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January 26, 2015

Meru Networks, Inc.
894 Ross Dr.
Sunnyvale, CA 94089

Dear Rajendran Chary,

Enclosed is the EMC Wireless test report for compliance testing of the Meru Networks, Inc., Broad Peak (AP121 & AP122) as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Title 47 of the CFR, Part 15, Subpart B for Unintentional Radiators and Part 15.407 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: (\Meru Networks, Inc.\EMCS42577B-FCC407 (UNII 2) Rev. 1)

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Electromagnetic Compatibility Criteria Test Report

for the

**Meru Networks, Inc.
Model Broad Peak (AP121 & AP122)**

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B
for Class B Digital Devices
&
FCC Part 15.407 for Intentional Radiators

MET Report: EMCS42577B-FCC407 (UNII 2) Rev. 1

January 26, 2015

Prepared For:

**Meru Networks, Inc.
894 Ross Dr.
Sunnyvale, CA 94089**

Prepared By:
MET Laboratories, Inc.
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Baltimore, MD 21230

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&
FCC Part 15.407 for Intentional Radiators



Ben Taylor, Project Engineer
Electromagnetic Compatibility Lab



Jennifer Warnell
Documentation Department

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



Asad Bajwa,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	January 16, 2015	Initial Issue.
1	January 26, 2015	Revised to reflect engineer corrections.

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List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
<i>d</i>	Measurement Distance
dB	Decibels
dB μ A	Decibels above one microamp
dB μ V	Decibels above one microvolt
dB μ A/m	Decibels above one microamp per meter
dB μ V/m	Decibels above one microvolt per meter
DC	Direct Current
E	Electric Field
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
EUT	Equipment Under Test
<i>f</i>	Frequency
FCC	Federal Communications Commission
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	kilohertz
kPa	kilopascal
kV	kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μ H	microhenry
μ	microfarad
μ s	microseconds
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
TWT	Traveling Wave Tube
V/m	Volts per meter
VCP	Vertical Coupling Plane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Meru Networks, Inc. Broad Peak (AP121 & AP122), with the requirements of Part 15, §15.407. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the Broad Peak (AP121 & AP122). Meru Networks, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Broad Peak (AP121 & AP122), has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.407, in accordance with Meru Networks, Inc., purchase order number 107001. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	Description	Results
§15.107	Conducted Emissions	Compliant
§15.109	Radiated Emissions	Compliant
§15.203	Antenna Requirements	Compliant
§15.207	AC Conducted Emissions 150KHz – 30MHz	Compliant
§15.403 (i)	26dB Occupied Bandwidth	Compliant
§15.407 (a)(2)	Conducted Transmitter Output Power	Compliant
§15.407 (a)(2)	Power Spectral Density	Compliant
§15.407 (b)(2), (3), (7)	Undesirable Emissions (15.205/15.209 - General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Compliant
§15.407(f)	RF Exposure	Compliant
§15.407(g)	Frequency Stability	Compliant
15.407 (h)(2)(ii)	Initial Channel Availability Check Time	Compliant
15.407 (h)	DFS Bandwidth	Compliant
15.407 (h)(2)(ii)	Radar Burst at the Beginning of Channel Availability Check Time	Compliant
15.407 (h)(2)(ii)	Radar Burst at the End of Channel Availability Check Time	Compliant
15.407 (h)(2)(iii)	Channel Move Time and Channel Closing Time	Compliant
15.407 (h)(2)(iv)	Non-Occupancy Period	Compliant
15.407 (h)(2)	Statistical Performance Check	Compliant

Table 1. Executive Summary of EMC Part 15.407 Compliance Testing

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Meru Networks, Inc. to perform testing on the Broad Peak (AP121 & AP122), under Meru Networks, Inc.'s purchase order number 107001.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Meru Networks, Inc. Broad Peak (AP121 & AP122).

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

Model(s) Tested:	Broad Peak (AP121)		
Model(s) Covered:	Broad Peak (AP121 & AP122)		
EUT Specifications:	Primary Power: 120 VAC, 60 Hz		
	FCC ID: RE7-AP122 IC: 6749A-AP8122		
	Type of Modulations:	OFDM	
	Equipment Code:	NII	
	Peak RF Output Power:	20.76 dBm	
	EUT Frequency Ranges:	5260-5320; 5500-5700 MHz (20 MHz) 5270-5310; 5510-5670 MHz (40 MHz) 5290-5290; 5530-5610 MHz (80 MHz)	
Analysis:	The results obtained relate only to the item(s) tested.		
Environmental Test Conditions:	Temperature: 15-35° C		
	Relative Humidity: 30-60%		
	Barometric Pressure: 860-1060 mbar		
Evaluated by:	Ben Taylor		
Report Date(s):	January 26, 2015		

Table 2. EUT Summary

B. References

CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
CFR 47, Part 15, Subpart E	Unlicensed National Information Infrastructure Devices (UNII)
RSS-210, Issue 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 5 August 2012	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
ISO/IEC 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories
ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices

Table 3. References

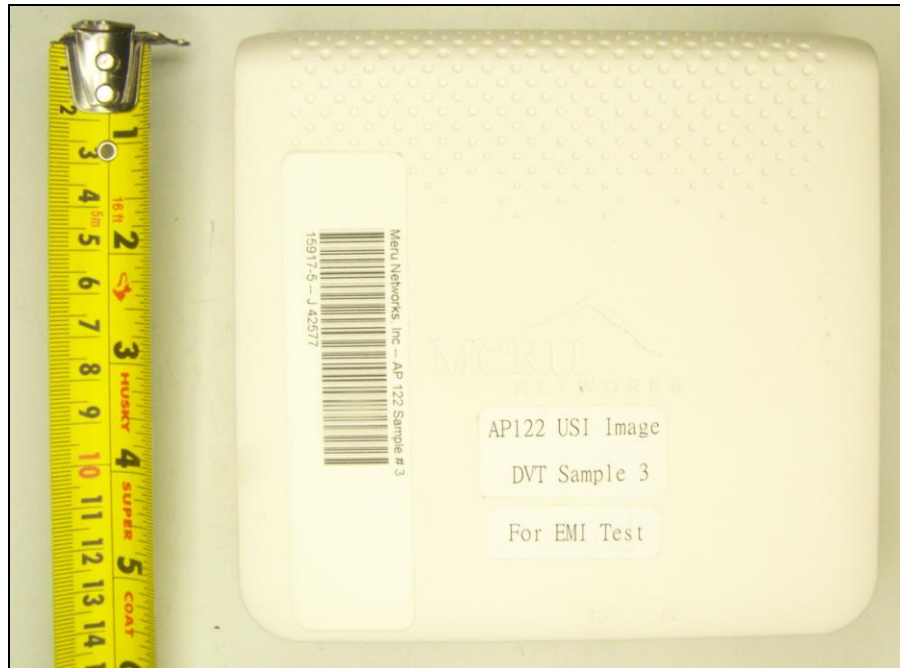
C. Test Site

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

Radiated Emissions measurements were performed in a 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 Meru Networks, Inc. Broad Peak (AP121 & AP122), Equipment Under Test (EUT), is an 802.11AC wireless access point (WAP) that allows wireless devices to connect to a wired network using Wi-Fi, standard. The WAP usually connects to a router (via a wired network), and can relay data between the wireless devices (such as computers or printers) and wired devices on the network. This is an indoor AP.



Photograph 1. Meru Networks, Inc. Broad Peak (AP121 & AP122)

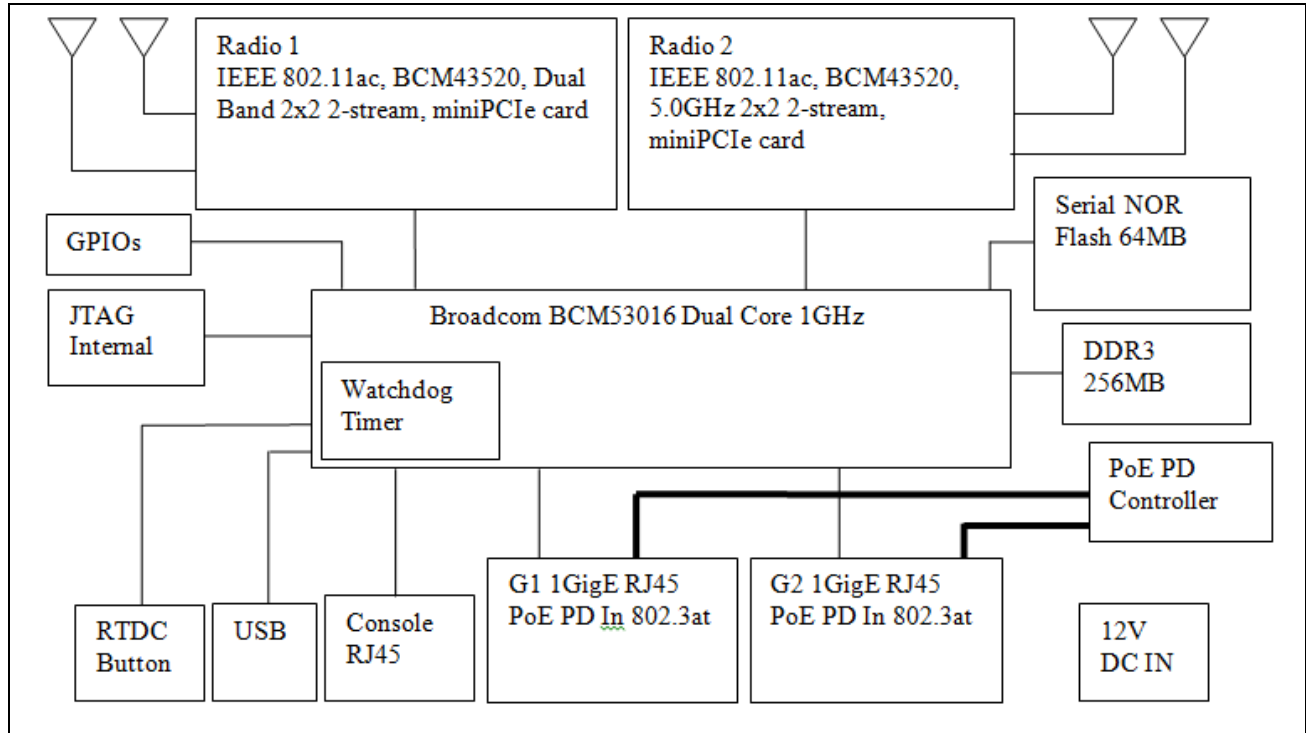


Figure 1. Block Diagram of Test Configuration

E. Equipment Configuration

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

Ref. ID	Name / Description	Model Number	Serial Number	Rev. #
1	Dual Radio Access Point	AP122	2914AP12216DCFD	Rev 1
2	Dual Radio Access Point	AP121	2914AP1210FF001	Rev 1

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	Power Design	PD-9001GR/AC
2	Laptop	IBM	IBM Thinkpad

Table 5. Support Equipment

SN	Meru Part Number	Description	Gain 2.4GHz/5.0GHz
1	RFA-25-P375-79-200RF	Internal PCB antenna (radio 1)	3 dBi at 2.4 GHz and 4dBi at 5 GHz
2	RFA-25-P375-70B-60RB	Internal PCB antenna (radio 2)	4dBi at 5 GHz

Table 6. Antenna List

G. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Max Length (m)	Shielded? (Y/N)	Termination Box ID & Port Name
1	Reset Console	dB9 Serial cable	1	1	--	Yes	To computer serial port or USB to Serial adapter
2	G1PoE	Data and Power Ethernet port	1	2	10	YES	To PoE injector or Ethernet switch
3	G2PoE	Data and Power Ethernet port	1	2	10	Yes	To PoE injector or Ethernet switch
4	12 DC	12 DV Audio jack	1	1	10	Yes	To DC adapter
5	A1, A3, A4 and A6	RPSMA to SMA co-axial cable	4	0.5	1	Yes	To power meter or spectrum Analyzer

Table 7. Ports and Cabling Information

H. Mode of Operation

During the normal operation the configuration is controlled by the Meru controller which sets the country code, ESSID, Operating frequency band and Channel etc.

I. Method of Monitoring EUT Operation

During the normal operation with controller Green or Blue LED indication on the Access point indicate the normal operation of the Access point. A Red LED indicates a failure of hardware or software settings.

J. 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.

K. Disposition of EUT

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

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria

§ 15.107 Conducted Emissions Limits

Test Requirement(s): **15.107 (a)** Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 8. 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 8. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

Frequency range (MHz)	Class A Conducted Limits (dB μ V)		*Class B Conducted Limits (dB μ V)	
	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.				

Table 8. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(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, test conditions, and test procedures of ANSI C63.4 were used. The EUT was powered through a 50 Ω /50 μ H LISN. An EMI receiver, connected to the measurement port of the LISN, scanned the frequency range from 150 kHz to 30 MHz in order to find the peak conducted emissions. All peak emissions within 6 dB of the limit were re-measured using a quasi-peak and/or average detector as appropriate.

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

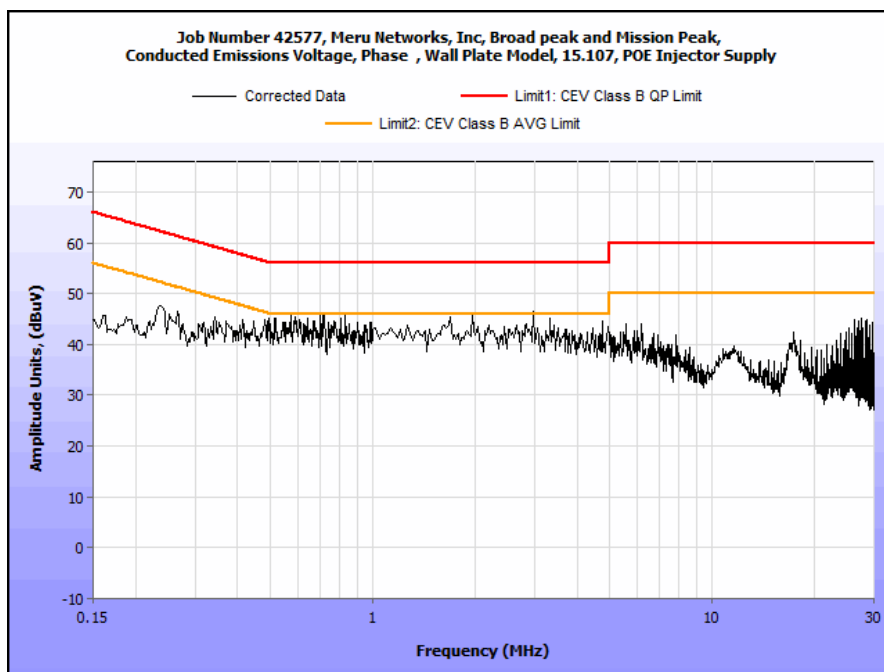
Test Engineer(s): Ben Taylor

Test Date(s): 08/21/14

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

Frequency (MHz)	Uncorrected Meter Reading (dBμV) QP	Cable Loss (dB)	Corrected Measurement (dBμV) QP	Limit (dBμV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBμV) Avg.	Cable Loss (dB)	Corrected Measurement (dBμV) Avg.	Limit (dBμV) Avg.	Margin (dB) Avg.
0.2238	37.09	0	37.09	62.68	-25.59	24.85	0	24.85	52.68	-27.83
0.34	34.48	0	34.48	59.2	-24.72	23.22	0	23.22	49.2	-25.98
0.577	33.43	0	33.43	56	-22.57	23.28	0	23.28	46	-22.72
0.8595	33.43	0	33.43	56	-22.57	17.8	0	17.8	46	-28.2
1.42	34.46	0	34.46	56	-21.54	27.56	0	27.56	46	-18.44
4.17	31.07	0.03	31.1	56	-24.9	18.22	0.03	18.25	46	-27.75

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

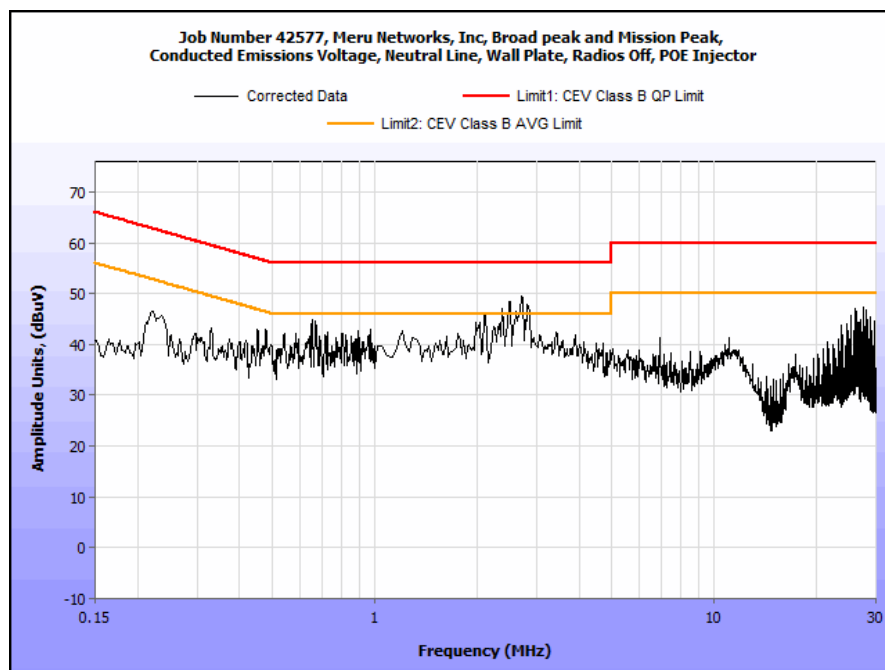


Plot 1. Conducted Emissions, Phase Line, PoE

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

Frequency (MHz)	Uncorrected Meter Reading (dBμV) QP	Cable Loss (dB)	Corrected Measurement (dBμV) QP	Limit (dBμV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBμV) Avg.	Cable Loss (dB)	Corrected Measurement (dBμV) Avg.	Limit (dBμV) Avg.	Margin (dB) Avg.
0.2335	42.19	0	42.19	62.32	-20.13	29.98	0	29.98	52.32	-22.34
0.384	29.43	0	29.43	58.19	-28.76	17.72	0	17.72	48.19	-30.47
0.4395	29.45	0	29.45	57.07	-27.62	17.54	0	17.54	47.07	-29.53
0.6415	29.56	0	29.56	56	-26.44	17.4	0	17.4	46	-28.6
1.58	30.02	0	30.02	56	-25.98	16.91	0	16.91	46	-29.09
26.23	43.03	0.17	43.2	60	-16.8	41.25	0.17	41.42	50	-8.58

Table 10. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz), PoE

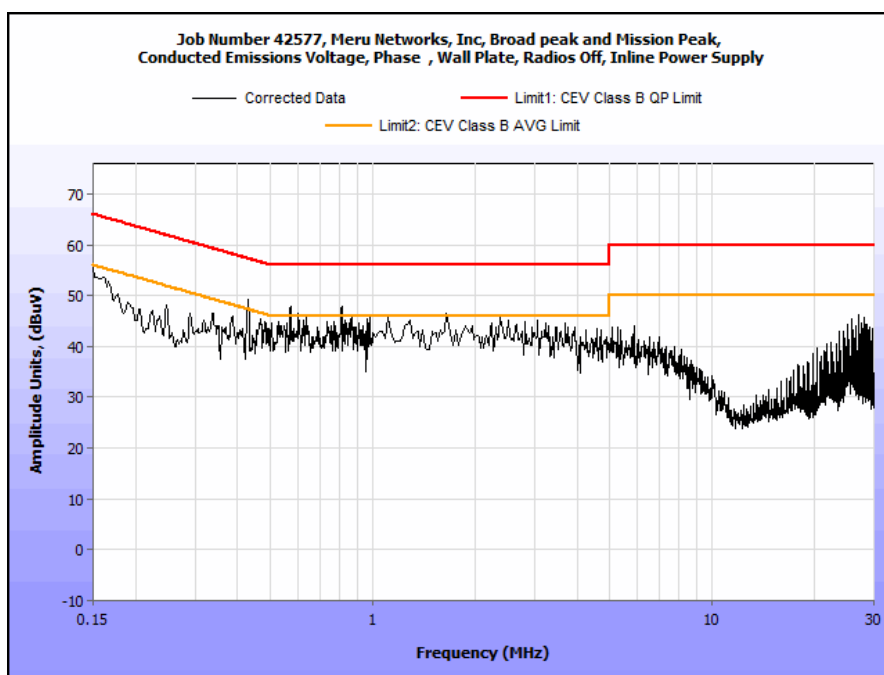


Plot 2. Conducted Emissions, Neutral Line, PoE

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

Frequency (MHz)	Uncorrected Meter Reading (dBμV) QP	Cable Loss (dB)	Corrected Measurement (dBμV) QP	Limit (dBμV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBμV) Avg.	Cable Loss (dB)	Corrected Measurement (dBμV) Avg.	Limit (dBμV) Avg.	Margin (dB) Avg.
0.1508	50.55	0	50.55	64.96	-15.41	36.23	0	36.23	55.96	-19.73
0.4945	33.81	0	33.81	56.09	-22.28	20.33	0	20.33	46.09	-25.76
0.5225	33.86	0	33.86	56	-22.14	21.11	0	21.11	46	-24.89
0.7322	33.58	0	33.58	56	-22.42	23.34	0	23.34	46	-22.66
1.34	33.51	0	33.51	56	-22.49	22.6	0	22.6	46	-23.4
27.61	35.44	0.17	35.61	60	-24.39	32.62	0.17	32.79	50	-17.21

Table 11. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz), AC/DC

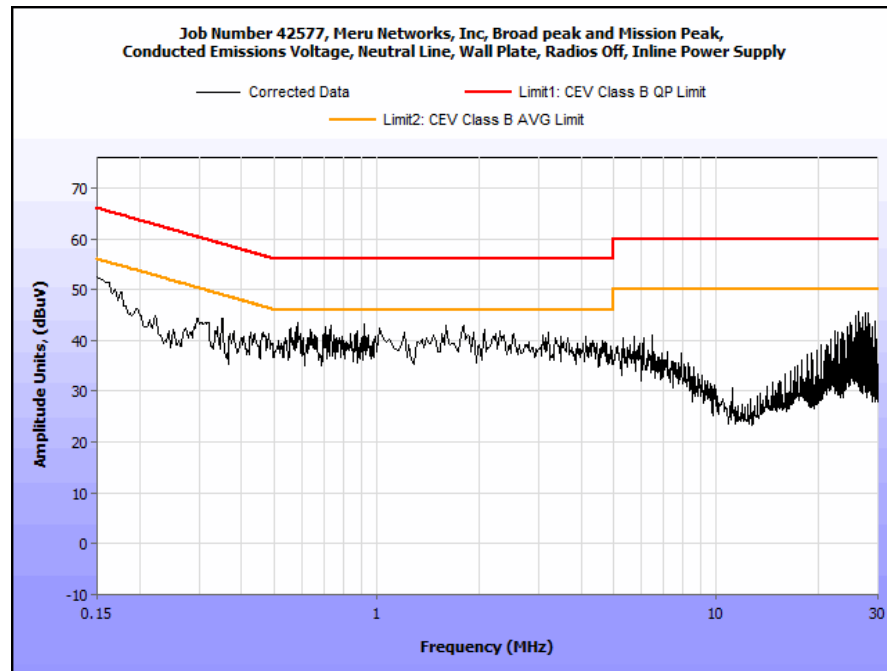


Plot 3. Conducted Emissions, Phase Line, AC/DC

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

Frequency (MHz)	Uncorrected Meter Reading (dBμV) QP	Cable Loss (dB)	Corrected Measurement (dBμV) QP	Limit (dBμV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBμV) Avg.	Cable Loss (dB)	Corrected Measurement (dBμV) Avg.	Limit (dBμV) Avg.	Margin (dB) Avg.
0.1562	48.35	0	48.35	65.66	-17.31	34.39	0	34.39	55.66	-21.27
0.304	41.643	0	41.643	60.13	-18.487	36.12	0	36.12	50.13	-14.01
0.598	31.21	0	31.21	56	-24.79	23.71	0	23.71	46	-22.29
0.704	30.95	0	30.95	56	-25.05	21.88	0	21.88	46	-24.12
1.808	30.38	0	30.38	56	-25.62	22.42	0	22.42	46	-23.58
27.61	41.82	0.17	41.99	60	-18.01	37.52	0.17	37.69	50	-12.31

Table 12. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz), AC/DC

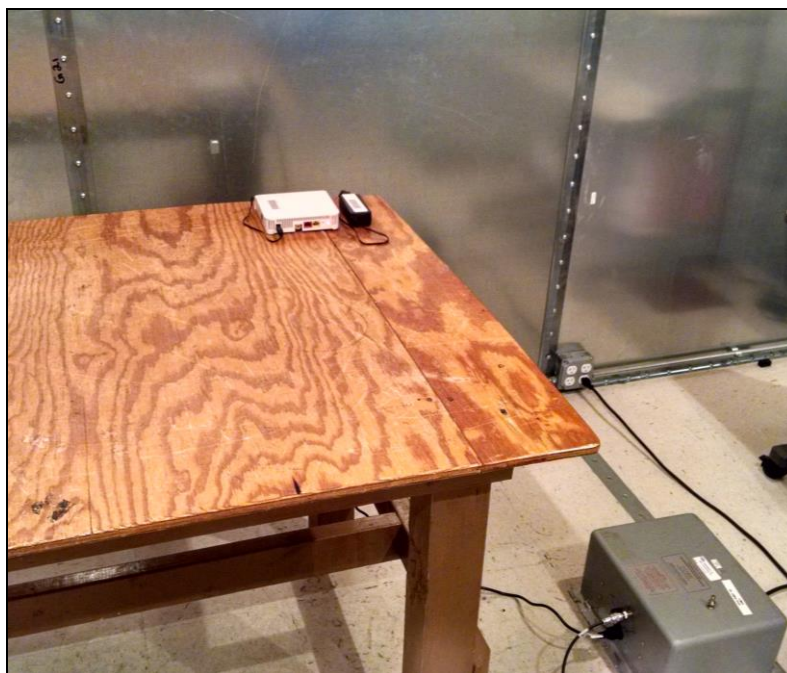


Plot 4. Conducted Emissions, Neutral Line, AC/DC

Conducted Emission Limits Test Setup



Photograph 2. Conducted Emissions, Test Setup, PoE



Photograph 3. Conducted Emissions, Test Setup, AC/DC

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 13.

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 13.

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

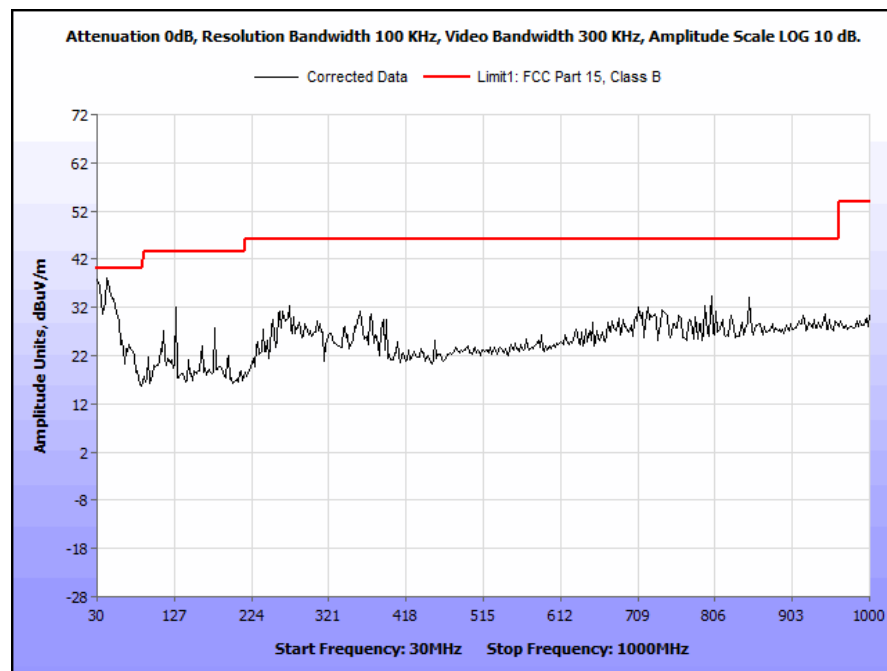
Test Engineer(s): Ben Taylor

Test Date(s): 08/21/14

Radiated Emissions Limits Test Results, Class B, PoE

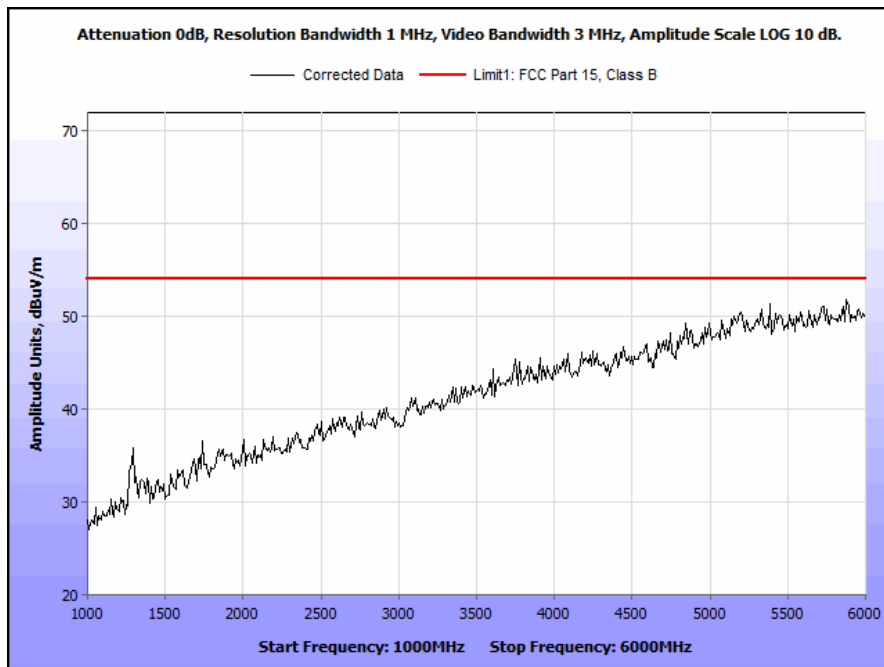
Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna Height (m)	Uncorrected Amplitude (dBμV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
49.498998	17	H	1.05	5.80	8.85	0.66	0.00	15.31	40.00	-24.69
49.498998	9	V	1.03	14.12	8.85	0.66	0.00	23.63	40.00	-16.37
129.5992	26	H	1.03	11.71	13.80	0.95	0.00	26.46	43.50	-17.04
129.5992	30	V	1.05	15.82	13.80	0.95	0.00	30.57	43.50	-12.93
257.31463	26	H	1.03	11.12	12.48	1.37	0.00	24.97	46.00	-21.03
257.31463	38	V	1.07	6.78	12.48	1.37	0.00	20.63	46.00	-25.37
359.07816	17	H	1.05	6.85	15.40	1.65	0.00	23.90	46.00	-22.10
359.07816	30	V	1.01	4.86	15.40	1.65	0.00	21.91	46.00	-24.09
737.07415	7	H	1.01	5.57	21.14	2.28	0.00	28.99	46.00	-17.01
737.07415	19	V	1.02	5.42	21.14	2.28	0.00	28.84	46.00	-17.16
817.11423	25	H	1.00	5.72	22.24	2.60	0.00	30.56	46.00	-15.44
817.11423	33	V	1.02	6.34	22.24	2.60	0.00	31.18	46.00	-14.82

Table 14. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz, PoE



Plot 5. Radiated Emissions, 30 MHz – 1 GHz, PoE

Table 15. Radiated Emissions Limits, Test Results, 1 GHz – 6 GHz, PoE

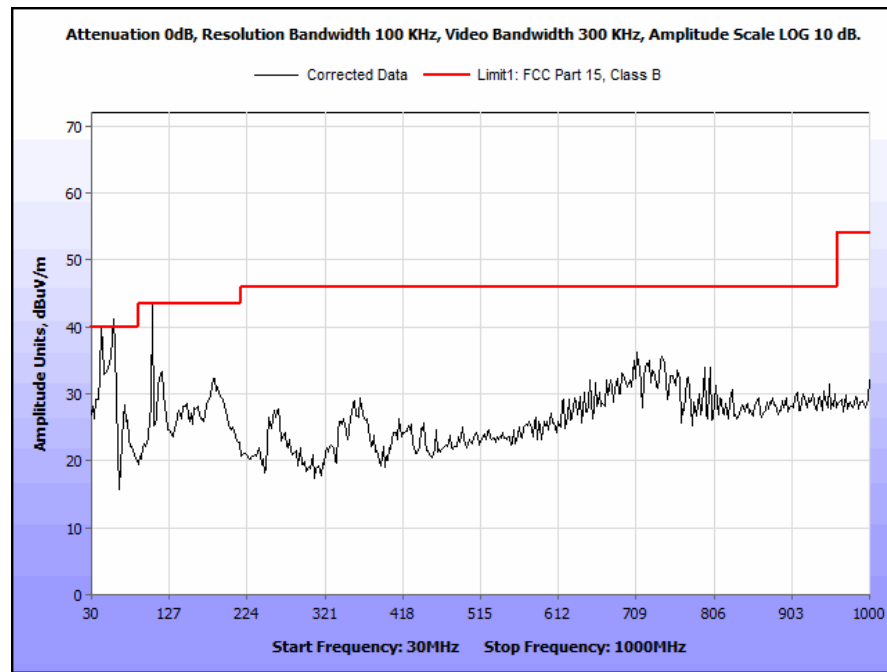


Plot 6. Radiated Emissions, 1 GHz – 6 GHz, PoE

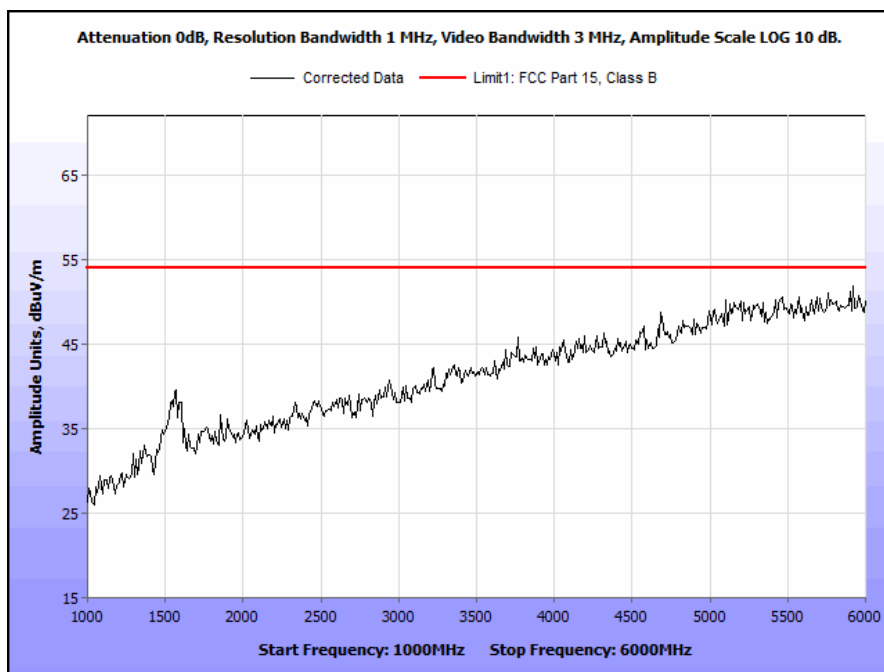
Radiated Emissions Limits Test Results, Class B, AC/DC

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna Height (m)	Uncorrected Amplitude (dBμV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
42.825651	9	H	1.06	5.65	12.22	0.61	0.00	18.48	40.00	-21.52
42.825651	11	V	1.05	20.38	12.22	0.61	0.00	33.21	40.00	-6.79
59.960121	2	H	1.06	6.71	7.40	0.69	0.00	14.80	40.00	-25.20
59.960121	7	V	1.05	25.08	7.40	0.69	0.00	33.17	40.00	-6.83
71.193754	2	H	1.04	5.87	8.18	0.79	0.00	14.84	40.00	-25.16
71.193754	5	V	1.08	20.21	8.18	0.79	0.00	29.18	40.00	-10.82
118.32359	12	H	1.04	6.16	13.66	0.91	0.00	20.73	43.50	-22.77
118.32359	3	V	1.06	14.18	13.66	0.91	0.00	28.75	43.50	-14.75
188.31663	14	H	1.01	7.78	11.30	1.12	0.00	20.20	43.50	-23.30
188.31663	10	V	1.02	15.46	11.30	1.12	0.00	27.88	43.50	-15.62
709.31864	19	H	1.05	5.57	20.79	2.23	0.00	28.59	46.00	-17.41
709.31864	16	V	1.03	9.54	20.79	2.23	0.00	32.56	46.00	-13.44

Table 16. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz, AC/DC

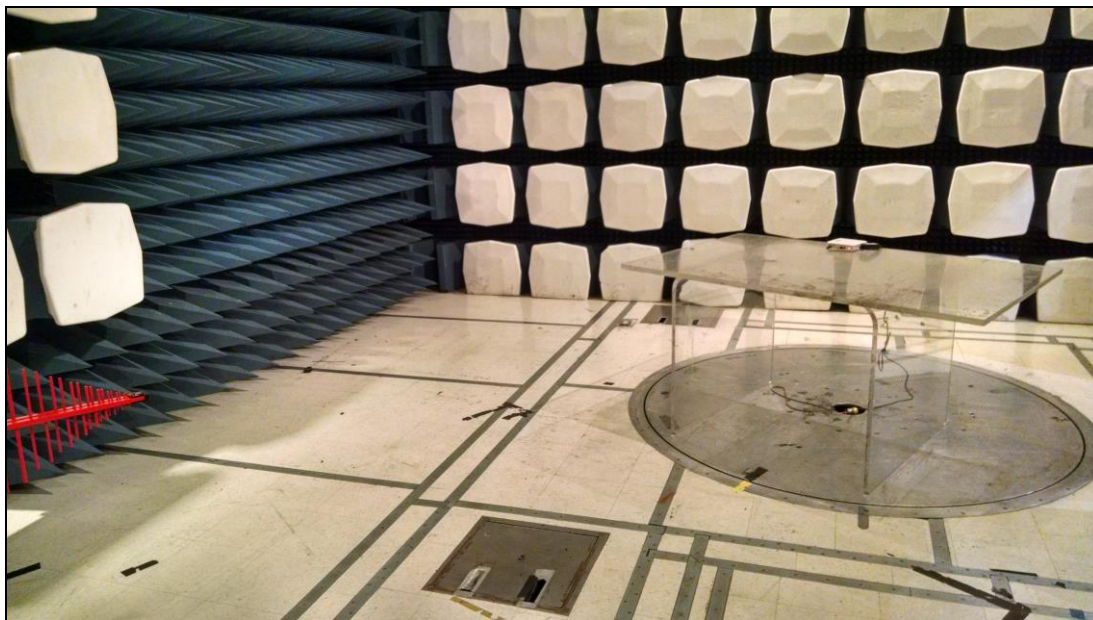


Plot 7. Radiated Emissions, 30 MHz – 1 GHz, AC/DC



Plot 8. Radiated Emissions, 1 GHz – 6GHz, AC/DC

Radiated Emissions Limits Test Setup



Photograph 4. Radiated Emissions, Test Setup, 30 MHz – 6 GHz

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

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

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

- a.) Antenna must be permanently attached to the unit.
- b.) Antenna must use a unique type of connector to attach to the EUT.
- c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Results: The EUT as tested is compliant the criteria of §15.203 because the EUT has a permanently installed antenna.

Test Engineer(s): Andy Shen

Test Date(s): 07/26/14

SN	Meru Part Number	Description	Gain 2.4GHz/5.0GHz
1	ANT-ABGN33O-W	Omni Directional Rubber Duck antenna	3/3dBi
2	ANT-ABGN46O-W	High Gain Omni Directional Rubber Duck antenna	4/6dBi
3	ANT-ABGN23O-W	Omni Directional Rubber Duck antenna	2/3dBi
4	ANT-I2ABGN-0304-O	Ceiling mount Omni Directional Antenna	3/4dBi
5	ANT-O4ABGN-0607-PT	Dual Band Wall Mount Patch 4-lead Antenna	6/7dBi
6	ANT-O4ABGN-0606-O	Outdoor Omni Directional 4-leads Dual Band Antenna	6/6dBi
7	ANT-ABGN-23	Dual Band Ceiling mount Omni Directional 3-lead Antenna	3/4dBi
8	ANT-6ABGN-24	Dual Band Ceiling mount Omni Directional 6-lead Antenna	2.5/4dBi
9	ANT-ABGN47O	Dual Band High Gain Dipole Omni Directional Antenna	4.7/4.7dBi
10	ANT-O6ABGN-0606-O	Dual Band Omni Directional 6-lead Antenna	6/6dBi
11	ANT-I3ABGN-0304-O	Dual Band Ceiling mount Omni Directional 3-lead Antenna	3/4dBi
12	ANT-O6ABGN-0607-PT	Dual Band Wall Mount Patch 6-lead Antenna	6/7dBi
13	ANT-O6ABGN-0607-PT	Dual Band Wall Mount Patch 6-lead Antenna	6/7dBi

Table 17. Antenna List

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207 Conducted Emissions Limits

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

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

Table 18. 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 μ H 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 μ H 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.

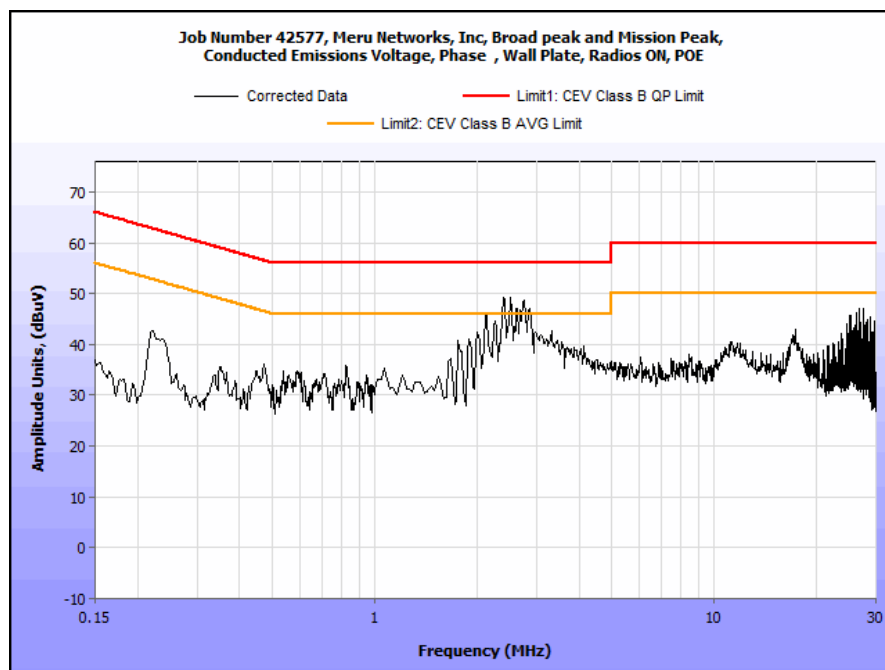
Test Engineer(s): Ben Taylor

Test Date(s): 08/21/14

Conducted Emissions 15.207(a) - Voltage, AC Power, Phase Line (120 VAC, 60 Hz), PoE

Frequency (MHz)	Uncorrected Meter Reading (dBμV) QP	Cable Loss (dB)	Corrected Measurement (dBμV) QP	Limit (dBμV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBμV) Avg.	Cable Loss (dB)	Corrected Measurement (dBμV) Avg.	Limit (dBμV) Avg.	Margin (dB) Avg.
0.2365	39.51	0	39.51	62.22	-22.71	34.9	0	34.9	52.22	-17.32
0.4725	33.1	0	33.1	56.47	-23.37	30.8	0	30.8	46.47	-15.67
1.893	34.07	0	34.07	56	-21.93	23.18	0	23.18	46	-22.82
2.502	45.88	0	45.88	56	-10.12	33.03	0	33.03	46	-12.97
17.43	34.97	0	34.97	60	-25.03	25.83	0	25.83	50	-24.17
27.6	44.67	0.17	44.84	60	-15.16	41.93	0.17	42.1	50	-7.9

Table 19. Conducted Emissions - Voltage, AC Power, 15.207(a), Phase Line (120 VAC, 60 Hz), PoE

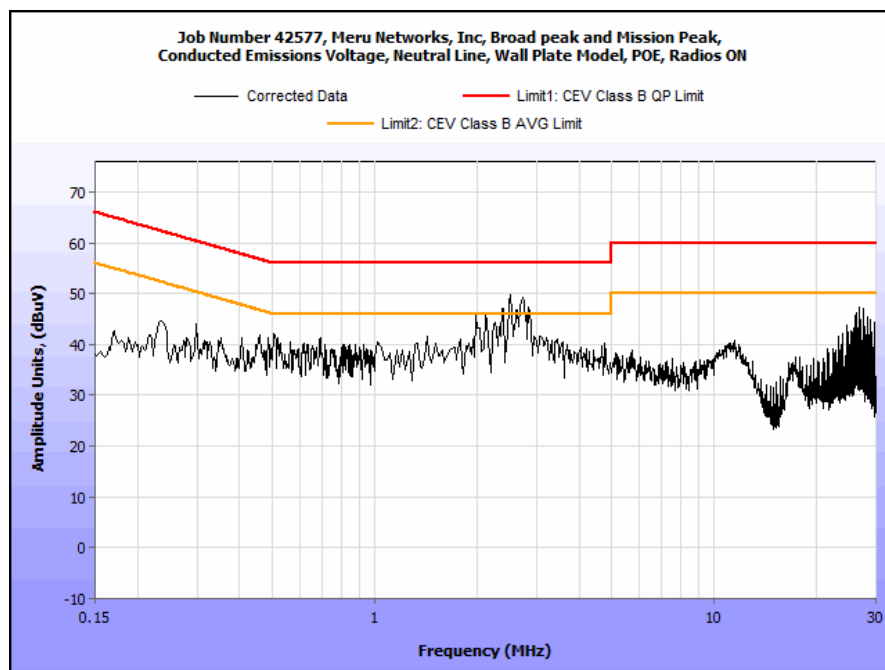


Plot 9. Conducted Emissions, 15.207(a), Phase Line, PoE

Conducted Emissions 15.207(a) - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz), PoE

Frequency (MHz)	Uncorrected Meter Reading (dBμV) QP	Cable Loss (dB)	Corrected Measurement (dBμV) QP	Limit (dBμV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBμV) Avg.	Cable Loss (dB)	Corrected Measurement (dBμV) Avg.	Limit (dBμV) Avg.	Margin (dB) Avg.
0.234	39.12	0	39.12	62.31	-23.19	26.5	0	26.5	52.31	-25.81
0.283	28.73	0	28.73	60.73	-32	17.9	0	17.9	50.73	-32.83
0.636	28.81	0	28.81	56	-27.19	18	0	18	46	-28
1.885	35.64	0	35.64	56	-20.36	25.85	0	25.85	46	-20.15
2.51	45.5	0	45.5	56	-10.5	36.52	0	36.52	46	-9.48
27.61	43.3	0.17	43.47	60	-16.53	38.81	0.17	38.98	50	-11.02

Table 20. Conducted Emissions - Voltage, AC Power, 15.207(a), Neutral Line (120 VAC, 60 Hz), PoE

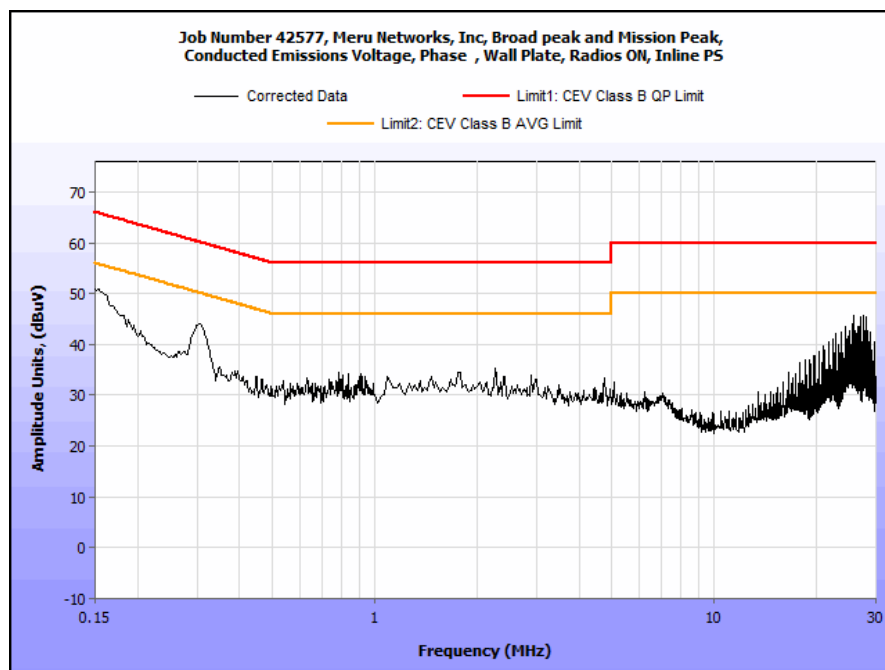


Plot 10. Conducted Emissions, 15.207(a), Neutral Line, PoE

Conducted Emissions 15.207(a) - Voltage, AC Power, Phase Line (120 VAC, 60 Hz), AC/DC

Frequency (MHz)	Uncorrected Meter Reading (dBμV) QP	Cable Loss (dB)	Corrected Measurement (dBμV) QP	Limit (dBμV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBμV) Avg.	Cable Loss (dB)	Corrected Measurement (dBμV) Avg.	Limit (dBμV) Avg.	Margin (dB) Avg.
0.153	48.21	0	48.21	79	-30.79	34.76	0	34.76	66	-31.24
0.3045	42.25	0	42.25	79	-36.75	36.15	0	36.15	66	-29.85
0.59	26.84	0	26.84	73	-46.16	21.94	0	21.94	60	-38.06
1.995	26.9	0	26.9	73	-46.1	21.6	0	21.6	60	-38.4
2.038	27.18	0	27.18	73	-45.82	21.82	0	21.82	60	-38.18
27.6	42.56	0.17	42.73	73	-30.27	39.31	0.17	39.48	60	-20.52

Table 21. Conducted Emissions - Voltage, AC Power, 15.207(a), Phase Line (120 VAC, 60 Hz), AC/DC

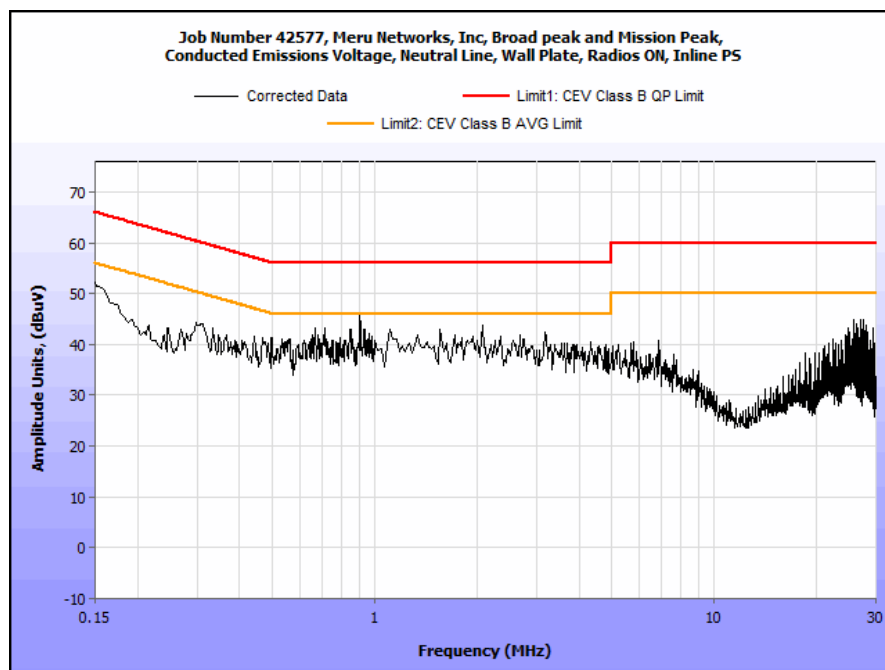


Plot 11. Conducted Emissions, 15.207(a), Phase Line, AC/DC

Conducted Emissions 15.207(a) - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz), AC/DC

Frequency (MHz)	Uncorrected Meter Reading (dBμV) QP	Cable Loss (dB)	Corrected Measurement (dBμV) QP	Limit (dBμV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBμV) Avg.	Cable Loss (dB)	Corrected Measurement (dBμV) Avg.	Limit (dBμV) Avg.	Margin (dB) Avg.
0.1664	45.2	0	45.2	79	-33.8	32.8	0	32.8	66	-33.2
0.3085	42.03	0	42.03	79	-36.97	36.41	0	36.41	66	-29.59
0.6168	31.1	0	31.1	73	-41.9	23.69	0	23.69	60	-36.31
0.8978	30.98	0	30.98	73	-42.02	24.07	0	24.07	60	-35.93
1.637	30.37	0	30.37	73	-42.63	22.78	0	22.78	60	-37.22
27.61	41.95	0.17	42.12	73	-30.88	38.15	0.17	38.32	60	-21.68

Table 22. Conducted Emissions - Voltage, AC Power, 15.207(a), Neutral Line (120 VAC, 60 Hz), AC/DC



Plot 12. Conducted Emissions, 15.207(a), Neutral Line, AC/DC

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.403(c) 26dB Bandwidth

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

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

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

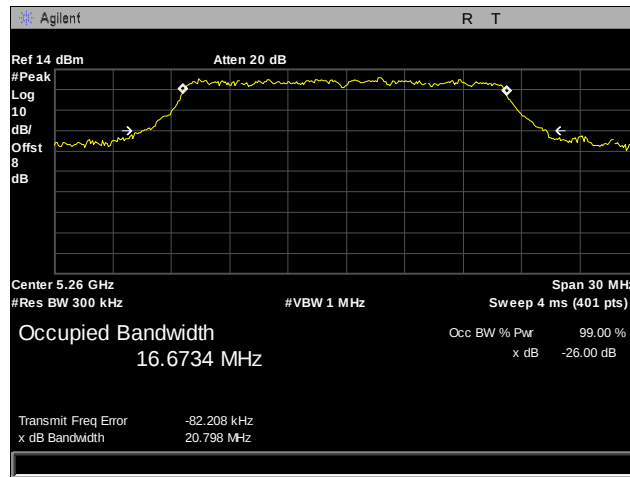
Test Engineer(s): Andy Shen

Test Date(s): 09/05/14

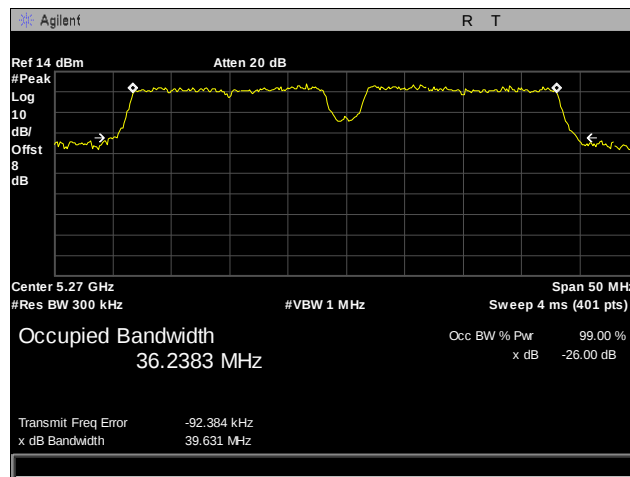


Figure 2. Occupied Bandwidth, Test Setup

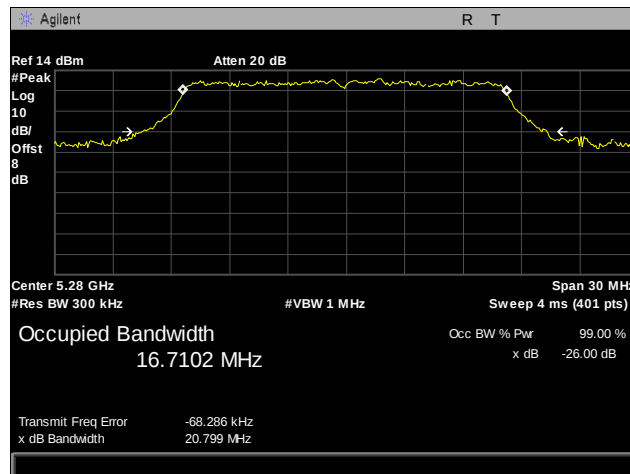
26 dB Occupied Bandwidth, 802.11a



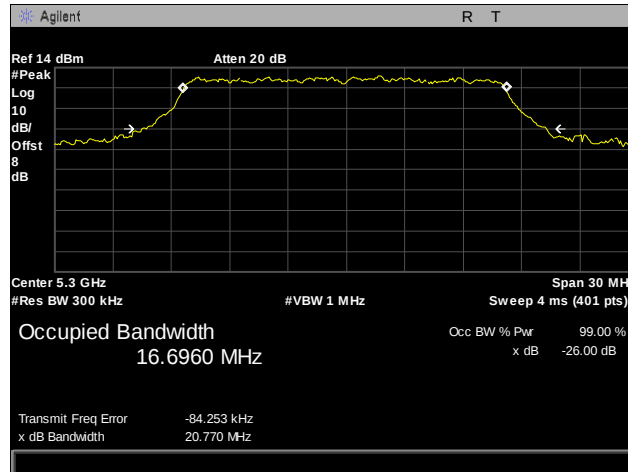
Plot 13. 26 dB Occupied Bandwidth, 802.11a, 5260 MHz



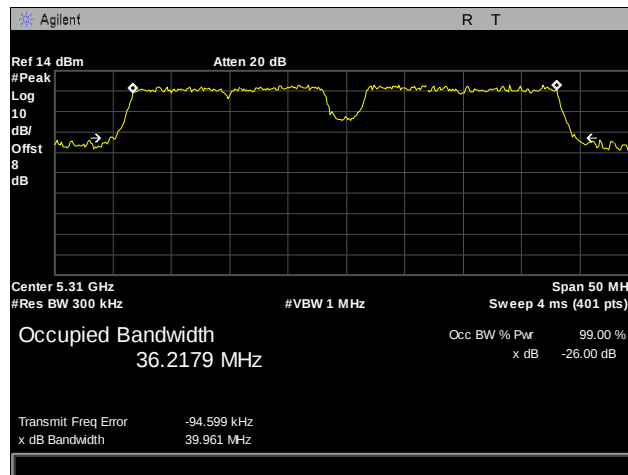
Plot 14. 26 dB Occupied Bandwidth, 802.11a, 5270 MHz



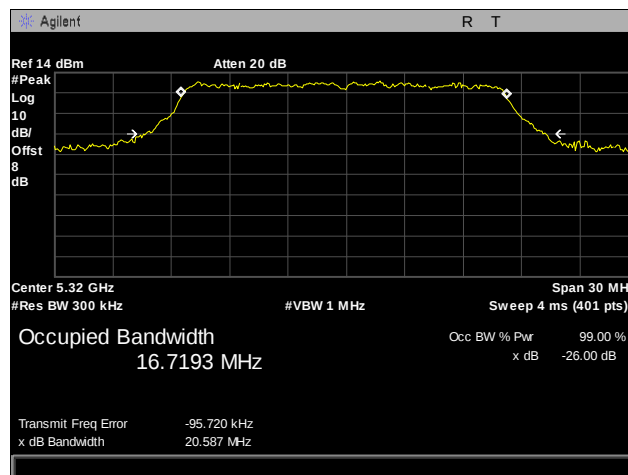
Plot 15. 26 dB Occupied Bandwidth, 802.11a, 5280 MHz



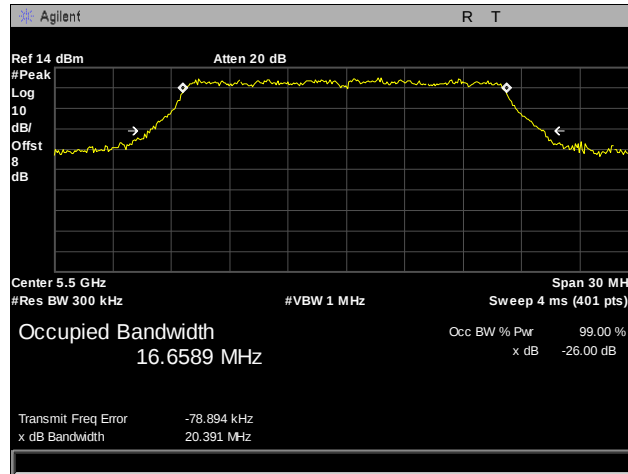
Plot 16. 26 dB Occupied Bandwidth, 802.11a, 5300 MHz



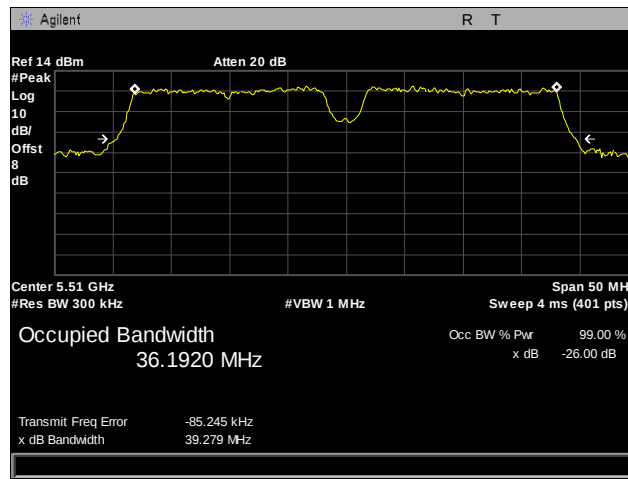
Plot 17. 26 dB Occupied Bandwidth, 802.11a, 5310 MHz



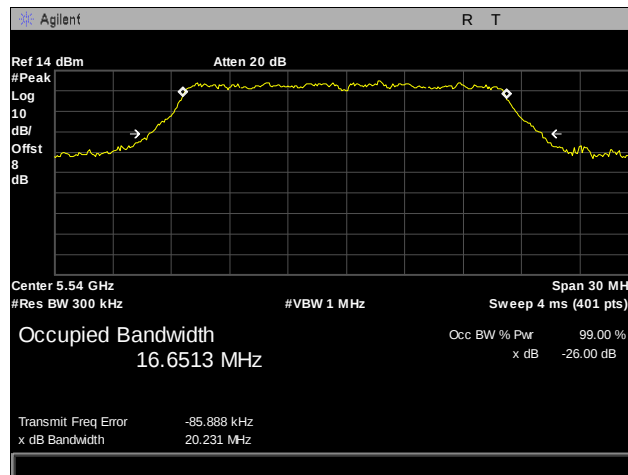
Plot 18. 26 dB Occupied Bandwidth, 802.11a, 5320 MHz



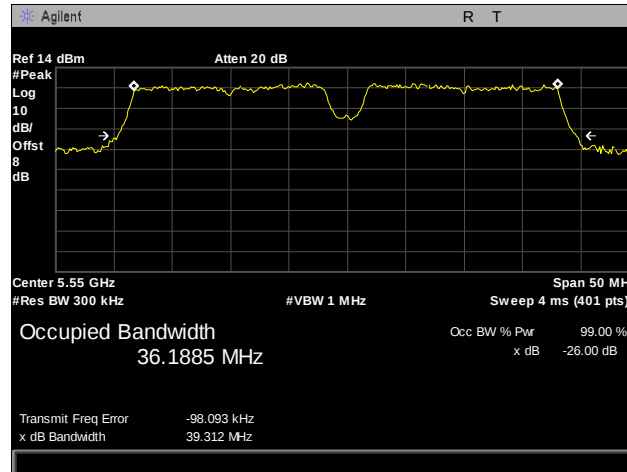
Plot 19. 26 dB Occupied Bandwidth, 802.11a, 5500 MHz



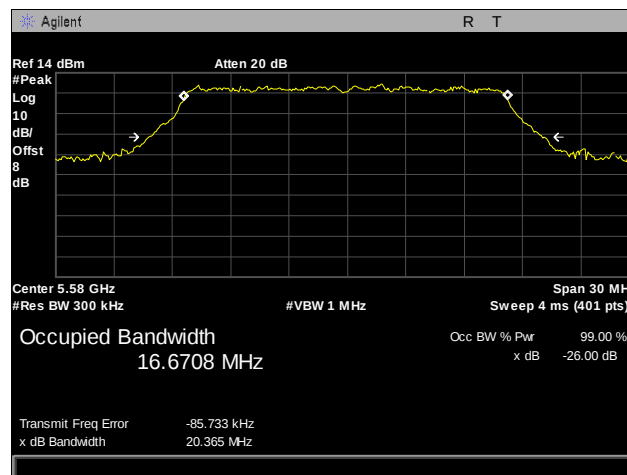
Plot 20. 26 dB Occupied Bandwidth, 802.11a, 5510 MHz



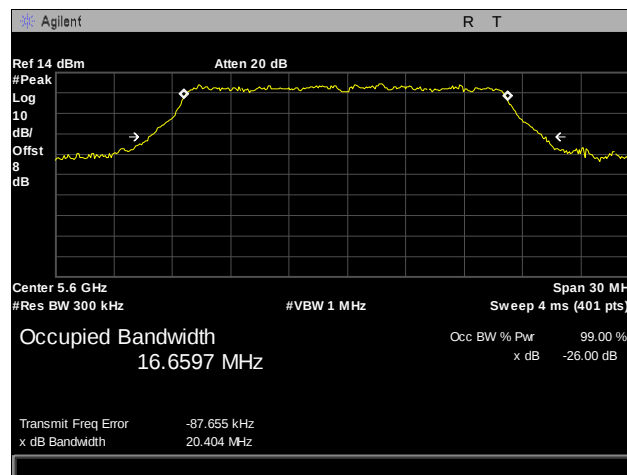
Plot 21. 26 dB Occupied Bandwidth, 802.11a, 5540 MHz



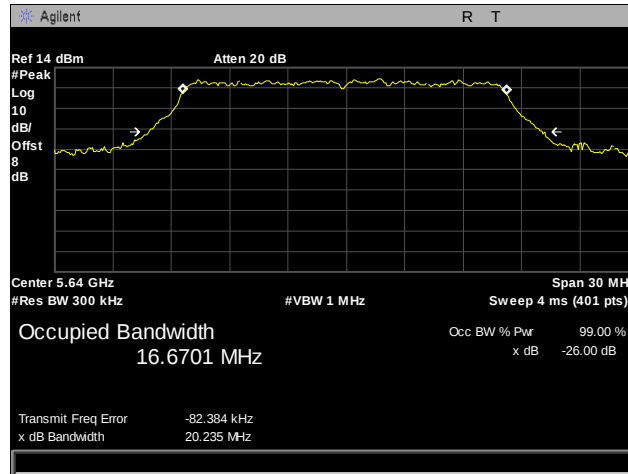
Plot 22. 26 dB Occupied Bandwidth, 802.11a, 5550 MHz



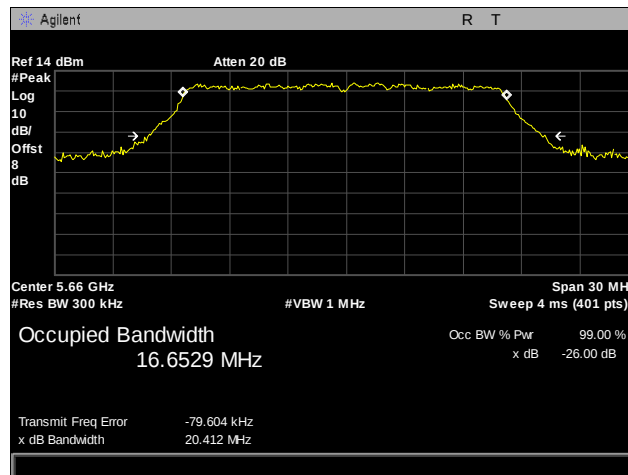
Plot 23. 26 dB Occupied Bandwidth, 802.11a, 5580 MHz



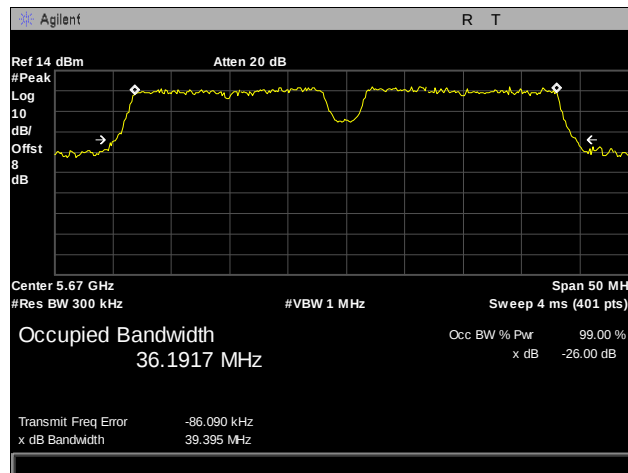
Plot 24. 26 dB Occupied Bandwidth, 802.11a, 5600 MHz



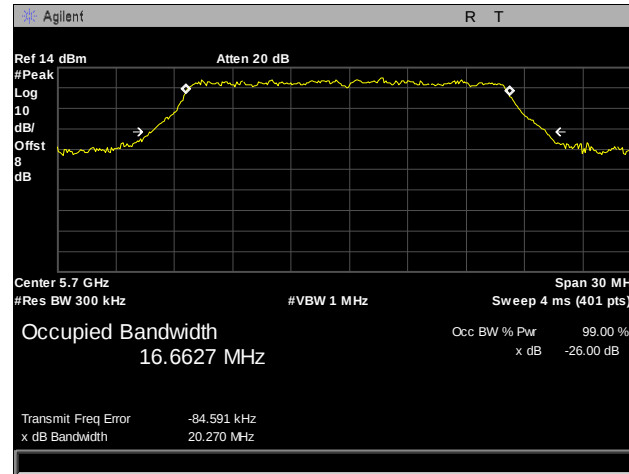
Plot 25. 26 dB Occupied Bandwidth, 802.11a, 5640 MHz



Plot 26. 26 dB Occupied Bandwidth, 802.11a, 5660 MHz

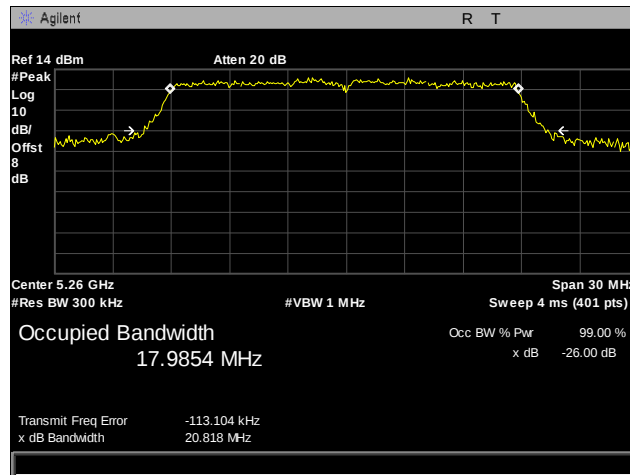


Plot 27. 26 dB Occupied Bandwidth, 802.11a, 5670 MHz

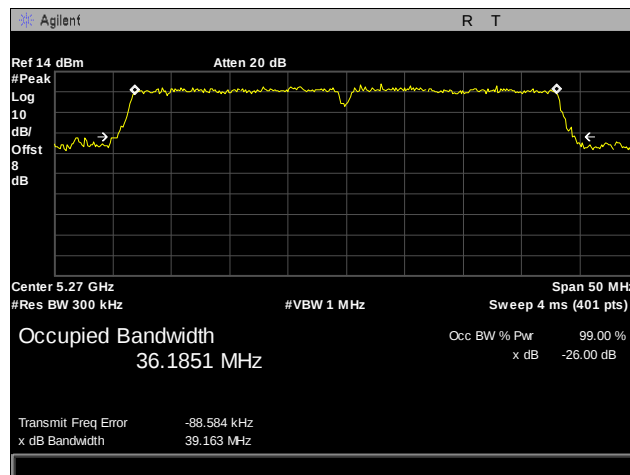


Plot 28. 26 dB Occupied Bandwidth, 802.11a, 5700 MHz

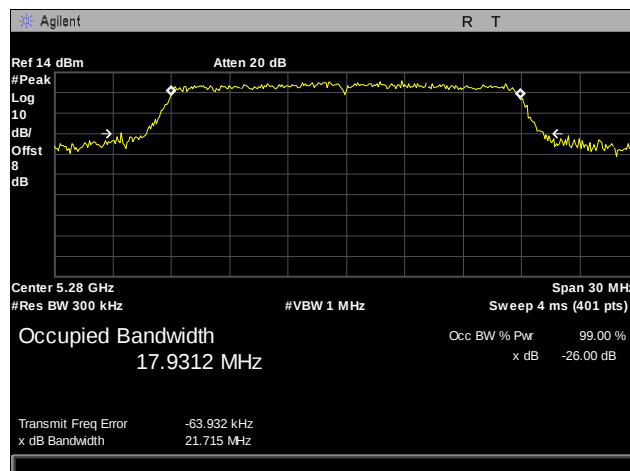
26 dB Occupied Bandwidth, 802.11n, Port 1



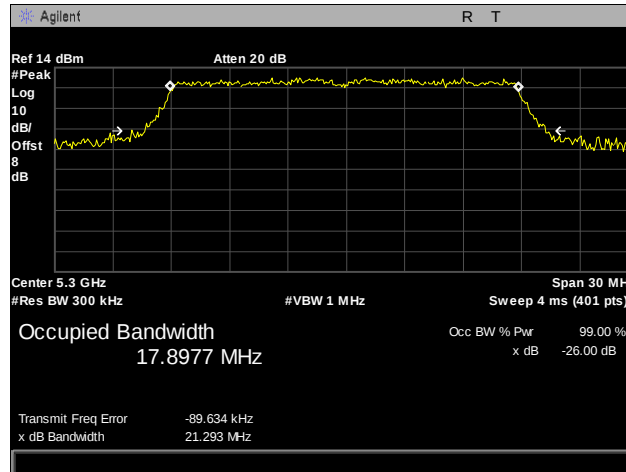
Plot 29. 26 dB Occupied Bandwidth, 802.11n, 5260 MHz, Port 1



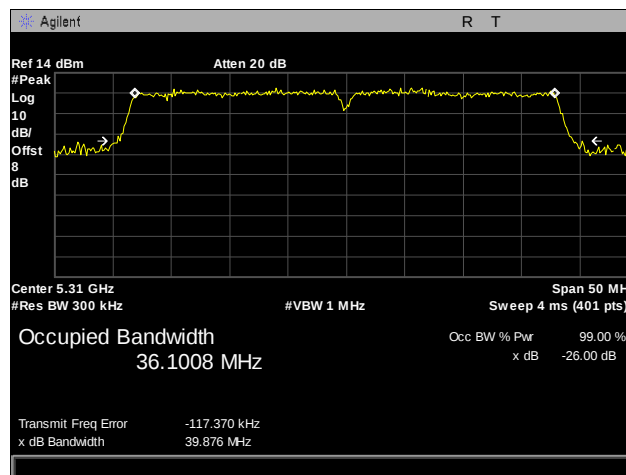
Plot 30. 26 dB Occupied Bandwidth, 802.11n, 5270 MHz, Port 1



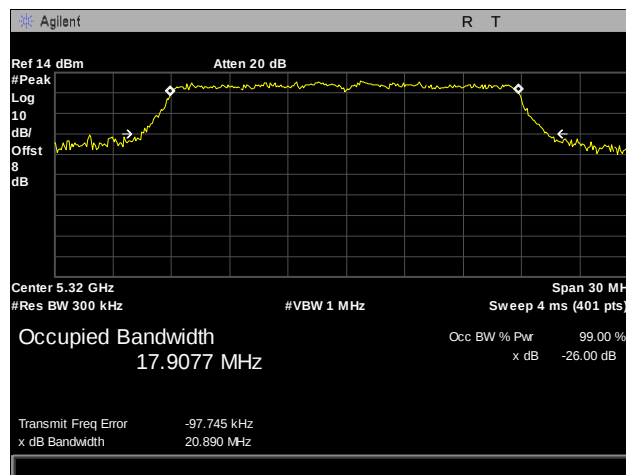
Plot 31. 26 dB Occupied Bandwidth, 802.11n, 5280 MHz, Port 1



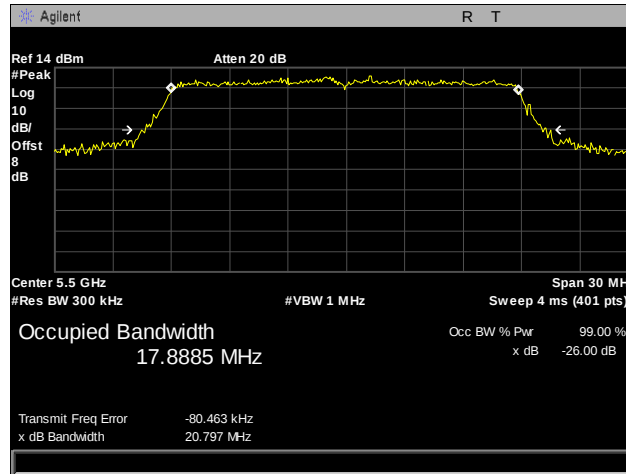
Plot 32. 26 dB Occupied Bandwidth, 802.11n, 5300 MHz, Port 1



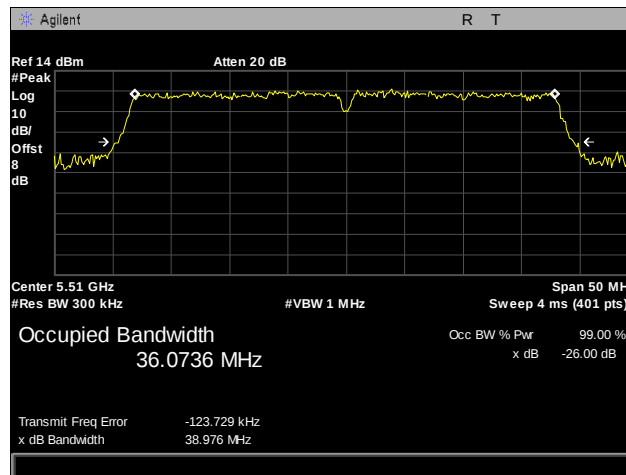
Plot 33. 26 dB Occupied Bandwidth, 802.11n, 5310 MHz, Port 1



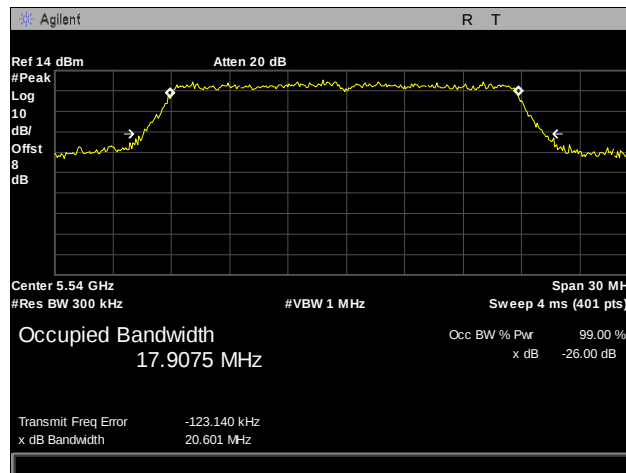
Plot 34. 26 dB Occupied Bandwidth, 802.11n, 5320 MHz, Port 1



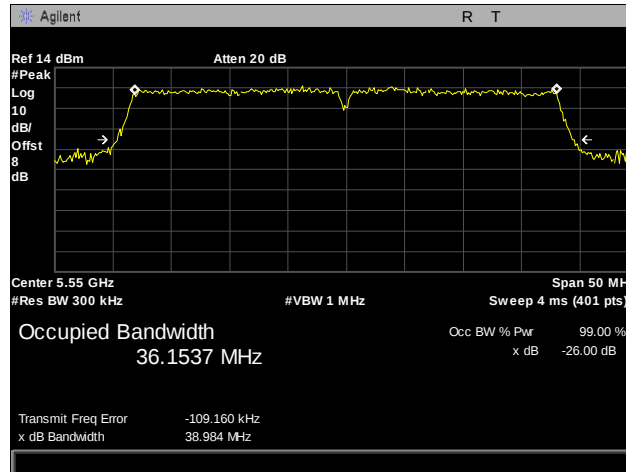
Plot 35. 26 dB Occupied Bandwidth, 802.11n, 5500 MHz, Port 1



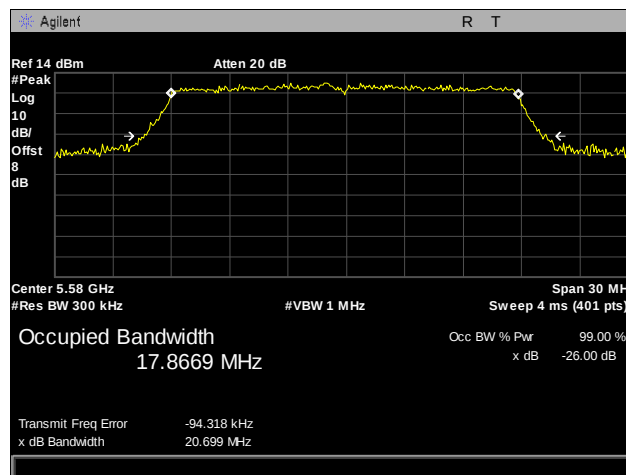
Plot 36. 26 dB Occupied Bandwidth, 802.11n, 5510 MHz, Port 1



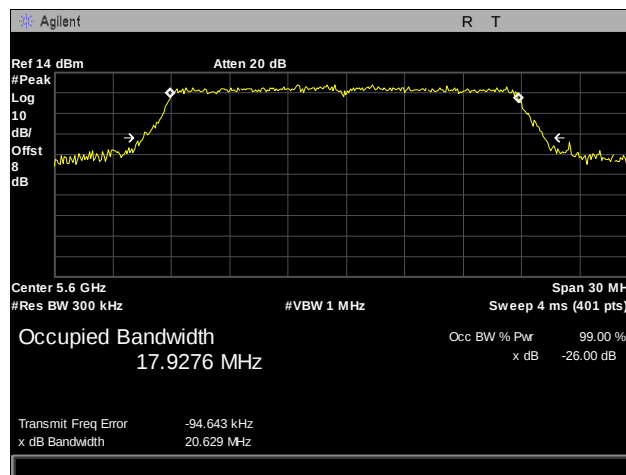
Plot 37. 26 dB Occupied Bandwidth, 802.11n, 5540 MHz, Port 1



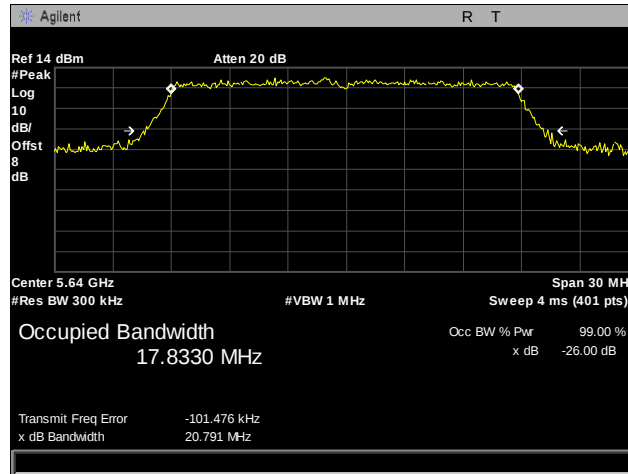
Plot 38. 26 dB Occupied Bandwidth, 802.11n, 5550 MHz, Port 1



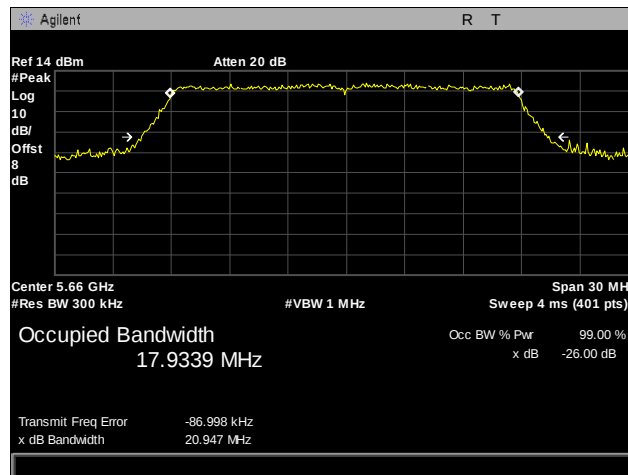
Plot 39. 26 dB Occupied Bandwidth, 802.11n, 5580 MHz, Port 1



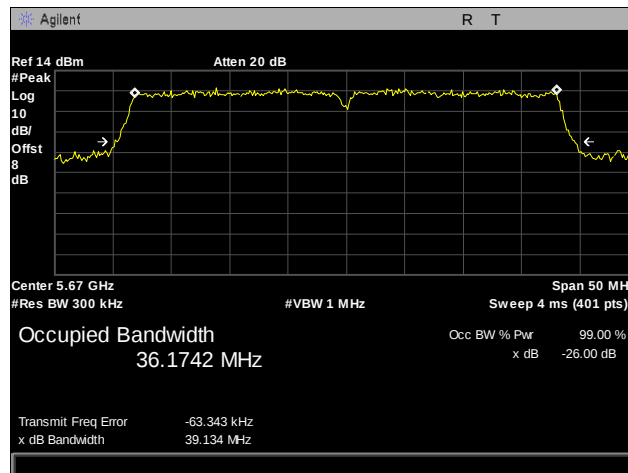
Plot 40. 26 dB Occupied Bandwidth, 802.11n, 5600 MHz, Port 1



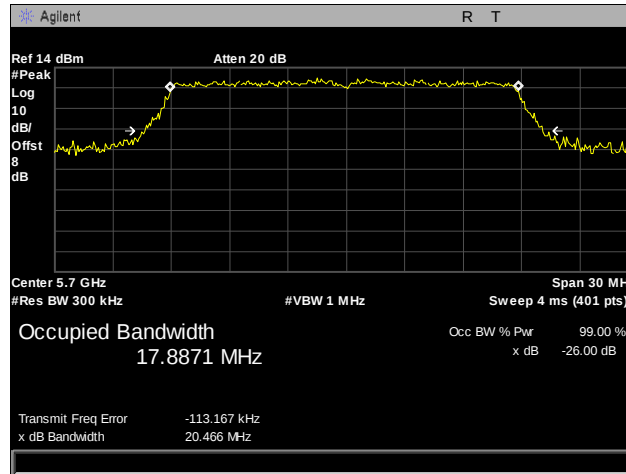
Plot 41. 26 dB Occupied Bandwidth, 802.11n, 5640 MHz, Port 1



Plot 42. 26 dB Occupied Bandwidth, 802.11n, 5660 MHz, Port 1

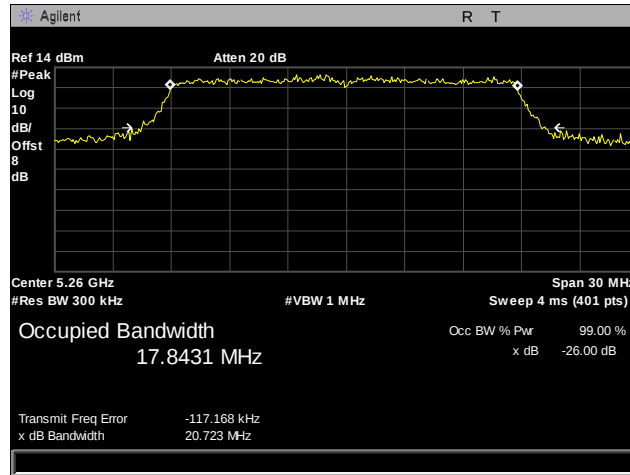


Plot 43. 26 dB Occupied Bandwidth, 802.11n, 5670 MHz, Port 1

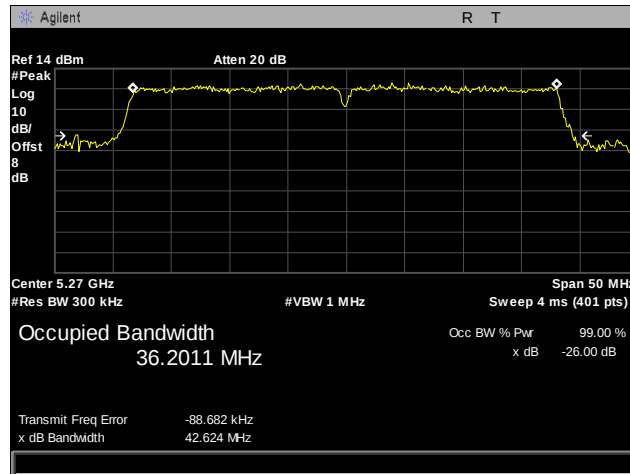


Plot 44. 26 dB Occupied Bandwidth, 802.11n, 5700 MHz, Port 1

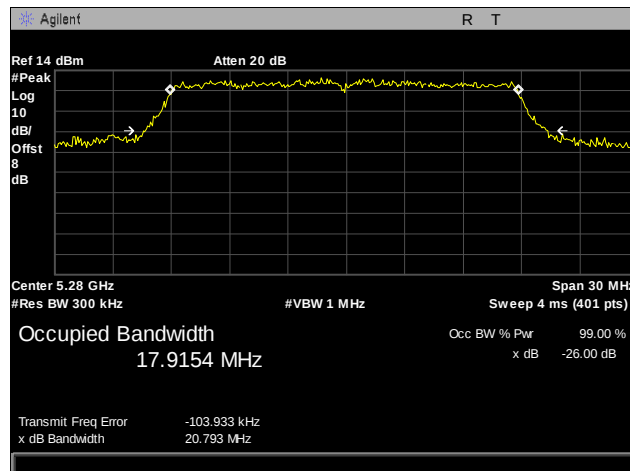
26 dB Occupied Bandwidth, 802.11n, Port 2



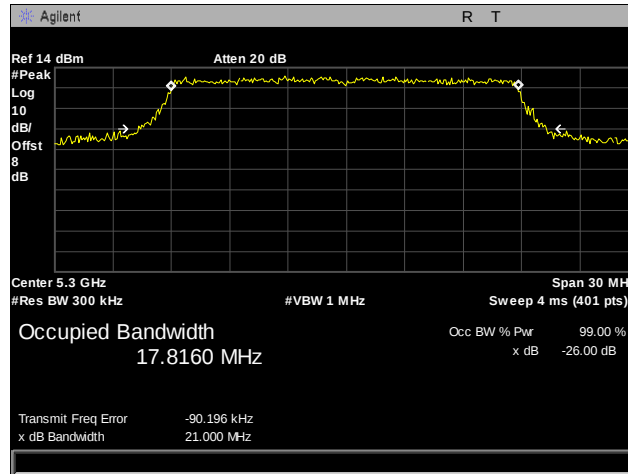
Plot 45. 26 dB Occupied Bandwidth, 802.11n, 5260 MHz, Port 2



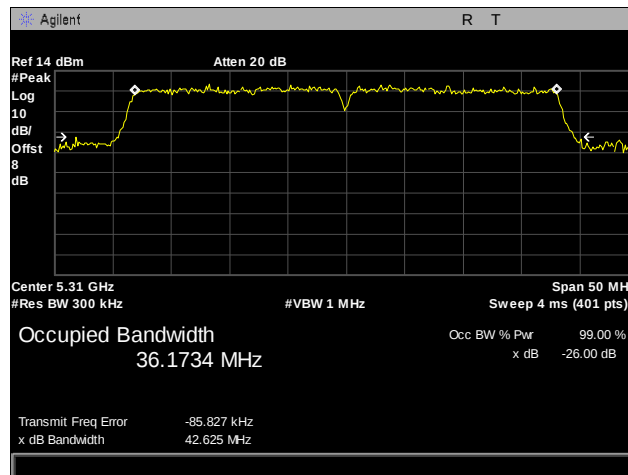
Plot 46. 26 dB Occupied Bandwidth, 802.11n, 5270 MHz, Port 2



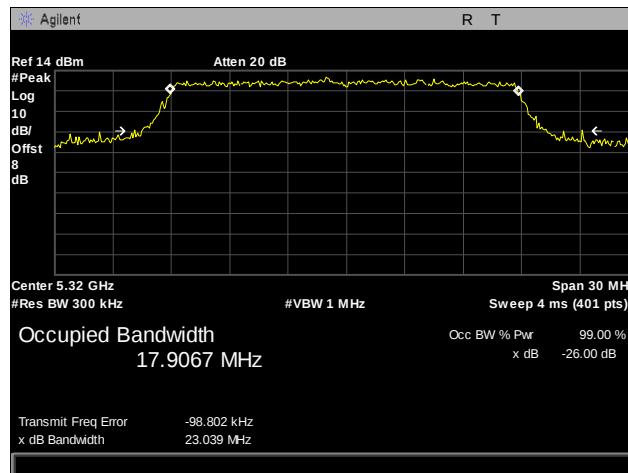
Plot 47. 26 dB Occupied Bandwidth, 802.11n, 5280 MHz, Port 2



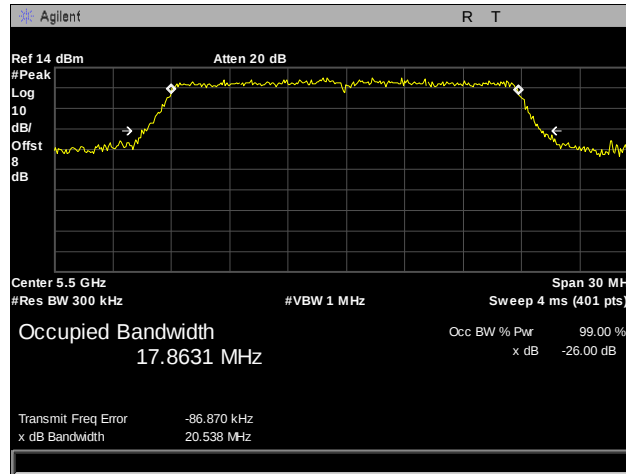
Plot 48. 26 dB Occupied Bandwidth, 802.11n, 5300 MHz, Port 2



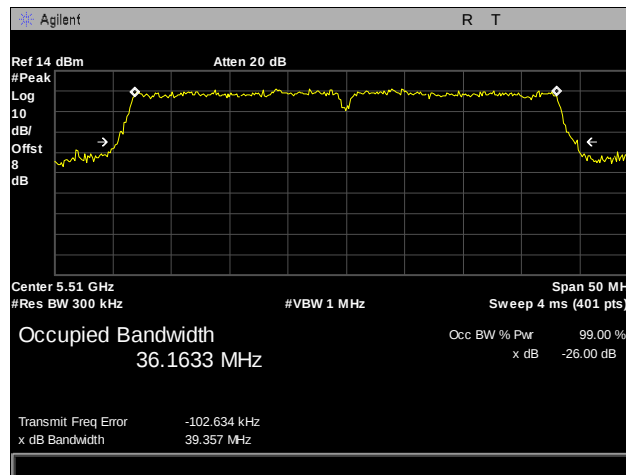
Plot 49. 26 dB Occupied Bandwidth, 802.11n, 5310 MHz, Port 2



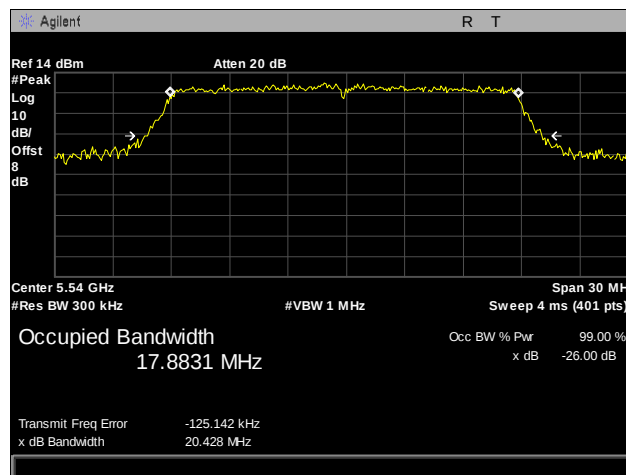
Plot 50. 26 dB Occupied Bandwidth, 802.11n, 5320 MHz, Port 2



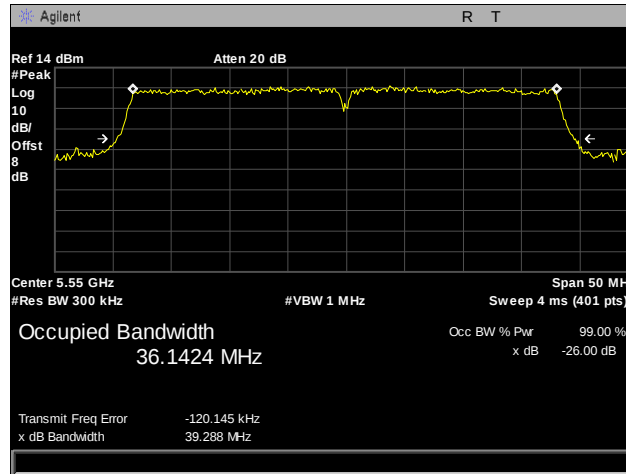
Plot 51. 26 dB Occupied Bandwidth, 802.11n, 5500 MHz, Port 2



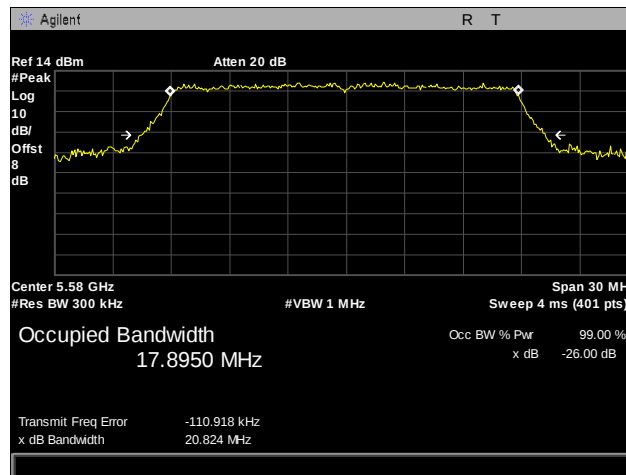
Plot 52. 26 dB Occupied Bandwidth, 802.11n, 5510 MHz, Port 2



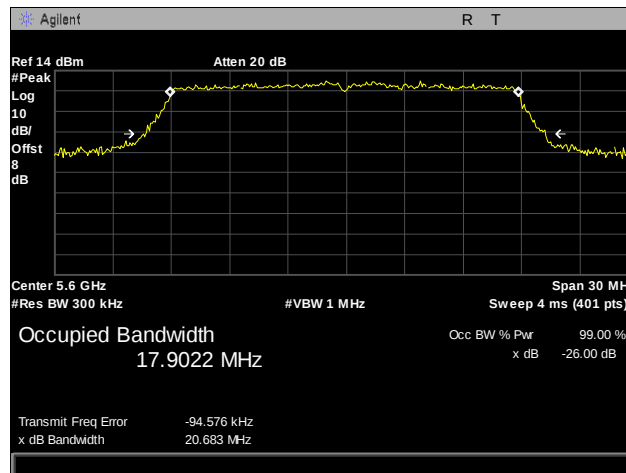
Plot 53. 26 dB Occupied Bandwidth, 802.11n, 5540 MHz, Port 2



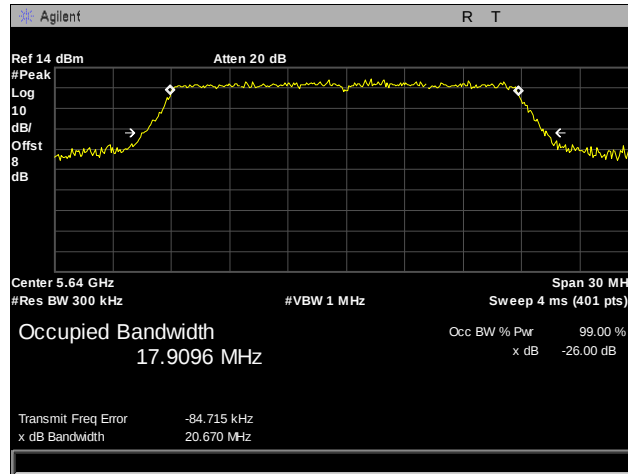
Plot 54. 26 dB Occupied Bandwidth, 802.11n, 5550 MHz, Port 2



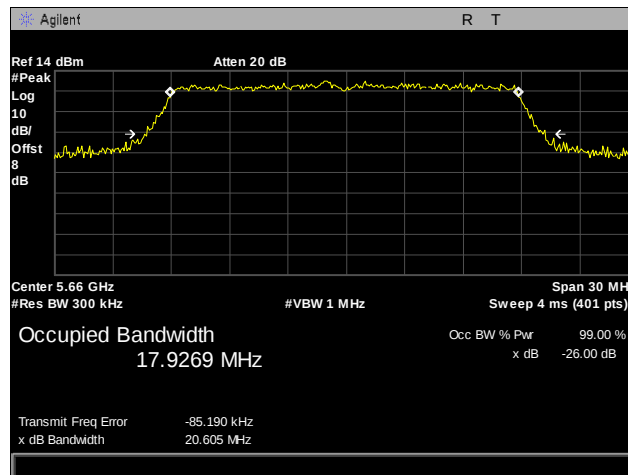
Plot 55. 26 dB Occupied Bandwidth, 802.11n, 5580 MHz, Port 2



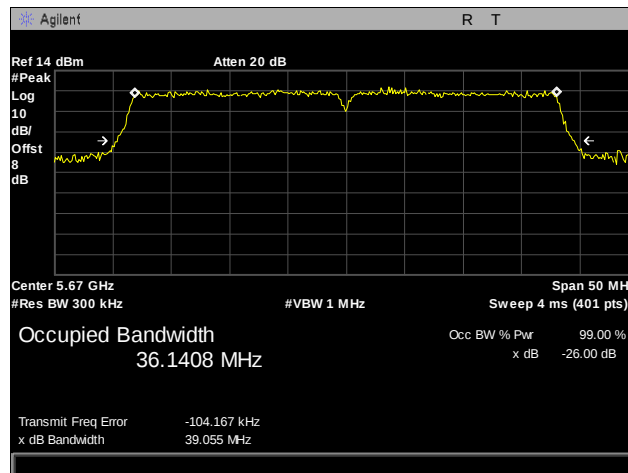
Plot 56. 26 dB Occupied Bandwidth, 802.11n, 5600 MHz, Port 2



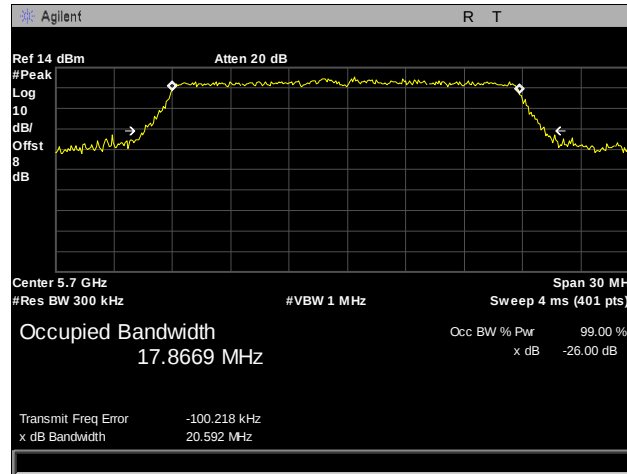
Plot 57. 26 dB Occupied Bandwidth, 802.11n, 5640 MHz, Port 2



Plot 58. 26 dB Occupied Bandwidth, 802.11n, 5660 MHz, Port 2

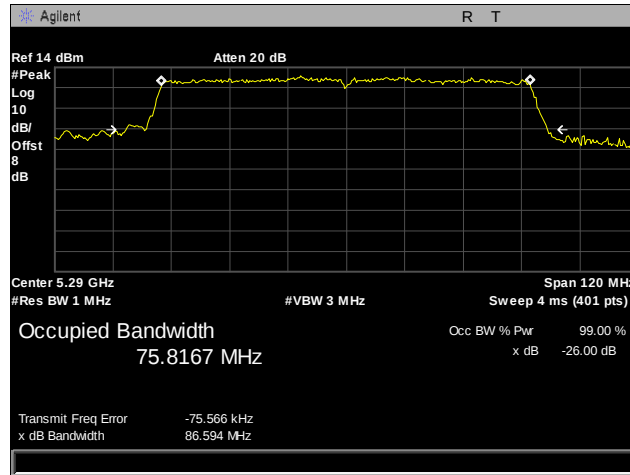


Plot 59. 26 dB Occupied Bandwidth, 802.11n, 5670 MHz, Port 2

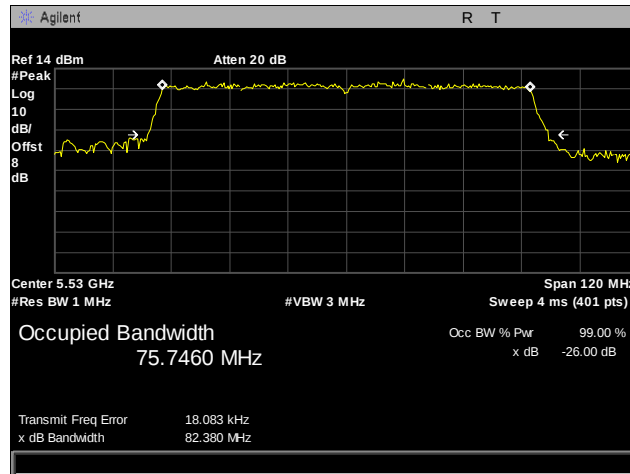


Plot 60. 26 dB Occupied Bandwidth, 802.11n, 5700 MHz, Port 2

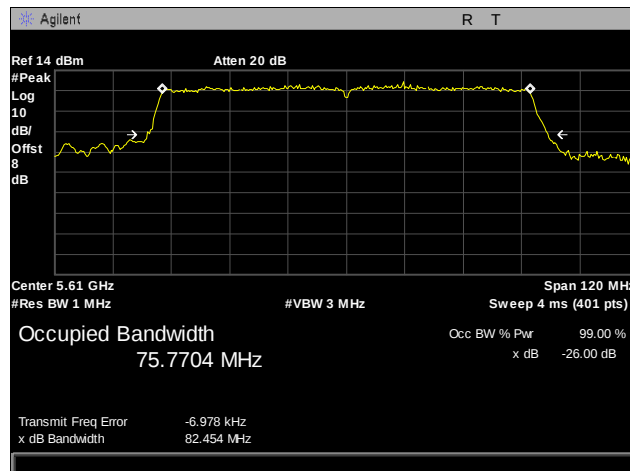
26 dB Occupied Bandwidth, 802.11ac, Port 1



Plot 61. 26 dB Occupied Bandwidth, 802.11ac, 5290 MHz, Port 1

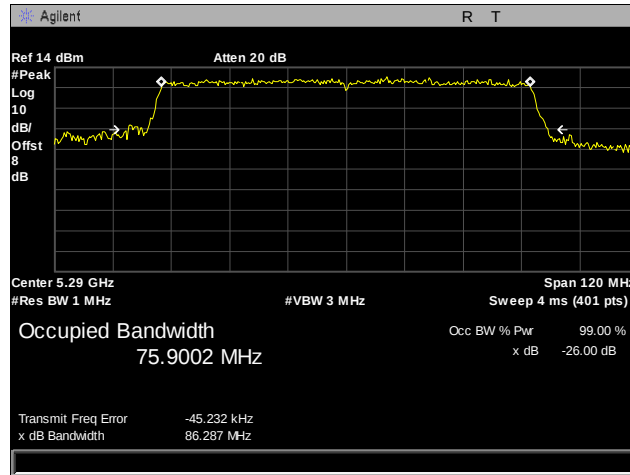


Plot 62. 26 dB Occupied Bandwidth, 802.11ac, 5530 MHz, Port 1

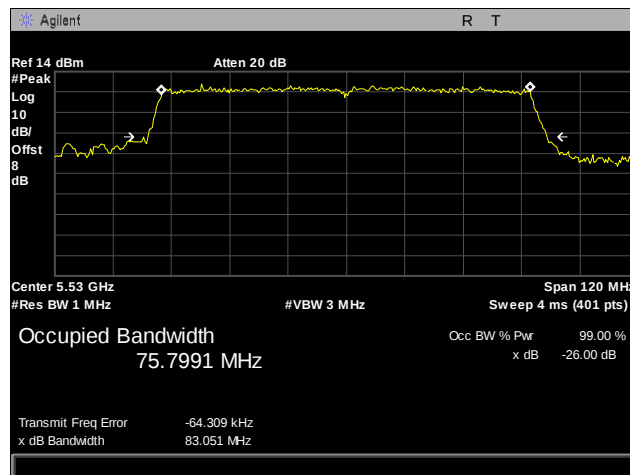


Plot 63. 26 dB Occupied Bandwidth, 802.11ac, 5610 MHz, Port 1

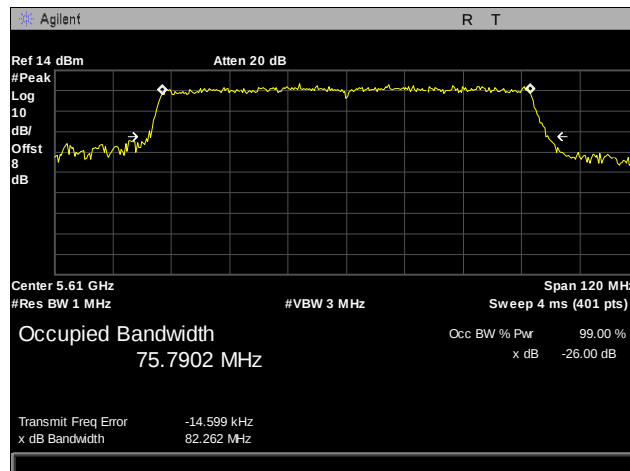
26 dB Occupied Bandwidth, 802.11ac, Port 2



Plot 64. 26 dB Occupied Bandwidth, 802.11ac, 5290 MHz, Port 2



Plot 65. 26 dB Occupied Bandwidth, 802.11ac, 5530 MHz, Port 2



Plot 66. 26 dB Occupied Bandwidth, 802.11ac, 5610 MHz, Port 2

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(a)(2) RF Power Output

Test Requirements: §15.407(a)(2): For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz..

Test Procedure: The EUT was connected to a spectrum analyzer through a attenuator and set to transmit continuously on the low, mid, and high channels. Its power was measured according to measurement method SA-1, as described in 789033 D02 General UNII Test Procedures v01. Plots were corrected for attenuator and cable loss.

Test Results: Equipment was compliant with the Peak Power Output limits of § 15.407(a)(2).

Test Engineer(s): Andy Shen

Test Date(s): 09/10/14

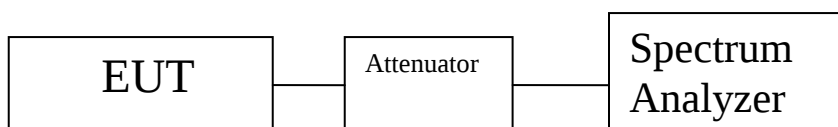


Figure 3. Power Output Test Setup

Frequency (MHz)	Mode	Port R1-A Power (dBm)	Port R1-B Power (dBm)	Summed Power (dBm)
5260	802.11a	18.55		18.55
5300	802.11a	18.54		18.54
5320	802.11a	19.23		19.23
5270	802.11a (40 MHz)	18.64		18.64
5310	802.11a (40 MHz)	19.01		19.01
5260	802.11n	15.21	16.77	19.07
5300	802.11n	16.65	16.66	19.67
5320	802.11n	16.11	16.24	19.19
5270	802.11n (40 MHz)	15.91	16.23	19.08
5310	802.11n (40 MHz)	15.67	16.11	18.91
5290	802.11ac	17.46	18.03	20.76

Table 23. RF Output Power, Test Results, Lower

Frequency (MHz)	Mode	Port R1-A Power (dBm)	Port R1-B Power (dBm)	Summed Power (dBm)
5500	802.11a	19.27		19.27
5600	802.11a	18.49		18.49
5700	802.11a	18.73		18.73
5510	802.11a (40 MHz)	18.97		18.97
5670	802.11a (40 MHz)	19.00		19.00
5500	802.11n	17.20	16.94	20.08
5600	802.11n	16.87	17.16	20.03
5700	802.11n	17.62	17.41	20.53
5510	802.11n (40 MHz)	16.69	16.75	19.73
5670	802.11n (40 MHz)	16.25	16.72	19.50

Table 24. RF Output Power, Test Results, Upper

Electromagnetic Compatibility Criteria for Intentional Radiators

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

Test Requirements: § 15.407(a)(2): In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test Procedure: The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level on the EUT. The RBW was set to 1MHz and the VBW was set to 3MHz. The method of measurement used was method SA-1 from 789033 D02 General UNII Test Procedures v01. Plots are correct for attenuators and cable loss.

Test Results: Equipment was compliant with the peak power spectral density limits of § 15.407 (a)(2).

Test Engineer(s): Andy Shen

Test Date(s): 09/10/14



Figure 4. Power Spectral Density Test Setup

Frequency (MHz)	Mode	Port R1-A PSD (dBm)	Port R1-B PSD (dBm)	Summed PSD (dBm)
5260	802.11a	8.71		8.71
5300	802.11a	8.42		8.42
5320	802.11a	8.47		8.47
5270	802.11a	5.46		5.46
5310	802.11a	5.80		5.80
5260	802.11n	5.95	6.16	9.07
5300	802.11n	5.78	6.00	8.90
5320	802.11n	6.12	6.30	9.22
5270	802.11n	4.83	5.25	8.06
5310	802.11n	4.79	5.75	8.31
5290	802.11ac	1.509	1.725	4.63

Table 25. Peak Spectral Density, Test Results, Lower

Frequency (MHz)	Mode	Port R1-A PSD (dBm)	Port R1-B PSD (dBm)	Summed PSD (dBm)
5500	802.11a	8.75		8.75
5600	802.11a	8.08		8.08
5700	802.11a	8.43		8.43
5510	802.11a	5.55		5.55
5670	802.11a	5.58		5.58
5500	802.11n	5.92	6.22	9.08
5600	802.11n	5.53	5.67	8.61
5700	802.11n	5.70	6.14	8.93
5510	802.11n	4.79	5.59	8.22
5670	802.11n	4.68	5.07	7.89

Table 26. Peak Spectral Density, Test Results, Upper

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(b)(2), (3), (7) Undesirable Emissions

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

§ 15.407(b)(2): For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

§ 15.407(b)(3): For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

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

Test Procedure: The transmitter was placed on an 80cm non-metallic table inside in a semi-anechoic chamber. Measurements were performed with the EUT rotated 360 degrees and varying the adjustable antenna mast height to determine worst case orientation for maximum emissions. A preamp was used in the range from 7-18GHz to improve noise floor. Plots were corrected for cable loss, antenna, and preamp gain.

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

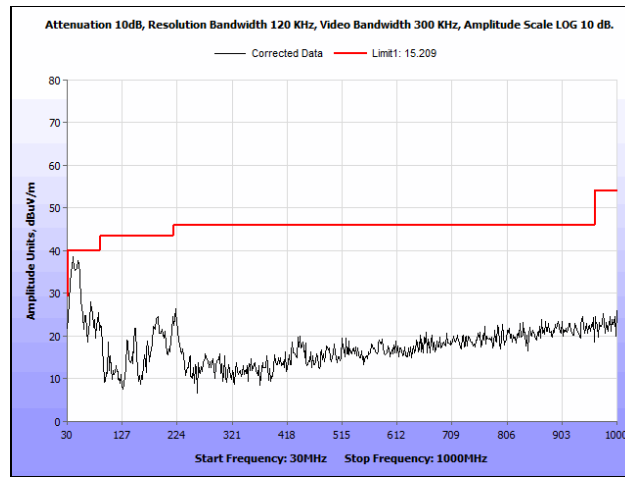
For measurements above 1 GHz, measurements were made with a Peak detector with 1 MHz resolution bandwidth. A notch filter was use to filter the transmitting signal. Where the spurious emissions fell into a restricted band, measurements were also made with an average detector to make sure they complied with 15.209 limits. Only noise floor was observed above 18 GHz.

Test Results: The EUT was compliant with the Radiated Emission limits for Intentional Radiators. See following pages for detailed test results. All emissions above 18 GHz were at the noise floor of the receiver.

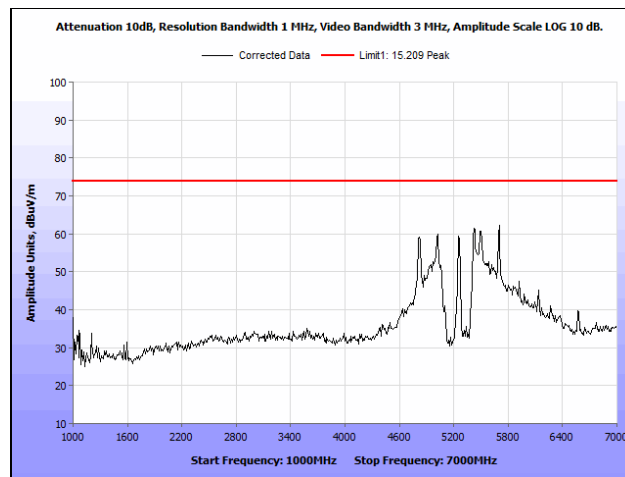
Test Engineer(s): Andy Shen

Test Date(s): 09/05/14

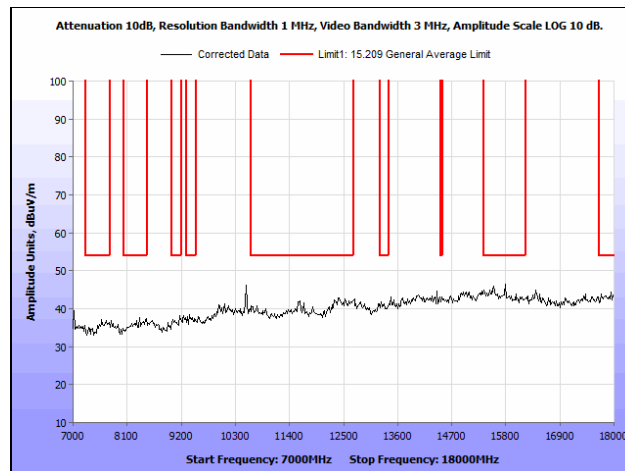
Radiated Spurious Emissions, 802.11a, Ceiling Antenna, Lower Band



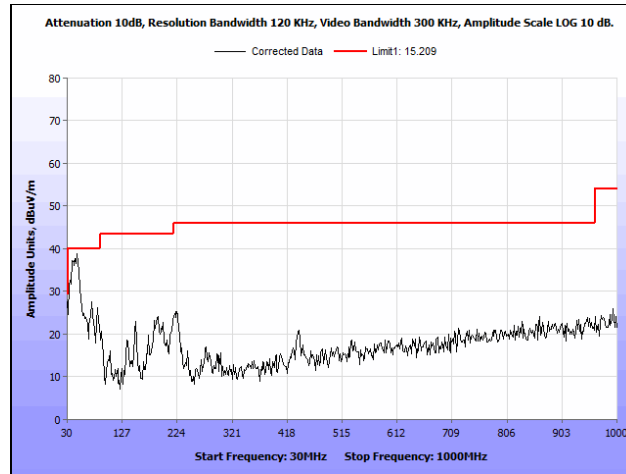
Plot 67. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 30 MHz – 1 GHz,



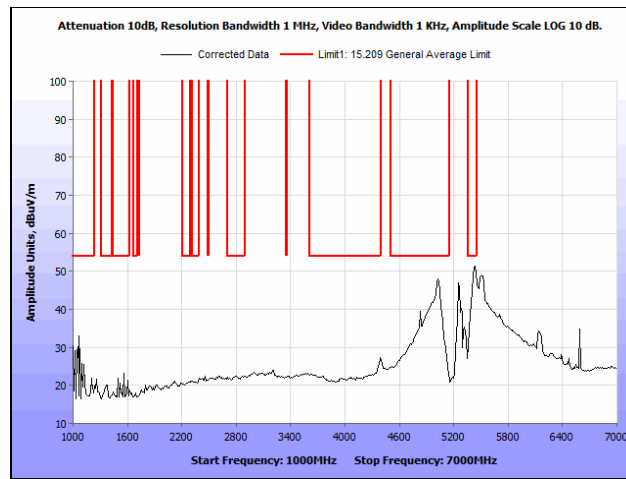
Plot 68. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 1 GHz – 7 GHz, Peak,



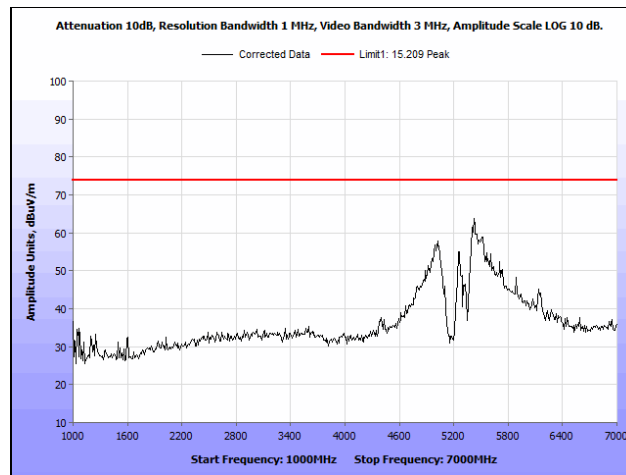
Plot 69. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 7 GHz – 18 GHz,



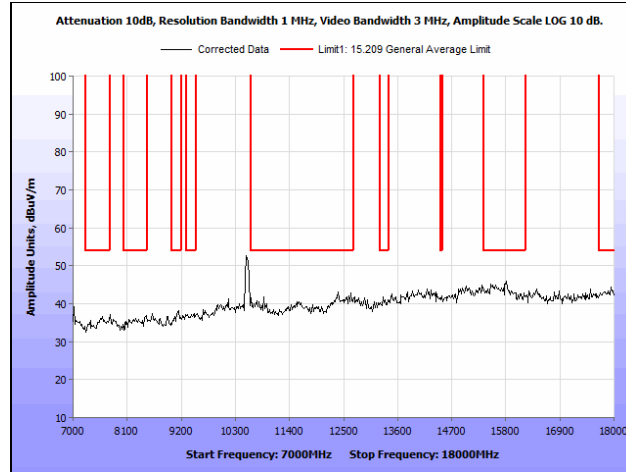
Plot 70. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 30 MHz – 1 GHz,



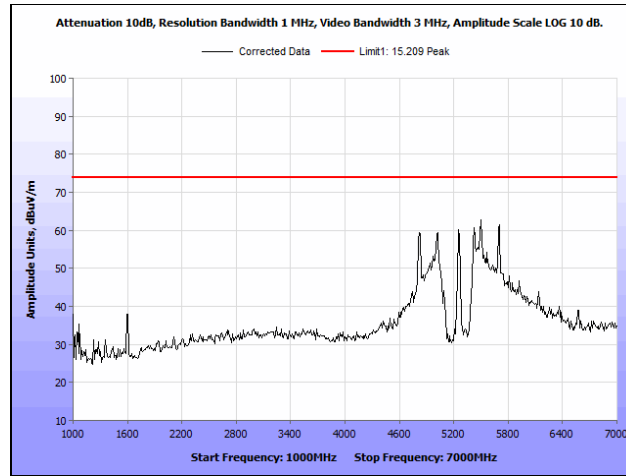
Plot 71. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 1 GHz – 7 GHz, Average,



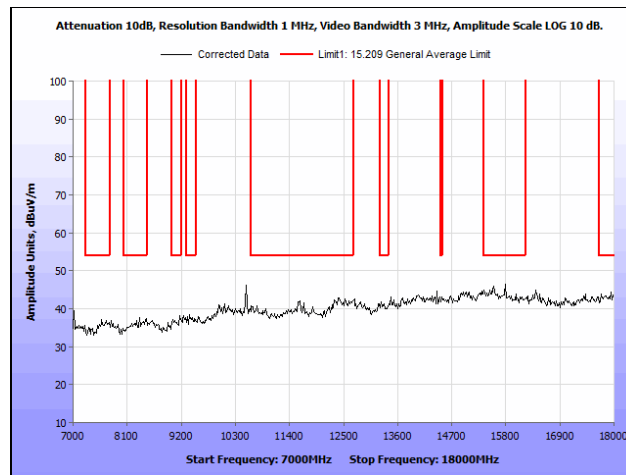
Plot 72. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 1 GHz – 7 GHz, Peak,



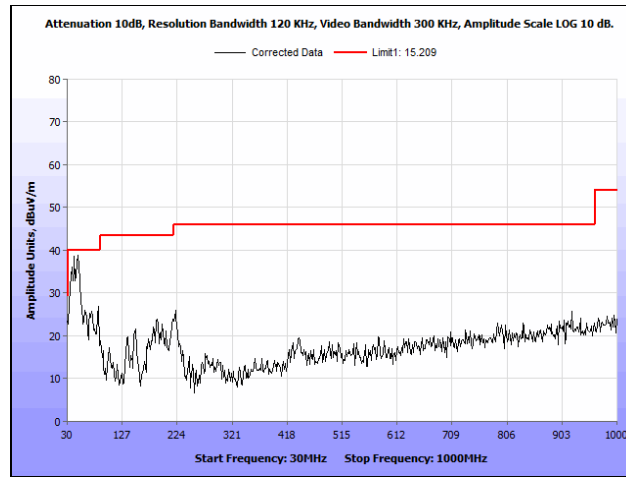
Plot 73. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 7 GHz – 18 GHz,



Plot 74. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 1 GHz – 7 GHz, Peak,



Plot 75. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 7 GHz – 18 GHz,



Plot 76. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 30 MHz – 1 GHz,

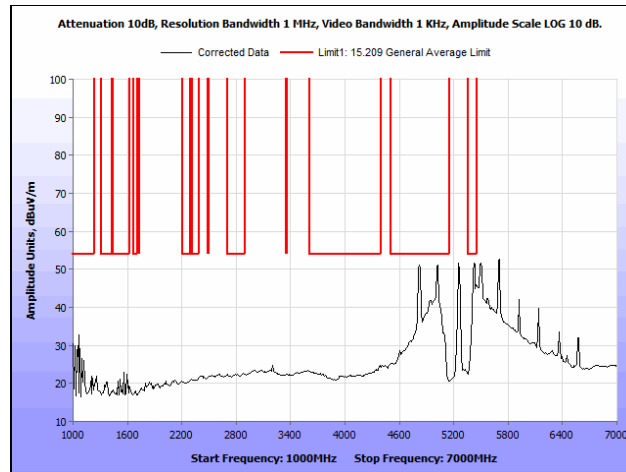
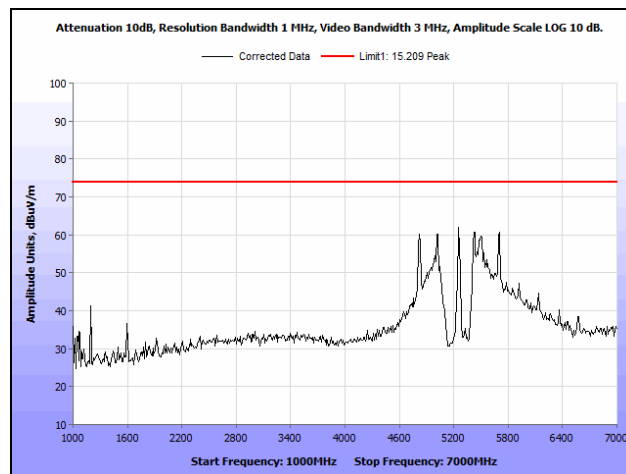
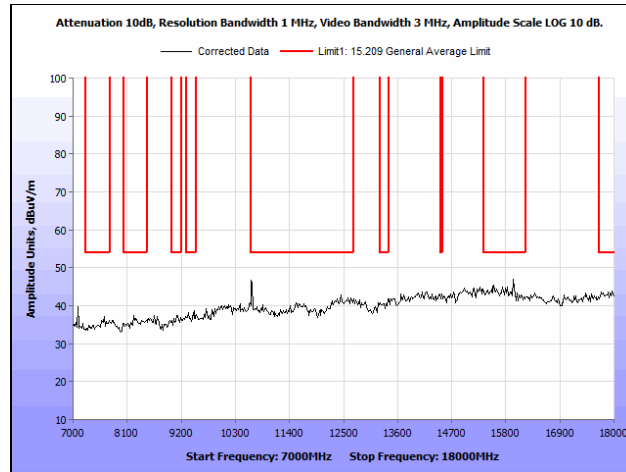


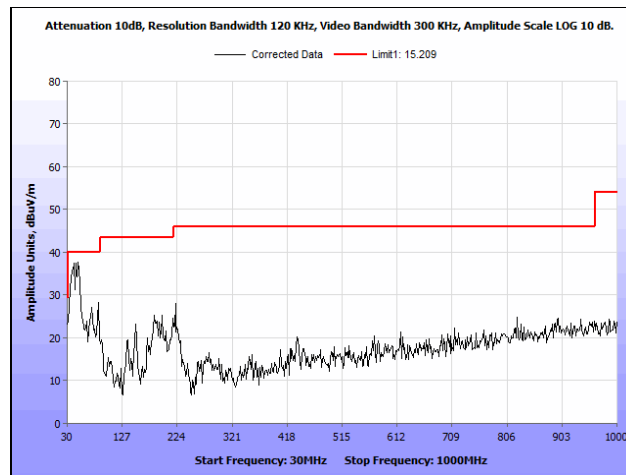
Table 27. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 1 GHz – 7 GHz, Average,



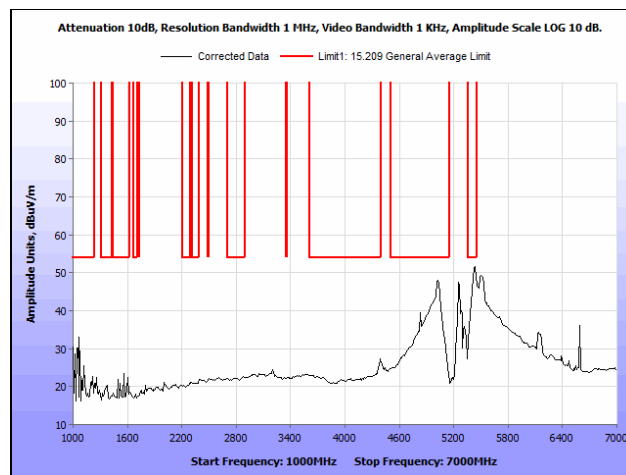
Plot 77. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 1 GHz – 7 GHz, Peak,



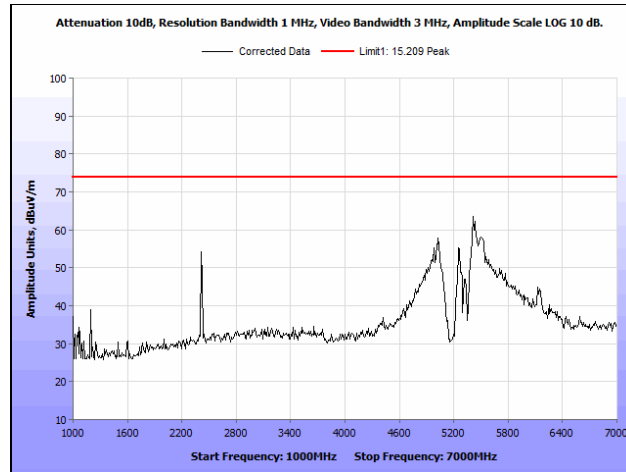
Plot 78. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 7 GHz – 18 GHz,



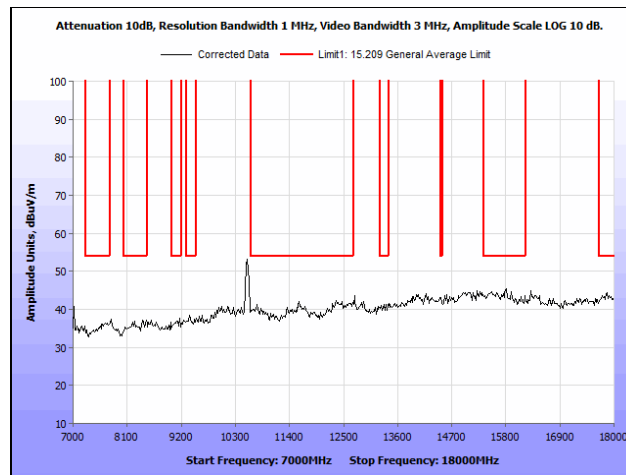
Plot 79. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 30 MHz – 1 GHz,



Plot 80. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 1 GHz – 7 GHz, Average,

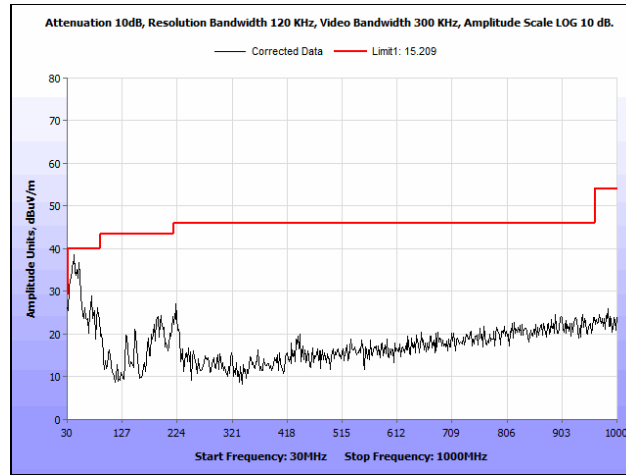


Plot 81. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 1 GHz – 7 GHz, Peak,

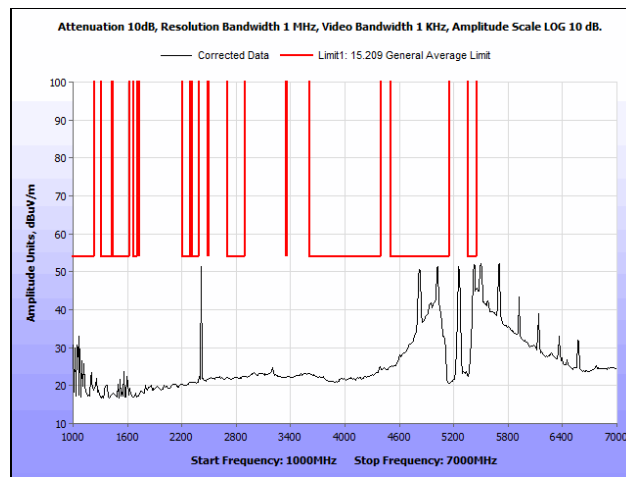


Plot 82. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 7 GHz – 18 GHz, Peak,

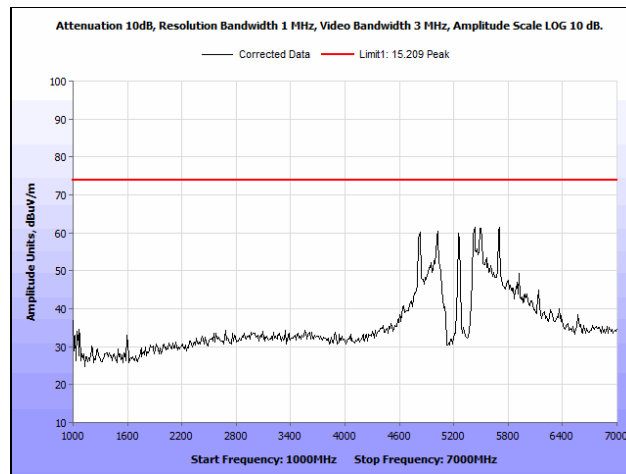
Radiated Spurious Emissions, 802.11n, , Lower Band



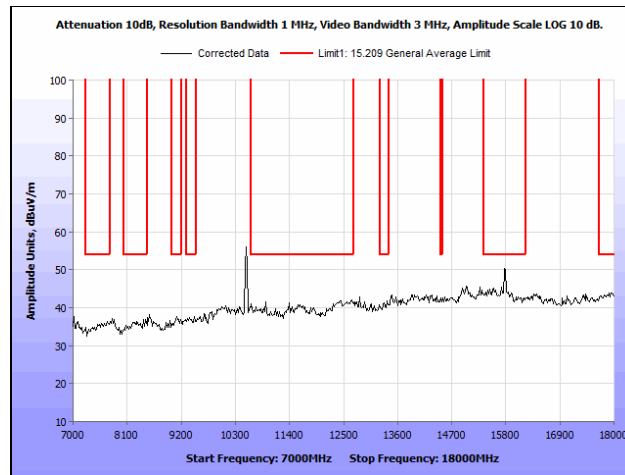
Plot 83. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 30 MHz – 1 GHz,



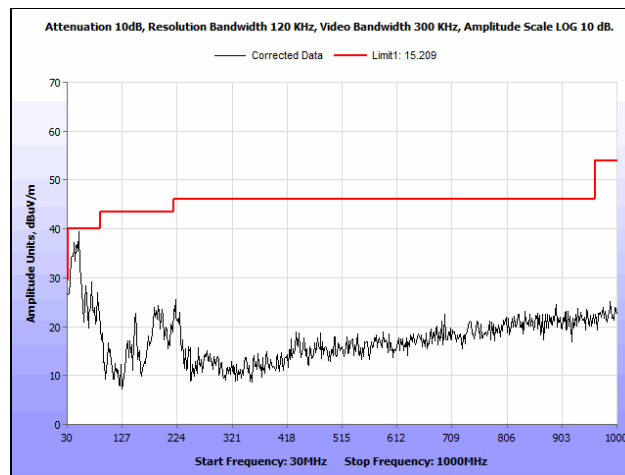
Plot 84. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 1 GHz – 7 GHz, Average,



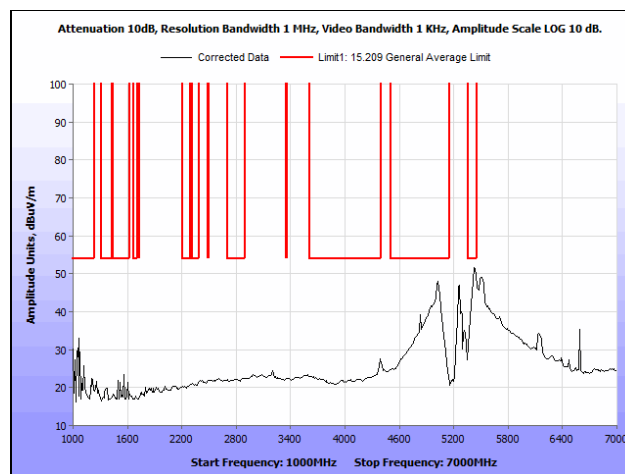
Plot 85. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 1 GHz – 7 GHz, Peak,



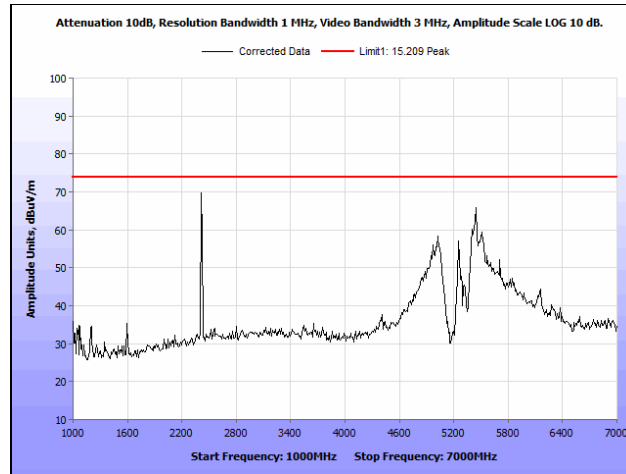
Plot 86. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 7 GHz – 18 GHz,



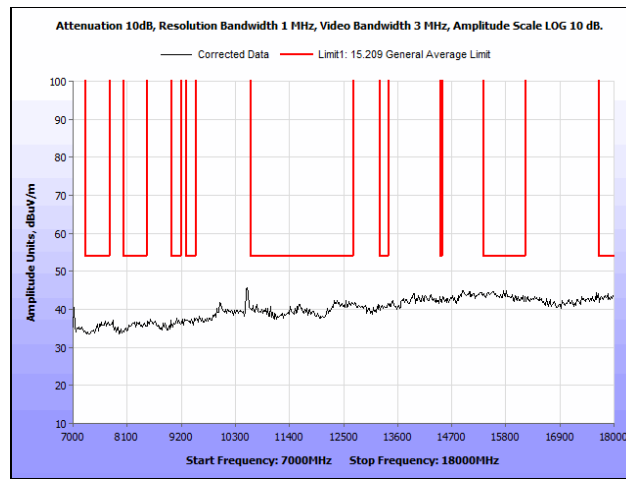
Plot 87. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 30 MHz – 1 GHz,



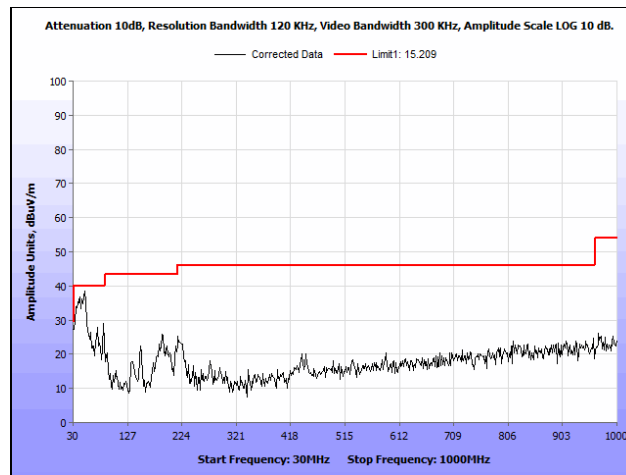
Plot 88. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 1 GHz – 7 GHz, Average,



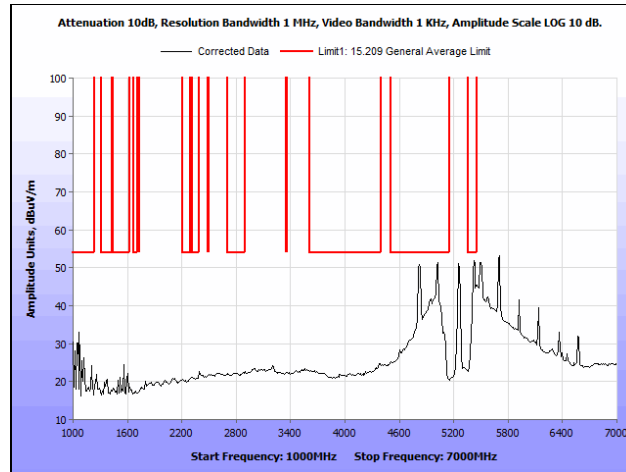
Plot 89. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 1 GHz – 7 GHz, Peak,



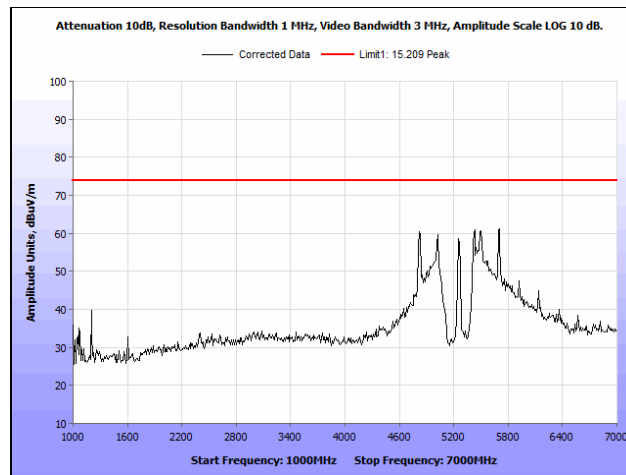
Plot 90. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 7 GHz – 18 GHz,



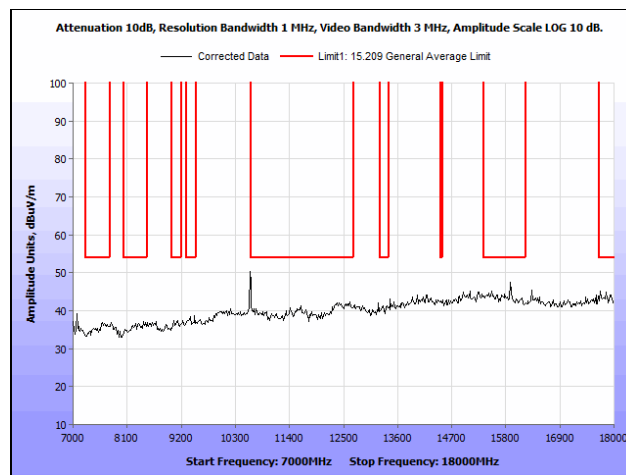
Plot 91. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 30 MHz – 1 GHz,



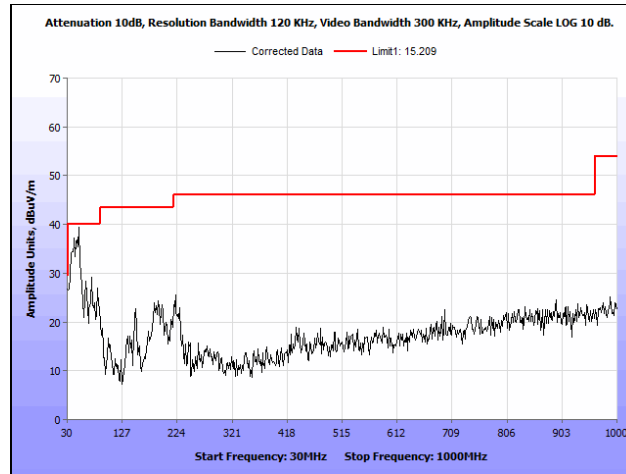
Plot 92. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 1 GHz – 7 GHz, Average,



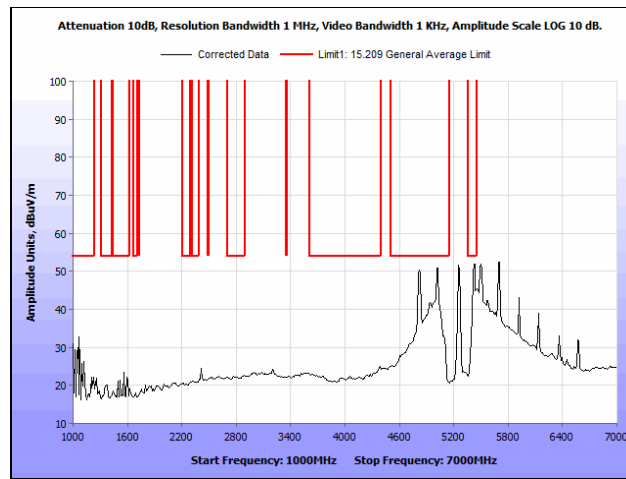
Plot 93. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 1 GHz – 7 GHz, Peak,



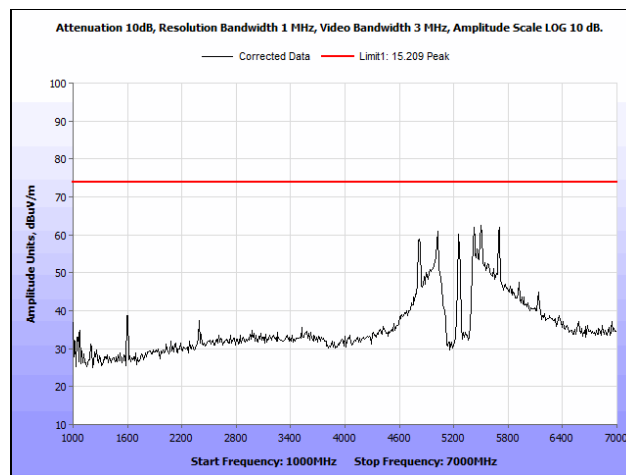
Plot 94. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 7 GHz – 18 GHz,



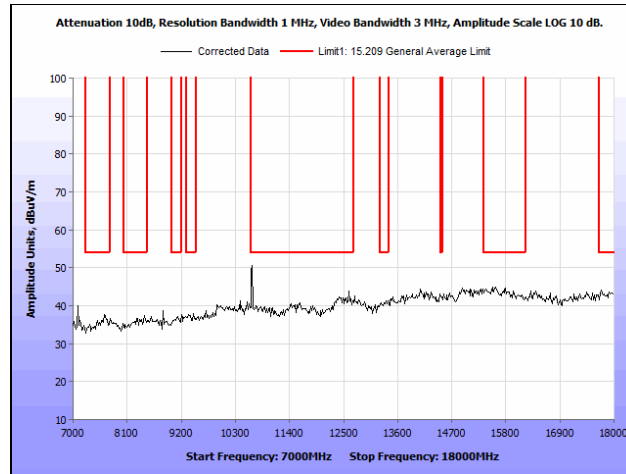
Plot 95. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 30 MHz – 1 GHz,



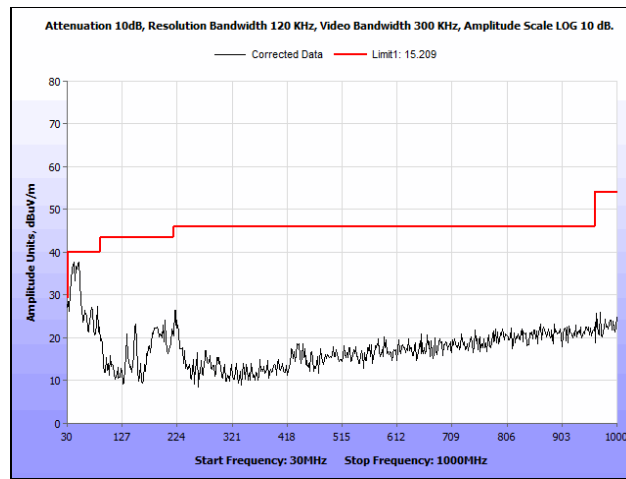
Plot 96. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 1 GHz – 7 GHz, Average,



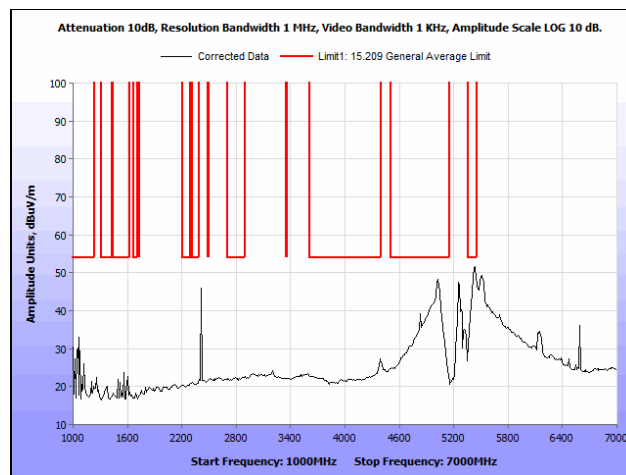
Plot 97. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 1 GHz – 7 GHz, Peak,



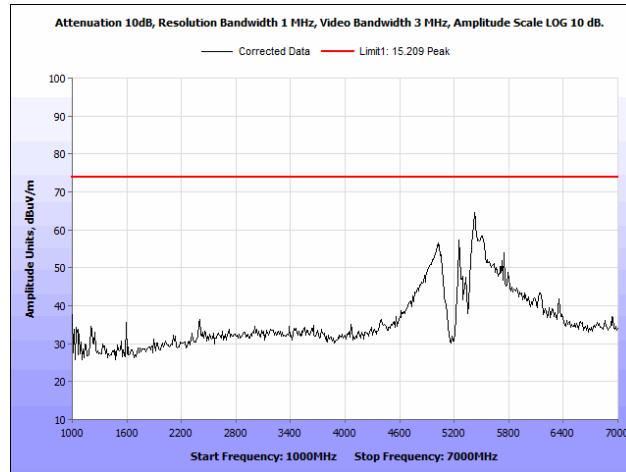
Plot 98. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 7 GHz – 18 GHz,



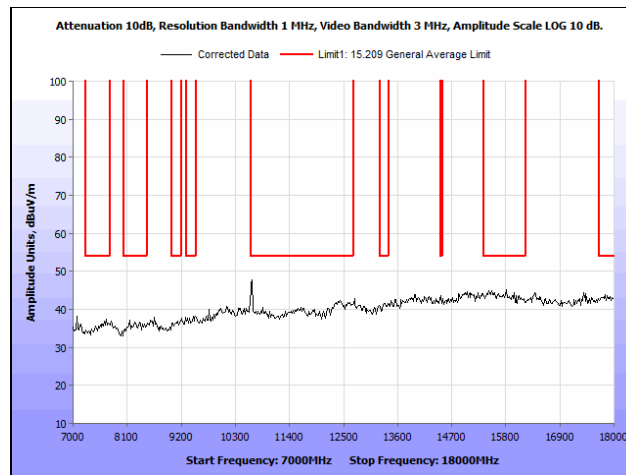
Plot 99. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 30 MHz – 1 GHz,



Plot 100. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 1 GHz – 7 GHz, Average,

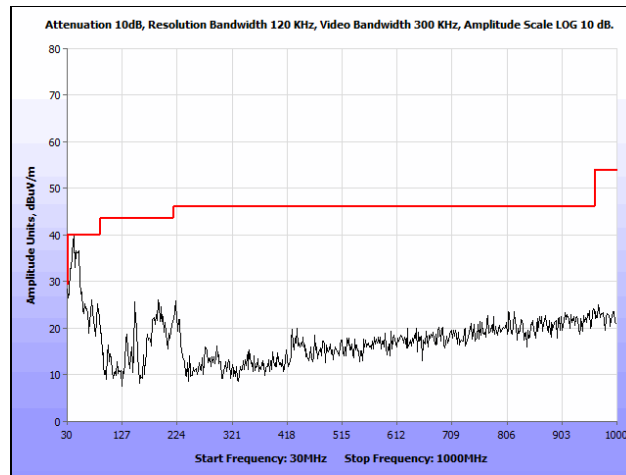


Plot 101. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 1 GHz – 7 GHz, Peak,

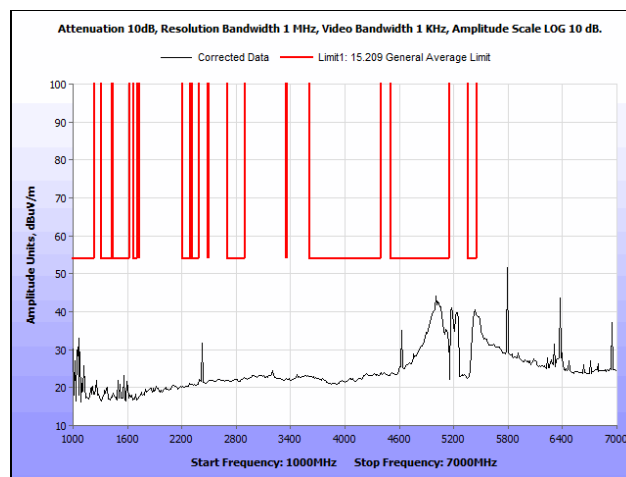


Plot 102. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 7 GHz – 18 GHz, Peak,

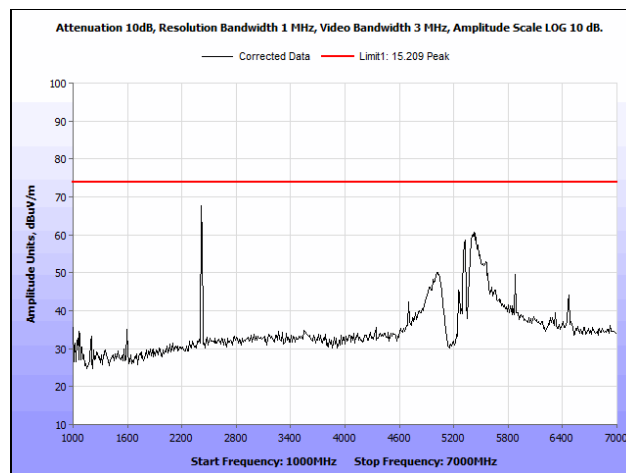
Radiated Spurious Emissions, 802.11ac , Lower Band



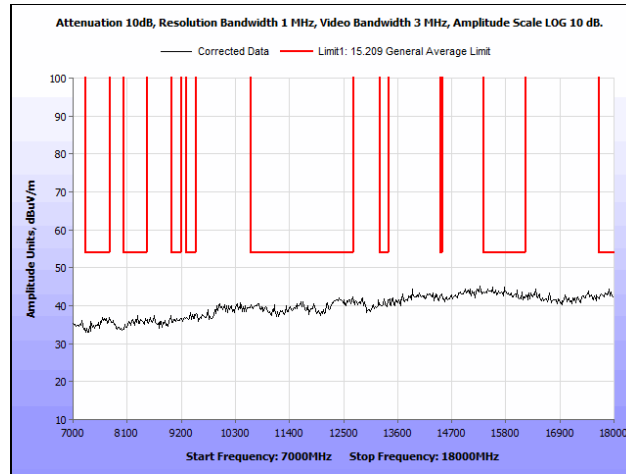
Plot 103. Radiated Spurious Emissions, 802.11ac 80 MHz, 30 MHz – 1 GHz,



Plot 104. Radiated Spurious Emissions, 802.11ac 80 MHz, 1 GHz – 7 GHz, Average,

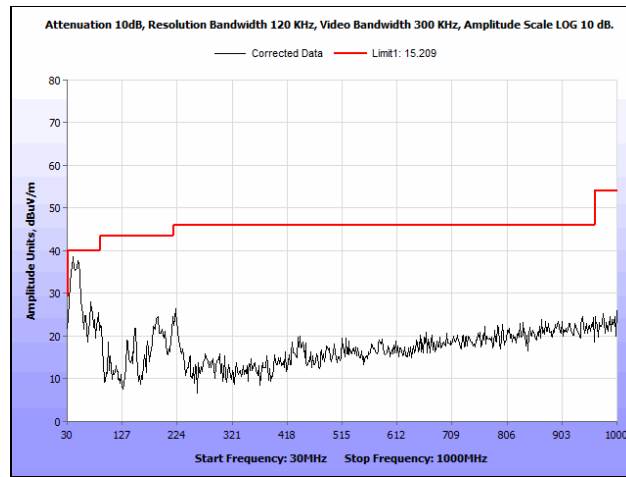


Plot 105. Radiated Spurious Emissions, 802.11ac 80 MHz, 1 GHz – 7 GHz, Peak,

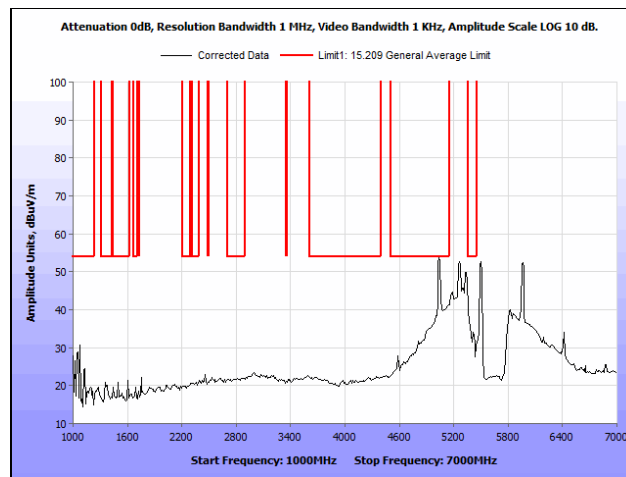


Plot 106. Radiated Spurious Emissions, 802.11ac 80 MHz, 7 GHz – 18 GHz,

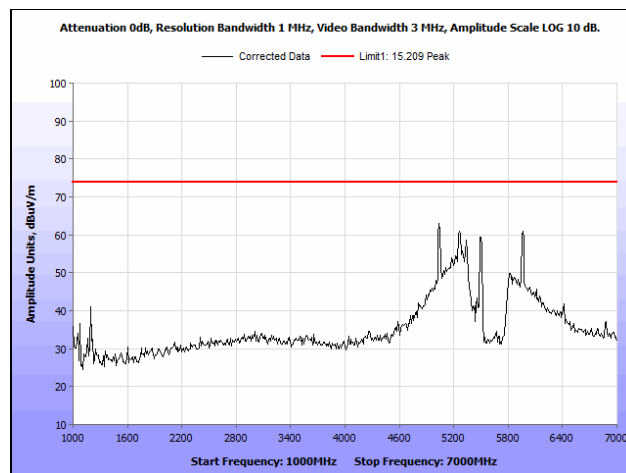
Radiated Spurious Emissions, 802.11a, , Upper Band



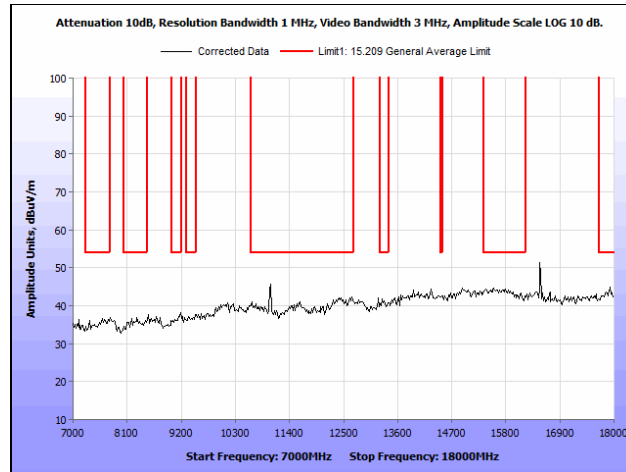
Plot 107. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 30 MHz – 1 GHz,



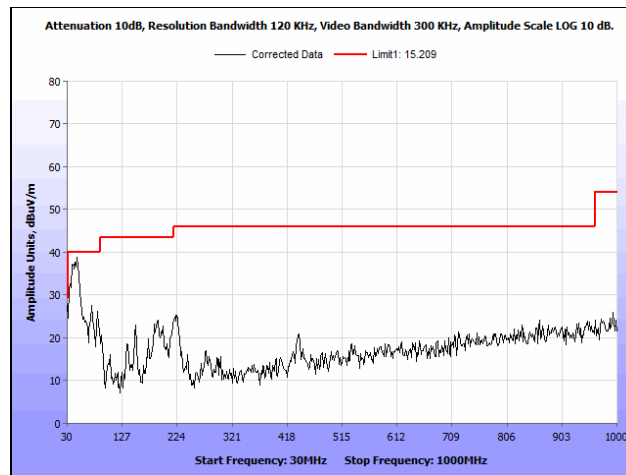
Plot 108. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 1 GHz – 7 GHz, Average,



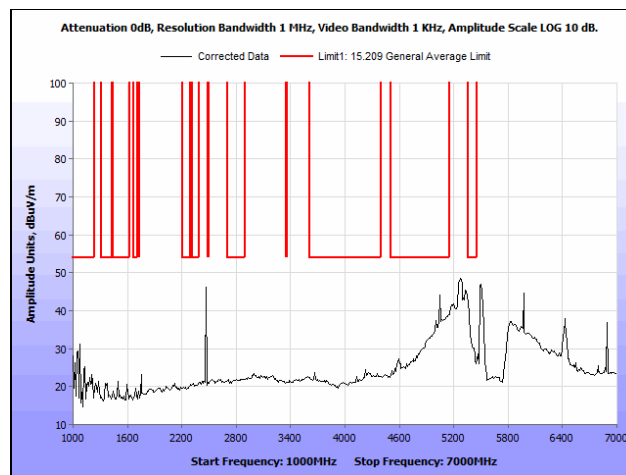
Plot 109. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 1 GHz – 7 GHz, Peak,



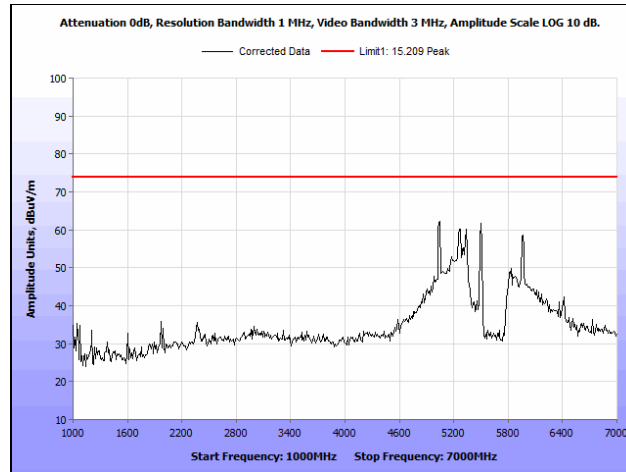
Plot 110. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 1 GHz – 7 GHz, Peak,



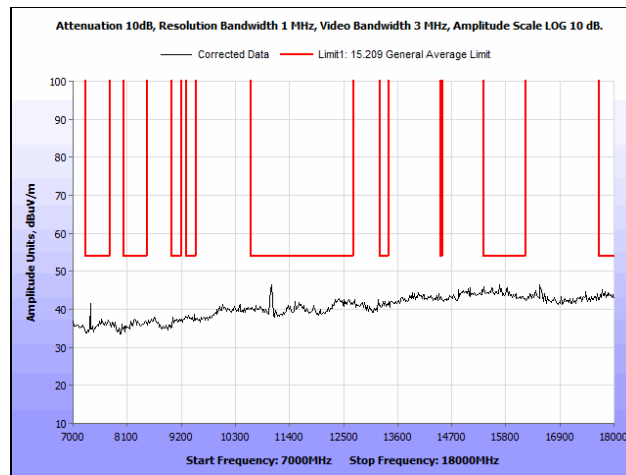
Plot 111. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 30 MHz – 1 GHz,



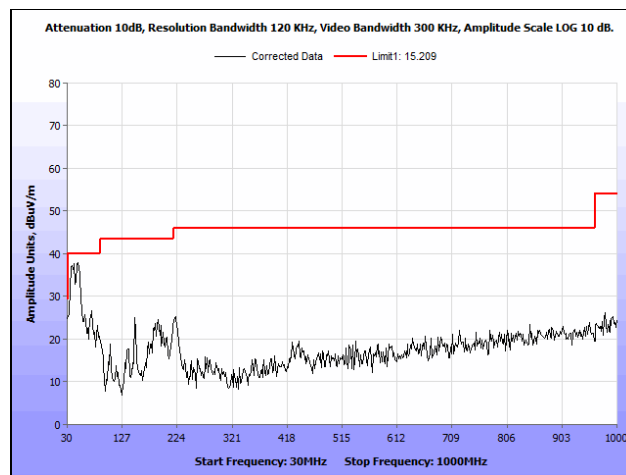
Plot 112. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 1 GHz – 7 GHz, Average,



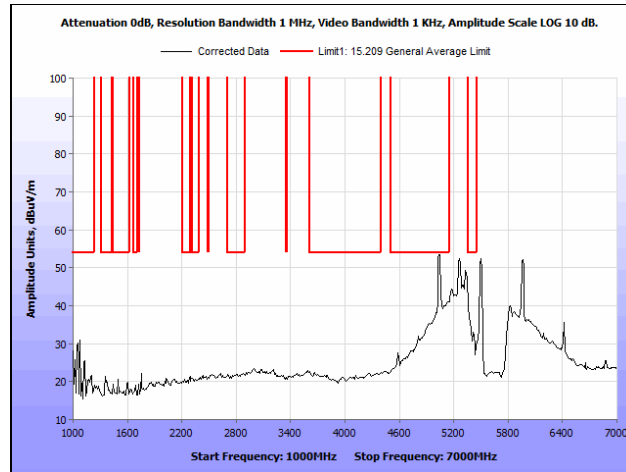
Plot 113. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 1 GHz – 7 GHz, Peak,



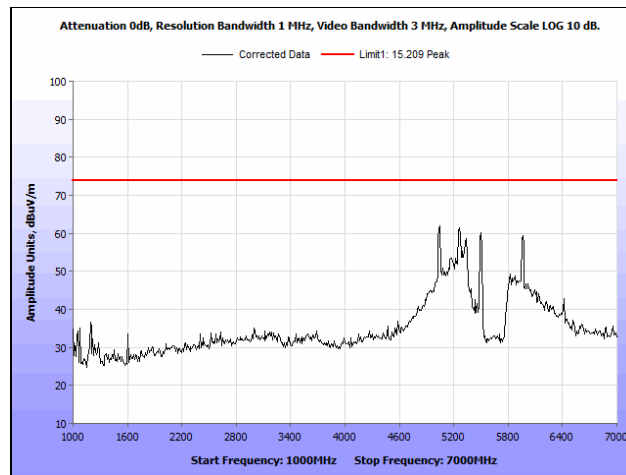
Plot 114. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 7 GHz – 18 GHz,



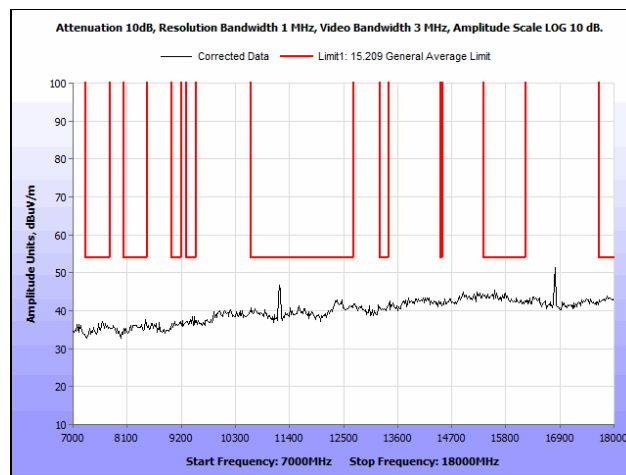
Plot 115. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 30 MHz – 1 GHz,



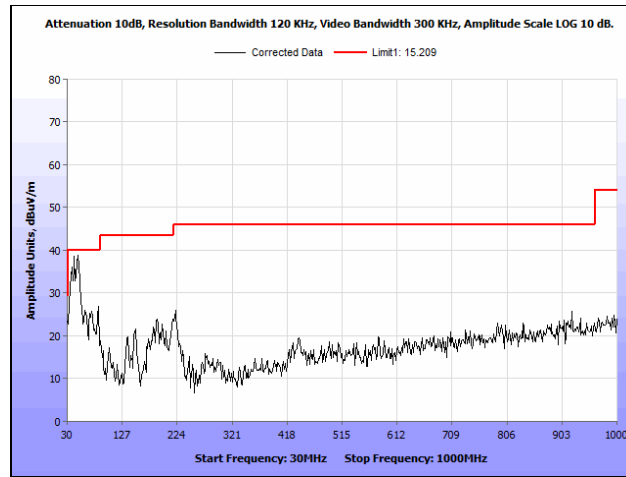
Plot 116. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 1 GHz – 7 GHz, Average,



Plot 117. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 1 GHz – 7 GHz, Peak,



Plot 118. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 7 GHz – 18 GHz,



Plot 119. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 30 MHz – 1 GHz,

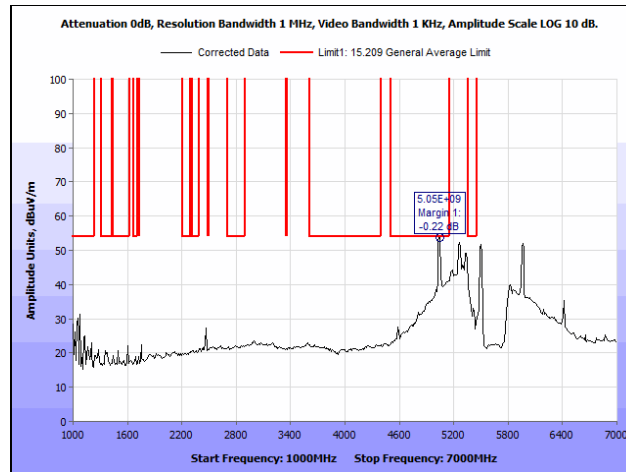
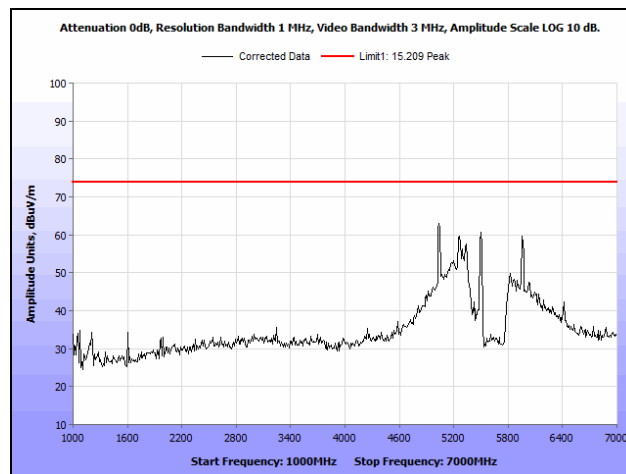
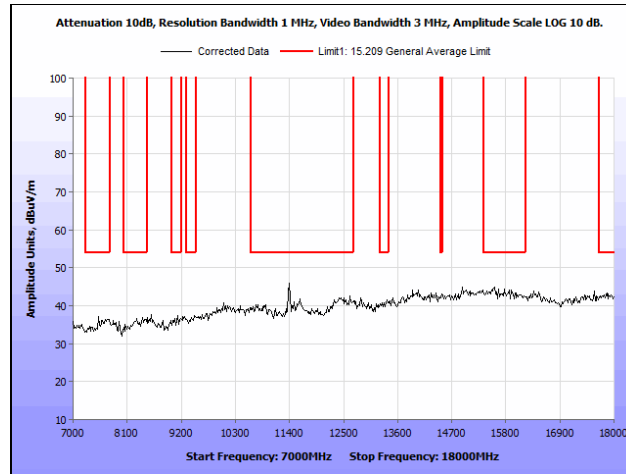


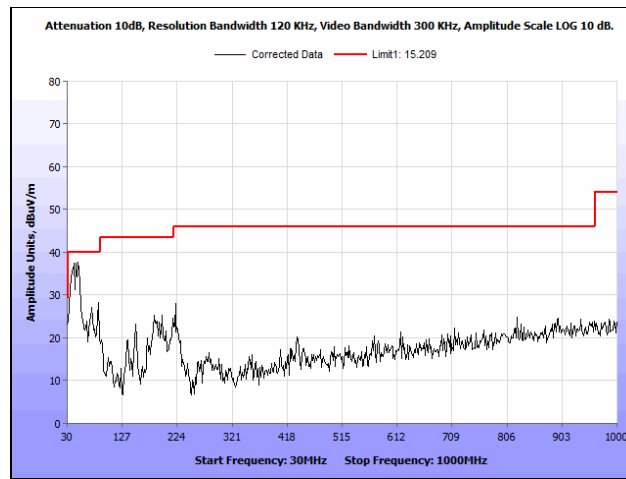
Table 28. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 1 GHz – 7 GHz, Average,



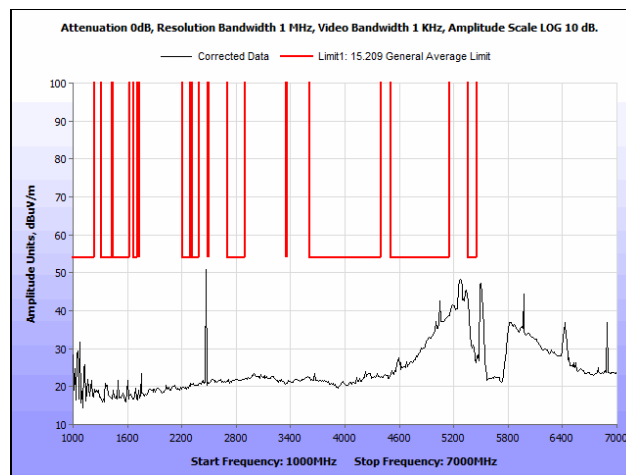
Plot 120. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 1 GHz – 7 GHz, Peak,



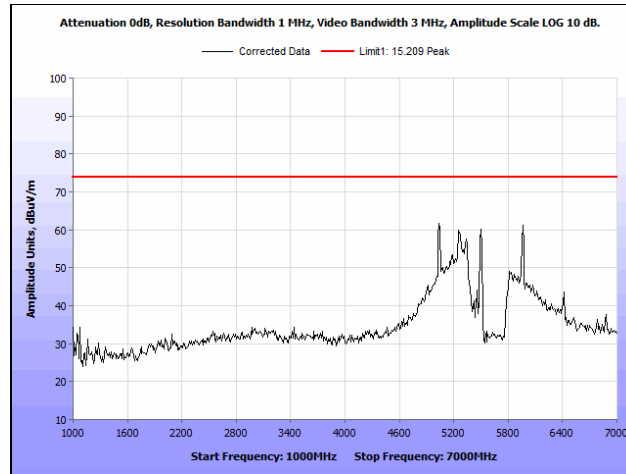
Plot 121. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 7 GHz – 18 GHz,



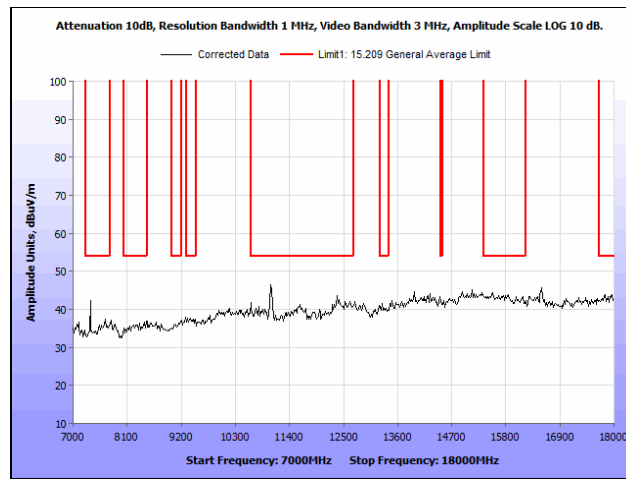
Plot 122. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 30 MHz – 1 GHz,



Plot 123. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 1 GHz – 7 GHz, Average,

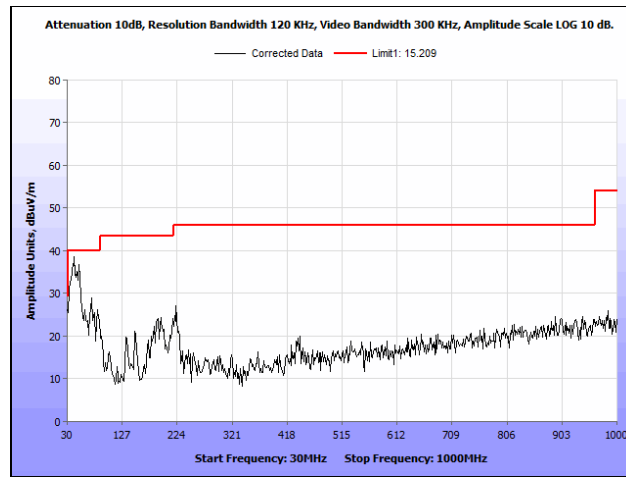


Plot 124. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 1 GHz – 7 GHz, Peak,

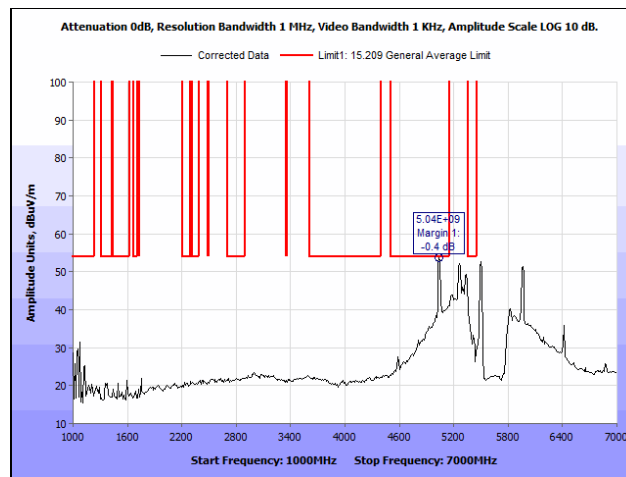


Plot 125. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 7 GHz – 18 GHz, Peak,

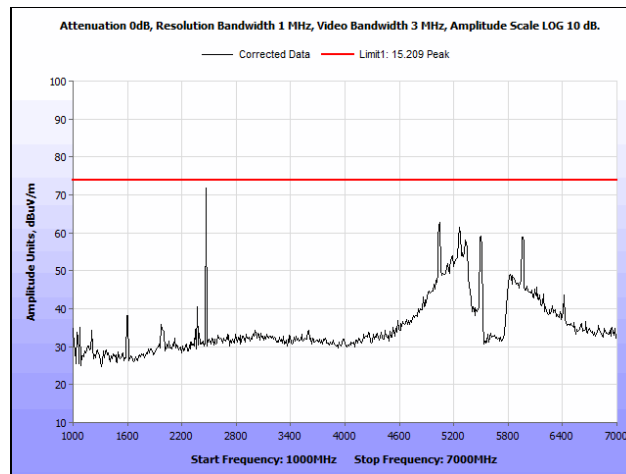
Radiated Spurious Emissions, 802.11n , Upper Band



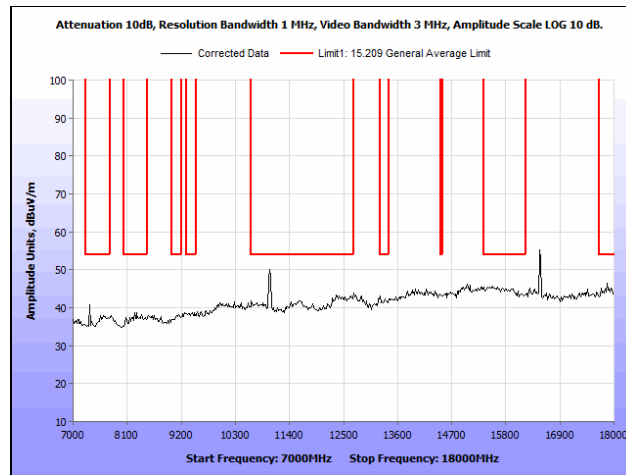
Plot 126. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 30 MHz – 1 GHz,



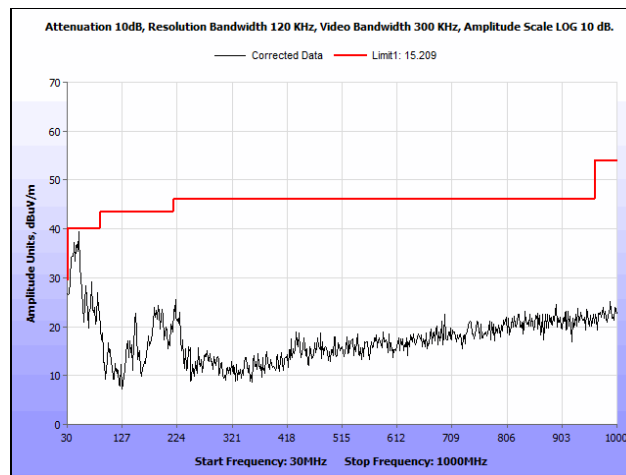
Plot 127. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 1 GHz – 7 GHz, Average,



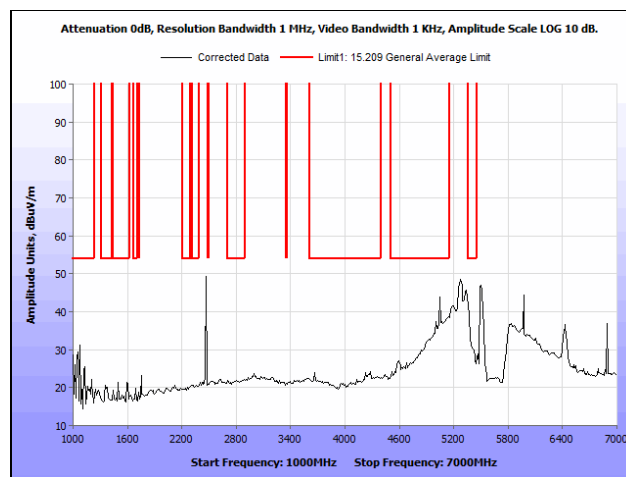
Plot 128. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 1 GHz – 7 GHz, Peak,



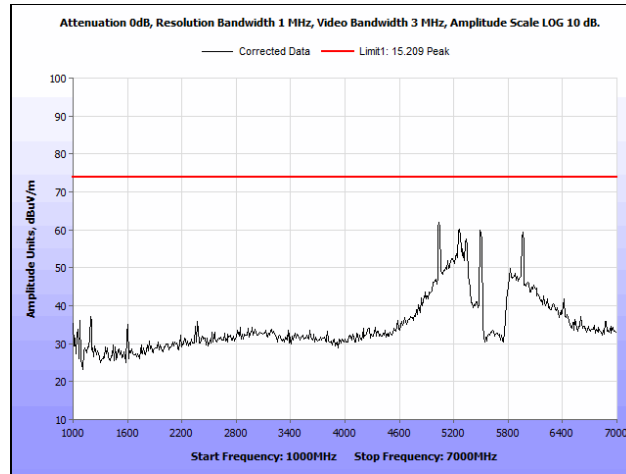
Plot 129. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 7 GHz – 18 GHz,



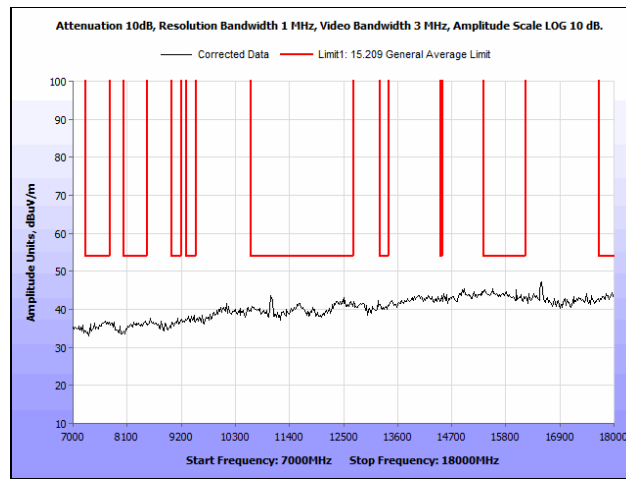
Plot 130. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 30 MHz – 1 GHz,



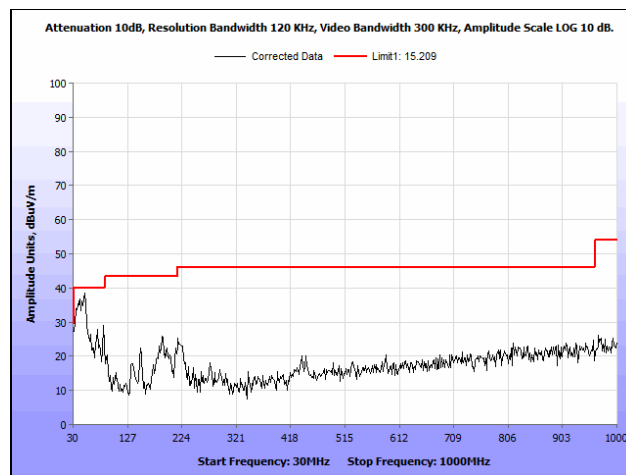
Plot 131. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 1 GHz – 7 GHz, Average,



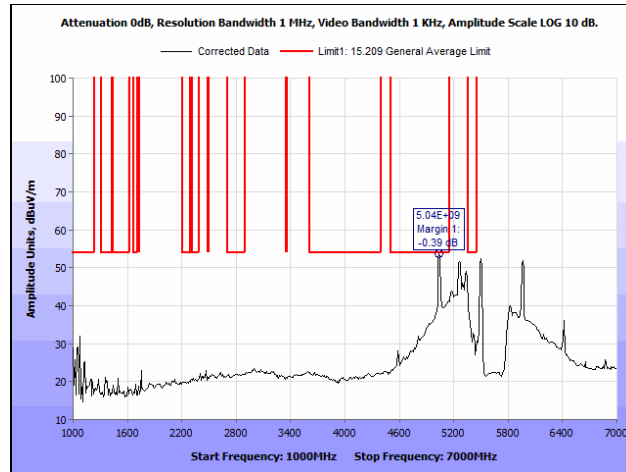
Plot 132. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 1 GHz – 7 GHz, Peak,



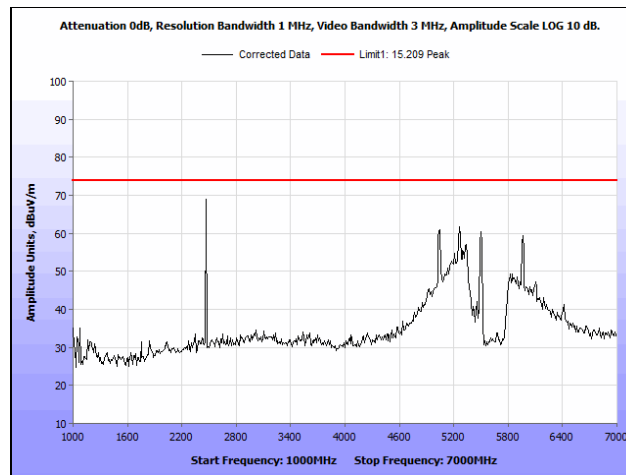
Plot 133. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 7 GHz – 18 GHz,



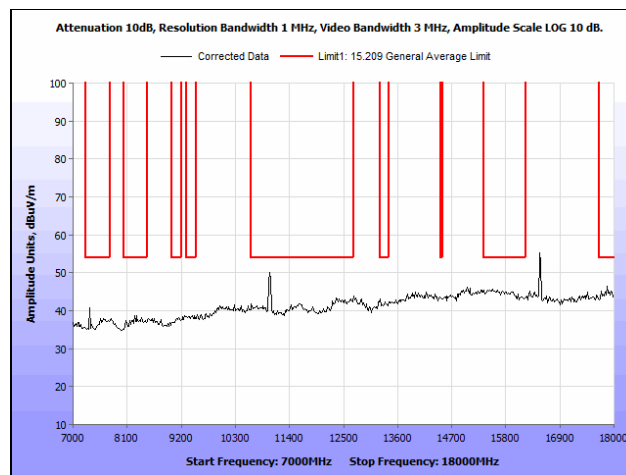
Plot 134. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 30 MHz – 1 GHz,



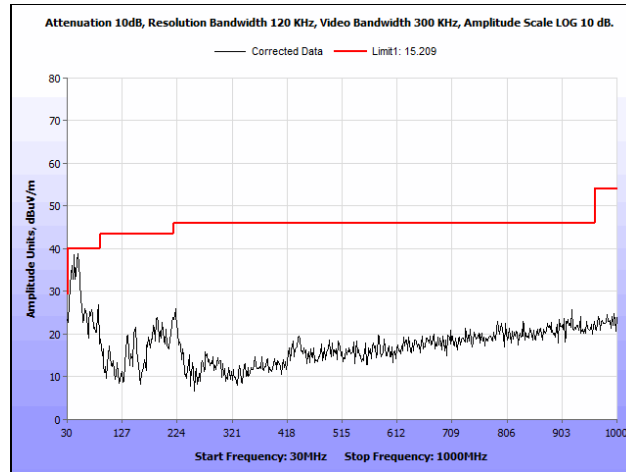
Plot 135. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 1 GHz – 7 GHz, Average,



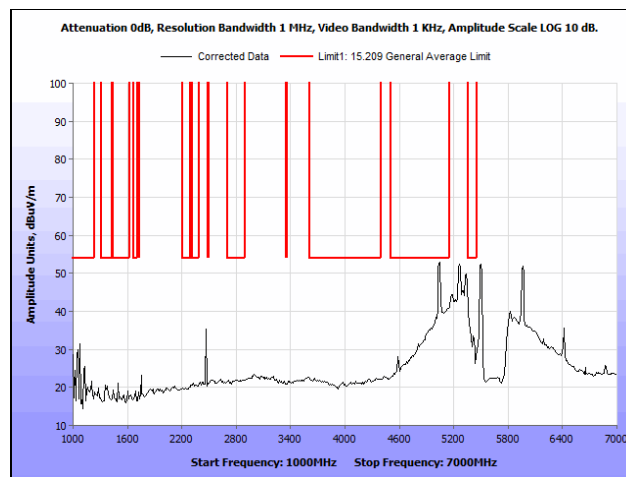
Plot 136. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 1 GHz – 7 GHz, Peak,



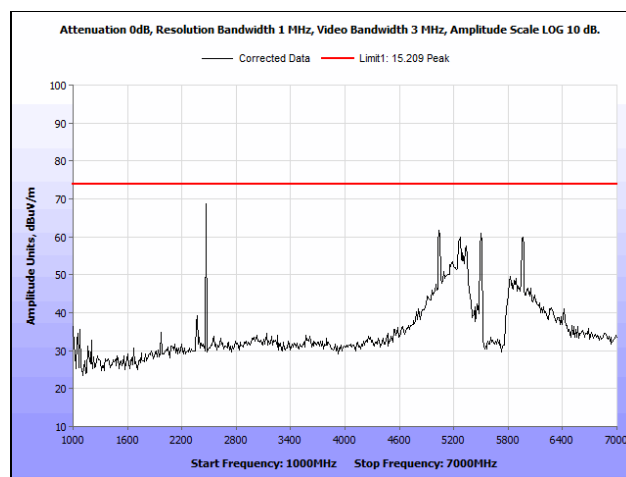
Plot 137. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 7 GHz – 18 GHz,



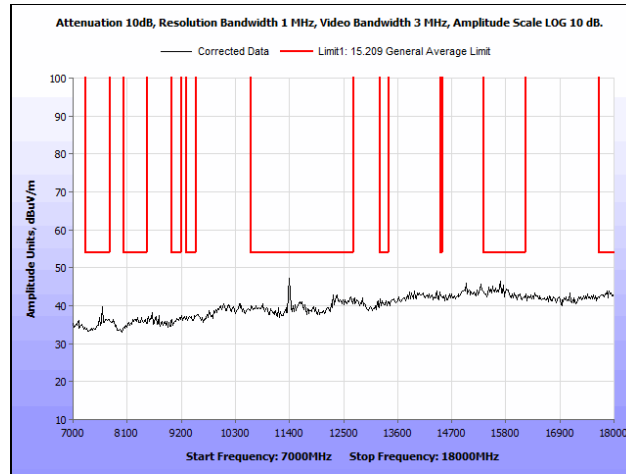
Plot 138. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 30 MHz – 1 GHz,



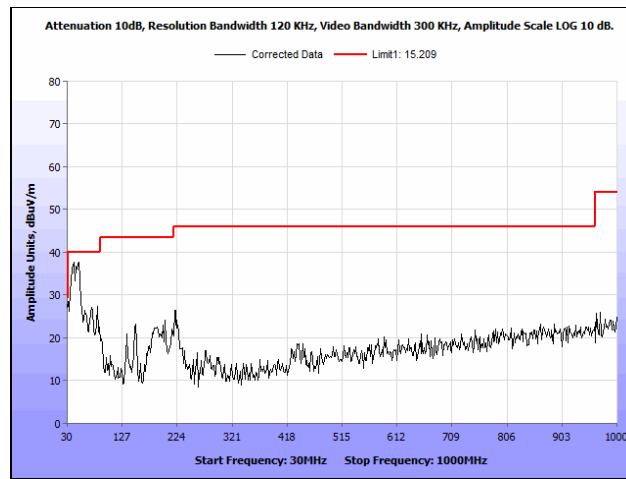
Plot 139. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 1 GHz – 7 GHz, Average,



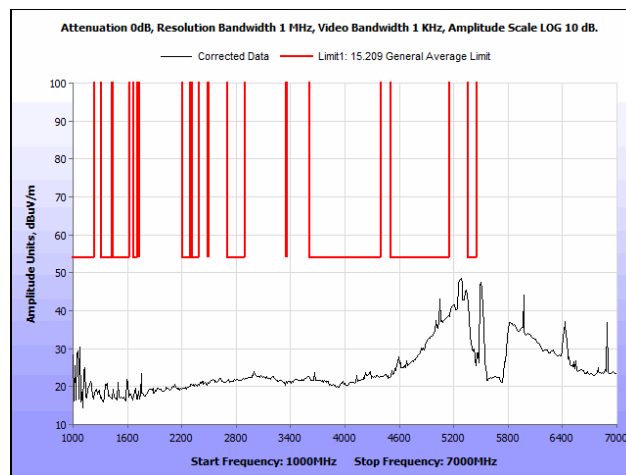
Plot 140. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 1 GHz – 7 GHz, Peak,



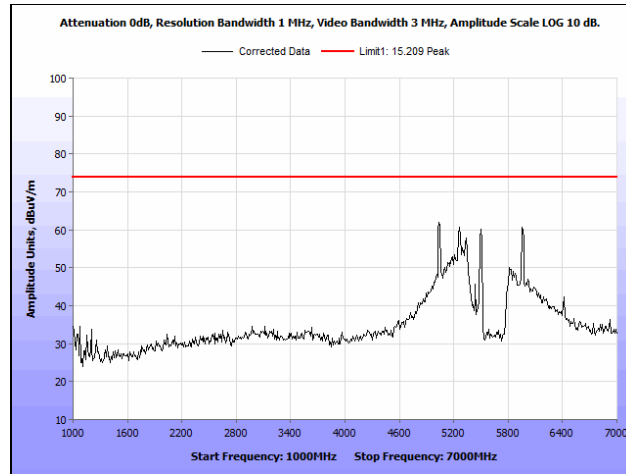
Plot 141. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 7 GHz – 18 GHz,



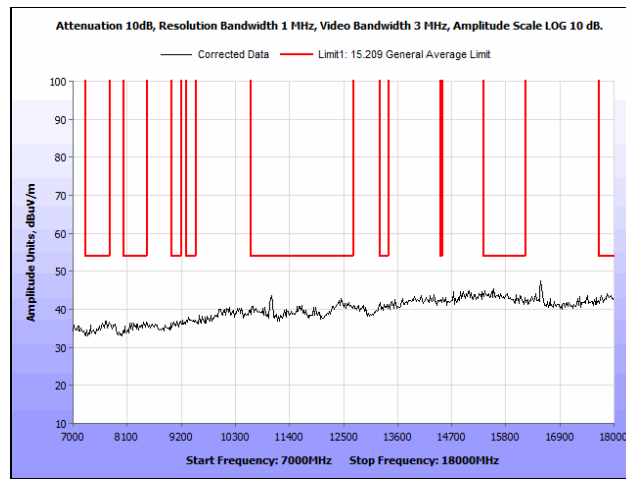
Plot 142. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 30 MHz – 1 GHz,



Plot 143. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 1 GHz – 7 GHz, Average,



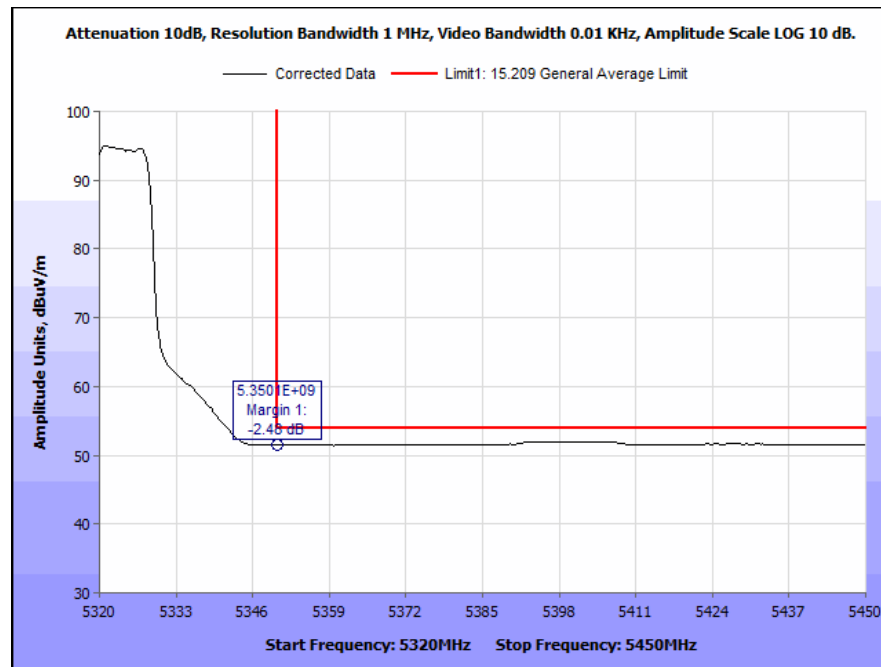
Plot 144. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 1 GHz – 7 GHz, Peak,



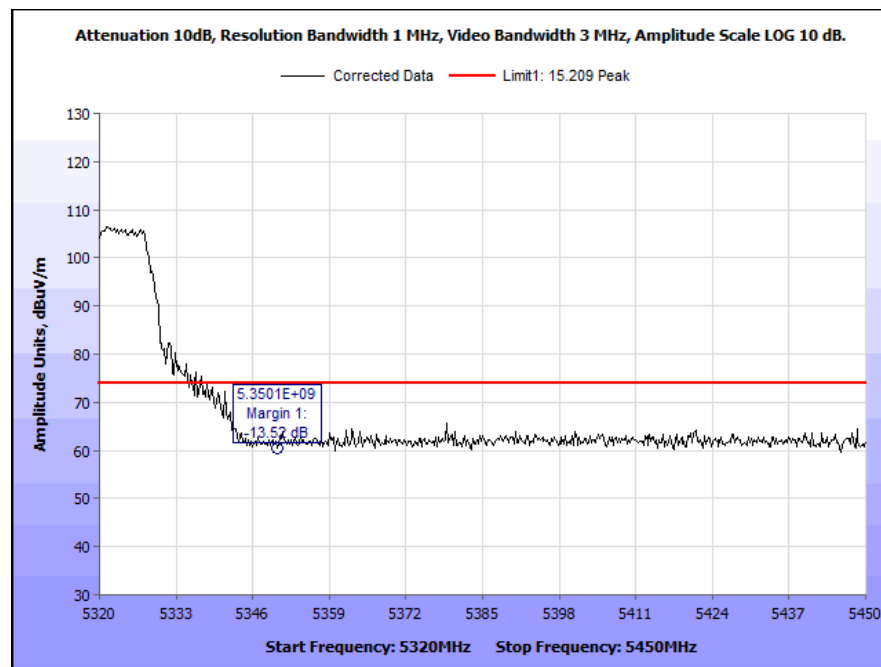
Plot 145. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 7 GHz – 18 GHz, Peak,

Band Edge, 802.11a 20 MHz, Lower Band

Note: Lower band edge compliance was shown in the UNI-1 report.



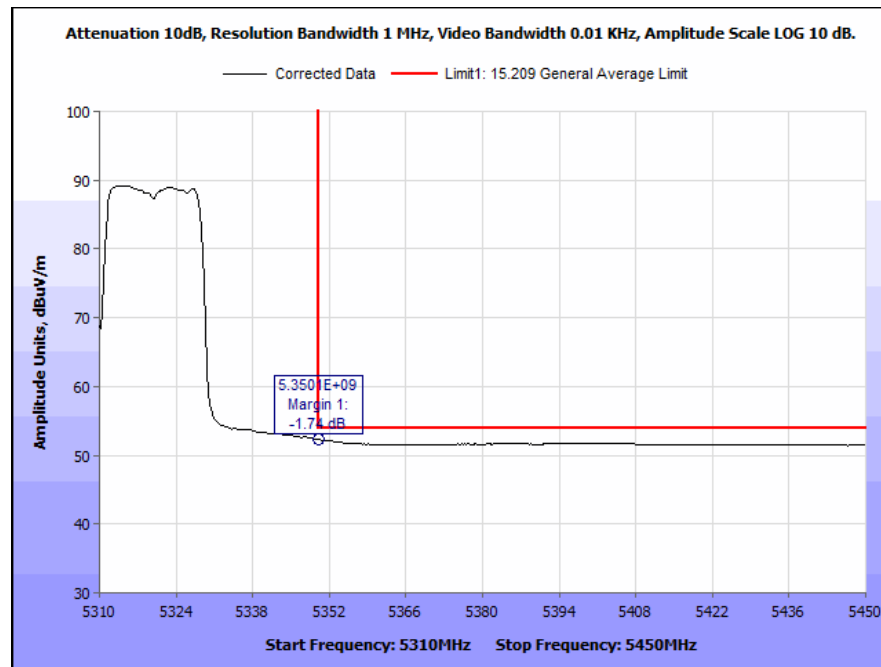
Plot 146. Radiated Band Edge, 802.11a 20 MHz, High Channel, (5350 MHz), Average



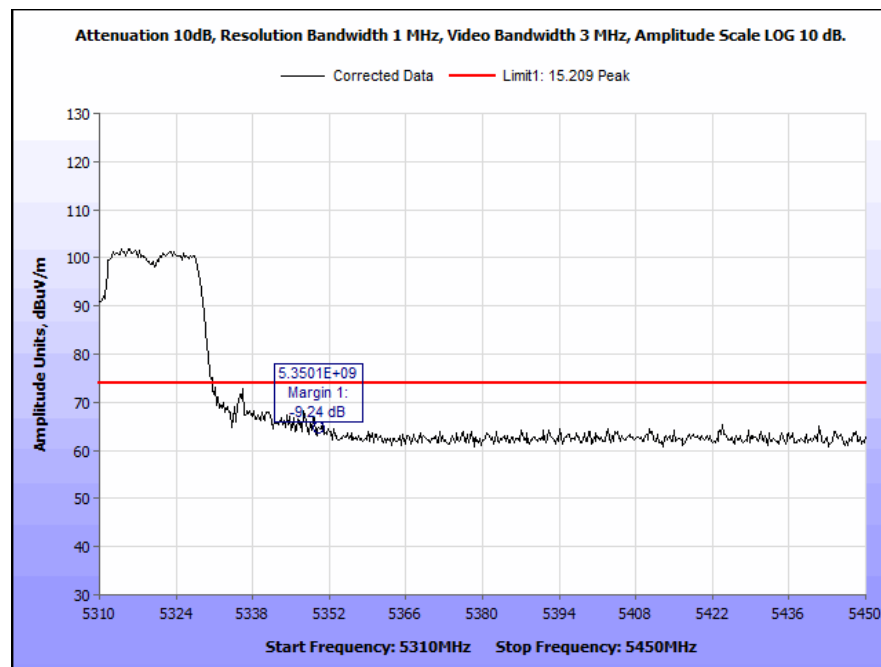
Plot 147. Radiated Band Edge, 802.11a 20 MHz, High Channel, (5350 MHz), Peak

Band Edge, 802.11a 40 MHz, Lower Band

Note: Lower band edge compliance was shown in the UNI-1 report



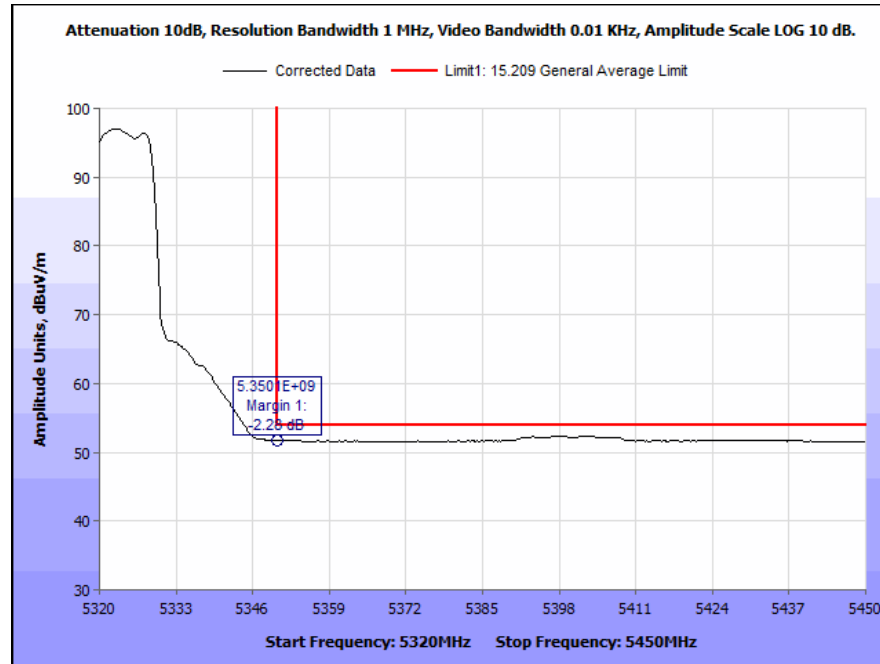
Plot 148. Radiated Band Edge, 802.11a 40 MHz, High Channel, (5350 MHz), Average



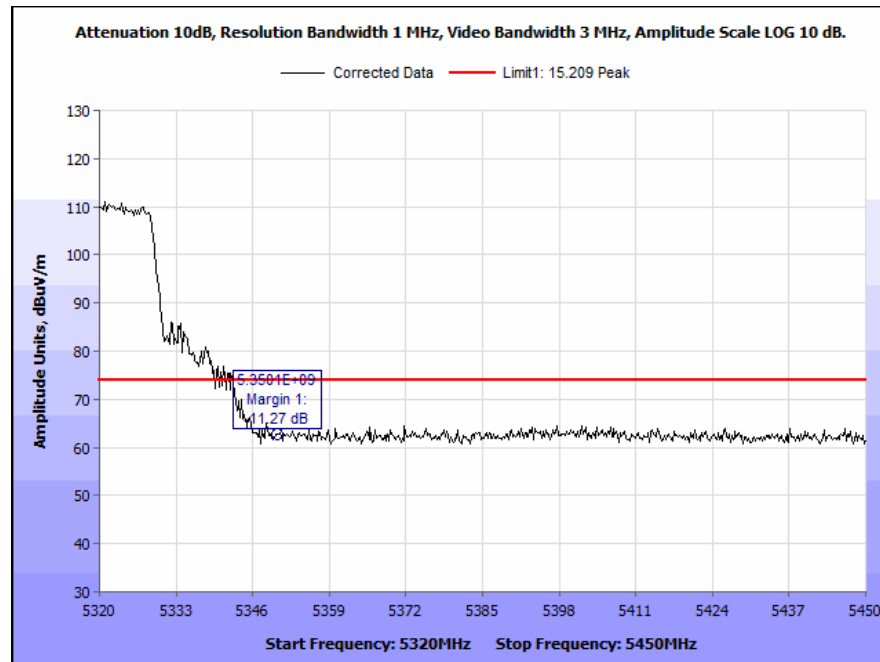
Plot 149. Radiated Band Edge, 802.11a 40 MHz, High Channel, (5350 MHz), Peak

Band Edge, 802.11n 20 MHz, Lower Band

Note: Lower band edge compliance was shown in the UNI-1 report.



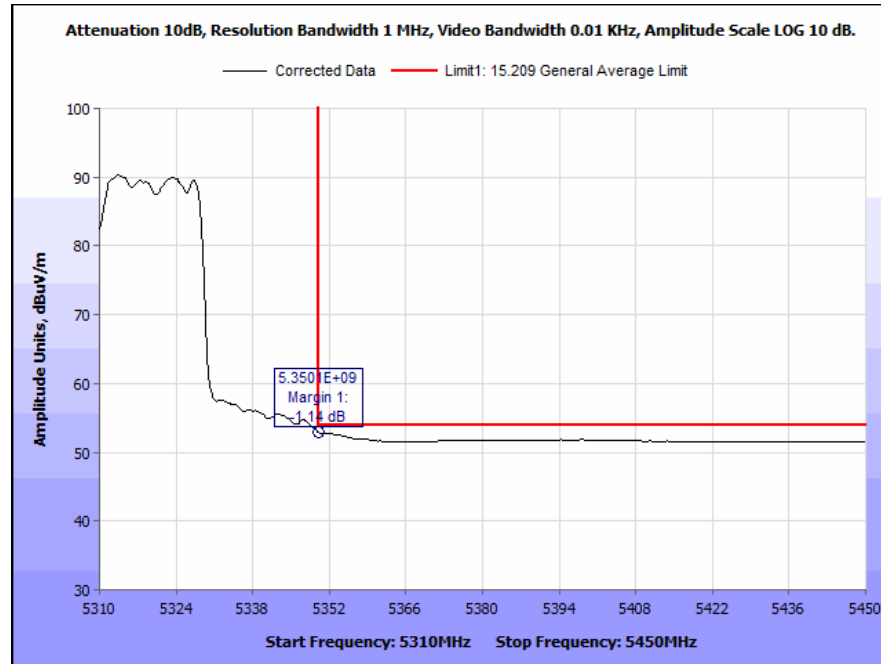
Plot 150. Radiated Band Edge, 802.11n 20 MHz, High Channel, (5350 MHz), Average



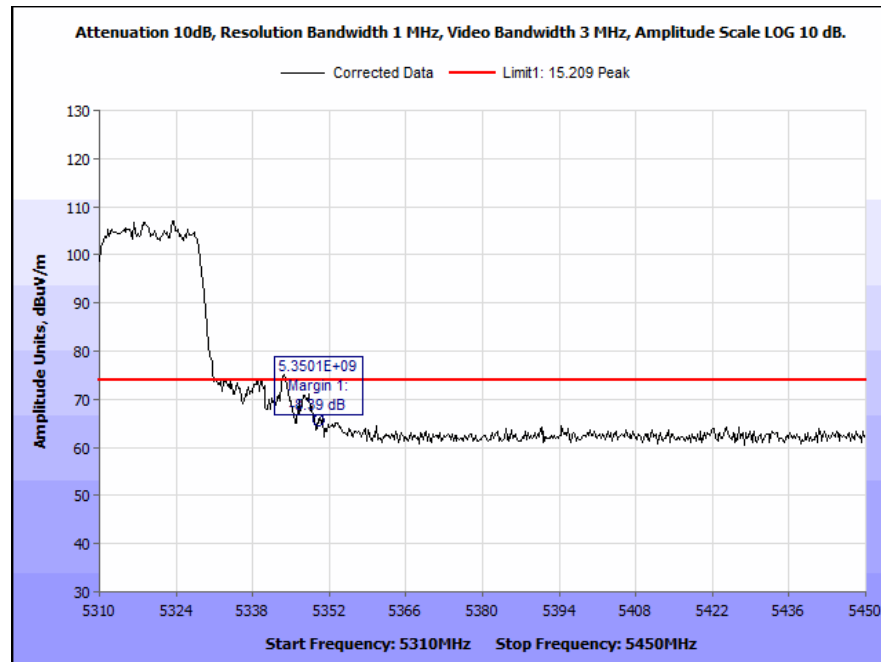
Plot 151. Radiated Band Edge, 802.11n 20 MHz, High Channel, (5350 MHz), Peak

Band Edge, 802.11n 40 MHz, Lower Band

Note: Lower band edge compliance was shown in the UNI-1 report.

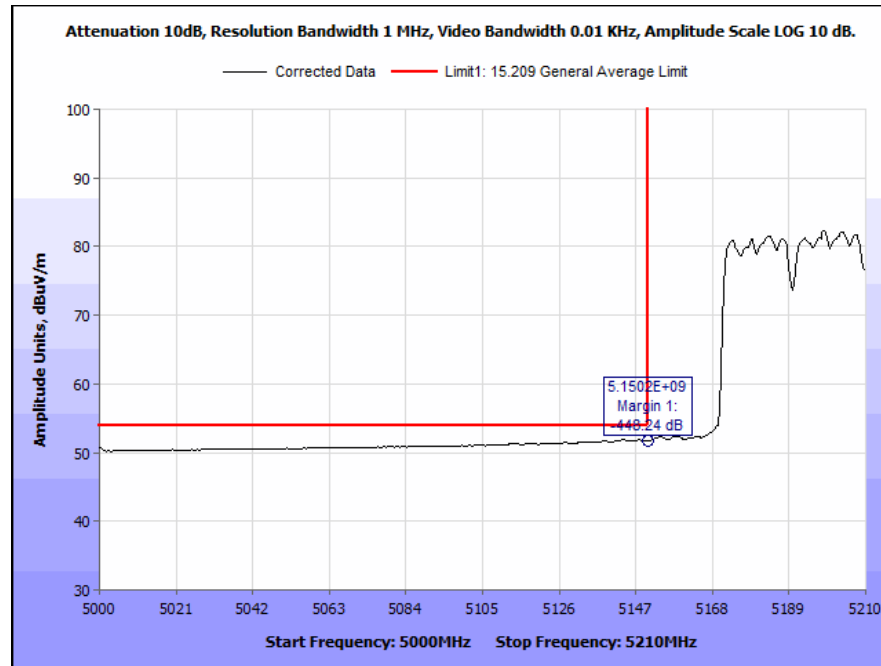


Plot 152. Radiated Band Edge, 802.11n 40 MHz, High Channel, (5350 MHz), Average

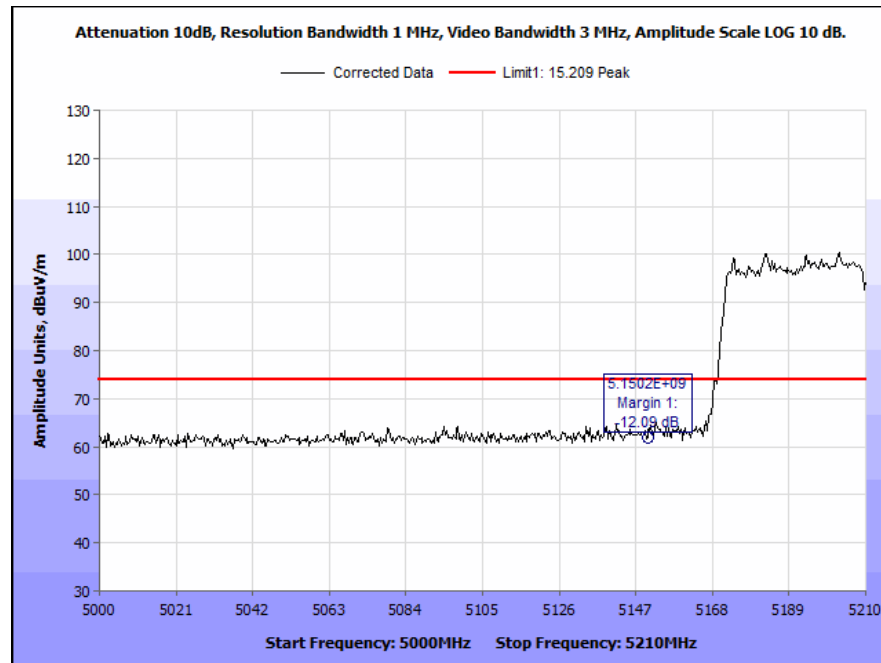


Plot 153. Radiated Band Edge, 802.11n 40 MHz, High Channel, (5350 MHz), Peak

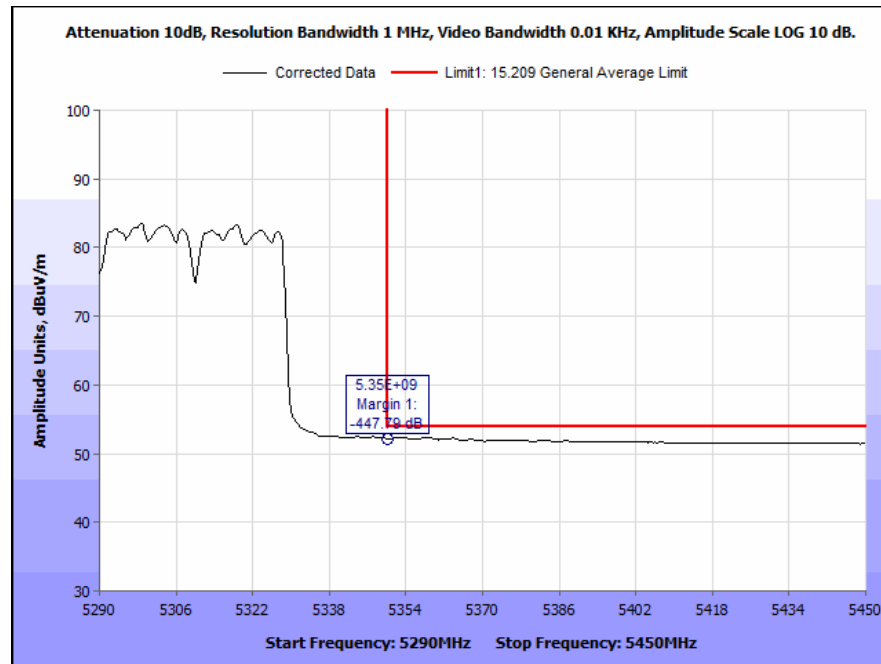
Band Edge, 802.11ac 80 MHz, Lower Band



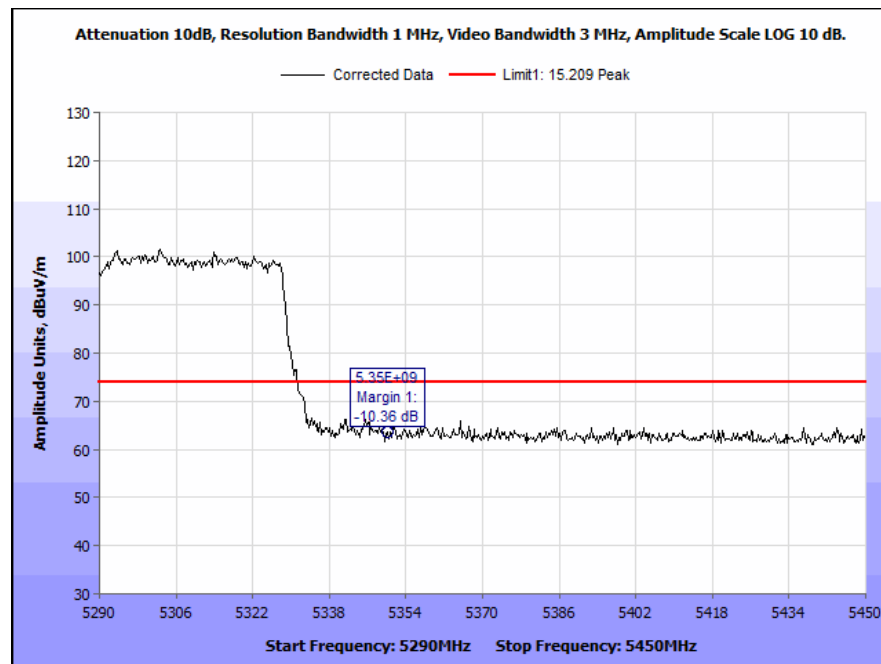
Plot 154. Radiated Band Edge, 802.11n 80 MHz, Low Channel, (5150 MHz), Average



Plot 155. Radiated Band Edge, 802.11ac 80 MHz, Low Channel, (5150 MHz), Peak

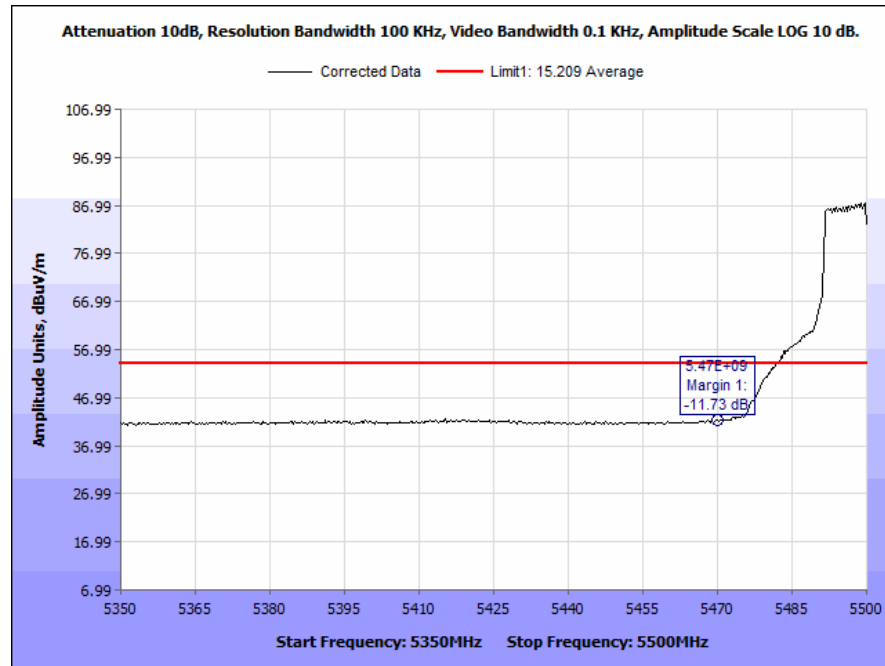


Plot 156. Radiated Band Edge, 802.11ac 80 MHz, High Channel, (5350 MHz), Average

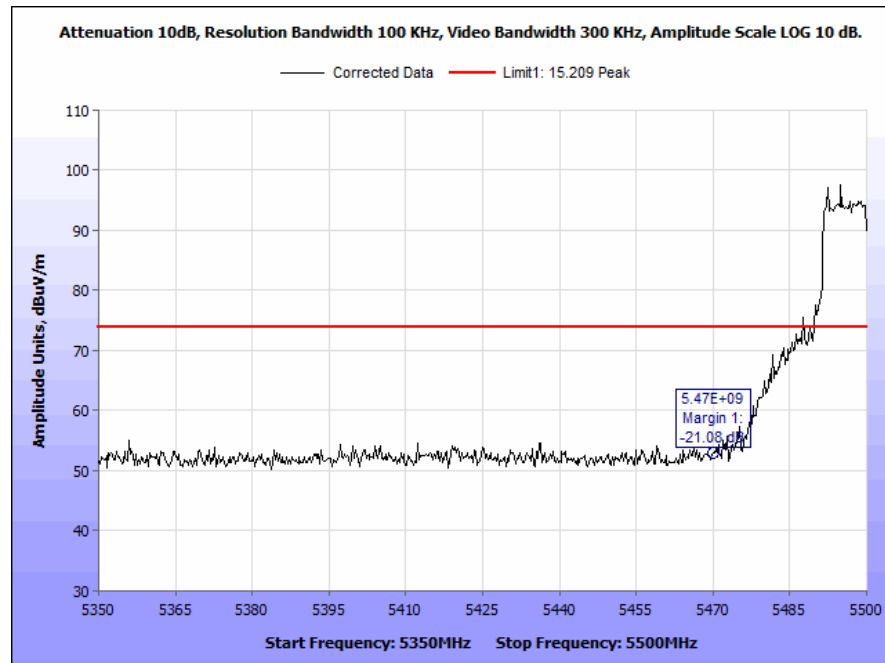


Plot 157. Radiated Band Edge, 802.11ac 80 MHz, High Channel, (5350 MHz), Peak

Band Edge, 802.11a 20 MHz, Upper Band

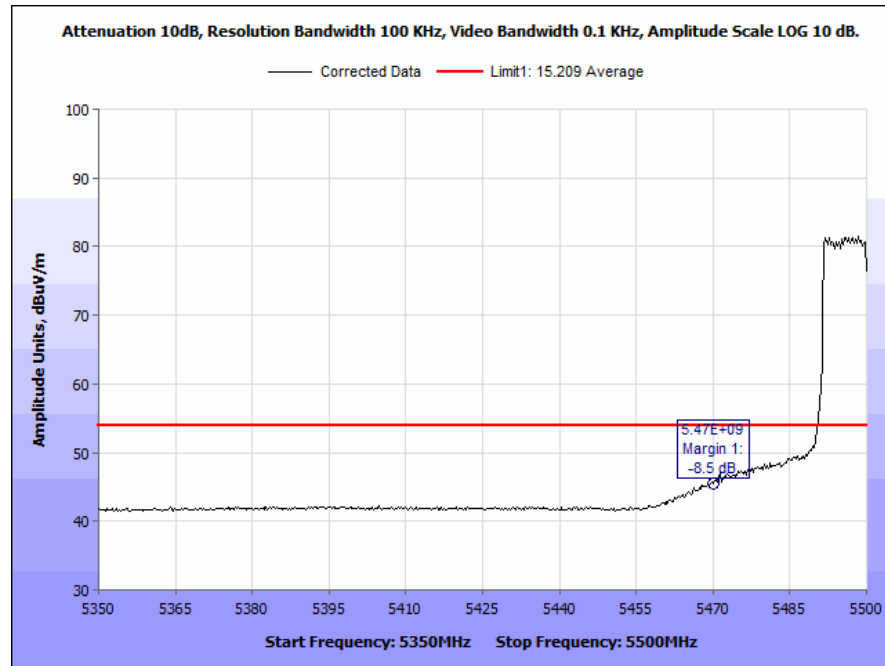


Plot 158. Radiated Band Edge, 802.11a 20 MHz, 5500 MHz, (5.47 GHz), Average

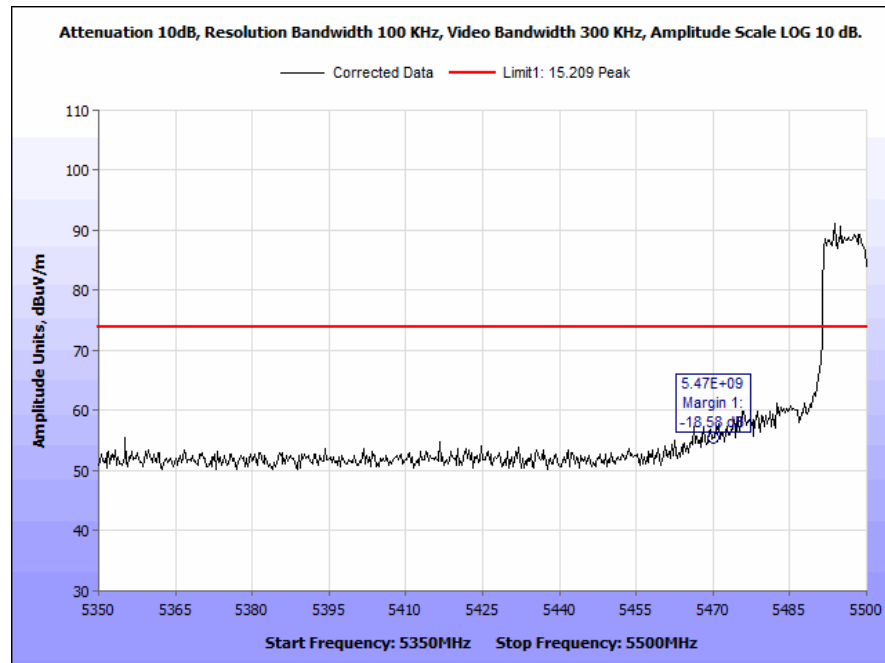


Plot 159. Radiated Band Edge, 802.11a 20 MHz, 5500 MHz, (5.47 GHz), Peak

Band Edge, 802.11a 40 MHz, Upper Band

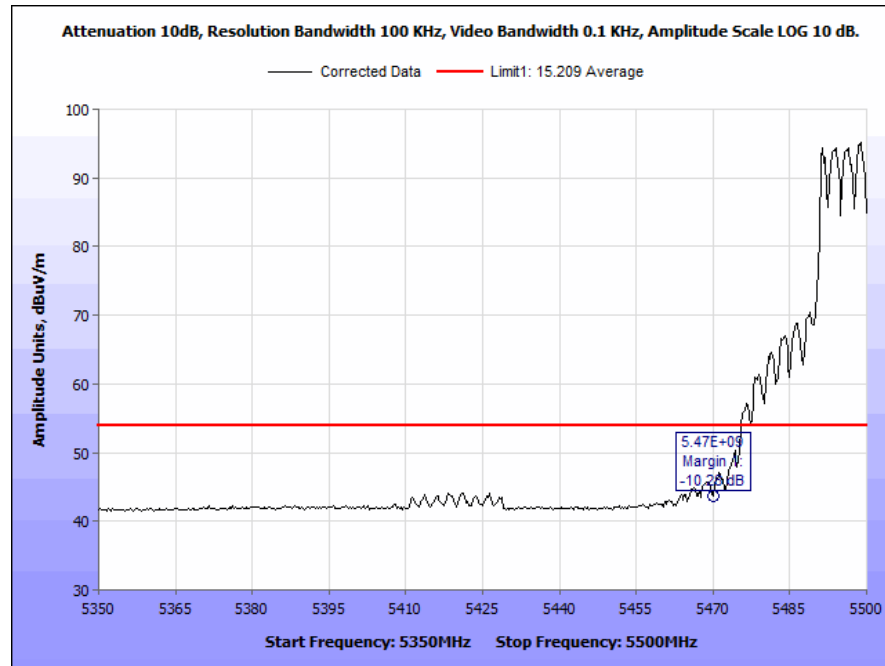


Plot 160. Radiated Band Edge, 802.11a 40 MHz, 5510 MHz, (5.47 GHz), Average

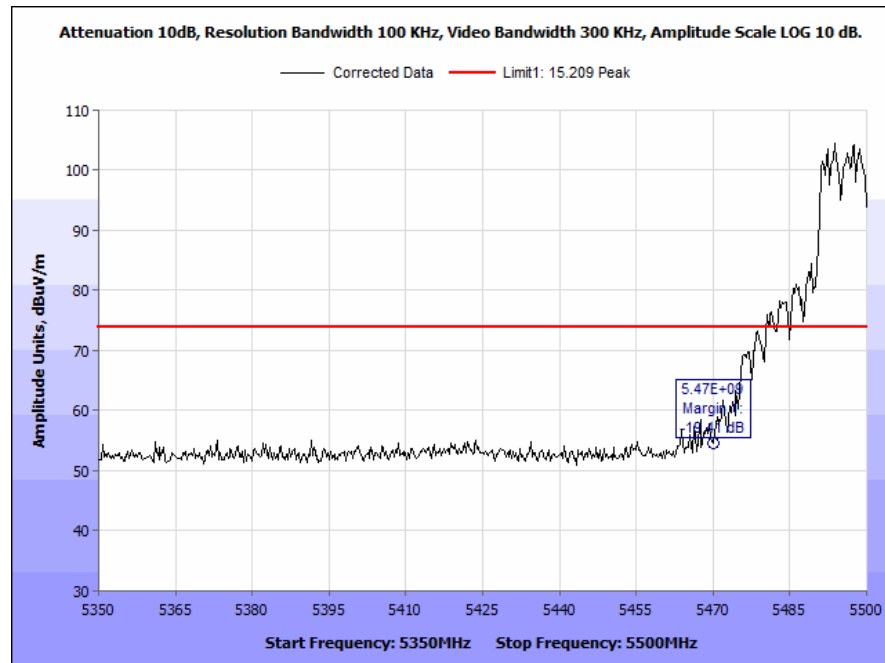


Plot 161. Radiated Band Edge, 802.11a 40 MHz, 5510 MHz, (5.47 GHz), Peak

Band Edge, 802.11n 20 MHz, Upper Band

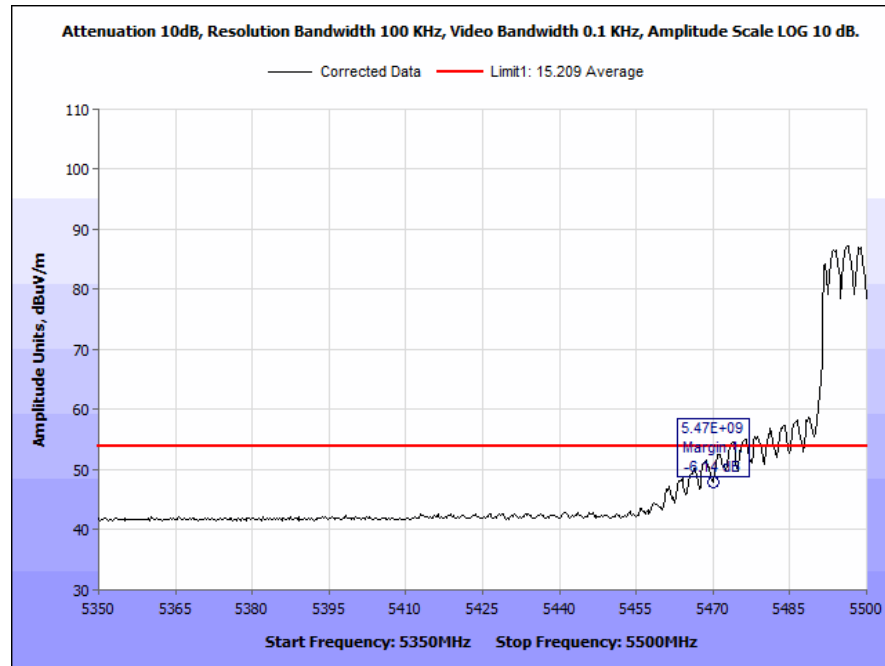


Plot 162. Radiated Band Edge, 802.11n 20 MHz, 5500 MHz, (5.47 GHz), Average

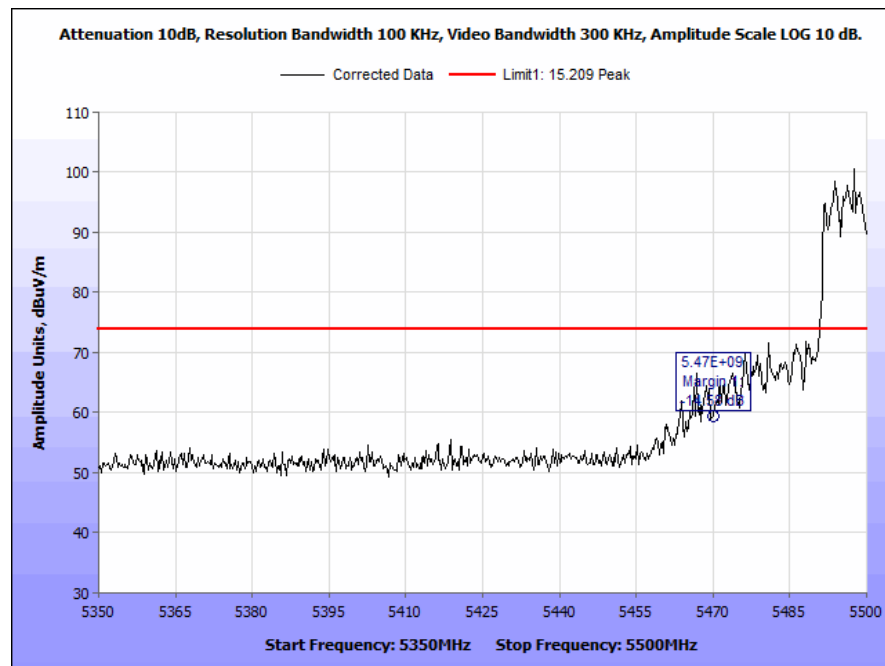


Plot 163. Radiated Band Edge, 802.11n 20 MHz, 5500 MHz, (5.47 GHz), Peak

Band Edge, 802.11n 40 MHz, Lower Band



Plot 164. Radiated Band Edge, 802.11n 40 MHz, 5510 MHz, (5.47 GHz), Average



Plot 165. Radiated Band Edge, 802.11n 40 MHz, 5510 MHz, (5.47 GHz), Peak

Electromagnetic Compatibility Criteria for Intentional Radiators

Co-location

Test Requirements: Devices designed to transmit simultaneously in multiple channels in single or multiple frequency bands or those using new “carrier aggregation techniques”, excluding cellular base stations or where specific guidance has been proved.

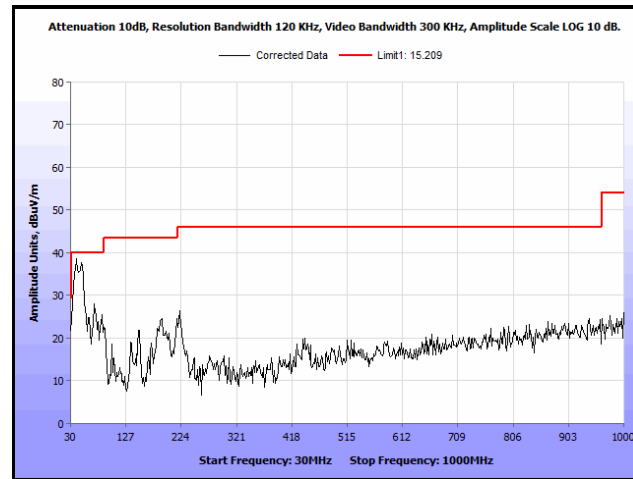
All devices that are capable of transmitting simultaneously in more than one Part-15 band between 5 and 6 GHz (*i.e.*, in two or more of the four U-NII bands or in the 5.8 GHz 15.247 band and at least one U-NII band) are subject to Permit But Ask provisions. This includes devices marketed as IEEE Std 802.11ac or “pre-standard” IEEE Std 802.11ac.

Test Procedure: The transmitter was placed on an 80cm wooden table inside in a semi-anechoic chamber. Measurements were performed with the EUT rotated 360 degrees and varying the adjustable antenna mast height to determine worst case orientation for maximum emissions. A preamp was used in the range from 7-18GHz to improve noise floor. Plots were corrected for cable loss, antenna, and preamp gain.

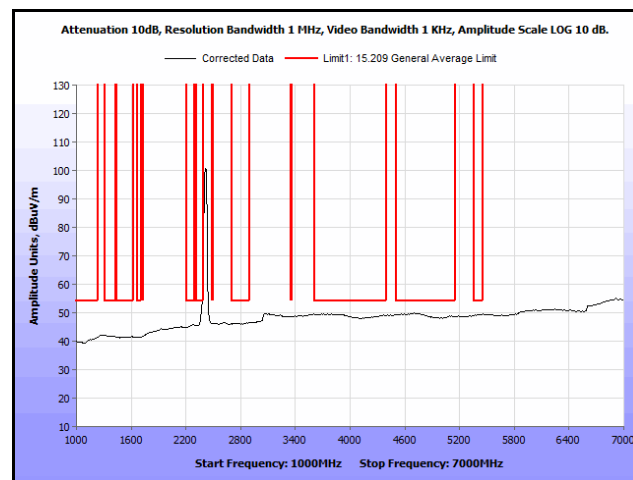
For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

For measurements above 1 GHz, measurements were made with a Peak detector with 1 MHz resolution bandwidth. Where the spurious emissions fell into a restricted band, measurements were also made with an average detector to make sure they complied with 15.209 limits. Only noise floor was seen above 18 GHz.

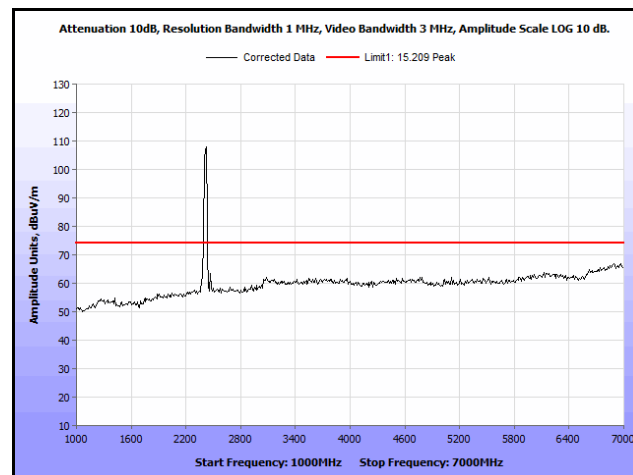
The EUT uses 2 radios that are co-located. The EUT was set to transmit on both radios using the following matrix below.



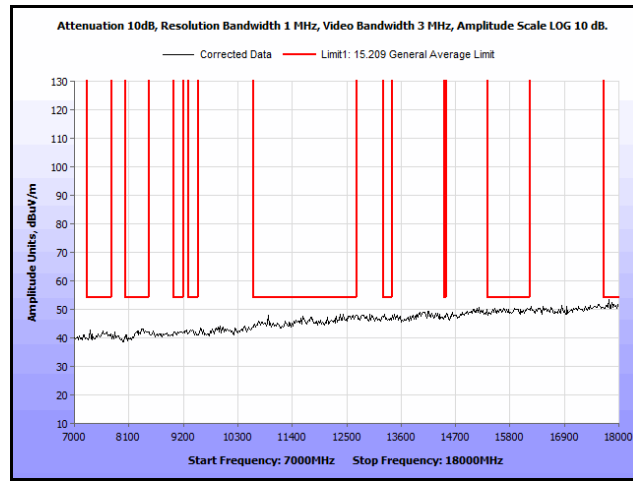
Plot 166. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2412 MHz, 30 MHz – 1 GHz, Peak



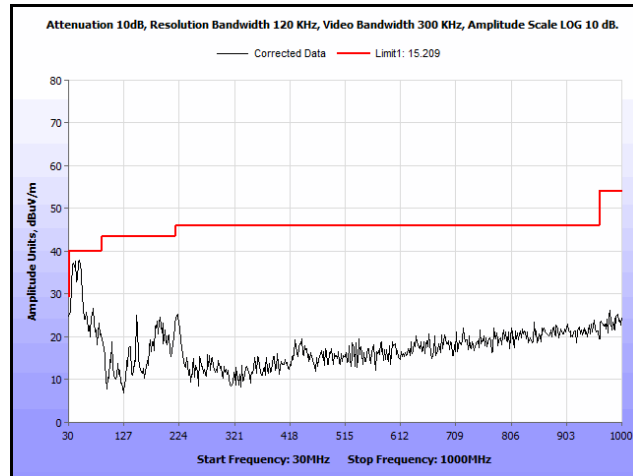
Plot 167. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2412 MHz, 1 GHz – 7 GHz, Avg.



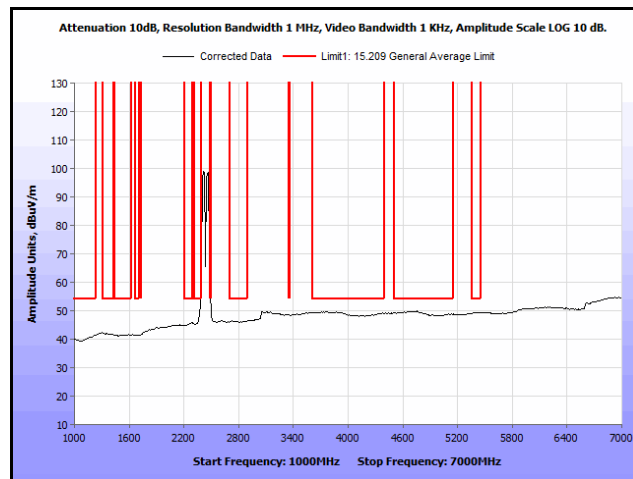
Plot 168. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2412 MHz, 1 GHz – 7 GHz, Peak



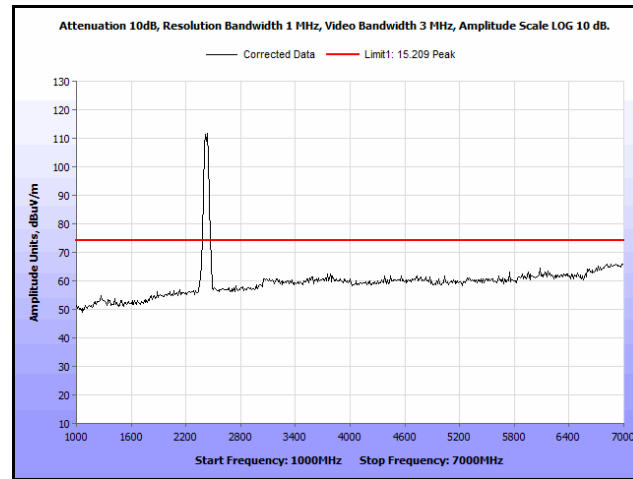
Plot 169. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2412 MHz, 7 GHz – 18 GHz, Peak



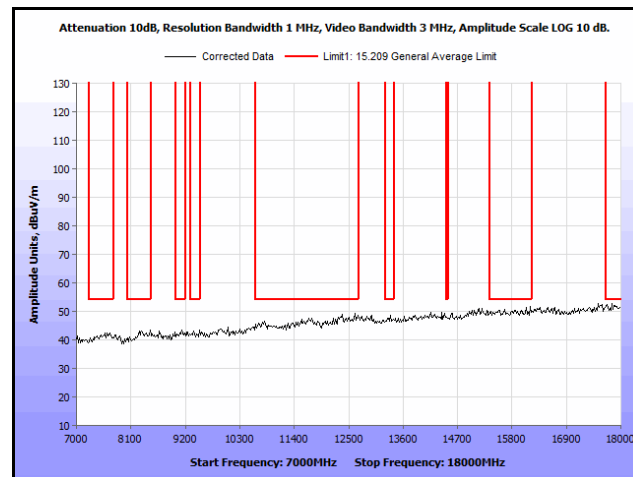
Plot 170. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2437 MHz, 30 MHz – 1 GHz, Peak



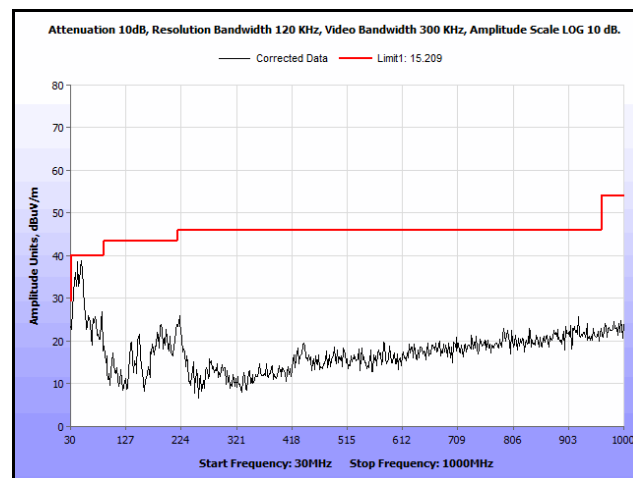
Plot 171. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2437 MHz, 1 GHz – 7 GHz, Avg.



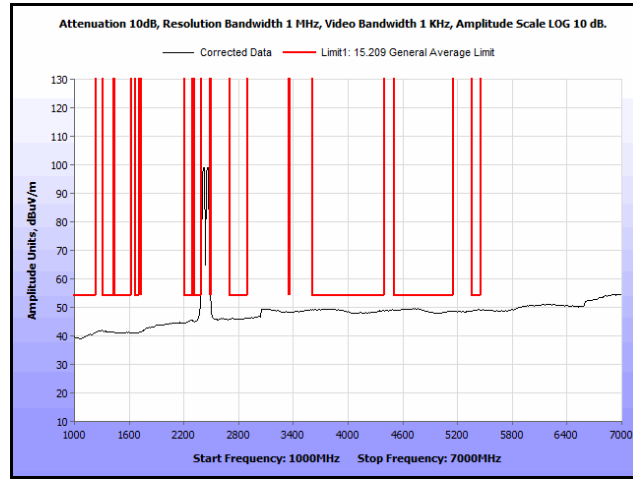
Plot 172. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2437 MHz, 1 GHz – 7 GHz, Peak



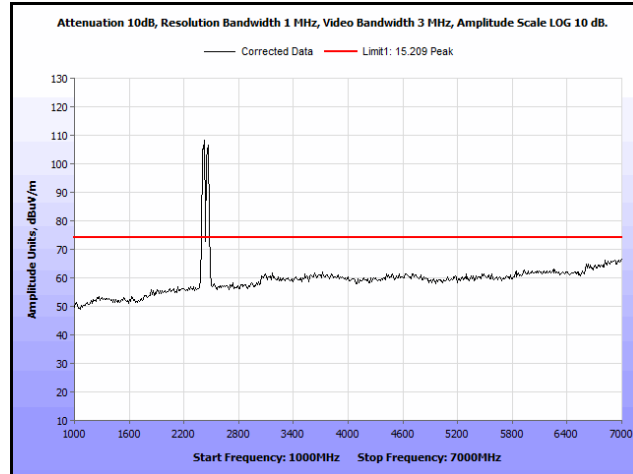
Plot 173. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2437 MHz, 7 GHz – 18 GHz, Peak



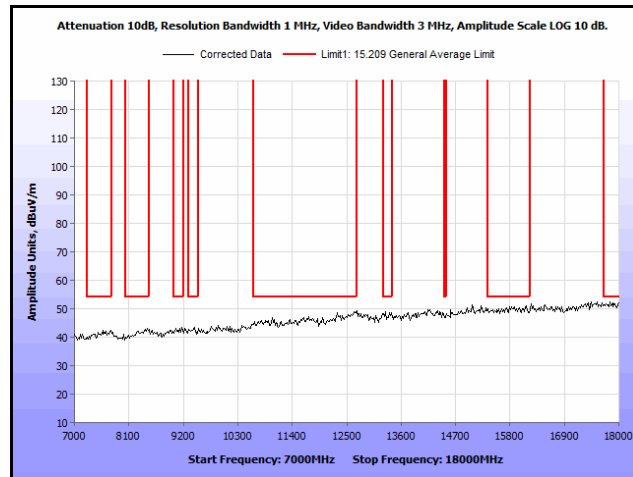
Plot 174. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2462 MHz, 30 MHz – 1 GHz, Peak



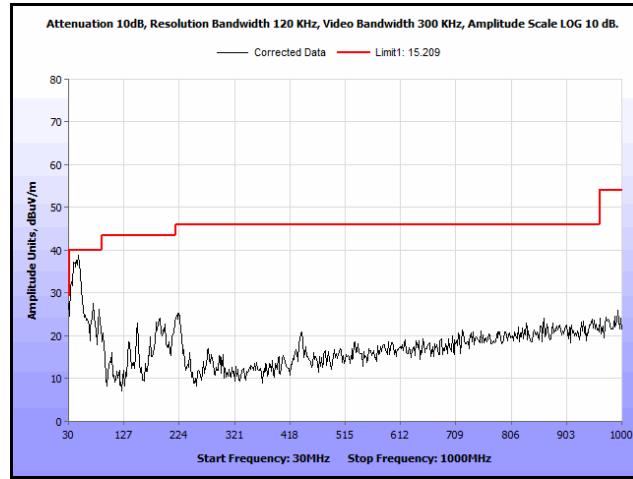
Plot 175. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2462 MHz, 1 GHz – 7 GHz, Avg.



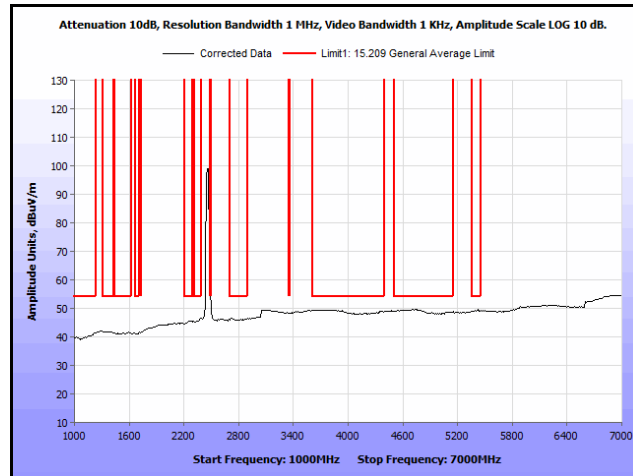
Plot 176. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2462 MHz, 1 GHz – 7 GHz, Peak



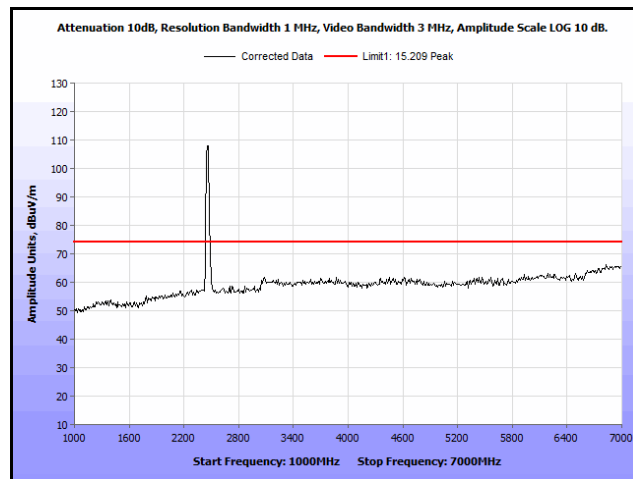
Plot 177. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2462 MHz, 7 GHz – 18 GHz, Peak



Plot 178. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2437 MHz & 2437 MHz, 30 MHz – 1 GHz, Peak



Plot 179. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2437 MHz & 2437 MHz, 1 GHz – 7 GHz, Avg.



Plot 180. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2437 MHz & 2437 MHz, 1 GHz – 7 GHz, Peak