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TEST REPORT

Report Number: 104799910MPK-004
Project Number: G104799910
Original Issue Date: November 12, 2021
Revision Date: February 7, 2022

Testing performed on the
Minibadge
Model Number: C1000

FCC ID: QGZC1000
IC: 4362A-C1000

to
FCC Part 15 Subpart E (15.407)
ISED RSS-247, Issue 2

For

Vocera Communications, Inc.

Test Performed by:	Test Authorized by:
Intertek	Vocera Communications, Inc.
1365 Adams Court	525 Race St, Ste 150
Menlo Park, CA 94025 USA	San Jose, CA 95126 USA

Prepared by: _____ **Date:** February 7, 2022
Anderson Soungpanya

Reviewed by: _____ **Date:** February 7, 2022
Krishna K Vemuri

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Report No. 104799910MPK-004	
Equipment Under Test:	Minibadge
Trade Name:	Vocera Communications, Inc.
Model Number:	C1000
Applicant:	Vocera Communications, Inc.
Contact:	Prakash Guda
Address:	Vocera Communications, Inc. 525 Race St, Ste 150 San Jose, CA 95126
Country:	USA
Tel. Number:	(408) 882-5100
Email:	Pguda@vocera.com
Applicable Regulation:	FCC Part 15, Subpart E (15.407) ISED RSS-247, Issue 2
Date of Test:	October 06 – 28, 2021

We attest to the accuracy of this report:

Anderson Soungpanya
Senior Project Engineer

Krishna K Vemuri
EMC Manager

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1.0 Introduction

1.1 Summary of Tests

Test	Reference FCC	Reference RSS-247	Result
26 dB Emission Band width and 99% Occupied Bandwidth	15.407(a)(1)(2)(3)	RSS-247, 6.2.1	Complies
Conducted Output Power	15.407(a)(1)(2)(3)	RSS-247, 6.2.1	Complies
Peak Power Spectral Density	15.407(a)(1)(2)(3)	RSS-247, 6.2.1	Complies
Undesirable Emissions	15.407(b)(1-8)	RSS-247, 6.2.1	Complies
Transmitter Radiated Emissions	15.407(b)(1-8) 15.209, 15.205	RSS-247, 6.2.1	Complies
Dynamic Frequency Selection & Transmit Power Control	15.407 (h)(1)(2)	RSS-247, 6.3	Complies
AC Line Conducted Emission	15.207	RSS-GEN	Complies
Frequency stability	15.407(g)	RSS-Gen	Complies*
Antenna Requirement	15.203	RSS-Gen	Complies. The EUT uses internal antenna.

*Manufacturers of U-NII devices are responsible for ensuring frequency stability.

EUT receive date: October 04, 2021

EUT receive condition: The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.

Test start date: October 06, 2021

Test completion date: October 28, 2021

The test results in this report pertain only to the item tested.

2.0 General Description

2.1 Product Description

Vocera Communications, Inc. supplied the following description of the EUT:

A small, lightweight, wearable communication device designed to simplify hospital communication and workflow and improve staff safety. A user can "wake up" and operate the device using only their voice, to stay connected even under restrictive PPE. They can make and receive calls; listen and respond to messages and alarm notifications. Visual indicators enable fast triaging of events. A dedicated panic button provides a direct connection to security personnel. The device can be used as a smartphone companion, or by itself.

For more information, see user's manual provided by the manufacturer.

This test report covers only the 5GHz WiFi radio.

The information about the 5GHz radio, installed in the model C1000, is presented below.

Radio Information	
Applicant	Vocera Communications, Inc.
Model Number	C1000
FCC Identifier	QGZC1000
IC Identifier	4362A-C1000
Modulation Technique	OFDM
Rated RF Output	17.29 dBm
Frequency Range	U-NII 1: 5150 – 5250 MHz U-NII 2a: 5250 – 5350 MHz U-NII 2c: 5470 – 5725 MHz (5600-5650 is excluded for RSS-247) U-NII 3: 5725 – 5850 MHz
Type of modulation	OFDM
Number of Channel(s)	25 for 802.11a/n/ac 20 MHz 12 for 802.11n/ac 40MHz 6 for 802.11ac 80MHz
Antenna(s) & Gain	Internal Antenna, Gain: 2.47 dBi
Applicant Name & Address	Vocera Communications Inc. 525 Race St, Ste 150 San Jose, CA 95126 USA

The EUT supports a wide range of data rates in 5GHz band:
IEEE 802.11a: 6 to 54mbps
IEEE 802.11n/ac 20MHz BW: MCS0 to MCS8
IEEE 802.11n/ac 40 & 80MHz BW: MCS0 to MCS9.

2.2 Related Submittal(s) Grants

None.

2.3 Test Methodology

Antenna conducted measurements were performed according to the FCC documents "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E" (789033 D02 General U-NII Test Procedures New Rules v02r01).

Radiated emissions measurements were performed according to the procedures in ANSI C63.10: 2013. Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Data Sheet"** of this Application.

All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The test site used to collect the radiated data is site 1 (10-m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC, IC and A2LA accredited.

2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn't take into account the measurement uncertainty.

Estimated Measurement Uncertainty

Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 1 GHz	1 GHz – 6 GHz	> 6 GHz
RF Power and Power Density – antenna conducted	1.1 dB	1.5 dB	–
Unwanted emissions - antenna conducted	1.2 dB	1.7 dB	2.0 dB
Bandwidth – antenna conducted	50 Hz	100 Hz	–
Radiated emissions	4.2 dB	5.4 dB	
AC mains conducted emissions	2.4 dB	-	-

3.0 System Test Configuration

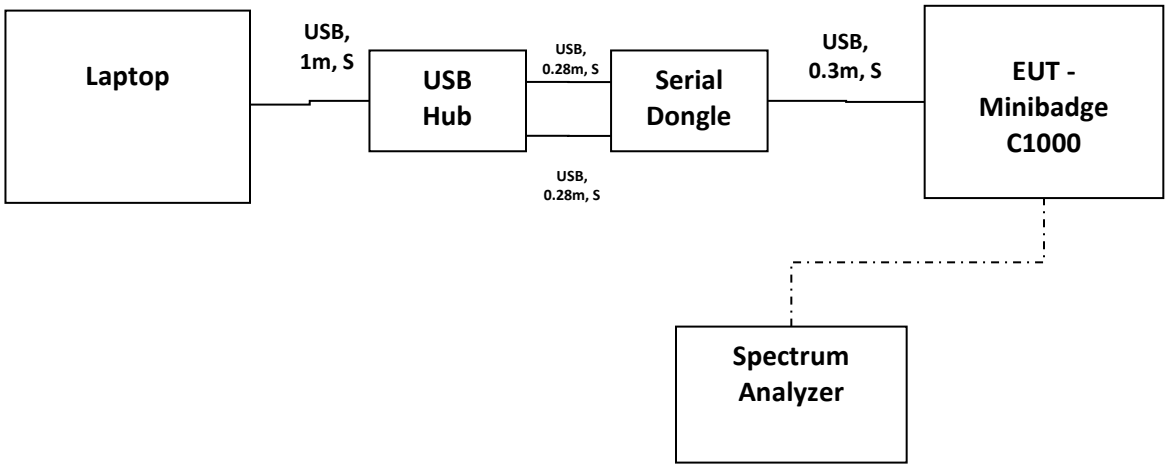
3.1 Support Equipment

Support Equipment		
Description	**Manufacturer**	**Model**
Laptop	Lenovo	T440P
USB Hub	Tendak	CP-029-BK
Serial Dongle	Vocera	210-01516-B04

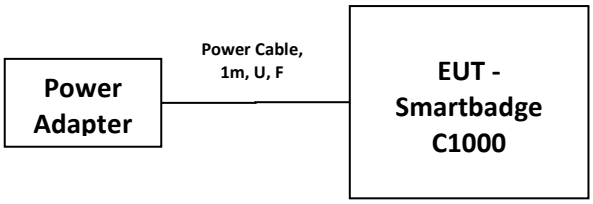
3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	**Manufacturer**	**Model**	**Serial Number/ID**
Minibadge – Conducted Unit	Vocera Communications, Inc.	C1000	AA3301J26008A6
Minibadge – Radiated Unit	Vocera Communications, Inc.	C1000	AA3301J2600878
Power Adapter	Vocera	WB-10E05R	D0714N55000843
Wired Headset	Vocera	V5000 Headset	230-02162

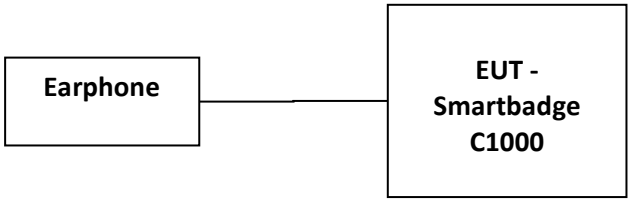
Antenna was removed and co-axial connector was installed for Conducted Measurements.



Radiated Measurements
Charging Mode



Radiated Measurements
Normal Mode



S = Shielded **U** = Unshielded	**F** = With Ferrite **M** = Meter

3.3 Justification

Preliminary testing was performed for all modulation/data rate modes. The worse-case data rate with highest power and widest spectrum were selected for final measurements:

OFDM, 6Mbps – for 802.11a
OFDM, MCS0 – for 802.11n/ac 20, 40 MHz BW & 802.11ac 80 MHz BW

Radiated band edge and Output Power tests were tested at reduced power (see below table). All other measurements were tested with the worst-case power setting.

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT was configured to continuously transmit. Different orientation of the EUT were tested and only the worse-case emissions were reported.

The EUT was tested in 2 configurations:

A/ Charging mode: tested with power adapter
B/ Normal mode: tested in battery mode and earphone.

3.4 Mode of Operation During Test

During transmitter testing, the transmitter was setup to transmit continuously using the maximum RF power setting provided by the manufacturers via test scripts. The corresponding output power in dBm can be found in section 4.2 of this report.

The table below reflects the RF power setting needed to be compliant with radiated restricted band edge requirements of 15.205 & 15.209.

802.11a		
Freq. MHz	Channel	GUI
5180	36	14
5200	40	16
5240	48	16
5260	52	16
5300	60	16
5320	64	16
5500	100	15
5580	116	16
5700	140	14
5720	144	16
5745	149	16
5785	157	16
5825	165	16

802.11n/ac 20MHz		
Freq. MHz	Channel	GUI
5180	36	15
5200	40	16
5240	48	16
5260	52	16
5300	60	16
5320	64	16
5500	100	16
5580	116	16
5700	140	14
5720	144	16
5745	149	16
5785	157	16
5825	165	16

802.11n/ac 40MHz		
Freq. MHz	Channel	GUI
5190	38	13
5230	46	16
5270	54	16
5310	62	14
5510	102	16
5550	110	16
5670	134	16
5710	142	16
5755	151	16
5795	159	16

802.11ac 80MHz		
Freq. MHz	Channel	GUI
5210	42	11
5290	58	12
5530	106	13
5610	122	14
5690	138	14
5775	155	14

3.5 Modifications required for Compliance

Intertek installed no modifications during compliance testing in order to bring the product into compliance.

3.6 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 Emission Bandwidth and 99% Occupied Bandwidth

15.407(a)(1)(2)(e)

4.1.1 Requirement

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500kHz.

4.1.2 Procedure

The Procedure, described in the FCC Publication 789033 D02 General U-NII Test Procedures New Rules v02r01, was used. Specifically, Section C.1 for Emission Bandwidth and Minimum Emission Bandwidth for measuring the Emission Bandwidth (EBW). Section C.2 was utilized for measuring the 6dB Bandwidth in the band 5.725-5.850 GHz. Section D was used for 99% Occupied Bandwidth.

The antenna port of the EUT was connected to the input of a spectrum analyzer (SA). For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier.

The Occupied bandwidth was measured using the build-in spectrum analyzer facility for 99% power bandwidth measurement.

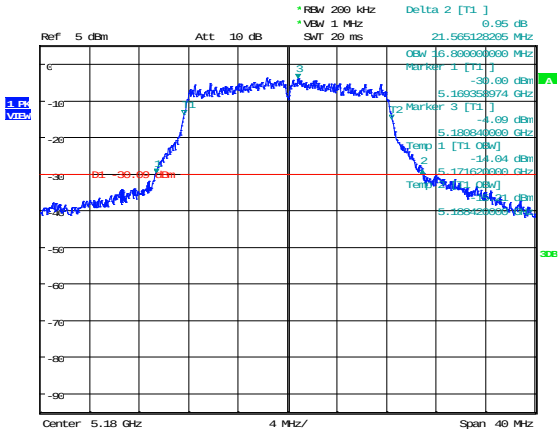
4.1.3 Test Result

Refer to the following plots for the test result:

Mode	Channel	Frequency MHz	26-dB Bandwidth, MHz	Occupied Bandwidth, MHz
802.11a	36	5180	21.57	16.80
	40	5200	21.62	16.78
	48	5240	21.60	16.80
	52	5260	21.54	16.82
	60	5300	21.47	16.82
	64	5320	21.60	16.82
	100	5500	21.67	16.80
	116	5580	21.73	16.84
	140	5700	21.60	16.82
	144	5720	21.73	16.86
	149	5745	21.60	16.84
	157	5785	22.24	16.82
	165	5825	22.31	16.88
802.11n/ac 20MHz BW	36	5180	21.82	17.92
	40	5200	22.18	18.12
	48	5240	21.92	17.96
	52	5260	21.86	17.90
	60	5300	22.44	17.94
	64	5320	22.12	17.90
	100	5500	21.41	17.88
	116	5580	22.05	18.02
	140	5700	22.05	18.00
	144	5720	21.54	17.90
	149	5745	21.86	17.94
	157	5785	22.05	17.96
	165	5825	21.54	17.94
802.11n/ac 40MHz BW	38	5190	39.79	36.32
	46	5230	39.74	36.40
	54	5270	39.74	36.36
	62	5310	39.87	36.32
	102	5510	39.62	36.28
	110	5550	39.74	36.32
	134	5670	39.74	36.32
	142	5710	39.49	36.32
	151	5755	39.62	36.32
	159	5795	39.74	36.32
802.11ac 80MHz BW	42	5210	80.31	75.52
	58	5290	81.54	75.76
	106	5530	82.56	75.68
	122	5610	81.54	75.76
	138	5690	82.56	75.68
	155	5775	81.92	75.68

Mode	Channel	Frequency MHz	6 dB Bandwidth	Limit
			MHz	kHz
802.11a	144	5720	16.41	> 500
	149	5745	16.41	> 500
	157	5785	16.41	> 500
	165	5825	16.22	> 500
802.11n/ac 20MHz	144	5720	17.56	> 500
	149	5745	17.50	> 500
	157	5785	17.50	> 500
	165	5825	17.50	> 500
802.11n/ac 40MHz	142	5710	36.28	> 500
	151	5755	36.41	> 500
	159	5795	36.41	> 500
802.11ac 80MHz	138	5690	75.51	> 500
	155	5775	75.64	> 500

Emission and 99% Occupied Bandwidth 802.11a 5180MHz



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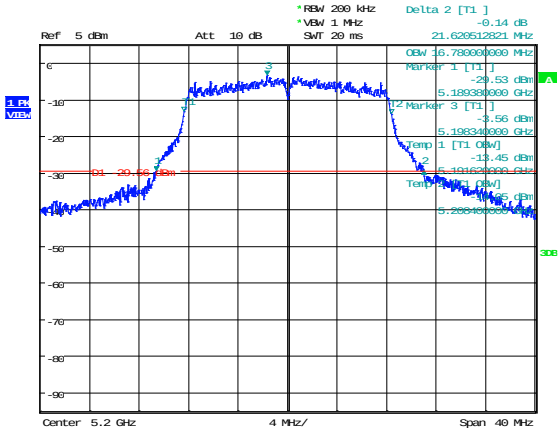
Emission and 99% Occupied Bandwidth 802.11a 5200MHz



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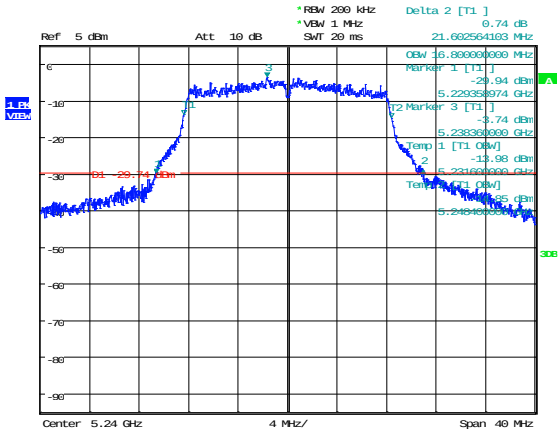

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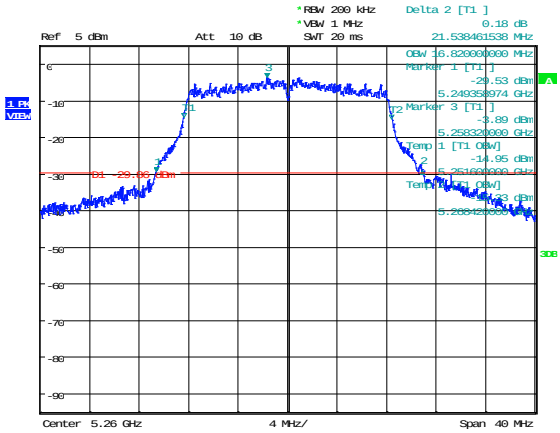
Emission and 99% Occupied Bandwidth 802.11a 5260MHz



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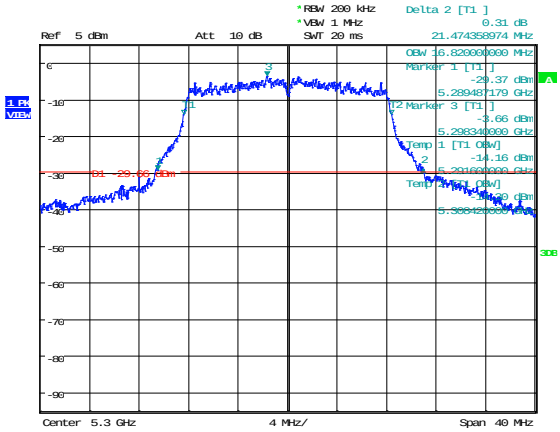
Emission and 99% Occupied Bandwidth 802.11a 5300MHz



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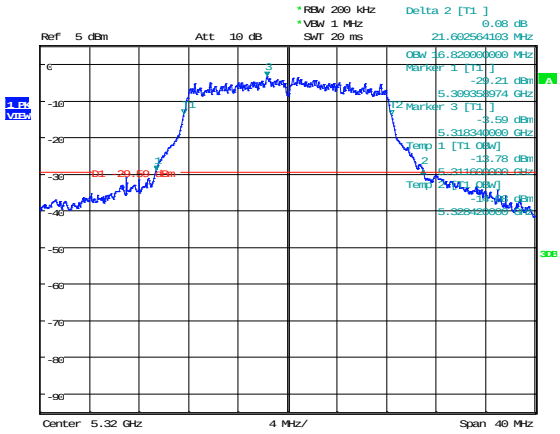
Emission and 99% Occupied Bandwidth 802.11a 5320MHz



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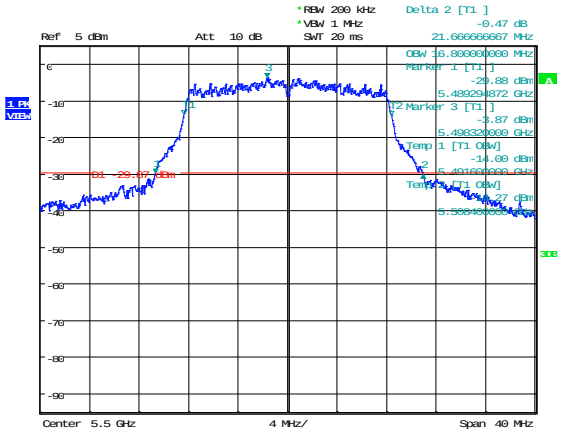
Emission and 99% Occupied Bandwidth 802.11a 5500MHz



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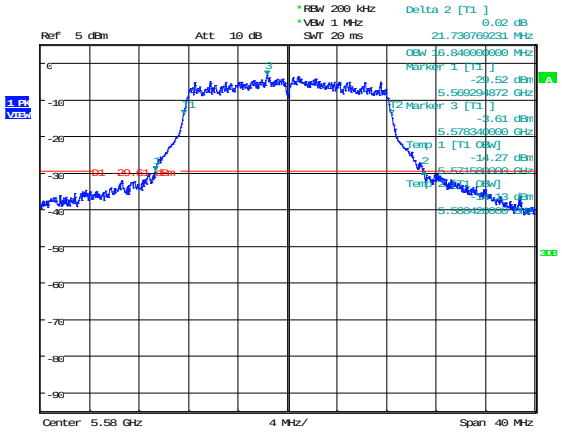
Emission and 99% Occupied Bandwidth 802.11a 5580MHz



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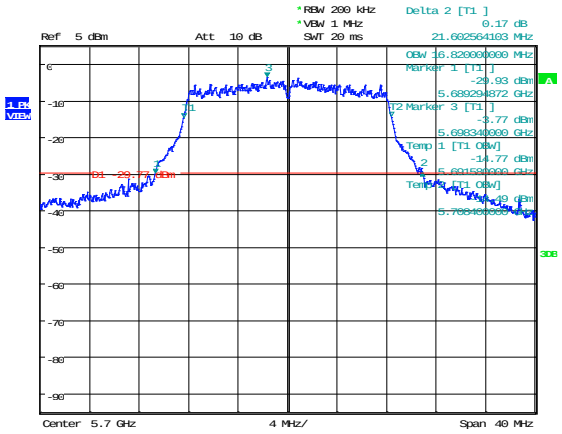
Emission and 99% Occupied Bandwidth 802.11a 5700MHz



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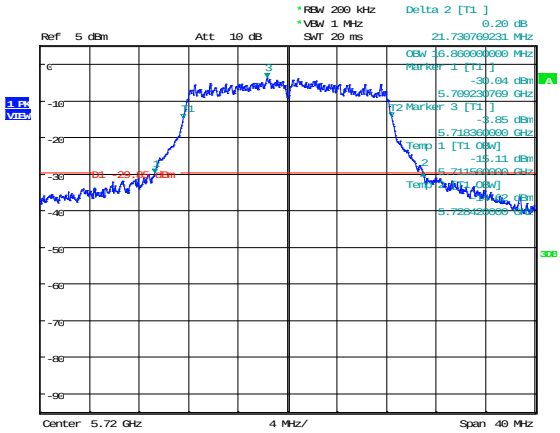
Emission and 99% Occupied Bandwidth 802.11a 5720MHz



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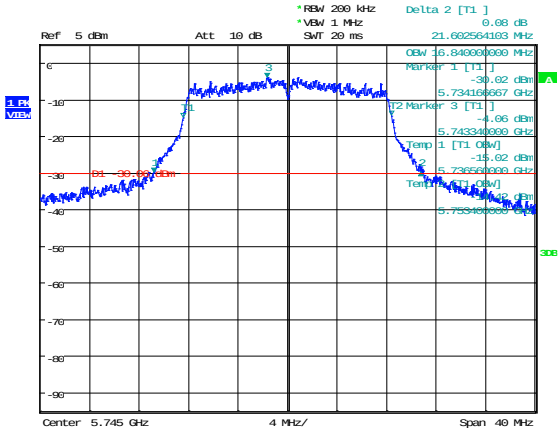
Emission and 99% Occupied Bandwidth 802.11a 5745MHz



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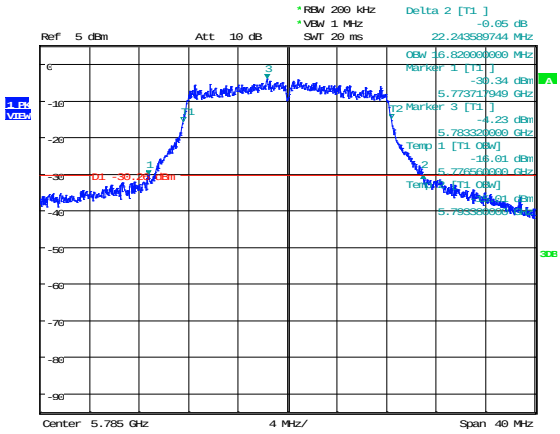
Emission and 99% Occupied Bandwidth 802.11a 5785MHz



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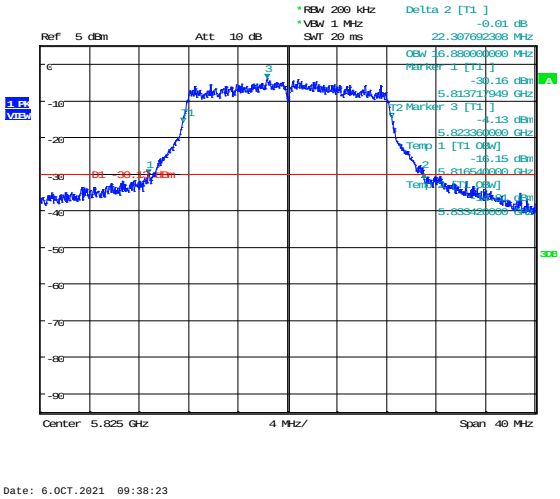
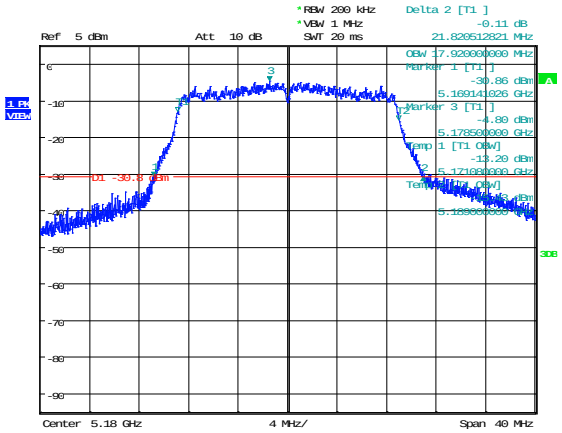
Emission and 99% Occupied Bandwidth 802.11a 5825MHz



Emission and 99% Occupied Bandwidth 802.11n/ac 5180MHz



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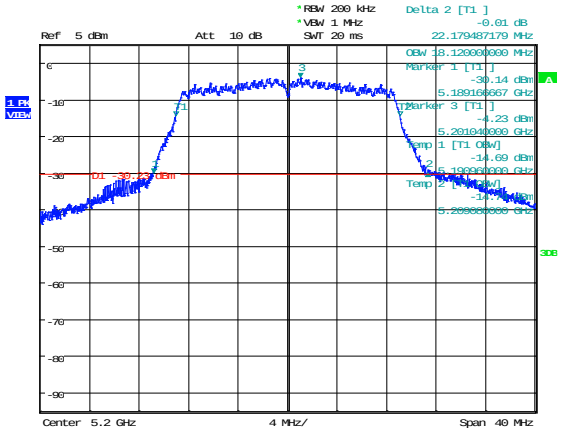
Emission and 99% Occupied Bandwidth 802.11n/ac 5200MHz



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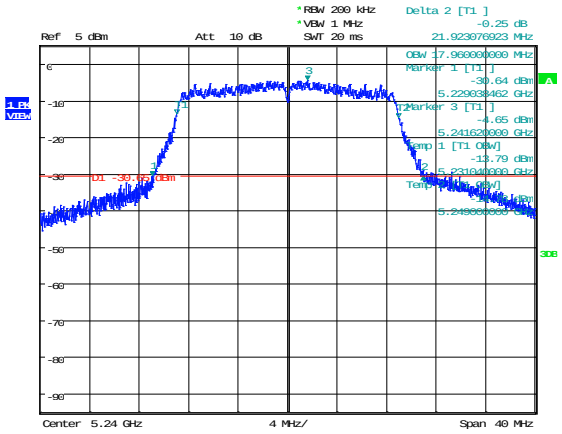
Emission and 99% Occupied Bandwidth 802.11n/ac 5240MHz



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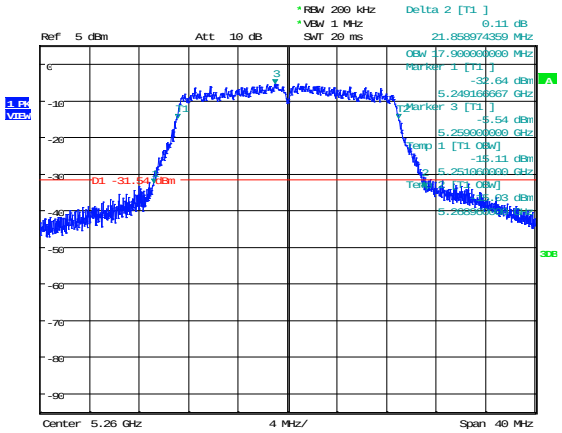
Emission and 99% Occupied Bandwidth 802.11n/ac 5260MHz



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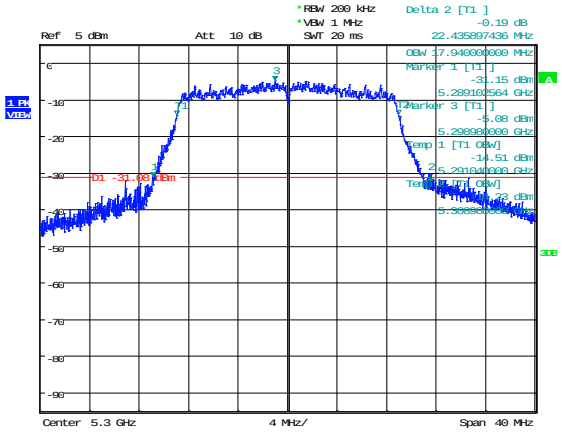
Emission and 99% Occupied Bandwidth 802.11n/ac 5300MHz



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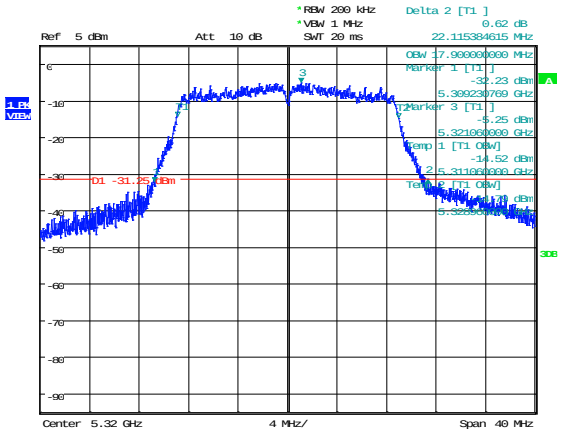
Emission and 99% Occupied Bandwidth 802.11n/ac 5320MHz



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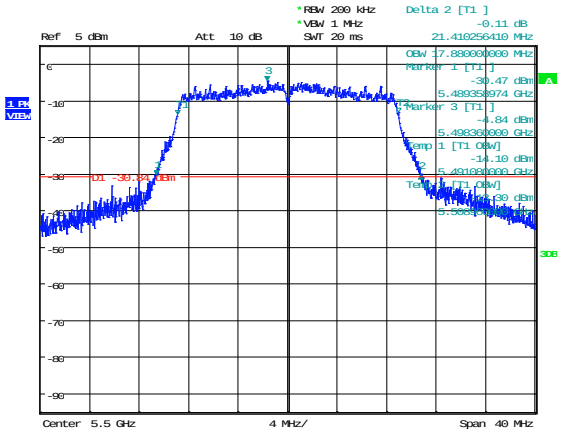

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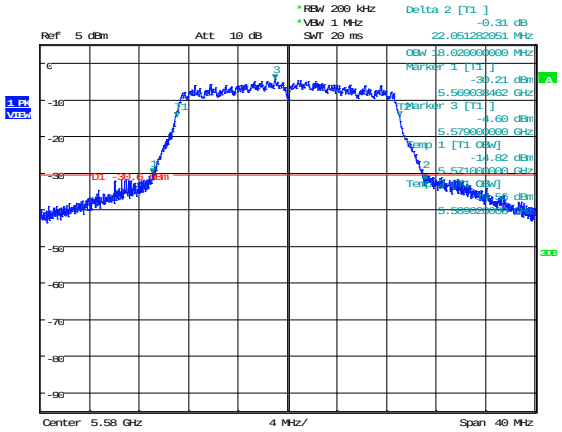

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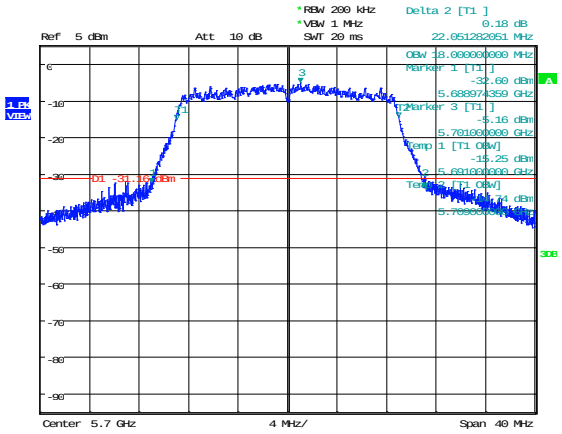

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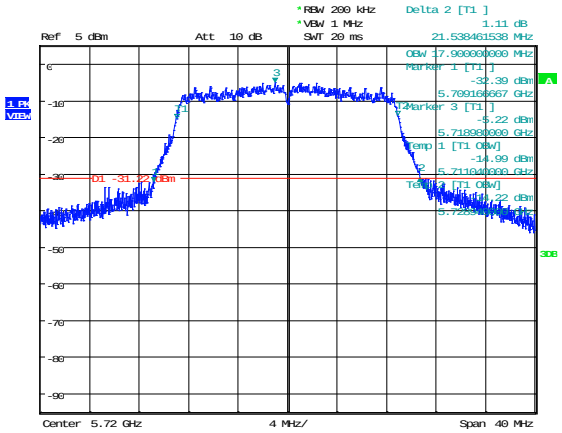
Emission and 99% Occupied Bandwidth 802.11n/ac 5720MHz



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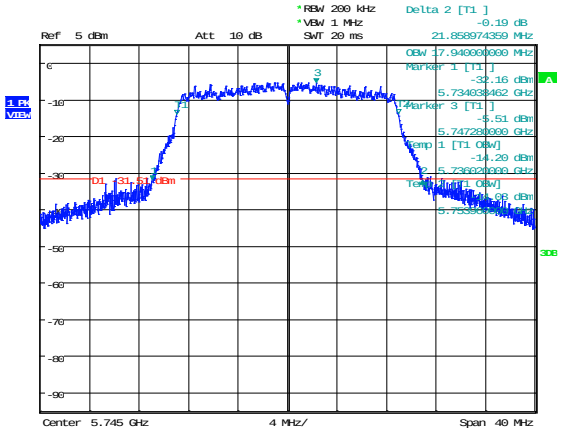

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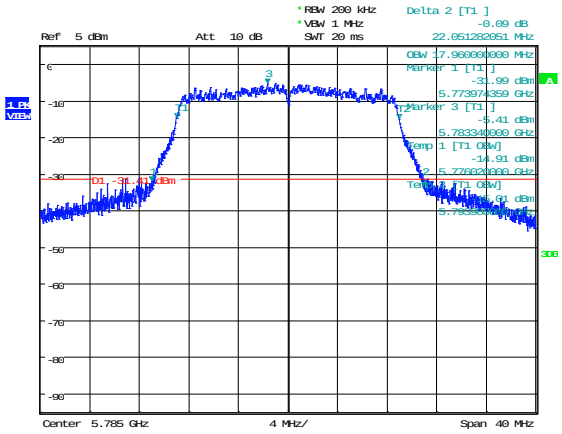

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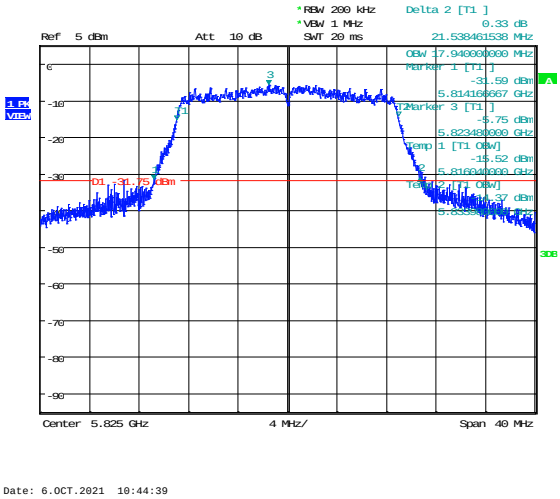
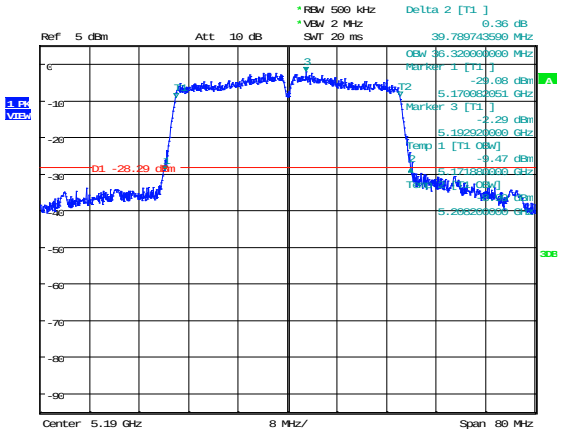


Emission and 99% Occupied Bandwidth 802.11n/ac 40MHz 5190MHz



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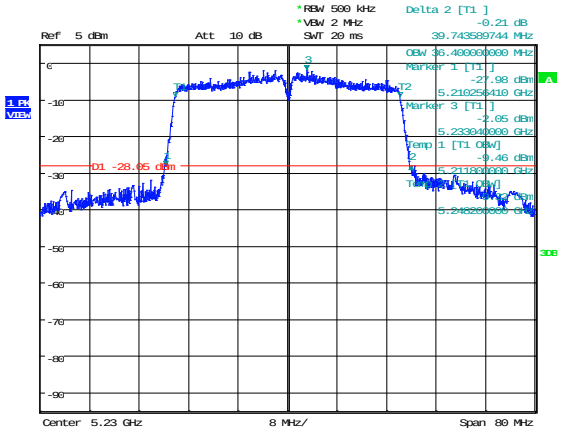

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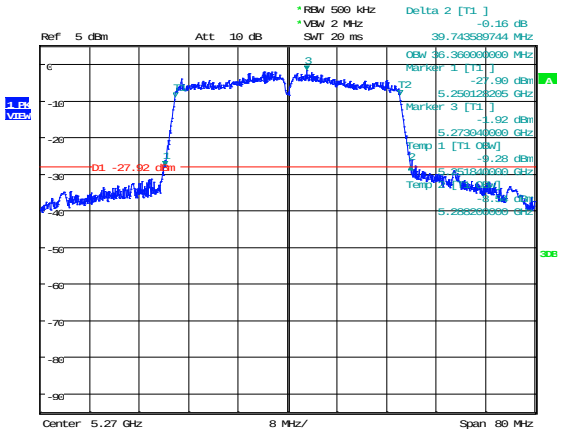

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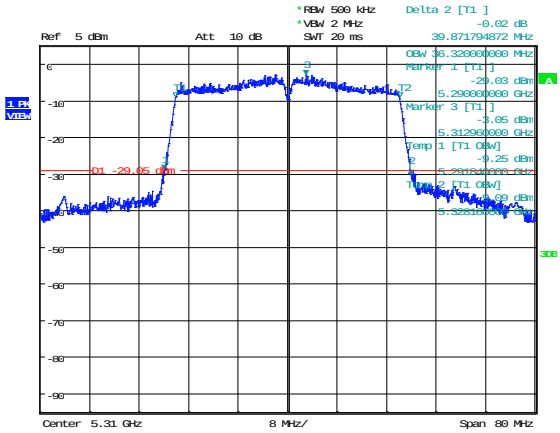
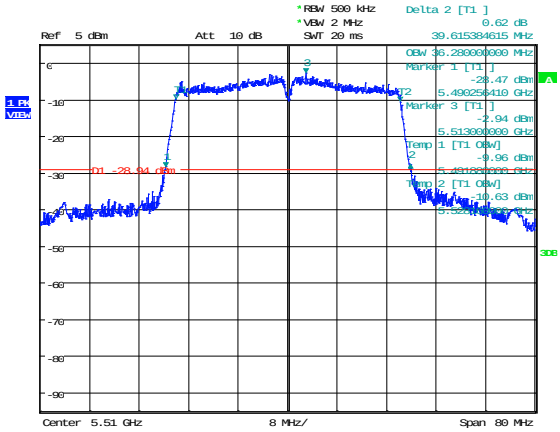


Date: 6.OCT.2021 11:04:25

Emission and 99% Occupied Bandwidth 802.11n/ac 40MHz 5510MHz



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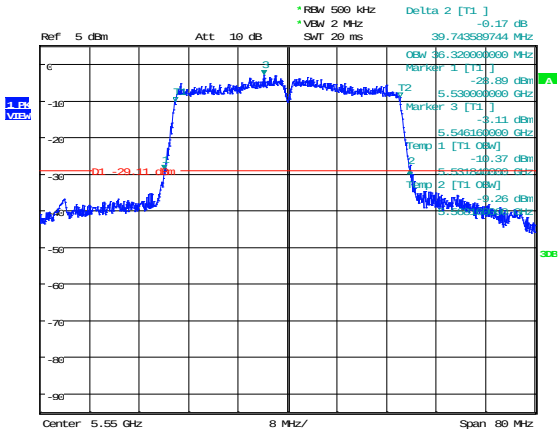

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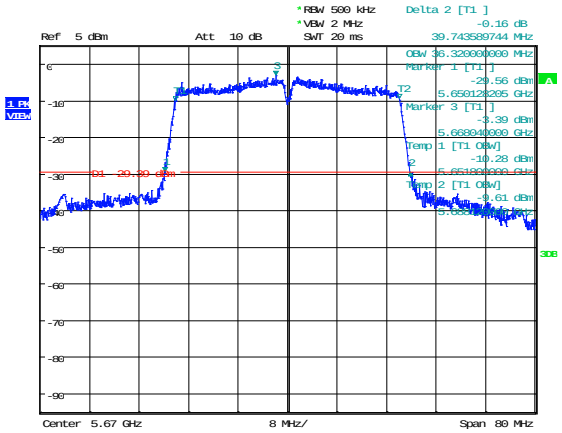
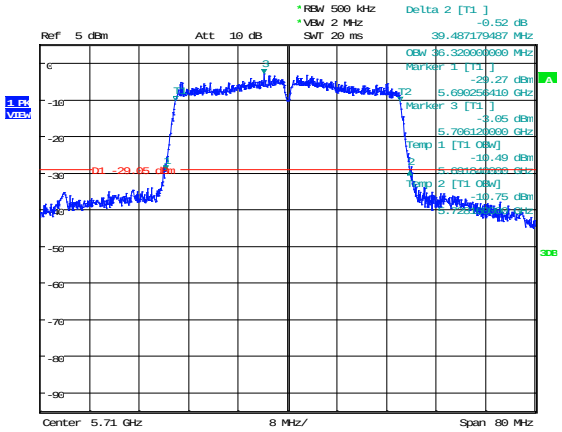


Date: 6.OCT.2021 11:22:48

Emission and 99% Occupied Bandwidth 802.11n/ac 40MHz 5710MHz



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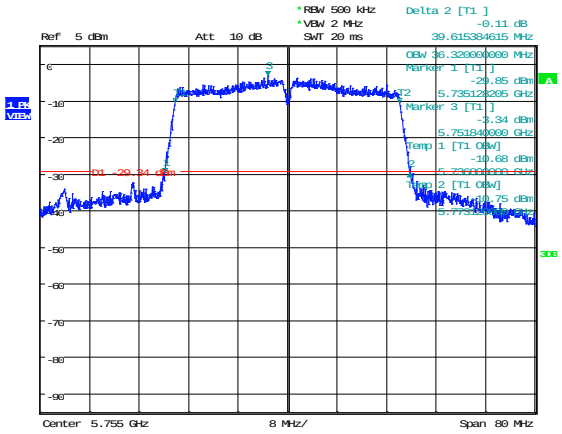

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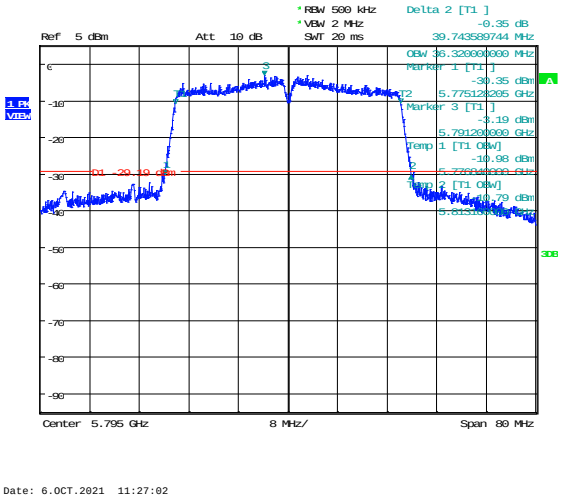
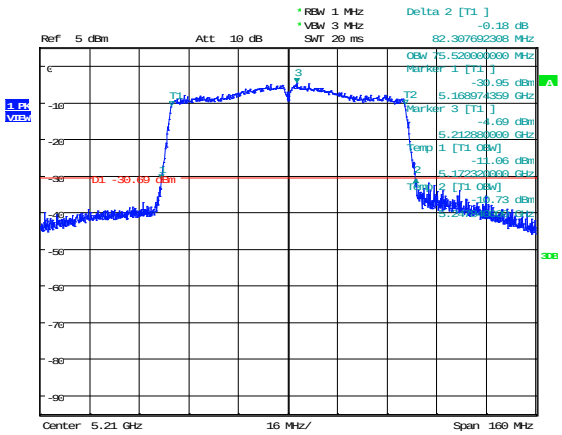


Emission and 99% Occupied Bandwidth 802.11n/ac 80MHz 5210 MHz



Date: 6.OCT.2021 11:40:33

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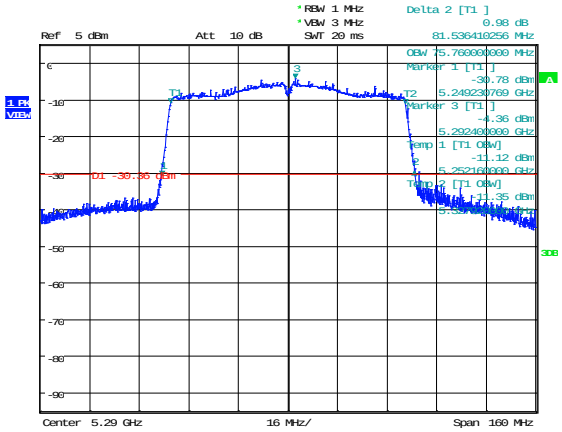

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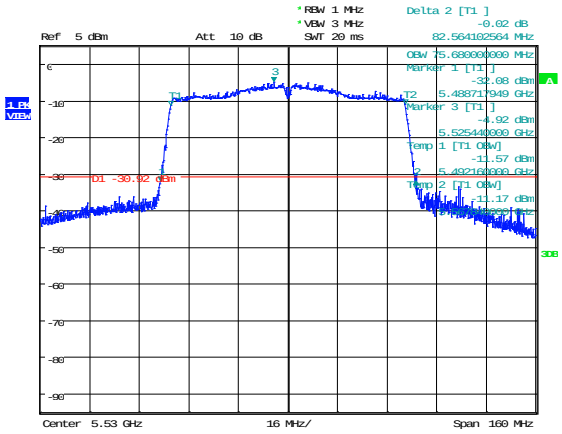

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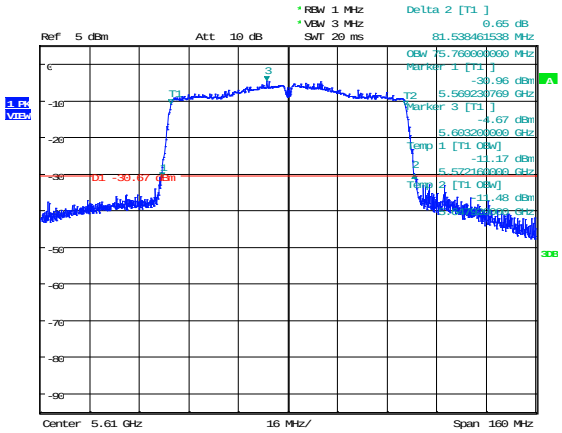
Emission and 99% Occupied Bandwidth 802.11n/ac 80MHz 5610 MHz



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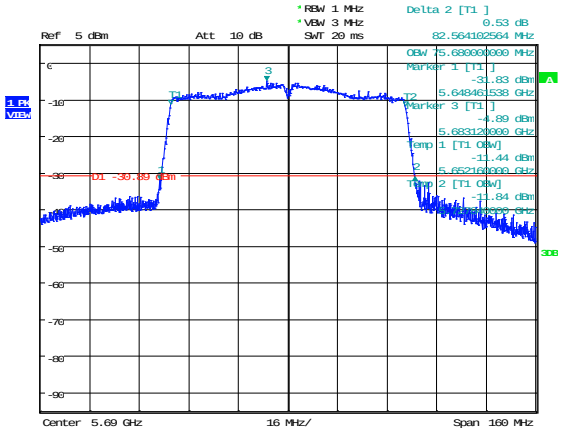

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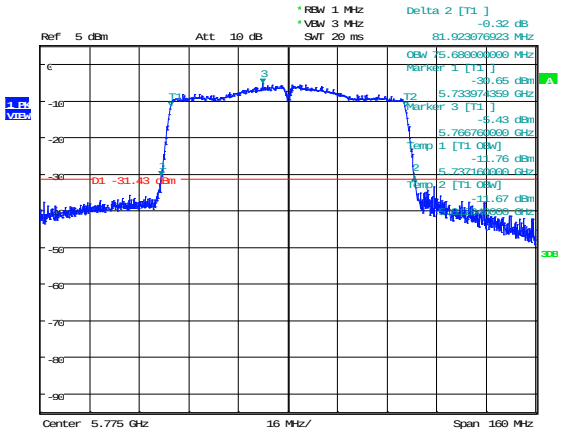

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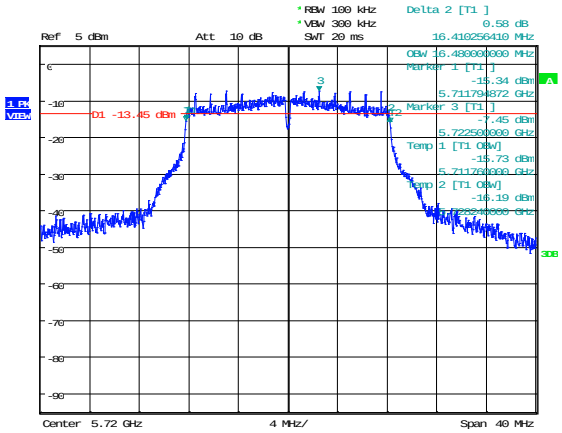
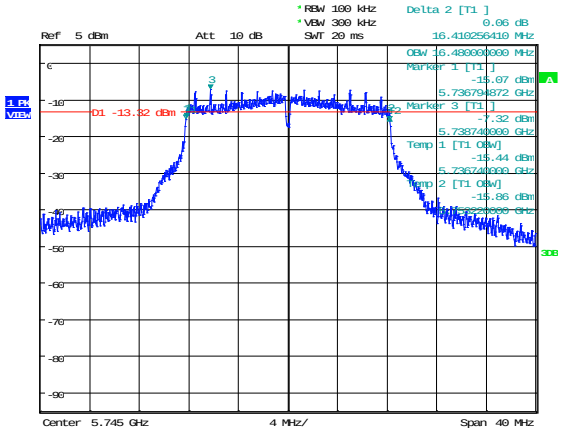
-6dB Occupied Bandwidth 802.11a 5720MHz



Date: 6.OCT.2021 11:49:34

-6dB Occupied Bandwidth 802.11a 5745MHz



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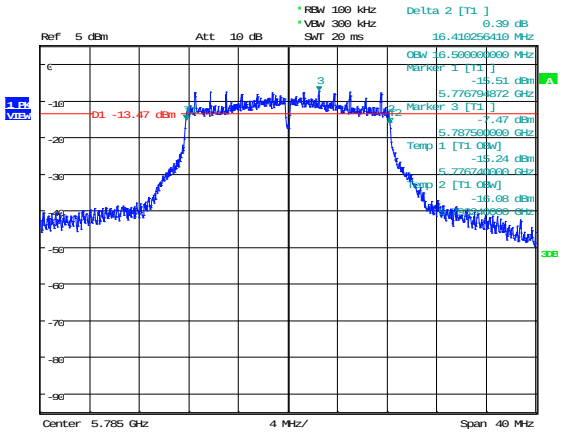
-6dB Occupied Bandwidth 802.11a 5785MHz



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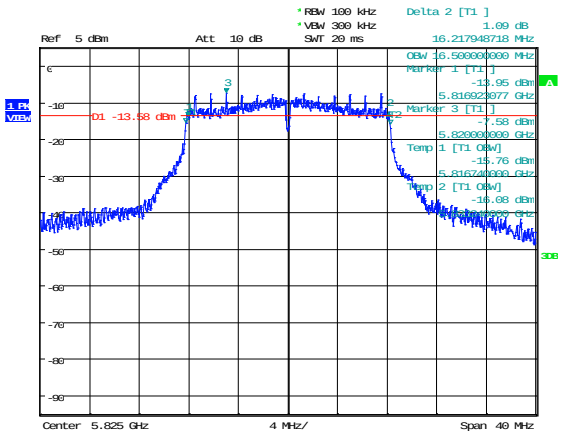
-6dB Occupied Bandwidth
802.11a 5825MHz



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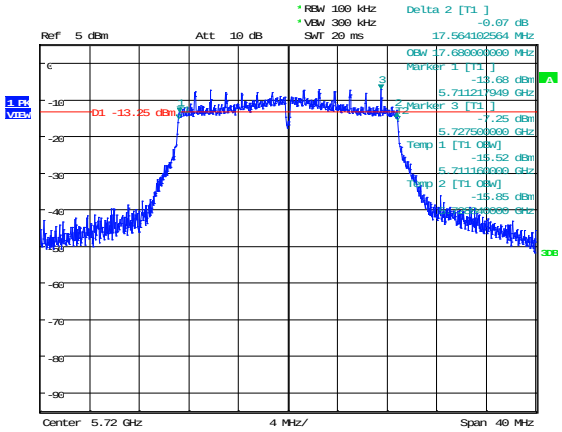
-6dB Occupied Bandwidth
802.11n/ac 5720MHz



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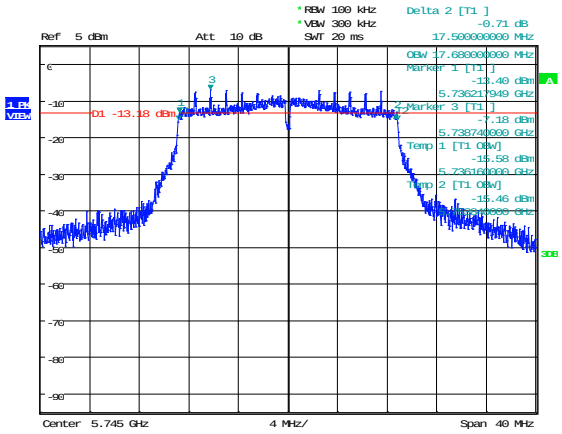
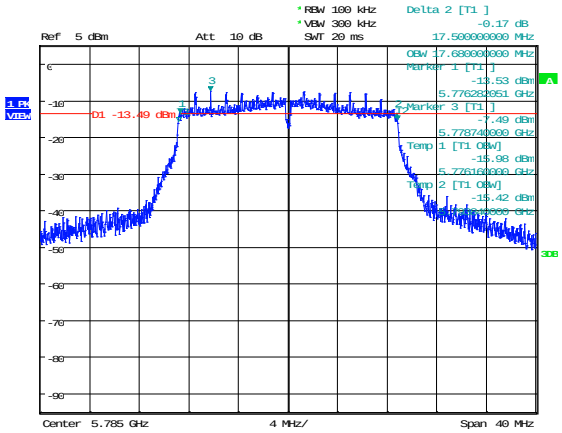
802.11n/ac 5745MHz



Date: 6.OCT.2021 11:57:25

-6dB Occupied Bandwidth
802.11n/ac 5785MHz



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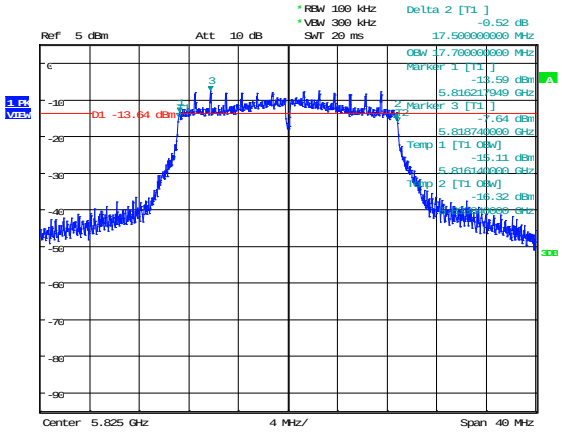
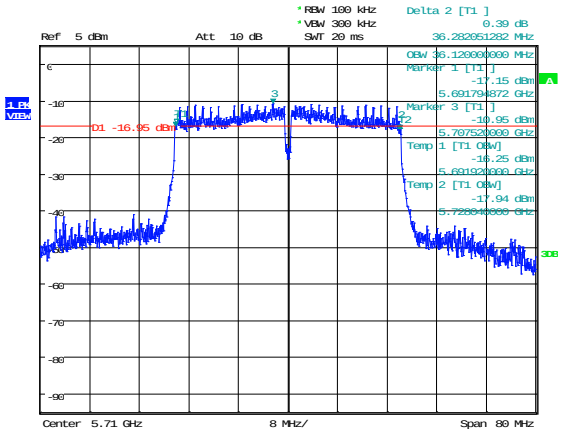
-6dB Occupied Bandwidth
802.11n/ac 5825MHz



Date: 6.OCT.2021 12:00:04

-6dB Occupied Bandwidth
802.11n/ac 40MHZ BW
5710MHz



Date: 6.OCT.2021 12:01:23

-6dB Occupied Bandwidth
802.11n/ac 40MHZ BW
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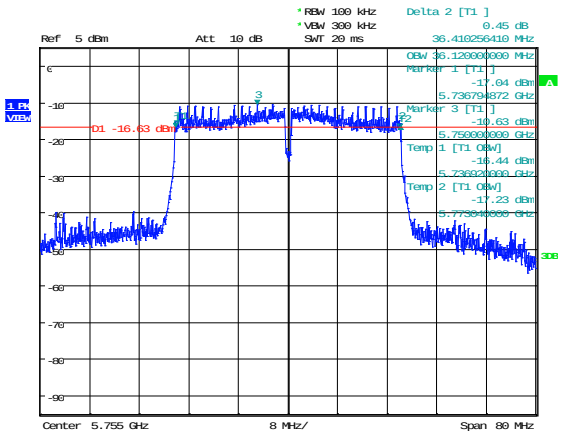

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-6dB Occupied Bandwidth
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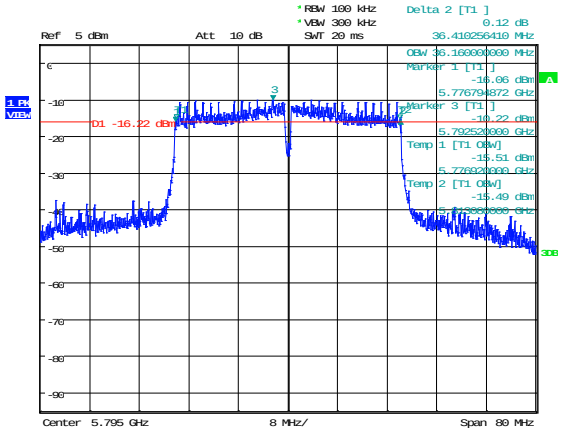
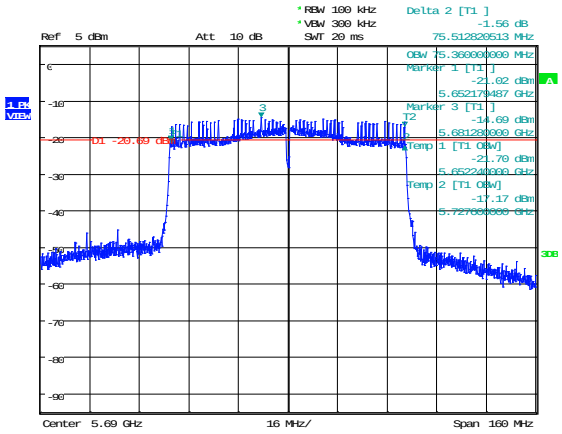
5795MHz



Date: 6.OCT.2021 12:04:48

-6dB Occupied Bandwidth
802.11n/ac 80MHZ BW
5690MHz



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-6dB Occupied Bandwidth
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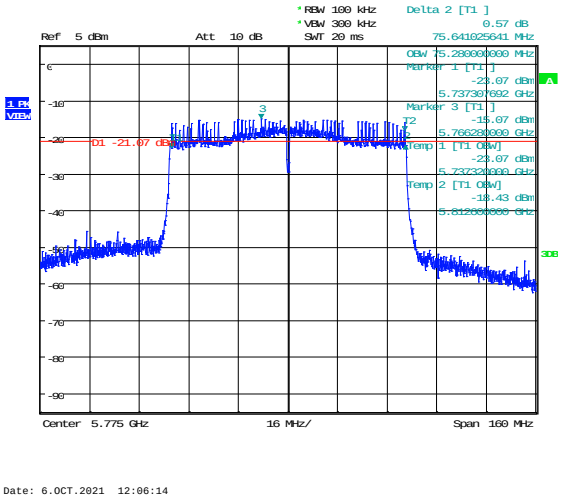
5775MHz



4.2 Maximum Conducted Output Power & Power Spectral Density FCC Rule 15.407

4.2.1 Requirement

4.2.1.1 FCC Rule 15.407(a)(1)(iv)

For 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. 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.

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. 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.

For the band 5.725-5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

4.2.1.2 Requirement (RSS-247; 6.2)

Frequency band 5150-5250 MHz
LE-LAN devices are restricted to indoor operation only in the band 5150-5250 MHz. The maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

Frequency band 5250-5350 MHz
The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;

The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

Frequency bands 5470-5600 MHz and 5650-5725 MHz
The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

Frequency band 5725-5850 MHz
The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipointFootnote3 systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

4.2.2 Procedure

The Procedure, described in the FCC Publication 789033 D02 General U-NII Test Procedures New Rules v02r01, was used. Specifically, Section E (2) (c) Method SA-1 for Maximum Conducted Output Power

The Procedure, described in the FCC Publication 789033 D02 General U-NII Test Procedures New Rules v02r01, was used. Specifically, procedure from Section F was utilized for Maximum Power Spectral Density (PSD).

Each antenna port of the EUT was connected to the input of a spectrum analyzer to measure the Maximum Conducted Transmitter Output Power & Peak Power Spectral Density (PPSD).

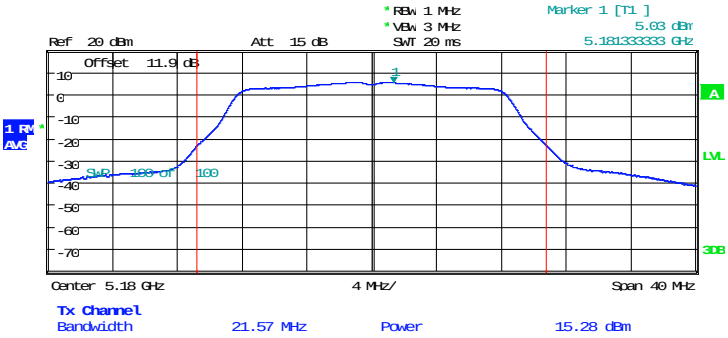
4.2.3 Test Results

Refer to the following plots for the test result:

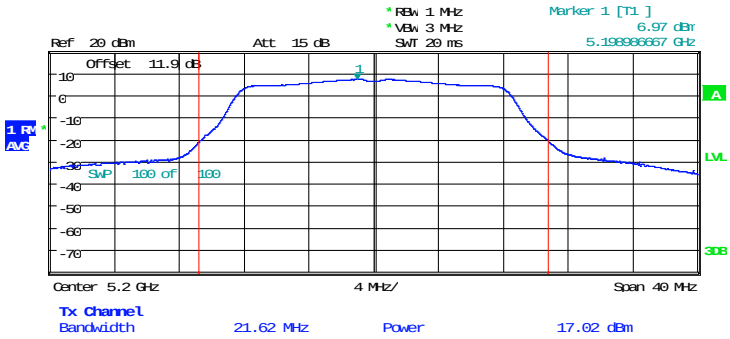
Mode	Channel	Frequency MHz	99% OBW	Antenna Gain	Output Power	Output Power Limit	EIRP	EIRP Limit
			MHz	dBi	dBm	dBm	dBm	dBm
802.11a	36	5180	16.80	2.47	15.28	22.3	17.75	22.3
	40	5200	16.78	2.47	17.02	22.2	19.49	22.3
	48	5240	16.80	2.47	17.04	22.3	19.51	22.3
	52	5260	16.82	2.47	16.93	23.3	19.40	29.3
	60	5300	16.82	2.47	16.98	23.3	19.45	29.3
	64	5320	16.82	2.47	16.95	23.3	19.42	29.3
	100	5500	16.80	2.47	16.08	23.3	18.55	29.3
	116	5580	16.84	2.47	17.29	23.3	19.76	29.3
	140	5700	16.82	2.47	14.96	23.3	17.43	29.3
	144	5720	16.86	2.47	16.91	23.3	19.38	29.3
	149	5745	16.84	2.47	17.08	30.0	19.55	-
	157	5785	16.82	2.47	16.93	30.0	19.40	-
	165	5825	16.88	2.47	16.89	30.0	19.36	-
802.11n/ac 20MHz BW	36	5180	17.92	2.47	15.61	22.5	18.08	22.5
	40	5200	18.12	2.47	16.66	22.6	19.13	22.5
	48	5240	17.96	2.47	16.58	22.5	19.05	22.5
	52	5260	17.90	2.47	16.50	23.5	18.97	29.5
	60	5300	17.94	2.47	16.54	23.5	19.01	29.5
	64	5320	17.90	2.47	16.52	23.5	18.99	29.5
	100	5500	17.88	2.47	16.43	23.5	18.90	29.5
	116	5580	18.02	2.47	16.39	23.6	18.86	29.5
	140	5700	18.00	2.47	14.56	23.6	17.03	29.5
	144	5720	17.90	2.47	16.08	23.5	18.55	29.5
	149	5745	17.94	2.47	16.27	30.0	18.74	-
	157	5785	17.96	2.47	16.08	30.0	18.55	-
	165	5825	17.94	2.47	16.41	30.0	18.88	-
802.11n/ac 40MHz BW	38	5190	36.32	2.47	13.81	23.0	16.28	23.0
	46	5210	36.40	2.47	16.46	23.0	18.93	23.0
	54	5270	36.36	2.47	16.34	24.0	18.81	30.0
	62	5310	36.32	2.47	14.63	24.0	17.10	30.0
	102	5510	36.28	2.47	16.32	24.0	18.79	30.0
	110	5550	36.32	2.47	16.33	24.0	18.80	30.0
	134	5670	36.32	2.47	16.35	24.0	18.82	30.0
	142	5710	36.32	2.47	16.22	24.0	18.69	30.0
	151	5755	36.32	2.47	16.13	30.0	18.60	-
	159	5795	36.32	2.47	16.04	30.0	18.51	-
802.11ac 80MHz BW	42	5210	75.52	2.47	11.88	23.0	14.35	23.0
	58	5290	75.76	2.47	12.62	24.0	15.09	30.0
	106	5530	75.68	2.47	13.53	24.0	16.00	30.0
	122	5610	75.76	2.47	14.38	24.0	16.85	30.0
	138	5690	75.68	2.47	14.16	24.0	16.63	30.0
	155	5775	75.68	2.47	14.06	30.0	16.53	-

Mode	Channel	Frequency MHz	99% OBW	Antenna Gain	PSD	PSD Limit	PSD EIRP	PSD EIRP Limit
			MHz	dBi	dBm	dBm	dBm	dBm
802.11a	36	5180	16.80	2.47	5.03	10.0	7.50	10.0
	40	5200	16.78	2.47	6.97	10.0	9.44	10.0
	48	5240	16.80	2.47	6.90	10.0	9.37	10.0
	52	5260	16.82	2.47	6.75	11.0	9.22	-
	60	5300	16.82	2.47	6.66	11.0	9.13	-
	64	5320	16.82	2.47	6.78	11.0	9.25	-
	100	5500	16.80	2.47	5.97	11.0	8.44	-
	116	5580	16.84	2.47	7.20	11.0	9.67	-
	140	5700	16.82	2.47	4.90	11.0	7.37	-
	144	5720	16.86	2.47	6.79	11.0	9.26	-
	149	5745	16.84	2.47	6.91	30.0	9.38	-
	157	5785	16.82	2.47	6.72	30.0	9.19	-
	165	5825	16.88	2.47	6.80	30.0	9.27	-
802.11n/ac	36	5180	17.92	2.47	5.28	10.0	7.75	10.0
	40	5200	18.12	2.47	6.28	10.0	8.75	10.0
	48	5240	17.96	2.47	6.11	10.0	8.58	10.0
	52	5260	17.90	2.47	6.05	11.0	8.52	-
	60	5300	17.94	2.47	6.30	11.0	8.77	-
	64	5320	17.90	2.47	6.18	11.0	8.65	-
	100	5500	17.88	2.47	6.06	11.0	8.53	-
	116	5580	18.02	2.47	5.95	11.0	8.42	-
	140	5700	18.00	2.47	4.18	11.0	6.65	-
	144	5720	17.90	2.47	5.83	11.0	8.30	-
	149	5745	17.94	2.47	5.98	30.0	8.45	-
	157	5785	17.96	2.47	5.71	30.0	8.18	-
	165	5825	17.94	2.47	6.13	30.0	8.60	-
802.11n/ac 40MHz BW	38	5190	36.32	2.47	0.51	10.0	2.98	10.0
	46	5210	36.40	2.47	3.20	10.0	5.67	10.0
	54	5270	36.36	2.47	3.10	11.0	5.57	-
	62	5310	36.32	2.47	1.42	11.0	3.89	-
	102	5510	36.28	2.47	2.91	11.0	5.38	-
	110	5550	36.32	2.47	2.96	11.0	5.43	-
	134	5670	36.32	2.47	2.99	11.0	5.46	-
	142	5710	36.32	2.47	2.80	11.0	5.27	-
	151	5755	36.32	2.47	2.76	30.0	5.23	-
	159	5795	36.32	2.47	2.76	30.0	5.23	-
802.11ac 80MHz BW	42	5210	75.52	2.47	-4.34	10.0	-1.87	10.0
	58	5290	75.76	2.47	-3.45	11.0	-0.98	-
	106	5530	75.68	2.47	-2.56	11.0	-0.09	-
	122	5610	75.76	2.47	-1.66	11.0	0.81	-
	138	5690	75.68	2.47	-2.08	11.0	0.39	-
	155	5775	75.68	2.47	-2.14	30.0	0.33	-

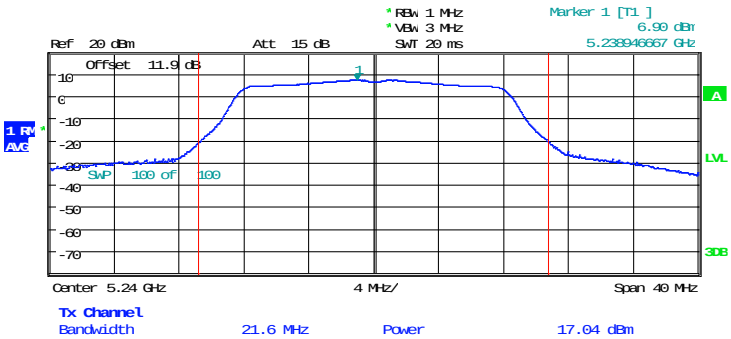
Output Power & Power Spectral Density 802.11a 5180MHz



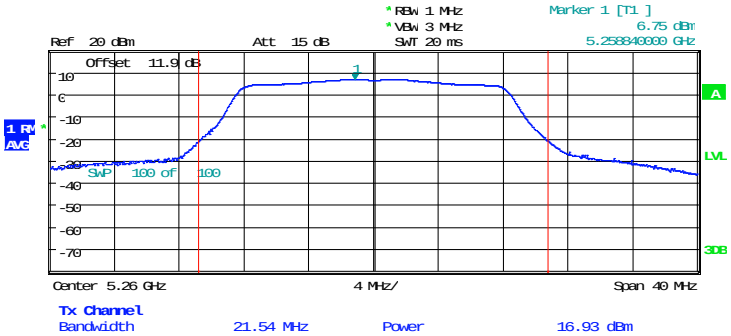
Output Power & Power Spectral Density 802.11a 5200MHz



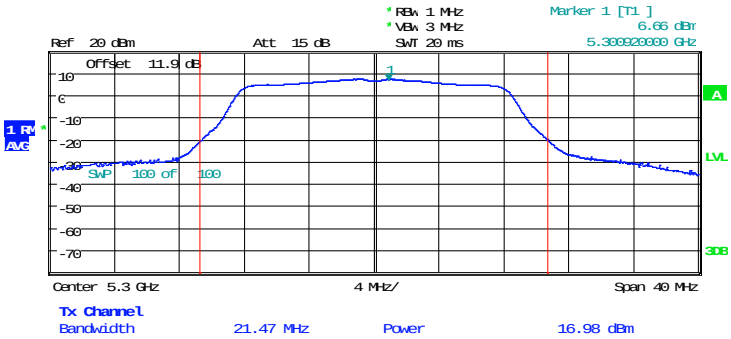
Output Power & Power Spectral Density 802.11a 5240MHz



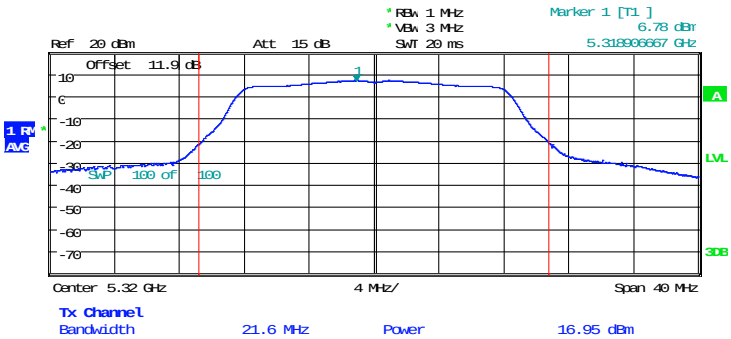
Output Power & Power Spectral Density 802.11a 5260MHz



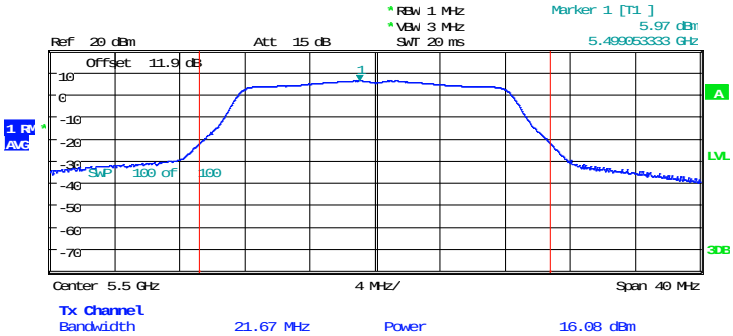
Output Power & Power Spectral Density 802.11a 5300MHz



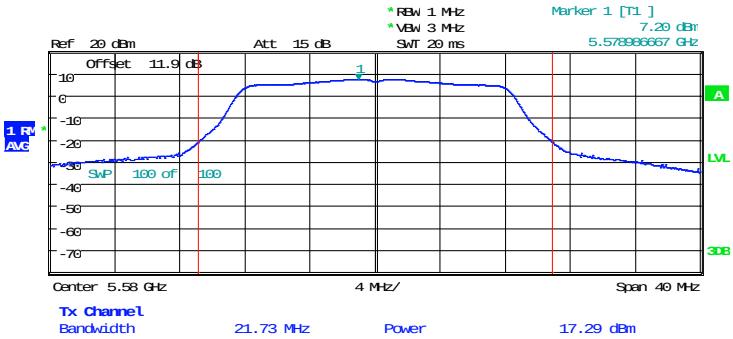
Output Power & Power Spectral Density 802.11a 5320MHz



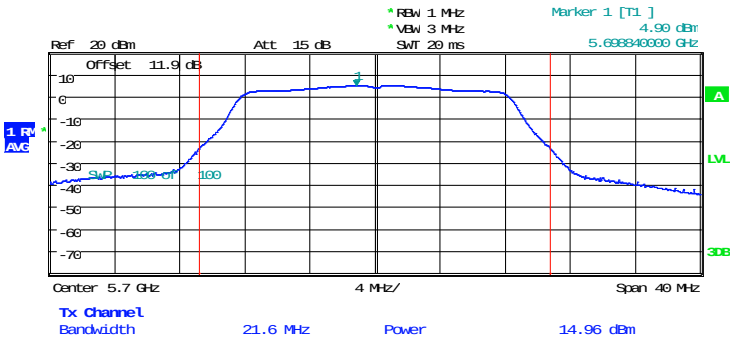
Output Power & Power Spectral Density 802.11a 5500MHz



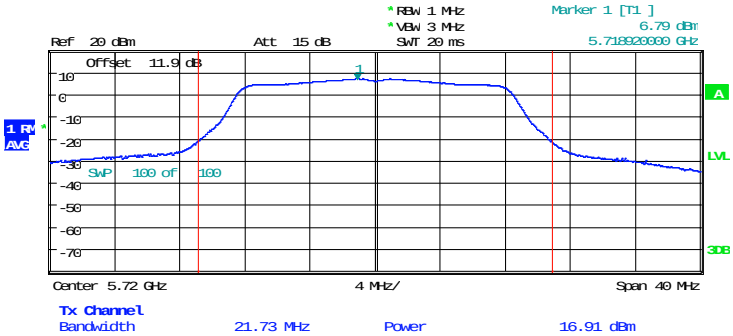
Output Power & Power Spectral Density 802.11a 5580MHz



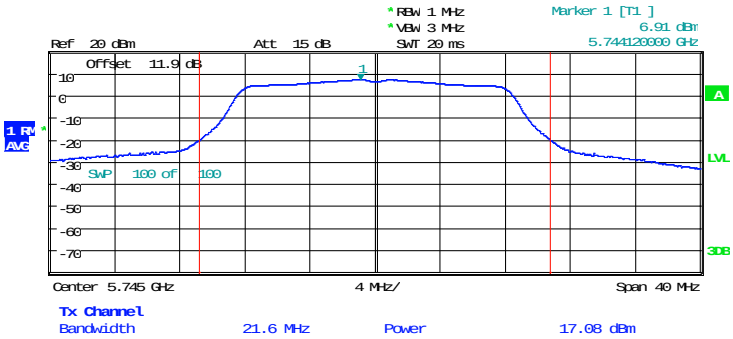
Output Power & Power Spectral Density 802.11a 5700MHz



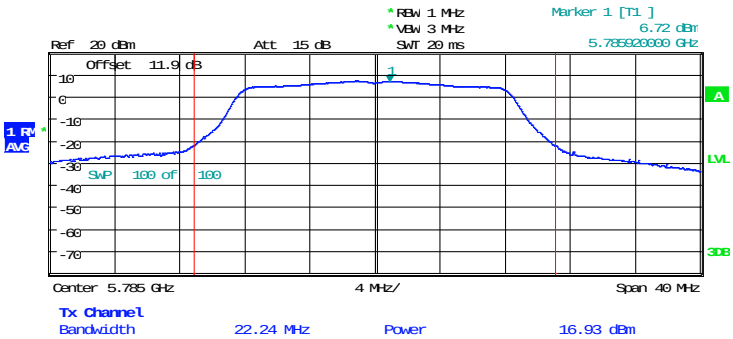
Output Power & Power Spectral Density 802.11a 5720MHz



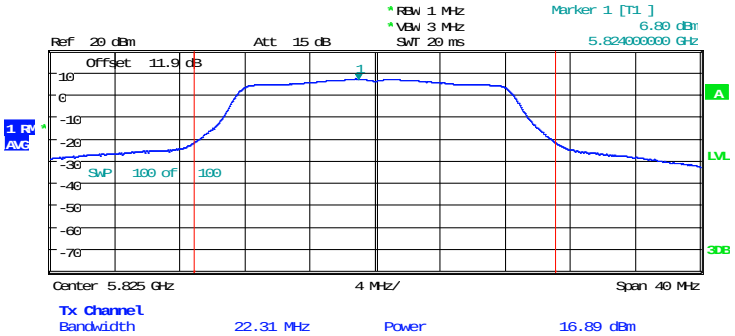
Output Power & Power Spectral Density 802.11a 5745MHz



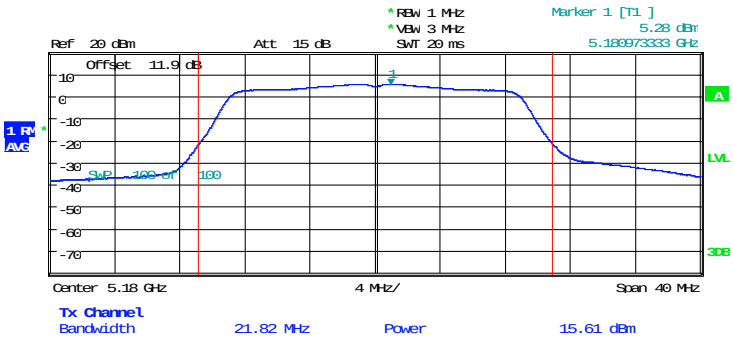
Output Power & Power Spectral Density 802.11a 5785MHz



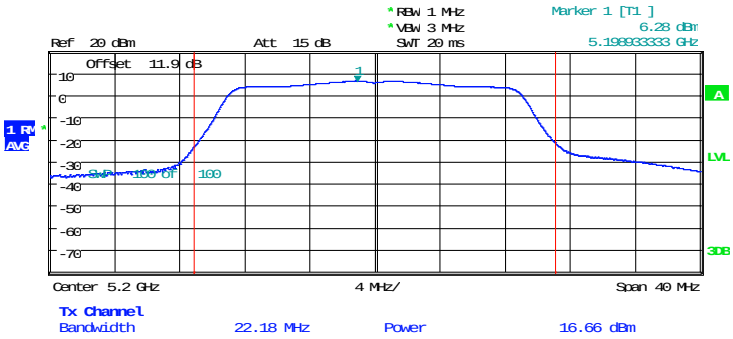
Output Power & Power Spectral Density
802.11a 5825MHz



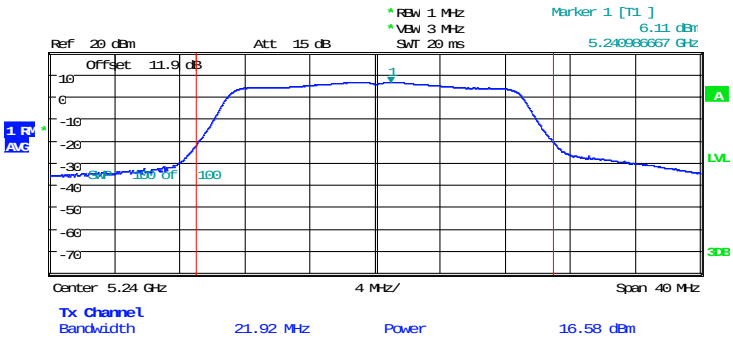
Output Power & Power Spectral Density 802.11n/ac 5180MHz



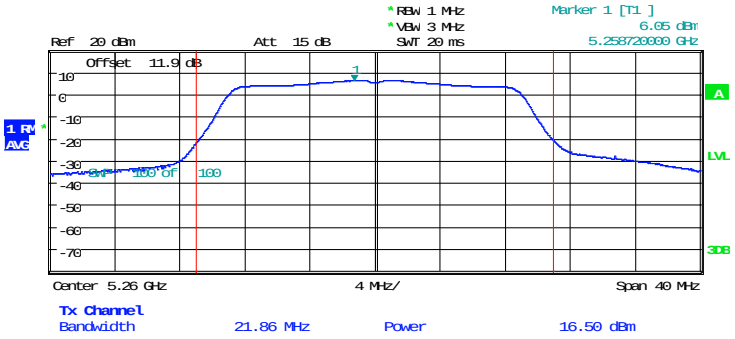
Output Power & Power Spectral Density 802.11n/ac 5200MHz



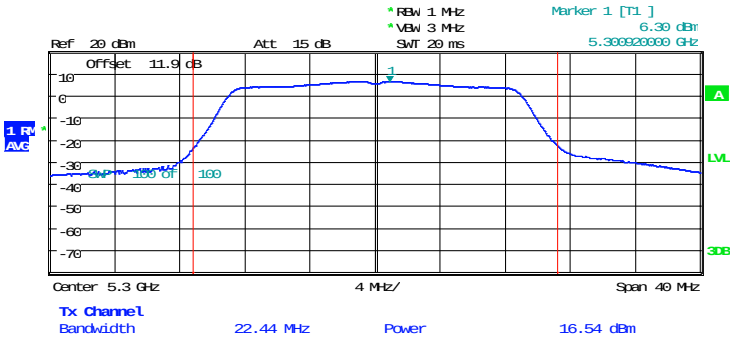
Output Power & Power Spectral Density 802.11n/ac 5240MHz



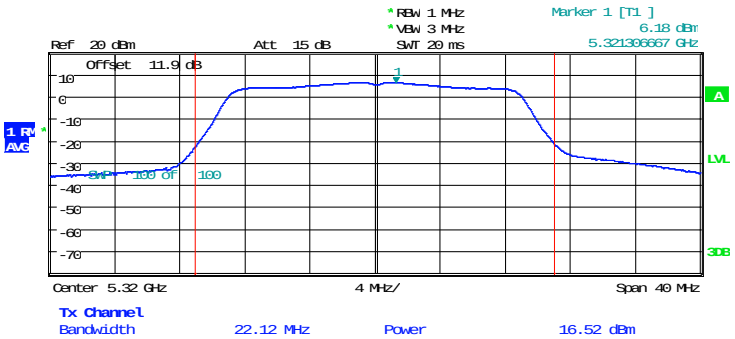
Output Power & Power Spectral Density 802.11n/ac 5260MHz



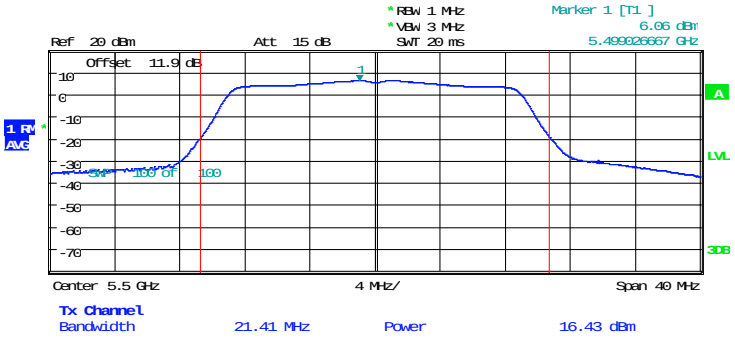
Output Power & Power Spectral Density 802.11n/ac 5300MHz



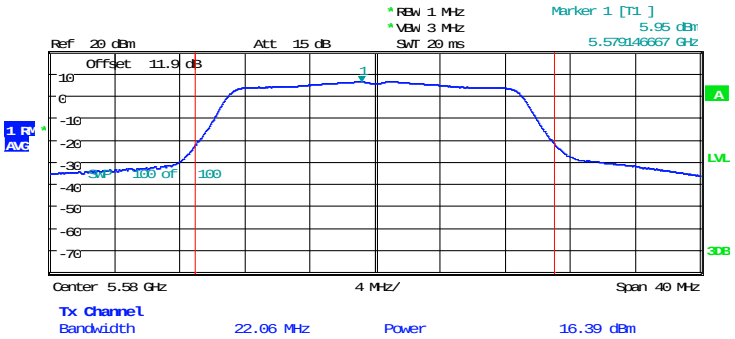
Output Power & Power Spectral Density 802.11n/ac 5320MHz



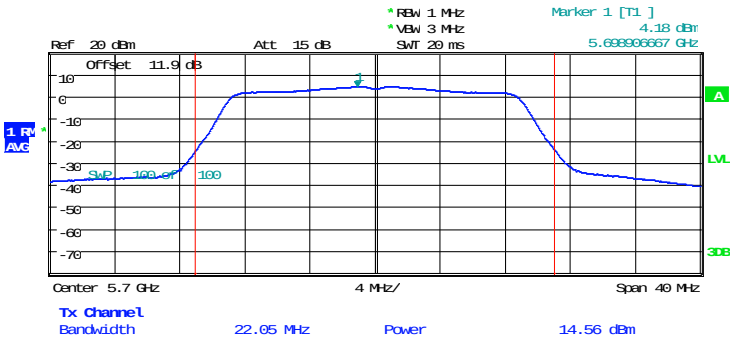
Output Power & Power Spectral Density 802.11n/ac 5500MHz



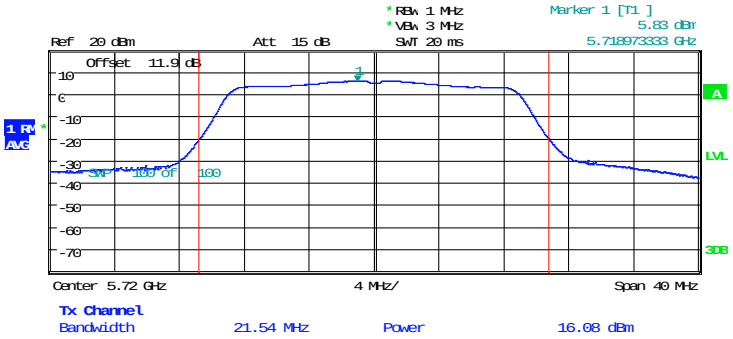
Output Power & Power Spectral Density 802.11n/ac 5580MHz



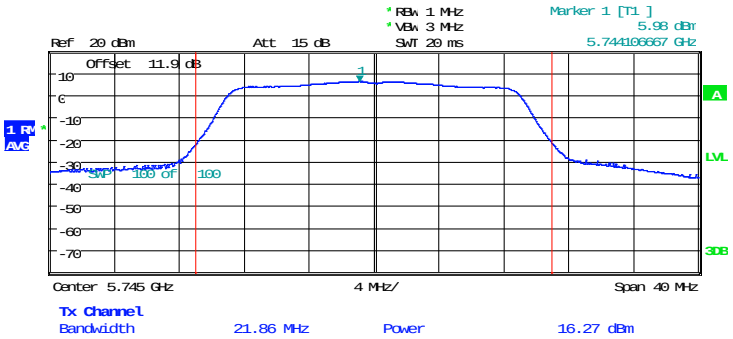
Output Power & Power Spectral Density 802.11n/ac 5700MHz



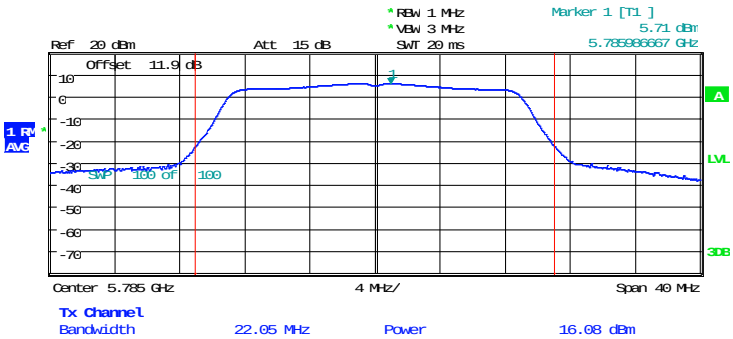
Output Power & Power Spectral Density 802.11n/ac 5720MHz



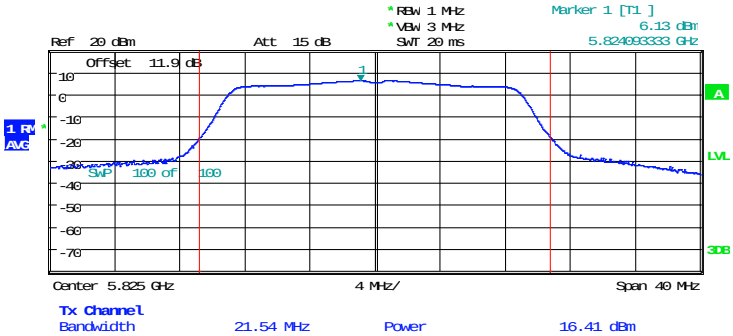
Output Power & Power Spectral Density 802.11n/ac 5745MHz



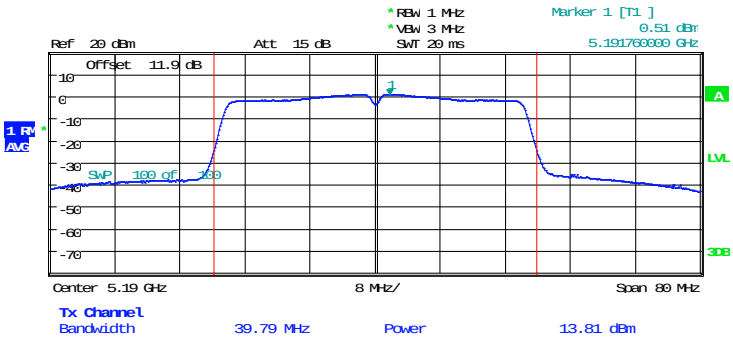
Output Power & Power Spectral Density 802.11n/ac 5785MHz



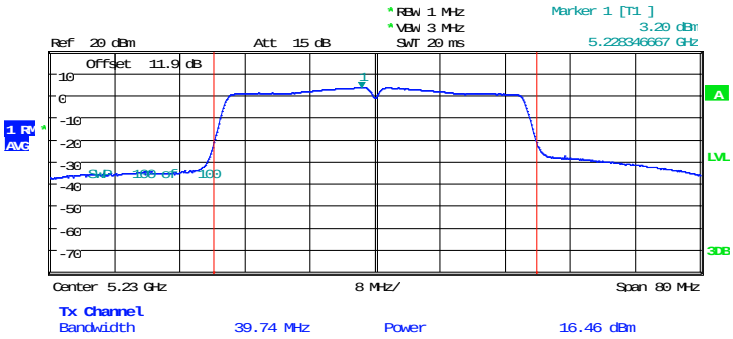
Output Power & Power Spectral Density 802.11n/ac 5825MHz



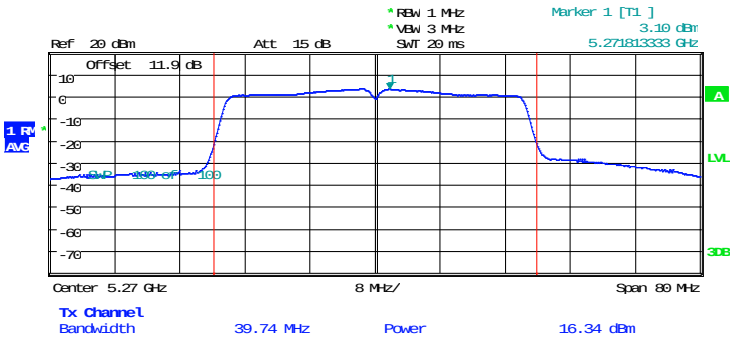
Output Power & Power Spectral Density 802.11n/ac 40MHz 5190MHz



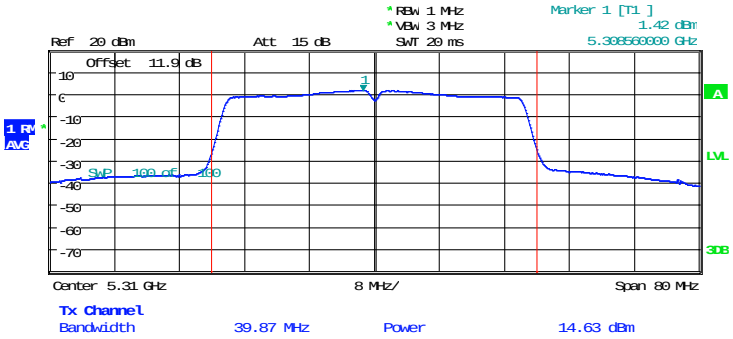
Output Power & Power Spectral Density 802.11n/ac 40MHz 5230MHz



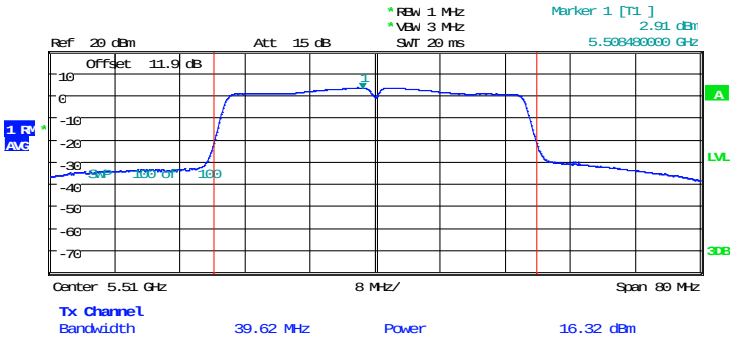
Output Power & Power Spectral Density 802.11n/ac 40MHz 5270MHz



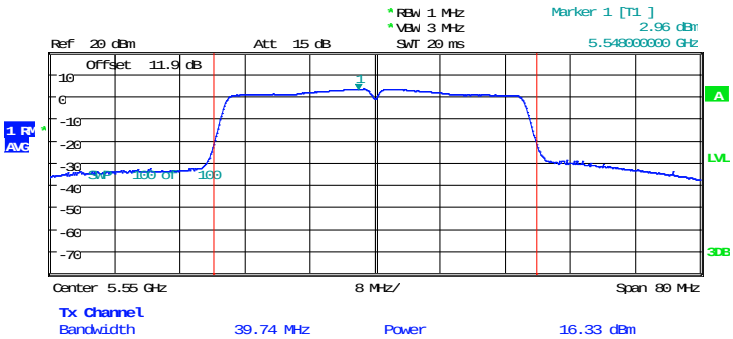
Output Power & Power Spectral Density
802.11n/ac 40MHz
5310MHz



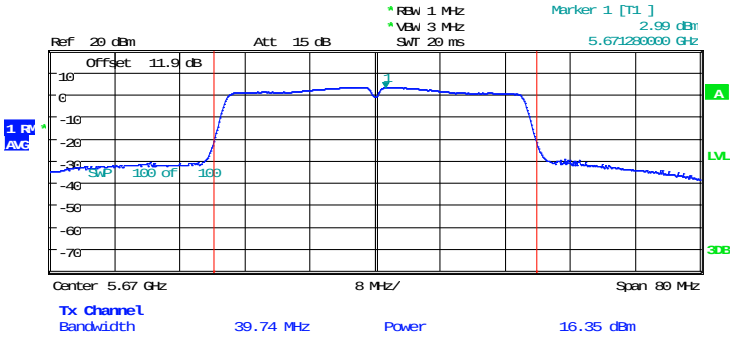
Output Power & Power Spectral Density
802.11n/ac 40MHz
5510MHz



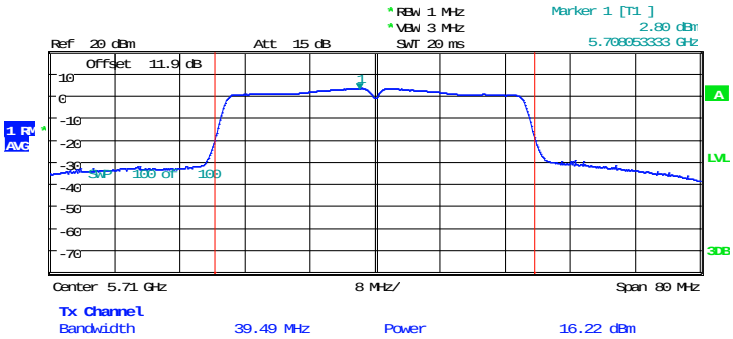
Output Power & Power Spectral Density
802.11n/ac 40MHz
5550MHz



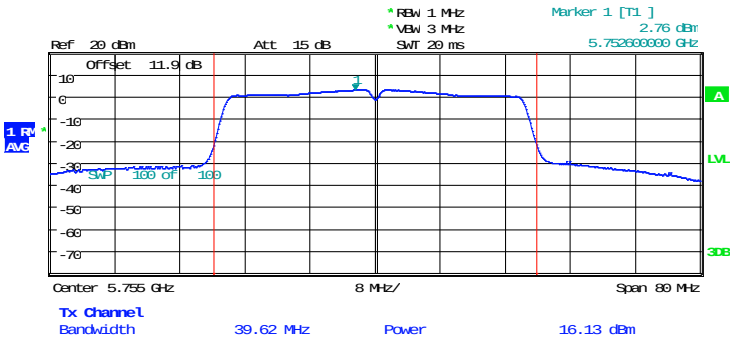
Output Power & Power Spectral Density 802.11n/ac 40MHz 5670MHz



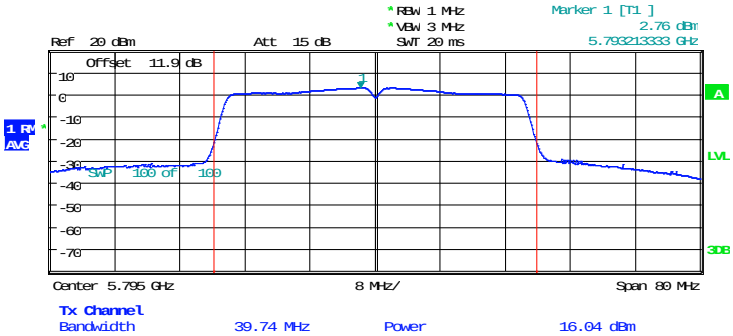
Output Power & Power Spectral Density 802.11n/ac 40MHz 5710MHz



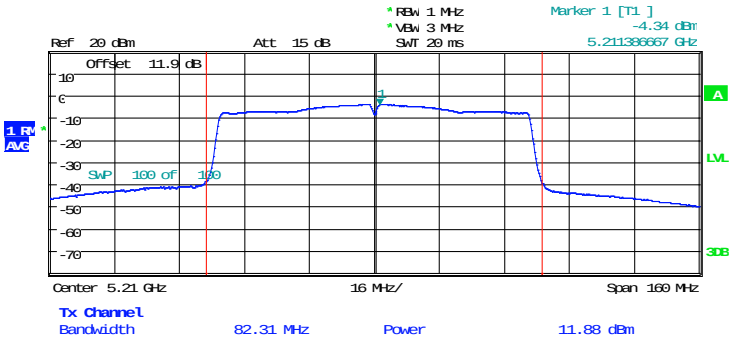
Output Power & Power Spectral Density 802.11n/ac 40MHz 5755MHz



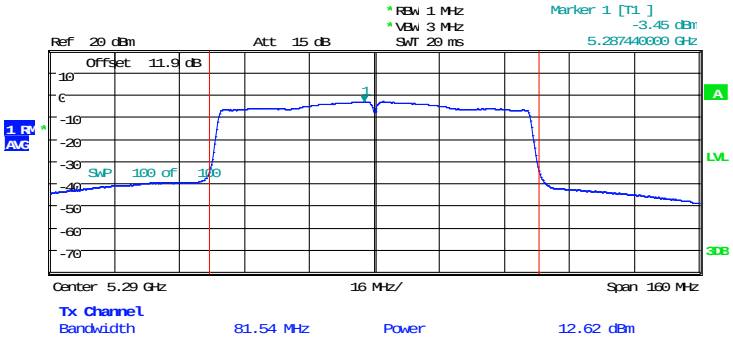
Output Power & Power Spectral Density
802.11n/ac 40MHz
5795MHz



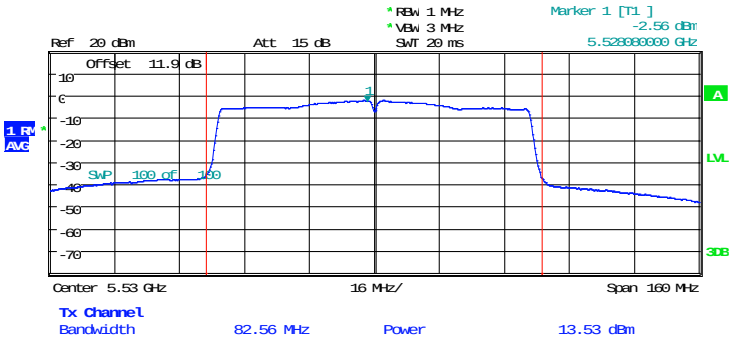
Output Power & Power Spectral Density 802.11ac 80MHz 5210MHz



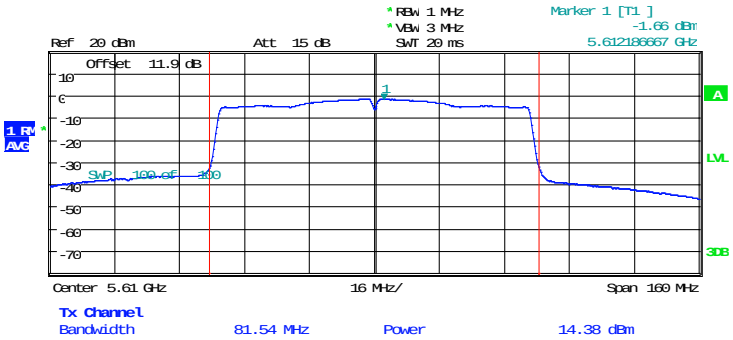
Output Power & Power Spectral Density 802.11ac 80MHz 5290MHz



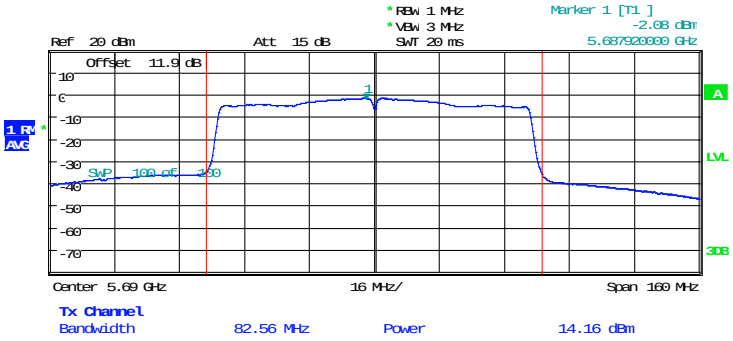
Output Power & Power Spectral Density 802.11ac 80MHz 5530MHz



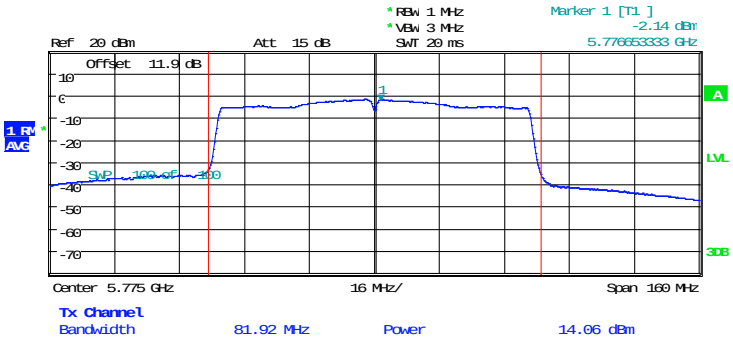
Output Power & Power Spectral Density 802.11ac 80MHz 5610MHz



Output Power & Power Spectral Density 802.11ac 80MHz 5690MHz



Output Power & Power Spectral Density 802.11ac 80MHz 5775MHz



4.3 Transmitter Radiated Emissions
FCC Rule 15.407(b) (1-8) 15.209, 15.205

4.3.1 Requirement

(b) Undesirable emission limits. Except as shown in paragraph (b) (7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(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 e.i.r.p. of −27 dBm/MHz.

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

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

(4) For transmitters operating in the 5.725-5.85 GHz band:

(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

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

(7) The provisions of §15.205 apply to intentional radiators operating under this section.

(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

Emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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.

4.3.2 Procedure

Radiated emission measurements were performed from 9 kHz to 40 GHz according to the procedure described in ANSI C63.10: 2013. Spectrum Analyzer Resolution Bandwidth is 200Hz or greater for frequencies 9kHz to 30MHz, 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz. Above 1000 MHz Peak and Average measurements were performed.

The EUT is placed on a plastic turntable that is 80 cm in height for below 1000MHz and 1.5m in height for above 1GHz. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at 3 meters for frequencies above 1 GHz and at 10 meters for frequencies below 1 GHz.

Measurements made from 1 GHz to 18GHz had a 5GHz notch filter in place. A preamp was used from 9kHz to 40GHz.

All measurements were made with a Peak Detector and compared to QP limits for 9 kHz – 1GHz and Average limits for 1GHz – 40 GHz.

Correlation measurements were performed below 30MHz between 10m ALSE and Open Field site according to FCC KDB 414788 D01 Radiated Test Site v01r01 section 2. All readings were within the acceptable tolerance.

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels).

<u>ANSI C63.10-2013; 5.6.2.2</u>
Determining worst-case mode for Spurious emissions:
For devices with multiple operating modes, measurements on the middle channel can be used to determine the worst-case mode(s). The worst-case modes are as follows:

Measure the mode with the highest output power and the mode with the highest output power spectral density for each modulation family (e.g., OFDM and direct sequence spread spectrum).

The highest output power and the highest output power spectral density were found in the middle channels of 802.11a, therefore Spurious emissions were measured using 802.11a.

4.3.3 Field Strength Calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF – AG; if measurement is performed at a distance other than specified in the rule, a Distance Correction Factor (DCF) shall be added.

Where FS = Field Strength in dB(μV/m)
RA = Receiver Amplitude (including preamplifier) in dB(μV); AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(μV) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(μV/m). This value in dB(μV/m) was converted to its corresponding level in μV/m.
RA = 52.0 dB(μV)
AF = 7.4 dB(1/m)
CF = 1.6 dB
AG = 29.0 dB
FS = 52.0+7.4+1.6-29.0 = 32 dB(μV/m).
Level in μV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m.

4.3.4 Antenna-port conducted measurements

Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

4.3.5 General Procedure for conducted measurements in restricted bands

a) Measure the conducted output power (in dBm) using the detector specified for determining quasi-peak, peak, and average conducted output power, respectively.

b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)

c) Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).

d) For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (*e.g.*, Watts, mW).

e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:
$E = EIRP – 20\log D + 104.8$
where:
E = electric field strength in dBµV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.
f) Compare the resultant electric field strength level to the applicable limit.
g) Perform radiated spurious emission test

4.3.6 Test Results

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

All conducted antenna port plots are corrected with the consideration of the EUT's Antenna Gain.

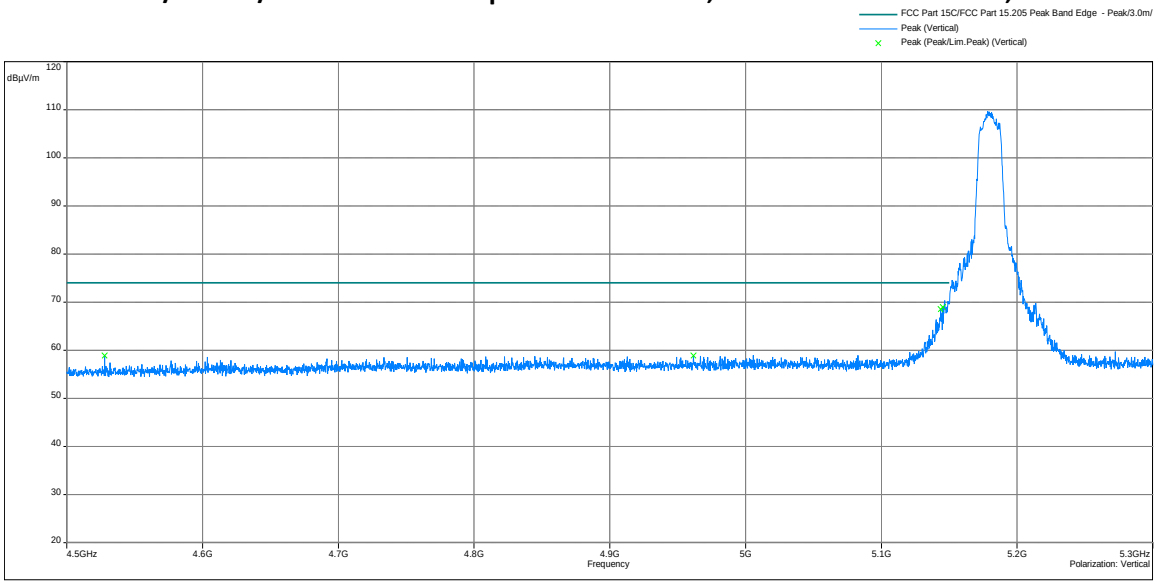
Radiated emission measurements were performed from 9kHz up to 40GHz.

9kHz – 30MHz Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels).

Test Results: Charging Mode

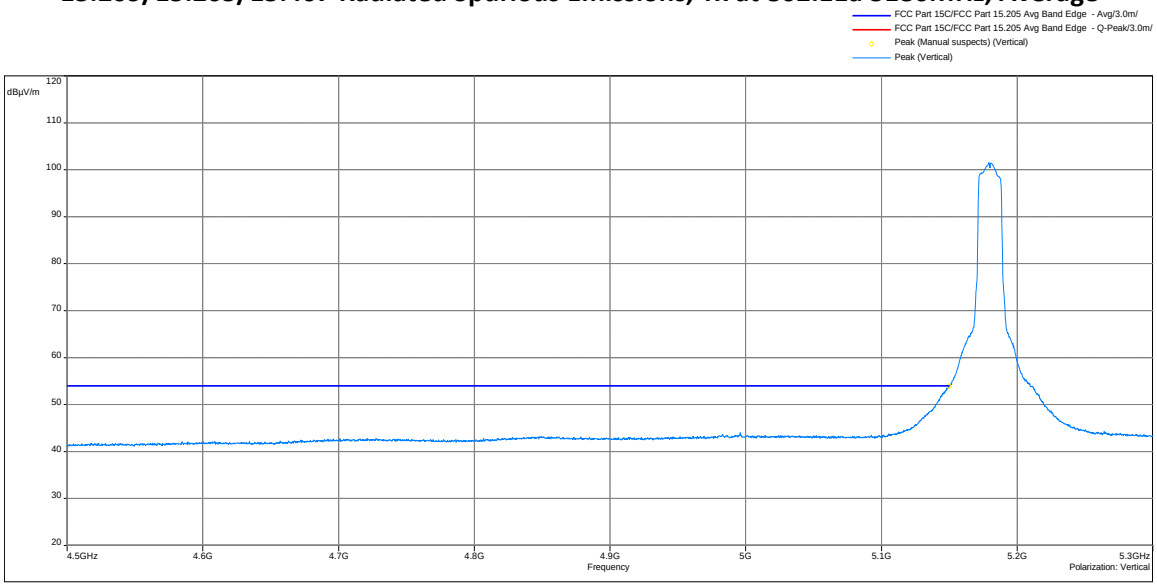
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5180MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Peak	68.04	74	-5.96	Pass

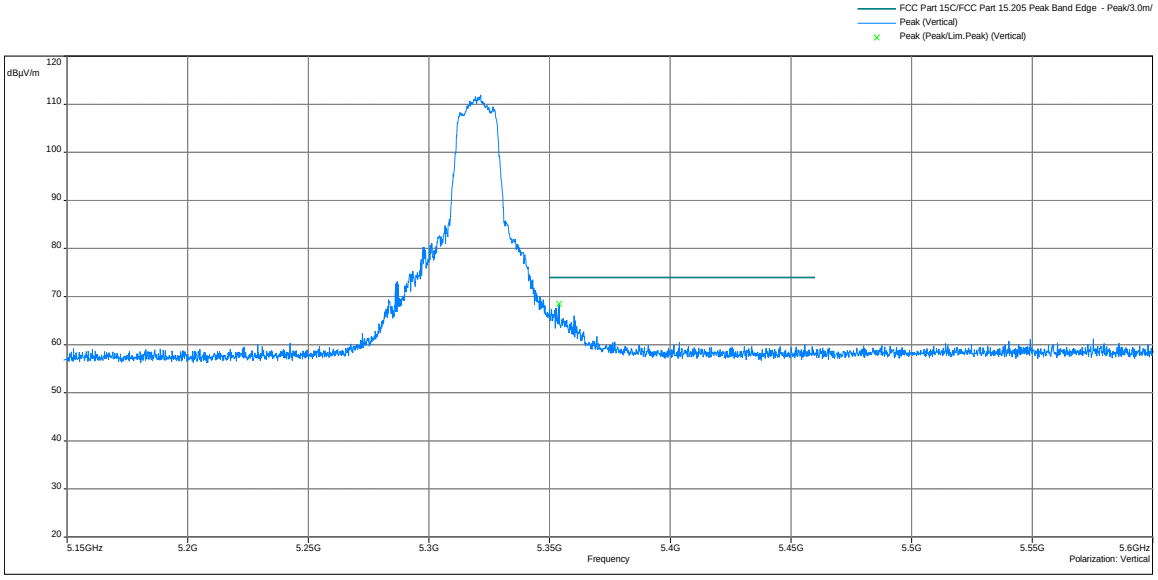
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5180MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Average	53.90	54	-0.10	Pass

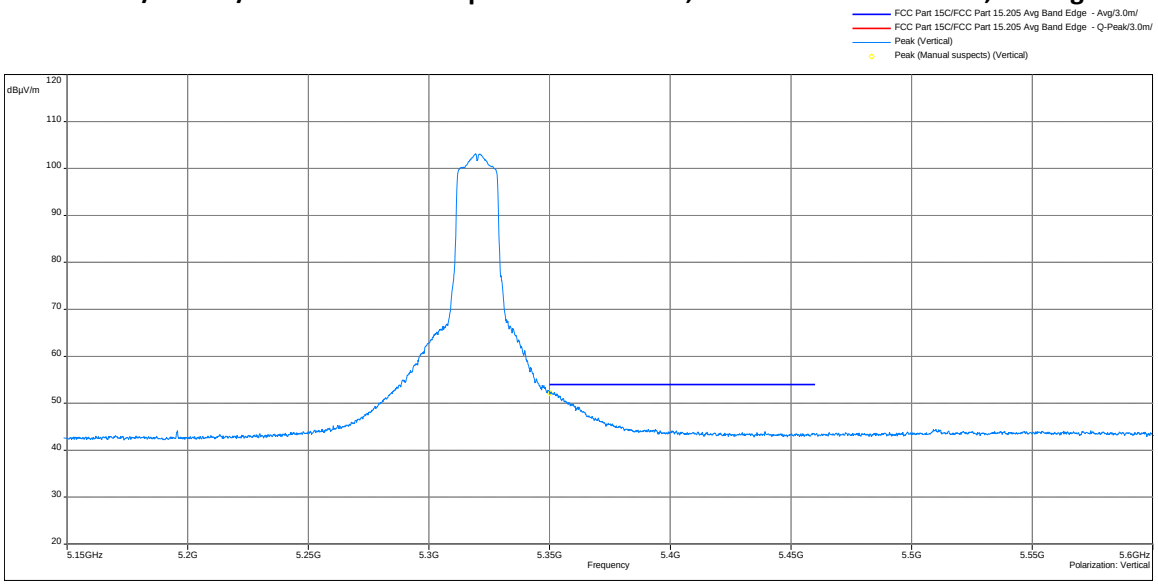
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5320MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Peak	67.91	74	-6.09	Pass

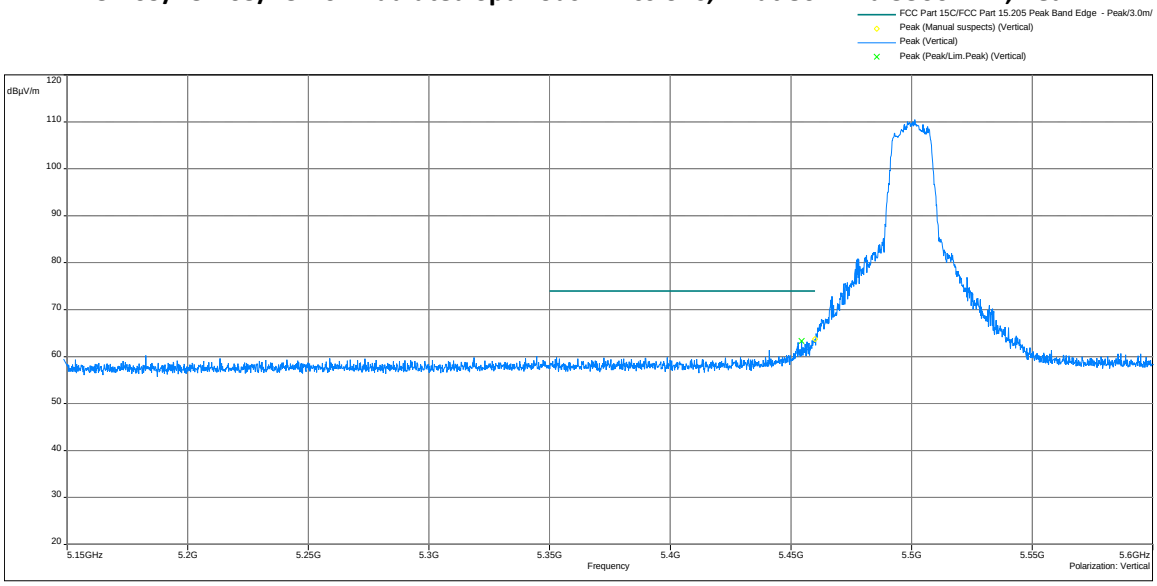
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5320MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Average	52.18	54	-1.82	Pass

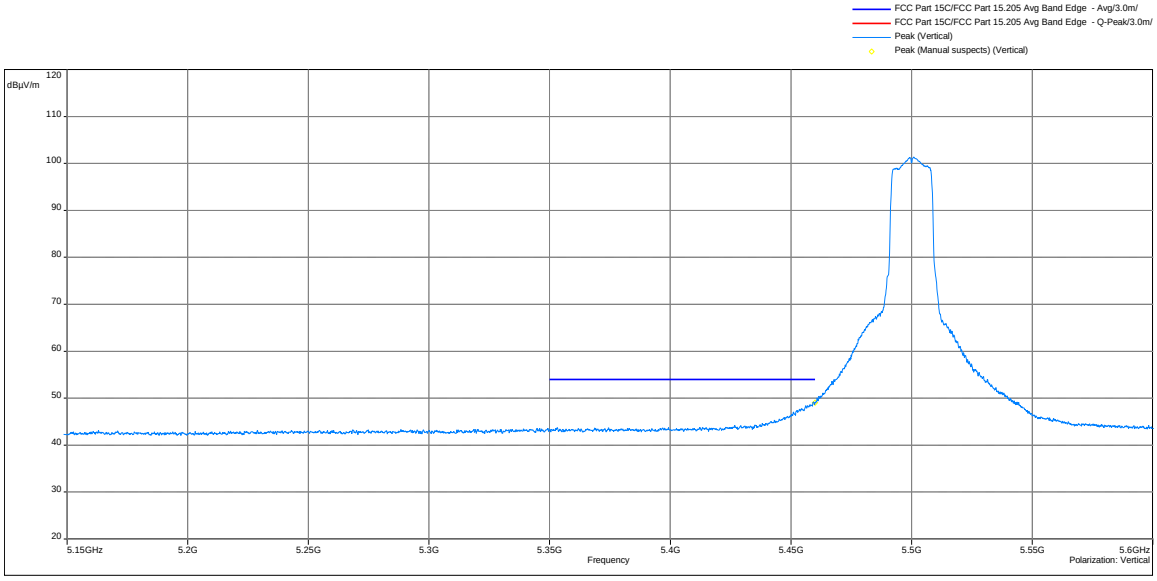
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5500MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Peak	63.75	74	-10.25	Pass
5470	Peak	68.19	68.23	-0.04	Pass

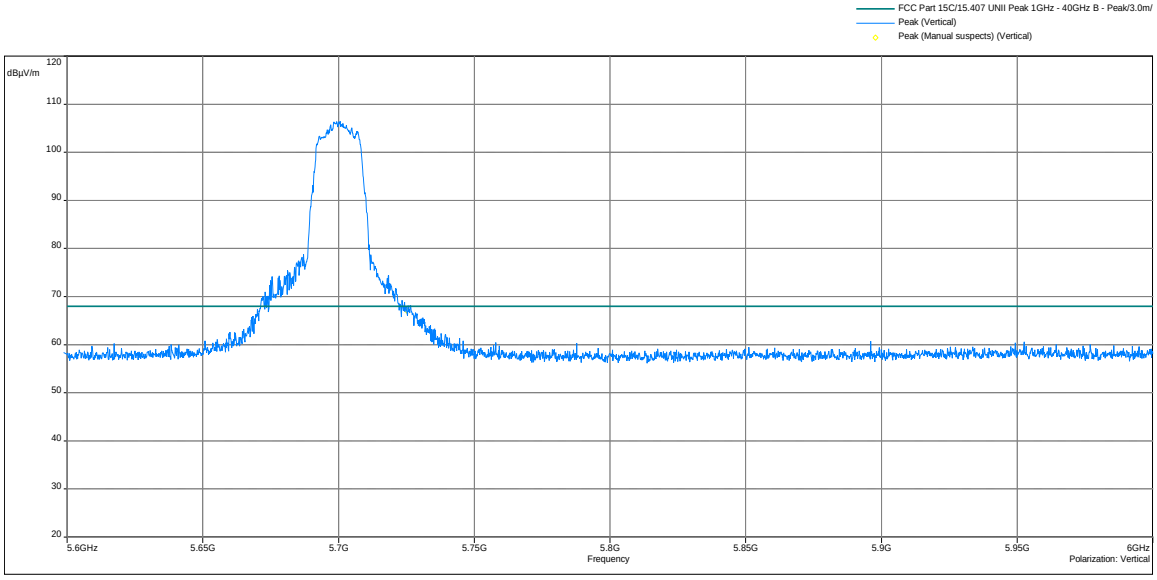
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5500MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Average	49.02	54	-4.98	Pass

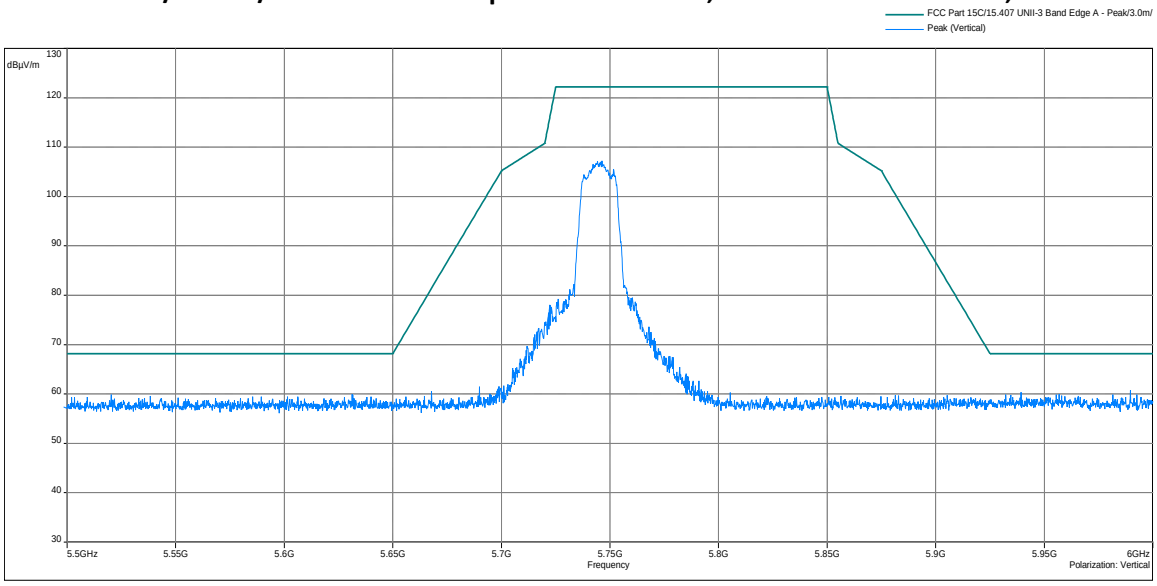
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5700MHz, Peak



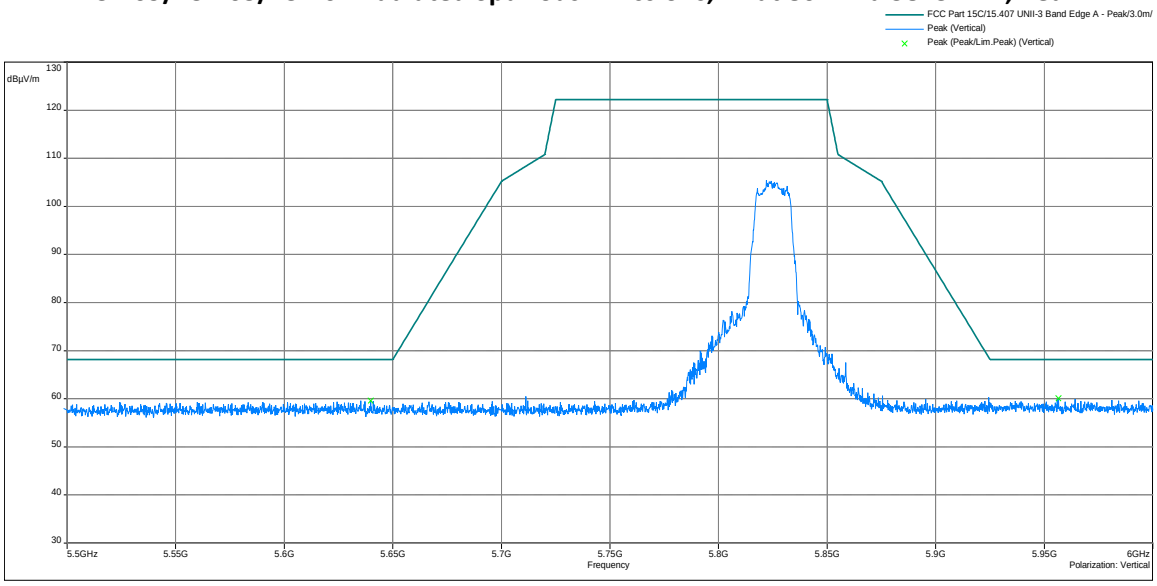
Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5725	Peak	67.13	68.23	-1.10	Pass

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5745MHz, Peak



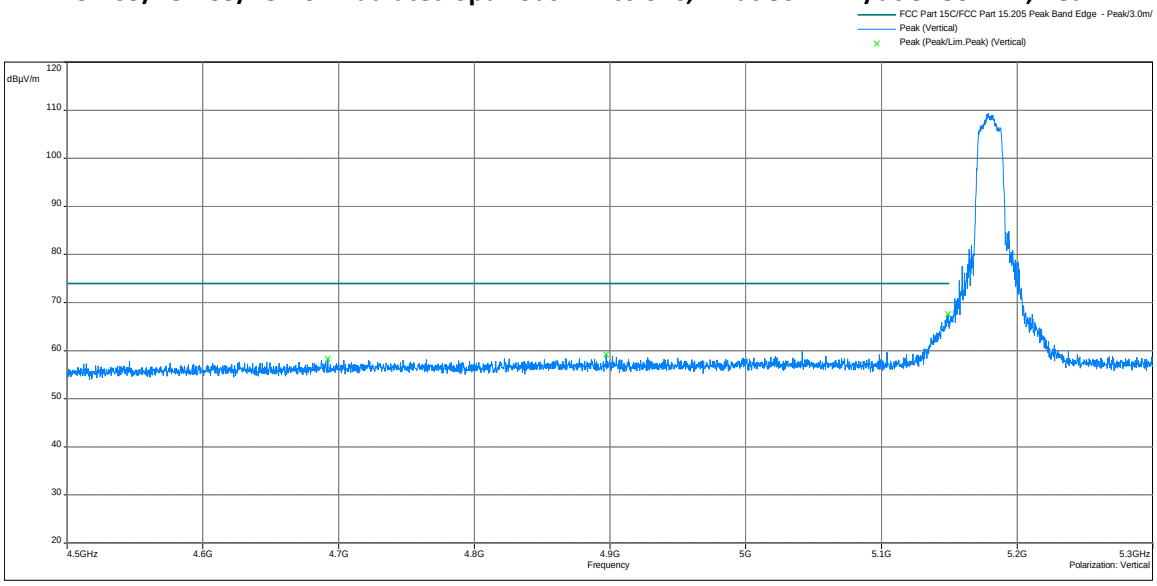
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5825MHz, Peak



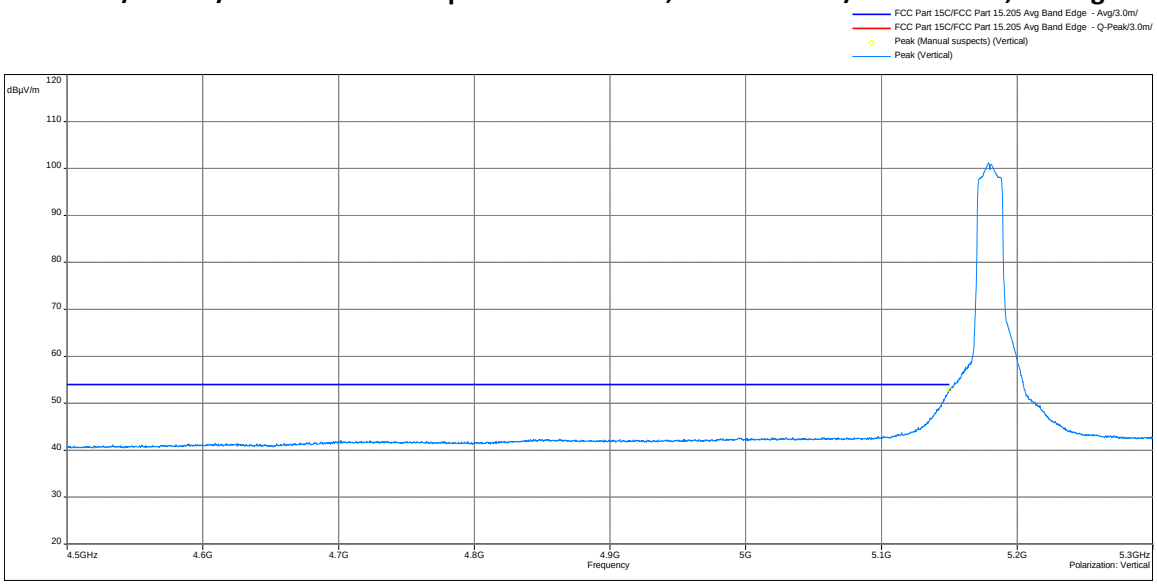
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5180MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Peak	67.55	74	-6.45	Pass

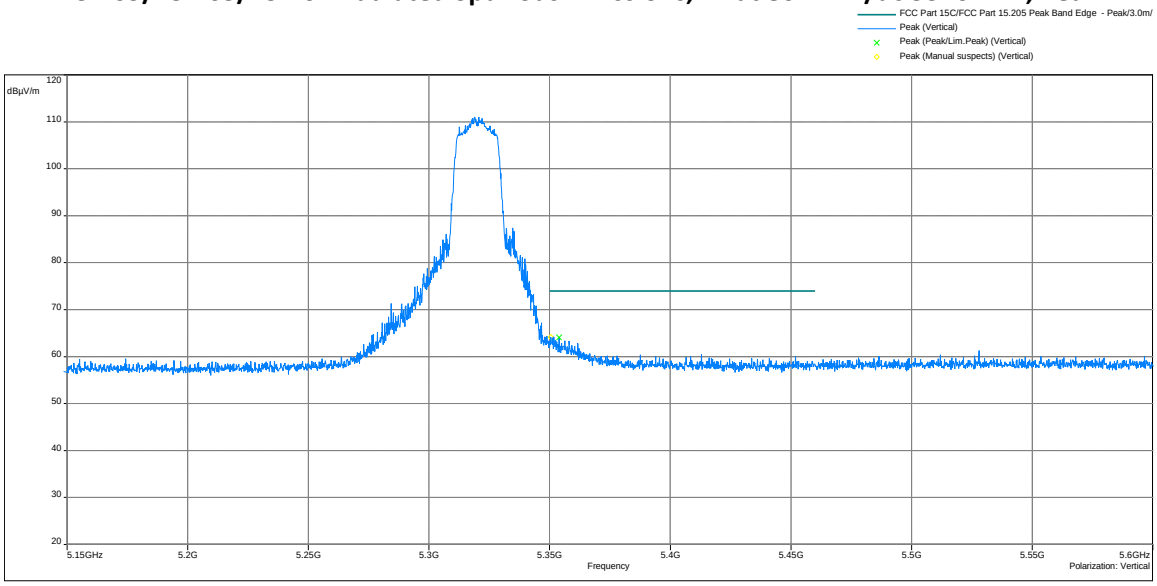
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5180MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Average	52.94	54	-1.06	Pass

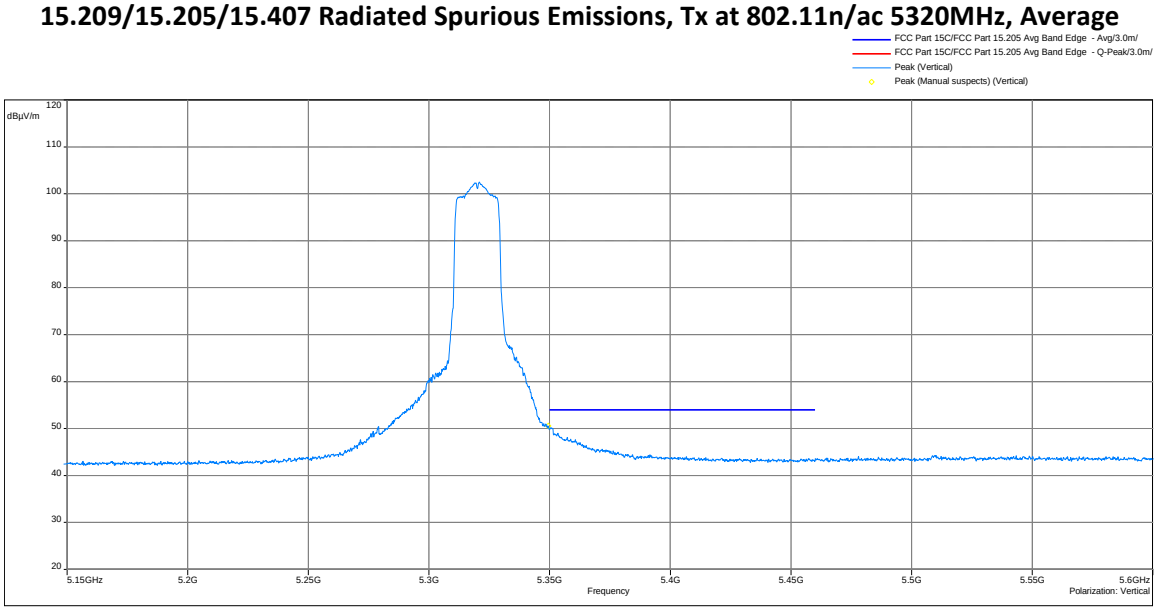
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5320MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Peak	64.13	74	-9.87	Pass

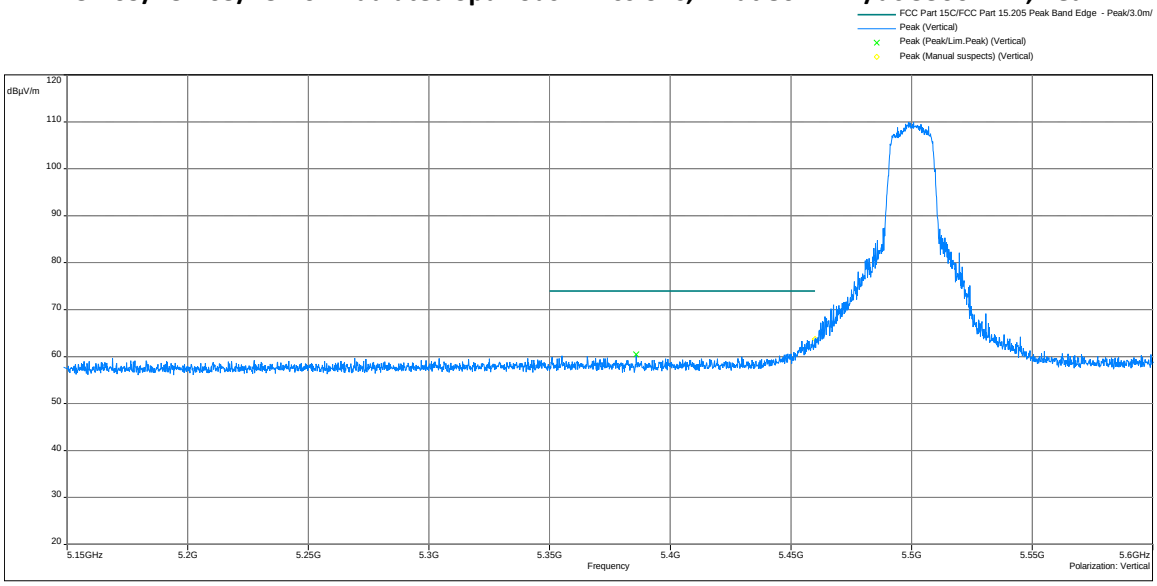
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5320MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Average	50.61	54	-3.39	Pass

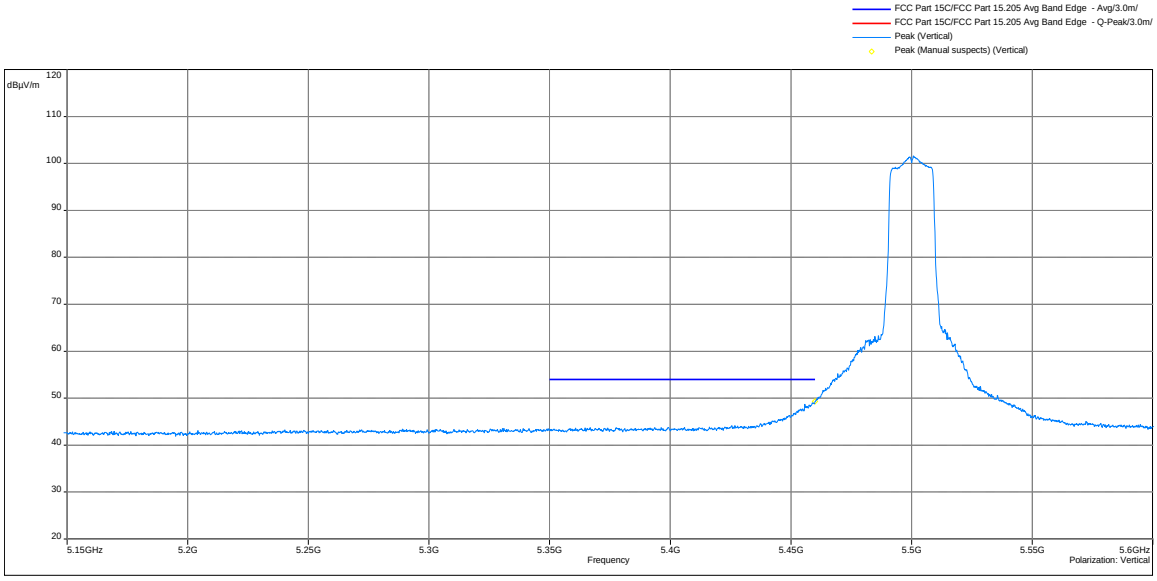
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5500MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Peak	63.72	74	-10.28	Pass
5470	Peak	68.01	68.23	-0.22	Pass

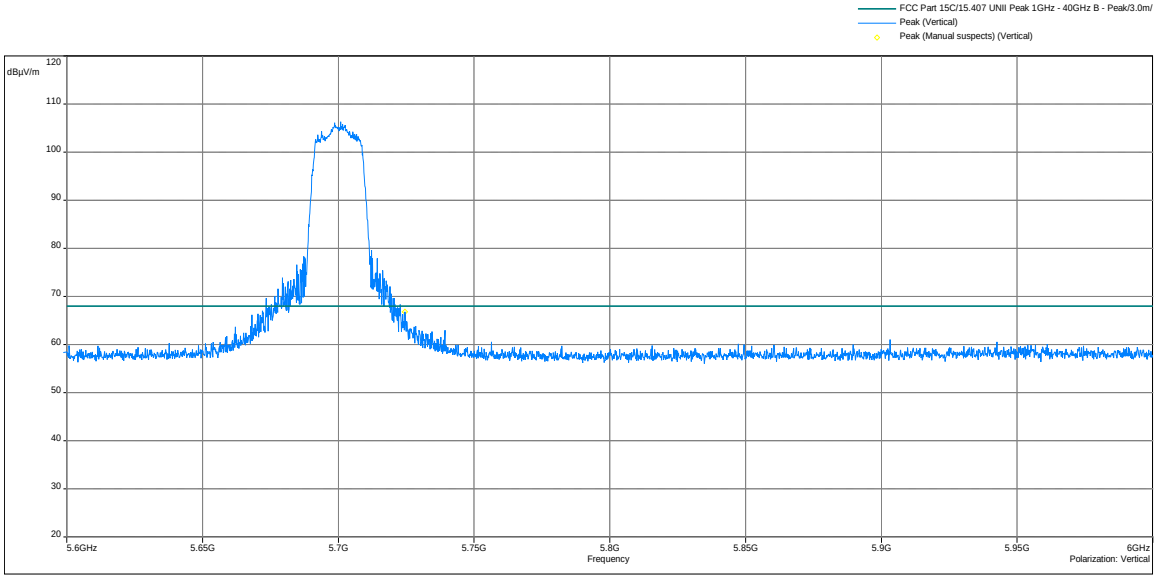
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5500MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Average	49.30	54	-5.70	Pass

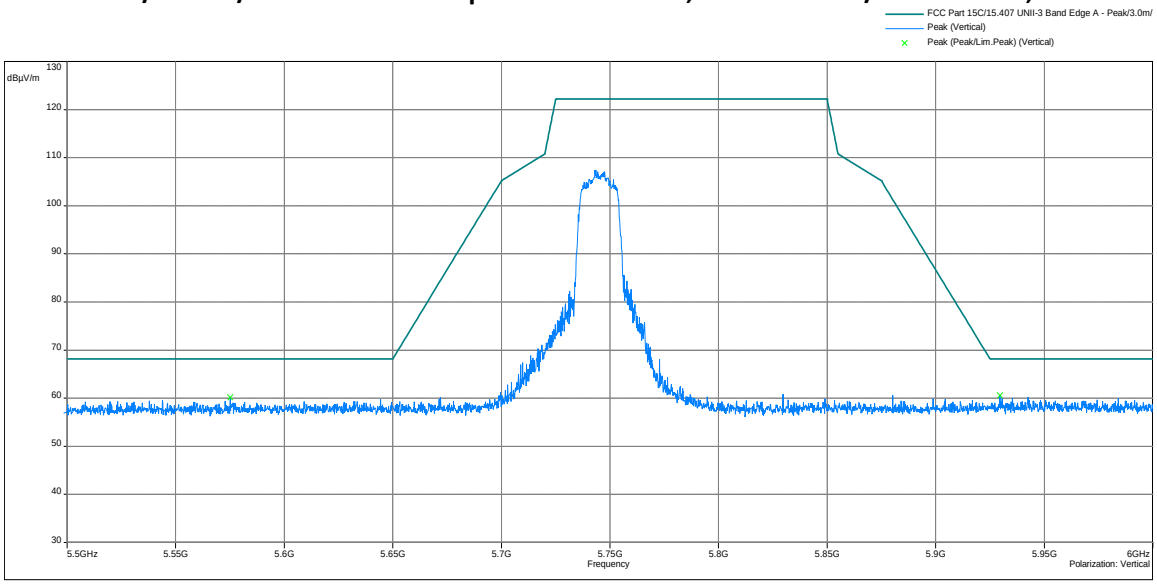
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5700MHz, Peak



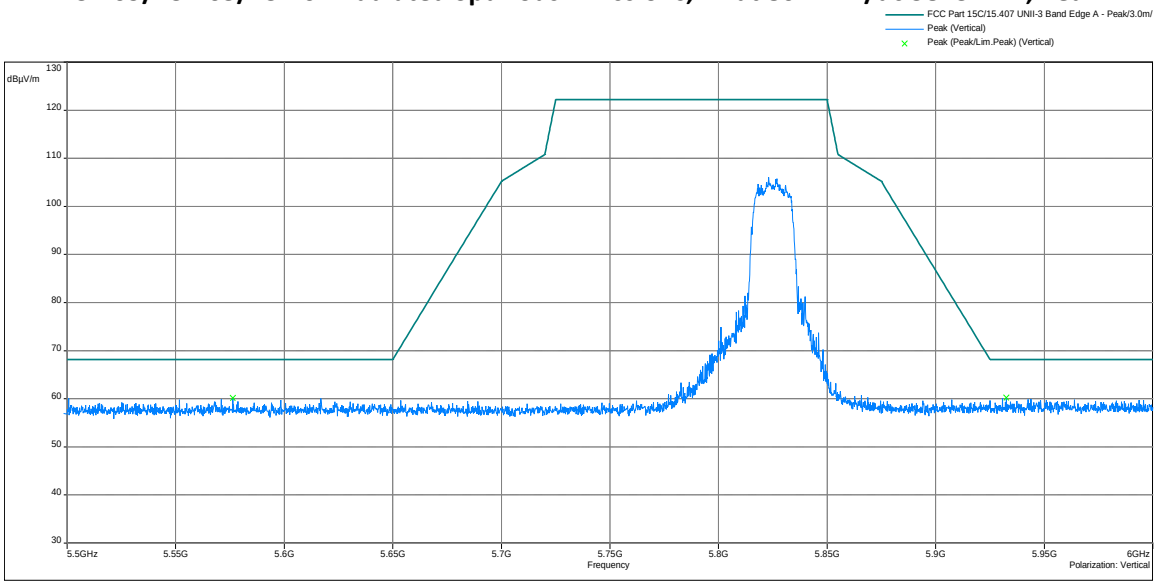
Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5725	Peak	66.83	68.23	-1.40	Pass

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5745MHz, Peak



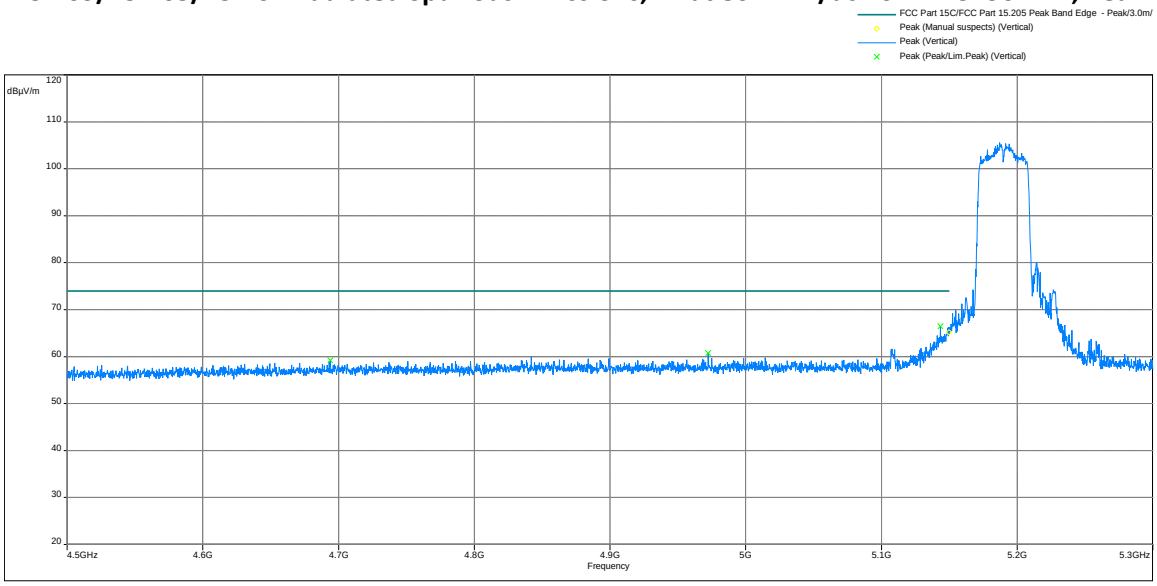
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5825MHz, Peak



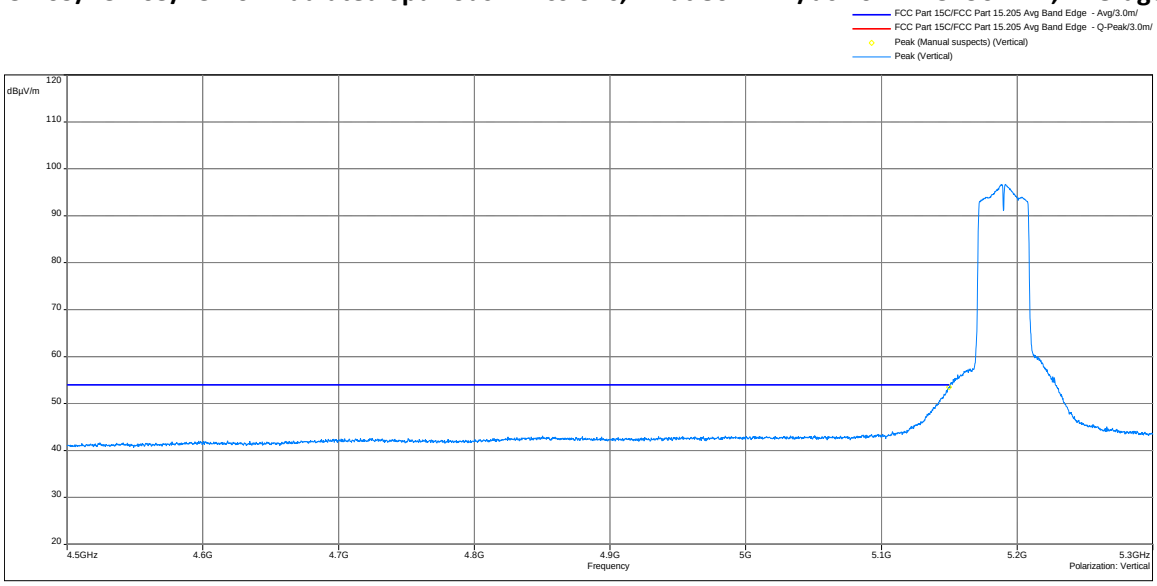
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5190MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Peak	65.18	74	-8.82	Pass

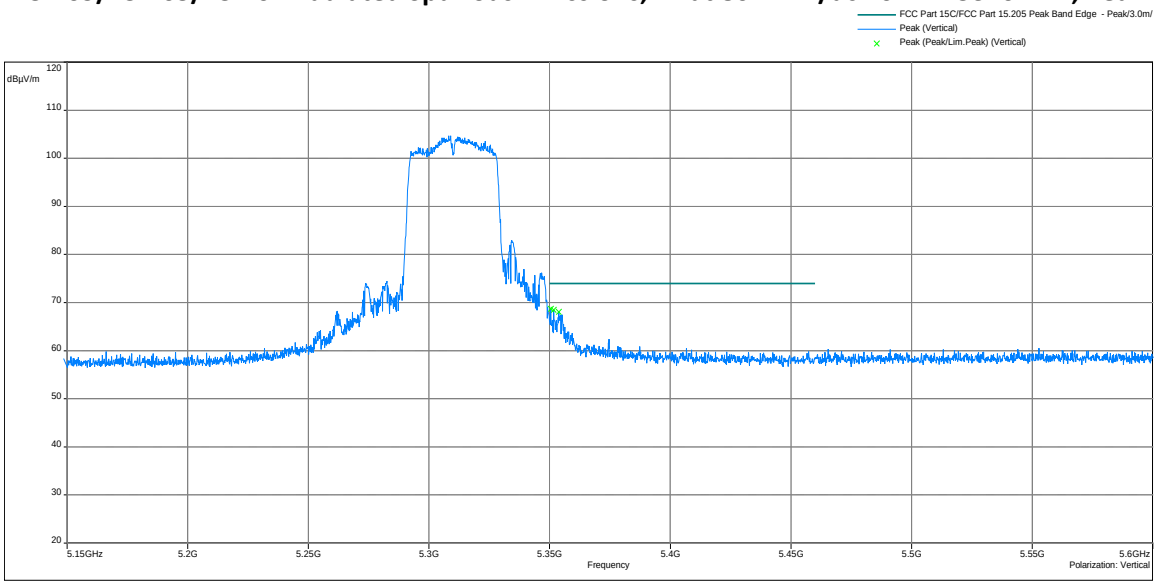
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5190MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Average	53.51	54	-0.49	Pass

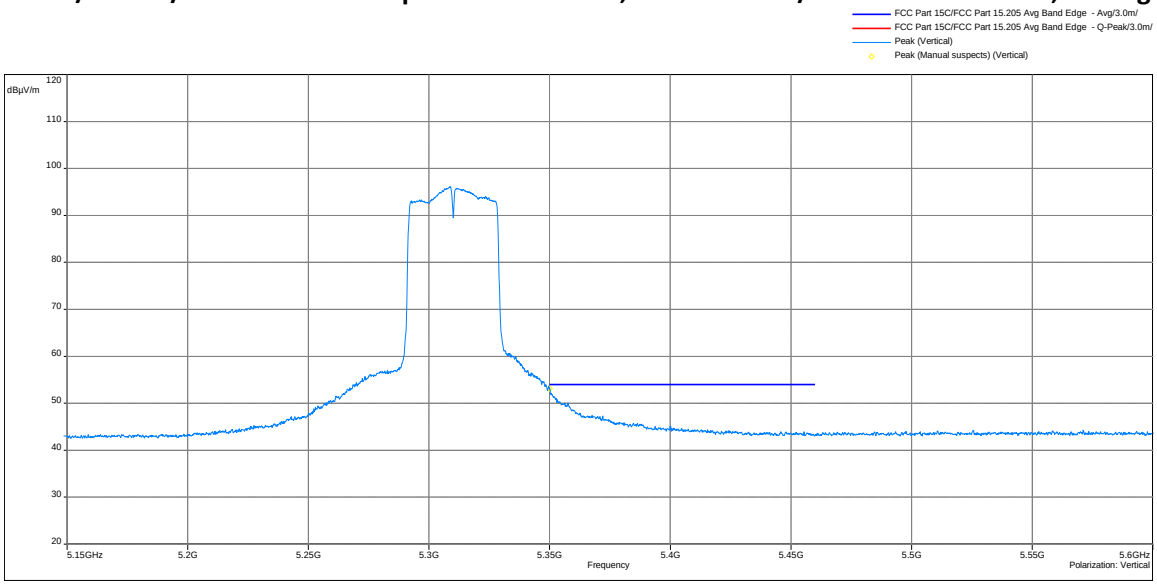
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5310MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Peak	68.06	74	-5.94	Pass

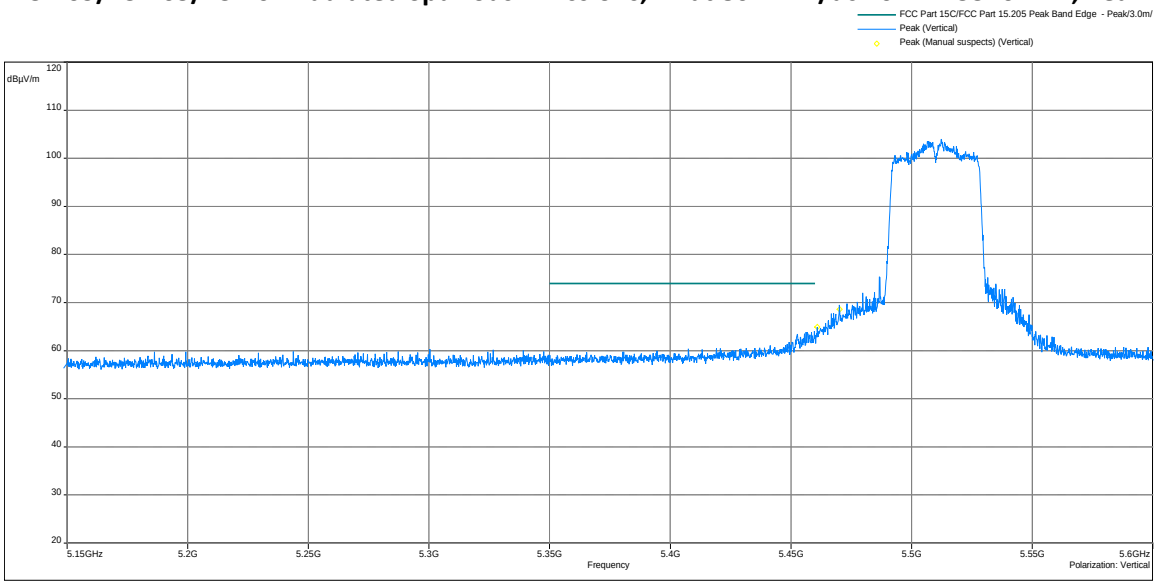
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5310MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Average	53.08	54	-0.92	Pass

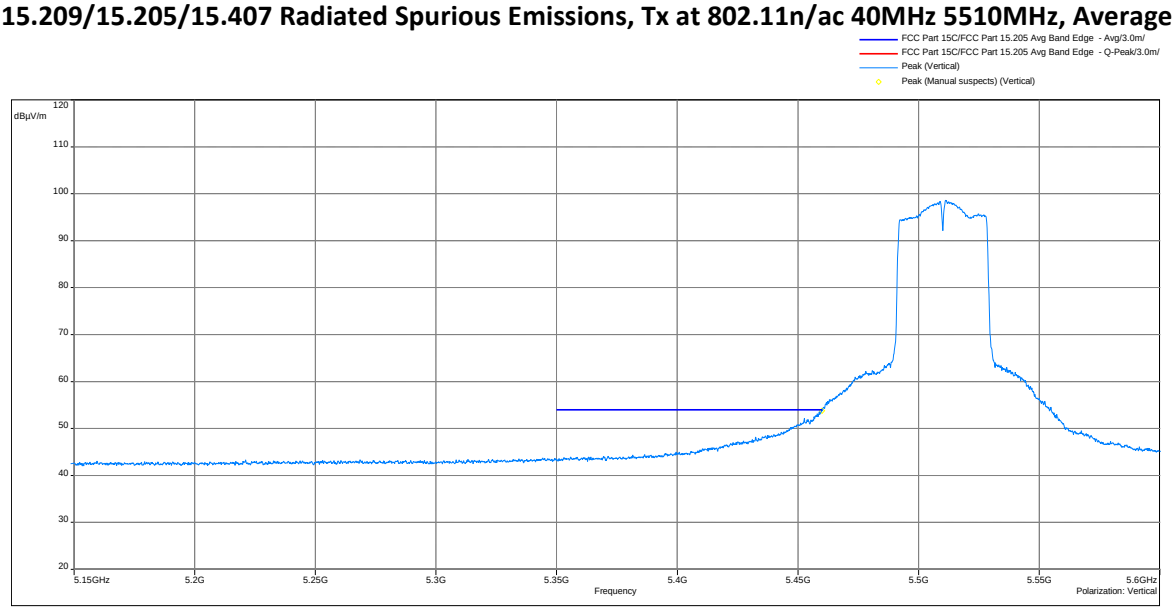
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5510MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Peak	64.90	74	-9.10	Pass
5470	Peak	68.12	68.23	-0.11	Pass

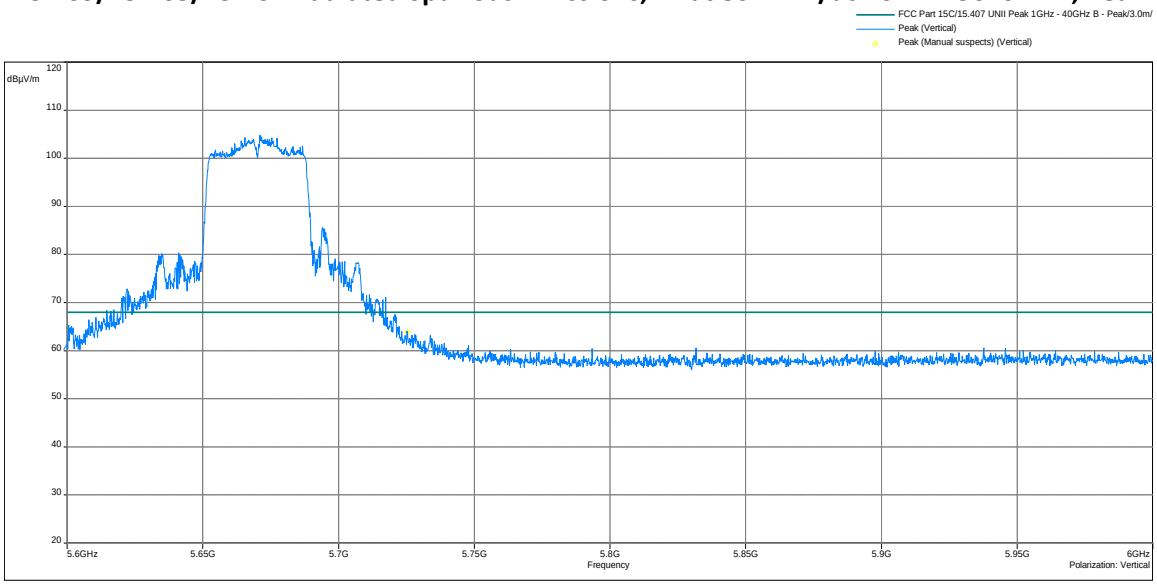
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5510MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Average	53.75	54	-0.25	Pass

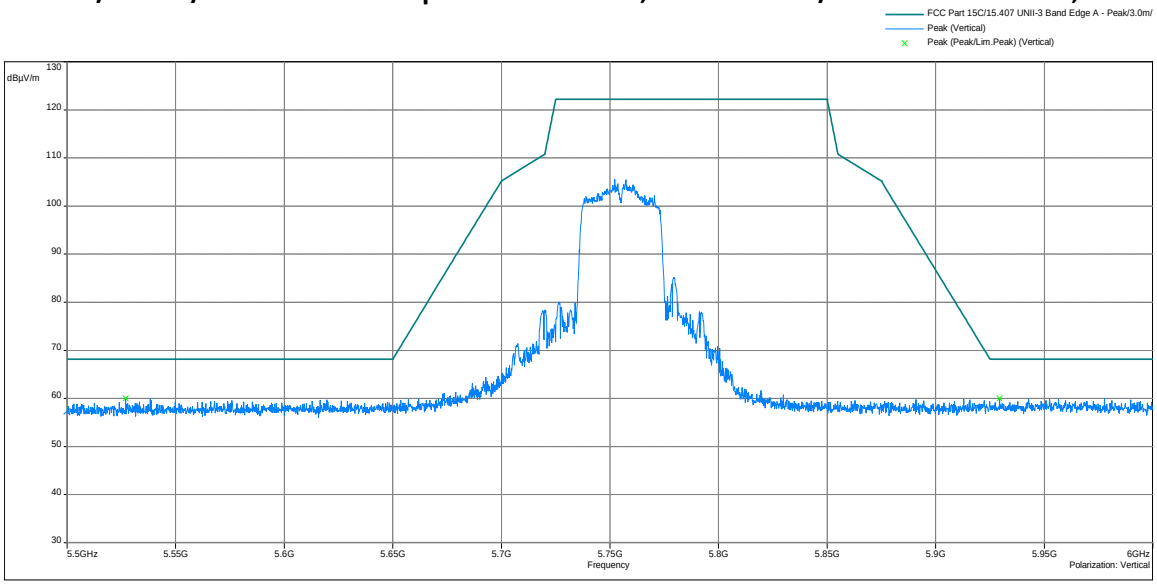
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5670MHz, Peak



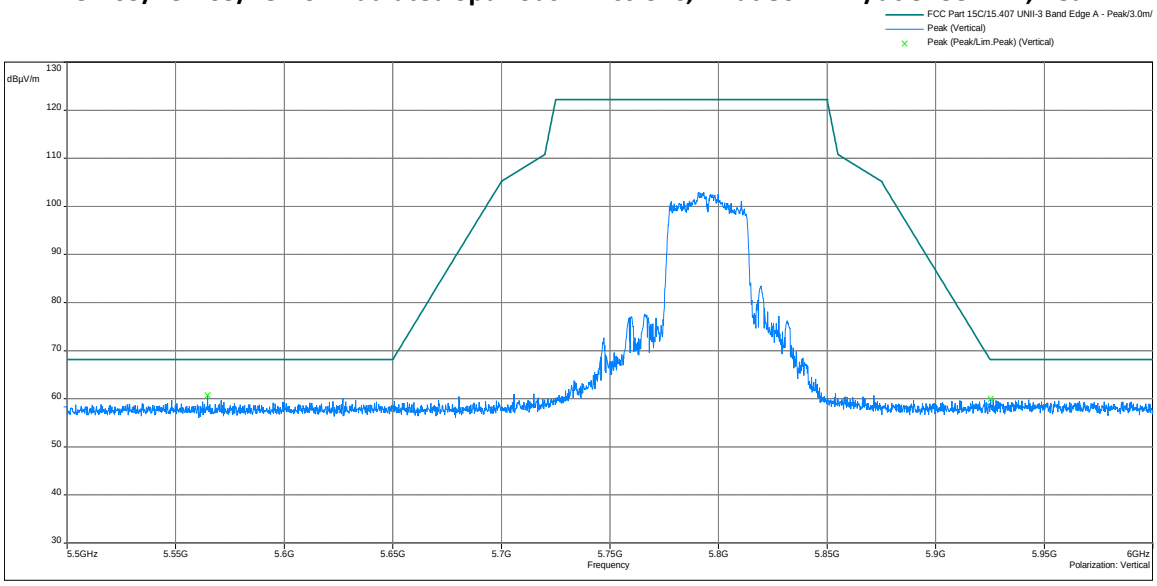
Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5725	Peak	63.79	68.23	-4.44	Pass

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5755MHz, Peak



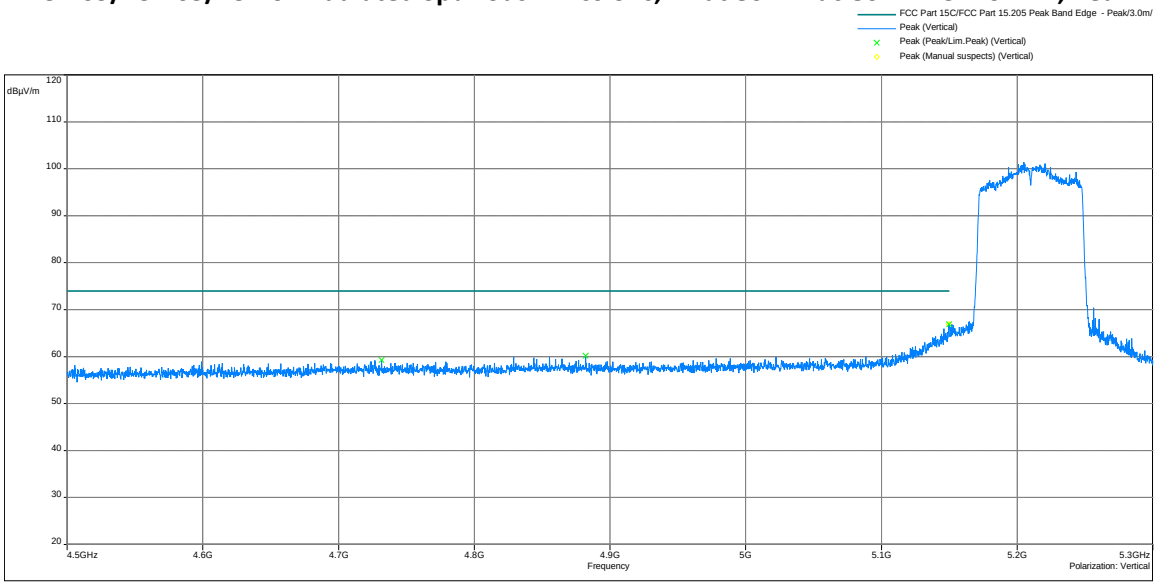
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5795MHz, Peak



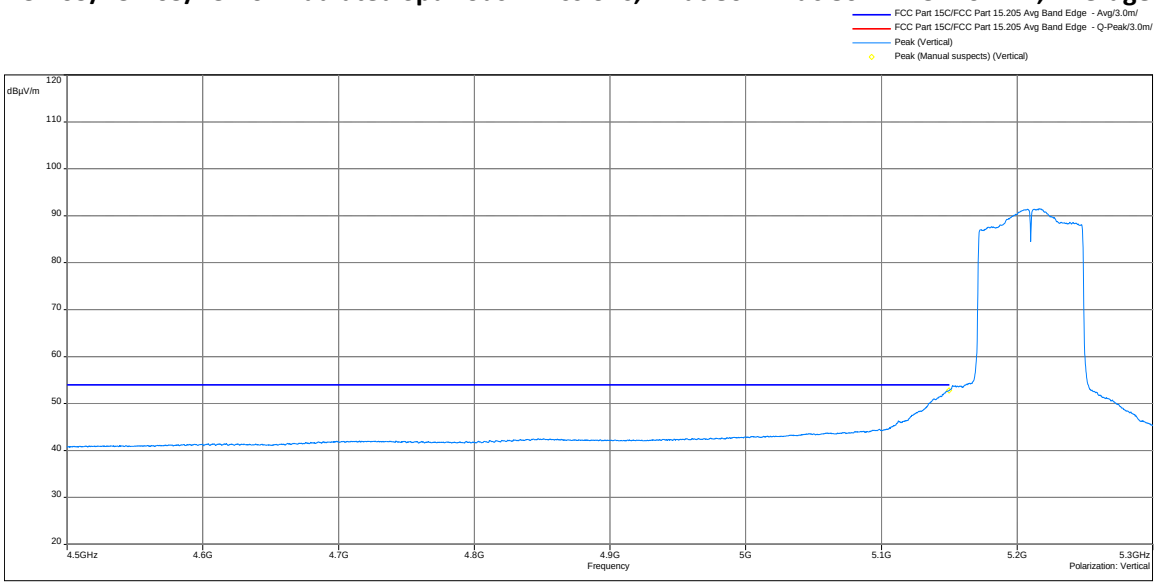
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5210MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Peak	66.85	74	-7.15	Pass

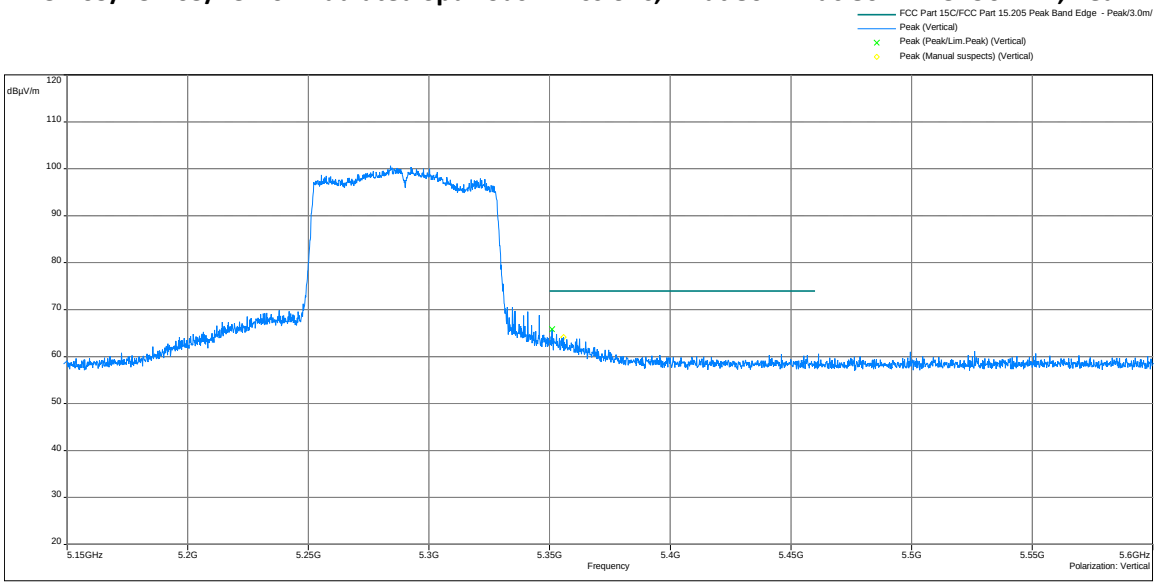
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5210MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Average	52.81	54	-1.19	Pass

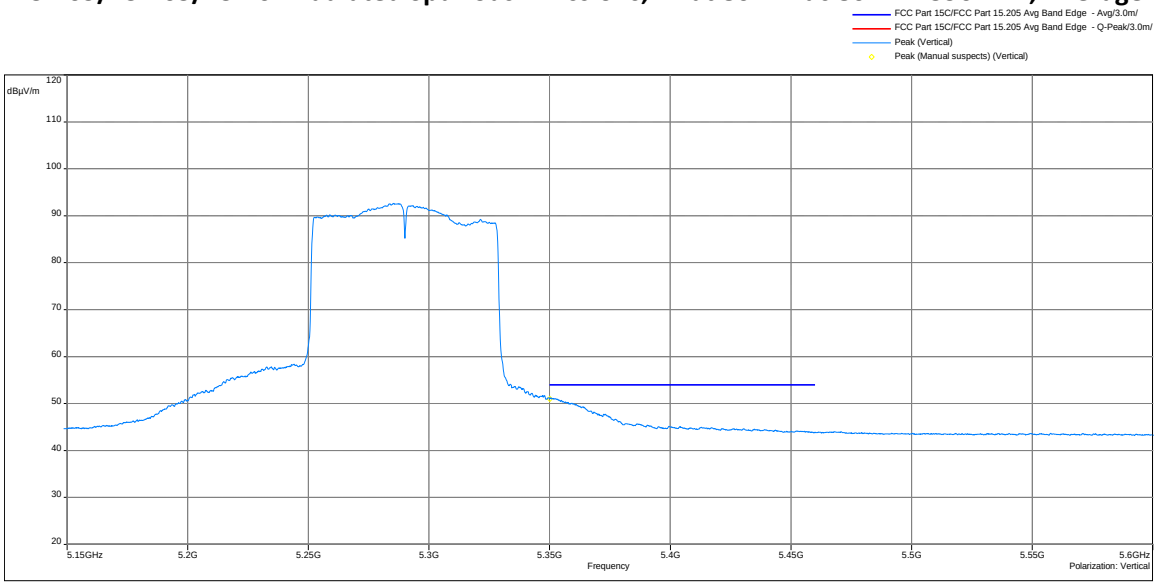
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5290MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Peak	65.85	74	-8.15	Pass

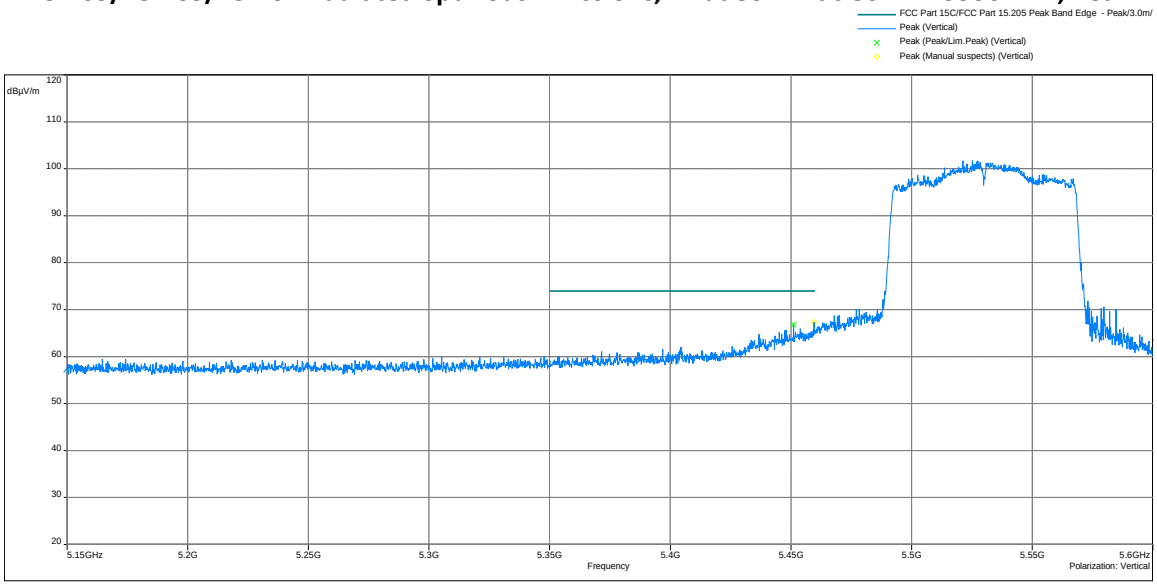
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 590MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Average	53.08	54	-0.92	Pass

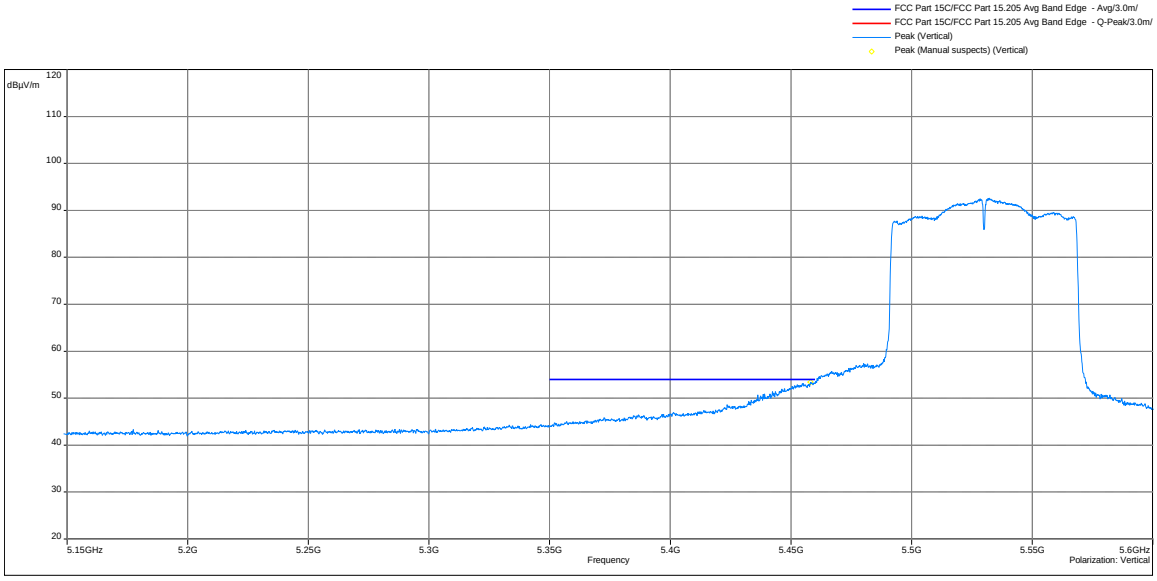
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5530MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Peak	67.36	74	-6.64	Pass
5470	Peak	68.11	68.23	-0.12	Pass

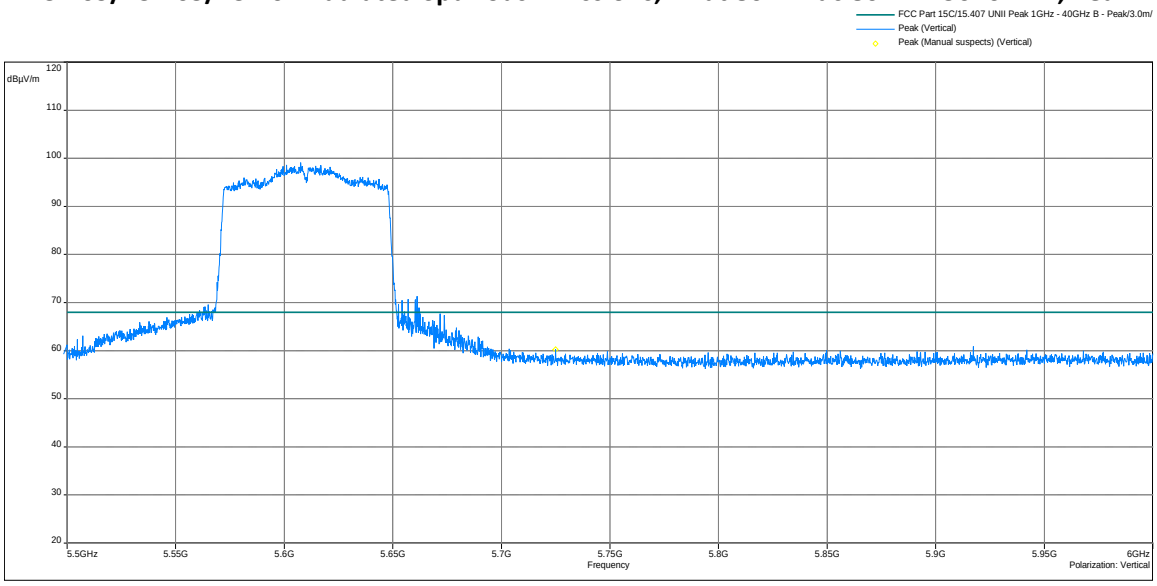
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5530MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Average	53.40	54	-0.60	Pass

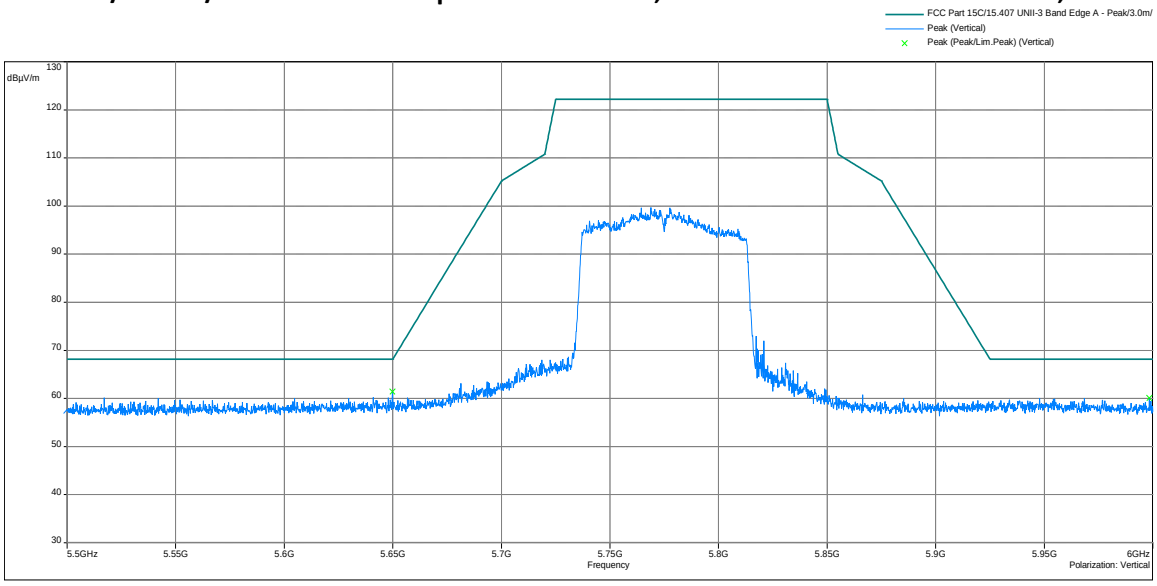
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5610MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5725	Peak	60.23	68.23	-8.00	Pass

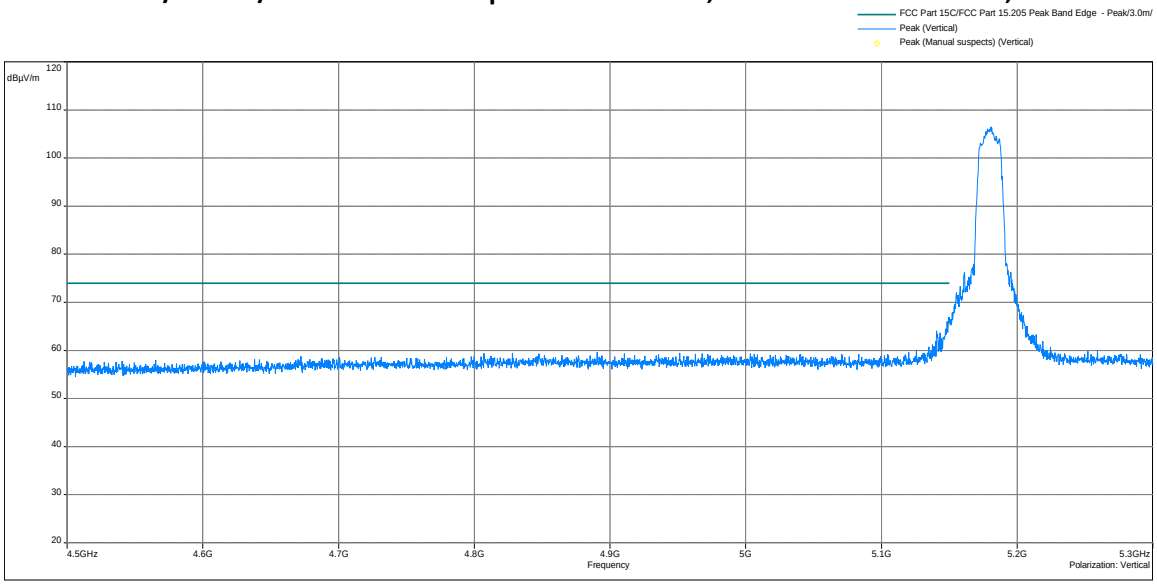
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5775MHz, Peak



Test Results: With Headphones

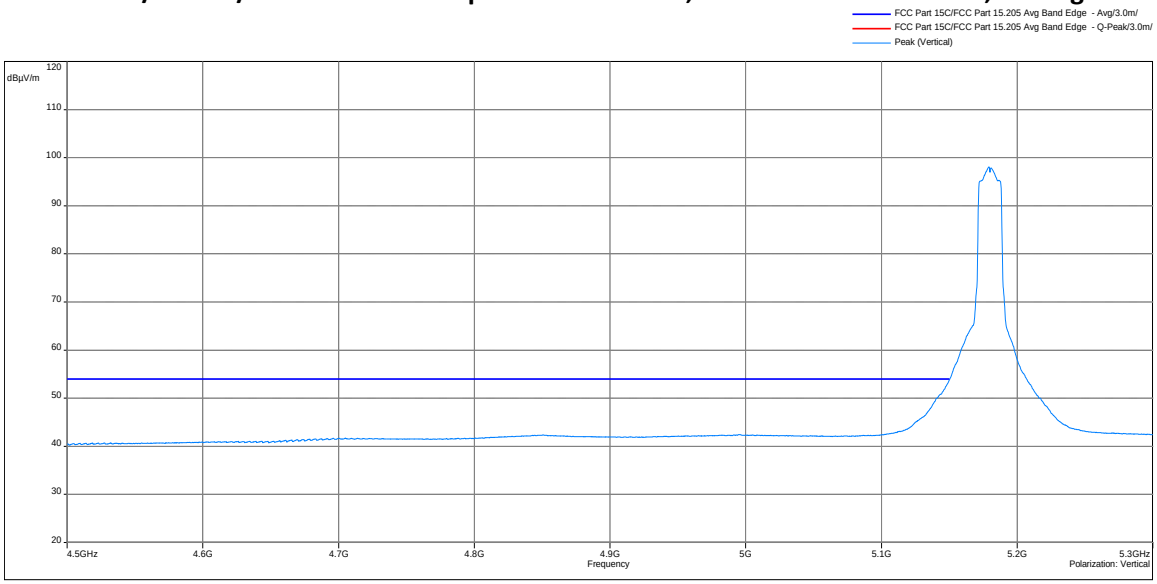
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5180MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Peak	65.67	74	-8.33	Pass

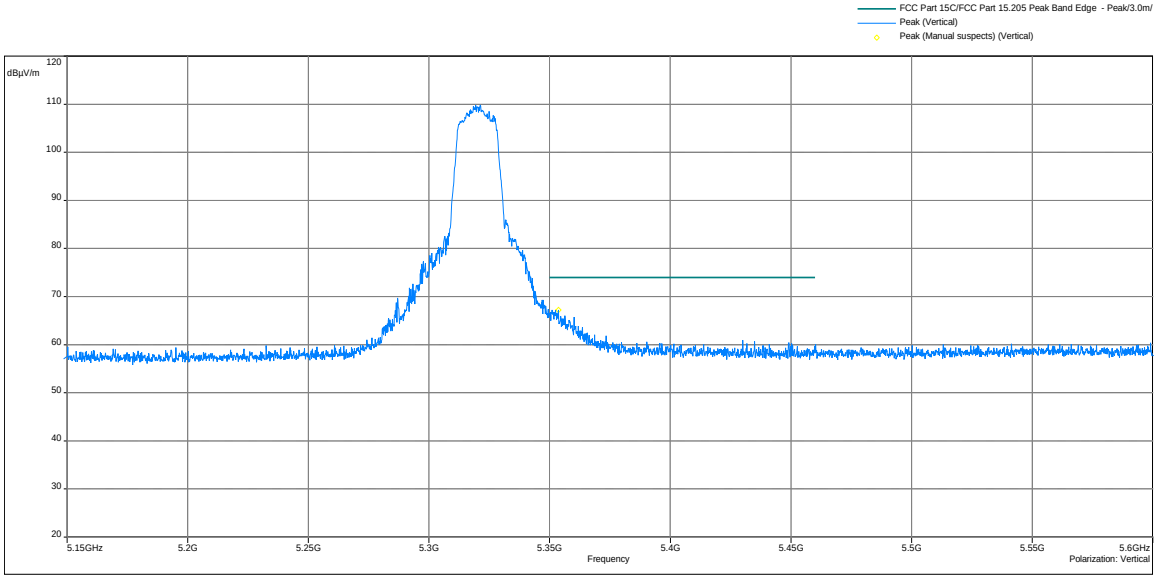
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5180MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Average	53.69	54	-0.31	Pass

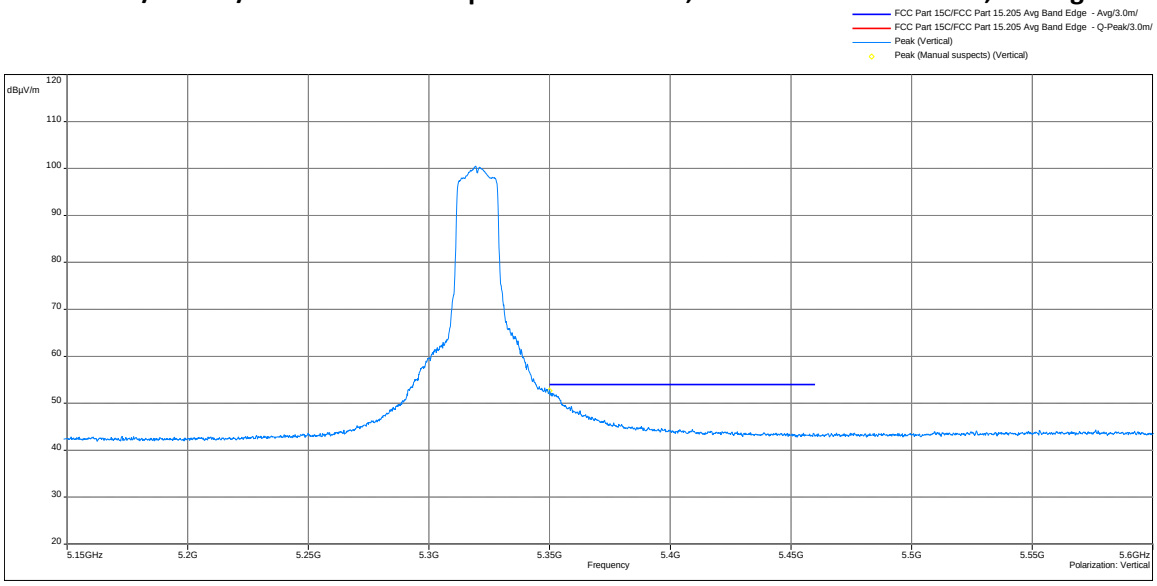
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5320MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Peak	67.22	74	-6.78	Pass

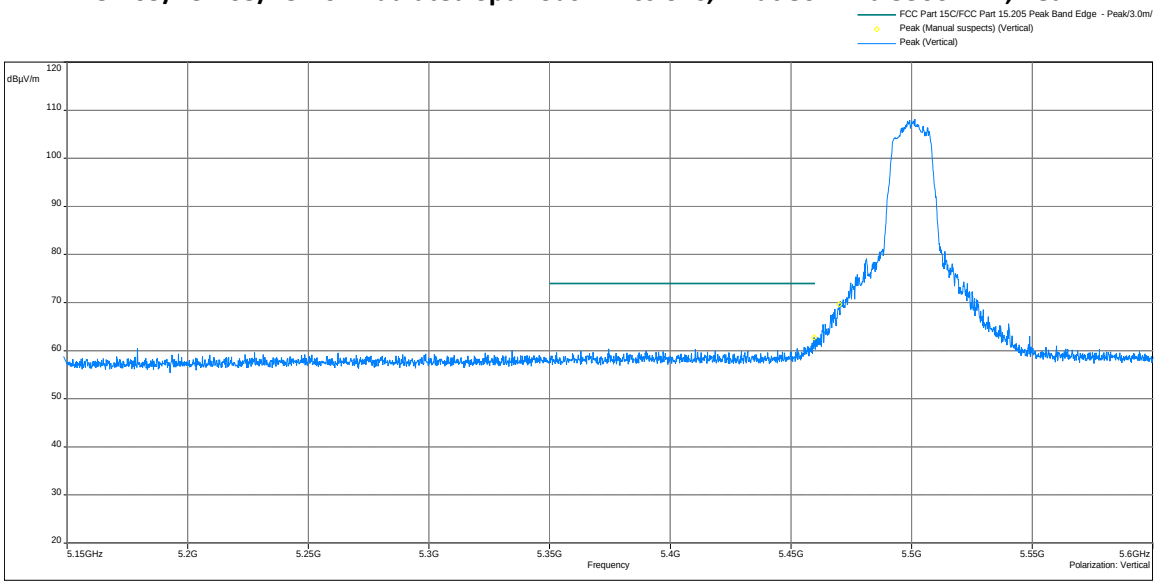
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5320MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Average	52.65	54	-1.35	Pass

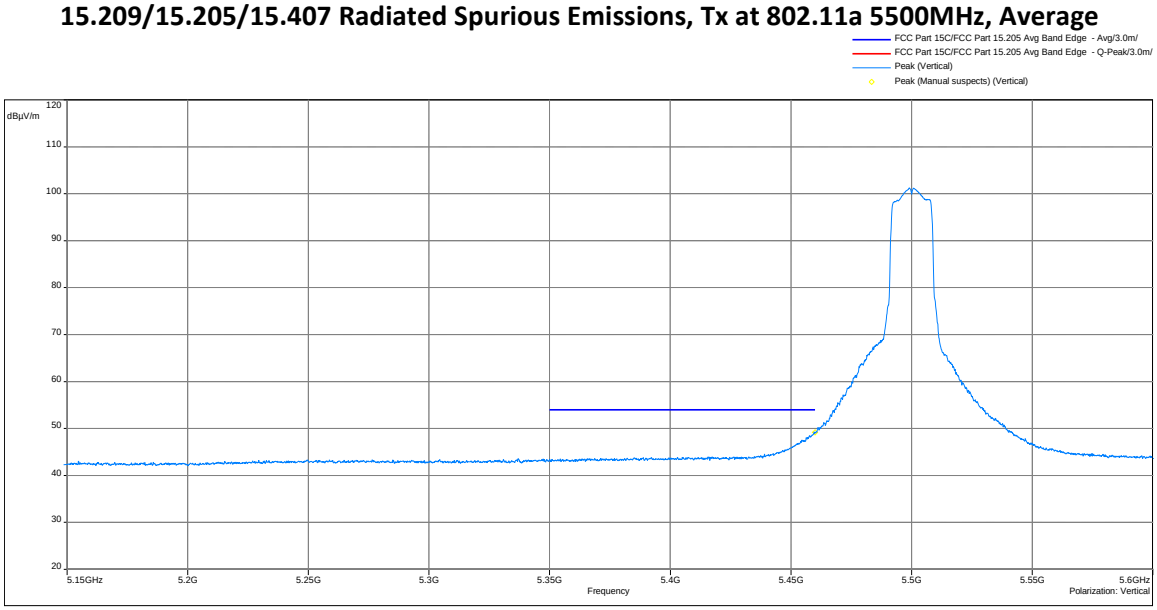
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5500MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Peak	62.76	74	-11.24	Pass
5470	Peak	68.15	68.23	-0.08	Pass

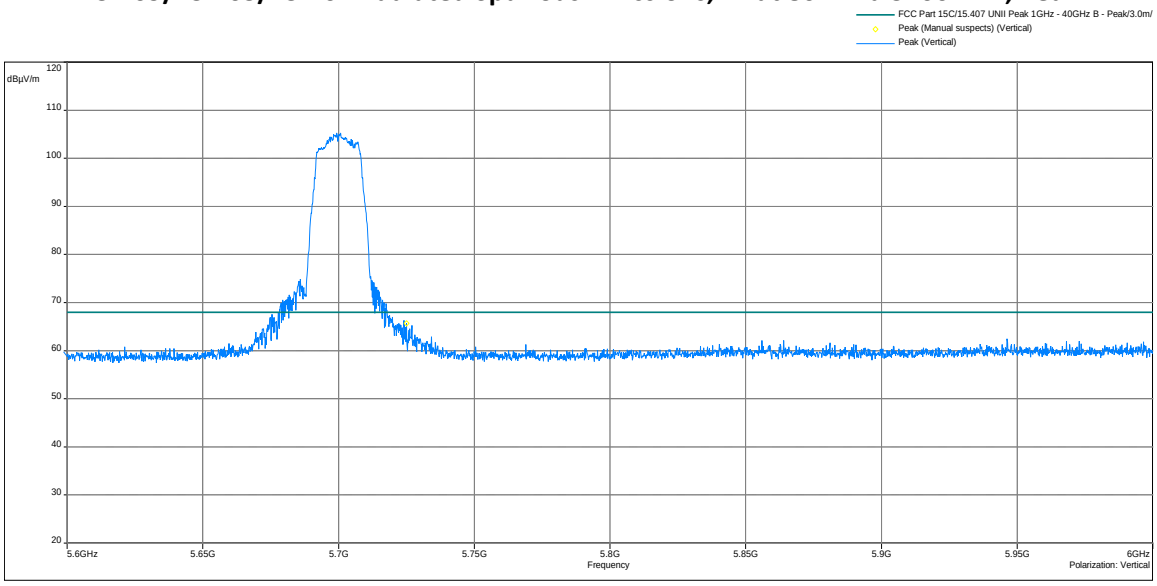
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5500MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Average	49.16	54	-4.84	Pass

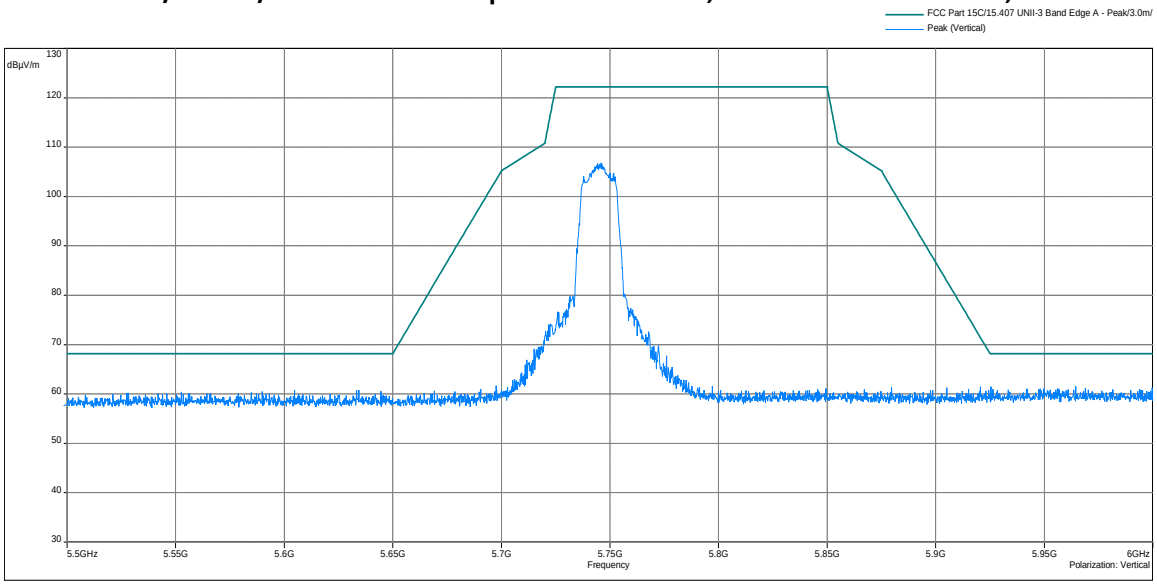
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5700MHz, Peak



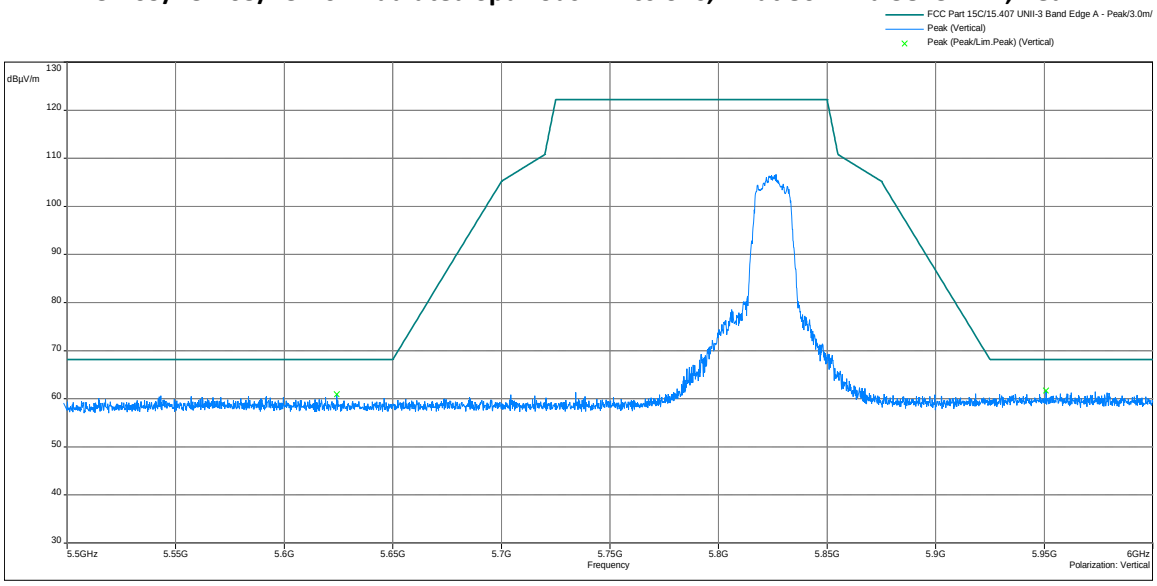
Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5725	Peak	66.68	68.23	-2.55	Pass

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5745MHz, Peak



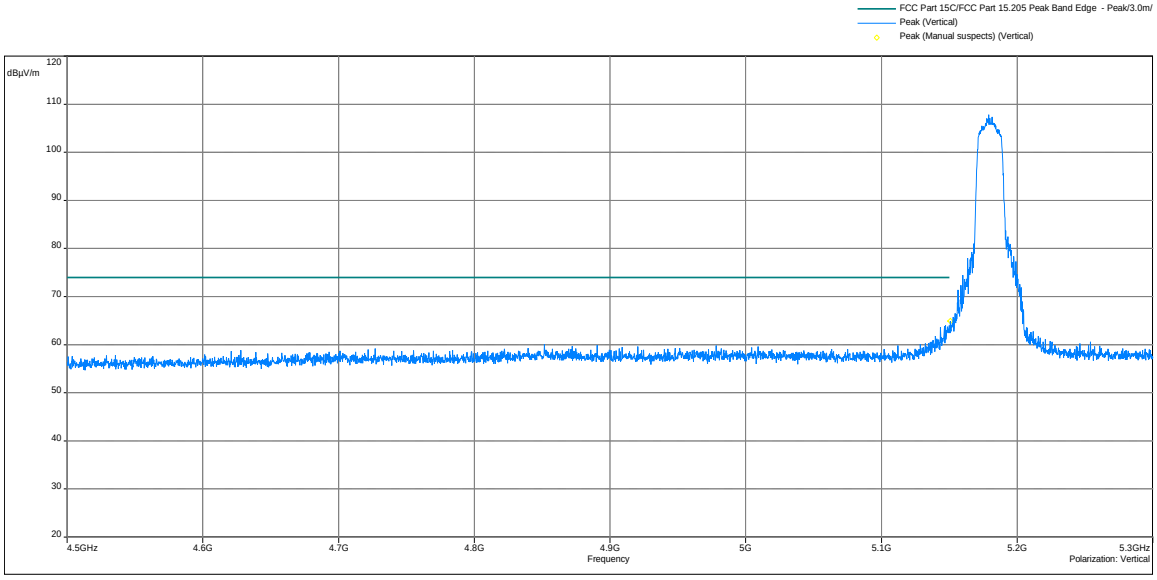
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11a 5825MHz, Peak



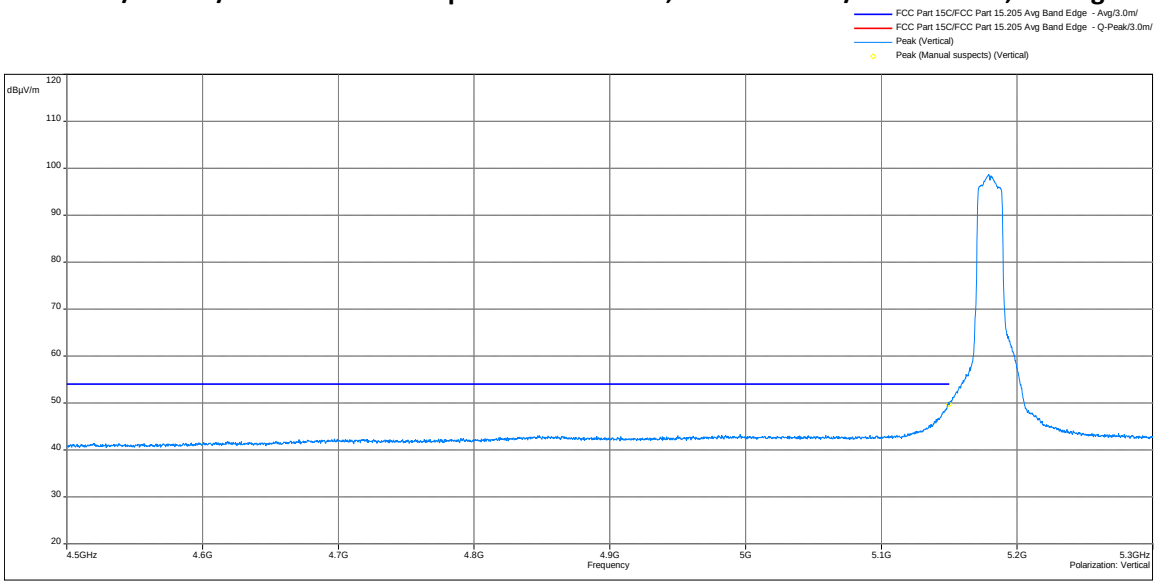
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5180MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Peak	64.93	74	-9.07	Pass

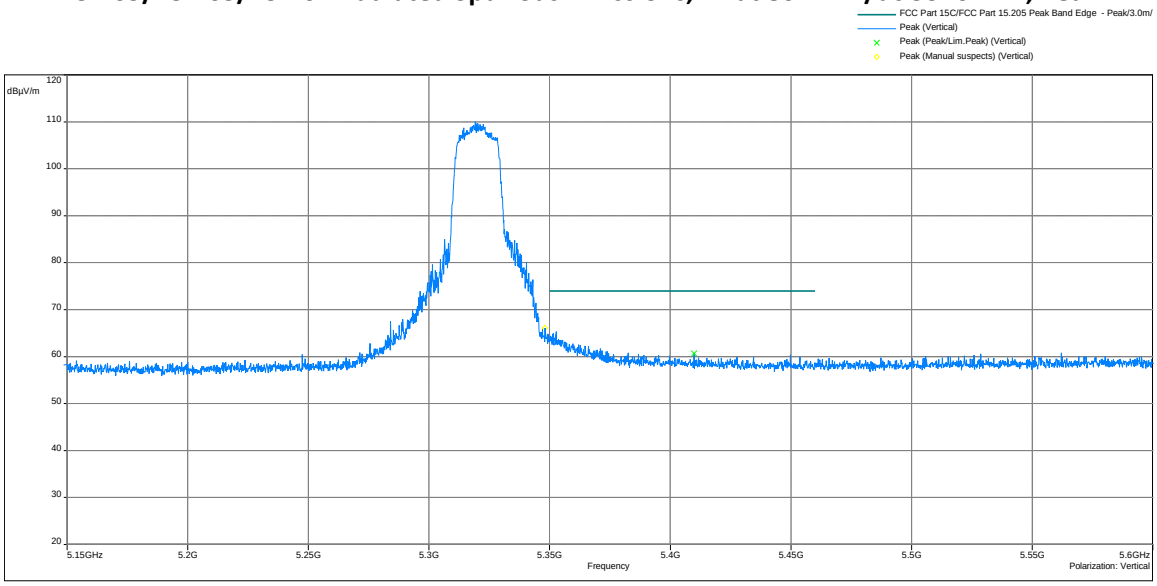
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5180MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Average	49.73	54	-4.26	Pass

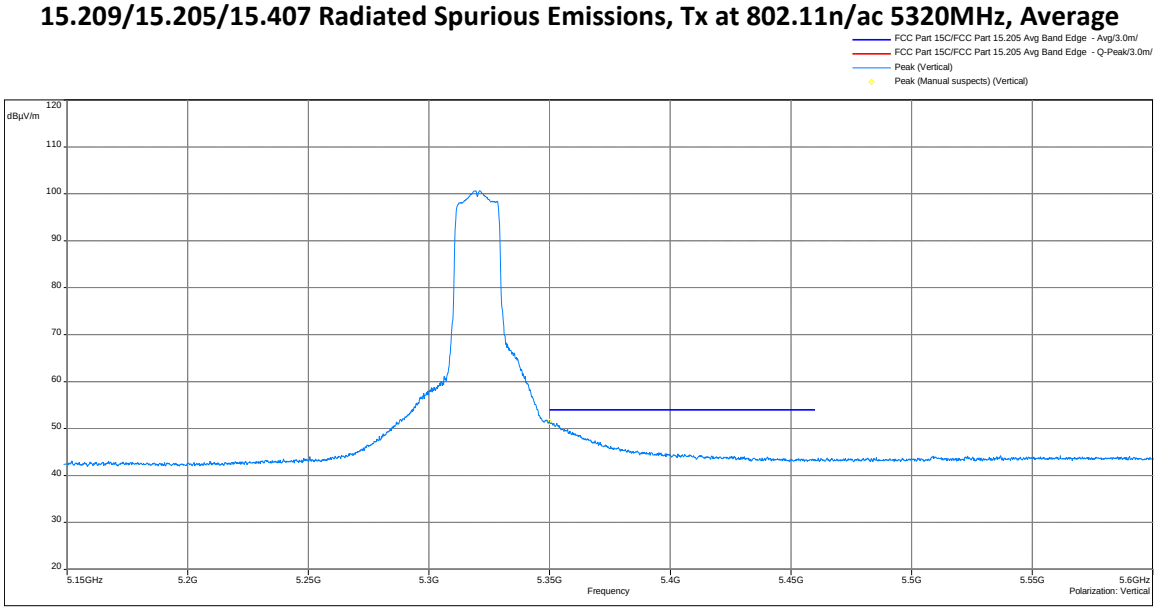
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5320MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Peak	66.13	74	-7.87	Pass

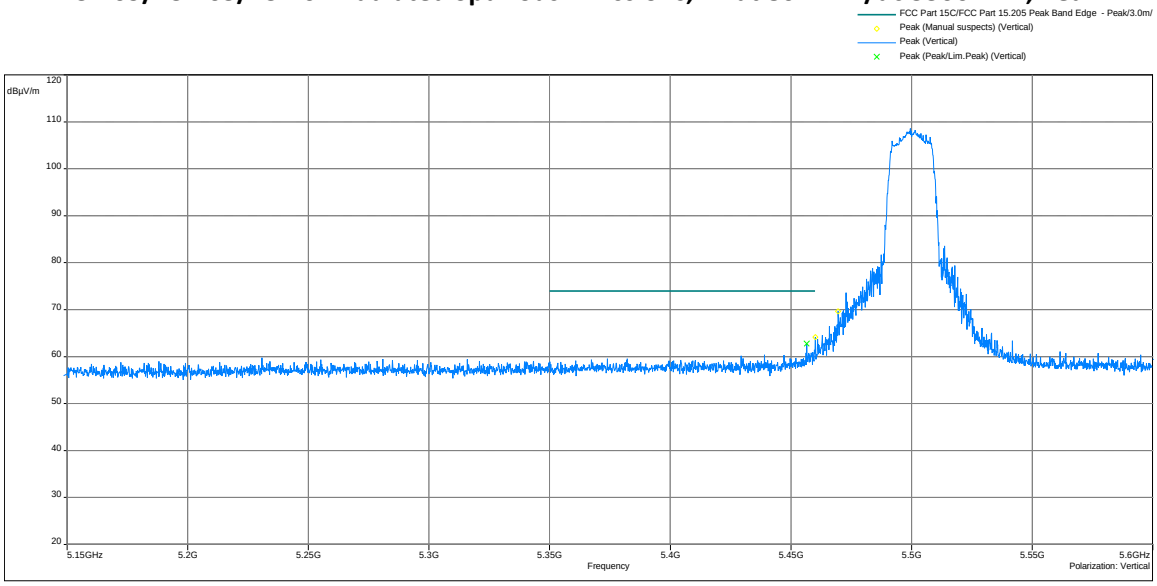
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5320MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Average	51.47	54	-2.53	Pass

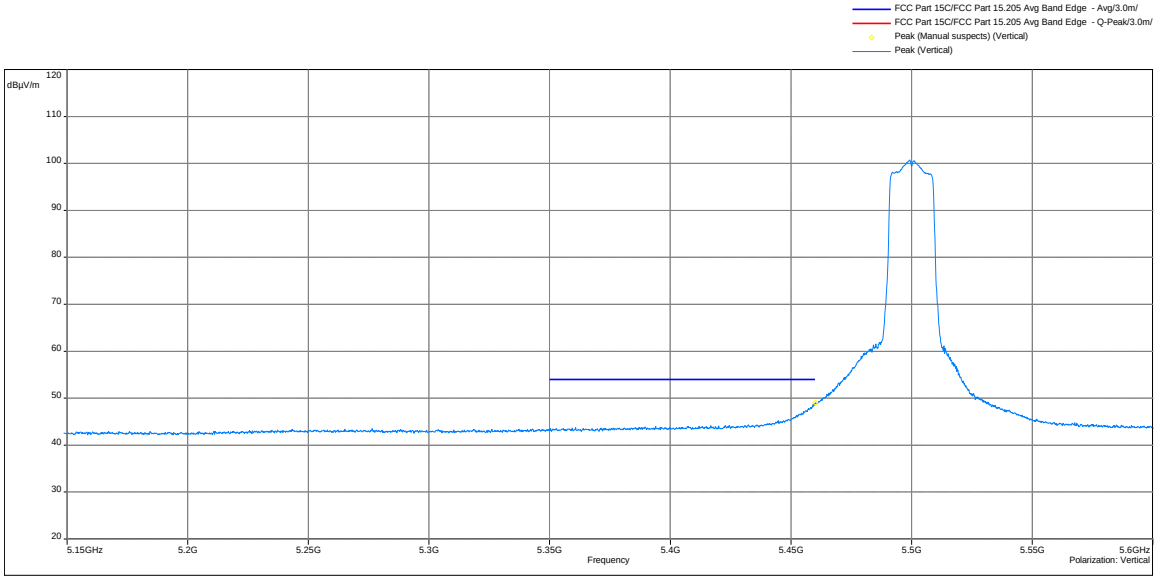
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5500MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Peak	64.13	74	-9.87	Pass
5470	Peak	68.20	68.23	-0.03	Pass

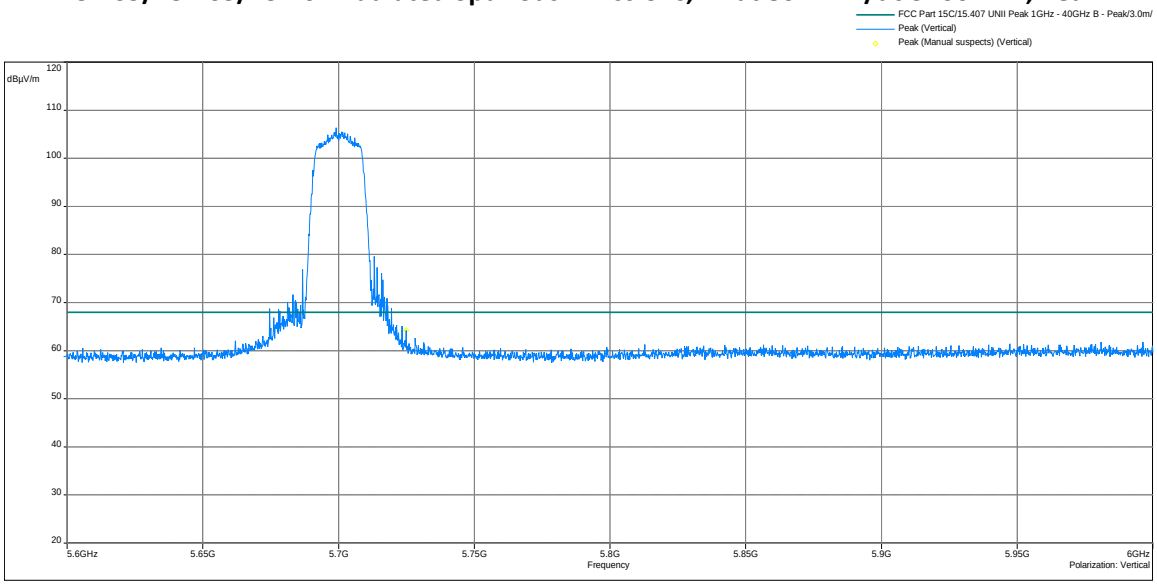
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5500MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Average	49.03	54	-4.97	Pass

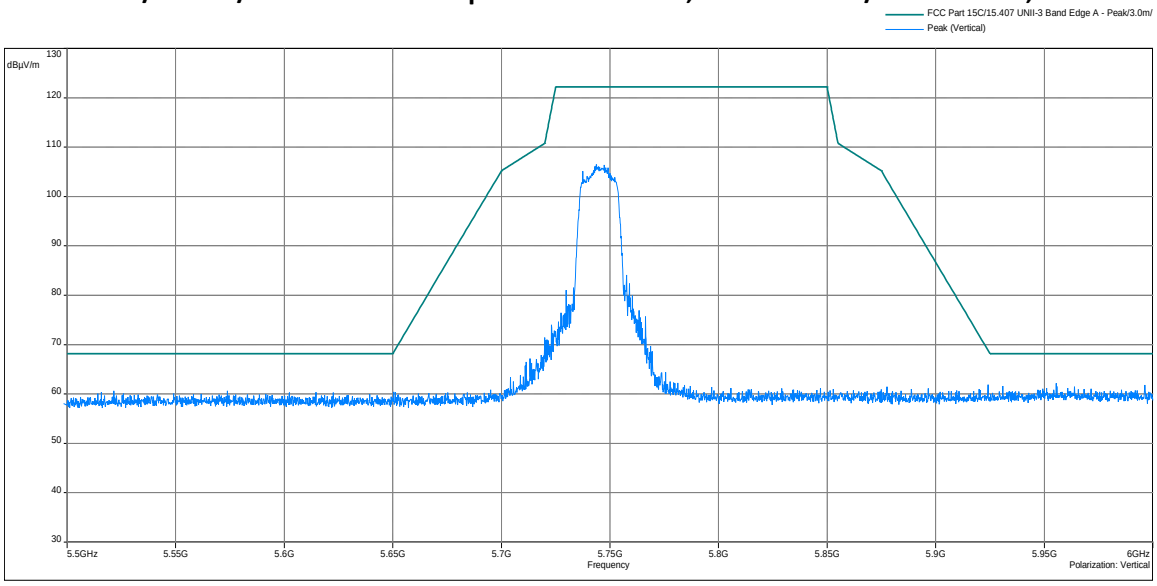
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5700MHz, Peak



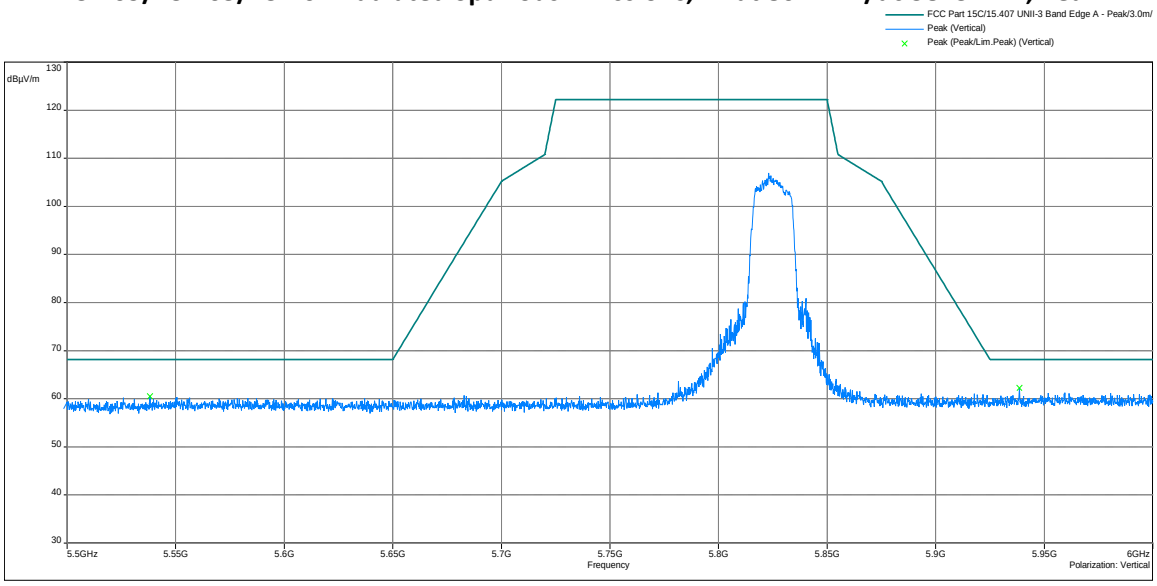
Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5725	Peak	64.20	68.23	-4.03	Pass

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5745MHz, Peak



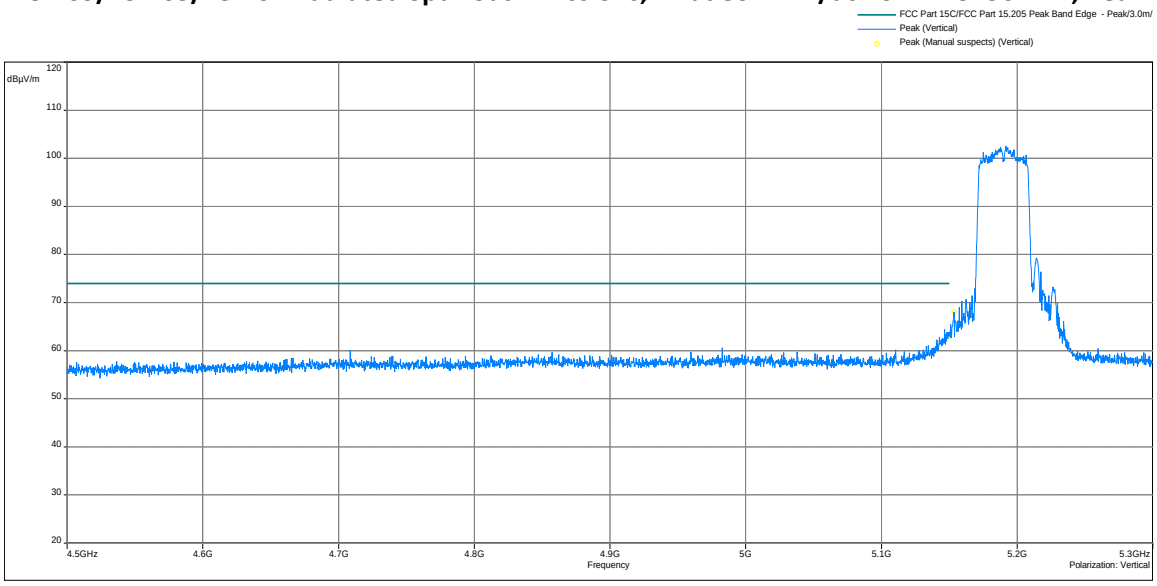
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5825MHz, Peak



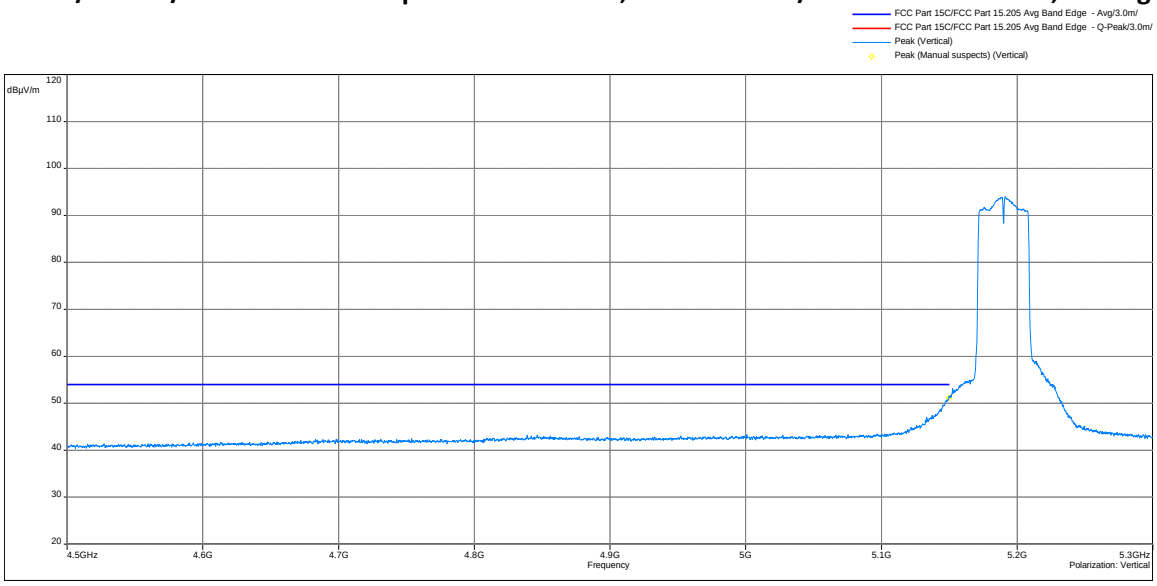
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5190MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Peak	62.89	74	-8.82	Pass

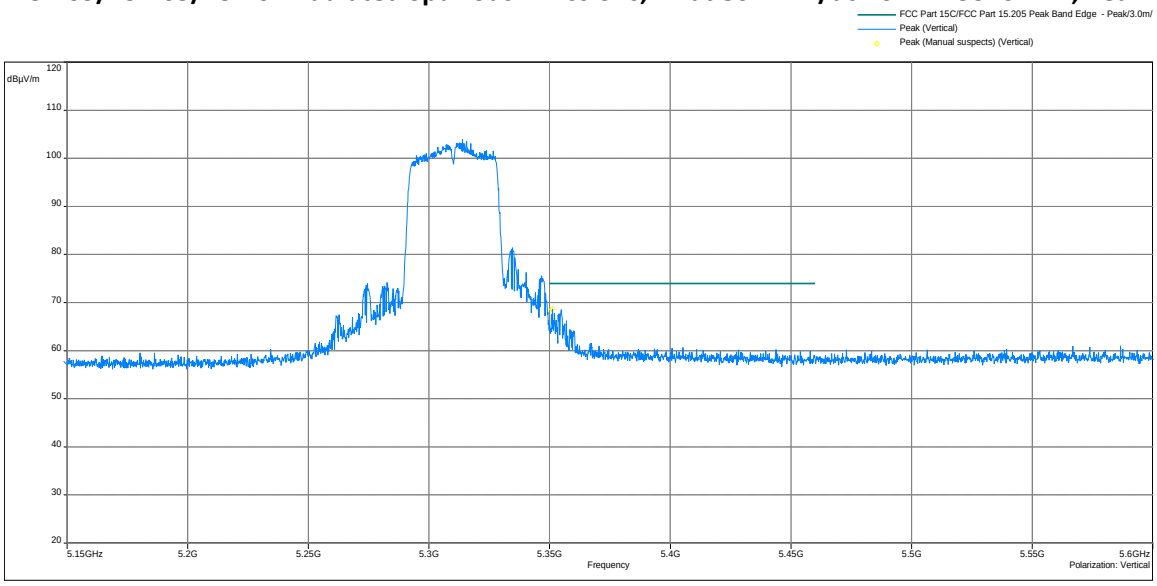
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5190MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Average	51.13	54	2.87	Pass

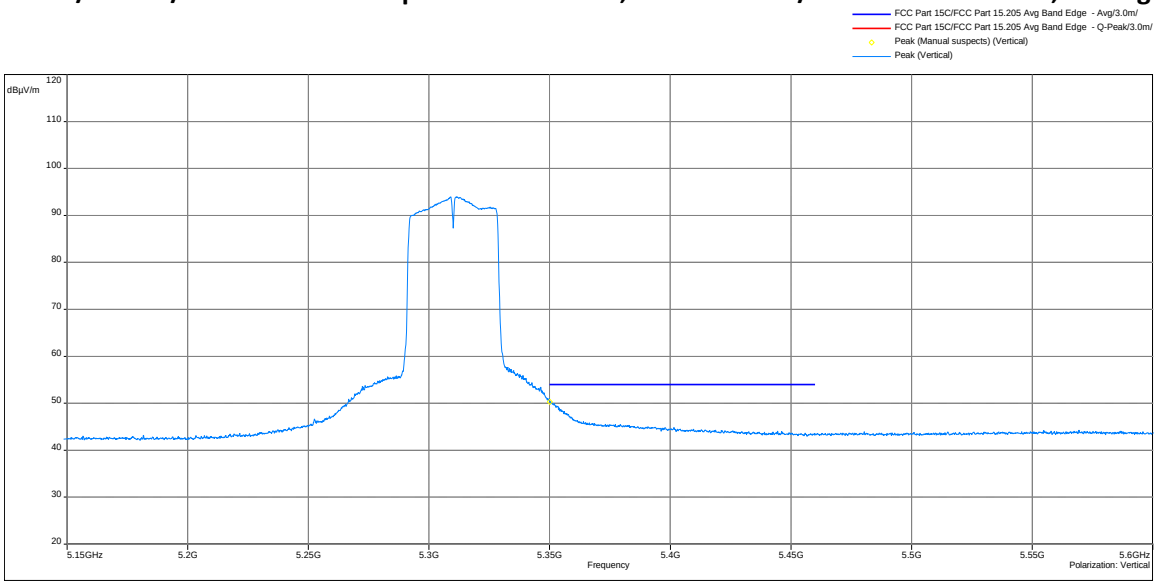
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5310MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Peak	68.05	74	-5.95	Pass

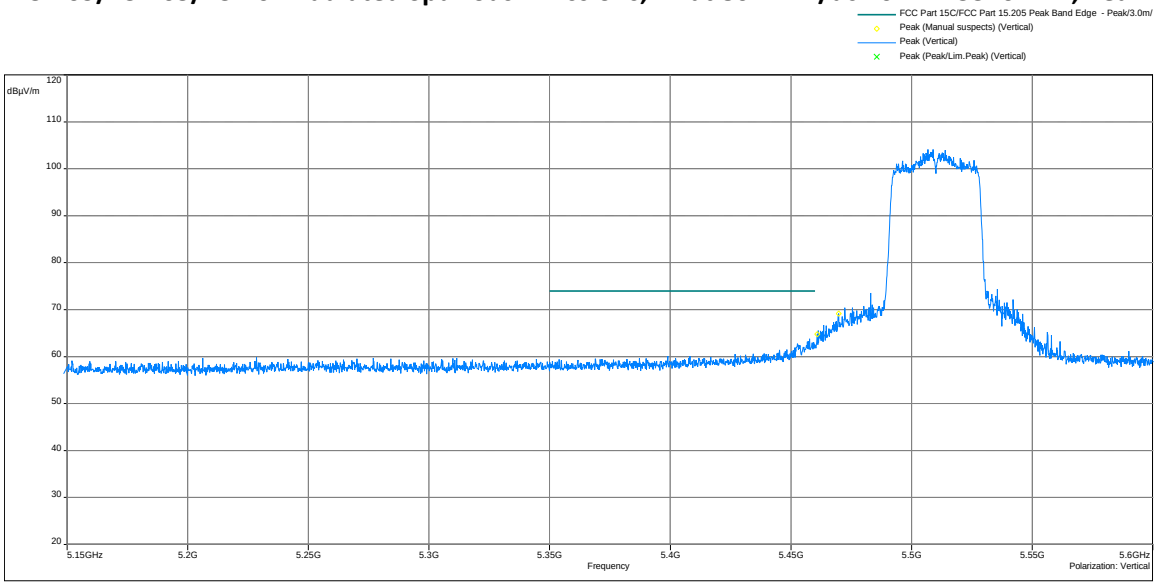
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5310MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Average	50.33	54	-3.67	Pass

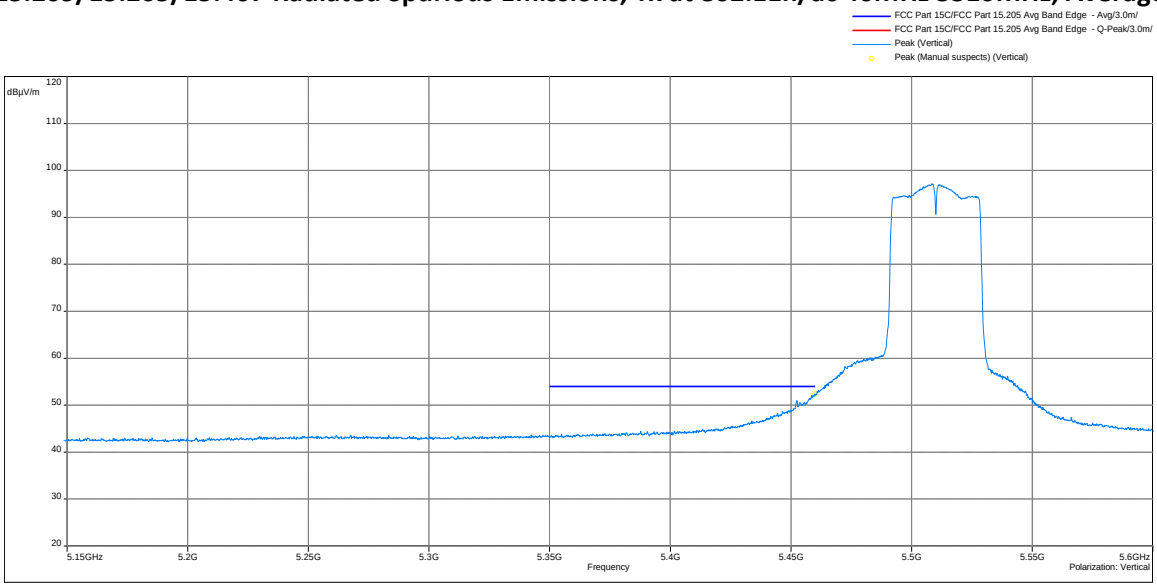
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5510MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Peak	64.82	74	-9.18	Pass
5470	Peak	68.13	68.23	-0.10	Pass

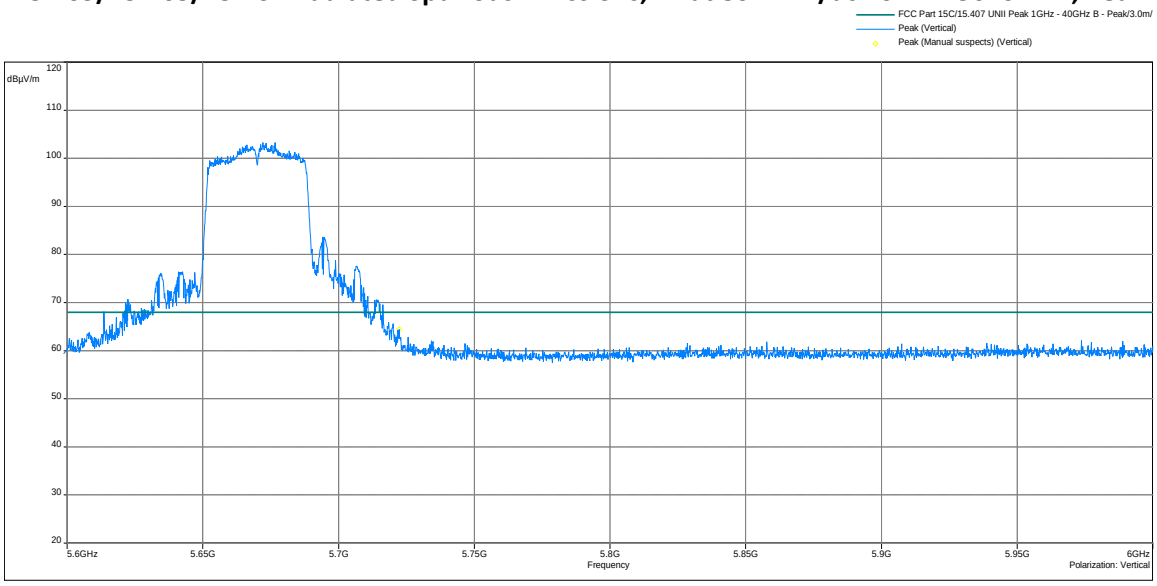
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5510MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Average	52.46	54	-1.54	Pass

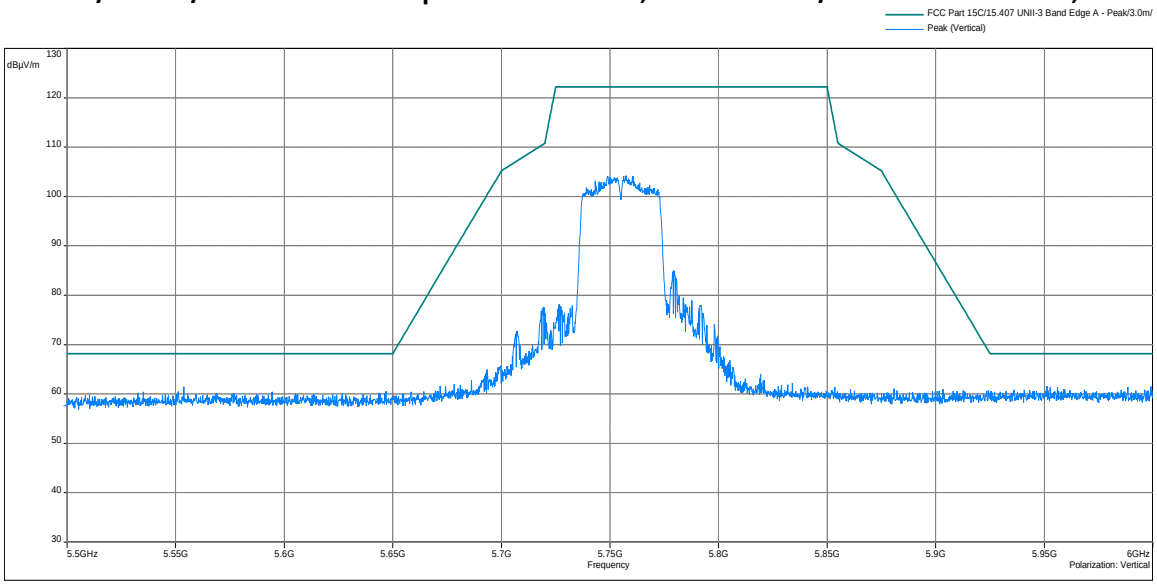
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5670MHz, Peak



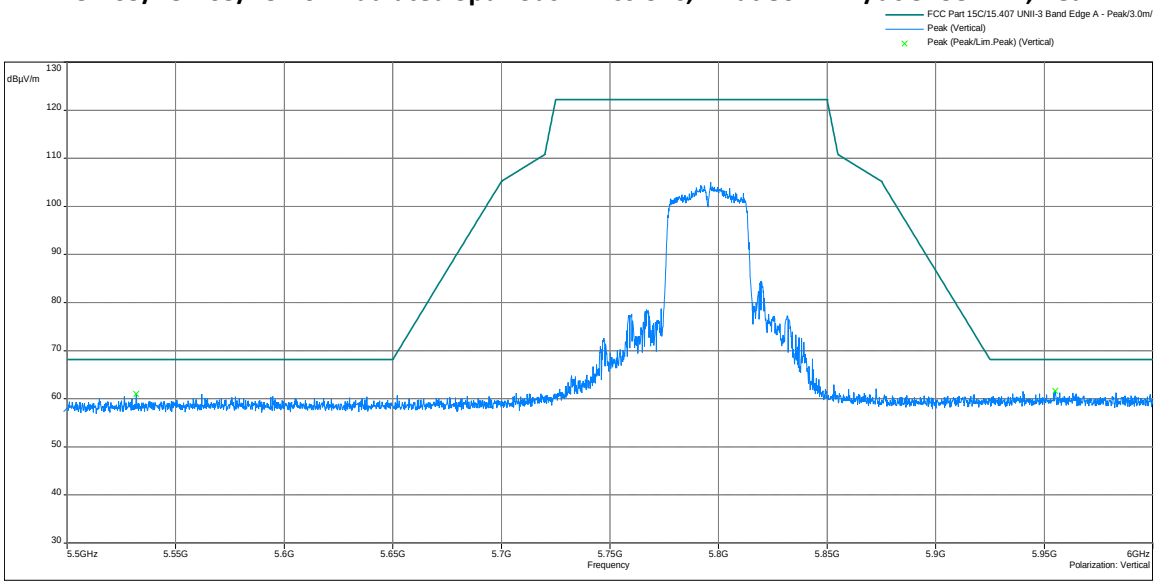
Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5725	Peak	64.43	68.23	-3.80	Pass

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 40MHz 5755MHz, Peak



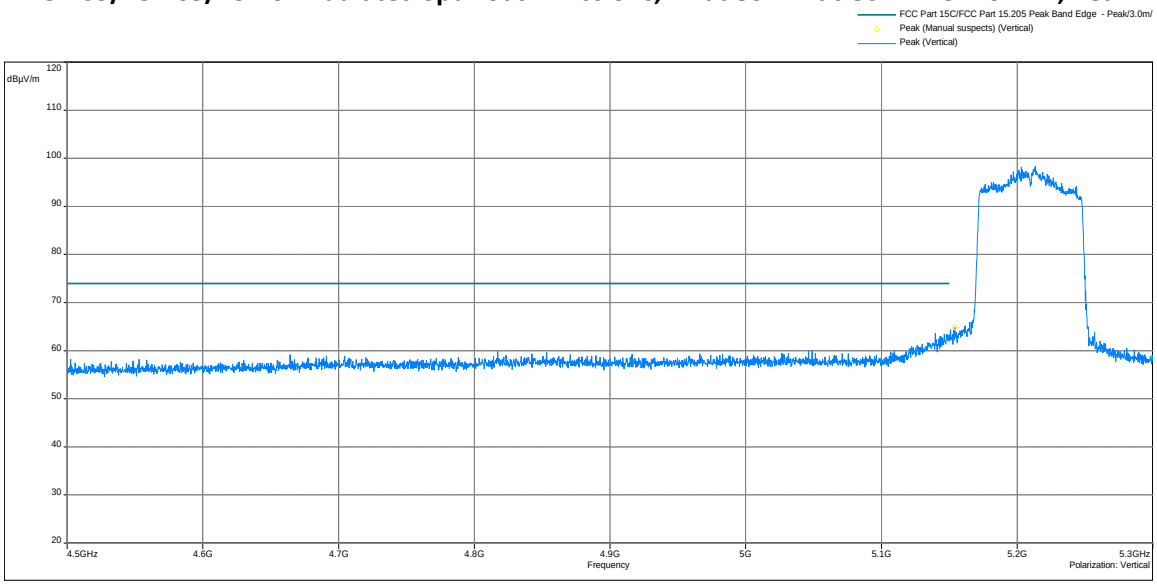
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11n/ac 5795MHz, Peak



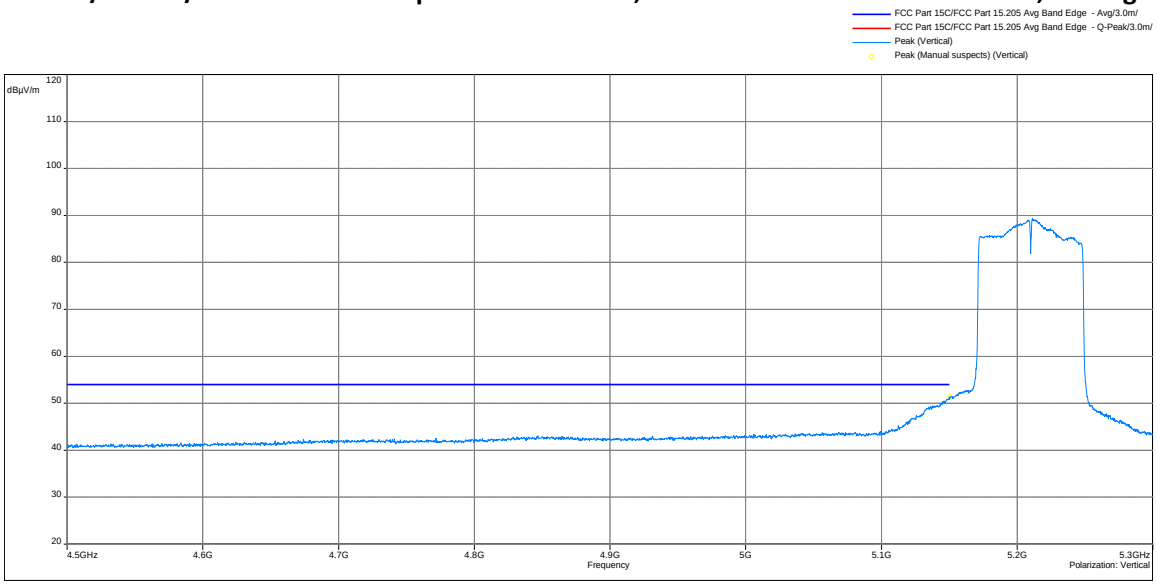
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5210MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Peak	64.88	74	-9.12	Pass

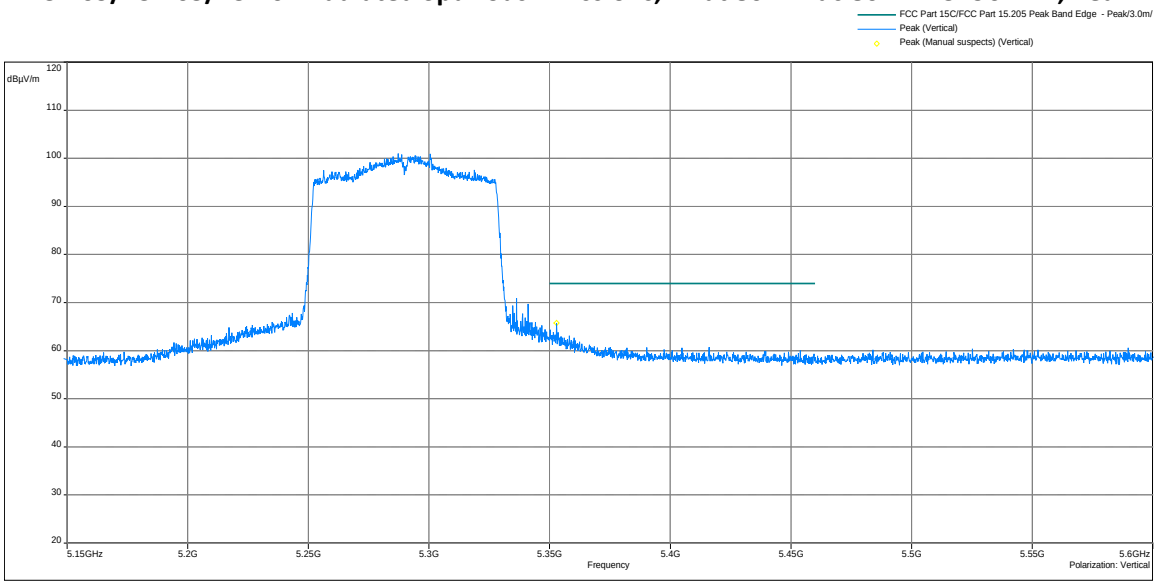
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5210MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5150	Average	51.42	54	-2.58	Pass

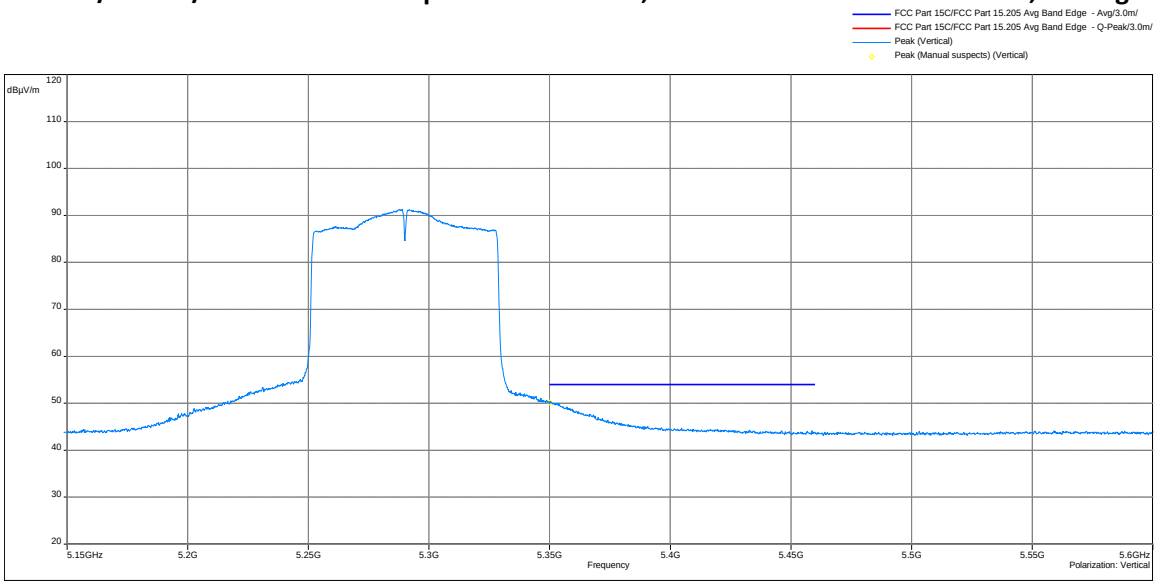
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5290MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Peak	65.75	74	-8.25	Pass

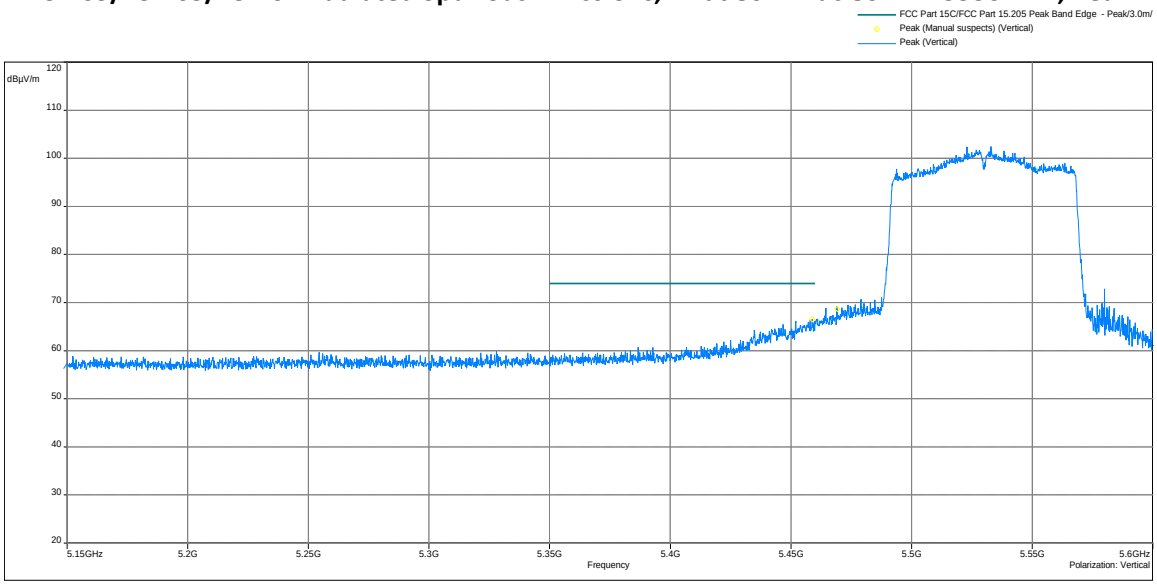
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 590MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5350	Average	50.18	54	-3.82	Pass

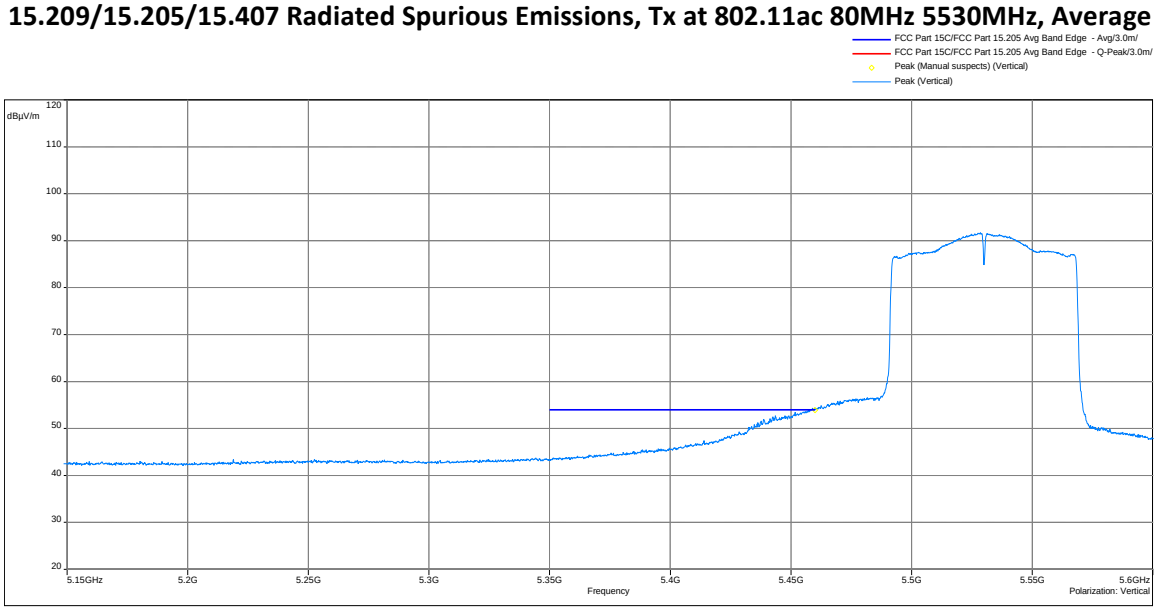
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5530MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Peak	66.53	74	-7.47	Pass
5470	Peak	68.15	68.23	-0.08	Pass

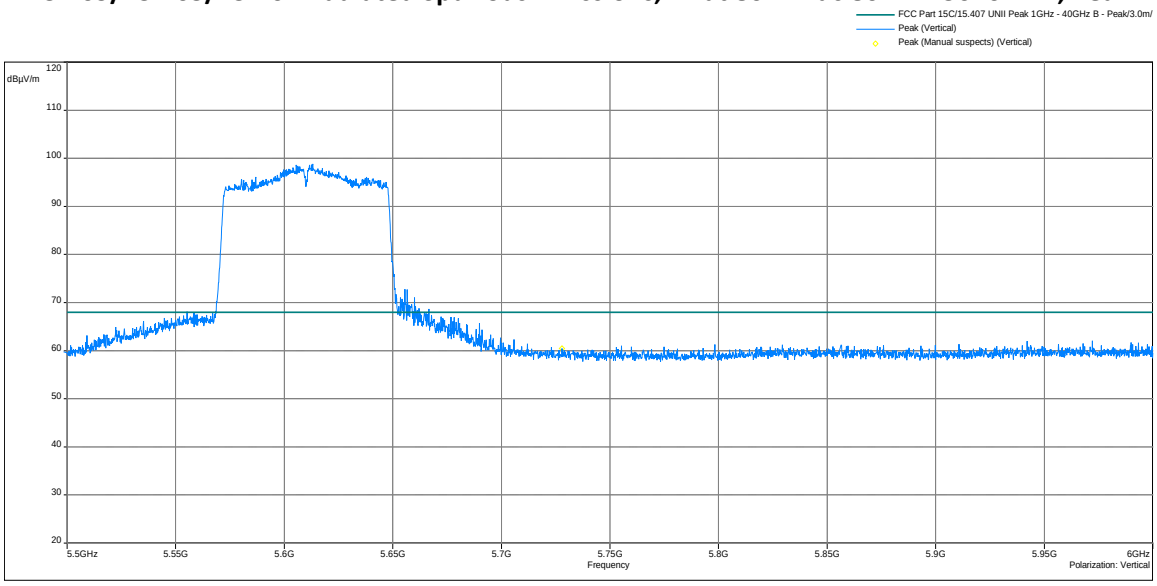
15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5530MHz, Average



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5460	Average	53.90	54	-0.10	Pass

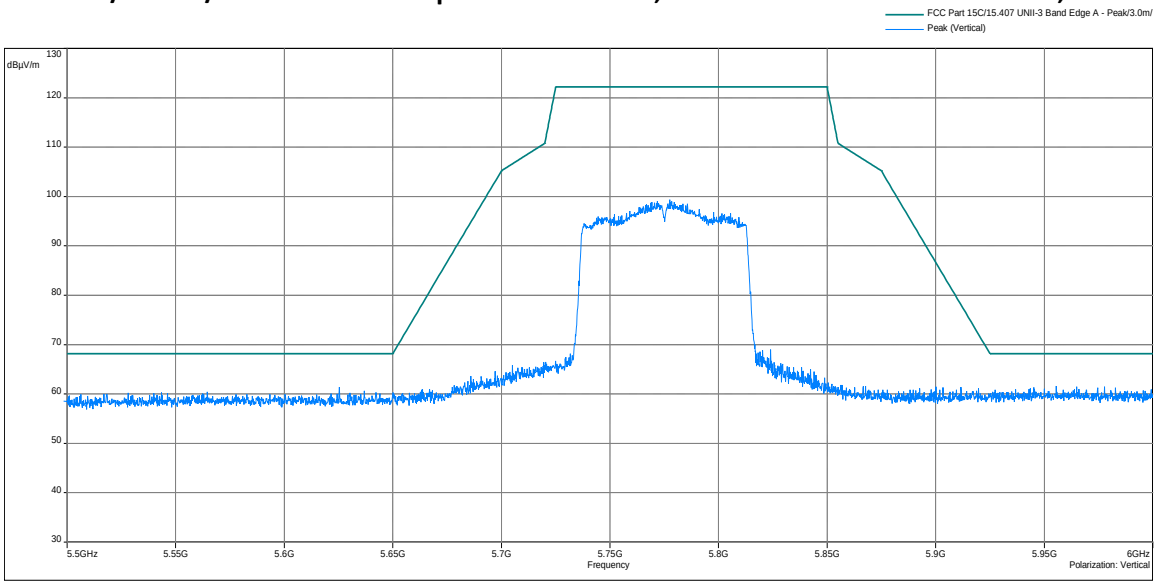
Radiated Out-of-Band Spurious Emissions at the Band Edges/Restricted Bands

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5610MHz, Peak



Frequency (MHz)	Detector	Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass / Fail?
5725	Peak	60.47	68.23	-7.76	Pass

15.209/15.205/15.407 Radiated Spurious Emissions, Tx at 802.11ac 80MHz 5775MHz, Peak

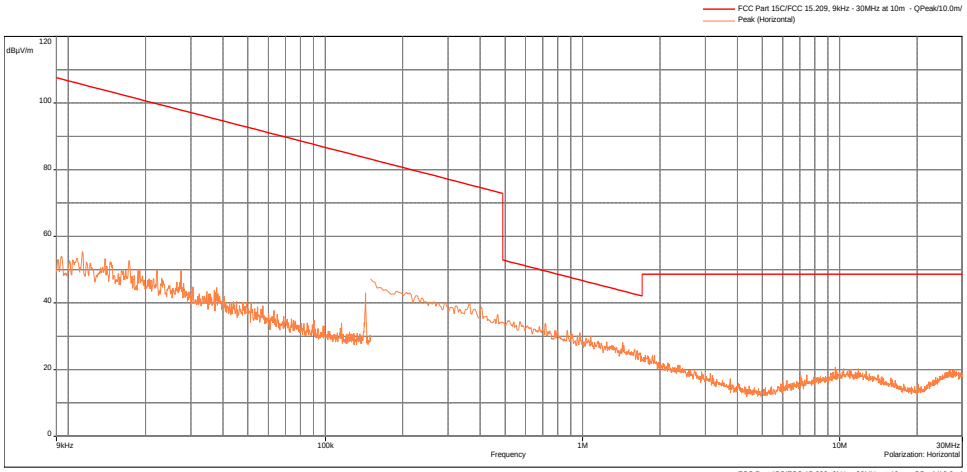


Out-of-Band Radiated Spurious Emissions

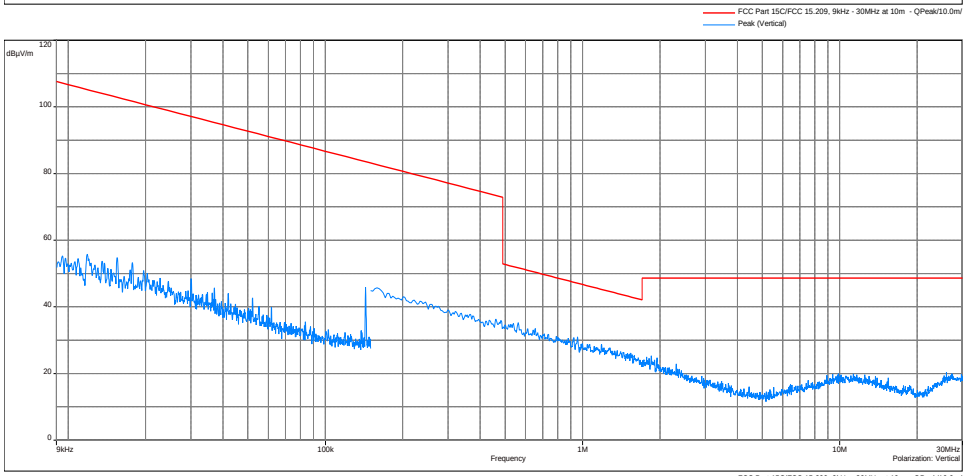
Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a

Radiated Spurious Emissions 9 kHz to 30 MHz, Peak Scan vs QP Limit

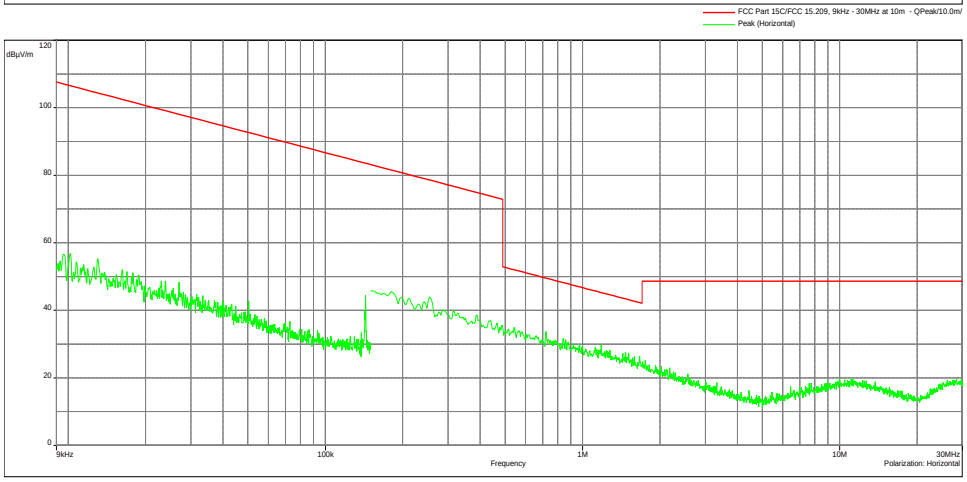
Antenna Position - Coaxial



Antenna Position - Coplanar

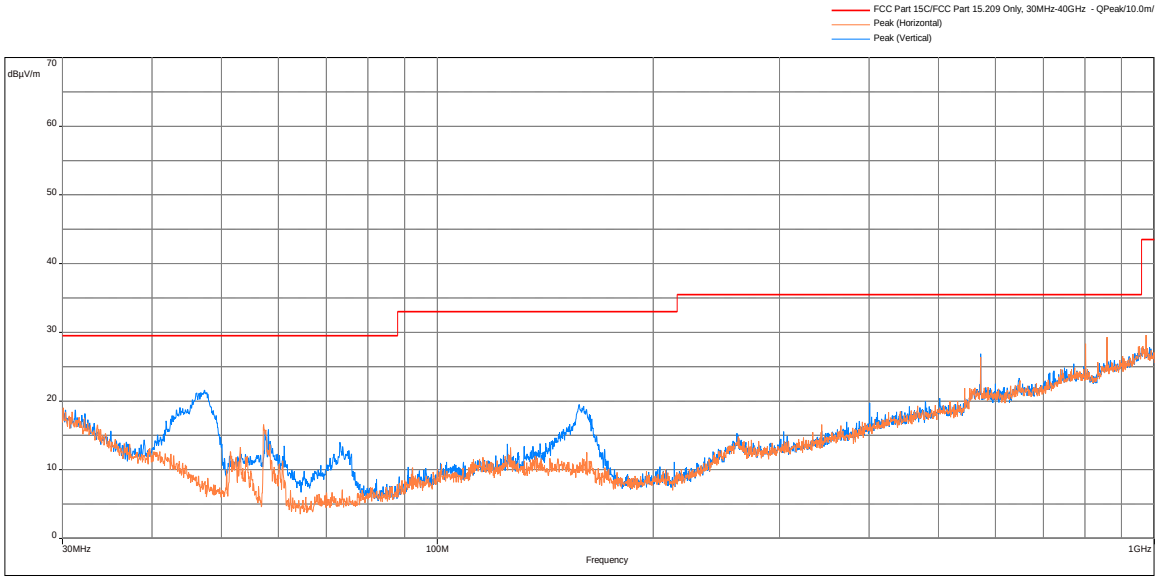


Antenna Position - Horizontal

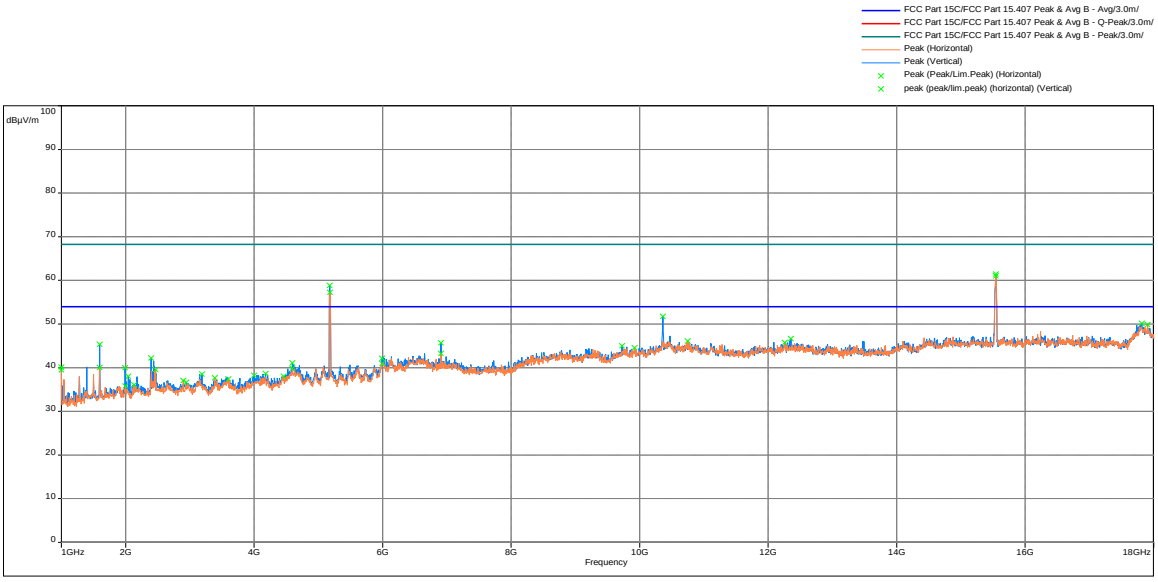


Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a 5180MHz

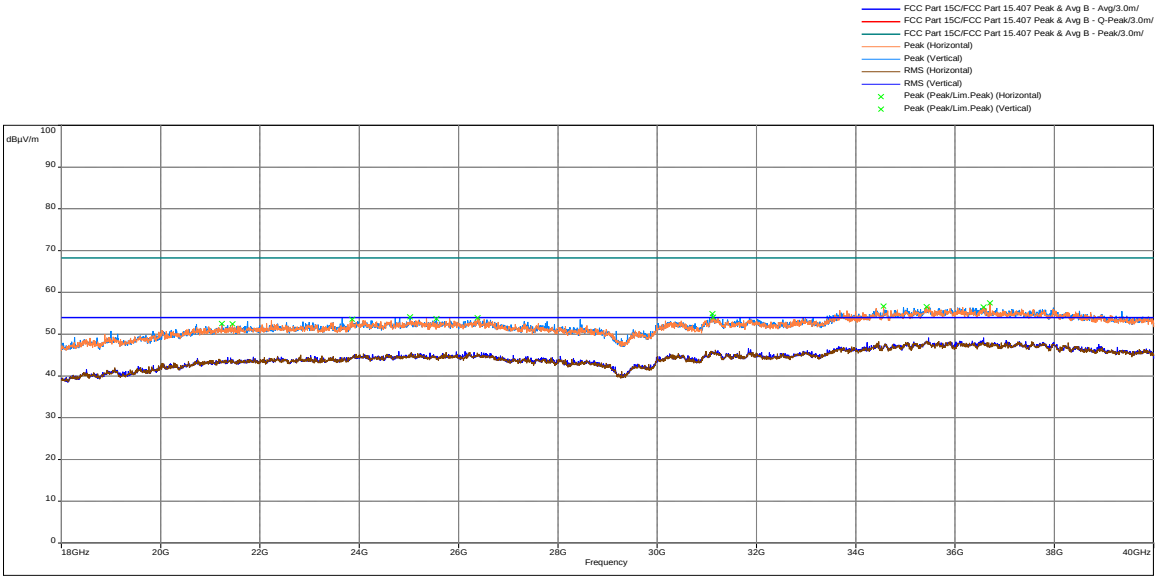
Radiated Spurious Emissions 30 MHz to 1000 MHz, Peak Scan vs QP Limit



Radiated Spurious Emissions 1000 to 18000 MHz, Peak Scan vs Peak & Avg Limit



Radiated Spurious Emissions 18000 to 40000 MHz, Peak & Avg Scan vs Peak & Avg Limit



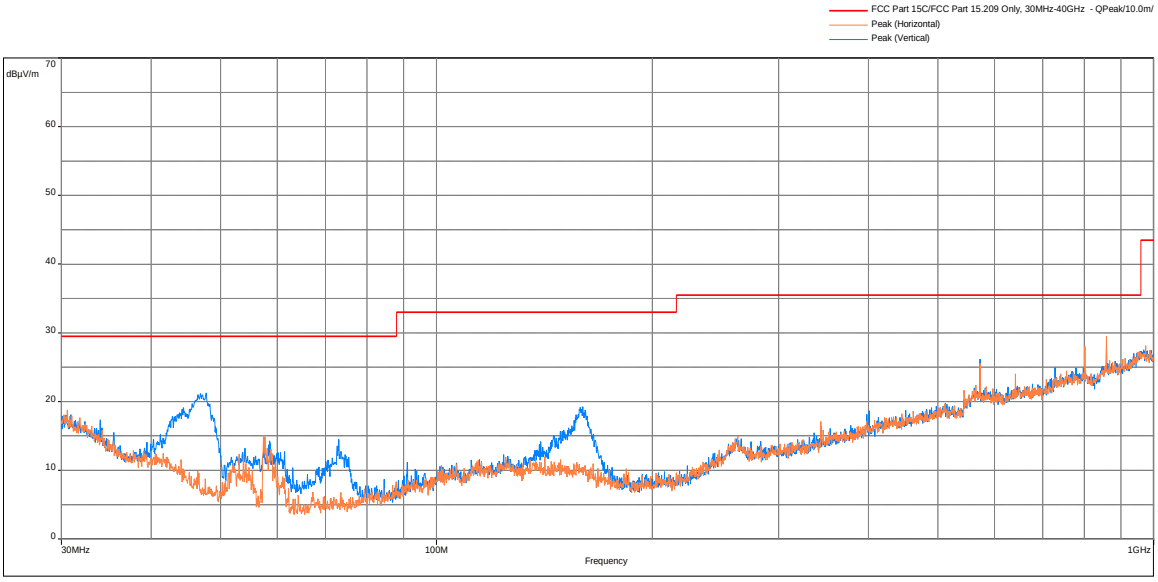
Frequency	FS@10m	Limit@ 10m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
58.13	15.83	29.5	-13.67	1.34	309	Vertical	-21.13
61.137	13.48	29.5	-16.02	1.43	45	Vertical	-21.18
73.165	14.02	29.5	-15.48	1.51	59	Vertical	-20.04
572.747	26.9	35.5	-8.6	1.50	311	Vertical	-4.06

Frequency	FS@3m	Limit@3m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
10363.6	51.73	68.23	-16.5	1.99	166	Vertical	1.77
15721.43	51.97	54	-2.03	1.97	254	Vertical	4.85

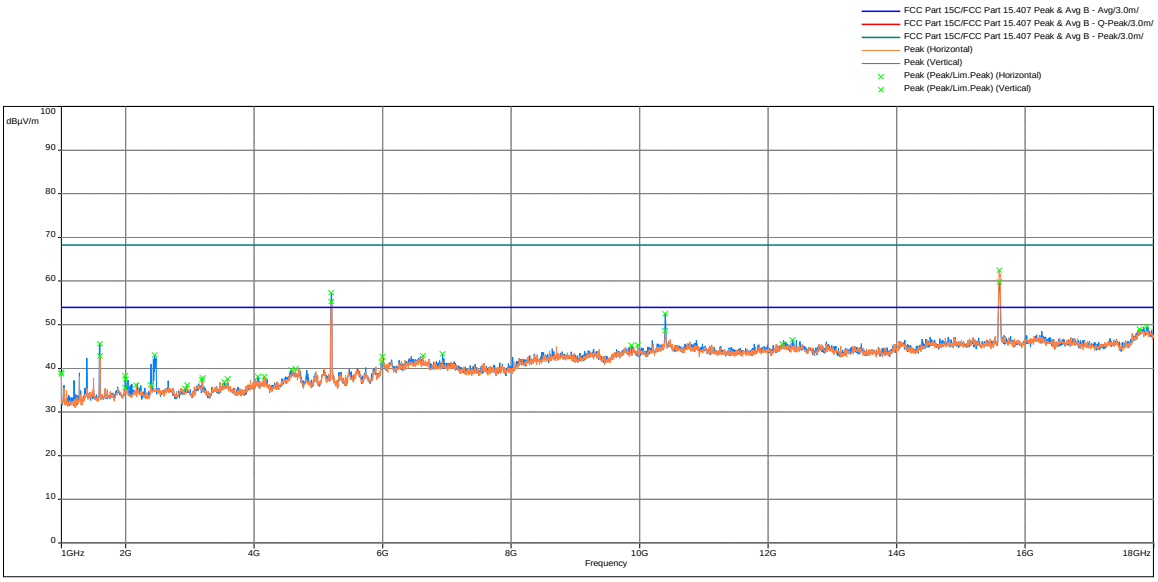
Note: Correction = AF + CF - Preamp

Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a 5200MHz

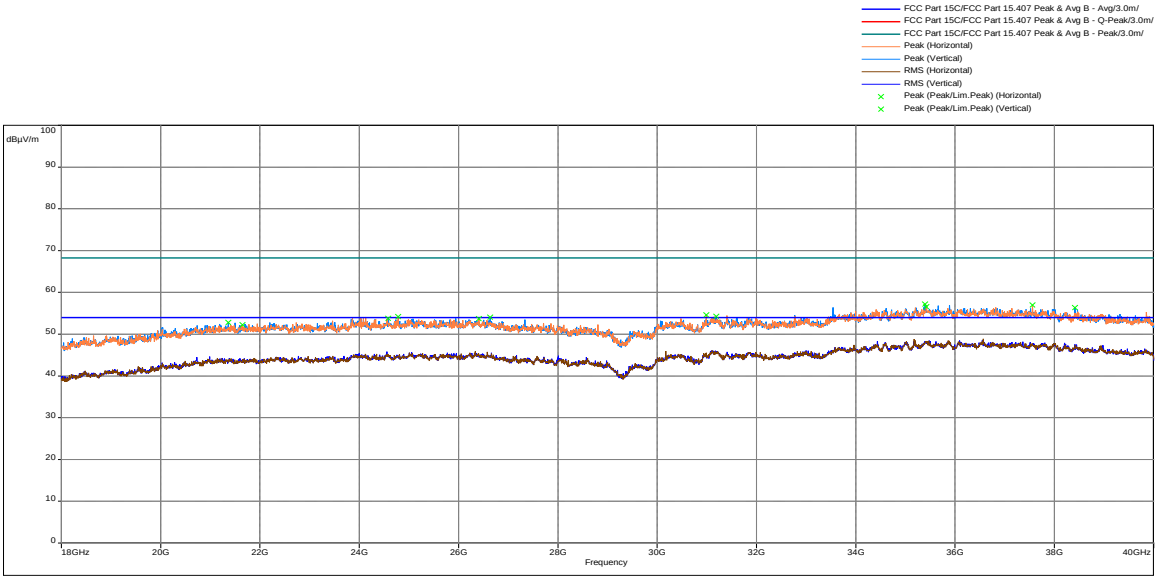
Radiated Spurious Emissions 30 MHz to 1000 MHz, Peak Scan vs QP Limit



Radiated Spurious Emissions 1000 to 18000 MHz, Peak Scan vs Peak & Avg Limit



Radiated Spurious Emissions 18000 to 40000 MHz, Peak & Avg Scan vs Peak & Avg Limit



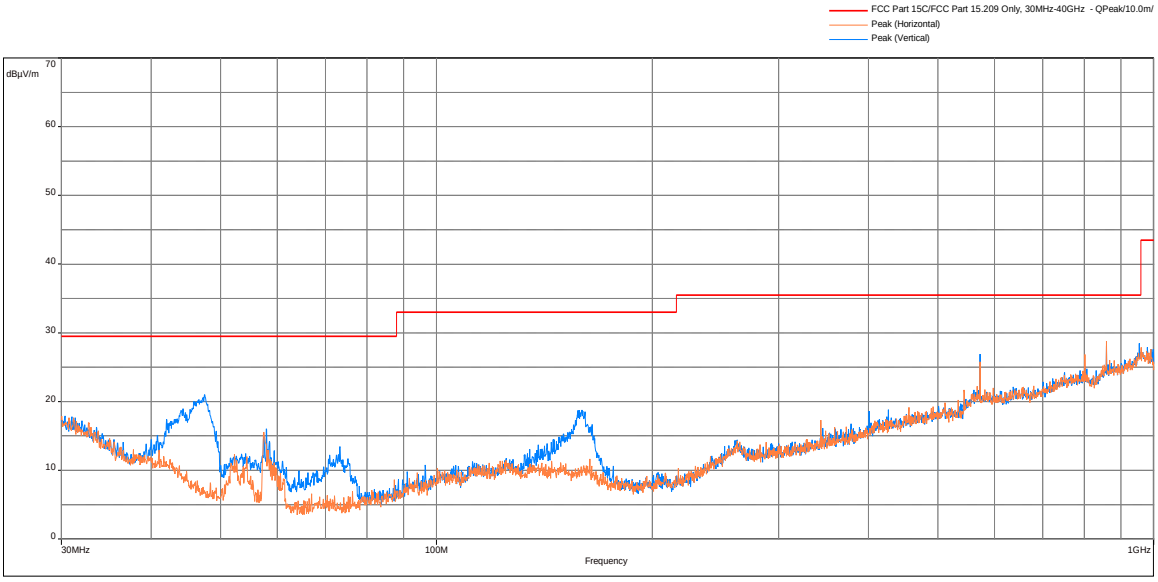
Frequency	FS@10m	Limit@ 10m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
47.751	21.26	29.5	-8.24	1.73	102	Vertical	-17.50
58.518	14.27	29.5	-15.23	1.66	298	Vertical	-21.17
73.100	14.53	29.5	-14.97	1.75	133	Vertical	-20.04
572.715	26.17	35.5	-9.33	1.57	0	Vertical	-4.05

Frequency	FS@3m	Limit@3m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
10397.03	52.49	54	-1.51	1.82	7	Vertical	1.91
15597.33	48.59	54	-5.41	1.97	15	Vertical	4.95

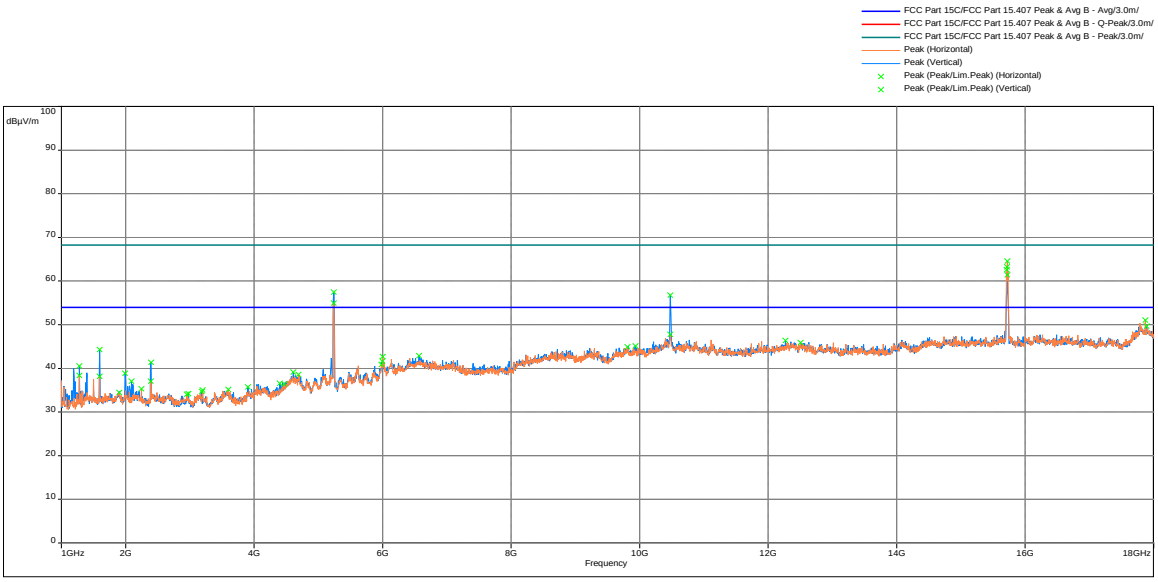
Note: Correction = AF + CF - Preamp Note: Correction = AF + CF - Preamp

Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a 5240MHz

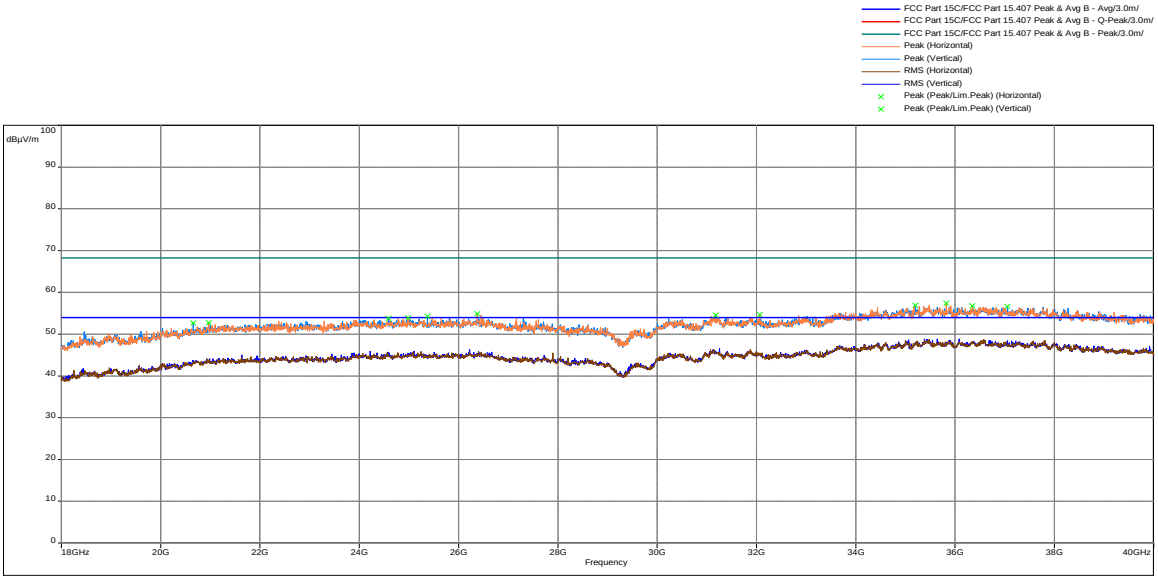
Radiated Spurious Emissions 30 MHz to 1000 MHz, Peak Scan vs QP Limit



Radiated Spurious Emissions 1000 to 18000 MHz, Peak Scan vs Peak & Avg Limit



Radiated Spurious Emissions 18000 to 40000 MHz, Peak & Avg Scan vs Peak & Avg Limit



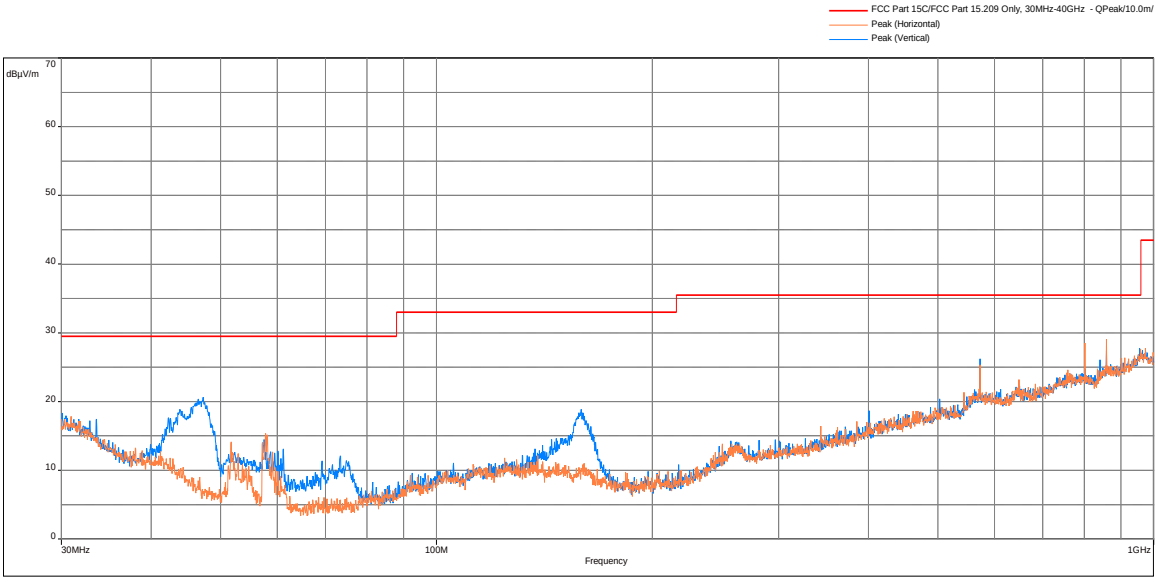
Frequency	FS@10m	Limit@ 10m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
47.751	21.26	29.5	-8.24	1.73	102	Vertical	-17.50
58.518	14.27	29.5	-15.23	1.66	298	Vertical	-21.17
73.100	14.53	29.5	-14.97	1.75	133	Vertical	-20.04
572.715	26.17	35.5	-9.33	1.57	0	Vertical	-4.05

Frequency	FS@3m	Limit@3m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
10476.93	50.74	54	-3.26	1.99	315	Vertical	1.56
15721.43	51.97	54	-2.03	1.97	254	Vertical	4.85

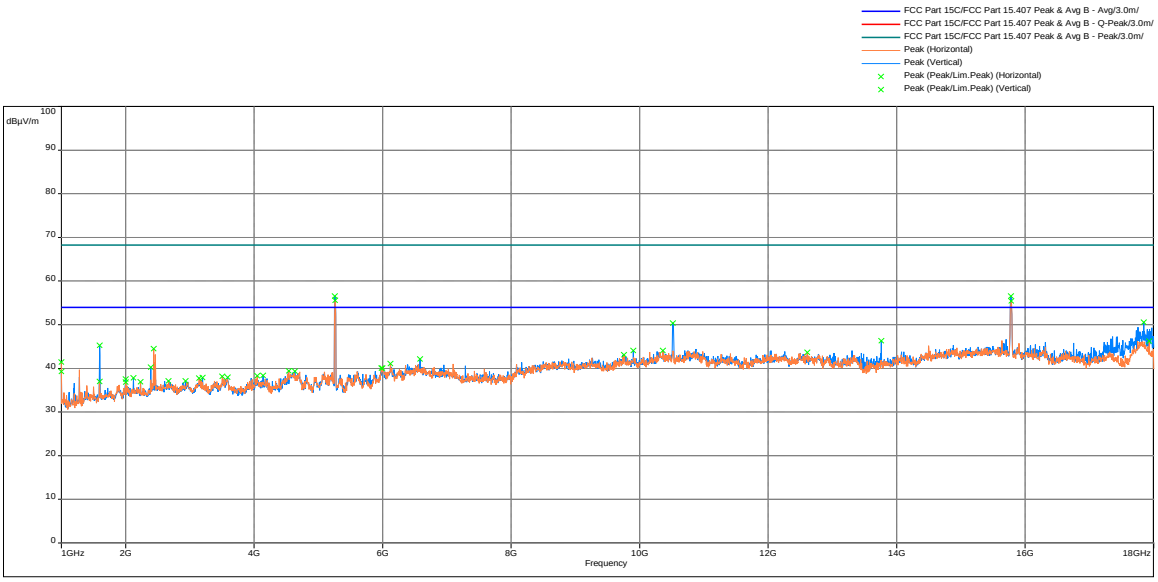
Note: Correction = AF + CF - Preamp

Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a 5260MHz

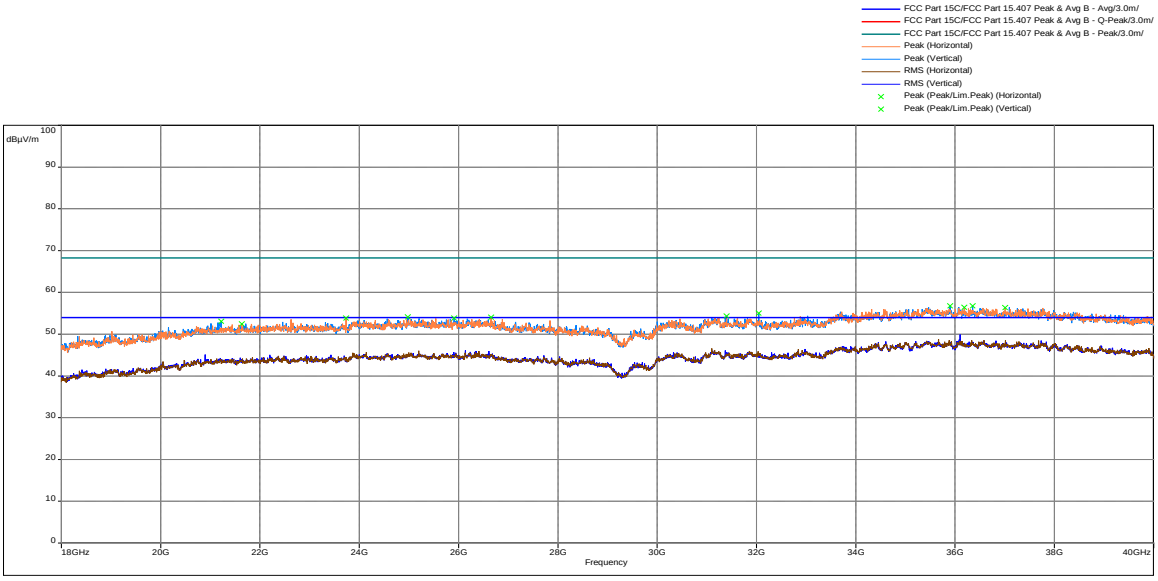
Radiated Spurious Emissions 30 MHz to 1000 MHz, Peak Scan vs QP Limit



Radiated Spurious Emissions 1000 to 18000 MHz, Peak Scan vs Peak & Avg Limit



Radiated Spurious Emissions 18000 to 40000 MHz, Peak & Avg Scan vs Peak & Avg Limit



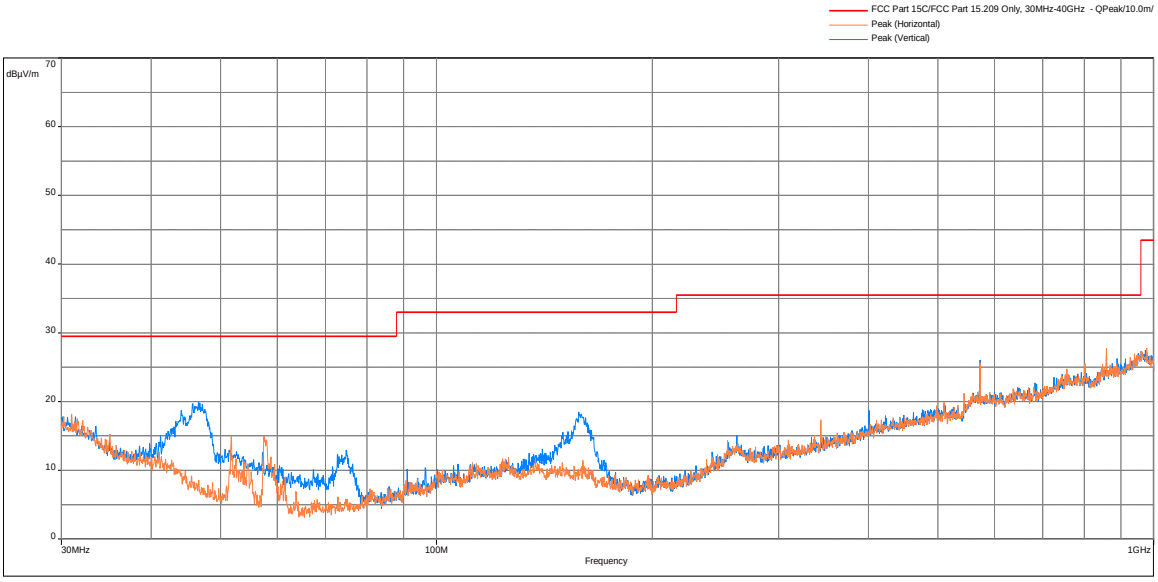
Frequency	FS@10m	Limit@ 10m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
47.298	20.64	29.5	-8.86	1.39	314	Vertical	-17.23
57.515	14.49	29.5	-15.01	1.52	116	Vertical	-21.08
60.134	12.81	29.5	-16.69	1.56	292	Vertical	-21.19
61.169	13.12	29.5	-16.38	1.46	306	Vertical	-21.17
572.715	26.25	35.5	-9.25	1.45	206	Vertical	-4.05

Frequency	FS@3m	Limit@3m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
10518.87	50.35	54	-3.65	2.01	311	Vertical	1.37
15779.23	47.81	54	-6.19	1.87	249	Vertical	4.71

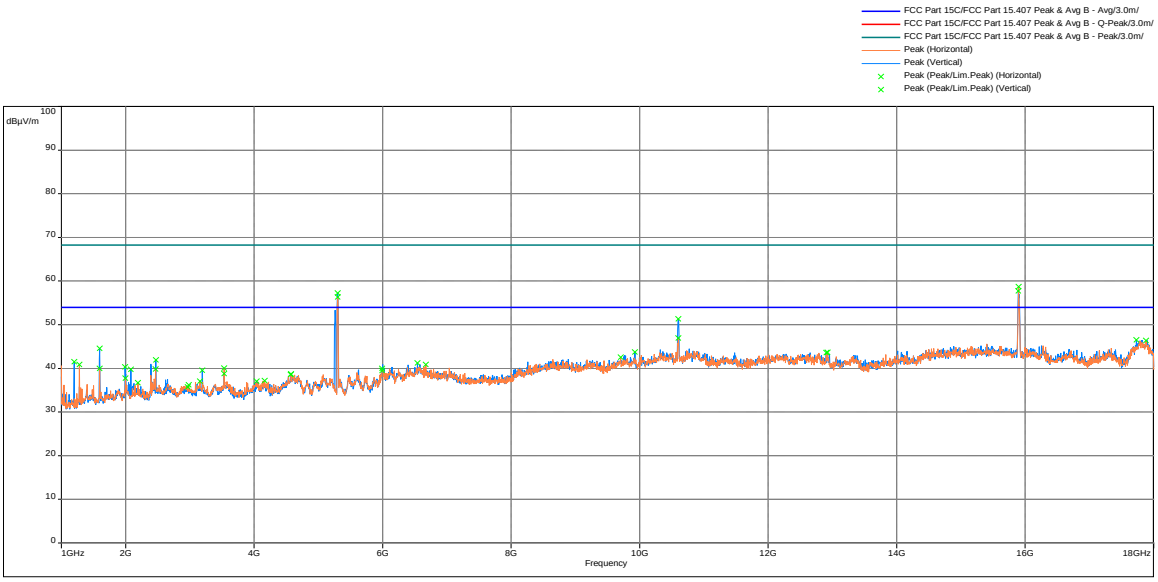
Note: Correction = AF + CF - Preamp

Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a 5300MHz

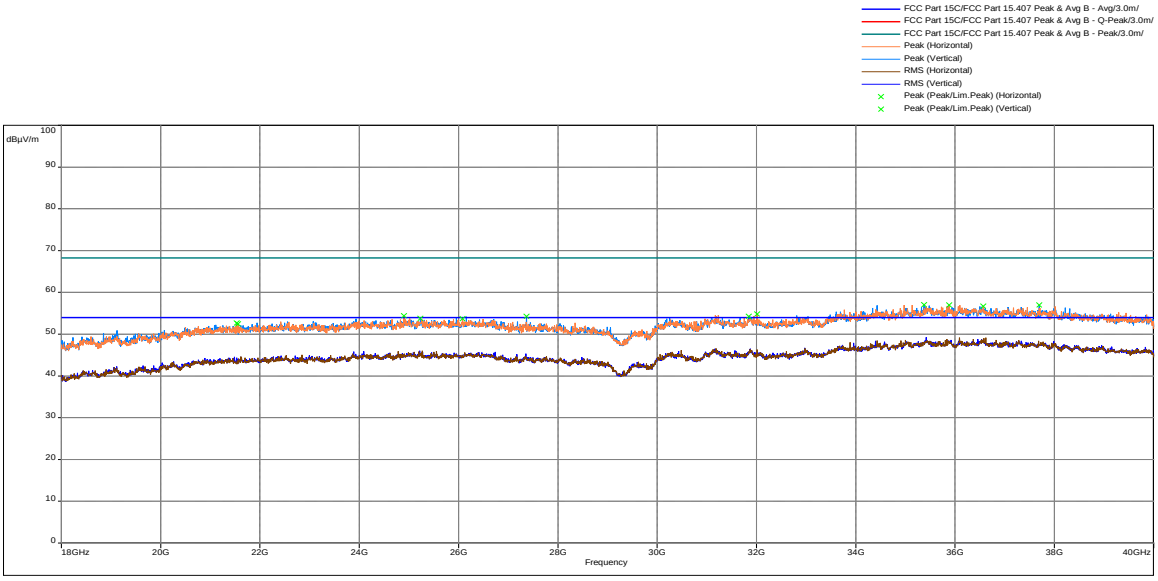
Radiated Spurious Emissions 30 MHz to 1000 MHz, Peak Scan vs QP Limit



Radiated Spurious Emissions 1000 to 18000 MHz, Peak Scan vs Peak & Avg Limit



Radiated Spurious Emissions 18000 to 40000 MHz, Peak & Avg Scan vs Peak & Avg Limit



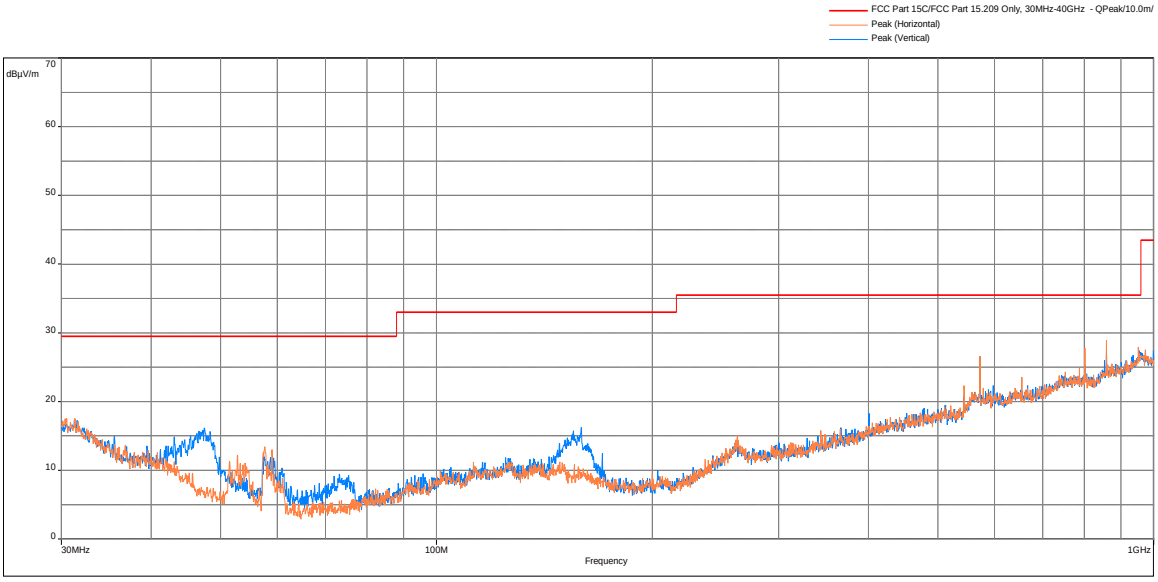
Frequency	FS@10m	Limit@ 10m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
46.587	19.96	29.5	-9.54	1.61	93	Vertical	-16.86
57.257	12.64	29.5	-16.86	1.70	272	Vertical	-21.06
60.425	10.70	29.5	-18.80	1.64	272	Vertical	-21.18
74.846	12.92	29.5	-16.58	1.72	94	Vertical	-19.85

Frequency	FS@3m	Limit@3m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
10599.33	51.3	54	-2.70	1.51	14	Vertical	1.02
15894.27	48.45	54	-5.55	1.95	2	Vertical	4.37

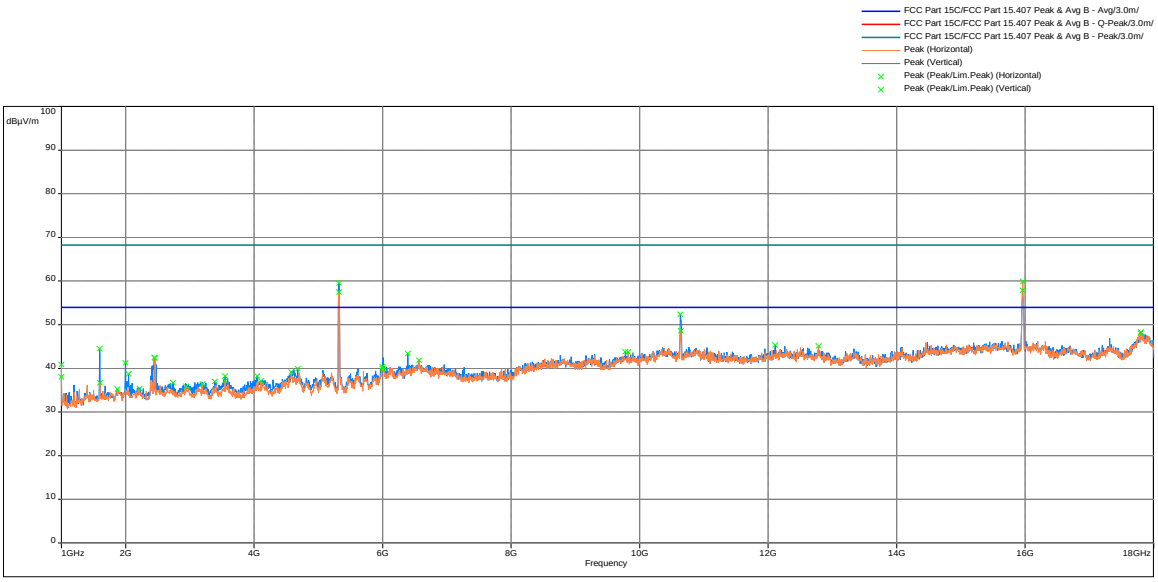
Note: Correction = AF + CF - Preamp

Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a 5320MHz

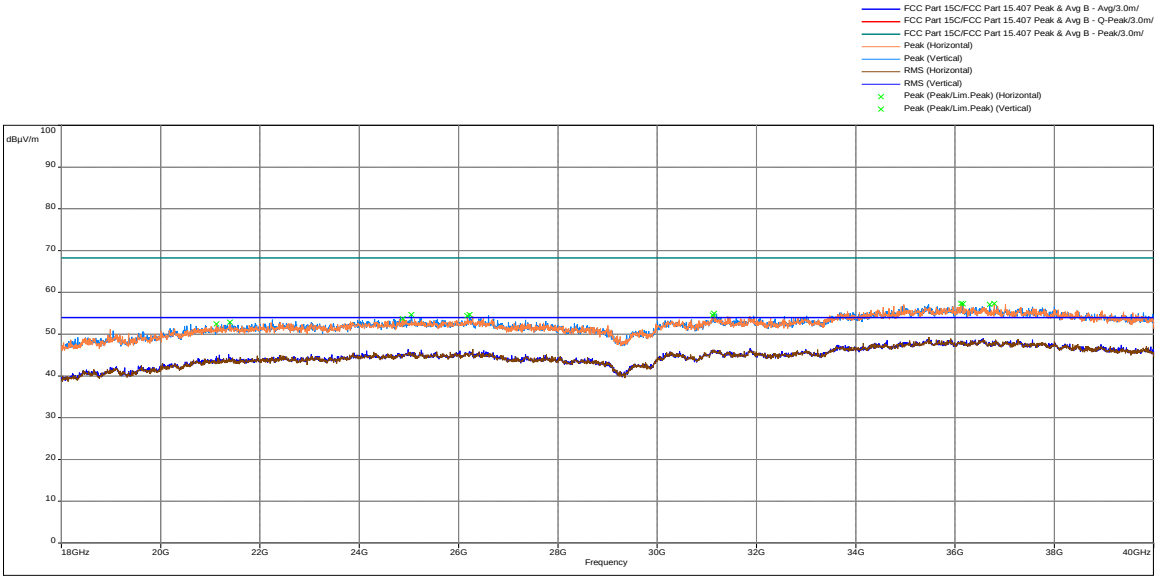
Radiated Spurious Emissions 30 MHz to 1000 MHz, Peak Scan vs QP Limit



Radiated Spurious Emissions 1000 to 18000 MHz, Peak Scan vs Peak & Avg Limit



Radiated Spurious Emissions 18000 to 40000 MHz, Peak & Avg Scan vs Peak & Avg Limit



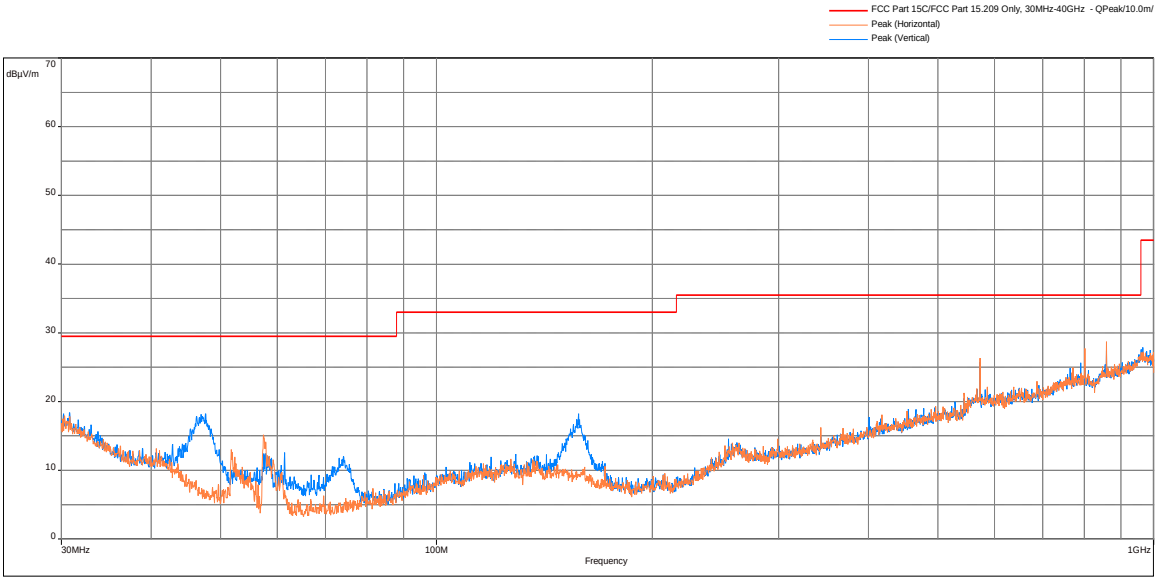
Frequency	FS@10m	Limit@ 10m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
43.09	14.85	29.5	-14.65	1.59	315	Vertical	-14.97
47.460	16.16	29.5	-13.34	1.43	355	Vertical	-17.33
57.483	11.99	29.5	-17.51	1.68	126	Vertical	-21.08
572.715	26.62	35.5	-8.88	3.12	173	Horizontal	-4.05

Frequency	FS@3m	Limit@3m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
10633.9	52.39	54	-1.61	1.51	13.5	Vertical	1.12
15956.03	50.43	54	-3.57	2.01	264	Horizontal	4.38

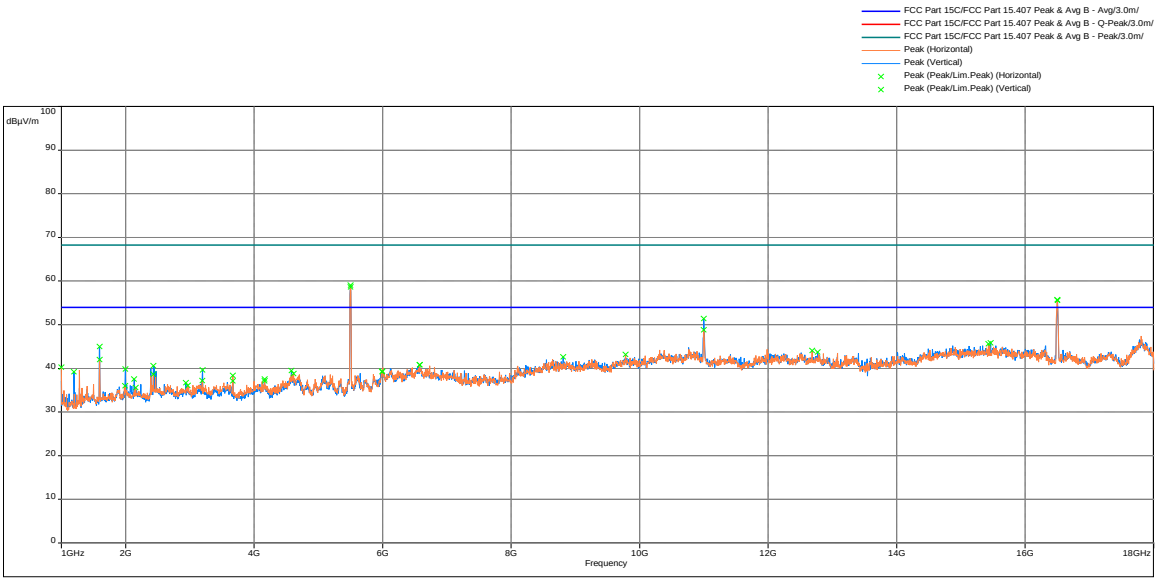
Note: Correction = AF + CF - Preamp

Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a 5500MHz

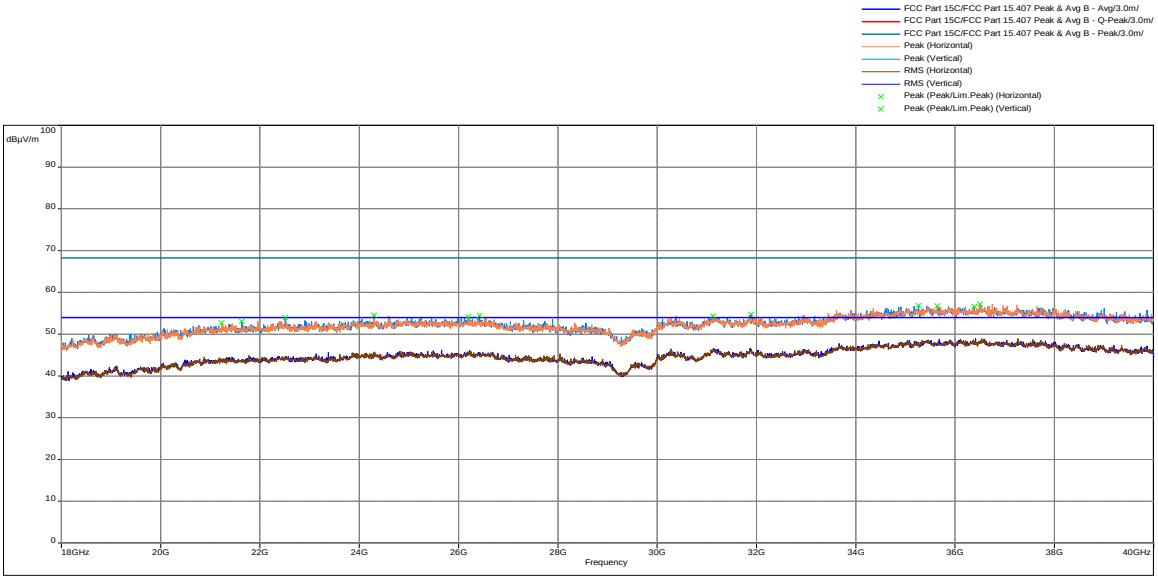
Radiated Spurious Emissions 30 MHz to 1000 MHz, Peak Scan vs QP Limit



Radiated Spurious Emissions 1000 to 18000 MHz, Peak Scan vs Peak & Avg Limit



Radiated Spurious Emissions 18000 to 40000 MHz, Peak & Avg Scan vs Peak & Avg Limit



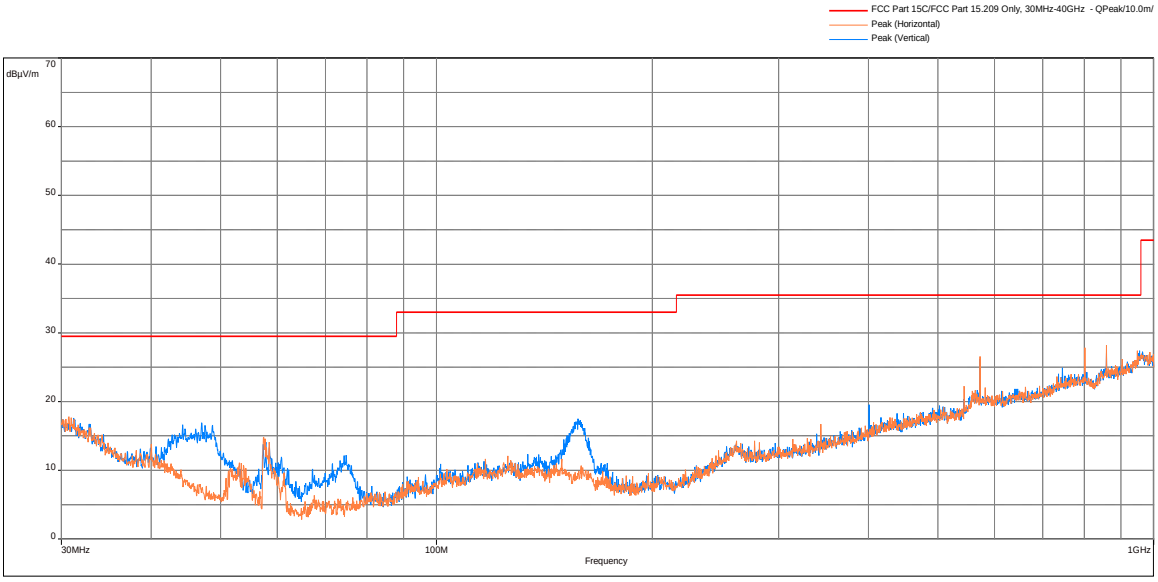
Frequency	FS@10m	Limit@ 10m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
47.654	18.23	29.5	-11.27	1.33	359	Vertical	-17.44
57.806	12.44	29.5	-17.06	1.70	15	Vertical	-21.11
61.428	12.6	29.5	-16.9	1.60	348	Vertical	-21.17
74.232	12.04	29.5	-17.46	1.37	100	Vertical	-19.92
572.715	26.32	35.5	-9.18	3.30	174	Horizontal	-4.05

Frequency	FS@3m	Limit@3m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
10997.7	51.41	54	-2.59	1.90	304	Vertical	0.79
16501.73	44.03	54	-9.97	1.96	255	Vertical	3.52

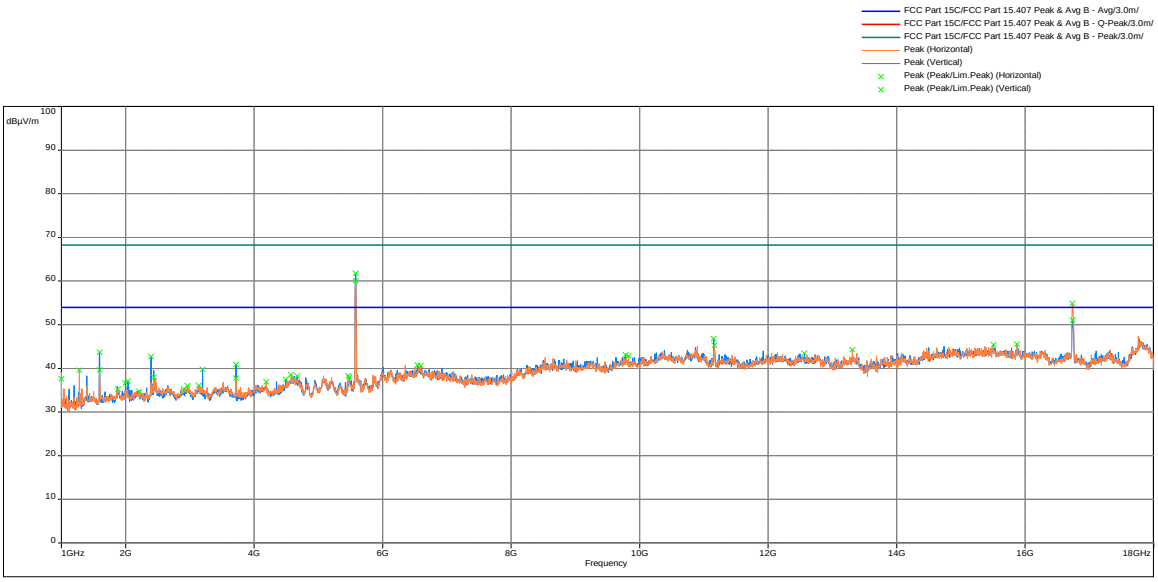
Note: Correction = AF + CF - Preamp

Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a 5580MHz

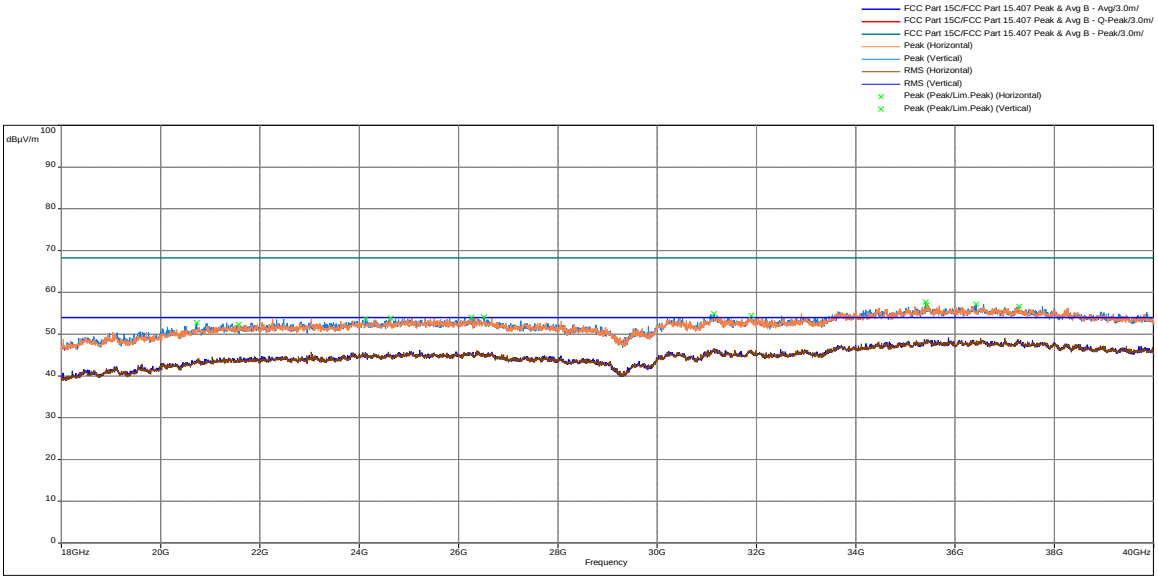
Radiated Spurious Emissions 30 MHz to 1000 MHz, Peak Scan vs QP Limit



Radiated Spurious Emissions 1000 to 18000 MHz, Peak Scan vs Peak & Avg Limit



Radiated Spurious Emissions 18000 to 40000 MHz, Peak & Avg Scan vs Peak & Avg Limit



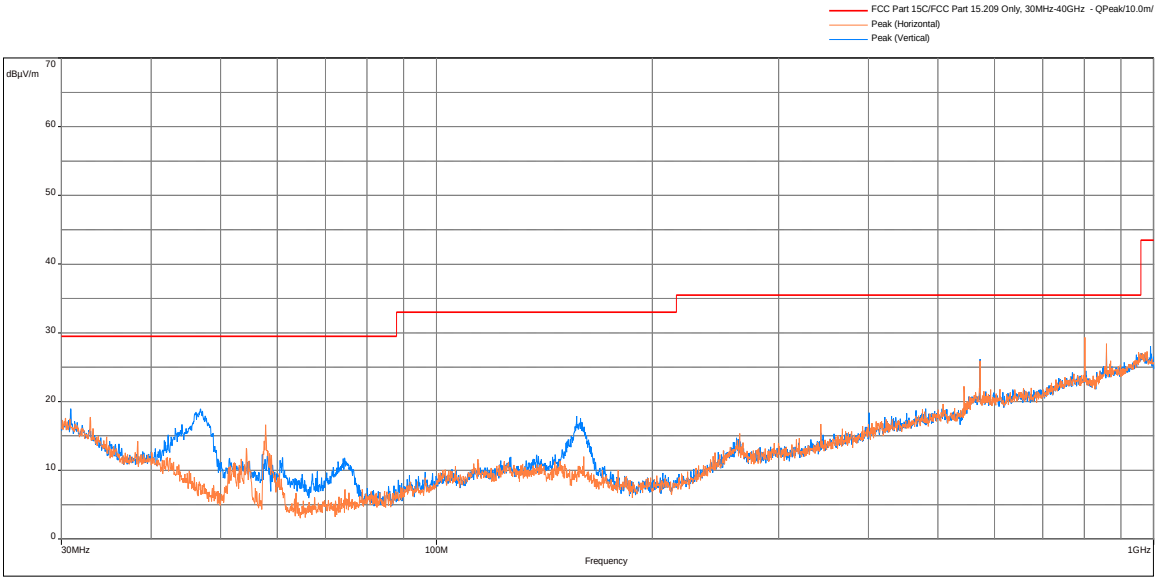
Frequency	FS@10m	Limit@ 10m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
47.072	16.93	29.5	-12.57	1.76	137	Vertical	-17.1
58.487	13.31	29.5	-16.19	1.87	268	Vertical	-21.16
74.846	12.18	29.5	-17.32	1.75	94	Vertical	-19.85
572.747	26.56	35.5	-8.94	3.42	75	Horizontal	-4.06

Frequency	FS@3m	Limit@3m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
10997.7	51.41	54	-2.59	1.90	304	Vertical	0.79
16501.73	44.03	54	-9.97	1.96	255	Vertical	3.52

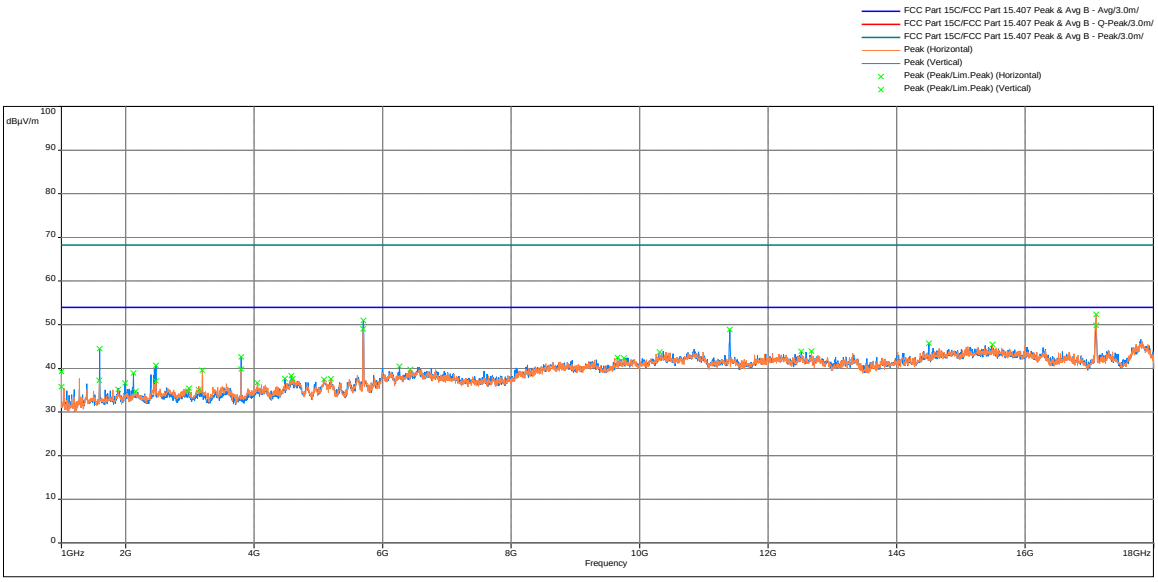
Note: Correction = AF + CF - Preamp

Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a 5700MHz

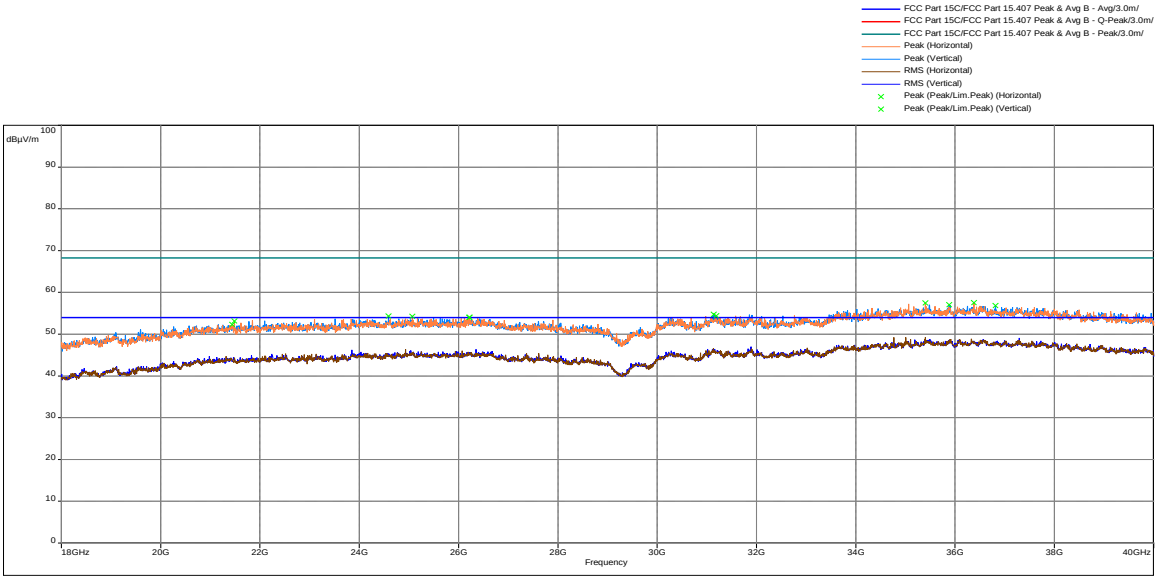
Radiated Spurious Emissions 30 MHz to 1000 MHz, Peak Scan vs QP Limit



Radiated Spurious Emissions 1000 to 18000 MHz, Peak Scan vs Peak & Avg Limit



Radiated Spurious Emissions 18000 to 40000 MHz, Peak & Avg Scan vs Peak & Avg Limit



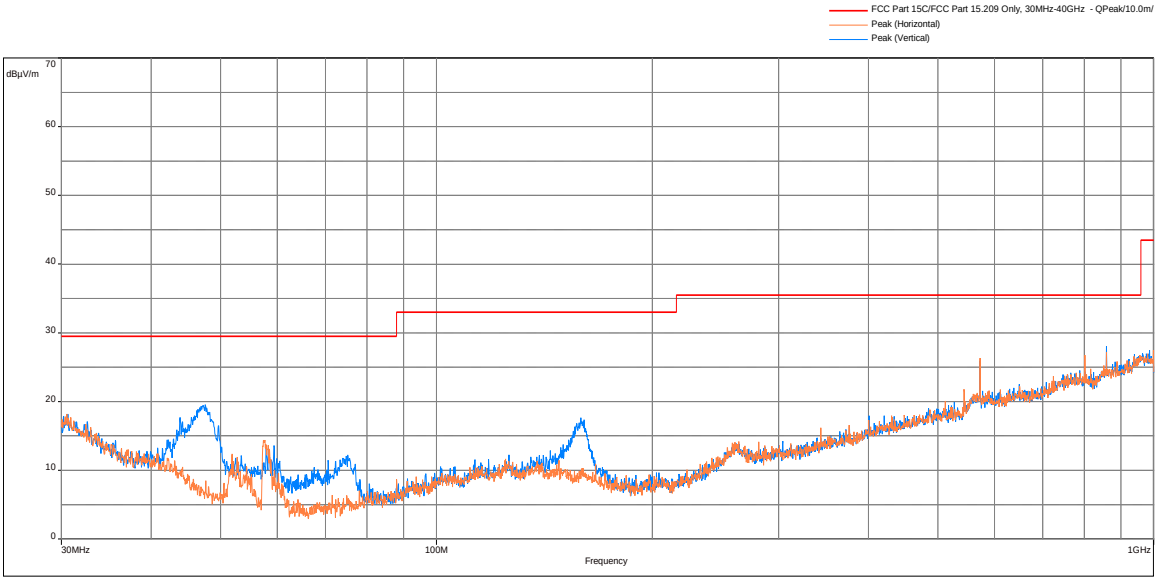
Frequency	FS@10m	Limit@ 10m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
58.097	12.11	29.5	-17.39	1.72	159	Vertical	-21.13
61.040	11.86	29.5	-17.64	1.66	334	Vertical	-21.18
74.458	11.8	29.5	-17.7	1.68	106	Vertical	-19.89
572.747	26.19	35.5	-9.31	1.29	235	Vertical	-4.06

Frequency	FS@3m	Limit@3m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
11400.03	48.87	54	-5.13	1.51	26	Vertical	1.19
17102.40	52.39	54	-1.61	2.05	292	Horizontal	4.49

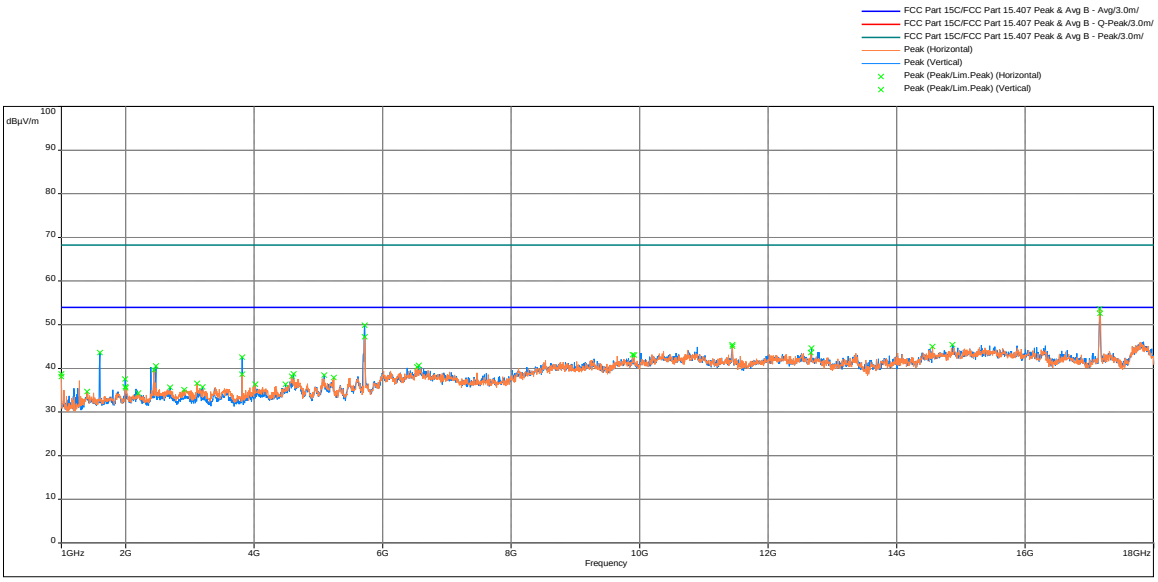
Note: Correction = AF + CF - Preamp

Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a 5720MHz

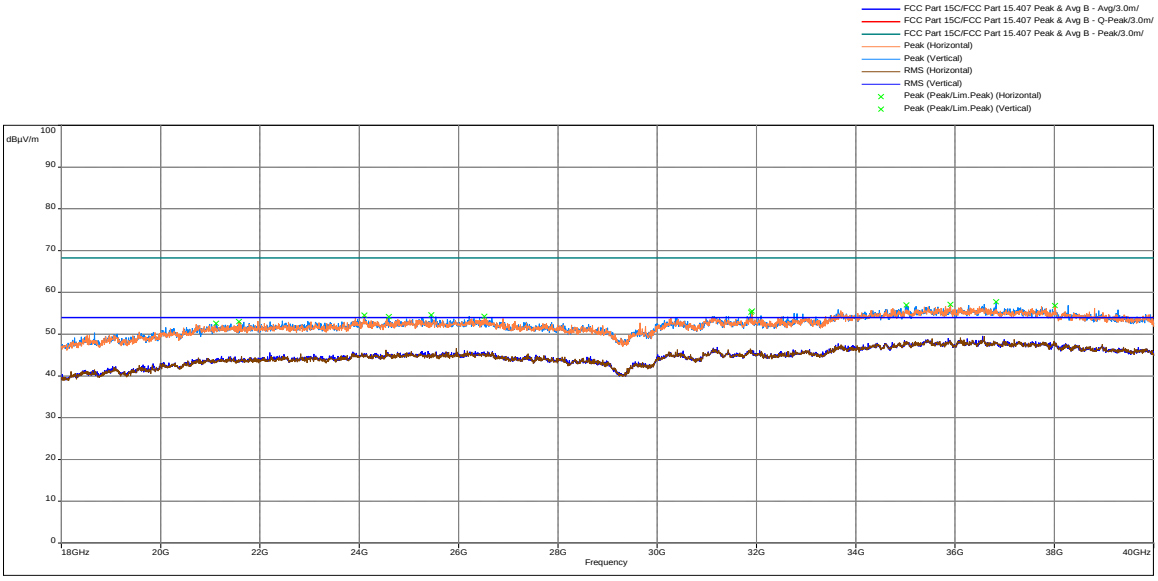
Radiated Spurious Emissions 30 MHz to 1000 MHz, Peak Scan vs QP Limit



Radiated Spurious Emissions 1000 to 18000 MHz, Peak Scan vs Peak & Avg Limit



Radiated Spurious Emissions 18000 to 40000 MHz, Peak & Avg Scan vs Peak & Avg Limit



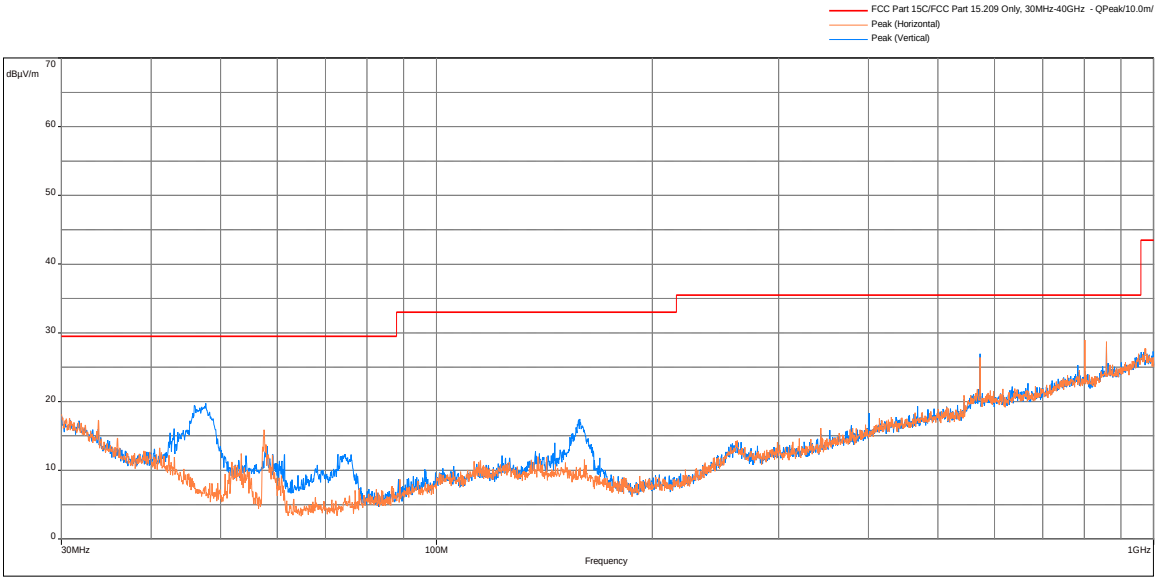
Frequency	FS@10m	Limit@ 10m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
58.3563	13.22	29.5	-16.28	1.87	76	Vertical	-21.15
59.391	13.62	29.5	-15.88	1.75	163	Vertical	-21.2
75.234	12.23	29.5	-17.27	1.57	85	Vertical	-19.81
572.747	26.31	35.5	-9.19	3.47	359	Horizontal	-4.06

Frequency	FS@3m	Limit@3m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
11440.27	45.04	54	-8.96	1.56	58	Horizontal	1.23
17159.07	53.61	54	-0.39	1.91	292	Horizontal	4.89

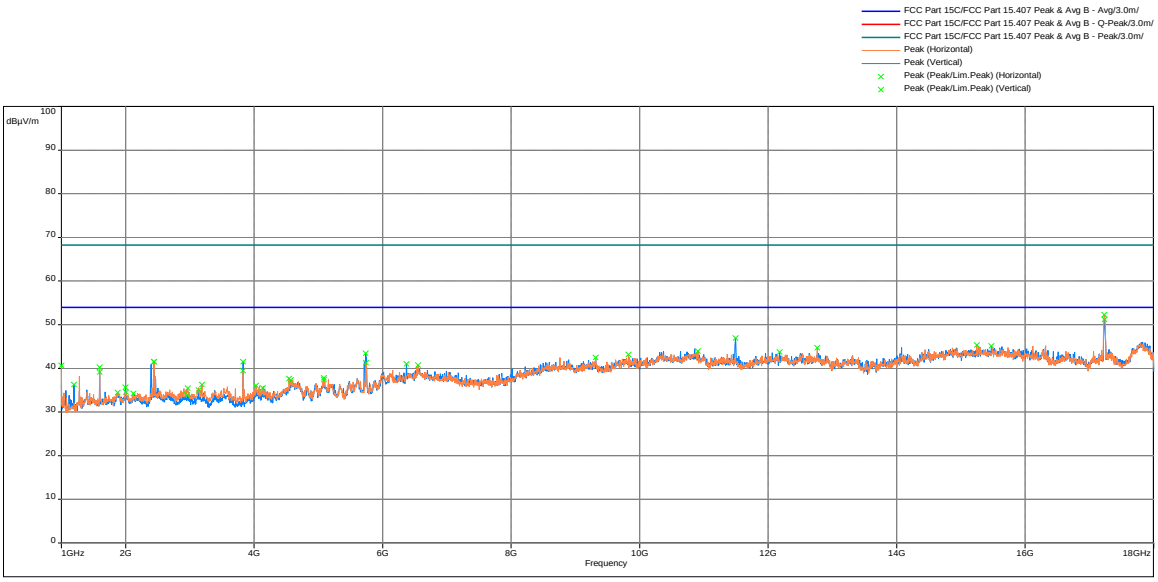
Note: Correction = AF + CF - Preamp

Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a 5745MHz

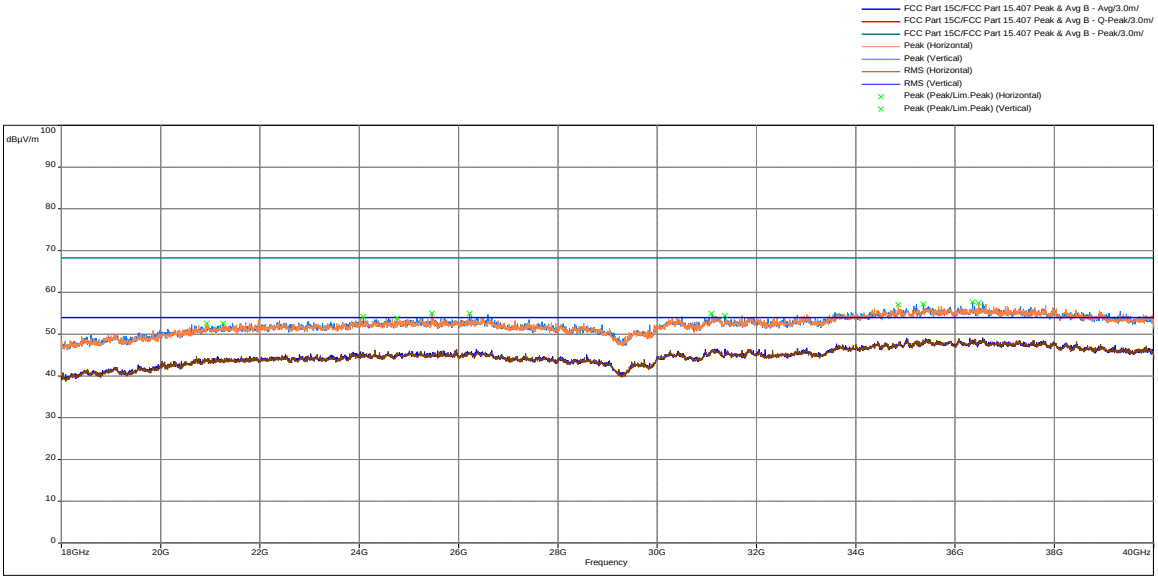
Radiated Spurious Emissions 30 MHz to 1000 MHz, Peak Scan vs QP Limit



Radiated Spurious Emissions 1000 to 18000 MHz, Peak Scan vs Peak & Avg Limit



Radiated Spurious Emissions 18000 to 40000 MHz, Peak & Avg Scan vs Peak & Avg Limit



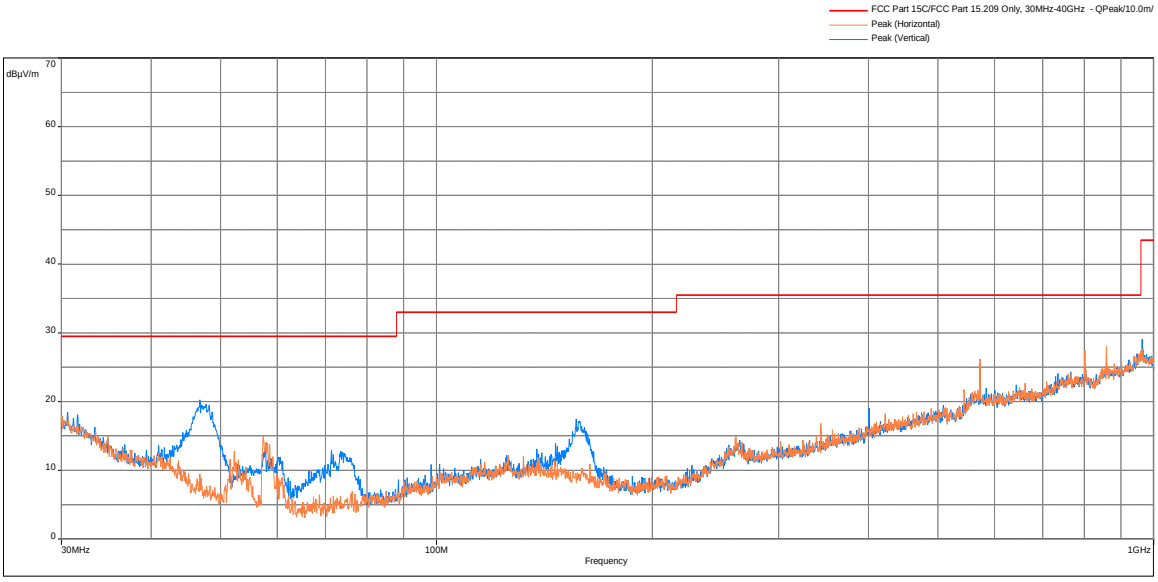
Frequency	FS@10m	Limit@ 10m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
47.683	19.77	29.5	-9.73	1.63	61	Vertical	-17.46
59.132	12.32	29.5	-17.18	1.48	167	Vertical	-21.20
72.874	12.35	29.5	-17.15	1.31	115	Vertical	-20.07
572.715	26.96	35.5	-8.54	2.85	123	Vertical	-4.05

Frequency	FS@3m	Limit@3m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
12762.87	44.72	54	-9.28	1.68	359	Horizontal	2.5
17229.9	52.34	54	-1.66	1.75	279	Horizontal	5.49

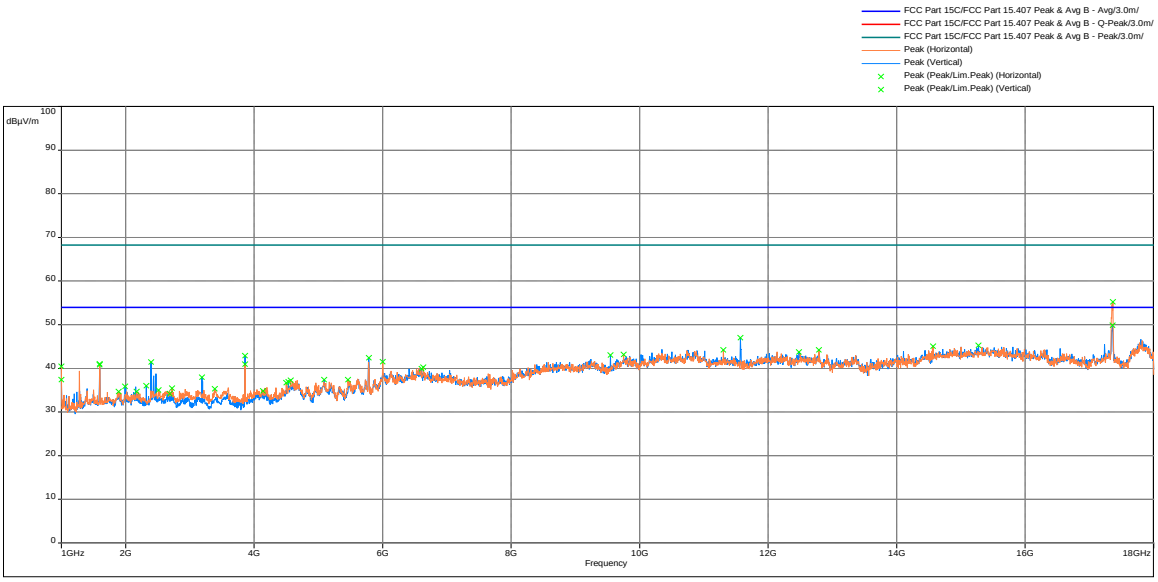
Note: Correction = AF + CF - Preamp

Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a 5785MHz

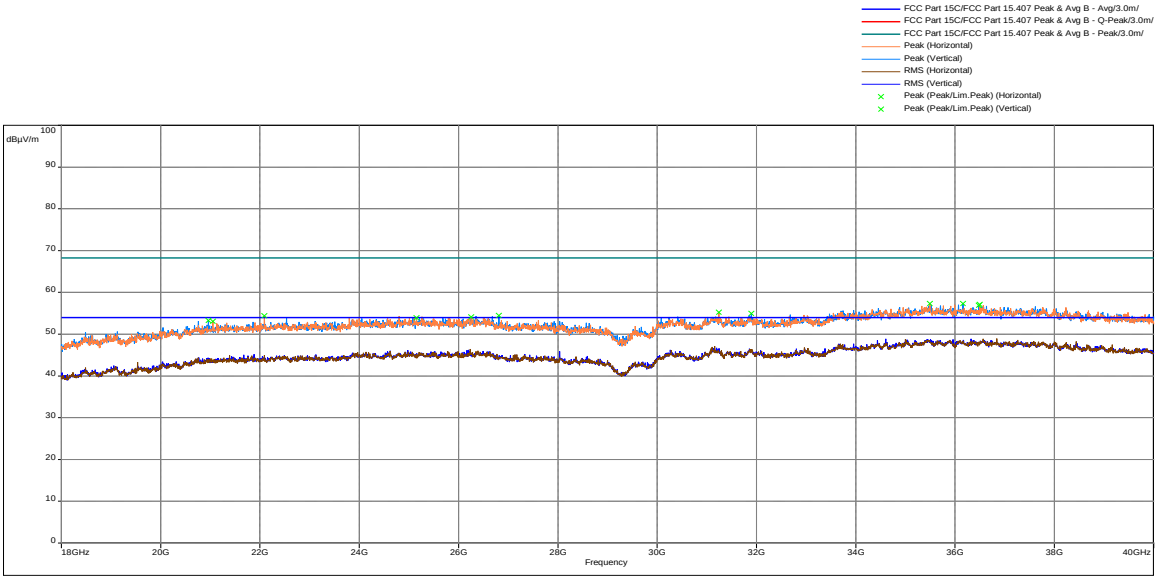
Radiated Spurious Emissions 30 MHz to 1000 MHz, Peak Scan vs QP Limit



Radiated Spurious Emissions 1000 to 18000 MHz, Peak Scan vs Peak & Avg Limit



Radiated Spurious Emissions 18000 to 40000 MHz, Peak & Avg Scan vs Peak & Avg Limit



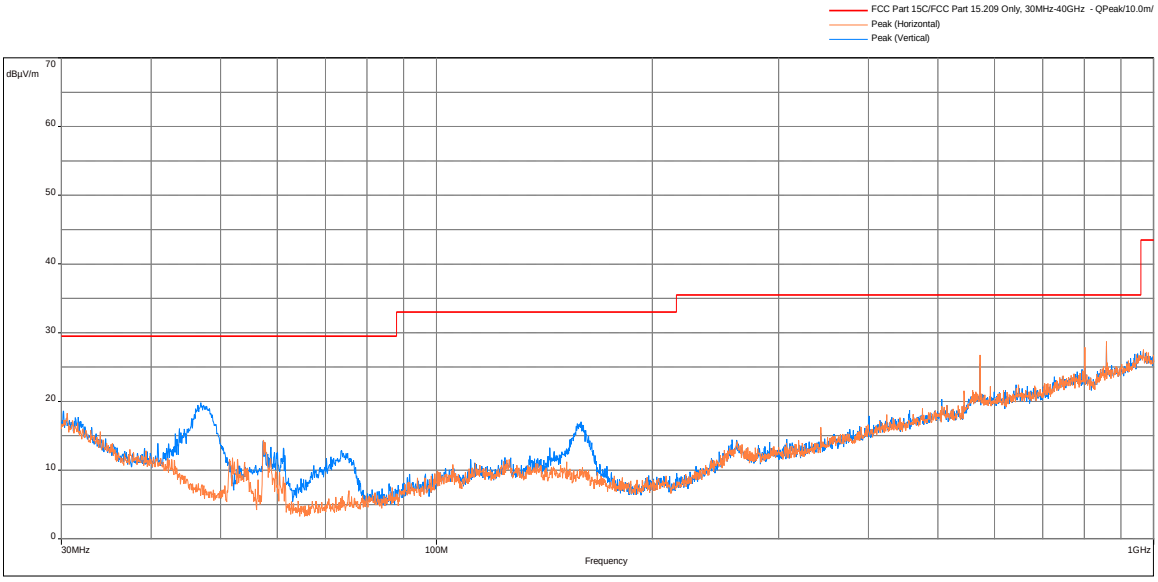
Frequency	FS@10m	Limit@ 10m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
47.683	19.77	29.5	-9.73	1.43	61	Vertical	-17.46
59.132	12.32	29.5	-17.18	1.69	167	Vertical	-21.20
72.874	12.35	29.5	-17.15	1.66	115	Vertical	-20.07
572.715	26.96	35.5	-8.54	2.74	123	Vertical	-4.05

Frequency	FS@3m	Limit@3m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
12788.37	44.24	54	-9.76	1.51	202	Horizontal	2.59
17362.5	43.52	54	-10.48	2.04	280	Horizontal	6.36

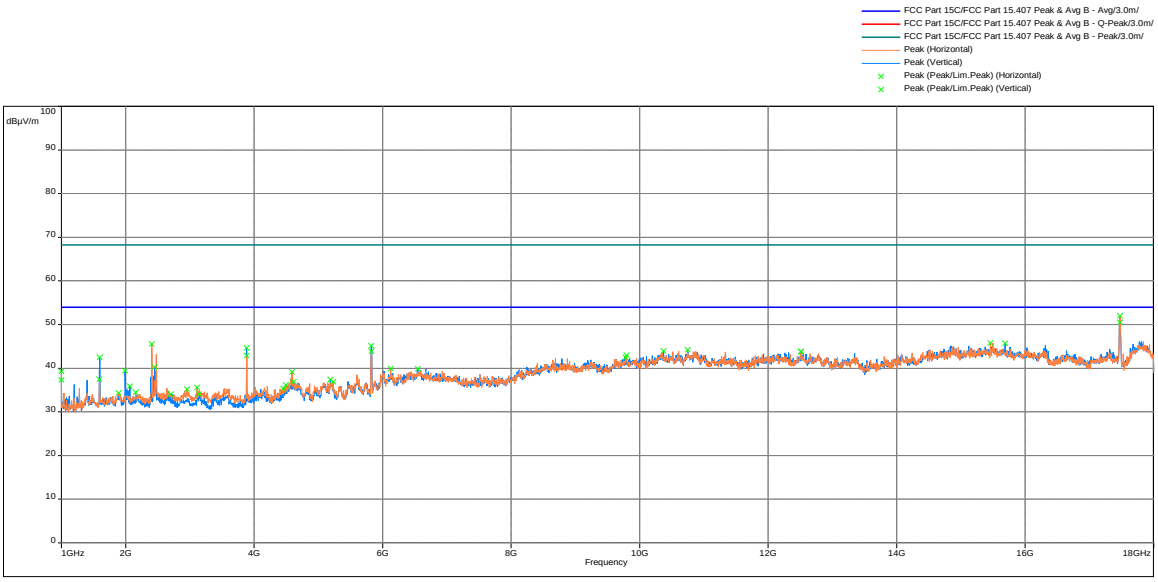
Note: Correction = AF + CF - Preamp

Test Results: 15.209 Radiated Spurious Emissions, Tx at 802.11a 5825MHz

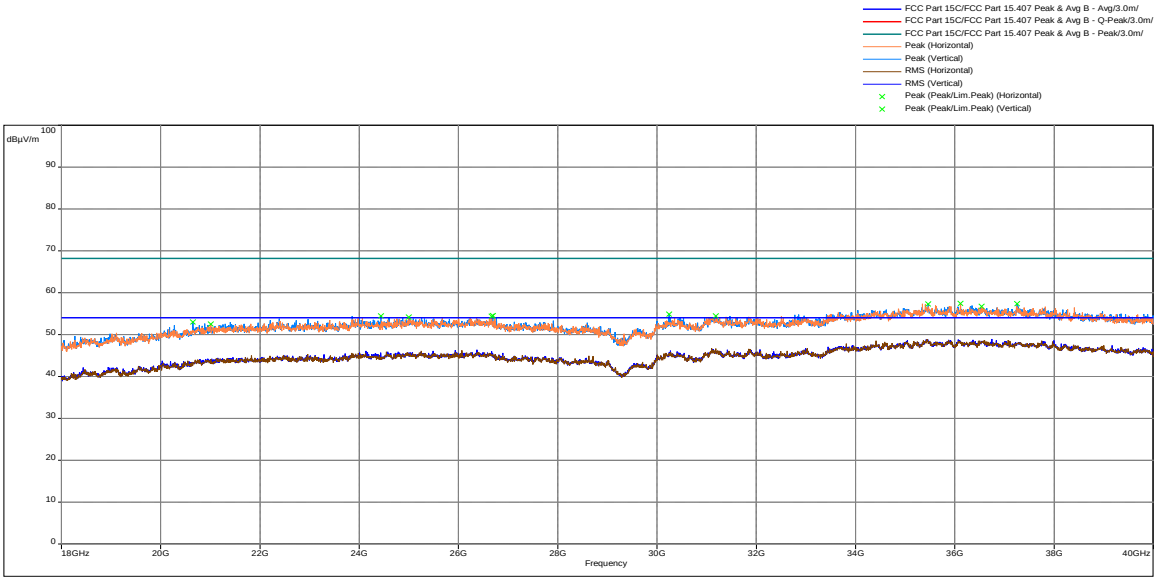
Radiated Spurious Emissions 30 MHz to 1000 MHz, Peak Scan vs QP Limit



Radiated Spurious Emissions 1000 to 18000 MHz, Peak Scan vs Peak & Avg Limit



Radiated Spurious Emissions 18000 to 40000 MHz, Peak & Avg Scan vs Peak & Avg Limit



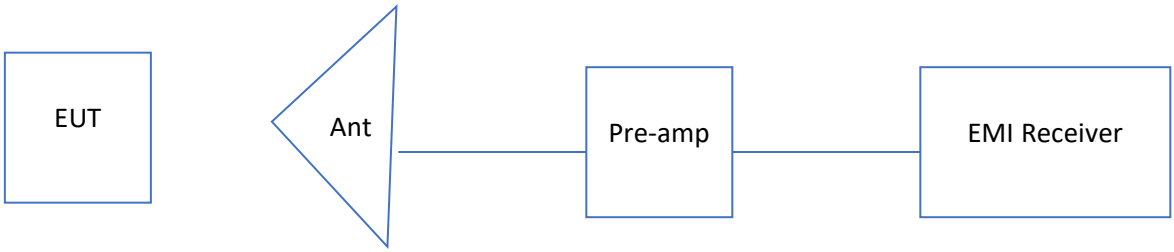
Frequency	FS@10m	Limit@ 10m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
46.94267	19.8	29.5	-9.7	1.00	60	Vertical	-17.03
57.61267	14.03	29.5	-15.47	1.32	0	Vertical	-21.09
572.715	26.75	35.5	-8.75	2.72	282	Horizontal	-4.05
859.0913	28.74	35.5	-6.76	3.02	0	Horizontal	0.88

Frequency	FS@3m	Limit@3m	Margin	Height	Azimuth	Polarity	Correction
MHz	dBuV/m	dBuV/m	(dB)	(m)	(deg)		dB
12507.3	43.8	54	-10.20	1.51	0	Horizontal	2.34
17475.27	52.04	54	-1.96	1.97	278.5	Horizontal	5.89

Note: Correction = AF + CF - Preamp

4.3.7 Test setup

The following photographs show the testing configurations used.



4.4 Dynamic Frequency Selection (DFS) & Transmit Power Control (TPC)

4.4.1 Requirement

15.407(h)(1) Transmit Power Control (TPC)

Transmit power control (TPC). U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

Applicability of DFS Requirements Prior to Use of a Channel

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

Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client With Radar Detection
DFS Detection Threshold	Yes	Not Required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not Required

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

4.4.1.1 DFS Detection Thresholds for Master or Client Devices with DFS Detection

Maximum Transmit Power	Values (See Notes 1, 2, and 3)
EIRP ≥ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. **Note 2:** Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. **Note3:** EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01	

Parameter	Value
Non-Occupancy Period	Minimum 30 minutes
Channel Availability Check Time	60 Seconds
Channel Move Time	10 seconds (see note 1)
Channel Closing Transmission Time	200 ms + an aggregate of 60 ms over remaining 10 Second period. (see note 1 and 2)
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth. (see note 3)
Note 1: *Channel Move Time* and the *Channel Closing Transmission Time* should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. **Note 2:** The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required to facilitate a *Channel* move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. **Note 3:** During the *U-NII Detection Bandwidth* detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

4.4.1.2 Test Waveform

Radar Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{\text{PRI}_{\mu sec}}\right)\right\}$	60.00%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 µsec, with a minimum increment of 1 µsec, excluding PRI values selected in Test A			
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

Radar Type	Pulse Width (µsec)	Chrip Width (MHz)	PRI (µsec)	Number of Pulses per Burst	Number of Burst	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

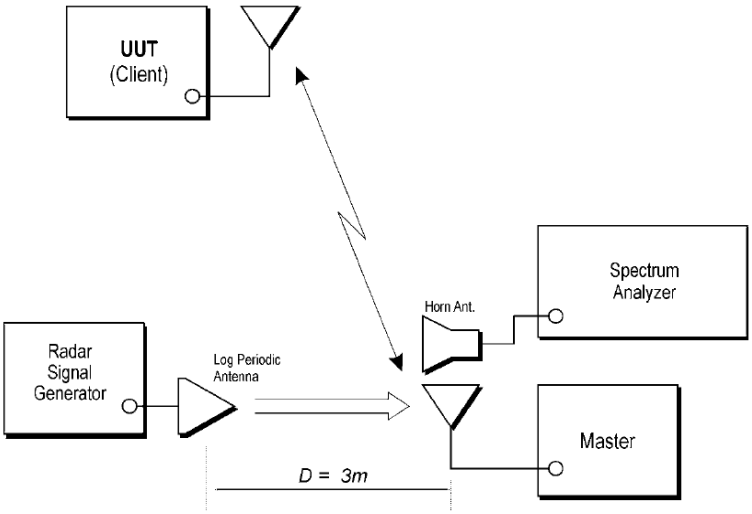
Radar Type	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

4.4.2 Procedure

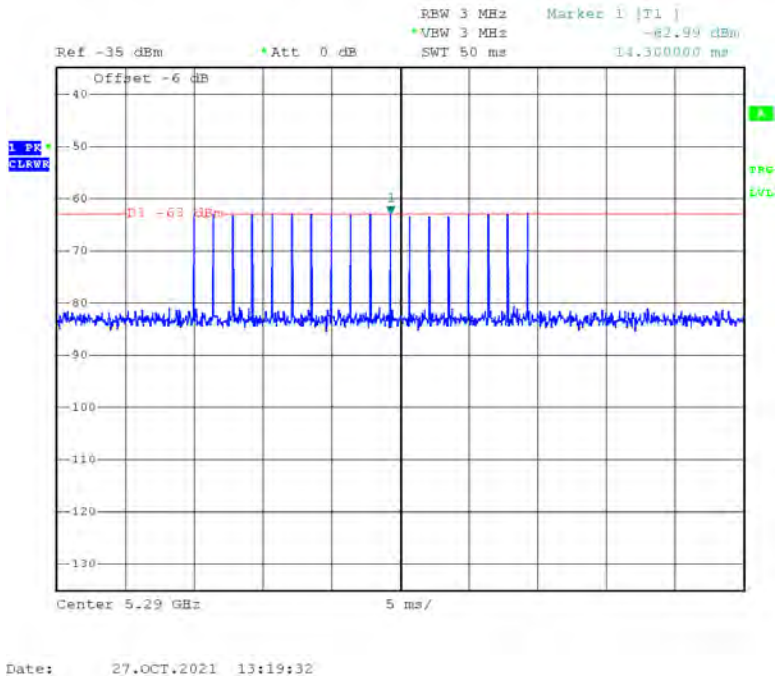
DFS Waveform Calibration

Calibration Procedure

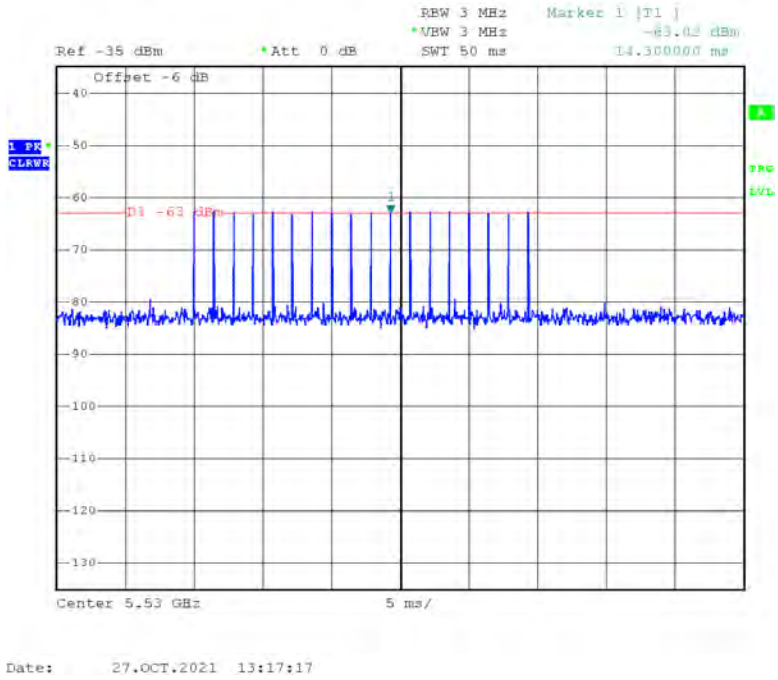
For the DFS signal, horn antenna was attached to a signal generator (RS SMU200A). On the Receive side another horn antenna was attached to a spectrum analyzer with a preamp inline. The spectrum analyzer's resolution bandwidth was set to 3 MHz and the video bandwidth was set to 3 MHz with peak detection. The field was corrected to account for cable loss, antenna gain and preamp. The DFS signal was calibrated to a field strength of -63 dBm. Test wave form 0 was utilized. The calibration setup is diagrammed below along with a setup picture.



Radar Type 0 Calibration 5290MHz



Radar Type 0 Calibration 5530MHz

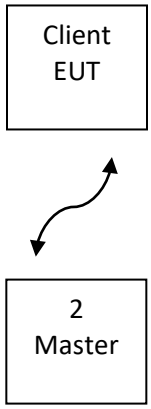


DFS Setup & Procedure

Test Procedure

A radiated test method was used and the test setup was made as depicted in the diagram below. DFS testing was setup as a client with injection into the master.

The diagram below depicts the setup of the EUT along with associated support equipment.



Item	Description	Model	Serial
2	Netgear	Nighthawk RAX200 FCC ID: PY318400434	69F31177A0646

Test Procedure Continued

The Master and Client (EUT) were placed in a semi-anechoic chamber. The simulated radar waveform was transmitted from a horn antenna towards the Master. The signal level of the simulated radar waveform was set 1 dB higher than calibrated level to -62 dBm and was applied to the Master. The horn antenna was connected to the spectrum analyzer and positioned towards the client with a level higher than emissions from the Master.

A Rhode & Schwarz Vector Signal Generator with Pulse Sequencer Software was used to generate the DFS radar signals. A Rhode & Schwarz Spectrum Analyzer was used to monitor the transmissions of the Client. The trigger of the spectrum analyzer was aligned with the end of the radar waveform burst from the signal generator.

Channel closing transmission time and channel move time were measured by applying a radar signal to the Master device. The EUT transmissions were observed while Type 0 Radar waveforms were applied. The time between the end of the applied radar waveform and the final transmission on the channel is the channel move time. The channel closing transmission time comprises only those fragments of the channel move time during which the EUT transmits.

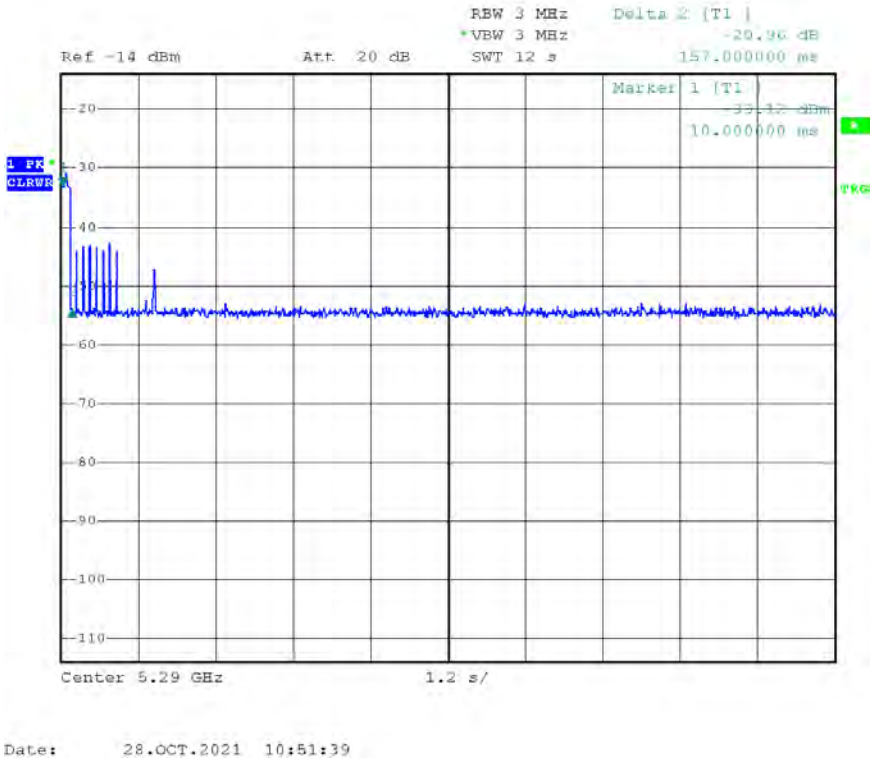
The EUT (client without DFS detection) was configured to communicate with a Master wirelessly. The test file/data was streamed from the Master to the Client. The channel load is recorded and presented in test results below.

4.4.3 Test Results

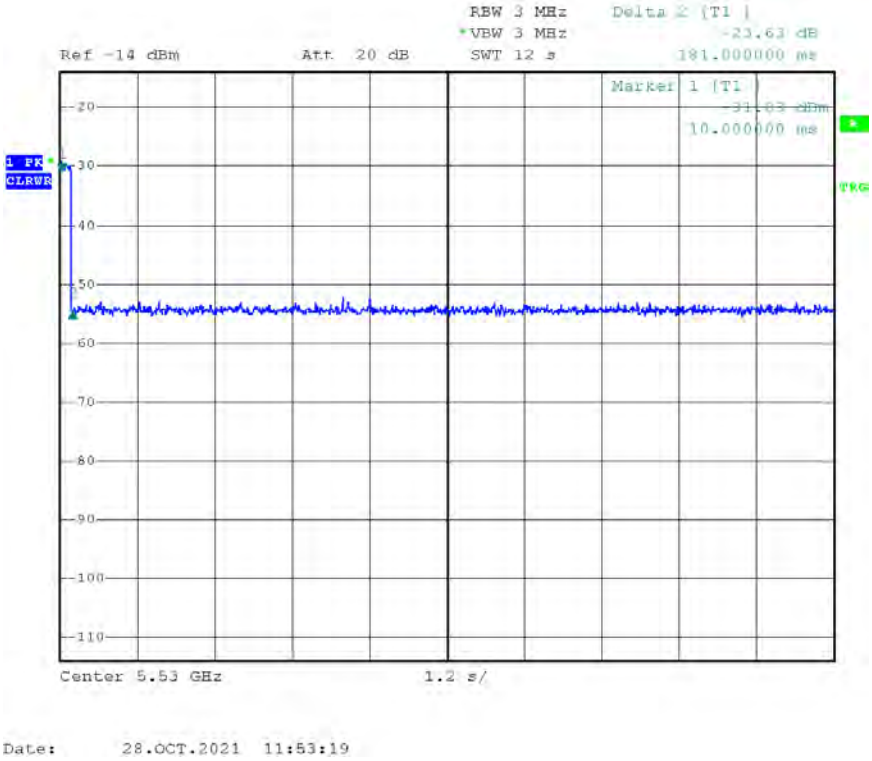
Transmit Power Control (TPC)
RF Power is 17.29dBm with an Antenna Gain of 2.47dBi: EIRP 19.76 dBm A TPC mechanism is not required. The Maximum EIRP is less than 500 mW or 27dBm

Channel Move Time Test Summary					
Description	**Radar Type**	**Frequency MHz**	**Measured Value**	**Limit Requirements**	**Results**
Channel Move Time	0	5290	157 ms	10s	Pass
		5530	181 ms	10s	Pass
Channel Closing Transmission Time Test Summary					
Description	**Radar Type**	**Frequency MHz**	**Aggregate Measured Value**	**Limit Requirements**	**Results**
Closing Transmission Time	0	5290	157 ms	260ms	Pass
		5530	181 ms	260ms	Pass
Channel Unoccupancy Time Test Summary					
Description	**Radar Type**	**Frequency MHz**	**Measured Value**	**Limit Requirements**	**Results**
Unoccupancy Time	0	5290	No Transmission Found	Minimum 30 minutes	Pass
		5530	No Transmission Found	Minimum 30 minutes	Pass

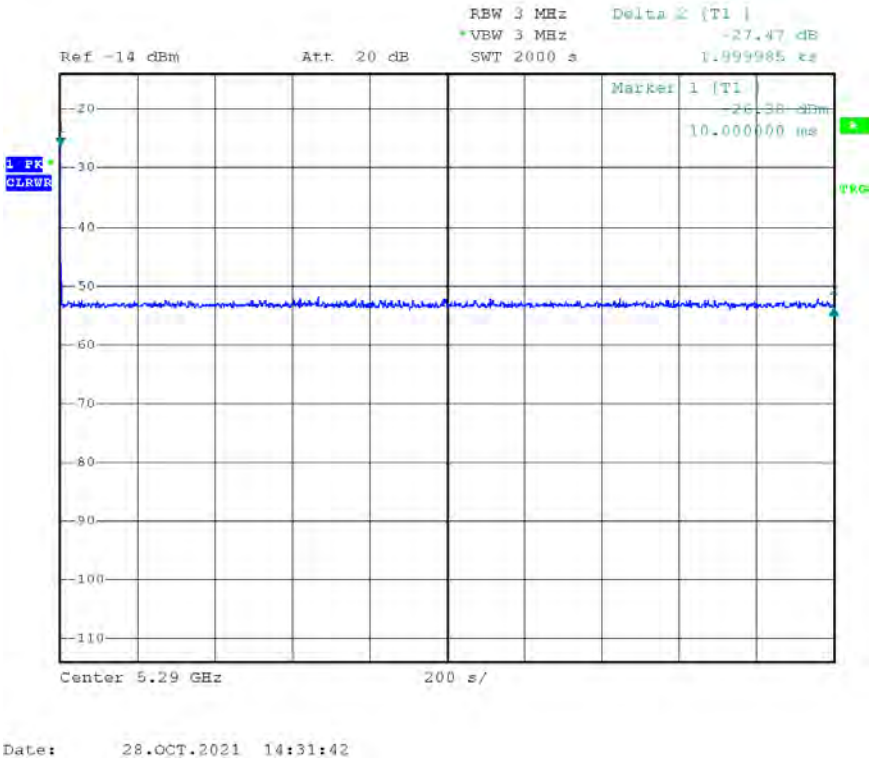
Channel Move Time (CMT) & Close Time, @ 5290 MHz, 802.11ac 80MHz



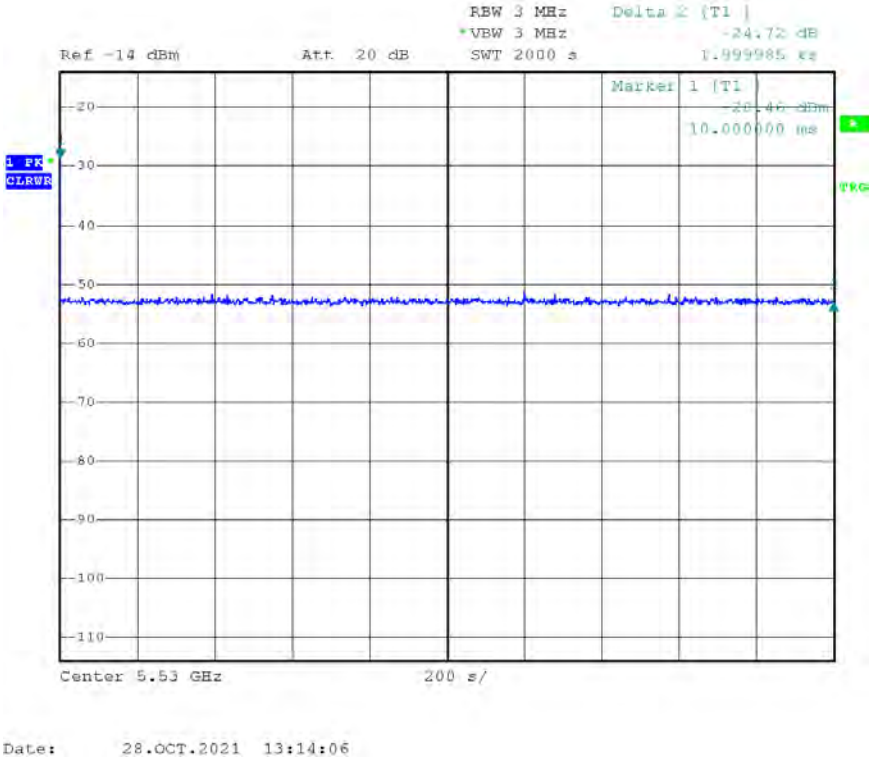
Channel Move Time (CMT) & Close Time, @ 5530 MHz, 802.11ac 80MHz



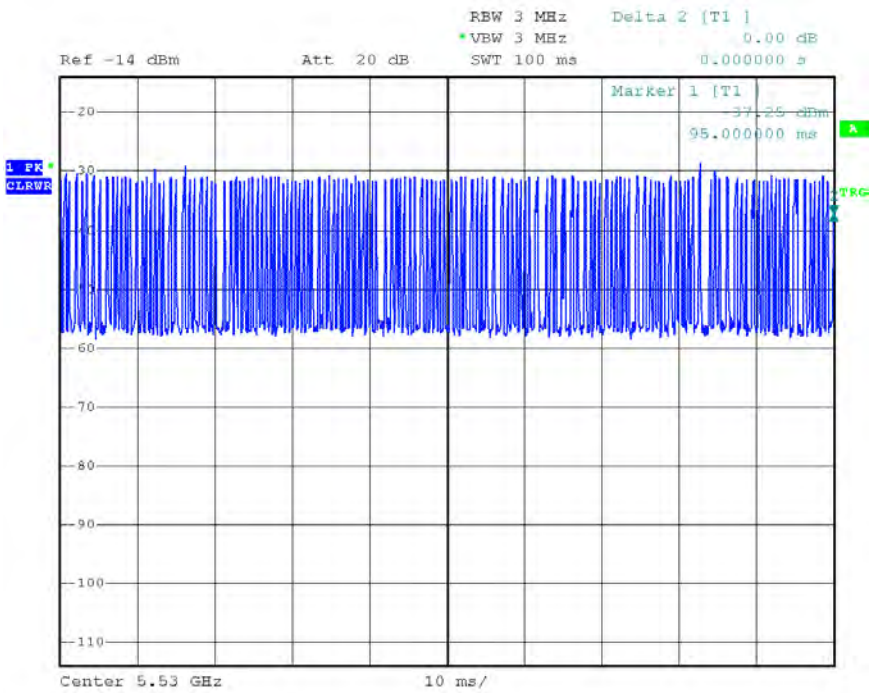
Channel Unoccupancy Time @ 5290 MHz, 802.11ac 80MHz



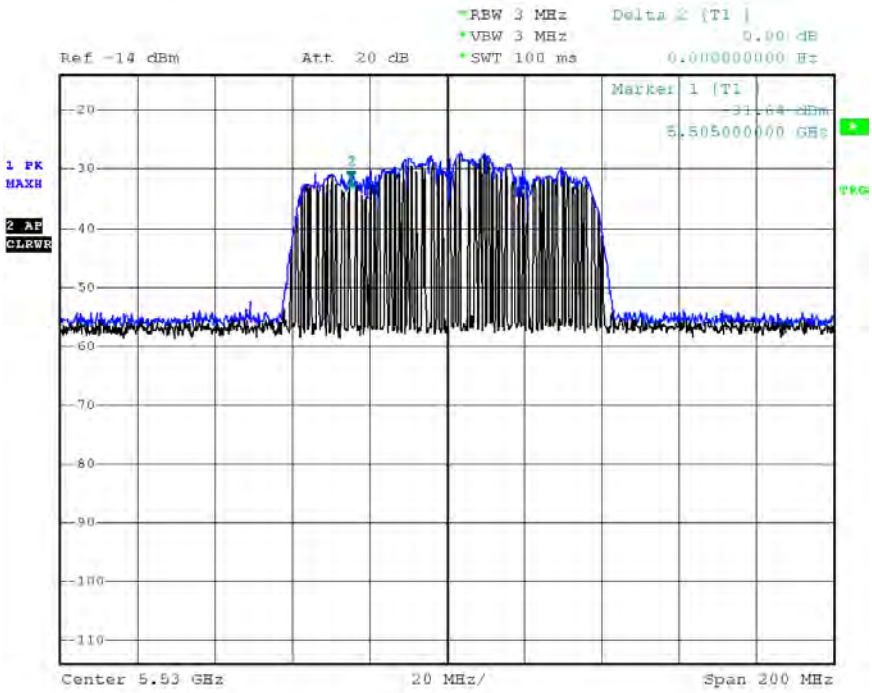
Channel Unoccupancy Time @ 5530 MHz, 802.11ac 80MHz



Channel Loading @ 802.11ac 80MHz

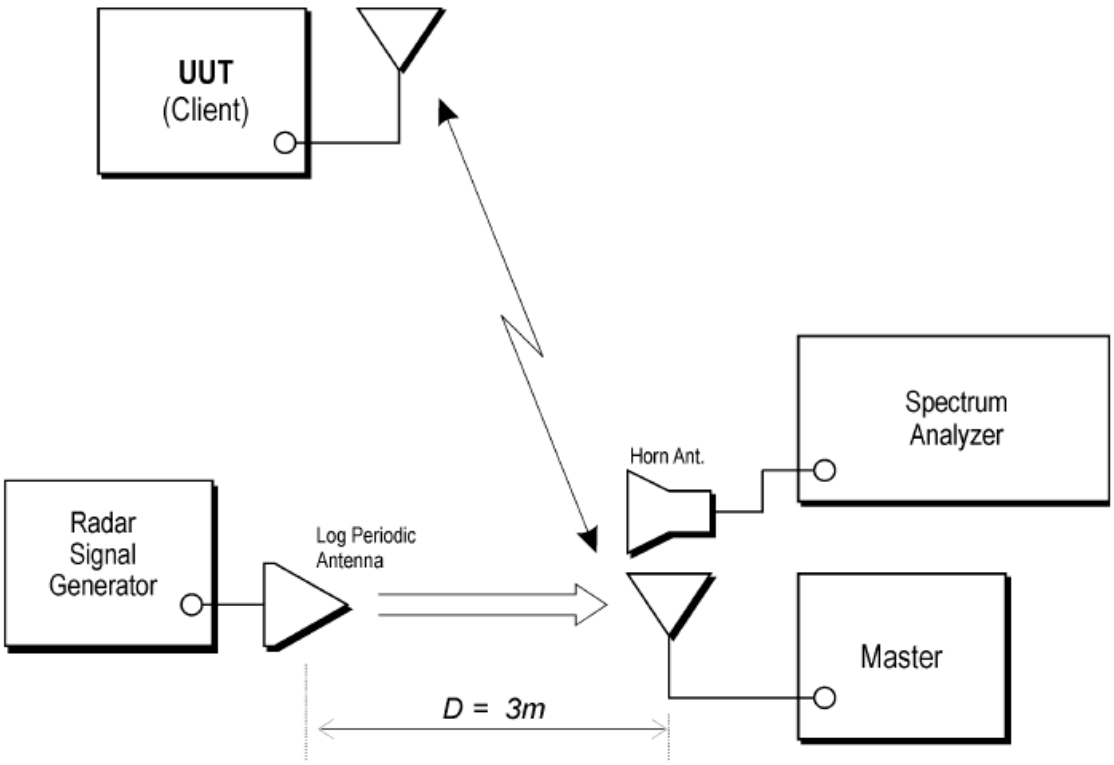


Date: 28.OCT.2021 11:51:09



Date: 28.OCT.2021 11:49:47

4.4.4 Test setup



4.5 AC Line Conducted Emission
FCC: 15.207; RSS-GEN

4.5.1 Requirement

Frequency Band MHz	FCC Part 15.207 Limits	
	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *
0.50-5.00	56	46
5.00-30.00	60	50

*Note: *Decreases linearly with the logarithm of the frequency*
At the transition frequency the lower limit applies.

4.5.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

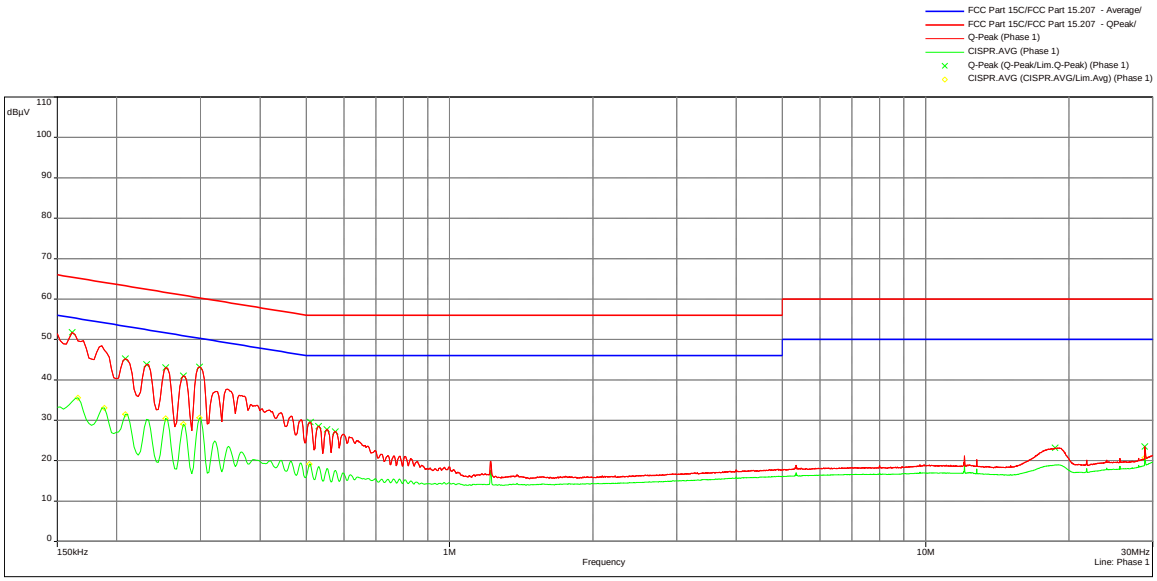
Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.10:2013.

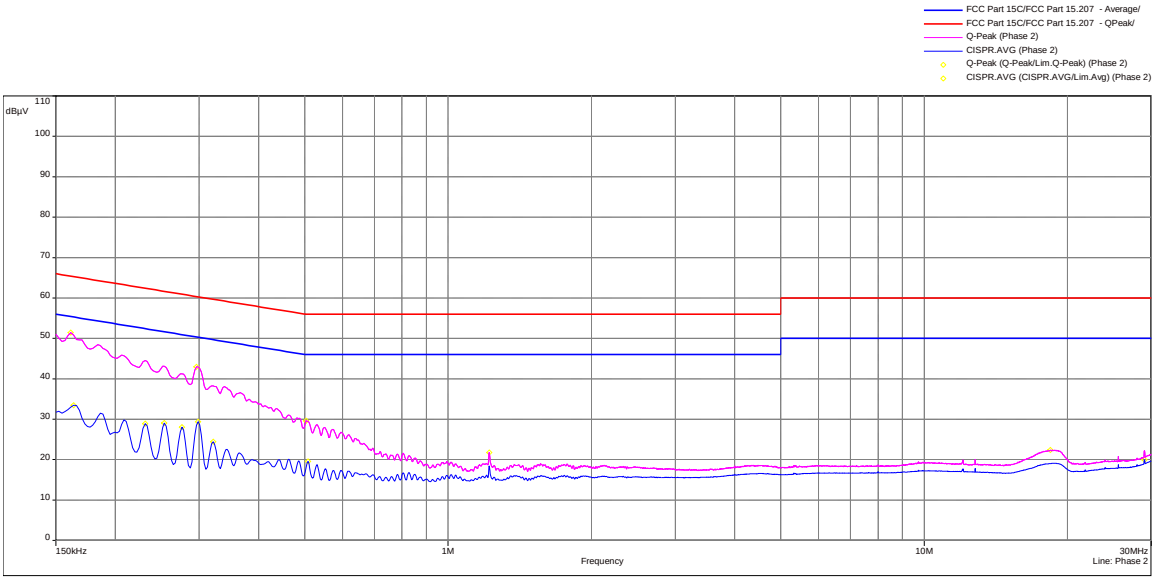
4.5.3 Test Results

15.207: Conducted Emissions 120VAC 60Hz

Phase 1



Phase 2



4.5.3 Test Results (Continued)

Frequency (MHz)	Q-Peak (dBµV)	Q-Peak Limit (dBµV)	Margin (dB)	Line	Correction (dB)
0.161	51.76	65.40	-13.64	Phase 1	20.42
0.161	51.47	65.40	-13.93	Phase 2	20.42
0.209	45.26	63.26	-18.00	Phase 1	20.41
0.231	43.83	62.41	-18.58	Phase 1	20.40
0.254	43.02	61.64	-18.62	Phase 1	20.41
0.276	41.03	60.94	-19.91	Phase 1	20.40
0.296	42.97	60.35	-17.38	Phase 2	20.41
0.299	43.21	60.28	-17.07	Phase 1	20.41
0.503	29.62	56.00	-26.38	Phase 2	20.43
0.510	29.56	56.00	-26.44	Phase 1	20.43
0.530	28.53	56.00	-27.47	Phase 1	20.44
0.553	27.70	56.00	-28.30	Phase 1	20.44
0.575	27.16	56.00	-28.84	Phase 1	20.44
1.221	21.77	56.00	-34.23	Phase 2	20.50
18.413	22.41	60.00	-37.59	Phase 2	21.26
18.706	23.20	60.00	-36.80	Phase 1	21.27
28.865	23.45	60.00	-36.55	Phase 1	21.67

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Margin (dB)	Line	Correction (dB)
0.164	33.42	55.28	-21.86	Phase 2	20.43
0.166	35.58	55.17	-19.59	Phase 1	20.42
0.188	33.06	54.11	-21.05	Phase 1	20.39
0.209	31.46	53.26	-21.80	Phase 1	20.41
0.231	28.92	52.41	-23.49	Phase 2	20.40
0.254	30.47	51.64	-21.17	Phase 1	20.41
0.254	29.03	51.64	-22.61	Phase 2	20.41
0.276	29.05	50.94	-21.88	Phase 1	20.40
0.276	28.04	50.94	-22.90	Phase 2	20.40
0.299	29.41	50.28	-20.88	Phase 2	20.41
0.299	30.59	50.28	-19.70	Phase 1	20.41
0.321	24.43	49.68	-25.25	Phase 2	20.42
0.508	19.15	46.00	-26.85	Phase 1	20.43
0.508	19.52	46.00	-26.48	Phase 2	20.43
28.862	20.71	50.00	-29.29	Phase 1	21.67
29.040	19.96	50.00	-30.04	Phase 2	21.67
0.164	33.42	55.28	-21.86	Phase 2	20.43

Results: **Complies** by 13.64 dB

5.0 List of Test Equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Asset #	Cal Int	Cal Due
EMI Receiver	Rohde and Schwarz	ESU40	ITS 00961	12	03/09/22
EMI Receiver	Rohde and Schwarz	ESR	ITS 01607	12	11/05/21
Horn Antenna	ETS Lindgren	3117PA	ITS 01636	12	12/17/21
Horn Antenna	ETS-Lindgren	3115	ITS 00982	12	05/13/22
Spectrum Analyzer	Rohde and Schwarz	FSU	ITS 00913	12	05/24/22
Spectrum Analyzer	Rohde and Schwarz	FSP-40	ITS 01200	12	01/07/22
Loop Antenna	EMCO	6512	ITS 01598	12	11/03/21
BI-Log Antenna	Teseq	CBL 6111D	ITS 01505	12	03/22/22
Pre-Amplifier	Sonoma Instrument	310N	ITS 00942	12	04/19/22
RF Cable	TRU Corporation	TRU CORE 300	ITS 01462	12	09/14/22
18-40 GHz Preamplifier	uComp Nordic	MCNS-50-18004000335P	ITS 01799	12	03/19/22
Horn Antenna	ETS-Lindgren	3116c	ITS 01376	12	05/13/22
RF Cable	TRU Corporation	TRU CORE 300	ITS 01465	12	09/14/22
RF Cable	TRU Corporation	TRU CORE 300	ITS 01470	12	09/14/22
RF Cable	TRU Corporation	TRU CORE 300	ITS 01342	12	09/14/22
Notch Filter	MICRO-TRONICS	BRM50702	ITS 01166	12	06/29/22
RF Cable	Mega Phase	EMC1-K1K1-236	ITS 01484	12	06/29/22
10m Semi-anechoic	Panashield	10m Chamber	ITS 00984	36	07/29/23
Notch Filter	MICRO-TRONICS	BRM50716	ITS 01798	12	02/26/22
Vector Signal Generator	Rohde and Schwarz	SMU200A	ITS 00880	12	12/09/21
Transient Limiter	Com-Powwer	LIT-153A	ITS 01457	12	11/13/21
LISN	Teseq	NNB 51	ITS	12	02/13/22

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
Tile	Quantum Change	3.4.K.22	Conducted Restricted Band Edge_Avg Conducted Restricted Band Edge_Peak
BAT-EMC	Nexio	3.20.0.23	104799910_Vocera 5GWIFI.bpp
RS Commander	Rohde Schwarz	1.6.4	Not Applicable (Screen grabber)

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewer Initials	Date	Change
1.0 / G104799910	AS	KV	November 12, 2021	Original document
1.1 / G104799910	AS	KV	February 7, 2022	Updated Block Diagram. Added TPC requirements.

END OF REPORT