Report No.: GTSL202101000075F02

Test Report

Applicant:	Dandong Dongfang Measurement & Control Technology Co., Ltd.
Address of Applicant:	No.136, Binjiang M. Road, Yanjiang Development Zone, Dandong, Liaoning, China.
Manufacturer:	Dandong Dongfang Measurement & Control Technology Co., Ltd.
Address of Manufacturer:	No.136, Binjiang M. Road, Yanjiang Development Zone, Dandong, Liaoning, China.

Equipment Under Test (EUT)

Product Name:	Customer Premise Equipment
Model No.:	DF-CPE201
Trade Mark:	N/A
FCC ID:	2AY2A-DF-CPE201
Applicable standards:	FCC CFR Title 47 Part 15 Subpart E Section 15.407
Date of sample receipt:	Jan. 12, 2021
Date of Test:	Jan. 12, 2021- Feb. 24, 2021
Date of report issue:	Feb. 24, 2021
Test Result :	PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Robinson Luo
Laboratory Manager

This 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.

2 Version

Version No.	Date	Description
00	Feb. 24, 2021	*Original*

Prepared By:  ***Date:*** ***Feb. 24, 2021***

Project Engineer

Check By:  ***Date:*** ***Feb. 24, 2021***

Reviewer

3 Contents

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203	PASS
AC Power Line Conducted Emission	15.207	PASS
Peak Transmit Power	15.407(a)(1)	PASS
Power Spectral Density	15.407(a)(1)	PASS
Undesirable Emission	15.407(b)(6), 15.205/15.209	PASS
Radiated Emission	15.205/15.209	PASS
Band Edge	15.407(b)(1)	PASS
Frequency Stability	15.407(g)	PASS

Remark:

Pass: The EUT complies with the essential requirements in the standard.

4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	± 4.34dB	(1)
Radiated Emission	30MHz ~ 1000MHz	± 4.24dB	(1)
Radiated Emission	1GHz ~ 40GHz	± 4.68dB	(1)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%. Remark: Test according to ANSI C63.10:2013 and ANSI C63.4:2014			

5 General Information

5.1 General Description of EUT

Product Name:	Customer Premise Equipment
Model No.:	DF-CPE201
Test sample(s) ID:	GTSL202101000075-1(Engineer sample) GTSL202101000075-2(Normal sample)
Sample(s) Status:	Engineer sample
Power supply:	DC 12V From external circuit
Adapter Information	Mode: XH1200-1500 Input: AC100-240V, 50/60Hz, 0.5A Output: DC 12V, 1.5A

WIFI

	20MHz system	40MHz system	80MHz system	160MHz system
Supported type:	802.11a 802.11n 802.11ac	802.11n 802.11ac	N/A	N/A
Operation frequency:	5180MHz-5240MHz 5745MHz-5825MHz	5190MHz-5230MHz 5755MHz-5795MHz	N/A	N/A
Modulation:	OFDM	OFDM	N/A	N/A
Channel number:	9	4	N/A	N/A
Channel separation:	20MHz	40MHz	N/A	N/A
Antenna type：	External ANT			
Antenna Gain：	3.0dBi			

Note: For more details, please refer to the user's manual of the EUT.

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing.

All test performed at the low, middle and high of operational frequency range of each mode.

Operation Frequency List WIFI on 5G Band：

Operating band	20MHz		40MHz		80MHz	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
U-NII 1 (5150MHz-5250MHz)	36	5180	38	5190	--	--
	40	5200				
	44	5220	46	5230		
	48	5240				
U-NII 3 (5725MHz-5850MHz)	149	5745	151	5755	--	--
	153	5765				
	157	5785	159	5795		
	161	5805				
	165	5825	--	--	--	--

Note:
1. "--"Means no channel(s) available any more.
2. The line display in grey is those Channels/Frequencies select to test in this report for each operation mode.

5.2 Test mode

Transmitting mode	Keep the EUT in transmitting with modulation and 100% Duty cycle

Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Pre-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.

Mode	Data rate	Mode	Data rate
802.11a	6Mbps	802.11n/ac(HT40)	13Mbps
802.11n/ac(HT20)	6.5Mbps		

5.3 Test Facility

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

● **FCC —Registration No.: 381383**

Global United Technology Services Co., Ltd., Shenzhen 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 files. Registration 381383.

● **IC —Registration No.: 9079A**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A.

● **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). LAB CODE:600179-0

5.4 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, sBaoan District, Shenzhen, Guangdong, China 518102

Tel: 0755-27798480

Fax: 0755-27798960

5.5 Description of Support Units

Manufacturer	Description	Model	Serial Number

5.6 Deviation from Standards

None.

5.7 Additional Instructions

Test Software	
Software name	MPTool
Software version	
Power level setup	Default

6 Test Instruments list

Radiated Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July. 02 2020	July. 01 2025
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 25 2020	June. 24 2021
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 25 2020	June. 24 2021
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June. 25 2020	June. 24 2021
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 25 2020	June. 24 2021
7	EMI Test Software	FARAD	EZ-EMC	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 25 2020	June. 24 2021
9	Coaxial Cable	GTS	N/A	GTS211	June. 25 2020	June. 24 2021
10	Coaxial cable	GTS	N/A	GTS210	June. 25 2020	June. 24 2021
11	Coaxial Cable	GTS	N/A	GTS212	June. 25 2020	June. 24 2021
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 25 2020	June. 24 2021
13	Amplifier(2GHz-20GHz)	HP	84722A	GTS206	June. 25 2020	June. 24 2021
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 25 2020	June. 24 2021
15	Band filter	Amindeon	82346	GTS219	June. 25 2020	June. 24 2021
16	Power Meter	Anritsu	ML2495A	GTS540	June. 25 2020	June. 24 2021
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 25 2020	June. 24 2021
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	June. 25 2020	June. 24 2021
19	Splitter	Agilent	11636B	GTS237	June. 25 2020	June. 24 2021
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 25 2020	June. 24 2021
21	Breitband hornantenne	SCHWARZBECK	BBHA 9170	GTS579	Oct. 18 2020	Oct. 17 2021
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 18 2020	Oct. 17 2021
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 18 2020	Oct. 17 2021
24	PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	GTS578	June. 25 2020	June. 24 2021

Conducted Emission

Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	May.15 2019	May.14 2022
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 25 2020	June. 24 2021
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June. 25 2020	June. 24 2021
4	ENV216 2-L-V-NETZNACHB.DE	ROHDE&SCHWARZ	ENV216	GTS226	June. 25 2020	June. 24 2021
5	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
6	EMI Test Software	FARAD	EZ-EMC	N/A	N/A	N/A
7	Thermo meter	KTJ	TA328	GTS233	June. 25 2020	June. 24 2021
8	Absorbing clamp	Elektronik-Feinmechanik	MDS21	GTS229	June. 25 2020	June. 24 2021
9	ISN	SCHWARZBECK	NTFM 8158	GTD565	June. 25 2020	June. 24 2021

RF Conducted Test:

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	MXA Signal Analyzer	Agilent	N9020A	GTS566	June. 25 2020	June. 24 2021
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 25 2020	June. 24 2021
3	Spectrum Analyzer	Agilent	E4440A	GTS533	June. 25 2020	June. 24 2021
4	MXG vector Signal Generator	Agilent	N5182A	GTS567	June. 25 2020	June. 24 2021
5	ESG Analog Signal Generator	Agilent	E4428C	GTS568	June. 25 2020	June. 24 2021
6	USB RF Power Sensor	DARE	RPR3006W	GTS569	June. 25 2020	June. 24 2021
7	RF Switch Box	Shongyi	RFSW3003328	GTS571	June. 25 2020	June. 24 2021
8	Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	GTS572	June. 25 2020	June. 24 2021

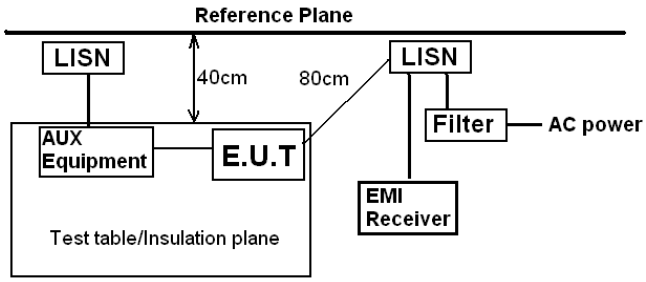
General used equipment:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	June. 25 2020	June. 24 2021
2	Barometer	ChangChun	DYM3	GTS255	June. 25 2020	June. 24 2021

7 Test results and Measurement Data

7.1 Antenna requirement:

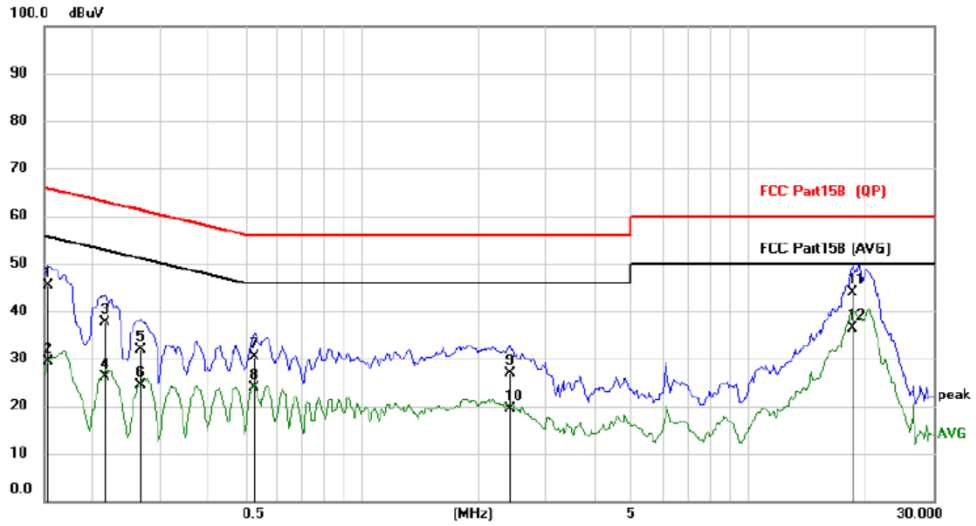
	Standard requirement:	FCC Part15 C Section 15.203
	15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling 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.	
	E.U.T Antenna:	
	The antennas are External ANT, the best case gain of the antennas are 3.00dBi,MIMO antenna gain is 6.01dBi reference to the appendix II for details,	

7.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207
Test Method:	ANSI C63.10:2013
Test Frequency Range:	150KHz to 30MHz
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto
Limit:	Frequency range (MHz) / Limit (dBuV): Quasi-peak / Average 0.15-0.5: 66 to 56* / 56 to 46* 0.5-5: 56 / 46 5-30: 60 / 50 * Decreases with the logarithm of the frequency.
Test setup:	 *Remark:* *E.U.T: Equipment Under Test* *LISN: Line Impedence Stabilization Network* *Test table height=0.8m*
Test procedure:	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test environment:	Temp.: 25 °C / Humid.: 52% / Press.: 1012mbar
Test voltage:	AC 120V, 60Hz
Test results:	Pass

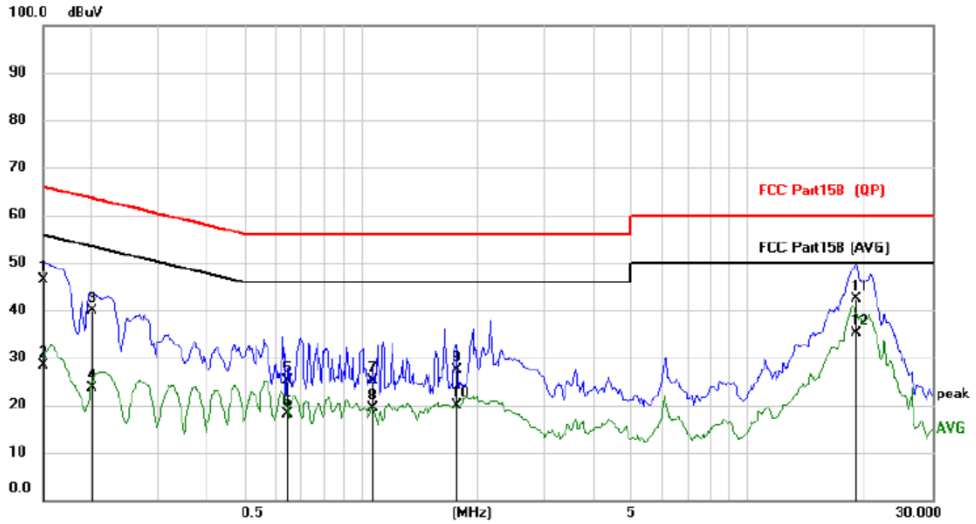
Measurement data

Line:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1539	34.40	10.92	45.32	65.79	-20.47	QP
2		0.1539	18.49	10.92	29.41	55.79	-26.38	AVG
3		0.2163	26.60	10.92	37.52	62.96	-25.44	QP
4		0.2163	15.31	10.92	26.23	52.96	-26.73	AVG
5		0.2670	21.07	10.92	31.99	61.21	-29.22	QP
6		0.2670	13.54	10.92	24.46	51.21	-26.75	AVG
7		0.5243	19.42	10.92	30.34	56.00	-25.66	QP
8		0.5243	13.06	10.92	23.98	46.00	-22.02	AVG
9		2.4119	16.01	10.98	26.99	56.00	-29.01	QP
10		2.4119	8.28	10.98	19.26	46.00	-26.74	AVG
11		18.5493	32.29	11.61	43.90	60.00	-16.10	QP
12	*	18.5493	24.87	11.61	36.48	50.00	-13.52	AVG

Neutral:

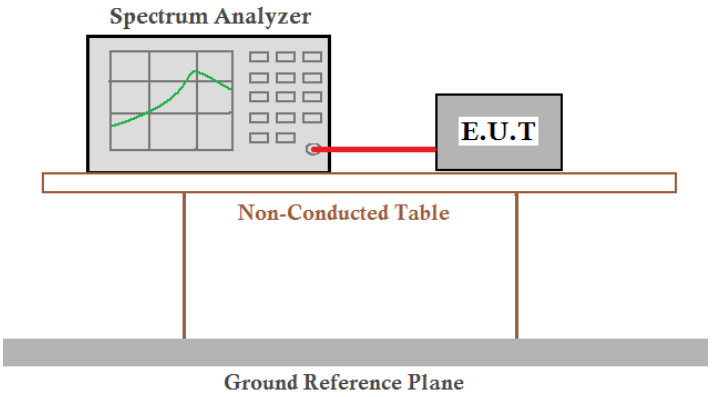


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1500	35.36	10.92	46.28	66.00	-19.72	QP
2		0.1500	17.56	10.92	28.48	56.00	-27.52	AVG
3		0.2007	28.90	10.92	39.82	63.58	-23.76	QP
4		0.2007	12.72	10.92	23.64	53.58	-29.94	AVG
5		0.6414	14.23	10.92	25.15	56.00	-30.85	QP
6		0.6414	7.09	10.92	18.01	46.00	-27.99	AVG
7		1.0743	14.14	10.92	25.06	56.00	-30.94	QP
8		1.0743	8.37	10.92	19.29	46.00	-26.71	AVG
9		1.7724	16.36	10.96	27.32	56.00	-28.68	QP
10		1.7724	9.00	10.96	19.96	46.00	-26.04	AVG
11		19.1070	30.75	11.64	42.39	60.00	-17.61	QP
12	*	19.1070	23.41	11.64	35.05	50.00	-14.95	AVG

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + Correct Factor
4. *If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.*

7.3 Emission Bandwidth

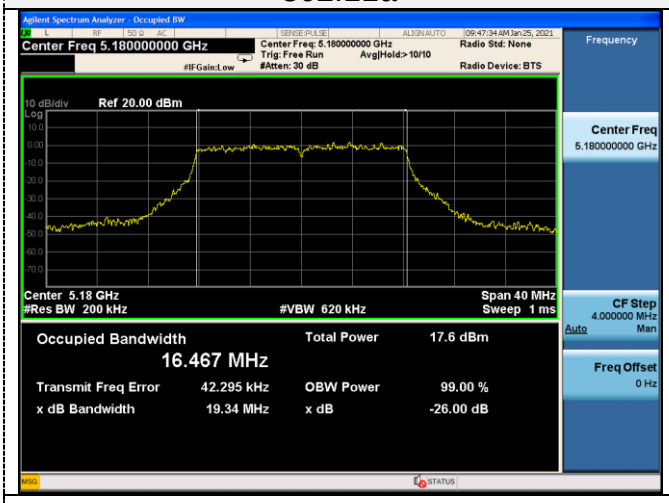
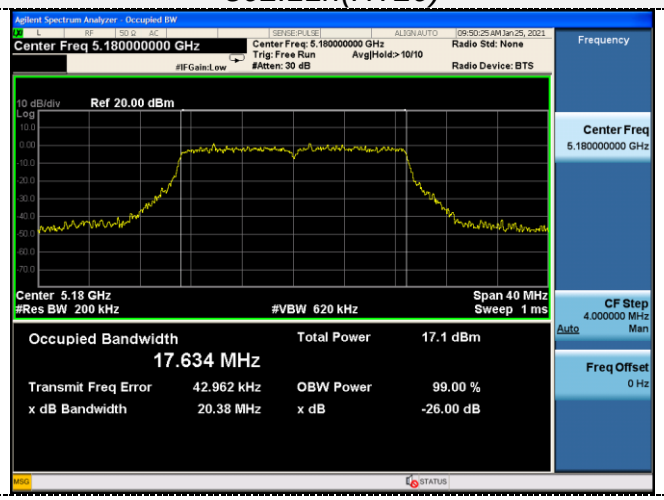
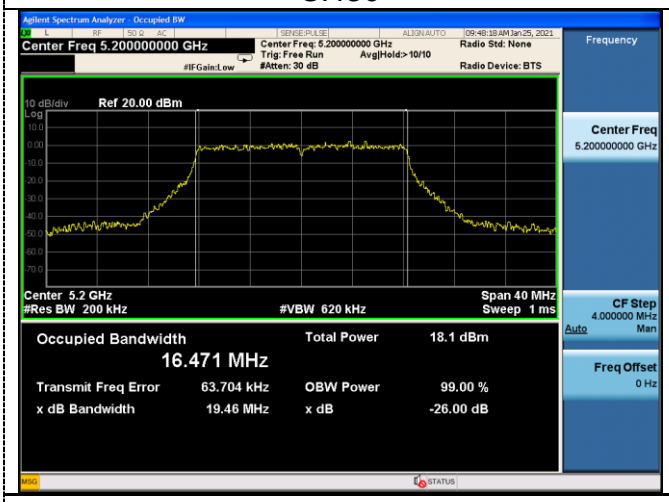
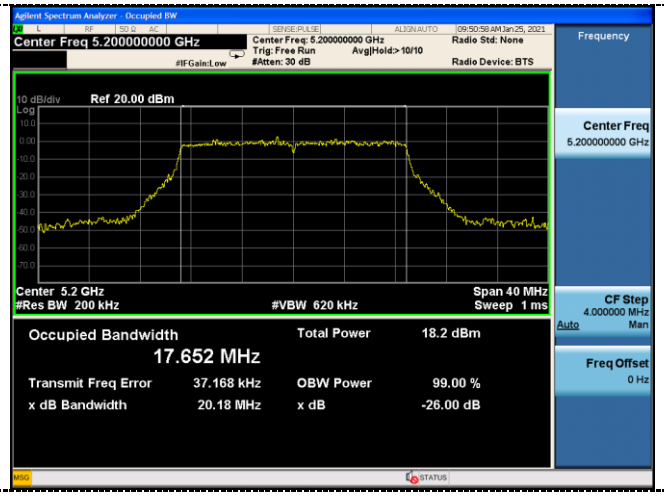
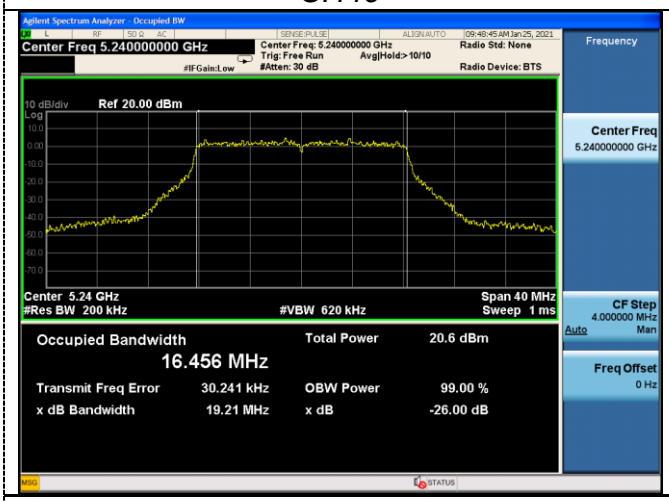
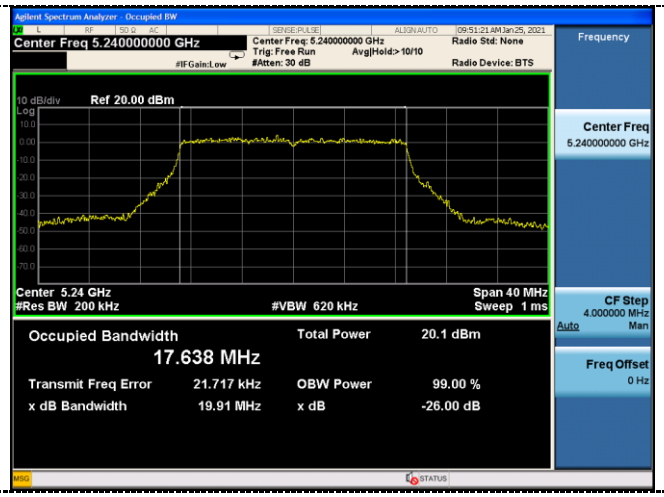
Test Requirement :	FCC Part15 E Section 15.407
Test Method :	KDB 789033 D02 General U-NII Test Procedures New Rules v02r01
Limit:	N/A
Test setup:	
Test procedure:	According to KDB 789033 D02 General U-NII Test Procedures New Rules v02r01.
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

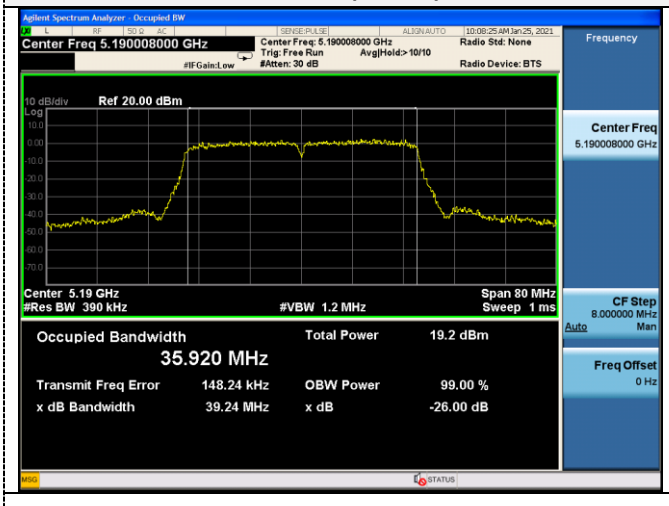
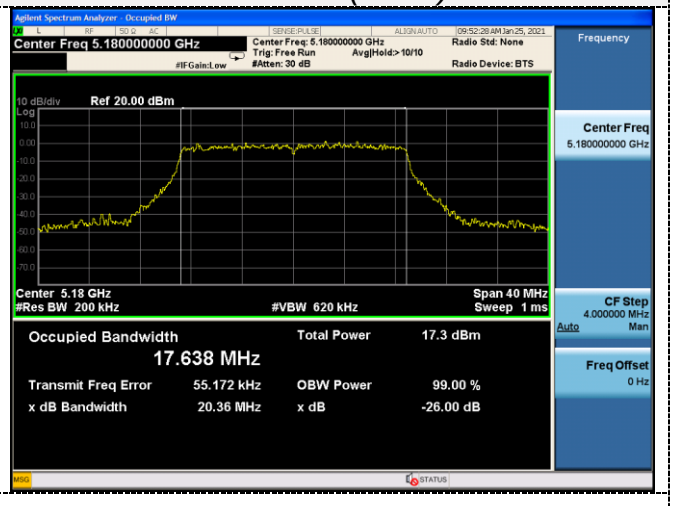
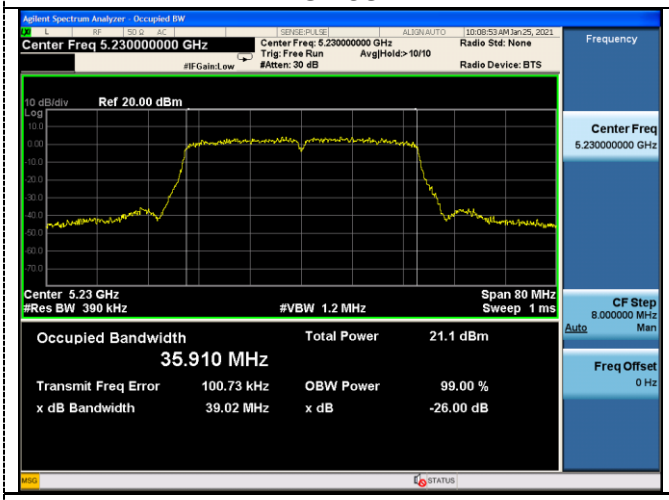
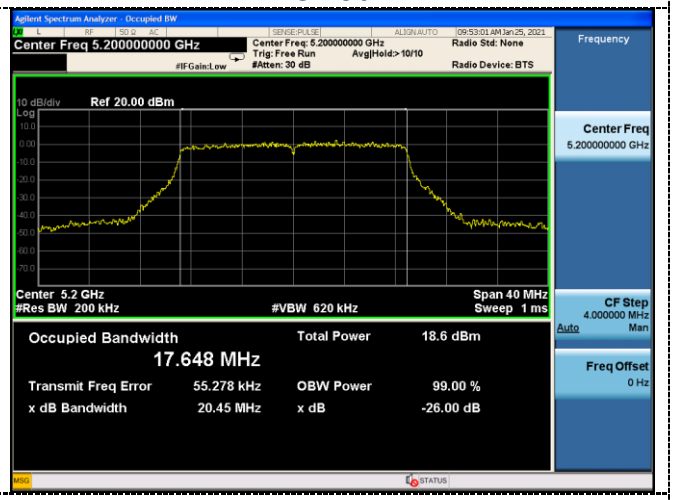
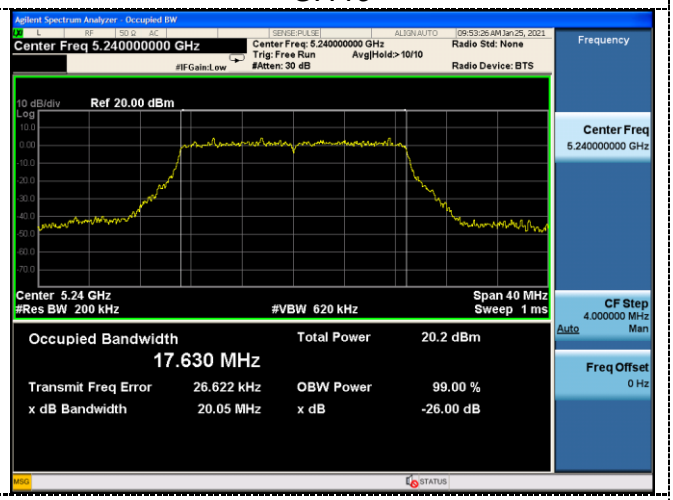
Measurement Data:

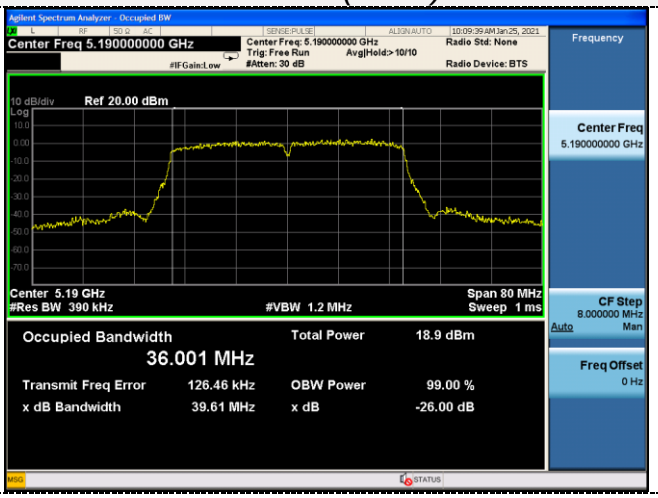
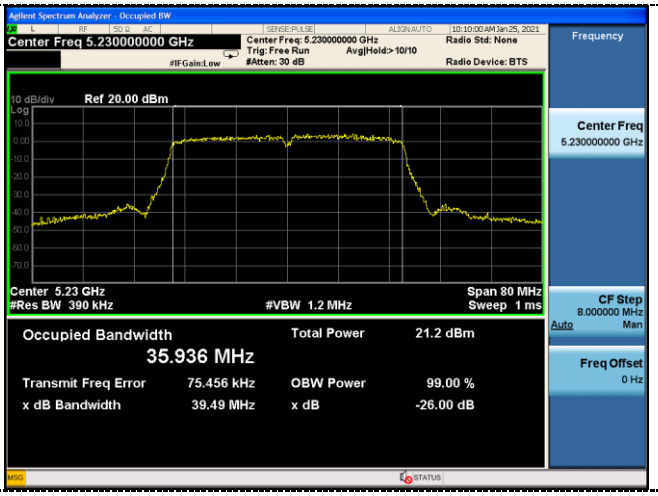
Type	Bands	Channel	26dB Bandwidth (MHz)	Limit (MHz)	Result
802.11a	U-NII 1	36	19.34	N/A	Pass
		40	19.46		
		48	19.21		
802.11n(HT20)	U-NII 1	36	20.38		
		40	20.18		
		48	19.91		
802.11n(HT40)	U-NII 1	38	39.24		
		46	39.02		
802.11ac(HT20)	U-NII 1	36	20.36	N/A	Pass
		40	20.45		
		48	20.05		
802.11ac(HT40)	U-NII 1	38	39.61		
		46	39.49		

Note:

1. *Measured 26dB bandwidth and 99% Bandwidth at difference data rate for each mode and recorded worst case for each mode.*
2. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac HT20 ,IEEE 802.11ac HT40 ;*

802.11a	802.11n(HT20)
	
CH36	CH36
	
CH40	CH40
	
CH48	CH48

802.11n(HT40)	802.11ac(HT20)
	
CH38	CH36
	
CH46	CH40
	
	CH48

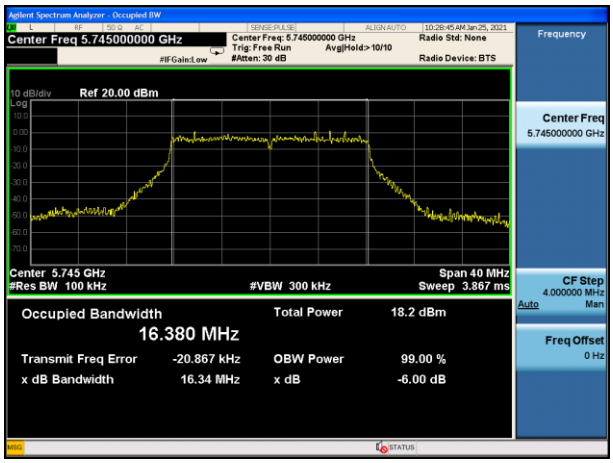
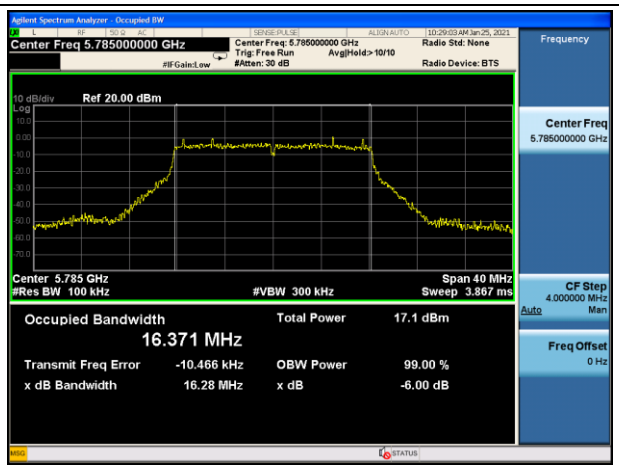
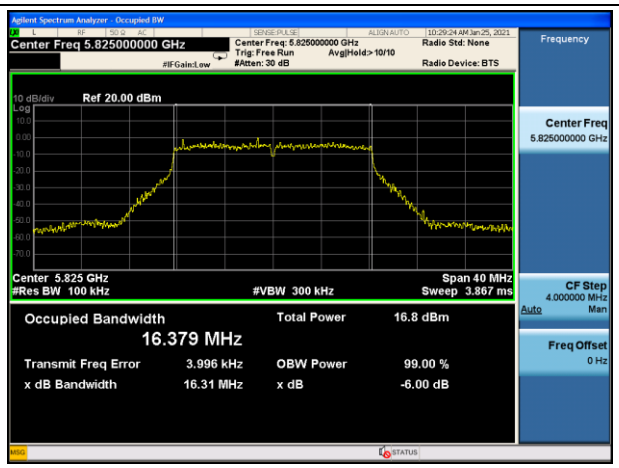
802.11ac(HT40)	
	
CH38	
	
CH46	

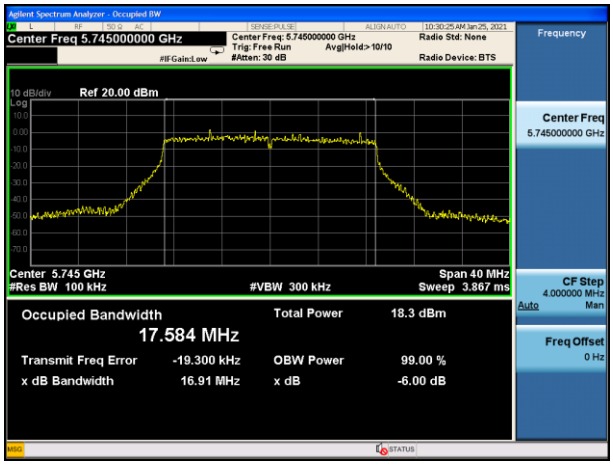
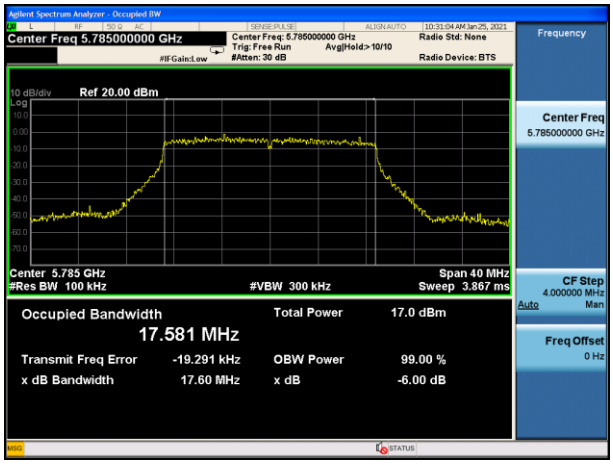
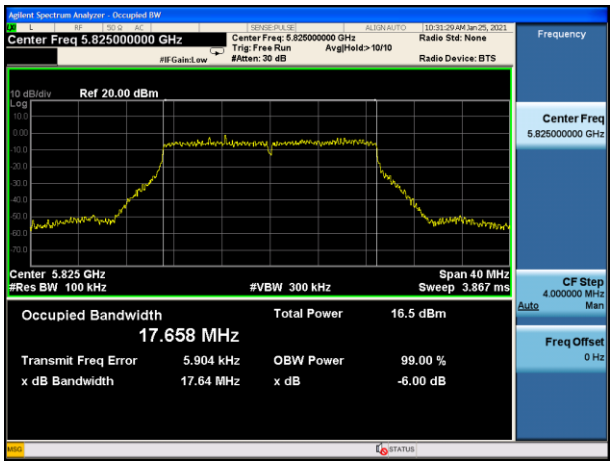
Type	Bands	Channel	6dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	U-NII 3	149	16.34	≥500KHz	Pass
		157	16.28		
		165	16.31		
802.11n(HT20)	U-NII 3	149	16.91		
		157	17.60		
		165	17.64		
802.11n(HT40)	U-NII 3	151	35.47		
		159	35.16		
802.11ac(HT20)	U-NII 3	149	17.58		
		157	17.73		
		165	17.62		
802.11ac(HT40)	U-NII 3	151	35.71		
		159	35.16		

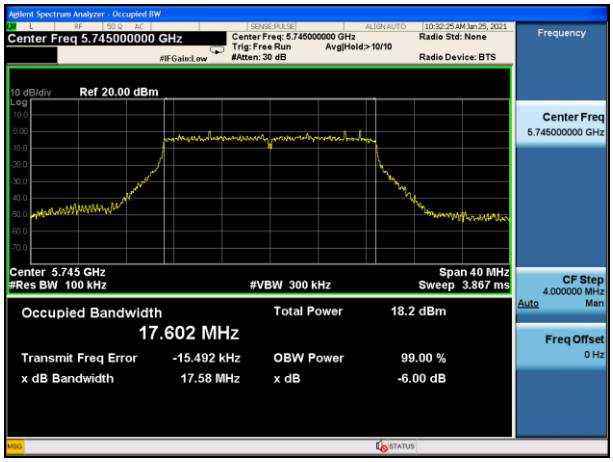
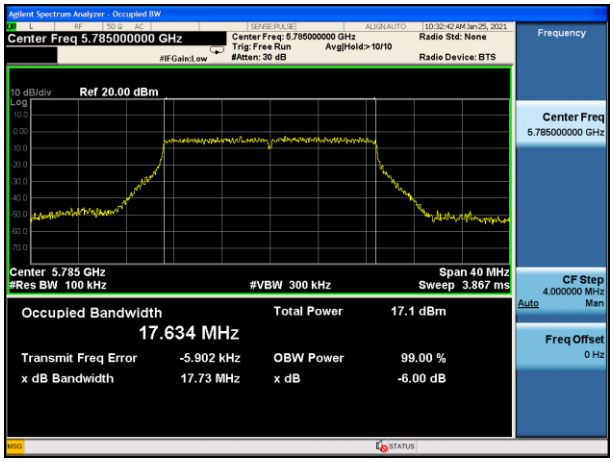
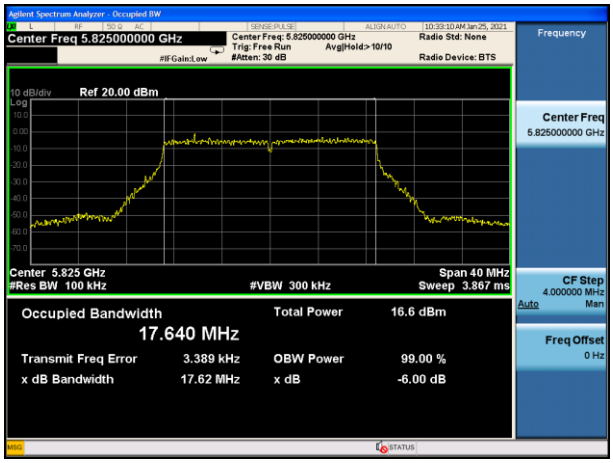
Note:

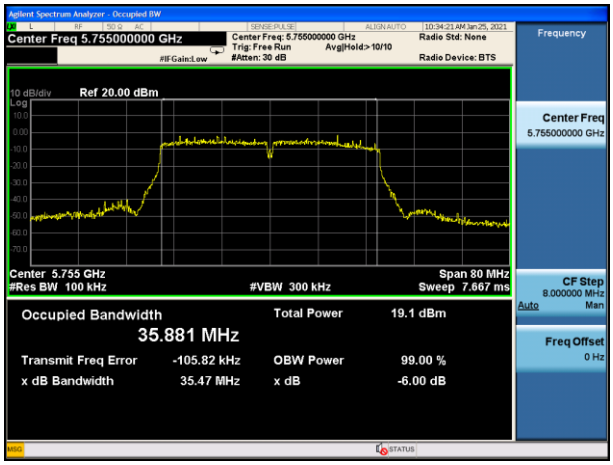
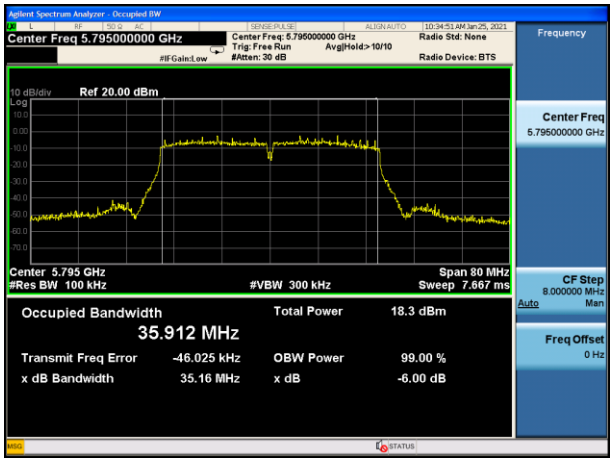
3. *Measured 26dB bandwidth and 99% Bandwidth at difference data rate for each mode and recorded worst case for each mode.*
4. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac HT20 ,IEEE 802.11ac HT40 ;*

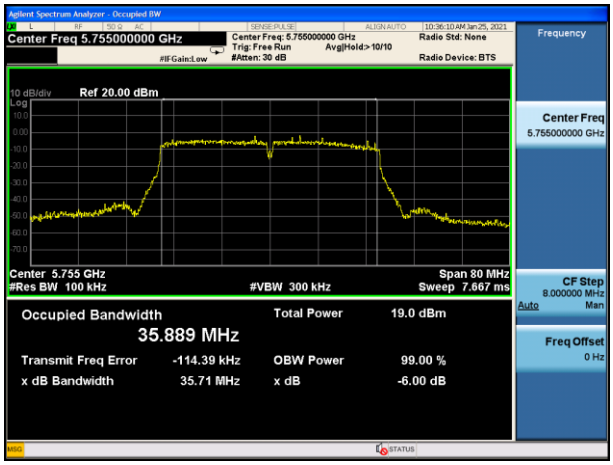
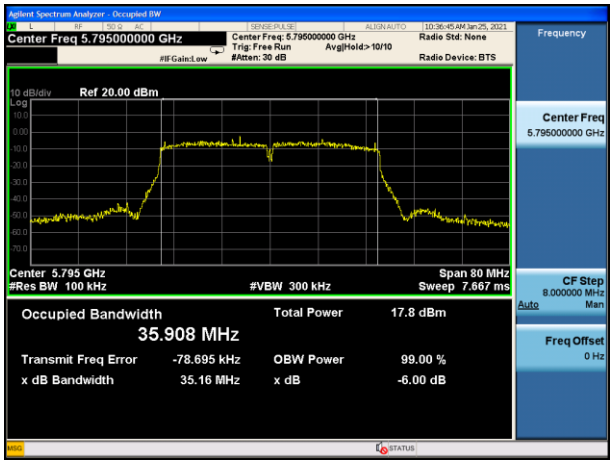
Test plot as follows:

802.11a

Lowest channel

Middle channel

Highest channel

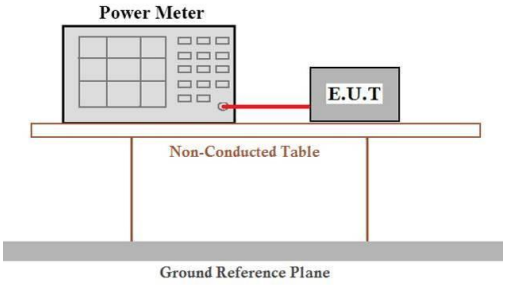
802.11n(HT20)

Lowest channel

Middle channel

Highest channel

802.11ac(HT20)

Lowest channel

Middle channel

Highest channel

802.11n(HT40)

Lowest channel

Highest channel

802.11ac(HT40)

Lowest channel

Highest channel

7.4 Maximum Conducted Average Output Power

Test Requirement	FCC Part15 E Section 15.407
Test Method :	KDB 789033 D02 General U-NII Test Procedures New Rules v02r01
Limit:	<table><tr><td>Frequency band (MHz)</td><td>Limit</td></tr><tr><td rowspan="3">5150-5250</td><td>≤1W(30dBm) for master device</td></tr><tr><td>≤250mW(23.98dBm) for client device</td></tr><tr><td>≤125mW(21dBm) for Outdoor access point</td></tr><tr><td>5250-5350</td><td>≤250mW(23.98dBm) for client device or 11dBm+10logB*</td></tr><tr><td>5470-5725</td><td>≤250mW(23.98dBm) for client device or 11dBm+10logB*</td></tr><tr><td colspan="2">Remark: *Where B is the 26dB emission bandwidth in MHz. The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.</td></tr></table>
Test setup:	
Test procedure:	**Measurement using an RF average power meter** (i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied a) The EUT is configured to transmit continuously or to transmit with a constant duty cycle. b) At all times when the EUT is transmitting, it must be transmitting at its maximum power control level. c) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five. (ii) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section B). (iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter. (iv) Adjust the measurement in dBm by adding 10 log(1/x) where x is the duty cycle (e.g., 10log(1/0.25) if the duty cycle is 25 percent).
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

U-NII 1

Type	Channel	Output power (dBm)	MIMO Antenna Gain	Elevation angel above 30° Max Turn table (°)	Elevation angel above 30° Max Horn height (m)	Elevation angel above 30° Max ERIP (dBm)	Limit ERIP (dBm)	Result
802.11a	36	14.52	6.01	311.2	1.56	20.53	21.0	Pass
	40	14.47	6.01	313.3	1.76	20.48		
	48	14.21	6.01	315.4	1.55	20.22		
802.11n(HT20)	36	13.36	6.01	316.5	1.62	19.37	21.0	Pass
	40	13.29	6.01	314.6	1.66	19.3		
	48	13.79	6.01	313.7	1.52	19.8		
802.11n(HT40)	38	13.61	6.01	316.8	1.84	19.62	21.0	Pass
	46	13.57	6.01	314.9	1.65	19.58		
802.11ac(HT20)	36	14.32	6.01	313.8	1.54	20.33	21.0	Pass
	40	14.27	6.01	320.5	1.57	20.28		
	48	14.42	6.01	318.4	1.65	20.43		
802.11ac(HT40)	38	13.63	6.01	317.6	1.57	19.64	21.0	Pass
	46	13.55	6.01	314.6	1.65	19.56		

Note: Output Power = Measured Power + Duty Factor
Duty Factor = 10 log (1/Duty Cycle) and ,and Test Mode : Keep the EUT in transmitting with modulation and 100% Duty cycle

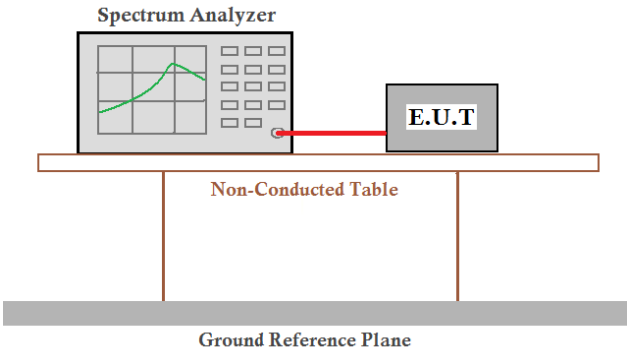
U-NII 3

Type	Channel	Output power Average (dBm)	Limit (dBm)	Result
802.11a	149	16.85	29.99	Pass
	157	16.42		
	165	16.33		
802.11n(HT20)	149	16.75	29.99	Pass
	157	16.48		
	165	16.37		
802.11n(HT40)	151	16.25	29.99	Pass
	159	16.95		
802.11ac(HT20)	149	16.63	29.99	Pass
	157	16.43		
	165	16.27		
802.11ac(HT40)	151	16.25	29.99	Pass
	159	16.37		

Note: Output Power = Measured Power + Duty Factor

Duty Factor = 10 log (1/Duty Cycle) and ,and Test Mode : Keep the EUT in transmitting with modulation and 100% Duty cycle

7.5 Power Spectral Density

Test Requirement:	FCC Part15 E Section 15.407
Test Method :	KDB 789033 D02 General U-NII Test Procedures New Rules v02r01
Limit:	Frequency band (MHz) / Limit 5150-5250 / ≤17dBm in 1MHz for master device 5150-5250 / ≤11dBm in 1MHz for client device 5250-5350 / ≤11dBm in 1MHz for client device 5470-5725 / ≤11dBm in 1MHz for client device Remark: The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test.
Test setup:	
Test procedure:	1) Create an average power spectrum for the EUT operating mode being tested by following the instructions in section E)2) for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power…”. 2) Use the peak search function on the instrument to find the peak of the spectrum. 3) Make the following adjustments to the peak value of the spectrum, if applicable: a) If Method SA-2 or SA-2 Alternative was used, add 10 log(1/x), where x is the duty cycle, to the peak of the spectrum. b) If Method SA-3 Alternative was used and the linear mode was used in step E)2)g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging. 4) The result is the PSD.
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

U-NII 1

Type	*Channel*	*P.S.D (dBm/MHz)*	*Limit (dBm/ MHz)*	*Result*
802.11a	36	0.362	16.99	Pass
	40	1.130		
	48	2.824		
802.11n(HT20)	36	-0.303		Pass
	40	0.286		
	48	2.113		
802.11n(HT40)	38	-1.969		Pass
	46	-0.049		
802.11ac(HT20)	36	-0.526		Pass
	40	0.585		
	48	2.051		
802.11ac(HT40)	38	-1.430		Pass
	46	0.258		

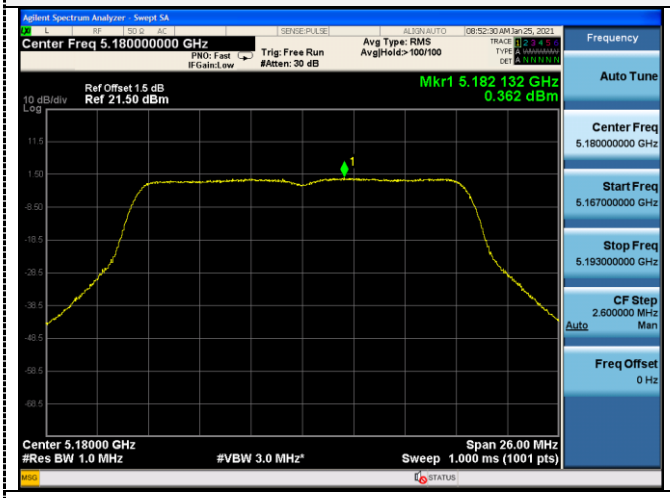
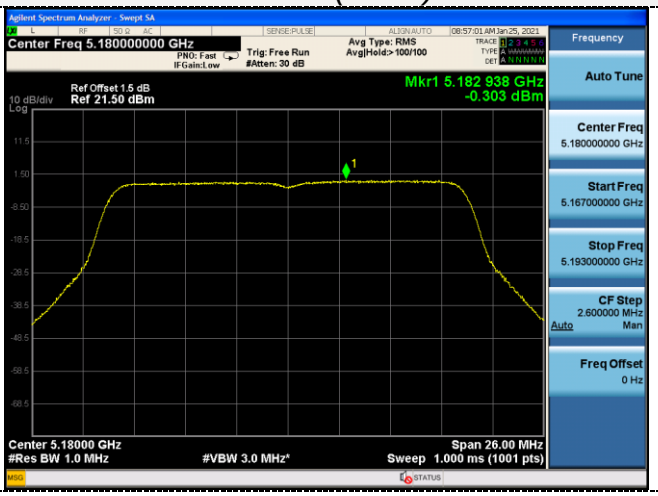
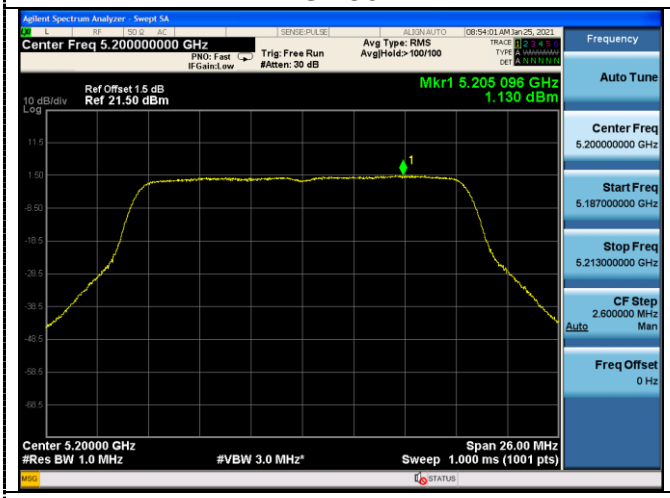
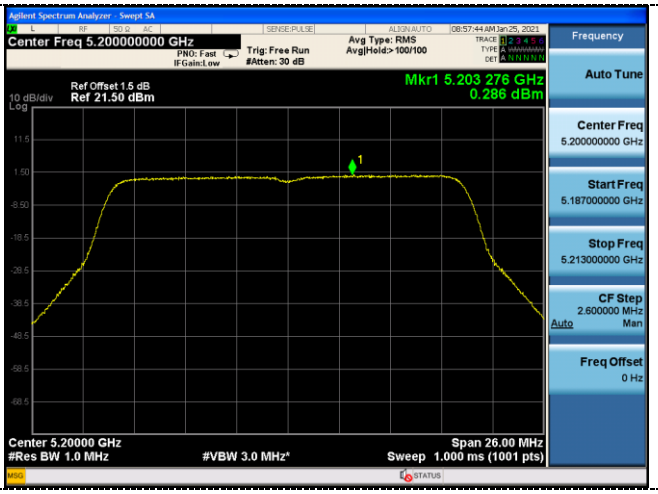
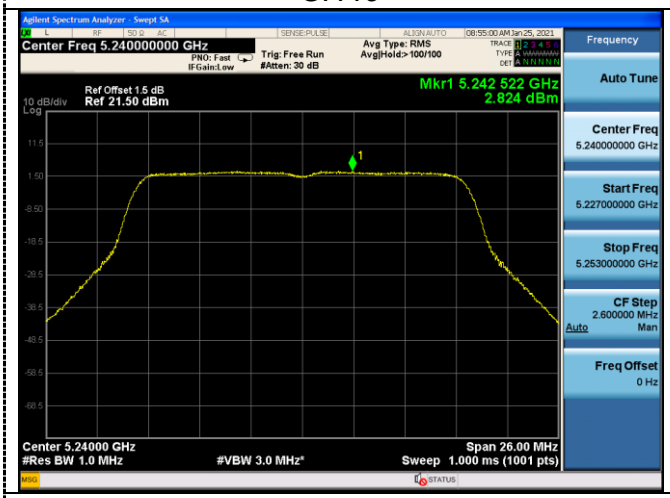
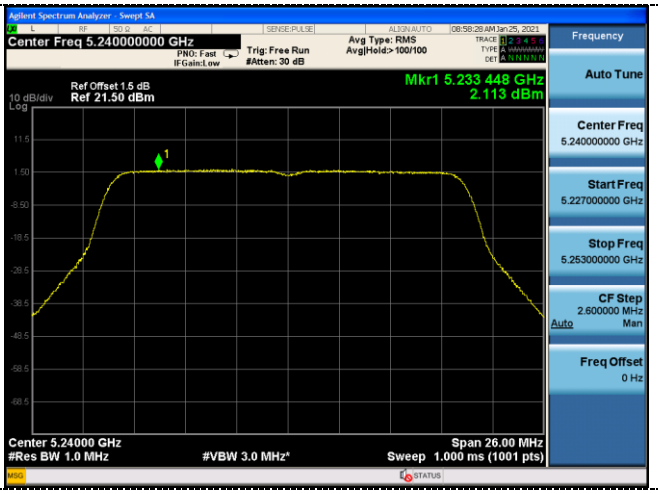
Note: 1:PSD = Measured psd + Duty Factor

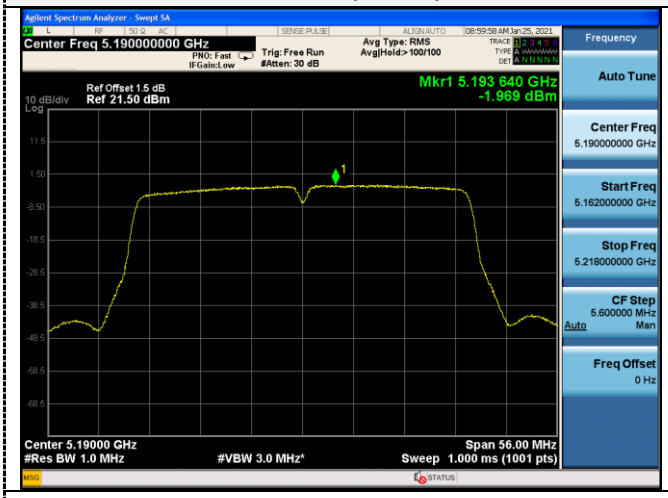
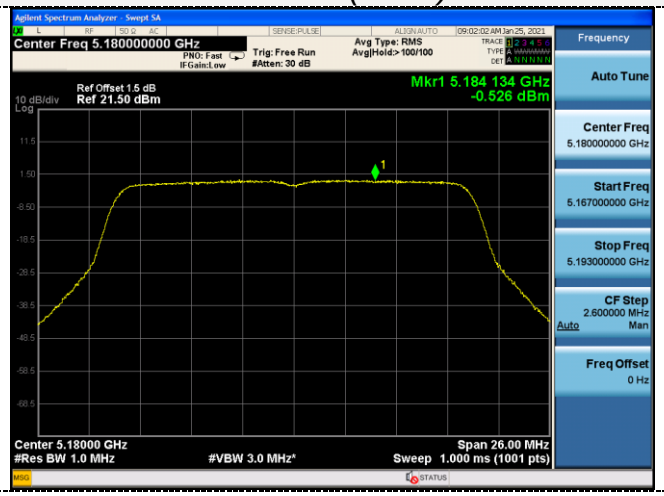
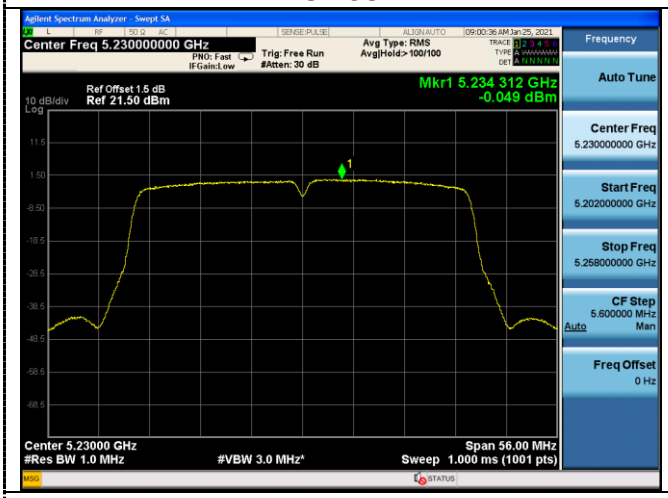
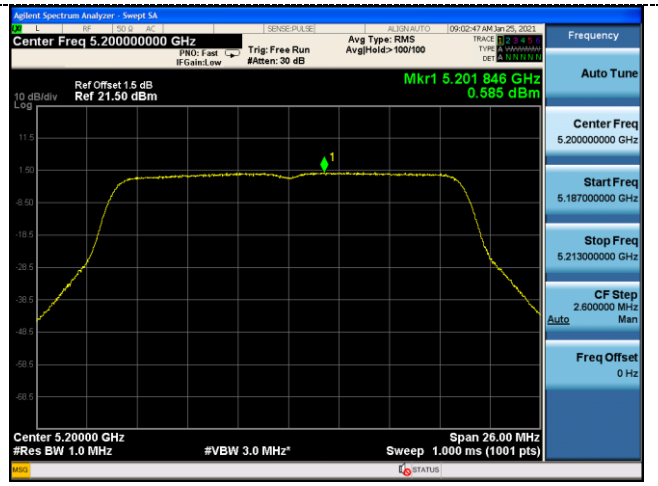
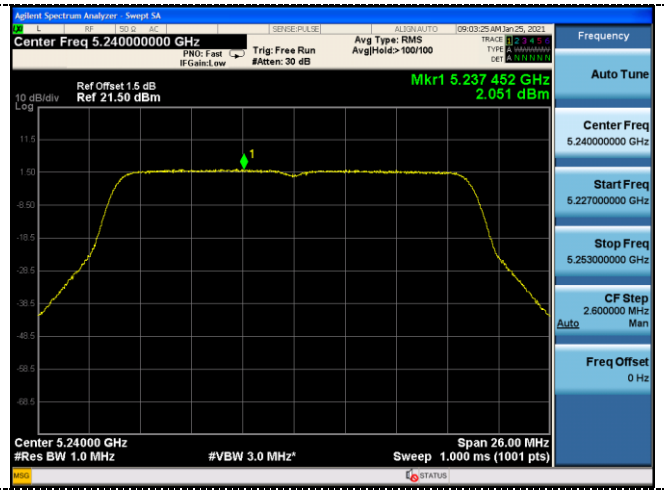
Duty Factor = 10 log (1/Duty Cycle) and ,and Test Mode : Keep the EUT in transmitting with modulation and 100% Duty cycle

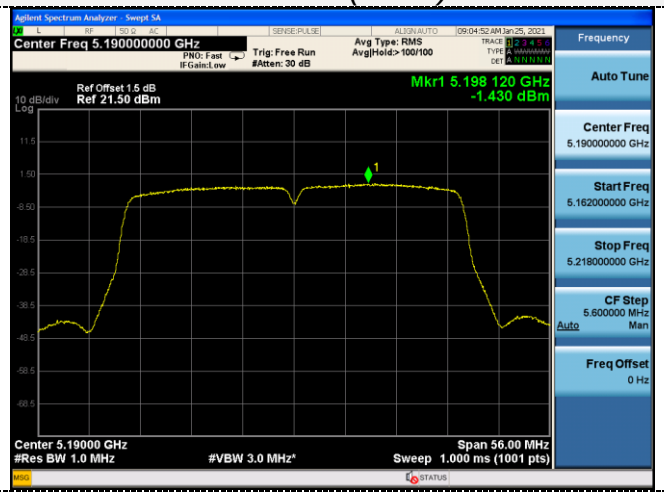
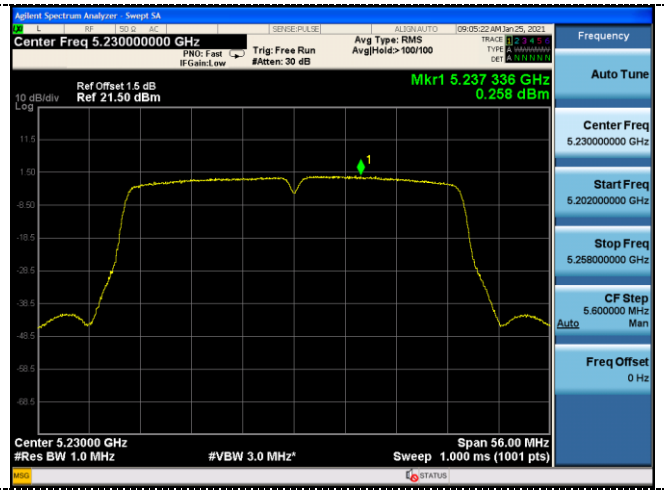
2.Measured output power at difference data rate for each mode and recorded worst case for each mode.

3.Test results including cable loss;

4.Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac HT20 ,IEEE 802.11ac HT40;

802.11a	802.11n(HT20)
	
CH36	CH36
	
CH40	CH40
	
CH48	CH48

802.11n(HT40)	802.11ac(HT20)
	
CH38	CH36
	
CH46	CH36
	
	CH48

802.11ac(HT40)	
	
CH38	
	
CH46	

U-NII 3

Type	*Channel*	*Power Spectral Density (dBm/300KHz)*	*RBW Factor (dB)*	*Power Spectral Density (dBm/500KHz)*	*Limit (dBm/500 KHz)*	*Result*
802.11a	149	-4.244	2.218	-2.026	29.99	Pass
	157	-5.629	2.218	-3.411		
	165	-5.661	2.218	-3.443		
802.11n (HT20)	149	-5.512	2.218	-3.294		
	157	-5.980	2.218	-3.762		
	165	-6.189	2.218	-3.971		
802.11n (HT40)	151	-7.176	2.218	-4.958		
	159	-8.529	2.218	-6.311		
802.11a c(HT20)	149	-5.214	2.218	-2.996		
	157	-6.659	2.218	-4.441		
	165	-6.896	2.218	-4.678		
802.11a c(HT40)	151	-7.156	2.218	-4.938		
	159	-8.489	2.218	-6.271		

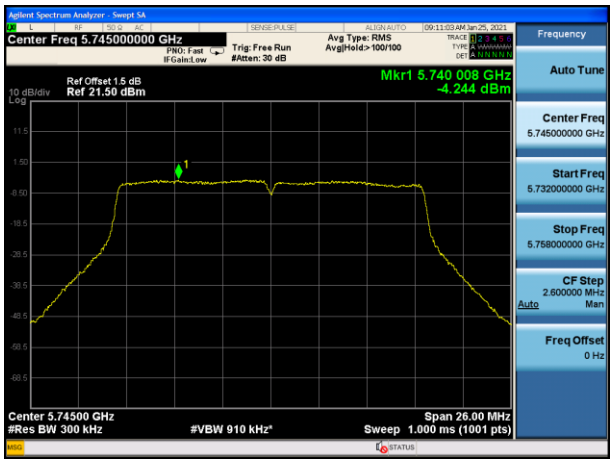
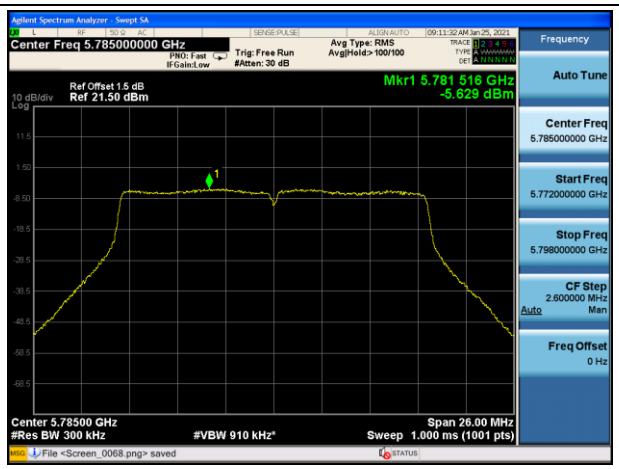
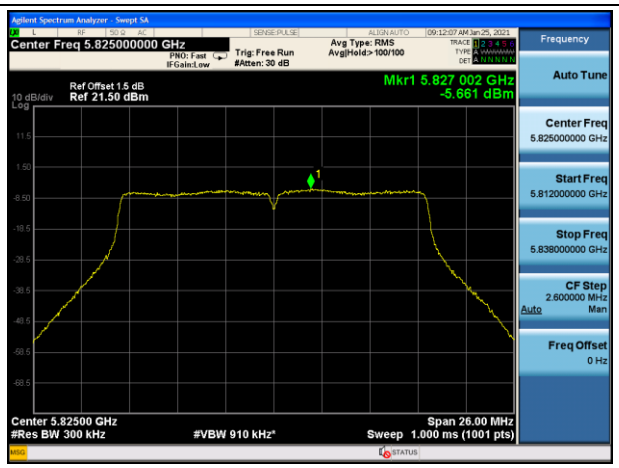
Note: Output Power = Measured Power + Duty Factor

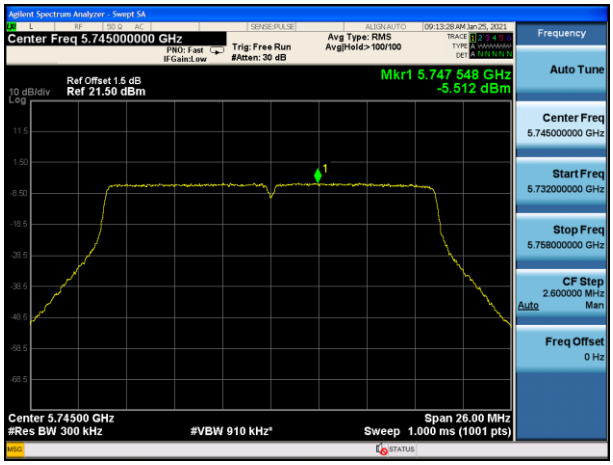
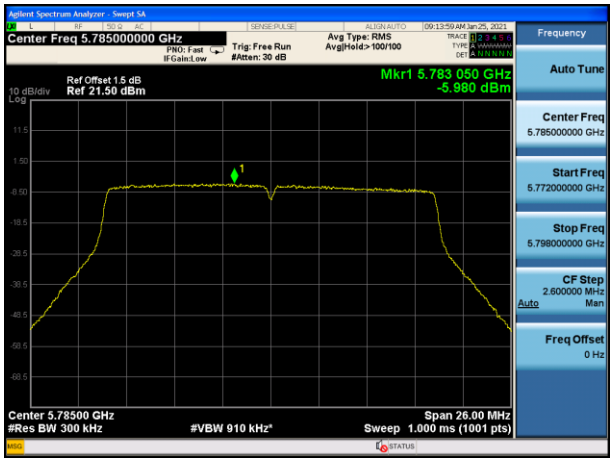
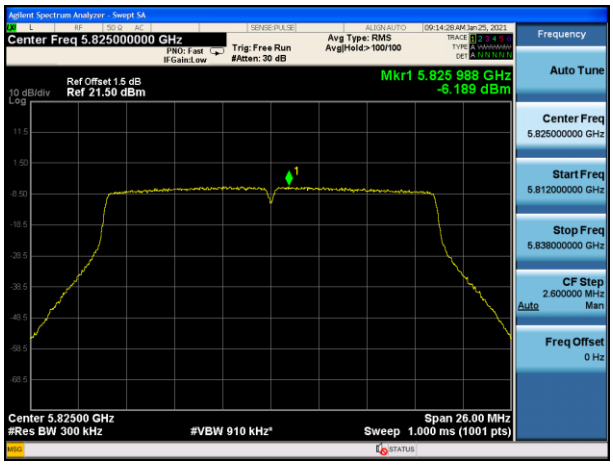
Duty Factor = 10 log (1/Duty Cycle) and ,and Test Mode : Keep the EUT in transmitting with modulation and 100% Duty cycle

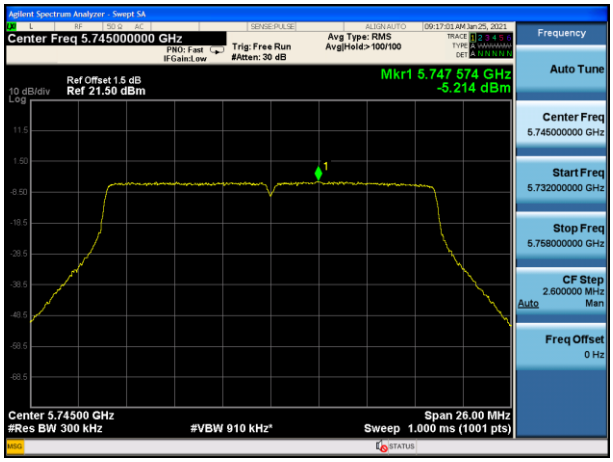
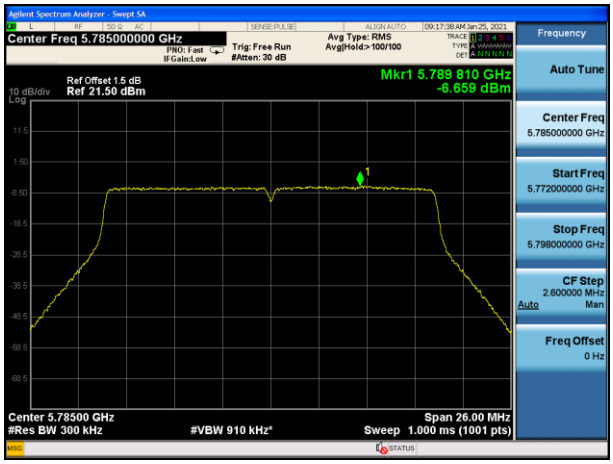
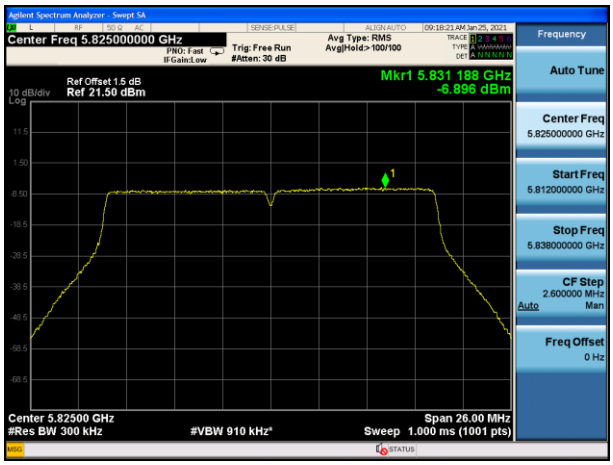
RBW factor = 10 log (500 KHz / 300 KHz) = 2.218 dB;

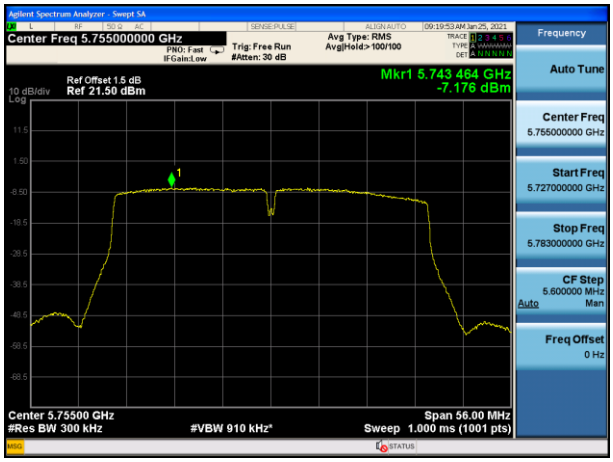
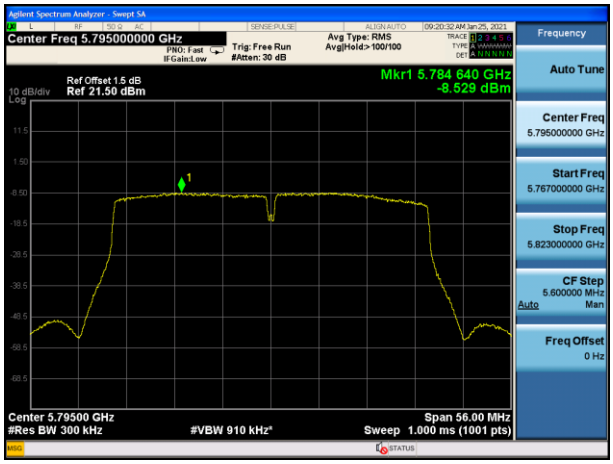
Report conducted PSD = measured conducted PSD + RBW factor;

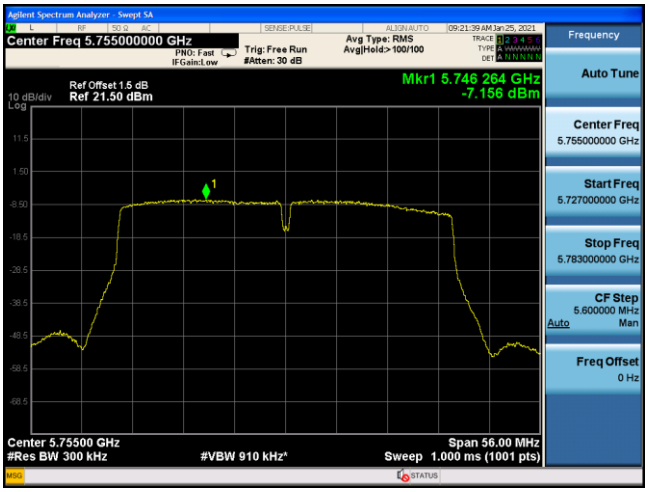
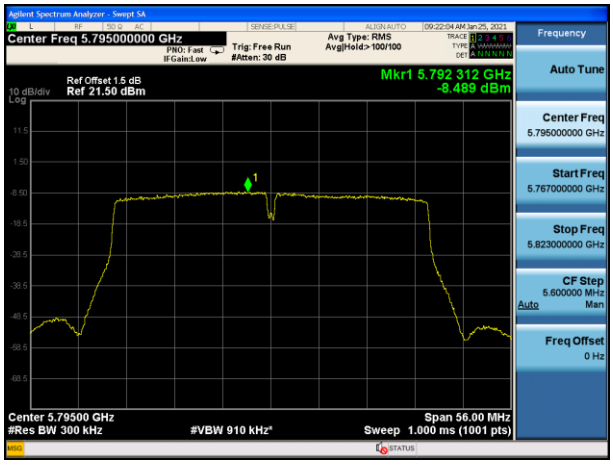
Test plot as follows:

802.11a

Lowest channel

Middle channel

Highest channel

802.11n(HT20)

Lowest channel

Middle channel

Highest channel

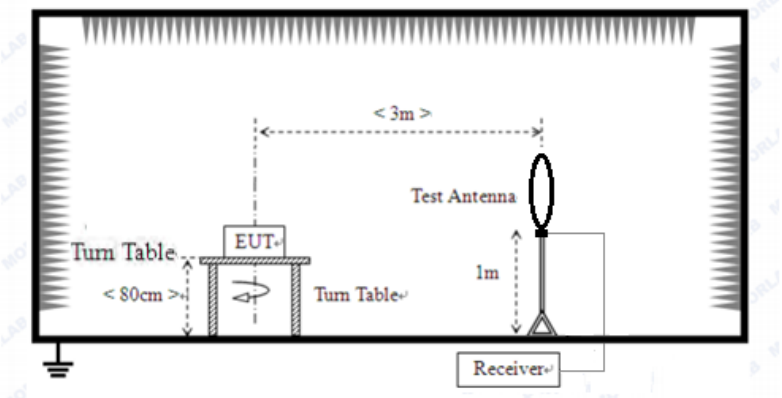
802.11ac(HT20)

Lowest channel

Middle channel

Highest channel

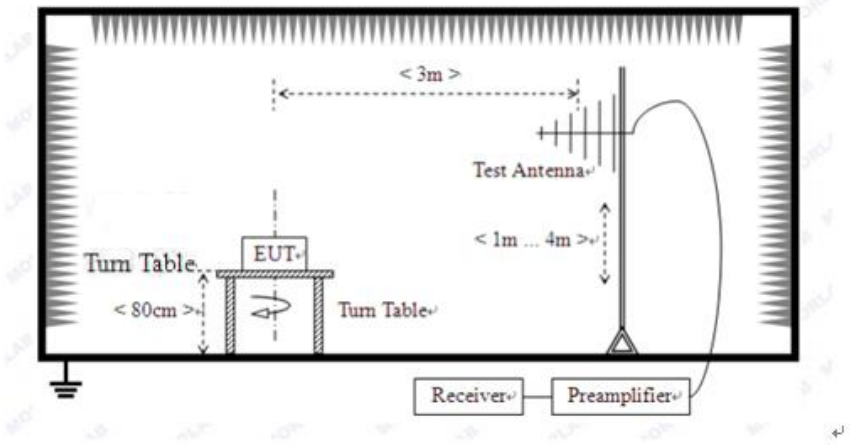
802.11n(HT40)

Lowest channel

Highest channel

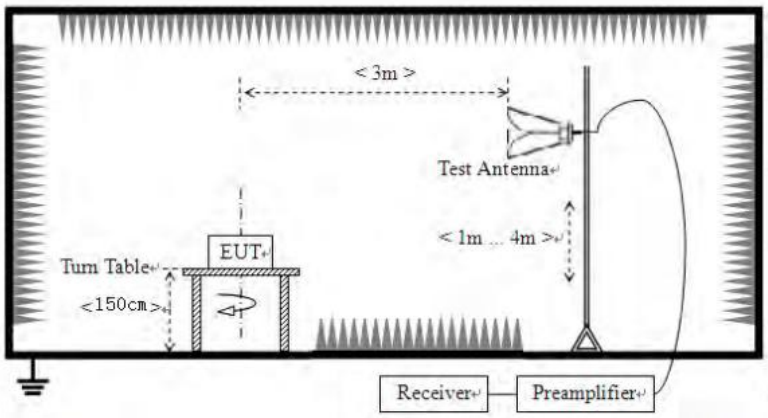
802.11ac(HT40)

Lowest channel

Highest channel

7.7 Radiated Emission Band Edge

<table>
<tr><td>Test Requirement :</td><td>FCC Part15 C Section 15.209 and 15.205 and FCC Part15 E Section 15.407 and 5.205</td></tr>
<tr><td>Test Method :</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Test Frequency Range:</td><td>9kHz to 40GHz</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m (Semi-Anechoic Chamber)</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><th>Frequency</th><th>Detector</th><th>RBW</th><th>VBW</th><th>Value</th></tr>
<tr><td>9kHz-150KHz</td><td>Quasi-peak</td><td>200Hz</td><td>1kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>150kHz-30MHz</td><td>Quasi-peak</td><td>9kHz</td><td>30kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>100KHz</td><td>300KHz</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>AV</td><td>1MHz</td><td>3MHz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><th>Frequency</th><th>Limit (uV/m)</th><th>Value</th><th>Measurement Distance</th></tr>
<tr><td>0.009MHz-0.490MHz</td><td>2400/F(KHz)</td><td>QP</td><td>300m</td></tr>
<tr><td>0.490MHz-1.705MHz</td><td>24000/F(KHz)</td><td>QP</td><td>300m</td></tr>
<tr><td>1.705MHz-30MHz</td><td>30</td><td>QP</td><td>30m</td></tr>
<tr><td>30MHz-88MHz</td><td>100</td><td>QP</td><td rowspan="7">3m</td></tr>
<tr><td>88MHz-216MHz</td><td>150</td><td>QP</td></tr>
<tr><td>216MHz-960MHz</td><td>200</td><td>QP</td></tr>
<tr><td>960MHz-1GHz</td><td>500</td><td>QP</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>500</td><td>Average</td></tr>
<tr><td>5000</td><td>Peak</td></tr>
</table>
</td></tr>
<tr><td>Test Procedure:</td><td>Substitution method was performed to determine the actual ERP emission levels of the EUT.
The following test procedure as below:
1>.Below 1GHz test procedure:
1. The EUT was placed on the top of a rotating table (0.8m for below 1GHz and 1.5 meters for above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</td></tr>
</table>

	2>.Above 1GHz test procedure: 1. On the test site as test setup graph above,the EUT shall be placed at the 0.8m support on the turntable and in the position closest to normal use as declared by the provider. 2. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter.The output of the test antenna shall be connected to the measuring receiver. 3. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test. 4. The test antenna shall be raised and lowered from 1m to 4m until a maximum signal level is detected by the measuring receiver. Then the turntable should be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver. 5. Repeat step 4 for test frequency with the test antenna polarized horizontally. 6. Remove the transmitter and replace it with a substitution antenna 7. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends vertically polarized, and with the signal generator tuned to a particular test frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output. 8. Repeat step 7 with both antennas horizontally polarized for each test frequency. 9. Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps 7 and 8 by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula: EIRP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBi) where: Pg is the generator output power into the substitution antenna.
Test setup:	For radiated emissions from 9kHz to 30MHz  For radiated emissions from 30MHz to1GHz

<table>
<tr><td></td><td colspan="6"> 

For radiated emissions above 1GHz

</td></tr>
<tr><td>Test Instruments:</td><td colspan="6">Refer to section 5.10 for details</td></tr>
<tr><td>Test mode:</td><td colspan="6">Refer to section 5.2 for details</td></tr>
<tr><td>Test environment:</td><td>Temp.:</td><td>25 °C</td><td>Humid.:</td><td>52%</td><td>Press.:</td><td>1012mbar</td></tr>
<tr><td>Test voltage:</td><td colspan="6">AC 120V, 60Hz</td></tr>
<tr><td>Test results:</td><td colspan="6">Pass</td></tr>
</table>

Remarks:

1. *Only the worst case Main Antenna test data.*
2. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

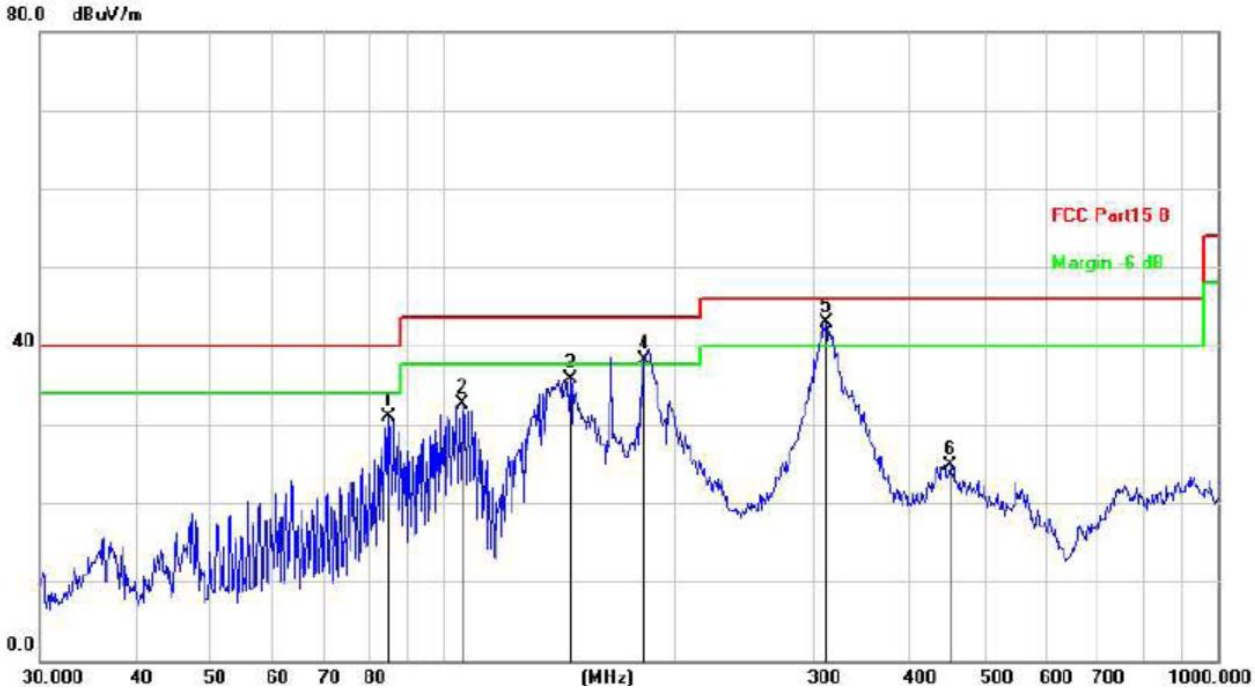
Measurement Data:

9 kHz ~ 30 MHz

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

30MHz~ 1GHz

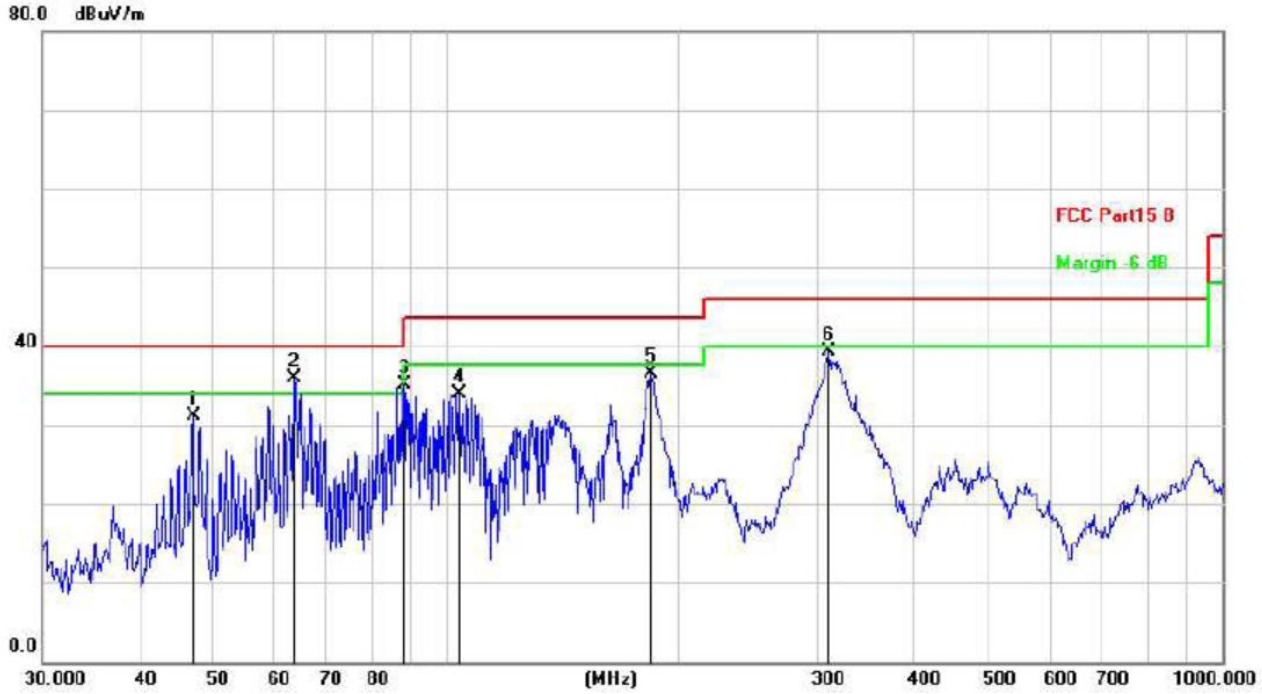
Horizontal:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		84.9993	51.97	-21.06	30.91	40.00	-9.09	QP
2		105.6414	52.94	-20.34	32.60	43.50	-10.90	QP
3		145.8610	53.67	-17.97	35.70	43.50	-7.80	QP
4	!	182.2098	56.53	-18.33	38.20	43.50	-5.30	QP
5	*	311.0867	61.13	-18.19	42.94	46.00	-3.06	QP
6		451.1349	40.74	-16.05	24.69	46.00	-21.31	QP

Final Level =Receiver Read level + Correct Factor
Note: Worst case 802.11n20 MIMO mode was recorded.

Vertical:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		46.9947	49.40	-18.35	31.05	40.00	-8.95	QP
2	*	63.5356	54.97	-19.16	35.81	40.00	-4.19	QP
3		88.0329	56.27	-21.21	35.06	43.50	-8.44	QP
4		103.8054	54.33	-20.40	33.93	43.50	-9.57	QP
5		183.2005	55.03	-18.53	36.50	43.50	-7.00	QP
6		309.9977	57.23	-17.92	39.31	46.00	-6.69	QP

Final Level =Receiver Read level + Correct Factor
Note: Worst case 802.11n20 MIMO mode was recorded.

Above 1GHz:

Note: All 802.11a / 802.11n (HT20) /802.11n (HT40) modes have been tested for above 1GHz test, only the worst case 802.11n20 MIMO mode was recorded.

U-NII 1 & 802.11n20 Mode (above 1GHz)

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
	5150.00	55.33	PK	H	68.20	12.87	48.05	34.44	7.12	34.28	7.28
36.00	5150.00	46.62	AV	H	54.00	7.38	39.34	34.44	7.12	34.28	7.28
(5180MHz)	10360.00	50.85	PK	H	68.20	17.35	35.12	39.20	11.45	34.92	15.73
	--	--	--	--	--	--	--	--	--	--	--
40.00	10400.00	50.79	PK	H	68.20	17.41	34.98	39.22	11.48	34.89	15.81
(5200MHz)	--	--	--	--	--	--	--	--	--	--	--
48.00	5350.50	46.67	PK	H	68.20	21.53	39.64	34.23	7.36	34.56	7.03
(5240MHz)	10480.00	50.39	PK	H	68.20	17.81	33.24	39.41	11.83	34.09	17.15
	--	--	--	--	--	--	--	--	--	--	--

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
	5150.00	53.76	PK	V	68.20	14.44	46.48	34.44	7.12	34.28	7.28
36.00	5150.00	46.59	AV	V	54.00	7.41	39.31	34.44	7.12	34.28	7.28
(5180MHz)	10360.00	50.68	PK	V	68.20	17.52	34.95	39.20	11.45	34.92	15.73
	--	--	--	--	--	--	--	--	--	--	--
40.00	10400.00	50.33	PK	V	68.20	17.87	34.52	39.22	11.48	34.89	15.81
(5200MHz)	--	--	--	--	--	--	--	--	--	--	--
48.00	5350.50	50.59	PK	V	68.20	17.61	43.56	34.23	7.36	34.56	7.03
(5240MHz)	10480.00	51.31	PK	V	68.20	16.89	34.16	39.41	11.83	34.09	17.15
	--	--	--	--	--	--	--	--	--	--	--

U-NII 3 & 802.11n20 Mode (above 1GHz)

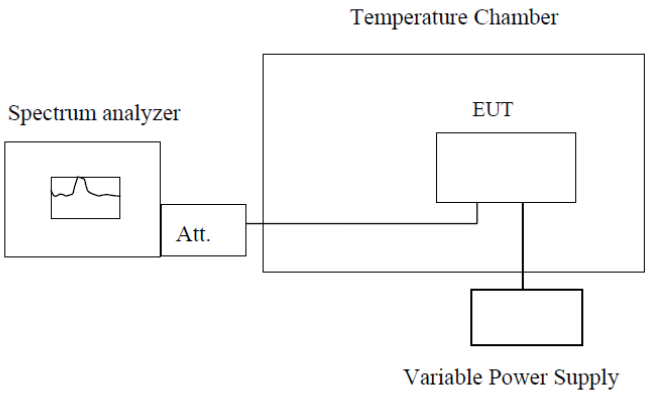
Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
	5720.00	50.43	PK	H	68.20	17.77	43.15	34.44	7.12	34.28	7.28
149.00	5720.00	46.79	AV	H	54.00	7.21	35.28	37.64	9.28	35.41	11.51
(5745MHz)	11490.00	49.55	PK	H	68.20	18.65	31.29	39.69	12.90	34.33	18.26
	--	--	--	--	--	--		--	--	--	--
157.00	11570.00	50.68	PK	H	68.20	17.52	32.23	39.71	13.05	34.31	18.45
(5785MHz)	--	--	--	--	--	--	--	--	--	--	--
48.00	5855.00	49.32	PK	H	68.20	18.88	37.78	37.64	9.28	35.38	11.54
(5825MHz)	11650.00	50.79	PK	H	68.20	17.41	32.17	39.73	13.19	34.30	18.62
	--	--	--	--	--	--	--	--	--	--	--

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
	5720.00	49.32	PK	V	68.20	18.88	42.04	34.44	7.12	34.28	7.28
149.00	5720.00	46.59	AV	V	54.00	7.41	35.08	37.64	9.28	35.41	11.51
(5745MHz)	11490.00	48.78	PK	V	68.20	19.42	30.52	39.69	12.90	34.33	18.26
	--	--	--	--	--	--	--	--	--	--	--
157.00	11570.00	50.66	PK	V	68.20	17.54	32.21	39.71	13.05	34.31	18.45
(5785MHz)	--	--	--	--	--	--	--	--	--	--	--
48.00	5855.00	51.38	PK	V	68.20	16.82	39.84	37.64	9.28	35.38	11.54
(5825MHz)	11650.00	5279.00	PK	V	68.20	-5210.80	5260.38	39.73	13.19	34.30	18.62
	--	--	--	--	--	--	--	--	--	--	--

Notes:

1. Level = Read Level + Antenna Factor+ Cable loss- Preamp Factor.
2. The test trace is same as the ambient noise (the test frequency range: 18GHz~40GHz), therefore no data appear in the report.
3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.
4. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.
5. Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac VHT20 ,IEEE 802.11ac VHT40;

7.8 Frequency stability

Test Requirement:	FCC Part15 C Section 15.407(g)
Test Method:	ANSI C63.10:2013, FCC Part 2.1055
Limit:	Manufactures 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
Test Procedure:	The EUT was setup to ANSI C63.4, 2003; tested to 2.1055 for compliance to FCC Part 15.407(g) requirements.
Test setup:	 **Note :** Measurement setup for testing on Antenna connector
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Remark: Set the EUT transmits at un-modulation mode to test frequency stability.

Measurement data:

Record worst case as below:

Reference Frequency: 802.11ac channel=36 frequency=5180MHz					
Voltage (V)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
12.00	-30	70.73	0.013654	Within the band of operation	Pass
	-20	85.24	0.016456		
	-10	106.26	0.020514		
	0	87.37	0.016867		
	10	96.98	0.018722		
	20	51.48	0.009938		
	30	74.75	0.014431		
	40	80.94	0.015625		
	50	86.58	0.016714		
13.2	25	101.50	0.019595		
10.8	25	70.36	0.013583		

Reference Frequency: 802.11ac channel=149 frequency=5745MHz					
Voltage (V)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
12.00	-30	89.74	0.015621	Within the band of operation	Pass
	-20	93.27	0.016235		
	-10	52.90	0.009208		
	0	64.94	0.011304		
	10	61.33	0.010675		
	20	55.61	0.00968		
	30	56.90	0.009904		
	40	87.67	0.01526		
	50	95.36	0.016599		
13.2	25	56.83	0.009892		
10.8	25	56.88	0.009901		

8 Test Setup Photo

Reference to the **appendix I** for details.

9 EUT Constructional Details

Reference to the **appendix II** for details.

---END---