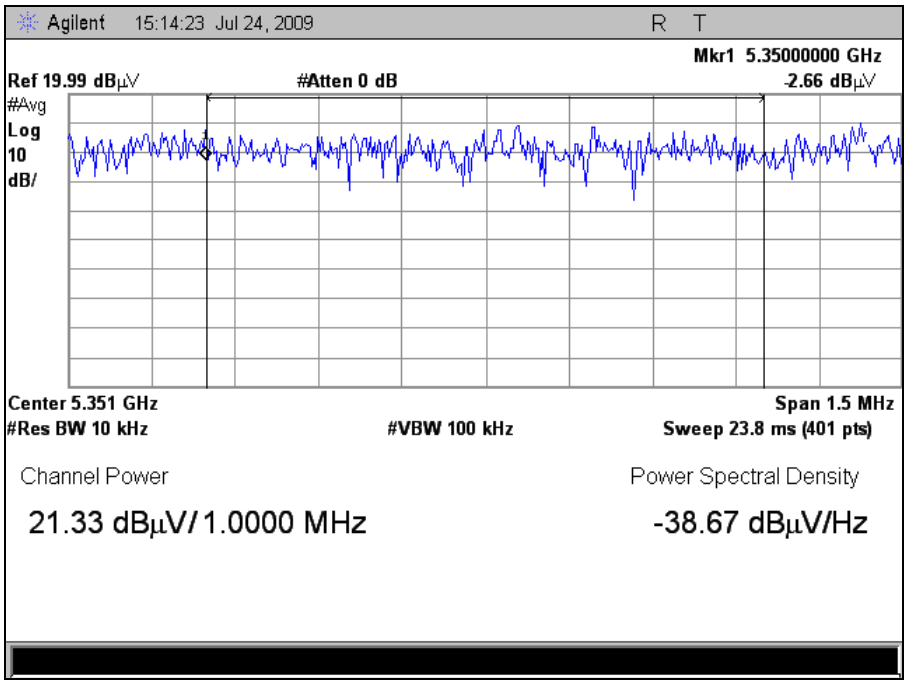


Plot 176. EIRP, Port 1, 802.11a, 5470 MHz Over 1 MHz, 5 dBi Omni

EIRP, 802.11n 20 MHz (5 dBi Omni)

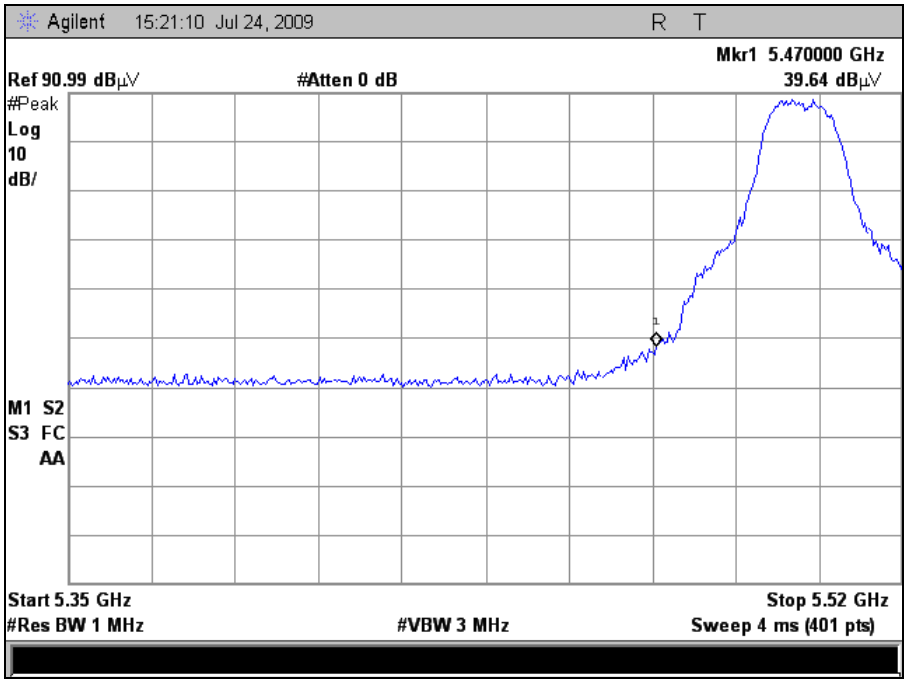


Plot 177. EIRP, 802.11n 20MHz, 5350 MHz Peak, 5 dBi Omni

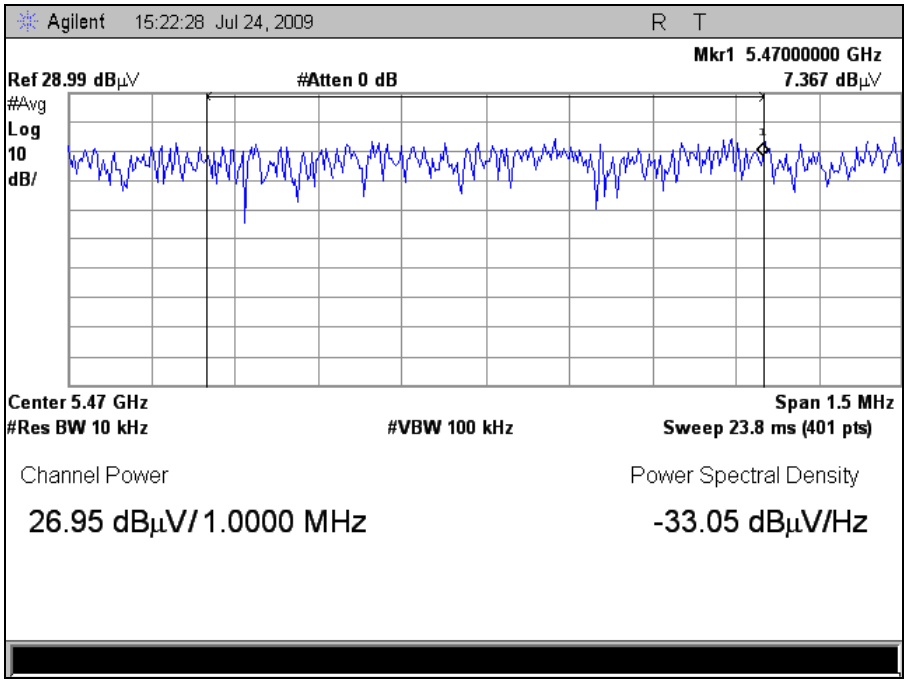


Plot 178. EIRP, 802.11n 20MHz, 5350 MHz Over 1 MHz, 5 dBi Omni

EIRP, 802.11n 20 MHz (5 dBi Omni)

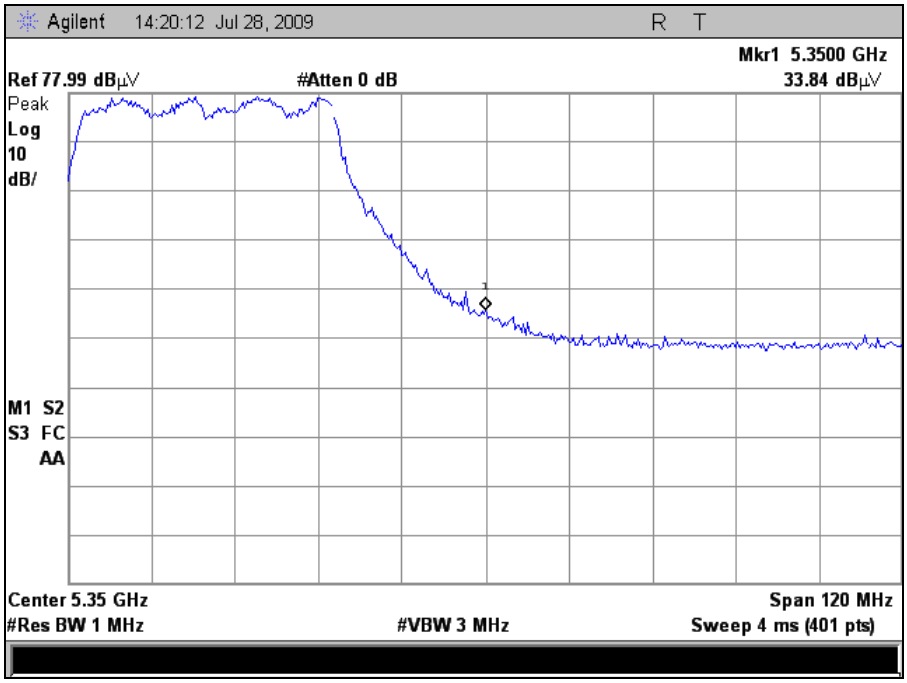


Plot 179. EIRP, 802.11n 20MHz, 5470 MHz Peak, 5 dBi Omni

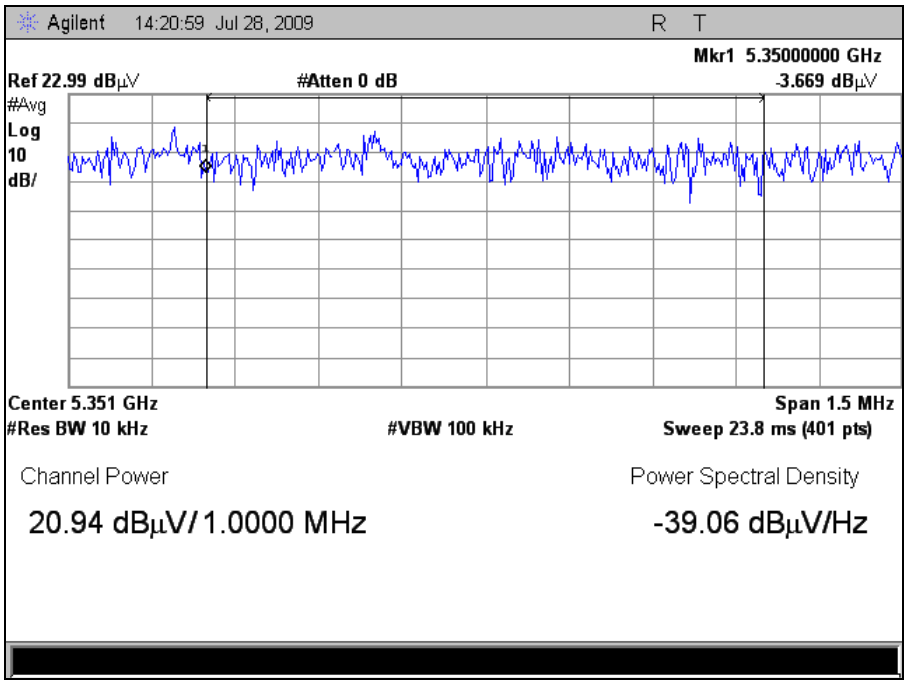


Plot 180. EIRP, 802.11n 20MHz, 5470 MHz Over 1 MHz, 5 dBi Omni

EIRP, 802.11n 40 MHz (5 dBi Omni)

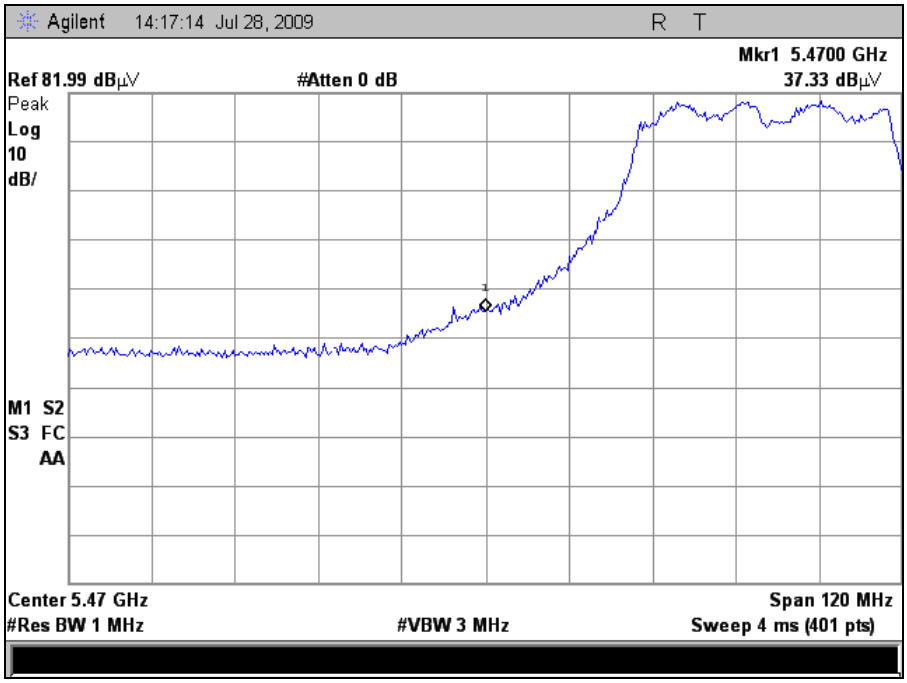


Plot 181. EIRP, 802.11n 40MHz, 5350 MHz Peak, 5 dBi Omni

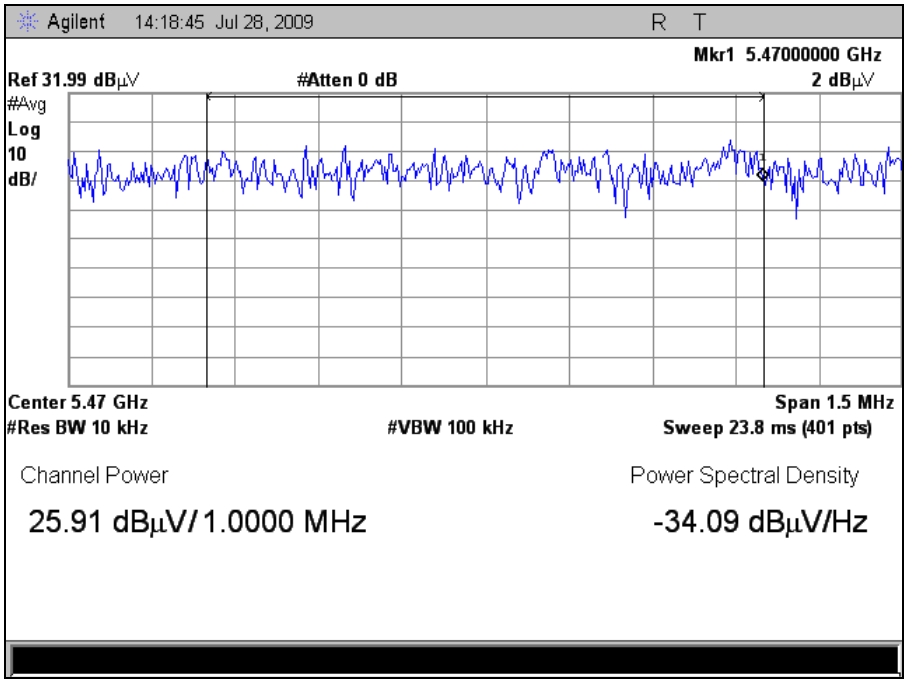


Plot 182. EIRP, 802.11n 40MHz, 5350 MHz Over 1 MHz, 5 dBi Omni

EIRP, 802.11n 40 MHz (5 dBi Omni)

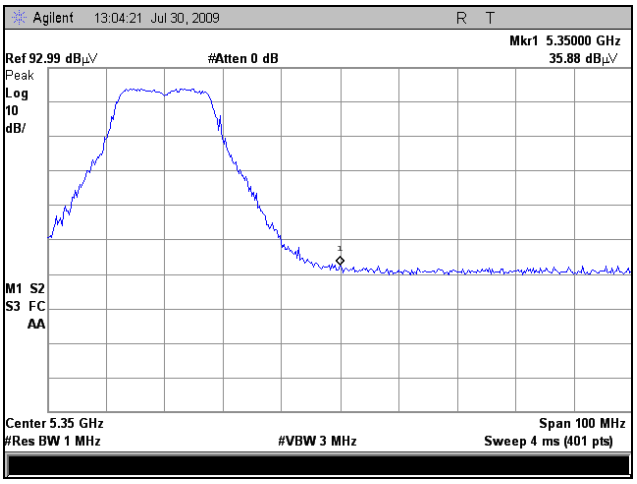


Plot 183. EIRP, 802.11n 40MHz, 5470 MHz Peak, 5 dBi Omni

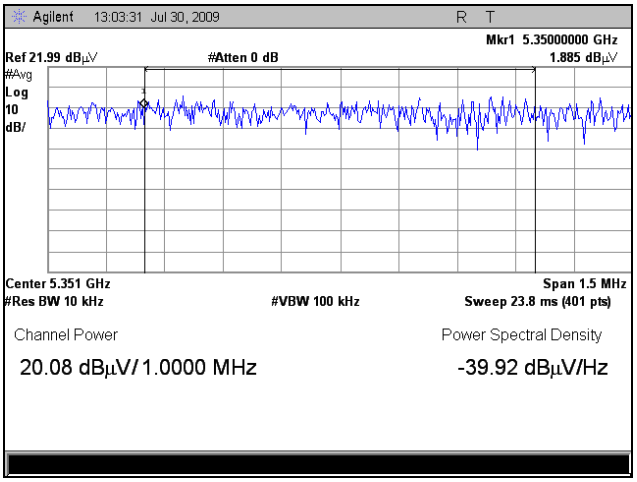


Plot 184. EIRP, 802.11n 40MHz, 5470 MHz Over 1 MHz, 5 dBi Omni

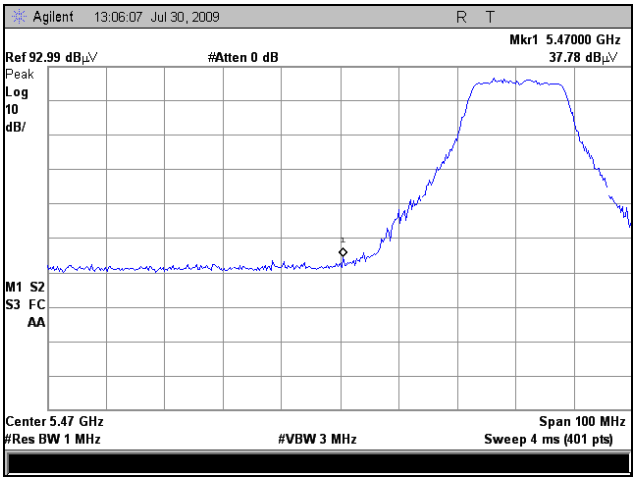
EIRP, 802.11a (19 dBi Panel)



Plot 185. EIRP, Port 1, 802.11a, 5350 MHz Peak, 19 dBi Panel

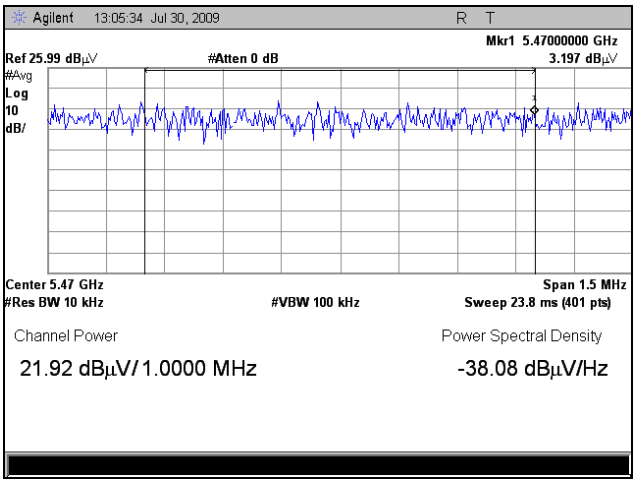


Plot 186. EIRP, Port 1, 802.11a, 5350 MHz Over 1 MHz, 19 dBi Panel

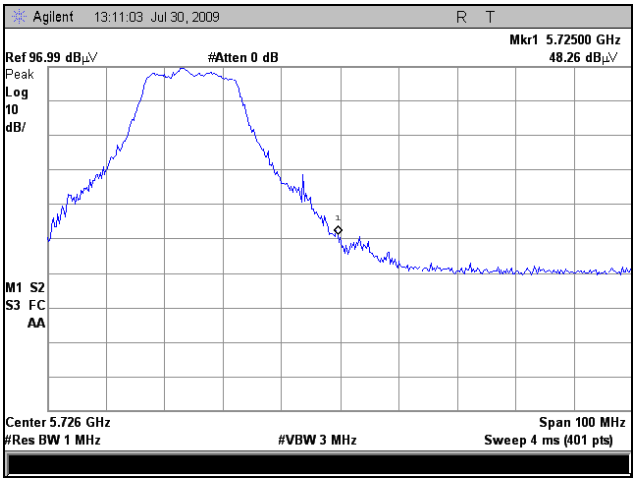


Plot 187. EIRP, Port 1, 802.11a, 5470 MHz Peak, 19 dBi Panel

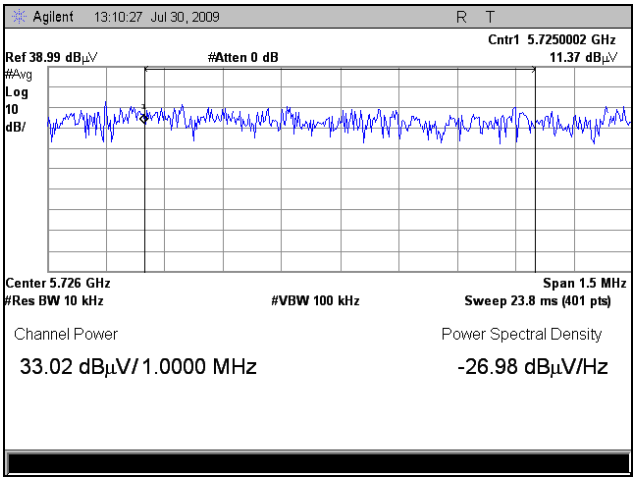
EIRP, 802.11a (19 dBi Panel)



Plot 188. EIRP, Port 1, 802.11a, 5470 MHz Over 1 MHz, 19 dBi Panel

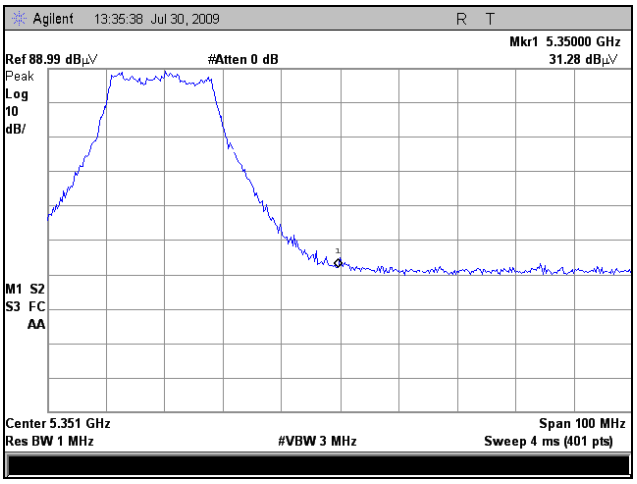


Plot 189. EIRP, Port 1, 802.11a, 5725 MHz Peak, 19 dBi Panel

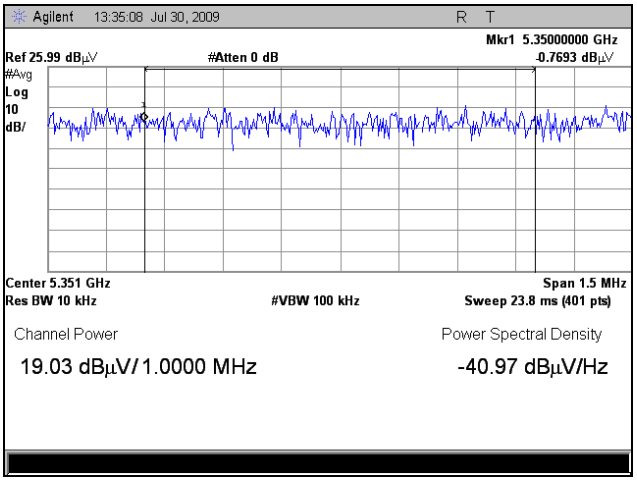


Plot 190. EIRP, Port 1, 802.11a, 5725 MHz Over 1 MHz, 19 dBi Panel

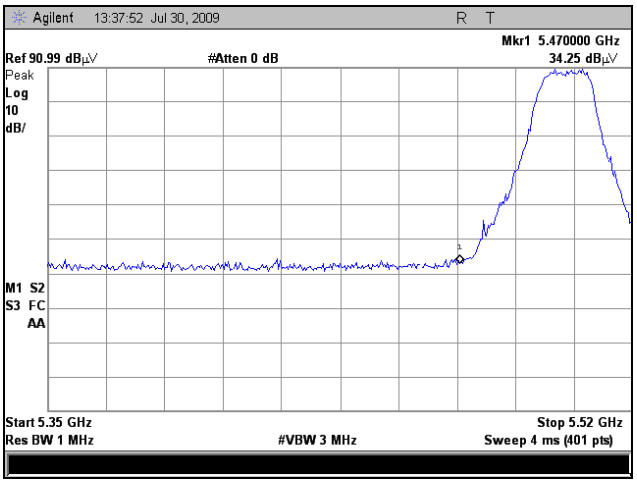
EIRP, 802.11n 20MHz



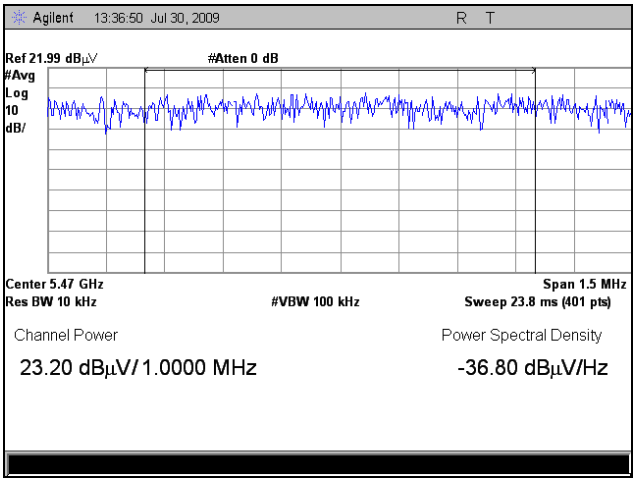
Plot 191. EIRP, 802.11n 20MHz, 5350 MHz Peak, 19 dBi Panel



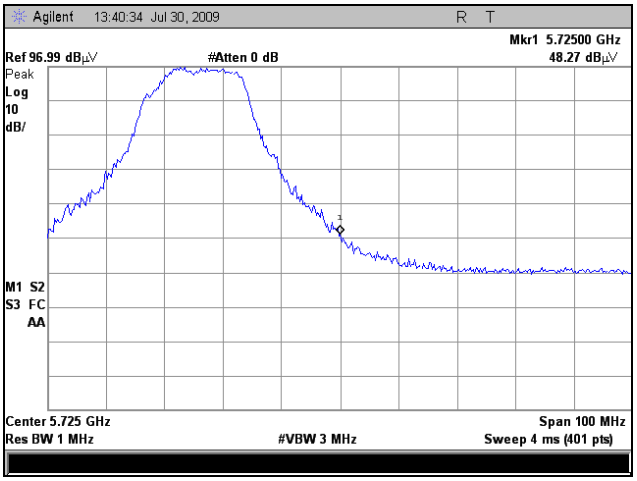
Plot 192. EIRP, 802.11n 20MHz, 5350 MHz Over 1 MHz, 19 dBi Panel



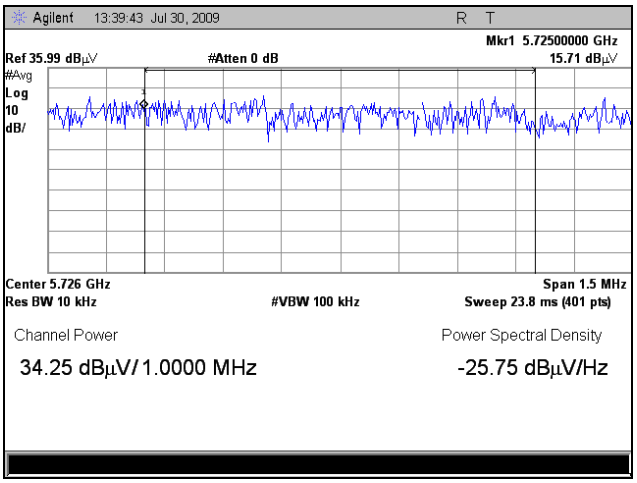
Plot 193. EIRP, 802.11n 20MHz, 5470 MHz Peak, 19 dBi Panel



Plot 194. EIRP, 802.11n 20MHz, 5470 MHz Over 1 MHz, 19 dBi Panel

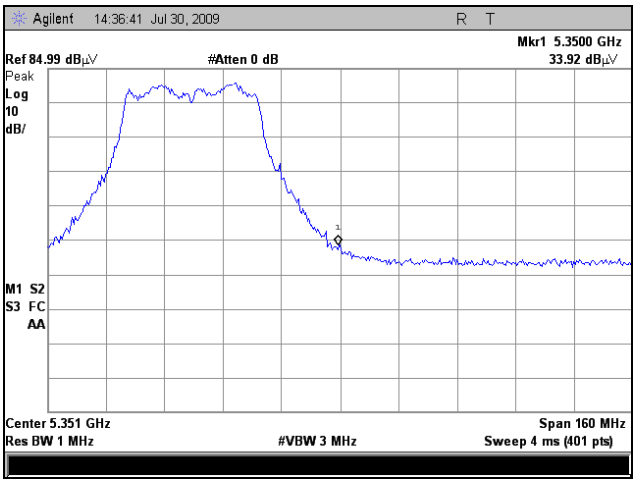


Plot 195. EIRP, 802.11n 20MHz, 5725 MHz Peak, 19 dBi Panel

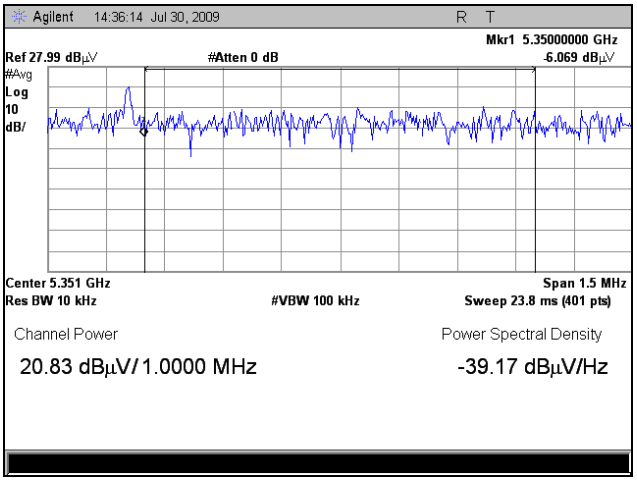


Plot 196. EIRP, 802.11n 20MHz, 5725 MHz Over 1 MHz, 19 dBi Panel

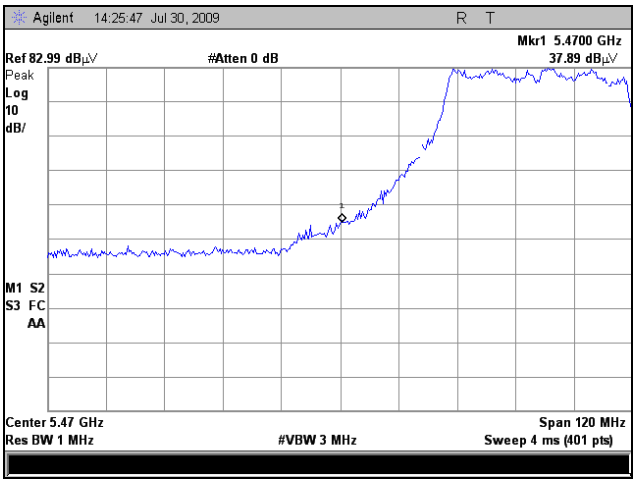
EIRP, 802.11n 40MHz



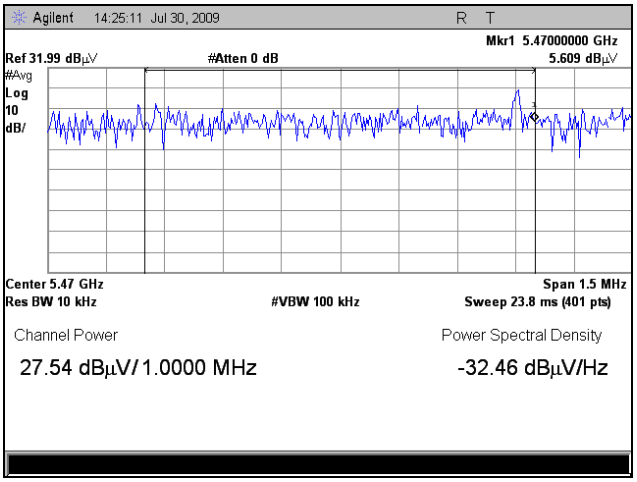
Plot 197. EIRP, 802.11n 40MHz, 5350 MHz Peak, 19 dBi Panel



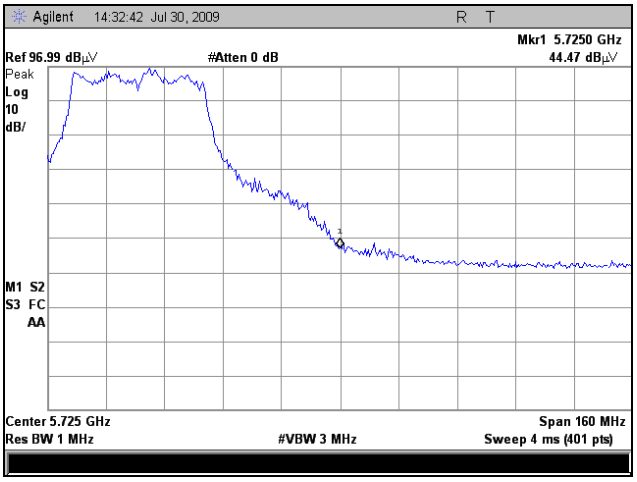
Plot 198. EIRP, 802.11n 40MHz, 5350 MHz Over 1 MHz, 19 dBi Panel



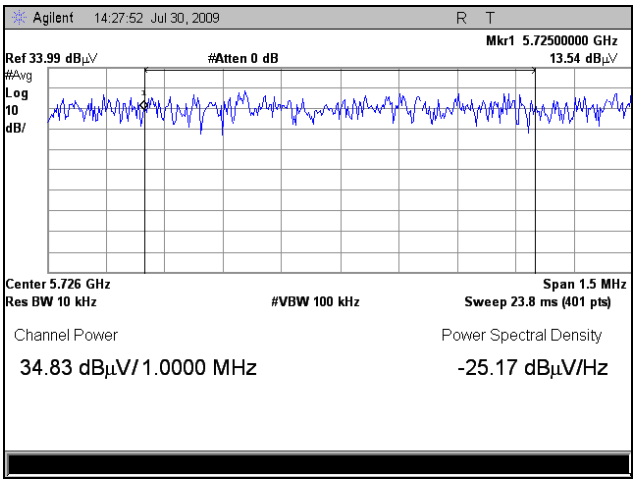
Plot 199. EIRP, 802.11n 40MHz, 5470 MHz Peak, 19 dBi Panel



Plot 200. EIRP, 802.11n 40MHz, 5470 MHz Over 1 MHz, 19 dBi Panel



Plot 201. EIRP, 802.11n 40MHz, 5725 MHz Peak, 19 dBi Panel



Plot 202. EIRP, 802.11n 40MHz, 5725 MHz Over 1 MHz, 19 dBi Panel

Restricted Band

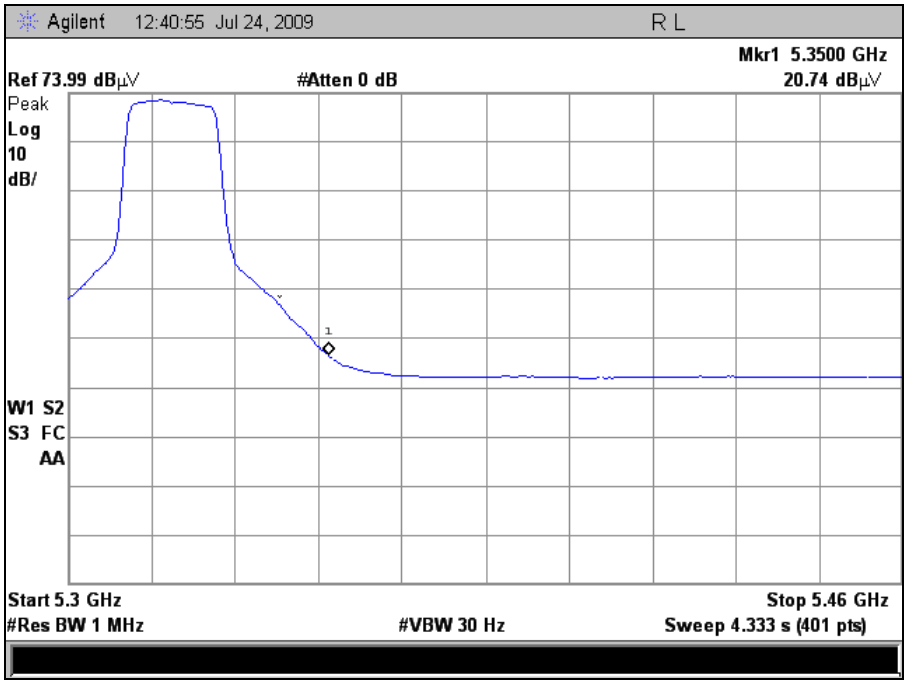
5dBi Omni Antenna									
802.11a	**Restricted Band Freq.**	**Uncorrected Peak (dBuV)**	**Cable Loss**	**ACF**	**DCF**	**Corrected**	**Limit (dBuV/m)**	**Margin**	
	5350 MHz	35	7.03	35	9.54	67.49	74	-6.51	Peak
	5350 MHz	20.74	7.03	35	9.54	53.23	54	-0.77	Average
	5460 MHz	32.32	7.03	35	9.54	64.81	74	-9.19	Peak
	5460 MHz	19.7	7.03	35	9.54	52.19	54	-1.81	Average
802.11n 20MHz	**Restricted Band Freq.**	**Uncorrected Peak (dBuV)**	**Cable Loss**	**ACF**	**DCF**	**Corrected**	**Limit (dBuV/m)**	**Margin**	
	5350 MHz	32.57	7.03	35	9.54	65.06	74	-8.94	Peak
	5350 MHz	20.46	7.03	35	9.54	52.95	54	-1.05	Average
	5460 MHz	35.61	7.03	35	9.54	68.1	74	-5.9	Peak
	5460 MHz	20.99	7.03	35	9.54	53.48	54	-0.52	Average
802.11n 40MHz	**Restricted Band Freq.**	**Uncorrected Peak (dBuV)**	**Cable Loss**	**ACF**	**DCF**	**Corrected**	**Limit (dBuV/m)**	**Margin**	
	5350 MHz	32.59	7.03	35	9.54	65.08	74	-8.92	Peak
	5350 MHz	20.96	7.03	35	9.54	53.45	54	-0.55	Average
	5460 MHz	34.01	7.03	35	9.54	66.5	74	-7.5	Peak
	5460 MHz	20.59	7.03	35	9.54	53.08	54	-0.92	Average

Table 60. Restricted Band Edge, Radiated, Test Results

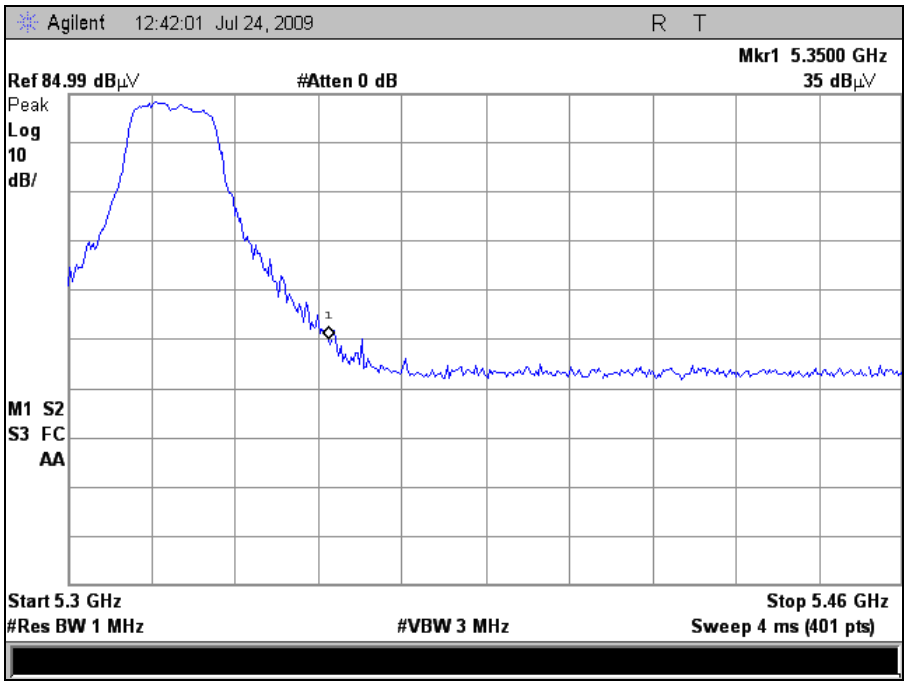
19dBi Panel Antenna									
	Restricted Band Freq.	**Uncorrected Peak (dBuV)**	**Cable Loss**	**ACF**	**DCF**	**Corrected**	**Limit (dBuV/m)**	**Margin**	
802.11a	5350 MHz	31.18	7.03	35	9.54	63.67	74	-10.33	Peak
	5350 MHz	19.7	7.03	35	9.54	52.19	54	-1.81	Average
	5460 MHz	32.78	7.03	35	9.54	65.27	74	-8.73	Peak
	5460 MHz	20.8	7.03	35	9.54	53.29	54	-0.71	Average
802.11n 20MHz	5350 MHz	34.47	7.03	35	9.54	66.96	74	-7.04	Peak
	5350 MHz	19.82	7.03	35	9.54	52.31	54	-1.69	Average
	5460 MHz	32.82	7.03	35	9.54	65.31	74	-8.69	Peak
	5460 MHz	21.02	7.03	35	9.54	53.51	54	-0.49	Average
802.11n 40MHz	5350 MHz	21.37	7.03	35	9.54	53.86	74	-20.14	Peak
	5350 MHz	21.37	7.03	35	9.54	53.86	54	-0.14	Average
	5460 MHz	31.71	7.03	35	9.54	64.2	74	-9.8	Peak
	5460 MHz	20.4	7.03	35	9.54	52.89	54	-1.11	Average

Table 61. Restricted Band Edge, Radiated, Test Results, 19 dBi Panel

Restricted Band, 802.11a, 5dBi Omni

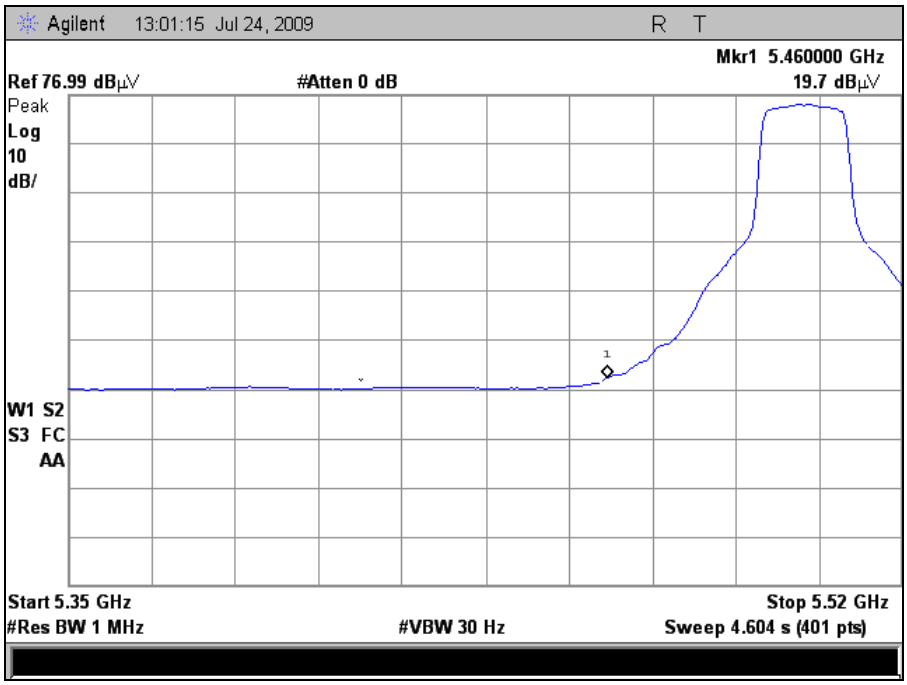


Plot 203. Restricted Band, Port 1, 802.11a, 5350 Average, 5dBi Omni

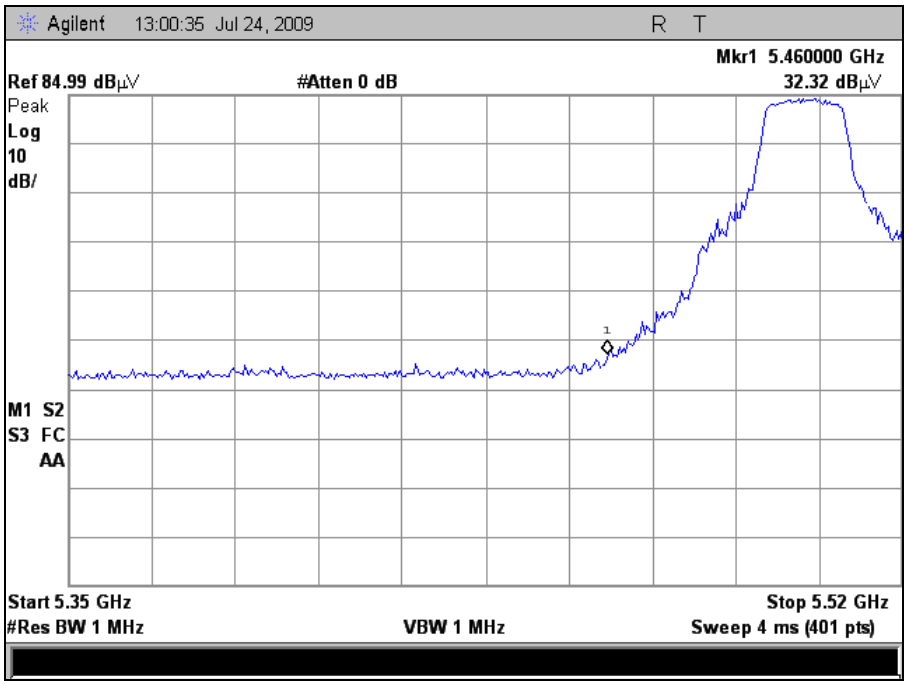


Plot 204. Restricted Band, Port 1, 802.11a, 5350 Peak, 5dBi Omni

Restricted Band, 802.11a, 5dBi Omni

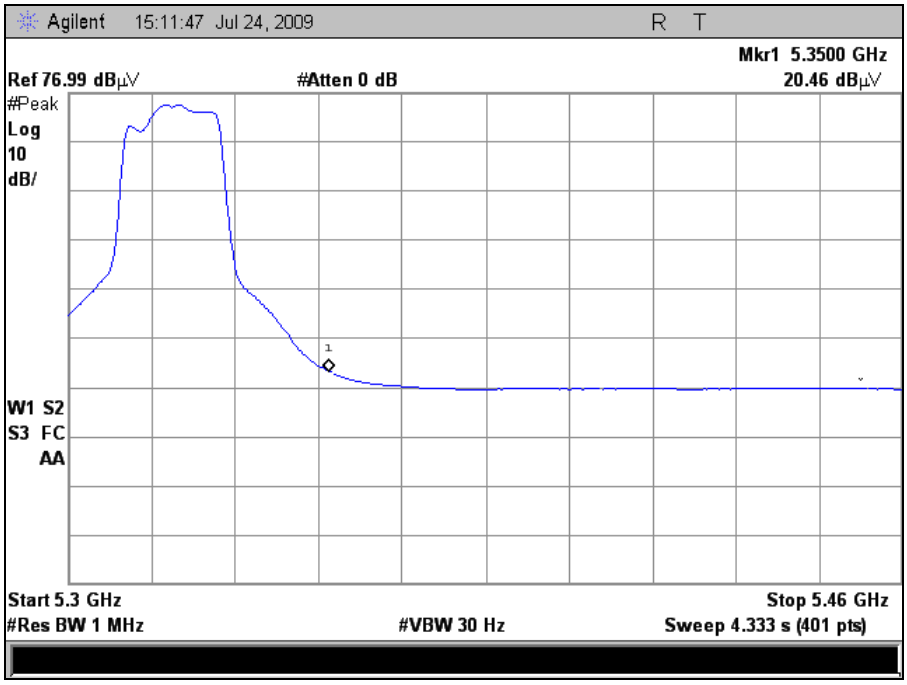


Plot 205. Restricted Band, Port 1, 802.11a, 5460 Average, 5dBi Omni

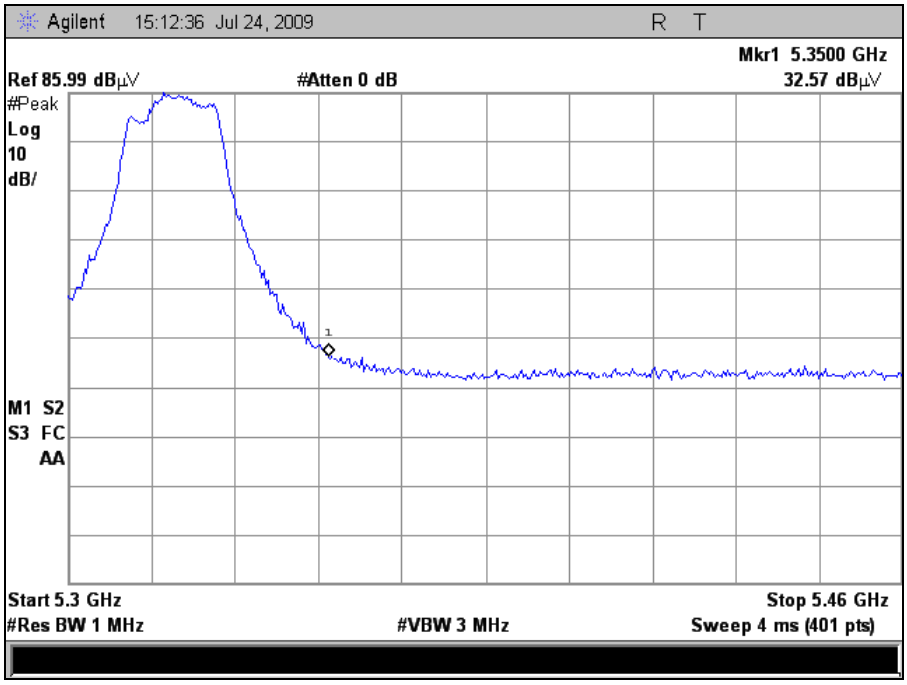


Plot 206. Restricted Band, Port 1, 802.11a, 5460 Peak, 5dBi Omni

Restricted Band, 802.11n 20MHz, 5dBi Omni

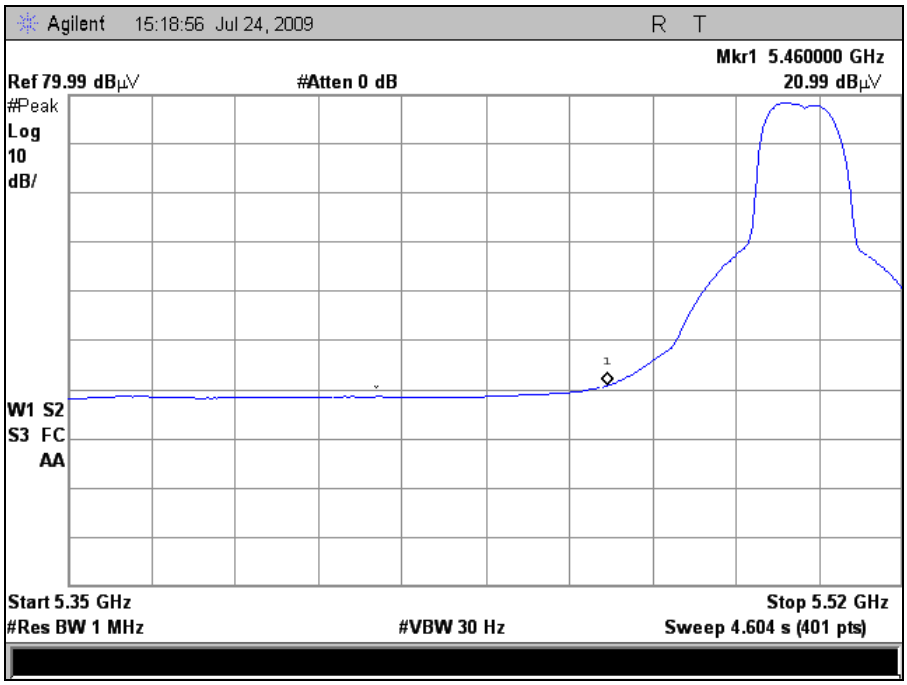


Plot 207. Restricted Band, Port 1, 802.11n 20MHz, 5350 Average, 5dBi Omni

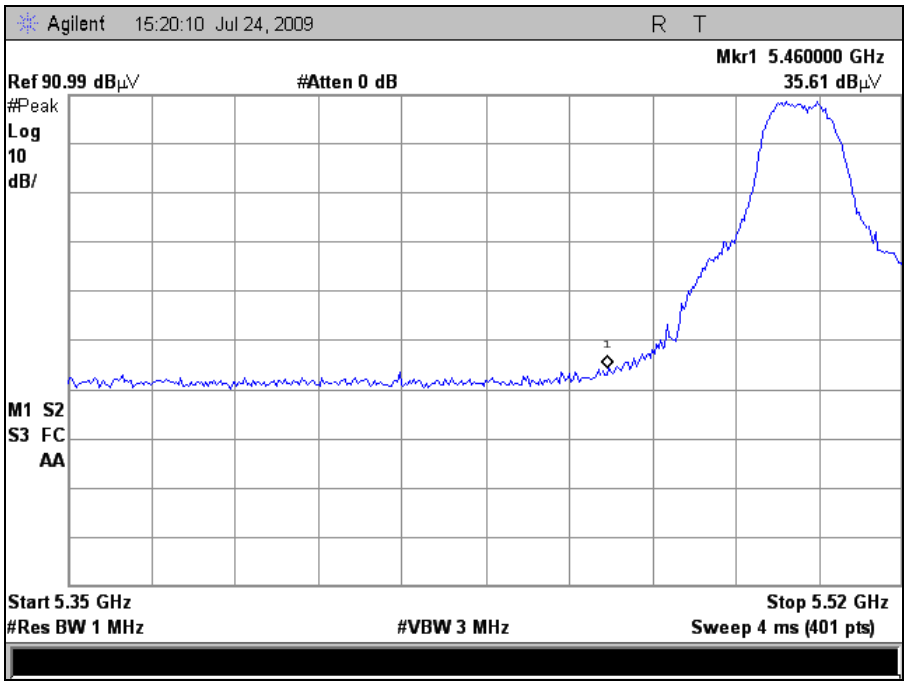


Plot 208. Restricted Band, Port 1, 802.11n 20MHz, 5350 Peak, 5dBi Omni

Restricted Band, 802.11n 20MHz, 5dBi Omni

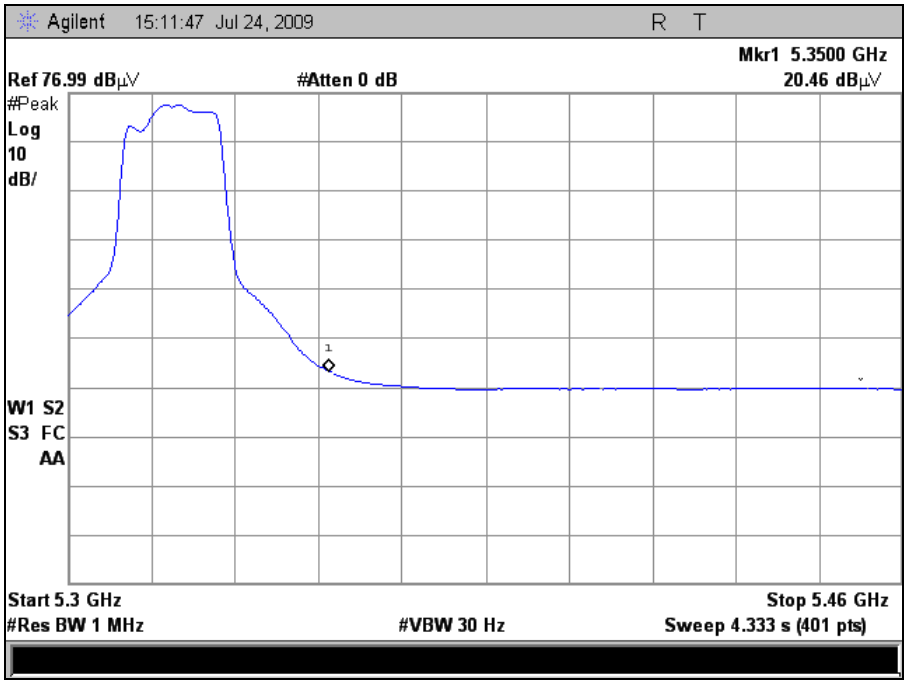


Plot 209. Restricted Band, Port 1, 802.11n 20MHz, 5460 Average, 5dBi Omni

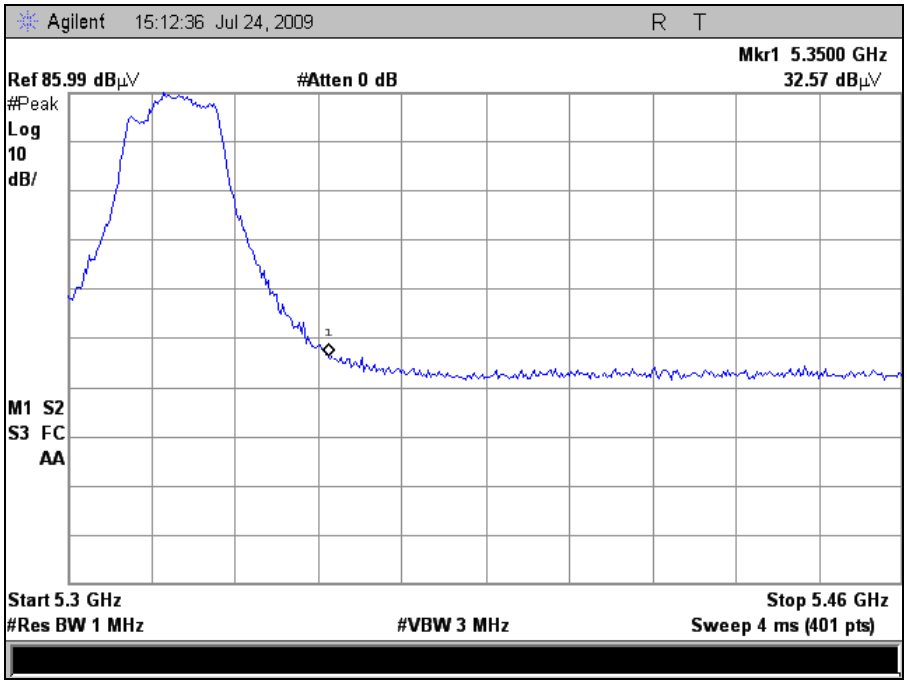


Plot 210. Restricted Band, Port 1, 802.11n 20MHz, 5460 Peak, 5dBi Omni

Restricted Band, 802.11n 20MHz, 5dBi Omni

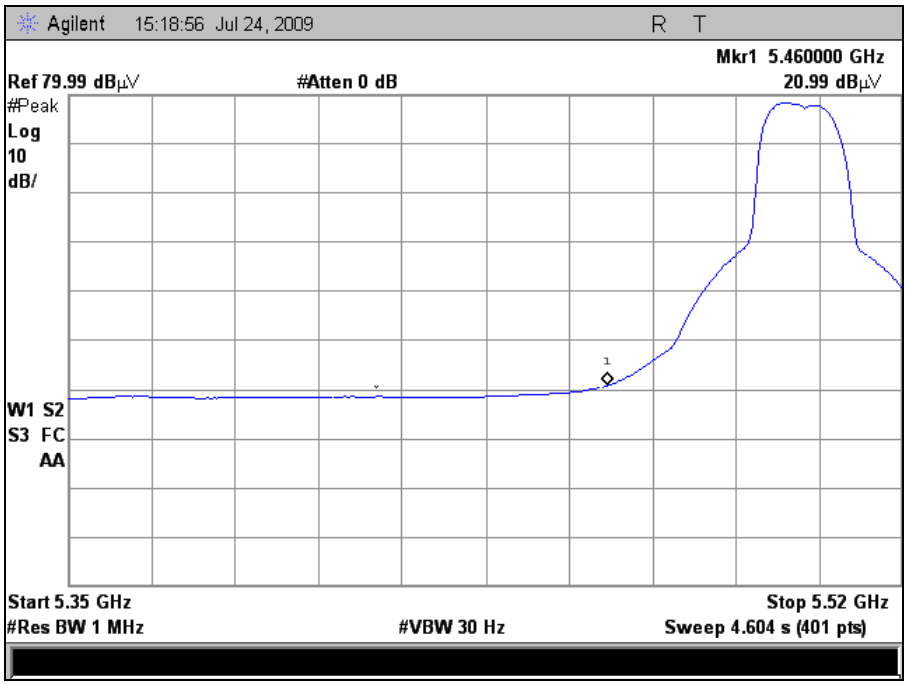


Plot 211. Restricted Band, Combined, 802.11n 20MHz, 5350 Avg. , 5dBi Omni

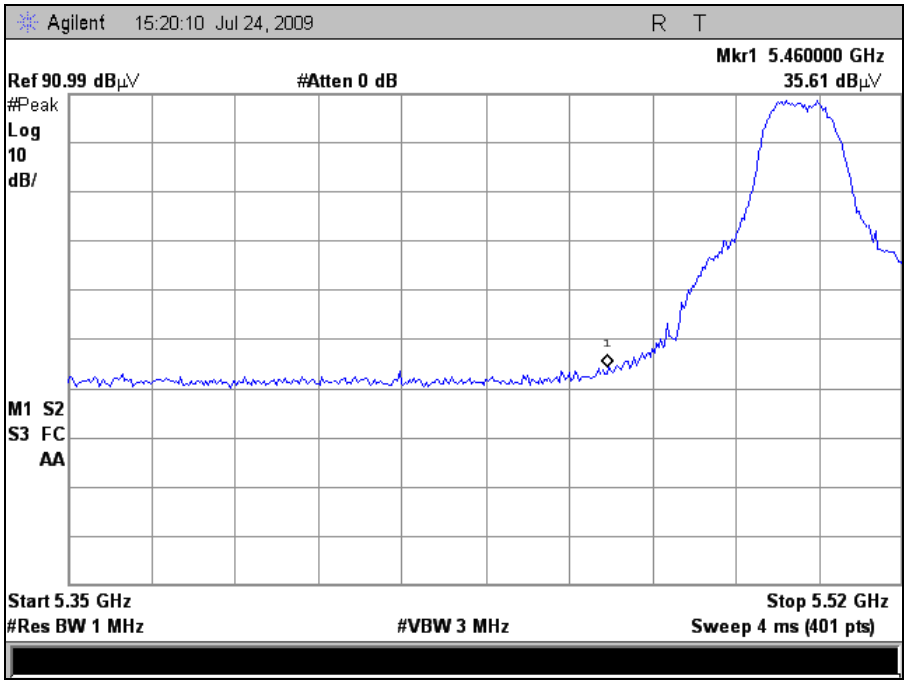


Plot 212. Restricted Band, Combined, 802.11n 20MHz, 5350 Peak, 5dBi Omni

Restricted Band, 802.11n 20MHz, 5dBi Omni

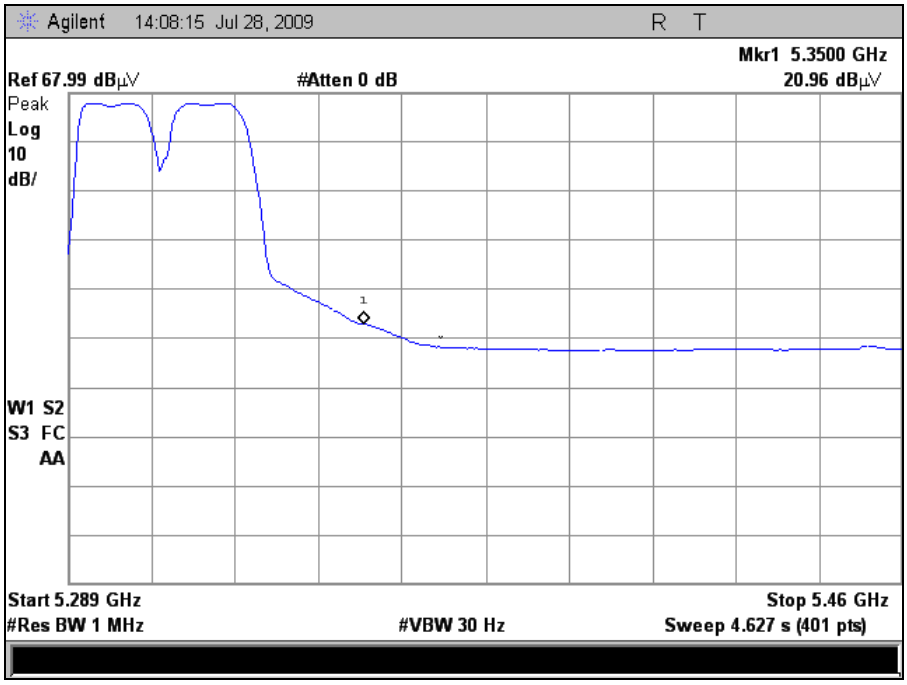


Plot 213. Restricted Band, Combined, 802.11n 20MHz, 5460 Avg. , 5dBi Omni

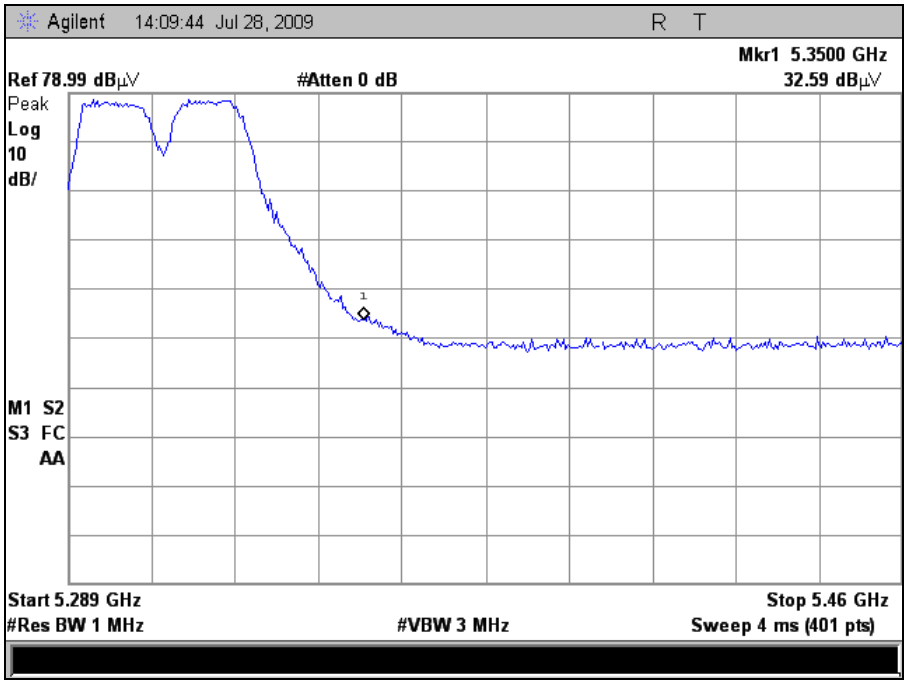


Plot 214. Restricted Band, Combined, 802.11n 20MHz, 5460 Peak, 5dBi Omni

Restricted Band, 802.11n 40MHz

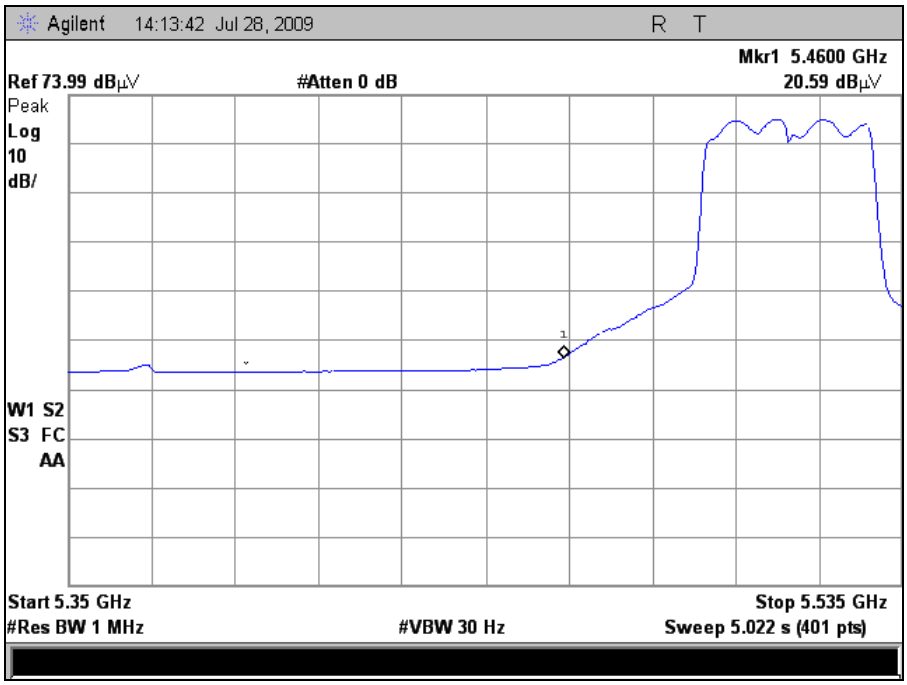


Plot 215. Restricted Band, Combined, 802.11n 40MHz, 5350 Avg., 5dBi Omni

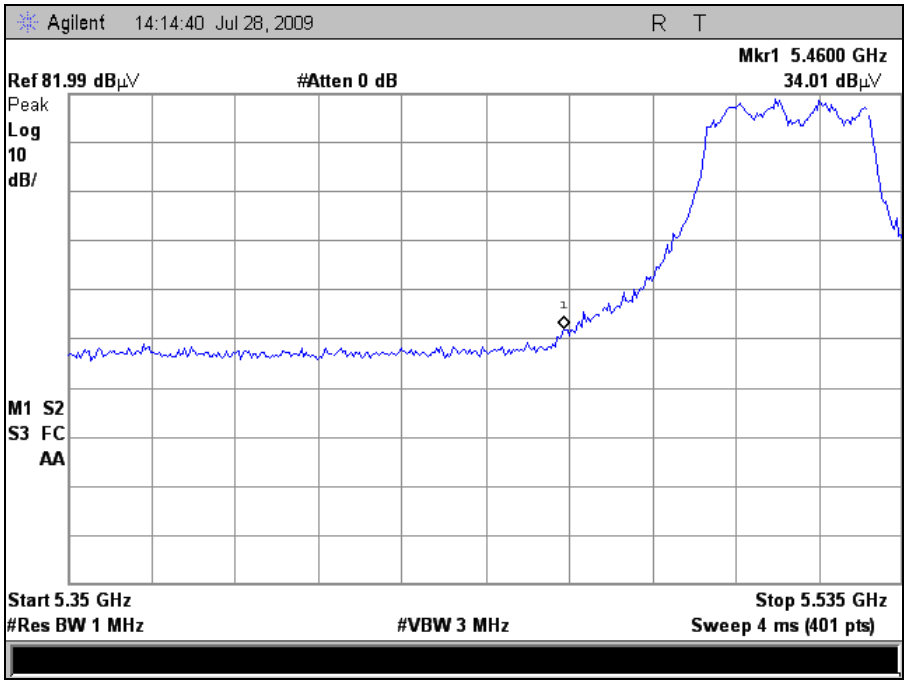


Plot 216. Restricted Band, Combined, 802.11n 40MHz, 5350 Peak, 5dBi Omni

Restricted Band, 802.11n 40MHz

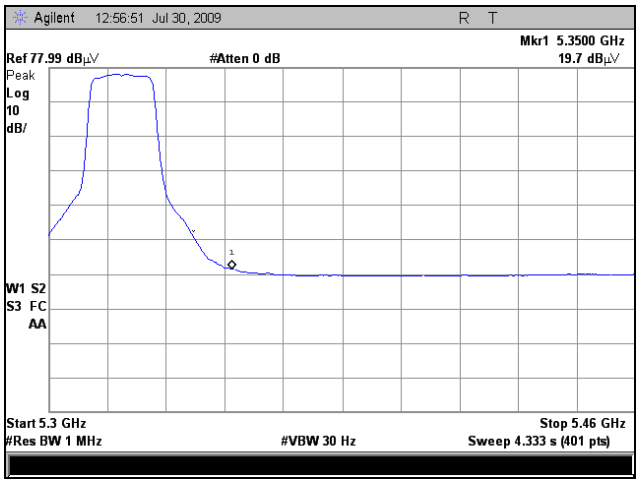


Plot 217. Restricted Band, Combined, 802.11n 40MHz, 5460 Avg., 5dBi Omni

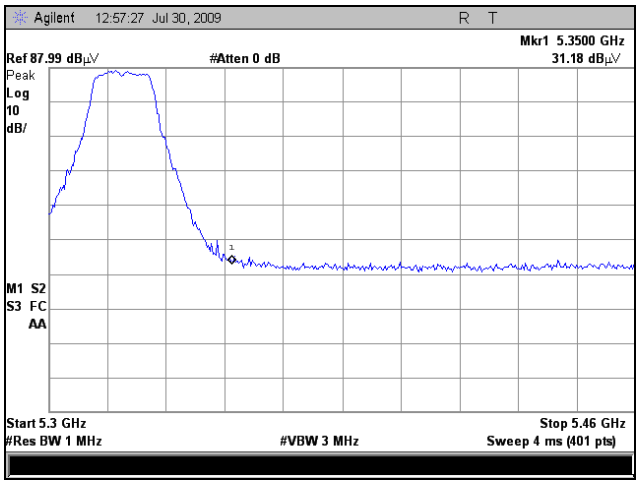


Plot 218. Restricted Band, Combined, 802.11n 40MHz, 5460 Peak, 5dBi Omni

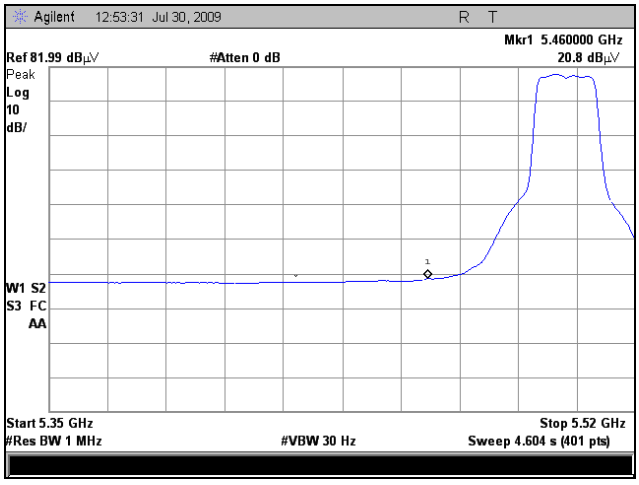
Restricted Band, 802.11a 19dBi Panel



Plot 219. Restricted Band, 802.11a, 5350 Average, 19 dBi Panel

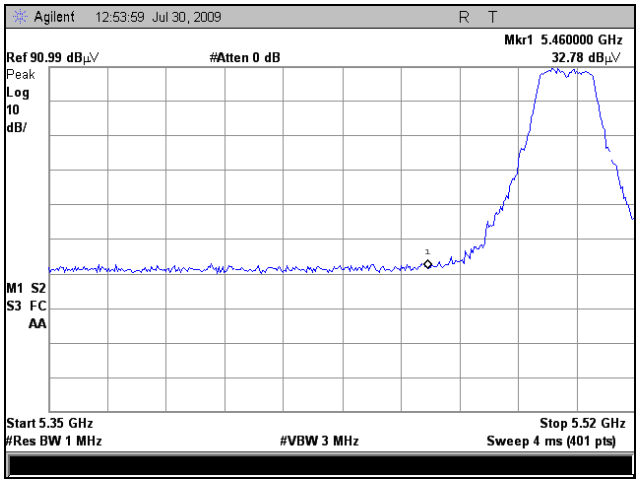


Plot 220. Restricted Band, 802.11a, 5350 Peak, 19 dBi Panel



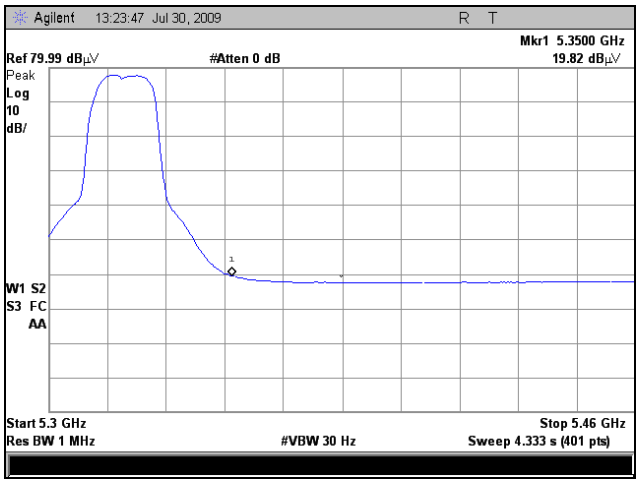
Plot 221. Restricted Band, 802.11a, 5460 Average, 19 dBi Panel

Restricted Band, 802.11a 19dBi Panel

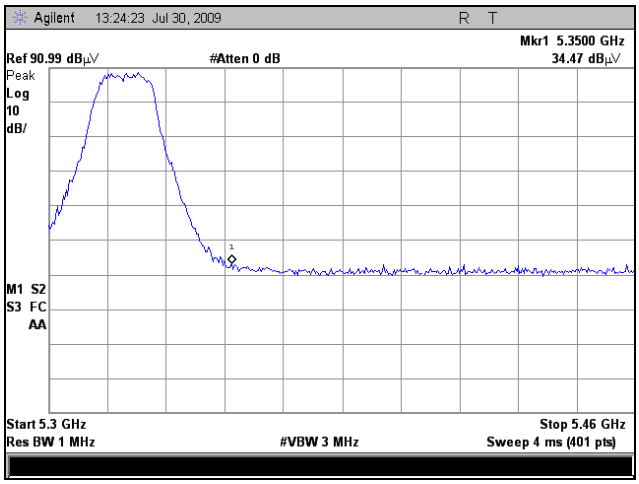


Plot 222. Restricted Band, 802.11a, 5460 Peak, 19 dBi Panel

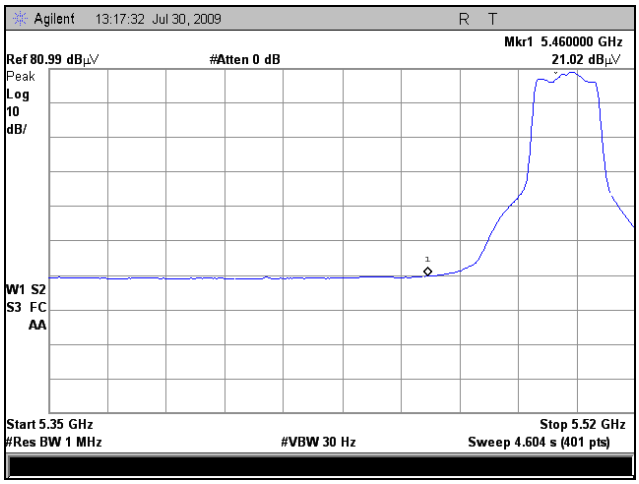
Restricted Band, Combined Ports, 802.11n 20MHz



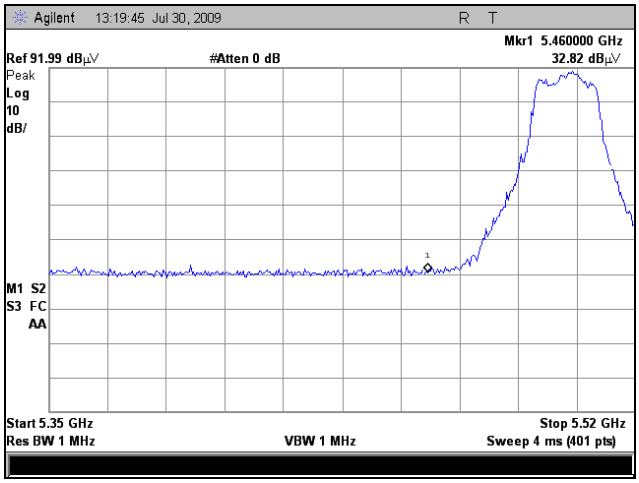
Plot 223. Restricted Band, 802.11n 20MHz, 5350 Average, 19 dBi Panel



Plot 224. Restricted Band, 802.11n 20MHz, 5350 Peak, 19 dBi Panel

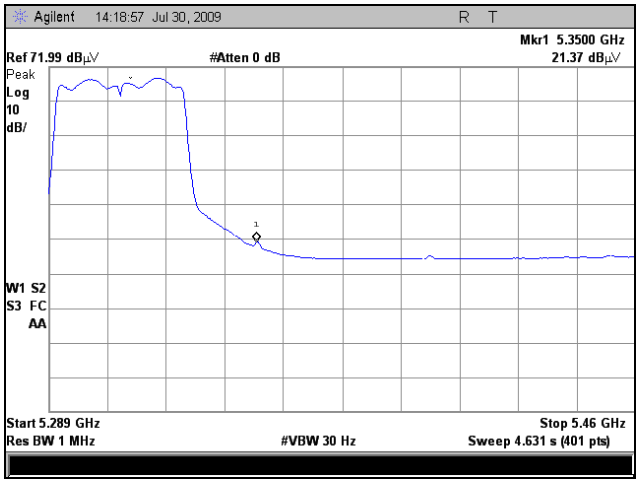


Plot 225. Restricted Band, 802.11n 20MHz, 5460 Average, 19 dBi Panel

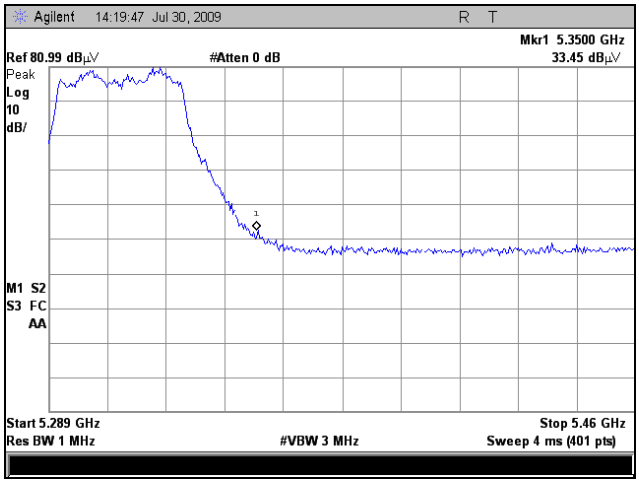


Plot 226. Restricted Band, 802.11n 20MHz, 5460 Peak, 19 dBi Panel

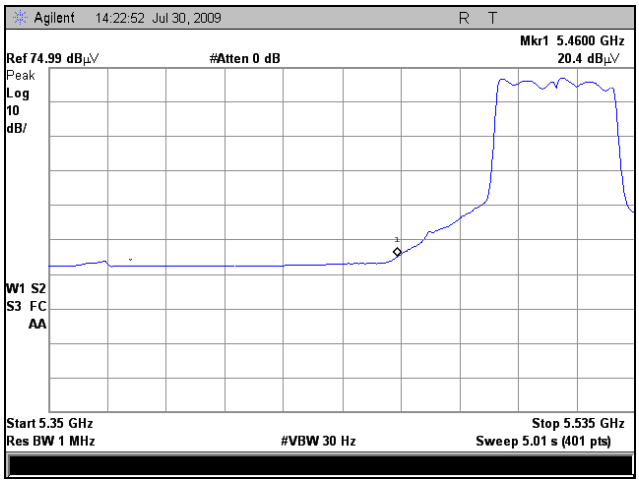
Restricted Band, Combined Ports, 802.11n 40MHz



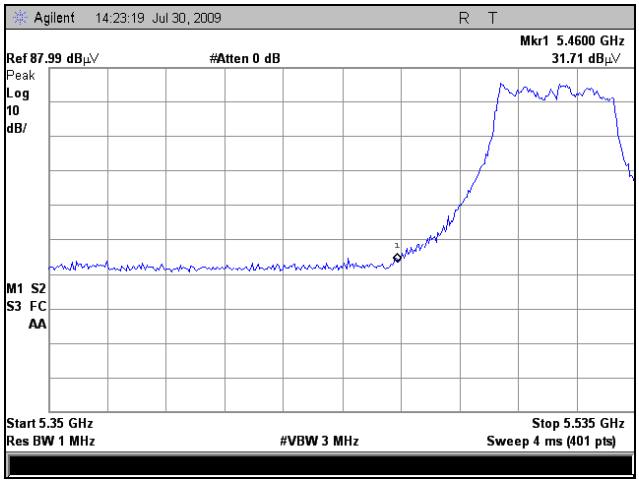
Plot 227. Restricted Band, Combined, 802.11n 40MHz, 5350 Avg., 19 dBi Panel



Plot 228. Restricted Band, Combined, 802.11n 40MHz, 5350 Peak, 19 dBi Panel

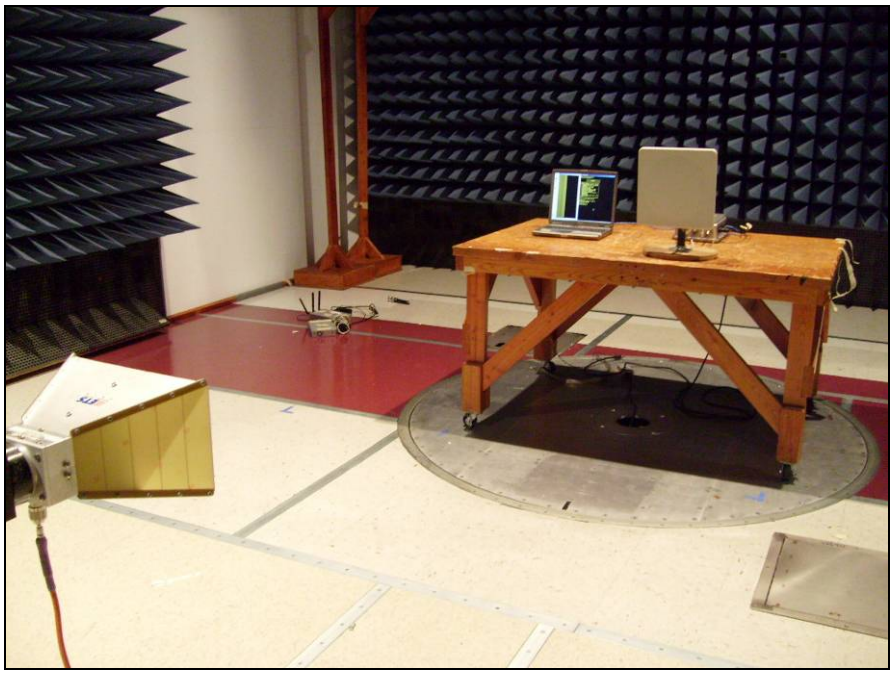


Plot 229. Restricted Band, Combined, 802.11n 40MHz, 5460 Avg., 19 dBi Panel



Plot 230. Restricted Band, Combined, 802.11n 40MHz, 5460 Peak, 19 dBi Panel

Photograph 8. Test Equipment and Setup for Various Radiated Measurements 5 dBi Omni



Photograph 9. 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 @ 5250-5350MHz and 5470-5725MHz; highest conducted power = 18.10 dBm (peak);therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

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

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

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

where, S = Power Density (1 mW/cm^2)
P = Power Input to antenna (64.56 mW)
G = Antenna Gain (79.43 numeric)

$R = \sqrt{((64.56*79.432) / 4*3.14)} = \sqrt{(5128.62 / 12.56)} =$ **20.21 cm**

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 user manual.

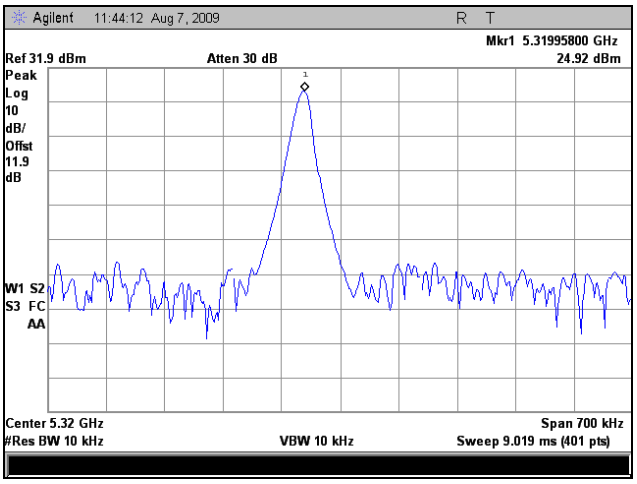
Test Procedure: The EUT was placed in an environmental chamber and the RF port was connected directly to a spectrum analyzer through an attenuator. Depending on which band was being investigated, the EUT was set to transmit at the low, mid, and high with the appropriate power level. If the EUT was capable 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. The resulting carrier frequencies were tabulated below with the temperature range of -40°C to +60°C .

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

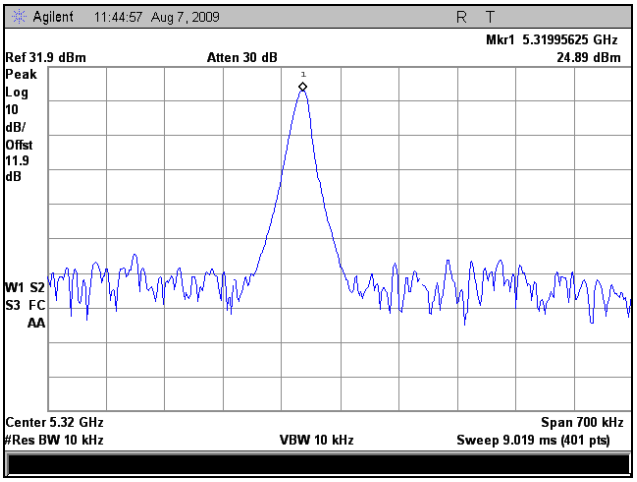
Test Engineer(s): 08/19/09 – 08/20/09

Test Date(s): Anderson Soungpanya

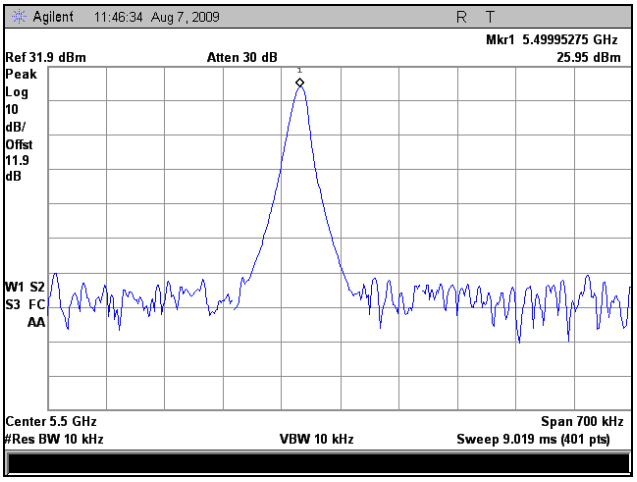
Frequency Stability, Port 1



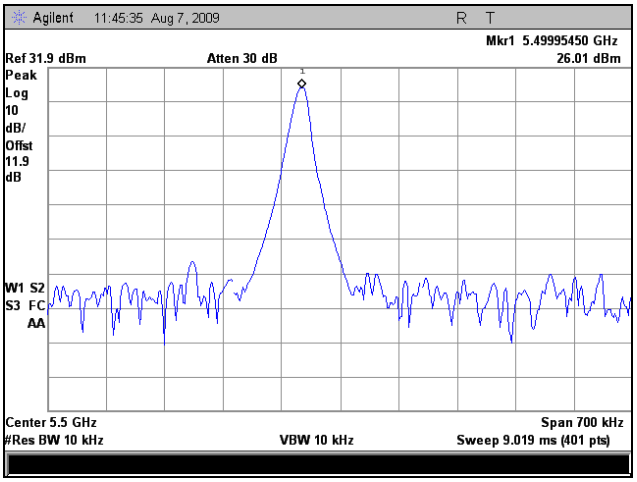
Plot 231. Freq. Stability, Port 1, 5320 MHz @-40C Low Volt.



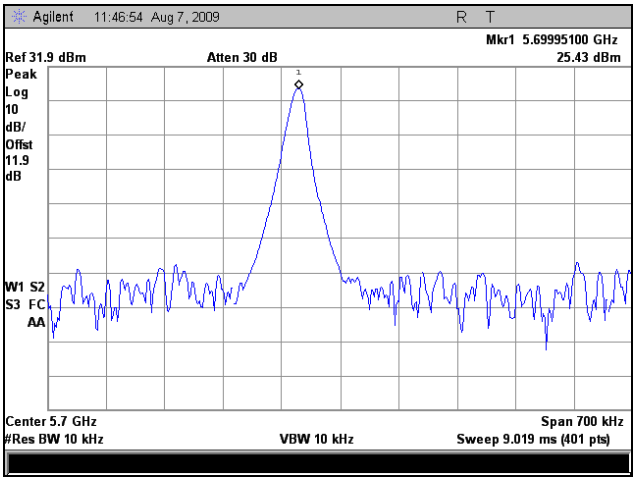
Plot 232. Freq. Stability, Port 1, 5320 MHz @-40C High Volt.



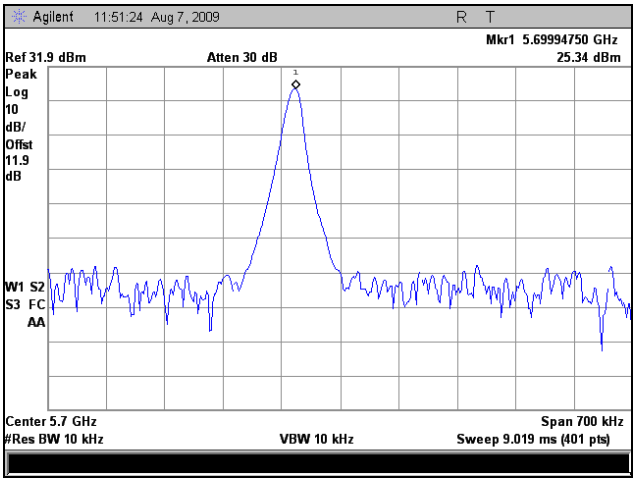
Plot 233. Freq. Stability, Port 1, 5500 MHz @-40C Low Volt.



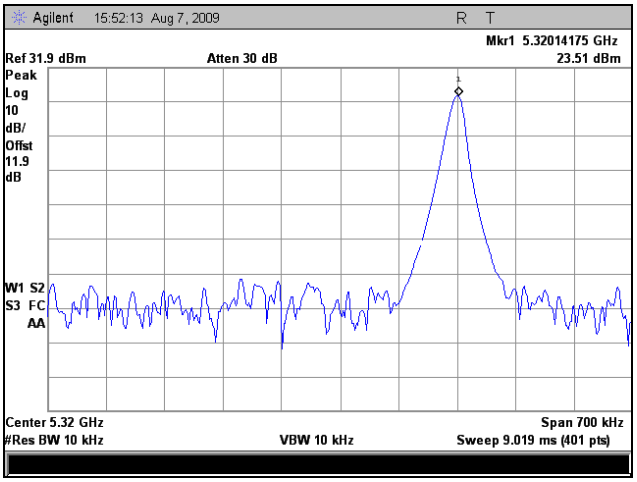
Plot 234. Freq. Stability, Port 1, 5500 MHz @-40C High Volt.



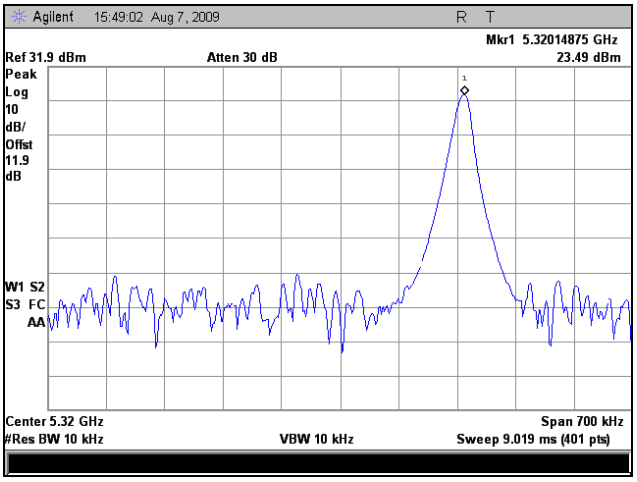
Plot 235. Freq. Stability, Port 1, 5700 MHz @-40C Low Volt.



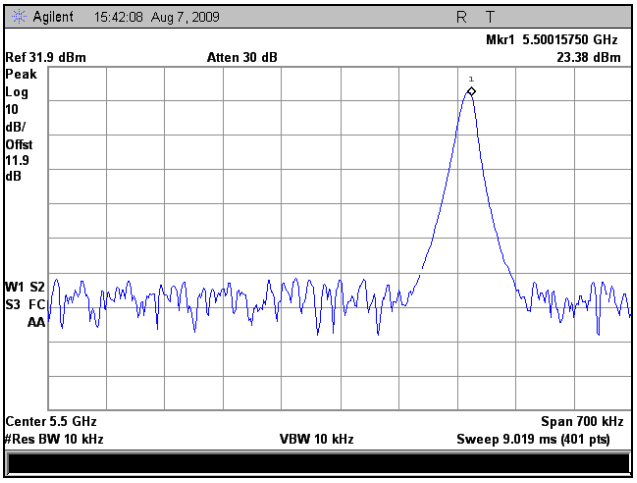
Plot 236. Freq. Stability, Port 1, 5700 MHz @-40C High Volt.



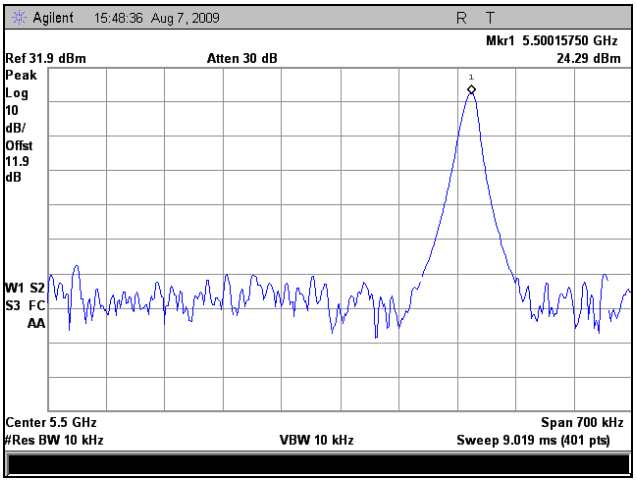
Plot 237. Freq. Stability, Port 1, 5320 MHz @+60C Low Volt.



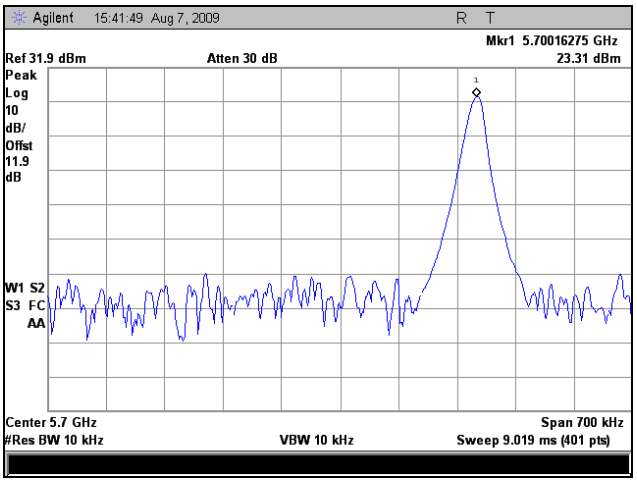
Plot 238. Freq. Stability, Port 1, 5320 MHz @+60C High Volt.



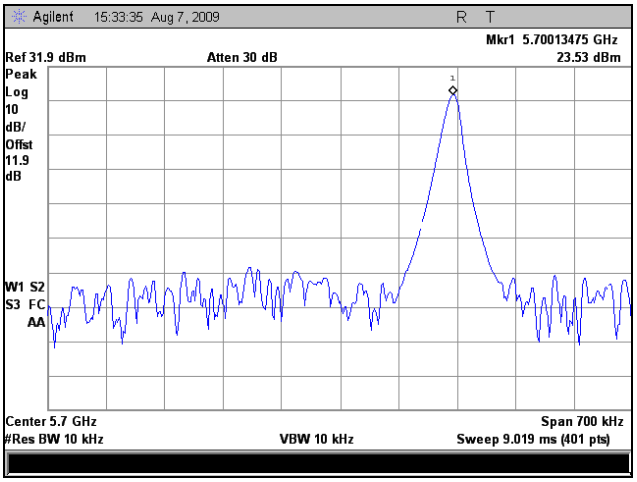
Plot 239. Freq. Stability, Port 1, 5500 MHz @+60C Low Volt.



Plot 240. Freq. Stability, Port 1, 5500 MHz @+60C High Volt.

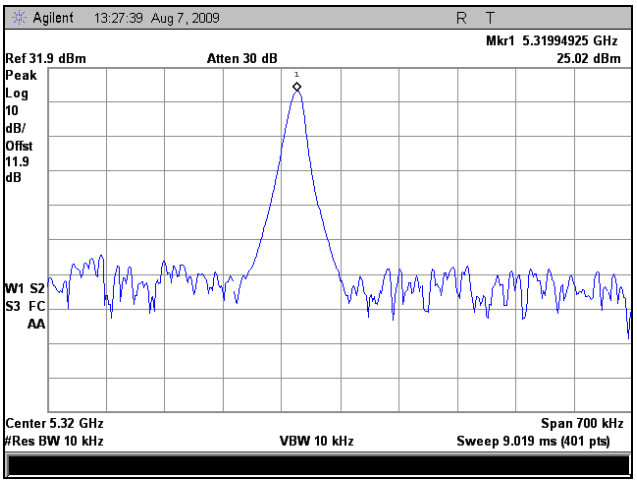


Plot 241. Freq. Stability, Port 1, 5700 MHz @+60C Low Volt.

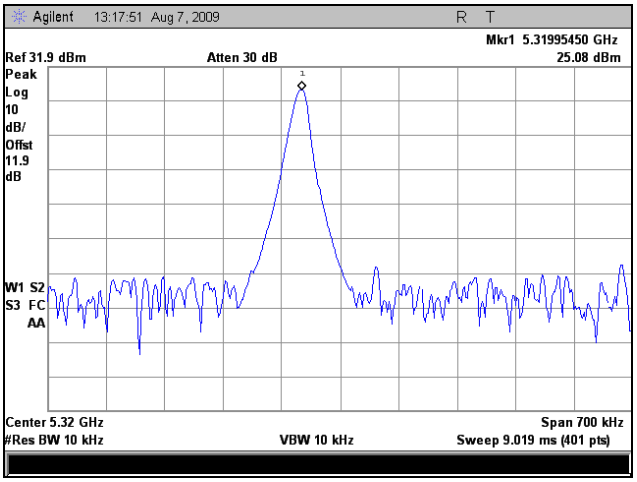


Plot 242. Freq. Stability, Port 1, 5700 MHz @+60C High Volt.

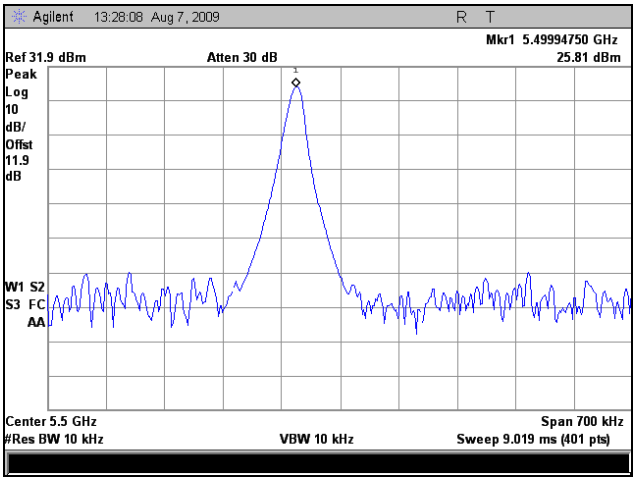
Frequency Stability, Port 2



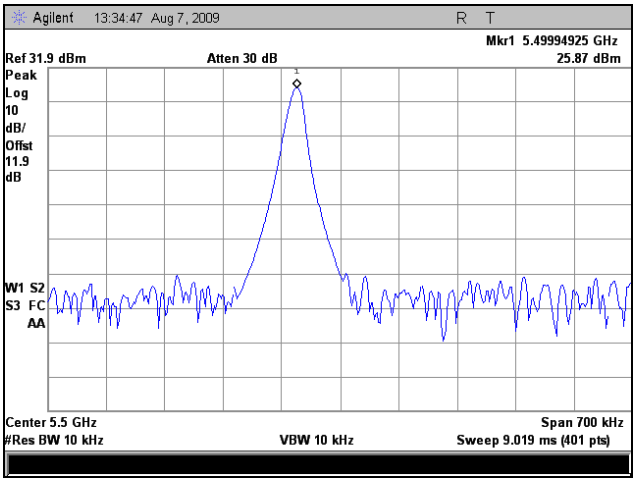
Plot 243. Freq. Stability, Port 2, 5320 MHz @-40C Low Volt.



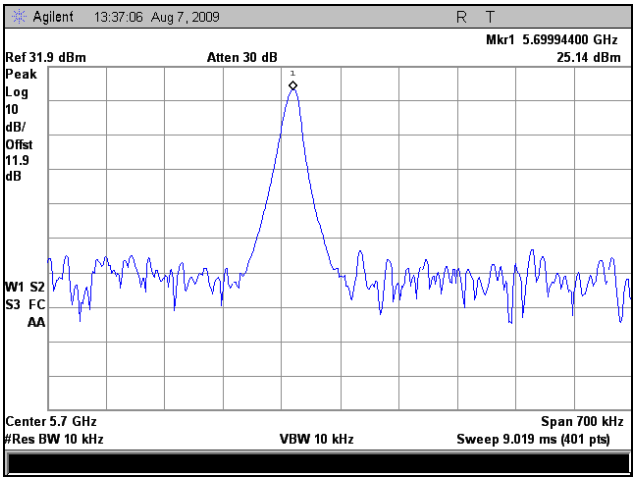
Plot 244. Freq. Stability, Port 2, 5320 MHz @-40C High Volt.



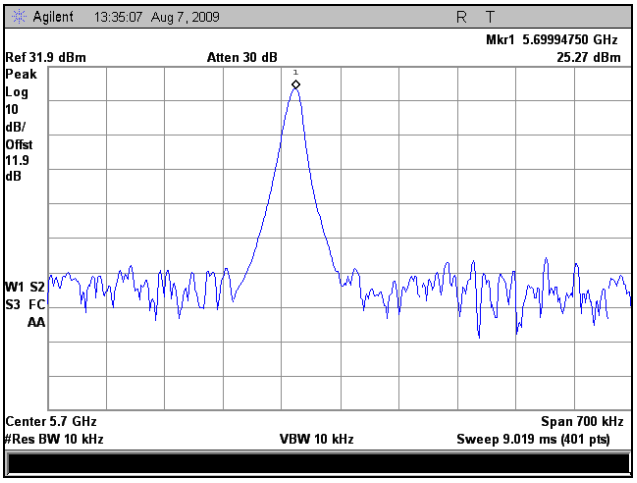
Plot 245. Freq. Stability, Port 2, 5500 MHz @-40C Low Volt.



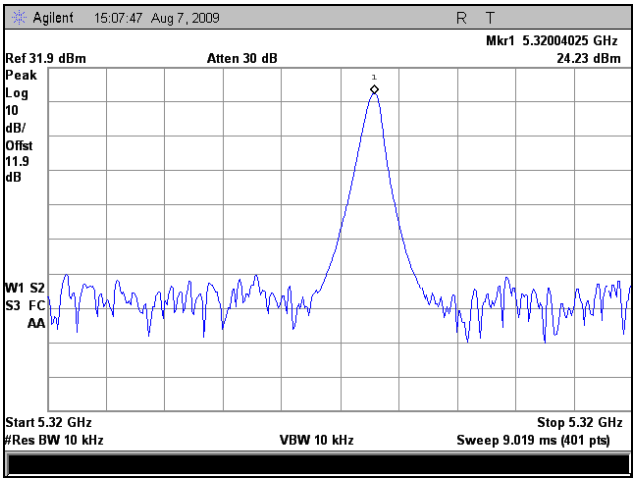
Plot 246. Freq. Stability, Port 2, 5500 MHz @-40C High Volt.



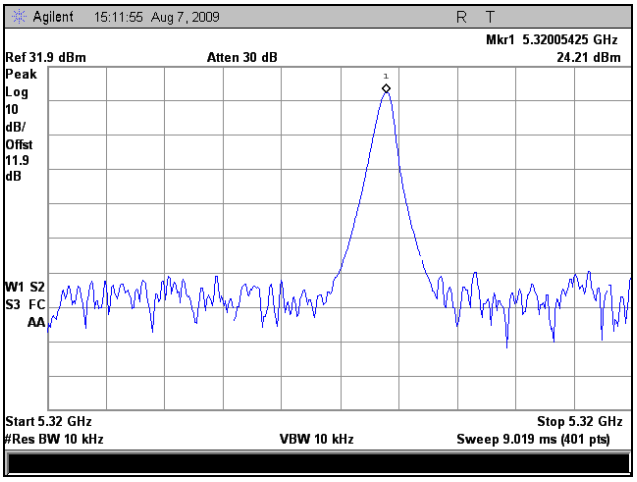
Plot 247. Freq. Stability, Port 2, 5700 MHz @-40C Low Volt.



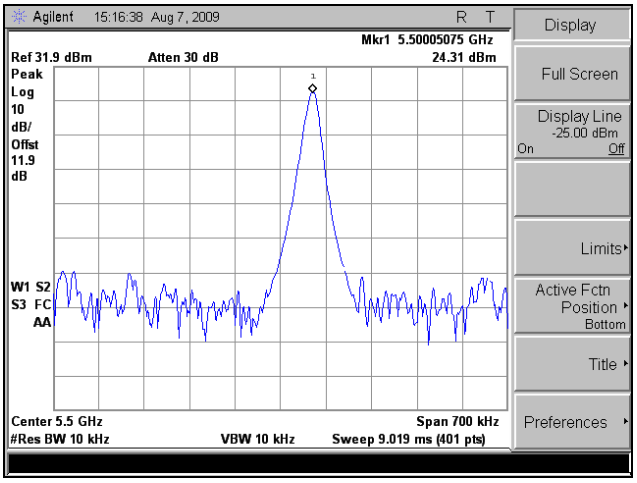
Plot 248. Freq. Stability, Port 2, 5700 MHz @-40C High Volt.



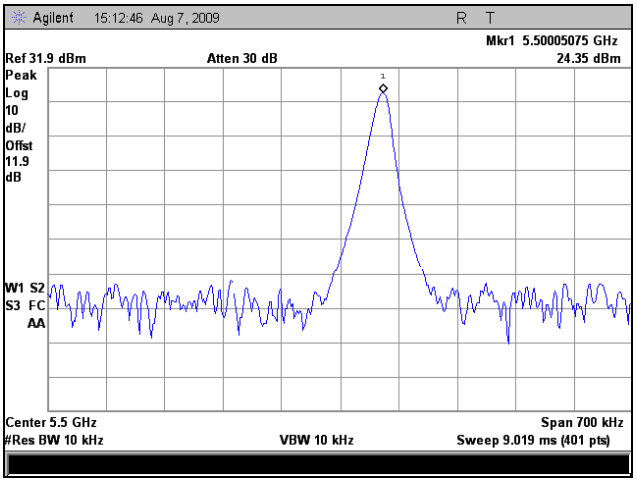
Plot 249. Freq. Stability, Port 2, 5320 MHz @+60C Low Volt.



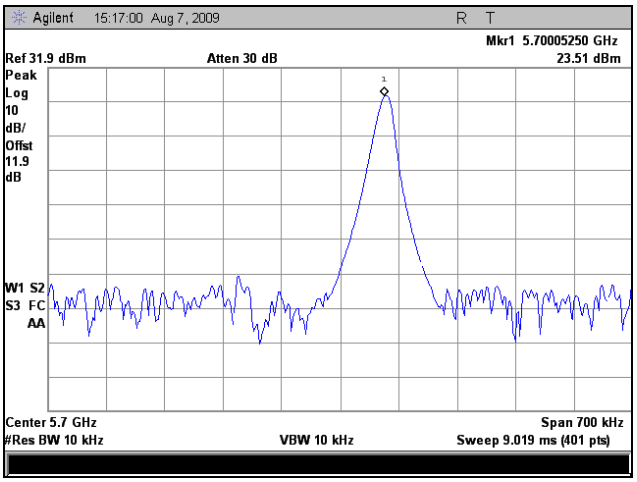
Plot 250. Freq. Stability, Port 2, 5320 MHz @+60C High Volt.



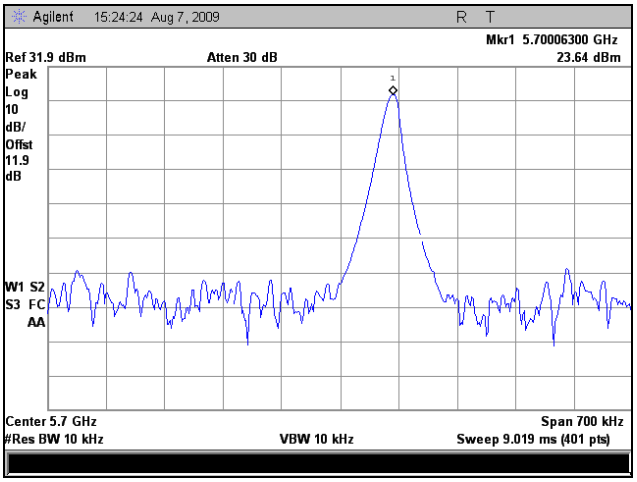
Plot 251. Freq. Stability, Port 2, 5500 MHz @+60C Low Volt.



Plot 252. Freq. Stability, Port 2, 5500 MHz @+60C High Volt.

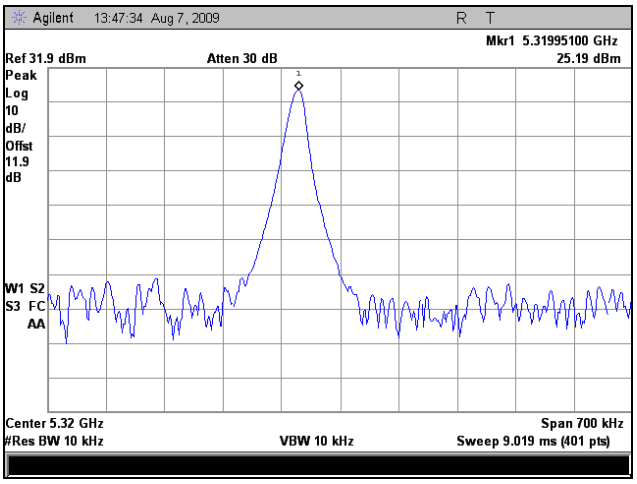


Plot 253. Freq. Stability, Port 2, 5700 MHz @+60C Low Volt.

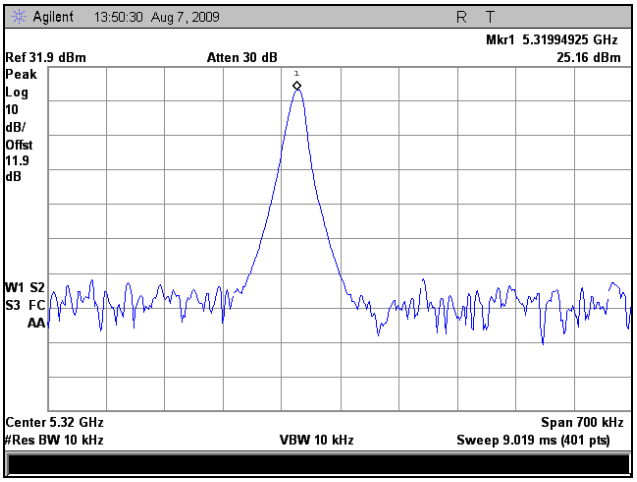


Plot 254. Freq. Stability, Port 2, 5700 MHz @+60C High Volt.

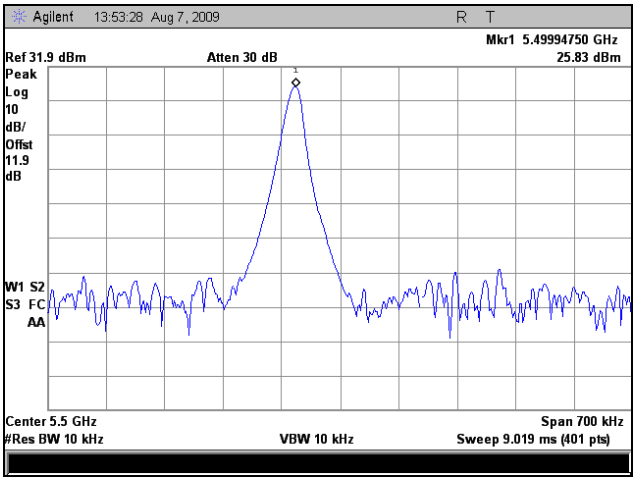
Frequency Stability, Port 3



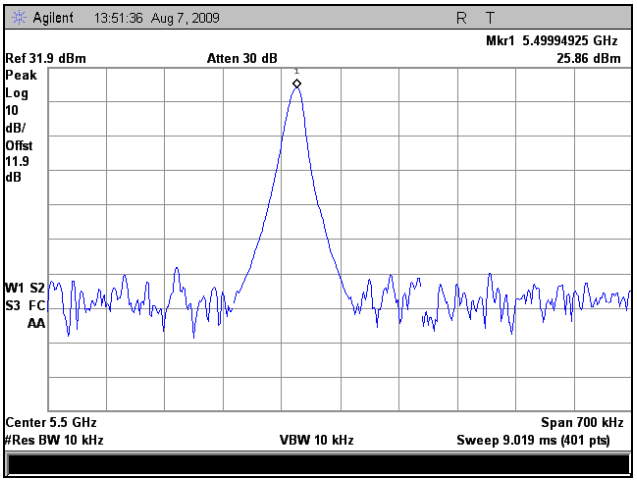
Plot 255. Freq. Stability, Port 3, 5320 MHz @-40C Low Volt.



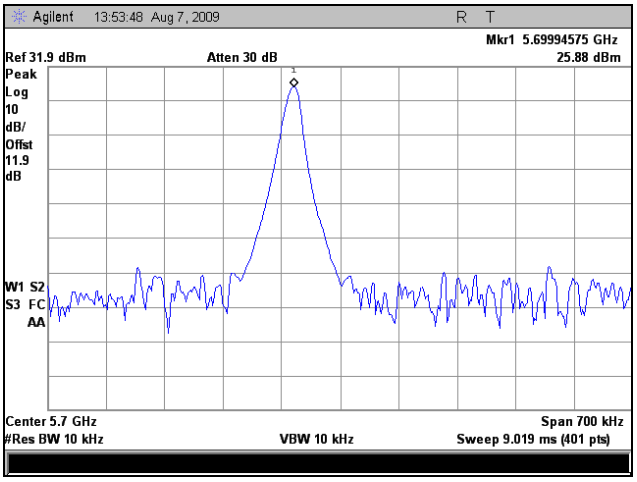
Plot 256. Freq. Stability, Port 3, 5320 MHz @-40C High Volt.



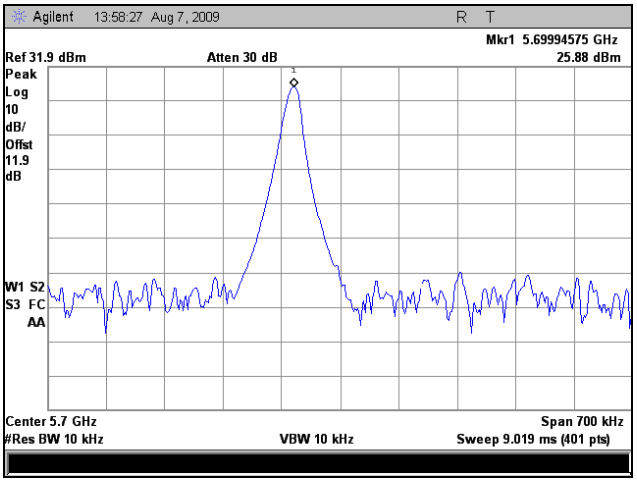
Plot 257. Freq. Stability, Port 3, 5500 MHz @-40C Low Volt.



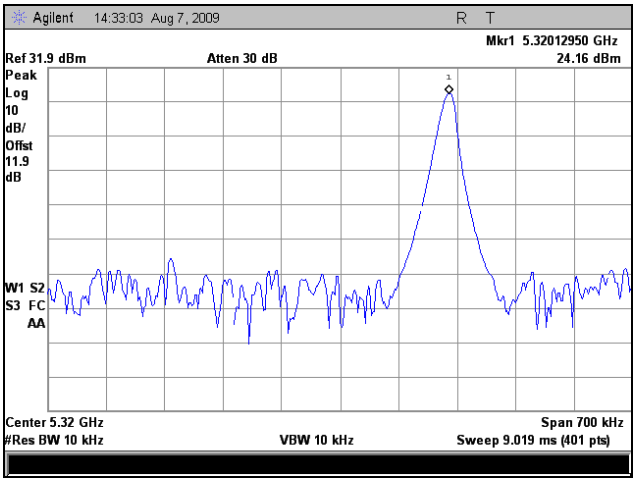
Plot 258. Freq. Stability, Port 3, 5500 MHz @-40C High Volt.



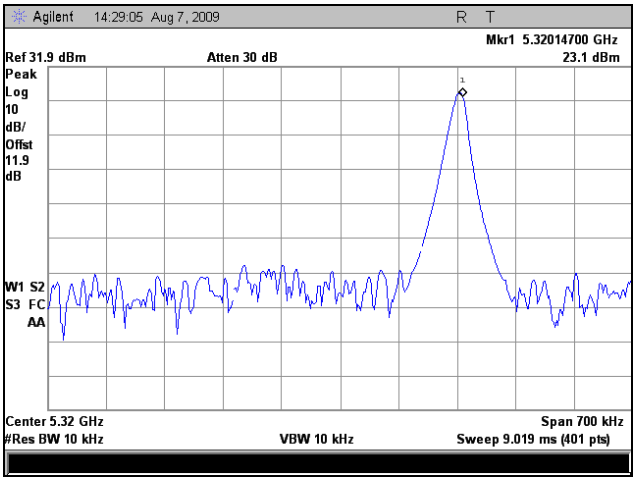
Plot 259. Freq. Stability, Port 3, 5700 MHz @-40C Low Volt.



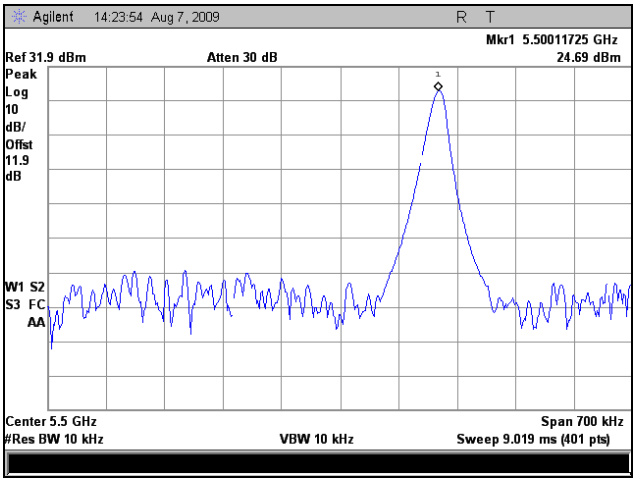
Plot 260. Freq. Stability, Port 3, 5700 MHz @-40C High Volt.



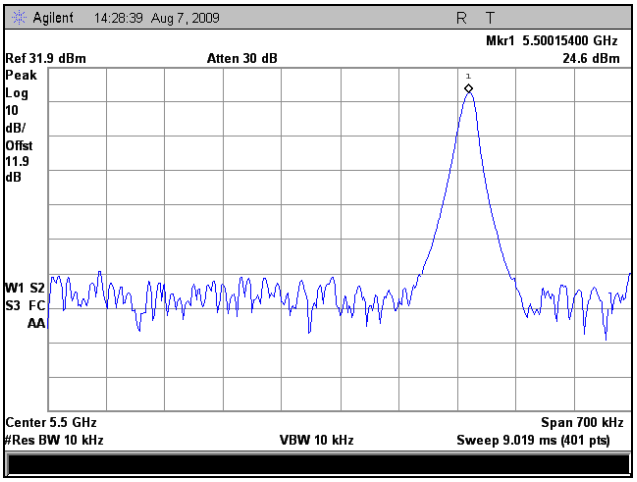
Plot 261. Freq. Stability, Port 3, 5320 MHz @+60C Low Volt.



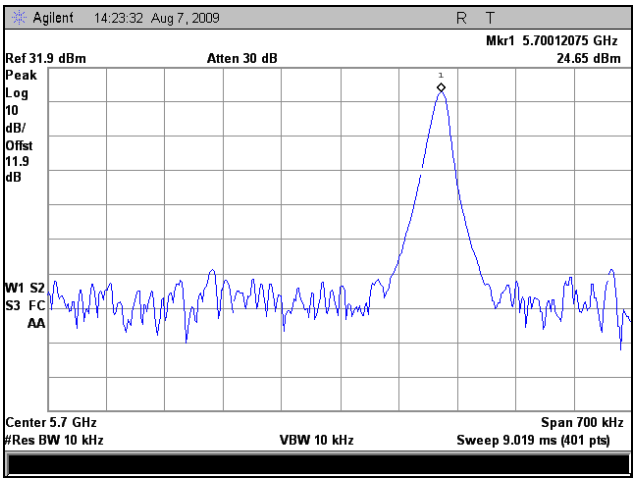
Plot 262. Freq. Stability, Port 3, 5320 MHz @+60C High Volt.



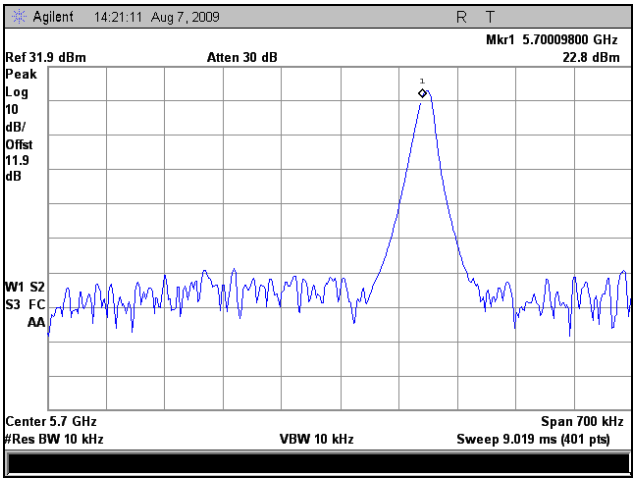
Plot 263. Freq. Stability, Port 3, 5500 MHz @+60C Low Volt.



Plot 264. Freq. Stability, Port 3, 5500 MHz @+60C High Volt.



Plot 265. Freq. Stability, Port 3, 5700 MHz @+60C Low Volt.



Plot 266. Freq. Stability, Port 3, 5700 MHz @+60C High Volt.

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 62.

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

Table 62. Spurious Emission Limits for Receivers

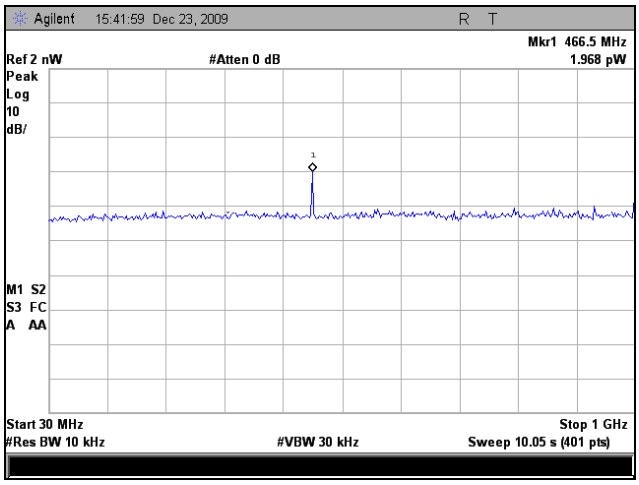
b) If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

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

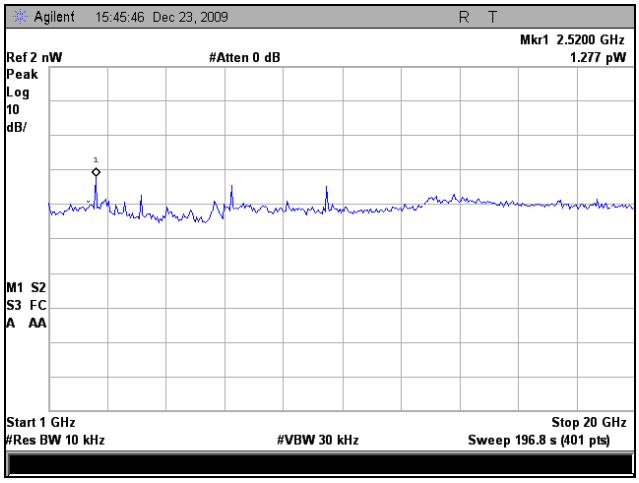
Test Results: The EUT was compliant with the Receiver Spurious Emission limits of this requirement.

Test Engineer(s): Anderson Soungpanya

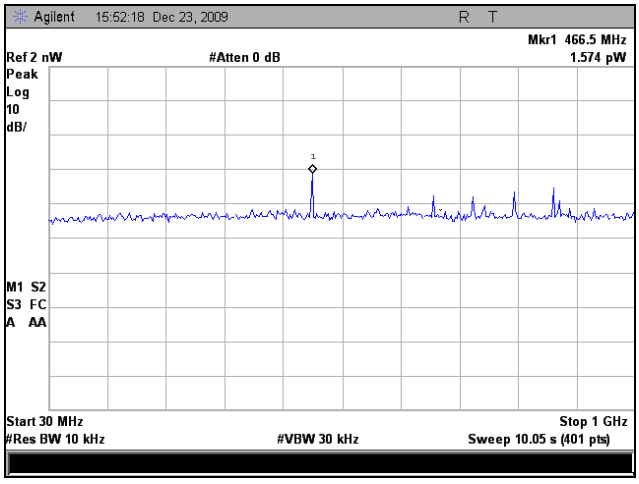
Test Date(s): 09/11/09



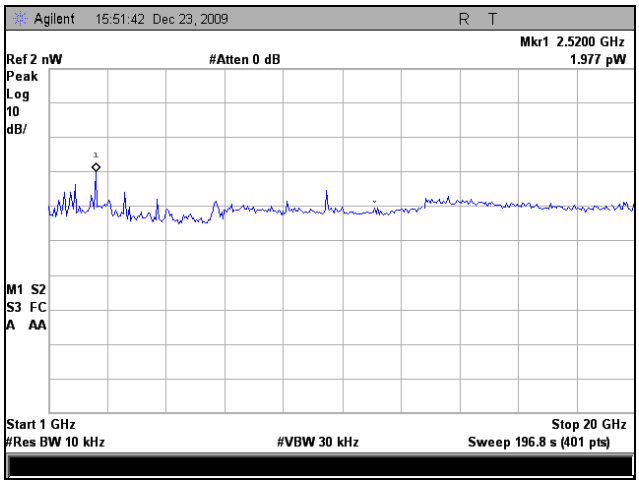
Plot 267. Conducted Receiver Spurious Emissions, Port 1, 30 MHz – 1 GHz



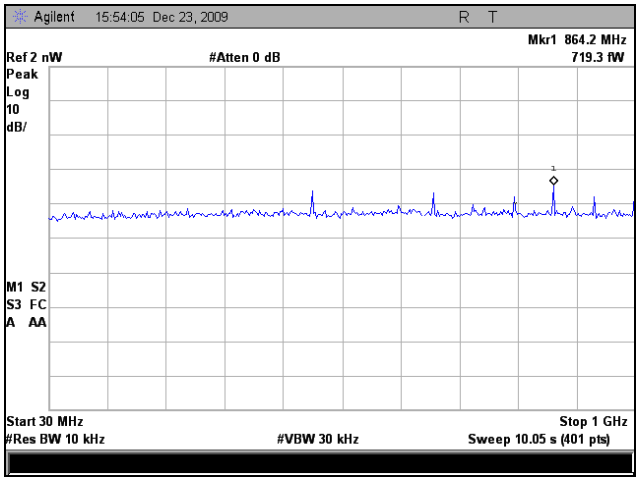
Plot 268. Conducted Receiver Spurious Emissions, Port 1, 1 GHz – 20 GHz



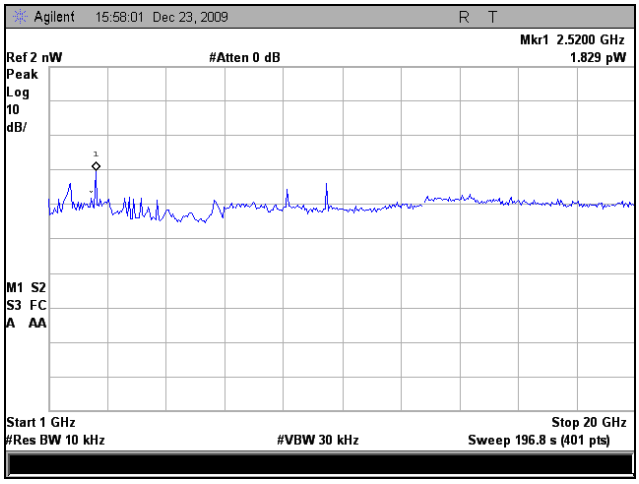
Plot 269. Conducted Receiver Spurious Emissions, Port 2, 30 MHz – 1 GHz



Plot 270. Conducted Receiver Spurious Emissions, Port 2, 1 GHz – 20 GHz



Plot 271. Conducted Receiver Spurious Emissions, Port 3, 30 MHz – 1 GHz



Plot 272. Conducted Receiver Spurious Emissions, Port 3, 1 GHz – 20 GHz

V. DFS Requirements and Radar Waveform Description & Calibration

A. DFS Requirements

DFS Detection Thresholds for Master or Client Devices Incorporating DFS

Maximum Transmit Power	Value
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm

Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna
Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.

DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2
U-NII Detection Bandwidth	Minimum 80% of the 99% power bandwidth. See Note 3.

Note 1: The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows:

- For the Short pulse radar Test Signals this instant is the end of the *Burst*.
- For the Frequency Hopping radar Test Signal, this instant is the end of the last radar *Burst* generated.
- For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.

Note 2: The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required facilitating *Channel* changes (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.
Note 3: During the *U-NII Detection Bandwidth* detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.

B. Radar Test Waveforms

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Trials
1	1	1428	18	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

A minimum of 30 unique waveforms are required for each of the short pulse radar types 2 through 4. For short pulse radar type 1, the same waveform is used a minimum of 30 times. If more than 30 waveforms are used for short pulse radar types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. The aggregate is the average of the percentage of successful detections of short pulse radar types 1-4.

Long Pulse Radar Test Waveform

Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per Bursts	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse radar test signal. If more than 30 waveforms are used for the Long Pulse radar test signal, then each additional waveform must also be unique and not repeated from the previous waveforms.

Each waveform is defined as follows:

1) The transmission period for the Long Pulse Radar test signal is 12 seconds.
2) There are a total of 8 to 20 Bursts in the 12 second period, with the number of Bursts being randomly chosen. This number is Burst_Count.
3) Each Burst consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each Burst within the 12 second sequence may have a different number of pulses.
4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a Burst will have the same pulse width. Pulses in different Bursts may have different pulse widths.
5) Each pulse has a linear FM chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a Burst will have the same chirp width. Pulses in different Bursts may have different chirp widths. The chirp is centered on the pulse. For example, with radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.
6) If more than one pulse is present in a Burst, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a Burst, the time between the first and second pulses is chosen independently of the time between the second and third pulses.
7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to Burst_Count. Each interval is of length (12,000,000 / Burst_Count) microseconds. Each interval contains one Burst. The start time for the Burst, relative to the beginning of the interval, is between 1 and [(12,000,000 / Burst_Count) – (Total Burst Length) + (One Random PRI Interval)] microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The start time for each Burst is chosen independently.

A representative example of a Long Pulse radar test waveform:

1) The total test signal length is 12 seconds.
2) 8 Bursts are randomly generated for the Burst_Count.
3) Burst 1 has 2 randomly generated pulses.
4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.
5) The PRI is randomly selected to be at 1213 microseconds.
6) Bursts 2 through 8 are generated using steps 3 – 5.
7) Each Burst is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, Burst 1 is randomly generated (1 to 1,500,000 minus the total Burst 1 length + 1 random PRI interval) at the 325,001 microsecond step. Bursts 2 through 8 randomly fall in successive 1,500,000 microsecond intervals (i.e. Burst 2 falls in the 1,500,001 – 3,000,000 microsecond range).

Graphical Representation of a Long Pulse radar Test Waveform

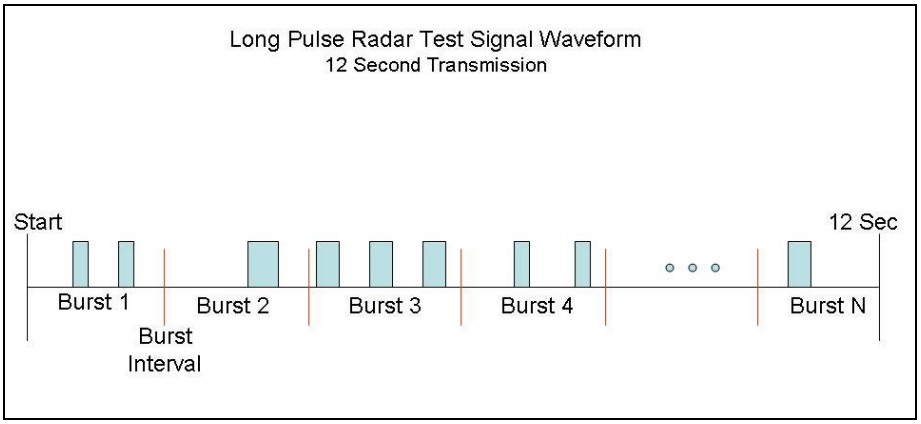


Figure 6. Long Pulse Radar Test Signal Waveform

Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	9	.333	300	70%	30

For the Frequency Hopping Radar Type, the same *Burst* parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected1 from the hopping sequence defined by the following algorithm:

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

C. Radar Waveform Calibration

The following equipment setup was used to calibrate the conducted Radar Waveform. A spectrum analyzer was used to establish the test signal level for each radar type. During this process there were no transmissions by either the Master or Client Device. The spectrum analyzer was switched to the zero span (Time Domain) mode at the frequency of the Radar Waveform generator. Peak detection was utilized. The spectrum analyzer's resolution bandwidth (RBW) was set to 3 MHz and the video bandwidth (VBW) was set to 3 MHz. The calibration setup is diagrammed in Figure 7, and the radar test signal generator is shown in Figure 7.

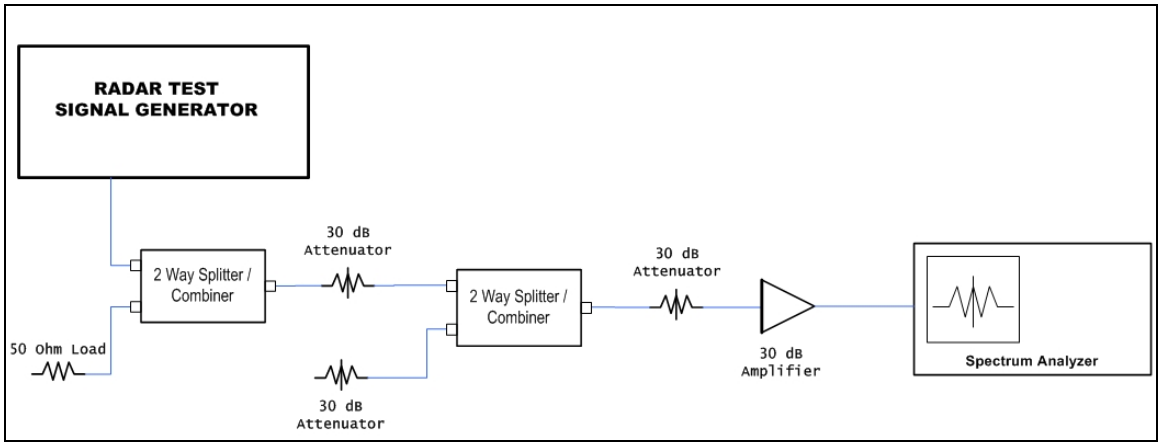
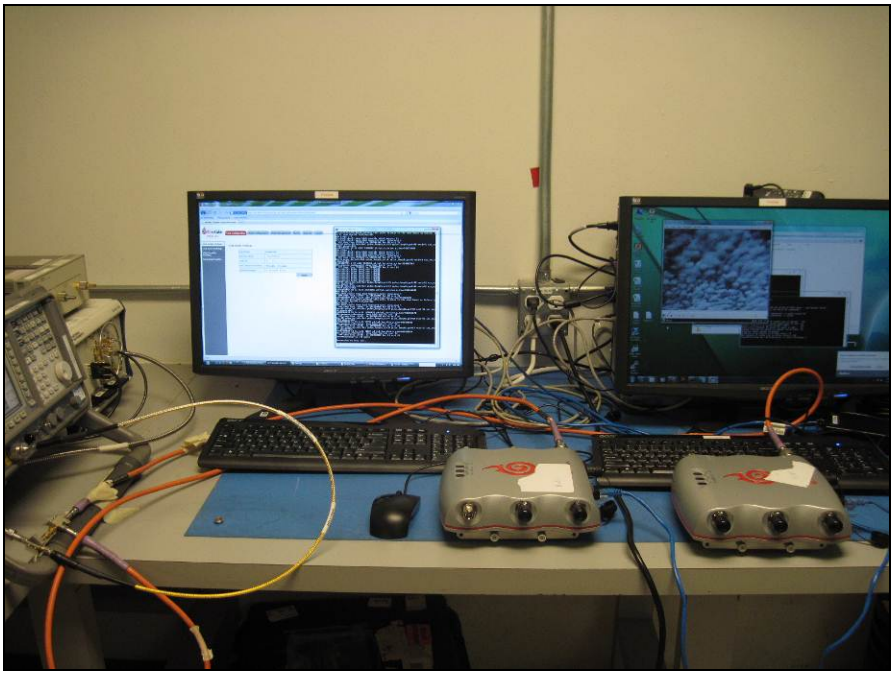
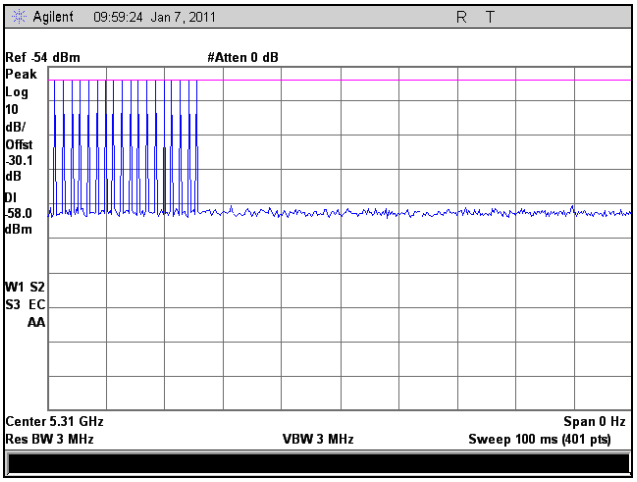


Figure 7. DFS Radar Waveform Calibration Setup

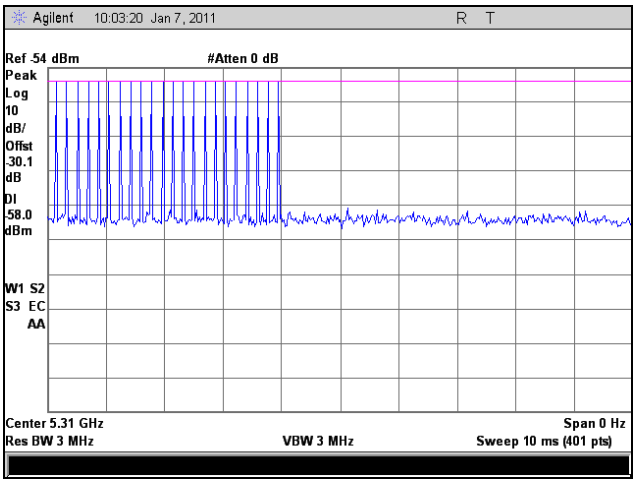


Photograph 10. DFS, Test Setup

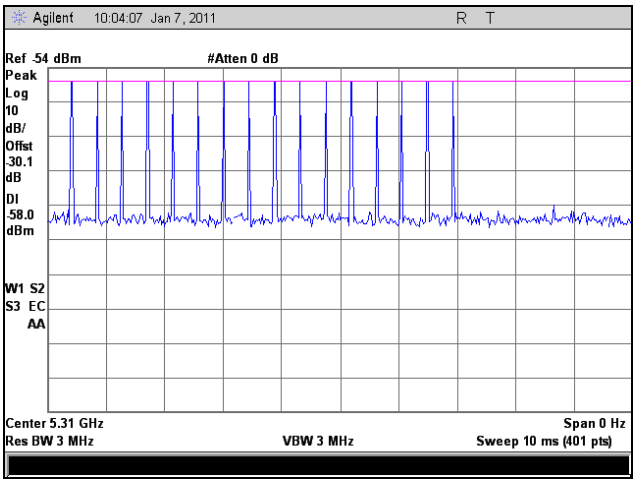
Radar Waveform Calibration, 5310 MHz (Probabilities and Bandwidth only)



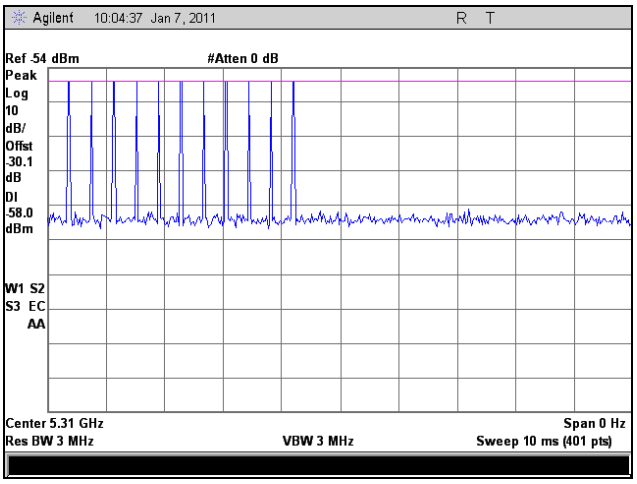
Plot 273. Radar Type 1 Calibration, 5310 MHz



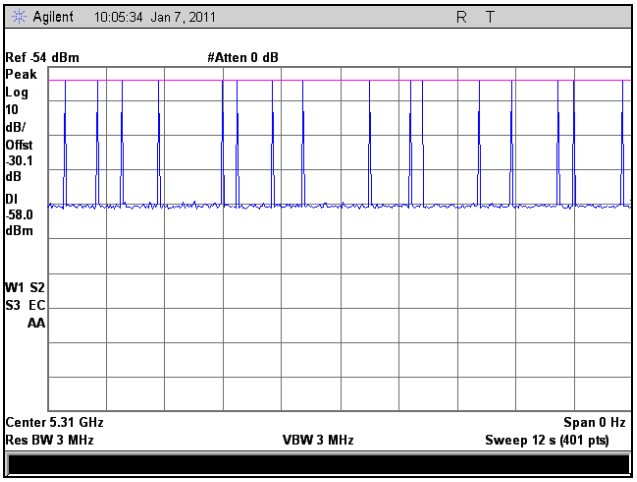
Plot 274. Radar Type 2 Calibration, 5310 MHz



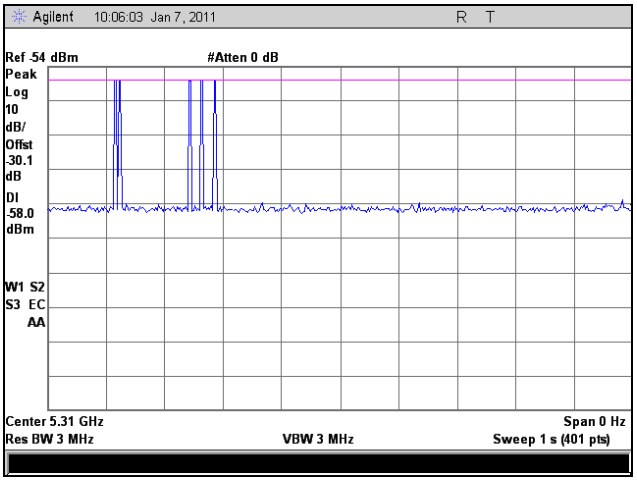
Plot 275. Radar Type 3 Calibration, 5310 MHz



Plot 276. Radar Type 4 Calibration, 5310 MHz

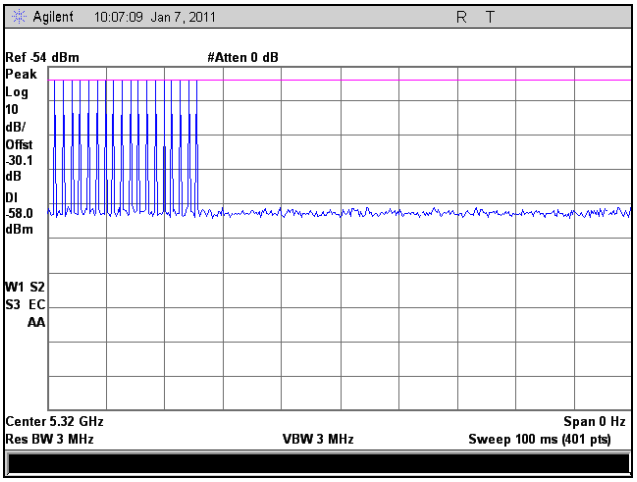


Plot 277. Radar Type 5 Calibration, 5310 MHz

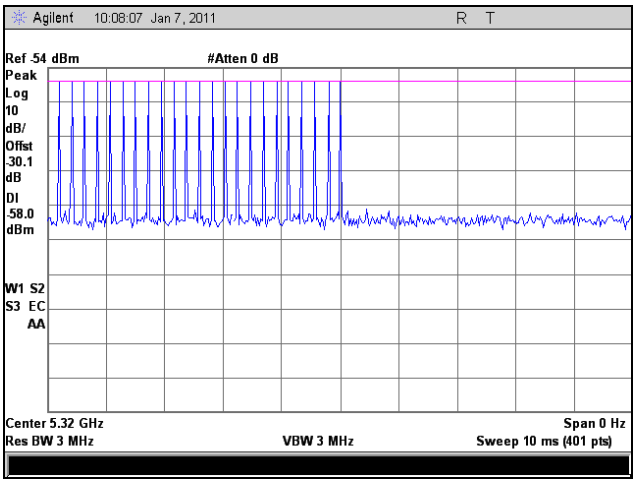


Plot 278. Radar Type 6 Calibration, 5310 MHz

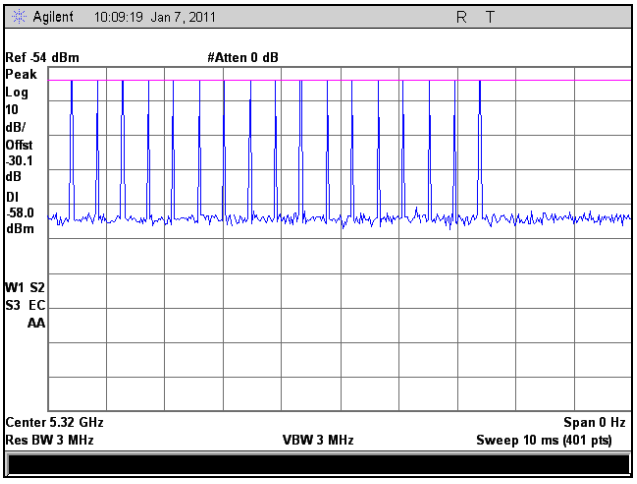
Radar Waveform Calibration, 5320 MHz (Probabilities only)



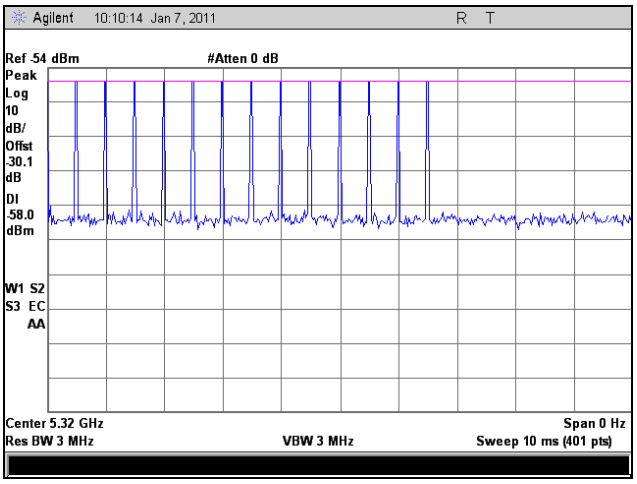
Plot 279. Radar Type 1 Calibration, 5320 MHz



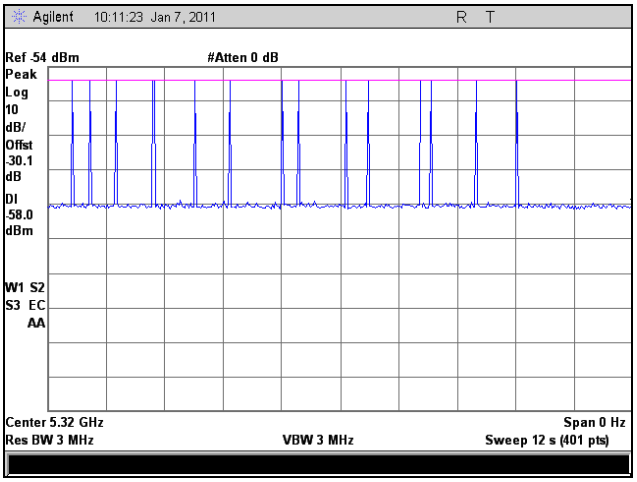
Plot 280. Radar Type 2 Calibration, 5320 MHz



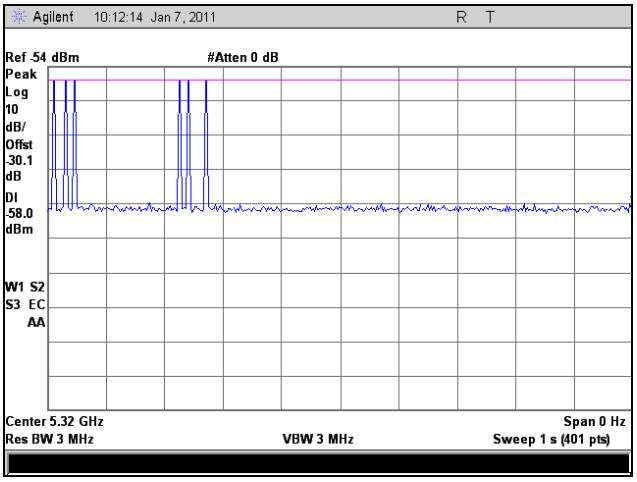
Plot 281. Radar Type 3 Calibration, 5320 MHz



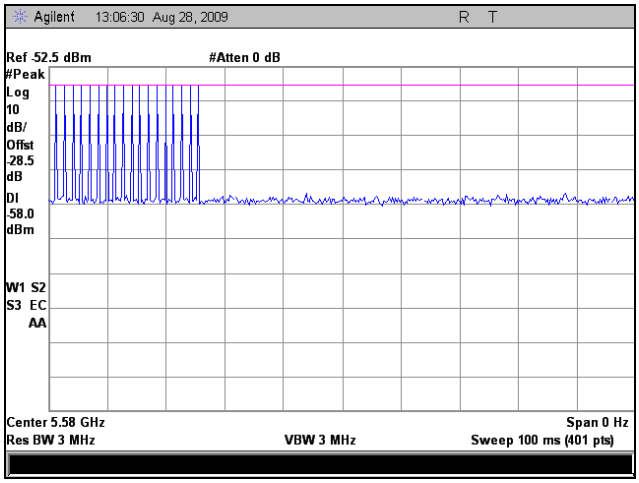
Plot 282. Radar Type 4 Calibration, 5320 MHz



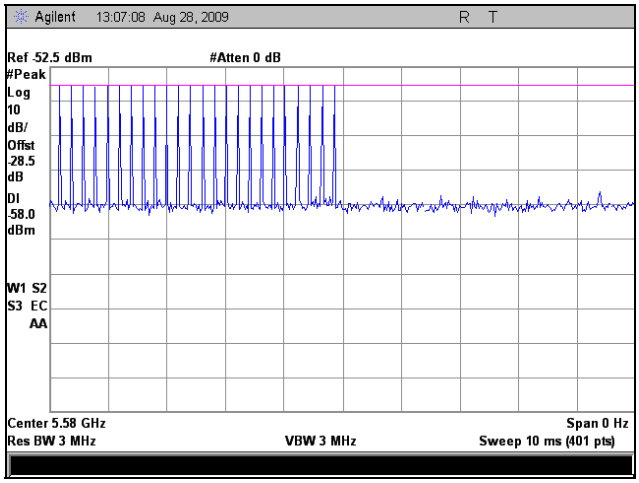
Plot 283. Radar Type 5 Calibration, 5320 MHz



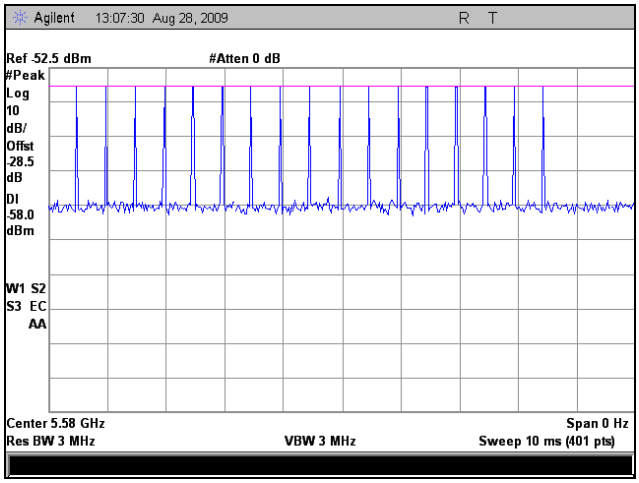
Plot 284. Radar Type 6 Calibration, 5320 MHz



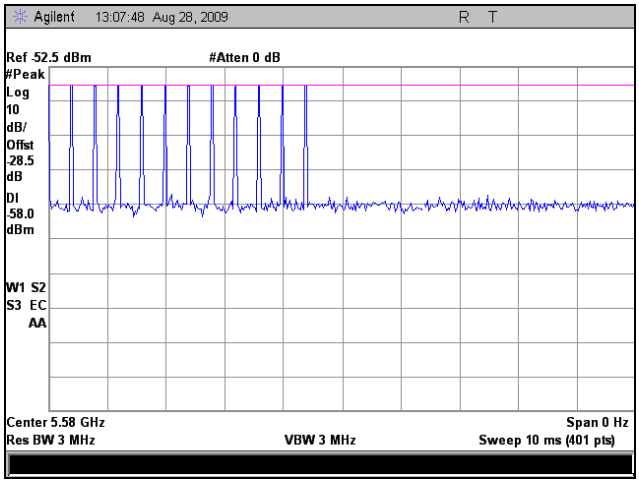
Plot 285. Calibration Plot, Bin 1, 5580 MHz (used for CACT, Bandwidth, Non Occupancy, Close Time & Move Time)



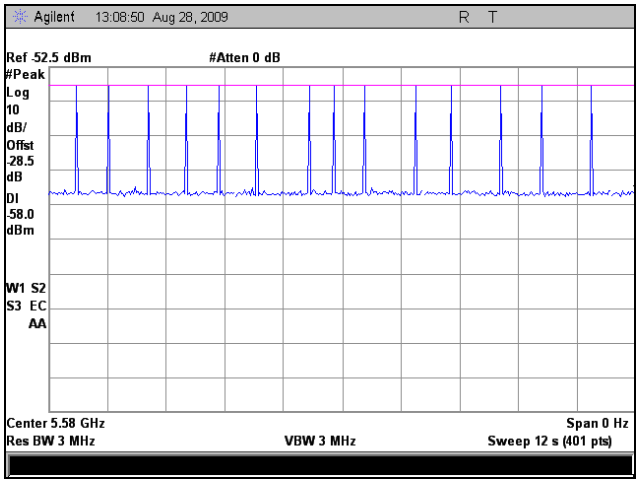
Plot 286. Calibration Plot, Bin 2, 5580 MHz (used for CACT, Bandwidth, Non Occupancy, Close Time & Move Time)



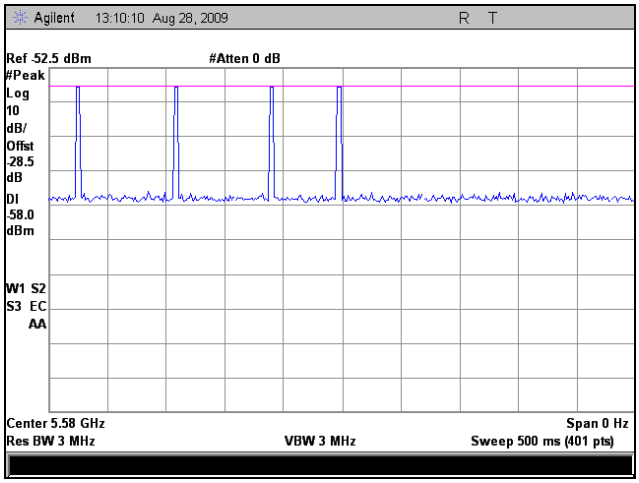
Plot 287. Calibration Plot, Bin 3, 5580 MHz (used for CACT, Bandwidth, Non Occupancy, Close Time & Move Time)



Plot 288. Calibration Plot, Bin 4, 5580 MHz (used for CACT, Bandwidth, Non Occupancy, Close Time & Move Time)



Plot 289. Calibration Plot, Bin 5, 5580 MHz (used for CACT, Bandwidth, Non Occupancy, Close Time & Move Time)



Plot 290. Calibration Plot, Bin 6, 5580 MHz (used for CACT, Bandwidth, Non Occupancy, Close Time & Move Time)

VI. DFS Test Procedure and Test Results

A. DFS Test Setup

1. A spectrum analyzer is used as a monitor to verify that the Unit Under Test (UUT) has vacated the Channel within the Channel Closing Transmission Time and Channel Move Time, and does not transmit on a Channel during the Non-Occupancy Period after the detection and subsequent Channel move. It is also used to monitor UUT transmissions during the Channel Availability Check Time.
2. The test setup, which consists of test equipment and equipment under test (EUT), is diagrammed in Figure 8 and pictured in Figure 8. Test Setup Diagram.

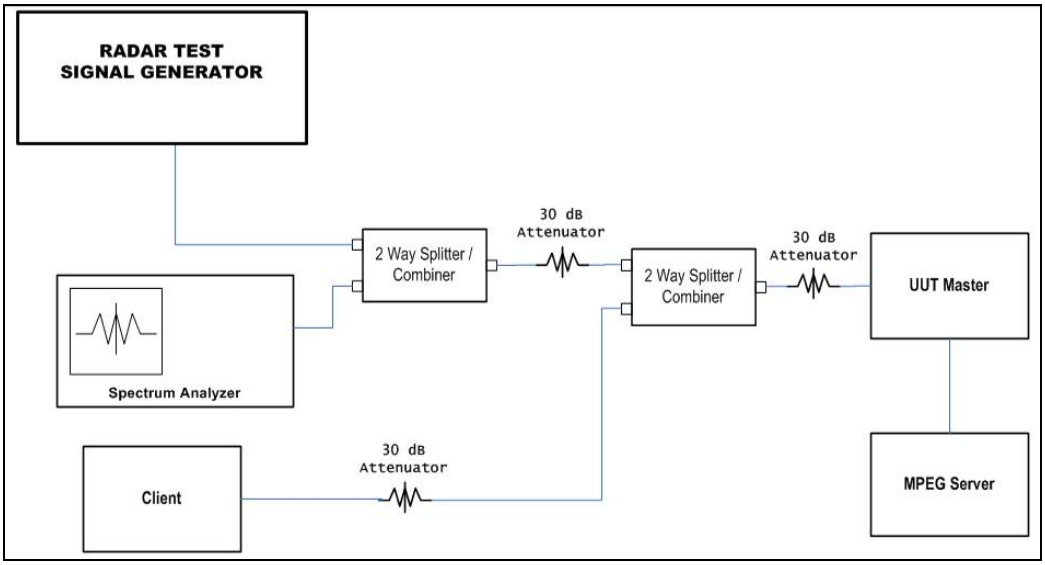


Figure 8. Test Setup Diagram

B. Description of Master Device

1. Operating Frequency Range – 5260-5700 MHz
2. Modes of Operation – 802.11a/802.11n
3. Highest and Lowest EIRP – Highest: 29.45 dBm; Lowest:16.65 dBm
4. List all antennas and associated gains –

Gain/Type	Model	Manufacturer
5dBi Omni	C812-510012-A	Wha Yu
19dBi Panel (5GHz)	MA-WA55-MIMO	MARS ANTENNAS & RF Systems LTD

5. List output power ranges – 9.67dBm – 18.10 dBm
6. List antenna impedance – 50 ohms
7. Antenna gain verification - Use antenna data sheet
8. State test file that is transmitted – 6 and ½ Magic Hours
9. Time for master to complete its power-on-cycle – 78 seconds

C. UNII Detection Bandwidth

Test Requirement(s): **§ 15.407** A minimum 80% detection rate is required across an EUT's 99% bandwidth.

Test Procedure: All UNII channels for this device have two channel bandwidths. Therefore, DFS testing was done at 20 MHz bandwidth at 5580 MHz and 40 MHz bandwidth at 5550 MHz.

A single burst of the short pulse radar type 1 is produced at 5580 and 5550 MHz, at the -63dBm test level. The UUT is set up as a standalone device (no associated client, and no data traffic).

A single radar burst is generated for a minimum of 10 trials, and the response of the UUT is recorded. The UUT must detect the radar waveform 90% or more of the time.

The radar frequency is increased in 1 MHz steps, repeating the above test sequence, until the detection rate falls below 90%. The highest frequency at which detection is greater than or equal to 90% is denoted F_H.

The radar frequency is decreased in 1 MHz steps, repeating the above test sequence, until the detection rate falls below 90%. The lowest frequency at which detection is greater than or equal to 90% is denoted F_L.

The U-NII Detection Bandwidth is calculated as follows:

$$\text{U-NII Detection Bandwidth} = F_H - F_L$$

Test Engineer: Anderson Soungpanya

Test Date: 08/26/09 – 09/02/09

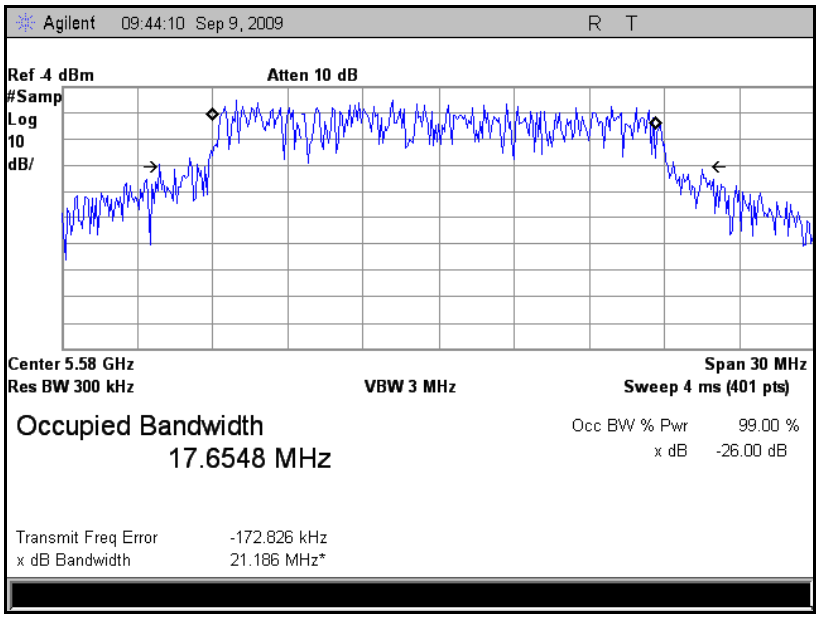
UNII Detection Bandwidth – Test Results

EUT Frequency- 5580MHz											
	DFS Detection Trials (1=Detection, 0= No Detection)										
Radar Frequency (MHz)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Detection Rate (%)**
5566	1	1	1	1	0	1	0	1	0	0	60
5567(FL)	1	1	1	1	1	1	1	1	1	0	90
5568	1	1	1	1	1	1	1	1	1	1	100
5569	1	1	1	1	1	1	1	1	1	1	100
5570	1	1	1	1	1	1	1	1	1	1	100
5571	1	1	1	1	1	1	1	1	1	1	100
5572	1	1	1	1	1	1	1	1	1	1	100
5573	1	1	1	1	1	1	1	1	1	1	100
5574	1	1	1	1	1	1	1	1	1	1	100
5575	1	1	1	1	1	1	1	1	1	1	100
5576	1	1	1	1	1	1	1	1	1	1	100
5577	1	1	1	1	1	1	1	1	1	1	100
5578	1	1	1	1	1	1	1	1	1	1	100
5579	1	1	1	1	1	1	1	1	1	1	100
5580	1	1	1	1	1	1	1	1	1	1	100
5581	1	1	1	1	1	1	1	1	1	1	100
5582	1	1	1	1	1	1	1	1	1	1	100
5583	1	1	1	1	1	1	1	1	1	1	100
5584	1	1	1	1	1	1	1	1	1	1	100
5585	1	1	1	1	1	1	1	1	1	1	100
5586	1	1	1	1	1	1	1	1	1	1	100
5587	1	1	1	1	1	1	1	1	1	1	100
5588	1	1	1	1	1	1	1	1	1	1	100
5589	1	1	1	1	1	1	1	1	1	1	100
5590	1	1	1	1	1	1	1	1	1	1	100
5591	1	1	1	1	1	1	1	1	1	1	100
5592	1	1	1	1	1	1	1	1	1	1	100
5593	1	1	1	1	1	1	1	1	1	1	100
5594	1	1	1	1	1	0	1	1	1	1	90
5595 (FH)	1	1	1	1	1	1	1	0	1	1	90
5596	1	1	1	0	1	0	1	0	1	0	60
Overall Detection Percentage											89.42%
Detection Bandwidth = f_h - f_l = 5595MHz-5567MHz = 28MHz											
EUT 99% Bandwidth = 17.6548 MHz											
OBW* 80% = 14.1238 MHz (Detection Bandwidth shall not be less than 14.1238MHz. Measured Detection Bandwidth is 28MHz.)											

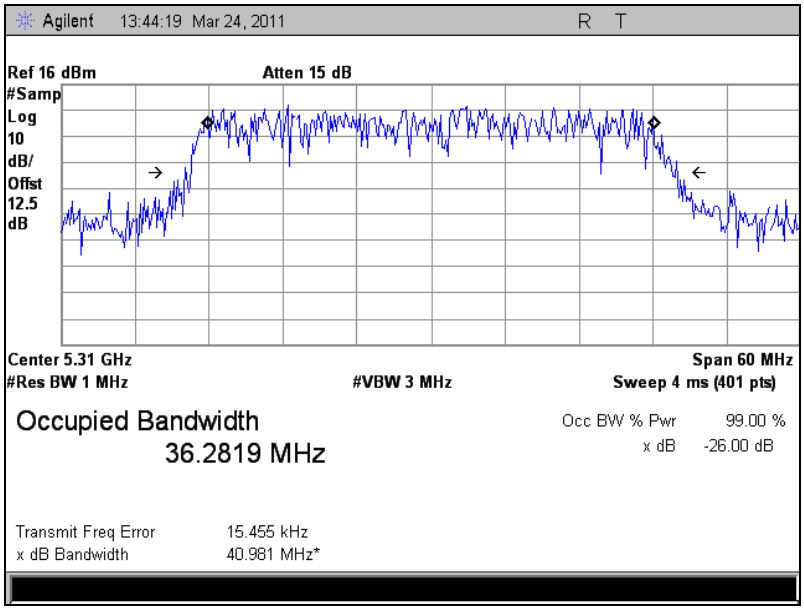
Table 63. UNII Detection Bandwidth, Test Results, 5580 MHz, 802.11a

EUT Frequency- 5310MHz 40MHz BW											
	DFS Detection Trials (1=Detection, 0= No Detection)										
Radar Frequency (MHz)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Detection Rate (%)**
5288	0	1	1	0	0	1	0	1	1	1	60
5289 (fL)	1	1	1	1	1	1	1	1	1	1	100
5290	1	1	1	1	1	1	1	1	1	1	100
5291	1	1	1	1	1	1	1	1	1	1	100
5292	1	1	1	1	1	1	1	1	1	1	100
5293	1	1	1	1	1	1	1	1	1	1	100
5294	1	1	1	1	1	1	1	1	1	1	100
5295	1	1	1	1	1	1	1	1	1	1	100
5296	1	1	1	1	1	1	1	1	1	1	100
5297	1	1	1	1	1	1	1	1	1	1	100
5298	1	1	1	1	1	1	1	1	1	1	100
5299	1	1	1	1	1	1	1	1	1	1	100
5300	1	1	1	1	1	1	1	1	1	1	100
5301	1	1	1	1	1	1	1	1	1	1	100
5302	1	1	1	1	1	1	1	1	1	1	100
5303	1	1	1	1	1	1	1	1	1	1	100
5304	1	1	1	1	1	1	1	1	1	1	100
5305	1	1	1	1	1	1	1	1	1	1	100
5306	1	1	1	1	1	1	1	1	1	1	100
5307	1	1	1	1	1	1	1	1	1	1	100
5308	1	1	1	1	1	1	1	1	1	1	100
5309	1	1	1	1	1	1	1	1	1	1	100
5310	1	1	1	1	1	1	1	1	1	1	100
5311	1	1	1	1	1	1	1	1	1	1	100
5312	1	1	1	1	1	1	1	1	1	1	100
5313	1	1	1	1	1	1	1	1	1	1	100
5314	1	1	1	1	1	1	1	1	1	1	100
5315	1	1	1	1	1	1	1	1	1	1	100
5316	1	1	1	1	1	1	1	1	1	1	100
5317	1	1	1	1	1	1	1	1	1	1	100
5318	1	1	1	1	1	1	1	1	1	1	100
5319	1	1	1	1	1	1	1	1	1	1	100
5320	1	1	1	1	1	1	1	1	1	1	100
5321	1	1	1	1	1	1	1	1	1	1	100
5322	1	1	1	1	1	1	1	1	1	1	100
5323	1	1	1	1	1	1	1	1	1	1	100
5324	1	1	1	1	1	1	1	1	1	1	100
5325	1	1	1	1	1	1	1	1	1	1	100
5326	1	1	1	1	1	1	1	1	1	1	100
5327	1	1	1	1	1	1	1	1	1	1	100
5328	1	1	1	1	1	1	1	1	1	1	100
5329	1	1	1	1	1	1	1	1	1	1	100
5330	1	1	1	1	1	1	1	1	1	1	100
5331 (fH)	1	1	1	1	1	1	1	1	1	1	100
5332	0	1	1	1	1	1	0	0	1	0	60
Overall Detection Percentage											86.23%
Detection Bandwidth = f_h - f_l = 5331MHz-5288MHz = 42MHz											
EUT 99% Bandwidth = 36.2819 MHz											
OBW* 80% = 29.03 MHz (Detection Bandwidth Limit shall not be under 29..03MHz. Measured Detection Bandwidth is 42MHz.)											

Table 64. UNII Detection Bandwidth, Test Results, 5310 MHz, 802.11n 40MHz



Plot 291. Occupied Bandwidth, 802.11a, 5580 MHz



Plot 292. Occupied Bandwidth, 802.11n 40MHz, 5310 MHz

D. Initial Channel Availability Check Time

Test Requirements: **§ 15.407** The Initial Channel Availability Check Time tests that the UUT does not emit beacon, control, or data signals on the test channel until the power-up sequence has been completed and the U-NII device has checked for radar waveforms, for one minute, on the test channel. This test does not use any of the radar waveforms and only needs to be performed once.

The UUT should not make any transmissions over the test channel, for at least 1 minute after completion of its power-on cycle.

Test Procedure: The U-NII device is powered on and instructed to operate at 5580 MHz.. At the same time the UUT is powered on, the spectrum analyzer is set to 5580MHz with a zero span and a 2.5 minute sweep time. The analyzer is triggered at the same time power is applied to the U-NII device.

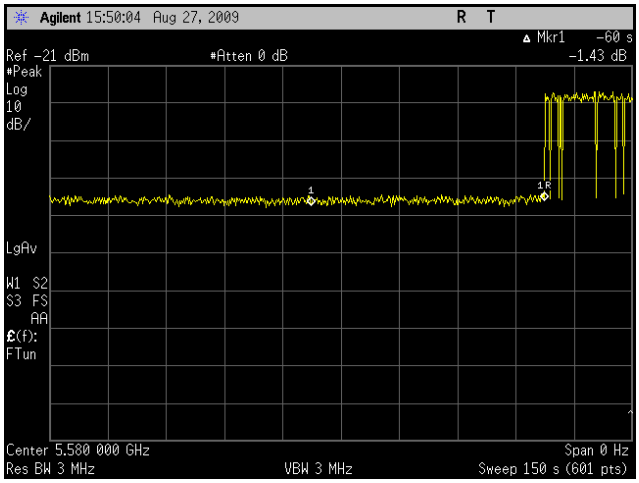
Test Results: The initial power up time of the EUT is indicated by marker 1R on Plot 293. Initial beacon/data transmission is indicated by marker 1.

The Equipment complies with § 15.407 Initial Channel Availability Check Time.

Test Engineer: Anderson Soungpanya

Test Date: 08/26/09 – 09/02/09

Initial Channel Availability Check Time – Plot



Plot 293. Initial Channel Availability Check Time, 150 seconds, 5580 MHz

E. Radar Burst at the Beginning of Channel Availability Check Time

Test Requirements: **§ 15.407** A Radar Burst at the Beginning of the Channel Availability Check Time tests that the UUT does not emit beacon, control, or data signals on the test Channel if it has detected a radar burst during that time period until the power-up sequence has been completed and the U-NII device checks for Radar Waveforms for one minute on the test Channel. The steps below define the procedure to verify successful radar detection on the selected Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold + 1 dB (-63dBm) occurs at the beginning of the Channel Availability Check Time.

Test Procedure: The UUT is powered on at T0. T1 denotes the instant when the UUT has completed its power-up sequence. The Channel Availability Check Time commences at instant T1 and will end no sooner than T1 + 60 seconds.

A single Burst of short pulse radar type 1, at -63 dBm, will commence within a 6 second window starting at T1.

Visual indication of the UUT of successful detection of the radar Burst will be recorded and reported. Observation of transmission at 5580 MHz will continue for 2.5 minutes after the radar Burst has been generated.

Verify that during the 2.5 minute measurement window, no UUT transmissions occur at 5580 MHz.

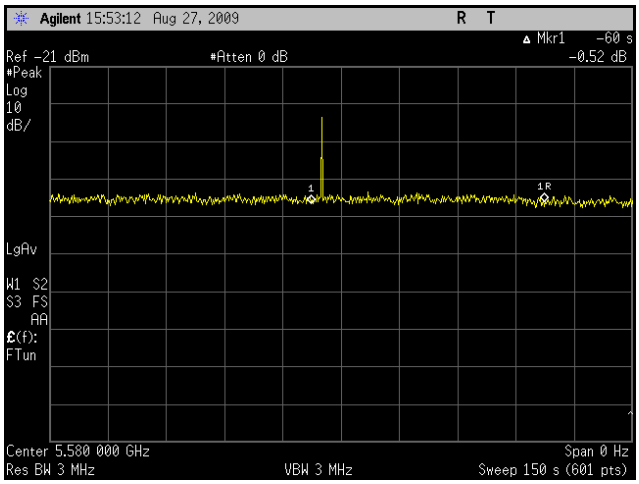
Test Results Plot 294 below indicates that there were no UUT transmissions during the 2.5 minute measurement window. Marker 1R indicates completion of the power-on cycle. Marker 1 indicates the end of the 60-second channel availability check time.

The equipment complies with § 15.407 Radar Burst at the Beginning of the Channel Availability Check Time.

Test Engineer: Anderson Soungpanya

Test Date: 08/26/09 – 09/02/09

Radar Burst at the Beginning of Channel Availability Check Time – Plot



Plot 294. Radar Burst at the Beginning of CACT, 250 seconds, 5580 MHz

F. Radar Burst at the End of Channel Availability Check Time

Test Requirements: **§ 15.407** A Radar Burst at the End of the Channel Availability Check Time tests that the UUT does not emit beacon, control, or data signals on the test Channel if it has detected a radar burst during that time period until the power-up sequence has been completed and the U-NII device checks for Radar Waveforms for one minute on the test Channel. The steps below define the procedure to verify successful radar detection on the selected Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold + 1 dB (-63dBm) occurs at the end of the Channel Availability Check Time.

Test Procedure: The steps below define the procedure to verify successful radar detection on the selected Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold + 1 dB (-63dBm) occurs at the end of the Channel Availability Check Time.

The UUT is powered on at T0. T1 denotes the instant when the UUT has completed its power-up sequence. The Channel Availability Check Time commences at instant T1 and will end no sooner than T1 + 60 seconds.

A single Burst of short pulse of radar type 1 at -63 dBm will commence within a 6 second window starting at T1+ 54 seconds.

Visual indication on the UUT of successful detection of the radar Burst will be recorded and reported. Observation of emissions at 5580 MHz will continue for 2.5 minutes after the radar Burst has been generated.

Verify that during the 2.5 minute measurement window no UUT transmissions occurred at 5580 MHz.

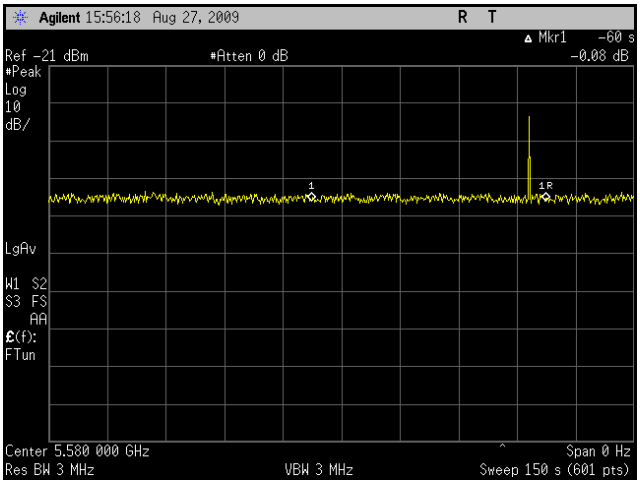
Test Results: Plot 295 indicates that no UUT transmissions occurred during the 2.5 minute measurement window. Marker 1R indicates completion of the power-on cycle. Marker 1 indicates the end of the 60-second channel availability check time.

The equipment complies with § 15.407 Radar Burst at the End of the Channel Availability Check Time.

Test Engineer: Anderson Soungpanya

Test Date: 08/26/09 – 09/02/09

Radar Burst at the End of Channel Availability Check Time – Plot



Plot 295. Radar Burst at the End of CACT, 250 seconds, 5580 MHz

G. In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time, and Non-Occupancy Period

Test Requirements: **§ 15.407** (Refer to DFS Response Requirement Values table in section III-A of this report.) The UUT shall continuously monitor for radar transmissions in the operating test channel. When a radar burst occurs in the test channel, it has 10 seconds to move to another channel. This 10 second window is termed Channel Move Time (CMT).

When a radar burst occurs, the UUT has 200 milliseconds, plus an aggregate of 60 milliseconds, to cease transmission in the operating test channel. This 200 ms + 60 ms requirement is termed Channel Closing Transmission Time (CCT).

After radar burst and subsequent move to another channel, the UUT shall not resume transmission, on the channel it moved from, for a period of 30 minutes. This requirement is termed Non-Occupancy Period (NOP).

Test Procedure: These tests define how the following DFS parameters are verified during In-Service Monitoring: Channel Closing Transmission Time, Channel Move Time, and Non-Occupancy Period.

The steps below define the procedure to determine the above mentioned parameters when a radar Burst with a level equal to the DFS Detection Threshold + 1dB (-63dBm) is generated on the Operating Channel of the U-NII device.

A U-NII device operating as a Client Device will associate with the UUT (Master) at 5580 MHz. Stream the MPEG test file from the Master Device to the Client Device on the selected Channel for the entire period of the test.

At time T0 the Radar Waveform generator sends a Burst of pulses for each of the radar types at -63dBm.

Observe the transmissions of the UUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the UUT during the observation time (Channel Move Time). Compare the Channel Move Time and Channel Closing Transmission Time results to the limits defined in the *DFS Response Requirement Values table*.

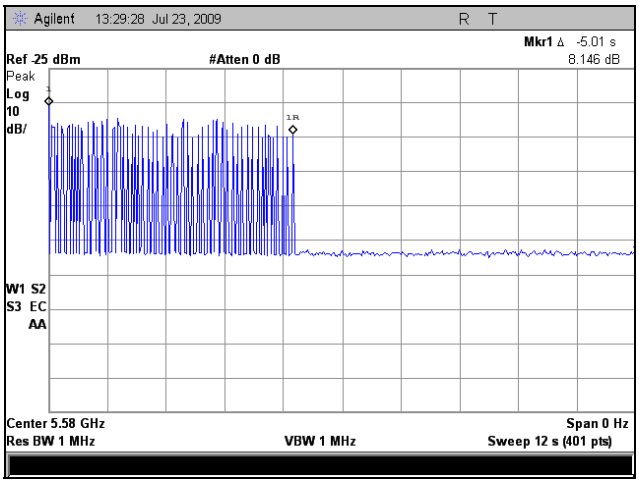
Test Results: Plot 296 and Plot 297 indicate cessation of transmission for more than 10 seconds after a radar burst (marker 1). Plot 298 depicts the 200 ms closing time window (marker 1), and Plot 299 depicts post 200 ms aggregate transmissions. Finally, Plot 300 shows that transmissions have not resumed within 30 minutes of channel move.

The UUT complies with § 15.407 In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time, and Non-Occupancy Period.

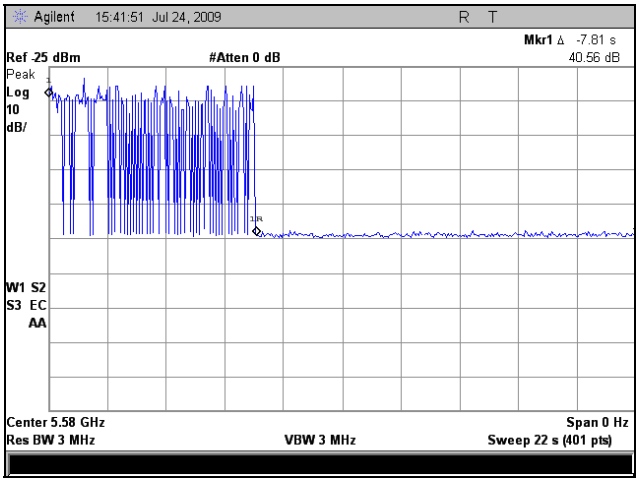
Test Engineer: Anderson Soungpanya

Test Date: 08/26/09 – 09/02/09

In-Service Monitoring for Channel Move Time – Plots

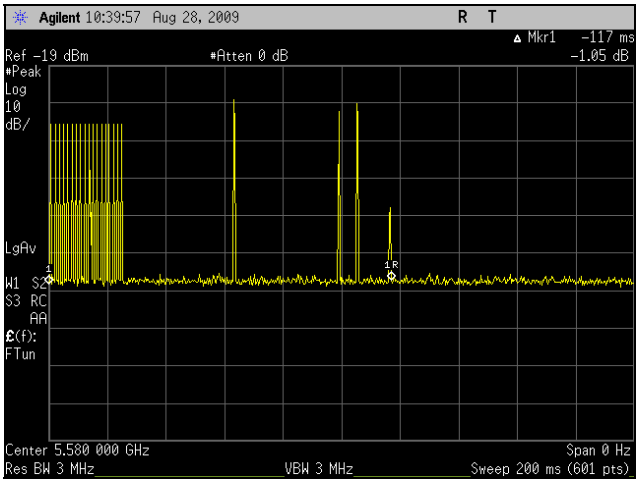


Plot 296. Channel Move Time for Radar Type 1, 10 seconds, 5580 MHz

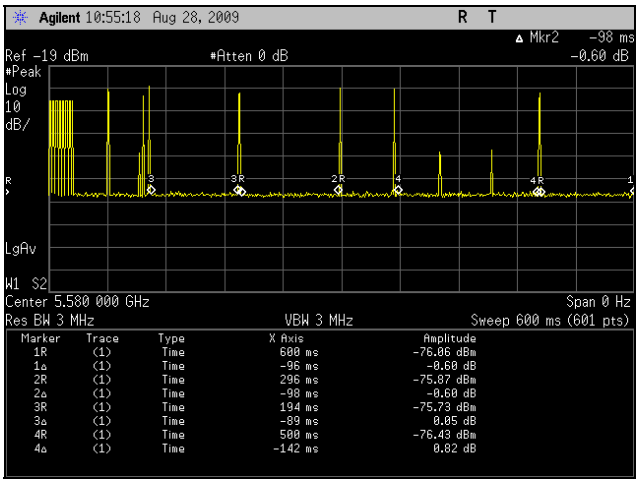


Plot 297. Channel Move Time for Radar Type 5, 22 seconds, 5580 MHz

In-Service Monitoring for Channel Closing Transmission Time – Plots

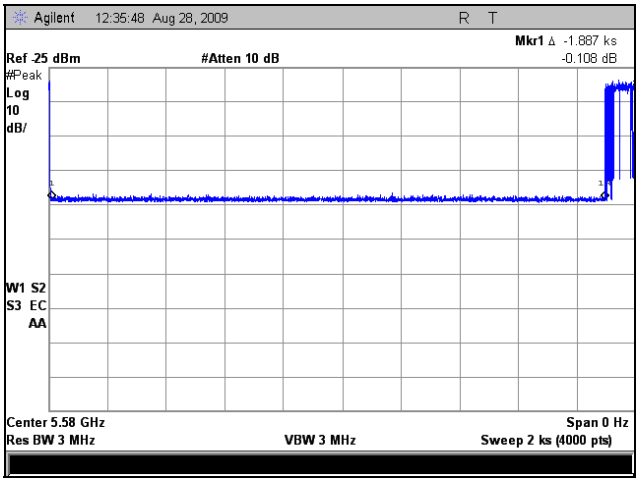


Plot 298. Channel Closing Transmission Time, 200 milliseconds, 5580 MHz~~, 802.11a~~



Plot 299. Channel Closing Transmission Time, 260 milliseconds, 5580 MHz

In-Service Monitoring for Non-Occupancy Period – Plot



Plot 300. Non-Occupancy Period, 30minutes, 5580 MHz

H. Statistical Performance Check

Test Requirements: **§ 15.407** During In-Service Monitoring, the EUT requires a minimum percentage of successful radar detections from all required radar waveforms at a level equal to the DFS Detection Threshold + 1dB.

Test Procedure: Stream the MPEG test file from the Master Device to the Client Device on the selected Channel for the entire period of the test. The Radar Waveform generator sends the individual waveform for each of the radar types 1-6 at -63dbm. Statistical data is gathered to determine the ability of the device to detect the radar test waveforms. The device can utilize a test mode to demonstrate when detection occurs to prevent the need to reset the device between trial runs. The percentage of successful detection is calculated by:

$$\frac{TotalWaveformDetections}{TotalWaveformTrials} \times 100$$

The Minimum number of trails, minimum percentage of successful detection and the average minimum percentage of successful detection are found in the Radar Test Waveforms section.

Test Results: Statistical performance for radar type 1 is tabulated in Table 65

The equipment complies with § 15.407 Statistical Performance Check.

Test Engineer: Anderson Soungpanya

Test Date: 08/26/09

Radar Type	Trial #	Pulses per Burst	Pulse Width (µsec)	PRI (µsec)	Detection 1 = Yes, 0 = No
1	1	18	1	1428	1
	2	18	1	1428	1
	3	18	1	1428	1
	4	18	1	1428	1
	5	18	1	1428	1
	6	18	1	1428	1
	7	18	1	1428	1
	8	18	1	1428	1
	9	18	1	1428	1
	10	18	1	1428	1
	11	18	1	1428	1
	12	18	1	1428	1
	13	18	1	1428	1
	14	18	1	1428	1
	15	18	1	1428	1
	16	18	1	1428	1
	17	18	1	1428	1
	18	18	1	1428	1
	19	18	1	1428	1
	20	18	1	1428	1
	21	18	1	1428	1
	22	18	1	1428	1
	23	18	1	1428	1
	24	18	1	1428	1
	25	18	1	1428	1
	26	18	1	1428	0
	27	18	1	1428	1
	28	18	1	1428	1
	29	18	1	1428	1
	30	18	1	1428	1
	Detection Percentage				96.7% (> 60%)

Table 65. Statistical Performance Check – Radar Type 1, 802.11n 20 MHz

Radar Type	Trial #	Pulse Width 1 to 5 µsec	PRI 150 to 230 µsec	Pulses per Burst 23 to 29	Detection 1 = Yes, 0 = No
2	1	2.2	185	23	1
	2	2.9	205	29	1
	3	2.8	157	27	1
	4	1.5	187	25	0
	5	3.1	208	23	1
	6	1.2	179	29	1
	7	3.2	163	26	1
	8	2.9	159	29	1
	9	5	166	27	1
	10	3.8	216	27	1
	11	2.5	184	27	1
	12	3.2	151	27	1
	13	3	206	26	1
	14	3.9	158	28	1
	15	1.9	156	27	1
	16	1.5	219	24	1
	17	2.6	229	28	1
	18	1	216	23	1
	19	4.9	156	27	1
	20	4.4	223	27	1
	21	2.5	191	23	1
	22	2.2	151	28	1
	23	4.4	151	29	1
	24	3.5	182	23	1
	25	1.6	195	27	1
	26	1.5	175	29	1
	27	5	166	29	1
	28	1.3	189	24	1
	29	1.8	175	27	1
	30	3.5	227	28	1
	Detection Percentage				96.7 (> 60%)

Table 66. Statistical Performance Check – Radar Type 2, 802.11n 20 MHz

Radar Type	Trial #	Pulse Width 6 to 10 µsec	PRI 200 to 500 µsec	Pulses per Burst 16 to 18	Detection 1 = Yes, 0 = No
3	1	7	276	16	1
	2	7.4	333	18	1
	3	7.7	450	18	1
	4	8.4	418	16	1
	5	5.9	500	16	1
	6	9	312	18	1
	7	7.2	363	17	1
	8	6.8	366	17	1
	9	7.4	361	16	1
	10	7	276	18	1
	11	5.6	263	16	1
	12	8.9	467	16	1
	13	8.3	445	16	1
	14	5.8	349	18	1
	15	6.9	480	16	1
	16	7.2	338	18	1
	17	6	261	18	1
	18	9.9	262	18	1
	19	6	400	16	1
	20	6.7	362	18	1
	21	6.8	322	17	1
	22	5.9	492	18	1
	23	8.8	327	18	0
	24	8.6	338	17	1
	25	10	257	17	1
	26	8.7	359	17	1
	27	5.7	368	16	1
	28	8.1	427	16	1
	29	8	378	18	1
	30	9.4	265	16	1
	Detection Percentage				96.7% (> 60%)

Table 67. Statistical Performance Check – Radar Type 3, 802.11n 20 MHz

Radar Type	Trial #	Pulse Width 11 to 20 µsec	PRI 200 to 500 µsec	Pulses per Burst 12 to 16	Detection 1 = Yes, 0 = No
4	1	18.4	460	15	1
	2	16	331	13	1
	3	19.9	339	13	1
	4	15.5	261	16	1
	5	15.5	340	14	1
	6	19.3	423	13	1
	7	10	404	14	1
	8	14.3	370	15	1
	9	14.1	360	14	1
	10	19.9	258	14	1
	11	13	345	16	1
	12	16.8	402	13	1
	13	13.2	309	16	1
	14	16.3	426	12	1
	15	17.8	334	14	1
	16	16.1	295	12	1
	17	10.6	470	15	1
	18	14.4	332	15	1
	19	11.2	361	15	1
	20	13.9	423	12	1
	21	14.9	275	13	1
	22	16.7	271	12	1
	23	15.3	408	15	1
	24	20	322	13	1
	25	16.2	392	14	1
	26	16.5	296	13	1
	27	13.7	358	12	1
	28	13.7	259	16	1
	29	13.8	264	13	1
	30	12.7	265	12	1
	Detection Percentage				100% (> 60%)

Table 68. Statistical Performance Check – Radar Type 4, 802.11n 20 MHz

Radar Type	Trial #	Filename*	Detection
			1 = Yes, 0 = No
5	1	bin5-trial 1	1
	2	bin5-trial 2	1
	3	bin5-trial 3	1
	4	bin5-trial 4	1
	5	bin5-trial 5	1
	6	bin5-trial 6	1
	7	bin5-trial 7	1
	8	bin5-trial 8	1
	9	bin5-trial 9	1
	10	bin5-trial 10	1
	11	bin5-trial 11	1
	12	bin5-trial 12	1
	13	bin5-trial 13	1
	14	bin5-trial 14	1
	15	bin5-trial 15	1
	16	bin5-trial 16	1
	17	bin5-trial 17	1
	18	bin5-trial 18	1
	19	bin5-trial 19	1
	20	bin5-trial 20	1
	21	bin5-trial 21	1
	22	bin5-trial 22	0
	23	bin5-trial 23	1
	24	bin5-trial 24	1
	25	bin5-trial 25	1
	26	bin5-trial 26	1
	27	bin5-trial 27	1
	28	bin5-trial 28	1
	29	bin5-trial 29	1
	30	bin5-trial 30	1
	Detection Percentage		**96.7% (> 60%)**

Table 69. Statistical Performance Check – Radar Type 5, 802.11n 20 MHz

Note: See Appendix

Radar Type	Trial #	Frequency (MHz)	Pulses/Hop	Pulse Width (µsec)	PRI (µsec)	Detection 1 = Yes, 0 = No
6	1	5500	9	1	333	1
	2	5500	9	1	333	1
	3	5500	9	1	333	1
	4	5500	9	1	333	1
	5	5500	9	1	333	1
	6	5500	9	1	333	0
	7	5500	9	1	333	1
	8	5500	9	1	333	1
	9	5500	9	1	333	1
	10	5500	9	1	333	1
	11	5500	9	1	333	1
	12	5500	9	1	333	1
	13	5500	9	1	333	1
	14	5500	9	1	333	1
	15	5500	9	1	333	1
	16	5500	9	1	333	0
	17	5500	9	1	333	1
	18	5500	9	1	333	0
	19	5500	9	1	333	1
	20	5500	9	1	333	1
	21	5500	9	1	333	1
	22	5500	9	1	333	1
	23	5500	9	1	333	1
	24	5500	9	1	333	1
	25	5500	9	1	333	1
	26	5500	9	1	333	1
	27	5500	9	1	333	1
	28	5500	9	1	333	1
	29	5500	9	1	333	1
	30	5500	9	1	333	0
	Detection Percentage					86.7% (> 60%)

Table 70. Statistical Performance Check – Radar Type 6, 802.11n 20 MHz

Radar Type	Trial #	Pulses per Burst	Pulse Width (µsec)	PRI (µsec)	Detection 1 = Yes, 0 = No
1	1	18	1	1428	1
	2	18	1	1428	1
	3	18	1	1428	1
	4	18	1	1428	1
	5	18	1	1428	1
	6	18	1	1428	1
	7	18	1	1428	1
	8	18	1	1428	1
	9	18	1	1428	1
	10	18	1	1428	1
	11	18	1	1428	1
	12	18	1	1428	1
	13	18	1	1428	1
	14	18	1	1428	1
	15	18	1	1428	1
	16	18	1	1428	1
	17	18	1	1428	1
	18	18	1	1428	0
	19	18	1	1428	1
	20	18	1	1428	1
	21	18	1	1428	1
	22	18	1	1428	1
	23	18	1	1428	1
	24	18	1	1428	1
	25	18	1	1428	1
	26	18	1	1428	1
	27	18	1	1428	1
	28	18	1	1428	1
	29	18	1	1428	1
	30	18	1	1428	1
	Detection Percentage				96.7% (> 60%)

Table 71. Statistical Performance Check – Radar Type 1, 802.11n 40MHz

Radar Type	Trial #	Pulse Width 1 to 5 µsec	PRI 150 to 230 µsec	Pulses per Burst 23 to 29	Detection 1 = Yes, 0 = No
2	1	2.8	216	28	1
	2	3.7	167	29	1
	3	1.4	208	25	1
	4	1	177	23	1
	5	2.7	185	24	1
	6	2.6	207	26	1
	7	4.2	197	25	1
	8	2.5	223	25	1
	9	2.2	158	25	1
	10	4.7	172	28	1
	11	3.6	181	26	1
	12	2.9	202	23	1
	13	2.5	227	26	1
	14	2.1	212	27	1
	15	3	193	29	1
	16	4.3	172	29	1
	17	3.7	216	28	1
	18	1.3	194	24	1
	19	4.9	166	24	1
	20	1	208	24	1
	21	2	150	27	1
	22	3.2	161	27	1
	23	1.6	168	26	1
	24	3.7	188	24	1
	25	3.2	208	28	1
	26	1.4	165	23	1
	27	1	171	24	1
	28	1.3	165	23	1
	29	3.6	191	27	1
	30	4.8	167	24	1
	Detection Percentage				100% (> 60%)

Table 72. Statistical Performance Check – Radar Type 2, 802.11n 40MHz

Radar Type	Trial #	Pulse Width 6 to 10 µsec	PRI 200 to 500 µsec	Pulses per Burst 16 to 18	Detection 1 = Yes, 0 = No
3	1	5.8	279	17	1
	2	8.6	476	18	1
	3	5.5	362	17	1
	4	8.3	392	17	1
	5	5.5	445	17	1
	6	8.6	392	16	1
	7	7.6	292	18	0
	8	6	448	18	1
	9	7.1	381	16	1
	10	9.9	395	17	0
	11	5	283	16	1
	12	5.1	347	16	1
	13	8.1	442	17	1
	14	9.7	391	16	0
	15	5.5	478	17	1
	16	5.4	300	18	1
	17	6.8	298	16	1
	18	6.4	268	16	1
	19	7.4	274	16	1
	20	5.2	392	17	1
	21	7	484	16	0
	22	8.6	274	16	1
	23	9.5	334	18	1
	24	8.4	363	18	1
	25	7.5	474	18	1
	26	6.8	400	18	1
	27	7.3	373	18	1
	28	9.6	306	17	1
	29	7.5	376	16	0
	30	9.7	276	18	1
	Detection Percentage				83.3%(> 60%)

Table 73. Statistical Performance Check – Radar Type 3, 802.11n 40MHz

Radar Type	Trial #	Pulse Width 11 to 20 µsec	PRI 200 to 500 µsec	Pulses per Burst 12 to 16	Detection 1 = Yes, 0 = No
4	1	16.2	296	15	1
	2	11.2	441	13	1
	3	14.1	343	13	1
	4	15.8	330	12	1
	5	14.5	356	16	1
	6	19.3	416	16	1
	7	18.4	288	12	1
	8	13.3	469	16	1
	9	13.1	285	12	1
	10	13.7	319	16	1
	11	13.8	368	14	1
	12	11.1	349	15	1
	13	16.3	382	16	1
	14	10	258	15	0
	15	19.1	403	16	1
	16	19.5	271	14	1
	17	11.6	386	12	1
	18	19.9	477	16	1
	19	14.7	370	12	1
	20	10.1	415	14	1
	21	10.6	465	13	1
	22	10.8	304	16	1
	23	13.9	326	12	1
	24	14.6	435	12	1
	25	16.1	479	16	1
	26	19.5	300	15	1
	27	18.7	460	14	1
	28	15.8	450	15	1
	29	16.6	496	16	1
	30	16	494	14	1
	Detection Percentage				96.7% (> 60%)

Table 74. Statistical Performance Check – Radar Type 4, 802.11n 40MHz

Radar Type	Trial #	Filename*	Detection
			1 = Yes, 0 = No
5	1	bin5-trial 1	1
	2	bin5-trial 2	1
	3	bin5-trial 3	1
	4	bin5-trial 4	1
	5	bin5-trial 5	1
	6	bin5-trial 6	1
	7	bin5-trial 7	1
	8	bin5-trial 8	1
	9	bin5-trial 9	1
	10	bin5-trial 10	1
	11	bin5-trial 11	1
	12	bin5-trial 12	1
	13	bin5-trial 13	1
	14	bin5-trial 14	1
	15	bin5-trial 15	1
	16	bin5-trial 16	1
	17	bin5-trial 17	1
	18	bin5-trial 18	1
	19	bin5-trial 19	1
	20	bin5-trial 20	1
	21	bin5-trial 21	1
	22	bin5-trial 22	1
	23	bin5-trial 23	0
	24	bin5-trial 24	1
	25	bin5-trial 25	1
	26	bin5-trial 26	1
	27	bin5-trial 27	1
	28	bin5-trial 28	1
	29	bin5-trial 29	1
	30	bin5-trial 30	1
	Detection Percentage		**96.7 (> 60%)**

Table 75. Statistical Performance Check – Radar Type 5, 802.11n 40MHz

Note: See Appendix

Radar Type	Trial #	Frequency (MHz)	Pulses/Hop	Pulse Width (µsec)	PRI (µsec)	Detection 1 = Yes, 0 = No
6	1	5310	9	1	333	1
	2	5310	9	1	333	1
	3	5310	9	1	333	1
	4	5310	9	1	333	1
	5	5310	9	1	333	1
	6	5310	9	1	333	1
	7	5310	9	1	333	1
	8	5310	9	1	333	1
	9	5310	9	1	333	1
	10	5310	9	1	333	1
	11	5310	9	1	333	1
	12	5310	9	1	333	1
	13	5310	9	1	333	1
	14	5310	9	1	333	1
	15	5310	9	1	333	1
	16	5310	9	1	333	1
	17	5310	9	1	333	1
	18	5310	9	1	333	0
	19	5310	9	1	333	1
	20	5310	9	1	333	1
	21	5310	9	1	333	1
	22	5310	9	1	333	1
	23	5310	9	1	333	1
	24	5310	9	1	333	1
	25	5310	9	1	333	1
	26	5310	9	1	333	1
	27	5310	9	1	333	1
	28	5310	9	1	333	1
	29	5310	9	1	333	1
	30	5310	9	1	333	1
	Detection Percentage					96.7% (> 60%)

Table 76. Statistical Performance Check – Radar Type 6, 802.11n 40MHz

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	09/10/2008	09/10/2009
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	
1S2464	LISN	SOLAR ELECTRONICS	9252-50-R24-BNC	09/26/2008	09/26/2009
1S2512	TRANSIENT LIMITER	AGILENT	11947A	SEE NOTE	
1S2520	THERMO-HYGROMETER	FISHER SCIENTIFIC	11-661-7D	11/14/2007	11/13/2009
1S2583	SPECTRUM ANALYZER, E4477A	AGILENT	01/26/2011	02/26/2011	1S2583
1S2607	SPECTRUM ANALYZER, E4407B	AGILENT	07/30/2010	07/30/2011	1S2607
1S2482	CHAMBER, 5 METER	PANASHIELD	641431	11/22/2008	11/22/2009
1S2108	RECIEVER, EMI, RF FILTER SECTION	HEWLETT PACKARD	85460A	11/06/2008	11/06/2009
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	
1S2108	RF FILTER SECTION	HEWLETT PACKARD	85460A	11/6/08	11/6/09
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 77. Test Equipment List

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

MET Asset	Equipment	Manufacturer	Last Cal Date	Cal Due Date
1S2243	NI PXI-1042 8-SLOT 3U CHASSIS	NATIONAL INSTRUMENTS	SEE NOTE	
1S2602	NI PXI-5421 16-BIT 100MS/S ARBITRARY WAVEFORM GENERATOR	NATIONAL INSTRUMENTS	SEE NOTE	
1S2278	NI PXI-5610 2.7GHZ RF UPCONVERTER	NATIONAL INSTRUMENTS	SEE NOTE	
1S2069	UPCONVERTER, 7206 PXI 4.9 TO 6GHZ	ASCOR	SEE NOTE	
N/A	SPLITTER/COMBINER, ZFSC-2-9G (QTY 2)	MINI-CIRCUITS	SEE NOTE	
N/A	30DB ATTENUATOR, BW-S30W2 (QTY 2)	PASTERNAK	SEE NOTE	
N/A	10DB ATTENUATOR, BW-S10W2 (QTY 2)	PASTERNAK	SEE NOTE	
1S2523	PRE-AMPLIFIER, 8449B	AGILENT	SEE NOTE	
1S2583	SPECTRUM ANALYZER, E4477A	AGILENT	01/26/2011	02/26/2011
1S2607	SPECTRUM ANALYZER, E4407B	AGILENT	07/30/2010	07/30/2011

Table 78. DFS 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.

. Appendix

