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August 27, 2010

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

Dear Mike Kriege,

Enclosed is the EMC Wireless test report for compliance testing of the Apple Inc., Model A1378 as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B, ICES-003, Issue 4 February 2004 for a Class B Digital Device, and FCC Part 15.407 and Industry Canada RSS-210, Annex 9, Issue 7, June 2007 for Intentional Radiators.

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

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\Apple Inc.\EMCS82333-FCC407 Rev. 1)

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Electromagnetic Compatibility Criteria
Test Report

for the

Apple Inc.
Model A1378

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class B Digital Devices
&
FCC Part 15.407 & RSS-210, Annex 9
for Intentional Radiators

MET Report: EMCS82333-FCC407 Rev. 1

August 27, 2010

Prepared For:

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

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

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for Intentional Radiators

Minh Ly, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of FCC Rules Parts 15B, Part 15.407 and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210 Annex 9 under normal use and maintenance.

Shawn McMillen, Wireless Manager
Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	August 26, 2010	Initial Issue.
1	August 27, 2010	Revised to reflect engineer corrections.

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List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**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
µF	**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 Apple Inc. Model A1378, with the requirements of FCC Part 15, §15.407 and Industry Canada RSS-210 Annex 9. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the Model A1378. Apple Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Model A1378, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15, §15.407 and Industry Canada RSS-210, Annex 9, in accordance with Apple Inc., quote number 0478295456. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	Industry Canada Reference	Description	Results
47 CFR Part 15.107 (a)	ICES-003 Issue 4 February 2004	Conducted Emission Limits for a Class B Digital Device	Compliant
47 CFR Part 15.109 (a)	ICES-003 Issue 4 February 2004	Radiated Emission Limits for a Class B Digital Device	Compliant
15.203	RSS-GEN 7.1.4	Antenna Requirements	Compliant
15.207	RSS-GEN 7.2.2; RSS-210 2.2	AC Conducted Emissions 150KHz – 30MHz	Compliant
15.403 (i)	A8.2	26dB Occupied Bandwidth	Compliant
15.407 (a)(3)	A9.2(3)	Conducted Transmitter Output Power	Compliant
15.407 (a)(3)	A9.2(3)	Power Spectral Density	Compliant
15.407 (a)(6)	N/A	Peak Excursion	Compliant
15.407 (b)(4), (6)	A9.3(4)	Undesirable Emissions (15.205/15.209 - General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Compliant
15.407(f)	RSS-GEN	RF Exposure	Compliant
15.407(g)	2.1	Frequency Stability	Compliant
N/A	RSS-Gen(4.8)	Receiver Spurious Emissions	Compliant

Table 1. Executive Summary of EMC Part 15.407 & RSS-210 Annex 9 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Apple Inc. to perform testing on the Model A1378, under Apple Inc.'s quote number 0478295456.

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

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

Model(s) Tested:	Model A1378	
Model(s) Covered:	Model A1378	
EUT Specifications:	Primary Power: 120 VAC, 60 Hz	
	FCC ID: BCGA1378 IC: 579C-A1378	
	Type of Modulations:	OFDM
	Equipment Code:	DTS
	EUT Frequency Ranges:	5180 – 5240 MHz 5260 – 5320 MHz 5500 – 5700 MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35º C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Minh Ly	
Report Date(s):	August 27, 2010	

Table 2. EUT Summary

B. References

RSS-210, Issue 7, June 2007	Low-power License-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
CFR 47, Part 15, Subpart E	Unlicensed National Information Infrastructure Devices (UNII)
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/NCSL Z540-1-1994	Calibration Laboratories and Measuring and Test Equipment - General Requirements
ANSI/ISO/IEC 17025:2000	General Requirements for the Competence of Testing and Calibration Laboratories
ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices

Table 3. References

C. Test Site

Radio 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 3 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Description of Test Sample

The Model A1378, Equipment Under Test (EUT) for the remainder of this document, is a wireless media client device.

E. Equipment Configuration

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

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

Table 4. Equipment Configuration

F. Support Equipment

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

Table 5. Support Equipment

G. Ports and Cabling Information

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

Table 6. Ports and Cabling Information

H. Mode of Operation

The device operates using 802.11b, 802.11g, 802.11a and 802.11n (ht20, mcs0-7 only).

I. Modifications

a) Modifications to EUT

Installed a low pass filter in the 2.4GHz path.

b) Modifications to Test Standard

No modifications were made to the test standard.

J. Disposition of EUT

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

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria

§ 15.107 Conducted Emissions Limits

Test Requirement(s):

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

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

15.207(a), Except as shown in paragraphs (b) and (c) of this section*, charging, AC adapters or battery eliminators the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the Table 7, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency range (MHz)	Class A Conducted Limits (dBµV)		*Class B Conducted Limits (dBµV)	
	Quasi-Peak	Average	Quasi-Peak	Average
* 0.15- 0.45	79	66	66 - 56	56 - 46
0.45 - 0.5	79	66	56	46
0.5 - 30	73	60	60	50
Note 1 — The lower limit shall apply at the transition frequencies. Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz. * -- Limits per Subsection 15.207(a).				

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

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

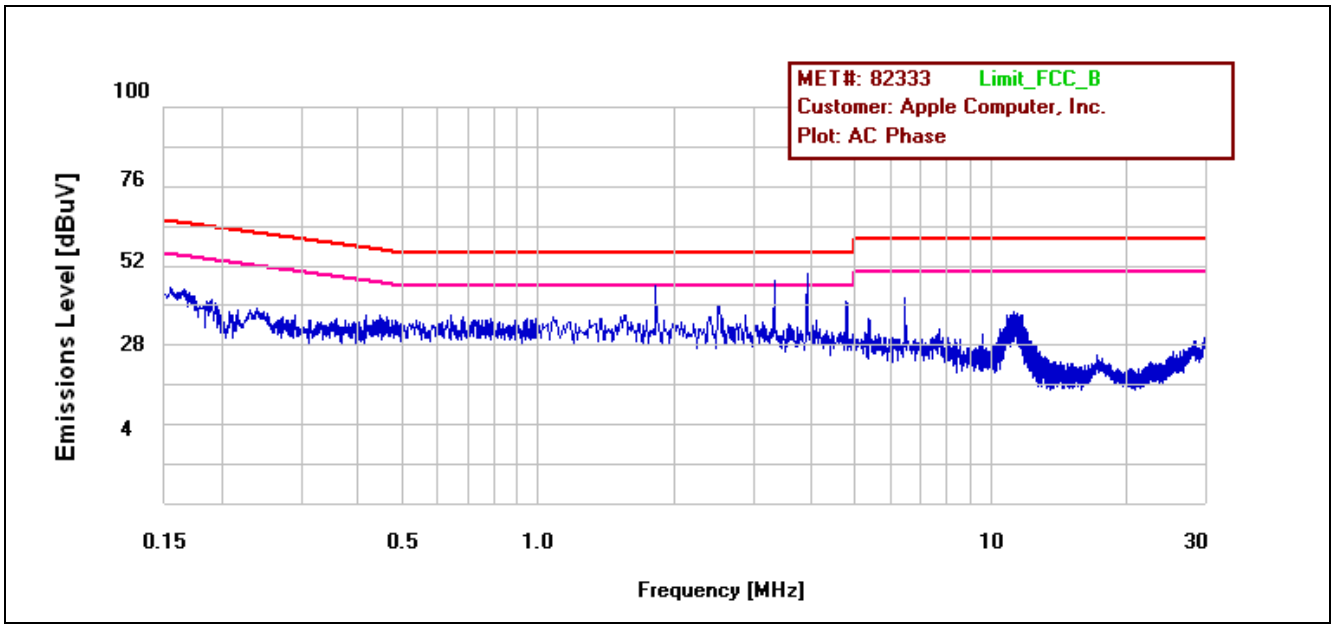
Test Engineer(s): Kenshi Chung

Test Date(s): 06/18/10

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

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

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

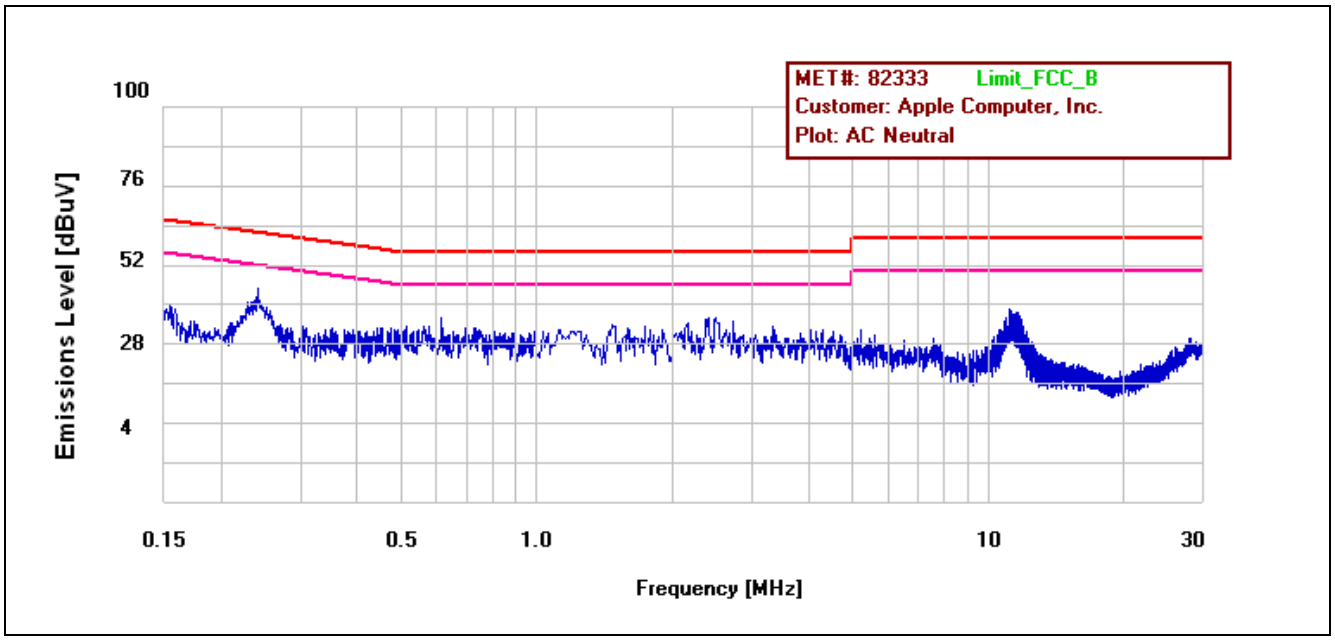


Plot 1. Conducted Emission, Phase Line Plot

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

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

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



Plot 2. Conducted Emission, Neutral Line Plot

Radiated Emission Limits

§ 15.109 Radiated Emissions Limits

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

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

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

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

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

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

Test Engineer(s): Minh Ly

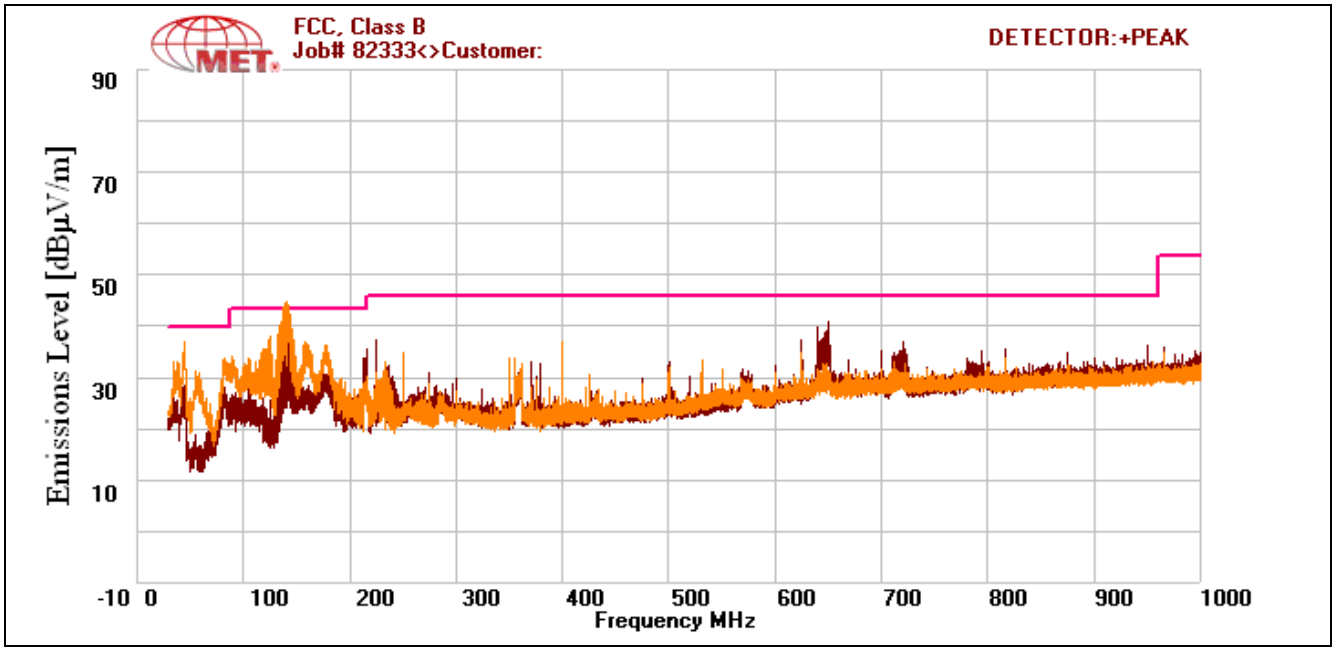
Test Date(s): 06/08/10

Radiated Emissions Limits Test Results, Class B

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

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

Note: The EUT was tested at 3 m.



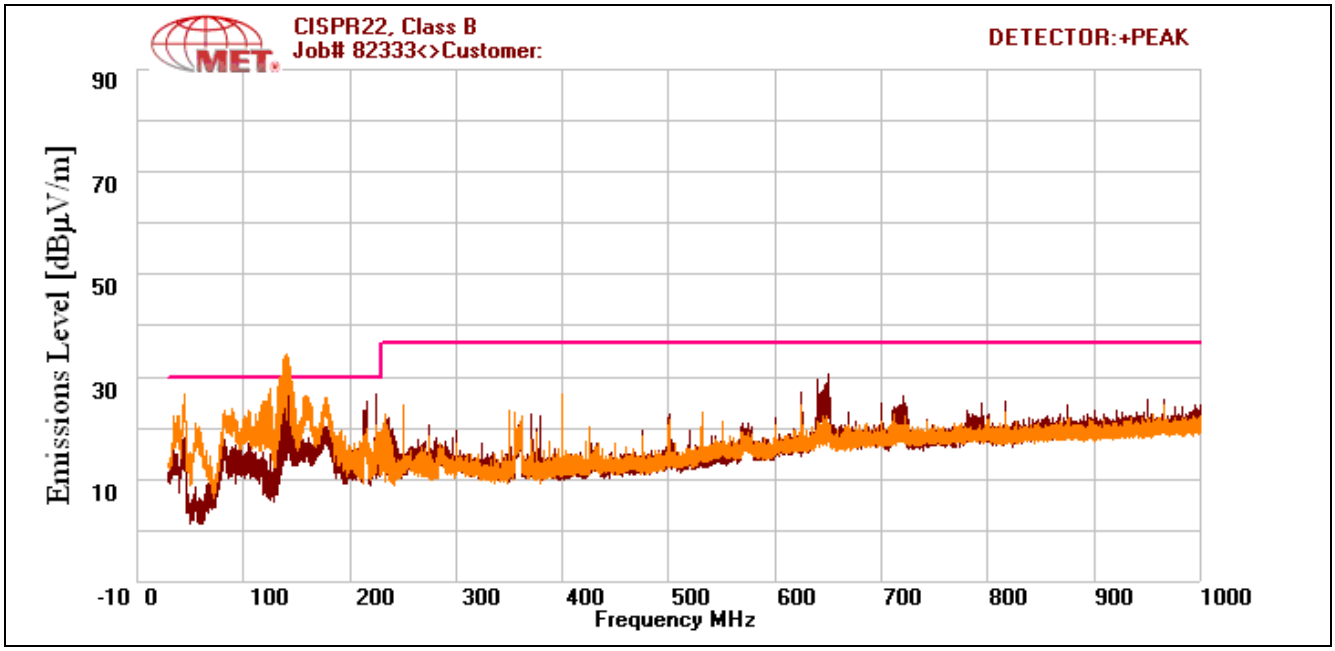
Plot 3. Radiated Emissions, 30 MHz - 1 GHz, FCC Limits

Radiated Emissions Limits Test Results, Class B

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

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

Note: The EUT was tested at 3 m.



Plot 4. Radiated Emissions, ICES-003 Limits

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

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

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

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

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

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

Results: The antenna will be permanently attached to the unit. Therefore, the EUT as tested is compliant with the criteria of §15.203.

Test Engineer(s): Minh Ly

Test Date(s): 06/02/10

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

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 non-metallic table, 80 cm above the ground plane inside a shielded room. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-1992 "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 compliant with the requirement(s) of this section. Pre-scans revealed that emissions profiles and amplitudes of emissions were similar when the EUT was transmitting on low, mid and high channels. Therefore, final measurements were taken when the EUT was transmitting on Channel 100 (HT20).

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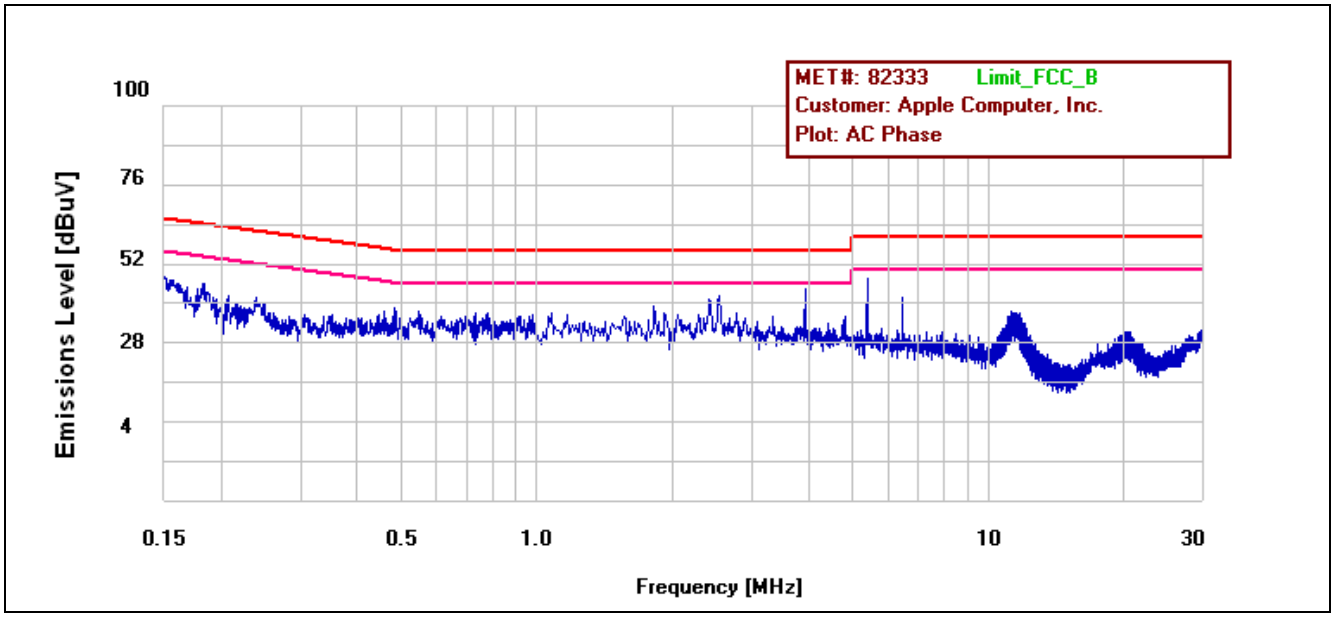
Test Engineer(s): Kenshi Chung

Test Date(s): 06/17/10

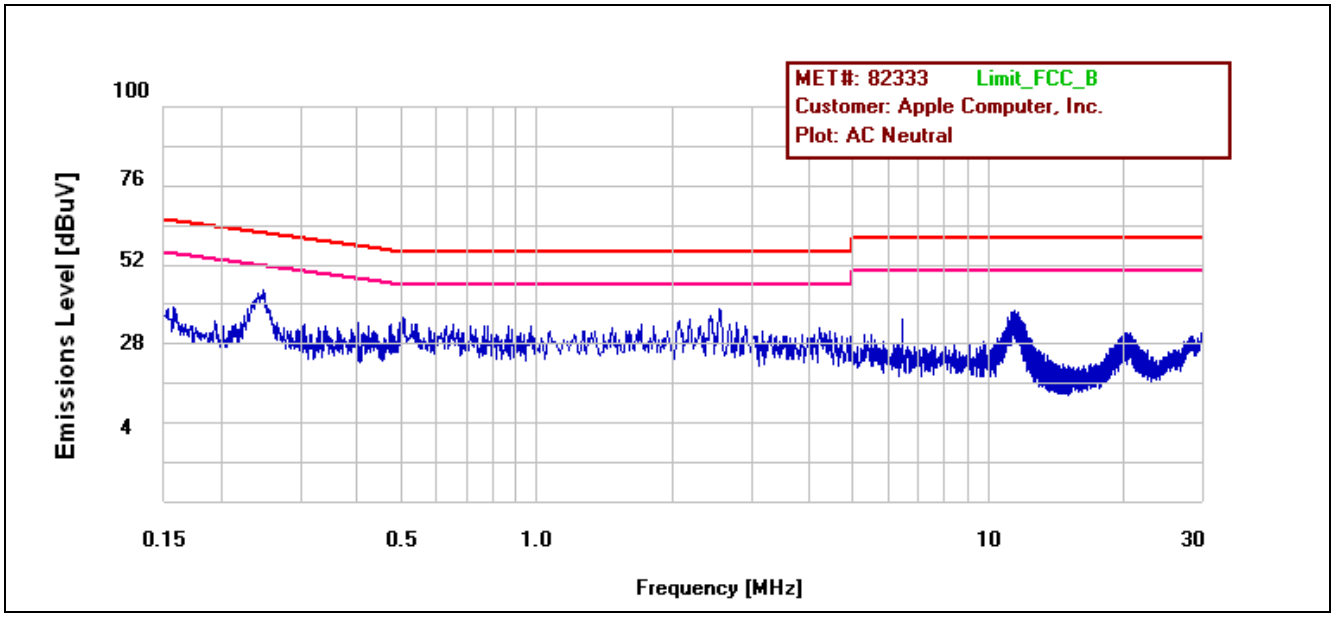
Conducted Emissions - Voltage, AC Power, (120V/60Hz)

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

Table 14. Conducted Emissions - Voltage, AC Power



Plot 5. Conducted Emission, Phase Line Plot



Plot 6. Conducted Emission, Neutral Line Plot

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 403(c) 26dB Bandwidth

Test Requirements: **§ 15.403 (i):** For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

Test Procedure: The transmitter was set to low, mid and high operating frequencies 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.

Test Results The 26 dB Bandwidth was compliant with the requirements of this section and was determined from the plots on the following pages.

Test Engineer(s): Minh Ly

Test Date(s): 06/18/10

Mode	Frequency (MHz)	26 dB Bandwidth (MHz)
802.11a	5180	19.974
	5200	20.290
	5240	19.482
	5260	20.391
	5300	19.891
	5320	19.438
	5500	20.729
	5600	20.794
	5700	20.892
802.11n 20MHz	5180	22.236
	5200	20.729
	5240	21.267
	5260	20.185
	5300	20.822
	5320	20.943
	5500	20.936
	5600	22.603
	5700	21.847

Table 15. -26dB Occupied Bandwidth, Test Results

Mode	Frequency (MHz)	99% Bandwidth (MHz)
802.11a	5180	16.3926
	5200	16.2976
	5240	16.4530
	5260	16.3133
	5300	16.3966
	5320	16.3510
	5500	16.3864
	5600	16.3503
	5700	16.4907
802.11n 20MHz	5180	17.6059
	5200	17.5982
	5240	17.3659
	5260	17.6575
	5300	17.7329
	5320	17.2113
	5500	17.6229
	5600	17.5877
	5700	17.6544

Table 16. 99% Occupied Bandwidth, Test Results

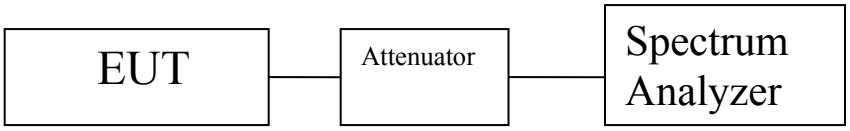
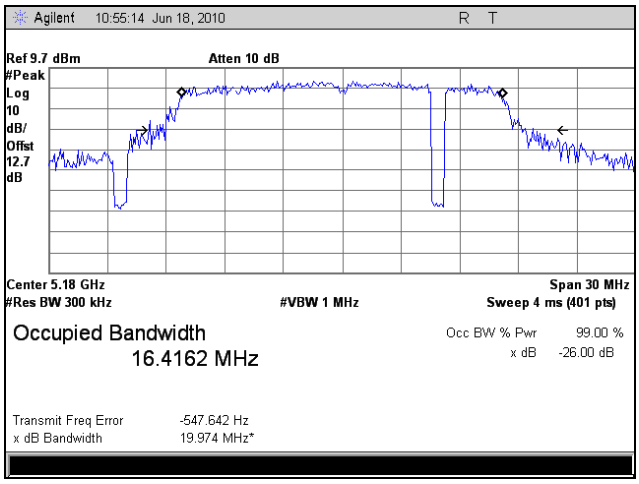
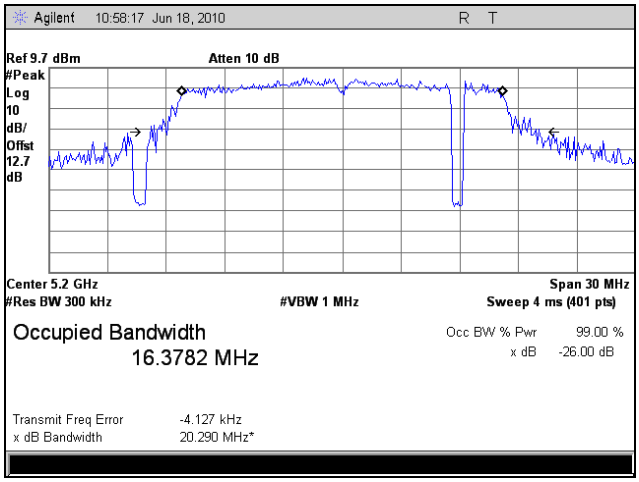


Figure 1. Occupied Bandwidth, Test Setup

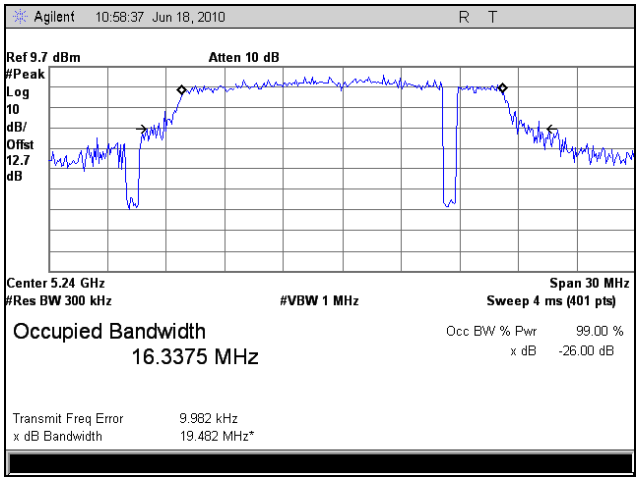
Occupied Bandwidth Test Results



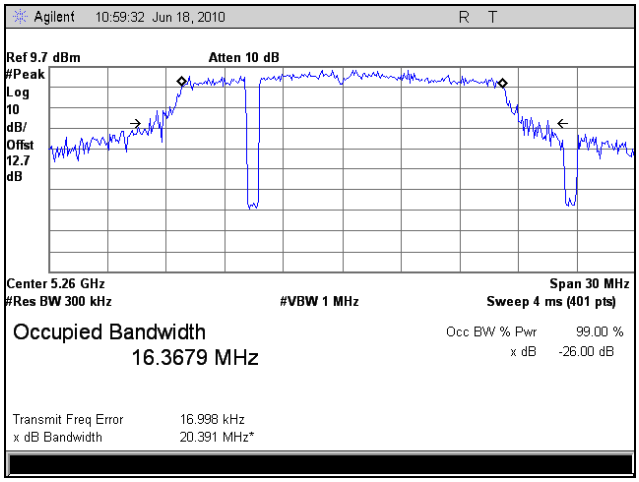
Plot 7. -26dB Occupied Bandwidth, 5180 MHz, 802.11a



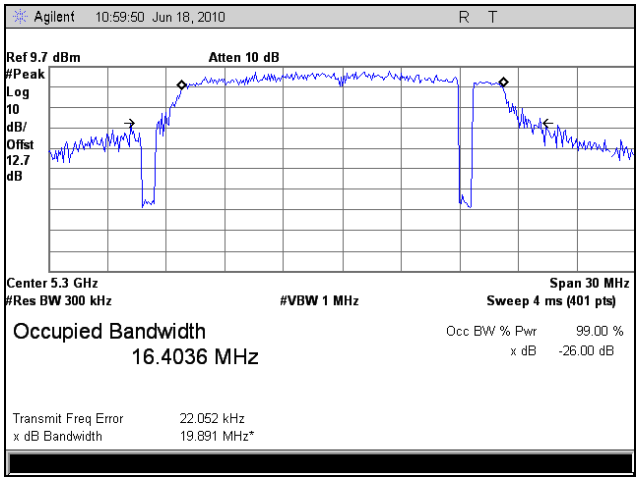
Plot 8. -26dB Occupied Bandwidth, 5200 MHz, 802.11a



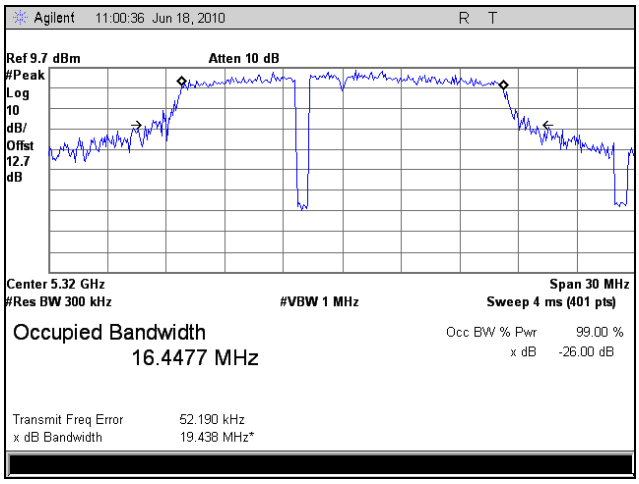
Plot 9. -26dB Occupied Bandwidth, 5240 MHz, 802.11a



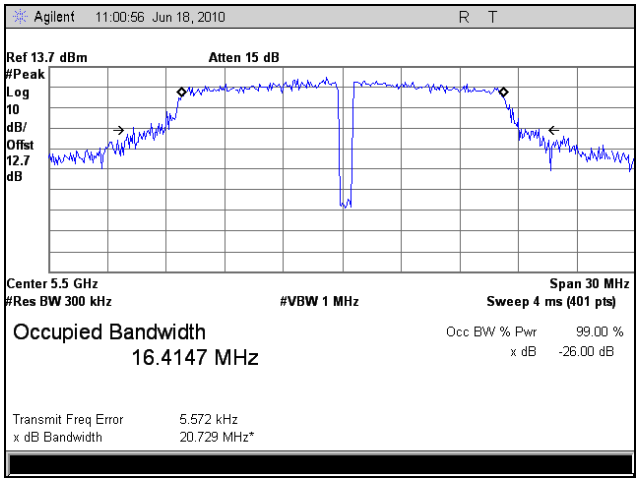
Plot 10. -26dB Occupied Bandwidth, 5260 MHz, 802.11a



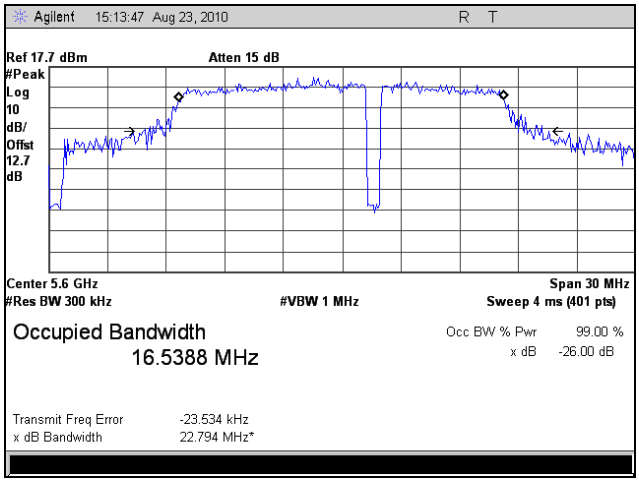
Plot 11. -26dB Occupied Bandwidth, 5300 MHz, 802.11a



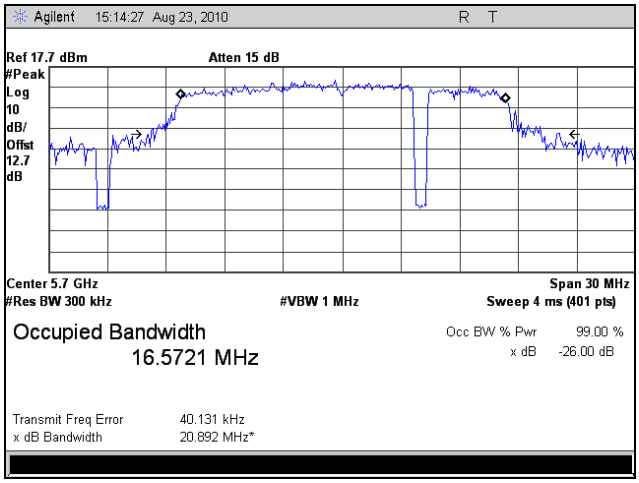
Plot 12. -26dB Occupied Bandwidth, 5320 MHz, 802.11a



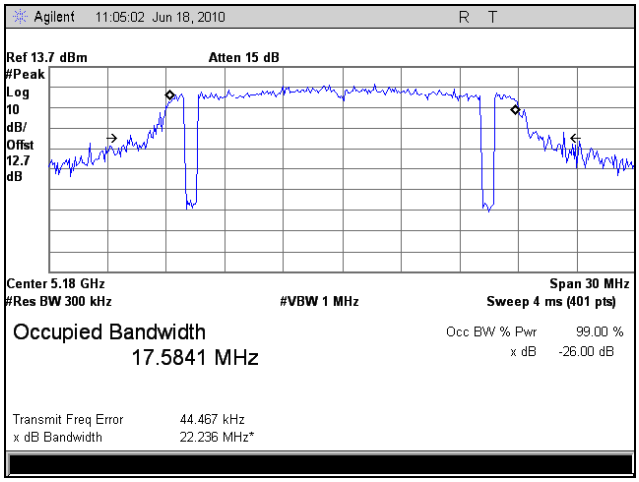
Plot 13. -26dB Occupied Bandwidth, 5500 MHz, 802.11a



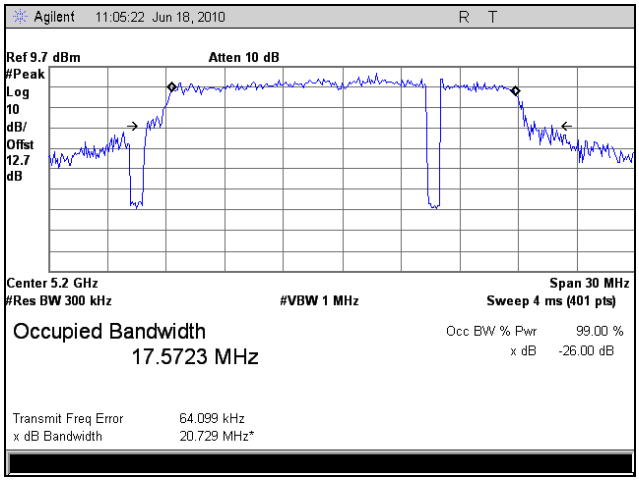
Plot 14. -26dB Occupied Bandwidth, 5600 MHz, 802.11a



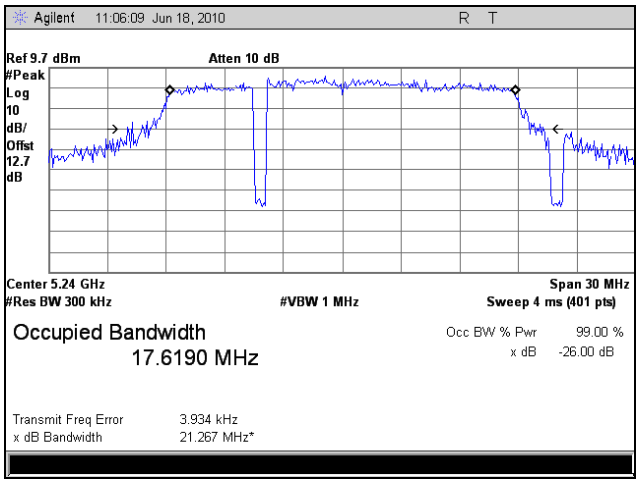
Plot 15. -26dB Occupied Bandwidth, 5700 MHz, 802.11a



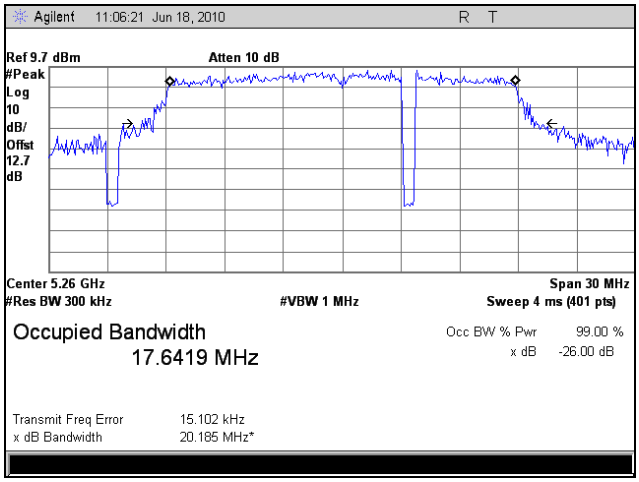
Plot 16. -26dB Occupied Bandwidth, 5180 MHz, 802.11n 20MHz



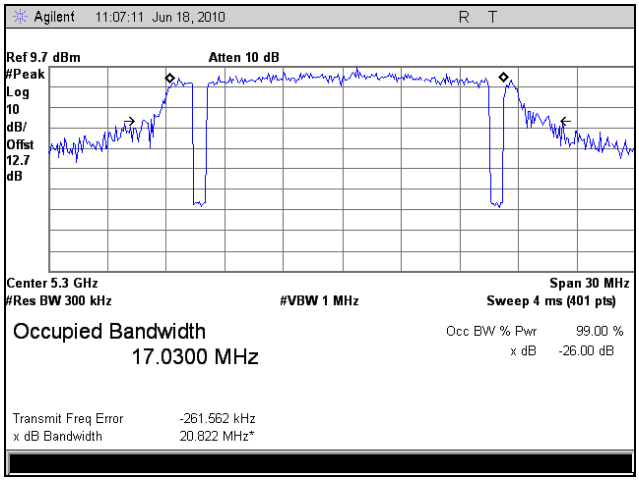
Plot 17. -26dB Occupied Bandwidth, 5200 MHz, 802.11n 20MHz



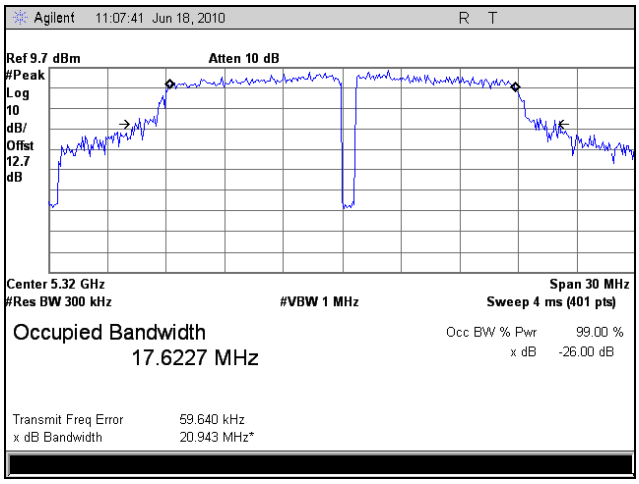
Plot 18. -26dB Occupied Bandwidth, 5240 MHz, 802.11n 20MHz



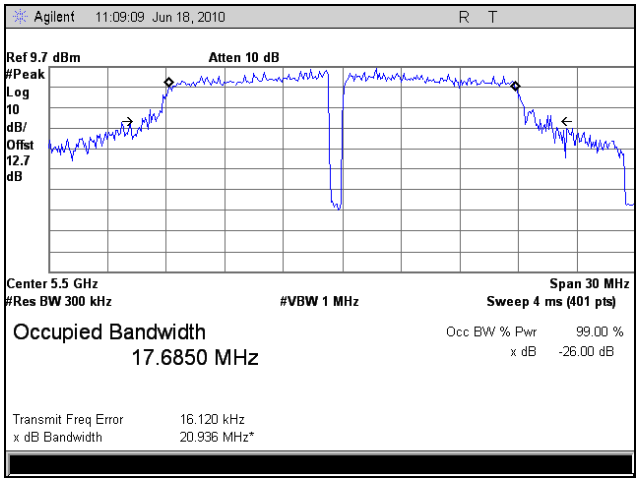
Plot 19. -26dB Occupied Bandwidth, 5260 MHz, 802.11n 20MHz



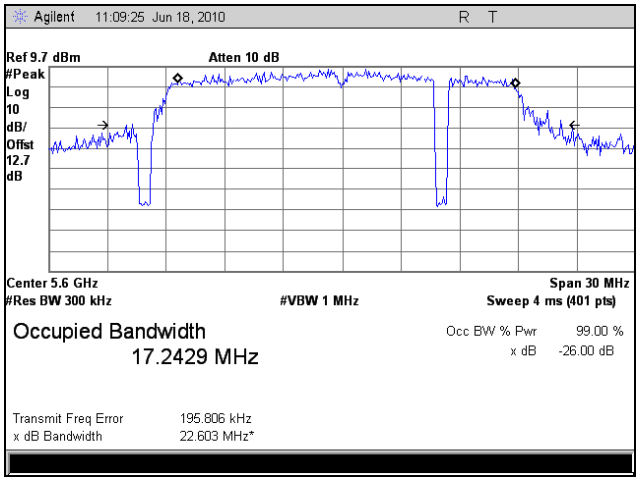
Plot 20. -26dB Occupied Bandwidth, 5300 MHz, 802.11n 20MHz



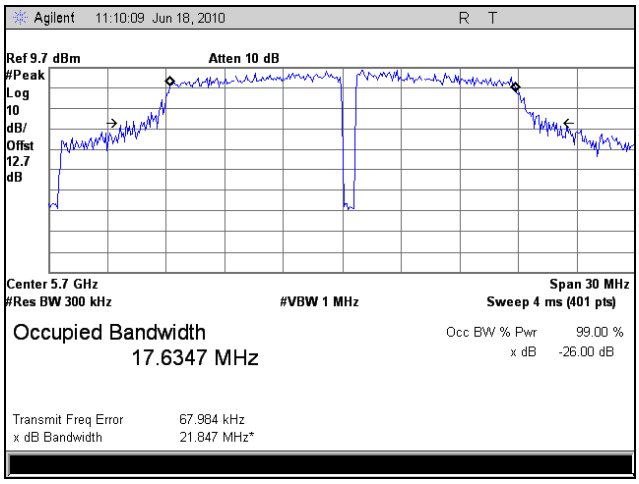
Plot 21. -26dB Occupied Bandwidth, 5320 MHz, 802.11n 20MHz



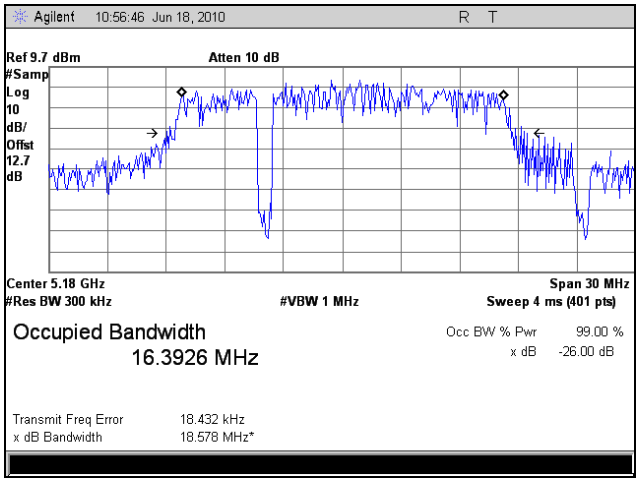
Plot 22. -26dB Occupied Bandwidth, 5500 MHz, 802.11n 20MHz



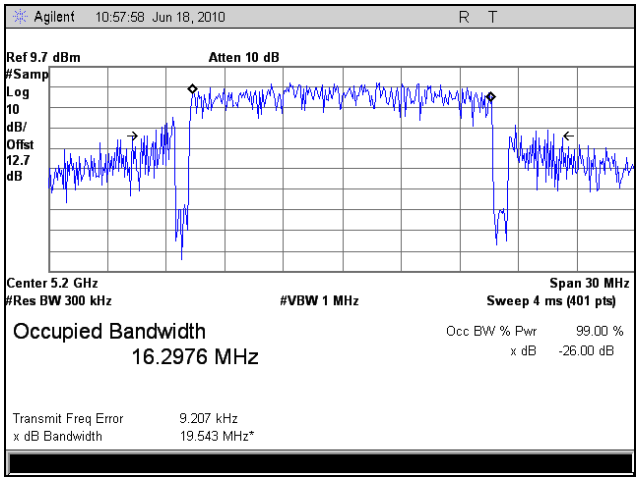
Plot 23. -26dB Occupied Bandwidth, 5600 MHz, 802.11n 20MHz



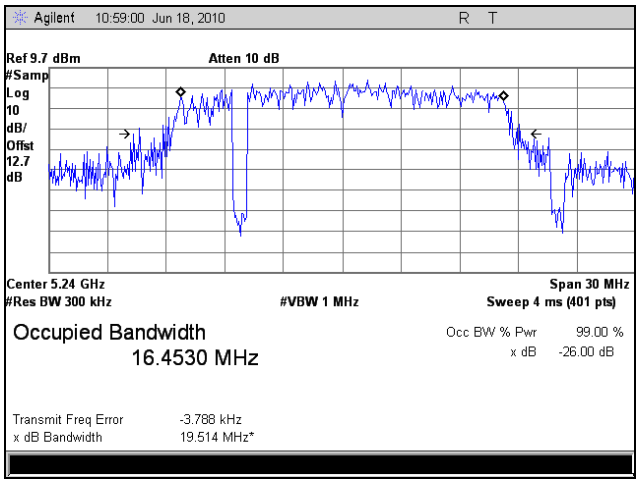
Plot 24. -26dB Occupied Bandwidth, 5700 MHz, 802.11n 20MHz



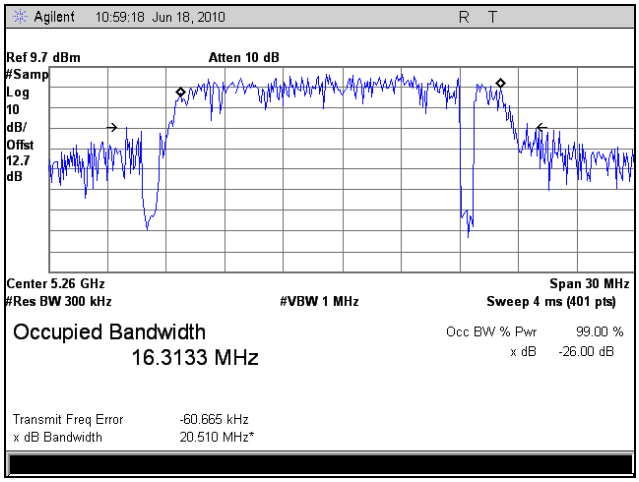
Plot 25. 99% Occupied Bandwidth, 5180 MHz, 802.11a



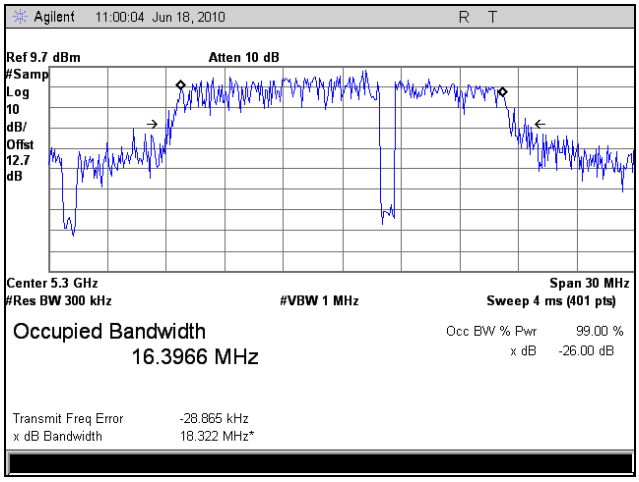
Plot 26. 99% Occupied Bandwidth, 5200 MHz, 802.11a



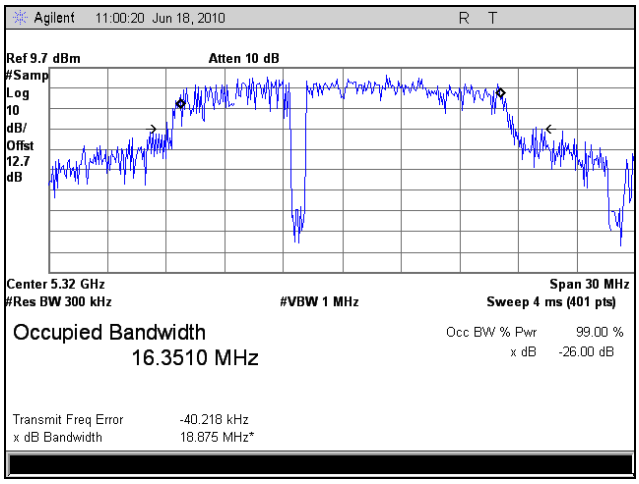
Plot 27. 99% Occupied Bandwidth, 5240 MHz, 802.11a



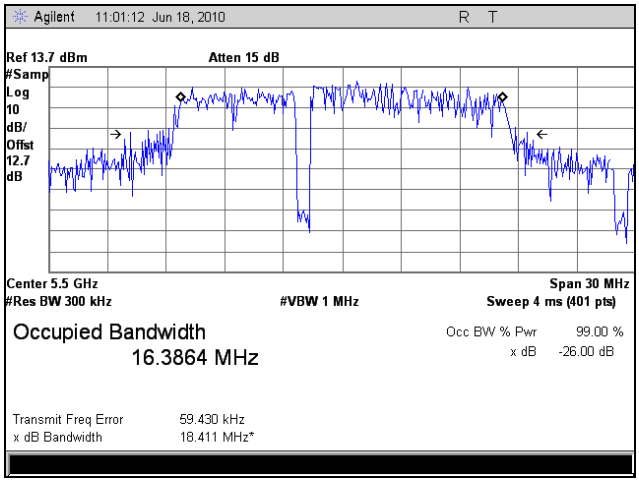
Plot 28. 99% Occupied Bandwidth, 5260 MHz, 802.11a



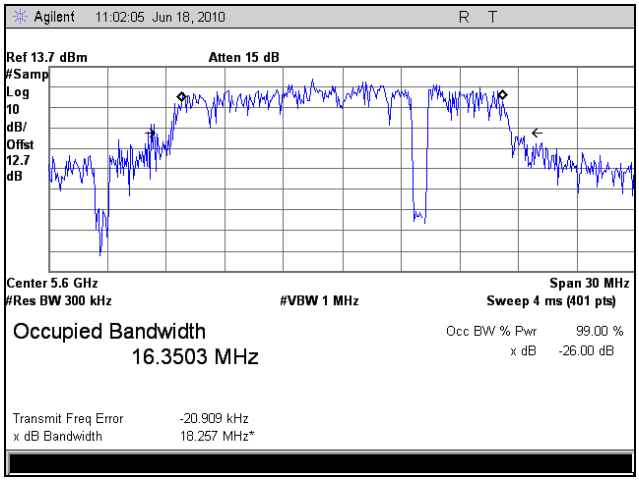
Plot 29. 99% Occupied Bandwidth, 5300 MHz, 802.11a



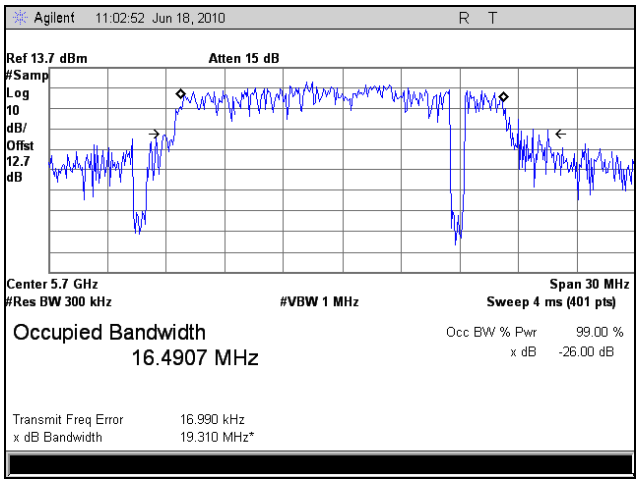
Plot 30. 99% Occupied Bandwidth, 5320 MHz, 802.11a



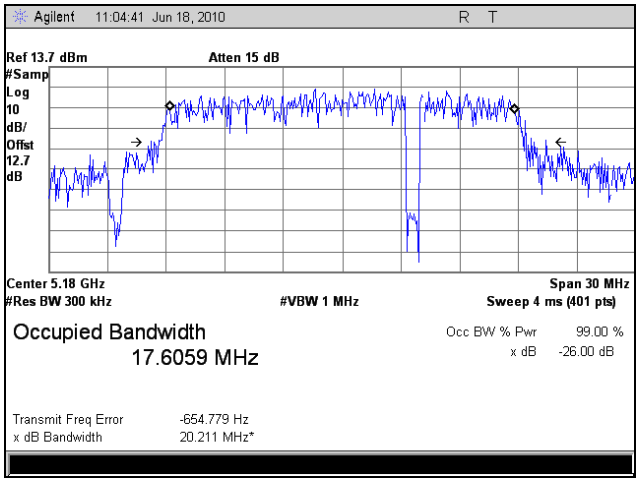
Plot 31. 99% Occupied Bandwidth, 5500 MHz, 802.11a



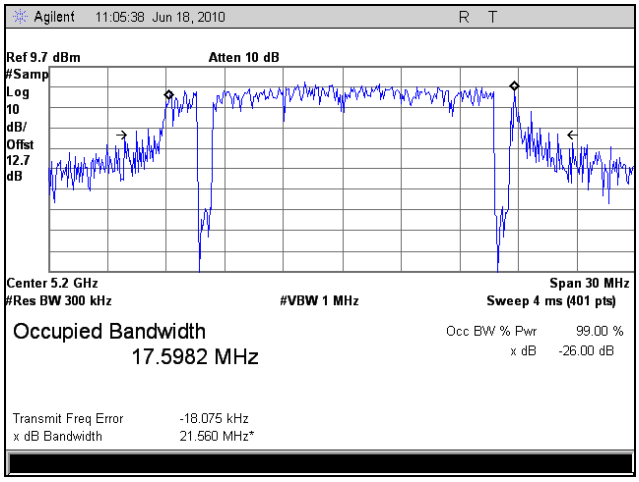
Plot 32. 99% Occupied Bandwidth, 5600 MHz, 802.11a



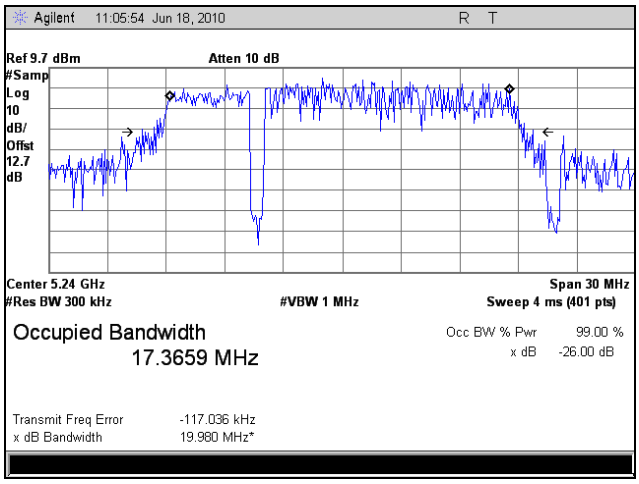
Plot 33. 99% Occupied Bandwidth, 5700 MHz, 802.11a



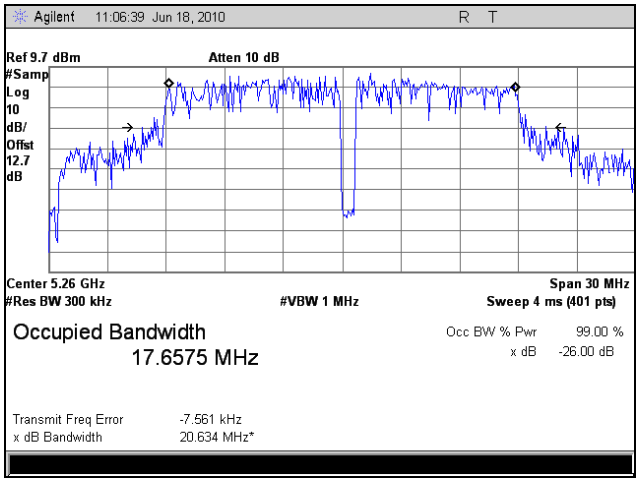
Plot 34. 99% Occupied Bandwidth, 5180 MHz, 802.11n 20MHz



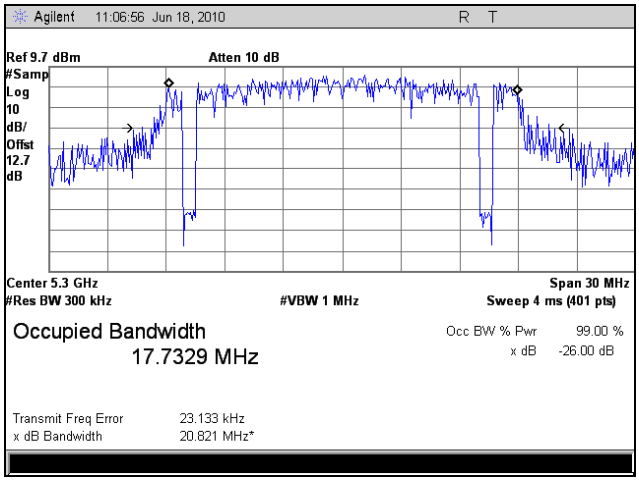
Plot 35. 99% Occupied Bandwidth, 5200 MHz, 802.11n 20MHz



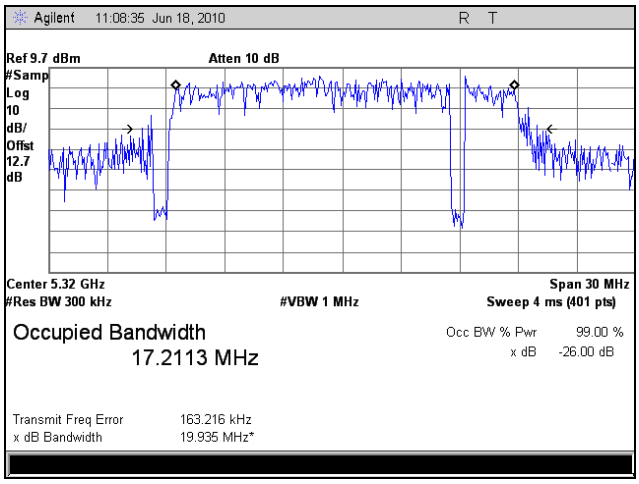
Plot 36. 99% Occupied Bandwidth, 5240 MHz, 802.11n 20MHz



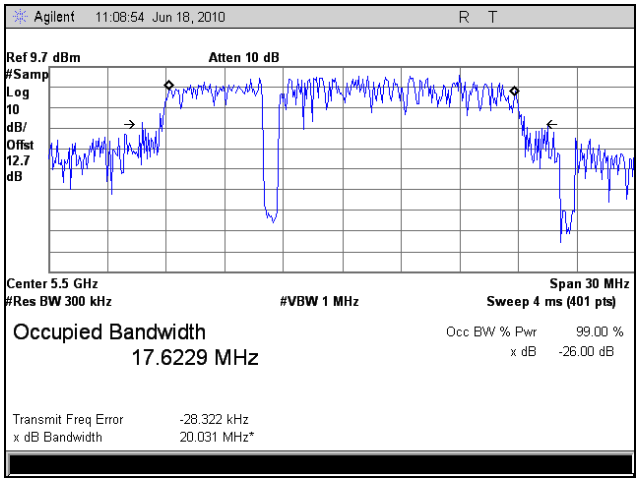
Plot 37. 99% Occupied Bandwidth, 5260 MHz, 802.11n 20MHz



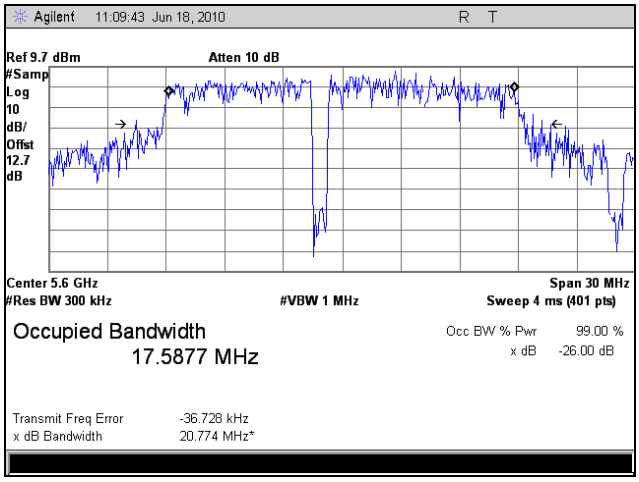
Plot 38. 99% Occupied Bandwidth, 5300 MHz, 802.11n 20MHz



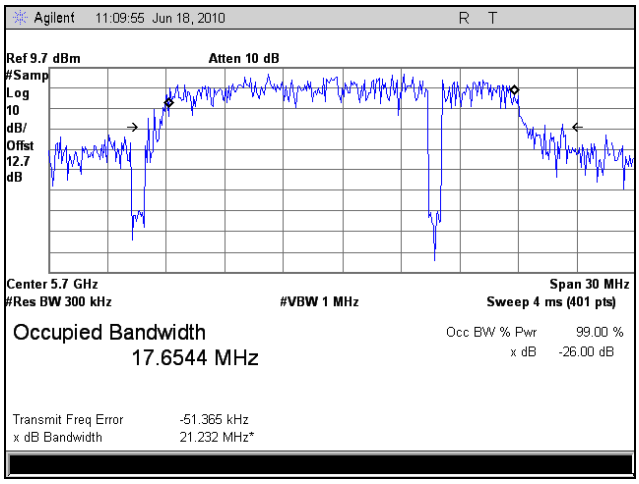
Plot 39. -99% Occupied Bandwidth, 5320 MHz, 802.11n 20MHz



Plot 40. 99% Occupied Bandwidth, 5500 MHz, 802.11n 20MHz



Plot 41. 99% Occupied Bandwidth, 5600 MHz, 802.11n 20MHz



Plot 42. 99% Occupied Bandwidth, 5700 MHz, 802.11n 20MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 407(a)(3) RF Power Output

Test Requirements: **§15.407(a) (3):** The maximum output power of the intentional radiator shall not exceed the following:

Digital Transmission Systems (MHz)	Output Limit
5150-5250	50mW
5250-5350	250mW
5470–5725	250mW
5725–5825	1W

Table 17. Output Power Requirements from §15.407

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

§15.407(a) (2): For the band 5.25–5.35 GHz and 5.47 – 5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, 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 at the maximum power level.

Test Results: Equipment was compliant with the Peak Power Output limits of **§ 15.401(a)(2)**.

Test Engineer(s): Minh Ly

Test Date(s): 06/04/10 and 08/23/10

Maximum Conducted Output Power			
Mode	**Frequency (MHz)**	**Measured Output Power (dBm)**	**Limit**
802.11a	5180	13.67	17
	5200	14.00	17
	5240	13.65	17
	5260	17.30	24
	5300	17.23	24
	5320	17.20	24
	5500	18.60	24
	5600	18.34	24
	5700	18.53	24
HT20	5180	14.36	17
	5200	13.87	17
	5240	14.39	17
	5260	17.33	24
	5300	17.38	24
	5320	17.34	24
	5500	18.52	24
	5600	18.49	24
	5700	18.05	24

Table 18. RF Power Output, Test Results

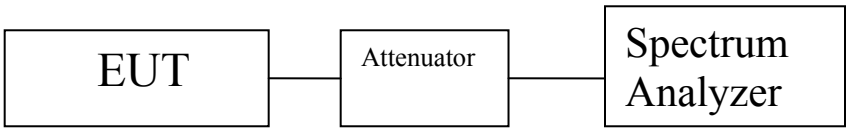
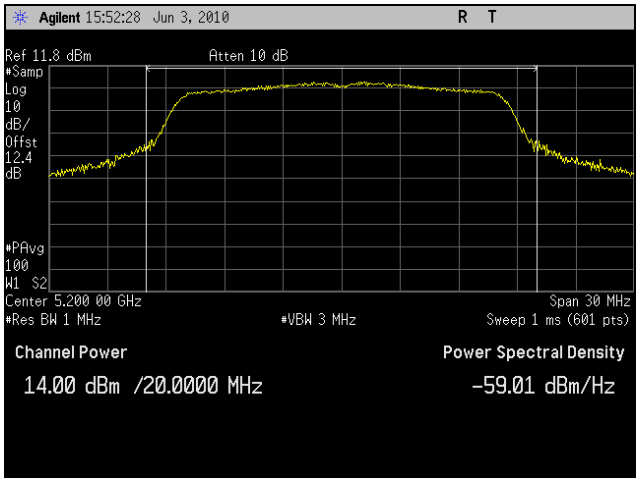


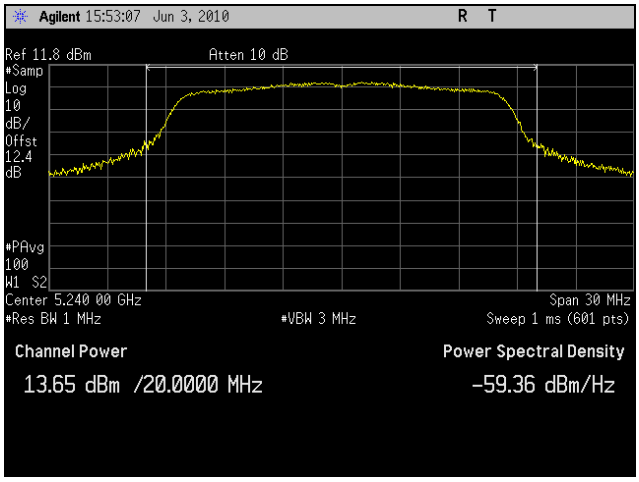
Figure 2. Power Output Test Setup

RF Output Power Test Results

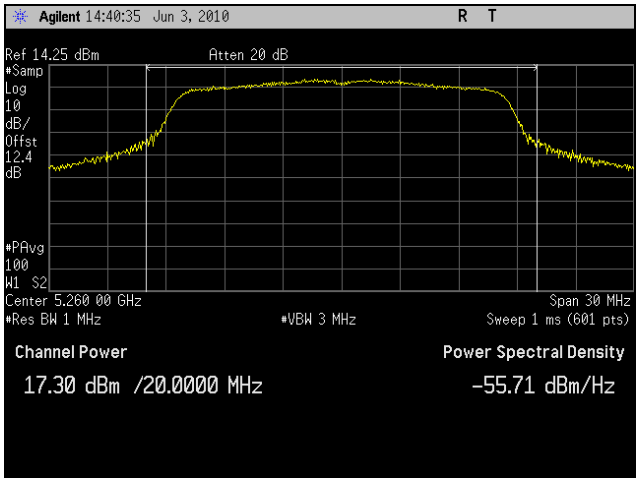
Plot 43. RF Power Output, 5180 MHz, 802.11a



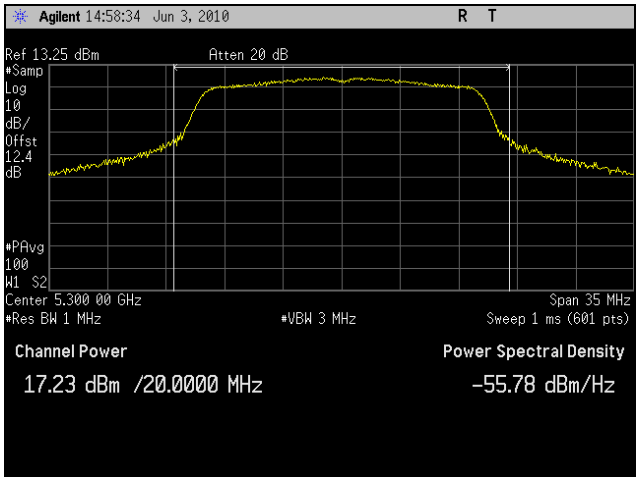
Plot 44. RF Power Output, 5200 MHz, 802.11a



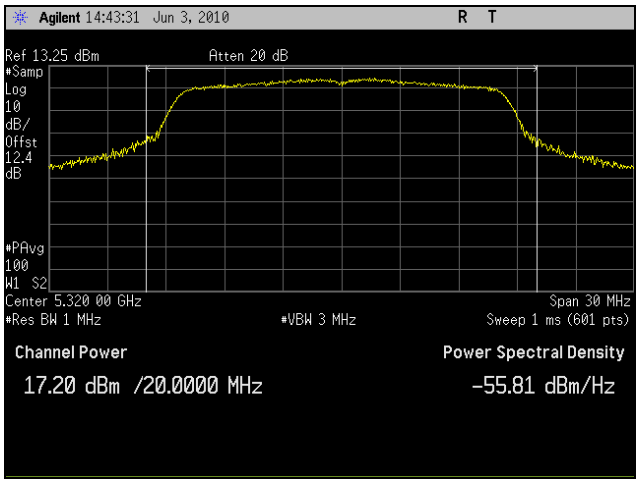
Plot 45. RF Power Output, 5240 MHz, 802.11a



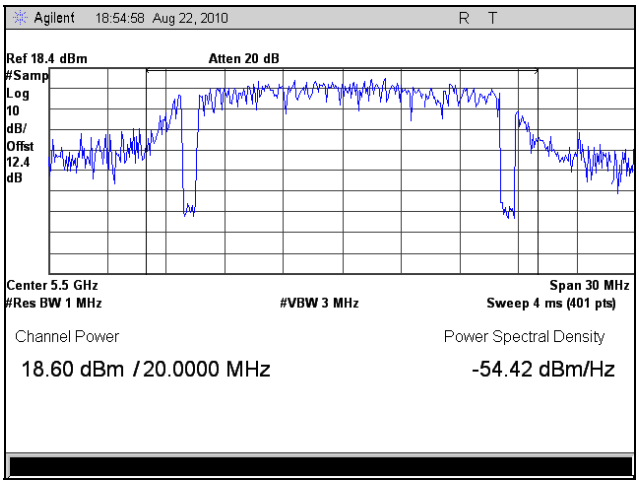
Plot 46. RF Power Output, 5260 MHz, 802.11a



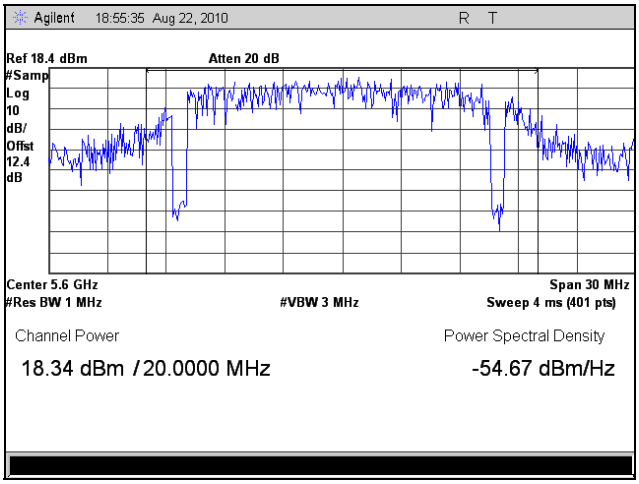
Plot 47. RF Power Output, 5300 MHz, 802.11a



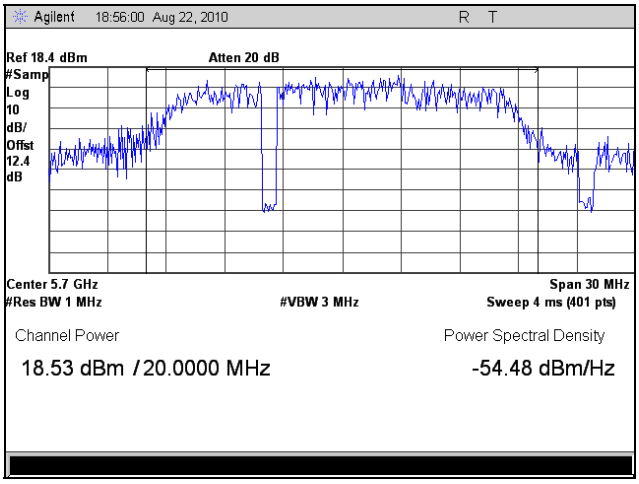
Plot 48. RF Power Output, 5320 MHz, 802.11a



Plot 49. RF Power Output, 5500 MHz, 802.11a

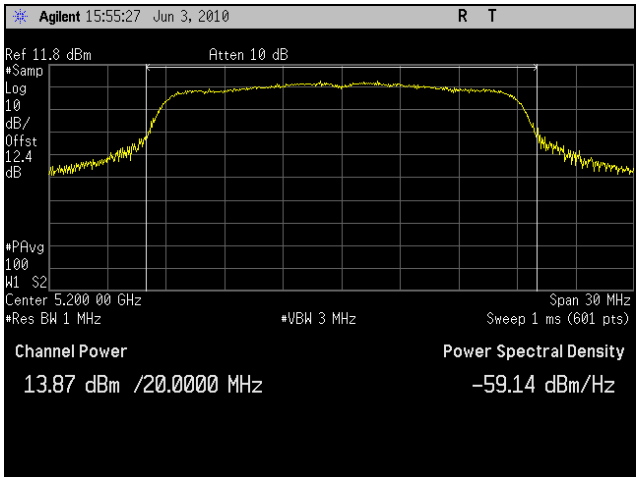


Plot 50. RF Power Output, 5600 MHz, 802.11a

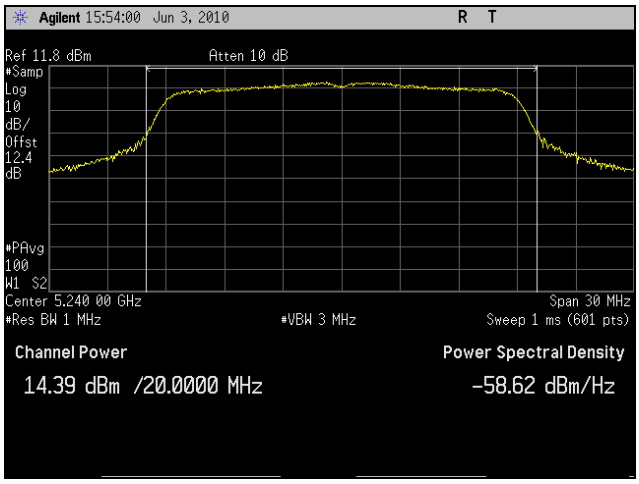


Plot 51. RF Power Output, 5700 MHz, 802.11a

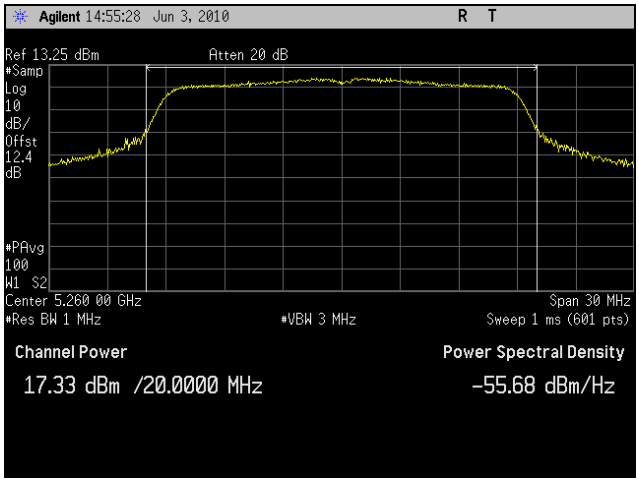
Plot 52. RF Power Output, 5180 MHz, 802.11n 20MHz



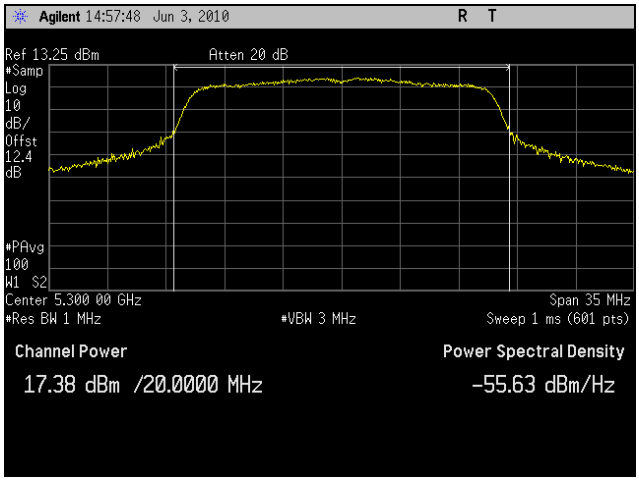
Plot 53. RF Power Output, 5200 MHz, 802.11n 20MHz



Plot 54. RF Power Output, 5240 MHz, 802.11n 20MHz

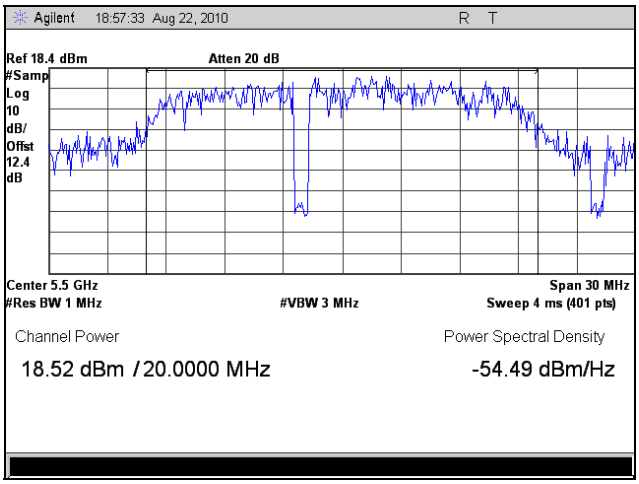


Plot 55. RF Power Output, 5260 MHz, 802.11n 20MHz

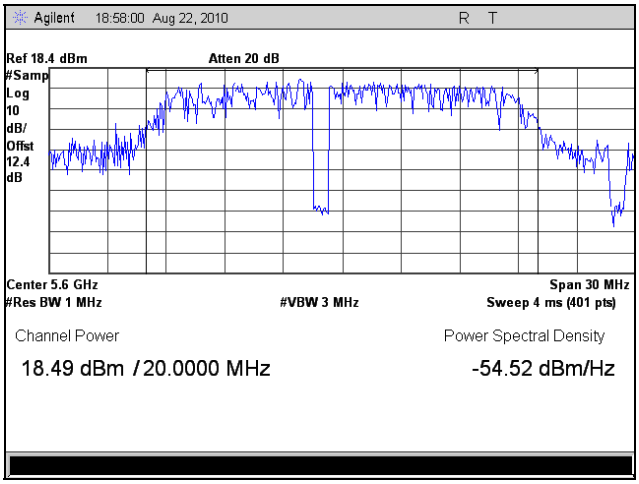


Plot 56. RF Power Output, 5300 MHz, 802.11n 20MHz

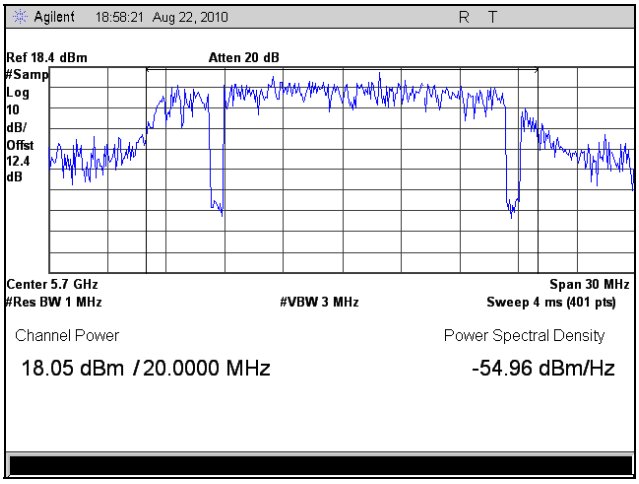
Plot 57. RF Power Output, 5320 MHz, 802.11n 20MHz



Plot 58. RF Power Output, 5500 MHz, 802.11n 20MHz



Plot 59. RF Power Output, 5600 MHz, 802.11n 20MHz



Plot 60. RF Power Output, 5700 MHz, 802.11n 20MHz

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 @ 5150-5250 MHz , 5250-5350MHz and 5470-5725MHz; highest conducted power = 18.60dBm (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 = **4.09 dBi**

where, S = Power Density (1 mW/cm^2)
P = Power Input to antenna (226.98 mW)
G = Antenna Gain (7.943 numeric)

S = (72.44*2.56 / 4*3.14*20.0^2) = (185.78 / 5024) = **0.036mW/cm^2**@ 20cm separation

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(a)(3) Peak Power Spectral Density

Test Requirements: **§ 15.407(a)(1) & (2):** The peak power spectral density shall not exceed 4 dBm in any 1-MHz band for the band 5.15-5.25 GHz and 11dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, Omni directional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

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 DA 02-2138 was used.

Test Results: Equipment was compliant with the peak power spectral density limits of **§ 15.407 (a)(1) and § 15.407 (a)(2).** The peak power spectral density was determined from plots on the following page(s).

Test Engineer(s): Minh Ly

Test Date(s): 06/04/10 and 08/23/10

Mode	Frequency (MHz)	PSD (dBm)
802.11a	5180	3.869
	5200	3.949
	5240	3.881
	5260	7.502
	5300	8.086
	5320	8.340
	5500	8.645
	5600	8.660
	5700	8.032
802.11n 20MHz	5180	3.846
	5200	3.820
	5240	3.837
	5260	6.91
	5300	7.313
	5320	7.325
	5500	8.120
	5600	8.094
	5700	7.891

Table 19. Power Spectral Density, Test Results

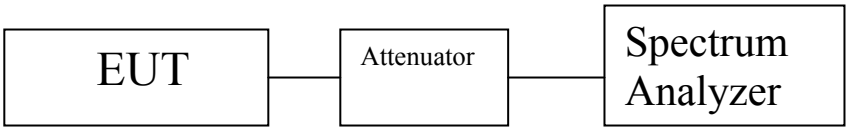
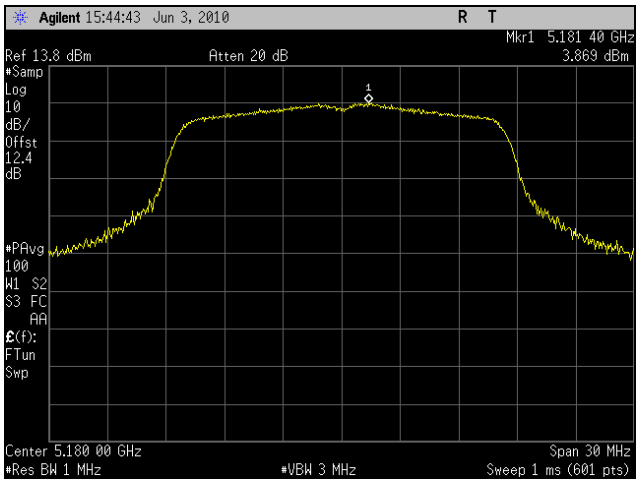
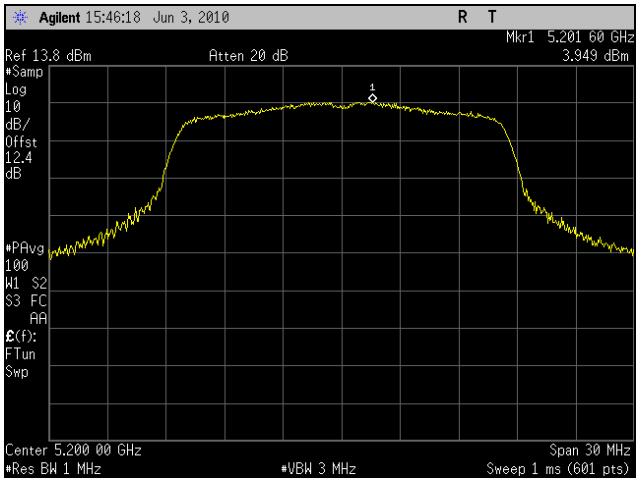


Figure 3. Power Spectral Density Test Setup

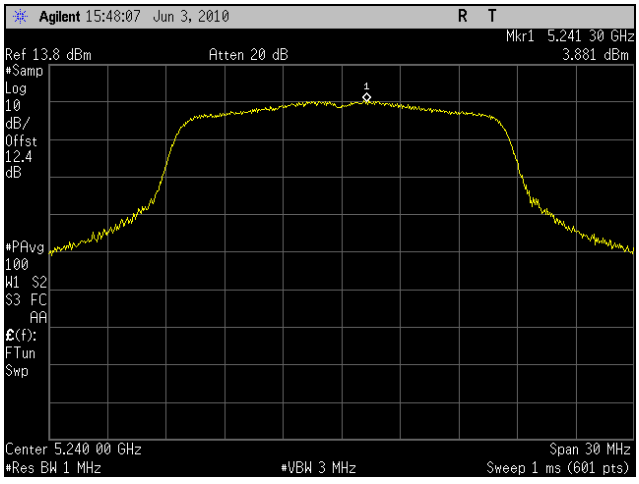
Power Spectral Density Test Results



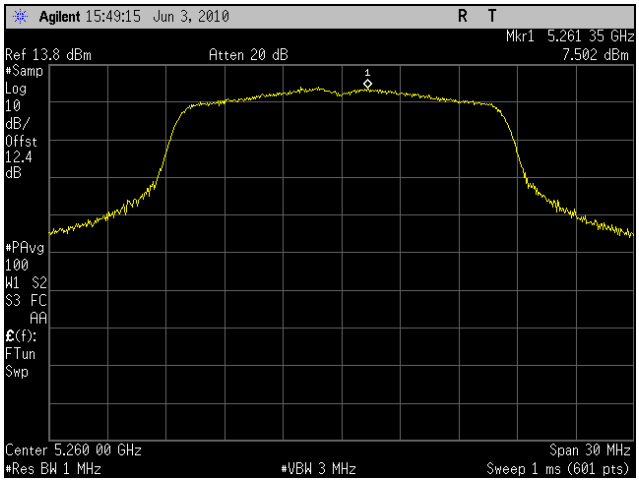
Plot 61. Power Spectral Density, 5180 MHz, 802.11a



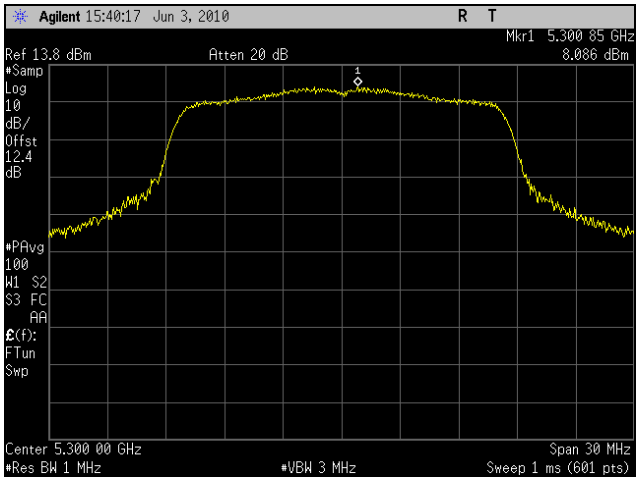
Plot 62. Power Spectral Density, 5200 MHz, 802.11a



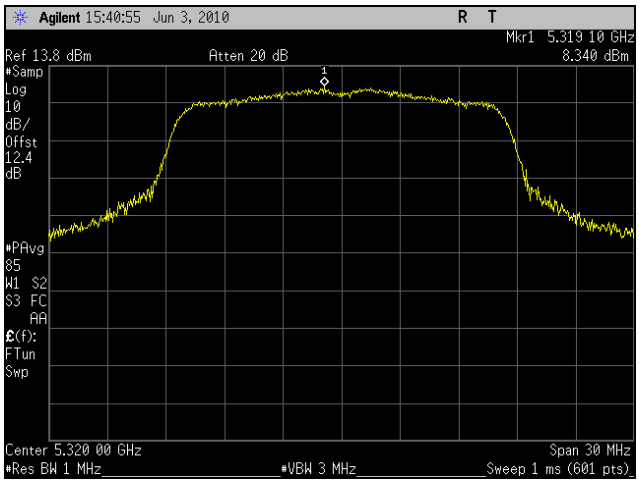
Plot 63. Power Spectral Density, 5240 MHz, 802.11a



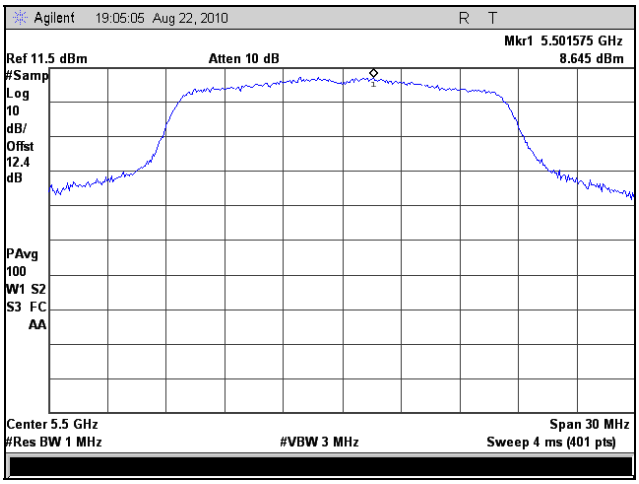
Plot 64. Power Spectral Density, 5260 MHz, 802.11a



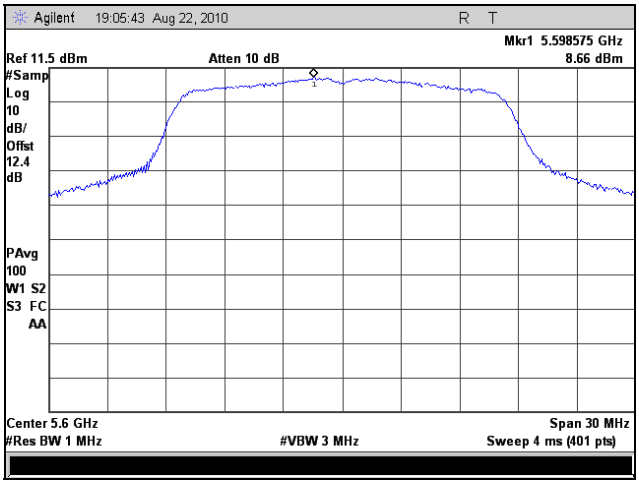
Plot 65. Power Spectral Density, 5300 MHz, 802.11a



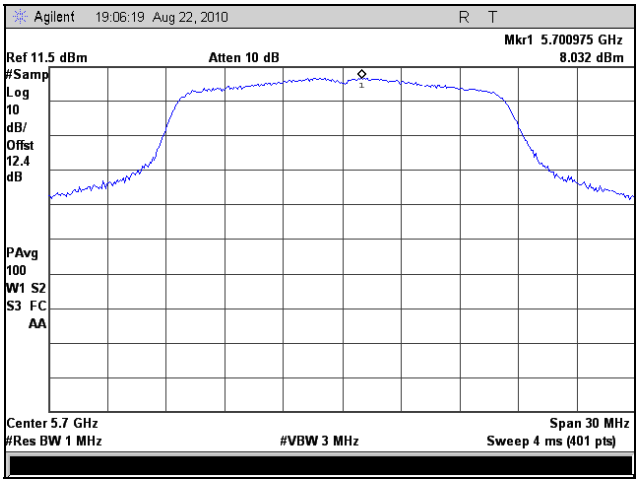
Plot 66. Power Spectral Density, 5320 MHz, 802.11a



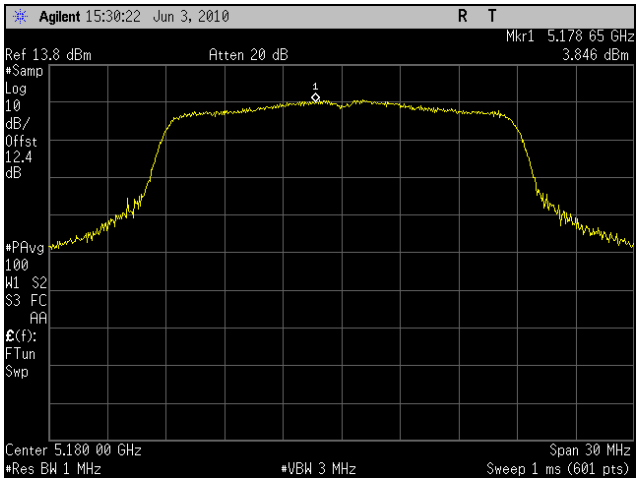
Plot 67. Power Spectral Density, 5500 MHz, 802.11a



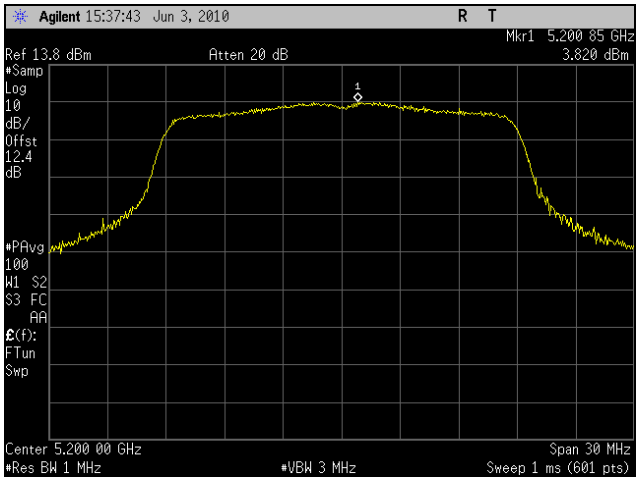
Plot 68. Power Spectral Density, 5600 MHz, 802.11a



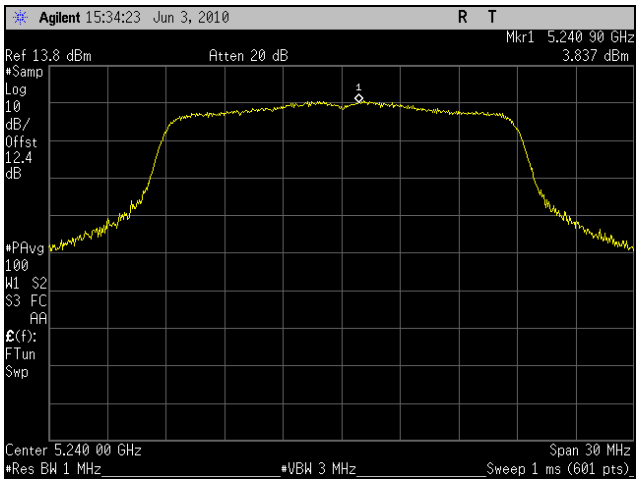
Plot 69. Power Spectral Density, 5700 MHz, 802.11a



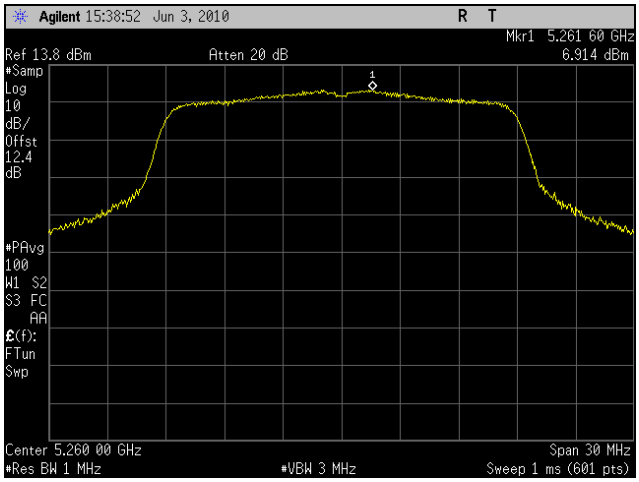
Plot 70. Power Spectral Density, 5180 MHz, 802.11n 20MHz



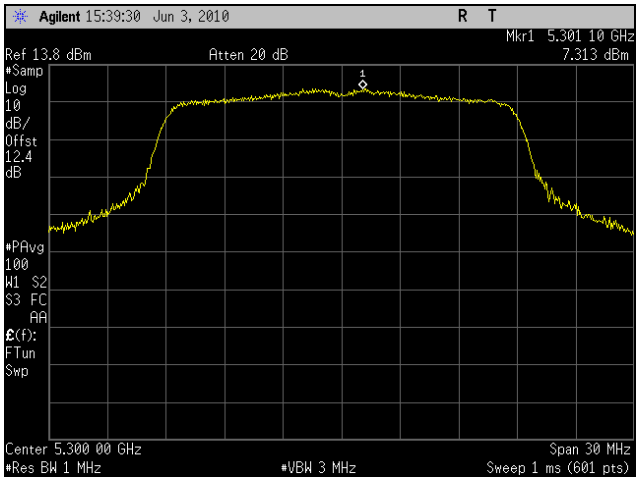
Plot 71. Power Spectral Density, 5200 MHz, 802.11n 20MHz



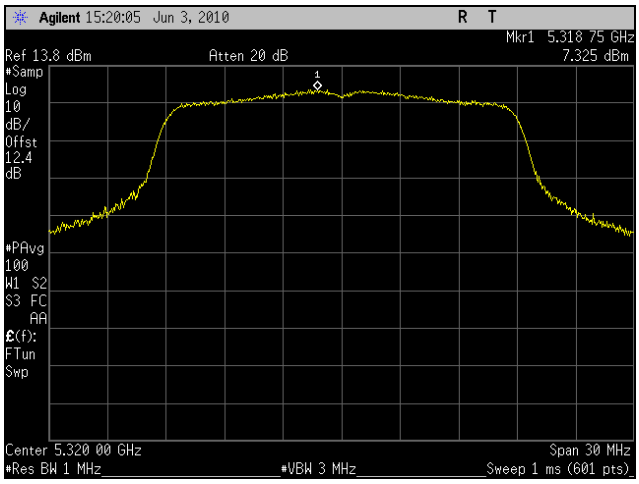
Plot 72. Power Spectral Density, 5240 MHz, 802.11n 20MHz



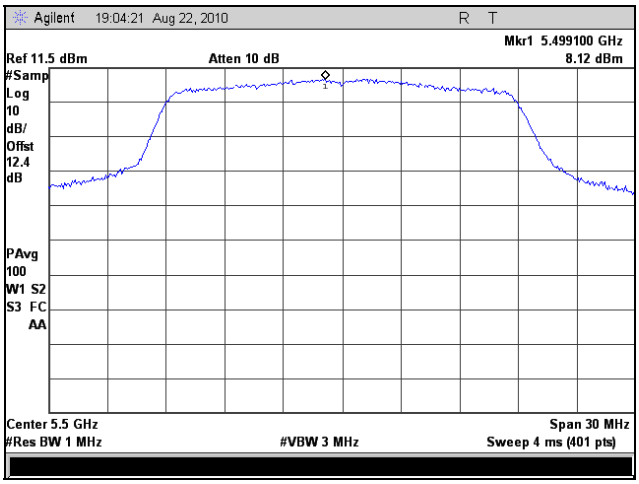
Plot 73. Power Spectral Density, 5260 MHz, 802.11n 20MHz



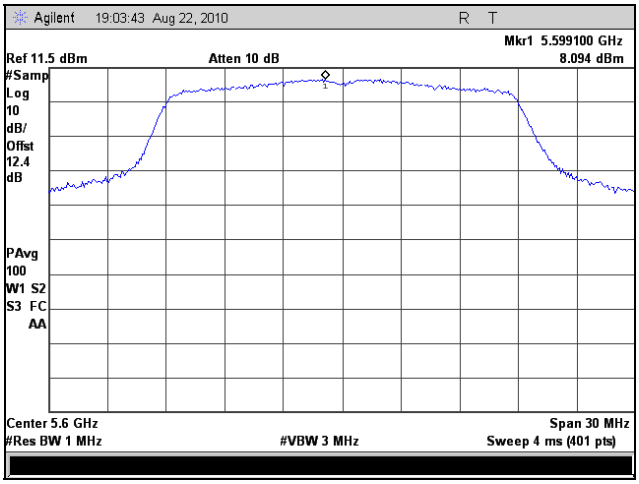
Plot 74. Power Spectral Density, 5300 MHz, 802.11n 20MHz



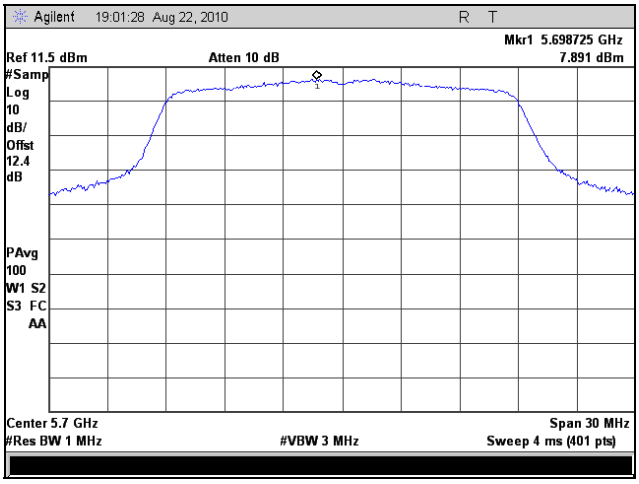
Plot 75. Power Spectral Density, 5320 MHz, 802.11n 20MHz



Plot 76. Power Spectral Density, 5500 MHz, 802.11n 20MHz



Plot 77. Power Spectral Density, 5600 MHz, 802.11n 20MHz



Plot 78. Power Spectral Density, 5700 MHz, 802.11n 20MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(a)(6) Peak Excursion Ratio

Test Requirements: **§ 15.407(a)(6):** The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

Test Procedure: 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 according to measurement method #1 from the FCC Public Notice DA 02-2138 for making conducted power measurements.

Test Results: Equipment was compliant 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): 06/18/10 and 08/23/10

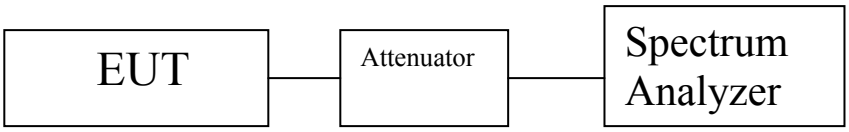
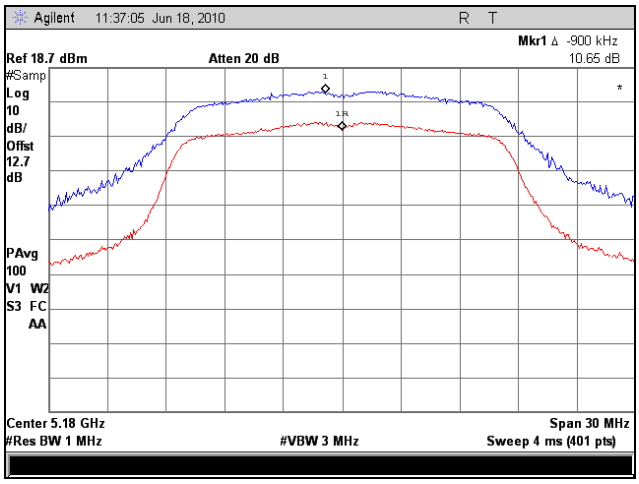
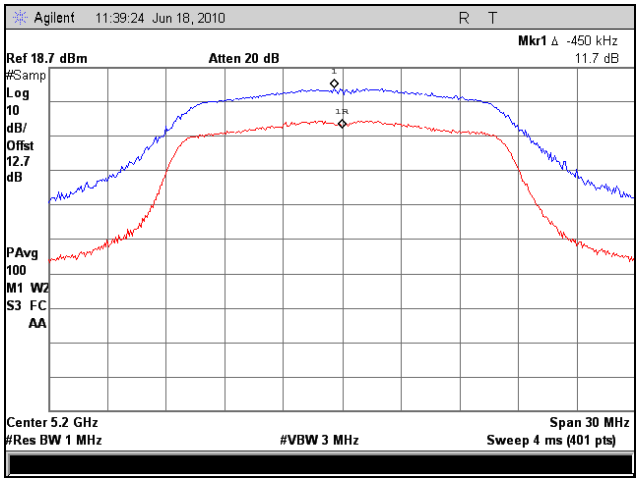


Figure 4. Peak Excursion Ration Test Setup

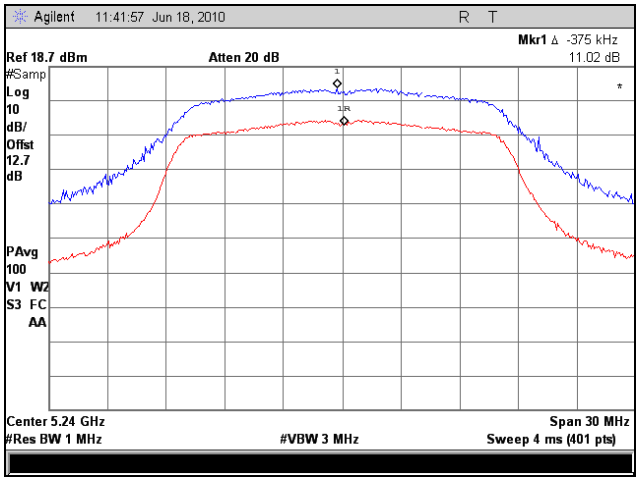
Peak Excursion Test Results



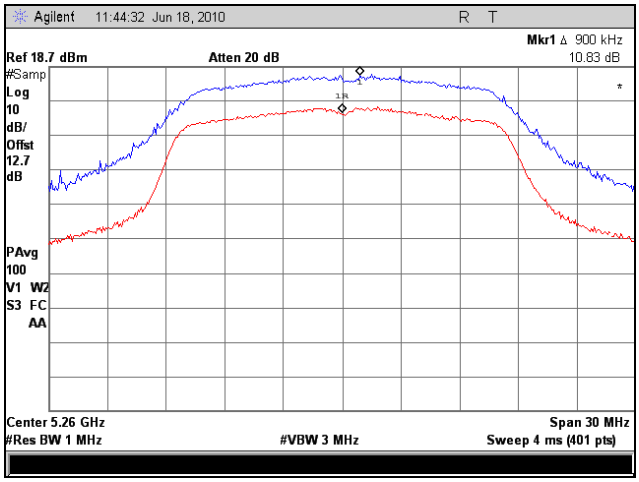
Plot 79. Peak Excursion Ratio, 5180 MHz, 802.11a



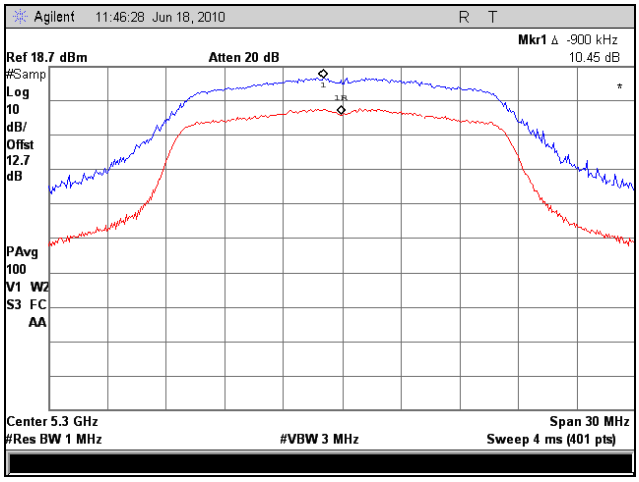
Plot 80. Peak Excursion Ratio, 5200 MHz, 802.11a



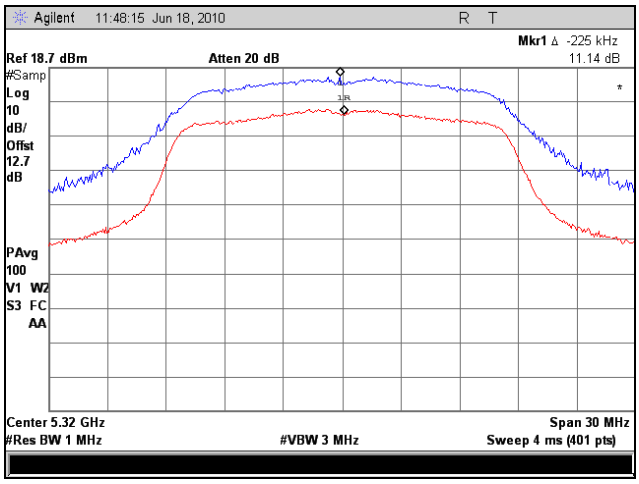
Plot 81. Peak Excursion Ratio, 5240 MHz, 802.11a



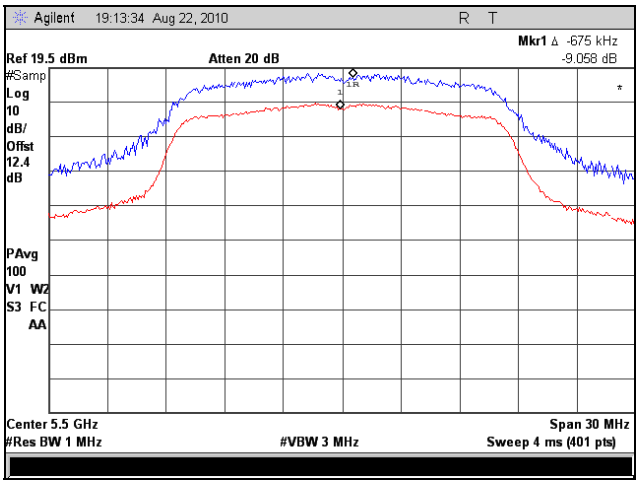
Plot 82. Peak Excursion Ratio, 5260 MHz, 802.11a



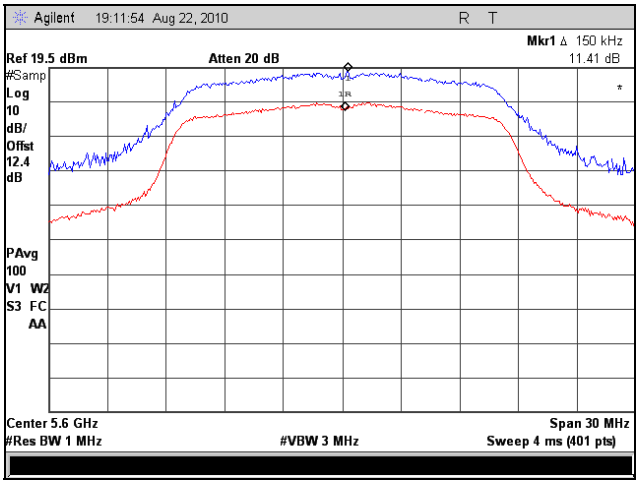
Plot 83. Peak Excursion Ratio, 5300 MHz, 802.11a



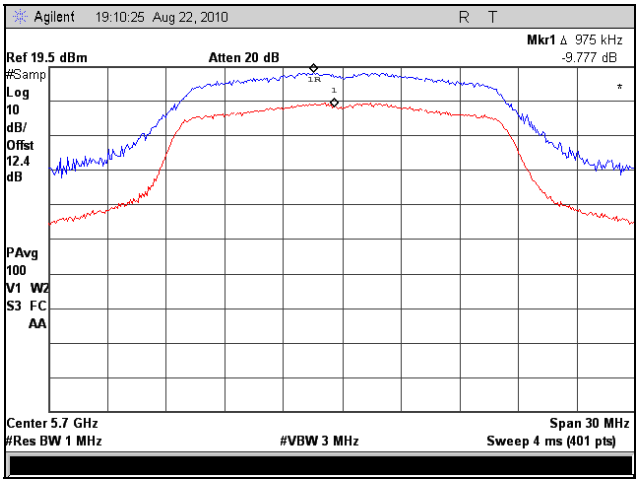
Plot 84. Peak Excursion Ratio, 5320 MHz, 802.11a



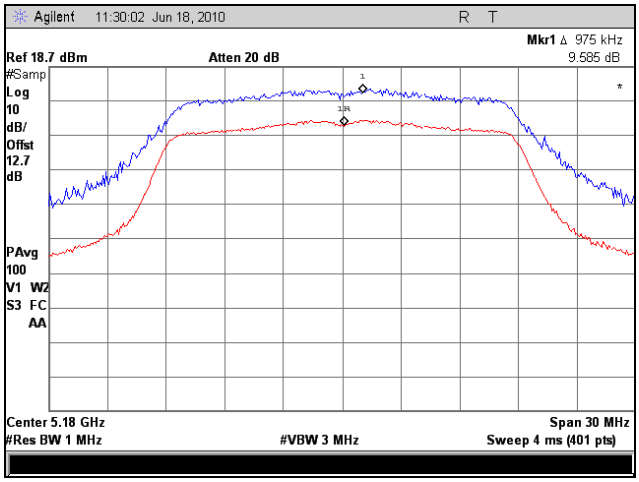
Plot 85. Peak Excursion Ratio, 5500 MHz, 802.11a



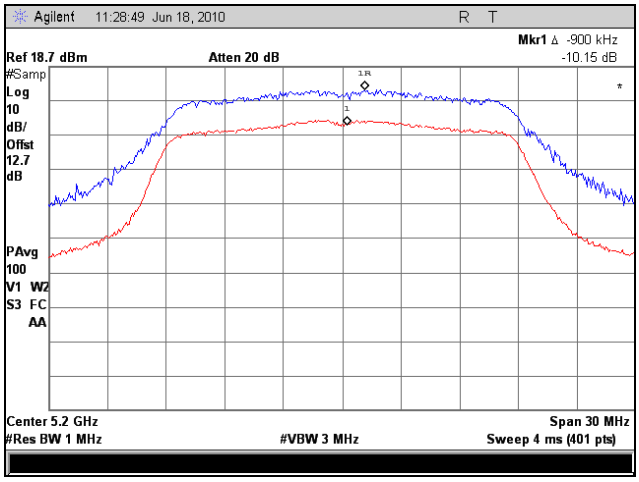
Plot 86. Peak Excursion Ratio, 5600 MHz, 802.11a



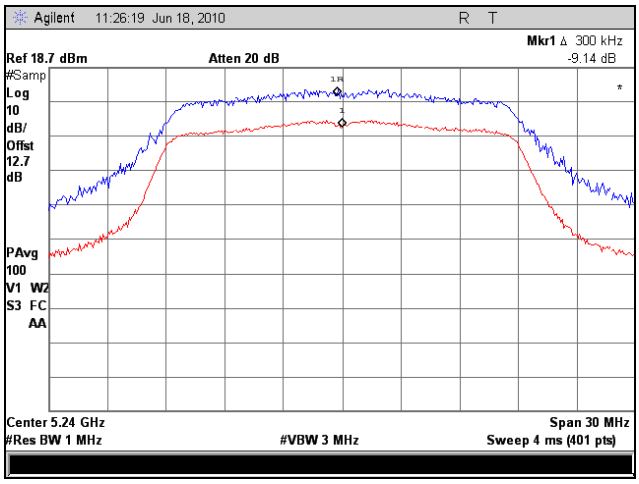
Plot 87. Peak Excursion Ratio, 5700 MHz, 802.11a



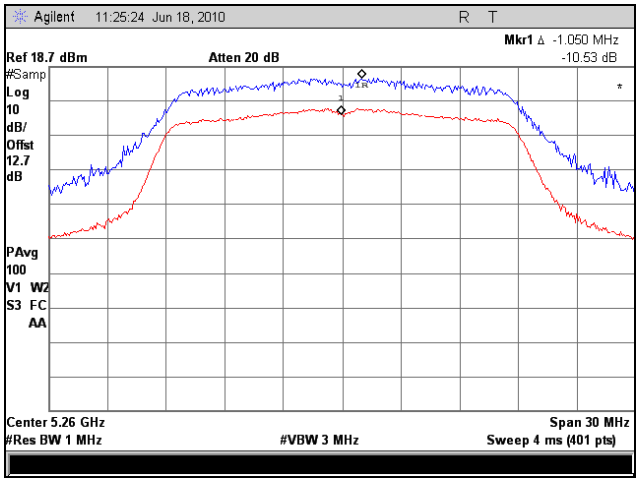
Plot 88. Peak Excursion Ratio, 5180 MHz, 802.11n 20MHz



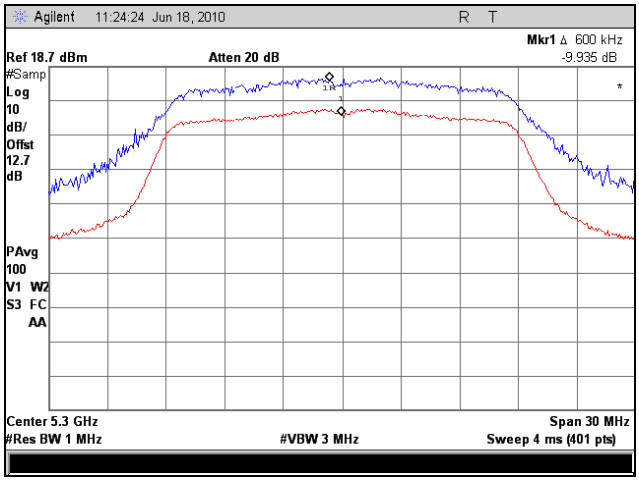
Plot 89. Peak Excursion Ratio, 5200 MHz, 802.11n 20MHz



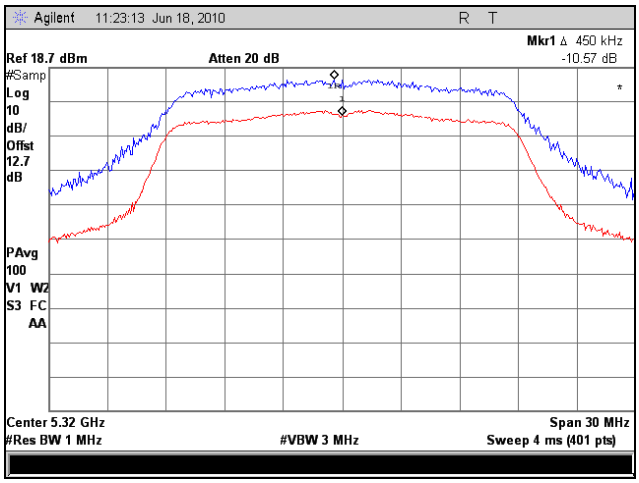
Plot 90. Peak Excursion Ratio, 5240 MHz, 802.11n 20MHz



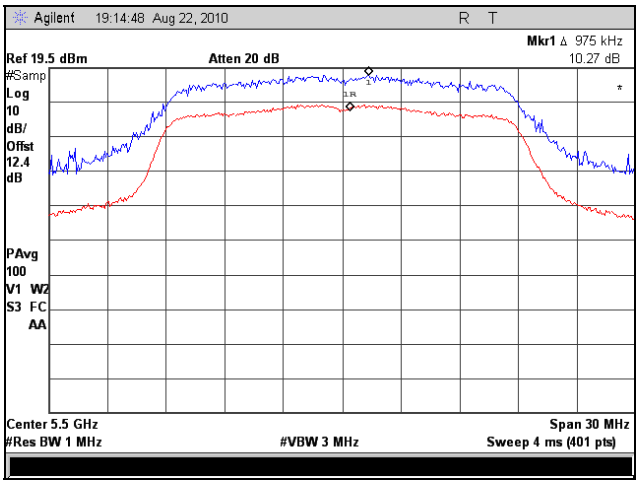
Plot 91. Peak Excursion Ratio, 5260 MHz, 802.11n 20MHz



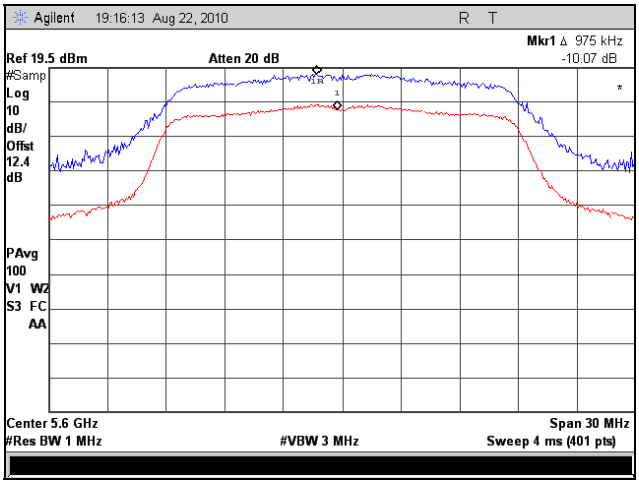
Plot 92. Peak Excursion Ratio, 5300 MHz, 802.11n 20MHz



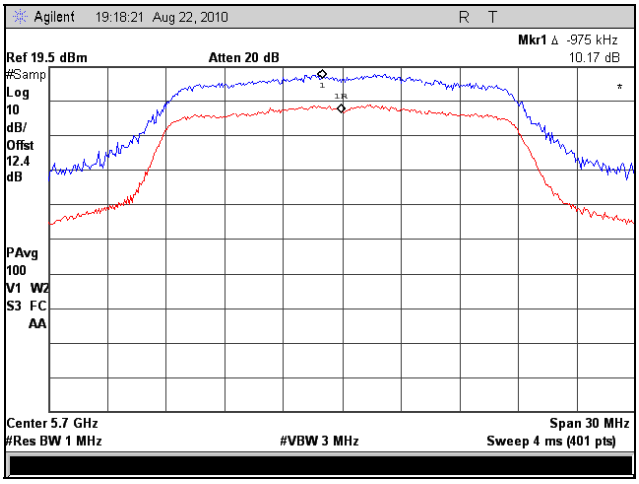
Plot 93. Peak Excursion Ratio, 5320 MHz, 802.11n 20MHz



Plot 94. Peak Excursion Ratio, 5500 MHz, 802.11n 20MHz



Plot 95. Peak Excursion Ratio, 5600 MHz, 802.11n 20MHz



Plot 96. Peak Excursion Ratio, 5700 MHz, 802.11n 20MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(b) Undesirable Emissions

Test Requirements: **§ 15.407(b)(1,2,3), (b)(6), (b)(7), §15.205:** Emissions outside the frequency band.

§ 15.407(b)(1,2,3): For transmitters operating in the 5.15-5.25 GHz band and 5.25-5.35 GHz and 5.47-5.725GHz: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm/MHz.

§ 15.407(b)(6): Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Section 15.207.

§ 15.407(b)(7): The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

Test Procedure: The transmitter was placed on an acrylic stand inside in a semi-anechoic chamber. Measurements were performed with the EUT rotated 360 degrees and varying the adjustable antenna mast height to determine worst case orientation for maximum emissions.

For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

For measurements above 1 GHz, measurements were made with a Peak detector with 1 MHz resolution bandwidth. Where the spurious emissions fell into a restricted band, measurements were also made with an average detector to make sure they complied with 15.209 limits. Emissions were explored up to 40 GHz.
The equation, **EIRP= E + 20 log D – 104.8** was used to convert an EIRP limit to a field strength limit.
E = field strength (dBuV/m)
D = Reference measurement distance (m)

Test Results: The EUT was compliant with the Radiated Emission limits for Intentional Radiators. See following pages for detailed test results.

Test Engineer(s): Minh Ly

Test Date(s): 06/04/10 and 08/23/10

§ 15.407(b)(4): Harmonic and Spurious Emissions Requirements – Radiated

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)
5180 MHz									
10.36	H	46.13	34.77	37.47	6.20	55.03	Peak	68.23	-13.20
15.54	H	49.15	35.36	40.43	7.71	61.93	Peak	74	-12.07
15.54	H	32.68	35.36	40.43	7.71	45.46	Avg.	54	-8.54
5240 MHz									
10.48	H	44.96	34.79	37.57	6.19	53.92	Peak	68.23	-14.31
15.72	H	46.71	35.32	40.57	7.83	59.80	Peak	74	-14.20
15.72	H	34.18	35.32	40.57	7.83	47.27	Avg.	54	-6.73
5260 MHz									
10.52	H	44.53	34.79	37.59	6.19	53.53	Peak	68.23	-14.70
15.78	H	45.87	35.26	40.61	7.89	59.11	Peak	74	-14.89
15.78	H	34.77	35.26	40.61	7.89	48.01	Avg.	54	-5.99
5320 MHz									
10.64	H	43.82	34.74	37.64	6.19	52.91	Peak	74	-21.09
10.64	H	31.37	34.74	37.64	6.19	40.46	Avg.	54	-13.54
15.96	H	45.86	35.04	40.71	8.06	59.58	Peak	74	-14.42
15.96	H	34.22	35.04	40.71	8.06	47.94	Avg.	54	-6.06
5500 MHz									
11	H	44.33	34.71	37.73	6.18	53.53	Peak	74	-20.47
11	H	31.09	34.71	37.73	6.18	40.29	Avg.	54	-13.71
16.5	H	46.39	34.27	40.99	8.20	61.31	Peak	68.23	-6.92
5600 MHz									
11.2	H	44.44	34.71	37.87	6.21	53.82	Peak	74	-20.18
11.2	H	29.7	34.71	37.87	6.21	39.08	Avg.	54	-14.92
16.8	H	45.69	34.20	40.78	8.11	60.37	Peak	68.23	-7.86
5700 MHz									
11.4	H	44.11	34.69	38.06	6.28	53.76	Peak	74	-20.24
11.4	H	29.86	34.69	38.06	6.28	39.51	Avg.	54	-14.49
17.1	H	45.13	34.14	40.73	7.98	59.70	Peak	68.23	-8.53

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

Table 20. Radiated Harmonics, Test Results, 802.11a

Freq. (GHz)	Antenna Polarity (H/V)	Raw Amp. @ 3 m (Peak) / (Avg.)	P. Amp (dB)	Ant. Cor. Factor (dB/m)	Cable Loss (dB)	EUT Field Strength Final Amp. (dBuV/m)	Limit Detector Peak / Avg. (Peak) / (Avg.)	Limit @ 3 m (dBuV/m)	Delta (dB)
5180 MHz									
10.36	H	43.91	34.77	37.47	6.20	52.81	Peak	68.23	-15.42
15.54	H	44.86	35.36	40.43	7.71	57.64	Peak	74	-16.36
15.54	H	31.45	35.36	40.43	7.71	44.23	Avg.	54	-9.77
5240 MHz									
10.48	H	41.22	34.79	37.57	6.19	50.18	Peak	68.23	-18.05
15.72	H	44.16	35.32	40.57	7.83	57.25	Peak	74	-16.75
15.72	H	31.85	35.32	40.57	7.83	44.94	Avg.	54	-9.06
5260 MHz									
10.52	H	43.58	34.79	37.59	6.19	52.58	Peak	68.23	-15.65
15.78	H	42.14	35.26	40.61	7.89	55.38	Peak	74	-18.62
15.78	H	32.05	35.26	40.61	7.89	45.29	Avg.	54	-8.71
5320 MHz									
10.64	H	41.06	34.74	37.64	6.19	50.15	Peak	74	-23.85
10.64	H	30.42	34.74	37.64	6.19	39.51	Avg.	54	-14.49
15.96	H	43.8	35.04	40.71	8.06	57.52	Peak	74	-16.48
15.96	H	31.84	35.04	40.71	8.06	45.56	Avg.	54	-8.44
5500 MHz									
11	H	45.95	34.71	37.73	6.18	55.15	Peak	74	-18.85
11	H	30.94	34.71	37.73	6.18	40.14	Avg.	54	-13.86
16.5	H	46.75	34.27	40.99	8.20	61.67	Peak	68.23	-6.56
5600 MHz									
11.2	H	43.6	34.71	37.87	6.21	52.98	Peak	74	-21.02
11.2	H	30.7	34.71	37.87	6.21	40.08	Avg.	54	-13.92
16.8	H	45.15	34.20	40.78	8.11	59.83	Peak	68.23	-8.40
5700 MHz									
11.4	H	43.67	34.69	38.06	6.28	53.32	Peak	74	-20.68
11.4	H	29.7	34.69	38.06	6.28	39.35	Avg.	54	-14.65
17.1	H	44.42	34.14	40.73	7.98	58.99	Peak	68.23	-9.24

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

Table 21. Radiated Harmonics, Test Results, 802.11n 20MHz

Channel (MHz)	Frequency (GHz)	Uncorrected (dBuV)	Cable Loss (dB)	ACF (dB/m)	DCF	Measured value (corrected) @ 3m dBuV/m	Limit @ 3m (dBuV/m)	Margin	Remark
5180	3.20	29.98	2.97	32.76	9.54	56.17	68.23	-12.09	Peak
	5.357	16.94	3.99	34.33	9.54	45.72	54	-8.28	Avg.
	5.363	28.68	3.99	34.33	9.54	57.47	74	-16.53	Peak
	5.466	27.67	4.04	34.46	9.54	56.63	68.23	-11.60	Peak
	7.04	32.74	4.77	35.58	9.54	63.55	68.23	-4.68	Peak
5200	3.206	30.19	3.01	32.75	9.54	56.41	68.23	-11.82	Peak
	5.361	22.06	3.99	34.33	9.54	50.85	54	-3.15	Avg.
	5.358	34.4	3.99	34.33	9.54	63.18	74	-10.82	Peak
	5.466	28.07	4.04	34.46	9.54	57.03	68.23	-11.20	Peak
	5.47	33.37	4.04	34.47	9.54	62.33	68.23	-5.90	Peak
5240	3.054	29.97	2.89	32.76	9.54	56.08	68.23	-12.15	Peak
	5.401	21.35	4.01	34.38	9.54	50.20	54	-3.80	Avg.
	5.397	33.39	4.01	34.38	9.54	62.23	74	-11.77	Peak
	5.465	27.75	4.04	34.46	9.54	56.71	68.23	-11.52	Peak
	6.76	32.77	4.62	35.58	9.54	63.43	68.23	-4.80	Peak
5260	3.119	29.4	2.95	32.76	9.54	55.57	68.23	-12.66	Peak
	5.419	23.47	4.02	34.40	9.54	52.35	54	-1.65	Avg.
	5.422	35.61	4.02	34.41	9.54	64.50	74	-9.50	Peak
	5.463	28.21	4.04	34.46	9.54	57.16	68.23	-11.07	Peak
	7.78	32.29	4.95	35.68	9.54	63.39	68.23	-4.84	Peak
5300	3.746	30.84	3.46	32.97	9.54	57.73	68.23	-10.50	Peak
	5.381	23.63	4.00	34.36	9.54	52.45	54	-1.55	Avg.
	5.38	35.28	4.00	34.35	9.54	64.10	74	-9.90	Peak
	5.462	33.72	4.03	34.46	9.54	62.67	68.23	-5.56	Peak
	7.599	32.83	5.01	35.68	9.54	63.98	68.23	-4.25	Peak
5320	3.068	30.71	2.90	32.76	9.54	56.84	68.23	-11.39	Peak
	5.401	23.35	4.01	34.38	9.54	52.20	54	-1.80	Avg.
	5.4	34.9	4.01	34.38	9.54	63.75	74	-10.25	Peak
	5.46	28.71	4.03	34.45	9.54	57.66	68.23	-10.57	Peak
	7.266	32.48	4.91	35.63	9.54	63.48	68.23	-4.75	Peak
5500	3.182	30.41	2.99	32.75	9.54	56.62	68.23	-11.61	Peak
	5.418	24.03	4.02	34.40	9.54	52.91	54	-1.09	Avg.
	5.418	36.21	4.02	34.40	9.54	65.09	74	-8.91	Peak
	5.469	38.65	4.04	34.46	9.54	67.61	68.23	-0.62	Peak
	6.794	31.8	4.64	35.58	9.54	62.48	68.23	-5.75	Peak
5600	3.13	30.21	2.95	32.76	9.54	56.38	68.23	-11.85	Peak
	5.441	17.87	4.03	34.43	9.54	46.79	54	-7.21	Avg.
	5.439	30.11	4.03	34.43	9.54	59.02	74	-14.98	Peak
	5.463	27.81	4.04	34.46	9.54	56.76	68.23	-11.47	Peak
	7.043	31.35	4.77	35.58	9.54	62.17	68.23	-6.06	Peak
5700	3.182	29.35	2.99	32.75	9.54	55.56	68.23	-12.67	Peak
	5.381	16.57	4.00	34.36	9.54	45.39	54	-8.61	Avg.
	5.4	28.39	4.01	34.38	9.54	57.24	74	-16.76	Peak
	5.462	28.69	4.03	34.46	9.54	57.64	68.23	-10.59	Peak
	6.95	31.82	4.72	35.57	9.54	62.58	68.23	-5.65	Peak

Table 22. Radiated Spurs, Test Results, 802.11a

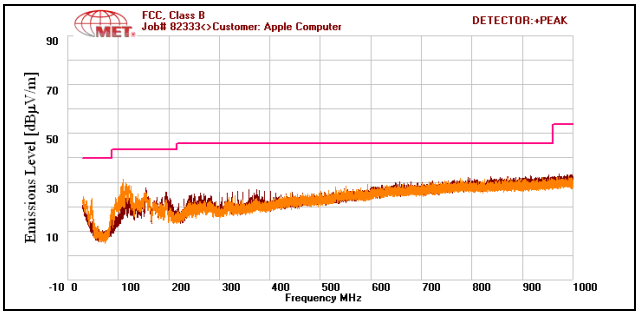
*Note: Measurements were made at 1m.
All other emissions were measured at the noise floor of the spectrum analyzer.

Channel (MHz)	Frequency (GHz)	Uncorrected (dBuV)	Cable Loss (dB)	ACF (dB/m)	DCF	Measured value (corrected) @ 3m dBuV/m	Limit @ 3m (dBuV/m)	Margin	Remark
5180	5.136	30.18	3.91	34.07	9.54	58.62	68.23	-9.61	Peak
	5.357	17.61	3.99	34.33	9.54	46.39	54	-7.61	Avg.
	5.356	29.17	3.99	34.32	9.54	57.95	74	-16.05	Peak
	5.463	28.2	4.04	34.46	9.54	57.15	68.23	-11.08	Peak
	7.01	32.23	4.76	35.58	9.54	63.02	68.23	-5.21	Peak
5200	3.794	30.09	3.50	33.03	9.54	57.07	68.23	-11.16	Peak
	5.361	21.96	3.99	34.33	9.54	50.75	54	-3.25	Avg.
	5.361	33.52	3.99	34.33	9.54	62.31	74	-11.69	Peak
	5.468	28.07	4.04	34.46	9.54	57.03	68.23	-11.20	Peak
	6.798	32.86	4.64	35.58	9.54	63.54	68.23	-4.69	Peak
5240	3.303	30.01	3.09	32.74	9.54	56.30	68.23	-11.93	Peak
	5.398	21.84	4.01	34.38	9.54	50.69	54	-3.31	Avg.
	5.401	32.87	4.01	34.38	9.54	61.72	74	-12.28	Peak
	5.462	27.85	4.03	34.46	9.54	56.80	68.23	-11.43	Peak
	7.365	32.59	4.97	35.65	9.54	63.66	68.23	-4.57	Peak
5260	3.158	29.93	2.98	32.76	9.54	56.12	68.23	-12.11	Peak
	5.418	22.9	4.02	34.40	9.54	51.78	54	-2.22	Avg.
	5.42	34.92	4.02	34.40	9.54	63.80	74	-10.20	Peak
	5.4602	27.9	4.03	34.45	9.54	56.85	68.23	-11.38	Peak
	6.98	32.85	4.74	35.57	9.54	63.62	68.23	-4.61	Peak
5300	3.054	30.1	2.89	32.76	9.54	56.21	68.23	-12.02	Peak
	5.381	23.39	4.00	34.36	9.54	52.21	54	-1.79	Avg.
	5.547	35.35	4.07	34.55	9.54	64.43	74	-9.57	Peak
	5.461	34.94	4.03	34.45	9.54	63.89	68.23	-4.34	Peak
	6.957	32.64	4.73	35.57	9.54	63.40	68.23	-4.83	Peak
5320	3.116	30.39	2.94	32.76	9.54	56.55	68.23	-11.68	Peak
	5.401	23.29	4.01	34.38	9.54	52.14	54	-1.86	Avg.
	5.4	35.04	4.01	34.38	9.54	63.89	74	-10.11	Peak
	5.469	28.01	4.04	34.46	9.54	56.97	68.23	-11.26	Peak
	7.093	33.38	4.80	35.59	9.54	64.24	68.23	-3.99	Peak
5500	3.059	29.99	2.90	32.76	9.54	56.11	68.23	-12.12	Peak
	5.418	23.78	4.02	34.40	9.54	52.66	54	-1.34	Avg.
	5.418	34.65	4.02	34.40	9.54	63.53	74	-10.47	Peak
	5.464	21.27	4.04	34.46	9.54	50.22	68.23	-18.01	Peak
	6.922	31.96	4.71	35.57	9.54	62.70	68.23	-5.53	Peak
5600	3.095	29.75	2.93	32.76	9.54	55.90	68.23	-12.33	Peak
	5.44	18.68	4.03	34.43	9.54	47.60	54	-6.40	Avg.
	5.441	30.52	4.03	34.43	9.54	59.44	74	-14.56	Peak
	5.466	28.2	4.04	34.46	9.54	57.16	68.23	-11.07	Peak
	6.993	32.44	4.75	35.58	9.54	63.22	68.23	-5.01	Peak
5700	3.088	30.77	2.92	32.76	9.54	56.91	68.23	-11.32	Peak
	5.38	16.89	4.00	34.35	9.54	45.71	54	-8.29	Avg.
	5.379	29.23	4.00	34.35	9.54	58.05	74	-15.95	Peak
	5.467	28.32	4.04	34.46	9.54	57.28	68.23	-10.95	Peak
	5.725	35.85	4.14	34.77	9.54	65.23	68.23	-3.00	Peak

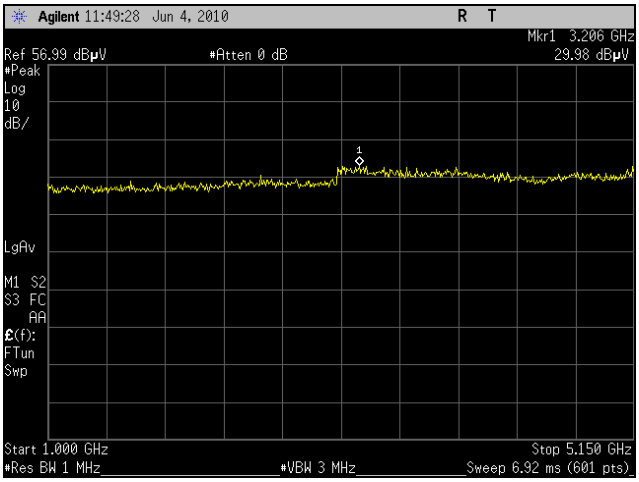
Table 23. Radiated Spurs, Test Results, 802.11n 20MHz

*Note: Measurements were made at 1m.
All other emissions were measured at the noise floor of the spectrum analyzer.

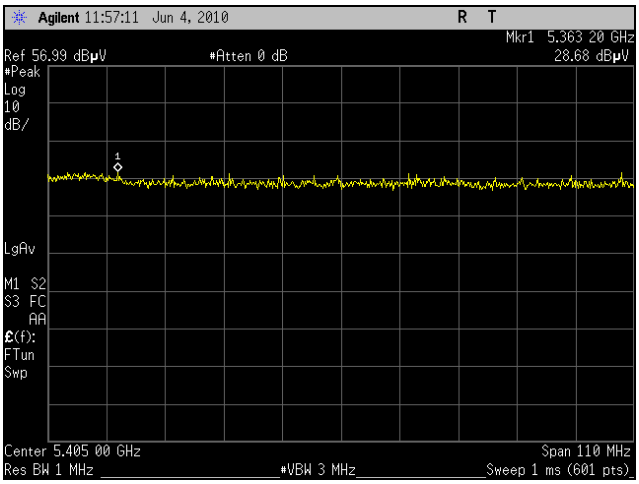
Radiated Spurious Emissions Test Results



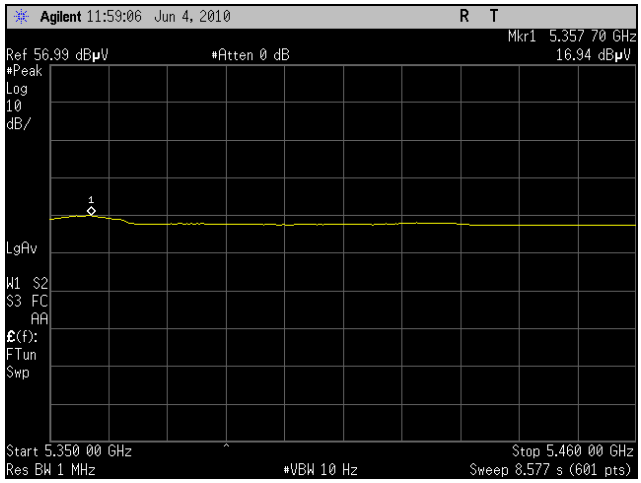
Plot 97. Radiated Spurs, 30 MHz – 1 GHz, Channel 5180 MHz, 802.11a



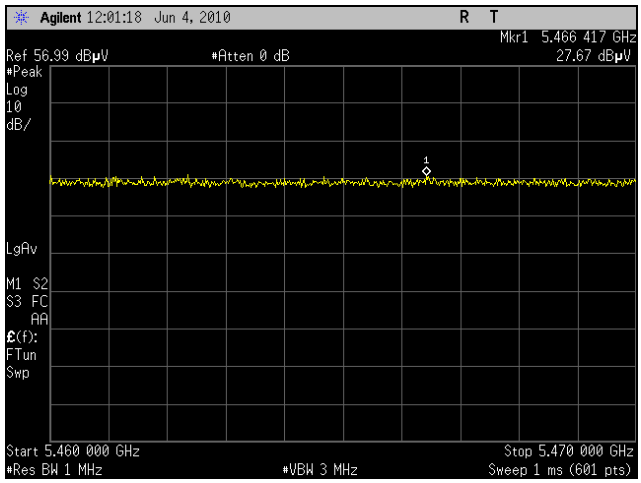
Plot 98. Radiated Spurs, 1 GHz – 5.15 GHz, Channel 5180 MHz, 802.11a



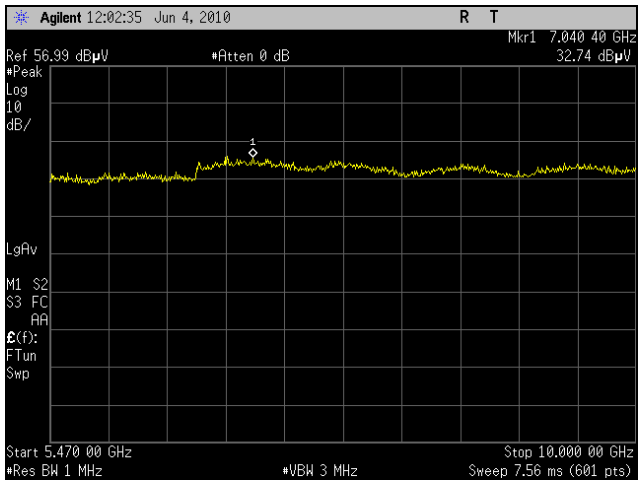
Plot 99. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5180 MHz, 802.11a



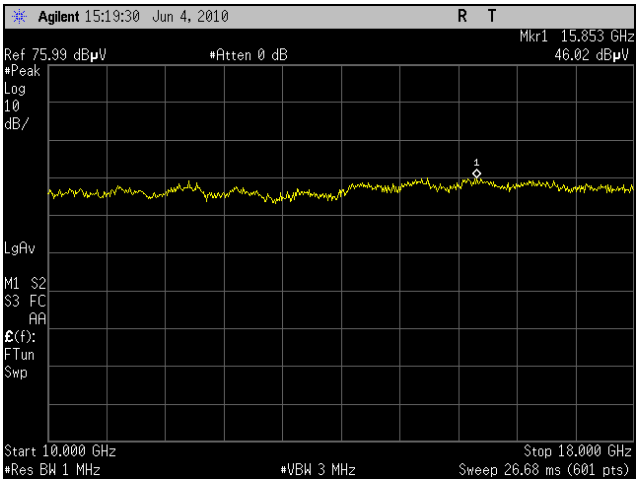
Plot 100. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5180 MHz, 802.11a



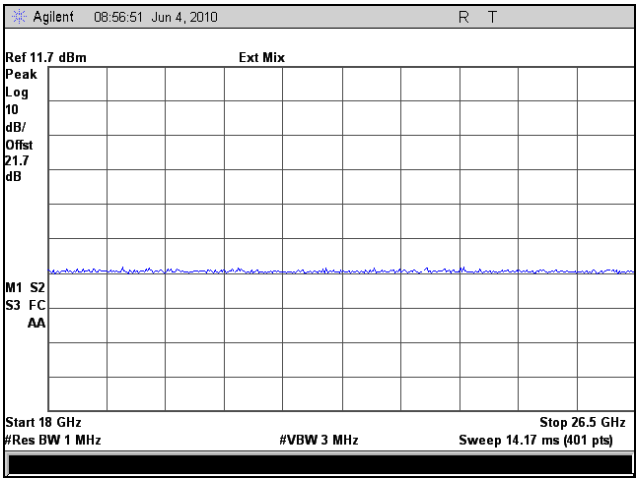
Plot 101. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5180 MHz, 802.11a



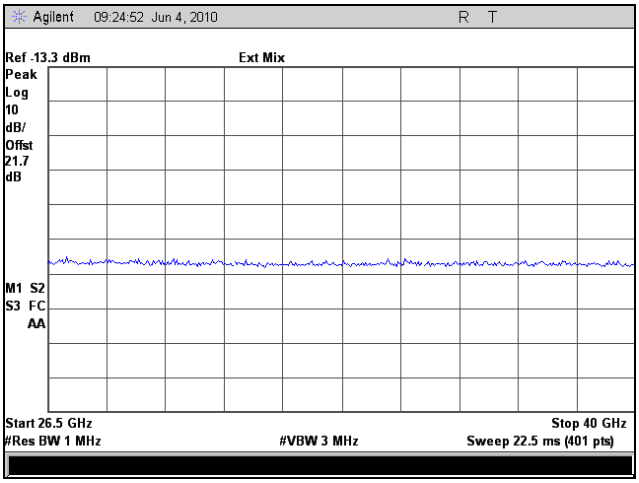
Plot 102. Radiated Spurs, 5.47 GHz – 10 GHz, Channel 5180 MHz, 802.11a



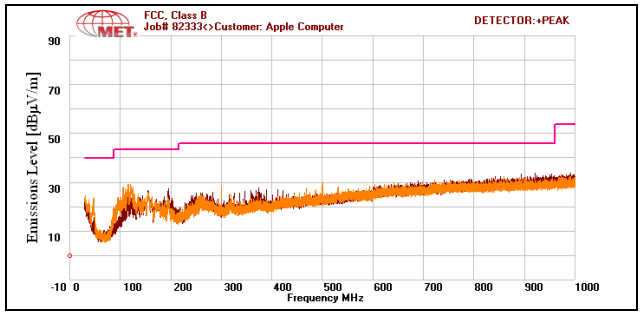
Plot 103. Radiated Spurs, 10 GHz – 18 GHz, Channel 5180 MHz, 802.11a



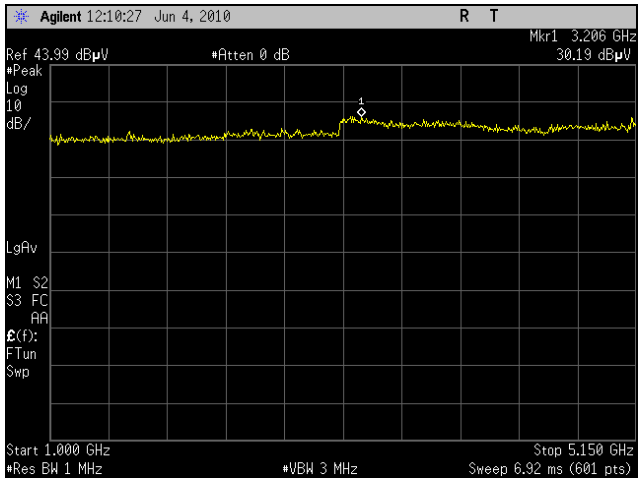
Plot 104. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5180 MHz, 802.11a



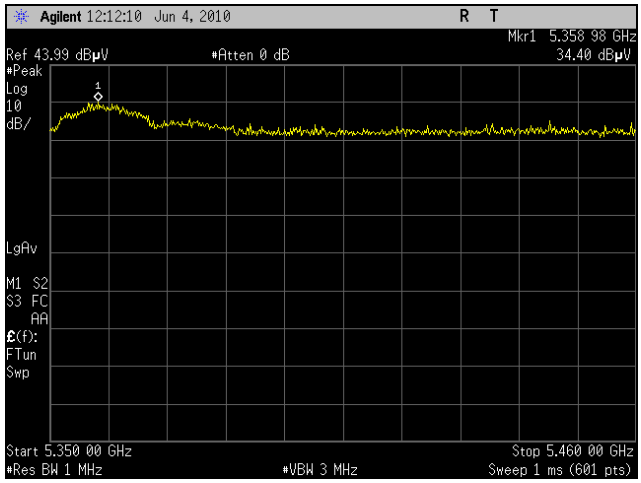
Plot 105. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5180 MHz, 802.11a



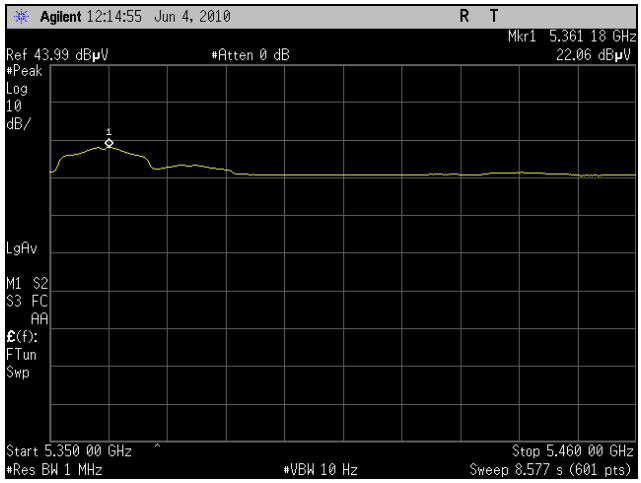
Plot 106. Radiated Spurs, 30 MHz – 1 GHz, Channel 5200 MHz, 802.11a



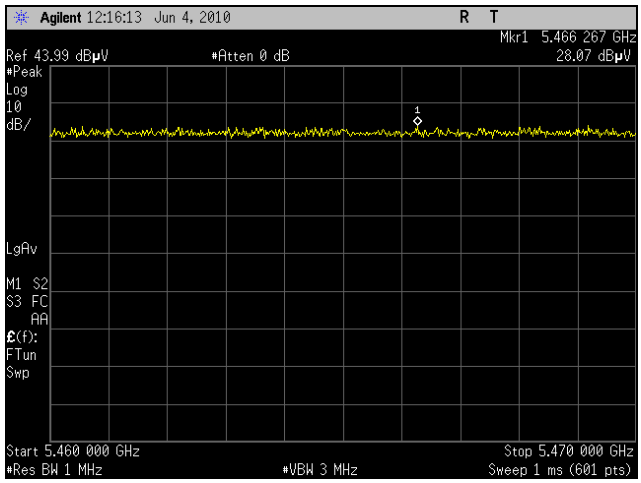
Plot 107. Radiated Spurs, 1 GHz – 5.15 GHz, Channel 5200 MHz, 802.11a



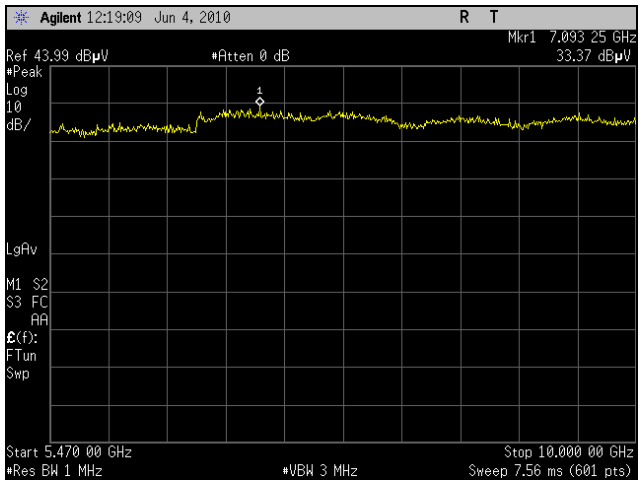
Plot 108. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5200 MHz, 802.11a



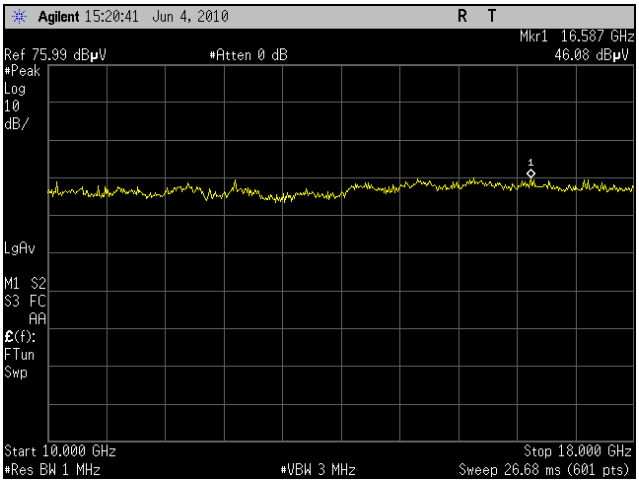
Plot 109. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5200 MHz, 802.11a



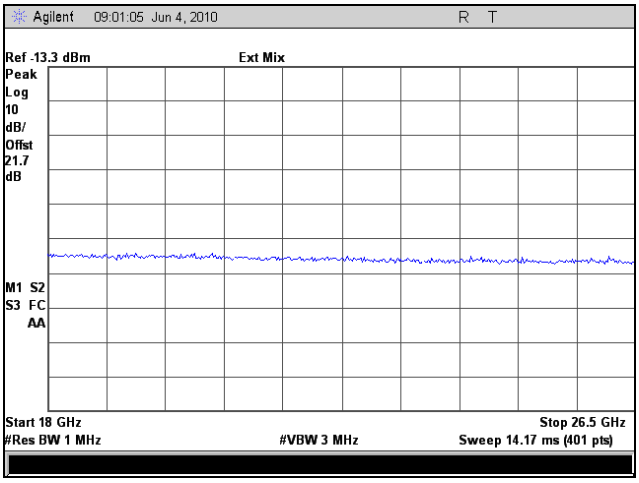
Plot 110. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5200 MHz, 802.11a



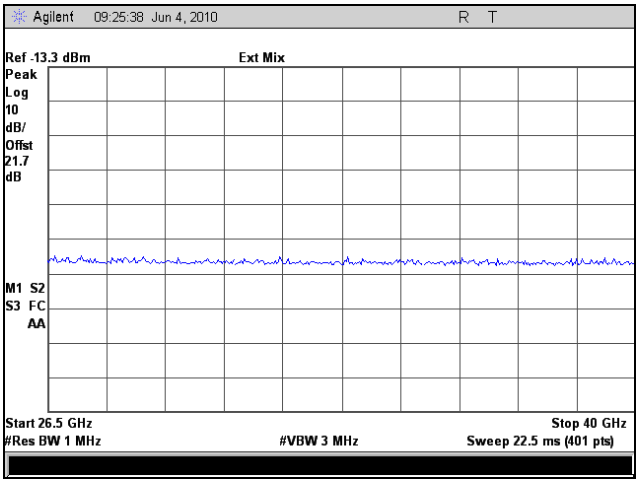
Plot 111. Radiated Spurs, 5.47 GHz – 10 GHz, Channel 5200 MHz, 802.11a



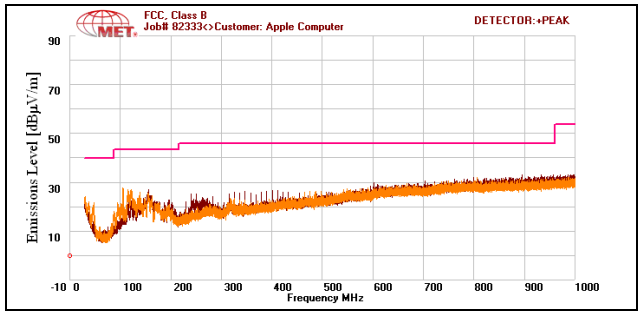
Plot 112. Radiated Spurs, 10 GHz – 18 GHz, Channel 5200 MHz, 802.11a



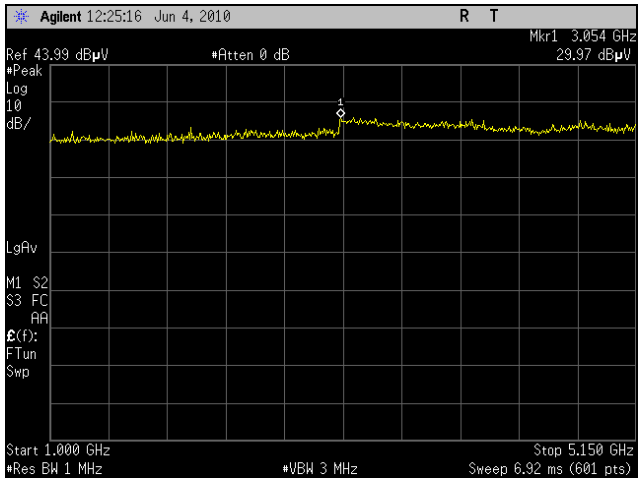
Plot 113. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5200 MHz, 802.11a



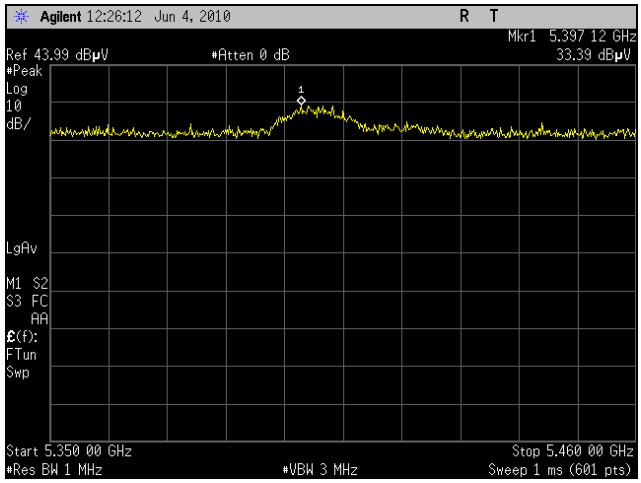
Plot 114. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5200 MHz, 802.11a



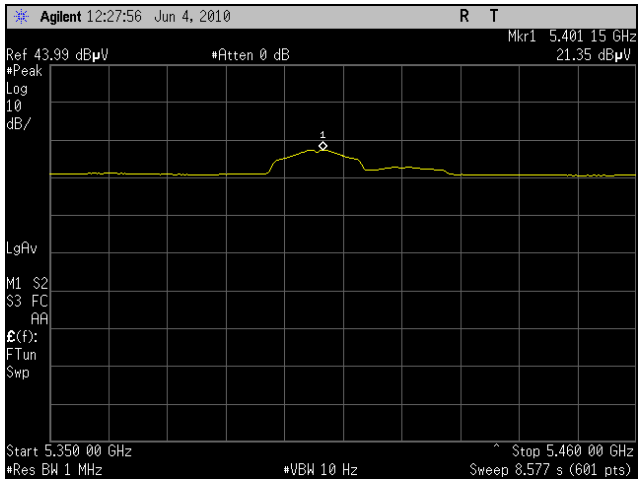
Plot 115. Radiated Spurs, 30 MHz – 1 GHz, Channel 5240 MHz, 802.11a



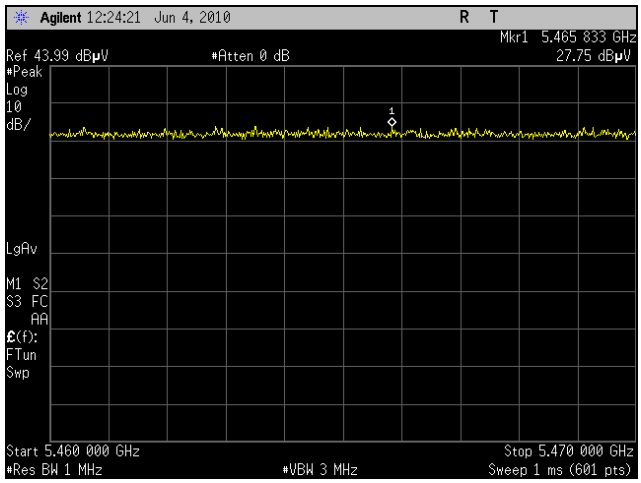
Plot 116. Radiated Spurs, 1 GHz – 5.15 GHz, Channel 5240 MHz, 802.11a



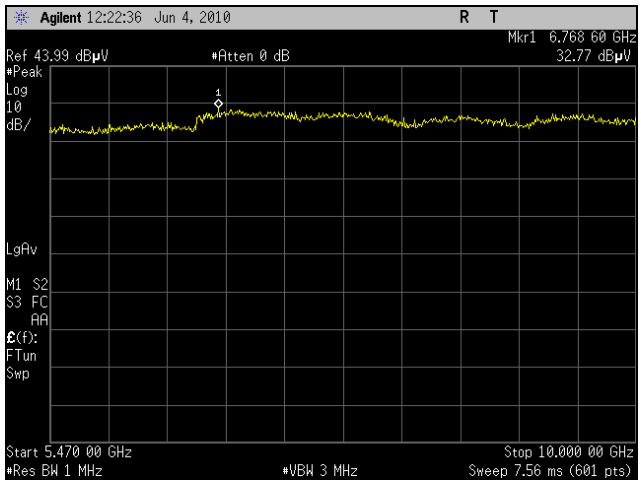
Plot 117. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5240 MHz, 802.11a



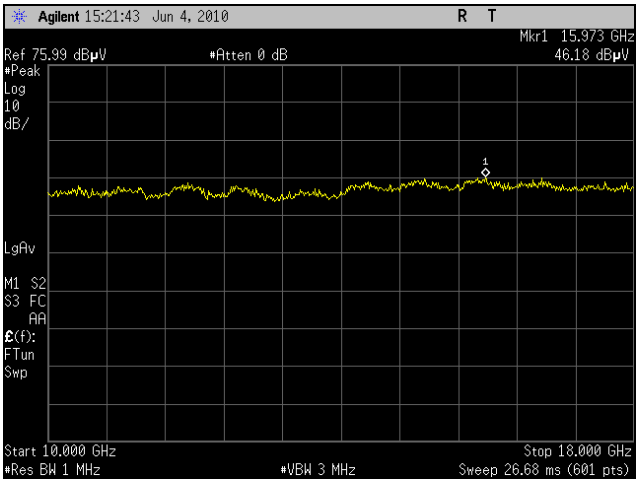
Plot 118. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5240 MHz, 802.11a



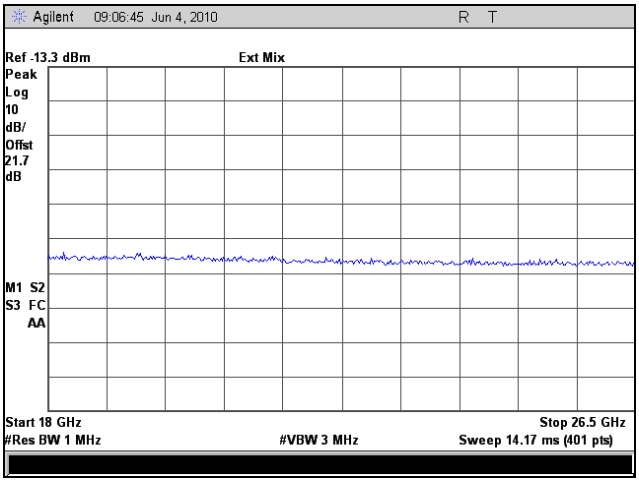
Plot 119. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5240 MHz, 802.11a



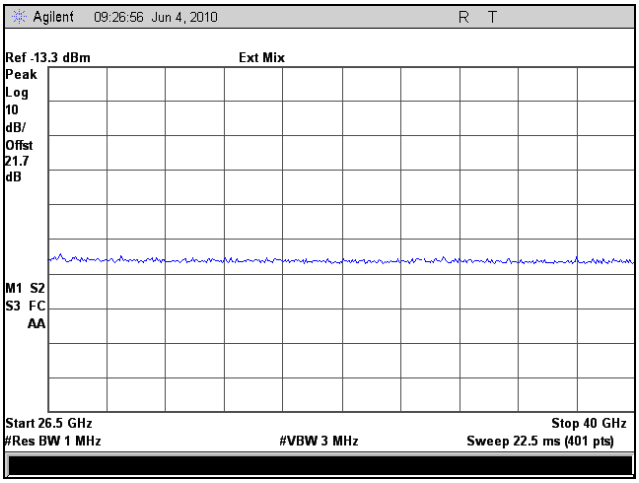
Plot 120. Radiated Spurs, 5.47 GHz – 10 GHz, Channel 5240 MHz, 802.11a



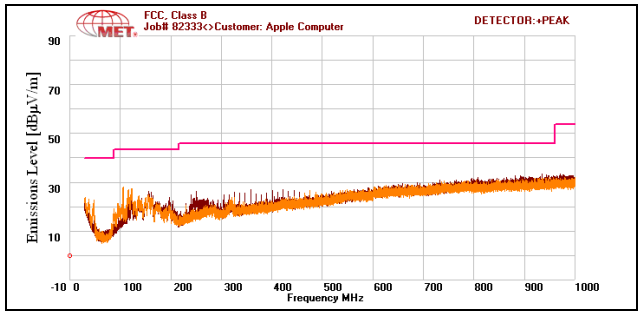
Plot 121. Radiated Spurs, 10 GHz – 18 GHz, Channel 5240 MHz, 802.11a



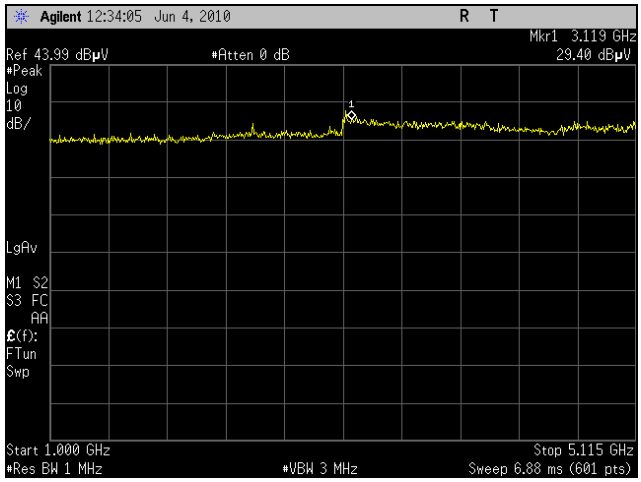
Plot 122. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5240 MHz, 802.11a



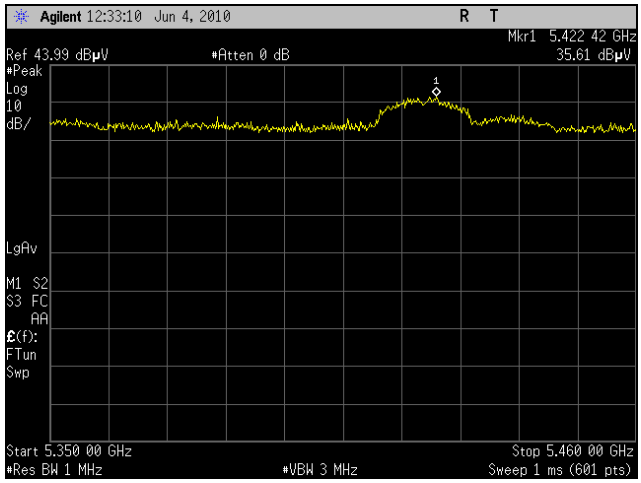
Plot 123. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5240 MHz, 802.11a



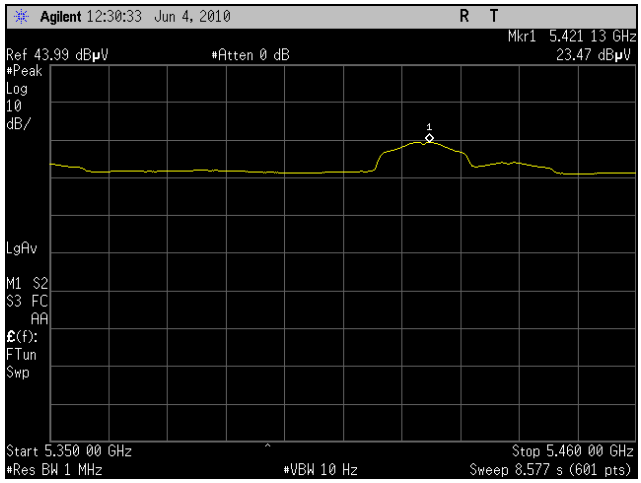
Plot 124. Radiated Spurs, 30 MHz – 1 GHz, Channel 5260 MHz, 802.11a



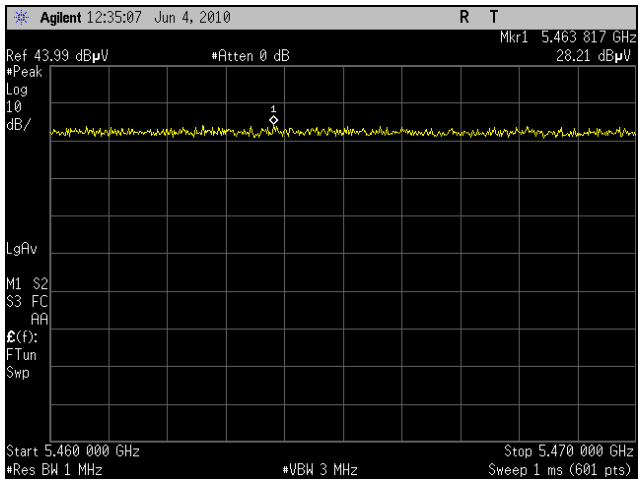
Plot 125. Radiated Spurs, 1 GHz – 5.115 GHz, Channel 5260 MHz, 802.11a



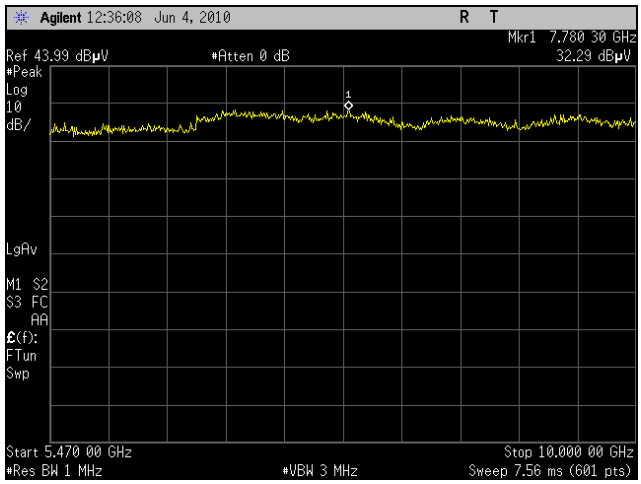
Plot 126. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5260 MHz, 802.11a



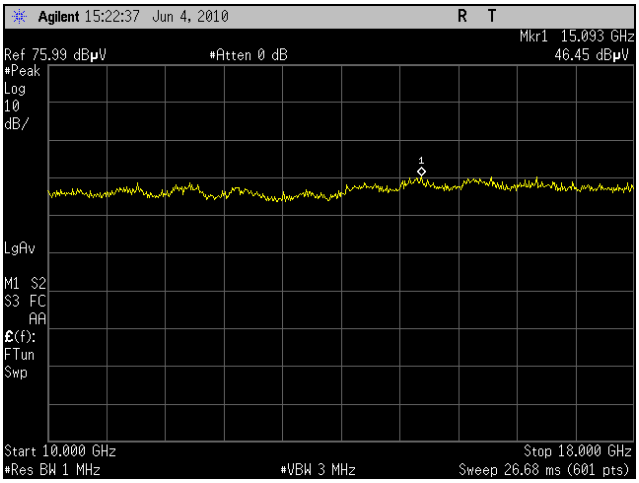
Plot 127. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5260 MHz, 802.11a



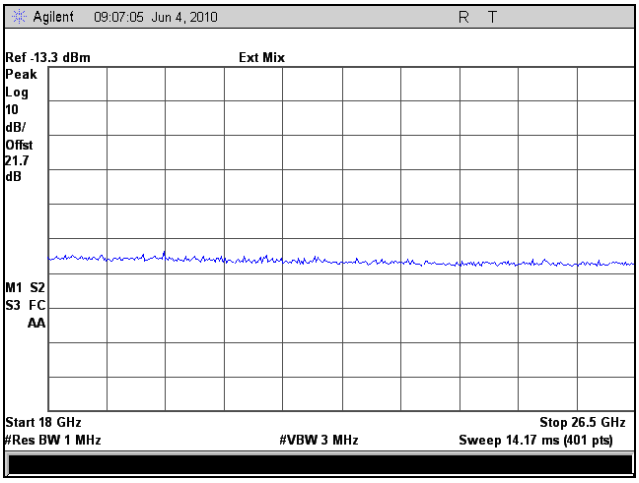
Plot 128. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5260 MHz, 802.11a



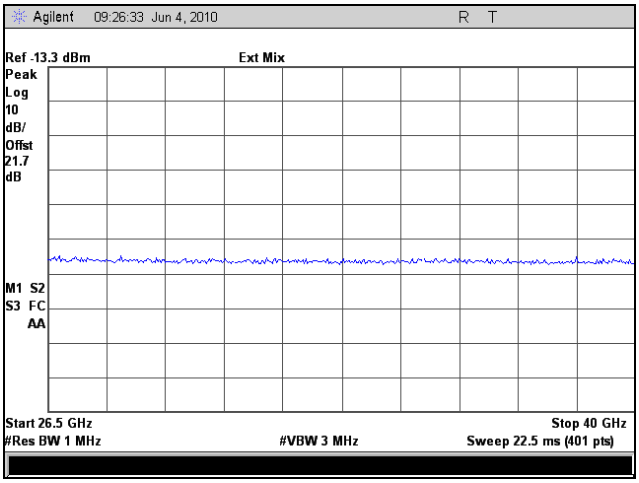
Plot 129. Radiated Spurs, 5.47 GHz – 10 GHz, Channel 5260 MHz, 802.11a



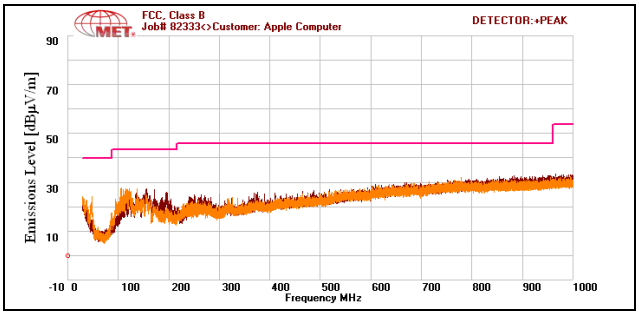
Plot 130. Radiated Spurs, 10 GHz – 18 GHz, Channel 5260 MHz, 802.11a



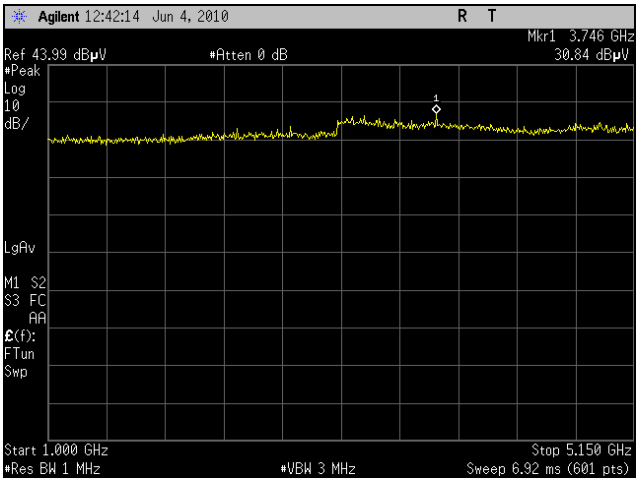
Plot 131. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5260 MHz, 802.11a



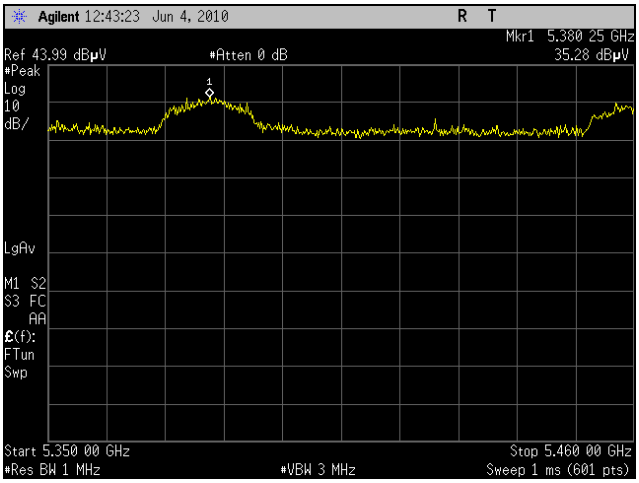
Plot 132. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5260 MHz, 802.11a



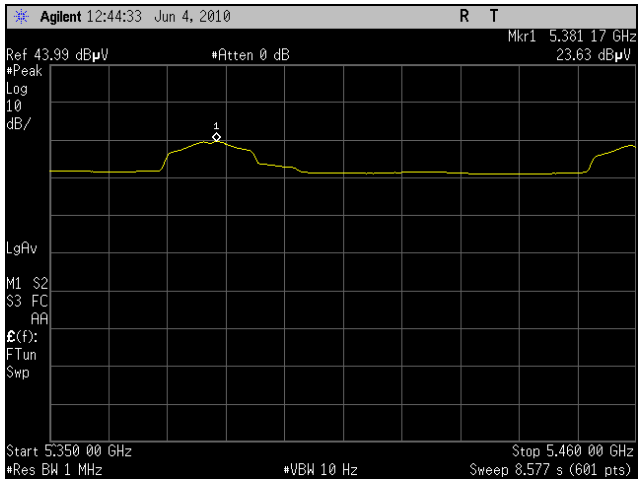
Plot 133. Radiated Spurs, 30 MHz – 1 GHz, Channel 5300 MHz, 802.11a



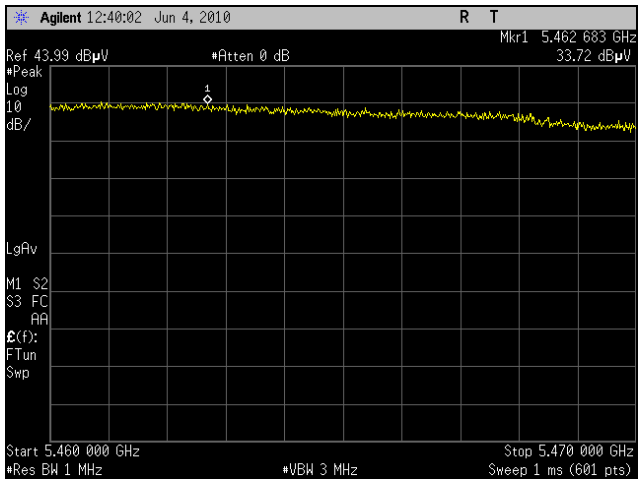
Plot 134. Radiated Spurs, 1 GHz – 5.15 GHz, Channel 5300 MHz, 802.11a



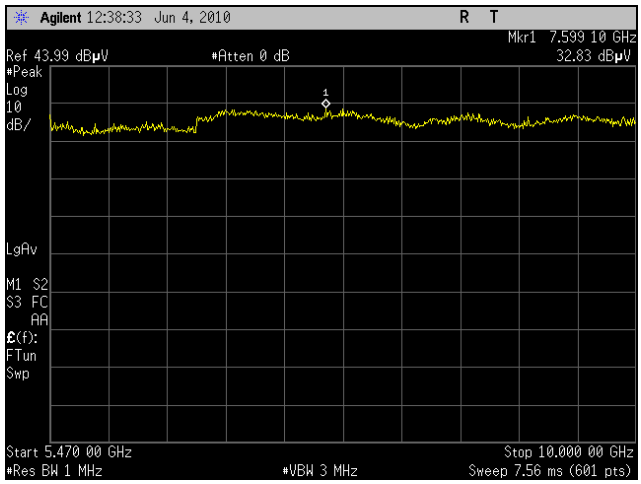
Plot 135. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5300 MHz, 802.11a



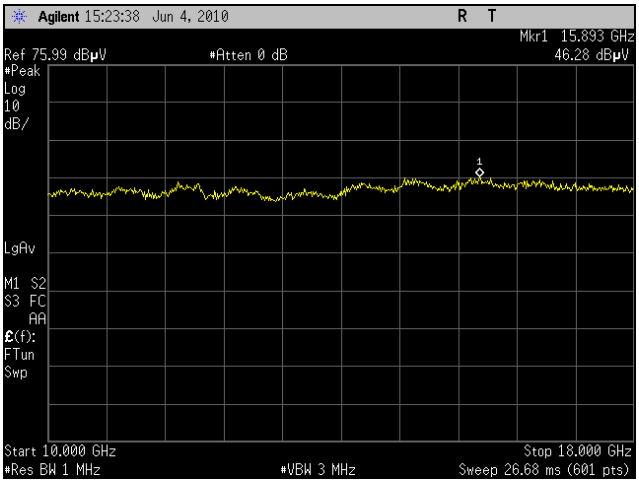
Plot 136. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5300 MHz, 802.11a



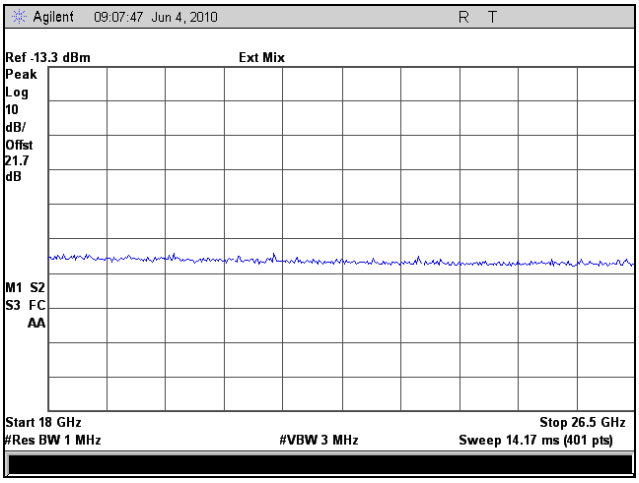
Plot 137. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5300 MHz, 802.11a



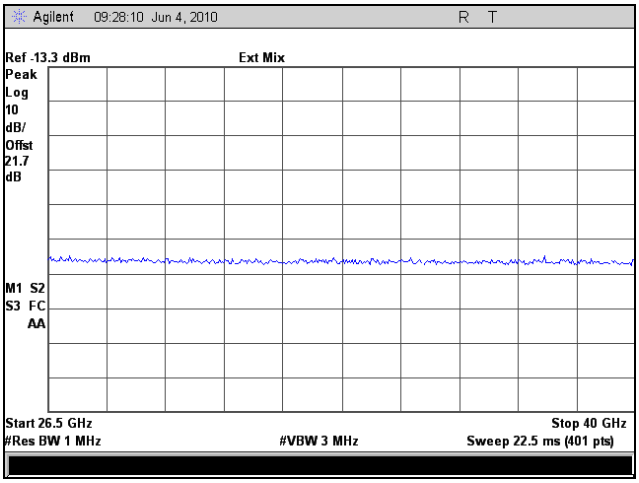
Plot 138. Radiated Spurs, 5.47 GHz – 10 GHz, Channel 5300 MHz, 802.11a



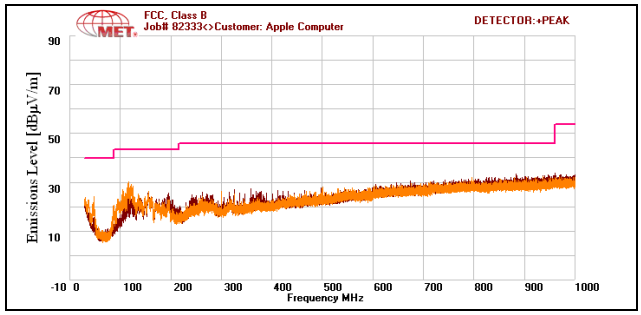
Plot 139. Radiated Spurs, 10 GHz – 18 GHz, Channel 5300 MHz, 802.11a



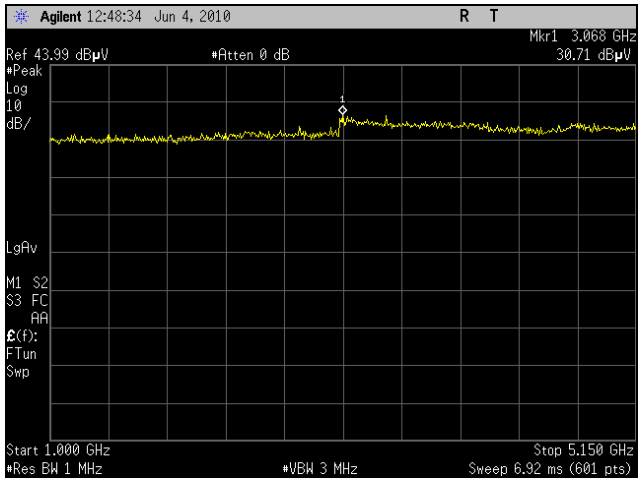
Plot 140. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5300 MHz, 802.11a



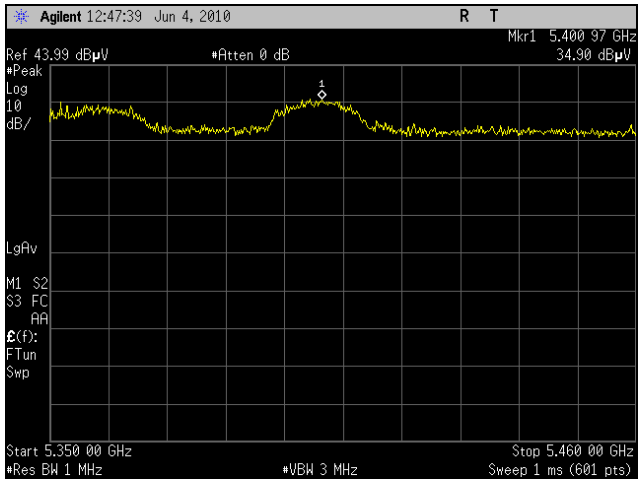
Plot 141. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5300 MHz, 802.11a



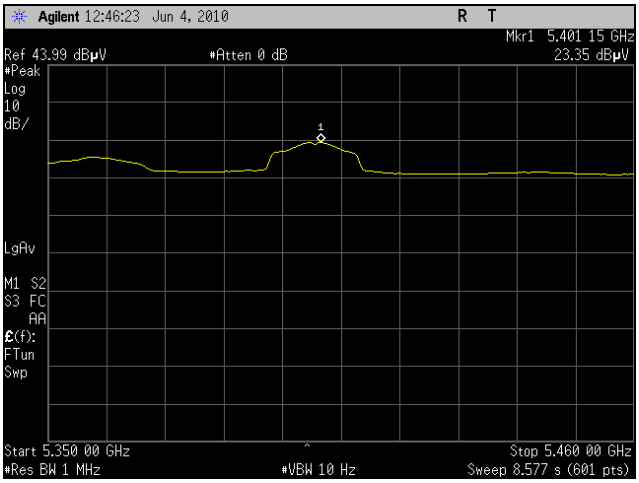
Plot 142. Radiated Spurs, 30 MHz – 1 GHz, Channel 5320 MHz, 802.11a



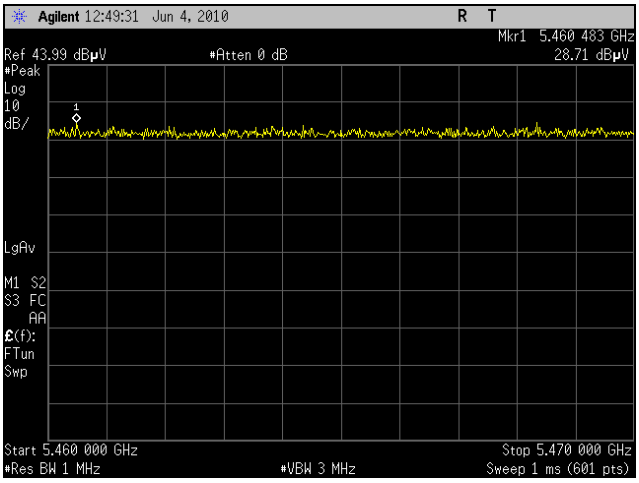
Plot 143. Radiated Spurs, 1 GHz – 5.15 GHz, Channel 5320 MHz, 802.11a



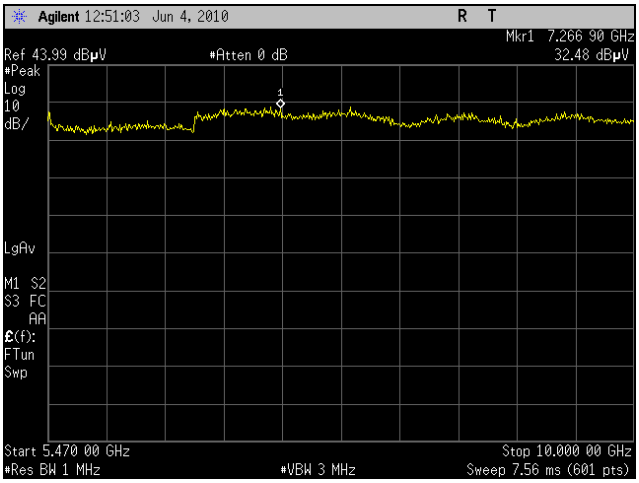
Plot 144. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5320 MHz, 802.11a



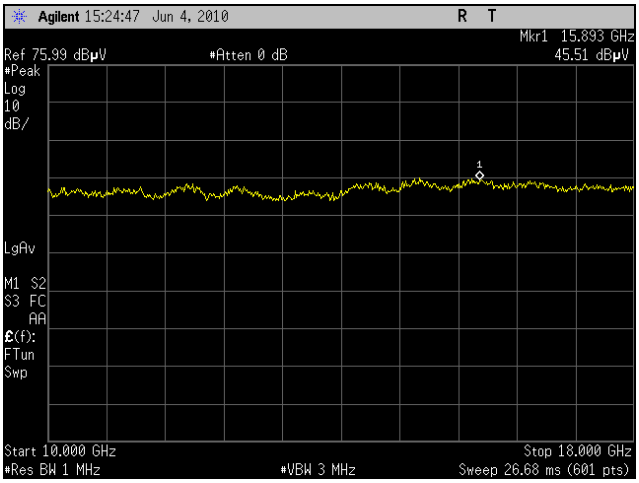
Plot 145. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5320 MHz, 802.11a



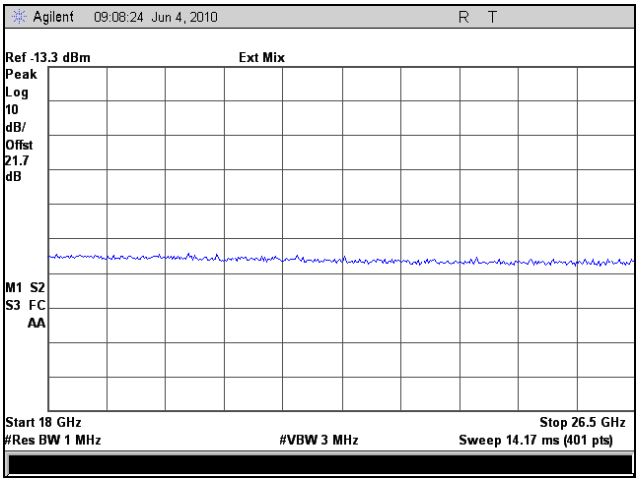
Plot 146. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5320 MHz, 802.11a



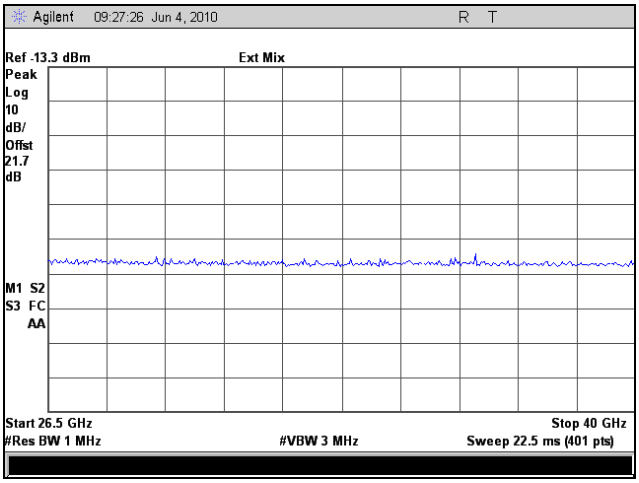
Plot 147. Radiated Spurs, 5.47 GHz – 10 GHz, Channel 5320 MHz, 802.11a



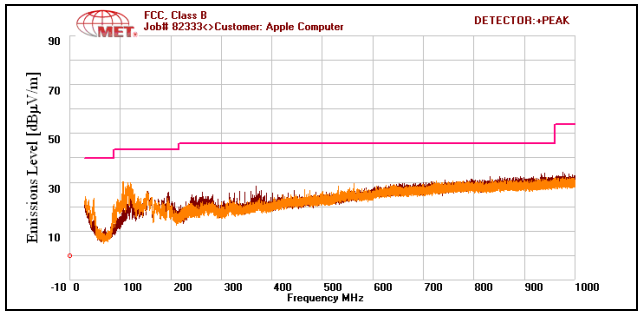
Plot 148. Radiated Spurs, 10 GHz – 18 GHz, Channel 5320 MHz, 802.11a



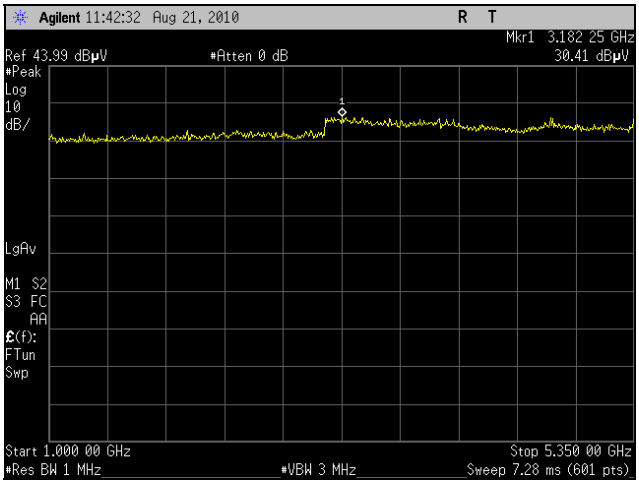
Plot 149. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5320 MHz, 802.11a



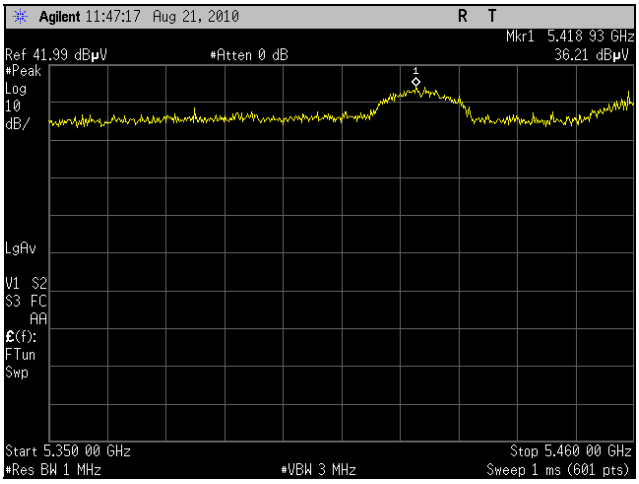
Plot 150. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5320 MHz, 802.11a



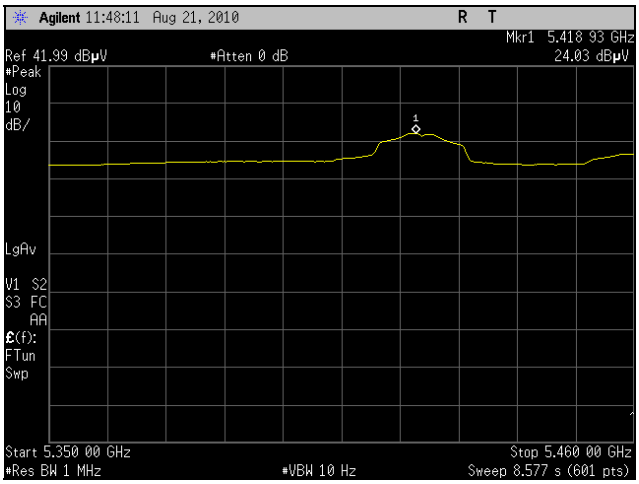
Plot 151. Radiated Spurs, 30 MHz – 1 GHz, Channel 5500 MHz, 802.11a



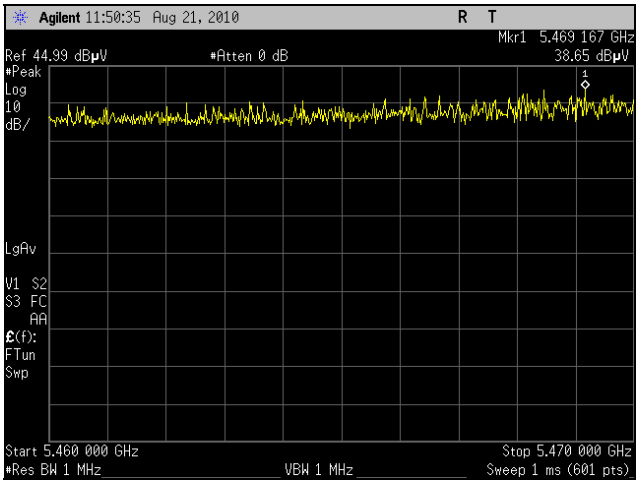
Plot 152. Radiated Spurs, 1 GHz – 5.35 GHz, Channel 5500 MHz, 802.11a



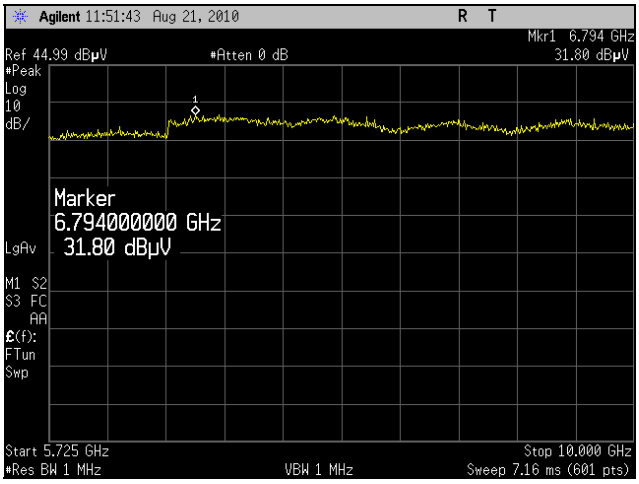
Plot 153. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5500 MHz, 802.11a



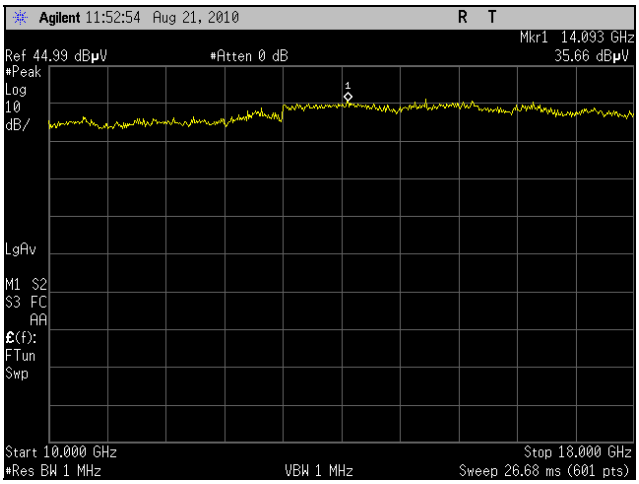
Plot 154. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5500 MHz, 802.11a



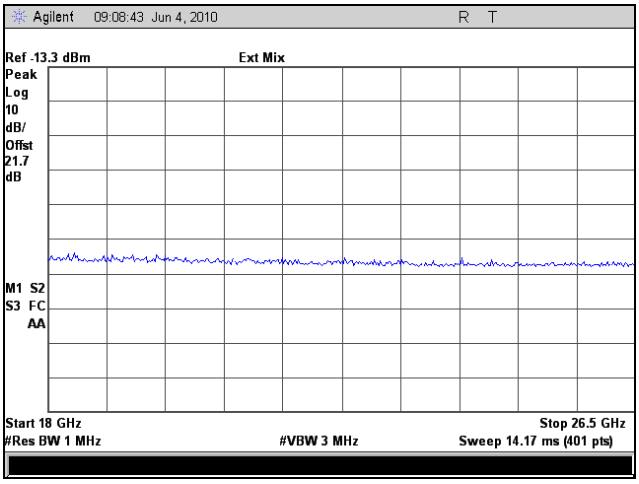
Plot 155. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5500 MHz, 802.11a



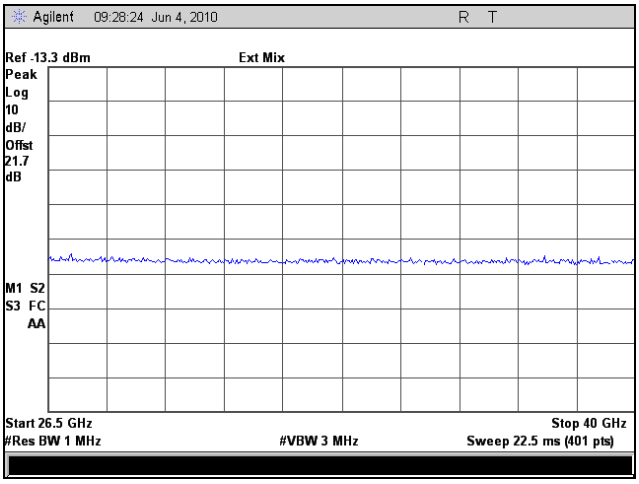
Plot 156. Radiated Spurs, 5.725 GHz – 10 GHz, Channel 5500 MHz, 802.11a



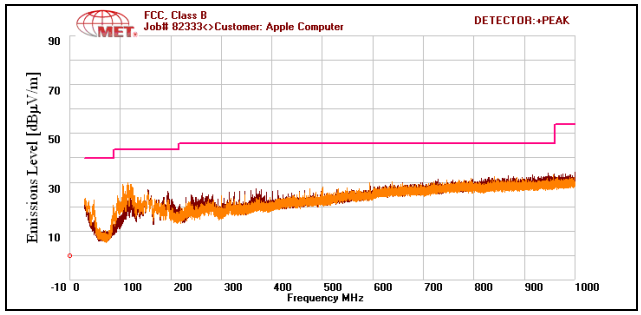
Plot 157. Radiated Spurs, 10 GHz – 18 GHz, Channel 5500 MHz, 802.11a



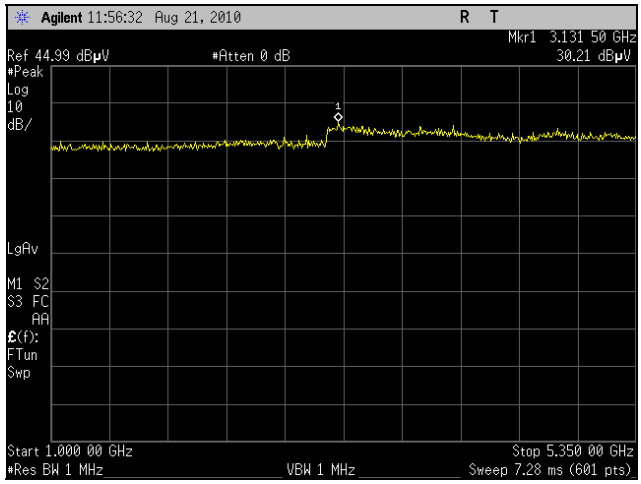
Plot 158. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5500 MHz, 802.11a



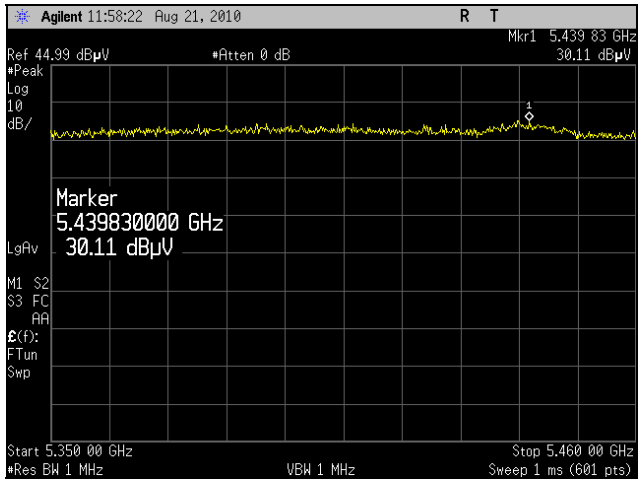
Plot 159. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5500 MHz, 802.11a



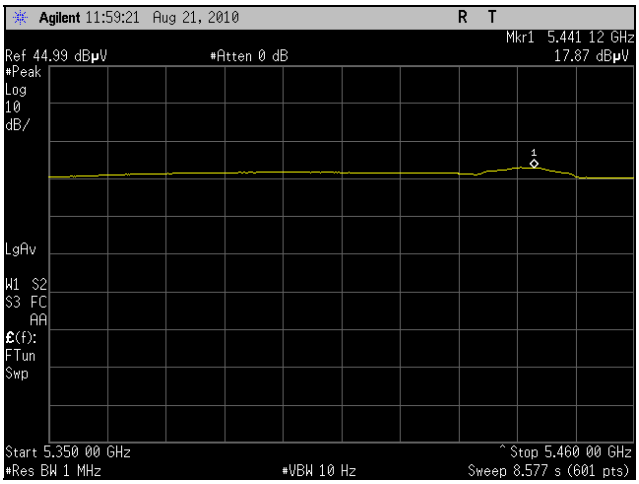
Plot 160. Radiated Spurs, 30 MHz – 1 GHz, Channel 5600 MHz, 802.11a



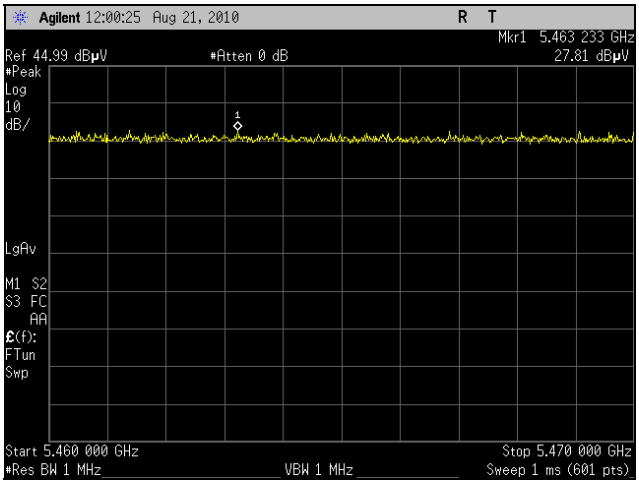
Plot 161. Radiated Spurs, 1 GHz – 5.35 GHz, Channel 5600 MHz, 802.11a



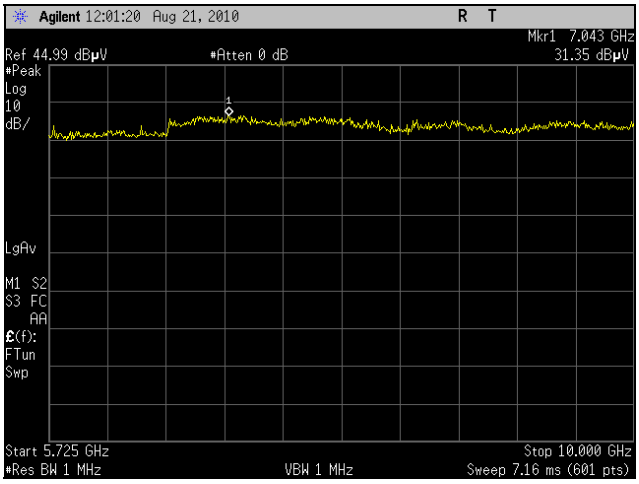
Plot 162. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5600 MHz, 802.11a



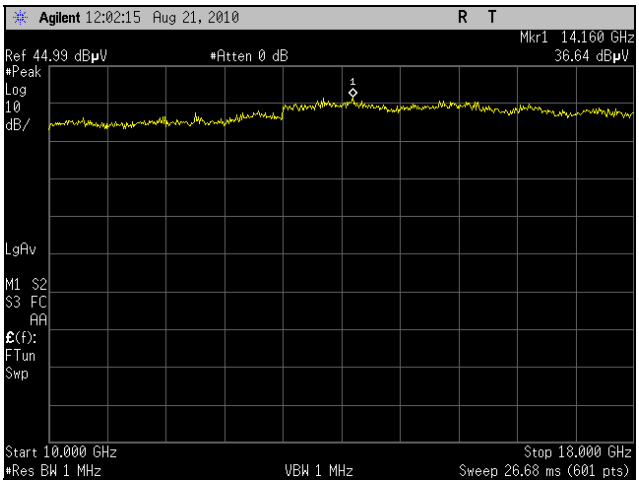
Plot 163. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5600 MHz, 802.11a



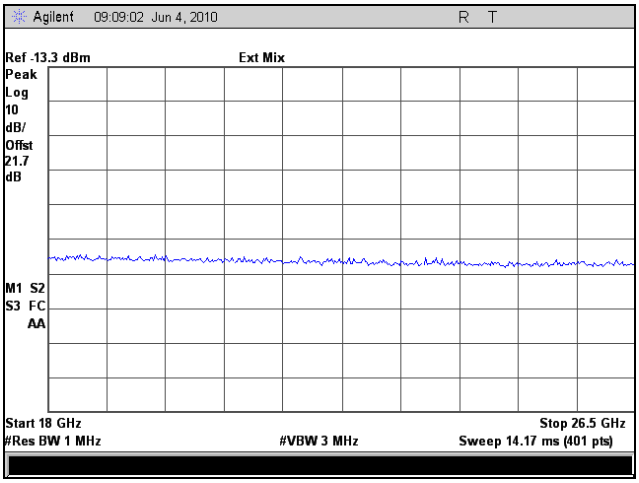
Plot 164. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5600 MHz, 802.11a



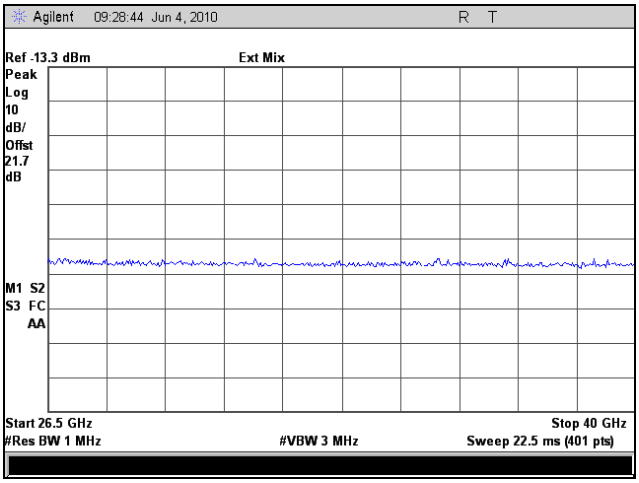
Plot 165. Radiated Spurs, 5.725 GHz – 10 GHz, Channel 5600 MHz, 802.11a



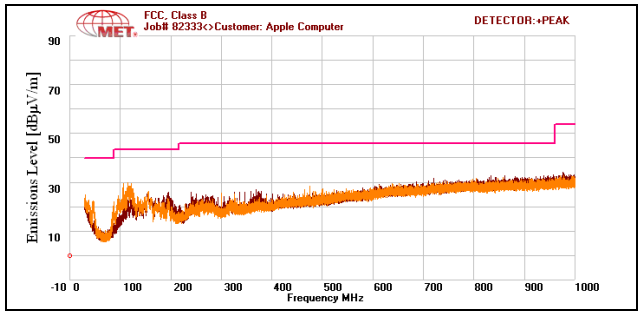
Plot 166. Radiated Spurs, 10 GHz – 18 GHz, Channel 5600 MHz, 802.11a



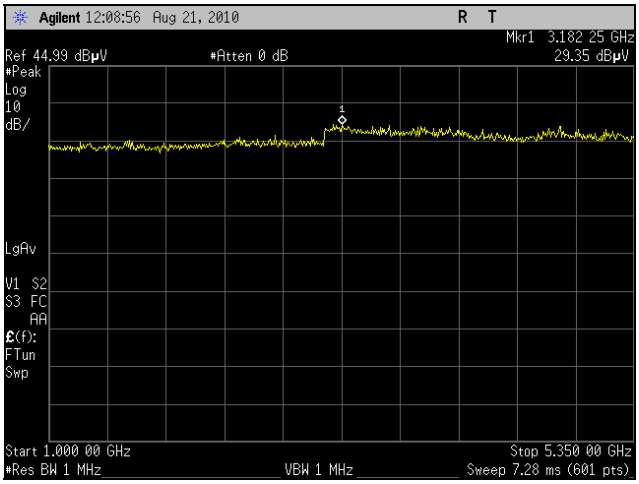
Plot 167. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5600 MHz, 802.11a



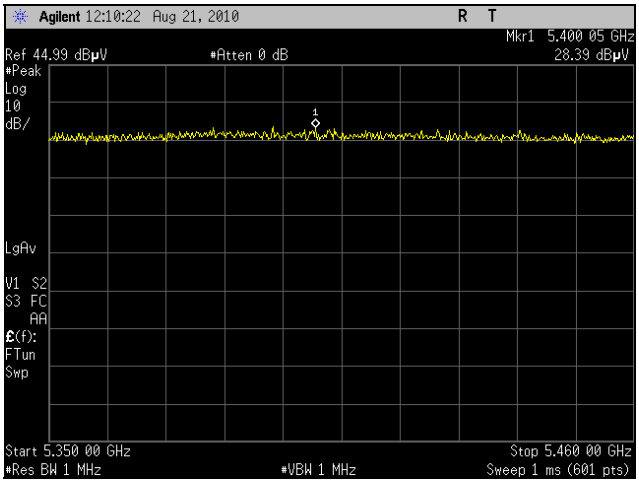
Plot 168. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5600 MHz, 802.11a



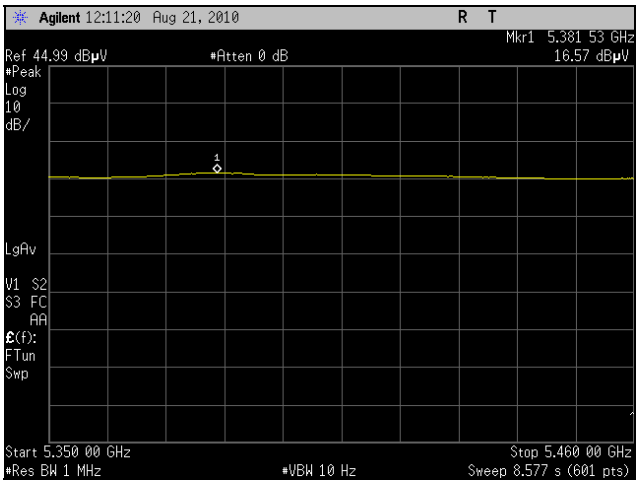
Plot 169. Radiated Spurs, 30 MHz – 1 GHz, Channel 5700 MHz, 802.11a



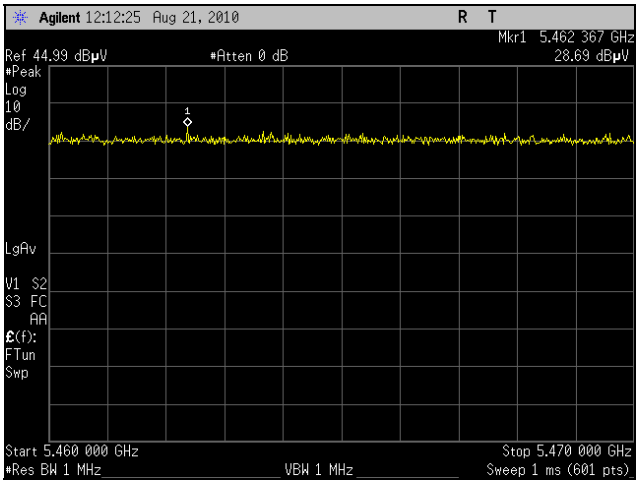
Plot 170. Radiated Spurs, 1 GHz – 5.35 GHz, Channel 5700 MHz, 802.11a



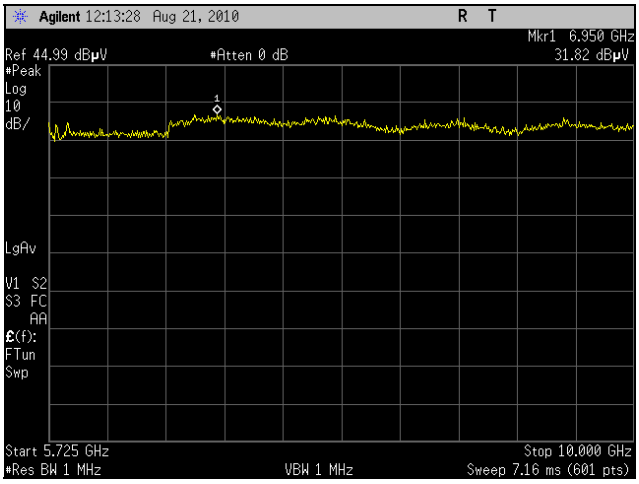
Plot 171. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5700 MHz, 802.11a



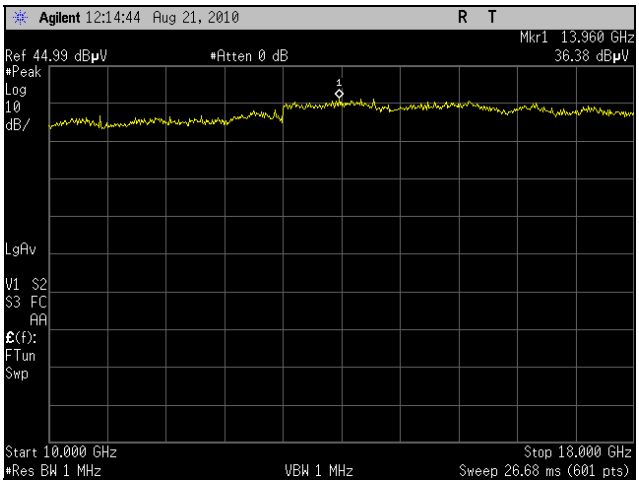
Plot 172. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5700 MHz, 802.11a



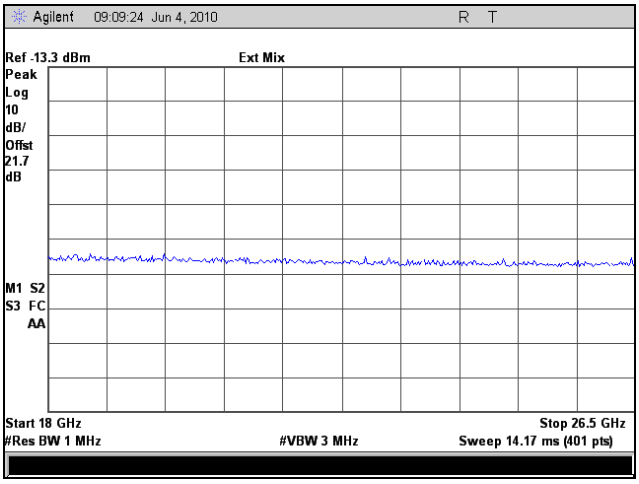
Plot 173. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5700 MHz, 802.11a



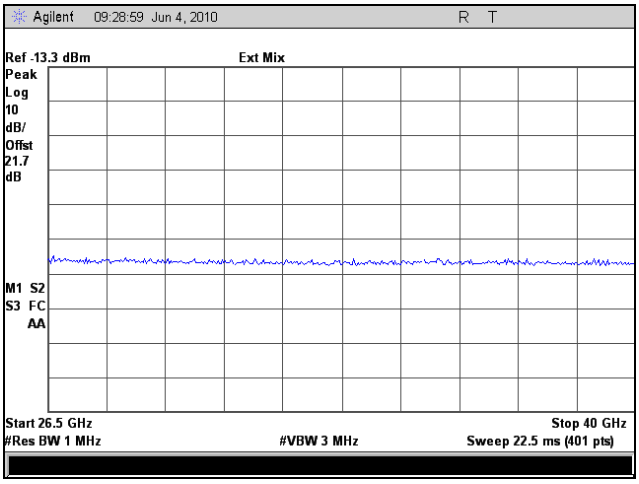
Plot 174. Radiated Spurs, 5.725 GHz – 10 GHz, Channel 5700 MHz, 802.11a



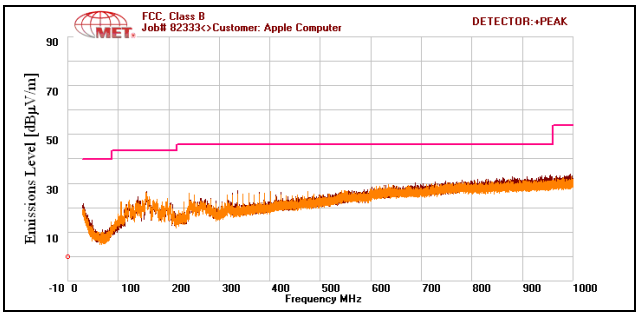
Plot 175. Radiated Spurs, 10 GHz – 18 GHz, Channel 5700 MHz, 802.11a



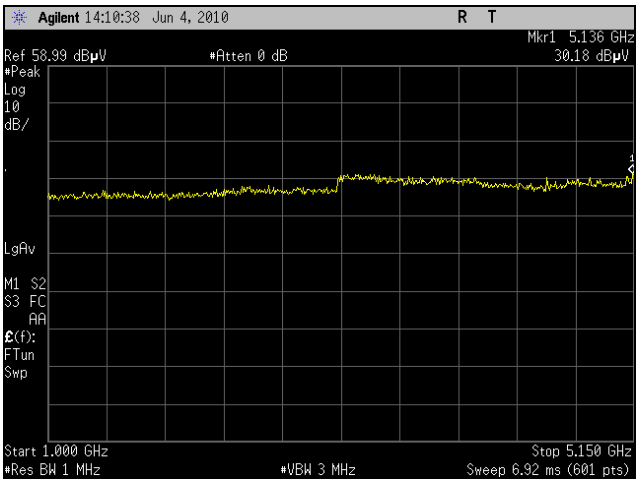
Plot 176. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5700 MHz, 802.11a



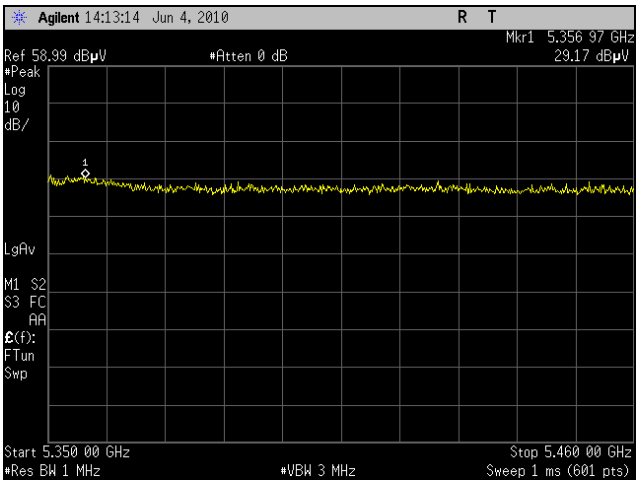
Plot 177. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5700 MHz, 802.11a



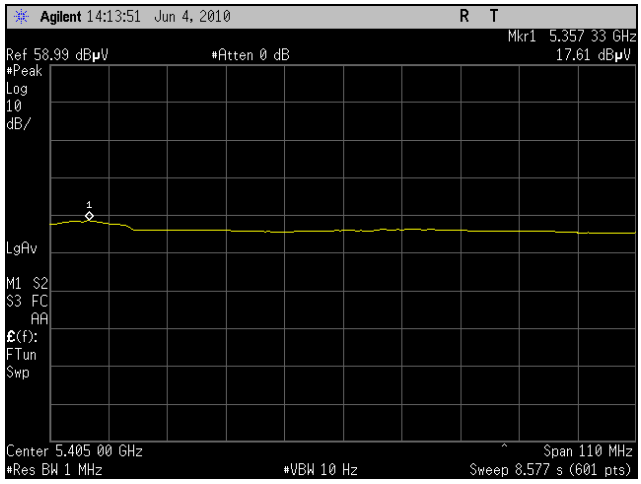
Plot 178. Radiated Spurs, 30 MHz – 1 GHz, Channel 5180 MHz, 802.11n 20MHz



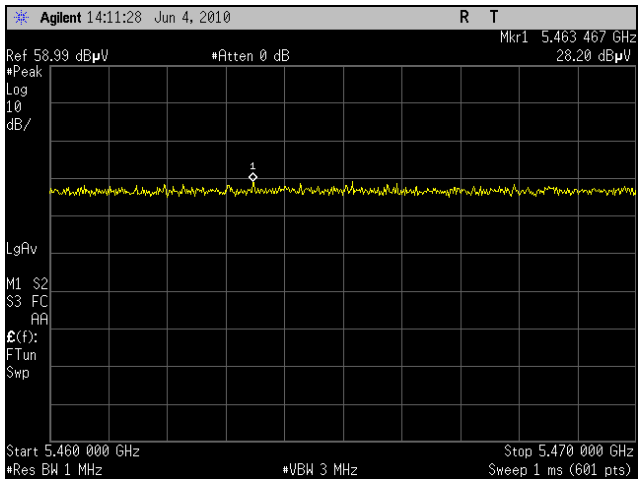
Plot 179. Radiated Spurs, 1 GHz – 5.15 GHz, Channel 5180 MHz, 802.11n 20MHz



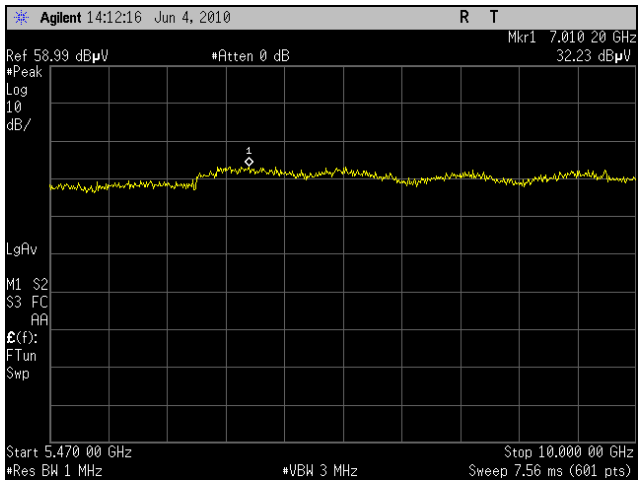
Plot 180. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5180 MHz, 802.11n 20MHz



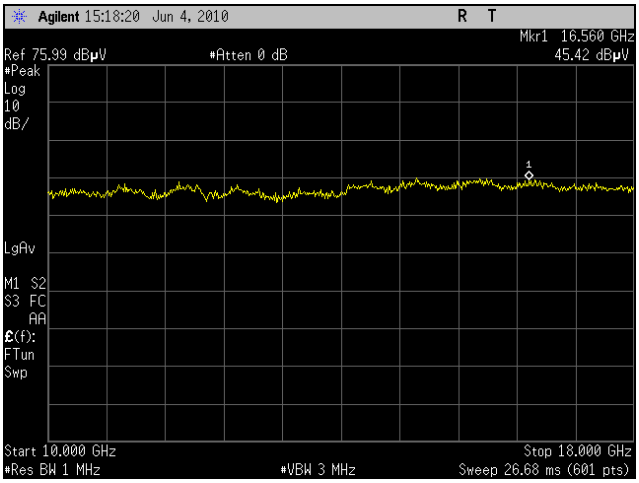
Plot 181. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5180 MHz, 802.11n 20MHz



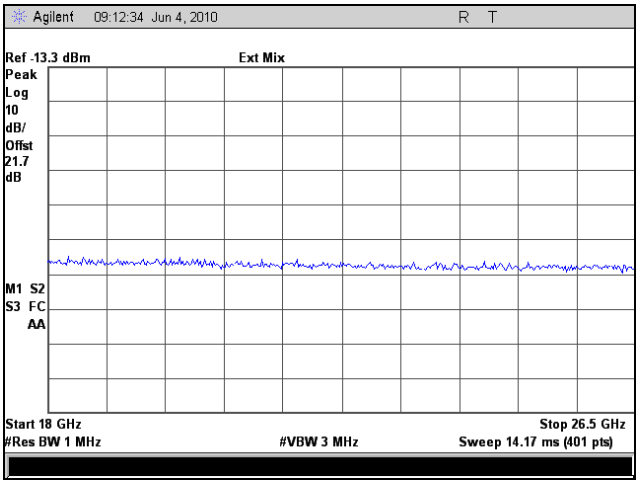
Plot 182. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5180 MHz, 802.11n 20MHz



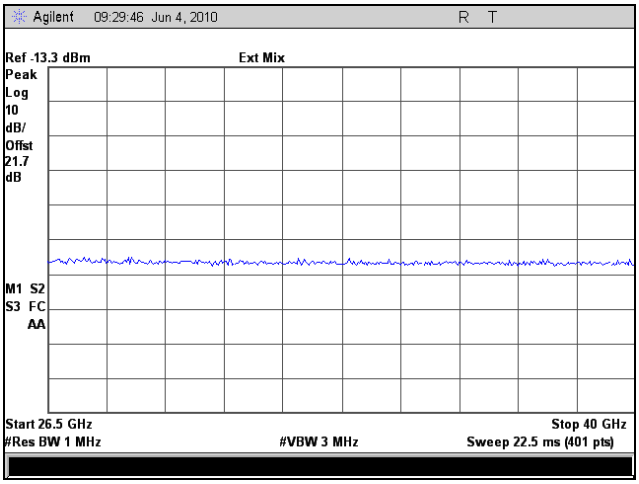
Plot 183. Radiated Spurs, 5.47 GHz – 10 GHz, Channel 5180 MHz, 802.11n 20MHz



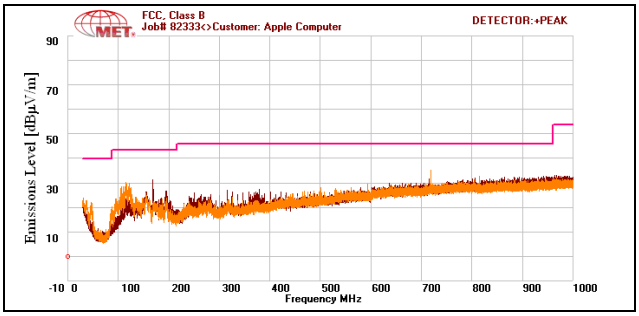
Plot 184. Radiated Spurs, 10 GHz – 18 GHz, Channel 5180 MHz, 802.11n 20MHz



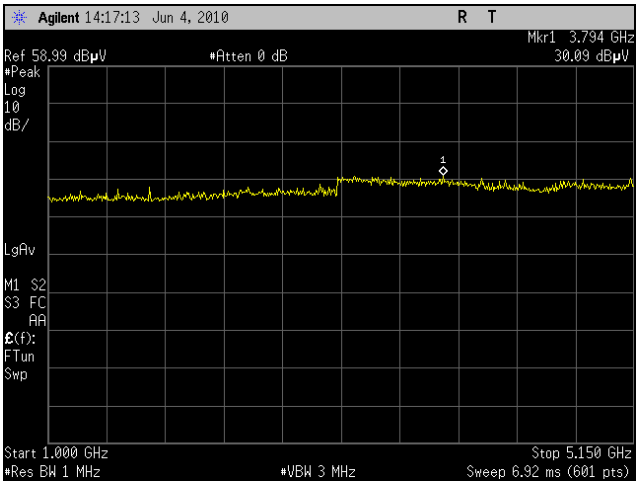
Plot 185. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5180 MHz, 802.11n 20MHz



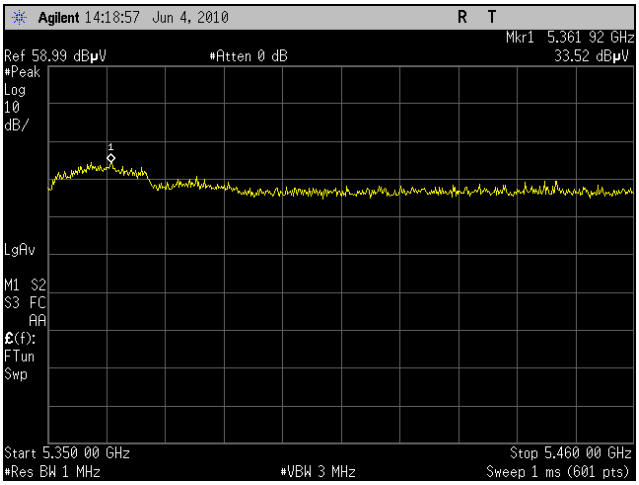
Plot 186. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5180 MHz, 802.11n 20MHz



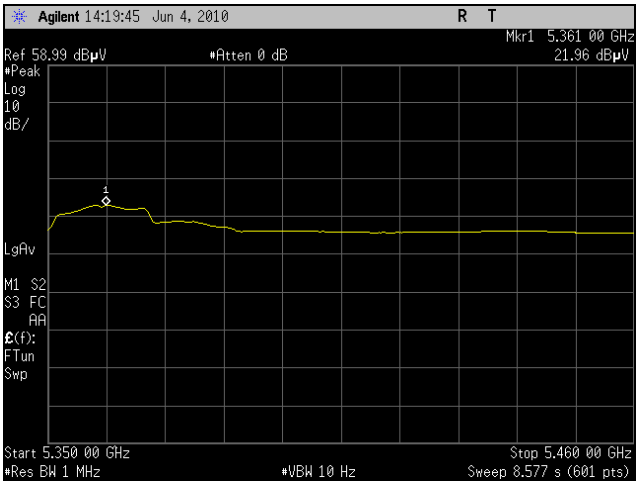
Plot 187. Radiated Spurs, 30 MHz – 1 GHz, Channel 5200 MHz, 802.11n 20MHz



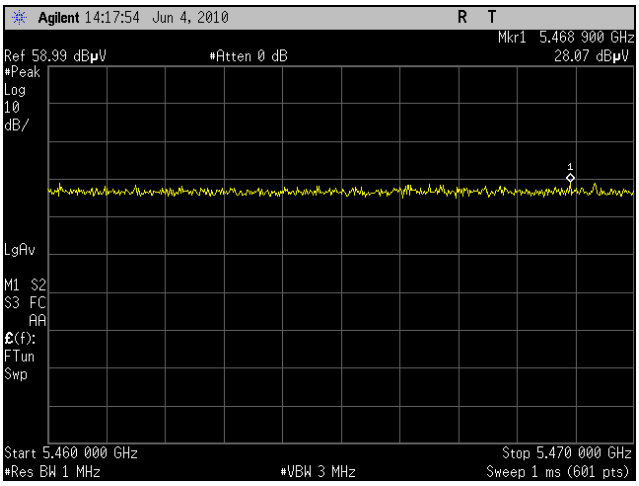
Plot 188. Radiated Spurs, 1 GHz – 5.15 GHz, Channel 5200 MHz, 802.11n 20MHz



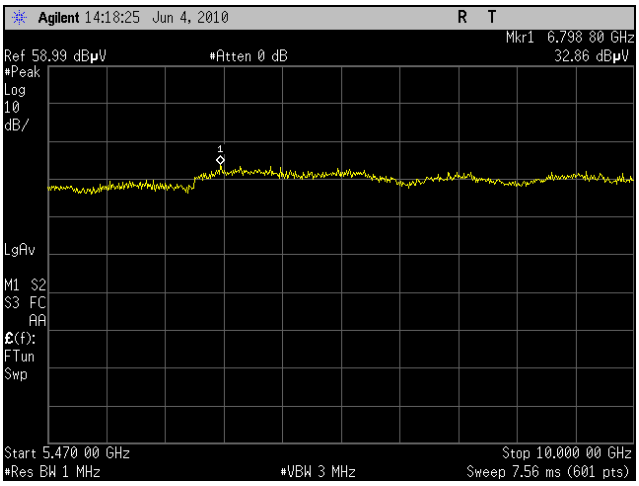
Plot 189. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5200 MHz, 802.11n 20MHz



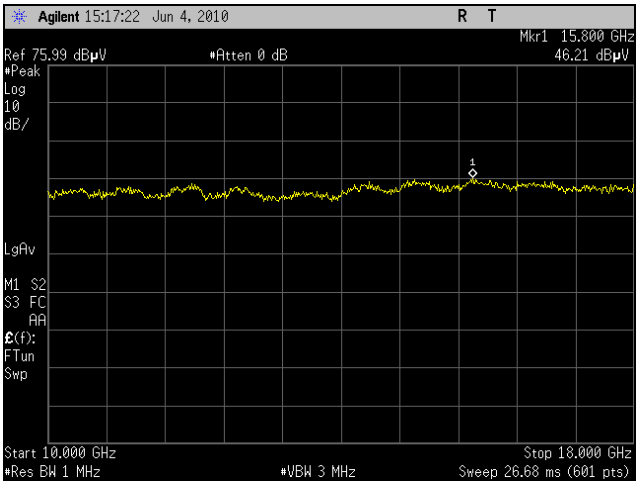
Plot 190. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5200 MHz, 802.11n 20MHz



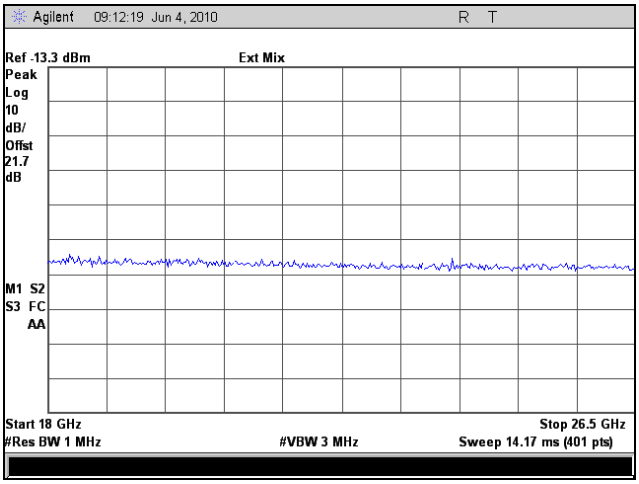
Plot 191. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5200 MHz, 802.11n 20MHz



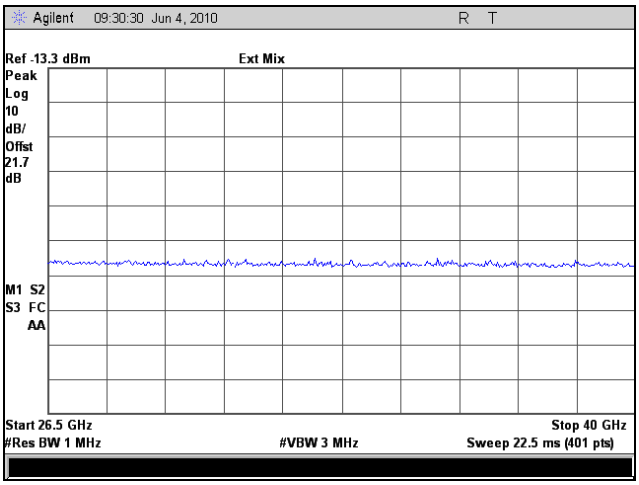
Plot 192. Radiated Spurs, 5.47 GHz – 10 GHz, Channel 5200 MHz, 802.11n 20MHz



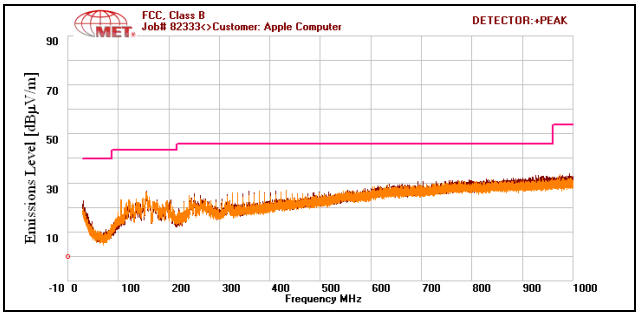
Plot 193. Radiated Spurs, 10 GHz – 18 GHz, Channel 5200 MHz, 802.11n 20MHz



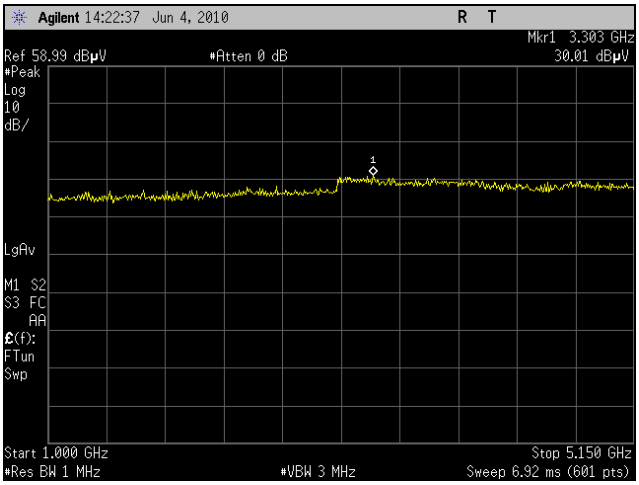
Plot 194. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5200 MHz, 802.11n 20MHz



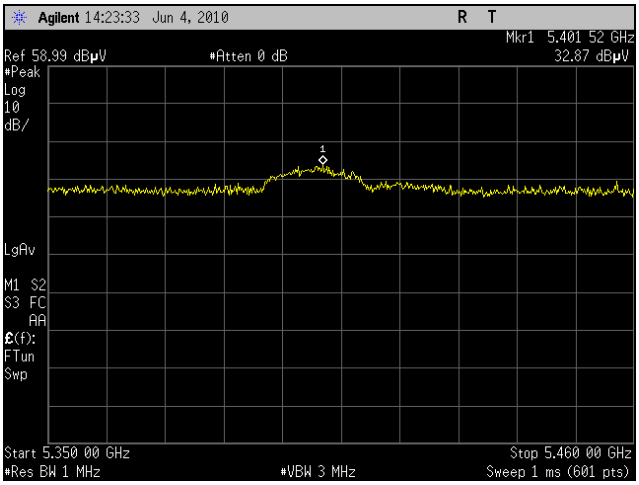
Plot 195. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5200 MHz, 802.11n 20MHz



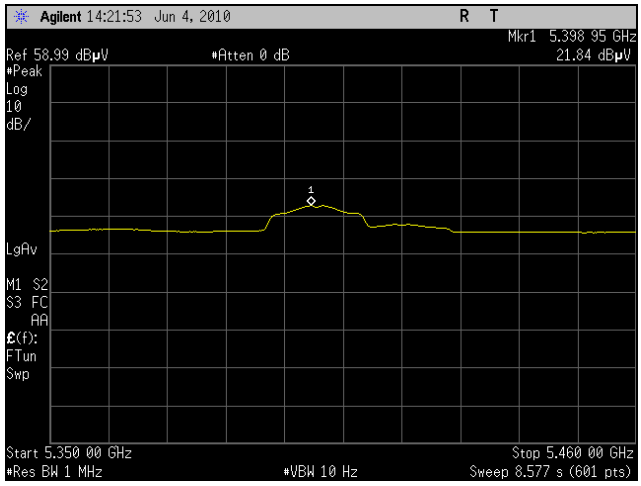
Plot 196. Radiated Spurs, 30 MHz – 1 GHz, Channel 5240 MHz, 802.11n 20MHz



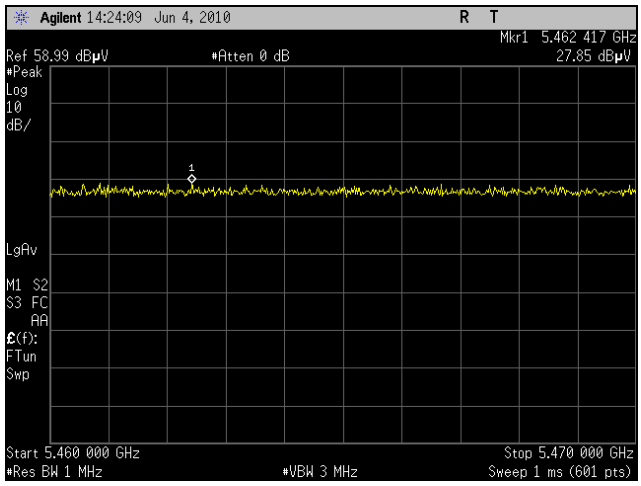
Plot 197. Radiated Spurs, 1 GHz – 5.15 GHz, Channel 5240 MHz, 802.11n 20MHz



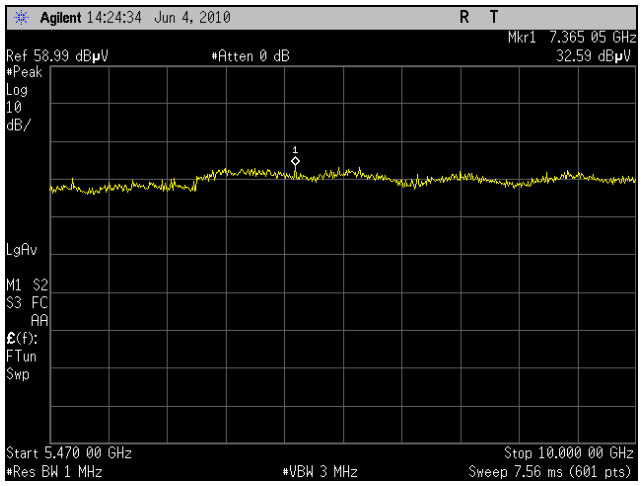
Plot 198. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5240 MHz, 802.11n 20MHz



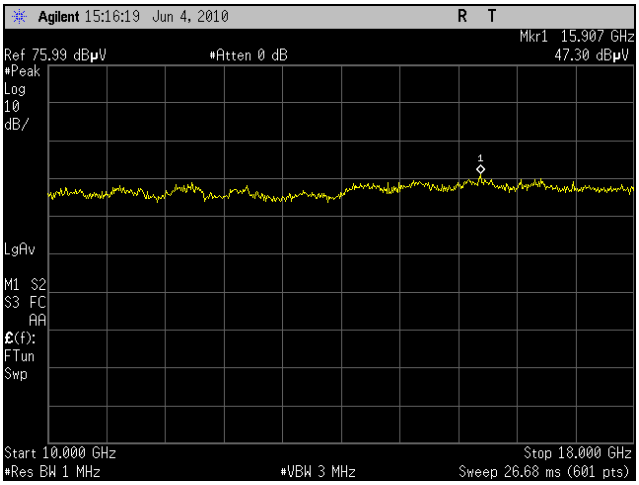
Plot 199. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5240 MHz, 802.11n 20MHz



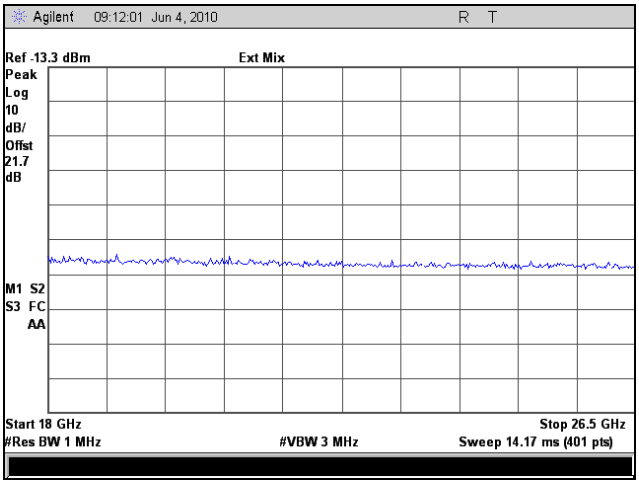
Plot 200. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5240 MHz, 802.11n 20MHz



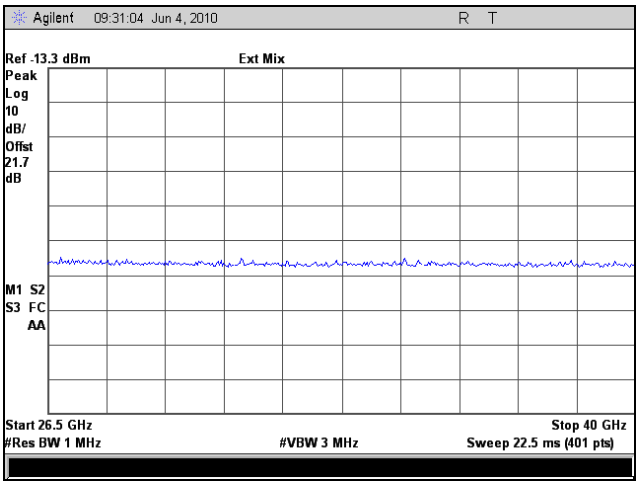
Plot 201. Radiated Spurs, 5.47 GHz – 10 GHz, Channel 5240 MHz, 802.11n 20MHz



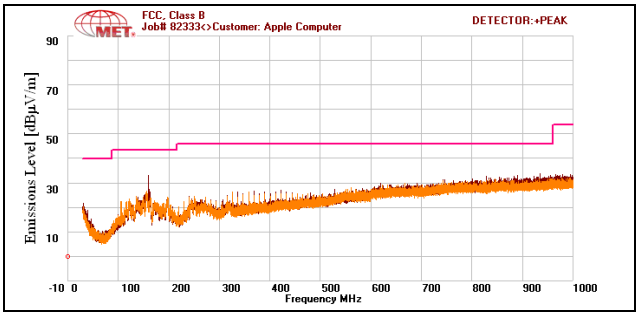
Plot 202. Radiated Spurs, 10 GHz – 18 GHz, Channel 5240 MHz, 802.11n 20MHz



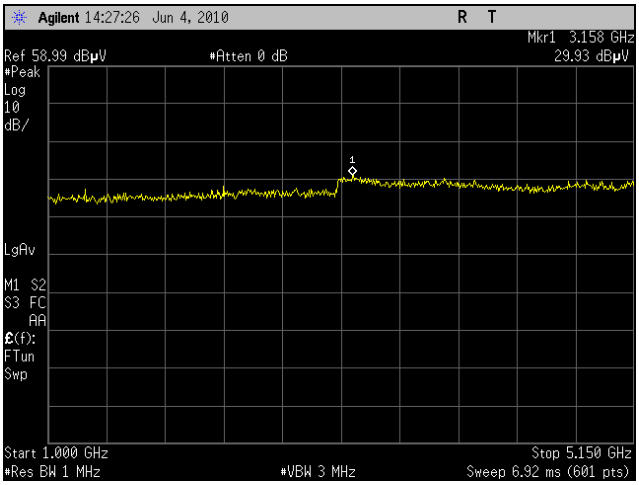
Plot 203. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5240 MHz, 802.11n 20MHz



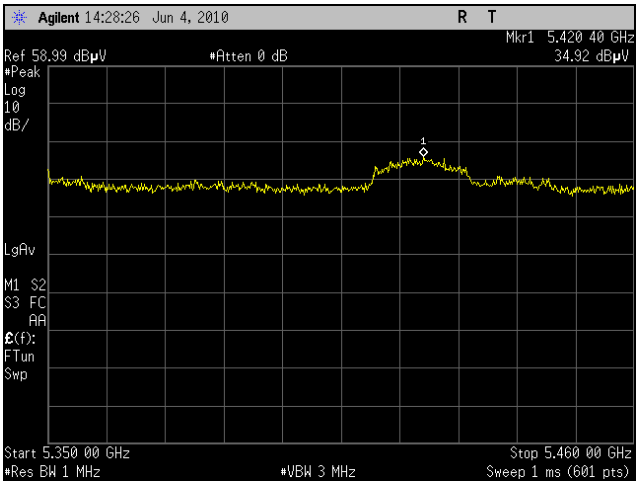
Plot 204. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5240 MHz, 802.11n 20MHz



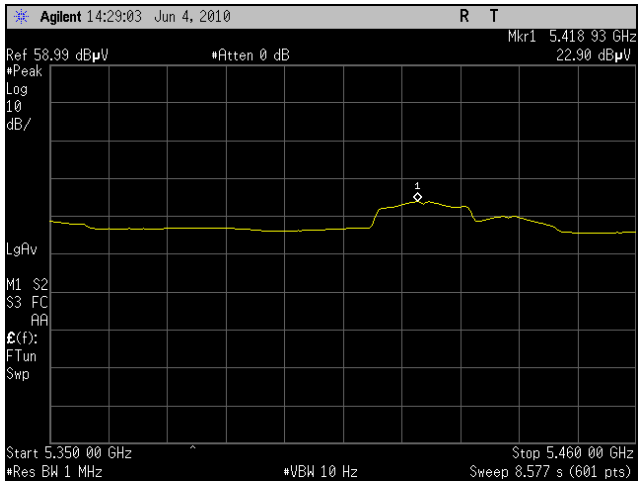
Plot 205. Radiated Spurs, 30 MHz – 1 GHz, Channel 5260 MHz, 802.11n 20MHz



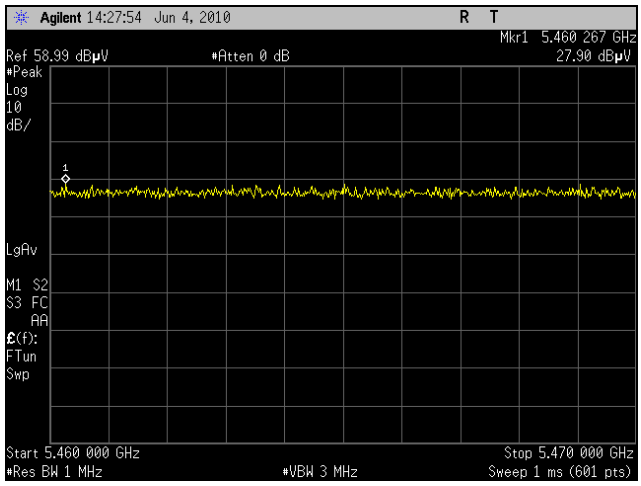
Plot 206. Radiated Spurs, 1 GHz – 5.15 GHz, Channel 5260 MHz, 802.11n 20MHz



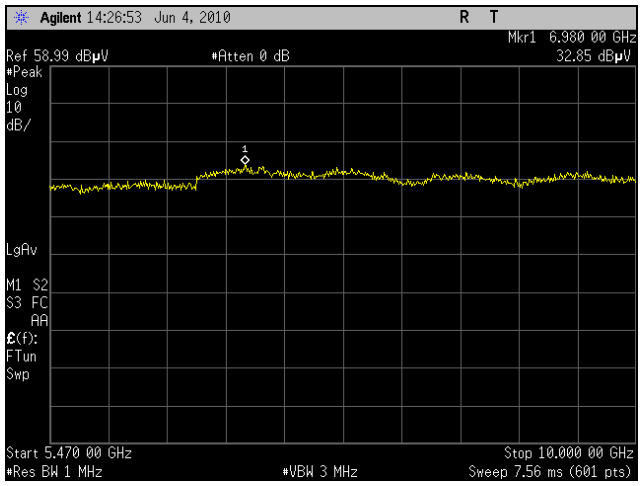
Plot 207. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5260 MHz, 802.11n 20MHz



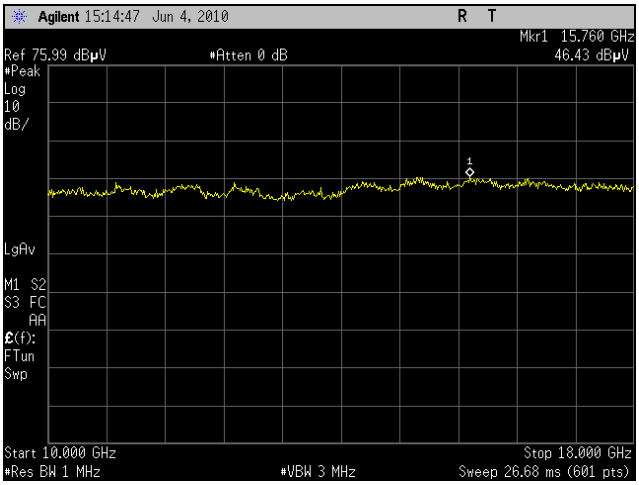
Plot 208. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5260 MHz, 802.11n 20MHz



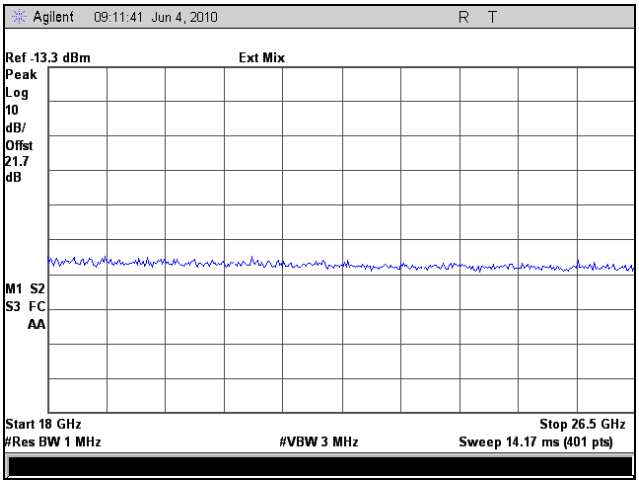
Plot 209. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5260 MHz, 802.11n 20MHz



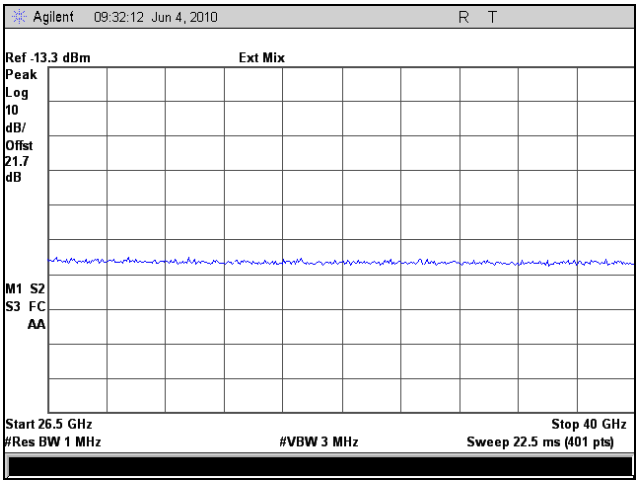
Plot 210. Radiated Spurs, 5.47 GHz – 10 GHz, Channel 5260 MHz, 802.11n 20MHz



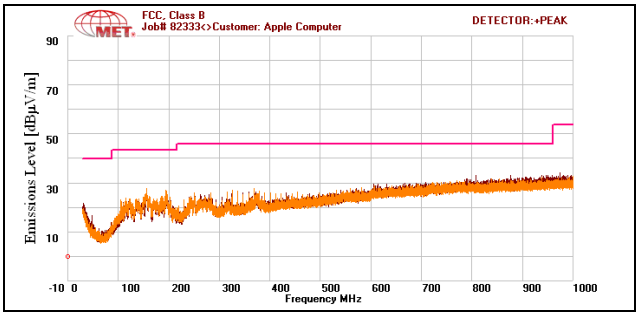
Plot 211. Radiated Spurs, 10 GHz – 18 GHz, Channel 5260 MHz, 802.11n 20MHz



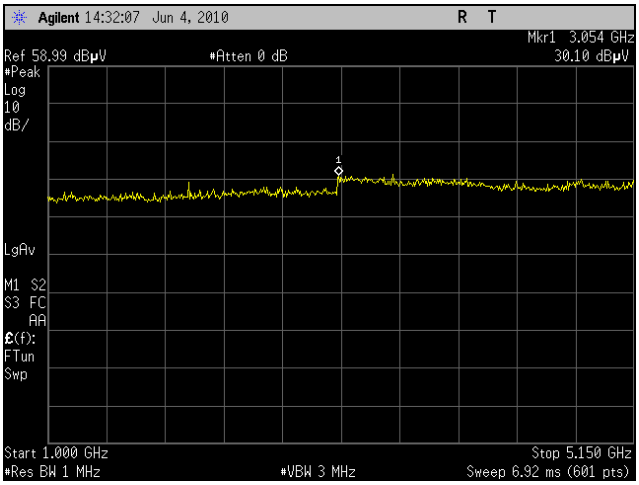
Plot 212. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5260 MHz, 802.11n 20MHz



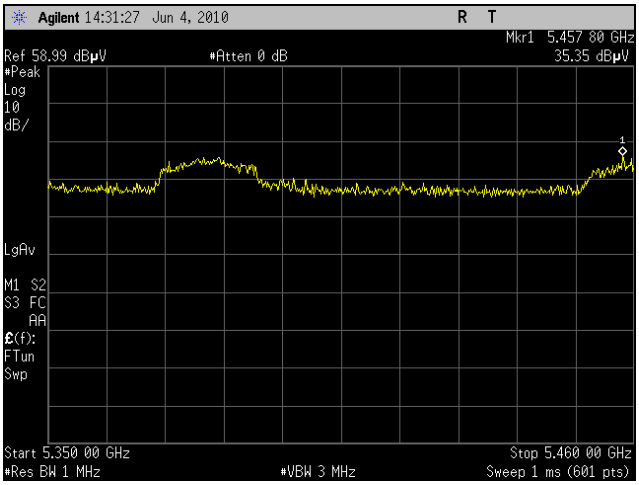
Plot 213. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5260 MHz, 802.11n 20MHz



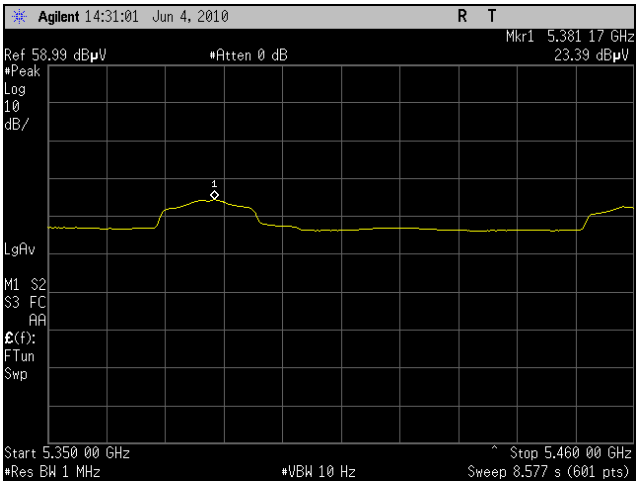
Plot 214. Radiated Spurs, 30 MHz – 1 GHz, Channel 5300 MHz, 802.11n 20MHz



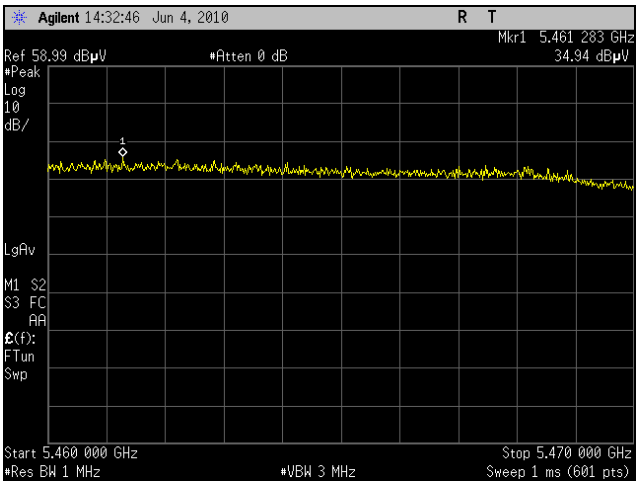
Plot 215. Radiated Spurs, 1 GHz – 5.15 GHz, Channel 5300 MHz, 802.11n 20MHz



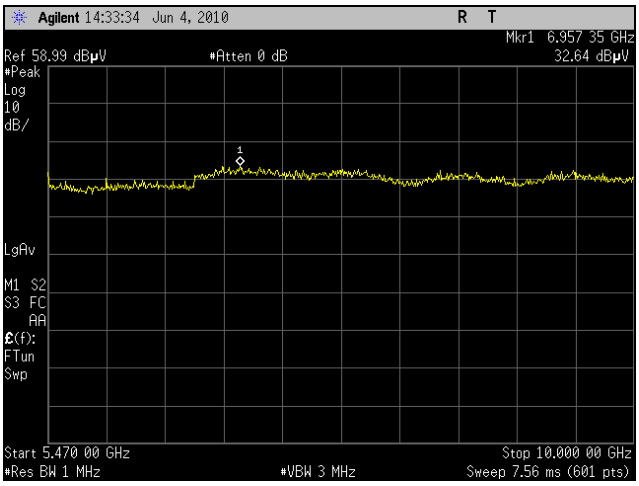
Plot 216. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5300 MHz, 802.11n 20MHz



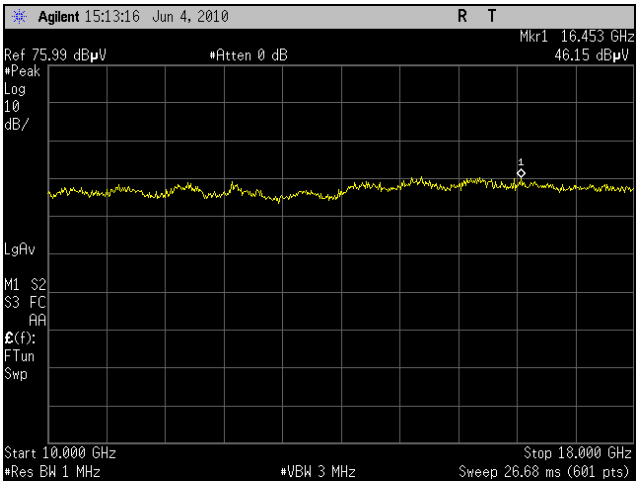
Plot 217. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5300 MHz, 802.11n 20MHz



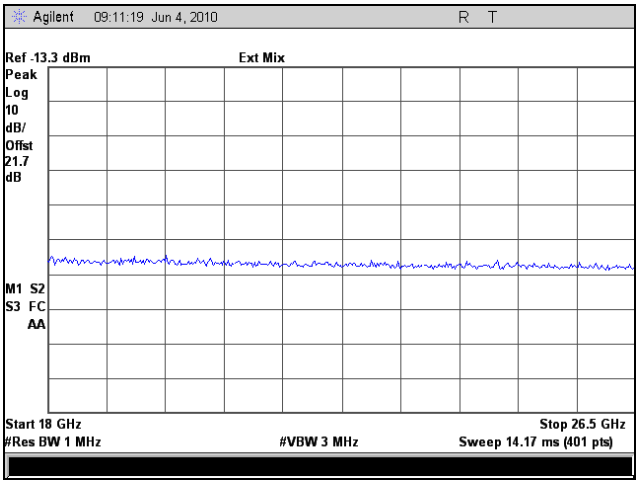
Plot 218. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5300 MHz, 802.11n 20MHz



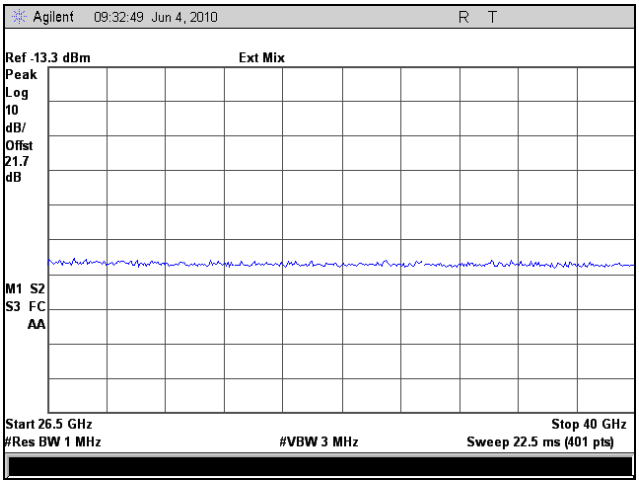
Plot 219. Radiated Spurs, 5.47 GHz – 10 GHz, Channel 5300 MHz, 802.11n 20MHz



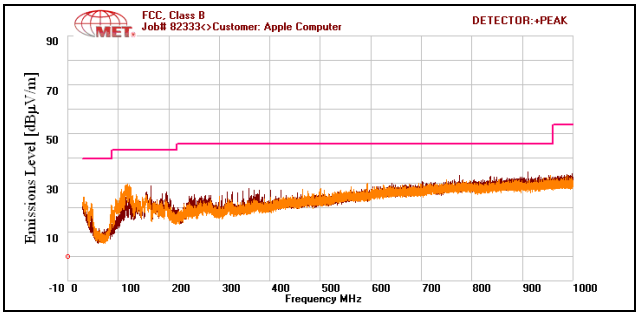
Plot 220. Radiated Spurs, 10 GHz – 18 GHz, Channel 5300 MHz, 802.11n 20MHz



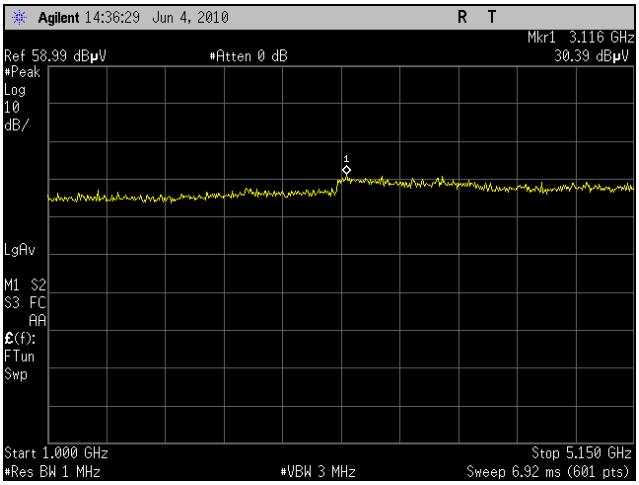
Plot 221. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5300 MHz, 802.11n 20MHz



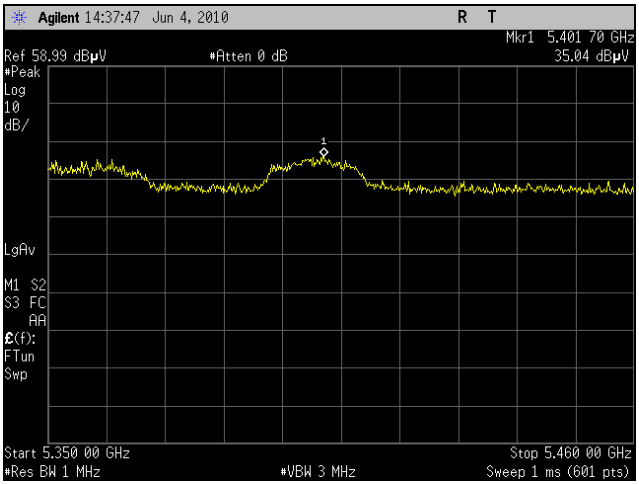
Plot 222. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5300 MHz, 802.11n 20MHz



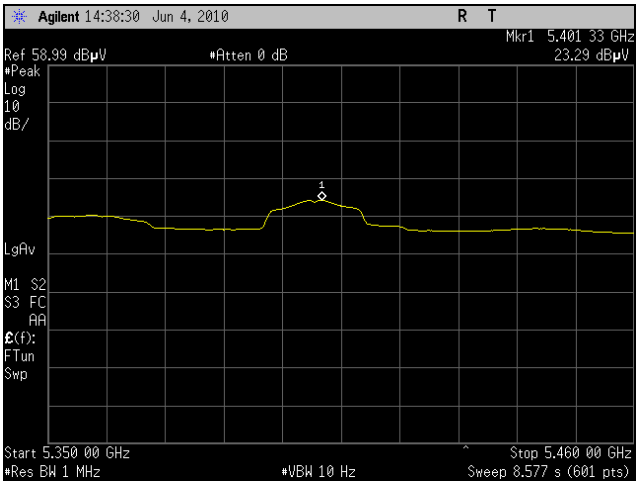
Plot 223. Radiated Spurs, 30 MHz – 1 GHz, Channel 5320 MHz, 802.11n 20MHz



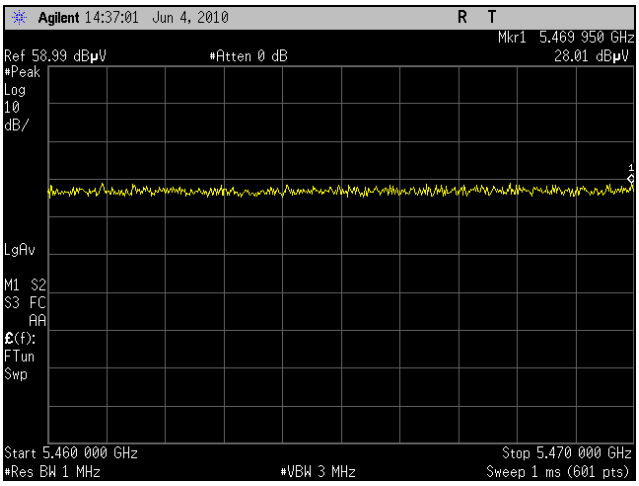
Plot 224. Radiated Spurs, 1 GHz – 5.15 GHz, Channel 5320 MHz, 802.11n 20MHz



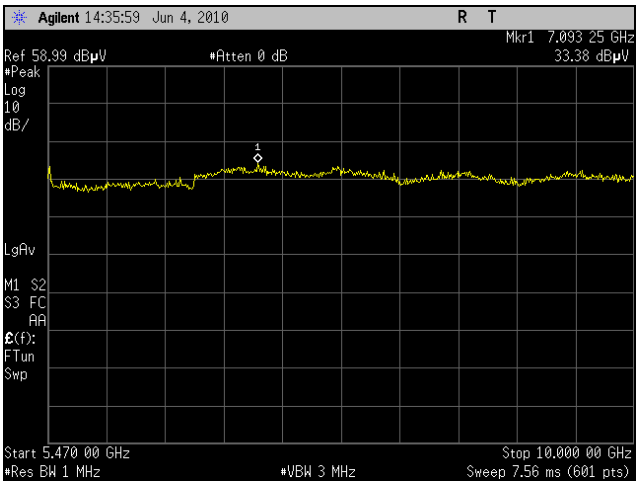
Plot 225. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5320 MHz, 802.11n 20MHz



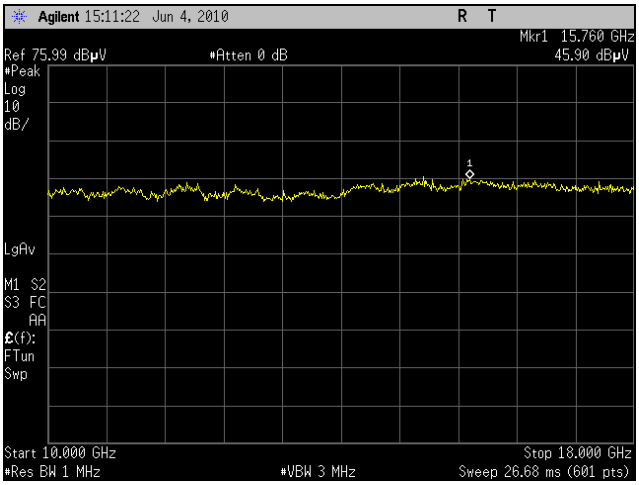
Plot 226. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5320 MHz, 802.11n 20MHz



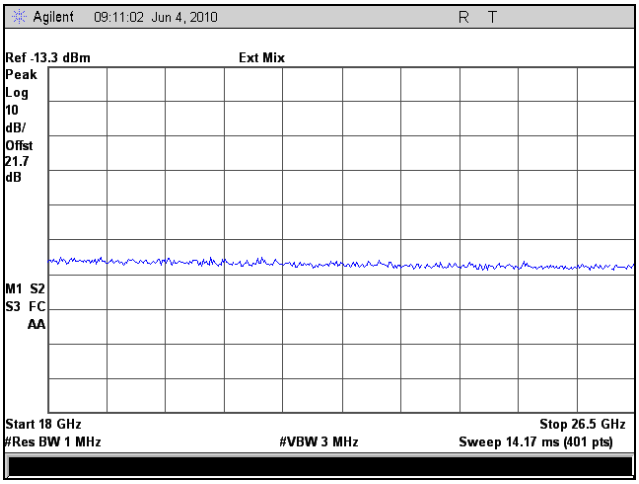
Plot 227. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5320 MHz, 802.11n 20MHz



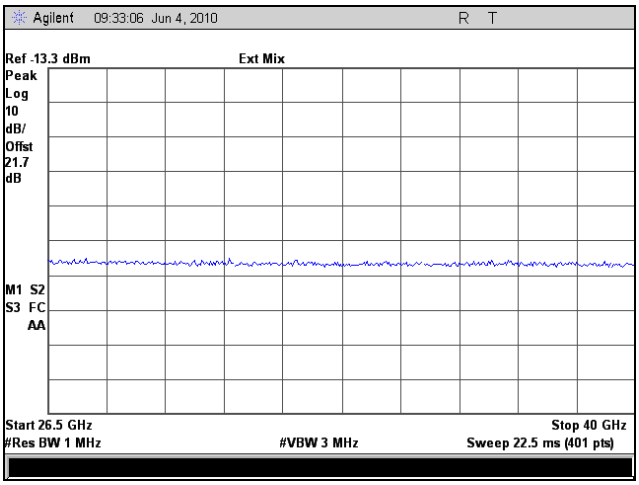
Plot 228. Radiated Spurs, 5.47 GHz – 10 GHz, Channel 5320 MHz, 802.11n 20MHz



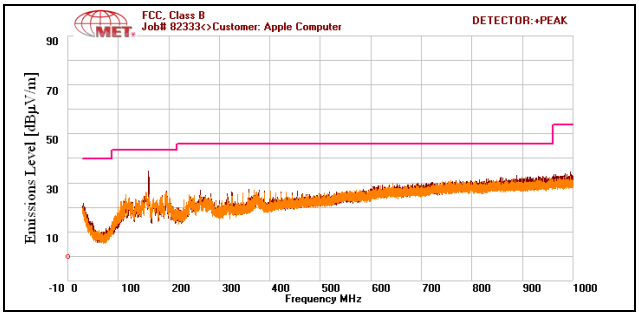
Plot 229. Radiated Spurs, 10 GHz – 18 GHz, Channel 5320 MHz, 802.11n 20MHz



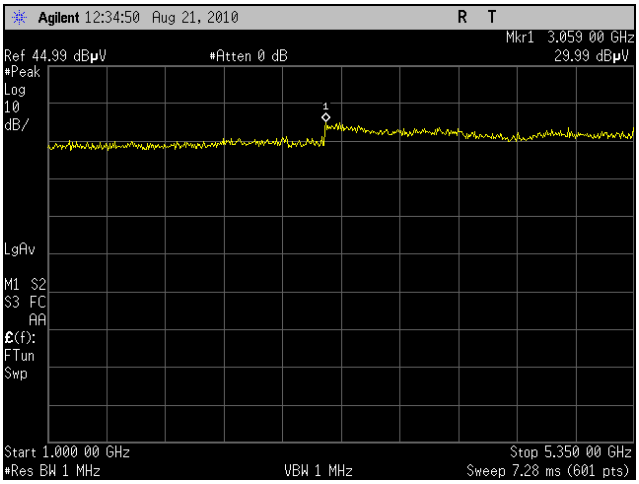
Plot 230. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5320 MHz, 802.11n 20MHz



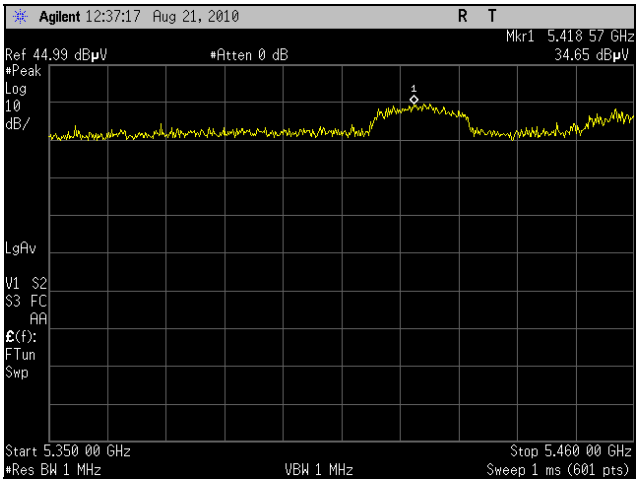
Plot 231. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5320 MHz, 802.11n 20MHz



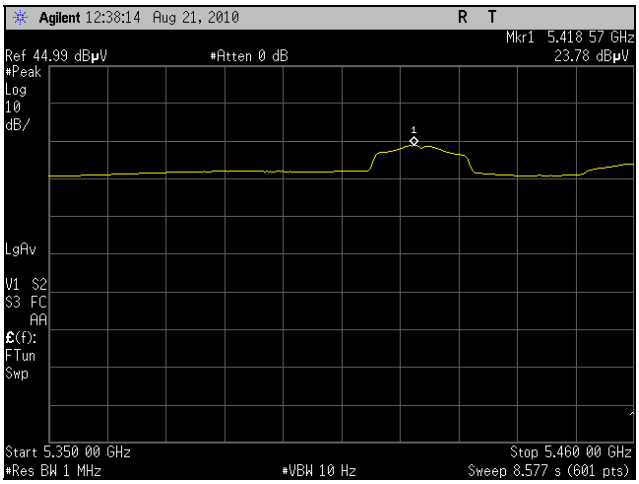
Plot 232. Radiated Spurs, 30 MHz – 1 GHz, Channel 5500 MHz, 802.11n 20MHz



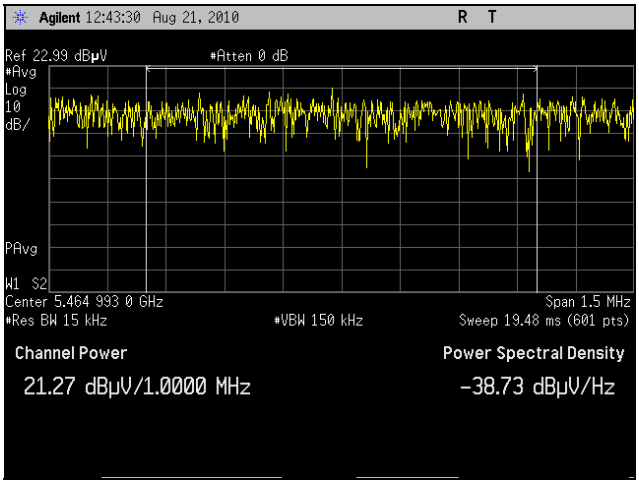
Plot 233. Radiated Spurs, 1 GHz – 5.35 GHz, Channel 5500 MHz, 802.11n 20MHz



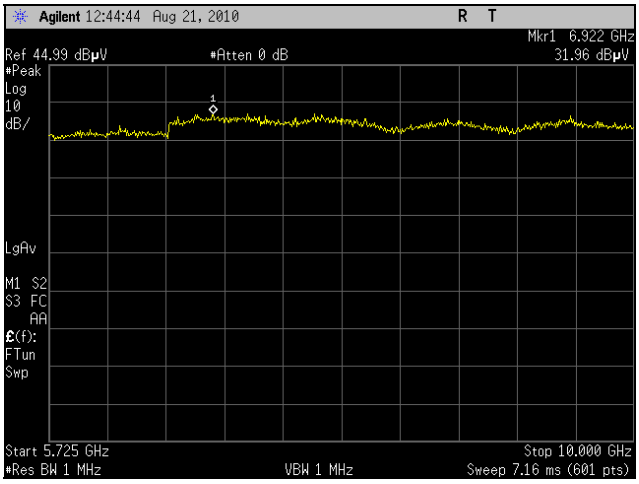
Plot 234. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5500 MHz, 802.11n 20MHz



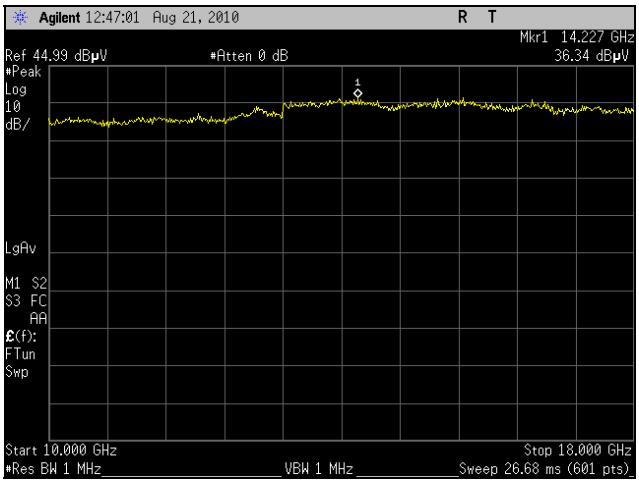
Plot 235. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5500 MHz, 802.11n 20MHz



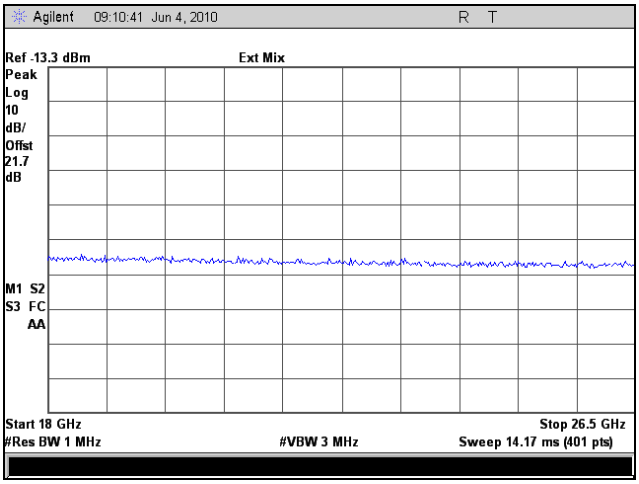
Plot 236. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5500 MHz, 802.11n 20MHz



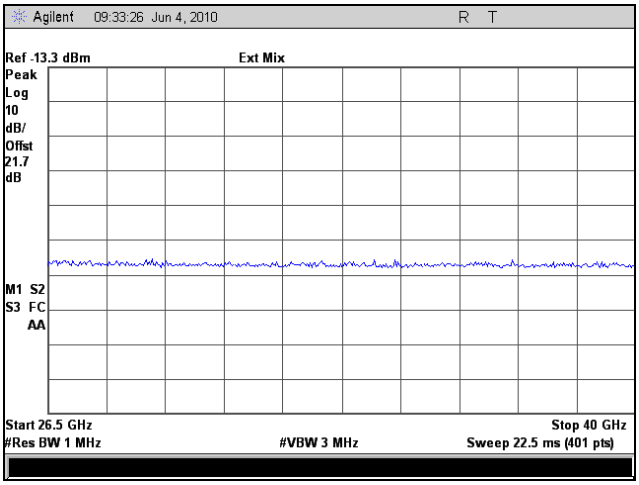
Plot 237. Radiated Spurs, 5.725 GHz – 10 GHz, Channel 5500 MHz, 802.11n 20MHz



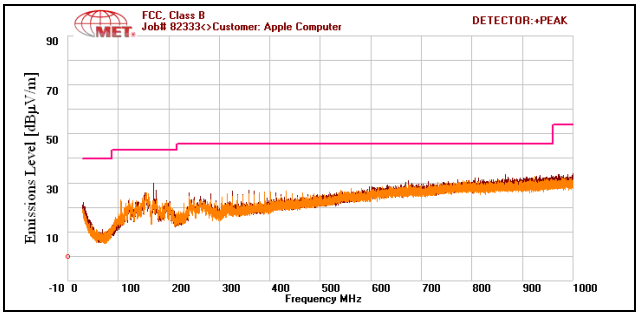
Plot 238. Radiated Spurs, 10 GHz – 18 GHz, Channel 5500 MHz, 802.11n 20MHz



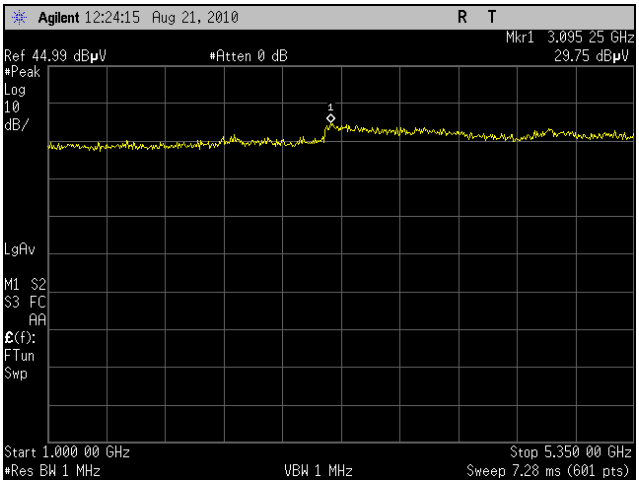
Plot 239. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5500 MHz, 802.11n 20MHz



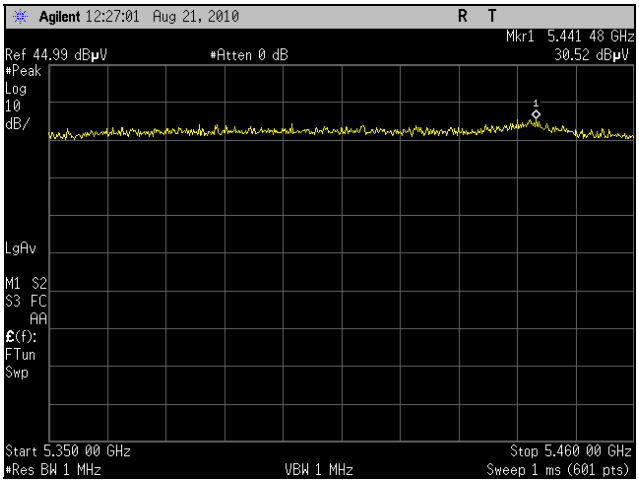
Plot 240. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5500 MHz, 802.11n 20MHz



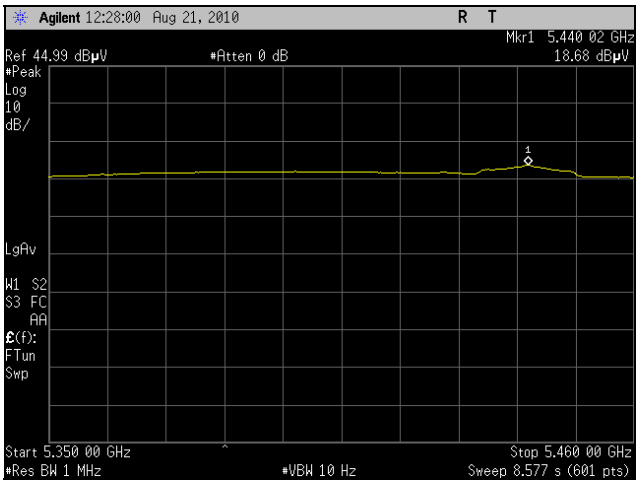
Plot 241. Radiated Spurs, 30 MHz – 1 GHz, Channel 5600 MHz, 802.11n 20MHz



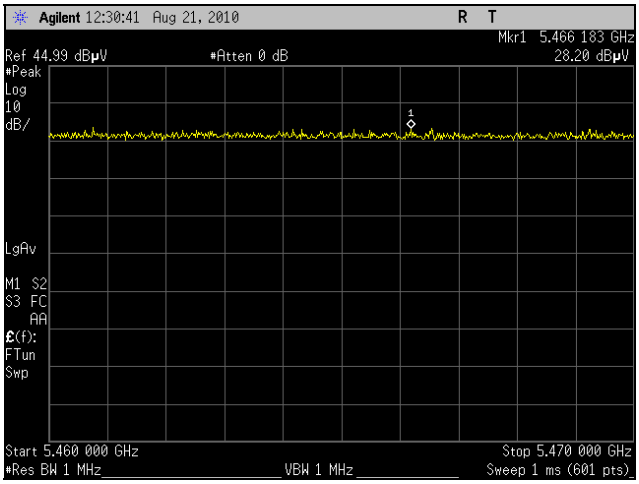
Plot 242. Radiated Spurs, 1 GHz – 5.35 GHz, Channel 5600 MHz, 802.11n 20MHz



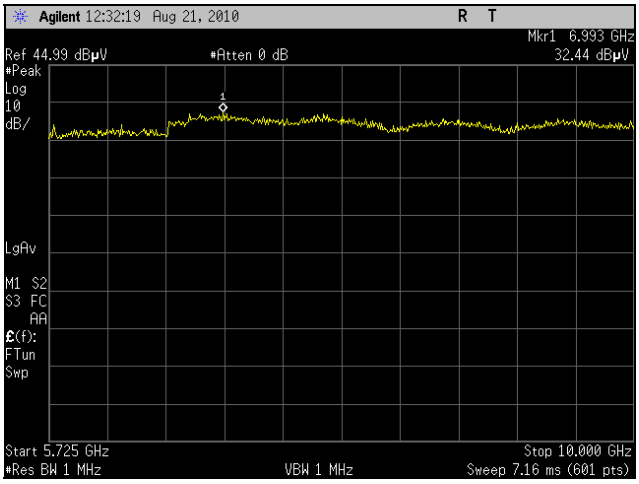
Plot 243. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5600 MHz, 802.11n 20MHz



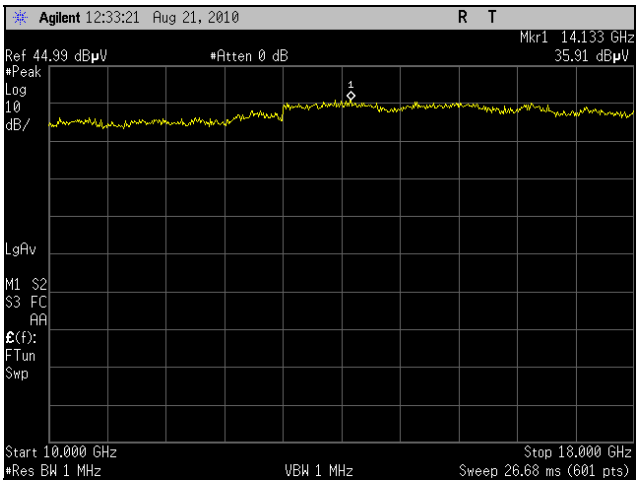
Plot 244. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5600 MHz, 802.11n 20MHz



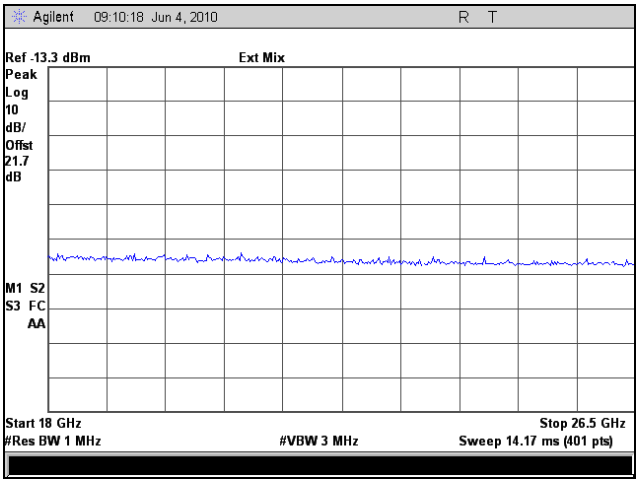
Plot 245. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5600 MHz, 802.11n 20MHz



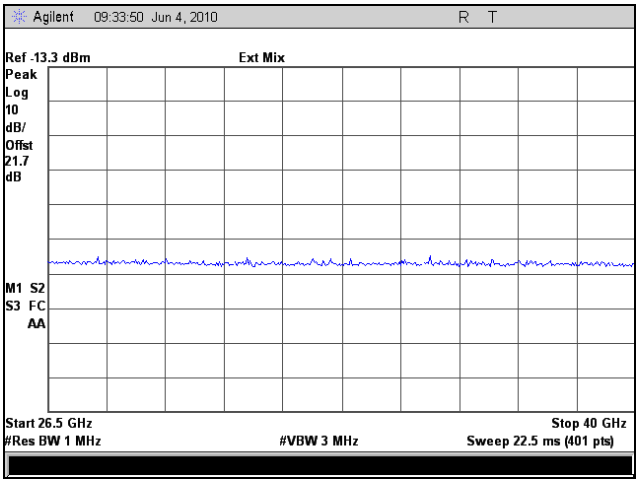
Plot 246. Radiated Spurs, 5.725 GHz – 10 GHz, Channel 5600 MHz, 802.11n 20MHz



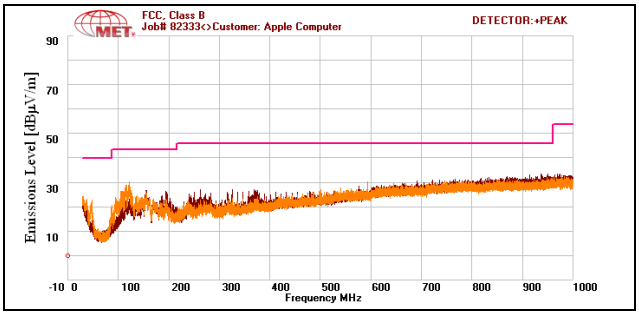
Plot 247. Radiated Spurs, 10 GHz – 18 GHz, Channel 5600 MHz, 802.11n 20MHz



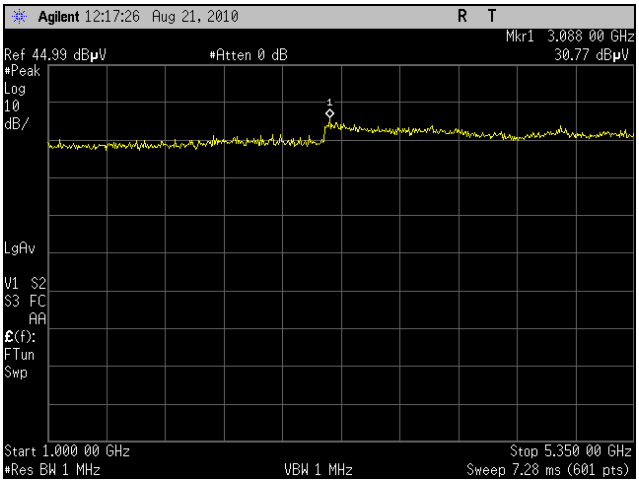
Plot 248. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5600 MHz, 802.11n 20MHz



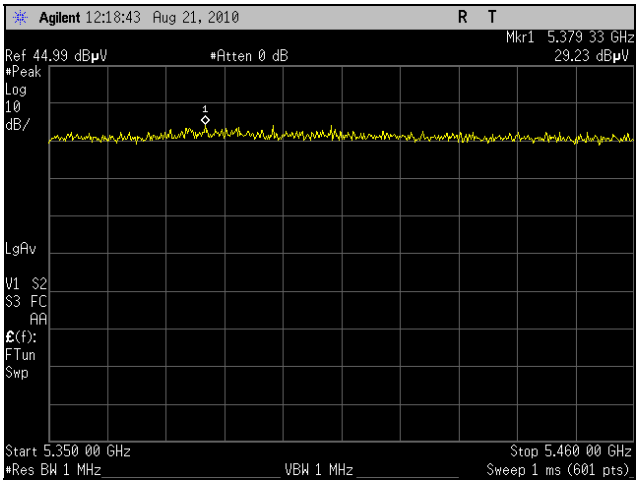
Plot 249. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5600 MHz, 802.11n 20MHz



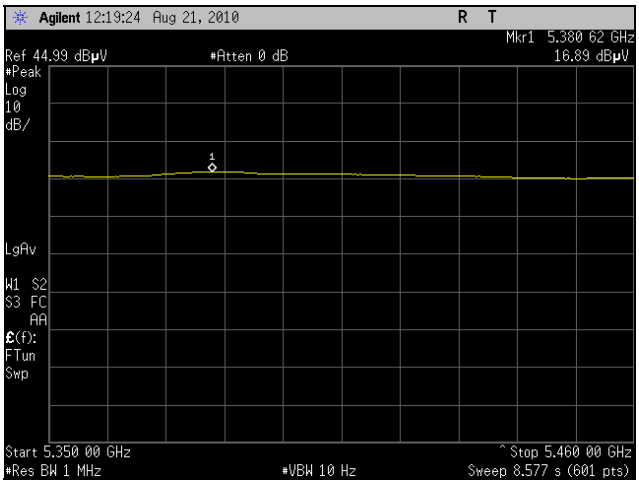
Plot 250. Radiated Spurs, 30 MHz – 1 GHz, Channel 5700 MHz, 802.11n 20MHz



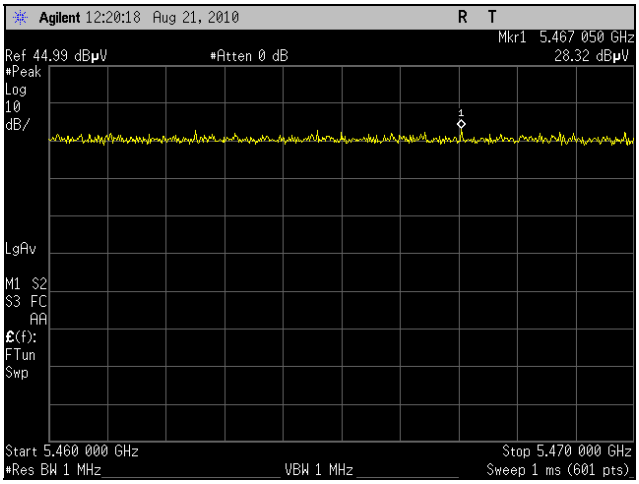
Plot 251. Radiated Spurs, 1 GHz – 5.35 GHz, Channel 5700 MHz, 802.11n 20MHz



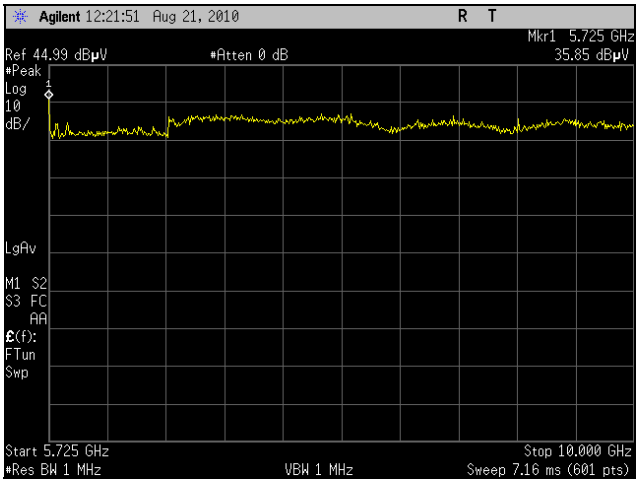
Plot 252. Radiated Spurs, 5.35 GHz – 5.46 GHz, Peak, Channel 5700 MHz, 802.11n 20MHz



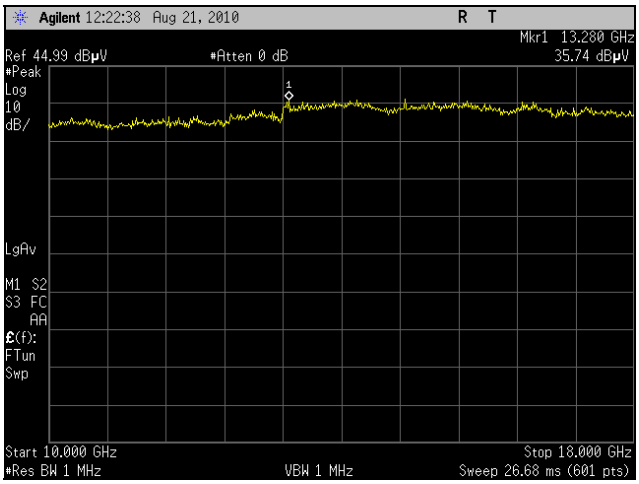
Plot 253. Radiated Spurs, 5.35 GHz – 5.46 GHz, Average, Channel 5700 MHz, 802.11n 20MHz



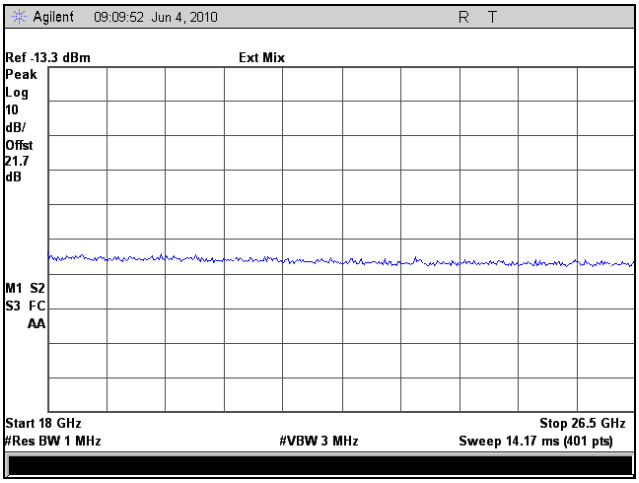
Plot 254. Radiated Spurs, 5.46 GHz – 5.47 GHz, Channel 5700 MHz, 802.11n 20MHz



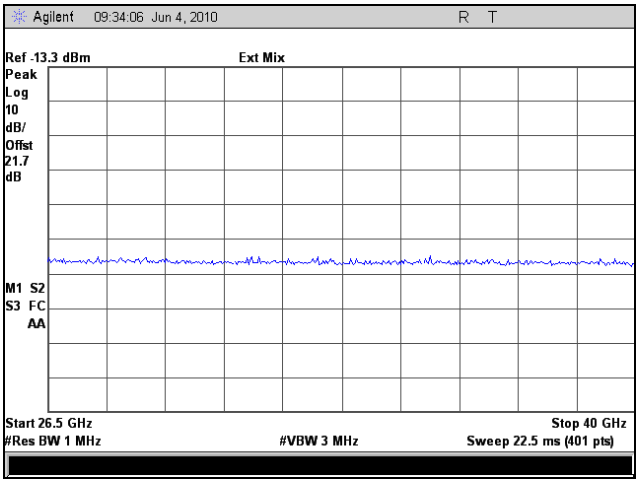
Plot 255. Radiated Spurs, 5.725 GHz – 10 GHz, Channel 5700 MHz, 802.11n 20MHz



Plot 256. Radiated Spurs, 10 GHz – 18 GHz, Channel 5700 MHz, 802.11n 20MHz



Plot 257. Radiated Spurs, 18 GHz – 26.5 GHz, Channel 5700 MHz, 802.11n 20MHz



Plot 258. Radiated Spurs, 26.5 GHz – 40 GHz, Channel 5700 MHz, 802.11n 20MHz

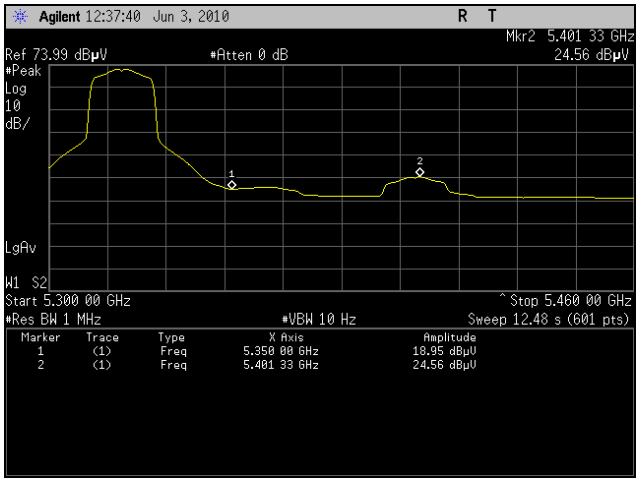
Radiated Band Edge Measurements

Test Procedures: The transmitter was turned on. Measurements were performed on the band edge channels. The EUT was rotated orthogonally through all three axes.

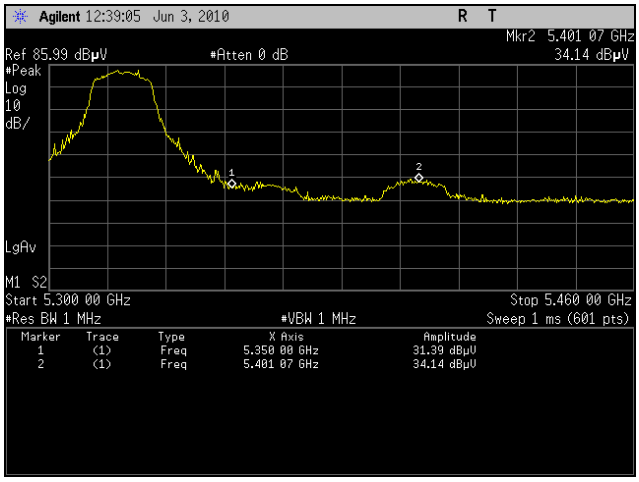
	Restricted Band Freq.	Uncorrected Peak (dBuV)	Cable Loss	ACF	DCF	Corrected	Limit (dBuV/m)	Margin	
802.11a	5350 MHz	34.14	3.99	34.32	9.54	62.91	74	-11.09	Peak
	5350 MHz	24.56	3.99	34.32	9.54	53.33	54	-0.67	Average
	5460 MHz	35.58	4.03	34.45	9.54	64.52	74	-9.48	Peak
	5460 MHz	23.81	4.03	34.45	9.54	52.75	54	-1.25	Average
HT20	5350 MHz	34.2	3.99	34.32	9.54	62.97	74	-11.03	Peak
	5350 MHz	24.02	3.99	34.32	9.54	52.79	54	-1.21	Average
	5460 MHz	34.93	4.03	34.45	9.54	63.87	74	-10.13	Peak
	5460 MHz	23.67	4.03	34.45	9.54	52.61	54	-1.39	Average

Table 24. Band Edge, Test Results

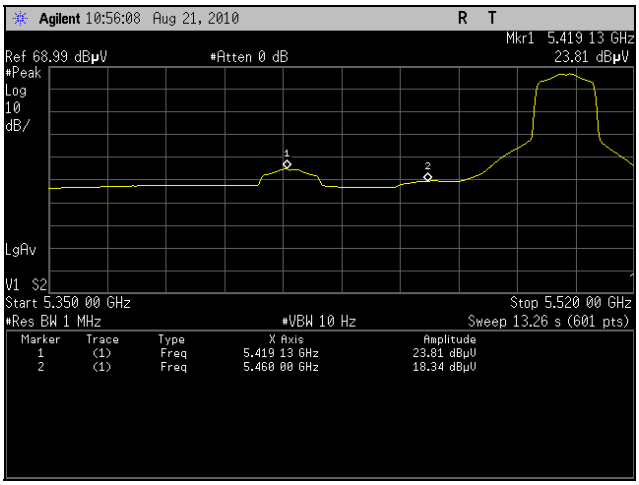
*Note: Measurements were made at 1m.



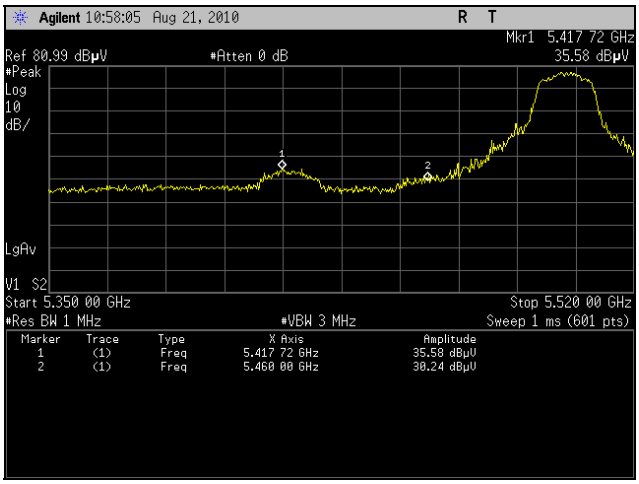
Plot 259. Radiated Band Edge, 5320 MHz, Average, 802.11a



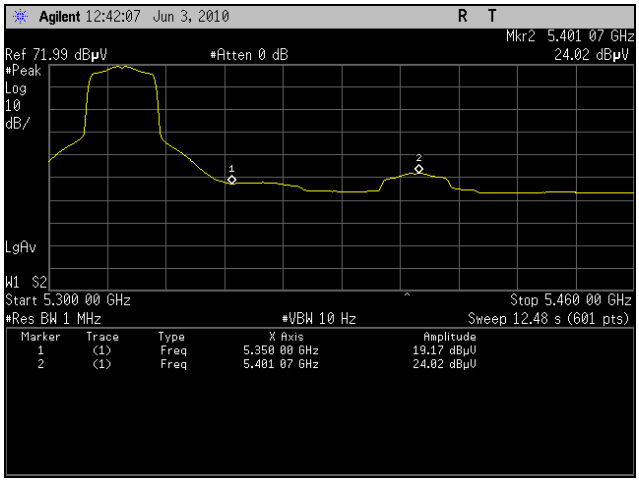
Plot 260. Radiated Band Edge, 5320 MHz, Peak, 802.11a



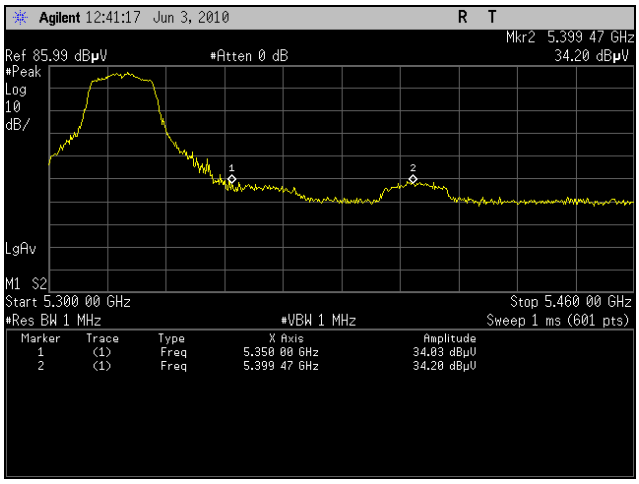
Plot 261. Radiated Band Edge, 5500 MHz, Average, 802.11a



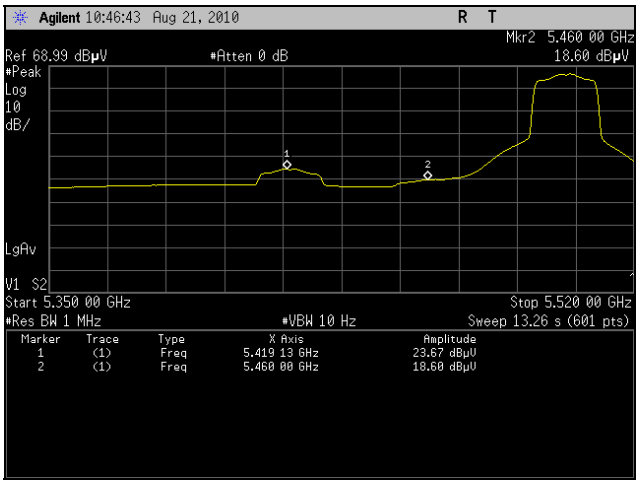
Plot 262. Radiated Band Edge, 5500 MHz, Peak, 802.11a



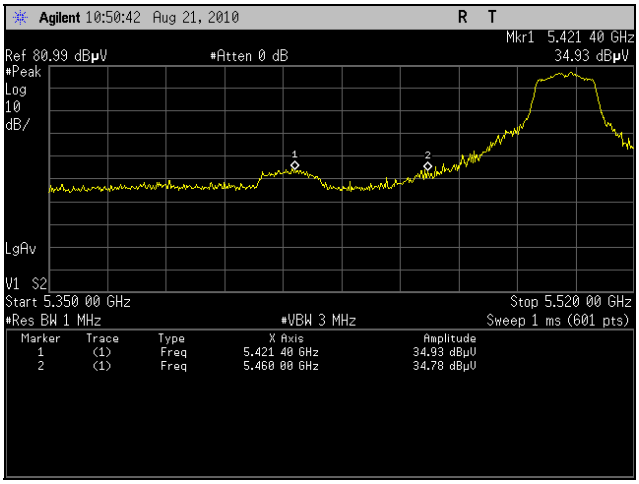
Plot 263. Radiated Band Edge, 5320 MHz, Average, 802.11n 20MHz



Plot 264. Radiated Band Edge, 5320 MHz, Peak, 802.11n 20MHz



Plot 265. Radiated Band Edge, 5500 MHz, Average, 802.11n 20MHz

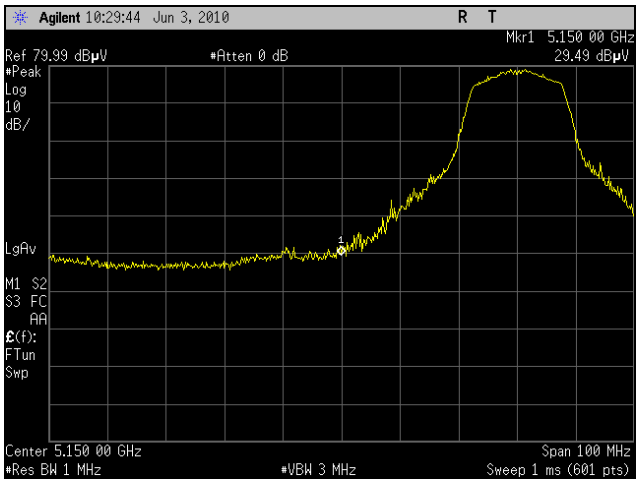


Plot 266. Radiated Band Edge, 5500 MHz, Peak, 802.11n 20MHz

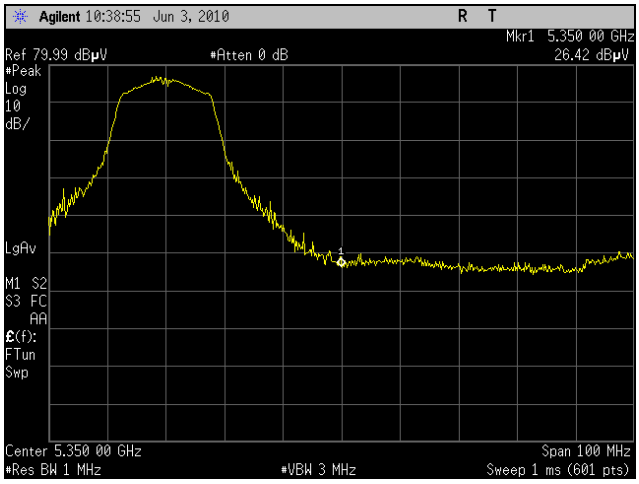
EIRP

	Band Edge Freq	Uncorrected Peak (dBuV)	Cable Loss	ACF	Corrected	Limit (dBuV/m)	Margin
802.11a	5.15	29.49	3.91	34.08	67.48	68.23	-0.75
	5.35	26.42	3.99	34.32	64.73	68.23	-3.5
	5.47	21.79	4.04	34.47	60.3	68.23	-7.93
	5.725	27.02	4.14	34.77	65.93	68.23	-2.3
	Band Edge Freq	**Uncorrected Peak (dBuV)**	**Cable Lost**	**ACF**	**Corrected**	**Limit (dBuV/m)**	**Margin**
802.11n 20MHz	5.15	29.69	3.91	34.08	67.68	68.23	-0.55
	5.35	26.89	3.99	34.32	65.2	68.23	-3.03
	5.47	23.39	4.04	34.47	61.9	68.23	-6.33
	5.725	28.38	4.14	34.77	67.29	68.23	-0.94

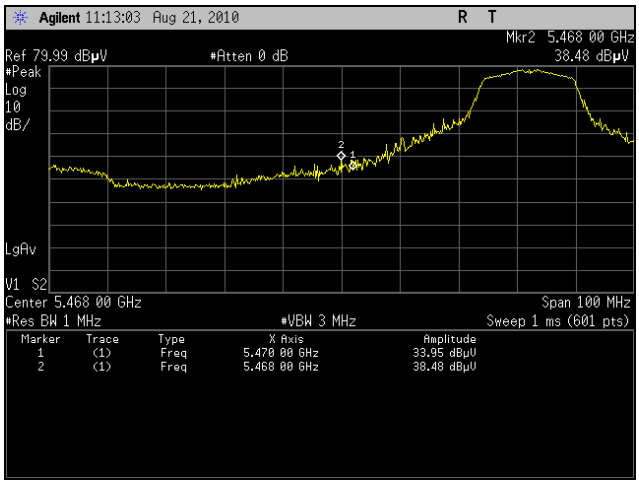
Table 25. EIRP Calculation



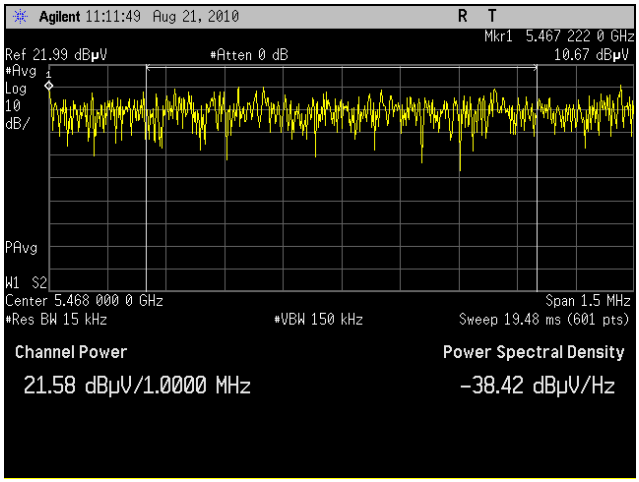
Plot 267. EIRP, 802.11a, 5150MHz, Peak



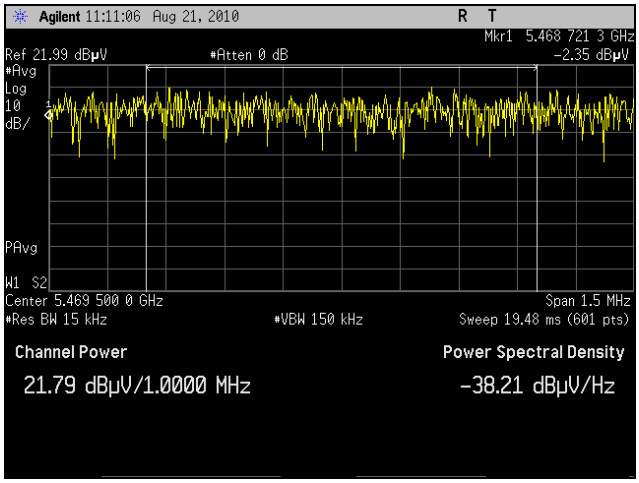
Plot 268. EIRP, 802.11a, 5350MHz, Peak



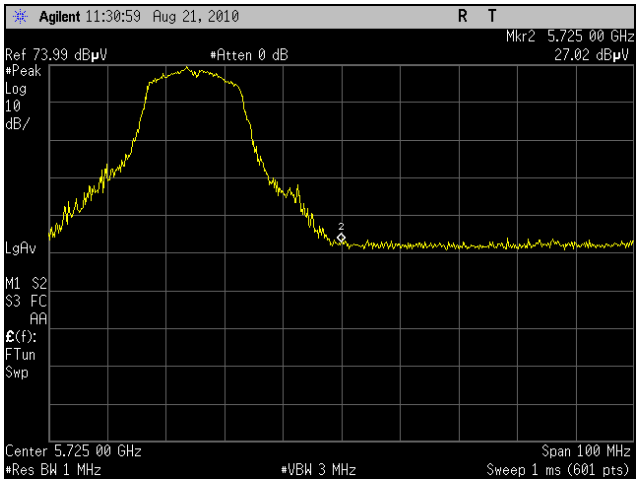
Plot 269. EIRP, 802.11a, 5470MHz, Peak



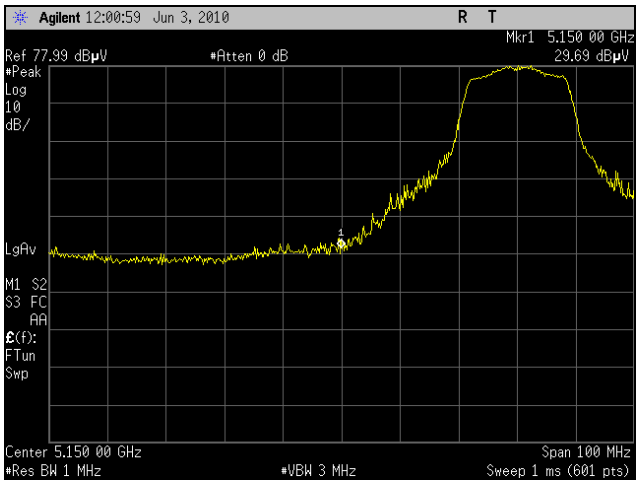
Plot 270. EIRP, 802.11a, 5468MHz



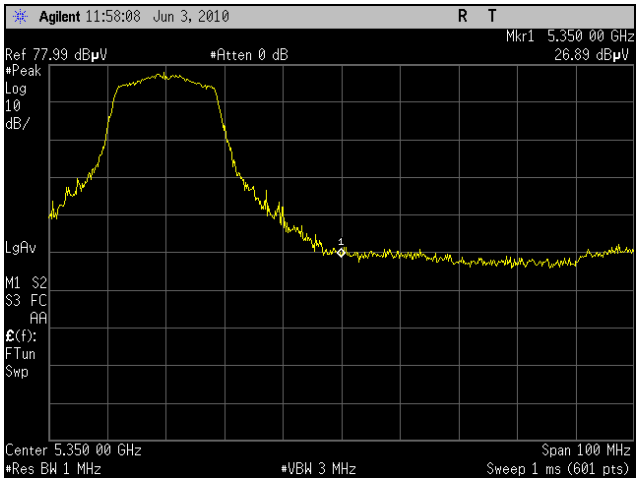
Plot 271. EIRP, 802.11a, 5470MHz



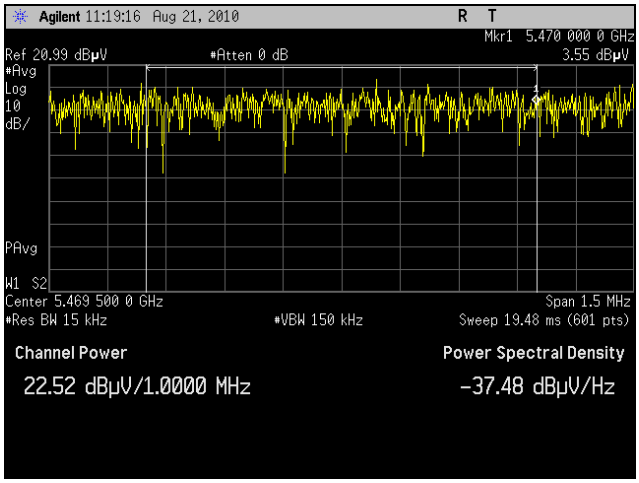
Plot 272. EIRP, 802.11a, 5725MHz, Peak



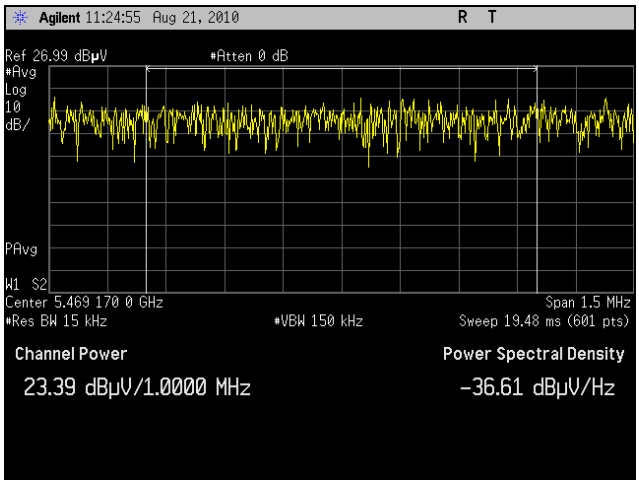
Plot 273. EIRP, 802.11n 20MHz, 5150MHz, Peak



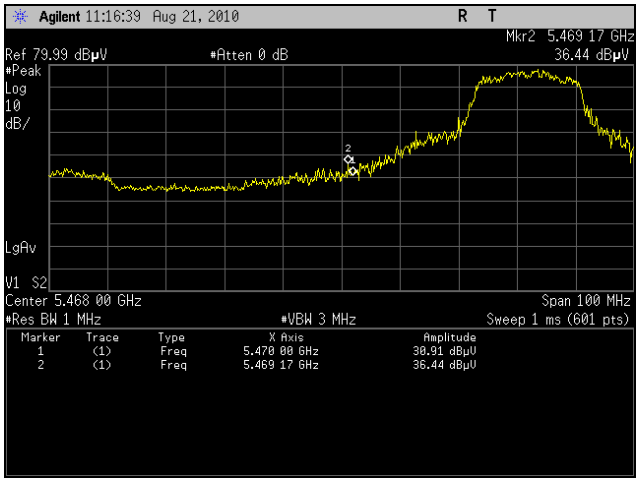
Plot 274. EIRP, 802.11n 20MHz, 5350MHz, Peak



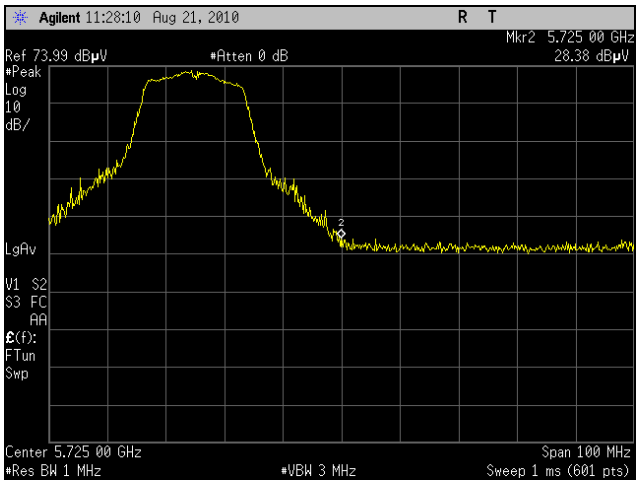
Plot 275. EIRP, 802.11n 20MHz, 5470MHz, Peak



Plot 276. EIRP, 802.11n 20MHz, 5469MHz



Plot 277. EIRP, 802.11n 20MHz, 5470MHz



Plot 278. EIRP, 802.11n 20MHz, 5725MHz, Peak

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(g) Frequency Stability

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

Test Procedure: The EUT was connected directly to a spectrum analyzer through an attenuator. The resolution band width of the spectrum analyzer was set to 10 KHz. The carrier frequency was recorded at +20°C as a reference. The drift of the carrier was then recorded at extreme conditions with 10 degree increment.

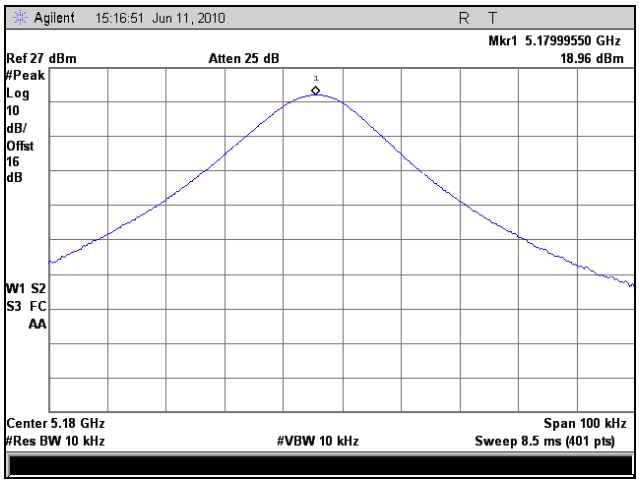
Test Results: The EUT was compliant with the requirements of **§15.407(g)**.

Test Engineer(s): Minh Ly

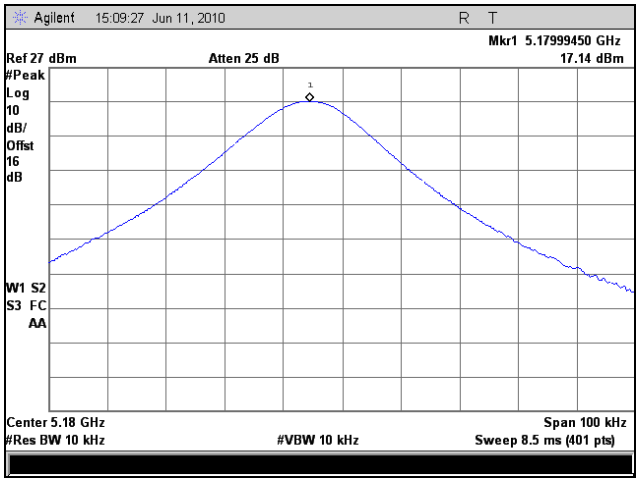
Test Date(s): 06/16/10

Frequency (Reference at +20°C)	**Temperature (°C)**	**Drift (MHz)**	**Delta (kHz)**
5180MHz	0	5179.99550	+100
	+10	5179.99450	0
	+20	5179.99450	0
	+35	5179.99875	+425
5320MHz	0	5319.99625	+125
	+10	5319.99400	-100
	+20	5319.99500	0
	+35	5319.99850	+350
5500MHz	0	5499.99600	+75
	+10	5499.99525	0
	+20	5499.99525	0
	+35	5499.99800	+275
5700MHz	0	5699.99600	+225
	+10	5699.99325	-50
	+20	5699.99375	0
	+35	5699.99825	+450

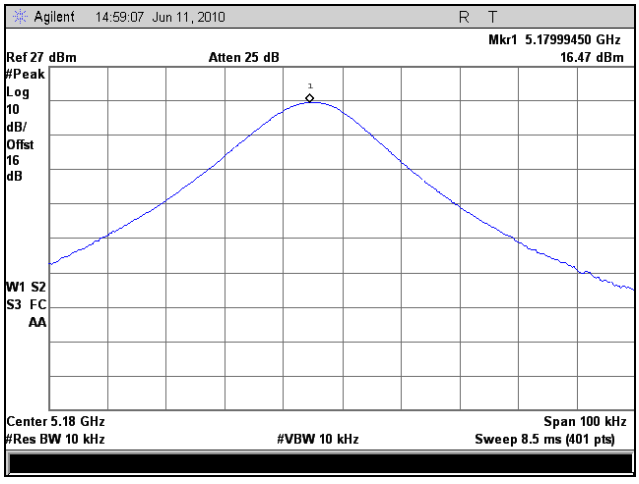
Frequency Stability Test Results



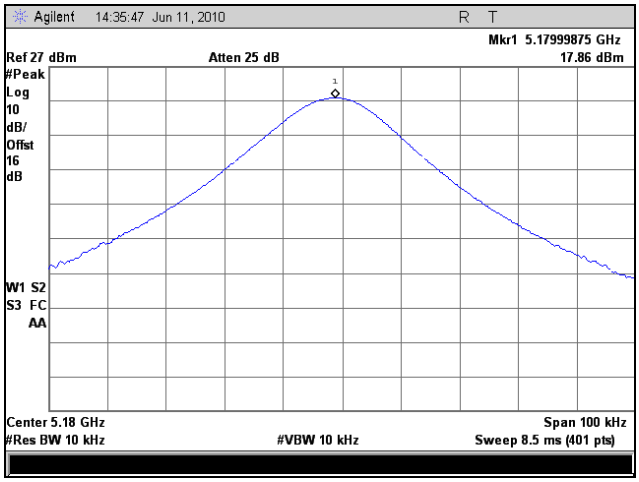
Plot 279. Frequency Stability, 0°C, 5180 MHz



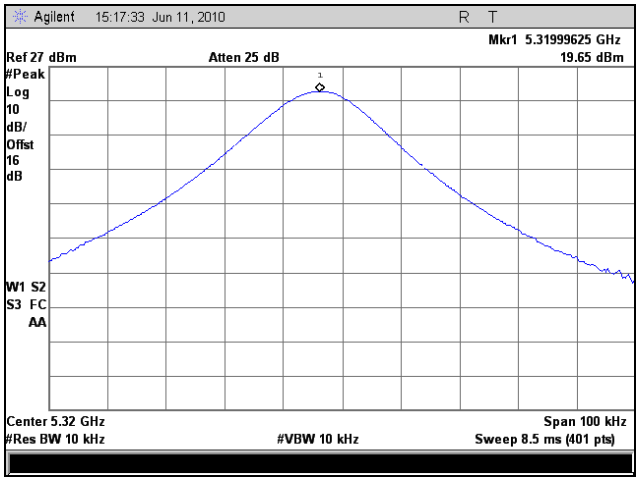
Plot 280. Frequency Stability, 10°C, 5180 MHz



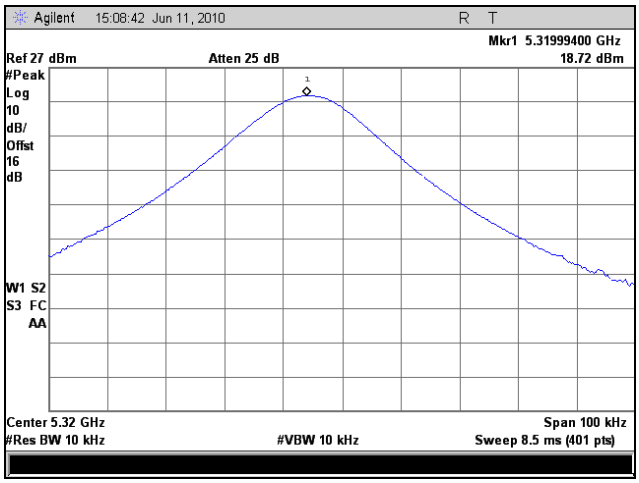
Plot 281. Frequency Stability, 20°C, 5180 MHz



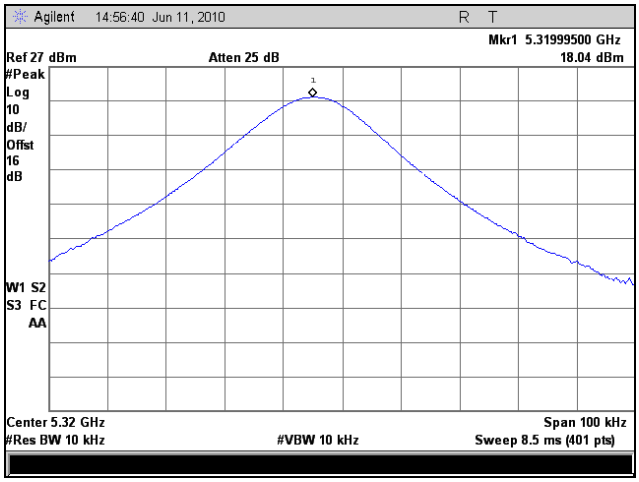
Plot 282. Frequency Stability, 35°C, 5180 MHz



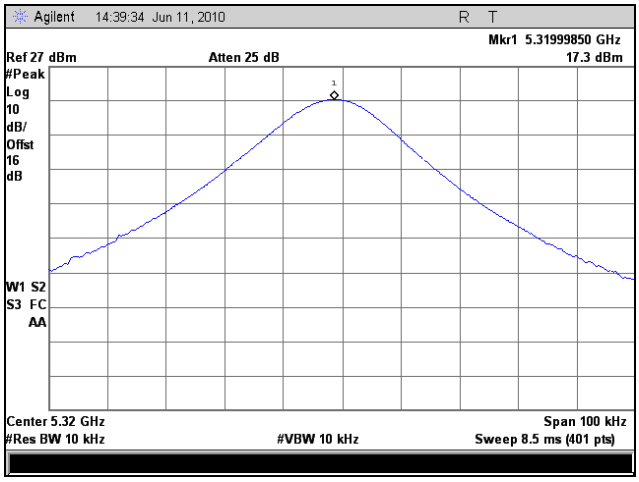
Plot 283. Frequency Stability, 0°C, 5320 MHz



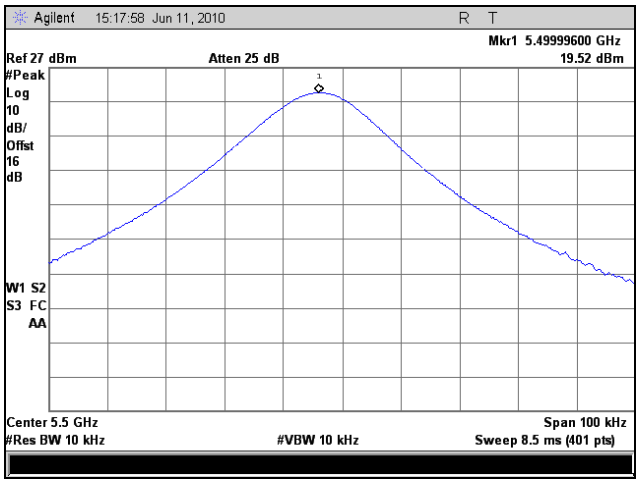
Plot 284. Frequency Stability, 10°C, 5320 MHz



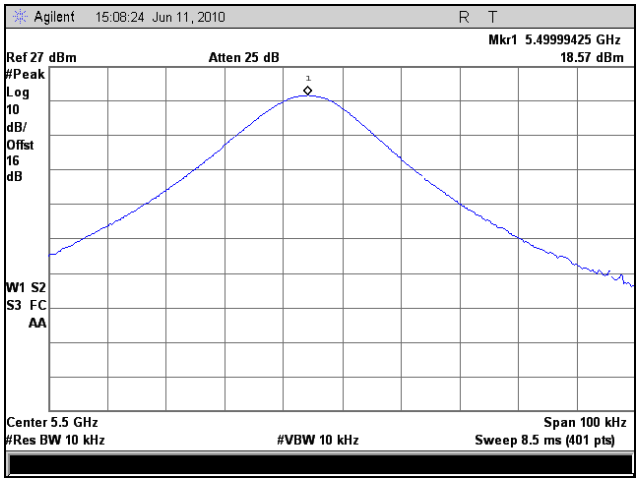
Plot 285. Frequency Stability, 20°C, 5320 MHz



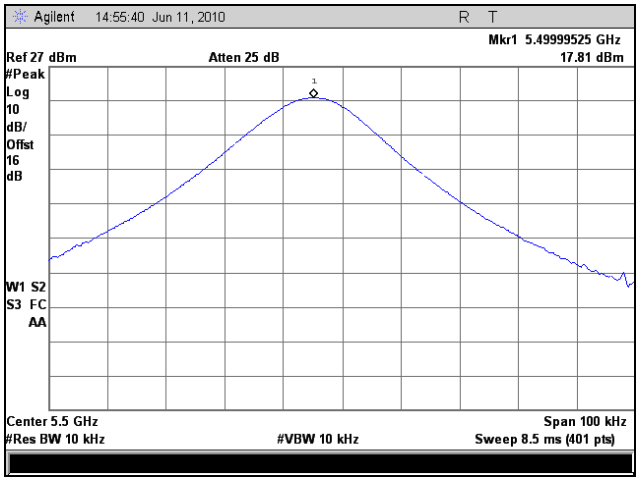
Plot 286. Frequency Stability, 35°C, 5320 MHz



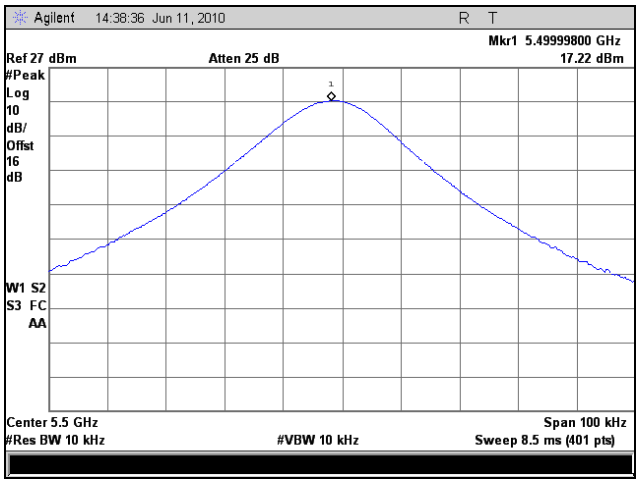
Plot 287. Frequency Stability, 0°C, 5500 MHz



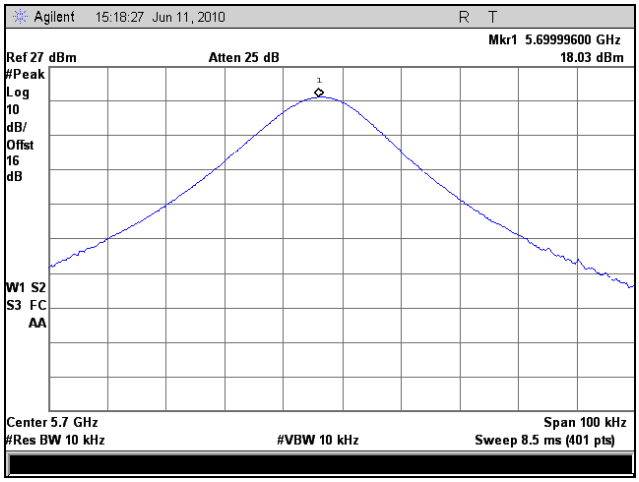
Plot 288. Frequency Stability, 10°C, 5500 MHz



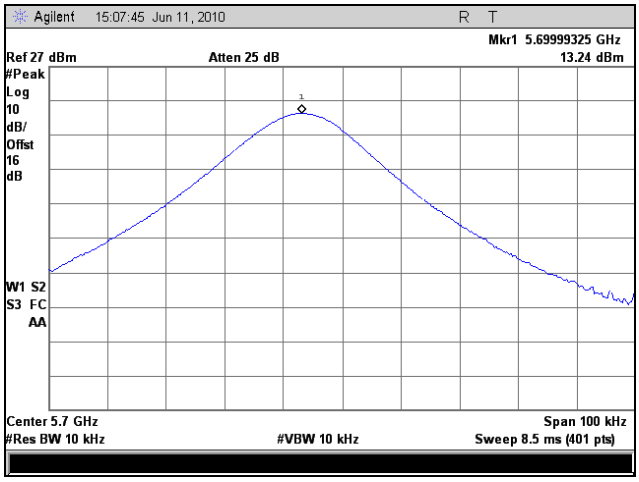
Plot 289. Frequency Stability, 20°C, 5500 MHz



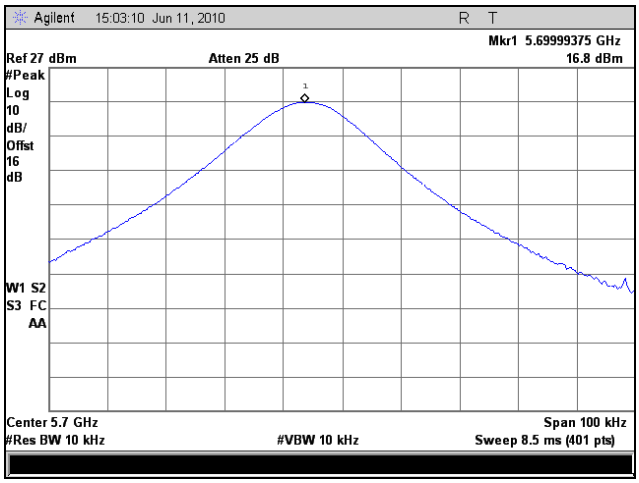
Plot 290. Frequency Stability, 35°C, 5500 MHz



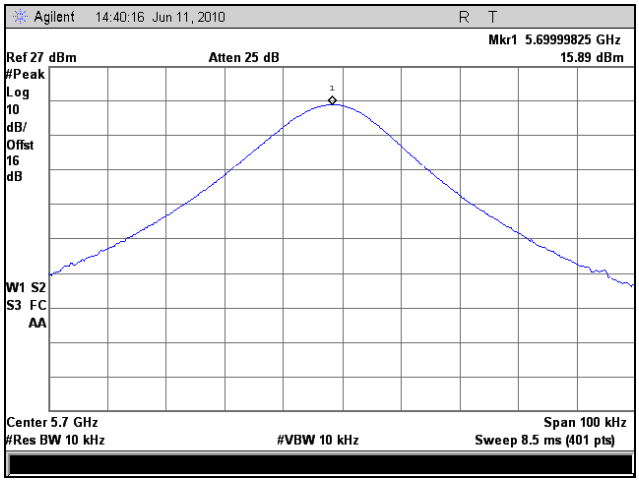
Plot 291. Frequency Stability, 0°C, 5700 MHz



Plot 292. Frequency Stability, 10°C, 5700 MHz



Plot 293. Frequency Stability, 20°C, 5700 MHz



Plot 294. Frequency Stability, 35°C, 5700 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

RSS-GEN Receiver Spurious

Test Requirement: If the device has a detachable antenna of known antenna impedance, then the antenna conducted method is permitted in lieu of a radiated measurement.

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.

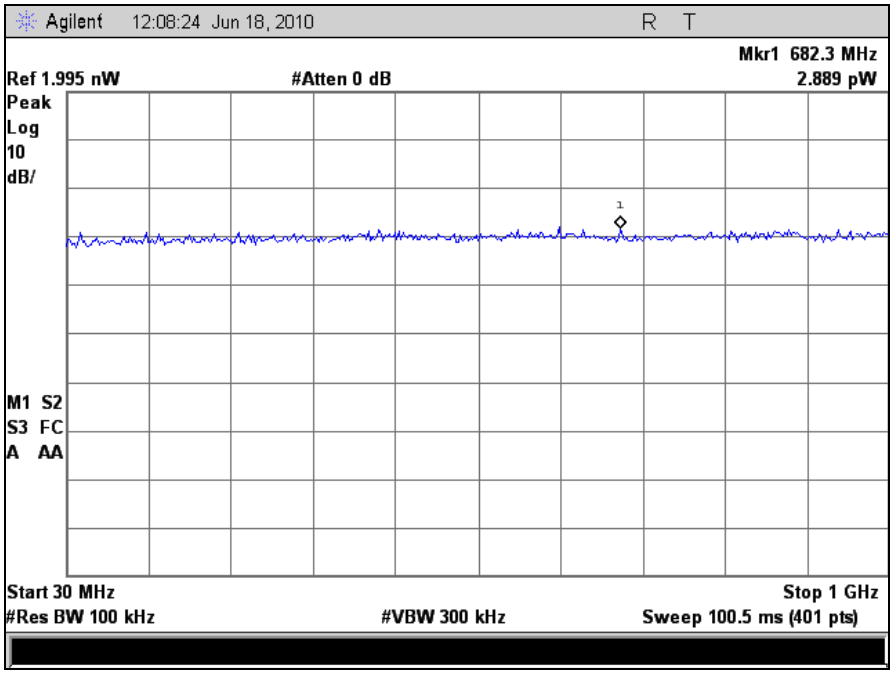
Test Procedure: The EUT was directly connected to a spectrum analyzer. Testing was performed conducted.

Results: The EUT as tested is compliant with the requirements of RSS-GEN.

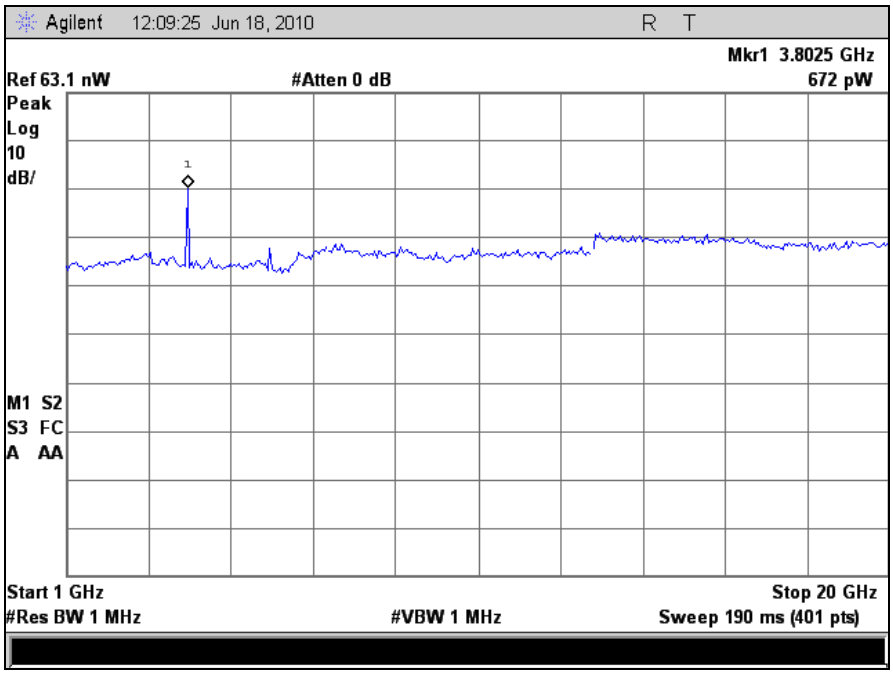
Test Engineer(s): Minh Ly

Test Date(s): 08/05/10

Receiver Spurious Emissions Test Results



Plot 295. Receiver Spurious Emission, 3 0MHz – 1 GHz



Plot 296. Receiver Spurious Emission, 1 GHz – 20 GHz

V. DFS Requirements and Radar Waveform Description & Calibration

A. DFS Requirements

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
Uniform Spreading	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 26. Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 27. Applicability of DFS Requirements During Normal Operation

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.	

Table 28. DFS Detection Thresholds for Master or Client Devices Incorporating DFS

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.

Table 29. DFS Response Requirement Values

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

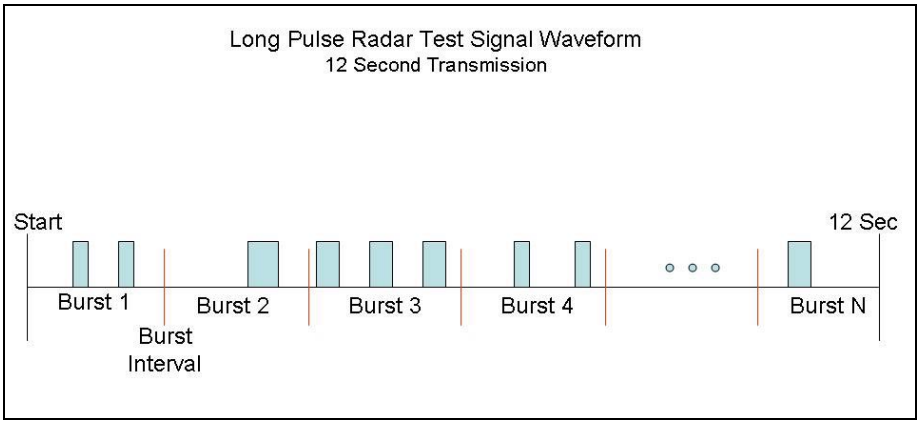


Figure 5. Long Pulse Radar Test Signal Waveform

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 radiated 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 6, and the radar test signal generator is shown in Photograph 1.

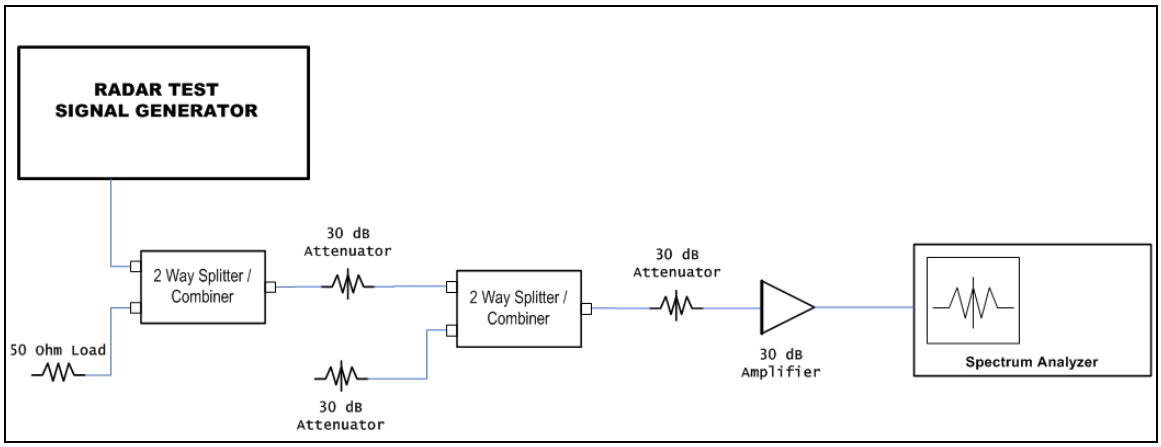
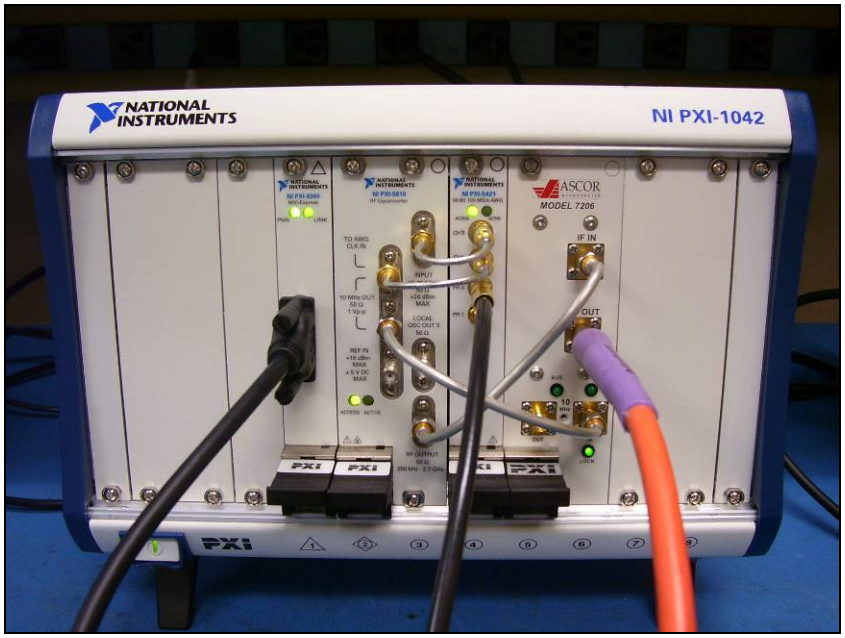
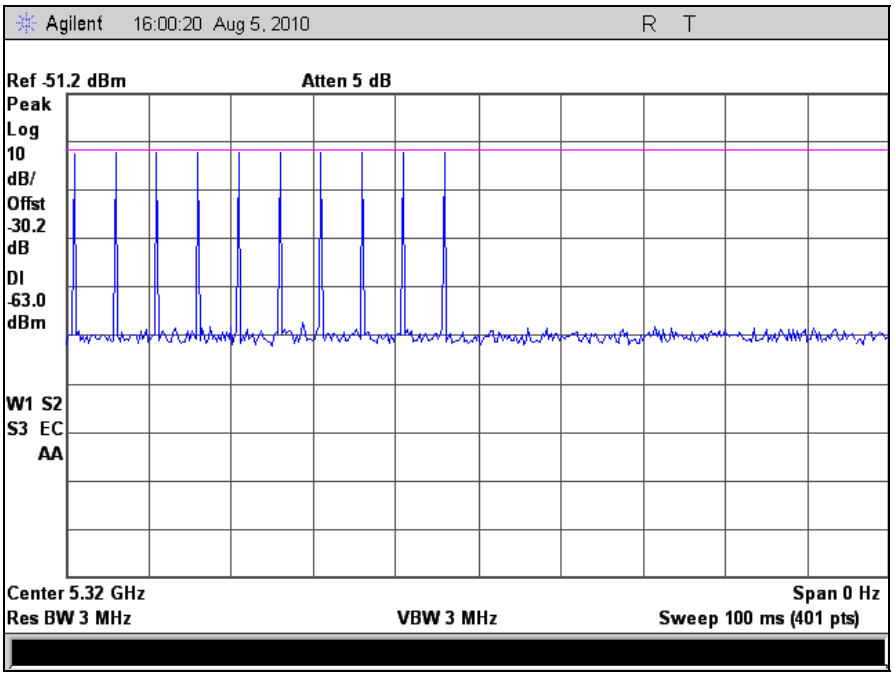


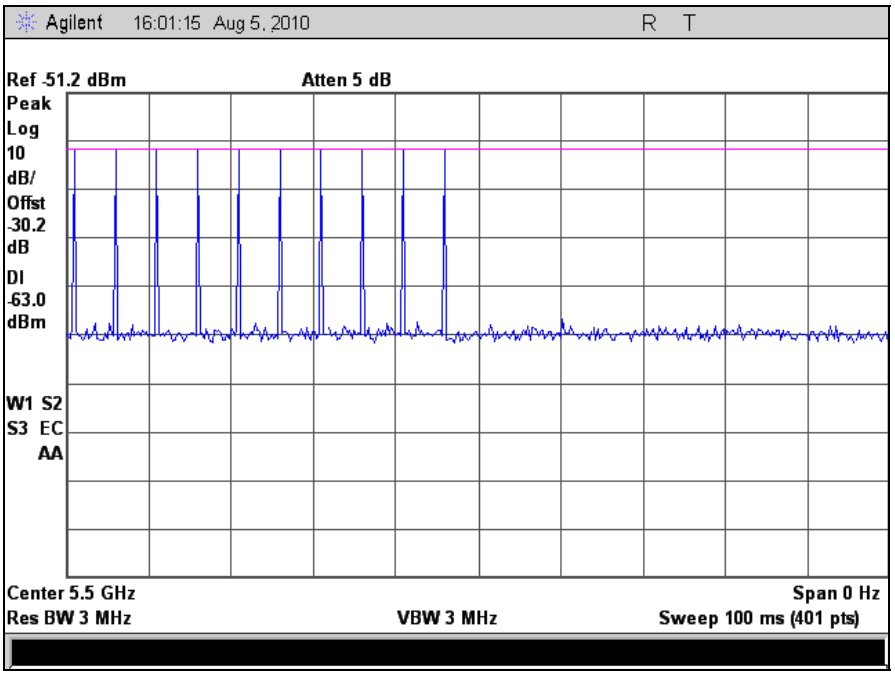
Figure 6. Calibration Test Setup



Photograph 1. DFS Radar Test Signal Generator



Plot 297. Calibration Plot, 5320 MHz, Bin 1



Plot 298. Calibration Plot, 5500 MHz, Bin 1

VI. DFS Test Procedure and Test Results

DFS Test Setup

The 5600 – 5650 MHz bands were disabled.

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 7 and pictured in Figure 7.

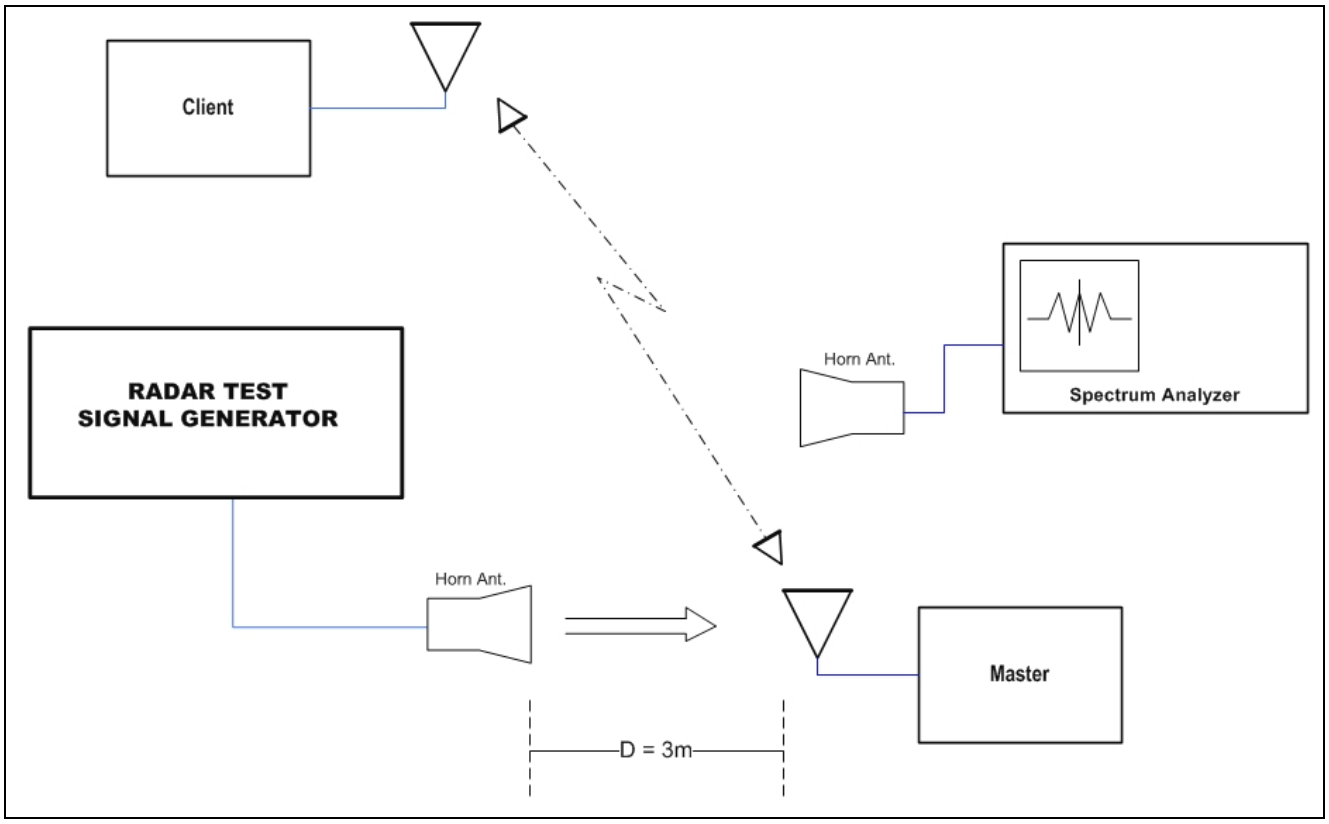


Figure 7. Test Setup Diagram

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 5320 & 5500 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.

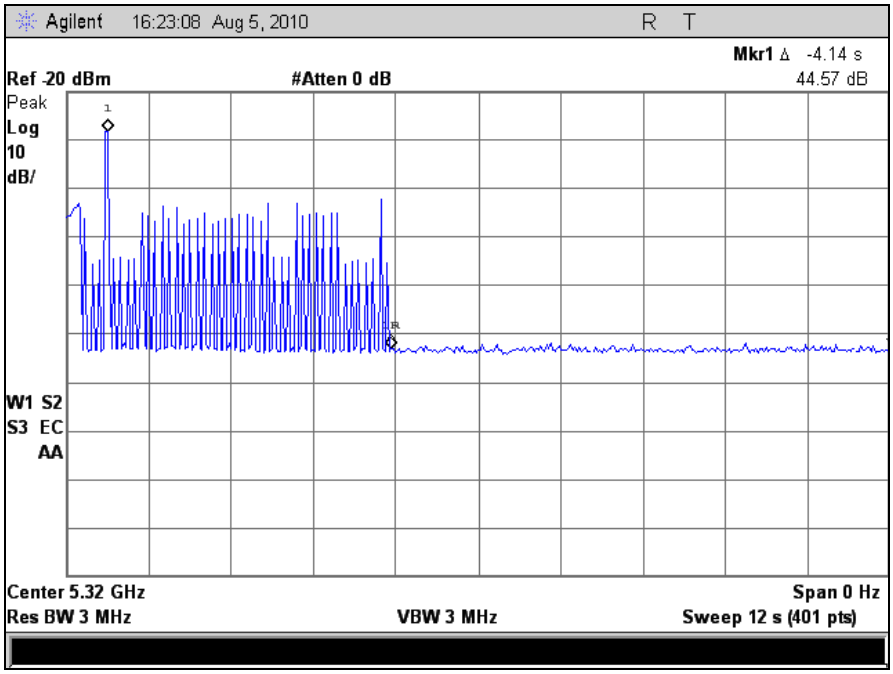
Observe the transmissions of the UUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the UUT during the observation time (Channel Move Time). Compare the Channel Move Time and Channel Closing Transmission Time results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

Test Results: The UUT complies with § 15.407 In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time, not applicable for Non-Occupancy Period.

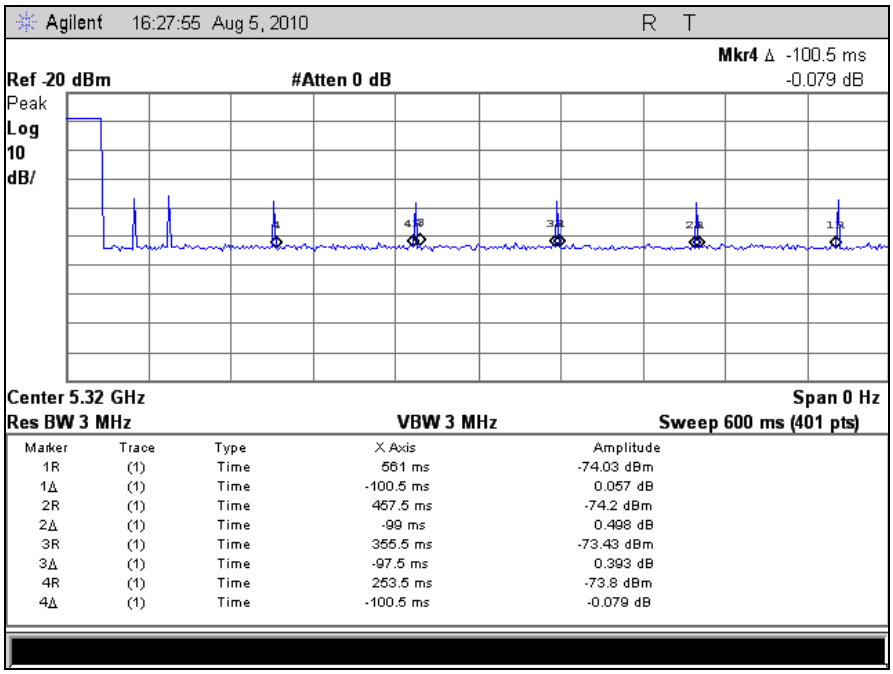
Test Engineer: Anderson Soungpanya

Test Date(s): 08/5/10

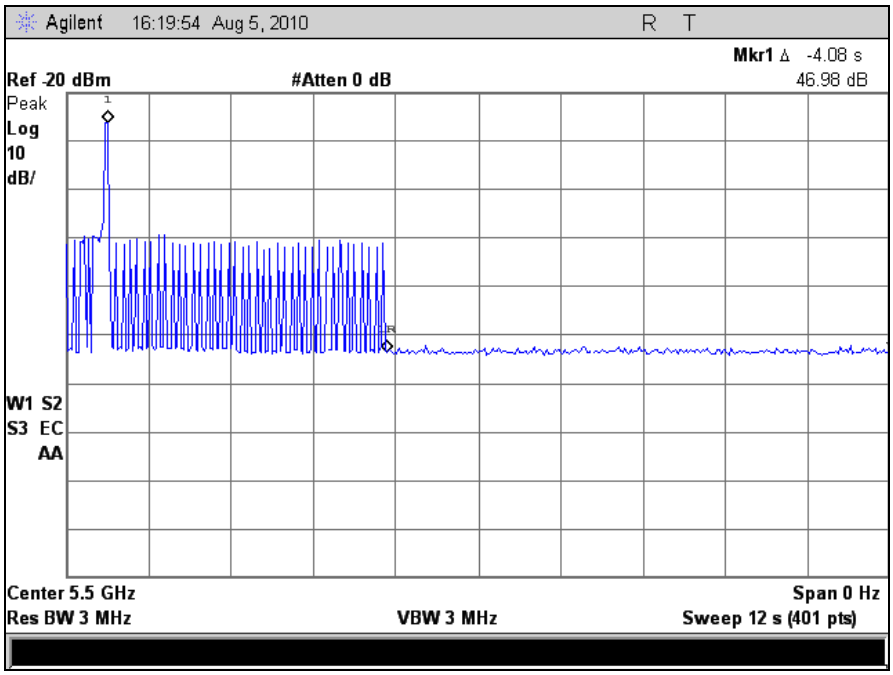
Initial Channel Availability Check Time Test Results



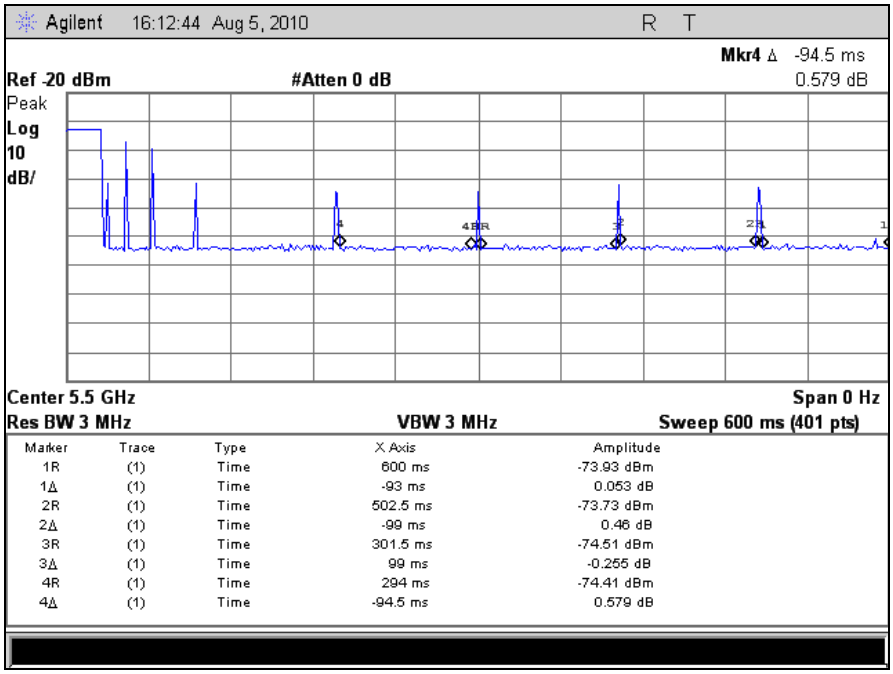
Plot 299. Channel Move Time in a 12 sec. Frame, 5320 MHz



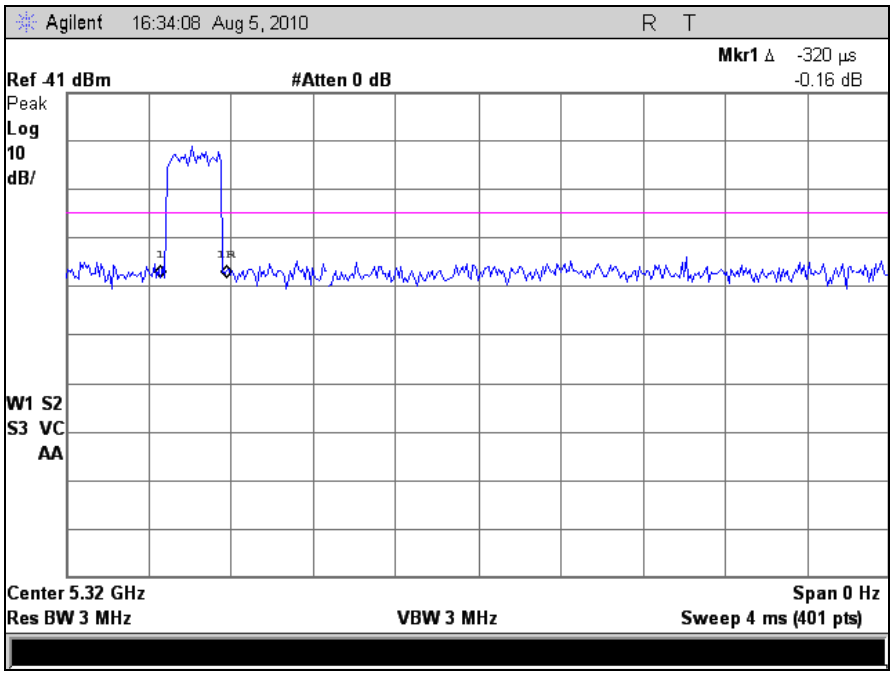
Plot 300. Channel Closing Transmission Time in a 600 msec. Frame, 5320 MHz



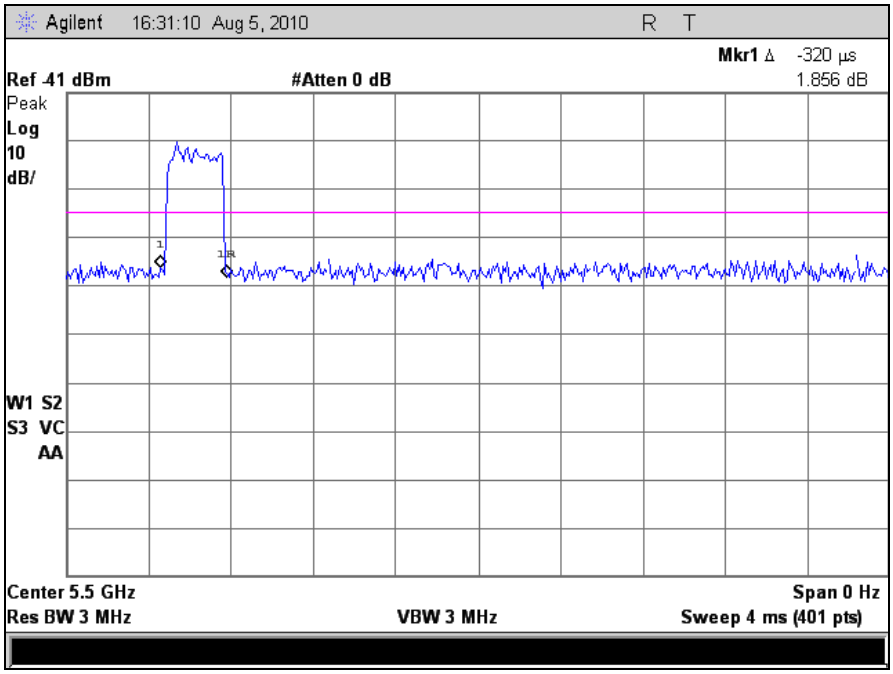
Plot 301. Channel Move Time in a 12 sec. Frame, 5500 MHz



Plot 302. Channel Closing Transmission Time in a 600 msec. Frame, 5500 MHz



Plot 303. Channel Closing Time, 5320 MHz, Beacon



Plot 304. Channel Closing Time, 5500 MHz, Beacon

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
1S2501	EMI RECEIVER	ROHDE&SCHWARZ	ESU40	06/03/2010	06/03/2011
1S2484	BILOG ANTENNA	TESEQ	CBL6112D	SEE NOTE	
1S2399	TURNTABLE CONTROLLER	SUNOL SCIENCE	SC99V	NOT REQUIRED	
1S2522	DIGITAL THERMO/HYGROMETER	CONTROL COMPANY	11-661-7D	11/11/2009	11/11/2010
1S2482	5M CHAMBER	PANASHIELD	N/A	10/16/2009	10/16/2010
1S2603	DOUBLE RIDGED WAVEGUIDE HORN	ETS-LINGREN	3117	04/09/2009	04/09/2011
1S2121	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	SEE NOTE	
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	
1S2034	COUPLER, DIRECTIONAL 1-20 GHZ	KRYTAR	101020020	SEE NOTE	
1S2583	SPECTRUM ANALYZER	AGILENT	E4447A	01/26/2010	01/26/2011
1S2460	ANALYZER, SPECTRUM 9 KHZ-40GHZ	AGILENT	E4407B	07/13/2010	07/13/2011
1S2229	TEMPERATURE CHAMBER	TENNY ENGINEERING	T63C	02/19/2010	02/19/2011
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 30. 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	
1S2460	ANALYZER, SPECTRUM 9 KHZ-40GHZ	AGILENT	E4407B	07/13/2010

Table 31. 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.

End of Report

