MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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March 2, 2012

Fortress Technologies
2 Technology Park Drive
Westford, MA 01886

Dear John Pacheco,

Enclosed is the EMC Wireless test report for compliance testing of the Fortress Technologies, ES2440 (Radio M5) as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B, ICES-003, Issue 4 February 2004 for a Class A Digital Device and FCC Part 15 Subpart C, RSS-210, Issue 8, Dec. 2010 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: (\Fortress Technologies\EMC32466B-FCC247 Rev. 1)

Electromagnetic Compatibility Criteria
Test Report

for the

Fortress Technologies
ES2440 (Radio M5)

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class A Digital Devices
&
15.247 Subpart C & RSS-210, Issue 8, Dec. 2010
for Intentional Radiators

MET Report: EMC32466B-FCC247 Rev. 1

March 2, 2012

Prepared For:

Fortress Technologies
2 Technology Park Drive
Westford, MA 01886

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

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&
15.247 Subpart C & RSS-210, Issue 8, Dec. 2010
for Intentional Radiators

Jeffrey Pratt, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules Parts 15B, 15.247 and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210, Issue 8, Dec. 2010 under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	January 5, 2012	Initial Issue.
1	March 2, 2012	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**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**microh**enry
µ	**microf**arad
µs	**micros**econds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Fortress Technologies ES2440 (Radio M5), with the requirements of Part 15, §15.247. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the ES2440 (Radio M5). Fortress Technologies should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the ES2440 (Radio M5), has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.247, in accordance with Fortress Technologies, purchase order number 0003235. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference 47 CFR Part 15.247:2005	IC Reference RSS-210 Issue 8: 2010; RSS-GEN Issue 3: 2010	Description	Compliance
47 CFR Part 15.107 (a)	ICES-003 Issue 4 February 2004	Conducted Emission Limits for a Class A Digital Device	Compliant
47 CFR Part 15.109 (a)	ICES-003 Issue 4 February 2004	Radiated Emission Limits for a Class A Digital Device	Compliant
Title 47 of the CFR, Part 15 §15.203	N/A	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	RSS-GEN (7.2.4)	Conducted Emission Limits	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(2)	RSS-Gen(4.6)	6dB Occupied Bandwidth	Compliant
		99% Occupied Bandwidth	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	RSS-210(A8.4)	Peak Power Output	Compliant
Title 47 of the CFR, Part 15 §15.247(d); §15.209; §15.205	RSS-210(A8.5)	Radiated Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RSS-210(A8.5)	RF Conducted Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RSS-210(A8.5)	RF Conducted Band Edge	Compliant
Title 47 of the CFR, Part 15; §15.247(e)	RSS-210(A8.2)	Peak Power Spectral Density	Compliant
Title 47 of the CFR, Part 15 §15.247(i)	RSS-Gen(5.6)	Maximum Permissible Exposure (MPE)	Compliant
N/A	RSS-Gen(4.10)	Receiver Spurious Emissions	Compliant

Table 1. Executive Summary of EMC Part 15.247 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Fortress Technologies to perform testing on the ES2440 (Radio M5), under Fortress Technologies's purchase order number 0003235.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Fortress Technologies, ES2440 (Radio M5).

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

Model(s) Tested:	ES2440 (Radio M5)	
Model(s) Covered:	ES2440 (Radio M5)	
EUT Specifications:	Primary Power: 120 VAC, 60 Hz	
	FCC ID: WYK-ES2440 IC: 8190A-ES2440	
	Type of Modulations:	ODFM
	Equipment Code:	DTS
	Peak RF Output Power:	25.88 dBm
	EUT Frequency Ranges:	5745 -5825 MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35º C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Jeffrey Pratt	
Report Date(s):	March 2, 2012	

Table 2. EUT Summary Table

B. References

CFR 47, Part 15, Subpart C	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
RSS-210, Issue 8, Dec. 2010	Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
RSS-GEN, Issue 3, Dec. 2010	General Requirements and Information for the Certification of Radio Apparatus
ICES-003, Issue 4 February 2004	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/NCSL Z540-1-1994	Calibration Laboratories and Measuring and Test Equipment - General Requirements
ANSI/ISO/IEC 17025:2000	General Requirements for the Competence of Testing and Calibration Laboratories
ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices

Table 3. References

C. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave., Baltimore, MD 21230. 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 Fortress Technologies ES2440, Equipment Under Test (EUT), is a quad radio access point/bridge. It embeds four COTS high power radios and three Ethernet ports in a ruggedized enclosure. The radios operate in accordance to the 802.11a, 802.11b, 802.11g, and 802.11n standards.

The ES2440 is intended to provided outdoor mobile connectivity in a secure manner both wired and wirelessly.

Photograph 1. Fortress Technologies ES2440

E. Equipment Configuration

Ref. ID	Name / Description	Model Number	Serial Number
1	Fortress High Capacity Infrastructure Mesh Point	ES2440	11022261

Table 4. Equipment Configuration

F. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number
1	PoE Adapter	Phihong	POE61U-560DG
2	2.4GHz Omni Antenna	Ubiquiti	AMO-2G10
3	2.4GHz Sector Antenna	PCTel	SP2327 15XP90
5	5.8GHz Omni Antenna	Ubiquiti	AMO-5G10
6	5.8GHz Sector Antenna	PCTel	SP4959 16XP90

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
1	ANT1A, ANT1B, ANT2A, ANT2B, ANT3A, ANT3B, ANT4A, ANT4B	Antenna	8	--	Y	--
2	DC Power	Provides power	1	--	N	--
3	Ethernet1/WAN/POE Ethernet 2 Ethernet 3	Standard RJ45 CAT5 Ethernet Cable	3	--	N	--
4	Serial	Standard RJ45 serial cable	1	--	N	--
	GPS	GPS antenna	1	--	N	--

Table 6. Ports and Cabling Information

H. Mode of Operation

The ES2440 can operate in 802.11a, 802.11b, 802.11g, and 802.11n modes. These modes may be configured using the UI of the product. Additionally, these modes may be entered by using ART, the Atheros Radio Test tool. This is a standard tool provide by Atheros for directly manipulating and configuring their chips during testing and manufacturing.

I. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

J. Disposition of EUT

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

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria

§ 15.107 Conducted Emissions Limits

Test Requirement(s):

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

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

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

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

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

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

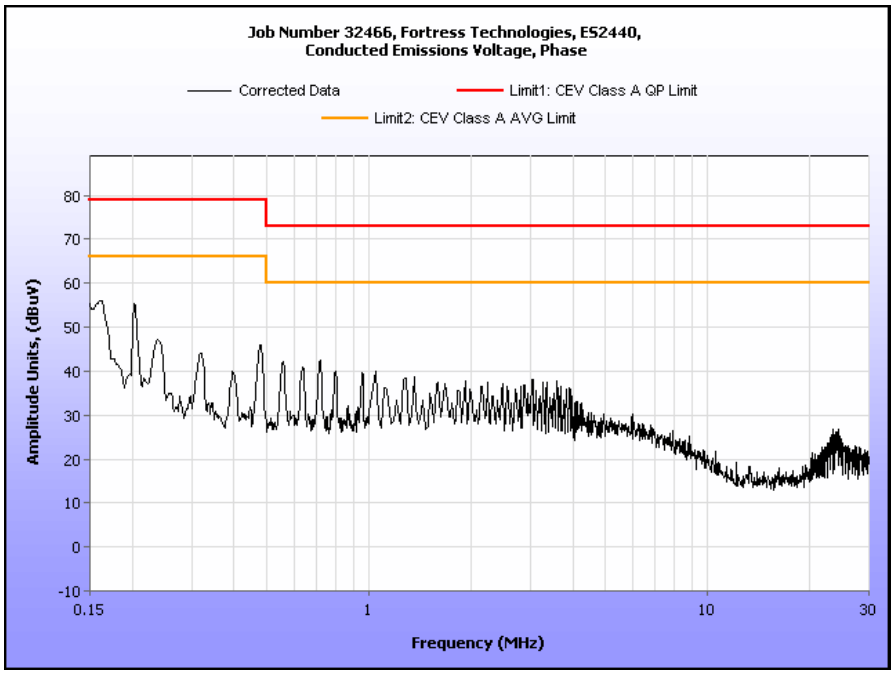
Test Engineer(s): Jeff Pratt

Test Date(s): 10/26/11

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

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.158	50.21	0	50.21	79	-28.79	42.13	0	42.13	66	-23.87
0.238	43.17	0.01	43.18	79	-35.82	37.86	0.01	37.87	66	-28.13
0.476	42.62	0	42.62	79	-36.38	37.98	0	37.98	66	-28.02
0.715	38.38	0	38.38	73	-34.62	33.1	0	33.1	60	-26.9
0.318	39.87	0	39.87	79	-39.13	34.91	0	34.91	66	-31.09
0.635	37.81	0	37.81	73	-35.19	33.36	0	33.36	60	-26.64

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

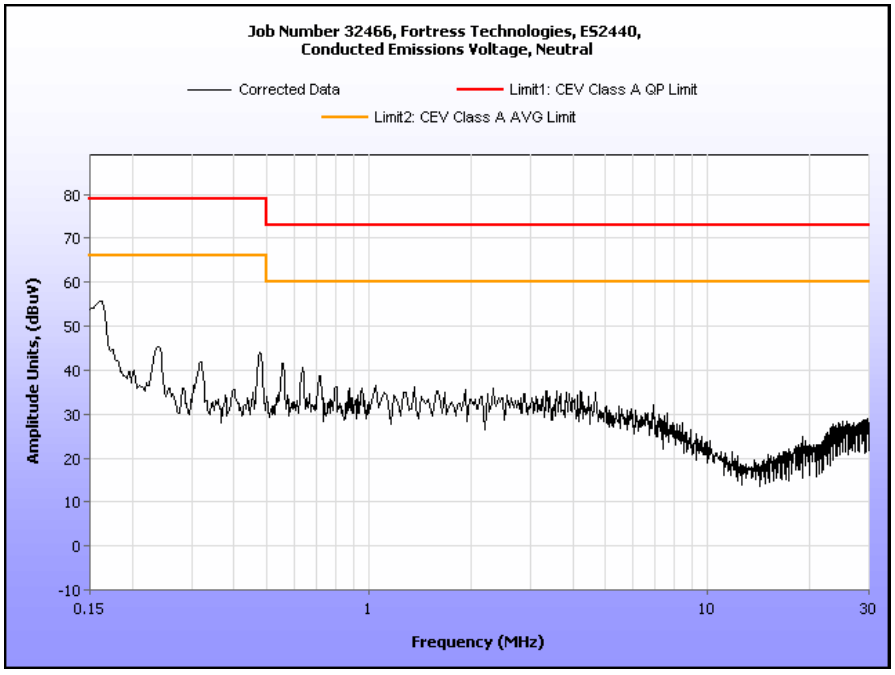


Plot 1. Conducted Emission, Phase Line Plot

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

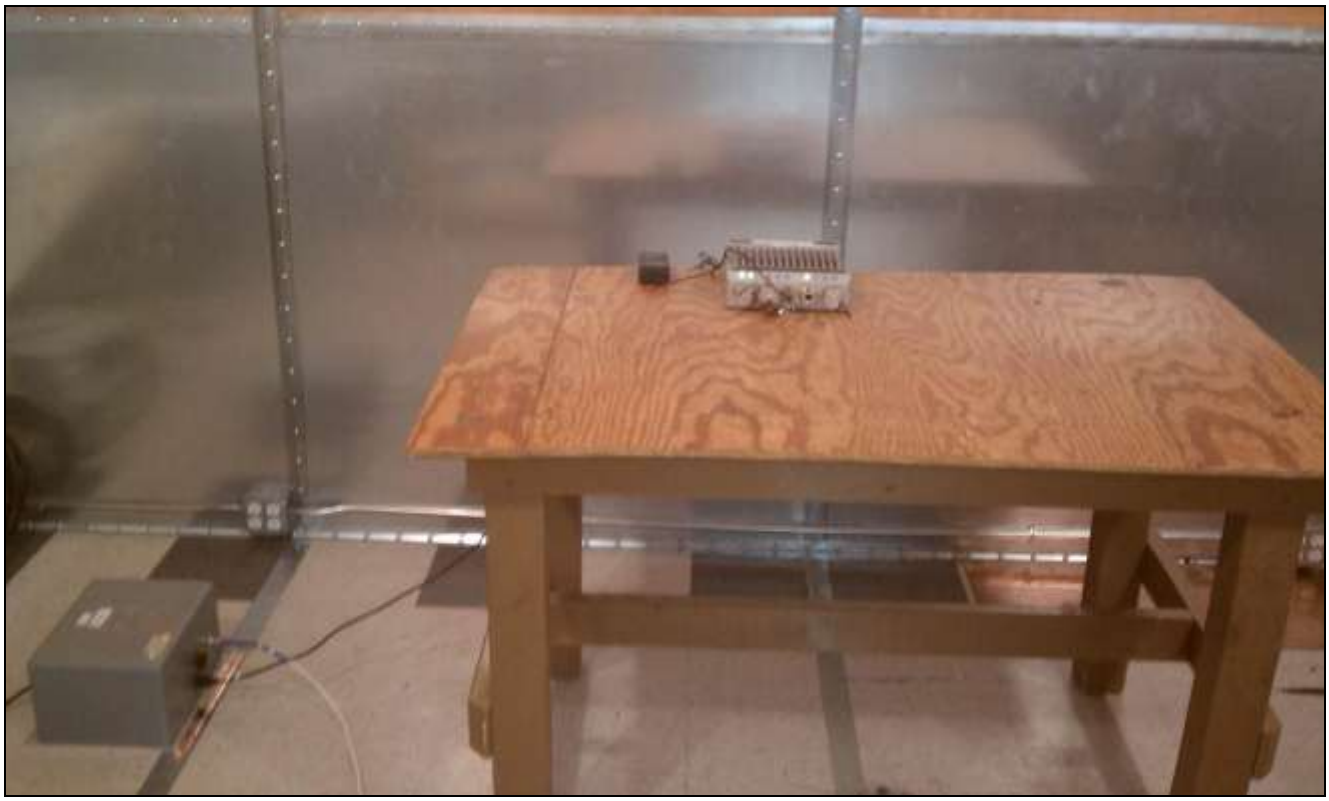
Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.238	41.73	0.01	41.74	79	-37.26	38.52	0.01	38.53	66	-27.47
0.477	42.14	0	42.14	79	-36.86	41.22	0	41.22	66	-24.78
0.158	50.36	0	50.36	79	-28.64	43.74	0	43.74	66	-22.26
0.557	38.85	0	38.85	73	-34.15	37.66	0	37.66	60	-22.34
0.634	38.48	0	38.48	73	-34.52	37.08	0	37.08	60	-22.92
0.318	39.36	0	39.36	79	-39.64	37.3	0	37.3	66	-28.7

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



Plot 2. Conducted Emission, Neutral Line Plot

Conducted Emission Limits Test Setup



Photograph 2. Conducted Emissions, Test Setup

Radiated Emission Limits

§ 15.109 Radiated Emissions Limits

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

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

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

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

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

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

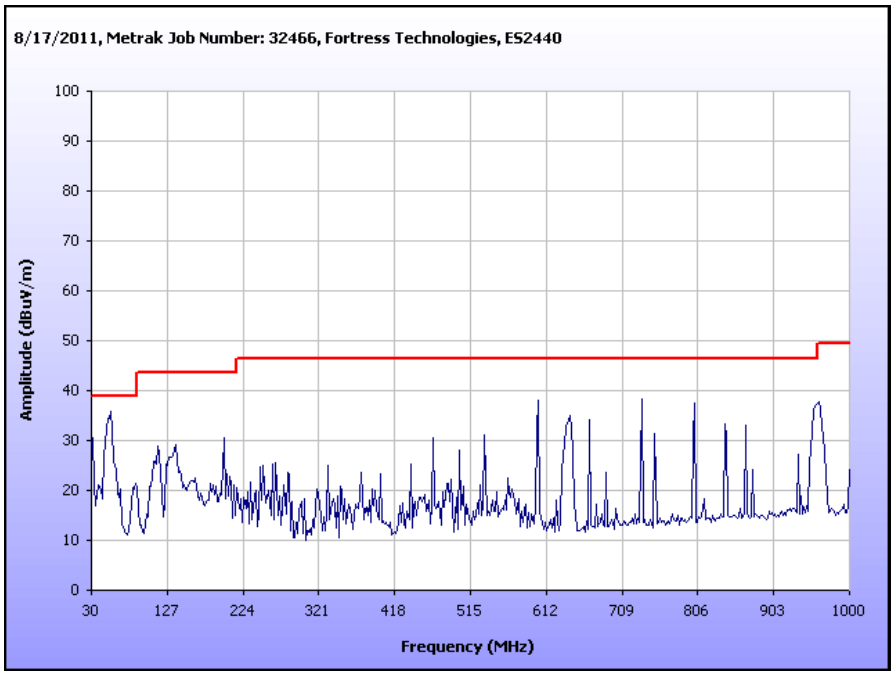
Test Engineer(s): Ben Taylor

Test Date(s): 08/17/11

Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
55.791583	109	H	3.17	18.18	7.44	0.23	10.46	15.39	39.00	-23.61
55.791583	11	V	1.02	36.23	7.44	0.23	10.46	33.44	39.00	-5.56
200.04008	158	H	1.39	14.54	12.99	0.23	10.46	17.30	43.50	-26.20
200.04008	207	V	1.06	25.18	12.99	0.23	10.46	27.94	43.50	-15.56
600.05078	81	H	1.17	26.84	19.50	1.17	10.46	37.05	46.40	-9.35
600.05078	89	V	1.05	26.07	19.50	1.17	10.46	36.28	46.40	-10.12
639.40882	349	H	1.45	17.26	19.99	1.17	10.46	27.96	46.40	-18.44
639.40882	253	V	1.05	18.79	19.99	1.17	10.46	29.49	46.40	-16.91
733.38482	59	H	1.34	27.58	20.90	1.50	10.46	39.52	46.40	-6.88
733.38482	89	V	1.02	24.75	20.90	1.50	10.46	36.69	46.40	-9.71
957.56513	202	H	1.01	17.42	23.10	1.72	10.46	31.78	46.40	-14.62
957.56513	350	V	1.05	13.38	23.10	1.72	10.46	27.74	46.40	-18.66

Table 11. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz, FCC Limits



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

Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
55.791583	109	H	3.17	18.18	7.44	0.23	10.46	15.39	40.00	-24.61
55.791583	11	V	1.02	36.23	7.44	0.23	10.46	33.44	40.00	-6.56
200.04008	158	H	1.39	14.54	12.99	0.23	10.46	17.30	40.00	-22.70
200.04008	207	V	1.06	25.18	12.99	0.23	10.46	27.94	40.00	-12.06
600.05078	81	H	1.17	26.84	19.50	1.17	10.46	37.05	47.00	-9.95
600.05078	89	V	1.05	26.07	19.50	1.17	10.46	36.28	47.00	-10.72
639.40882	349	H	1.45	17.26	19.99	1.17	10.46	27.96	47.00	-19.04
639.40882	253	V	1.05	18.79	19.99	1.17	10.46	29.49	47.00	-17.51
733.38482	59	H	1.34	27.58	20.90	1.50	10.46	39.52	47.00	-7.48
733.38482	89	V	1.02	24.75	20.90	1.50	10.46	36.69	47.00	-10.31
957.56513	202	H	1.01	17.42	23.10	1.72	10.46	31.78	47.00	-15.22
957.56513	350	V	1.05	13.38	23.10	1.72	10.46	27.74	47.00	-19.26

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

Radiated Emission Limits Test Setup

Photograph 3. Radiated Emission, Test Setup

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

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

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

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

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

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

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

Test Engineer(s): Jeff Pratt

Test Date(s): 10/17/11

Gain	Type	Model	Manufacturer
10 dBi	Omni	AMO-2G10 AMO-5G10	Ubiquiti
15.5 dBi	Sector	SP2327 15XP90 SP4959 16XP90	PCTel

Table 13. Antenna List

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207(a) Conducted Emissions Limits

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

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

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

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

Test Results: The EUT was compliant with this requirement.

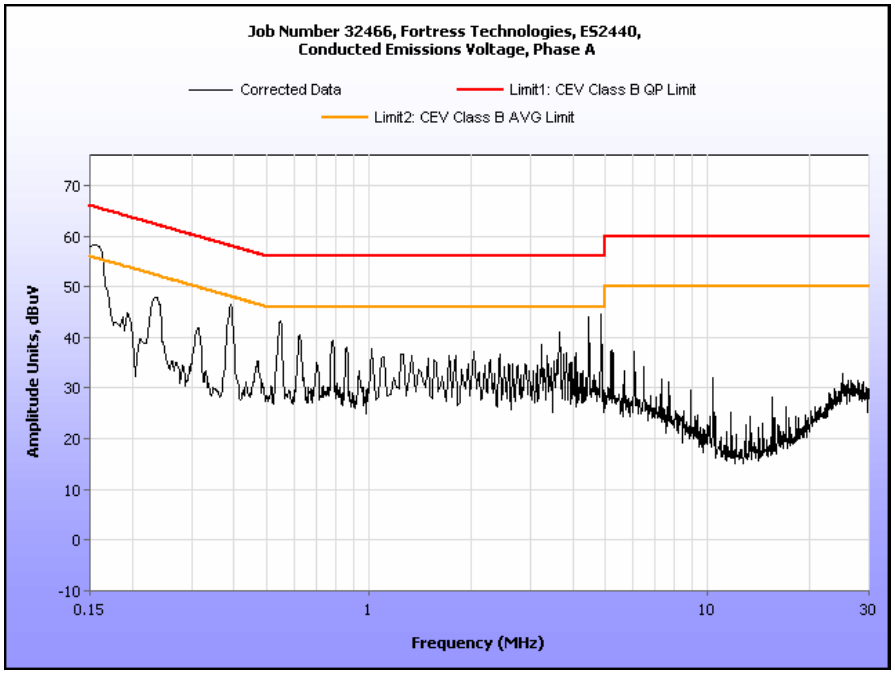
Test Engineer(s): Jeff Pratt

Test Date(s): 10/26/11

15.207(a) Conducted Emissions Test Results

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.158	51.65	0	51.65	65.57	-13.92	42.28	0	42.28	55.57	-13.29
0.397	42.33	0	42.33	57.92	-15.59	37.54	0	37.54	47.92	-10.38
0.557	40.15	0	40.15	56	-15.85	35.02	0	35.02	46	-10.98
0.636	39.88	0	39.88	56	-16.12	34.92	0	34.92	46	-11.08
4.473	40.99	0.08	41.07	56	-14.93	36	0.08	36.08	46	-9.92
4.879	41.82	0.1	41.92	56	-14.08	36.16	0.1	36.26	46	-9.74

Table 15. Conducted Emissions, 15.207(a), Phase Line, Test Results

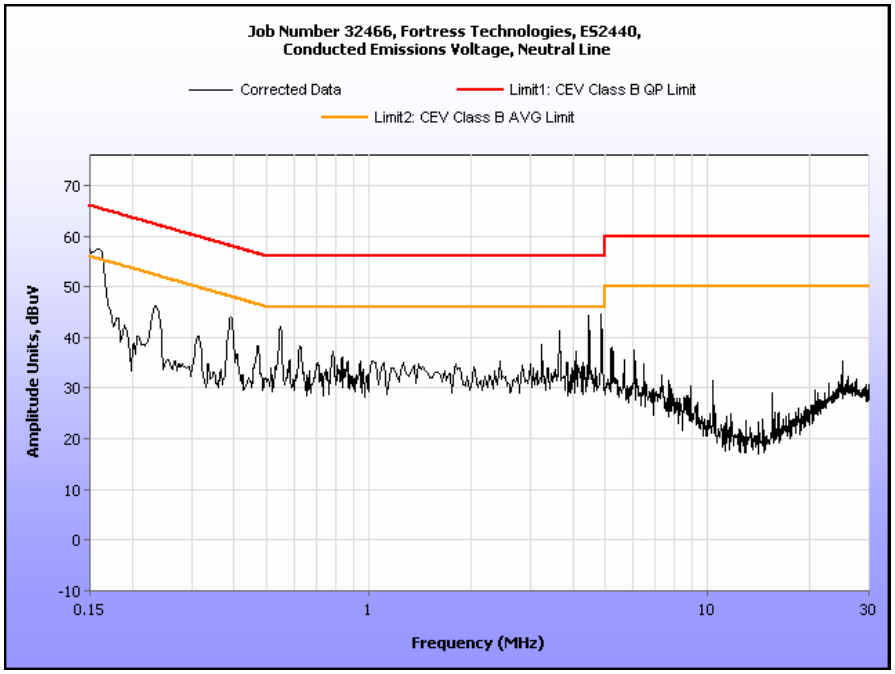


Plot 4. Conducted Emissions, 15.207(a), Phase Line

15.207(a) Conducted Emissions Test Results

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.154	50.88	0	50.88	65.78	-14.9	42.59	0	42.59	55.78	-13.19
0.238	41.93	0.01	41.94	62.17	-20.23	37.09	0.01	37.1	52.17	-15.07
0.393	41.46	0	41.46	58	-16.54	40.41	0	40.41	48	-7.59
4.468	42.45	0.08	42.53	56	-13.47	41.87	0.08	41.95	46	-4.05
4.872	43.32	0.1	43.42	56	-12.58	42.58	0.1	42.68	46	-3.32
5.278	35.96	0.1	36.06	60	-23.94	34.5	0.1	34.6	50	-15.4

Table 16. Conducted Emissions, 15.207(a), Neutral Line, Test Results



Plot 5. Conducted Emissions, 15.207(a), Neutral Line

15.207(a) Conducted Emissions Test Setup Photo

Photograph 4. Conducted Emissions, 15.207(a), Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a)(2) 6 dB and 99% Bandwidth

Test Requirements: **§ 15.247(a)(2):** Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Procedure: The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately 1% of the total emission bandwidth, VBW > RBW. The 6 dB Bandwidth was measured and recorded. The measurements were performed on the low, mid and high channels.

Test Results The EUT was compliant with § 15.247 (a)(2).

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

Test Engineer(s): Jeff Pratt

Test Date(s): 09/16/11

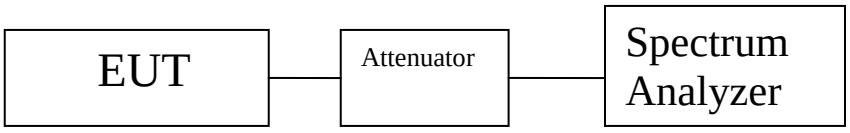


Figure 1. Block Diagram, Occupied Bandwidth Test Setup

Occupied Bandwidth Test Results

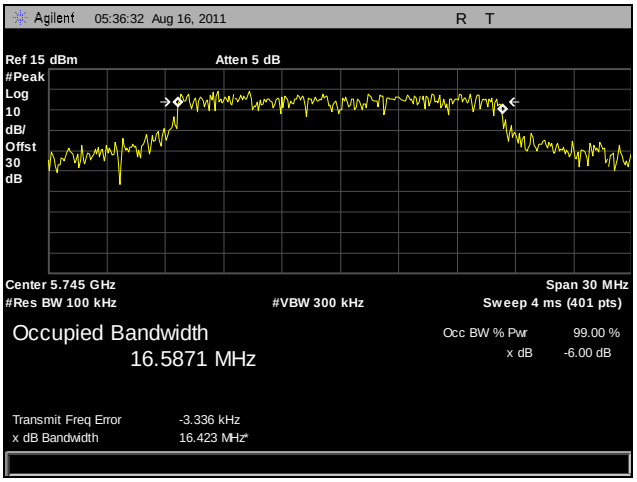
Occupied Bandwidth			
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**
802.11a Port A	Low	5745	16.423
	Mid	5785	16.499
	High	5825	16.518
802.11n 20 MHz Port A	Low	5745	17.819
	Mid	5785	17.741
	High	5825	17.564
802.11n 20 MHz Port B	Low	5745	17.717
	Mid	5785	17.718
	High	5825	17.761
802.11n 40 MHz Port A	Low	5755	36.278
	Mid	5785	36.187
	High	5815	36.402
802.11n 40 MHz Port B	Low	5755	33.193
	Mid	5785	36.428
	High	5815	36.464

Table 17. 6 dB Occupied Bandwidth, Test Results

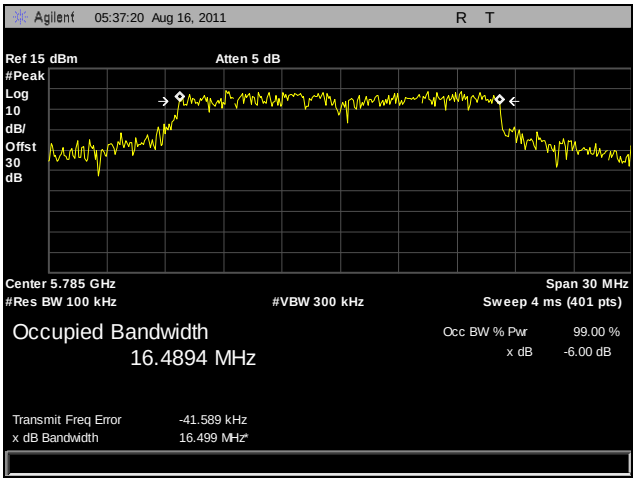
Occupied Bandwidth			
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured 99% Bandwidth (MHz)**
802.11a Port A	Low	5745	16.5705
	Mid	5785	16.5547
	High	5825	16.5915
802.11n 20 MHz Port A	Low	5745	17.8529
	Mid	5785	17.8188
	High	5825	17.7386
802.11n 20 MHz Port B	Low	5745	17.7744
	Mid	5785	17.7907
	High	5825	17.6138
802.11n 40 MHz Port A	Low	5755	36.5744
	Mid	5785	36.6409
	High	5815	36.6146
802.11n 40 MHz Port B	Low	5755	36.9168
	Mid	5785	36.5974
	High	5815	35.8987

Table 18. 99% Occupied Bandwidth, Test Results

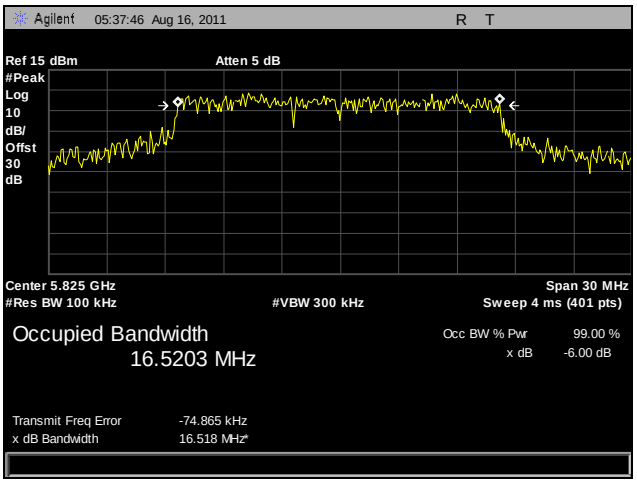
Occupied Bandwidth Test Results, 802.11a Port A



Plot 6. 6 dB Occupied Bandwidth, Low Channel, 802.11a, Port A

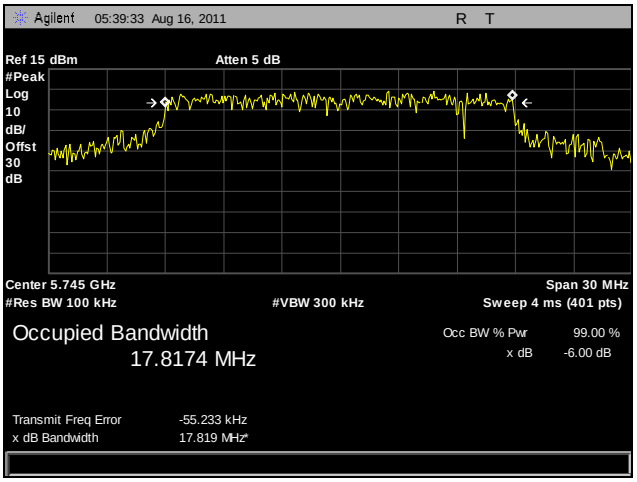


Plot 7. 6 dB Occupied Bandwidth, Mid Channel, 802.11a, Port A

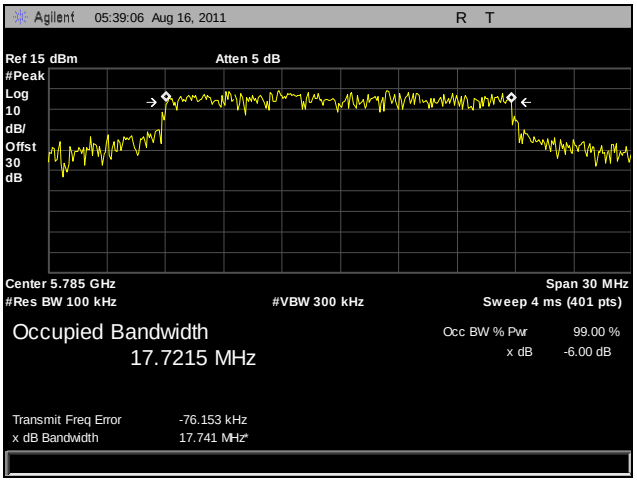


Plot 8. 6 dB Occupied Bandwidth, High Channel, 802.11a, Port A

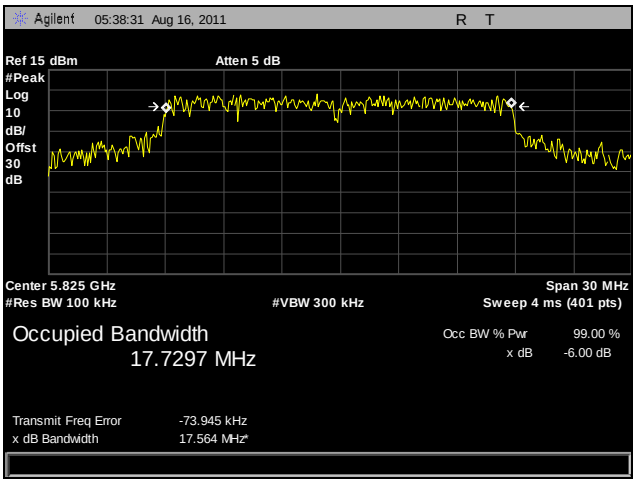
Occupied Bandwidth Test Results, 802.11n 20 MHz Port A



Plot 9. 6 dB Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port A

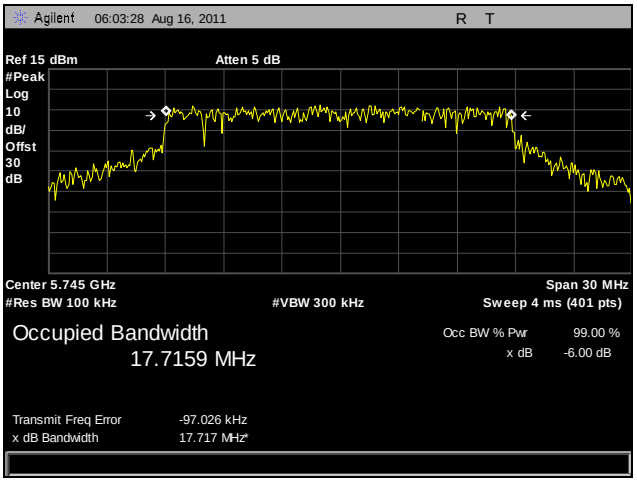


Plot 10. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port A

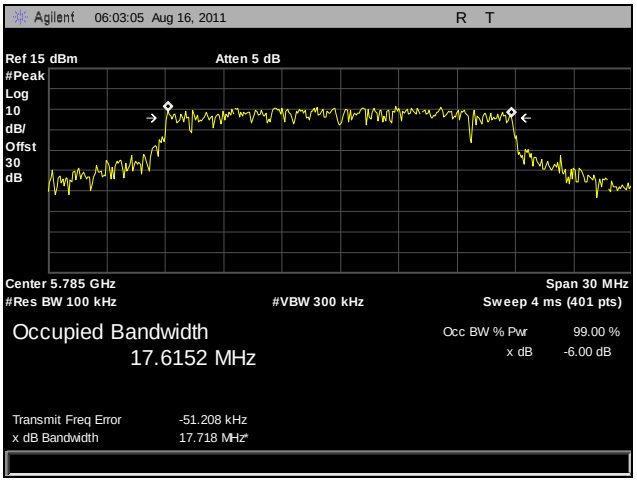


Plot 11. 6 dB Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port A

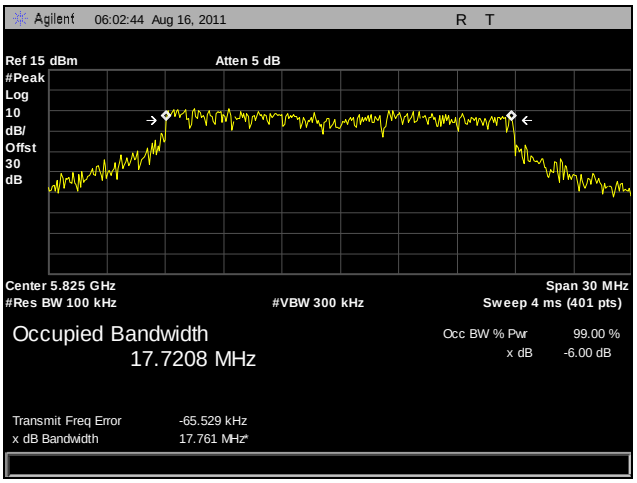
Occupied Bandwidth Test Results, 802.11n 20 MHz Port B



Plot 12. 6 dB Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port B

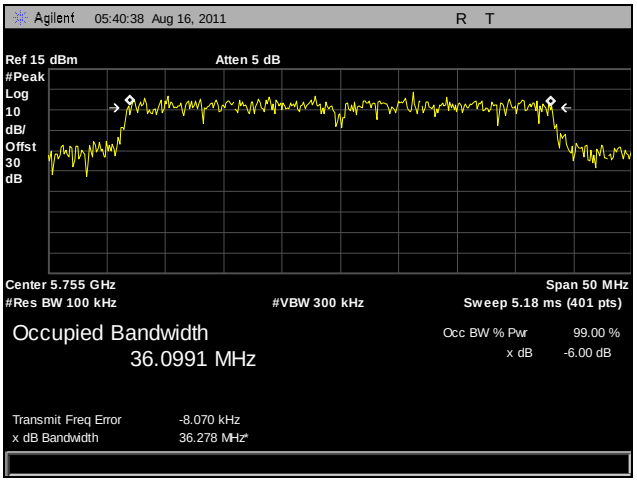


Plot 13. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port B

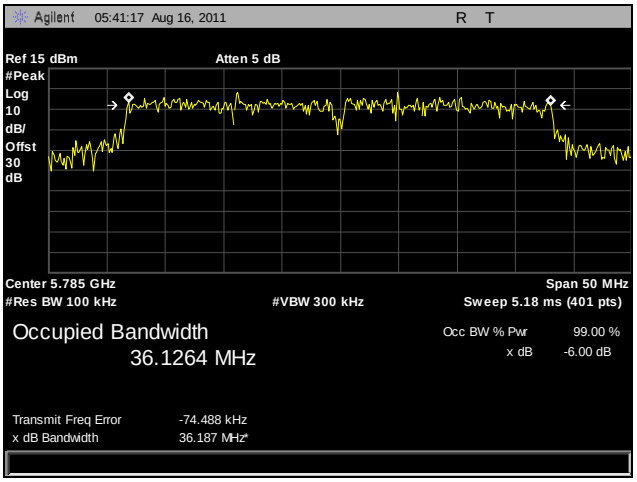


Plot 14. 6 dB Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port B

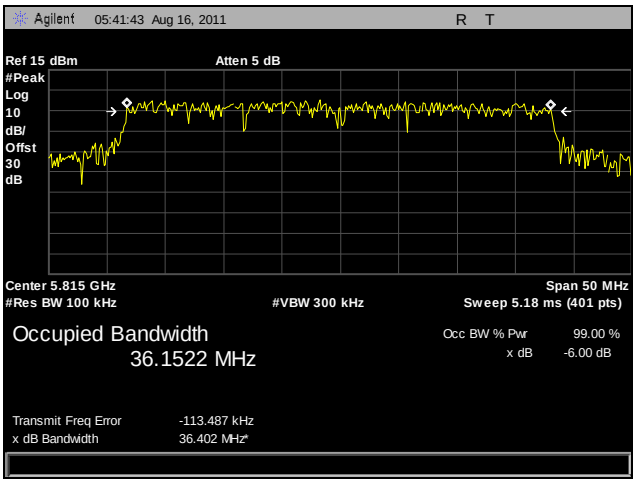
Occupied Bandwidth Test Results, 802.11n 40 MHz Port A



Plot 15. 6 dB Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port A

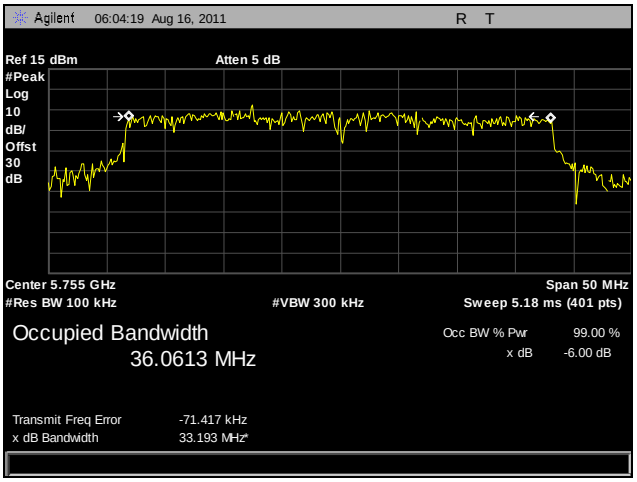


Plot 16. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 40 MHz, Port A

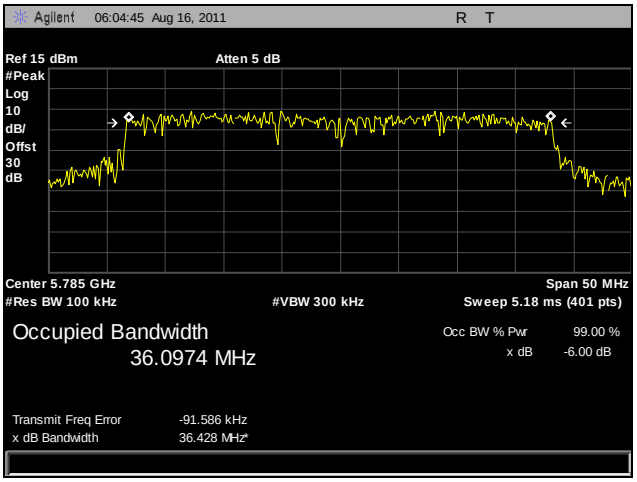


Plot 17. 6 dB Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port A

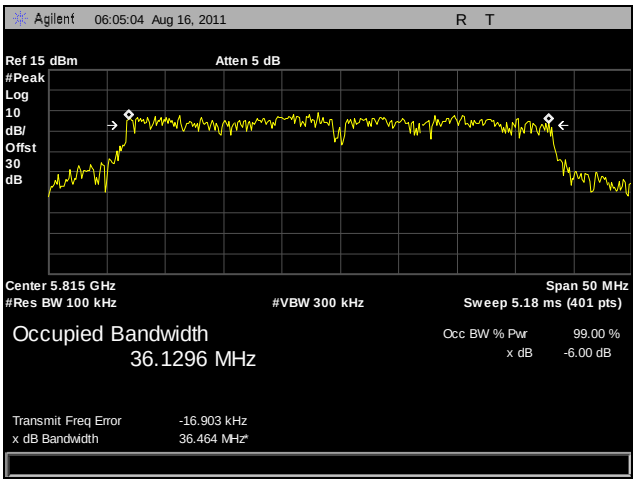
Occupied Bandwidth Test Results, 802.11n 40 MHz Port B



Plot 18. 6 dB Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port B

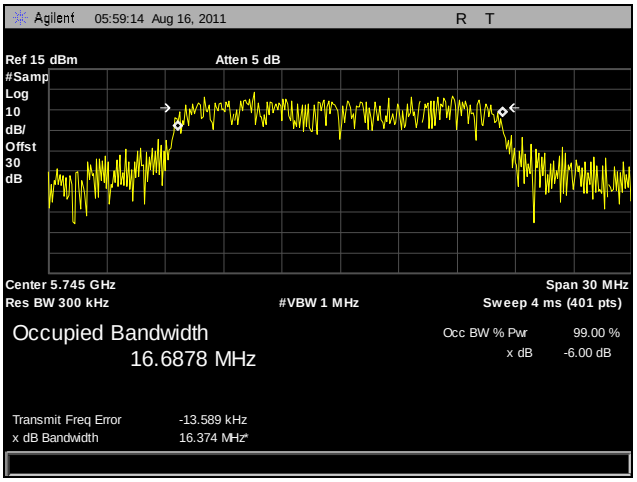


Plot 19. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 40 MHz, Port B

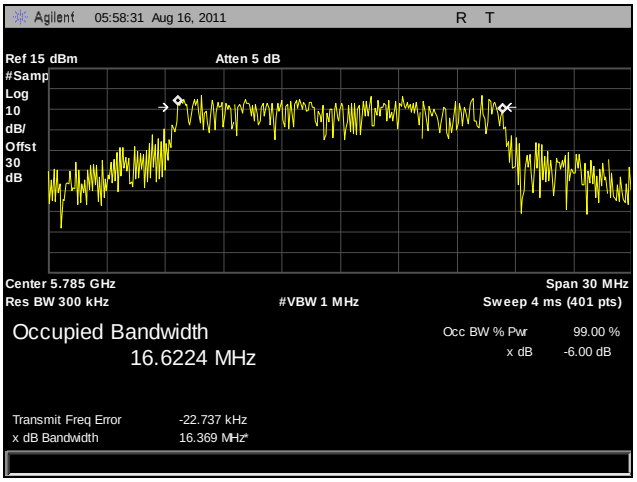


Plot 20. 6 dB Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port B

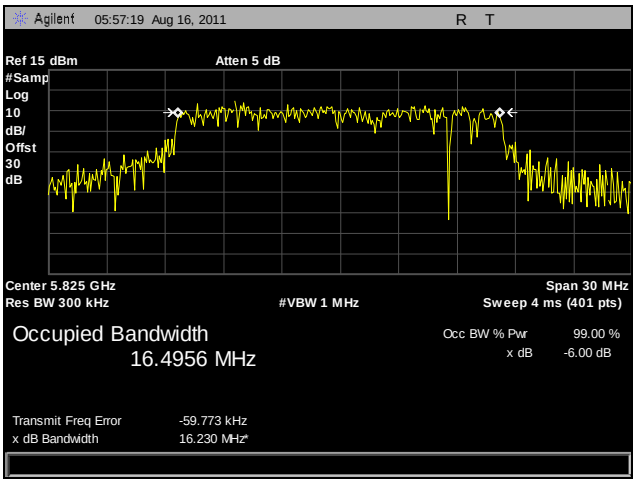
Occupied Bandwidth Test Results, 802.11a Port B



Plot 21. 99% Occupied Bandwidth, Low Channel, 802.11a, Port B

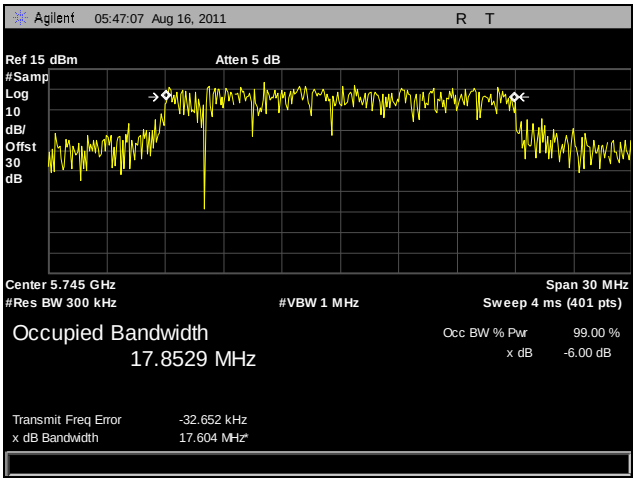


Plot 22. 99% Occupied Bandwidth, Mid Channel, 802.11a, Port B

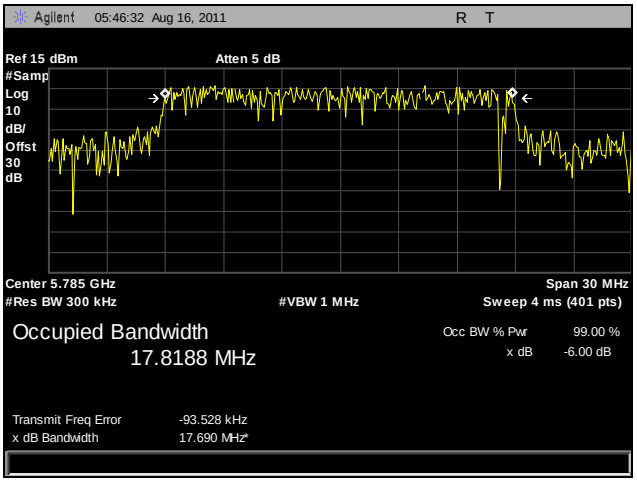


Plot 23. 99% Occupied Bandwidth, High Channel, 802.11a, Port B

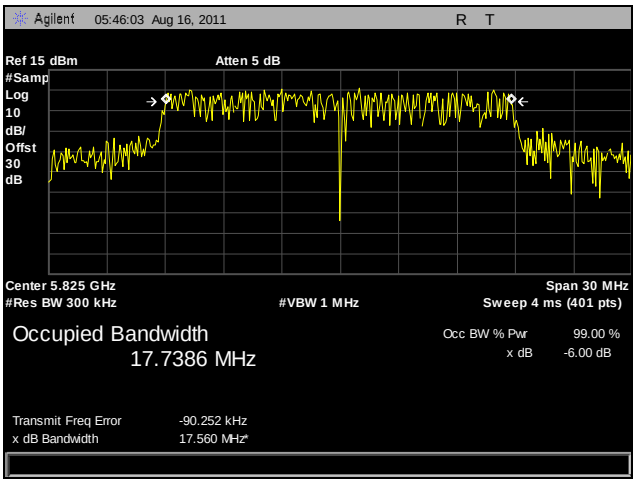
Occupied Bandwidth Test Results, 802.11n 20 MHz Port A



Plot 24. 99% Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port A

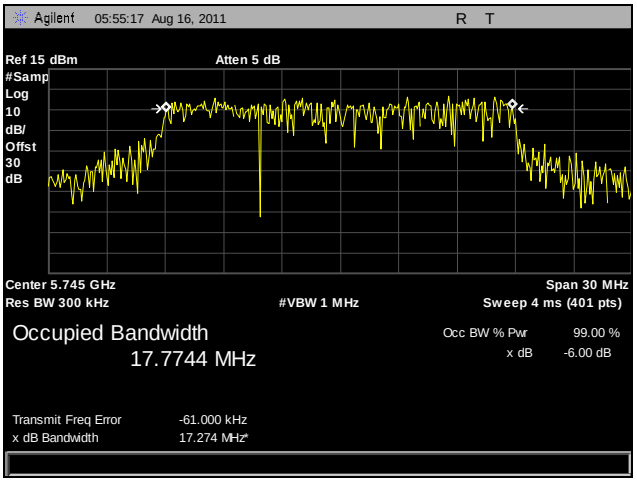


Plot 25. 99% Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port A

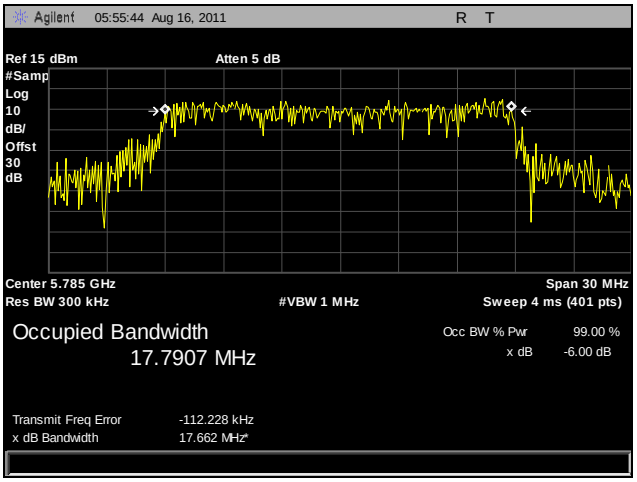


Plot 26. 99% Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port A

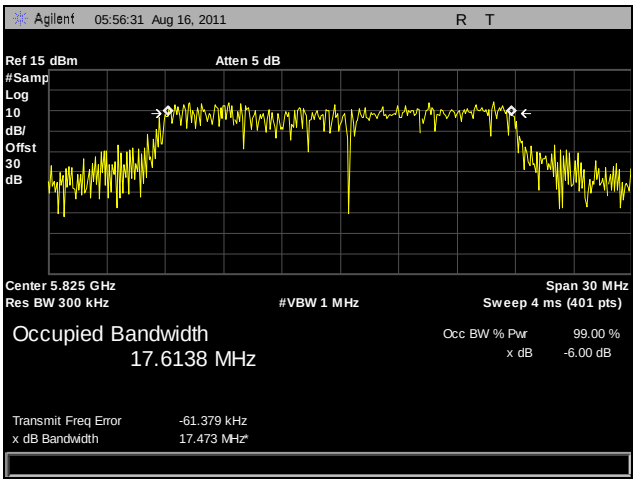
Occupied Bandwidth Test Results, 802.11n 20 MHz Port B



Plot 27. 99% Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port B

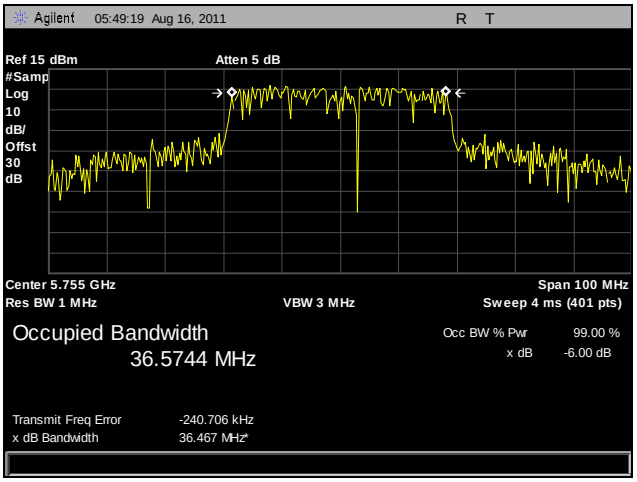


Plot 28. 99% Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port B

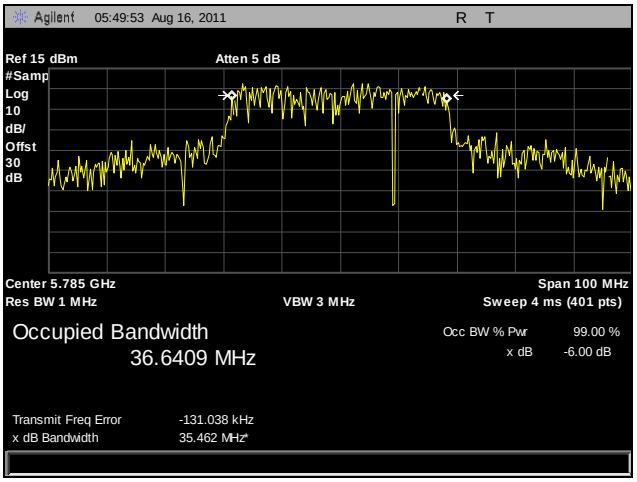


Plot 29. 99% Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port B

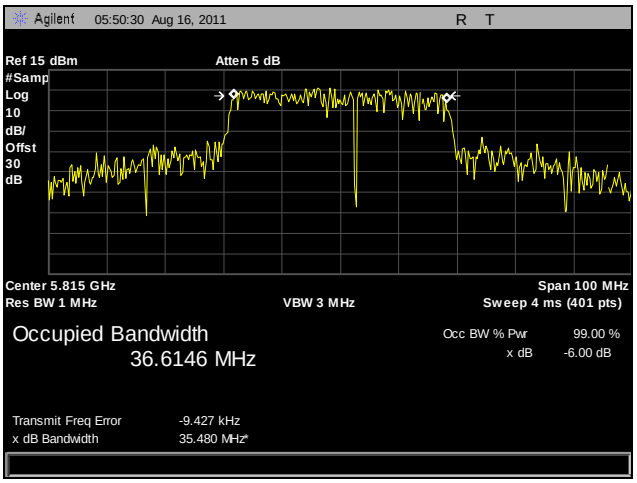
Occupied Bandwidth Test Results, 802.11n 40 MHz Port A



Plot 30. 99% Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port A

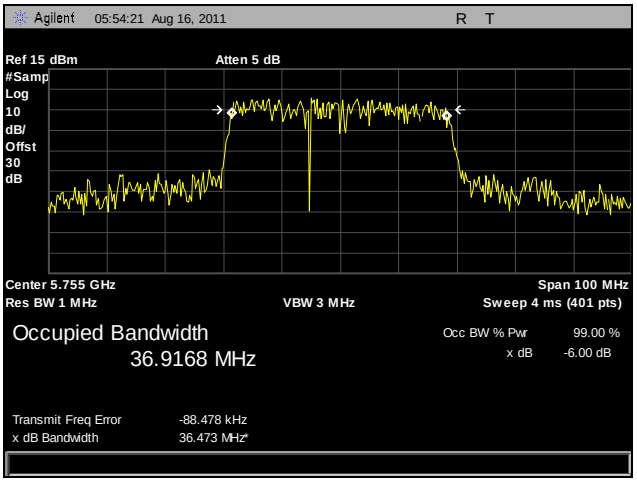


Plot 31. 99% Occupied Bandwidth, Mid Channel, 802.11n 40 MHz, Port A

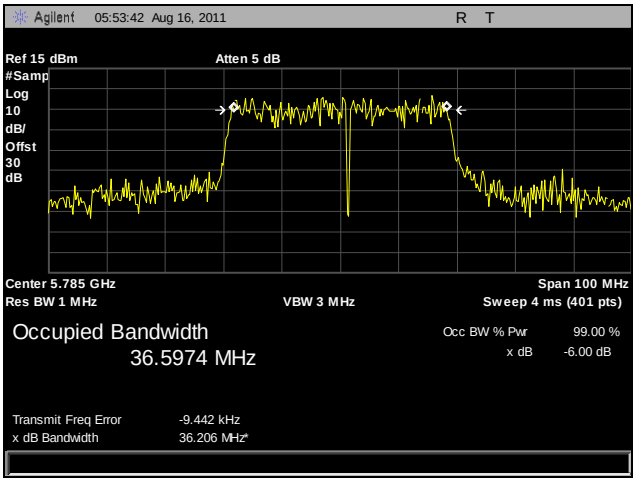


Plot 32. 99% Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port A

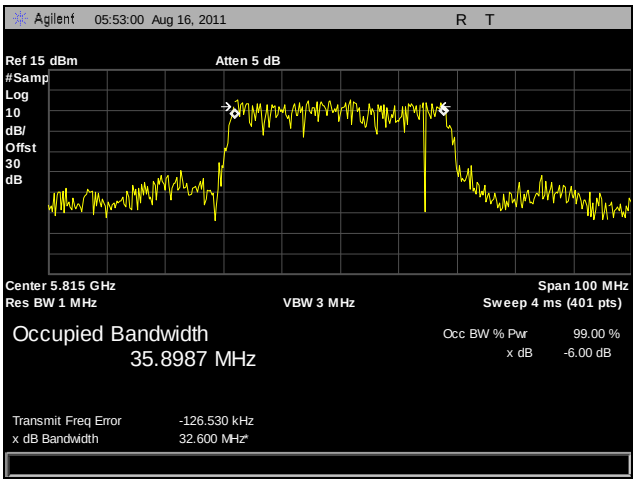
Occupied Bandwidth Test Results, 802.11n 40 MHz Port B



Plot 33. 99% Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port B



Plot 34. 99% Occupied Bandwidth, Mid Channel, 802.11n 40 MHz, Port B



Plot 35. 99% Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port B

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output

Test Requirements: **§15.247(b):** The maximum peak output power of the intentional radiator shall not exceed the following:

Digital Transmission Systems (MHz)	Output Limit (Watts)
902-928	1.000
2400–2483.5	1.000
5725– 5850	1.000

Table 19. Output Power Requirements from §15.247(b)

§15.247(c): if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in the Table 19, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400 – 2483.5 MHz band and using a point to point application may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Fixed, point-to-point operation excludes the use of point-to-multipoint systems, Omni-directional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

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

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

Test Engineer(s): Jeff Pratt

Test Date(s): 09/16/11

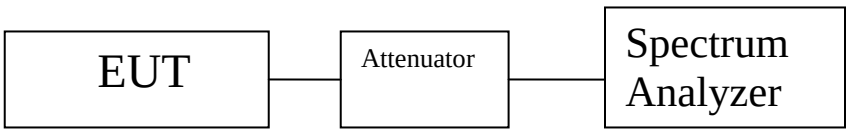


Figure 2. Peak Power Output Test Setup

Peak Power Output Test Results

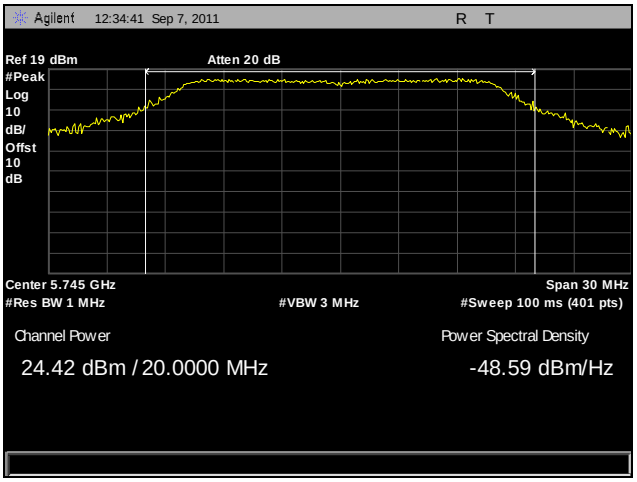
Channel (MHz)	Mode/Mod. Type	Port 2A Conducted Power (dBm)	Port 2A Conducted Power (mW)	Port 2B Conducted Power (dBm)	Port 2B Conducted Power (mW)	Summed Conducted Power (mW)	Summed Conducted Power (dBm)	Antenna Gain (dBi)	Limit (dBm)	Margin (dB)
5745	802.11a	24.42	276.69416			276.694165	24.42	10	26	-1.58
5785	802.11a	25.39	345.93938			345.939378	25.39	10	26	-0.61
5825	802.11a	24.43	277.33201			277.33201	24.43	10	26	-1.57
5745	802.11n HT20	21.91	155.2387	23.66	232.27368	387.512381	25.8828558	10	26	-0.1171442
5785	802.11n HT20	23.1	204.17379	22.07	161.06456	365.238358	25.6257638	10	26	-0.3742362
5825	802.11n HT20	23.14	206.06299	21.69	147.57065	353.633645	25.4855358	10	26	-0.5144642
5755	802.11n HT40	22.85	192.75249	22.43	174.98467	367.73716	25.6553752	10	26	-0.3446248
5785	802.11n HT40	22.68	185.35316	20.04	100.92529	286.278451	24.5678866	10	26	-1.4321134
5815	802.11n HT40	22.5	177.82794	19.46	88.30799	266.135931	24.2510351	10	26	-1.7489649

Table 20. Peak Power Output, Test Results

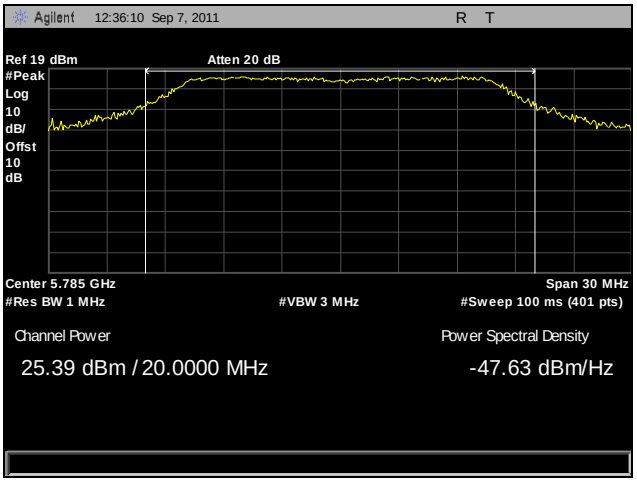
Channel (MHz)	Mode/Mod. Type	Port 2A Conducted Power (dBm)	Port 2A Conducted Power (mW)	Port 2B Conducted Power (dBm)	Port 2B Conducted Power (mW)	Summed Conducted Power (mW)	Summed Conducted Power (dBm)	Antenna Gain (dBi)	Limit (dBm)	Margin (dB)
5745	802.11a	19.84	96.38			96.38	19.84	15.5	20.5	-0.66
5785	802.11a	19.93	98.40			98.40	19.93	15.5	20.5	-0.57
5825	802.11a	20.17	103.99			103.99	20.17	15.5	20.5	-0.33
5745	802.11n HT20	17.26	53.21	16.01	39.90	93.11	19.69	15.5	20.5	-0.81
5785	802.11n HT20	17.83	60.67	16.60	45.71	106.38	20.27	15.5	20.5	-0.23
5825	802.11n HT20	17.67	58.48	15.43	34.91	93.39	19.70	15.5	20.5	-0.80
5755	802.11n HT40	17.85	60.95	15.92	39.08	100.04	20.00	15.5	20.5	-0.50
5785	802.11n HT40	18.25	66.83	15.20	33.11	99.95	20.00	15.5	20.5	-0.50
5815	802.11n HT40	17.74	59.43	14.81	30.27	89.70	19.53	15.5	20.5	-0.97

Table 21. Peak Power Output, Test Results, Sector Antenna

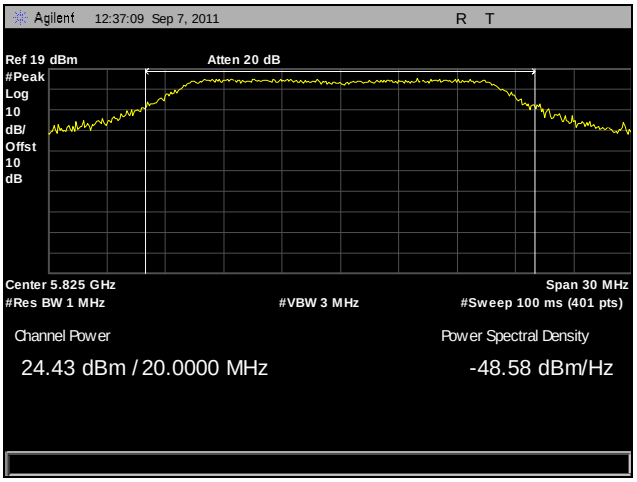
Peak Power Output Test Results, 802.11a Port A



Plot 36. Peak Power Output, Low Channel, 802.11a, Port A

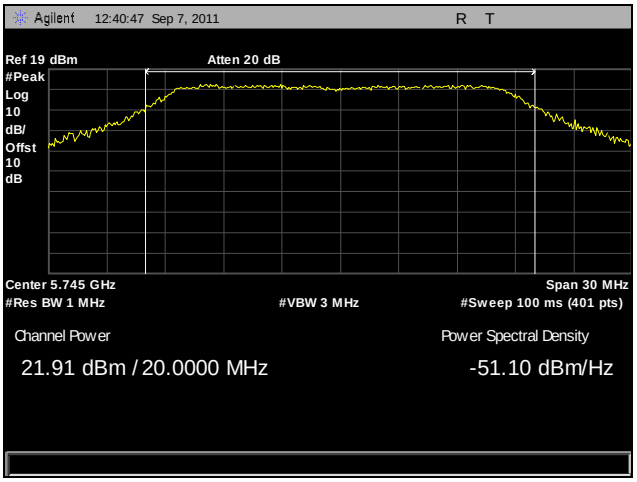


Plot 37. Peak Power Output, Mid Channel, 802.11a, Port A

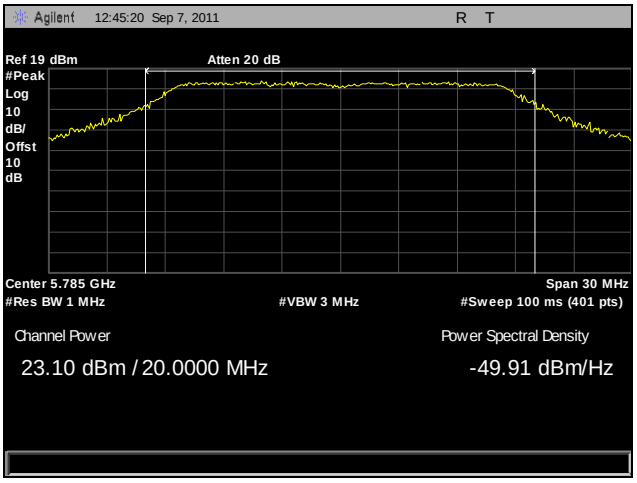


Plot 38. Peak Power Output, High Channel, 802.11a, Port A

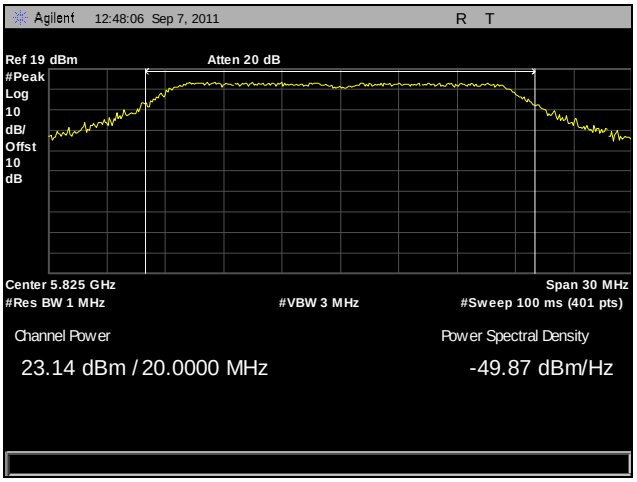
Peak Power Output Test Results, 802.11n 20 MHz Port A



Plot 39. Peak Power Output, Low Channel, 802.11n 20 MHz, Port A

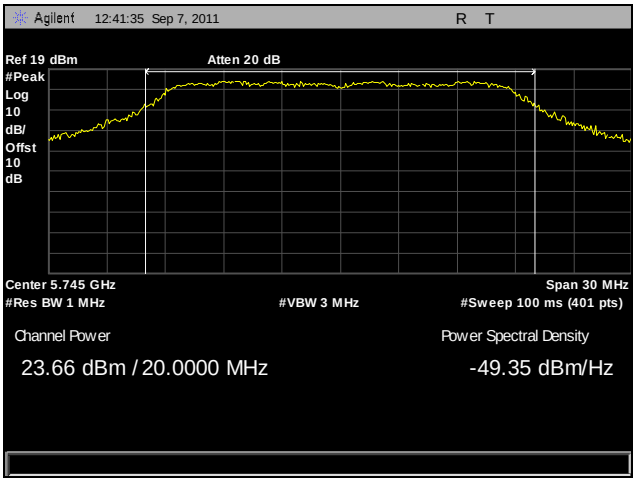


Plot 40. Peak Power Output, Mid Channel, 802.11n 20 MHz, Port A

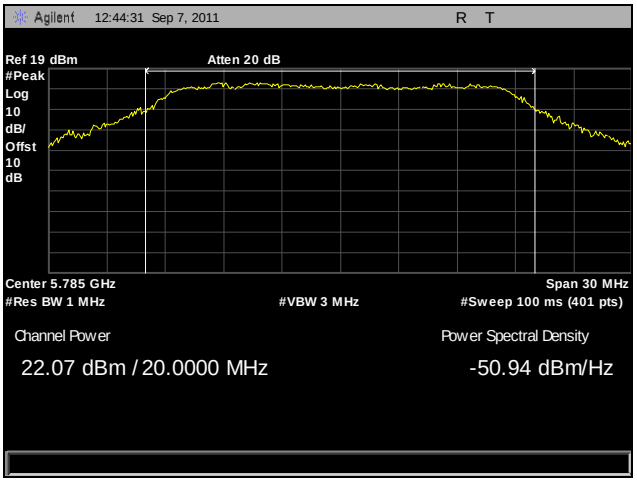


Plot 41. Peak Power Output, High Channel, 802.11n 20 MHz, Port A

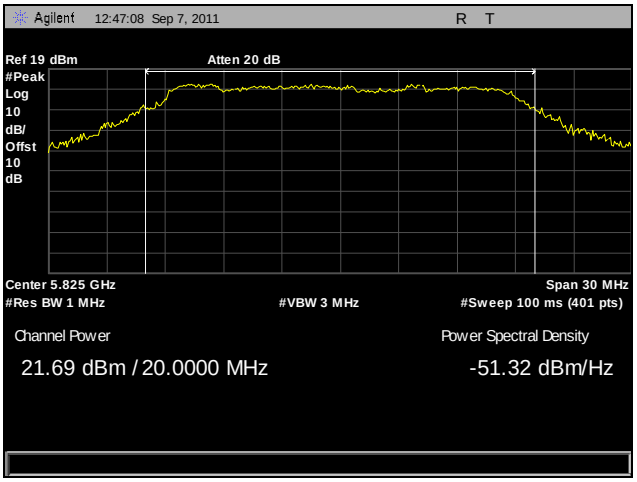
Peak Power Output Test Results, 802.11n 20 MHz Port B



Plot 42. Peak Power Output, Low Channel, 802.11n 20 MHz, Port B

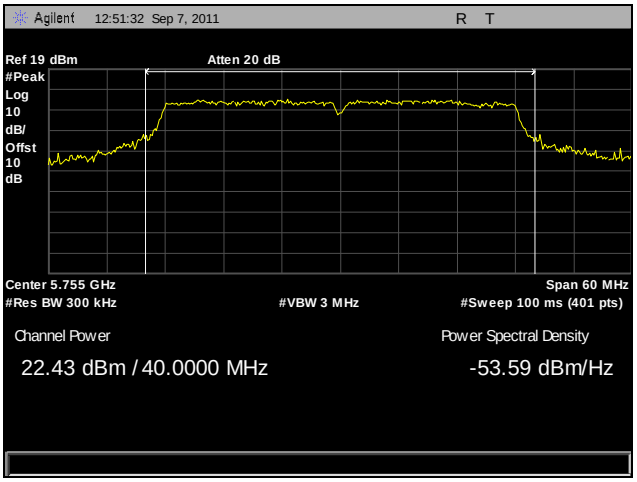


Plot 43. Peak Power Output, Mid Channel, 802.11n 20 MHz, Port B

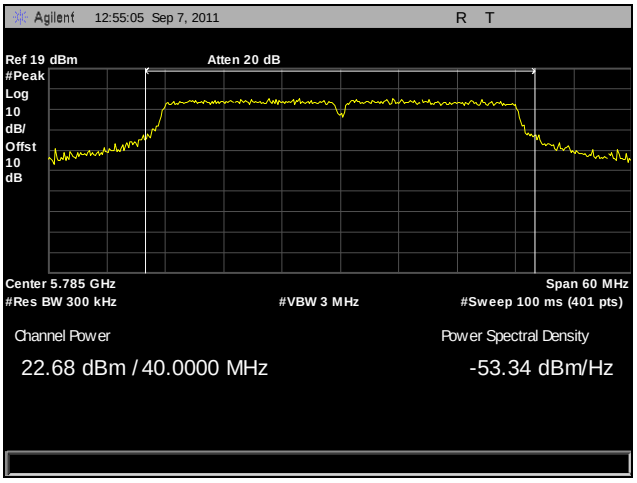


Plot 44. Peak Power Output, High Channel, 802.11n 20 MHz, Port B

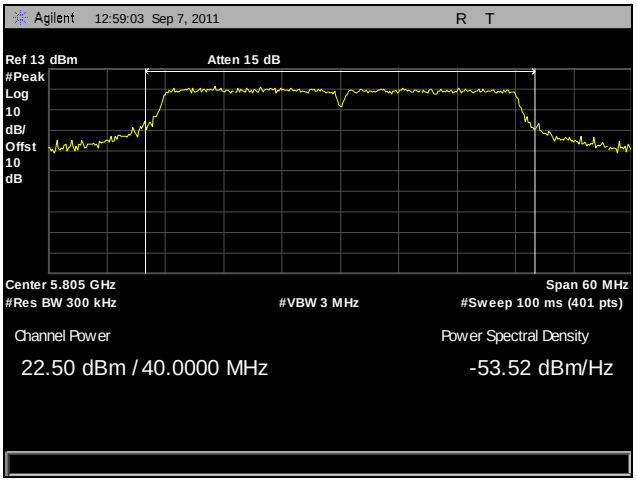
Peak Power Output Test Results, 802.11n 40 MHz Port A



Plot 45. Peak Power Output, Low Channel, 802.11n 40 MHz, Port A

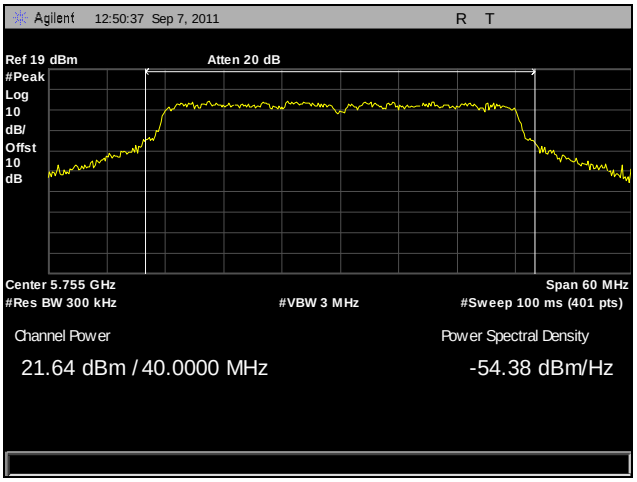


Plot 46. Peak Power Output, Mid Channel, 802.11n 40 MHz, Port A

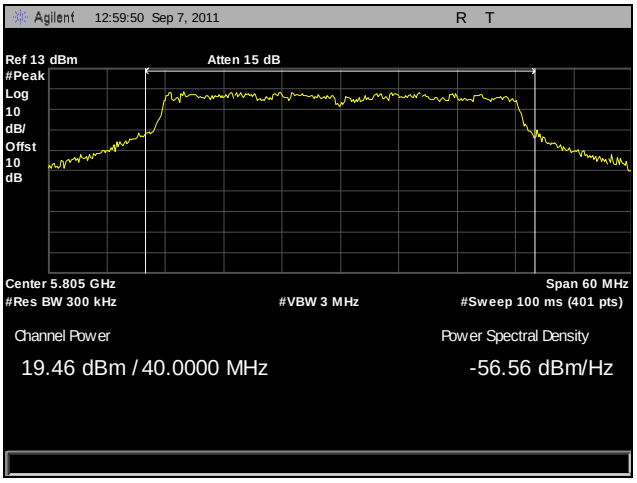


Plot 47. Peak Power Output, High Channel, 802.11n 40 MHz, Port A

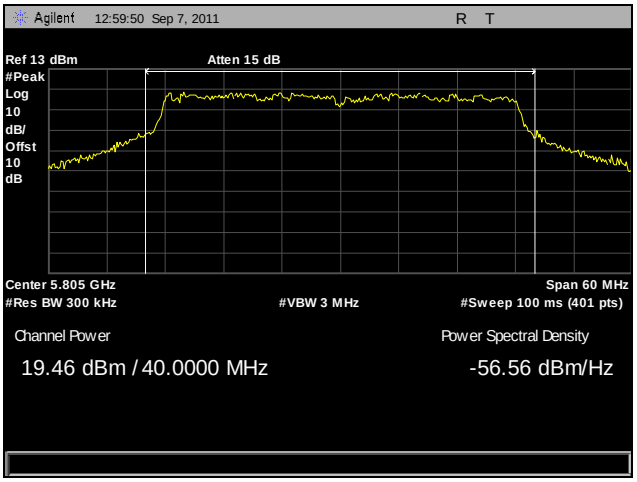
Peak Power Output Test Results, 802.11n 40 MHz Port B



Plot 48. Peak Power Output, Low Channel, 802.11n 40 MHz, Port B

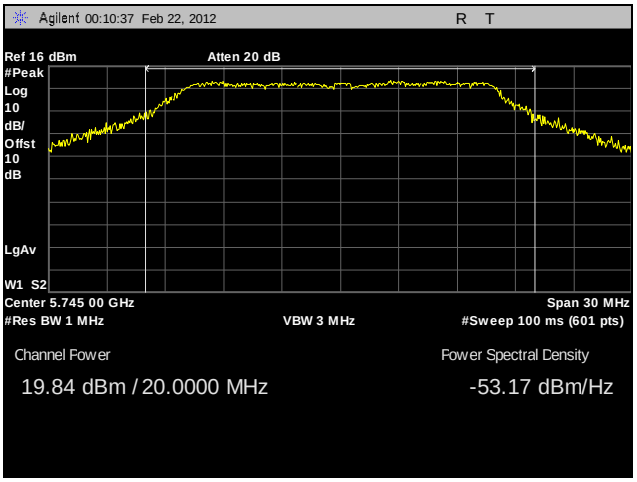


Plot 49. Peak Power Output, Mid Channel, 802.11n 40 MHz, Port B

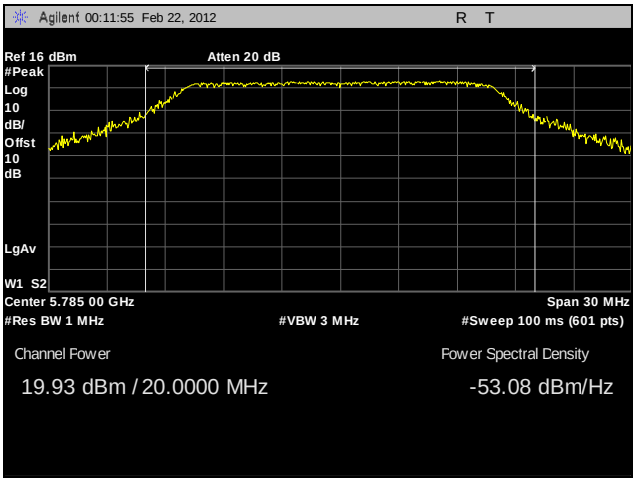


Plot 50. Peak Power Output, High Channel, 802.11n 40 MHz, Port B

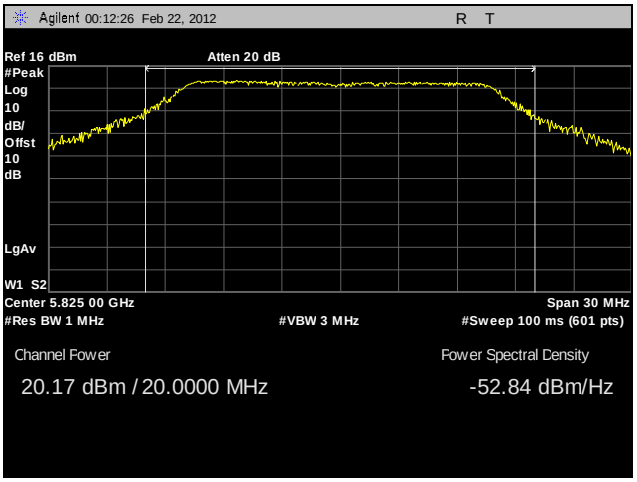
Peak Power Output Test Results, 802.11a Port A, Sector Antenna



Plot 51. Peak Power Output, Low Channel, 802.11a, Port A, Sector Antenna

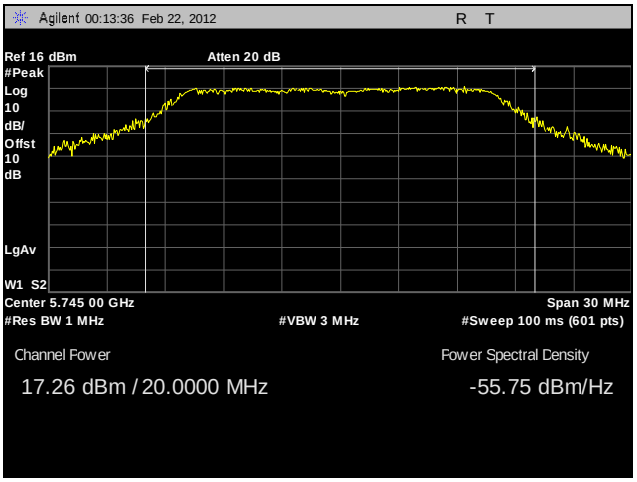


Plot 52. Peak Power Output, Mid Channel, 802.11a, Port A, Sector Antenna

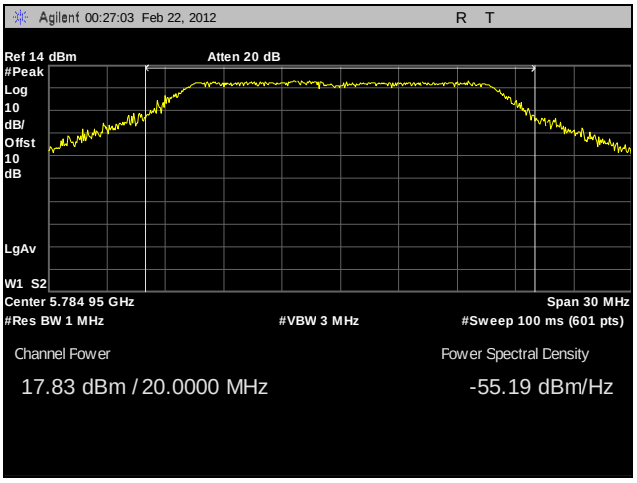


Plot 53. Peak Power Output, High Channel, 802.11a, Port A, Sector Antenna

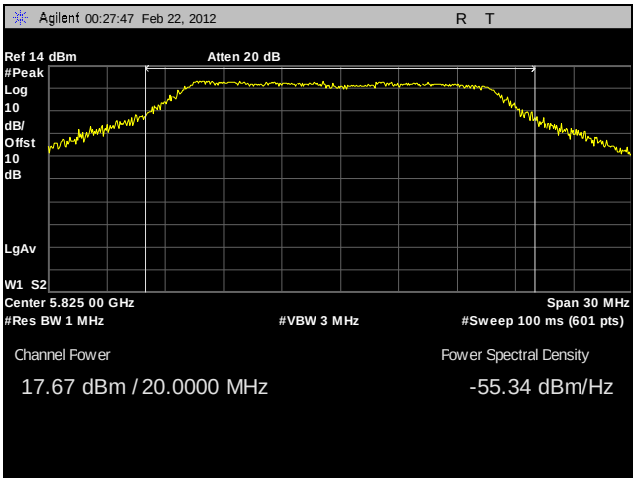
Peak Power Output Test Results, 802.11n 20 MHz Port A, Sector Antenna



Plot 54. Peak Power Output, Low Channel, 802.11n 20 MHz, Port A, Sector Antenna

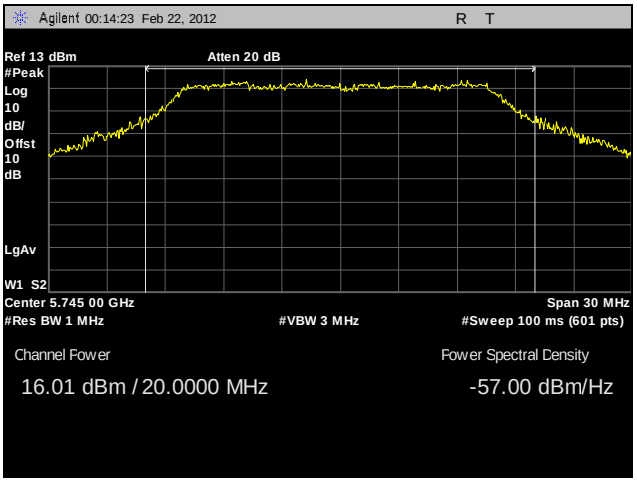


Plot 55. Peak Power Output, Mid Channel, 802.11n 20 MHz, Port A, Sector Antenna

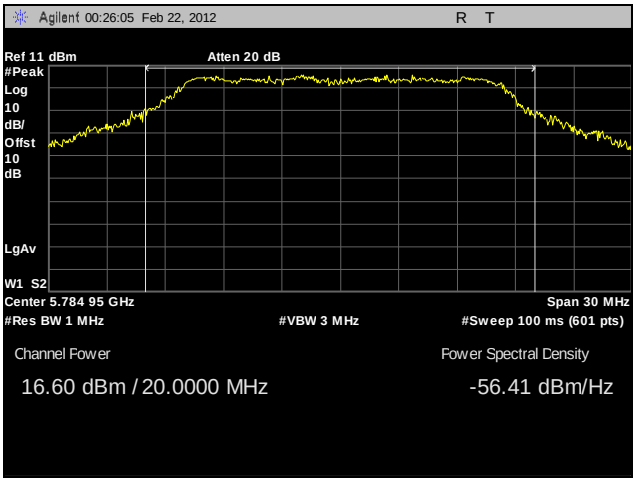


Plot 56. Peak Power Output, High Channel, 802.11n 20 MHz, Port A, Sector Antenna

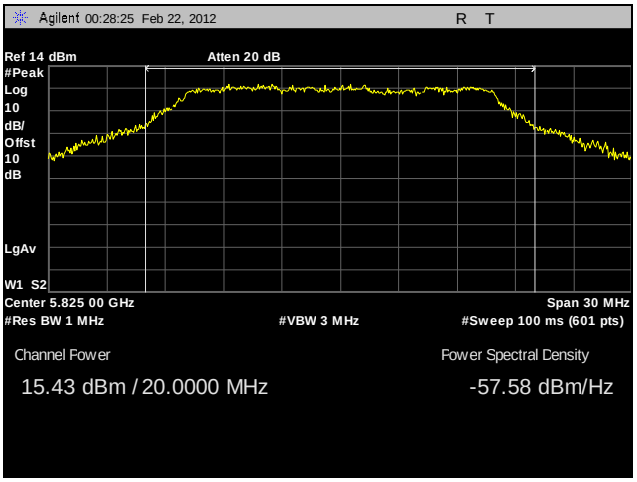
Peak Power Output Test Results, 802.11n 20 MHz Port B, Sector Antenna



Plot 57. Peak Power Output, Low Channel, 802.11n 20 MHz, Port B, Sector Antenna

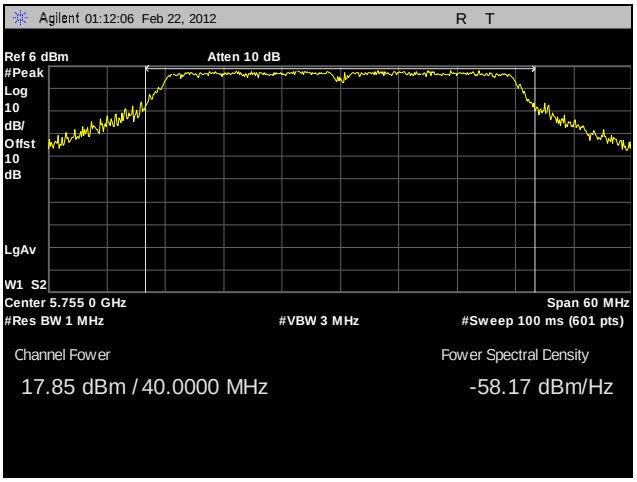


Plot 58. Peak Power Output, Mid Channel, 802.11n 20 MHz, Port B, Sector Antenna

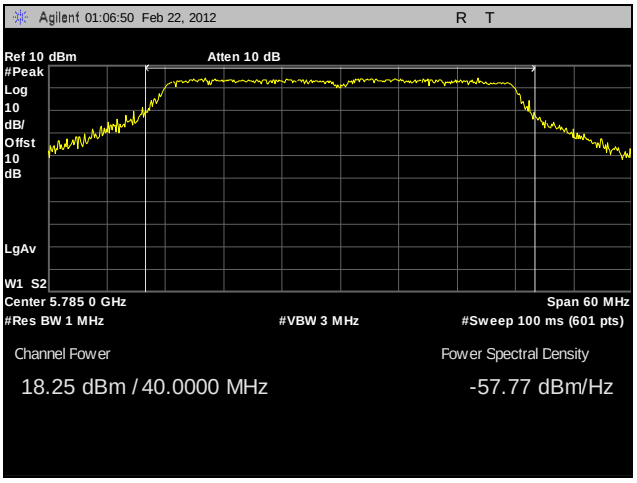


Plot 59. Peak Power Output, High Channel, 802.11n 20 MHz, Port B, Sector Antenna

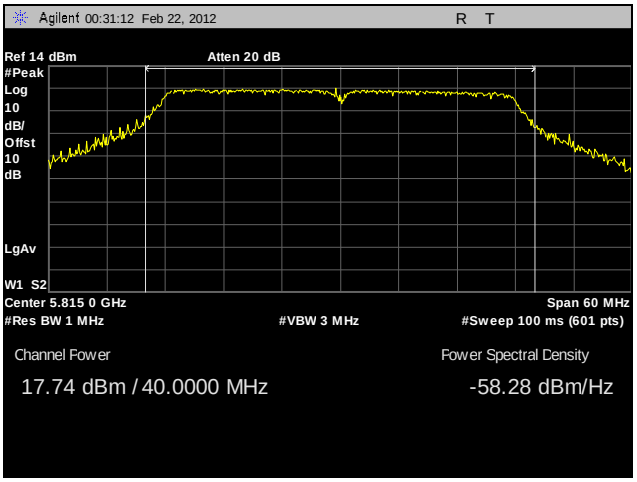
Peak Power Output Test Results, 802.11n 40 MHz Port A, Sector Antenna



Plot 60. Peak Power Output, Low Channel, 802.11n 40 MHz, Port A, Sector Antenna

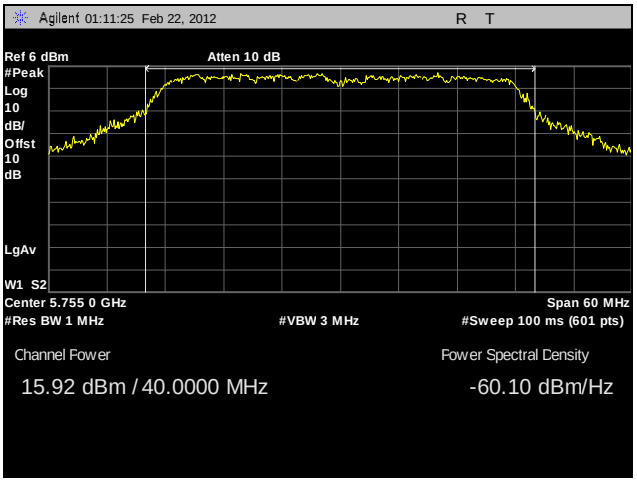


Plot 61. Peak Power Output, Mid Channel, 802.11n 40 MHz, Port A, Sector Antenna

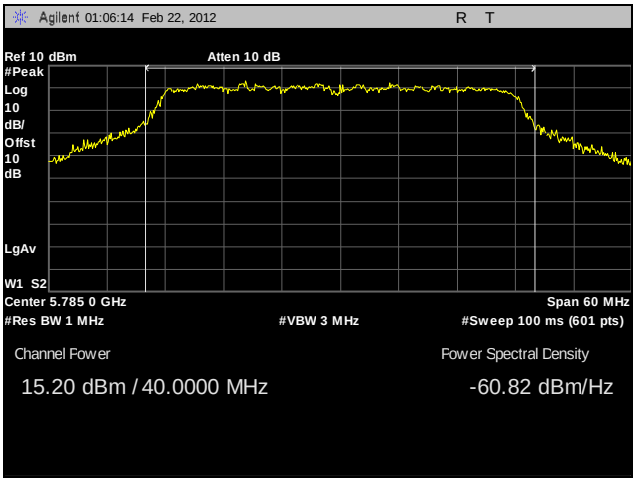


Plot 62. Peak Power Output, High Channel, 802.11n 40 MHz, Port A, Sector Antenna

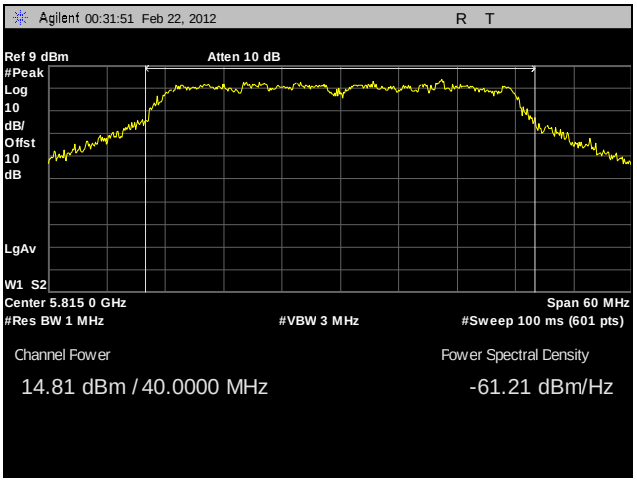
Peak Power Output Test Results, 802.11n 40 MHz Port B, Sector Antenna



Plot 63. Peak Power Output, Low Channel, 802.11n 40 MHz, Port B, Sector Antenna



Plot 64. Peak Power Output, Mid Channel, 802.11n 40 MHz, Port B, Sector Antenna



Plot 65. Peak Power Output, High Channel, 802.11n 40 MHz, Port B, Sector Antenna

Electromagnetic Compatibility Criteria for Intentional Radiators

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

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

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

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

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

Table 22. Restricted Bands of Operation

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

Test Requirement(s): **§ 15.209 (a):** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 23.

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

Table 23. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)

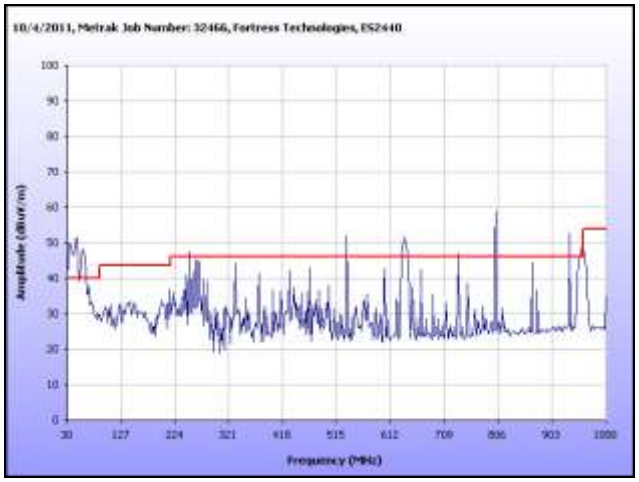
Test Procedures: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line.

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

Test Engineer(s): Jeff Pratt

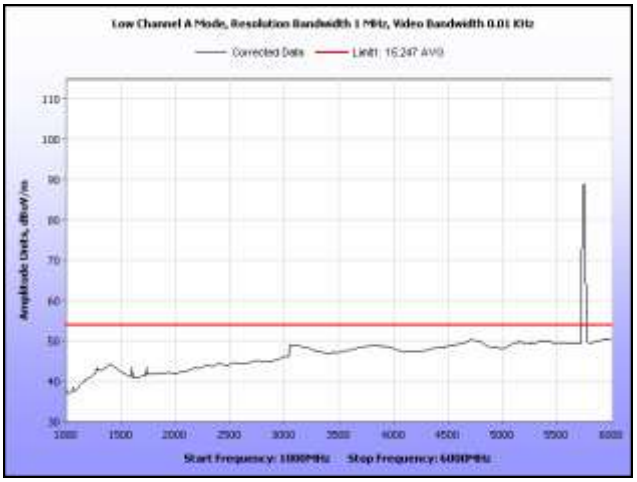
Test Date(s): 10/06/11

Radiated Spurious Emissions Test Results, 802.11a, Omni Antenna

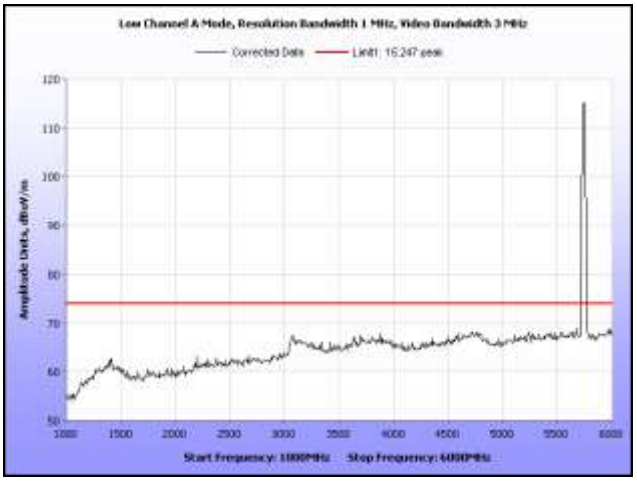


Plot 66. Radiated Spurious Emissions, Low Channel, 802.11a, Omni Antenna, 30 MHz – 1 GHz

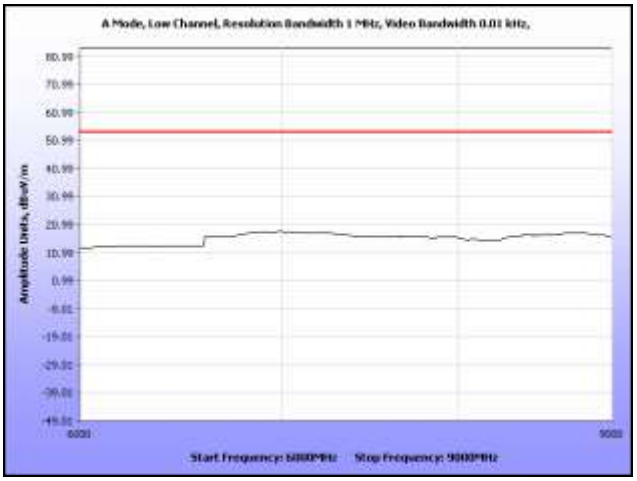
Note: Emissions which exceed the limit are digital emissions.



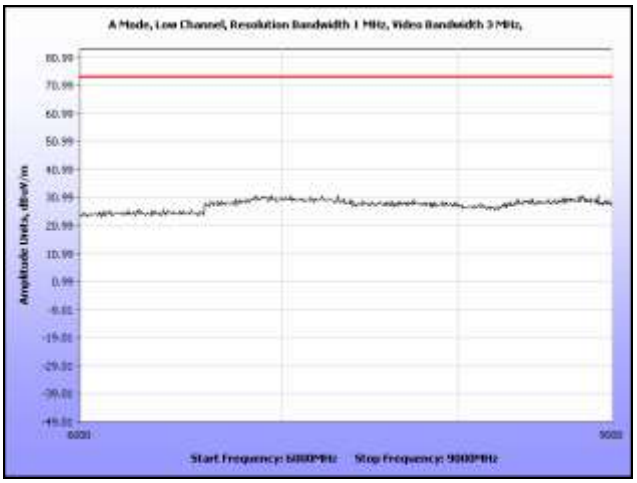
Plot 67. Radiated Spurious Emissions, Low Channel, 802.11a, Omni Antenna, 1 GHz – 6 GHz, Average



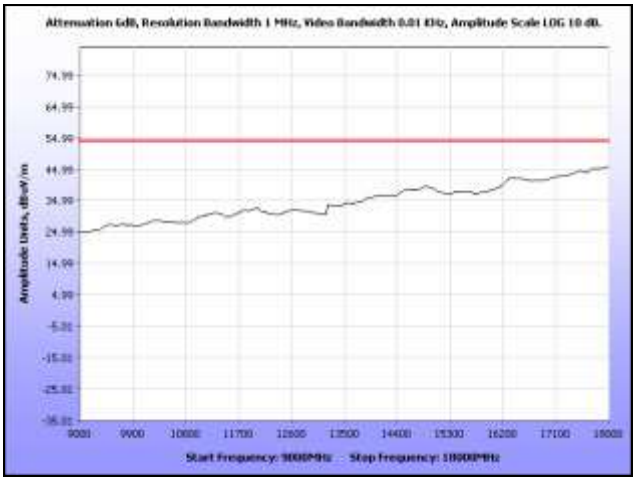
Plot 68. Radiated Spurious Emissions, Low Channel, 802.11a, Omni Antenna, 1 GHz – 6 GHz, Peak



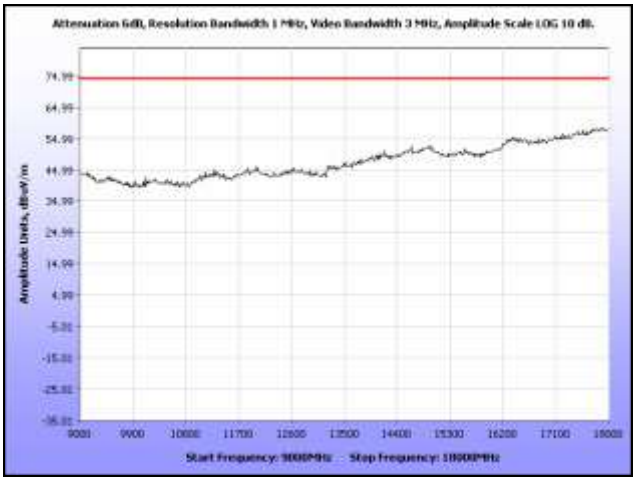
Plot 69. Radiated Spurious Emissions, Low Channel, 802.11a, Omni Antenna, 6 GHz – 9 GHz, Average



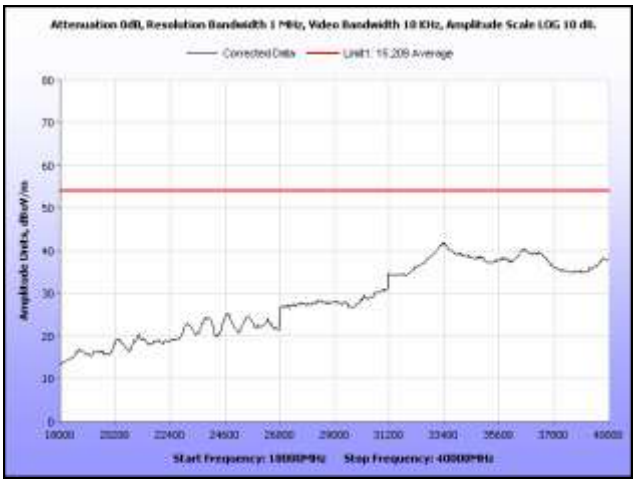
Plot 70. Radiated Spurious Emissions, Low Channel, 802.11a, Omni Antenna, 6 GHz – 9 GHz, Peak



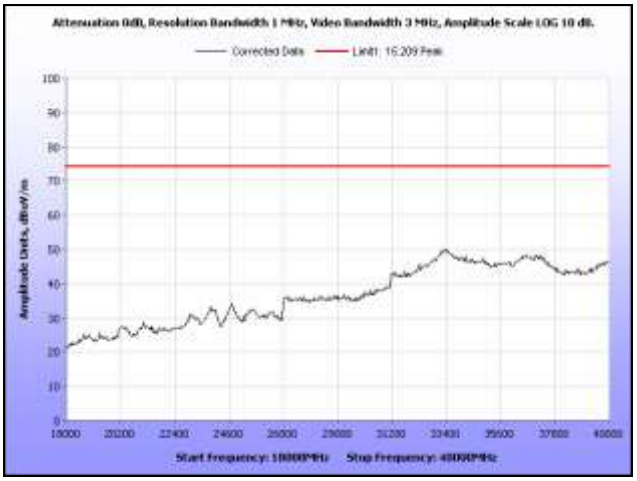
Plot 71. Radiated Spurious Emissions, Low Channel, 802.11a, Omni Antenna, 9 GHz – 18 GHz, Average



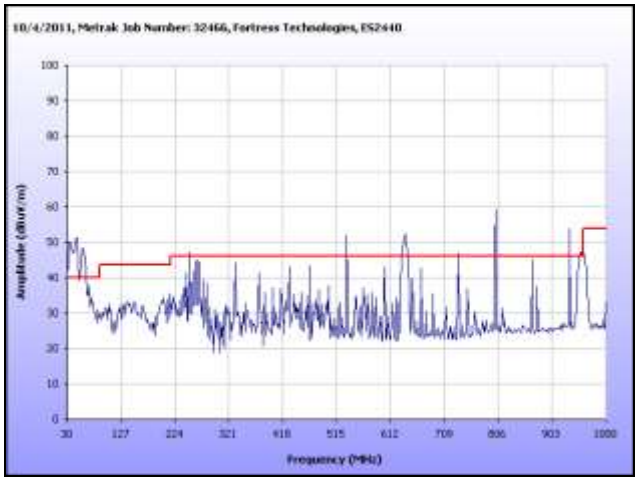
Plot 72. Radiated Spurious Emissions, Low Channel, 802.11a, Omni Antenna, 9 GHz – 18 GHz, Peak



Plot 73. Radiated Spurious Emissions, Low Channel, 802.11a, Omni Antenna, 18 GHz – 40 GHz, Average

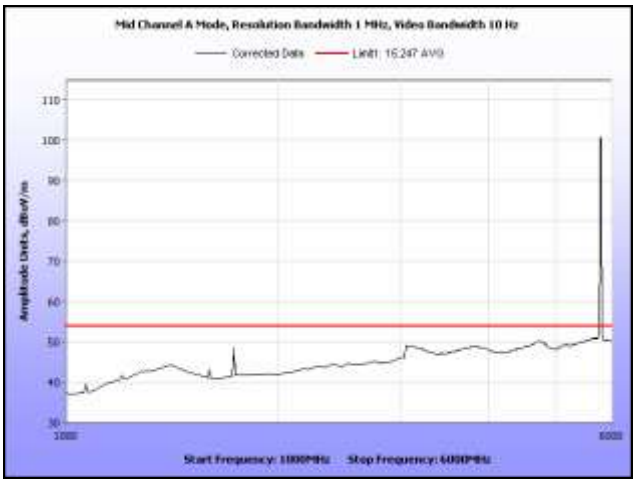


Plot 74. Radiated Spurious Emissions, Low Channel, 802.11a, Omni Antenna, 18 GHz – 40 GHz, Peak

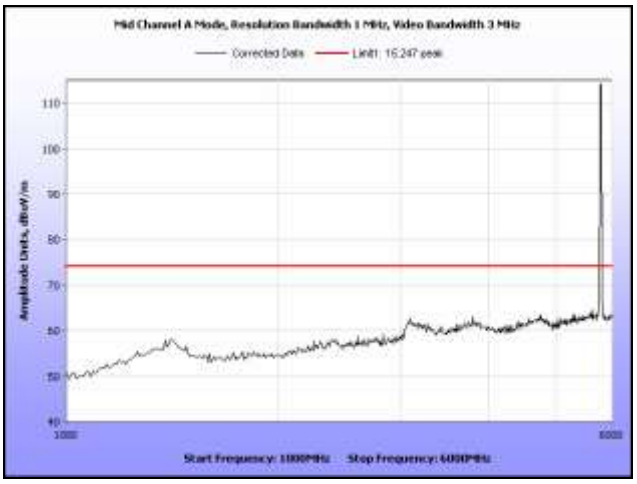


Plot 75. Radiated Spurious Emissions, Mid Channel, 802.11a, Omni Antenna, 30 MHz – 1 GHz

Note: Emissions which exceed the limit are digital emissions.

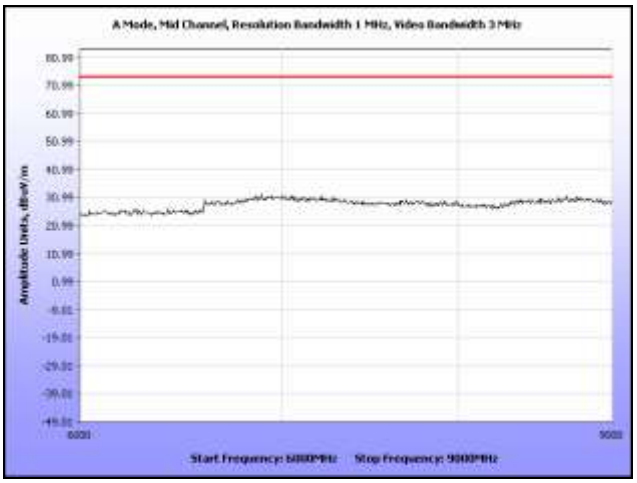


Plot 76. Radiated Spurious Emissions, Mid Channel, 802.11a, Omni Antenna, 1 GHz – 6 GHz, Average

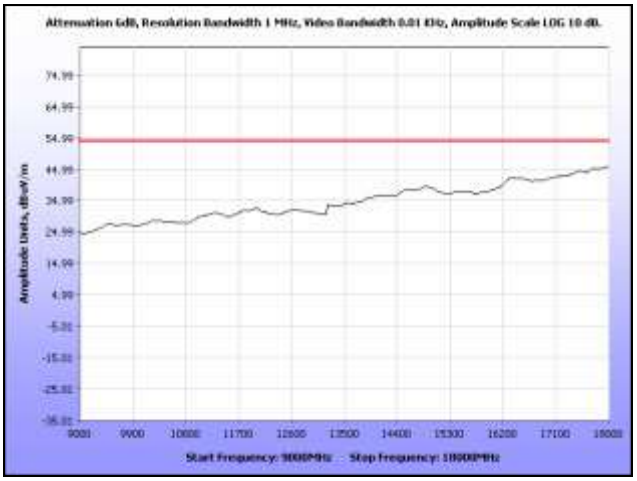


Plot 77. Radiated Spurious Emissions, Mid Channel, 802.11a, Omni Antenna, 1 GHz – 6 GHz, Peak

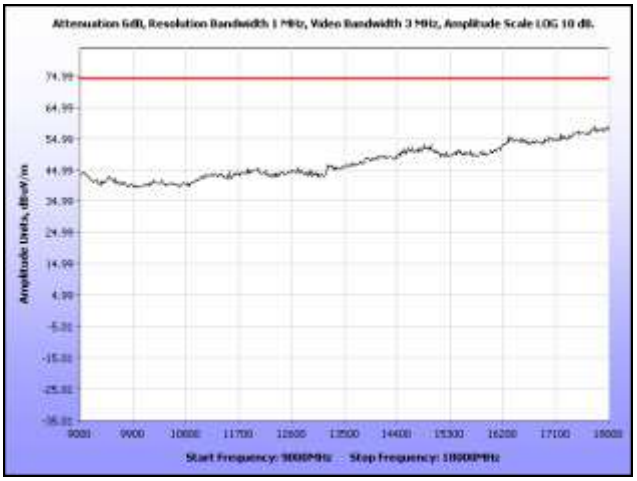
Plot 78. Radiated Spurious Emissions, Mid Channel, 802.11a, Omni Antenna, 6 GHz – 9 GHz, Average



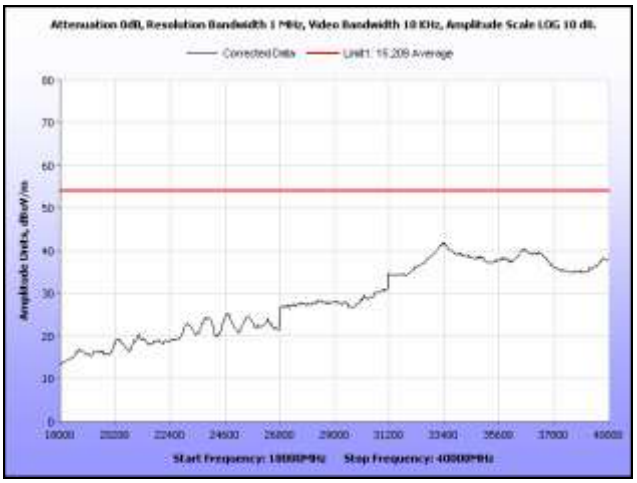
Plot 79. Radiated Spurious Emissions, Mid Channel, 802.11a, Omni Antenna, 6 GHz – 9 GHz, Peak



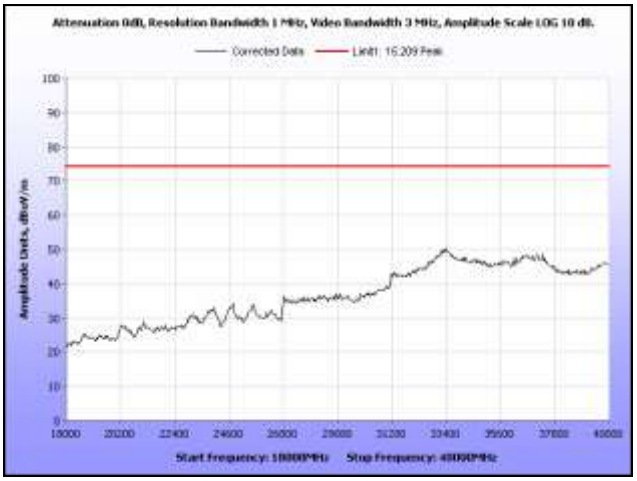
Plot 80. Radiated Spurious Emissions, Mid Channel, 802.11a, Omni Antenna, 9 GHz – 18 GHz, Average



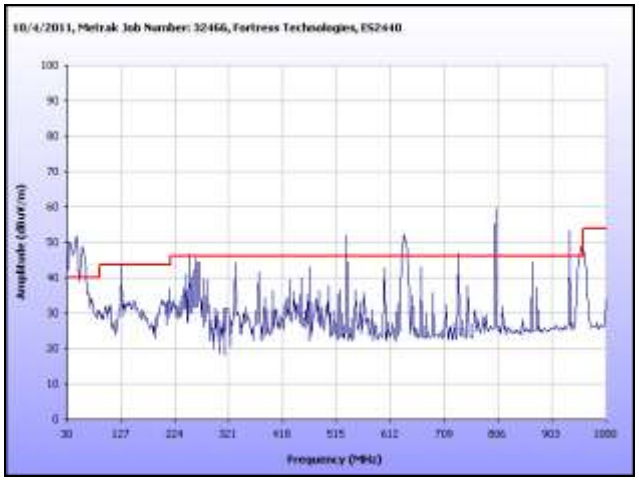
Plot 81. Radiated Spurious Emissions, Mid Channel, 802.11a, Omni Antenna, 9 GHz – 18 GHz, Peak



Plot 82. Radiated Spurious Emissions, Mid Channel, 802.11a, Omni Antenna, 18 GHz – 40 GHz, Average

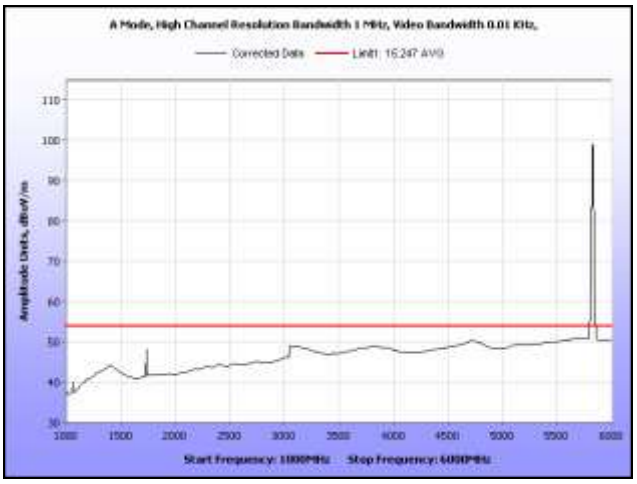


Plot 83. Radiated Spurious Emissions, Mid Channel, 802.11a, Omni Antenna, 18 GHz – 40 GHz, Peak

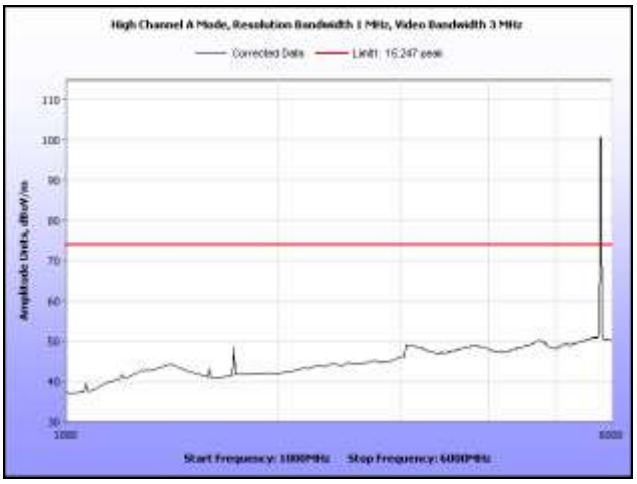


Plot 84. Radiated Spurious Emissions, High Channel, 802.11a, Omni Antenna, 30 MHz – 1 GHz

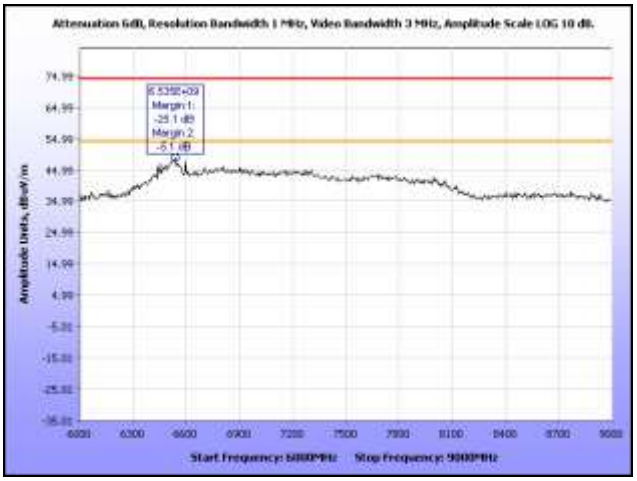
Note: Emissions which exceed the limit are digital emissions.



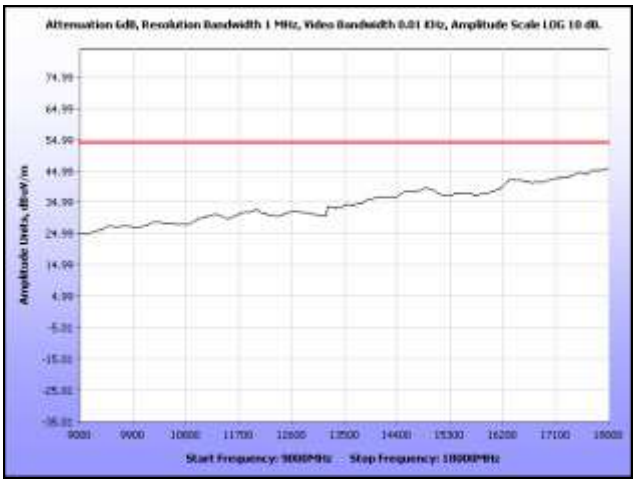
Plot 85. Radiated Spurious Emissions, High Channel, 802.11a, Omni Antenna, 1 GHz – 6 GHz, Average



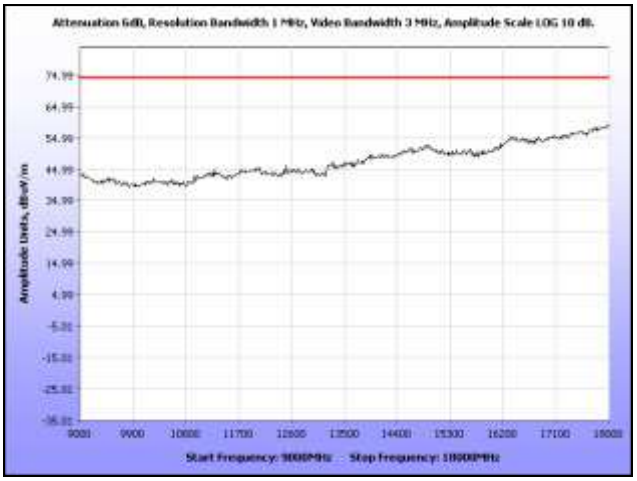
Plot 86. Radiated Spurious Emissions, High Channel, 802.11a, Omni Antenna, 1 GHz – 6 GHz, Peak



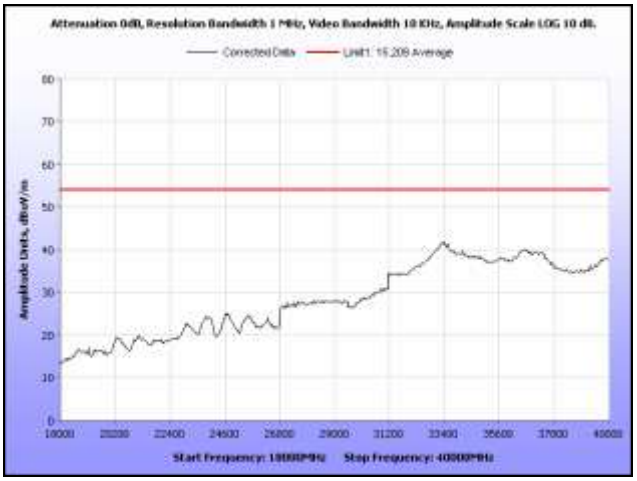
Plot 87. Radiated Spurious Emissions, High Channel, 802.11a, Omni Antenna, 6 GHz – 9 GHz



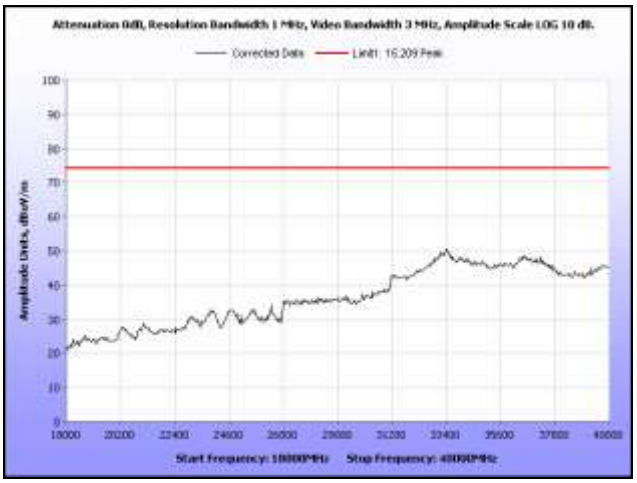
Plot 88. Radiated Spurious Emissions, High Channel, 802.11a, Omni Antenna, 9 GHz – 18 GHz, Average



Plot 89. Radiated Spurious Emissions, High Channel, 802.11a, Omni Antenna, 9 GHz – 18 GHz, Peak

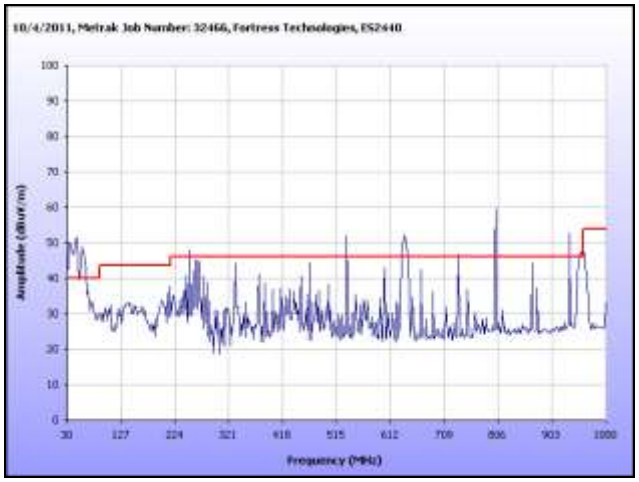


Plot 90. Radiated Spurious Emissions, High Channel, 802.11a, Omni Antenna, 18 GHz – 40 GHz, Average



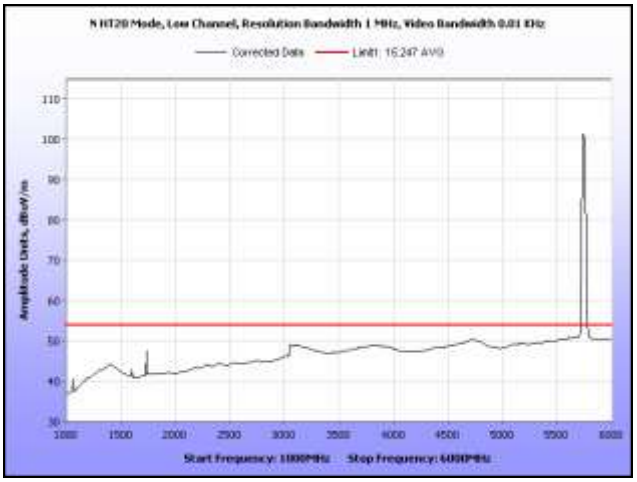
Plot 91. Radiated Spurious Emissions, High Channel, 802.11a, Omni Antenna, 18 GHz – 40 GHz, Peak

Radiated Spurious Emissions Test Results, 802.11n 20 MHz, Omni Antenna

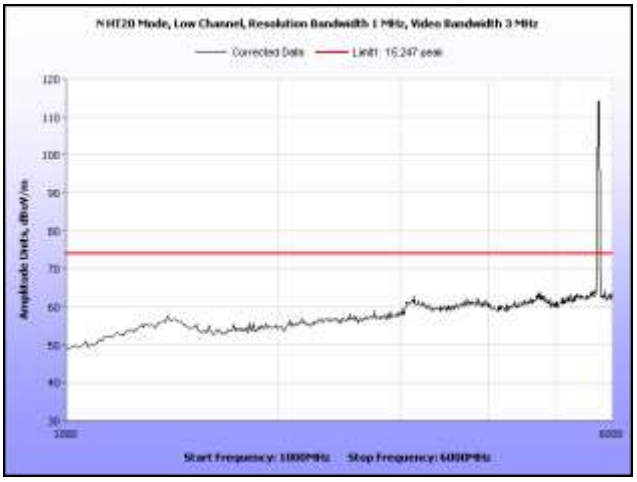


Plot 92. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Omni Antenna, 30 MHz – 1 GHz

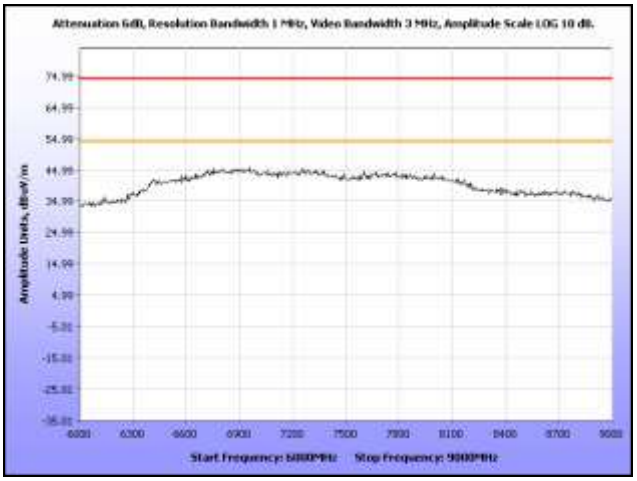
Note: Emissions which exceed the limit are digital emissions.



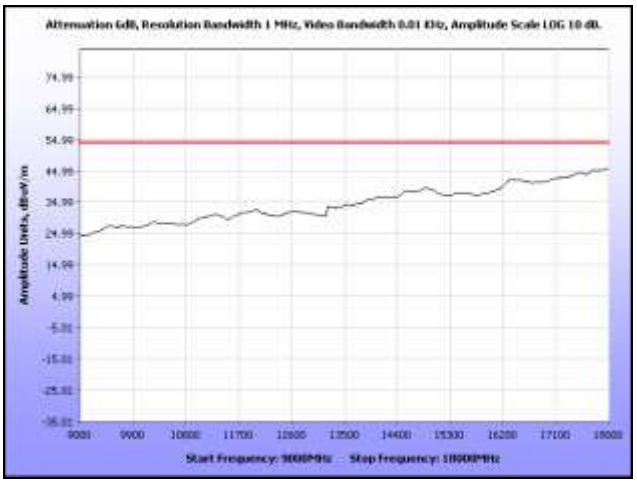
Plot 93. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Omni Antenna, 1 GHz – 6 GHz, Average



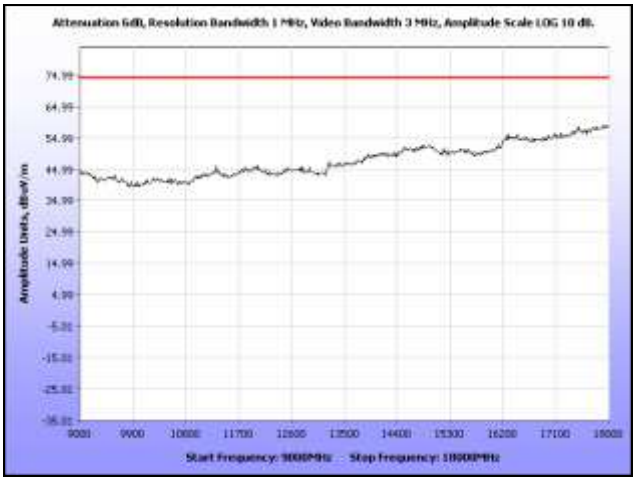
Plot 94. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Omni Antenna, 1 GHz – 6 GHz, Peak



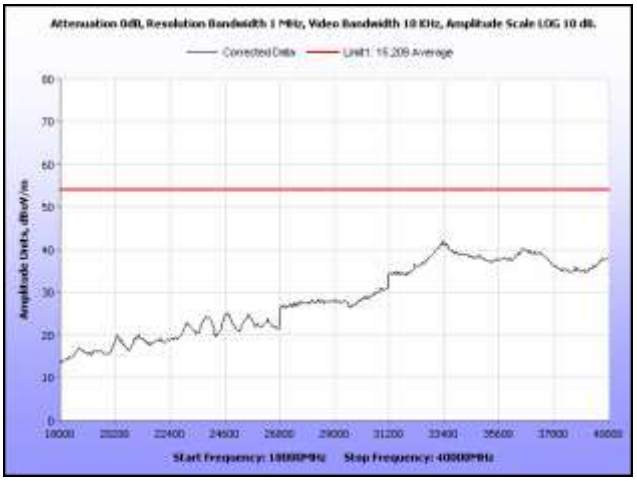
Plot 95. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Omni Antenna, 6 GHz – 9 GHz



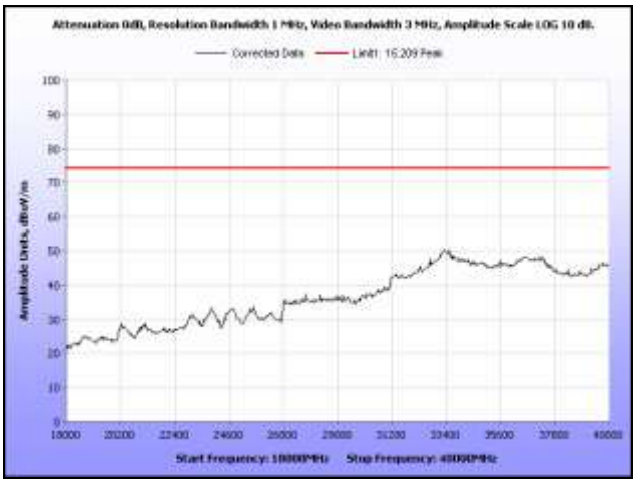
Plot 96. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Omni Antenna, 9 GHz – 18 GHz, Average



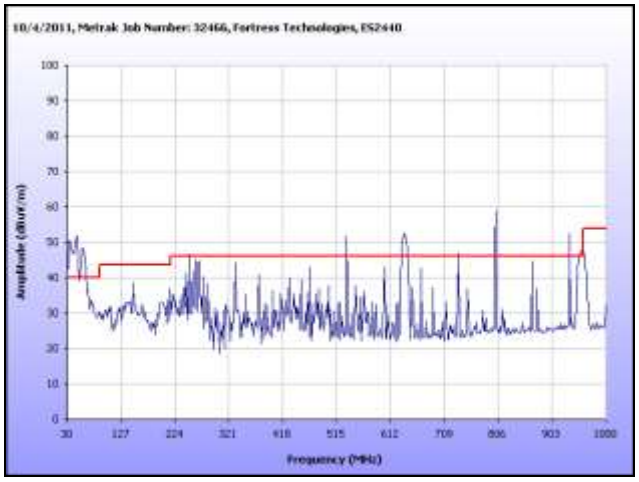
Plot 97. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Omni Antenna, 9 GHz – 18 GHz, Peak



Plot 98. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Omni Antenna, 18 GHz – 40 GHz, Average

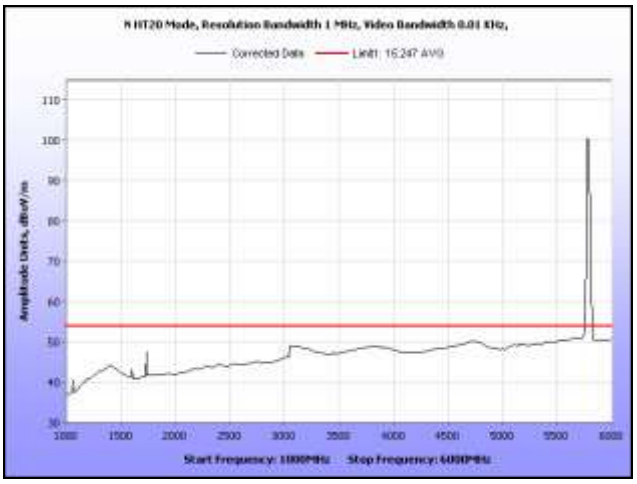


Plot 99. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Omni Antenna, 18 GHz – 40 GHz, Peak

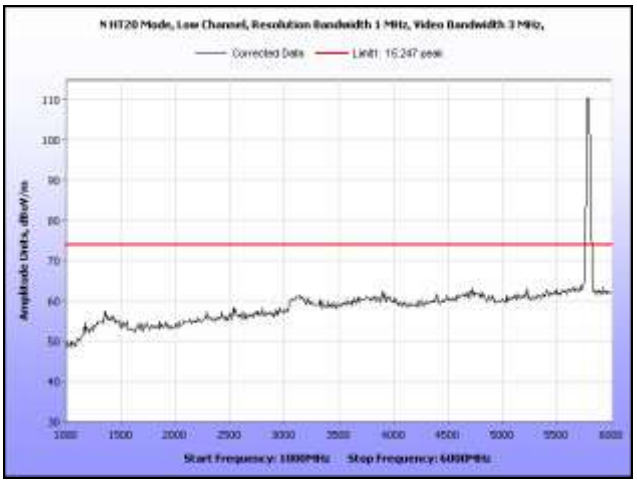


Plot 100. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Omni Antenna, 30 MHz – 1 GHz

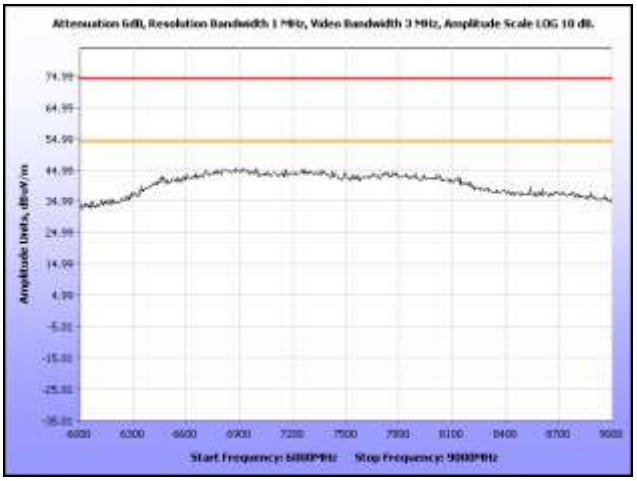
Note: Emissions which exceed the limit are digital emissions.



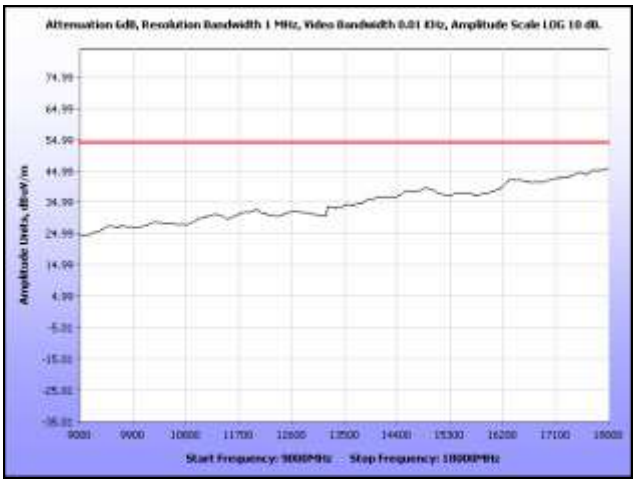
Plot 101. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Omni Antenna, 1 GHz – 6 GHz, Average



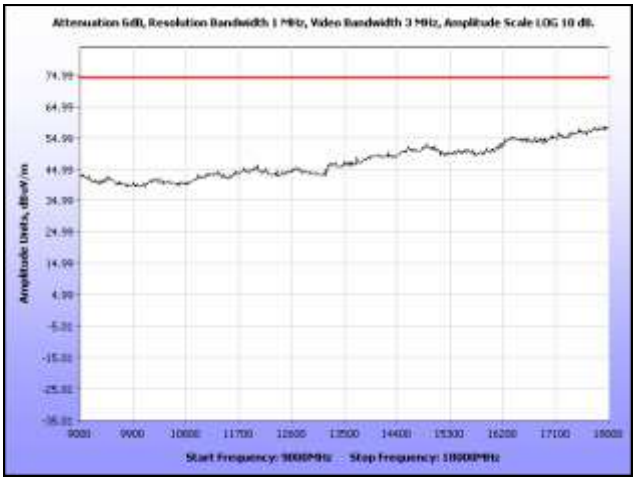
Plot 102. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Omni Antenna, 1 GHz – 6 GHz, Peak



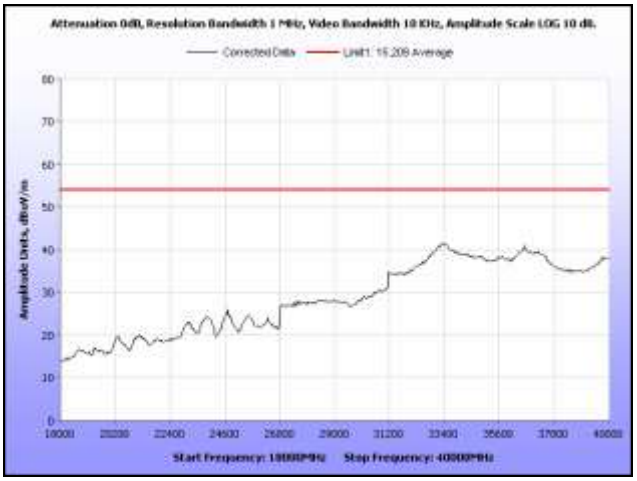
Plot 103. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Omni Antenna, 6 GHz – 9 GHz



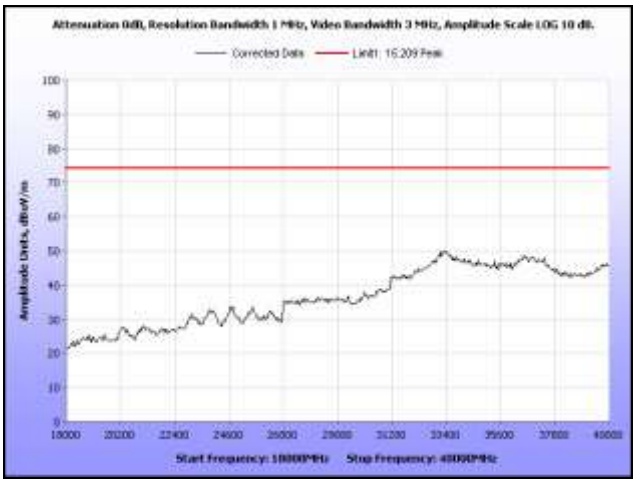
Plot 104. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Omni Antenna, 9 GHz – 18 GHz, Average



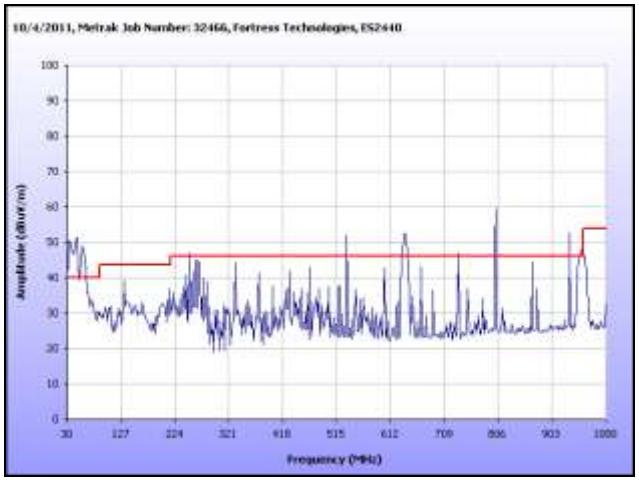
Plot 105. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Omni Antenna, 9 GHz – 18 GHz, Peak



Plot 106. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Omni Antenna, 18 GHz – 40 GHz, Average

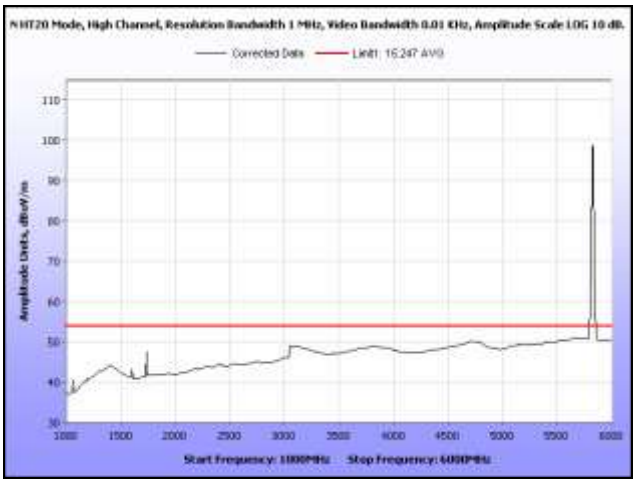


Plot 107. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Omni Antenna, 18 GHz – 40 GHz, Peak

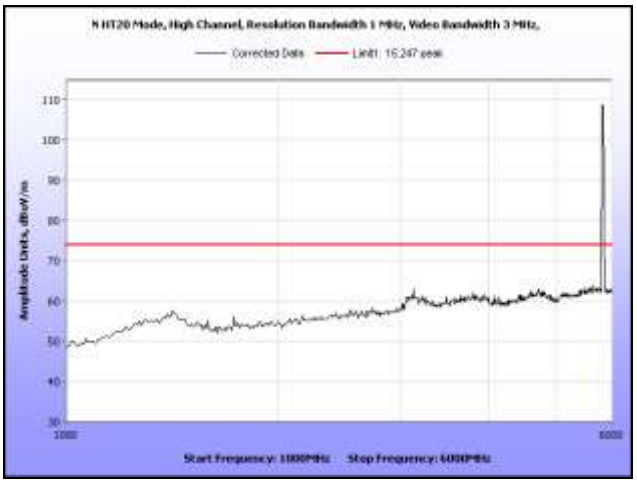


Plot 108. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Omni Antenna, 30 MHz – 1 GHz

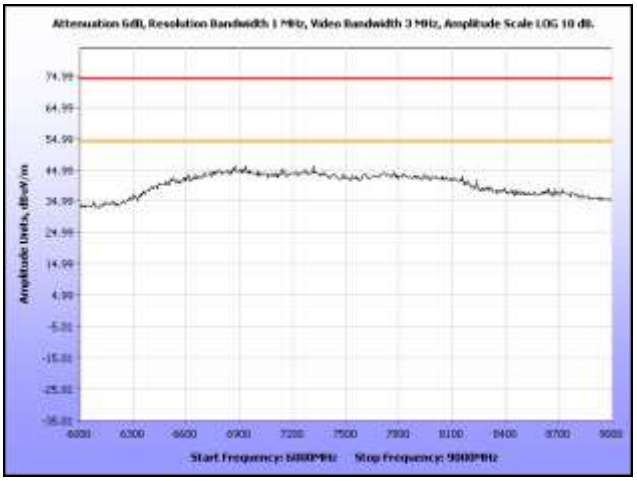
Note: Emissions which exceed the limit are digital emissions.



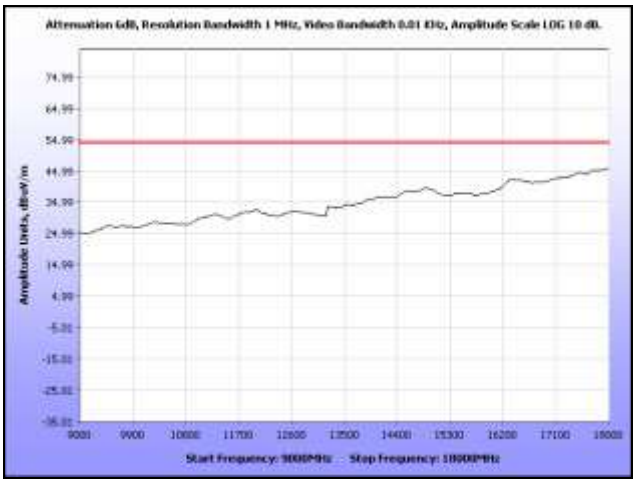
Plot 109. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Omni Antenna, 1 GHz – 6 GHz, Average



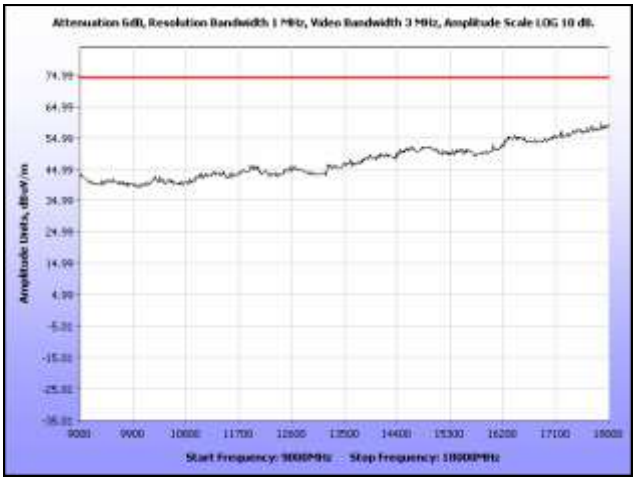
Plot 110. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Omni Antenna, 1 GHz – 6 GHz, Peak



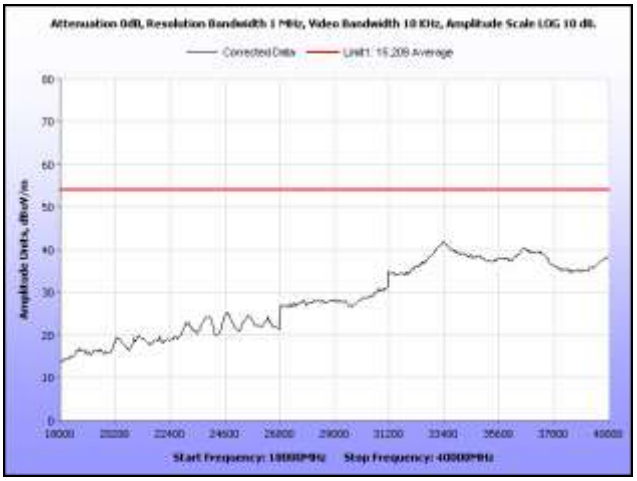
Plot 111. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Omni Antenna, 6 GHz – 9 GHz



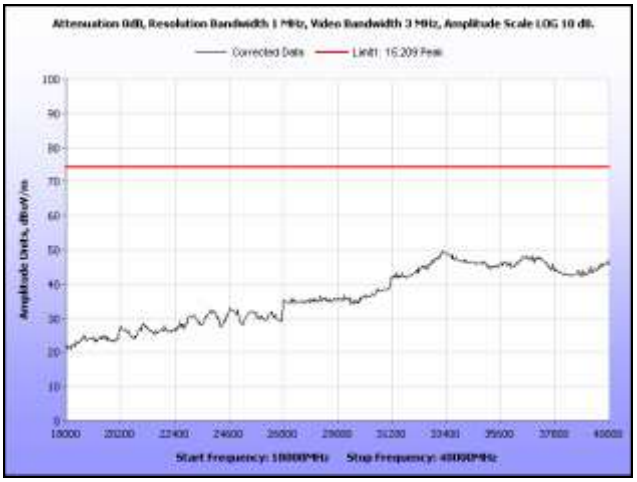
Plot 112. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Omni Antenna, 9 GHz – 18 GHz, Average



Plot 113. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Omni Antenna, 9 GHz – 18 GHz, Peak

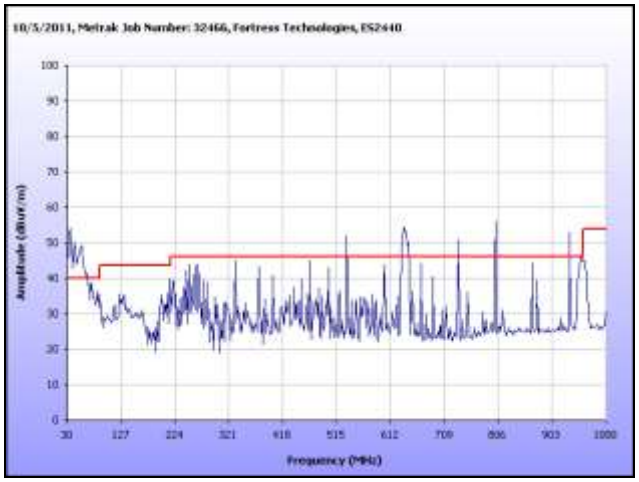


Plot 114. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Omni Antenna, 18 GHz – 40 GHz, Average

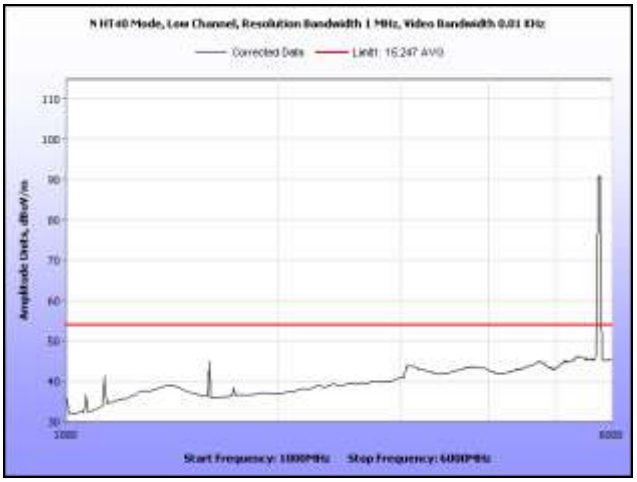


Plot 115. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Omni Antenna, 18 GHz – 40 GHz, Peak

Radiated Spurious Emissions Test Results, 802.11n 40 MHz, Omni Antenna

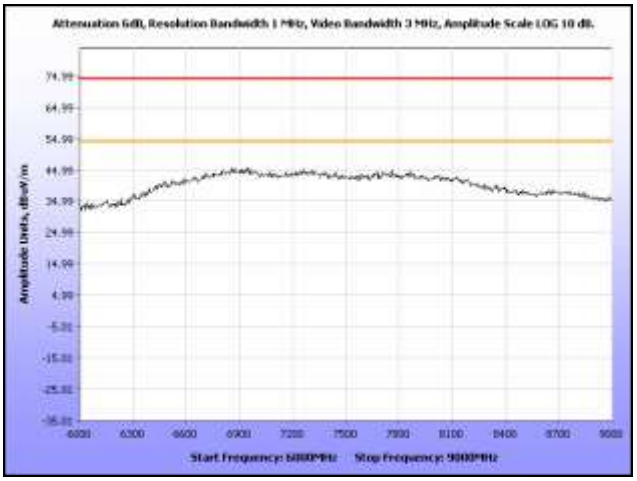


Plot 116. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Omni Antenna, 30 MHz – 1 GHz
Note: Emissions which exceed the limit are digital emissions.

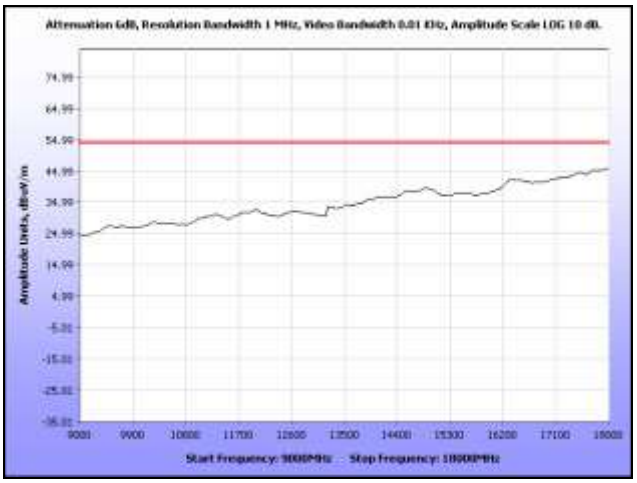


Plot 117. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Omni Antenna, 1 GHz – 6 GHz, Average

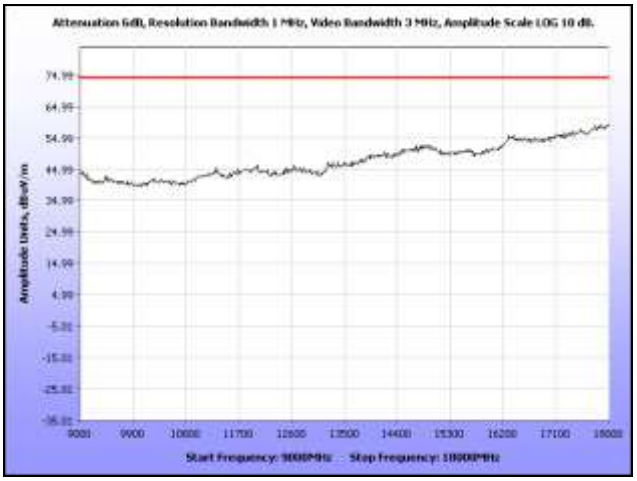
Plot 118. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Omni Antenna, 1 GHz – 6 GHz, Peak



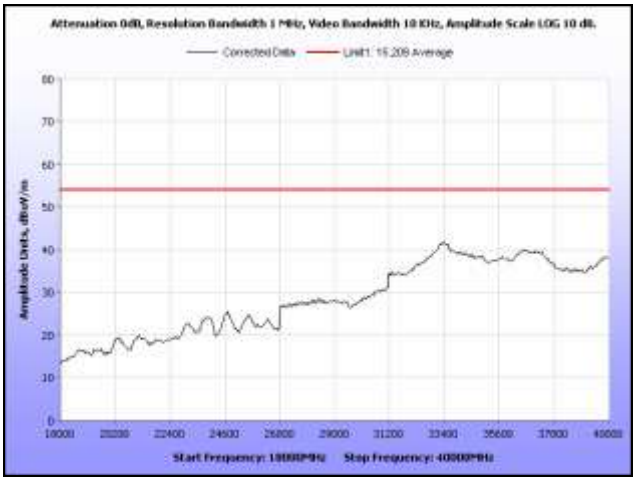
Plot 119. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Omni Antenna, 6 GHz – 9 GHz



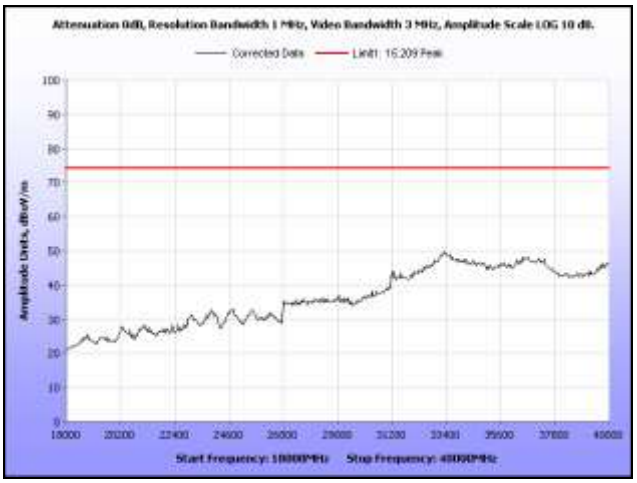
Plot 120. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Omni Antenna, 9 GHz – 18 GHz, Average



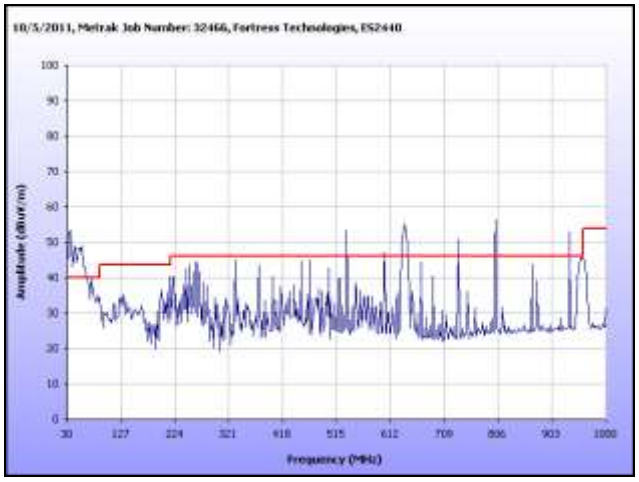
Plot 121. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Omni Antenna, 9 GHz – 18 GHz, Peak



Plot 122. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Omni Antenna, 18 GHz – 40 GHz, Average

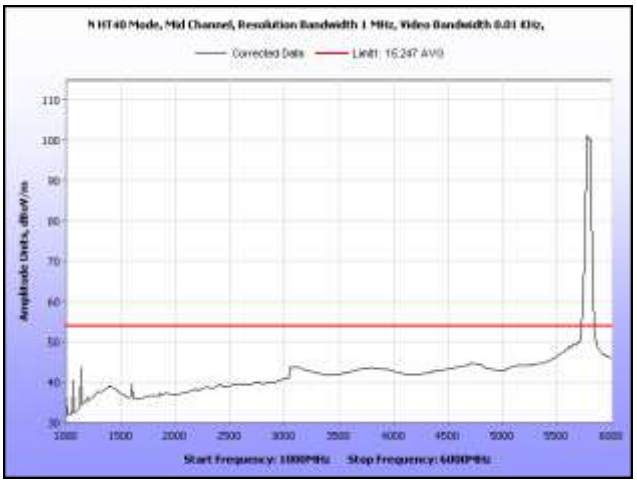


Plot 123. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Omni Antenna, 18 GHz – 40 GHz, Peak

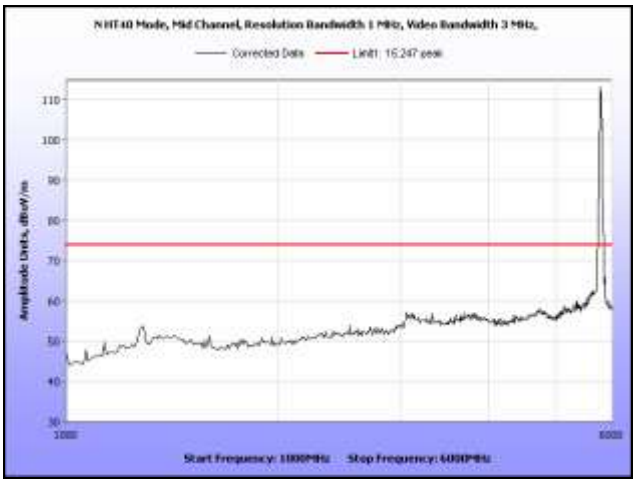


Plot 124. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Omni Antenna, 30 MHz – 1 GHz

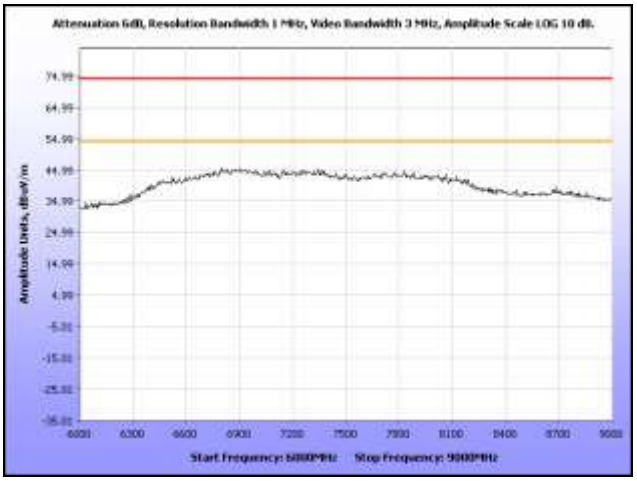
Note: Emissions which exceed the limit are digital emissions.



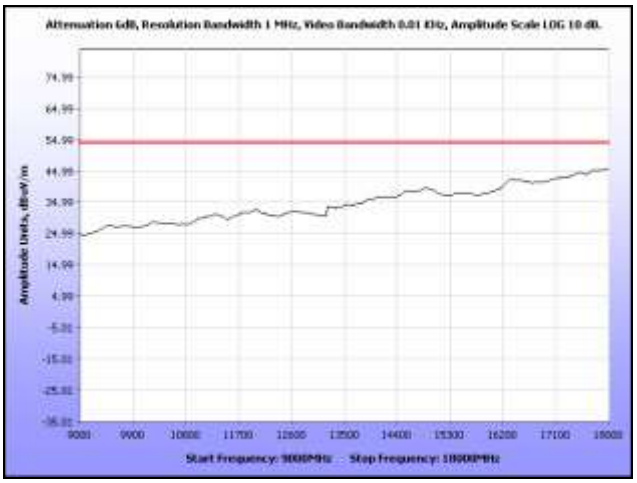
Plot 125. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Omni Antenna, 1 GHz – 6 GHz, Average



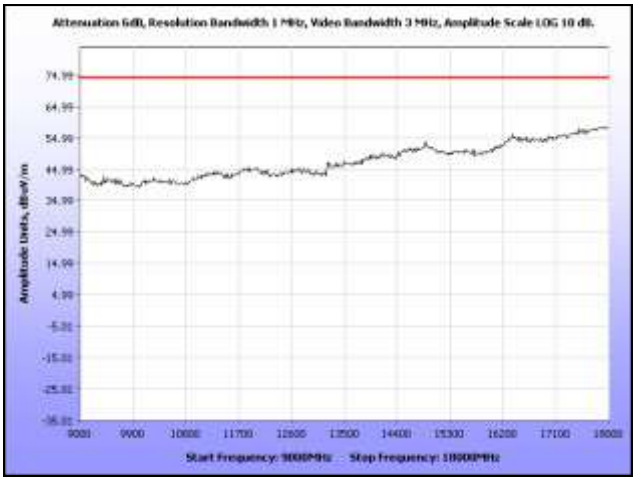
Plot 126. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Omni Antenna, 1 GHz – 6 GHz, Peak



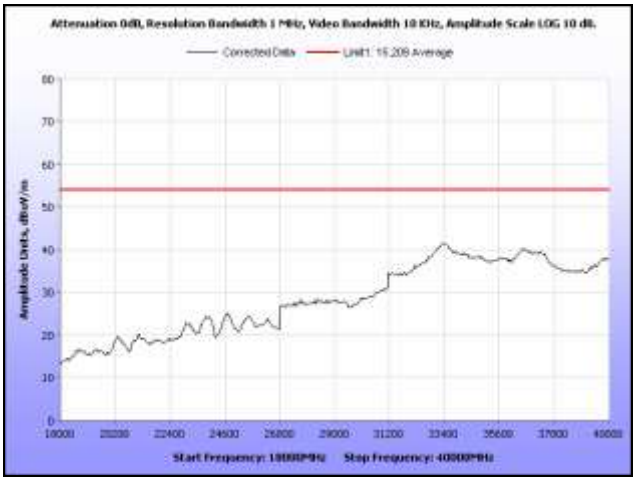
Plot 127. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Omni Antenna, 6 GHz – 9 GHz



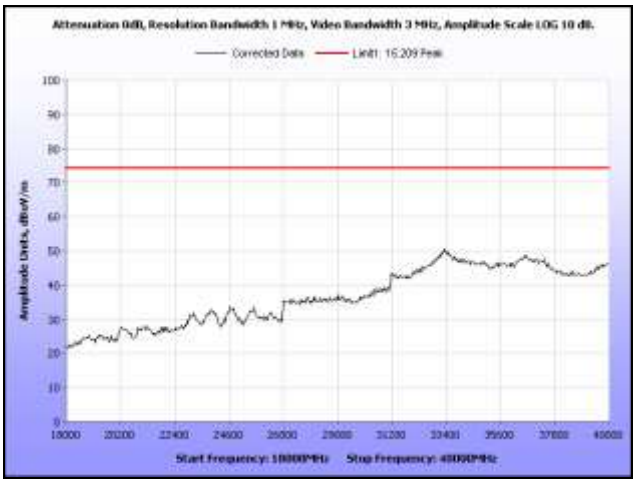
Plot 128. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Omni Antenna, 9 GHz – 18 GHz, Average



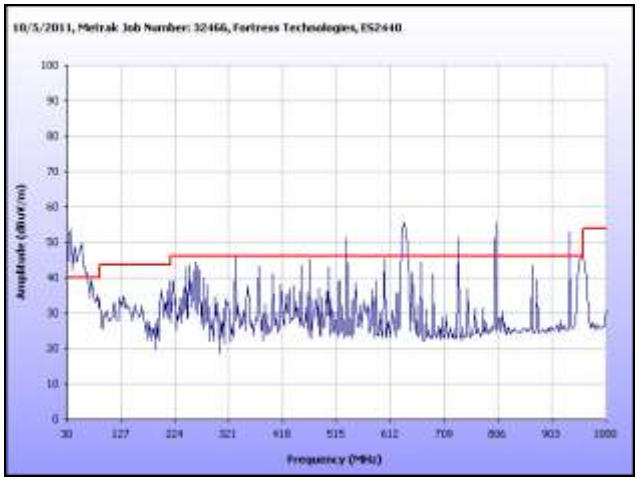
Plot 129. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Omni Antenna, 9 GHz – 18 GHz, Peak



Plot 130. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Omni Antenna, 18 GHz – 40 GHz, Average

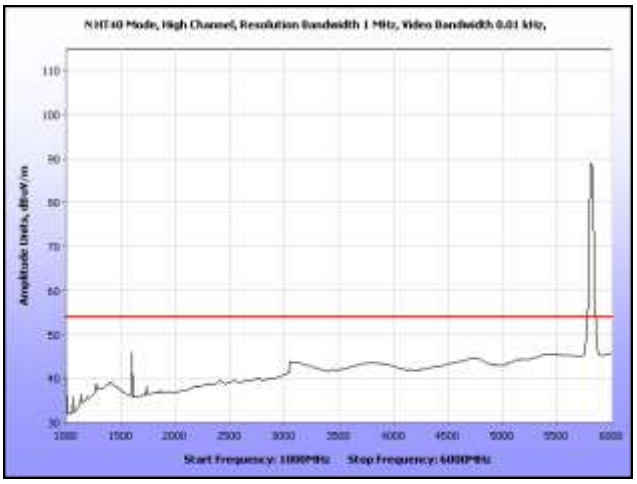


Plot 131. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Omni Antenna, 18 GHz – 40 GHz, Peak

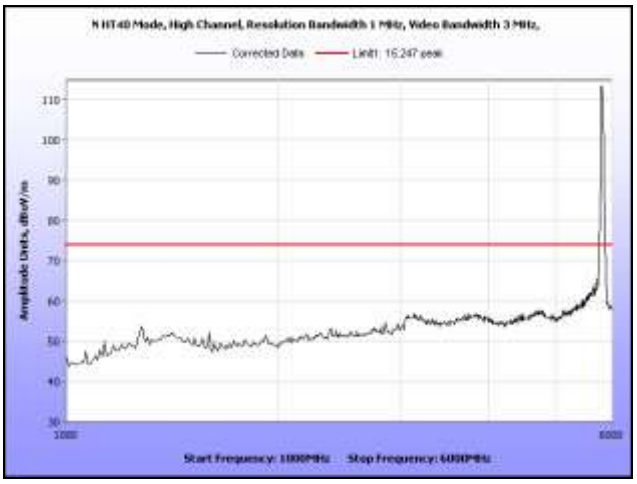


Plot 132. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Omni Antenna, 30 MHz – 1 GHz

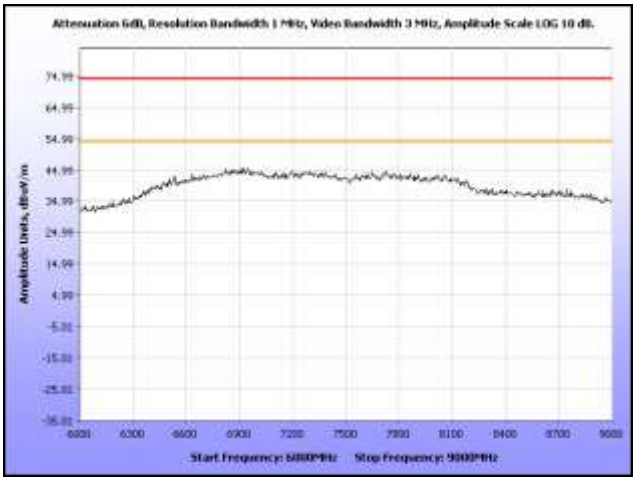
Note: Emissions which exceed the limit are digital emissions.



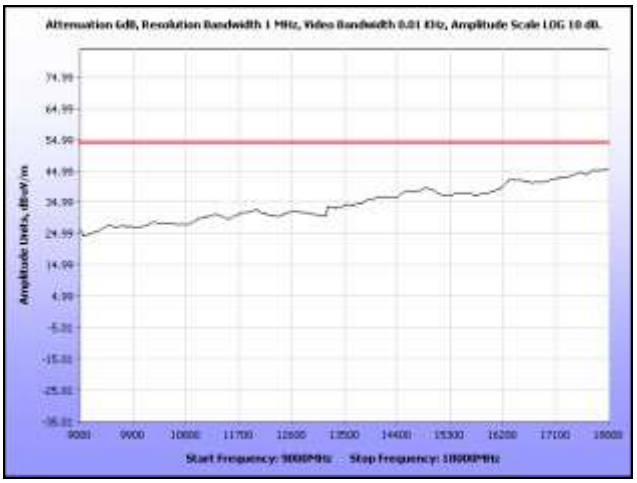
Plot 133. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Omni Antenna, 1 GHz – 6 GHz, Average



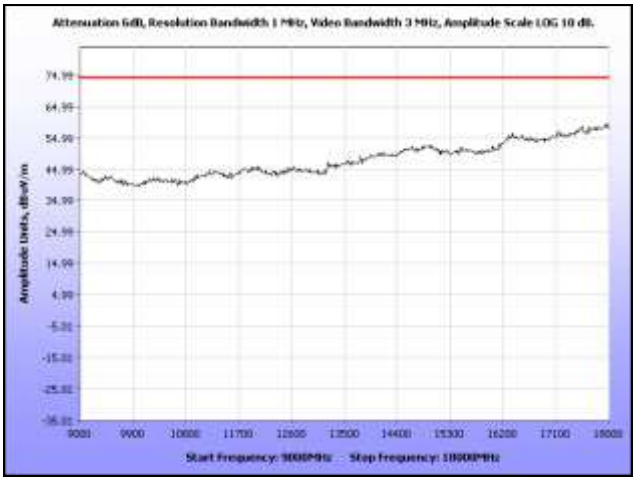
Plot 134. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Omni Antenna, 1 GHz – 6 GHz, Peak



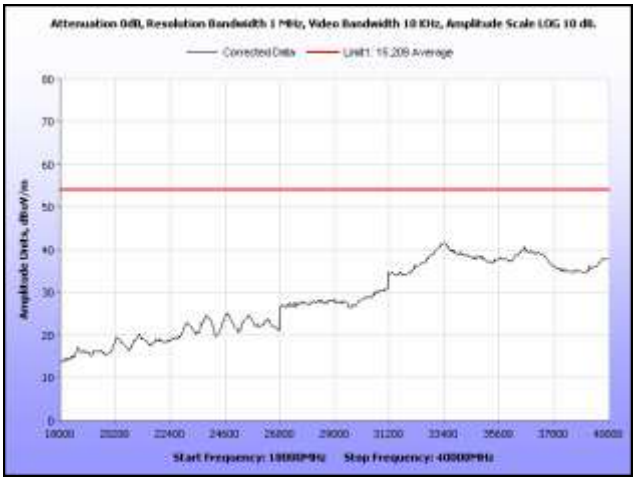
Plot 135. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Omni Antenna, 6 GHz – 9 GHz



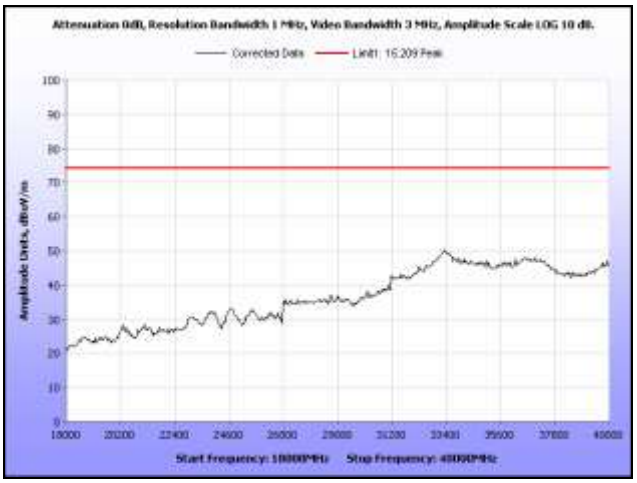
Plot 136. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Omni Antenna, 9 GHz – 18 GHz, Average



Plot 137. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Omni Antenna, 9 GHz – 18 GHz, Peak

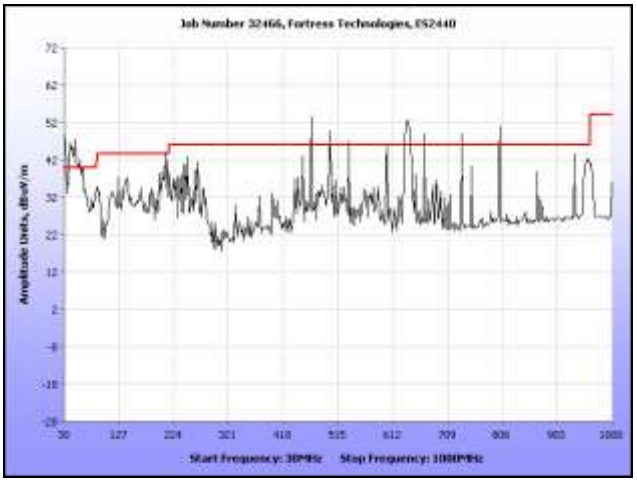


Plot 138. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Omni Antenna, 18 GHz – 40 GHz, Average



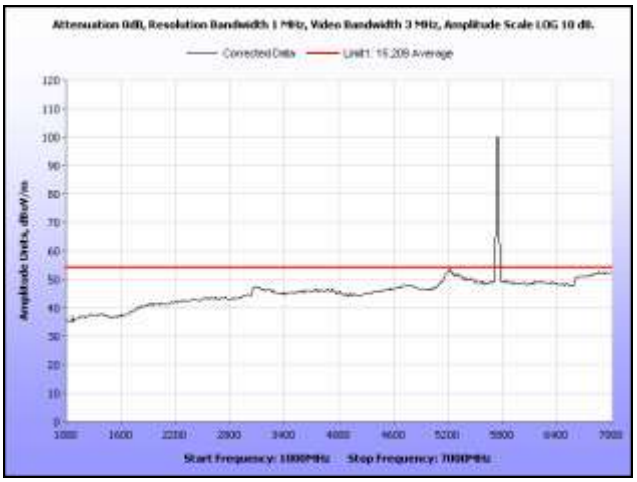
Plot 139. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Omni Antenna, 18 GHz – 40 GHz, Peak

Radiated Spurious Emissions Test Results, 802.11a, Sector Antenna

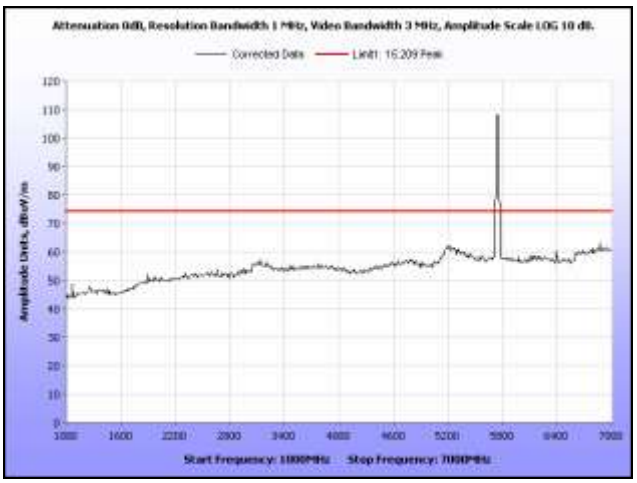


Plot 140. Radiated Spurious Emissions, Low Channel, 802.11a, Sector Antenna, 30 MHz – 1 GHz

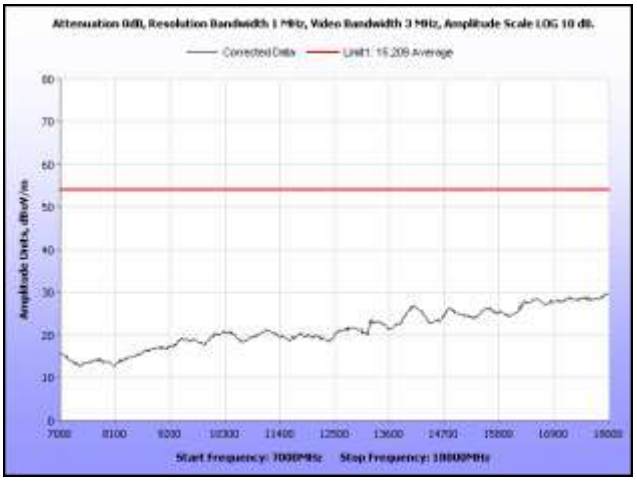
Note: Emissions which exceed the limit are digital emissions.



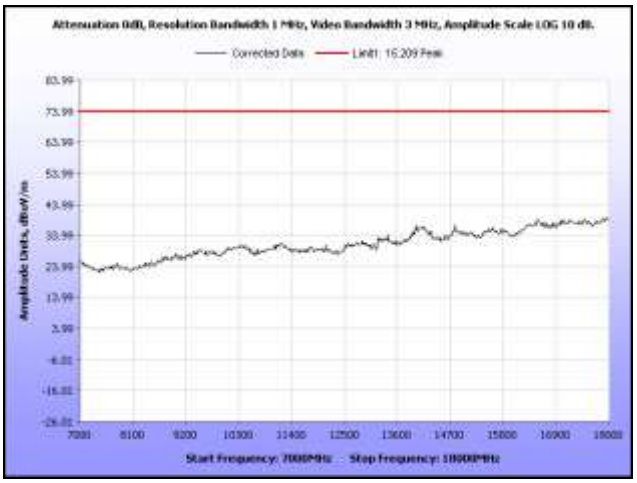
Plot 141. Radiated Spurious Emissions, Low Channel, 802.11a, Sector Antenna, 1 GHz – 7 GHz, Average



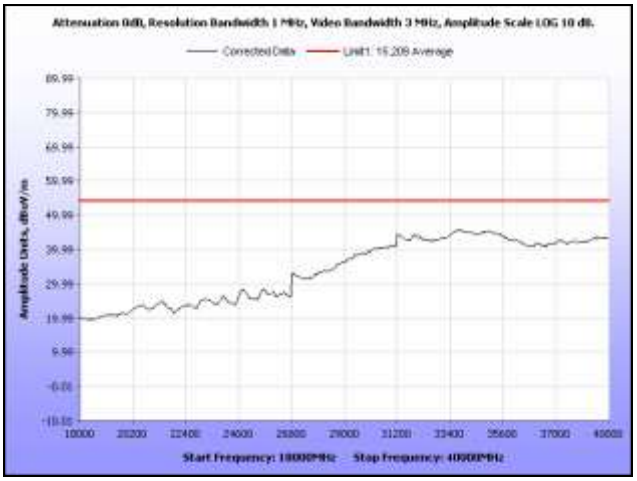
Plot 142. Radiated Spurious Emissions, Low Channel, 802.11a, Sector Antenna, 1 GHz – 7 GHz, Peak



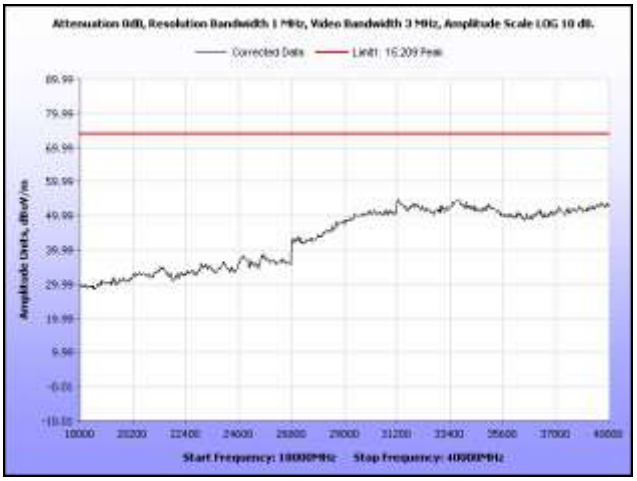
Plot 143. Radiated Spurious Emissions, Low Channel, 802.11a, Sector Antenna, 7 GHz – 18 GHz, Average



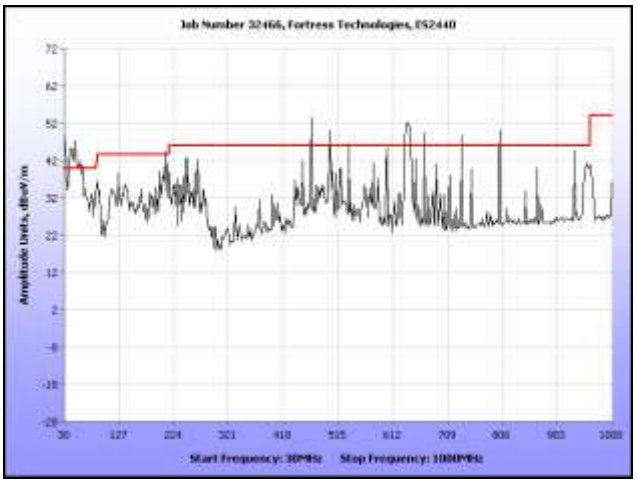
Plot 144. Radiated Spurious Emissions, Low Channel, 802.11a, Sector Antenna, 7 GHz – 18 GHz, Peak



Plot 145. Radiated Spurious Emissions, Low Channel, 802.11a, Sector Antenna, 18 GHz – 40 GHz, Average



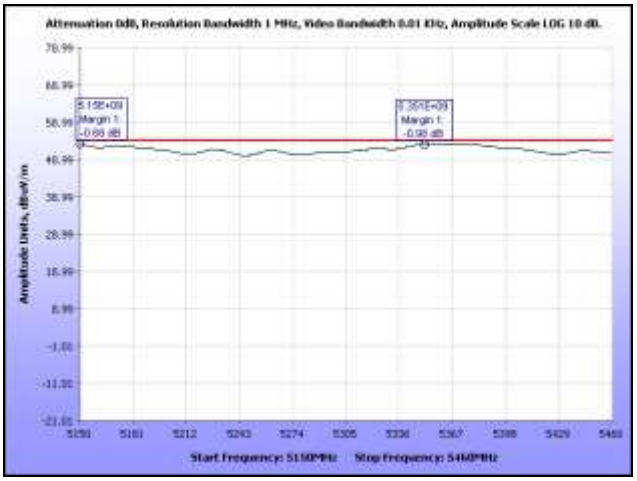
Plot 146. Radiated Spurious Emissions, Low Channel, 802.11a, Sector Antenna, 18 GHz – 40 GHz, Peak



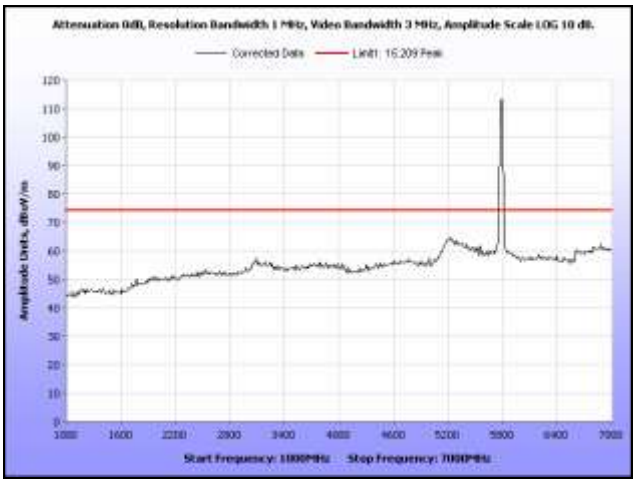
Plot 147. Radiated Spurious Emissions, Mid Channel, 802.11a, Sector Antenna, 30 MHz – 1 GHz

Note: Emissions which exceed the limit are digital emissions.

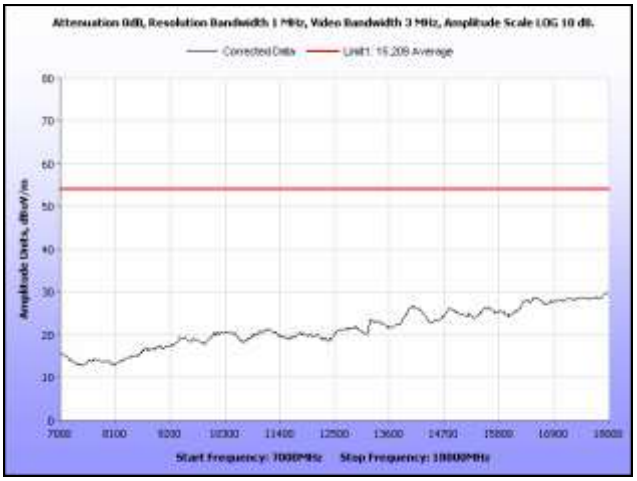
Plot 148. Radiated Spurious Emissions, Mid Channel, 802.11a, Sector Antenna, 1 GHz – 7 GHz, Average



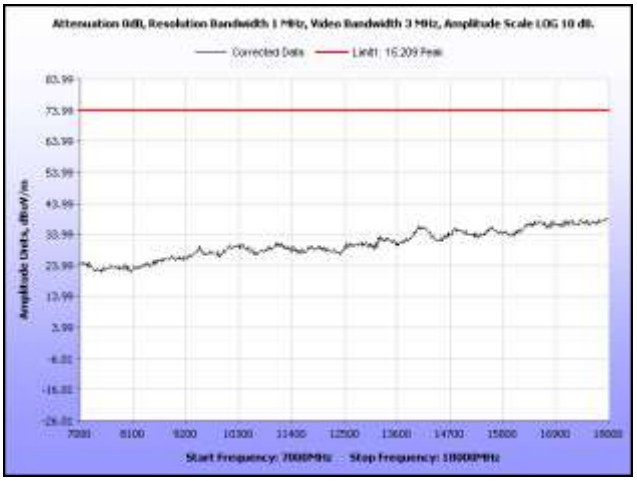
Plot 149. Radiated Spurious Emissions, Mid Channel, 802.11a, Sector Antenna, Smaller Span



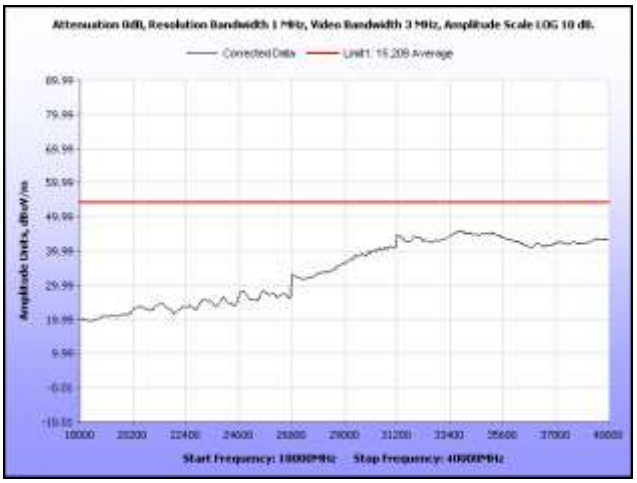
Plot 150. Radiated Spurious Emissions, Mid Channel, 802.11a, Sector Antenna, 1 GHz – 7 GHz, Peak



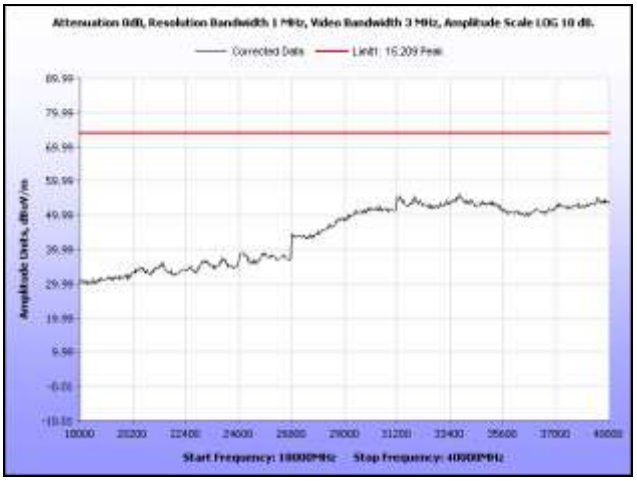
Plot 151. Radiated Spurious Emissions, Mid Channel, 802.11a, Sector Antenna, 7 GHz – 18 GHz, Average



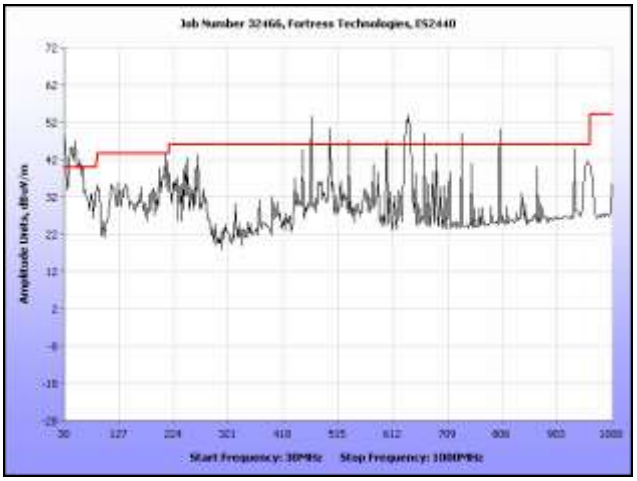
Plot 152. Radiated Spurious Emissions, Mid Channel, 802.11a, Sector Antenna, 7 GHz – 18 GHz, Peak



Plot 153. Radiated Spurious Emissions, Mid Channel, 802.11a, Sector Antenna, 18 GHz – 40 GHz, Average

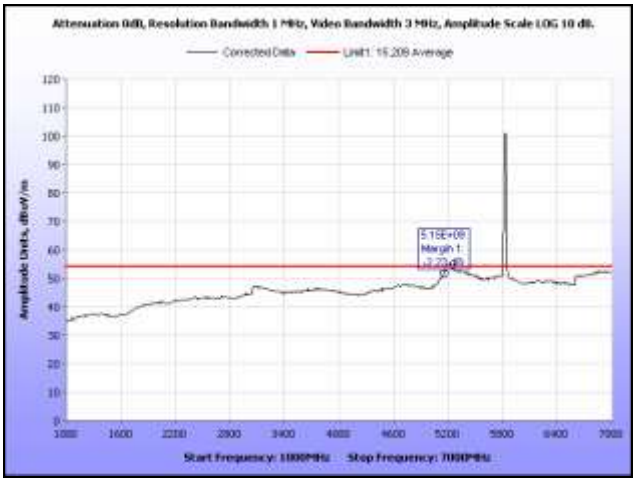


Plot 154. Radiated Spurious Emissions, Mid Channel, 802.11a, Sector Antenna, 18 GHz – 40 GHz, Peak

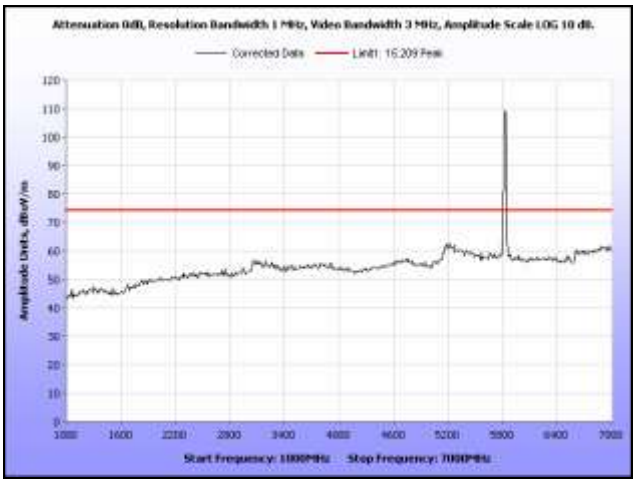


Plot 155. Radiated Spurious Emissions, High Channel, 802.11a, Sector Antenna, 30 MHz – 1 GHz

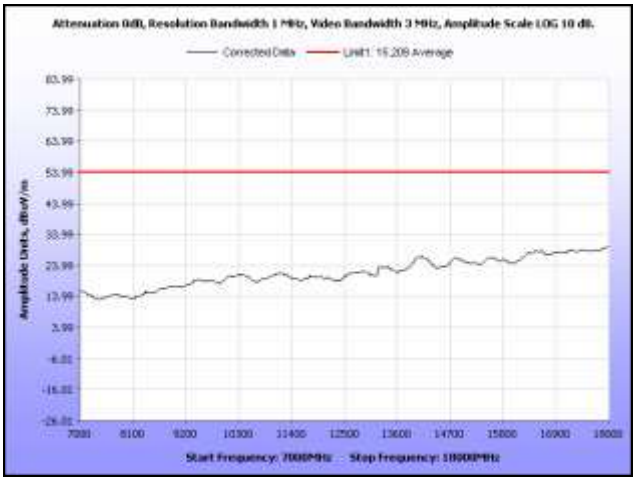
Note: Emissions which exceed the limit are digital emissions.



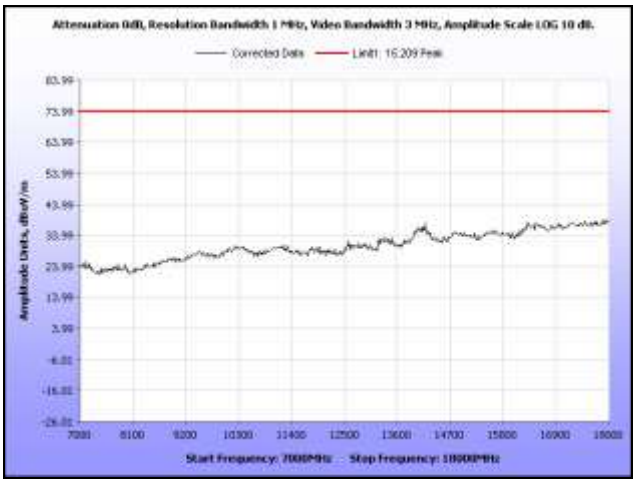
Plot 156. Radiated Spurious Emissions, High Channel, 802.11a, Sector Antenna, 1 GHz – 7 GHz, Average



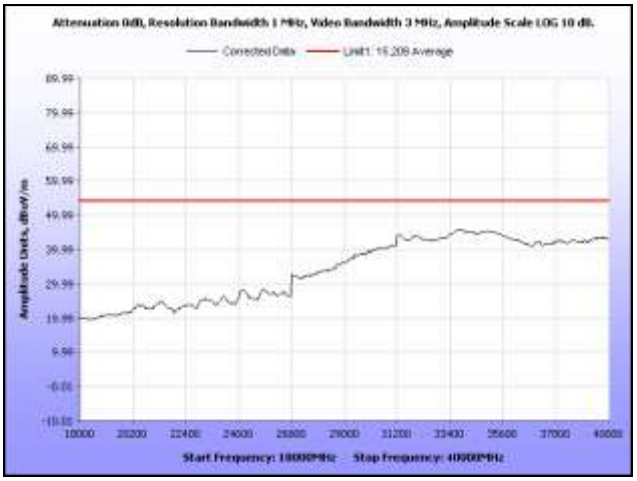
Plot 157. Radiated Spurious Emissions, High Channel, 802.11a, Sector Antenna, 1 GHz – 7 GHz, Peak



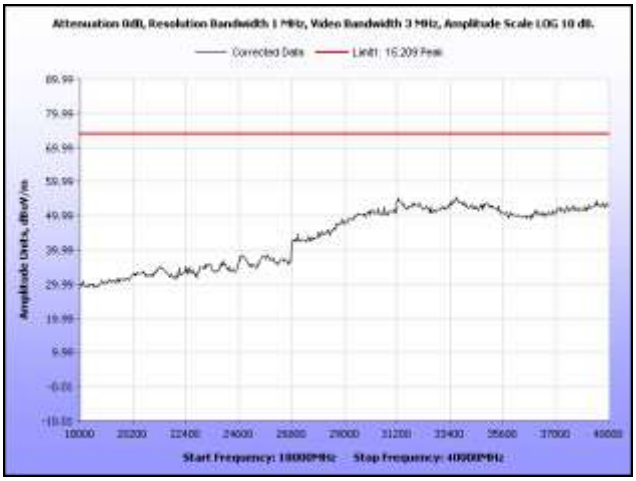
Plot 158. Radiated Spurious Emissions, High Channel, 802.11a, Sector Antenna, 7 GHz – 18 GHz, Average



Plot 159. Radiated Spurious Emissions, High Channel, 802.11a, Sector Antenna, 7 GHz – 18 GHz, Peak

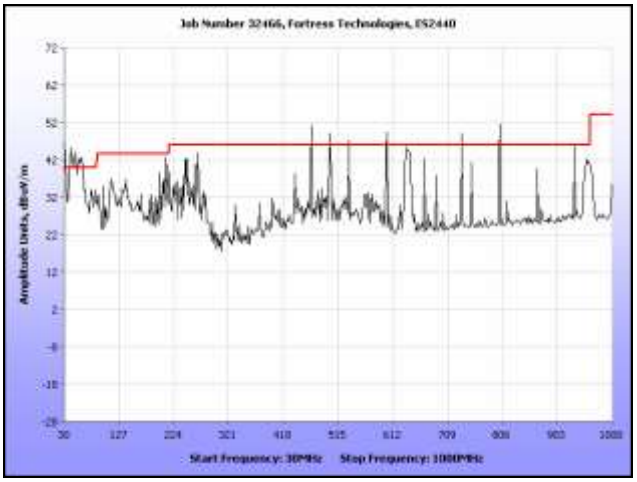


Plot 160. Radiated Spurious Emissions, High Channel, 802.11a, Sector Antenna, 18 GHz – 40 GHz, Average



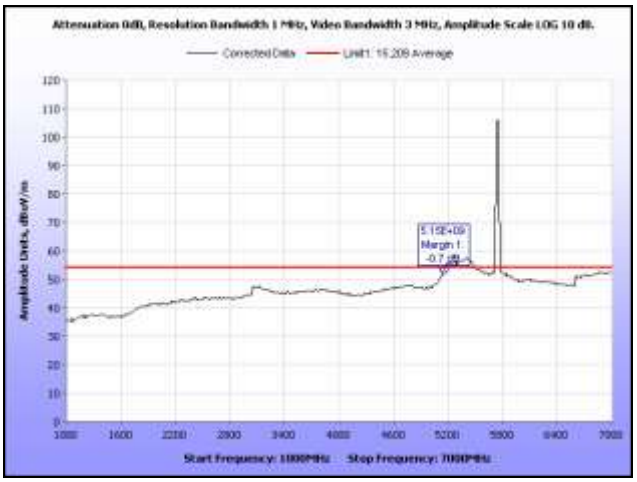
Plot 161. Radiated Spurious Emissions, High Channel, 802.11a, Sector Antenna, 18 GHz – 40 GHz, Peak

Radiated Spurious Emissions Test Results, 802.11n 20 MHz, Sector Antenna

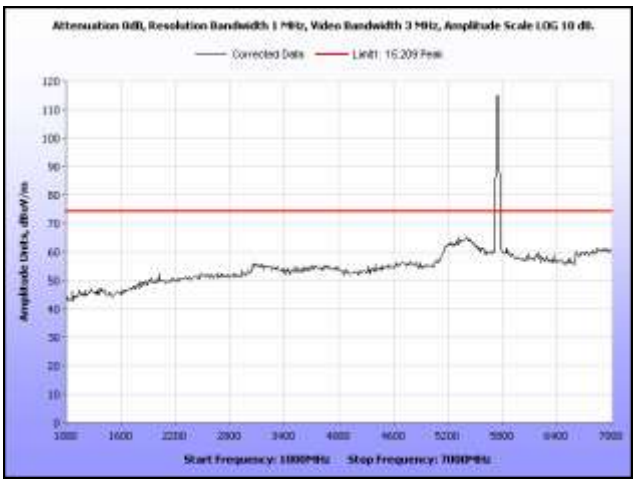


Plot 162. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Sector Antenna, 30 MHz – 1 GHz

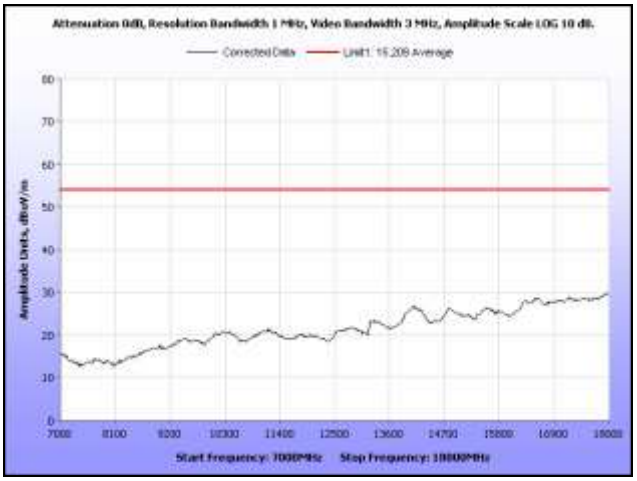
Note: Emissions which exceed the limit are digital emissions.



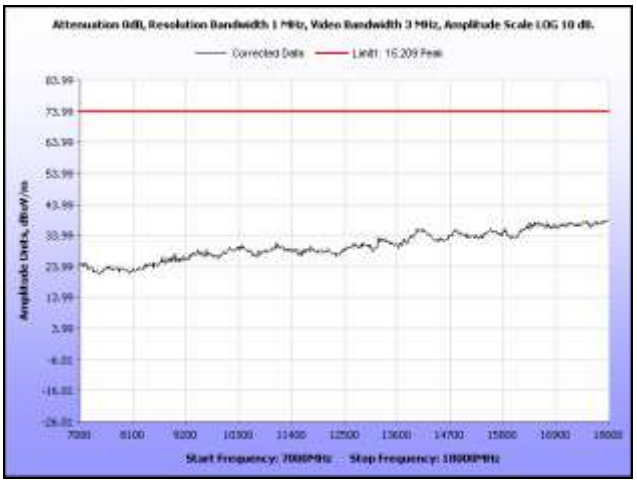
Plot 163. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Sector Antenna, 1 GHz – 7 GHz, Average



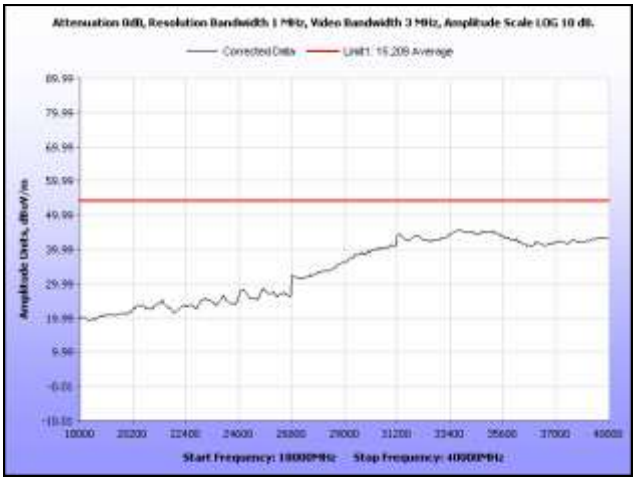
Plot 164. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Sector Antenna, 1 GHz – 7 GHz, Peak



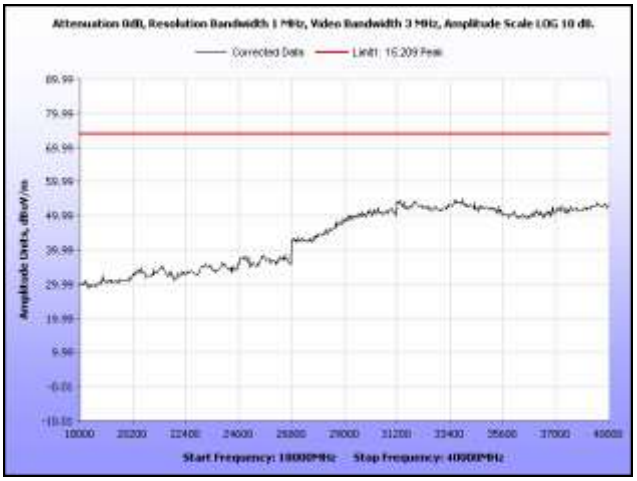
Plot 165. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Sector Antenna, 7 GHz – 18 GHz, Average



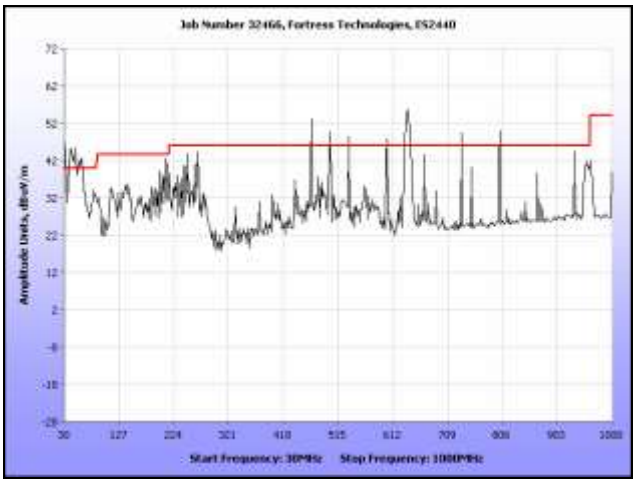
Plot 166. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Sector Antenna, 7 GHz – 18 GHz, Peak



Plot 167. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Sector Antenna, 18 GHz – 40 GHz, Average



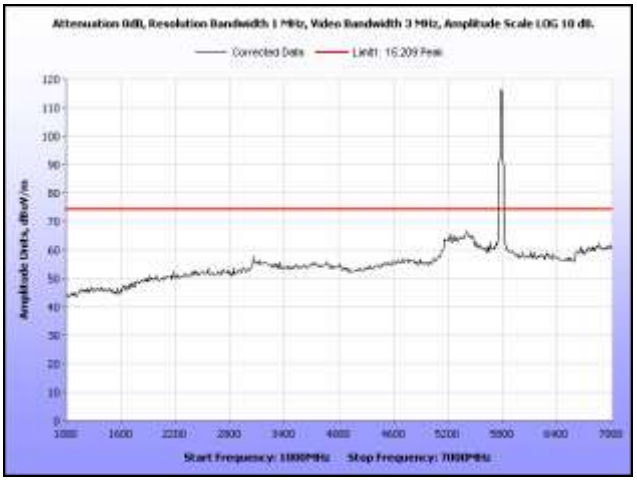
Plot 168. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, Sector Antenna, 18 GHz – 40 GHz, Peak



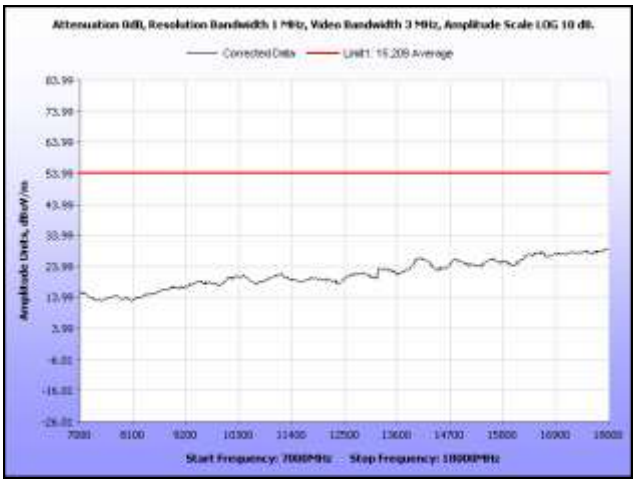
Plot 169. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Sector Antenna, 30 MHz – 1 GHz

Note: Emissions which exceed the limit are digital emissions.

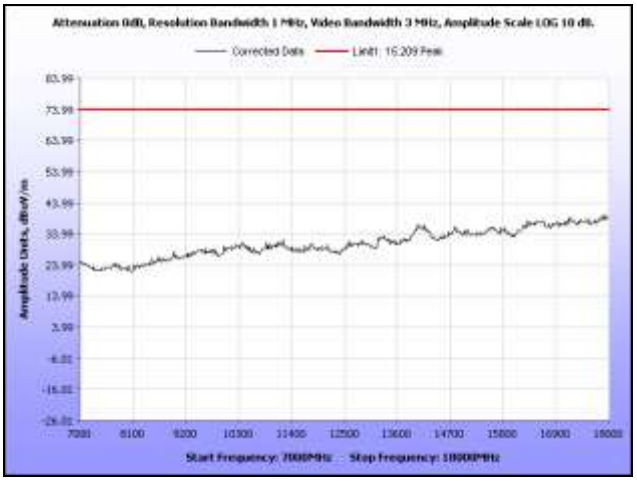
Plot 170. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Sector Antenna, 1 GHz – 7 GHz, Average



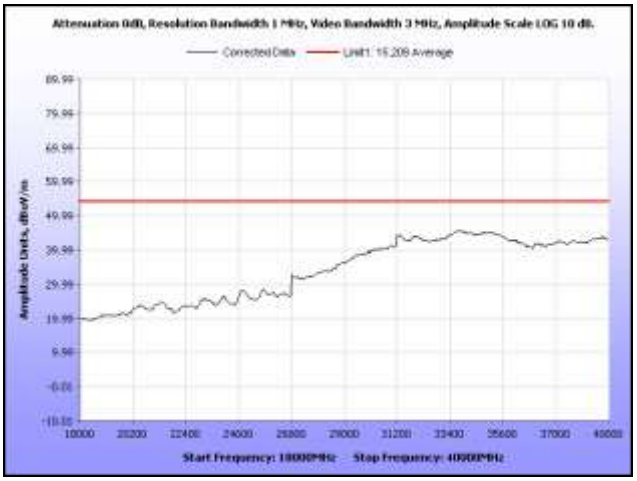
Plot 171. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Sector Antenna, 1 GHz – 7 GHz, Peak



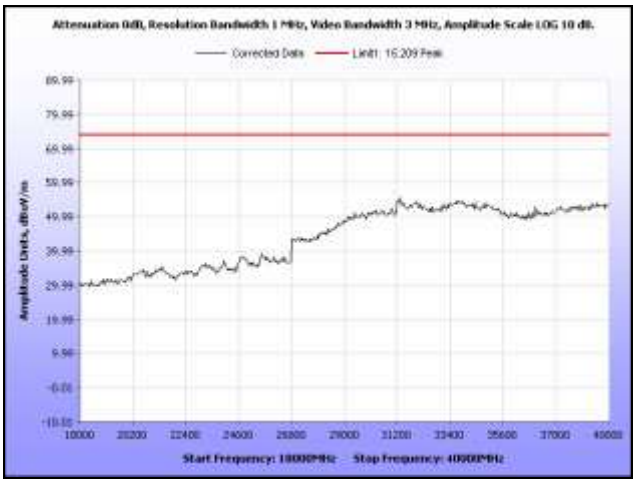
Plot 172. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Sector Antenna, 7 GHz – 18 GHz, Average



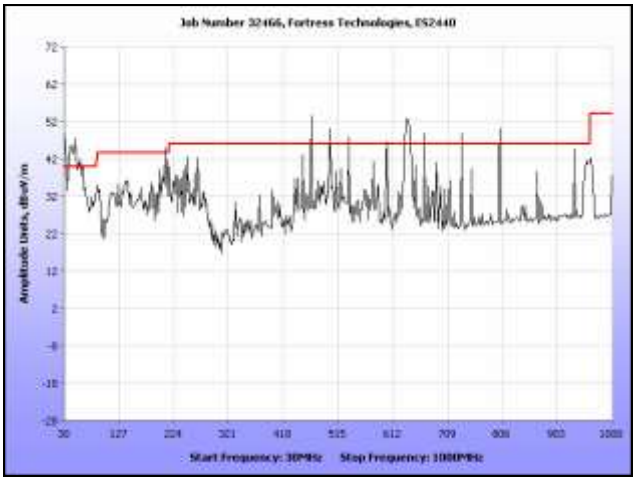
Plot 173. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Sector Antenna, 7 GHz – 18 GHz, Peak



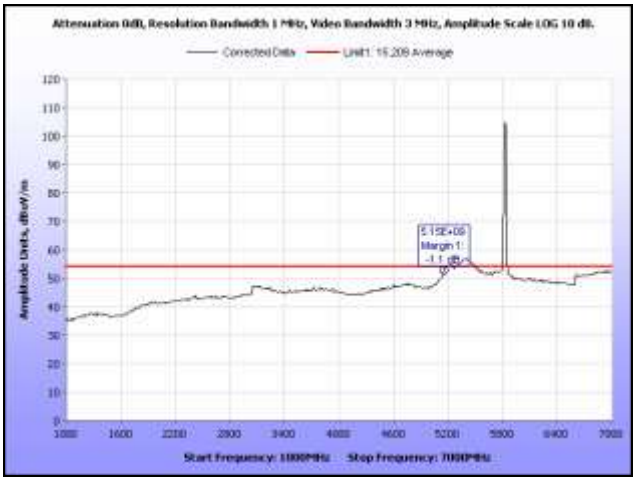
Plot 174. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Sector Antenna, 18 GHz – 40 GHz, Average



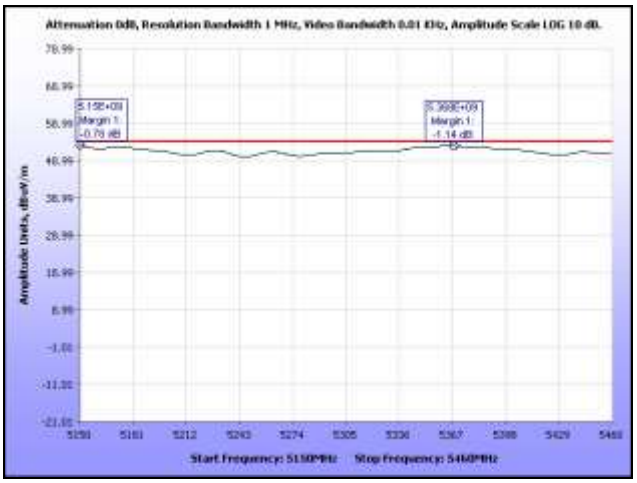
Plot 175. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, Sector Antenna, 18 GHz – 40 GHz, Peak



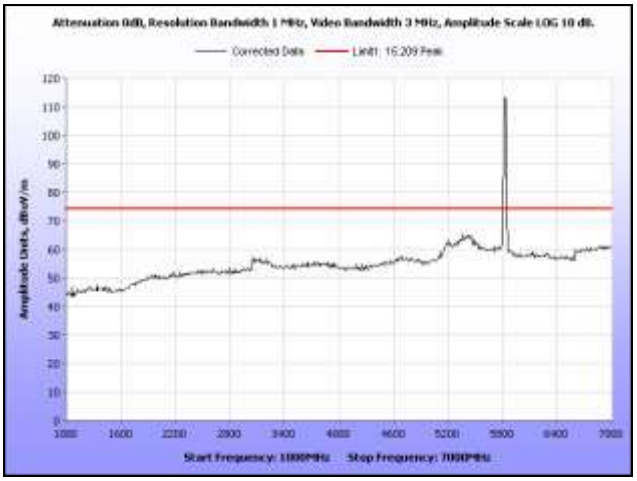
Plot 176. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Sector Antenna, 30 MHz – 1 GHz
Note: Emissions which exceed the limit are digital emissions.



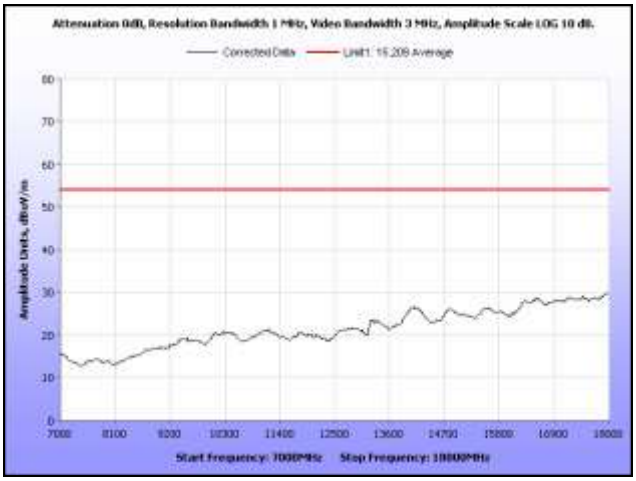
Plot 177. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Sector Antenna, 1 GHz – 7 GHz, Average



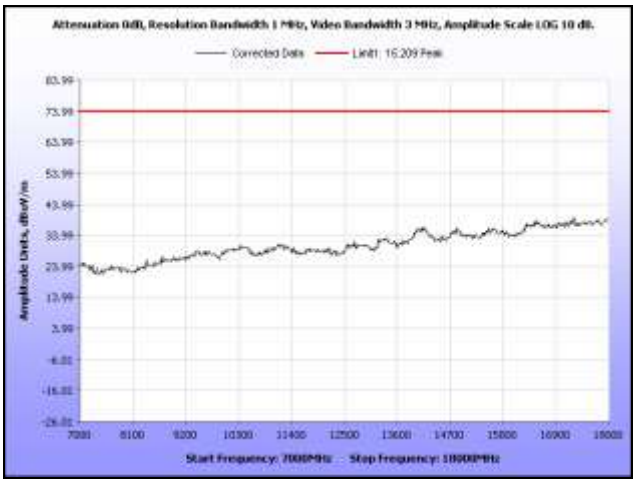
Plot 178. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Sector Antenna, Smaller Span



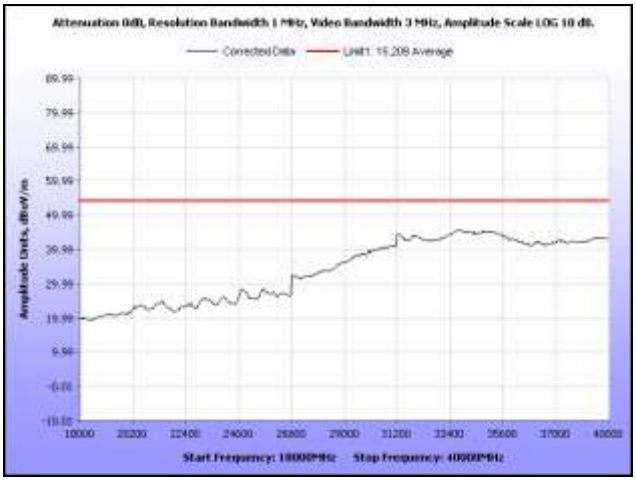
Plot 179. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Sector Antenna, 1 GHz – 7 GHz, Peak



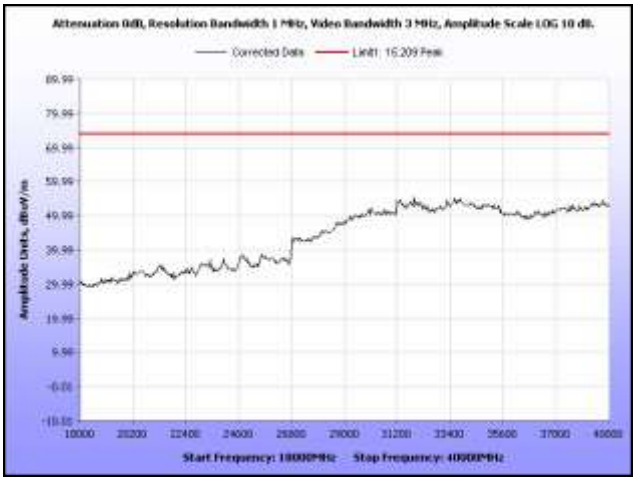
Plot 180. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Sector Antenna, 7 GHz – 18 GHz, Average



Plot 181. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Sector Antenna, 7 GHz – 18 GHz, Peak

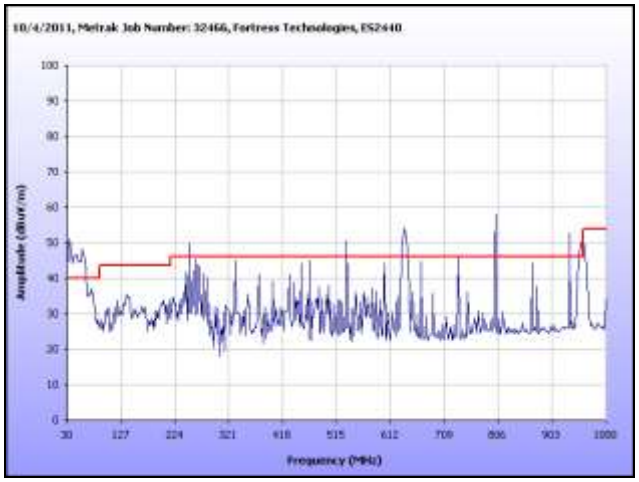


Plot 182. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Sector Antenna, 18 GHz – 40 GHz, Average

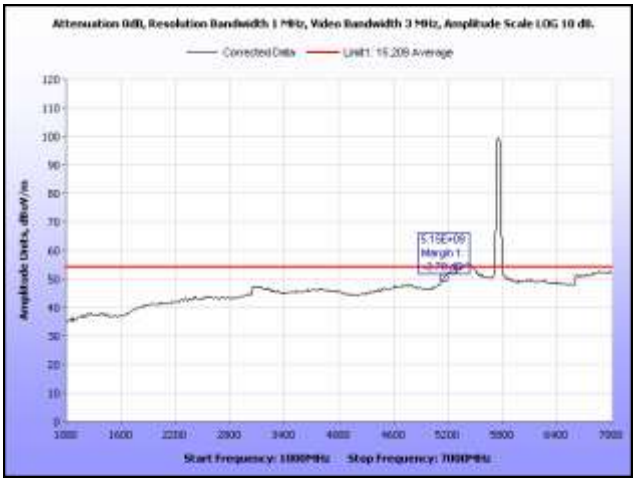


Plot 183. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, Sector Antenna, 18 GHz – 40 GHz, Peak

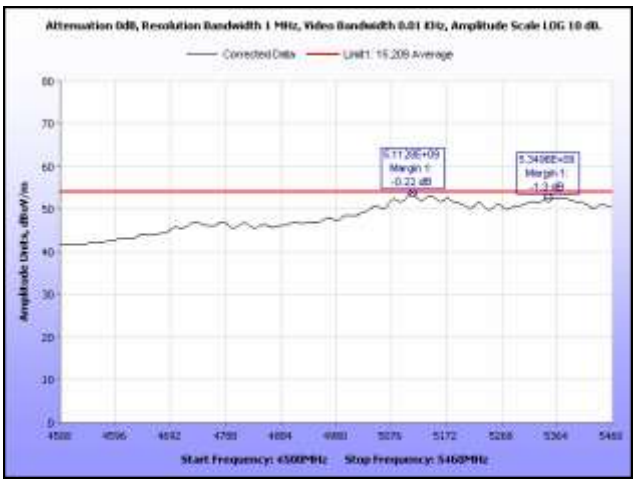
Radiated Spurious Emissions Test Results, 802.11n 40 MHz, Sector Antenna



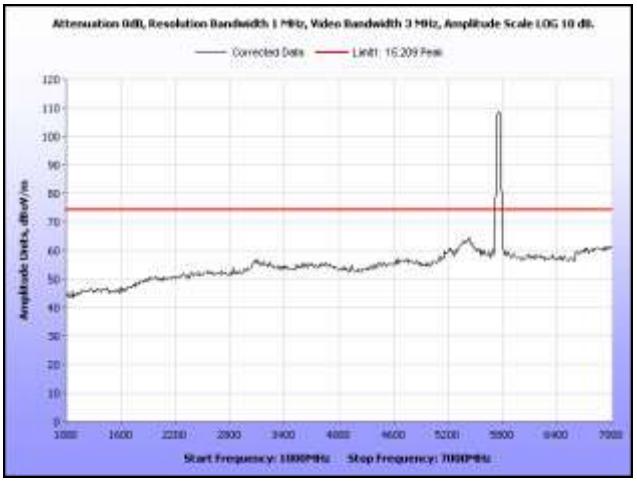
Plot 184. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Sector Antenna, 30 MHz – 1 GHz
Note: Emissions which exceed the limit are digital emissions.



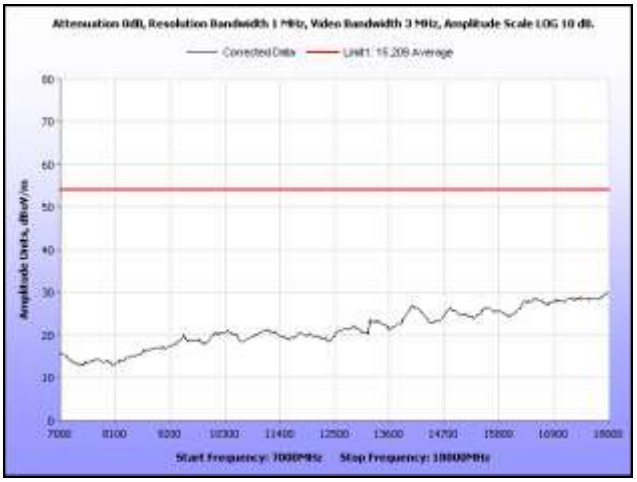
Plot 185. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Sector Antenna, 1 GHz – 7 GHz, Average



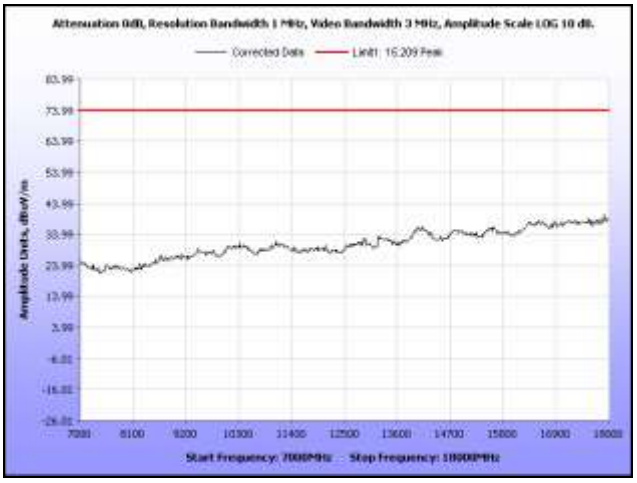
Plot 186. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Sector Antenna, Smaller Span



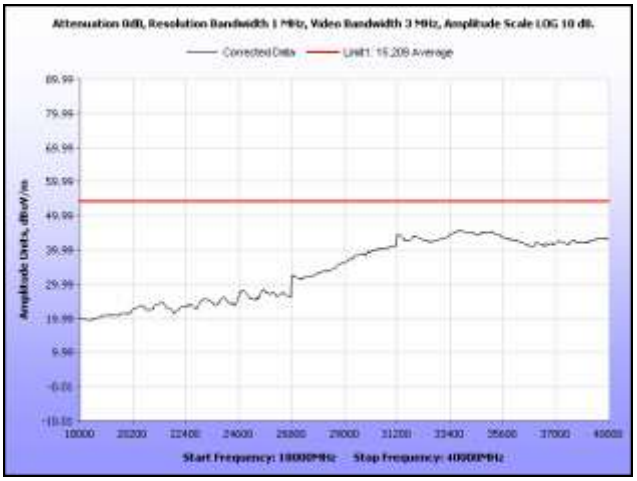
Plot 187. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Sector Antenna, 1 GHz – 7 GHz, Peak



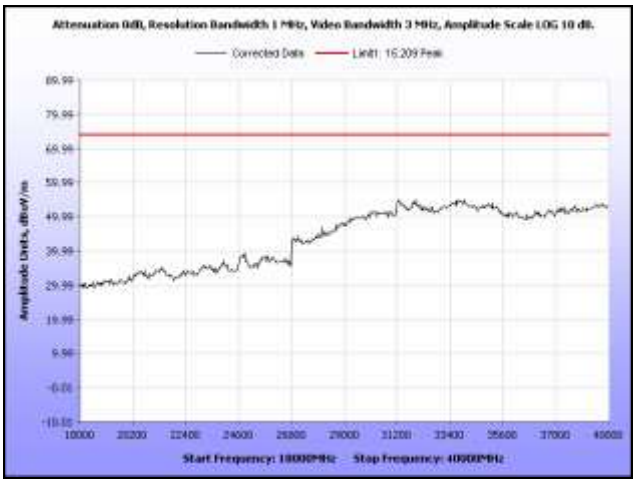
Plot 188. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Sector Antenna, 7 GHz – 18 GHz, Average



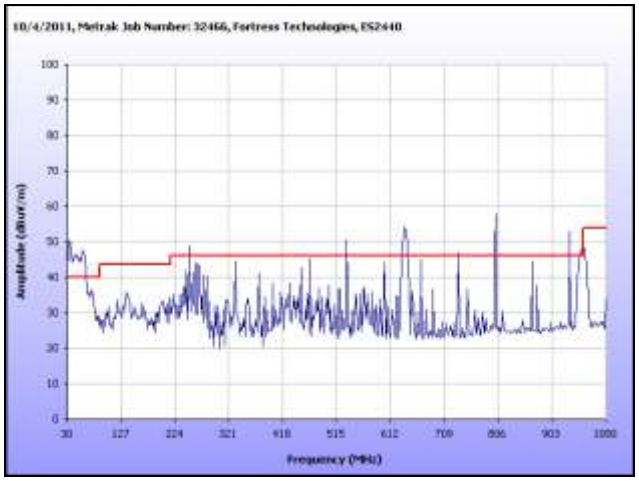
Plot 189. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Sector Antenna, 7 GHz – 18 GHz, Peak



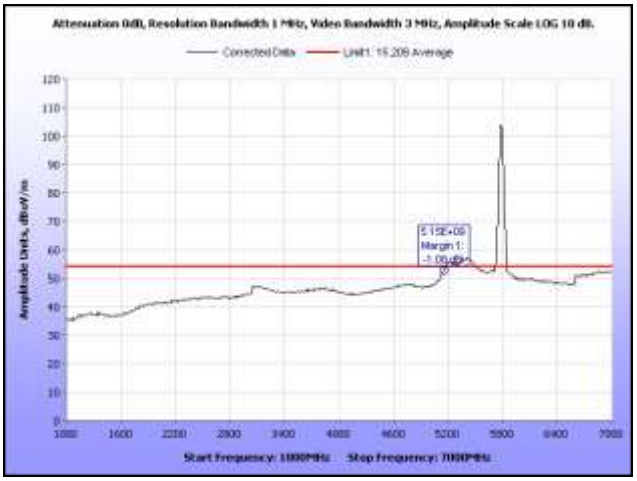
Plot 190. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Sector Antenna, 18 GHz – 40 GHz, Average



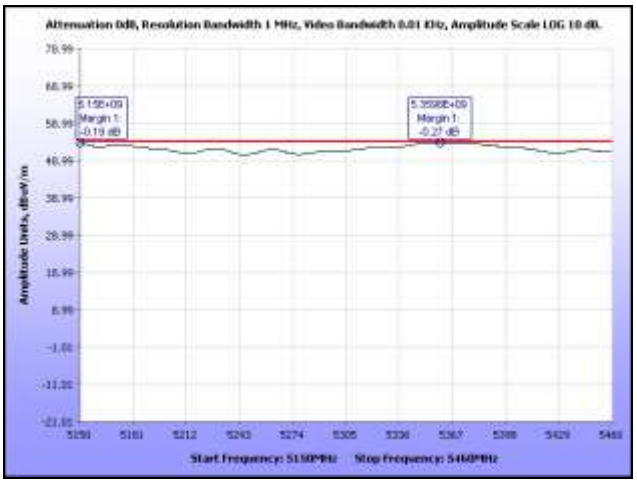
Plot 191. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, Sector Antenna, 18 GHz – 40 GHz, Peak



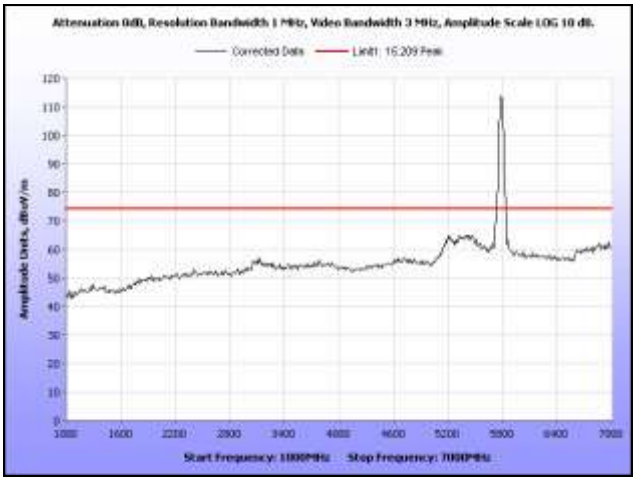
Plot 192. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Sector Antenna, 30 MHz – 1 GHz
Note: Emissions which exceed the limit are digital emissions.



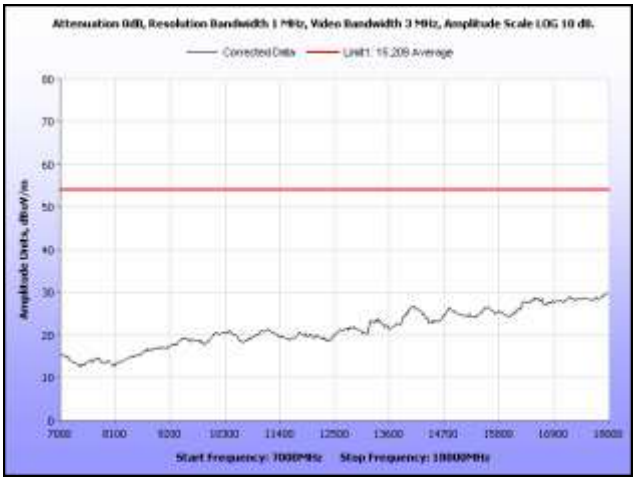
Plot 193. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Sector Antenna, 1 GHz – 7 GHz, Average



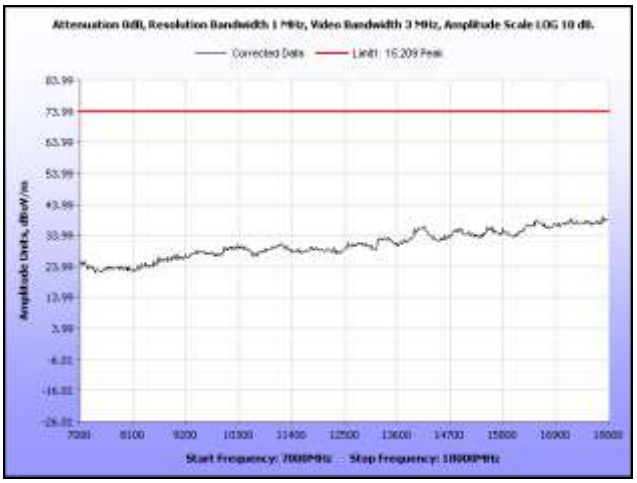
Plot 194. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Sector Antenna, Smaller Span



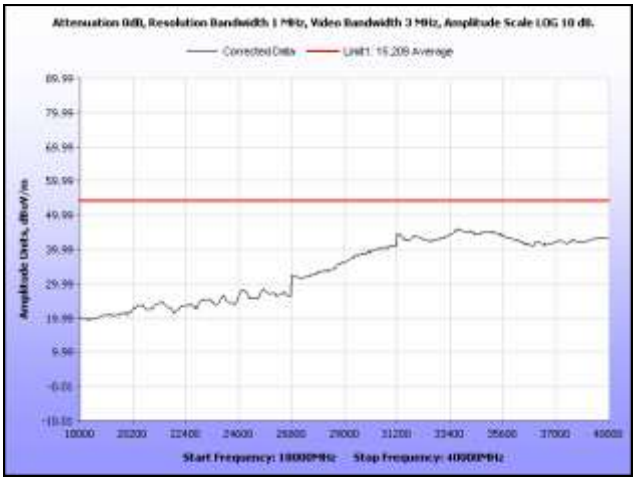
Plot 195. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Sector Antenna, 1 GHz – 7 GHz, Peak



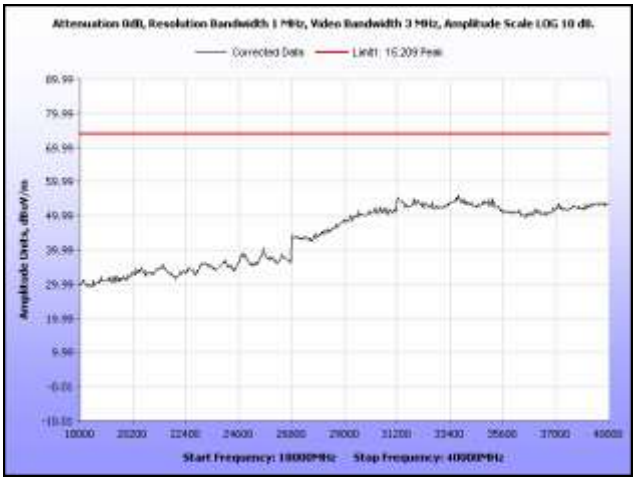
Plot 196. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Sector Antenna, 7 GHz – 18 GHz, Average



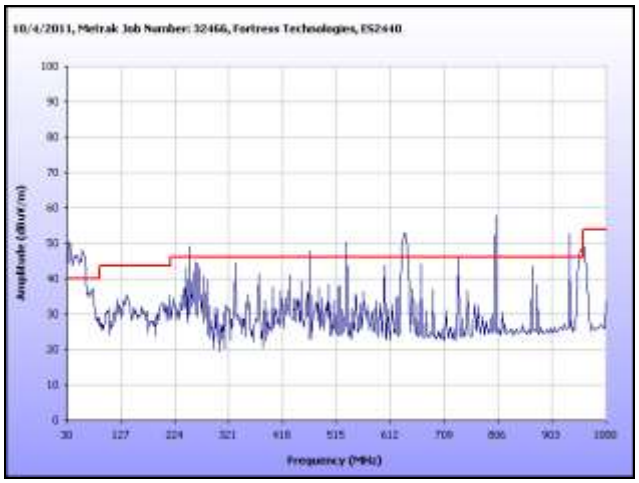
Plot 197. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Sector Antenna, 7 GHz – 18 GHz, Peak



Plot 198. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Sector Antenna, 18 GHz – 40 GHz, Average

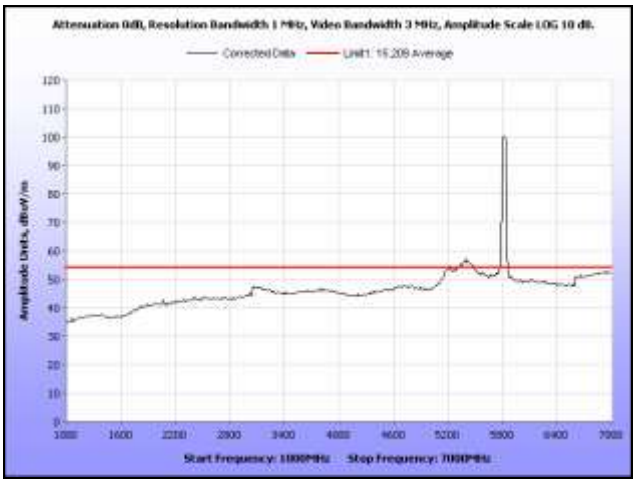


Plot 199. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, Sector Antenna, 18 GHz – 40 GHz, Peak

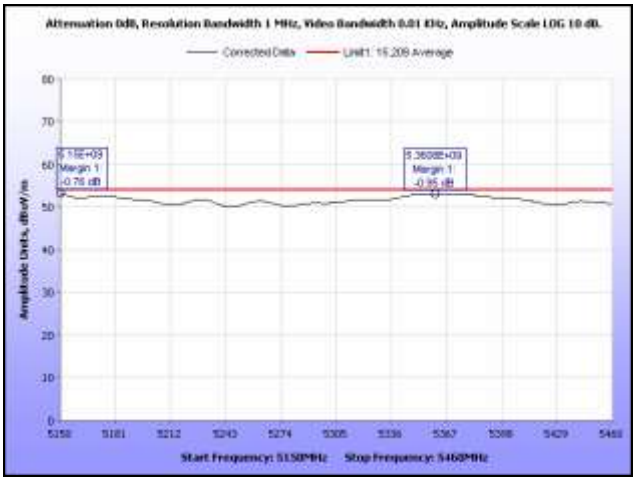


Plot 200. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Sector Antenna, 30 MHz – 1 GHz

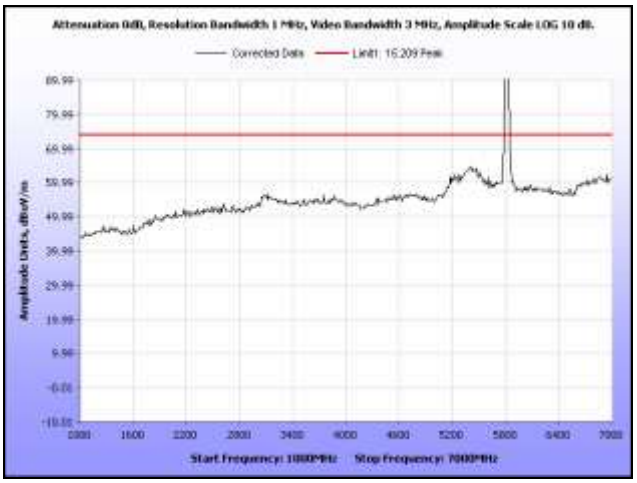
Note: Emissions which exceed the limit are digital emissions.



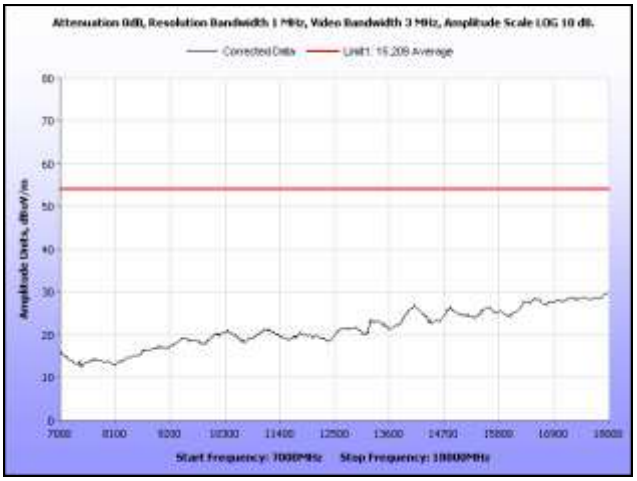
Plot 201. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Sector Antenna, 1 GHz – 7 GHz, Average



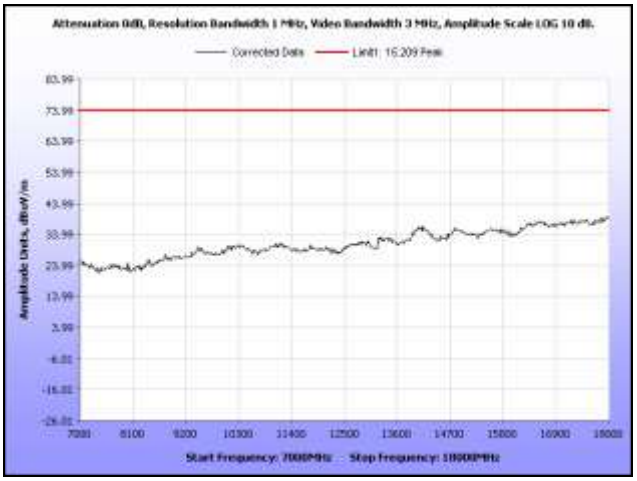
Plot 202. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Sector Antenna, Smaller Span



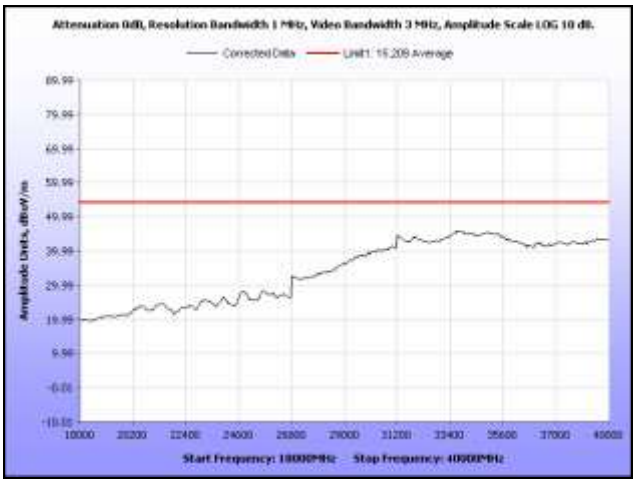
Plot 203. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Sector Antenna, 1 GHz – 7 GHz, Peak



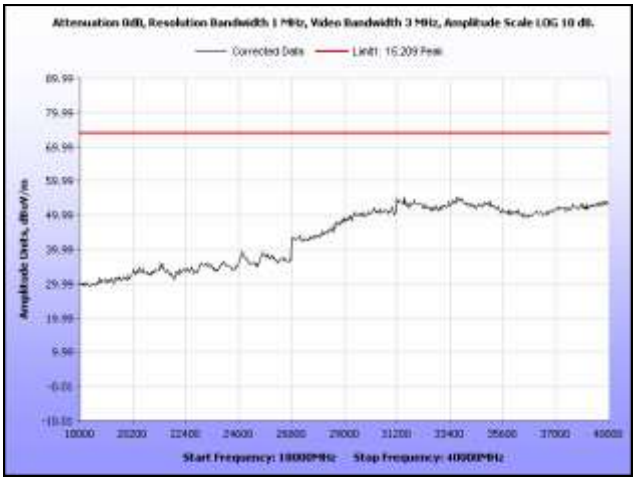
Plot 204. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Sector Antenna, 7 GHz – 18 GHz, Average



Plot 205. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Sector Antenna, 7 GHz – 18 GHz, Peak



Plot 206. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Sector Antenna, 18 GHz – 40 GHz, Average



Plot 207. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, Sector Antenna, 18 GHz – 40 GHz, Peak

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) RF Conducted Spurious Emissions Requirements and Band Edge

Test Requirement: **15.247(d)** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Test Procedure: For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

The transmitter was connected directly to a spectrum analyzer through an attenuator. Measurements were taken of the low, mid, and high channels, and emissions were compared to a 20 dBc limit line.

See following pages for detailed test results with RF Conducted Spurious Emissions.

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

Test Engineer(s): Jeff Pratt

Test Date(s): 09/13/11

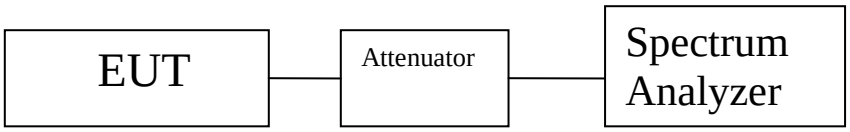
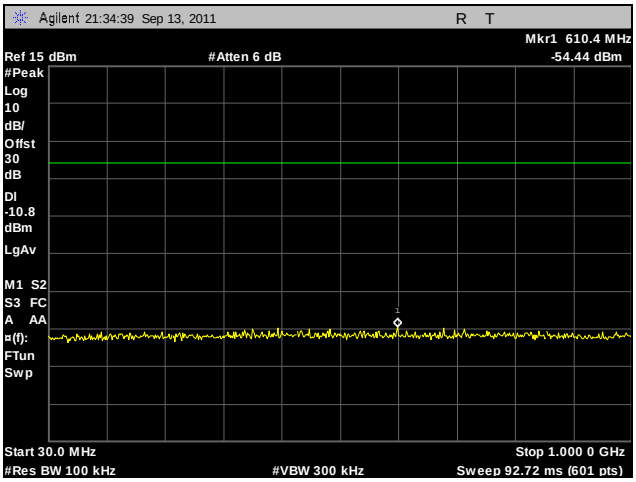
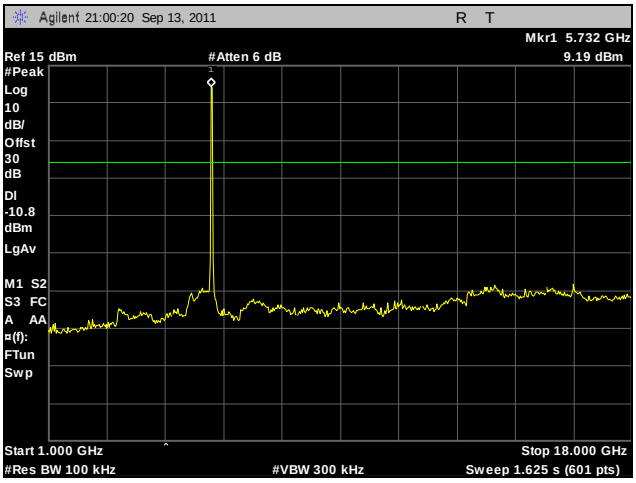


Figure 3. Block Diagram, Conducted Spurious Emissions Test Setup

Conducted Spurious Emissions Test Results, 802.11a Port A

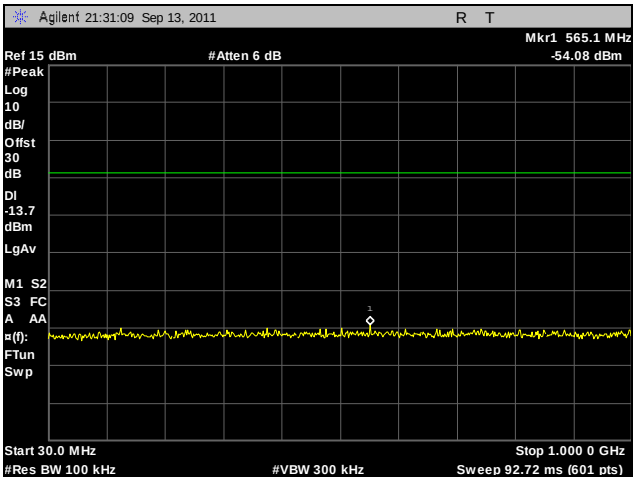


Plot 208. Conducted Spurious Emissions, Low Channel, 802.11a, Port A, 30 MHz – 1 GHz

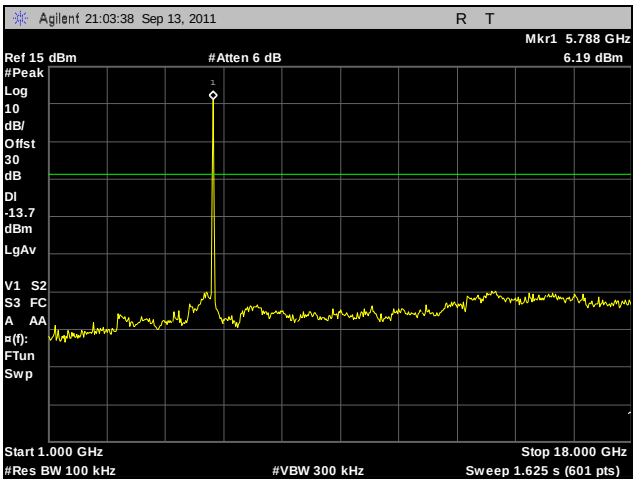


Plot 209. Conducted Spurious Emissions, Low Channel, 802.11a, Port A, 1 GHz – 18 GHz

Plot 210. Conducted Spurious Emissions, Low Channel, 802.11a, Port A, 18 GHz – 40 GHz

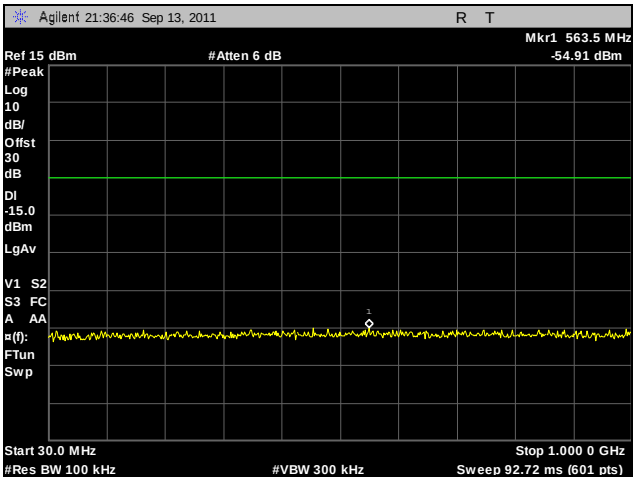


Plot 211. Conducted Spurious Emissions, Mid Channel, 802.11a, Port A, 30 MHz – 1 GHz

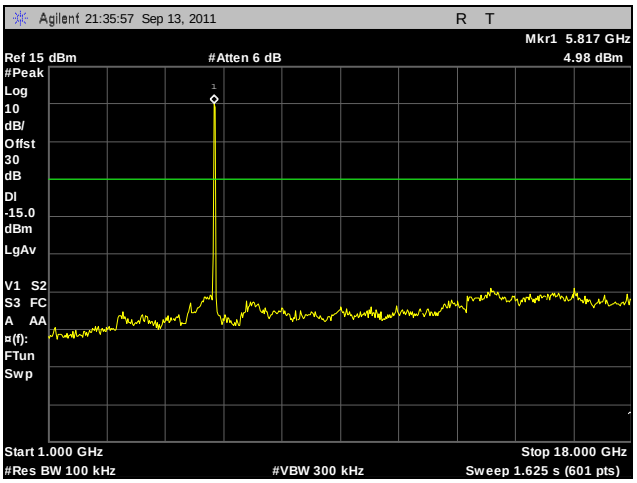


Plot 212. Conducted Spurious Emissions, Mid Channel, 802.11a, Port A, 1 GHz – 18 GHz

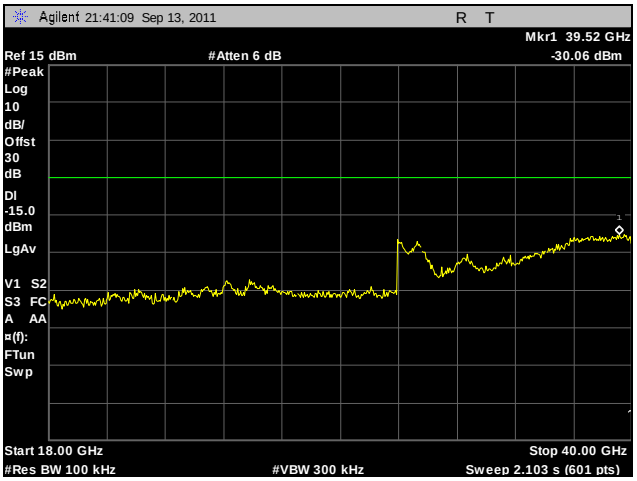
Plot 213. Conducted Spurious Emissions, Mid Channel, 802.11a, Port A, 18 GHz – 40 GHz



Plot 214. Conducted Spurious Emissions, High Channel, 802.11a, Port A, 30 MHz – 1 GHz

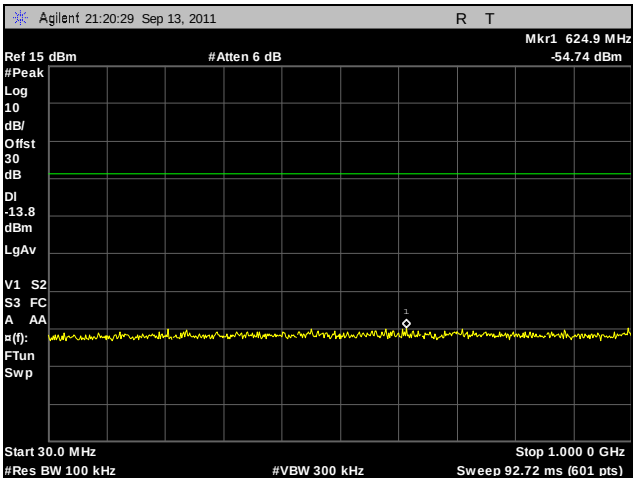


Plot 215. Conducted Spurious Emissions, High Channel, 802.11a, Port A, 1 GHz – 18 GHz

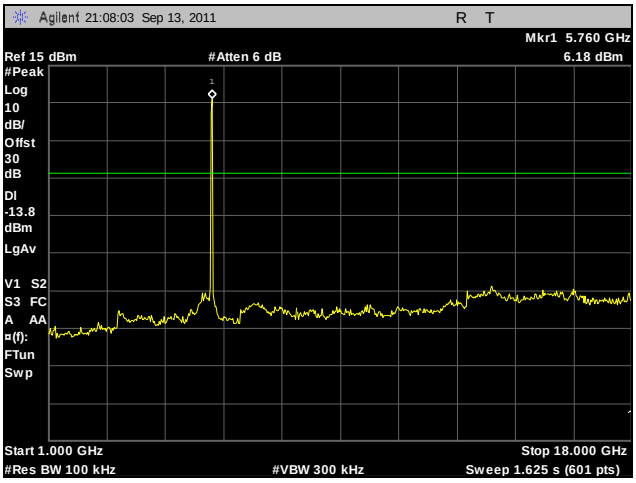


Plot 216. Conducted Spurious Emissions, High Channel, 802.11a, Port A, 18 GHz – 40 GHz

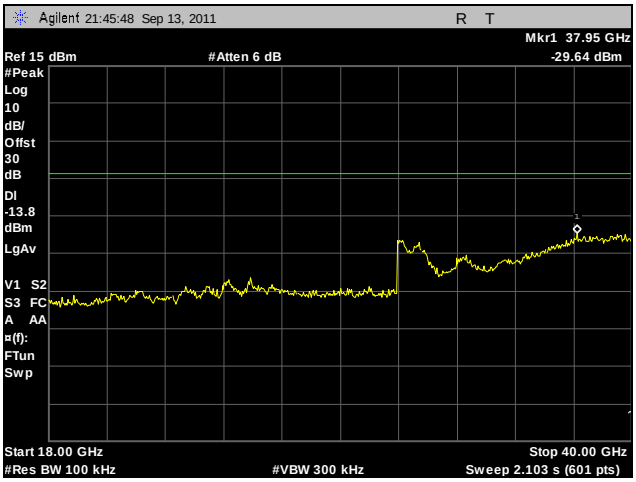
Conducted Spurious Emissions Test Results, 802.11n 20 MHz Port A



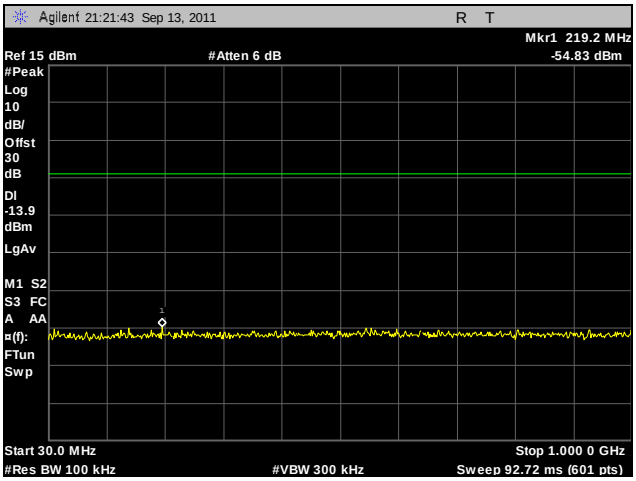
Plot 217. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port A, 30 MHz – 1 GHz



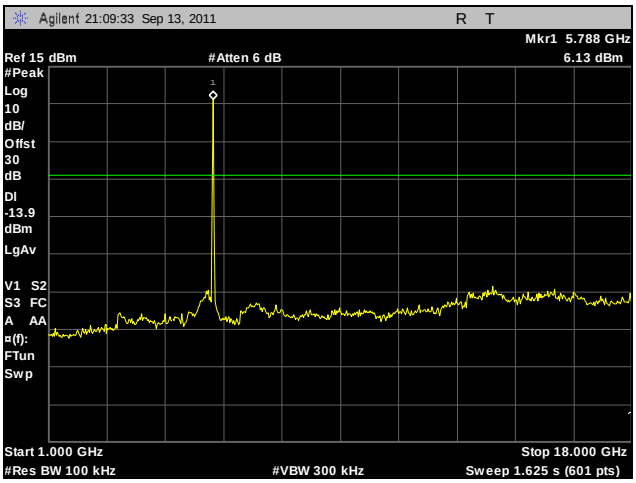
Plot 218. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port A, 1 GHz – 18 GHz



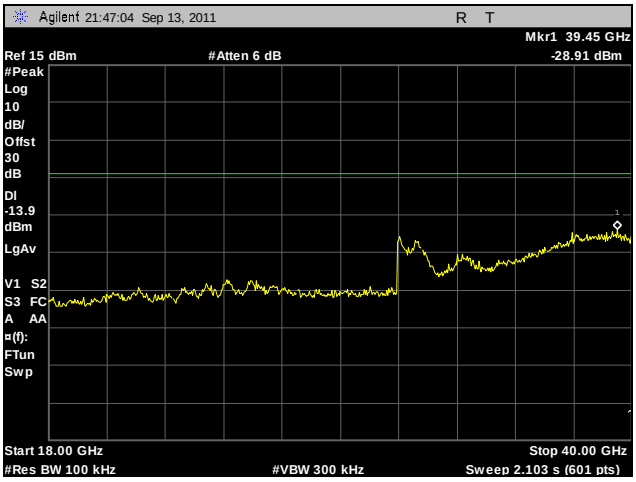
Plot 219. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port A, 18 GHz – 40 GHz



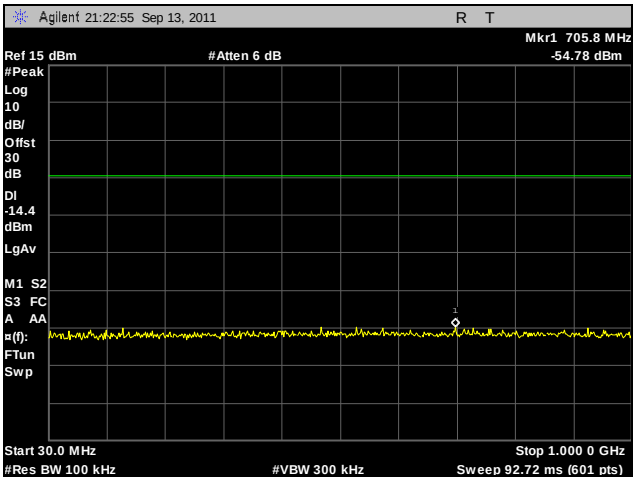
Plot 220. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port A, 30 MHz – 1 GHz



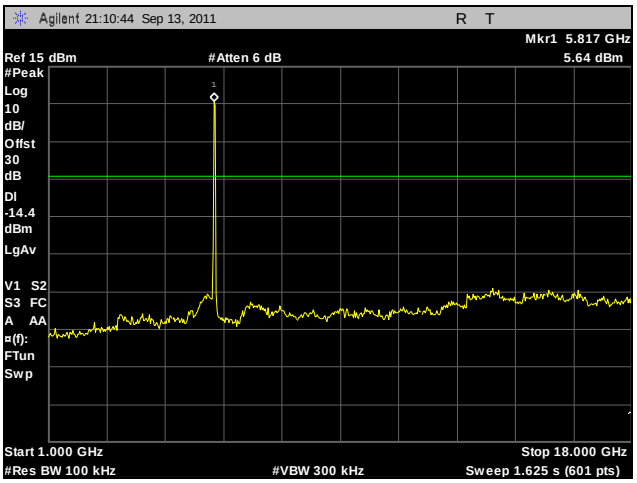
Plot 221. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port A, 1 GHz – 18 GHz



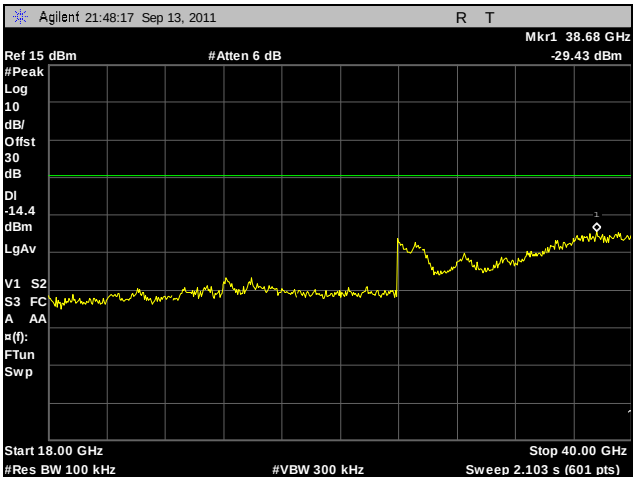
Plot 222. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port A, 18 GHz – 40 GHz



Plot 223. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port A, 30 MHz – 1 GHz

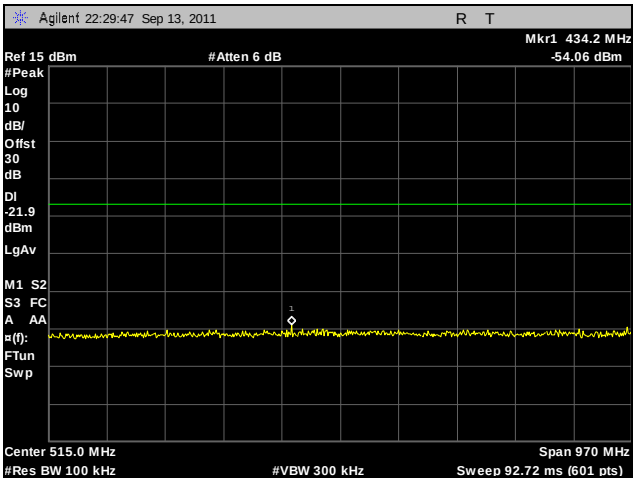


Plot 224. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port A, 1 GHz – 18 GHz

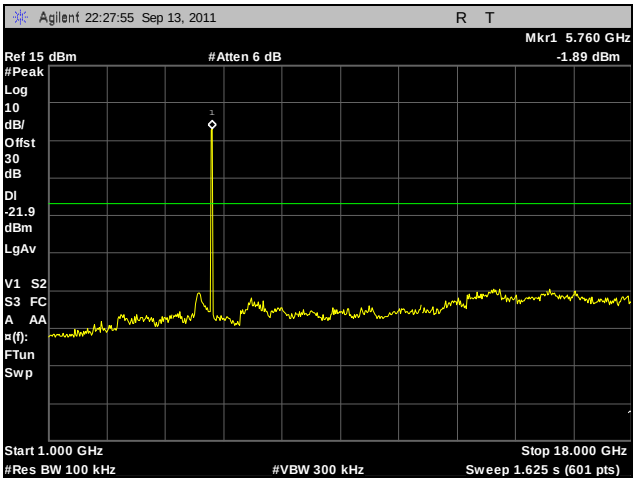


Plot 225. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port A, 18 GHz – 40 GHz

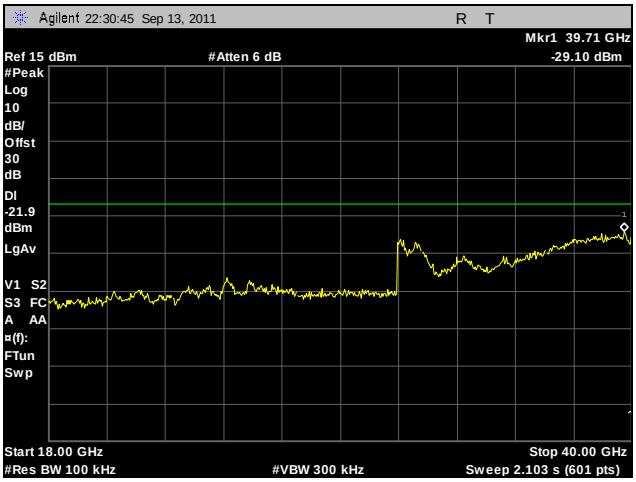
Conducted Spurious Emissions Test Results, 802.11n 20 MHz Port B



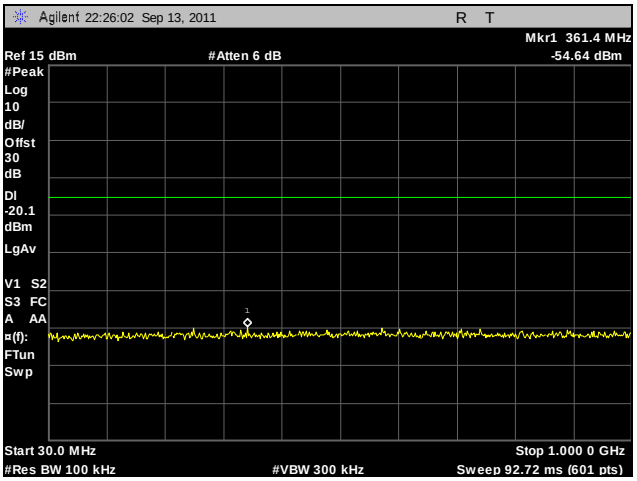
Plot 226. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port B, 30 MHz – 1 GHz



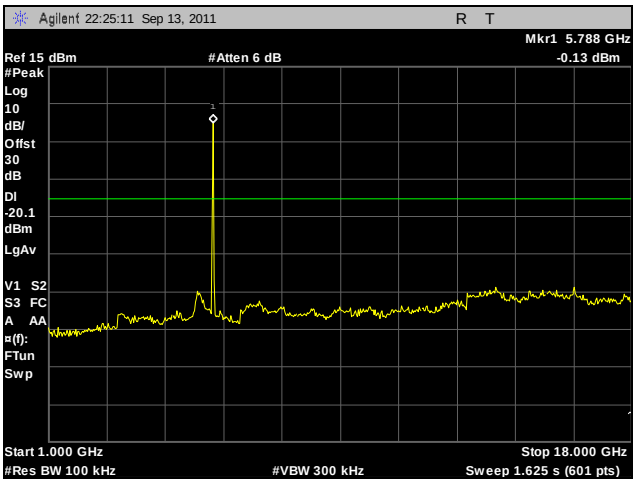
Plot 227. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port B, 1 GHz – 18 GHz



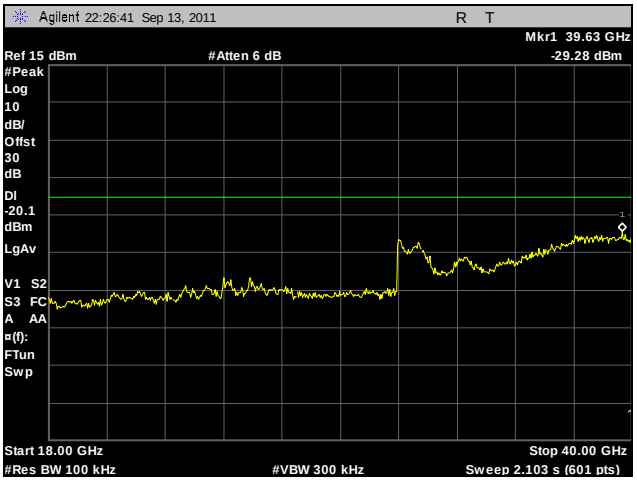
Plot 228. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port B, 18 GHz – 40 GHz



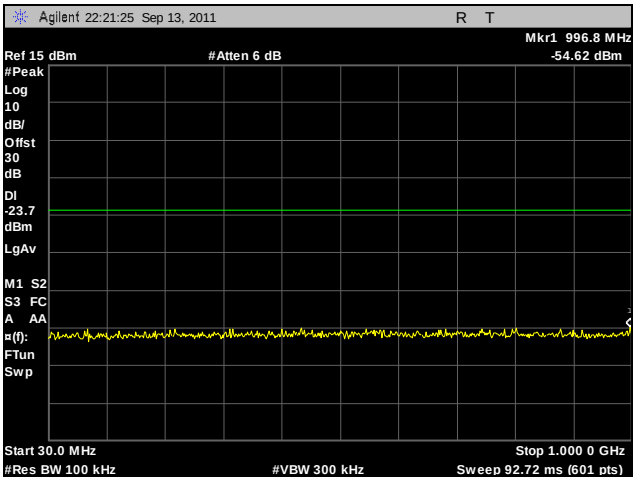
Plot 229. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port B, 30 MHz – 1 GHz



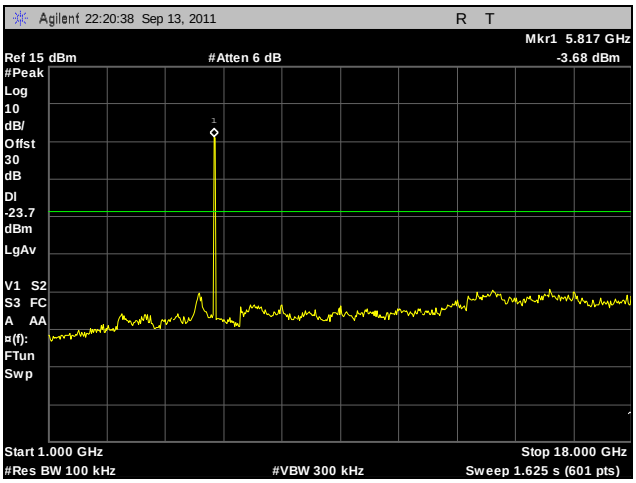
Plot 230. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port B, 1 GHz – 18 GHz



Plot 231. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port B, 18 GHz – 40 GHz



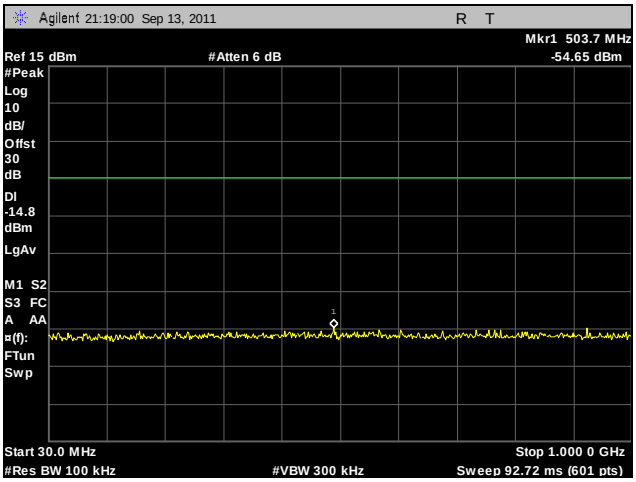
Plot 232. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port B, 30 MHz – 1 GHz



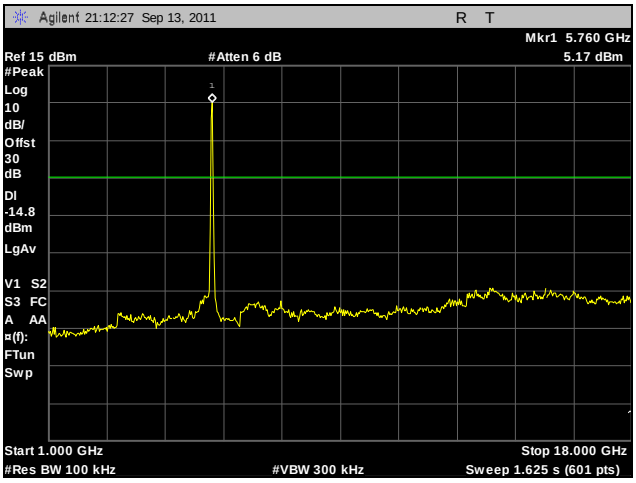
Plot 233. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port B, 1 GHz – 18 GHz

Plot 234. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port B, 18 GHz – 40 GHz

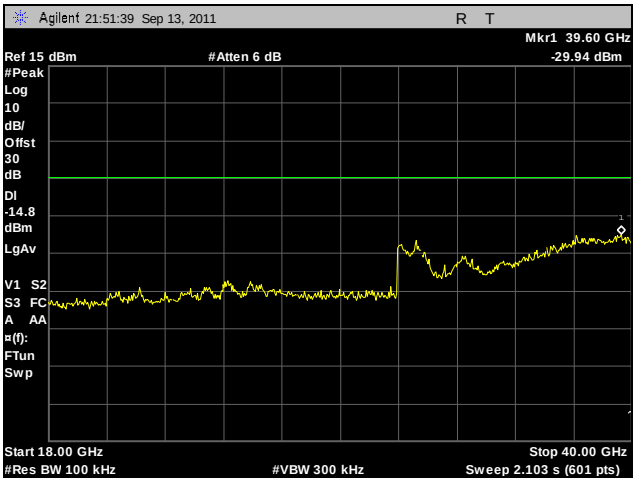
Conducted Spurious Emissions Test Results, 802.11n 40 MHz Port A



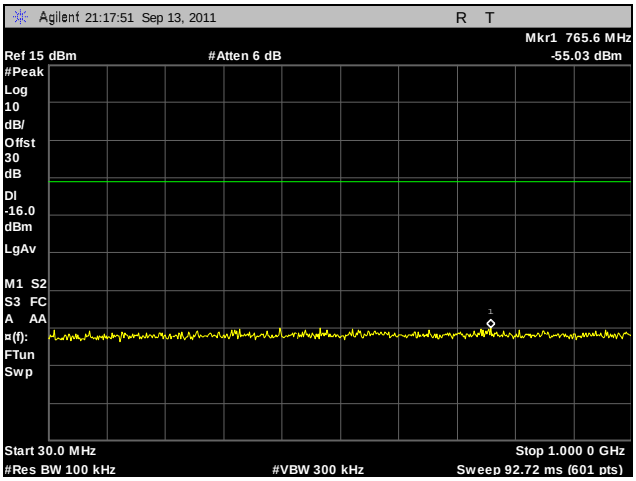
Plot 235. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port A, 30 MHz – 1 GHz



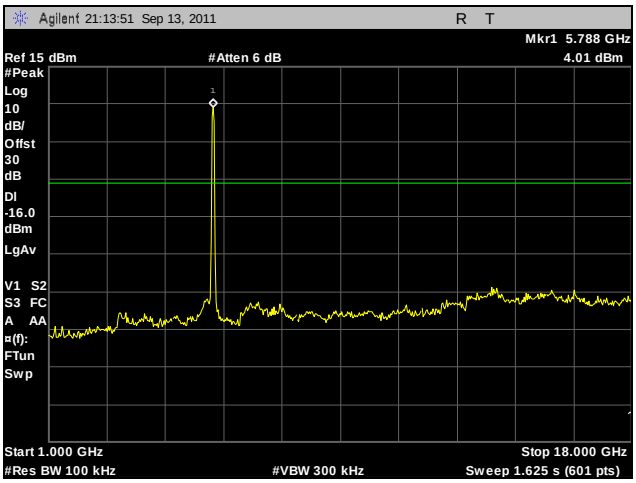
Plot 236. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port A, 1 GHz – 18 GHz



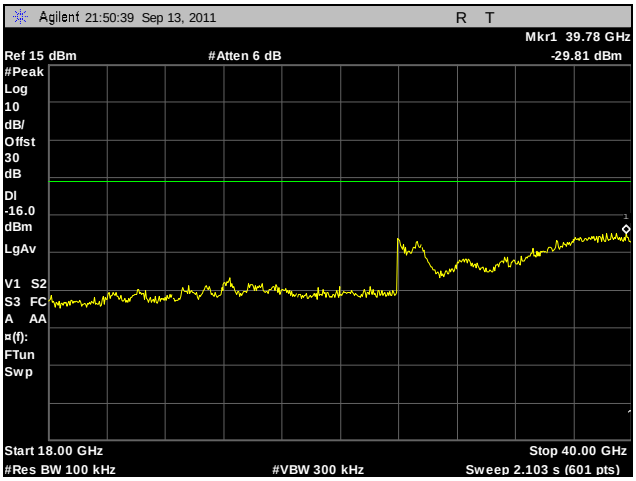
Plot 237. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port A, 18 GHz – 40 GHz



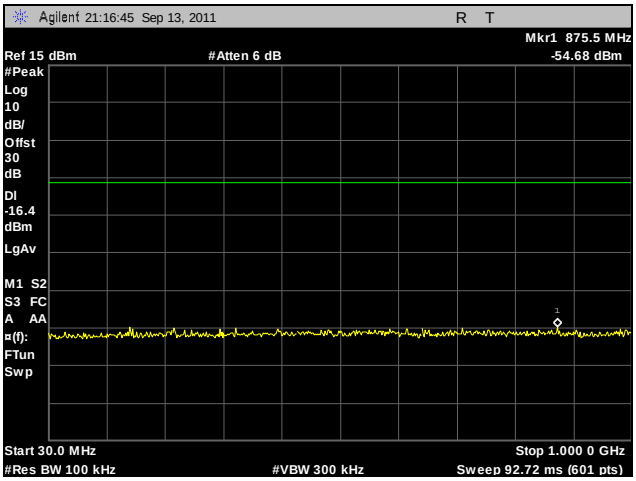
Plot 238. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port A, 30 MHz – 1 GHz



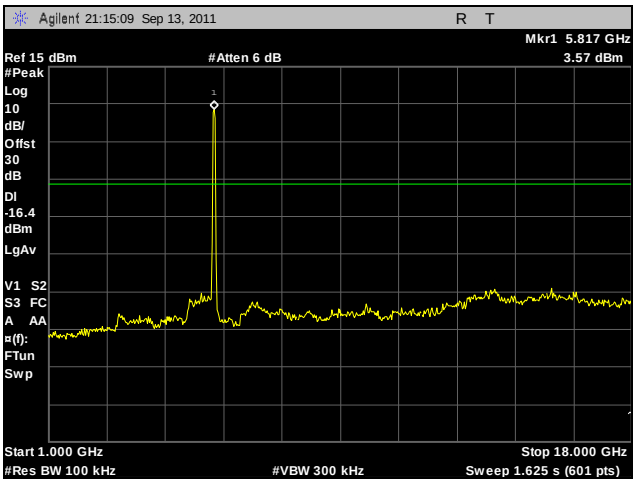
Plot 239. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port A, 1 GHz – 18 GHz



Plot 240. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port A, 18 GHz – 40 GHz



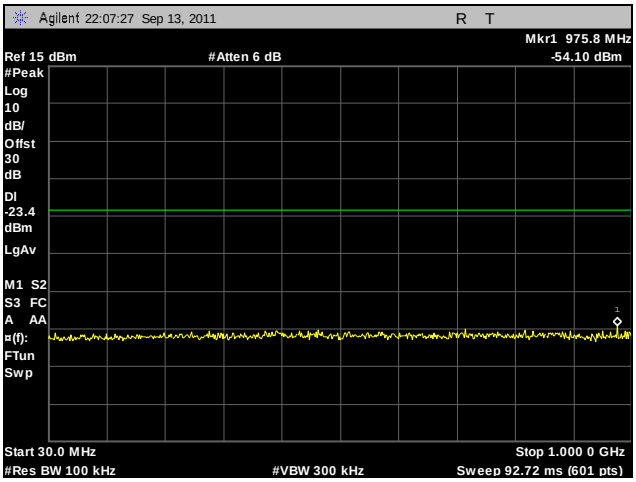
Plot 241. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port A, 30 MHz – 1 GHz



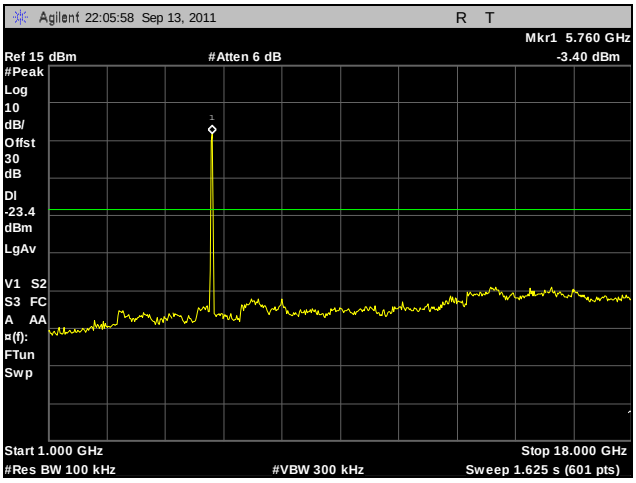
Plot 242. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port A, 1 GHz – 18 GHz

Plot 243. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port A, 18 GHz – 40 GHz

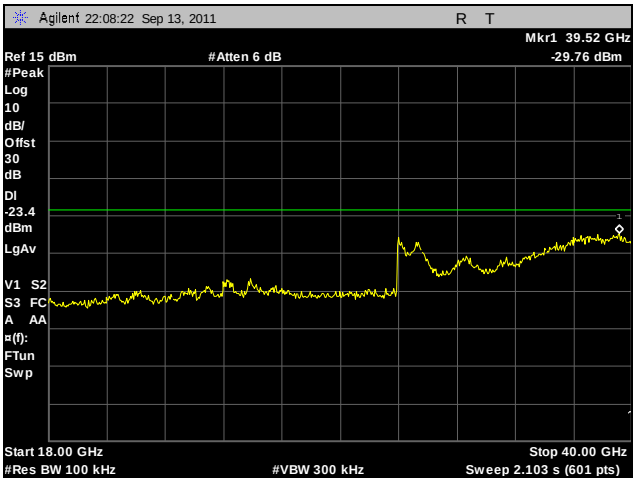
Conducted Spurious Emissions Test Results, 802.11n 40 MHz Port B



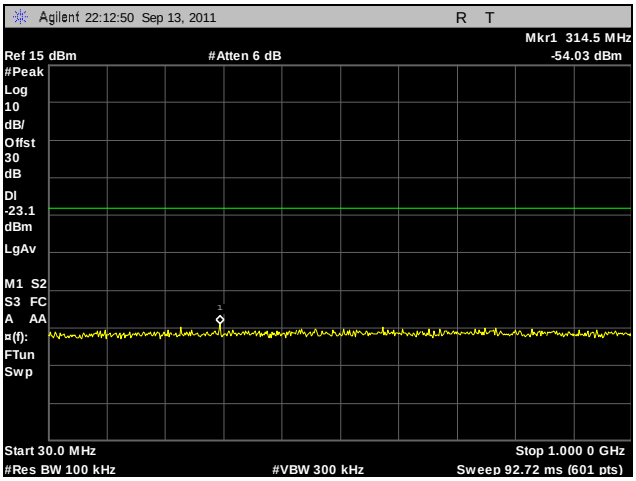
Plot 244. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port B, 30 MHz – 1 GHz



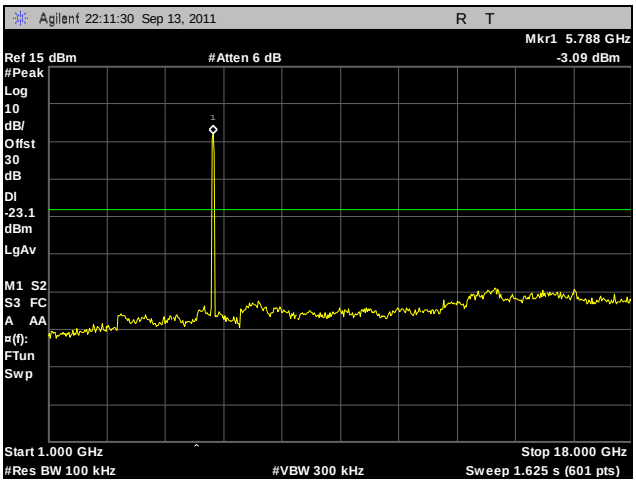
Plot 245. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port B, 1 GHz – 18 GHz



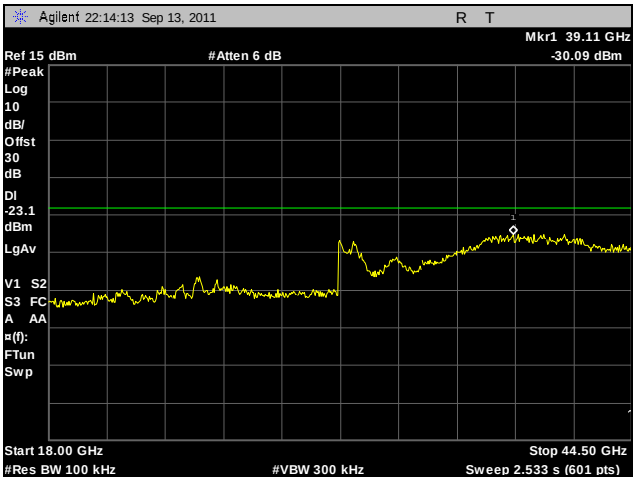
Plot 246. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port B, 18 GHz – 40 GHz



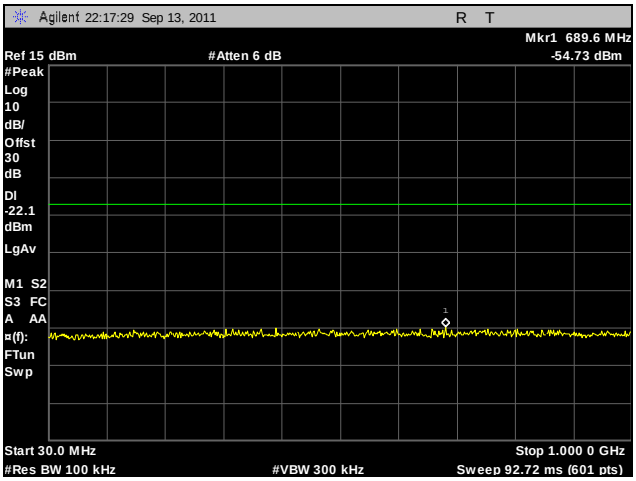
Plot 247. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port B, 30 MHz – 1 GHz



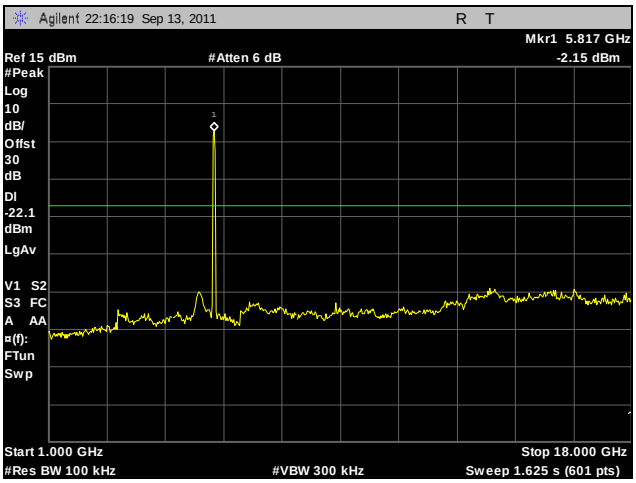
Plot 248. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port B, 1 GHz – 18 GHz



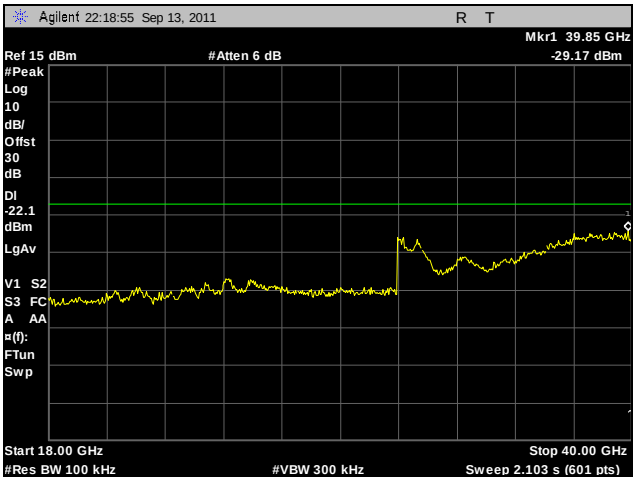
Plot 249. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port B, 18 GHz – 40 GHz



Plot 250. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port B, 30 MHz – 1 GHz

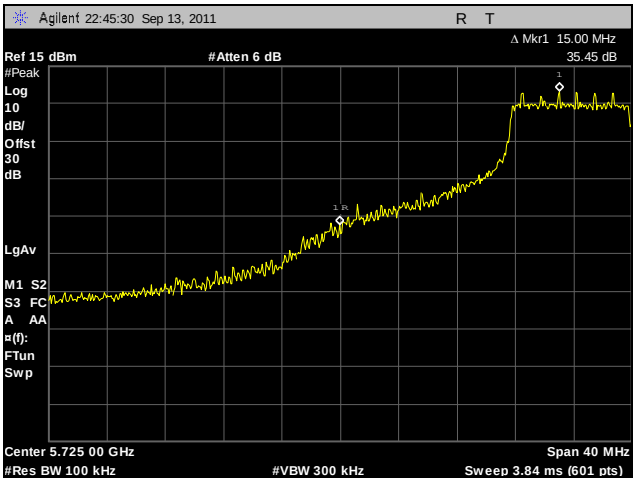


Plot 251. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port B, 1 GHz – 18 GHz

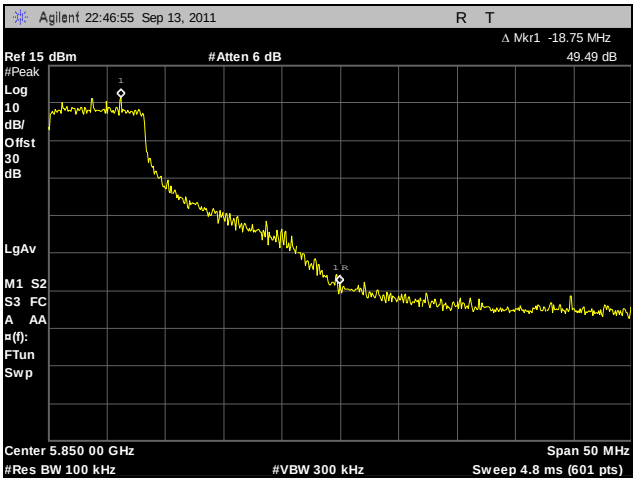


Plot 252. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port B, 18 GHz – 40 GHz

Conducted Band Edge Test Results, 802.11a

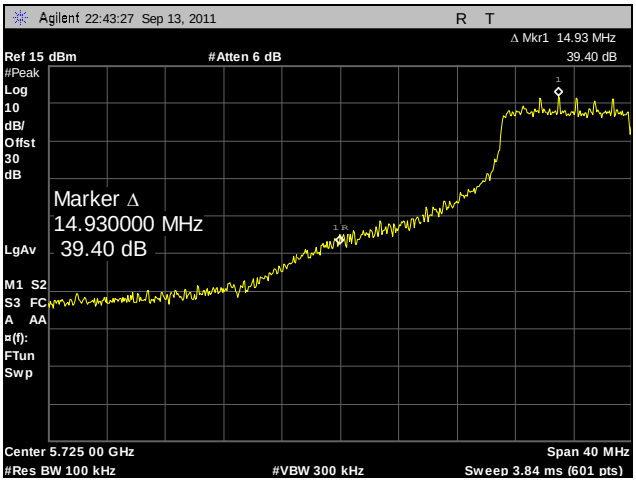


Plot 253. Conducted Band Edge, Low Channel, 802.11a, Port A

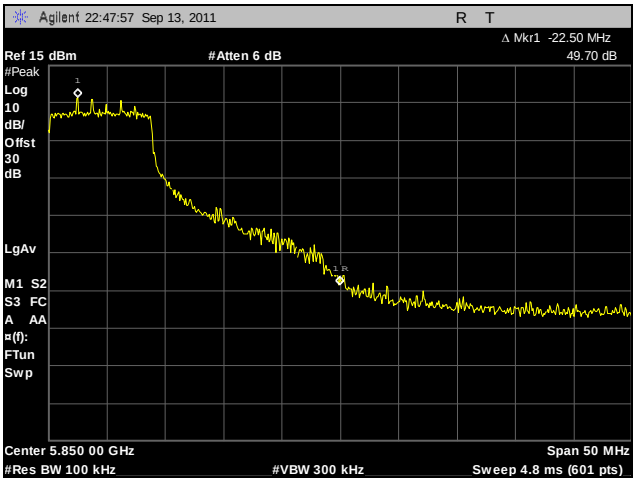


Plot 254. Conducted Band Edge, High Channel, 802.11a, Port A

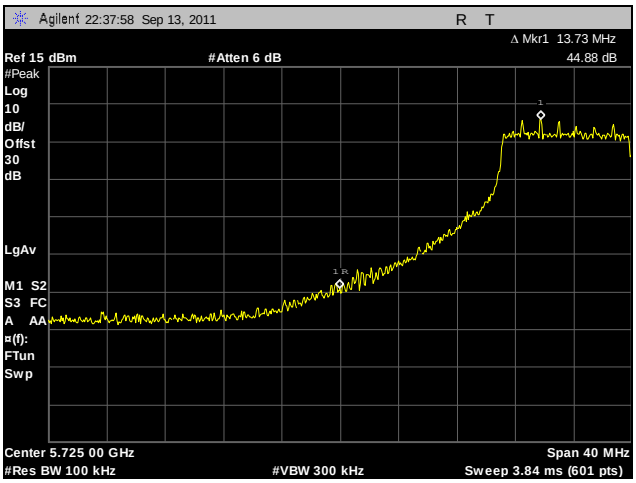
Conducted Band Edge Test Results, 802.11n 20 MHz



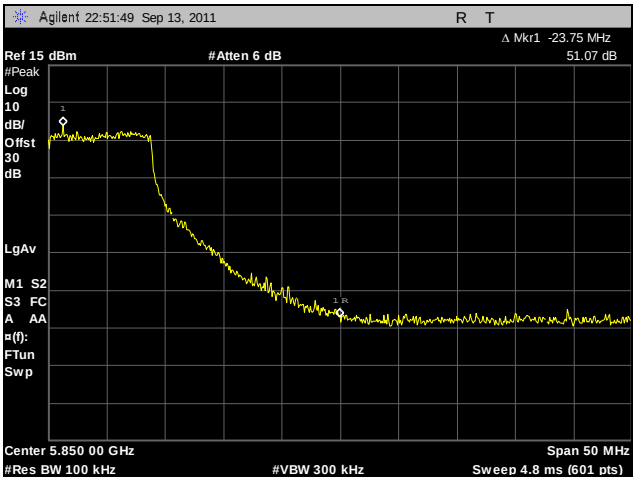
Plot 255. Conducted Band Edge, Low Channel, 802.11n 20 MHz, Port A



Plot 256. Conducted Band Edge, High Channel, 802.11n 20 MHz, Port A

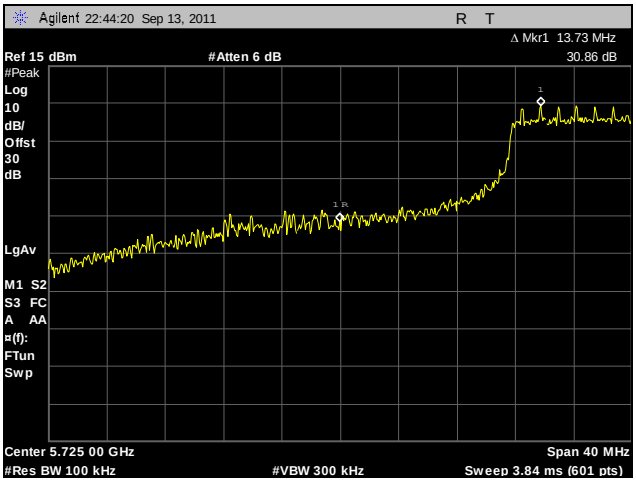


Plot 257. Conducted Band Edge, Low Channel, 802.11n 20 MHz, Port B

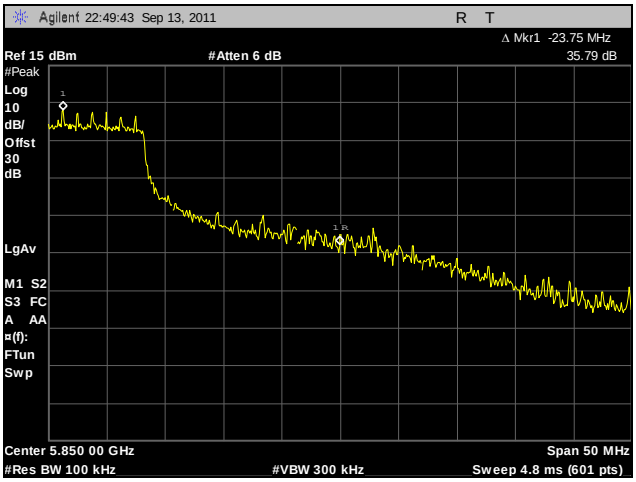


Plot 258. Conducted Band Edge, High Channel, 802.11n 20 MHz, Port B

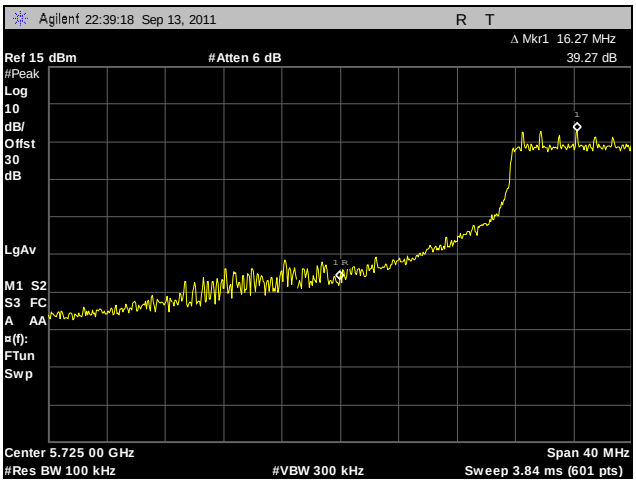
Conducted Band Edge Test Results, 802.11n 40 MHz



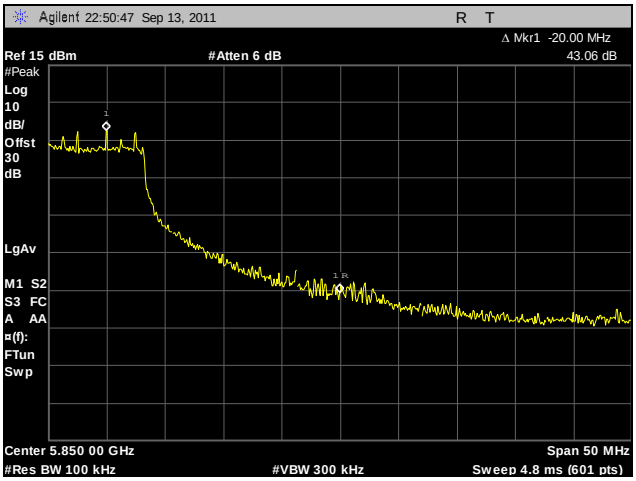
Plot 259. Conducted Band Edge, Low Channel, 802.11n 40 MHz, Port A



Plot 260. Conducted Band Edge, High Channel, 802.11n 40 MHz, Port A



Plot 261. Conducted Band Edge, Low Channel, 802.11n 40 MHz, Port B



Plot 262. Conducted Band Edge, High Channel, 802.11n 40 MHz, Port B

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(e) Peak Power Spectral Density

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

Test Procedure: The transmitter was connected directly to a spectrum analyzer through an attenuator. With an RBW of 3 kHz, a VBW of 10 kHz, and the trace set to Max Hold with a Peak detector, the frequency of peak power spectral density was found and centered. The span was reduced and the sweep time changed to (span/RBW) = (span/3kHz) seconds. The level of peak spectral density was found and recorded.

Test Results: The EUT was compliant with the peak power spectral density limits of **§ 15.247 (e)**.

The peak power spectral density was determined from plots on the following page(s).

Test Engineer: Jeff Pratt

Test Date: 09/16/11

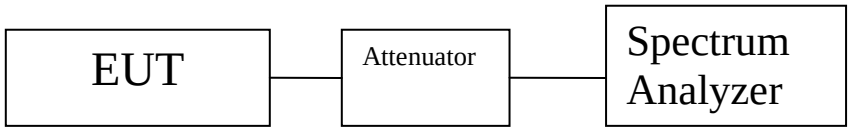


Figure 4. Block Diagram, Peak Power Spectral Density Test Setup

Peak Power Spectral Density Test Results

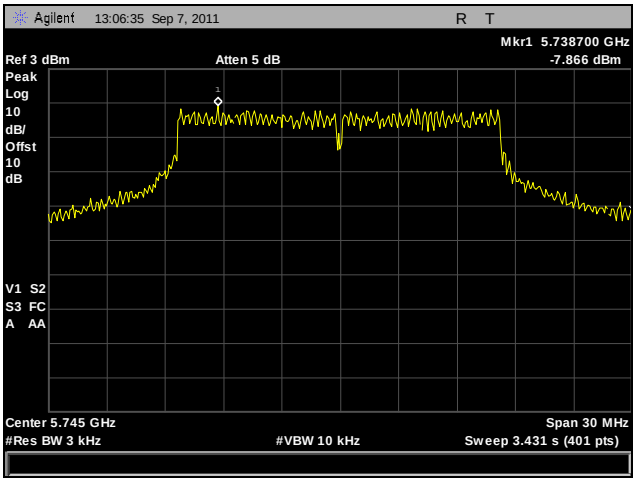
Channel (MHz)	Mode / Mod. Type	Port 2A Spectral Density (dBm / MHz)	Port 2A Spectral Density (mW / MHz)	Port 2B Spectral Density (dBm/MHz)	Port 2B Spectral Density (mW / MHz)	Summed Spectral Density (mW / MHz)	Summed Spectral Density (dBm / MHz)	Antenna Gain (dBi)	Limit (dBm / MHz)	Margin (dB)
5745	a	-7.252	0.1882782			0.18827818	-7.252	10	4	-11.252
5785	a	-9.87	0.1030386			0.10303861	-9.87	10	4	-13.87
5825	a	-10.46	0.0899498			0.08994976	-10.46	10	4	-14.46
5745	HT20	-9.088	0.1233673	-11.16	0.07655966	0.19992694	-6.99128673	10	4	-10.991287
5785	HT20	-10.23	0.0948418	-6.504	0.22366601	0.31850786	-4.96879844	10	4	-8.9687984
5825	HT20	-10.45	0.0901571	-9.163	0.1212551	0.21141221	-6.74869934	10	4	-10.748699
5755	HT40	-12.41	0.0574116	-11.64	0.06854882	0.12596047	-8.99765731	10	4	-12.997657
5785	HT40	-6.951	0.2017902	-11.63	0.06870684	0.27049701	-5.67837529	10	4	-9.6783753
5815	HT40	-11.29	0.0743019	-12.81	0.05236004	0.12666196	-8.97353805	10	4	-12.973538

Table 24. Peak Power Spectral Density, Test Results

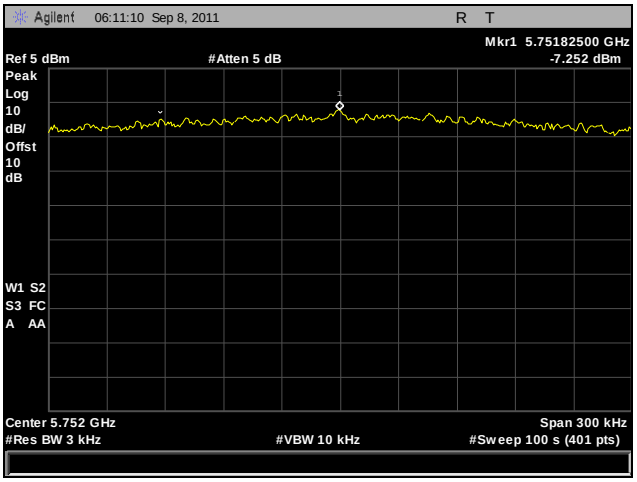
Channel (MHz)	Mode / Mod. Type	Port 2A Spectral Density (dBm / MHz)	Port 2A Spectral Density (mW / MHz)	Port 2B Spectral Density (dBm/MHz)	Port 2B Spectral Density (mW / MHz)	Summed Spectral Density (mW / MHz)	Summed Spectral Density (dBm / MHz)	Antenna Gain (dBi)	Limit (dBm / MHz)	Margin (dB)
5745	802.11a	-8.76	0.133045442			0.133045442	-8.76	15.5	8	-16.76
5785	802.11a	-6.34	0.23227368			0.23227368	-6.34	15.5	8	-14.34
5825	802.11a	-10.64	0.086297855			0.086297855	-10.64	15.5	8	-18.64
5745	802.11n HT20	-15.55	0.027861212	-10.19	0.095719407	0.123580619	-9.080496344	15.5	8	-17.0805
5785	802.11n HT20	-12.53	0.055847019	-11.84	0.065463617	0.121310637	-9.161011172	15.5	8	-17.16101
5825	802.11n HT20	-11.98	0.063386971	-10.11	0.097498964	0.160885935	-7.934819215	15.5	8	-15.93482
5755	802.11n HT40	-15.66	0.027164393	-11.06	0.078342964	0.105507357	-9.767172562	15.5	8	-17.76717
5785	802.11n HT40	-8.79	0.132129563	-10.72	0.084722741	0.216852305	-6.638359576	15.5	8	-14.63836
5815	802.11n HT40	-11.41	0.07227698	-13.99	0.03990249	0.112179471	-9.500866139	15.5	8	-17.50087

Table 25. Peak Power Spectral Density, Test Results, Sector Antenna

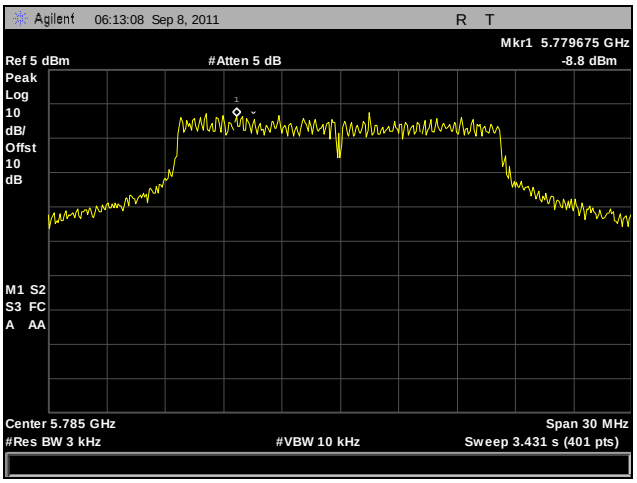
Peak Power Spectral Density, 802.11a Port A



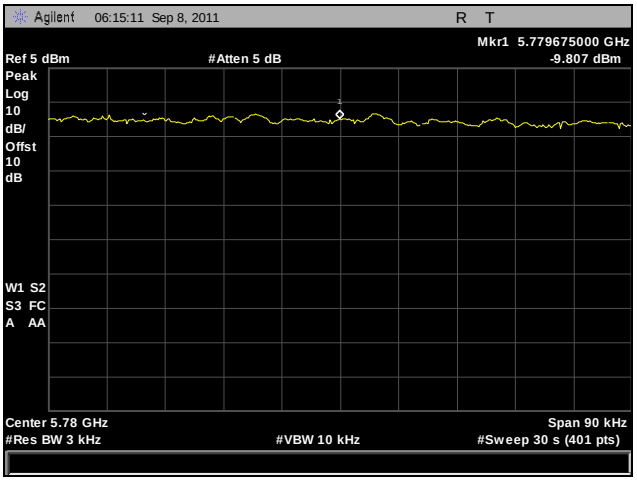
Plot 263. Peak Power Spectral Density, Low Channel, 802.11a, Port A, Determination



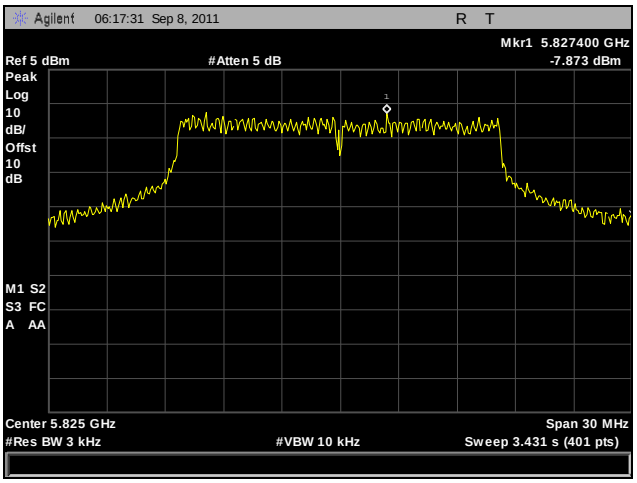
Plot 264. Peak Power Spectral Density, Low Channel, 802.11a, Port A



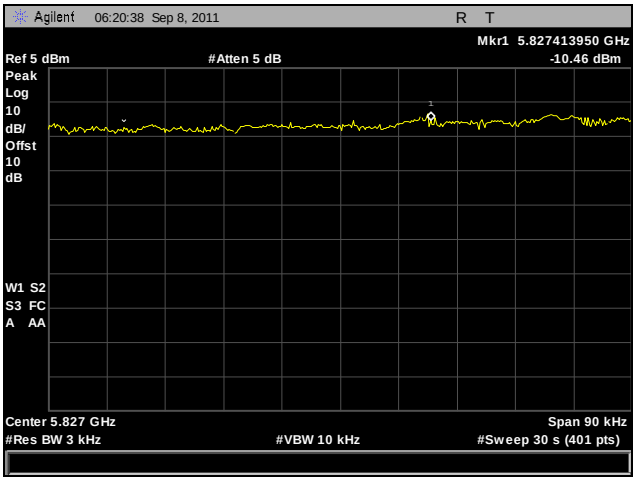
Plot 265. Peak Power Spectral Density, Mid Channel, 802.11a, Port A, Determination



Plot 266. Peak Power Spectral Density, Mid Channel, 802.11a, Port A

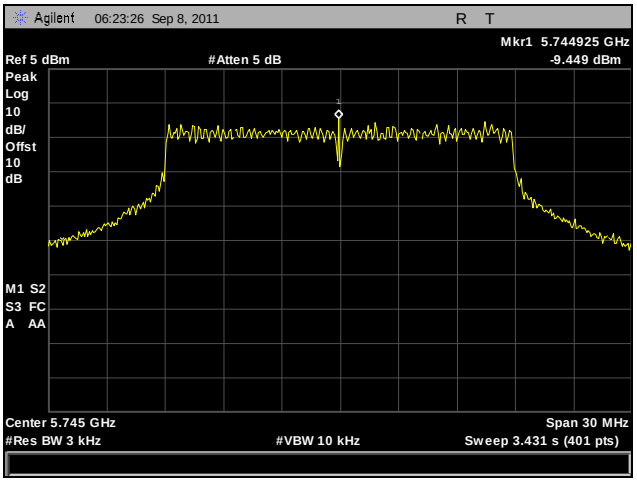


Plot 267. Peak Power Spectral Density, High Channel, 802.11a, Port A, Determination

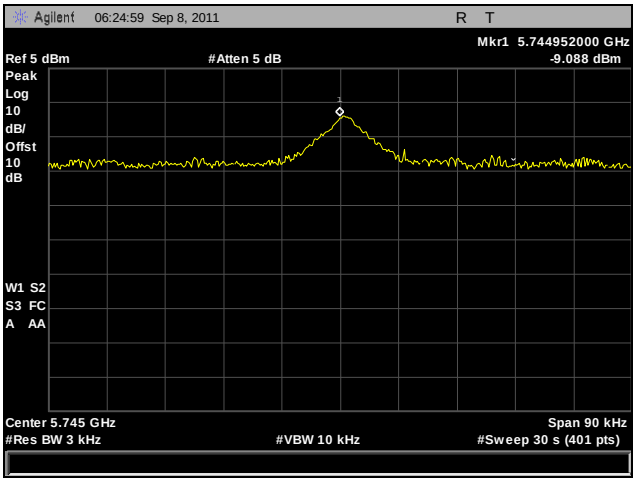


Plot 268. Peak Power Spectral Density, High Channel, 802.11a, Port A

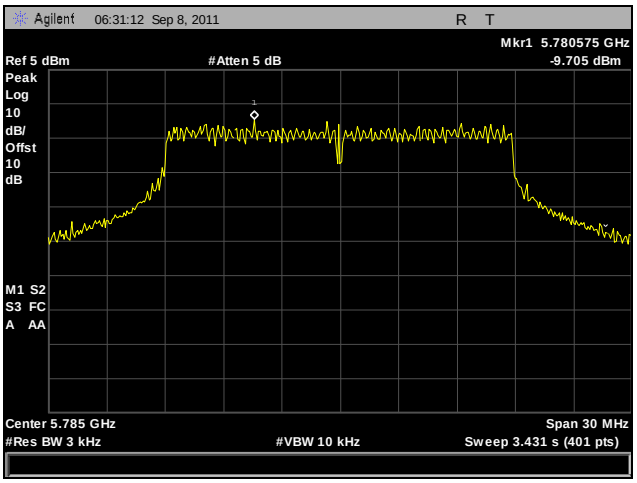
Peak Power Spectral Density, 802.11a 20 MHz Port A



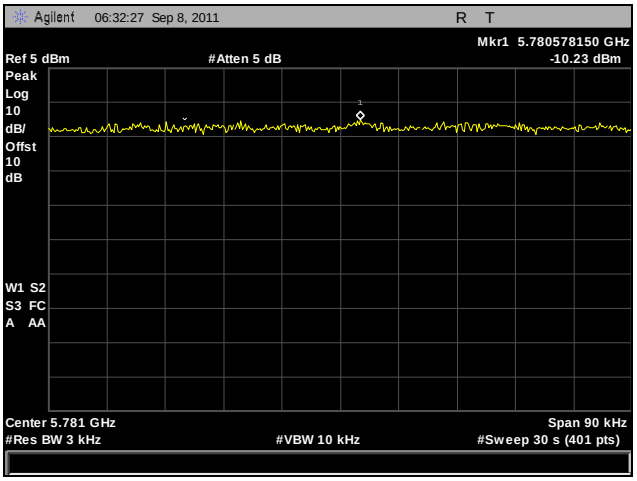
Plot 269. Peak Power Spectral Density, Low Channel, 802.11a 20 MHz, Port A, Determination



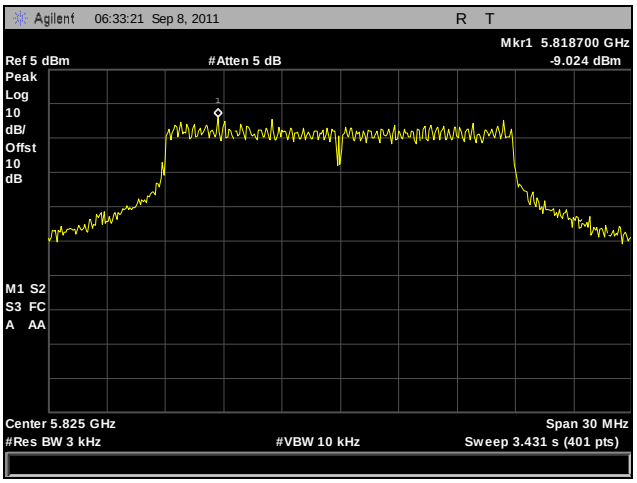
Plot 270. Peak Power Spectral Density, Low Channel, 802.11a 20 MHz, Port A



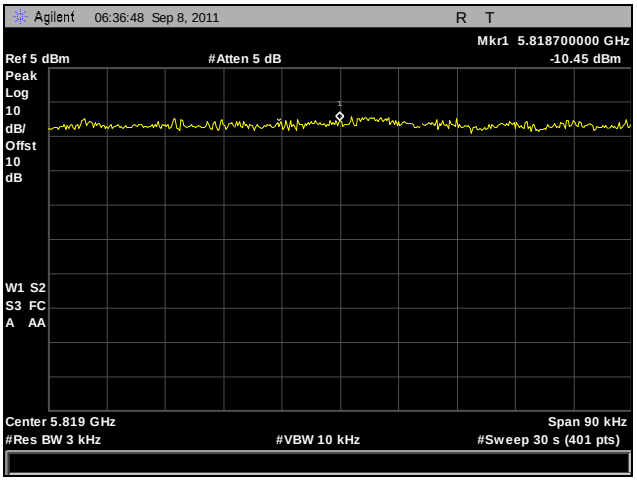
Plot 271. Peak Power Spectral Density, Mid Channel, 802.11a 20 MHz, Port A, Determination



Plot 272. Peak Power Spectral Density, Mid Channel, 802.11a 20 MHz, Port A

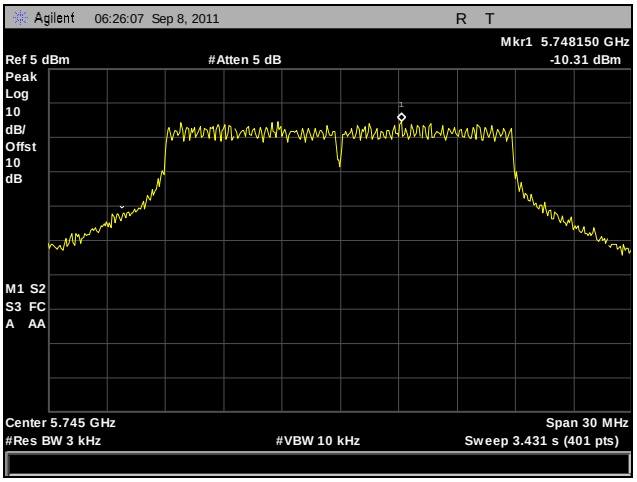


Plot 273. Peak Power Spectral Density, High Channel, 802.11a 20 MHz, Port A, Determination

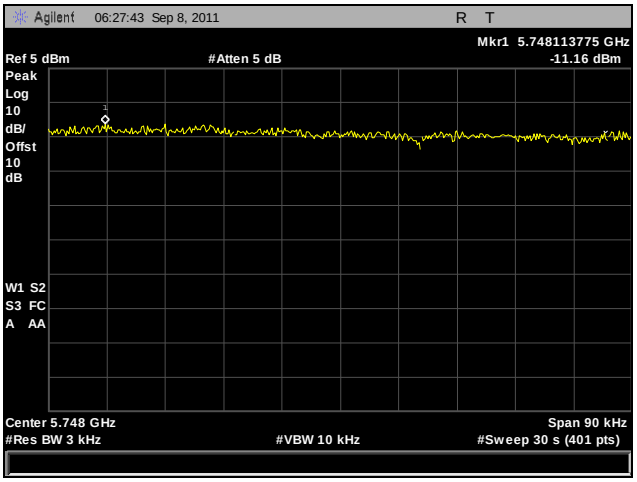


Plot 274. Peak Power Spectral Density, High Channel, 802.11a 20 MHz, Port A

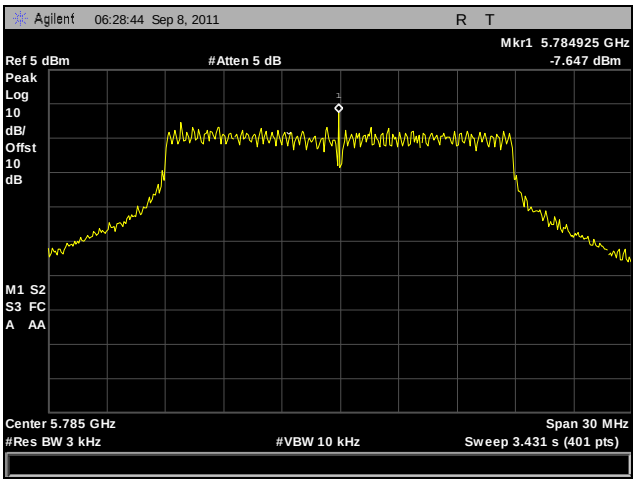
Peak Power Spectral Density, 802.11a 20 MHz Port B



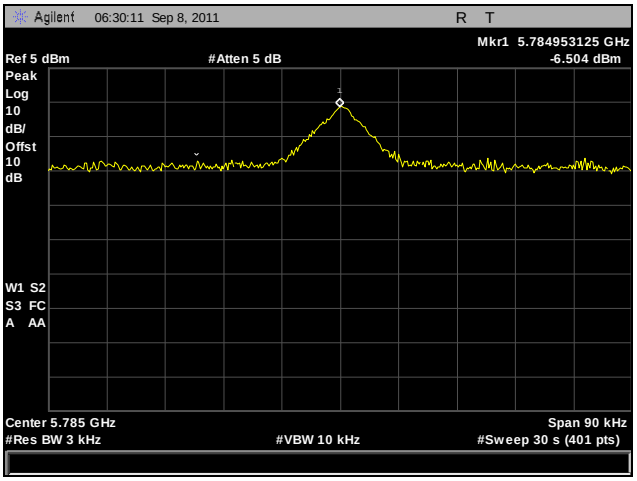
Plot 275. Peak Power Spectral Density, Low Channel, 802.11a 20 MHz, Port B, Determination



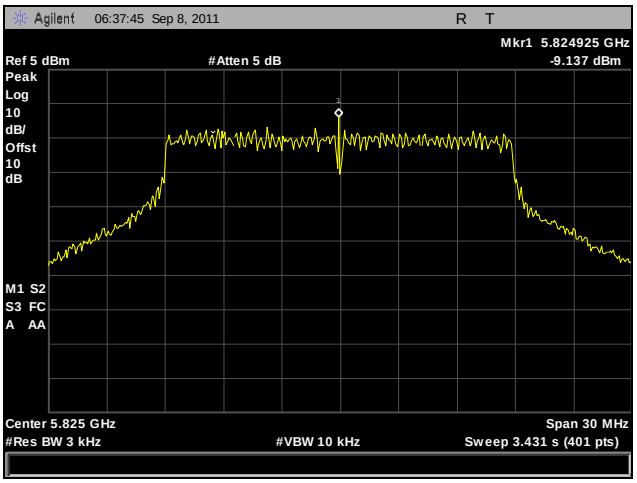
Plot 276. Peak Power Spectral Density, Low Channel, 802.11a 20 MHz, Port B



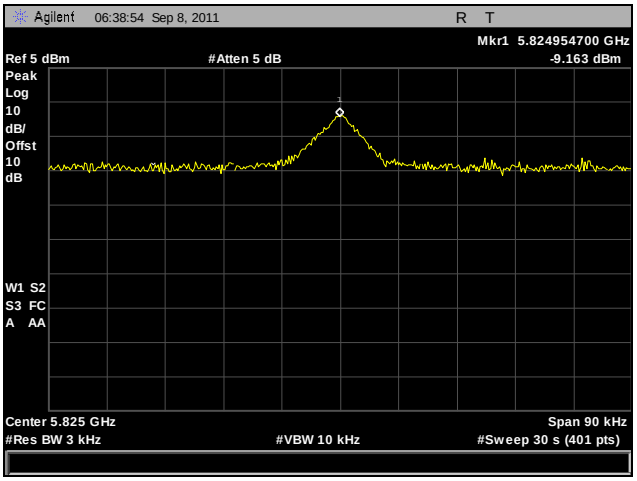
Plot 277. Peak Power Spectral Density, Mid Channel, 802.11a 20 MHz, Port B, Determination



Plot 278. Peak Power Spectral Density, Mid Channel, 802.11a 20 MHz, Port B

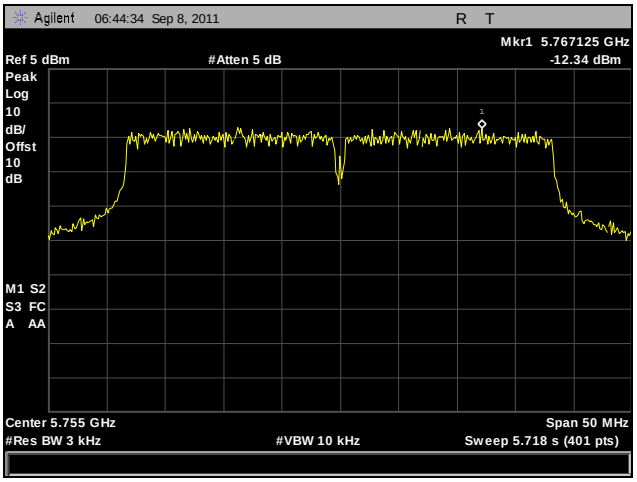


Plot 279. Peak Power Spectral Density, High Channel, 802.11a 20 MHz, Port B, Determination

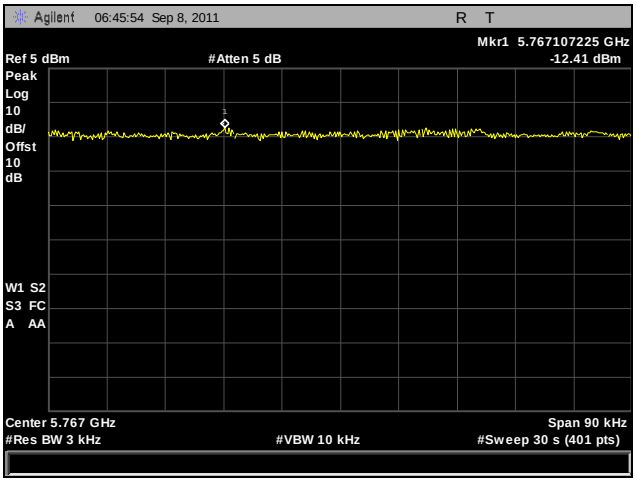


Plot 280. Peak Power Spectral Density, High Channel, 802.11a 20 MHz, Port B

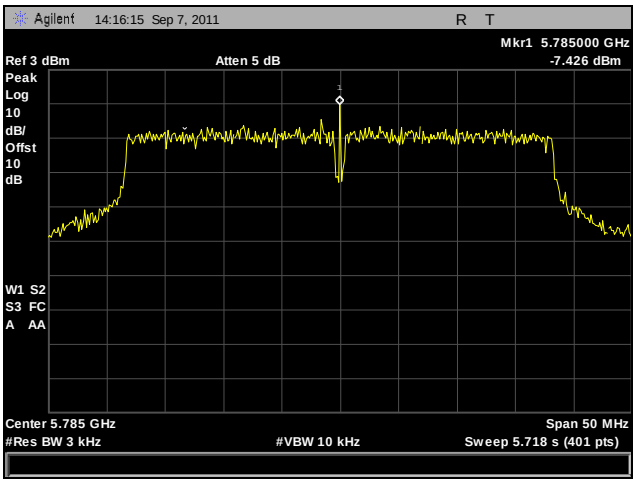
Peak Power Spectral Density, 802.11a 40 MHz Port A



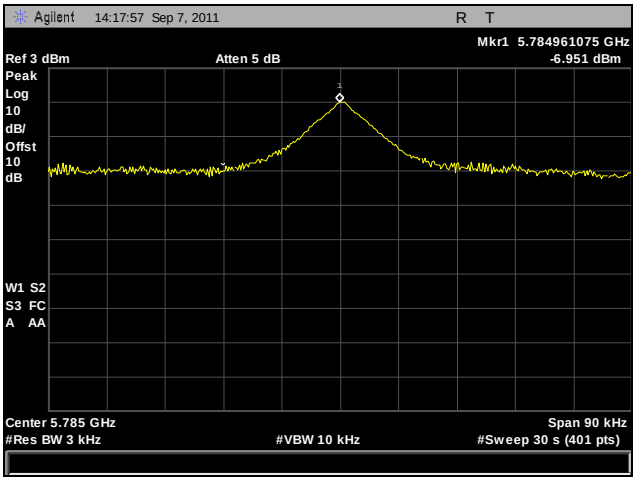
Plot 281. Peak Power Spectral Density, Low Channel, 802.11a 40 MHz, Port A, Determination



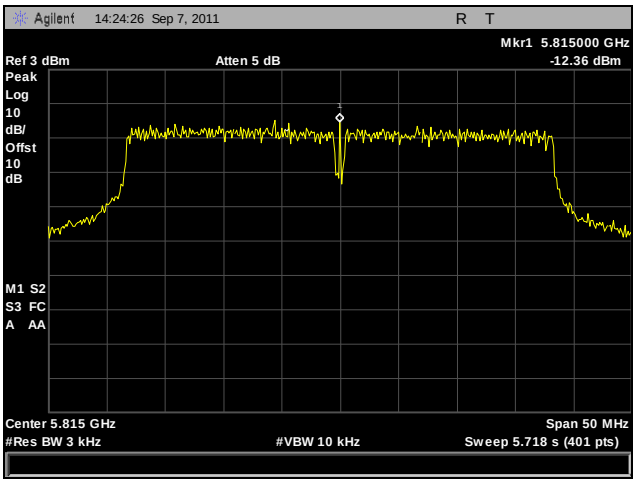
Plot 282. Peak Power Spectral Density, Low Channel, 802.11a 40 MHz, Port A



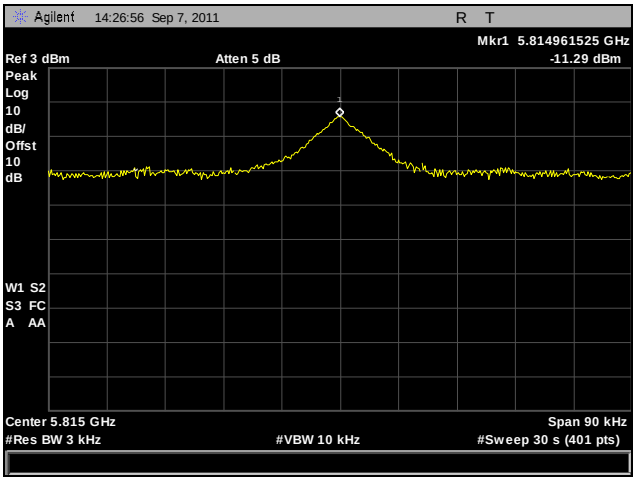
Plot 283. Peak Power Spectral Density, Mid Channel, 802.11a 40 MHz, Port A, Determination



Plot 284. Peak Power Spectral Density, Mid Channel, 802.11a 40 MHz, Port A

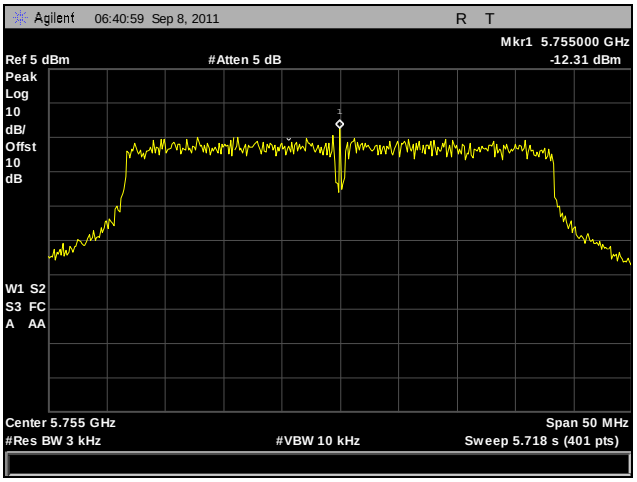


Plot 285. Peak Power Spectral Density, High Channel, 802.11a 40 MHz, Port A, Determination

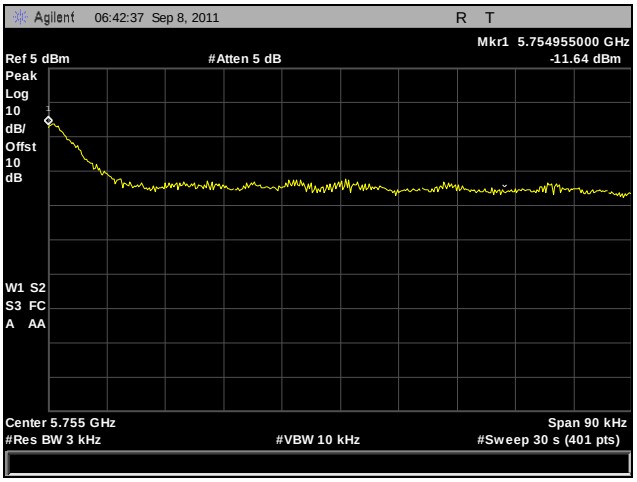


Plot 286. Peak Power Spectral Density, High Channel, 802.11a 40 MHz, Port A

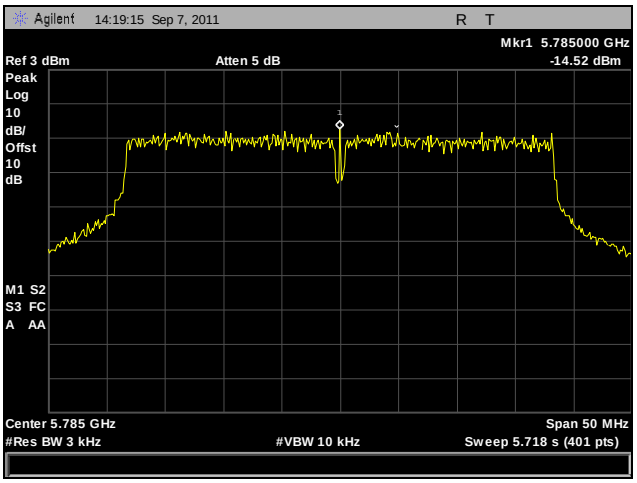
Peak Power Spectral Density, 802.11a 40 MHz Port B



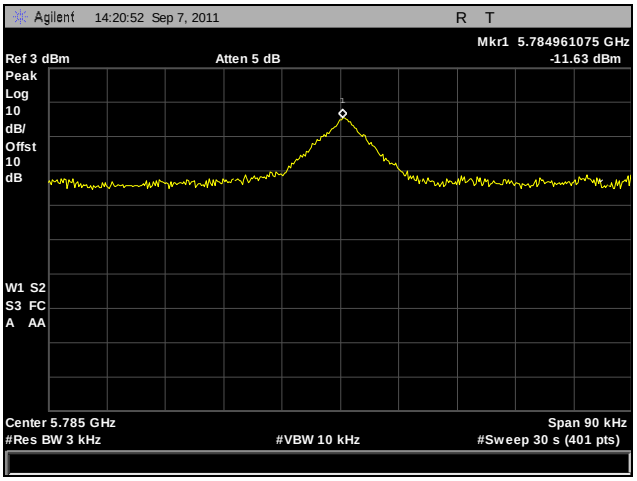
Plot 287. Peak Power Spectral Density, Low Channel, 802.11a 40 MHz, Port B, Determination



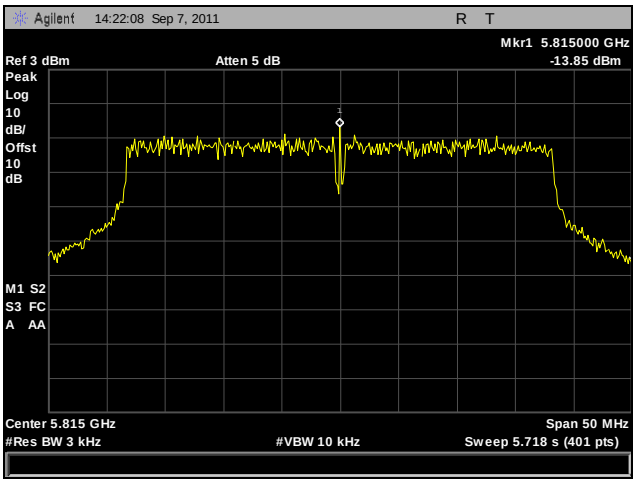
Plot 288. Peak Power Spectral Density, Low Channel, 802.11a 40 MHz, Port B



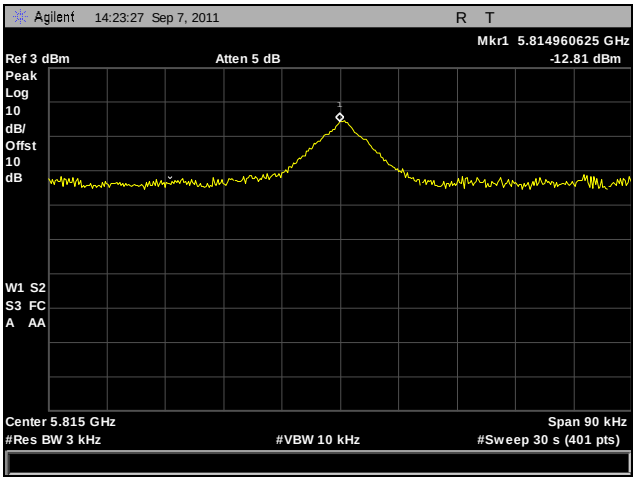
Plot 289. Peak Power Spectral Density, Mid Channel, 802.11a 40 MHz, Port B, Determination



Plot 290. Peak Power Spectral Density, Mid Channel, 802.11a 40 MHz, Port B

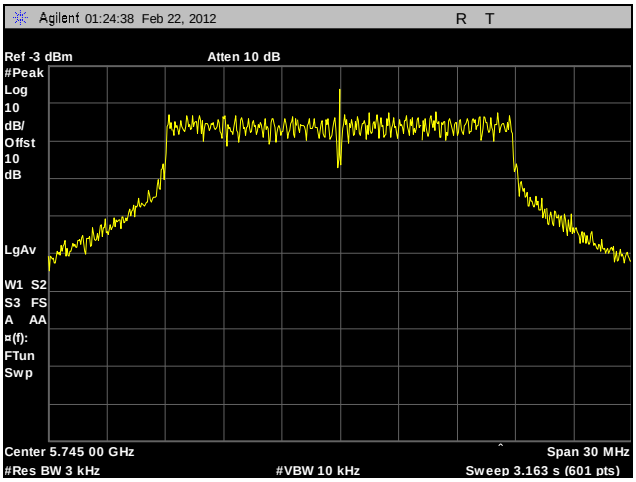


Plot 291. Peak Power Spectral Density, High Channel, 802.11a 40 MHz, Port B, Determination

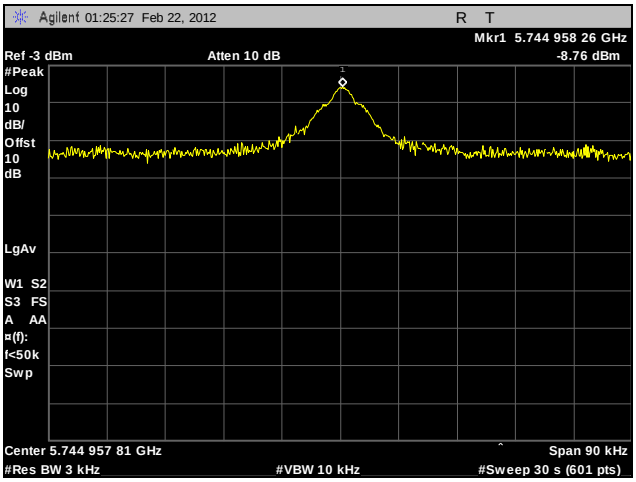


Plot 292. Peak Power Spectral Density, High Channel, 802.11a 40 MHz, Port B

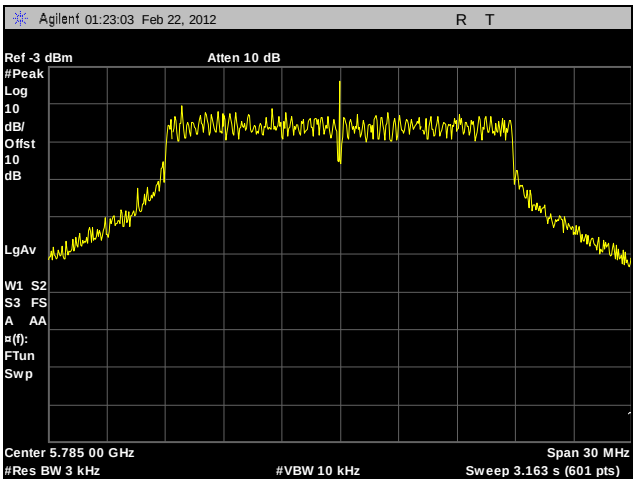
Peak Power Spectral Density, 802.11a Port A, Sector Antenna



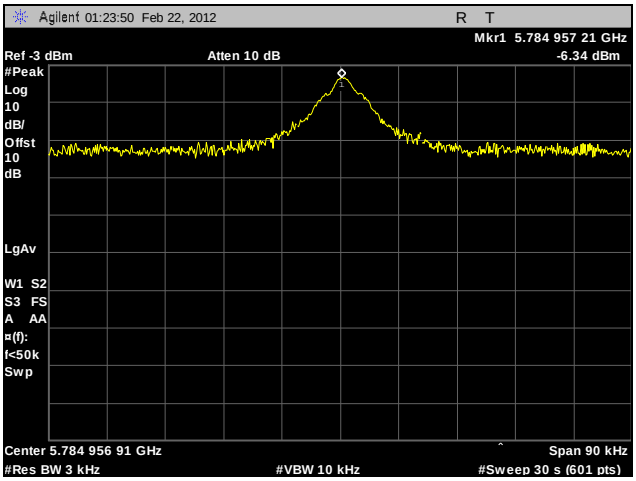
Plot 293. Peak Power Spectral Density, Low Channel, 802.11a, Port A, Sector Antenna, Determination



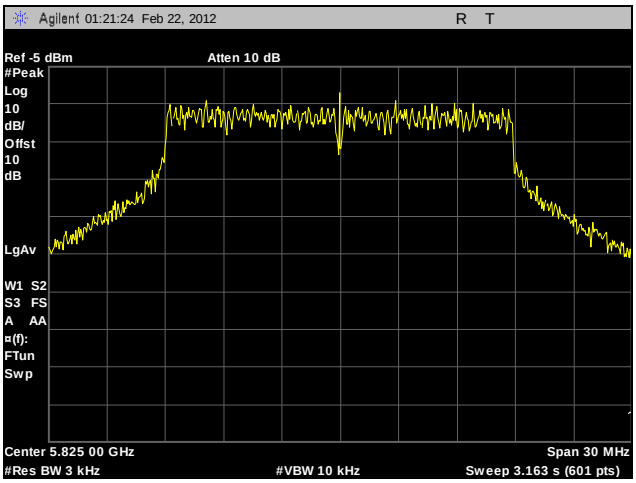
Plot 294. Peak Power Spectral Density, Low Channel, 802.11a, Port A, Sector Antenna



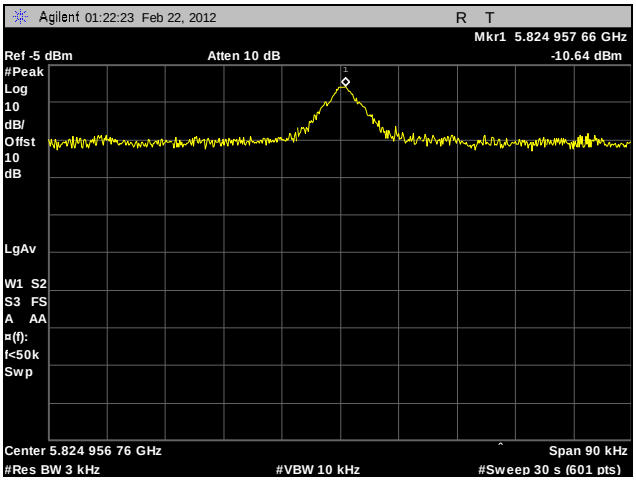
Plot 295. Peak Power Spectral Density, Mid Channel, 802.11a, Port A, Sector Antenna, Determination



Plot 296. Peak Power Spectral Density, Mid Channel, 802.11a, Port A, Sector Antenna

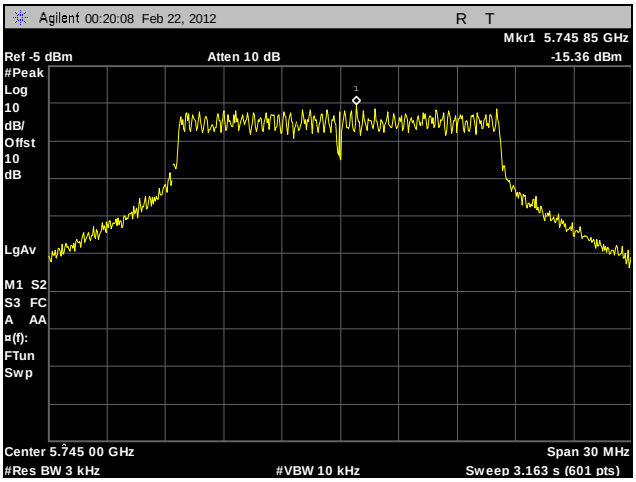


Plot 297. Peak Power Spectral Density, High Channel, 802.11a, Port A, Sector Antenna, Determination

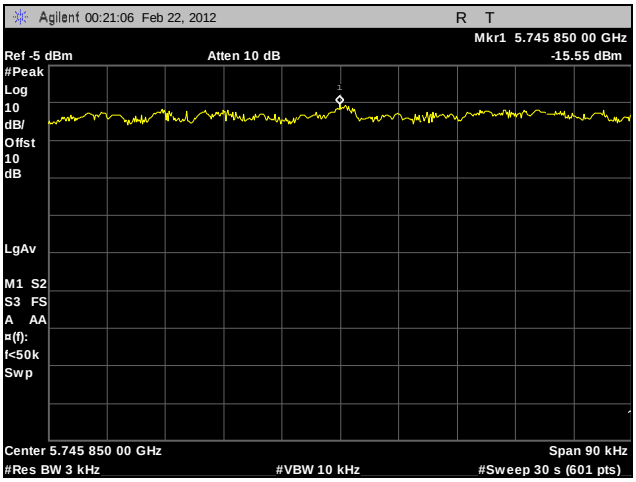


Plot 298. Peak Power Spectral Density, High Channel, 802.11a, Port A, Sector Antenna

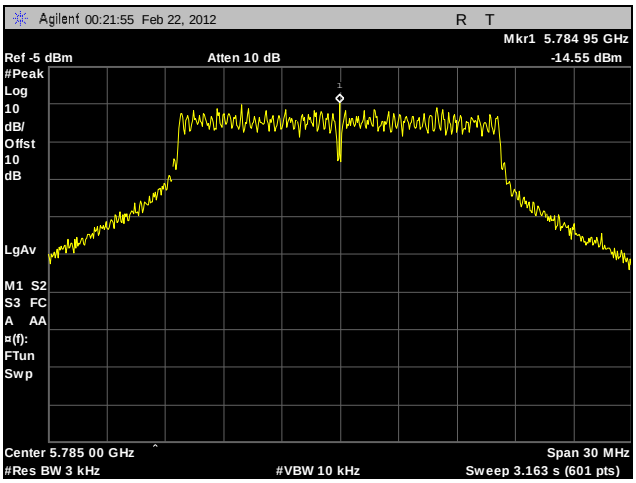
Peak Power Spectral Density, 802.11a 20 MHz Port A, Sector Antenna



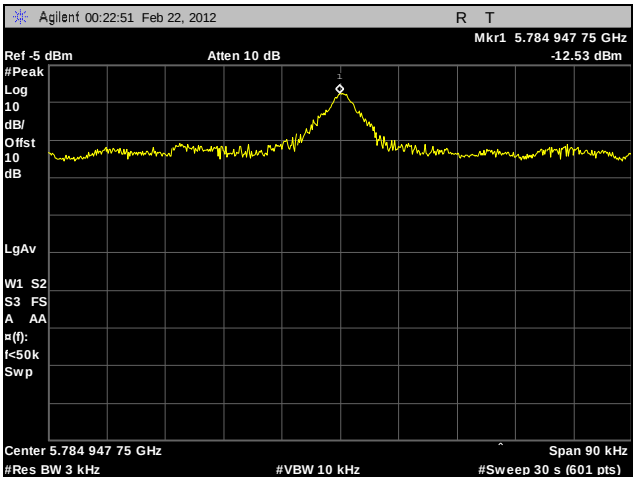
Plot 299. Peak Power Spectral Density, Low Channel, 802.11a 20 MHz, Port A, Sector Antenna, Determination



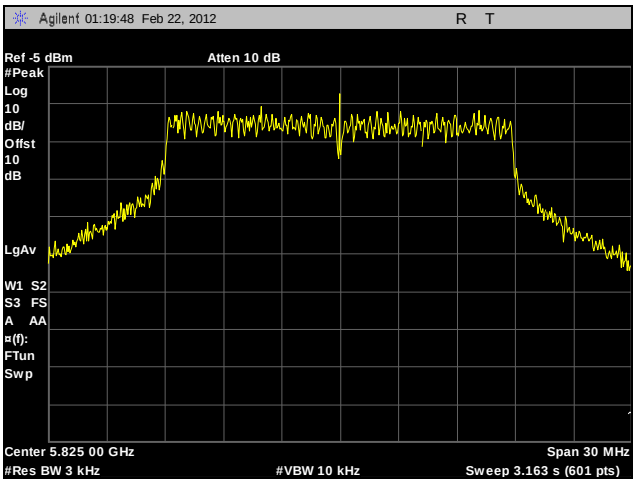
Plot 300. Peak Power Spectral Density, Low Channel, 802.11a 20 MHz, Port A, Sector Antenna



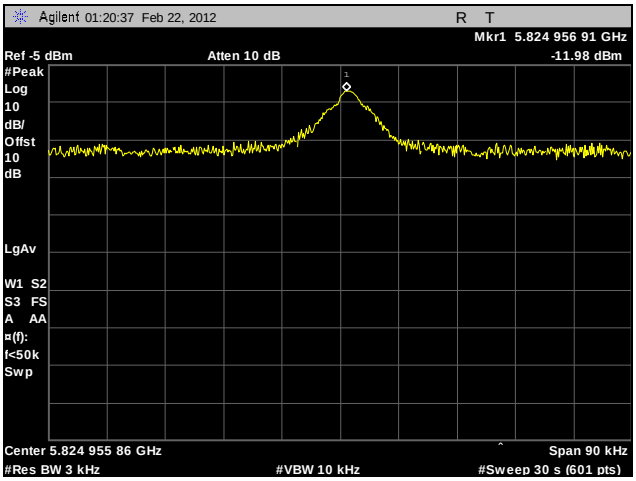
Plot 301. Peak Power Spectral Density, Mid Channel, 802.11a 20 MHz, Port A, Sector Antenna, Determination



Plot 302. Peak Power Spectral Density, Mid Channel, 802.11a 20 MHz, Port A, Sector Antenna

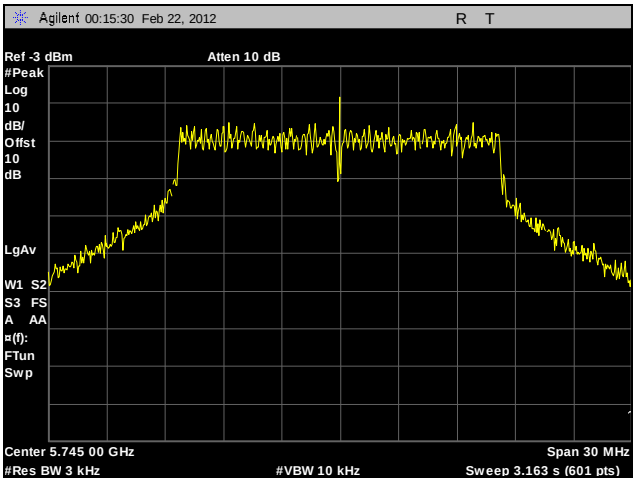


Plot 303. Peak Power Spectral Density, High Channel, 802.11a 20 MHz, Port A, Sector Antenna, Determination

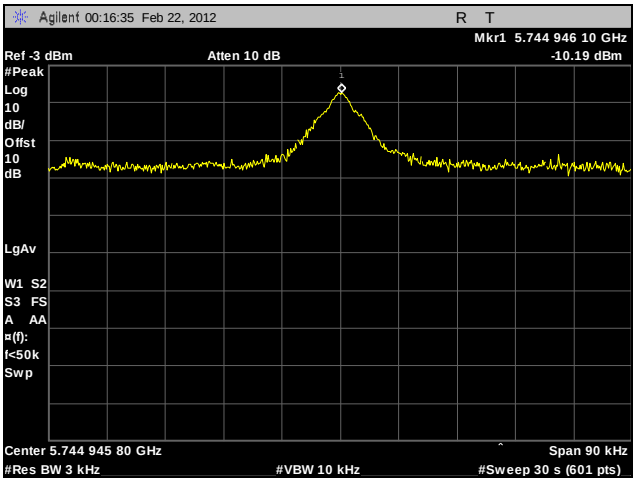


Plot 304. Peak Power Spectral Density, High Channel, 802.11a 20 MHz, Port A, Sector Antenna

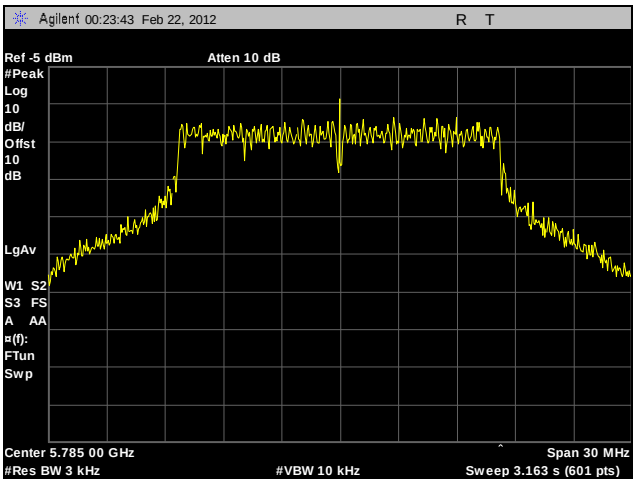
Peak Power Spectral Density, 802.11a 20 MHz Port B, Sector Antenna



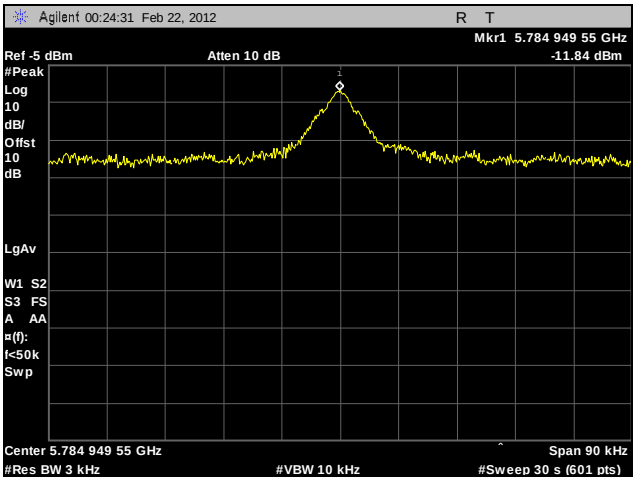
Plot 305. Peak Power Spectral Density, Low Channel, 802.11a 20 MHz, Port B, Sector Antenna, Determination



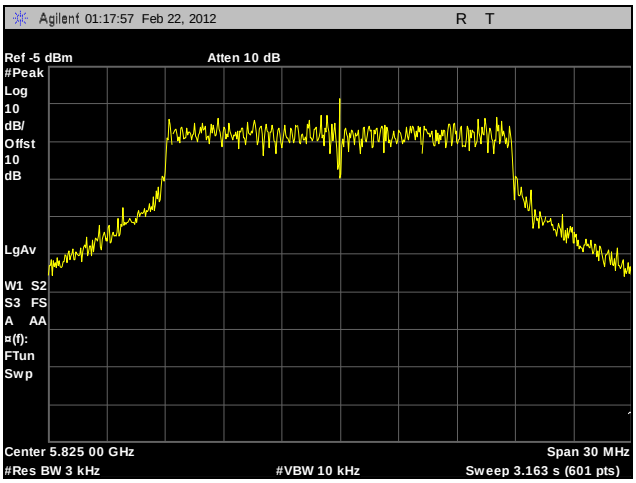
Plot 306. Peak Power Spectral Density, Low Channel, 802.11a 20 MHz, Port B, Sector Antenna



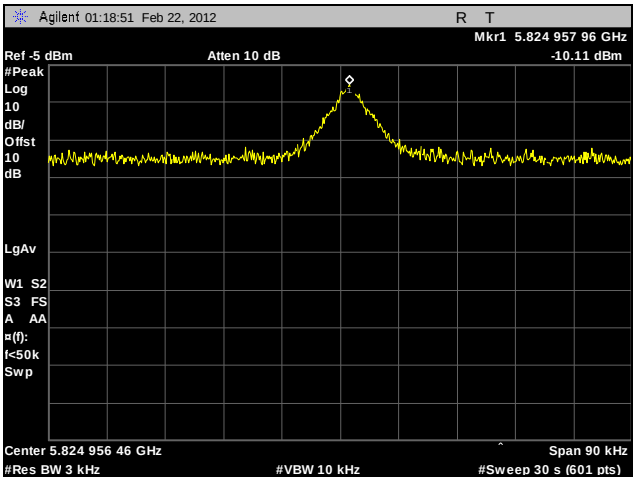
Plot 307. Peak Power Spectral Density, Mid Channel, 802.11a 20 MHz, Port B, Sector Antenna, Determination



Plot 308. Peak Power Spectral Density, Mid Channel, 802.11a 20 MHz, Port B, Sector Antenna

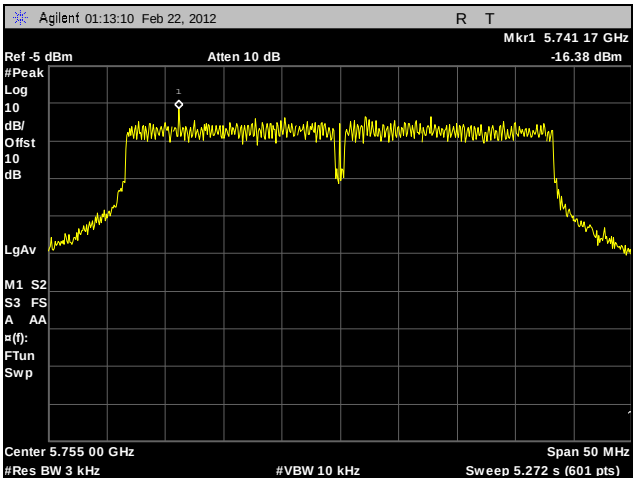


Plot 309. Peak Power Spectral Density, High Channel, 802.11a 20 MHz, Port B, Sector Antenna, Determination

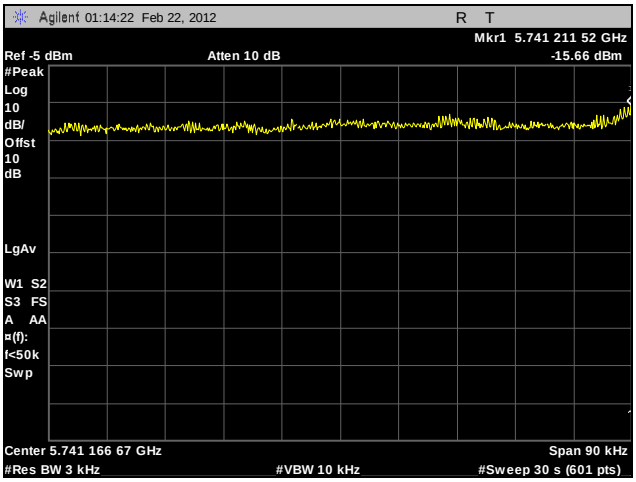


Plot 310. Peak Power Spectral Density, High Channel, 802.11a 20 MHz, Port B, Sector Antenna

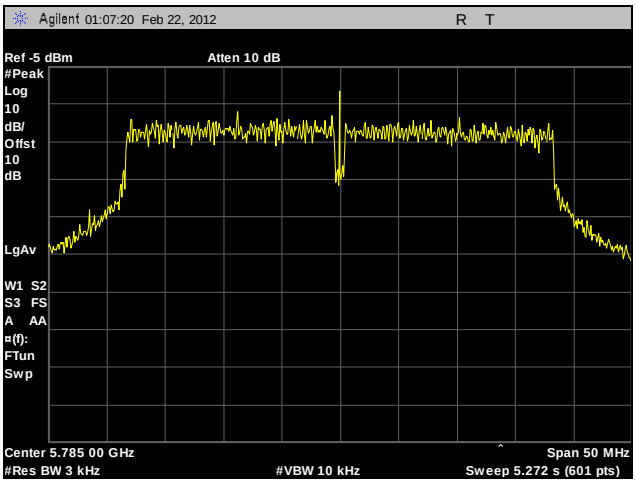
Peak Power Spectral Density, 802.11a 40 MHz Port A, Sector Antenna



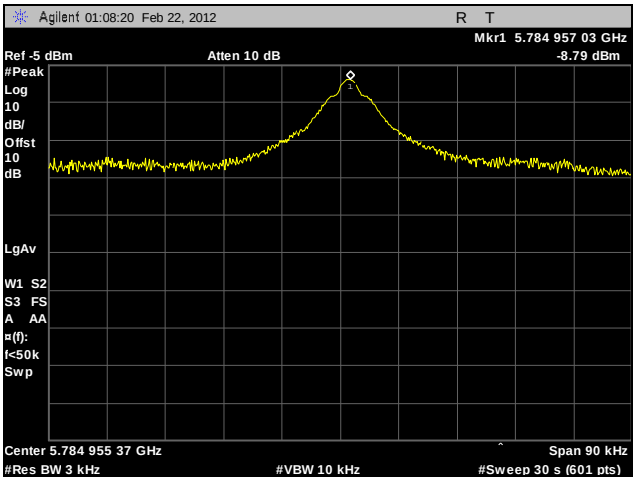
Plot 311. Peak Power Spectral Density, Low Channel, 802.11a 40 MHz, Port A, Sector Antenna, Determination



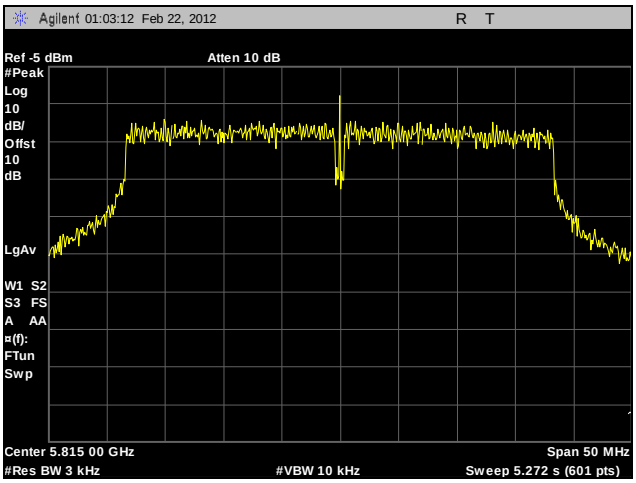
Plot 312. Peak Power Spectral Density, Low Channel, 802.11a 40 MHz, Port A, Sector Antenna



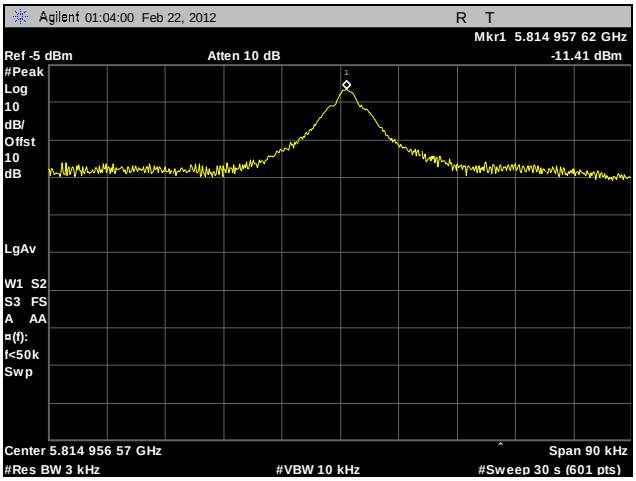
Plot 313. Peak Power Spectral Density, Mid Channel, 802.11a 40 MHz, Port A, Sector Antenna, Determination



Plot 314. Peak Power Spectral Density, Mid Channel, 802.11a 40 MHz, Port A, Sector Antenna

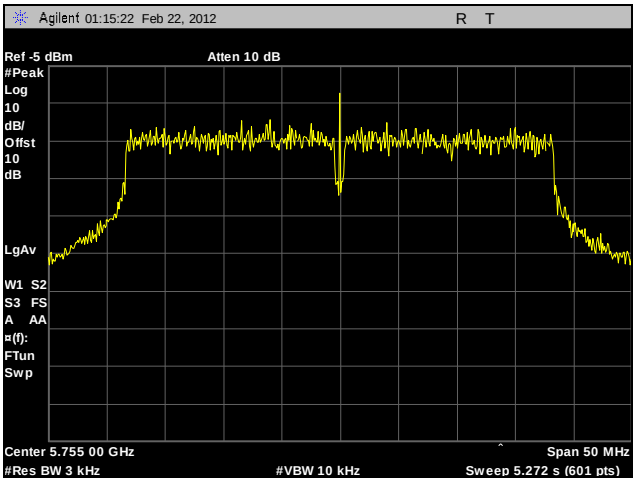


Plot 315. Peak Power Spectral Density, High Channel, 802.11a 40 MHz, Port A, Sector Antenna, Determination

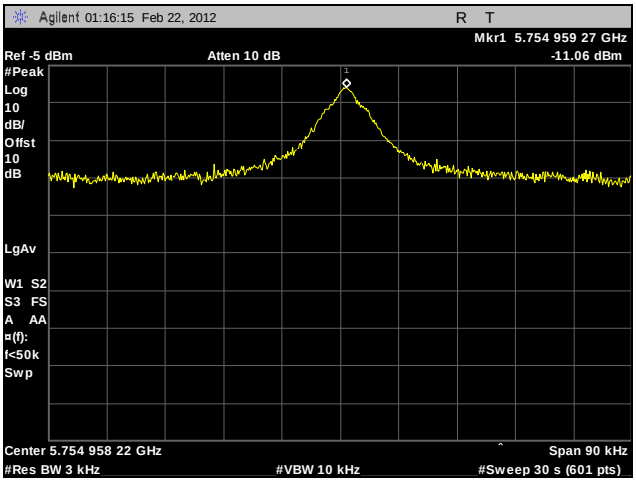


Plot 316. Peak Power Spectral Density, High Channel, 802.11a 40 MHz, Port A, Sector Antenna

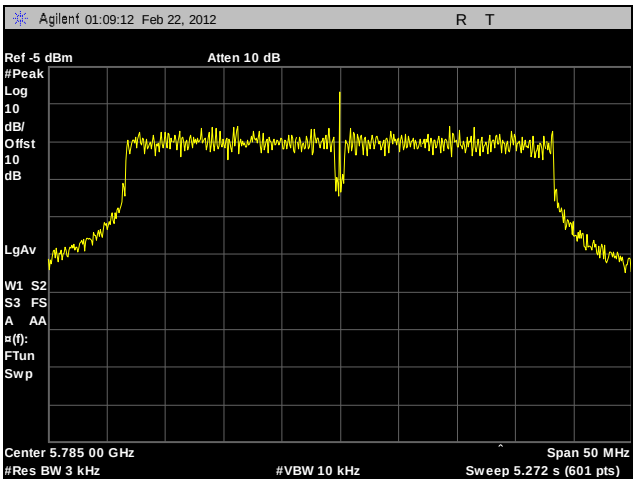
Peak Power Spectral Density, 802.11a 40 MHz Port B, Sector Antenna



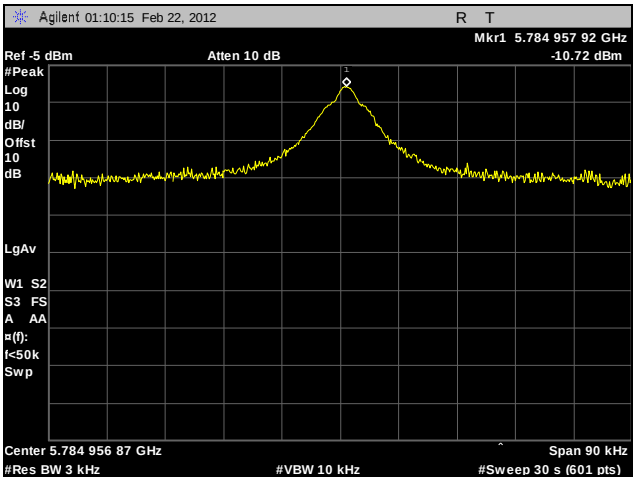
Plot 317. Peak Power Spectral Density, Low Channel, 802.11a 40 MHz, Port B, Sector Antenna, Determination



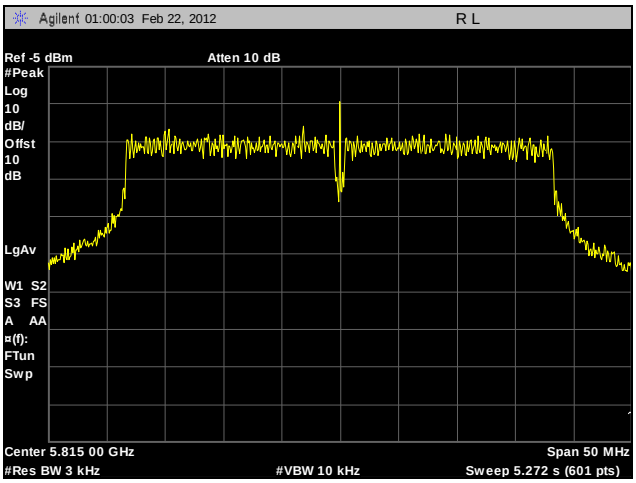
Plot 318. Peak Power Spectral Density, Low Channel, 802.11a 40 MHz, Port B, Sector Antenna



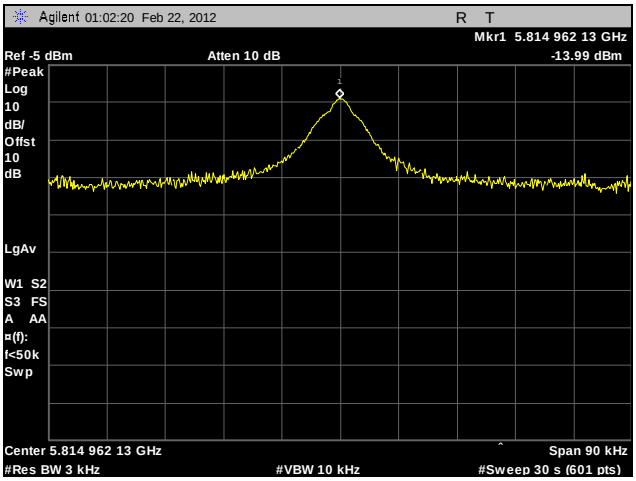
Plot 319. Peak Power Spectral Density, Mid Channel, 802.11a 40 MHz, Port B, Sector Antenna, Determination



Plot 320. Peak Power Spectral Density, Mid Channel, 802.11a 40 MHz, Port B, Sector Antenna



Plot 321. Peak Power Spectral Density, High Channel, 802.11a 40 MHz, Port B, Sector Antenna, Determination



Plot 322. Peak Power Spectral Density, High Channel, 802.11a 40 MHz, Port B, Sector Antenna

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(i) Maximum Permissible 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 @ 5725-5850 MHz; highest conducted power = 25.88*dBm* (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

Gain of Omni Antenna @ 5.8GHz = 10 dBi

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

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

where, S = Power Density (mW/cm^2)
P = Power Input to antenna (387.51mW)
G = Numeric Antenna Gain (10)
R = Radius (20 cm)

S = (387.51 * 10)/(4*3.14*20^2) = 0.771 mW/cm^2, when 10 dBi antenna is used
Gain of Sector Antenna @ 5.8GHz = 15.5 dBi
Maximum Allowable Conducted Power given 15.5 dBi Antenna = 20.5 dBm

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

where, S = Power Density (mW/cm^2)
P = Power Input to antenna (112.20 mW)
G = Numeric Antenna Gain (35.48)
R = Radius (20 cm)

S = (112.20 * 35.48)/(4*3.14*20^2) = 0.792 mW/cm^2, when 15.5 dBi antenna is used

Electromagnetic Compatibility Criteria for Intentional Radiators

RSS-GEN Receiver Spurious Emissions Requirements

Test Requirements: The following receiver spurious emission limits shall be complied with:

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 26.

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

Table 26. Spurious Emission Limits for Receivers

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

Test Procedures: The EUT was programmed for receive mode only. Conducted measurements were taken at the antenna port of the EUT. 100 kHz resolution bandwidth was used from 30 MHz - 1 GHz and 300 kHz resolution was used for measurements done above 1 GHz. All plots are corrected for cable loss.

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

Test Engineer(s): Jeff Pratt

Test Date(s): 10/04/11

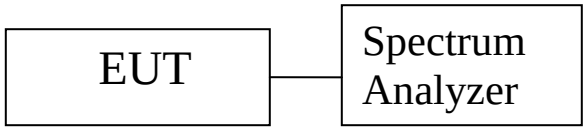
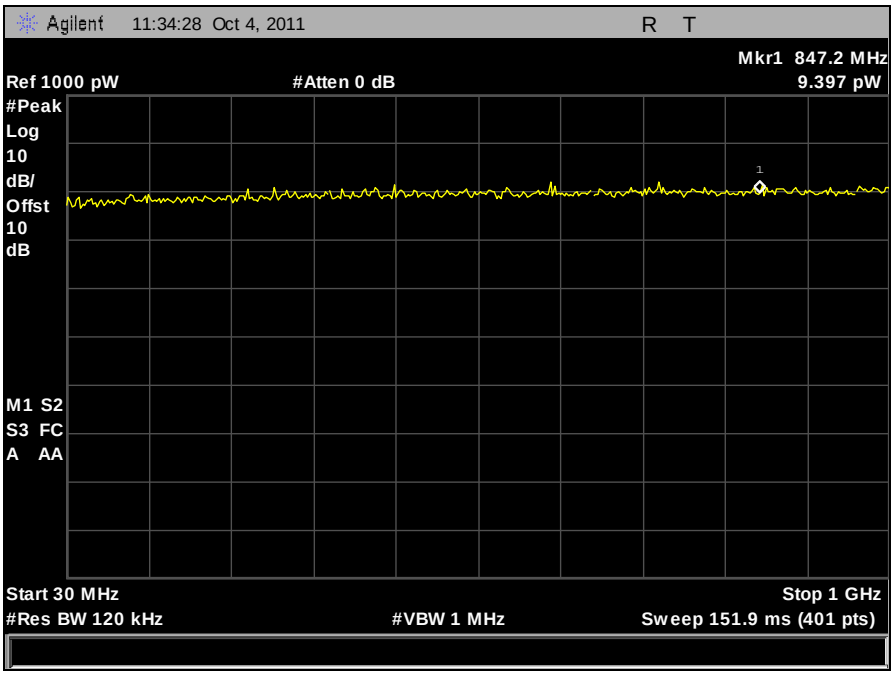
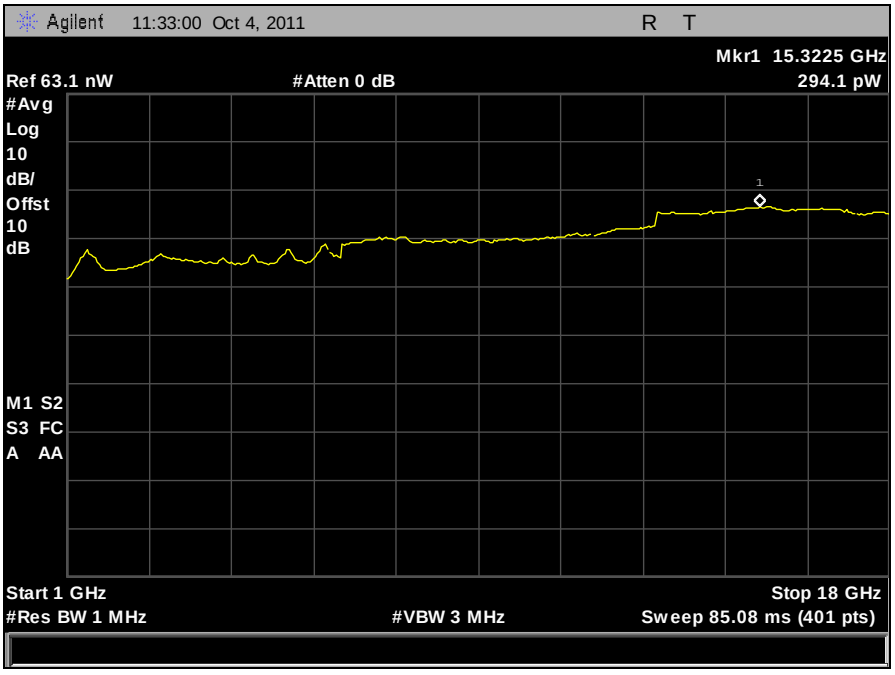


Figure 5. Block Diagram, Conducted Receiver Spurious Emissions Test Setup

Conducted Receiver Spurious Emissions, Port A

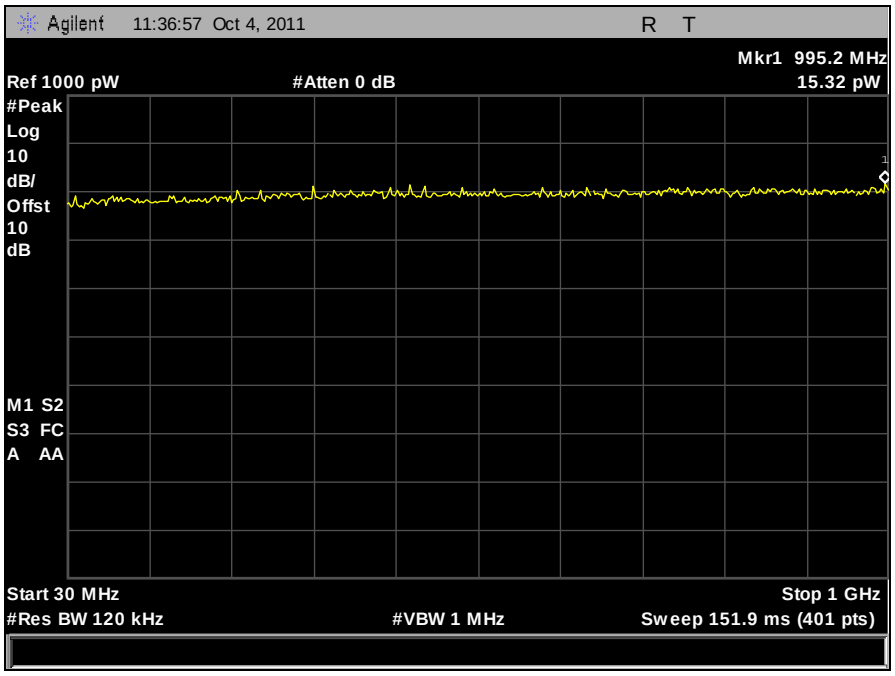


Plot 323. Receiver Spurious Emission, 30 MHz – 1 GHz, Port A

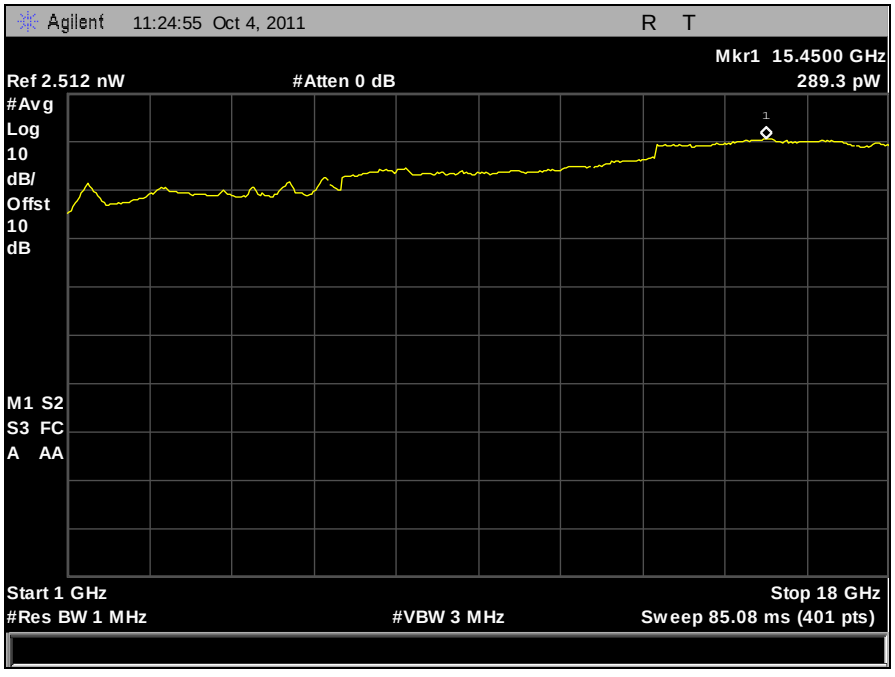


Plot 324. Receiver Spurious Emission, 1 GHz – 18 GHz, Port A

Conducted Receiver Spurious Emissions, Port B



Plot 325. Receiver Spurious Emission, 30 MHz – 1 GHz, Port B



Plot 326. Receiver Spurious Emission, 1 GHz – 18 GHz, Port B

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
1T4771	SPECTRUM ANALYZER	AGILENT	E4446A	6/25/2011	6/25/2012
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4612	SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4407B	10/27/2010	10/27/2011
1T4483	ANTENNA; HORN	ETS-LINDGREN	3117	7/19/2011	7/19/2012
1T4745	ANTENNA, HORN	ETS-LINDGREN	3116	10/4/2011	10/4/2012
1T4751	ANTENNA – BILOG	SUNOL SCIENCES	JB6	11/3/2010	11/3/2011
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	6/14/2011	6/14/2012
1T4565	LISN (24 AMP)	SOLAR ELECTRONICS	9252-50-R-24-BNC	10/28/2010	10/28/2011
1T4752	PRE-AMPLIFIER	MITEQ	JS44-18004000-35-8P	SEE NOTE	
1T4394	ISOLATION TRANSFORMER	TOPAZ	91005-31	SEE NOTE	
1T4563	LISN (24 AMP)	SOLAR ELECTRONICS	9252-50-R-24-BNC	10/6/2010	10/6/2011
1T2109	RECEIVER, EMI, RECEIVER SECTION	HEWLETT PACKARD	85462A	1/7/2011	1/7/2012
1T2108	RECEIVER, EMI, FILTER SECTION	HEWLETT PACKARD	85460A	1/7/2011	1/7/2012
1T4728	PROGRAMMABLE AC POWER SOURCE	QUADTECH	31010	SEE NOTE	
1T4502	COMB GENERATOR	COM-POWER	CGC-255	10/6/2010	10/6/2011
1T4634	THERMO/HYGRO/BAROMETER	CONTROL COMPANY	02-401	3/11/2010	3/11/2012
1T4758	THERMO-HYGROMETER	CONTROL COMPANY	4040	5/21/2010	5/21/2012
1T4568	RADIATING NOISE SOURCE	MET LABORATORIES	N/A	SEE NOTE	

Table 27. 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

1. Label and User's Manual Information

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

§ 15.19 Labeling requirements.

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

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

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

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

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

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

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

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

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

§ 15.21 Information to user.

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

Verification & User's Manual Information

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

§ 15.105 Information to the user.

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

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

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

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

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

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

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

ICES-003 Procedural & Labeling Requirements

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

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

Procedural Requirements:

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

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

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

Labeling Requirements:

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

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

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

End of Report