



802.11ac(HT20)



Low



Mid



High

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802.11ac(HT40)



Low



High

802.11ac(HT80)





802.11ax(HT20)



Low



Mid



High

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802.11ax(HT40)



Low



High

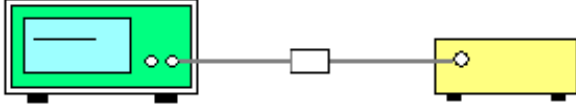
802.11ax(HT80)





4.5. Power Spectral Density

4.5.1. Test Specification

Test Requirement:	FCC Part15 E Section 15.407 (a)
Test Method:	KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section F
Limit:	17dBm/MHz for Band I 5150MHz-5250MHz
Test Setup:	 Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. Set the spectrum analyzer or EMI receiver span to view the entire emission bandwidth. 1. Set RBW =1 MHz, VBW ≥ 3*RBW, Sweep time = Auto, Detector = RMS. 2. Allow the sweeps to continue until the trace stabilizes. 3. Use the peak marker function to determine the maximum amplitude level. 4. The E.I.R.P spectral density used radiated test method. At a test site that has been validated using the procedures of ANSI C63.4 or the latest CISPR 16-1-4 for measurements above 1 GHz, so as to simulate a near free-space environment.
Test Result:	PASS

4.5.2. Test Instruments

RF Test Room					
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 10, 2020	Dec. 09, 2021
RF cable	Times	1-40G	HKE-034	Dec. 10, 2020	Dec. 09, 2021
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 10, 2020	Dec. 09, 2021

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



4.5.3. Test data

ANT 1

Configuration Band I (5150 - 5250 MHz)				
Mode	Test channel	Level [dBm/MHz]	Limit (dBm/MHz)	Result
11a	CH36	0.536	17	PASS
11a	CH40	2.260	17	PASS
11a	CH48	2.218	17	PASS
11n(HT20)	CH36	1.636	17	PASS
11n(HT20)	CH40	1.712	17	PASS
11n(HT20)	CH48	1.720	17	PASS
11n(HT40)	CH38	-1.056	17	PASS
11n(HT40)	CH46	-1.186	17	PASS
11ac(HT20)	CH36	0.379	17	PASS
11ac(HT20)	CH40	-0.003	17	PASS
11ac(HT20)	CH48	-0.621	17	PASS
11ac(HT40)	CH38	-3.010	17	PASS
11ac(HT40)	CH46	-3.243	17	PASS
11ac(HT80)	CH42	-5.661	17	PASS
11ax(HT20)	CH36	3.094	17	PASS
11ax(HT20)	CH40	1.855	17	PASS
11ax(HT20)	CH48	1.476	17	PASS
11ax(HT40)	CH38	-1.260	17	PASS
11ax(HT40)	CH46	-1.031	17	PASS
11ax(HT80)	CH42	-3.141	17	PASS



Test plots as follows:

Band I (5150 – 5250 MHz)



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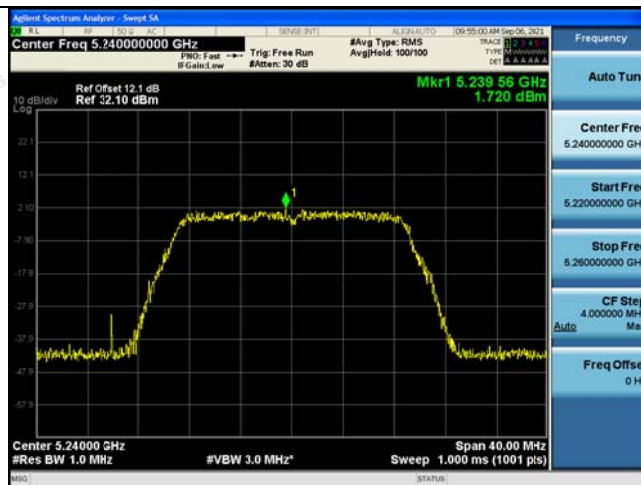
802.11n(HT20)



Low



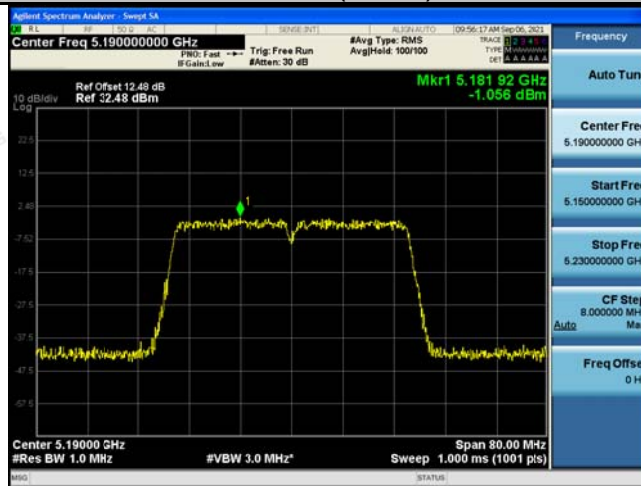
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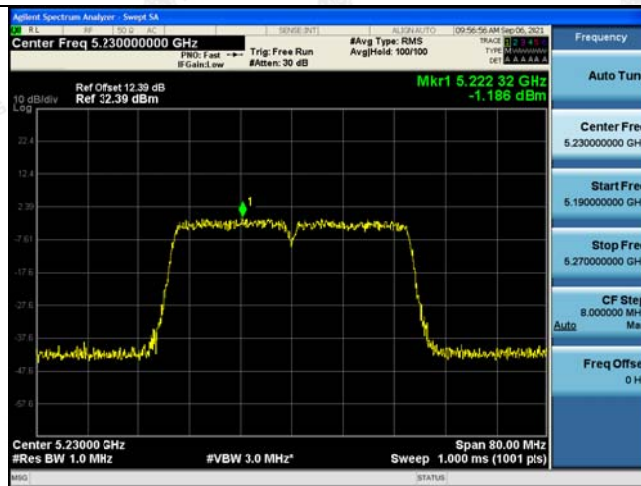
High



802.11n(HT40)



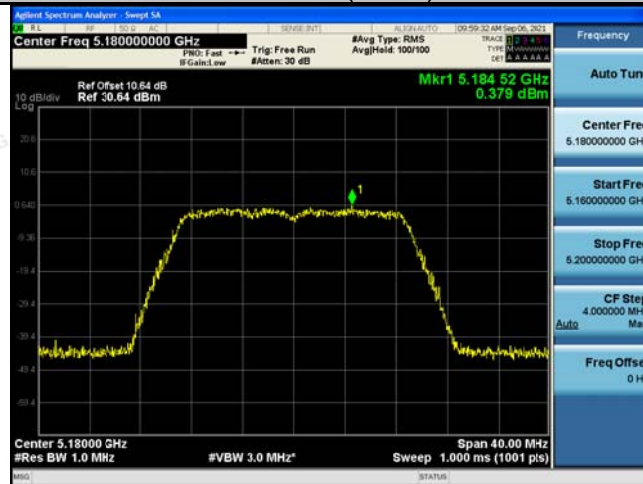
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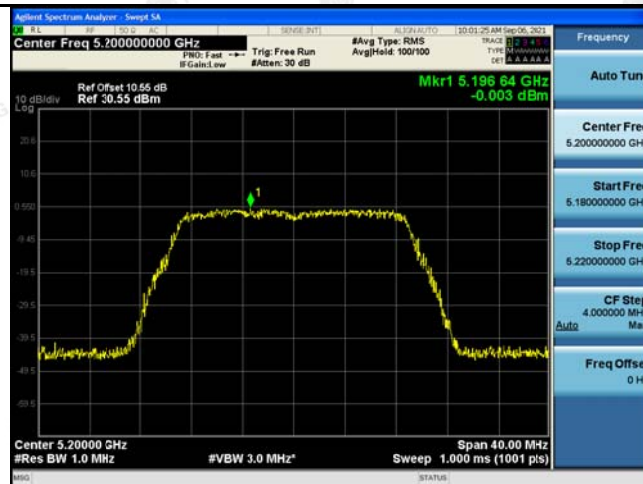
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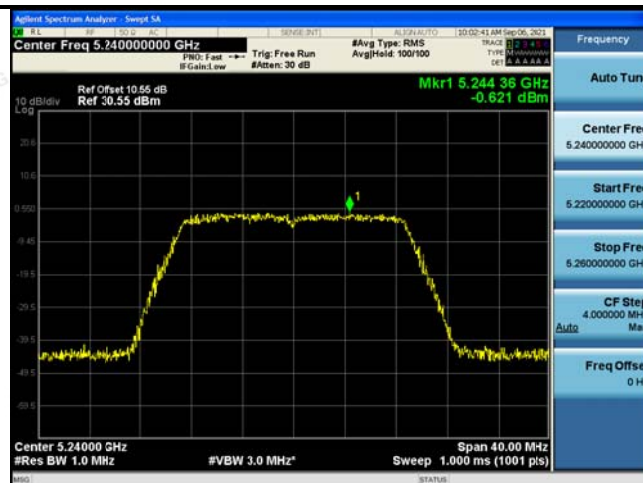
802.11ac(HT20)



Low



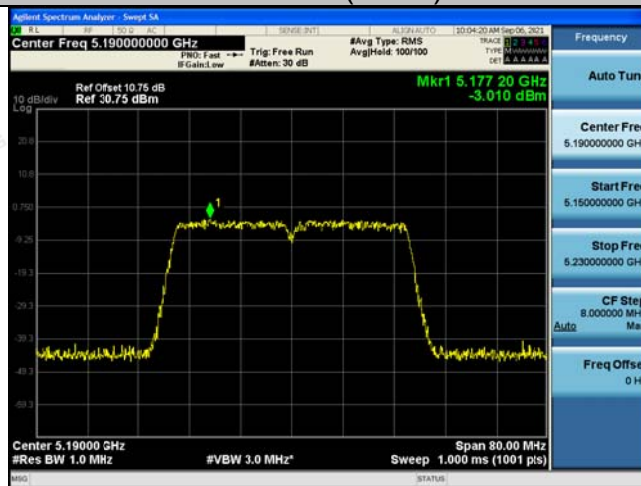
Mid



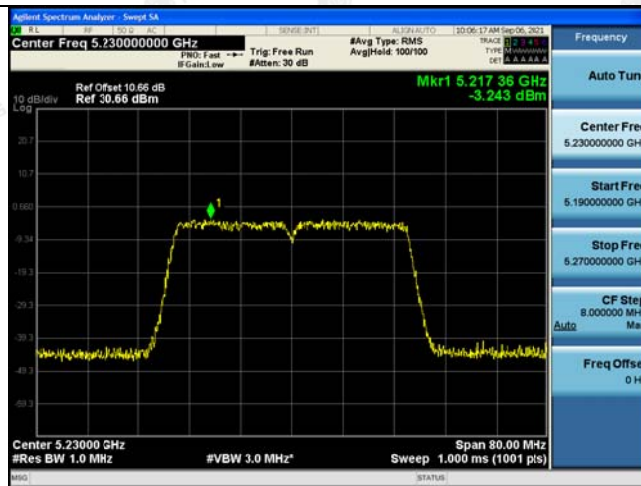
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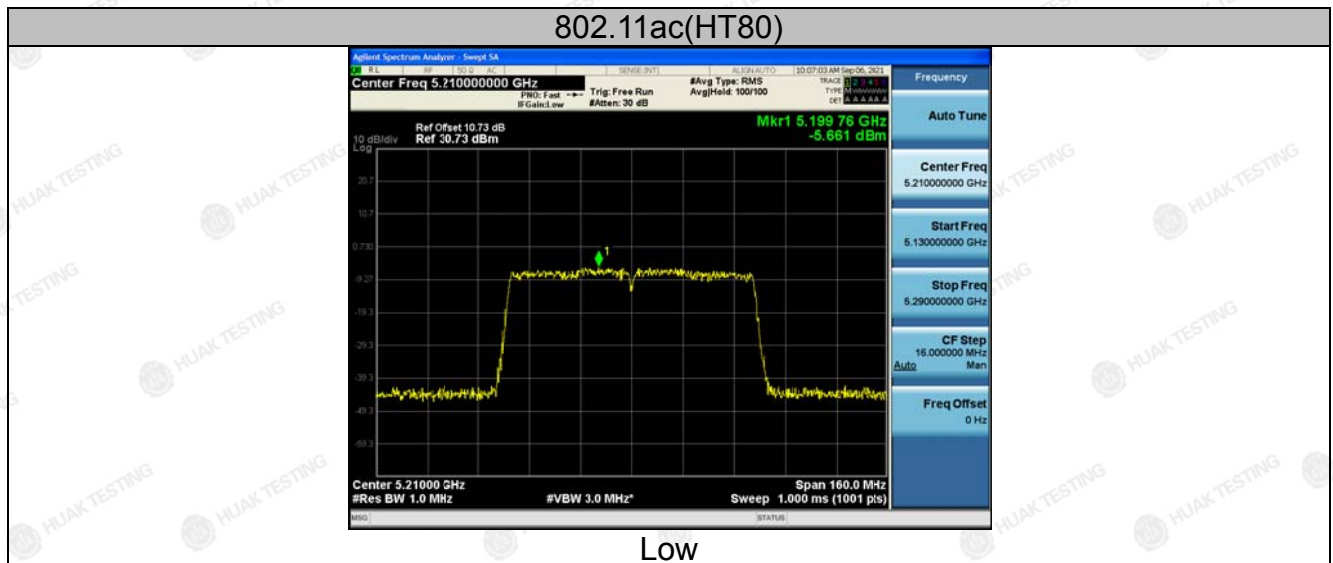
802.11ac(HT40)



Low

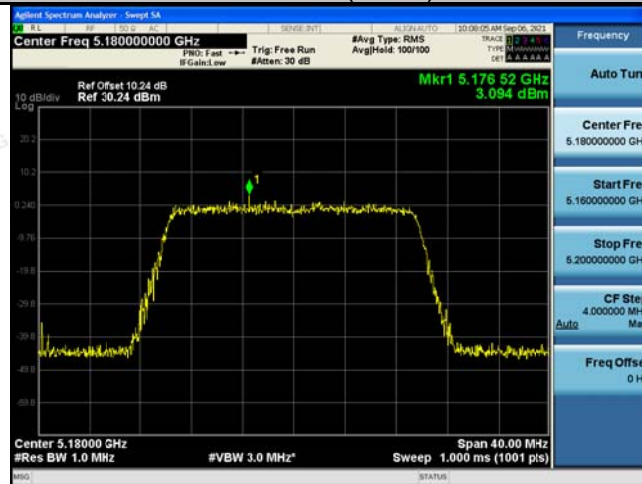


High

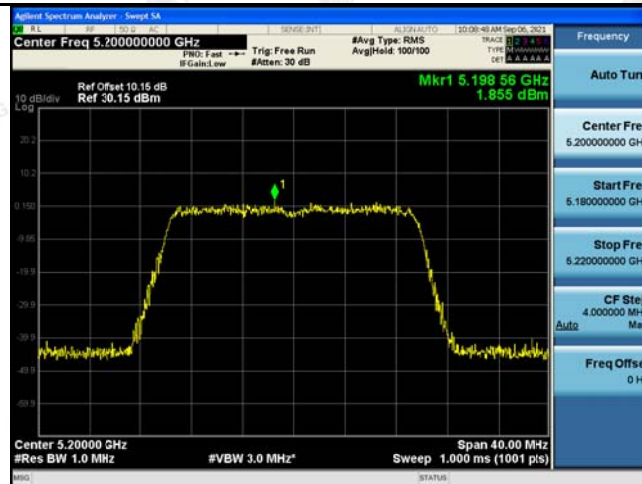




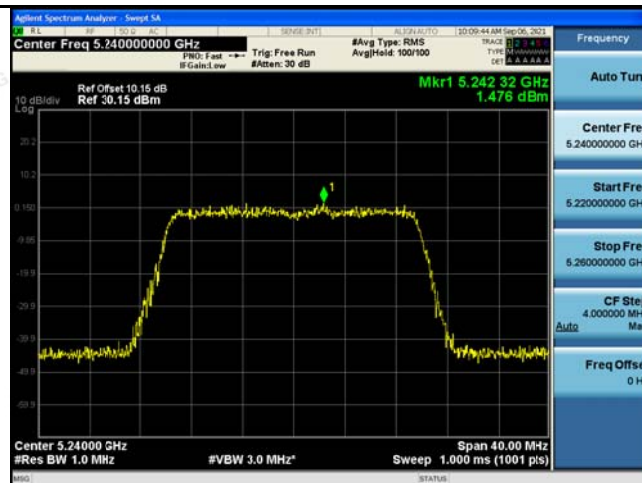
802.11ax(HT20)



Low



Mid



High

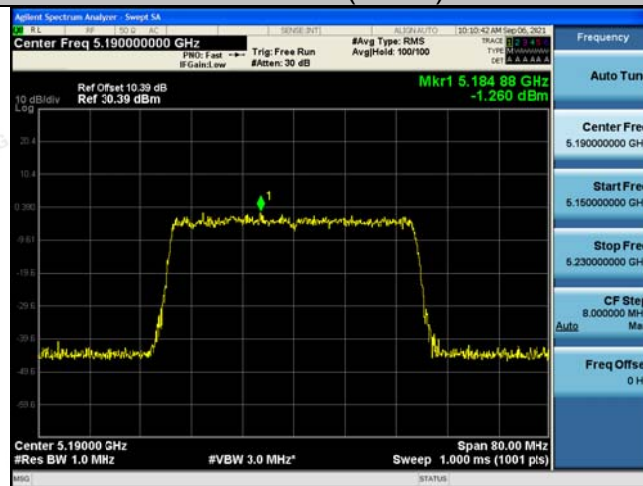
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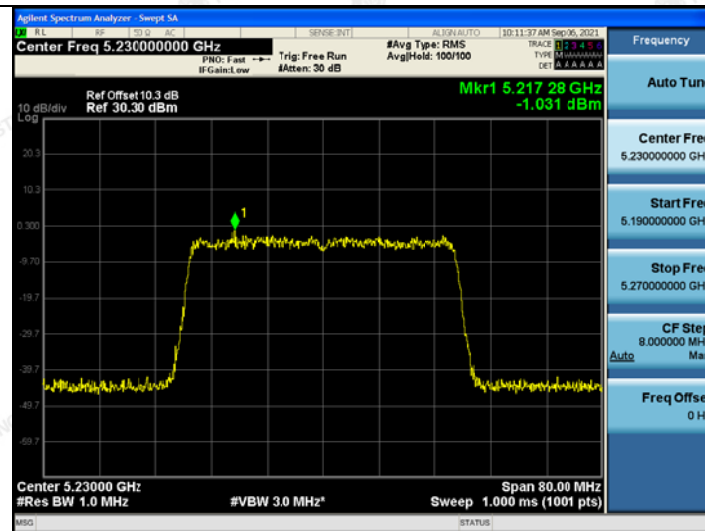
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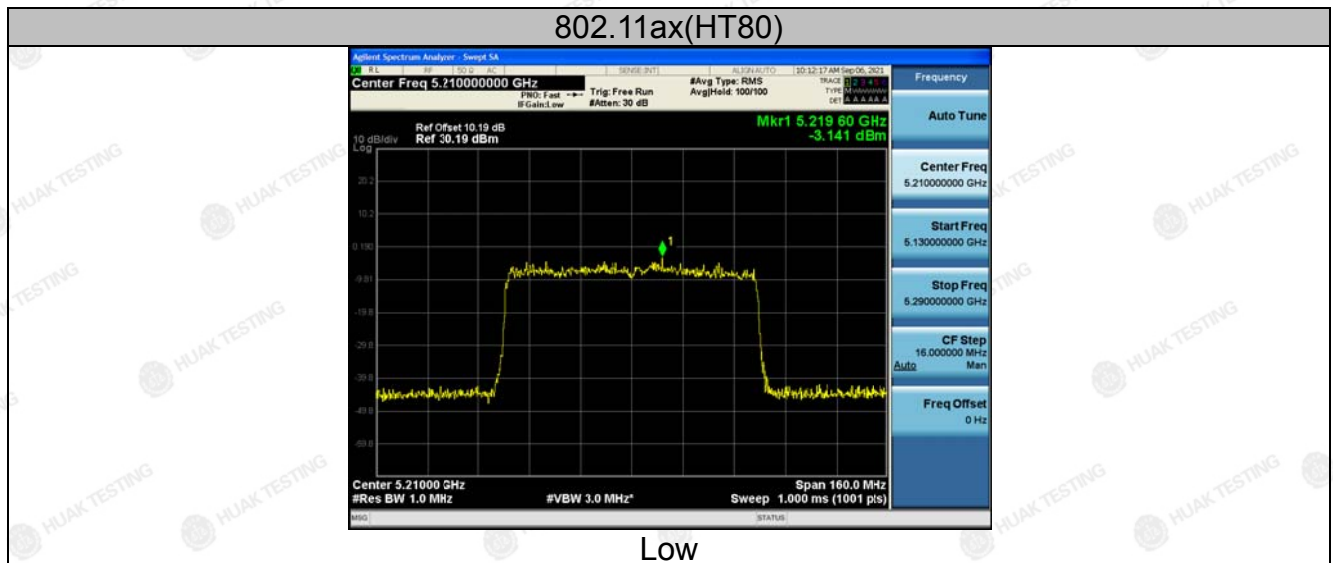
802.11ax(HT40)



Low



High





ANT 2

Configuration Band I (5150 - 5250 MHz)				
Mode	Test channel	Level [dBm/MHz]	Limit (dBm/MHz)	Result
11a	CH36	3.807	17	PASS
11a	CH40	3.784	17	PASS
11a	CH48	3.388	17	PASS
11n(HT20)	CH36	2.680	17	PASS
11n(HT20)	CH40	3.302	17	PASS
11n(HT20)	CH48	1.818	17	PASS
11n(HT40)	CH38	-0.237	17	PASS
11n(HT40)	CH46	-0.441	17	PASS
11ac(HT20)	CH36	1.103	17	PASS
11ac(HT20)	CH40	2.364	17	PASS
11ac(HT20)	CH48	2.123	17	PASS
11ac(HT40)	CH38	0.251	17	PASS
11ac(HT40)	CH46	-0.420	17	PASS
11ac(HT80)	CH42	-4.732	17	PASS
11ax(HT20)	CH36	2.651	17	PASS
11ax(HT20)	CH40	3.343	17	PASS
11ax(HT20)	CH48	2.028	17	PASS
11ax(HT40)	CH38	-0.710	17	PASS
11ax(HT40)	CH46	-0.464	17	PASS
11ax(HT80)	CH42	-1.191	17	PASS



Test plots as follows:

Band I (5150 – 5250 MHz)



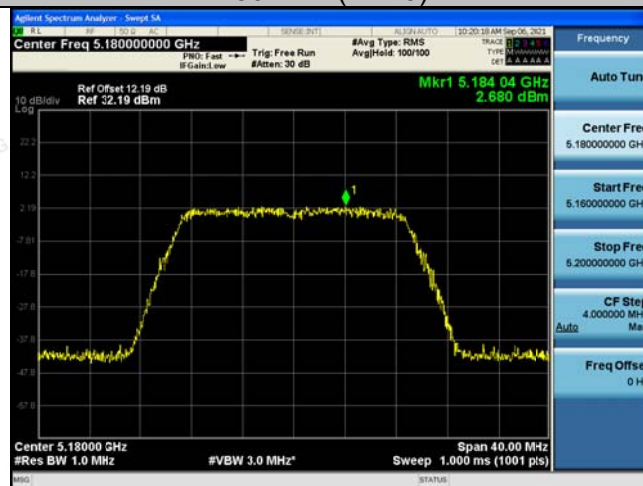
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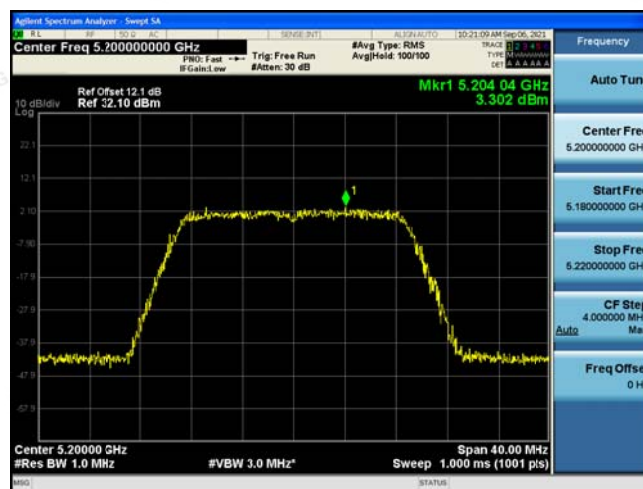
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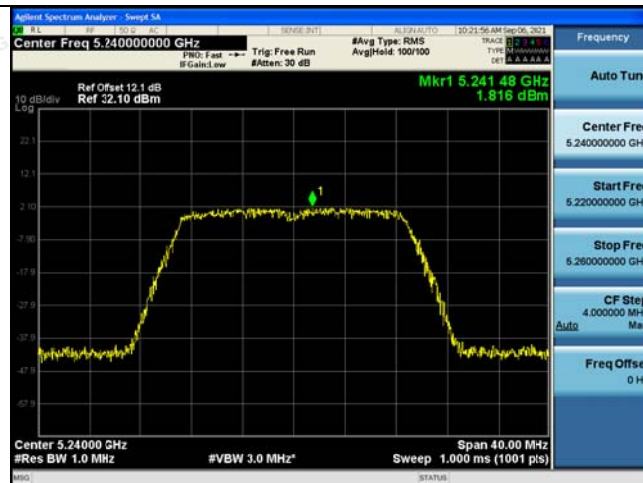
802.11n(HT20)



Low



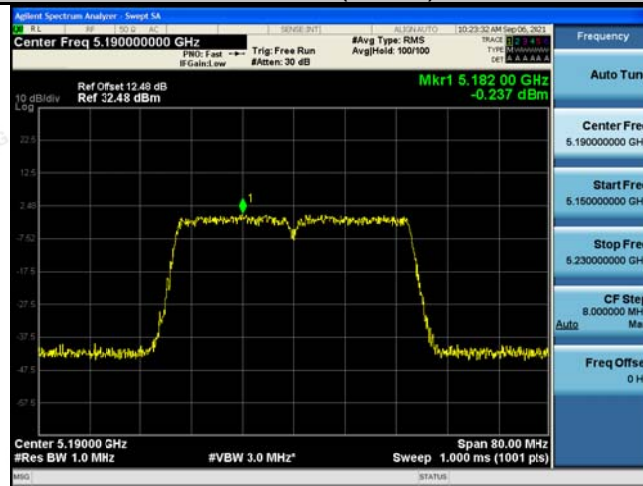
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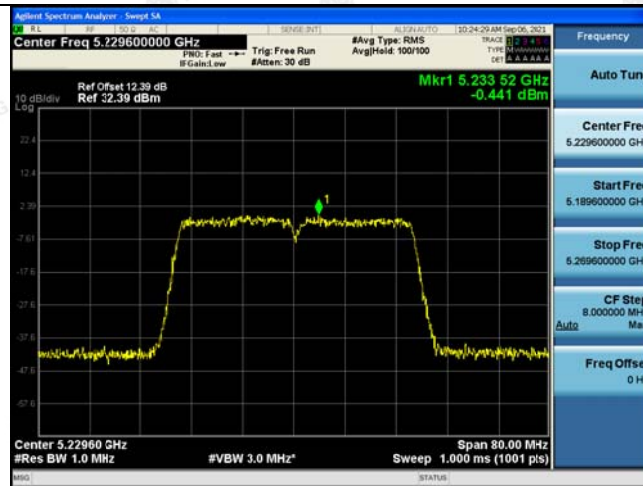
High



802.11n(HT40)



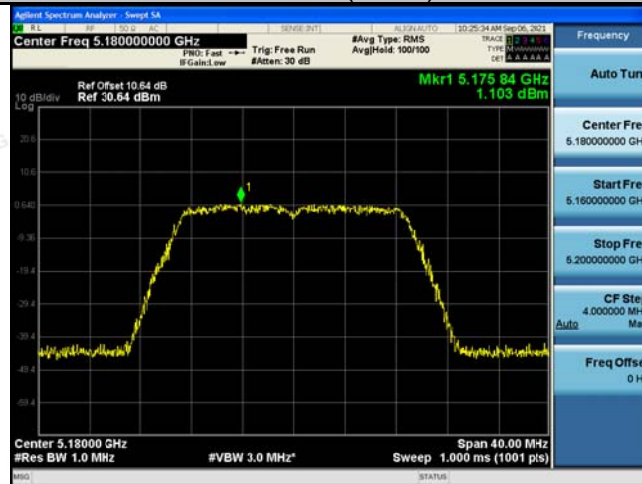
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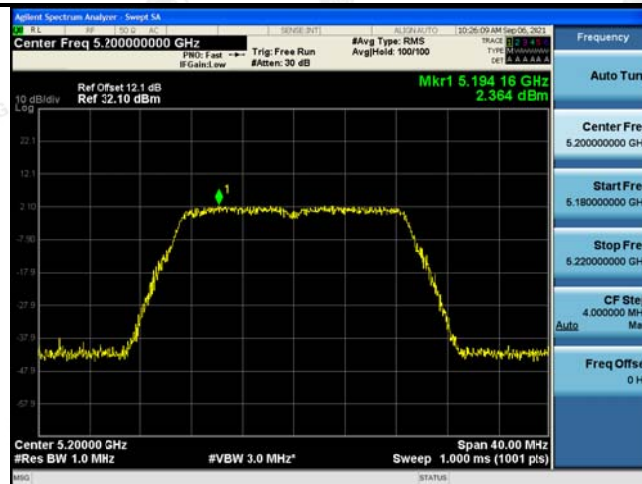
High



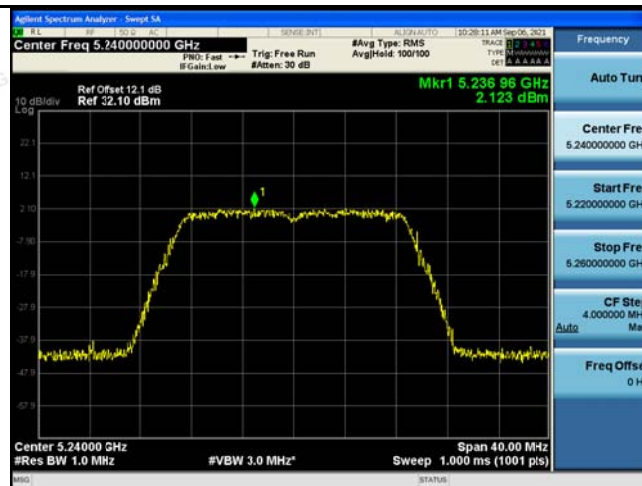
802.11ac(HT20)



Low



Mid



High

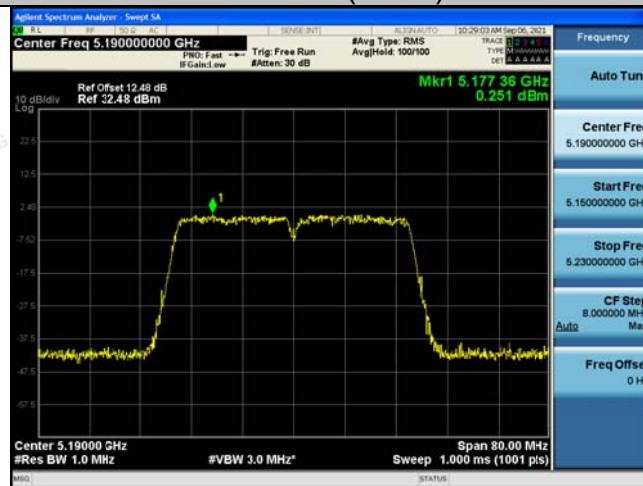
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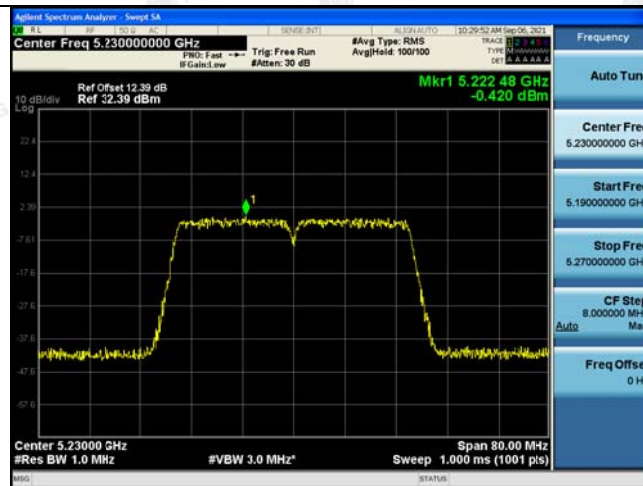
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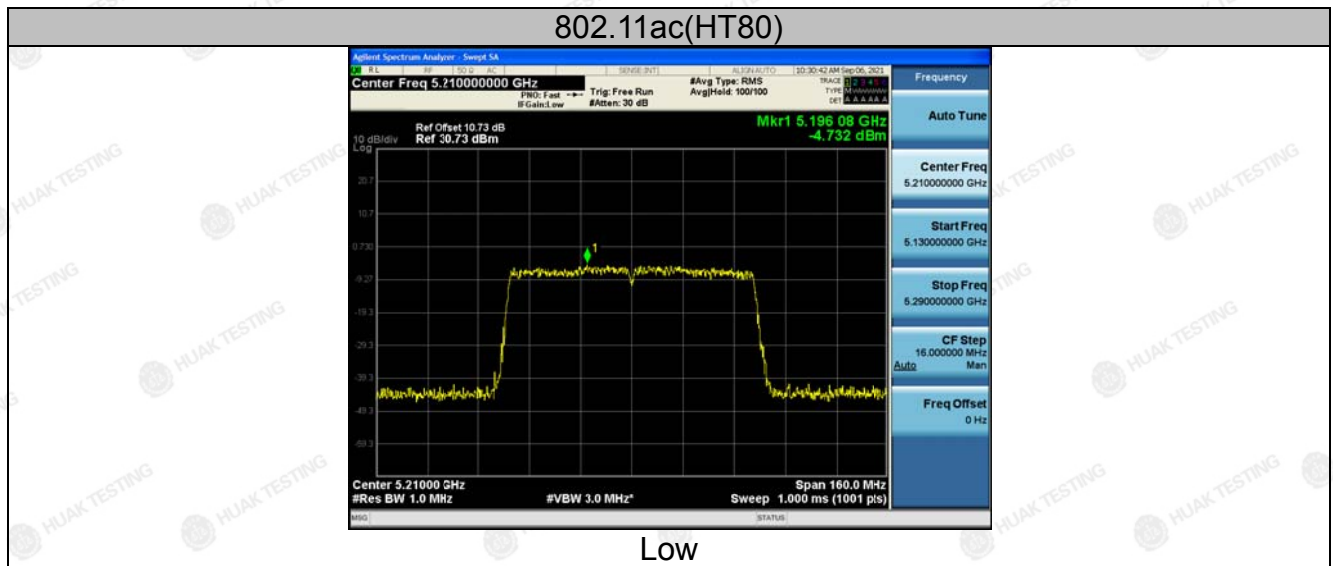
802.11ac(HT40)



Low

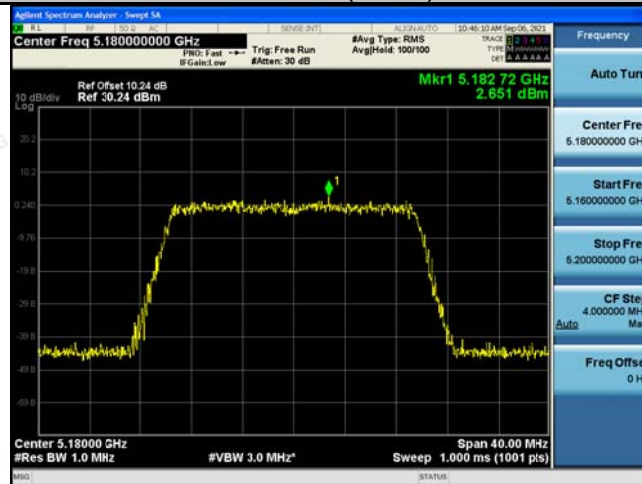


High

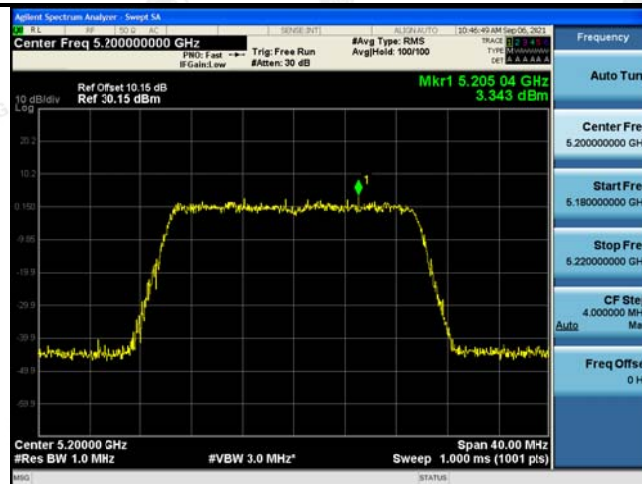




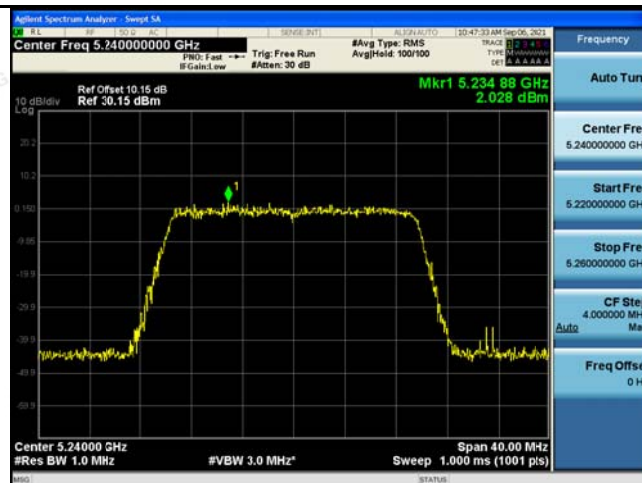
802.11ax(HT20)



Low



Mid



High

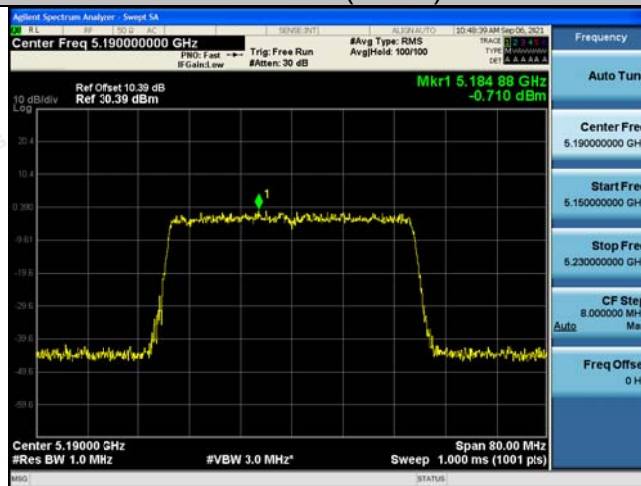
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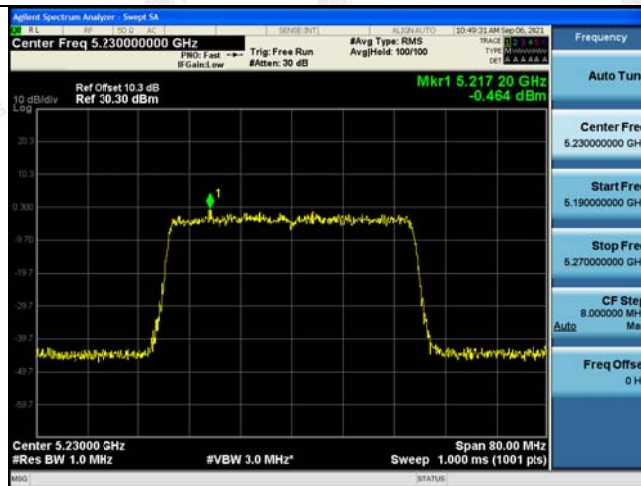
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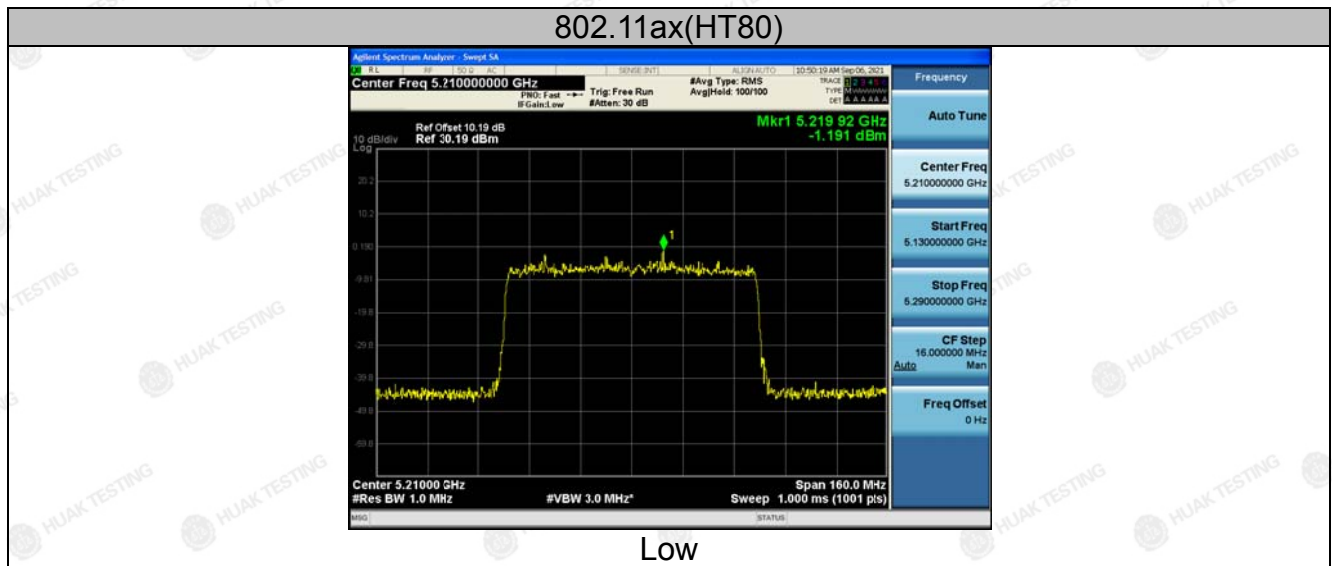
802.11ax(HT40)



Low



High





ANT 3

Configuration Band I (5150 - 5250 MHz)				
Mode	Test channel	Level [dBm/MHz]	Limit (dBm/MHz)	Result
11a	CH36	5.577	17	PASS
11a	CH40	3.957	17	PASS
11a	CH48	2.462	17	PASS
11n(HT20)	CH36	3.110	17	PASS
11n(HT20)	CH40	3.273	17	PASS
11n(HT20)	CH48	3.387	17	PASS
11n(HT40)	CH38	0.658	17	PASS
11n(HT40)	CH46	-0.938	17	PASS
11ac(HT20)	CH36	1.330	17	PASS
11ac(HT20)	CH40	1.004	17	PASS
11ac(HT20)	CH48	0.199	17	PASS
11ac(HT40)	CH38	-1.929	17	PASS
11ac(HT40)	CH46	-1.463	17	PASS
11ac(HT80)	CH42	-5.176	17	PASS
11ax(HT20)	CH36	3.701	17	PASS
11ax(HT20)	CH40	2.653	17	PASS
11ax(HT20)	CH48	1.505	17	PASS
11ax(HT40)	CH38	0.601	17	PASS
11ax(HT40)	CH46	-0.059	17	PASS
11ax(HT80)	CH42	-2.968	17	PASS

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Test plots as follows:

Band I (5150 – 5250 MHz)



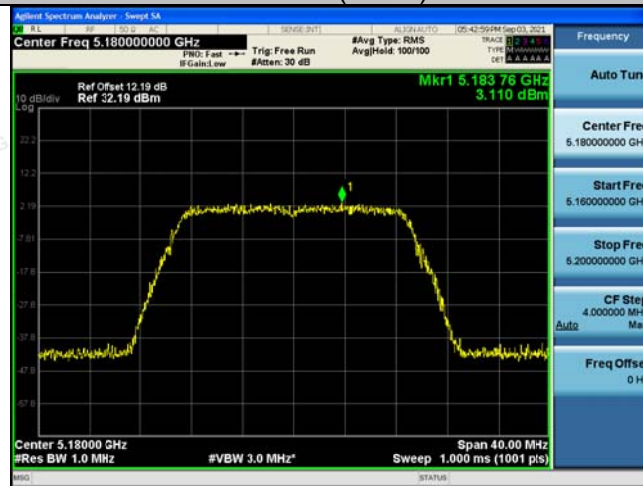
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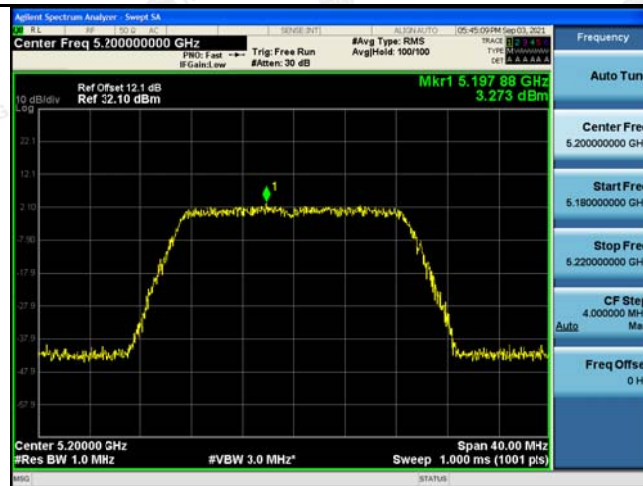
1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China



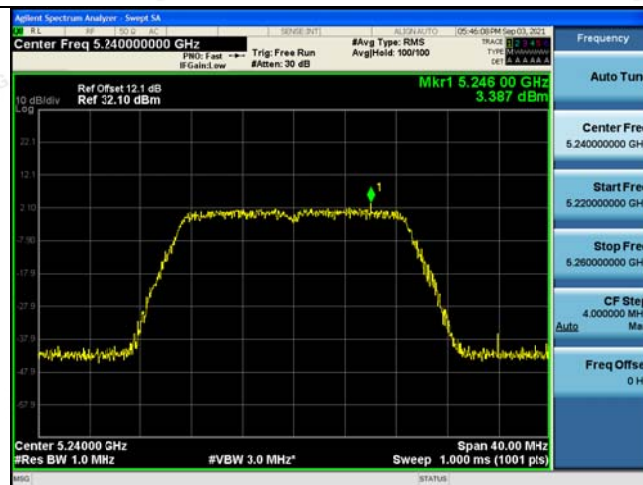
802.11n(HT20)



Low



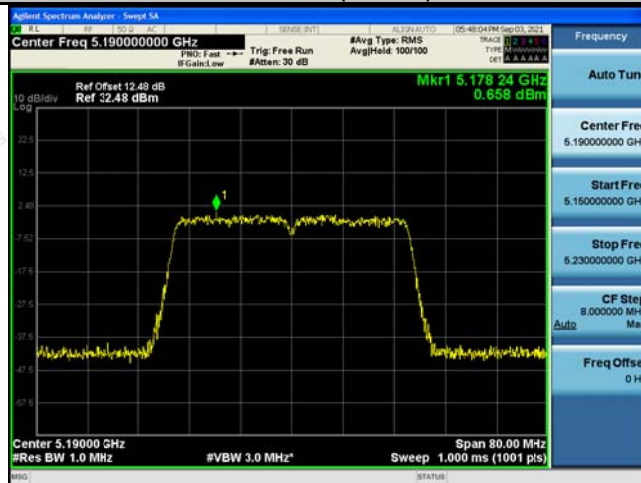
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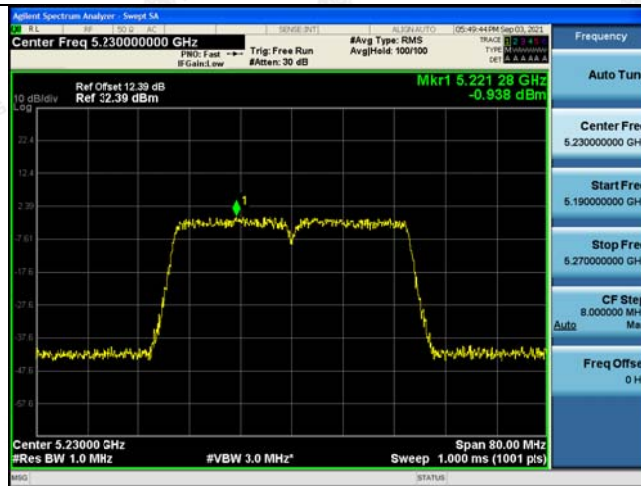
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802.11n(HT40)



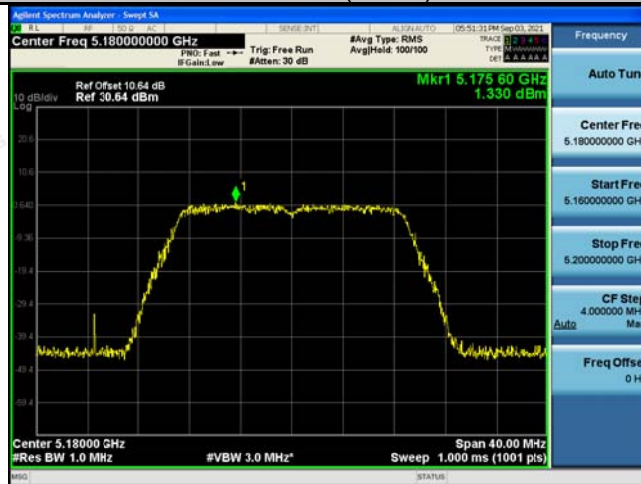
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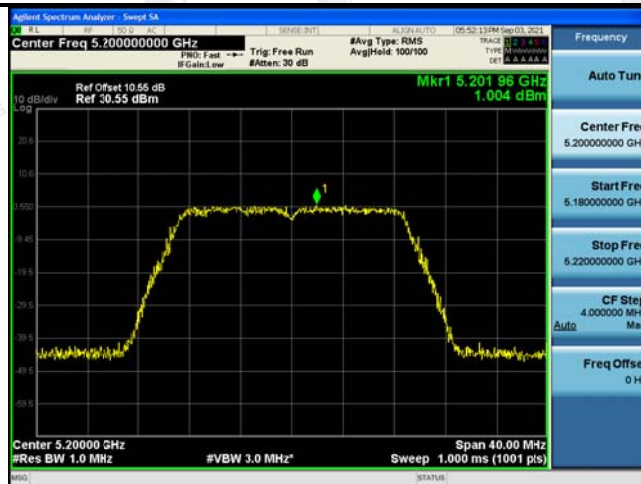
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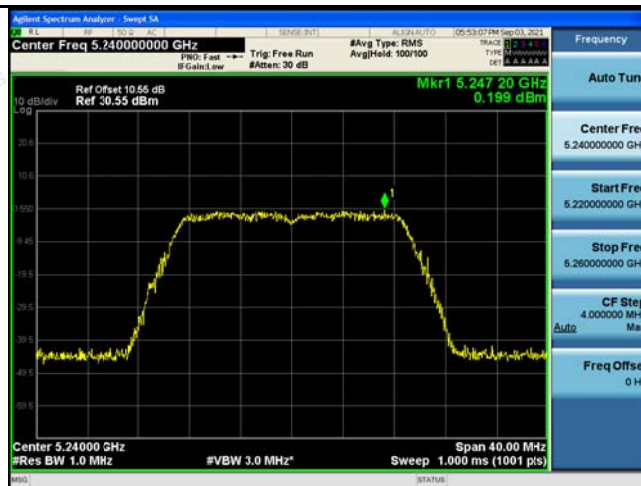
802.11ac(HT20)



Low



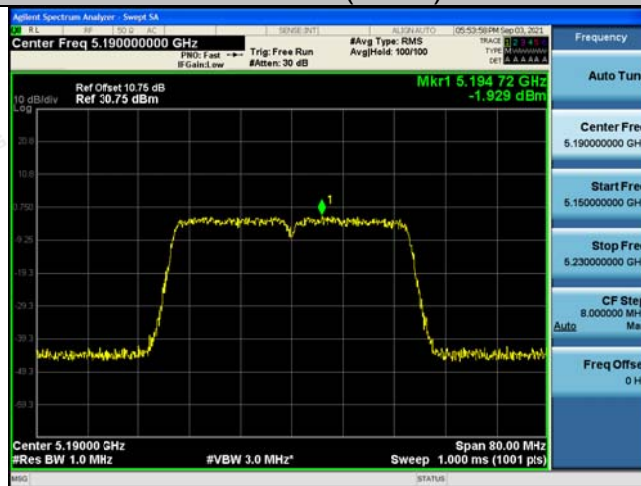
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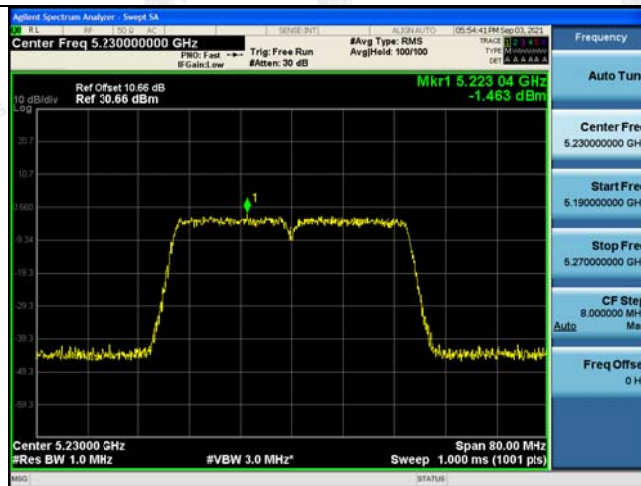
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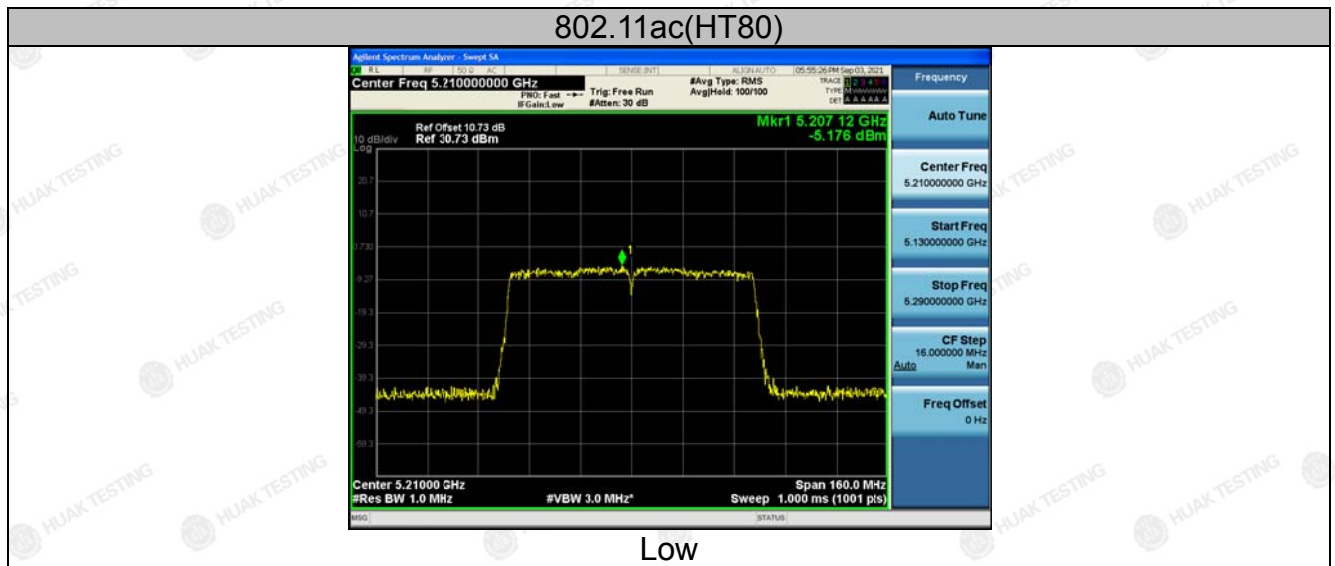
802.11ac(HT40)



Low

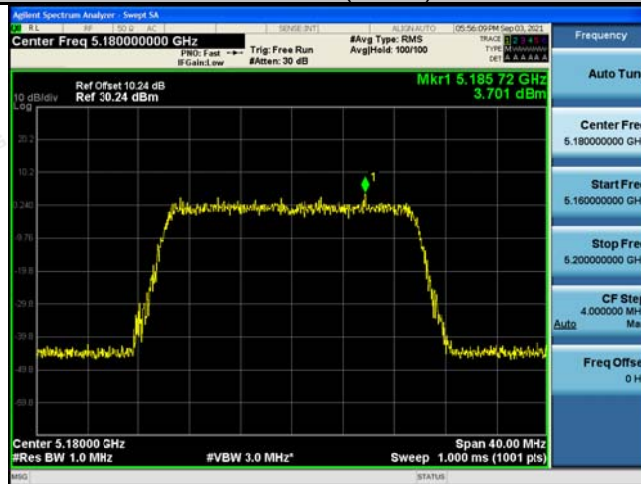


High

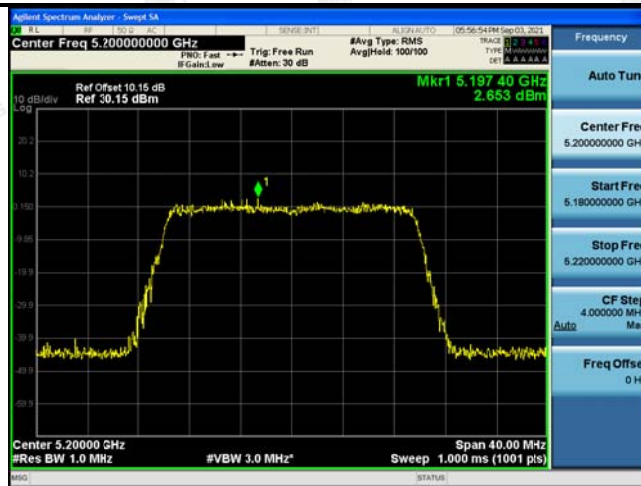




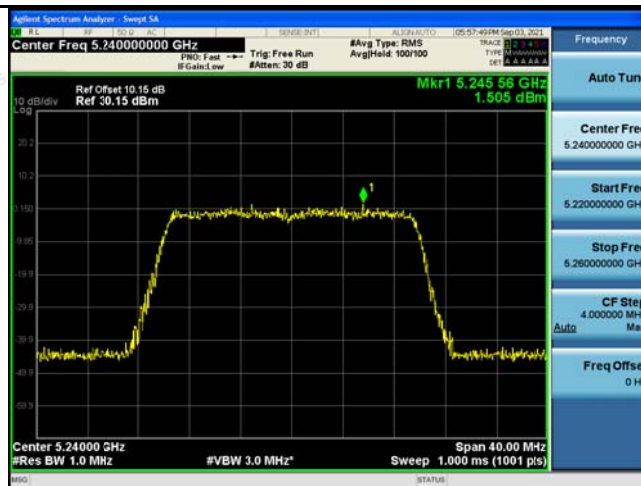
802.11ax(HT20)



Low



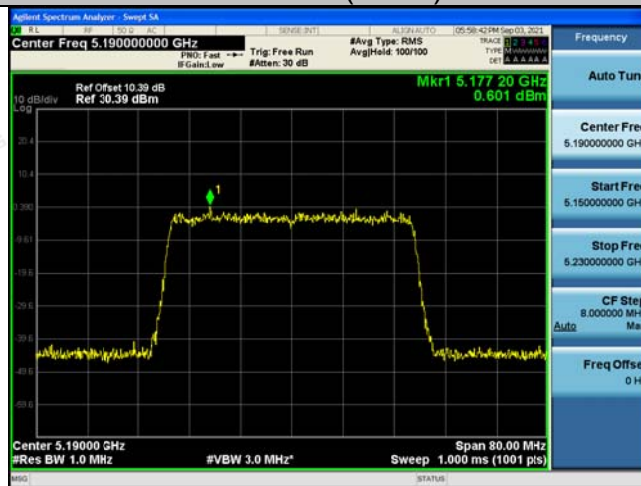
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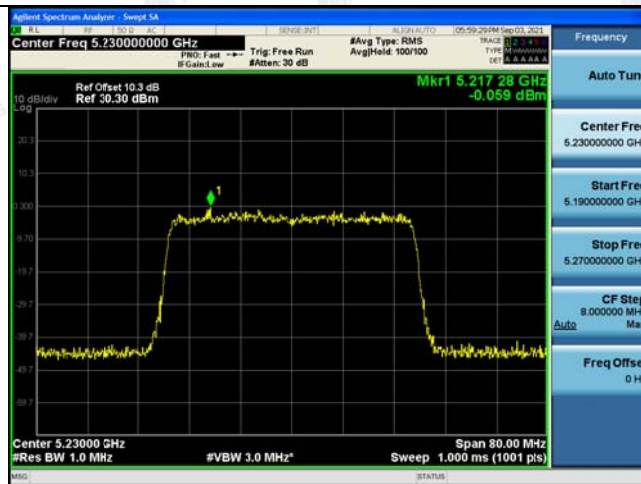
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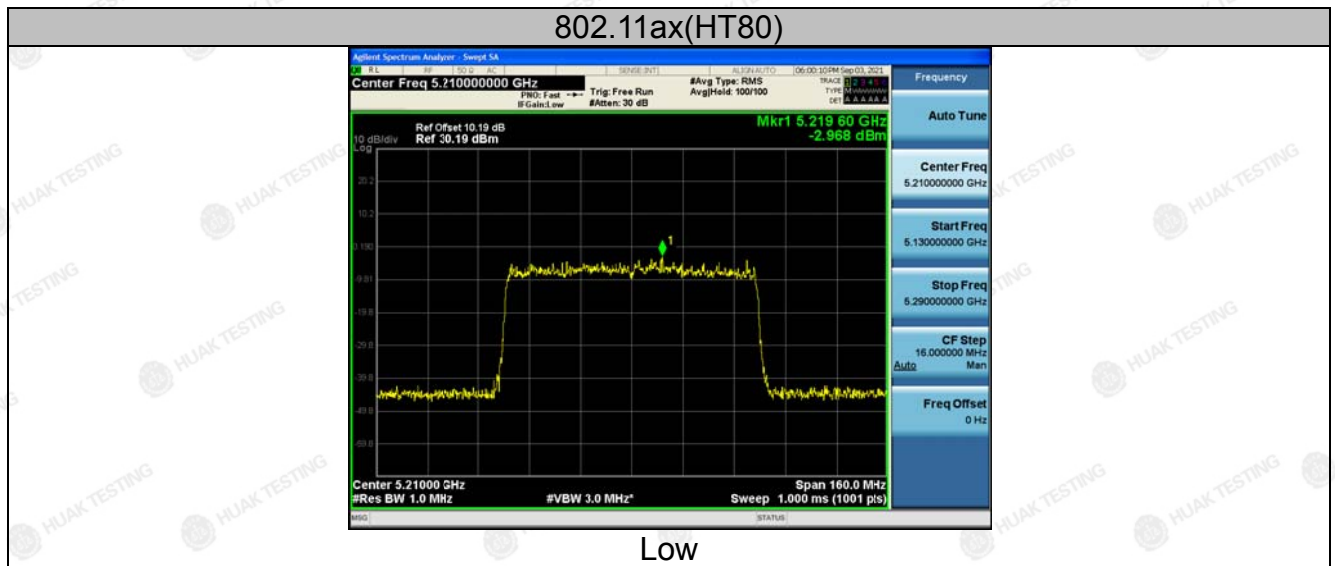
802.11ax(HT40)



Low



High





ANT 4

Configuration Band I (5150 - 5250 MHz)				
Mode	Test channel	Level [dBm/MHz]	Limit (dBm/MHz)	Result
11a	CH36	3.092	17	PASS
11a	CH40	2.866	17	PASS
11a	CH48	2.105	17	PASS
11n(HT20)	CH36	2.144	17	PASS
11n(HT20)	CH40	2.723	17	PASS
11n(HT20)	CH48	1.188	17	PASS
11n(HT40)	CH38	-0.465	17	PASS
11n(HT40)	CH46	-1.460	17	PASS
11ac(HT20)	CH36	0.491	17	PASS
11ac(HT20)	CH40	1.007	17	PASS
11ac(HT20)	CH48	0.428	17	PASS
11ac(HT40)	CH38	-2.350	17	PASS
11ac(HT40)	CH46	-2.926	17	PASS
11ac(HT80)	CH42	-5.871	17	PASS
11ax(HT20)	CH36	3.106	17	PASS
11ax(HT20)	CH40	2.052	17	PASS
11ax(HT20)	CH48	1.856	17	PASS
11ax(HT40)	CH38	-0.419	17	PASS
11ax(HT40)	CH46	-2.234	17	PASS
11ax(HT80)	CH42	-1.722	17	PASS



Test plots as follows:

Band I (5150 – 5250 MHz)



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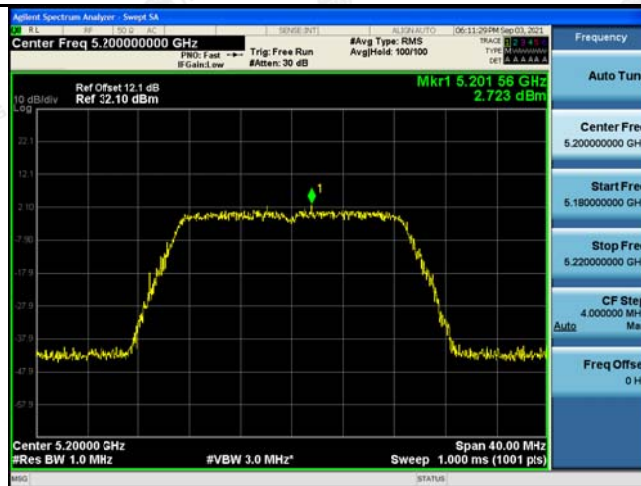
1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China



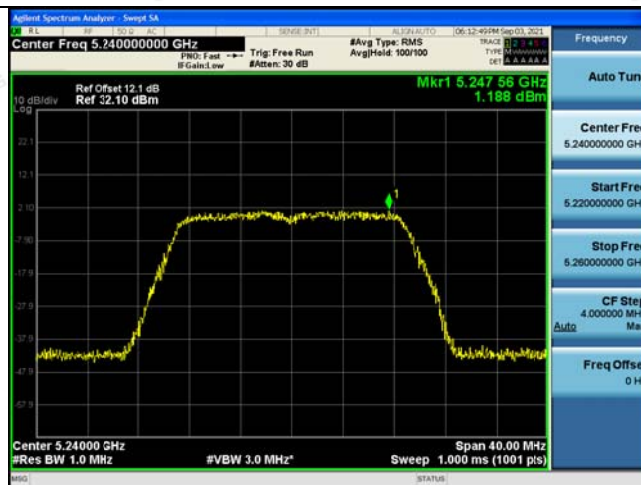
802.11n(HT20)



Low



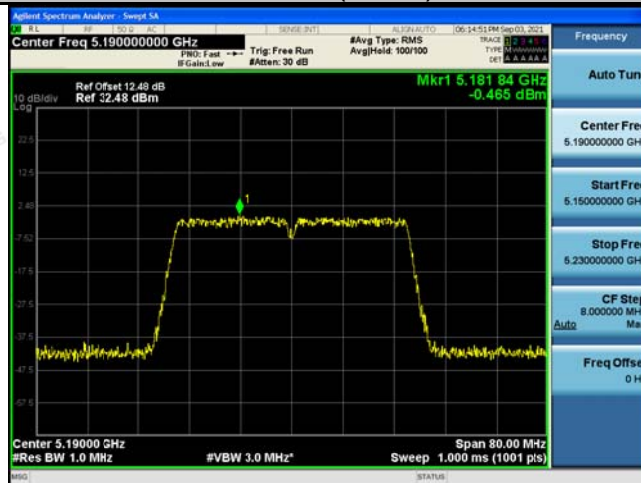
Mid



High



802.11n(HT40)



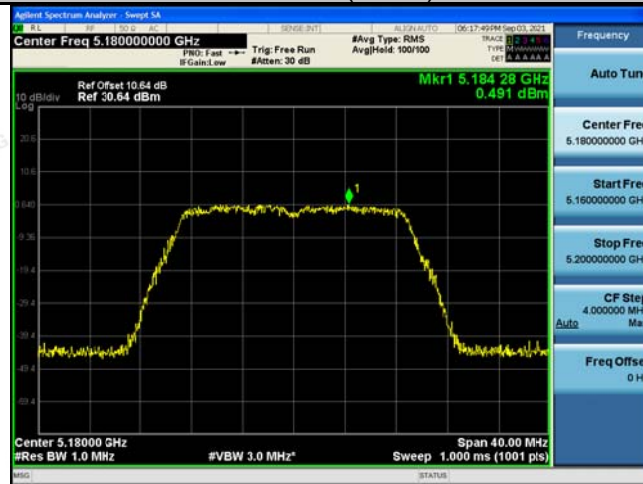
Low



High



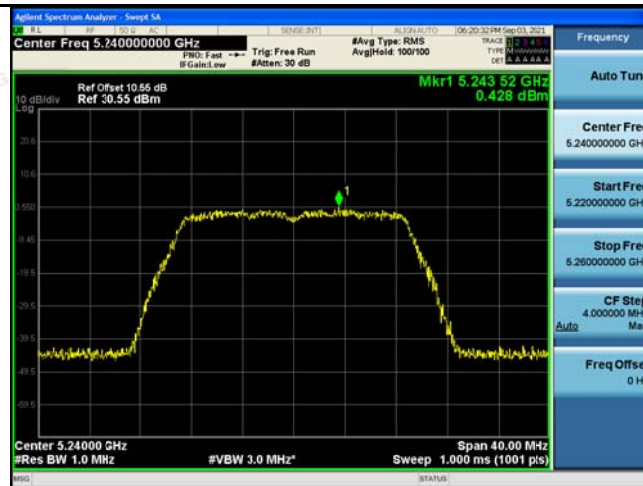
802.11ac(HT20)



Low



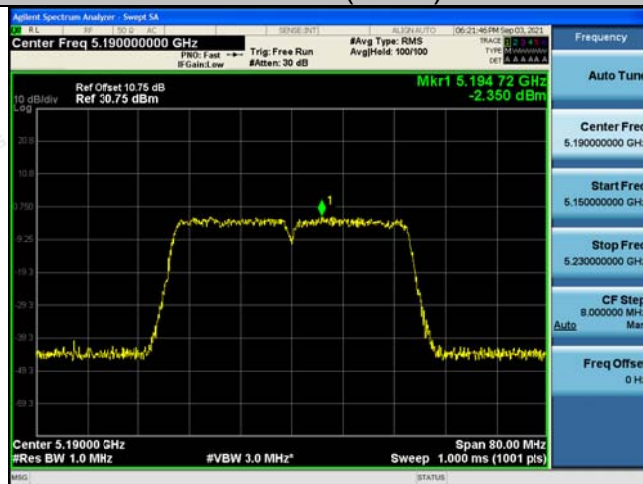
Mid



High



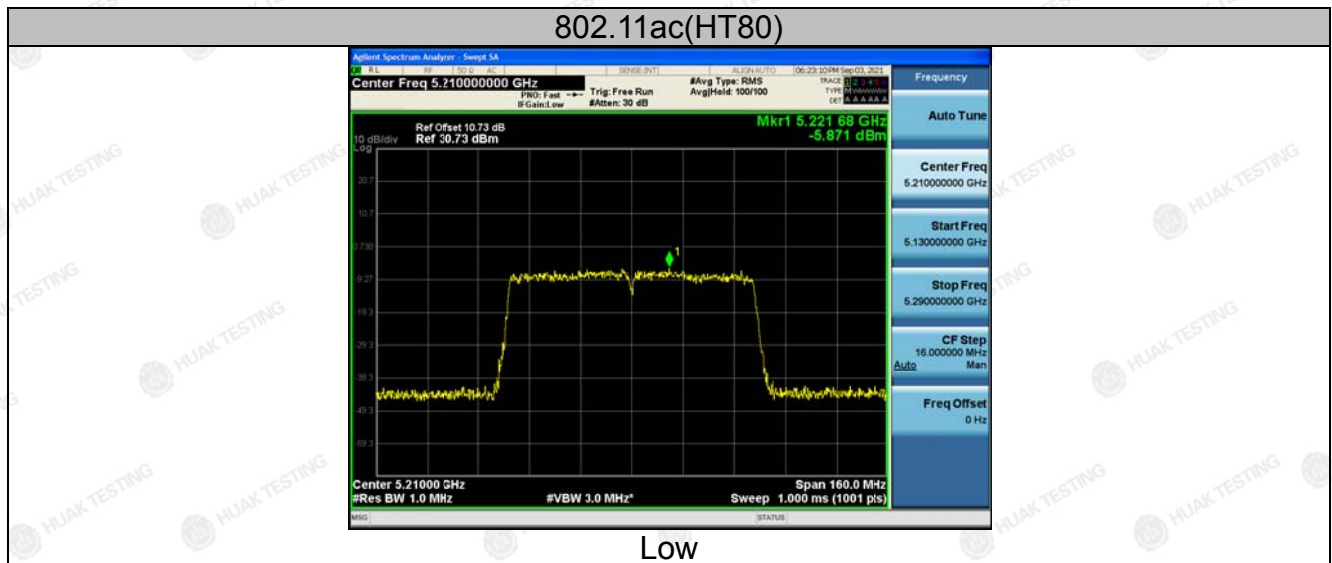
802.11ac(HT40)



Low

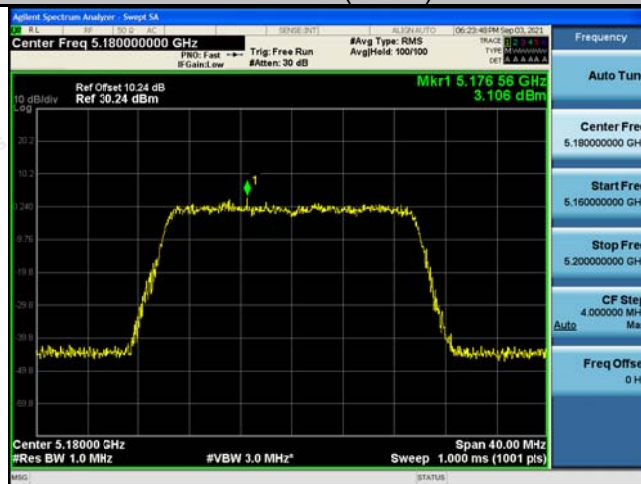


High

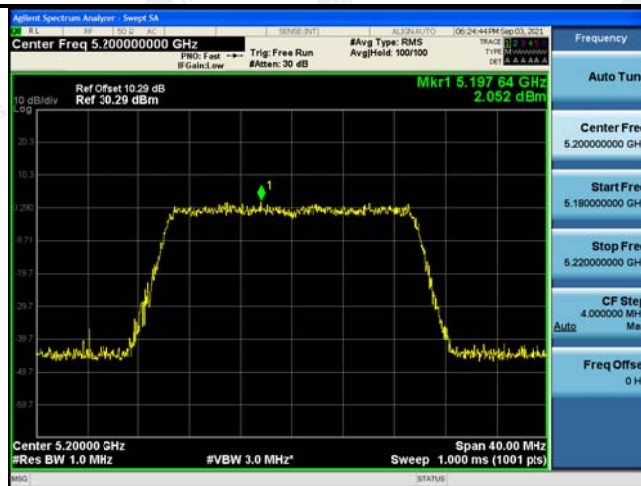




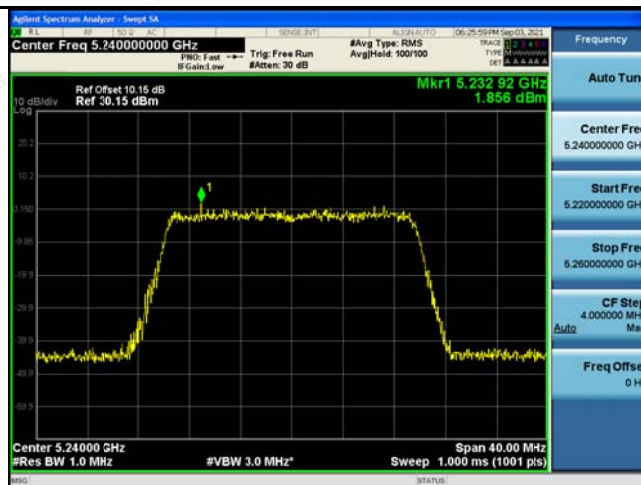
802.11ax(HT20)



Low



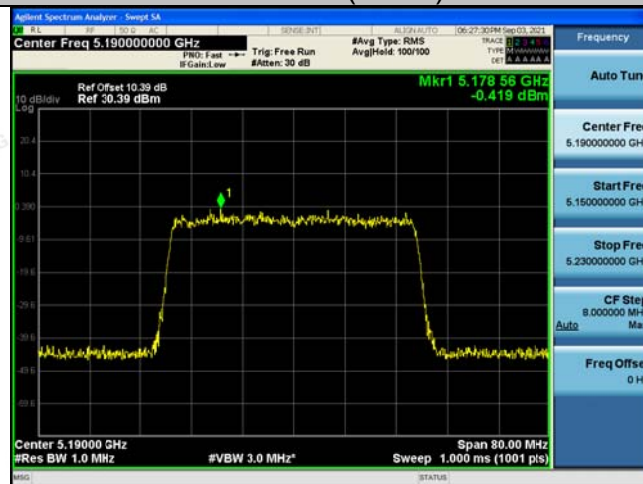
Mid



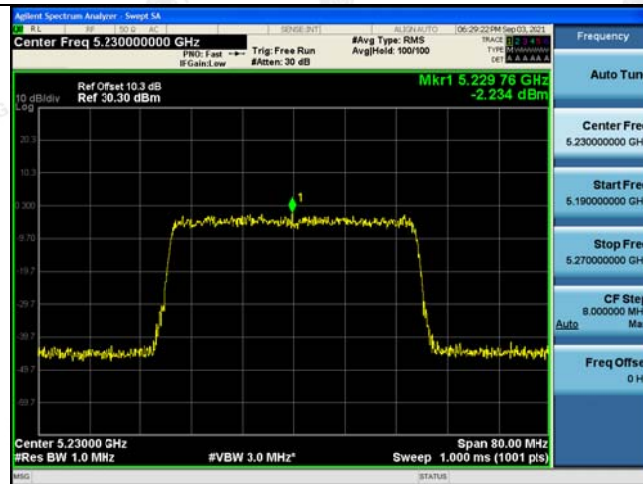
High



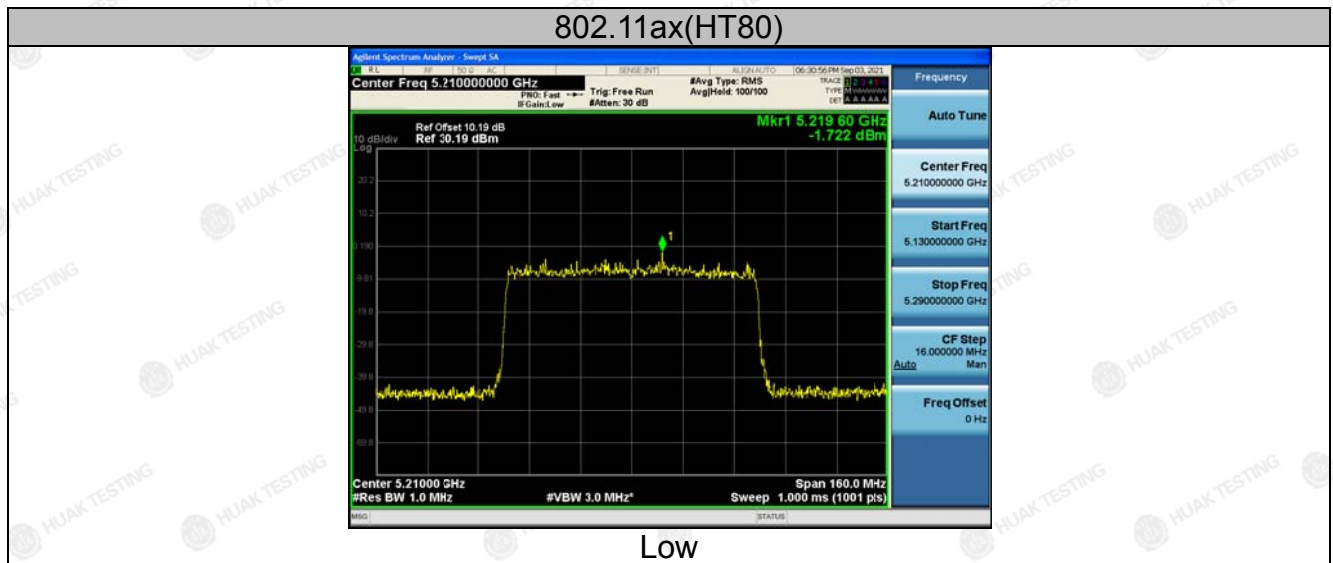
802.11ax(HT40)



Low



High





**For MIMO antenna port 1+antenna port 2
Configuration Band IV (5150 - 5250MHz)**

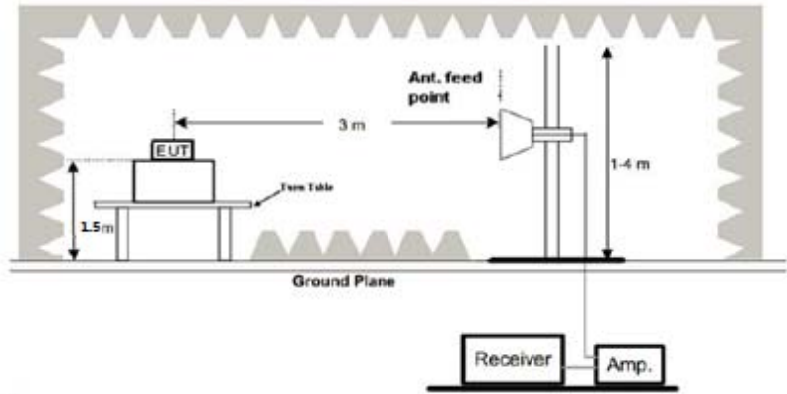
Mode	Test channel	Power Density (dBm)	Limit (dBm/MHz)	Result
11a	CH36	/	17	/
11a	CH40	/	17	/
11a	CH48	/	17	/
11n(HT20)	CH36	8.45	12	PASS
11n(HT20)	CH40	8.82	12	PASS
11n(HT20)	CH48	8.13	12	PASS
11n(HT40)	CH38	5.79	12	PASS
11n(HT40)	CH46	5.03	12	PASS
11ac(HT20)	CH36	6.86	12	PASS
11ac(HT20)	CH40	7.20	12	PASS
11ac(HT20)	CH48	6.67	12	PASS
11ac(HT40)	CH38	4.45	12	PASS
11ac(HT40)	CH46	4.16	12	PASS
11ac(HT80)	CH42	0.68	12	PASS
11ax(HT20)	CH36	9.17	12	PASS
11ax(HT20)	CH40	8.54	12	PASS
11ax(HT20)	CH48	7.74	12	PASS
11ax(HT40)	CH38	5.63	12	PASS
11ax(HT40)	CH46	5.15	12	PASS
11ax(HT80)	CH42	3.84	12	PASS
Note: 1 According to KDB 662911, Result power = $10\log(10^{(ant1/10)}+10^{(ant2/10)}+10^{(ant3/10)}+10^{(ant4/10)})$. 2 Result unit: W, The end result is converted to units of dBm. Limit=17dBm-(direction gain-6dBi)=17-(5+10log4-6)=12dBm				

Note: This product supports antenna 1, antenna 2 and antenna 3, antenna4 launch, but only support 802.11 n/ac/ax for MIMO mode, not support 802.11 a for MIMO mode.



4.6. Band edge

4.6.1. Test Specification

Test Requirement:	FCC CFR47 Part 15E Section 15.407
Test Method:	ANSI C63.10 2013
Limit:	(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz. (2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz. (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz. (4) For transmitters operating in the 5.725-5.85 GHz band: (i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge. The limit of frequency below 1GHz and which fall in restricted bands should complies 15.209.
Test Setup:	 The diagram illustrates the test setup for band edge testing. It shows an Equipment Under Test (EUT) placed on a Test Table, which is 1.5m high. The EUT is positioned 3m away from an Antenna Feed Point. The Antenna Feed Point is mounted on a vertical structure that is 1.4m high. The entire setup is on a Ground Plane. A Receiver and an Amplifier (Amp.) are connected to the Antenna Feed Point.
Test Mode:	Transmitting mode with modulation



Test Procedure:	1. The EUT was placed on the top of a rotating table 1.5 meters 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 rota 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, quasipeak or average method as specified and then reported in a data sheet.
Test Result:	PASS



4.6.2. Test Instruments

Radiated Emission Test Site (966)					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Receiver	R&S	ESRP3	HKE-005	Dec. 10, 2020	Dec. 09, 2021
Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 10, 2020	Dec. 09, 2021
Preamplifier	EMCI	EMC051845S E	HKE-015	Dec. 10, 2020	Dec. 09, 2021
Preamplifier	Agilent	83051A	HKE-016	Dec. 10, 2020	Dec. 09, 2021
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 10, 2020	Dec. 09, 2021
Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	Dec. 10, 2020	Dec. 09, 2021
Horn antenna	Schwarzbeck	9120D	HKE-013	Dec. 10, 2020	Dec. 09, 2021
Antenna Mast	Keleto	CC-A-4M	N/A	N/A	N/A
Position controller	Taiwan MF	MF7802	HKE-011	Dec. 10, 2020	Dec. 09, 2021
Radiated test software	Tonscend	TS+ Rev 2.5.0.0	HKE-082	N/A	N/A
RF cable (9KHz-1GHz)	Times	381806-001	N/A	N/A	N/A
Hf antenna	Schwarzbeck	LB-180400-KF	HKE-031	Dec. 10, 2020	Dec. 09, 2021
RF cable	Tonscend	1-18G	HKE-099	Dec. 10, 2020	Dec. 09, 2021
RF cable	Times	1-40G	HKE-034	Dec. 10, 2020	Dec. 09, 2021
Horn Antenna	Schwarzbeck	BBHA 9170	HKE-017	Dec. 10, 2020	Dec. 09, 2021
Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 10, 2020	Dec. 09, 2021

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

**4.6.3. Test Data****ANT 1**

Operation Mode: 802.11a Mode with 5.2G TX CH Low

Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
5150	54.86	-2.49	52.37	74	-21.63	peak
5150	/	-2.49	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
5150	56.32	-2.49	53.83	74	-20.17	peak
5150	/	-2.49	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						