

## 14 Conducted Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.407(a) KDB 662911 D01 Multiple Transmitter Output v02r01, October 31, 2013
Test Method:	KDB 789033 D02 General U-NII Test Procedures New Rules v02r01 Section E ANSI C63.10:2013
Test Limit:	<b>For the band 5.15-5.25 GHz</b> For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. <b>For the 5.25-5.35 GHz and 5.47-5.725 GHz bands</b> For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. <b>For the band 5.725-5.850 GHz</b> For the band 5.725-5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.
Test Result:	PASS

### 14.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum analyzer.
2. Refer to section 4 of this report, according to KDB 789033 and ANSI C63.10, select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each).
3. Record the test results and calculate the final test data.

### 14.2 Test Result:

**Note:**

**Conducted Output Power = Measurements + Duty Cycle Factor**

According to ANSI C63.10 clause 14.4.3.1,

**Directional gain=antenna gain + 10log(N)**

N is number of array elements or staves

According to ANSI C63.10 clause 11.7,

For those cases where it is specified that the conducted output power be reduced by the amount in dB that the directional gain of the transmitting antenna exceeds 6dBi, the output power effective limit shall be calculated as follows in Equation:

$$P_{\text{out}} = P_{\text{Limit}} - (G_{\text{TX}} - 6)$$

For U-NII-1: the Directional gain is 7.7dBi that greater than 6dBi, Limit of power (SUM) is **28.3dBm**.

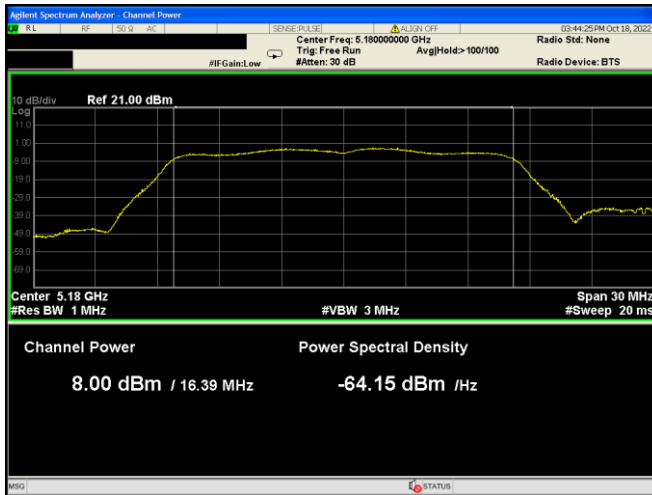
For U-NII-3: the Directional gain is 7.83dBi that greater than 6dBi, Limit of power (SUM) is **28.17dBm**.

Band	Operation mode	Channel	Duty Cycle Factor (dB)	Conducted Output Power (dBm)			
				Ant. 1	Ant. 2	SUM	Limit
U-NII-1	802.11a	Low	0.21	8.21	8.13	/	30dBm
		Middle		7.93	7.84	/	30dBm
		High		8.84	8.73	/	30dBm
	802.11n(HT20)	Low	0.22	8.15	8.12	11.15	28.3dBm
		Middle		7.95	7.83	10.90	28.3dBm
		High		8.68	8.67	11.69	28.3dBm
	802.11ac(VHT20)	Low	0.39	8.34	8.26	11.31	28.3dBm
		Middle		7.99	8.06	11.04	28.3dBm
		High		8.62	8.88	11.76	28.3dBm
	802.11n(HT40)	Low	0.39	7.94	8.01	10.99	28.3dBm
High		8.77		8.82	11.81	28.3dBm	
802.11ac(VHT40)	Low	0.71	8.35	8.14	11.26	28.3dBm	
	High		<b>9.12</b>	<b>9.12</b>	<b>12.13</b>	28.3dBm	
802.11ac(VHT80)	Middle	1.21	8.83	8.72	11.79	28.3dBm	
U-NII-3	802.11a	Low	0.21	12.01	12.21	/	30dBm
		Middle		12.44	12.38	/	30dBm
		High		13.13	<b>13.30</b>	/	30dBm
	802.11n(HT20)	Low	0.23	12.12	11.70	14.93	28.17dBm
		Middle		12.73	12.14	15.46	28.17dBm
		High		13.13	13.16	16.16	28.17dBm
	802.11ac(VHT20)	Low	0.41	12.32	12.21	15.28	28.17dBm
		Middle		12.72	12.65	15.70	28.17dBm
		High		<b>13.20</b>	13.22	<b>16.22</b>	28.17dBm
	802.11n(HT40)	Low	0.40	11.44	11.54	14.50	28.17dBm
High		11.99		11.93	14.97	28.17dBm	
802.11ac(VHT40)	Low	0.71	11.90	11.53	14.73	28.17dBm	
	High		12.43	12.46	15.46	28.17dBm	
802.11ac(VHT80)	Middle	1.26	11.53	11.73	14.64	28.17dBm	

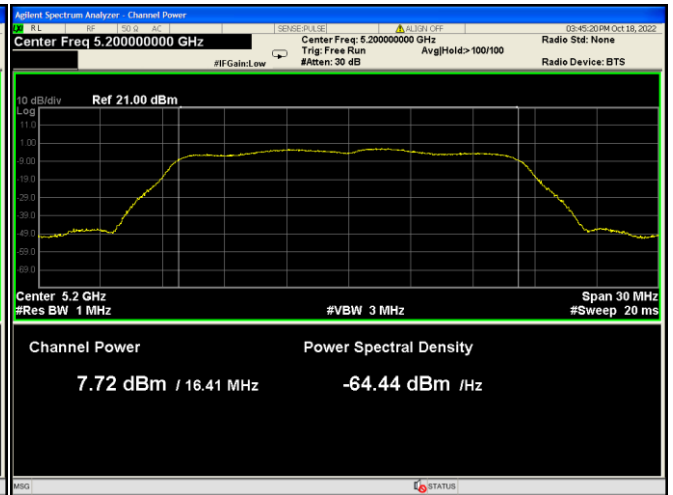
Test plots refer to next page:

**Ant. 1  
U-NII-1**

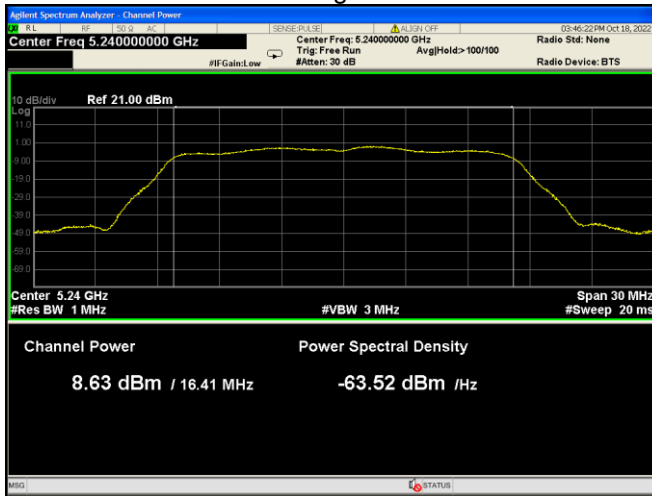
802.11a Low channel



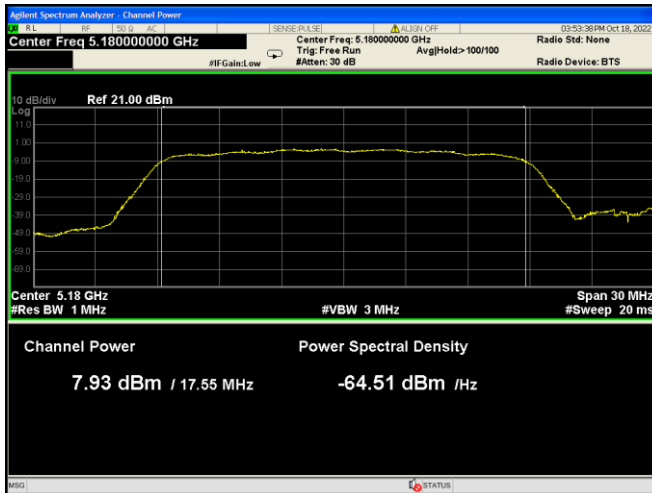
802.11a Middle channel



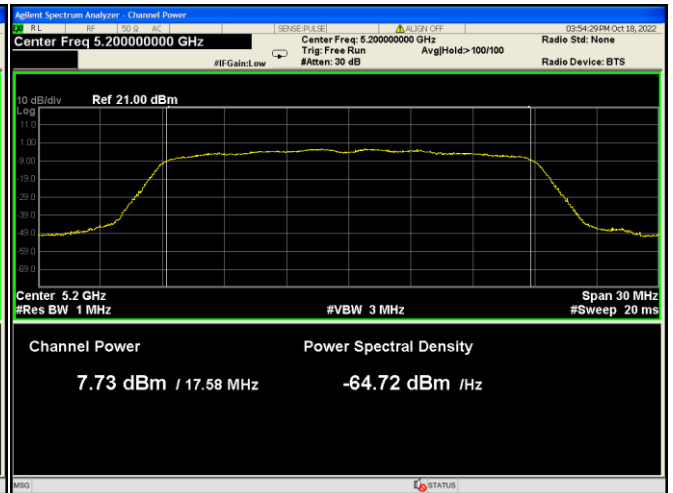
802.11a High channel



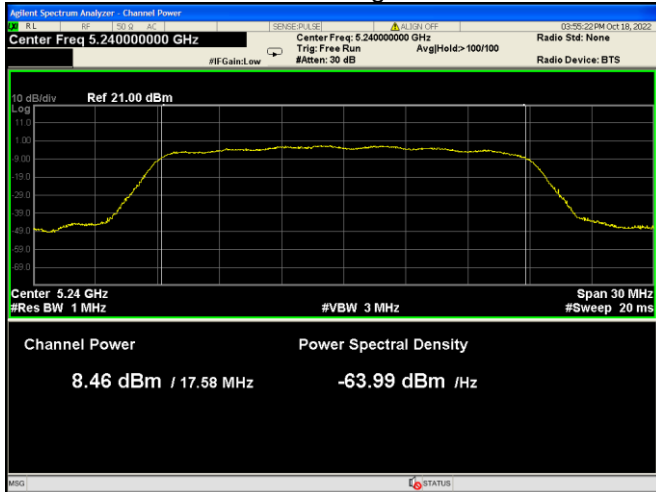
802.11n HT20 Low channel



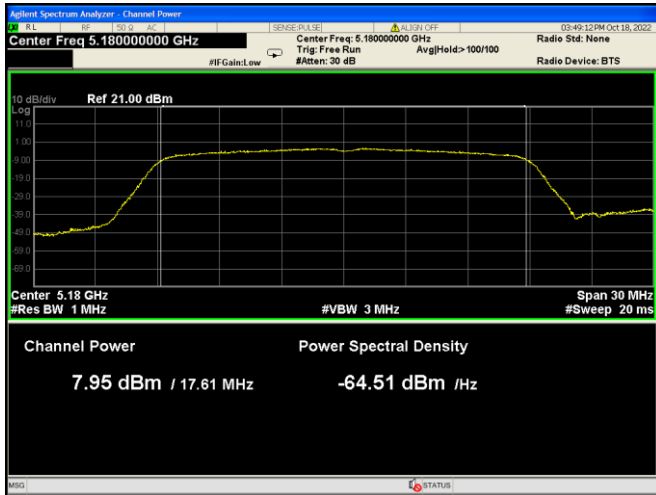
802.11n HT20 Middle channel



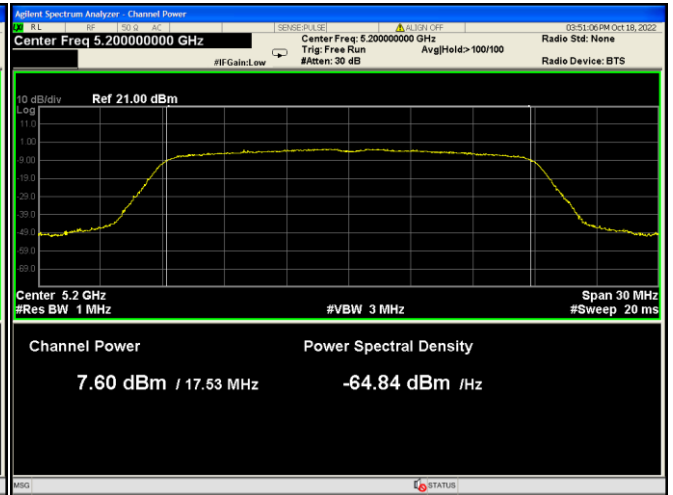
802.11n HT20 High channel



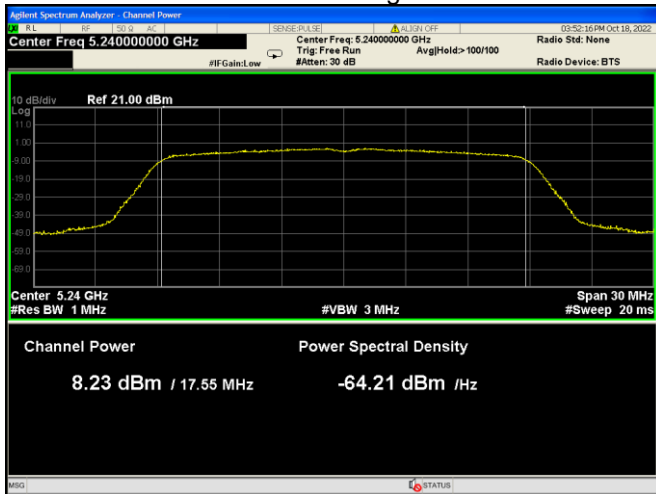
802.11ac VHT20 Low channel



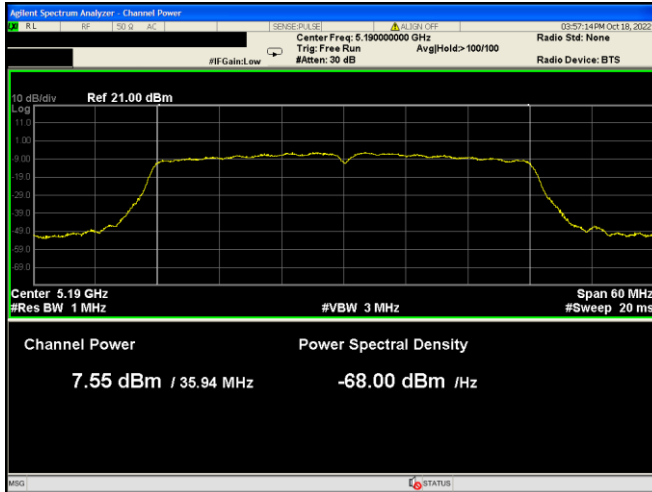
802.11ac VHT20 Middle channel



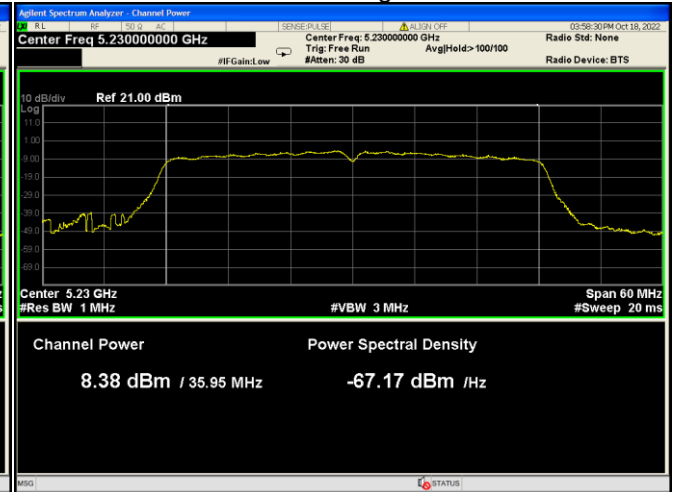
802.11ac VHT20 High channel



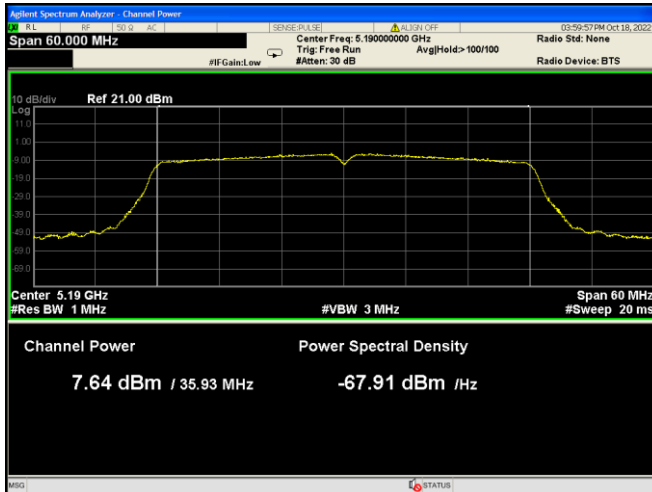
802.11n HT40 Low channel



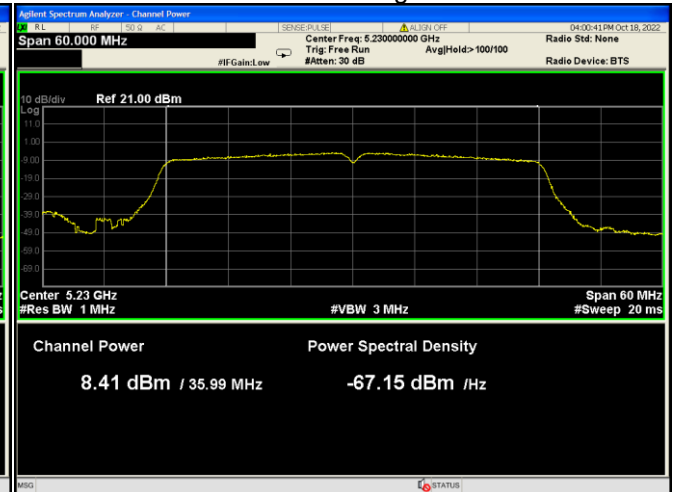
802.11n HT40 High channel



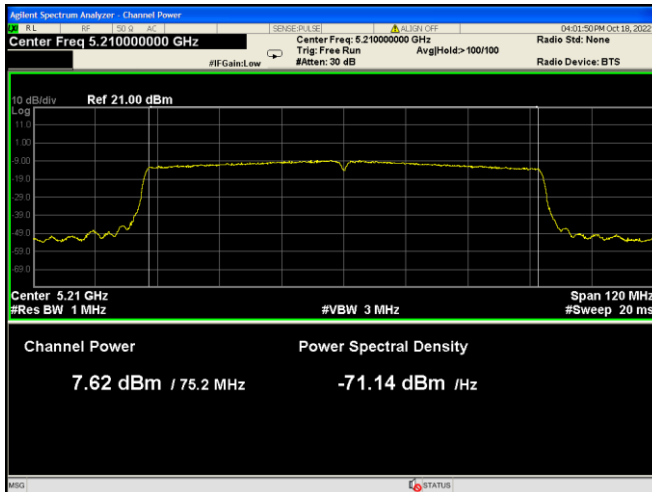
802.11ac VHT40 Low channel



802.11ac VHT40 High channel

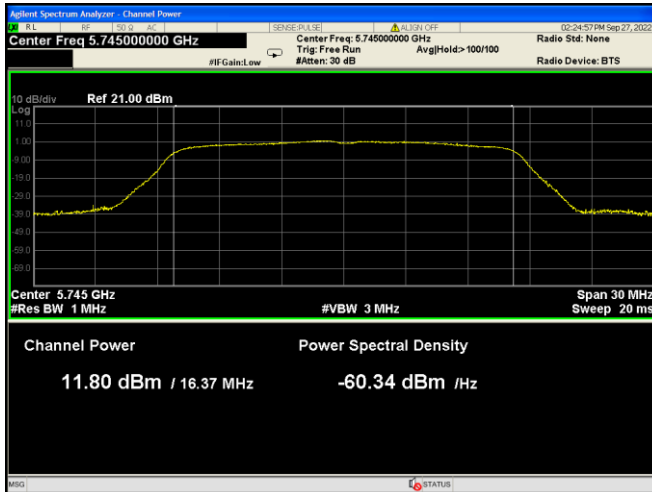


802.11ac VHT80 Middle channel

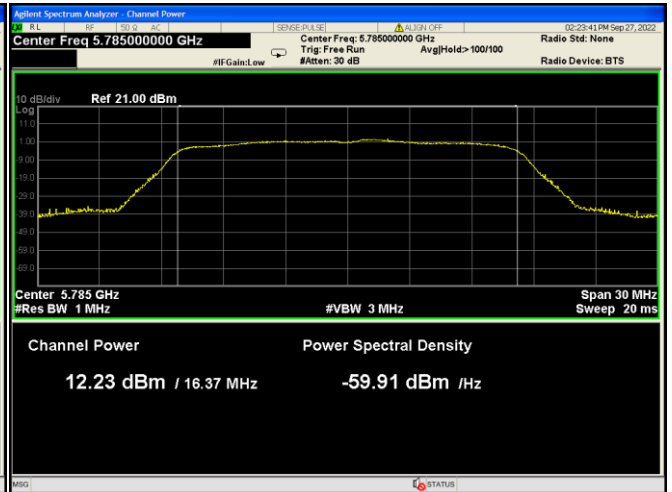


U-NII-3

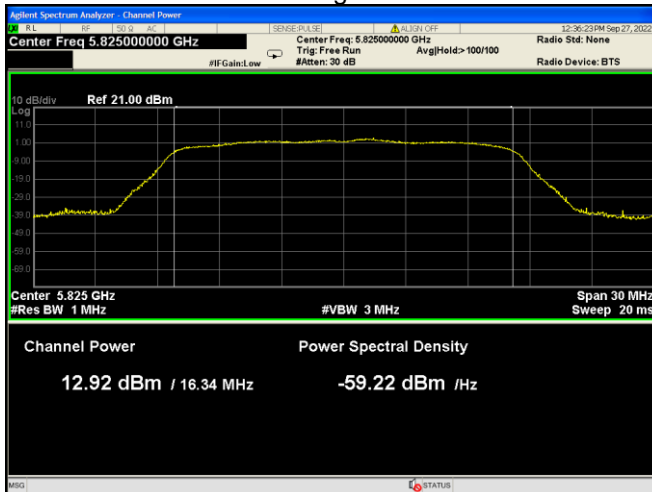
802.11a Low channel



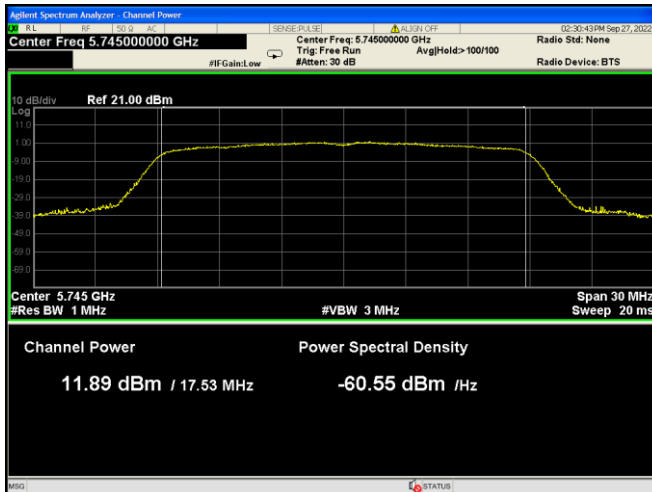
802.11a Middle channel



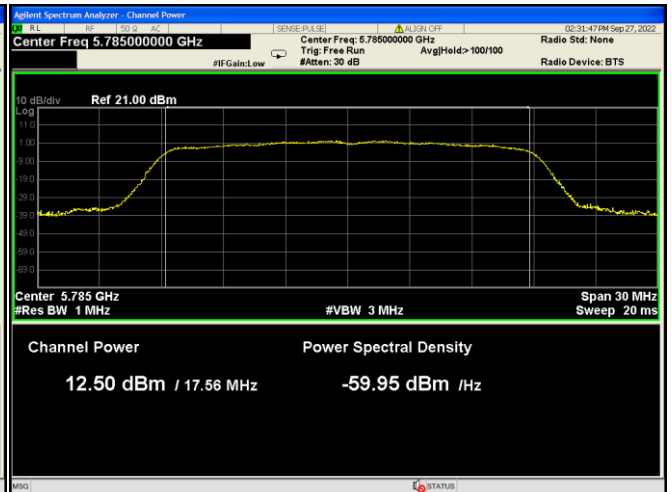
802.11a High channel



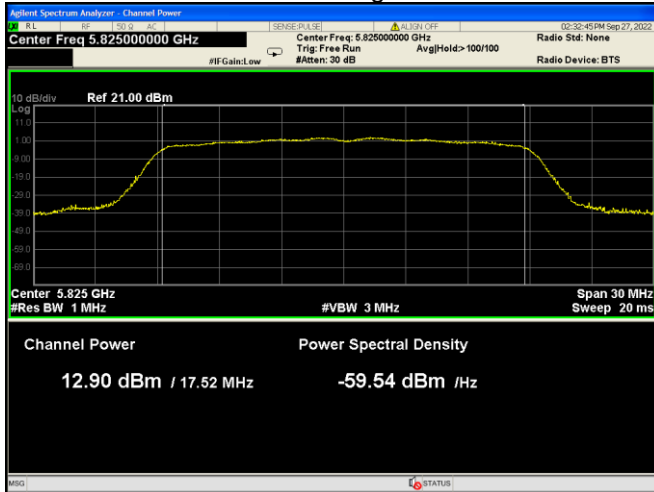
802.11n HT20 Low channel



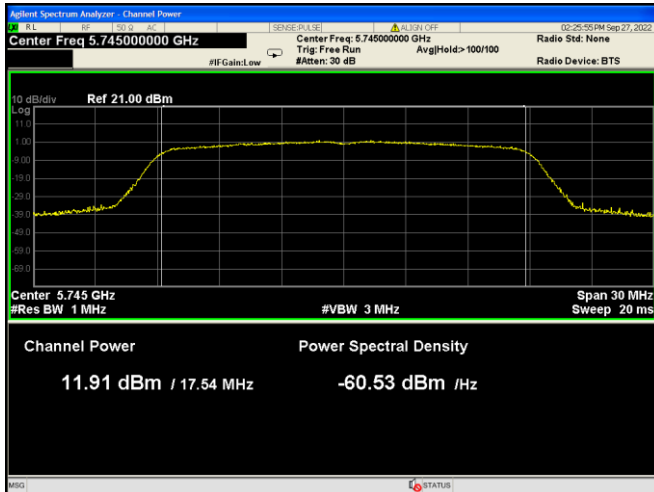
802.11n HT20 Middle channel



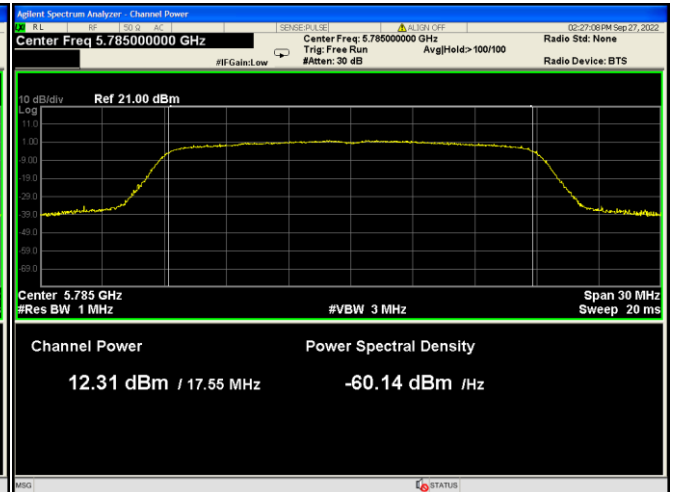
802.11n HT20 High channel



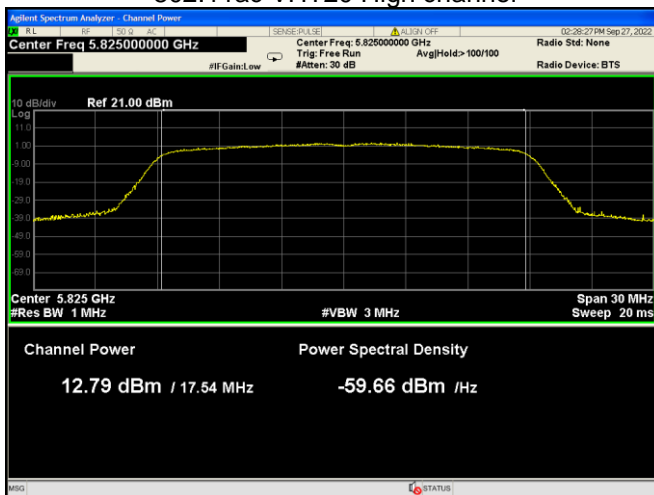
802.11ac VHT20 Low channel



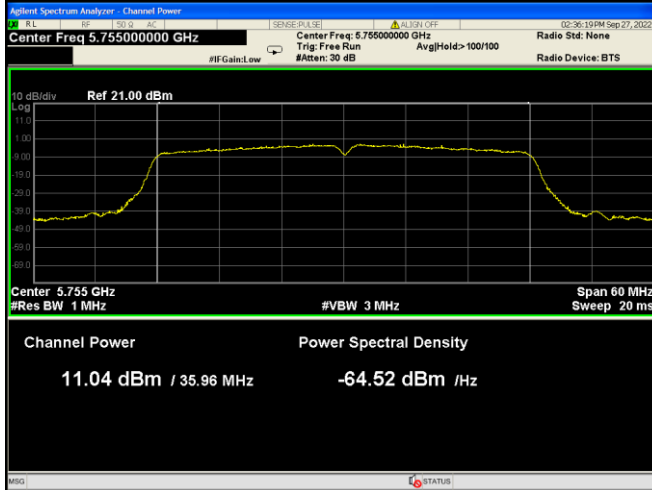
802.11ac VHT20 Middle channel



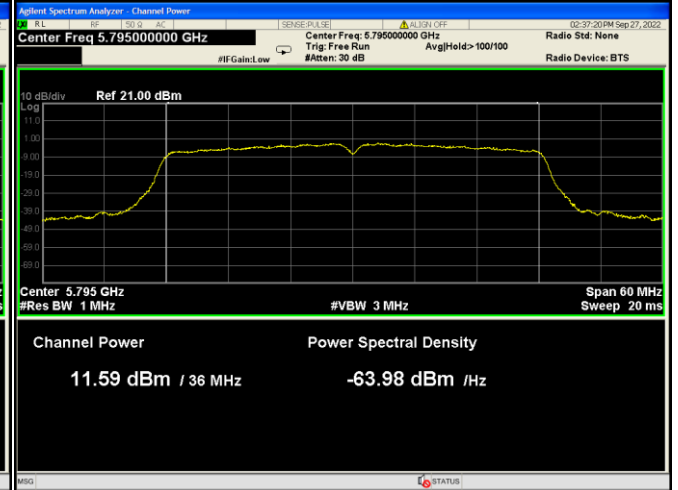
802.11ac VHT20 High channel



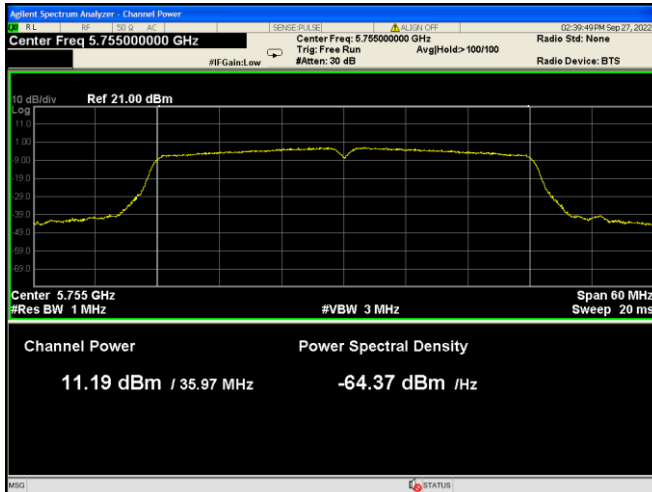
802.11n HT40 Low channel



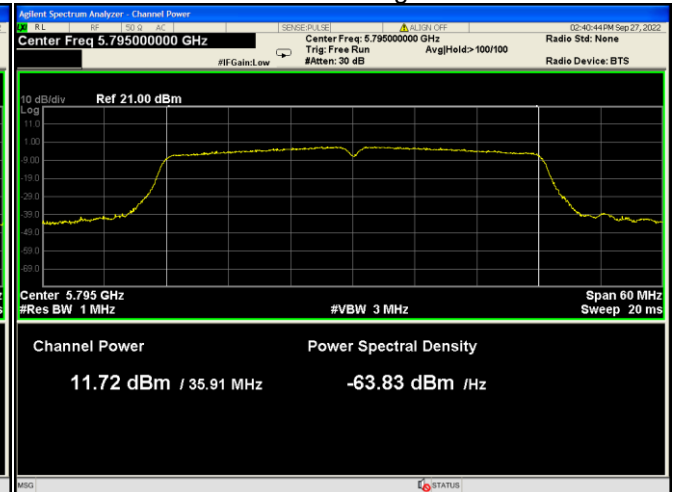
802.11n HT40 High channel



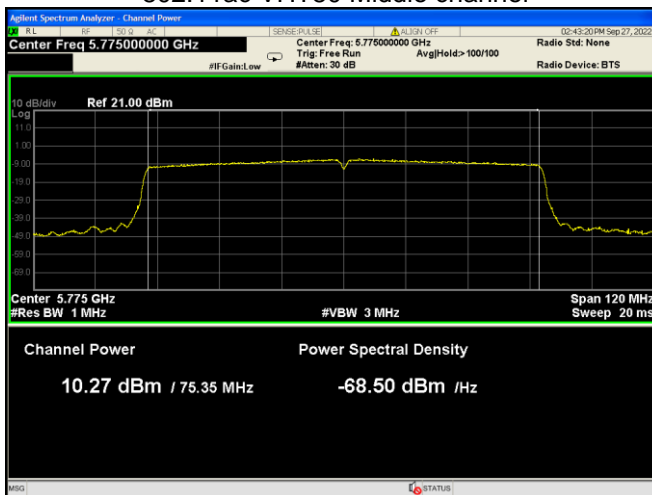
802.11ac VHT40 Low channel



802.11ac VHT40 High channel



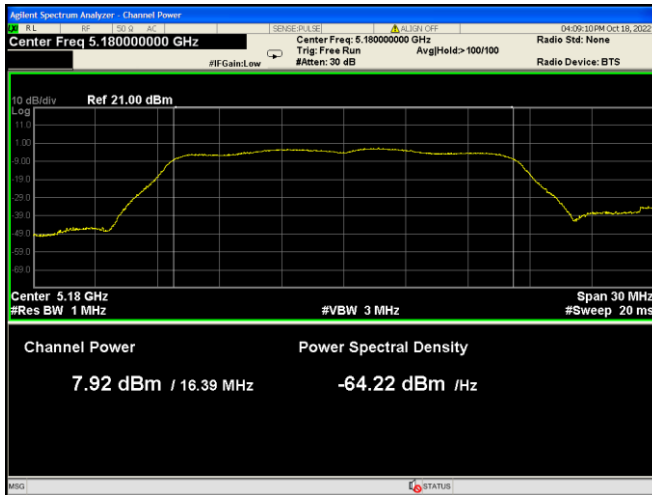
802.11ac VHT80 Middle channel



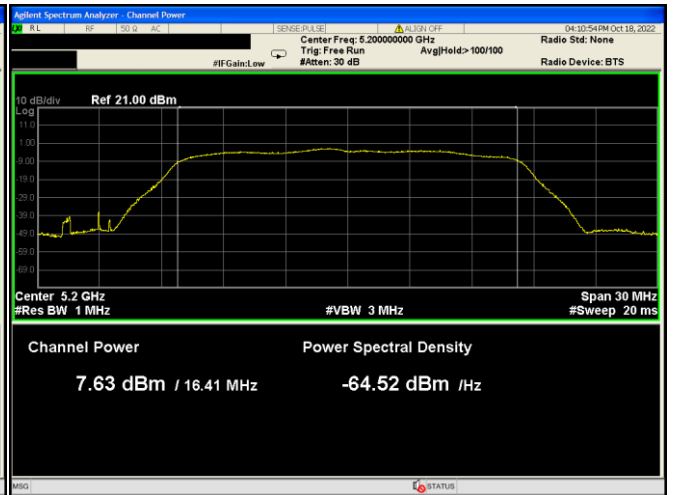


**Ant. 2  
U-NII-1**

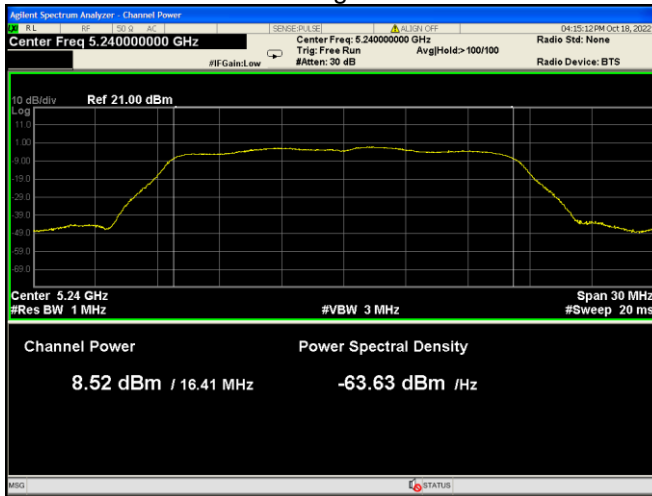
802.11a Low channel



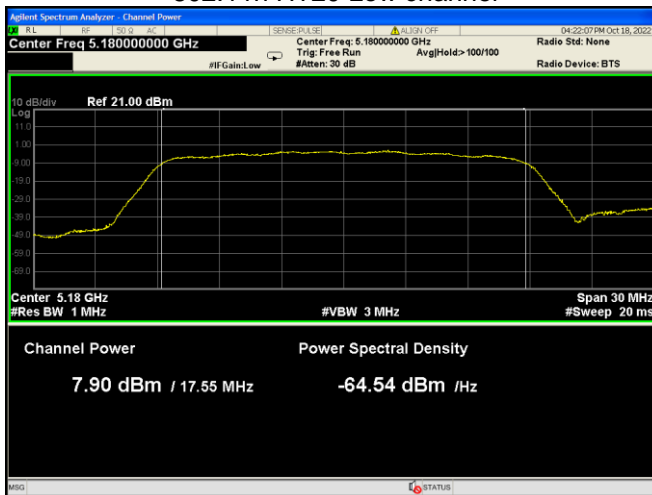
802.11a Middle channel



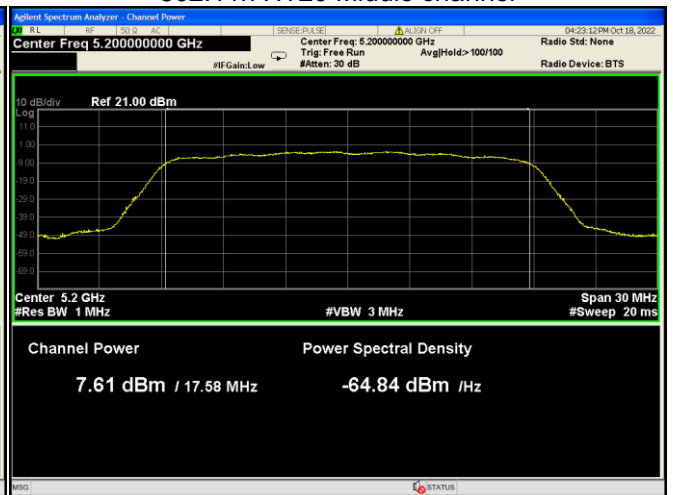
802.11a High channel



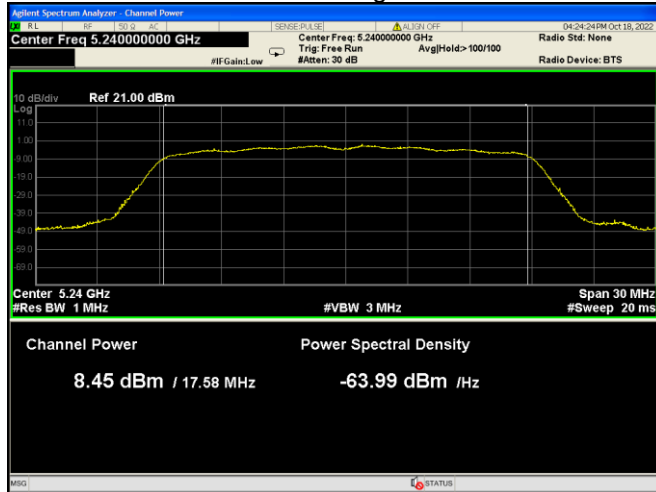
802.11n HT20 Low channel



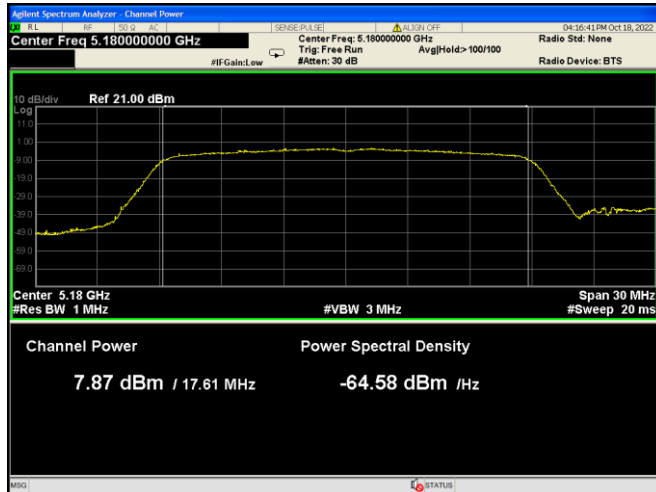
802.11n HT20 Middle channel



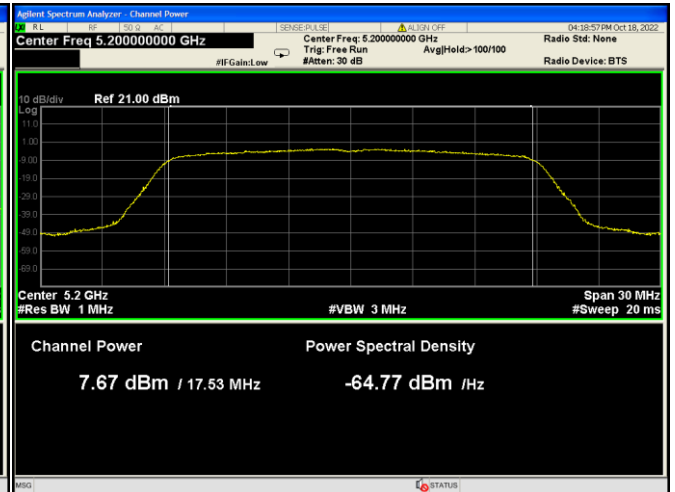
802.11n HT20 High channel



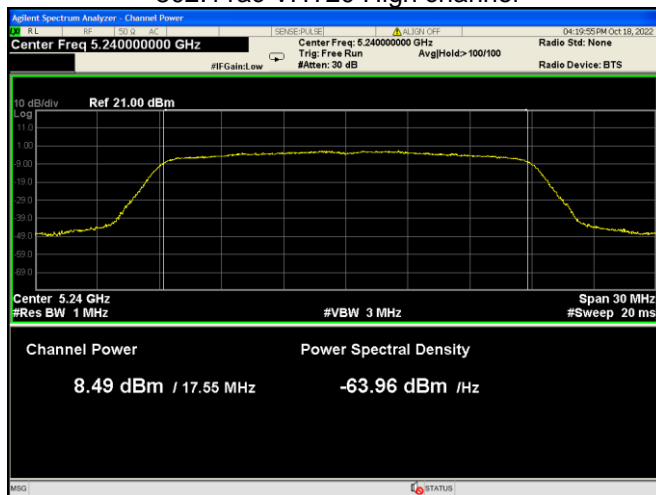
802.11ac VHT20 Low channel



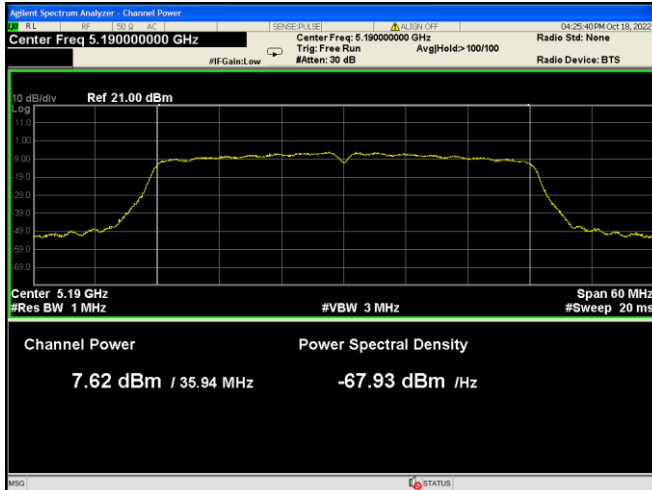
802.11ac VHT20 Middle channel



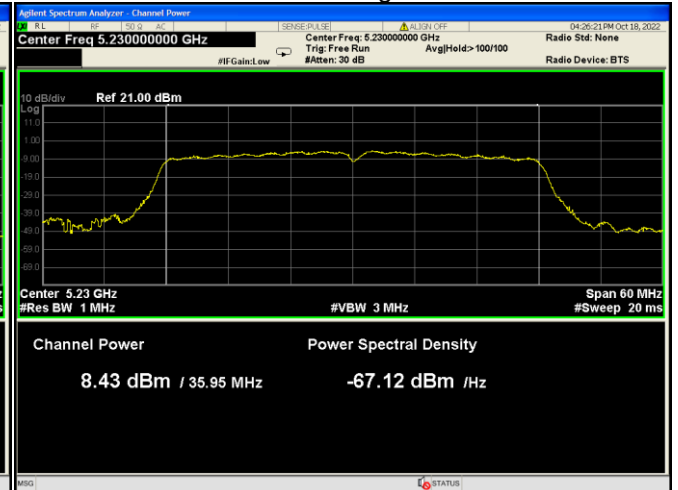
802.11ac VHT20 High channel



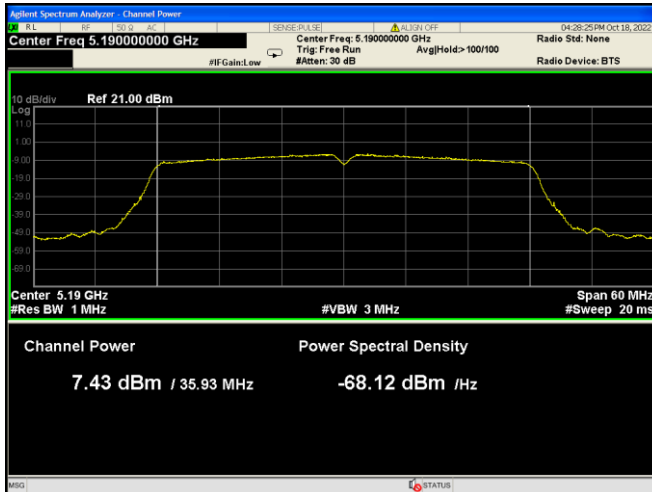
802.11n HT40 Low channel



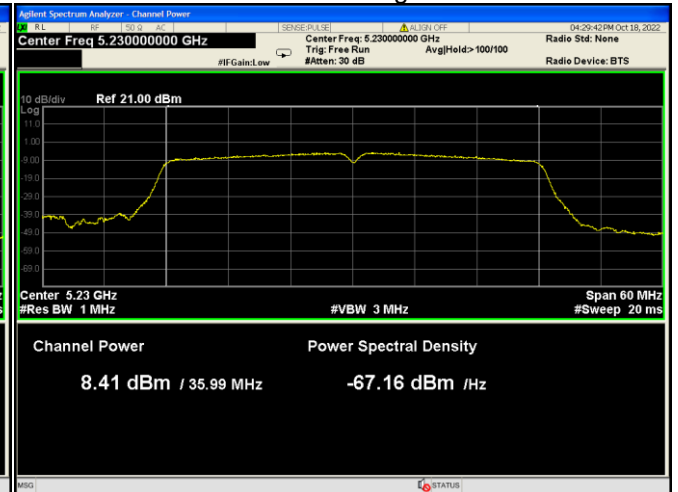
802.11n HT40 High channel



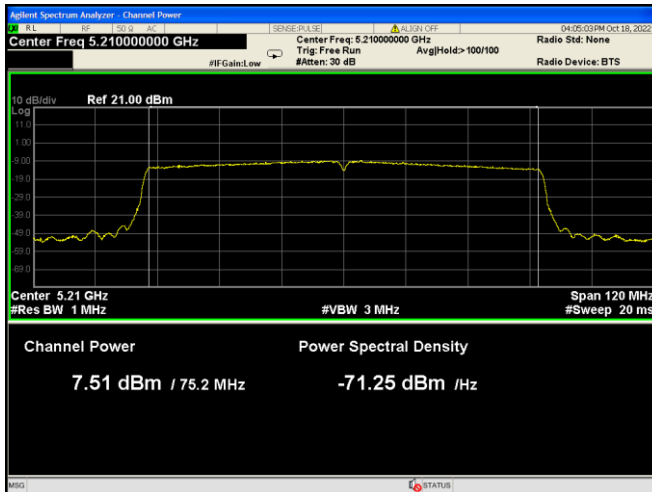
802.11ac VHT40 Low channel



802.11ac VHT40 High channel

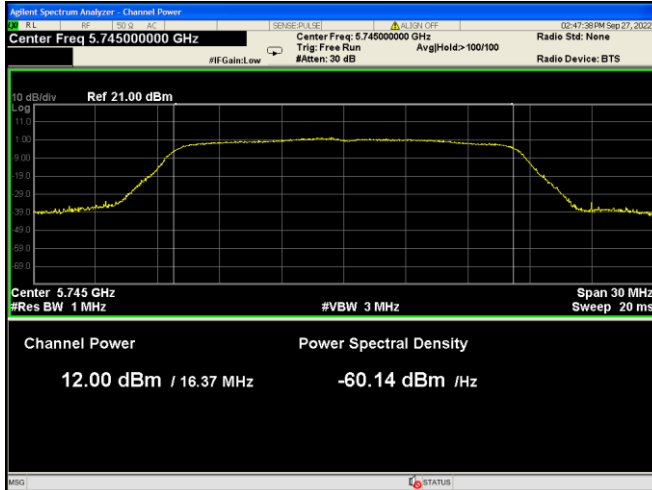


802.11ac VHT80 Middle channel

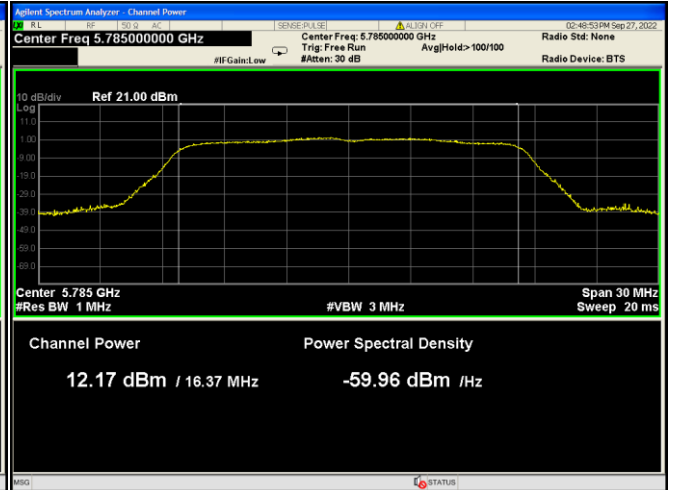


U-NII-3

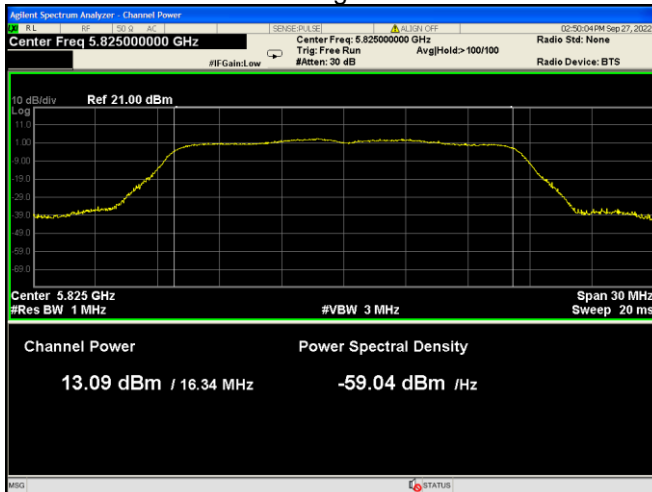
802.11a Low channel



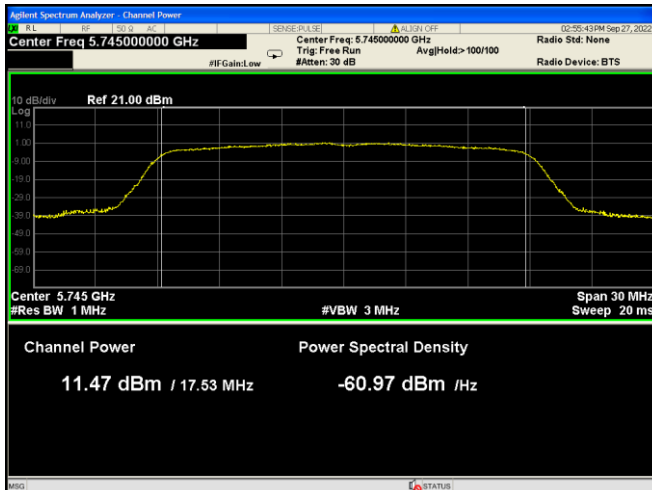
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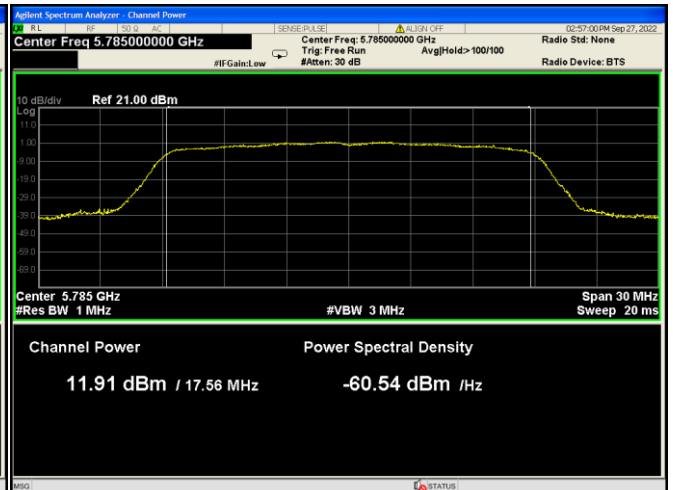
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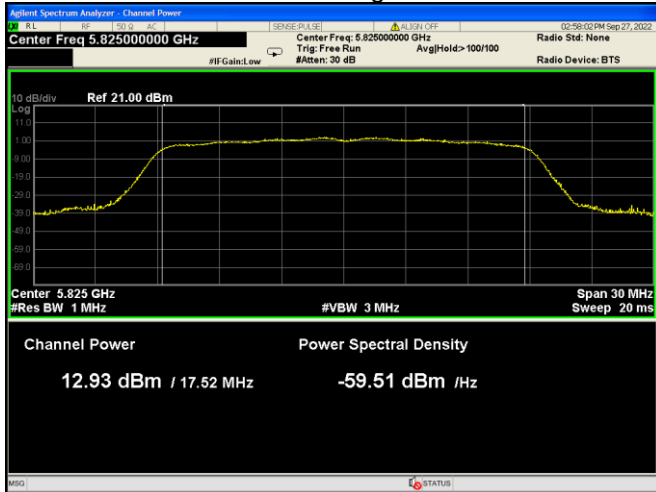
802.11n HT20 Low channel



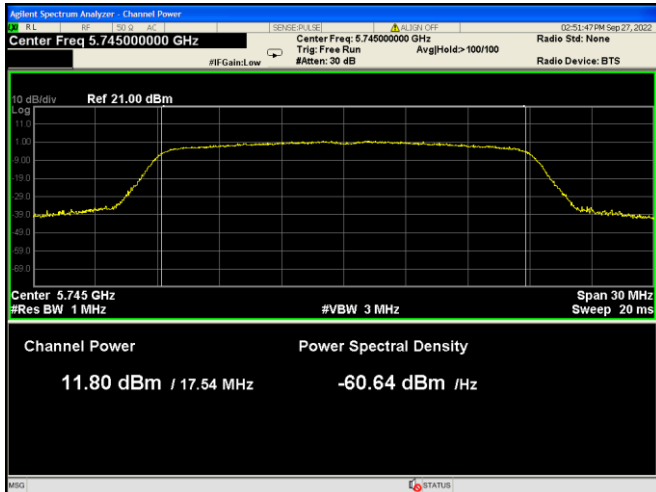
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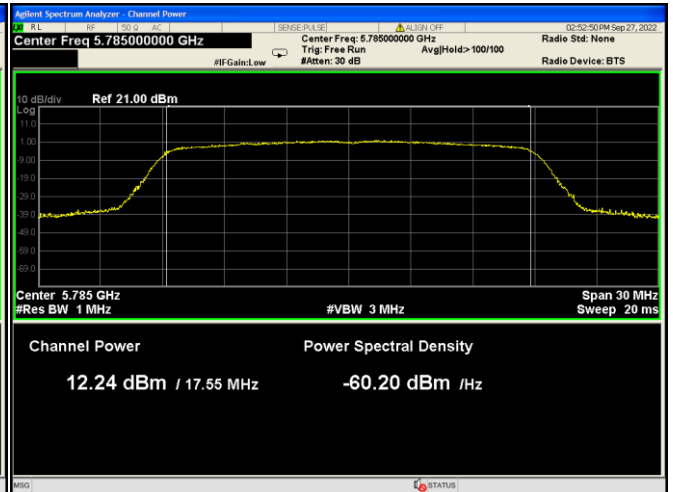
802.11n HT20 High channel



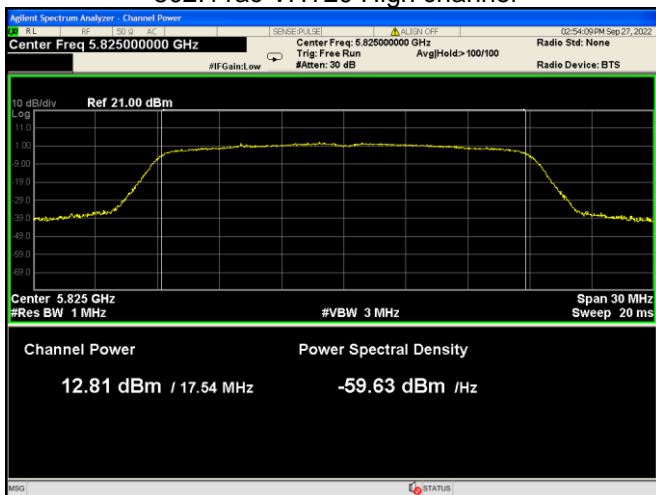
802.11ac VHT20 Low channel



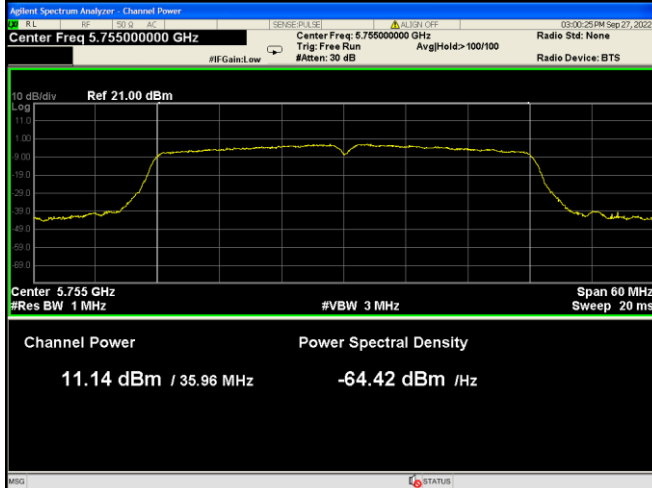
802.11ac VHT20 Middle channel



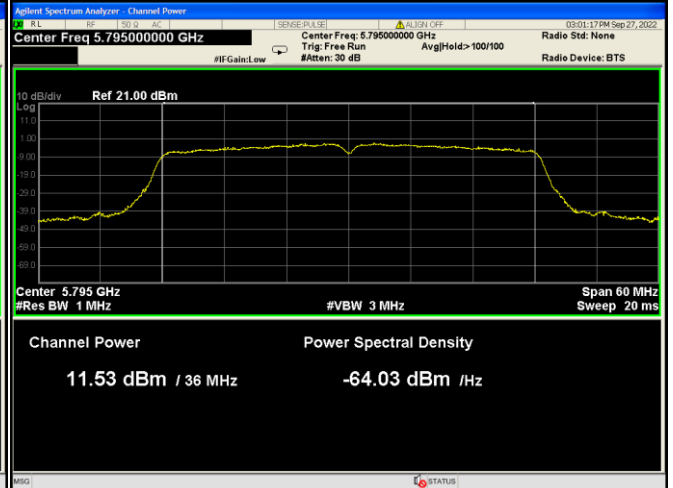
802.11ac VHT20 High channel



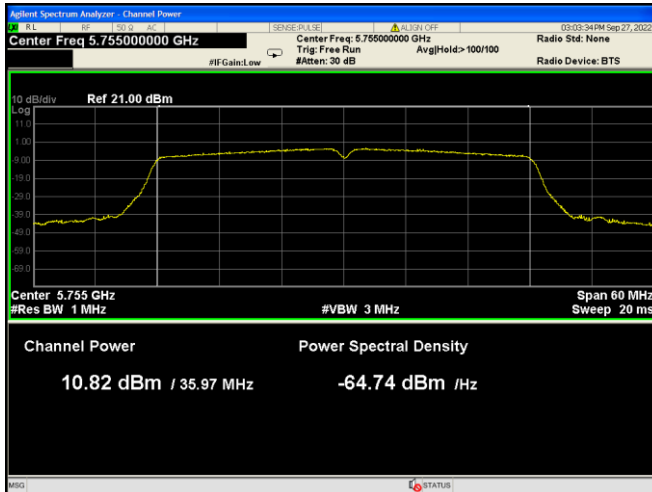
802.11n HT40 Low channel



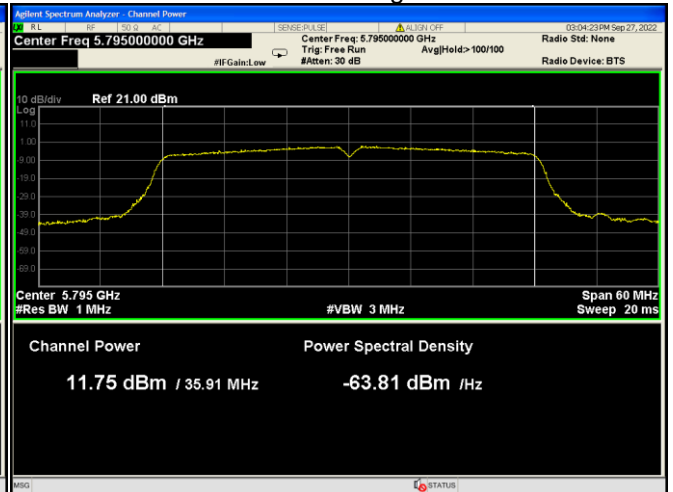
802.11n HT40 High channel



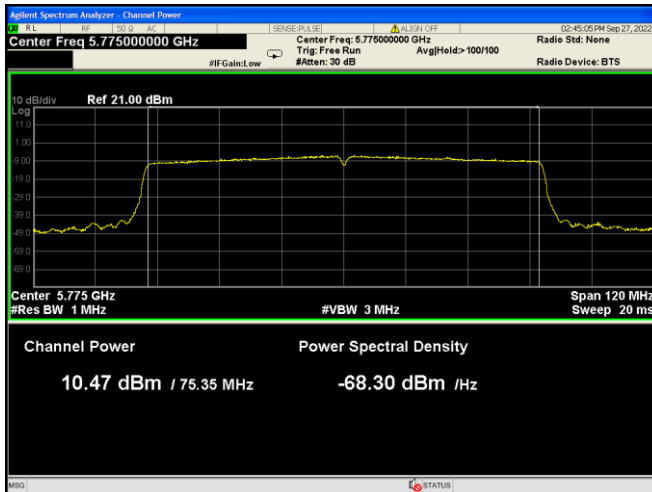
802.11ac VHT40 Low channel



802.11ac VHT40 High channel



802.11ac VHT80 Middle channel



## 15 Power Spectral density

Test Requirement:	FCC CFR47 Part 15 Section 15.407(a) KDB 662911 D01 Multiple Transmitter Output v02r01, October 31, 2013 ANSI C63.10:2013
Test Method:	KDB 789033 D02 General UNII Test Procedures New Rules v02r01, Section F
Test Limit:	<b>For the band 5.15-5.25 GHz</b> For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. <b>For the 5.25-5.35 GHz and 5.47-5.725 GHz bands</b> The maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. <b>For the band 5.725-5.850 GHz</b> The maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.
Test Result:	PASS

### 15.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum analyzer.
2. Refer to section 4 of this report, according to KDB 789033 and ANSI C63.10, select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each).
3. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
4. 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 II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
5. The result is the Maximum PSD over 1 MHz reference bandwidth.
6. For devices operating in the band 5.725–5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz).

## 15.2 Test Result:

Band	Operation mode	Channel	Duty Cycle Factor (dB)	Power Spectral density (dBm)			
				Ant. 1	Ant. 2	SUM	Limit
U-NII-1	802.11a	Low	0.21	-2.36	-2.41	/	17dBm/MHz
		Middle		-2.41	-2.58	/	17dBm/MHz
		High		-1.41	-1.38	/	17dBm/MHz
	802.11n(HT20)	Low	0.22	-2.35	-2.34	0.67	15.3dBm/MHz
		Middle		-2.50	-2.52	0.50	15.3dBm/MHz
		High		-1.76	-1.73	1.27	15.3dBm/MHz
	802.11ac(VHT20)	Low	0.39	-2.38	-2.12	0.76	15.3dBm/MHz
		Middle		-2.58	-2.41	0.52	15.3dBm/MHz
		High		-1.42	-1.49	1.56	15.3dBm/MHz
	802.11n(HT40)	Low	0.39	-5.20	-5.10	-2.14	15.3dBm/MHz
		High		-4.77	-4.63	-1.69	15.3dBm/MHz
	802.11ac(VHT40)	Low	0.71	-4.91	-4.83	-1.86	15.3dBm/MHz
High		-4.30		-4.38	-1.33	15.3dBm/MHz	
802.11ac(VHT80)	Middle	1.21	-8.03	-7.88	-4.94	15.3dBm/MHz	
U-NII-3	802.11a	Low	0.21	4.68	4.83	/	30dBm/500kHz
		Middle		4.93	4.92	/	30dBm/500kHz
		High		5.04	4.98	/	30dBm/500kHz
	802.11n(HT20)	Low	0.23	4.52	4.56	7.55	28.17dBm/500kHz
		Middle		4.71	4.81	7.77	28.17dBm/500kHz
		High		4.90	5.06	7.99	28.17dBm/500kHz
	802.11ac(VHT20)	Low	0.41	4.90	4.67	7.79	28.17dBm/500kHz
		Middle		5.14	4.84	8.00	28.17dBm/500kHz
		High		5.33	5.11	8.23	28.17dBm/500kHz
	802.11n(HT40)	Low	0.40	2.67	2.60	5.64	28.17dBm/500kHz
		High		2.98	3.23	6.12	28.17dBm/500kHz
	802.11ac(VHT40)	Low	0.71	2.66	2.88	5.78	28.17dBm/500kHz
High		3.10		3.37	6.24	28.17dBm/500kHz	
802.11ac(VHT80)	Middle	1.26	-0.34	0.13	2.91	28.17dBm/500kHz	



**Note:****Conducted Output Power = Measurements + Duty Cycle Factor**

According to ANSI C63.10 clause 14.4.3.1,

$$\text{Directional gain} = \text{antenna gain} + 10\log(N)$$

N is number of array elements or staves

According to ANSI C63.10 clause 11.7,

For those cases where it is specified that the conducted output power be reduced by the amount in dB that the directional gain of the transmitting antenna exceeds 6dBi, the output power effective limit shall be calculated as follows in Equation:

$$P_{\text{out}} = P_{\text{Limit}} - (G_{\text{TX}} - 6)$$

For U-NII-1: the Directional gain is 7.7dBi that greater than 6dBi, Limit of PSD (SUM) is **15.3dBm/MHz**.

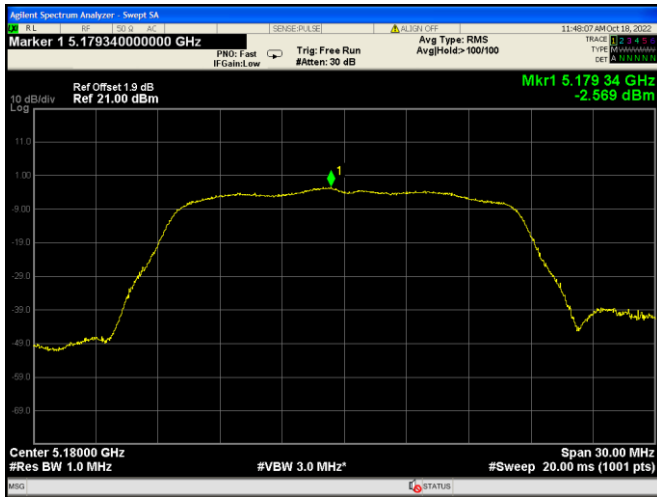
For U-NII-3: the Directional gain is 7.83dBi that greater than 6dBi, Limit of PSD (SUM) is

**28.17dBm/500kHz**.

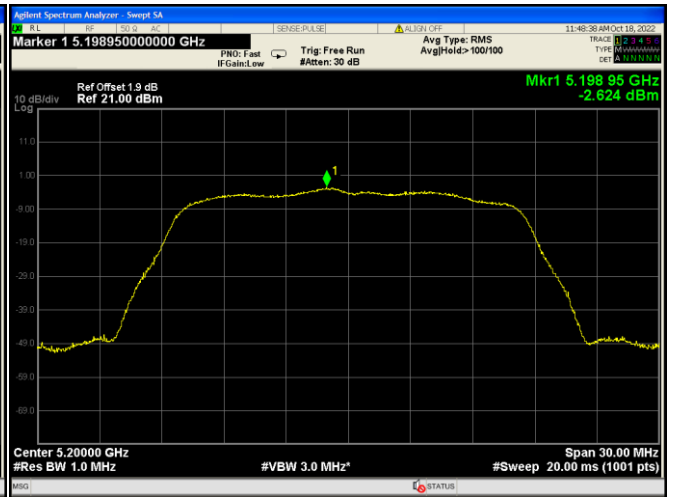
Test plots refer to next page:

Ant. 1  
U-NII-1

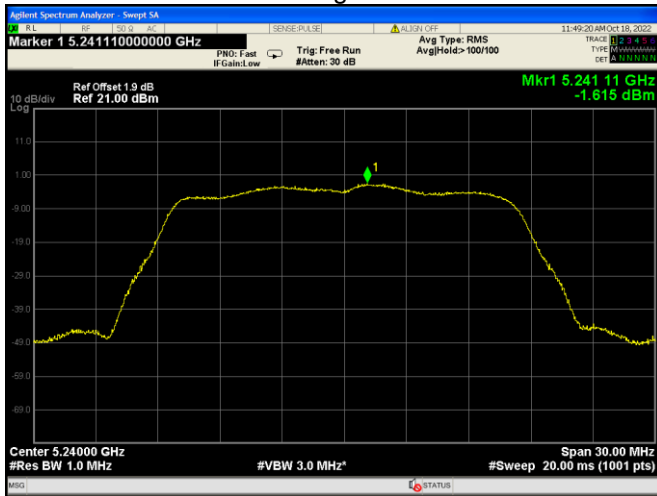
802.11a Low channel



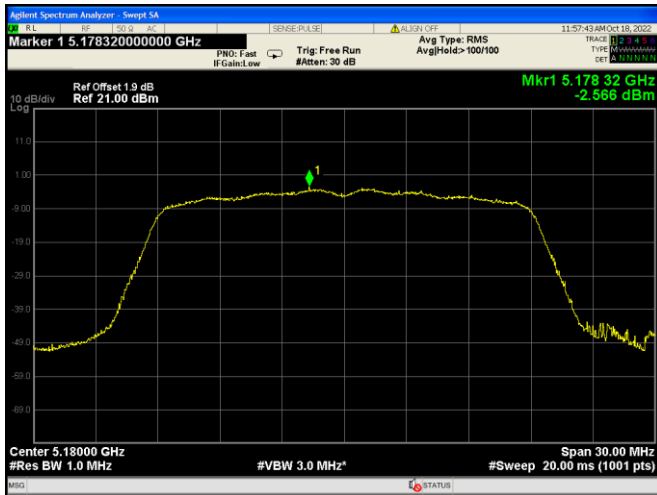
802.11a Middle channel



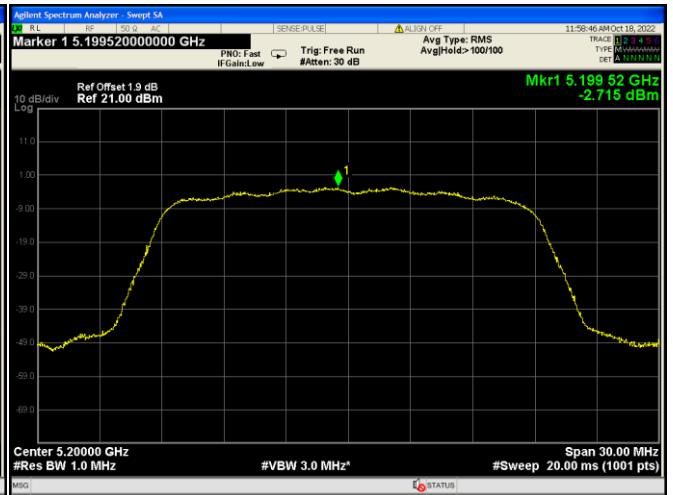
802.11a High channel



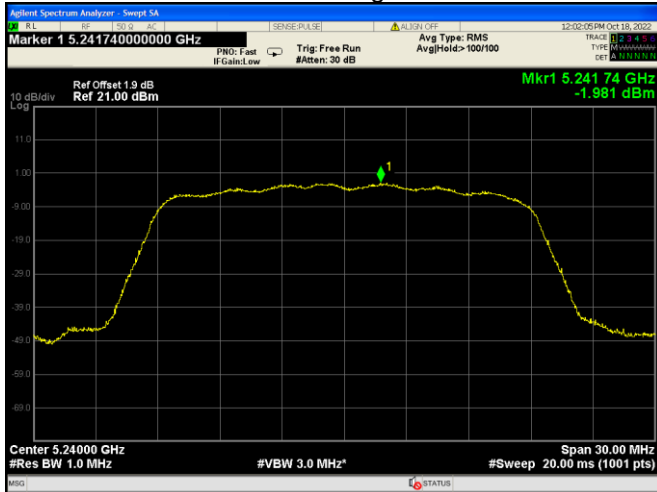
802.11n HT20 Low channel



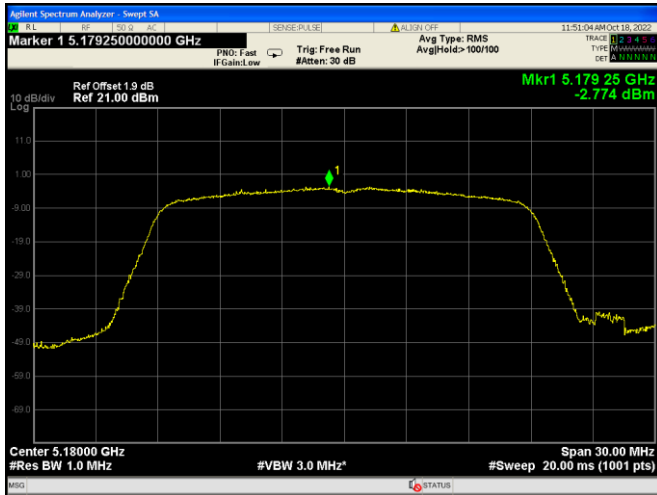
802.11n HT20 Middle channel



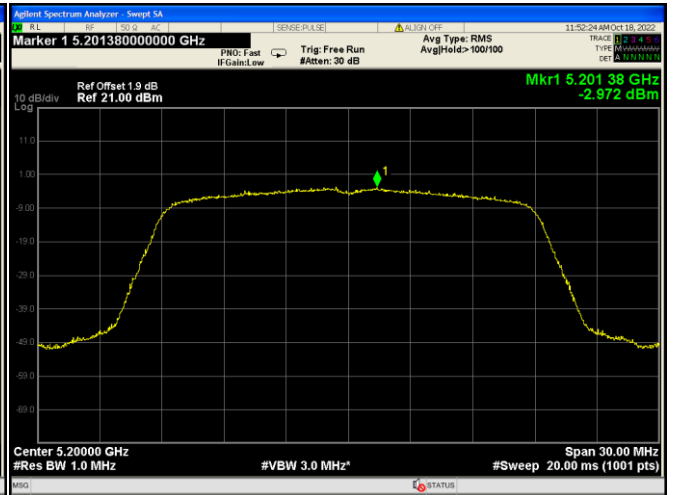
802.11n HT20 High channel



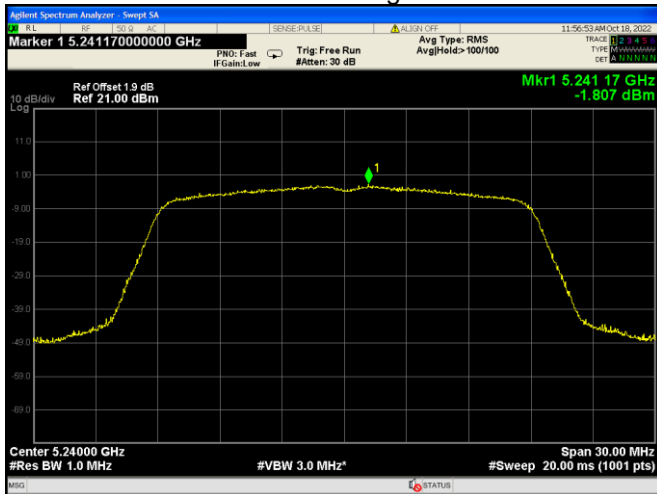
802.11ac VHT20 Low channel



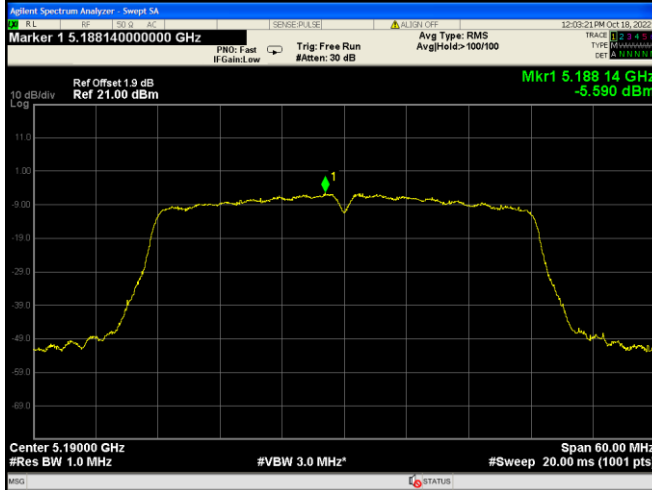
802.11ac VHT20 Middle channel



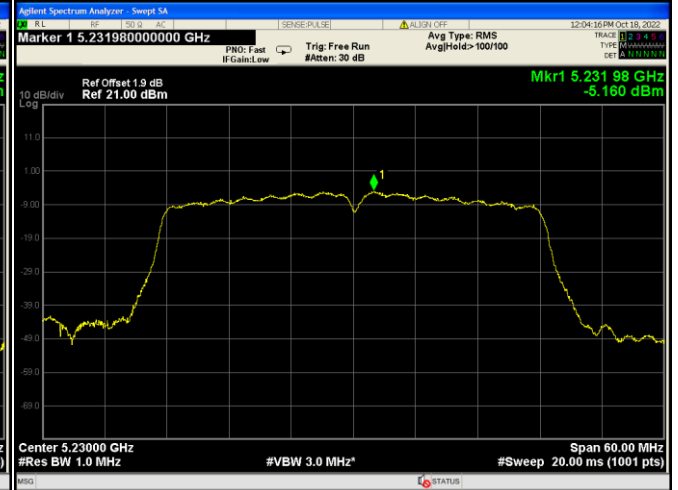
802.11ac VHT20 High channel



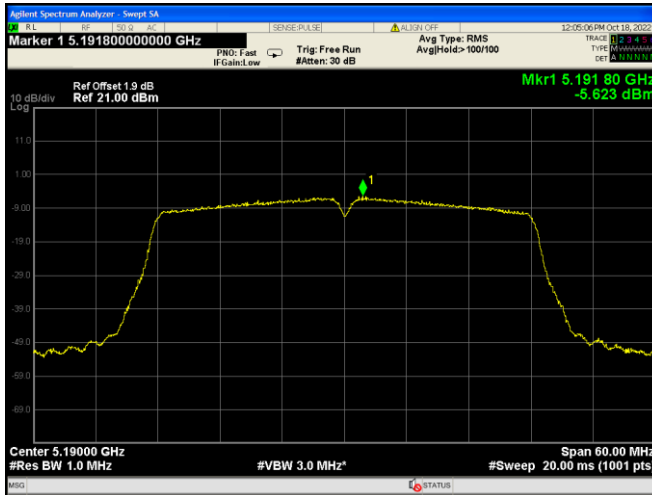
802.11n HT40 Low channel



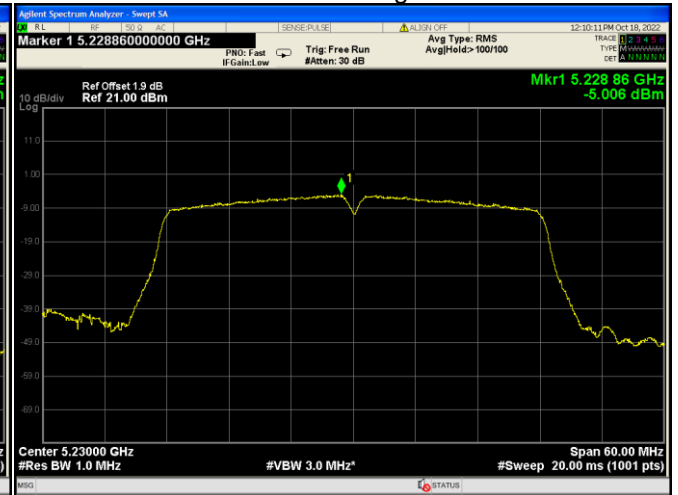
802.11n HT40 High channel



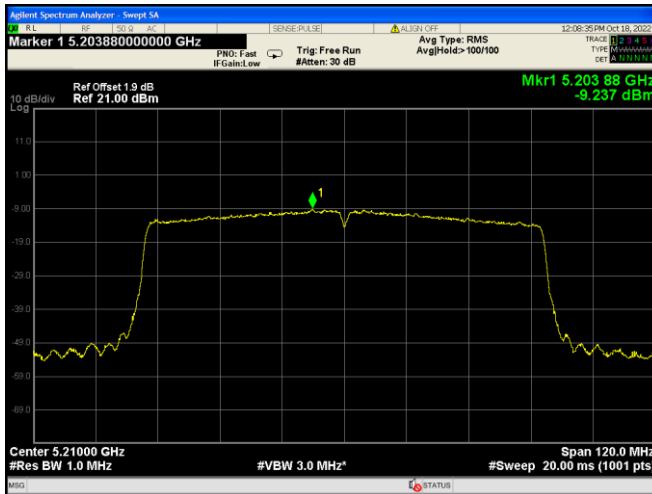
802.11ac VHT40 Low channel



802.11ac VHT40 High channel

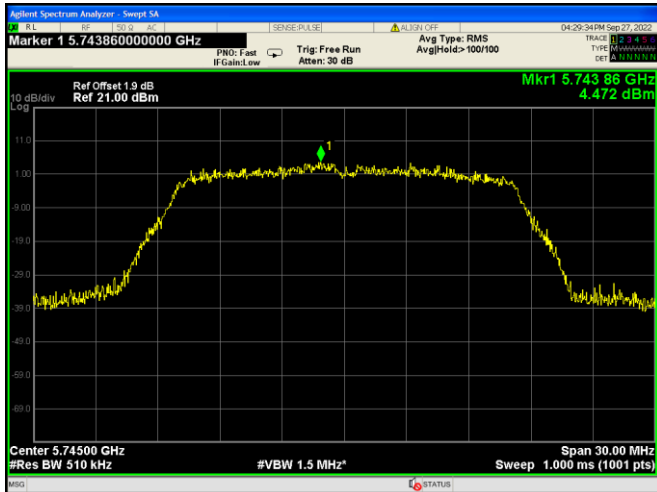


802.11ac VHT80 Middle channel

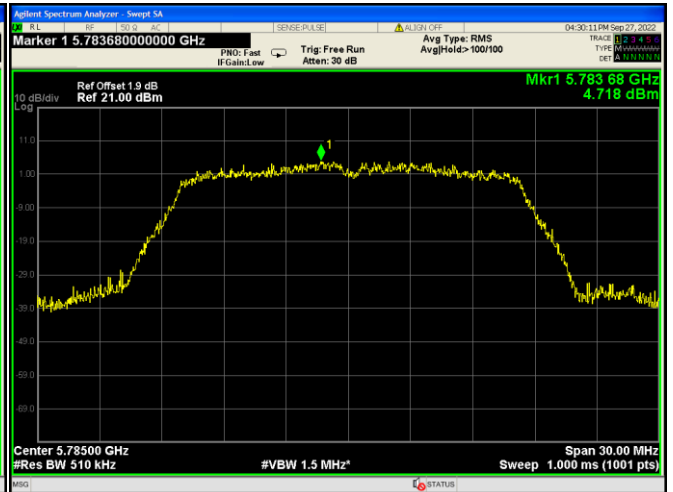


U-NII-3

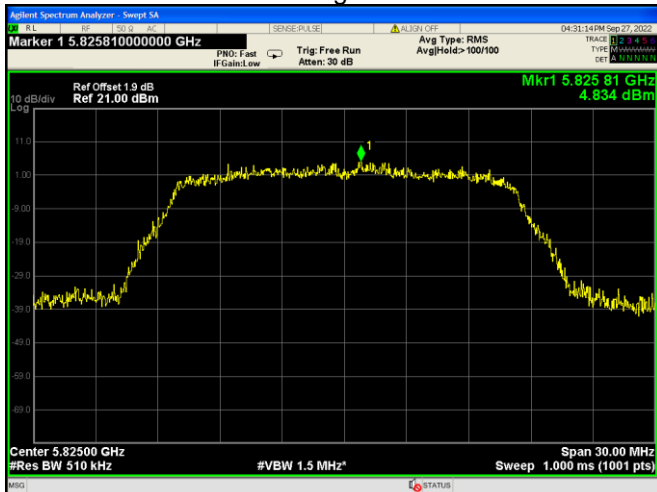
802.11a Low channel



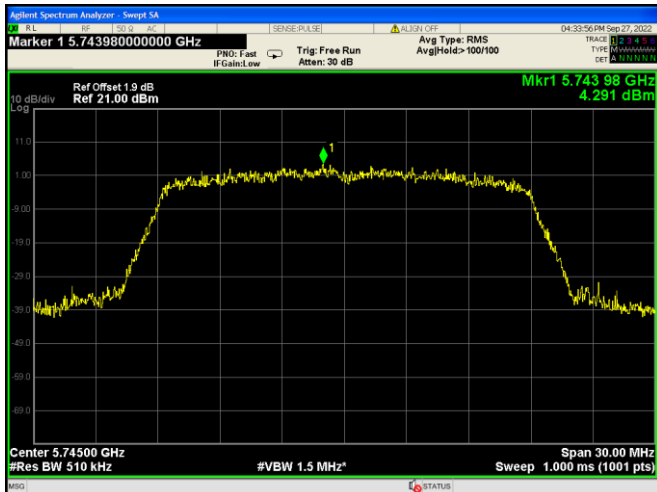
802.11a Middle channel



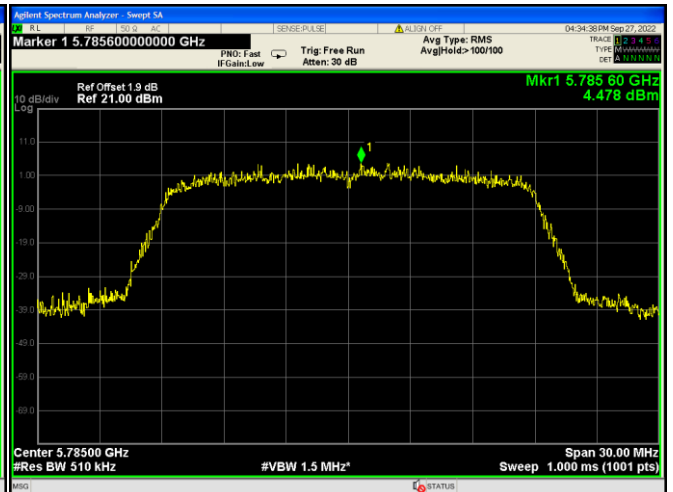
802.11a High channel



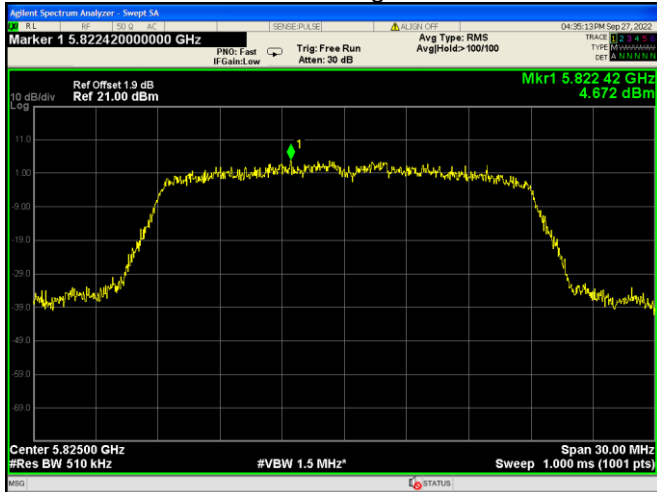
802.11n HT20 Low channel



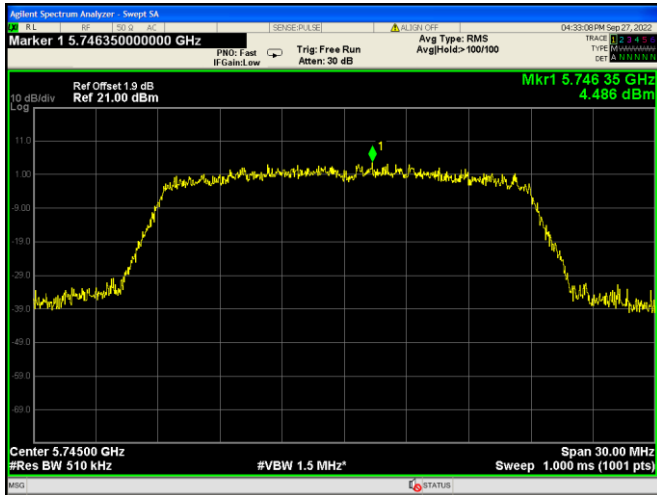
802.11n HT20 Middle channel



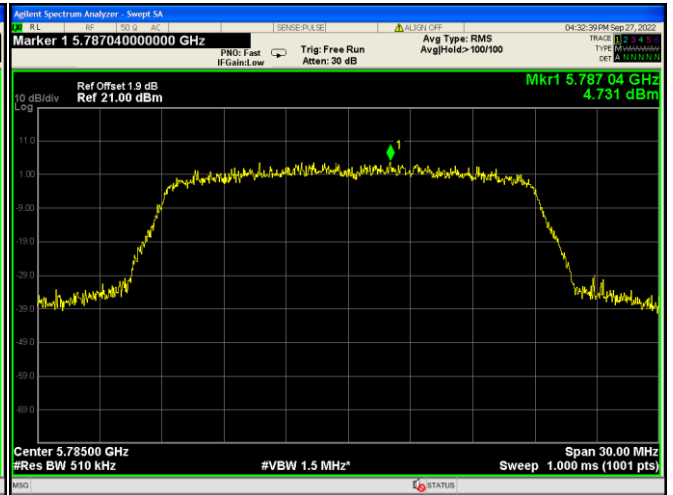
802.11n HT20 High channel



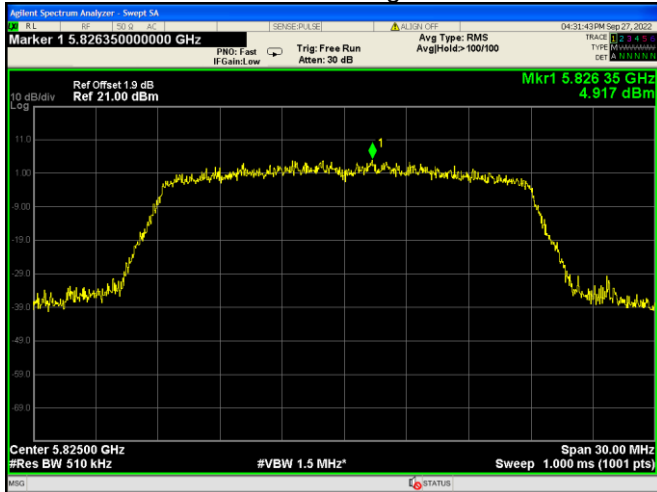
802.11ac VHT20 Low channel



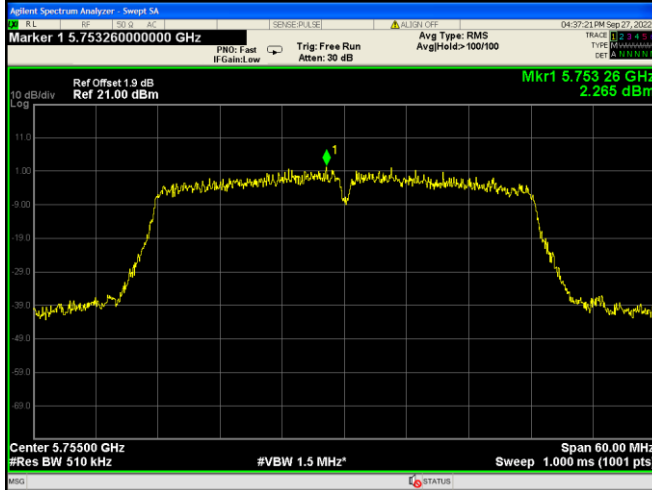
802.11ac VHT20 Middle channel



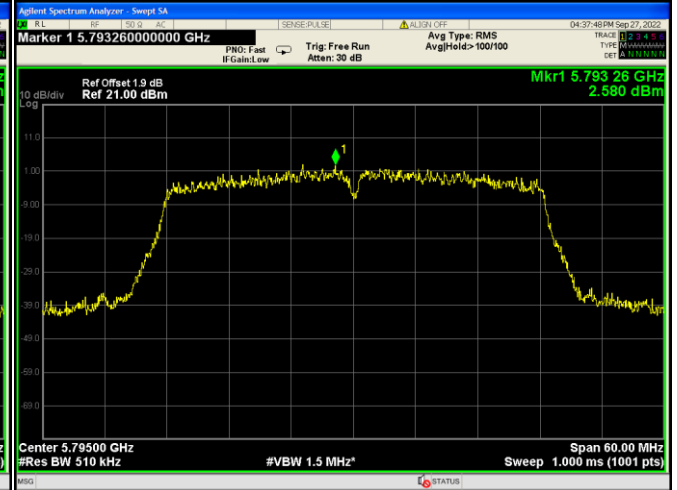
802.11ac VHT20 High channel



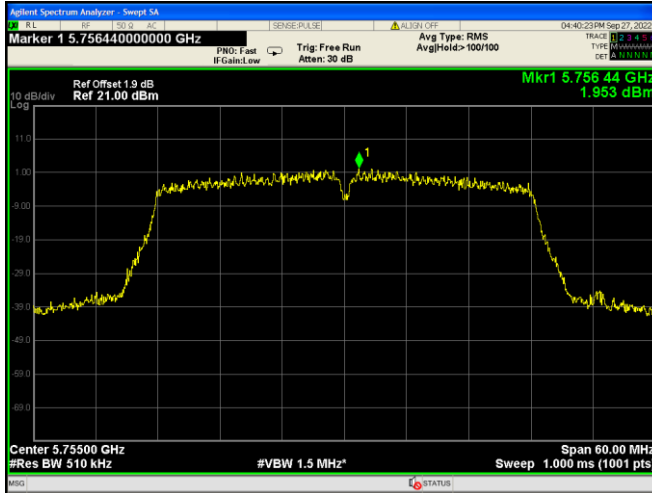
802.11n HT40 Low channel



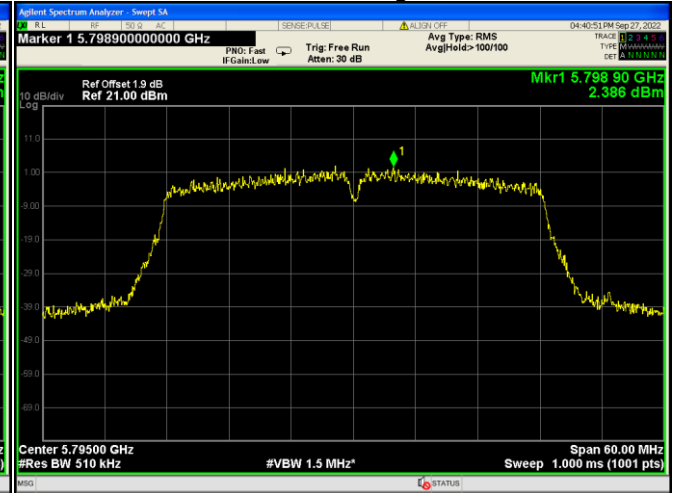
802.11n HT40 High channel



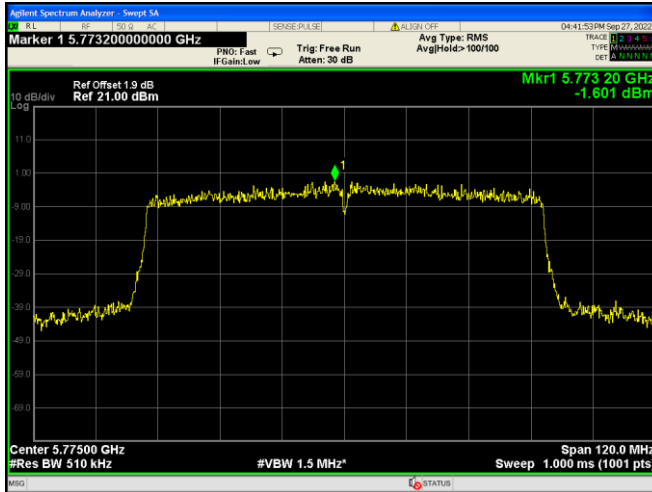
802.11ac VHT40 Low channel



802.11ac VHT40 High channel

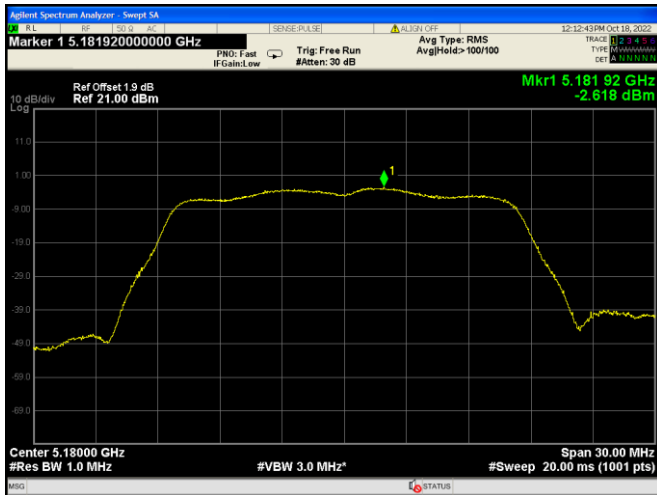


802.11ac VHT80 Middle channel

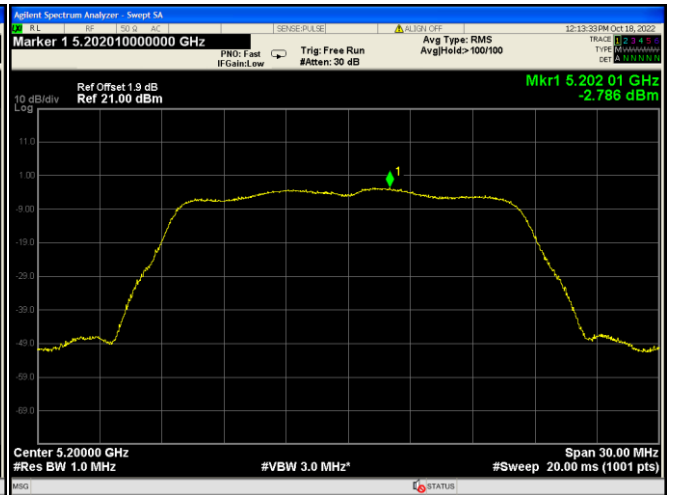


Ant. 2  
U-NII-1

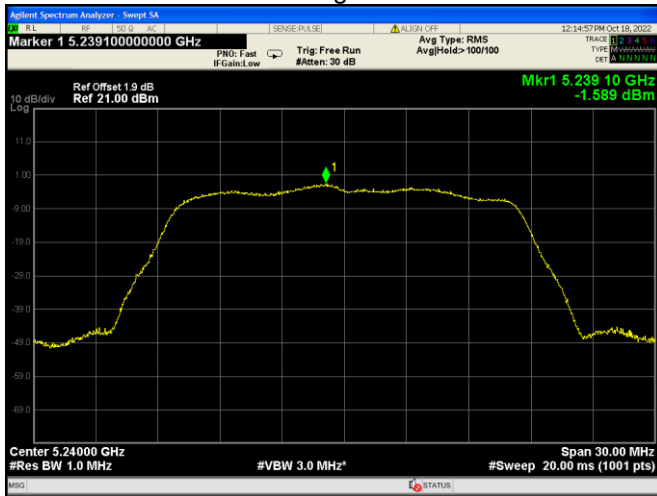
802.11a Low channel



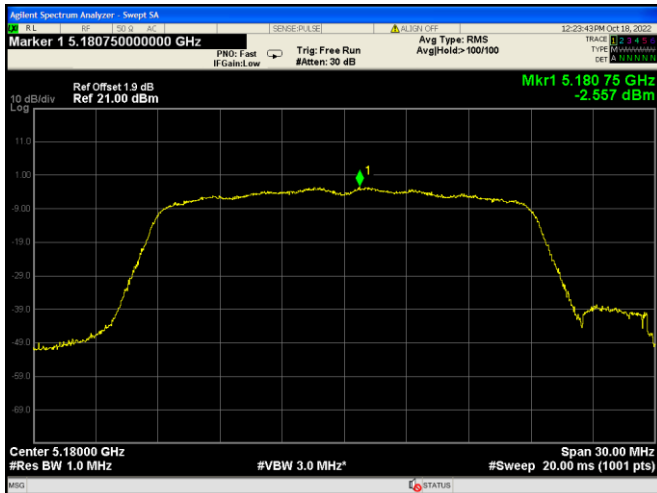
802.11a Middle channel



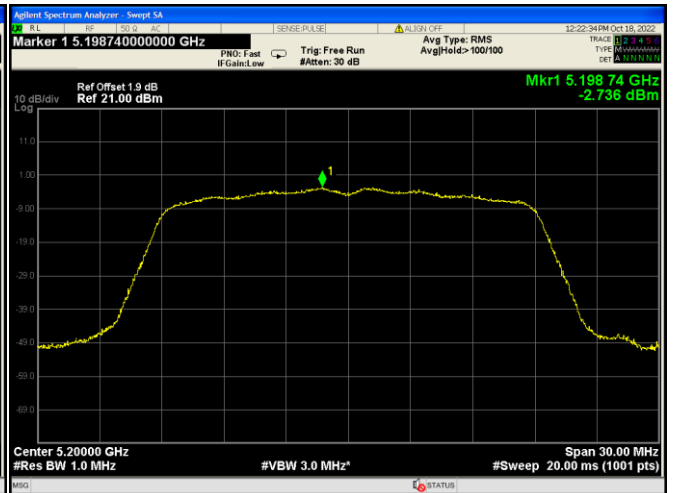
802.11a High channel



802.11n HT20 Low channel

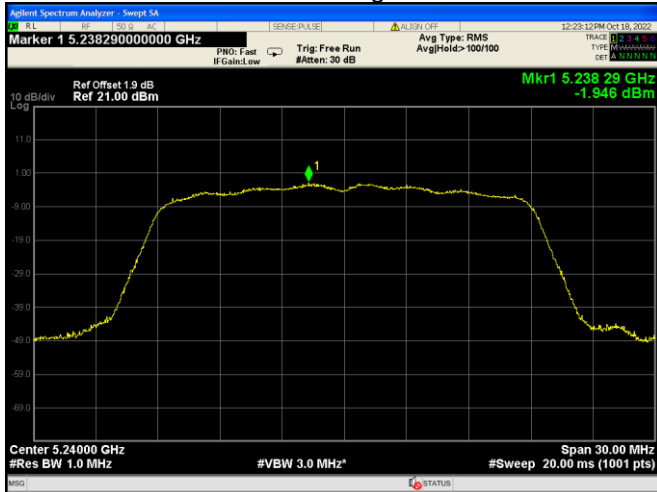


802.11n HT20 Middle channel

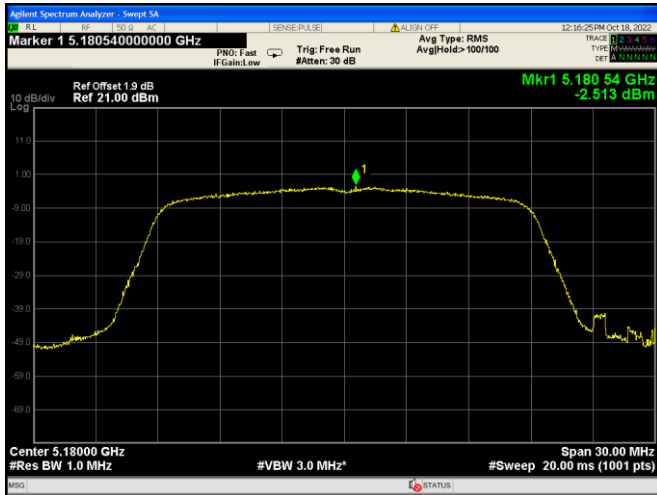




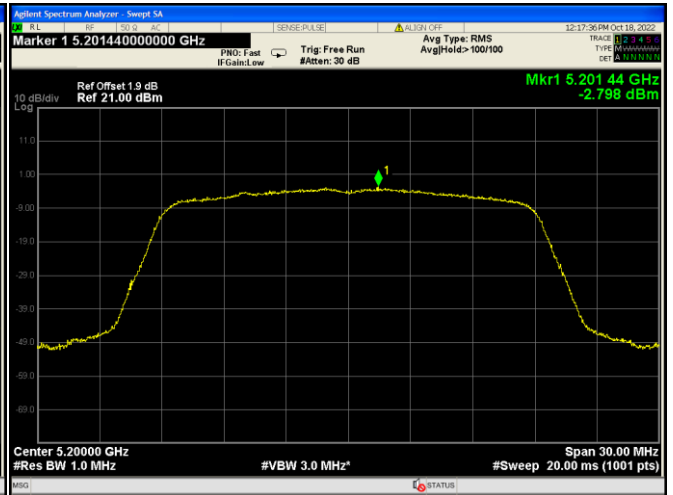
802.11n HT20 High channel



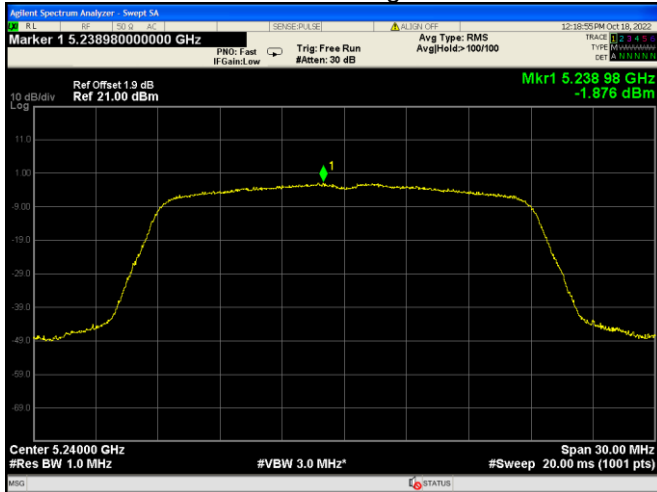
802.11ac VHT20 Low channel



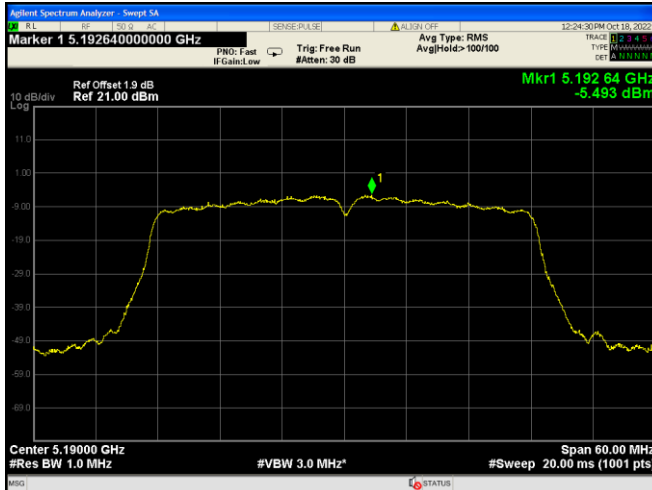
802.11ac VHT20 Middle channel



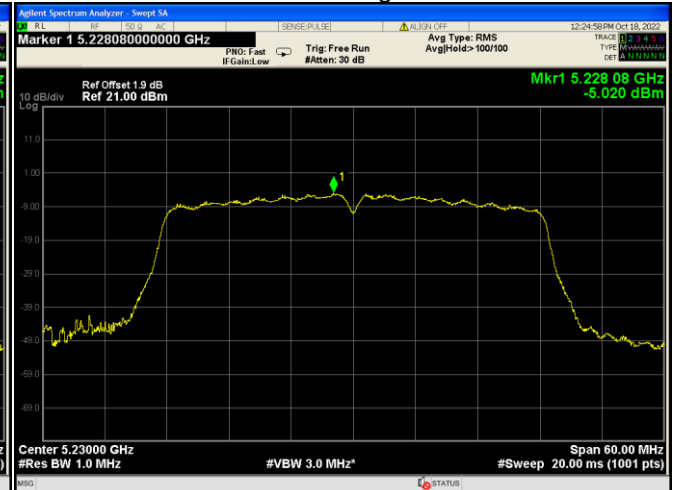
802.11ac VHT20 High channel



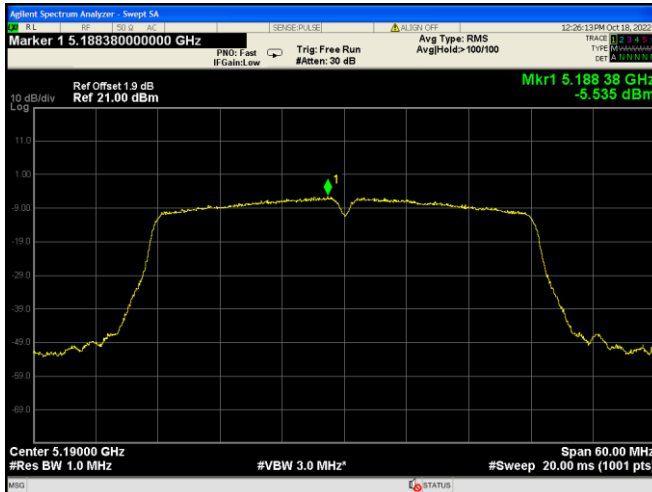
802.11n HT40 Low channel



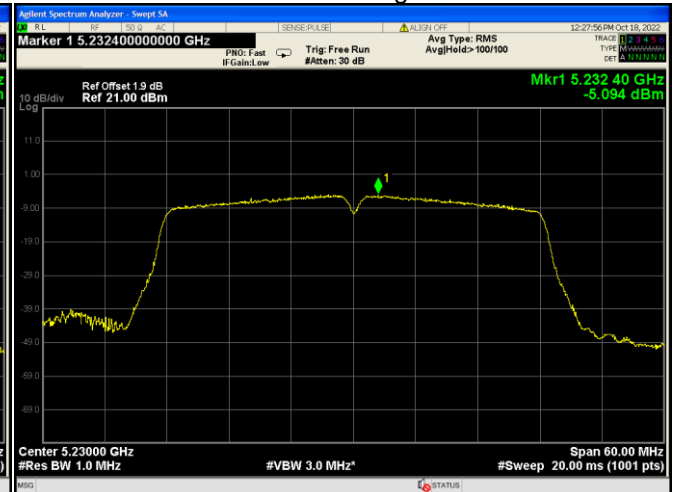
802.11n HT40 High channel



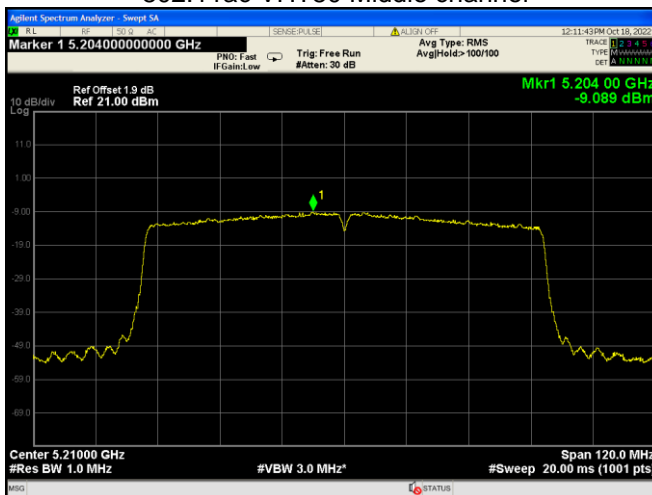
802.11ac VHT40 Low channel



802.11ac VHT40 High channel

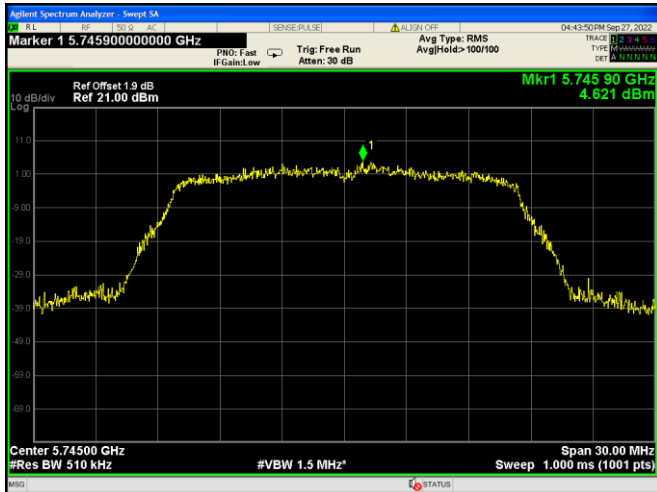


802.11ac VHT80 Middle channel

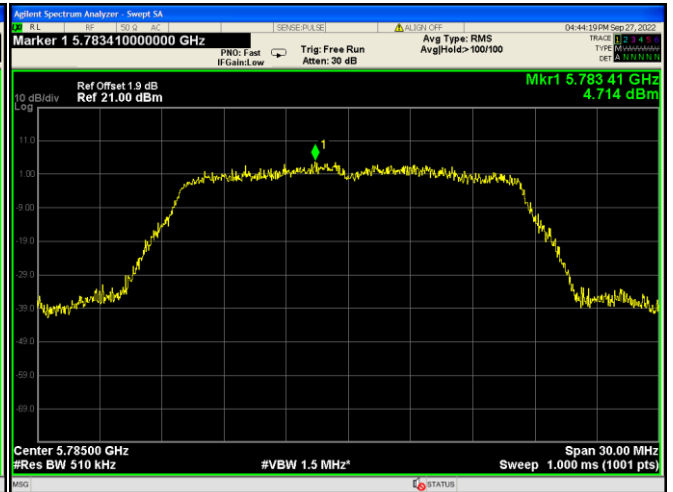


U-NII-3

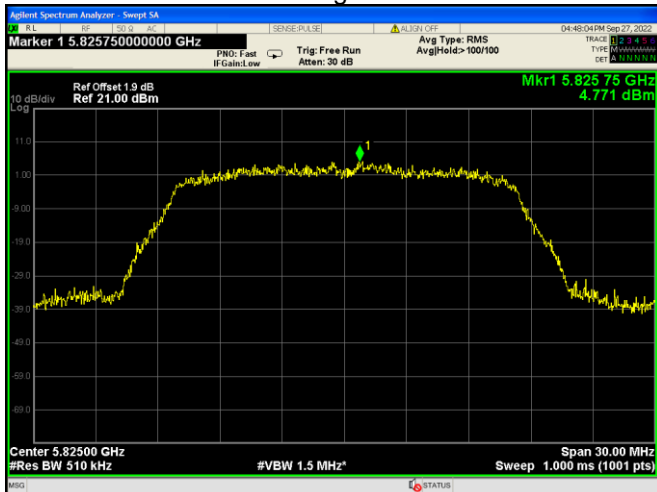
802.11a Low channel



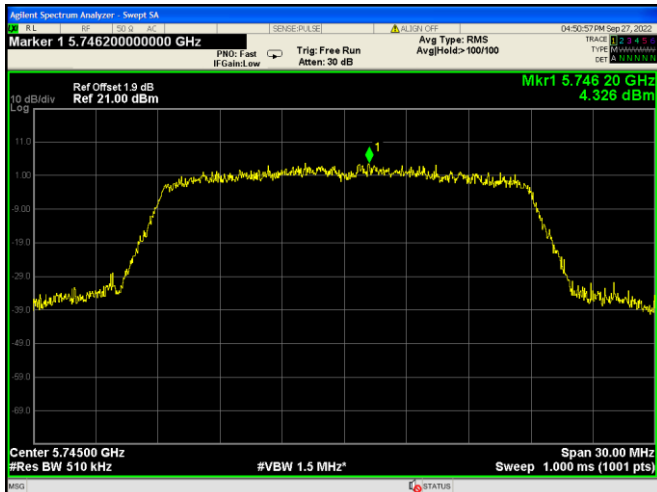
802.11a Middle channel



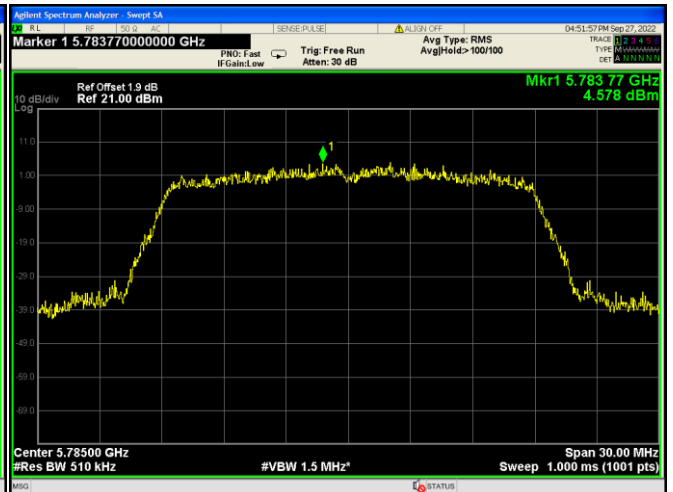
802.11a High channel



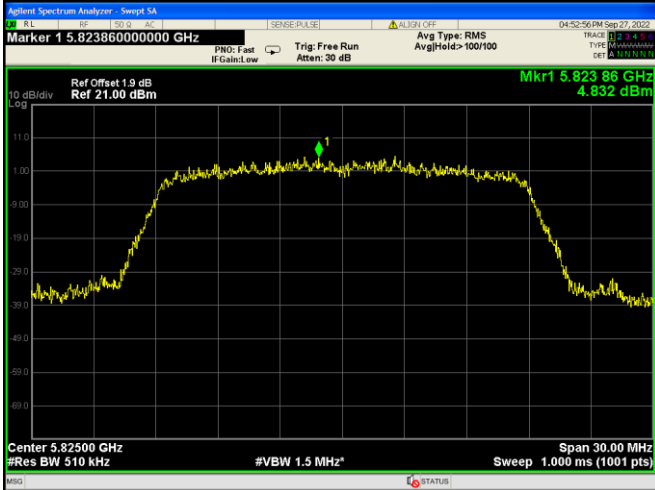
802.11n HT20 Low channel



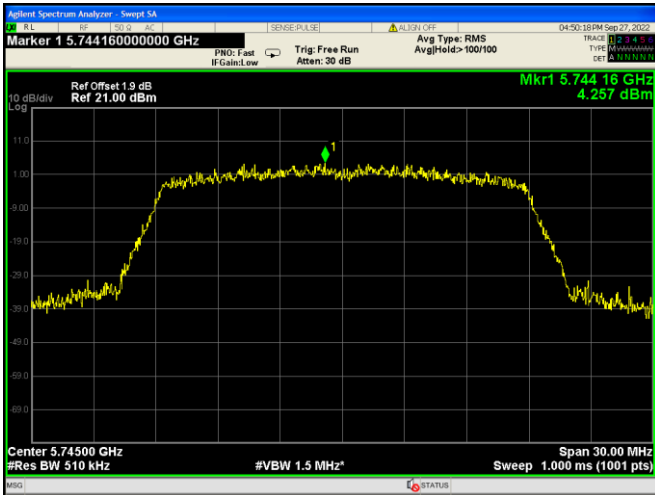
802.11n HT20 Middle channel



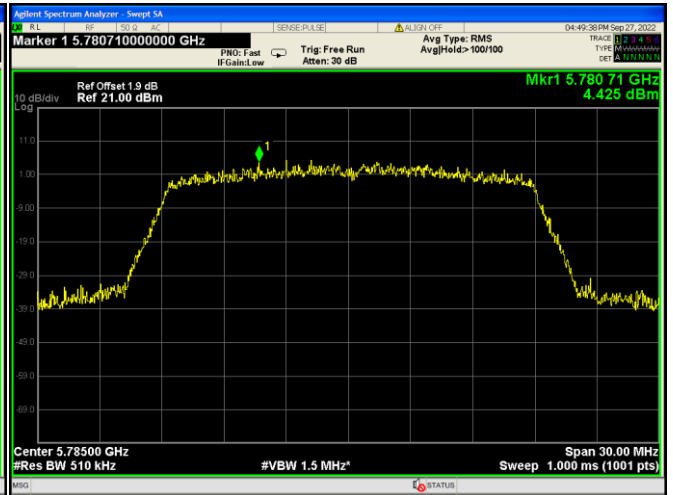
802.11n HT20 High channel



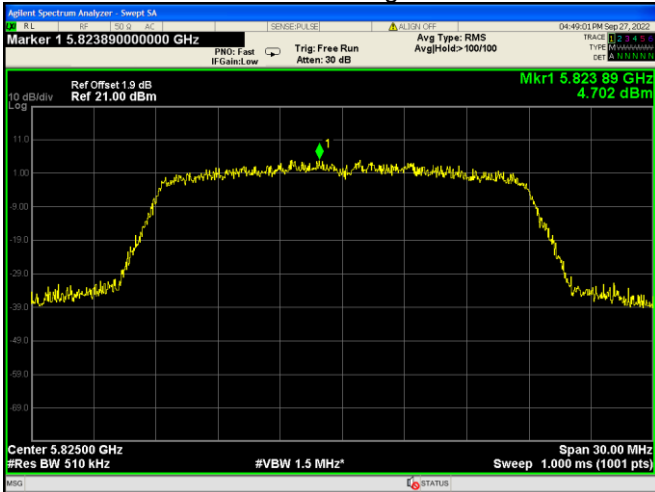
802.11ac VHT20 Low channel



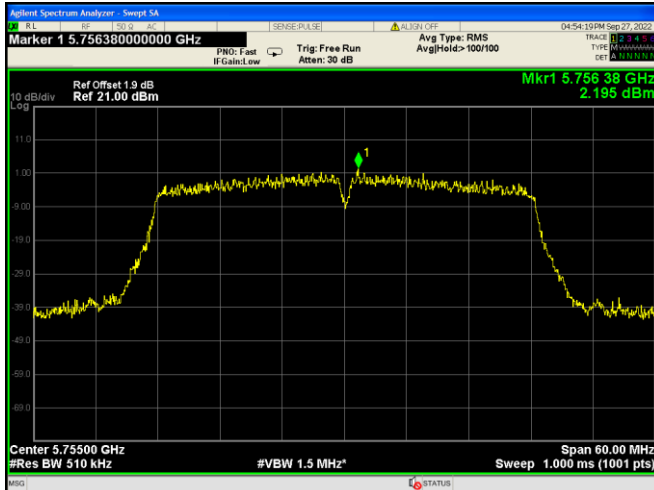
802.11ac VHT20 Middle channel



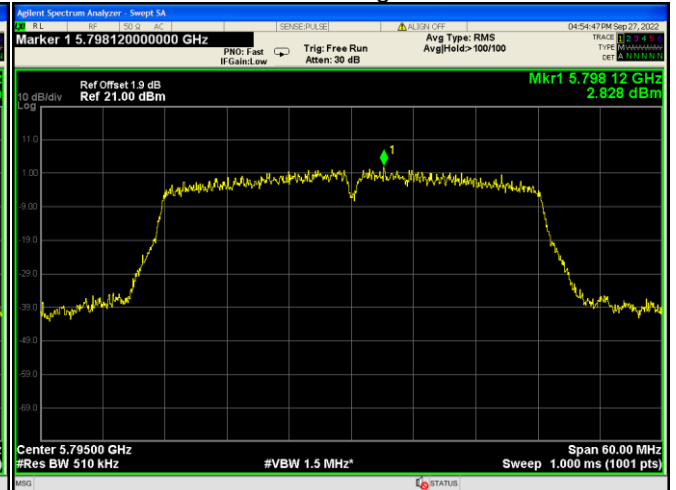
802.11ac VHT20 High channel



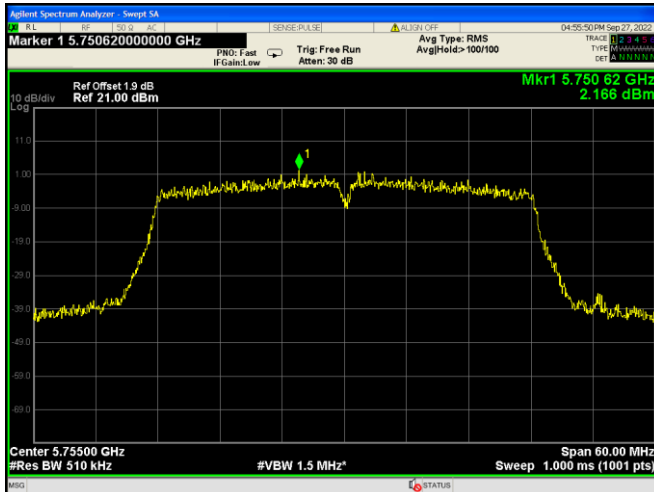
802.11n HT40 Low channel



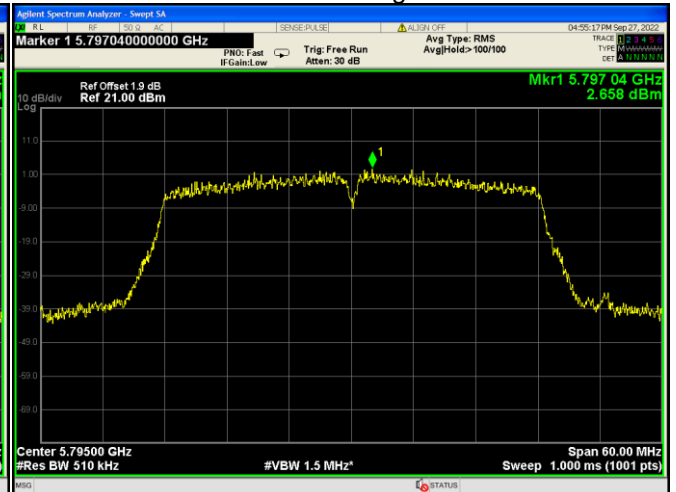
802.11n HT40 High channel



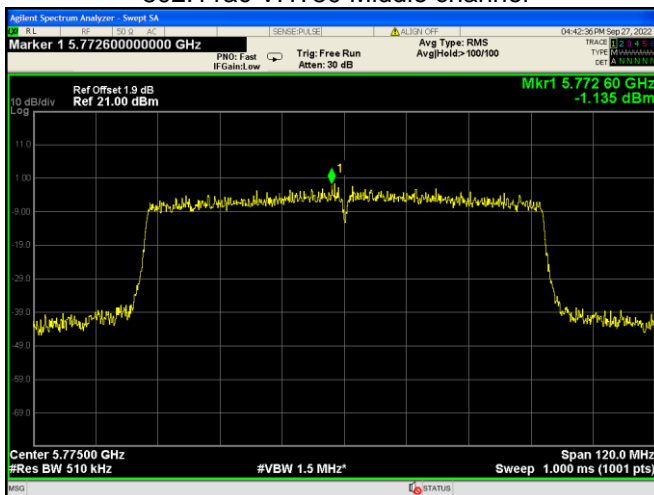
802.11ac VHT40 Low channel



802.11ac VHT40 High channel



802.11ac VHT80 Middle channel



## 16 Frequency Stability

Test Requirement:	FCC CFR47 Part 15 Section 15.407(g) ANSI C63.10:2013
Test Method:	KDB 789033 D02 General UNII Test Procedures New Rules v02r01
Test Limit:	According to 47CFR part 15 subpart E section 15.407(g): Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.
Test Result:	PASS

### 16.1 Test Procedure:

According to § 2.1055 Measurements required: Frequency stability, the following test procedure was performed.

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted absence of unmodulation signal and fixed channelise.
3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.
4. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings.
5.  $f_c$  is declaring of channel frequency.
6. Then the frequency stability formula is  $(f_c - f) / f_c \times 10^6$  ppm.
7. Extreme temperature rule is -30°C~ 50°C.
8. Extreme voltage is 85 to 115 percent of the nominal value.

### 16.2 Test Result:

Note: the manufacturer declared that the maximum frequency stability is below 20ppm.

Both Ant. 1 and Ant. 2 have been tested separately, and the report only shows the worst case.

#### Ant. 1

U-NII-1 Test Frequency:5180MHz				
Temperature (°C)	Power Supply (VAC)	Frequency deviation (MHz)	Frequency deviation (ppm)	Limit (ppm)
50	120	/	/	/
40		0.0061	1.18	20
30		0.0027	0.52	20
20		0.0017	0.33	20
10		0.0033	0.64	20
0		0.0049	0.95	20
-10		0.0050	0.97	20
-20		/	/	/
-30		/	/	/
20		102	0.0018	0.35
20	138	0.0019	0.37	20

U-NII-3 Test Frequency:5785MHz				
Temperature (°C)	Power Supply (VAC)	Frequency deviation (MHz)	Frequency deviation (ppm)	Limit (ppm)
50	120	/	/	/
40		-0.0010	-0.18	20
30		-0.0008	-0.14	20
20		0.0017	0.29	20
10		-0.0028	-0.48	20
0		0.0051	0.89	20
-10		0.0038	0.66	20
-20		/	/	/
-30		/	/	/
20		102	-0.0017	-0.29
20	138	0.0032	0.55	20

## **17 Antenna Requirement**

According to the FCC Part 15 Paragraph 15.203, 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. This product has two external antennas with RP-SMA connector and Gain is (U-NII-1: 4.69dBi, U-NII-3: 4.82dBi) fulfil the requirement of this section.

Note: Please refer to EUT photos for more details.

## **18 RF Exposure**

Note: Please refer to RF Exposure Report: WTD22D09190663W003.

## **19 Photographs of test setup and EUT.**

Note: Please refer to appendix: Appendix-WN572HP3-Photos.

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