TEST REPORT

Report Number: 103930307MPK-002A
Project Number: G103930307
August 20, 2019

Testing performed on the
Connected AC Android Control Module
Model Number: AP6255

FCC ID: 2AHLA-SP01500243
IC: 4811A-SP01500243

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

For

Bosch Automotive Service Solutions, Inc.

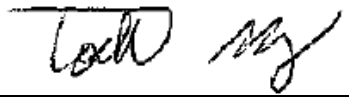
Test Performed by:	Test Authorized by:
Intertek	Bosch Automotive Service Solutions, Inc
1365 Adams Court	655 Eisenhower Dr
Menlo Park, CA 94025 USA	Owatonna, MN 55060 USA

Prepared by: _____ **Date:** August 20, 2019
Todd Moy

Reviewed by: _____ **Date:** August 20, 2019
Krishna K Vemuri

Report No. 103930307MPK-002	
Equipment Under Test:	Connected AC Android Control Module
Trade Name:	Bosch Automotive Service Solutions, Inc
Model Number:	AP6255
Part Number:	CBA-G19-UBS2
Applicant:	Bosch Automotive Service Solutions, Inc
Contact:	Bill Brown
Address:	Bosch Automotive Service Solutions, Inc 655 Eisenhower Dr Owatonna, MN 55060
Country:	USA
Tel. Number:	(507) 455-8312
Email:	bill.brown2@us.bosch.com
Applicable Regulation:	FCC Part 15, Subpart E (15.407) Industry Canada RSS-247, Issue 2
Date of Test:	June 24-July 25, 2019

We attest to the accuracy of this report:



Todd Moy
Project Engineer

Krishna K Vemuri
Engineering Team Lead

TABLE OF CONTENTS

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
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 an antenna with a unique attachment.

*Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

EUT receive date: June 24, 2019

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: Jun 24, 2019

Test completion date: July 25, 2019

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

2.0 General Description

2.1 Product Description

Bosch Automotive Service Solutions, Inc. supplied the following description of the EUT:

The module is a single board computer with Rockchip ARM Cortex-A17 CPU, Quad core processor.

Features:

- On Board DDR3L 935MHz, 2GB
- Wi-Fi, IEEE 802.11a/b/g/n/ac dual-band radio with virtual-simultaneous dual-band operation
- Bluetooth, V4.2+EDR with integrated PA for Class 1.5 and Low Energy (BLE)
- On Board eMMC, 64GB
- 1 xmicro-SD
- 1 RS232
- 2 2W speaker outputs
- 2 USB 2.0 Host, 1 USB OTG 2.0
- 1 LVDS Output
- 1 Capacitive touchscreen input

Radio Information	
Applicant	Bosch Automotive Service Solutions, Inc.
Model Number	AP6255
FCC Identifier	2AHLA-SP01500243
IC Identifier	4811A-SP01500243
Modulation Technique	OFDM
Rated RF Output	10.15 dBm for 5180~5240 MHz
Frequency Range	U-NII 1: 5150 – 5250 MHz
Type of modulation	OFDM
Number of Channel(s)	4 for 802.11a/n 20 MHz 2 for 802.11n 40MHz 1 for 802.11ac 80MHz
Antenna(s) & Gain	Antenna with Unique Connection, Gain: +4.3 dBi
Applicant Name & Address	Bosch Automotive Service Solutions, Inc. 655 Eisenhower Dr. Owatonna, MN 55060 USA

The EUT supports the following configurations:

Channels in 5150 – 5250 MHz band							
Number	**Frequency, MHz**	**802.11a/n 20MHz Channels**		**802.11n 40MHz Channels**		**802.11ac 80MHz Channels**	
36	5180	√	X				
38	5190			√	X		
40	5200	√	X				
42	5210					√	X
44	5220	√					
46	5230			√	X		
48	5240	√	X				

List of channels:
√ - available
X - tested

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

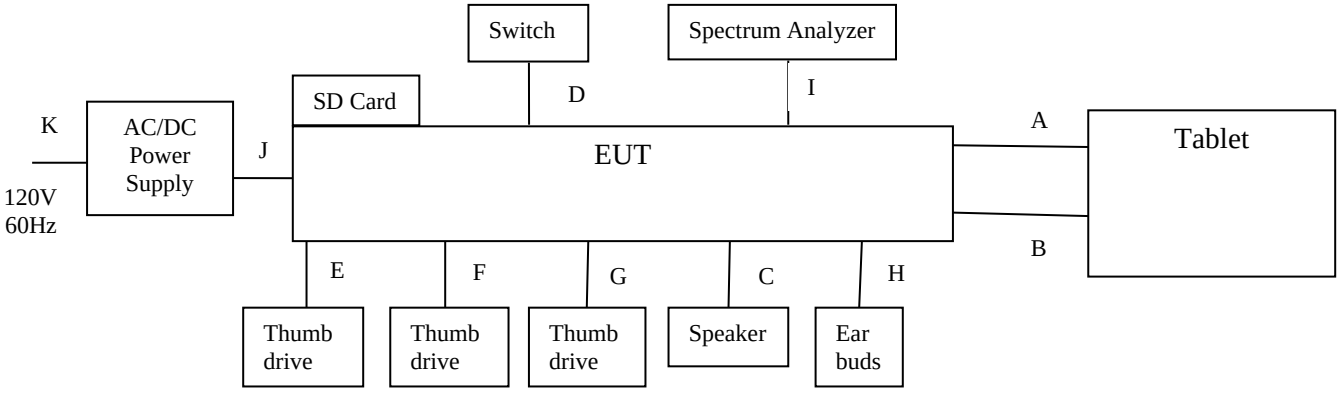
Support Equipment		
Description	**Manufacturer**	**Model Number**
Tablet	OSD DISPLAYS	OSD101T3990-81TS
Power Supply	XP POWER LLC	ECS130US12-XE1141
Thumb drive	Freescale	-
Thumb drive	HP	-
Thumb drive	Kingston	-
Speaker	Visaton	FR 58
Earbuds	-	-
Switch	-	-
SD Memory Card	-	-

Cables					
ID	**Description**	**Length (m)**	**Shielding**	**Ferrites**	**Termination**
A	Ribbon Cable	0.1	No	No	Tablet
B	Ribbon Cable	0.1	No	No	Tablet
C	Power Cable	0.6	No	No	Speaker
D	Power Cable	0.6	No	No	Switch
E	Micro-USB to USB	0.6	Yes	No	Thumb drive
F	USB Extender	0.6	Yes	No	Thumb drive
G	USB Extender	0.6	Yes	No	Thumb drive
H	Headphone Extender	0.4	No	No	Earbuds
I	SMA Cable	0.2	Yes	No	EUT
J	DC Power Cable	0.5	No	No	Power Supply
K	AC Power Cable	2.0	No	No	Power Supply

3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	**Manufacturer**	**Part Number**	**Serial Number (LOT Number)**
Connected AC Android Control Module	Bosch Automotive Service Solutions, Inc	CBA-G19-UBS2	209498-1-010

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



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, 6MB/s – for 802.11a
OFDM, MCS0 – for 802.11n 20MHz
OFDM, MCS0 – for 802.11n 40MHz
OFDM, MCS0 – for 802.11ac 80MHz

Different orientations of the EUT were tested and only the worse-case emissions were reported.

For radiated emission measurements the EUT is placed on a non-conductive table.

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.

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.

Tested By	Test Date
Todd Moy	June 26, 2019

4.1.3 Test Result

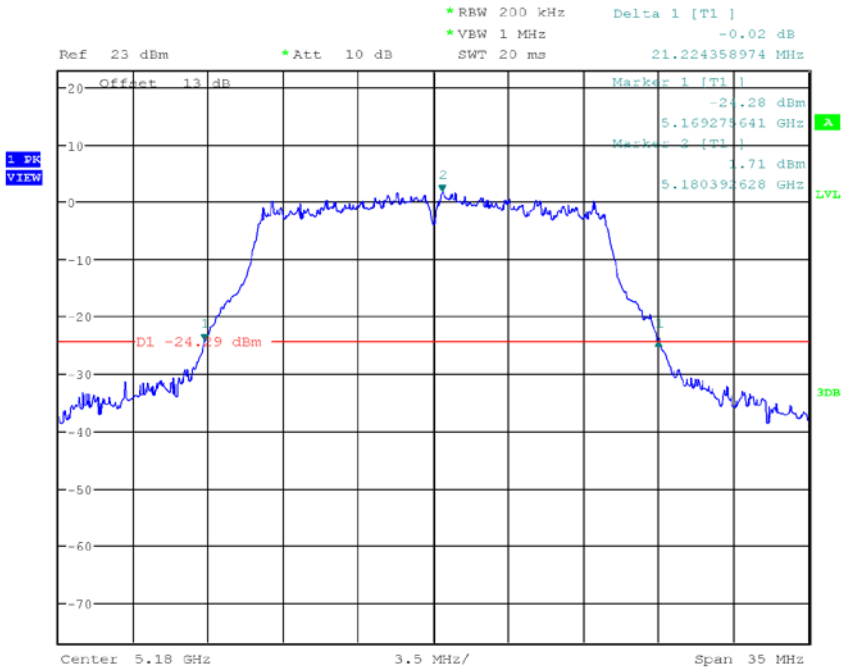
Refer to the following plots for the test result:

Mode	Channel	Frequency MHz	26-dB Bandwidth, MHz	Plot #
802.11a	36	5180	21.224	1.1
	40	5200	21.159	1.2
	48	5240	21.280	1.3
802.11n 20MHz	36	5180	21.561	1.4
	40	5200	22.191	1.5
	48	5240	21.954	1.6
802.11n 40MHz	38	5190	40.250	1.7
	46	5230	40.321	1.8
802.11ac 80MHz	42	5210	82.205	1.9

Mode	Channel	Frequency MHz	Occupied Bandwidth, MHz	Plot #
802.11a	36	5180	16.827	1.10
	40	5200	16.771	1.11
	48	5240	16.771	1.12
802.11n 20MHz	36	5180	17.949	1.13
	40	5200	17.983	1.14
	48	5240	17.893	1.15
802.11n 40MHz	38	5190	36.571	1.16
	46	5230	36.458	1.17
802.11ac 80MHz	42	5210	76.058	1.18

Plot 1. 1

802.11a 5180MHz



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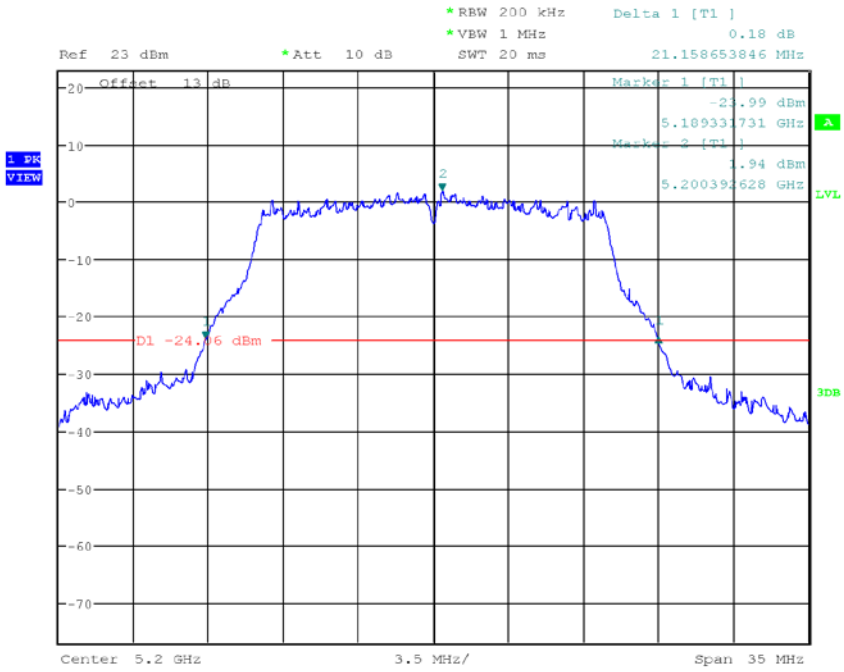
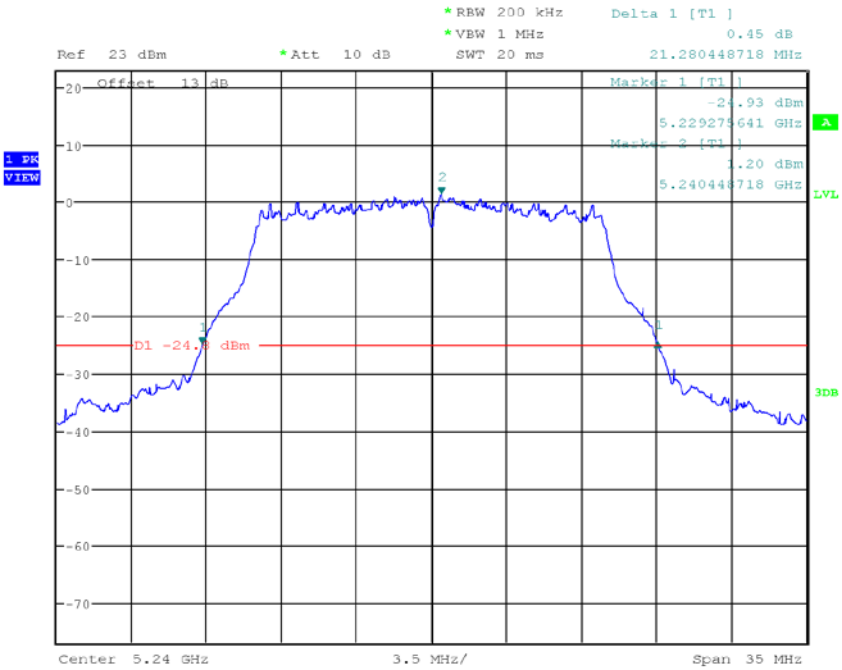
Plot 1. 2

802.11a 5200MHz



Plot 1. 3

802.11a 5240MHz



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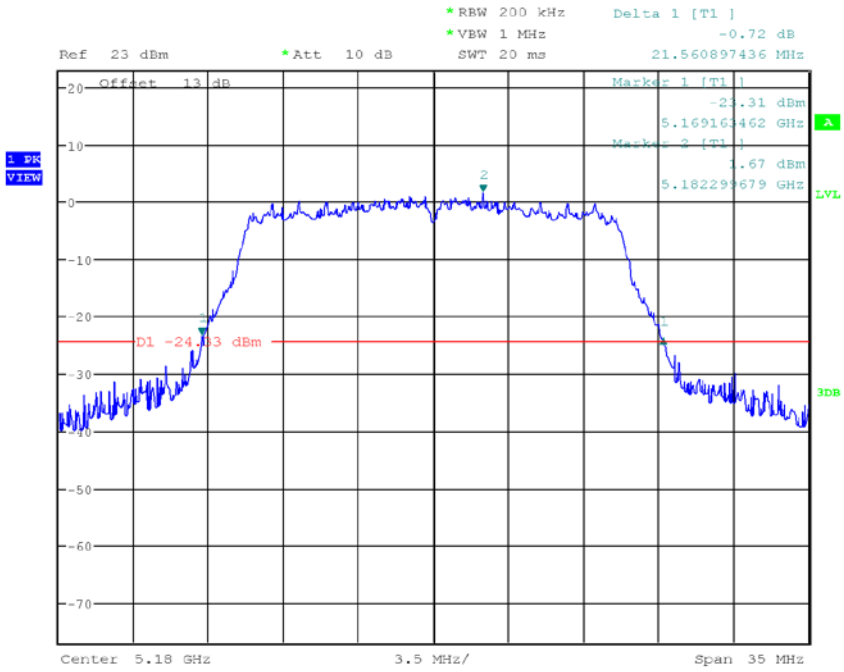
Plot 1. 4

802.11n 20MHz, 5180MHz



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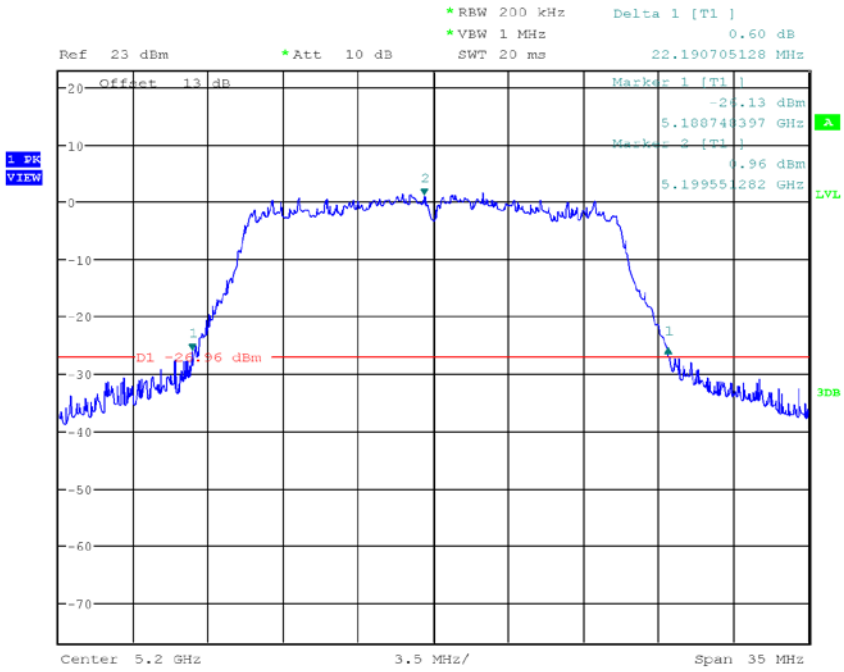
Plot 1. 5

802.11n 20MHz, 5200MHz



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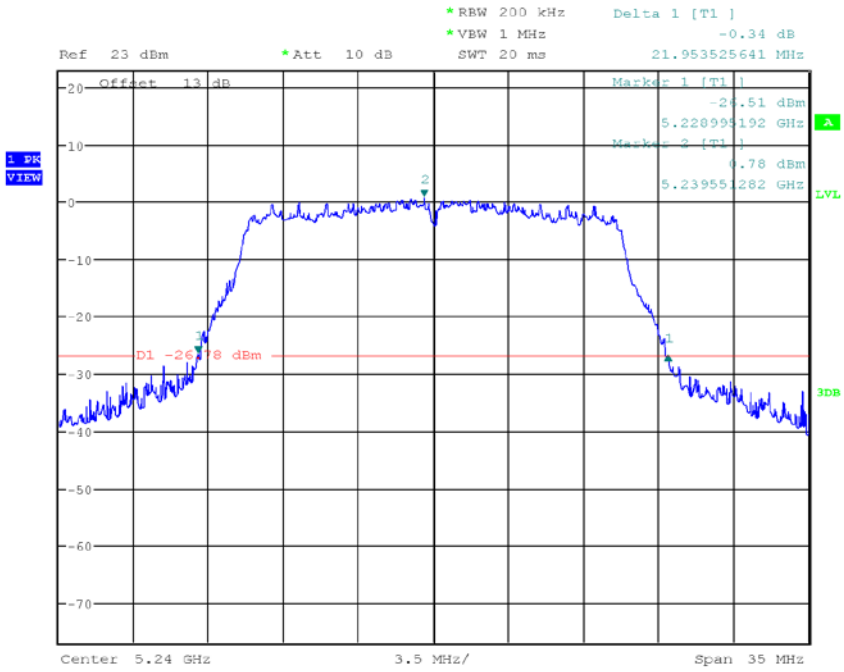
Plot 1. 6

802.11n 20MHz, 5240MHz



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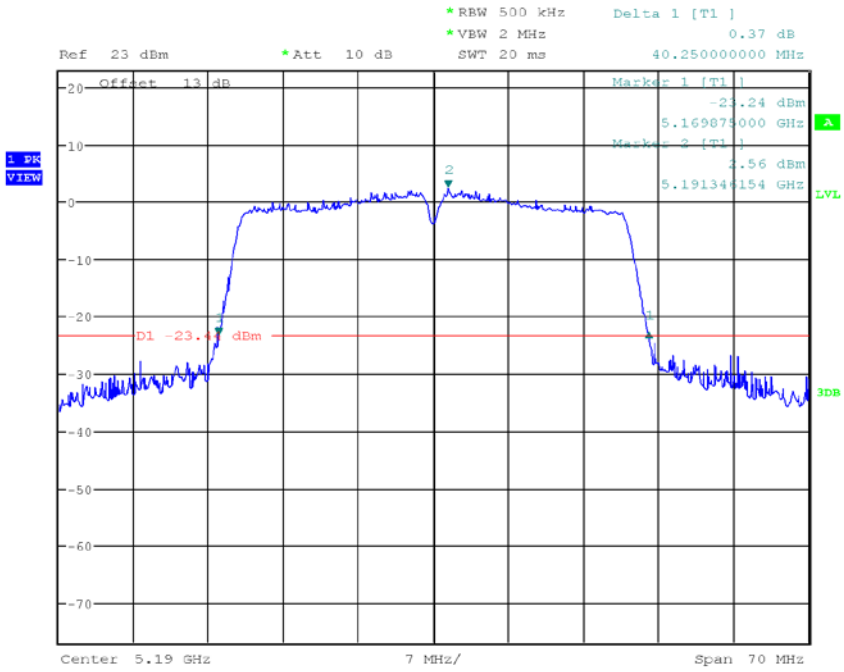
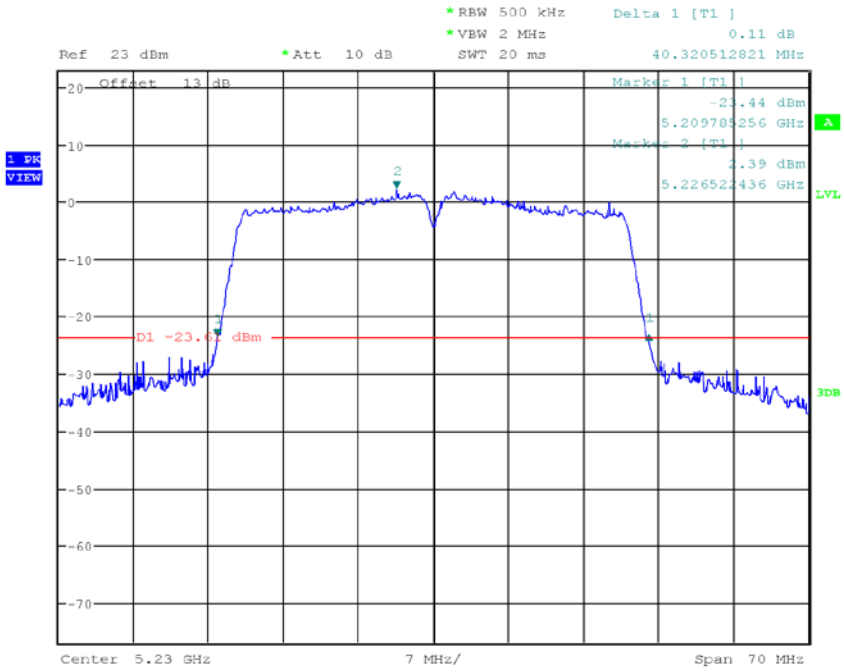
Plot 1. 7

802.11n 40MHz, 5190MHz



Plot 1. 8

802.11n 40MHz, 5230MHz



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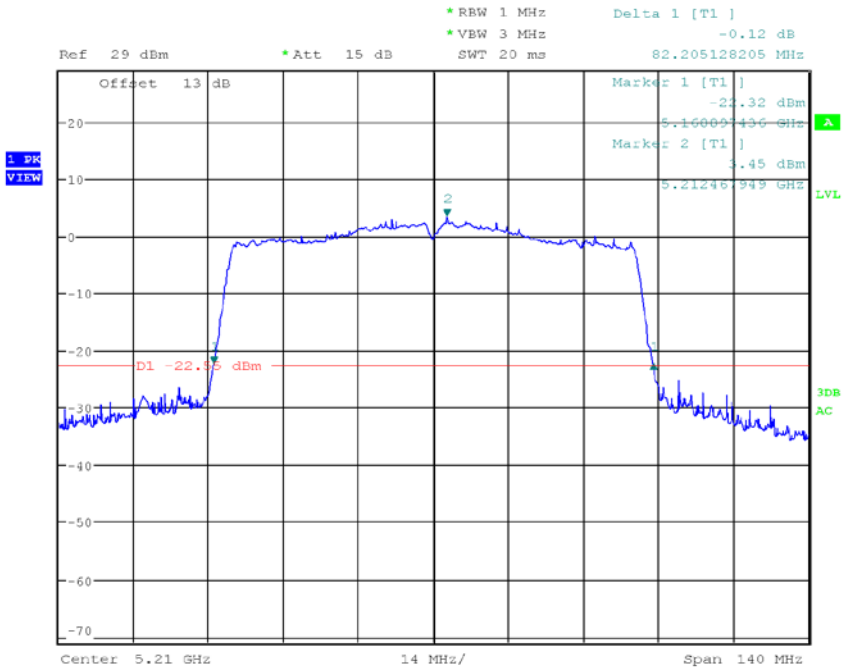
Plot 1. 9

802.11ac 80MHz, 5210MHz



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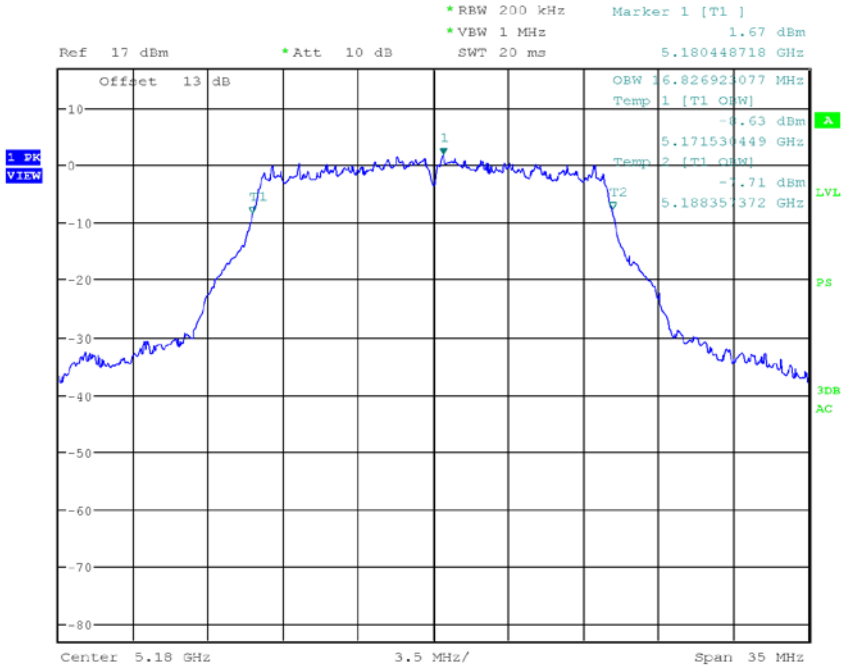
Plot 1. 90

802.11a 5180MHz



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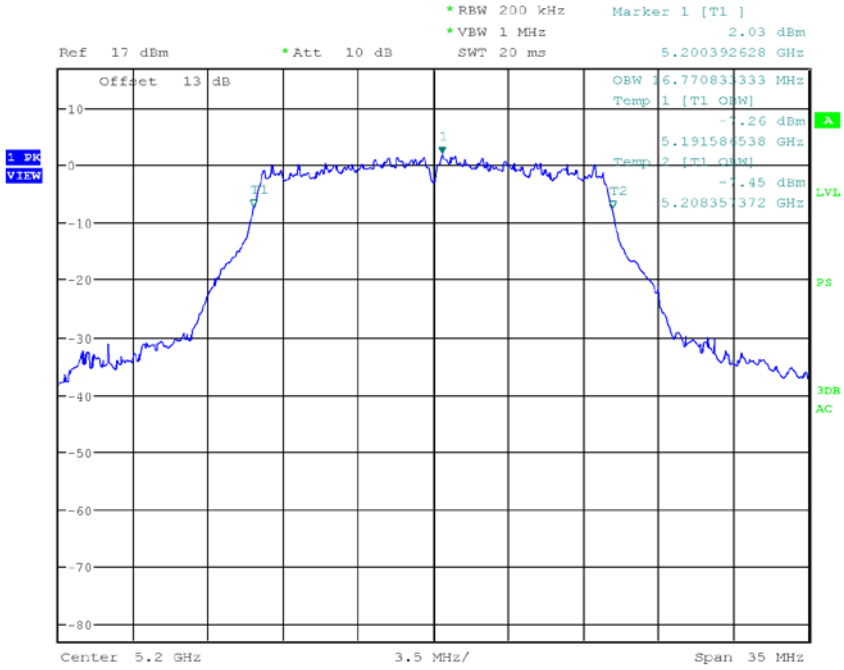
Plot 1. 11

802.11a 5200MHz



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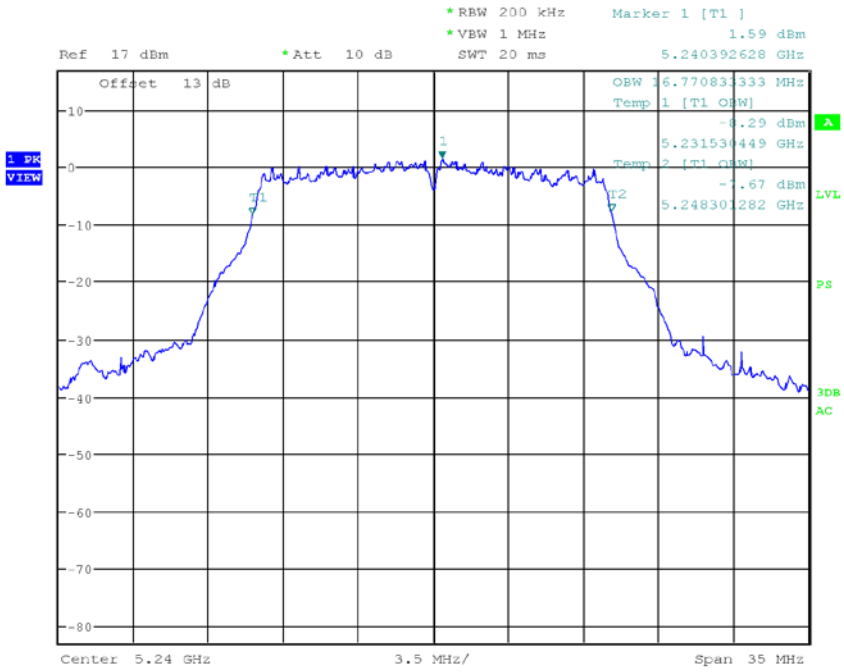
Plot 1. 12

802.11a 5240MHz



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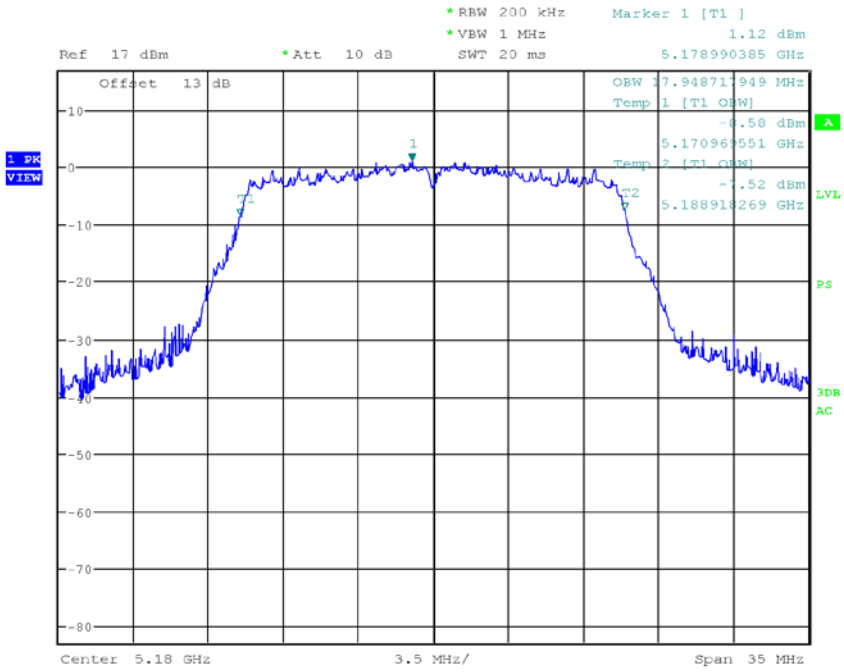
Plot 1. 13

802.11n 20MHz, 5180MHz



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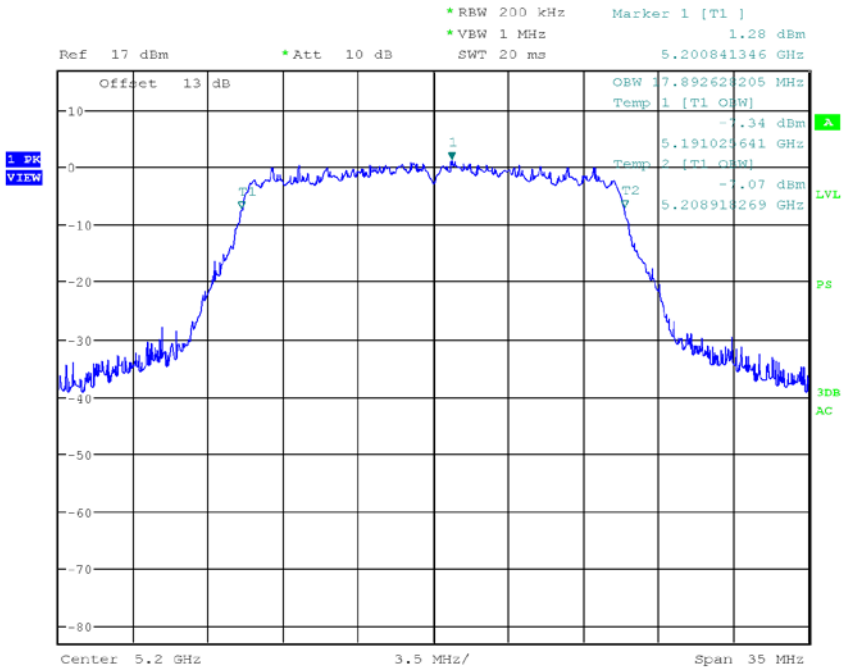
Plot 1. 14

802.11n 20MHz, 5200MHz



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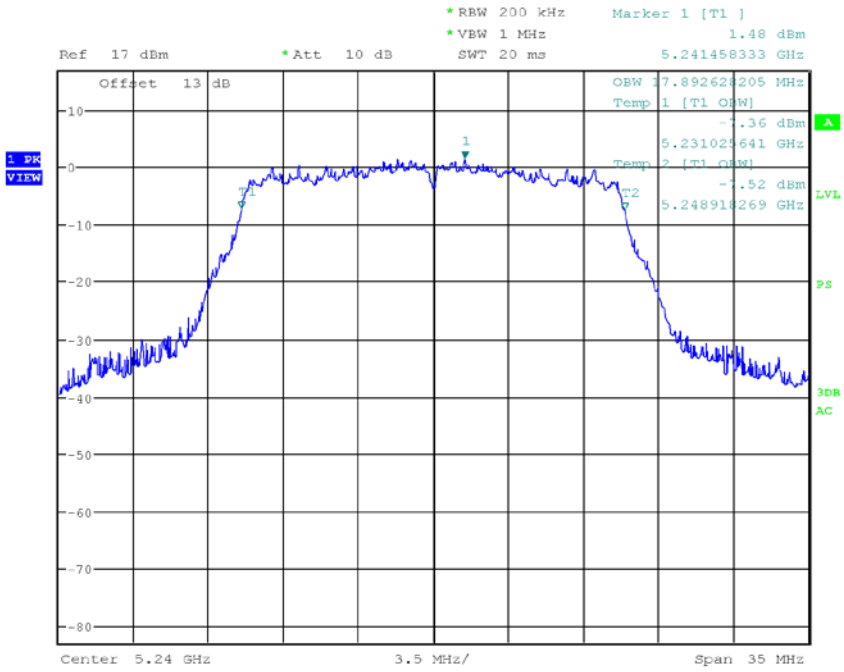
Plot 1. 15

802.11n 20MHz, 5240MHz



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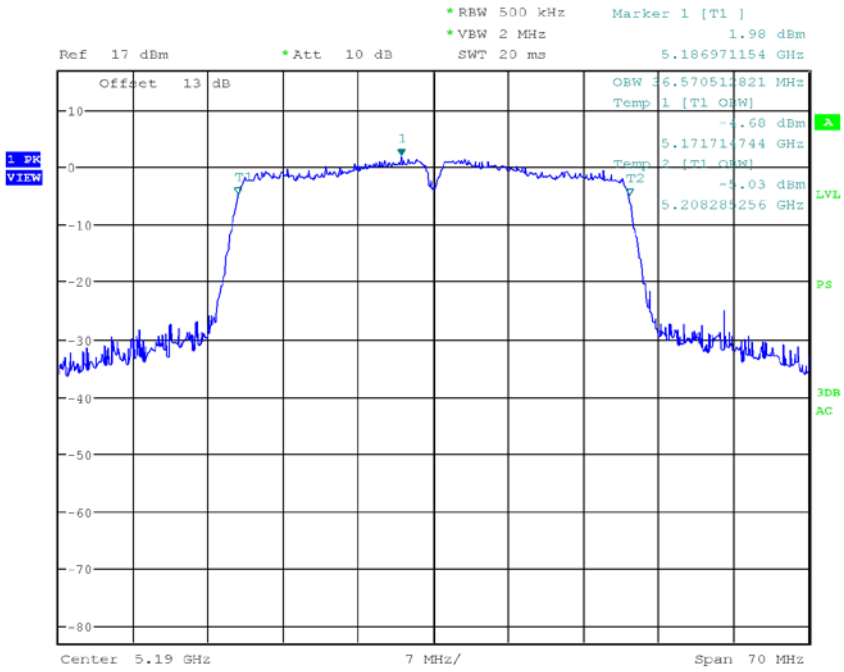
Plot 1. 16

802.11n 40MHz, 5190MHz



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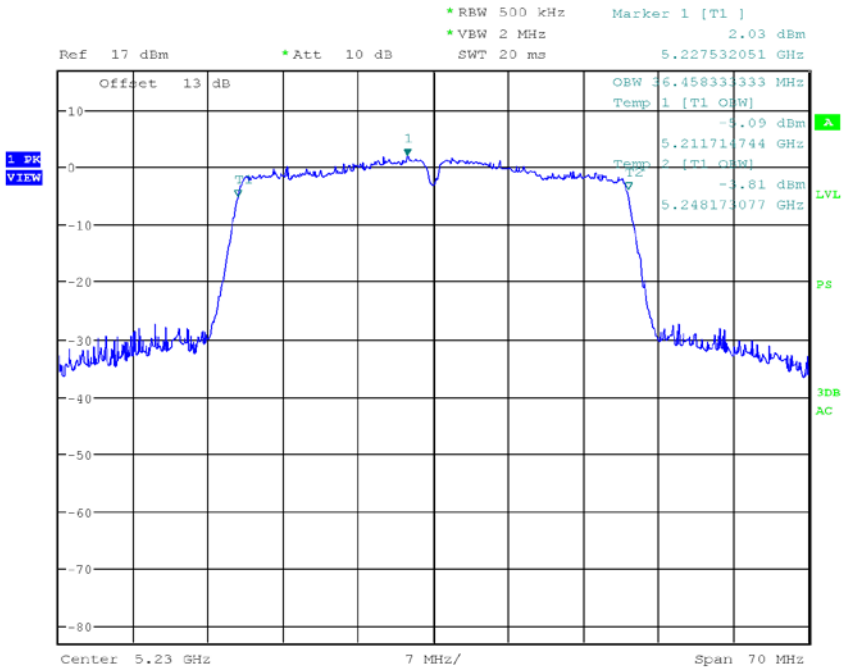
Plot 1. 17

802.11n 40MHz, 5230MHz



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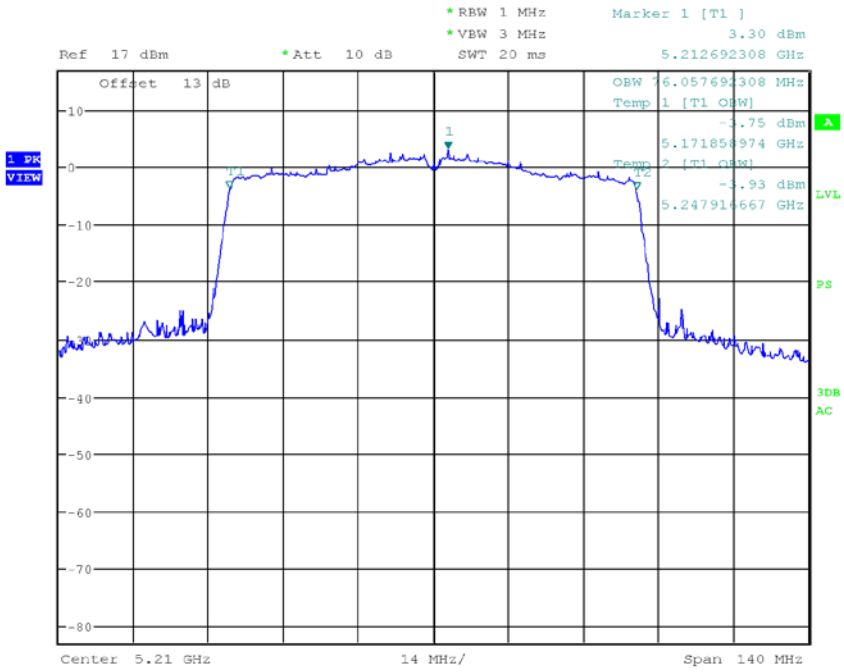
Plot 1. 18

802.11ac 80MHz, 5210MHz



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4.2 Maximum Conducted Output Power & Power Spectral Density
FCC Rule 15.407(a)(1)(iv)

4.2.1 Requirement

For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. 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.

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).

Tested By	Test Date
Todd Moy	June 27, 2019

4.2.3 Test Results

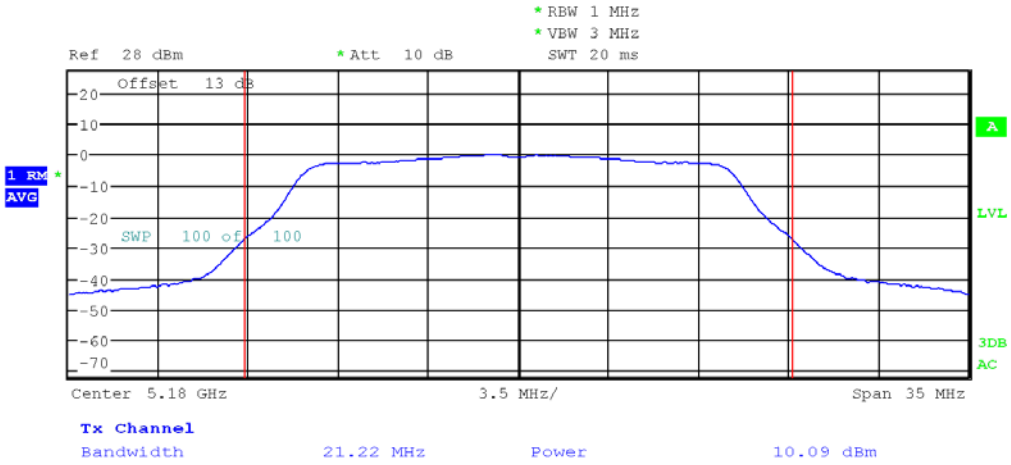
Refer to the following plots for the test result:

Mode	Channel	Frequency MHz	Conducted power (average) dBm	Conducted power Limit dBm	Plot #
802.11a	36	5180	10.09	24	2.1
	40	5200	10.30	24	2.2
	48	5240	10.15	24	2.3
802.11n 20MHz	36	5180	9.81	24	2.4
	40	5200	9.95	24	2.5
	48	5240	9.88	24	2.6
802.11n 40MHz	38	5190	10.12	24	2.7
	46	5230	10.09	24	2.8
802.11ac 80MHz	42	5210	9.76	24	2.9

Mode	Channel	Frequency MHz	PSD (Peak) dBm	PSD Limit dBm	Plot #
802.11a	36	5180	-0.09	11	2.10
	40	5200	0.07	11	2.11
	48	5240	-0.12	11	2.12
802.11n 20MHz	36	5180	-0.56	11	2.13
	40	5200	-0.41	11	2.14
	48	5240	-0.48	11	2.15
802.11n 40MHz	38	5190	-3.56	11	2.16
	46	5230	-3.34	11	2.17
802.11ac 80MHz	42	5210	-6.3	11	2.18

Plot 2. 1

802.11a, 5180MHz



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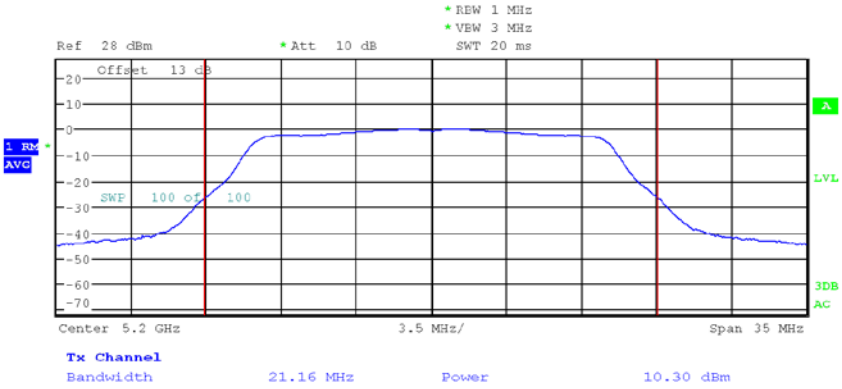
Plot 2. 2

802.11a, 5200MHz



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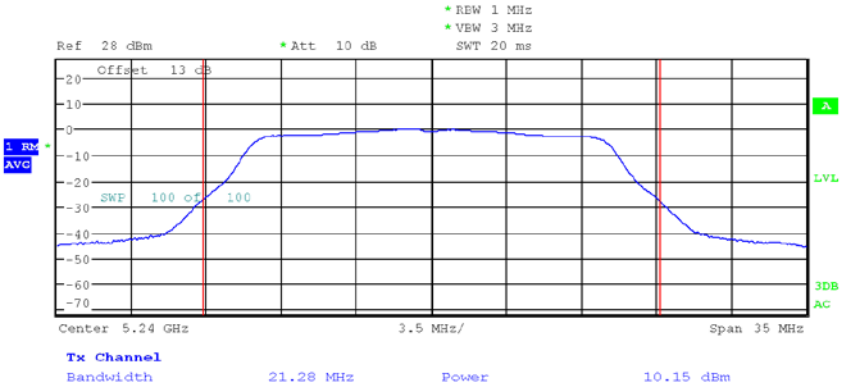
Plot 2. 3

802.11a, 5240MHz



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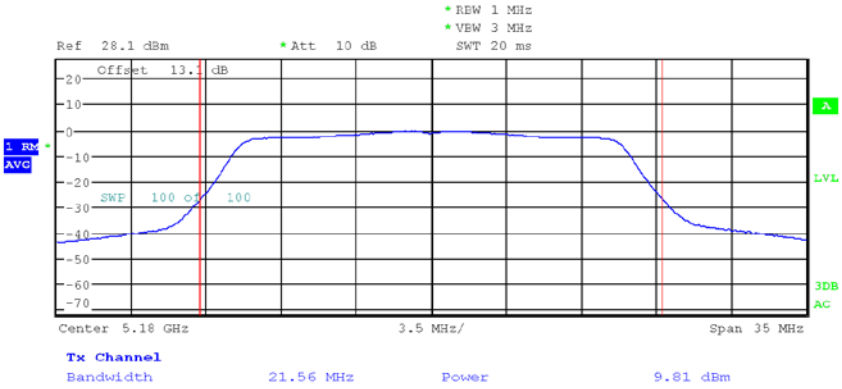
Plot 2. 4

802.11n 20MHz, 5180MHz



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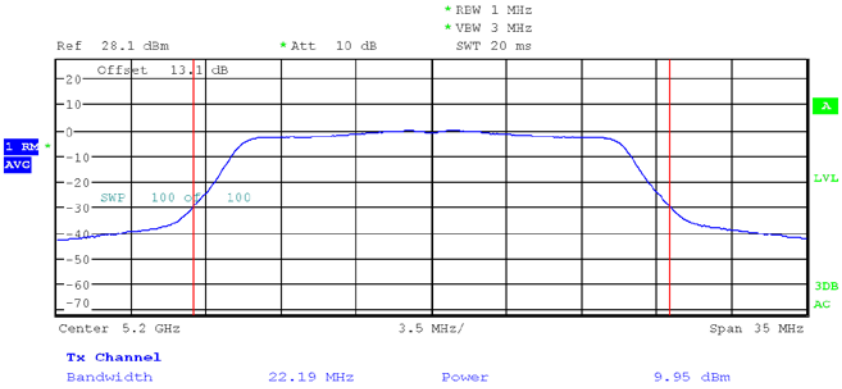
Plot 2. 5

802.11n 20MHz, 5200MHz



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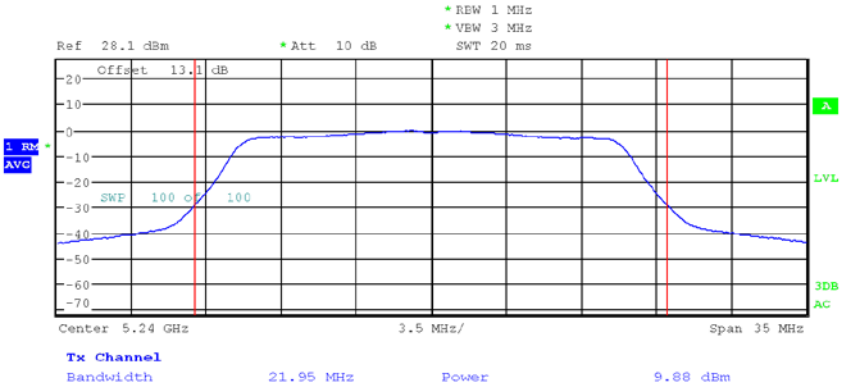
Plot 2. 6

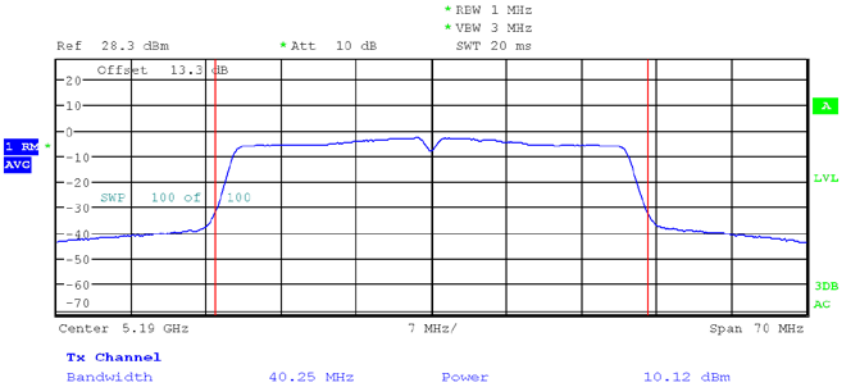
802.11n 20MHz, 5240MHz



Date: 27.JUN.2019 10:58:29

Plot 2. 7

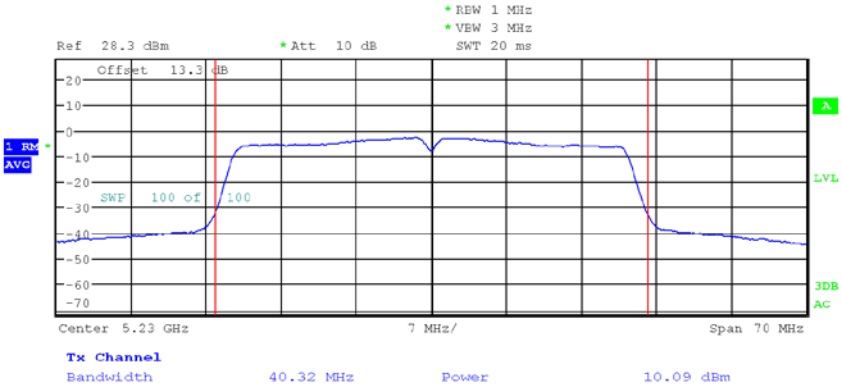
802.11n 40MHz, 5190MHz



Date: 27.JUN.2019 11:12:18

Plot 2. 8

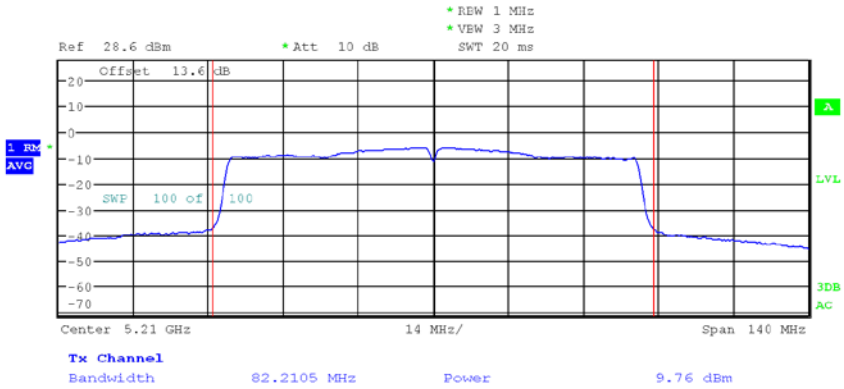
802.11n 40MHz, 5230MHz



Date: 27.JUN.2019 11:13:14

Plot 2. 9

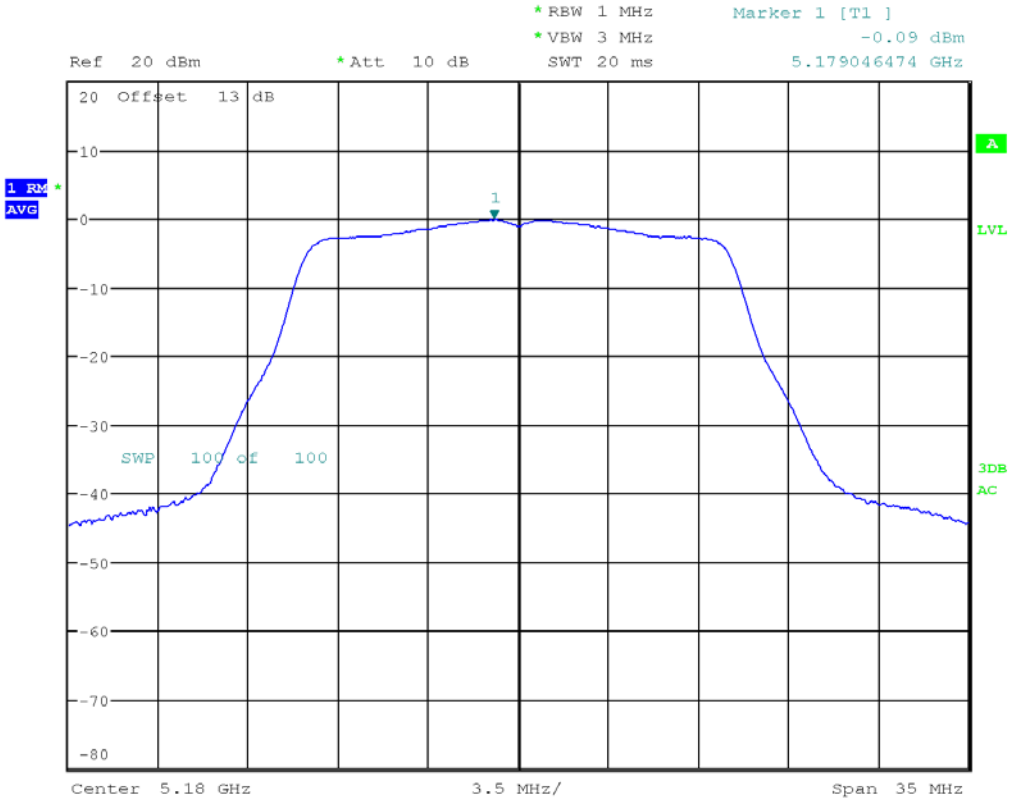
802.11ac 80MHz, 5210MHz



Date: 27.JUN.2019 11:26:59

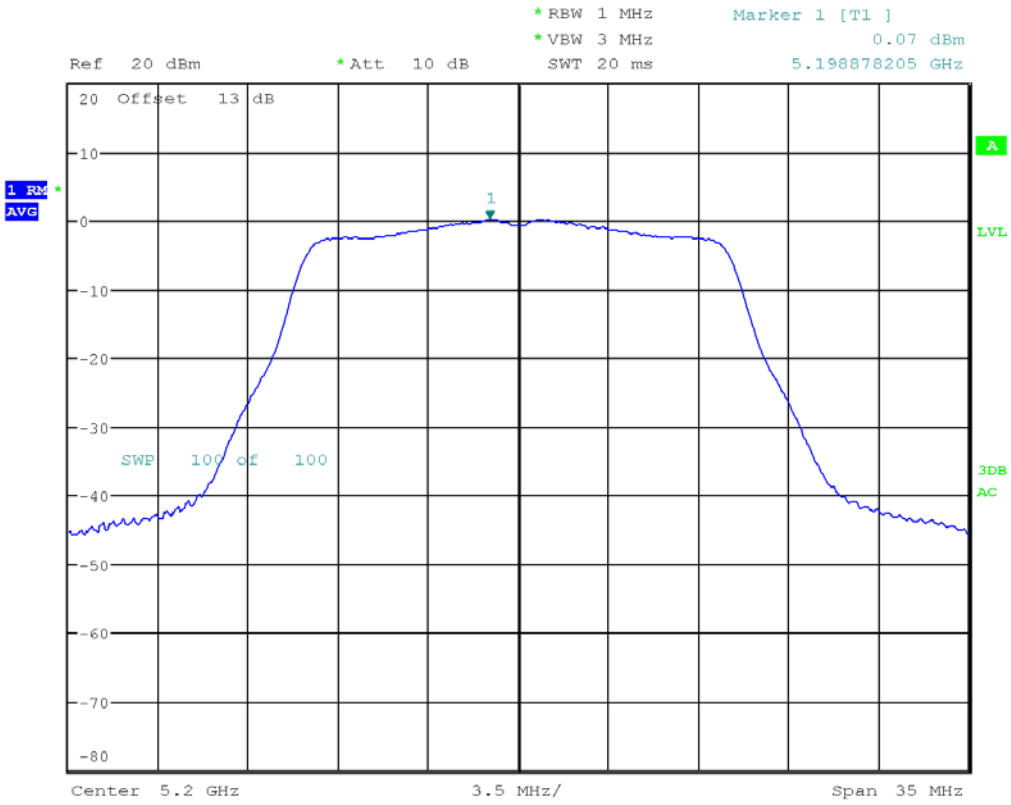
Plot 2. 90

802.11a, 5180MHz



Plot 2. 11

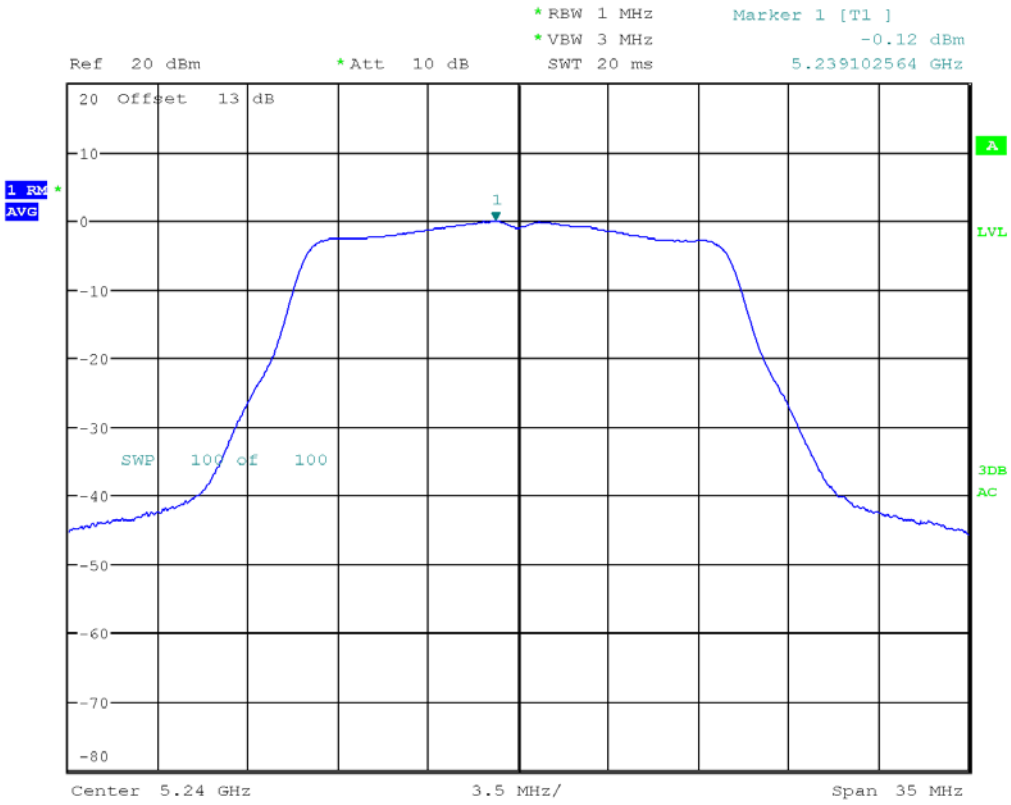
802.11a, 5200MHz



Date: 27.JUN.2019 11:36:48

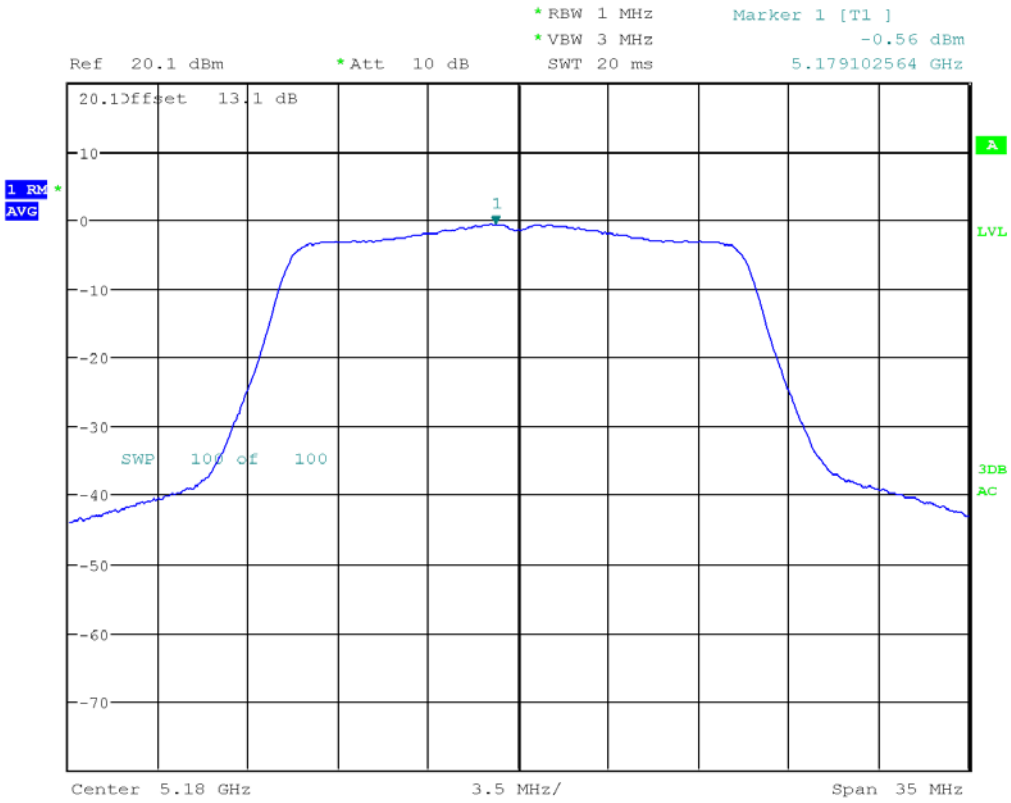
Plot 2. 12

802.11a, 5240MHz



Plot 2. 13

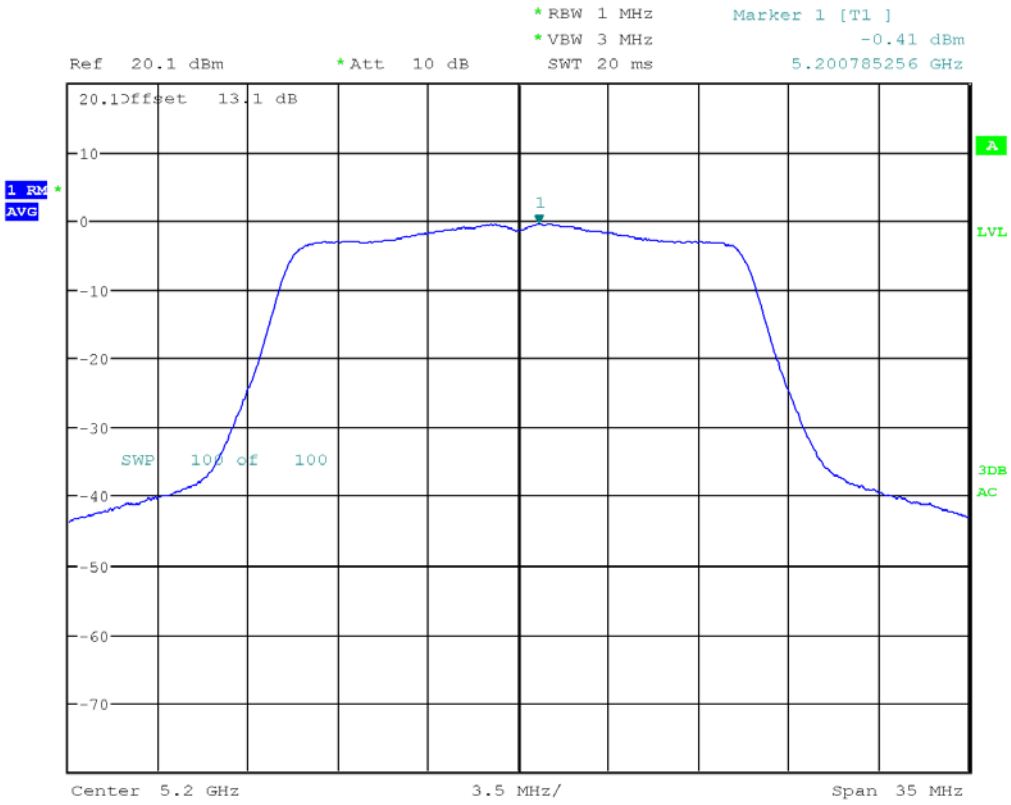
802.11n 20MHz, 5180MHz



Date: 27.JUN.2019 11:39:06

Plot 2. 14

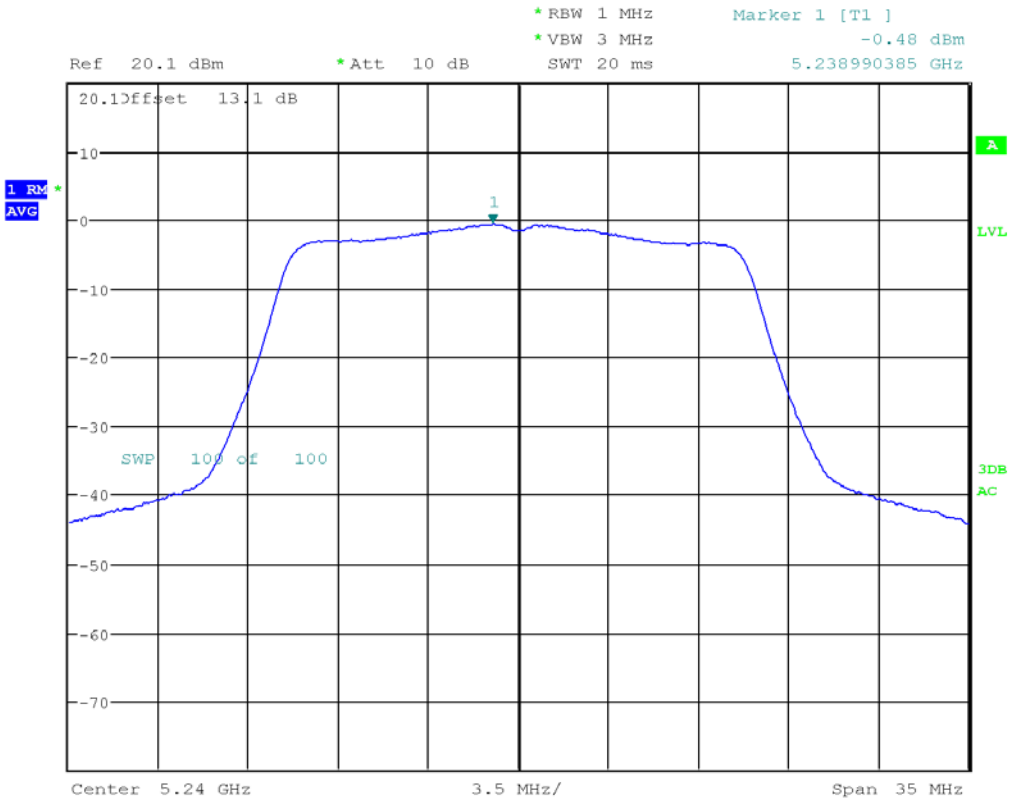
802.11n 20MHz, 5200MHz



Date: 27.JUN.2019 11:39:49

Plot 2. 15

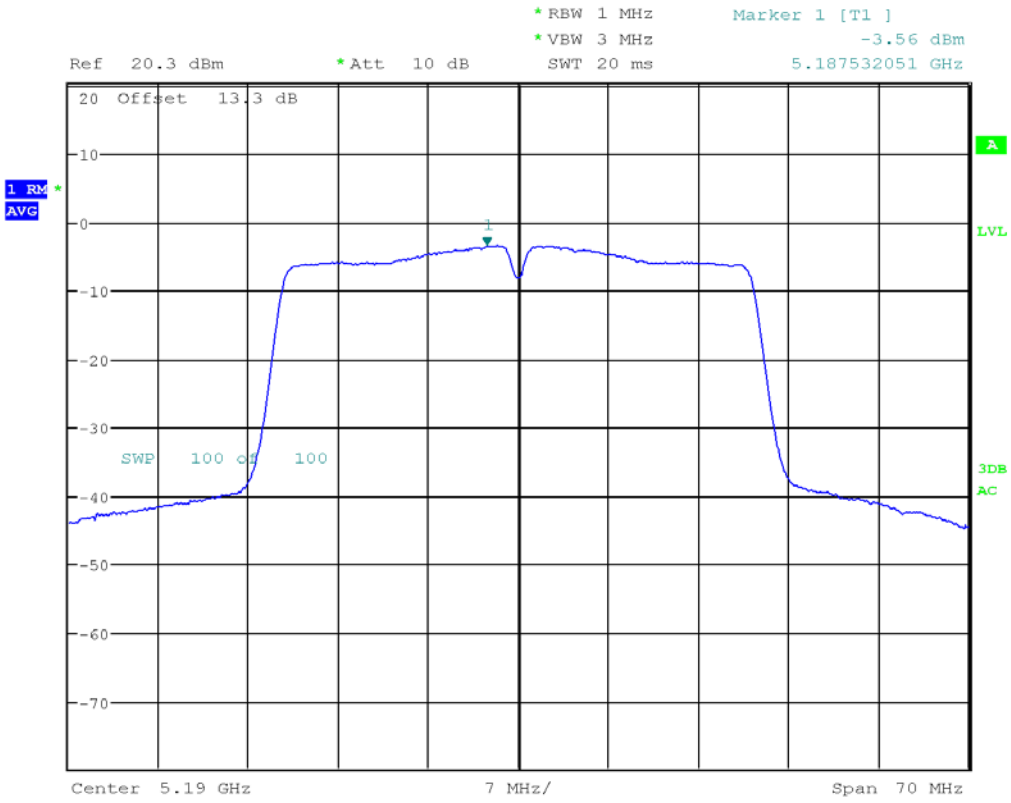
802.11n 20MHz, 5240MHz



Date: 27.JUN.2019 11:40:33

Plot 2. 16

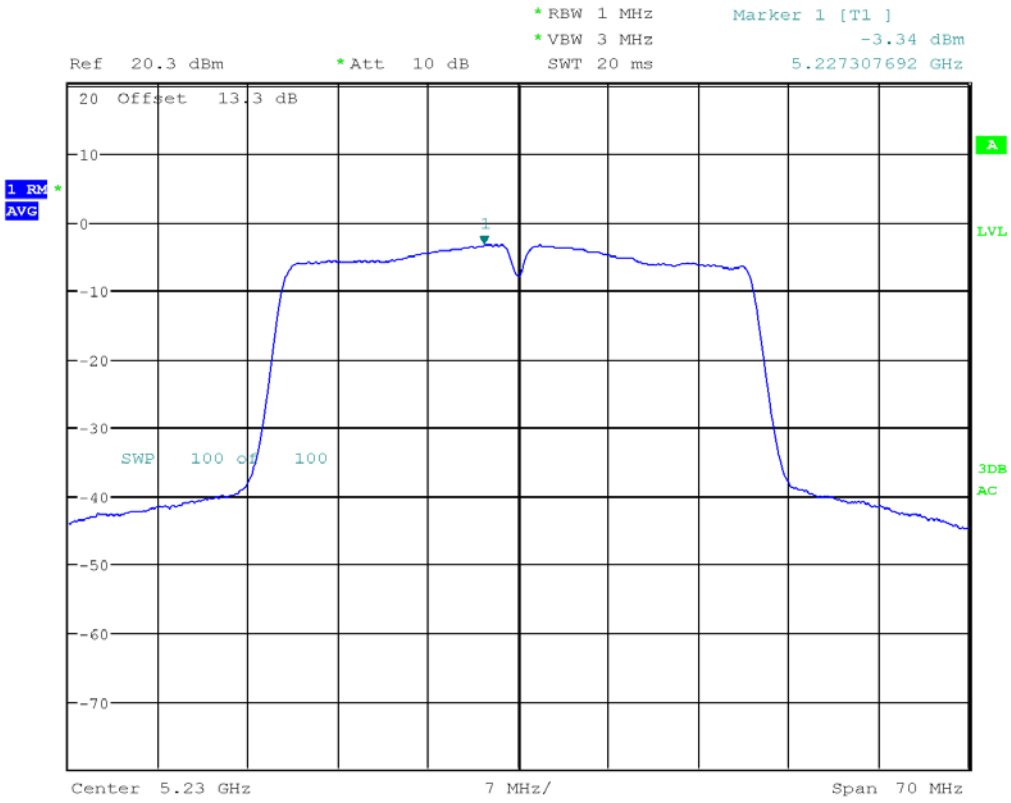
802.11n 40MHz, 5190MHz



Date: 27.JUN.2019 11:46:29

Plot 2. 17

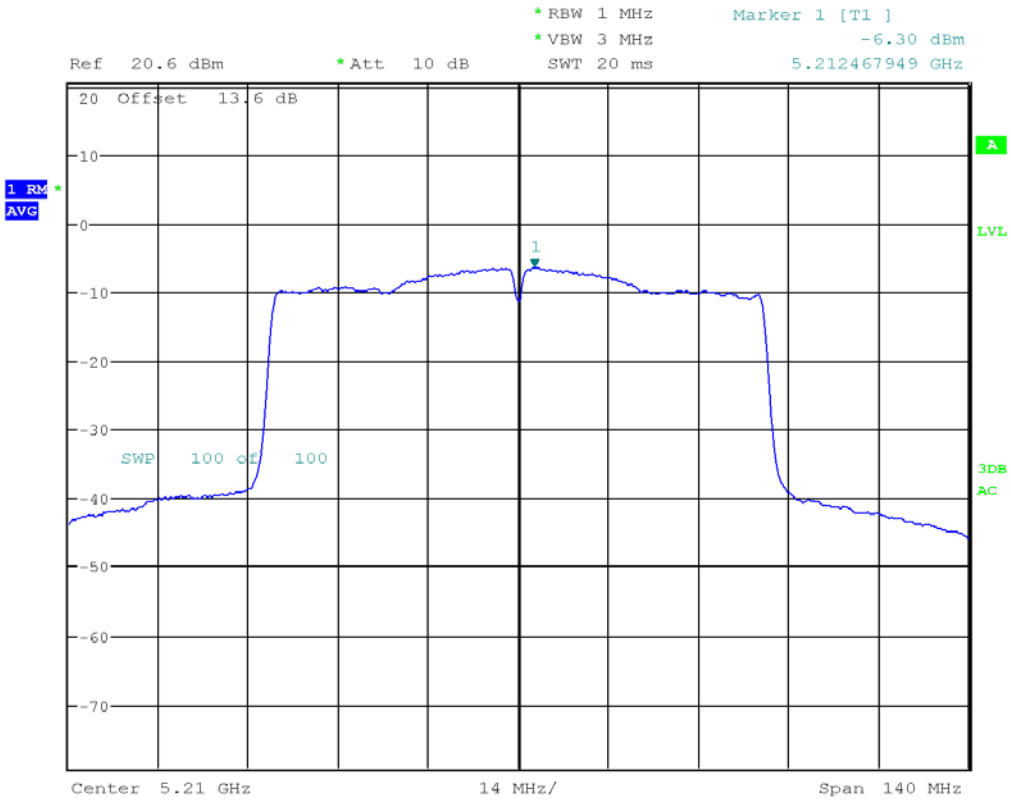
802.11n 40MHz, 5230MHz



Date: 27.JUN.2019 11:50:42

Plot 2. 18

802.11ac 80MHz, 5210MHz



Date: 27.JUN.2019 12:10:26

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.

Note: An out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz peak emission limit.

4.3.2 Procedure

Radiated emission measurements were performed from 30 MHz to 40 GHz according to the procedure described in ANSI C64.10. Spectrum Analyzer Resolution Bandwidth is 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 30 MHz to 40 GHz were measured with 50 ohm terminator on the output of the EUT RF port. A preamp was used from 30MHz to 40GHz.

All measurements were made with a Peak Detector and compared to QP limits for 30MHz – 1GHz and Average & Peak limits for 1GHz – 40 GHz.

Radiated measurements were performed on the X, Y and Z orientation of the EUT. Data is presented with the worst-case configuration (the configuration which resulted in the highest emission levels).

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 – 20log 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.

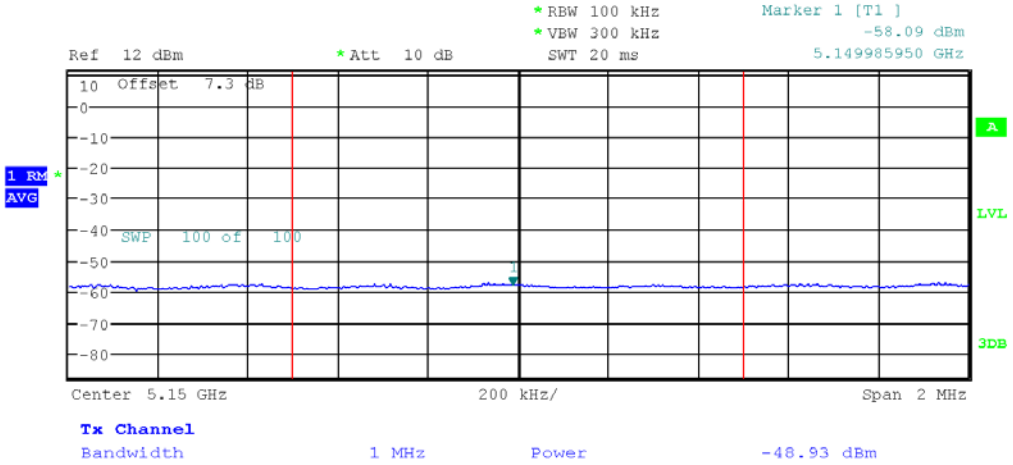
All conducted antenna port plots are corrected with the consideration of a 3.1 dBi Antenna Gain.

Radiated emission measurements were performed up to 40GHz. No Emissions were identified when scanned from 18-40 GHz.

Tested By	Test Date
Todd Moy	June 25 – July 23, 2019

Test Results: 15.209/15.205 Restricted Band Emissions at Antenna Port

Out-of-Band Spurious Emissions at the Average Band Edge - 802.11a, 5180 MHz

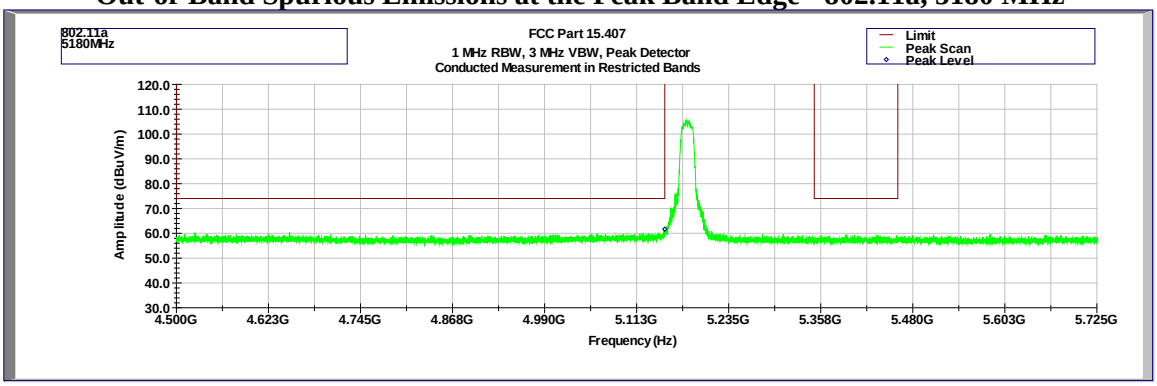


Date: 28.JUN.2019 09:57:59

Frequency	Corrected Amplitude	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dBm	dB(µV/m)	dB(µV/m)	dB		
5.150	-48.93	46.33	54	-7.67	RMS	Pass

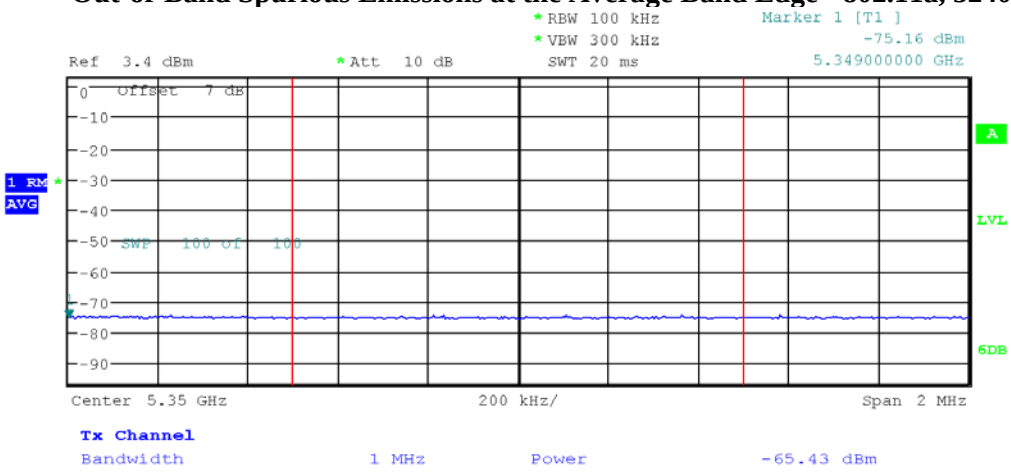
E = Corrected Amplitude – 20log D + 104.8
Corrected Amplitude = EIRP+ δ
D = 3 (meters)
Section II.G.3.d (ii) “Integration Method” was utilized per 789033 D02 General U-NII Test Procedures New Rules v02r01

Out-of-Band Spurious Emissions at the Peak Band Edge - 802.11a, 5180 MHz



Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB(µV/m)	dB(µV/m)	dB		
5.150	61.67	74	-12.33	Peak	Pass

Out-of-Band Spurious Emissions at the Average Band Edge - 802.11a, 5240 MHz

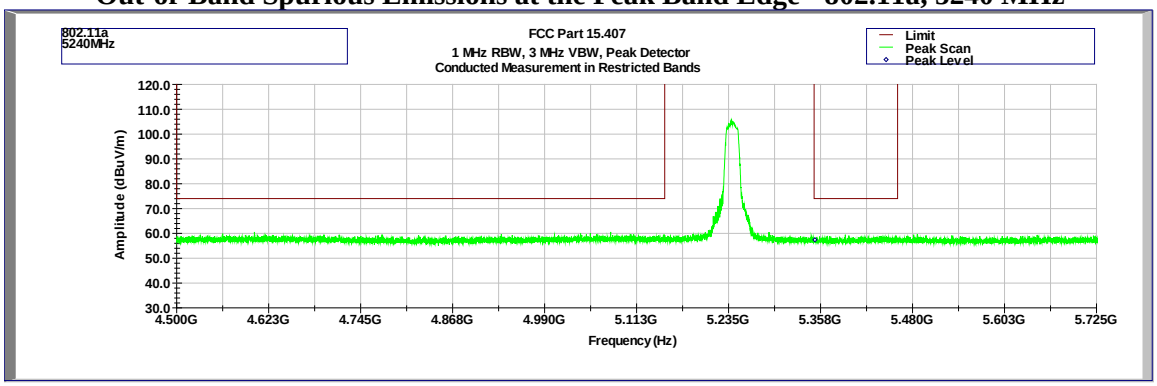


Date: 28.JUN.2019 10:36:02

Frequency	Corrected Amplitude	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dBm	dB(µV/m)	dB(µV/m)	dB		
5.350	-65.42	29.84	54	-24.16	RMS	Pass

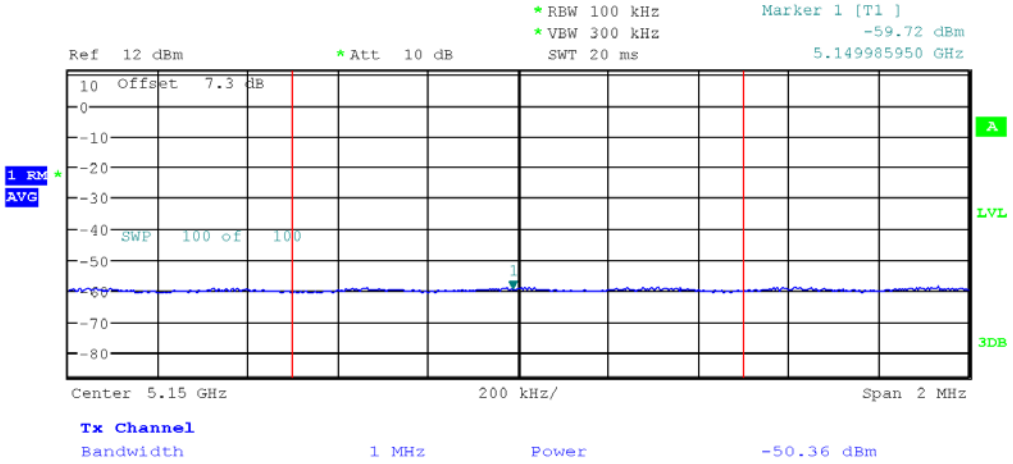
E = Corrected Amplitude – 20log D + 104.8
Corrected Amplitude = EIRP+ δ
D = 3 (meters)
Section II.G.3.d (ii) “Integration Method” was utilized per 789033 D02 General U-NII Test Procedures New Rules v02r01

Out-of-Band Spurious Emissions at the Peak Band Edge - 802.11a, 5240 MHz



Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB(µV/m)	dB(µV/m)	dB		
5.350	57.42	74	-16.58	Peak	Pass

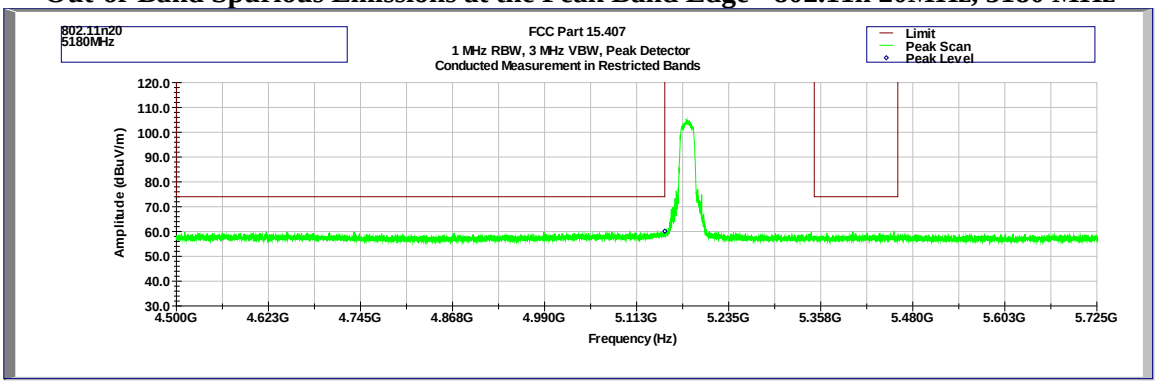
Out-of-Band Spurious Emissions at the Average Band Edge - 802.11n 20MHz, 5180 MHz



Frequency	Corrected Amplitude	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dBm	dB(µV/m)	dB(µV/m)	dB		
5.150	-50.36	44.90	54	-9.10	RMS	Pass

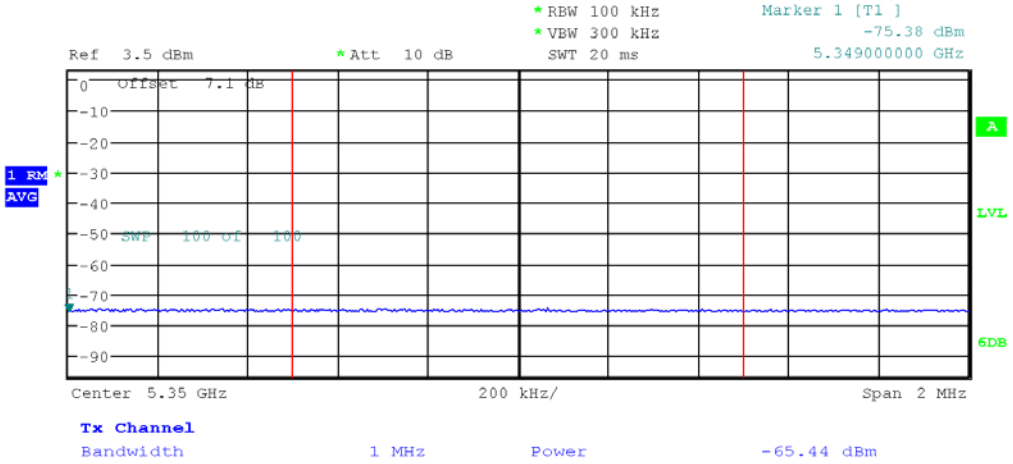
E = Corrected Amplitude – 20log D + 104.8
Corrected Amplitude = EIRP+ δ
D = 3 (meters)
Section II.G.3.d (ii) “Integration Method” was utilized per 789033 D02 General U-NII Test Procedures New Rules v02r01

Out-of-Band Spurious Emissions at the Peak Band Edge - 802.11n 20MHz, 5180 MHz



Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB(µV/m)	dB(µV/m)	dB		
5.150	60.12	74	-13.88	Peak	Pass

Out-of-Band Spurious Emissions at the Average Band Edge - 802.11n20, 5240 MHz

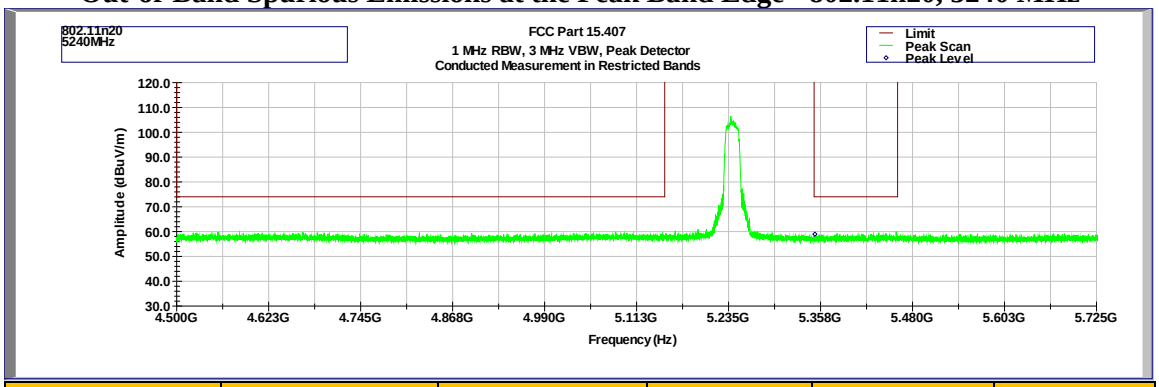


Date: 28.JUN.2019 10:37:10

Frequency	Corrected Amplitude	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dBm	dB(µV/m)	dB(µV/m)	dB		
5.350	-65.44	29.82	54	-24.18	RMS	Pass

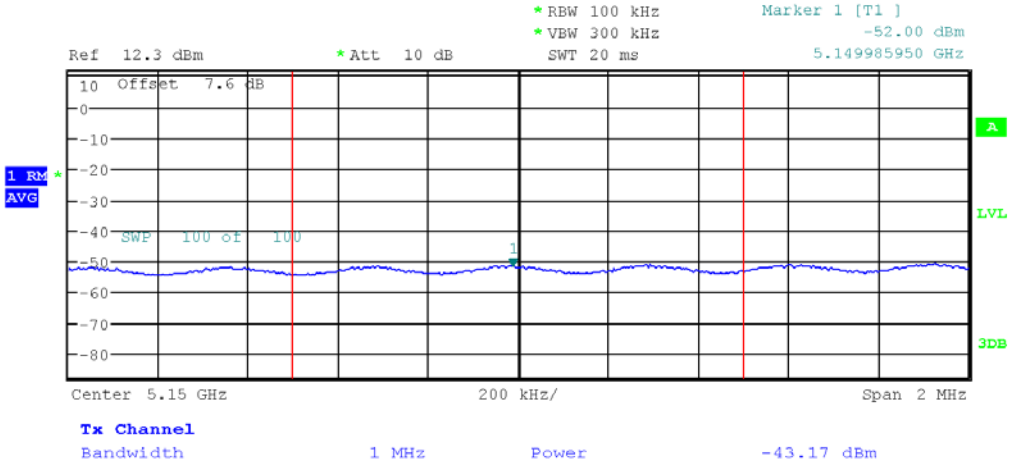
E = Corrected Amplitude – 20log D + 104.8
Corrected Amplitude = EIRP+ δ
D = 3 (meters)
Section II.G.3.d (ii) “Integration Method” was utilized per 789033 D02 General U-NII Test Procedures New Rules v02r01

Out-of-Band Spurious Emissions at the Peak Band Edge - 802.11n20, 5240 MHz



Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB(µV/m)	dB(µV/m)	dB		
5.350	58.96	74	-15.04	Peak	Pass

Out-of-Band Spurious Emissions at the Average Band Edge - 802.11n 40MHz, 5190 MHz



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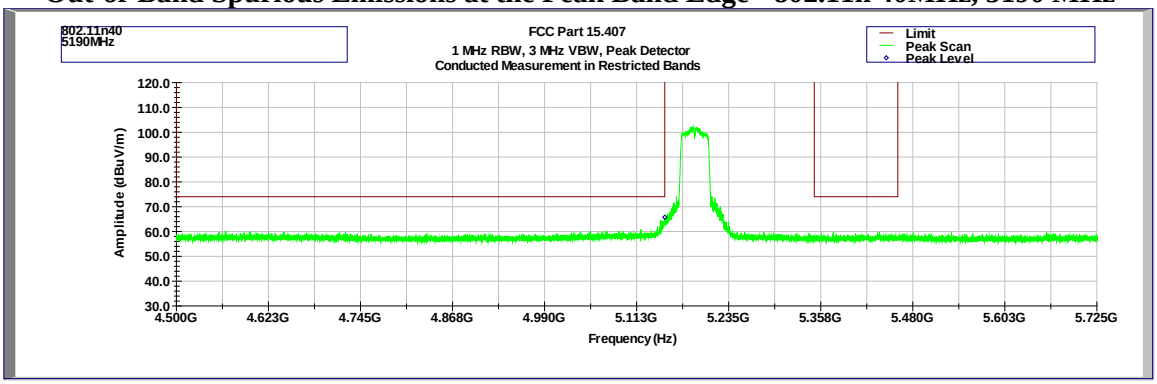
Frequency	Corrected Amplitude	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dBm	dB(µV/m)	dB(µV/m)	dB		
5.150	-43.17	52.09	54	-1.91	RMS	Pass

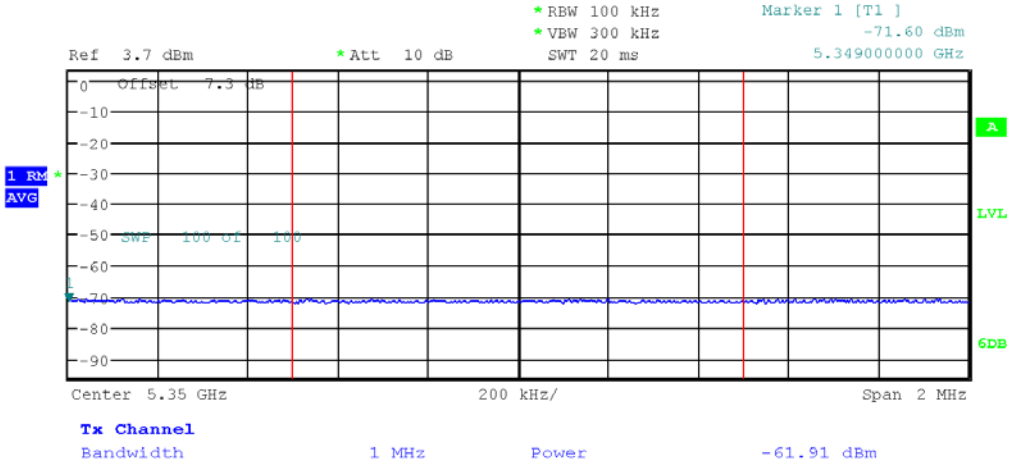
E = Corrected Amplitude – 20log D + 104.8
Corrected Amplitude = EIRP+ δ
D = 3 (meters)
Section II.G.3.d (ii) “Integration Method” was utilized per 789033 D02 General U-NII Test Procedures New Rules v02r01

Out-of-Band Spurious Emissions at the Peak Band Edge - 802.11n 40MHz, 5190 MHz



Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB(µV/m)	dB(µV/m)	dB		
5.150	65.75	74	-8.25	Peak	Pass

Out-of-Band Spurious Emissions at the Average Band Edge - 802.11n40, 5230 MHz

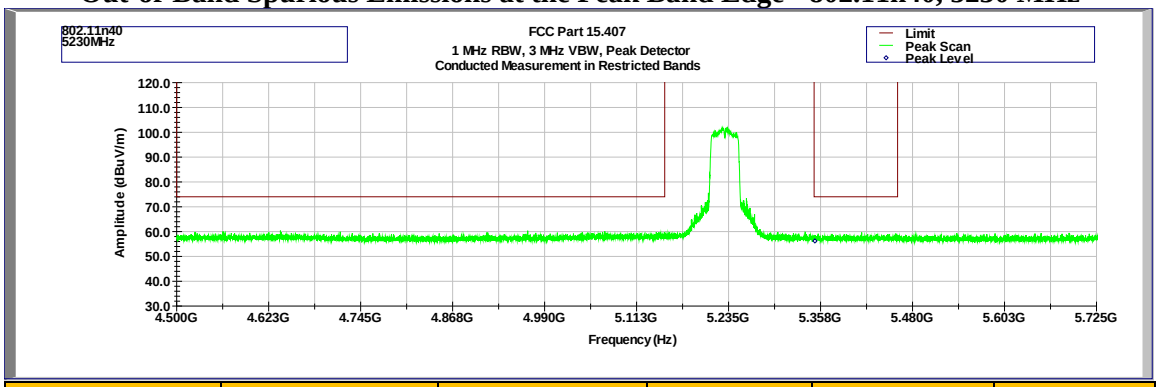


Date: 28.JUN.2019 10:39:49

Frequency	Corrected Amplitude	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dBm	dB(µV/m)	dB(µV/m)	dB		
5.350	-61.91	33.35	54	-20.65	RMS	Pass

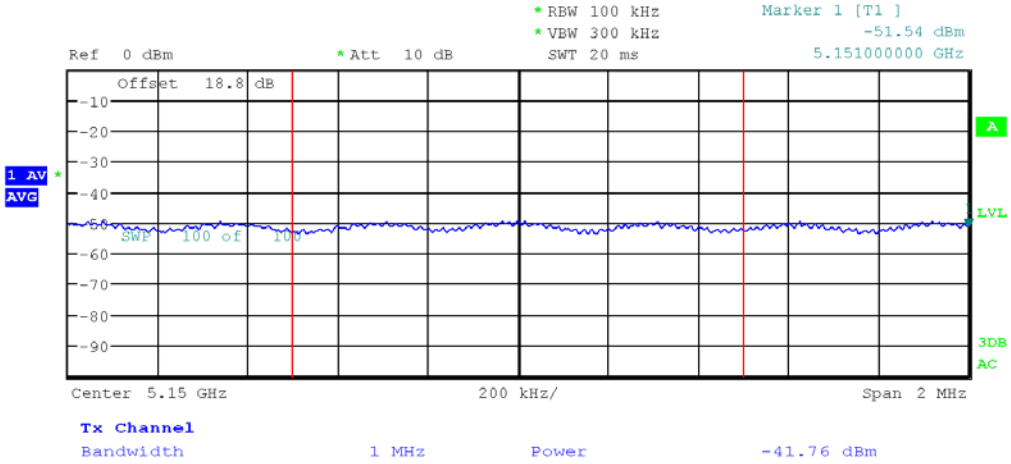
E = Corrected Amplitude – 20log D + 104.8
Corrected Amplitude = EIRP+ δ
D = 3 (meters)
Section II.G.3.d (ii) “Integration Method” was utilized per 789033 D02 General U-NII Test Procedures New Rules v02r01

Out-of-Band Spurious Emissions at the Peak Band Edge - 802.11n40, 5230 MHz



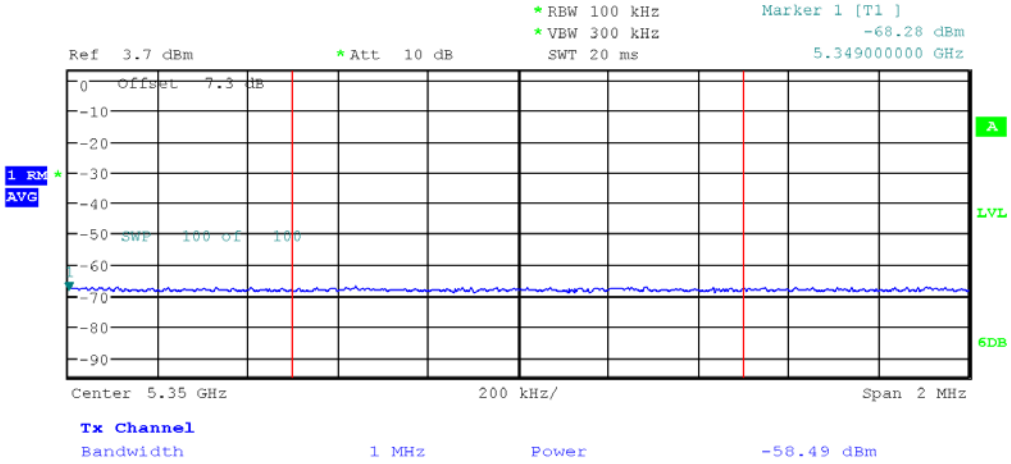
Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB(µV/m)	dB(µV/m)	dB		
5.350	56.21	74	-17.79	Peak	Pass

Out-of-Band Spurious Emissions at the Average Band Edge - 802.11ac 80MHz, 5210 MHz



Date: 23.JUL.2019 12:04:20

Out-of-Band Spurious Emissions at the Average Band Edge - 802.11ac 80MHz, 5210 MHz

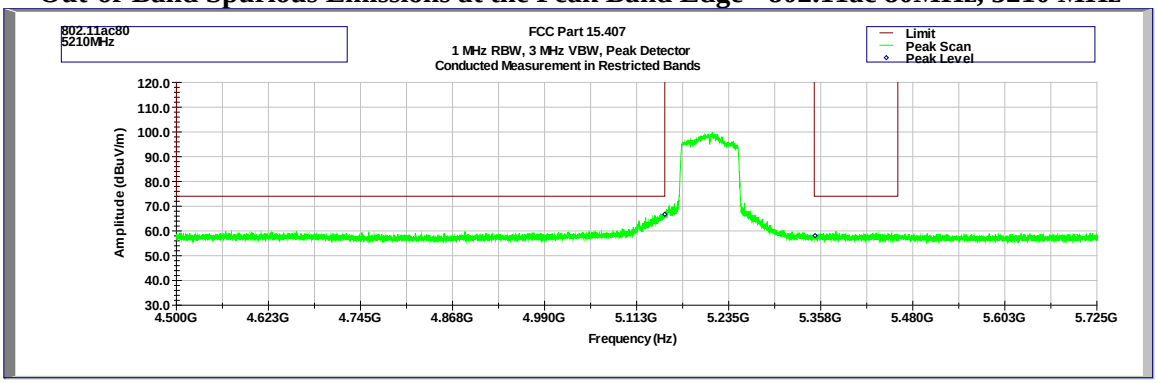


Date: 28.JUN.2019 10:41:36

Frequency	Corrected Amplitude	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dBm	dB(µV/m)	dB(µV/m)	dB		
5.150	-41.76	53.50	54	-0.50	RMS	Pass
5.350	-58.49	36.77	54	-17.23	RMS	Pass

E = Corrected Amplitude – 20log D + 104.8
Corrected Amplitude = EIRP+ δ
D = 3 (meters)
Section II.G.3.d (ii) “Integration Method” was utilized per 789033 D02 General U-NII Test Procedures New Rules v02r01

Out-of-Band Spurious Emissions at the Peak Band Edge - 802.11ac 80MHz, 5210 MHz

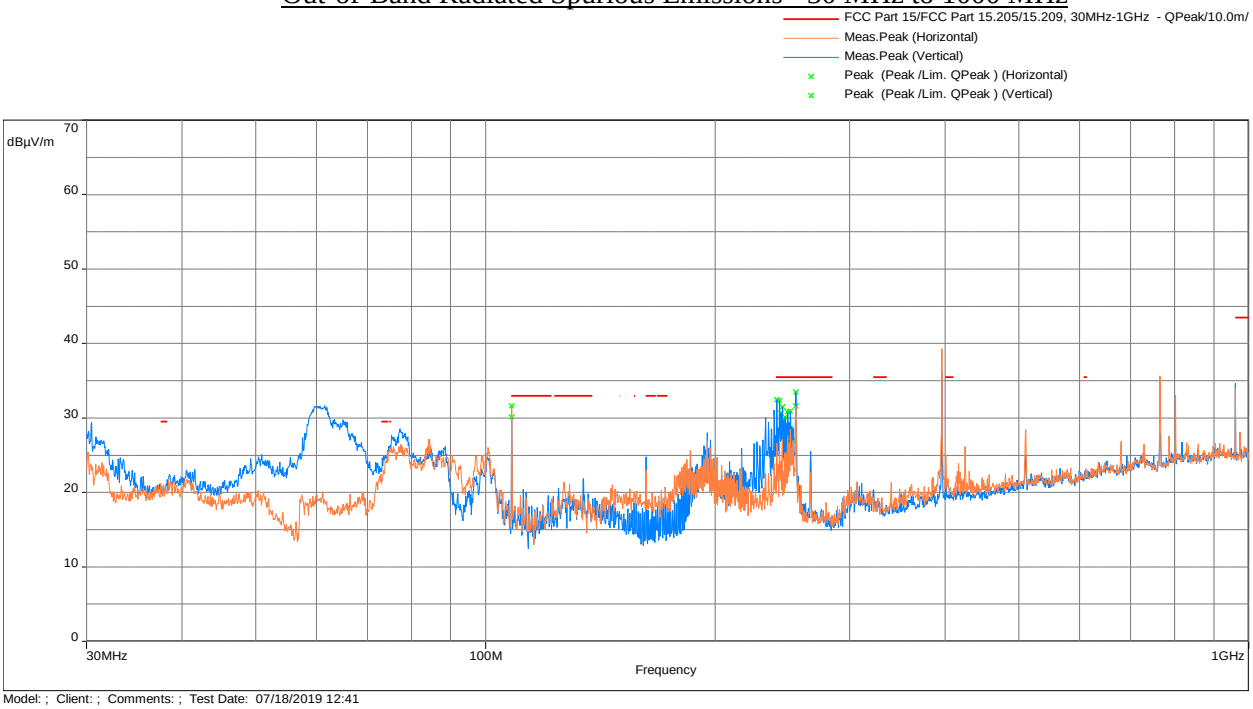


Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB(µV/m)	dB(µV/m)	dB		
5.15	66.70	74	-7.30	Peak	Pass
5.35	58.07	74	-15.93	Peak	Pass

Out-of-Band Radiated Spurious Emissions

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

Out-of-Band Radiated Spurious Emissions - 30 MHz to 1000 MHz

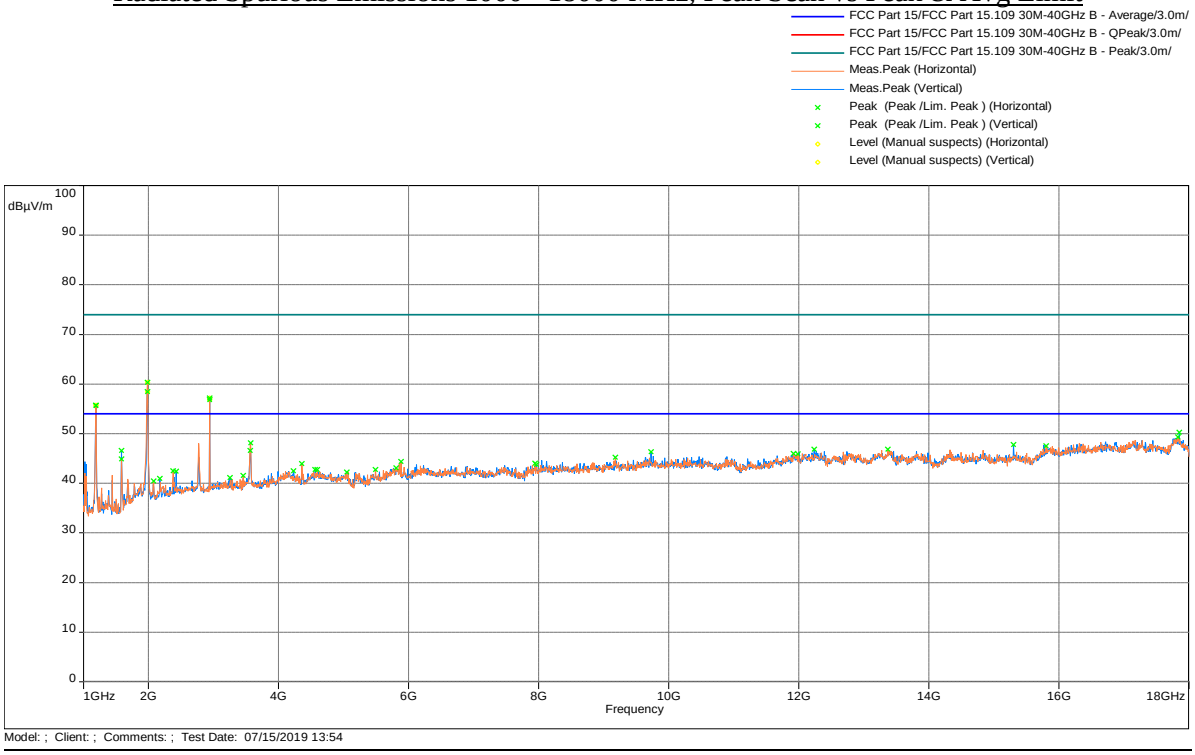


Frequency (MHz)	QP@10m (dBµV/m)	QP Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
108.140	28.4	33	-4.6	150.25	4	Horizontal	-14.3	28.4
108.225	28.1	33	-4.9	223	1.42	Vertical	-14.3	28.1
240.740	28.8	35.5	-6.7	243.5	1.24	Vertical	-11.4	28.8
255.022	28.5	35.5	-7.1	232.5	1	Vertical	-11.6	28.5
255.100	28.1	35.5	-7.4	171.5	3.69	Horizontal	-11.6	28.1

Frequency (MHz)	PK@10m (dBµV/m)	Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
61.590	31.7	57.8*	-26.2	73.5	2.98	Vertical	47.1	-15.4
396.110	36.1	57.8*	-21.7	82	1	Vertical	43.7	-7.6
396.110	39.3	57.8*	-18.5	87.5	3.02	Horizontal	46.9	-7.6

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

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



Freq. MHz	Ave@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1188.350	34.9	54	-19.1	17.75	1.25	Vertical	-16.1
1188.350	32.7	54	-21.3	76.5	3.16	Horizontal	-16.1

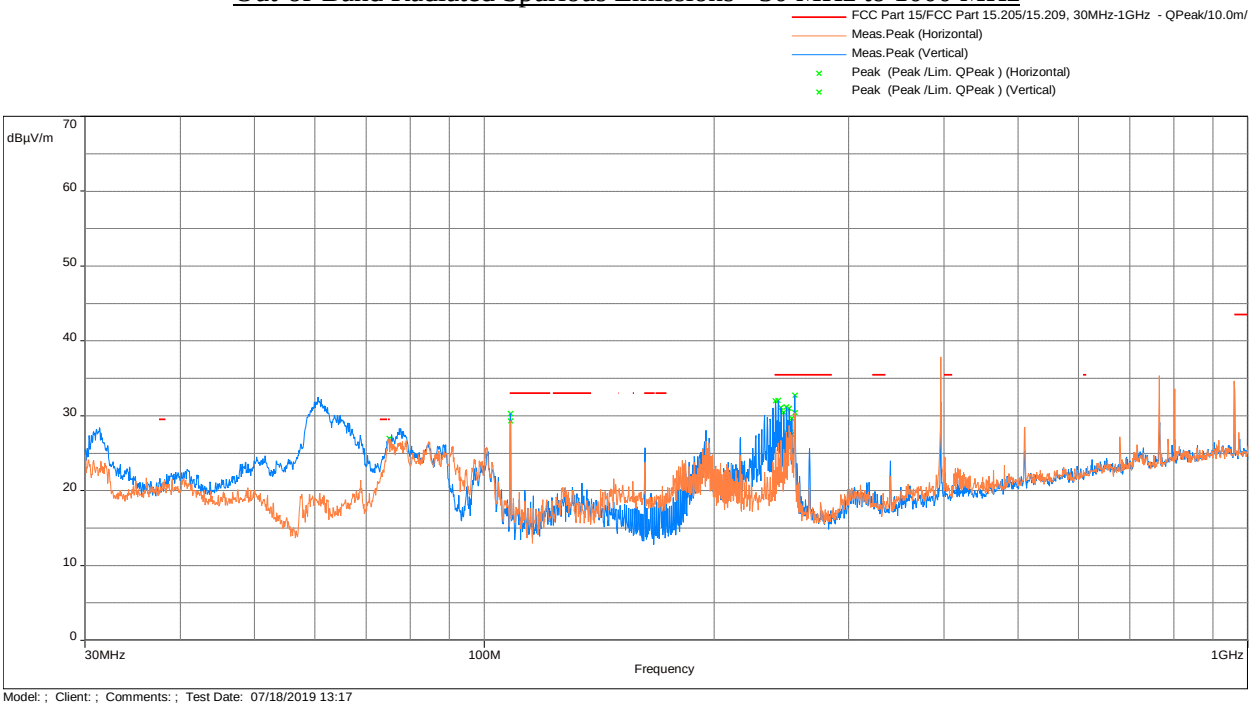
Freq. MHz	Peak@3m dB(uV/m)	Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1980.900	58.5	68.3*	-9.8	335.5	2.24	Vertical	-13.5
1980.900	60.4	68.3*	-7.9	350.75	3.23	Horizontal	-13.5
2939.700	57.1	68.3*	-11.1	222.25	2.24	Vertical	-12.4
2939.700	56.8	68.3*	-11.4	225.75	3.23	Horizontal	-12.4

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

Note: Radiated emission measurements were performed up to 40GHz. No Emissions were identified when scanned from 18-40 GHz.

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

Out-of-Band Radiated Spurious Emissions - 30 MHz to 1000 MHz



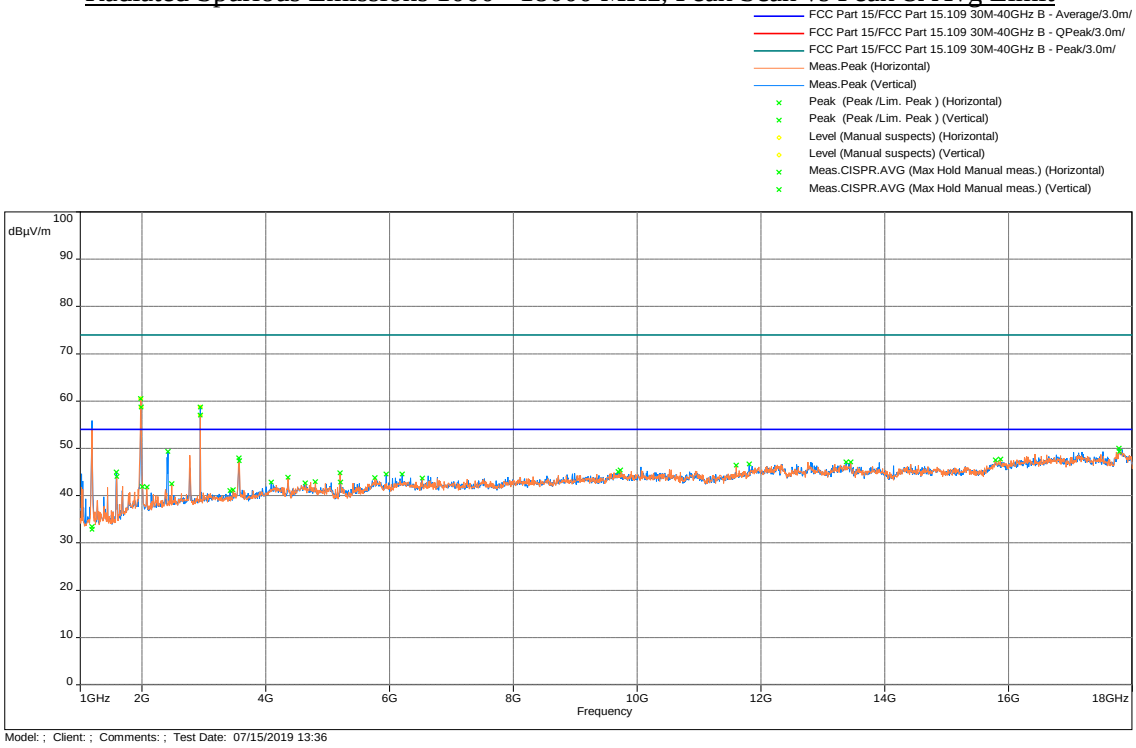
Model: ; Client: ; Comments: ; Test Date: 07/18/2019 13:17

Frequency (MHz)	QP@10m (dBµV/m)	QP Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
108.197	27.4	33	-5.6	320.5	4	Horizontal	41.8	-14.3
108.219	28.2	33	-4.8	199.75	1.49	Vertical	42.5	-14.3
240.788	30.0	35.5	-5.5	233.5	1	Vertical	41.5	-11.4
255.108	28.9	35.5	-6.6	124	1.06	Vertical	40.4	-11.6
255.095	26.7	35.5	-8.8	24	3.61	Horizontal	38.3	-11.6

Frequency (MHz)	PK@10m (dBµV/m)	Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
60.587	32.5	57.8*	-25.3	283	3	Vertical	47.9	-15.4
396.078	37.4	57.8*	-20.4	292.75	2.02	Horizontal	45.0	-7.6

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

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



Freq. MHz	Ave@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1188.109	33.4	54	-20.6	116	3	Vertical	-16.1
1188.294	32.9	54	-21.1	150.25	1.26	Horizontal	-16.1

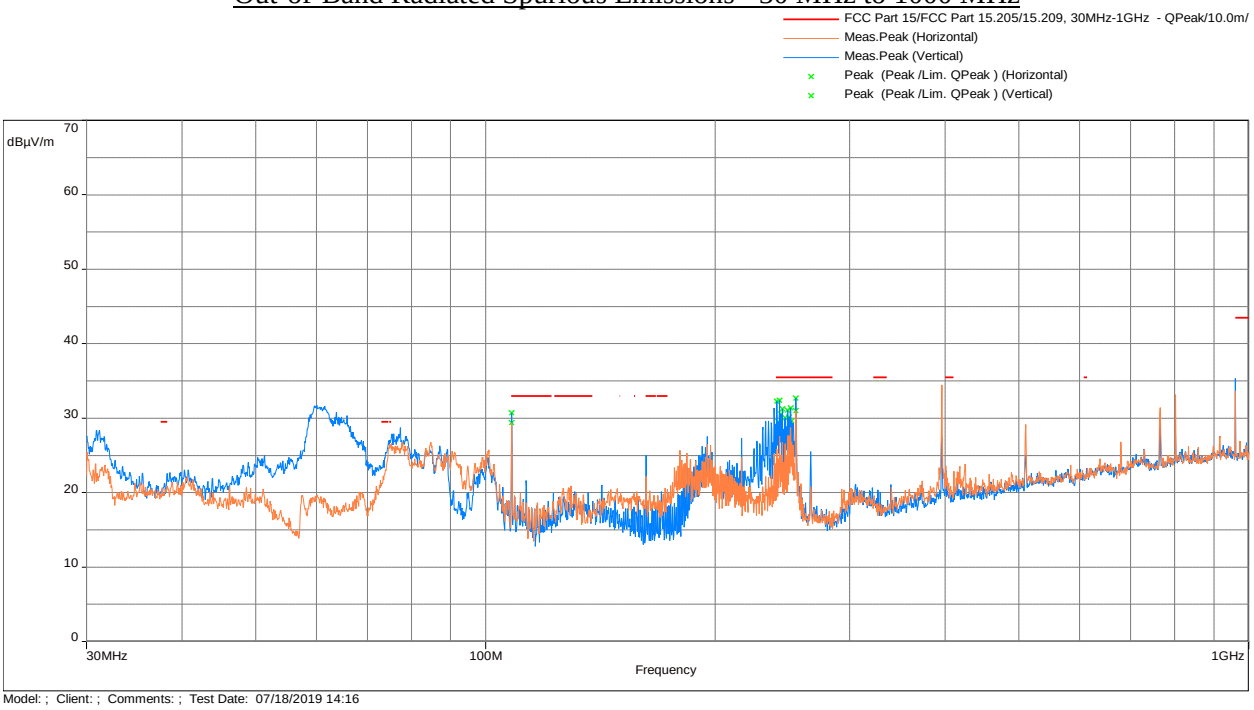
Freq. MHz	Peak@3m dB(uV/m)	Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1979.767	60.5	68.3*	-7.8	342.25	3.25	Horizontal	-13.5
1980.333	58.7	68.3*	-9.6	0.25	2.26	Vertical	-13.5
2939.700	58.7	68.3*	-9.6	222.75	2.26	Vertical	-12.4
2939.700	57.0	68.3*	-11.3	225.75	3.25	Horizontal	-12.4

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

Note: Radiated emission measurements were performed up to 40GHz. No Emissions were identified when scanned from 18-40 GHz.

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

Out-of-Band Radiated Spurious Emissions - 30 MHz to 1000 MHz

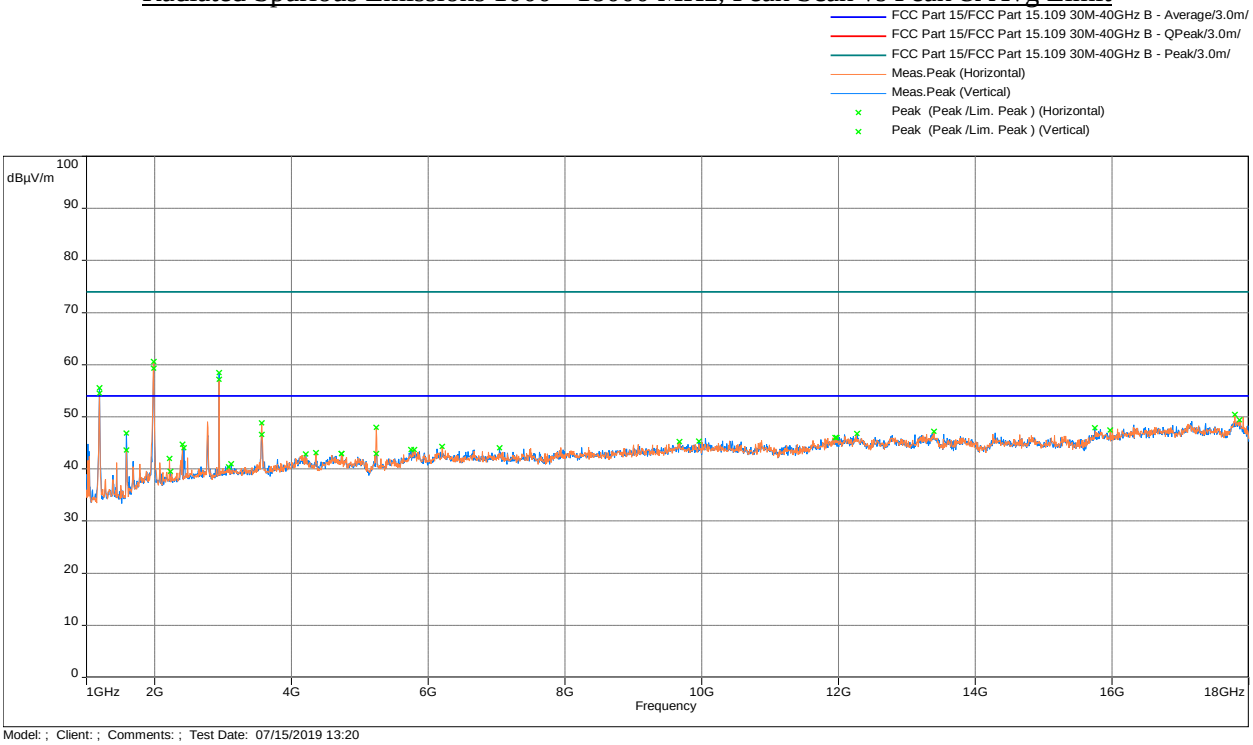


Frequency (MHz)	QP@10m (dBµV/m)	QP Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
108.200	27.7	33	-5.3	213.5	2.29	Vertical	42.1	-14.3
108.286	27.9	33	-5.1	324	4	Horizontal	42.2	-14.3
244.732	27.7	35.5	-7.8	313.75	1.24	Vertical	39.2	-11.6
254.935	29.1	35.5	-6.4	136	1	Vertical	40.7	-11.6
255.021	28.0	35.5	-7.5	174.75	3.78	Horizontal	39.6	-11.6

Frequency (MHz)	PK@10m (dBµV/m)	Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
60.102	31.7	57.8*	-26.1	3.99	3.99	Vertical	47.1	-15.4
396.110	34.5	57.8*	-23.3	1.98	1.98	Horizontal	42.1	-7.6

Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

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



Model: ; Client: ; Comments: ; Test Date: 07/15/2019 13:20

Freq. MHz	Ave@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1188.350	35.13	54	-18.87	17	1.27	Vertical	-16.1
1188.350	32.55	54	-21.45	75	3.24	Horizontal	-16.1

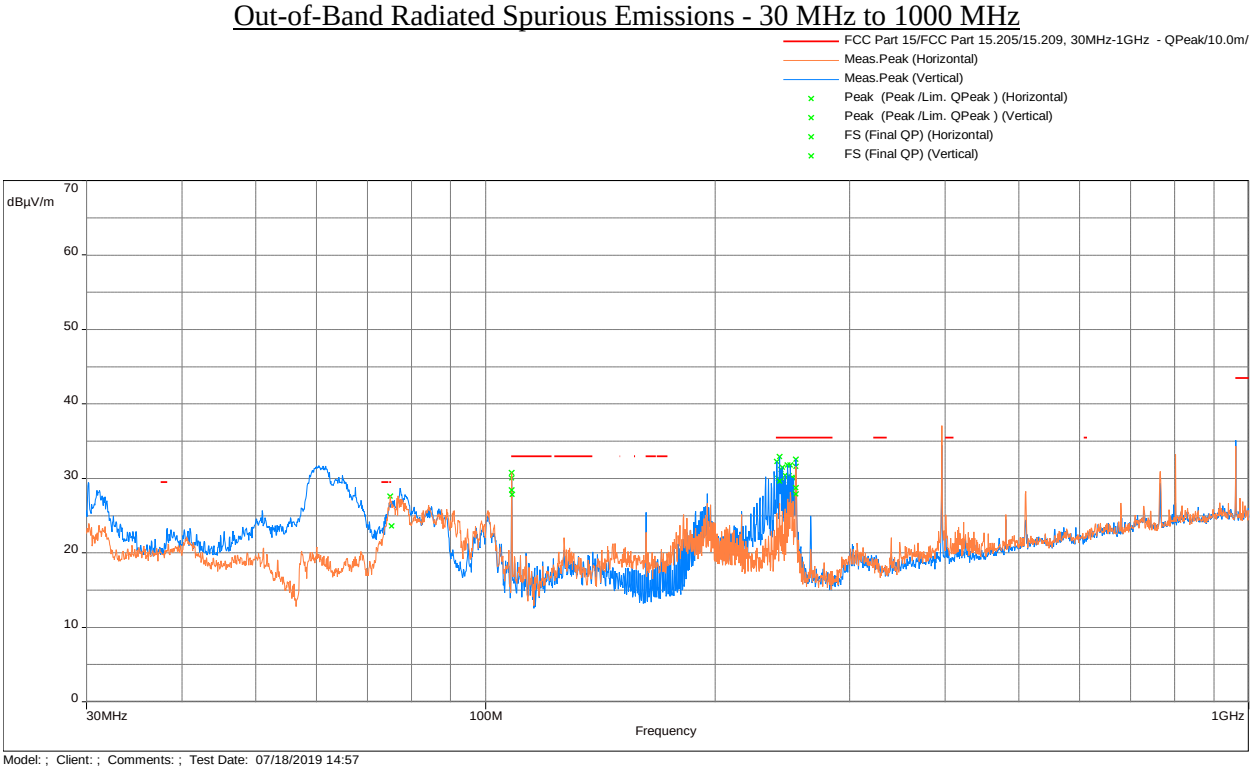
Freq. MHz	Peak@3m dB(uV/m)	Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1980.333	59.3	68.3*	-9.0	61.25	1.25	Vertical	-13.5
1980.333	60.6	68.3*	-7.7	359.25	3.23	Horizontal	-13.5
2939.700	58.5	68.3*	-9.8	231.5	2.24	Vertical	-12.4
2939.700	57.2	68.3*	-11.1	182.25	2.23	Horizontal	-12.4

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

Note: Radiated emission measurements were performed up to 40GHz. No Emissions were identified when scanned from 18-40 GHz.

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 802.11n 20MHz 5180MHz

Out-of-Band Radiated Spurious Emissions - 30 MHz to 1000 MHz

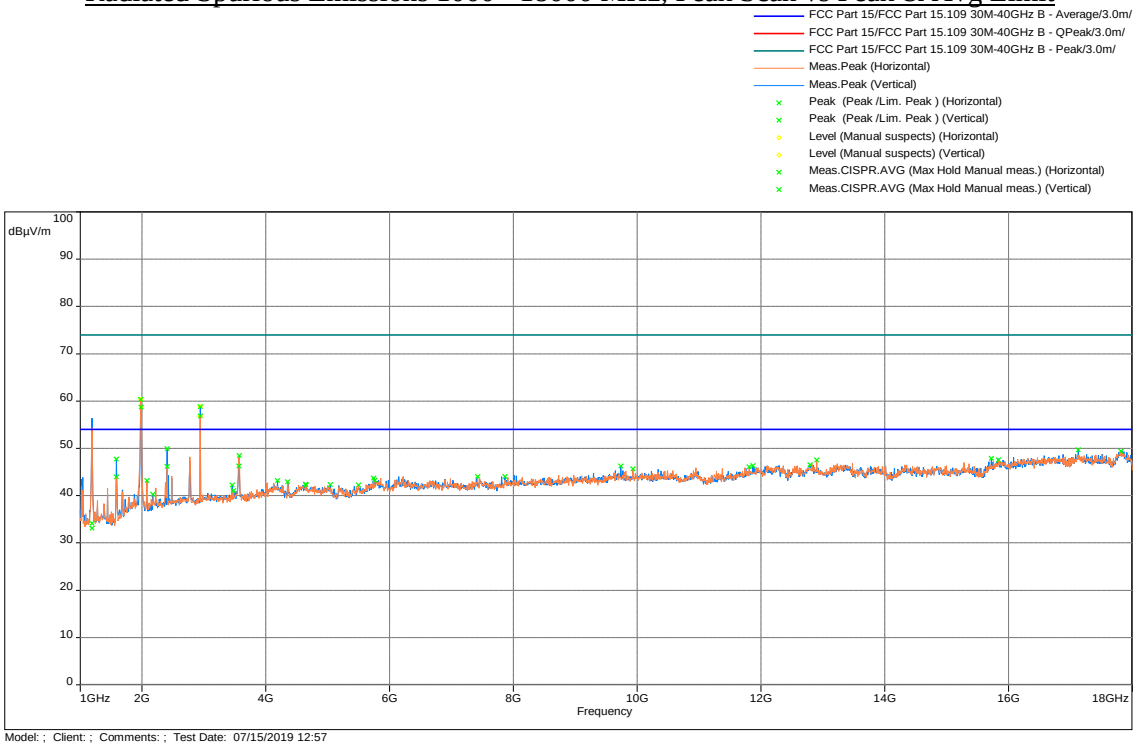


Frequency (MHz)	QP@10m (dBµV/m)	QP Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
108.216	28.4	33.0	-4.6	220	1.33	Vertical	42.8	-14.3
108.267	27.9	33.0	-5.2	320.5	4	Horizontal	42.2	-14.3
242.833	29.6	35.5	-5.9	241.25	1.08	Vertical	41.0	-11.4
255.051	27.9	35.5	-7.6	173	3.76	Horizontal	39.5	-11.6
255.075	28.7	35.5	-6.8	126.5	1.27	Vertical	40.3	-11.6

Frequency (MHz)	PK@10m (dBµV/m)	Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
60.490	31.7	57.8*	-26.1	295	3.99	Vertical	39.3	-7.6
396.110	34.5	57.8*	-23.4	328.25	0.99	Vertical	49.9	-15.4
396.110	37.1	57.8*	-20.7	89	0.99	Horizontal	52.5	-15.4

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

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



Freq. MHz	Ave@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1188.350	34.4	54	-19.6	119.25	3.14	Vertical	-16.1
1188.173	33.3	54	-20.7	151.5	1.26	Horizontal	-16.1

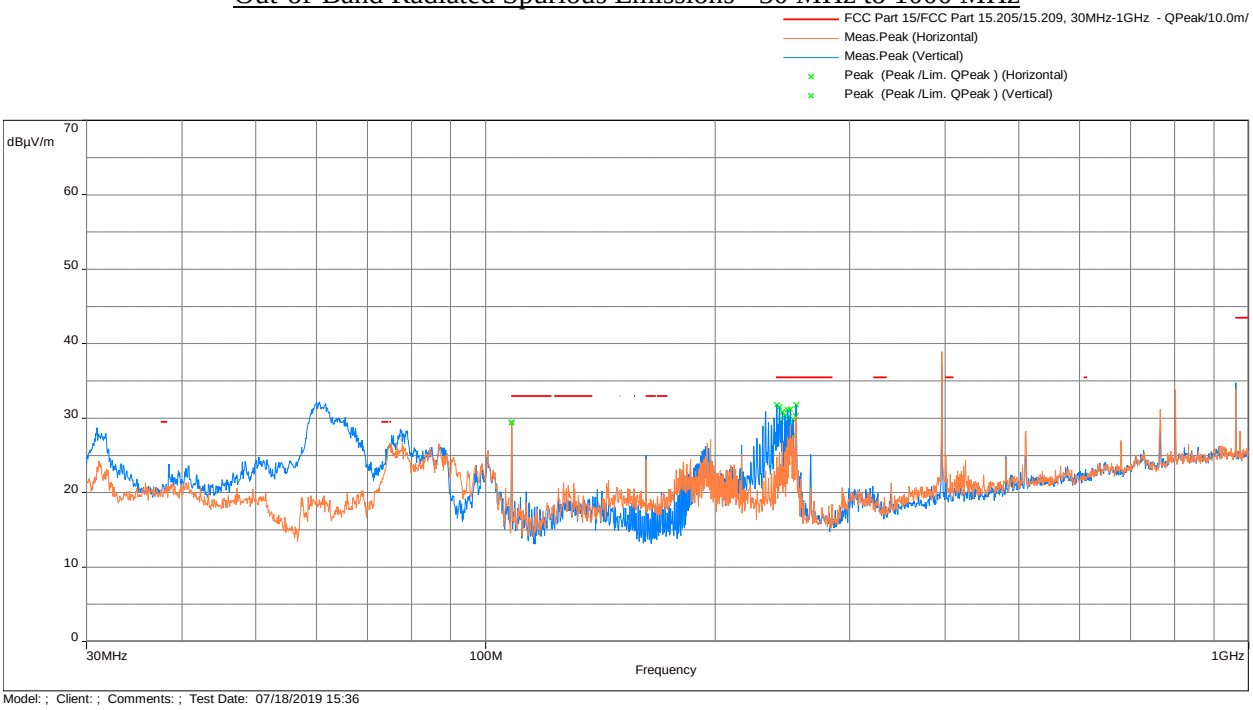
Freq. MHz	Peak@3m dB(uV/m)	Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1979.767	60.3	68.3*	-8.0	342.25	3.25	Horizontal	-13.5
1980.333	58.7	68.3*	-9.6	61.5	1.26	Vertical	-13.5
2939.133	58.8	68.3*	-9.5	223	2.26	Vertical	-12.4
2939.700	56.9	68.3*	-11.4	234.5	3.25	Horizontal	-12.4

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

Note: Radiated emission measurements were performed up to 40GHz. No Emissions were identified when scanned from 18-40 GHz.

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 802.11n 20MHz 5200MHz

Out-of-Band Radiated Spurious Emissions - 30 MHz to 1000 MHz

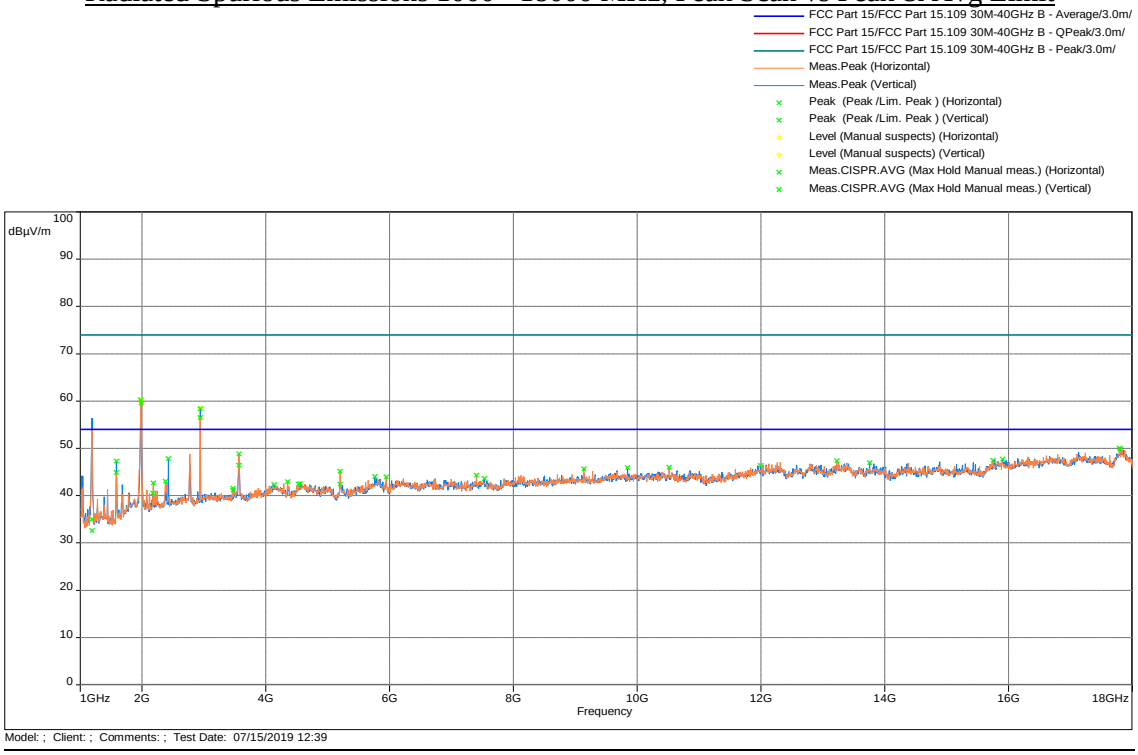


Frequency (MHz)	QP@10m (dBµV/m)	QP Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
108.223	27.5	33	-5.6	257.75	1.45	Vertical	41.8	-14.3
108.231	26.4	33	-6.6	0	4	Horizontal	40.7	-14.3
240.713	29.3	35.5	-6.2	236.5	2.26	Vertical	40.7	-11.4
255.012	28.9	35.5	-6.6	133.75	1	Vertical	40.5	-11.6
255.053	26.5	35.5	-9.0	11	3.79	Horizontal	38.1	-11.6

Frequency (MHz)	PK@10m (dBµV/m)	Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
60.038	32.2	57.8*	-25.6	Vertical	72	Vertical	67.6	-7.6
396.110	36.9	57.8*	-20.9	Vertical	329.75	Vertical	411.5	-15.4
396.110	39.0	57.8*	-18.8	Horizontal	77.25	Horizontal	411.5	-15.4

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

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



Freq. MHz	Ave@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1188.350	35.3	54	-18.7	19.25	1.25	Vertical	-16.1
1188.350	32.9	54	-21.1	76.75	3.16	Horizontal	-16.1

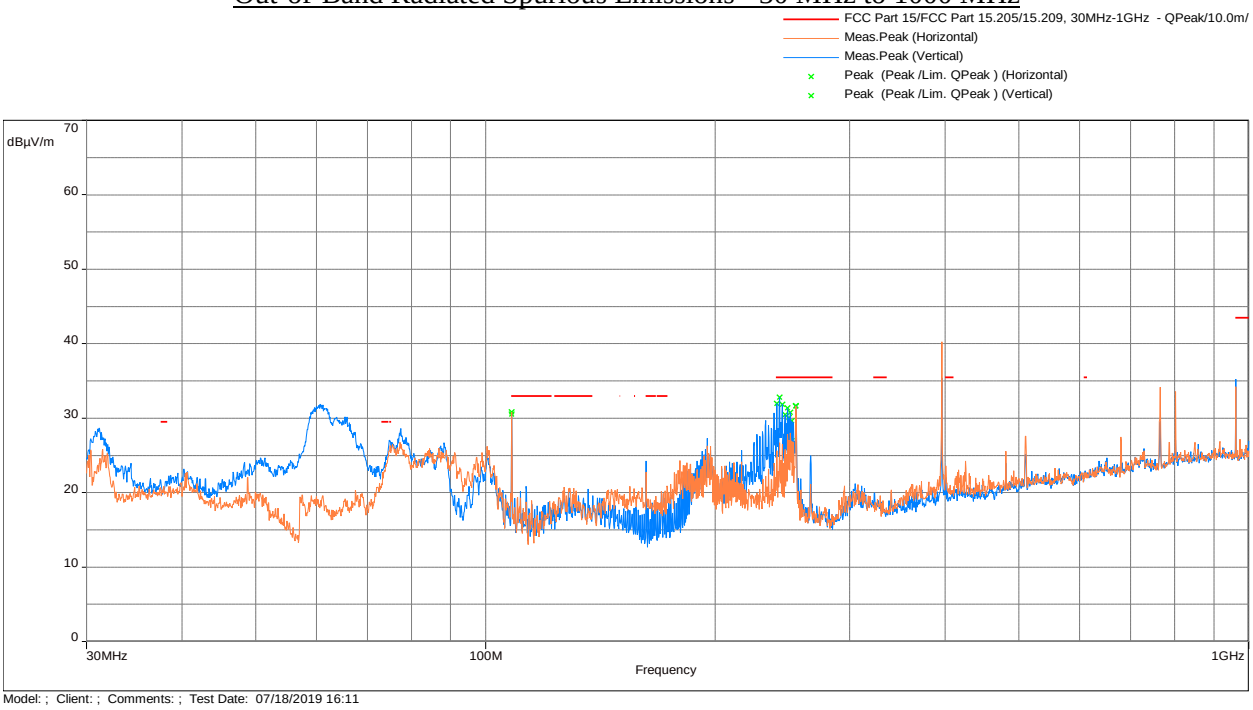
Freq. MHz	Peak@3m dB(uV/m)	Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1979.767	60.2	68.3*	-8.1	351	3.23	Horizontal	-13.5
1981.467	59.6	68.3*	-8.7	70.5	1.25	Vertical	-13.5
2939.700	58.4	68.3*	-9.9	223	2.24	Vertical	-12.4
2939.700	56.5	68.3*	-11.8	181.75	2.23	Horizontal	-12.4

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

Note: Radiated emission measurements were performed up to 40GHz. No Emissions were identified when scanned from 18-40 GHz.

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 802.11n 20MHz 5240MHz

Out-of-Band Radiated Spurious Emissions - 30 MHz to 1000 MHz

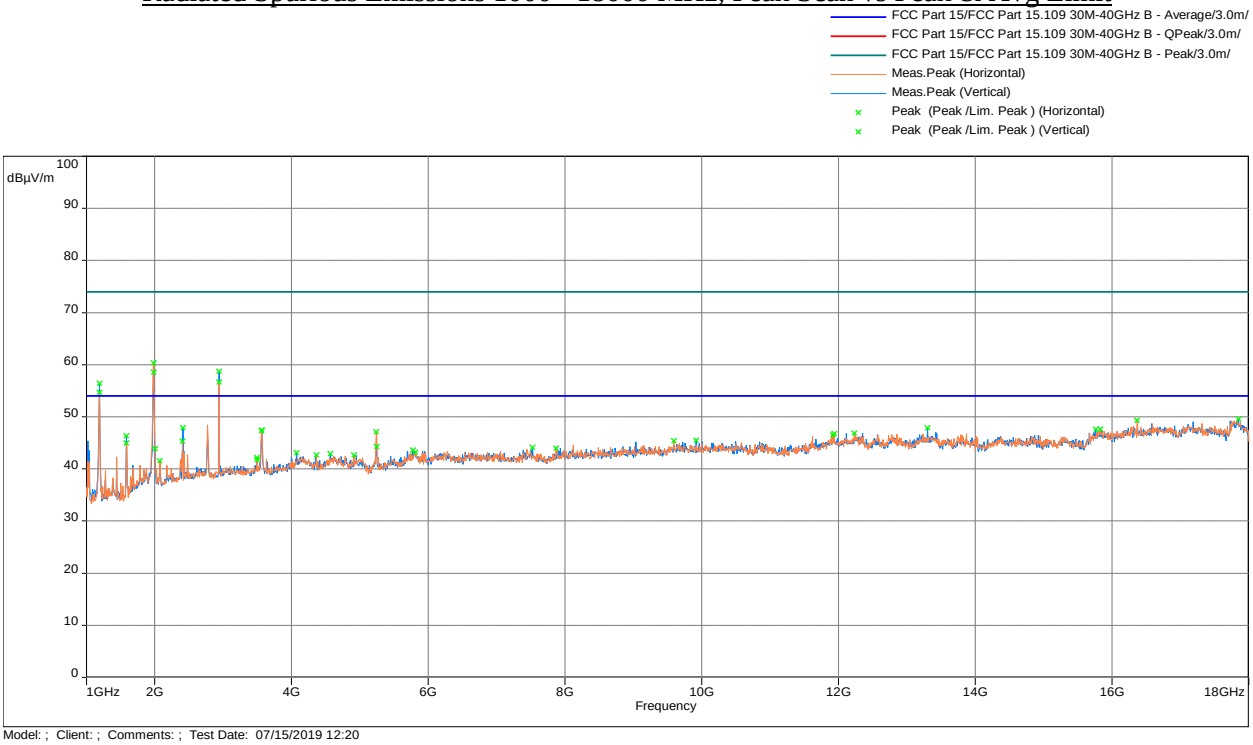


Frequency (MHz)	QP@10m (dBµV/m)	QP Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
108.228	28.4	33	-4.6	219.5	1.41	Vertical	42.7	-14.3
108.206	28.1	33	-4.9	133.75	3.64	Horizontal	42.5	-14.3
242.801	29.4	35.5	-6.2	308	1.04	Vertical	40.8	-11.4
255.091	29.1	35.5	-6.4	128.5	1	Vertical	40.7	-11.6
255.114	27.7	35.5	-7.8	175.25	3.57	Horizontal	39.3	-11.6

Frequency (MHz)	PK@10m (dBµV/m)	Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
60.749	31.9	57.8*	-25.9	303.75	3	Vertical	39.5	-7.6
396.110	35.4	57.8*	-22.4	104.75	1.00	Vertical	50.8	-15.4
396.110	40.2	57.8*	-17.6	75.5	1.98	Horizontal	55.6	-15.4

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

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



Model: ; Client: ; Comments: ; Test Date: 07/15/2019 12:20

Freq. MHz	Ave@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1188.350	34.4	54	-19.6	118.75	3.16	Vertical	-16.1
1188.229	33.5	54	-20.5	150.75	1.26	Horizontal	-16.1

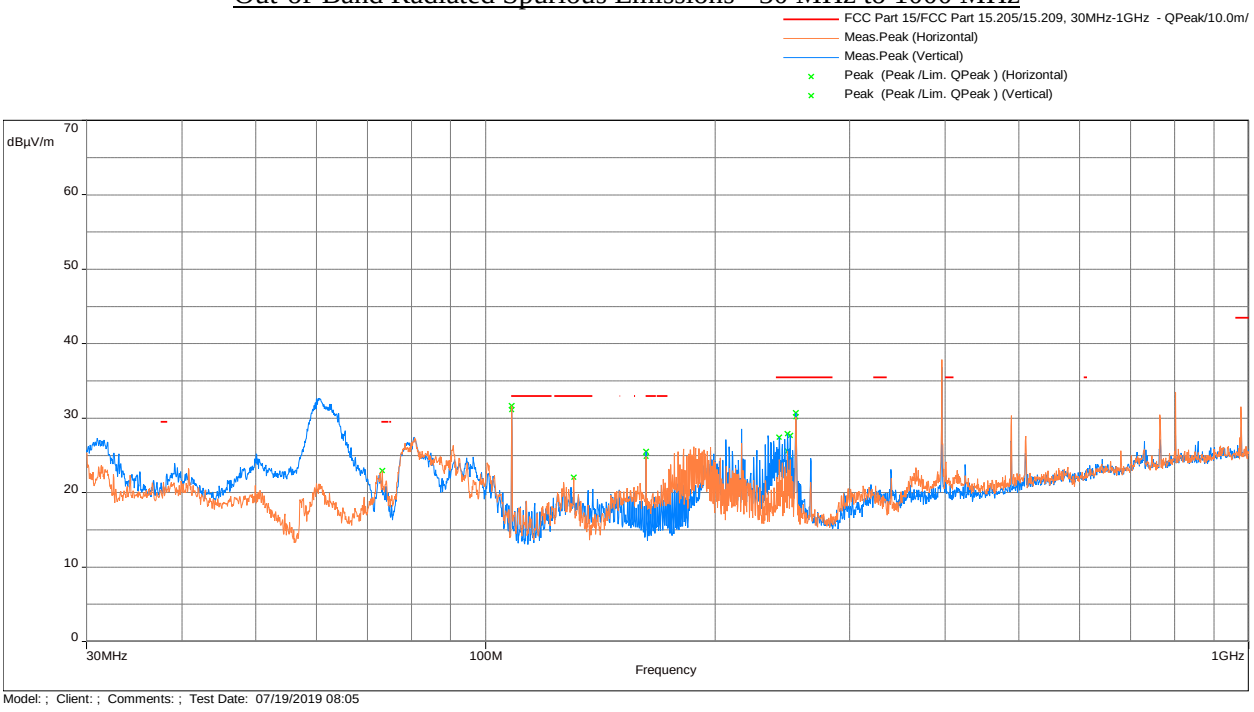
Freq. MHz	Peak@3m dB(uV/m)	Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1980.333	58.6	68.3*	-9.7	335	2.26	Vertical	-13.5
1980.333	60.3	68.3*	-8.0	341.5	3.24	Horizontal	-13.5
2939.133	58.7	68.3*	-9.6	231.75	2.26	Vertical	-12.4
2939.133	56.7	68.3*	-11.6	163.25	1.27	Horizontal	-12.4

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

Note: Radiated emission measurements were performed up to 40GHz. No Emissions were identified when scanned from 18-40 GHz.

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 802.11n 40MHz 5190MHz

Out-of-Band Radiated Spurious Emissions - 30 MHz to 1000 MHz

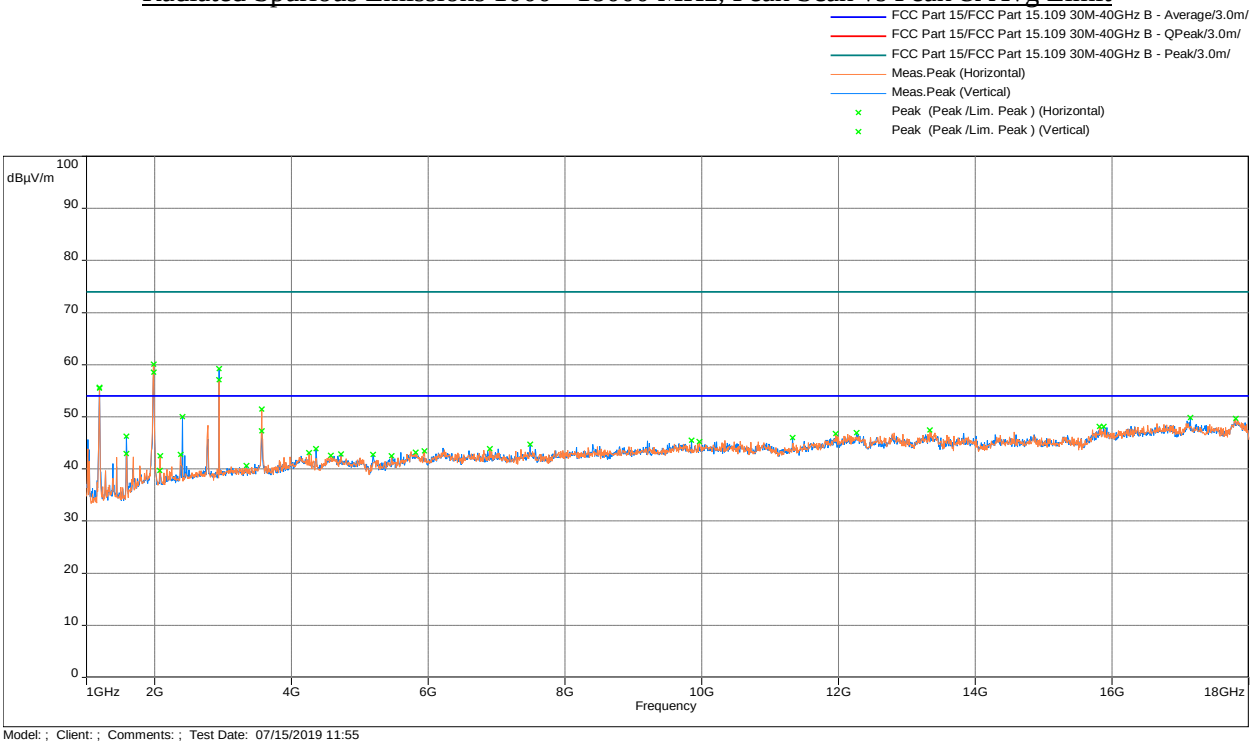


Frequency (MHz)	QP@10m (dBµV/m)	QP Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
108.132	28.3	33	-4.7	146	3.68	Horizontal	42.7	-14.3
108.204	28.9	33	-4.1	213.5	1.44	Vertical	43.3	-14.3
254.997	25.5	35.5	-10.0	3	3.82	Horizontal	37.1	-11.6
255.051	26.3	35.5	-9.2	234	1	Vertical	37.9	-11.6

Frequency (MHz)	PK@10m (dBµV/m)	Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
60.361	32.7	57.8*	-25.1	286.75	3	Vertical	40.3	-7.6
396.110	36.9	57.8*	-20.9	189.5	1	Vertical	52.3	-15.4
396.143	37.7	57.8*	-20.1	81.75	1.98	Horizontal	53.1	-15.4

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

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



Model: ; Client: ; Comments: ; Test Date: 07/15/2019 11:55

Freq. MHz	Ave@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1188.355	33.6	54	-20.4	12.75	1.65	Vertical	-16.1
1188.350	36.0	54	-18.0	77.5	3.14	Horizontal	-16.1

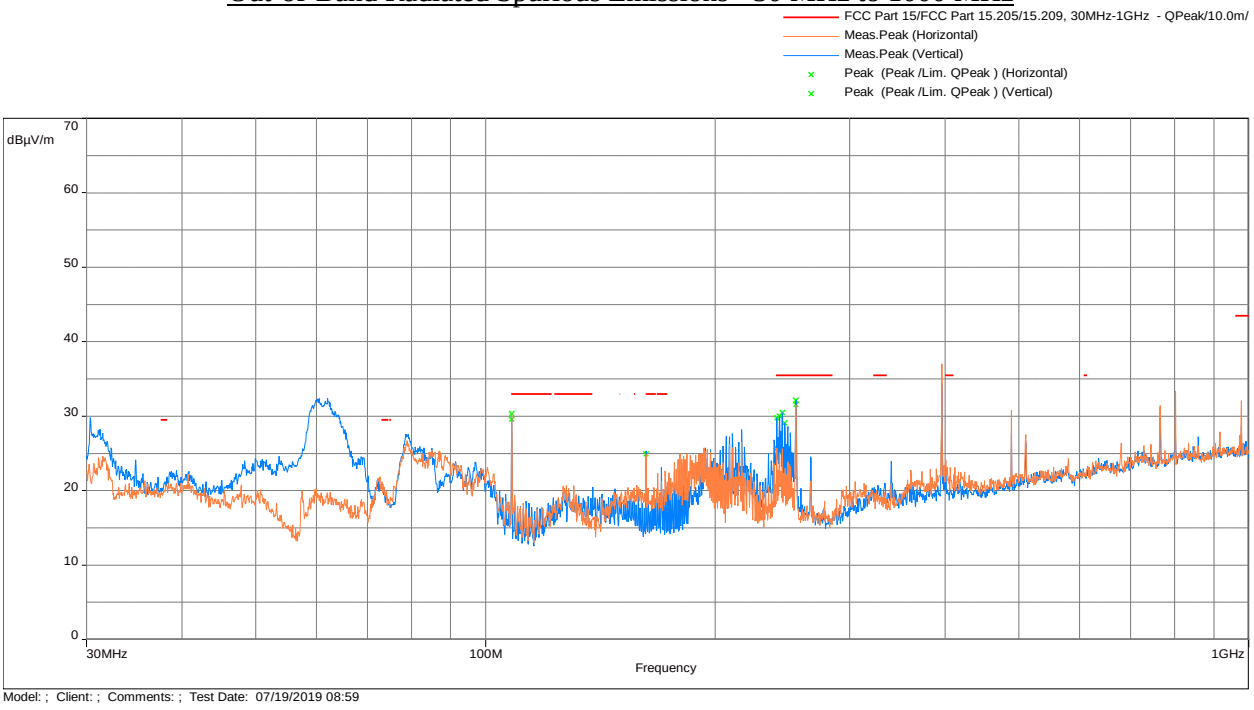
Freq. MHz	Peak@3m dB(uV/m)	Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1980.333	58.6	68.3*	-9.8	71.25	1.26	Vertical	-13.5
1980.333	60.1	68.3*	-8.2	351.25	3.23	Horizontal	-13.5
2938.567	57.1	68.3*	-11.2	154.25	1.26	Horizontal	-12.4
2939.133	59.2	68.3*	-9.1	223.25	2.24	Vertical	-12.4

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

Note: Radiated emission measurements were performed up to 40GHz. No Emissions were identified when scanned from 18-40 GHz.

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 802.11n 40MHz 5230MHz

Out-of-Band Radiated Spurious Emissions - 30 MHz to 1000 MHz

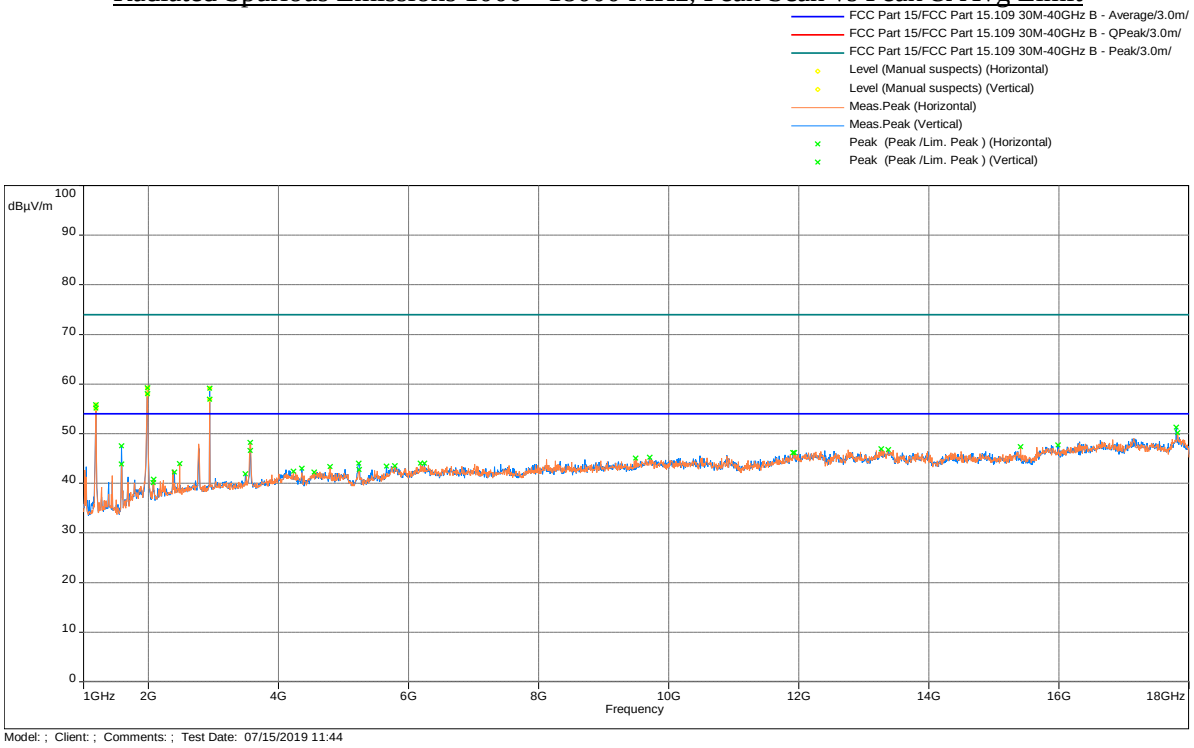


Frequency (MHz)	QP@10m (dBµV/m)	QP Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
108.166	28.8	33	-4.2	219.5	1.42	Vertical	43.2	-14.3
108.229	28.0	33	-5.0	140.25	3.68	Horizontal	42.4	-14.3
244.824	27.0	35.5	-8.5	135.75	1.07	Vertical	38.6	-11.6
255.042	26.0	35.5	-9.5	189.25	3.65	Horizontal	37.6	-11.6
255.096	27.2	35.5	-8.3	128.5	1	Vertical	38.7	-11.6

Frequency (MHz)	PK@10m (dBµV/m)	Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
60.523	32.4	57.8*	-25.4	276.75	3	Vertical	40.0	-7.6
396.110	34.3	57.8*	-23.5	308.5	1	Vertical	49.7	-15.4
396.110	37.0	57.8*	-20.8	88	1	Horizontal	52.4	-15.4

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

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



Freq. MHz	Ave@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1188.229	34.5	54	-19.5	114.5	3	Vertical	-16.1
1188.470	34.3	54	-19.7	85.75	1.92	Horizontal	-16.1

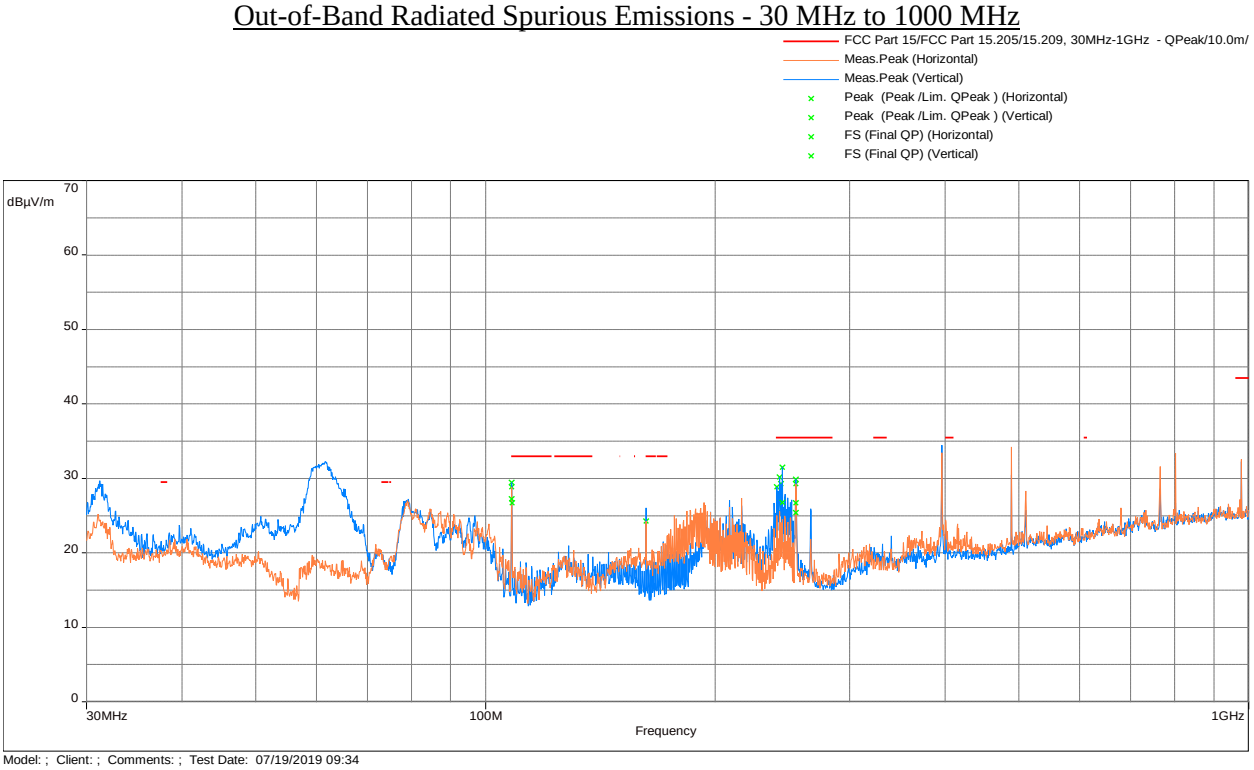
Freq. MHz	Peak@3m dB(uV/m)	Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1980.333	59.2	68.3*	-9.1	350	3.25	Horizontal	-13.5
1980.900	58.0	68.3*	-10.3	61.5	1.26	Vertical	-13.5
2939.700	59.1	68.3*	-9.2	222.75	2.26	Vertical	-12.4
2939.700	57.0	68.3*	-11.4	154.5	1.27	Horizontal	-12.4

*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

Note: Radiated emission measurements were performed up to 40GHz. No Emissions were identified when scanned from 18-40 GHz.

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 802.11ac 80MHz 5210MHz

Out-of-Band Radiated Spurious Emissions - 30 MHz to 1000 MHz

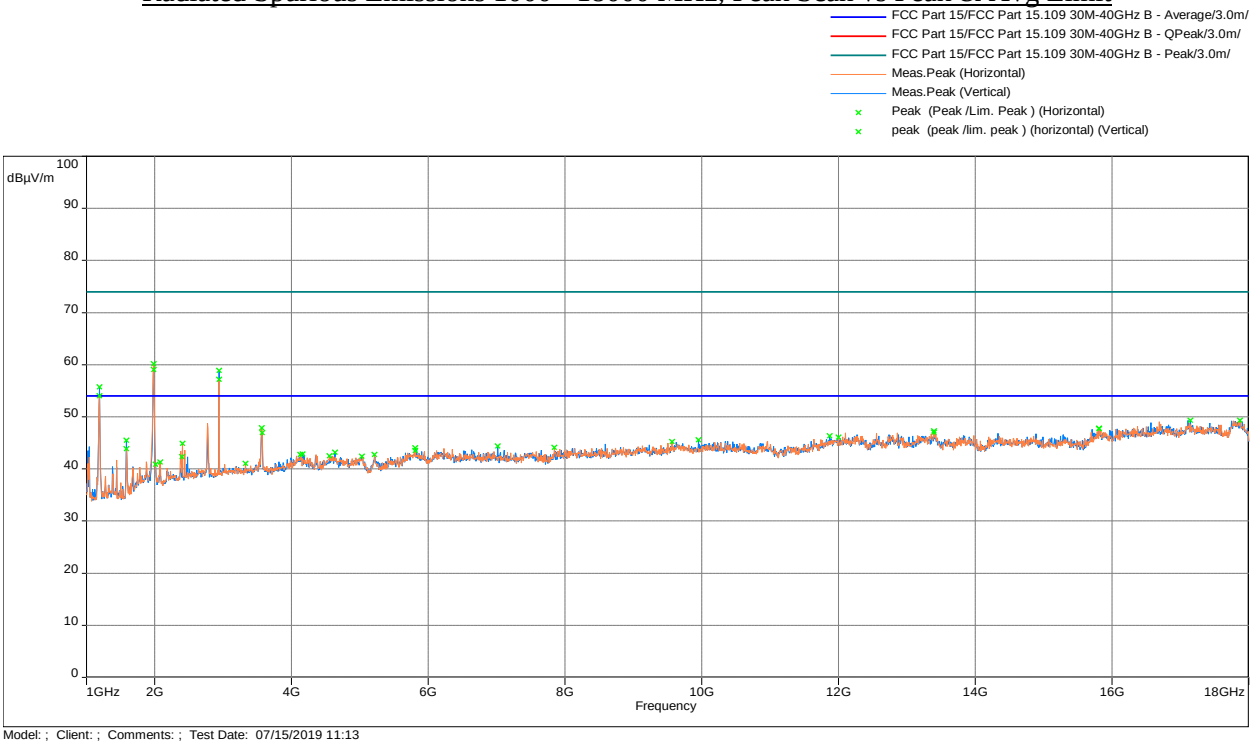


Frequency (MHz)	QP@10m (dBµV/m)	QP Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
108.220	27.3	33	-5.7	237.25	2.27	Vertical	41.6	-14.3
108.303	26.7	33	-6.3	323.5	4	Horizontal	41.0	-14.3
244.826	26.8	35.5	-8.7	130.5	1.12	Vertical	38.4	-11.6
255.046	25.4	35.5	-10.1	230	1	Vertical	37.0	-11.6
255.067	26.7	35.5	-8.8	174	3.65	Horizontal	38.3	-11.6

Frequency (MHz)	PK@10m (dBµV/m)	Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
61.719	32.3	57.8*	-25.5	71.25	3	Vertical	39.9	-7.6
396.110	34.4	57.8*	-23.4	74	1	Vertical	49.8	-15.4
396.110	33.4	57.8*	-24.4	328.5	2.98	Horizontal	48.8	-15.4

Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407(b).

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



Model: ; Client: ; Comments: ; Test Date: 07/15/2019 11:13

Freq. MHz	Ave@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1188.229	36.5	54	-17.5	15.5	1.64	Vertical	-16.1
1188.350	34.0	54	-20.0	75.75	3.16	Horizontal	-16.1

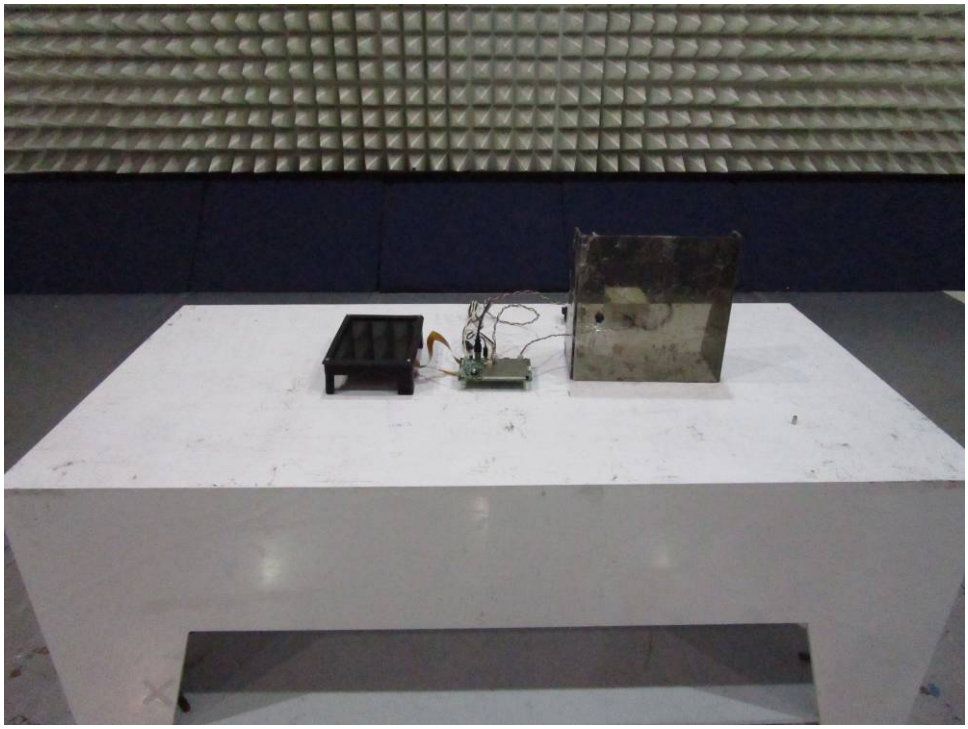
Freq. MHz	Peak@3m dB(uV/m)	Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
1980.333	60.2	68.3*	-8.1	3.23	342	Horizontal	-13.5
1980.333	59.1	68.3*	-9.2	1.24	71.25	Vertical	-13.5
2939.700	57.2	68.3*	-11.1	1.23	154.5	Horizontal	-12.4
2939.133	58.9	68.3*	-9.4	2.24	223	Vertical	-12.4

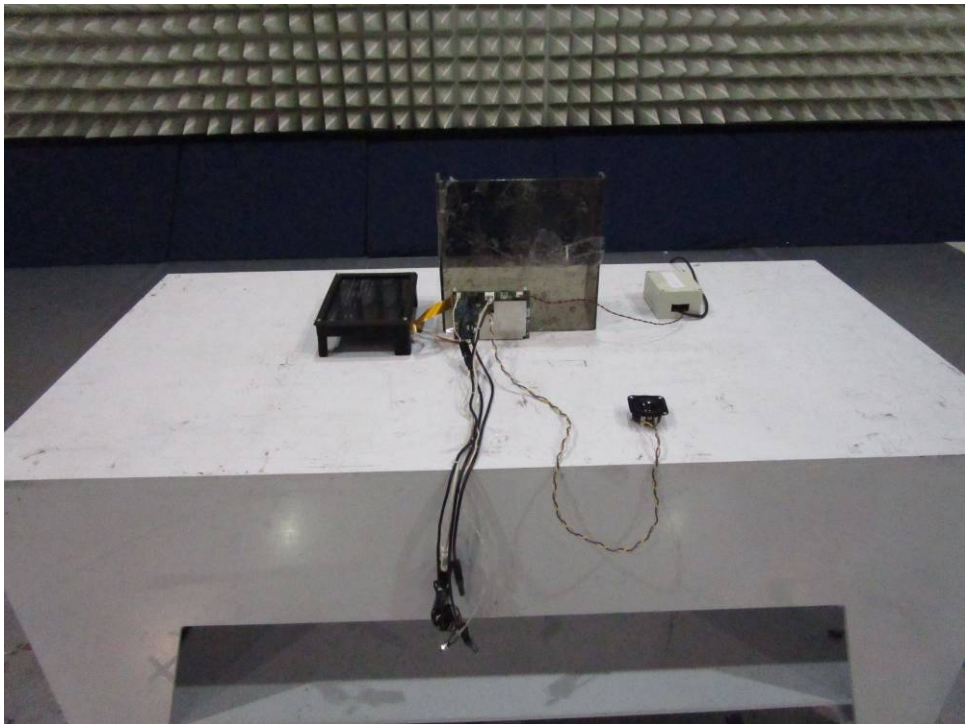
*Note: The following frequencies do not fall into the restricted band of FCC PT 15. 205, the limits for these frequencies are subject to FCC PT 15.407.

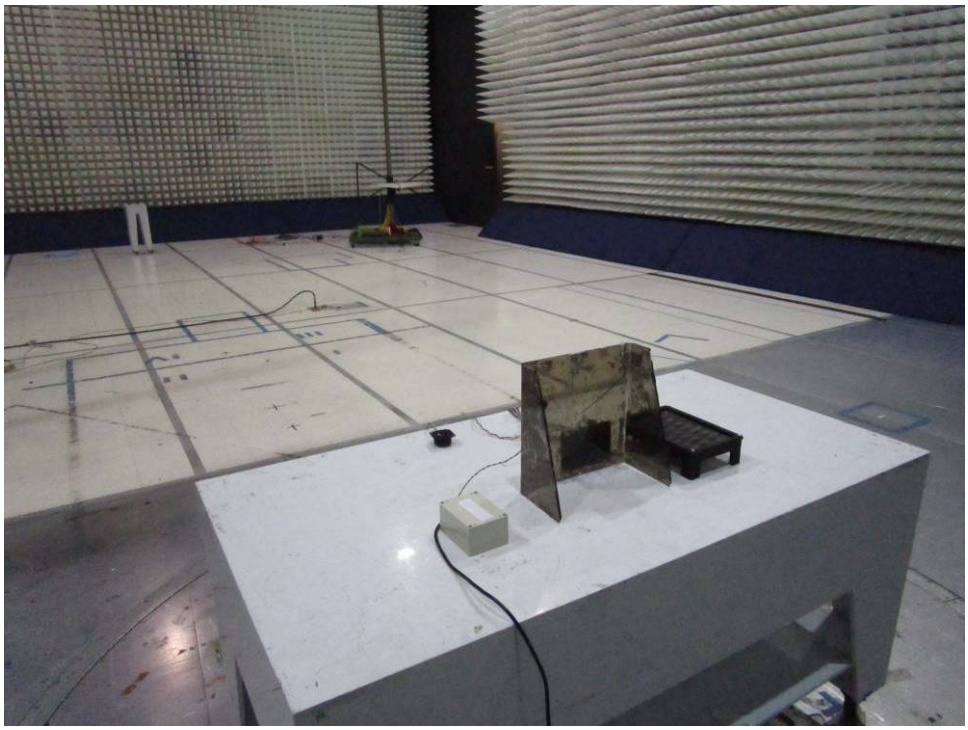
Note: Radiated emission measurements were performed up to 40GHz. No Emissions were identified when scanned from 18-40 GHz.

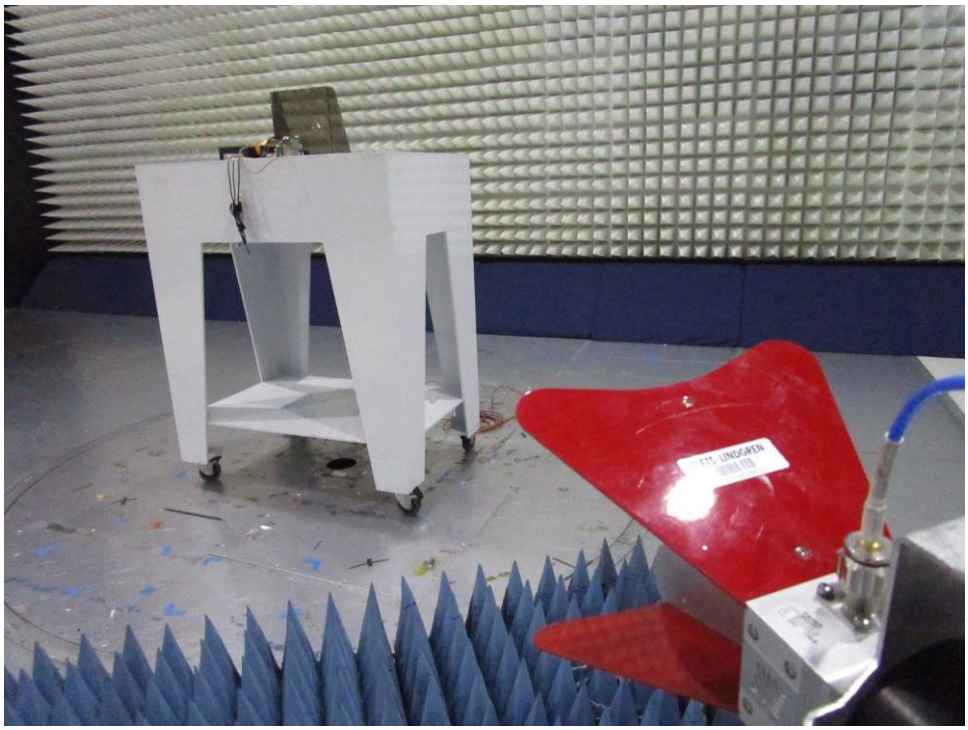
4.3.7 Test setup

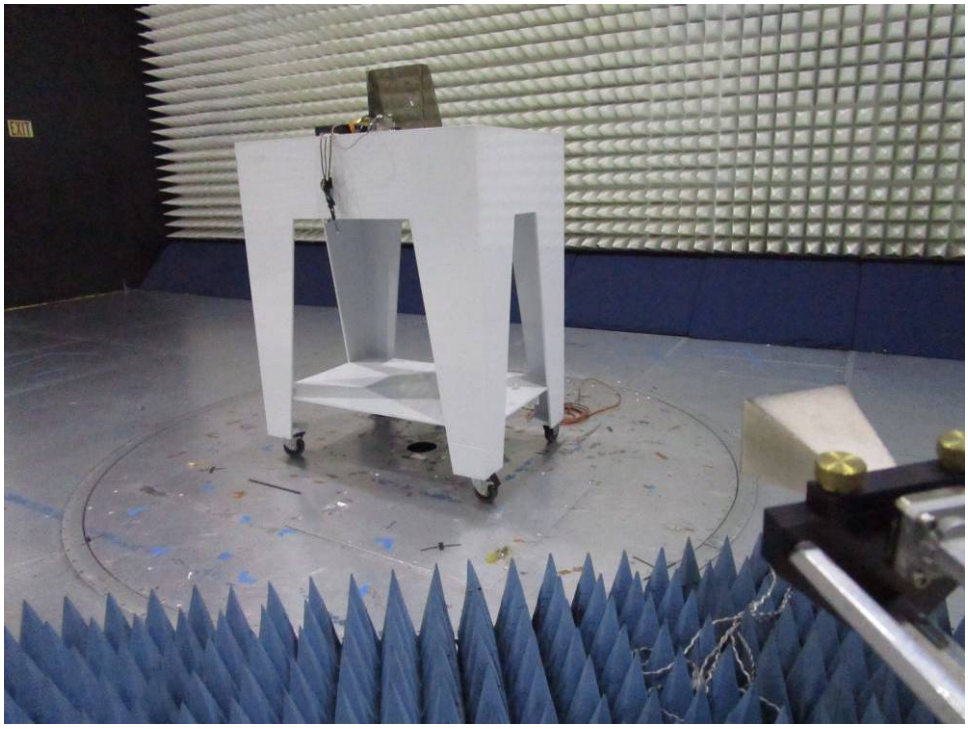
The following photographs show the testing configurations used.

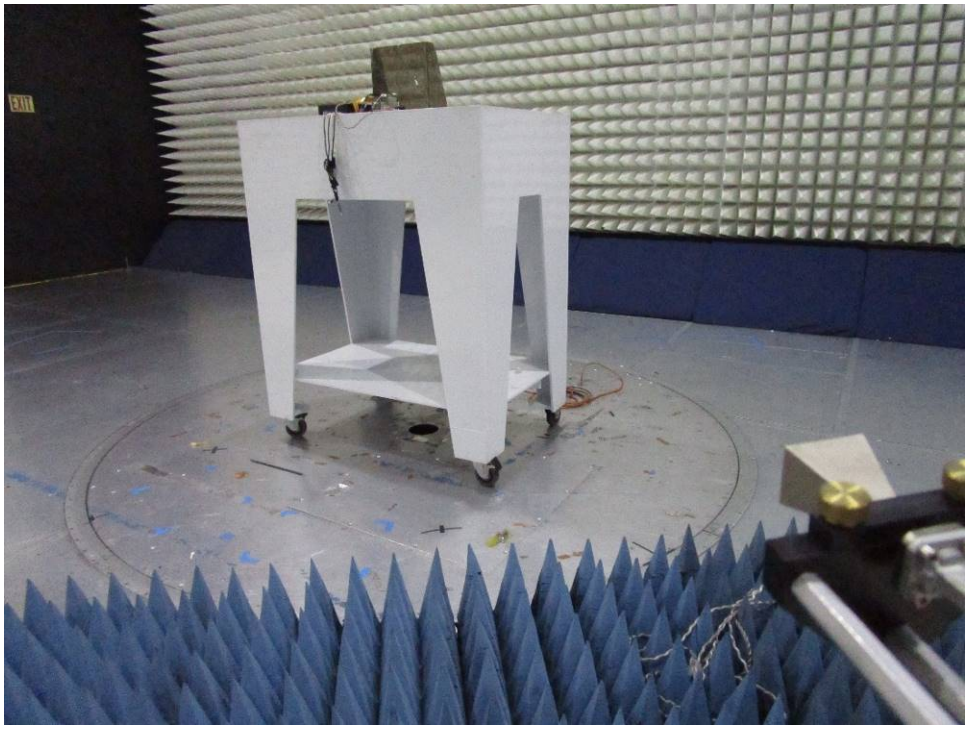







ETC LINDGREN





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

4.4.1 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.

4.4.2 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 C63.4:2014.

Tested By	Test Date
Todd Moy	July 22, 2019

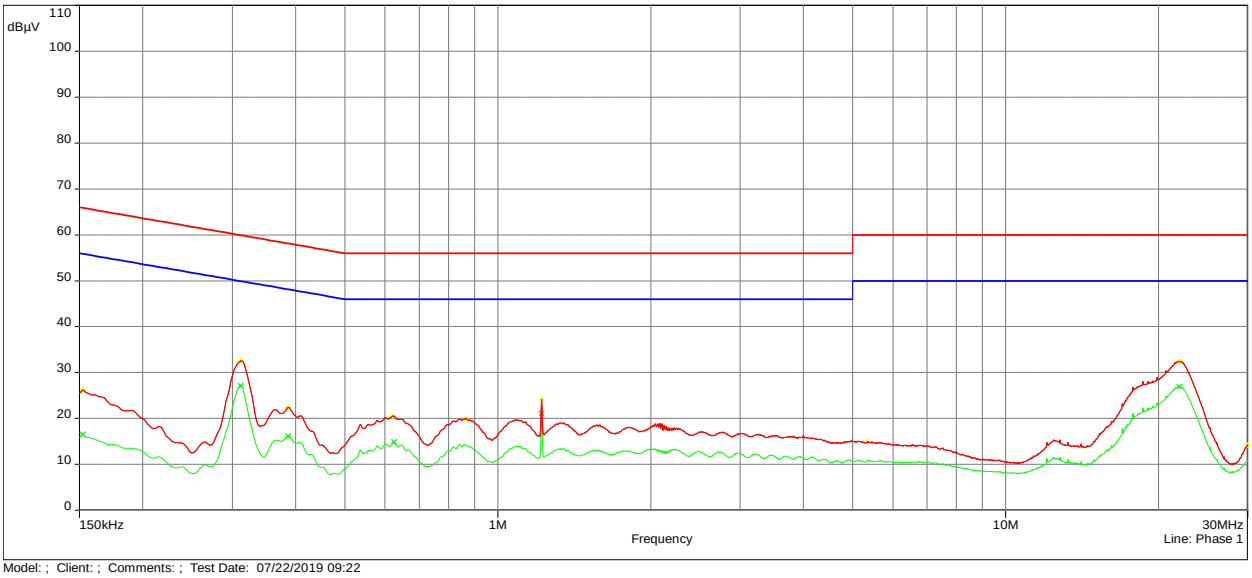
4.4.3 Test Results

15.207: Conducted Emissions 120VAC 60Hz

Phase 1

Sub-range 1
Frequencies: 150 kHz - 30 MHz (Mode: - Step: 2.25 kHz)
Settings: RBW: 9kHz, VBW: 30kHz, Sweep time: 1e+03 ms, Attenuation: 10 dB, Sweep count 3, Preamp: Off, LN Preamp: Off, Preselector: On
Line:Phase 1

FCC Part 15/FCC Part 15.107 B - Average/
FCC Part 15/FCC Part 15.107 B - QPeak/
Meas.QPeak (Phase 1)
Mes. CISPR AVG (Phase 1)
QPeak (QPeak /Lim. QPeak) (Phase 1)
CISPR AVG (CISPR AVG /Lim. Average) (Phase 1)

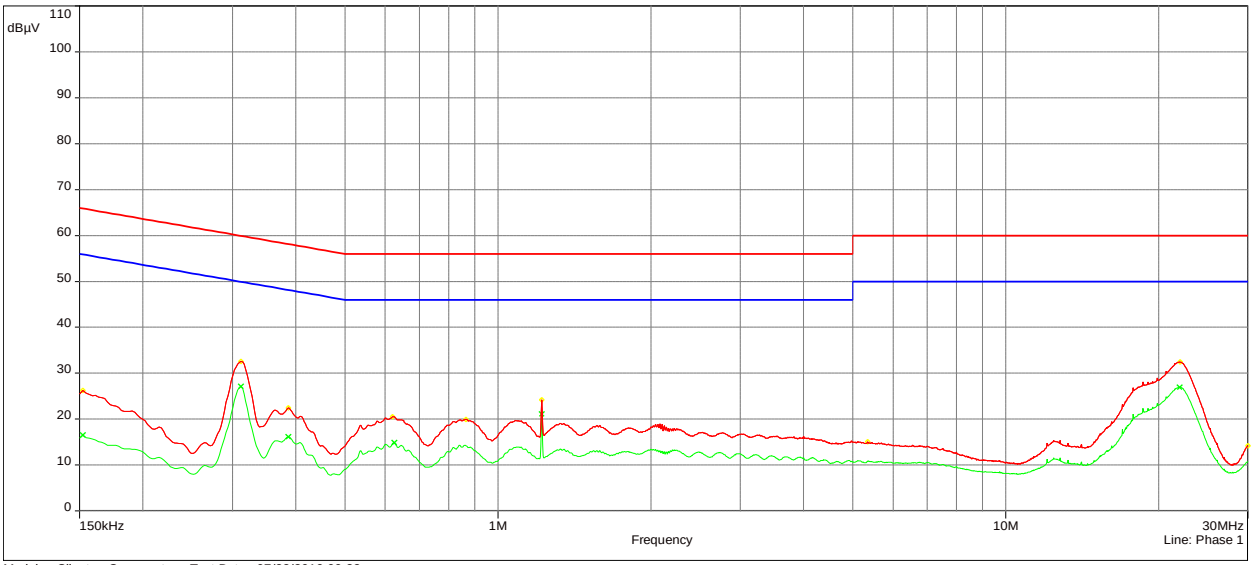


Model: ; Client: ; Comments: ; Test Date: 07/22/2019 09:22

Phase 2

Sub-range 1
Frequencies: 150 kHz - 30 MHz (Mode: - Step: 2.25 kHz)
Settings: RBW: 9kHz, VBW: 30kHz, Sweep time: 1e+03 ms, Attenuation: 10 dB, Sweep count 3, Preamp: Off, LN Preamp: Off, Preselector: On
Line:Phase 1

FCC Part 15/FCC Part 15.107 B - Average/
FCC Part 15/FCC Part 15.107 B - QPeak/
Meas.QPeak (Phase 1)
Mes. CISPR AVG (Phase 1)
QPeak (QPeak /Lim. QPeak) (Phase 1)
CISPR AVG (CISPR AVG /Lim. Average) (Phase 1)



Model: ; Client: ; Comments: ; Test Date: 07/22/2019 09:22

4.4.3 Test Results (Continued)

Quasi Peak Table					
Frequency (MHz)	QPeak (dBµV)	Lim. QPeak (dBµV)	QPeak-Lim (dB)	Phase	Correction (dB)
0.152	26.3	65.9	-39.6	Phase 1	11.3
0.152	26.5	65.9	-39.4	Phase 2	11.3
0.312	32.6	59.9	-27.3	Phase 1	11.0
0.312	32.9	59.9	-27.0	Phase 2	11.0
0.386	22.5	58.1	-35.7	Phase 1	10.9
0.386	22.4	58.1	-35.7	Phase 2	10.9
0.620	20.6	56	-35.4	Phase 1	10.9
0.620	20.4	56	-35.6	Phase 2	10.9
0.866	19.9	56	-36.1	Phase 1	10.9
0.868	19.9	56	-36.1	Phase 2	10.9
1.221	24.3	56	-31.8	Phase 1	10.9
1.221	24.1	56	-31.9	Phase 2	10.9
5.109	14.7	60	-45.3	Phase 2	11.1
5.348	15.1	60	-44.9	Phase 1	11.1
21.923	31.5	60	-28.6	Phase 2	11.3
22.040	32.4	60	-27.6	Phase 1	11.3
29.994	14.1	60	-45.9	Phase 2	11.2
29.999	14.2	60	-45.8	Phase 1	11.2

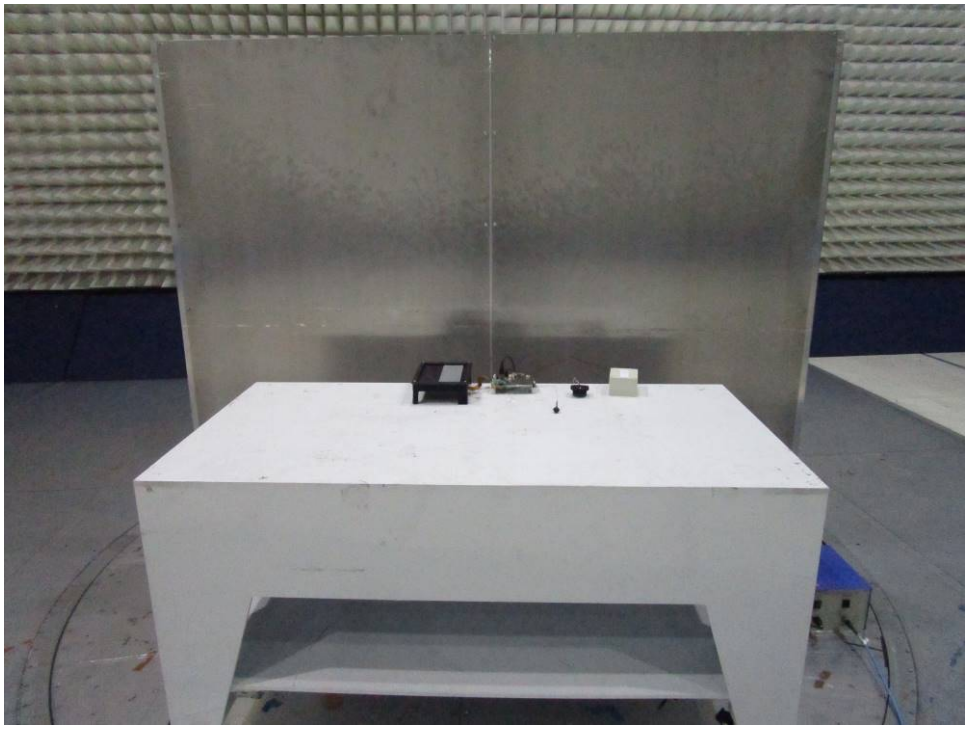
4.4.3 Test Results (Continued)

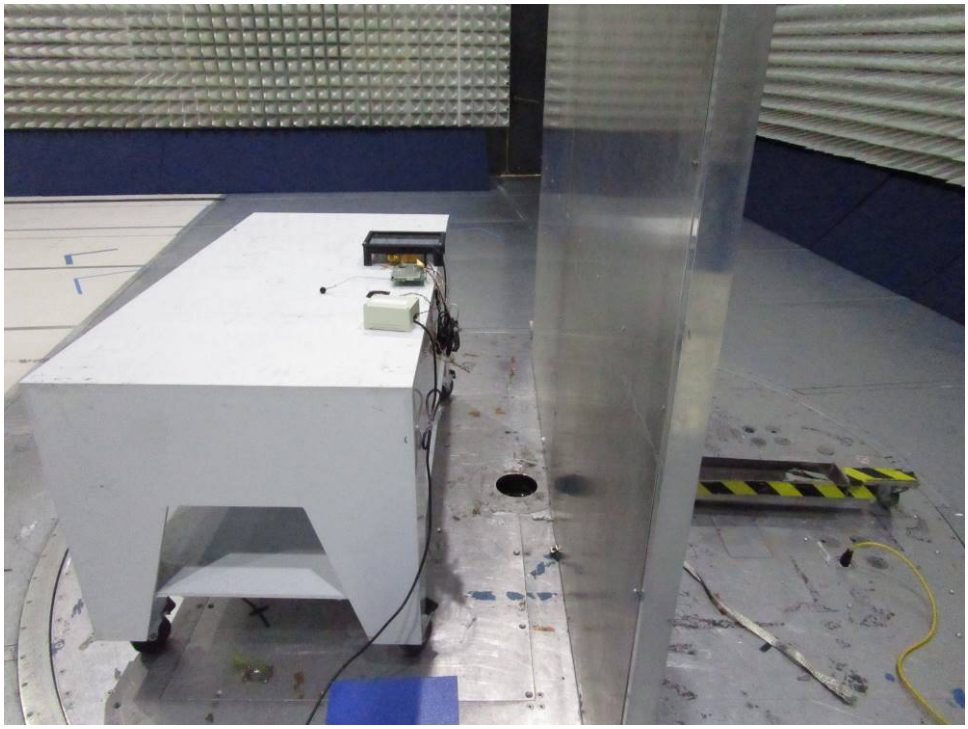
Average Table					
Frequency (MHz)	AVG (dBµV)	Lim. Average (dBµV)	AVG-Lim (dB)	Phase	Correction (dB)
0.152	16.5	55.9	-39.4	Phase 1	11.3
0.152	15.4	55.9	-40.5	Phase 2	11.3
0.312	27.1	49.9	-22.8	Phase 1	11.0
0.312	27.5	49.9	-22.4	Phase 2	11.0
0.386	16.1	48.1	-32.0	Phase 1	10.9
0.386	16.2	48.1	-32.0	Phase 2	10.9
0.625	14.7	46	-31.3	Phase 2	10.9
0.625	14.9	46	-31.1	Phase 1	10.9
0.863	14.2	46	-31.8	Phase 2	10.9
1.221	21.1	46	-25.0	Phase 1	10.9
1.221	21.0	46	-25.0	Phase 2	10.9
21.968	26.0	50	-24.0	Phase 2	11.3
22.027	26.9	50	-23.1	Phase 1	11.3

Results: **Complies** by 22.4 dB

4.4.4 Test setup

The following photographs show the testing configurations used.





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
Spectrum Analyzer	Rohde and Schwarz	FSU	ITS 00913	12	03/26/20
Horn Antenna (10-40 GHz)	ETS-Lindgren	3116C	ITS 01376	12	04/15/20
Pre-Amplifier (18-40GHz)	Miteq	TTA1840-35-S-M	ITS 01393	12	02/08/20
Active Horn Antenna	ETS-Lindgren	3117-PA	ITS 01636	12	01/17/20
EMI Receiver	Rohde and Schwarz	ESR7	ITS 01607	12	10/23/19
Bi-Log Antenna	Antenna Research	LPB-2513	ITS 00355	12	04/24/20
Pre-Amplifier	Sonoma Instrument	310N	ITS 00415	12	04/17/20
Notch Filter	MICRO-TRONICS	BRM50703	ITS 01167	12	05/14/20
LISN	Com-Power	LIN-115A	ITS 01283	12	10/03/19
RE Cable	TRU Corporation	TRU CORE 300	ITS 01462	12	09/17/19
RE Cable	TRU Corporation	TRU CORE 300	ITS 01465	12	09/17/19
RE Cable	TRU Corporation	TRU CORE 300	ITS 01470	12	09/17/19
RF Cable	TRU Corporation	TRU CORE 300	ITS 01342	12	12/05/19
RE Cable	TRU Corporation	TRU CORE 300	ITS 01462	12	09/17/19
Attenuator	Fairview	SA 18H-30	ITS 01633	12	#

Verify before use

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
Tile	Quantum Change	3.4.K.22	Conducted Spurious_30M-26GHz
BAT-EMC	Nexio	3.17.0.10	Bosch July 15, 2019
BAT-EMC	Nexio	3.17.0.10	Bosch July 17, 2019
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 / G103930307	TM	KV	August 20, 2019	Original document

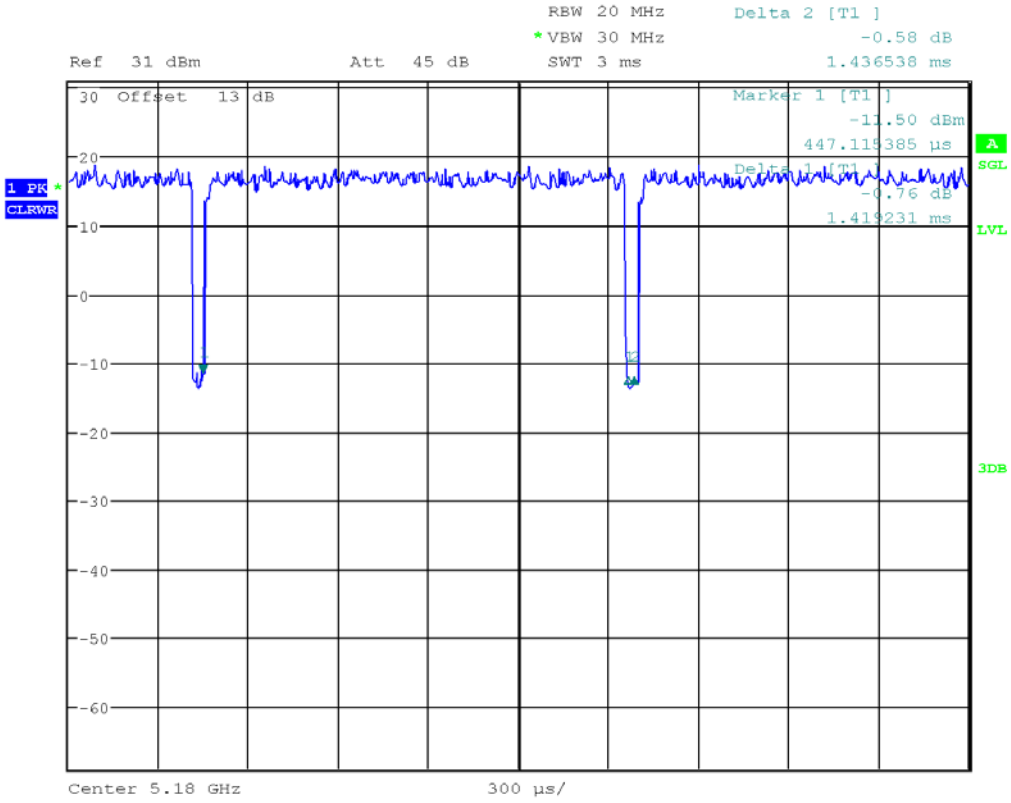
Annex A – Duty Cycle Measurement

Standard	Data Rate	On Time ms	Period ms	DCF Power Averaging	DCF Linear Voltage Averaging	Plot #
802.11a	6 Mbps	1.419	1.437	0.055	0.109	A.1
802.11n20	0 MCS	1.32	1.362	0.136	0.272	A.2
802.11n40	0 MCS	0.652	0.699	0.302	0.605	A.3
802.11ac80	0 MCS	0.322	0.367	0.568	1.136	A.4

Duty Cycle:
DC= On Time / Period

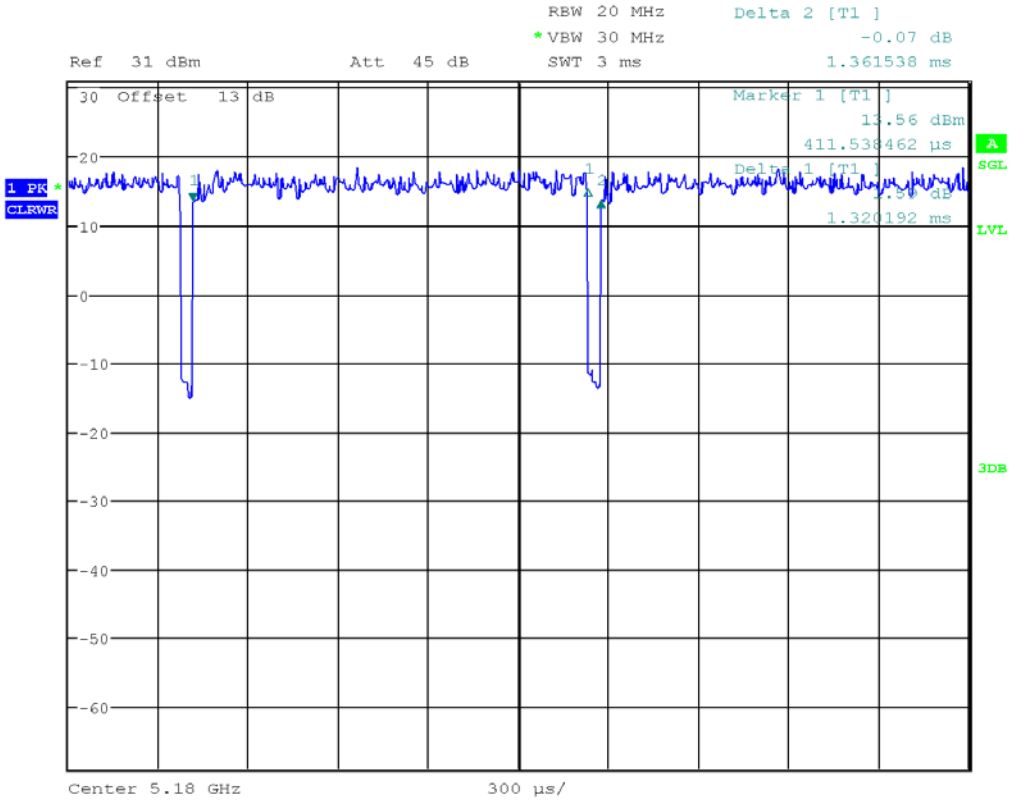
Duty Cycle Correction Factor (DCF) δ (dB):
DCF Power Averaging = 10 log (1/DC)
DCF Linear Voltage Averaging = 20 log (1/DC)

plot A.1 – 802.11a duty cycle

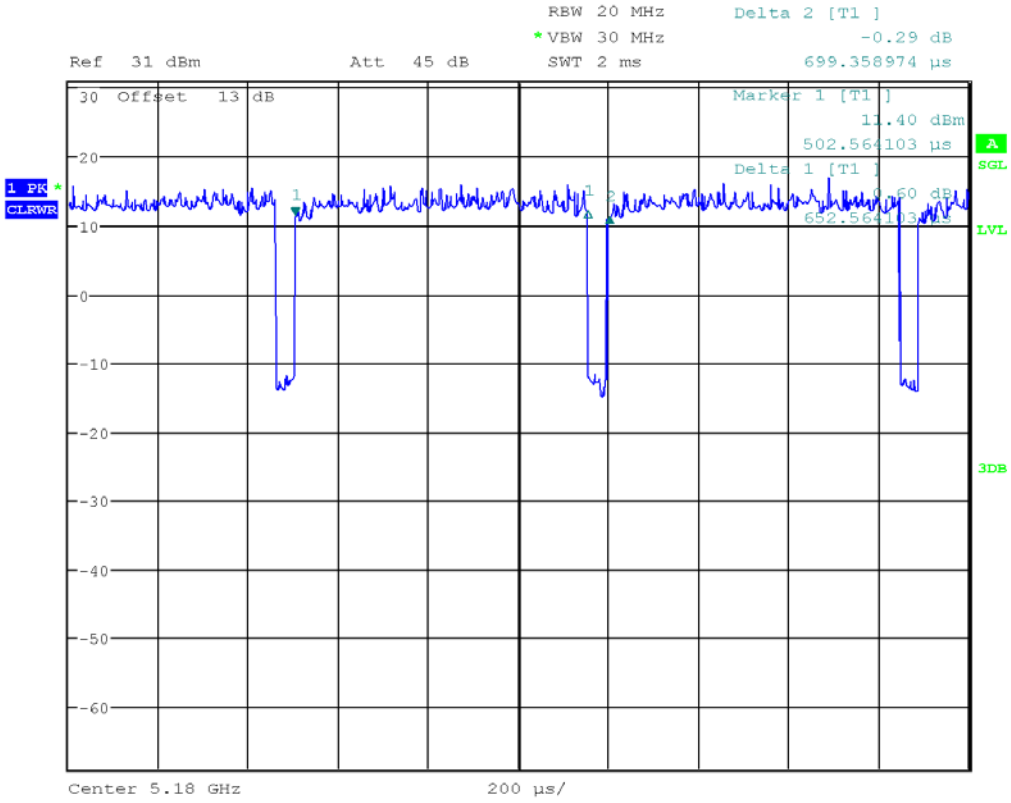


Date: 26.JUN.2019 11:20:23

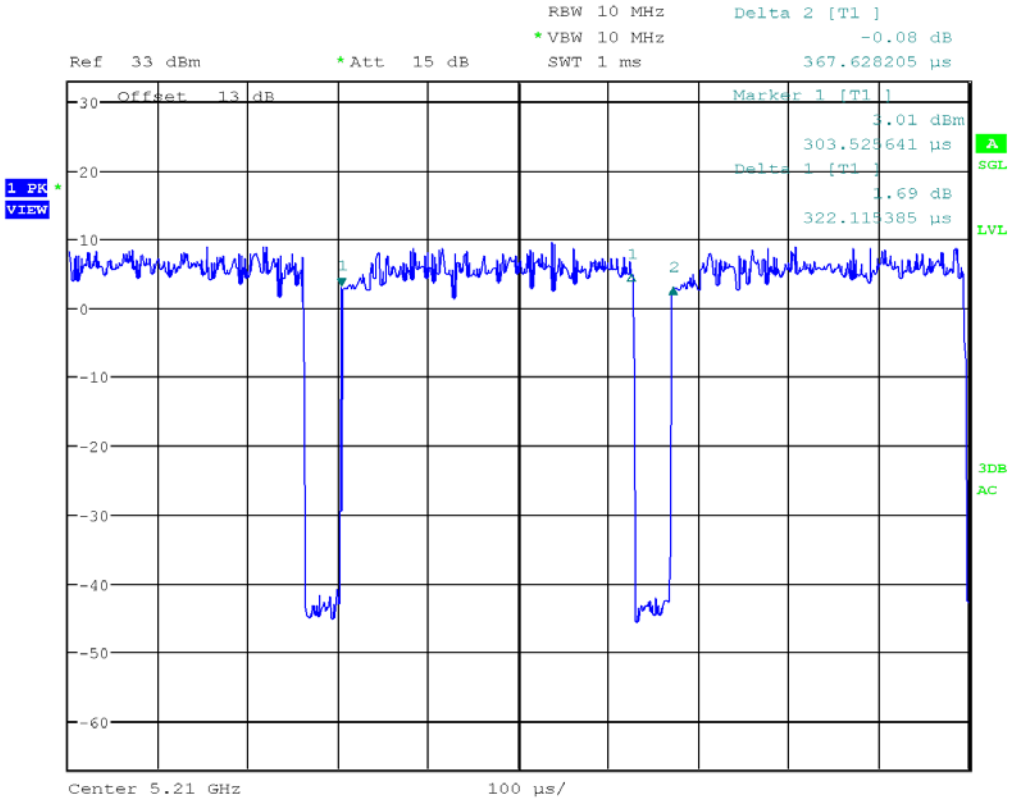
plot A.2 – 802.11n20 duty cycle



plot A.3 – 802.11n40 duty cycle



plot A.4 – 802.11ac80 duty cycle



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