RF TEST REPORT

Applicant	Huawei Technologies Co., Ltd.
FCC ID	QISWS5200V2
Product	1200Mbps Wireless Router
Model	WS5200 V2
Report No.	R1909H0175-R2V1
Issue Date	December 2, 2019

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15E (2018)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Peng Tao   Kai Xu

Performed by: Peng Tao   *Approved by: Kai Xu*

TA Technology (Shanghai) Co., Ltd.

No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China

TEL: +86-021-50791141/2/3

FAX: +86-021-50791141/2/3-8000

TABLE OF CONTENT

Summary of measurement results

Number	Test Case	Clause in FCC rules	Verdict
1	Average conducted output power	15.407(a)	PASS
2	Occupied bandwidth	15.407(e)	PASS
3	Frequency stability	15.407(g)	PASS
4	Power spectral density	15.407(a)	PASS
5	Unwanted Emissions	15.407(b)	PASS
6	Conducted Emissions	15.207	PASS
Date of Testing: September 21, 2019~ September 25, 2019			

1. Test Laboratory

1.1. Notes of the test report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

1.3. Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
Address:	No.145, Jintang Rd, Tangzhen Industry Park, Pudong
City:	Shanghai
Post code:	201201
Country:	P. R. China
Contact:	Xu Kai
Telephone:	+86-021-50791141/2/3
Fax:	+86-021-50791141/2/3-8000
Website:	http://www.ta-shanghai.com
E-mail:	xukai@ta-shanghai.com

2. General Description of Equipment under Test

Client Information

Applicant	Huawei Technologies Co., Ltd.
Applicant address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C
Manufacturer	Huawei Technologies Co., Ltd.
Manufacturer address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

General information

EUT Description	
Model	WS5200 V2
SN	VXC7S1981400018931
Hardware Version	AM1WS5200V2M1
Software Version	10.0.2.7
Power Supply	AC /DC Adapter
Antenna Type	External Antenna
Antenna Gain	Antenna 1: 4 dBi Antenna 2: 4 dBi
additional beamforming gain	4 dBi
Test Mode(s)	U-NII-1(5150MHz-5250MHz) U-NII-3(5725MHz-5850MHz)
Modulation Type	802.11a/n (HT20/HT40) : OFDM 802.11ac (VHT20/VHT40/VHT80): OFDM
Max. Conducted Power	22.90 dBm
Operating Frequency Range(s)	U-NII-1: 5150-5250MHz U-NII-3: 5725-5850MHz
Operating temperature range:	0 ° C to 40° C
Operating voltage range:	11.4 V to 12.6 V
State DC voltage:	12V
EUT Accessory	
Adapter	Manufacture: Huawei Technologies Co., Ltd. Model : HW-120100U01
Note: The information of the EUT is declared by the manufacturer.	

3. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC CFR47 Part 15E (2018) Unlicensed National Information Infrastructure Devices

ANSI C63.10 (2013)

KDB 789033 D02 General UNII Test Procedures New Rules v02r01

KDB 662911 D01 Multiple Transmitter Output v02r01

4. Test Configuration

Test Mode

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate. Preliminary tests have been done on all the configuration for confirming worst case. Data rate below means worst-case rate of each test item.

Worst-case data rates are shown as following table.

Band	**Data Rate**
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ac VHT80	MCS0
The device supports non-beamforming and beamforming function in 802.11n/ac, after pre-testing, beamforming mode has the worst emission value, so the worst case was recorded.	

Band	**Data Rate**		
	Antenna 1	**Antenna 2**	**MIMO**
802.11a	6 Mbps	6 Mbps	MCS8
802.11n HT20	MCS0	MCS0	MCS8
802.11n HT40	MCS0	MCS0	MCS8
802.11ac VHT20	MCS0	MCS0	MCS8
802.11ac VHT40	MCS0	MCS0	MCS8
802.11ac VHT80	MCS0	MCS0	MCS8
The device supports non-beamforming and beamforming function in 802.11n/ac, after pre-testing, beamforming mode has the worst emission value, so the worst case was recorded.			

The worst case Antenna mode for each of the following tests for Wi-Fi:

Test Cases	Antenna 1	Antenna 2	MIMO
Average conducted output power	O	O	O
Occupied bandwidth	--	802.11a	802.11n HT20/HT40/ 802.11ac VHT20/VHT40/VHT80
Frequency stability	--	802.11a	--
Power Spectral Density	O	O	O
Unwanted Emissions	--	802.11a	802.11n HT20/HT40/ 802.11ac VHT80
Conducted Emissions	--	O	--
Note：“O”: test all bands			

According to RF Output power results in chapter 5.1, MIMO was selected as the worst antenna for 802.11n HT20/40, 802.11ac VHT20/40/80. SISO Antenna 2 was selected as the worst SISO antenna for 802.11a.

Wireless Technology and Frequency Range

<table>
<tr><th colspan="2">Wireless Technology</th><th>Bandwidth</th><th>Channel</th><th>Frequency</th></tr>
<tr><td rowspan="15">Wi-Fi</td><td rowspan="7">U-NII-1</td><td rowspan="4">20 MHz</td><td>36</td><td>5180MHz</td></tr>
<tr><td>40</td><td>5200MHz</td></tr>
<tr><td>44</td><td>5220MHz</td></tr>
<tr><td>48</td><td>5240MHz</td></tr>
<tr><td rowspan="2">40 MHz</td><td>38</td><td>5190MHz</td></tr>
<tr><td>46</td><td>5230MHz</td></tr>
<tr><td>80 MHz</td><td>42</td><td>5210MHz</td></tr>
<tr><td rowspan="8">U-NII-3</td><td rowspan="5">20 MHz</td><td>149</td><td>5745MHz</td></tr>
<tr><td>153</td><td>5765MHz</td></tr>
<tr><td>157</td><td>5785MHz</td></tr>
<tr><td>161</td><td>5805MHz</td></tr>
<tr><td>165</td><td>5825MHz</td></tr>
<tr><td rowspan="2">40 MHz</td><td>151</td><td>5755MHz</td></tr>
<tr><td>159</td><td>5795MHz</td></tr>
<tr><td>80 MHz</td><td>155</td><td>5775MHz</td></tr>
<tr><td colspan="5">Does this device support TPC Function? ☒Yes ☐No</td></tr>
<tr><td colspan="5">Does this device support TDWR Band? ☐Yes ☒No</td></tr>
</table>

5. Test Case Results

5.1. Occupied Bandwidth

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.

For U-NII-1/U-NII-2A/U-NII-2C, set RBW ≈1% OCB kHz, VBW ≥ 3 × RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the fundamental emission.

For U-NII-3, Set RBW = 100 kHz, VBW ≥ 3 × RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

Use the 99 % power bandwidth function of the instrument

Test Setup

Limits

Rule FCC Part §15.407(e)

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

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor *k* = 2, *U*= 936 Hz.

Test Results:

U-NII-1

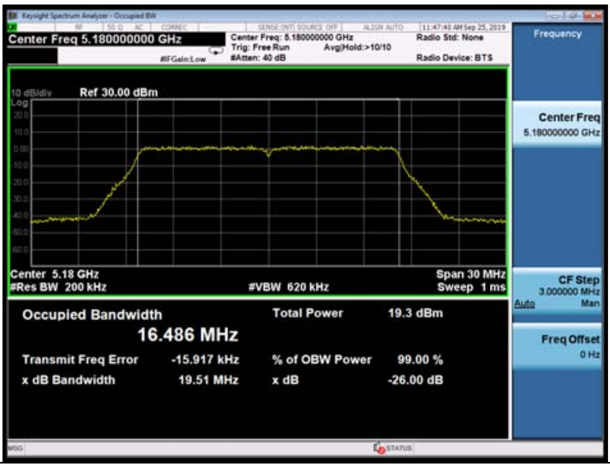
Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5180	16.486	19.51	PASS
	5200	16.496	19.42	PASS
	5240	16.538	20.26	PASS
802.11n HT20	5180	17.564	19.74	PASS
	5200	17.570	19.65	PASS
	5240	17.584	23.66	PASS
802.11n HT40	5190	35.741	38.91	PASS
	5230	35.729	38.70	PASS
802.11ac VHT20	5180	17.564	19.73	PASS
	5200	17.566	19.69	PASS
	5240	17.587	20.52	PASS
802.11ac VHT40	5190	35.748	38.69	PASS
	5230	35.741	38.59	PASS
802.11ac VHT80	5210	75.239	84.02	PASS

U-NII-3

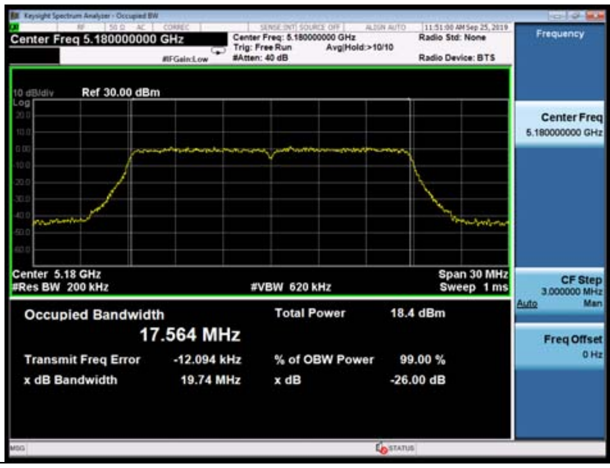
Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11a	5745	16.473	16.38	500	PASS
	5785	16.501	16.40	500	PASS
	5825	16.481	16.36	500	PASS
802.11n HT20	5745	17.576	17.58	500	PASS
	5785	17.583	17.59	500	PASS
	5825	17.580	17.59	500	PASS
802.11n HT40	5755	35.759	34.94	500	PASS
	5795	35.839	34.12	500	PASS
802.11ac VHT20	5745	17.577	17.34	500	PASS
	5785	17.589	17.62	500	PASS
	5825	17.573	17.57	500	PASS
802.11ac VHT40	5755	35.767	33.41	500	PASS
	5795	35.814	35.07	500	PASS
802.11ac VHT80	5775	75.353	75.17	500	PASS

Antenna 1

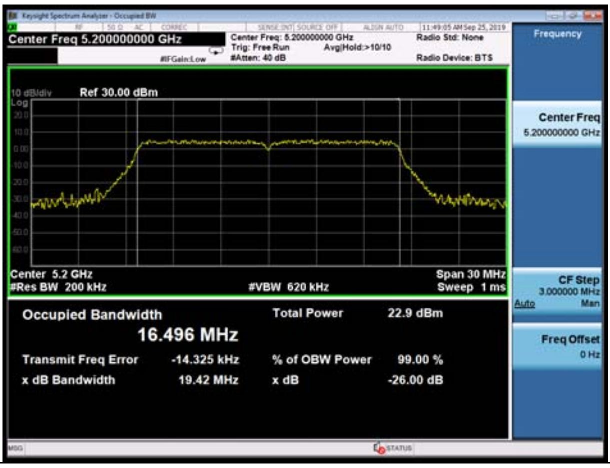
U-NII-1, 802.11a
Carrier frequency (MHz): 5180



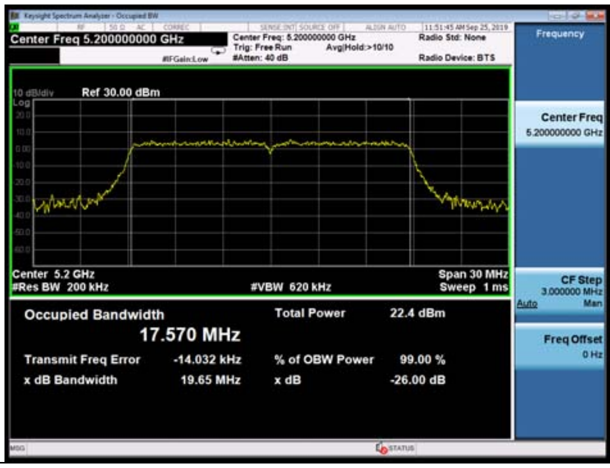
U-NII-1, 802.11n HT20
Carrier frequency (MHz): 5180



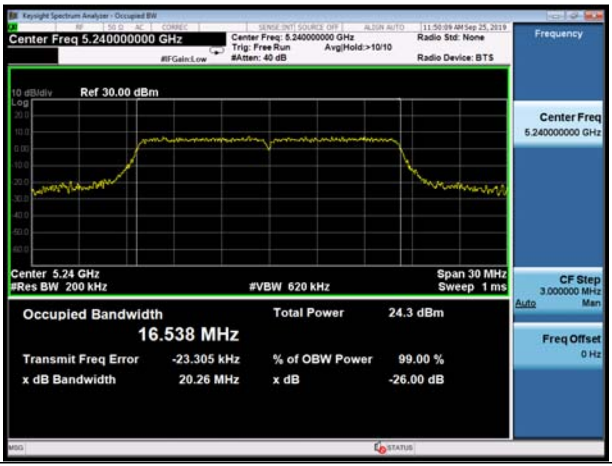
U-NII-1, 802.11a
Carrier frequency (MHz): 5200



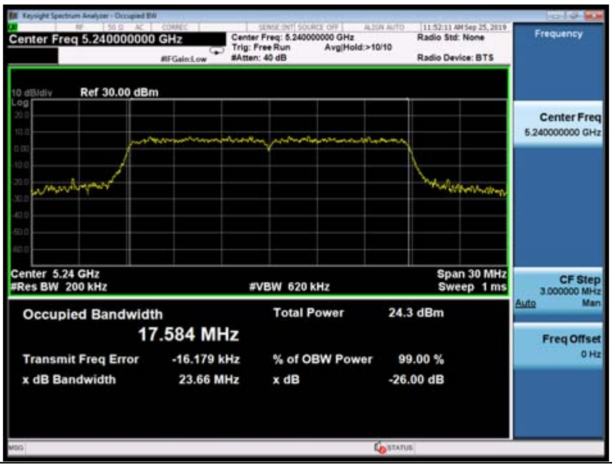
U-NII-1, 802.11n HT20
Carrier frequency (MHz): 5200



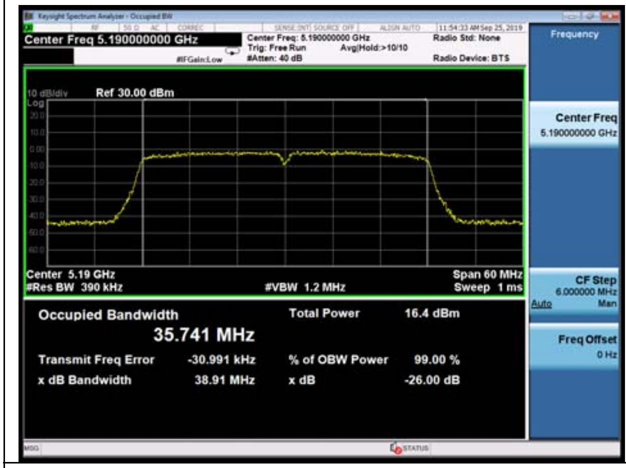
U-NII-1, 802.11a
Carrier frequency (MHz):5240



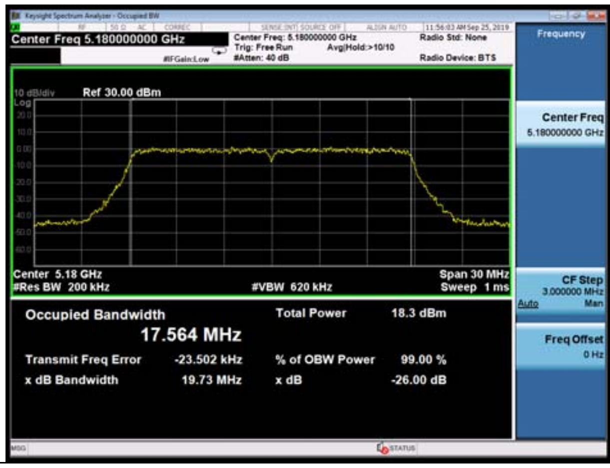
U-NII-1, 802.11n HT20
Carrier frequency (MHz):5240



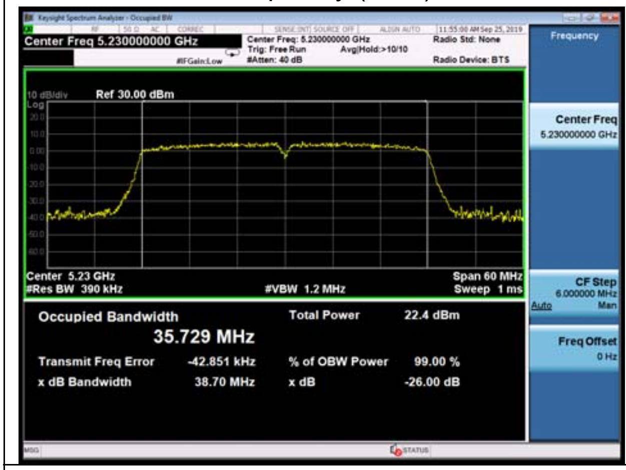
U-NII-1, 802.11n HT40
Carrier frequency (MHz): 5190



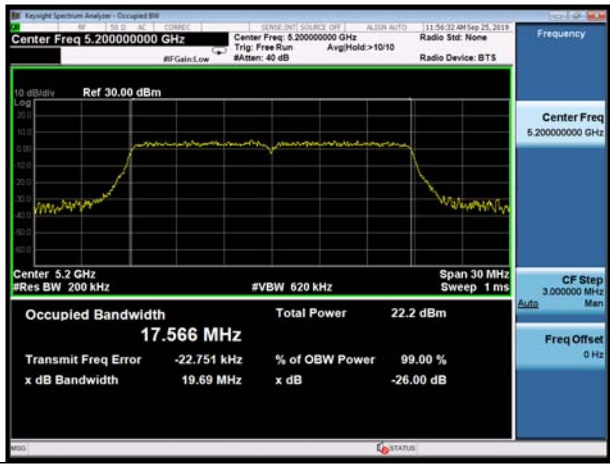
U-NII-1, 802.11ac VHT20
Carrier frequency (MHz): 5180



U-NII-1, 802.11n HT40
Carrier frequency (MHz): 5230

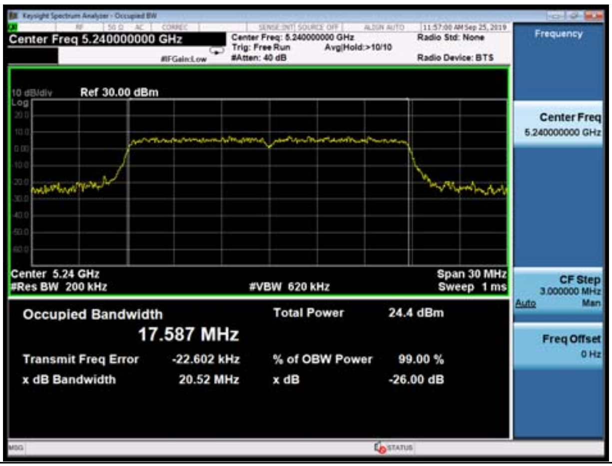


U-NII-1, 802.11ac VHT20
Carrier frequency (MHz): 5200



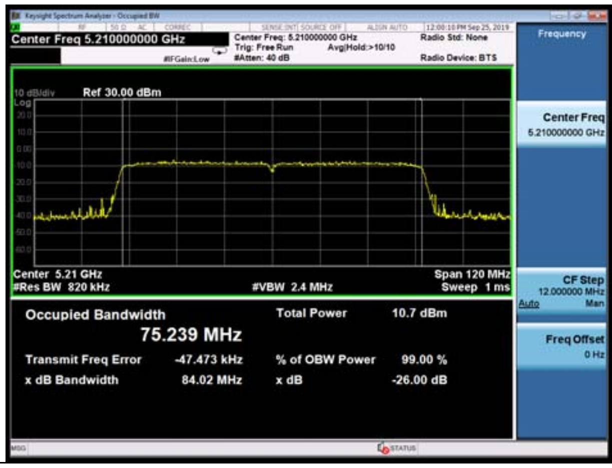
U-NII-1, 802.11ac VHT40
Carrier frequency (MHz): 5190

U-NII-1, 802.11ac VHT20
Carrier frequency (MHz):5240



U-NII-1, 802.11ac VHT40
Carrier frequency (MHz): 5230

U-NII-1, 802.11ac VHT80
Carrier frequency (MHz): 5210



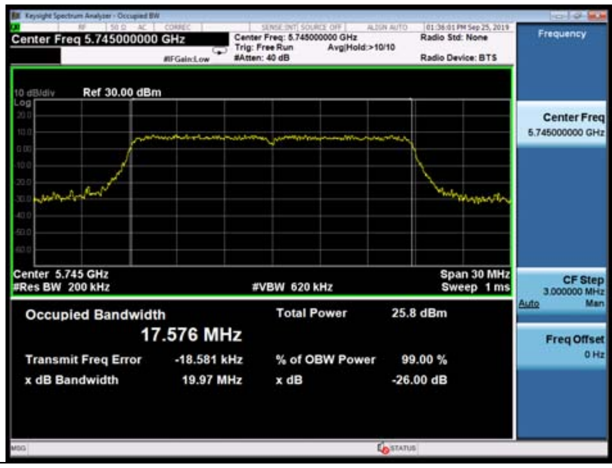
99% bandwidth

U-NII-3, 802.11a

Carrier frequency (MHz): 5745

U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5745

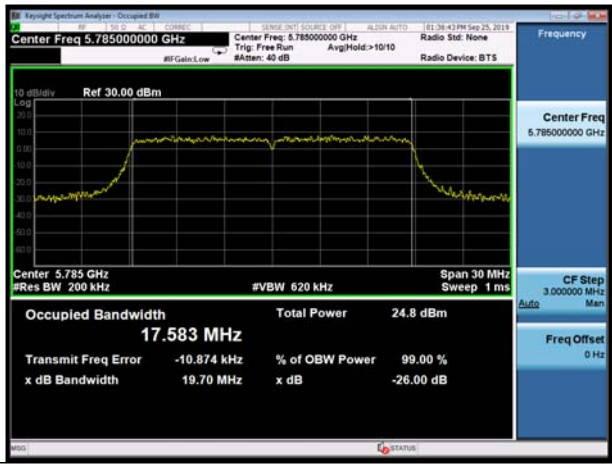


U-NII-3, 802.11a

Carrier frequency (MHz): 5785

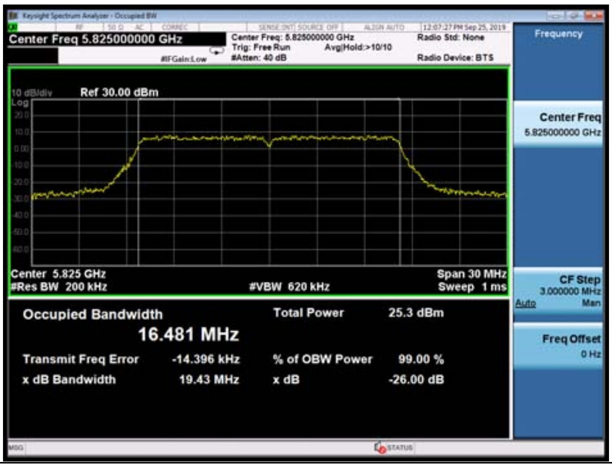
U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5785



U-NII-3, 802.11a

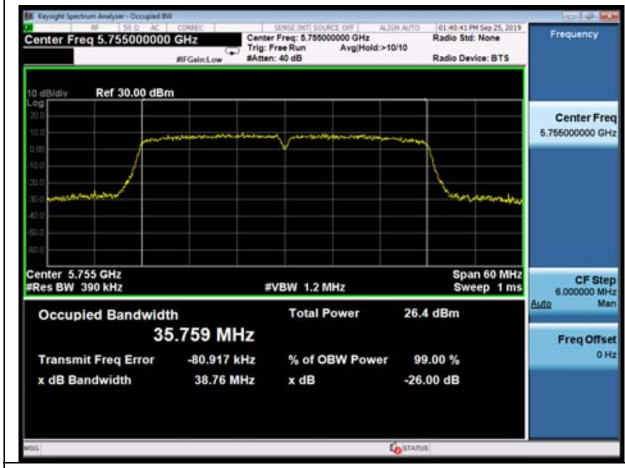
Carrier frequency (MHz): 5825



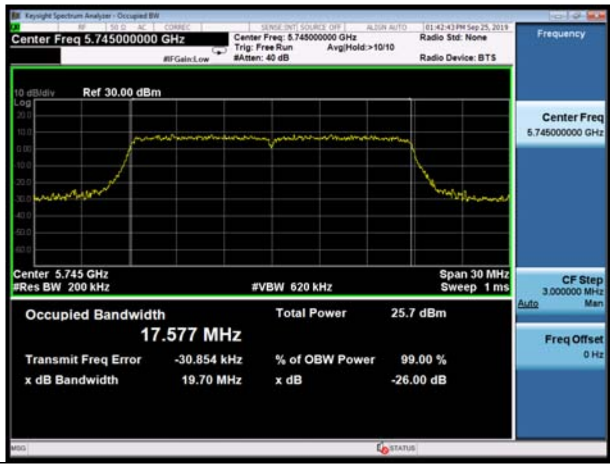
U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5825

U-NII-3, 802.11n HT40
Carrier frequency (MHz): 5755

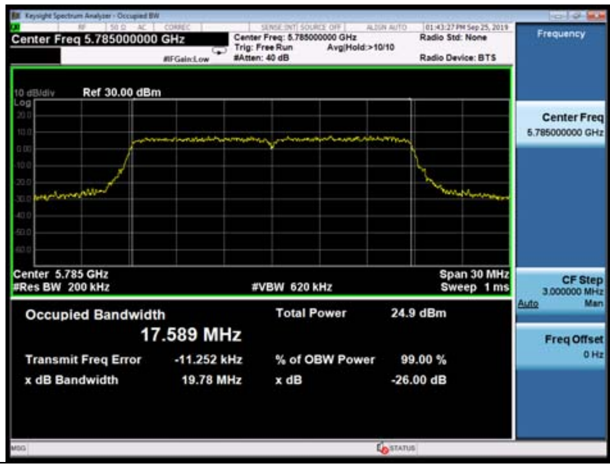


U-NII-3, 802.11ac VHT20
Carrier frequency (MHz): 5745

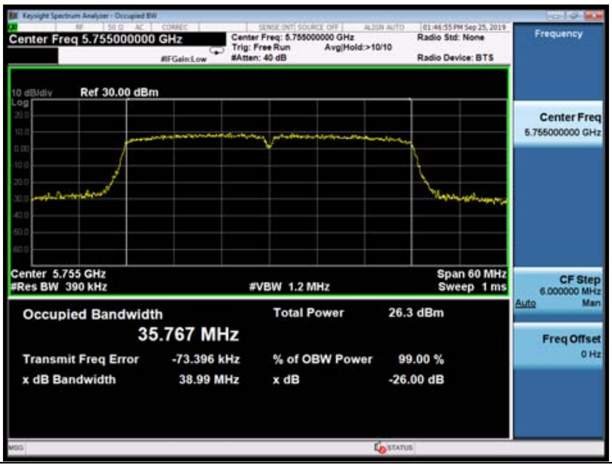


U-NII-3, 802.11n HT40
Carrier frequency (MHz): 5795

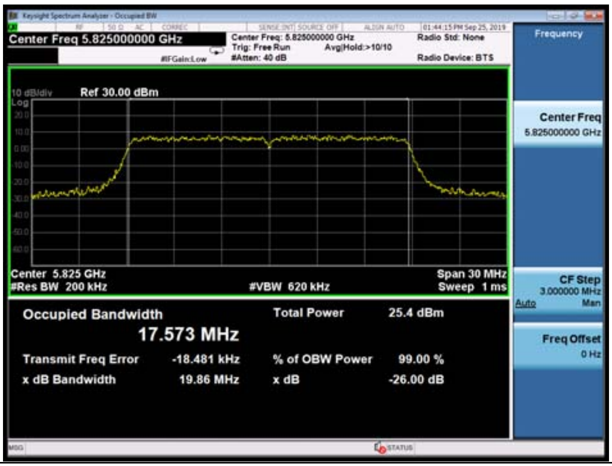
U-NII-3, 802.11ac VHT20
Carrier frequency (MHz): 5785



U-NII-3, 802.11ac VHT40
Carrier frequency (MHz): 5755

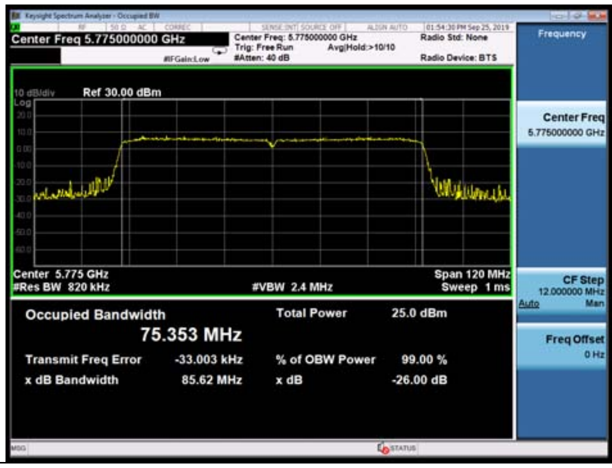


U-NII-3, 802.11ac VHT20
Carrier frequency (MHz): 5825



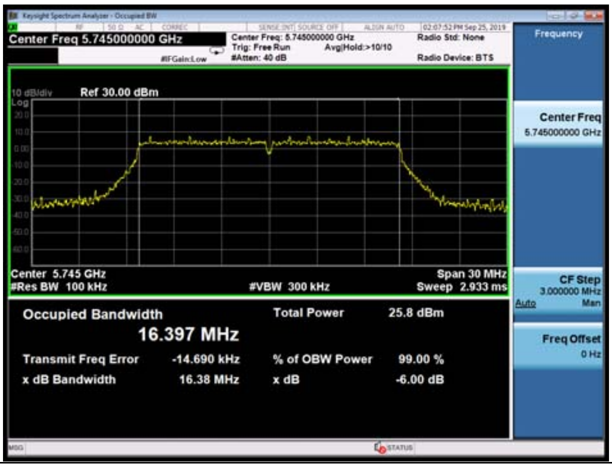
U-NII-3, 802.11ac VHT40
Carrier frequency (MHz): 5795

U-NII-3, 802.11ac VHT80
Carrier frequency (MHz): 5775

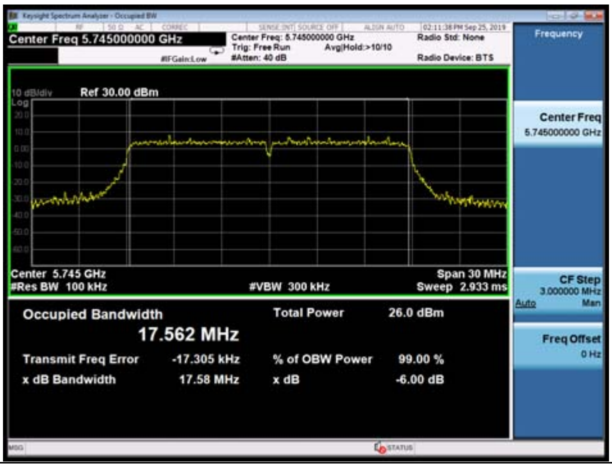


Minimum 6 dB bandwidth

U-NII-3, 802.11a
Carrier frequency (MHz): 5745

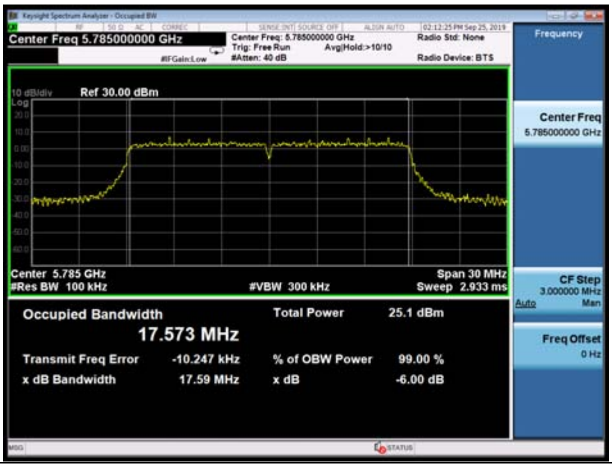


U-NII-3, 802.11n HT20
Carrier frequency (MHz): 5745



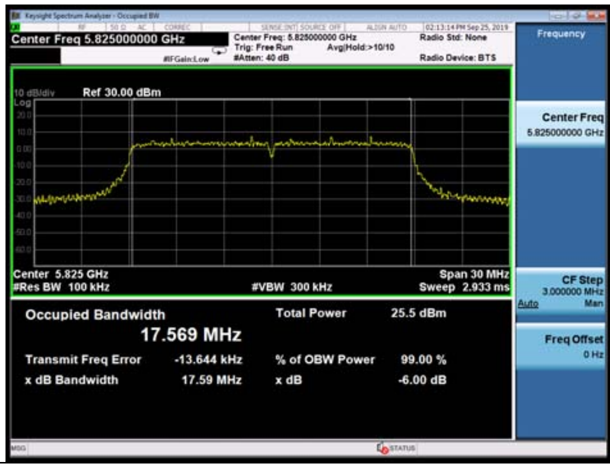
U-NII-3, 802.11a
Carrier frequency (MHz): 5785

U-NII-3, 802.11n HT20
Carrier frequency (MHz): 5785



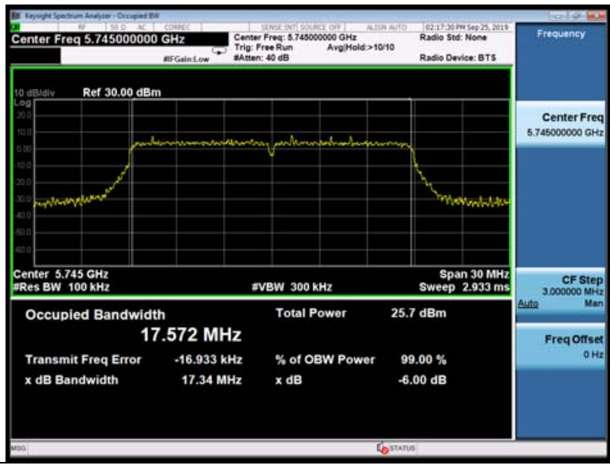
U-NII-3, 802.11a
Carrier frequency (MHz): 5825

U-NII-3, 802.11n HT20
Carrier frequency (MHz): 5825



U-NII-3, 802.11n HT40
Carrier frequency (MHz): 5755

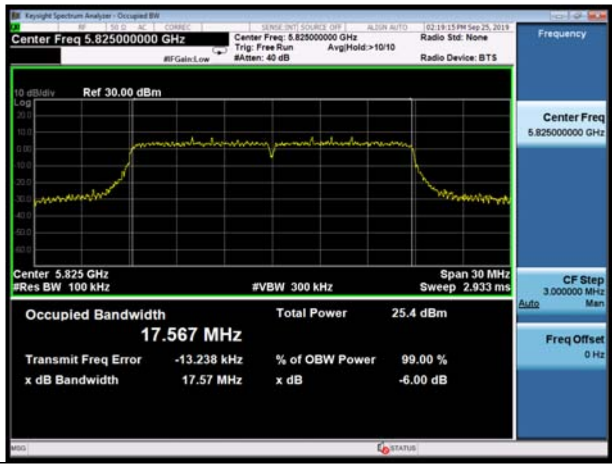
U-NII-3, 802.11ac VHT20
Carrier frequency (MHz): 5745

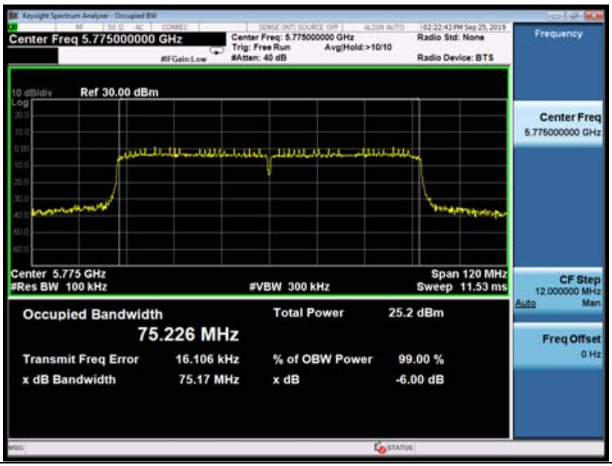


U-NII-3, 802.11n HT40
Carrier frequency (MHz): 5795

U-NII-3, 802.11ac VHT20
Carrier frequency (MHz): 5785

<table>
<tr>
<td>U-NII-3, 802.11ac VHT40
Carrier frequency (MHz): 5755

</td>
<td>U-NII-3, 802.11ac VHT20
Carrier frequency (MHz): 5825

</td>
</tr>
<tr>
<td>U-NII-3, 802.11ac VHT40
Carrier frequency (MHz): 5795

</td>
<td>U-NII-3, 802.11ac VHT80
Carrier frequency (MHz): 5775

</td>
</tr>
</table>

5.2. Average Power Output –Conducted

Ambient condition

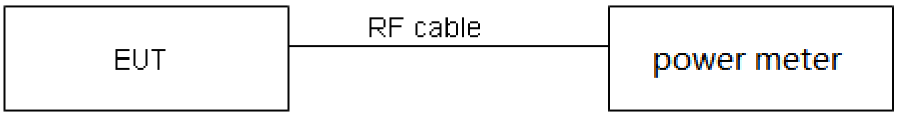
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

During the process of the testing, The EUT was connected to the average power meter through an external attenuator and a known loss cable. The EUT is max power transmission with proper modulation. We use Maximum average Conducted Output Power Level Method in KDB789033 for this test

The conducted Power is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically.

Test Setup



Limits

Rule FCC Part 15.407(a)(1)(2)(3)
(1) For the band 5.15-5.25 GHz.
(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).
(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23

dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.
(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(2)For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.44 dB.

Test Results

Band	T_{on} (ms)	$T_{(on+off)}$ (ms)	Duty cycle	Duty cycle correction Factor(dB)
802.11a	2.75	2.77	0.99	0.03
802.11n HT20	2.55	2.58	0.99	0.05
802.11n HT40	1.25	1.29	0.97	0.14
802.11ac VHT20	2.56	2.59	0.99	0.05
802.11ac VHT40	1.26	1.33	0.95	0.24
802.11ac VHT80	0.60	0.64	0.94	0.28
Note: when Duty cycle>0.98, Duty cycle correction Factor not required.				

SISO Antenna1& SISO Antenna2 Power Index						
Packet Type	**CH36**	**CH40**	**CH48**	**CH149**	**CH157**	**CH165**
802.11a	300	300	190	190	190	190
802.11n HT20	300	300	190	190	190	190
802.11ac VHT20	190	190	190	190	190	190
Packet Type	**CH38**	**CH46**	**CH151**	**CH159**	/	/
802.11n HT40	300	300	300	300	/	/
802.11ac VHT40	300	300	300	300	/	/
Packet Type	**CH42**	**CH155**	/	/	/	/
802.11ac VHT80	50	300	/	/	/	/

MIMO Antenna1& MIMO Antenna2 Power Index(without Beamforming)						
Packet Type	**CH36**	**CH40**	**CH48**	**CH149**	**CH157**	**CH165**
802.11a	300	300	190	190	190	190
802.11n HT20	300	300	190	190	190	190
802.11ac VHT20	190	190	190	190	190	190
Packet Type	**CH38**	**CH46**	**CH151**	**CH159**	/	/
802.11n HT40	300	300	300	300	/	/
802.11ac VHT40	300	300	300	300	/	/
Packet Type	**CH42**	**CH155**	/	/	/	/
802.11ac VHT80	50	300	/	/	/	/

MIMO Antenna1& MIMO Antenna2 Power Index(with Beamforming)

Packet Type	CH36	CH40	CH48	CH149	CH157	CH165
802.11ac VHT20	190	190	190	190	190	190
Packet Type	**CH38**	**CH46**	**CH151**	**CH159**	/	/
802.11ac VHT40	300	300	300	300	/	/
Packet Type	**CH42**	**CH155**	/	/	/	/
802.11ac VHT80	50	300	/	/	/	/

SISO Antenna 1

U-NII-1

Network Standards	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	36/5180	11.77	11.80	30	PASS
	40/5200	15.69	15.72	30	PASS
	48/5240	17.47	17.50	30	PASS
802.11n HT20	36/5180	11.58	11.63	30	PASS
	40/5200	15.48	15.53	30	PASS
	48/5240	17.43	17.48	30	PASS
802.11n HT40	38/5190	9.08	9.22	30	PASS
	46/5230	15.14	15.28	30	PASS
802.11ac VHT20	36/5180	11.53	11.58	30	PASS
	40/5200	15.48	15.53	30	PASS
	48/5240	17.38	17.43	30	PASS
802.11ac VHT40	38/5190	9.10	9.34	30	PASS
	46/5230	15.22	15.46	30	PASS
802.11ac VHT80	42/5210	2.24	2.52	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

U-NII-3

Network Standards	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	149/5745	18.34	18.37	30	PASS
	157/5785	18.10	18.13	30	PASS
	165/5825	18.26	18.29	30	PASS
802.11n HT20	149/5745	18.76	18.81	30	PASS
	157/5785	18.28	18.33	30	PASS
	165/5825	18.31	18.36	30	PASS
802.11n HT40	151/5755	19.01	19.15	30	PASS
	159/5795	19.63	19.77	30	PASS
802.11ac VHT20	149/5745	18.72	18.77	30	PASS
	157/5785	18.50	18.55	30	PASS
	165/5825	18.31	18.36	30	PASS
802.11ac VHT40	151/5755	18.92	19.16	30	PASS
	159/5795	19.64	19.88	30	PASS
802.11ac VHT80	155/5775	17.01	17.29	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

SISO Antenna 2

U-NII-1

Network Standards	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	36/5180	11.85	11.88	30	PASS
	40/5200	15.62	15.65	30	PASS
	48/5240	17.32	17.35	30	PASS
802.11n HT20	36/5180	11.45	11.50	30	PASS
	40/5200	15.23	15.28	30	PASS
	48/5240	17.41	17.46	30	PASS
802.11n HT40	38/5190	9.23	9.37	30	PASS
	46/5230	14.88	15.02	30	PASS
802.11ac VHT20	36/5180	11.39	11.44	30	PASS
	40/5200	15.30	15.35	30	PASS
	48/5240	17.33	17.38	30	PASS
802.11ac VHT40	38/5190	9.18	9.42	30	PASS
	46/5230	14.78	15.02	30	PASS
802.11ac VHT80	42/5210	3.07	3.35	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

U-NII-3

Network Standards	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	149/5745	19.02	19.05	30	PASS
	157/5785	18.82	18.85	30	PASS
	165/5825	18.53	18.56	30	PASS
802.11n HT20	149/5745	18.88	18.93	30	PASS
	157/5785	18.88	18.93	30	PASS
	165/5825	18.57	18.62	30	PASS
802.11n HT40	151/5755	19.31	19.45	30	PASS
	159/5795	19.80	19.94	30	PASS
802.11ac VHT20	149/5745	18.98	19.03	30	PASS
	157/5785	18.74	18.79	30	PASS
	165/5825	18.64	18.69	30	PASS
802.11ac VHT40	151/5755	19.35	19.59	30	PASS
	159/5795	19.75	19.99	30	PASS
802.11ac VHT80	155/5775	17.15	17.43	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

MIMO

without Beamforming

U-NII-1

Network Standards	Channel/ Frequency (MHz)	MIMO Antenna 1		MIMO Antenna 2		Total Power (dBm)	Limit (dBm)	Conclusion
		Average Power Measured (dBm)	Average Power with duty factor (dBm)	Average Power Measured (dBm)	Average Power with duty factor (dBm)			
802.11a	36/5180	11.91	11.94	11.45	11.48	14.73	30	PASS
	44/5220	15.66	15.69	15.58	15.61	18.66	30	PASS
	48/5240	17.61	17.64	17.46	17.49	20.58	30	PASS
802.11n HT20	36/5180	11.49	11.54	11.04	11.09	14.33	30	PASS
	44/5220	15.44	15.49	15.37	15.42	18.47	30	PASS
	48/5240	17.46	17.51	17.40	17.45	20.49	30	PASS
802.11n HT40	38/5190	9.02	9.16	8.70	8.84	12.01	30	PASS
	46/5230	15.15	15.29	14.88	15.02	18.16	30	PASS
802.11ac VHT20	36/5180	11.35	11.40	11.12	11.17	14.30	30	PASS
	44/5220	15.49	15.54	15.33	15.38	18.47	30	PASS
	48/5240	17.33	17.38	17.43	17.48	20.44	30	PASS
802.11ac VHT40	38/5190	8.88	9.12	8.83	9.07	12.11	30	PASS
	46/5230	15.14	15.38	14.98	15.22	18.31	30	PASS
802.11ac VHT80	42/5210	1.19	1.47	1.35	1.63	4.56	30	PASS

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),
The Total Power =10log($10^{(\text{Power antenna1 in dBm/10})}+10^{(\text{Power antenna2 in dBm/10})}$.
2. The manufacturer declared the transmitter output signals is CDD mode And N_{ss}=2. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = G_{ANT} + Array Gain,
For power measurements on IEEE 802.11 devices,
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.
So directional gain = G_{ANT} + Array Gain =4+0=4 dBi<6dBi. So the power limt is 30dBm.

U-NII-3

Network Standards	Channel/ Frequency (MHz)	MIMO Antenna 1		MIMO Antenna 2		Total Power (dBm)	Limit (dBm)	Conclusion
		Average Power Measured (dBm)	Average Power with duty factor (dBm)	Average Power Measured (dBm)	Average Power with duty factor (dBm)			
802.11a	36/5180	18.50	18.53	18.95	18.98	21.77	30	PASS
	44/5220	18.69	18.72	18.66	18.69	21.72	30	PASS
	48/5240	18.23	18.26	18.37	18.40	21.34	30	PASS
802.11n HT20	36/5180	18.62	18.67	18.83	18.88	21.79	30	PASS
	44/5220	18.43	18.48	18.82	18.87	21.69	30	PASS
	48/5240	18.23	18.28	18.54	18.59	21.45	30	PASS
802.11n HT40	38/5190	18.92	19.06	19.38	19.52	22.30	30	PASS
	46/5230	19.62	19.76	19.63	19.77	22.77	30	PASS
802.11ac VHT20	36/5180	18.59	18.64	18.93	18.98	21.82	30	PASS
	44/5220	18.41	18.46	18.78	18.83	21.66	30	PASS
	48/5240	18.03	18.08	18.49	18.54	21.33	30	PASS
802.11ac VHT40	38/5190	18.92	19.16	19.44	19.68	22.44	30	PASS
	46/5230	19.58	19.82	19.70	19.94	22.89	30	PASS
802.11ac VHT80	42/5210	16.82	17.10	17.06	17.34	20.23	30	PASS

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),
The Total Power =10log($10^{(\text{Power antenna1 in dBm/10})}+10^{(\text{Power antenna2 in dBm/10})}$.

2. The manufacturer declared the transmitter output signals is CDD mode And N_{ss}=2. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = G_{ANT} + Array Gain,

For power measurements on IEEE 802.11 devices,

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

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

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

So directional gain = G_{ANT} + Array Gain =4+0=4 dBi<6dBi. So the power limt is 30dBm.

MIMO
with Beamforming
U-NII-1

Network Standards	Channel/ Frequency (MHz)	MIMO Antenna 1		MIMO Antenna 2		Total Power (dBm)	Limit (dBm)	Conclusion
		Average Power Measured (dBm)	Average Power with duty factor (dBm)	Average Power Measured (dBm)	Average Power with duty factor (dBm)			
802.11ac VHT20	36/5180	11.83	11.88	11.28	11.33	14.62	30	PASS
	44/5220	15.71	15.76	15.31	15.36	18.58	30	PASS
	48/5240	17.38	17.43	17.34	17.39	20.42	30	PASS
802.11ac VHT40	38/5190	8.92	9.16	8.98	9.22	12.20	30	PASS
	46/5230	15.10	15.34	14.89	15.13	18.25	30	PASS
802.11ac VHT80	42/5210	1.08	1.36	1.06	1.34	4.36	30	PASS

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),
The Total Power =10log($10^{(\text{Power antenna1 in dBm}/10)}+10^{(\text{Power antenna2 in dBm}/10)}$).
2. The manufacturer declared the transmitter output signals is CDD mode And N_{ss}=2. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = G_{ANT} + Array Gain,
For power measurements on IEEE 802.11 devices,
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.
So directional gain = G_{ANT} + Array Gain =4+0=4 dBi<6dBi. So the power limt is 30dBm.

U-NII-3

Network Standards	Channel/ Frequency (MHz)	MIMO Antenna 1		MIMO Antenna 2		Total Power (dBm)	Limit (dBm)	Conclusion
		Average Power Measured (dBm)	Average Power with duty factor (dBm)	Average Power Measured (dBm)	Average Power with duty factor (dBm)			
802.11ac VHT20	36/5180	18.70	18.75	18.91	18.96	21.87	30	PASS
	44/5220	18.62	18.67	18.76	18.81	21.75	30	PASS
	48/5240	18.08	18.13	18.56	18.61	21.39	30	PASS
802.11ac VHT40	38/5190	18.92	19.16	19.44	19.68	22.44	30	PASS
	46/5230	19.56	19.80	19.74	19.98	22.90	30	PASS
802.11ac VHT80	42/5210	16.75	17.03	17.03	17.31	20.18	30	PASS

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),
The Total Power =10log($10^{(\text{Power antenna1 in dBm/10})}+10^{(\text{Power antenna2 in dBm/10})}$.

2. The manufacturer declared the transmitter output signals is CDD mode And N_{ss}=2. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = G_{ANT} + Array Gain,
For power measurements on IEEE 802.11 devices,
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.
So directional gain = G_{ANT} + Array Gain =4+0=4 dBi<6dBi. So the power limt is 30dBm.

5.3. Frequency Stability

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

1. Frequency stability with respect to ambient temperature

a) Supply the EUT with a nominal ac voltage or install a new or fully charged battery in the EUT. If possible, a dummy load shall be connected to the EUT because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, then the EUT shall be placed in the center of the chamber with the antenna adjusted to the shortest length possible. Turn ON the EUT and tune it to one of the number of frequencies shown in 5.6.
b) Couple the unlicensed wireless device output to the measuring instrument by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away), or by connecting a dummy load to the measuring instrument, through an attenuator if necessary.
c) Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).
d) Turn the EUT OFF and place it inside the environmental temperature chamber. For devices that have oscillator heaters, energize only the heater circuit.
e) Set the temperature control on the chamber to the highest specified in the regulatory requirements for the type of device and allow the oscillator heater and the chamber temperature to stabilize.
f) While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.
g) Measure the frequency at each of frequencies specified in 5.6.
h) Switch OFF the EUT but do not switch OFF the oscillator heater.
i) Lower the chamber temperature by not more that 10°C, and allow the temperature inside the chamber to stabilize.

j) Repeat step f) through step i) down to the lowest specified temperature.

2. Frequency stability when varying supply voltage

Unless otherwise specified, these tests shall be made at ambient room temperature (+15°C to +25 °C). An antenna shall be connected to the antenna output terminals of the EUT if possible. If the EUT is equipped with or uses an adjustable-length antenna, then it shall be fully extended.

a) Supply the EUT with nominal voltage or install a new or fully charged battery in the EUT. Turn ON the EUT and couple its output to a frequency counter or other frequency-measuring instrument.

b) Tune the EUT to one of the number of frequencies required in 5.6. Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).
c) Measure the frequency at each of the frequencies specified in 5.6.
d) Repeat the above procedure at 85% and 115% of the nominal supply voltage.

Limit

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.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 936Hz

Test Results

Voltage (V)	Temperature (°C)	U-NII-1 Test Results			
		5200MHz			
		1min	2min	5min	10min
12	0	5199.999402	5199.996118	5199.986629	5199.977226
12	5	5199.993370	5199.994544	5199.977152	5199.971406
12	10	5199.987865	5199.987347	5199.976179	5199.967189
12	15	5199.978390	5199.985260	5199.975513	5199.964182
12	20	5199.975467	5199.979512	5199.967497	5199.961062
12	30	5199.968282	5199.975339	5199.966451	5199.951746
12	35	5199.960827	5199.971358	5199.964069	5199.942791
12	40	5199.955715	5199.964006	5199.962120	5199.936615
11.4	25	5199.946876	5199.958760	5199.957170	5199.926745
12.6	25	5199.942540	5199.955091	5199.948982	5199.921795
MHz		-0.057460	-0.044909	-0.051018	-0.078205
PPM		-11.049982	-8.636435	-9.811089	-15.039498

Voltage (V)	Temperature (°C)	U-NII-3 Test Results			
		5785MHz			
		1min	2min	5min	10min
12	0	5785.005383	5785.000651	5784.994343	5784.987627
12	5	5784.997157	5784.998256	5784.992831	5784.984239
12	10	5784.993271	5784.991273	5784.990695	5784.978299
12	15	5784.986356	5784.989272	5784.988745	5784.968516
12	20	5784.976464	5784.987352	5784.981545	5784.964863
12	30	5784.967383	5784.985788	5784.973511	5784.957800
12	35	5784.962825	5784.978685	5784.970095	5784.952075
12	40	5784.956121	5784.977194	5784.960170	5784.951012
11.4	25	5784.951707	5784.972312	5784.952642	5784.948059
12.6	25	5784.948656	5784.963159	5784.951627	5784.942347
MHz		-0.051344	-0.036841	-0.048373	-0.057653
PPM		-8.875340	-6.368364	-8.361801	-9.966031

5.4. Power Spectral Density

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.

Set RBW = 510 kHz, VBW =1.5MHz for the band 5.725-5.85 GHz

Set RBW = 1 MHz, VBW =3MHz for the band 5.150-5.250 GHz

The conducted PSD is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically.

Test setup

Limits

Rule FCC Part 15.407(a)(1)/ Part 15.407(a)(2) / Part 15.407(a)(3)

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. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmittingantennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Frequency Bands/MHz	Limits
5150-5250	17dBm/MHz
5725-5850	30dBm/500kHz

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor *k* = 2, *U*= 0.75dB.

Test Results:

Note: Power Spectral Density =Read Value+Duty cycle correction factor

Antenna 1

U-NII-1

Network Standards	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	36	0.30	0.33	17	PASS
	40	4.25	4.28	17	PASS
	48	6.07	6.10	17	PASS
802.11n HT20	36	0.14	0.19	17	PASS
	40	4.00	4.05	17	PASS
	48	6.12	6.17	17	PASS
802.11n HT40	38	-5.05	-4.92	17	PASS
	46	0.79	0.93	17	PASS
802.11ac VHT20	36	0.17	0.22	17	PASS
	40	4.11	4.16	17	PASS
	48	5.84	5.89	17	PASS
802.11ac VHT40	38	-4.95	-4.70	17	PASS
	46	0.91	1.15	17	PASS
802.11ac VHT80	42	-15.29	-15.01	17	PASS

U-NII-3

Network Standards	Channel Number	Read Value (dBm/500kHz)	Power Spectral Density (dBm/500kHz)	Limit (dBm/500kHz)	Conclusion
802.11a	149	4.63	4.66	30	PASS
	157	3.78	3.81	30	PASS
	165	4.38	4.41	30	PASS
802.11n HT20	149	4.09	4.14	30	PASS
	157	3.62	3.67	30	PASS
	165	4.38	4.43	30	PASS
802.11n HT40	151	1.95	2.09	30	PASS
	159	3.43	3.56	30	PASS
802.11ac VHT20	149	4.66	4.71	30	PASS
	157	3.45	3.50	30	PASS
	165	4.18	4.23	30	PASS
802.11ac VHT40	151	2.32	2.56	30	PASS
	159	2.88	3.12	30	PASS
802.11ac VHT80	155	-2.99	-2.71	30	PASS

Antenna 2

U-NII-1

Network Standards	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	36	1.09	1.12	17	PASS
	40	4.96	4.99	17	PASS
	48	6.41	6.44	17	PASS
802.11n HT20	36	0.32	0.37	17	PASS
	40	4.21	4.26	17	PASS
	48	5.24	5.29	17	PASS
802.11n HT40	38	-3.92	-3.79	17	PASS
	46	1.20	1.34	17	PASS
802.11ac VHT20	36	0.57	0.62	17	PASS
	40	4.70	4.75	17	PASS
	48	5.95	6.00	17	PASS
802.11ac VHT40	38	-4.06	-3.82	17	PASS
	46	0.80	1.05	17	PASS
802.11ac VHT80	42	-12.78	-12.50	17	PASS

U-NII-3

Network Standards	Channel Number	Read Value (dBm/500kHz)	Power Spectral Density (dBm/500kHz)	Limit (dBm/500kHz)	Conclusion
802.11a	149	4.94	4.97	30	PASS
	157	4.00	4.03	30	PASS
	165	4.77	4.80	30	PASS
802.11n HT20	149	4.72	4.77	30	PASS
	157	4.19	4.24	30	PASS
	165	4.56	4.61	30	PASS
802.11n HT40	151	3.05	3.19	30	PASS
	159	3.65	3.78	30	PASS
802.11ac VHT20	149	4.65	4.70	30	PASS
	157	4.41	4.46	30	PASS
	165	4.58	4.63	30	PASS
802.11ac VHT40	151	2.07	2.31	30	PASS
	159	4.21	4.45	30	PASS
802.11ac VHT80	155	-2.50	-2.22	30	PASS

MIMO

without Beamforming

U-NII-1

Network Standards	Channel/ Frequency (MHz)	Power Spectral Density					Limit (dBm /MHz)	Conclusion
		Antenna 1		Antenna 2		Total Power (dBm /MHz)		
		Read Value (dBm/MHz)	PSD (dBm /MHz)	Read Value (dBm/MHz)	PSD (dBm /MHz)			
802.11a	36/5180	1.21	1.24	1.68	1.71	4.49	17	PASS
	40/5200	4.82	4.85	5.72	5.75	8.33	17	PASS
	48/5240	6.53	6.56	6.24	6.27	9.43	17	PASS
802.11n HT20	36/5180	-0.05	0.00	0.80	0.85	3.45	17	PASS
	40/5200	3.97	4.02	4.36	4.41	7.23	17	PASS
	48/5240	5.77	5.82	5.89	5.94	8.89	17	PASS
802.11n HT40	38/5190	-4.59	-4.45	-3.82	-3.69	-1.04	17	PASS
	46/5230	0.99	1.13	1.17	1.30	4.23	17	PASS
802.11ac VHT20	36/5180	-0.31	-0.26	0.02	0.07	2.92	17	PASS
	40/5200	3.71	3.76	4.96	5.01	7.44	17	PASS
	48/5240	6.02	6.07	5.89	5.94	9.02	17	PASS
802.11ac VHT40	38/5190	-5.11	-4.86	-4.07	-3.83	-1.30	17	PASS
	46/5230	1.34	1.58	0.89	1.13	4.37	17	PASS
802.11ac VHT80	42/5210	-15.79	-15.51	-12.81	-12.53	-10.76	17	PASS

Note: 1. Power Spectral Density =Read Value+Duty cycle correction factor

2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density=10log($10^{(\text{PSD antenna1 in dBm}/10)}+10^{(\text{PSD antenna2 in dBm}/10)}$).

3. The manufacturer declared the transmitter output signals is CDD mode And Nss=2. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = GANT + Array Gain, For PSD measurements on all devices,Array Gain=10log(Nant/Nss)dB,so directional gain=GANT+Array Gain=4+10log（2/2)=4＜6 dBi. So the PSD limt is 17 dBm.

U-NII-3

Network Standards	Channel/ Frequency (MHz)	Power Spectral Density					Limit (dBm /MHz)	Conclusion
		Antenna 1		Antenna 2		Total Power (dBm /MHz)		
		Read Value (dBm/MHz)	PSD (dBm /MHz)	Read Value (dBm/MHz)	PSD (dBm /MHz)			
802.11a	149/5745	4.72	4.76	4.92	4.95	7.86	30	PASS
	157/5785	4.22	4.25	4.64	4.68	7.48	30	PASS
	165/5825	5.04	5.07	4.92	4.95	8.02	30	PASS
802.11n HT20	149/5745	3.92	3.97	4.76	4.81	7.42	30	PASS
	157/5785	3.65	3.70	4.22	4.27	7.00	30	PASS
	165/5825	4.05	4.10	4.76	4.81	7.48	30	PASS
802.11n HT40	151/5755	1.42	1.56	2.78	2.92	5.30	30	PASS
	159/5795	3.07	3.21	4.13	4.27	6.78	30	PASS
802.11ac VHT20	149/5745	4.03	4.08	4.49	4.54	7.32	30	PASS
	157/5785	3.85	3.90	3.47	3.52	6.73	30	PASS
	165/5825	3.81	3.86	4.14	4.19	7.04	30	PASS
802.11ac VHT40	151/5755	2.44	2.68	2.49	2.73	5.72	30	PASS
	159/5795	3.09	3.33	4.30	4.55	6.99	30	PASS
802.11ac VHT80	155/5775	-3.06	-2.79	-2.36	-2.08	0.59	30	PASS

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),
The Total Power =10log(10$^{(\text{Power antenna1 in dBm/10})}$+10$^{(\text{Power antenna2 in dBm/10})}$).
2. The manufacturer declared the transmitter output signals is CDD mode And Nss=2. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = GANT + Array Gain, For PSD measurements on all devices,Array Gain=10log(Nant/Nss)dB, so directional gain=GANT+Array Gain=4+10log（2/2)= 4＜6 dBi.   So the PSD limt is 30 dBm.

MIMO

with Beamforming

U-NII-1

Network Standards	Channel/ Frequency (MHz)	Power Spectral Density					Limit (dBm /MHz)	Conclusion
		Antenna 1		Antenna 2		Total Power (dBm /MHz)		
		Read Value (dBm/MHz)	PSD (dBm /MHz)	Read Value (dBm/MHz)	PSD (dBm /MHz)			
802.11ac VHT20	36/5180	0.25	0.30	0.33	0.38	3.35	17	PASS
	40/5200	3.68	3.73	4.56	4.61	7.20	17	PASS
	48/5240	5.83	5.88	6.25	6.30	9.11	17	PASS
802.11ac VHT40	38/5190	-4.97	-4.73	-4.13	-3.88	-1.28	17	PASS
	46/5230	1.29	1.53	1.27	1.52	4.54	17	PASS
802.11ac VHT80	42/5210	-15.29	-15.01	-12.40	-12.12	-10.32	17	PASS

Note: 1. Power Spectral Density =Read Value+Duty cycle correction factor

2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density=10log(10$^{(\text{PSD antenna1 in dBm/10})}$+10$^{(\text{PSD antenna2 in dBm/10})}$.

3. The manufacturer declared the transmitter output signals is CDD mode And Nss=2. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = GANT + Array Gain, For PSD measurements on all devices,Array Gain=10log(Nant/Nss)dB,so directional gain=GANT+Array Gain=4+10log（2/2)=4＜6 dBi. So the PSD limt is 17 dBm.

U-NII-3

Network Standards	Channel/ Frequency (MHz)	Power Spectral Density					Limit (dBm /MHz)	Conclusion
		Antenna 1		Antenna 2		Total Power (dBm /MHz)		
		Read Value (dBm/MHz)	PSD (dBm /MHz)	Read Value (dBm/MHz)	PSD (dBm /MHz)			
802.11ac VHT20	149/5745	4.30	4.35	4.85	4.90	7.64	30	PASS
	157/5785	3.96	4.01	3.50	3.55	6.80	30	PASS
	165/5825	3.54	3.59	4.57	4.62	7.15	30	PASS
802.11ac VHT40	151/5755	1.82	2.06	2.57	2.81	5.46	30	PASS
	159/5795	2.99	3.23	4.19	4.43	6.88	30	PASS
802.11ac VHT80	155/5775	-3.15	-2.87	-2.51	-2.23	0.47	30	PASS

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),
The Total Power =10log(10$^{(\text{Power antenna1 in dBm/10})}$+10$^{(\text{Power antenna2 in dBm/10})}$).

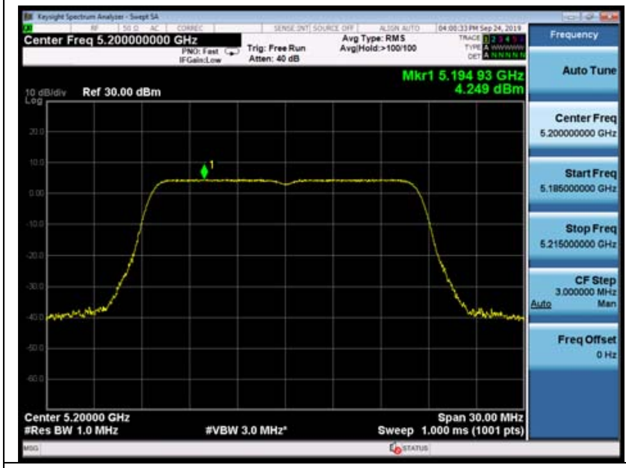
2. The manufacturer declared the transmitter output signals is CDD mode And Nss=2. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = GANT + Array Gain, For PSD measurements on all devices,Array Gain=10log(Nant/Nss)dB, so directional gain=GANT+Array Gain=4+10log（2/2)= 4＜6 dBi. So the PSD limt is 30 dBm.

SISO Antenna 1

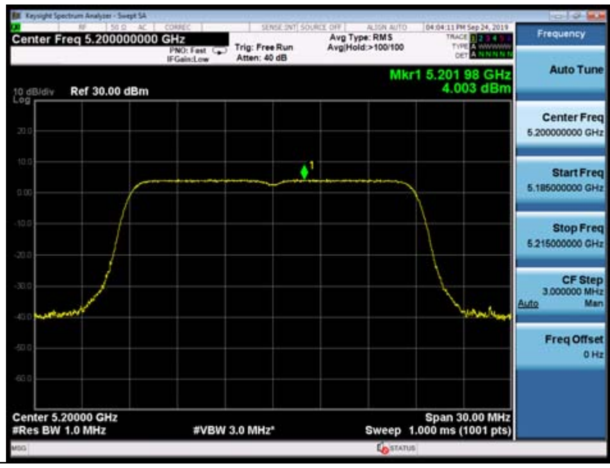
U-NII-1, 802.11a, Channel No.: 36

U-NII-1, 802.11n HT20, Channel No.: 36

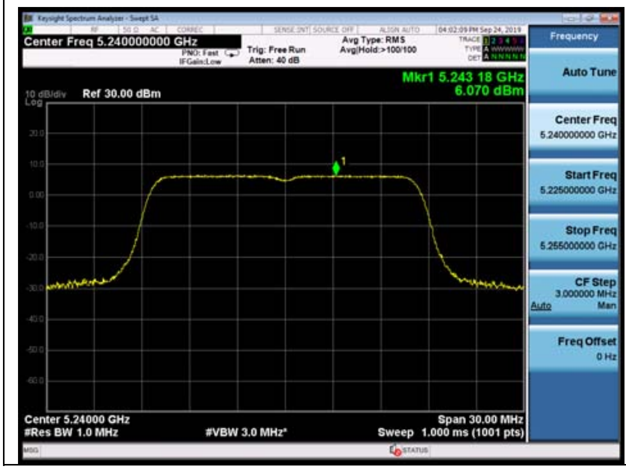
U-NII-1, 802.11a, Channel No.: 40



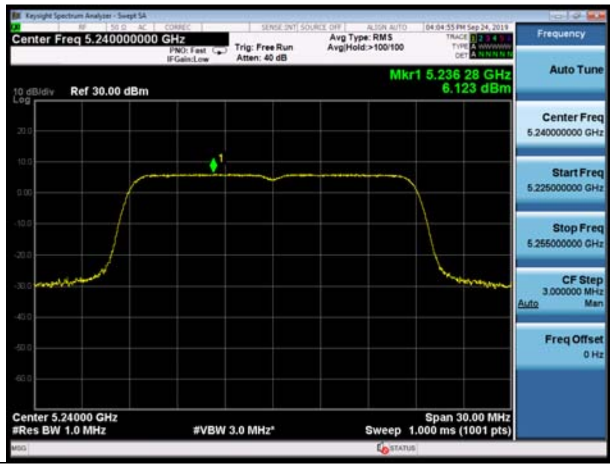
U-NII-1, 802.11n HT20, Channel No.: 40



U-NII-1, 802.11a, Channel No.: 48

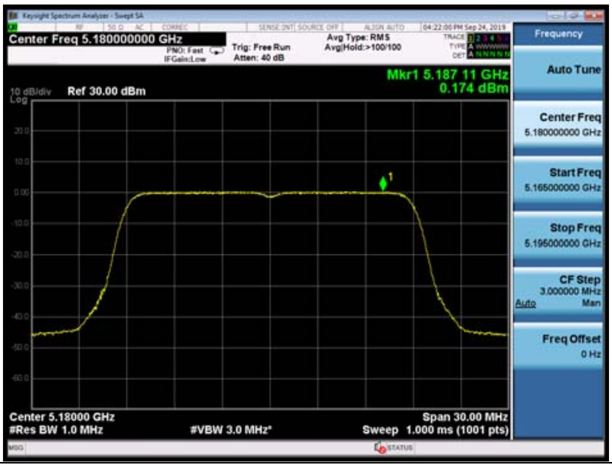


U-NII-1, 802.11n HT20, Channel No.: 48



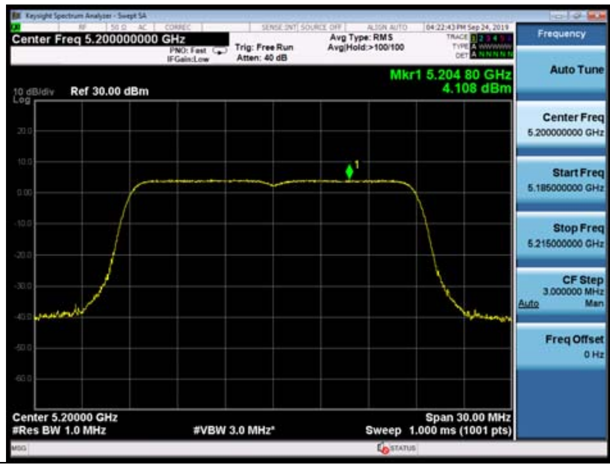
U-NII-1, 802.11n HT40, Channel No.: 38

U-NII-1, 802.11ac VHT20, Channel No.: 36

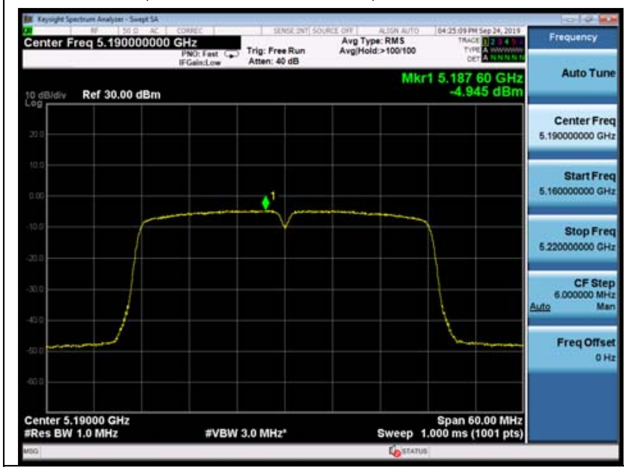


U-NII-1, 802.11n HT40, Channel No.: 46

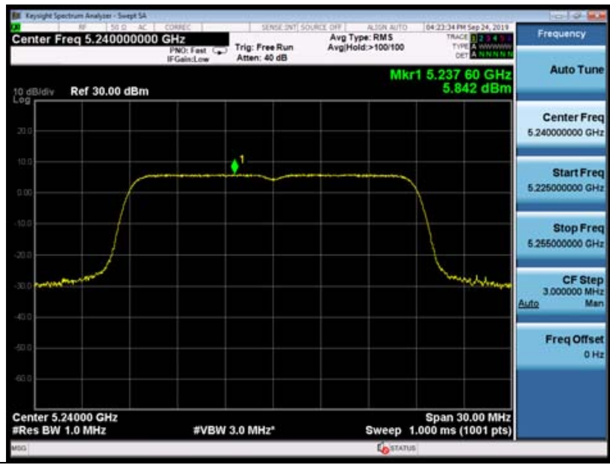
U-NII-1, 802.11ac VHT20, Channel No.: 40



U-NII-1, 802.11ac VHT40, Channel No.: 38

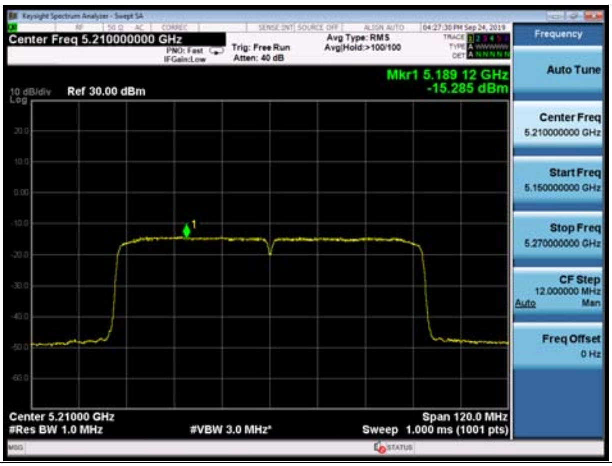


U-NII-1, 802.11ac VHT20, Channel No.: 48



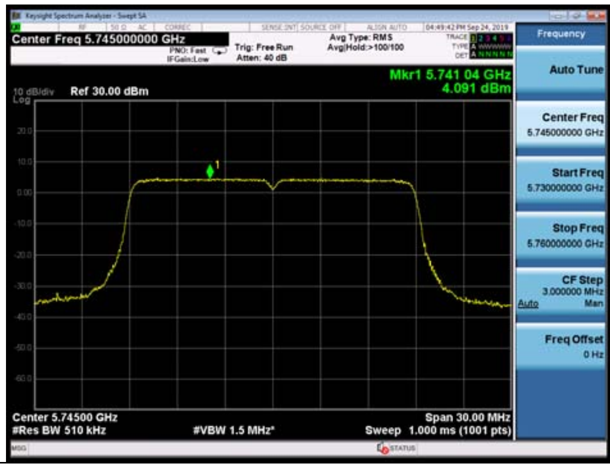
U-NII-1, 802.11ac VHT40, Channel No.: 46

U-NII-1, 802.11ac VHT80, Channel No.: 42



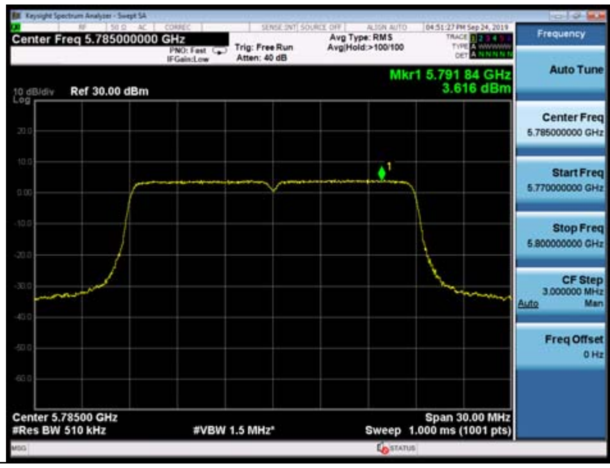
U-NII-3, 802.11a, Channel No.: 149

U-NII-3, 802.11n HT20, Channel No.: 149



U-NII-3, 802.11a, Channel No.: 157

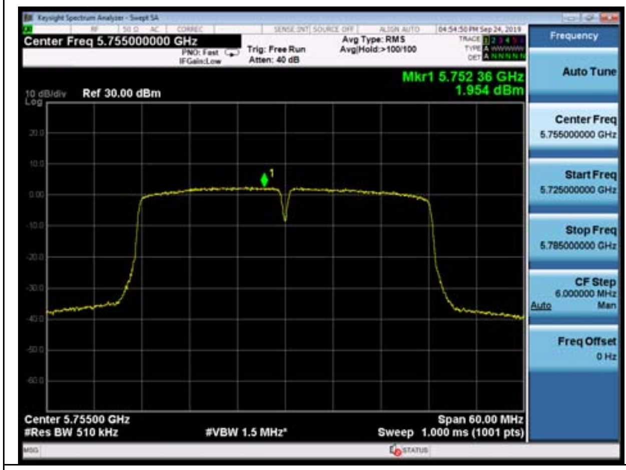
U-NII-3, 802.11n HT20, Channel No.: 157



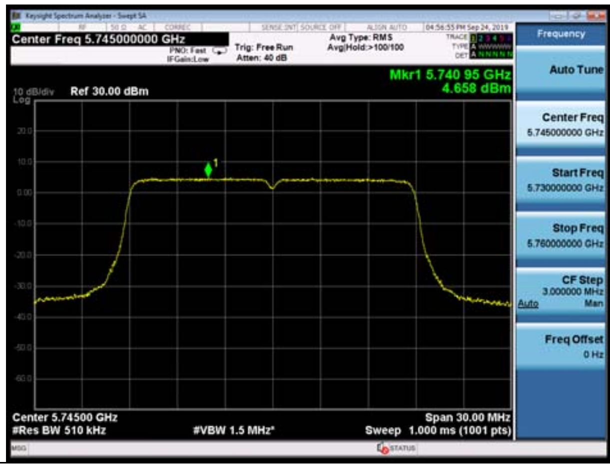
U-NII-3, 802.11a, Channel No.: 165

U-NII-3, 802.11n HT20, Channel No.: 165

U-NII-3, 802.11n HT40, Channel No.: 151

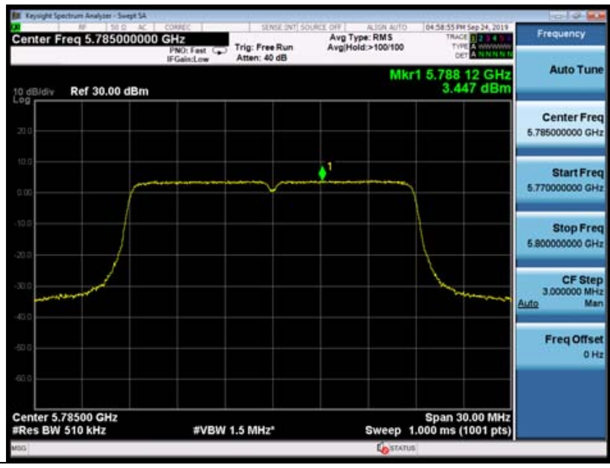


U-NII-3, 802.11ac VHT20, Channel No.: 149



U-NII-3, 802.11n HT40, Channel No.: 159

U-NII-3, 802.11ac VHT20, Channel No.: 157

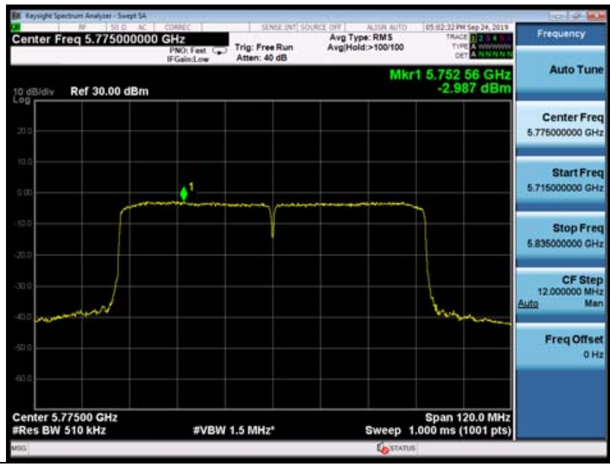


U-NII-3, 802.11ac VHT40, Channel No.: 151

U-NII-3, 802.11ac VHT20, Channel No.: 165

U-NII-3, 802.11ac VHT40, Channel No.: 159

U-NII-3, 802.11ac VHT80, Channel No.: 155

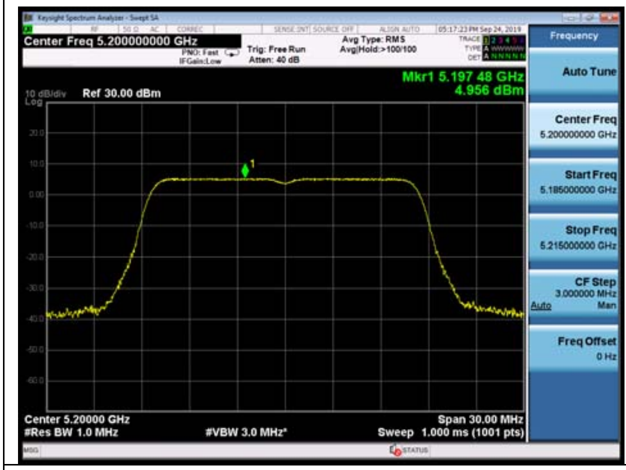


SISO Antenna 2

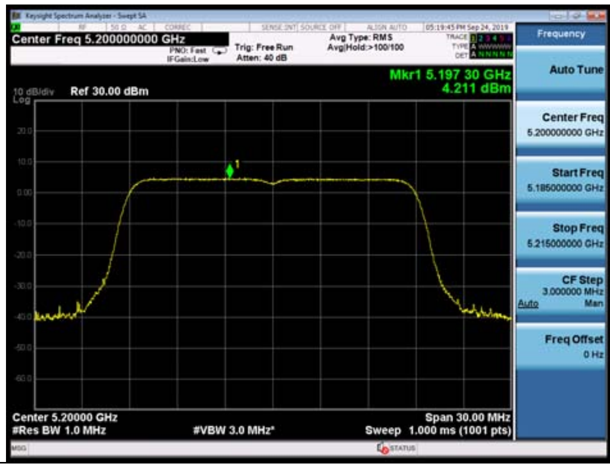
U-NII-1, 802.11a, Channel No.: 36

U-NII-1, 802.11n HT20, Channel No.: 36

U-NII-1, 802.11a, Channel No.: 40

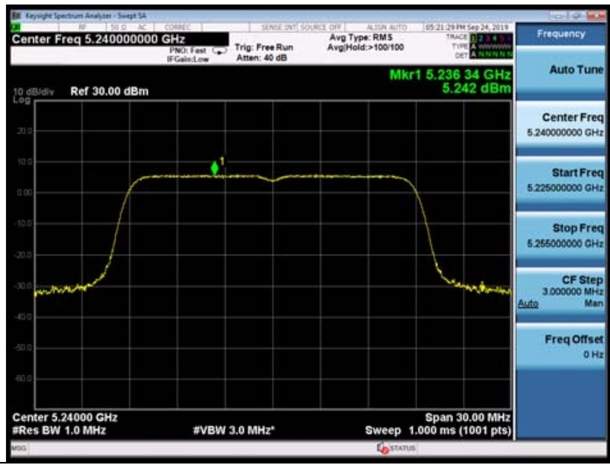


U-NII-1, 802.11n HT20, Channel No.: 40



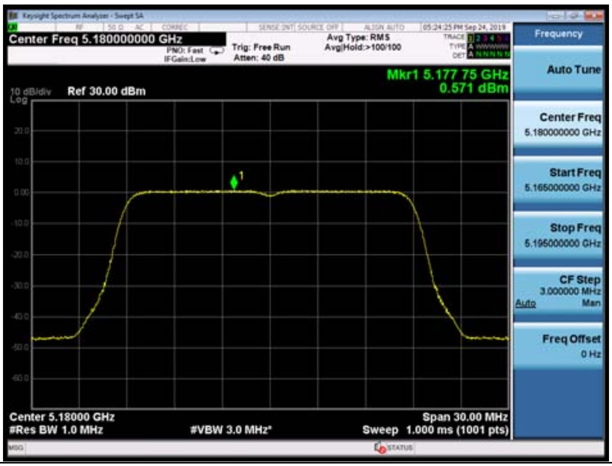
U-NII-1, 802.11a, Channel No.: 48

U-NII-1, 802.11n HT20, Channel No.: 48

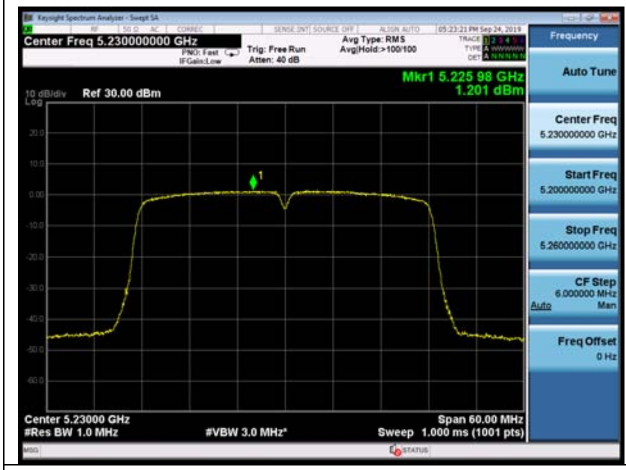


U-NII-1, 802.11n HT40, Channel No.: 38

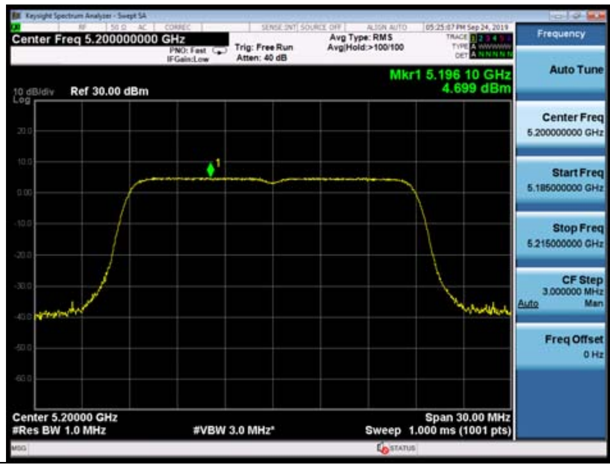
U-NII-1, 802.11ac VHT20, Channel No.: 36



U-NII-1, 802.11n HT40, Channel No.: 46

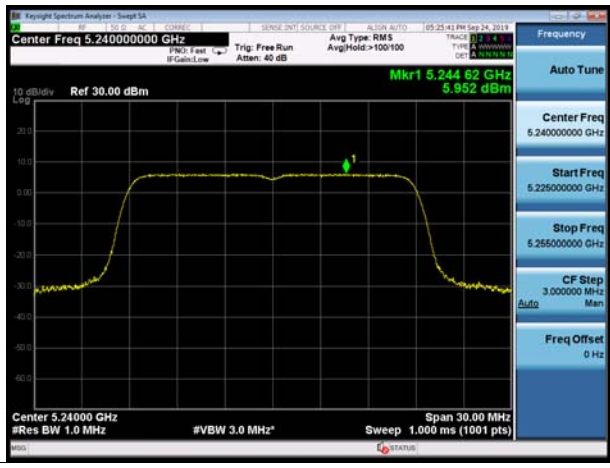


U-NII-1, 802.11ac VHT20, Channel No.: 40



U-NII-1, 802.11ac VHT40, Channel No.: 38

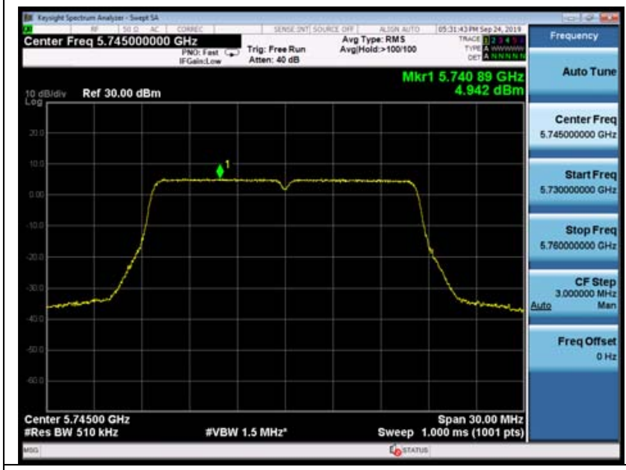
U-NII-1, 802.11ac VHT20, Channel No.: 48



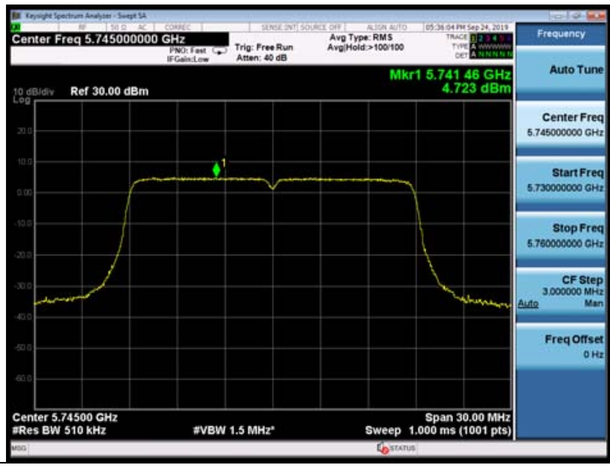
U-NII-1, 802.11ac VHT40, Channel No.: 46

U-NII-1, 802.11ac VHT80, Channel No.: 42

U-NII-3, 802.11a, Channel No.: 149

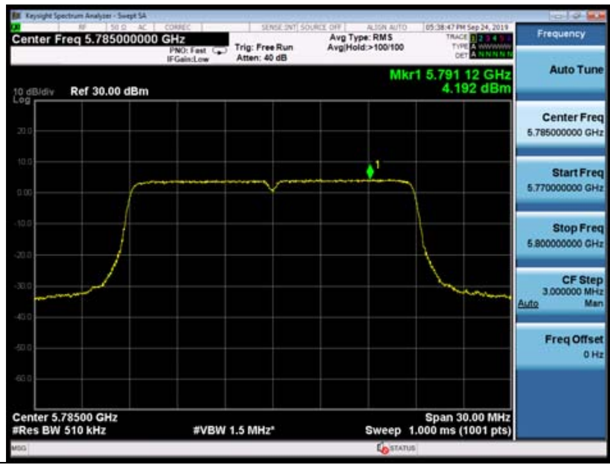


U-NII-3, 802.11n HT20, Channel No.: 149



U-NII-3, 802.11a, Channel No.: 157

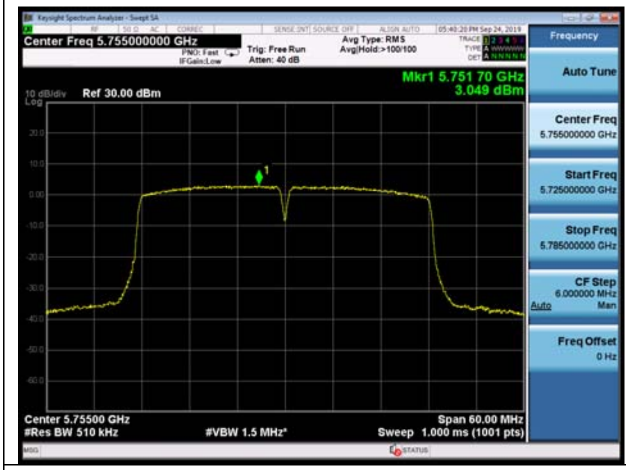
U-NII-3, 802.11n HT20, Channel No.: 157



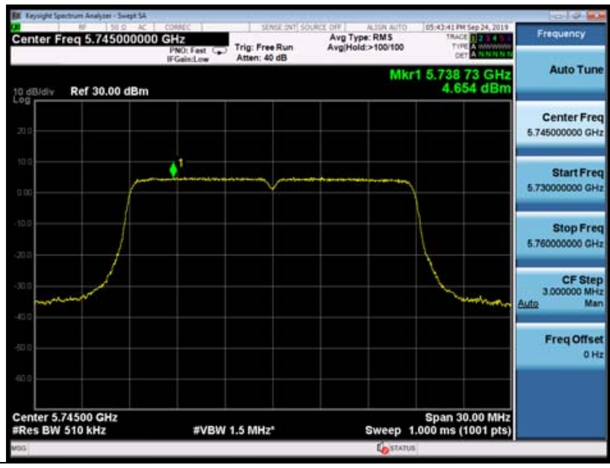
U-NII-3, 802.11a, Channel No.: 165

U-NII-3, 802.11n HT20, Channel No.: 165

U-NII-3, 802.11n HT40, Channel No.: 151

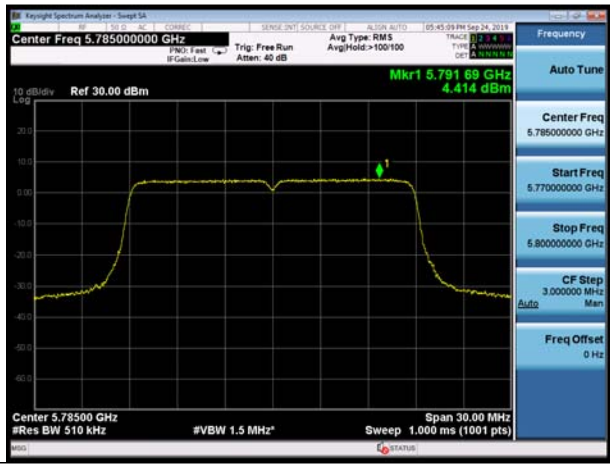


U-NII-3, 802.11ac VHT20, Channel No.: 149



U-NII-3, 802.11n HT40, Channel No.: 159

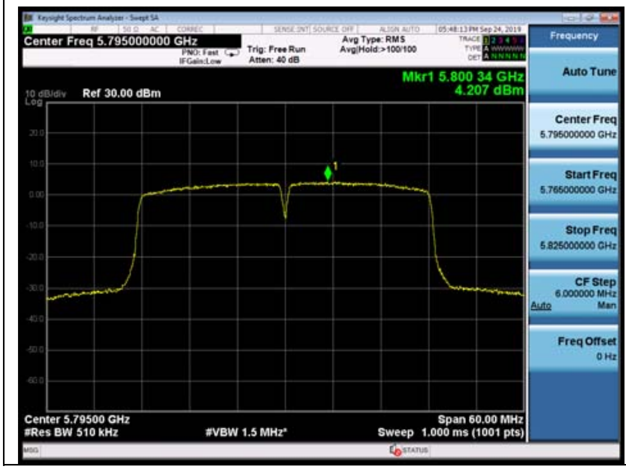
U-NII-3, 802.11ac VHT20, Channel No.: 157



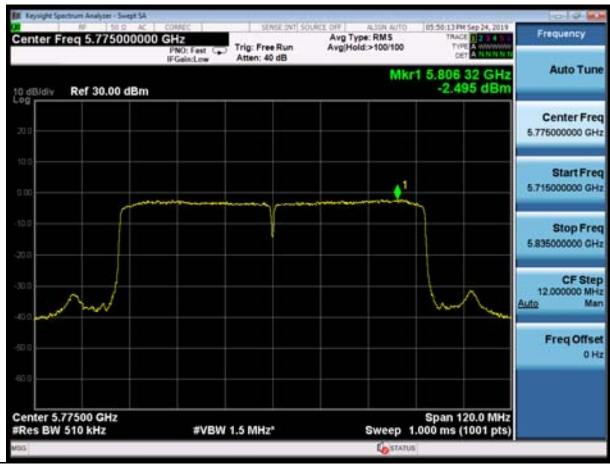
U-NII-3, 802.11ac VHT40, Channel No.: 151

U-NII-3, 802.11ac VHT20, Channel No.: 165

U-NII-3, 802.11ac VHT40, Channel No.: 159



U-NII-3, 802.11ac VHT80, Channel No.: 155

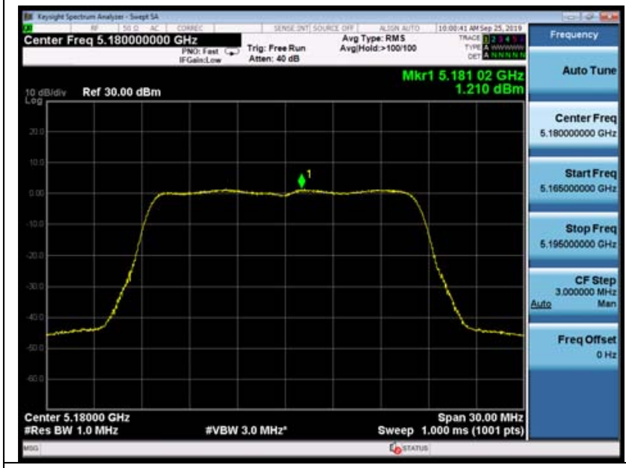


MIMO

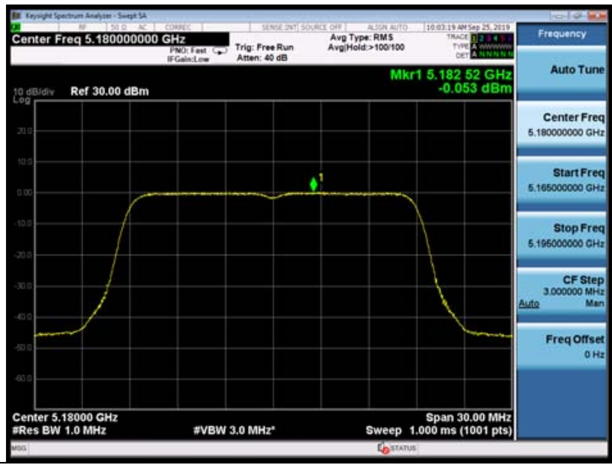
without Beamforming

MIMO Antenna 1

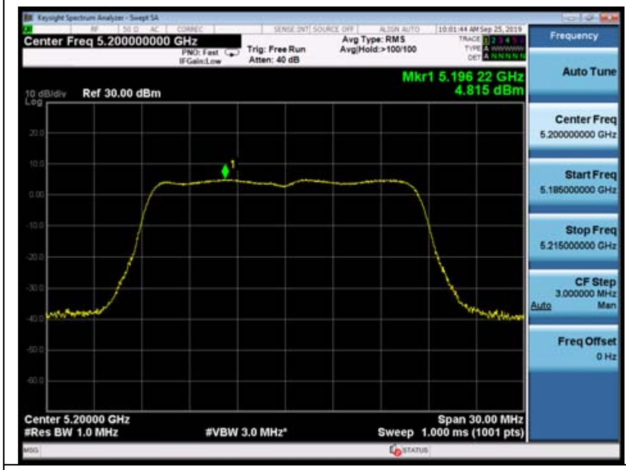
U-NII-1, 802.11a, Channel No.: 36



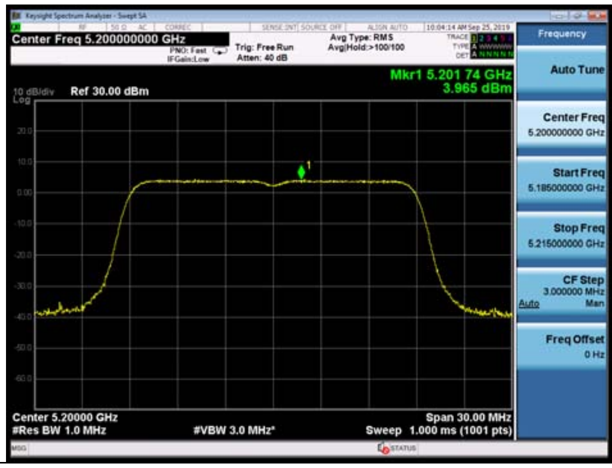
U-NII-1, 802.11n HT20, Channel No.: 36



U-NII-1, 802.11a, Channel No.: 40



U-NII-1, 802.11n HT20, Channel No.: 40

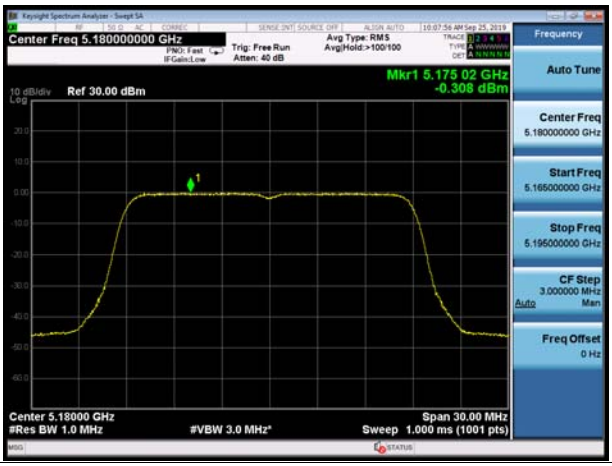


U-NII-1, 802.11a, Channel No.: 48

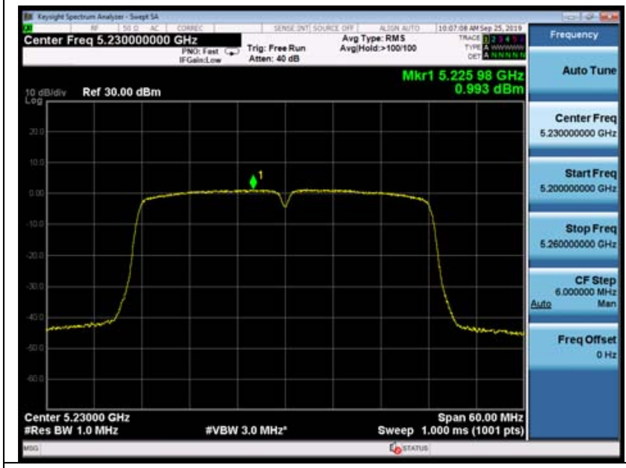
U-NII-1, 802.11n HT20, Channel No.: 48

U-NII-1, 802.11n HT40, Channel No.: 38

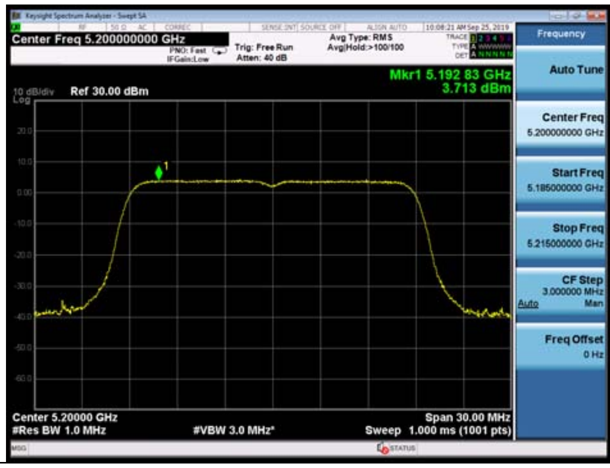
U-NII-1, 802.11ac VHT20, Channel No.: 36



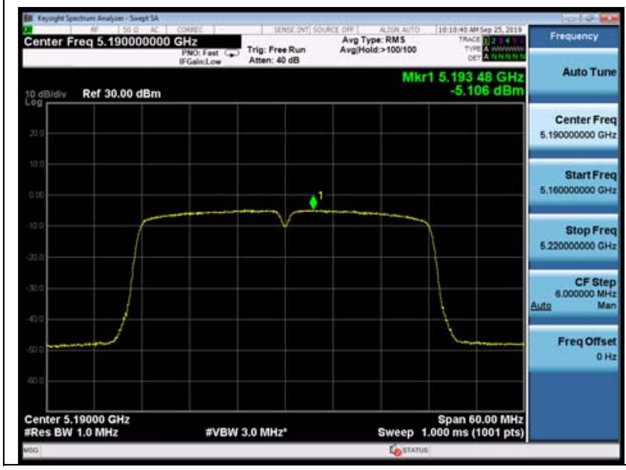
U-NII-1, 802.11n HT40, Channel No.: 46



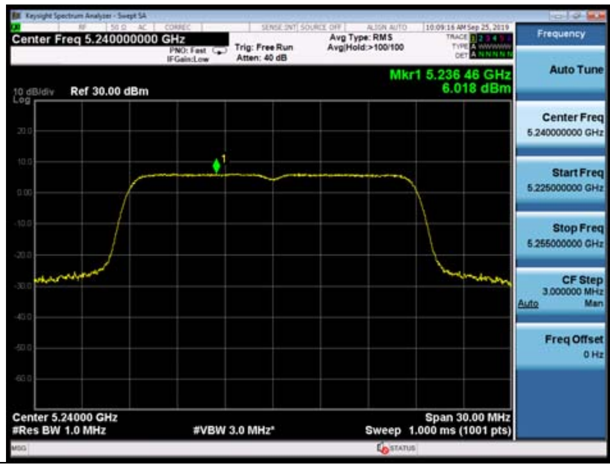
U-NII-1, 802.11ac VHT20, Channel No.: 40



U-NII-1, 802.11ac VHT40, Channel No.: 38



U-NII-1, 802.11ac VHT20, Channel No.: 48

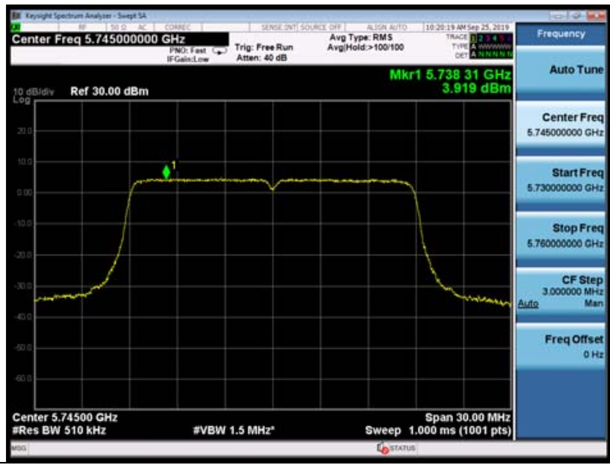


U-NII-1, 802.11ac VHT40, Channel No.: 46

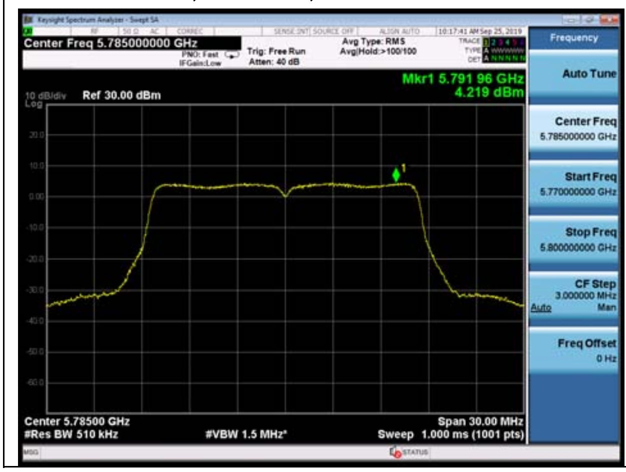
U-NII-1, 802.11ac VHT80, Channel No.: 42

U-NII-3, 802.11a, Channel No.: 149

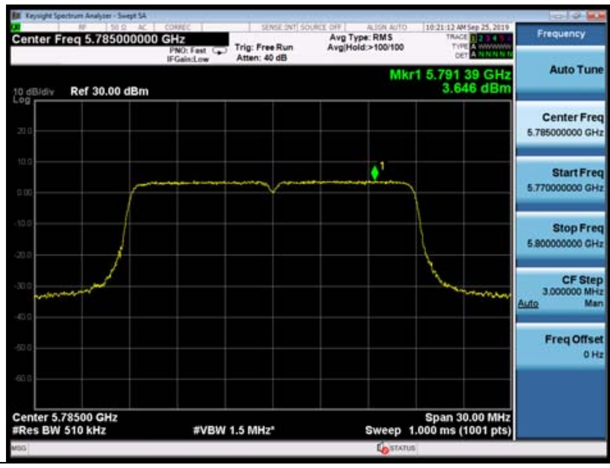
U-NII-3, 802.11n HT20, Channel No.: 149



U-NII-3, 802.11a, Channel No.: 157



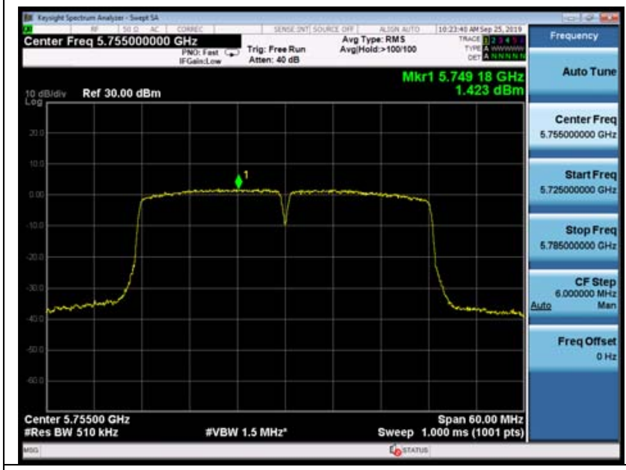
U-NII-3, 802.11n HT20, Channel No.: 157



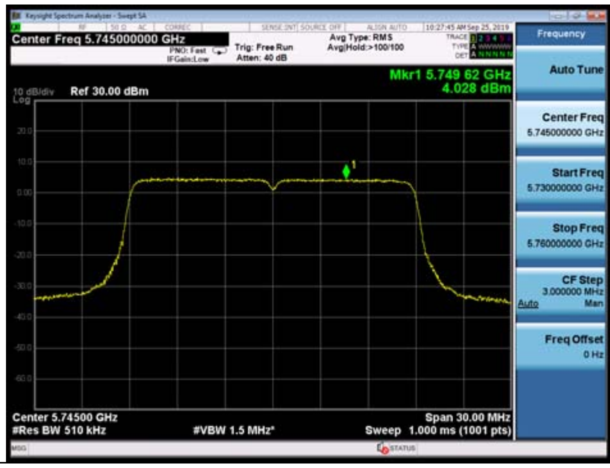
U-NII-3, 802.11a, Channel No.: 165

U-NII-3, 802.11n HT20, Channel No.: 165

U-NII-3, 802.11n HT40, Channel No.: 151

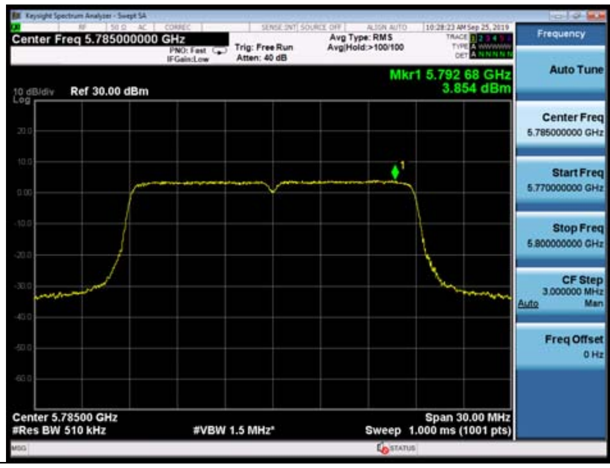


U-NII-3, 802.11ac VHT20, Channel No.: 149



U-NII-3, 802.11n HT40, Channel No.: 159

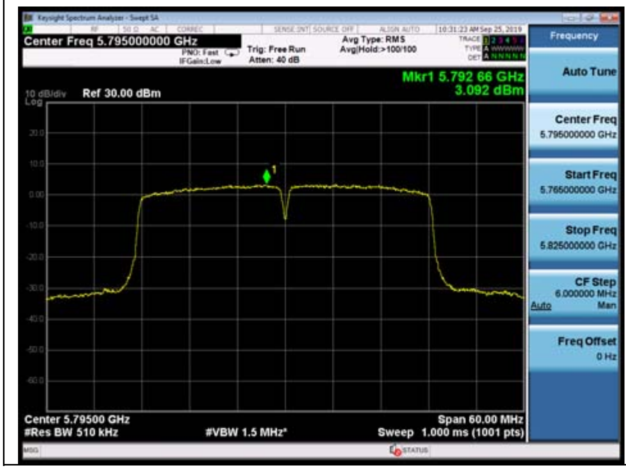
U-NII-3, 802.11ac VHT20, Channel No.: 157



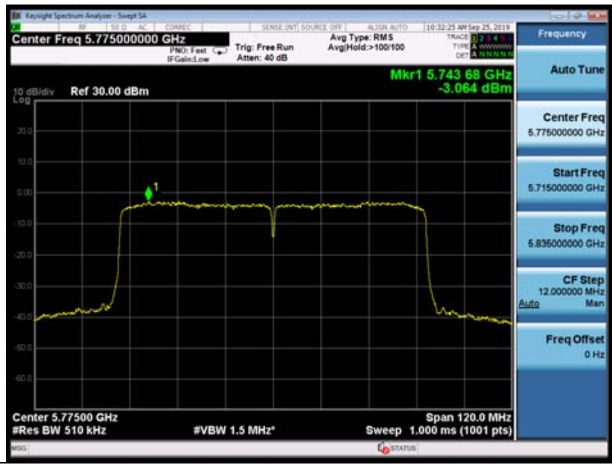
U-NII-3, 802.11ac VHT40, Channel No.: 151

U-NII-3, 802.11ac VHT20, Channel No.: 165

U-NII-3, 802.11ac VHT40, Channel No.: 159



U-NII-3, 802.11ac VHT80, Channel No.: 155

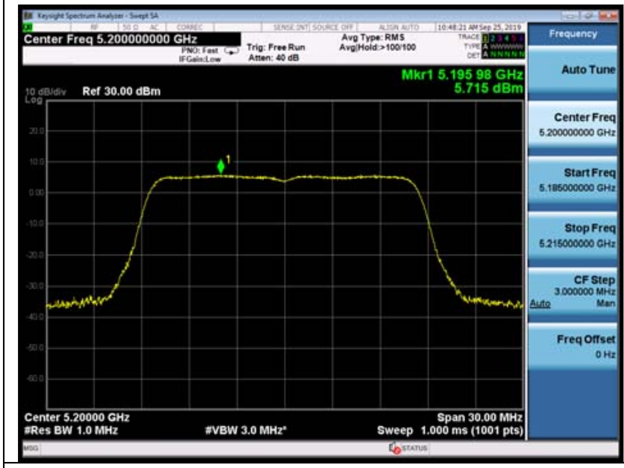


MIMO Antenna 2

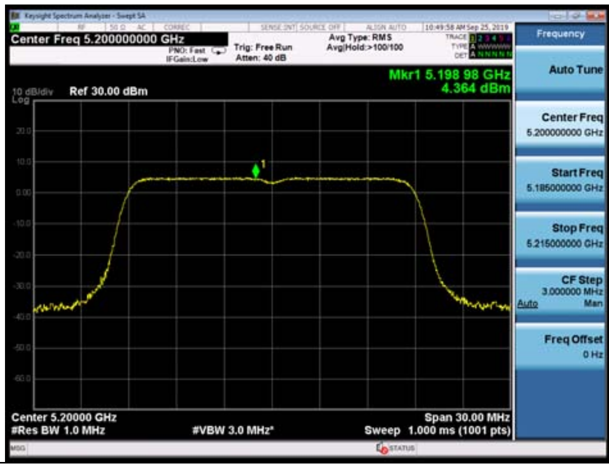
U-NII-1, 802.11a, Channel No.: 36

U-NII-1, 802.11n HT20, Channel No.: 36

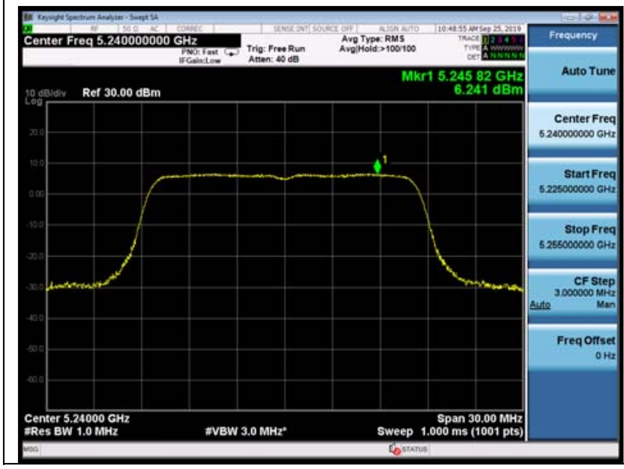
U-NII-1, 802.11a, Channel No.: 40



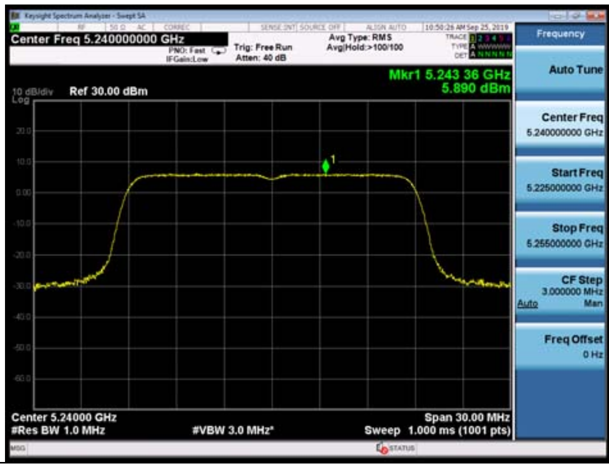
U-NII-1, 802.11n HT20, Channel No.: 40



U-NII-1, 802.11a, Channel No.: 48



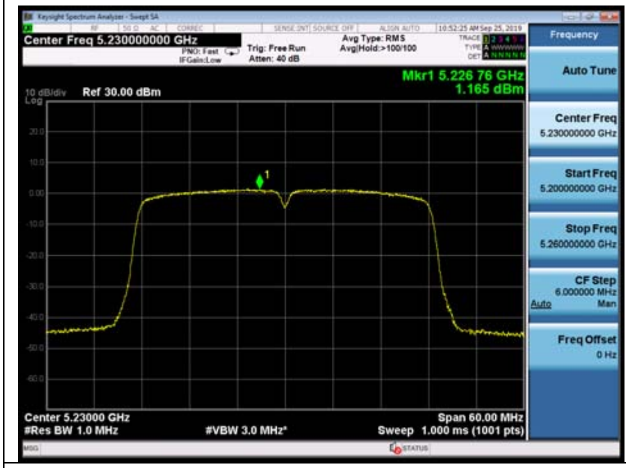
U-NII-1, 802.11n HT20, Channel No.: 48



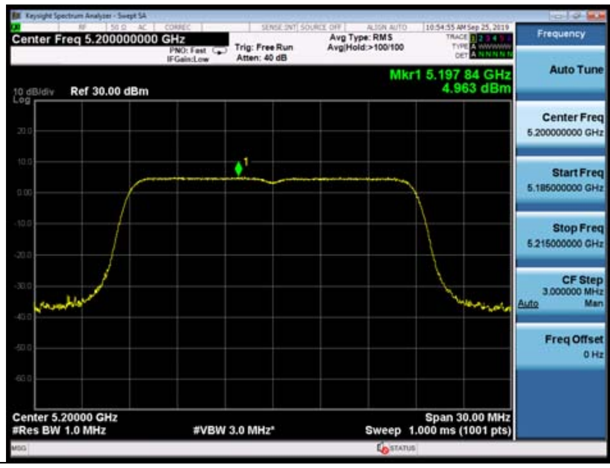
U-NII-1, 802.11n HT40, Channel No.: 38

U-NII-1, 802.11ac VHT20, Channel No.: 36

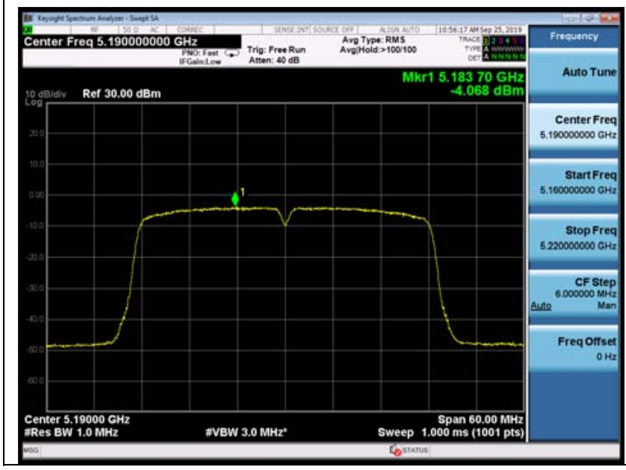
U-NII-1, 802.11n HT40, Channel No.: 46



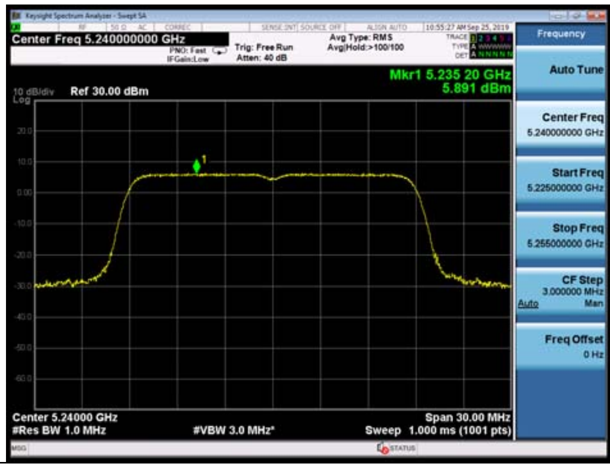
U-NII-1, 802.11ac VHT20, Channel No.: 40



U-NII-1, 802.11ac VHT40, Channel No.: 38

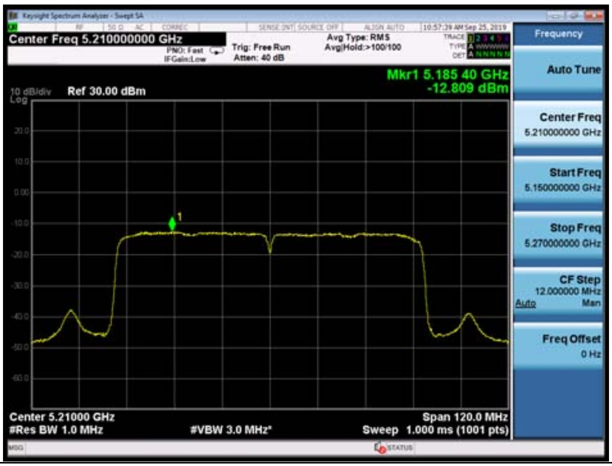


U-NII-1, 802.11ac VHT20, Channel No.: 48

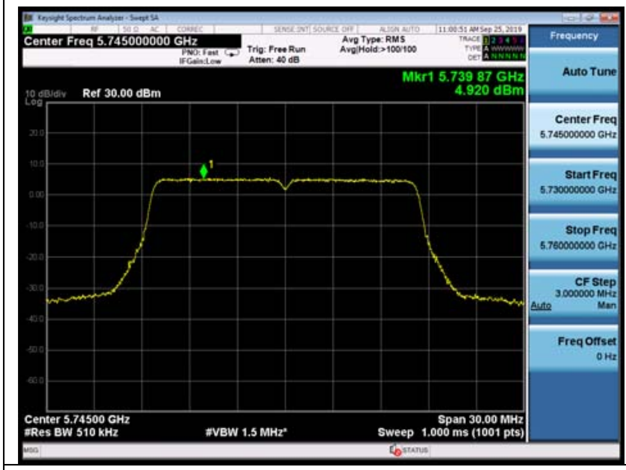


U-NII-1, 802.11ac VHT40, Channel No.: 46

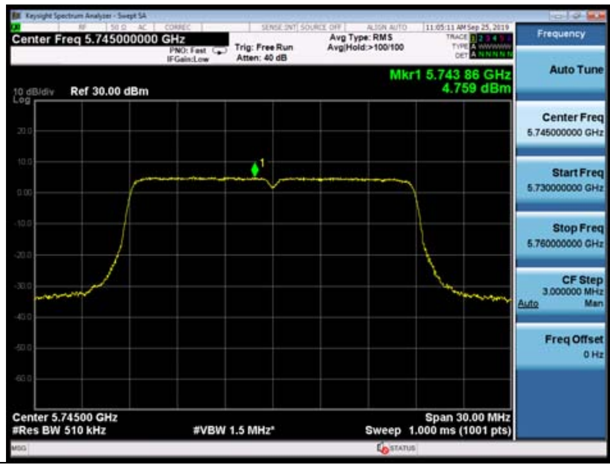
U-NII-1, 802.11ac VHT80, Channel No.: 42



U-NII-3, 802.11a, Channel No.: 149

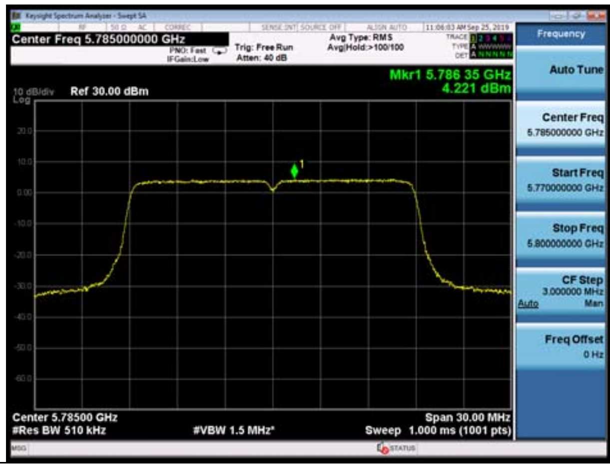


U-NII-3, 802.11n HT20, Channel No.: 149

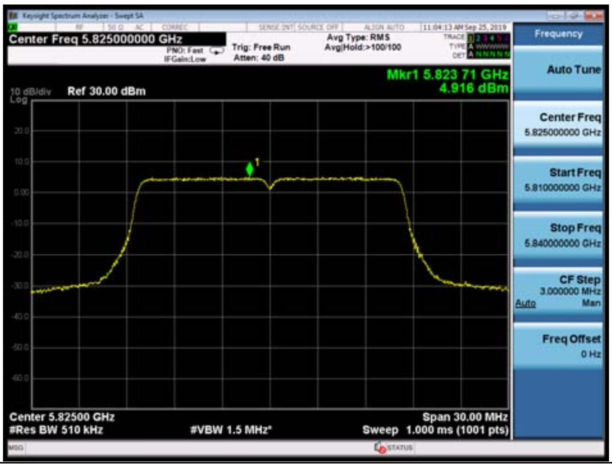


U-NII-3, 802.11a, Channel No.: 157

U-NII-3, 802.11n HT20, Channel No.: 157

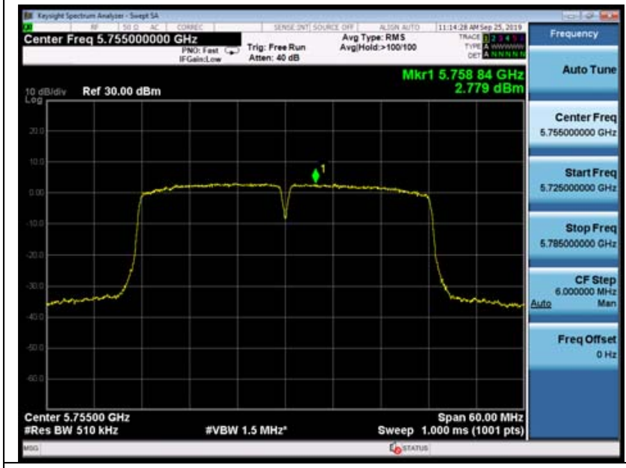


U-NII-3, 802.11a, Channel No.: 165

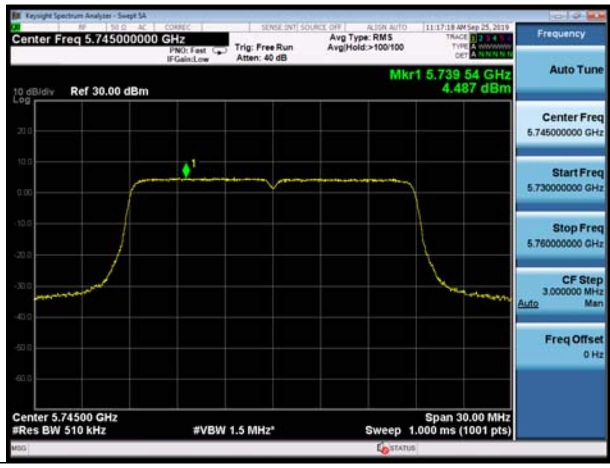


U-NII-3, 802.11n HT20, Channel No.: 165

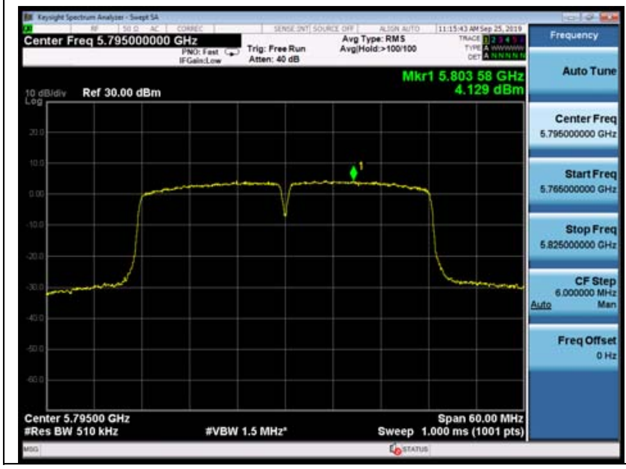
U-NII-3, 802.11n HT40, Channel No.: 151



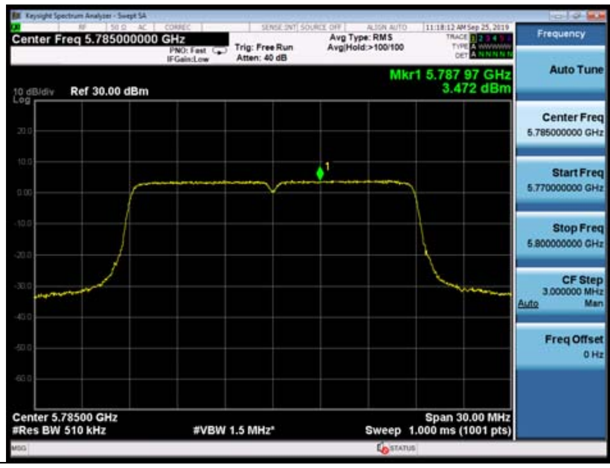
U-NII-3, 802.11ac VHT20, Channel No.: 149



U-NII-3, 802.11n HT40, Channel No.: 159



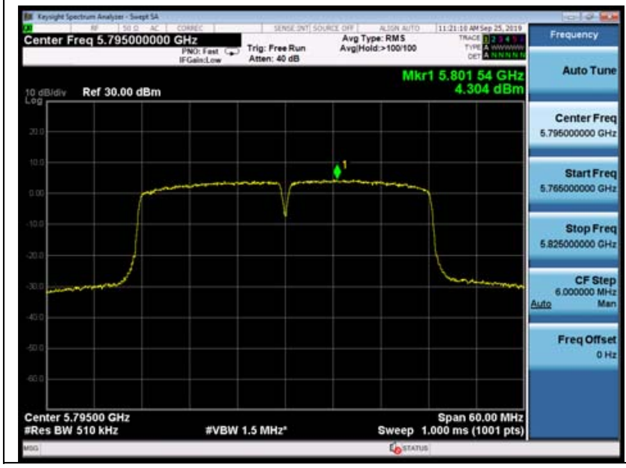
U-NII-3, 802.11ac VHT20, Channel No.: 157



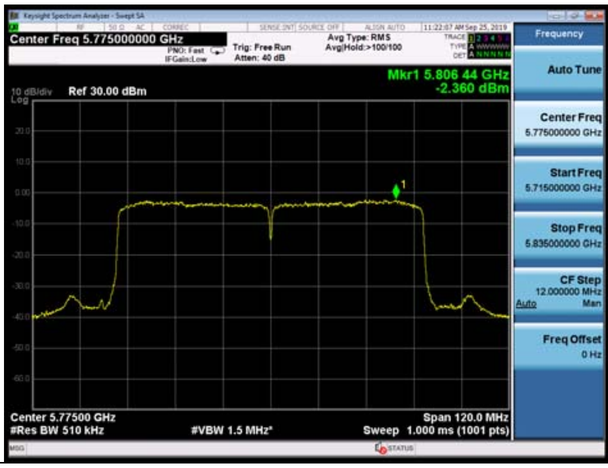
U-NII-3, 802.11ac VHT40, Channel No.: 151

U-NII-3, 802.11ac VHT20, Channel No.: 165

U-NII-3, 802.11ac VHT40, Channel No.: 159



U-NII-3, 802.11ac VHT80, Channel No.: 155

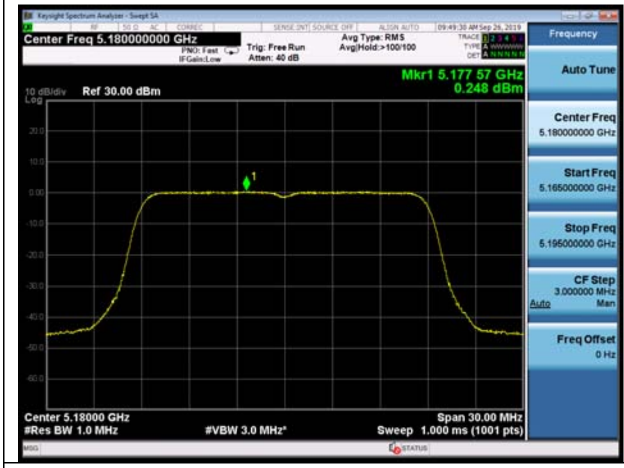


MIMO

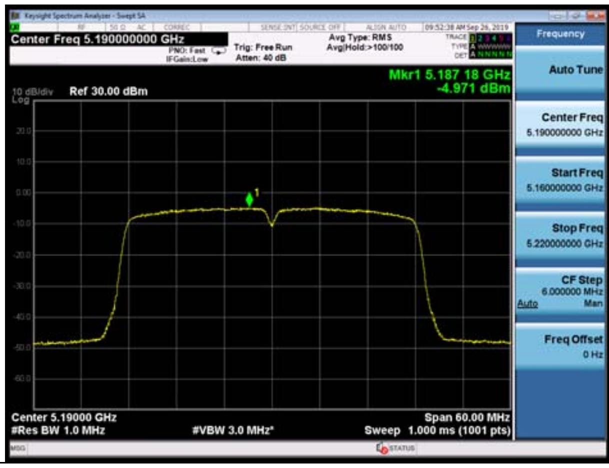
with Beamforming

MIMO Antenna 1

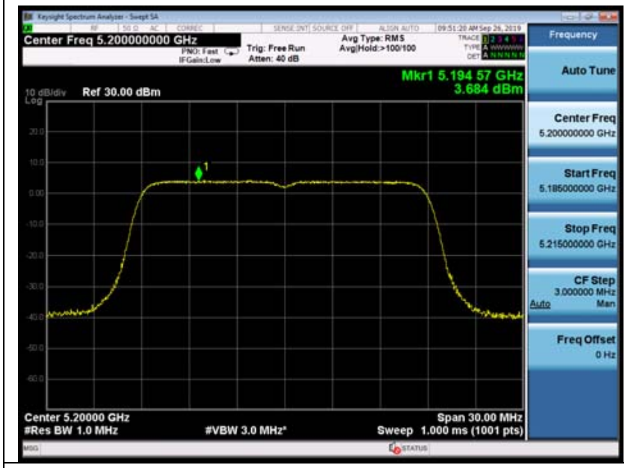
U-NII-1, 802.11ac VHT20, Channel No.: 36



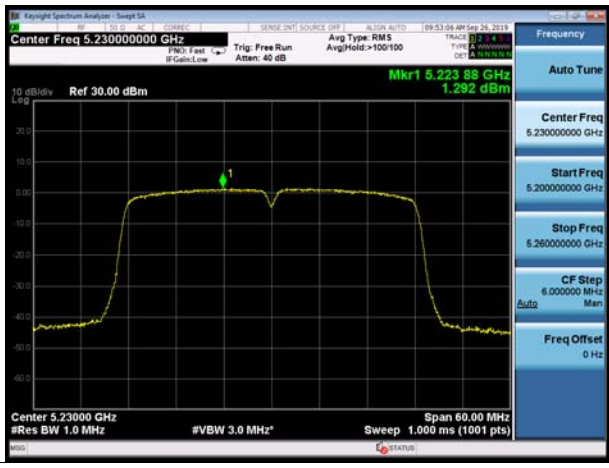
U-NII-1, 802.11ac VHT40, Channel No.: 38



U-NII-1, 802.11ac VHT20, Channel No.: 40



U-NII-1, 802.11ac VHT40, Channel No.: 46



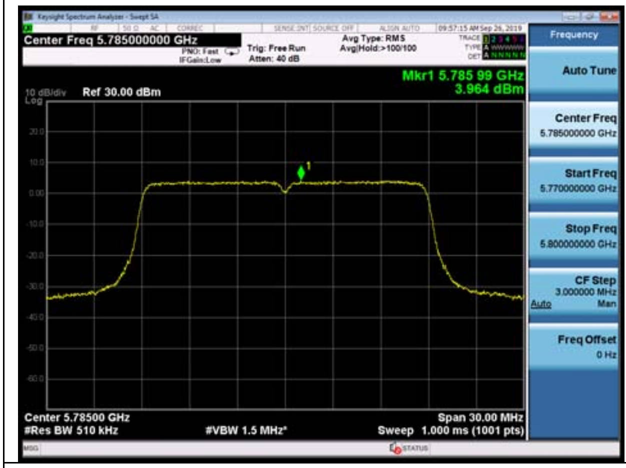
U-NII-1, 802.11ac VHT20, Channel No.: 48

U-NII-1, 802.11ac VHT80, Channel No.: 42

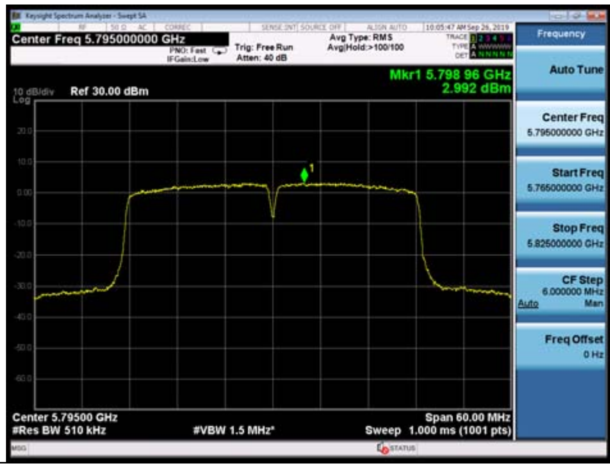
U-NII-3, 802.11ac VHT20, Channel No.: 149

U-NII-3, 802.11ac VHT40, Channel No.: 151

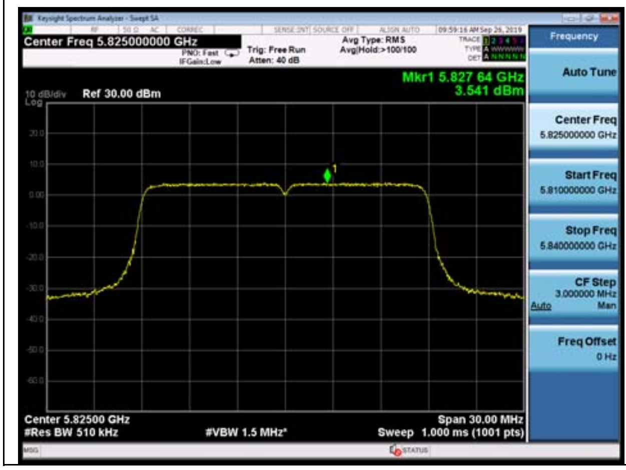
U-NII-3, 802.11ac VHT20, Channel No.: 157



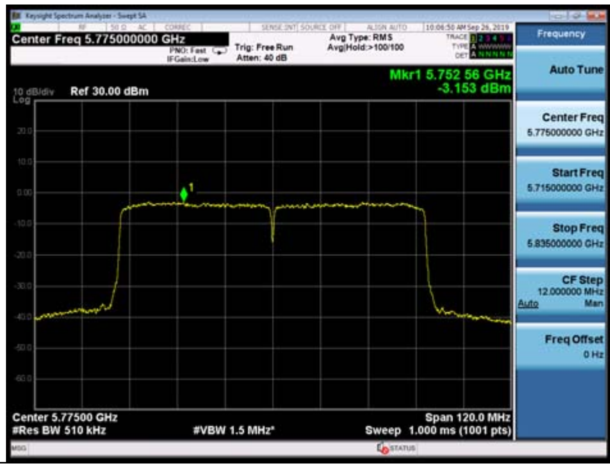
U-NII-3, 802.11ac VHT40, Channel No.: 159



U-NII-3, 802.11ac VHT20, Channel No.: 165



U-NII-3, 802.11ac VHT80, Channel No.: 155

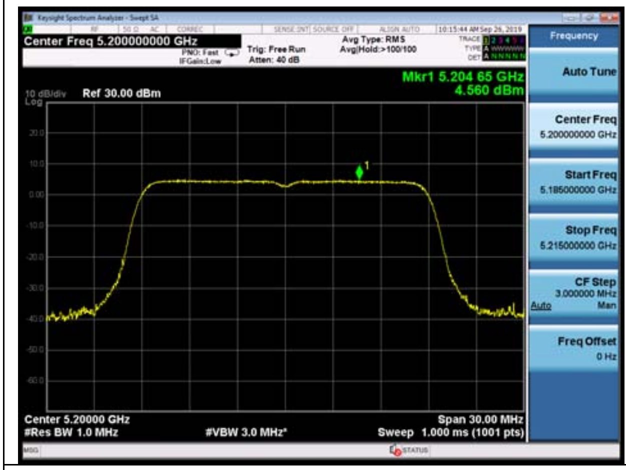


MIMO Antenna 2

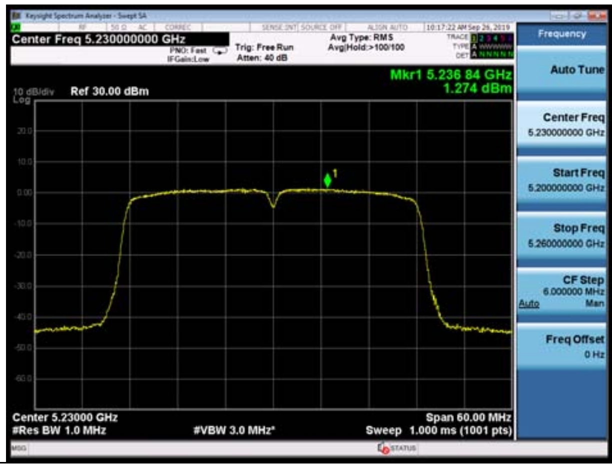
U-NII-1, 802.11ac VHT20, Channel No.: 36

U-NII-1, 802.11ac VHT40, Channel No.: 38

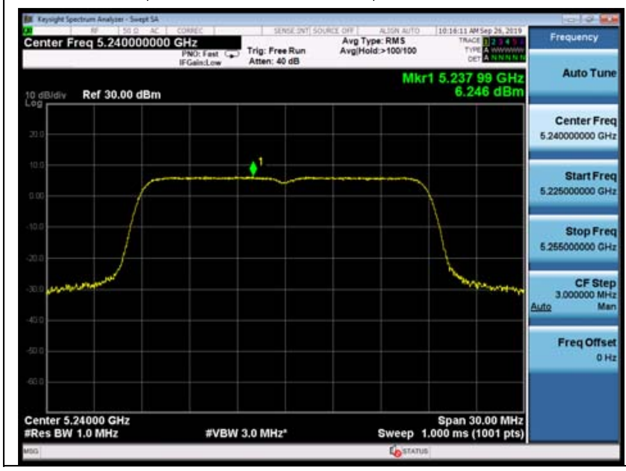
U-NII-1, 802.11ac VHT20, Channel No.: 40



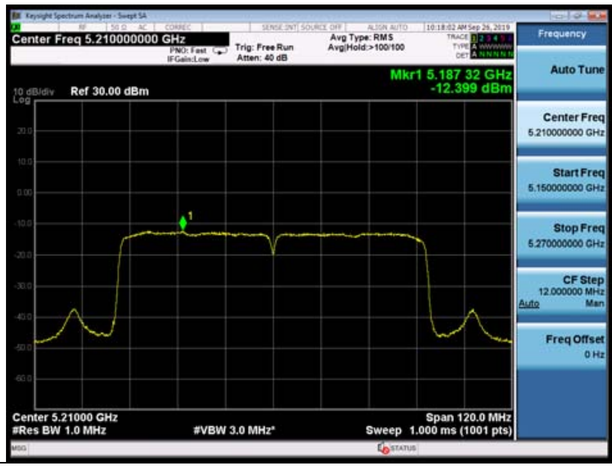
U-NII-1, 802.11ac VHT40, Channel No.: 46

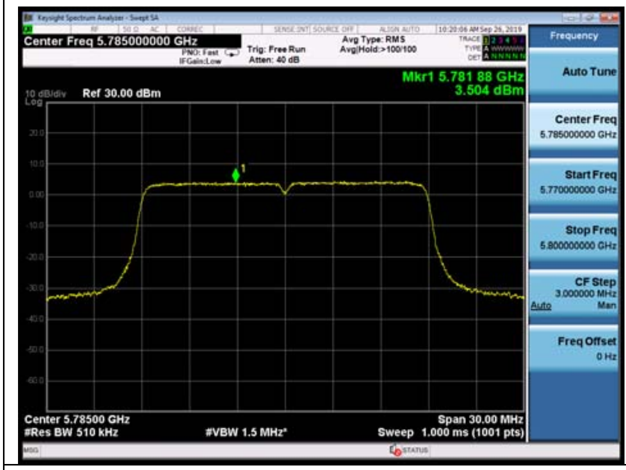
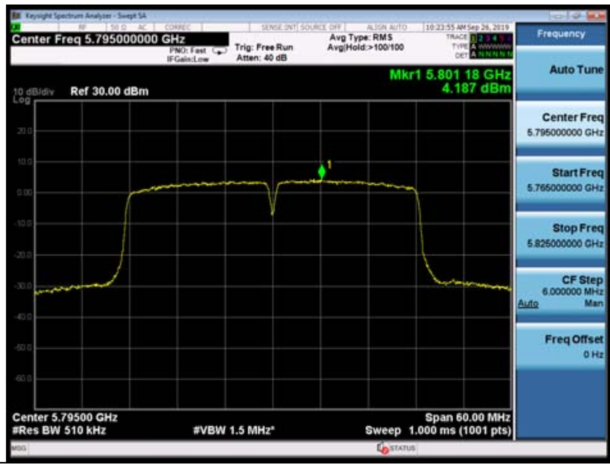
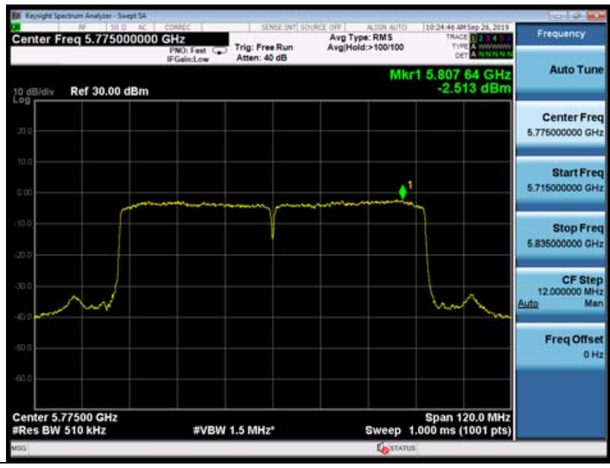


U-NII-1, 802.11ac VHT20, Channel No.: 48



U-NII-1, 802.11ac VHT80, Channel No.: 42



U-NII-3, 802.11ac VHT20, Channel No.: 149	U-NII-3, 802.11ac VHT40, Channel No.: 151
	
U-NII-3, 802.11ac VHT20, Channel No.: 157	U-NII-3, 802.11ac VHT40, Channel No.: 159
	
U-NII-3, 802.11ac VHT20, Channel No.: 165	U-NII-3, 802.11ac VHT80, Channel No.: 155
	

5.5. Unwanted Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10-2013. The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna. The radiated emissions measurements were made in a typical installation configuration.
Sweep the whole frequency band range from 9kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

During the test, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.
Set the spectrum analyzer in the following:
Below 1GHz (detector: Peak and Quasi-Peak)
RBW=100kHz / VBW=300kHz / Sweep=AUTO
Above 1GHz (detector: Peak):
I) Peak emission levels are measured by setting the instrument as follows:
1) RBW = 1 MHz.
2) VBW ≥ [3 × RBW]
3) Detector = peak.
4) Sweep time = auto.
5) Trace mode = max hold.
6) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, then the time required for the trace to stabilize will increase by a factor of approximately 1 / D, where D is the duty cycle.

II) Average emission levels are measured by setting the instrument as follows:
a) RBW = 1 MHz.
b) VBW ≥ [3 × RBW].
c) Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)

e) Sweep time = auto.

f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

Reduce the video bandwidth until no significant variations in the displayed signal are observed in subsequent traces, provided the video bandwidth is no less than 1 Hz. For regulatory requirements that specify averaging only over the transmit duration (e.g., digital transmission system [DTS] and Unlicensed National Information Infrastructure [U-NII]), the video bandwidth shall be greater than [1 / (minimum transmitter on time)] and no less than 1 Hz.

The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the loop antenna is vertical, others antenna are vertical and horizontal.

The test is in transmitting mode.