RF TEST REPORT

Applicant	Quectel Wireless Solutions Co., Ltd
FCC ID	XMR202102FC21
Product	Wi-Fi&BT module
Model	FC21
Report No.	R2101A0021-R3V2
Issue Date	July 12, 2021

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15E (2020)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Prepared by: Peng Tao

Approved by: Kai Xu

TA Technology (Shanghai) Co., Ltd.

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Version	Revision description	Issue Date
Rev.0	Initial issue of report.	June 2, 2021
Rev.1	Update data in page 11	June 25, 2021
Rev.2	Update data	July 12, 2021
Note: This revised report (Report No. R2101A0021-R3V2) supersedes and replaces the previously issued report (Report No. R2101A0021-R3V1). Please discard or destroy the previously issued report and dispose of it accordingly.		

Summary of measurement results

Number	Test Case	Clause in FCC rules	Verdict
1	Average 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 26, 2021~ April 29, 2021 and July 9, 2021~ July 10, 2021 Date of Sample Received: February 3, 2021			
Note: PASS: The EUT complies with the essential requirements in the standard. FAIL: The EUT does not comply with the essential requirements in the standard. 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
Contact:	Xu Kai
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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	Quectel Wireless Solutions Co., Ltd
Applicant address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China
Manufacturer	Quectel Wireless Solutions Co., Ltd
Manufacturer address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

2.2. General information

EUT Description		
Model	FC21	
SN:	E1821BN10000003	
Hardware Version	R1.0	
Software Version	FC21SA-Q73	
Power Supply	External power supply	
Antenna Type	External Antenna	
Antenna Gain	5150~5250 MHz	4.48dBi
	5250~5350 MHz	4.48dBi
	5470~5725 MHz	5.05dBi
	5725~5850 MHz	4.54dBi
Test Band	U-NII-1(5150MHz-5250MHz) U-NII-2A(5250MHz-5350MHz) U-NII-2C(5470MHz-5600MHz, 5650MHz-5725MHz) U-NII-3(5725MHz-5850MHz)	
Modulation Type	802.11a/n (HT20/HT40) : OFDM 802.11ac (VHT20/VHT40/VHT80): OFDM	
Max. Conducted Power	16.86 dBm	
Operating Frequency Range(s)	U-NII-1: 5150MHz-5250MHz U-NII-2A:5250MHz -5350MHz U-NII-2C: 5470MHz-5600MHz, 5650MHz-5725MHz U-NII-3: 5725MHz -5850MHz	
Extreme temperature range:	-20 ° C to 50° C	
Operating temperature range:	-40 ° C to 85° C	
Operating voltage range:	3.14 V to 3.46 V	
State DC voltage:	3.3V	
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 (2020) Unlicensed National Information Infrastructure Devices

ANSI C63.10 (2013)

Reference standard:

KDB 789033 D02 General UNII Test Procedures New Rules 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.

Mode	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ac VHT80	MCS0

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-2A	20 MHz	52	5260MHz
			56	5280MHz
			60	5300MHz
			64	5320MHz
		40 MHz	54	5270MHz
			62	5310MHz
		80 MHz	58	5290MHz
	U-NII-2C	20 MHz	100	5500MHz
			104	5520MHz

			108	5540MHz
			112	5560MHz
			116	5580MHz
			132	5660MHz
			136	5680MHz
			140	5700MHz
			144	5720MHz
		40 MHz	102	5510MHz
			110	5550MHz
			134	5670MHz
			142	5710MHz
		80 MHz	106	5530MHz
			138	5690MHz
	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
Does this device support TPC Function? ☒Yes ☐No				
Does this device support TDWR Band? ☐Yes ☒No				

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.

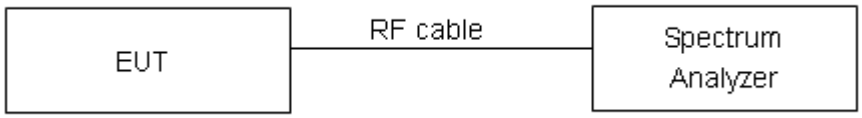
For U-NII-1/U-NII-2A/U-NII-2C, set RBW ≈1% OCB kHz, VBW ≥ 3 × RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the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

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5180	16.295	20.27	PASS
	5200	16.316	20.66	PASS
	5240	16.309	19.72	PASS
802.11n HT20	5180	17.362	20.30	PASS
	5200	17.390	20.56	PASS
	5240	17.367	20.05	PASS
802.11n HT40	5190	35.828	41.03	PASS
	5230	35.937	41.79	PASS
802.11ac VHT20	5180	17.355	19.86	PASS
	5200	17.388	20.27	PASS
	5240	17.392	20.37	PASS
802.11ac VHT40	5190	35.835	40.79	PASS
	5230	35.877	40.98	PASS
802.11ac VHT80	5210	75.206	86.10	PASS

U-NII-2A

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5260	16.277	20.10	PASS
	5300	16.287	20.01	PASS
	5320	16.273	19.82	PASS
802.11n HT20	5260	17.368	19.92	PASS
	5300	17.382	20.36	PASS
	5320	17.360	19.77	PASS
802.11n HT40	5270	35.838	40.13	PASS
	5310	35.876	42.73	PASS
802.11ac VHT20	5260	17.360	19.93	PASS
	5300	17.371	19.99	PASS
	5320	17.403	19.92	PASS
802.11ac VHT40	5270	35.775	41.06	PASS
	5310	35.859	44.00	PASS
802.11ac VHT80	5290	75.034	83.33	PASS

U-NII-2C

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5500	16.270	19.87	PASS
	5580	16.268	19.39	PASS
	5700	16.295	19.44	PASS
	5720	16.317	19.91	PASS
802.11n HT20	5500	17.358	19.64	PASS
	5580	17.360	19.85	PASS
	5700	17.352	19.62	PASS
	5720	17.365	19.73	PASS
802.11n HT40	5510	35.812	40.67	PASS
	5550	35.817	40.32	PASS
	5670	35.835	41.30	PASS
	5710	35.816	40.69	PASS
802.11ac VHT20	5500	17.348	19.62	PASS
	5580	17.337	19.65	PASS
	5700	17.385	19.83	PASS
	5720	17.367	20.04	PASS
802.11ac VHT40	5510	35.838	40.75	PASS
	5550	35.866	41.41	PASS
	5670	35.822	42.57	PASS
	5710	35.781	40.08	PASS
802.11ac VHT80	5530	75.133	81.91	PASS
	5690	74.805	81.25	PASS

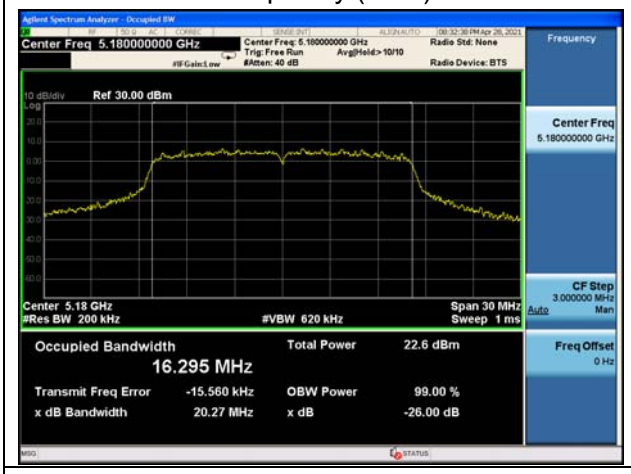
U-NII-3

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11a	5745	16.288	15.33	500	PASS
	5785	16.303	15.14	500	PASS
	5825	16.268	15.16	500	PASS
802.11n HT20	5745	17.386	15.13	500	PASS
	5785	17.361	15.16	500	PASS
	5825	17.352	15.17	500	PASS
802.11n HT40	5755	35.834	35.16	500	PASS
	5795	35.824	35.17	500	PASS
802.11ac	5745	17.377	15.15	500	PASS

VHT20	5785	17.360	15.17	500	PASS
	5825	17.369	15.14	500	PASS
802.11ac VHT40	5755	35.820	35.16	500	PASS
	5795	35.788	35.14	500	PASS
802.11ac VHT80	5775	74.964	75.22	500	PASS

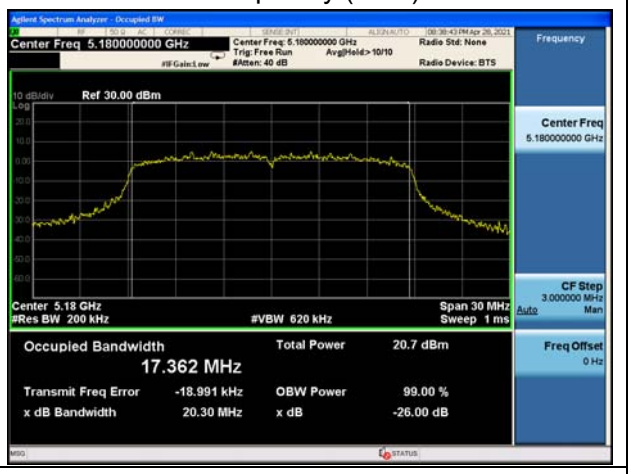
U-NII-1, 802.11a

Carrier frequency (MHz): 5180



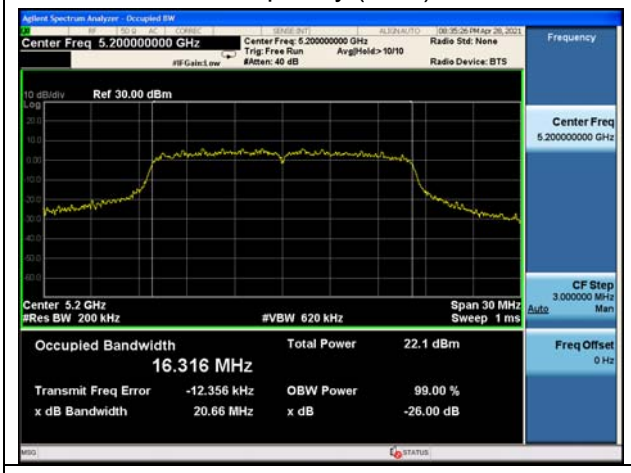
U-NII-1, 802.11n HT20

Carrier frequency (MHz): 5180



U-NII-1, 802.11a

Carrier frequency (MHz): 5200



U-NII-1, 802.11n HT20

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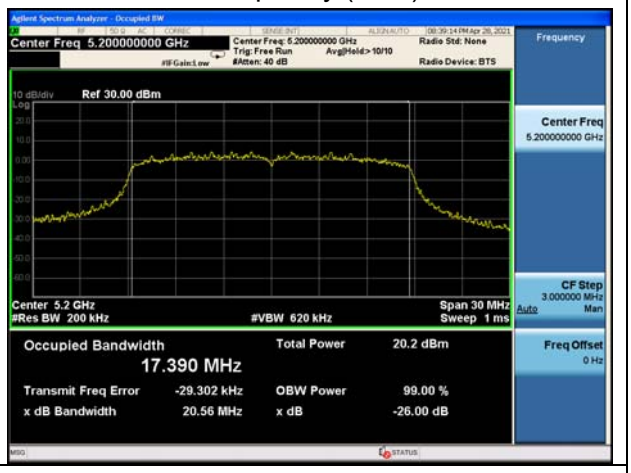
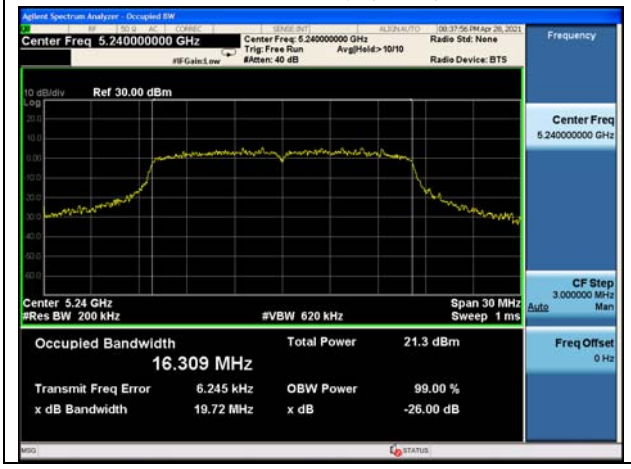


U-NII-1, 802.11a

Carrier frequency (MHz):5240

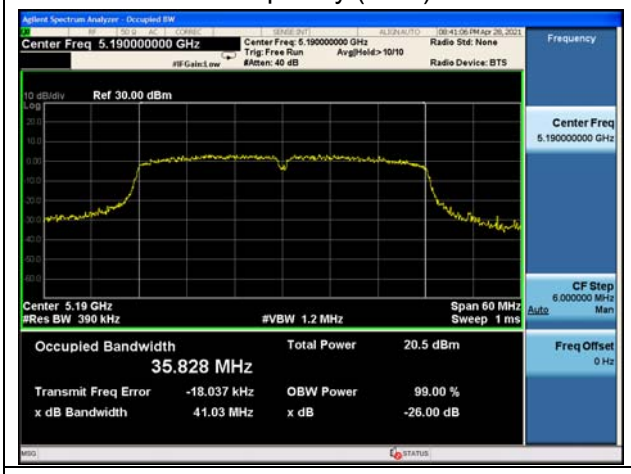


U-NII-1, 802.11n HT20

Carrier frequency (MHz):5240

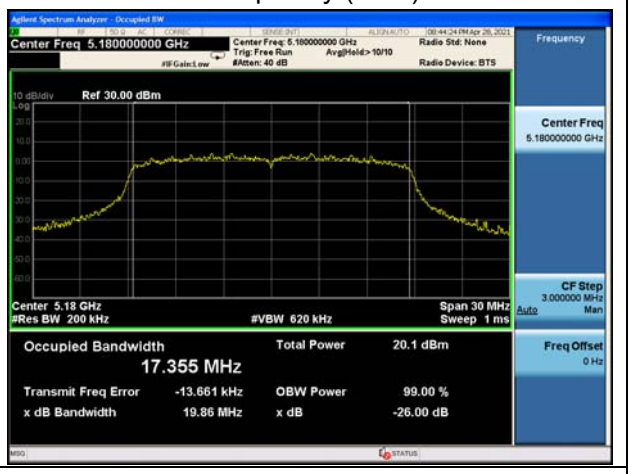
U-NII-1, 802.11n HT40

Carrier frequency (MHz): 5190



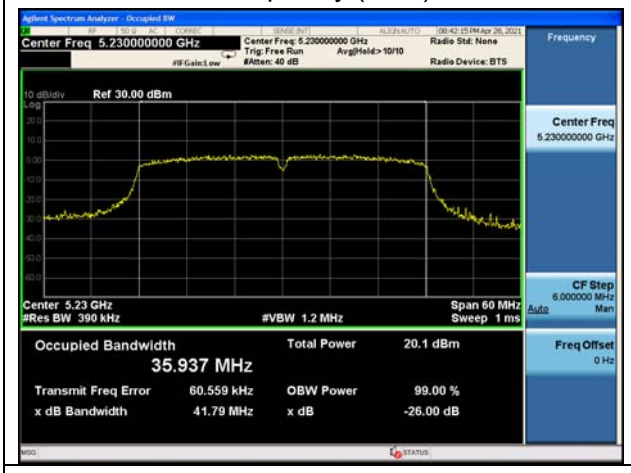
U-NII-1, 802.11ac VHT20

Carrier frequency (MHz): 5180



U-NII-1, 802.11n HT40

Carrier frequency (MHz): 5230



U-NII-1, 802.11ac VHT20

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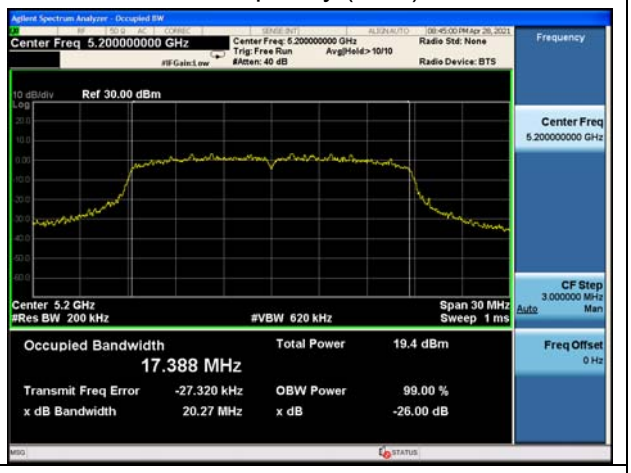

U-NII-1, 802.11ac VHT40

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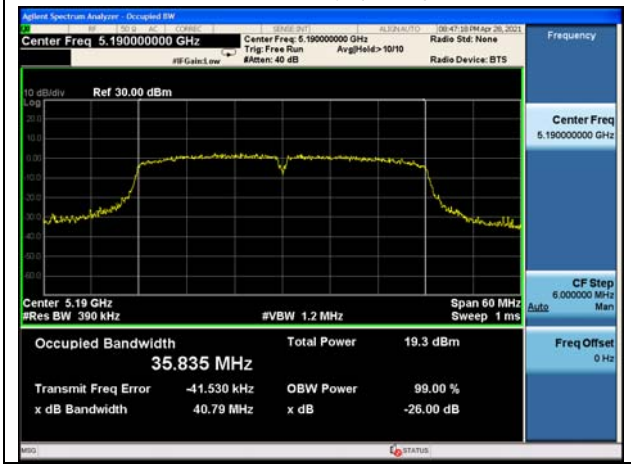
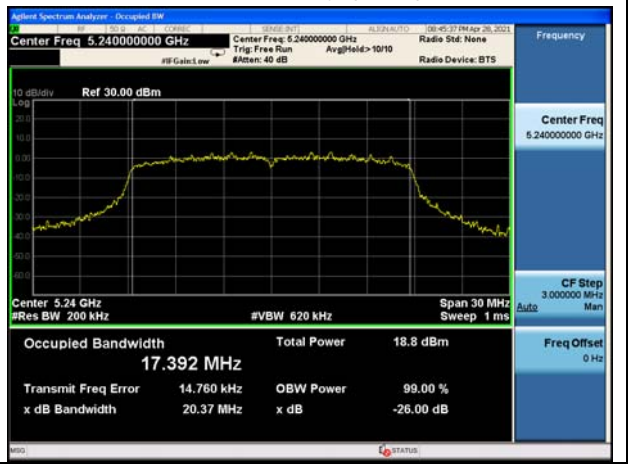


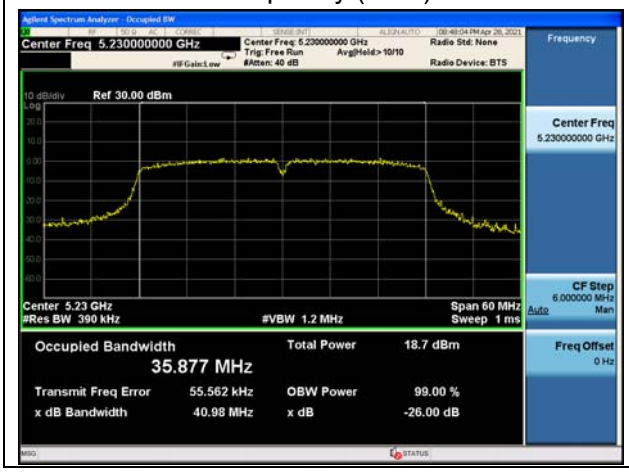
U-NII-1, 802.11ac VHT20

Carrier frequency (MHz):5240



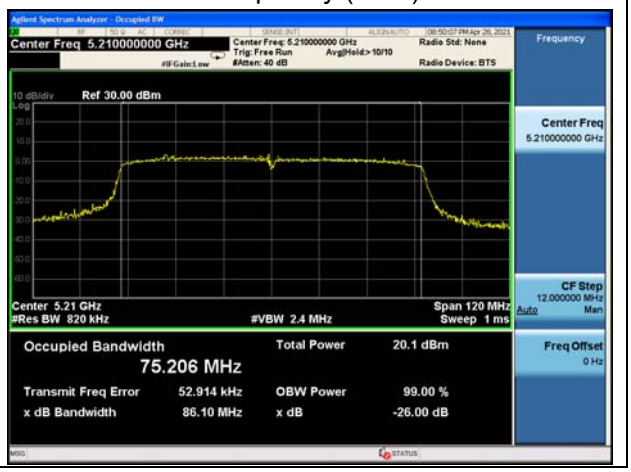
U-NII-1, 802.11ac VHT40

Carrier frequency (MHz): 5230



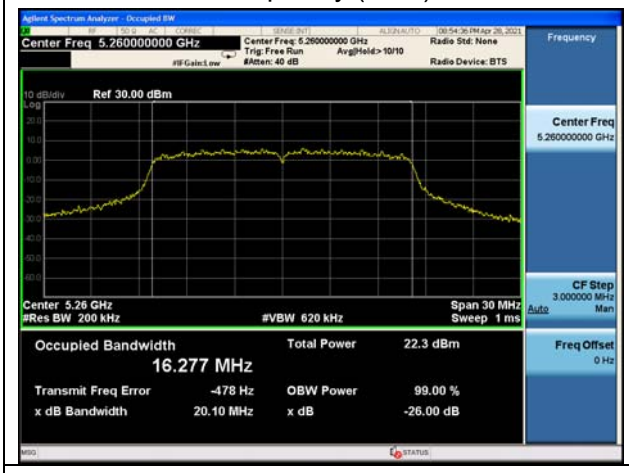
U-NII-1, 802.11ac VHT80

Carrier frequency (MHz): 5210



U-NII-2A, 802.11a

Carrier frequency (MHz): 5260

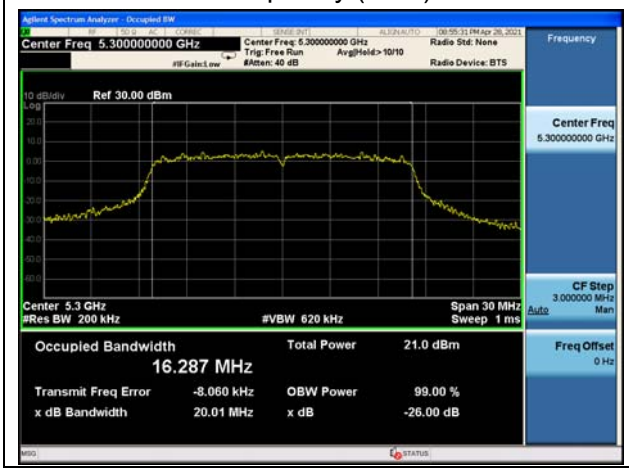


U-NII-2A, 802.11n HT20

Carrier frequency (MHz): 5260

U-NII-2A, 802.11a

Carrier frequency (MHz): 5300

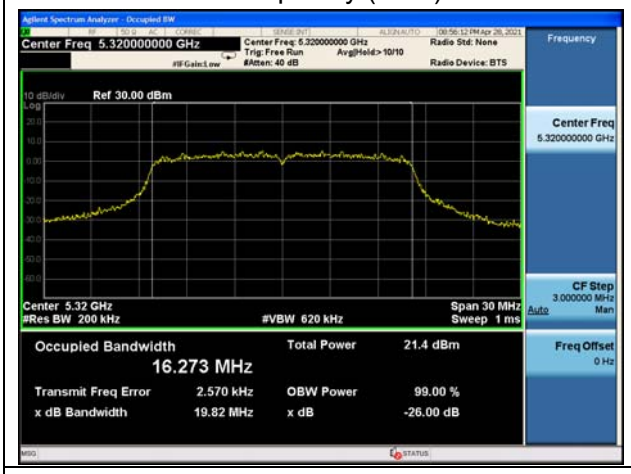


U-NII-2A, 802.11n HT20

Carrier frequency (MHz): 5300

U-NII-2A, 802.11a

Carrier frequency (MHz):5320

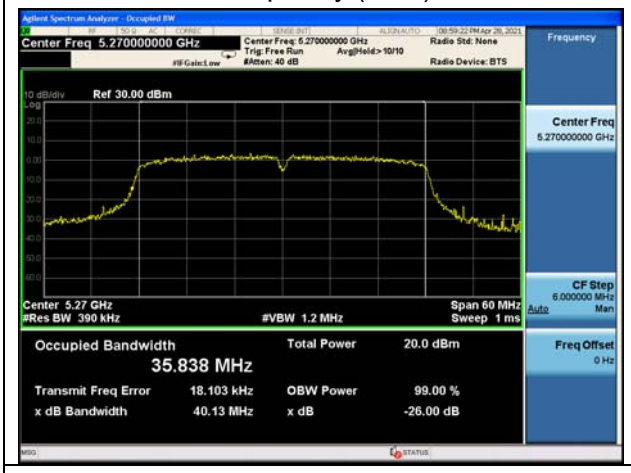


U-NII-2A, 802.11n HT20

Carrier frequency (MHz):5320

U-NII-2A, 802.11n HT40

Carrier frequency (MHz): 5270

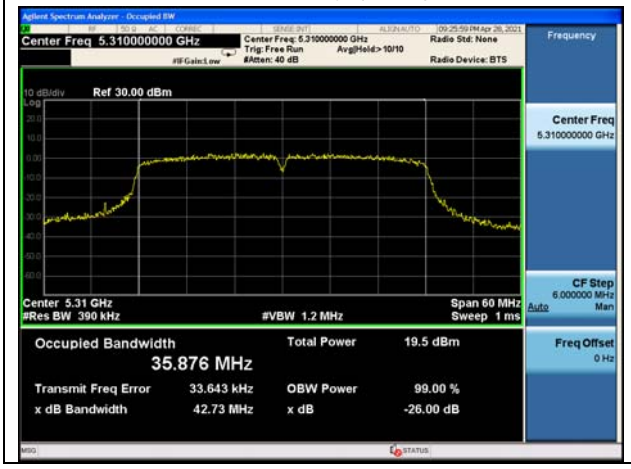


U-NII-2A, 802.11ac VHT20

Carrier frequency (MHz):5260

U-NII-2A, 802.11n HT40

Carrier frequency (MHz): 5310



U-NII-2A, 802.11ac VHT20

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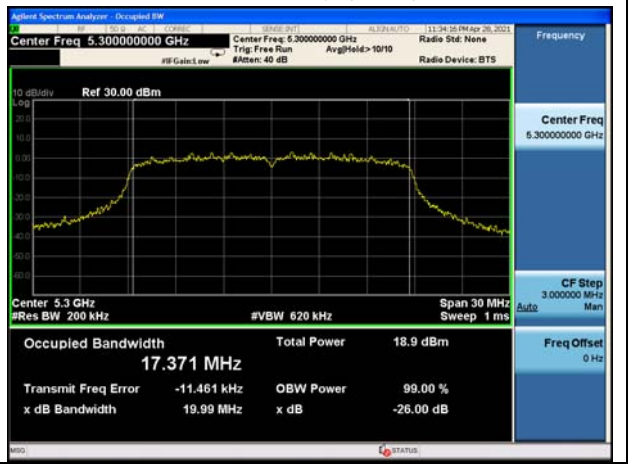

U-NII-2A, 802.11ac VHT40

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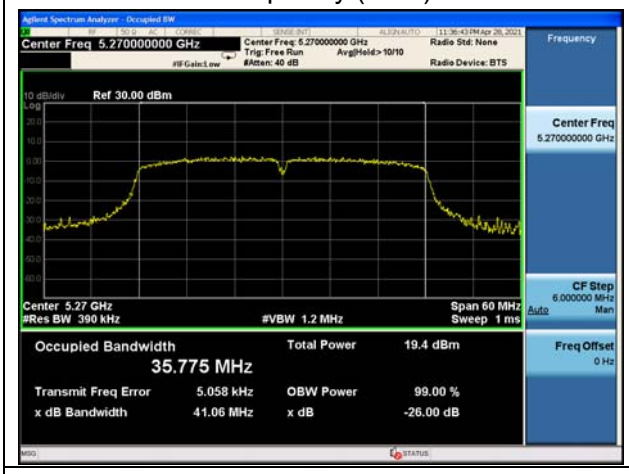

U-NII-2A, 802.11ac VHT20

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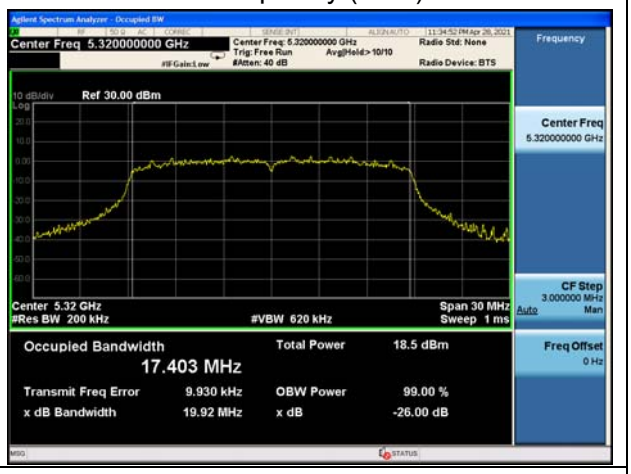
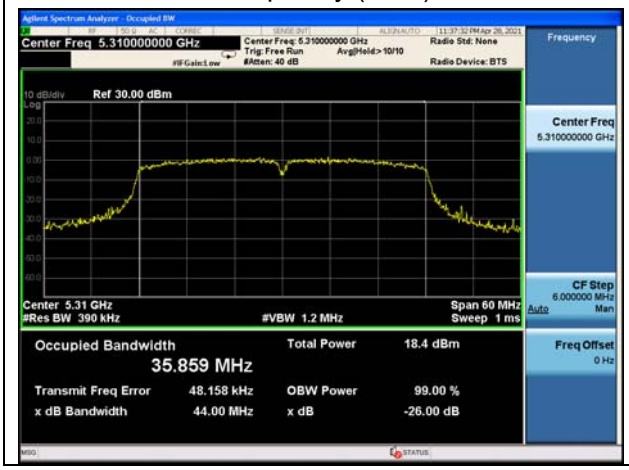


U-NII-2A, 802.11ac VHT40

Carrier frequency (MHz): 5310

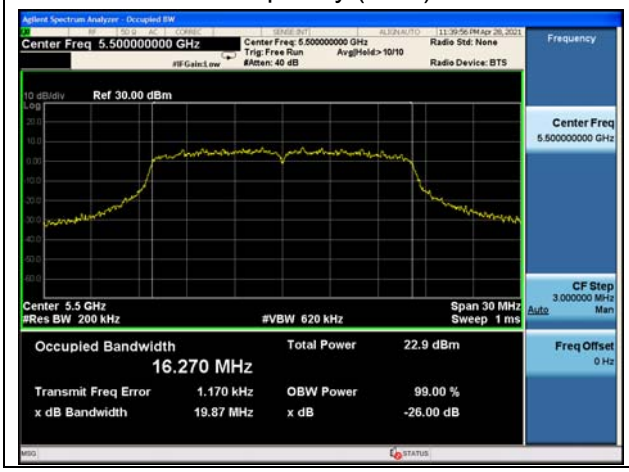


U-NII-2A, 802.11ac VHT80

Carrier frequency (MHz): 5290

U-NII-2C, 802.11a

Carrier frequency (MHz): 5500

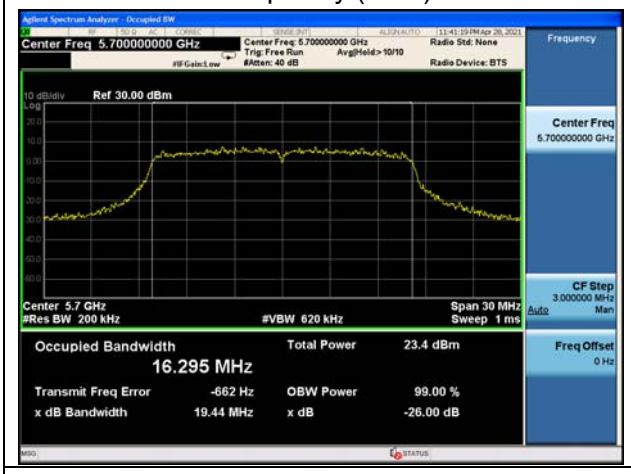


U-NII-2C, 802.11a

Carrier frequency (MHz): 5580

U-NII-2C, 802.11a

Carrier frequency (MHz): 5700



U-NII-2C, 802.11a

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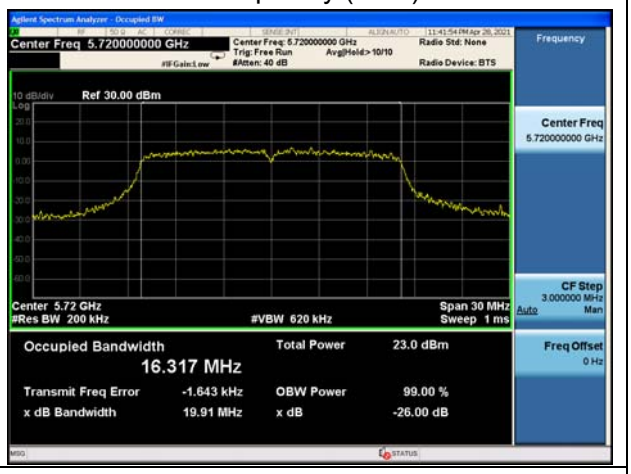
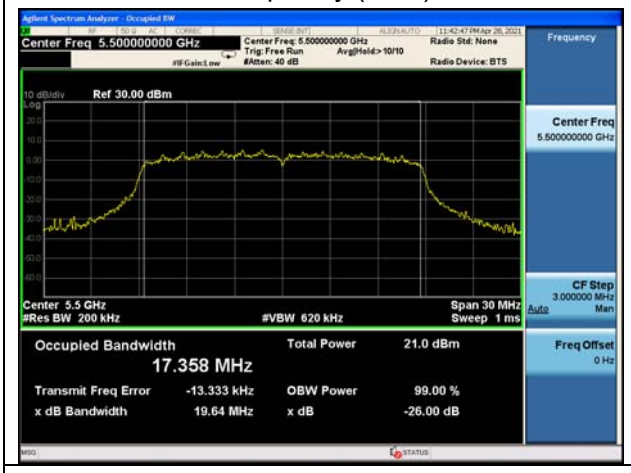


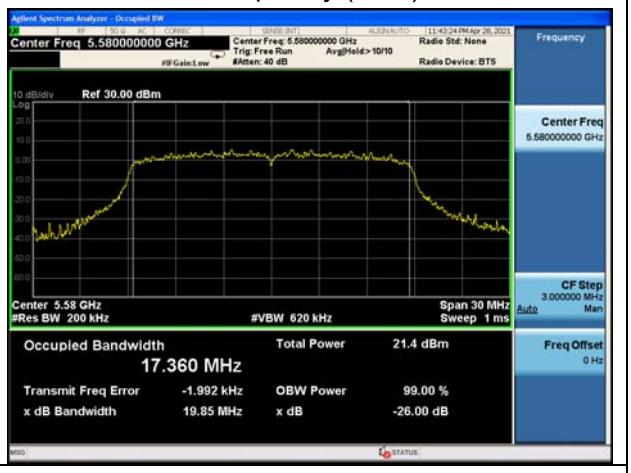
U-NII-2C, 802.11n HT20

Carrier frequency (MHz): 5500



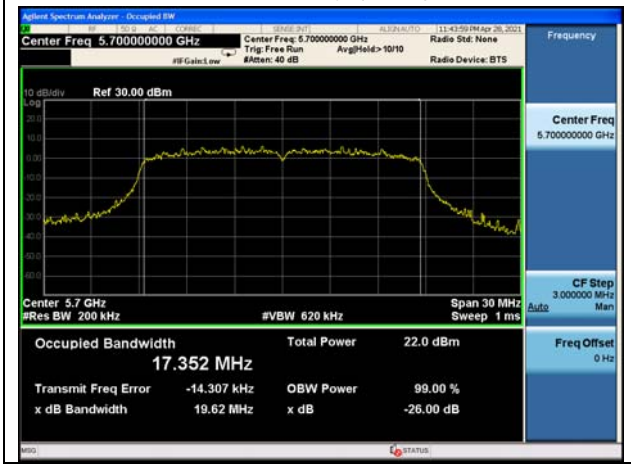
U-NII-2C, 802.11n HT20

Carrier frequency (MHz): 5580



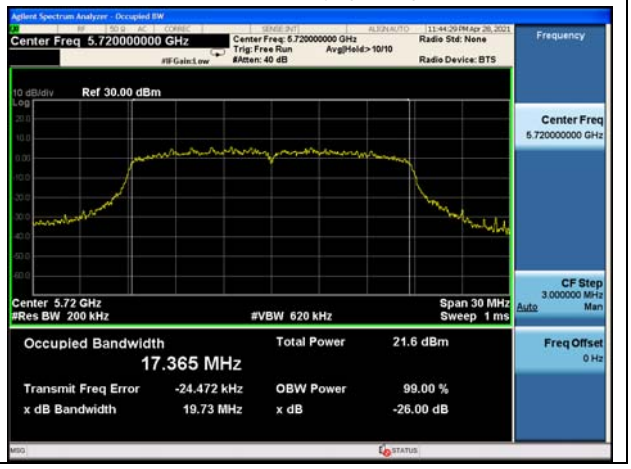
U-NII-2C, 802.11n HT20

Carrier frequency (MHz): 5700



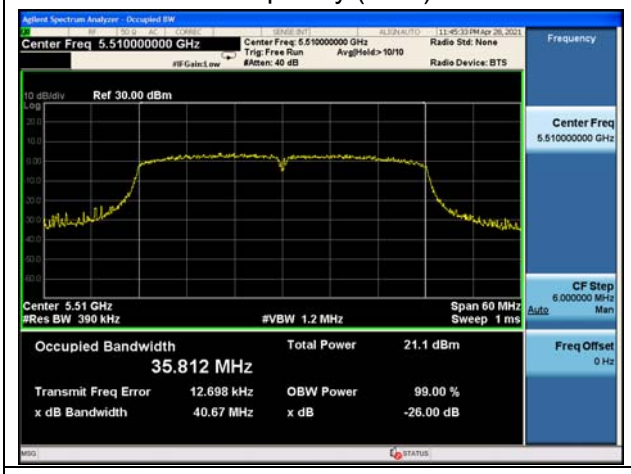
U-NII-2C, 802.11n HT20

Carrier frequency (MHz): 5720



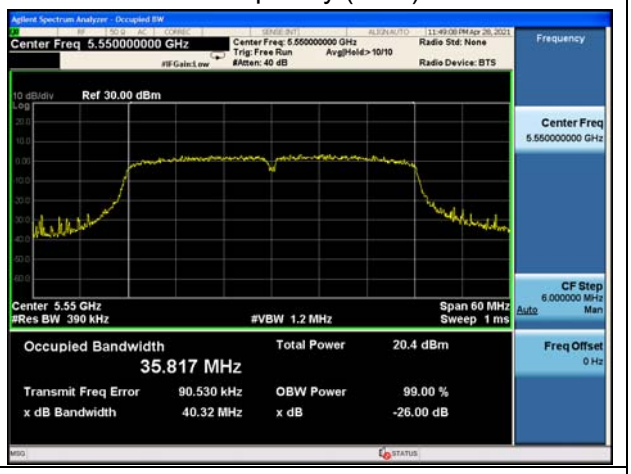
U-NII-2C, 802.11n HT40

Carrier frequency (MHz): 5510



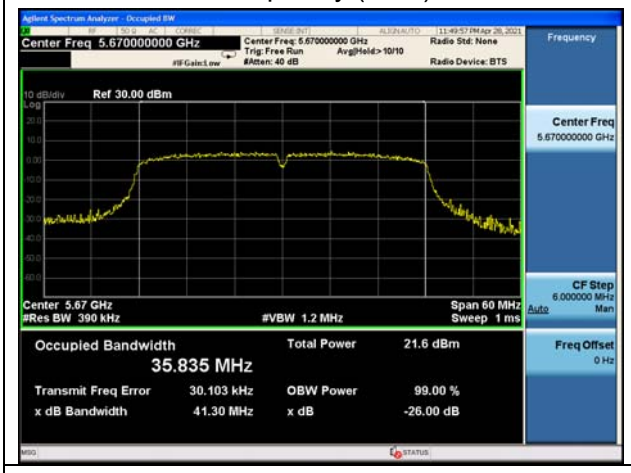
U-NII-2C, 802.11n HT40

Carrier frequency (MHz): 5550



U-NII-2C, 802.11n HT40

Carrier frequency (MHz): 5670

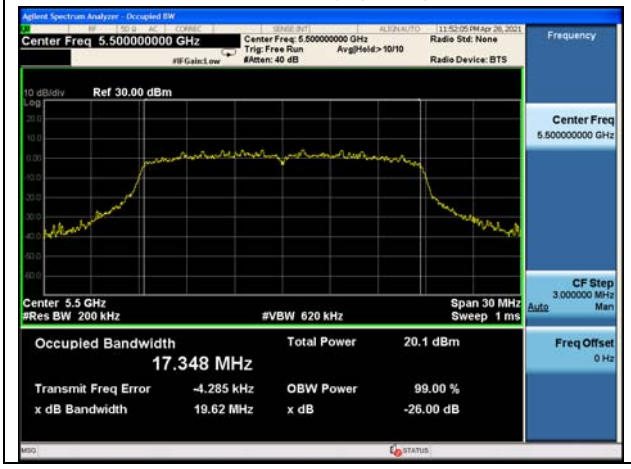


U-NII-2C, 802.11n HT40

Carrier frequency (MHz): 5710

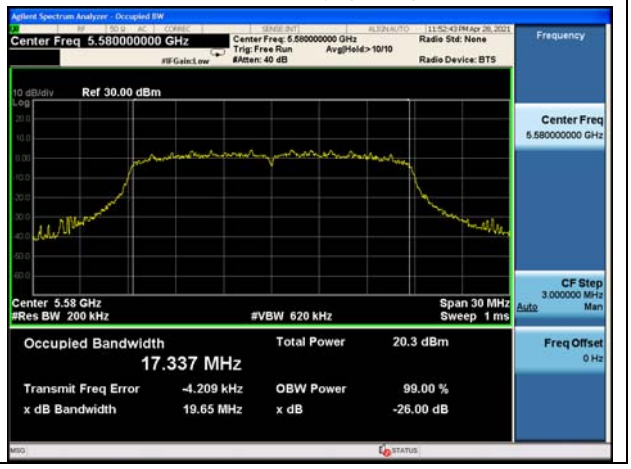
U-NII-2C, 802.11ac VHT20

Carrier frequency (MHz): 5500

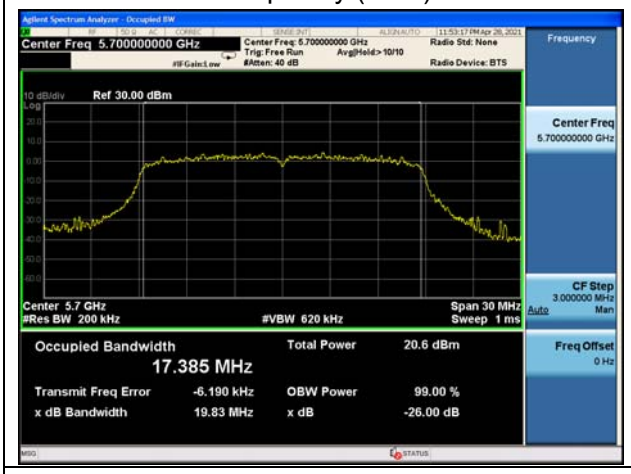


U-NII-2C, 802.11ac VHT20

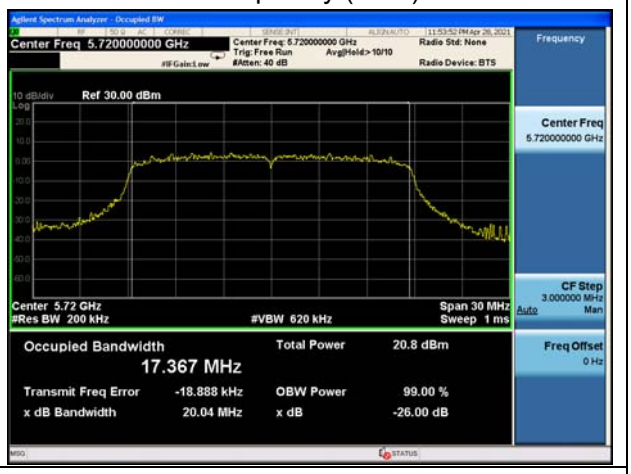
Carrier frequency (MHz): 5580



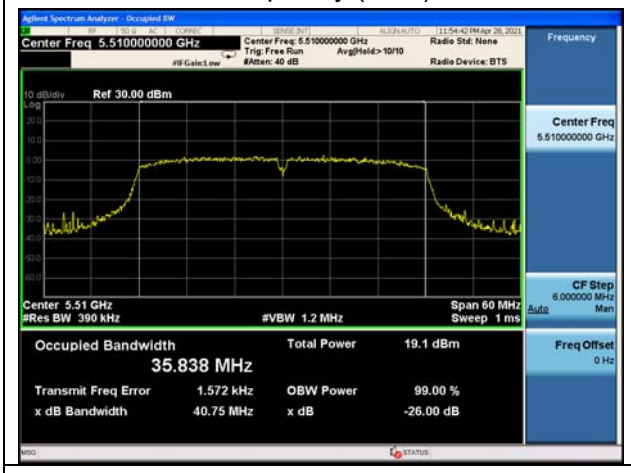
U-NII-2C, 802.11ac VHT20
Carrier frequency (MHz): 5700



U-NII-2C, 802.11ac VHT20
Carrier frequency (MHz): 5720

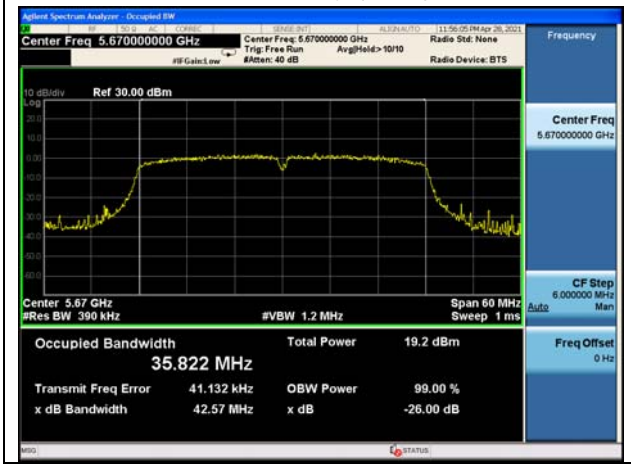


U-NII-2C, 802.11ac VHT40
Carrier frequency (MHz): 5510

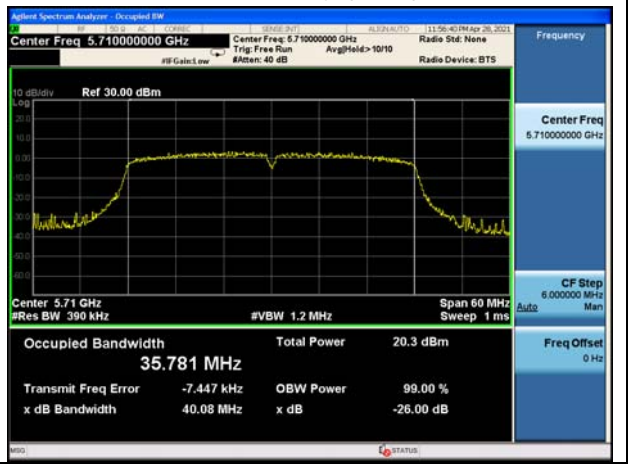


U-NII-2C, 802.11ac VHT40
Carrier frequency (MHz): 5550

U-NII-2C, 802.11ac VHT40
Carrier frequency (MHz): 5670

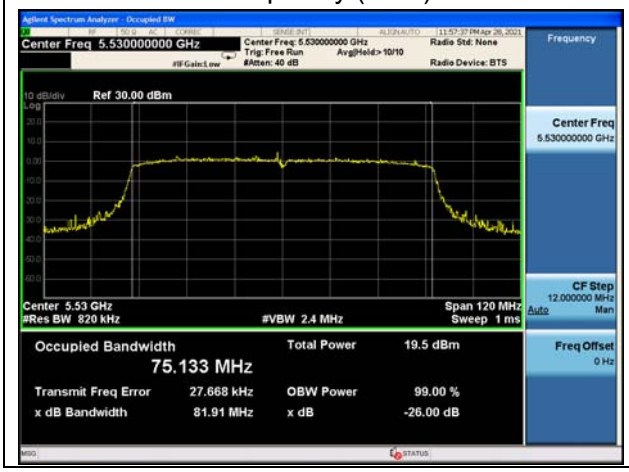


U-NII-2C, 802.11ac VHT40
Carrier frequency (MHz): 5710



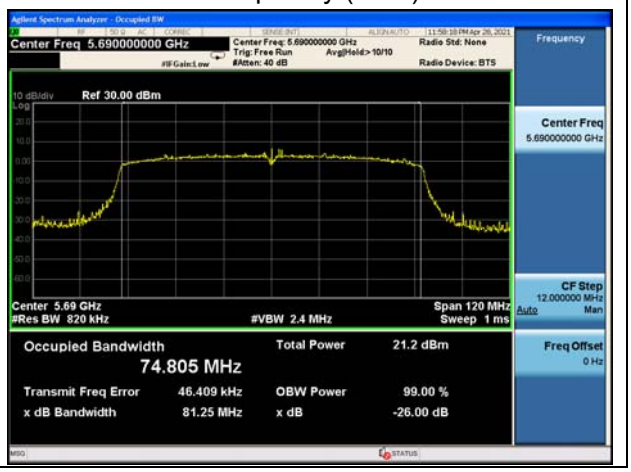
U-NII-2C, 802.11ac VHT80

Carrier frequency (MHz): 5530



U-NII-2C, 802.11ac VHT80

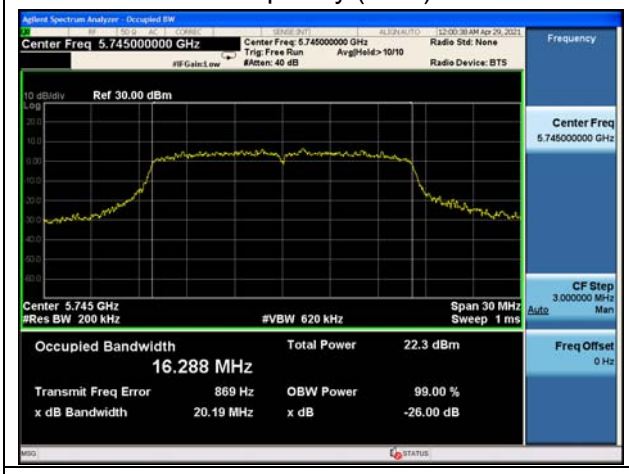
Carrier frequency (MHz): 5690



99% bandwidth

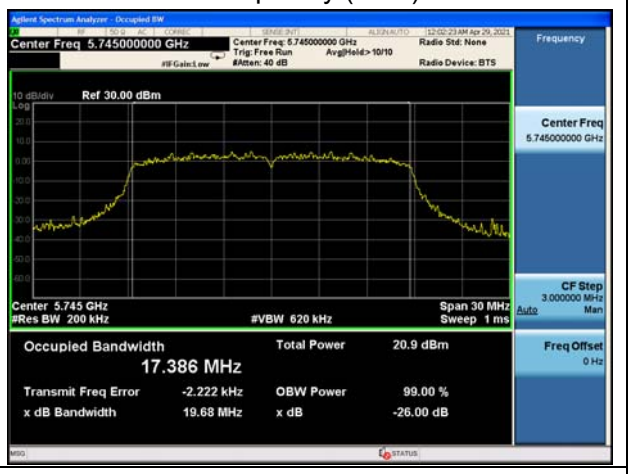
U-NII-3, 802.11a

Carrier frequency (MHz): 5745



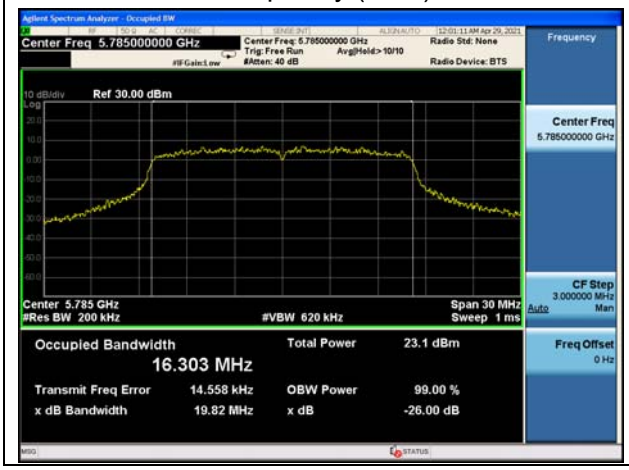
U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5745



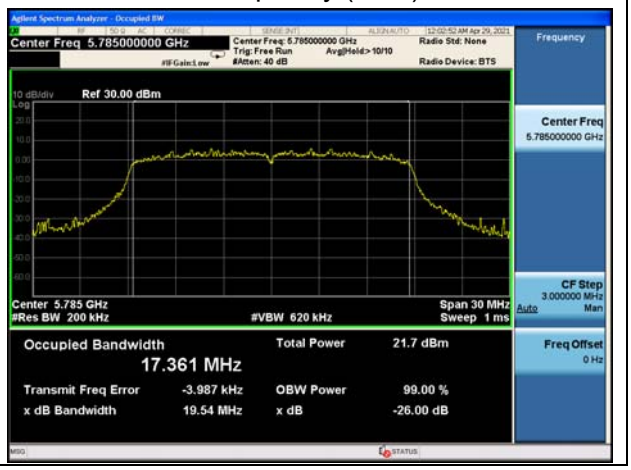
U-NII-3, 802.11a

Carrier frequency (MHz): 5785



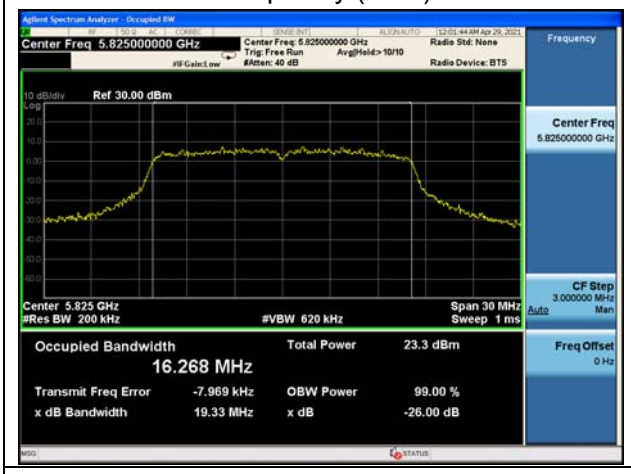
U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5785



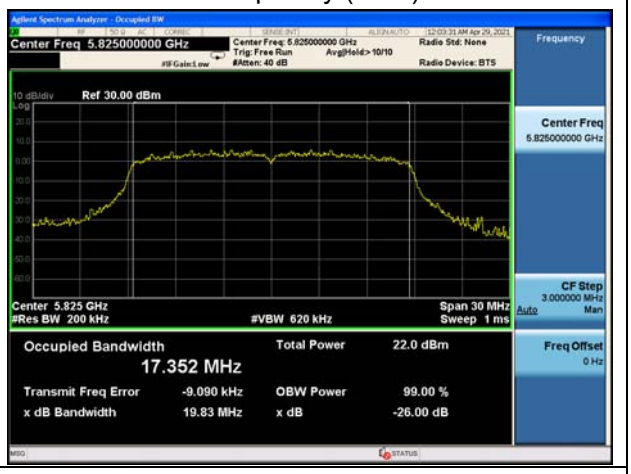
U-NII-3, 802.11a

Carrier frequency (MHz): 5825



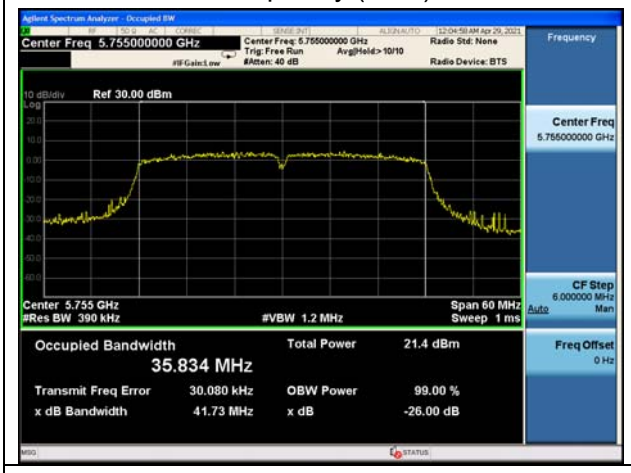
U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5825



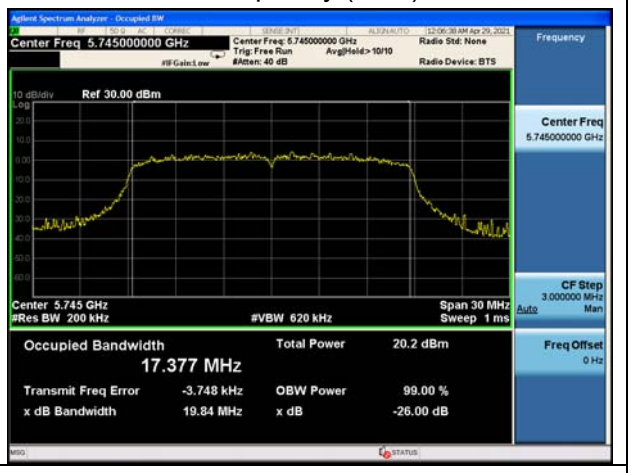
U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5755



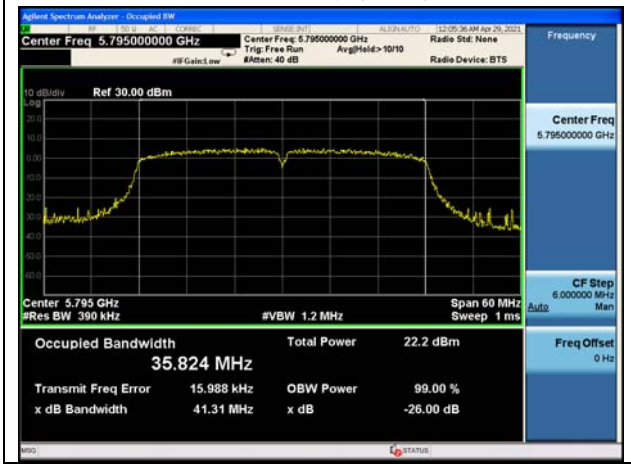
U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5745



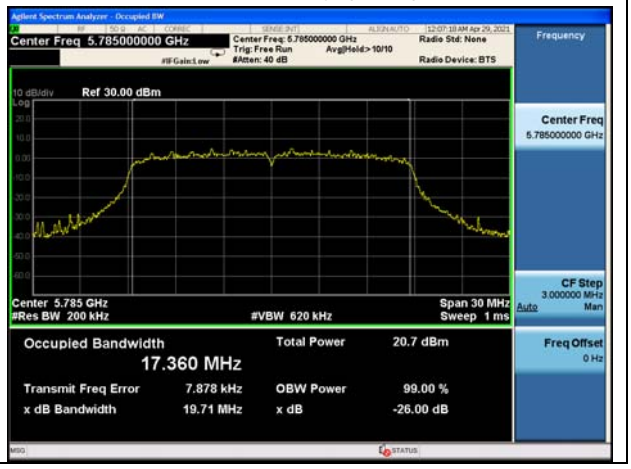
U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5795



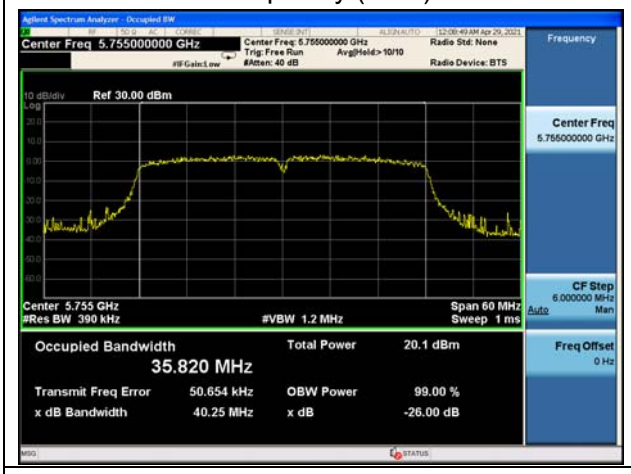
U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5785



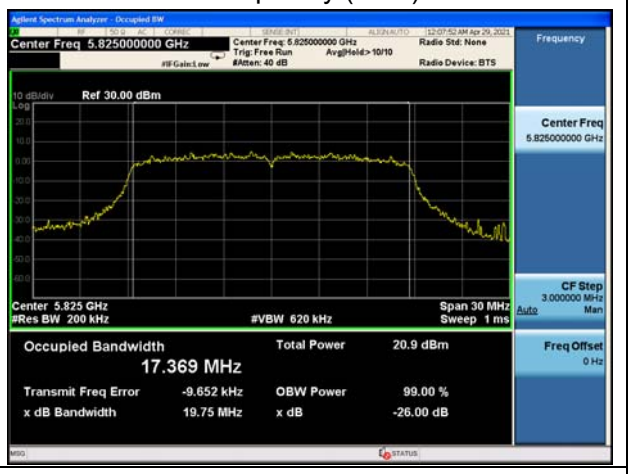
U-NII-3, 802.11ac VHT40

Carrier frequency (MHz): 5755



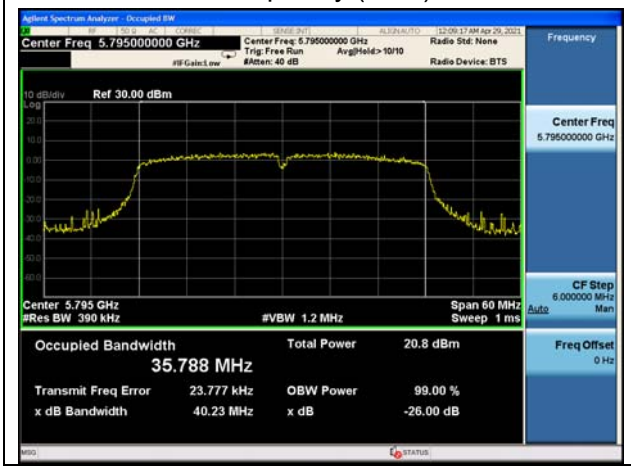
U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5825



U-NII-3, 802.11ac VHT40

Carrier frequency (MHz): 5795



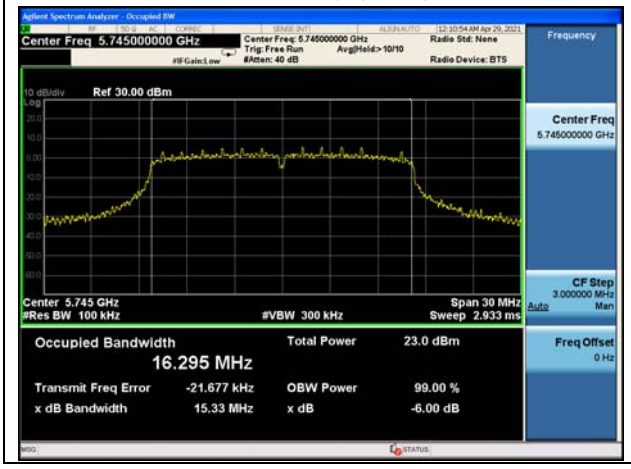
U-NII-3, 802.11ac VHT80

Carrier frequency (MHz): 5775

Minimum 6 dB bandwidth

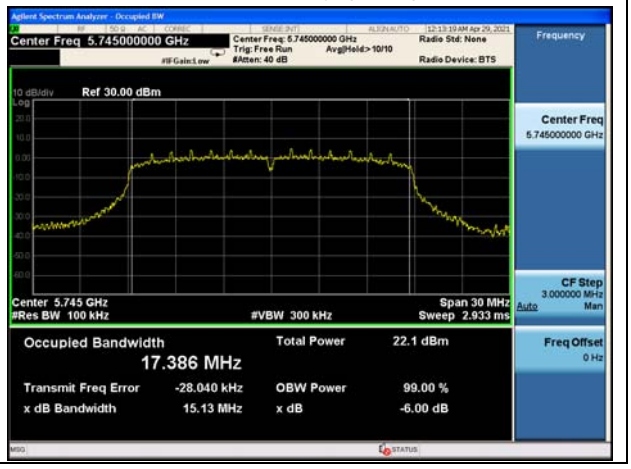
U-NII-3, 802.11a

Carrier frequency (MHz): 5745



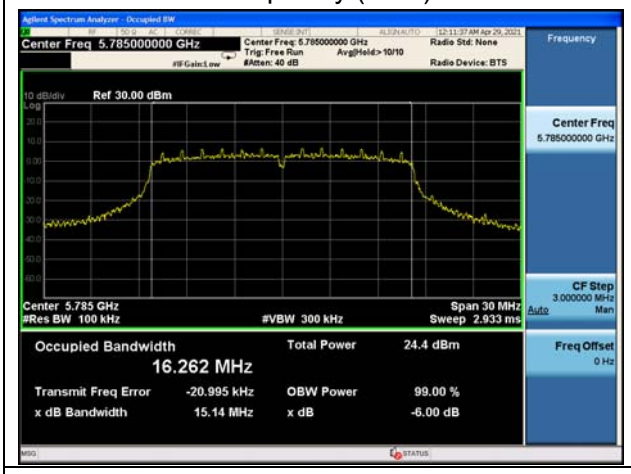
U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5745



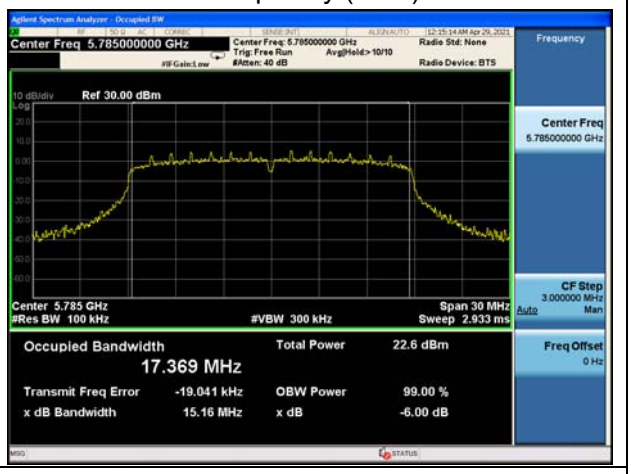
U-NII-3, 802.11a

Carrier frequency (MHz): 5785



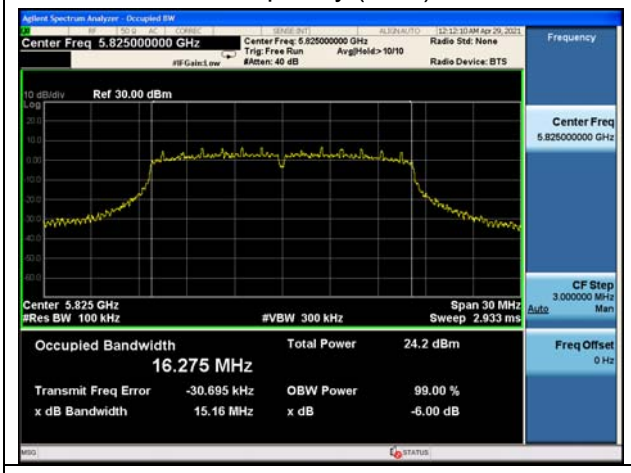
U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5785



U-NII-3, 802.11a

Carrier frequency (MHz): 5825

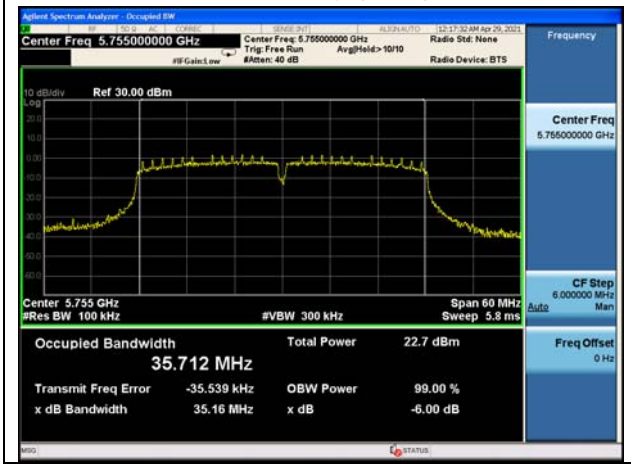


U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5825

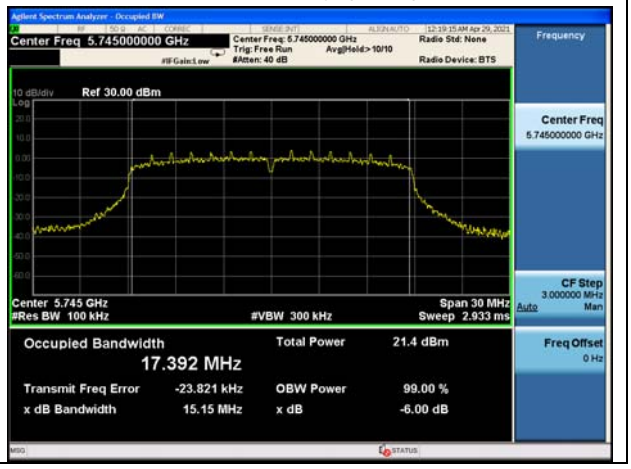
U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5755



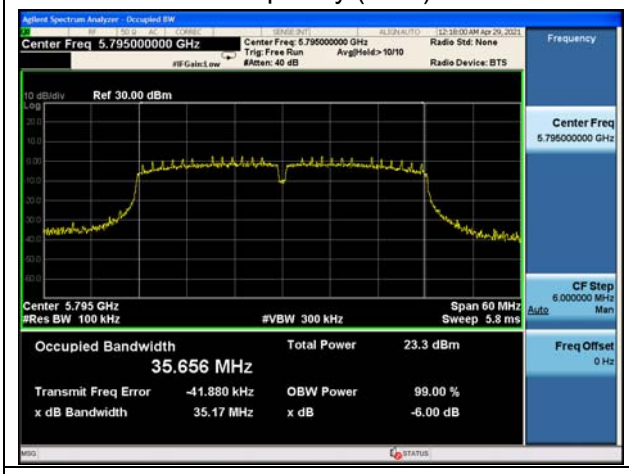
U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5745



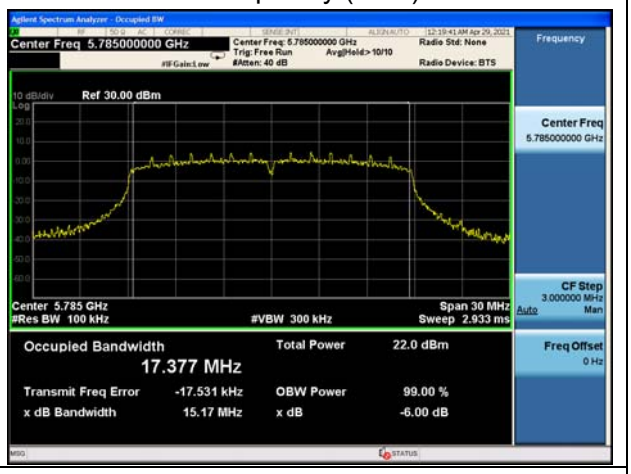
U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5795



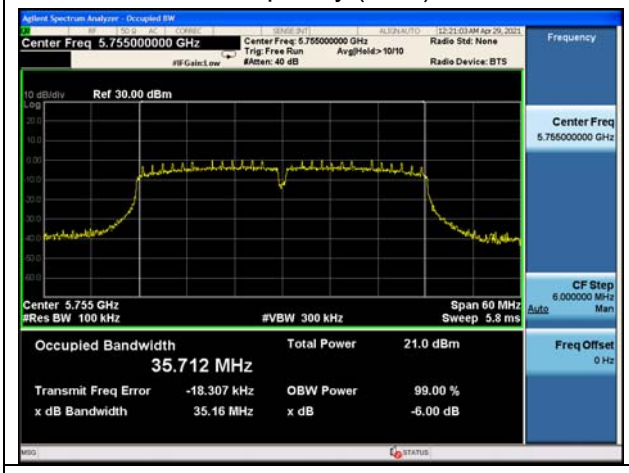
U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5785



U-NII-3, 802.11ac VHT40

Carrier frequency (MHz): 5755

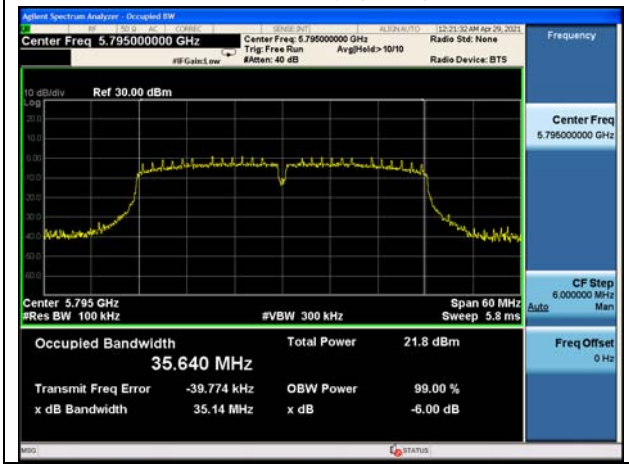


U-NII-3, 802.11ac VHT20

Carrier frequency (MHz): 5825

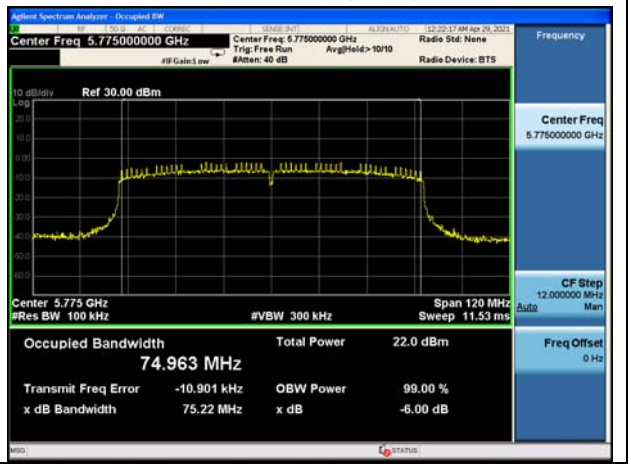
U-NII-3, 802.11ac VHT40

Carrier frequency (MHz): 5795



U-NII-3, 802.11ac VHT80

Carrier frequency (MHz): 5775



5.2. Average Power Output

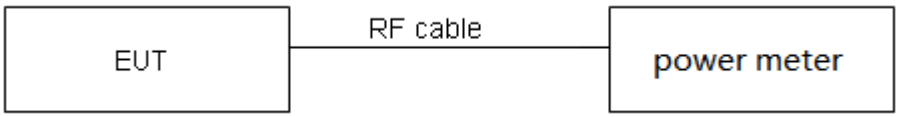
Ambient condition

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

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 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. 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.

(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

Mode	T_{on} (ms)	$T_{(on+off)}$ (ms)	Duty cycle	Duty cycle correction Factor(dB)
802.11a	2.03	2.14	0.95	0.23
802.11n HT20	1.88	2.05	0.92	0.37
802.11n HT40	0.93	1.08	0.86	0.65
802.11ac VHT20	1.91	2.02	0.95	0.24
802.11ac VHT40	0.94	1.10	0.85	0.72
802.11ac VHT80	0.46	0.59	0.78	1.10
Note: when Duty cycle≥0.98, Duty cycle correction Factor not required.				

Power Index								
Channel	802.11a	802.11n HT20	802.11ac VHT20	Channel	802.11n HT40	802.11ac VHT40	Channel	802.11ac VHT80
CH36	15	13.5	12.5	CH38	13.5	12	CH42	12
CH40	15	13.5	12.5	CH46	13.5	12	/	/
CH48	15	13.5	12.5	/	/	/	/	/
CH52	15	13.5	12.5	CH54	13.5	12	CH58	12
CH60	15	13.5	12.5	CH62	13.5	12	/	/
CH64	15	13.5	12.5	/	/	/	/	/
CH100	15	13.5	12.5	CH102	13.5	12	CH106	12
CH116	15	13.5	12.5	CH110	13.5	12	CH138	12
CH140	15	13.5	12.5	CH134	13.5	12	/	/
CH144	15	13.5	12.5	CH142	13.5	12	/	/
CH149	15	13.5	12.5	CH151	13.5	12	CH155	12
CH157	15	13.5	12.5	CH159	13.5	12	/	/
CH165	15	13.5	12.5	/	/	/	/	/

Network Standards		Channel/Frequency (MHz)	B=26 dB bandwidth (MHz)	Limit 11 dBm + 10 log B (dBm)	Final Limit(dBm)
U-NII-2A	802.11a	52/5260	20.10	24.03＞24	24.00
		60/5300	20.01	24.01＞24	24.00
		64/5320	19.82	23.97＜24	23.97
	802.11n HT20	52/5260	19.92	23.99＜24	23.99
		60/5300	20.36	24.09＞24	24.00
		64/5320	19.77	23.96＜24	23.96
	802.11n HT40	54/5270	40.13	27.03＞24	24.00
		62/5310	42.73	27.31＞24	24.00
	802.11ac VHT20	52/5260	19.93	24.00	24.00
		60/5300	19.99	24.01＞24	24.00
		64/5320	19.92	23.99＜24	23.99
	802.11ac VHT40	54/5270	41.06	27.13＞24	24.00
		62/5310	44.00	27.43＞24	24.00
	802.11ac VHT80	58/5290	83.33	30.21＞24	24.00
U-NII-2C	802.11a	100/5500	19.87	23.98＜24	23.98
		116/5580	19.39	23.88＜24	23.88
		140/5700	19.44	23.89＜24	23.89
		144/5720	19.91	23.99＜24	23.99
	802.11n HT20	100/5500	19.64	23.93＜24	23.93
		116/5580	19.85	23.98＜24	23.98
		140/5700	19.62	23.93＜24	23.93
		144/5720	19.73	23.95＜24	23.95
	802.11n HT40	102/5510	40.67	27.09＞24	24.00
		110/5550	40.32	27.06＞24	24.00
		134/5670	41.30	27.16＞24	24.00
		142/5710	40.69	27.09＞24	24.00
	802.11ac VHT20	100/5500	19.62	23.93＜24	23.93
		116/5580	19.65	23.93＜24	23.93
		140/5700	19.83	23.97＜24	23.97
		144/5720	20.04	24.02＞24	24.00
	802.11ac VHT40	102/5510	40.75	27.10＞24	24.00
		110/5550	41.41	27.17＞24	24.00
		134/5670	42.57	27.29＞24	24.00
		142/5710	40.08	27.03＞24	24.00
	802.11ac VHT80	106/5530	81.91	30.13＞24	24.00
		138/5690	81.25	30.10＞24	24.00
Note: 250mW=24dBm					

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

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	16.17	16.40	24	PASS
	40/5200	15.25	15.48	24	PASS
	48/5240	15.31	15.54	24	PASS
802.11n HT20	36/5180	14.24	14.61	24	PASS
	40/5200	13.58	13.95	24	PASS
	48/5240	13.75	14.12	24	PASS
802.11n HT40	38/5190	13.72	14.37	24	PASS
	46/5230	13.38	14.03	24	PASS
802.11ac VHT20	36/5180	13.62	13.86	24	PASS
	40/5200	12.63	12.87	24	PASS
	48/5240	12.71	12.95	24	PASS
802.11ac VHT40	38/5190	12.44	13.16	24	PASS
	46/5230	12.06	12.78	24	PASS
802.11ac VHT80	42/5210	12.08	13.18	24	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

U-NII-2A

Network Standards	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	52/5260	15.42	15.65	24.00	PASS
	60/5300	14.73	14.96	24.00	PASS
	64/5320	14.64	14.87	23.97	PASS
802.11n HT20	52/5260	13.76	14.13	23.99	PASS
	60/5300	13.09	13.46	24.00	PASS
	64/5320	13.02	13.39	23.96	PASS
802.11n HT40	54/5270	13.42	14.07	24.00	PASS
	62/5310	12.87	13.52	24.00	PASS
802.11ac VHT20	52/5260	12.96	13.20	24.00	PASS
	60/5300	12.02	12.26	24.00	PASS
	64/5320	12.03	12.27	23.99	PASS
802.11ac VHT40	54/5270	11.71	12.43	24.00	PASS
	62/5310	11.38	12.10	24.00	PASS
802.11ac VHT80	58/5290	11.95	13.05	24.00	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

U-NII-2C

Network Standards	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	100/5500	16.20	16.43	23.98	PASS
	116/5580	16.53	16.76	23.88	PASS
	140/5700	16.63	16.86	23.89	PASS
	144/5720	16.42	16.65	23.99	PASS
802.11n HT20	100/5500	14.52	14.89	23.93	PASS
	116/5580	14.76	15.13	23.98	PASS
	140/5700	14.95	15.32	23.93	PASS
	144/5720	14.73	15.10	23.95	PASS
802.11n HT40	102/5510	14.24	14.89	24.00	PASS
	110/5550	13.97	14.62	24.00	PASS
	134/5670	14.17	14.82	24.00	PASS
	142/5710	14.74	15.39	24.00	PASS
802.11ac	100/5500	13.64	13.88	23.93	PASS

VHT20	116/5580	13.92	14.16	23.93	PASS
	140/5700	14.07	14.31	23.97	PASS
	144/5720	13.95	14.19	24.00	PASS
802.11ac VHT40	102/5510	12.88	13.60	24.00	PASS
	110/5550	12.37	13.09	24.00	PASS
	134/5670	13.16	13.88	24.00	PASS
	142/5710	12.56	13.28	24.00	PASS
802.11ac VHT80	106/5530	12.18	13.28	24.00	PASS
	138/5690	12.72	13.82	24.00	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	16.23	16.46	30	PASS
	157/5785	16.53	16.76	30	PASS
	165/5825	16.58	16.81	30	PASS
802.11n HT20	149/5745	14.45	14.82	30	PASS
	157/5785	14.92	15.29	30	PASS
	165/5825	14.96	15.33	30	PASS
802.11n HT40	151/5755	14.53	15.18	30	PASS
	159/5795	14.69	15.34	30	PASS
802.11ac VHT20	149/5745	13.64	13.88	30	PASS
	157/5785	14.06	14.30	30	PASS
	165/5825	14.03	14.27	30	PASS
802.11ac VHT40	151/5755	13.14	13.86	30	PASS
	159/5795	13.15	13.87	30	PASS
802.11ac VHT80	155/5775	12.79	13.89	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

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
3.3	-20	5200.006576	5199.998061	5199.996112	5199.995413
3.3	-10	5199.997195	5199.991136	5199.993678	5199.987575
3.3	0	5199.993685	5199.982671	5199.987203	5199.985037
3.3	10	5199.988610	5199.980717	5199.983095	5199.977033
3.3	20	5199.987512	5199.974944	5199.976155	5199.968025
3.3	30	5199.979896	5199.969282	5199.966164	5199.962725
3.3	40	5199.976713	5199.964608	5199.963619	5199.960385
3.3	50	5199.976601	5199.962508	5199.957681	5199.956292
3.14	20	5199.971616	5199.960453	5199.949627	5199.955576
3.46	20	5199.965953	5199.954215	5199.946097	5199.954274
MHz		-0.034047	-0.045785	-0.053903	-0.045726
PPM		-6.547538	-8.804865	-10.365875	-8.793400

Voltage (V)	Temperature (°C)	U-NII-2A Test Results			
		5300MHz			
		1min	2min	5min	10min
3.3	-20	5300.002528	5299.997932	5299.988423	5299.981900
3.3	-10	5299.993565	5299.992525	5299.985591	5299.975558
3.3	0	5299.986282	5299.984374	5299.975793	5299.969388
3.3	10	5299.976796	5299.979671	5299.971759	5299.968163
3.3	20	5299.969565	5299.978312	5299.966940	5299.959028
3.3	30	5299.965114	5299.970654	5299.960605	5299.953590
3.3	40	5299.964446	5299.962674	5299.958080	5299.951043
3.3	50	5299.958752	5299.954733	5299.956546	5299.944775
3.14	20	5299.957924	5299.947086	5299.955103	5299.937567
3.46	20	5299.948973	5299.937821	5299.951624	5299.933984
MHz		-0.051027	-0.062179	-0.048376	-0.066016
PPM		-9.627673	-11.731881	-9.127631	-12.455779

Voltage (V)	Temperature (°C)	U-NII-2C Test Results			
		5580MHz			
		1min	2min	5min	10min
3.3	-20	5580.003954	5579.995396	5579.990882	5579.990160
3.3	-10	5579.998522	5579.991239	5579.986589	5579.983592
3.3	0	5579.996010	5579.988932	5579.986335	5579.977573
3.3	10	5579.990810	5579.986752	5579.978886	5579.973082
3.3	20	5579.988833	5579.977821	5579.970705	5579.966204
3.3	30	5579.986498	5579.974276	5579.967374	5579.960050
3.3	40	5579.984594	5579.970122	5579.959833	5579.955633
3.3	50	5579.978892	5579.962591	5579.955978	5579.953688
3.14	20	5579.975948	5579.956022	5579.948773	5579.953262
3.46	20	5579.973882	5579.946654	5579.948113	5579.945335
MHz		-0.026118	-0.053346	-0.051887	-0.054665
PPM		-4.680623	-9.560298	-9.298712	-9.796659

Voltage (V)	Temperature (°C)	U-NII-3 Test Results			
		5785MHz			
		1min	2min	5min	10min
3.3	-20	5785.003427	5785.000939	5784.998895	5784.994947
3.3	-10	5784.998455	5784.991307	5784.996493	5784.991340
3.3	0	5784.991028	5784.983854	5784.993433	5784.989475
3.3	10	5784.986170	5784.976412	5784.989633	5784.984000
3.3	20	5784.977372	5784.972146	5784.984924	5784.976990
3.3	30	5784.971998	5784.968114	5784.977267	5784.975418
3.3	40	5784.966488	5784.961422	5784.972979	5784.968525
3.3	50	5784.957635	5784.954963	5784.967339	5784.968422
3.14	20	5784.947946	5784.948641	5784.966282	5784.967053
3.46	20	5784.939827	5784.943823	5784.961929	5784.960285
MHz		-0.060173	-0.056177	-0.038071	-0.039715
PPM		-10.401528	-9.710853	-6.580971	-6.865133

5.4. Power Spectral Density

Ambient condition

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

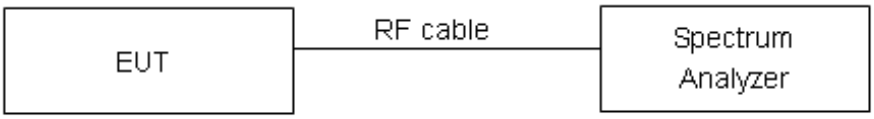
Method of Measurement

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, 5.250-5.350GHz, 5.470-5.725GHz.
Set RBW = 470kHz, 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)(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 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 5.25-5.35 GHz and 5.47-5.725 GHz bands, 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 500kHz 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
5.25-5.35 GHz and 5.47-5.725 GHz	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:

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

U-NII-1

Mode	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	36	4.242	4.47	11	PASS
	40	3.523	3.75	11	PASS
	48	3.511	3.74	11	PASS
802.11n HT20	36	2.452	2.82	11	PASS
	40	2.241	2.61	11	PASS
	48	2.135	2.51	11	PASS
802.11n HT40	38	-0.843	-0.19	11	PASS
	46	-1.639	-0.99	11	PASS
802.11ac VHT20	36	1.123	1.36	11	PASS
	40	1.264	1.50	11	PASS
	48	1.039	1.28	11	PASS
802.11ac VHT40	38	-2.120	-1.40	11	PASS
	46	-3.237	-2.52	11	PASS
802.11ac VHT80	42	-5.409	-4.30	11	PASS

U-NII-2A

Mode	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	52	3.848	4.07	11	PASS
	60	3.585	3.81	11	PASS
	64	3.181	3.41	11	PASS
802.11n HT20	52	1.923	2.29	11	PASS
	60	1.124	1.49	11	PASS
	64	1.440	1.81	11	PASS
802.11n HT40	54	-1.729	-1.08	11	PASS
	62	-2.288	-1.64	11	PASS
802.11ac VHT20	52	1.685	1.92	11	PASS
	60	0.338	0.58	11	PASS
	64	-0.11	0.13	11	PASS
802.11ac VHT40	54	-2.239	-1.52	11	PASS
	62	-3.188	-2.47	11	PASS
802.11ac VHT80	58	-5.353	-4.25	11	PASS

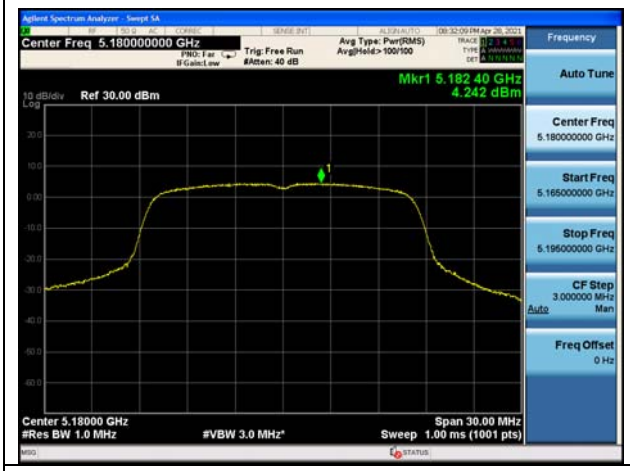
U-NII-2C

Mode	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	100	5.036	5.26	11	PASS
	116	5.381	5.61	11	PASS
	140	5.552	5.78	11	PASS
	144	5.115	5.34	11	PASS
802.11n HT20	100	2.844	3.21	11	PASS
	116	3.250	3.62	11	PASS
	140	3.997	4.37	11	PASS
	144	3.255	3.63	11	PASS
802.11n HT40	102	-0.483	0.17	11	PASS
	110	-1.228	-0.58	11	PASS
	134	-0.587	0.06	11	PASS
	142	0.245	0.89	11	PASS
802.11ac VHT20	100	1.869	2.11	11	PASS
	116	2.146	2.39	11	PASS
	140	2.571	2.81	11	PASS
	144	2.565	2.80	11	PASS
802.11ac VHT40	102	-2.293	-1.58	11	PASS
	110	-3.016	-2.30	11	PASS
	134	-1.799	-1.08	11	PASS
	142	-1.245	-0.53	11	PASS
802.11ac VHT80	106	-5.936	-4.83	11	PASS
	138	-5.173	-4.07	11	PASS

U-NII-3

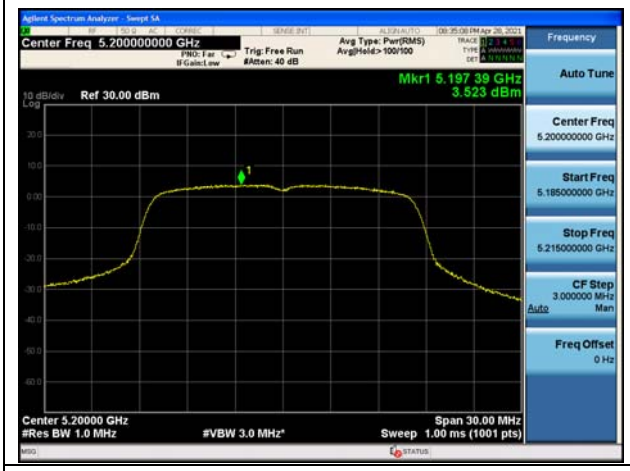
Mode	Channel Number	Read Value (dBm/470kHz)	Power Spectral Density (dBm/500kHz)	Limit (dBm/500kHz)	Conclusion
802.11a	149	1.309	1.80	30	PASS
	157	2.086	2.58	30	PASS
	165	2.077	2.57	30	PASS
802.11n HT20	149	-0.43	0.21	30	PASS
	157	0.236	0.88	30	PASS
	165	0.431	1.07	30	PASS
802.11n HT40	151	-3.535	-2.62	30	PASS
	159	-2.501	-1.58	30	PASS
802.11ac VHT20	149	-1.072	-0.56	30	PASS
	157	-0.624	-0.11	30	PASS
	165	-0.508	0.00	30	PASS
802.11ac VHT40	151	-4.777	-3.79	30	PASS
	159	-3.857	-2.87	30	PASS
802.11ac VHT80	155	-7.443	-6.07	30	PASS
Note:PSD=Read Value+Duty cycle+10*LOG(500/470) correction factor					

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

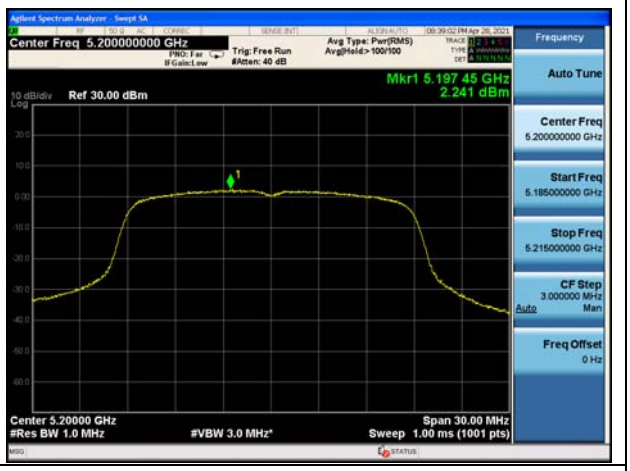


U-NII-1, 802.11n HT20, Channel No.: 36

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



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



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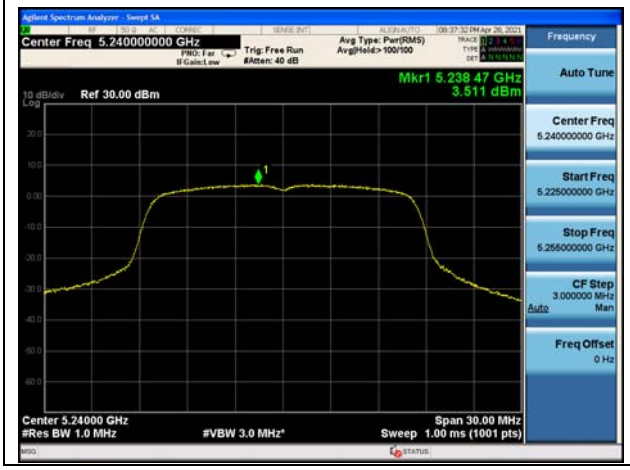
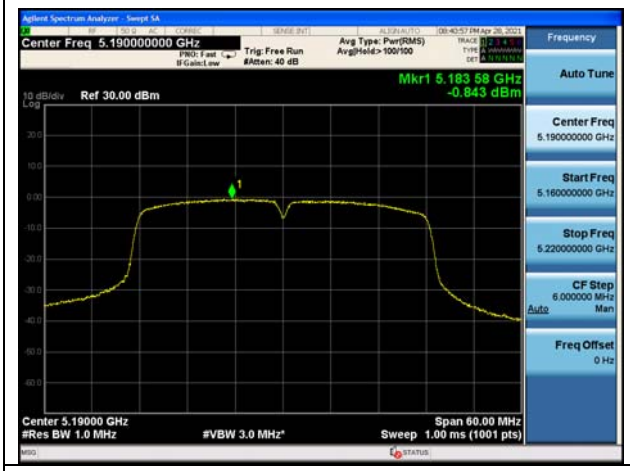


U-NII-1, 802.11n HT20, Channel No.: 48

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



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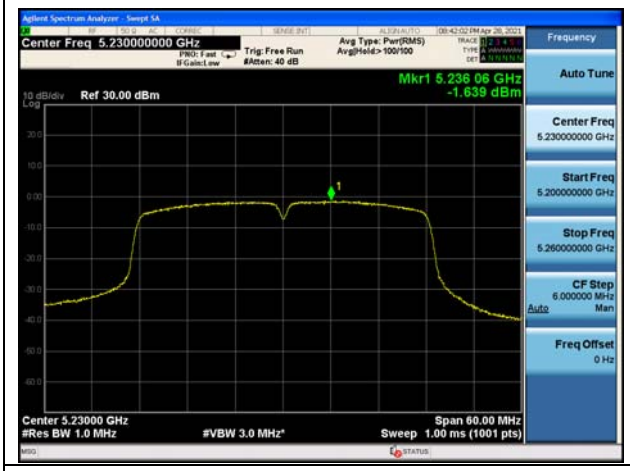
U-NII-1, 802.11n HT40, Channel No.: 46



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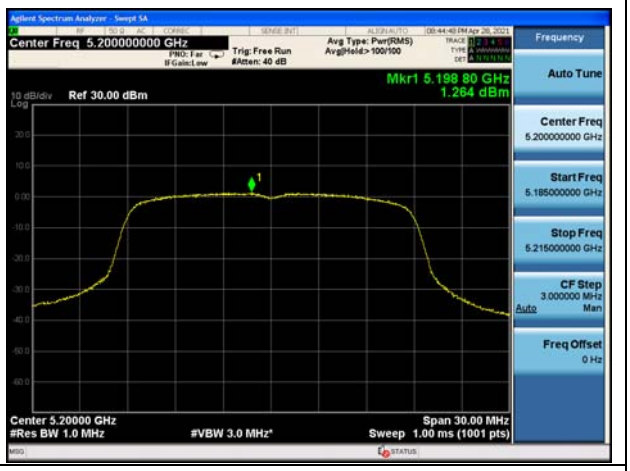

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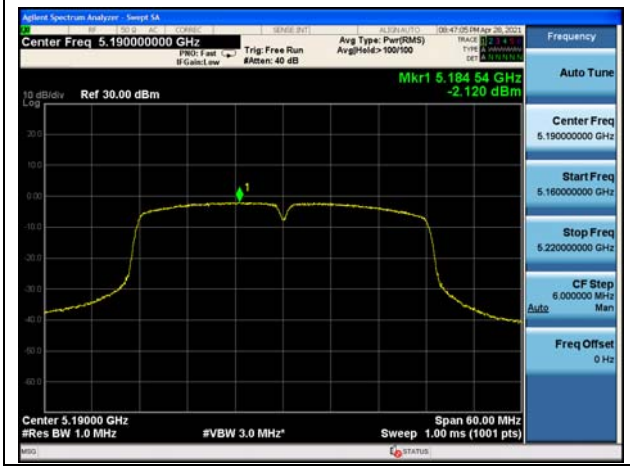

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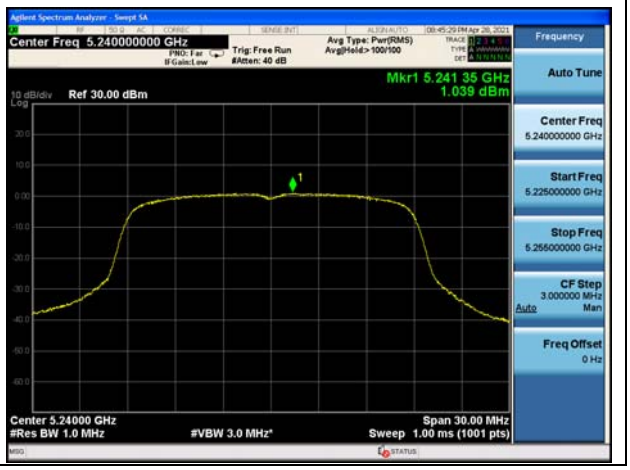

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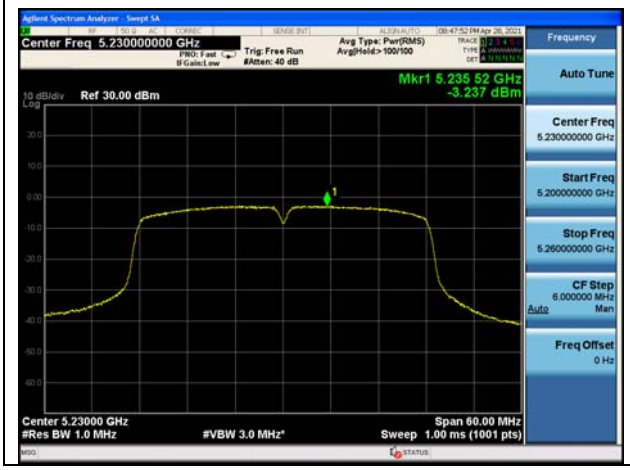

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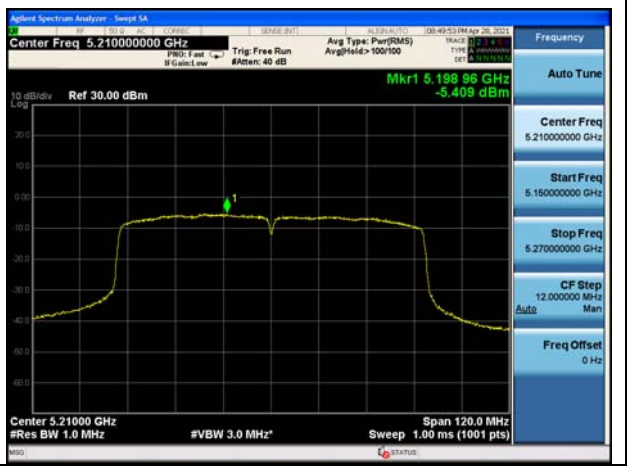
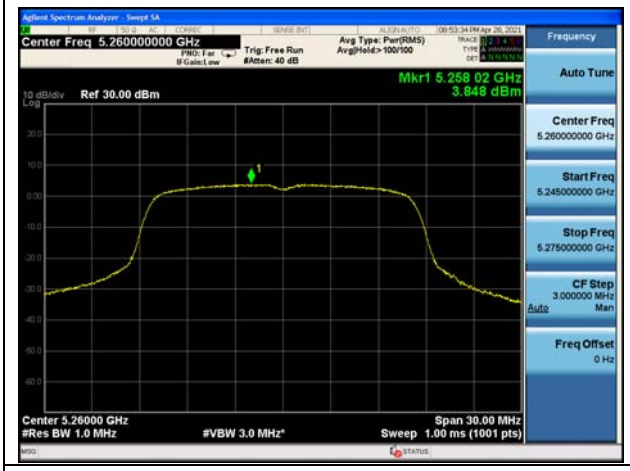


U-NII-2A, 802.11a, Channel No.: 52



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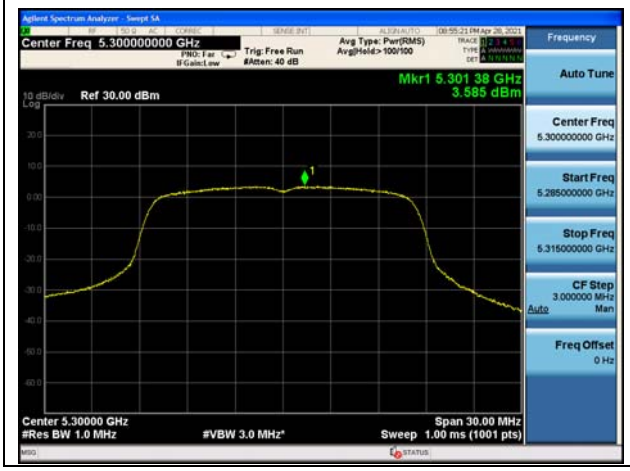
U-NII-2A, 802.11a, Channel No.: 60



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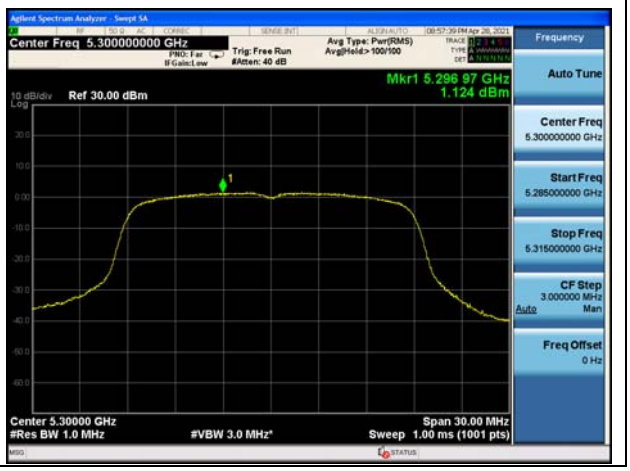

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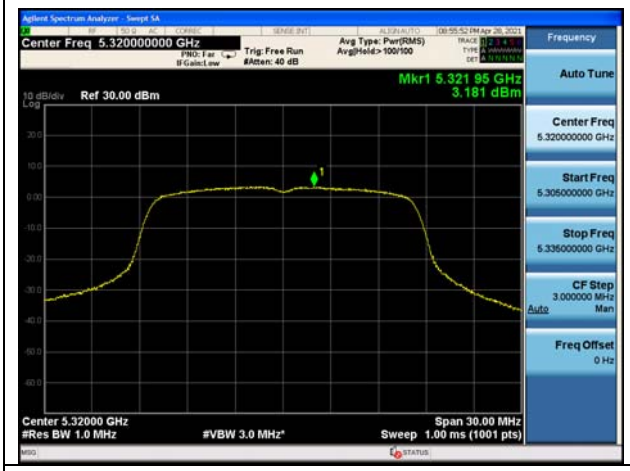
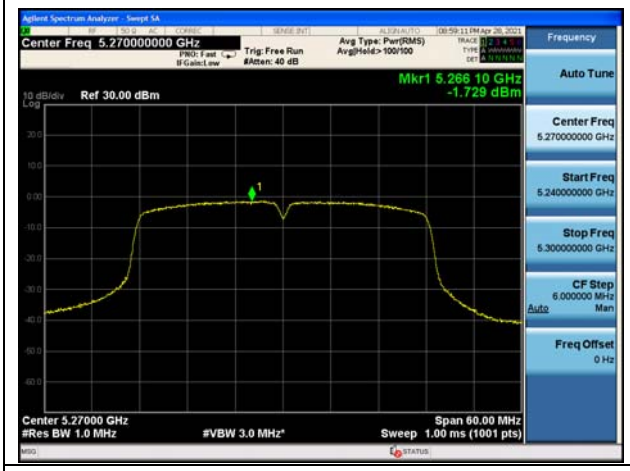


U-NII-2A, 802.11n HT20, Channel No.: 64

U-NII-2A, 802.11n HT40, Channel No.: 54



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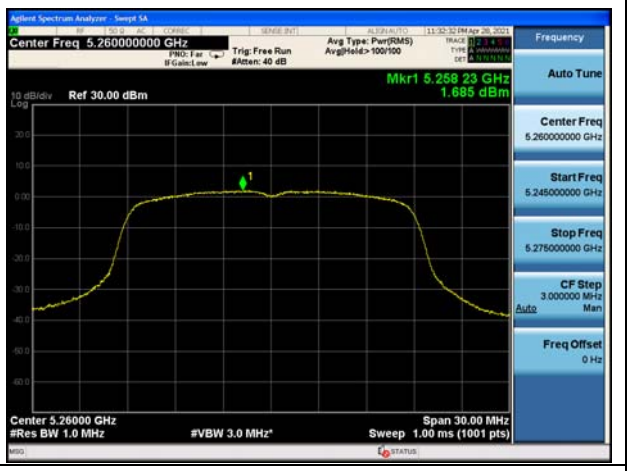

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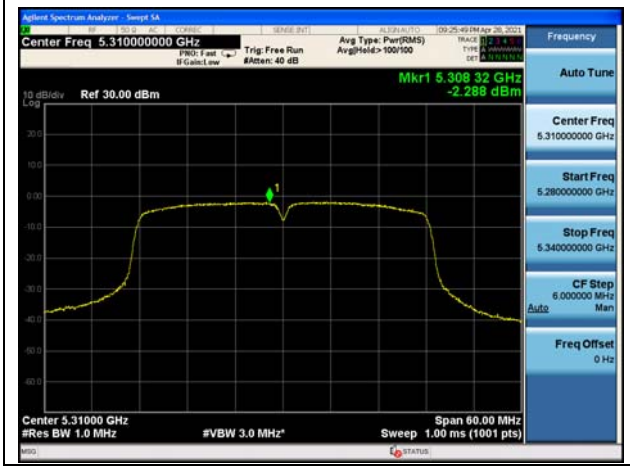

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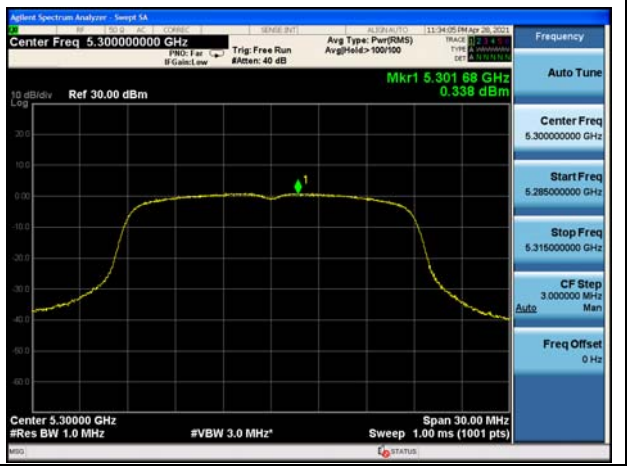

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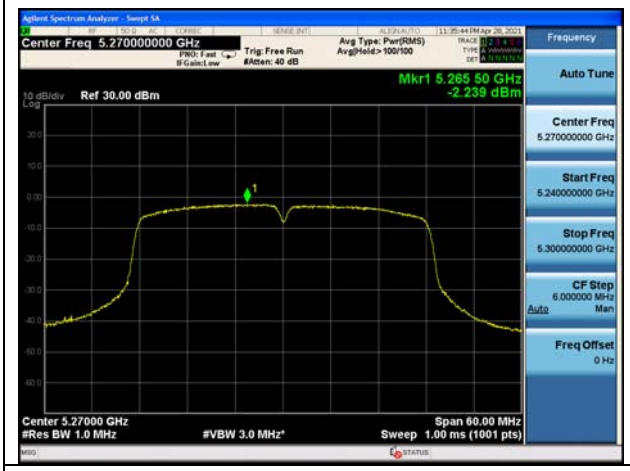

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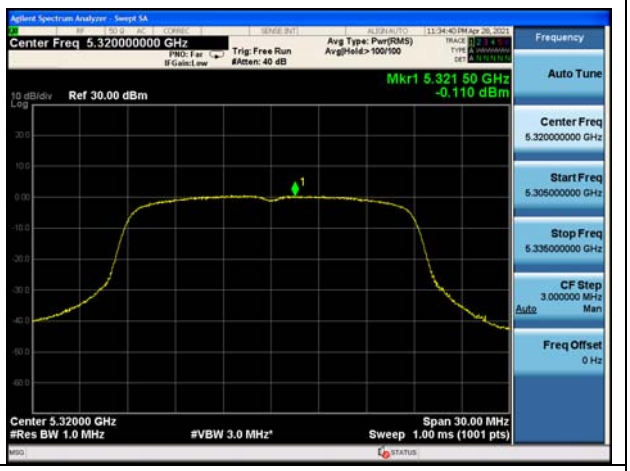

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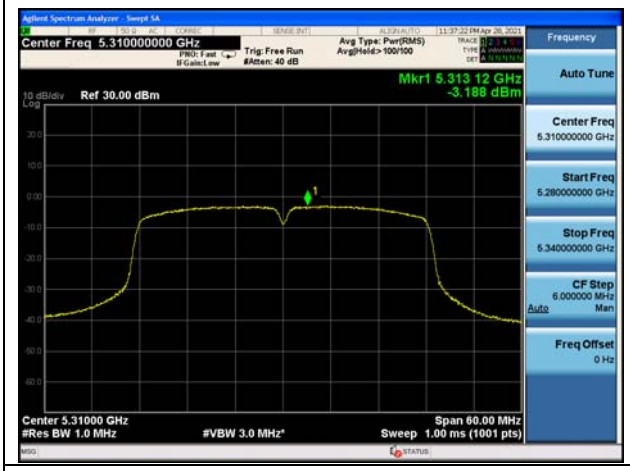
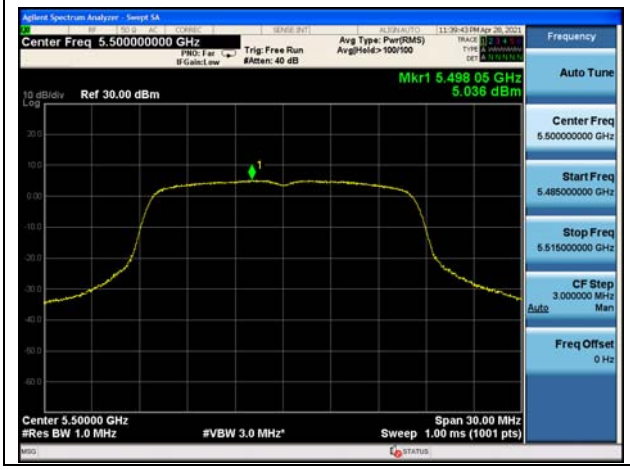
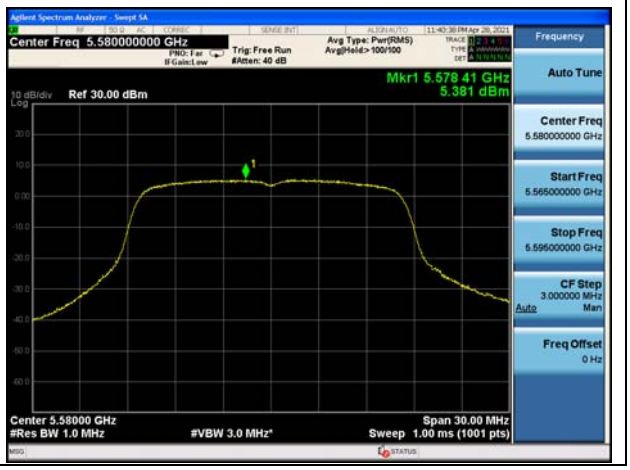


U-NII-2A, 802.11ac VHT80, Channel No.: 58

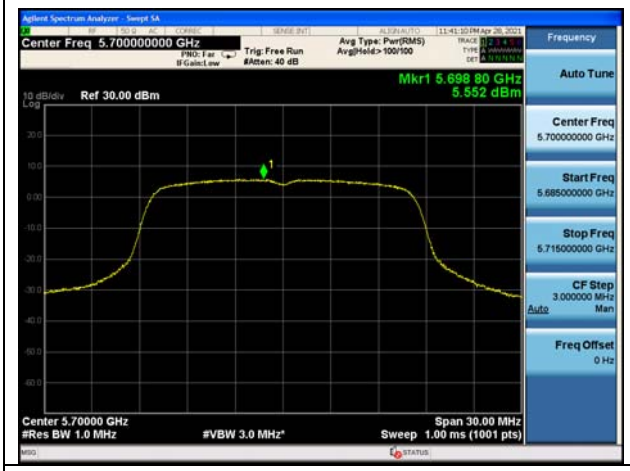
U-NII-2C, 802.11a, Channel No.: 100



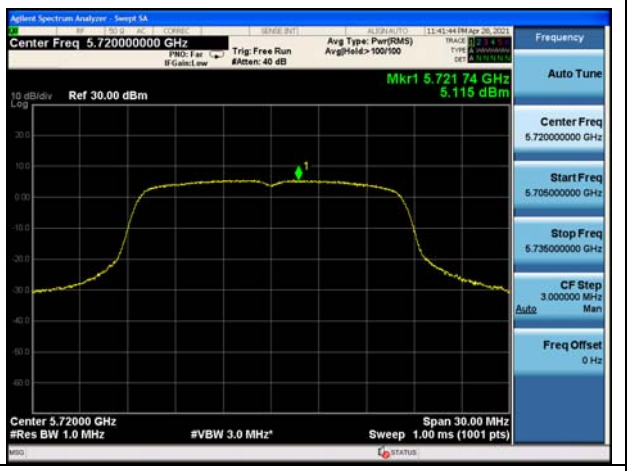
U-NII-2C, 802.11a, Channel No.: 116



U-NII-2C, 802.11a, Channel No.: 140



U-NII-2C, 802.11a, Channel No.: 144



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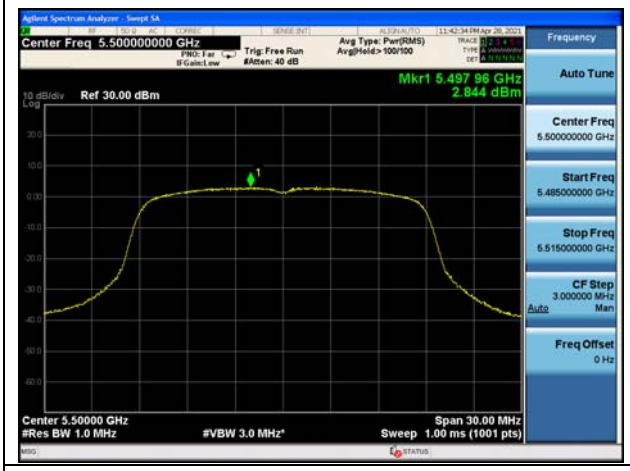

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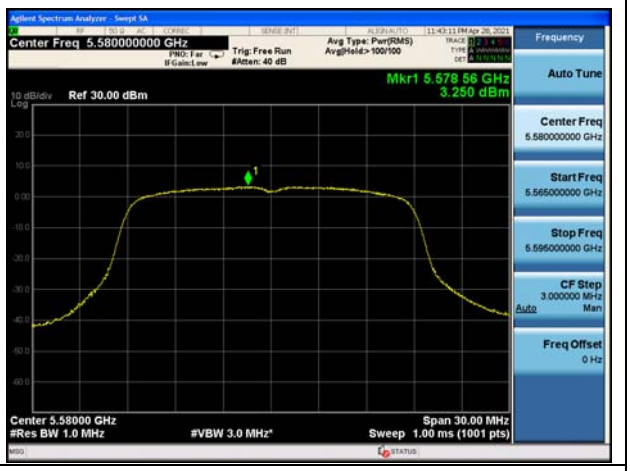

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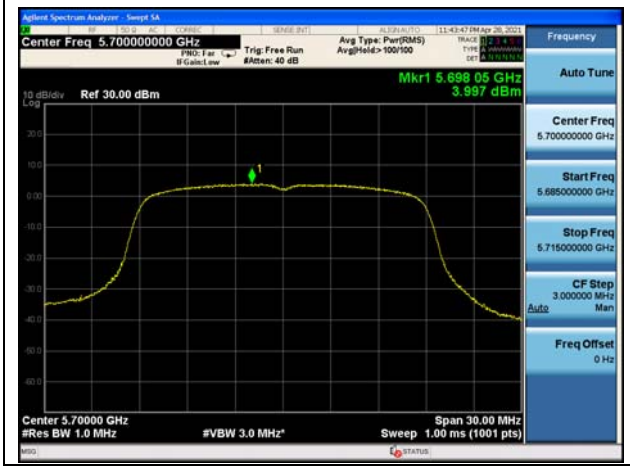

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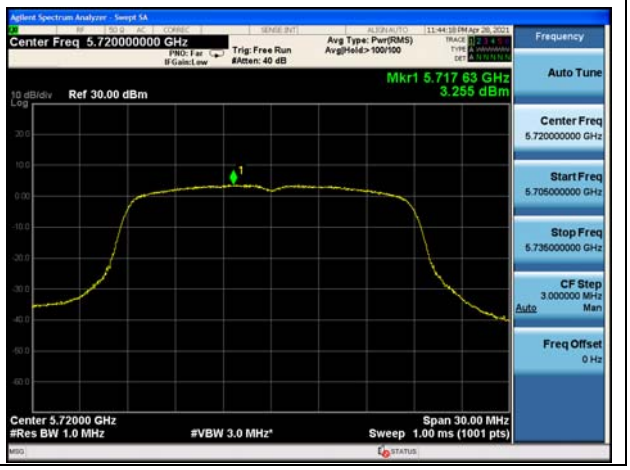
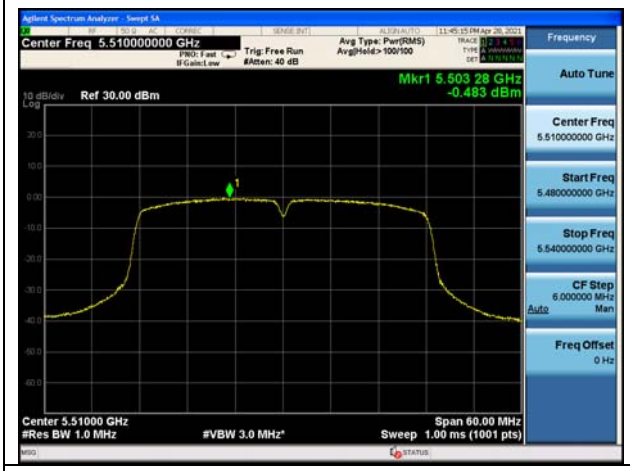
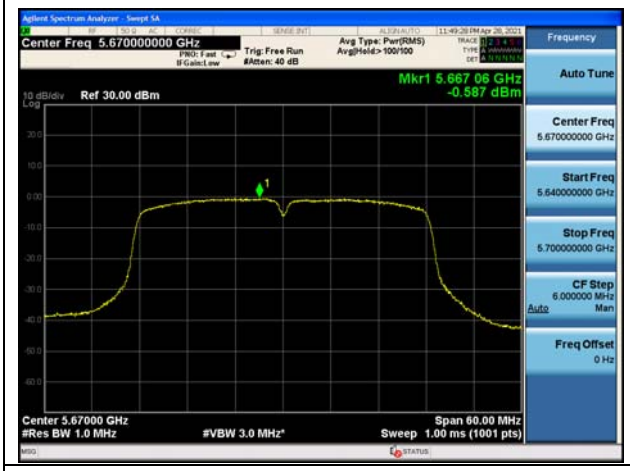


U-NII-2C, 802.11n HT40, Channel No.: 102



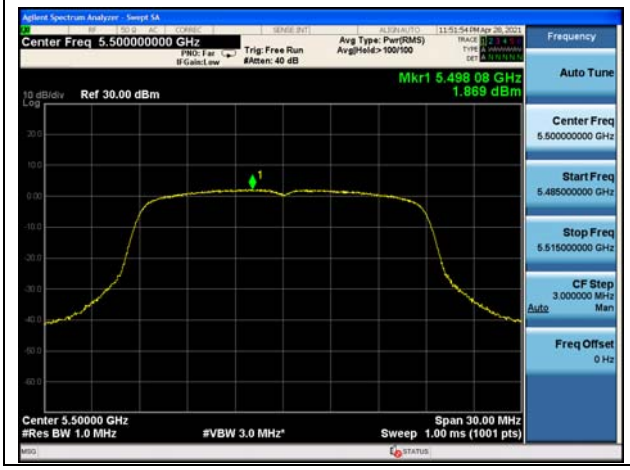
U-NII-2C, 802.11n HT40, Channel No.: 110

U-NII-2C, 802.11n HT40, Channel No.: 134



U-NII-2C, 802.11n HT40, Channel No.: 142

U-NII-2C, 802.11ac VHT20, Channel No.: 100



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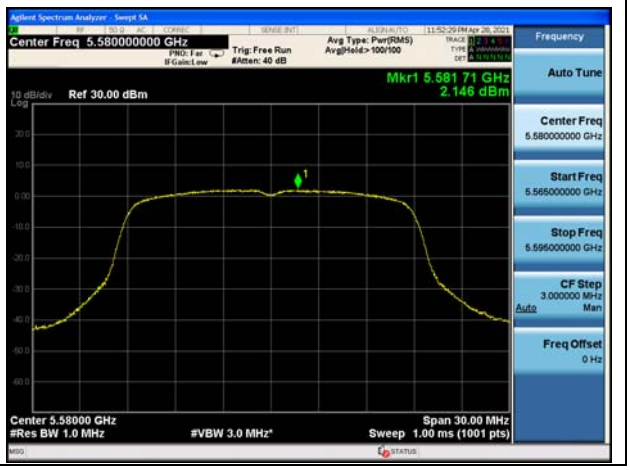

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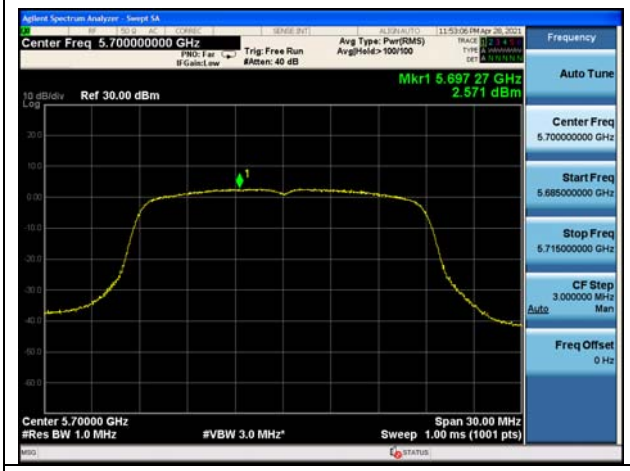

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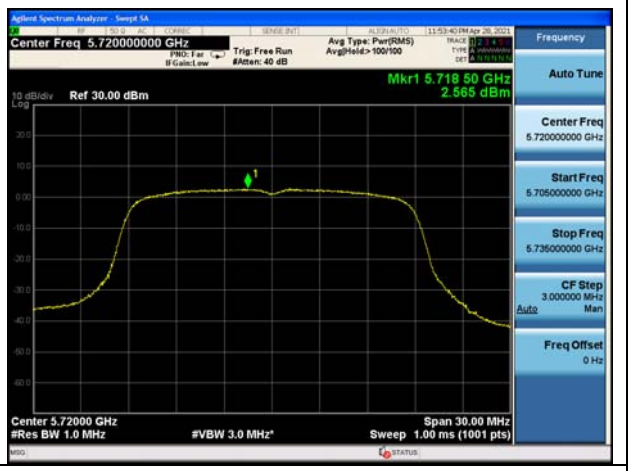

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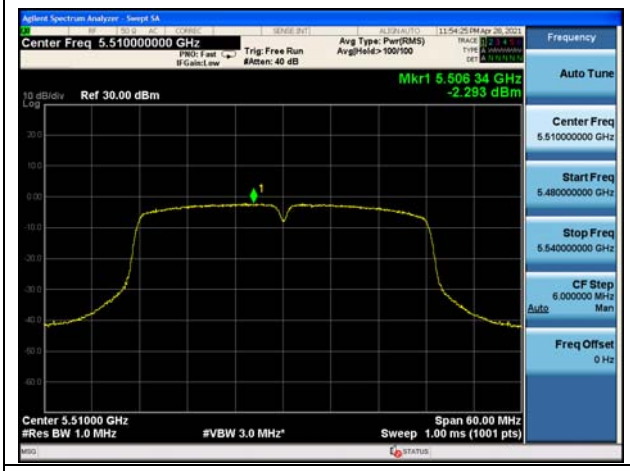

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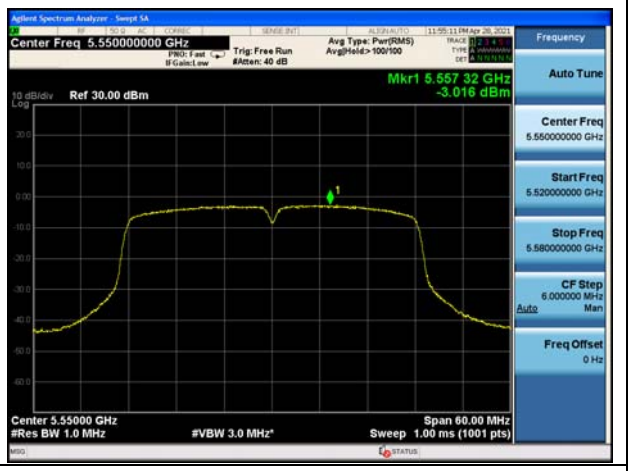

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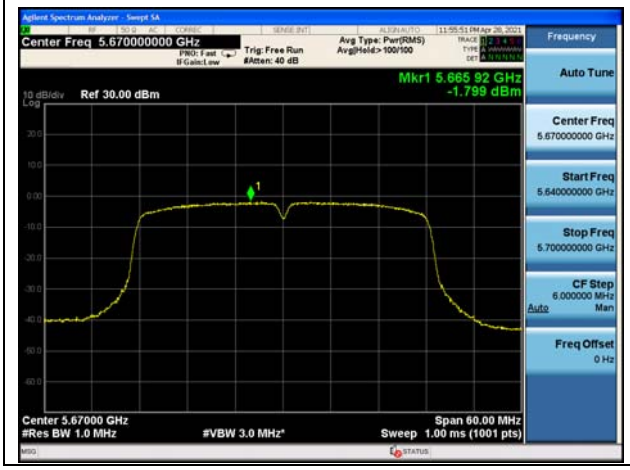
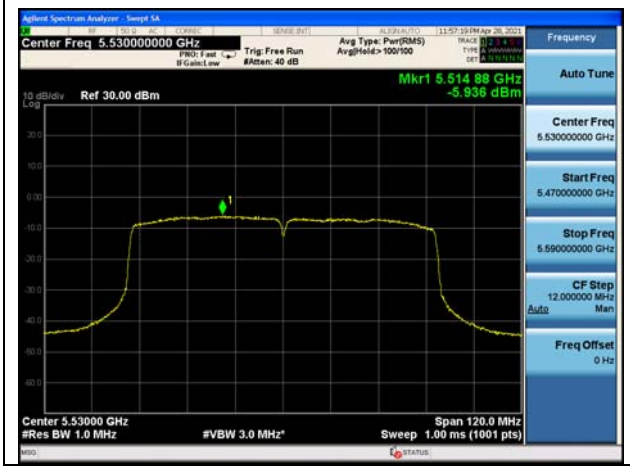
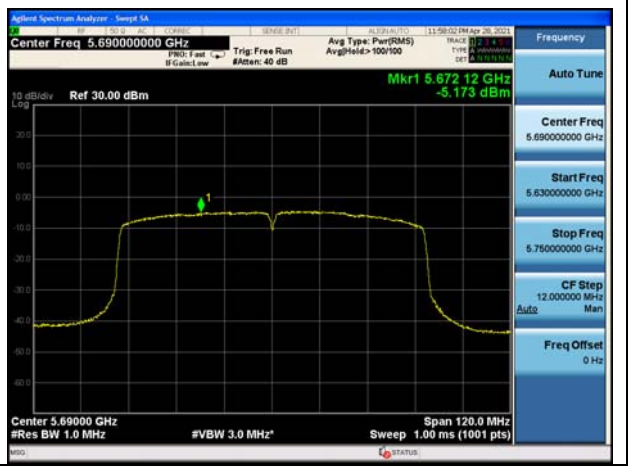


U-NII-2C, 802.11ac VHT40, Channel No.: 142

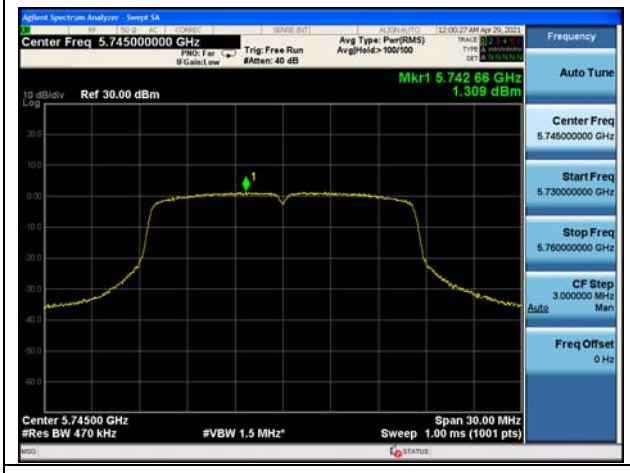
U-NII-2C, 802.11ac VHT80, Channel No.: 106



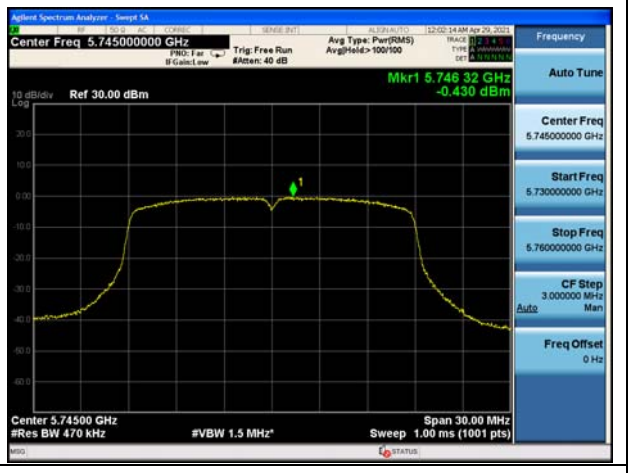
U-NII-2C, 802.11ac VHT80, Channel No.: 138



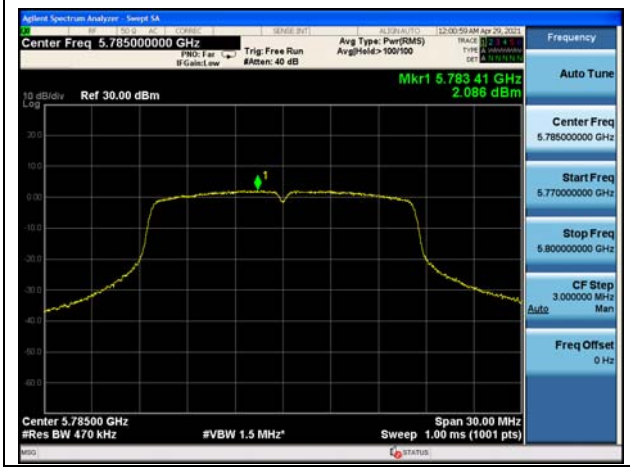
U-NII-3, 802.11a, Channel No.: 149



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

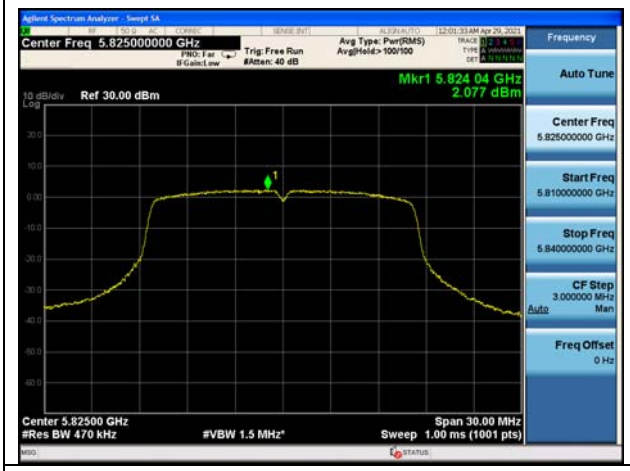


U-NII-3, 802.11a, Channel No.: 157



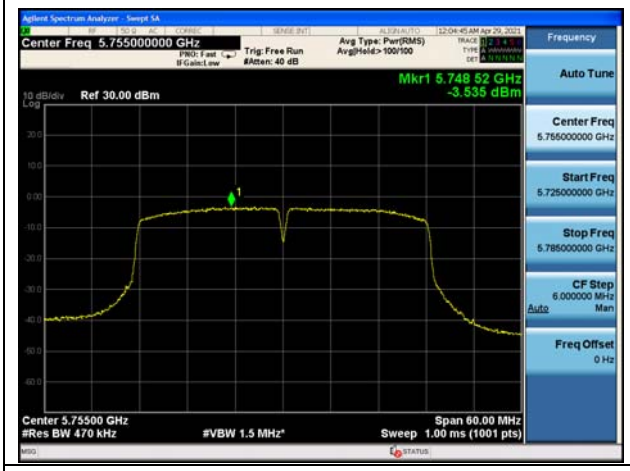
U-NII-3, 802.11n HT20, Channel No.: 157

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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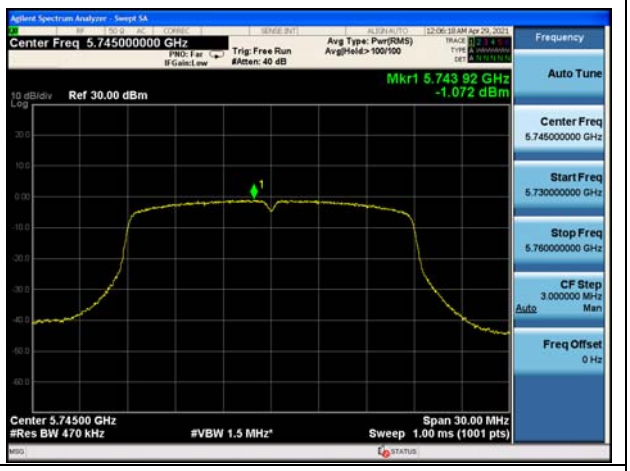

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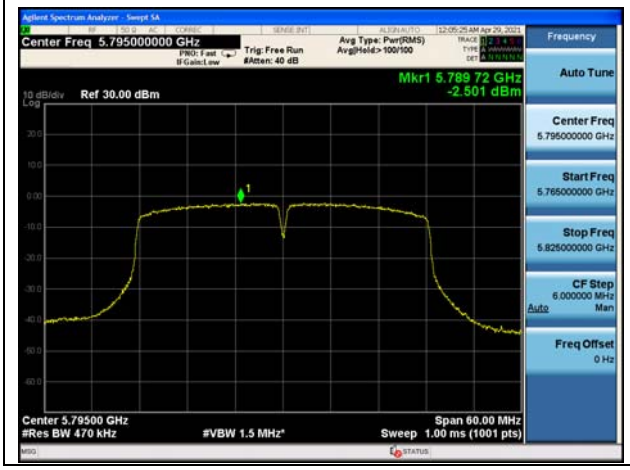
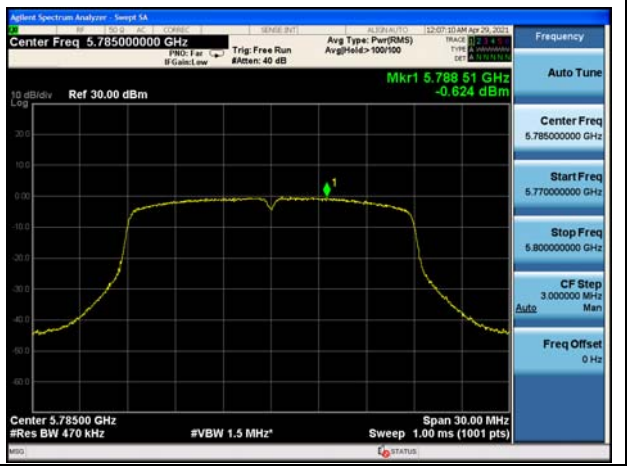


U-NII-3, 802.11ac VHT20, Channel No.: 157



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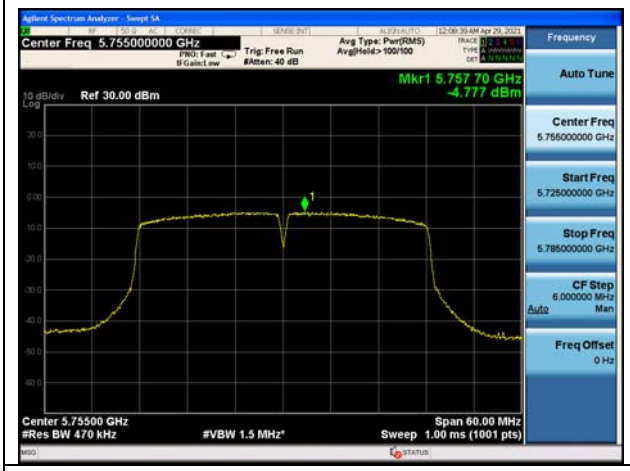
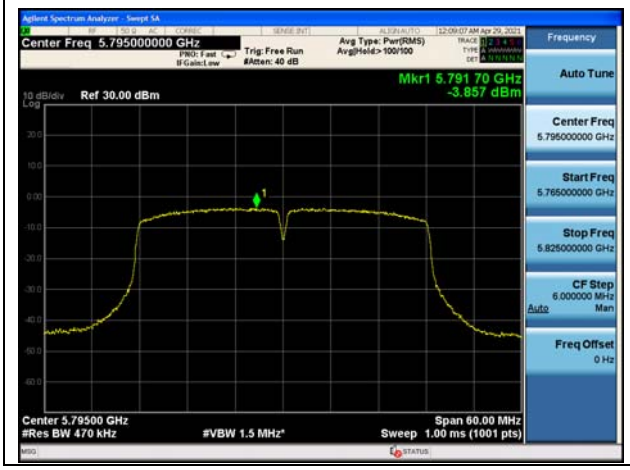
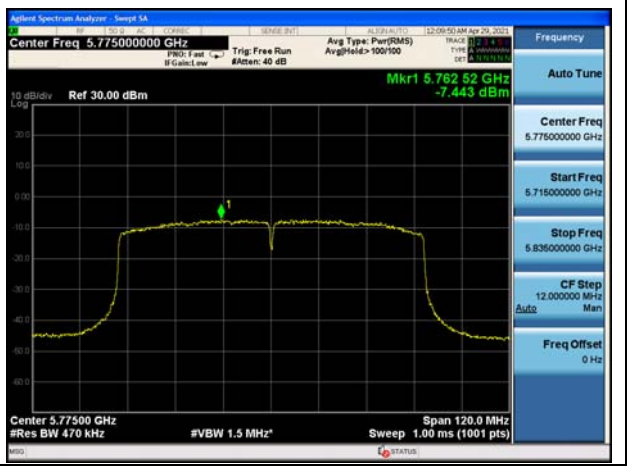


U-NII-3, 802.11ac VHT20, Channel No.: 165

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



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



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. 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:
9kHz~150 kHz
RBW=200Hz, VBW=1kHz/ Sweep=AUTO
150 kHz~30MHz
RBW=9KHz, VBW=30KHz,/ Sweep=AUTO
Below 1GHz
RBW=100kHz / VBW=300kHz / Sweep=AUTO
a) Peak emission levels are measured by setting the instrument as follows:
Above 1GHz
PEAK: RBW=1MHz VBW=3MHz/ Sweep=AUTO
b) Average emission levels are measured by setting the instrument as follows:
Above 1GHz
AVERAGE: RBW=1MHz / VBW=3MHz / Sweep=AUTO
c) Detector: The measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
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.

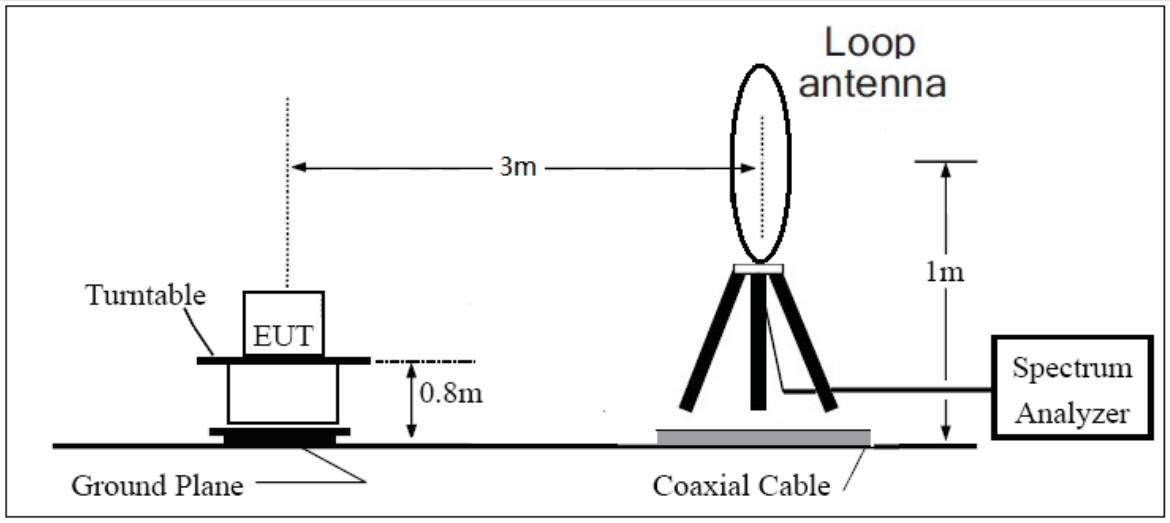
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

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.

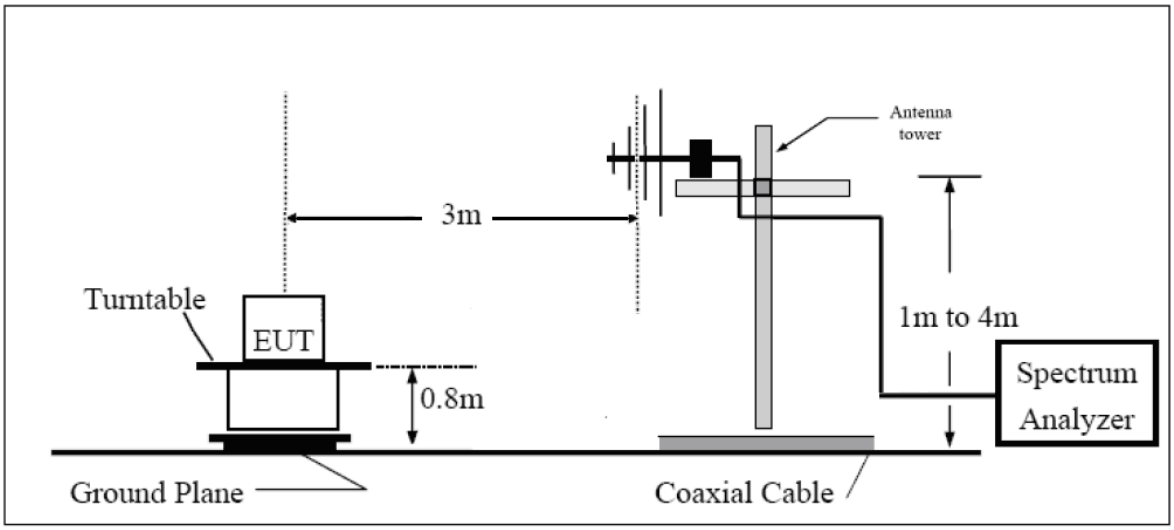
The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the loop antenna is vertical, others antenna are vertical and horizontal.

The test is in transmitting mode.

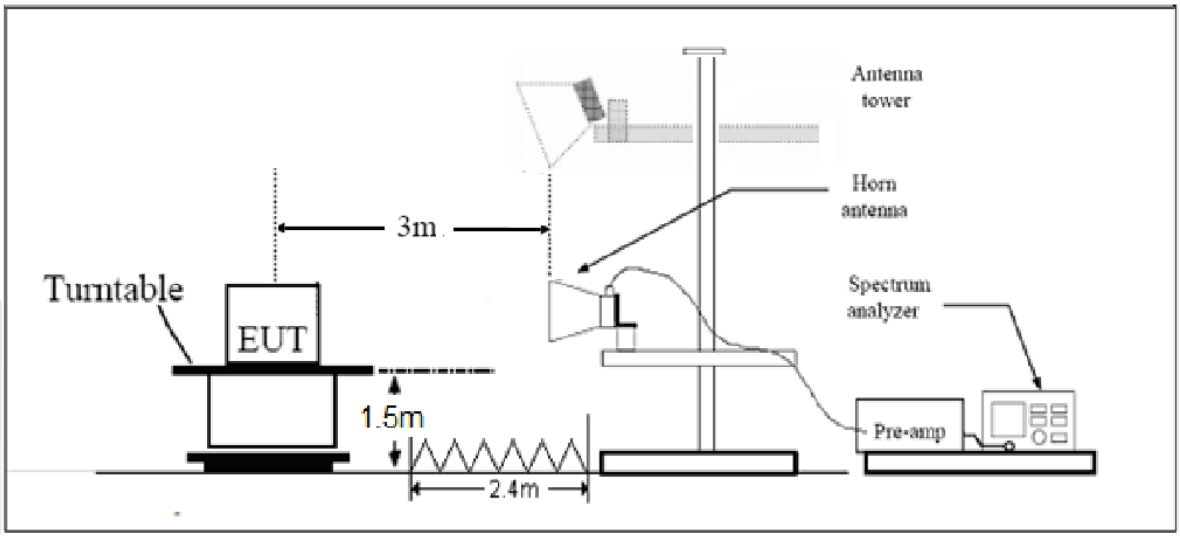
9KHz~~~30MHz



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).

Straddle channels 138, 142 and 144 are considered to be operating in both U-NII-2C and U-NII-3. The worst case out-of-band emission limit, i.e., −27 dBm/MHz peak EIRP, applies at the band edges. The band edges are considered to be 5.47 GHz and 5.85 GHz.

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 HT20/HT40 and 802.11ac mode for VHT20/VHT40, therefore investigated worst case to representative mode in test report.

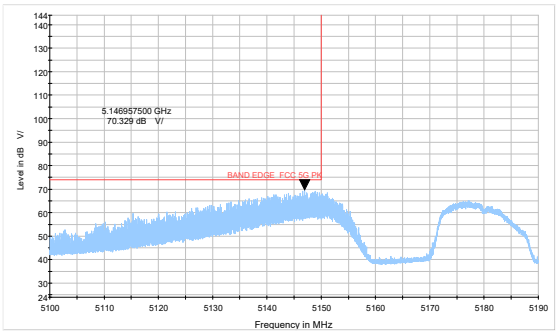
A font (Level in dBm)in the test plot =(level in dB μ V/m)

A font (Level in dBμV/)in the test plot =(level in dB μ V/m)

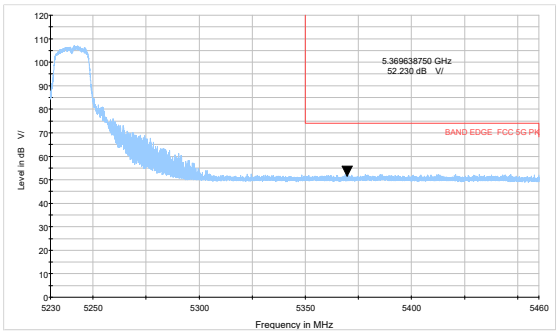
The signal beyond the limit is carrier.

U-NII-1

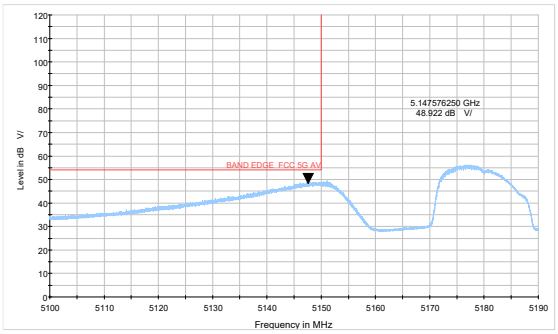
802.11a-Channel 36: Peak



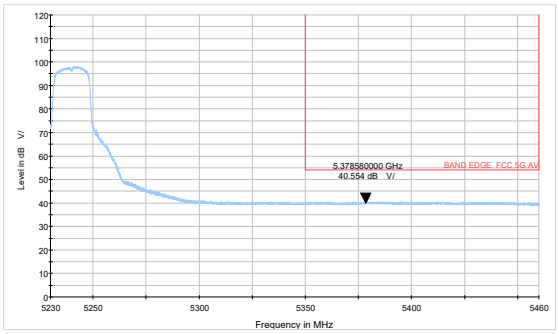
802.11a-Channel 48: Peak



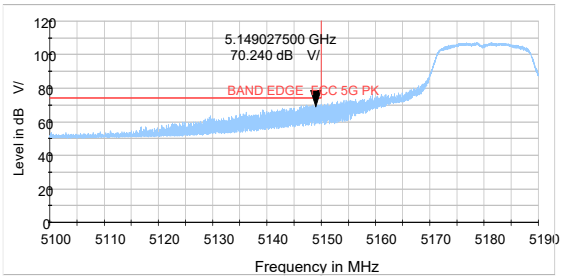
802.11a-Channel 36: Average



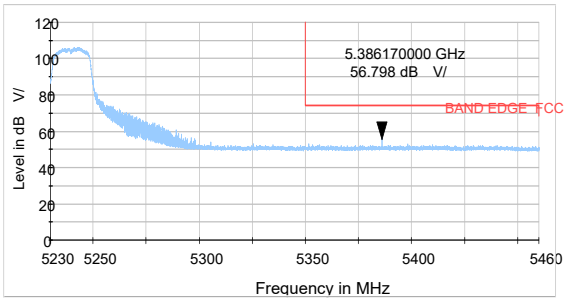
802.11a-Channel 48: Average



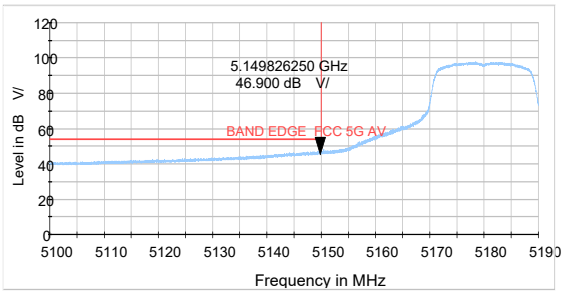
802.11n HT20-Channel 36: Peak



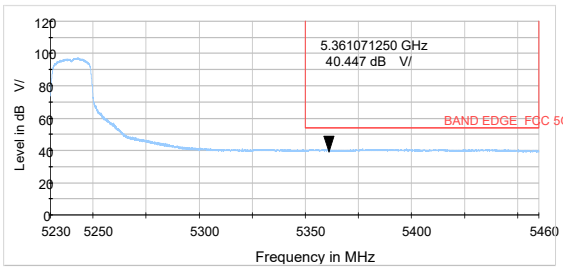
802.11n HT20-Channel 48: Peak



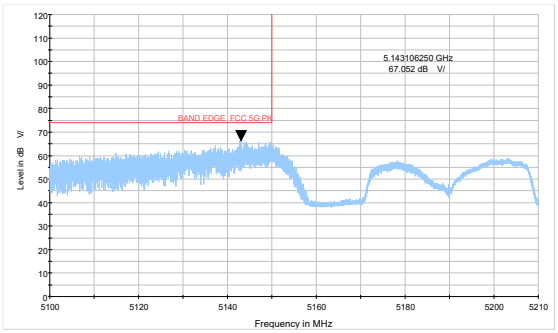
802.11n HT20-Channel 36: Average



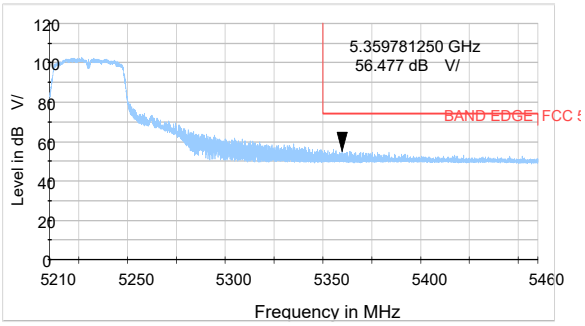
802.11n HT20-Channel 48: Average



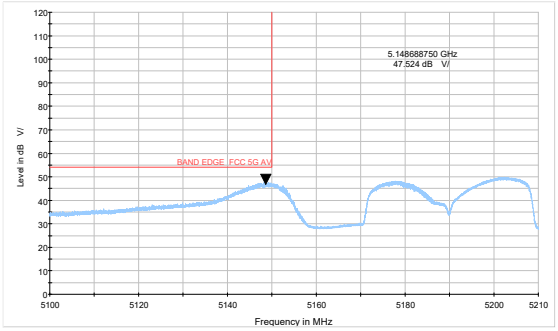
802.11n HT40-Channel 38: Peak



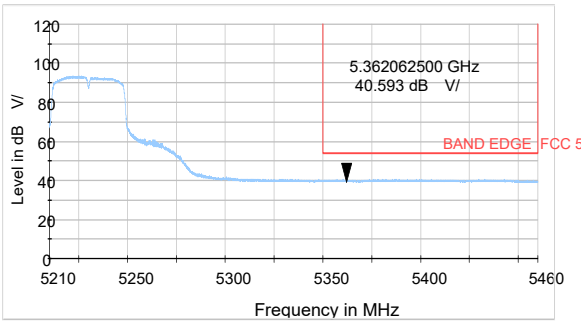
802.11n HT40-Channel 46: Peak



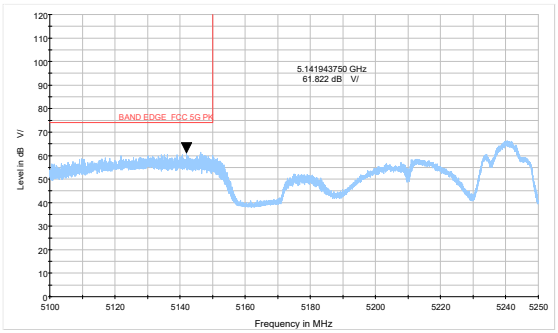
802.11n HT40-Channel 38: Average



802.11n HT40-Channel 46: Average



802.11ac VHT80 –Channel 42: Peak



802.11ac VHT80- Channel 42: Average