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
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408) 748-3585 ● FAX (510) 489-6372
13501 MCCALLEN PASS ● AUSTIN, TX 78753 ● PHONE (512) 287-2500 ● FAX (512) 287-2513

January 19, 2018

Rajant Corporation
400 East King Street
Malvern, PA 19335

Dear Keith Sullivan,

Enclosed is the EMC Wireless test report for compliance testing of the Rajant Corporation, 5 GHz Mini PCI Radio, FCC ID VJA-WLM200N526ESD as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Title 47 of the CFR, Part 15.407, Subpart E (UNII 1).

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.

Joel Huna
Documentation Department

Reference: (\Rajant Corporation\ EMC96376-FCC407 UNII 1 Rev. 2)

A2LA ACCREDITED
TESTING CERT #0591.01

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
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408) 748-3585 ● FAX (510) 489-6372
13501 MCCALLEN PASS ● AUSTIN, TX 78753 ● PHONE (512) 287-2500 ● FAX (512) 287-2513

Electromagnetic Compatibility Criteria
Test Report

for the

Rajant Corporation
Model 5 GHz Mini PCI Radio, FCC ID VJA-WLM200N526ESD

Tested under
The FCC Certification Rules
contained in
Title 47 of the CFR
15.407 Subpart E

MET Report: EMC96376-FCC407 UNII 1 Rev. 2

January 19, 2018

Prepared For:

Rajant Corporation
400 East King Street
Malvern, PA 19335

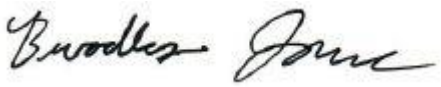
Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Ave.
Baltimore, MD 21230

Electromagnetic Compatibility Criteria
Test Report

for the

Rajant Corporation
Model 5 GHz Mini PCI Radio, FCC ID VJA-WLM200N526ESD

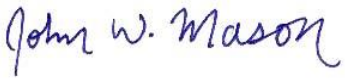
Tested under
The FCC Certification Rules
contained in
Title 47 of the CFR
15.407 Subpart E



Bradley Jones, Project Engineer
Electromagnetic Compatibility Lab

Joel Huna
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.



John Mason,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	December 8, 2017	Initial Issue.
1	December 20, 2017	Retest RE Data.
2	January 19, 2018	TCB Corrections.

Table of Contents

List of Tables

List of Photographs

List of Plots

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 Rajant Corporation 5 GHz Mini PCI Radio, FCC ID VJA-WLM200N526ESD, 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 5 GHz Mini PCI Radio, FCC ID VJA-WLM200N526ESD. Rajant Corporation should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the 5 GHz Mini PCI Radio, FCC ID VJA-WLM200N526ESD, 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 Rajant Corporation, purchase order number 2017323. All tests were conducted using measurement procedure ANSI C63.4-2014.

FCC Reference	Description	Results
§15.203	Antenna Requirement	Compliant
§15.403(2)(i)	26dB Occupied Bandwidth	Compliant
§15.407 (a)(1)(i), (a)(2), (a)(3)	Maximum Conducted Output Power	Compliant
§15.407 (a)(1)(i)	EIRP Above 30° Elevation	Compliant
§15.407(b)(6)	Conducted Emission Limits	Compliant
§15.407 (a)(1)(i), (a)(2), (a)(3)	Maximum Power Spectral Density	Compliant
§15.407 (b)(1)& (6 - 7)	Undesirable Emissions	Compliant
§15.407(f)	RF Exposure	Compliant
§15.407(g)	Frequency Stability	Not Applicable

Table 1. Executive Summary of EMC Part 15.407 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Rajant Corporation to perform testing on the 5 GHz Mini PCI Radio, FCC ID VJA-WLM200N526ESD, under Rajant Corporation's purchase order number 2017323.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Rajant Corporation 5 GHz Mini PCI Radio, FCC ID VJA-WLM200N526ESD.

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

Model(s) Tested:	5 GHz Mini PCI Radio, FCC ID VJA-WLM200N526ESD	
Model(s) Covered:	5 GHz Mini PCI Radio, FCC ID VJA-WLM200N526ESD	
EUT Specifications:	Primary Power: 110 VAC, 60 Hz	
	FCC ID: VJA-WLM200N526ESD	
	Type of Modulations:	OFDM
	Equipment Code:	NII
	Max. RF Output Power:	26.11 dBm
	EUT Frequency Ranges:	5180-5240 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	
Type of Filing:	CIIPC	
Evaluated by:	Bradley Jones	
Report Date(s):	January 19, 2018	

Table 2. EUT Summary

B. References

CFR 47, Part 15, Subpart E	Unlicensed National Information Infrastructure Devices (UNII)
ANSI C63.4:2014	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 C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices
789033 D02 General UNII Test Procedures New Rules v01	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E

Table 3. References

C. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave., Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

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

D. Description of Test Sample

The Rajant Corporation 5 GHz Mini PCI Radio, FCC ID VJA-WLM200N526ESD, Equipment Under Test (EUT), is a high powered radio module operating on 5 GHz U-NII 1 and 3 bands. The radio features integrated Lightning & ESD* protection. The radio module is designed for reliable fixed, and portable wireless data networking applications.

The EUT is designed and manufactured by Compex Systems limited. Rajant obtained a change of ID with permission of Compex Systems for the purpose of granting operating channels, transmit power, and antenna configurations that were not obtained by Compex Systems under the OEM FCC-ID TK4WLM200N5-26ESD. There are no hardware differences between Rajant FCC ID VJA-WLM200N526ESD and OEM FCC ID TK4WLM200N5-26ESD.

E. 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	Qty
1	Test PC	Lenovo G50	G50	1
2	AC/DC POE	Tycon Power	TP-POE-HP-48G-RC	1
3	Rajant Corporation Modular Host	Development	Development	1
4	Mini PCI Extender	Adex	--	1
5	mini PCI Radio Card (EUT)	Compex Systems / Rajant Corporation	WLM200N526ESD	1
6	Antenna Fixture	Rajant Corporation	Development	1
-	10m shielded Ethernet data cable	--	--	1
-	IO Cable ASSY	Rajant Corporation	06-100055-603	1
-	AC PWR Cord	For Item 2	--	1
7	Antenna 5100 MHz 6dBi Omni	PC TEL	BOA51508	2
-	3m shielded Ethernet data cable	--	--	2

Table 4. Support Equipment

F. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Shielded? (Y/N)	Termination Box ID & Port Name
A	Laptop PWR In	PC Power Adapter to PC	1	3m	N	A
B	Laptop Ethernet	Connects Laptop Ethernet to AC/DC POE Input	1	3m	Y	Item 1B to Item 2C
C	POE Data Input	Connects Laptop Ethernet to AC/DC POE Data input	1	3m	Y	Item 1B to Item 2C
D	POE Data/Pwr Out	Data I/O, PWR Out of POE, connects to ETH0 of modular host.	1	30 m	Y	Item 2D to Item 3E
E	POE AC PWR input	AC Power input Item 2	1	3m	N	--
F	Modular Host Eth0	Data I/O, PWR input modular host, Port ETH0	1	30m	Y	Item 3E to Item 2D
G	Modular Host Multi IO	Multi IO connector	1	1m	Y	--
J	Radio Chain 0	Radio Chain 0 to antenna	1	.3m	Y	Item 5F to Item 6H
K	Radio Chain 1	Radio Chain 1 to antenna	1	.3m	Y	Item 5G to Item 6I
H	Chain 0 antenna	Antenna	--	--	--	Item 6H to Item7
I	Chain 1 antenna	Antenna	--	--	--	Item 6 I to Item 7

Table 5. Ports and Cabling Information

G. Mode of Operation

Continuous transmit mode is necessary for verification of compliance to the applicable rule parts.

H. Method of Monitoring EUT Operation

Direct observation of the output on each RF chain (conducted and radiated) is required to verify the operation of the radio in the intended mode.

I. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

J. Disposition of EUT

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

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

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

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

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

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

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

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

Test Engineer(s): Bradley Jones

Test Date(s): 10/13/17

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 403(i) 26dB Bandwidth

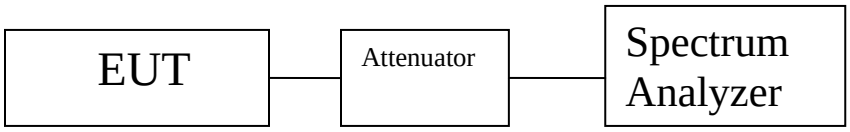
Test Requirements: **§ 15.403(i):** For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of 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 operating frequencies at the highest output power and connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately equal to 1% of the total emission bandwidth, VBW > RBW. The 26 dB Bandwidth was measured and recorded.

Test Results The 26 dB Bandwidth was compliant with the requirements of this section.

Test Engineer(s): Bradley Jones

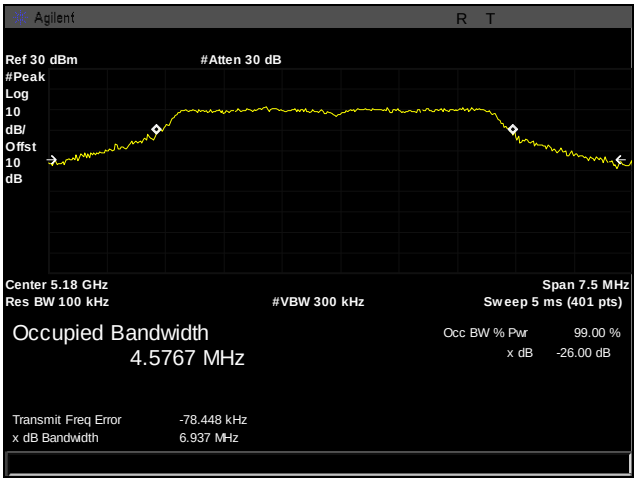
Test Date(s): 10/13/17



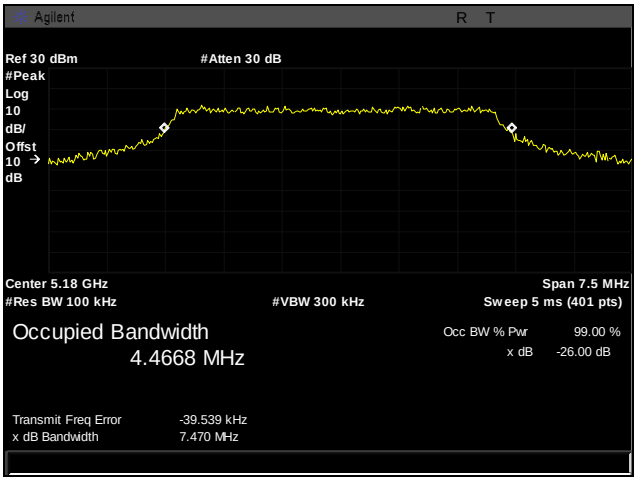
Test modes	Nominal bandwidth(MHz)	Test frequency (MHz)	Chain 0	Chain 1
			26 dB Bandwidth(MHz)	26 dB Bandwidth(MHz)
802.11ac	5	5180	5.215	7.470
802.11ac	5	5210	5.071	7.171
802.11ac	5	5240	7.409	6.716
802.11ac	10	5180	11.639	15
802.11ac	10	5210	15	15
802.11ac	10	5240	14.994	15
802.11ac	20	5180	25.008	23.633
802.11ac	20	5220	30	30
802.11ac	20	5240	30	30
802.11n	20	5180	25.222	25.851
802.11n	20	5200	30	30
802.11n	20	5240	30	30
802.11ac	40	5190	49.892	49.392
802.11ac	40	5230	60	58.861

Table 6. 26 dB Occupied Bandwidth, Test Results

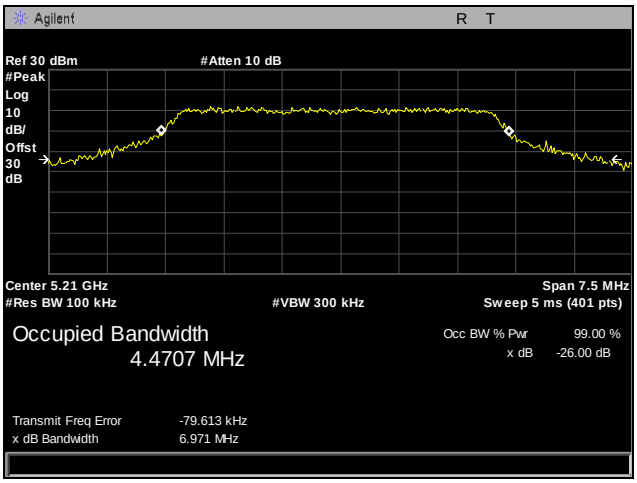
Occupied Bandwidth, 5 MHz



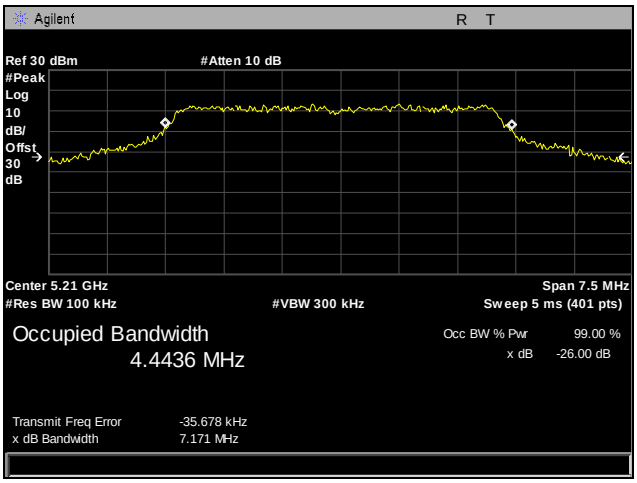
Plot 1. Occupied Bandwidth, 5 MHz, 5180 MHz, Channel 36, H, 24



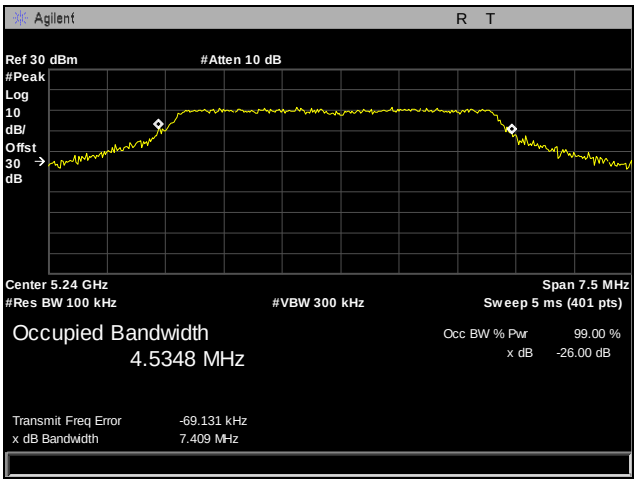
Plot 2. Occupied Bandwidth, 5 MHz, 5180 MHz, Channel 36, I, 24



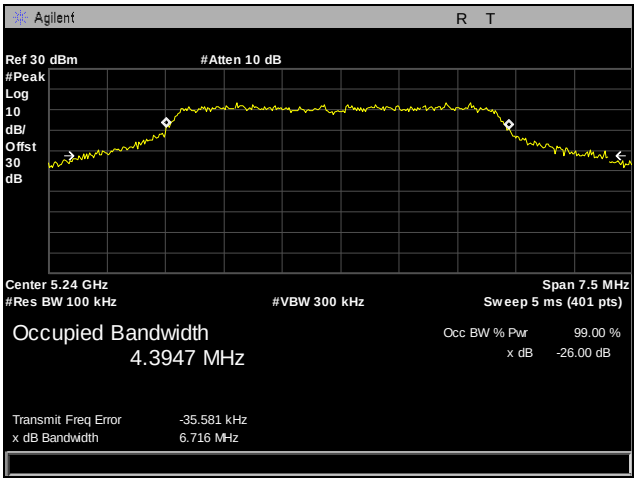
Plot 3. Occupied Bandwidth, 5 MHz, 5210 MHz, Channel 42, H, 24



Plot 4. Occupied Bandwidth, 5 MHz, 5210 MHz, Channel 42, I, 24

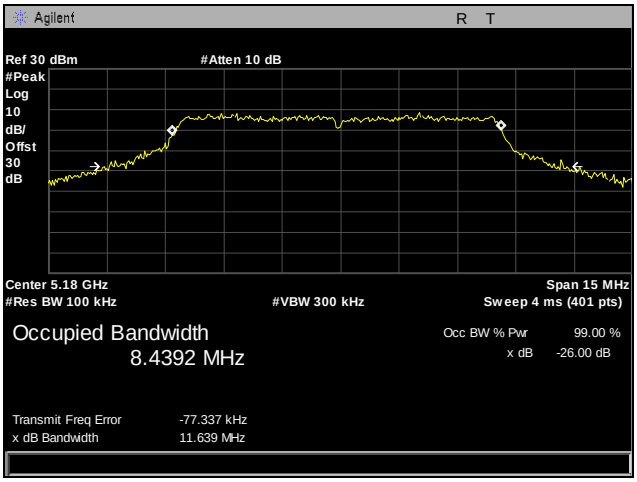


Plot 5. Occupied Bandwidth, 5 MHz, 5240 MHz, Channel 48, H, 23

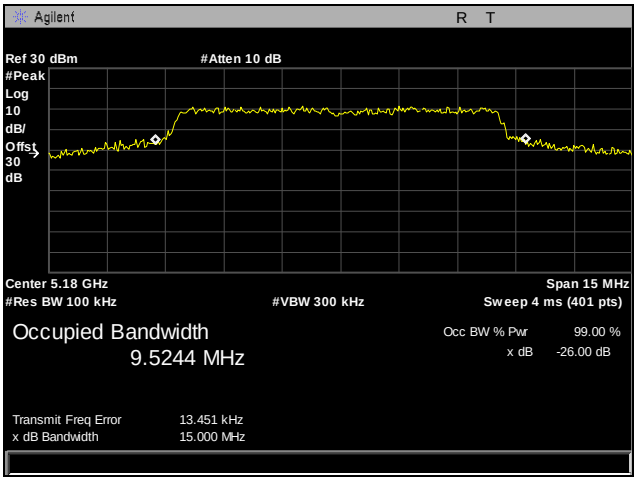


Plot 6. Occupied Bandwidth, 5 MHz, 5240 MHz, Channel 48, I, 23

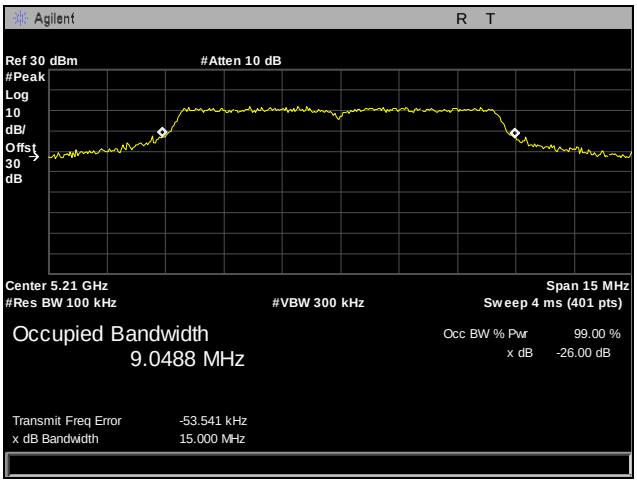
Occupied Bandwidth, 10 MHz



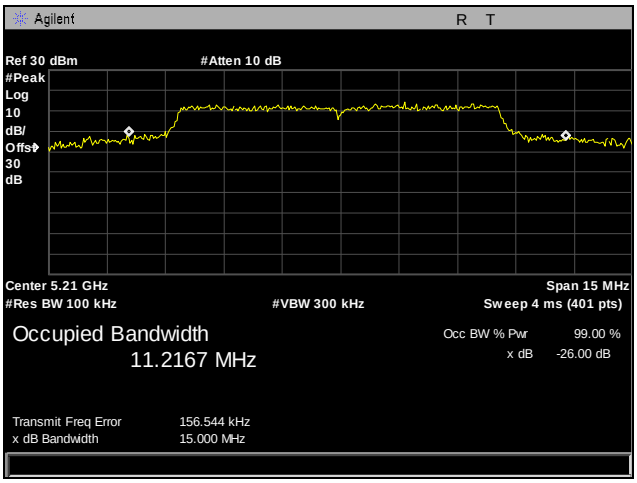
Plot 7. Occupied Bandwidth, 10 MHz, 5180 MHz, Channel 36, H, 24



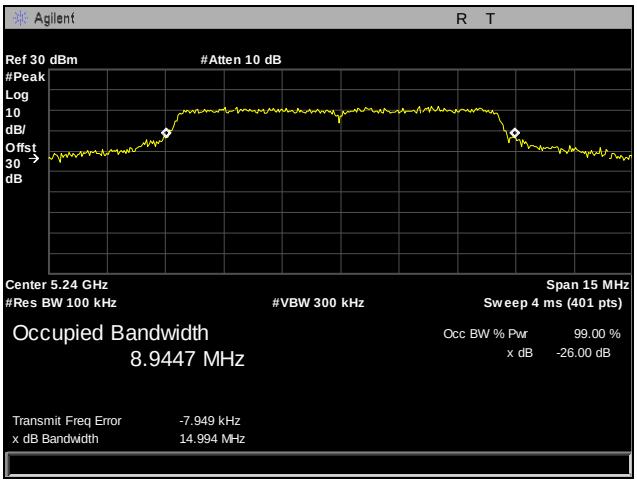
Plot 8. Occupied Bandwidth, 10 MHz, 5180 MHz, Channel 36, I, 24



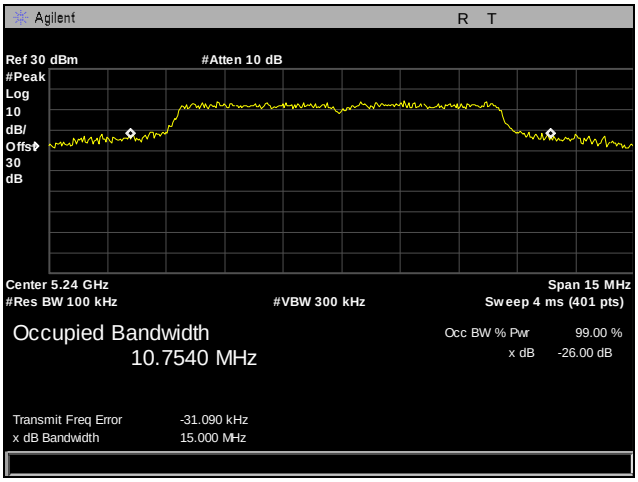
Plot 9. Occupied Bandwidth, 10 MHz, 5210 MHz, Channel 42, H, 27



Plot 10. Occupied Bandwidth, 10 MHz, 5210 MHz, Channel 42, I, 27

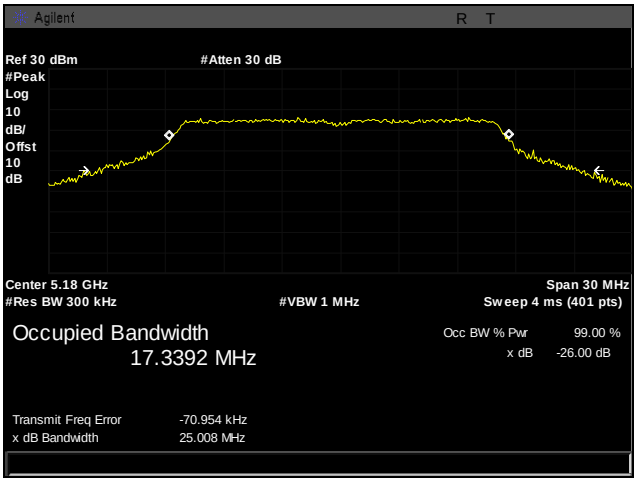


Plot 11. Occupied Bandwidth, 10 MHz, 5240 MHz, Channel 48, H, 27

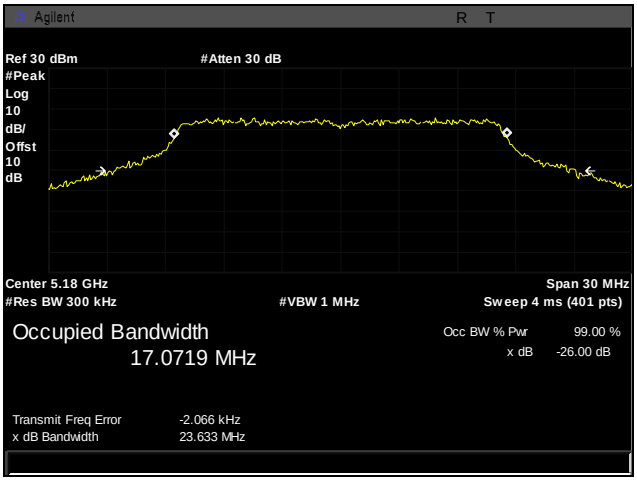


Plot 12. Occupied Bandwidth, 10 MHz, 5240 MHz, Channel 48, I, 27

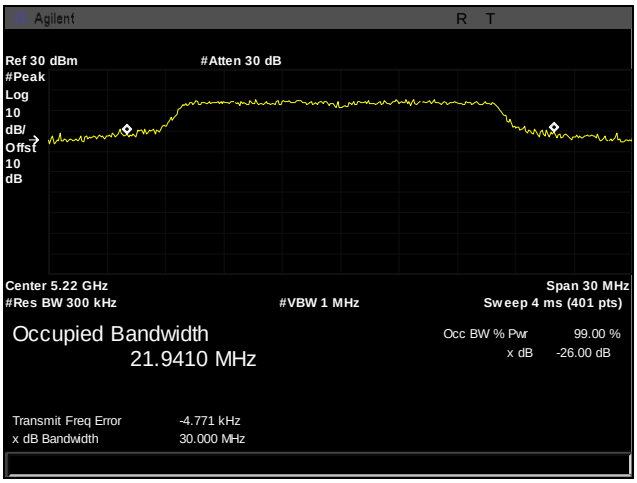
Occupied Bandwidth, 20 MHz



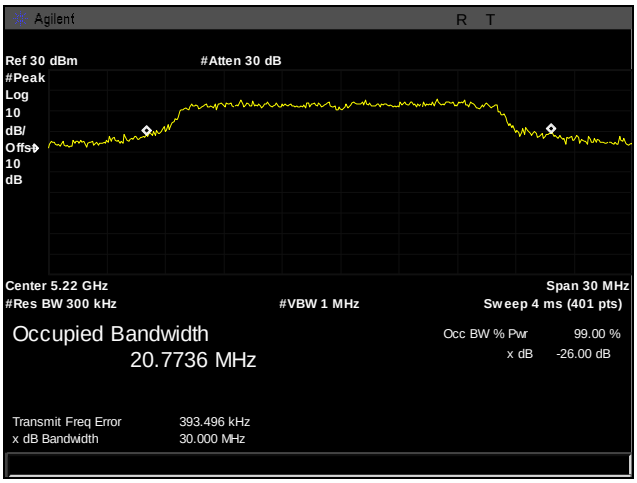
Plot 13. Occupied Bandwidth, 20 MHz, 5180 MHz, Channel 36, H, 20



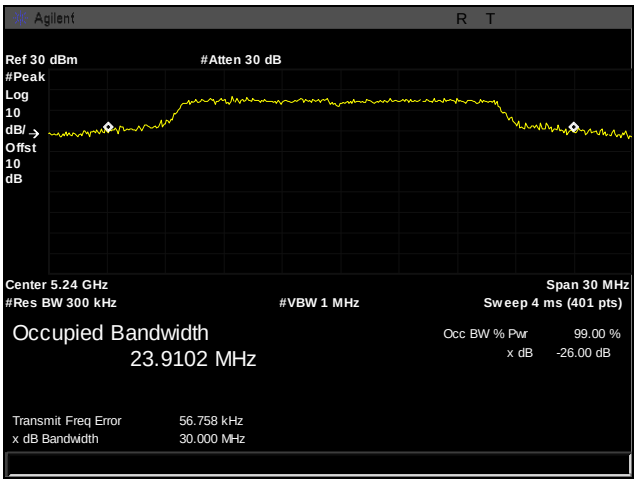
Plot 14. Occupied Bandwidth, 20 MHz, 5180 MHz, Channel 36, I, 20



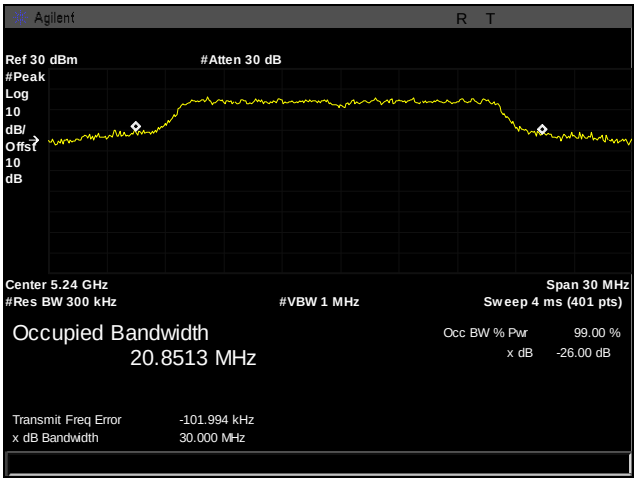
Plot 15. Occupied Bandwidth, 20 MHz, 5220 MHz, Channel 44, H, 29



Plot 16. Occupied Bandwidth, 20 MHz, 5220 MHz, Channel 44, I, 29

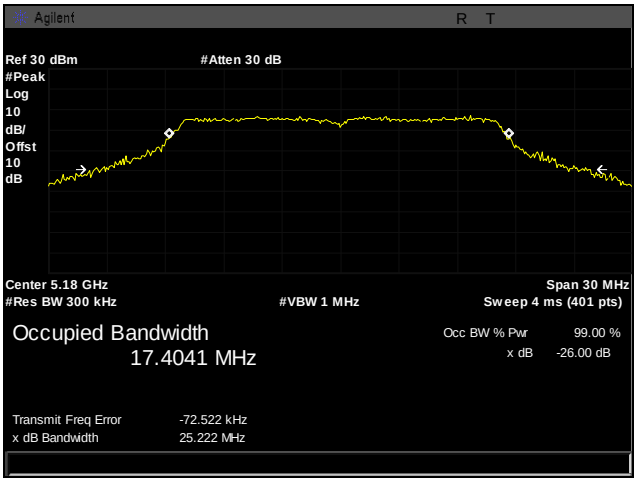


Plot 17. Occupied Bandwidth, 20 MHz, 5240 MHz, Channel 48, H, 29

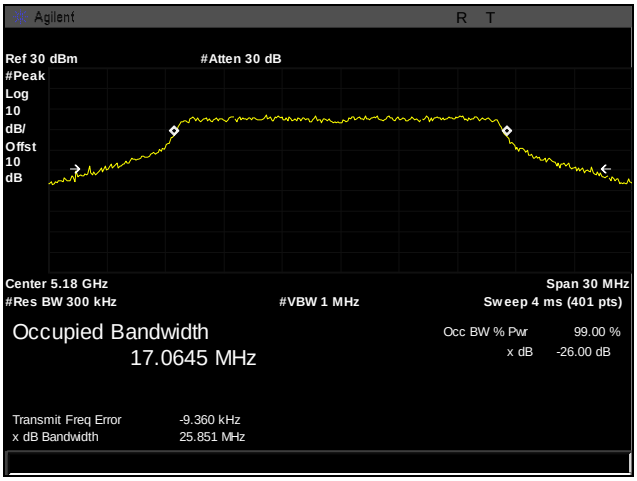


Plot 18. Occupied Bandwidth, 20 MHz, 5240 MHz, Channel 48, I, 29

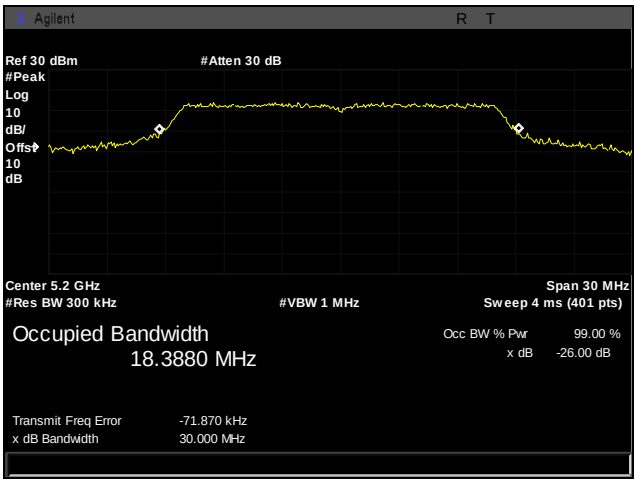
Occupied Bandwidth, 802.11n 20 MHz



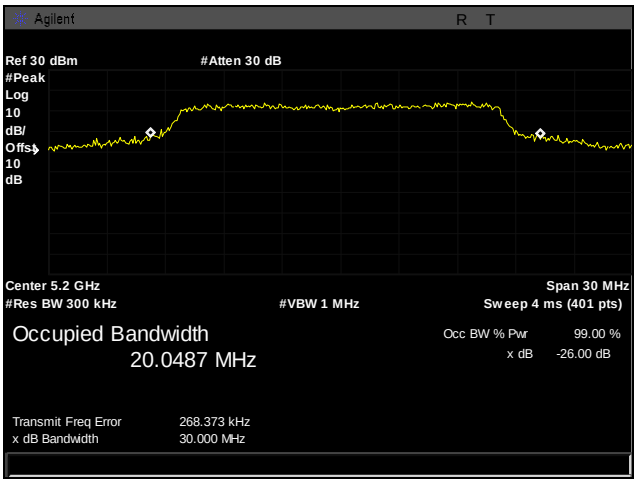
Plot 19. Occupied Bandwidth, 802.11n 20 MHz, 5180 MHz, Channel 36, H, 21



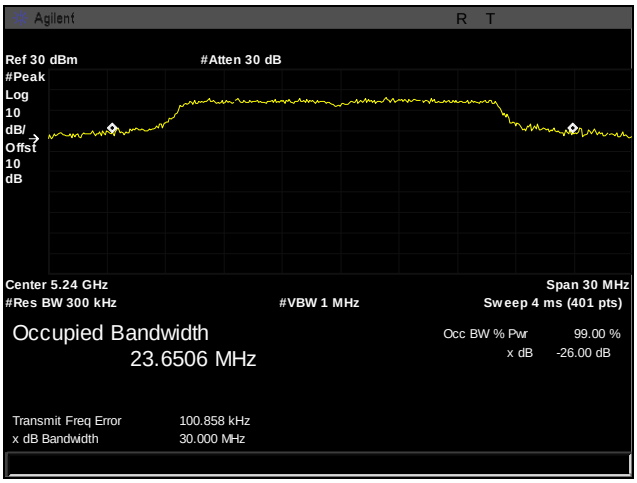
Plot 20. Occupied Bandwidth, 802.11n 20 MHz, 5180 MHz, Channel 36, I, 21



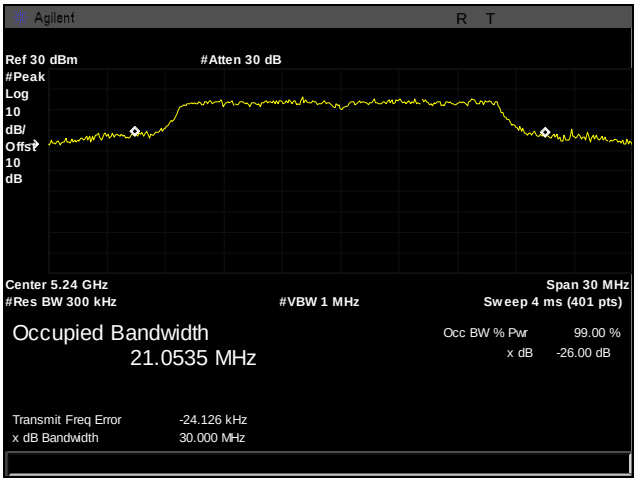
Plot 21. Occupied Bandwidth, 802.11n 20 MHz, 5200 MHz, Channel 40, H, 28



Plot 22. Occupied Bandwidth, 802.11n 20 MHz, 5200 MHz, Channel 40 I, 28

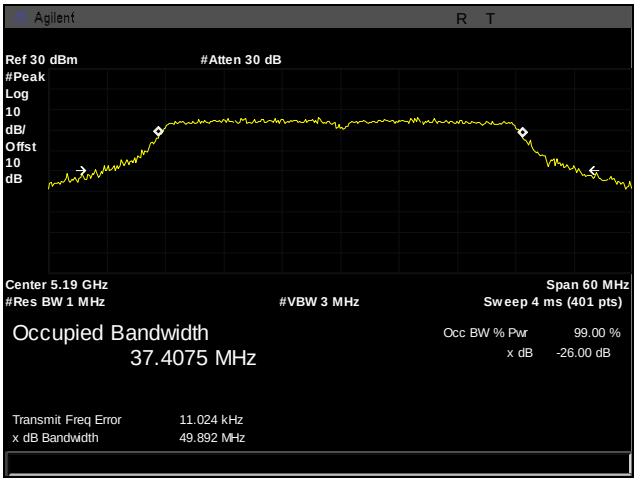


Plot 23. Occupied Bandwidth, 802.11n 20 MHz, 5240 MHz, Channel 48, H, 29

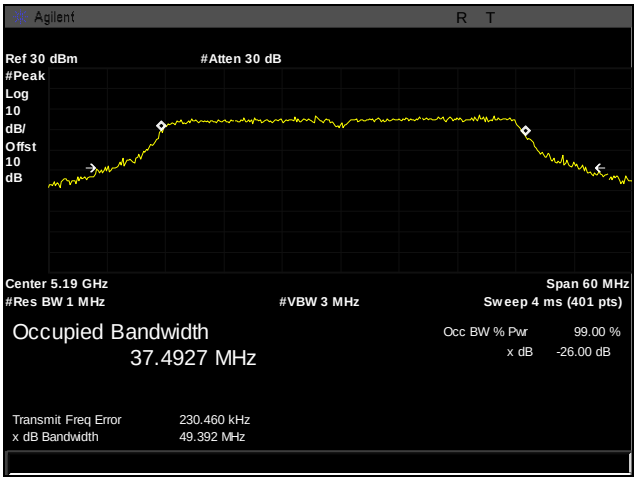


Plot 24. Occupied Bandwidth, 802.11n 20 MHz, 5240 MHz, Channel 48, I, 29

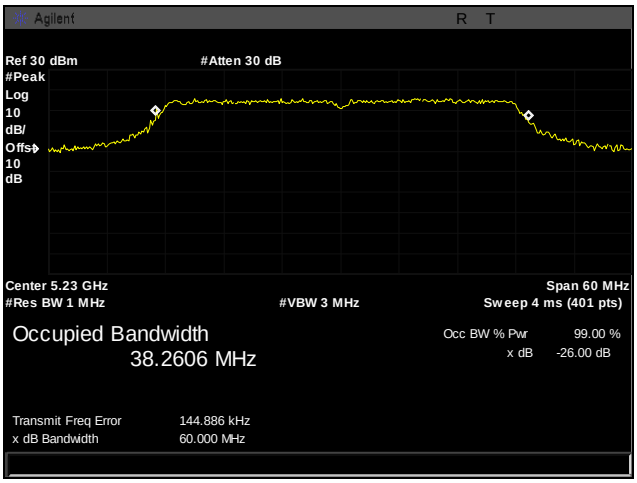
Occupied Bandwidth, 802.11n 40 MHz



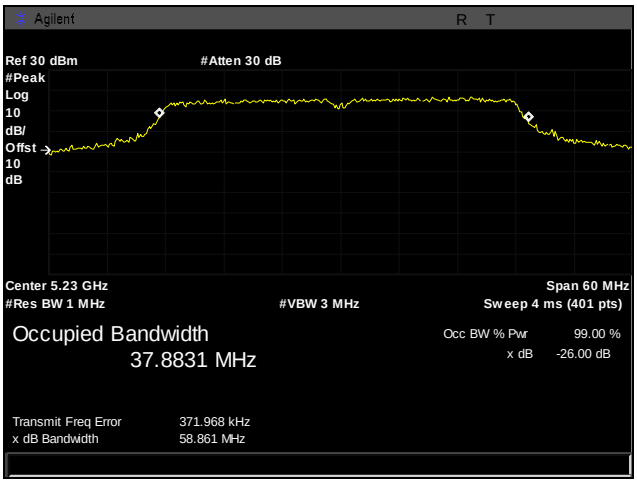
Plot 25. Occupied Bandwidth, 802.11n 40 MHz, 5190 MHz, Channel 36, H, 16



Plot 26. Occupied Bandwidth, 802.11n 40 MHz, 5190 MHz, Channel 36, I, 16



Plot 27. Occupied Bandwidth, 802.11n 40 MHz, 5230 MHz, Channel 48, H, 26



Plot 28. Occupied Bandwidth, 802.11n 40 MHz, 5230 MHz, Channel 48 I, 26

Electromagnetic Compatibility Criteria for Intentional Radiators

§15. 407(a)(1) Maximum Conducted Output Power

Test Requirements:

§15.407(a)(1)(i): For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.
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.

§15.407(a)(1)(ii): For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.
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.

§15.407(a)(1)(iii): For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.
Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

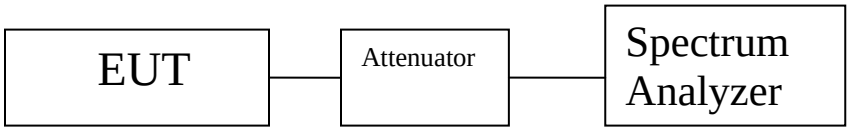
§15.407(a)(1)(iv): For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.
If transmitting antennas of directional gain greater than 6 dBi 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 EUT was connected to a spectrum analyzer through a cable and attenuator. Measurements were taken with the EUT set to transmit continuously on its low, mid, and high channels. Its power was measured according to measurement method SA-1, as described in 789033 D02 General UNII Test Procedures v01.

Test Results: The EUT as tested is compliant with the requirements of this section.

Test Engineer(s): Bradley Jones

Test Date(s): 10/11/17



5 MHz								
Frequency (MHz)	Channel	Antenna H	Antenna I	Total Power	Antenna Gain	Limit dBm	Margin	Power
5180	36	14.59	15.36	18.00234269	9	27	-8.997657314	21
5210	42	15.83	15.33	18.59749156	9	27	-8.402508435	21
5240	48	15.51	14.41	18.00503386	9	27	-8.994966141	21

Table 7. Output Power, 5 MHz, Test Results

10 MHz								
Frequency (MHz)	Channel	Antenna H	Antenna I	Total Power	Antenna Gain	Limit dBm	Margin	Power
5180	36	18.67	18.06	21.38600106	9	27	-5.613998937	24
5210	42	18.31	18.19	21.26071441	9	27	-5.739285591	24
5240	48	18.24	18.17	21.21544099	9	27	-5.784559012	24

Table 8. Output Power, 10 MHz, Test Results

20 MHz								
Frequency (MHz)	Channel	Antenna H	Antenna I	Total Power	Antenna Gain	Limit dBm	Margin	Power
5180	36	13.19	13.02	16.11613171	9	27	-10.88386829	20
5220	44	21.83	21.37	24.61638745	9	27	-2.383612551	28
5240	48	20.03	22.95	24.74122167	9	27	-2.258778328	26

Table 9. Output Power, 20 MHz, Test Results

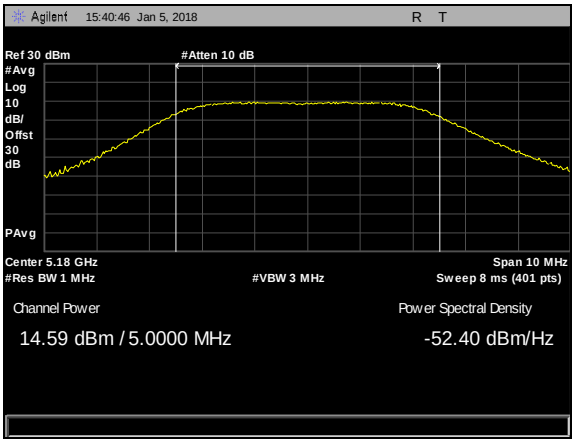
802.11n 20 MHz								
Frequency (MHz)	Channel	Antenna H	Antenna I	Total Power	Antenna Gain	Limit dBm	Margin	Power
5180	36	14.76	13.69	17.26816982	9	27	-9.731830182	21
5200	40	21.36	20.64	24.02520365	9	27	-2.974796348	27
5240	48	23.75	22.34	26.11227251	9	27	-0.887727491	26

Table 10. Output Power, 802.11n 20 MHz, Test Results

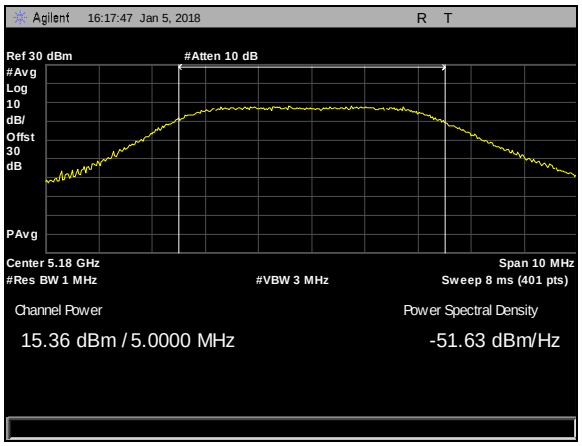
802.11n 40 MHz								
Frequency (MHz)	Channel	Antenna H	Antenna I	Total Power	Antenna Gain	Limit dBm	Margin	Power
5190	38	10.41	10.05	13.24402908	9	27	-13.75597092	16
5230	46	21.17	20.94	24.06682236	9	27	-2.933177637	26

Table 11. Output Power, 802.11n 40 MHz, Test Results

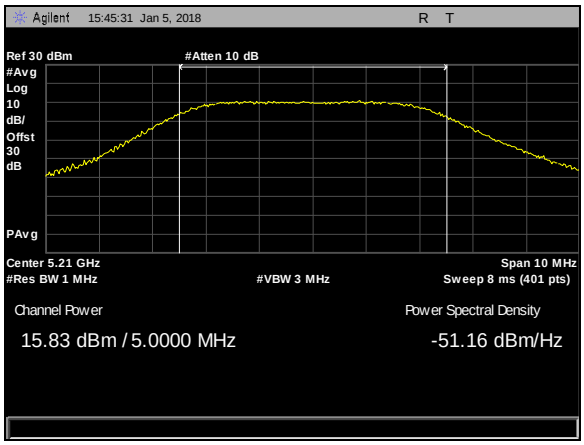
Conducted Transmitter Output Power, 5 MHz



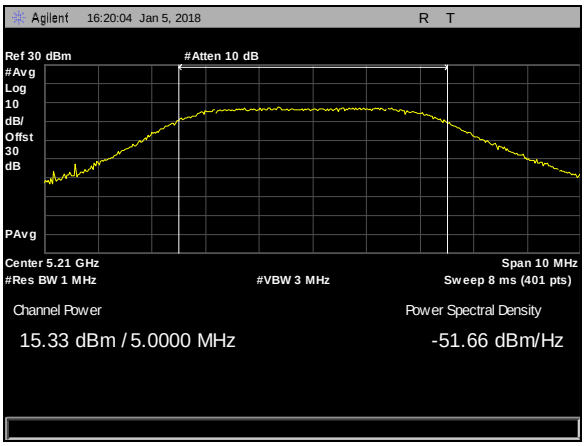
Plot 29. Conducted Transmitter Output Power, 5 MHz, 5180 MHz, Channel 36, H, 21



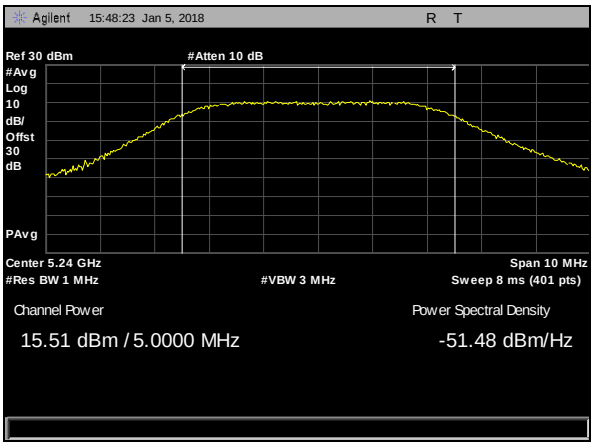
Plot 30. Conducted Transmitter Output Power, 5 MHz, 5180 MHz, Channel 36, I, 21



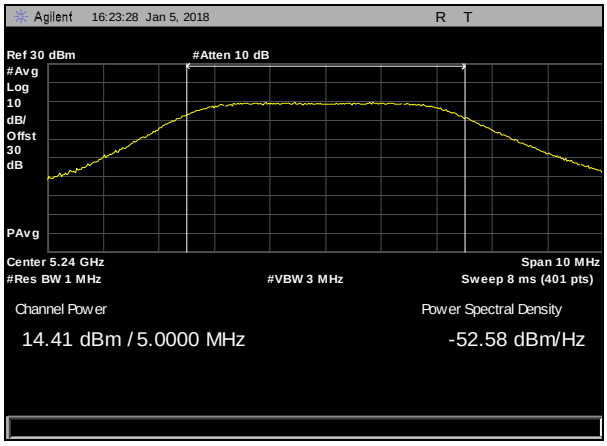
Plot 31. Conducted Transmitter Output Power, 5 MHz, 5210 MHz, Channel 42, H, 21



Plot 32. Conducted Transmitter Output Power, 5 MHz, 5210 MHz, Channel 42, I, 24

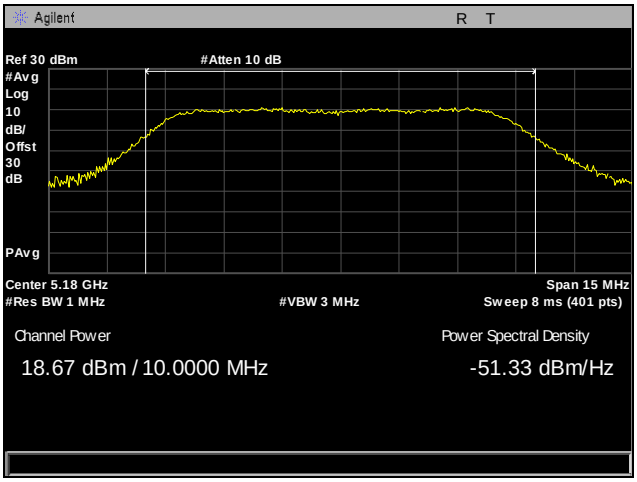


Plot 33. Conducted Transmitter Output Power, 5 MHz, 5240 MHz, Channel 48, H, 21

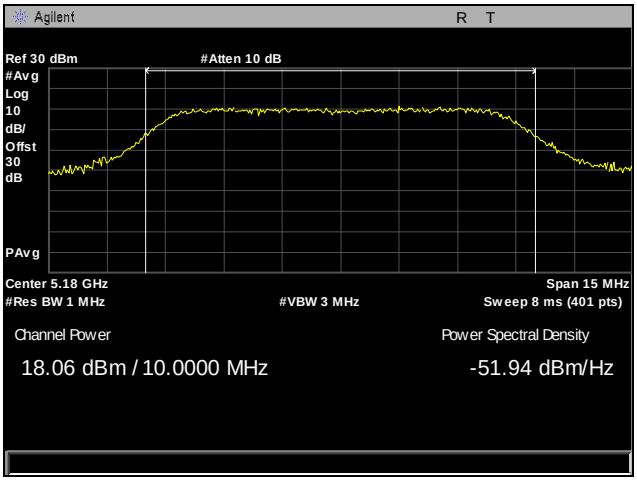


Plot 34. Conducted Transmitter Output Power, 5 MHz, 5240 MHz, Channel 48, I, 21

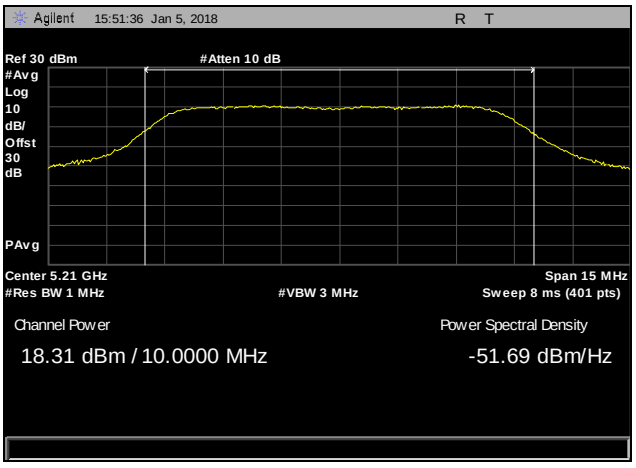
Conducted Transmitter Output Power, 10 MHz



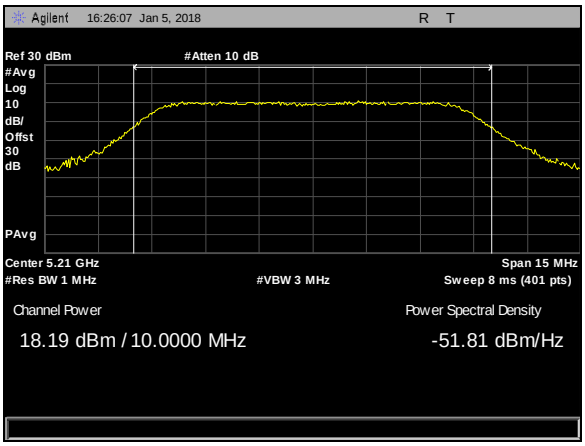
Plot 35. Conducted Transmitter Output Power, 10 MHz, 5180 MHz, Channel 36, H, 24



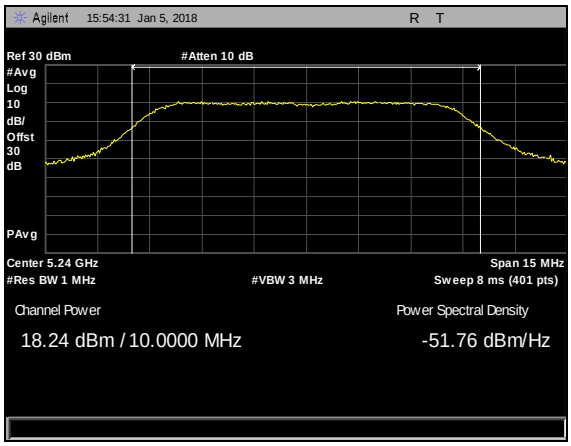
Plot 36. Conducted Transmitter Output Power, 10 MHz, 5180 MHz, Channel 36, I, 24



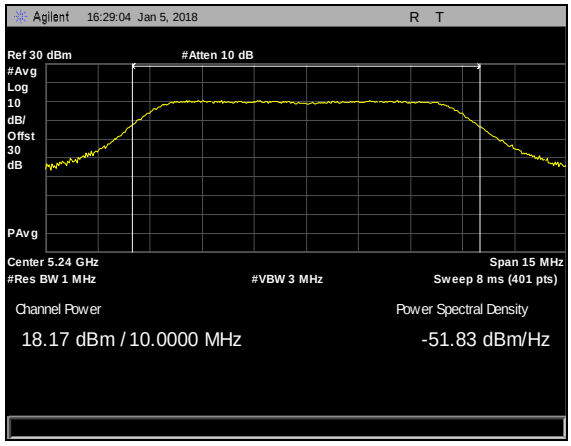
Plot 37. Conducted Transmitter Output Power, 10 MHz, 5210 MHz, Channel 42, H, 24



Plot 38. Conducted Transmitter Output Power, 10 MHz, 5210 MHz, Channel 42, I, 24

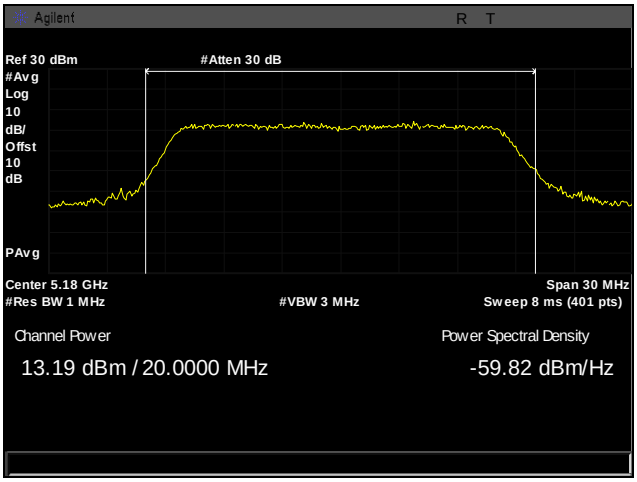


Plot 39. Conducted Transmitter Output Power, 10 MHz, 5240 MHz, Channel 48, H, 24

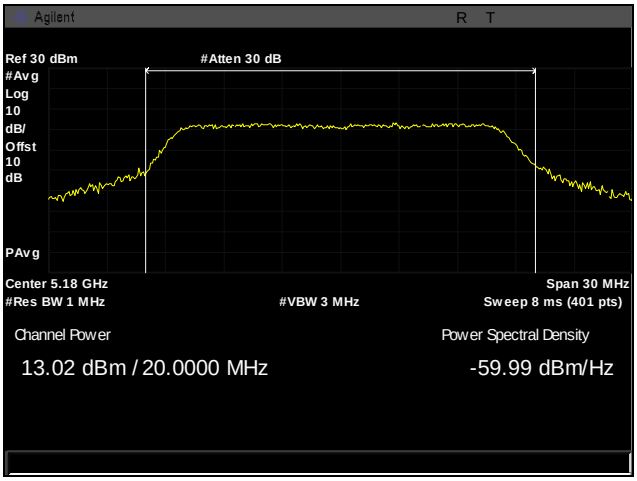


Plot 40. Conducted Transmitter Output Power, 10 MHz, 5240 MHz, Channel 48, I, 24

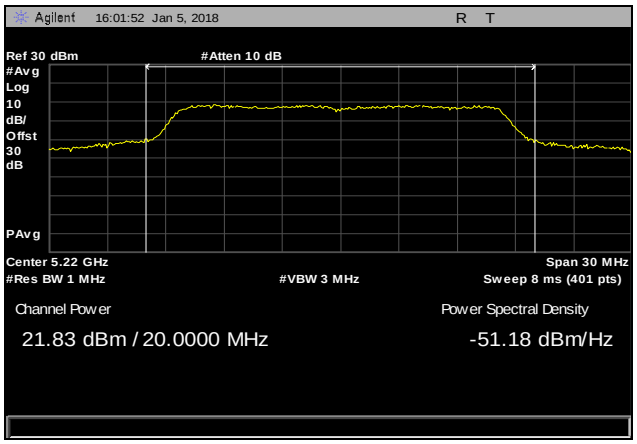
Conducted Transmitter Output Power, 20 MHz



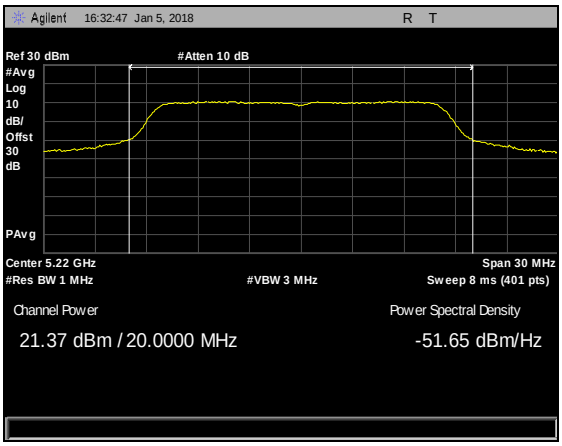
Plot 41. Conducted Transmitter Output Power, 20 MHz, 5180 MHz, Channel 36, H, 20



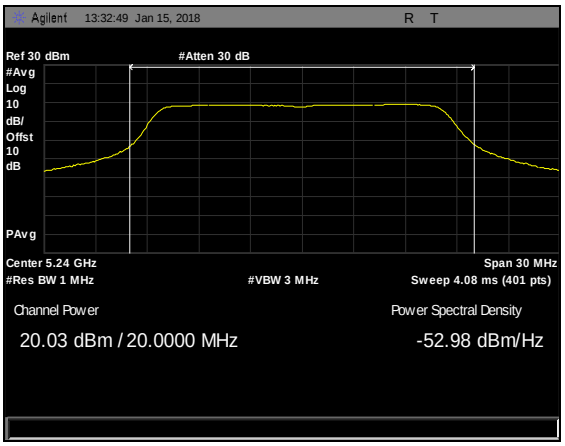
Plot 42. Conducted Transmitter Output Power, 20 MHz, 5180 MHz, Channel 36, I, 20



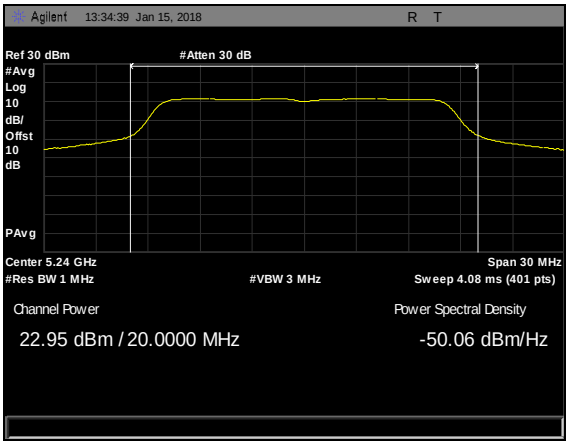
Plot 43. Conducted Transmitter Output Power, 20 MHz, 5220 MHz, Channel 44, H, 28



Plot 44. Conducted Transmitter Output Power, 20 MHz, 5220 MHz, Channel 44, I, 28

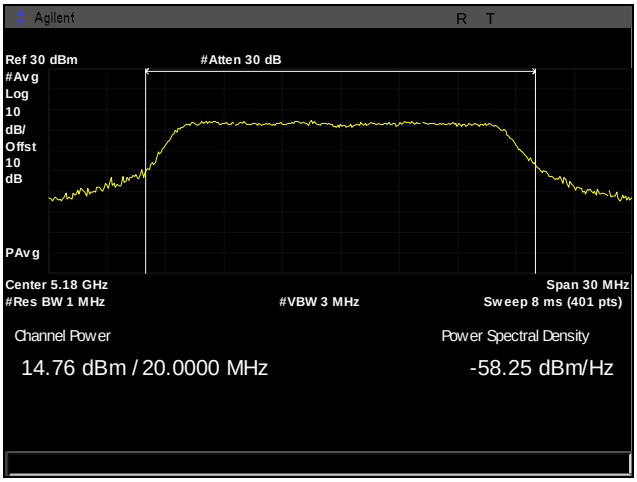


Plot 45. Conducted Transmitter Output Power, 20 MHz, 5240 MHz, Channel 48, H, 26

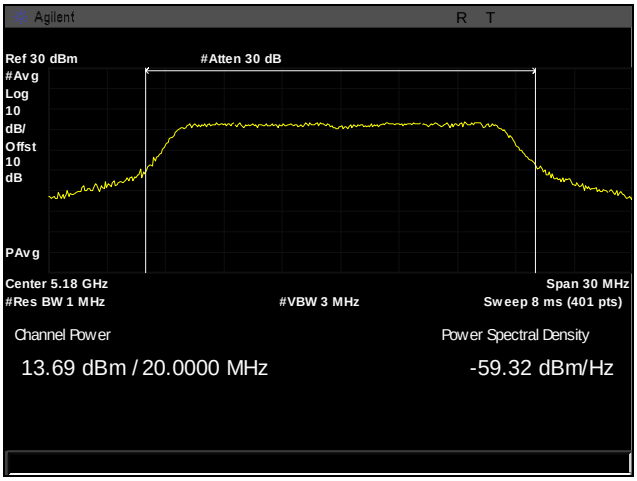


Plot 46. Conducted Transmitter Output Power, 20 MHz, 5240 MHz, Channel 48, I, 26

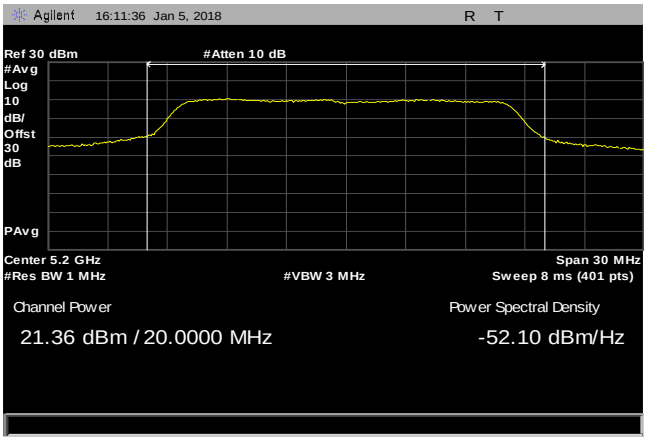
Conducted Transmitter Output Power, 802.11n 20 MHz



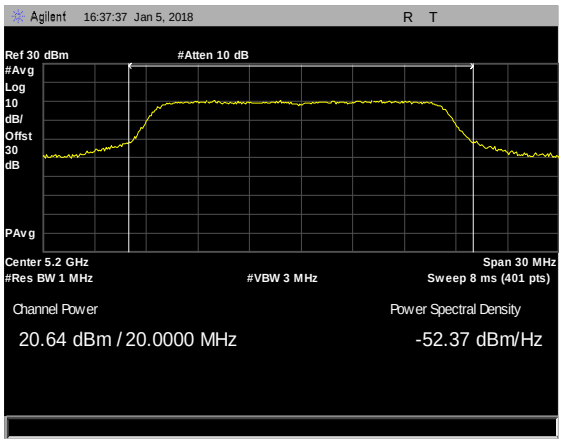
Plot 47. Conducted Transmitter Output Power, 802.11n 20 MHz, 5180 MHz, Channel 36, H, 21



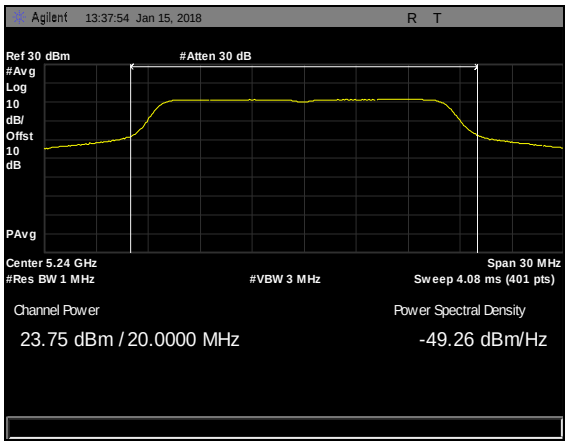
Plot 48. Conducted Transmitter Output Power, 802.11n 20 MHz, 5180 MHz, Channel 36, I, 21



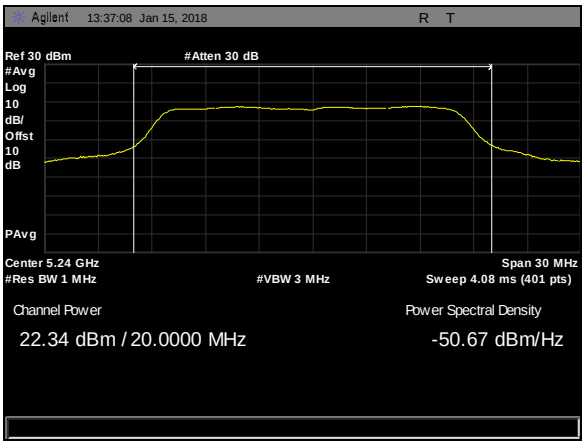
Plot 49. Conducted Transmitter Output Power, 802.11n 20 MHz, 5200 MHz, Channel 40, H, 27



Plot 50. Conducted Transmitter Output Power, 802.11n 20 MHz, 5200 MHz, Channel 40 I, 27

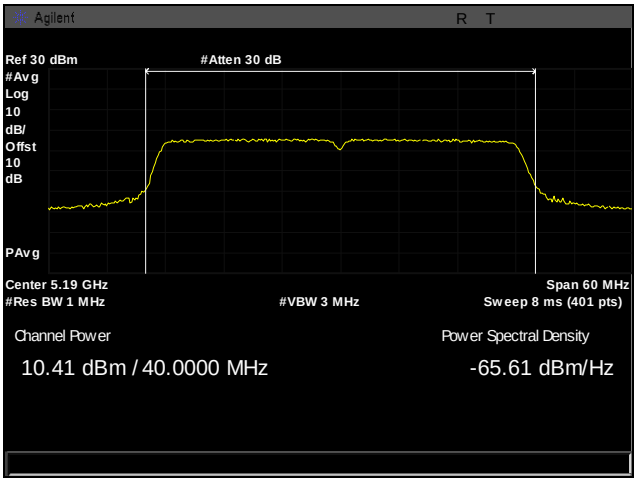


Plot 51. Conducted Transmitter Output Power, 802.11n 20 MHz, 5240 MHz, Channel 48, H, 26

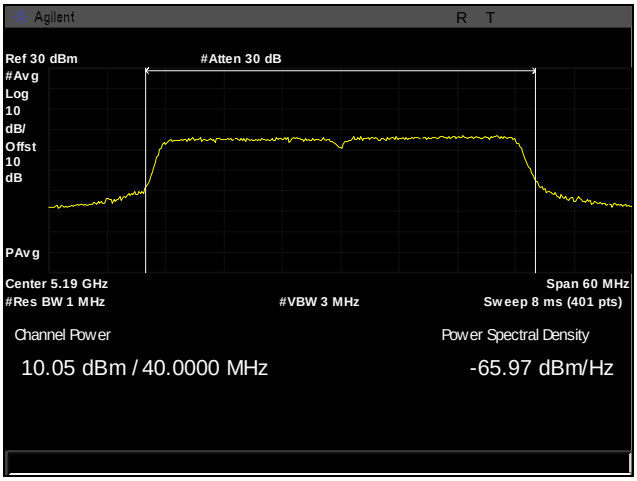


Plot 52. Conducted Transmitter Output Power, 802.11n 20 MHz, 5240 MHz, Channel 48, I, 26

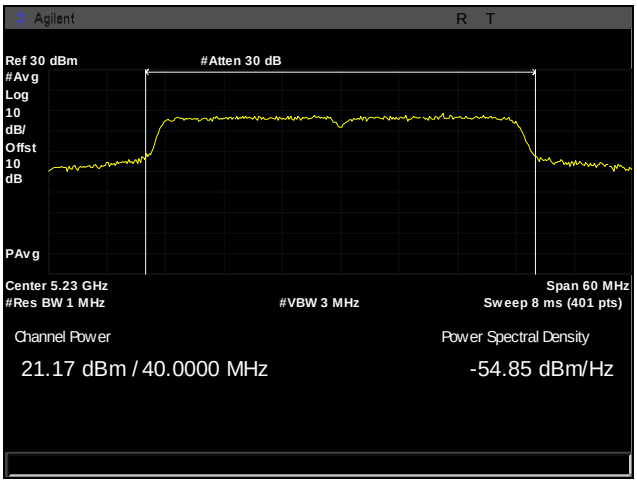
Conducted Transmitter Output Power, 802.11n 40 MHz



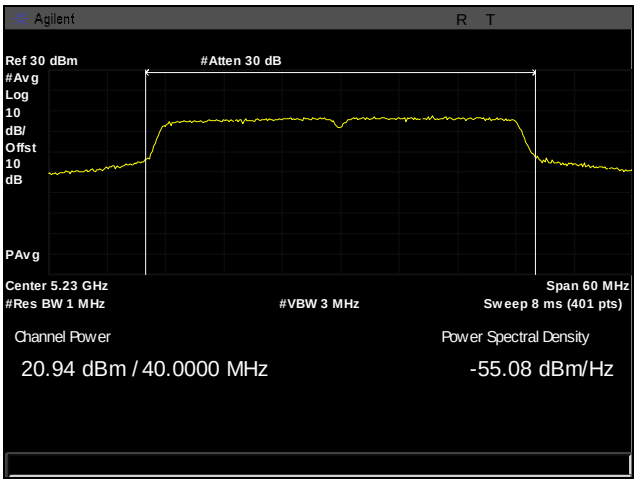
Plot 53. Conducted Transmitter Output Power, 802.11n 40 MHz, 5190 MHz, Channel 36, H, 16



Plot 54. Conducted Transmitter Output Power, 802.11n 40 MHz, 5190 MHz, Channel 36, I, 16



Plot 55. Conducted Transmitter Output Power, 802.11n 40 MHz, 5230 MHz, Channel 48, H, 26



Plot 56. Conducted Transmitter Output Power, 802.11n 40 MHz, 5230 MHz, Channel 48 I, 26

§15.407(a)(1)(i) EIRP Above 30° Elevation

Test Requirements: **§15.407(a)(1)(i):** The maximum E.I.R.P. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

Test Procedure: The EUT was connected to a spectrum analyzer through a cable and attenuator. Measurements were taken with the EUT set to transmit continuously on its low, mid, and high channels. Its power was measured according KDB 789033 D02 General UNII Test Procedures v01.

Test Results: The EUT as tested is compliant with the requirements of this section.

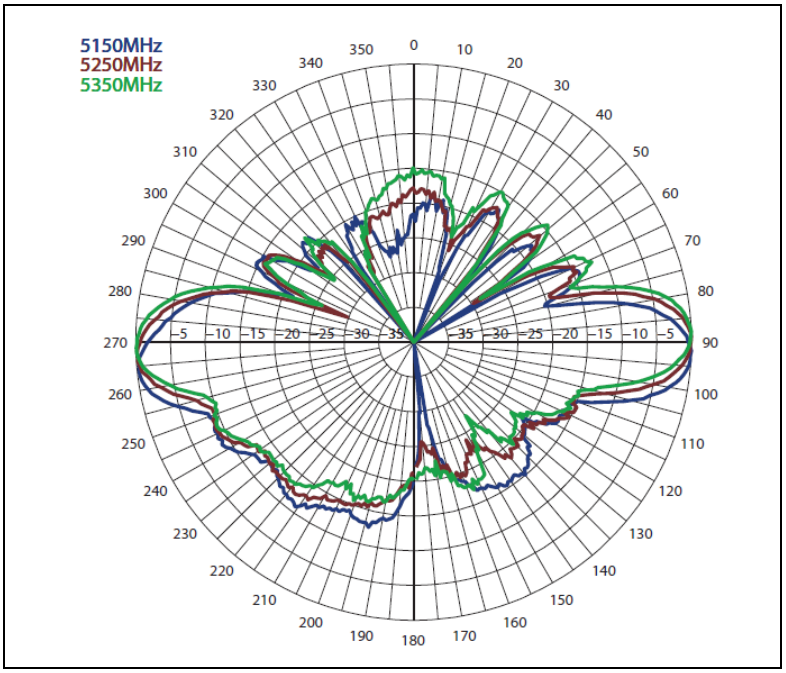
Test Engineer(s): Bradley Jones

Test Date(s): 10/20/17

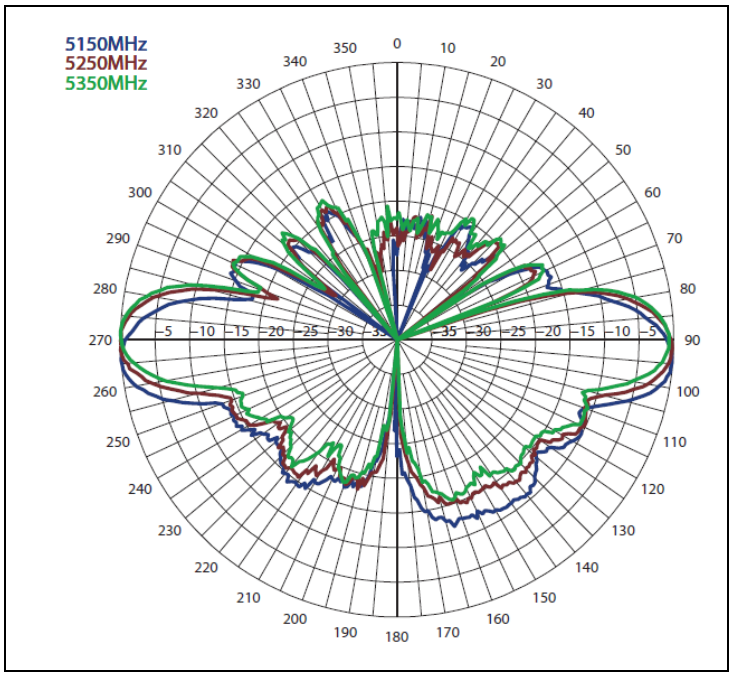
	Max OP	Frequency	Bandwidth	Highest Gain	Angle	EIRP	mW	limit	margin
0 deg	23.64	5240	20M HT20	-9.79	31.79	13.85	24.2661	125	-100.734
90 deg	23.64	5240	20M HT20	-6.03	47.97	17.61	57.67665	125	-67.3234
	dBm	**MHz**		**dBi**	**degrees**				

Table 12. EIRP Above 30° Elevation, Test Results

Note 1: Reference angle in radiation pattern is 88.78˚. Search is conducted from (30+88.78) to (90+88.78).
Note 2: Reference angle in radiation pattern is 91.81˚. Search is conducted from (30+91.81) to (90+91.81).



Plot 57. E-Plane, 0°



Plot 58. E-Plane, 90°

Electromagnetic Compatibility Criteria for Intentional Radiators

§15.407(a)(1) Maximum Power Spectral Density

Test Requirements:

§15.407(a)(1)(i): In addition, the maximum power spectral density shall not exceed 17 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.

§15.407(a)(1)(ii): In addition, the maximum power spectral density shall not exceed 17 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..

§15.407(a)(1)(iii): In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

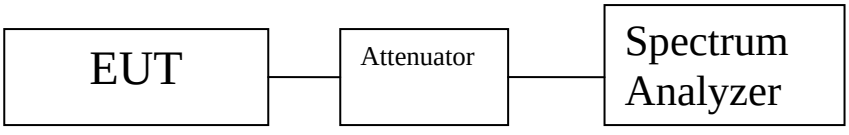
§15.407(a)(1)(iv): In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in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

Test Procedure: The EUT was connected to a spectrum analyzer through a cable and attenuator. Measurements were taken with the EUT set to transmit continuously on its low, mid, and high channels. Its power was measured according KDB 789033 D02 General UNII Test Procedures v01.

Test Results: The EUT as tested is compliant with the requirements of this section.

Test Engineer(s): Bradley Jones

Test Date(s): 10/17/17



5 MHz								
Frequency (MHz)	Channel	Antenna H	Antenna I	Total Power	Antenna Gain	Limit dBm	Margin	Power
5180	36	10.24	10.85	13.56600106	9	14	-0.433998937	21
5210	42	10.66	10.67	13.67530283	9	14	-0.324697165	21
5240	48	10.43	10.24	13.34633892	9	14	-0.653661085	21

Table 13. Power Spectral Density, 5 MHz, Test Results

10 MHz								
Frequency (MHz)	Channel	Antenna H	Antenna I	Total Power	Antenna Gain	Limit dBm	Margin	Power
5180	36	9.505	10.69	13.14809204	9	14	-0.851907958	24
5210	42	10.83	10.76	13.80544099	9	14	-0.194559012	24
5240	48	10.62	10.68	13.66040357	9	14	-0.339596428	24

Table 14. Power Spectral Density, 10 MHz, Test Results

20 MHz								
Frequency (MHz)	Channel	Antenna H	Antenna I	Total Power	Antenna Gain	Limit dBm	Margin	Power
5180	36	3.606	2.093	5.925357011	9	14	-8.074642989	20
5220	44	10.82	10.84	13.84031147	9	14	-0.15968853	28
5240	48	9.104	10.6	12.92639926	9	14	-1.073600741	26

Table 15. Power Spectral Density, 20 MHz, Test Results

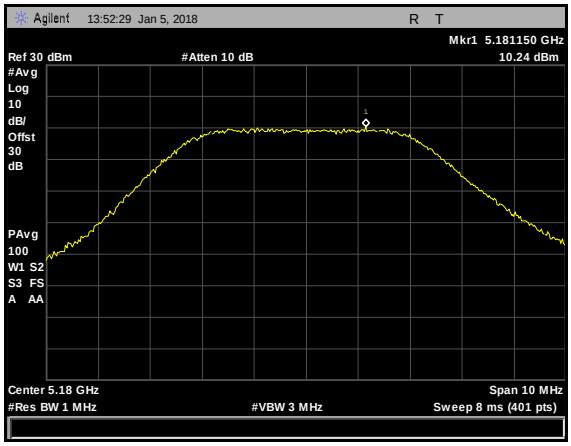
802.11n 20 MHz								
Frequency (MHz)	Channel	Antenna H	Antenna I	Total Power	Antenna Gain	Limit dBm	Margin	Power
5180	36	1.371	2.888	5.205702357	9	14	-8.794297643	21
5200	40	10.68	10.57	13.63564821	9	14	-0.364351787	27
5240	48	10.29	10.22	13.26544099	9	14	-0.734559012	26

Table 16. Power Spectral Density, 802.11n 20 MHz, Test Results

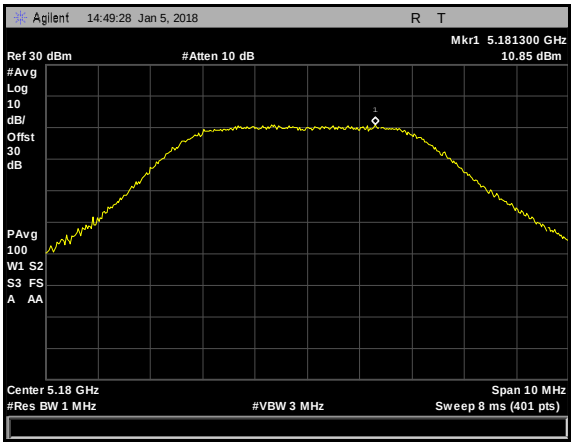
802.11n 40 MHz								
Frequency (MHz)	Channel	Antenna H	Antenna I	Total Power	Antenna Gain	Limit dBm	Margin	Power
5190	38	-3.943	-2.17	0.043656569	9	14	-13.95634343	16
5230	46	8.098	7.121	10.64721577	9	14	-3.352784228	26

Table 17. Power Spectral Density, 802.11n 40 MHz, Test Results

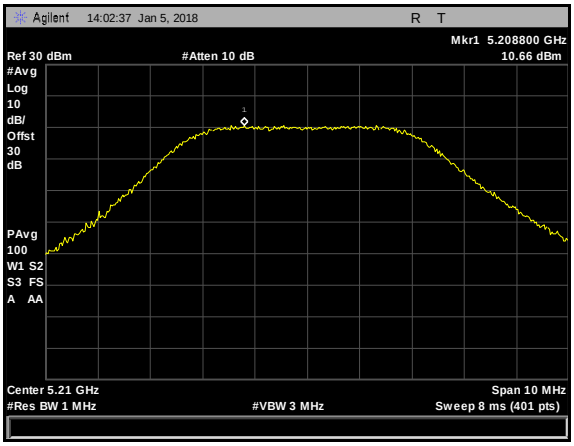
Power Spectral Density, 5 MHz



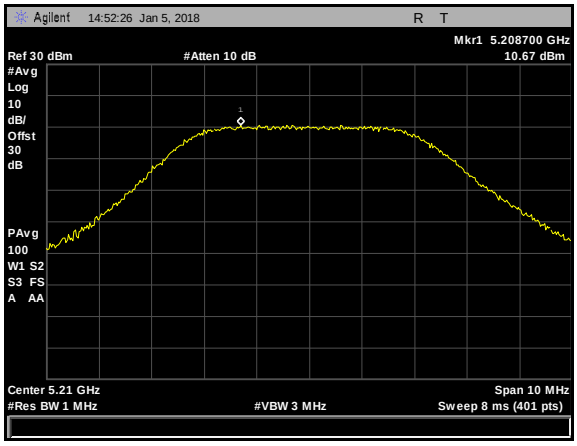
Plot 59. Power Spectral Density, 5 MHz, 5180 MHz, Channel 36, H, 21



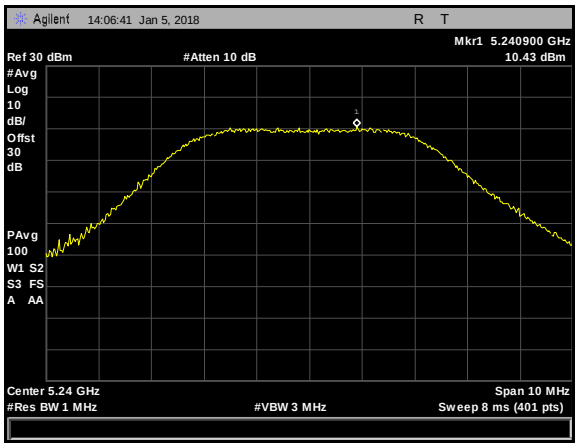
Plot 60. Power Spectral Density, 5 MHz, 5180 MHz, Channel 36, I, 21



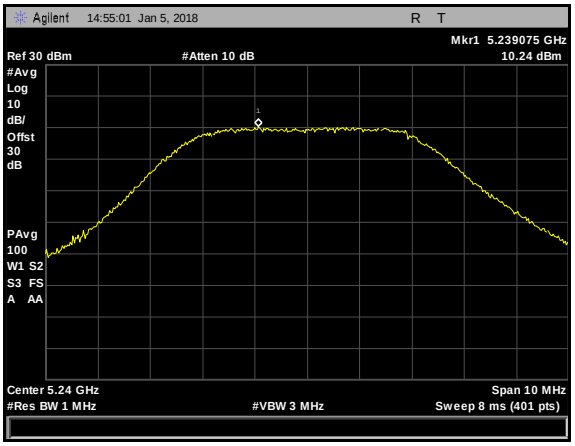
Plot 61. Power Spectral Density, 5 MHz, 5210 MHz, Channel 42, H, 21



Plot 62. Power Spectral Density, 5 MHz, 5210 MHz, Channel 42, I, 21

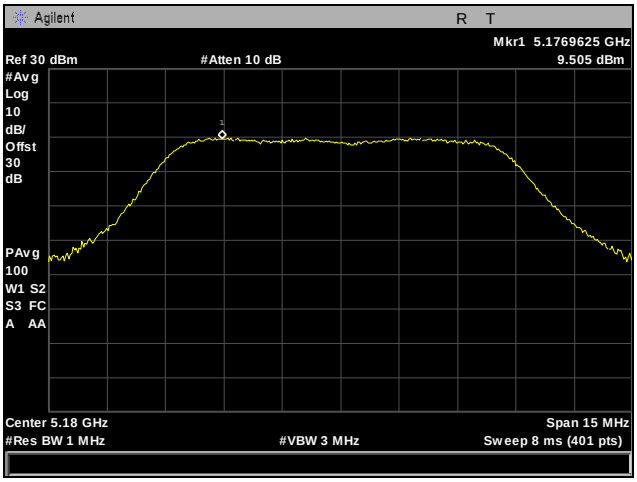


Plot 63. Power Spectral Density, 5 MHz, 5240 MHz, Channel 48, H, 21

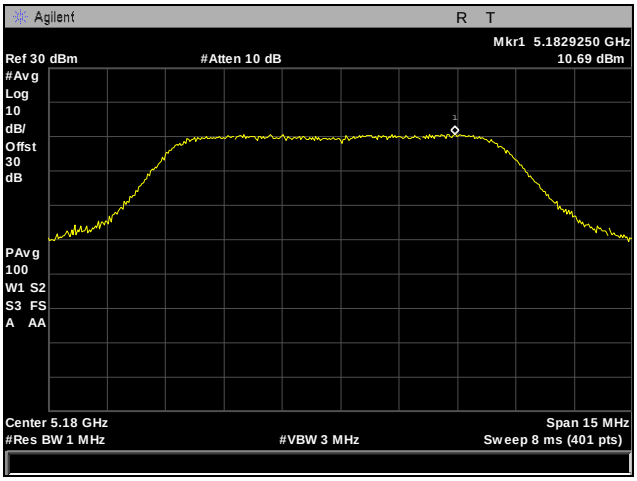


Plot 64. Power Spectral Density, 5 MHz, 5240 MHz, Channel 48, I, 21

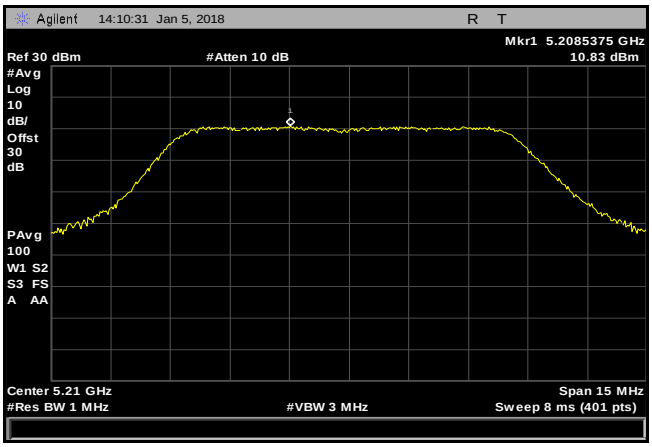
Power Spectral Density, 10 MHz



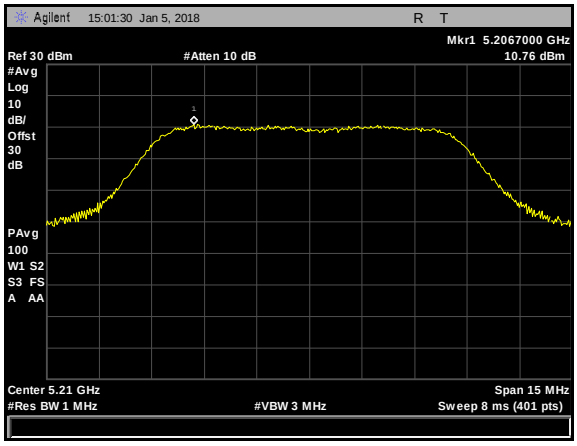
Plot 65. Power Spectral Density, 10 MHz, 5180 MHz, Channel 36, H, 24



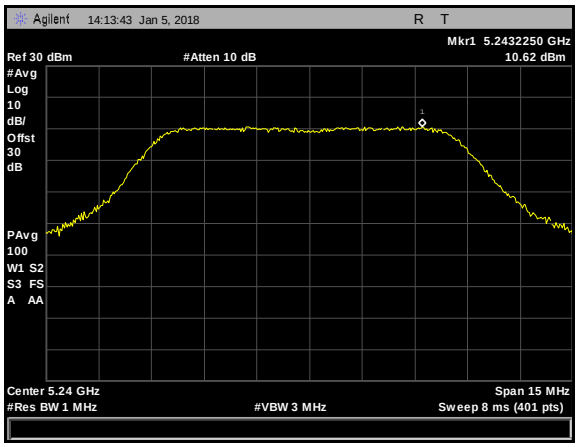
Plot 66. Power Spectral Density, 10 MHz, 5180 MHz, Channel 36, I, 24



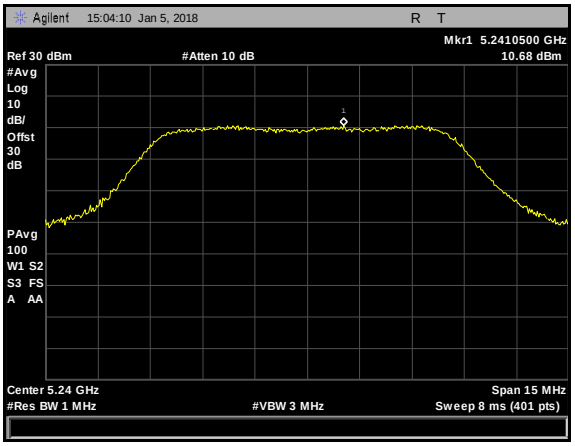
Plot 67. Power Spectral Density, 10 MHz, 5210 MHz, Channel 42, H, 24



Plot 68. Power Spectral Density, 10 MHz, 5210 MHz, Channel 42, I, 24

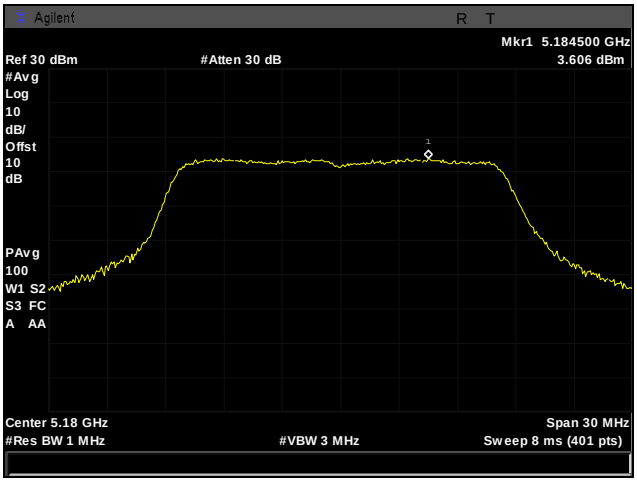


Plot 69. Power Spectral Density, 10 MHz, 5240 MHz, Channel 48, H, 24

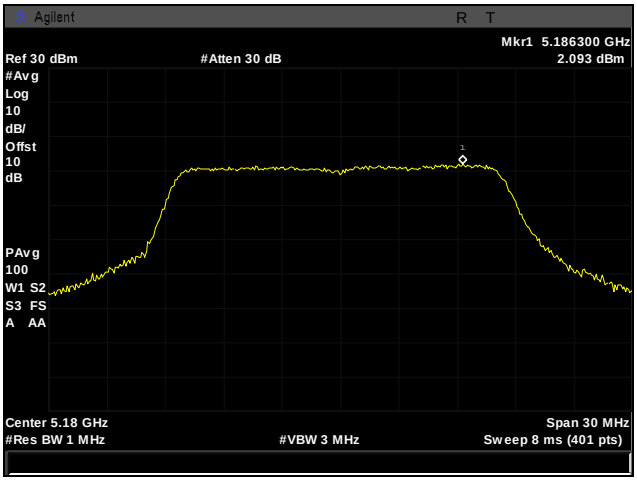


Plot 70. Power Spectral Density, 10 MHz, 5240 MHz, Channel 48, I, 24

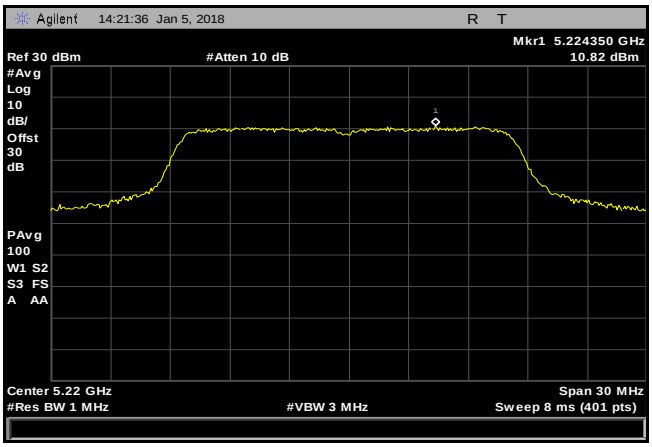
Power Spectral Density, 20 MHz



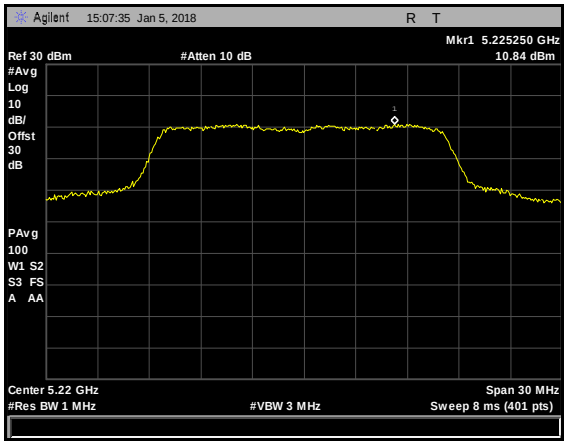
Plot 71. Power Spectral Density, 20 MHz, 5180 MHz, Channel 36, H, 20



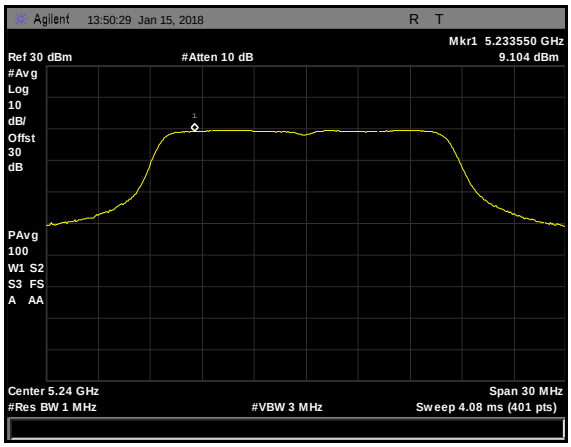
Plot 72. Power Spectral Density, 20 MHz, 5180 MHz, Channel 36, I, 20



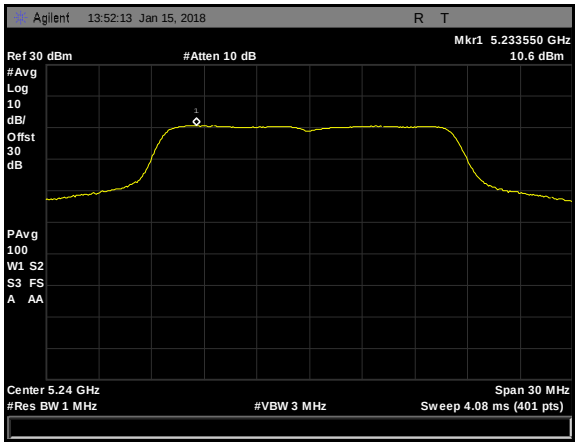
Plot 73. Power Spectral Density, 20 MHz, 5220 MHz, Channel 44, H, 28



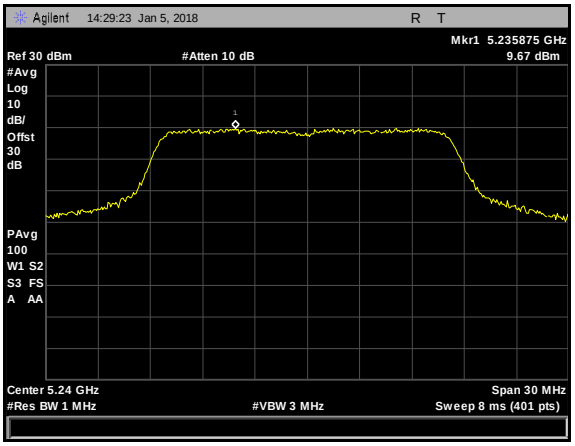
Plot 74. Power Spectral Density, 20 MHz, 5220 MHz, Channel 44, I, 28



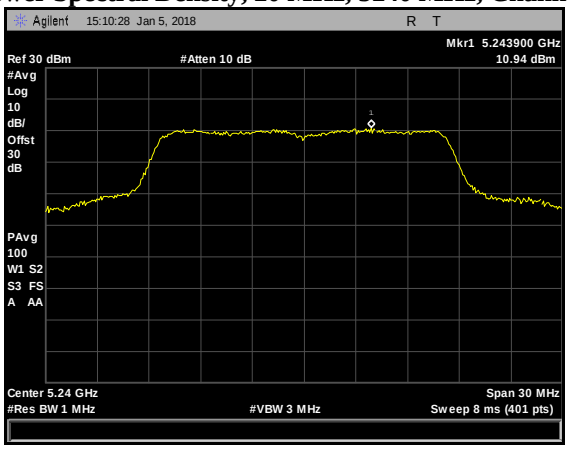
Plot 75. Power Spectral Density, 20 MHz, 5240 MHz, Channel 48, H, 26



Plot 76. Power Spectral Density, 20 MHz, 5240 MHz, Channel 48, I, 26

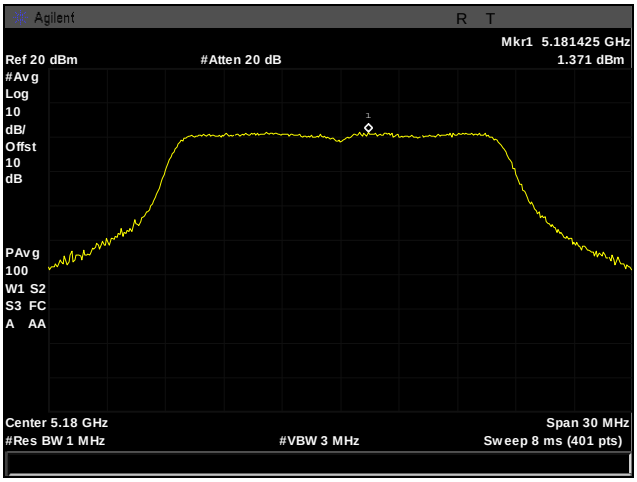


Plot 77. Power Spectral Density, 20 MHz, 5240 MHz, Channel 48, H, 28

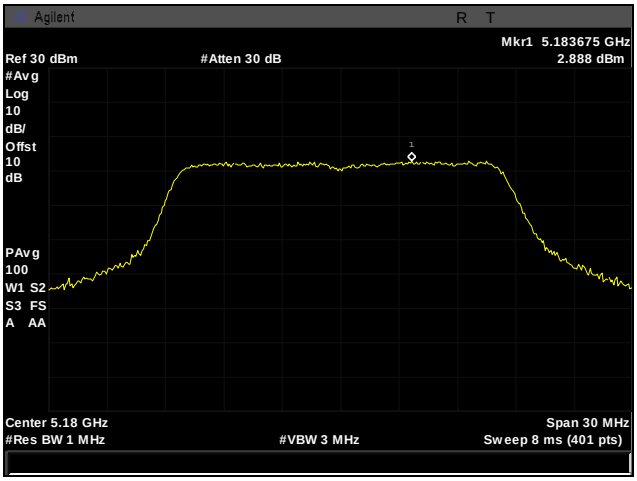


Plot 78. Power Spectral Density, 20 MHz, 5240 MHz, Channel 48, I, 28

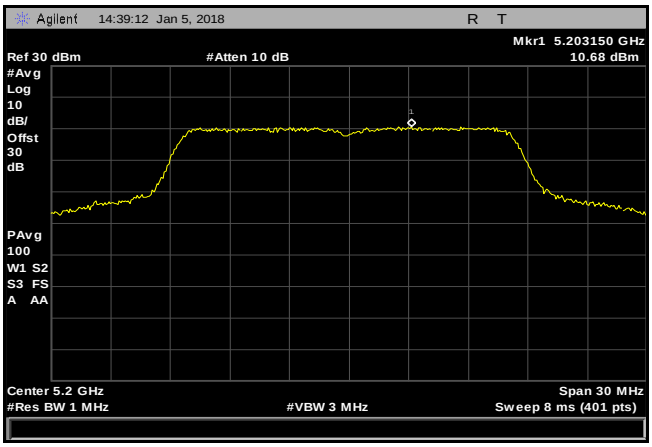
Power Spectral Density, 802.11n 20 MHz



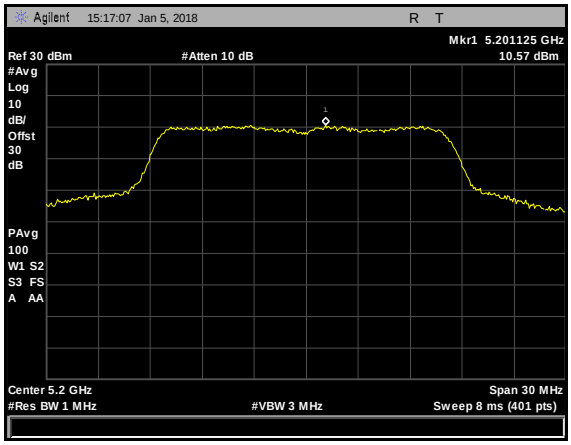
Plot 79. Power Spectral Density, 802.11n 20 MHz, 5180 MHz, Channel 36, H, 21



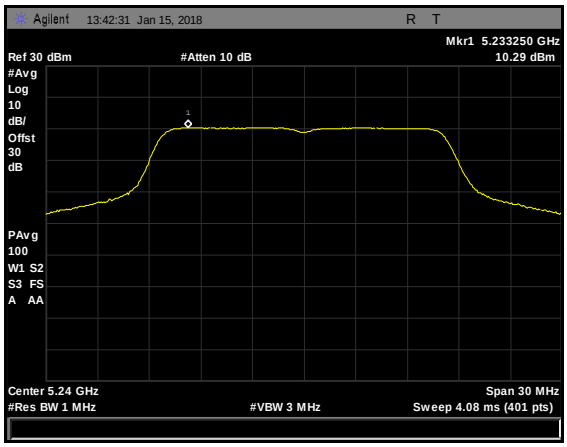
Plot 80. Power Spectral Density, 802.11n 20 MHz, 5180 MHz, Channel 36, I, 21



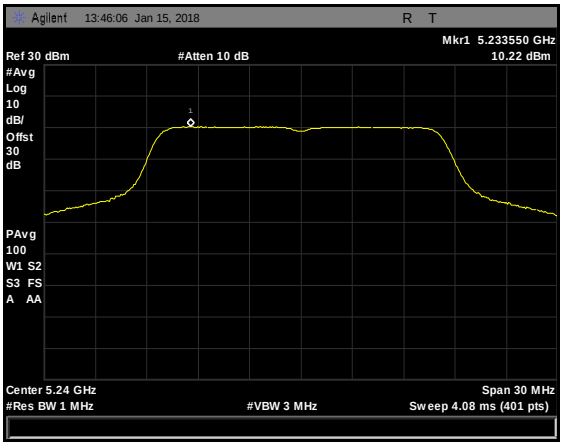
Plot 81. Power Spectral Density, 802.11n 20 MHz, 5200 MHz, Channel 40, H, 27



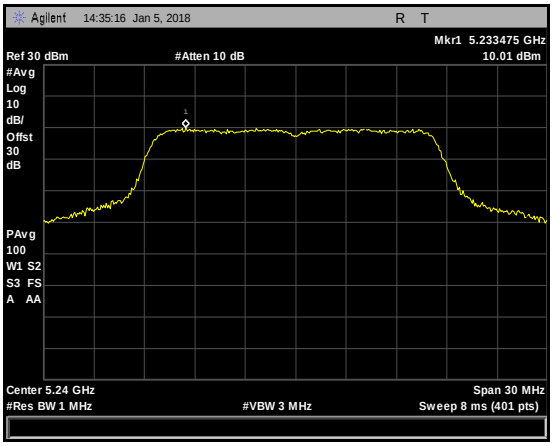
Plot 82. Power Spectral Density, 802.11n 20 MHz, 5200 MHz, Channel 40 I, 27



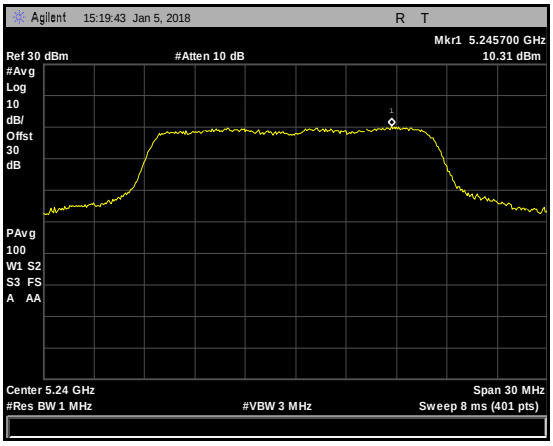
Plot 83. Power Spectral Density, 802.11n 20 MHz, 5240 MHz, Channel 48, H, 26



Plot 84. Power Spectral Density, 802.11n 20 MHz, 5240 MHz, Channel 48, I, 26

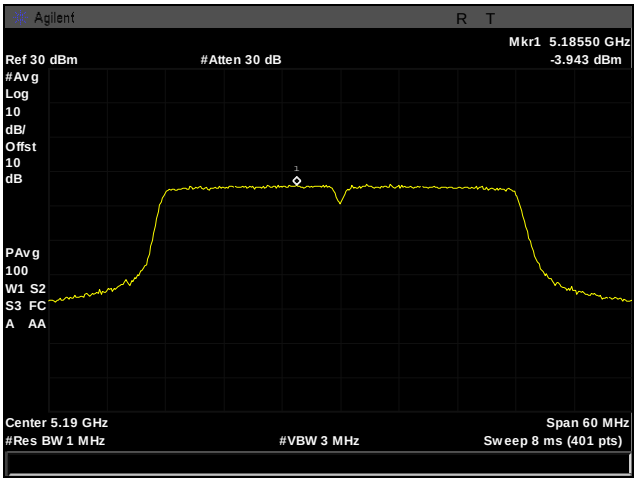


Plot 85. Power Spectral Density, 802.11n 20 MHz, 5240 MHz, Channel 48, H, 27

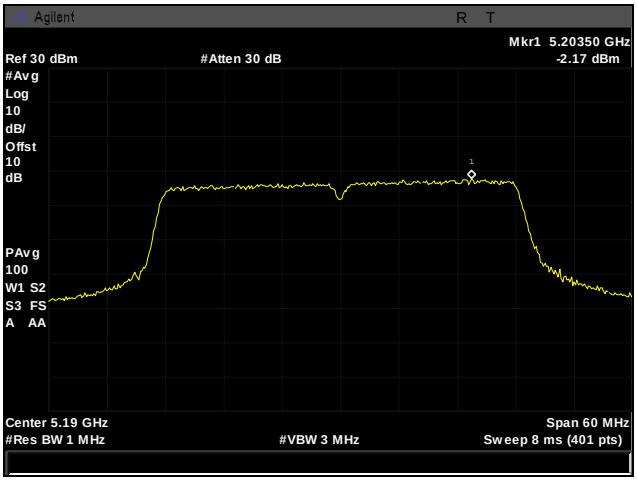


Plot 86. Power Spectral Density, 802.11n 20 MHz, 5240 MHz, Channel 48, I, 27

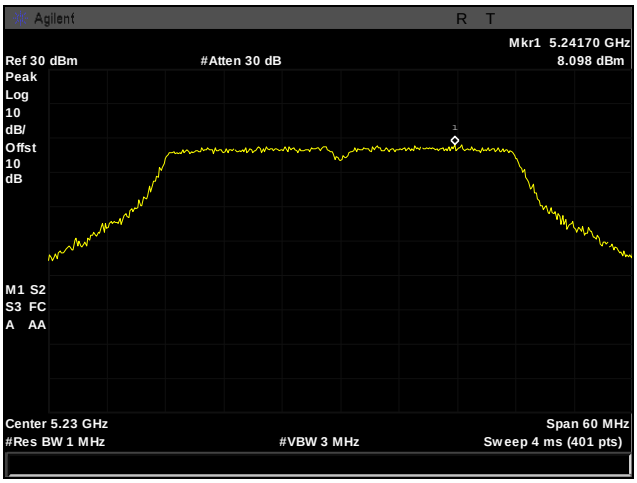
Power Spectral Density, 802.11n 40 MHz



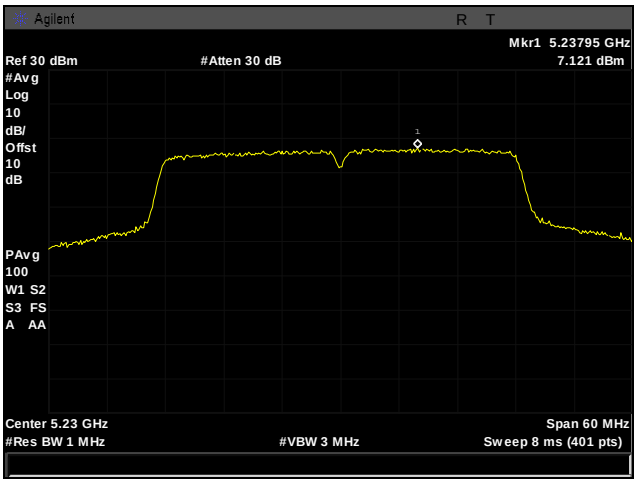
Plot 87. Power Spectral Density, 802.11n 40 MHz, 5190 MHz, Channel 36, H, 16



Plot 88. Power Spectral Density, 802.11n 40 MHz, 5190 MHz, Channel 36, I, 16



Plot 89. Power Spectral Density, 802.11n 40 MHz, 5230 MHz, Channel 48, H, 26



Plot 90. Power Spectral Density, 802.11n 40 MHz, 5230 MHz, Channel 48 I, 26

Electromagnetic Compatibility Criteria for Intentional Radiators

§15.407(b)(1) & (6 – 7) Undesirable Emissions

Test Requirements:

§ 15.407(b)(1): 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 EIRP 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 EUT was placed on a non-conducting stand on a turntable in a chamber. To find the maximum emission the EUT was set to transmit on low, mid, and high channels. Additionally, the turntable was rotated 360 degrees, the EUT was oriented through its three orthogonal axes, and the receive antenna height was varied in order to maximize emissions.

For frequencies from 30 MHz to 1 GHz, measurements were first made using a peak detector with a 100 kHz resolution bandwidth. Emissions which exceeded the limits were re-measured using a quasi-peak detector with a 120 kHz resolution bandwidth.

Above 1 GHz, measurements were made pursuant the method described in FCC KDB 789033 D02 General UNII Test Procedure New Rules v01. The equation, **EIRP= E + 20 log D – 104.8** was used to convert field strength to EIRP (**E** = field strength (dBµV/m) and **D** = Reference measurement distance**).**

For emissions above 1 GHz and in restricted bands, measurements of the field strength were made with a peak detector and an average detector and compared with the limits of 15.209.

As an alternative, according to FCC KDB 789033 D02 General UNII Test Procedure New Rules v01, all emissions above 1 GHz that comply with the peak and average limits of 15.209 satisfy the requirements of unwanted emissions in 15.407.

Test Results:

For below 1 GHz, the EUT was compliant with the requirements of this section.
Support equipment for this EUT was modified for the Radiated Emissions test under 1 GHz The support equipment for the EUT was modified after initial radiated tests. Ferrites were added to the POE cable. The EUT, formerly attached via a ribbon cable, was instead placed directly inside of the host with the lid removed. No modifications were made to the EUT itself.

For above 1 GHz, the EUT was compliant with the requirements of this section.

Test Engineer(s): Bradley Jones

Test Date(s): 10/16/17 and 12/14/17

