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

914 WEST PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230-3432 ● PHONE (410) 354-3300 ● FAX (410) 354-3313
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3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408) 748-3585 ● FAX (510) 489-6372
13301 MCCALLEN PASS ● AUSTIN, TX 78753 ● PHONE (512) 287-2500 ● FAX (512) 287-2513

January 27, 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., Mission Peak (AP822iV2) 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.\EMCS42577H-FCC407 Rev. 1 (UNII 2))

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Electromagnetic Compatibility Criteria
Test Report

for the

Meru Networks, Inc.
Model Mission Peak (AP822iV2)

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: EMCS42577H-FCC407 Rev. 1 (UNII 2)

January 27, 2015

Prepared For:

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

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

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Andy Shen, 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
∅	January 21, 2015	Initial Issue.
1	January 27, 2015	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
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 Meru Networks, Inc. Mission Peak (AP822iV2), 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 Mission Peak (AP822iV2). 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 Mission Peak (AP822iV2), 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), (5), (6)	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 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Meru Networks, Inc. to perform testing on the Mission Peak (AP822iV2), 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. Mission Peak (AP822iV2).

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

Model(s) Tested:	Mission Peak (AP822iV2)	
Model(s) Covered:	Mission Peak (AP822iV2)	
EUT Specifications:	Primary Power: 120 VAC, 60 Hz	
	FCC ID: RE7-AP822IV2 IC: 6749A-AP822IV2	
	Type of Modulations:	OFDM, BPSK,QPSK,QAM16,QAM64
	Equipment Code:	NII
	Peak RF Output Power:	21.84 dBm
	EUT Frequency Ranges:	5260 MHz – 5320 MHz 5500 MHz – 5700 MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35º C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Andy Shen	
Report Date(s):	January 27, 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. Mission Peak (AP822iV2), 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. The EUT supports 2.4 GHz and 5 GHz operation.

Photograph 1. Meru Networks, Inc. Mission Peak (AP822iV2)

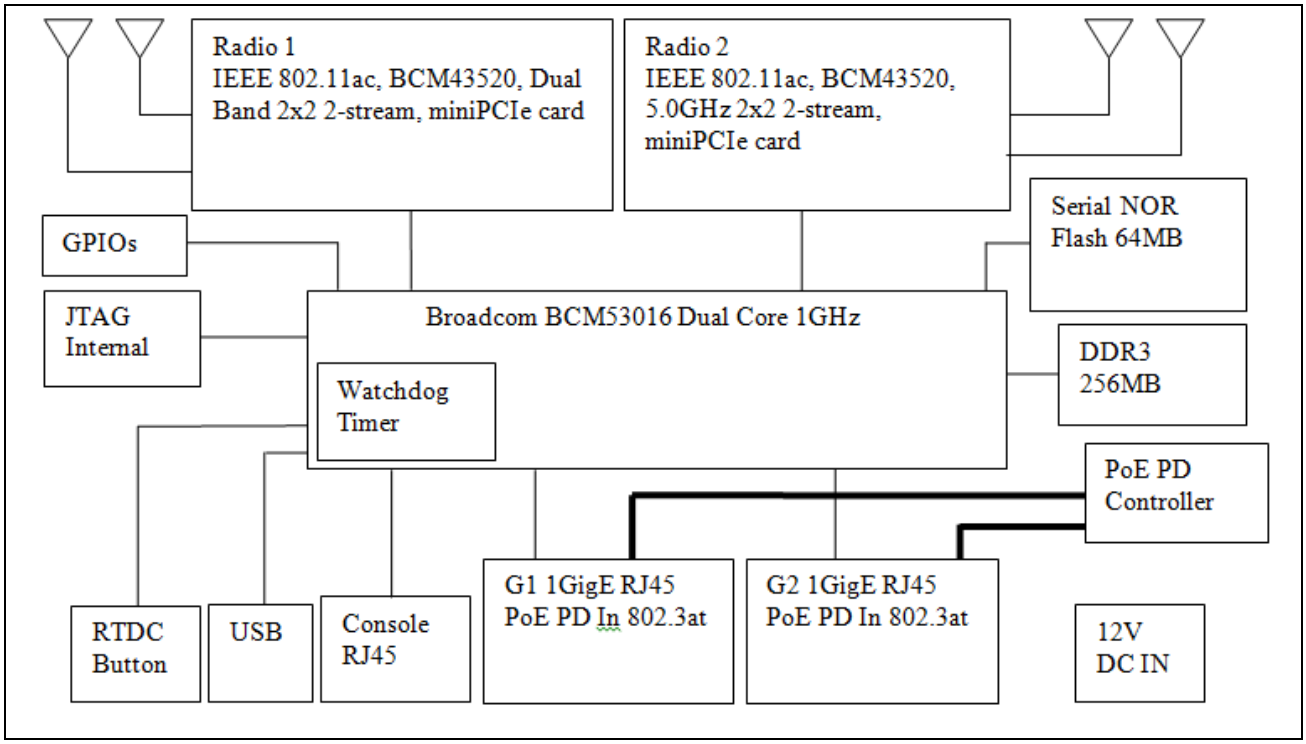


Figure 1. Block Diagram of Test Configuration

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	AP822iV2	2614B822I16DBBE	Rev 1
2	Dual Radio Access Point	AP822iV2	2614B822i16DBC4	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	Labtop	IBM	IBM Thinkpad

Table 5. Support Equipment

Meru Part Number	Description	Gain
MERU-ANT-P1446	Internal PCB antenna	3 dBi at 2.4 GHz and 4 dBi 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 (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.				

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 50Ω/50µH 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):

Danny Alvendia

Test Date(s):

07/28/14

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

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
42577 Meru PoE Rad_Off 120V L	0.16	46.7	65.465	-18.765	Pass	35.04	55.465	-20.425	Pass
42577 Meru PoE Rad_Off 120V L	0.2	46.06	63.617	-17.557	Pass	28	53.617	-25.617	Pass
42577 Meru PoE Rad_Off 120V L	0.43	45.58	57.277	-11.697	Pass	36.36	47.277	-10.917	Pass
42577 Meru PoE Rad_Off 120V L	0.45	45.59	56.9	-11.31	Pass	37.01	46.9	-9.89	Pass
42577 Meru PoE Rad_Off 120V L	23.83	46.66	60	-13.34	Pass	30.59	50	-19.41	Pass
42577 Meru PoE Rad_Off 120V L	29.93	48.46	60	-11.54	Pass	32.52	50	-17.48	Pass

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

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
42577 Meru PoE Rad_Off 120V N	0.17	45.12	64.963	-19.843	Pass	29.37	54.963	-25.593	Pass
42577 Meru PoE Rad_Off 120V N	0.44	44.77	57.086	-12.316	Pass	32.92	47.086	-14.166	Pass
42577 Meru PoE Rad_Off 120V N	16.32	46.51	60	-13.49	Pass	29.57	50	-20.43	Pass
42577 Meru PoE Rad_Off 120V N	22.04	46.42	60	-13.58	Pass	27.54	50	-22.46	Pass
42577 Meru PoE Rad_Off 120V N	23.08	45.81	60	-14.19	Pass	29.23	50	-20.77	Pass
42577 Meru PoE Rad_Off 120V N	29.885	47.63	60	-12.37	Pass	32.59	50	-17.41	Pass

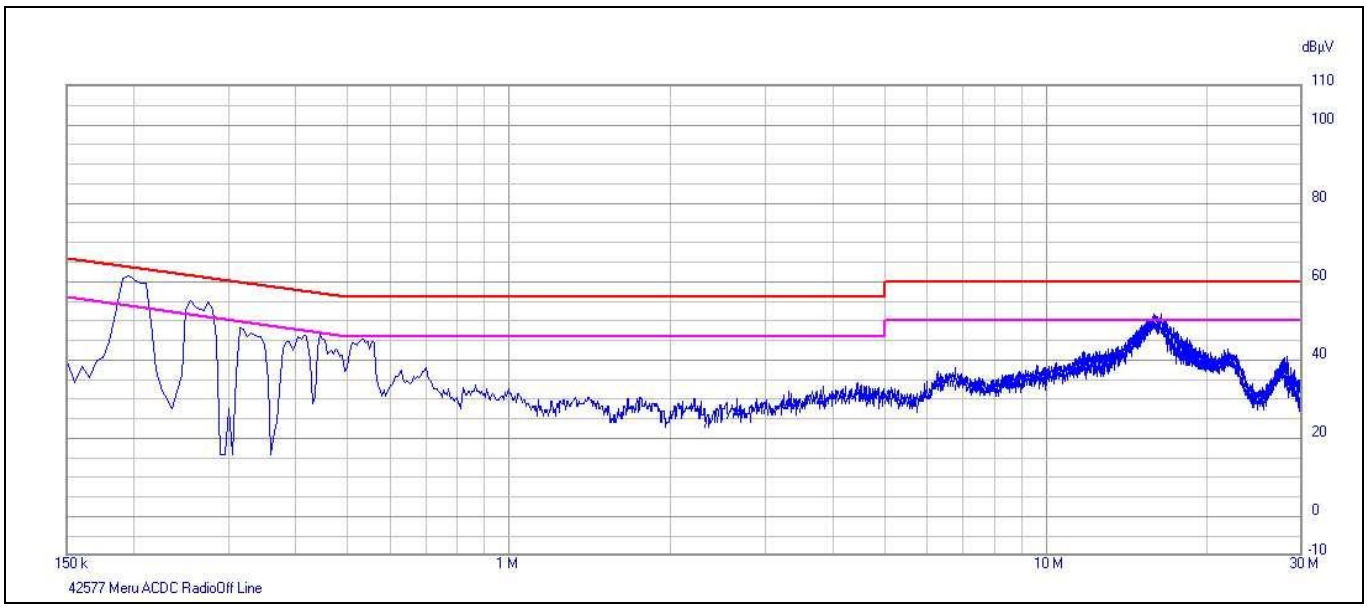
Table 10. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz), PoE

Plot 2. Conducted Emissions, Neutral Line, PoE

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

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
42577 CEV ACDC RadOff L	0.195	57.81	63.827	-6.017	Pass	40.17	53.827	-13.657	Pass
42577 CEV ACDC RadOff L	0.255	51.09	61.605	-10.515	Pass	33.29	51.605	-18.315	Pass
42577 CEV ACDC RadOff L	0.315	42.22	59.854	-17.634	Pass	20.77	49.854	-29.084	Pass
42577 CEV ACDC RadOff L	0.445	40.87	56.993	-16.123	Pass	22.88	46.993	-24.113	Pass
42577 CEV ACDC RadOff L	14.47	46.73	60	-13.27	Pass	37.42	50	-12.58	Pass
42577 CEV ACDC RadOff L	15.785	46.88	60	-13.12	Pass	39.03	50	-10.97	Pass

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

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
42577 CEV ACDC RadOff N	0.205	56.12	63.413	-7.293	Pass	33.83	53.413	-19.583	Pass
42577 CEV ACDC RadOff N	0.26	50	61.444	-11.444	Pass	23.09	51.444	-28.354	Pass
42577 CEV ACDC RadOff N	0.27	49.45	61.131	-11.681	Pass	23.09	51.131	-28.041	Pass
42577 CEV ACDC RadOff N	0.32	40.09	59.724	-19.634	Pass	23.6	49.724	-26.124	Pass
42577 CEV ACDC RadOff N	0.46	35.09	56.712	-21.622	Pass	25.81	46.712	-20.902	Pass
42577 CEV ACDC RadOff N	16.07	38.45	60	-21.55	Pass	24.43	50	-25.57	Pass

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.

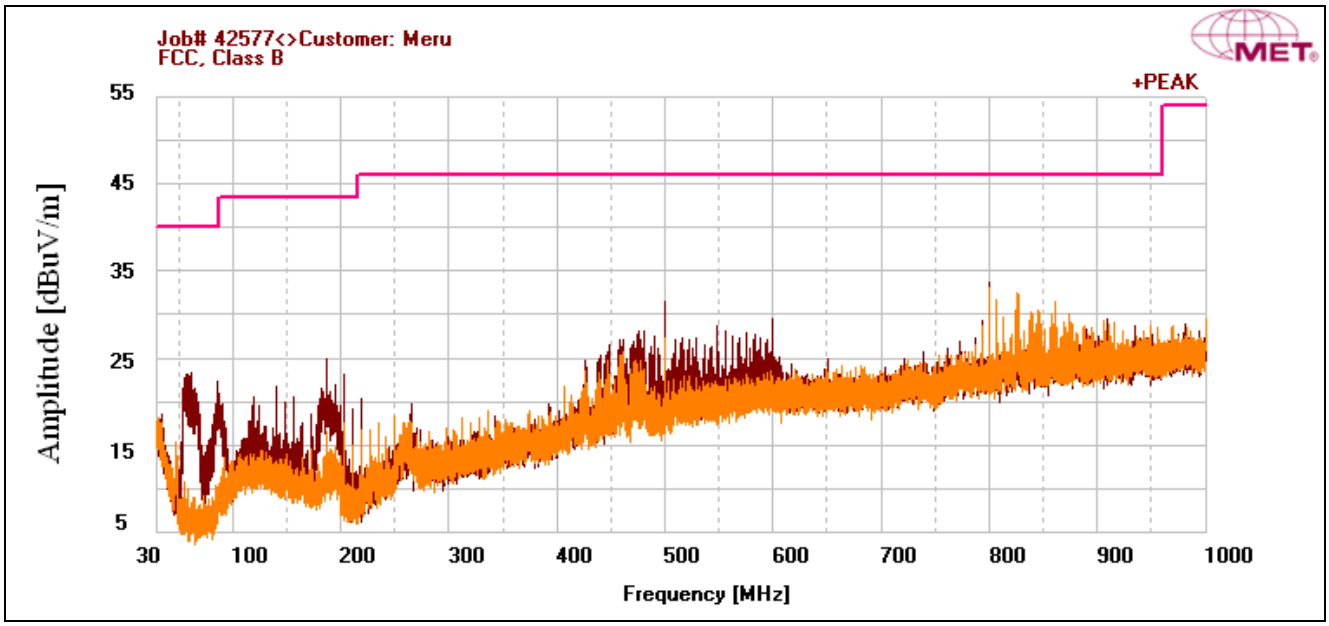
Test Engineer(s): Andy Shen

Test Date(s): 07/24/14

Radiated Emissions Limits Test Results, Class B, PoE

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBµV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
187	H	79	130.11	9.1	9.52	0	2.43	0	21.05	43.5	-22.45
495.84	V	173	100	5.63	16.935	0	3.999	0	26.564	46	-19.436
500.02	H	267	181.41	5.66	17.01	0	4.017	0	26.687	46	-19.313
800	H	169	115.8	8.67	19.67	0	5.182	0	33.522	46	-12.478
806.78	V	46	100	5.63	19.758	0	5.204	0	30.592	46	-15.408
825.94	V	20	100	1.78	20.177	0	5.267	0	27.224	46	-18.776

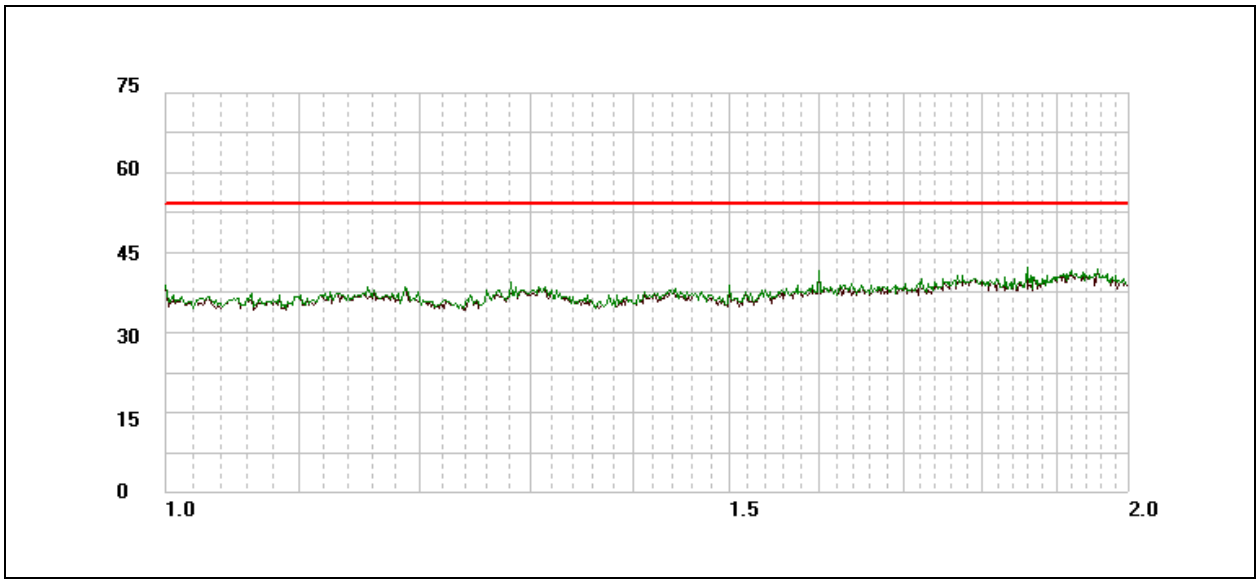
Table 14. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz, PoE



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

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBµV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1189	H	104	160.23	29.03	28.507	33.471	0	0	24.066	54	-29.934
1282.5	V	133	215.88	29.61	28.722	33.431	0	0	24.901	54	-29.099
1594.367	V	120	114.94	30.2	28.955	33.3	0	0	25.855	54	-28.145
1860	H	17	100	29.14	30.816	33.189	0	0	26.767	54	-27.233
1924	V	73	100	30.44	31.174	33.162	0	0	28.452	54	-25.548
1956	H	0	100	29.79	31.354	33.148	0	0	27.996	54	-26.004

Table 15. Radiated Emissions Limits, Test Results, 1 GHz – 2 GHz, PoE

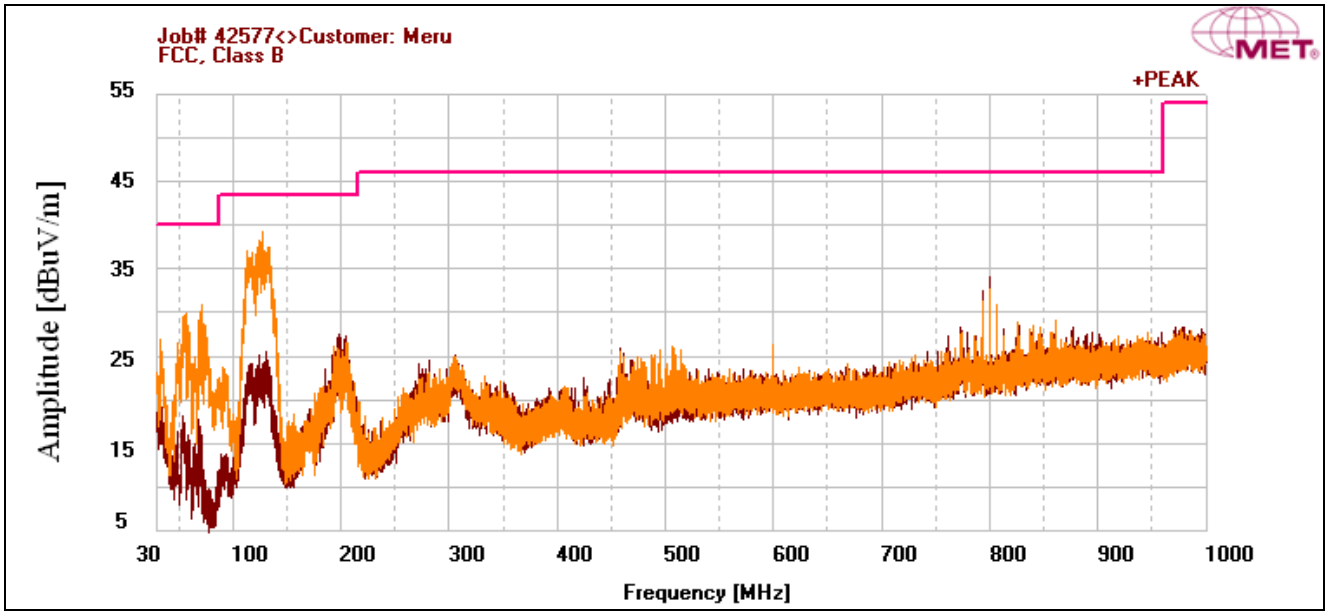


Plot 6. Radiated Emissions, 1 GHz – 2 GHz, PoE

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

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBµV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
71.385	V	151	169.7	13.92	6.801	0	1.477	0	22.198	40	-17.802
131.229	V	283	125.7	13.92	12.479	0	2.021	0	28.42	43.5	-15.08
600.018	V	191	100	1.56	18.82	0	4.486	0	24.866	46	-21.134
793.23	H	269	100.11	5.61	19.792	0	5.156	0	30.558	46	-15.442
800.01	H	264	103.88	9.16	19.67	0	5.182	0	34.012	46	-11.988
806.74	H	270	100.11	3.77	19.758	0	5.204	0	28.732	46	-17.268

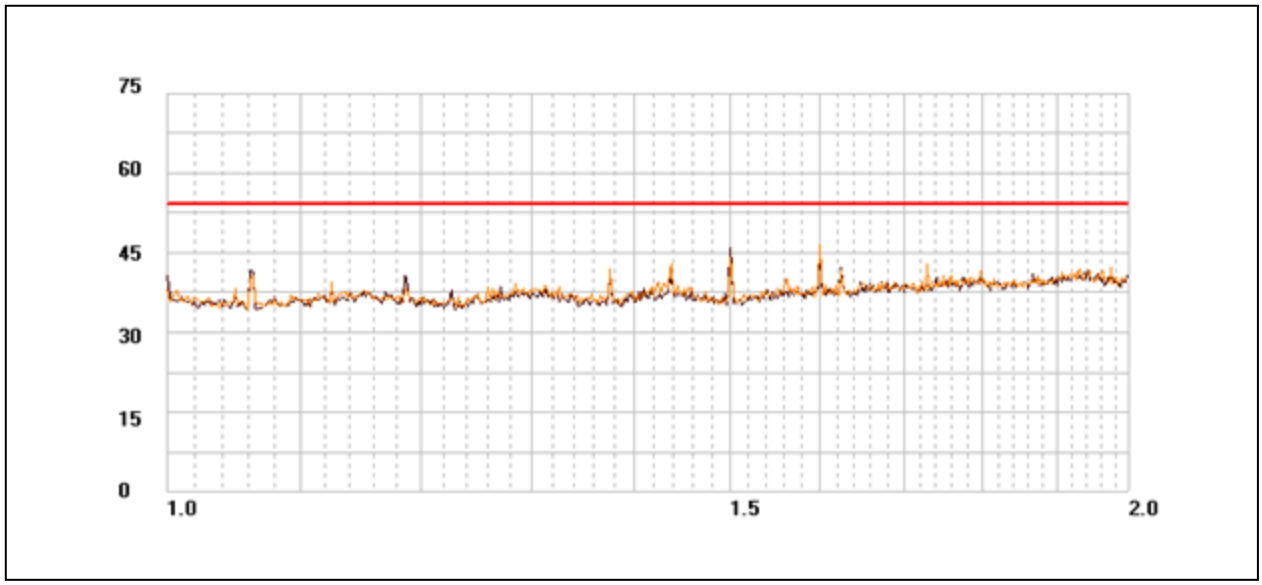
Table 16. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz, AC/DC



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

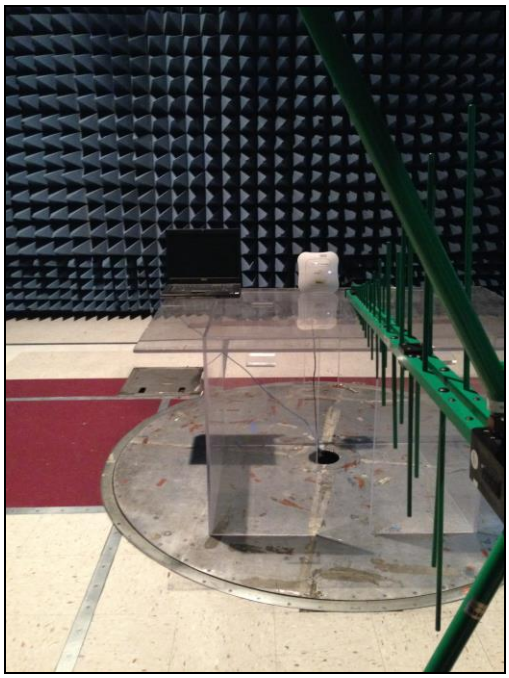
Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBµV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1062.667	H	0	167.17	45.04	27.901	33.524	0	0	39.417	54	-14.583
1375.133	H	37	130.05	38.25	28.5	33.392	0	0	33.358	54	-20.642
1500.267	H	99	137.52	47.17	28.202	33.34	0	0	42.032	54	-11.968
1625.333	V	154	198.29	46.69	29.203	33.287	0	0	42.606	54	-11.394
1625.333	H	169	128.58	43.51	29.203	33.287	0	0	39.426	54	-14.574
1750.5	V	0	128.11	43.42	30.203	33.235	0	0	40.388	54	-13.612

Table 17. Radiated Emissions Limits, Test Results, 1 GHz – 2 GHz, AC/DC

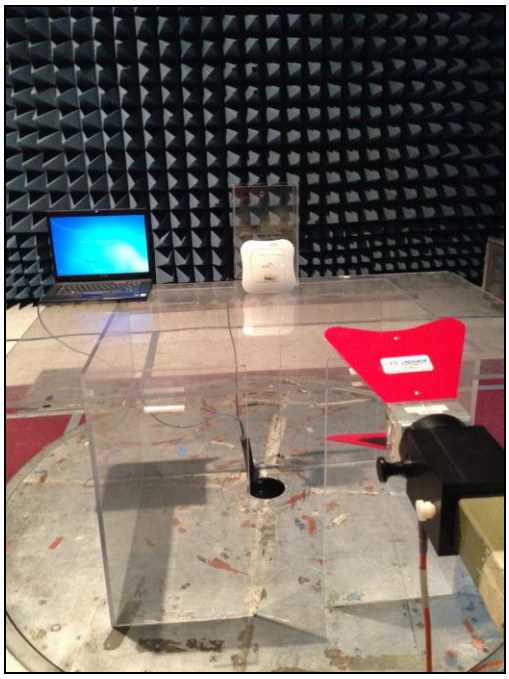


Plot 8. Radiated Emissions, 1 GHz – 2 GHz, AC/DC

Radiated Emissions Limits Test Setup



Photograph 4. Radiated Emissions, Test Setup, 30 MHz – 1 GHz



Photograph 5. Radiated Emissions, Test Setup, 1 GHz – 2 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 internal antennas.

Test Engineer(s): Andy Shen

Test Date(s): 07/26/14

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207 Conducted Emissions Limits

Test Requirement(s): **§ 15.207 (a):** For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 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 (dBμV)	
	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 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): Danny Alvendia

Test Date(s): 07/28/14

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

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
42577 Meru PoE Rad_Off 120V L	0.16	46.7	65.465	-18.765	Pass	35.04	55.465	-20.425	Pass
42577 Meru PoE Rad_Off 120V L	0.2	46.06	63.617	-17.557	Pass	28	53.617	-25.617	Pass
42577 Meru PoE Rad_Off 120V L	0.43	45.58	57.277	-11.697	Pass	36.36	47.277	-10.917	Pass
42577 Meru PoE Rad_Off 120V L	0.45	45.59	56.9	-11.31	Pass	37.01	46.9	-9.89	Pass
42577 Meru PoE Rad_Off 120V L	23.83	46.66	60	-13.34	Pass	30.59	50	-19.41	Pass
42577 Meru PoE Rad_Off 120V L	29.93	48.46	60	-11.54	Pass	32.52	50	-17.48	Pass

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

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
42577 Meru PoE Rad_Off 120V N	0.17	45.12	64.963	-19.843	Pass	29.37	54.963	-25.593	Pass
42577 Meru PoE Rad_Off 120V N	0.44	44.77	57.086	-12.316	Pass	32.92	47.086	-14.166	Pass
42577 Meru PoE Rad_Off 120V N	16.32	46.51	60	-13.49	Pass	29.57	50	-20.43	Pass
42577 Meru PoE Rad_Off 120V N	22.04	46.42	60	-13.58	Pass	27.54	50	-22.46	Pass
42577 Meru PoE Rad_Off 120V N	23.08	45.81	60	-14.19	Pass	29.23	50	-20.77	Pass
42577 Meru PoE Rad_Off 120V N	29.885	47.63	60	-12.37	Pass	32.59	50	-17.41	Pass

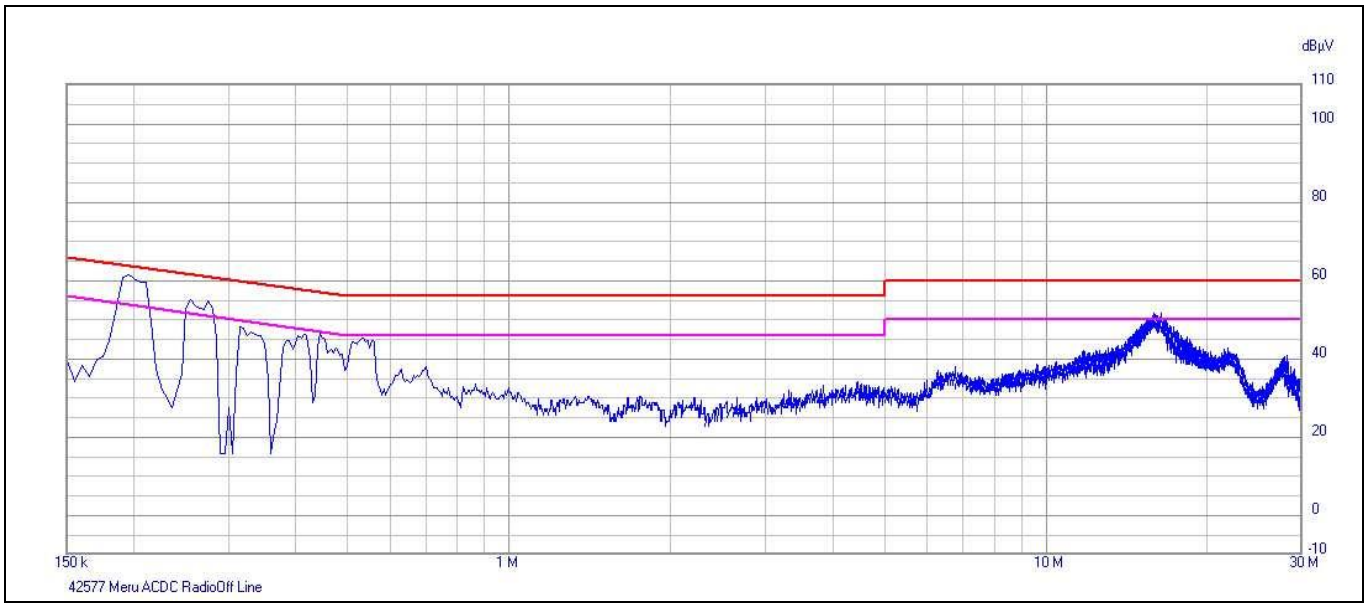
Table 20. Conducted Emissions - Voltage, AC Power, 15.207(a), Neutral Line (120 VAC, 60 Hz), PoE

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

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
42577 CEV ACDC RadOff L	0.195	57.81	63.827	-6.017	Pass	40.17	53.827	-13.657	Pass
42577 CEV ACDC RadOff L	0.255	51.09	61.605	-10.515	Pass	33.29	51.605	-18.315	Pass
42577 CEV ACDC RadOff L	0.315	42.22	59.854	-17.634	Pass	20.77	49.854	-29.084	Pass
42577 CEV ACDC RadOff L	0.445	40.87	56.993	-16.123	Pass	22.88	46.993	-24.113	Pass
42577 CEV ACDC RadOff L	14.47	46.73	60	-13.27	Pass	37.42	50	-12.58	Pass
42577 CEV ACDC RadOff L	15.785	46.88	60	-13.12	Pass	39.03	50	-10.97	Pass

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

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
42577 CEV ACDC RadOff N	0.205	56.12	63.413	-7.293	Pass	33.83	53.413	-19.583	Pass
42577 CEV ACDC RadOff N	0.26	50	61.444	-11.444	Pass	23.09	51.444	-28.354	Pass
42577 CEV ACDC RadOff N	0.27	49.45	61.131	-11.681	Pass	23.09	51.131	-28.041	Pass
42577 CEV ACDC RadOff N	0.32	40.09	59.724	-19.634	Pass	23.6	49.724	-26.124	Pass
42577 CEV ACDC RadOff N	0.46	35.09	56.712	-21.622	Pass	25.81	46.712	-20.902	Pass
42577 CEV ACDC RadOff N	16.07	38.45	60	-21.55	Pass	24.43	50	-25.57	Pass

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(i) 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): Benjamin Taylor

Test Date(s): 09/05/14

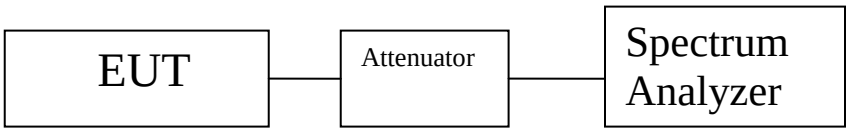
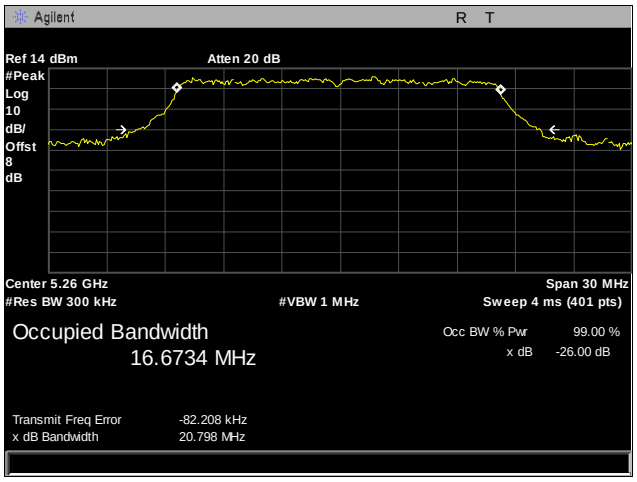
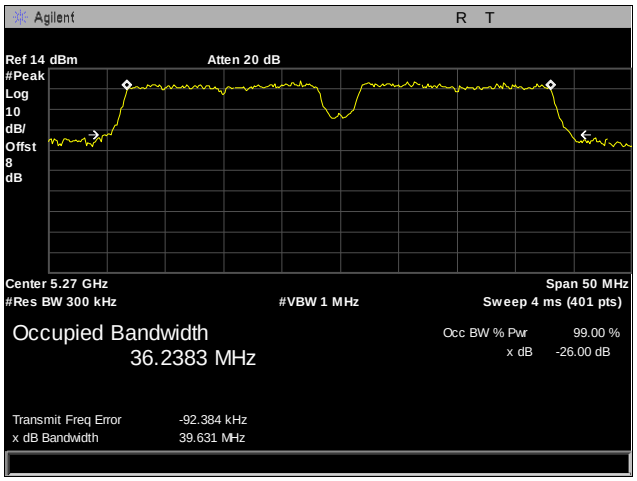


Figure 2. Occupied Bandwidth, Test Setup

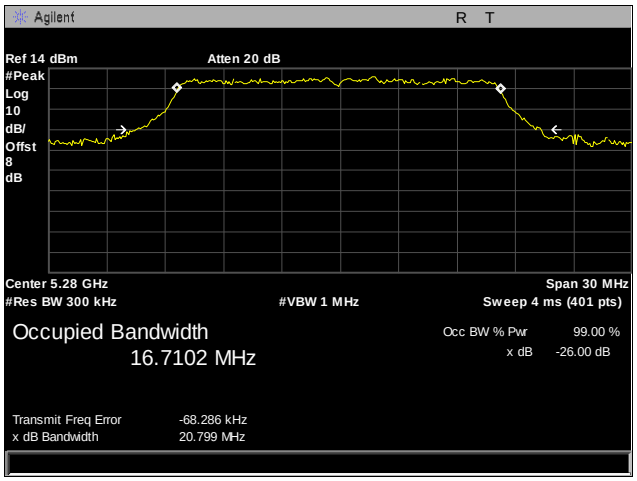
26 dB Occupied Bandwidth, 802.11a



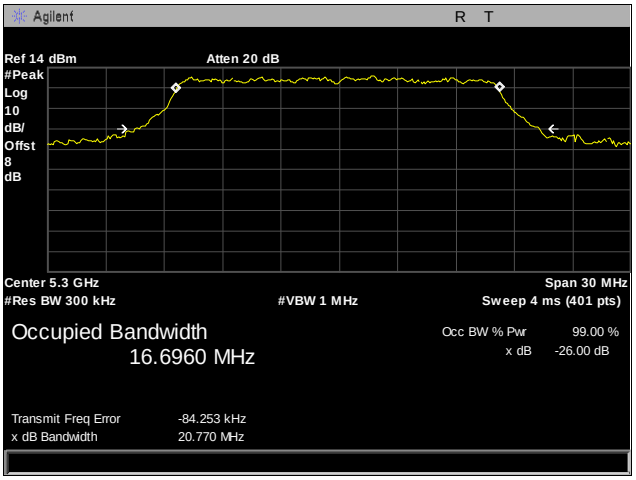
Plot 13. 26 dB Occupied Bandwidth, 802.11a, 5260 MHz



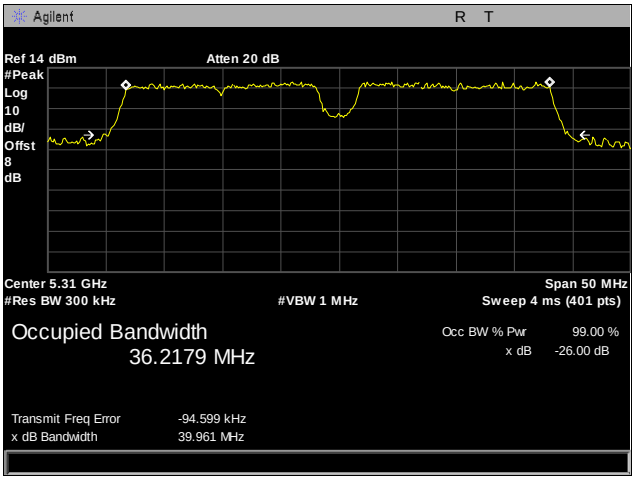
Plot 14. 26 dB Occupied Bandwidth, 802.11a, 5270 MHz



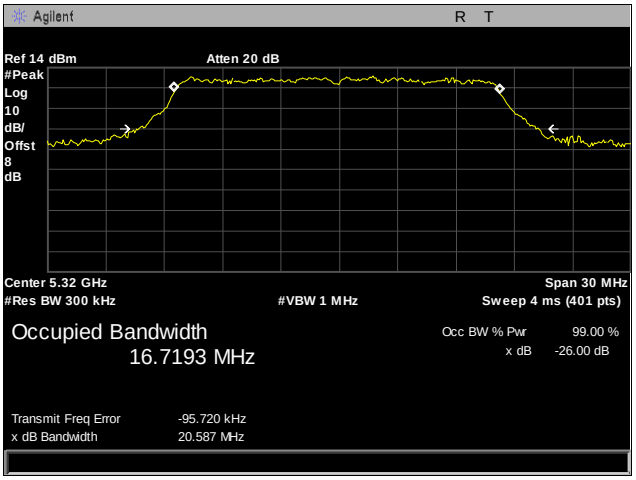
Plot 15. 26 dB Occupied Bandwidth, 802.11a, 5280 MHz



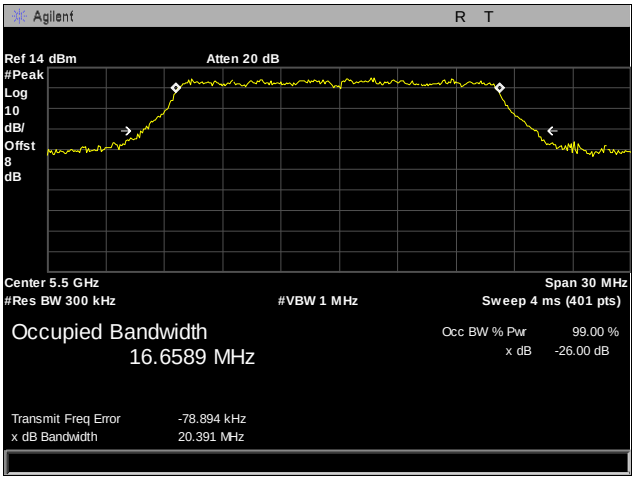
Plot 16. 26 dB Occupied Bandwidth, 802.11a, 5300 MHz



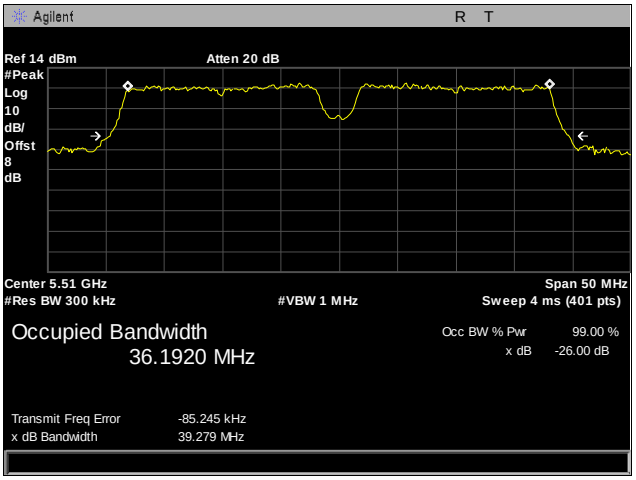
Plot 17. 26 dB Occupied Bandwidth, 802.11a, 5310 MHz



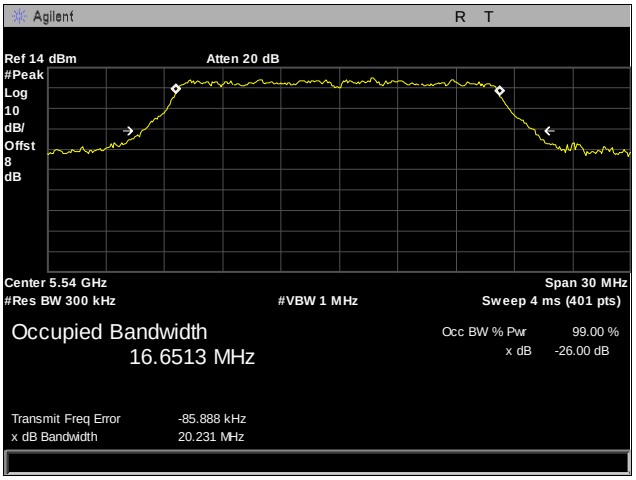
Plot 18. 26 dB Occupied Bandwidth, 802.11a, 5320 MHz



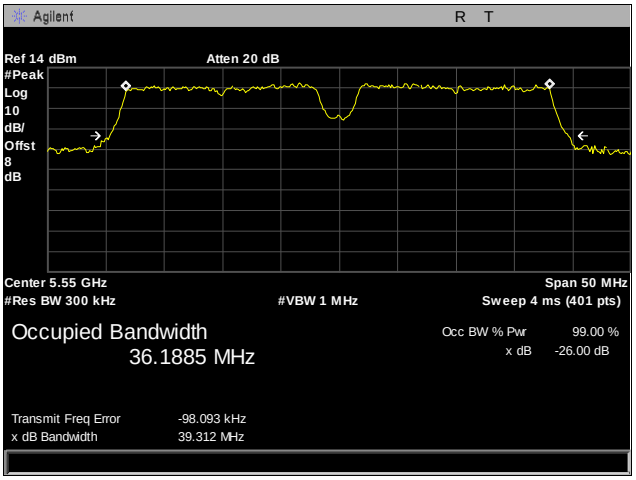
Plot 19. 26 dB Occupied Bandwidth, 802.11a, 5500 MHz



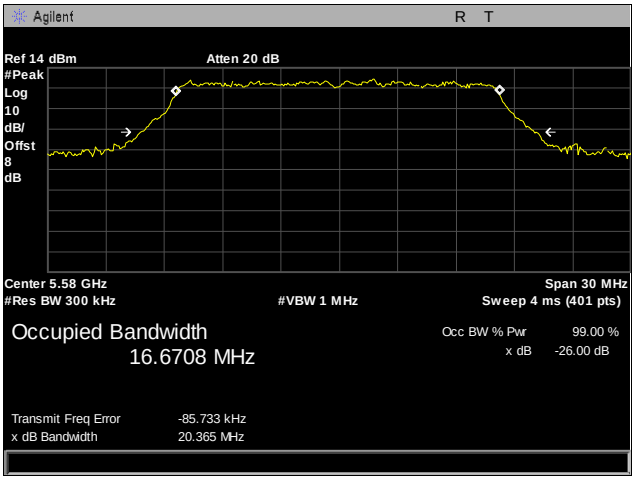
Plot 20. 26 dB Occupied Bandwidth, 802.11a, 5510 MHz



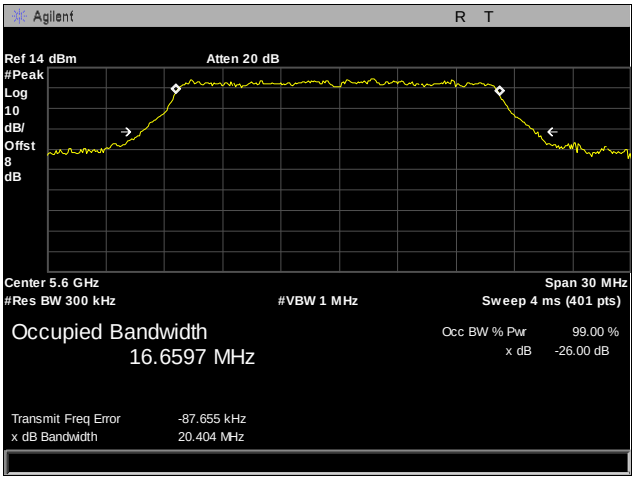
Plot 21. 26 dB Occupied Bandwidth, 802.11a, 5540 MHz



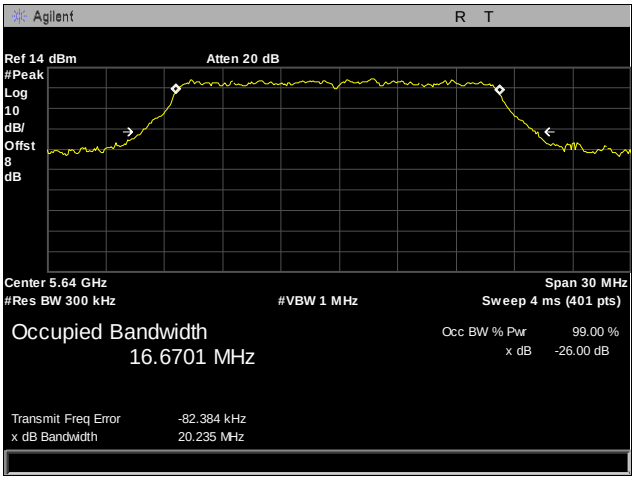
Plot 22. 26 dB Occupied Bandwidth, 802.11a, 5550 MHz



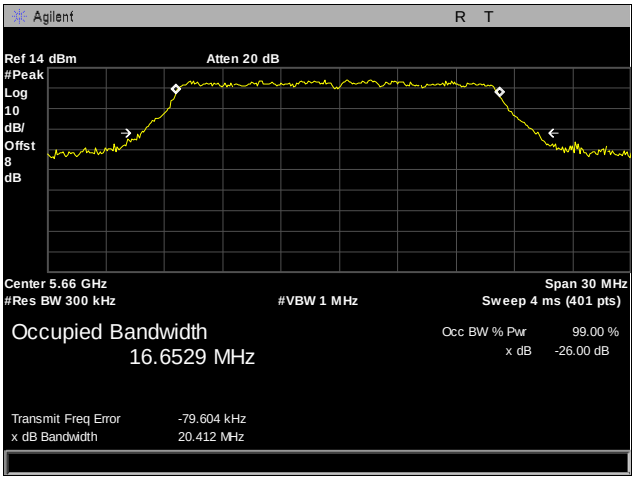
Plot 23. 26 dB Occupied Bandwidth, 802.11a, 5580 MHz



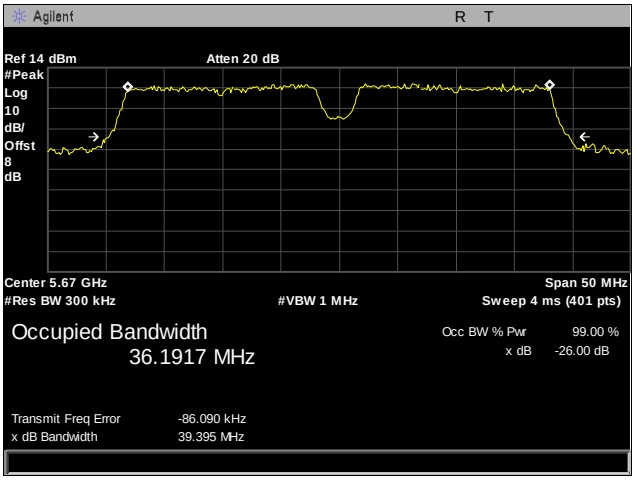
Plot 24. 26 dB Occupied Bandwidth, 802.11a, 5600 MHz



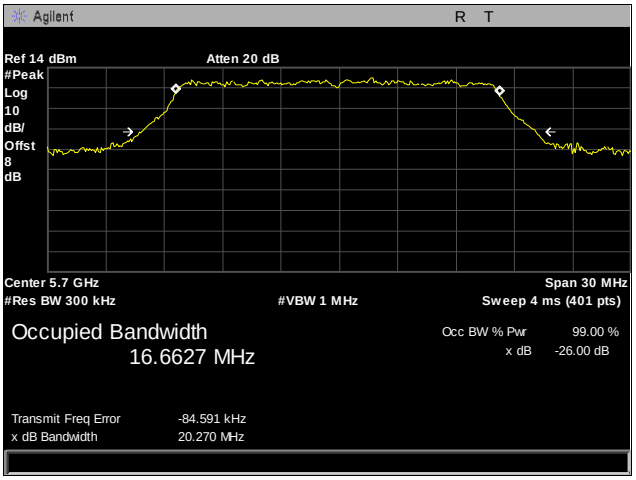
Plot 25. 26 dB Occupied Bandwidth, 802.11a, 5640 MHz



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

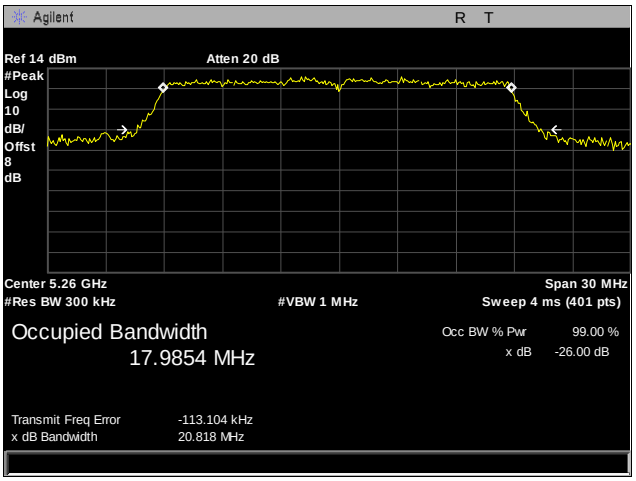


Plot 27. 26 dB Occupied Bandwidth, 802.11a, 5670 MHz

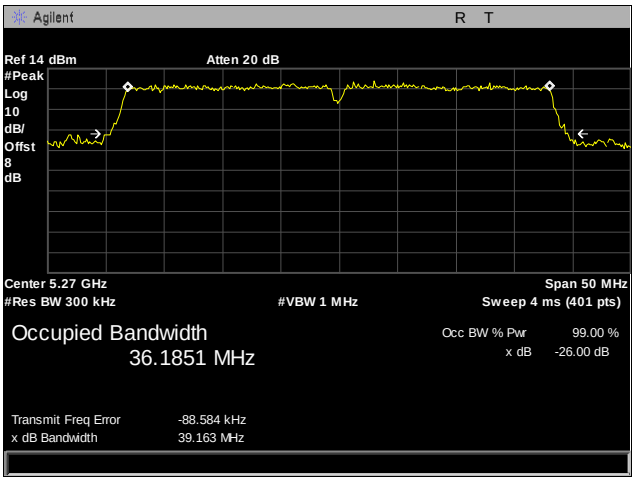


Plot 28. 26 dB Occupied Bandwidth, 802.11a, 5700 MHz

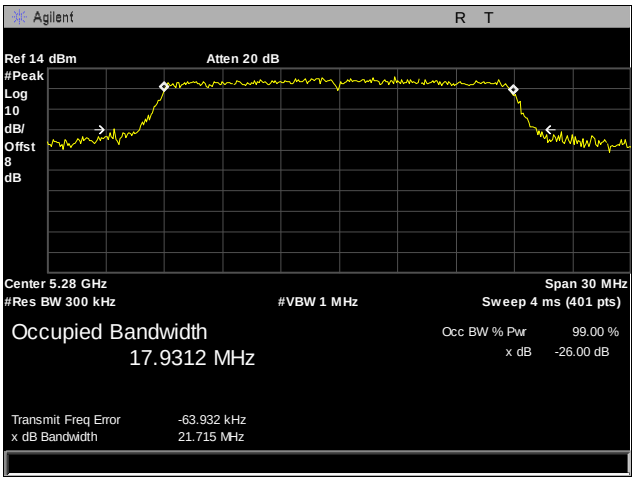
26 dB Occupied Bandwidth, 802.11n, Port 1



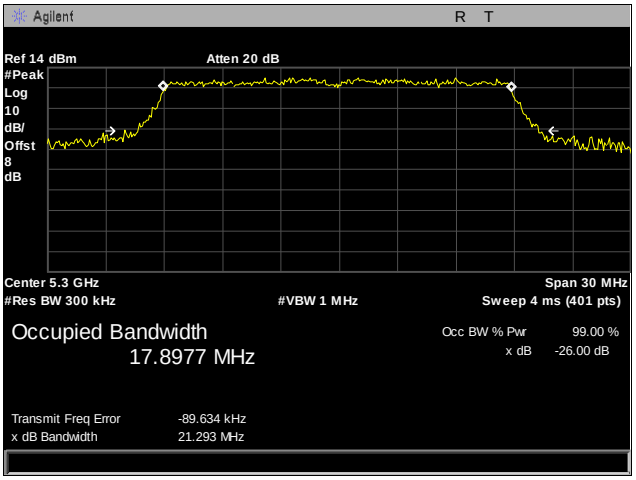
Plot 29. 26 dB Occupied Bandwidth, 802.11n, 5260 MHz, Port 1



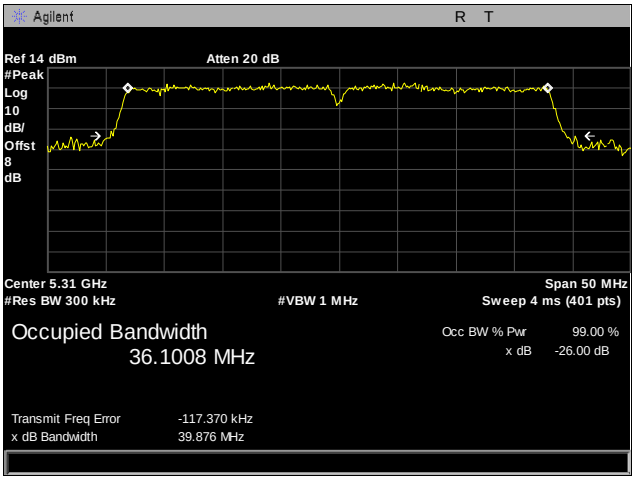
Plot 30. 26 dB Occupied Bandwidth, 802.11n, 5270 MHz, Port 1



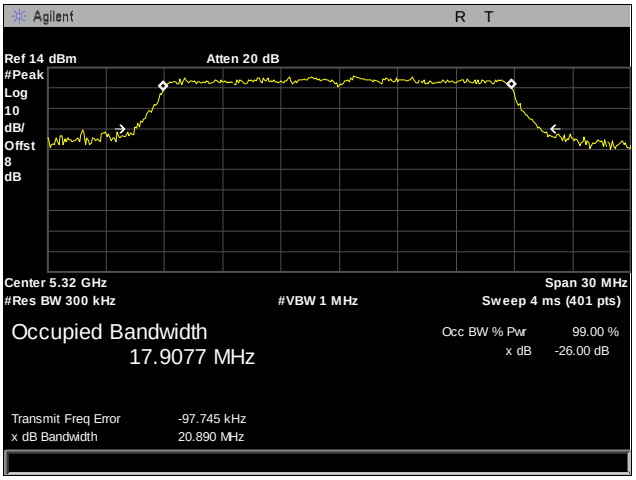
Plot 31. 26 dB Occupied Bandwidth, 802.11n, 5280 MHz, Port 1



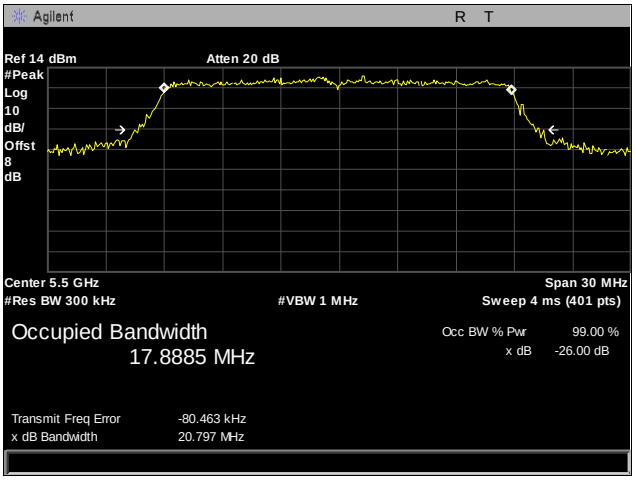
Plot 32. 26 dB Occupied Bandwidth, 802.11n, 5300 MHz, Port 1



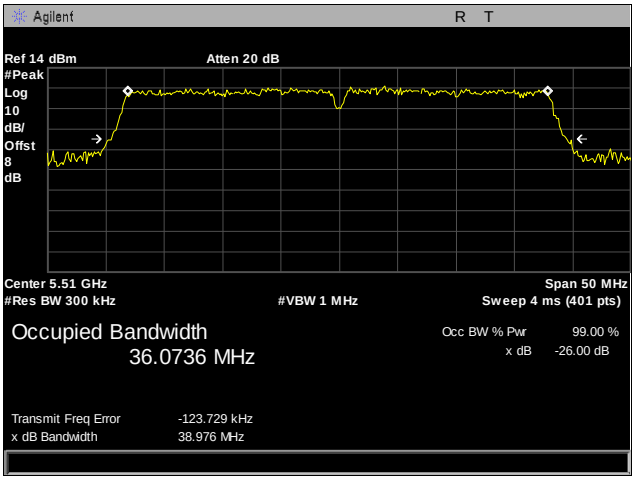
Plot 33. 26 dB Occupied Bandwidth, 802.11n, 5310 MHz, Port 1



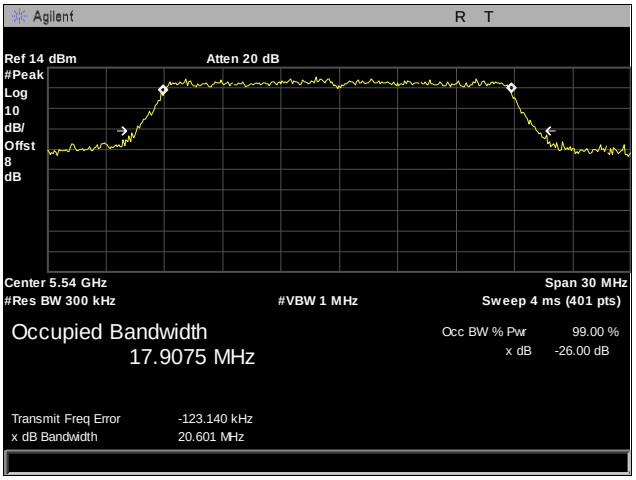
Plot 34. 26 dB Occupied Bandwidth, 802.11n, 5320 MHz, Port 1



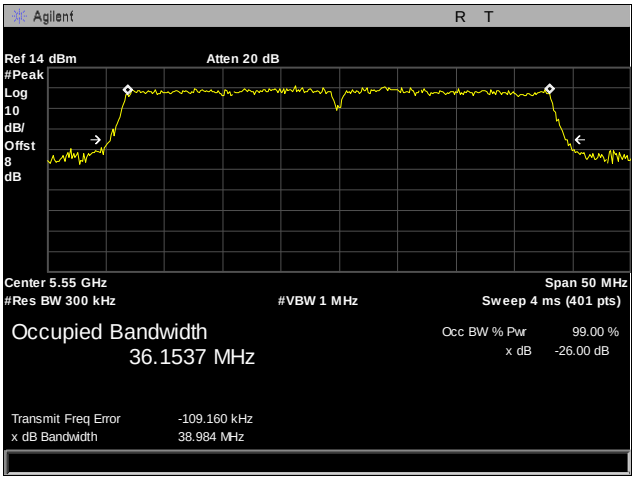
Plot 35. 26 dB Occupied Bandwidth, 802.11n, 5500 MHz, Port 1



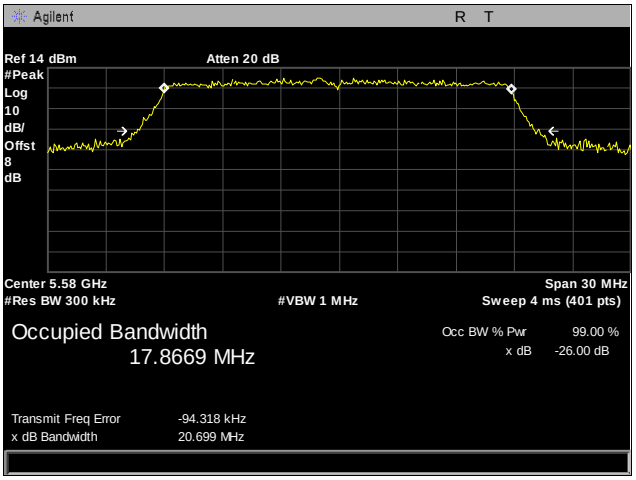
Plot 36. 26 dB Occupied Bandwidth, 802.11n, 5510 MHz, Port 1



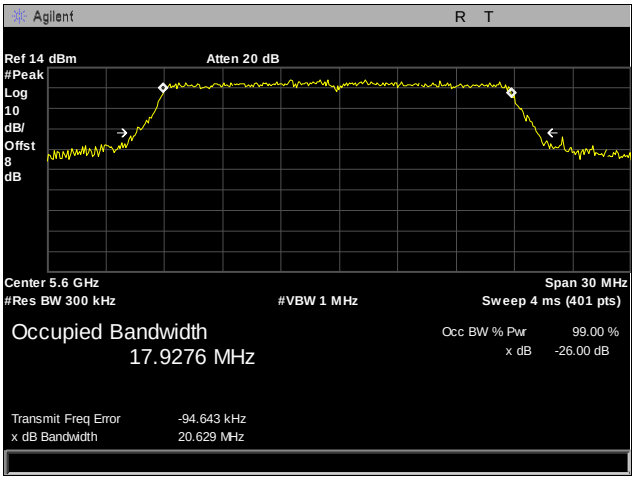
Plot 37. 26 dB Occupied Bandwidth, 802.11n, 5540 MHz, Port 1



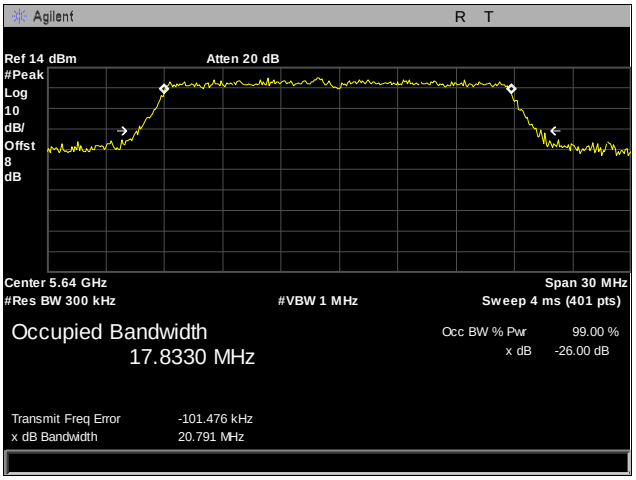
Plot 38. 26 dB Occupied Bandwidth, 802.11n, 5550 MHz, Port 1



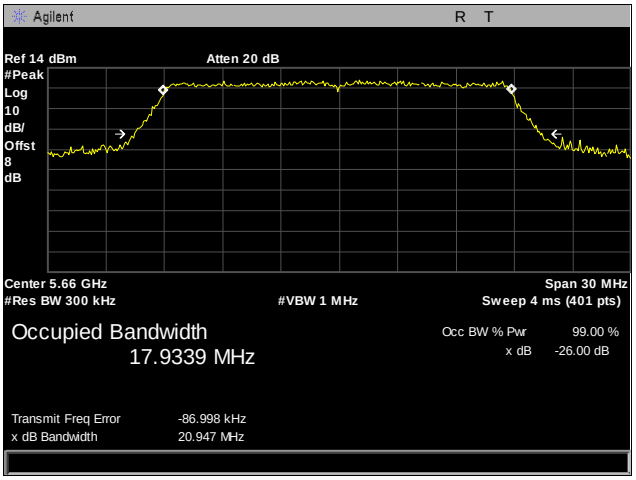
Plot 39. 26 dB Occupied Bandwidth, 802.11n, 5580 MHz, Port 1



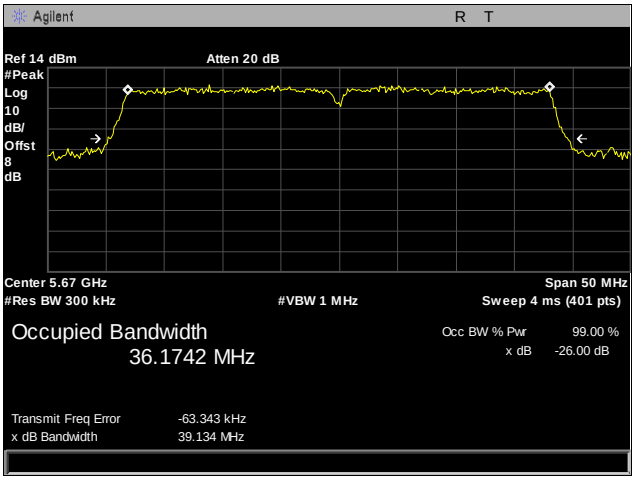
Plot 40. 26 dB Occupied Bandwidth, 802.11n, 5600 MHz, Port 1



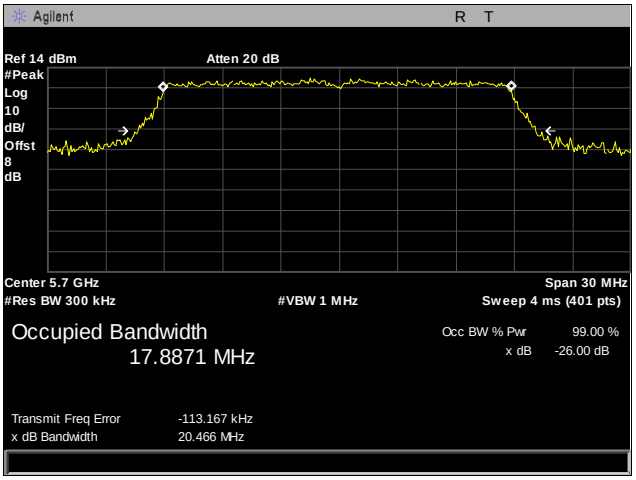
Plot 41. 26 dB Occupied Bandwidth, 802.11n, 5640 MHz, Port 1



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

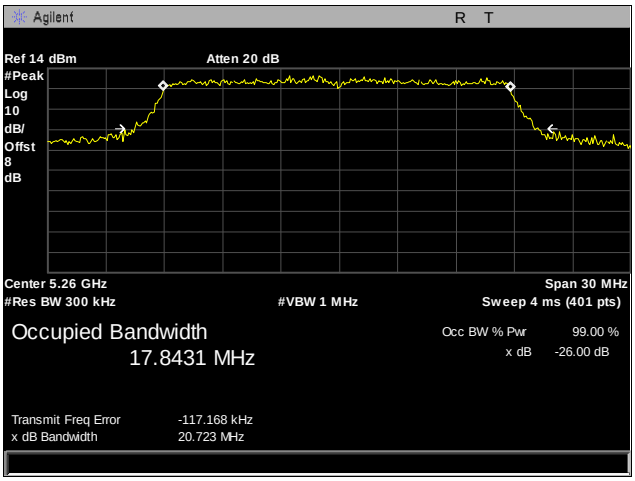


Plot 43. 26 dB Occupied Bandwidth, 802.11n, 5670 MHz, Port 1

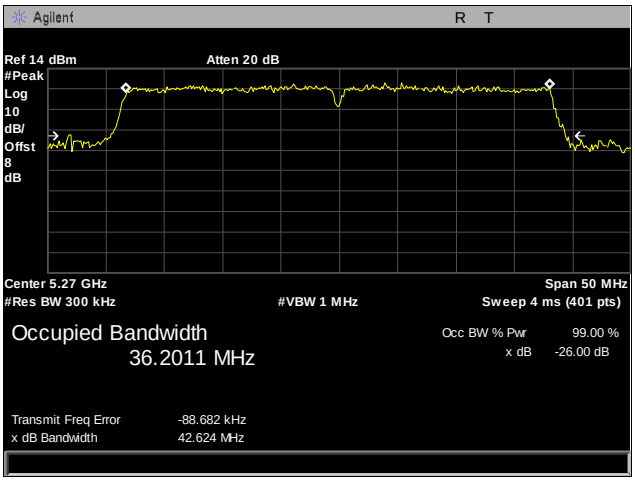


Plot 44. 26 dB Occupied Bandwidth, 802.11n, 5700 MHz, Port 1

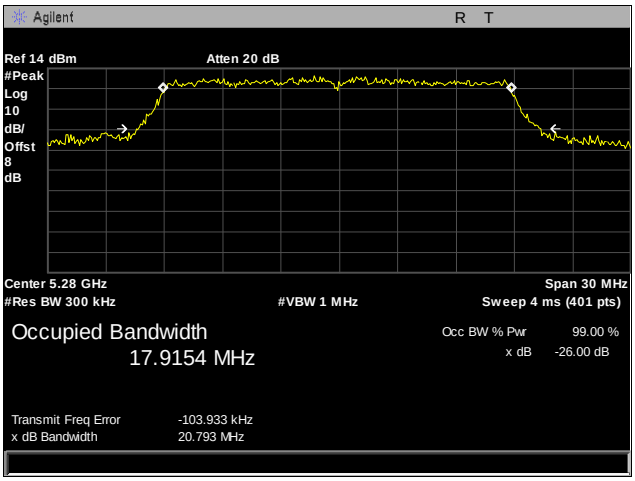
26 dB Occupied Bandwidth, 802.11n, Port 2



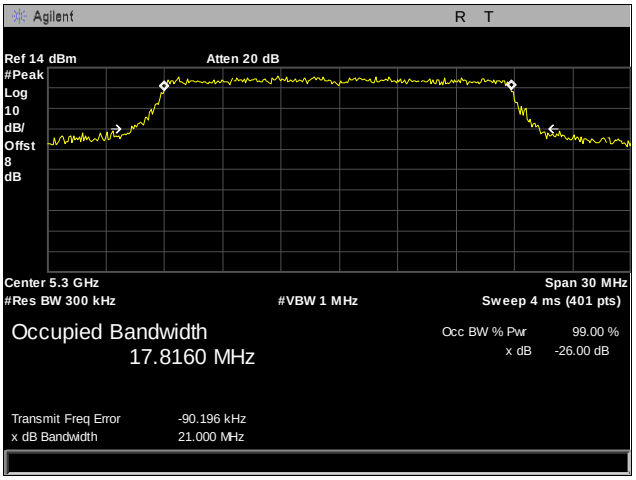
Plot 45. 26 dB Occupied Bandwidth, 802.11n, 5260 MHz, Port 2



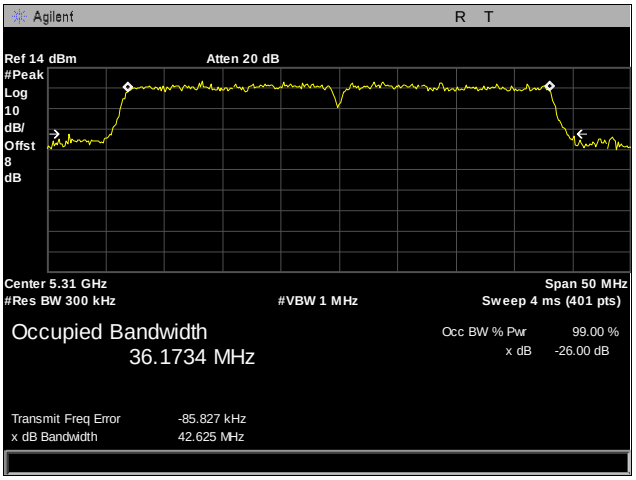
Plot 46. 26 dB Occupied Bandwidth, 802.11n, 5270 MHz, Port 2



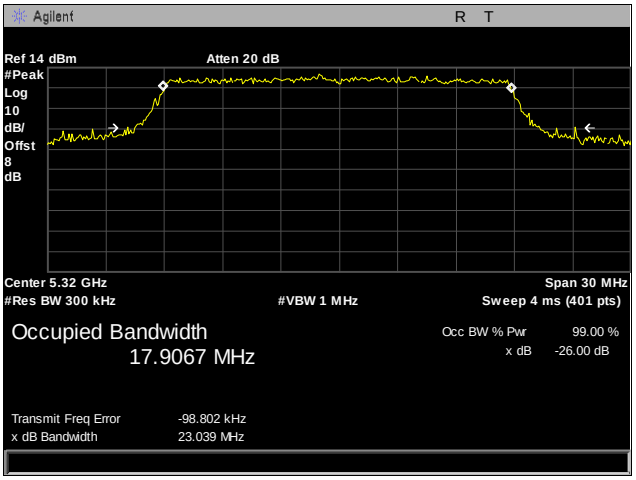
Plot 47. 26 dB Occupied Bandwidth, 802.11n, 5280 MHz, Port 2



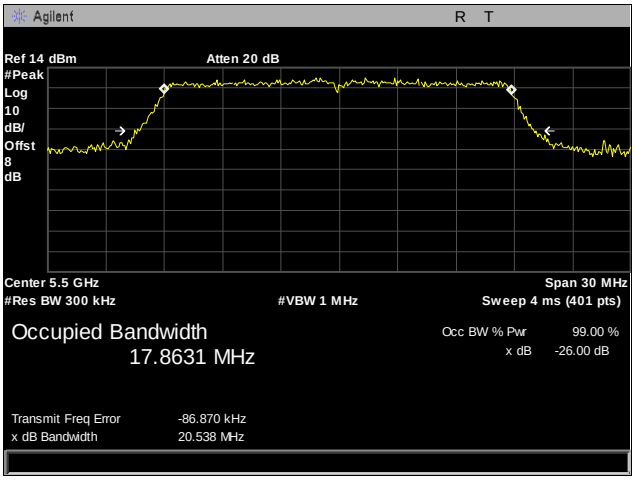
Plot 48. 26 dB Occupied Bandwidth, 802.11n, 5300 MHz, Port 2



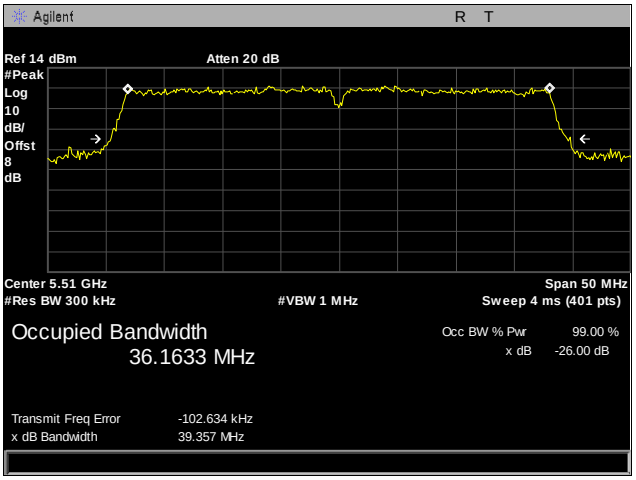
Plot 49. 26 dB Occupied Bandwidth, 802.11n, 5310 MHz, Port 2



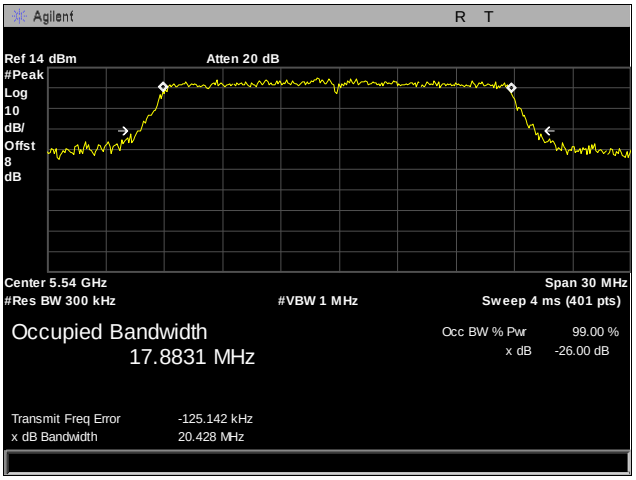
Plot 50. 26 dB Occupied Bandwidth, 802.11n, 5320 MHz, Port 2



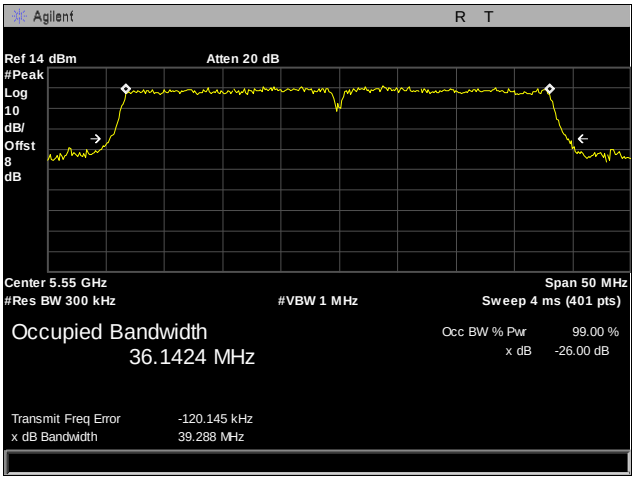
Plot 51. 26 dB Occupied Bandwidth, 802.11n, 5500 MHz, Port 2



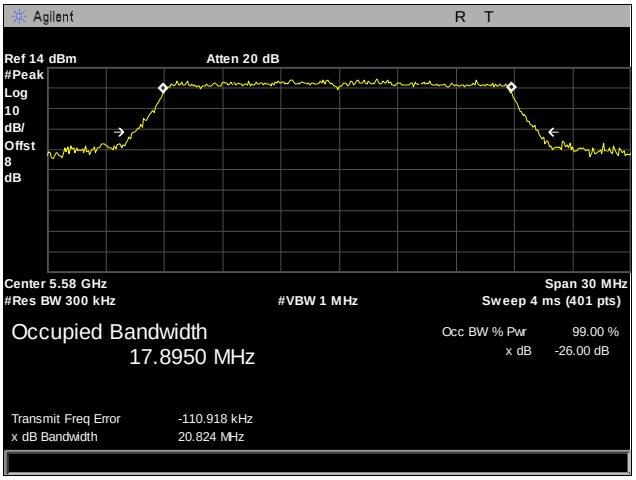
Plot 52. 26 dB Occupied Bandwidth, 802.11n, 5510 MHz, Port 2



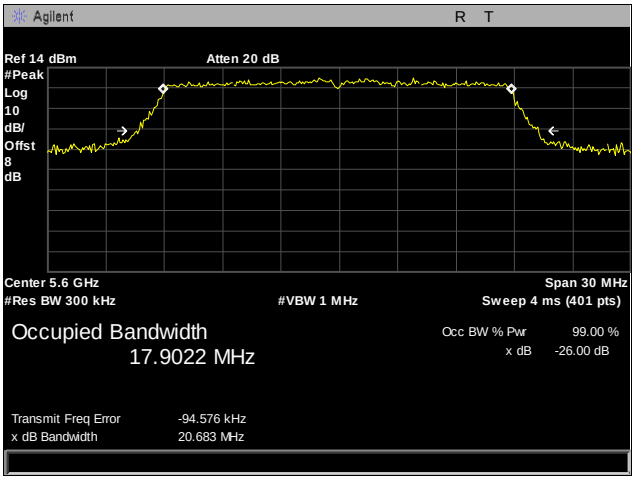
Plot 53. 26 dB Occupied Bandwidth, 802.11n, 5540 MHz, Port 2



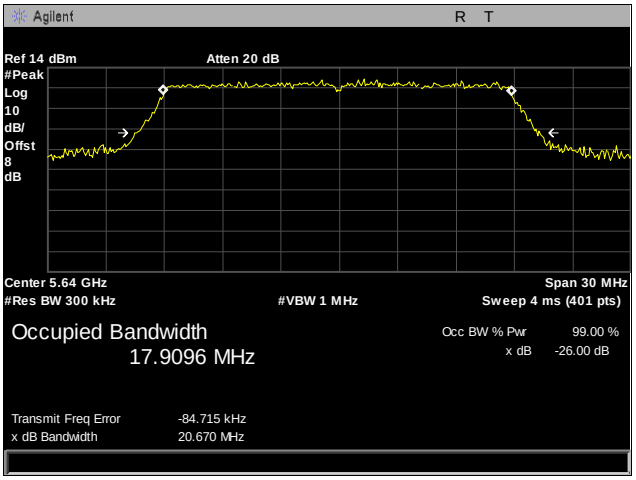
Plot 54. 26 dB Occupied Bandwidth, 802.11n, 5550 MHz, Port 2



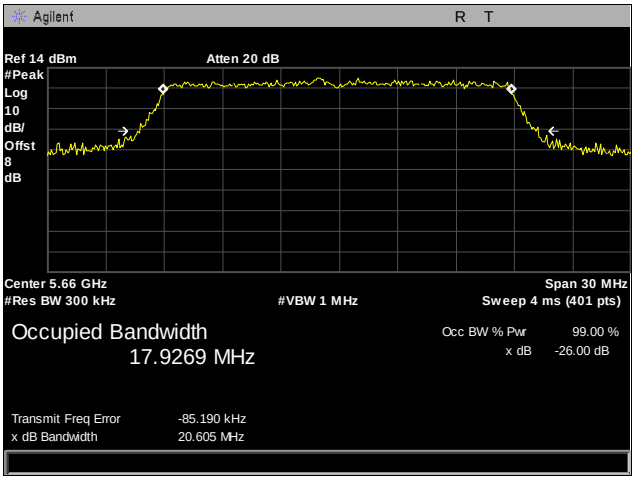
Plot 55. 26 dB Occupied Bandwidth, 802.11n, 5580 MHz, Port 2



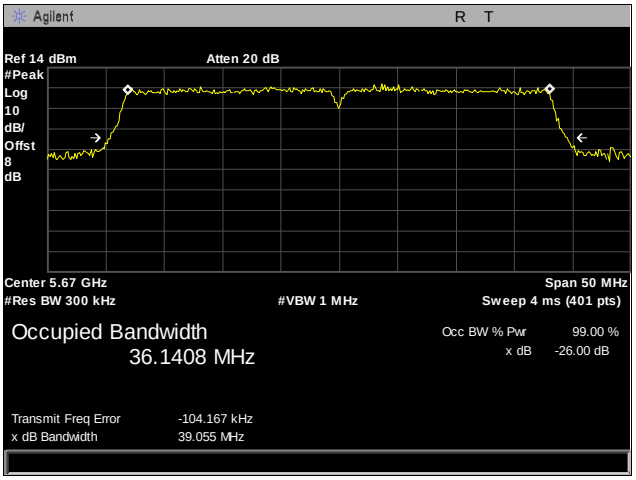
Plot 56. 26 dB Occupied Bandwidth, 802.11n, 5600 MHz, Port 2



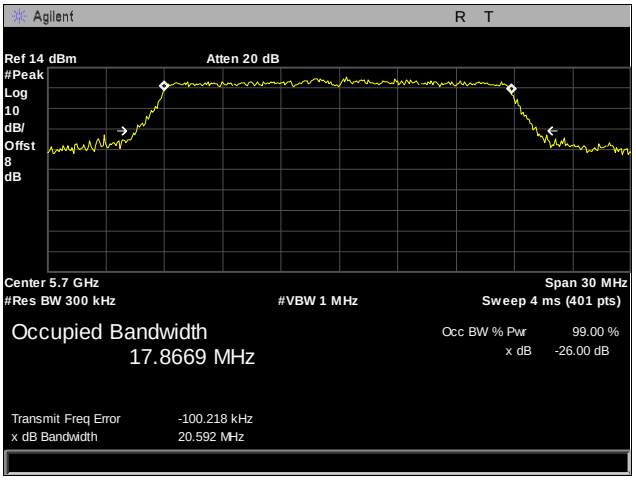
Plot 57. 26 dB Occupied Bandwidth, 802.11n, 5640 MHz, Port 2



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

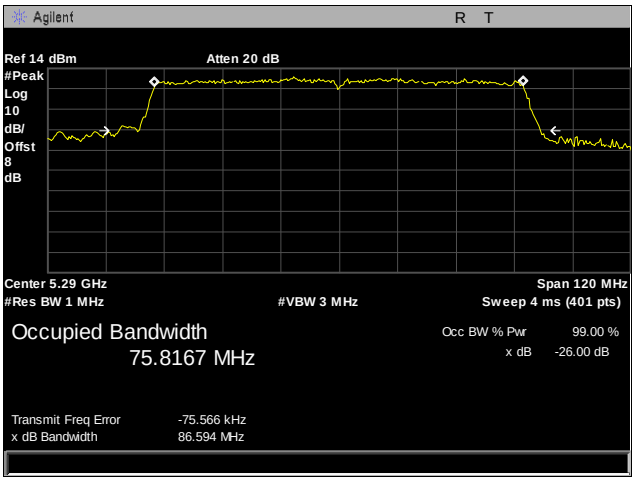


Plot 59. 26 dB Occupied Bandwidth, 802.11n, 5670 MHz, Port 2

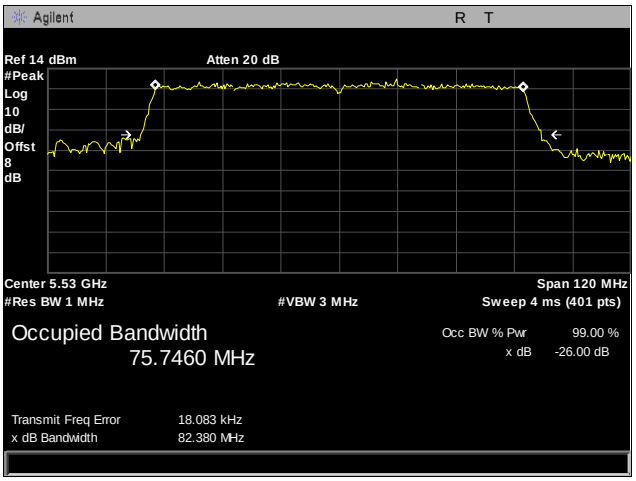


Plot 60. 26 dB Occupied Bandwidth, 802.11n, 5700 MHz, Port 2

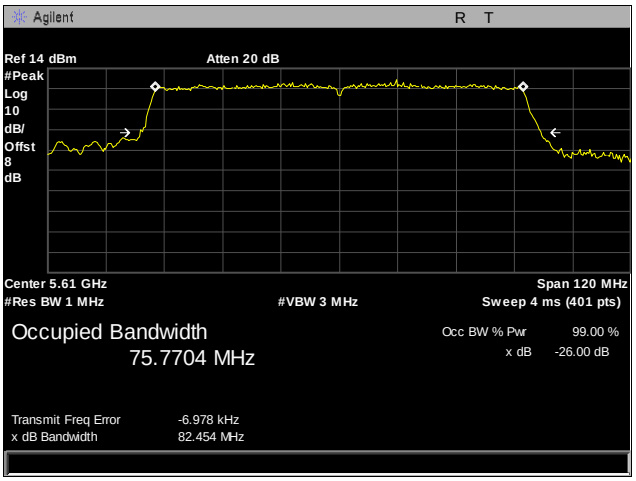
26 dB Occupied Bandwidth, 802.11ac, Port 1



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

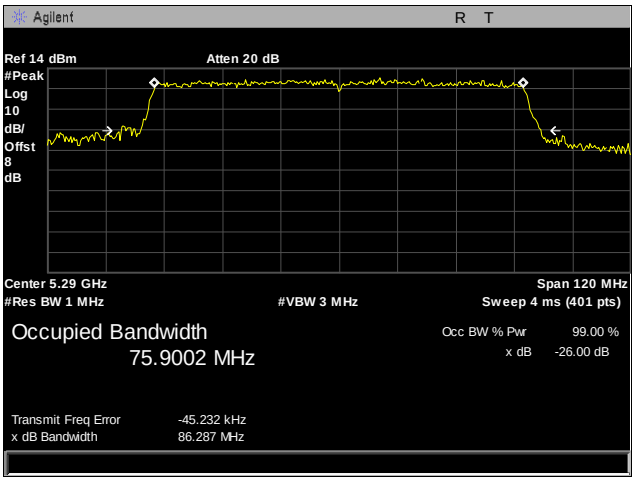


Plot 62. 26 dB Occupied Bandwidth, 802.11ac, 5530 MHz, Port 1

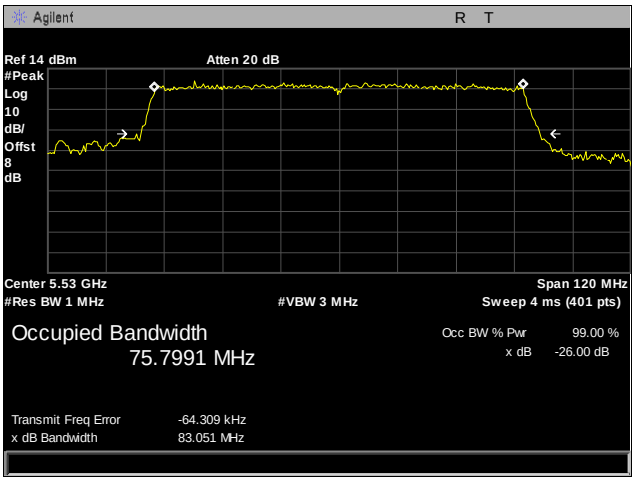


Plot 63. 26 dB Occupied Bandwidth, 802.11ac, 5610 MHz, Port 1

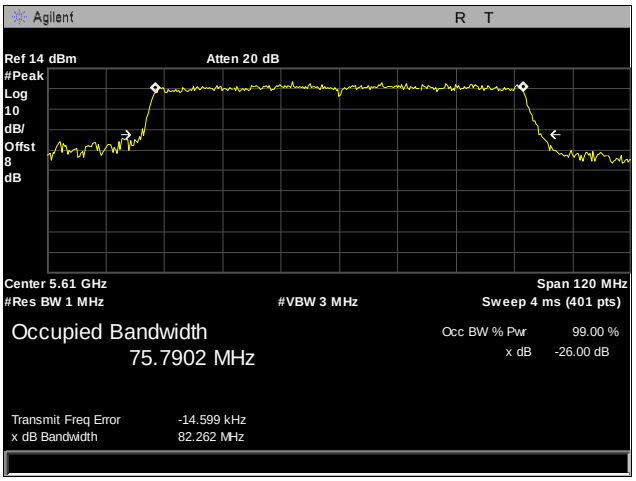
26 dB Occupied Bandwidth, 802.11ac, Port 2



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 an 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 New Rule v01. Plots were corrected for attenuator and cable loss. EUT will be professionally installed and Meru Networks will lower power accordingly when both radios are operating simultaneously and in the same band.

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

Test Engineer(s): Benjamin Taylor

Test Date(s): 09/10/14

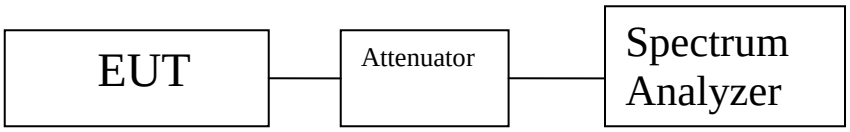


Figure 3. Power Output Test Setup

Frequency (MHz)	Mode	Port R1-A Power (dBm)	Port R1-B Power (dBm)	Summed Power (dBm)	Antenna Gain (dBi)	Limit (dBm)	Margin (dB)
5260	802.11a	20.79		20.79	7.70	22.30	-1.51
5300	802.11a	20.01		20.01	7.70	22.30	-2.29
5320	802.11a	19.39		19.39	7.70	22.30	-2.91
5270	802.11a	19.46		19.46	7.70	22.30	-2.84
5310	802.11a	19.22		19.22	7.70	22.30	-3.08
5260	802.11n	16.91	17.21	20.07	7.70	22.30	-2.23
5300	802.11n	17.05	17.07	20.07	7.70	22.30	-2.23
5320	802.11n	16.97	16.77	19.88	7.70	22.30	-2.42
5270	802.11n	17.71	19.19	21.52	7.70	22.30	-0.78
5310	802.11n	18.27	18.67	21.48	7.70	22.30	-0.82
5290	802.11ac	18.11	18.73	21.44	7.70	22.30	-0.86

Table 23. RF Output Power, Test Results, Lower

Frequency (MHz)	Mode	Port R1-A Power (dBm)	Port R1-B Power (dBm)	Summed Power (dBm)	Antenna Gain (dBi)	Limit (dBm)	Margin (dB)
5500	802.11a	19.27		19.27	7.70	22.30	-3.03
5600	802.11a	18.49		18.49	7.70	22.30	-3.81
5700	802.11a	18.73		18.73	7.70	22.30	-3.57
5510	802.11a	18.97		18.97	7.70	22.30	-3.33
5670	802.11a	19.00		19.00	7.70	22.30	-3.30
5500	802.11n	16.88	17.23	20.07	7.70	22.30	-2.23
5600	802.11n	15.76	16.73	19.28	7.70	22.30	-3.02
5700	802.11n	16.01	16.56	19.30	7.70	22.30	-3.00
5510	802.11n	19.22	18.40	21.84	7.70	22.30	-0.46
5670	802.11n	18.29	18.83	21.58	7.70	22.30	-0.72

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

Test Engineer(s): Benjamin Taylor

Test Date(s): 09/10/14

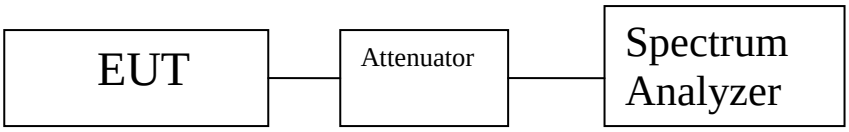


Figure 4. Power Spectral Density Test Setup

Frequency (MHz)	Mode	Port R1-A PSD (dBm)	Port R1-B PSD (dBm)	Summed PSD (dBm)	Antenna Gain (dBi)	Limit (dBm)	Margin (dB)
5260	802.11a	8.71		8.71	7.70	9.30	-0.59
5300	802.11a	8.42		8.42	7.70	9.30	-0.88
5320	802.11a	8.47		8.47	7.70	9.30	-0.83
5270	802.11a	5.46		5.46	7.70	9.30	-3.84
5310	802.11a	5.80		5.80	7.70	9.30	-3.50
5260	802.11n	5.95	6.16	9.07	7.70	9.30	-0.23
5300	802.11n	5.78	6.00	8.90	7.70	9.30	-0.40
5320	802.11n	6.12	6.30	9.22	7.70	9.30	-0.08
5270	802.11n	4.83	5.25	8.06	7.70	9.30	-1.24
5310	802.11n	4.79	5.75	8.31	7.70	9.30	-0.99
5290	802.11ac	1.509	1.725	4.63	7.70	9.30	-4.67

Table 25. Peak Spectral Density, Test Results, Lower

Frequency (MHz)	Mode	Port R1-A PSD (dBm)	Port R1-B PSD (dBm)	Summed PSD (dBm)	Antenna Gain (dBi)	Limit (dBm)	Margin (dB)
5500	802.11a	8.75		8.75	7.70	9.30	-0.56
5600	802.11a	8.08		8.08	7.70	9.30	-1.22
5700	802.11a	8.43		8.43	7.70	9.30	-0.87
5510	802.11a	5.55		5.55	7.70	9.30	-3.75
5670	802.11a	5.58		5.58	7.70	9.30	-3.72
5500	802.11n	5.92	6.22	9.08	7.70	9.30	-0.22
5600	802.11n	5.53	5.67	8.61	7.70	9.30	-0.69
5700	802.11n	5.70	6.14	8.93	7.70	9.30	-0.37
5510	802.11n	4.79	5.59	8.22	7.70	9.30	-1.08
5670	802.11n	4.68	5.07	7.89	7.70	9.30	-1.41

Table 26. Peak Spectral Density, Test Results, Upper

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(b)(4), (6), (7) Undesirable Emissions

Test Requirements: **§ 15.407(b)(4), (6), (7)**; **§15.205:** Emissions outside the frequency band.

§ 15.407(b)(2)(3):
For transmitters operating in the 5.15-5.25 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.

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

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

Test Procedure: The transmitter was placed on an 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.

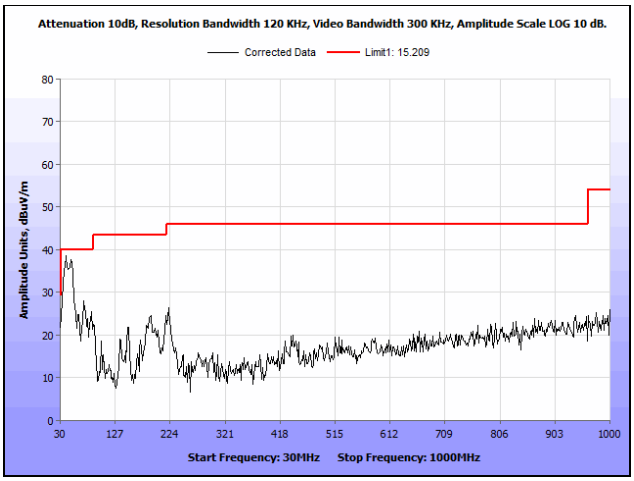
For measurements above 1 GHz, measurements were made with a Peak detector with 1 MHz resolution bandwidth. A notch filter was use to filter the transmitting signal. Where the spurious emissions fell into a restricted band, measurements were also made with an average detector to make sure they complied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

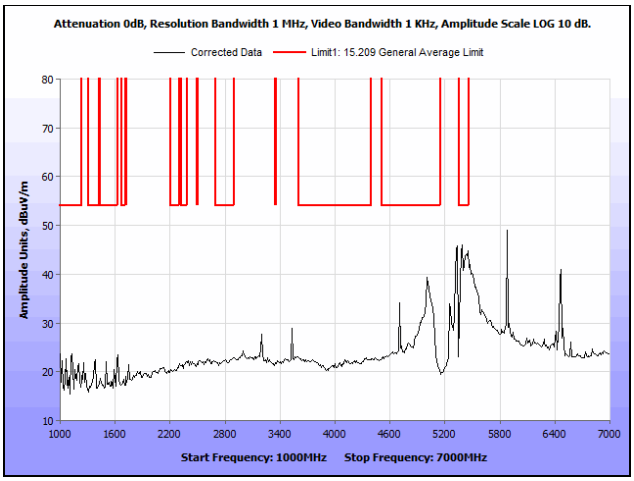
Test Engineer(s): Andy Shen and Ajaz Khan

Test Date(s): 09/05/14

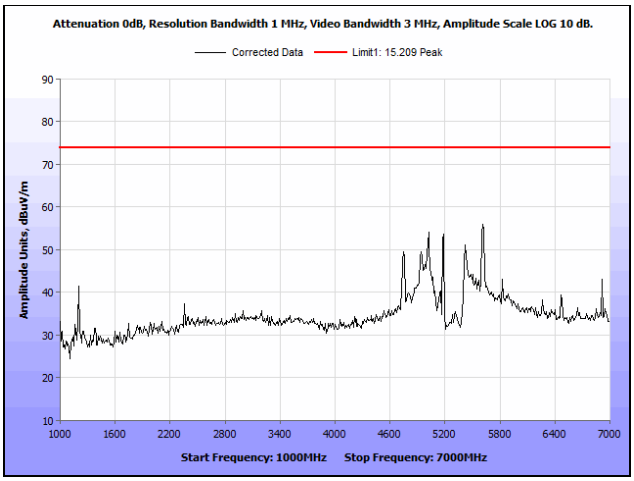
Radiated Spurious Emissions, 802.11a, Lower Band



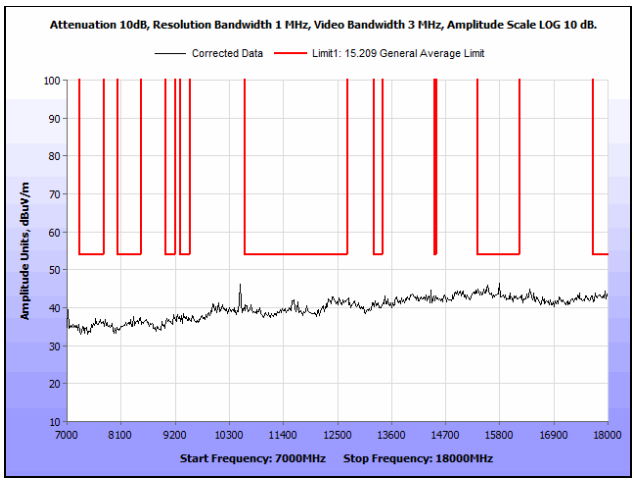
Plot 67. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 30 MHz – 1 GHz



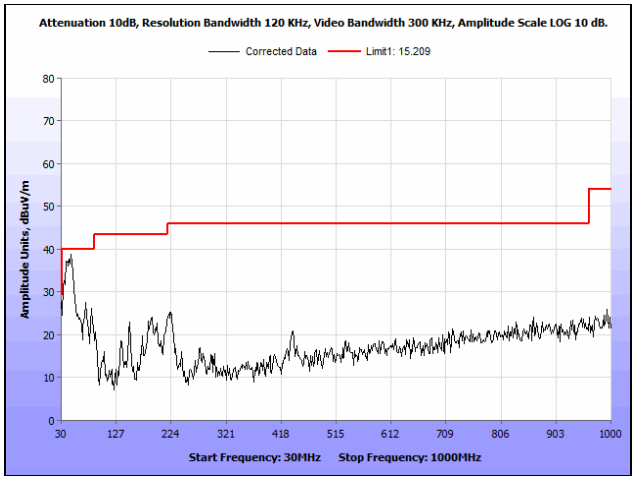
Plot 68. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 1 GHz – 7 GHz, Average



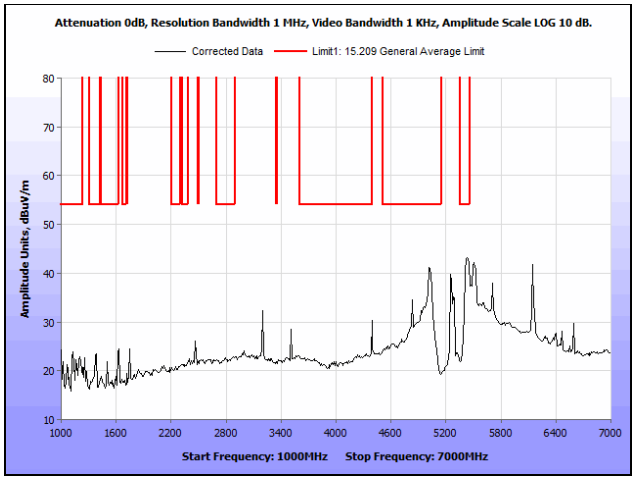
Plot 69. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 1 GHz – 7 GHz, Peak



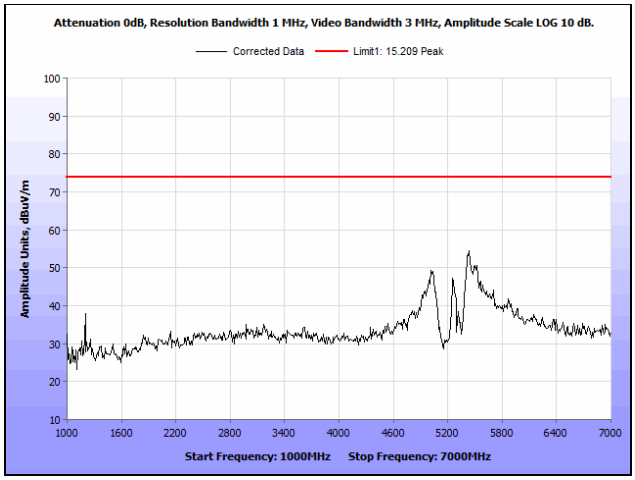
Plot 70. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 7 GHz – 18 GHz



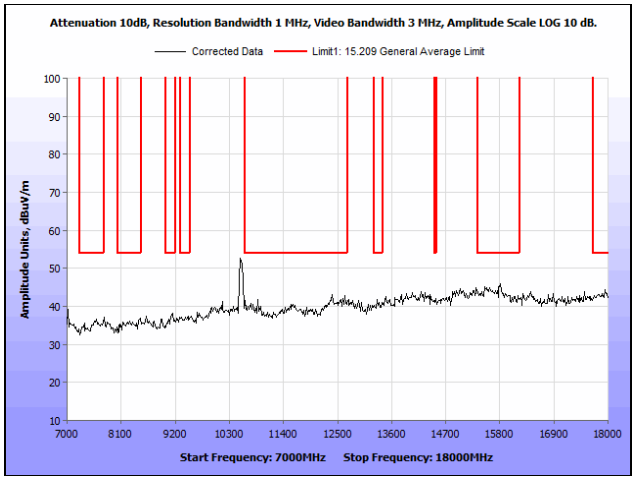
Plot 71. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 30 MHz – 1 GHz



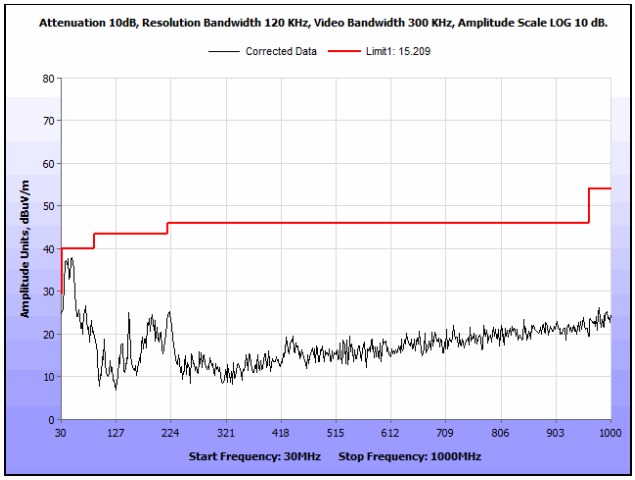
Plot 72. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 1 GHz – 7 GHz, Average



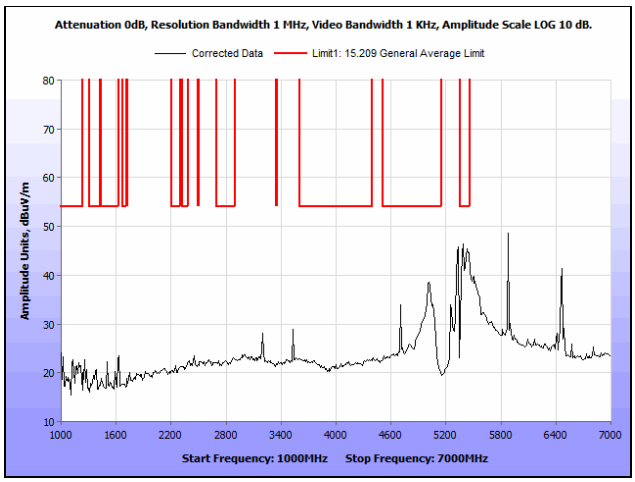
Plot 73. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 1 GHz – 7 GHz, Peak



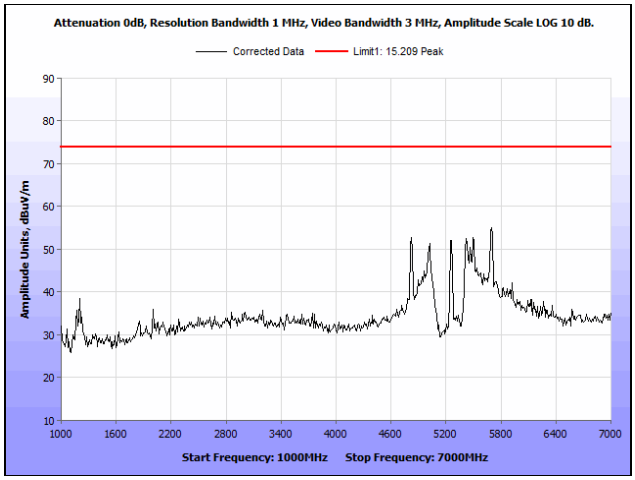
Plot 74. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 7 GHz – 18 GHz



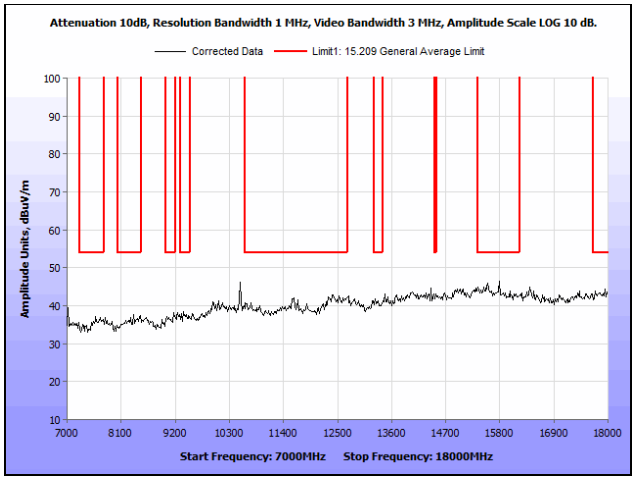
Plot 75. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 30 MHz – 1 GHz



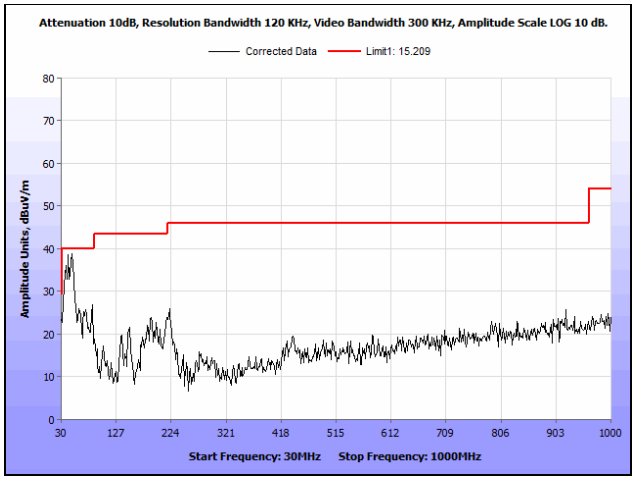
Plot 76. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 1 GHz – 7 GHz, Average



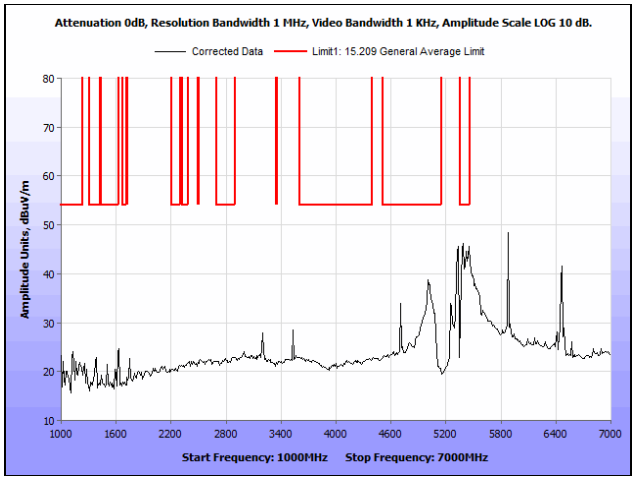
Plot 77. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 1 GHz – 7 GHz, Peak



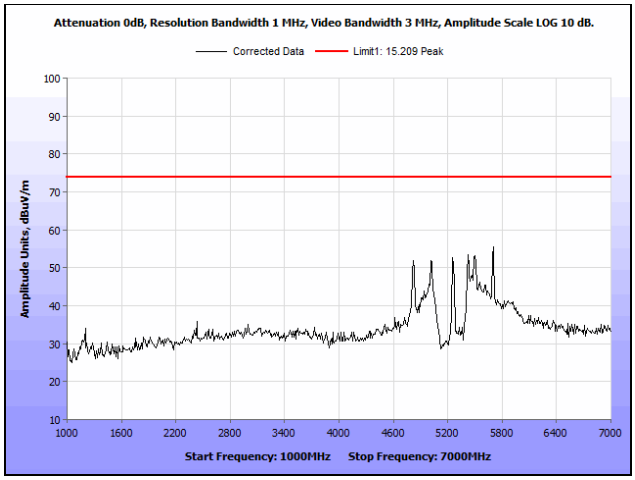
Plot 78. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 7 GHz – 18 GHz



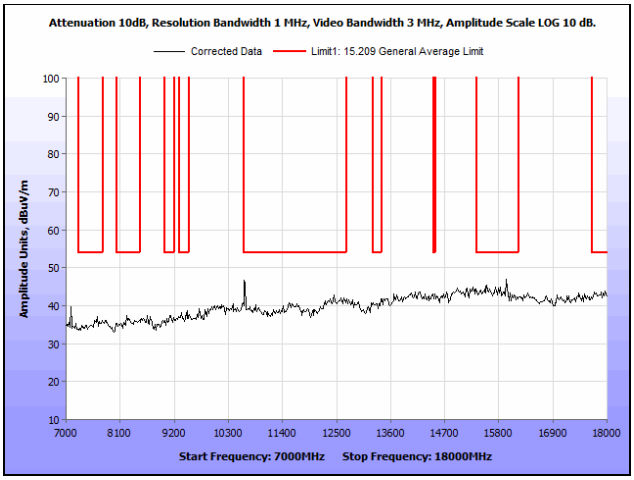
Plot 79. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 30 MHz – 1 GHz, Average



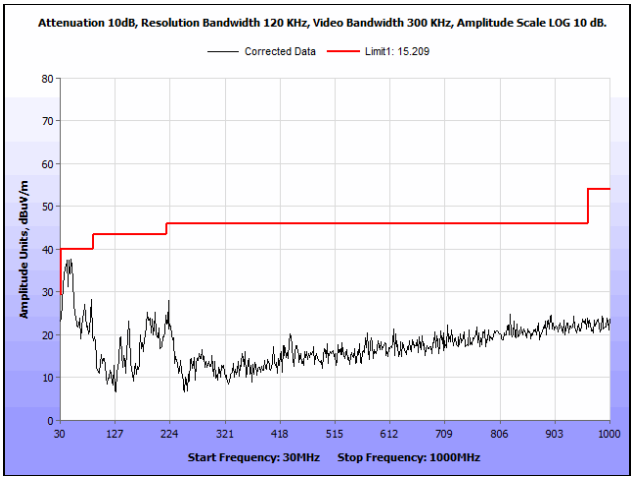
Plot 80. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 1 GHz – 7 GHz, Average



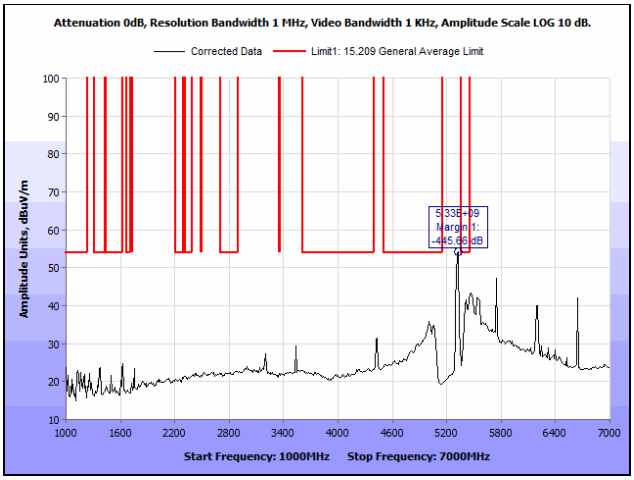
Plot 81. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 1 GHz – 7 GHz, Peak



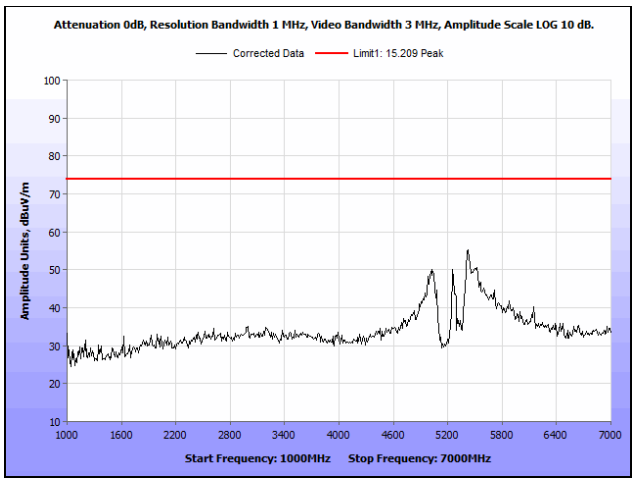
Plot 82. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 7 GHz – 18 GHz



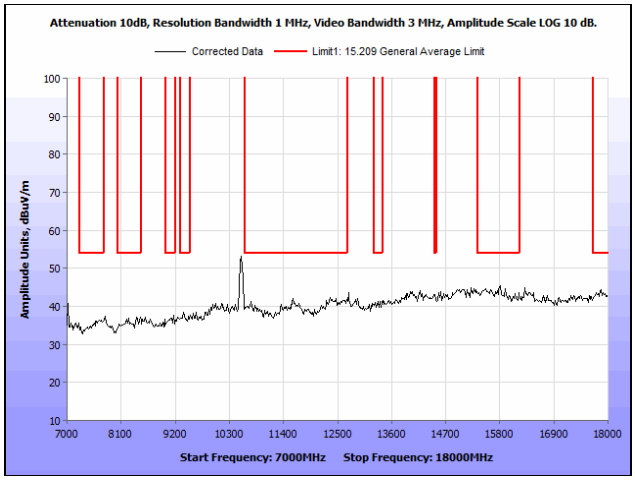
Plot 83. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 30 MHz – 1 GHz



Plot 84. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 1 GHz – 7 GHz, Average

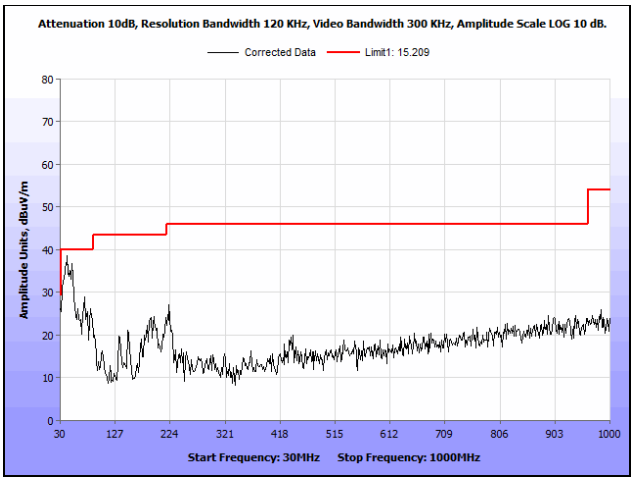


Plot 85. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 1 GHz – 7 GHz, Peak

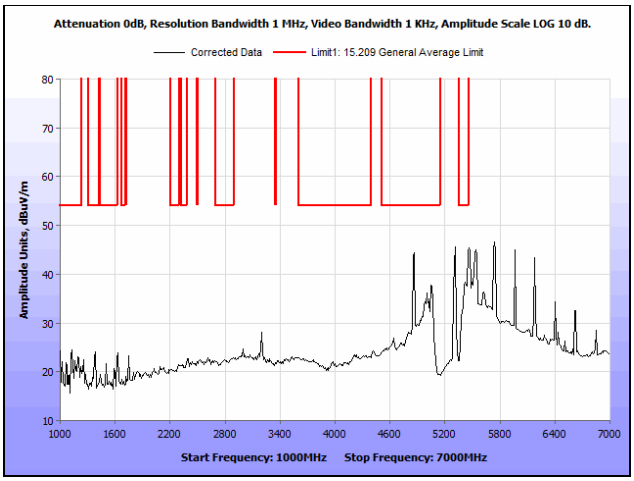


Plot 86. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 7 GHz – 18 GHz, Peak

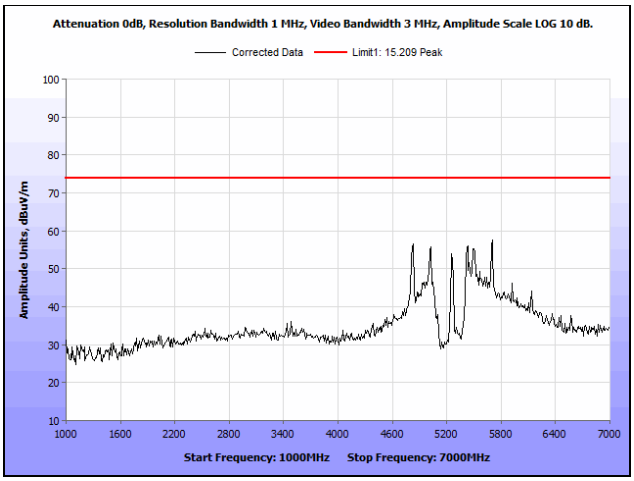
Radiated Spurious Emissions, 802.11n, Omni Antenna, Lower Band



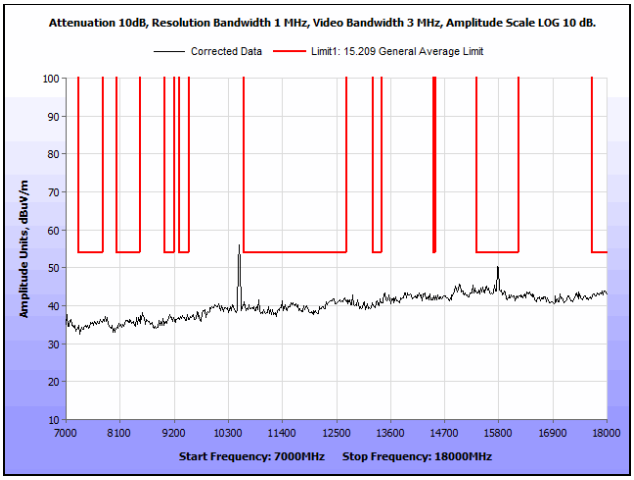
Plot 87. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 30 MHz – 1 GHz



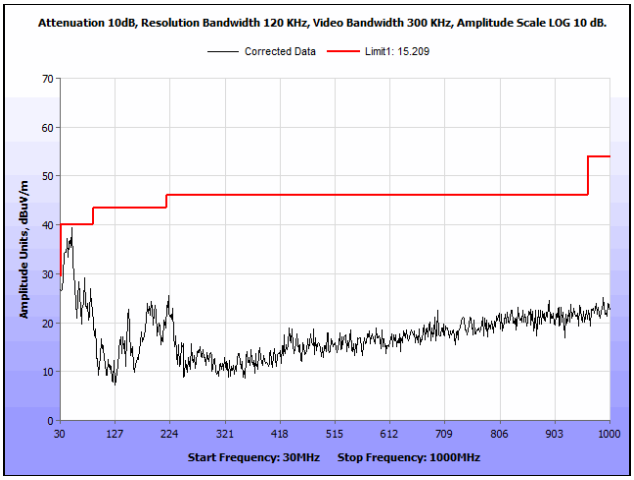
Plot 88. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 1 GHz – 7 GHz, Average



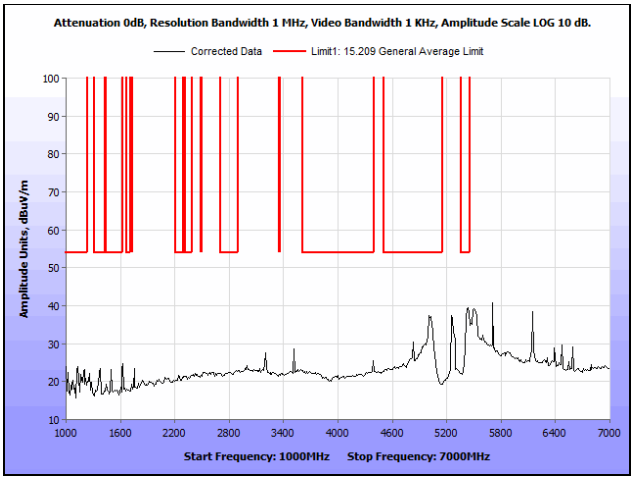
Plot 89. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 1 GHz – 7 GHz, Peak



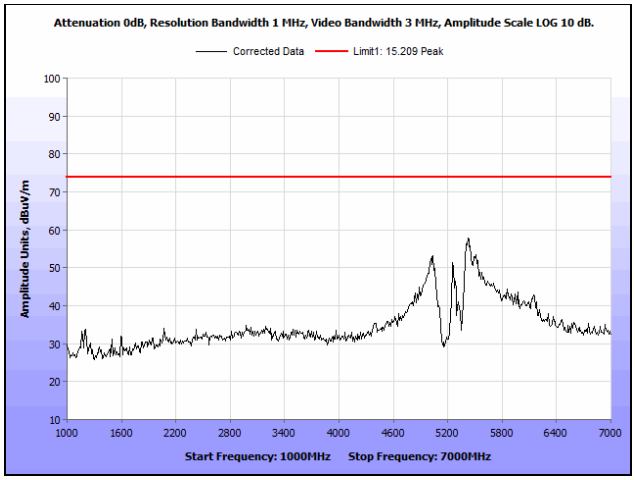
Plot 90. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 7 GHz – 18 GHz



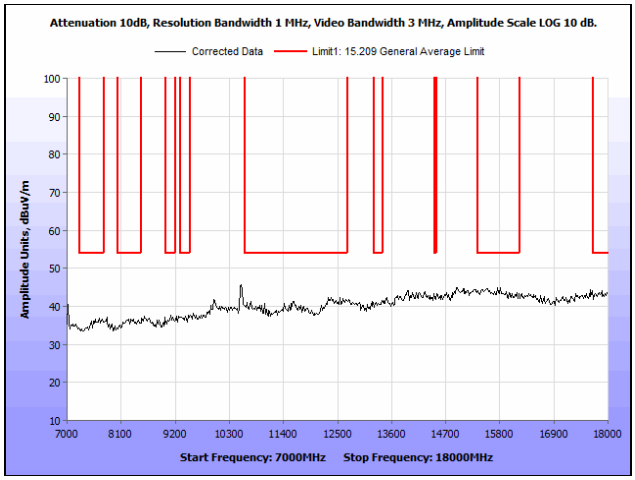
Plot 91. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 30 MHz – 1 GHz



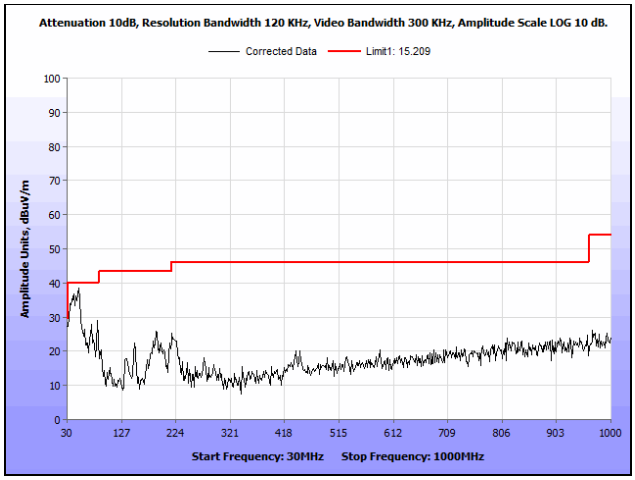
Plot 92. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 1 GHz – 7 GHz, Average



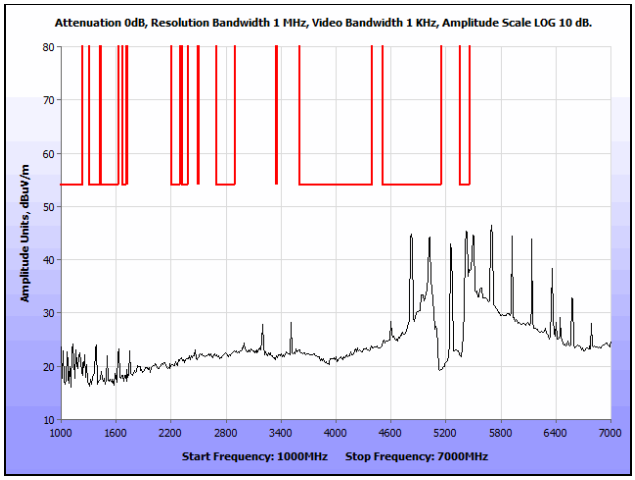
Plot 93. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 1 GHz – 7 GHz, Peak



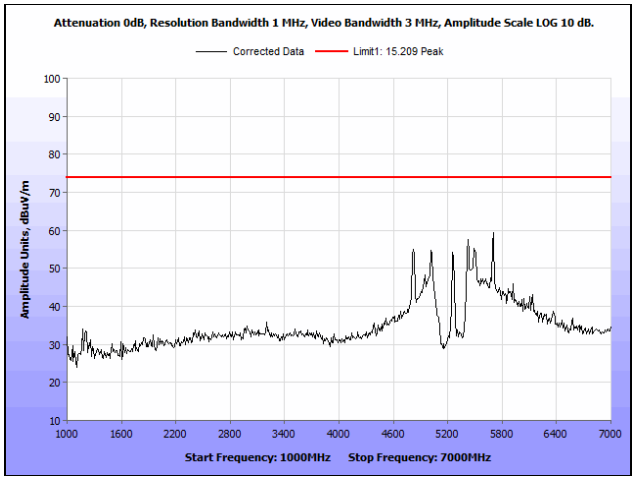
Plot 94. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 7 GHz – 18 GHz



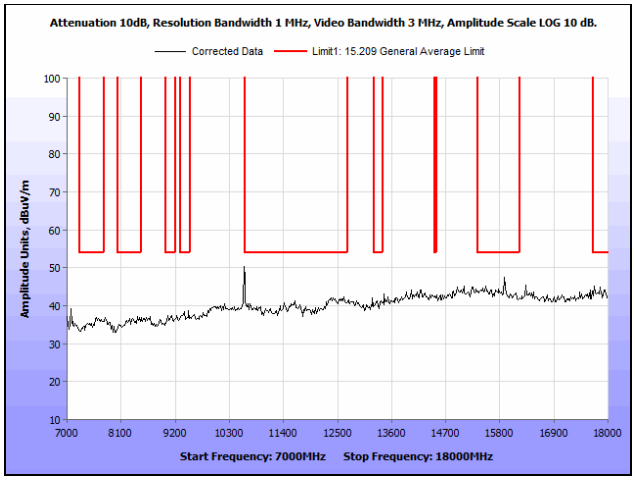
Plot 95. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 30 MHz – 1 GHz



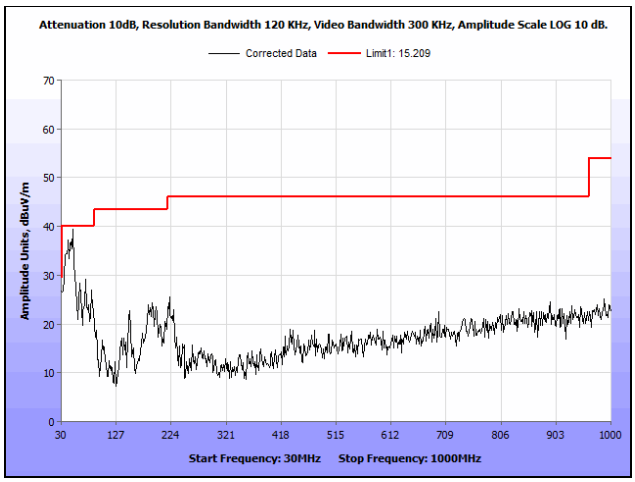
Plot 96. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 1 GHz – 7 GHz, Average



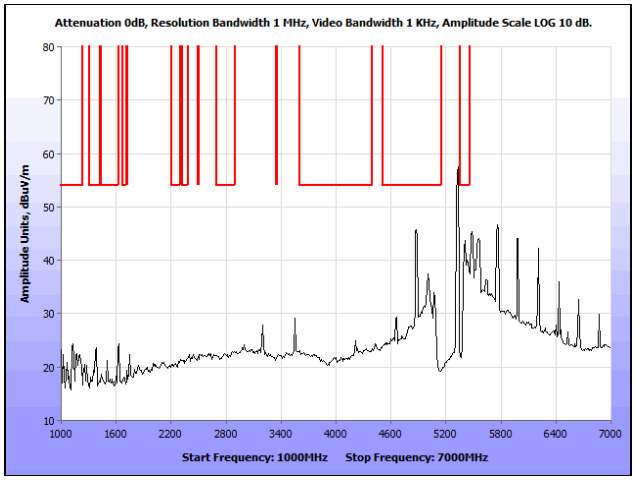
Plot 97. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 1 GHz – 7 GHz, Peak



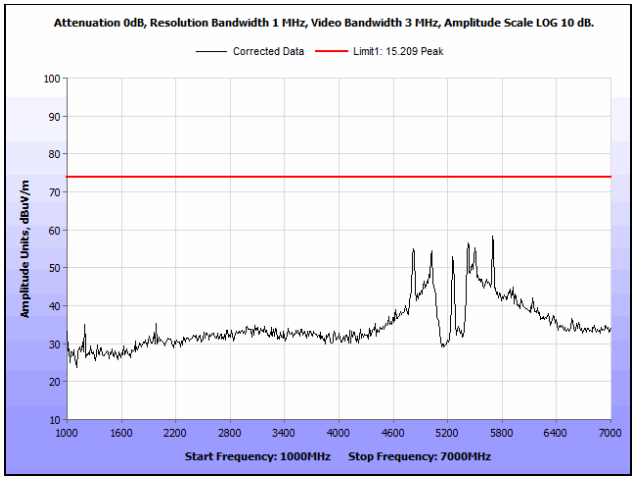
Plot 98. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 7 GHz – 18 GHz



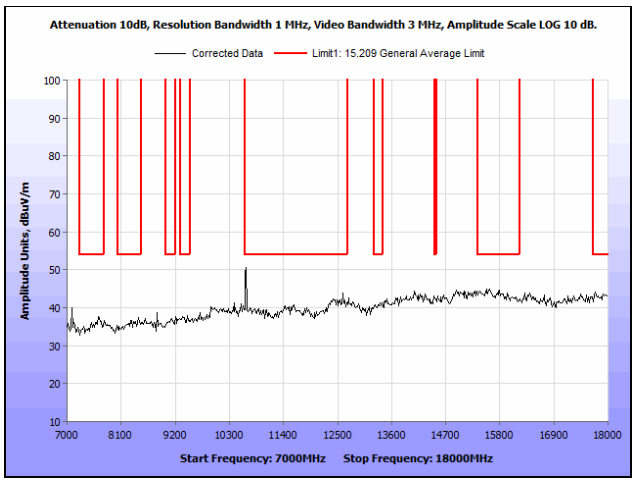
Plot 99. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 30 MHz – 1 GHz



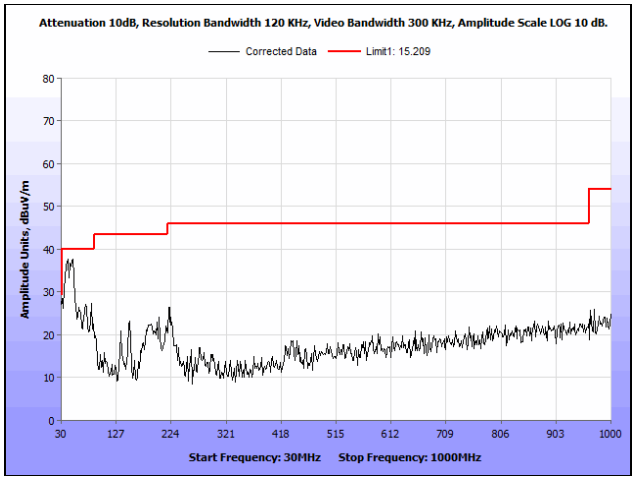
Plot 100. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 1 GHz – 7 GHz, Average



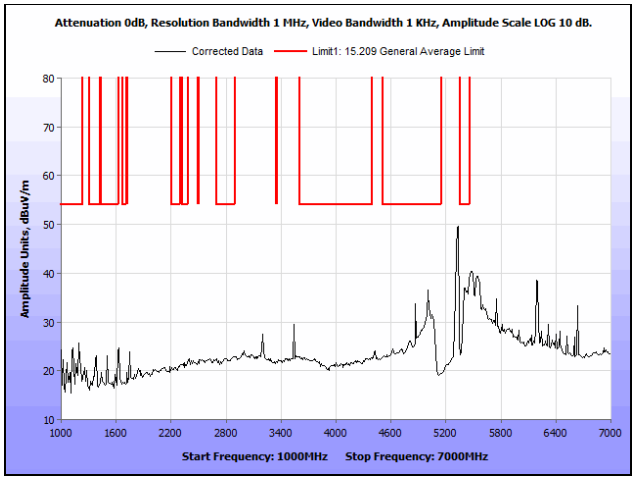
Plot 101. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 1 GHz – 7 GHz, Peak



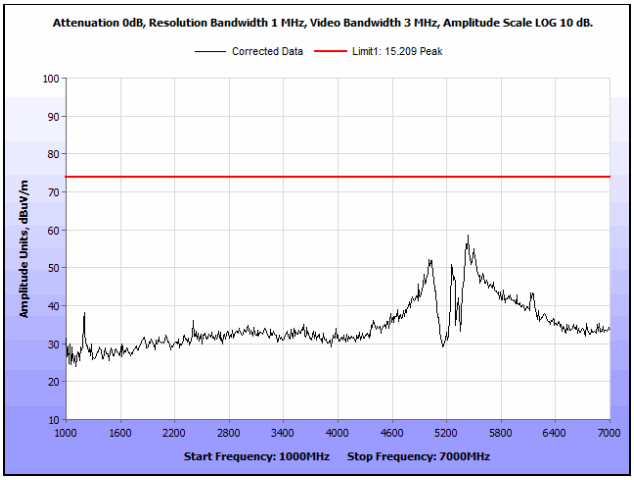
Plot 102. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 7 GHz – 18 GHz



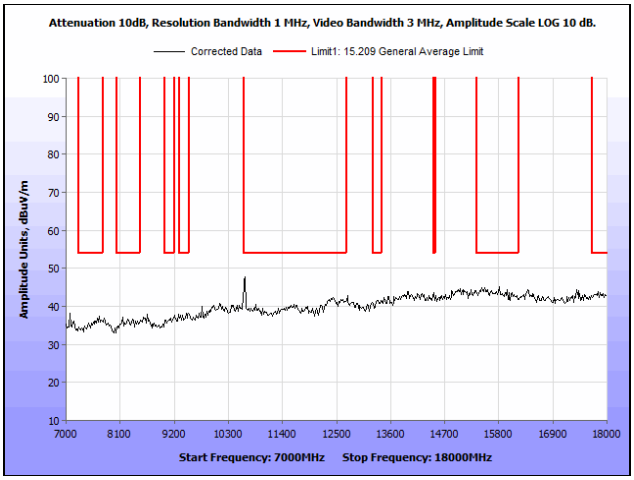
Plot 103. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 30 MHz – 1 GHz



Plot 104. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 1 GHz – 7 GHz, Average

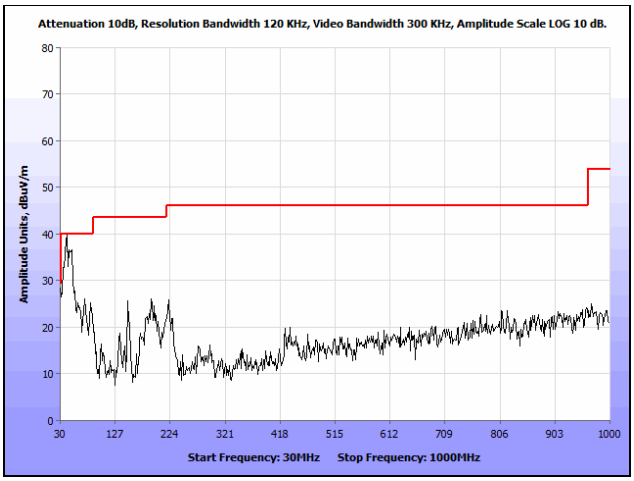


Plot 105. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 1 GHz – 7 GHz, Peak

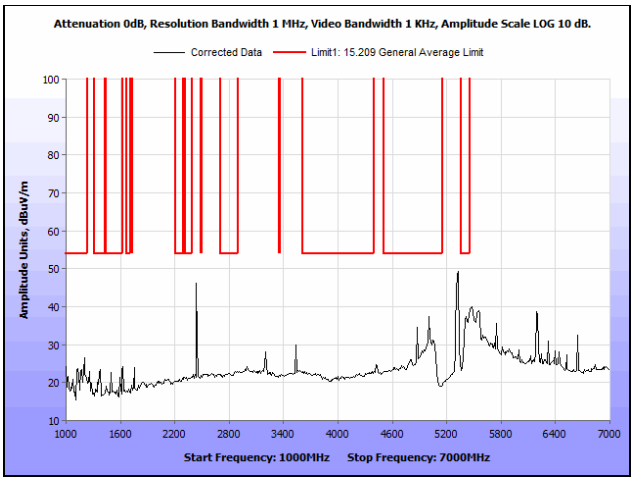


Plot 106. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 7 GHz – 18 GHz, Peak

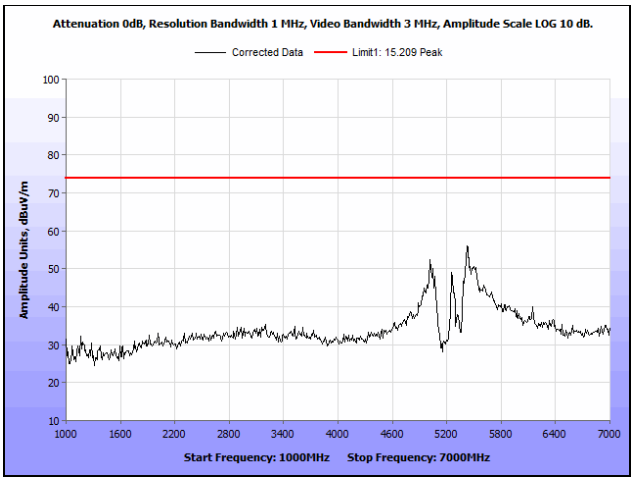
Radiated Spurious Emissions, 802.11ac, Lower Band



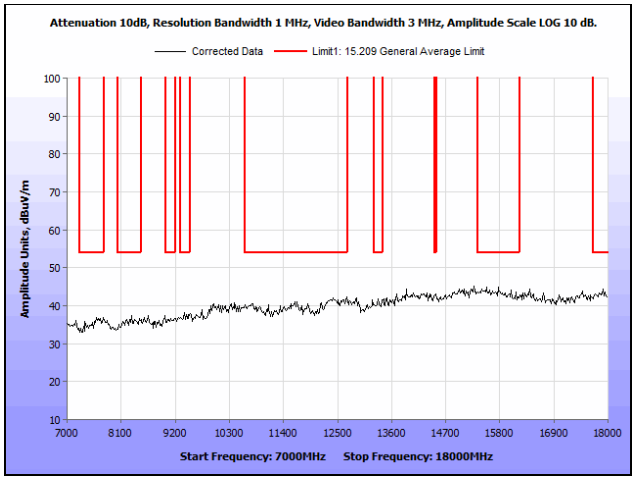
Plot 107. Radiated Spurious Emissions, 802.11ac 80 MHz, 30 MHz – 1 GHz



Plot 108. Radiated Spurious Emissions, 802.11ac 80 MHz, 1 GHz – 7 GHz, Average

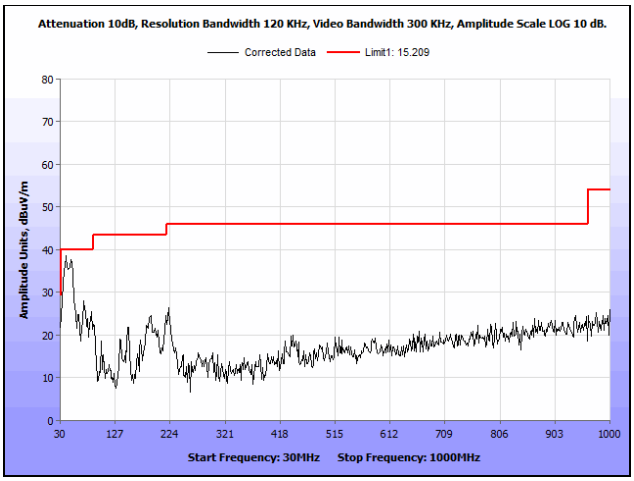


Plot 109. Radiated Spurious Emissions, 802.11ac 80 MHz, 1 GHz – 7 GHz, Peak

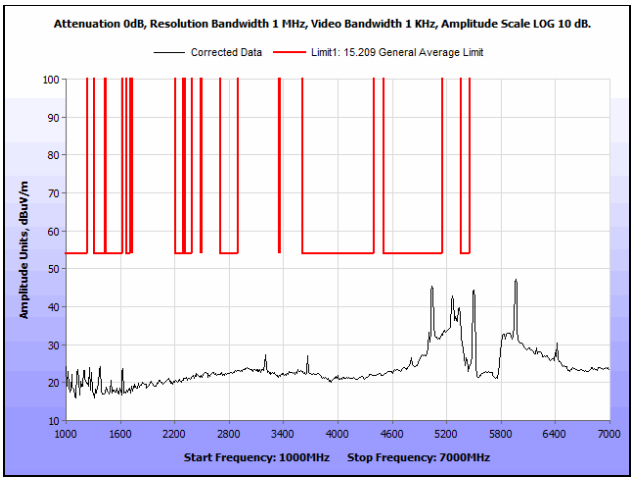


Plot 110. Radiated Spurious Emissions, 802.11ac 80 MHz, 7 GHz – 18 GHz

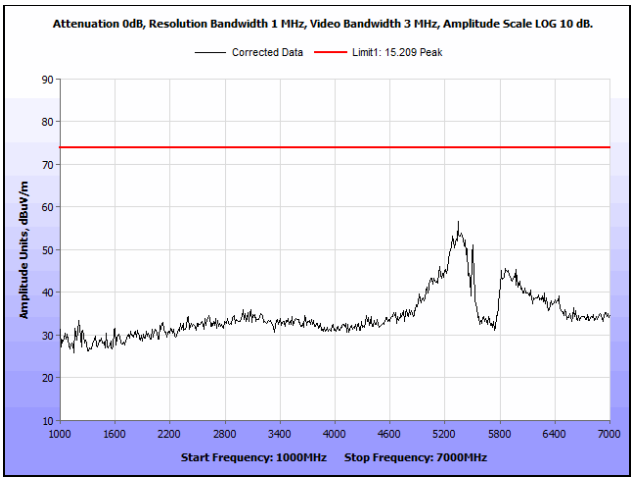
Radiated Spurious Emissions, 802.11a, Upper Band



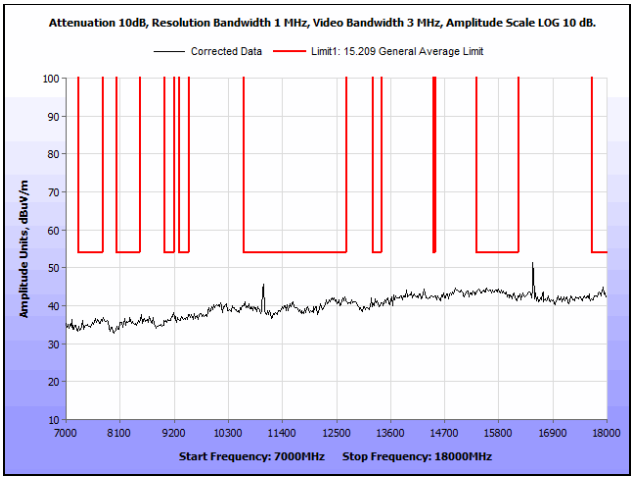
Plot 111. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 30 MHz – 1 GHz



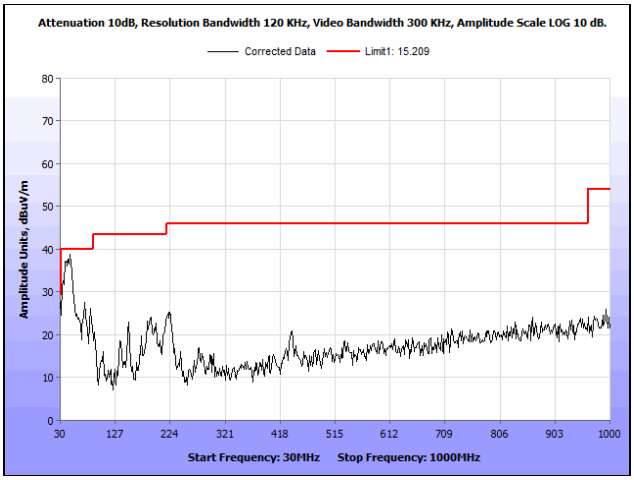
Plot 112. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 1 GHz – 7 GHz, Average



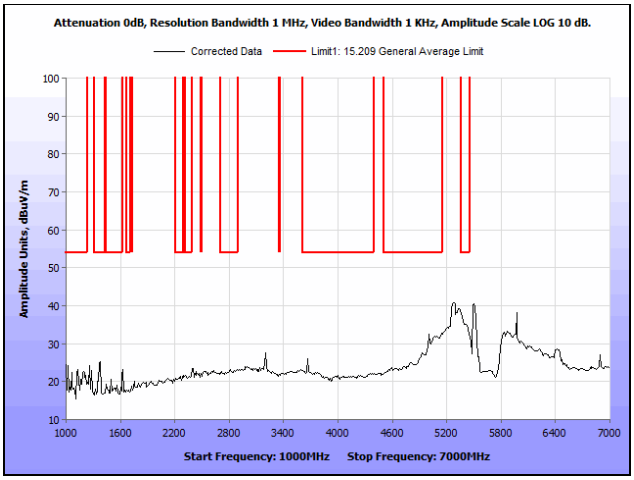
Plot 113. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 1 GHz – 7 GHz, Peak



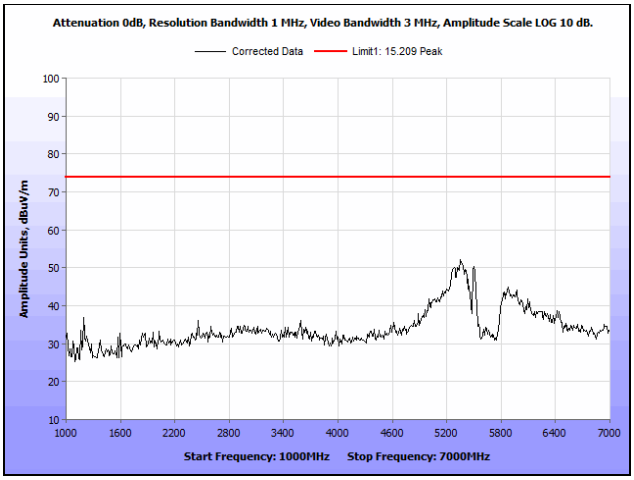
Plot 114. Radiated Spurious Emissions, 802.11a 20 MHz, Low Channel, 7 GHz – 18 GHz



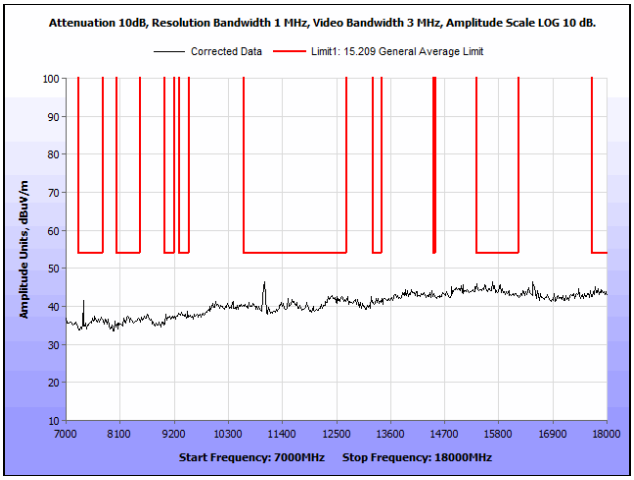
Plot 115. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 30 MHz – 1 GHz



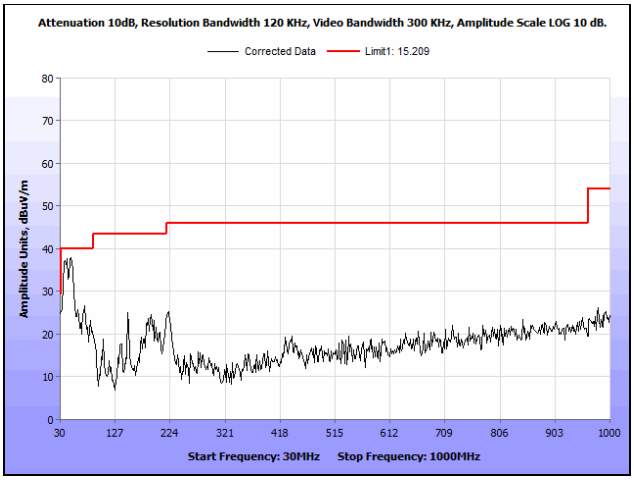
Plot 116. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 1 GHz – 7 GHz, Average



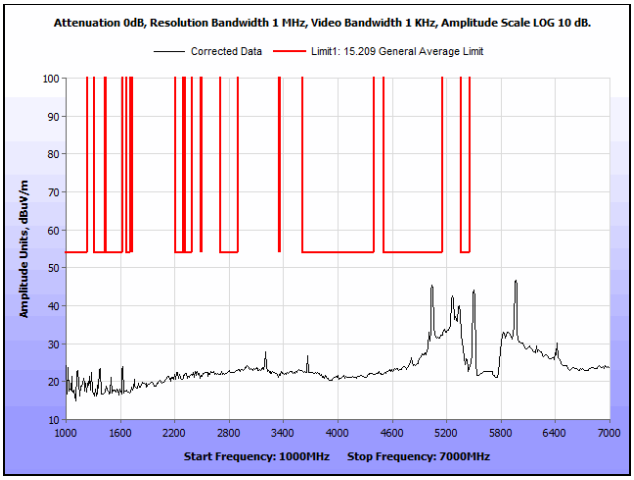
Plot 117. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 1 GHz – 7 GHz, Peak



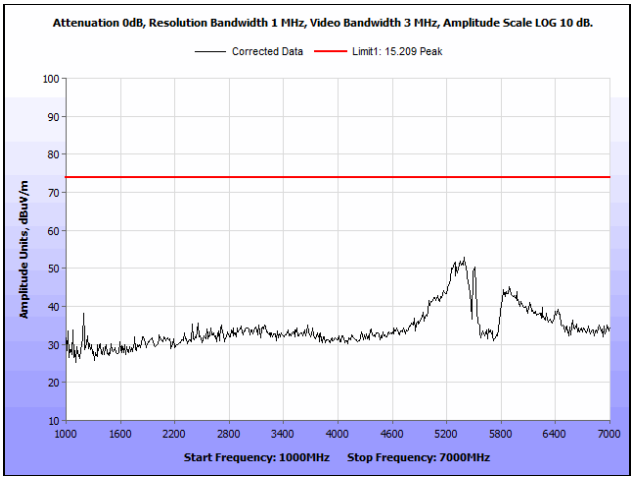
Plot 118. Radiated Spurious Emissions, 802.11a 40 MHz, Low Channel, 7 GHz – 18 GHz



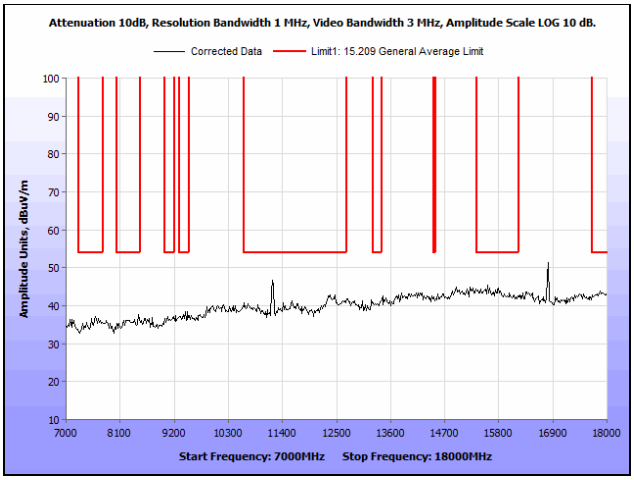
Plot 119. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 30 MHz – 1 GHz



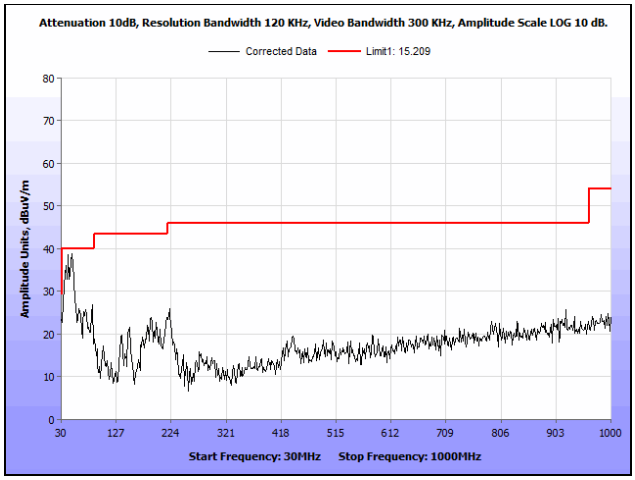
Plot 120. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 1 GHz – 7 GHz, Average



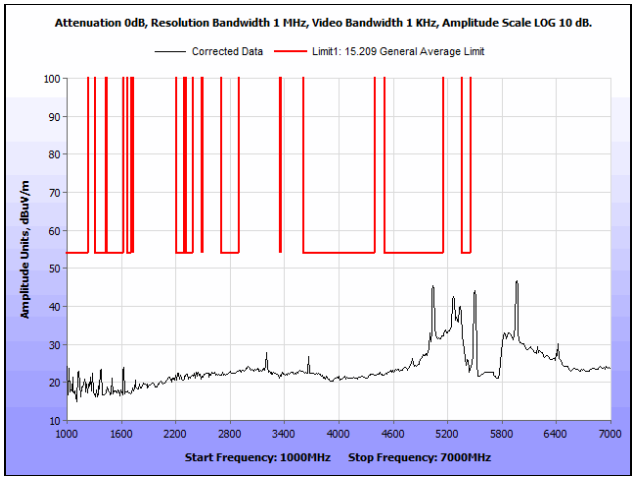
Plot 121. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 1 GHz – 7 GHz, Peak



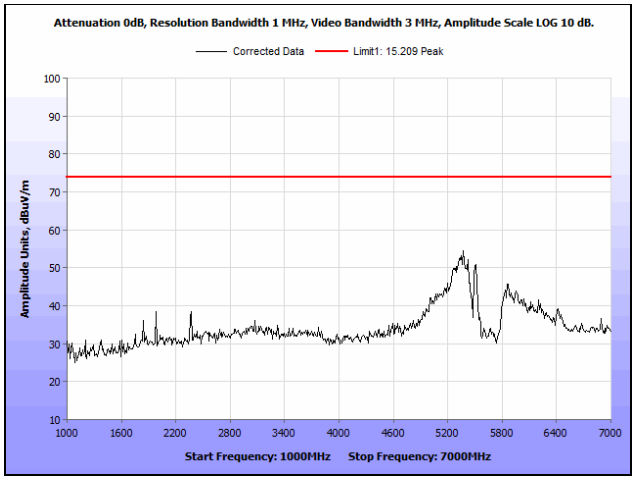
Plot 122. Radiated Spurious Emissions, 802.11a 20 MHz, Mid Channel, 7 GHz – 18 GHz



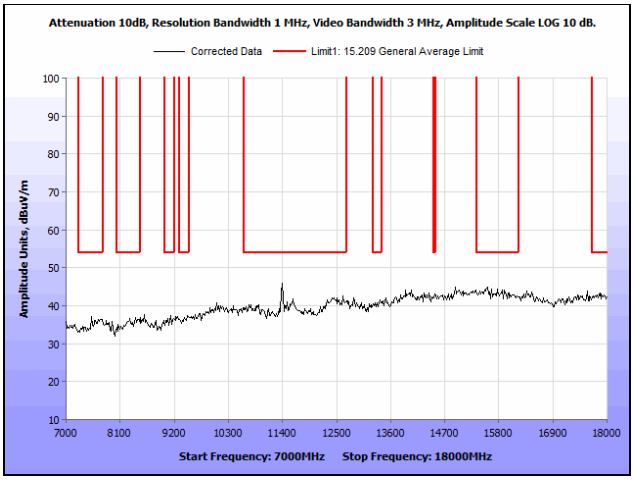
Plot 123. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 30 MHz – 1 GHz, Average



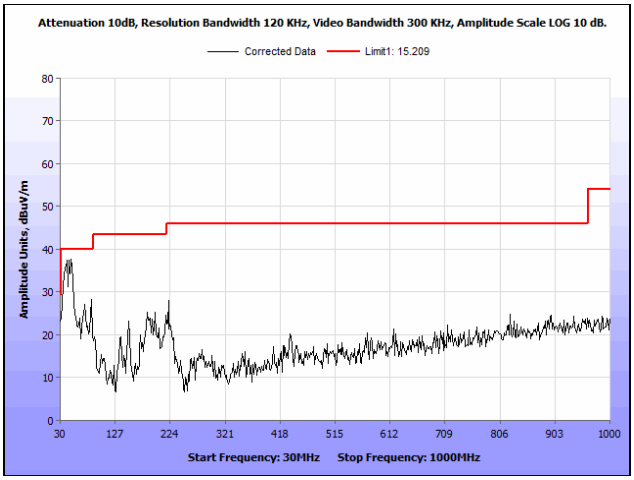
Plot 124. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 1 GHz – 7 GHz, Average



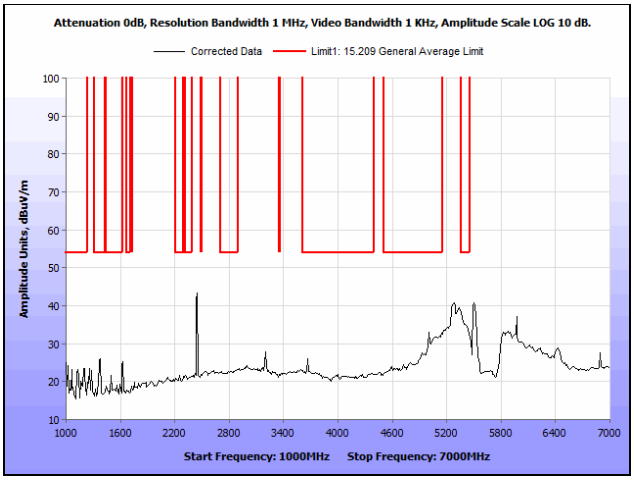
Plot 125. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 1 GHz – 7 GHz, Peak



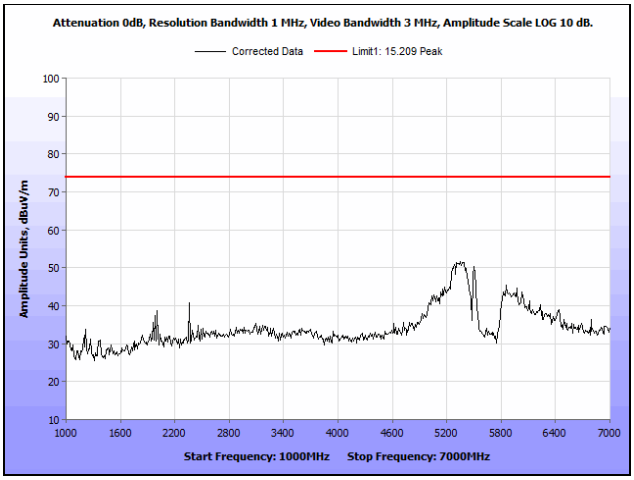
Plot 126. Radiated Spurious Emissions, 802.11a 20 MHz, High Channel, 7 GHz – 18 GHz



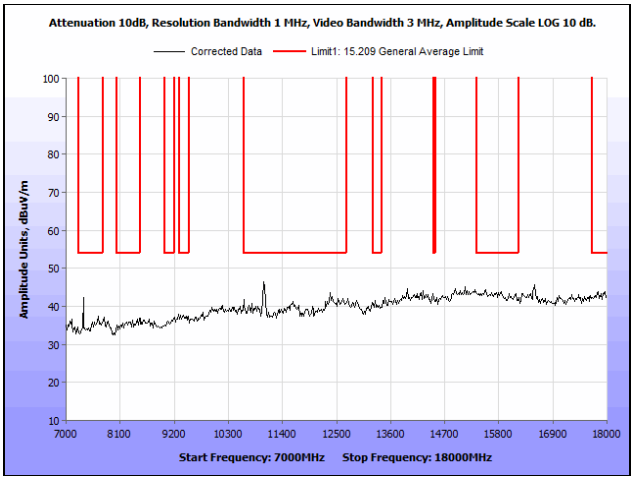
Plot 127. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 30 MHz – 1 GHz



Plot 128. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 1 GHz – 7 GHz, Average

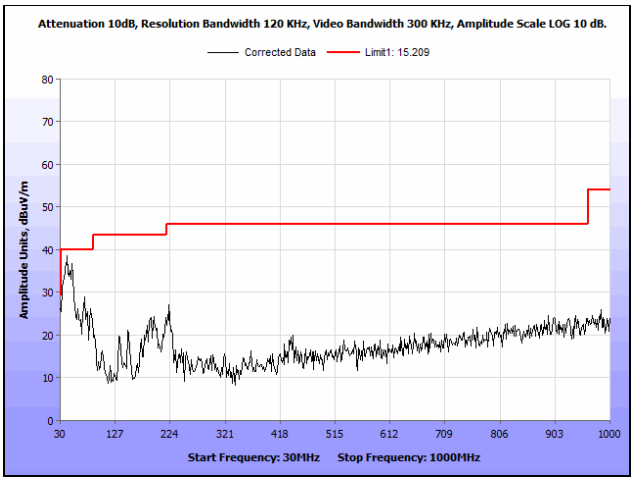


Plot 129. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 1 GHz – 7 GHz, Peak

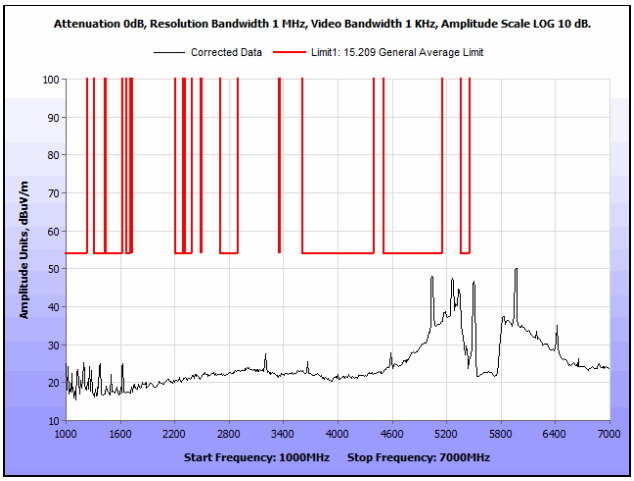


Plot 130. Radiated Spurious Emissions, 802.11a 40 MHz, High Channel, 7 GHz – 18 GHz, Peak

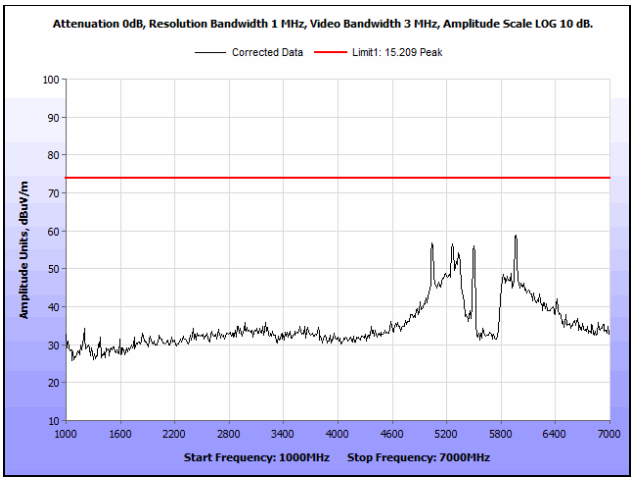
Radiated Spurious Emissions, 802.11n, Upper Band



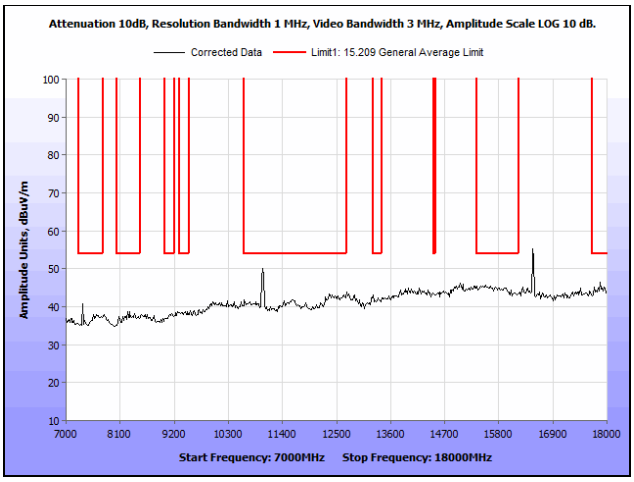
Plot 131. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 30 MHz – 1 GHz



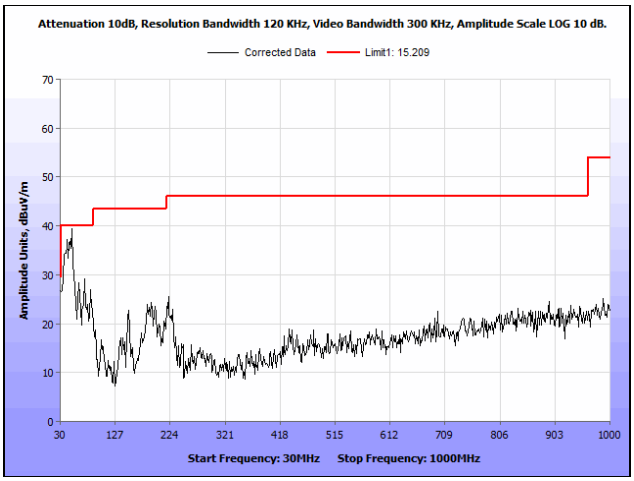
Plot 132. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 1 GHz – 7 GHz, Average



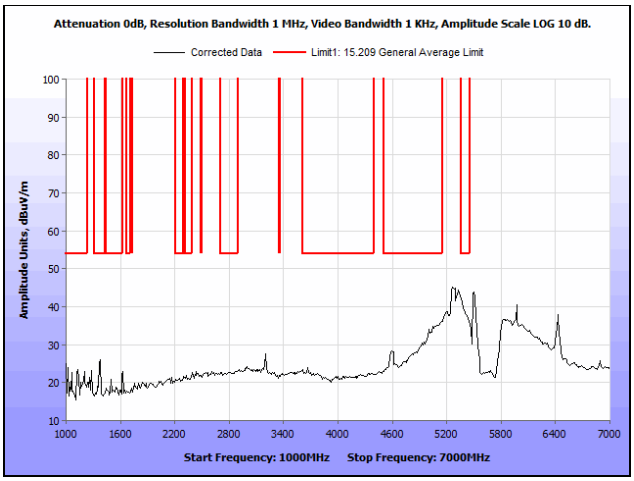
Plot 133. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 1 GHz – 7 GHz, Peak



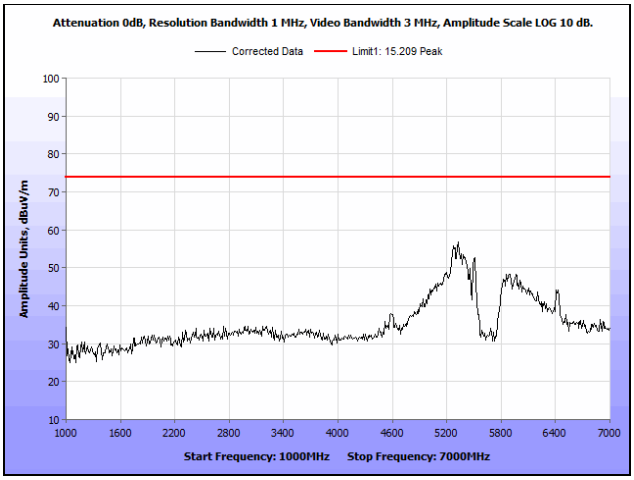
Plot 134. Radiated Spurious Emissions, 802.11n 20 MHz, Low Channel, 7 GHz – 18 GHz



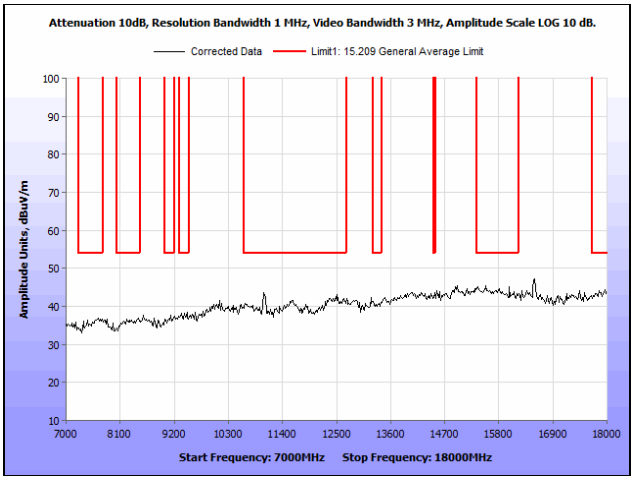
Plot 135. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 30 MHz – 1 GHz



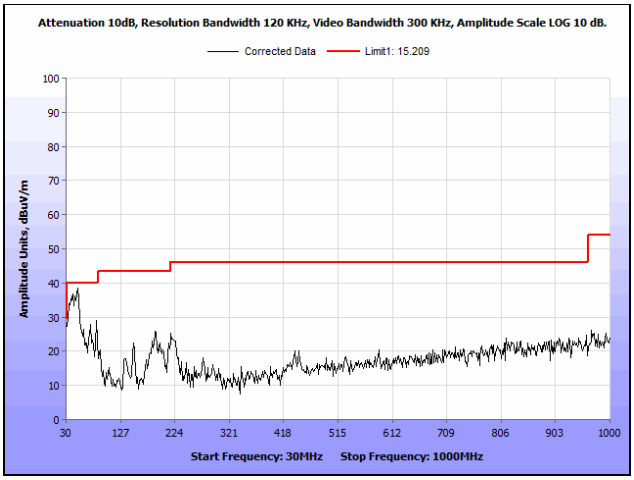
Plot 136. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 1 GHz – 7 GHz, Average



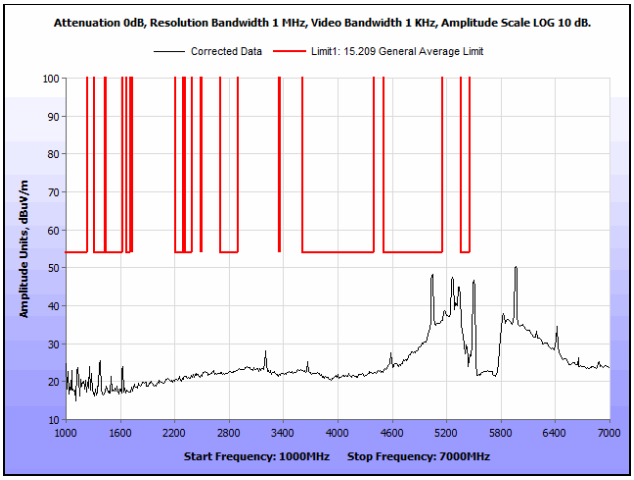
Plot 137. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 1 GHz – 7 GHz, Peak



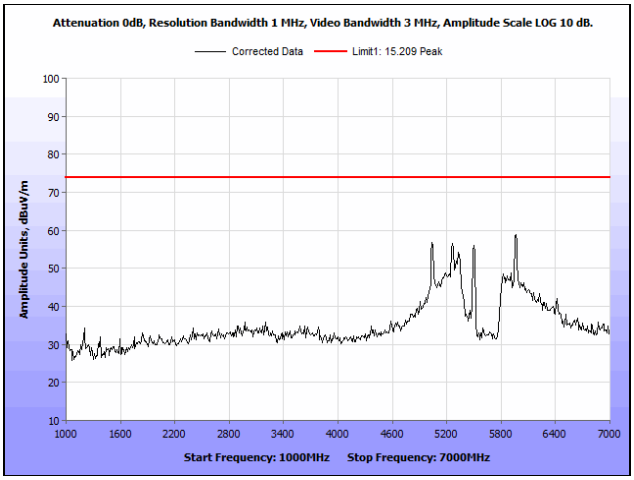
Plot 138. Radiated Spurious Emissions, 802.11n 40 MHz, Low Channel, 7 GHz – 18 GHz



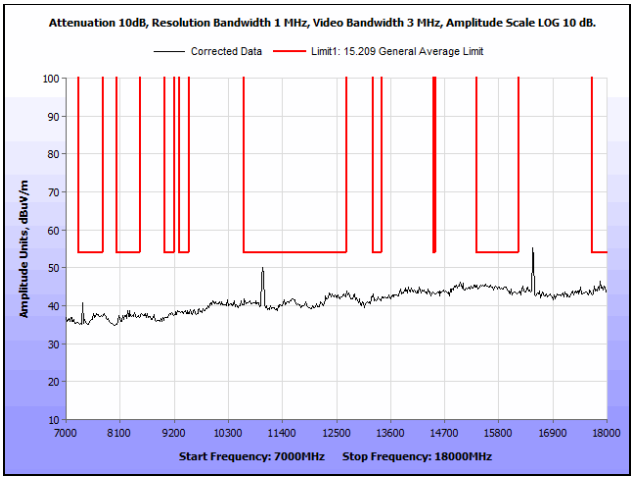
Plot 139. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 30 MHz – 1 GHz



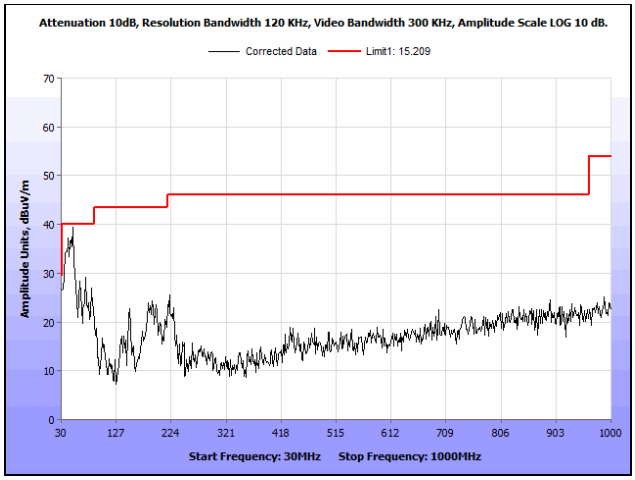
Plot 140. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 1 GHz – 7 GHz, Average



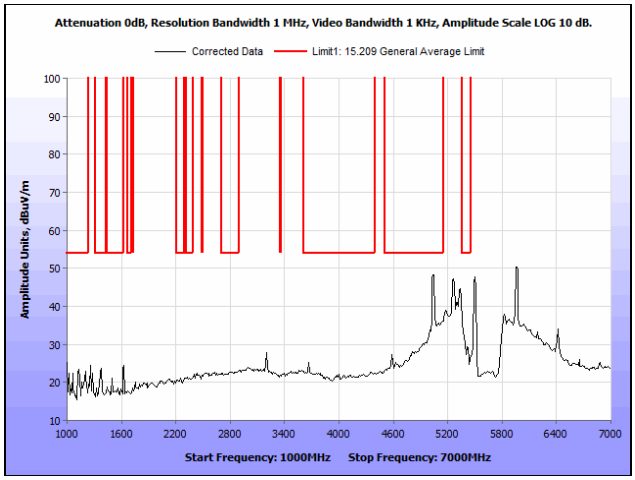
Plot 141. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 1 GHz – 7 GHz, Peak



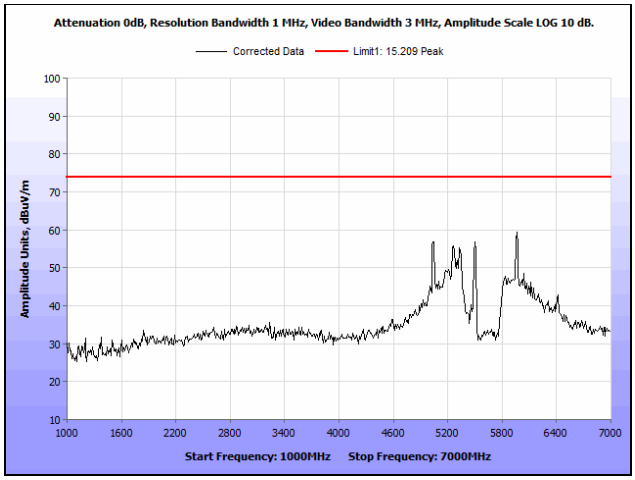
Plot 142. Radiated Spurious Emissions, 802.11n 20 MHz, Mid Channel, 7 GHz – 18 GHz



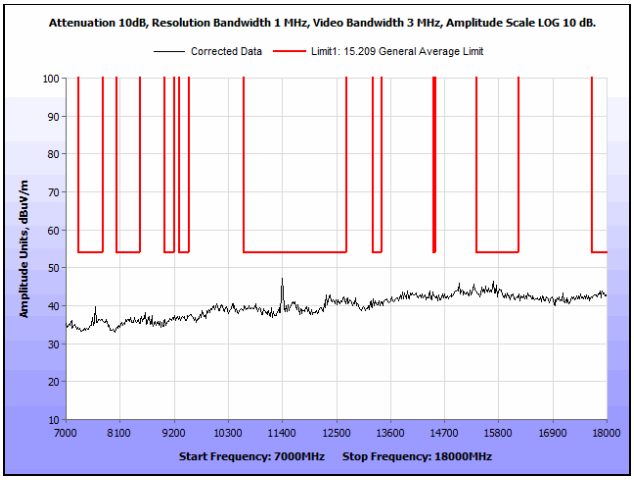
Plot 143. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 30 MHz – 1 GHz



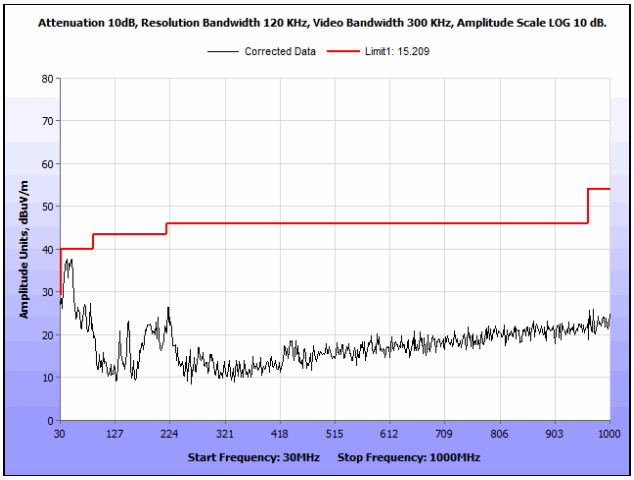
Plot 144. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 1 GHz – 7 GHz, Average



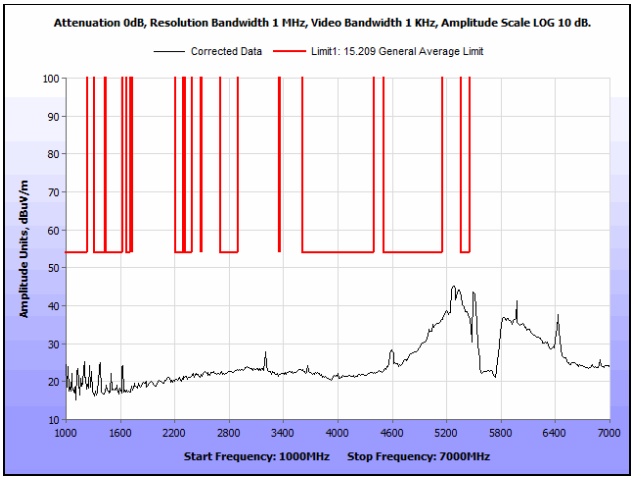
Plot 145. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 1 GHz – 7 GHz, Peak



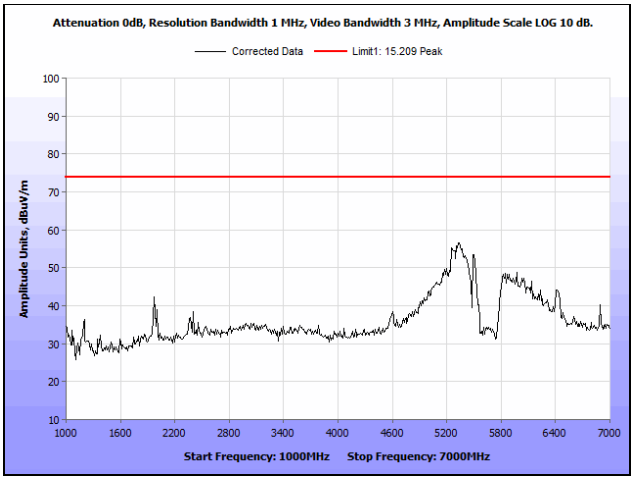
Plot 146. Radiated Spurious Emissions, 802.11n 20 MHz, High Channel, 7 GHz – 18 GHz



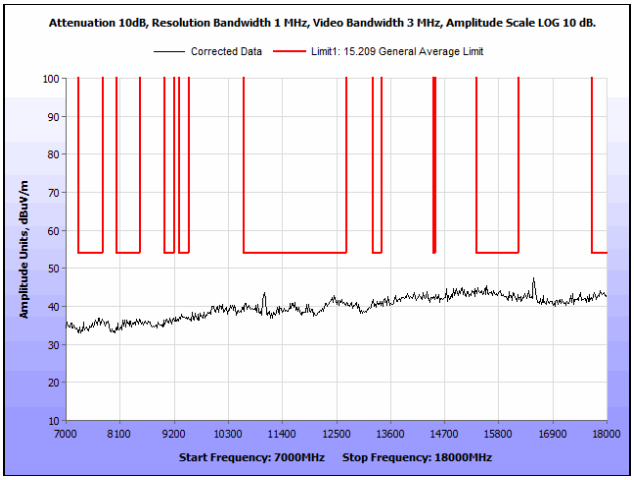
Plot 147. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 30 MHz – 1 GHz



Plot 148. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 1 GHz – 7 GHz, Average

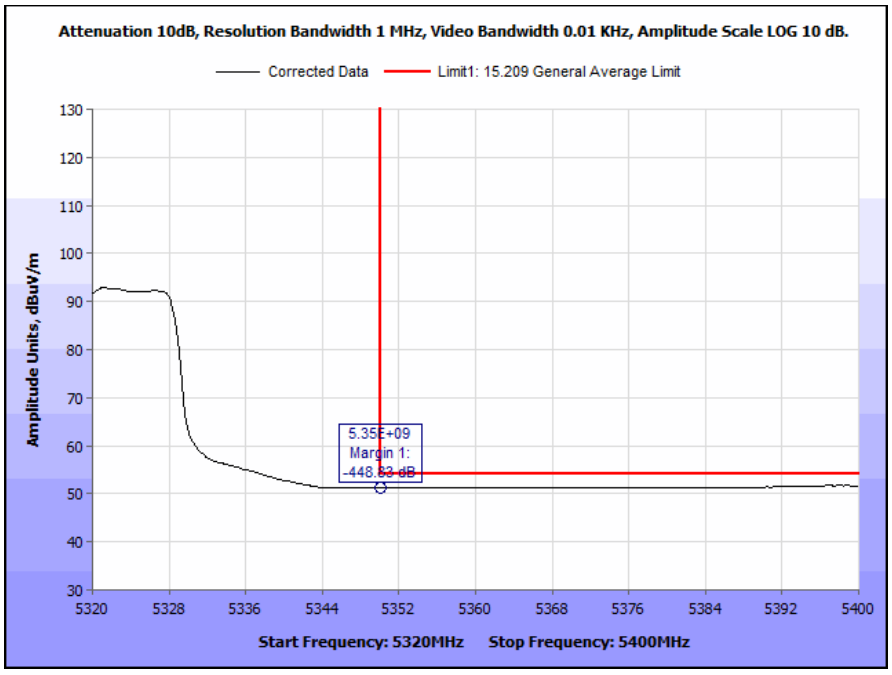


Plot 149. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 1 GHz – 7 GHz, Peak

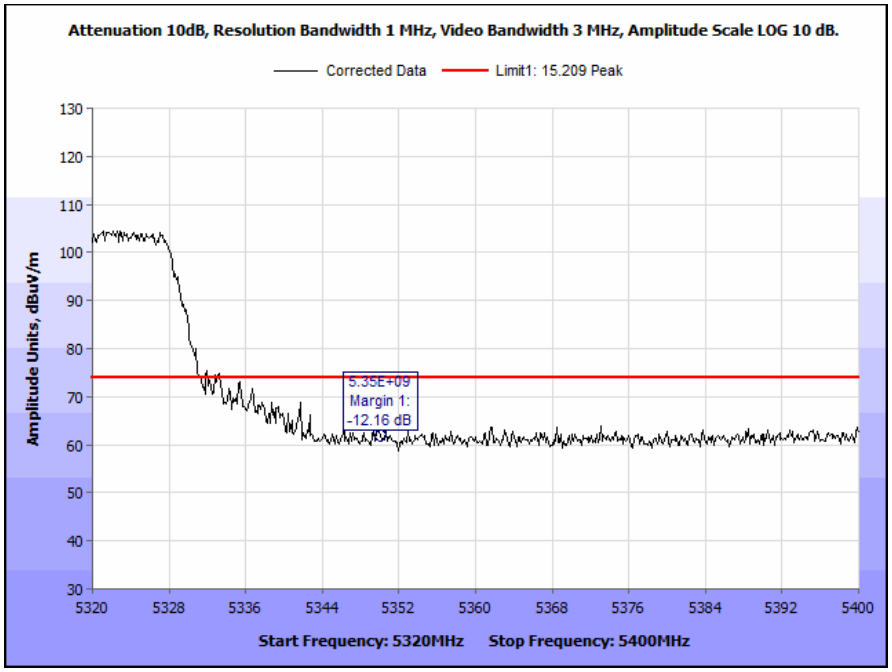


Plot 150. Radiated Spurious Emissions, 802.11n 40 MHz, High Channel, 7 GHz – 18 GHz, Peak

Band Edge, 802.11a, Lower Band

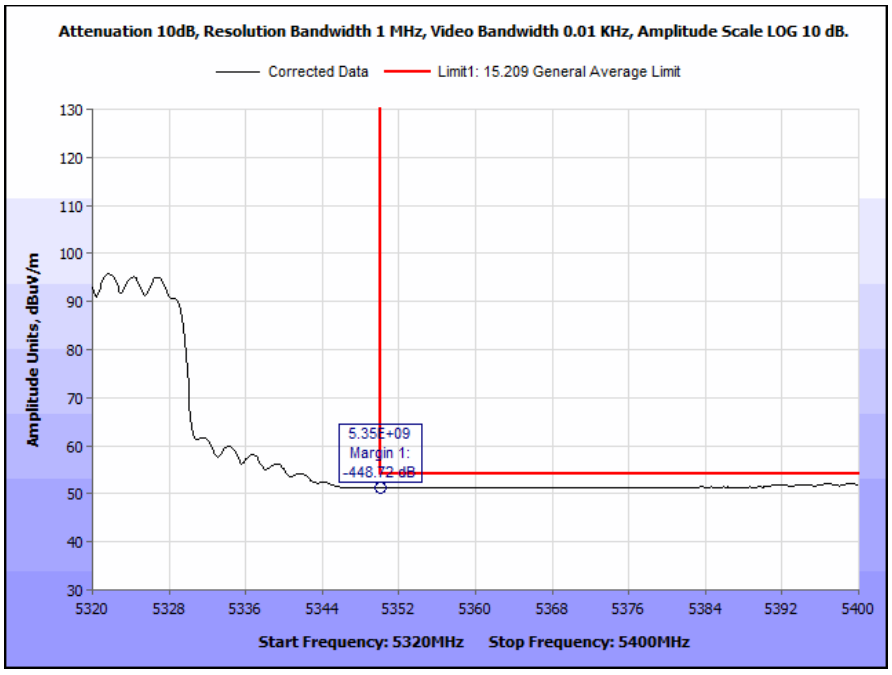


Plot 151. Radiated Band Edge, 802.11a, High Channel (5350 MHz), Average

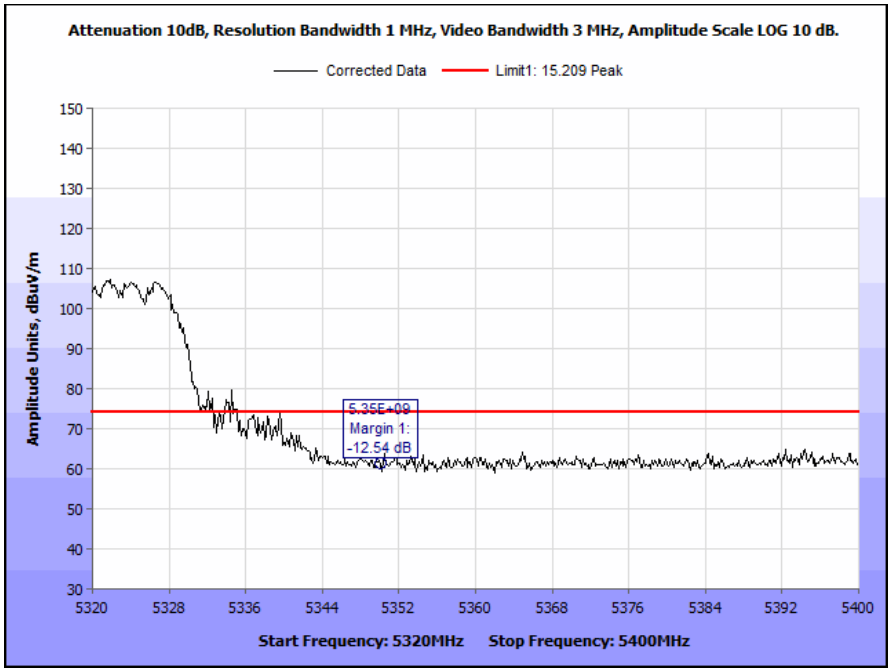


Plot 152. Radiated Band Edge, 802.11a, High Channel (5350 MHz), Peak

Band Edge, 802.11n 20 MHz, Lower Band

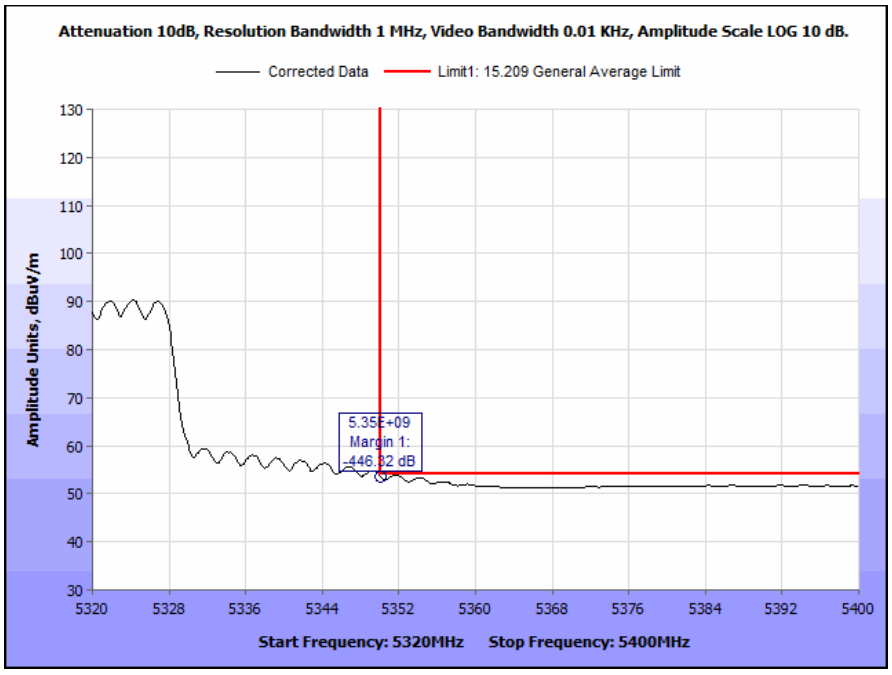


Plot 153. Radiated Band Edge, 802.11n 20 MHz, High Channel (5350 MHz), Average

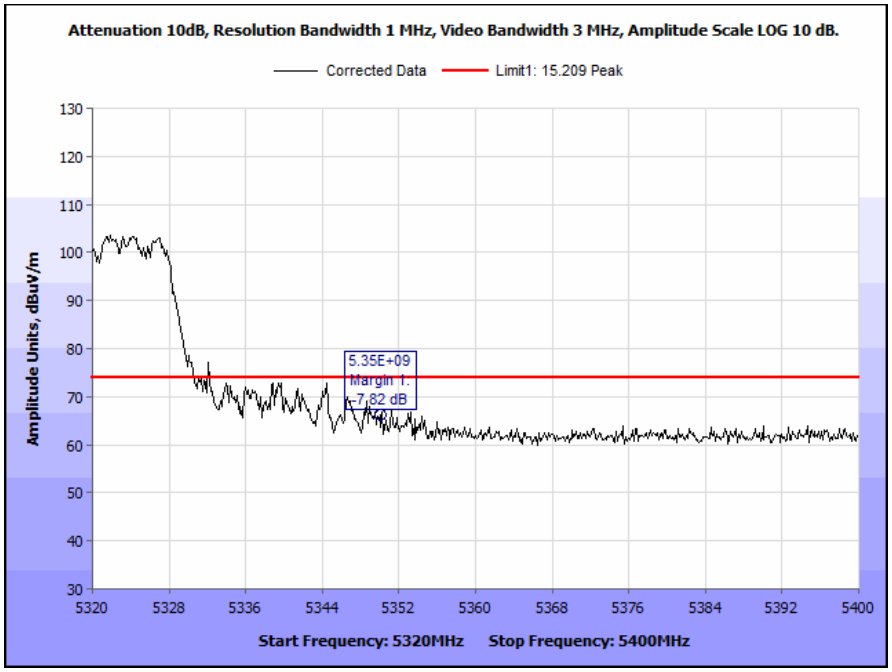


Plot 154. Radiated Band Edge, 802.11n 20 MHz, High Channel (5350 MHz), Peak

Band Edge, 802.11n 40 MHz, Lower Band

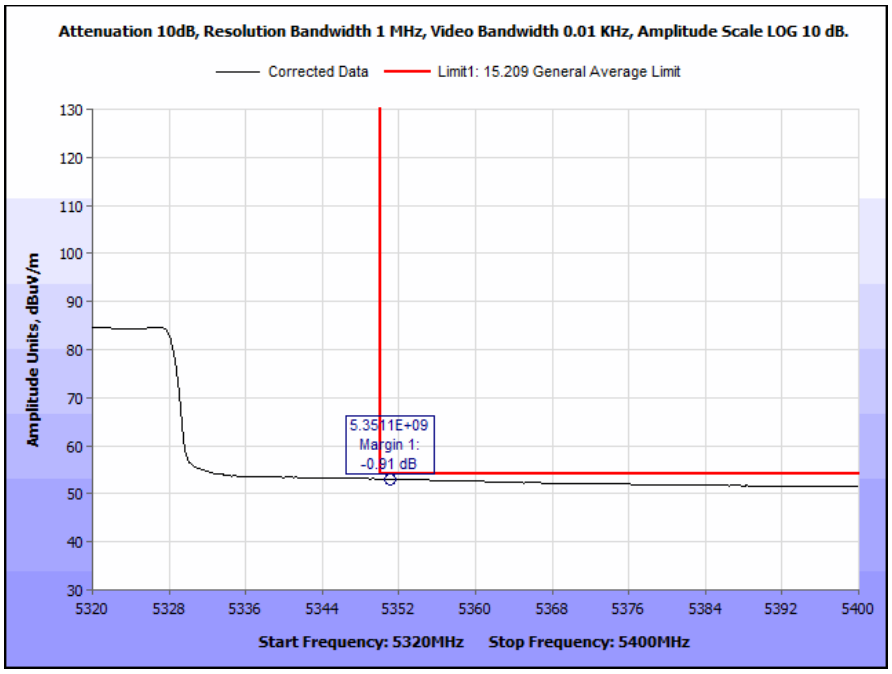


Plot 155. Radiated Band Edge, 802.11n 40 MHz, High Channel (5350 MHz), Average



Plot 156. Radiated Band Edge, 802.11n 40 MHz, High Channel (5350 MHz), Peak

Band Edge, 802.11ac 80 MHz, Lower Band



Plot 157. Radiated Band Edge, 802.11ac 80 MHz (5350 MHz), Average

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.

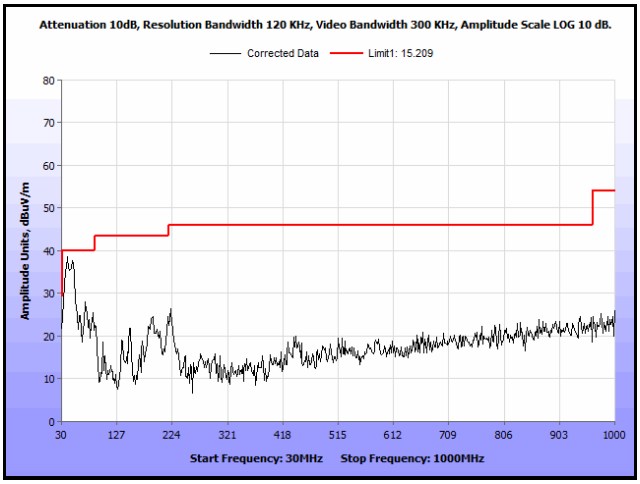
All devices that are capable of transmitting simultaneously in more than one Part-15 band between 5 and 6 GHz (*i.e.,* in two or more of the four U-NII bands or in the 5.8 GHz 15.247 band and at least one U-NII band) are subject to Permit But Ask provisions. This includes devices marketed as IEEE Std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

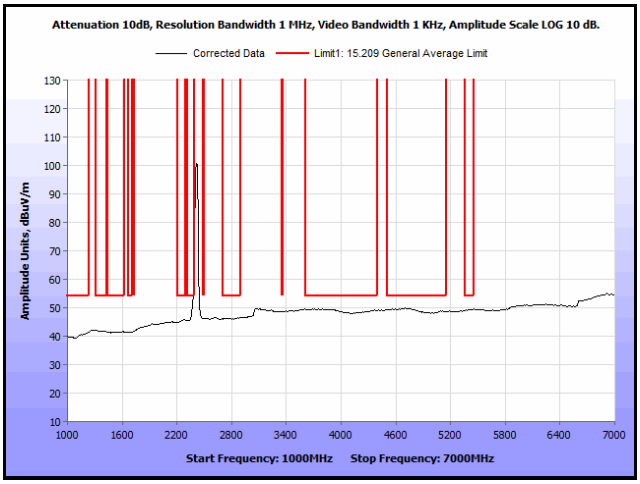
For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

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.

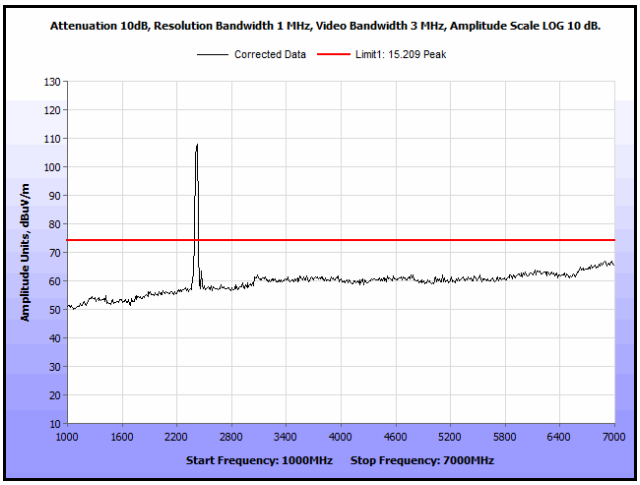
The EUT uses 2 radios that are co-located. The EUT was set to transmit on both radios using the following matrix below.



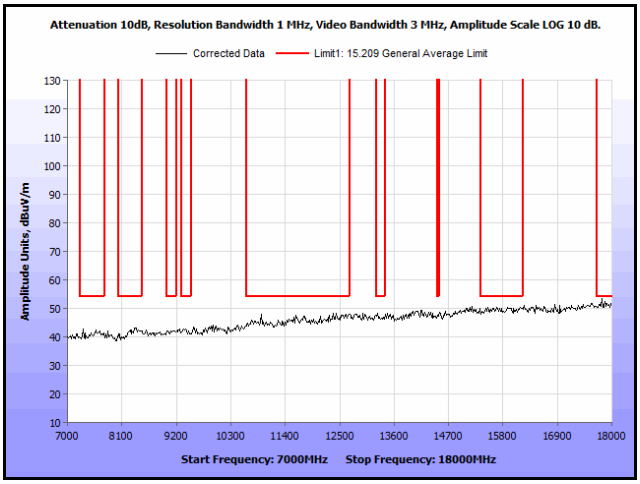
Plot 158. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2412 MHz, 30 MHz – 1 GHz, Peak



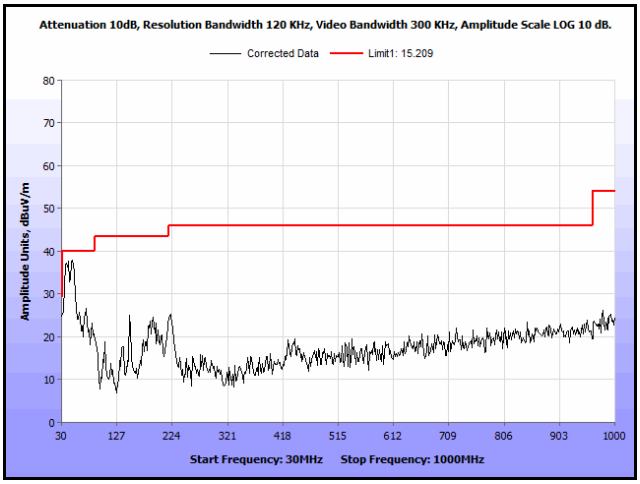
Plot 159. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2412 MHz, 1 GHz – 7 GHz, Avg



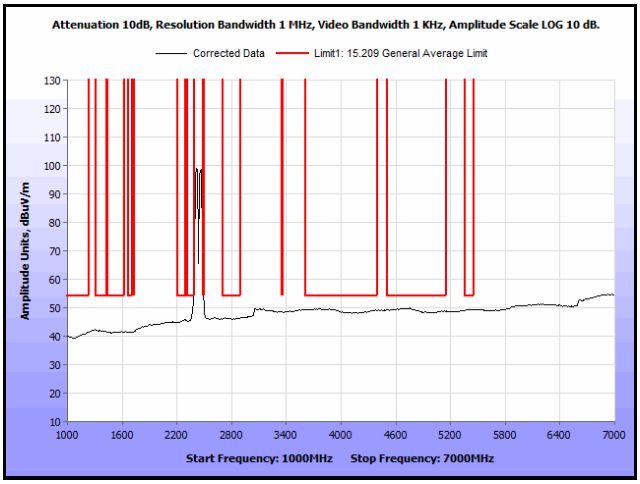
Plot 160. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2412 MHz, 1 GHz – 7 GHz, Peak



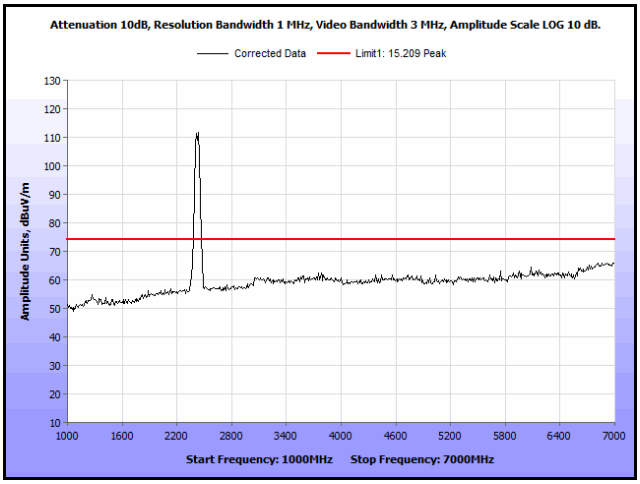
Plot 161. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2412 MHz, 7 GHz – 18 GHz, Peak



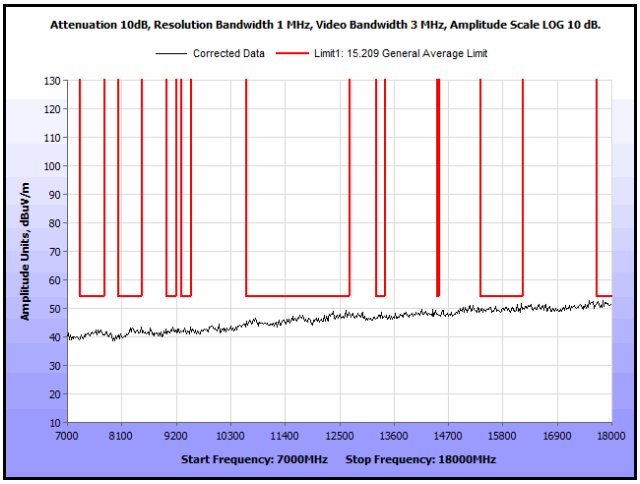
Plot 162. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2437 MHz, 30 MHz – 1 GHz, Peak



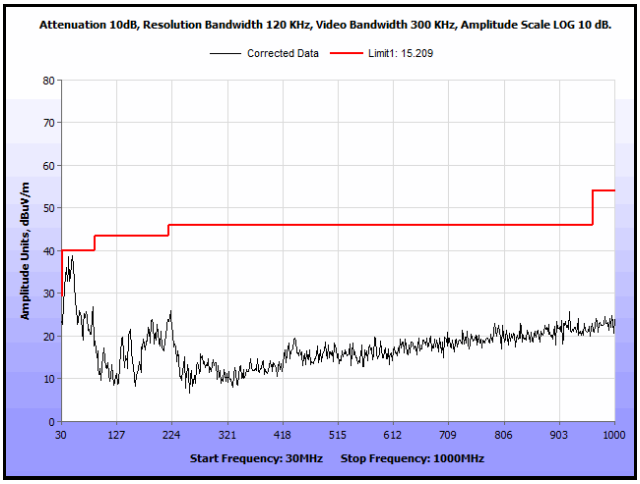
Plot 163. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2437 MHz, 1 GHz – 7 GHz, Avg



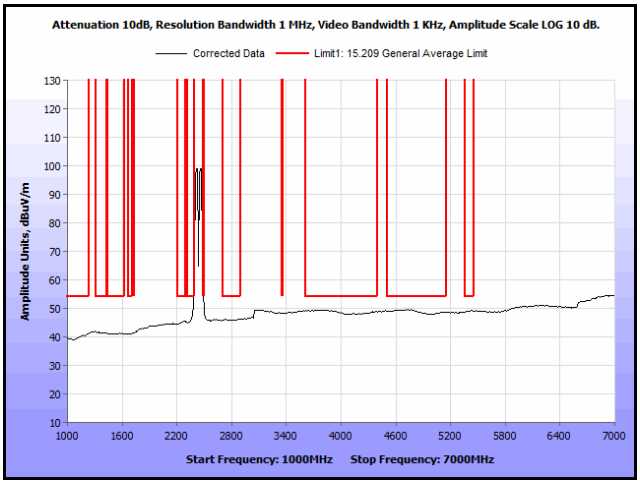
Plot 164. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2437 MHz, 1 GHz – 7 GHz, Peak



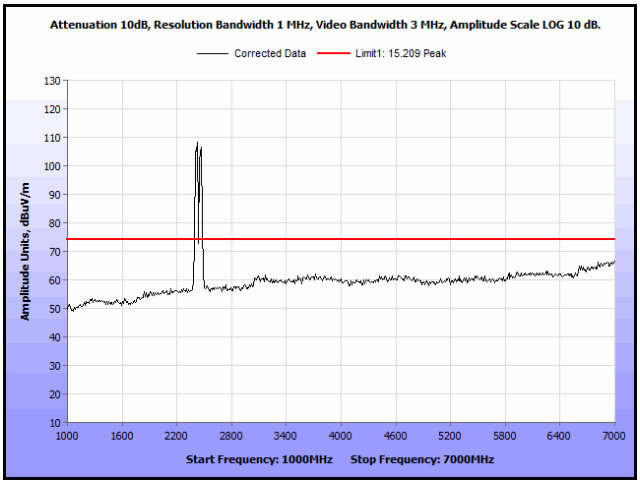
Plot 165. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2437 MHz, 7 GHz – 18 GHz, Peak



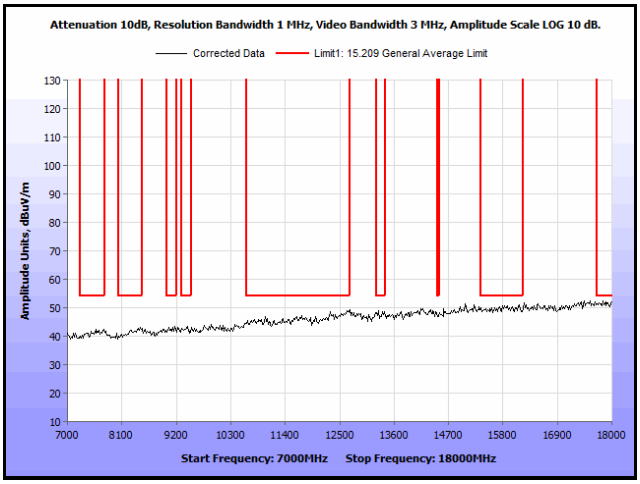
Plot 166. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2462 MHz, 30 MHz – 1 GHz, Peak



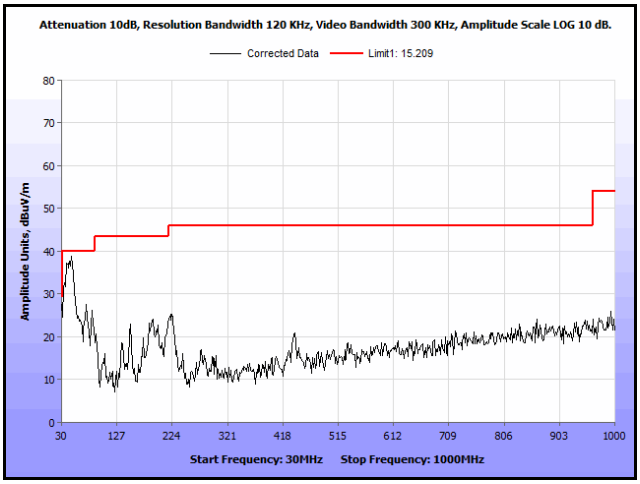
Plot 167. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2462 MHz, 1 GHz – 7 GHz, Avg



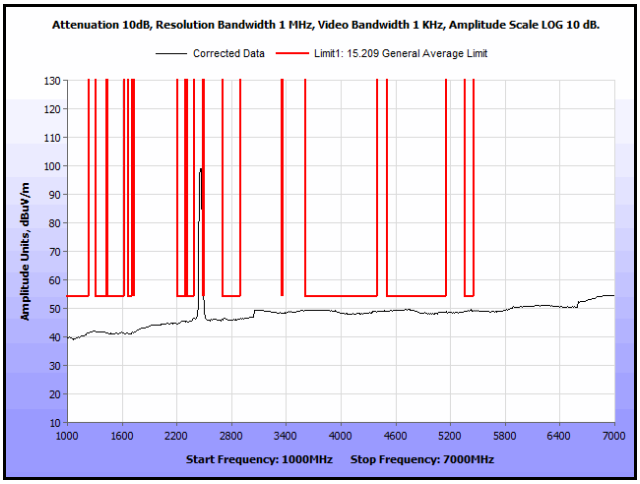
Plot 168. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2462 MHz, 1 GHz – 7 GHz, Peak



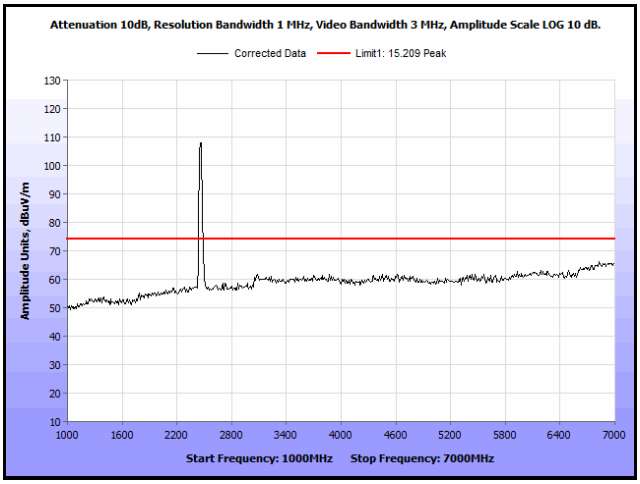
Plot 169. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2412 MHz & 2462 MHz, 7 GHz – 18 GHz, Peak



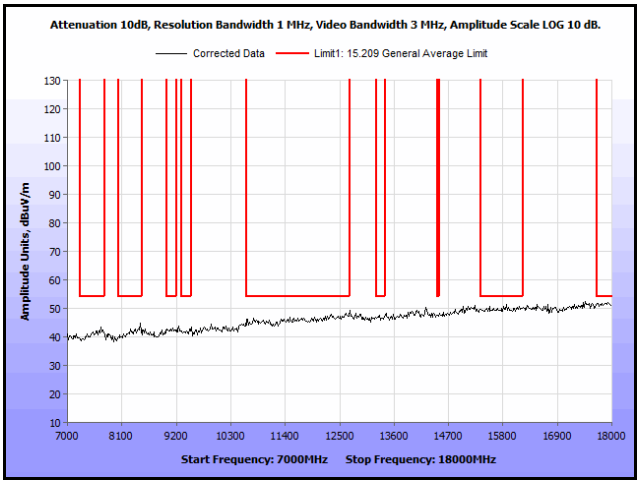
Plot 170. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2437 MHz & 2437 MHz, 30 MHz – 1 GHz, Peak



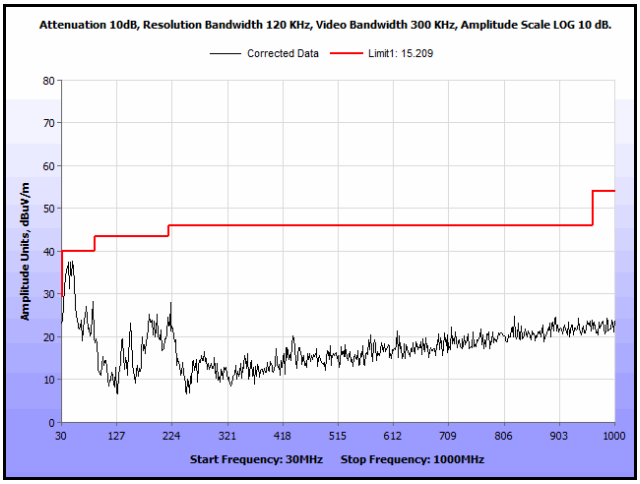
Plot 171. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2437 MHz & 2437 MHz, 1 GHz – 7 GHz, Avg



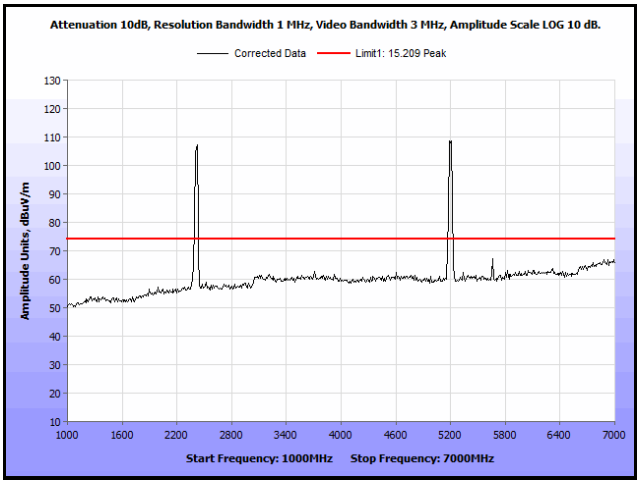
Plot 172. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2437 MHz & 2437 MHz, 1 GHz – 7 GHz, Peak



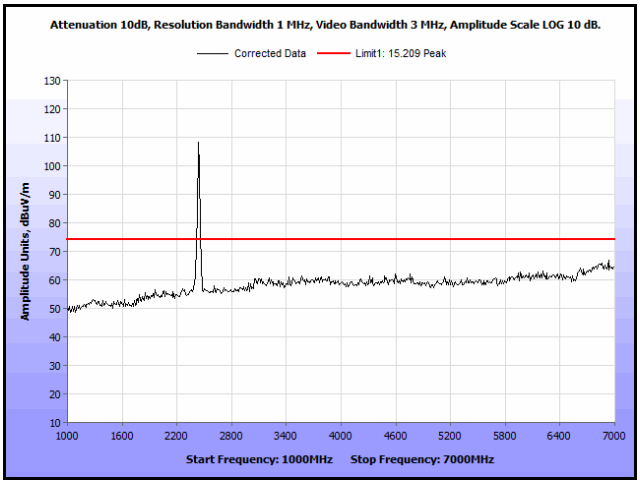
Plot 173. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2437 MHz & 2437 MHz, 7 GHz – 18 GHz, Peak



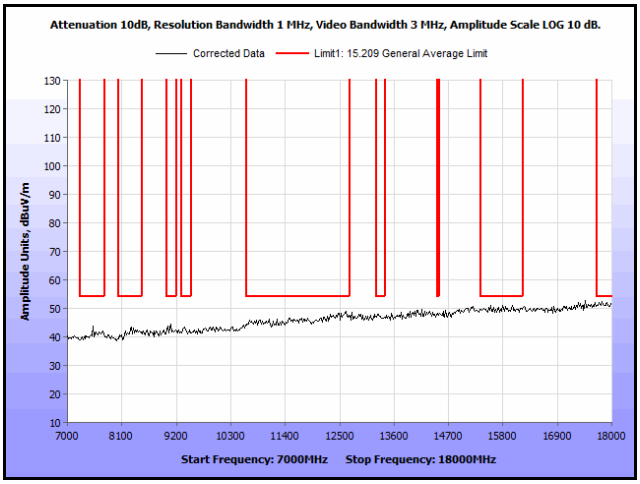
Plot 174. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2437 MHz & 2462 MHz, 30 MHz – 1 GHz, Peak



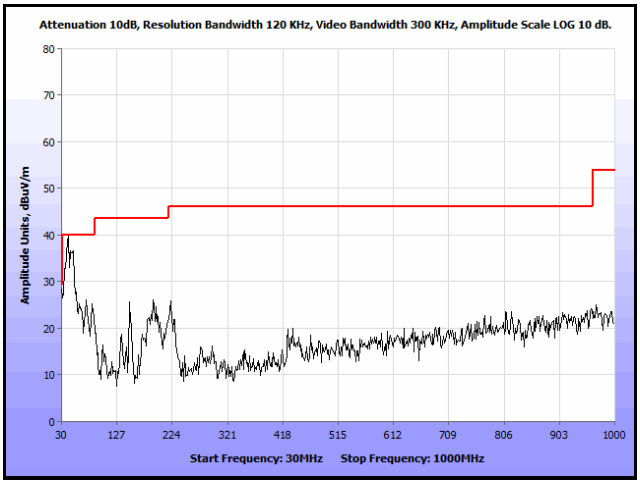
Plot 175. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2437 MHz & 2462 MHz, 1 GHz – 7 GHz, Avg



Plot 176. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2437 MHz & 2462 MHz, 1 GHz – 7 GHz, Peak



Plot 177. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2437 MHz & 2462 MHz, 7 GHz – 18 GHz, Peak



Plot 178. Radiated Spurs, Co-Location, 802.11n 20 MHz, 2462 MHz & 2462 MHz, 30 MHz – 1 GHz, Peak

