

TEST REPORT

Reference No. : WTF20S05031693W002
FCC ID..... : 2AWKO-IE1200M
Applicant..... : Innovative Energy Systems and Technology Pte Ltd
Address : 102F Pasir Panjang Road. #03-03. Citilink Warehouse, Singapore 118530
Manufacturer : Shenzhen Leadingplus Electronic Co.,Ltd.
Address : NO. 337-339, B Block, JieMeiKang Creative Industry Park, Donghuan Road, Longhua New District, Shenzhen, Guangdong, China
Product Name : WiFi-AC Booster
Model No. : IE-1200M
Brand : Innovative Energy
Standards : FCC CFR47 Part 15 E Section 15.407: 2018
Date of Receipt sample..... : 2020-05-27
Date of Test..... : 2020-05-28 to 2020-06-16
Date of Issue : 2020-06-17
Test Result : **Pass**

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company.
The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:

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2 Contents

	Page
1 COVER PAGE.....	1
2 CONTENTS	2
3 REVISION HISTORY	4
4 GENERAL INFORMATION.....	5
4.1 GENERAL DESCRIPTION OF E.U.T.	5
4.2 DETAILS OF E.U.T.	5
4.3 CHANNEL LIST	5
4.4 TEST MODE DESCRIPTION:.....	7
4.5 TEST FACILITY	8
5 EQUIPMENT USED DURING TEST	9
5.1 EQUIPMENTS LIST	9
5.2 DESCRIPTION OF SUPPORT UNITS	10
5.3 MEASUREMENT UNCERTAINTY	10
5.4 TEST EQUIPMENT CALIBRATION	10
6 TEST SUMMARY	11
7 CONDUCTED EMISSION	12
7.1 E.U.T. OPERATION	12
7.2 EUT SETUP.....	12
7.3 MEASUREMENT DESCRIPTION	12
7.4 CONDUCTED EMISSION TEST RESULT	13
8 RADIATED EMISSIONS.....	15
8.1 EUT OPERATION.....	15
8.2 TEST SETUP	16
8.3 SPECTRUM ANALYZER SETUP	17
8.4 TEST PROCEDURE	18
8.5 CORRECTED AMPLITUDE & MARGIN CALCULATION	18
8.6 SUMMARY OF TEST RESULTS	19
9 DUTY CYCLE.....	29
9.1 SUMMARY OF TEST RESULTS	29
10 BAND EDGE	36
10.1 TEST PRODUCE	36
10.2 TEST RESULT	37
11 26 DB BANDWIDTH AND 99% OCCUPIED BANDWIDTH	49
11.1 TEST PROCEDURE:.....	49
11.2 TEST RESULT:	50
12 CONDUCTED OUTPUT POWER	65
12.1 TEST PROCEDURE:.....	65
12.2 TEST RESULT :	66
13 POWER SPECTRAL DENSITY	81
13.1 TEST PROCEDURE:.....	81
13.2 TEST RESULT:	82
14 FREQUENCY STABILITY.....	97
14.1 TEST PROCEDURE:.....	97
14.2 TEST RESULT:	98
15 ANTENNA REQUIREMENT	101

16 RF EXPOSURE.....102

17 PHOTOGRAPHS OF TEST SETUP AND EUT.....103

3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTF20S05031 693W002	2020-05-27	2020-05-28 to 2020-06-16	2020-06-17	original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	WiFi-AC Booster
Model(s):	IE-1200M
Model Description:	N/A
Wi-Fi Specification:	2.4G-802.11b/g/n HT20/n HT40 5G-802.11a/n/ac HT20 /n/ac HT40 /ac HT80
Hardware Version:	V1.0
Software Version:	V1.0

4.2 Details of E.U.T.

Operation Frequency:	802.11a/ n(HT20/40)/ac(HT20/40/80): 5150MHz to 5250MHz
Max. RF output power:	18.64dBm
Type of Modulation:	OFDM
Antenna installation:	internal permanent antenna
Antenna Gain:	1.0dBi
Ratings:	Input: AC 100-240V~50/60Hz

4.3 Channel List

Band I (5.15-5.25GHz)			
channel	Frequency(MHz)	channel	Frequency(MHz)
36	5180	38	5190
40	5200	42	5210
44	5220	46	5230
48	5240		

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

For 802.11a/n(HT20)/ac(HT20):

channel	Frequency(MHz)	channel	Frequency(MHz)
36	5180	40	5200
48	5240		

For 802.11 n(HT40)/ac(HT40):

channel	Frequency(MHz)	channel	Frequency(MHz)
38	5190	46	5230

For 802.11 ac(HT80):

channel	Frequency(MHz)	channel	Frequency(MHz)
42	5210		

4.4 Test Mode Description:

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Transmitting duty cycle is no less 98%.

The software is installed in operation system, named "RFTestTool.apk", Version 1, date 20160518.

Test Items	Mode	Data Rate	Channel	TX/RX
Radiated Emissions	802.11a	6 Mbps	U-NII-1 36/40/48	TX
	802.11n(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11n(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11ac(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT80)	MCS0	U-NII-1 42	TX
Duty Cycle	802.11a	6 Mbps	U-NII-1 36/40/48	TX
	802.11n(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11n(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11ac(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT80)	MCS0	U-NII-1 42	TX
Band Edge	802.11a	6 Mbps	U-NII-1 36/40/48	TX
	802.11n(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11n(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11ac(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT80)	MCS0	U-NII-1 42	TX
6dB Bandwidth	802.11a	6 Mbps	U-NII-1 36/40/48	TX
	802.11n(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11n(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11ac(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT80)	MCS0	U-NII-1 42	TX
26dB Bandwidth and 99% Occupied Bandwidth	802.11a	6 Mbps	U-NII-1 36/40/48	TX
	802.11n(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11n(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11ac(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT80)	MCS0	U-NII-1 42	TX

Conducted Output Power	802.11a	6 Mbps	U-NII-1 36/40/48	TX
	802.11n(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11n(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11ac(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT80)	MCS0	U-NII-1 42	TX
Power Spectral Density	802.11a	6 Mbps	U-NII-1 36/40/48	TX
	802.11n(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11n(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT20)	MCS0	U-NII-1 36/40/48	TX
	802.11ac(HT40)	MCS0	U-NII-1 38/46	TX
	802.11ac(HT80)	MCS0	U-NII-1 42	TX
Frequency Stability	Un-modulation	/	U-NII-1 36/40/48	TX

4.5 Test Facility

The test facility has a test site registered with the following organizations:

ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.

Waltek Services(Shenzhen) Co., Ltd. Has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files.

Registration number 7760A, October 15, 2016.

FCC Designation No.: CN1201. Test Firm Registration No.: 523476.

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration number 523476, September 10, 2019.

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions Test Site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	100947	2019-09-17	2020-09-16
2.	LISN	R&S	ENV216	101215	2019-09-17	2020-09-16
3.	Cable	Top	TYPE16(3.5M)	-	2019-09-17	2020-09-16
Conducted Emissions Test Site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101155	2019-09-17	2020-09-16
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	2019-09-17	2020-09-16
3.	Limiter	York	MTS-IMP-136	261115-001-0024	2019-09-17	2020-09-16
4.	Cable	LARGE	RF300	-	2019-09-17	2020-09-16
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP	100091	2020-04-20	2021-04-19
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	2020-04-20	2021-04-19
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2019-08-11	2020-08-10
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2019-09-17	2020-09-16
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2020-04-19	2021-04-18
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2020-04-20	2021-04-19
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2020-04-20	2021-04-19
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	2020-04-20	2021-04-19
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	2020-04-20	2021-04-19
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2020-04-25	2021-04-24
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	2020-04-20	2021-04-19
4	Cable	HUBER+SUHNER	CBL2	525178	2020-04-20	2021-04-19
RF Conducted Testing						

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	2019-09-17	2020-09-16
2.	Spectrum Analyzer (9k~6GHz)	R&S	FSL6	100959	2019-09-17	2020-09-16
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	2019-09-17	2020-09-16

5.2 Description of Support Units

Equipment	Manufacturer	Model No.	Series No.
/	/	/	/

5.3 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (30M~1000MHz)
	± 5.47 dB (1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)

5.4 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

6 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207(a)	PASS
Radiated Emissions	15.407(a) 15.205(a) 15.209(a)	PASS
Duty Cycle	KDB 789033	--
6dB Bandwidth	15.407(a)	N/A
26 dB Emission Bandwidth & 99% Occupied Bandwidth	15.407(a)	PASS
Maximum Conducted Output Power	15.407(a)	PASS
Power Spectral Density	15.407(a)	PASS
Restricted bands around fundamental frequency	15.407(a)	PASS
Antenna Requirement	15.203	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

7 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.10:2013
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

7.1 E.U.T. Operation

Operating Environment :

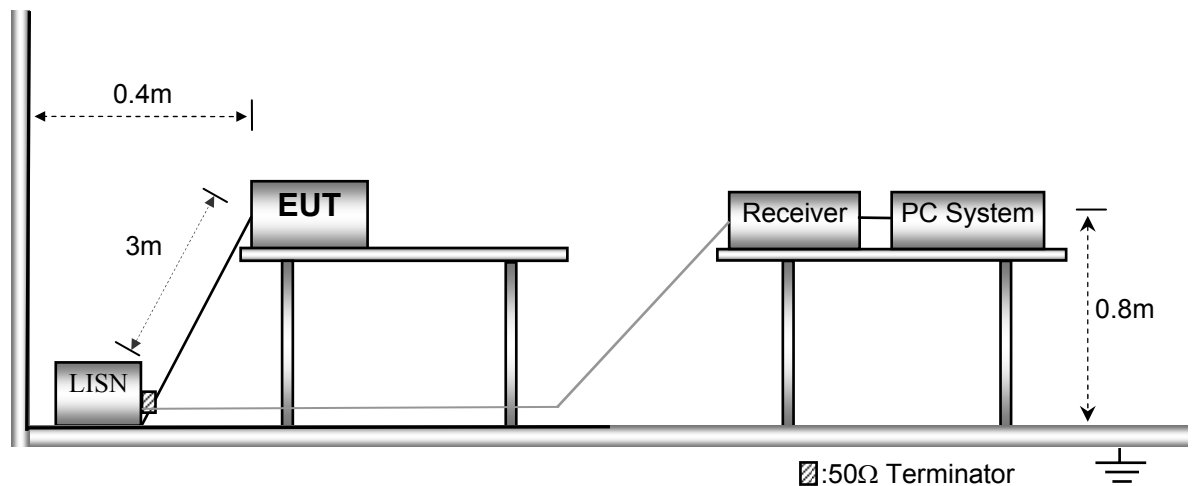
Temperature:	21.5 °C
Humidity:	51.9 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation :

The test was performed in transmitting mode, the test data were shown in the report.

7.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.



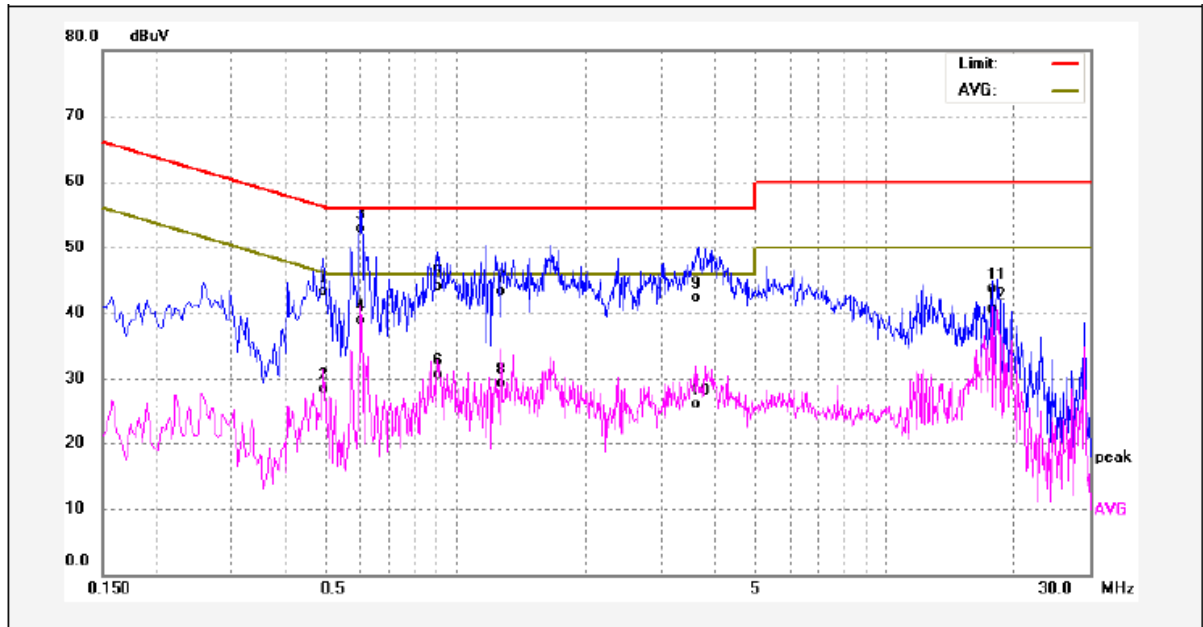
7.3 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

7.4 Conducted Emission Test Result

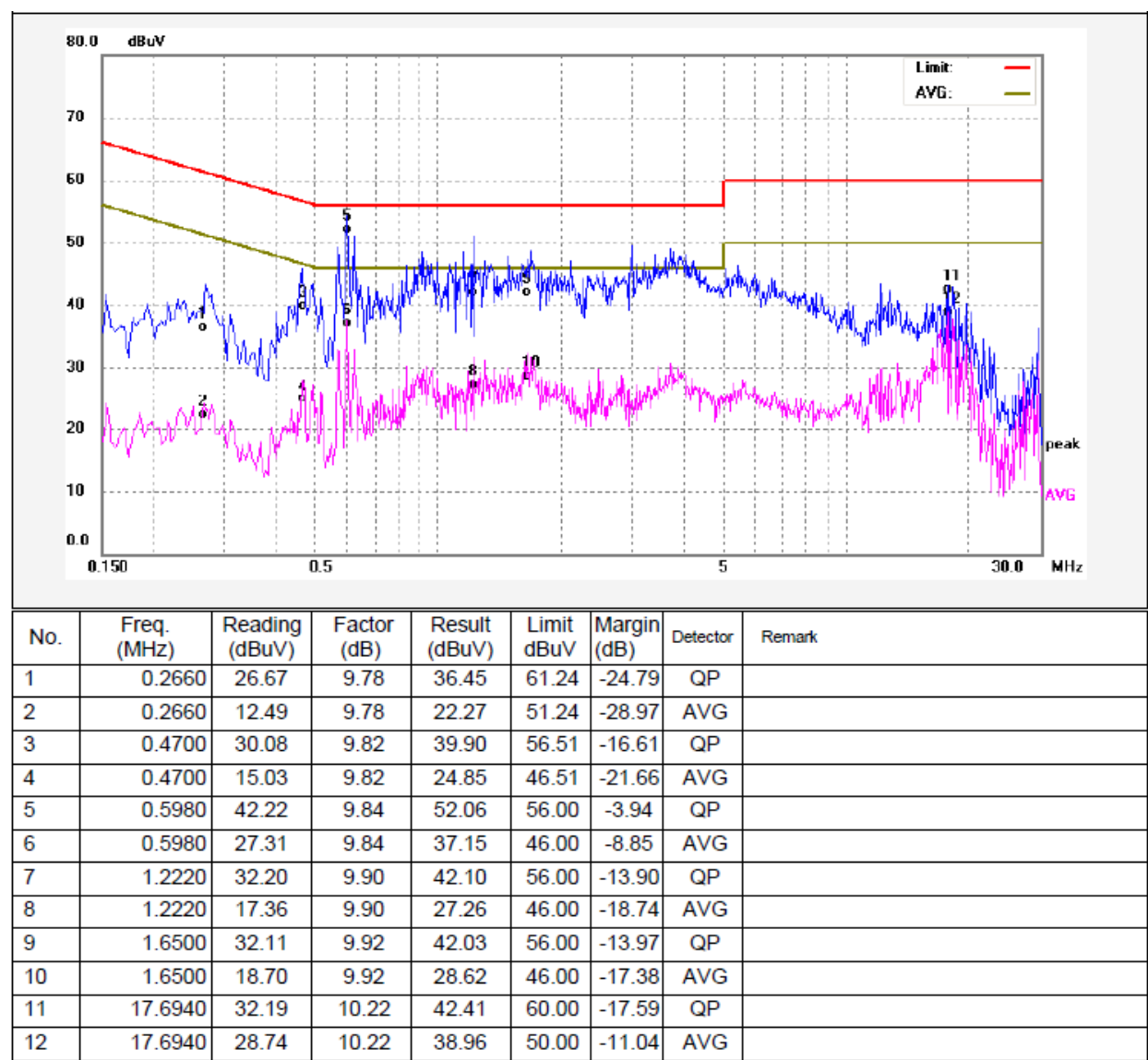
An initial pre-scan was performed on the live and neutral lines.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.4900	33.59	9.81	43.40	56.17	-12.77	QP	
2	0.4900	18.79	9.81	28.60	46.17	-17.57	AVG	
3	0.5980	43.05	9.84	52.89	56.00	-3.11	QP	
4	0.5980	28.98	9.84	38.82	46.00	-7.18	AVG	
5	0.9060	34.14	9.87	44.01	56.00	-11.99	QP	
6	0.9060	20.81	9.87	30.68	46.00	-15.32	AVG	
7	1.2740	33.47	9.90	43.37	56.00	-12.63	QP	
8	1.2740	19.44	9.90	29.34	46.00	-16.66	AVG	
9	3.6260	32.29	9.94	42.23	56.00	-13.77	QP	
10	3.6260	16.24	9.94	26.18	46.00	-19.82	AVG	
11	17.6940	33.54	10.22	43.76	60.00	-16.24	QP	
12	17.6940	30.41	10.22	40.63	50.00	-9.37	AVG	

Neutral line:



8 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.407

Test Method: ANSI C63.10:2013

Test Result: PASS

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Distance	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
1.705 ~ 30	30	30	$100 * 30$	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

8.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

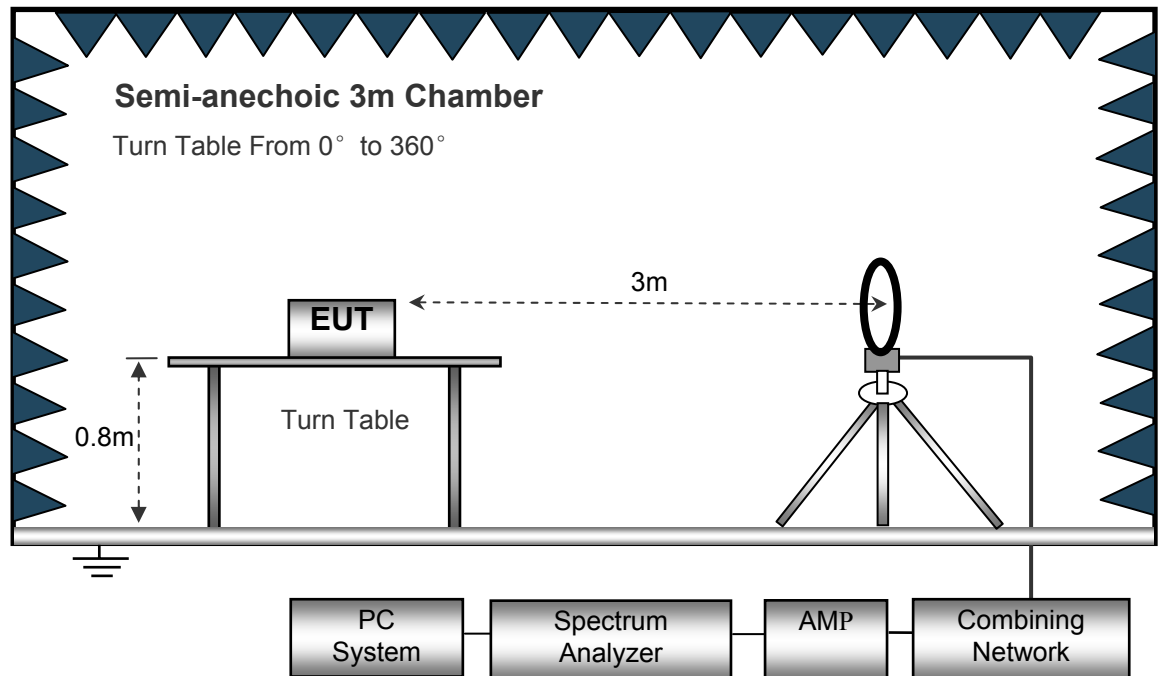
EUT Operation :

The test was performed in transmitting mode, the test data were shown in the report.

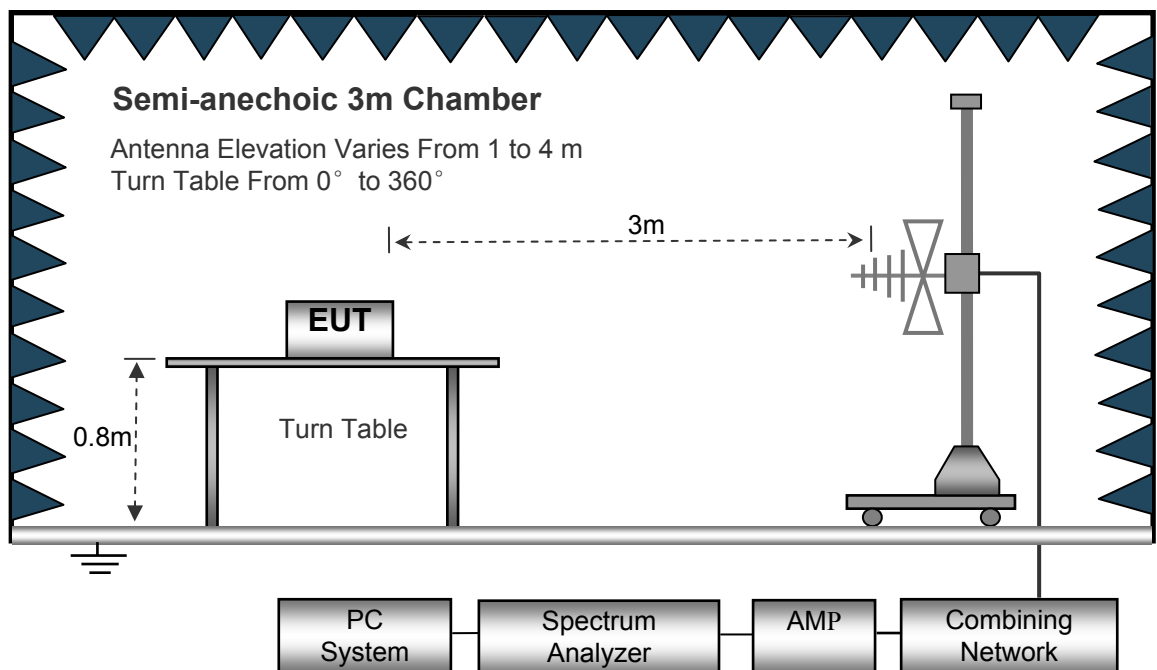
8.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10: 2013.

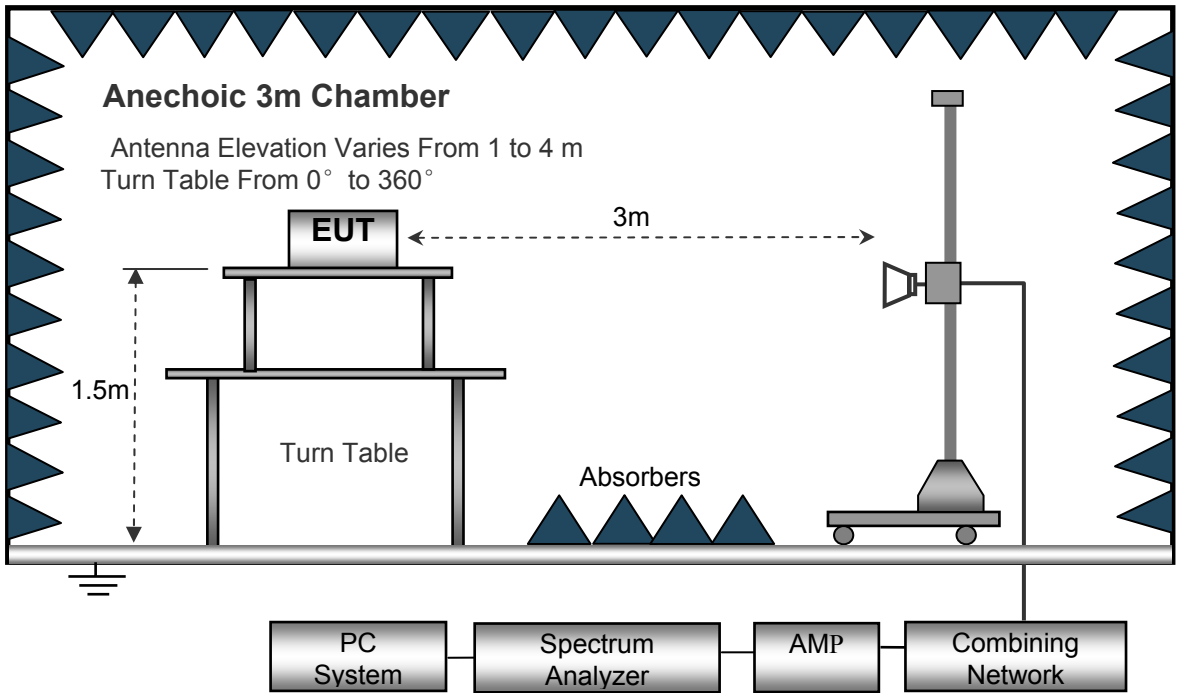
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



8.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed Auto
IF Bandwidth.....10kHz
Video Bandwidth.....10kHz
Resolution Bandwidth.....10kHz

30MHz ~ 1GHz

Sweep Speed Auto
Detector PK
Resolution Bandwidth.....100kHz
Video Bandwidth.....300kHz

Above 1GHz

Sweep Speed Auto
Detector PK
Resolution Bandwidth.....1MHz
Video Bandwidth.....3MHz
Detector Ave.
Resolution Bandwidth.....1MHz
Video Bandwidth.....10Hz

8.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are performed in X,Y and Z axis positioning(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand),the worst condition was tested putting the eut in X axis,so the worst data were shown as follow.
8. A 2.4GHz high -pass filter is used during radiated emissions above 1GHz measurement.

8.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

8.6 Summary of Test Results

Test Frequency: 9KHz~30MHz

Frequency	Measurement results dBμV @3m	Detector PK/QP	Correct factor dB/m	Extrapolation factor dB	Measurement results (calculated) dBμV/m @30m	Limits dBμV/m @30m	Margin dB
(MHz)	Measurement results	Detector	Correct factor	Extrapolation factor	Measurement results (calculated)	Limits	Margin
ANT1+ANT2 U-NII-1:802.11a 5180MHz							
6.021	25.11	QP	21.84	40.00	6.95	29.54	-22.59
15.730	24.56	QP	21.35	40.00	5.91	29.54	-23.63
25.680	25.30	QP	20.67	40.00	5.97	29.54	-23.57
ANT1+ANT2 U-NII-1:802.11n20 5180MHz							
6.021	25.04	QP	21.84	40.00	6.88	29.54	-22.66
15.730	25.33	QP	21.35	40.00	6.68	29.54	-22.86
25.680	24.56	QP	20.67	40.00	5.23	29.54	-24.31
ANT1+ANT2 U-NII-1:802.11ac 20 5180MHz							
6.021	24.36	QP	21.84	40.00	6.20	29.54	-23.34
15.730	25.83	QP	21.35	40.00	7.18	29.54	-22.36
25.680	25.79	QP	20.67	40.00	6.46	29.54	-23.08
ANT1+ANT2 U-NII-1:802.11n40 5190MHz							
6.021	24.71	QP	21.84	40.00	6.55	29.54	-22.99
15.730	25.38	QP	21.35	40.00	6.73	29.54	-22.81
25.680	25.61	QP	20.67	40.00	6.28	29.54	-23.26
ANT1+ANT2 U-NII-1:802.11ac40 5190MHz							
6.021	24.33	QP	21.84	40.00	6.17	29.54	-23.37
15.730	25.62	QP	21.35	40.00	6.97	29.54	-22.57
25.680	25.32	QP	20.67	40.00	5.99	29.54	-23.55
ANT1+ANT2 U-NII-1:802.11ac80 5210MHz							
6.021	25.11	QP	21.84	40.00	6.95	29.54	-22.59
15.730	24.76	QP	21.35	40.00	6.11	29.54	-23.43
25.680	25.33	QP	20.67	40.00	6.00	29.54	-23.54

Test Frequency : 30MHz ~ 18GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
ANT1+ANT2 802.11a U-NII-1 Low Channel 5180MHz									
223.45	41.55	QP	112	1.0	H	-11.62	29.93	46.00	-16.07
223.45	37.25	QP	244	2.0	V	-11.62	25.63	46.00	-20.37
4527.51	51.49	PK	284	1.9	H	-2.03	49.46	74.00	-24.54
4527.51	46.75	Ave	284	1.9	H	-2.03	44.72	54.00	-9.28
5115.16	53.25	PK	55	1.4	H	-1.02	52.23	74.00	-21.77
5115.16	48.45	Ave	55	1.4	H	-1.02	47.43	54.00	-6.57
10360.00	40.60	PK	216	1.2	H	5.33	45.93	74.00	-28.07
10360.00	35.68	Ave	216	1.2	H	5.33	41.01	54.00	-12.99
ANT1+ANT2 802.11a U-NII-1 Middle channel 5200MHz									
223.45	42.01	QP	6	1.4	H	-11.62	30.39	46.00	-15.61
223.45	36.12	QP	132	1.7	V	-11.62	24.50	46.00	-21.50
4522.71	50.96	PK	157	1.7	H	-1.94	49.02	74.00	-24.98
4522.71	47.22	Ave	157	1.7	H	-1.94	45.28	54.00	-8.72
5115.88	52.46	PK	255	1.8	H	-1.06	51.40	74.00	-22.60
5115.88	49.49	Ave	255	1.8	H	-1.06	48.43	54.00	-5.57
10400.00	40.67	PK	16	2.0	H	5.21	45.88	74.00	-28.12
10400.00	35.26	Ave	16	2.0	H	5.21	40.47	54.00	-13.53

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
ANT1+ANT2 802.11a U-NII-1 High channel 5240MHz									
223.45	43.24	QP	119	1.5	H	-11.62	31.62	46.00	-14.38
223.45	36.39	QP	36	1.9	V	-11.62	24.77	46.00	-21.23
4532.59	51.64	PK	316	2.0	H	-2.24	49.40	74.00	-24.60
4532.59	46.81	Ave	316	2.0	H	-2.24	44.57	54.00	-9.43
5125.24	52.75	PK	123	1.3	H	-1.09	51.66	74.00	-22.34
5125.24	48.58	Ave	123	1.3	H	-1.09	47.49	54.00	-6.51
10480.00	40.69	PK	74	1.6	H	5.14	45.83	74.00	-28.17
10480.00	35.99	Ave	74	1.6	H	5.14	41.13	54.00	-12.87

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
ANT1+ANT2 802.11n(HT20) U-NII-1 Low Channel 5180MHz									
223.45	42.31	QP	205	1.3	H	-11.62	30.69	46.00	-15.31
223.45	38.46	QP	192	2.0	V	-11.62	26.84	46.00	-19.16
4515.04	49.27	PK	15	1.0	H	-2.14	47.13	74.00	-26.87
4515.04	48.42	Ave	15	1.0	H	-2.14	46.28	54.00	-7.72
5130.35	47.96	PK	71	1.6	H	-1.06	46.90	74.00	-27.10
5130.35	38.47	Ave	71	1.6	H	-1.06	37.41	54.00	-16.59
10360.00	40.14	PK	66	1.4	H	5.33	45.47	74.00	-28.53
10360.00	34.48	Ave	66	1.4	H	5.33	39.81	54.00	-14.19
ANT1+ANT2 802.11n(HT20) U-NII-1 Middle channel 5200MHz									
223.45	43.37	QP	22	1.7	H	-11.62	31.75	46.00	-14.25
223.45	38.07	QP	258	1.8	V	-11.62	26.45	46.00	-19.55
4508.90	49.77	PK	231	1.5	H	-2.12	47.65	74.00	-26.35
4508.90	48.80	Ave	231	1.5	H	-2.12	46.68	54.00	-7.32
5147.29	49.80	PK	257	1.1	H	-1.06	48.74	74.00	-25.26
5147.29	39.19	Ave	257	1.1	H	-1.06	38.13	54.00	-15.87
10400.00	39.90	PK	84	1.5	H	5.21	45.11	74.00	-28.89
10400.00	35.36	Ave	84	1.5	H	5.21	40.57	54.00	-13.43

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
ANT1+ANT2 802.11n(HT20) U-NII-1 High channel 5240MHz									
223.45	42.93	QP	271	1.1	H	-11.62	31.31	46.00	-14.69
223.45	38.56	QP	227	1.0	V	-11.62	26.94	46.00	-19.06
4502.97	49.99	PK	111	1.1	H	-1.96	48.03	74.00	-25.97
4502.97	49.26	Ave	111	1.1	H	-1.96	47.30	54.00	-6.70
5139.51	51.05	PK	279	1.2	H	-1.06	49.99	74.00	-24.01
5139.51	38.61	Ave	279	1.2	H	-1.06	37.55	54.00	-16.45
10480.00	41.79	PK	36	1.8	H	5.14	46.93	74.00	-27.07
10480.00	35.78	Ave	36	1.8	H	5.14	40.92	54.00	-13.08

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
ANT1+ANT2 802.11n(HT40) U-NII-1 Low Channel 5190MHz									
223.45	36.78	QP	80	1.4	H	-11.62	25.16	46.00	-20.84
223.45	43.98	QP	73	1.0	V	-11.62	32.36	46.00	-13.64
4537.37	42.31	PK	312	1.5	H	-1.89	40.42	74.00	-33.58
4537.37	36.83	Ave	312	1.5	H	-1.89	34.94	54.00	-19.06
5143.58	45.93	PK	110	1.9	H	-1.06	44.87	74.00	-29.13
5143.58	37.72	Ave	110	1.9	H	-1.06	36.66	54.00	-17.34
10380.00	38.72	PK	244	1.6	H	5.26	43.98	74.00	-30.02
10380.00	33.58	Ave	244	1.6	H	5.26	38.84	54.00	-15.16
ANT1+ANT2 802.11n(HT40) U-NII-1 High channel 5230MHz									
223.45	37.69	QP	15	1.7	H	-11.62	26.07	46.00	-19.93
223.45	44.69	QP	309	1.4	V	-11.62	33.07	46.00	-12.93
4522.46	41.44	PK	341	1.8	H	-1.94	39.50	74.00	-34.50
4522.46	37.61	Ave	341	1.8	H	-1.94	35.67	54.00	-18.33
5121.75	45.33	PK	274	1.8	H	-1.06	44.27	74.00	-29.73
5121.75	38.73	Ave	274	1.8	H	-1.06	37.67	54.00	-16.33
10460.00	41.13	PK	334	1.3	H	5.28	46.41	74.00	-27.59
10480.00	35.67	Ave	334	1.3	H	5.28	40.95	54.00	-13.05

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
ANT1+ANT2 802.11ac(HT20) U-NII-1 Low Channel 5180MHz									
223.45	35.14	QP	212	1.0	H	-11.62	23.52	46.00	-22.48
223.45	47.36	QP	149	1.6	V	-11.62	35.74	46.00	-10.26
4523.99	45.84	PK	257	1.4	H	-1.86	43.98	74.00	-30.02
4523.99	38.90	Ave	257	1.4	H	-1.86	37.04	54.00	-16.96
5125.12	43.07	PK	169	1.1	H	-1.06	42.01	74.00	-31.99
5125.12	37.49	Ave	169	1.1	H	-1.06	36.43	54.00	-17.57
10360.00	45.13	PK	327	1.7	H	5.33	50.46	74.00	-23.54
10360.00	37.57	Ave	327	1.7	H	5.33	42.90	54.00	-11.10
ANT1+ANT2 802.11ac(HT20) U-NII-1 Middle channel 5200MHz									
223.45	34.25	QP	247	1.7	H	-11.62	22.63	46.00	-23.37
223.45	47.35	QP	292	1.7	V	-11.62	35.73	46.00	-10.27
4521.54	46.16	PK	350	2.0	H	-1.82	44.34	74.00	-29.66
4521.54	39.83	Ave	350	2.0	H	-1.82	38.01	54.00	-15.99
5123.29	43.95	PK	145	1.8	H	-1.06	42.89	74.00	-31.11
5123.29	37.49	Ave	145	1.8	H	-1.06	36.43	54.00	-17.57
10400.00	39.94	PK	159	1.5	H	5.21	45.15	74.00	-28.85
10400.00	36.17	Ave	159	1.5	H	5.21	41.38	54.00	-12.62

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
ANT1+ANT2 802.11ac(HT20) U-NII-1 High channel 5240MHz									
223.45	34.25	QP	118	1.2	H	-11.62	22.63	46.00	-23.37
223.45	47.34	QP	303	1.2	V	-11.62	35.72	46.00	-10.28
4528.47	47.11	PK	18	1.4	H	-1.81	45.30	74.00	-28.70
4528.47	39.52	Ave	18	1.4	H	-1.81	37.71	54.00	-16.29
5138.36	45.93	PK	304	2.0	H	-1.06	44.87	74.00	-29.13
5138.36	38.48	Ave	304	2.0	H	-1.06	37.42	54.00	-16.58
10480.00	39.68	PK	331	1.3	H	5.14	44.82	74.00	-29.18
10480.00	35.03	Ave	331	1.3	H	5.14	40.17	54.00	-13.83

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
ANT1+ANT2 802.11ac(HT40) U-NII-1 Low Channel 5190MHz									
223.45	36.74	QP	297	1.7	H	-11.62	25.12	46.00	-20.88
223.45	42.97	QP	16	1.5	V	-11.62	31.35	46.00	-14.65
4501.15	38.71	PK	138	1.4	H	-1.91	36.80	74.00	-37.20
4501.15	31.91	Ave	138	1.4	H	-1.91	30.00	54.00	-24.00
5148.93	47.65	PK	160	1.4	H	-1.06	46.59	74.00	-27.41
5148.93	38.35	Ave	160	1.4	H	-1.06	37.29	54.00	-16.71
10380.00	37.75	PK	211	1.6	H	5.26	43.01	74.00	-30.99
10380.00	33.29	Ave	211	1.6	H	5.26	38.55	54.00	-15.45
ANT1+ANT2 802.11ac(HT40) U-NII-1 High channel 5230MHz									
223.45	36.19	QP	207	1.3	H	-11.62	24.57	46.00	-21.43
223.45	42.66	QP	54	1.6	V	-11.62	31.04	46.00	-14.96
4516.41	38.20	PK	248	1.2	H	-1.93	36.27	74.00	-37.73
4516.41	32.58	Ave	248	1.2	H	-1.93	30.65	54.00	-23.35
5129.01	47.49	PK	205	1.8	H	-1.06	46.43	74.00	-27.57
5129.01	38.95	Ave	205	1.8	H	-1.06	37.89	54.00	-16.11
10460.00	39.78	PK	23	1.2	H	5.28	45.06	74.00	-28.94
10480.00	36.08	Ave	23	1.2	H	5.28	41.36	54.00	-12.64

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
ANT1+ANT2 802.11ac(HT80) U-NII-1 Low Channel 5210MHz									
223.45	42.83	QP	57	1.9	H	-11.62	31.21	46.00	-14.79
4520.37	36.46	QP	249	1.6	V	-11.62	24.84	46.00	-21.16
4519.52	31.18	PK	177	1.9	H	-1.88	29.30	74.00	-44.70
4519.52	41.52	Ave	177	1.9	H	-1.88	39.64	54.00	-14.36
5129.57	35.58	PK	329	2.0	H	-1.06	34.52	74.00	-39.48
5129.57	46.97	Ave	329	2.0	H	-1.06	45.91	54.00	-8.09
10420.00	39.71	PK	110	1.8	H	4.65	44.36	74.00	-29.64
10420.00	36.54	Ave	110	1.8	H	4.65	41.19	54.00	-12.81

Test Frequency: 18GHz~40GHz

The measurements were more than 20 dB below the limit and not reported.

9 Duty cycle

Test Requirement:	47 CFR Part 15C 15.407 KDB789033 D02 General U-NII Test Procedures New Rules v02r01, Section (B)
Test Method:	ANSI C63.10: 2013
Test Limit:	N/A
Test Result:	PASS
Remark:	Through Pre-scan, and found 802.11a at lowest channel is the worst case. Only the worst case is recorded in the report.

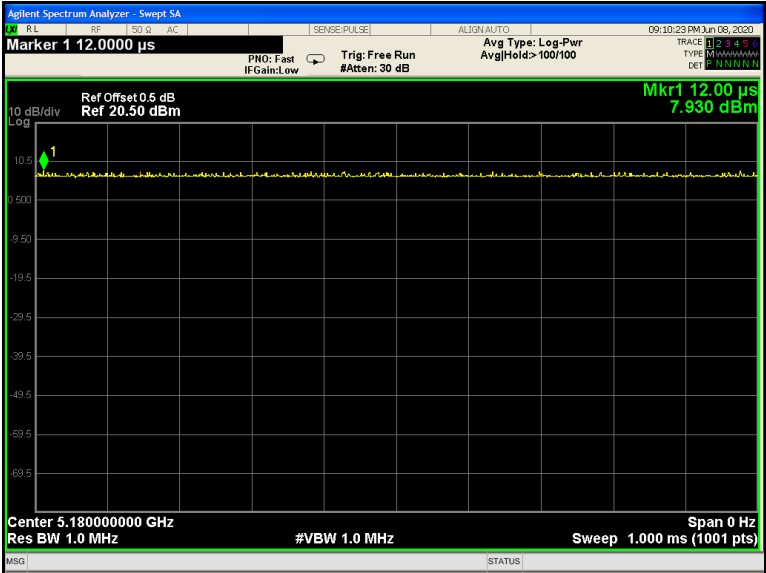
9.1 Summary of Test Results

802.11a mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
36	100	100	100
149	100	100	100
802.11n(HT20) mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
36	100	100	100
149	100	100	100
802.11n(HT40) mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
38	100	100	100
151	100	100	100
802.11ac(HT20) mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
36	100	100	100
149	100	100	100
802.11ac(HT40) mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
38	100	100	100
151	100	100	100
802.11ac(HT80) mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
42	100	100	100
155	100	100	100

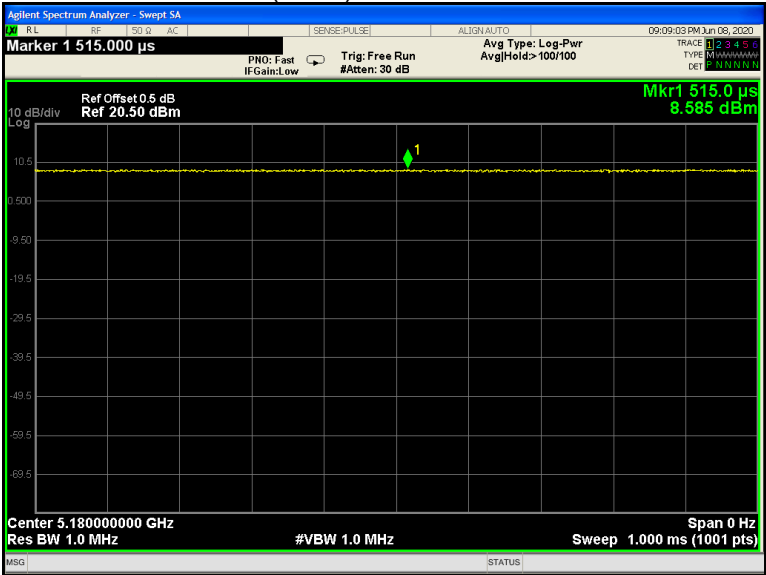
Test result plots shown as follows:

ANT 1

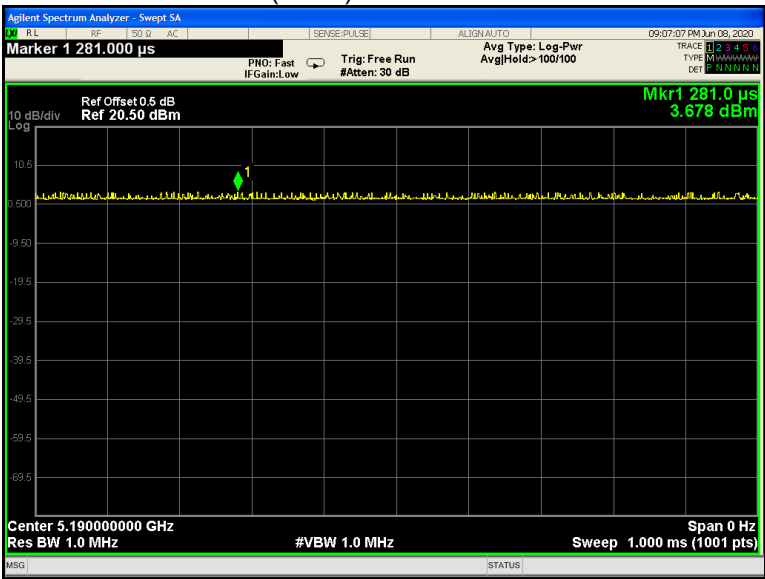
802.11a U-NII-1 Low channel



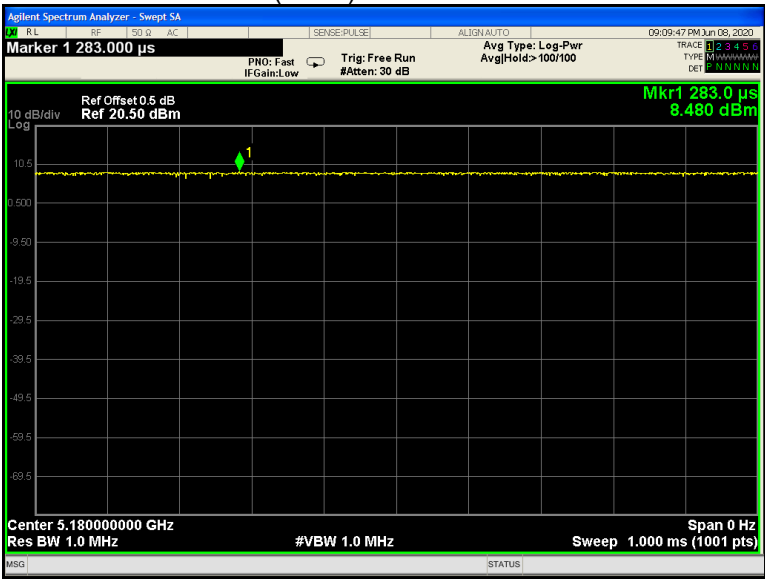
802.11n(HT20) U-NII-1 Low channel



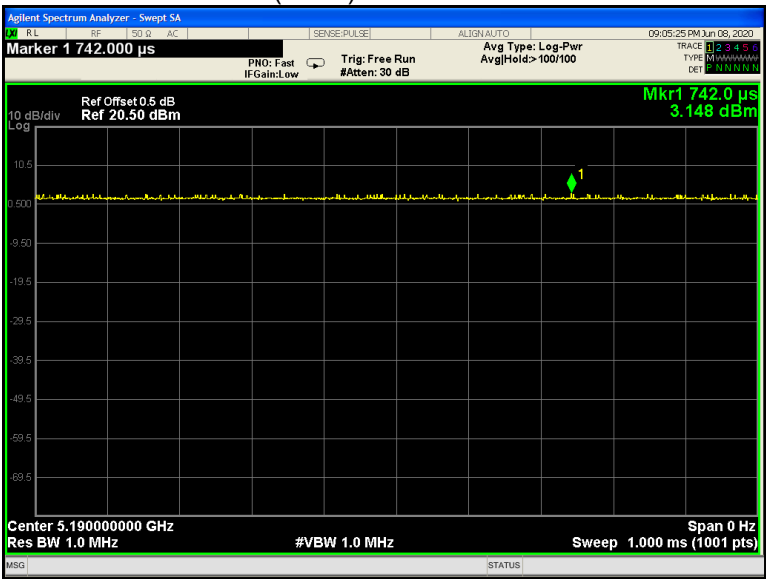
802.11n(HT40) U-NII-1 Low channel



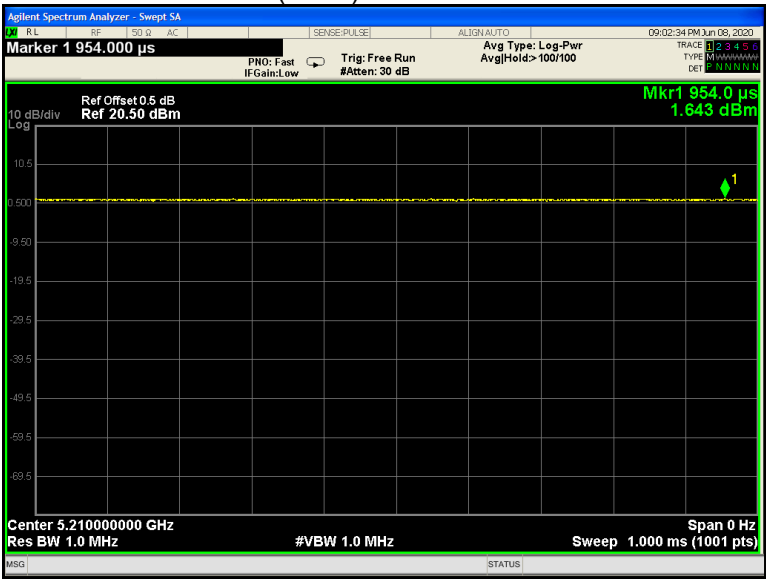
802.11ac(HT20) U-NII-1 Low channel



802.11ac(HT40) U-NII-1 Low channel

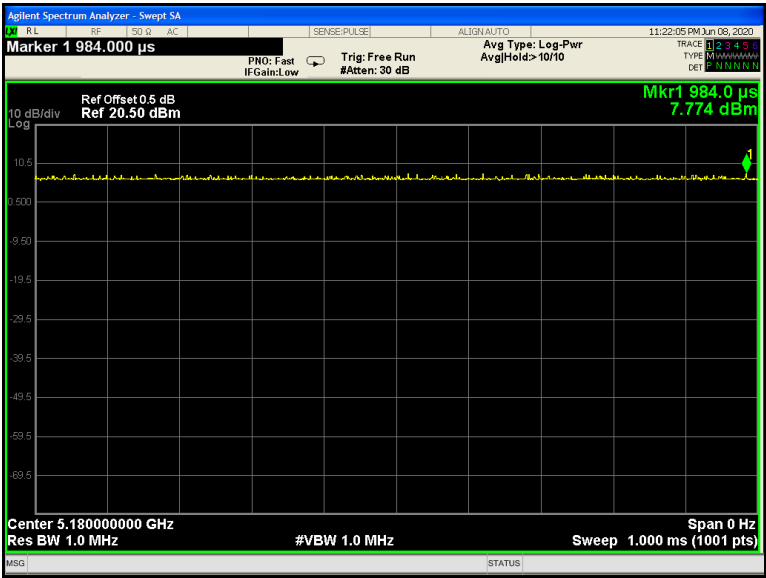


802.11ac(HT80) U-NII-1 Low channel

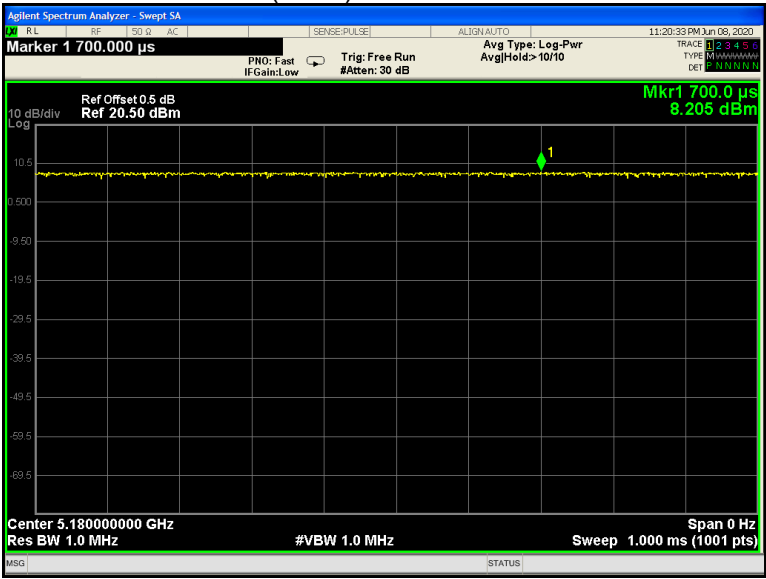


ANT 2

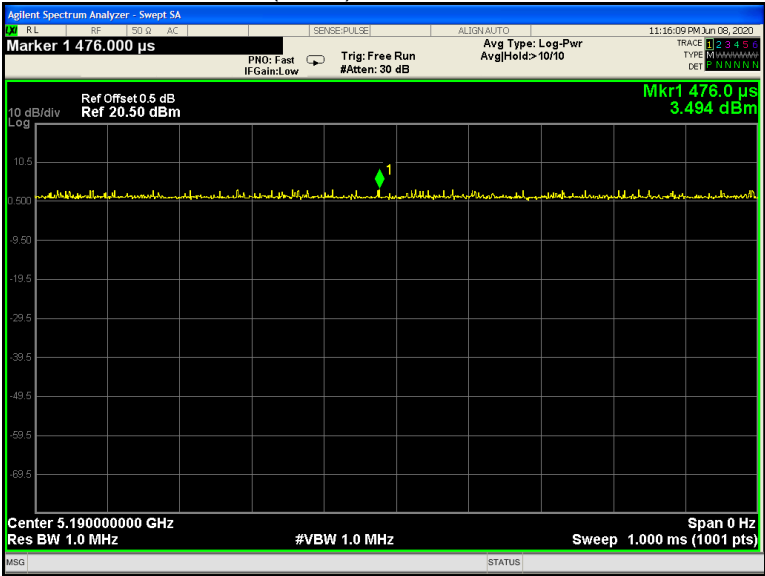
802.11a U-NII-1 Low channel



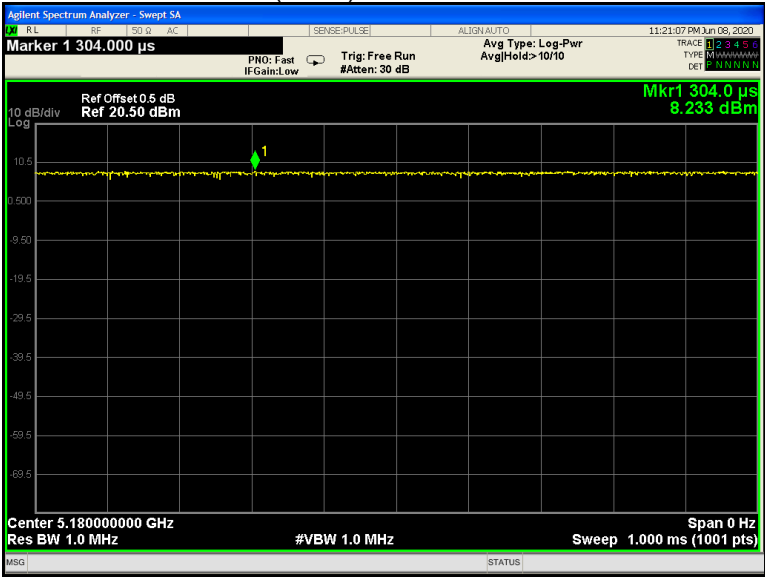
802.11n(HT20) U-NII-1 Low channel



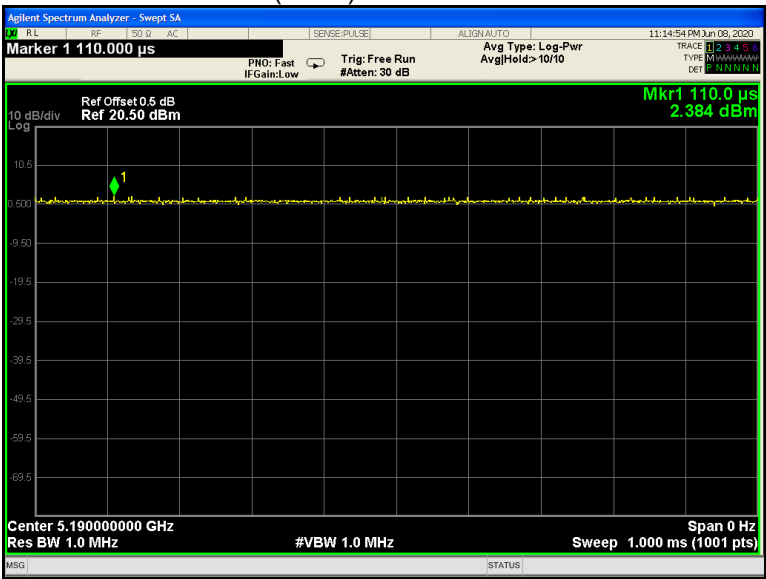
802.11n(HT40) U-NII-1 Low channel



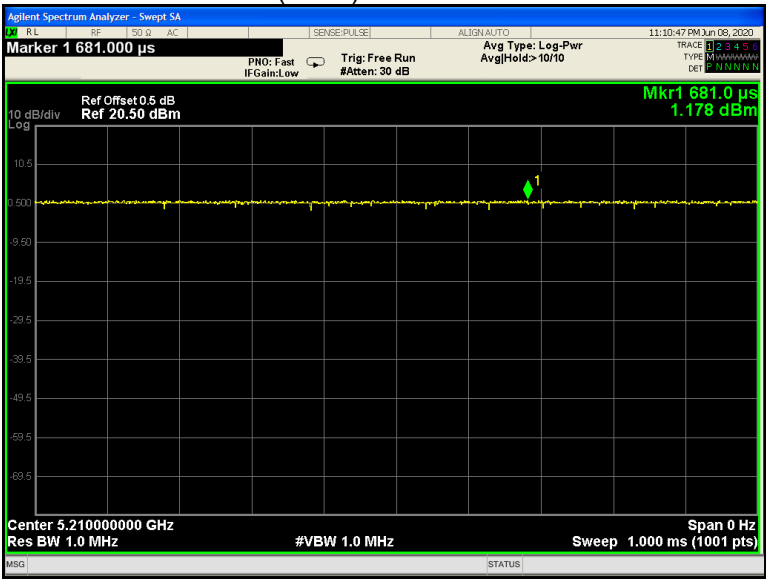
802.11ac(HT20) U-NII-1 Low channel



802.11ac(HT40) U-NII-1 Low channel



802.11ac(HT80) U-NII-1 Low channel



10 Band Edge

Test Requirement:	FCC CFR47 Part 15 Section 15.407
Test Method:	ANSI C63.10 2013
Test Limit:	(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 -27dBm/MHz. (2) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.
Test Result:	PASS

10.1 Test Produce

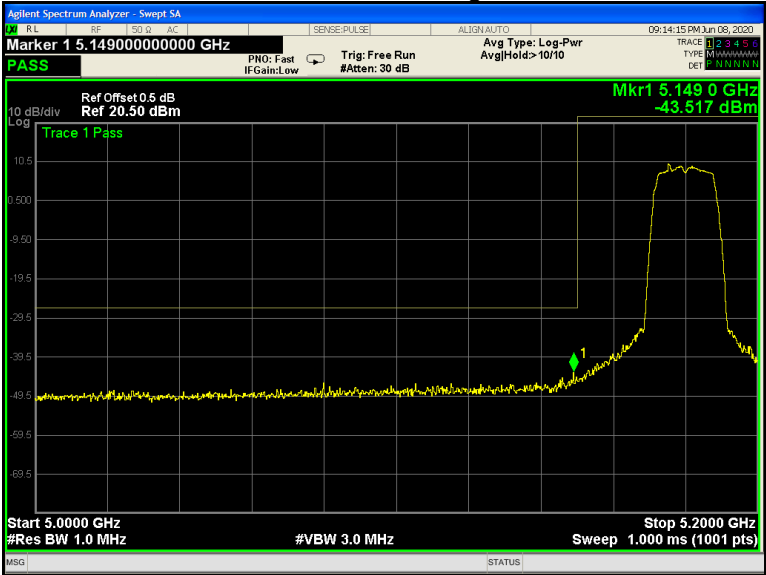
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

10.2 Test Result

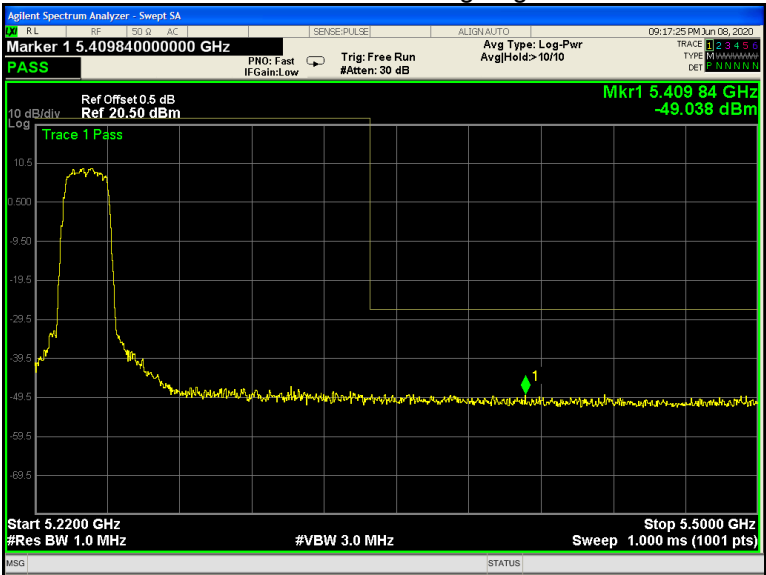
Test result plots shown as follows:

ANT 1

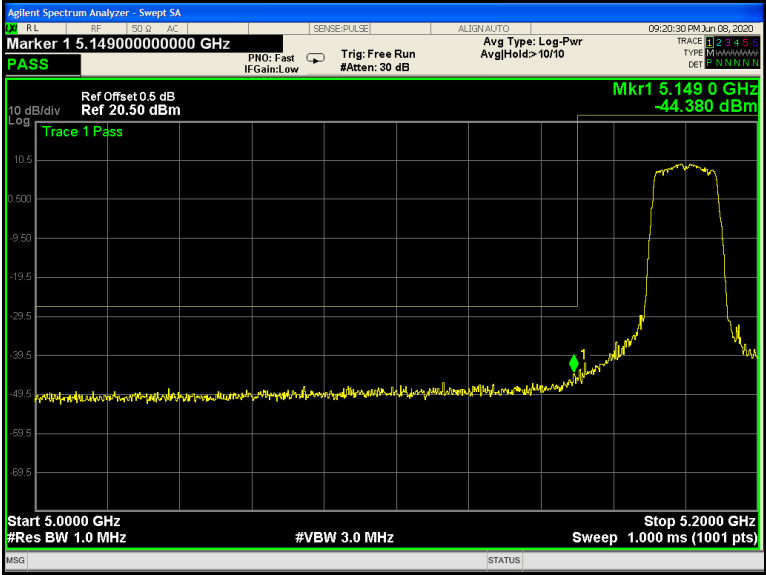
802.11a U-NII-1 Band edge-left side



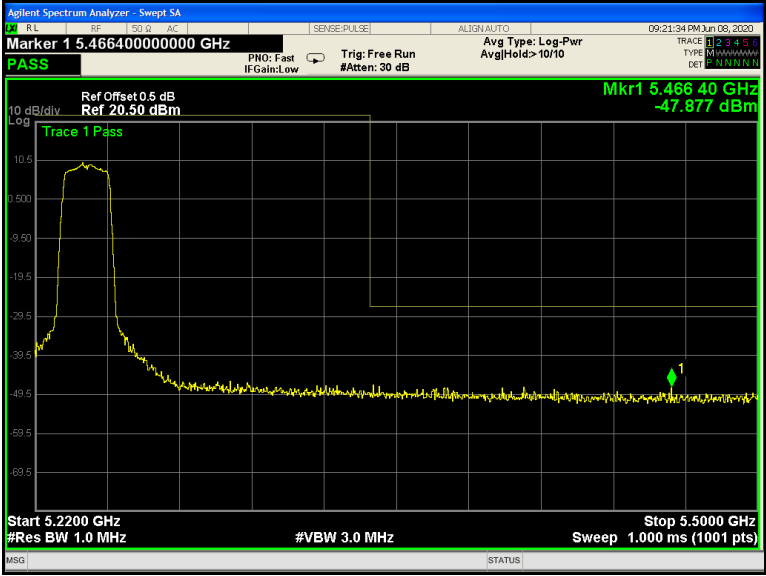
802.11a U-NII-1 Band edge-right side



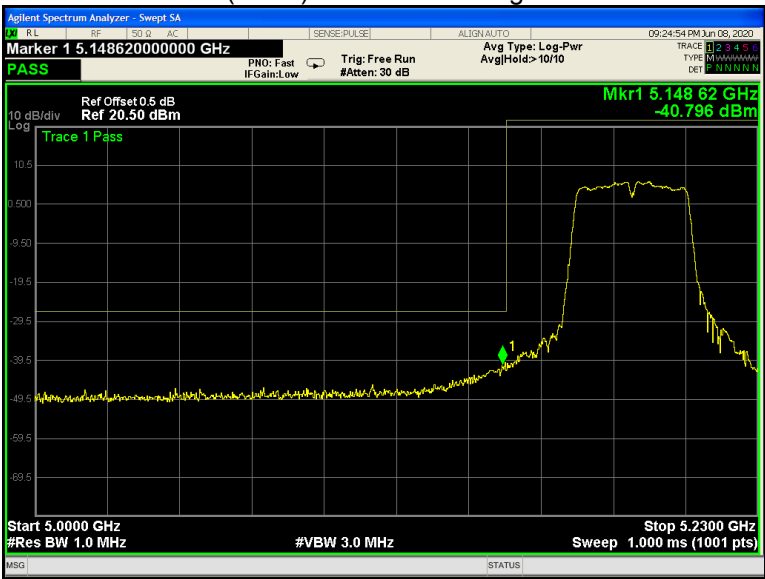
802.11n(HT20) U-NII-1 Band edge-left side



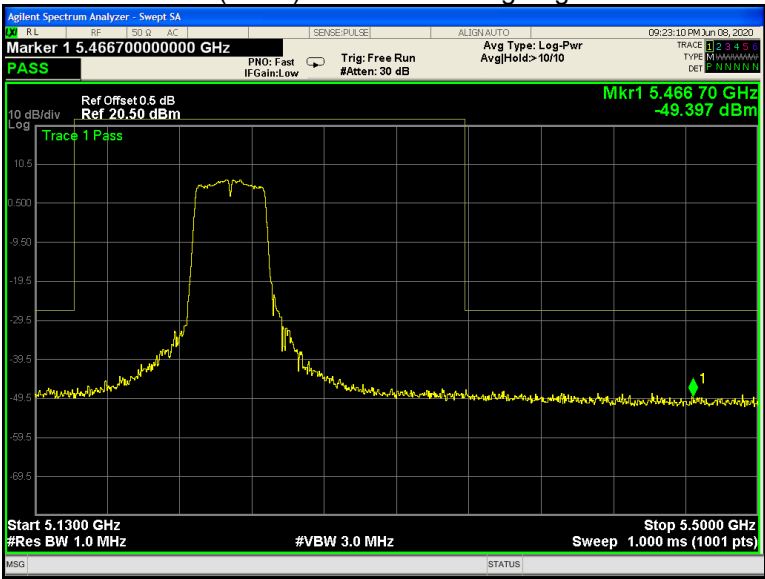
802.11n(HT20) U-NII-1 Band edge-right side



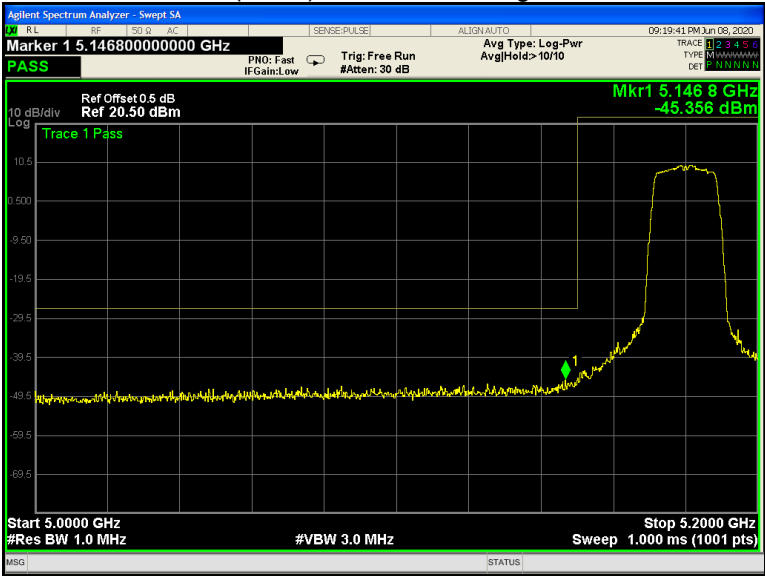
802.11n(HT40) U-NII-1 Band edge-left side



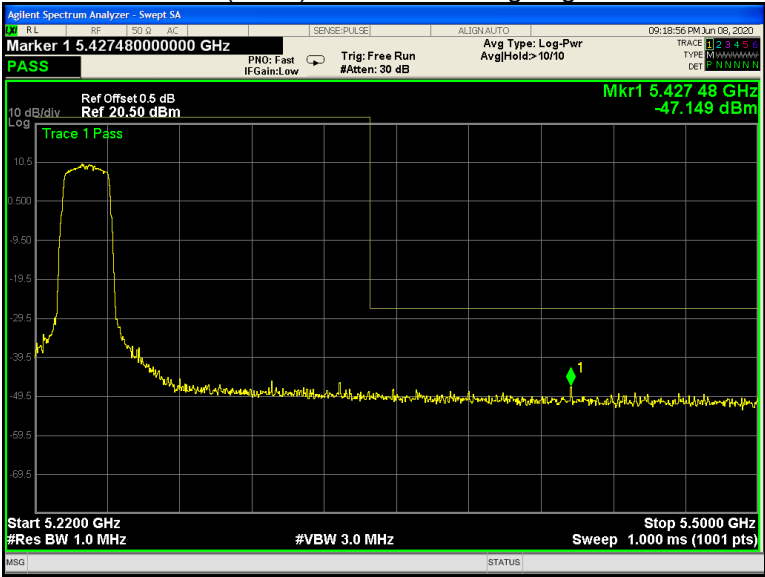
802.11n(HT40) U-NII-1 Band edge-right side



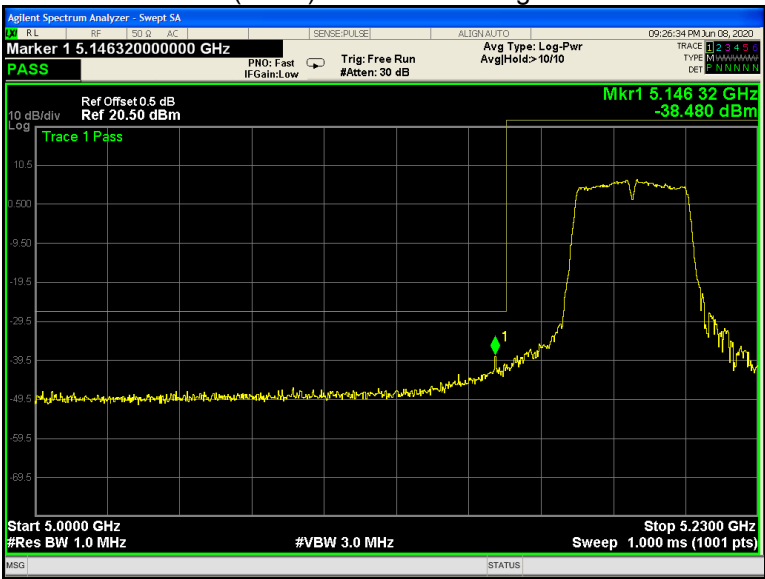
802.11ac(HT20) U-NII-1 Band edge-left side



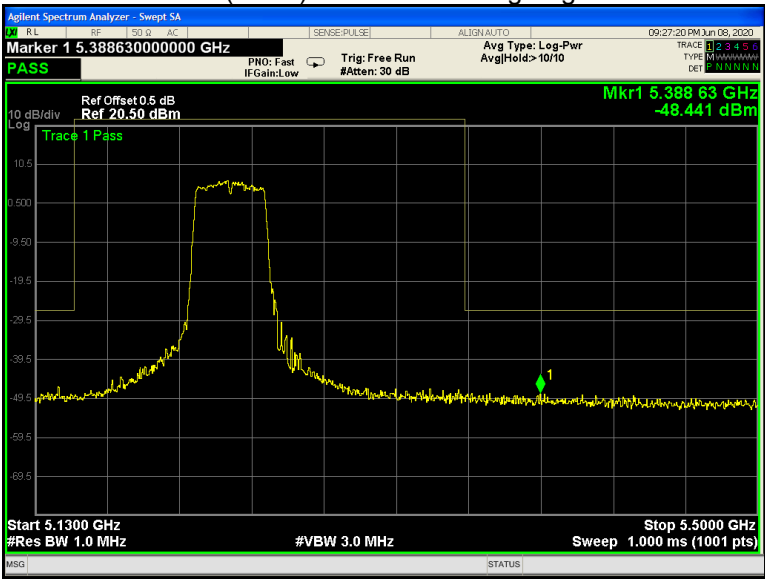
802.11ac(HT20) U-NII-1 Band edge-right side



802.11ac(HT40) U-NII-1 Band edge-left side



802.11ac(HT40) U-NII-1 Band edge-right side



802.11ac(HT80) U-NII-1 Band edge-left side

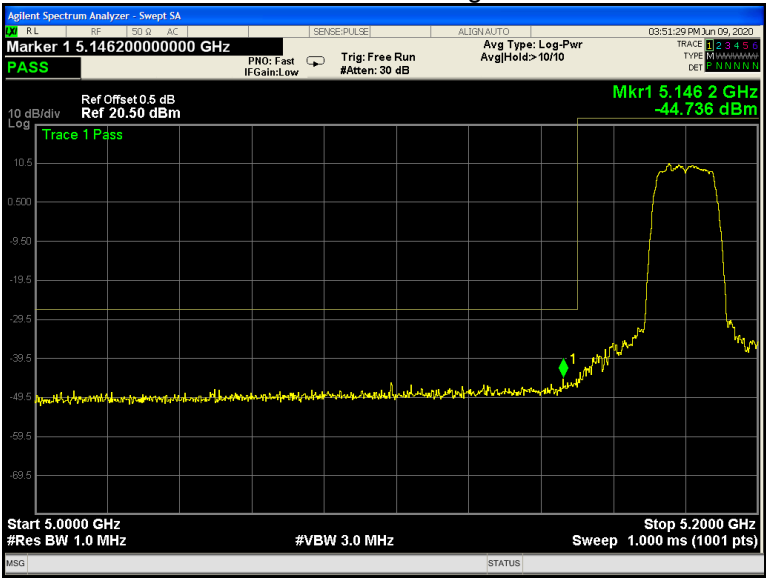


802.11ac(HT80) U-NII-1 Band edge-right side

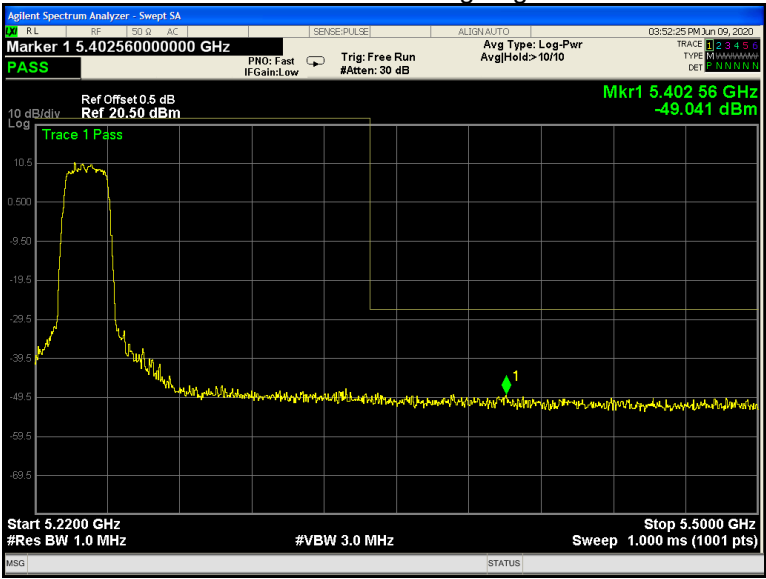


ANT 2

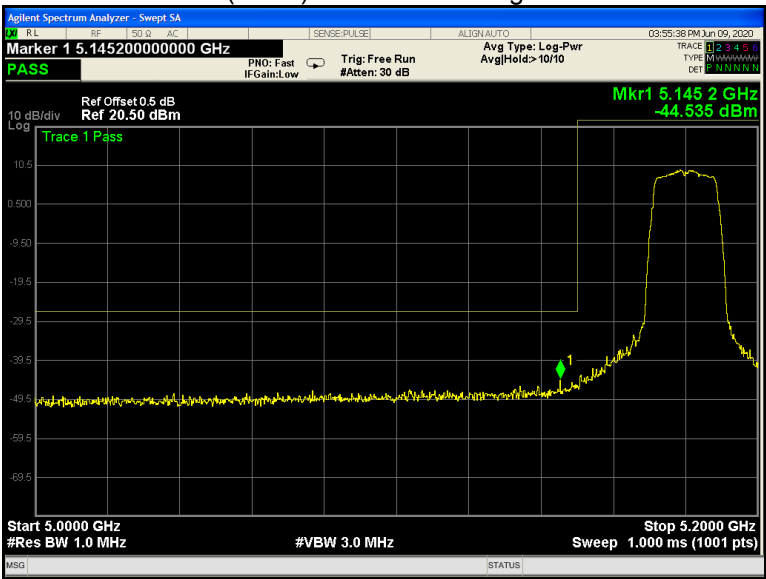
802.11a U-NII-1 Band edge-left side



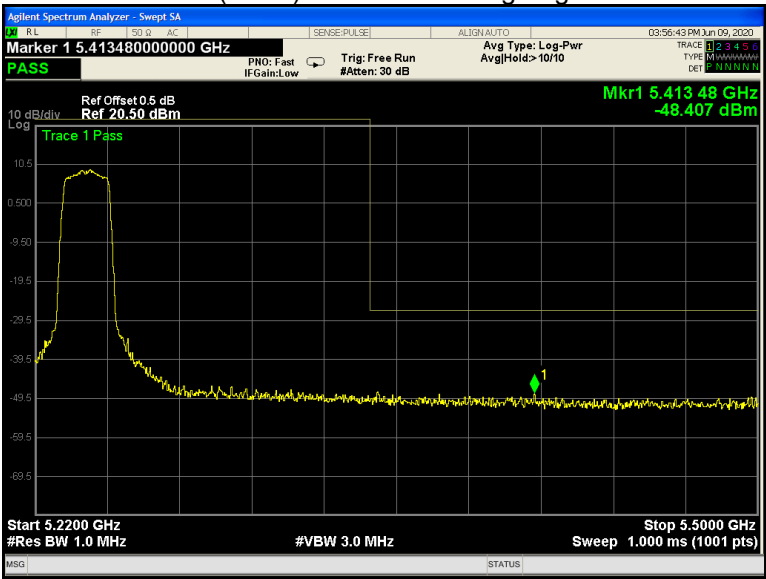
802.11a U-NII-1 Band edge-right side



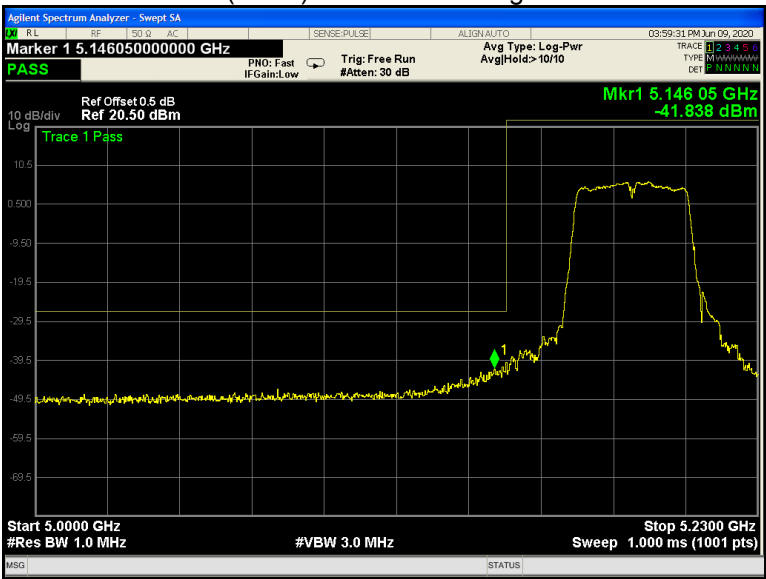
802.11n(HT20) U-NII-1 Band edge-left side



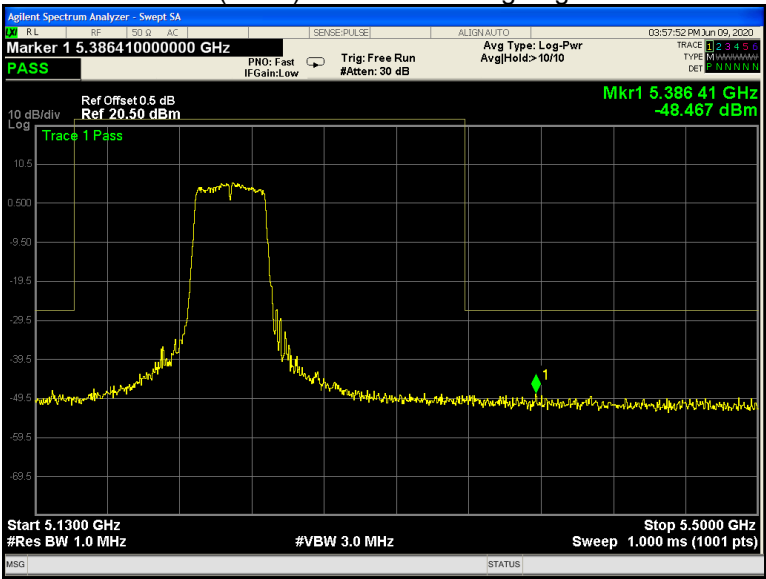
802.11n(HT20) U-NII-1 Band edge-right side



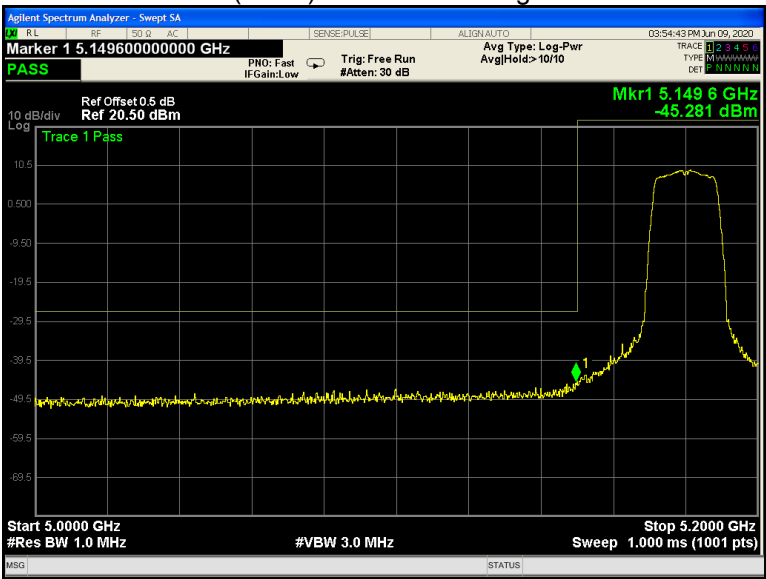
802.11n(HT40) U-NII-1 Band edge-left side



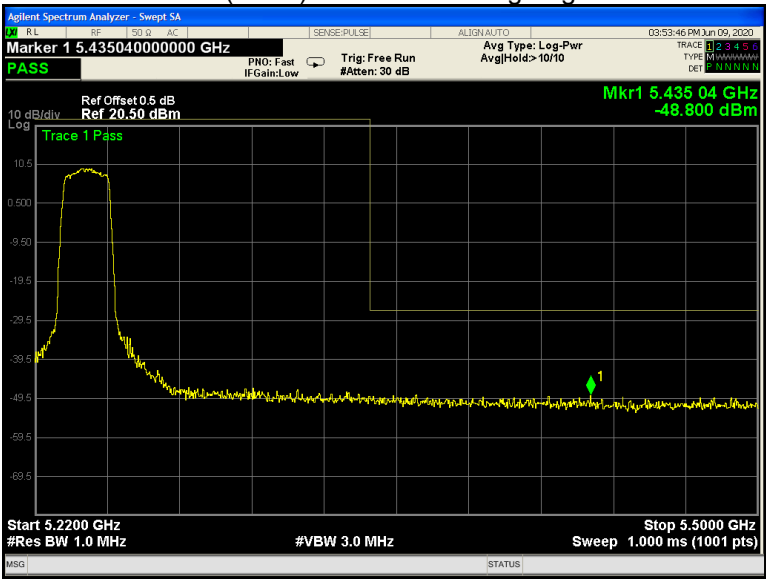
802.11n(HT40) U-NII-1 Band edge-right side



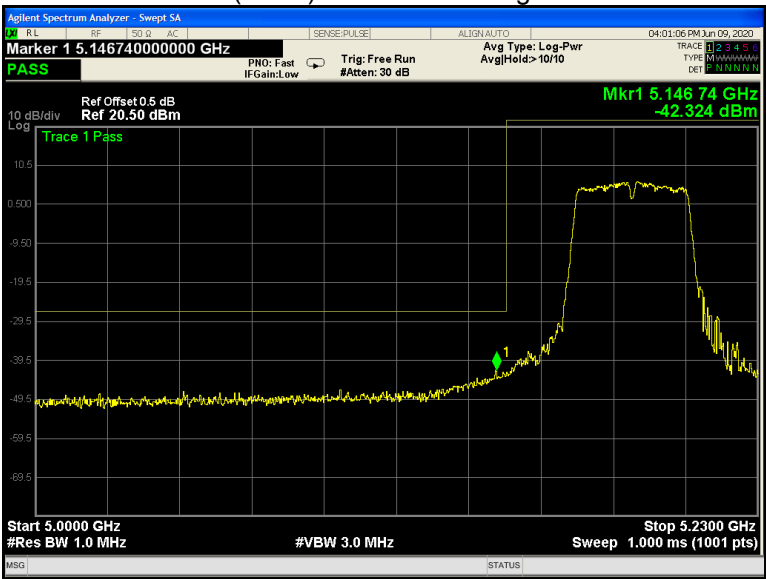
802.11ac(HT20) U-NII-1 Band edge-left side



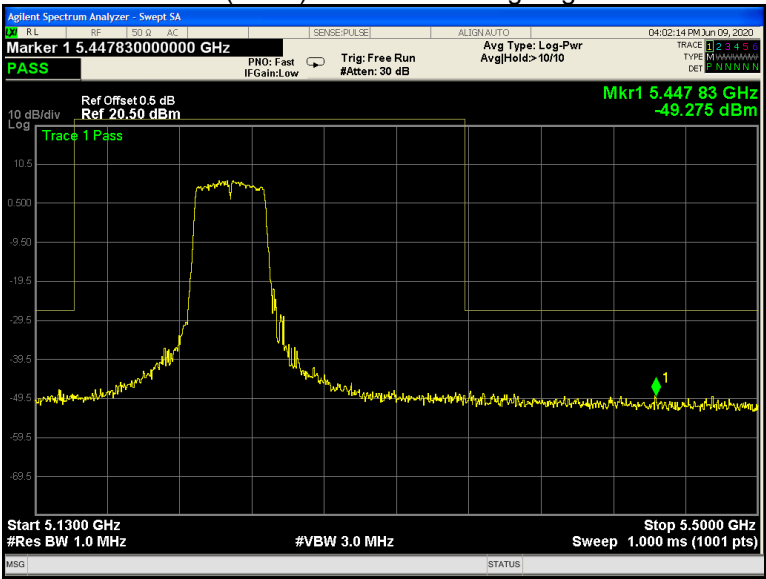
802.11ac(HT20) U-NII-1 Band edge-right side



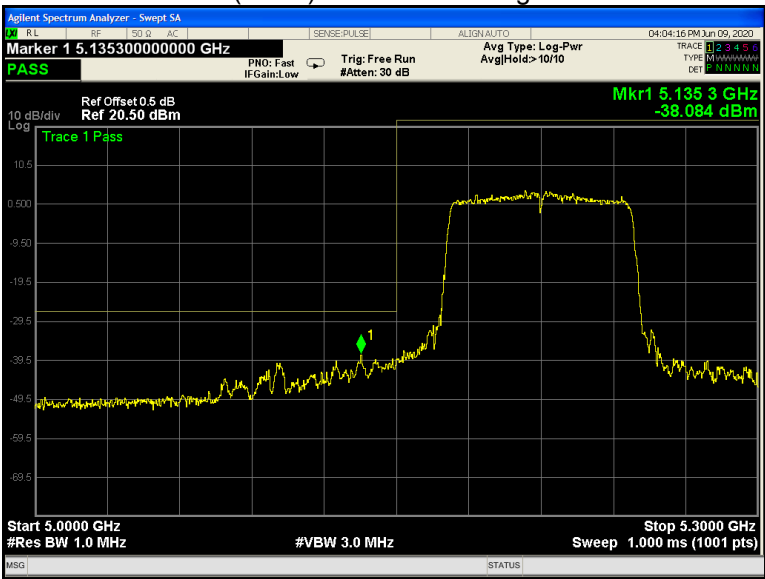
802.11ac(HT40) U-NII-1 Band edge-left side



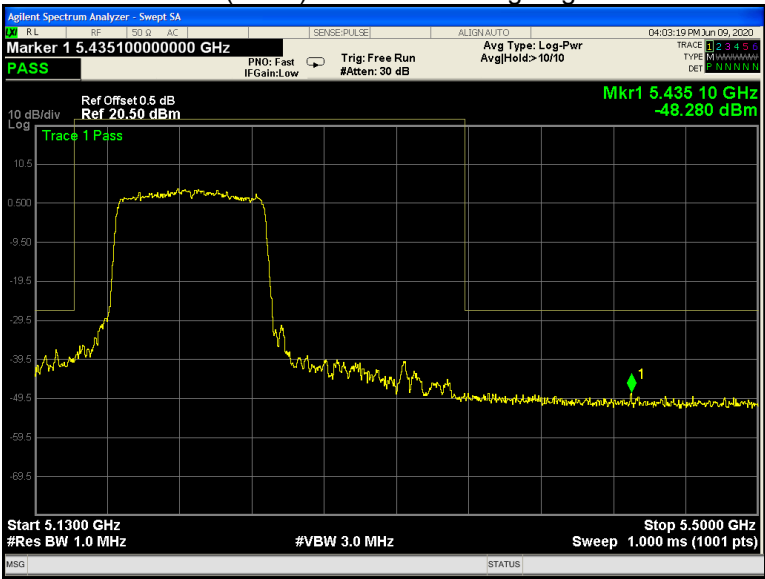
802.11ac(HT40) U-NII-1 Band edge-right side



802.11ac(HT80) U-NII-1 Band edge-left side



802.11ac(HT80) U-NII-1 Band edge-right side



11 26 dB Bandwidth and 99% Occupied Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.407 (a) KDB662911 D01 Multiple Transmitter Output v02r01
Test Method:	KDB789033 D02 General U-NII Test Procedures New Rules v02r01 Section D
Test Limit:	No restriction limits
Test Result:	PASS

11.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 1% to 5% of the OBW, VBW = 3x RBW

11.2 Test Result:**ANT 1**

Band	Operation mode	26 dB Bandwidth (MHz)			99% Bandwidth (MHz)		
		Low	Middle	High	Low	Middle	High
U-NII-1	802.11a	19.52	19.64	19.63	16.642	16.646	16.641
	802.11n(HT20)	20.02	20.02	20.09	17.585	17.586	17.588
	802.11n(HT40)	40.06	/	40.13	36.037	/	36.020
	802.11ac(HT20)	20.04	20.02	19.98	17.598	17.598	17.588
	802.11ac(HT40)	39.86	/	39.97	36.012	/	36.010
	802.11ac(HT80)	81.14	/	/	75.100	/	/

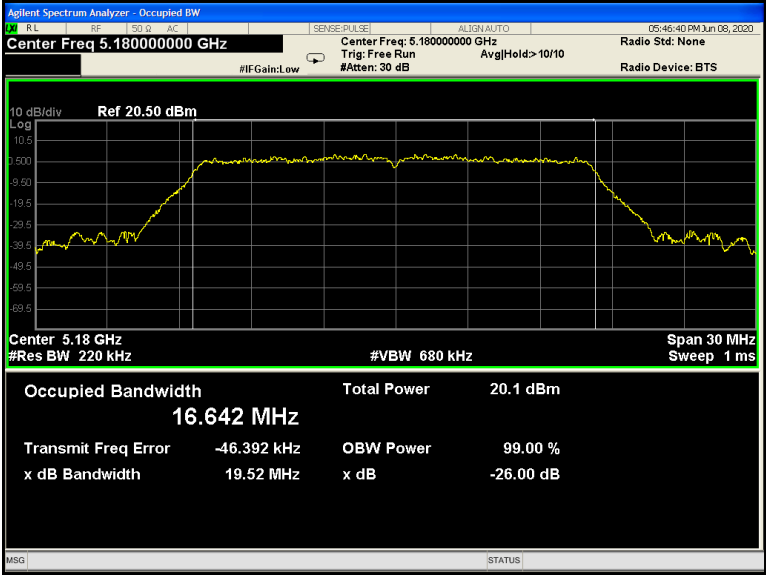
ANT 2

Band	Operation mode	26 dB Bandwidth (MHz)			99% Bandwidth (MHz)		
		Low	Middle	High	Low	Middle	High
U-NII-1	802.11a	19.49	19.54	19.52	16.608	16.605	16.610
	802.11n(HT20)	19.98	19.94	20.11	17.579	17.582	17.587
	802.11n(HT40)	40.12	/	39.94	36.019	/	36.013
	802.11ac(HT20)	20.10	19.99	20.14	17.588	17.598	17.589
	802.11ac(HT40)	39.94	/	39.89	36.000	/	36.009
	802.11ac(HT80)	80.85	/	/	75.084	/	/

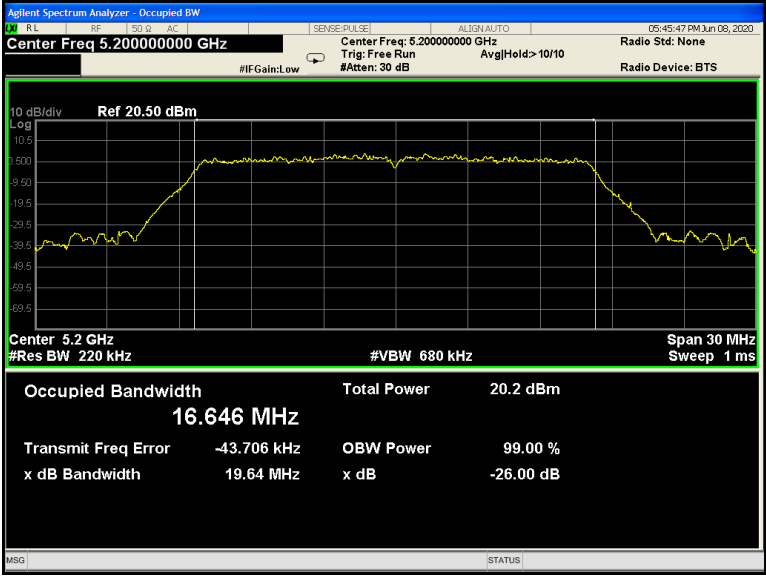
Test result plots shown as follows:

ANT 1

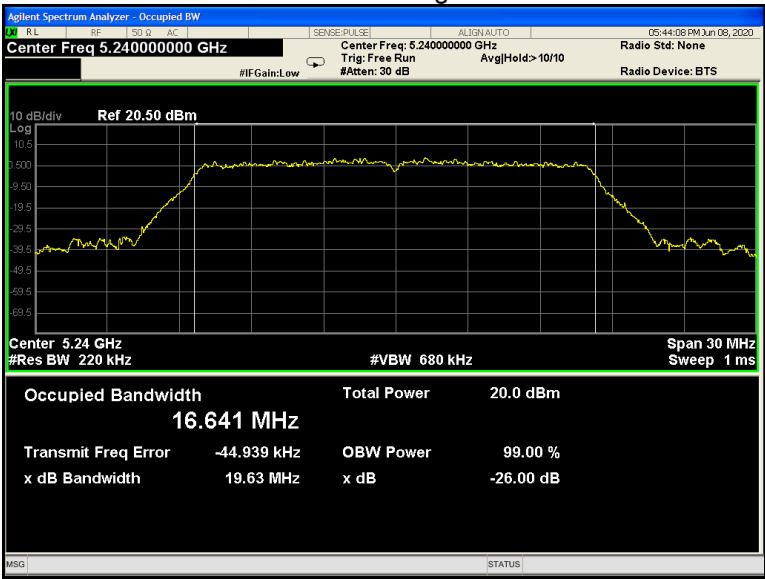
802.11a U-NII-1 Low channel



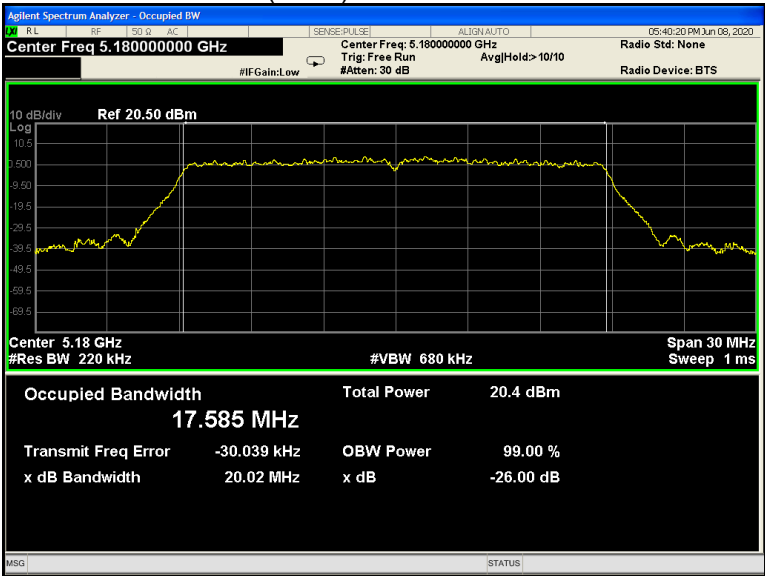
802.11a U-NII-1 Middle channel



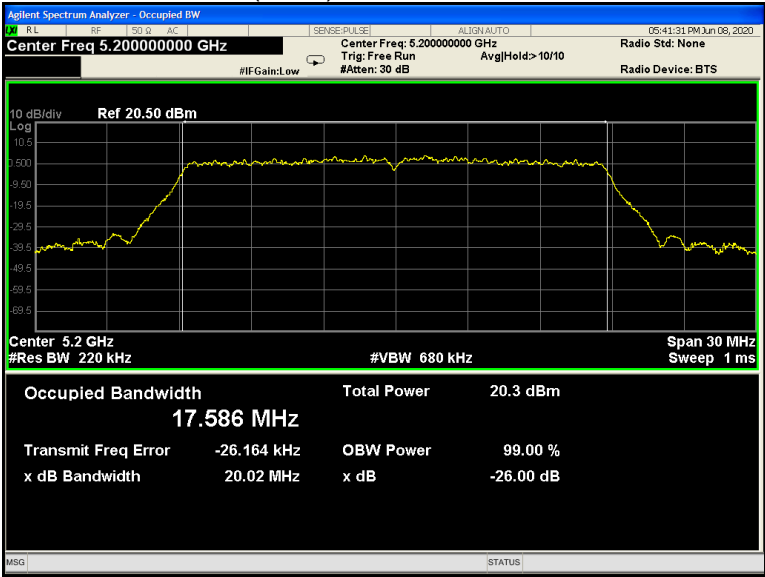
802.11a U-NII-1 High channel



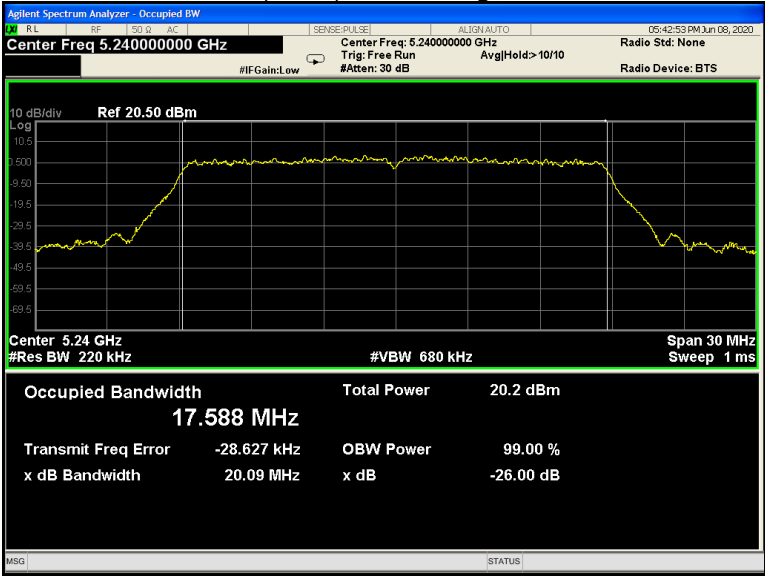
802.11n(HT20) U-NII-1 Low channel



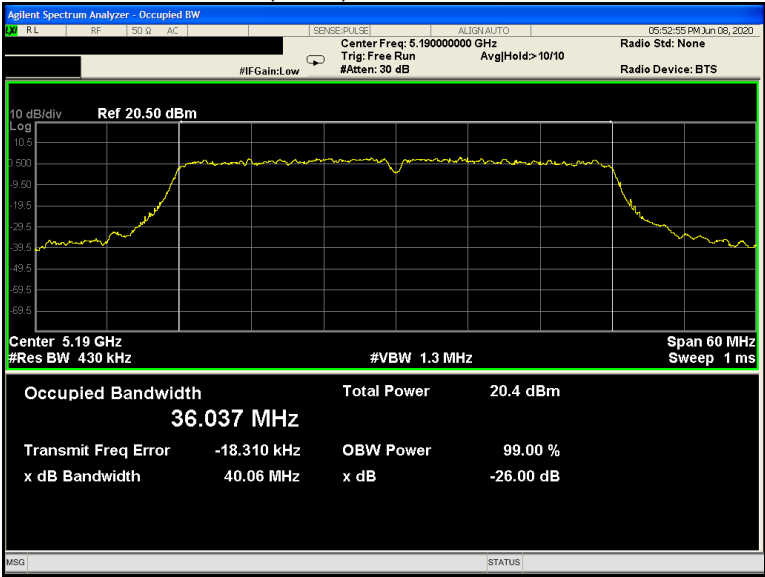
802.11n(HT20) U-NII-1 Middle channel



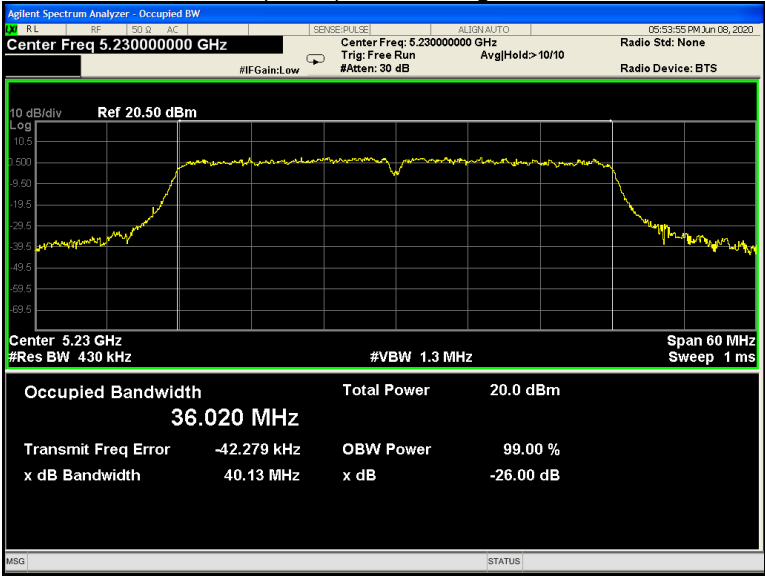
802.11n(HT20) U-NII-1 High channel



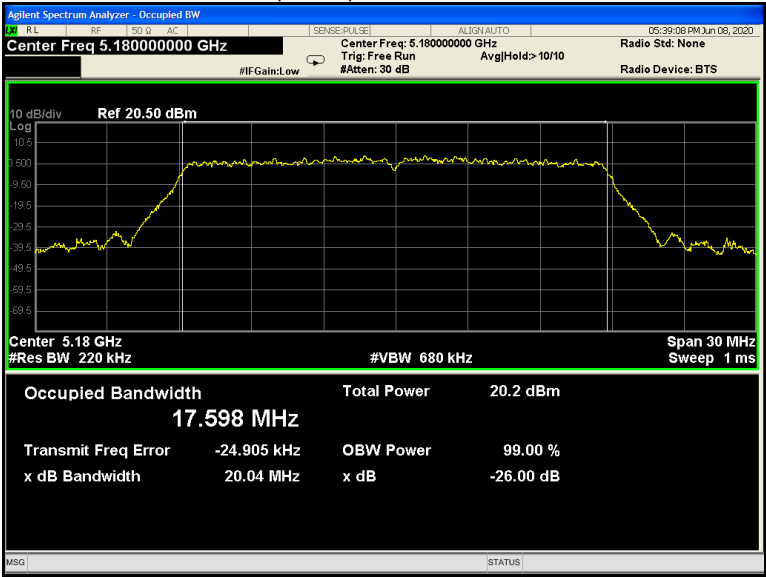
802.11n(HT40) U-NII-1 Low channel



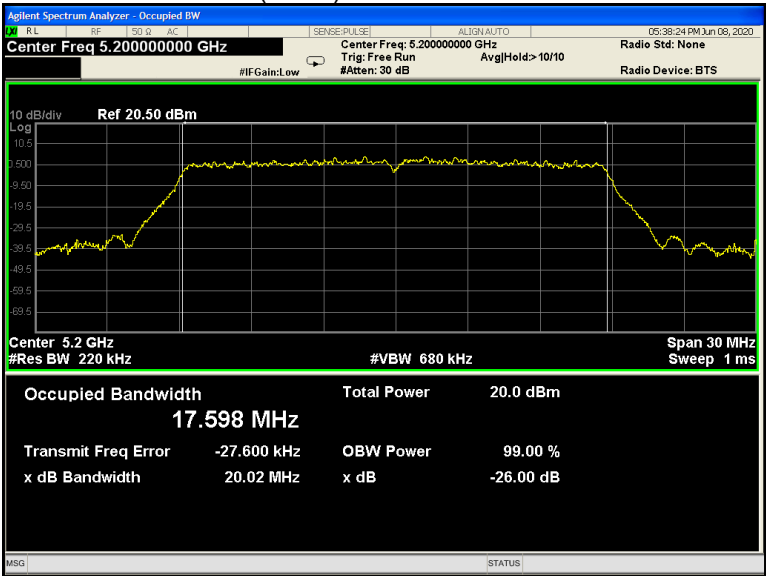
802.11n(HT40) U-NII-1 High channel



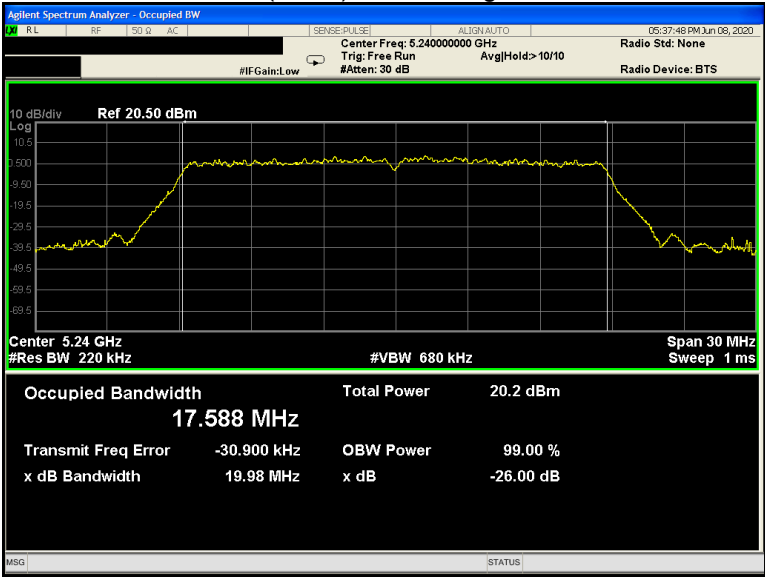
802.11ac(HT20) U-NII-1 Low channel



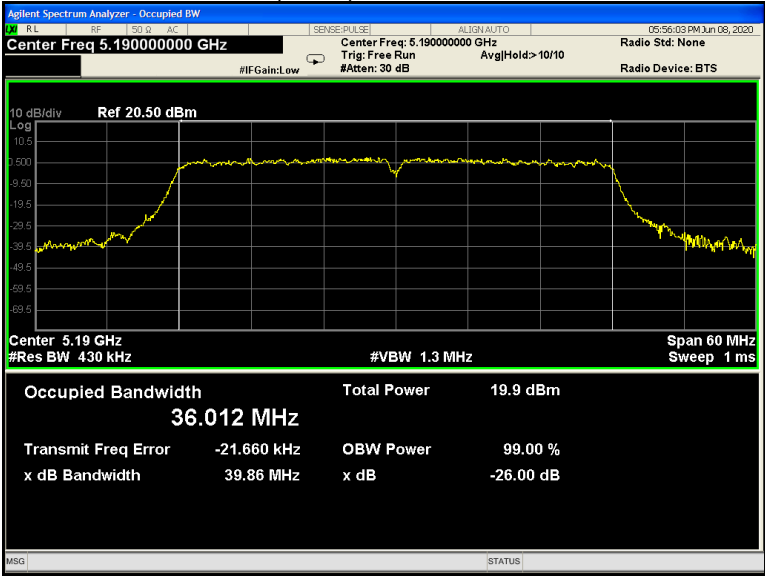
802.11ac(HT20) U-NII-1 Middle channel



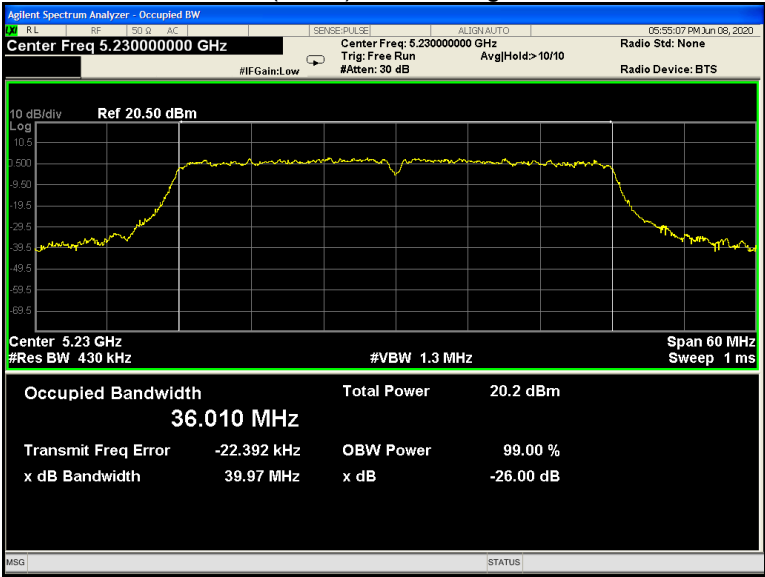
802.11ac(HT20) U-NII-1 High channel



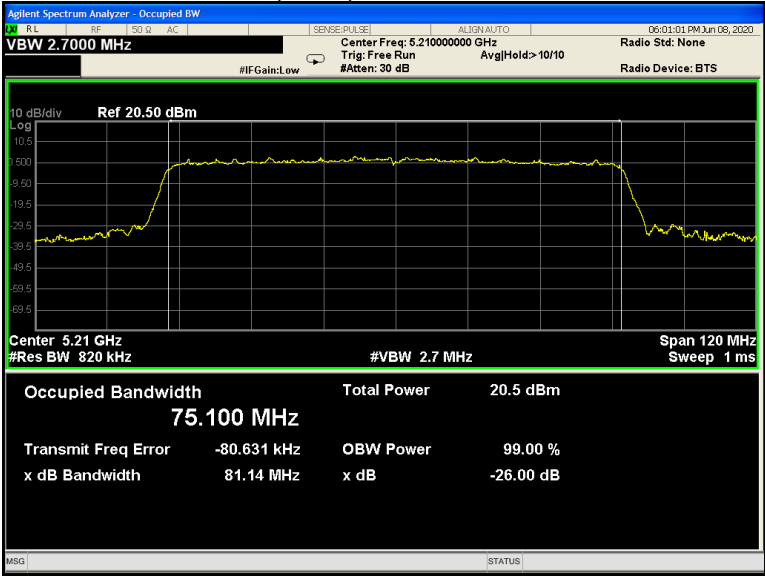
802.11ac(HT40) U-NII-1 Low channel



802.11 ac(HT40) U-NII-1 High channel

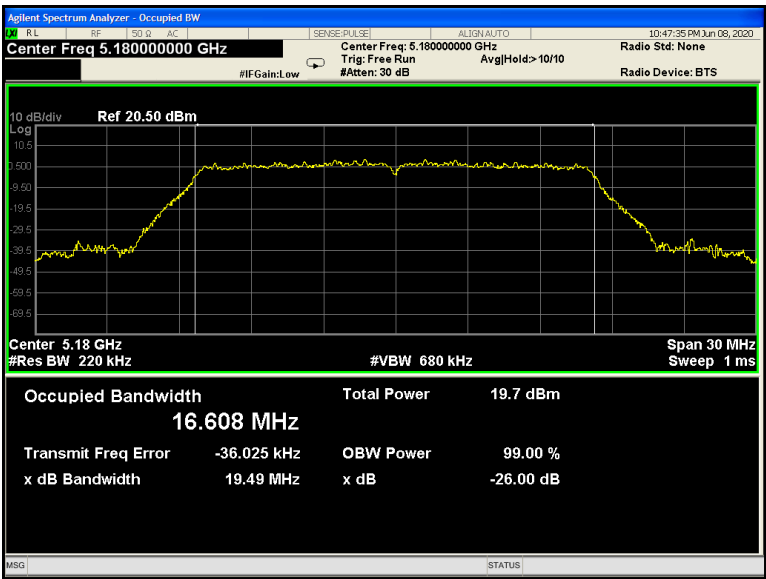


802.11ac(HT80) U-NII-1 Low channel

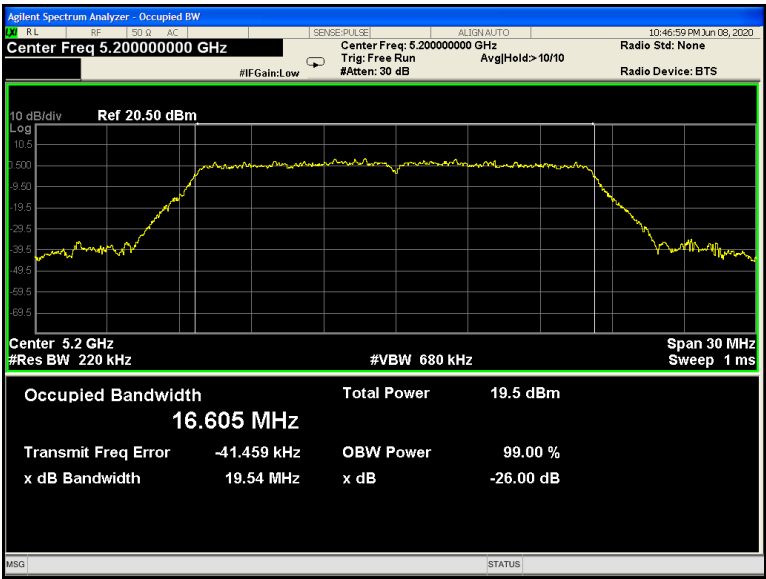


ANT 2

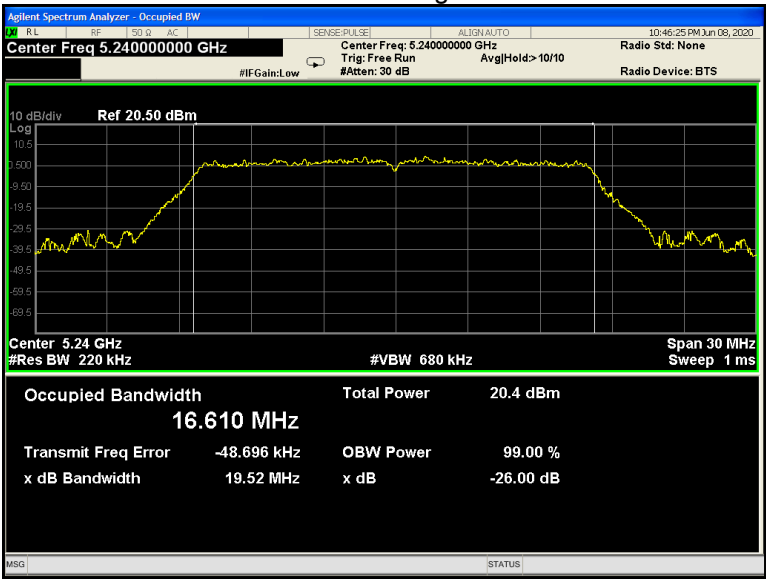
802.11a U-NII-1 Low channel



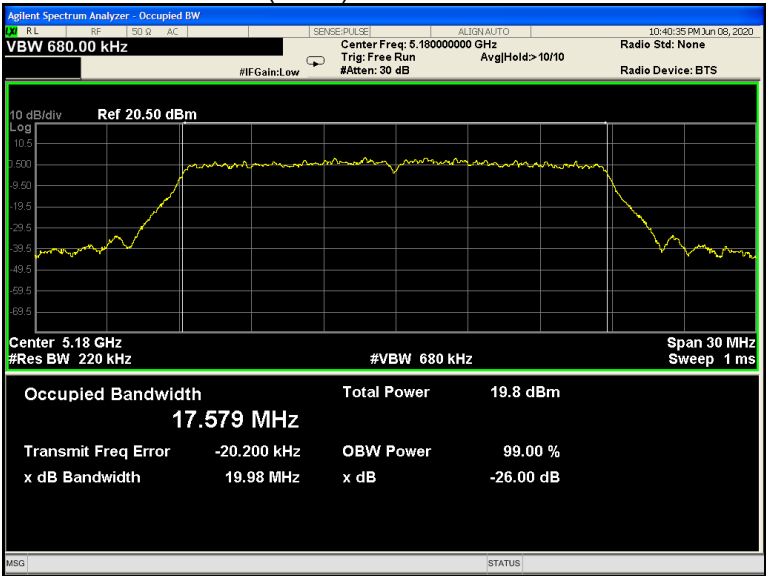
802.11a U-NII-1 Middle channel



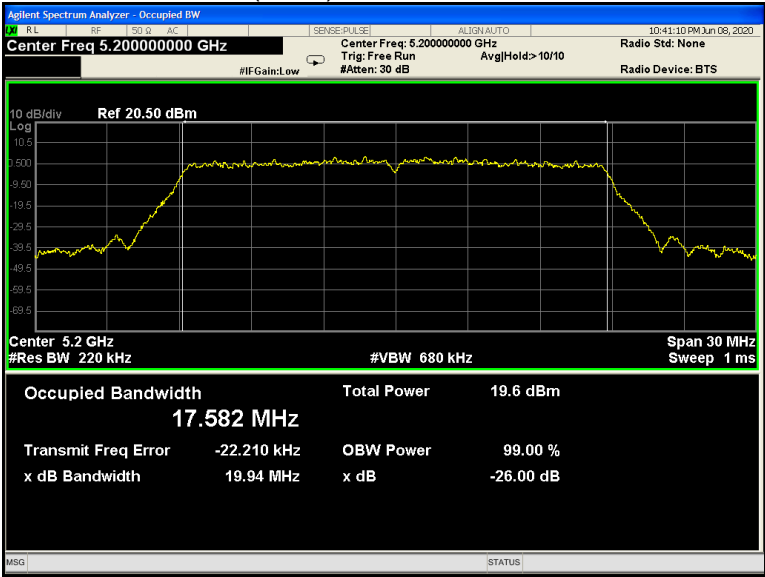
802.11a U-NII-1 High channel



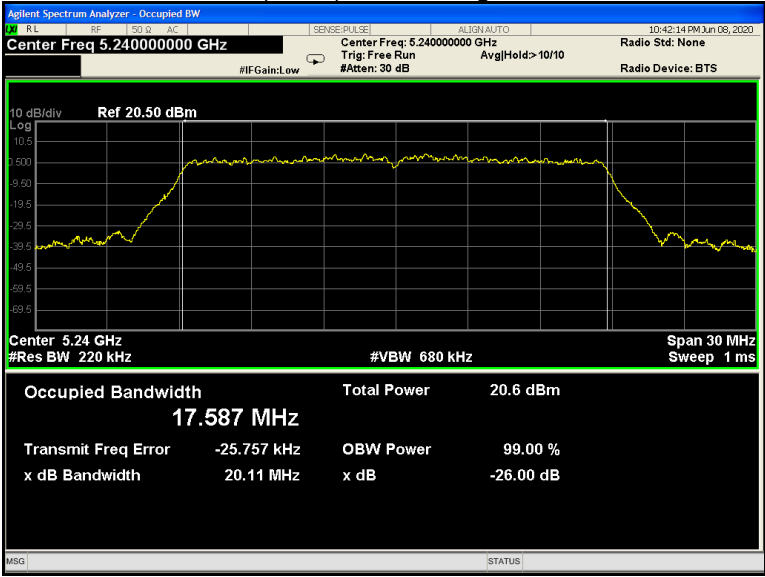
802.11n(HT20) U-NII-1 Low channel



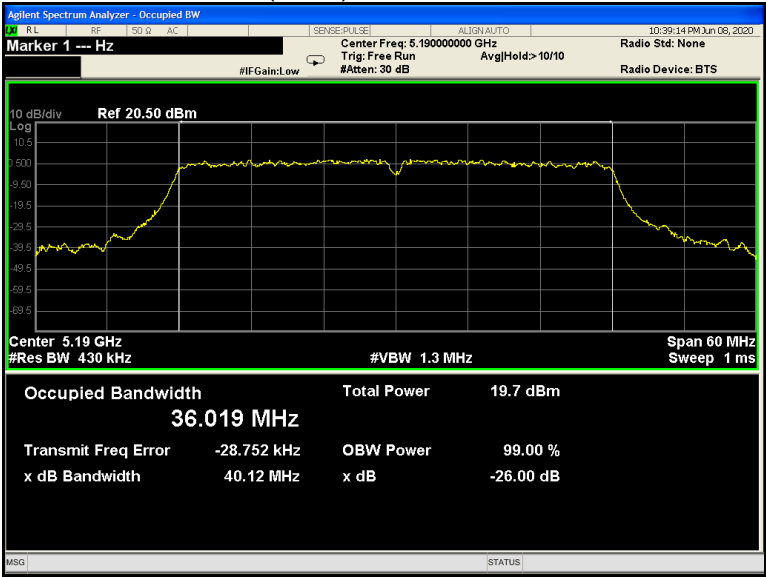
802.11n(HT20) U-NII-1 Middle channel



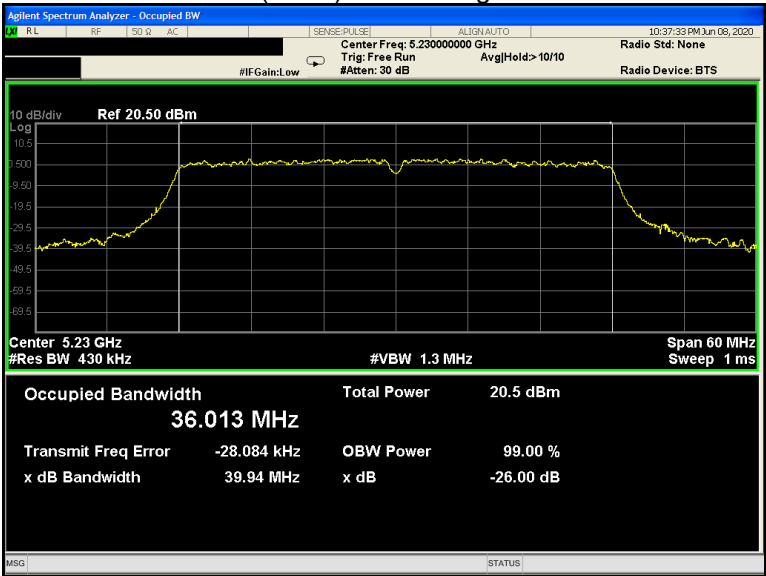
802.11n(HT20) U-NII-1 High channel



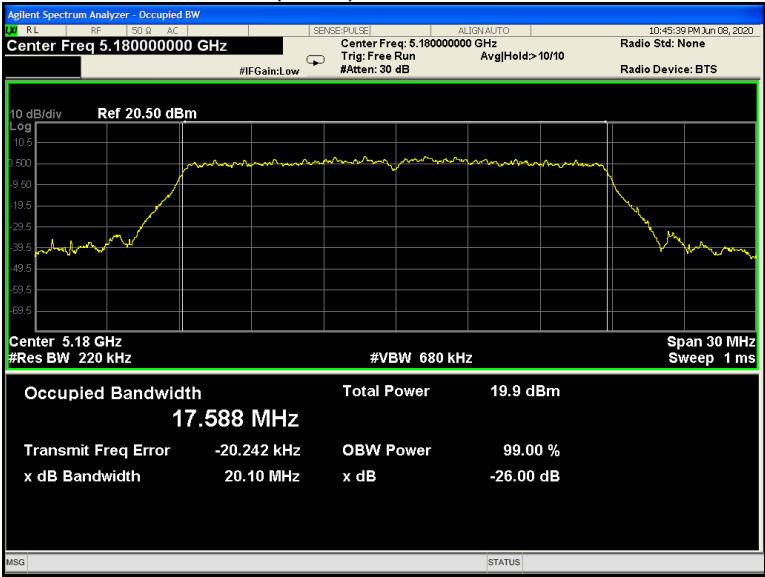
802.11n(HT40) U-NII-1 Low channel



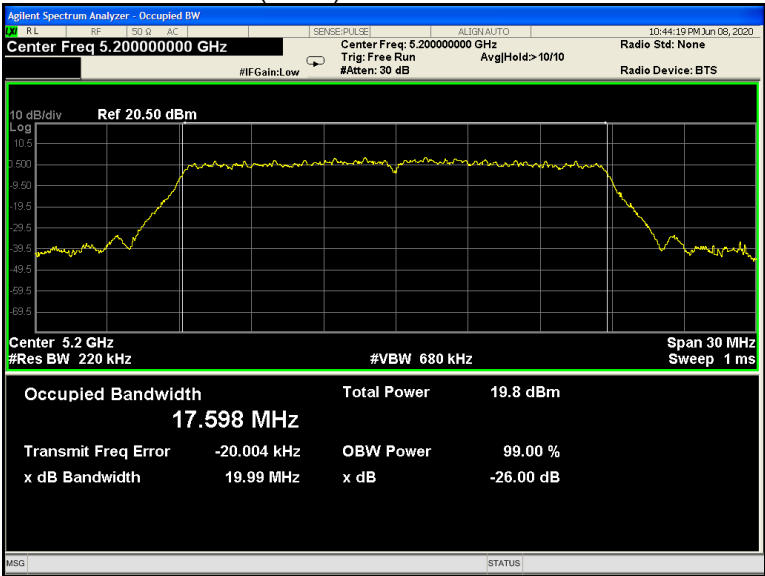
802.11n(HT40) U-NII-1 High channel



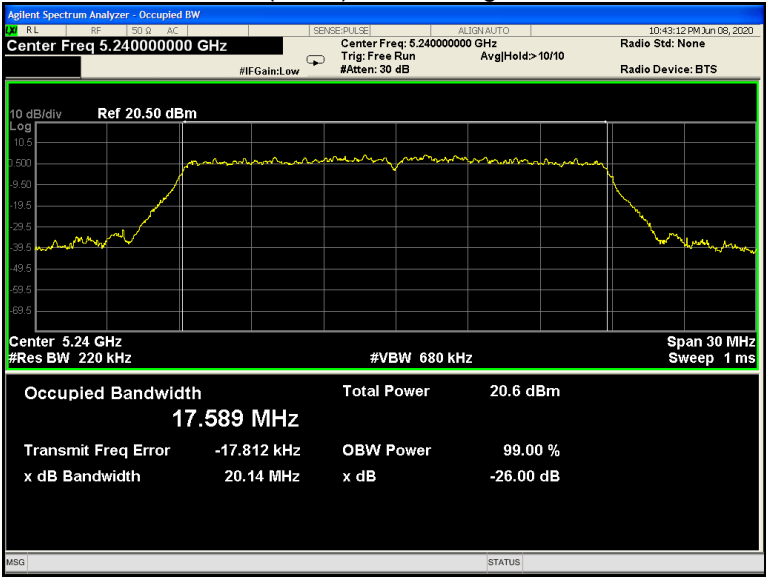
802.11ac(HT20) U-NII-1 Low channel



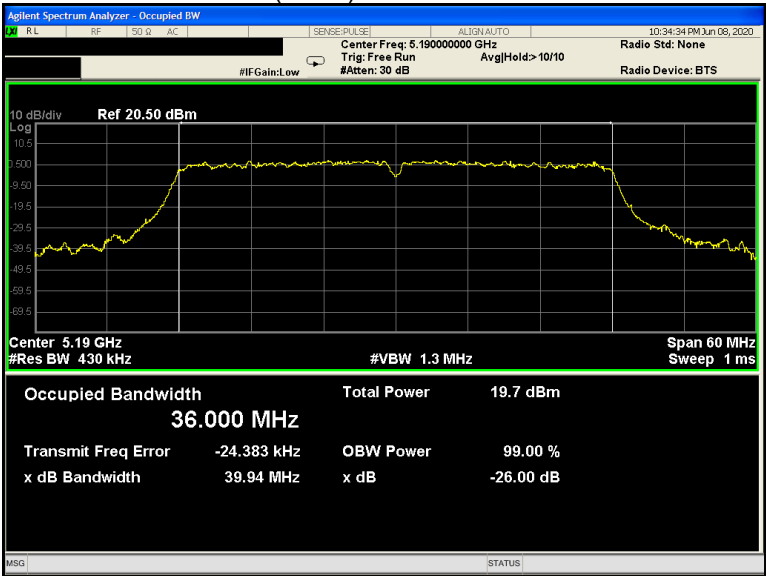
802.11ac(HT20) U-NII-1 Middle channel



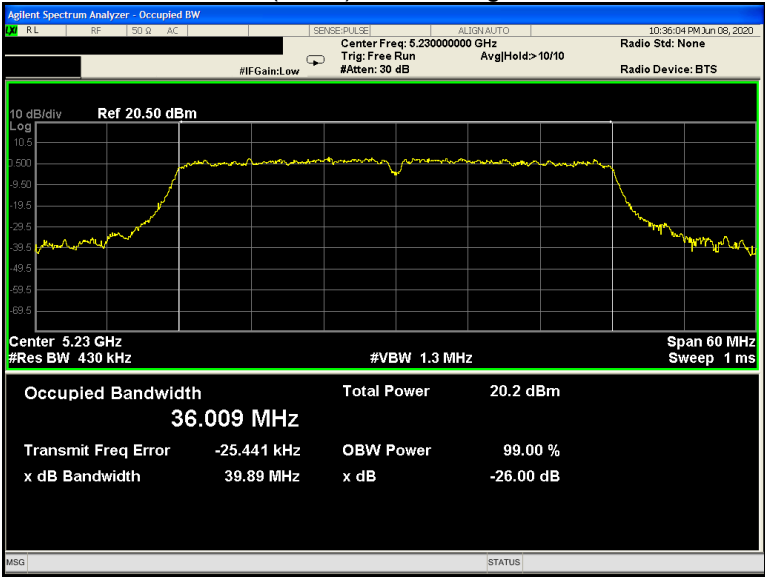
802.11ac(HT20) U-NII-1 High channel



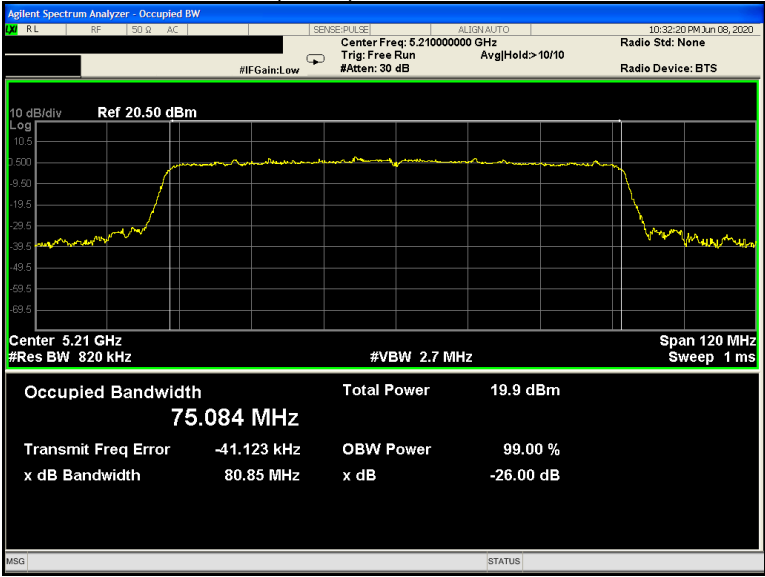
802.11ac(HT40) U-NII-1 Low channel



802.11 ac(HT40) U-NII-1 High channel



802.11ac(HT80) U-NII-1 Low channel



12 Conducted Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.407(a) KDB662911 D01 Multiple Transmitter Output v02r01
Test Method:	KDB789033 D02 General U-NII Test Procedures New Rules v02r01 Section E
Test Limit:	U-NII-1 250mW(24dBm) U-NII-3 1W(30dBm)
Test Result:	PASS Conducted output power= measurement power+10log(1/x)
Remark:	X is duty cycle=1, so 10log(1/1)=0 Conducted output power= measurement power

12.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1 MHz. VBW = 3 MHz. Sweep = auto; Detector Function = Peak, Set the span to fully encompass the DTS bandwidth.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

12.2 Test Result :

ANT1+ ANT 2

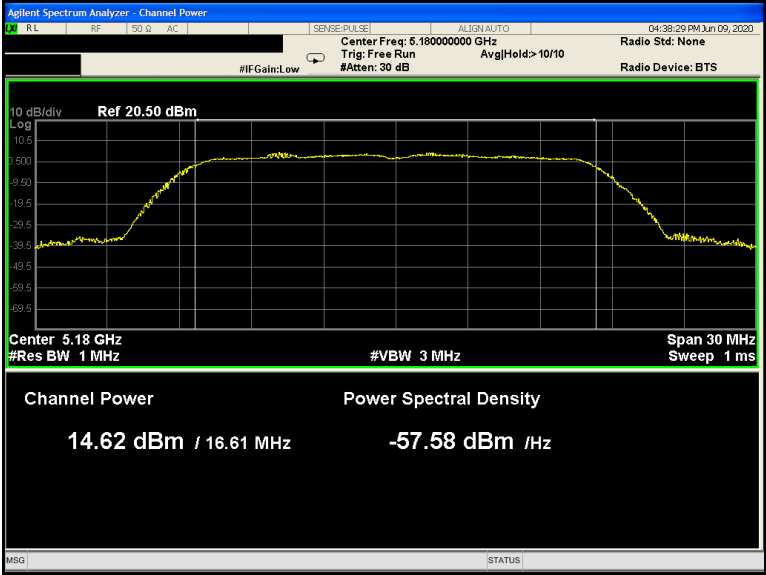
Band	Operation mode	Conducted Output Power (dBm)		
		Low	Middle	High
U-NII-1	802.11a	17.71	17.41	17.19
	802.11n(HT20)	17.65	17.59	17.30
	802.11n(HT40)	17.58	/	18.64
	802.11ac(HT20)	17.80	17.68	17.45
	802.11ac(HT40)	17.59	/	17.34
	802.11ac(HT80)	18.31	/	/

* All transmit signals are completely uncorrelated with each other, Directional gain = G_{ANT} which is less than 6dBi. So the limit does not be reduced.

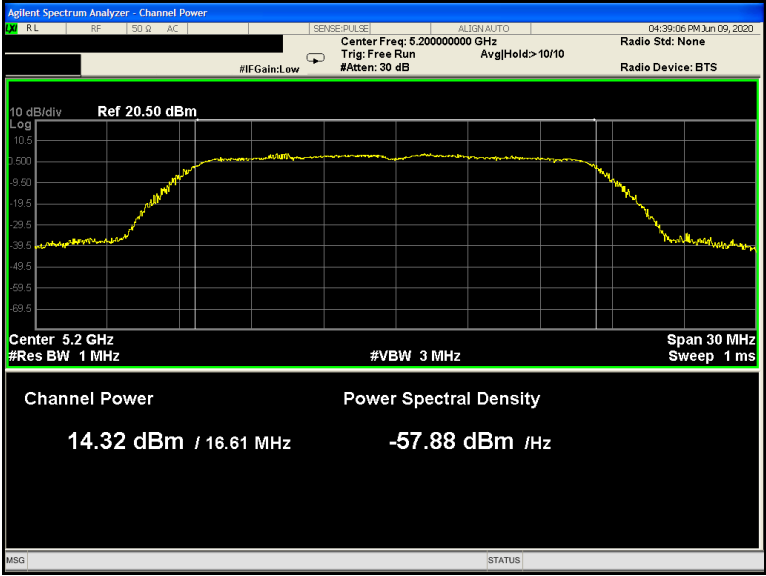
Test result plots shown as follows:

ANT 1

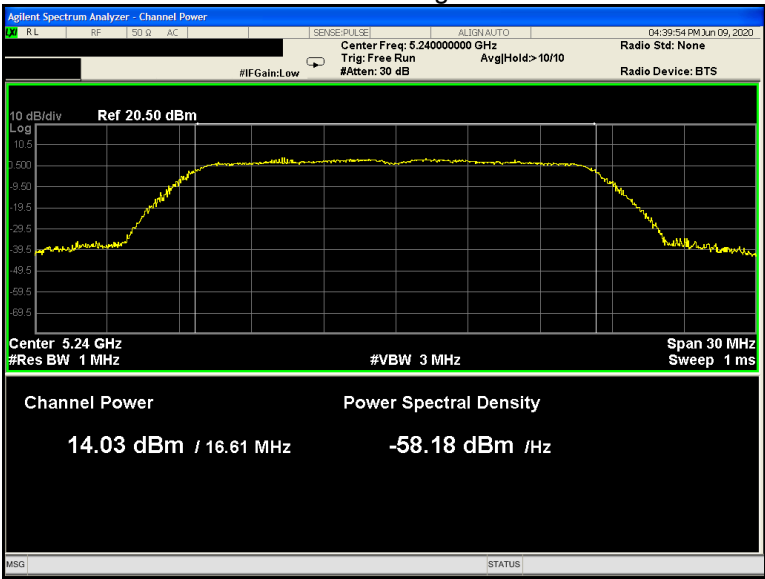
802.11a U-NII-1 Low channel



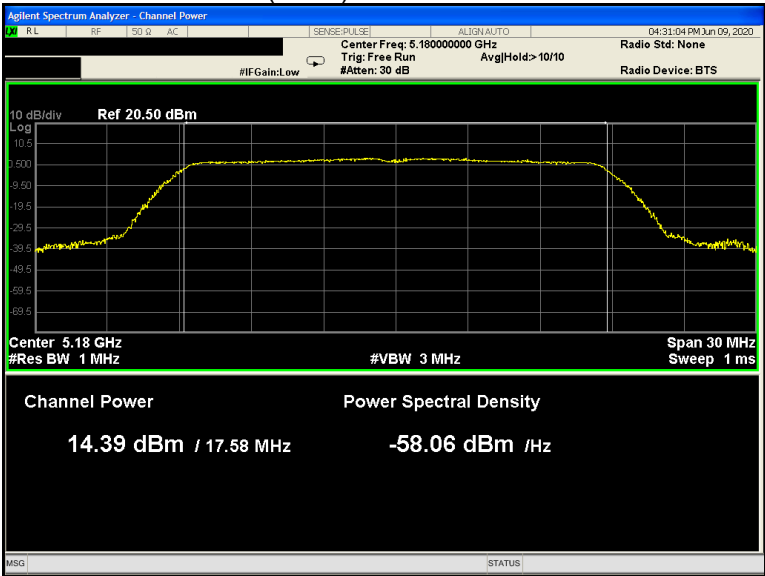
802.11a U-NII-1 Middle channel



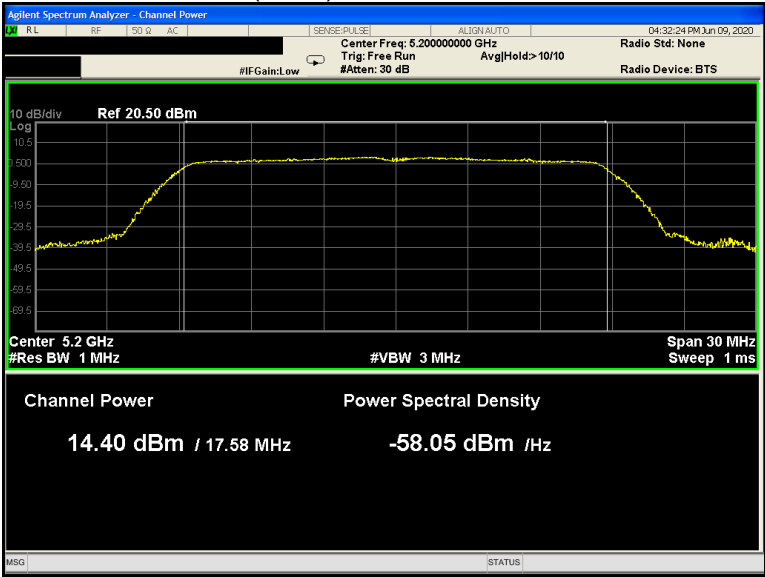
802.11a U-NII-1 High channel



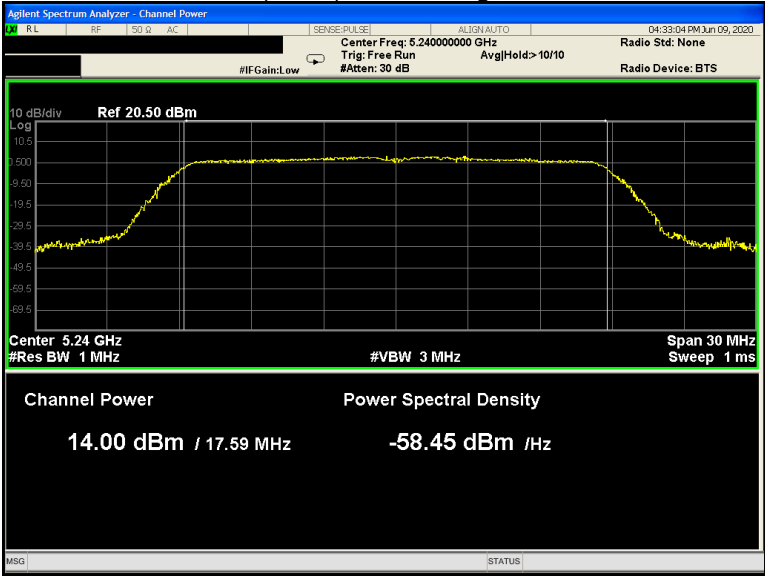
802.11n(HT20) U-NII-1 Low channel



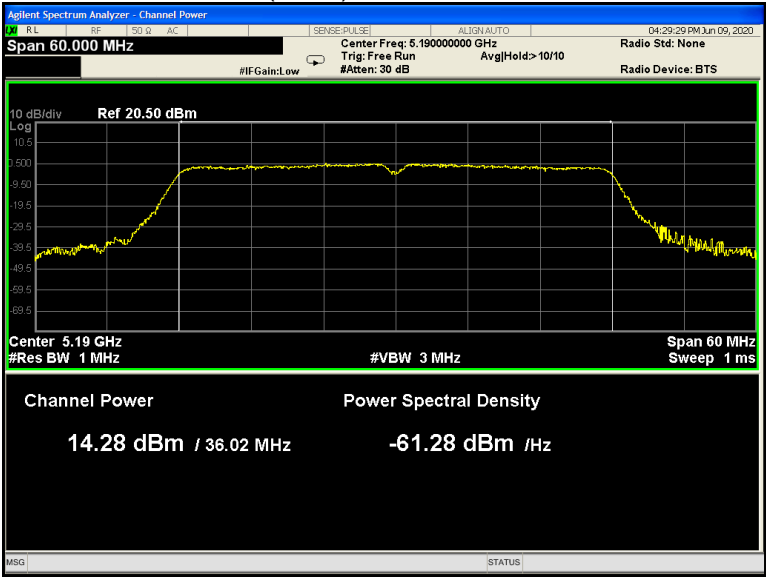
802.11n(HT20) U-NII-1 Middle channel



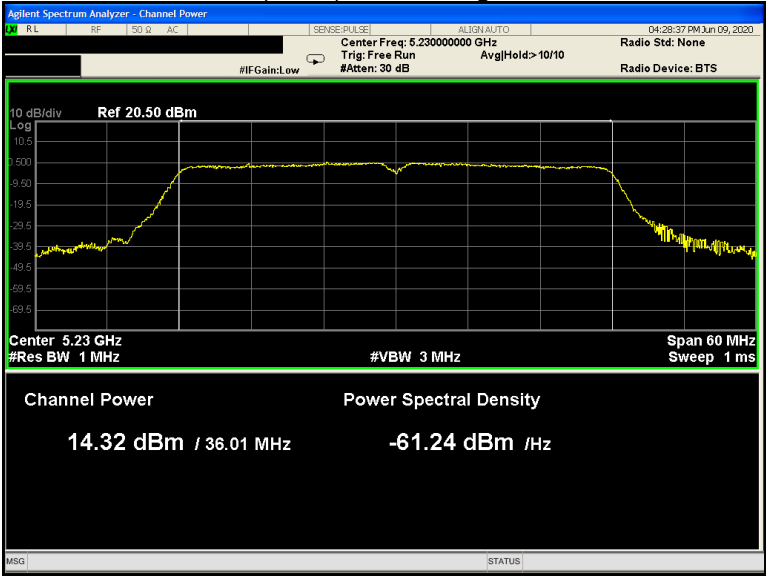
802.11n(HT20) U-NII-1 High channel



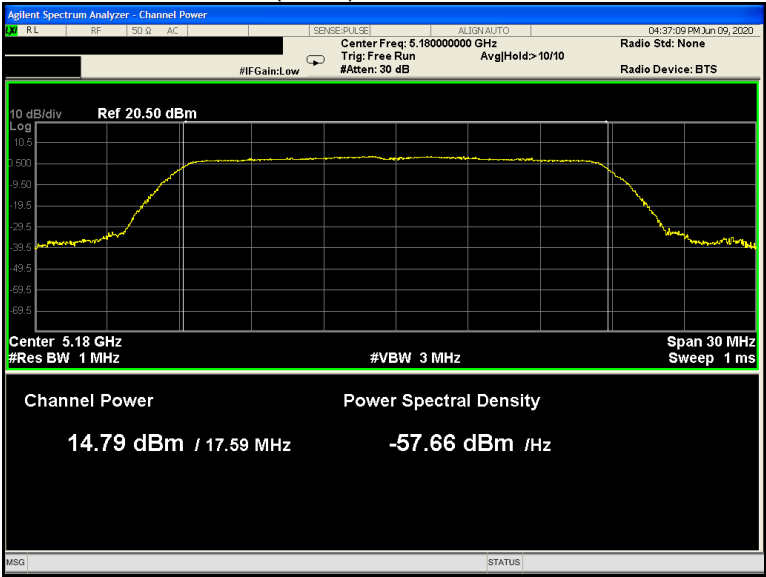
802.11n(HT40) U-NII-1 Low channel



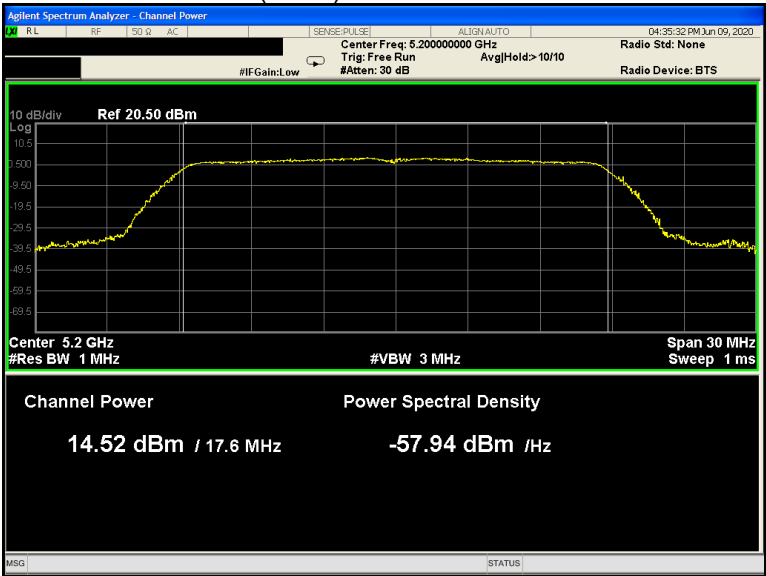
802.11n(HT40) U-NII-1 High channel



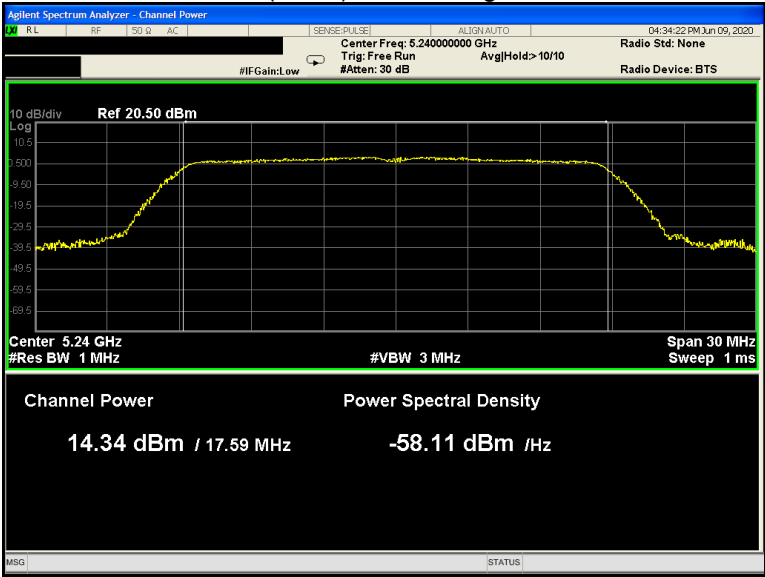
802.11ac(HT20) U-NII-1 Low channel



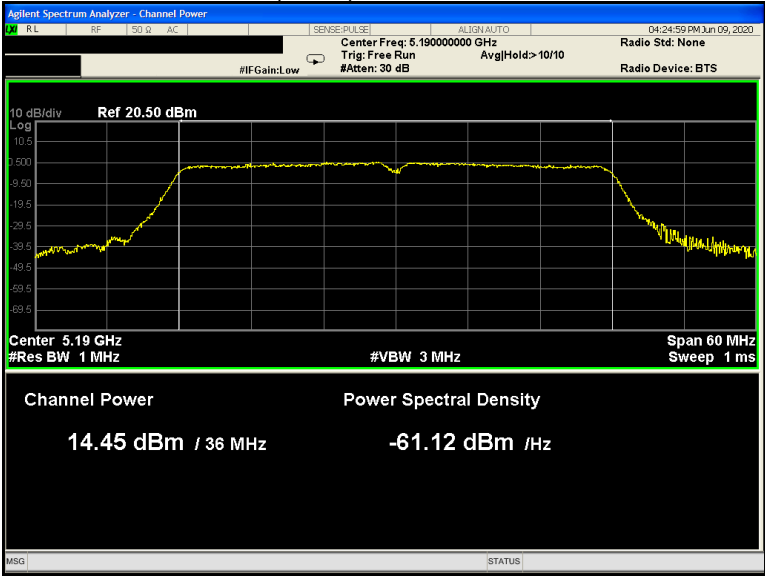
802.11ac(HT20) U-NII-1 Middle channel



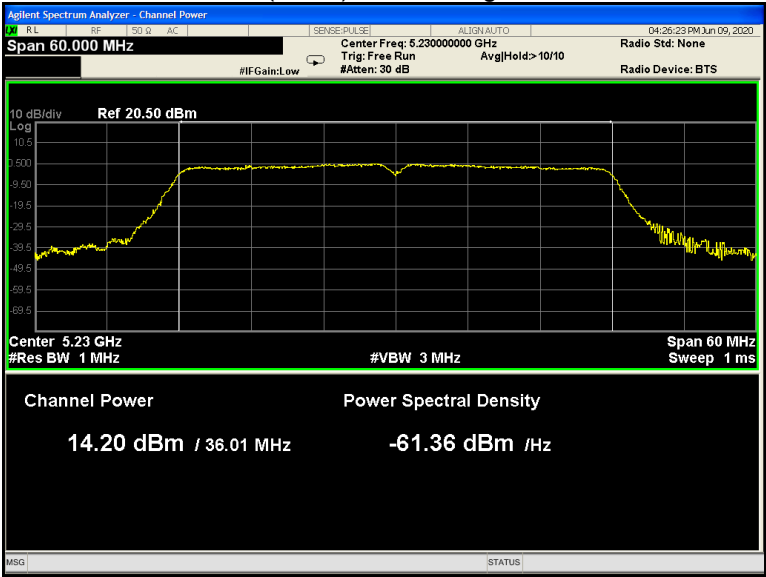
802.11ac(HT20) U-NII-1 High channel



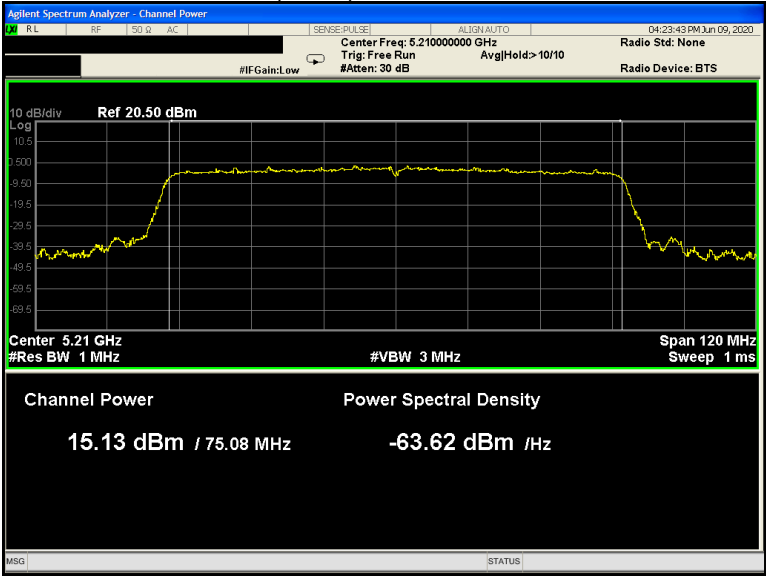
802.11ac(HT40) U-NII-1 Low channel



802.11ac(HT40) U-NII-1 High channel

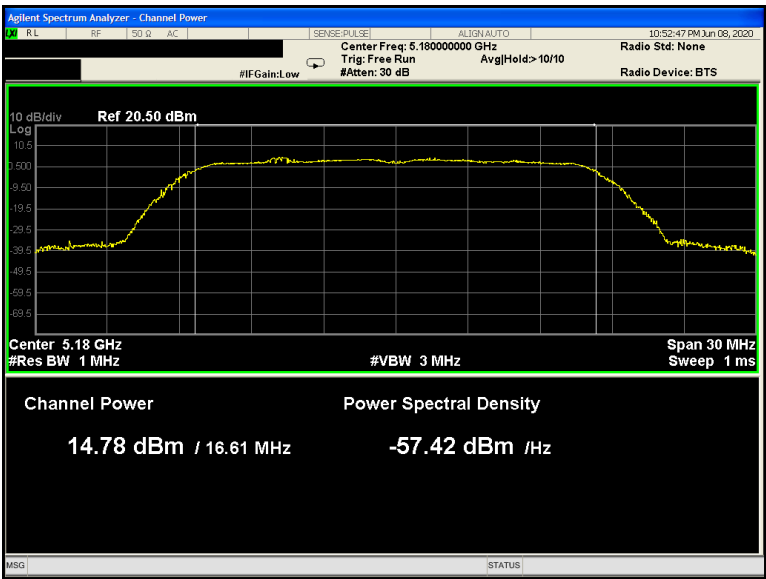


802.11ac(HT80) U-NII-1 Low channel

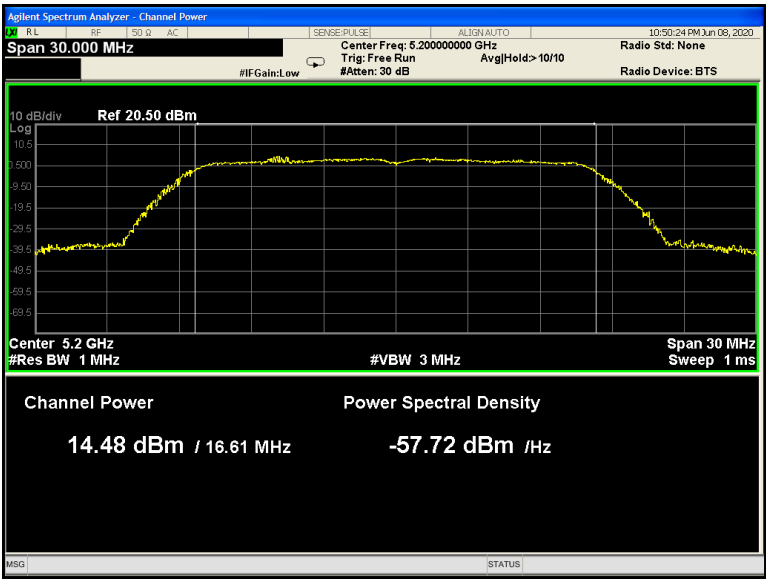


ANT 2

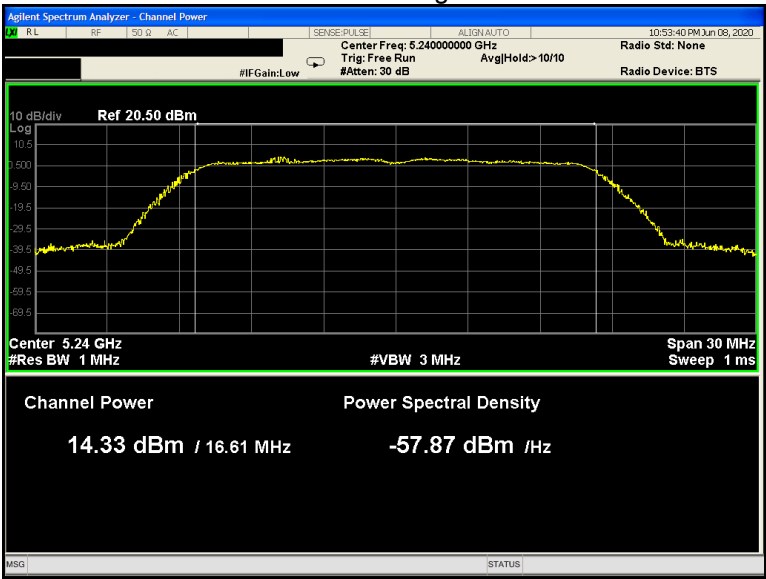
802.11a U-NII-1 Low channel



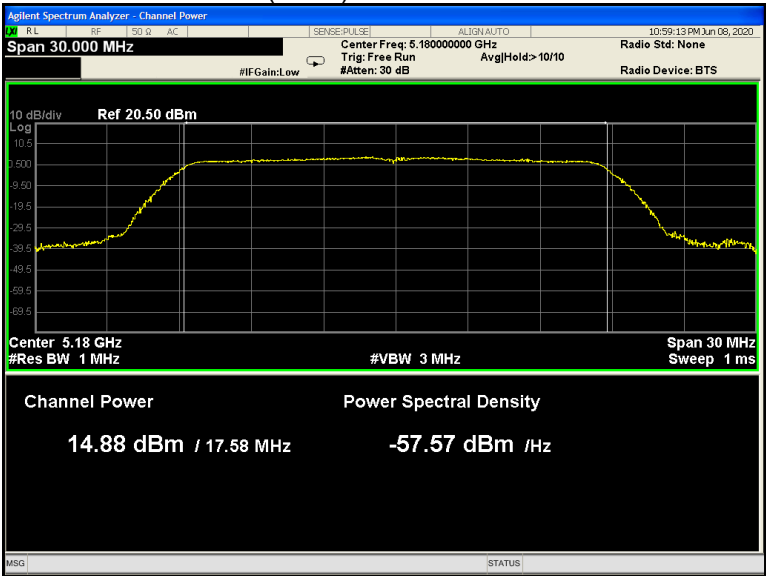
802.11a U-NII-1 Middle channel



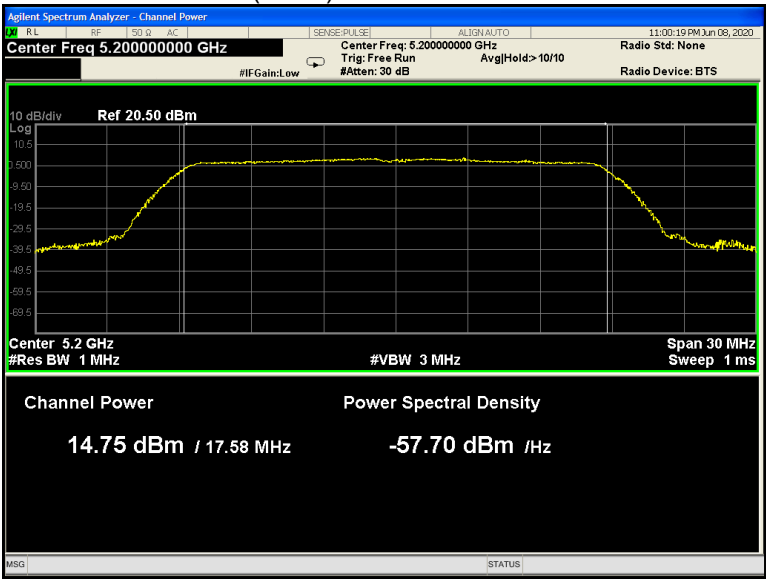
802.11a U-NII-1 High channel



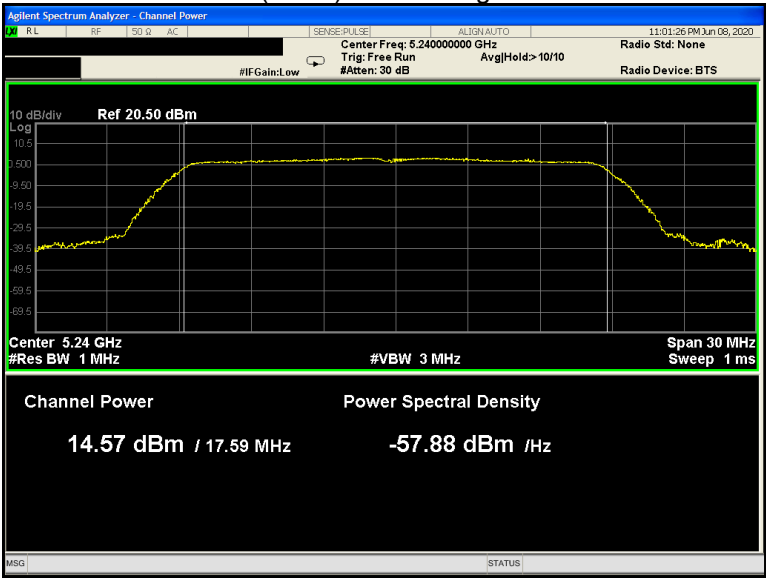
802.11n(HT20) U-NII-1 Low channel



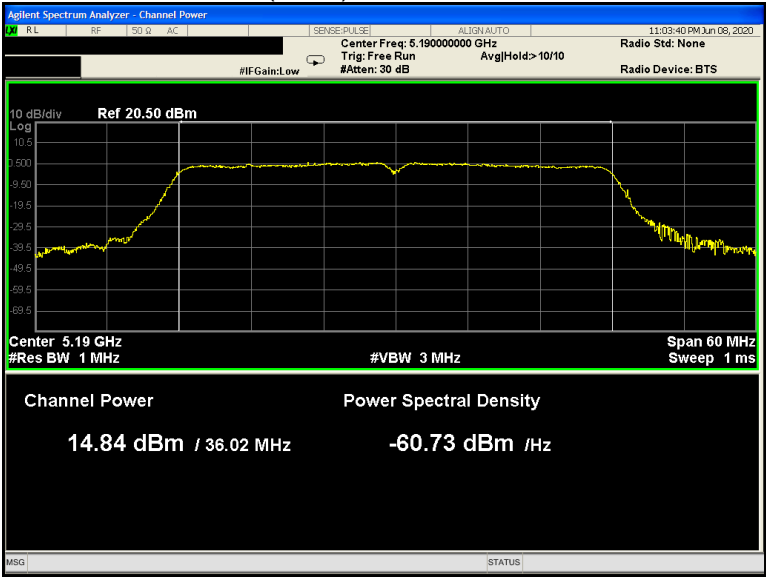
802.11n(HT20) U-NII-1 Middle channel



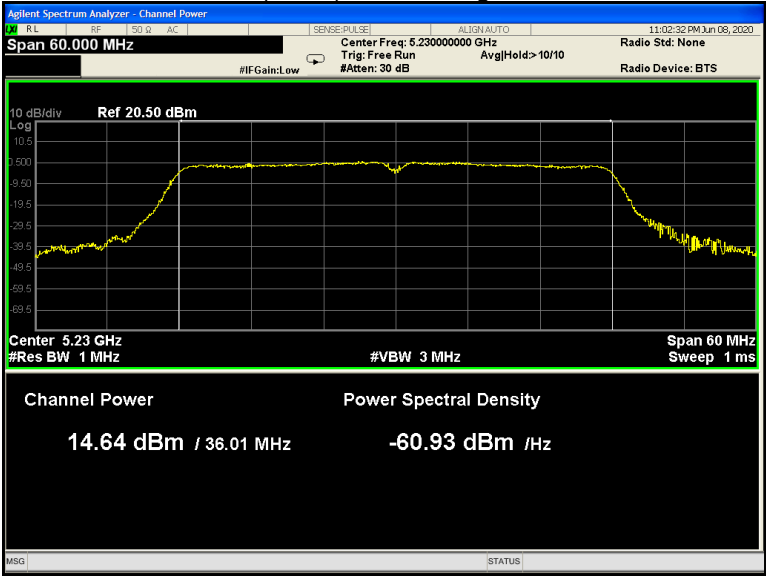
802.11n(HT20) U-NII-1 High channel



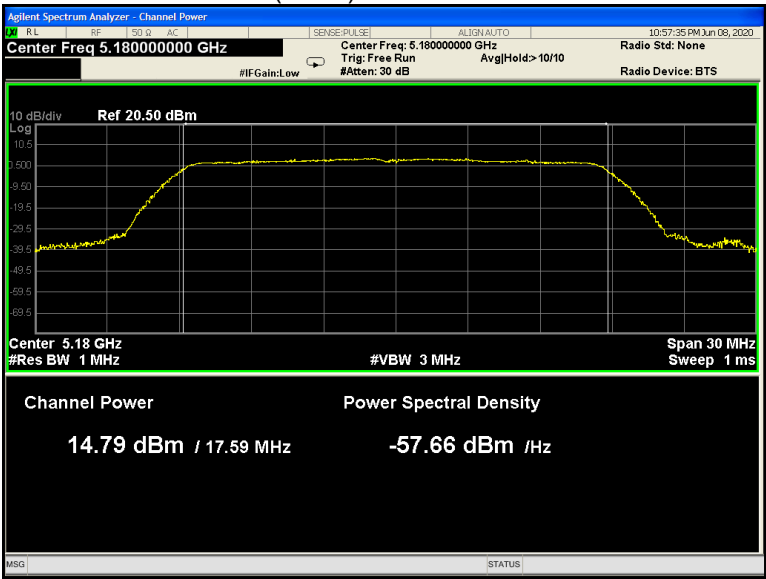
802.11n(HT40) U-NII-1 Low channel



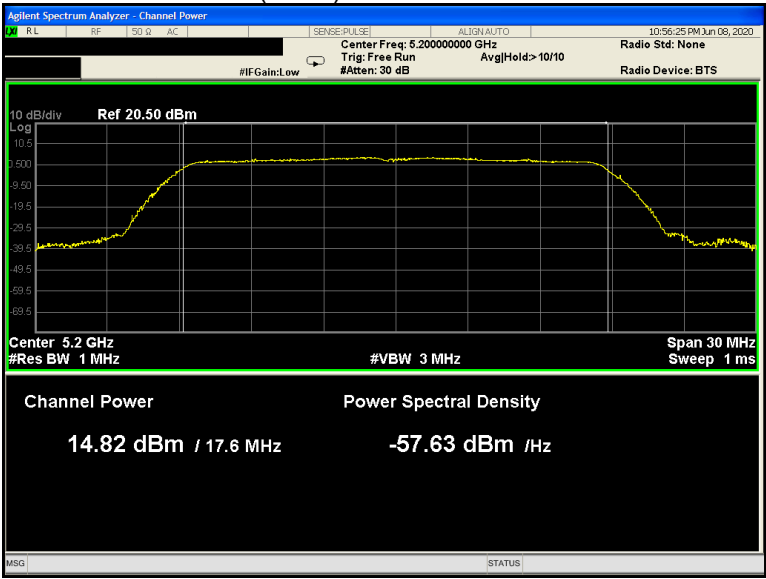
802.11n(HT40) U-NII-1 High channel



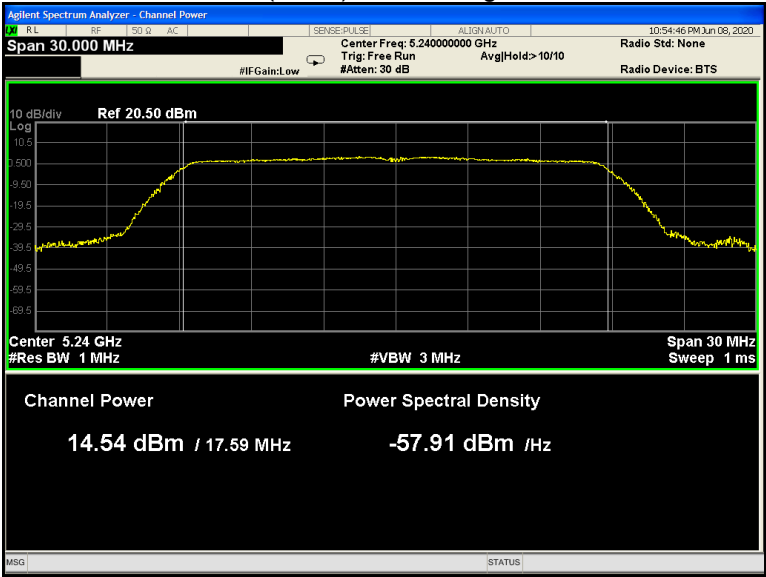
802.11ac(HT20) U-NII-1 Low channel



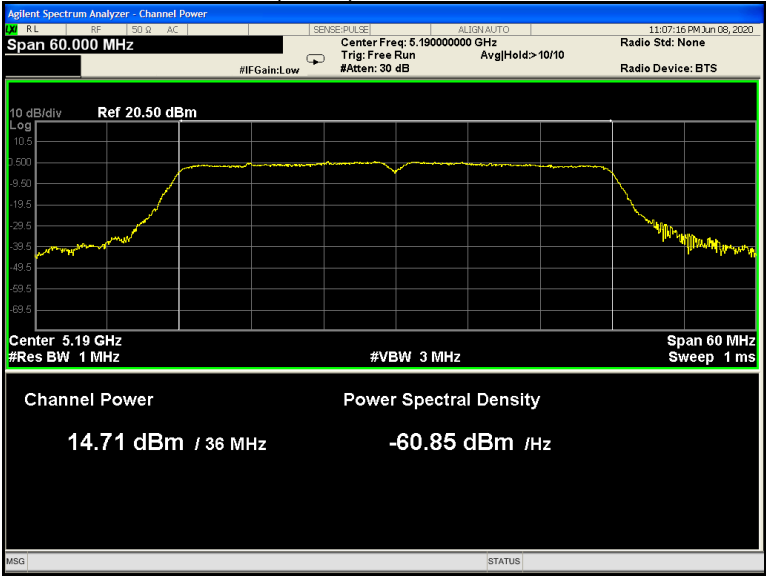
802.11ac(HT20) U-NII-1 Middle channel



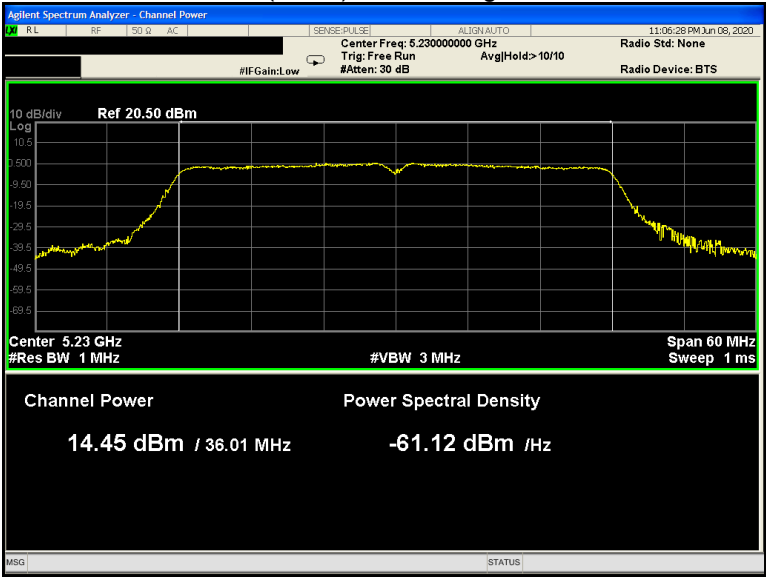
802.11ac(HT20) U-NII-1 High channel



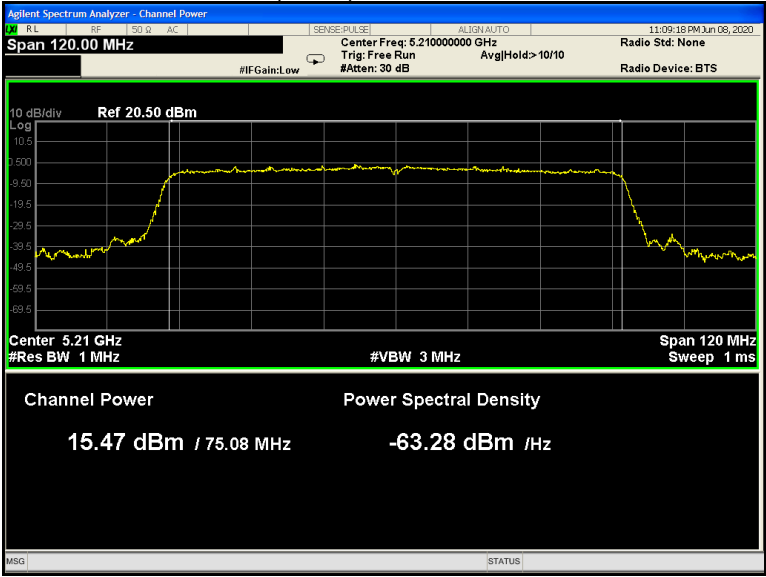
802.11ac(HT40) U-NII-1 Low channel



802.11ac(HT40) U-NII-1 High channel



802.11ac(HT80) U-NII-1 Low channel



13 Power Spectral density

Test Requirement:	FCC CFR47 Part 15 Section 15.407(a) KDB662911 D01 Multiple Transmitter Output v02r01
Test Method:	KDB789033 D02 General U-NII Test Procedures New Rules v02r01, Section F
Test Limit:	$\leq 11.00\text{dBm/MHz}$ for Operation in the U-NII-1(5150MHz-5250MHz)of mobile device $\leq 30.00\text{dBm/500KHz}$ for Operation in the U-NII-3(5725MHz- 5850MHz)of device
Test Result:	PASS

13.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer:
U-NII-1
RBW = 1MHz, VBW $\geq 3 \times$ RBW Sweep = auto; Detector Function = Peak. Trace = Max hold.
U-NII-3
RBW = 510KHz, VBW $\geq 3 \times$ RBW Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section
Submit this plot.

13.2 Test Result:

ANT 1 + ANT2

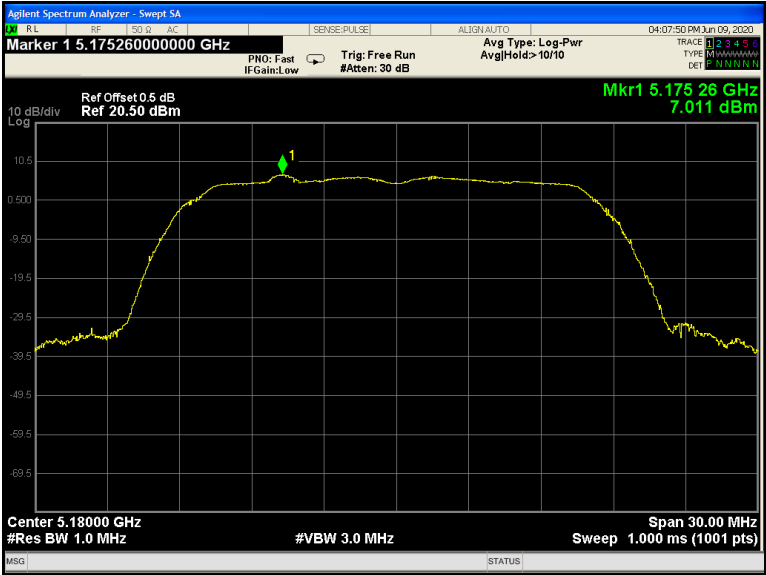
Band	Operation mode	Power Spectral Density (dBm/MHz)		
		Low	Middle	High
U-NII-1	802.11a	10.29	10.19	10.16
	802.11n(HT20)	9.64	9.28	9.14
	802.11n(HT40)	6.48	/	6.35
	802.11ac(HT20)	9.44	9.46	9.16
	802.11ac(HT40)	8.83	/	6.51
	802.11ac(HT80)	4.93	/	/
	Limit	$\leq 11.00 \text{ dBm/MHz}$		

* All transmit signals are completely uncorrelated with each other, Directional gain = G_{ANT} which is less than 6dBi. So the limit does not be reduced.

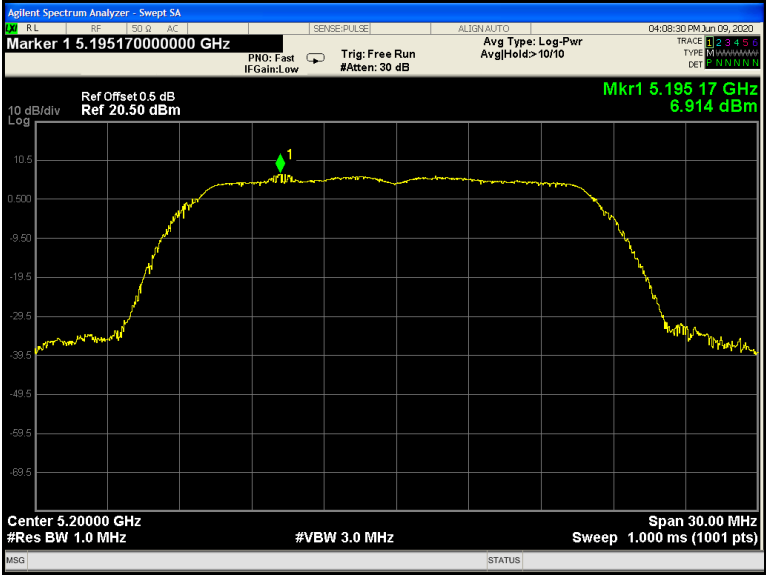
Test result plots shown as follows:

ANT 1

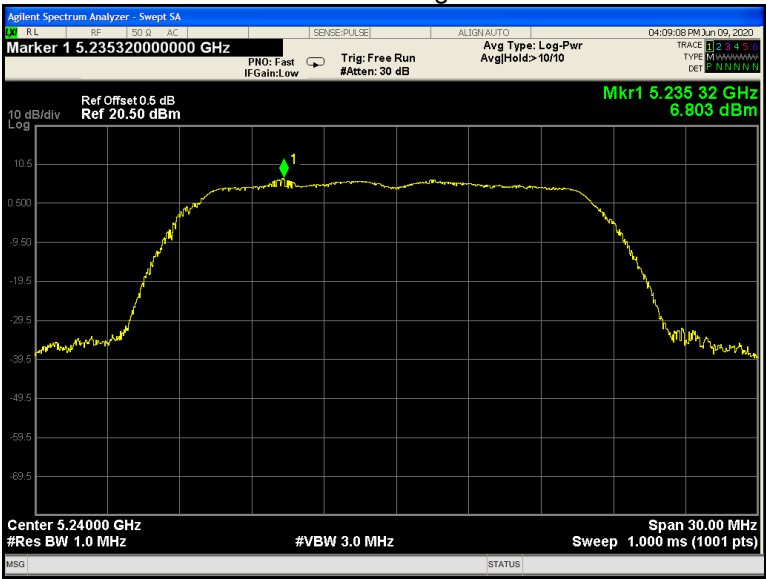
802.11a U-NII-1 Low channel



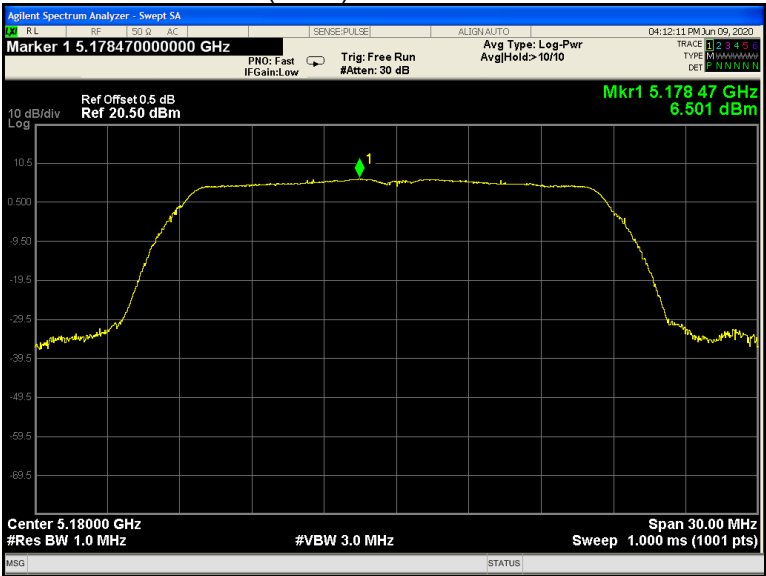
802.11a U-NII-1 Middle channel



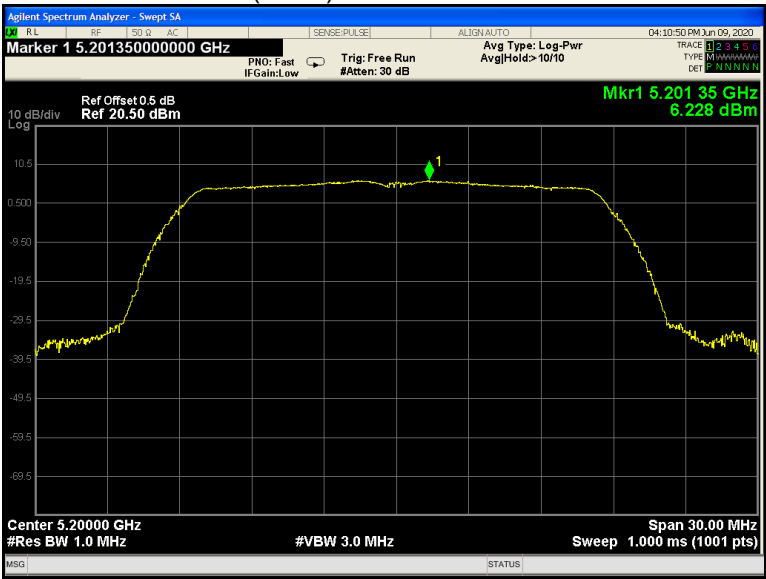
802.11a U-NII-1 High channel



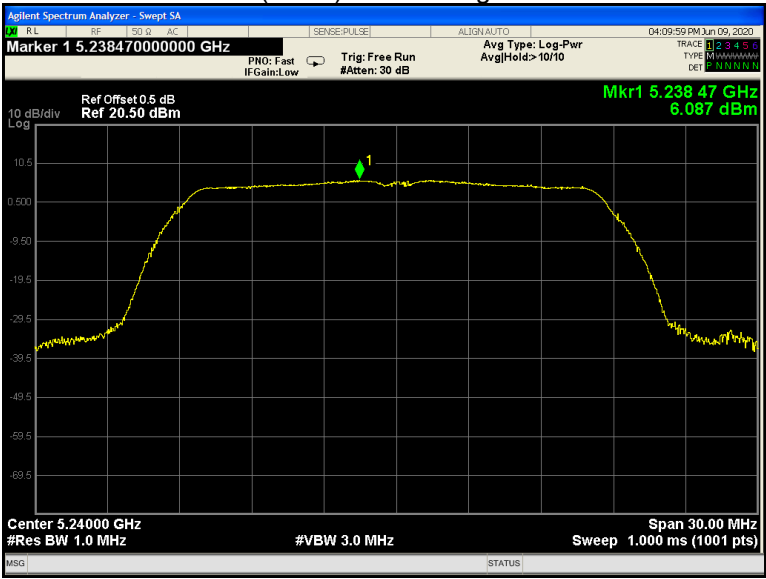
802.11n(HT20) U-NII-1 Low channel



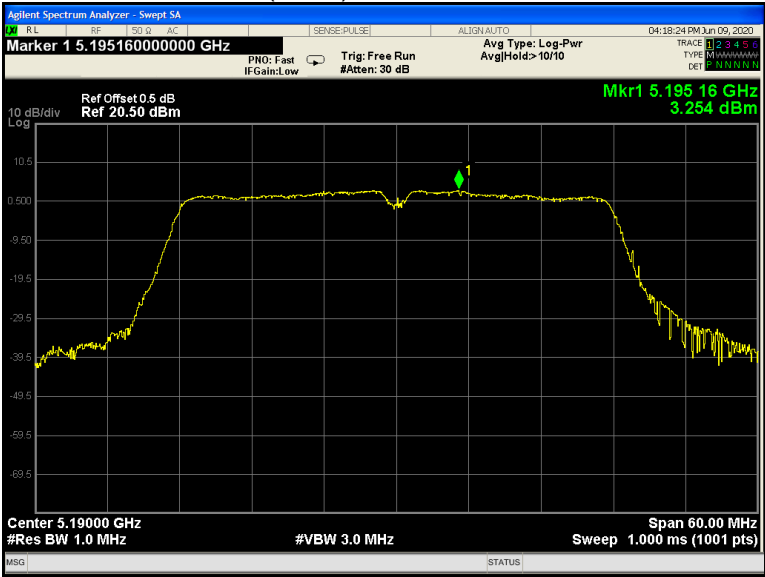
802.11n(HT20) U-NII-1 Middle channel



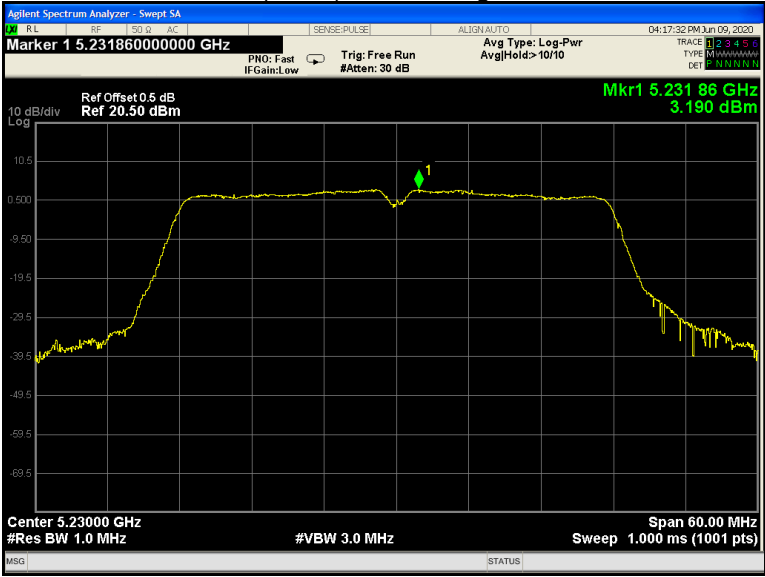
802.11n(HT20) U-NII-1 High channel



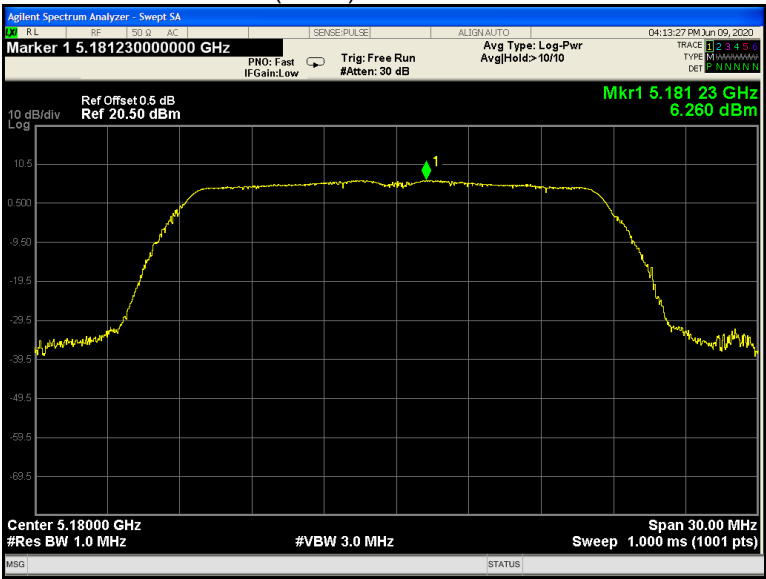
802.11n(HT40) U-NII-1 Low channel



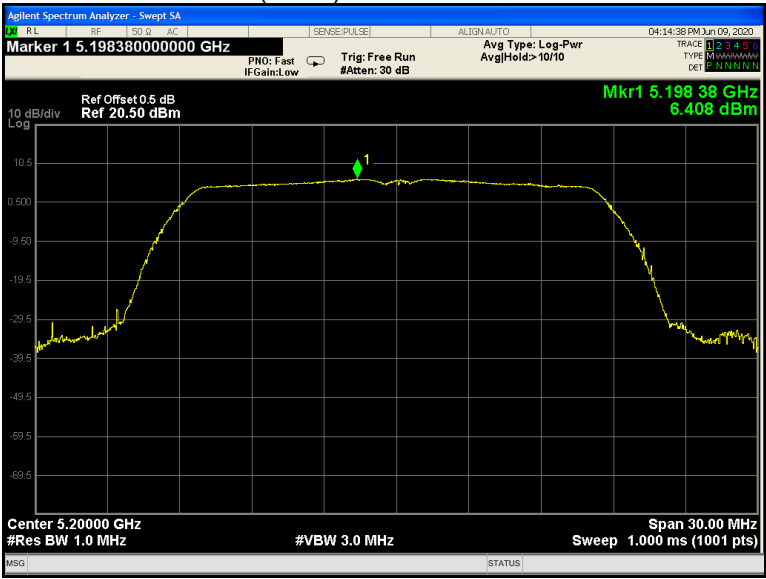
802.11n(HT40) U-NII-1 High channel



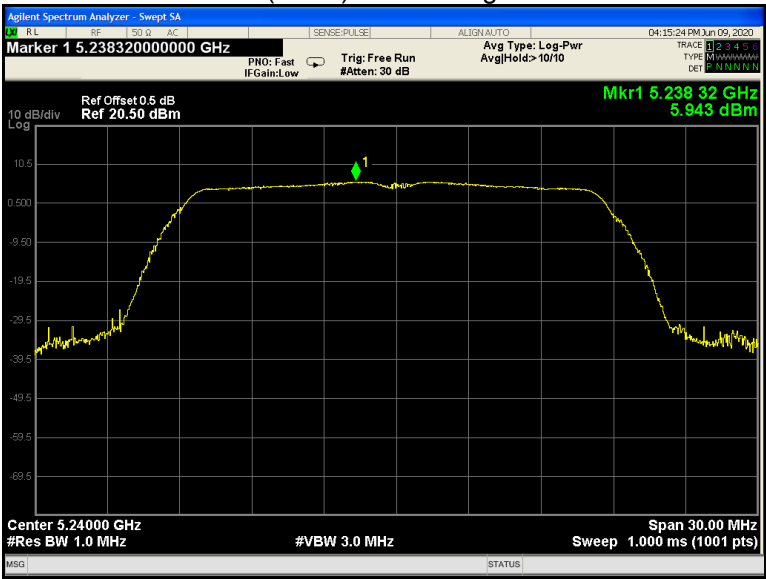
802.11ac(HT20) U-NII-1 Low channel



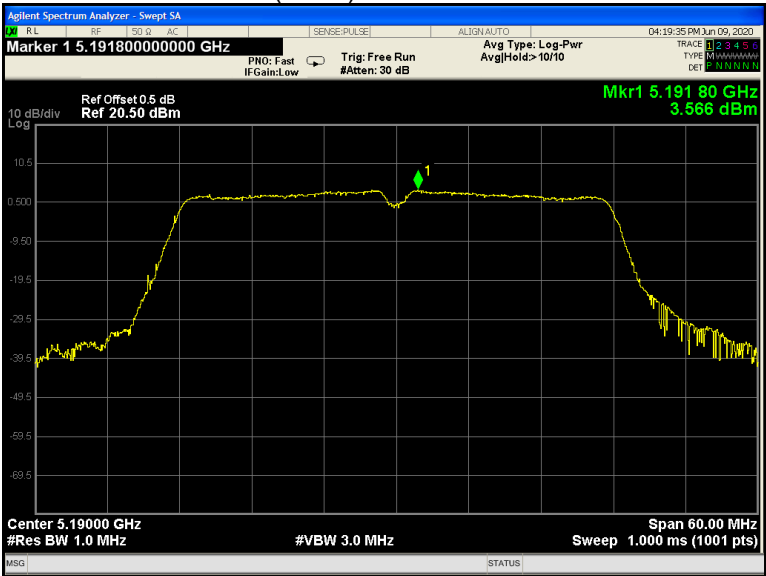
802.11ac(HT20) U-NII-1 Middle channel



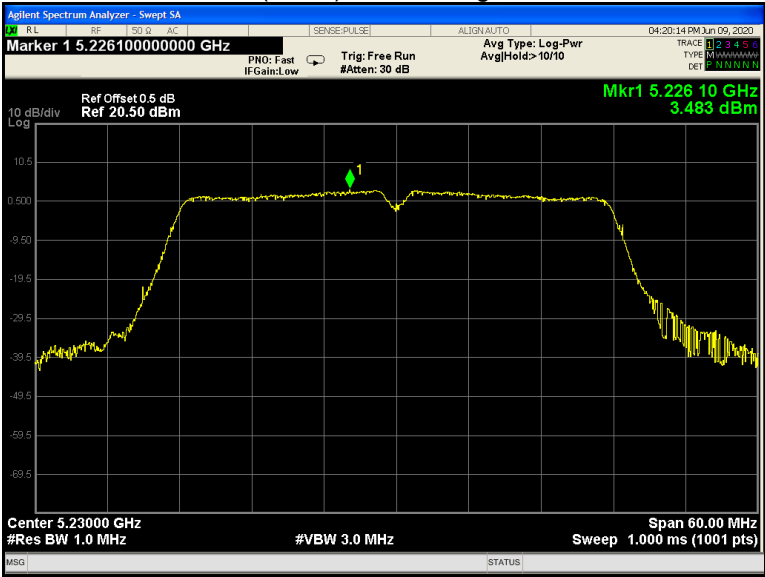
802.11ac(HT20) U-NII-1 High channel



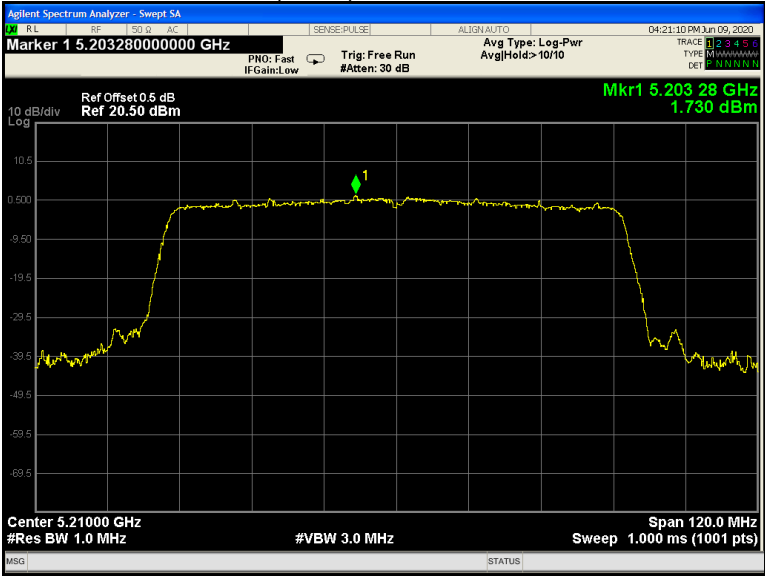
802.11ac(HT40) U-NII-1 Low channel



802.11n(HT40) U-NII-1 High channel

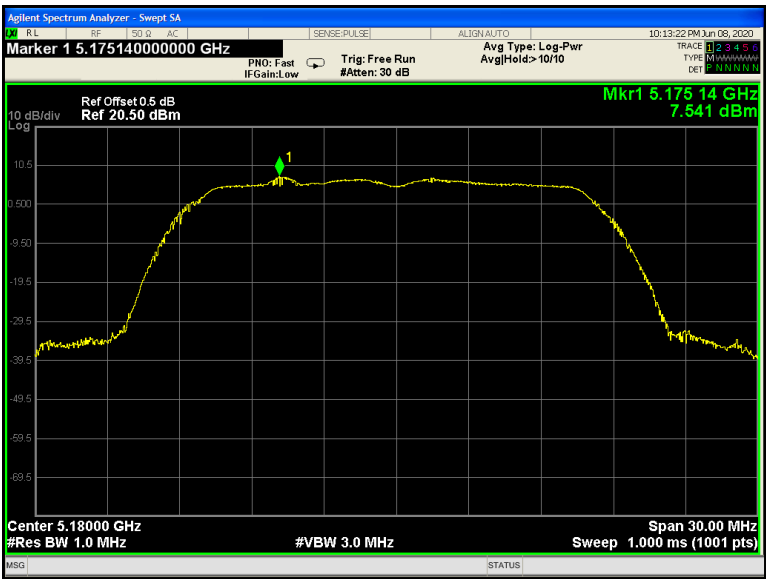


802.11ac(HT80) U-NII-1 Low channel

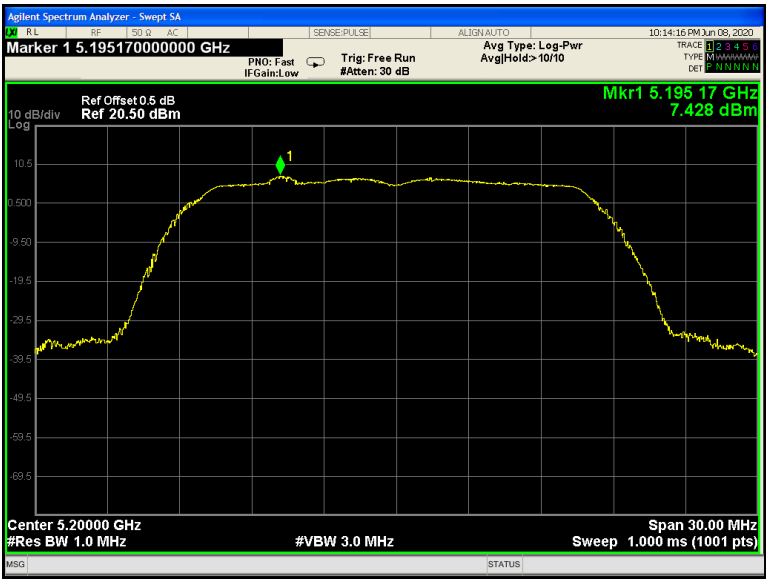


ANT 2

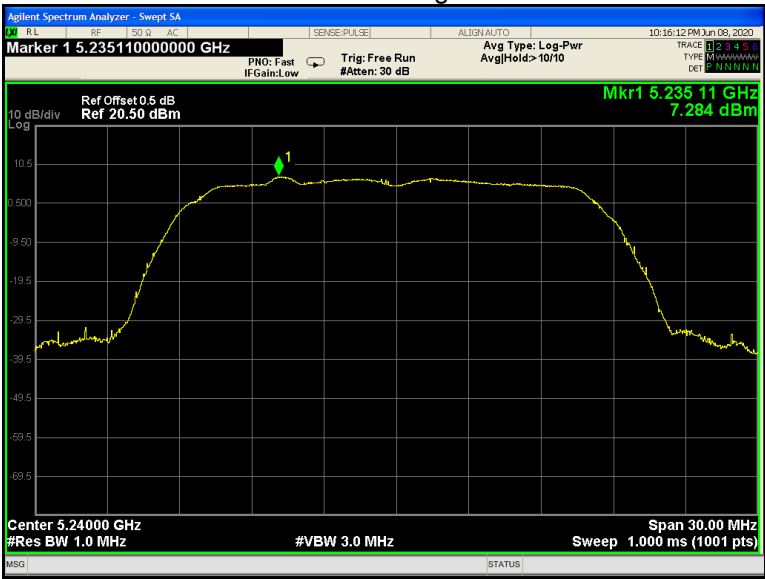
802.11a U-NII-1 Low channel



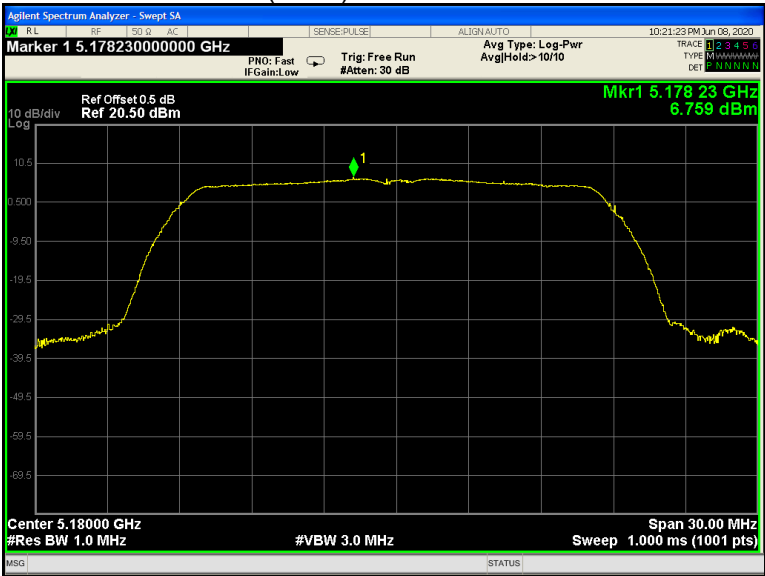
802.11a U-NII-1 Middle channel



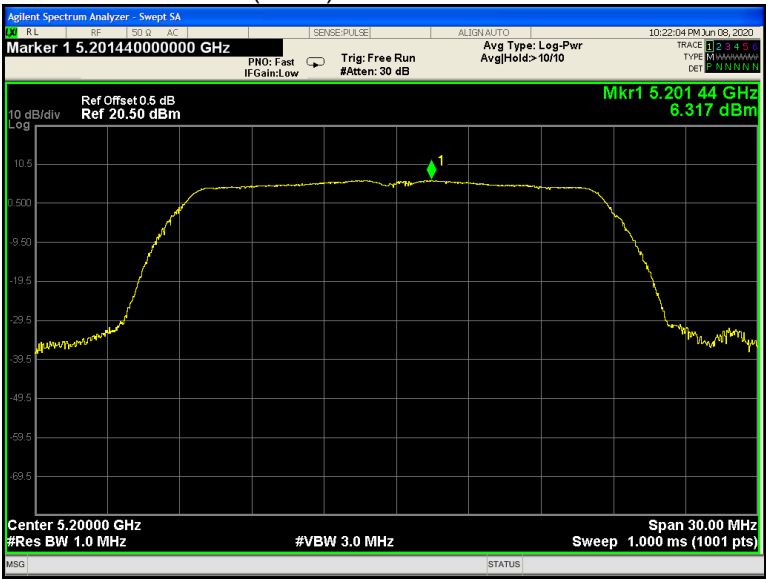
802.11a U-NII-1 High channel



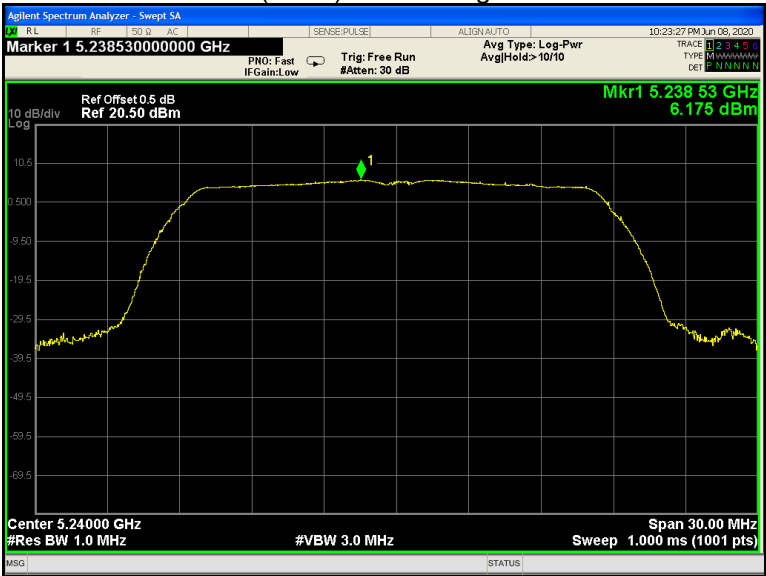
802.11n(HT20) U-NII-1 Low channel



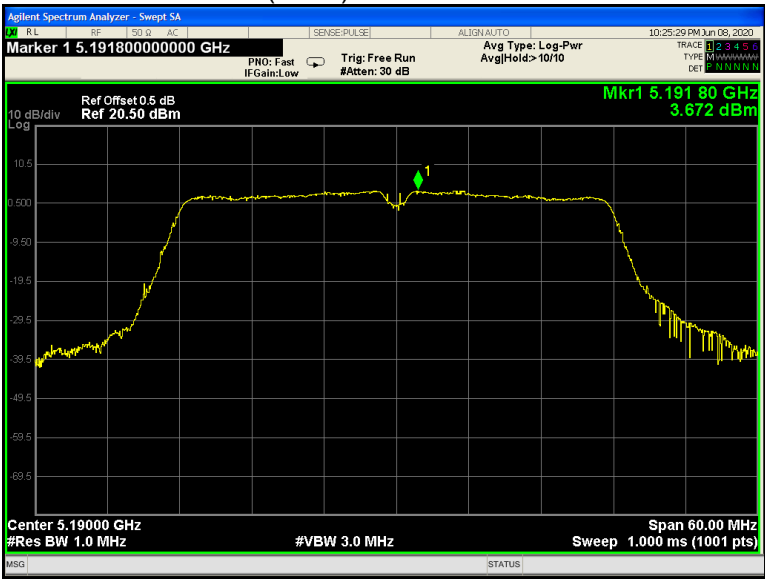
802.11n(HT20) U-NII-1 Middle channel



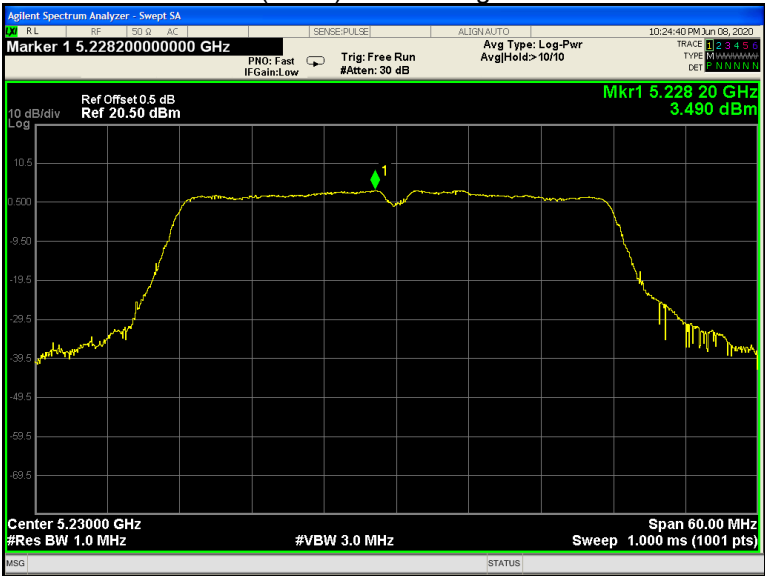
802.11n(HT20) U-NII-1 High channel



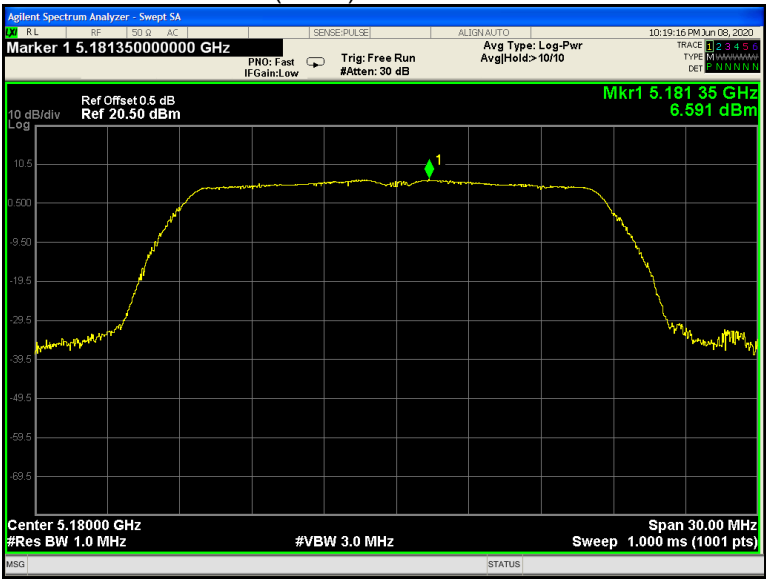
802.11n(HT40) U-NII-1 Low channel



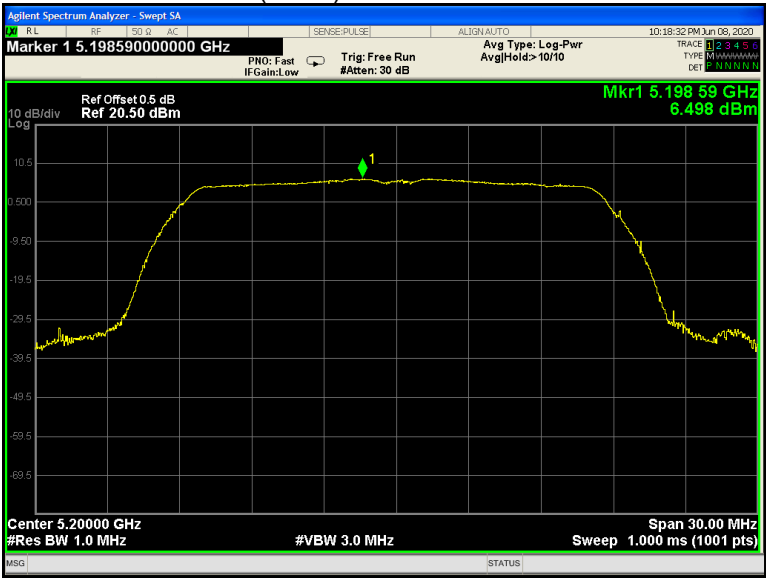
802.11n(HT40) U-NII-1 High channel



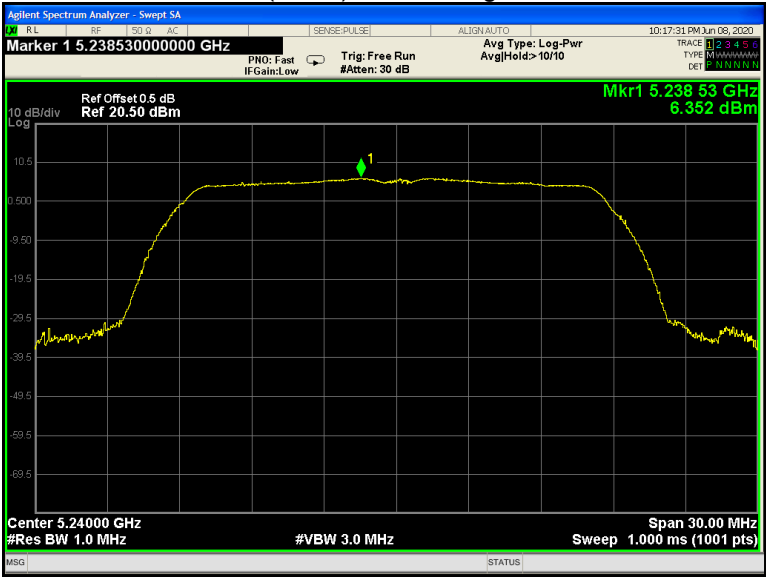
802.11ac(HT20) U-NII-1 Low channel



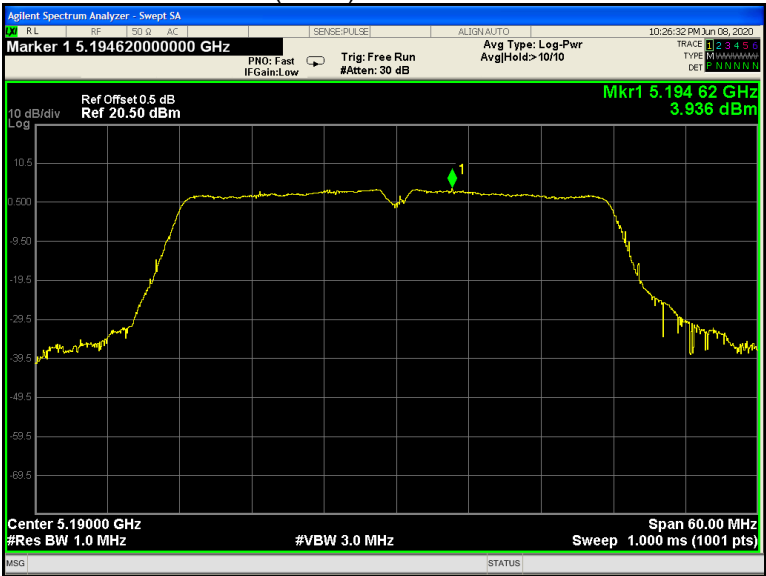
802.11ac(HT20) U-NII-1 Middle channel



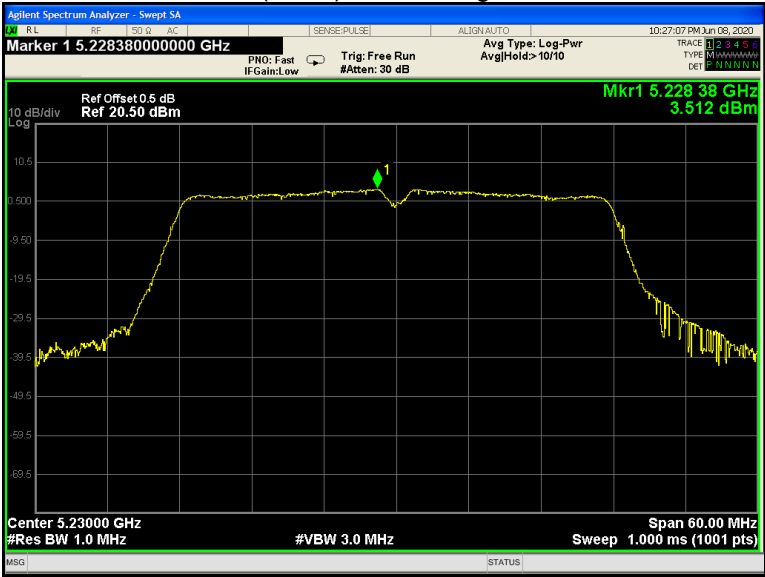
802.11ac(HT20) U-NII-1 High channel



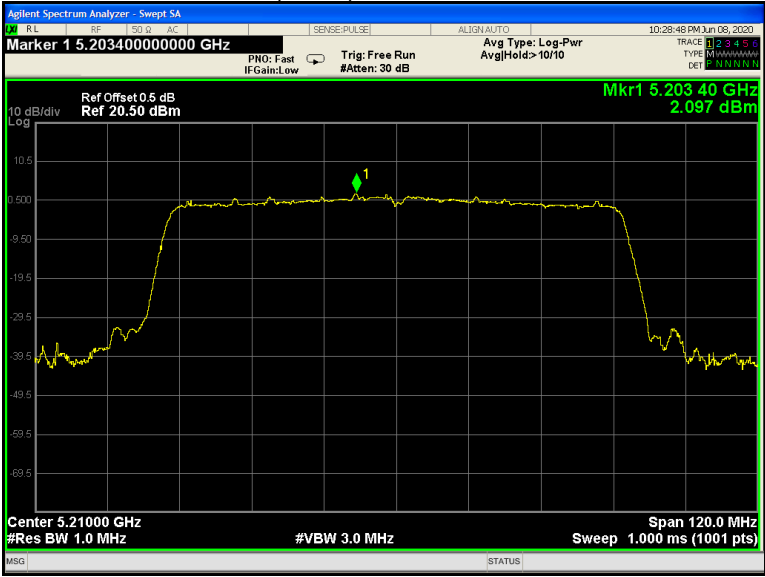
802.11ac(HT40) U-NII-1 Low channel



802.11n(HT40) U-NII-1 High channel



802.11ac(HT80) U-NII-1 Low channel



14 Frequency Stability

Test Requirement:	FCC CFR47 Part 15 Section 15.407(g)
Test Method:	ANSI C63.10:2013
Test Limit:	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 users manual or 20ppm.
Test Result:	PASS

14.1 Test Procedure:

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
EUT have transmitted absence of unmodulation signal and fixed channelise. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings. f_c is declaring of channel frequency. Then the frequency error formula is $(f_c - f)/f_c \times 10^6$ ppm and the limit is less than ± 20 ppm. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.
2. Extreme temperature rule is $-15^{\circ}\text{C} \sim 45^{\circ}\text{C}$.

14.2 Test Result:

Remark: All channel have been tested for all mode , only the low channel were shown follow up:

802.11a U-NII-1

U-NII-1 Test Frequency:5180MHz				
Temperature (°C)	Power Supply (VAC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
45	120	1800	0.3456	20
30		1813	0.3543	20
20		1811	0.3498	20
10		1806	0.3484	20
0		1808	0.3492	20
-10		1813	0.3553	20
-15		1802	0.3479	20
20	108	1813	0.3547	20
20	132	1801	0.3466	20

802.11n(HT20) U-NII-1

U-NII-1 Test Frequency:5180MHz				
Temperature (°C)	Power Supply (VAC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
45	120	1708	0.3297	20
30		1720	0.352	20
20		1719	0.3319	20
10		1712	0.3325	20
0		1711	0.3303	20
-10		1716	0.3319	20
-15		1716	0.3316	20
20	108	1710	0.3301	20
20	132	1705	0.3295	20

802.11ac(HT20) U-NII-1

U-NII-1 Test Frequency:5180MHz				
Temperature (°C)	Power Supply (VAC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
45	120	1810	0.3494	20
30		1800	0.3471	20
20		1799	0.3463	20
10		1805	0.3481	20
0		1807	0.3487	20
-10		1804	0.3482	20
-15		1798	0.3471	20
20	108	1812	0.3498	20
20	132	1804	0.3485	20

802.11n(HT40) U-NII-1

U-NII-1 Test Frequency:5190MHz				
Temperature (°C)	Power Supply (VAC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
45	120	1811	0.3489	20
30		1803	0.3474	20
20		1817	0.3501	20
10		1811	0.3484	20
0		1812	0.3491	20
-10		1819	0.3505	20
-15		1817	0.3552	20
20	108	1808	0.3484	20
20	132	1806	0.3457	20

802.11ac(HT40) U-NII-1

U-NII-1 Test Frequency:5190MHz				
Temperature (°C)	Power Supply (VAC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
45	120	1780	0.3430	20
30		1786	0.3441	20
20		1783	0.3450	20
10		1786	0.3441	20
0		1792	0.3414	20
-10		1779	0.3428	20
-15		1789	0.3447	20
20	108	1781	0.3457	20
20	132	1779	0.3428	20

802.11ac(HT80) U-NII-1

U-NII-1 Test Frequency:5210MHz				
Temperature (°C)	Power Supply (VAC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
45	120	1844	0.3560	20
30		1837	0.3526	20
20		1843	0.3537	20
10		1841	0.3537	20
0		1833	0.3518	20
-10		1841	0.3521	20
-15		1845	0.3541	20
20	108	1844	0.3539	20
20	132	1848	0.3543	20

15 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

This device uses an anti-helix interface antenna to the intentional radiator. Antenna connectors complied with the requirement.

16 RF Exposure

Remark: refer to MPE test report: WTF20S05031693W003.

17 Photographs of test setup and EUT.

Note: Please refer to appendix: Appendix-IE-1200M-Photos.

=====End of Report=====