RF TEST REPORT

Applicant	Shanghai Smawave Technology Co. ,Ltd
FCC ID	2AU8HSRP410-A
Product	LTE CPE
Brand	Smawave
Model	SRP410-a
Report No.	R2001A0014-R9V1
Issue Date	May 7, 2020

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15E (2019)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Peng Tao

Performed by: Peng Tao

Kai Xu

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

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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: April 11, 2020~ April 26, 2020			
Note: All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

Note: This revised report (Report No.: R2001A0014-R9V1) supersedes and replaces the previously issued report (Report No.: R2001A0014-R9). Please discard or destroy the previously issued report and dispose of it accordingly.

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.

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

2.1. Applicant and Manufacturer Information

Applicant	Shanghai Smawave Technology Co. ,Ltd
Applicant address	3/F, Building 8, 1001 North Qinzhou Road，Xuhui District, Shanghai, China
Manufacturer	Shanghai Smawave Technology Co. ,Ltd
Manufacturer address	3/F, Building 8, 1001 North Qinzhou Road，Xuhui District, Shanghai, China

2.2. General information

EUT Description	
Model	SRP410-a
SN	6201A20010300144
Hardware Version	SGL6010_V1.2
Software Version	SG626_V1.0
Power Supply	DC Power
Antenna Type	External Antenna
Antenna Gain	Antenna 1: 5dBi Antenna 2: 5dBi
Directional Gain	5dBi
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	16.97dBm
Operating Frequency Range(s)	U-NII-1: 5150-5250MHz U-NII-3: 5725-5850MHz
Operating temperature range:	-40 ° C to 70° C
Operating voltage range:	9V to 14V
State DC voltage:	12V
Note:1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.	

3. Applied Standards

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

Test standards:

FCC CFR47 Part 15E (2019) Unlicensed National Information Infrastructure Devices

ANSI C63.10 (2013)

Reference standard:

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		
	Antenna 1	**Antenna 2**	**MIMO**
802.11a	54	54	54
802.11n HT20	MCS7	MCS7	MCS7
802.11n HT40	MCS7	MCS7	MCS7
802.11ac VHT20	MCS9	MCS9	MCS9
802.11ac VHT40	MCS9	MCS9	MCS9
802.11ac VHT80	MCS9	MCS9	MCS9

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	--	O	--
Frequency stability	--	802.11a	--
Power Spectral Density	O	O	O
Unwanted Emissions	--	802.11a	802.11n-HT20/40 802.11ac-VHT20/40/80
Conducted Emissions	--	O	--
Note：“O”: test all bands			

Wireless Technology and Frequency Range

Wireless Technology		Bandwidth	Channel	Frequency
Wi-Fi	U-NII-1	20 MHz	36	5180MHz
			40	5200MHz
			44	5220MHz
			48	5240MHz
		40 MHz	38	5190MHz
			46	5230MHz
		80 MHz	42	5210MHz
	U-NII-3	20 MHz	149	5745MHz
			153	5765MHz
			157	5785MHz
			161	5805MHz
			165	5825MHz
		40 MHz	151	5755MHz
			159	5795MHz
		80 MHz	155	5775MHz

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.

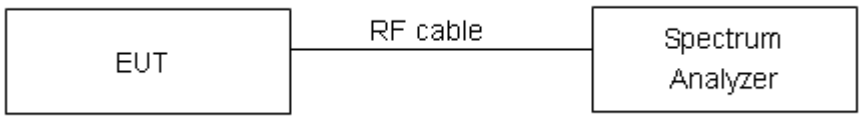
For U-NII-1/U-NII-2A/U-NII-2C, set RBW ≈1% OCB kHz, VBW ≥ 3 × RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the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

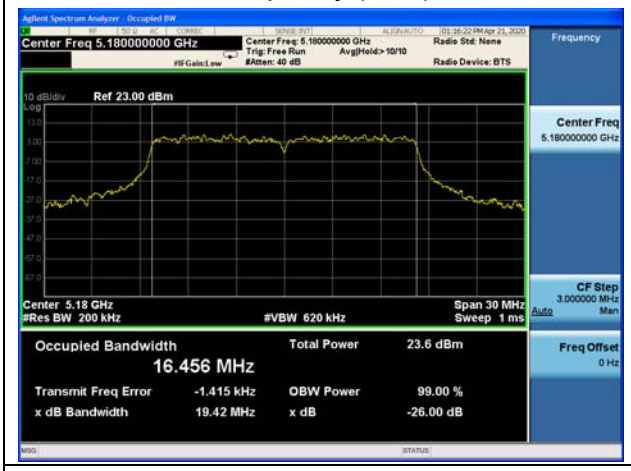
Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5180	16.456	19.42	PASS
	5200	16.470	19.42	PASS
	5240	16.484	20.60	PASS
802.11n HT20	5180	17.586	20.27	PASS
	5200	17.596	20.39	PASS
	5240	17.590	20.35	PASS
802.11n HT40	5190	36.328	41.90	PASS
	5230	36.384	44.61	PASS
802.11ac VHT20	5180	17.553	20.14	PASS
	5200	17.576	20.20	PASS
	5240	17.553	20.67	PASS
802.11ac VHT40	5190	36.428	42.98	PASS
	5230	36.517	42.97	PASS
802.11ac VHT80	5210	77.234	114.2	PASS

U-NII-3

Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11a	5745	16.463	16.42	500	PASS
	5785	16.471	16.41	500	PASS
	5825	16.466	16.40	500	PASS
802.11n HT20	5745	17.573	17.08	500	PASS
	5785	17.600	17.04	500	PASS
	5825	17.573	16.82	500	PASS
802.11n HT40	5755	36.335	35.46	500	PASS
	5795	36.399	36.10	500	PASS
802.11ac VHT20	5745	17.589	17.18	500	PASS
	5785	17.577	17.10	500	PASS
	5825	17.561	16.42	500	PASS
802.11ac VHT40	5755	36.392	35.44	500	PASS
	5795	36.491	35.68	500	PASS
802.11ac VHT80	5775	77.184	79.29	500	PASS

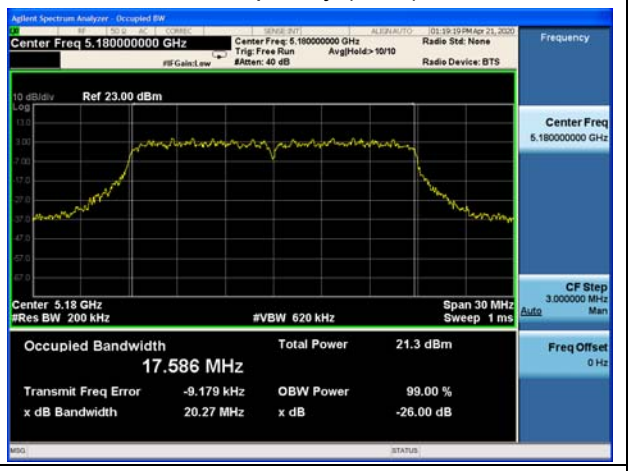
U-NII-1, 802.11a

Carrier frequency (MHz): 5180



U-NII-1, 802.11n HT20

Carrier frequency (MHz): 5180



U-NII-1, 802.11a

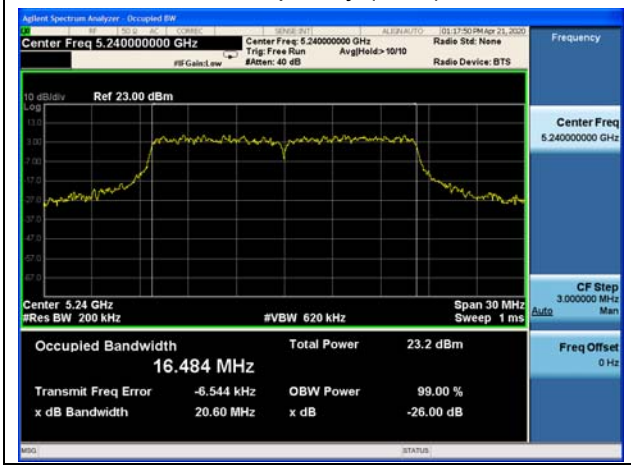
Carrier frequency (MHz): 5200

U-NII-1, 802.11n HT20

Carrier frequency (MHz): 5200

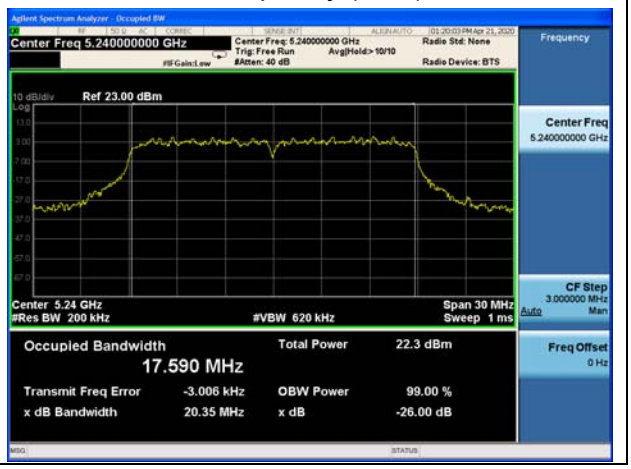
U-NII-1, 802.11a

Carrier frequency (MHz):5240



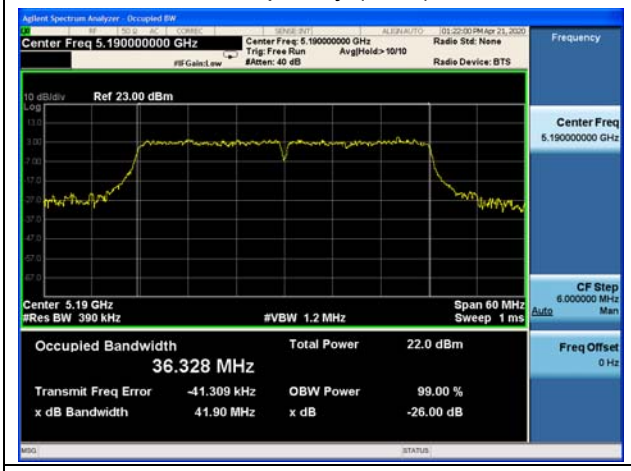
U-NII-1, 802.11n HT20

Carrier frequency (MHz):5240



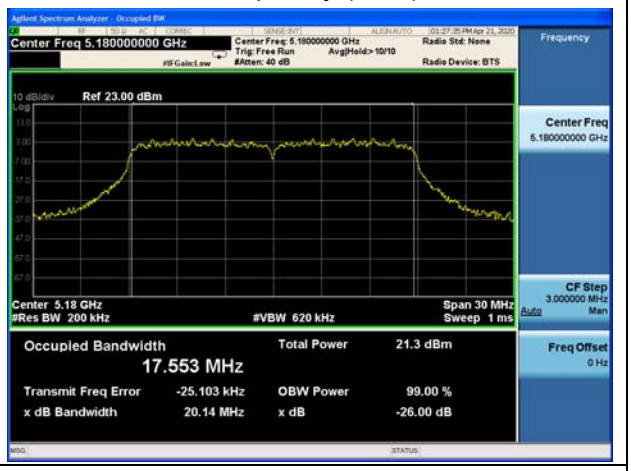
U-NII-1, 802.11n HT40

Carrier frequency (MHz): 5190



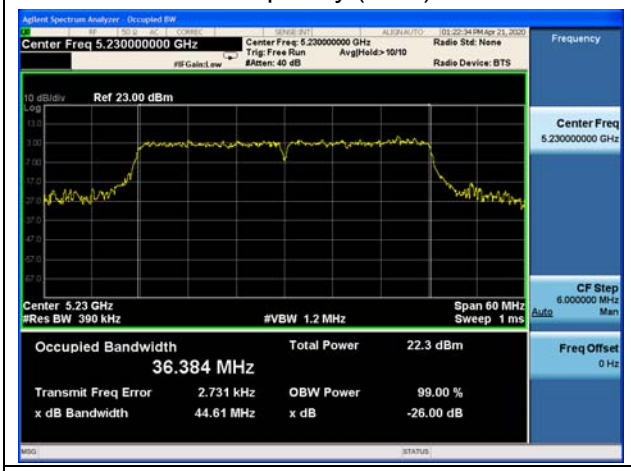
U-NII-1, 802.11ac VHT20

Carrier frequency (MHz): 5180



U-NII-1, 802.11n HT40

Carrier frequency (MHz): 5230

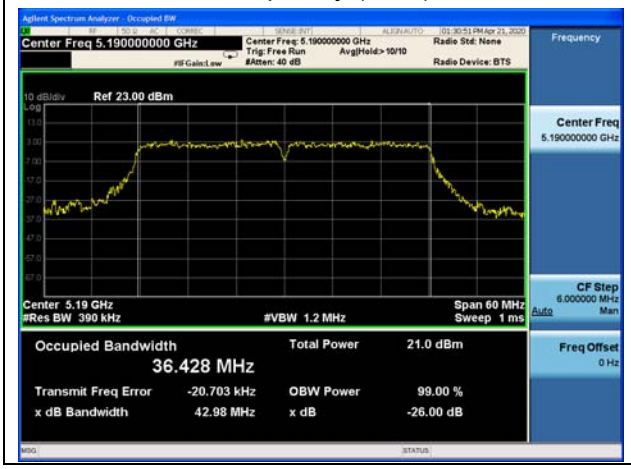


U-NII-1, 802.11ac VHT20

Carrier frequency (MHz): 5200

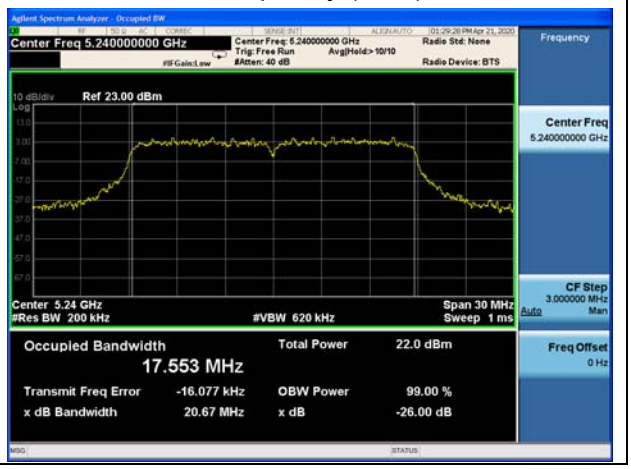
U-NII-1, 802.11ac VHT40

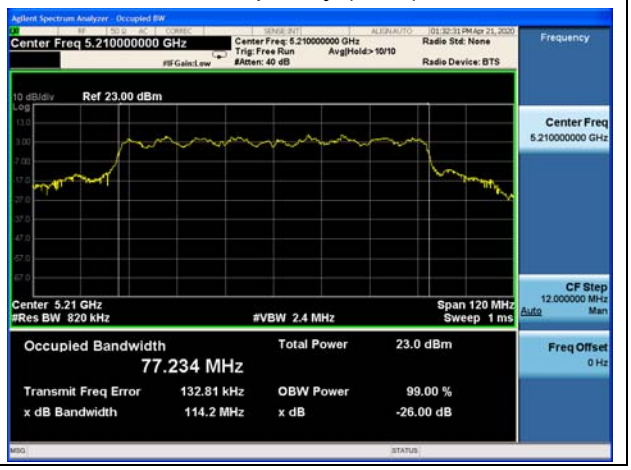
Carrier frequency (MHz): 5190



U-NII-1, 802.11ac VHT20

Carrier frequency (MHz):5240

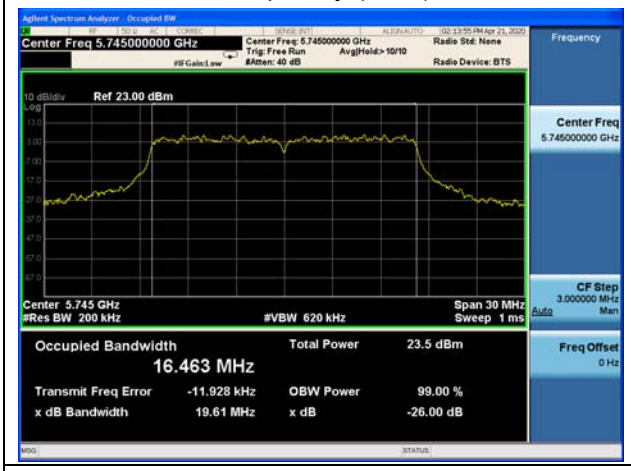


U-NII-1, 802.11ac VHT40 Carrier frequency (MHz): 5230	U-NII-1, 802.11ac VHT80 Carrier frequency (MHz): 5210
	

99% bandwidth

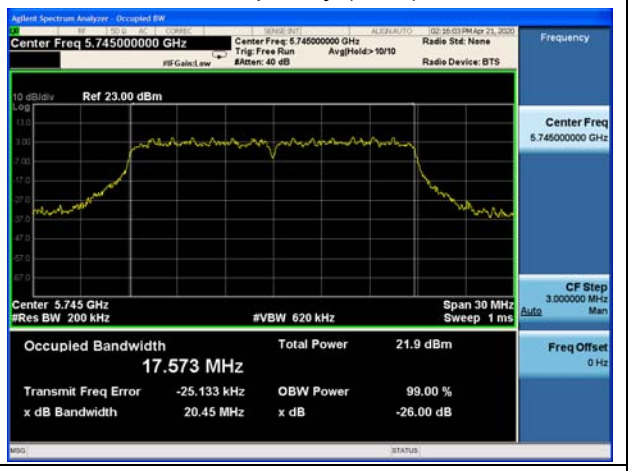
U-NII-3, 802.11a

Carrier frequency (MHz): 5745



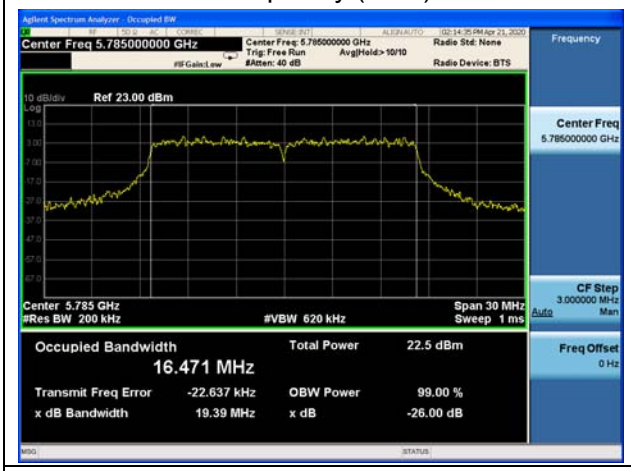
U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5745



U-NII-3, 802.11a

Carrier frequency (MHz): 5785

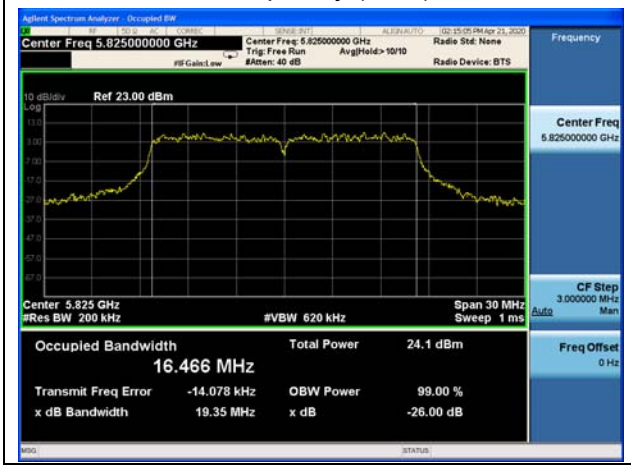


U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5785

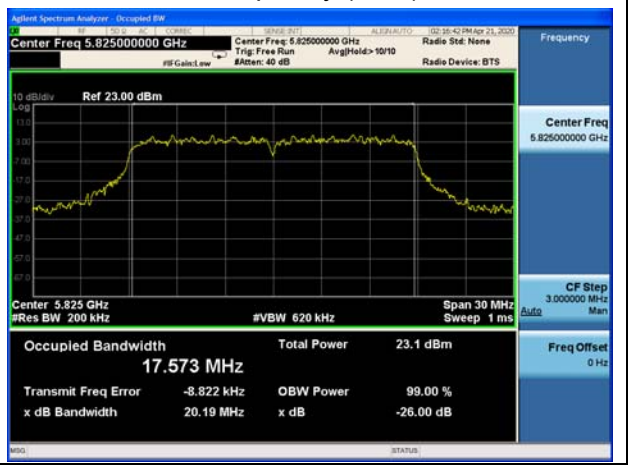
U-NII-3, 802.11a

Carrier frequency (MHz): 5825



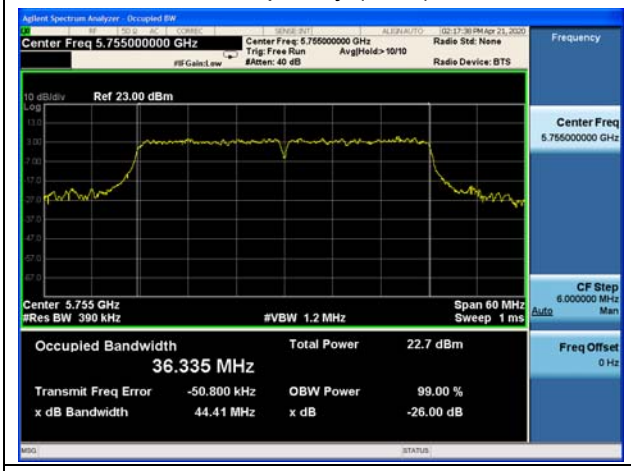
U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5825



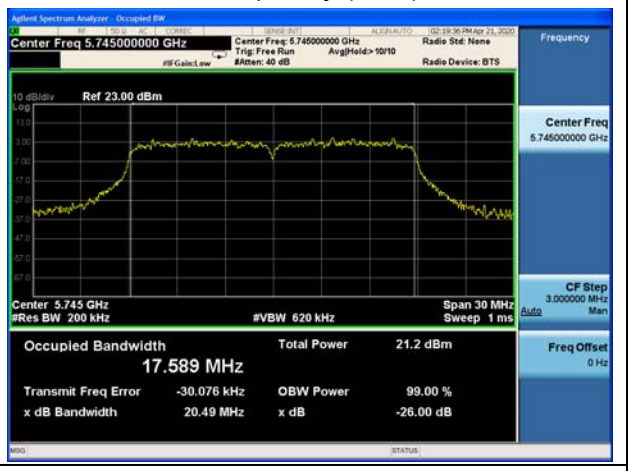
U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5755



U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5745

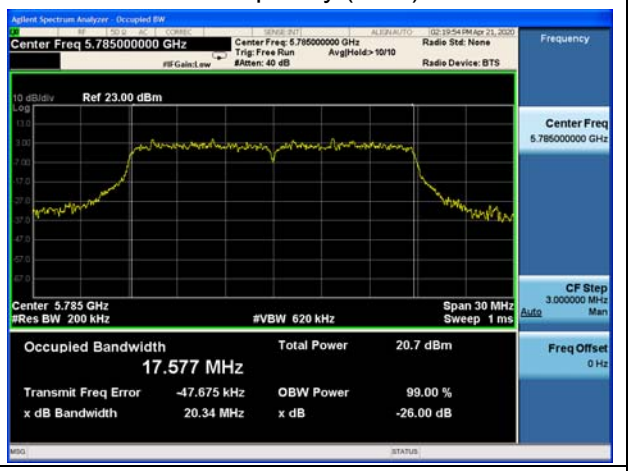


U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5795

U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5785



U-NII-3, 802.11ac VHT40

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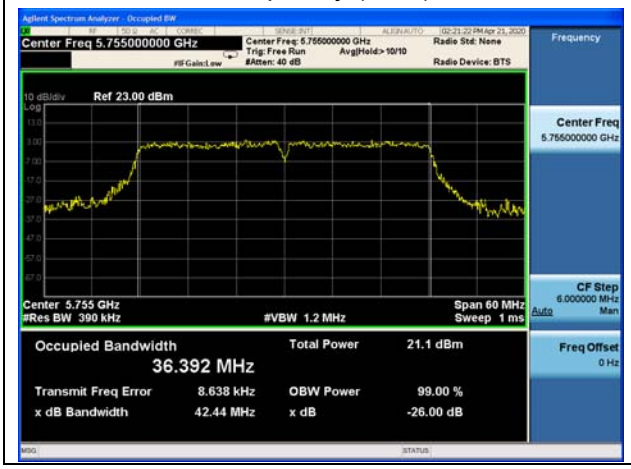
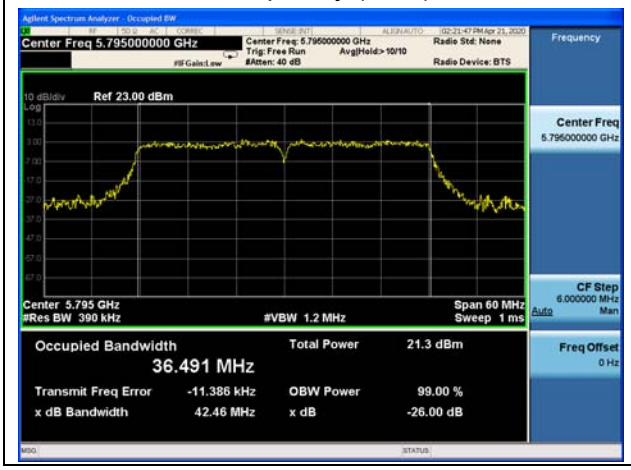
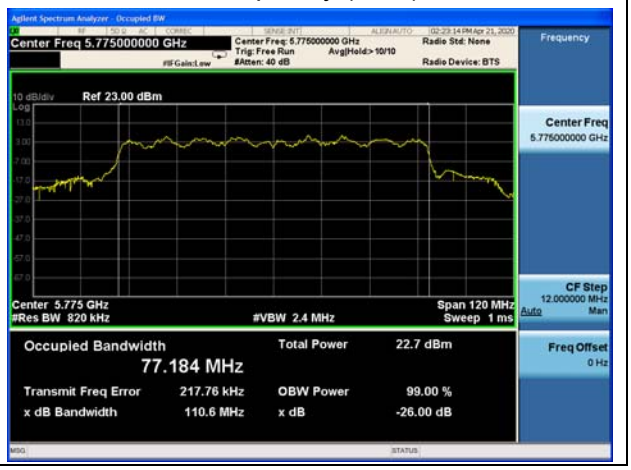


U-NII-3, 802.11ac VHT20

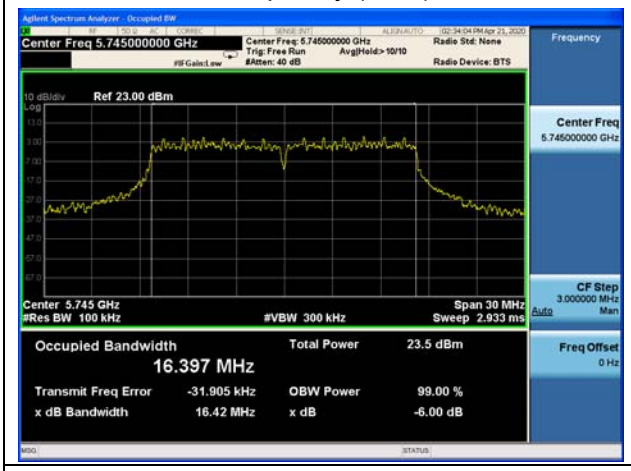
Carrier frequency (MHz): 5825

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

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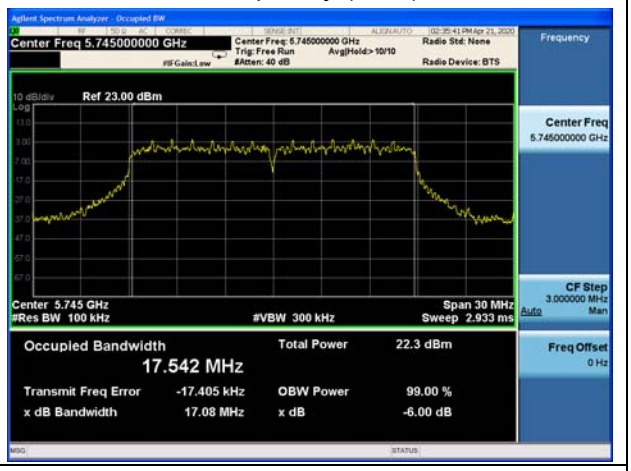
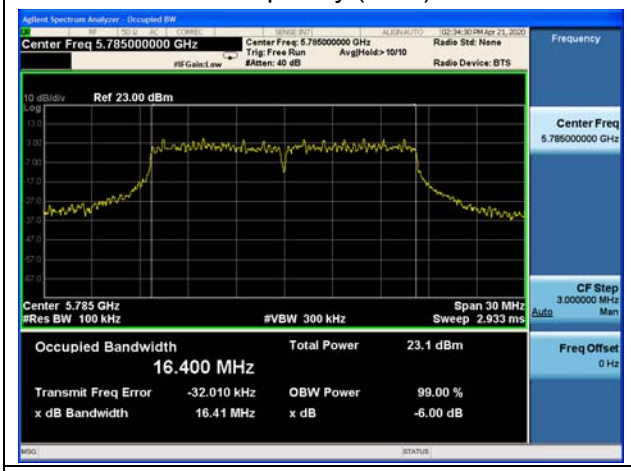


U-NII-3, 802.11a

Carrier frequency (MHz): 5785

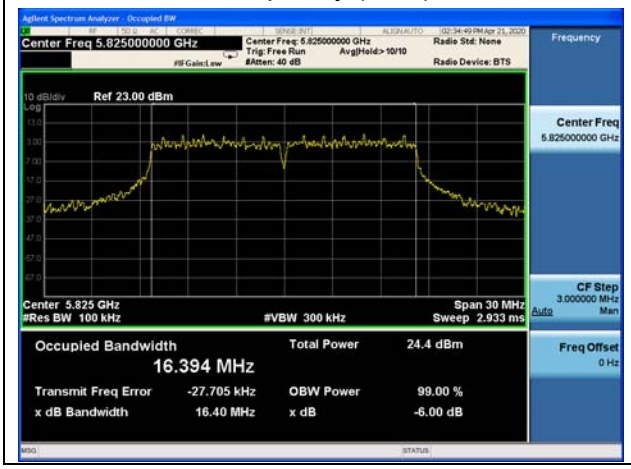


U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5785

U-NII-3, 802.11a

Carrier frequency (MHz): 5825



U-NII-3, 802.11n HT20

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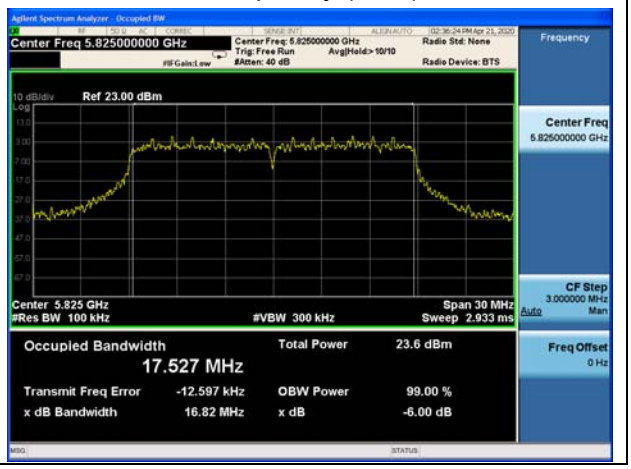
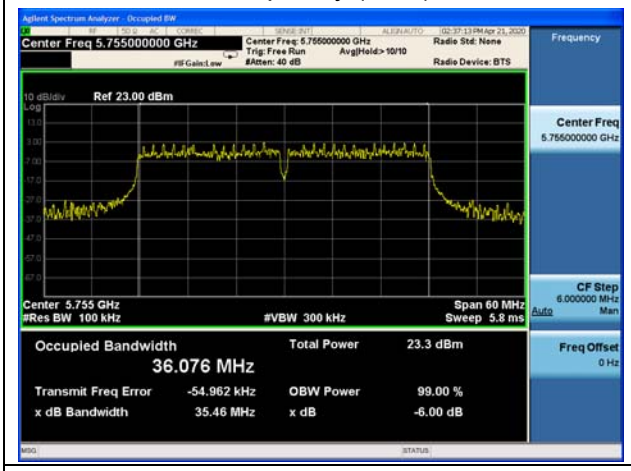


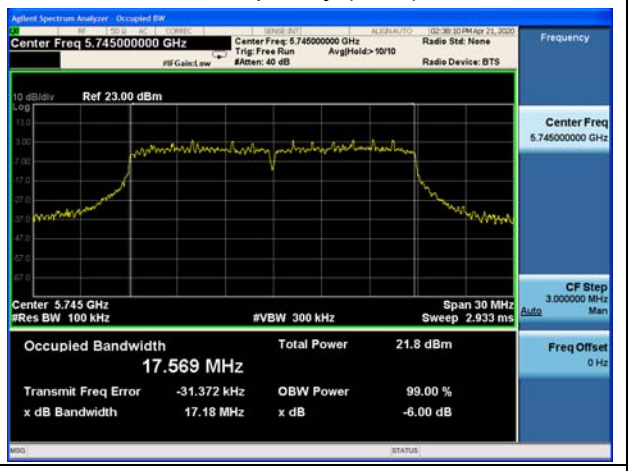
U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5755



U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5745



U-NII-3, 802.11n HT40

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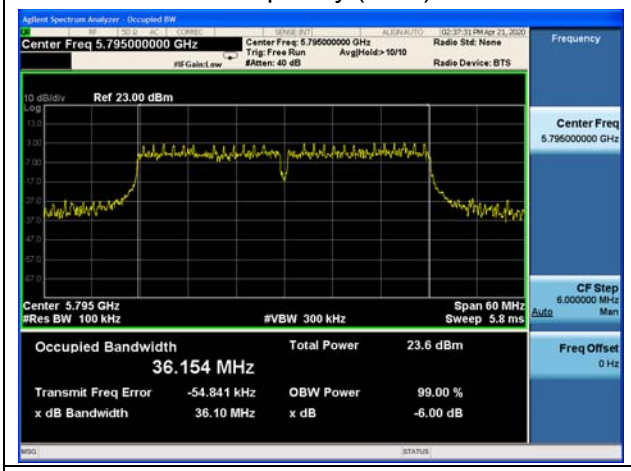
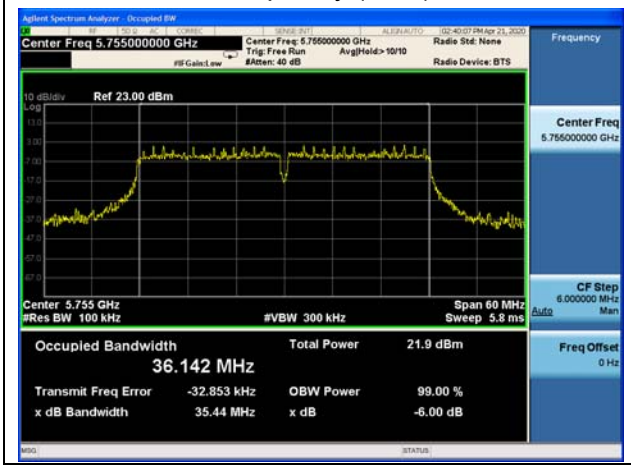


U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5785

U-NII-3, 802.11ac VHT40

Carrier frequency (MHz): 5755



U-NII-3, 802.11ac VHT20

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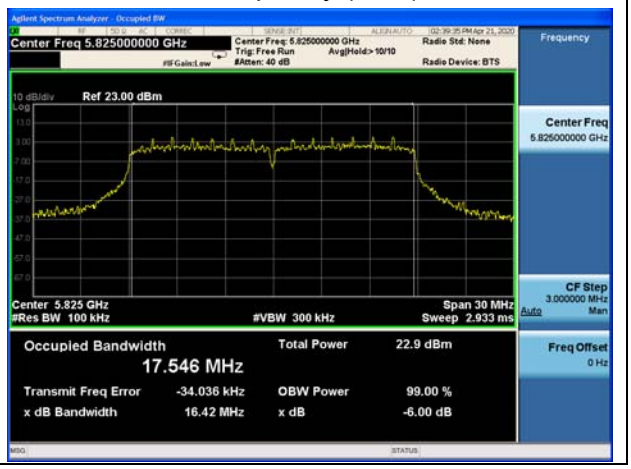
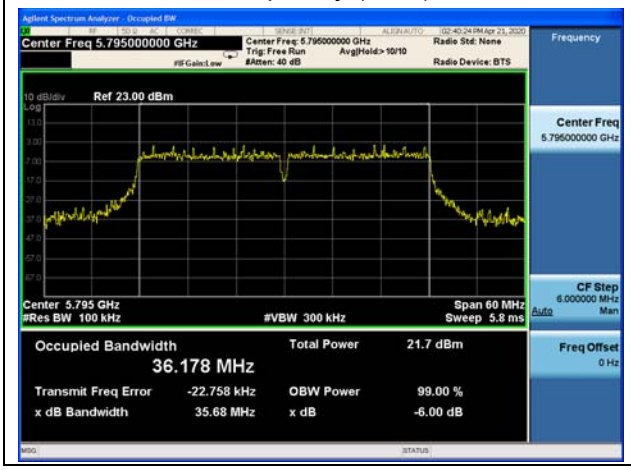
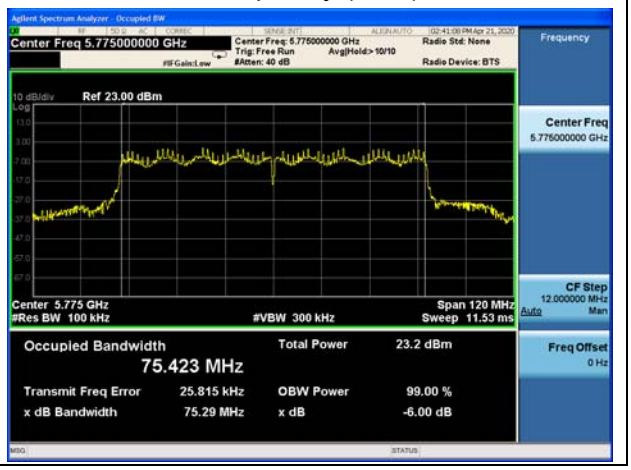


U-NII-3, 802.11ac VHT40 Carrier frequency (MHz): 5795	U-NII-3, 802.11ac VHT80 Carrier frequency (MHz): 5775
	

5.2. Average Power Output –Conducted

Ambient condition

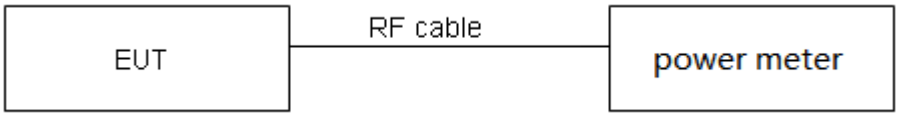
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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	0.25	0.33	0.75	1.23
802.11n HT20	0.23	0.36	0.64	1.93
802.11n HT40	0.13	0.21	0.62	2.06
802.11ac VHT20	0.25	0.35	0.72	1.43
802.11ac VHT40	0.13	0.22	0.57	2.47
802.11ac VHT80	0.23	0.30	0.76	1.19
Note: when Duty cycle>0.98, Duty cycle correction Factor not required.				

SISO Antenna 1 Power Index							SISO Antenna 2 Power Index					
Packet Type	**CH36**	**CH40**	**CH48**	**CH149**	**CH157**	**CH165**	**CH36**	**CH40**	**CH48**	**CH149**	**CH157**	**CH165**
802.11a	40	40	40	40	40	40	38	38	38	38	38	38
802.11n HT20	38	38	38	38	38	38	36	36	36	36	36	36
802.11ac VHT20	39	39	39	39	39	39	37	37	37	37	37	37
Packet Type	**CH38**	**CH46**	**CH151**	**CH159**	/	/	**CH38**	**CH46**	**CH151**	**CH159**	/	/
802.11n HT40	39	39	39	39	/	/	37	37	37	37	/	/
802.11ac VHT40	38	38	38	38	/	/	36	36	36	36	/	/
Packet Type	**CH42**	**CH155**	/	/	/	/	**CH42**	**CH155**	/	/	/	/
802.11ac VHT80	40	40	/	/	/	/	38	38	/	/	/	/

Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor

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	15.33	16.56	30	PASS
	40/5200	15.49	16.72	30	PASS
	48/5240	15.31	16.54	30	PASS
802.11n HT20	36/5180	14.69	16.62	30	PASS
	40/5200	14.53	16.46	30	PASS
	48/5240	14.27	16.20	30	PASS
802.11n HT40	38/5190	14.77	16.83	30	PASS
	46/5230	14.63	16.69	30	PASS
802.11ac VHT20	36/5180	15.46	16.89	30	PASS
	40/5200	15.36	16.79	30	PASS
	48/5240	15.52	16.95	30	PASS
802.11ac VHT40	38/5190	14.34	16.81	30	PASS
	46/5230	14.23	16.70	30	PASS
802.11ac VHT80	42/5210	15.61	16.80	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	15.49	16.72	30	PASS
	157/5785	15.64	16.87	30	PASS
	165/5825	15.33	16.56	30	PASS
802.11n HT20	149/5745	14.36	16.29	30	PASS
	157/5785	14.52	16.45	30	PASS
	165/5825	14.47	16.40	30	PASS
802.11n HT40	151/5755	14.34	16.40	30	PASS
	159/5795	14.76	16.82	30	PASS
802.11ac VHT20	149/5745	15.45	16.88	30	PASS
	157/5785	15.39	16.82	30	PASS
	165/5825	15.47	16.90	30	PASS
802.11ac VHT40	151/5755	14.46	16.93	30	PASS
	159/5795	14.43	16.90	30	PASS
802.11ac VHT80	155/5775	15.21	16.40	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	15.74	16.97	30	PASS
	40/5200	15.52	16.75	30	PASS
	48/5240	15.35	16.58	30	PASS
802.11n HT20	36/5180	14.51	16.44	30	PASS
	40/5200	14.63	16.56	30	PASS
	48/5240	14.46	16.39	30	PASS
802.11n HT40	38/5190	14.22	16.28	30	PASS
	46/5230	14.64	16.70	30	PASS
802.11ac VHT20	36/5180	15.52	16.95	30	PASS
	40/5200	15.48	16.91	30	PASS
	48/5240	15.26	16.69	30	PASS
802.11ac VHT40	38/5190	14.33	16.80	30	PASS
	46/5230	14.15	16.62	30	PASS
802.11ac VHT80	42/5210	15.34	16.53	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	15.34	16.57	30	PASS
	157/5785	15.46	16.69	30	PASS
	165/5825	15.31	16.54	30	PASS
802.11n HT20	149/5745	14.36	16.29	30	PASS
	157/5785	14.75	16.68	30	PASS
	165/5825	14.54	16.47	30	PASS
802.11n HT40	151/5755	14.32	16.38	30	PASS
	159/5795	14.45	16.51	30	PASS
802.11ac VHT20	149/5745	15.45	16.88	30	PASS
	157/5785	15.25	16.68	30	PASS
	165/5825	15.44	16.87	30	PASS
802.11ac VHT40	151/5755	14.34	16.81	30	PASS
	159/5795	14.42	16.89	30	PASS
802.11ac VHT80	155/5775	15.33	16.52	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

MIMO

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	12.19	13.42	12.45	13.68	16.57	30.00	PASS
	44/5220	12.56	13.79	12.23	13.46	16.64	30.00	PASS
	48/5240	12.48	13.71	12.67	13.90	16.82	30.00	PASS
802.11n HT20	36/5180	11.87	13.80	11.94	13.87	16.84	30.00	PASS
	44/5220	11.77	13.70	11.75	13.68	16.70	30.00	PASS
	48/5240	11.85	13.78	11.93	13.86	16.83	30.00	PASS
802.11n HT40	38/5190	11.85	13.91	11.71	13.77	16.85	30.00	PASS
	46/5230	11.94	14.00	11.69	13.75	16.89	30.00	PASS
802.11ac VHT20	36/5180	12.31	13.74	12.29	13.72	16.74	30.00	PASS
	44/5220	12.47	13.90	12.31	13.74	16.83	30.00	PASS
	48/5240	12.28	13.71	12.35	13.78	16.76	30.00	PASS
802.11ac VHT40	38/5190	11.45	13.92	11.51	13.98	16.96	30.00	PASS
	46/5230	11.53	14.00	11.31	13.78	16.90	30.00	PASS
802.11ac VHT80	42/5210	12.44	13.63	12.51	13.70	16.68	30.00	PASS

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),

The Total Power $=10\log(10^{(\text{Power antenna1 in dBm}/10)}+10^{(\text{Power antenna2 in dBm}/10)})$.

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 =5dBi<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	149/5745	12.45	13.68	12.39	13.62	16.66	30.00	PASS
	157/5785	12.40	13.63	12.16	13.39	16.53	30.00	PASS
	165/5825	12.26	13.49	12.22	13.45	16.48	30.00	PASS
802.11n HT20	149/5745	11.74	13.67	11.85	13.78	16.73	30.00	PASS
	157/5785	11.68	13.61	11.72	13.65	16.64	30.00	PASS
	165/5825	11.49	13.42	11.60	13.53	16.48	30.00	PASS
802.11n HT40	151/5755	11.40	13.46	11.45	13.51	16.49	30.00	PASS
	159/5795	11.34	13.40	11.21	13.27	16.34	30.00	PASS
802.11ac VHT20	149/5745	12.31	13.74	12.45	13.88	16.82	30.00	PASS
	157/5785	12.17	13.60	12.43	13.86	16.75	30.00	PASS
	165/5825	12.15	13.58	12.37	13.80	16.71	30.00	PASS
802.11ac VHT40	151/5755	11.34	13.81	11.41	13.88	16.85	30.00	PASS
	159/5795	11.39	13.86	11.53	14.00	16.94	30.00	PASS
802.11ac VHT80	155/5775	12.44	13.63	12.56	13.75	16.70	30.00	PASS

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

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 =5dBi<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	-40	5199.992750	5199.986965	5199.984718	5199.983414
13	-30	5200.002373	5199.983680	5199.978619	5199.977856
14	-10	5199.996940	5199.981063	5199.969154	5199.973964
15	10	5199.989436	5199.976463	5199.962745	5199.964762
16	20	5199.988959	5199.973479	5199.957462	5199.957790
17	30	5199.987849	5199.972651	5199.957284	5199.950562
18	45	5199.983028	5199.972280	5199.952869	5199.946161
19	70	5199.979265	5199.962288	5199.943260	5199.940525
9	20	5199.969884	5199.958563	5199.940475	5199.940059
14	20	5199.960679	5199.956799	5199.938405	5199.930891
MHz		-0.039321	-0.043201	-0.061595	-0.069109
PPM		-7.561678	-8.307876	-11.845154	-13.290100

Voltage (V)	Temperature (°C)	U-NII-3 Test Results			
		5785MHz			
		1min	2min	5min	10min
12	-40	5784.997929	5784.994949	5784.988958	5784.980340
13	-30	5784.997501	5784.991130	5784.981476	5784.978190
14	-10	5784.993804	5784.982304	5784.976958	5784.969362
15	10	5784.989466	5784.977105	5784.967802	5784.963369
16	20	5784.987895	5784.975360	5784.960503	5784.956175
17	30	5784.985662	5784.965374	5784.956938	5784.950584
18	45	5784.982993	5784.964111	5784.955526	5784.947469
19	70	5784.979567	5784.954417	5784.945708	5784.943118
9	20	5784.971965	5784.947100	5784.942132	5784.936056
14	20	5784.962203	5784.938499	5784.937500	5784.927940
MHz		-0.037797	-0.061501	-0.062500	-0.072060
PPM		-6.533651	-10.631109	-10.803738	-12.456378

5.4. Power Spectral Density

Ambient condition

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

Method of Measurement

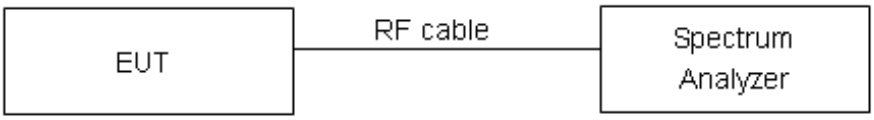
The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.

Set RBW = 500 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

SISO Antenna 1

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Network Standards	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	36	3.437	4.67	17	PASS
	40	4.009	5.24	17	PASS
	48	4.383	5.62	17	PASS
802.11n HT20	36	2.533	4.46	17	PASS
	40	2.91	4.84	17	PASS
	48	3.873	5.80	17	PASS
802.11n HT40	38	-0.144	1.91	17	PASS
	46	1.237	3.30	17	PASS
802.11ac VHT20	36	1.818	3.25	17	PASS
	40	3.05	4.48	17	PASS
	48	4.047	5.48	17	PASS
802.11ac VHT40	38	-2.864	-0.40	17	PASS
	46	0.395	2.86	17	PASS
802.11ac VHT80	42	-3.661	-2.47	17	PASS

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Network Standards	Channel Number	Read Value (dBm/500kHz)	Power Spectral Density (dBm/500kHz)	Limit (dBm/500kHz)	Conclusion
802.11a	149	1.93	3.17	30	PASS
	157	1.52	2.75	30	PASS
	165	2.47	3.70	30	PASS
802.11n HT20	149	0.04	1.97	30	PASS
	157	0.32	2.24	30	PASS
	165	2.04	3.97	30	PASS
802.11n HT40	151	-2.43	-0.37	30	PASS
	159	-1.92	0.14	30	PASS
802.11ac VHT20	149	0.13	1.57	30	PASS
	157	0.52	1.95	30	PASS
	165	2.16	3.59	30	PASS
802.11ac VHT40	151	-3.14	-0.67	30	PASS
	159	-2.46	0.01	30	PASS
802.11ac VHT80	155	-5.18	-3.99	30	PASS

SISO 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	2.41	3.65	17	PASS
	40	3.37	4.60	17	PASS
	48	4.02	5.25	17	PASS
802.11n HT20	36	2.51	4.43	17	PASS
	40	2.43	4.36	17	PASS
	48	3.09	5.02	17	PASS
802.11n HT40	38	-2.79	-0.73	17	PASS
	46	0.76	2.81	17	PASS
802.11ac VHT20	36	2.16	3.59	17	PASS
	40	2.86	4.29	17	PASS
	48	3.97	5.41	17	PASS
802.11ac VHT40	38	-2.80	-0.34	17	PASS
	46	0.39	2.85	17	PASS
802.11ac VHT80	42	-2.38	-1.19	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	1.24	2.47	30	PASS
	157	0.65	1.88	30	PASS
	165	1.40	2.64	30	PASS
802.11n HT20	149	-0.08	1.84	30	PASS
	157	-1.20	0.73	30	PASS
	165	0.64	2.57	30	PASS
802.11n HT40	151	-2.97	-0.91	30	PASS
	159	-3.39	-1.33	30	PASS
802.11ac VHT20	149	-0.43	1.00	30	PASS
	157	-0.39	1.05	30	PASS
	165	-0.05	1.39	30	PASS
802.11ac VHT40	151	-3.81	-1.35	30	PASS
	159	-4.07	-1.60	30	PASS
802.11ac VHT80	155	-5.56	-4.37	30	PASS

MIMO

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	2.83	4.06	2.896	4.13	7.11	17.00	PASS
	40/5200	0.99	2.22	2.365	3.60	5.97	17.00	PASS
	48/5240	2.52	3.75	2.977	4.21	7.00	17.00	PASS
802.11n HT20	36/5180	0.32	2.25	0.577	2.50	5.39	17.00	PASS
	40/5200	-1.05	0.87	0.296	2.22	4.61	17.00	PASS
	48/5240	1.02	2.94	1.811	3.74	6.37	17.00	PASS
802.11n HT40	38/5190	-4.67	-2.61	-2.697	-0.64	1.50	17.00	PASS
	46/5230	-2.42	-0.37	-1.952	0.11	2.89	17.00	PASS
802.11ac VHT20	36/5180	1.63	3.06	1.780	3.21	6.15	17.00	PASS
	40/5200	0.89	2.33	1.868	3.30	5.85	17.00	PASS
	48/5240	1.85	3.28	2.581	4.01	6.67	17.00	PASS
802.11ac VHT40	38/5190	-3.70	-1.24	-2.173	0.29	2.60	17.00	PASS
	46/5230	-2.37	0.09	-1.658	0.81	3.47	17.00	PASS
802.11ac VHT80	42/5210	-3.828	-2.64	-3.310	-2.12	0.64	17.00	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=$10\log(10^{(\text{PSD antenna1 in dBm/10})}+10^{(\text{PSD antenna2 in dBm/10})})$

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<6 dBi. So the PSD limt is 17dBm.

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	-1.37	-0.13	-1.51	-0.28	2.81	30.00	PASS
	157/5785	-2.31	-1.08	-1.97	-0.73	2.11	30.00	PASS
	165/5825	0.23	1.46	-1.60	-0.36	3.66	30.00	PASS
802.11n HT20	149/5745	-1.78	0.15	-2.72	-0.80	2.71	30.00	PASS
	157/5785	-2.66	-0.74	-3.28	-1.35	1.98	30.00	PASS
	165/5825	-1.14	0.79	-3.55	-1.62	2.76	30.00	PASS
802.11n HT40	151/5755	-5.24	-3.18	-6.02	-3.96	-0.54	30.00	PASS
	159/5795	-4.45	-2.39	-6.49	-4.43	-0.28	30.00	PASS
802.11ac VHT20	149/5745	-1.42	0.02	-1.59	-0.15	2.94	30.00	PASS
	157/5785	-1.38	0.05	-3.17	-1.74	2.26	30.00	PASS
	165/5825	-0.70	0.73	-2.47	-1.04	2.95	30.00	PASS
802.11ac VHT40	151/5755	-5.55	-3.09	-6.18	-3.72	-0.38	30.00	PASS
	159/5795	-4.95	-2.49	-6.73	-4.27	-0.28	30.00	PASS
802.11ac VHT80	155/5775	-7.19	-6.00	-7.69	-6.49	-3.23	30.00	PASS

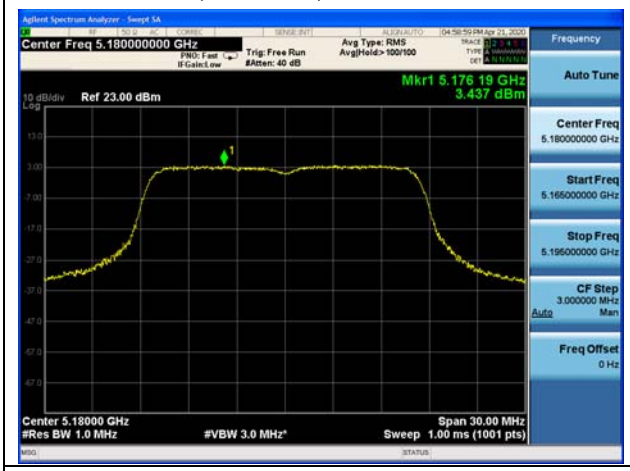
Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),

The Total Power $=10\log(10^{(\text{Power antenna1 in dBm}/10)}+10^{(\text{Power antenna2 in dBm}/10)})$.

2. The manufacturer declared the transmitter output signals is CDD mode And Nss=1. 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<6 dBi. So the PSD limt is 30dBm.

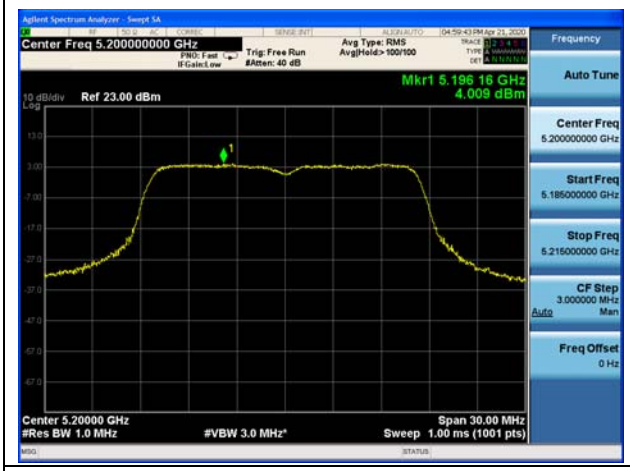
SISO Antenna 1

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

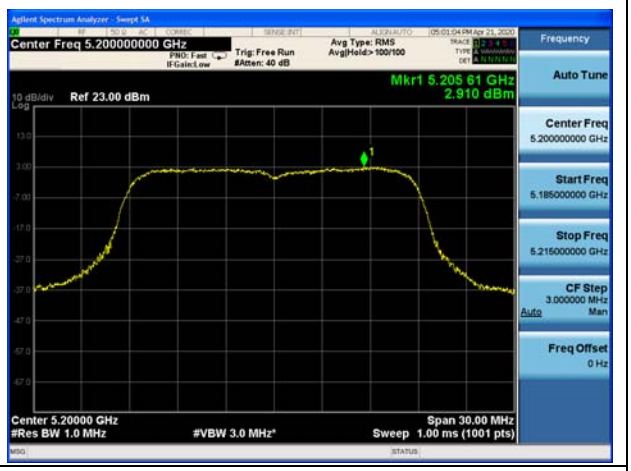


U-NII-1, 802.11n HT20, Channel No.: 36

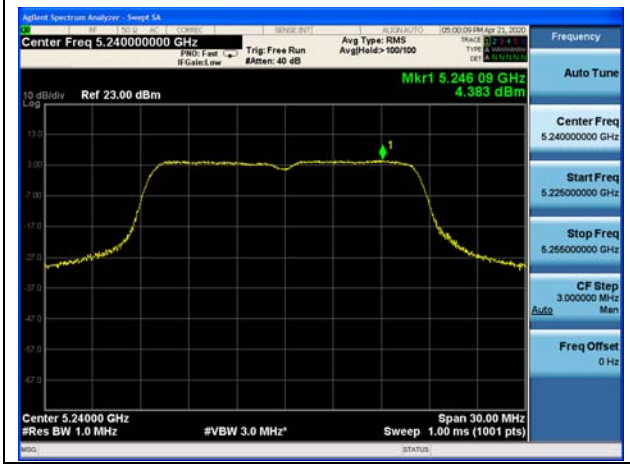
U-NII-1, 802.11a, Channel No.: 40



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

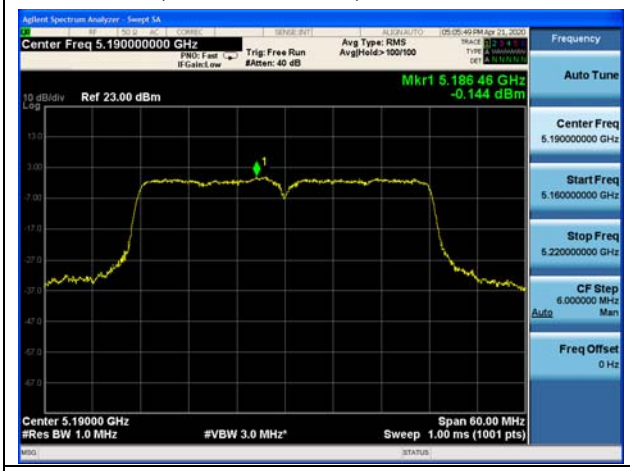


U-NII-1, 802.11a, Channel No.: 48

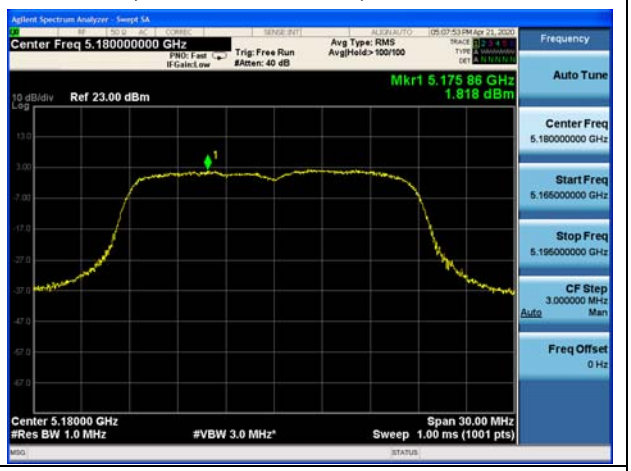


U-NII-1, 802.11n HT20, Channel No.: 48

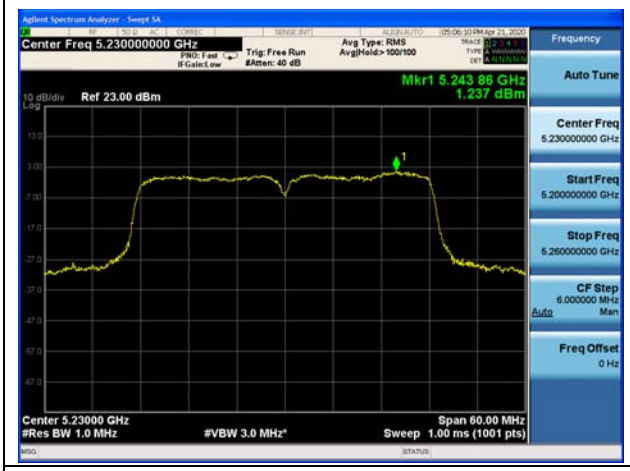
U-NII-1, 802.11n HT40, Channel No.: 38



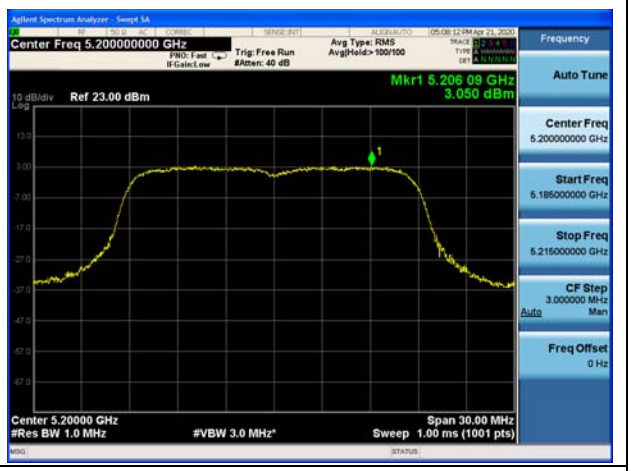
U-NII-1, 802.11ac VHT20, Channel No.: 36



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

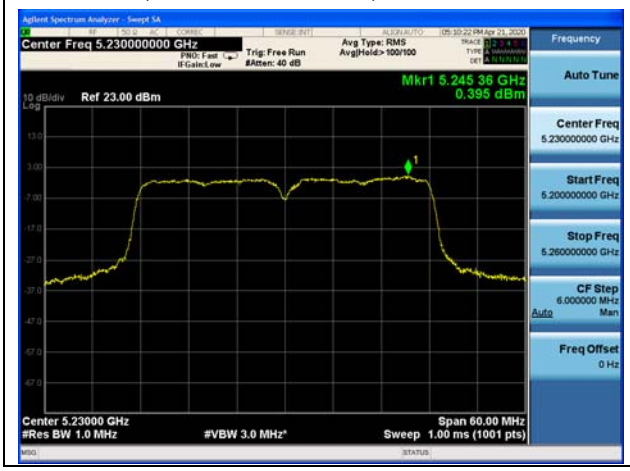


U-NII-1, 802.11ac VHT20, Channel No.: 40

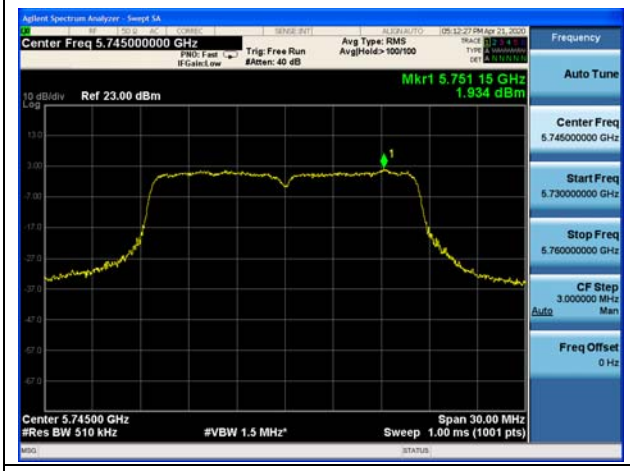


U-NII-1, 802.11ac VHT40, Channel No.: 38

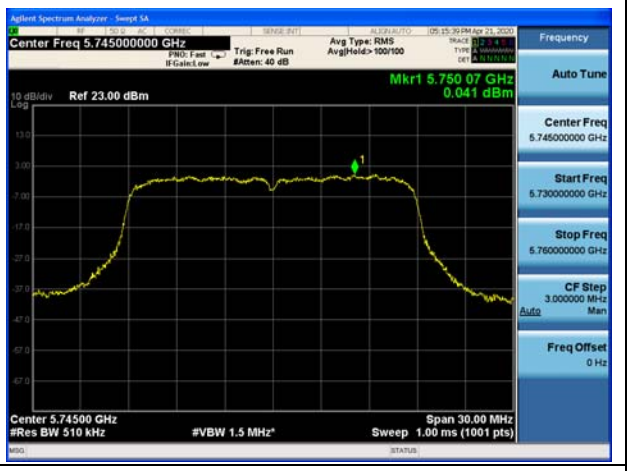
U-NII-1, 802.11ac VHT20, Channel No.: 48

U-NII-1, 802.11ac VHT40, Channel No.: 46	U-NII-1, 802.11ac VHT80, Channel No.: 42
	

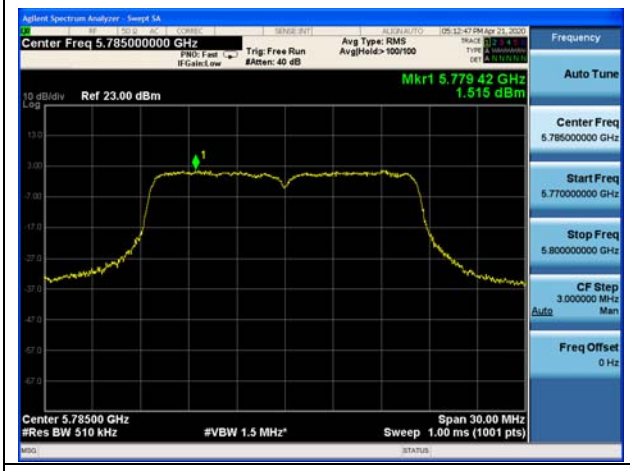
U-NII-3, 802.11a, Channel No.: 149



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



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



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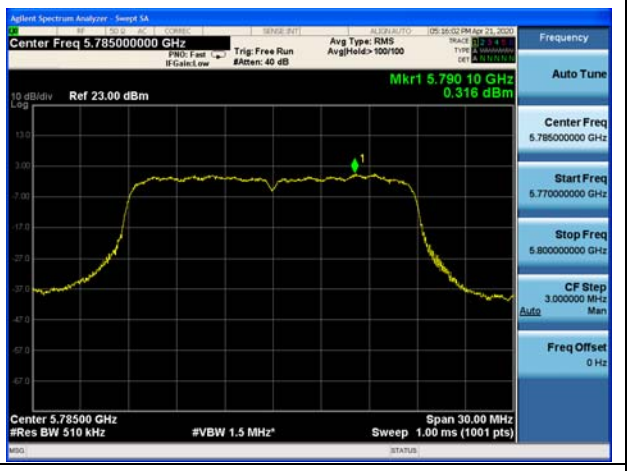
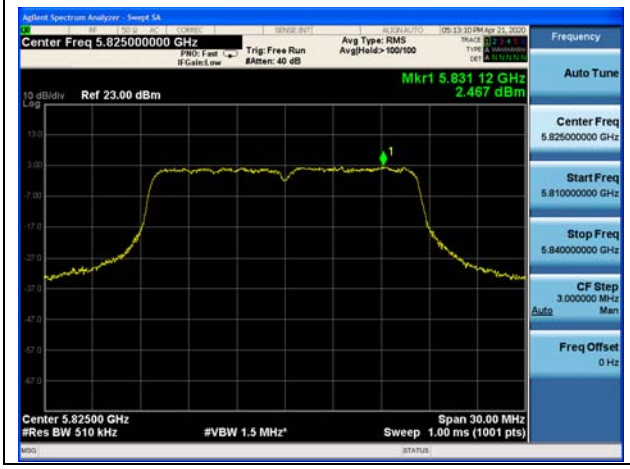
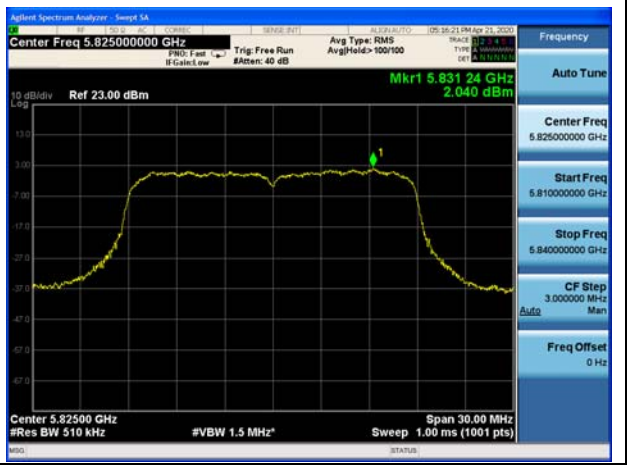


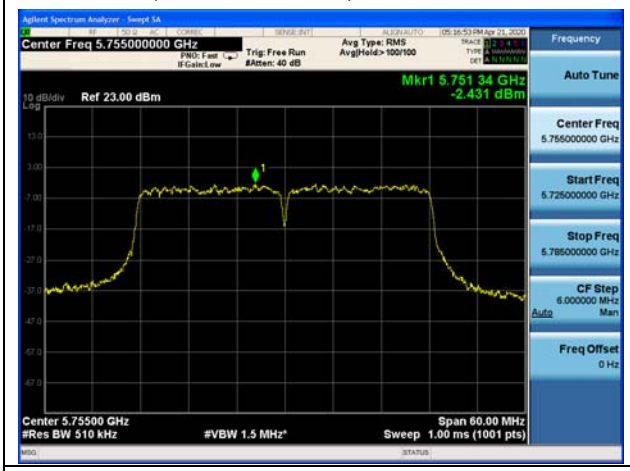
U-NII-3, 802.11a, Channel No.: 165



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

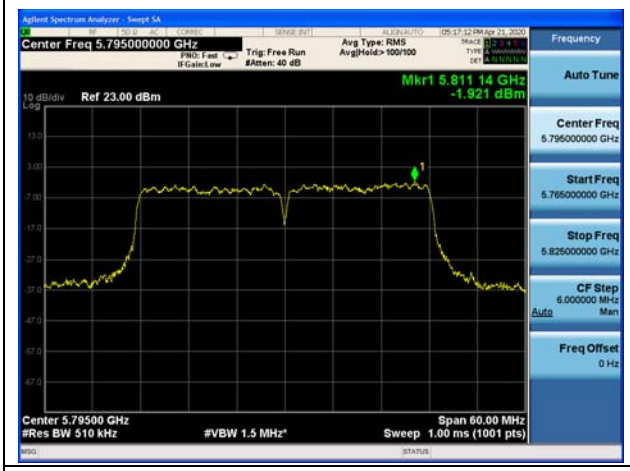


U-NII-3, 802.11n HT40, Channel No.: 151

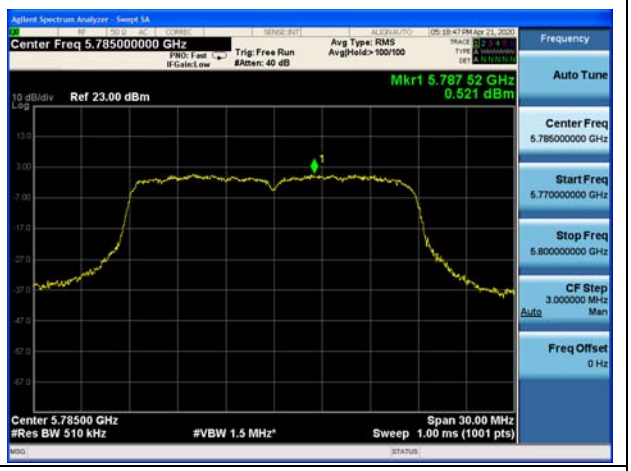


U-NII-3, 802.11ac VHT20, Channel No.: 149

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



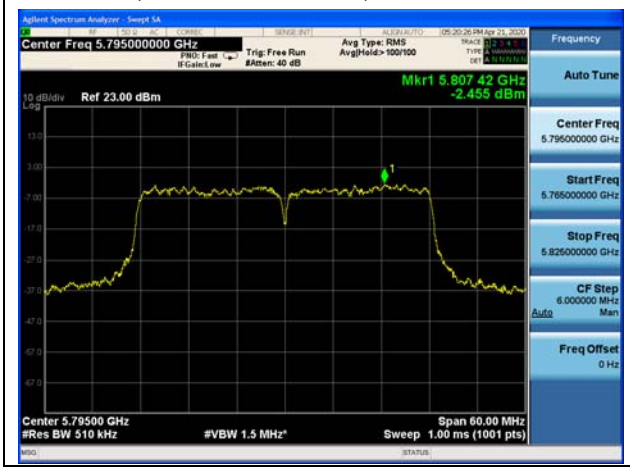
U-NII-3, 802.11ac VHT20, Channel No.: 157



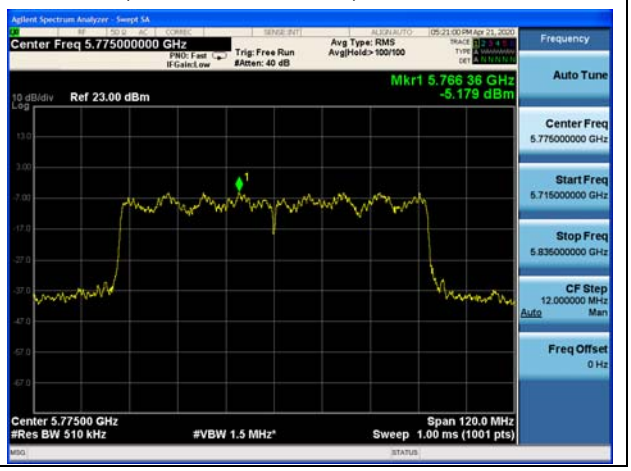
U-NII-3, 802.11ac VHT40, Channel No.: 151

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

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

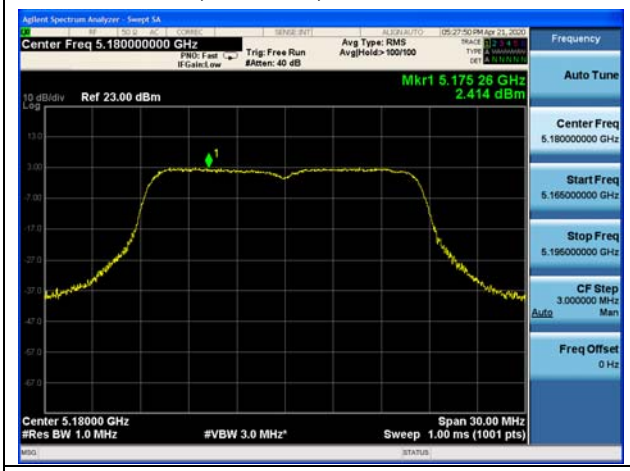


U-NII-3, 802.11ac VHT80, Channel No.: 155



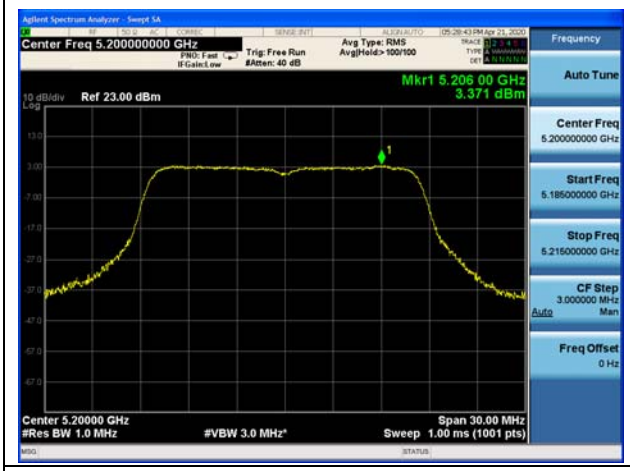
SISO Antenna 2

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



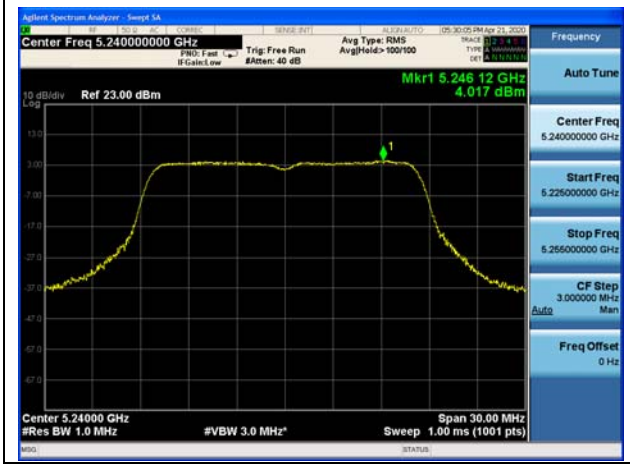
U-NII-1, 802.11n HT20, Channel No.: 36

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



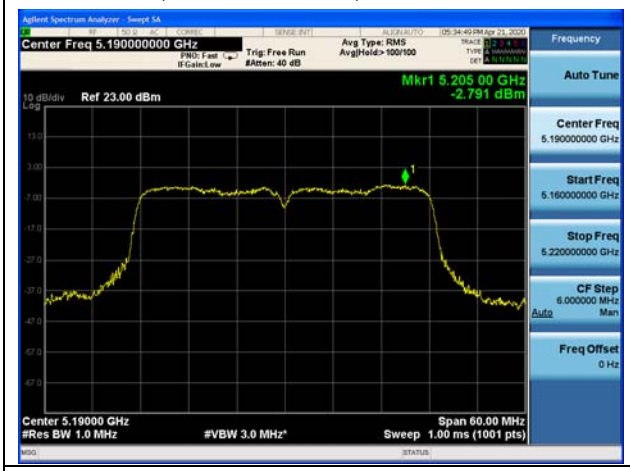
U-NII-1, 802.11n HT20, Channel No.: 40

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

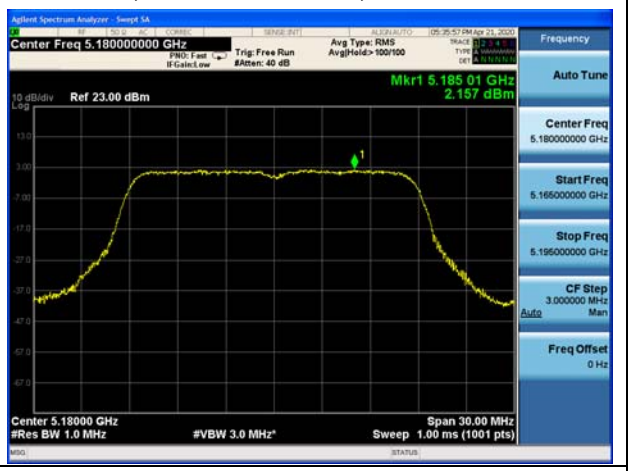


U-NII-1, 802.11n HT20, Channel No.: 48

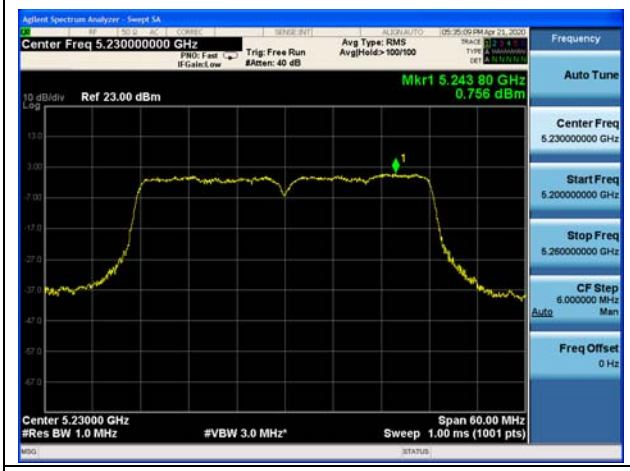
U-NII-1, 802.11n HT40, Channel No.: 38



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

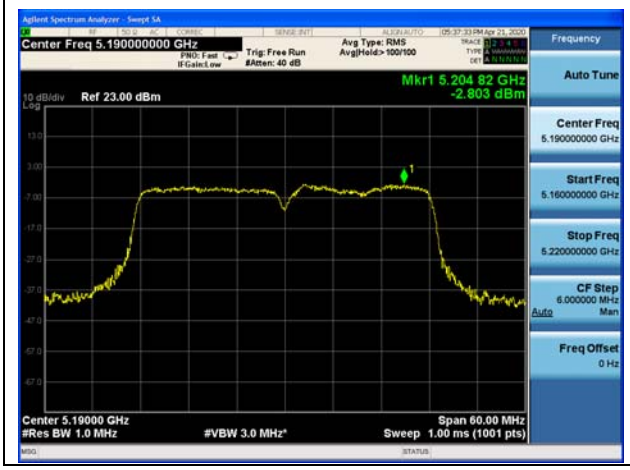


U-NII-1, 802.11n HT40, Channel No.: 46



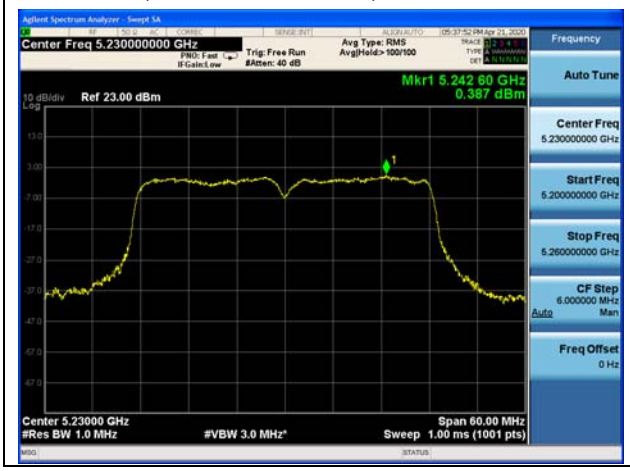
U-NII-1, 802.11ac VHT20, Channel No.: 40

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



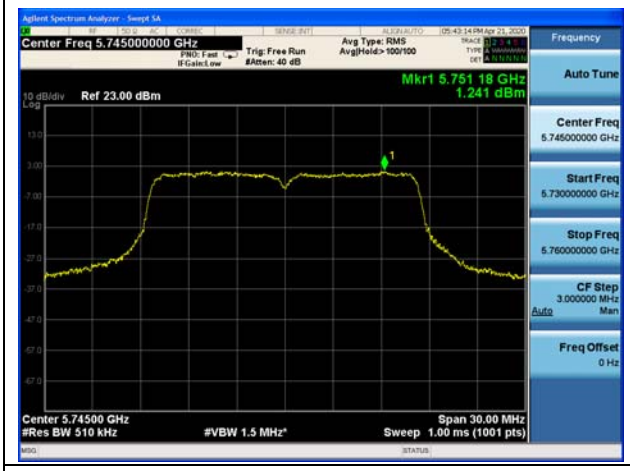
U-NII-1, 802.11ac VHT20, Channel No.: 48

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



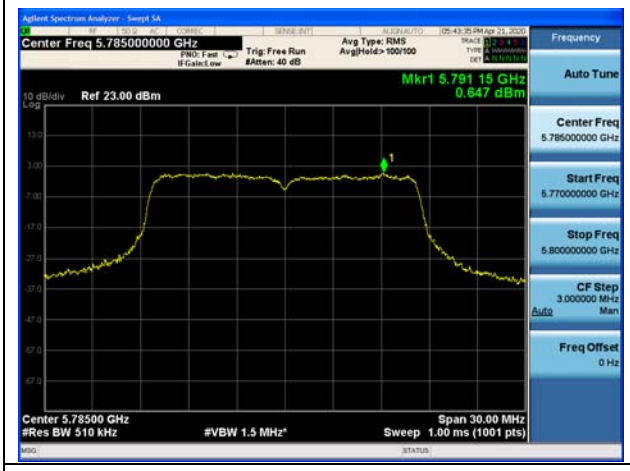
U-NII-1, 802.11ac VHT80, Channel No.: 42

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

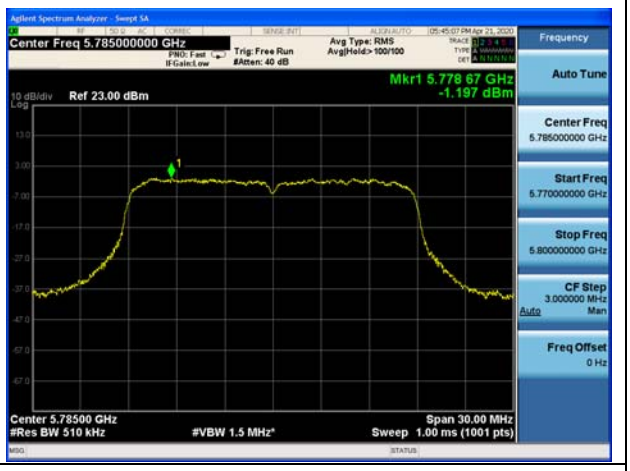


U-NII-3, 802.11n HT20, Channel No.: 149

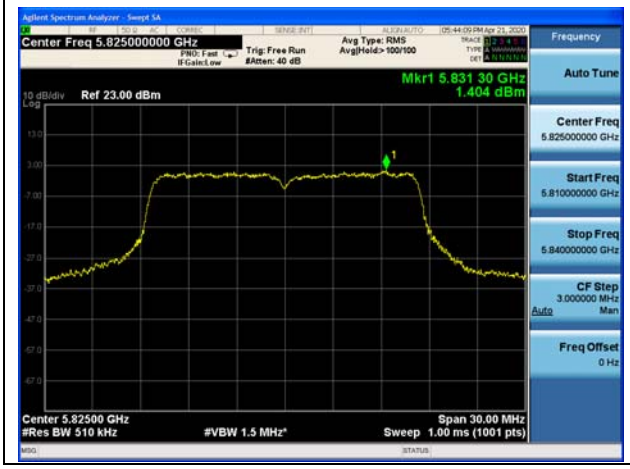
U-NII-3, 802.11a, Channel No.: 157



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

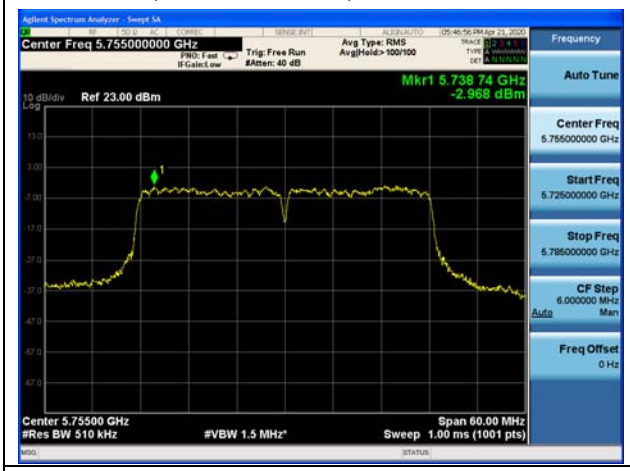


U-NII-3, 802.11a, Channel No.: 165

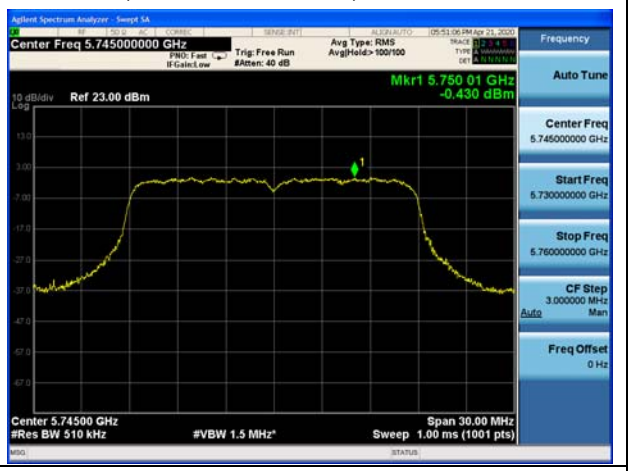


U-NII-3, 802.11n HT20, Channel No.: 165

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

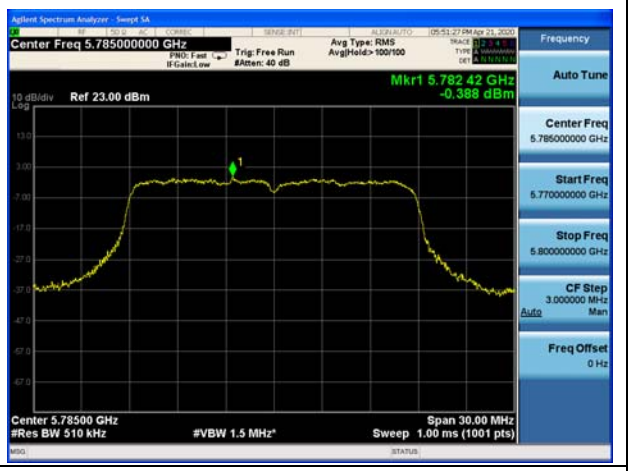


U-NII-3, 802.11ac VHT20, Channel No.: 149



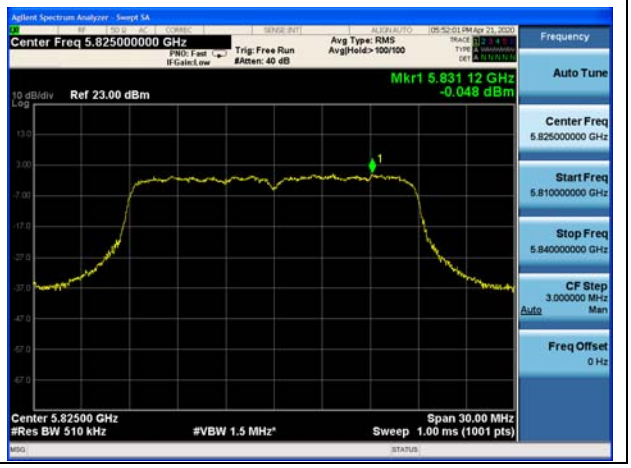
U-NII-3, 802.11n HT40, Channel No.: 159

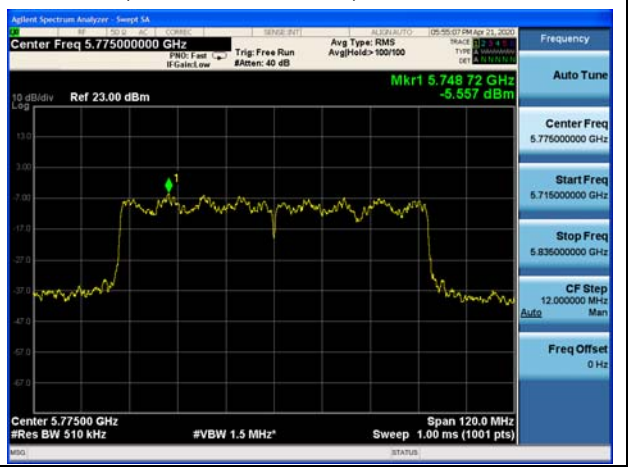
U-NII-3, 802.11ac VHT20, Channel No.: 157



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 Antenna 1

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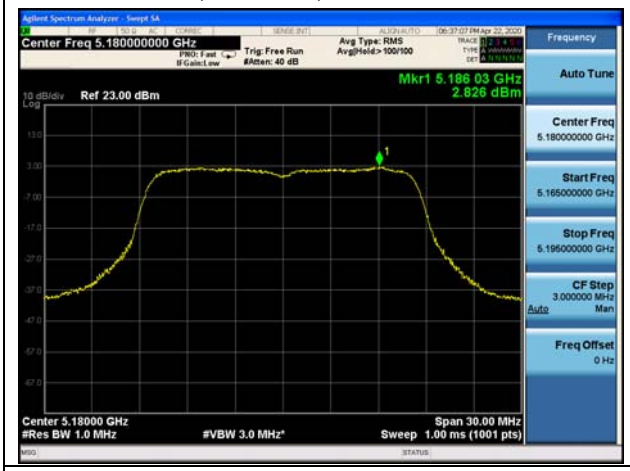

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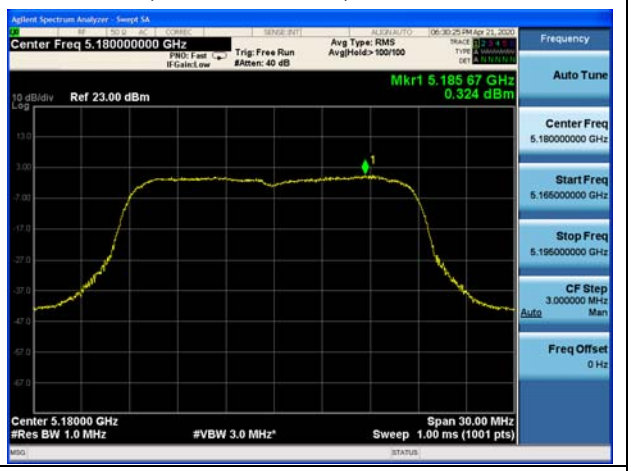

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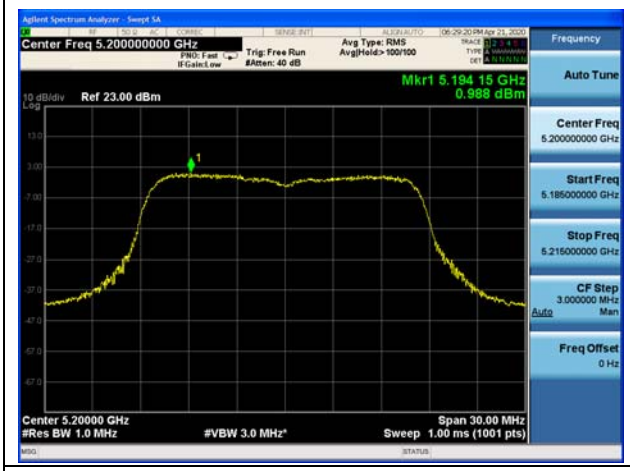

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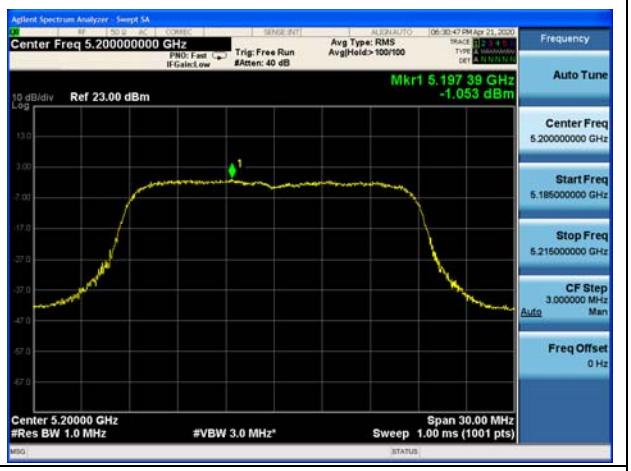

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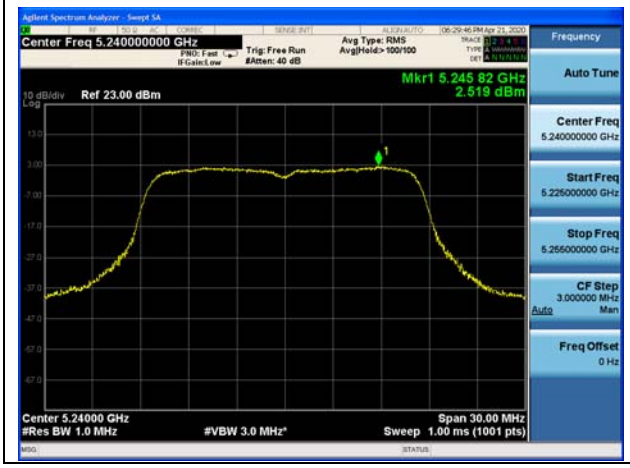

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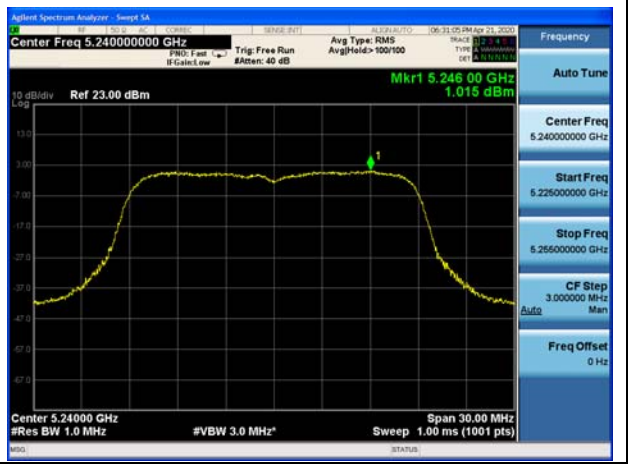

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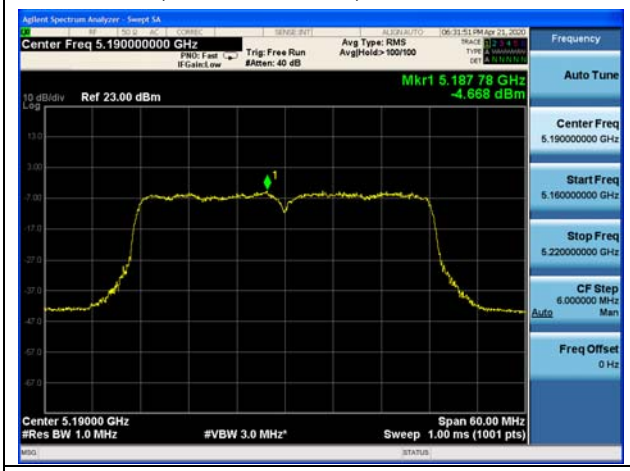

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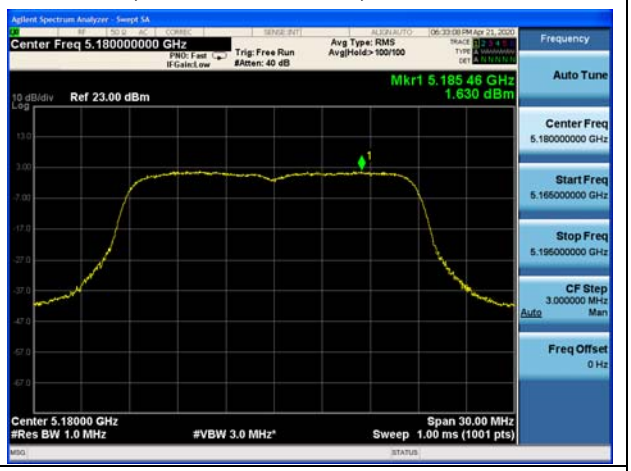
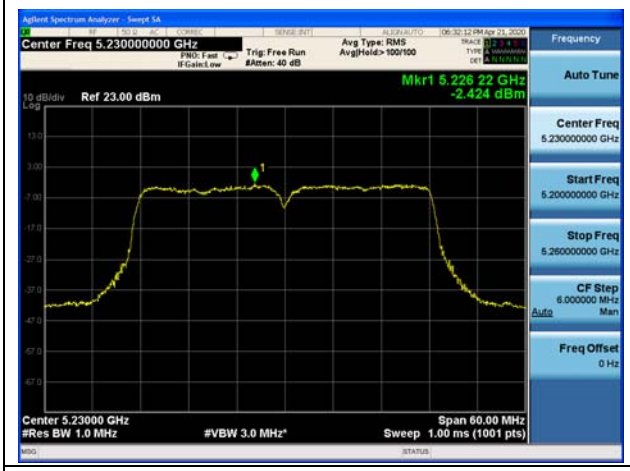


U-NII-1, 802.11n HT40, Channel No.: 46



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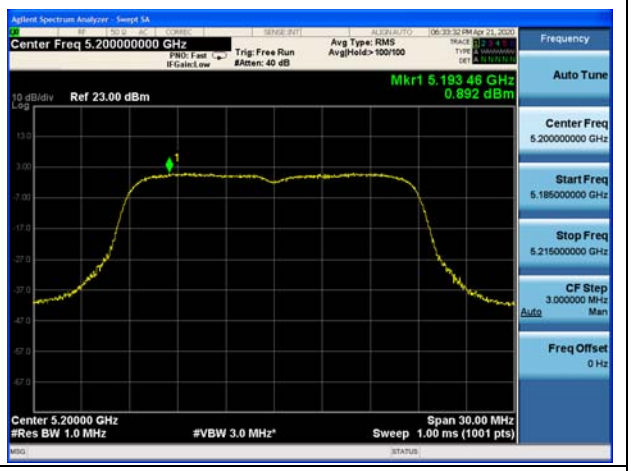

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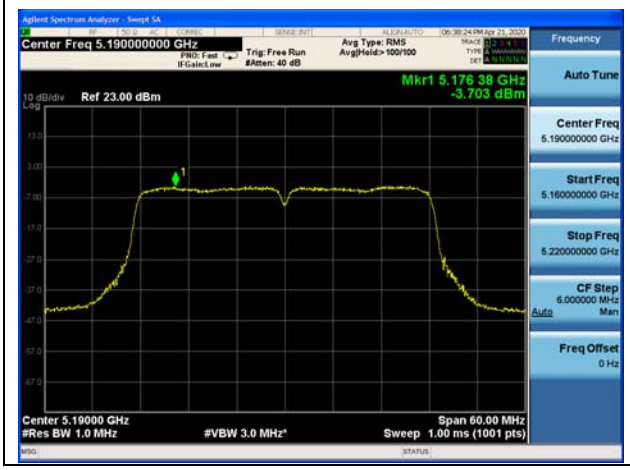

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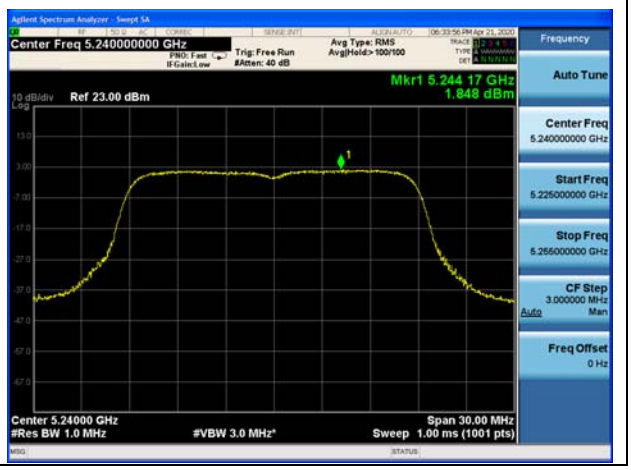
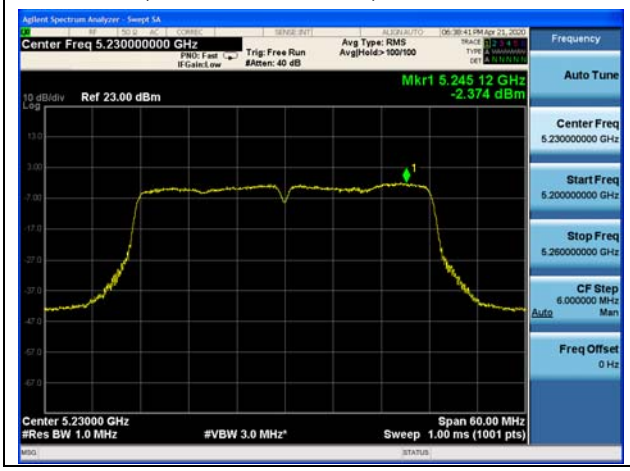
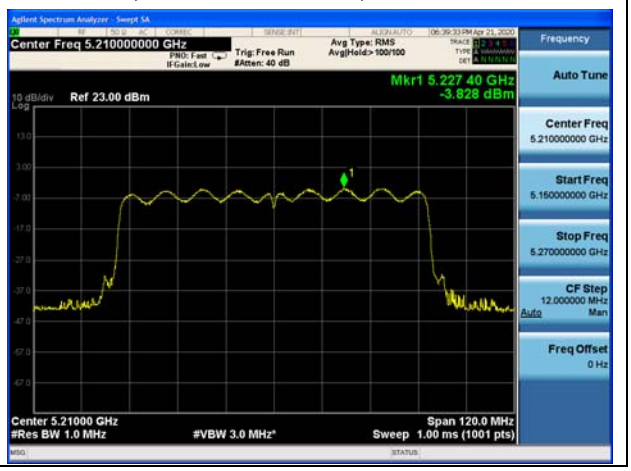
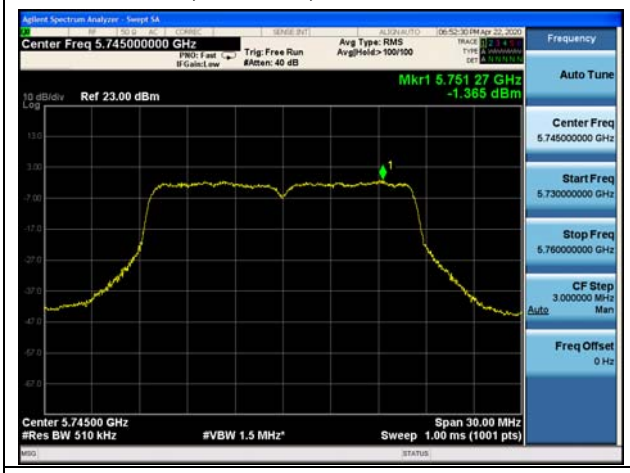


U-NII-1, 802.11ac VHT40, Channel No.: 46	U-NII-1, 802.11ac VHT80, Channel No.: 42
	

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

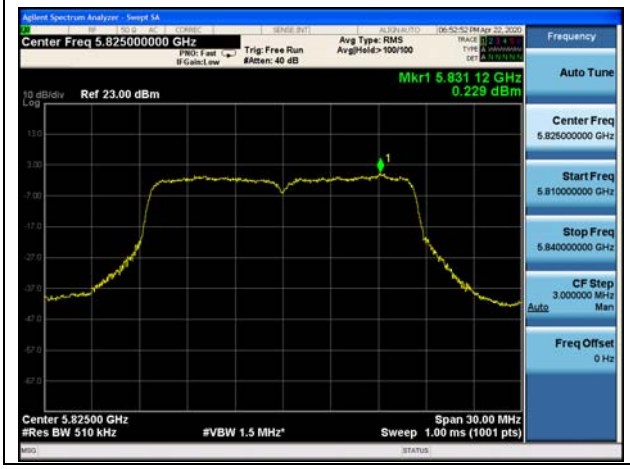


U-NII-3, 802.11n HT20, Channel No.: 149

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

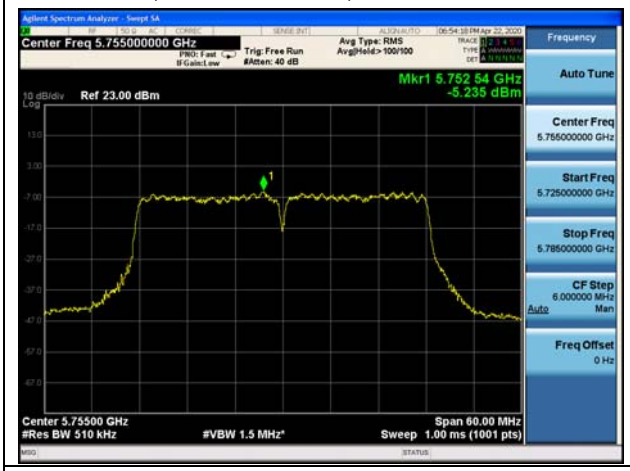
U-NII-3, 802.11n HT20, Channel No.: 157

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



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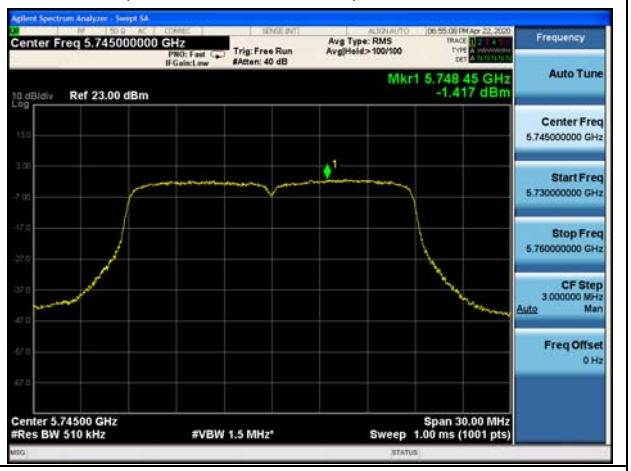

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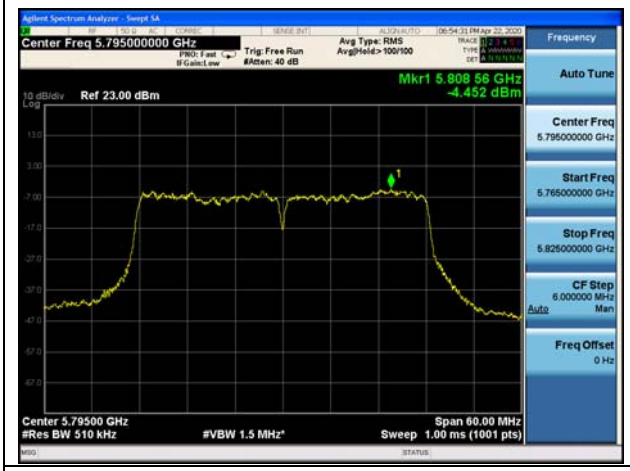

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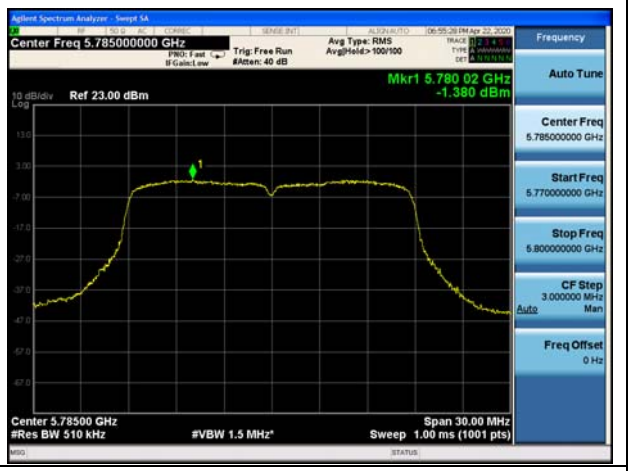

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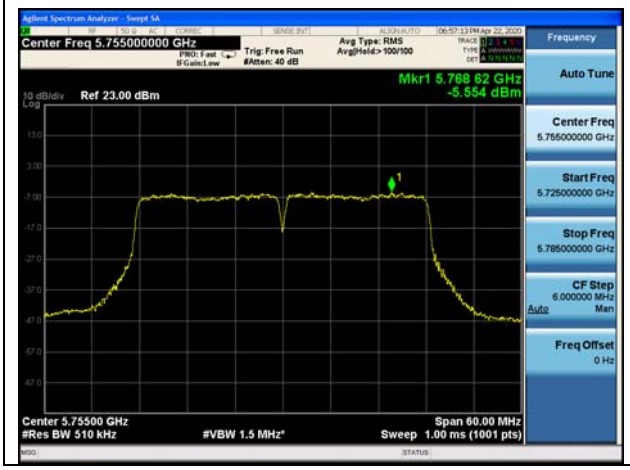

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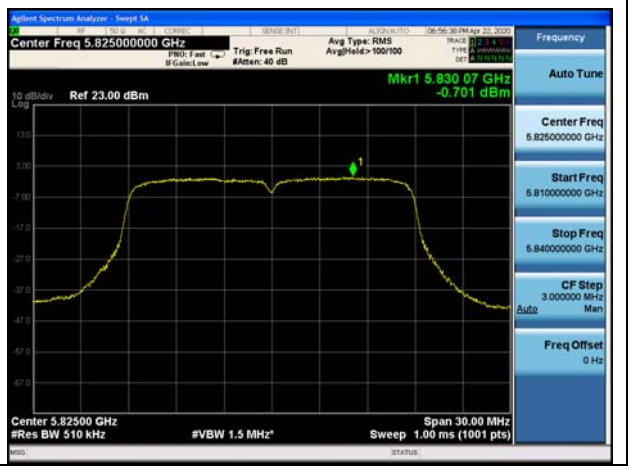

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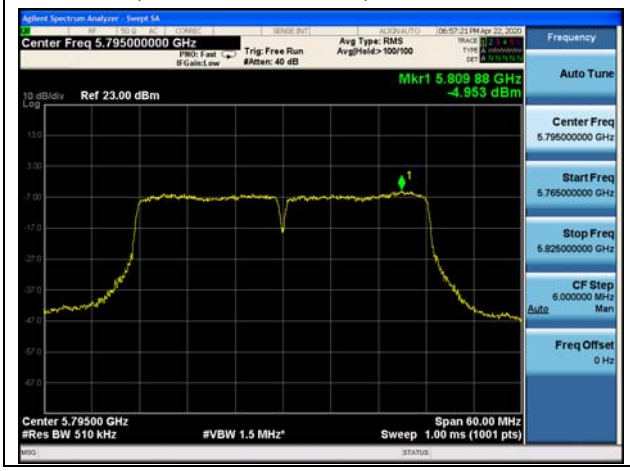
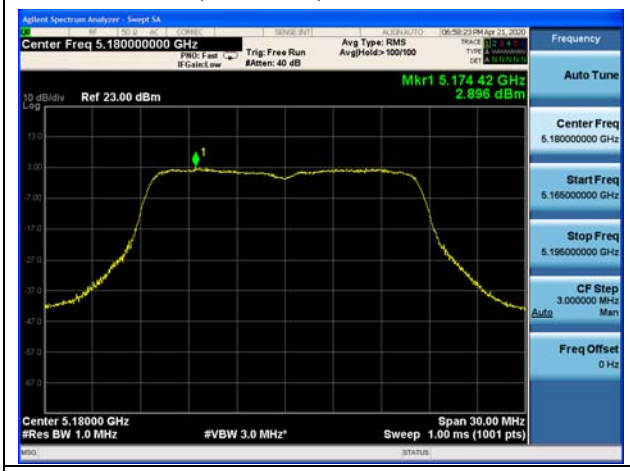


U-NII-3, 802.11ac VHT80, Channel No.: 155

MIMO Antenna 2

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



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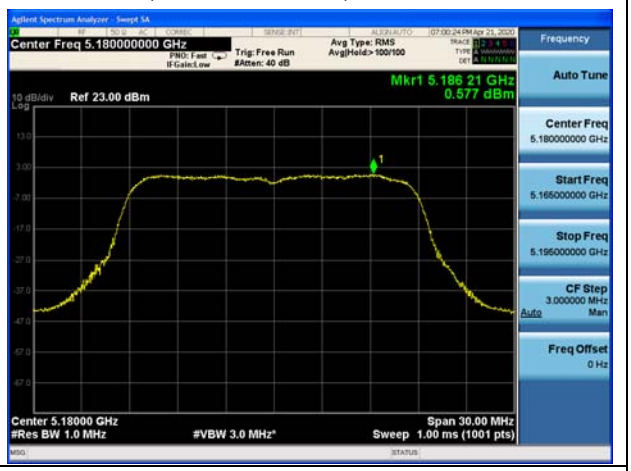

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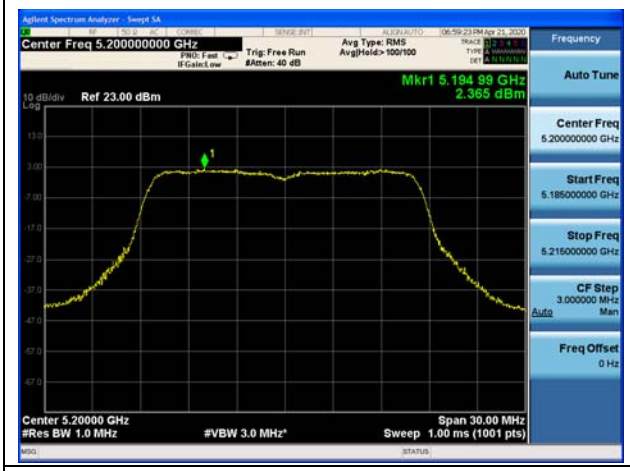

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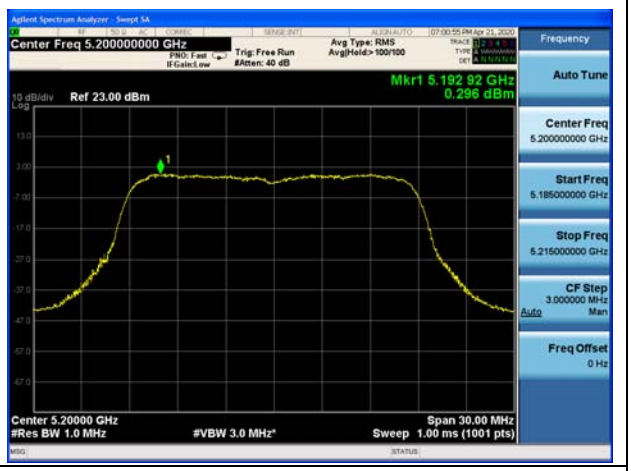

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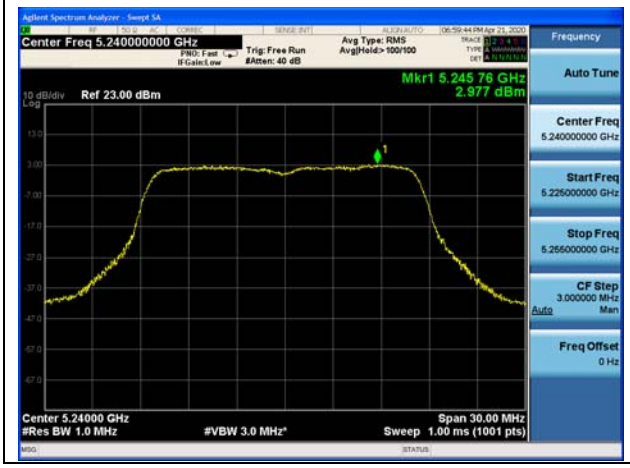
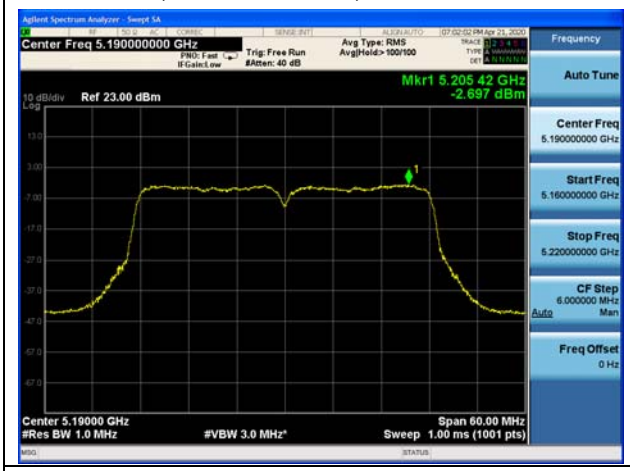


U-NII-1, 802.11n HT20, Channel No.: 48

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



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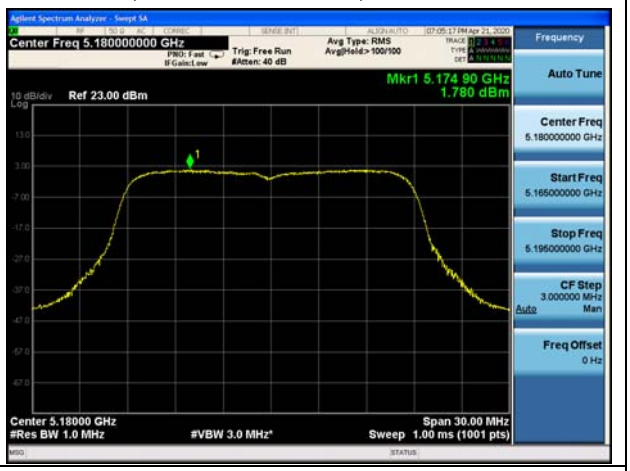

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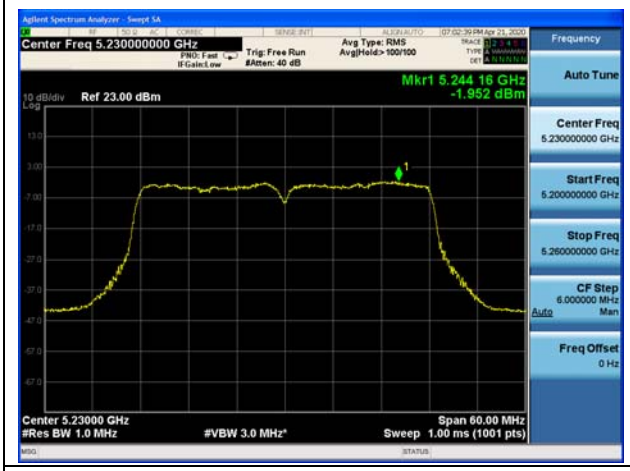
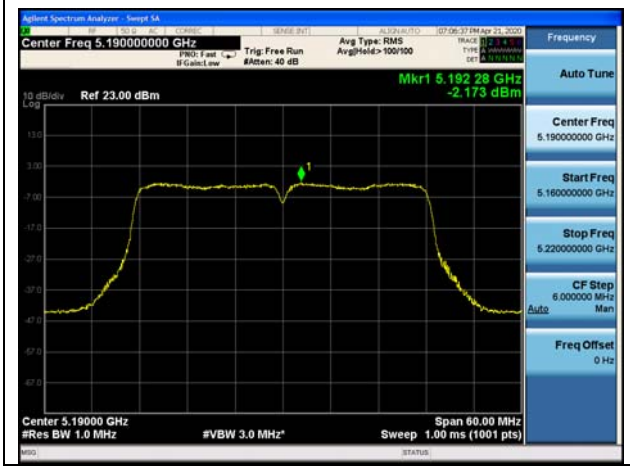
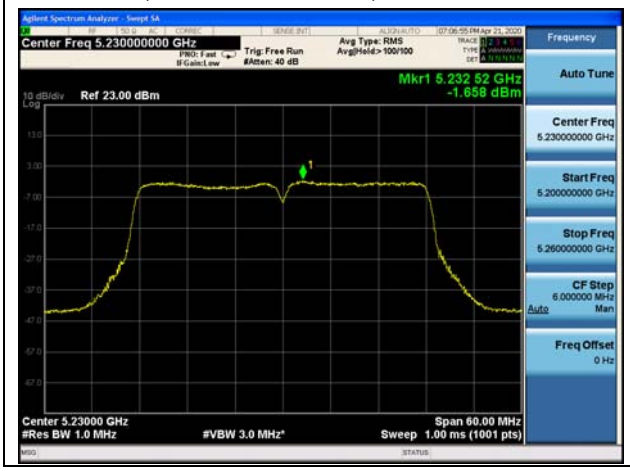


U-NII-1, 802.11ac VHT20, Channel No.: 40

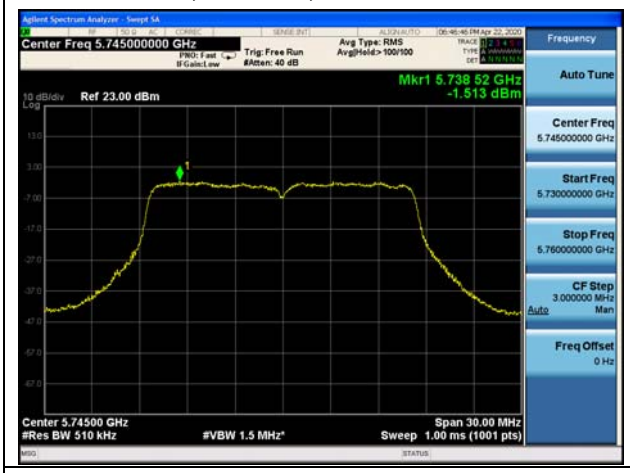
U-NII-1, 802.11ac VHT40, Channel No.: 38



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

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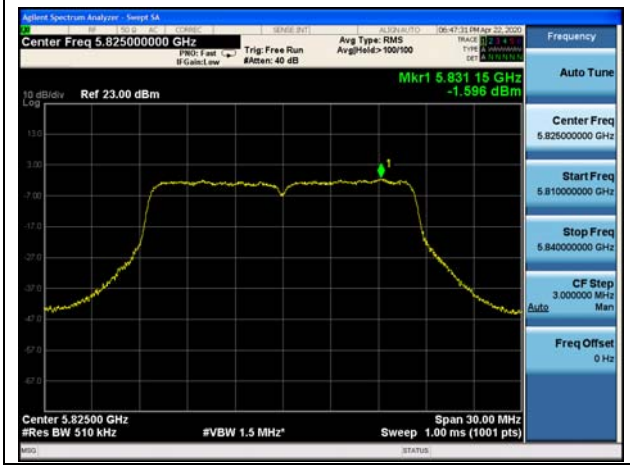

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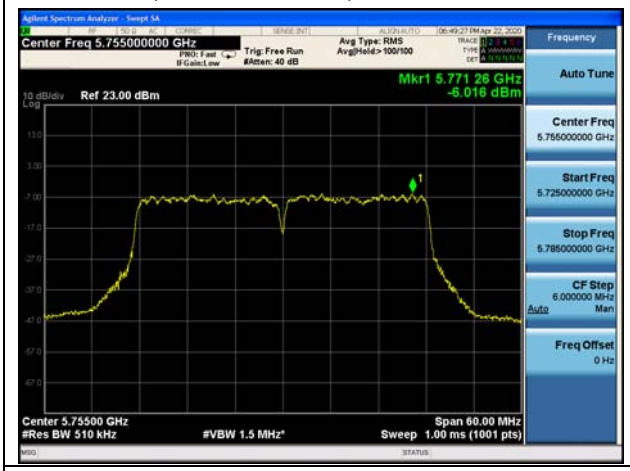

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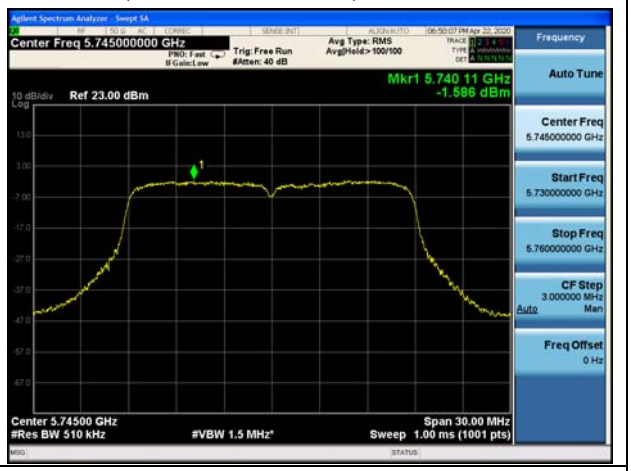

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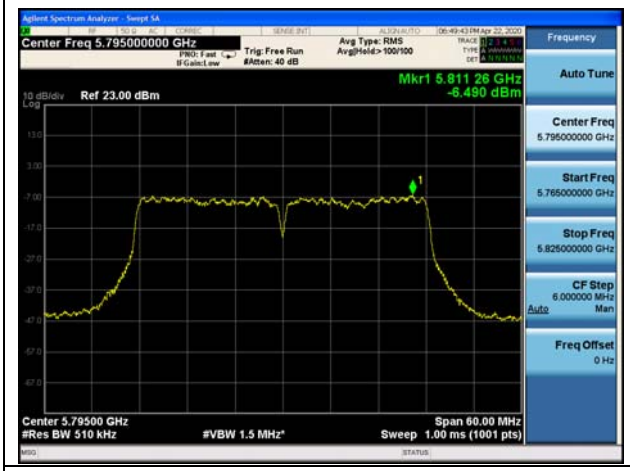

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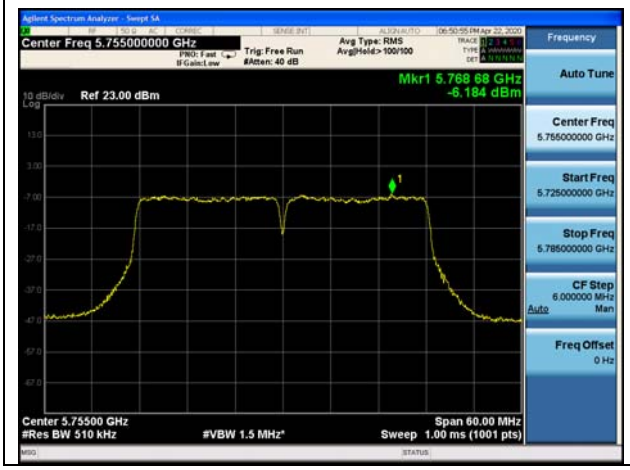
U-NII-3, 802.11ac VHT40, Channel No.: 151



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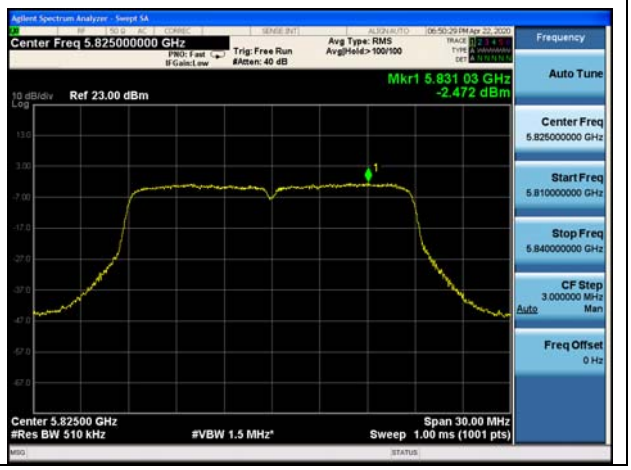

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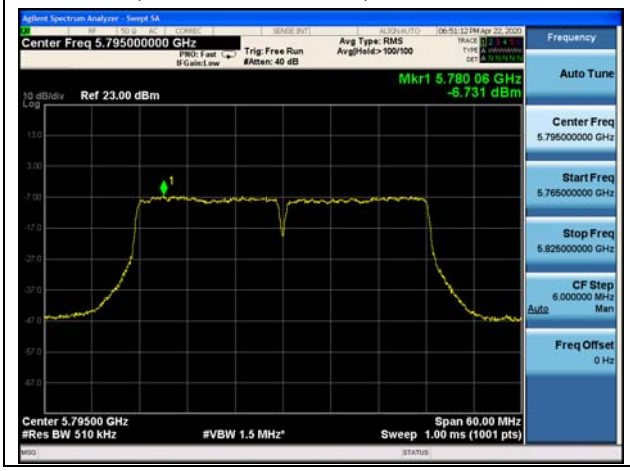


U-NII-3, 802.11ac VHT80, Channel No.: 155

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.

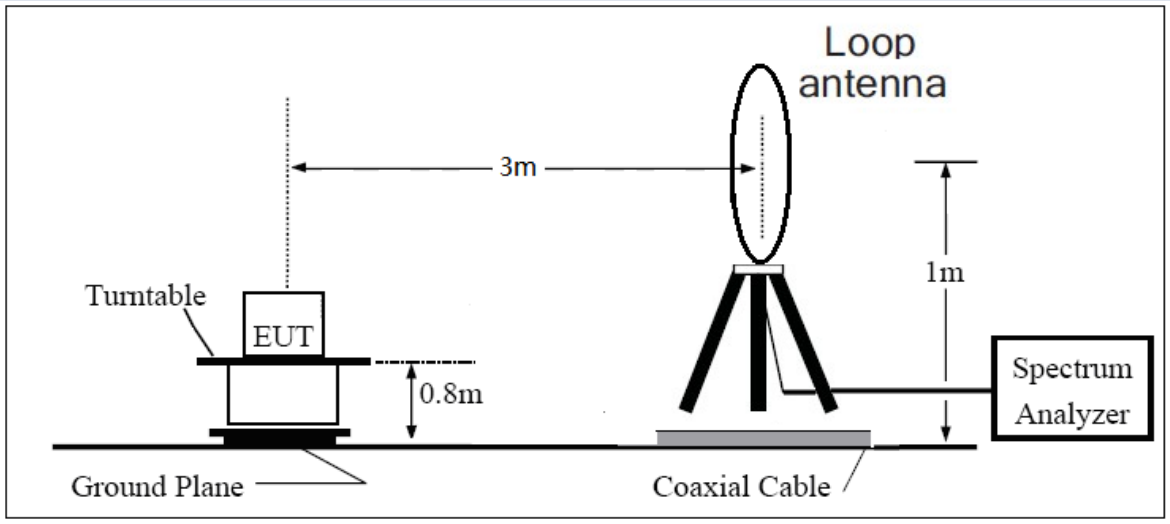
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

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.

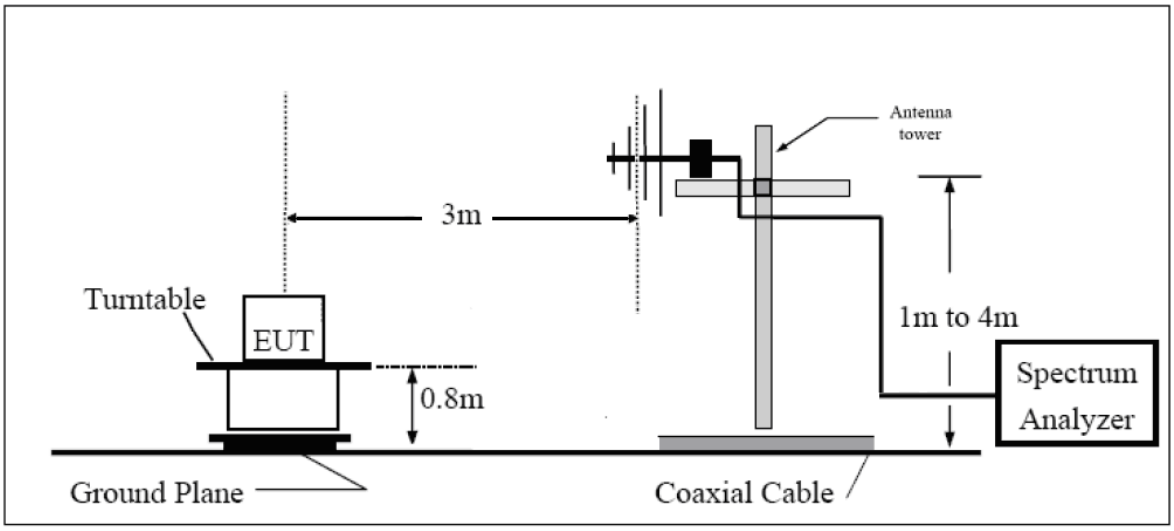
The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the loop antenna is vertical, others antenna are vertical and horizontal.

The test is in transmitting mode.

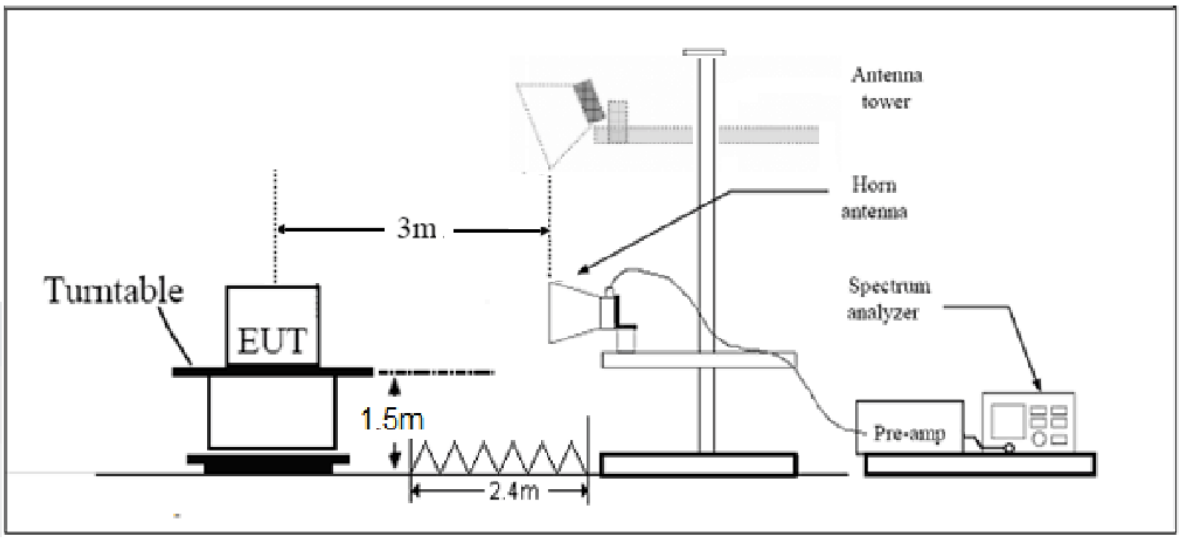
9KHz~~~30MHz



30MHz~~~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Limits

(1) For transmitters operating in the 5725-5850 MHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(2) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz(68.2dBμV/m).

(3) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz(68.2dBμV/m).

(4) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz(68.2dBμV/m).

Note: the following formula is used to convert the EIRP to field strength

§1、E[dBμV/m] = EIRP[dBm] - 20 log(d[meters]) + 104.77, where E = field strength and

d = distance at which field strength limit is specified in the rules;

§2、E[dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters

(5) Unwanted spurious emissions fallen in restricted bands per FCC Part15.205 shall comply with the general field strength limits set forth in § 15.209 as below table.

Frequency of emission (MHz)	Field strength(uV/m)	Field strength(dBuV/m)
0.009–0.490	2400/F(kHz)	/
0.490–1.705	24000/F(kHz)	/
1.705–30.0	30	/
30-88	100	40
88-216	150	43.5
216-960	200	46
Above960	500	54

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor *k* = 1.96.

Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.17 dB
200MHz-1GHz	4.84 dB
1-18GHz	4.35 dB
18-26.5GHz	5.90 dB
26.5GHz~40GHz	5.92 dB

Test Results:

The modulation and bandwidth are similar for 802.11n mode for 20MHz/40MHz and 802.11ac mode for V20MHz/V40MHz, therefore investigated worst case to representative mode in test report.

Band	T_{on} (ms)	$T_{(on+off)}$ (ms)	Duty cycle	Duty cycle correction Factor(dB)
802.11a	0.25	0.33	0.75	1.23
802.11n HT20	0.23	0.36	0.64	1.93
802.11n HT40	0.13	0.21	0.62	2.06
802.11ac VHT20	0.25	0.35	0.72	1.43
802.11ac VHT40	0.13	0.22	0.57	2.47
802.11ac VHT80	0.23	0.30	0.76	1.19
Note: when Duty cycle>0.98, Duty cycle correction Factor not required.				

U-NII-1

802.11a-Channel 36

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5149.5	59.072	--	200.0	V	135	1.23	60.302	13.698	74
5147.9	--	44.355	200.0	V	135	1.23	45.585	8.415	54

802.11a-Channel 48

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5356.7	54.795	--	200.0	V	135	1.23	56.025	17.975	74
5353.4	--	43.854	200.0	V	135	1.23	45.084	8.916	54

802.11n HT20-Channel 36

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5148.5	58.477	--	150	V	65	1.93	60.407	13.593	74
5147.5	--	42.482	150	V	65	1.93	44.412	9.588	54

802.11n HT20-Channel 48

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5384.6	53.639	--	150	V	65	1.93	55.569	18.431	74
5353.8	--	41.337	150	V	65	1.93	43.267	10.733	54

802.11n HT40-Channel 38

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5147.2	70.629	--	150	V	78	2.06	72.689	1.311	74
5150.0	--	42.059	150	V	78	2.06	44.119	9.881	54

802.11n HT40-Channel 46

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5417.7	42.391	--	150	V	78	2.06	44.451	29.549	74
5369.5	--	35.569	150	V	78	2.06	37.629	16.371	54

802.11ac HT80-Channel 42

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5142.1	71.642	--	200	V	90	1.19	74.022	1.168	74
5144.2	--	46.820	200	V	90	1.19	48.01	5.99	54

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802.11a-Channel 149

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5632.1	51.705	--	200.0	V	135	1.23	52.935	15.265	68.2
--	--	--	200.0	V	135	1.23	--	--	--

802.11a-Channel 165

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5944.2	51.861	--	200.0	V	135	1.23	53.091	15.109	68.2
--	--	--	200.0	V	135	1.23	--	--	--

802.11n HT20-Channel 149

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5637.9	52.199	--	150	V	65	1.93	54.129	14.071	68.2
--	--	--	150	V	65	1.93	--	--	--

802.11n HT20-Channel 165

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5933.7	52.093	--	150	V	65	1.93	54.023	14.177	68.2
--	--	--	150	V	65	1.93	--	--	54

802.11n HT40-Channel 151

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5611.3	51.849	--	150	V	78	2.06	53.909	14.291	68.2
--	--	--	150	V	78	2.06	--	--	--

802.11n HT40-Channel 159

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5940.5	51.863	--	150	V	78	2.06	53.923	14.277	68.2
--	--	--	150	V	78	2.06	--	--	--

802.11ac HT80-Channel 155

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
5647.2	53.927	--	200	V	90	1.19	55.117	13.083	68.2
--	--	--	200	V	90	1.19	--	--	--

Result of RE

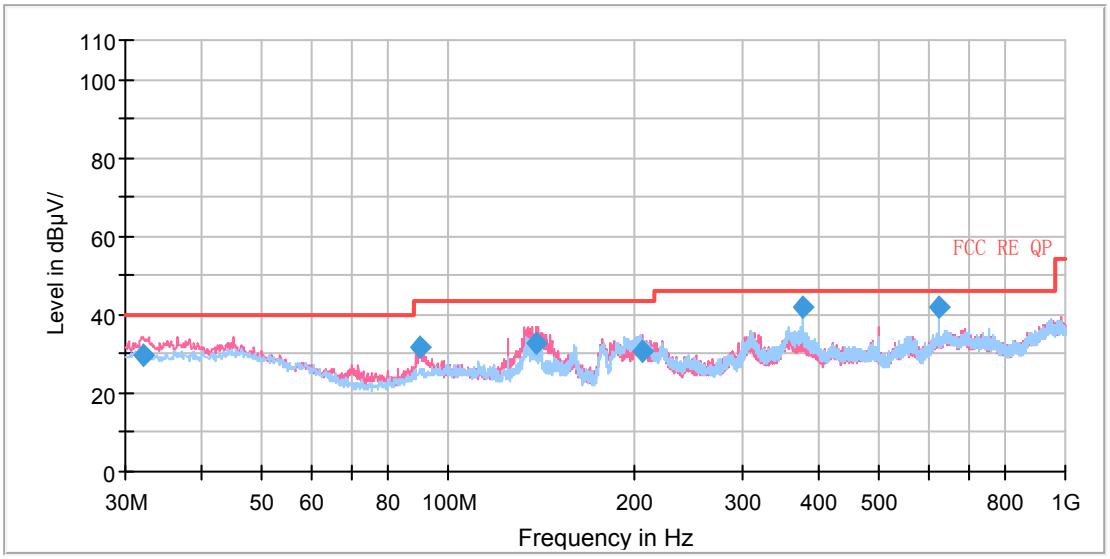
Test result

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the Emissions in the frequency band 9kHz-30MHz and 26.5GHz-40GHz are more than 20dB below the limit are not reported.

After the pretest, SISO Antenna 2 was selected as the worst antenna for 802.11a, MIMO was selected for 802.11n-HT20/40, 802.11ac-VHT80.

During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes with all channels, 802.11a, Channel 36 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

Continuous TX mode:



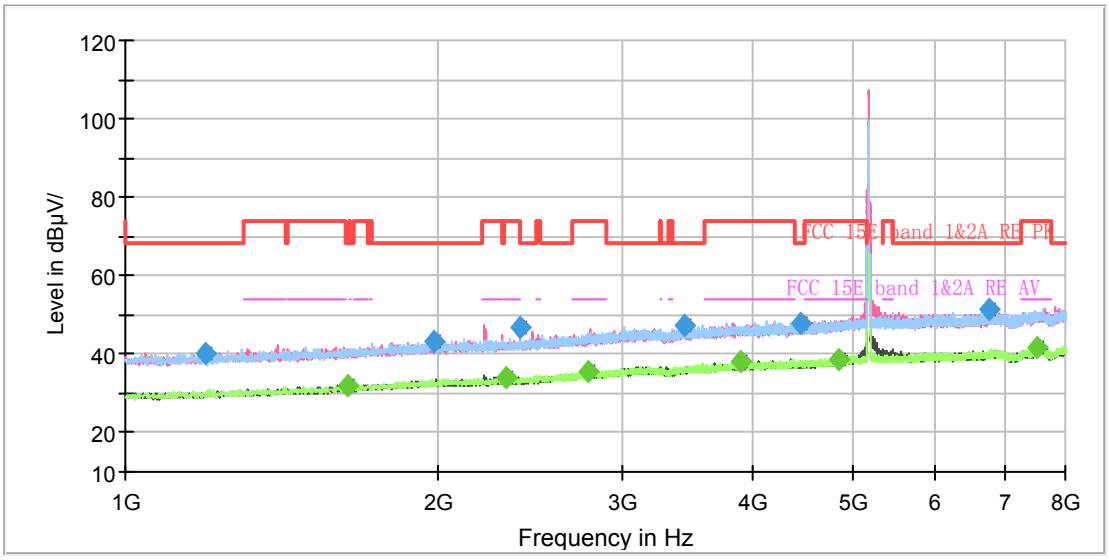
Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
32.019850	29.56	109.0	V	160.0	3.9	10.44	40.00
90.032756	31.87	109.0	V	269.0	-3.4	11.63	43.50
139.108153	32.50	100.0	V	74.0	-7.3	11.00	43.50
206.385500	30.60	100.0	V	110.0	-5.4	12.90	43.50
375.020000	42.01	100.0	H	254.0	1.5	3.99	46.00
625.012500	41.95	123.0	H	241.0	4.2	4.05	46.00

Remark: 1. Correction Factor = Antenna factor+ Insertion loss(cable loss+amplifier gain)

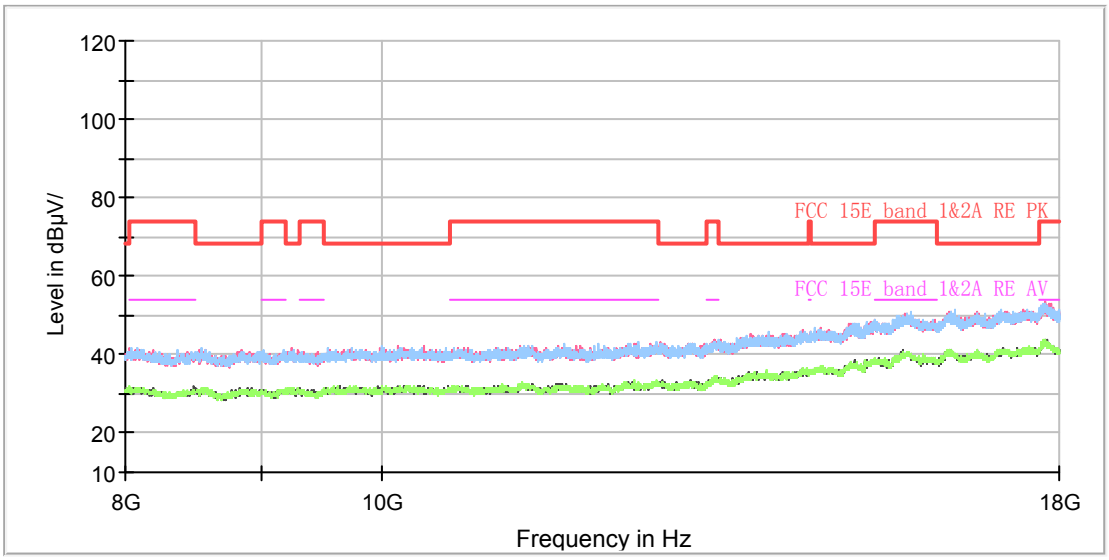
2. Margin = Limit – Quasi-Peak

802.11a CH36



Radiates Emission from 1GHz to 8GHz

Note: The signal beyond the limit is carrier.



Radiates Emission from 8GHz to 18GHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor
1196.000000	40.41	---	68.20	27.79	100.0	H	182.0	-7.8
1637.000000	---	32.20	54.00	21.80	200.0	V	353.0	-5.4
1983.500000	43.42	---	68.20	24.78	200.0	V	177.0	-3.5
2321.250000	---	34.27	54.00	19.73	100.0	V	101.0	-2.2
2394.750000	46.75	---	68.20	21.45	100.0	V	161.0	-2.0
2782.375000	---	35.38	54.00	18.62	100.0	V	341.0	0.0
3445.625000	47.20	---	68.20	21.00	100.0	V	229.0	2.2
3900.625000	---	38.18	54.00	15.82	200.0	V	221.0	3.8
4461.500000	47.72	---	68.20	20.48	100.0	V	153.0	4.9
4844.750000	---	38.85	54.00	15.15	100.0	V	179.0	6.0
6747.875000	51.19	---	68.20	17.01	200.0	H	183.0	8.9
7532.750000	---	41.48	54.00	12.52	100.0	V	229.0	9.9

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)