FCC TEST REPORT

Product Name:	SET TOP BOX
Trade Mark:	N/A
Model No.:	KM2 PLUS
Add. Model No.:	KM2 PRO, KM3 PRO, KM3 PLUS, KM5 PRO, KM5 PLUS, KM6 PRO, KM6 PLUS, KM7 RPO, KM7 PLUS, HP44H, HP4414
Report Number:	220608033RFC-4
Test Standards:	FCC 47 CFR Part 15 Subpart E
FCC ID:	2AGKB-KM2PLUS
Test Result:	PASS
Date of Issue:	August 5, 2022

Prepared for:

Videostrong Technology Co., Ltd
604, Lushi industrial Building, 28 District Bao'an District, Shenzhen, China

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China
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Version

Version No.	Date	Description
V1.0	August 5, 2022	Original

CONTENTS

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Videostrong Technology Co., Ltd
Address of Applicant:	604, Lushi industrial Building, 28 District Bao'an District, Shenzhen, China
Manufacturer:	Videostrong Technology Co., Ltd
Address of Manufacturer:	604, Lushi industrial Building, 28 District Bao'an District, Shenzhen, China

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	SET TOP BOX		
Model No.:	KM2 PLUS		
Add. Model No.:	KM2 PRO, KM3 PRO, KM3 PLUS, KM5 PRO, KM5 PLUS, KM6 PRO, KM6 PLUS, KM7 RPO, KM7 PLUS, HP44H, HP4414		
Trade Mark:	N/A		
DUT Stage:	Identical Prototype		
EUT Supports Function: (Provided by the customer)	2.4 GHz ISM Band:	IEEE 802.11b/g/n	
		Bluetooth 5.0	
	5 GHz U-NII Bands:	5 150 MHz to 5 250 MHz	IEEE 802.11a/n/ac
		5 250 MHz to 5 350 MHz	IEEE 802.11a/n/ac
		5 470 MHz to 5 725 MHz	IEEE 802.11a/n/ac
		5 725 MHz to 5 850 MHz	IEEE 802.11a/n/ac
Software Version:	C2.1.4 (Provided by the customer)		
Hardware Version:	5800-2AHP44H-1102 (Provided by the customer)		
Sample Received Date:	June 6, 2022		
Sample Tested Date:	June 10, 2022 to July 11, 2022		
Note: The additional model KM2 PRO, KM3 PRO, KM3 PLUS, KM5 PRO, KM5 PLUS, KM6 PRO, KM6 PLUS, KM7 RPO, KM7 PLUS, HP44H, HP4414 is identical with the test model KM2 PLUS except the model number for marketing purpose.			

1.2.2 Description of Accessories

Adapter	
Model No.:	TEKA012-1201000UK
Input:	100-240 V~50/60 Hz 0.35 A Max
Output:	12.0 V ⎓ 1.0 A
AC Cable:	N/A
DC Cable:	1.2 Meter, Unshielded without ferrite

Cable	
Description:	HDMI Cable
Connector:	HDMI-A
Cable Type:	Shielded with two ferrite
Length:	1.5 Meter

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Bands:	5150 MHz to 5250 MHz (U-NII-1)	
	5250 MHz to 5350 MHz (U-NII-2A)	
	5470 MHz to 5725 MHz (U-NII-2C)	
	5 725 MHz to 5 850 MHz (U-NII-3)	
Frequency Ranges:	5180 MHz to 5240 MHz	
	5260 MHz to 5320 MHz	
	5500 MHz to 5700 MHz	
	5 745 MHz to 5 825 MHz	
Support Standards:	IEEE 802.11a/n/ac	
TPC Function:	Not Support	
DFS Operational mode:	Slave without radar Interference detection function	
Type of Modulation:	IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK)	
	IEEE 802.11n: OFDM(64QAM, 16QAM, QPSK, BPSK)	
	IEEE 802.11ac: OFDM(256QAM, 64QAM, 16QAM, QPSK, BPSK)	
Channel Spacing:	IEEE 802.11a/n-HT20/ac-VHT20: 20 MHz	
	IEEE 802.11n-HT40/ac-VHT40: 40 MHz	
	IEEE 802.11ac-VHT80: 80 MHz	
Data Rate:	IEEE 802.11a: Up to 54 Mbps	
	IEEE 802.11n-HT20: Up to MCS15	
	IEEE 802.11n-HT40: Up to MCS15	
	IEEE 802.11ac-VHT20: Up to MCS8	
	IEEE 802.11ac-VHT40: Up to MCS9	
	IEEE 802.11ac-VHT80: Up to MCS9	
Number of Channels:	5150 MHz to 5250 MHz: 4 for IEEE 802.11a/n-HT20/ac-VHT20 2 for IEEE 802.11n-HT40)/ac-VHT40 1 for IEEE 802.11acVHT80	
	5250 MHz to 5350 MHz: 4 for IEEE 802.11a/n-HT20/ac-VHT20 2 for IEEE 802.11n-HT40)/ac-VHT40 1 for IEEE 802.11acVHT80	
	5470 MHz to 5725 MHz: 11 for IEEE 802.11a/n-HT20/ac-VHT20 5 for IEEE 802.11n-HT40/ac-VHT40 2 for IEEE 802.11ac-VHT80	
	5725 MHz to 5850 MHz: 5 for IEEE 802.11a/n-HT20/ac-VHT20 2 for IEEE 802.11n-HT40/ac-VHT40 1 for IEEE 802.11ac-VHT80	
Antenna Type:	Ant. 0	PCB Antenna
	Ant. 1	PCB Antenna
Antenna Gain: (Provided by the customer)	Ant. 0	5150 MHz to 5250 MHz: 2 dBi
		5250 MHz to 5350 MHz: 2 dBi
		5470 MHz to 5725 MHz: 2 dBi
		5725 MHz to 5850 MHz: 2 dBi
	Ant. 1	5150 MHz to 5250 MHz: 2 dBi
		5250 MHz to 5350 MHz: 2 dBi

		5470 MHz to 5725 MHz: 2 dBi				
		5725 MHz to 5850 MHz: 2 dBi				
Max. Conducted Avg. Power (dBm):	**SISO_Ant. 0**		**U-NII-1**	**U-NII-2A**	**U-NII-2C**	**U-NII-3**
	IEEE 802.11a:		15.89	16.21	17.46	18.29
	SISO_Ant. 1		**U-NII-1**	**U-NII-2A**	**U-NII-2C**	**U-NII-3**
	IEEE 802.11a:		16.07	16.89	17.84	17.84
	MIMO_Ant. 0+1		**U-NII-1**	**U-NII-2A**	**U-NII-2C**	**U-NII-3**
	IEEE 802.11n-HT20:		17.87	18.75	19.59	21.38
	IEEE 802.11n-HT40:		17.19	17.81	18.87	20.45
	IEEE 802.11ac-VHT20:		18.00	18.90	19.64	21.51
	IEEE 802.11ac-VHT40:		17.16	17.80	18.77	20.37
	IEEE 802.11ac-VHT80:		16.23	17.05	17.41	20.20
Normal Test Voltage:	120V~60Hz/ 240V~50Hz					

1.4 OTHER INFORMATION

None.

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	FCC ID	Supplied by
Notebook	DELL	Inspiron 5409	N/A	N/A	UnionTrust
Wireless Home Router	SAGEMCOM	FAST5280	N/A	VW3FAST5280	UnionTrust
Mouse	ASUS	N/A	N/A	N/A	UnionTrust
Monitor	DELL	P2719H	N/A	N/A	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable x 2	SMA	0.3 Meter	UnionTrust

1.6 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China, China 518109
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories
CAB identifier: CN0032

FCC Accredited Lab.
Designation Number: CN1194
Test Firm Registration Number: 259480

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9kHz-150kHz	±3.2 dB
2	Conducted emission 150kHz-30MHz	±2.7 dB
3	Radiated emission 9kHz-30MHz	±4.7 dB
4	Radiated emission 30MHz-1GHz	±4.6 dB
5	Radiated emission 1GHz-18GHz	±4.4 dB
6	Radiated emission 18GHz-40GHz	±4.6 dB

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart E Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Antenna Requirement	FCC 47 CFR Part 15 Subpart C Section 15.203 FCC 47 CFR Part 15 Subpart C Section 15.407(a)(1) (2)	N/A	PASS
26 dB emission bandwidth	FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(2)(5)	KDB 789033 D02 v02r01 Section C.1	PASS
6 dB bandwidth	FCC 47 CFR Part 15 Subpart E Section 15.407 (e)	KDB 789033 D02 v02r01 Section C.2	PASS
Maximum conducted output power	FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3)	KDB 789033 D02 v02r01 Section E.3.a (Method PM)	PASS
Peak Power Spectral Density	FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3)	KDB 789033 D02 v02r01 Section F	PASS
Radiated Emissions and Band Edge Measurement	FCC 47 CFR Part 15 Subpart E Section 15.407 (b)(1)(2)(3)(4)(6) FCC 47 CFR Part 15 Subpart C Section 15.209/205	KDB 789033 D02 v02r01 Section G.3, G.4, G.5, and G.6	PASS
Dynamic Frequency Selection	FCC 47 CFR Part 15 Subpart E Section 15.407 (h)	KDB 905462 D03 Client Without DFS New Rules v01r02	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart E Section 15.407 (b)(6) FCC 47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013, Section 6.2.	PASS

For Dynamic Frequency Selection

Test Case	Result
Channel Availability Check Time	N/A[1]
U-NII Detection Bandwidth	N/A[1]
Channel Closing Transmission Time	PASS
Channel Move Time	PASS
DFS Detection Threshold	N/A[1]
Non- Occupancy Period	N/A[1]

Note:

1) The EUT is slave, NA In this whole report not applicable.

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date**	**Cal. Due date**
☒	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	Euroshiedpn-CT001270-1317	22-Jan-2021	21-Jan-2024
☒	Receiver	R&S	ESIB26	100114	5-Nov-2021	4-Nov-2022
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	15-Apr-2022	14-Apr-2023
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	11-Nov-2021	10-Nov-2023
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	11-Nov-2021	10-Nov-2023
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	11-Nov-2021	10-Nov-2023
☒	Preamplifier	HP	8447F	2805A02960	5-Nov-2021	4-Nov-2022
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	17-Apr-2022	16-Apr-2024
☒	Pre-amplifier	ETS-LINDGREN	00118385	00201874	6-Nov-2021	5-Nov-2022
☐	Horn Antenna	ETS-LINDGREN	3116C	00200180	17-Apr-2022	16-Apr-2024
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	14-Nov-2020	13-Nov-2022
☒	Pre-amplifier	ETS-LINDGREN	00118384	00202652	17-Nov-2020	16-Nov-2022
☒	Band Rejection Filter (5150MHz~5880MHz)	Micro-Tronics	BRM50716	G186	6-Nov-2021	5-Nov-2022
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date**	**Cal. Due date**
☒	Receiver	R&S	ESR7	101181	5-Nov-2021	4-Nov-2022
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	5-Nov-2021	4-Nov-2022
☒	LISN	R&S	ESH2-Z5	860014/024	5-Nov-2021	4-Nov-2022
☒	LISN	ETS-Lindgren	3816/2SH	00201088	5-Nov-2021	4-Nov-2022
☒	Test Software	Audix	e3	Software Version: 9 20151119i		

RF Conducted Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date**	**Cal. Due date**
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	15-Apr-2022	14-Apr-2023
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	5-Nov-2021	4-Nov-2022
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430023	5-Nov-2021	4-Nov-2022
☐	EXG-B RF Analog Signal Generator	KEYSIGHT	N5171B	MY53051777	5-Nov-2021	4-Nov-2022
☒	MXG X-Series RF Vector Signal Generator	KEYSIGHT	N5182B	MY51350267	5-Nov-2021	4-Nov-2022

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage	Relative Humidity (%)
NT/NV	+15 to +35	120V~60Hz or 240V~50Hz	20 to 75

Remark:
1) NV: Normal Voltage; NT: Normal Temperature

4.1.2 Record of Normal Environment and Test Sample

Test Item	Temp. (°C)	Relative Humidity (%)	Pressure (kPa)	Sample No.	Tested by
AC Power Line Conducted Emission	24.5	47	101.1	220606012-A06/7	David Zhang
26 dB emission bandwidth	26.1	47	100.3	220606012-A01/7	Hank Wu
Maximum conducted output power					
Peak Power Spectral Density					
6 dB bandwidth					
Dynamic Frequency Selection					
Radiated Emissions and Band Edge Measurement	24.1	53	100.2	220606012-A05/7	Fire Huo

4.2 TEST CHANNELS

Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11a IEEE 802.11n-HT20 IEEE 802.11ac-VHT20	5150 MHz to 5250 MHz	Channel 36	Channel 44	Channel 48
		5180 MHz	5220 MHz	5240 MHz
	5250 MHz to 5350 MHz	Channel 52	Channel 60	Channel 64
		5260 MHz	5300 MHz	5320 MHz
	5470 MHz to 5725 MHz	Channel 100	Channel 120	Channel 140/ Channel 144
		5500 MHz	5600 MHz	5700 MHz/ 5720MHz
	5725 MHz to 5850 MHz	Channel 144/ Channel 149	Channel 157	Channel 165
		5720MHz/ 5745 MHz	5785 MHz	5825 MHz
IEEE 802.11n-HT40 IEEE 802.11ac-VHT40	5150 MHz to 5250 MHz	Channel 38	--	Channel 46
		5190 MHz	--	5230 MHz
	5250 MHz to 5350 MHz	Channel 54	--	Channel 62
		5270 MHz	--	5310 MHz
	5470 MHz to 5725 MHz	Channel 102	Channel 118	Channel 134/ Channel 142
		5510 MHz	5590 MHz	5670 MHz/ 5710MHz
	5725 MHz to 5850 MHz	Channel 142/ Channel 151	--	Channel 159
		5710MHz/ 5755 MHz	--	5795 MHz
IEEE 802.11ac-VHT80	5150 MHz to 5250 MHz	--	Channel 42	--
		--	5210 MHz	--
	5250 MHz to 5350 MHz	--	Channel 58	--
		--	5290 MHz	--
	5470 MHz to 5725 MHz	Channel 106	--	Channel 122/ Channel 138
		5530 MHz	--	5610 MHz/ 5569 MHz
	5725 MHz to 5850 MHz	Channel 138	Channel 155	--
		5610 MHz/	5775 MHz	--

4.3 EUT TEST STATUS

Mode	Tx/Rx Function	Description
IEEE 802.11a/n/ac	1Tx/1Rx or 2Tx/2Rx	1. Keep the EUT in transmitting mode with all kind of modulation and all kind of data rate.

Power Setting (Provided by the customer)
Power Setting: not applicable, test used software default power level.

Test Software (Provided by the customer)
Test software name: cmd.exe;

4.4 PRE-SCAN

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. Following data rate was (were) selected for the final test as listed below

Mode	Worst-case data rates
IEEE 802.11a	6 Mbps
IEEE 802.11n-HT20	MCS0
IEEE 802.11n-HT40	MCS0
IEEE 802.11ac-VHT20	MCS0
IEEE 802.11ac-VHT40	MCS0
IEEE 802.11ac-VHT80	MCS0

4.5 TEST SETUP

4.5.1 For Radiated Emissions test setup

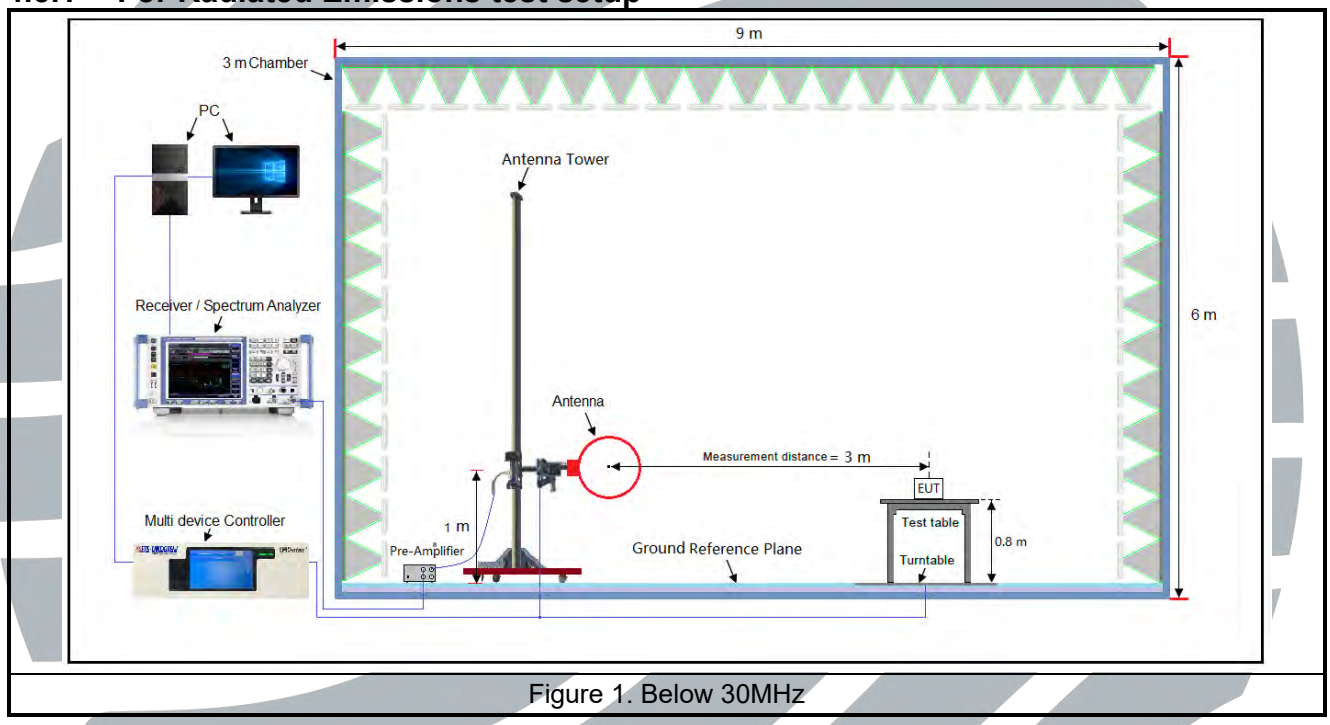


Figure 1. Below 30MHz

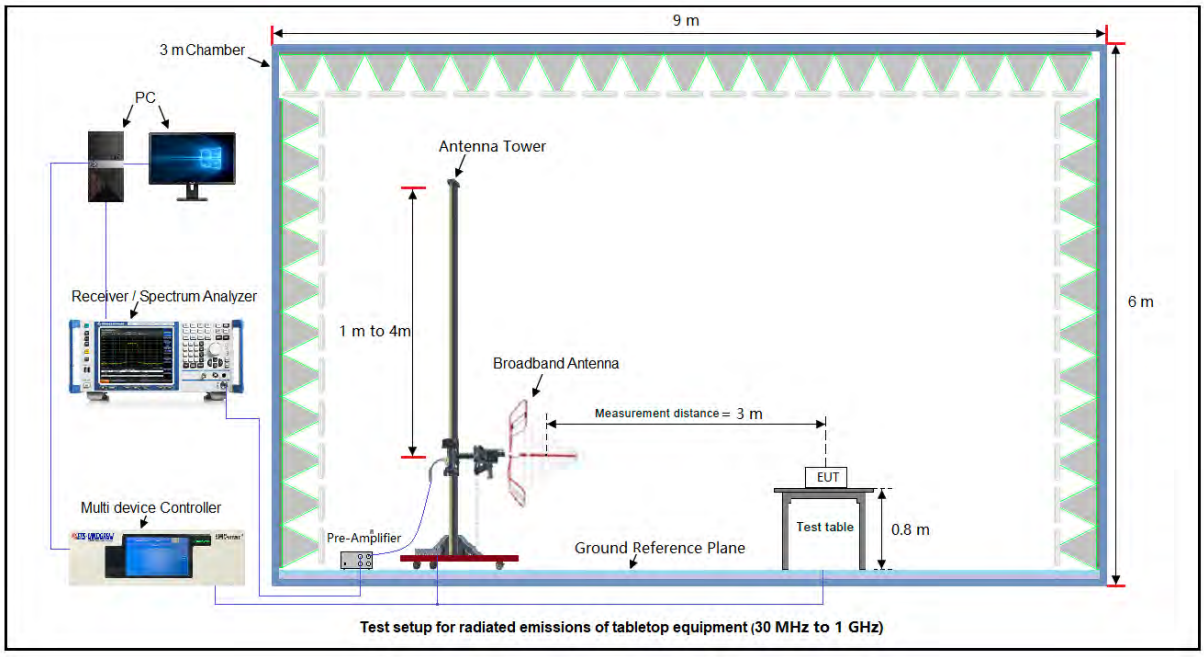


Figure 2. 30MHz to 1GHz

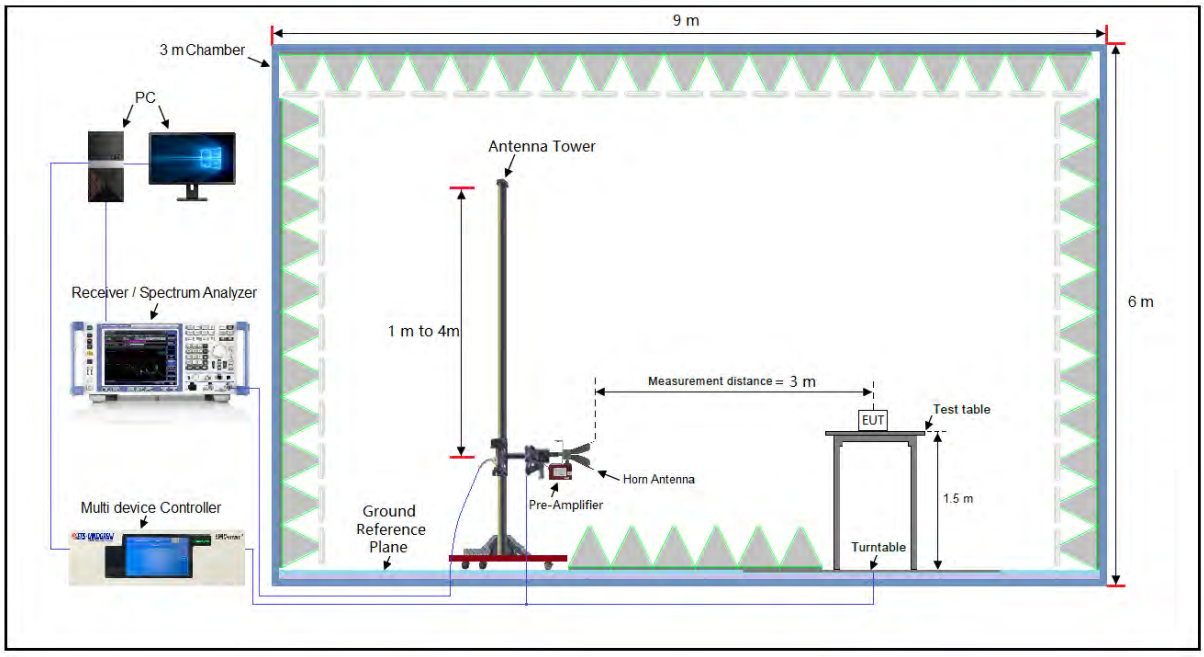
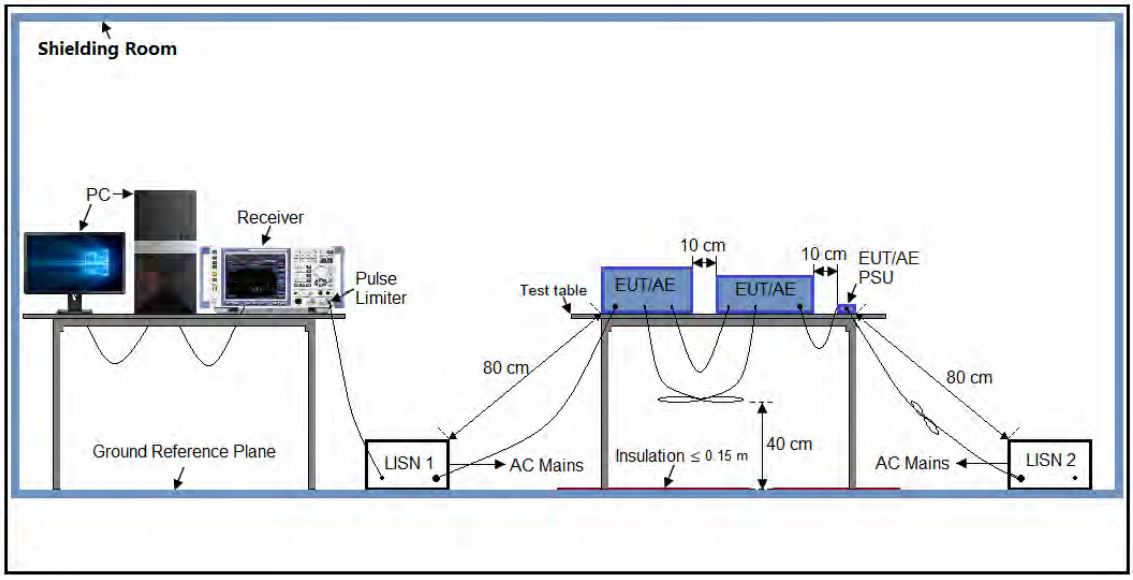
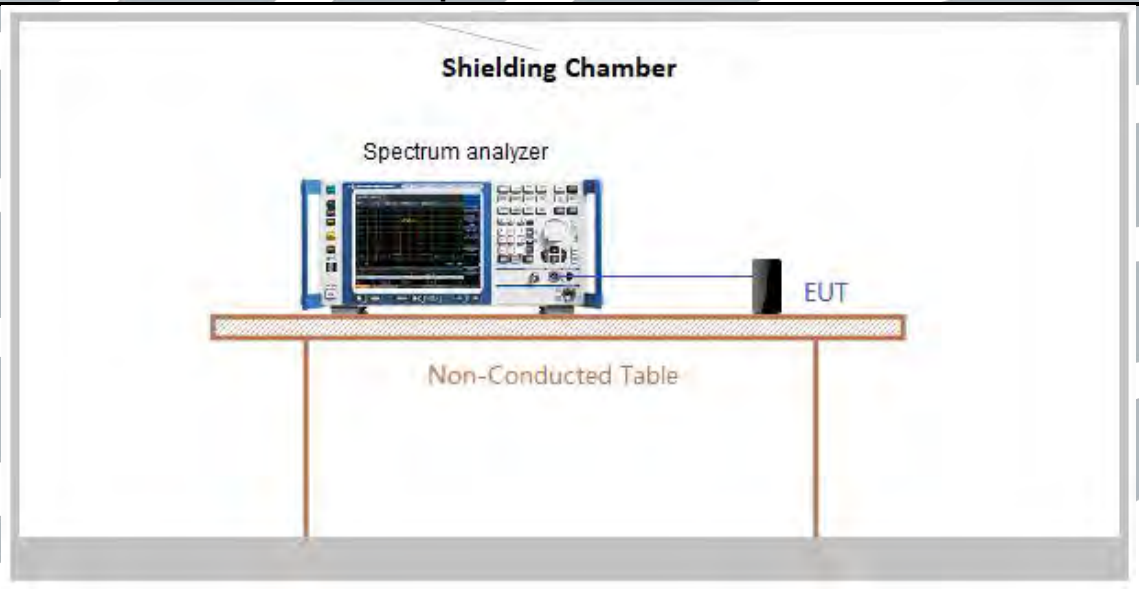


Figure 3. Above 1GHz

4.5.2 For Conducted Emissions test setup



4.5.3 For Conducted RF test setup



Normal Environment

4.6 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by AC-DC adapter. Only the worst case data were recorded in this test report.

The signal is maximized through rotation and placement in the three orthogonal axes. 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 three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Therefore, all final radiated testing was performed with the EUT in orientation.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.7 DUTY CYCLE

Test Procedure: ANSI C63.10-2013 Clause 12.2.

Test Results

Mode	Data Rates	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/T Minimum VBW (kHz)
IEEE 802.11a	6 Mbps	2.060	2.240	0.92	91.96	0.36	0.49
IEEE 802.11n-HT20	MCS 0	1.900	2.060	0.92	92.23	0.35	0.53
IEEE 802.11n-HT40	MCS 0	0.940	1.105	0.85	85.07	0.70	1.06
IEEE 802.11ac-VHT20	MCS 0	1.920	2.150	0.89	89.30	0.49	0.52
IEEE 802.11ac-VHT40	MCS 0	0.950	1.095	0.87	86.76	0.62	1.05
IEEE 802.11ac-VHT80	MCS 0	0.450	0.710	0.63	63.38	1.98	2.22

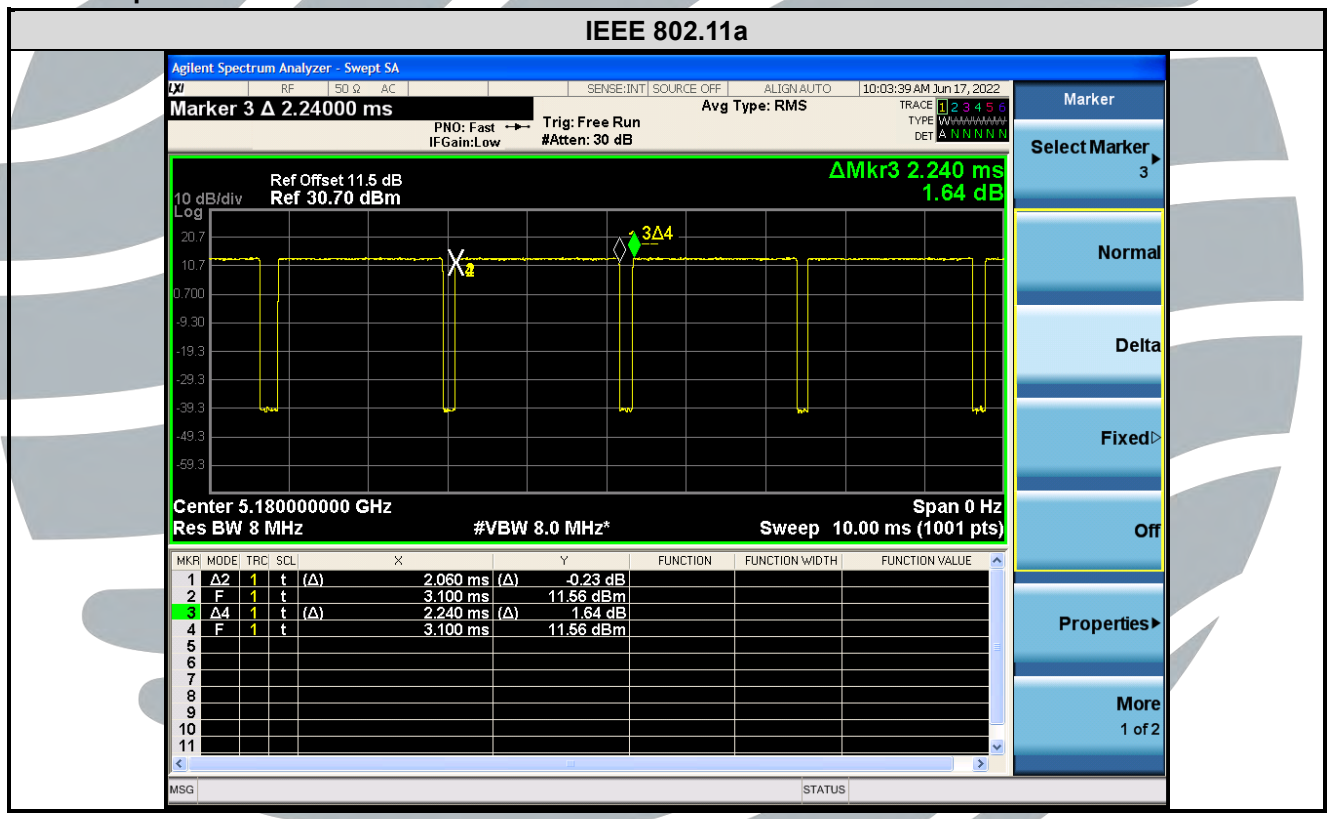
Remark:

1) Duty cycle= On Time/ Period;

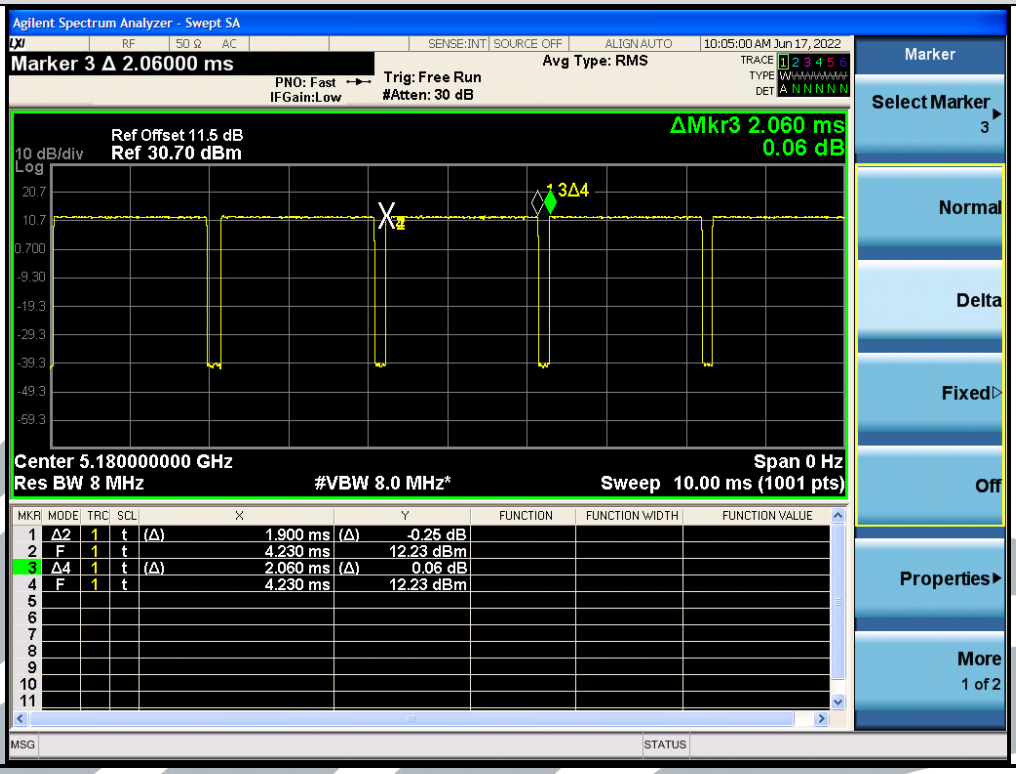
2) Duty Cycle factor = 10 * log(1/ Duty cycle)

The test plots as follows

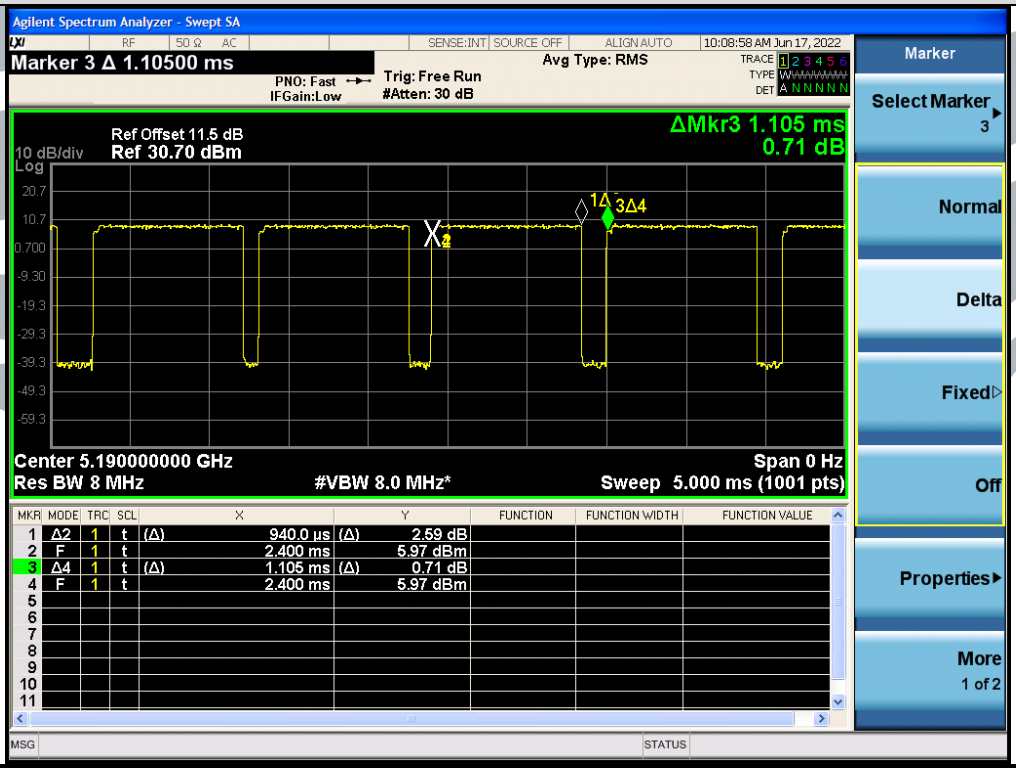
IEEE 802.11a



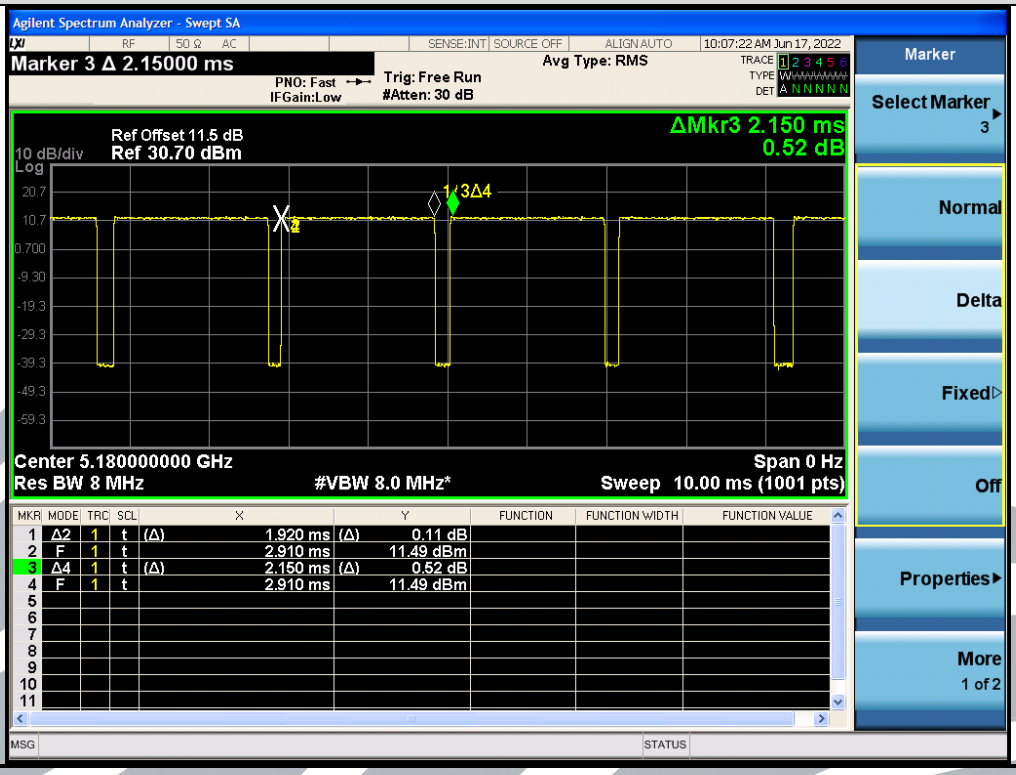
IEEE 802.11n-HT20



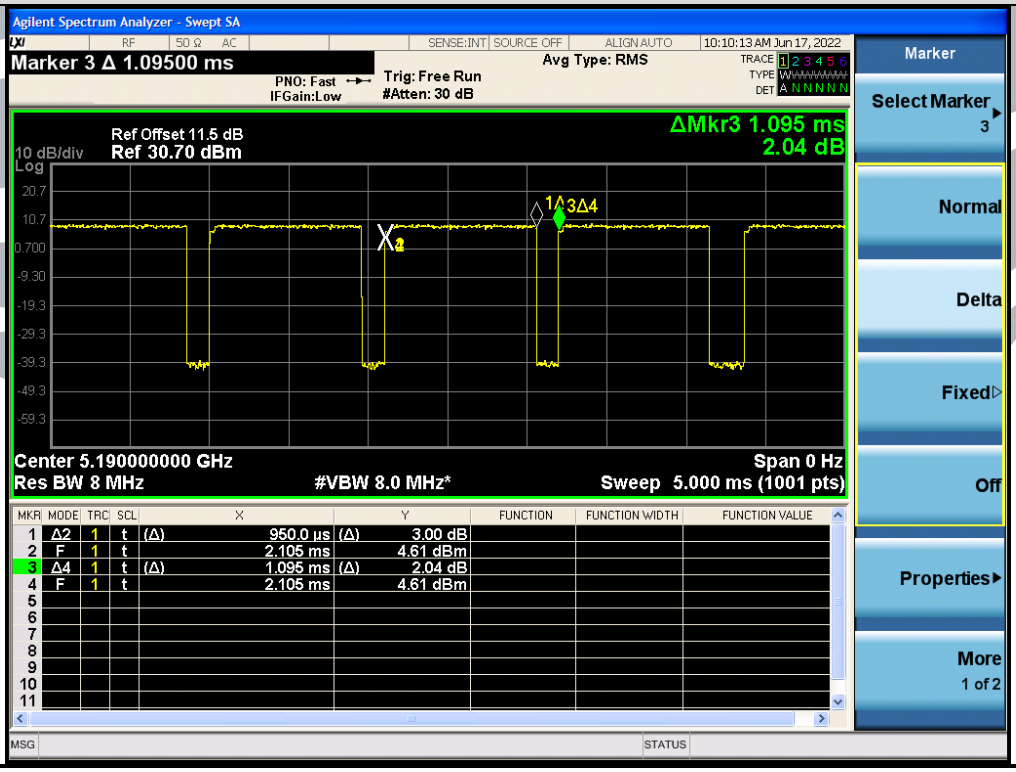
IEEE 802.11n-HT40



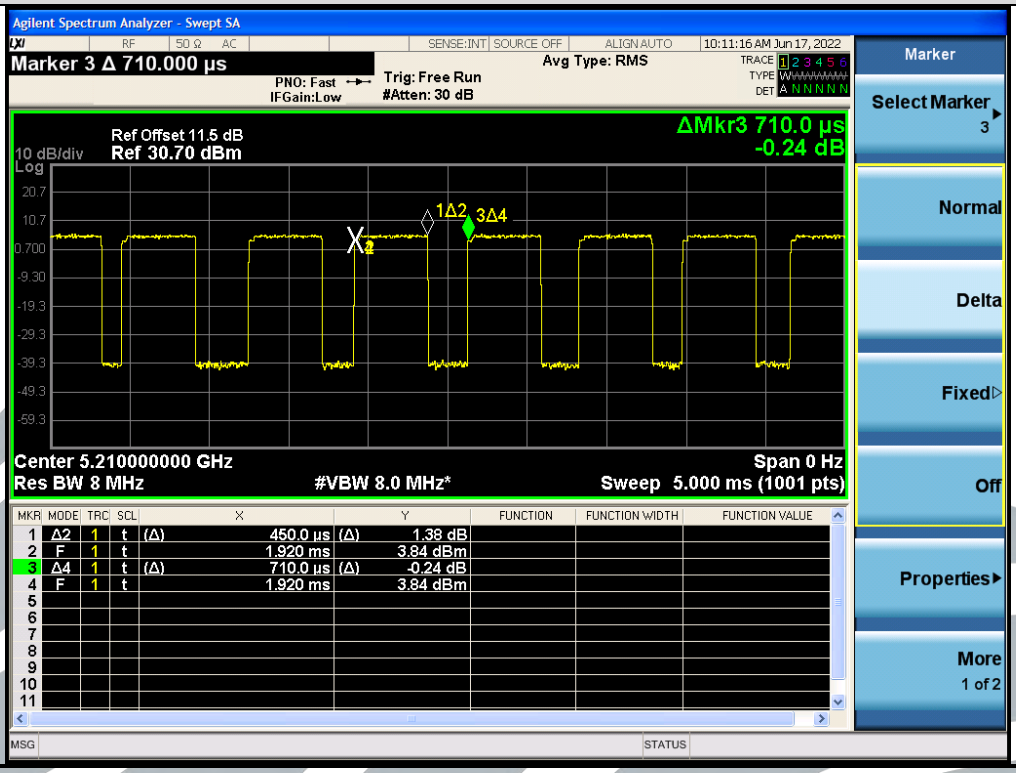
IEEE 802.11ac-VHT20



IEEE 802.11ac-VHT40



IEEE 802.11ac-VHT80



5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 15	Radio Frequency Devices
3	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices
4	KDB 789033 D02 General UNII Test Procedures New Rules v02r01	Guidelines for compliance testing of unlicensed national information infrastructure (U-NII) device part 15, subpart E
5	KDB 905462 D06 802.11 Channel Plans New Rules v02	Operation in U-NII bands -802.11 channel PLAN(§15.407)
6	KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02	Compliance measurement procedures for Unlicensed –National Information Infrastructure devices operates in the frequency bands 5250 MHz to 5350 MHz and 5470 MHz to 5725 MHz bands incorporating dynamic frequency selection
7	KDB 905462 D03 Client Without DFS New Rules v01r02	U-NII client devices without radar detection capability
8	KDB 662911 D01 Multiple Transmitter Output v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

5.2 ANTENNA REQUIREMENT

Standard Requirement
15.203 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, 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. **15.407(a)(1) (2) requirement:** The conducted output power limit specified in paragraph (a) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (a) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power and the peak power spectral density shall be reduced by the by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
EUT Antenna:
Both antenna in the interior of the equipment and no consideration of replacement. The transmit signals are correlated with each other and the antenna gain of both chains is completely consistent, the best case directional gain of the antenna is 2 dBi (See section 5.5).

5.3 26 DB BANDWIDTH

Test Requirement: FCC 47 CFR Part 15 Subpart E Section 15.407 (a) (2)(5)

Test Method: KDB 789033 D02 v02r01 Section C.1

Limit: None; for reporting purposes only.

Test Procedure:

The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum analyzer.

Spectrum analyzer according to the following Settings:
a) Set RBW = approximately 1 % of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

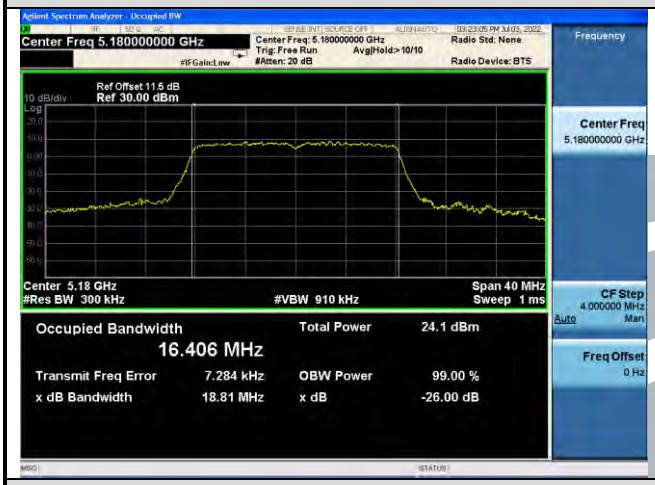
Test Mode: Transmitter mode

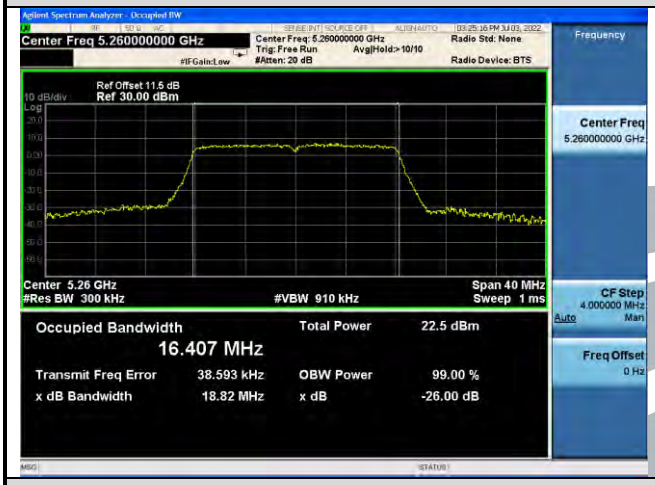
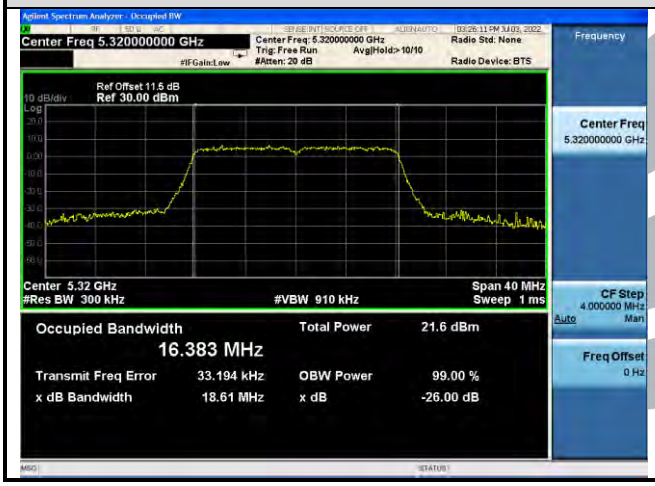
Test Results: Pass

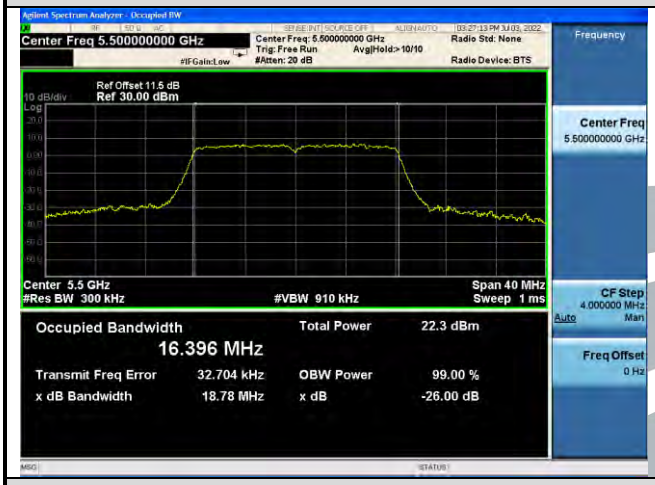
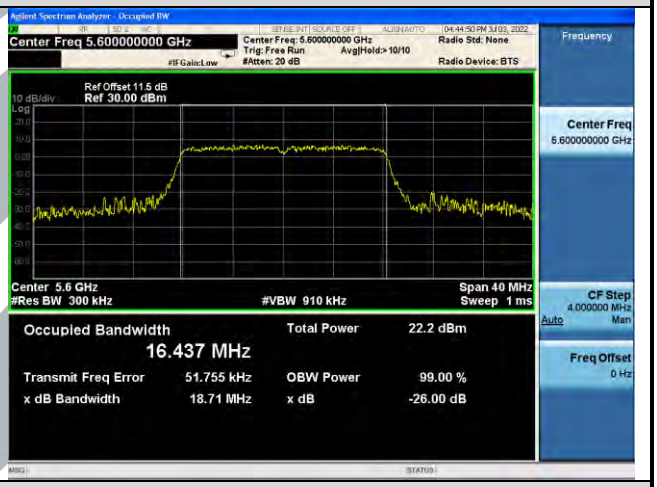
Mode	Channel	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
		Ant. 0	Ant. 1	Ant. 0	Ant. 1
IEEE 802.11a	36 (5180)	18.81	18.92	16.406	16.401
	44 (5220)	18.66	18.72	16.332	16.416
	48 (5240)	18.61	18.85	16.383	16.390
	52 (5260)	18.82	18.64	16.407	16.393
	60 (5300)	18.99	18.54	16.403	16.418
	64 (5320)	18.61	18.75	16.383	16.404
	100 (5500)	18.78	18.75	16.396	16.381
	120 (5600)	20.57	18.71	16.431	16.437
	140 (5700)	30.43	24.10	16.559	16.486
	144 (5720)	35.43	27.25	16.904	16.546
IEEE 802.11n-HT20	36 (5180)	19.70	19.57	17.547	17.552
	44 (5220)	19.61	19.70	17.559	17.566
	48 (5240)	19.75	19.73	17.577	17.581
	52 (5260)	19.55	19.54	17.575	17.549
	60 (5300)	19.47	19.62	17.546	17.563
	64 (5320)	19.58	19.67	17.568	17.556
	100 (5500)	19.62	19.55	17.570	17.556
	120 (5600)	19.46	19.72	17.561	17.580
	140 (5700)	26.17	19.63	17.660	17.560
	144 (5720)	31.64	19.46	17.711	17.588
IEEE 802.11n-HT40	38 (5190)	41.47	41.52	36.132	36.254
	46 (5230)	41.20	40.94	36.195	36.147
	54 (5270)	41.59	40.78	36.127	36.156
	62 (5310)	41.34	41.31	36.203	36.162
	102 (5510)	41.15	41.15	36.177	36.255

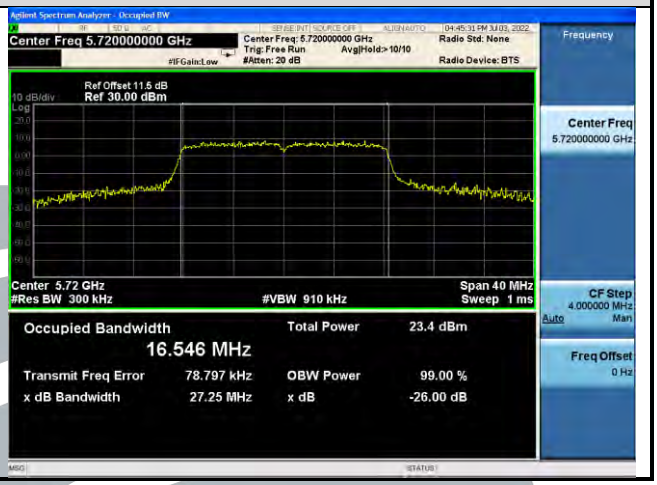
	118 (5590)	42.10	41.26	36.199	36.146
	134 (5670)	41.59	40.91	36.238	36.210
	142 (5710)	49.78	41.50	36.385	36.182
IEEE 802.11ac-VHT20	36 (5180)	19.59	19.54	17.558	17.569
	44 (5220)	19.56	19.64	17.561	17.570
	48 (5240)	19.64	19.48	17.565	17.548
	52 (5260)	19.55	19.59	17.576	17.560
	60 (5300)	19.72	19.65	17.571	17.552
	64 (5320)	19.57	19.56	17.554	17.547
	100 (5500)	19.64	19.73	17.569	17.578
	120 (5600)	19.63	19.48	17.579	17.562
	140 (5700)	30.34	19.56	17.666	17.571
	144 (5720)	27.16	19.59	17.683	17.594
IEEE 802.11ac-VHT40	38 (5190)	41.32	40.93	36.152	36.116
	46 (5230)	41.02	41.28	36.127	36.150
	54 (5270)	41.25	41.07	36.175	36.169
	62 (5310)	41.43	40.87	36.278	36.216
	102 (5510)	41.78	41.33	36.230	36.196
	118 (5590)	41.17	41.45	36.172	36.154
	134 (5670)	41.47	40.83	36.186	36.287
	142 (5710)	52.54	53.69	36.286	36.273
IEEE 802.11ac-VHT80	42 (5210)	81.86	81.63	74.794	74.680
	58 (5290)	81.78	81.47	74.535	74.764
	106 (5530)	81.41	82.39	74.713	74.688
	122 (5610)	81.95	81.68	74.534	74.562
	138 (5690)	89.23	81.87	74.941	74.718

The test plots as follows:

IEEE 802.11a	
Ant. 0	**Ant. 1**
Channel 36	
	
Channel 44	
	
Channel 48	
	

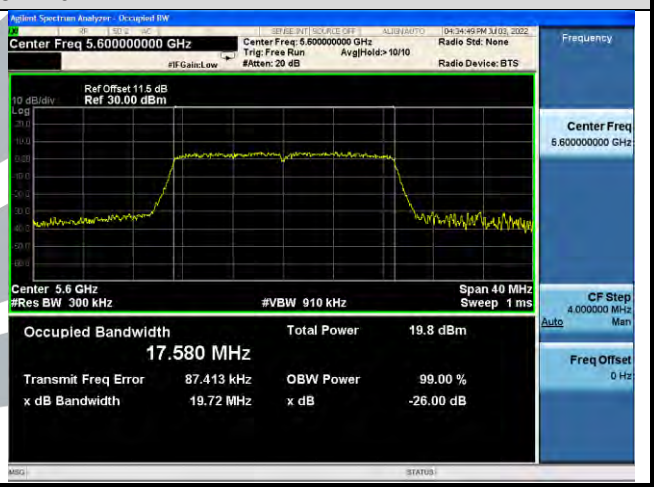
IEEE 802.11a	
Ant. 0	Ant. 1
Channel 52	
	
Channel 60	
	
Channel 64	
	

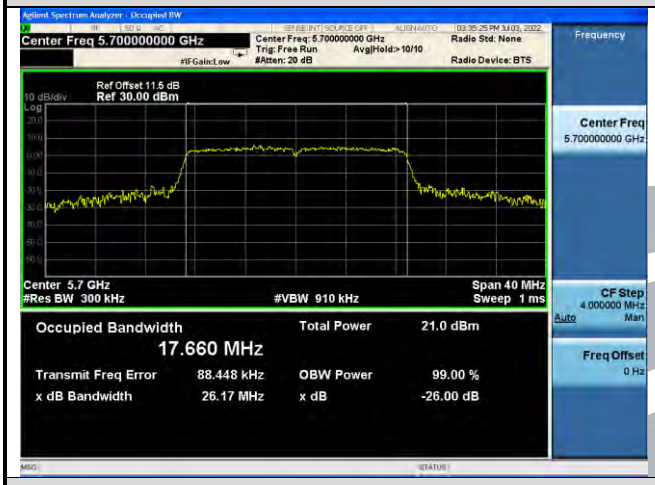
IEEE 802.11a	
Ant. 0	Ant. 1
Channel 100	
	
Channel 120	
	
Channel 140	
	

IEEE 802.11a	
Ant. 0	Ant. 1
Channel 144	
	

IEEE 802.11n-HT20	
Ant. 0	Ant. 1
Channel 36	
	
Channel 44	
	

IEEE 802.11n-HT20	
Ant. 0	Ant. 1
Channel 48	
	
Channel 52	
	
Channel 60	
	

IEEE 802.11n-HT20	
Ant. 0	Ant. 1
Channel 64	
	
Channel 100	
	
Channel 120	
	

IEEE 802.11n-HT20	
Ant. 0	Ant. 1
Channel 140	
	
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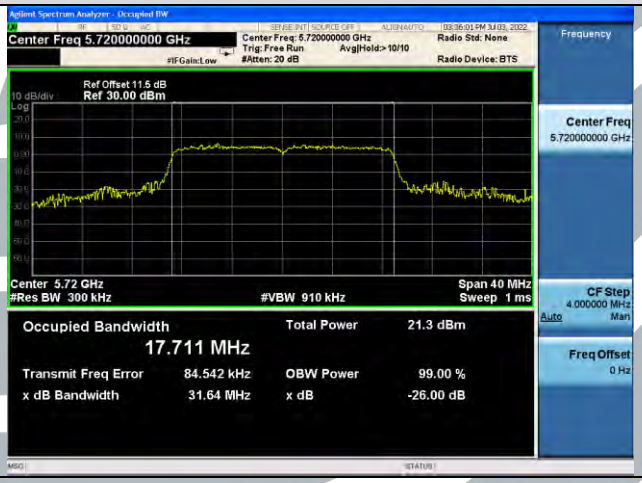
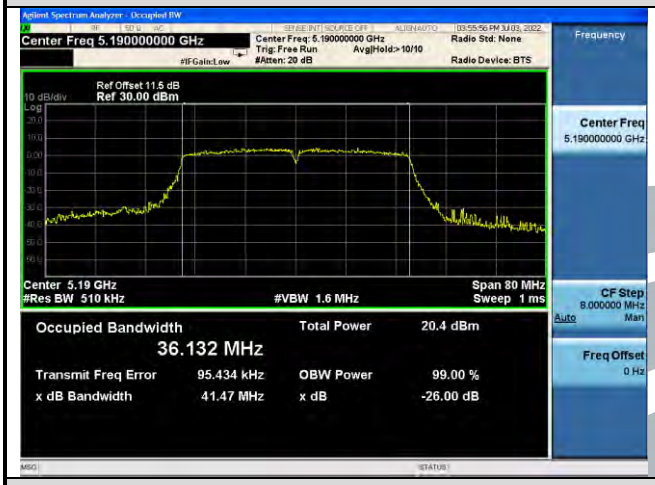
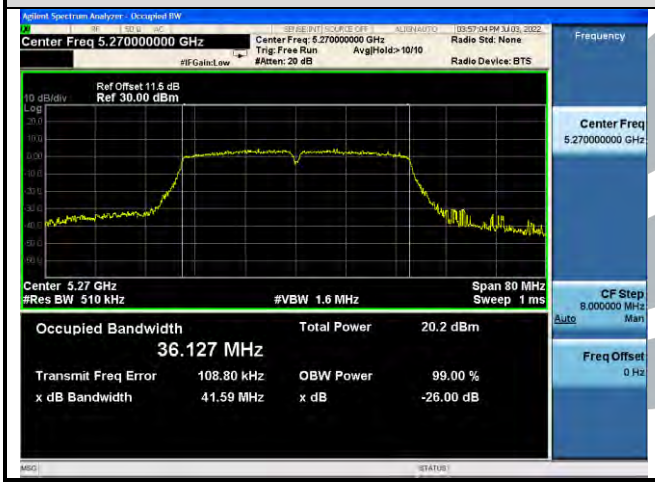
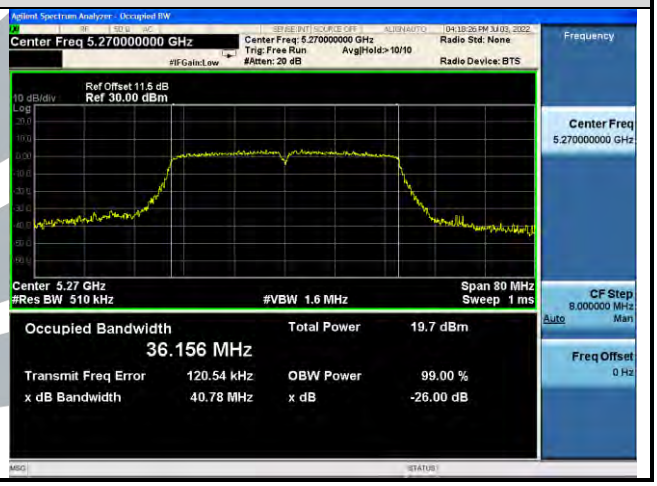
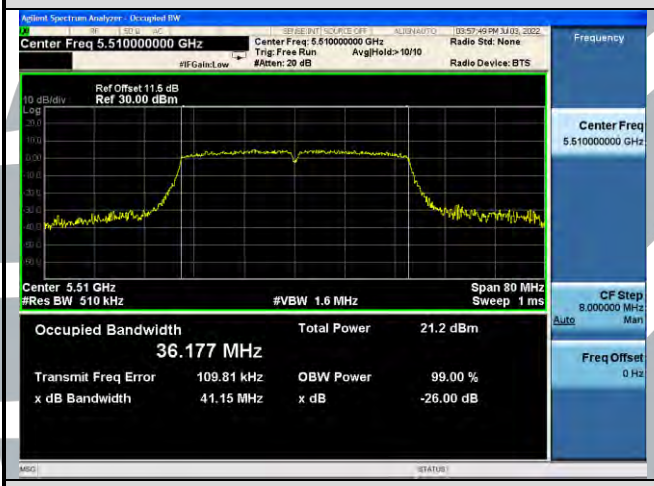
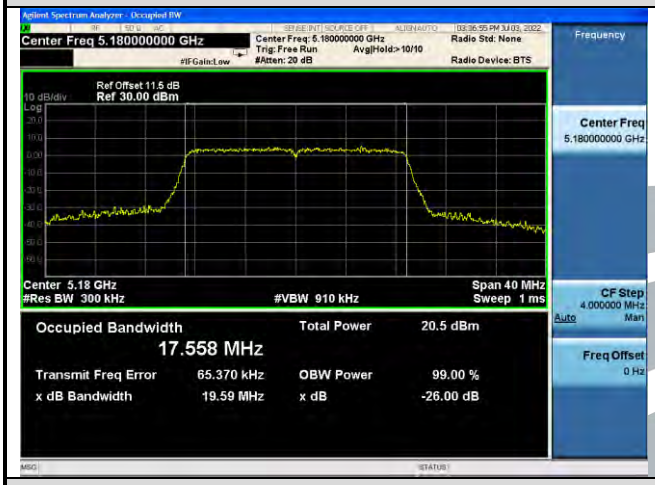
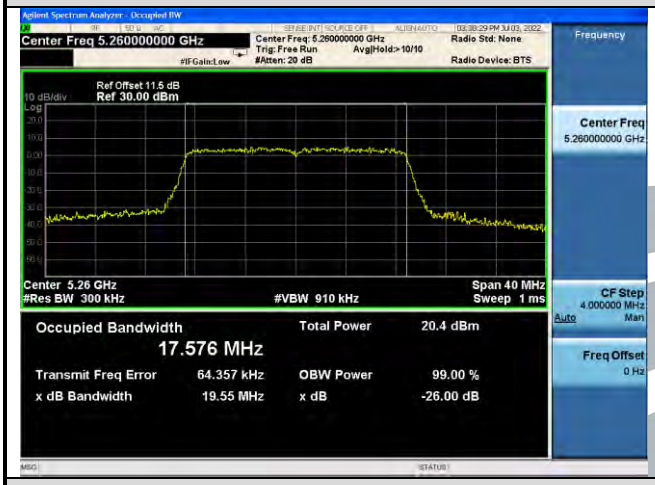
	

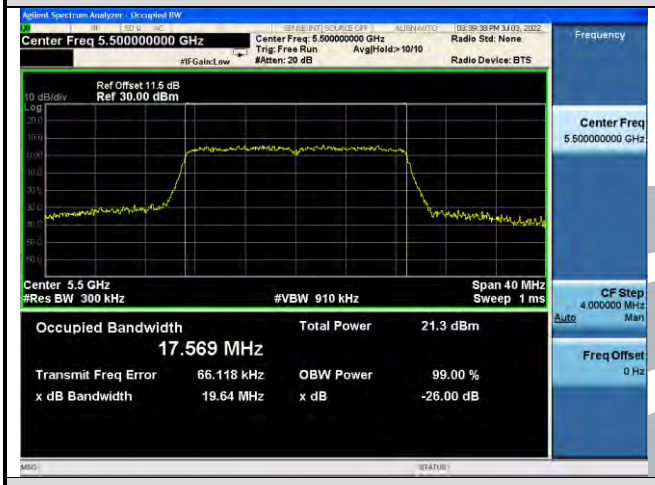
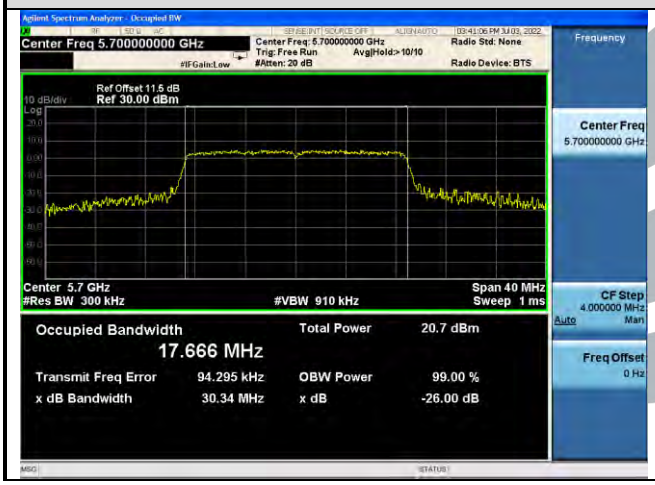
IEEE 802.11n-HT40	
Ant. 0	Ant. 1
Channel 38	
	
Channel 46	
	
Channel 54	
	

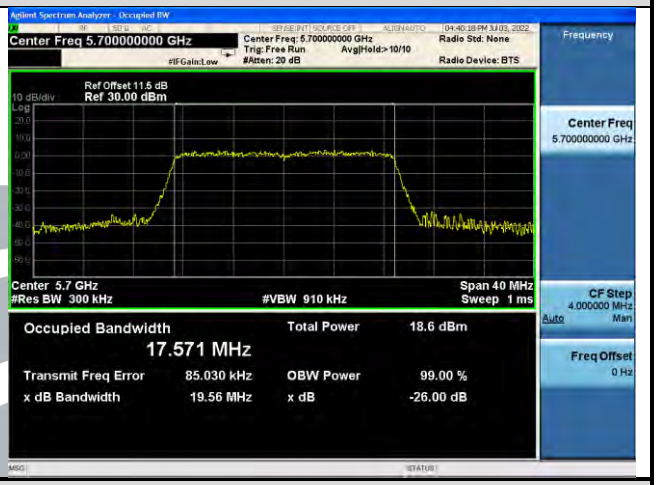
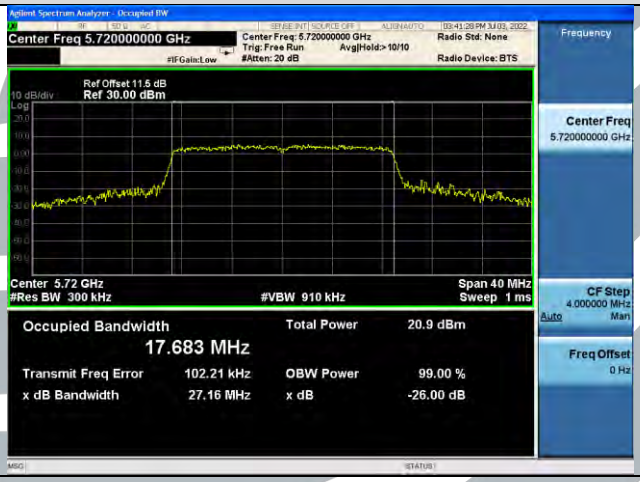
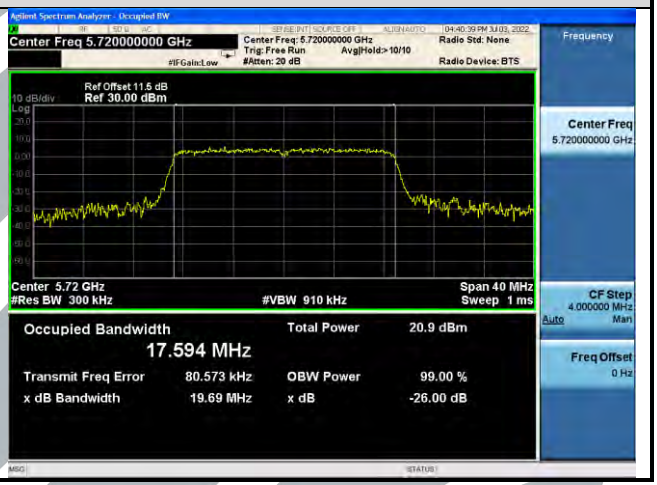
IEEE 802.11n-HT40	
Ant. 0	Ant. 1
Channel 62	
	
Channel 102	
	
Channel 118	
	

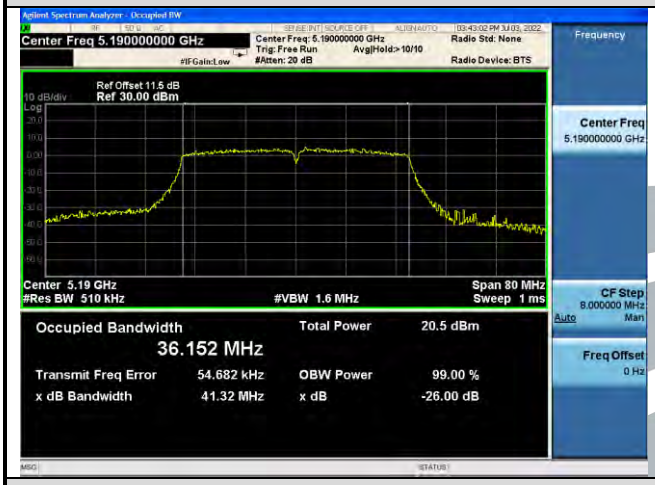
IEEE 802.11n-HT40	
Ant. 0	Ant. 1
Channel 134	
	
Channel 142	
	

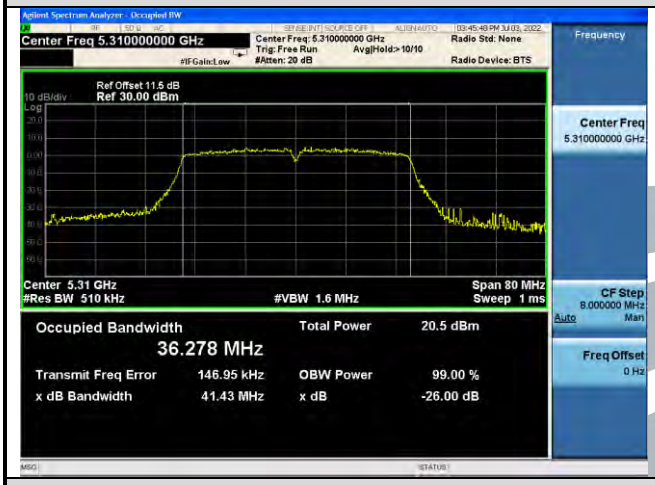
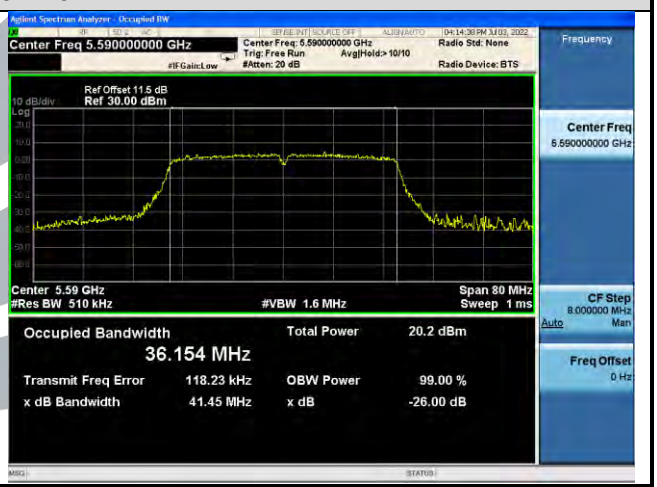
IEEE 802.11ac-VHT20	
Ant. 0	Ant. 1
Channel 36	
	
Channel 44	
	
Channel 48	
	

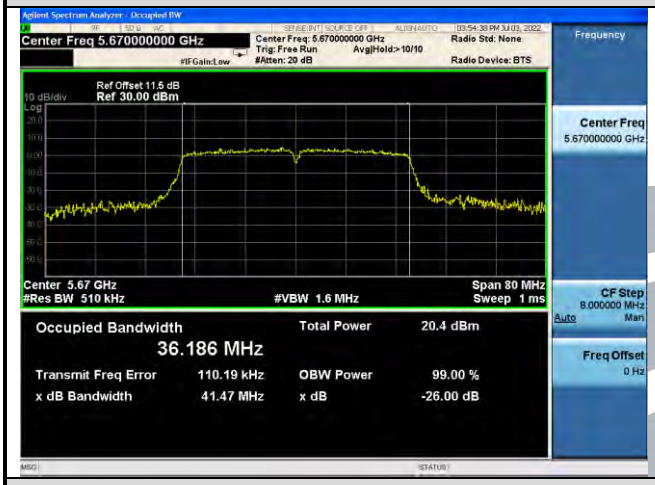
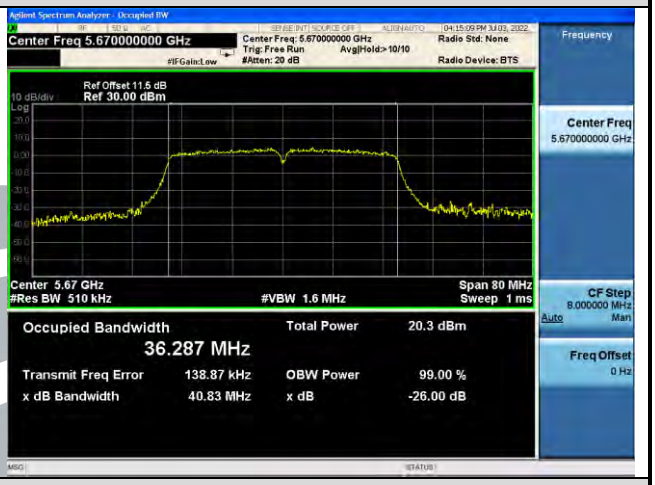
IEEE 802.11ac-VHT20	
Ant. 0	Ant. 1
Channel 52	
	
Channel 60	
	
Channel 64	
	

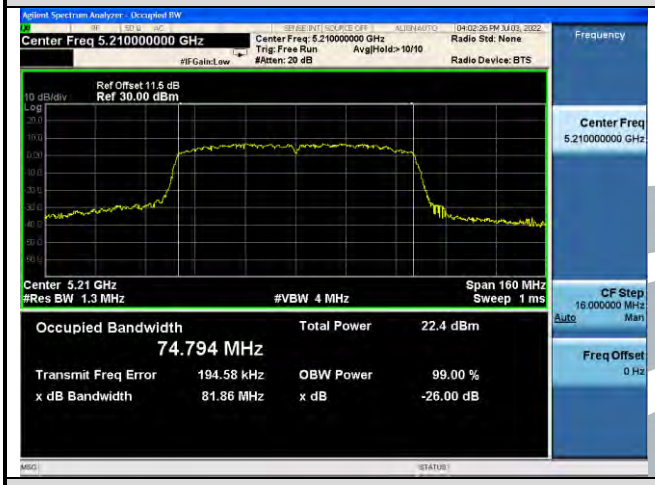
IEEE 802.11ac-VHT20	
Ant. 0	Ant. 1
Channel 100	
	
Channel 120	
	
Channel 140	
	

IEEE 802.11ac-VHT20	
Ant. 0	Ant. 1
Channel 140	
	
Channel 144	
	

IEEE 802.11ac-VHT40	
Ant. 0	Ant. 1
Channel 38	
	
Channel 46	
	
Channel 54	
	

IEEE 802.11ac-VHT40	
Ant. 0	Ant. 1
Channel 62	
	
Channel 102	
	
Channel 118	
	

IEEE 802.11ac-VHT40	
Ant. 0	Ant. 1
Channel 134	
	
Channel 142	
	

IEEE 802.11ac-VHT80	
Ant. 0	Ant. 1
Channel 42	
	
Channel 58	
	
Channel 106	
	

IEEE 802.11ac-VHT80	
Ant. 0	Ant. 1
Channel 138	
	

5.46 DB BANDWIDTH

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.407 (e)

Test Method: KDB 789033 D02 v02r01Section C.2

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

Test Procedure:

The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer.

Spectrum analyzer according to the following Settings:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 * RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

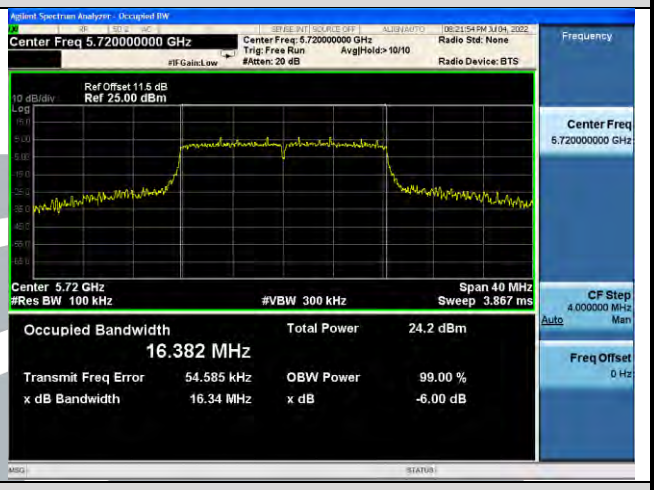
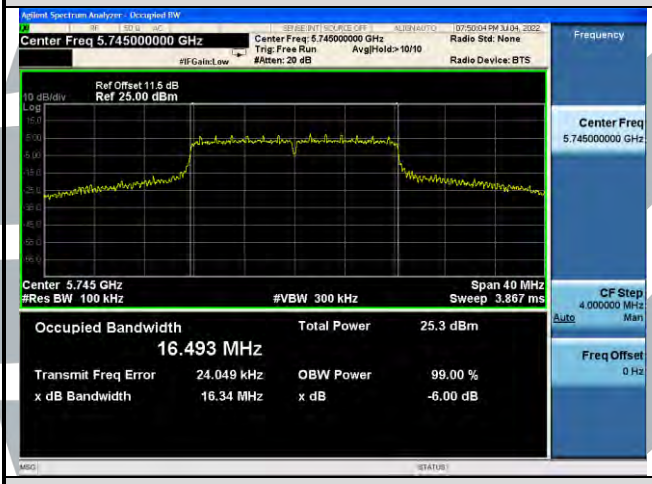
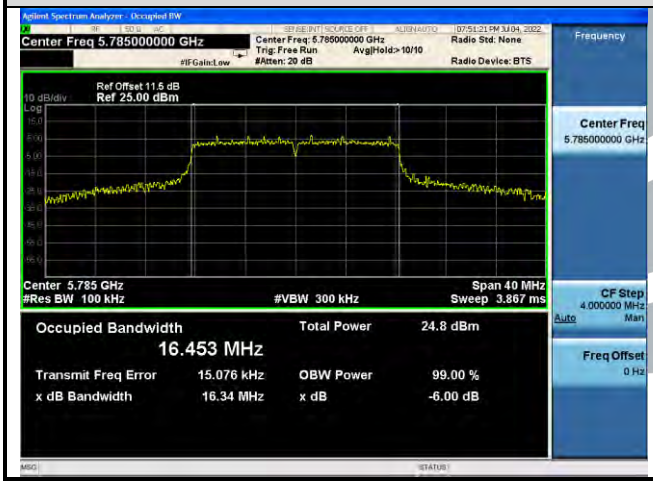
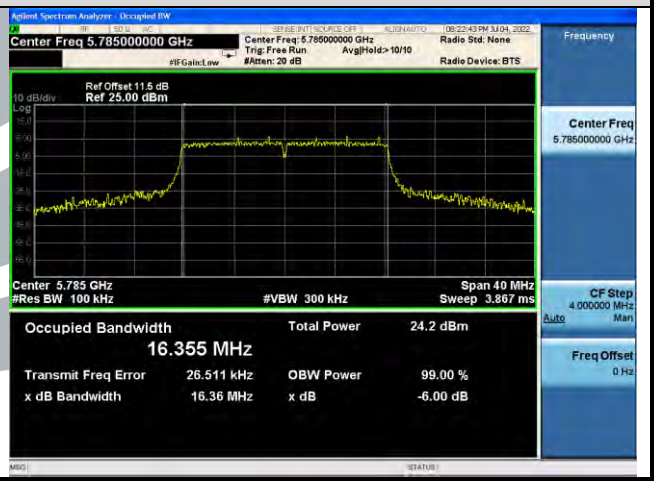
Test Mode: Transmitter mode

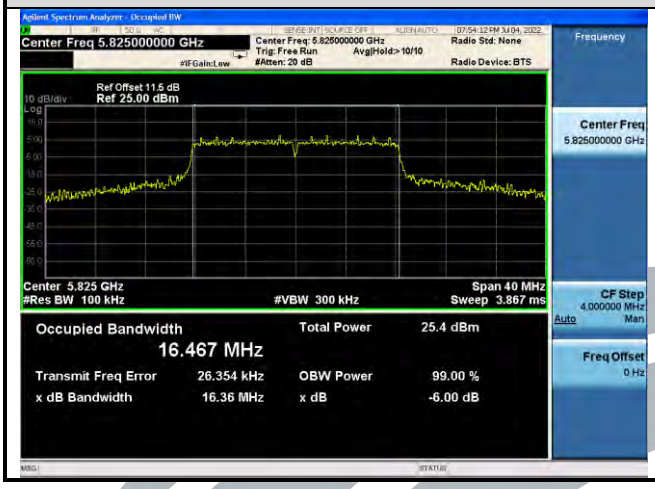
Test Results: Pass

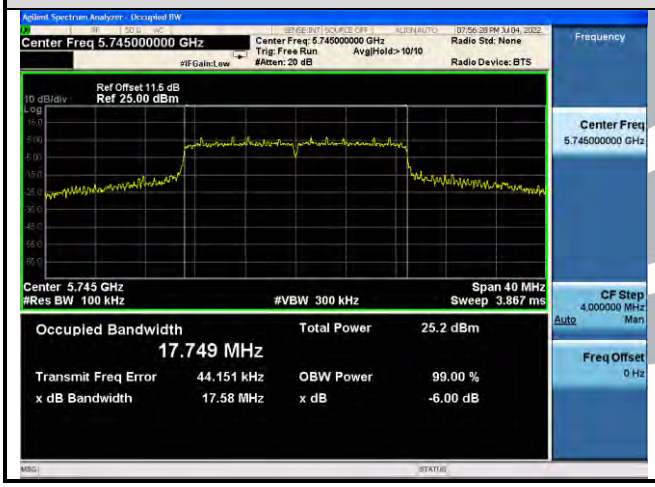
Test Data:

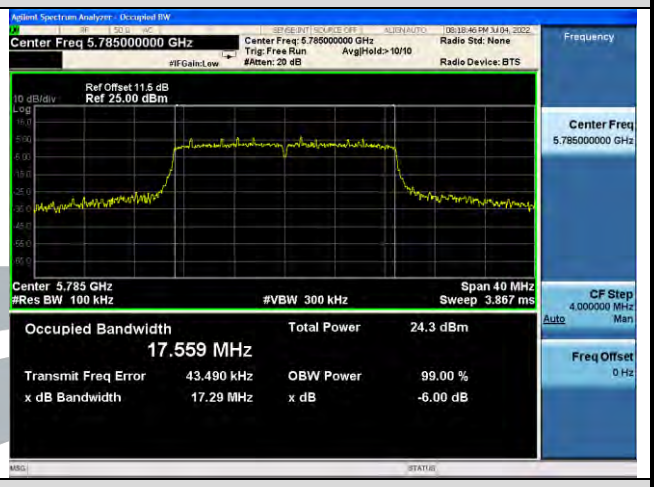
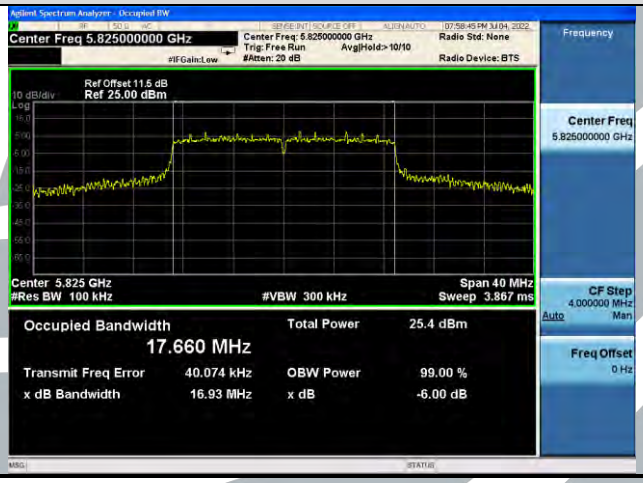
Mode	Channel/ Frequency (MHz)	6 dB Bandwidth (MHz)		99% Bandwidth (MHz)		6 dB Bandwidth Limit	Result
		Ant. 0	Ant. 1	Ant. 0	Ant. 1		
IEEE 802.11a	144 (5720)	16.37	16.34	16.495	16.382	> 500 kHz	Pass
	149 (5745)	16.34	16.37	16.493	16.359	> 500 kHz	Pass
	157 (5785)	16.34	16.36	16.453	16.355	> 500 kHz	Pass
	165 (5825)	16.36	16.36	16.467	16.353	> 500 kHz	Pass
IEEE 802.11n-HT20	144 (5720)	17.58	17.58	17.595	17.561	> 500 kHz	Pass
	149 (5745)	17.58	17.80	17.749	17.578	> 500 kHz	Pass
	157 (5785)	16.96	17.29	17.655	17.559	> 500 kHz	Pass
	165 (5825)	16.93	17.58	17.660	17.561	> 500 kHz	Pass
IEEE 802.11n-HT40	142 (5710)	35.22	35.20	35.982	35.964	> 500 kHz	Pass
	151 (5755)	35.17	35.02	36.245	35.968	> 500 kHz	Pass
	159 (5795)	34.44	35.22	36.144	35.890	> 500 kHz	Pass
IEEE 802.11ac-VHT20	144 (5720)	35.17	35.02	36.245	35.968	> 500 kHz	Pass
	149 (5745)	17.56	17.57	17.664	17.580	> 500 kHz	Pass
	157 (5785)	16.67	17.60	17.664	17.586	> 500 kHz	Pass
	165 (5825)	16.57	17.24	17.637	17.573	> 500 kHz	Pass
IEEE 802.11ac-VHT40	142 (5710)	35.41	34.23	35.963	35.925	> 500 kHz	Pass
	151 (5755)	35.23	35.21	35.228	35.958	> 500 kHz	Pass
	159 (5795)	35.22	35.21	36.149	35.899	> 500 kHz	Pass
IEEE 802.11ac-VHT80	138 (5690)	75.16	74.02	74.958	74.707	> 500 kHz	Pass
	155 (5775)	75.09	72.79	75.228	74.746	> 500 kHz	Pass

The test plots as follows:

IEEE 802.11a	
Ant. 0	**Ant. 1**
Channel 144	
	
Channel 149	
	
Channel 157	
	

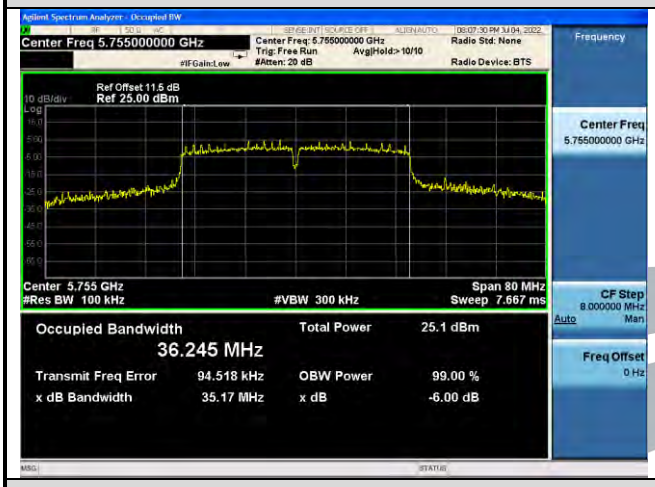
Channel 165	
	

IEEE 802.11n-HT20	
Ant. 0	Ant. 1
Channel 144	
	
Channel 149	
	

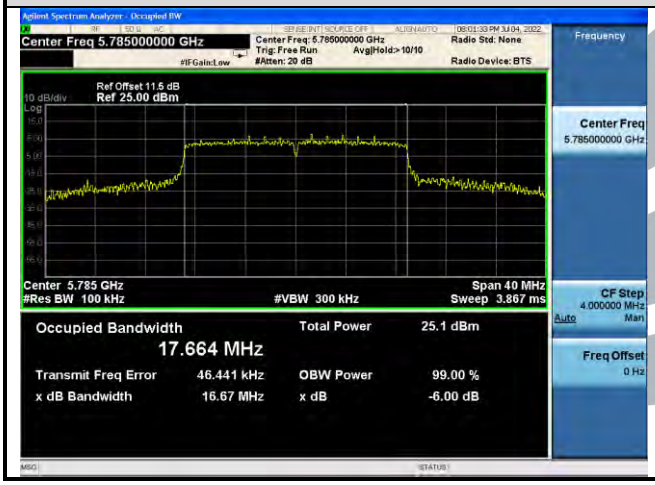
Channel 157	
	
Channel 165	
	

IEEE 802.11n-HT40	
Ant. 0	Ant. 1
Channel 142	
	

Channel 151



Channel 159

IEEE 802.11ac-VHT20	
Ant. 0	Ant. 1
Channel 144	
	
Channel 149	
	
Channel 157	
	

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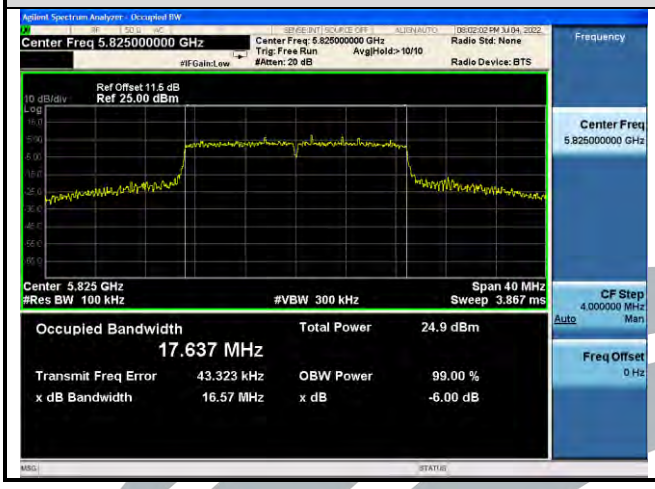
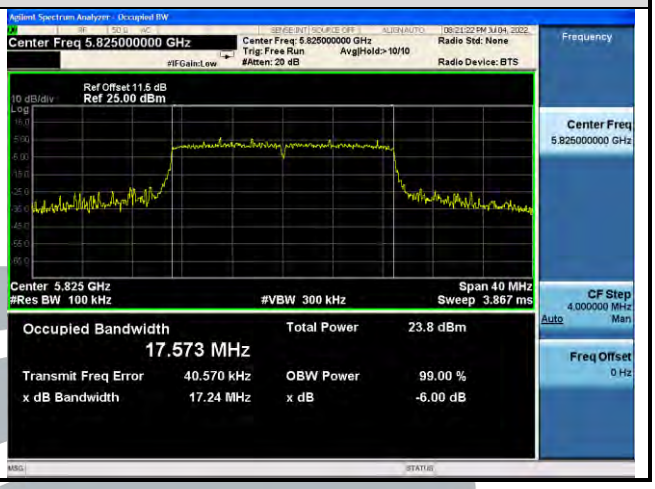
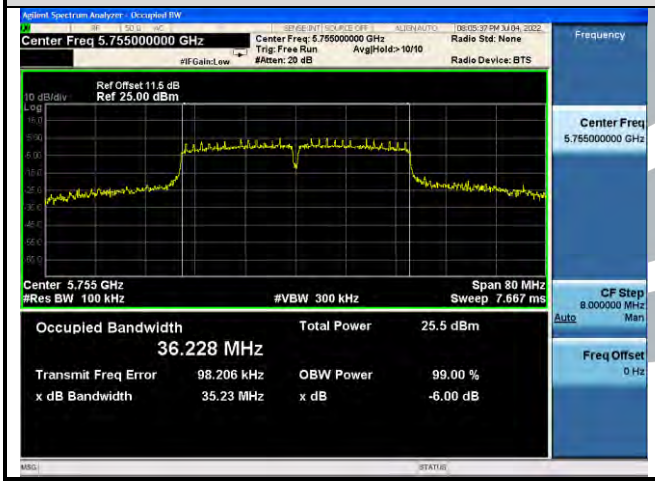
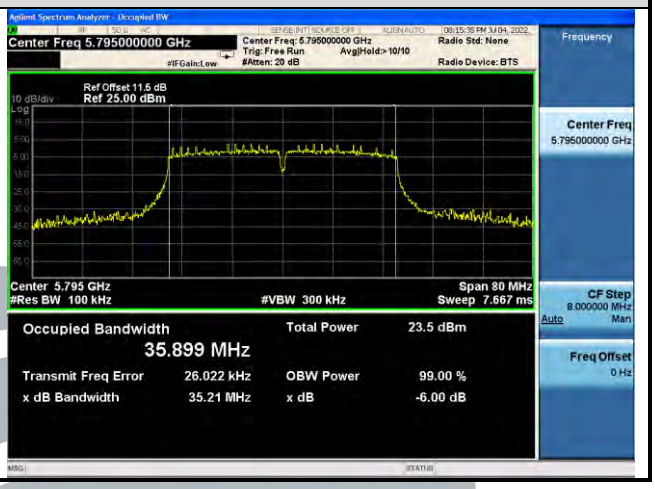
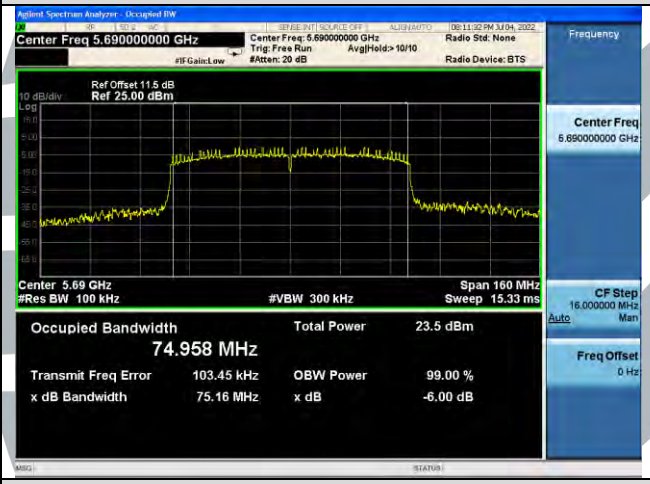
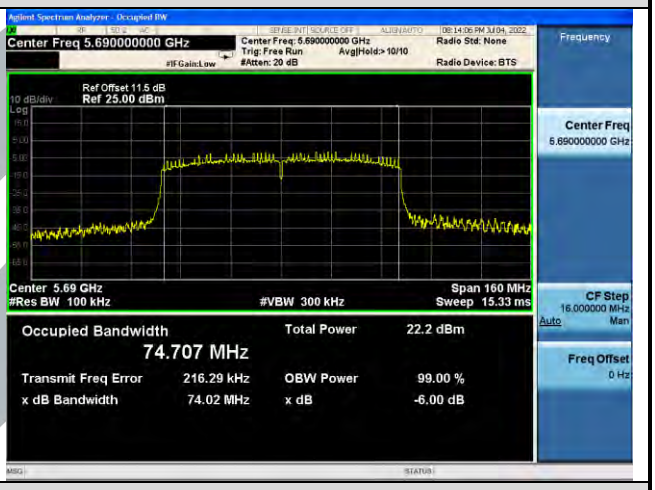
	

IEEE 802.11ac-VHT40	
Ant. 0	Ant. 1
Channel 142	
	
Channel 151	
	

Channel 159	
	

IEEE 802.11ac-VHT80	
Ant. 0	Ant. 1
Channel 138	
	
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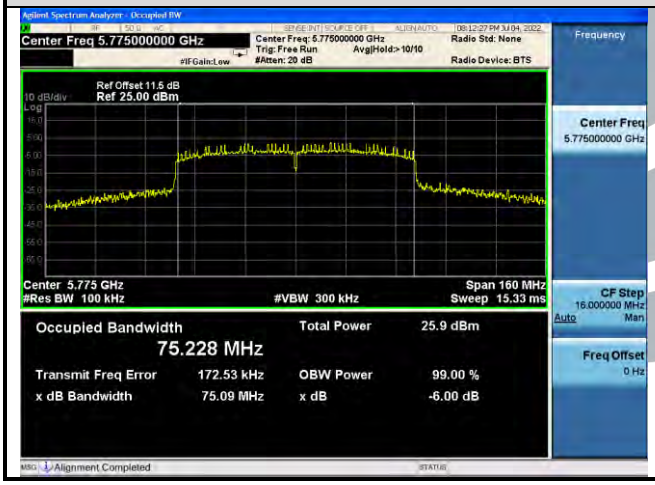
	

5.5 MAXIMUM CONDUCTED OUTPUT POWER

Test Requirement: FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3)

Test Method: KDB 789033 D02 v02r01 Section E.3.a (Method PM)

Limits:

1. For the band 5.15-5.25 GHz.
   (i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

   (ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

   (iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

   (iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

2. For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. 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.

3. For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Test Procedure:

1. Connected the EUT's antenna port to measure device by 10dB attenuator.
2. Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of Tx on burst.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Transmitter mode

Test Results: Pass

Test Data:

Directional gain and the maximum output power limit.

Frequency (MHz)	Antenna Gain (dBi)		Correlated Directional gain (dBi)		Limit	
	Ant .0	Ant .1	Power	PSD	Power (dBm)	PSD (dBm/3kHz)
U-NII-1	2	2	2	5.01	24	11
U-NII-2A	2	2	2	5.01	24	11
U-NII-2C	2	2	2	5.01	24	11
U-NII-3	2	2	2	5.01	30	30

For CDD transmissions, directional gain is calculated as follows. In all formulas,

N_{ANT} = number of transmit antennas and
N_{SS} = number of spatial streams. (Assume N_{SS} = 1 unless you have specific information to the contrary.)

If all antennas have the same gain, G_{ANT}, Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

For power measurements on IEEE 802.11 devices, 1,2

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths $\geq$ 40 MHz for any N_{ANT};

Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.

For U-NII-2A, U-NII-2C Band:

IEEE 802.11a: the minimum 26 dB emission bandwidth is 18.54 MHz
11 dBm + $10\log_{10}$ (18.54) = 23.68 dBm < 24 dBm (200mW)
So the 23.68 dB limit applicable

IEEE 802.11n-HT20/ac-VHT20: the minimum 26 dB emission bandwidth is 19.47 MHz
11 dBm + $10\log_{10}$ (19.47) = 23.89 dBm < 24 dBm (200mW)
So the 23.89 dB limit applicable

IEEE 802.11n-HT40/ac-VHT40/ac-VHT80: the minimum 26 dB emission bandwidth is 40.78 MHz
11 dBm + $10\log_{10}$ (40.78) = 27.10 dBm > 24 dBm (200mW)
So the 24 dB limit applicable

Mode	Band	Ch.	Freq. (MHz)	CONDUCTED AVG POWER						
				Meas Value (dBm)		Corr'd Value (dBm)			Limit (dBm)	Result
				Ant. 0	Ant. 1	Ant. 0	Ant. 1	Total		
IEEE 802.11a	U-NII-1	36	5180	15.40	14.39	15.76	14.75		24	Pass
		44	5220	15.29	15.37	15.65	15.73		24	Pass
		48	5240	15.53	15.71	15.89	16.07		24	Pass
	U-NII-2A	52	5260	15.78	16.05	16.14	16.41		23.68	Pass
		60	5300	15.85	16.53	16.21	16.89		23.68	Pass
		64	5320	15.73	16.18	16.09	16.54		23.68	Pass
	U-NII-2C	100	5500	14.23	13.33	14.59	13.69		23.68	Pass
		116	5580	15.00	15.22	15.36	15.58	N/A	23.68	Pass
		120	5600	14.74	15.48	15.10	15.84		23.68	Pass
		140	5700	15.99	16.25	16.35	16.61		23.68	Pass
		144	5720	17.10	17.48	17.46	17.84		23.68	Pass
	U-NII-3	144	5720	17.10	17.48	17.46	17.84		30	Pass
		149	5745	16.56	16.58	16.92	16.94		30	Pass
		157	5785	17.17	17.27	17.53	17.63		30	Pass
		165	5825	17.93	17.33	18.29	17.69		30	Pass
IEEE 802.11n-HT20	U-NII-1	36	5180	13.84	13.71	14.19	14.06	17.14	24	Pass
		44	5220	14.31	14.21	14.66	14.56	17.62	24	Pass
		48	5240	14.55	14.46	14.90	14.81	17.87	24	Pass
	U-NII-2A	52	5260	14.86	14.77	15.21	15.12	18.18	23.89	Pass
		60	5300	15.31	14.80	15.66	15.15	18.42	23.89	Pass
		64	5320	15.44	15.33	15.79	15.68	18.75	23.89	Pass
	U-NII-2C	100	5500	14.55	11.14	14.90	11.49	16.53	23.89	Pass
		116	5580	14.77	14.00	15.12	14.35	17.76	23.89	Pass
		120	5600	14.68	14.17	15.03	14.52	17.79	23.89	Pass
		140	5700	15.95	13.91	16.30	14.26	18.41	23.89	Pass
		144	5720	16.19	16.26	16.54	16.61	19.59	23.89	Pass
	U-NII-3	144	5720	16.19	16.26	16.54	16.61	19.59	30	Pass
		149	5745	17.38	17.22	17.73	17.57	20.66	30	Pass
		157	5785	18.01	17.76	18.36	18.11	21.25	30	Pass
		165	5825	18.18	17.85	18.53	18.20	21.38	30	Pass
IEEE 802.11n-HT40	U-NII-1	38	5190	13.45	10.50	14.15	11.20	15.93	24	Pass
		46	5230	13.92	12.98	14.62	13.68	17.19	24	Pass
	U-NII-2A	54	5270	14.48	13.68	15.18	14.38	17.81	24	Pass
		62	5310	14.88	11.55	15.58	12.25	17.24	24	Pass
	U-NII-2C	102	5510	14.41	8.35	15.11	9.05	16.07	24	Pass
		110	5550	14.11	12.34	14.81	13.04	17.03	24	Pass
		118	5590	14.33	12.77	15.03	13.47	17.33	24	Pass
		134	5670	14.87	13.67	15.57	14.37	18.02	24	Pass
		142	5710	15.65	14.61	16.35	15.31	18.87	24	Pass
	U-NII-3	142	5710	15.65	14.61	16.35	15.31	18.87	30	Pass
		151	5755	17.43	15.32	18.13	16.02	20.21	30	Pass
		159	5795	17.65	15.57	18.35	16.27	20.45	30	Pass
IEEE 802.11ac-VHT20	U-NII-1	36	5180	13.88	13.39	14.37	13.88	17.14	24	Pass
		44	5220	14.33	14.05	14.82	14.54	17.69	24	Pass
		48	5240	14.59	14.41	15.08	14.90	18.00	24	Pass
	U-NII-2A	52	5260	14.88	14.39	15.37	14.88	18.14	23.89	Pass
		60	5300	15.35	14.78	15.84	15.27	18.58	23.89	Pass
		64	5320	15.51	15.28	16.00	15.77	18.90	23.89	Pass
	U-NII-2C	100	5500	14.55	11.06	15.04	11.55	16.65	23.89	Pass
		116	5580	14.63	13.98	15.12	14.47	17.82	23.89	Pass
		120	5600	14.33	14.11	14.82	14.60	17.72	23.89	Pass
		140	5700	15.79	13.78	16.28	14.27	18.40	23.89	Pass
		144	5720	16.09	16.19	16.58	16.68	19.64	23.89	Pass

	U-NII-3	144	5720	16.09	16.19	16.58	16.68	19.64	30	Pass
		149	5745	17.28	17.16	17.77	17.65	20.72	30	Pass
		157	5785	17.93	17.77	18.42	18.26	21.35	30	Pass
		165	5825	18.18	17.82	18.67	18.31	21.51	30	Pass
IEEE 802.11ac-VHT40	U-NII-1	38	5190	13.54	10.49	14.16	11.11	15.90	24	Pass
		46	5230	13.99	13.02	14.61	13.64	17.16	24	Pass
	U-NII-2A	54	5270	14.65	13.63	15.27	14.25	17.80	24	Pass
		62	5310	14.78	11.63	15.40	12.25	17.11	24	Pass
	U-NII-2C	102	5510	14.35	8.56	14.97	9.18	15.98	24	Pass
		110	5550	14.08	12.51	14.70	13.13	16.99	24	Pass
		118	5590	14.45	12.78	15.07	13.40	17.32	24	Pass
		134	5670	14.99	13.75	15.61	14.37	18.04	24	Pass
		142	5710	15.51	14.74	16.13	15.36	18.77	23.69	Pass
	U-NII-3	142	5710	15.51	14.74	16.13	15.36	18.77	30	Pass
		151	5755	17.49	15.32	18.11	15.94	20.17	30	Pass
		159	5795	17.68	15.54	18.30	16.16	20.37	30	Pass
IEEE 802.11ac-VHT80	U-NII-1	42	5210	12.91	8.49	14.89	10.47	16.23	24	Pass
	U-NII-2A	58	5290	13.87	8.88	15.85	10.86	17.05	24	Pass
	U-NII-2C	106	5530	13.66	6.85	15.64	8.83	16.46	24	Pass
		122	5610	13.19	11.48	15.17	13.46	17.41	24	Pass
		138	5690	12.12	12.66	14.10	14.64	17.39	24	Pass
	U-NII-3	138	5690	12.12	12.66	14.10	14.64	17.39	30	Pass
		155	5775	16.96	12.23	18.94	14.21	20.20	30	Pass

Remark:
1. Corr'd Power = Meas Power + Duty Cycle Factor
2. Total (Ant. 0+1) = $10*\log[(10^{\text{Ant. 0}/10})+(10^{\text{Ant. 1}/10})]$

5.6 PEAK POWER SPECTRAL DENSITY

Test Requirement: FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3)

Test Method: KDB 789033 D02 v02r01 Section F

Limits:

1. For the band 5.15-5.25 GHz.
   (i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

   (ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

   (iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

   (iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

2. For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. 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.
3. For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Test Procedure:

The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer.

Spectrum analyzer according to the following Settings:

1. For U-NII-1, U-NII-2A, U-NII-2C band:

Using method SA-2

a) Set span to encompass the entire emission bandwidth (EBW) of the signal.
b) Set RBW = 1 MHz, Set VBW ≥ 3 RBW, Detector = RMS
c) Sweep time = auto, trigger set to “free run”.
d) Trace average at least 100 traces in power averaging mode.
e) Record the max value and add 10 log (1/duty cycle)

2. For U-NII-3 band:

a) Set span to encompass the entire emission bandwidth (EBW) of the signal.
b) Set RBW = 500 kHz, Set VBW ≥ 3 RBW, Detector = RMS
c) Use the peak marker function to determine the maximum power level in any 500 kHz band segment within the fundamental EBW.
d) Sweep time = auto, trigger set to “free run”.
e) Trace average at least 100 traces in power averaging mode.
f) Record the max value and add 10 log (1/duty cycle)

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.5.3 for details.
Instruments Used: Refer to section 3 for details
Test Mode: Transmitter mode
Test Results: Pass
Test Data:

Directional gain and the maximum output power limit.

Frequency (MHz)	Antenna Gain (dBi)		Correlated Directional gain (dBi)		Limit	
	Ant .0	Ant .1	Power	PSD	Power (dBm)	PSD (dBm/3kHz)
U-NII-1	2	2	2	5.01	24	11
U-NII-2A	2	2	2	5.01	24	11
U-NII-2C	2	2	2	5.01	24	11
U-NII-3	2	2	2	5.01	30	30

For CDD transmissions, directional gain is calculated as follows. In all formulas,

N_{ANT} = number of transmit antennas and
N_{SS} = number of spatial streams. (Assume N_{SS} = 1 unless you have specific information to the contrary.)

If all antennas have the same gain, G_{ANT}, Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

For power measurements on IEEE 802.11 devices, 1,2

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.

For U-NII-1, U-NII-2A, U-NII-2C bands:

Mode	Band	Ch.	Freq. (MHz)	Maximum power spectral density					Limit (dBm)	Result
				Meas Value (dBm/MHz)		Corr'd Value (dBm/MHz)				
				Ant. 0	Ant. 1	Ant. 0	Ant. 1	Total		
IEEE 802.11a	U-NII-1	36	5180	4.705	3.737	5.07	4.10	N/A	11	Pass
		44	5220	4.209	4.209	4.57	4.57		11	Pass
		48	5240	4.212	4.454	4.58	4.82		11	Pass
	U-NII-2A	52	5260	4.487	4.444	4.85	4.81		11	Pass
		60	5300	4.192	5.229	4.56	5.59		11	Pass
		64	5320	3.789	4.623	4.15	4.99		11	Pass
	U-NII-2C	100	5500	3.952	3.332	4.32	3.70		11	Pass
		120	5600	4.165	5.087	4.53	5.45		11	Pass
		140	5700	4.211	4.649	4.57	5.01		11	Pass
		144	5720	5.558	5.704	5.92	6.07		11	Pass
IEEE 802.11n-HT20	U-NII-1	36	5180	2.719	2.346	3.07	2.70	5.90	11	Pass
		44	5220	2.433	1.772	2.78	2.12	5.48	11	Pass
		48	5240	2.476	2.296	2.83	2.65	5.75	11	Pass
	U-NII-2A	52	5260	2.259	2.348	2.61	2.70	5.67	11	Pass
		60	5300	2.796	2.189	3.15	2.54	5.86	11	Pass
		64	5320	2.623	2.350	2.97	2.70	5.85	11	Pass
	U-NII-2C	100	5500	3.310	-0.336	3.66	0.02	5.22	11	Pass
		120	5600	2.980	2.292	3.33	2.64	6.01	11	Pass
		140	5700	3.556	0.971	3.91	1.32	5.81	11	Pass
		144	5720	3.381	3.212	3.73	3.56	6.66	11	Pass
IEEE 802.11n-HT40	U-NII-1	38	5190	-0.377	-3.374	0.33	-2.67	2.09	11	Pass
		46	5230	-0.265	-1.095	0.44	-0.39	3.05	11	Pass
	U-NII-2A	54	5270	-0.270	-1.089	0.43	-0.39	3.05	11	Pass
		62	5310	-0.177	-3.200	0.53	-2.50	2.28	11	Pass
	U-NII-2C	102	5510	0.398	-5.601	1.10	-4.90	2.07	11	Pass
		118	5590	0.597	-1.047	1.30	-0.34	3.56	11	Pass
		134	5670	1.022	-0.593	1.72	0.11	4.00	11	Pass
		142	5710	0.492	0.080	1.19	0.78	4.00	11	Pass
IEEE 802.11ac-VHT20	U-NII-1	36	5180	2.420	1.658	2.91	2.15	5.56	11	Pass
		44	5220	2.461	1.820	2.95	2.31	5.65	11	Pass
		48	5240	2.385	1.915	2.88	2.41	5.66	11	Pass
	U-NII-2A	52	5260	2.687	2.026	3.18	2.52	5.87	11	Pass
		60	5300	2.905	1.629	3.40	2.12	5.82	11	Pass
		64	5320	2.733	2.375	3.22	2.87	6.06	11	Pass
	U-NII-2C	100	5500	3.307	-0.337	3.80	0.15	5.36	11	Pass
		120	5600	2.952	2.483	3.44	2.97	6.23	11	Pass
		140	5700	3.397	0.937	3.89	1.43	5.84	11	Pass
		144	5720	3.646	3.037	4.14	3.53	6.85	11	Pass
IEEE 802.11ac-VHT40	U-NII-1	38	5190	-0.377	-3.633	0.24	-3.02	1.92	11	Pass
		46	5230	-0.265	-1.414	0.35	-0.80	2.83	11	Pass
	U-NII-2A	54	5270	-0.270	-0.958	0.35	-0.34	3.03	11	Pass
		62	5310	-0.177	-3.239	0.44	-2.62	2.18	11	Pass
	U-NII-2C	102	5510	0.492	-5.366	1.11	-4.75	2.11	11	Pass
		118	5590	0.880	-0.768	1.50	-0.15	3.76	11	Pass
		134	5670	0.597	-0.530	1.21	0.09	3.70	11	Pass
		142	5710	1.022	0.401	1.64	1.02	4.35	11	Pass
IEEE 802.11ac-VHT80	U-NII-1	42	5210	-4.180	-8.846	-2.20	-6.87	-0.92	11	Pass
	U-NII-2A	58	5290	-3.843	-8.517	-1.86	-6.54	-0.59	11	Pass
	U-NII-2C	106	5530	-3.163	-9.576	-1.18	-7.60	-0.29	11	Pass
		122	5610	-3.290	-5.076	-1.31	-3.10	0.90	11	Pass
		138	5690	-3.052	-4.542	-1.07	-2.56	1.26	11	Pass

For U-NII-3 band:

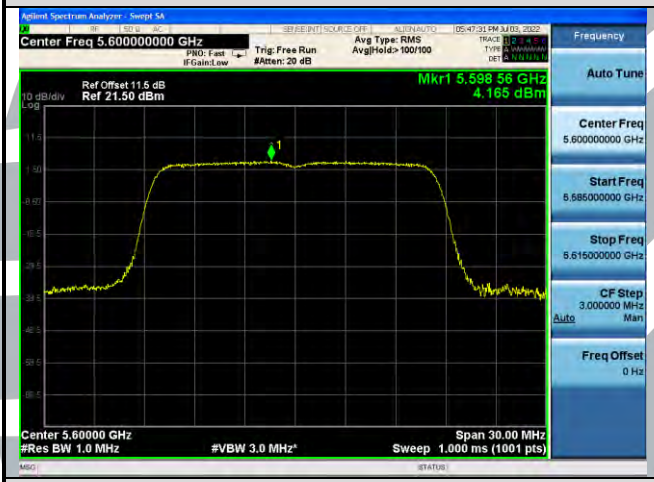
Mode	Band	Ch.	Freq. (MHz)	Maximum power spectral density					Limit (dBm)	Result
				Meas Value (dBm/500kHz)		Corr'd Value (dBm/500kHz)				
				Ant. 0	Ant. 1	Ant. 0	Ant. 1	Total		
IEEE 802.11a	U-NII-3	144	5720	3.926	3.887	4.29	4.25	N/A	30	Pass
		149	5745	3.379	3.138	3.74	3.50		30	Pass
		157	5785	3.909	3.847	4.27	4.21		30	Pass
		165	5825	4.367	3.820	4.73	4.18		30	Pass
IEEE 802.11n-HT20	U-NII-3	144	5720	0.761	1.741	1.11	2.09	4.64	30	Pass
		149	5745	2.053	2.801	2.40	3.15	5.80	30	Pass
		157	5785	2.715	3.440	3.07	3.79	6.45	30	Pass
		165	5825	2.836	3.154	3.19	3.51	6.36	30	Pass
IEEE 802.11n-HT40	U-NII-3	142	5710	-2.242	-1.657	-1.54	-0.95	1.77	30	Pass
		151	5755	-0.011	-6.674	0.69	-5.97	1.54	30	Pass
		159	5795	-0.115	-0.741	0.59	-0.04	3.30	30	Pass
IEEE 802.11ac-VHT20	U-NII-3	144	5720	0.662	1.671	1.15	2.16	4.70	30	Pass
		149	5745	2.190	2.760	2.68	3.25	5.99	30	Pass
		157	5785	2.891	3.360	3.38	3.85	6.63	30	Pass
		165	5825	2.911	2.906	3.40	3.40	6.41	30	Pass
IEEE 802.11ac-VHT40	U-NII-3	142	5710	-2.212	-1.182	-1.60	-0.57	1.96	30	Pass
		151	5755	-0.465	-0.710	0.15	-0.09	3.04	30	Pass
		159	5795	-0.167	-0.824	0.45	-0.21	3.14	30	Pass
IEEE 802.11ac-VHT80	U-NII-3	138	5690	-5.632	-5.766	-3.65	-3.79	-0.71	30	Pass
		155	5775	-3.721	-7.037	-1.74	-5.06	-0.08	30	Pass

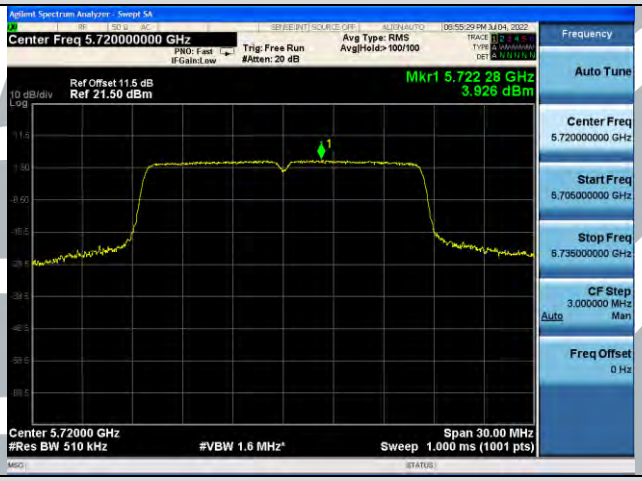
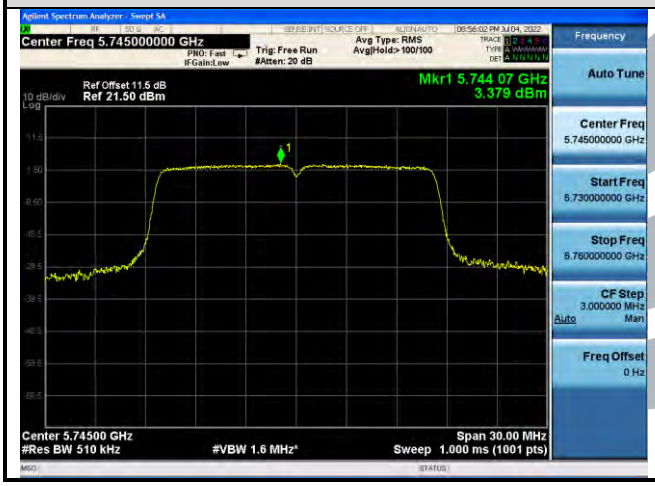
Remark:
1. Corr'd PSD = Meas PSD + Duty Cycle Factor
2. Total (Ant. 0+1) = $10*\log[(10^{\text{Ant. 0}/10})+(10^{\text{Ant. 1}/10})]$

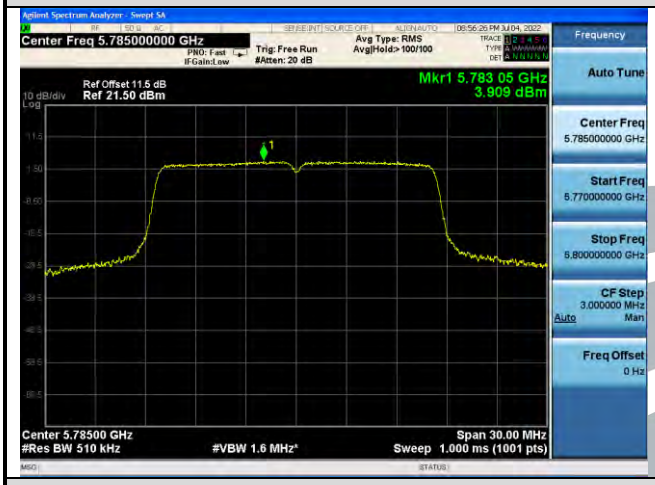
The test plots as follows:

IEEE 802.11a	
Ant. 0	Ant. 1
Channel 36	
	
Channel 44	
	
Channel 48	
	

IEEE 802.11a	
Ant. 0	Ant. 1
Channel 52	
	
Channel 60	
	
Channel 64	
	

IEEE 802.11a	
Ant. 0	Ant. 1
Channel 100	
	
Channel 120	
	
Channel 140	
	

IEEE 802.11a	
Ant. 0	Ant. 1
Channel 144_ U-NII-2C	
	
Channel 144_ U-NII-3	
	
Channel 149	
	

IEEE 802.11a	
Ant. 0	Ant. 1
Channel 157	
	
Channel 165