RF TEST REPORT

Applicant	Shanghai Smawave Technology Co. ,Ltd
FCC ID	2AU8HSRP410-B
Product	LTE CPE
Brand	Smawave
Model	SRP410-b
Report No.	R2001A0016-R3
Issue Date	August 12, 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.

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

TA Technology (Shanghai) Co., Ltd.

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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
Test Date:March 27, 2020 ~ August 10, 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.			

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
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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-b
IMEI	862165040679399
Hardware Version	SGL6010_V1.0
Software Version	SG626U_V1.0.0
Power Supply	External power supply
Antenna Type	External Antenna
Antenna Gain	Antenna 1: 5.00 dBi Antenna 2: 5.00 dBi
Directional Gain	NA
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	23.18 dBm
Operating Frequency Range(s)	U-NII-1: 5150MHz-5250MHz U-NII-3: 5725MHz -5850MHz
Operating temperature range:	-40 ° C to 70° C
Operating voltage range:	9 V to 14 V
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 lie-down position (X 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	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 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	--	--	O
Power Spectral Density	O	O	O
Unwanted Emissions	--	--	O
Conducted Emissions	--	--	802.11n HT20
Note：“O”: test all bands			

According to RF Output power results in chapter 5.2, MIMO was selected as the worst antenna.

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.

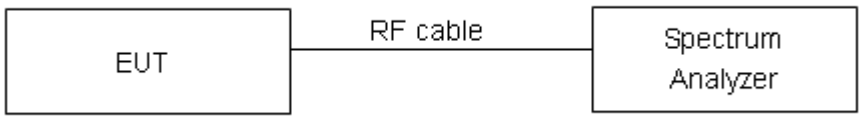
For U-NII-1/U-NII-2A/U-NII-2C, set RBW ≈1% OCB kHz, VBW ≥ 3 × RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the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

MIMO Antenna

U-NII-1

Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5180	16.757	29.16	PASS
	5200	16.862	29.57	PASS
	5240	16.959	29.57	PASS
802.11n HT20	5180	17.742	28.88	PASS
	5200	17.816	29.49	PASS
	5240	17.858	29.89	PASS
802.11n HT40	5190	37.120	59.97	PASS
	5230	36.718	59.23	PASS
802.11ac VHT20	5180	17.885	28.86	PASS
	5200	18.011	29.59	PASS
	5240	18.087	29.44	PASS
802.11ac VHT40	5190	36.929	59.96	PASS
	5230	36.920	59.78	PASS
802.11ac VHT80	5210	76.339	115.70	PASS

U-NII-3

Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11a	5745	16.697	16.30	500	PASS
	5785	16.902	16.26	500	PASS
	5825	16.768	16.28	500	PASS
802.11n HT20	5745	16.560	16.36	500	PASS
	5785	17.748	16.19	500	PASS
	5825	17.745	16.29	500	PASS
802.11n HT40	5755	36.667	36.03	500	PASS
	5795	36.738	36.08	500	PASS
802.11ac VHT20	5745	17.865	16.21	500	PASS
	5785	17.950	15.81	500	PASS
	5825	18.085	15.82	500	PASS
802.11ac VHT40	5755	37.909	35.78	500	PASS
	5795	36.754	35.98	500	PASS
802.11ac VHT80	5775	76.126	75.13	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

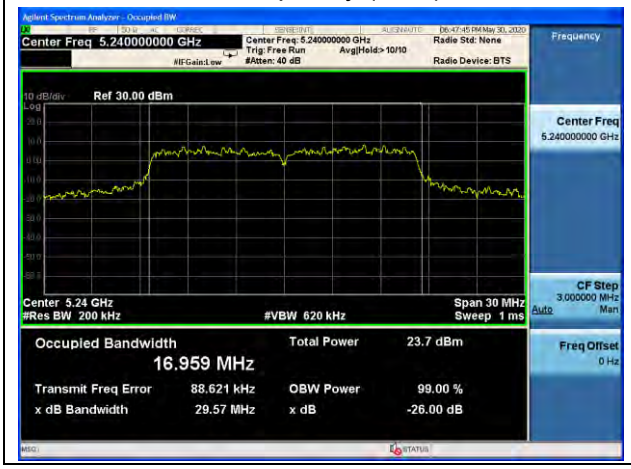
Carrier frequency (MHz): 5200

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

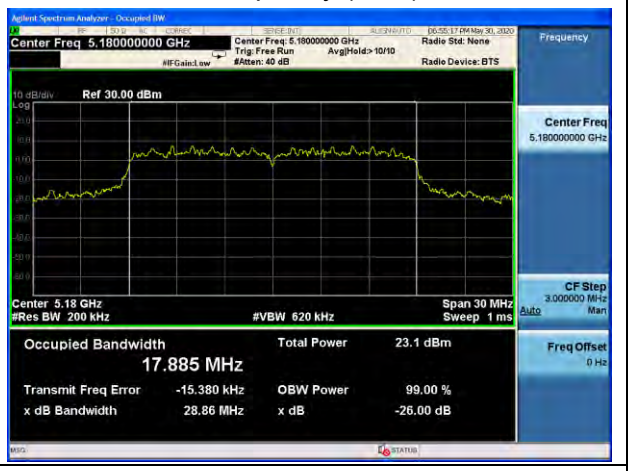
Carrier frequency (MHz):5240

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

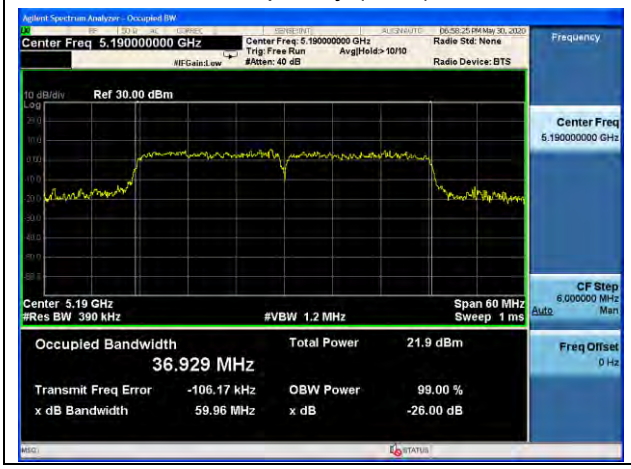
Carrier frequency (MHz): 5230

U-NII-1, 802.11ac VHT20

Carrier frequency (MHz): 5200

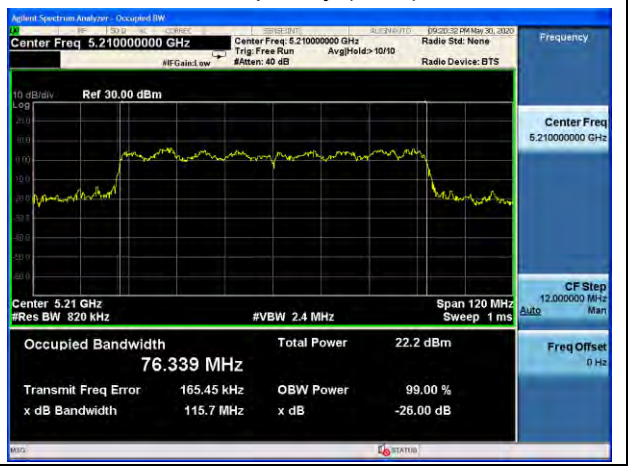
U-NII-1, 802.11ac VHT40

Carrier frequency (MHz): 5190



U-NII-1, 802.11ac VHT20

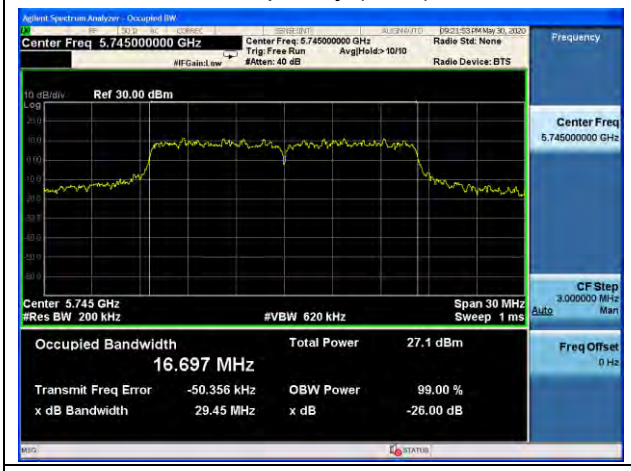
Carrier frequency (MHz):5240

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

99% bandwidth

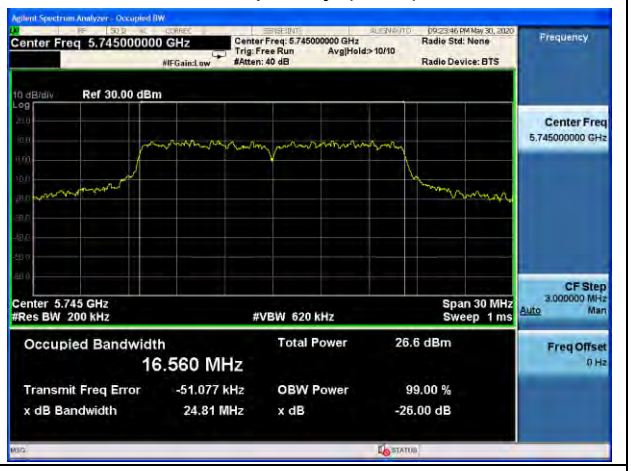
U-NII-3, 802.11a

Carrier frequency (MHz): 5745



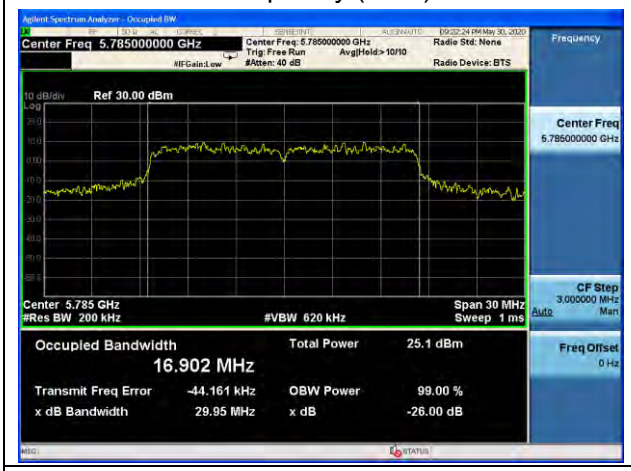
U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5745



U-NII-3, 802.11a

Carrier frequency (MHz): 5785

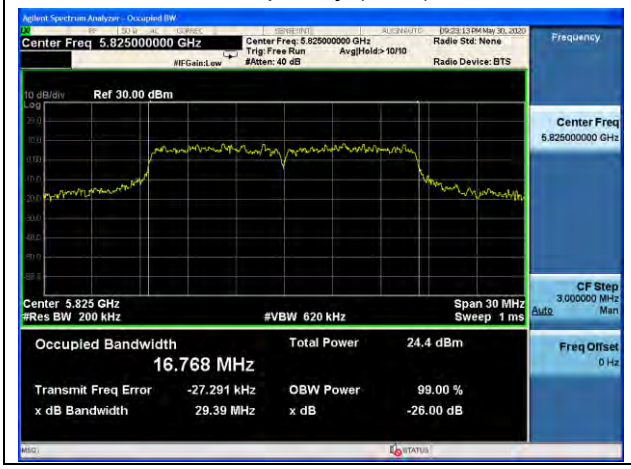


U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5785

U-NII-3, 802.11a

Carrier frequency (MHz): 5825

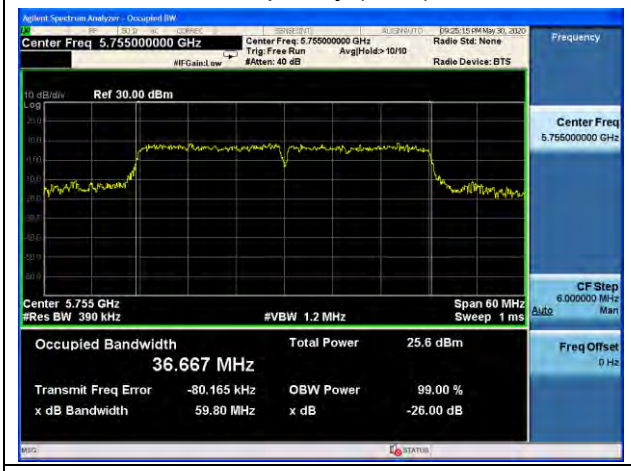


U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5825

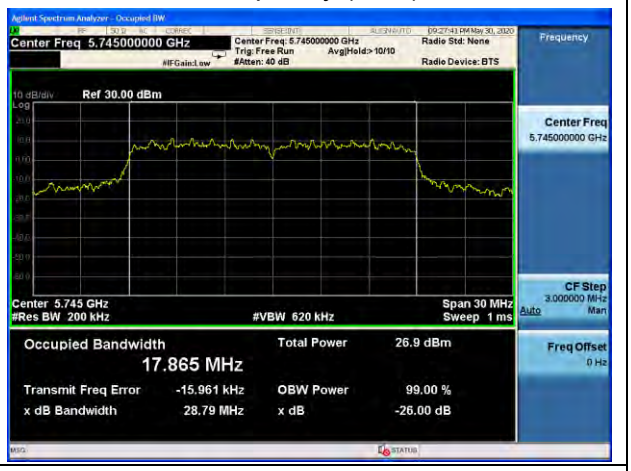
U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5755



U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5745

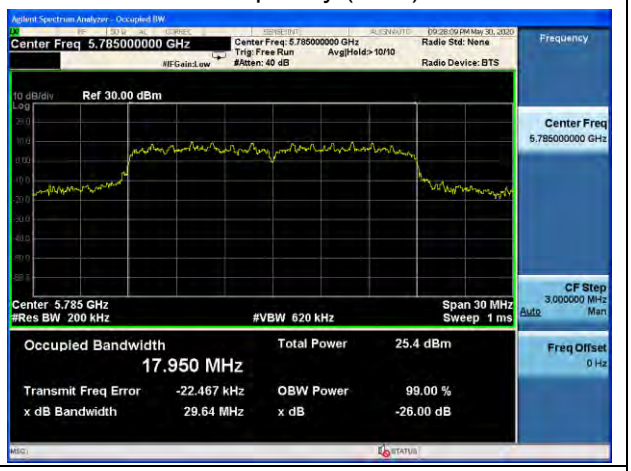


U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5795

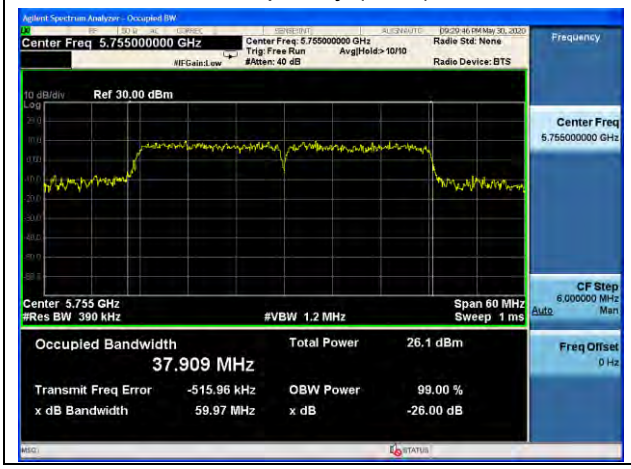
U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5785



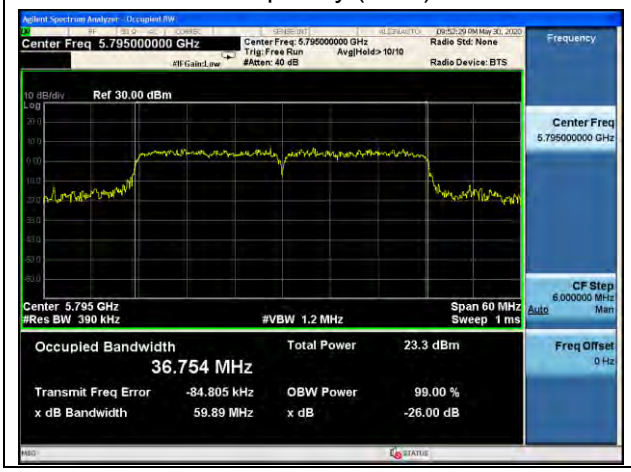
U-NII-3, 802.11ac VHT40

Carrier frequency (MHz): 5755



U-NII-3, 802.11ac VHT20

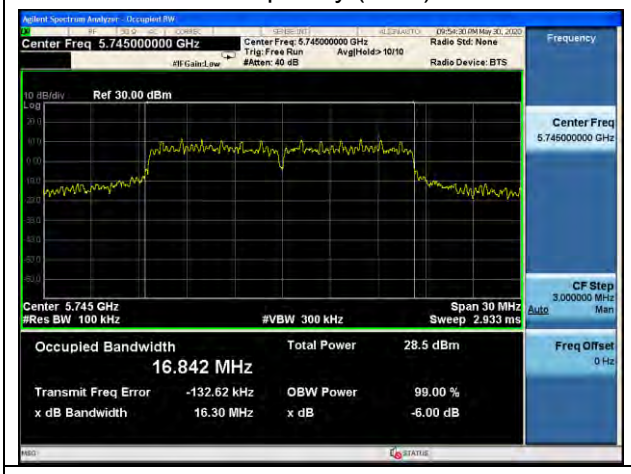
Carrier frequency (MHz): 5825

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

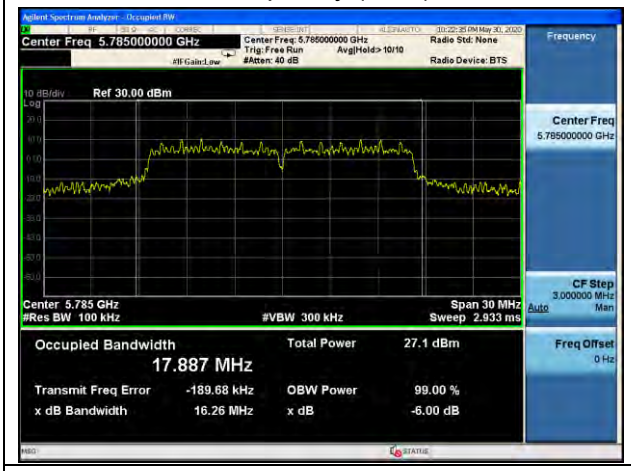


U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5745

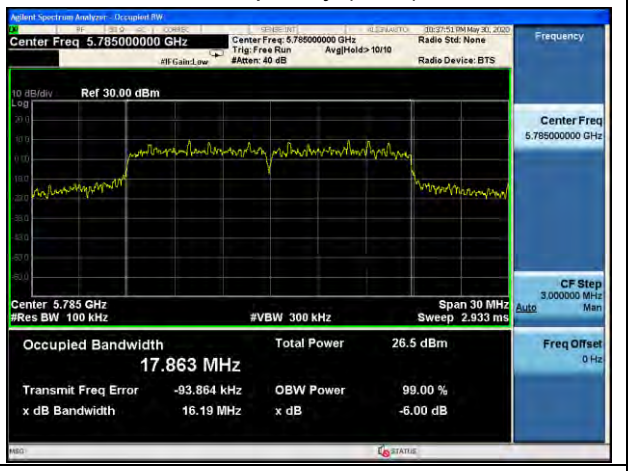
U-NII-3, 802.11a

Carrier frequency (MHz): 5785



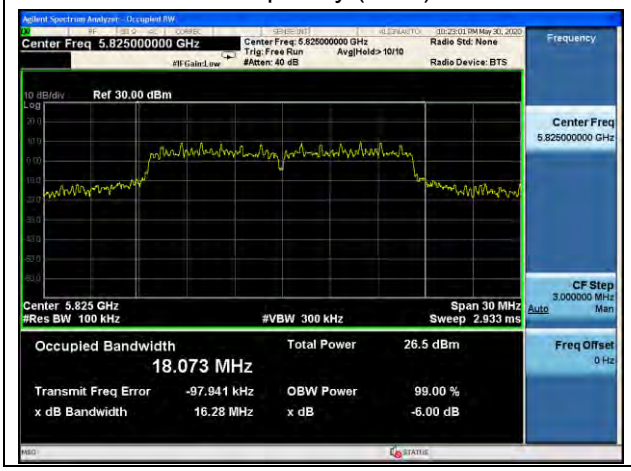
U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5785



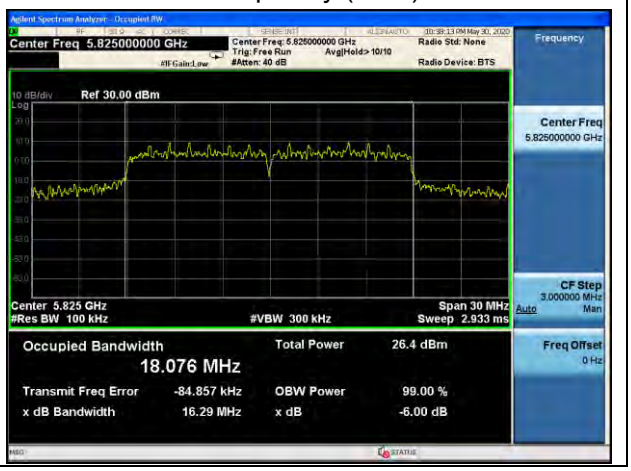
U-NII-3, 802.11a

Carrier frequency (MHz): 5825



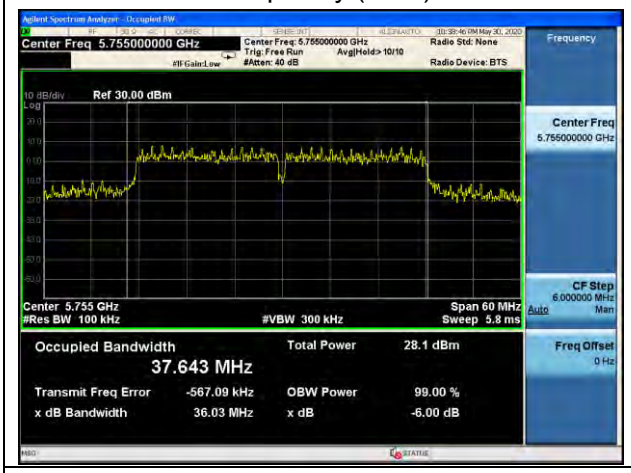
U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5825



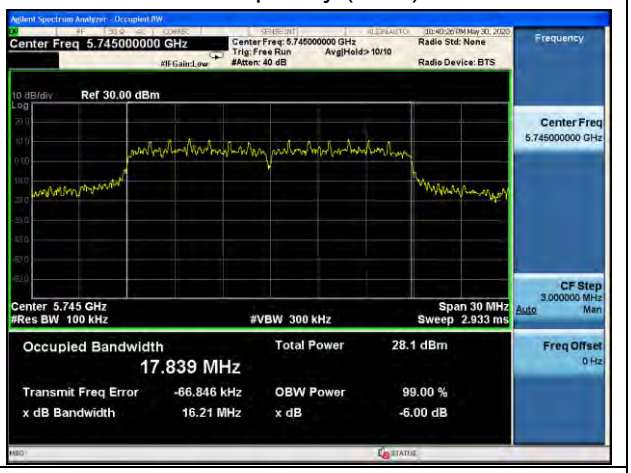
U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5755



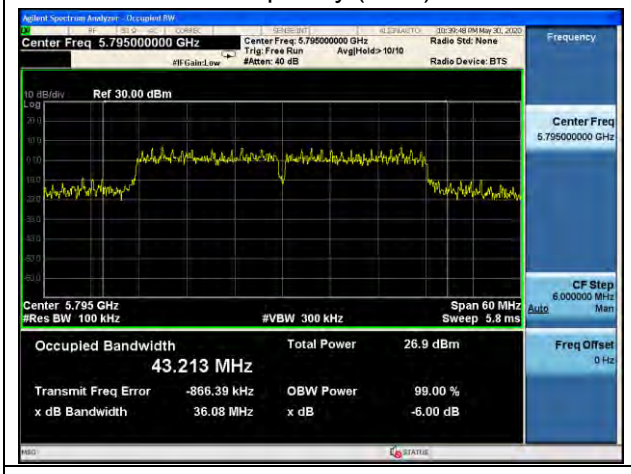
U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5745



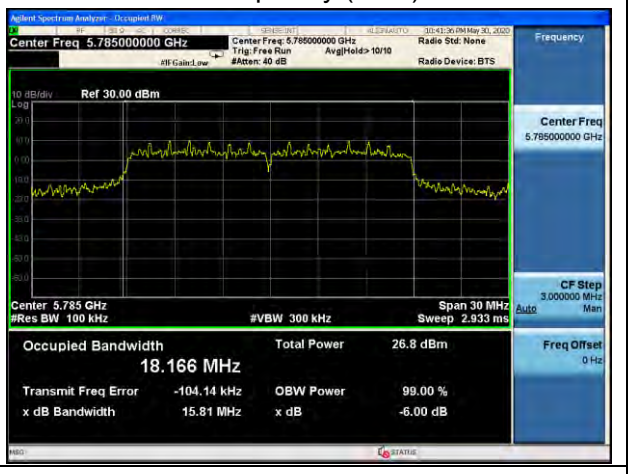
U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5795



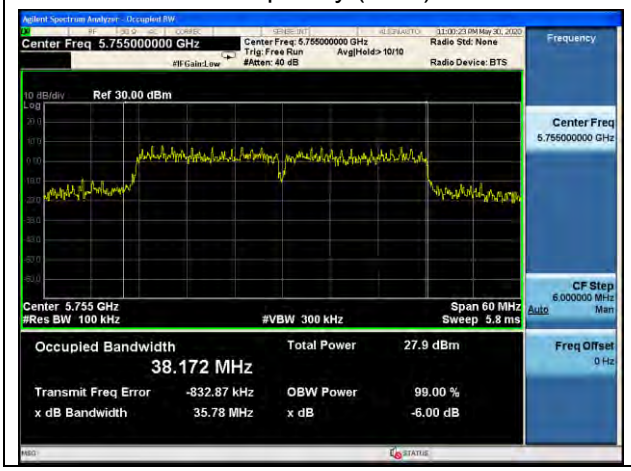
U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5785



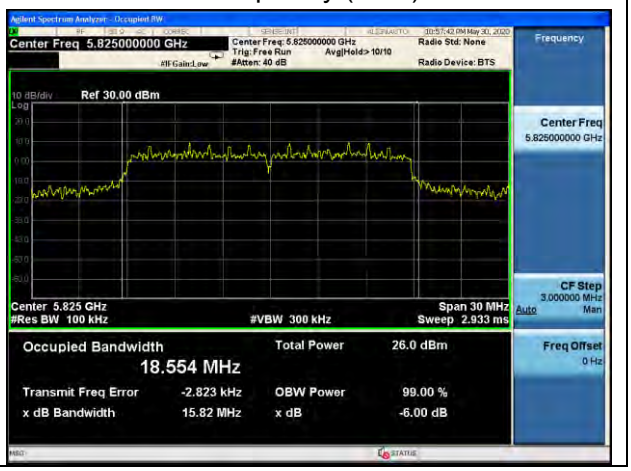
U-NII-3, 802.11ac VHT40

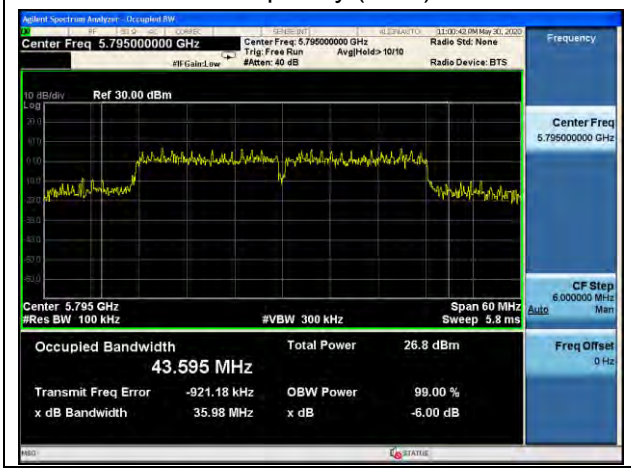
Carrier frequency (MHz): 5755



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
	

5.2. Average Power Output –Conducted

Ambient condition

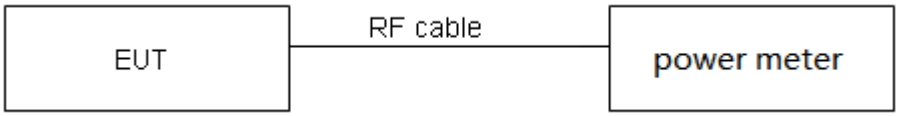
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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) (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.

density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3)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	0.36	0.69	1.62
802.11n HT20	0.23	0.35	0.65	1.86
802.11n HT40	0.13	0.22	0.58	2.35
802.11ac HT20	0.51	0.59	0.86	0.64
802.11ac HT40	0.27	0.38	0.71	1.47
802.11ac HT80	0.51	0.60	0.86	0.66
Note: when Duty cycle>0.98, Duty cycle correction Factor not required.				

SISO Antenna 1 & Antenna 2

Single Antenna Power Index						
Packet Type	**CH36**	**CH40**	**CH48**	**CH149**	**CH157**	**CH165**
802.11a	63	63	63	63	63	63
802.11n HT20	63	63	63	63	63	63
802.11ac VHT20	63	63	63	63	63	63
Packet Type	**CH38**	**CH46**	**CH151**	**CH159**	/	/
802.11n HT40	63	63	63	63	/	/
802.11ac VHT40	63	63	63	63	/	/
Packet Type	**CH42**	**CH155**	/	/	/	/
802.11ac VHT80	63	63	/	/	/	/

MIMO Antenna 1 & Antenna 2

MIMO Antenna Power Index						
Packet Type	**CH36**	**CH40**	**CH48**	**CH149**	**CH157**	**CH165**
802.11a	61	62	62	63	63	63
802.11n HT20	62	62	60	63	63	63
802.11ac VHT20	61	61	61	63	63	63
Packet Type	**CH38**	**CH46**	**CH151**	**CH159**	/	/
802.11n HT40	63	63	63	63	/	/
802.11ac VHT40	63	63	63	63	/	/
Packet Type	**CH42**	**CH155**	/	/	/	/
802.11ac VHT80	63	63	/	/	/	/

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	15.73	17.35	24	PASS
	40/5200	15.11	16.73	24	PASS
	48/5240	15.81	17.43	24	PASS
802.11n HT20	36/5180	15.56	17.42	24	PASS
	40/5200	15.04	16.90	24	PASS
	48/5240	15.89	17.75	24	PASS
802.11n HT40	38/5190	14.86	17.21	24	PASS
	46/5230	14.90	17.25	24	PASS
802.11ac VHT20	36/5180	16.27	16.91	24	PASS
	40/5200	15.41	16.05	24	PASS
	48/5240	16.22	16.86	24	PASS
802.11ac VHT40	38/5190	15.52	16.99	24	PASS
	46/5230	15.62	17.09	24	PASS
802.11ac VHT80	42/5210	15.93	16.59	24	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	19.57	21.19	30	PASS
	157/5785	18.25	19.87	30	PASS
	165/5825	17.81	19.43	30	PASS
802.11n HT20	149/5745	19.45	21.31	30	PASS
	157/5785	18.05	19.91	30	PASS
	165/5825	17.86	19.72	30	PASS
802.11n HT40	151/5755	18.64	20.99	30	PASS
	159/5795	17.60	19.95	30	PASS
802.11ac VHT20	149/5745	20.17	20.81	30	PASS
	157/5785	18.54	19.18	30	PASS
	165/5825	18.00	18.64	30	PASS
802.11ac VHT40	151/5755	19.24	20.71	30	PASS
	159/5795	18.12	19.59	30	PASS
802.11ac VHT80	155/5775	18.92	19.58	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	19.44	21.06	24	PASS
	40/5200	18.77	20.39	24	PASS
	48/5240	18.36	19.98	24	PASS
802.11n HT20	36/5180	19.43	21.29	24	PASS
	40/5200	18.72	20.58	24	PASS
	48/5240	18.32	20.18	24	PASS
802.11n HT40	38/5190	18.81	21.16	24	PASS
	46/5230	17.97	20.32	24	PASS
802.11ac VHT20	36/5180	20.52	21.16	24	PASS
	40/5200	19.32	19.96	24	PASS
	48/5240	18.87	19.51	24	PASS
802.11ac VHT40	38/5190	19.56	21.03	24	PASS
	46/5230	18.34	19.81	24	PASS
802.11ac VHT80	42/5210	18.56	19.22	24	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

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Network Standards	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	149/5745	18.08	19.70	30	PASS
	157/5785	16.80	18.42	30	PASS
	165/5825	17.64	19.26	30	PASS
802.11n HT20	149/5745	17.74	19.60	30	PASS
	157/5785	16.71	18.57	30	PASS
	165/5825	17.50	19.36	30	PASS
802.11n HT40	151/5755	16.73	19.08	30	PASS
	159/5795	16.28	18.63	30	PASS
802.11ac VHT20	149/5745	17.91	18.55	30	PASS
	157/5785	16.32	16.96	30	PASS
	165/5825	17.27	17.91	30	PASS
802.11ac VHT40	151/5755	16.31	17.78	30	PASS
	159/5795	16.02	17.49	30	PASS
802.11ac VHT80	155/5775	15.35	16.01	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

MIMO Antenna

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	14.92	16.54	18.55	20.17	21.73	24.00	PASS
	44/5220	13.66	15.28	17.82	19.44	20.85	24.00	PASS
	48/5240	14.59	16.21	17.14	18.76	20.68	24.00	PASS
802.11n HT20	36/5180	14.27	16.13	18.72	20.58	21.91	24.00	PASS
	44/5220	14.22	16.08	17.95	19.81	21.35	24.00	PASS
	48/5240	14.18	16.04	16.88	18.74	20.61	24.00	PASS
802.11n HT40	38/5190	15.16	17.51	19.23	21.58	23.02	24.00	PASS
	46/5230	14.96	17.31	18.03	20.38	22.12	24.00	PASS
802.11ac VHT20	36/5180	14.92	15.56	18.53	19.17	20.74	24.00	PASS
	44/5220	14.19	14.83	17.93	18.57	20.10	24.00	PASS
	48/5240	14.95	15.59	17.47	18.11	20.04	24.00	PASS
802.11ac VHT40	38/5190	14.80	16.27	18.43	19.90	21.46	24.00	PASS
	46/5230	14.63	16.10	17.80	19.27	20.98	24.00	PASS
802.11ac VHT80	42/5210	14.20	14.86	17.46	18.12	19.80	24.00	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 =5+0=5 dBi<6dBi. So the power limt is 24dBm.

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	16.92	18.54	19.73	21.35	23.18	30.00	PASS
	157/5785	15.19	16.81	17.05	18.67	20.85	30.00	PASS
	165/5825	16.46	18.08	17.24	18.86	21.50	30.00	PASS
802.11n HT20	149/5745	16.52	18.38	18.52	20.38	22.51	30.00	PASS
	157/5785	15.50	17.36	17.34	19.20	21.39	30.00	PASS
	165/5825	16.62	18.48	16.93	18.79	21.65	30.00	PASS
802.11n HT40	151/5755	15.66	18.01	17.95	20.30	22.32	30.00	PASS
	159/5795	15.46	17.81	16.62	18.97	21.44	30.00	PASS
802.11ac VHT20	149/5745	16.28	16.92	18.37	19.01	21.09	30.00	PASS
	157/5785	15.31	15.95	17.00	17.64	19.88	30.00	PASS
	165/5825	16.17	16.81	16.72	17.36	20.10	30.00	PASS
802.11ac VHT40	151/5755	15.52	16.99	17.75	19.22	21.26	30.00	PASS
	159/5795	15.24	16.71	16.46	17.93	20.37	30.00	PASS
802.11ac VHT80	155/5775	14.59	15.25	16.76	17.42	19.48	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 $=5+0=5$ dBi<6dBi. So the power limt is 30dBm.

5.3. Frequency Stability

Ambient condition

Temperature	Relative humidity	Pressure
23℃ ~25℃	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℃ , 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℃ to +25 ℃). 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	5200.006582	5199.999921	5199.995758	5199.992942
12	-30	5200.013551	5199.990707	5199.985882	5199.988546
12	-20	5200.011597	5199.984730	5199.984763	5199.983831
12	0	5200.010893	5199.978115	5199.984002	5199.977540
12	10	5200.000918	5199.977568	5199.977266	5199.973783
12	30	5199.992230	5199.967651	5199.970887	5199.969531
12	60	5199.982865	5199.965661	5199.963269	5199.964203
12	70	5199.975241	5199.965160	5199.961919	5199.960404
9	25	5199.967184	5199.958833	5199.959210	5199.950787
14	25	5199.965141	5199.954142	5199.950616	5199.946500
MHz		-0.034859	-0.045858	-0.049384	-0.053500
PPM		-6.703703	-8.818860	-9.496880	-10.288369

Voltage (V)	Temperature (°C)	U-NII-3 Test Results			
		5785MHz			
		1min	2min	5min	10min
12	-40	5784.993148	5784.988093	5784.987842	5784.981080
12	-30	5784.990193	5784.983849	5784.978189	5784.976026
12	-20	5784.989526	5784.979139	5784.978090	5784.973196
12	0	5784.981121	5784.972583	5784.969221	5784.968094
12	10	5784.979026	5784.970552	5784.959521	5784.960602
12	30	5784.971074	5784.961986	5784.952869	5784.955497
12	60	5784.964212	5784.960440	5784.951400	5784.947244
12	70	5784.955841	5784.956253	5784.946468	5784.944626
9	25	5784.954946	5784.954776	5784.940925	5784.942567
14	25	5784.950710	5784.952315	5784.940130	5784.933980
MHz		-0.049290	-0.047685	-0.059870	-0.066020
PPM		-8.520240	-8.242890	-10.349149	-11.412318

5.4. Power Spectral Density

Ambient condition

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

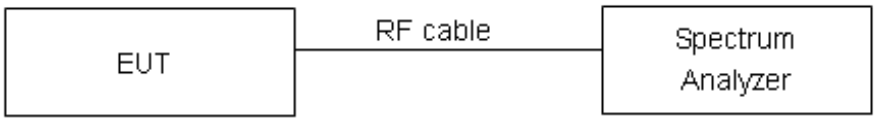
Method of Measurement

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

Set RBW = 1MHz, VBW =3MHz for the band 5.150-5.250GHz.
Set RBW = 510kHz, VBW =1.5MHz for the band 5.725-5.850GHz

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)(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.
(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.

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	11dBm/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:

SISO Antenna 1

U-NII-1

Network Standards	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	36/5180	4.85	6.47	11	PASS
	40/5200	4.46	6.08	11	PASS
	48/5240	4.97	6.59	11	PASS
802.11n HT20	36/5180	4.51	6.37	11	PASS
	40/5200	3.79	5.65	11	PASS
	48/5240	5.20	7.07	11	PASS
802.11n HT40	38/5190	0.49	2.84	11	PASS
	46/5230	1.14	3.49	11	PASS
802.11ac VHT20	36/5180	4.60	5.23	11	PASS
	40/5200	4.24	4.87	11	PASS
	48/5240	5.28	5.92	11	PASS
802.11ac VHT40	38/5190	1.33	2.80	11	PASS
	46/5230	2.22	3.69	11	PASS
802.11ac VHT80	42/5210	-0.25	0.41	11	PASS
Note:PSD=Read Value+Duty cycle correction factor					

U-NII-3

Network Standards	Channel Number	Read Value (dBm/500kHz)	Power Spectral Density (dBm/500kHz)	Limit (dBm/500kHz)	Conclusion
802.11a	149/5745	6.27	7.88	30	PASS
	157/5785	4.43	6.05	30	PASS
	165/5825	4.36	5.98	30	PASS
802.11n HT20	149/5745	5.78	7.64	30	PASS
	157/5785	4.51	6.37	30	PASS
	165/5825	4.24	6.10	30	PASS
802.11n HT40	151/5755	2.02	4.37	30	PASS
	159/5795	0.93	3.28	30	PASS
802.11ac VHT20	149/5745	5.93	6.57	30	PASS
	157/5785	4.27	4.90	30	PASS
	165/5825	3.88	4.51	30	PASS
802.11ac VHT40	151/5755	2.30	3.77	30	PASS
	159/5795	1.48	2.95	30	PASS
802.11ac VHT80	155/5775	0.24	0.90	30	PASS
Note: 1. Power Spectral Density =Read Value+Duty cycle correction factor					

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	36/5180	8.74	10.36	11	PASS
	40/5200	7.91	9.53	11	PASS
	48/5240	7.94	9.56	11	PASS
802.11n HT20	36/5180	8.20	10.06	11	PASS
	40/5200	7.85	9.71	11	PASS
	48/5240	7.73	9.59	11	PASS
802.11n HT40	38/5190	4.96	7.31	11	PASS
	46/5230	4.20	6.55	11	PASS
802.11ac VHT20	36/5180	9.28	9.91	11	PASS
	40/5200	8.39	9.02	11	PASS
	48/5240	8.03	8.66	11	PASS
802.11ac VHT40	38/5190	5.65	7.12	11	PASS
	46/5230	4.54	6.01	11	PASS
802.11ac VHT80	42/5210	3.46	4.12	11	PASS
Note:PSD=Read Value+Duty cycle correction factor					

U-NII-3

Network Standards	Channel Number	Read Value (dBm/500kHz)	Power Spectral Density (dBm/500kHz)	Limit (dBm/500kHz)	Conclusion
802.11a	149/5745	4.22	5.84	30	PASS
	157/5785	3.27	4.89	30	PASS
	165/5825	4.31	5.93	30	PASS
802.11n HT20	149/5745	4.33	6.19	30	PASS
	157/5785	3.17	5.03	30	PASS
	165/5825	4.03	5.89	30	PASS
802.11n HT40	151/5755	0.52	2.87	30	PASS
	159/5795	-0.54	1.82	30	PASS
802.11ac VHT20	149/5745	4.03	4.66	30	PASS
	157/5785	3.00	3.63	30	PASS
	165/5825	3.83	4.46	30	PASS
802.11ac VHT40	151/5755	-0.92	0.55	30	PASS
	159/5795	-0.62	0.85	30	PASS
802.11ac VHT80	155/5775	-2.19	-1.53	30	PASS
Note: 1. Power Spectral Density =Read Value+Duty cycle correction factor					

MIMO Antenna

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	3.59	5.21	6.86	8.48	10.16	11.00	PASS
	40/5200	2.87	4.49	6.06	7.67	9.38	11.00	PASS
	48/5240	3.88	5.50	6.62	8.24	10.10	11.00	PASS
802.11n HT20	36/5180	3.11	4.97	7.03	8.89	10.37	11.00	PASS
	40/5200	2.96	4.82	6.97	8.83	10.29	11.00	PASS
	48/5240	3.38	5.25	6.10	7.96	9.82	11.00	PASS
802.11n HT40	38/5190	1.08	3.43	5.38	7.74	9.11	11.00	PASS
	46/5230	1.67	4.02	3.96	6.31	8.32	11.00	PASS
802.11ac VHT20	36/5180	4.40	5.04	7.20	7.83	9.67	11.00	PASS
	40/5200	3.30	3.94	6.20	6.83	8.63	11.00	PASS
	48/5240	3.97	4.61	6.37	7.01	8.98	11.00	PASS
802.11ac VHT40	38/5190	0.81	2.28	4.31	5.78	7.38	11.00	PASS
	46/5230	0.78	2.25	4.65	6.12	7.61	11.00	PASS
802.11ac VHT80	42/5210	-0.88	-0.22	2.47	3.13	4.78	11.00	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=5+10log（2/2)=5<6 dBi. So the PSD limt is 11 dBm.