

TEST REPORT

Applicant: MeLE Technologies (Shenzhen) Co., LTD.

Address of Applicant: 3FW Mele Building, No.28 Cuijing Rd., Pingshan District, Shenzhen, Guangdong Province, (518118), P.R.China

Manufacturer/Factory: MeLE Technologies (Shenzhen) Co., LTD.

Address of Manufacturer/Factory: 3FW Mele Building, No.28 Cuijing Rd., Pingshan District, Shenzhen, Guangdong Province, (518118), P.R.China

Equipment Under Test (EUT)

Product Name: Fanless Mini PC

Model No.: PCG02 GLE, PCG02 GLK

Trade Mark: MeLE

FCC ID: WF7PCG02202002

Applicable standards: FCC CFR Title 47 Part 15 Subpart E Section 15.407

Date of sample receipt: Dec. 01, 2020

Date of Test: Dec. 01 - Dec. 10, 2020

Date of report issue: Dec. 10, 2020

Test Result : PASS *

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

Authorized Signature:

A circular stamp with the text "GLOBAL UNITED TECHNOLOGY SERVICES" around the perimeter and "GTS" in the center. Overlaid on the stamp is a handwritten signature in black ink.

Robinson Luo
Laboratory Manager

2 Version

Version No.	Date	Description
00	Dec. 10, 2020	Original

Prepared By:



Date:

Dec. 10, 2020

Project Engineer

Check By:



Reviewer

Date:

Dec. 10, 2020

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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	30MHz-200MHz	3.8039dB	(1)
Radiated Emission	200MHz-1GHz	3.9679dB	(1)
Radiated Emission	1GHz-18GHz	4.29dB	(1)
Radiated Emission	18GHz-40GHz	3.30dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	3.44dB	(1)

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

5 General Information

5.1 General Description of EUT

Product Name:	Fanless Mini PC			
Model No.:	PCG02 GLE, PCG02 GLK			
Test Model No.:	PCG02 GLE			
Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits.The only difference should be the Appearance, RAM, storage and/or operating system.				
Serial No.:	N/A			
Hardware Version:	N/A			
Software Version:	N/A			
Test sample(s) ID:	GTSL202012000015-1			
Sample(s) Status:	Engineer sample			
Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels
	U-NII Band I	IEEE 802.11a	5180-5240	4
		IEEE 802.11n/ac 20MHz	5180-5240	4
		IEEE 802.11n/ac 40MHz	5190-5230	2
		IEEE 802.11ac 80MHz	5210	1
Modulation technology:	OFDM MIMO: 802.11n/ac SISO: 802.11a			
Antenna Type:	Antenna 1: Integral Antenna Antenna 2: FPC Antenna			
Antenna gain:	Antenna 1: 2.0dBi Antenna 2: 2.0dBi			
Power supply:	Switching Adaptor Model: FJ-SW0503000N Input: AC 100-240V, 50/60Hz, 0.6A Max Output: DC 5.0V, 3.0A			

Directional gain of MIMO = $G_{ANT} + 10 \log(N_{ANT})$ dBi=5.00dBi

Channel list for 802.11a/n/ac(HT20)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180MHz	40	5200MHz	44	5220MHz	48	5240MHz

Channel list for 802.11n(HT40)/ac(HT40)			
Channel	Frequency	Channel	Frequency
38	5190MHz	46	5230MHz

Channel list for 802.11ac(HT80)	
Channel	Frequency
42	5210MHz

5.2 Test mode

Transmitting mode	Keep the EUT in transmitting with modulation..
<i>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.</i>	
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
802.11a/n/ac(HT20)	6/6.5 Mbps
802.11n/ac(HT40)	13.5 Mbps
802.11ac(HT80)	29.3 Mbps

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

None.

5.6 Deviation from Standards

None.

5.7 Abnormalities from Standard Conditions

None.

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	AUDIX	E3	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	AUDIX	E3	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

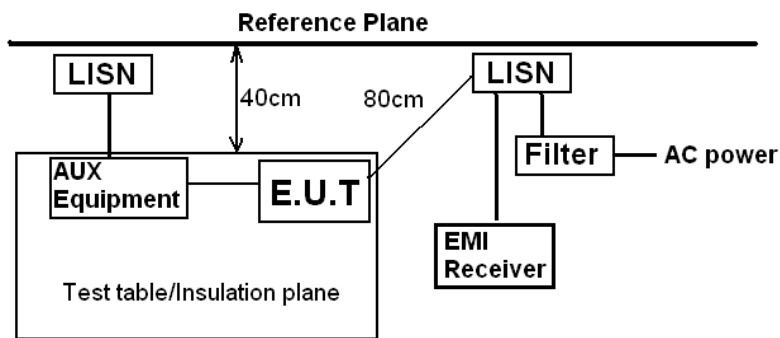
General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	June. 25 2020	June. 24 2021
2	Barometer	ChangChun	DYM3	GTS255	June. 25 2020	June. 24 2021

7 Test results and Measurement Data

7.1 Antenna requirement:

Standard requirement:	FCC Part15 C Section 15.203
<i>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.</i>	
E.U.T Antenna:	
<i>The antennas are integral antenna and FPC antenna, the best case gain of the antennas are 2.0dBi, reference to the appendix II for details</i>	

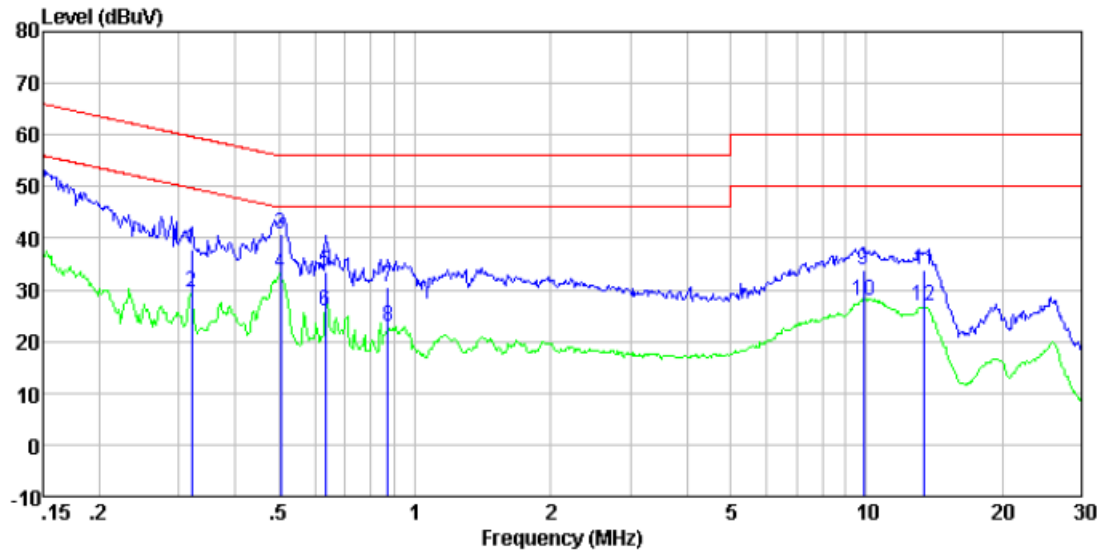
7.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207					
Test Method:	ANSI C63.10:2013					
Test Frequency Range:	150KHz to 30MHz					
Class / Severity:	Class B					
Receiver setup:	RBW=9KHz, VBW=30KHz					
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 procedure	The E.U.T and simulators are connected to the main power through a line impedance stabilization network(L.I.S.N.). The provide a 50ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs). 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 setup:	Reference Plane  <i>Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</i>					
Test Instruments:	Refer to section 5.10 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					

Remark: Both high and low voltages have been tested to show only the worst low voltage test data.

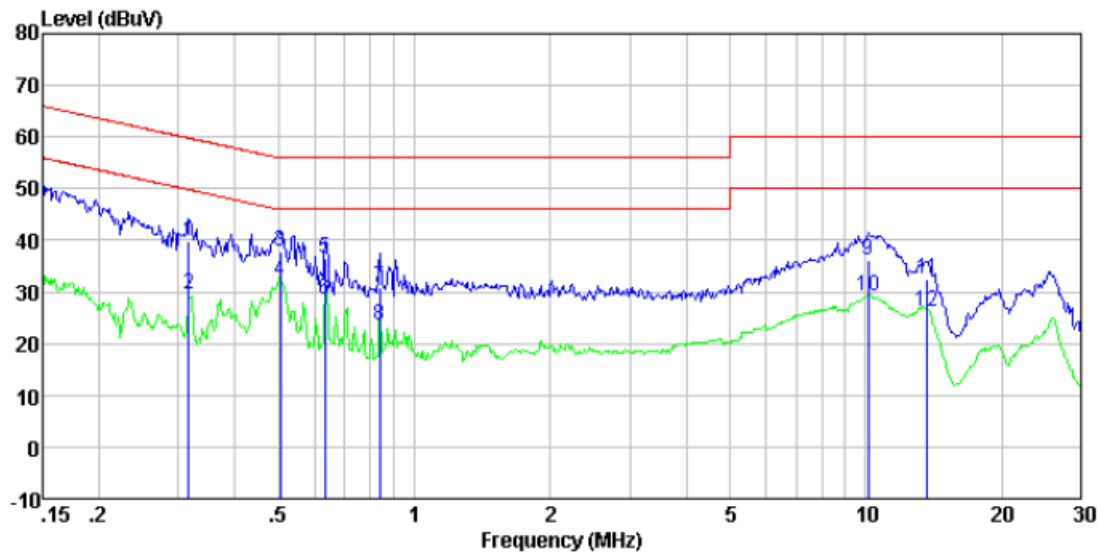
Measurement data:

Line:



Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.32	17.56	20.39	0.01	37.96	59.71	-21.75	QP
0.32	8.98	20.39	0.01	29.38	49.71	-20.33	Average
0.50	20.41	20.31	0.01	40.73	56.00	-15.27	QP
0.50	12.82	20.31	0.01	33.14	46.00	-12.86	Average
0.63	13.34	20.28	0.02	33.64	56.00	-22.36	QP
0.63	5.45	20.28	0.02	25.75	46.00	-20.25	Average
0.87	10.43	20.22	0.03	30.68	56.00	-25.32	QP
0.87	2.56	20.22	0.03	22.81	46.00	-23.19	Average
9.86	13.44	20.20	0.11	33.75	60.00	-26.25	QP
9.86	7.46	20.20	0.11	27.77	50.00	-22.23	Average
13.48	13.33	20.20	0.15	33.68	60.00	-26.32	QP
13.48	6.39	20.20	0.15	26.74	50.00	-23.26	Average

Neutral:

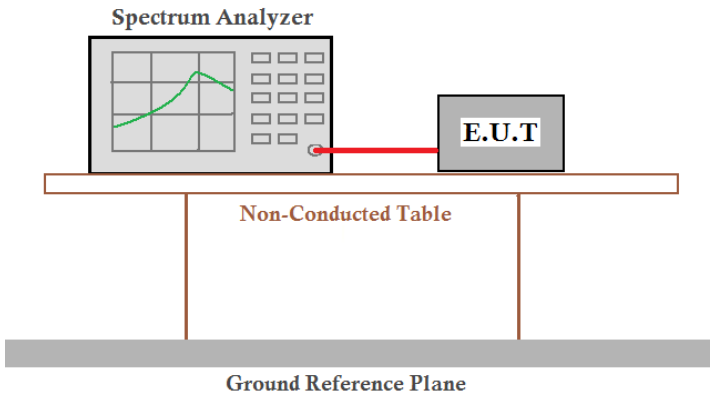


Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.32	19.28	20.39	0.01	39.68	59.80	-20.12	QP
0.32	9.19	20.39	0.01	29.59	49.80	-20.21	Average
0.50	17.44	20.31	0.01	37.76	56.00	-18.24	QP
0.50	11.79	20.31	0.01	32.11	46.00	-13.89	Average
0.63	16.04	20.28	0.02	36.34	56.00	-19.66	QP
0.63	8.11	20.28	0.02	28.41	46.00	-17.59	Average
0.84	10.51	20.23	0.03	30.77	56.00	-25.23	QP
0.84	3.26	20.23	0.03	23.52	46.00	-22.48	Average
10.13	15.77	20.20	0.11	36.08	60.00	-23.92	QP
10.13	8.77	20.20	0.11	29.08	50.00	-20.92	Average
13.70	12.17	20.20	0.15	32.52	60.00	-27.48	QP
13.70	5.83	20.20	0.15	26.18	50.00	-23.82	Average

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 + LISN Factor + Cable Loss

7.3 Emission Bandwidth and 99% Occupied Bandwidth

Test Requirement:	FCC Part15 E Section 15.407
Test Method:	KDB 789033 D02 General U-NII Test Procedures New Rules v02r01 KDB 662911 D01 Multiple Transmitter Output v02r01
Limit:	N/A
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T are placed on a Non-Conducted Table. The table is supported by two vertical legs. Below the table is a Ground Reference Plane.
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:

Antenna 1:

CH. No.	Frequency (MHz)	99% Occupied Bandwidth (MHz)			26dB Occupied Bandwidth (MHz)		
		802.11a	802.11n (HT20)	802.11ac (HT20)	802.11a	802.11n (HT20)	802.11ac (HT20)
36	5180	16.963	18.006	18.030	21.53	21.82	21.94
40	5200	16.903	18.109	18.004	21.79	21.90	21.71
48	5240	16.917	18.013	17.974	21.38	21.89	21.64

CH. No.	Frequency (MHz)	99% Occupied Bandwidth (MHz)		26dB Occupied Bandwidth (MHz)	
		802.11n(HT40)	802.11ac(HT40)	802.11n(HT40)	802.11ac(HT40)
38	5190	36.229	36.197	39.69	39.40
46	5230	36.231	36.204	39.28	39.87

CH. No.	Frequency (MHz)	99% Occupied Bandwidth (MHz)	26dB Occupied Bandwidth (MHz)
		802.11ac(HT80)	802.11ac(HT80)
42	5210	75.687	80.22

Antenna 2:

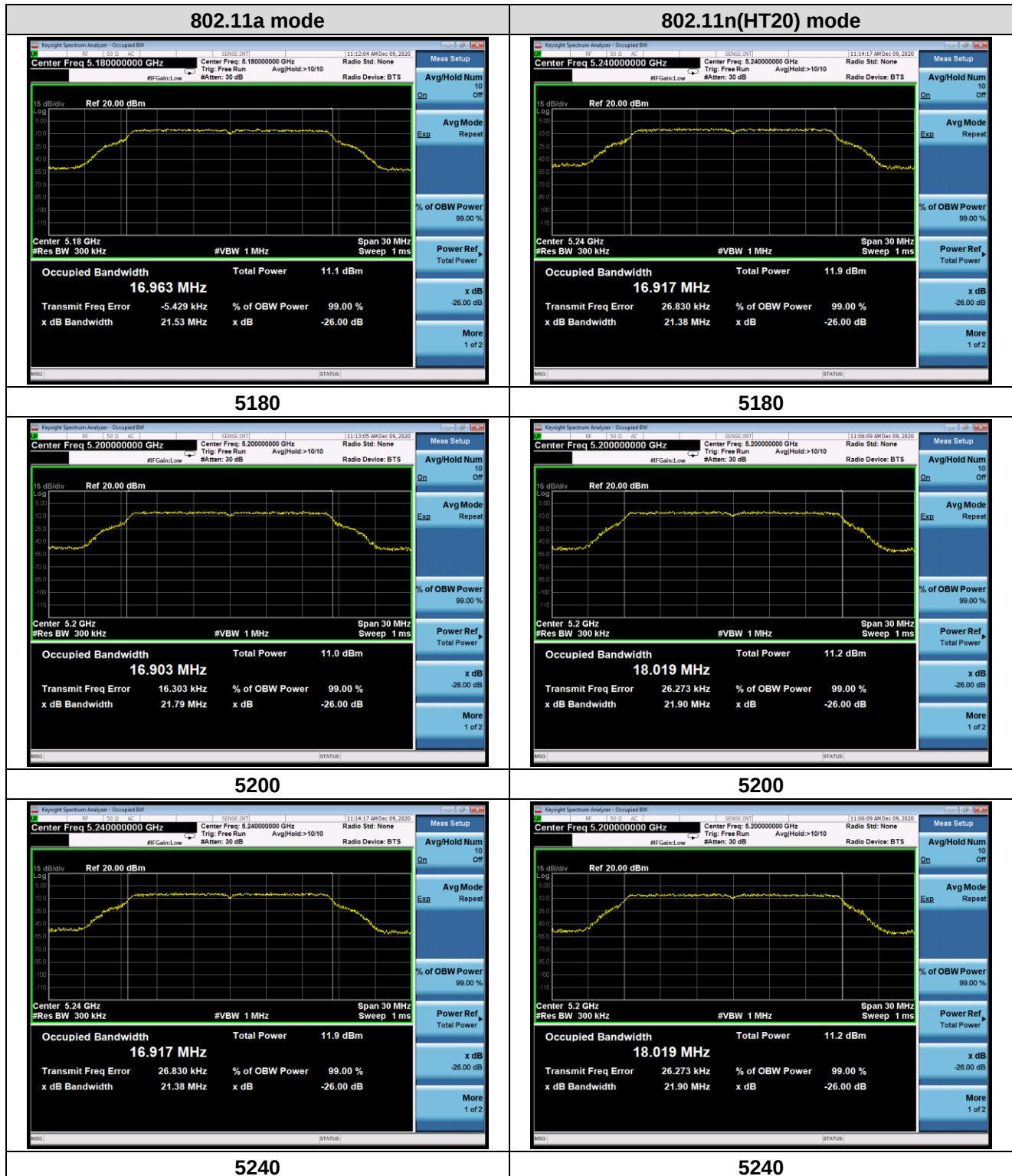
CH. No.	Frequency (MHz)	99% Occupied Bandwidth (MHz)			26dB Occupied Bandwidth (MHz)		
		802.11a	802.11n (HT20)	802.11ac (HT20)	802.11a	802.11n (HT20)	802.11ac (HT20)
36	5180	16.925	18.036	17.976	21.62	21.58	21.59
40	5200	16.960	18.016	18.013	21.70	21.77	21.72
48	5240	16.899	17.993	17.949	21.70	21.62	21.62

CH. No.	Frequency (MHz)	99% Occupied Bandwidth (MHz)		26dB Occupied Bandwidth (MHz)	
		802.11n(HT40)	802.11ac(HT40)	802.11n(HT40)	802.11ac(HT40)
38	5190	36.211	36.235	39.80	39.81
46	5230	36.183	36.215	39.58	39.36

CH. No.	Frequency (MHz)	99% Occupied Bandwidth (MHz)	26dB Occupied Bandwidth (MHz)
		802.11ac(HT80)	802.11ac(HT80)
42	5210	75.636	80.02

Test plots as followed:

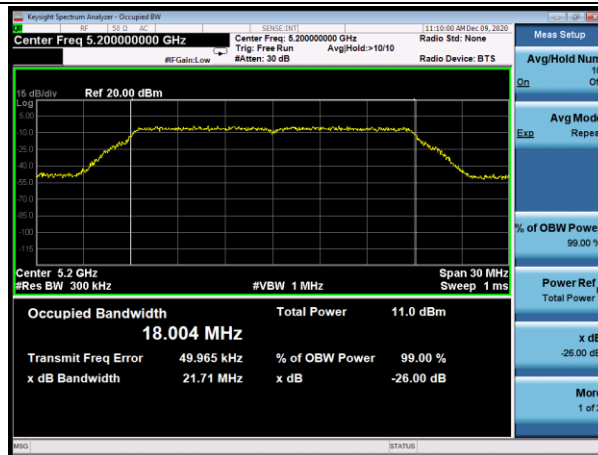
Antenna 1:



802.11ac(HT20) mode



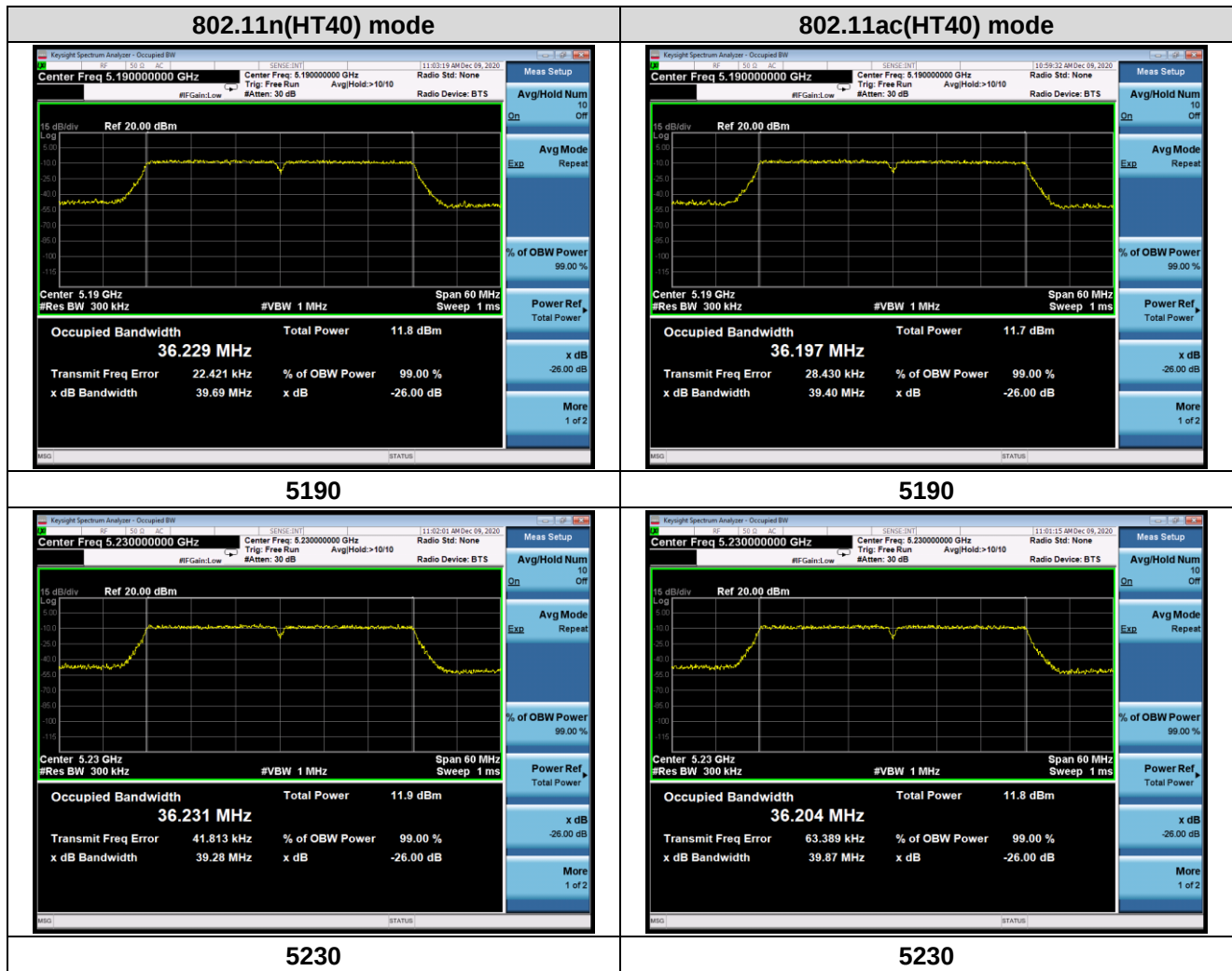
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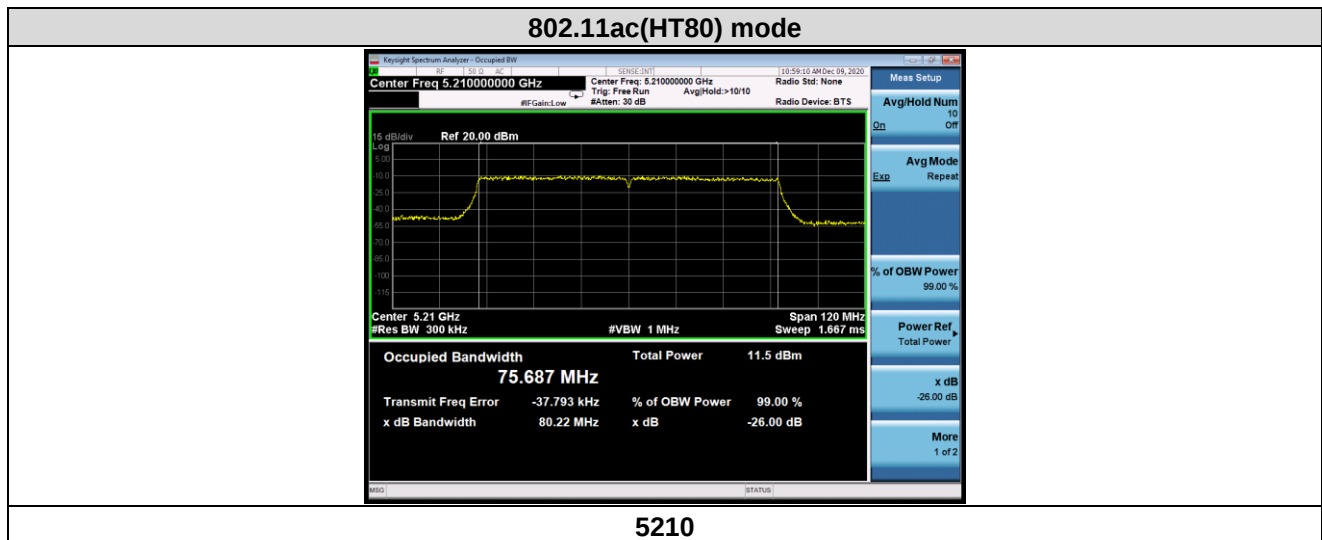


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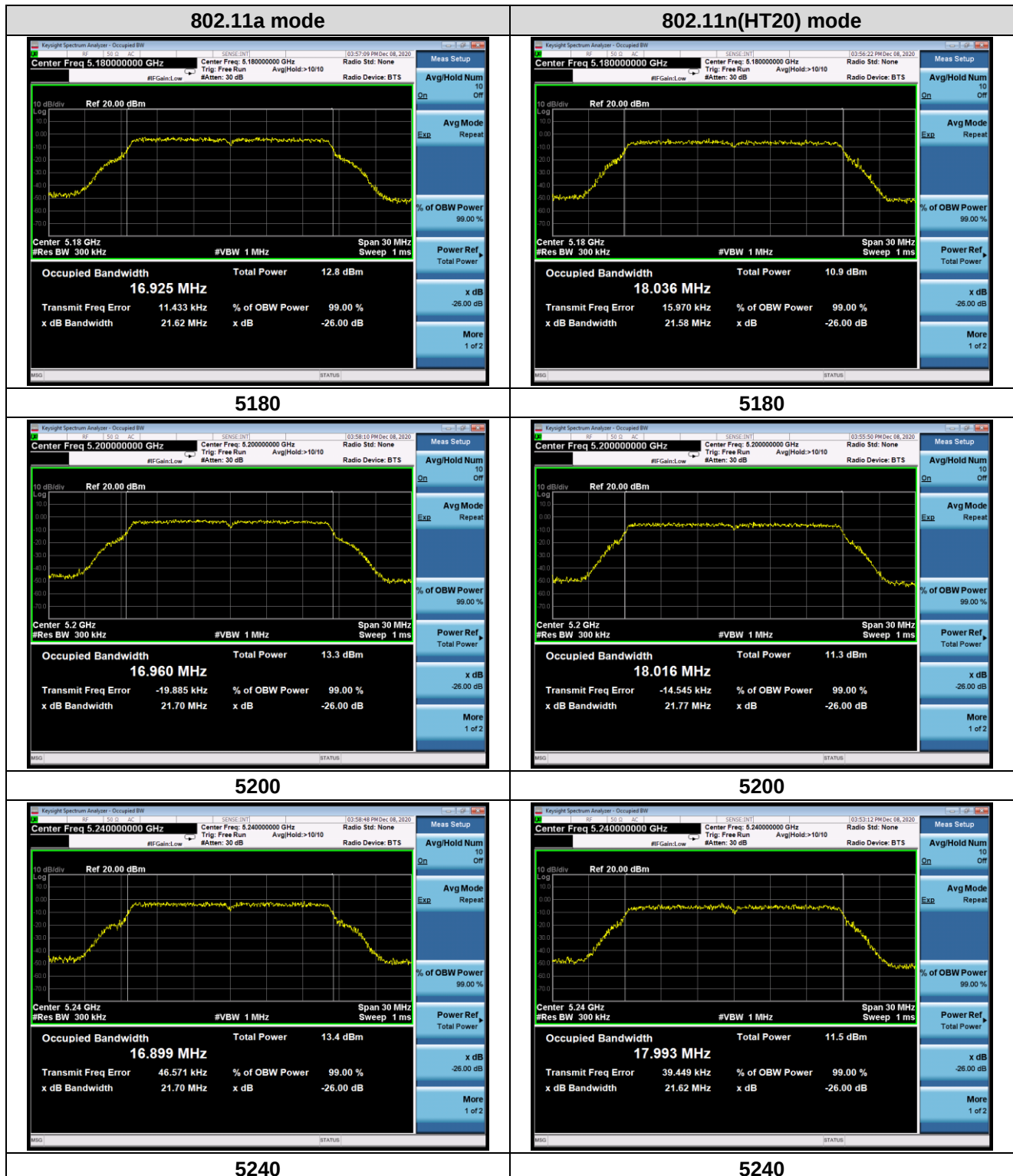


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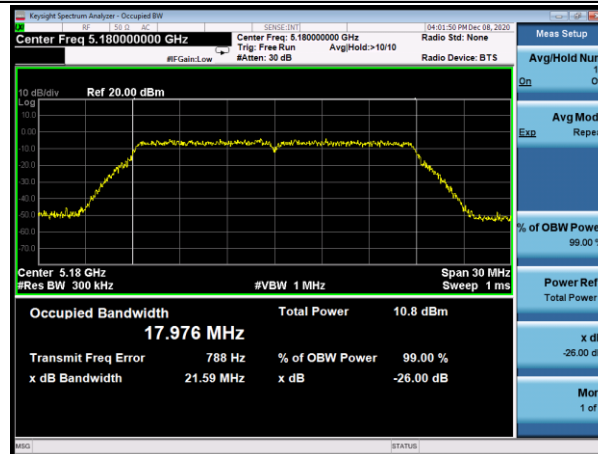




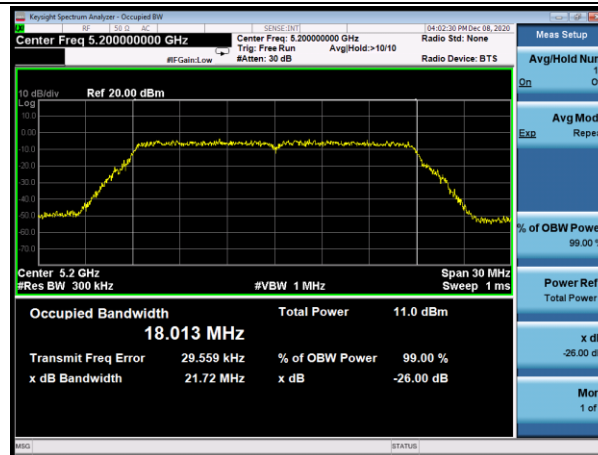
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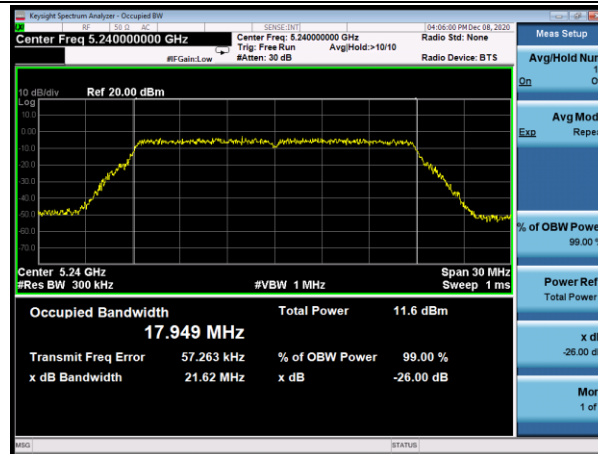
802.11ac(HT20) mode



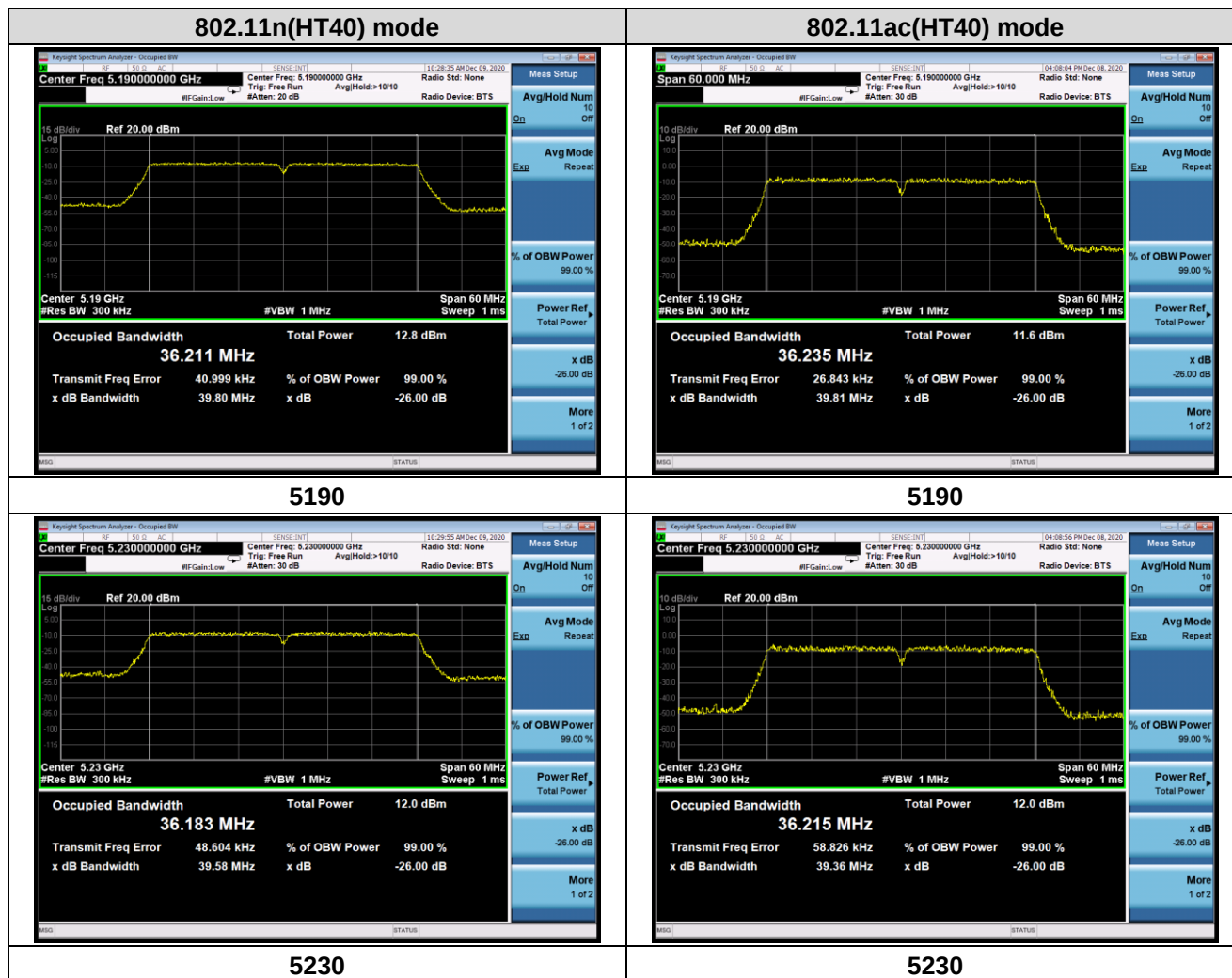
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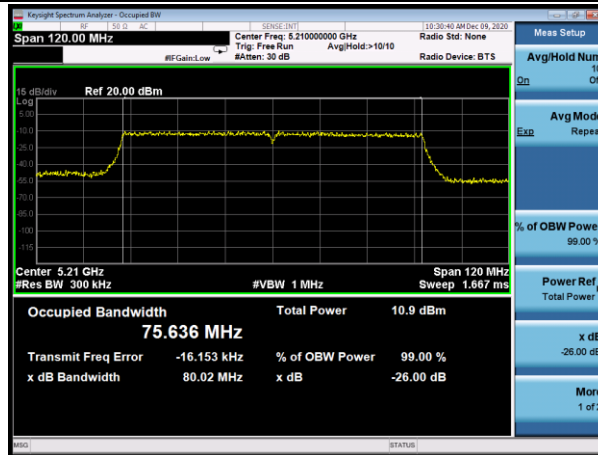
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5240

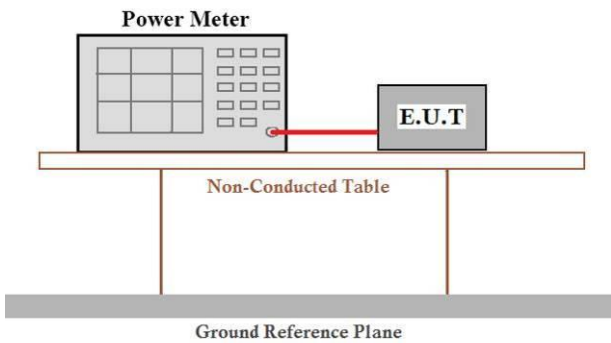


802.11ac(HT80) mode



5210

7.4 Peak Transmit Power

Test Requirement:	FCC Part15 E Section 15.407	
Test Method:	KDB 789033 D02 General U-NII Test Procedures New Rules v02r01 KDB 662911 D01 Multiple Transmitter Output v02r01	
Limit:	Frequency band (MHz)	Limit
	5150-5250	$\leq 1\text{W}(30\text{dBm})$ for master device
		$\leq 250\text{mW}(23.98\text{dBm})$ for client device
	5250-5350	$\leq 250\text{mW}(23.98\text{dBm})$ for client device or $11\text{dBm}+10\log B^*$
	5470-5725	$\leq 250\text{mW}(23.98\text{dBm})$ for client device or $11\text{dBm}+10\log B^*$
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.		
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., $10\log(1/0.25)$ 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

Modulation	Duty cycle	Duty Factor
802.11a	98.8%	0.05
802.11n(HT20)	98.8%	0.05
802.11n(HT40)	97.5%	0.11
802.11ac(HT20)	98.9%	0.05
802.11ac(HT40)	97.4%	0.11
802.11ac(HT80)	95.2%	0.21

Antenna 1:

802.11a mode						
CH No.	Frequency (MHz)	Measured Power (dBm)	Duty Factor	Output Power (dBm)	Limit (dBm)	Result
36	5180	15.79	0.05	15.84	23.98	Pass
40	5200	15.65	0.05	15.70	23.98	Pass
48	5240	15.87	0.05	15.92	23.98	Pass
802.11n(HT20) mode						
CH No.	Frequency (MHz)	Measured Power (dBm)	Duty Factor	Output Power (dBm)	Limit (dBm)	Result
36	5180	13.92	0.05	13.97	23.98	Pass
40	5200	13.82	0.05	13.87	23.98	Pass
48	5240	14.74	0.05	14.79	23.98	Pass
802.11ac(HT20) mode						
CH No.	Frequency (MHz)	Measured Power (dBm)	Duty Factor	Output Power (dBm)	Limit (dBm)	Result
36	5180	13.36	0.05	13.41	23.98	Pass
40	5200	13.80	0.05	13.85	23.98	Pass
48	5240	14.24	0.05	14.29	23.98	Pass
802.11n(HT40) mode						
CH No.	Frequency (MHz)	Measured Power (dBm)	Duty Factor	Output Power (dBm)	Limit (dBm)	Result
38	5190	14.22	0.11	14.33	23.98	Pass
46	5230	14.38	0.11	14.49	23.98	Pass
802.11 ac(HT40) mode						
CH No.	Frequency (MHz)	Measured Power (dBm)	Duty Factor	Output Power (dBm)	Limit (dBm)	Result
38	5190	14.11	0.11	14.22	23.98	Pass
46	5230	14.37	0.11	14.48	23.98	Pass
802.11 ac(HT80)						
CH No.	Frequency (MHz)	Measured Power (dBm)	Duty Factor	Output Power (dBm)	Limit (dBm)	Result
42	5210	14.27	0.21	14.48	23.98	Pass

Note: Output Power = Measured Power + Duty Factor

Duty Factor = 10 log (1/Duty Cycle)

Antenna 2:

802.11a mode						
CH No.	Frequency (MHz)	Measured Power (dBm)	Duty Factor	Output Power (dBm)	Limit (dBm)	Result
36	5180	15.13	0.05	15.18	23.98	Pass
40	5200	15.48	0.05	15.53	23.98	Pass
48	5240	15.73	0.05	15.78	23.98	Pass
802.11n(HT20) mode						
CH No.	Frequency (MHz)	Measured Power (dBm)	Duty Factor	Output Power (dBm)	Limit (dBm)	Result
36	5180	12.62	0.05	12.67	23.98	Pass
40	5200	13.13	0.05	13.18	23.98	Pass
48	5240	13.22	0.05	13.27	23.98	Pass
802.11ac(HT20) mode						
CH No.	Frequency (MHz)	Measured Power (dBm)	Duty Factor	Output Power (dBm)	Limit (dBm)	Result
36	5180	13.12	0.05	13.17	23.98	Pass
40	5200	13.12	0.05	13.17	23.98	Pass
48	5240	13.51	0.05	13.56	23.98	Pass
802.11n(HT40) mode						
CH No.	Frequency (MHz)	Measured Power (dBm)	Duty Factor	Output Power (dBm)	Limit (dBm)	Result
38	5190	13.28	0.11	13.39	23.98	Pass
46	5230	13.47	0.11	13.58	23.98	Pass
802.11 ac(HT40) mode						
CH No.	Frequency (MHz)	Measured Power (dBm)	Duty Factor	Output Power (dBm)	Limit (dBm)	Result
38	5190	13.57	0.11	13.68	23.98	Pass
46	5230	13.55	0.11	13.66	23.98	Pass
802.11 ac(HT80)						
CH No.	Frequency (MHz)	Measured Power (dBm)	Duty Factor	Output Power (dBm)	Limit (dBm)	Result
42	5210	13.12	0.21	13.33	23.98	Pass

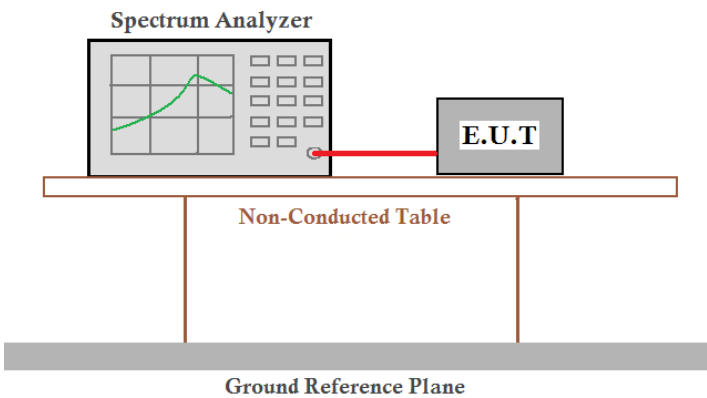
Note: Output Power = Measured Power + Duty Factor

Duty Factor = 10 log (1/Duty Cycle)

MIMO:

802.11n(HT20) mode						
CH No.	Frequency (MHz)	Measured Power (dBm)		Total (dBm)	Limit (dBm)	Result
		Antenna 1	Antenna 2			
36	5180	13.97	12.67	16.38	23.98	Pass
40	5200	13.87	13.18	16.55	23.98	Pass
48	5240	14.79	13.27	17.11	23.98	Pass
802.11ac(HT20) mode						
CH No.	Frequency (MHz)	Measured Power (dBm)		Total (dBm)	Limit (dBm)	Result
		Antenna 1	Antenna 2			
36	5180	13.41	13.17	16.30	23.98	Pass
40	5200	13.85	13.17	16.53	23.98	Pass
48	5240	14.29	13.56	16.95	23.98	Pass
802.11n(HT40) mode						
CH No.	Frequency (MHz)	Measured Power (dBm)		Total (dBm)	Limit (dBm)	Result
		Antenna 1	Antenna 2			
38	5190	14.33	13.39	16.90	23.98	Pass
46	5230	14.49	13.58	17.07	23.98	Pass
802.11 ac(HT40) mode						
CH No.	Frequency (MHz)	Measured Power (dBm)		Total (dBm)	Limit (dBm)	Result
		Antenna 1	Antenna 2			
38	5190	14.22	13.68	16.97	23.98	Pass
46	5230	14.48	13.66	17.10	23.98	Pass
802.11 ac(HT80)						
CH No.	Frequency (MHz)	Measured Power (dBm)		Total (dBm)	Limit (dBm)	Result
		Antenna 1	Antenna 2			
42	5210	14.48	13.33	16.95	23.98	Pass

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 KDB 662911 D01 Multiple Transmitter Output v02r01	
Limit:	Frequency band (MHz)	Limit
	5150-5250	≤17dBm in 1MHz for master device
		≤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:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.	
Test procedure:	1) Create an average power spectrum for the EUT operating mode being tested by following the instructions in section E2) 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 E2)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

Modulation	Duty cycle	Duty Factor
802.11a	98.8%	0.05
802.11n(HT20)	98.8%	0.05
802.11n(HT40)	97.5%	0.11
802.11ac(HT20)	98.9%	0.05
802.11ac(HT40)	97.4%	0.11
802.11ac(HT80)	95.2%	0.21

Antenna 1:

802.11a mode						
CH No.	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Total PSD Power(dBm/MHz)	Limit (dBm/MHz)	Result
36	5180	4.245	0.05	4.295	11	Pass
40	5200	4.627	0.05	4.677	11	Pass
48	5240	5.103	0.05	5.153	11	Pass
802.11n(HT20) mode						
CH No.	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Total PSD Power(dBm/MHz)	Limit (dBm/MHz)	Result
36	5180	2.268	0.05	2.318	11	Pass
40	5200	3.297	0.05	3.347	11	Pass
48	5240	3.317	0.05	3.367	11	Pass
802.11ac(HT20) mode						
CH No.	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Total PSD Power(dBm/MHz)	Limit (dBm/MHz)	Result
36	5180	2.578	0.05	2.628	11	Pass
40	5200	2.825	0.05	2.875	11	Pass
48	5240	3.484	0.05	3.534	11	Pass
802.11n(HT40) mode						
CH No.	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Total PSD Power(dBm/MHz)	Limit (dBm/MHz)	Result
38	5190	-0.055	0.11	0.055	11	Pass
46	5230	0.737	0.11	0.847	11	Pass
802.11 ac(HT40) mode						
CH No.	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Total PSD Power(dBm/MHz)	Limit (dBm/MHz)	Result
38	5190	0.626	0.11	0.736	11	Pass
46	5230	0.693	0.11	0.803	11	Pass
802.11 ac(HT80)						
CH No.	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Total PSD Power(dBm/MHz)	Limit (dBm/MHz)	Result
42	5210	-1.992	0.21	-1.782	11	Pass

Note: Output Power = Measured Power + Duty Factor

Duty Factor = 10 log (1/Duty Cycle)

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Antenna 2:

802.11a mode						
CH No.	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Total PSD Power(dBm/MHz)	Limit (dBm/MHz)	Result
36	5180	2.375	0.05	2.425	11	Pass
40	5200	2.547	0.05	2.597	11	Pass
48	5240	3.186	0.05	3.236	11	Pass
802.11n(HT20) mode						
CH No.	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Total PSD Power(dBm/MHz)	Limit (dBm/MHz)	Result
36	5180	2.138	0.05	2.188	11	Pass
40	5200	2.666	0.05	2.716	11	Pass
48	5240	3.511	0.05	3.561	11	Pass
802.11ac(HT20) mode						
CH No.	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Total PSD Power(dBm/MHz)	Limit (dBm/MHz)	Result
36	5180	2.471	0.05	2.521	11	Pass
40	5200	2.594	0.05	2.644	11	Pass
48	5240	3.242	0.05	3.292	11	Pass
802.11n(HT40) mode						
CH No.	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Total PSD Power(dBm/MHz)	Limit (dBm/MHz)	Result
38	5190	0.698	0.11	0.808	11	Pass
46	5230	0.537	0.11	0.647	11	Pass
802.11 ac(HT40) mode						
CH No.	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Total PSD Power(dBm/MHz)	Limit (dBm/MHz)	Result
38	5190	-0.081	0.11	0.029	11	Pass
46	5230	1.265	0.11	1.375	11	Pass
802.11 ac(HT80)						
CH No.	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Total PSD Power(dBm/MHz)	Limit (dBm/MHz)	Result
42	5210	-2.295	0.21	-2.085	11	Pass

Note: Output Power = Measured Power + Duty Factor

Duty Factor = 10 log (1/Duty Cycle)

MIMO:

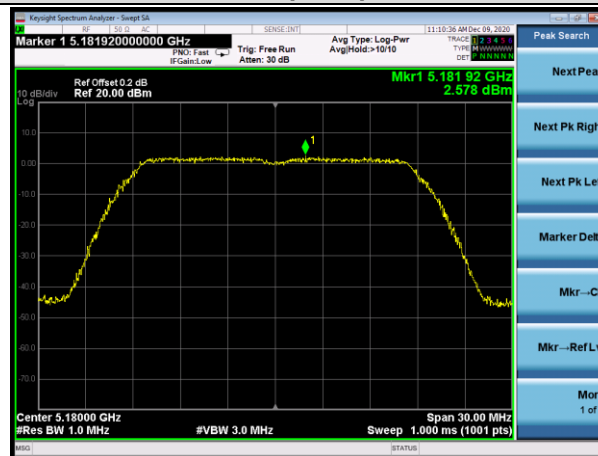
802.11n(HT20) mode						
CH No.	Frequency (MHz)	Measured Power (dBm/MHz)		Total (dBm/MHz)	Limit (dBm/MHz)	Result
		Antenna 1	Antenna 2			
36	5180	2.318	2.188	5.264	11	Pass
40	5200	3.347	2.716	6.053	11	Pass
48	5240	3.367	3.561	6.475	11	Pass
802.11ac(HT20) mode						
CH No.	Frequency (MHz)	Measured Power (dBm/MHz)		Total (dBm/MHz)	Limit (dBm/MHz)	Result
		Antenna 1	Antenna 2			
36	5180	2.628	2.521	5.585	11	Pass
40	5200	2.875	2.644	5.771	11	Pass
48	5240	3.534	3.292	6.425	11	Pass
802.11n(HT40) mode						
CH No.	Frequency (MHz)	Measured Power (dBm/MHz)		Total (dBm/MHz)	Limit (dBm/MHz)	Result
		Antenna 1	Antenna 2			
38	5190	0.055	0.808	3.458	11	Pass
46	5230	0.847	0.647	3.758	11	Pass
802.11 ac(HT40) mode						
CH No.	Frequency (MHz)	Measured Power (dBm/MHz)		Total (dBm/MHz)	Limit (dBm/MHz)	Result
		Antenna 1	Antenna 2			
38	5190	0.736	0.029	3.407	11	Pass
46	5230	0.803	1.375	4.109	11	Pass
802.11 ac(HT80)						
CH No.	Frequency (MHz)	Measured Power (dBm/MHz)		Total (dBm/MHz)	Limit (dBm/MHz)	Result
		Antenna 1	Antenna 2			
42	5210	-1.782	-2.085	1.079	11	Pass

Test plots as followed:

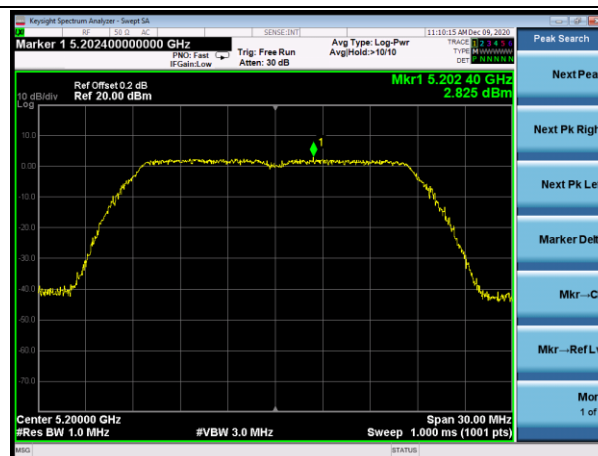
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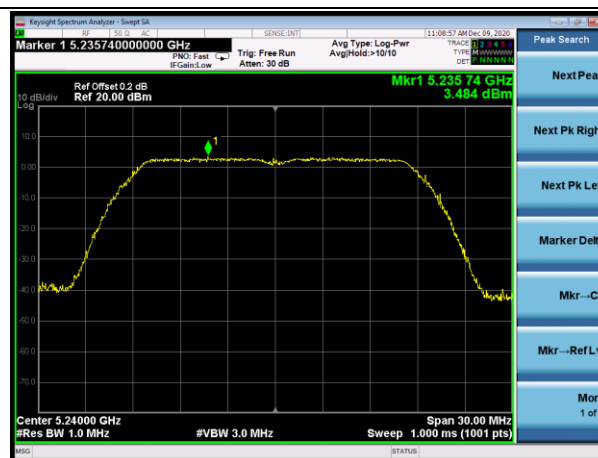
802.11ac(HT20) mode



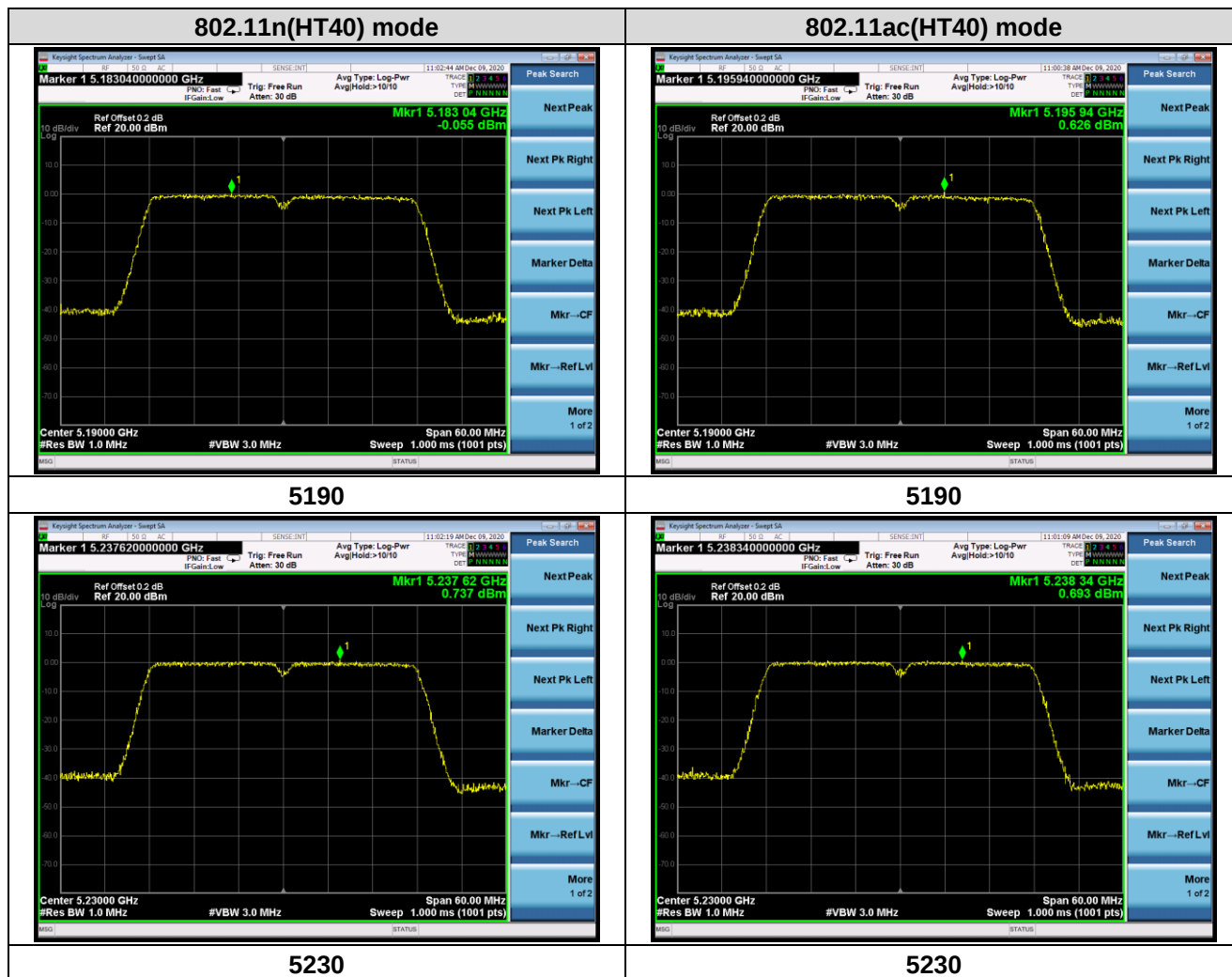
5180



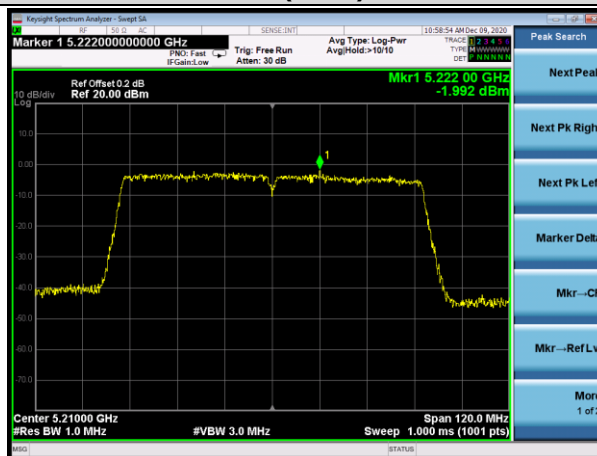
5200



5240

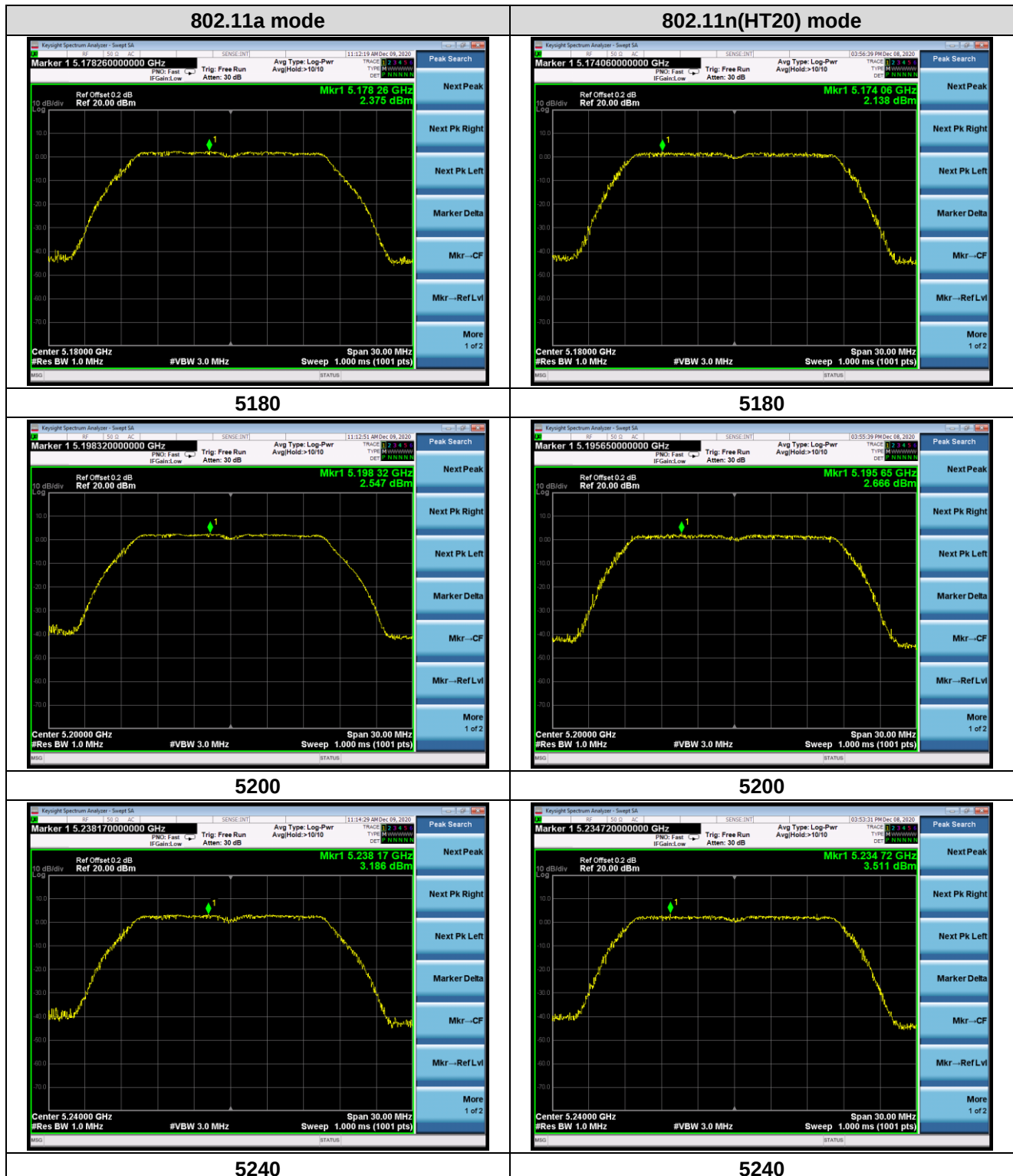


802.11ac(HT80) mode

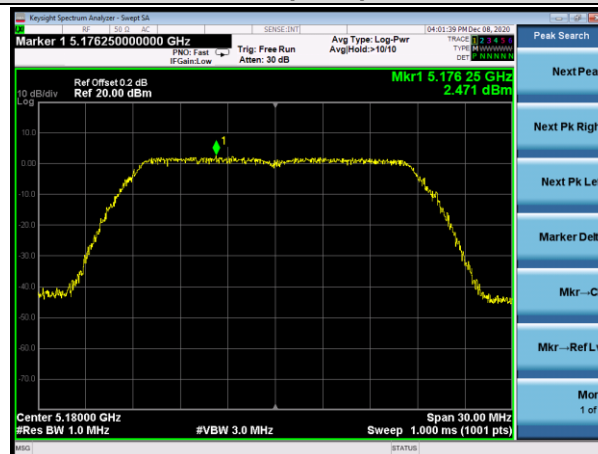


5210

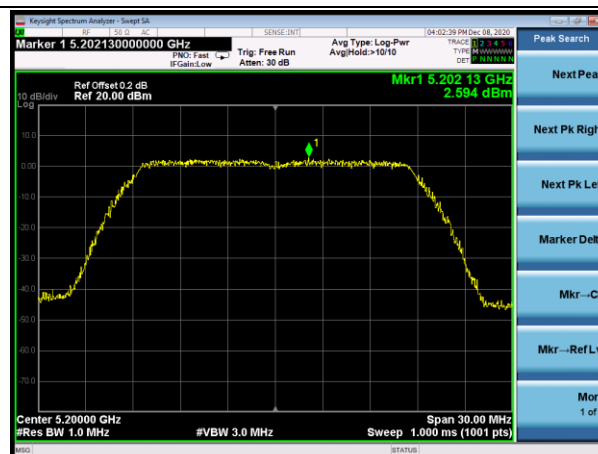
Antenna 2:



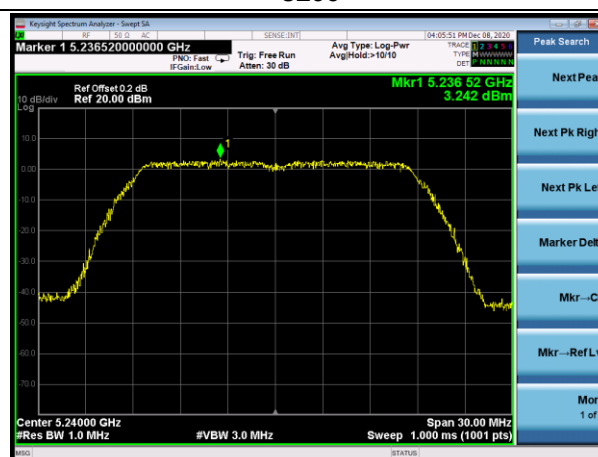
802.11ac(HT20) mode



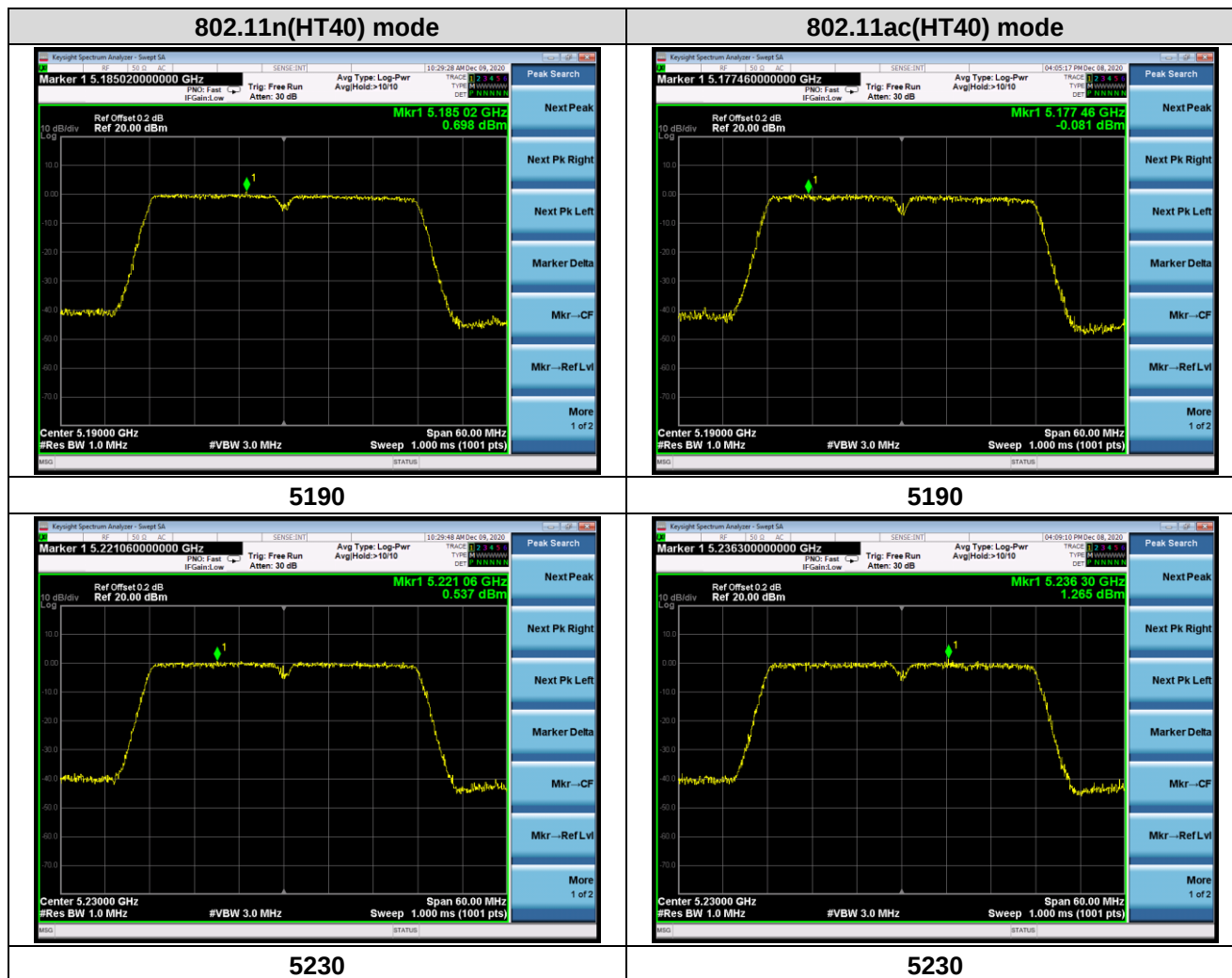
5180



5200



5240



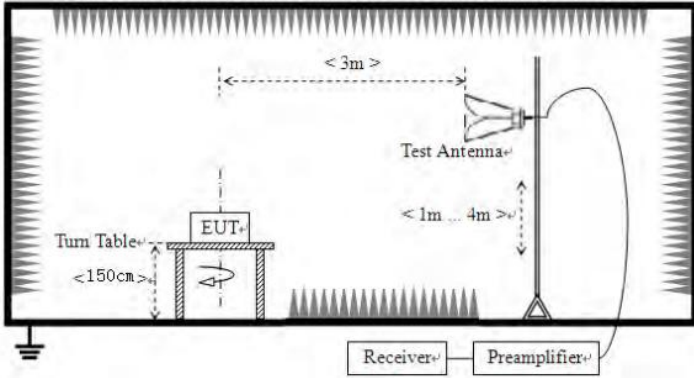
802.11ac(HT80) mode



5210

7.6 Band Edge

Test Requirement:	FCC Part15 E Section 15.407 and 5.205																								
Test Method:	ANSI C63.10:2013																								
Test site:	Measurement Distance: 3m (Semi-Anechoic Chamber)																								
Receiver setup:	<table><tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</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>					Frequency	Detector	RBW	VBW	Remark	30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak Value	Above 1GHz	Peak	1MHz	3MHz	Peak Value	AV	1MHz	3MHz	Average Value	
Frequency	Detector	RBW	VBW	Remark																					
30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak Value																					
Above 1GHz	Peak	1MHz	3MHz	Peak Value																					
	AV	1MHz	3MHz	Average Value																					
Limit:	<table><tr><td>Frequency</td><td>Limit (dBuV/m @3m)</td><td>Remark</td></tr><tr><td>30MHz-88MHz</td><td>40.0</td><td>Quasi-peak Value</td></tr><tr><td>88MHz-216MHz</td><td>43.5</td><td>Quasi-peak Value</td></tr><tr><td>216MHz-960MHz</td><td>46.0</td><td>Quasi-peak Value</td></tr><tr><td>960MHz-1GHz</td><td>54.0</td><td>Quasi-peak Value</td></tr><tr><td rowspan="2">Above 1GHz</td><td>54.0</td><td>Average Value</td></tr><tr><td>68.2</td><td>Peak Value</td></tr></table> Undesirable emission limits: (1) For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. (2) For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band. (3) For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz.					Frequency	Limit (dBuV/m @3m)	Remark	30MHz-88MHz	40.0	Quasi-peak Value	88MHz-216MHz	43.5	Quasi-peak Value	216MHz-960MHz	46.0	Quasi-peak Value	960MHz-1GHz	54.0	Quasi-peak Value	Above 1GHz	54.0	Average Value	68.2	Peak Value
Frequency	Limit (dBuV/m @3m)	Remark																							
30MHz-88MHz	40.0	Quasi-peak Value																							
88MHz-216MHz	43.5	Quasi-peak Value																							
216MHz-960MHz	46.0	Quasi-peak Value																							
960MHz-1GHz	54.0	Quasi-peak Value																							
Above 1GHz	54.0	Average Value																							
	68.2	Peak Value																							
Test Procedure:	a. The EUT was placed on the top of a rotating table 1.5 m above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. c. 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. d. 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 rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. f. 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.
Test setup:	For radiated emissions above 1GHz 
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Remarks:

- Only the worst case Main Antenna test data.
- Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
- The emission levels of other frequencies are very lower than the limit and not show in test report.
- The pre-test were performed on lowest, middle and highest frequencies, only the worst case's (lowest and highest frequencies) data was showed.
- According to KDB 789033 D02 v02r01 section G) 1) (d), for For measurements above 1000 MHz @ 3m distance, the limit of field strength is computed as follows:
 $E[\text{dBuV/m}] = \text{EIRP}[\text{dBm}] + 95.2;$
For example, if $\text{EIRP} = -27\text{dBm}$
 $E[\text{dBuV/m}] = -27 + 95.2 = 68.2\text{dBuV/m}.$

Measurement Data:

All antennas and mode have test, only the worst case report.

Antenna 1:

802.11a					PK			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
5150.00	47.53	32.07	8.99	37.49	51.10	68.20	-17.10	Horizontal
5350.00	36.72	31.75	9.29	37.20	40.56	68.20	-27.64	Horizontal
5150.00	45.01	32.07	8.99	37.49	48.58	68.20	-19.62	Vertical
5350.00	36.94	31.75	9.29	37.20	40.78	68.20	-27.42	Vertical

802.11a					AV			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
5150.00	39.82	32.07	8.99	37.49	43.39	54.00	-10.61	Horizontal
5350.00	31.97	31.75	9.29	37.20	35.81	54.00	-18.19	Horizontal
5150.00	38.84	32.07	8.99	37.49	42.41	54.00	-11.59	Vertical
5350.00	31.38	31.75	9.29	37.20	35.22	54.00	-18.78	Vertical

MIMO:

802.11n(HT20)					PK			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
5150.00	45.45	32.07	8.99	37.49	49.02	68.20	-19.18	Horizontal
5350.00	37.46	31.75	9.29	37.20	41.30	68.20	-26.90	Horizontal
5150.00	45.16	32.07	8.99	37.49	48.73	68.20	-19.47	Vertical
5350.00	37.10	31.75	9.29	37.20	40.94	68.20	-27.26	Vertical

802.11n(HT20)					AV			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
5150.00	39.42	32.07	8.99	37.49	42.99	54.00	-11.01	Horizontal
5350.00	37.09	31.75	9.29	37.20	40.93	54.00	-13.07	Horizontal
5150.00	38.35	32.07	8.99	37.49	41.92	54.00	-12.08	Vertical
5350.00	37.12	31.75	9.29	37.20	40.96	54.00	-13.04	Vertical

802.11ac(HT20)					PK			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
5150.00	47.40	32.07	8.99	37.49	50.97	68.20	-17.23	Horizontal
5350.00	36.58	31.75	9.29	37.20	40.42	68.20	-27.78	Horizontal
5150.00	44.86	32.07	8.99	37.49	48.43	68.20	-19.77	Vertical
5350.00	36.77	31.75	9.29	37.20	40.61	68.20	-27.59	Vertical

802.11ac(HT20)					AV			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
5150.00	39.73	32.07	8.99	37.49	43.30	54.00	-10.70	Horizontal
5350.00	31.92	31.75	9.29	37.20	35.76	54.00	-18.24	Horizontal
5150.00	38.71	32.07	8.99	37.49	42.28	54.00	-11.72	Vertical
5350.00	31.30	31.75	9.29	37.20	35.14	54.00	-18.86	Vertical

802.11n(HT40)					PK			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
5150.00	45.48	32.07	8.99	37.49	49.05	68.20	-19.15	Horizontal
5350.00	37.49	31.75	9.29	37.20	41.33	68.20	-26.87	Horizontal
5150.00	45.20	32.07	8.99	37.49	48.77	68.20	-19.43	Vertical
5350.00	37.14	31.75	9.29	37.20	40.98	68.20	-27.22	Vertical

802.11n(HT40)					AV			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
5150.00	39.46	32.07	8.99	37.49	43.03	54.00	-10.97	Horizontal
5350.00	37.14	31.75	9.29	37.20	40.98	54.00	-13.02	Horizontal
5150.00	38.38	32.07	8.99	37.49	41.95	54.00	-12.05	Vertical
5350.00	37.15	31.75	9.29	37.20	40.99	54.00	-13.01	Vertical

802.11ac(HT40)					PK			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
5150.00	47.28	32.07	8.99	37.49	50.85	68.20	-17.35	Horizontal
5350.00	36.45	31.75	9.29	37.20	40.29	68.20	-27.91	Horizontal
5150.00	44.73	32.07	8.99	37.49	48.30	68.20	-19.90	Vertical
5350.00	36.61	31.75	9.29	37.20	40.45	68.20	-27.75	Vertical

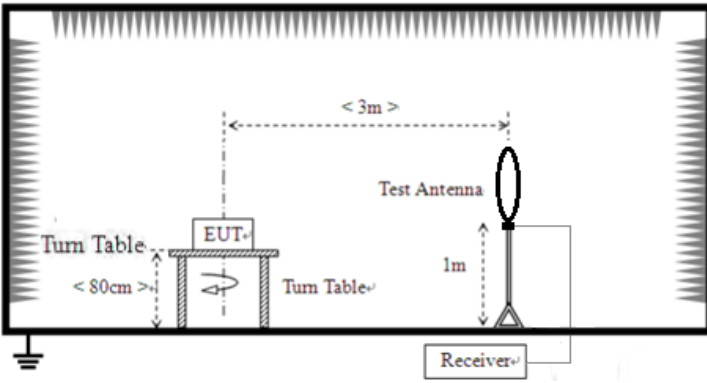
802.11ac(HT40)					AV			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
5150.00	39.64	32.07	8.99	37.49	43.21	54.00	-10.79	Horizontal
5350.00	31.86	31.75	9.29	37.20	35.70	54.00	-18.30	Horizontal
5150.00	38.59	32.07	8.99	37.49	42.16	54.00	-11.84	Vertical
5350.00	31.23	31.75	9.29	37.20	35.07	54.00	-18.93	Vertical

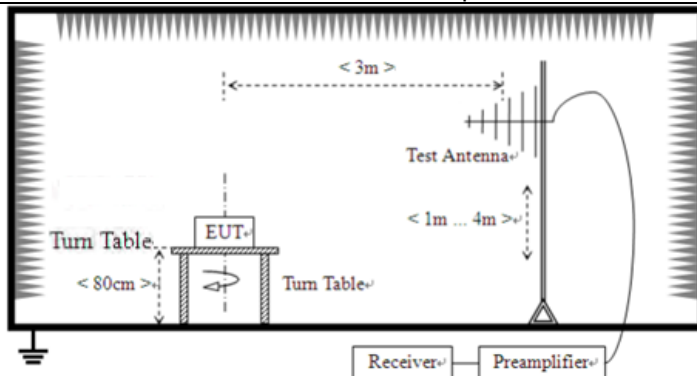
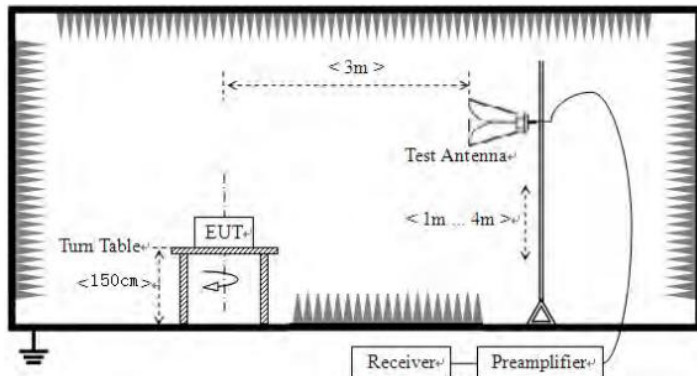
802.11ac(HT80)					PK			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
5150.00	45.39	32.07	8.99	37.49	48.96	68.20	-19.24	Horizontal
5350.00	37.41	31.75	9.29	37.20	41.25	68.20	-26.95	Horizontal
5150.00	45.08	32.07	8.99	37.49	48.65	68.20	-19.55	Vertical
5350.00	37.02	31.75	9.29	37.20	40.86	68.20	-27.34	Vertical

802.11ac(HT80)					AV			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
5150.00	39.35	32.07	8.99	37.49	42.92	54.00	-11.08	Horizontal
5350.00	37.01	31.75	9.29	37.20	40.85	54.00	-13.15	Horizontal
5150.00	38.30	32.07	8.99	37.49	41.87	54.00	-12.13	Vertical
5350.00	37.06	31.75	9.29	37.20	40.90	54.00	-13.10	Vertical

7.7 Radiated Emission

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 40GHz				
Test site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	9kHz-150KHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
	150kHz-30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		AV	1MHz	3MHz	Average Value
Limit:					
	Frequency		Limit (uV/m)	Value	Measurement Distance
	0.009MHz-0.490MHz		2400/F(KHz)	QP	300m
	0.490MHz-1.705MHz		24000/F(KHz)	QP	300m
	1.705MHz-30MHz		30	QP	30m
	30MHz-88MHz		100	QP	3m
	88MHz-216MHz		150	QP	
	216MHz-960MHz		200	QP	
	960MHz-1GHz		500	QP	
	Above 1GHz		500	Average	
			5000	Peak	
Test Procedure:	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 rotatable 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. 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: $\text{EIRP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$ 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 to 1GHz

									
For radiated emissions above 1GHz									
									
		Test Instruments:		Refer to section 5.10 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							

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:

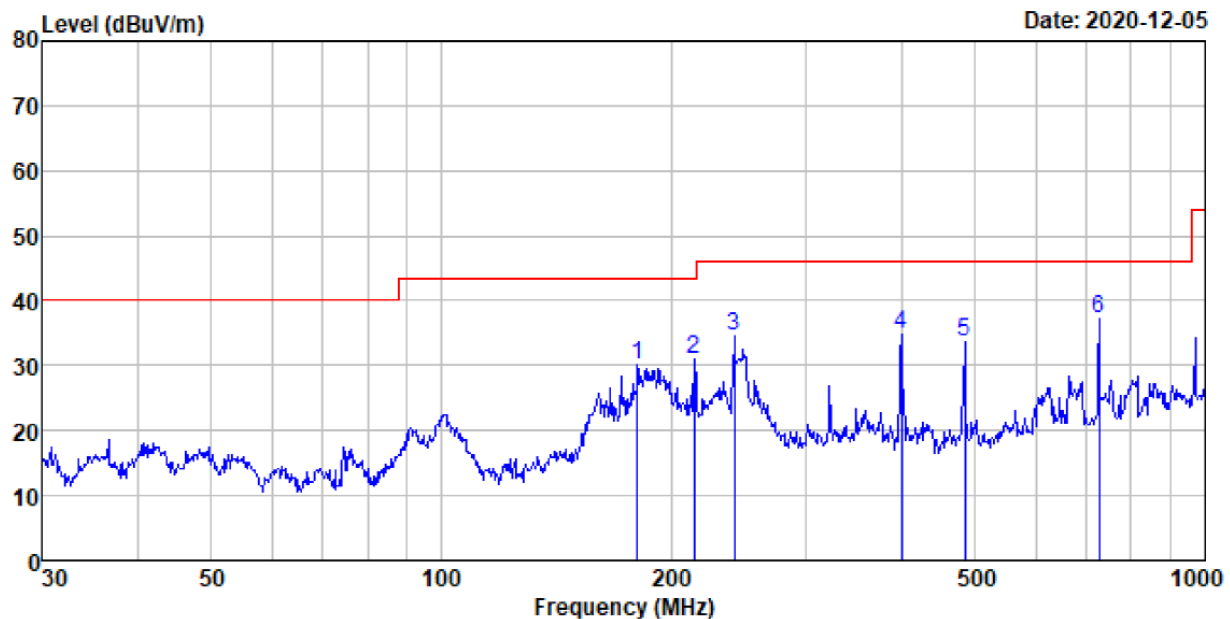
9 kHz ~ 30 MHz

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

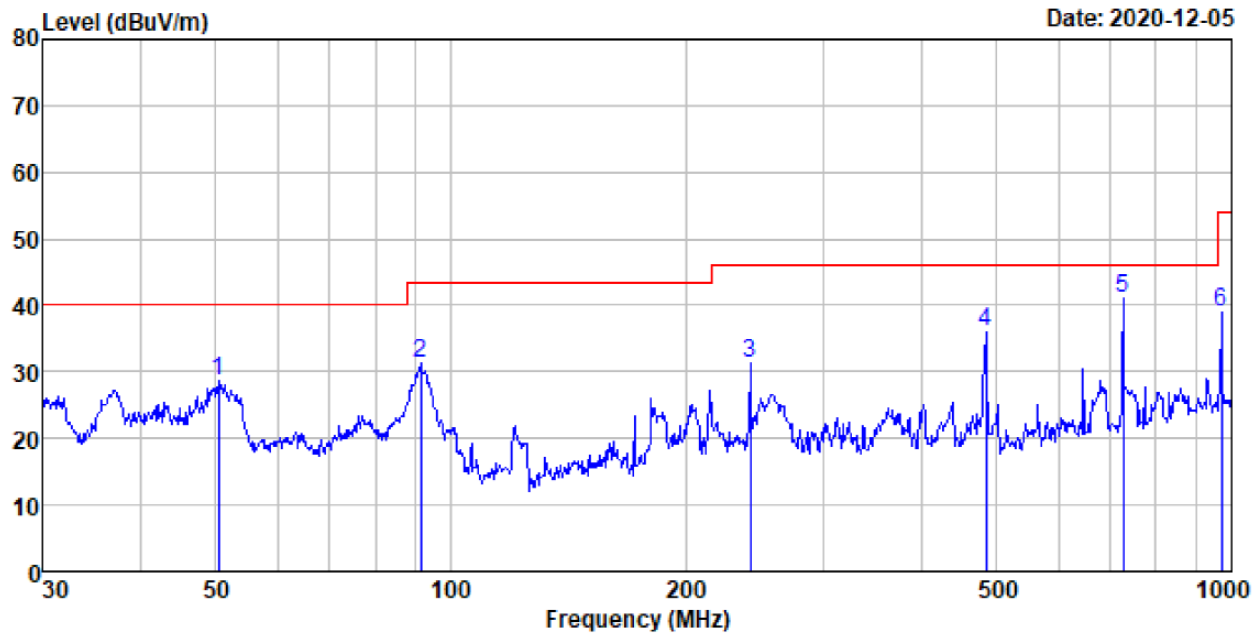
Pre-scan all test modes, found worst case at antenna 1 5240MHz of 802.11a mode, and so only show the test result of antenna 1 5240MHz of 802.11a mode

Horizontal:



	Freq	ReadAntenna	Preamp	Cable	Level	Limit	Over	Remark
	MHz	Level	Factor	Factor	Loss	Line	Limit	
	MHz	dBm	dB/m	dB	dB	dBm/m	dBm/m	dB
1	180.649	55.67	9.88	37.24	1.74	30.05	43.50	-13.45 QP
2	214.514	54.74	11.78	37.35	1.93	31.10	43.50	-12.40 QP
3	241.676	57.41	12.48	37.37	2.08	34.60	46.00	-11.40 QP
4	400.432	53.95	15.61	37.52	2.85	34.89	46.00	-11.11 QP
5	483.910	50.72	17.11	37.51	3.23	33.55	46.00	-12.45 QP
6	726.805	50.24	20.27	37.63	4.19	37.07	46.00	-8.93 QP

Vertical:



	Freq	Read Level	Antenna Factor	Preamplifier	Cable Loss	Level	Limit	Over Limit	Remark
	MHz	dBm	dB/m	dB	dB	dBm/m	dBm/m	dB	
1	50.409	50.86	13.14	36.19	0.77	28.58	40.00	-11.42	QP
2	91.495	55.79	10.98	36.65	1.12	31.24	43.50	-12.26	QP
3	241.676	54.09	12.48	37.37	2.08	31.28	46.00	-14.72	QP
4	483.910	53.16	17.11	37.51	3.23	35.99	46.00	-10.01	QP
5	726.805	54.29	20.27	37.63	4.19	41.12	46.00	-4.88	QP
6	968.934	48.72	22.71	37.54	5.11	39.00	54.00	-15.00	QP

Above 1GHz:

All antennas and mode have test, only the worst case report.

Antenna 1:

802.11a 5180MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10360	30.10	39.67	14.62	32.65	51.74	68.20	-16.46	Vertical
15540	31.47	38.60	17.66	34.46	53.27	68.20	-14.93	Vertical
10360	29.80	39.67	14.62	32.65	51.44	68.20	-16.76	Horizontal
15540	31.99	38.60	17.66	34.46	53.79	68.20	-14.41	Horizontal

802.11a 5200MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10400	30.35	39.75	14.63	32.71	52.02	68.20	-16.18	Vertical
15600	31.17	38.33	17.67	34.17	53.00	68.20	-15.20	Vertical
10400	29.01	39.75	14.63	32.71	50.68	68.20	-17.52	Horizontal
15600	31.45	38.33	17.67	34.17	53.28	68.20	-14.92	Horizontal

802.11a 5240MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
11490	28.76	39.82	14.68	32.86	50.40	68.20	-17.80	Vertical
17235	30.90	38.09	17.73	33.66	53.06	68.20	-15.14	Vertical
11490	29.22	39.82	14.68	32.86	50.86	68.20	-17.34	Horizontal
17235	30.65	38.09	17.73	33.66	52.81	68.20	-15.39	Horizontal

MIMO:**802.11n(HT20) 5180MHz**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10360	29.96	39.67	14.62	32.65	51.60	68.20	-16.60	Vertical
15540	31.35	38.60	17.66	34.46	53.15	68.20	-15.05	Vertical
10360	29.63	39.67	14.62	32.65	51.27	68.20	-16.93	Horizontal
15540	31.84	38.60	17.66	34.46	53.64	68.20	-14.56	Horizontal

802.11n(HT20) 5200MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10400	30.21	39.75	14.63	32.71	51.88	68.20	-16.32	Vertical
15600	31.05	38.33	17.67	34.17	52.88	68.20	-15.32	Vertical
10400	28.84	39.75	14.63	32.71	50.51	68.20	-17.69	Horizontal
15600	31.30	38.33	17.67	34.17	53.13	68.20	-15.07	Horizontal

802.11n(HT20) 5240MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
11490	28.62	39.82	14.68	32.86	50.26	68.20	-17.94	Vertical
17235	30.78	38.09	17.73	33.66	52.94	68.20	-15.26	Vertical
11490	29.05	39.82	14.68	32.86	50.69	68.20	-17.51	Horizontal
11490	30.50	38.09	17.73	33.66	52.66	68.20	-15.54	Horizontal

802.11ac(HT20) 5180MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10360	29.79	39.67	14.62	32.65	51.43	68.20	-16.77	Vertical
15540	31.20	38.60	17.66	34.46	53.00	68.20	-15.20	Vertical
10360	29.43	39.67	14.62	32.65	51.07	68.20	-17.13	Horizontal
15540	31.65	38.60	17.66	34.46	53.45	68.20	-14.75	Horizontal

802.11ac(HT20) 5200MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10400	30.04	39.75	14.63	32.71	51.71	68.20	-16.49	Vertical
15600	30.90	38.33	17.67	34.17	52.73	68.20	-15.47	Vertical
10400	28.64	39.75	14.63	32.71	50.31	68.20	-17.89	Horizontal
15600	31.11	38.33	17.67	34.17	52.94	68.20	-15.26	Horizontal

802.11ac(HT20) 5240MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
11490	28.45	39.82	14.68	32.86	50.09	68.20	-18.11	Vertical
17235	30.63	38.09	17.73	33.66	52.79	68.20	-15.41	Vertical
11490	28.85	39.82	14.68	32.86	50.49	68.20	-17.71	Horizontal
17235	30.31	38.09	17.73	33.66	52.47	68.20	-15.73	Horizontal

802.11nHT40) 5190MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
11510	30.22	39.67	14.62	32.65	51.86	68.20	-16.34	Vertical
17265	30.84	38.60	17.66	34.46	52.64	68.20	-15.56	Vertical
11510	29.48	39.67	14.62	32.65	51.12	68.20	-17.08	Horizontal
17265	31.11	38.60	17.66	34.46	52.91	68.20	-15.29	Horizontal

802.11n(HT40) 5230MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
11590	29.84	39.75	14.63	32.71	51.51	68.20	-16.69	Vertical
17385	30.31	38.33	17.67	34.17	52.14	68.20	-16.06	Vertical
11590	29.13	39.75	14.63	32.71	50.80	68.20	-17.40	Horizontal
17385	31.61	38.33	17.67	34.17	53.44	68.20	-14.76	Horizontal

802.11acHT40) 5190MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
11510	29.99	39.67	14.62	32.65	51.63	68.20	-16.58	Vertical
17265	30.65	38.60	17.66	34.46	52.45	68.20	-15.75	Vertical
11510	29.21	39.67	14.62	32.65	50.85	68.20	-17.35	Horizontal
17265	30.86	38.60	17.66	34.46	52.66	68.20	-15.54	Horizontal

802.11ac(HT40) 5230MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
11590	29.61	39.75	14.63	32.71	51.28	68.20	-16.93	Vertical
17385	30.12	38.33	17.67	34.17	51.95	68.20	-16.25	Vertical
11590	28.86	39.75	14.63	32.71	50.53	68.20	-17.67	Horizontal
17385	31.36	38.33	17.67	34.17	53.19	68.20	-15.01	Horizontal

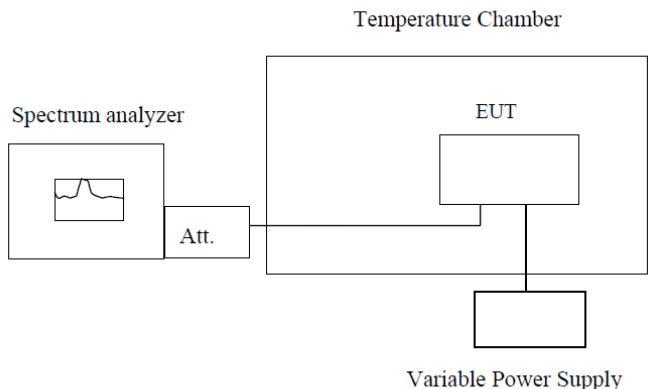
802.11ac(HT80) 5210MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
11550	29.26	39.75	14.63	32.71	50.93	68.20	-17.28	Vertical
17325	29.83	38.33	17.67	34.17	51.66	68.20	-16.54	Vertical
11550	28.45	39.75	14.63	32.71	50.12	68.20	-18.08	Horizontal
17325	30.99	38.33	17.67	34.17	52.82	68.20	-15.38	Horizontal

Notes:

1. Level = Read Level + Antenna Factor+ Cable loss- Preamplifier 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.

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:

Band: I			Test Frequency: 5180.00MHz	
Temperature (°C)	Voltage (V)	Frequency Deviation (Hz)	Frequency Deviation (ppm)	Result
25	AC 120V	35000.00	6.75676	PASS
25	AC 108V	31000.00	5.98456	PASS
25	AC 132V	29000.00	5.59846	PASS

Band: I			Test Frequency: 5180.00MHz	
Voltage (V)	Temperature (°C)	Frequency Deviation (Hz)	Frequency Deviation (ppm)	Result
AC 120V	-20	33000.00	6.37066	PASS
AC 120V	-10	39000.00	7.52896	PASS
AC 120V	0	27000.00	5.21236	PASS
AC 120V	10	26000.00	5.01931	PASS
AC 120V	20	22000.00	4.24710	PASS
AC 120V	30	27000.00	5.21236	PASS
AC 120V	40	28000.00	5.40541	PASS
AC 120V	50	28000.00	5.40541	PASS

8 Test Setup Photo

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

9 EUT Constructional Details

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

---END---