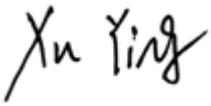
RF TEST REPORT

Applicant	Quectel Wireless Solutions Co., Ltd.
FCC ID	XMR202302AF31G
Product	Wi-Fi & Bluetooth Module
Brand	Quectel
Model	AF31G
Report No.	R2211A1014-R3V1
Issue Date	June 9, 2023

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15E (2022)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.



Prepared by: Xu Ying

Approved by: Xu Kai

TA Technology (Shanghai) Co., Ltd.

Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
TEL: +86-021-50791141/2/3
FAX: +86-021-50791141/2/3-8000

TABLE OF CONTENT

Version	Revision description	Issue Date
Rev.0	Initial issue of report.	April 28, 2023
Rev.1	Update data.	June 9, 2023
Note: This revised report (Report No.: R2211A1014-R3V1) supersedes and replaces the previously issued report (Report No.: R2211A1014-R3). 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: February 22, 2023 ~ April 6, 2023 and June 7, 2023 ~ June 9, 2023 Date of Sample Received: February 15, 2023			
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:	Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
City:	Shanghai
Post code:	201201
Country:	P. R. China
Contact:	Xu Kai
Telephone:	+86-021-50791141/2/3
Fax:	+86-021-50791141/2/3-8000
Website:	http://www.ta-shanghai.com
E-mail:	xukai@ta-shanghai.com

2. General Description of Equipment under Test

2.1. Applicant and Manufacturer Information

Applicant	Quectel Wireless Solutions Co., Ltd.
Applicant address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233
Manufacturer	Quectel Wireless Solutions Co., Ltd.
Manufacturer address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233

2.2. General information

EUT Description		
Model	AF31G	
SN	E1C22KA19000889	
Hardware Version	R1.0	
Software Version	NA	
Power Supply	External power supply	
Antenna Type	External Antenna	
Antenna Connector	A permanently attached antenna (meet with the standard FCC Part 15.203 requirement)	
Directional Gain	MIMO For Power: 5.40dBi MIMO For PSD: 8.41dBi	
Operating Frequency Range(s)	U-NII-1: 5150MHz-5250MHz U-NII-2A: 5250MHz-5350MHz U-NII-2C: 5470MHz-5725MHz U-NII-3: 5725MHz-5850MHz	
Modulation Type	802.11a/n (HT20/HT40): OFDM 802.11ac (VHT20/VHT40/VHT80): OFDM	
Max. Output Power	15.29 dBm	
Testing 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	3.3 V	
Auxiliary test equipment		
Antenna	Manufacturer	FOXCONN
	Model	ACE-Antenna
	Antenna Gain	Antenna 1: 5.40 dBi;
		Antenna 2: 5.10 dBi
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.		

2. This device support automatically discontinue transmission, while the device is not transmitting any information, the device can automatically discontinue transmission and become standby mode for power saving. The device can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.

3. (a) Manufacturers implements security features in any digitally modulated devices capable of operating in any of the U-NII bands, so that third parties are not able to reprogram the device to operate outside the parameters for which the device was certified. The software prevents the user from operating the transmitter with operating frequencies, output power, modulation types or other radio frequency parameters outside those that were approved for the device. Manufacturers uses means including, but not limited to the use of a private network that allows only authenticated users to download software, electronic signatures in software or coding in hardware that is decoded by software to verify that new software can be legally loaded into a device to meet these requirements and must describe the methods in their application for equipment authorization.

(b) Manufacturers take steps to ensure that DFS functionality cannot be disabled by the operator of the U-NII device.

4. The antenna gain is provided by the manufacturer.

5.The antenna is for testing only and will not be sold with the equipment.

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 (2022) Unlicensed National Information Infrastructure Devices

ANSI C63.10-2013

Reference standard:

KDB 789033 D02 General UNII Test Procedures New Rules v02r01

KDB 662911 D01 Multiple Transmitter Output v02r01

4. Test Configuration

Test Mode

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

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

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

Worst-case data rates are shown as following table.

Mode	Data Rate		
	Antenna 1	Antenna 2	CDD/MIMO
802.11a	6 Mbps	6 Mbps	6 Mbps
802.11n HT20	MCS0	MCS0	MCS8
802.11n HT40	MCS0	MCS0	MCS8
802.11ac VHT20	MCS0	MCS0	MCS0
802.11ac VHT40	MCS0	MCS0	MCS0
802.11ac VHT80	MCS0	MCS0	MCS0

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

Test Cases	Antenna 1	Antenna 2	CDD/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	--	--	802.11a
Note: “O”: test all bands			

According to RF Output power results in chapter 5.2, CDD/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-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
			120	5600MHz
			124	5620MHz
			128	5640MHz
			132	5660MHz
			136	5680MHz
			140	5700MHz
			144	5720MHz
		40 MHz	102	5510MHz
			110	5550MHz
			118	5590MHz
			126	5630MHz
			134	5670MHz
			142	5710MHz

		80 MHz	106	5530MHz
			122	5610MHz
			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
20°C ~25°C	45%~50%

Method of Measurement

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

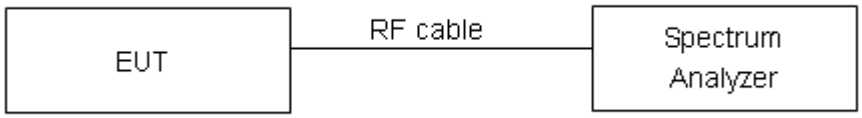
For U-NII-1/U-NII-2A/U-NII-2C, set RBW ≈1% OCB kHz, VBW ≥ 3 × RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the 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	16.319	19.34	PASS
	5200	16.315	19.16	PASS
	5240	16.321	19.51	PASS
802.11n HT20	5180	17.435	20.50	PASS
	5200	17.431	20.18	PASS
	5240	17.449	19.99	PASS
802.11n HT40	5190	35.909	41.66	PASS
	5230	35.929	40.63	PASS
802.11ac VHT20	5180	17.453	20.18	PASS
	5200	17.434	20.13	PASS
	5240	17.476	20.57	PASS
802.11ac VHT40	5190	35.948	44.92	PASS
	5230	35.924	41.57	PASS
802.11ac VHT80	5210	75.108	83.56	PASS

U-NII-2A

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5260	16.328	19.68	PASS
	5300	16.299	19.93	PASS
	5320	16.327	19.39	PASS
802.11n HT20	5260	17.445	20.15	PASS
	5300	17.467	19.93	PASS
	5320	17.447	19.86	PASS
802.11n HT40	5270	35.930	41.07	PASS
	5310	35.942	41.19	PASS
802.11ac VHT20	5260	17.456	20.10	PASS
	5300	17.462	20.18	PASS
	5320	17.461	20.00	PASS
802.11ac VHT40	5270	35.922	40.43	PASS
	5310	35.955	40.48	PASS
802.11ac VHT80	5290	75.198	85.53	PASS

U-NII-2C

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5500	16.336	19.36	PASS
	5520	16.305	19.30	PASS
	5600	16.347	19.12	PASS
	5680	16.302	19.25	PASS
	5700	16.335	19.50	PASS
	5720	16.305	19.17	PASS
802.11n HT20	5500	17.460	20.26	PASS
	5600	17.434	20.43	PASS
	5680	17.461	20.33	PASS
	5700	17.448	20.15	PASS
	5720	17.437	19.80	PASS
802.11n HT40	5510	35.911	41.26	PASS
	5550	35.924	41.09	PASS
	5590	35.941	41.23	PASS
	5670	35.939	42.77	PASS
	5710	35.981	41.77	PASS
802.11ac VHT20	5500	17.445	20.37	PASS
	5600	17.464	20.05	PASS
	5700	17.454	20.22	PASS
	5720	17.439	20.10	PASS
802.11ac VHT40	5510	35.959	41.07	PASS
	5590	35.960	42.21	PASS
	5670	35.938	44.41	PASS
	5710	35.980	41.57	PASS
802.11ac VHT80	5530	75.027	82.50	PASS
	5610	75.129	81.80	PASS
	5690	75.216	81.68	PASS

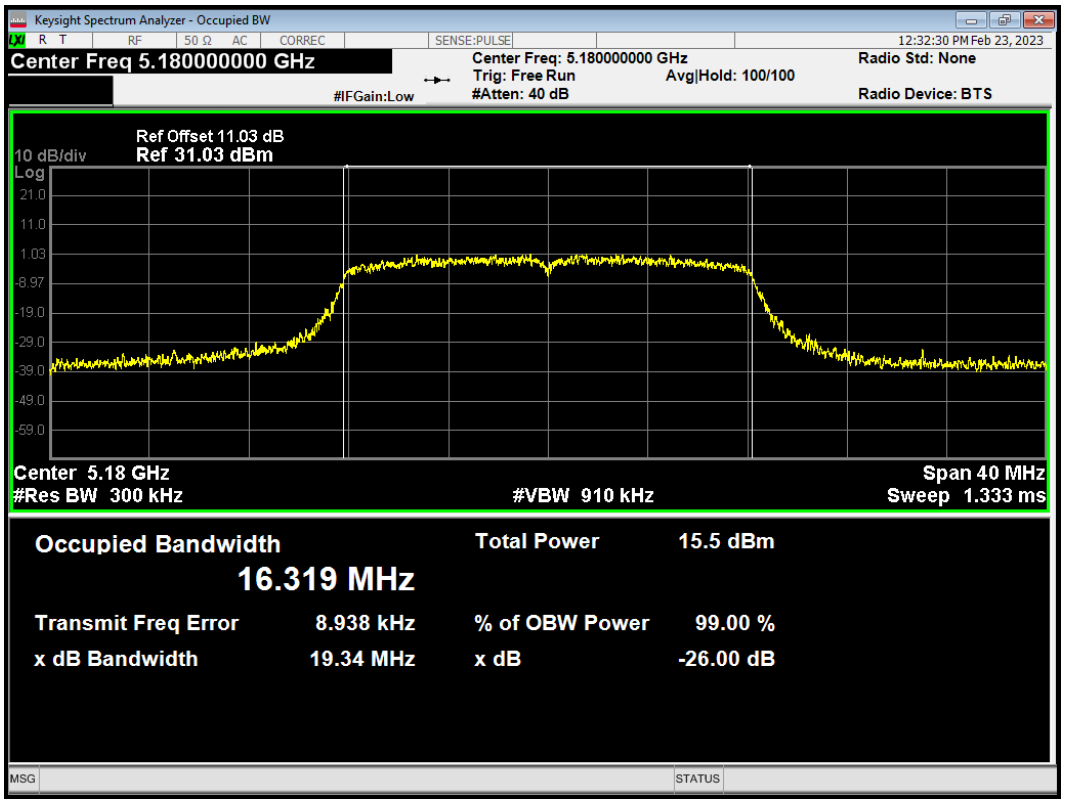
U-NII-3

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11a	5720	16.305	15.85	500	PASS
	5745	16.337	15.29	500	PASS
	5785	16.324	15.04	500	PASS
	5825	16.321	15.29	500	PASS
802.11n HT20	5720	17.437	14.36	500	PASS
	5745	17.455	15.07	500	PASS
	5785	17.447	15.10	500	PASS
	5825	17.456	13.53	500	PASS
802.11n HT40	5710	35.981	31.93	500	PASS
	5755	35.950	32.58	500	PASS
	5795	35.959	35.13	500	PASS
802.11ac VHT20	5720	17.439	14.87	500	PASS
	5745	17.461	13.78	500	PASS
	5785	17.491	15.42	500	PASS
	5825	17.466	15.10	500	PASS
802.11ac VHT40	5710	35.980	32.81	500	PASS
	5755	35.967	31.33	500	PASS
	5795	35.968	30.72	500	PASS
802.11ac VHT80	5690	75.216	75.09	500	PASS
	5775	75.245	73.80	500	PASS

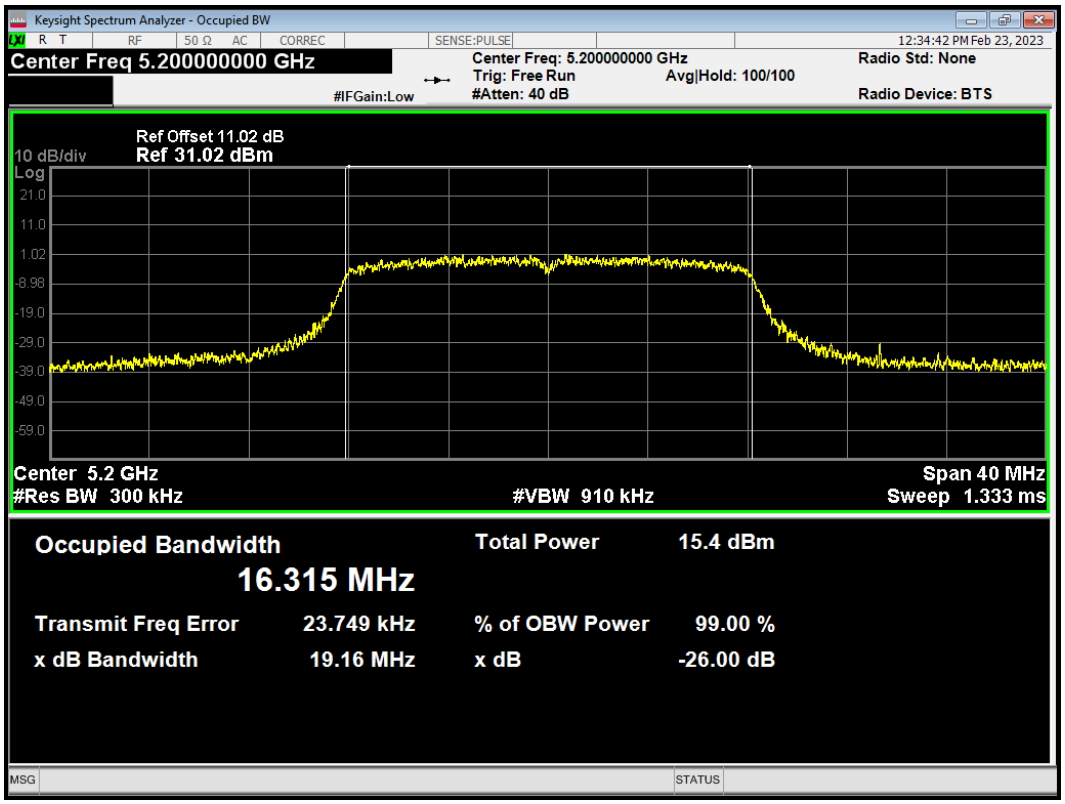
99% bandwidth

U-NII-1

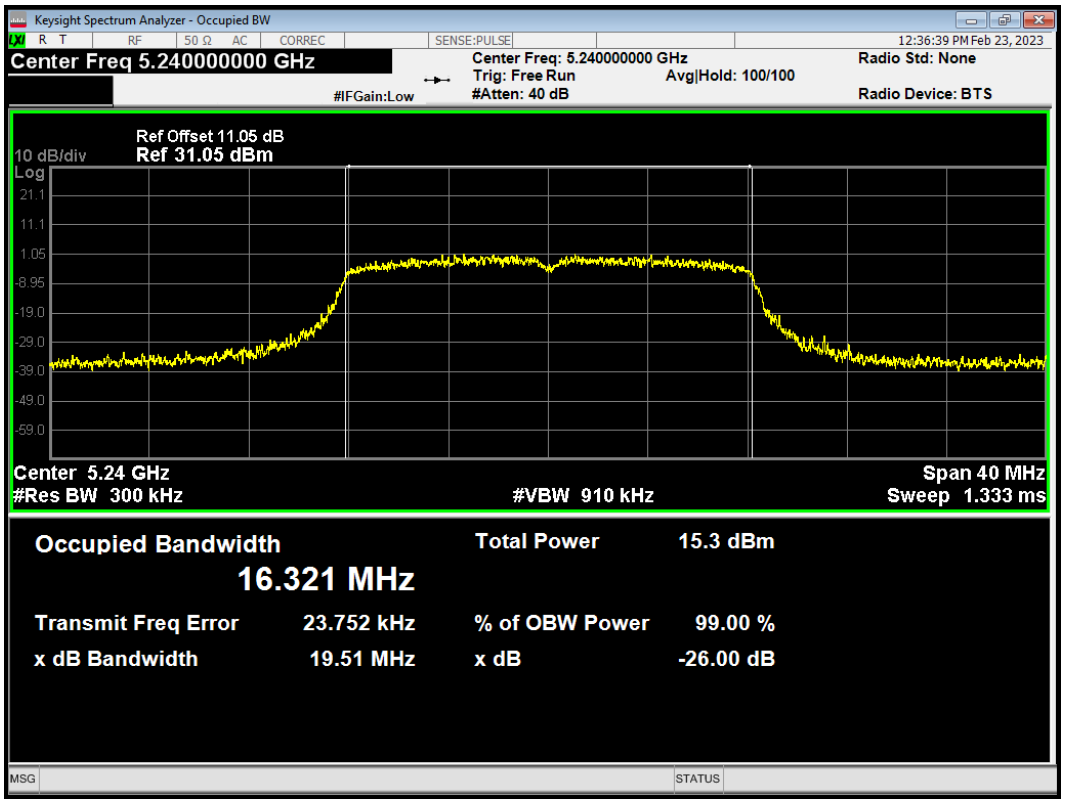
OBW 802.11a 5180MHz



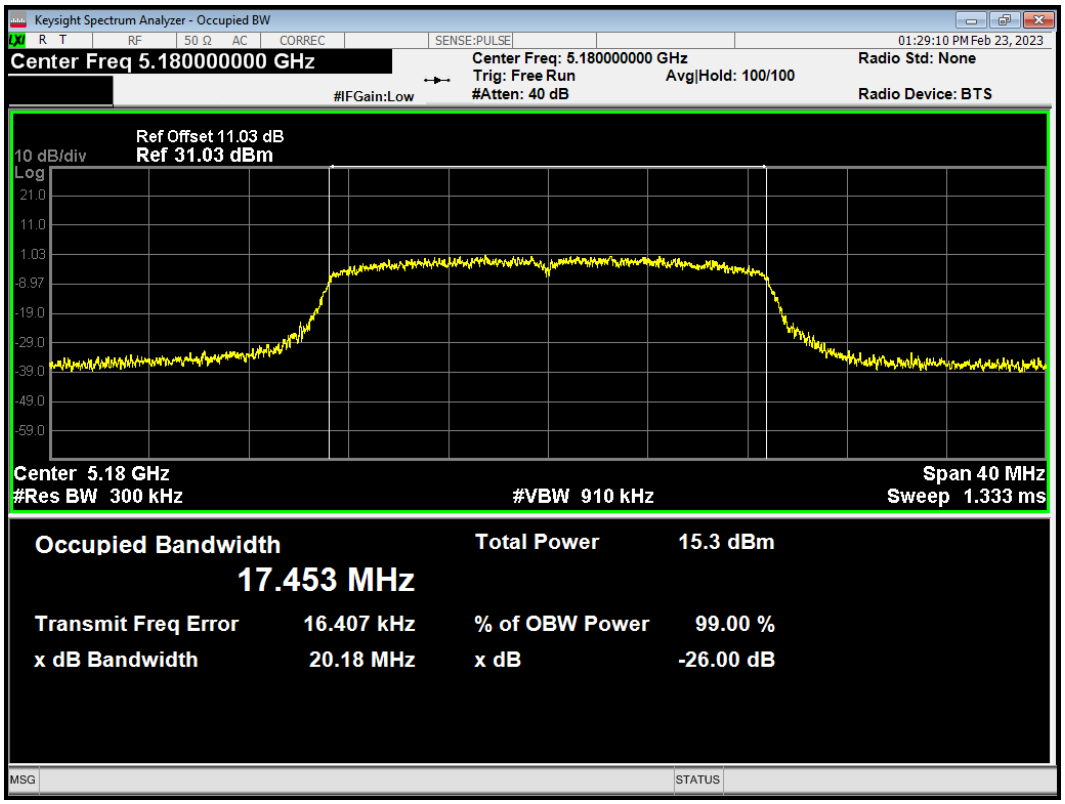
OBW 802.11a 5200MHz



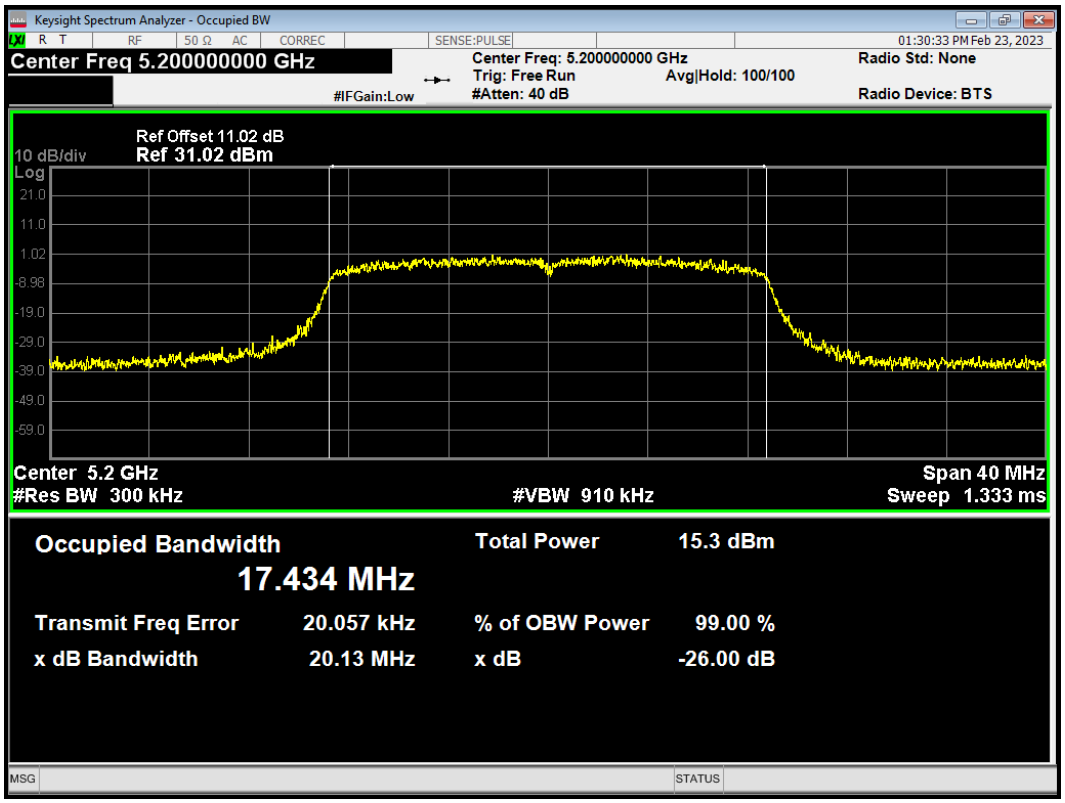
OBW 802.11a 5240MHz



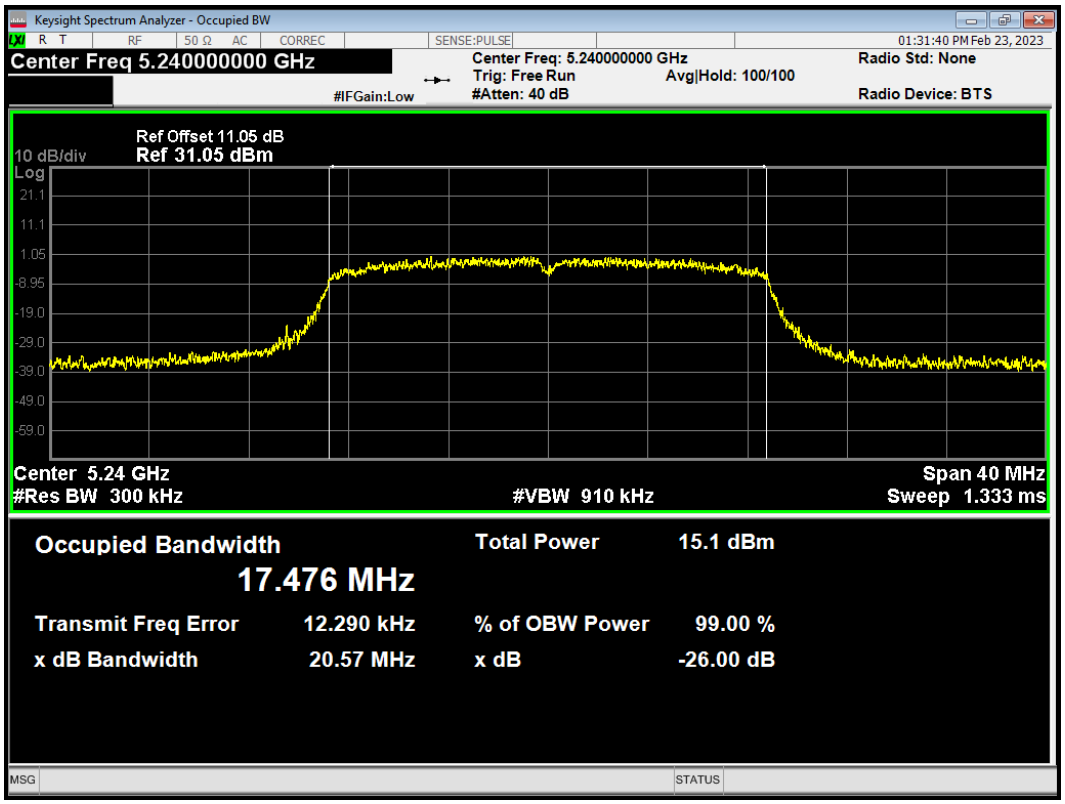
OBW 802.11ac(VHT20) 5180MHz



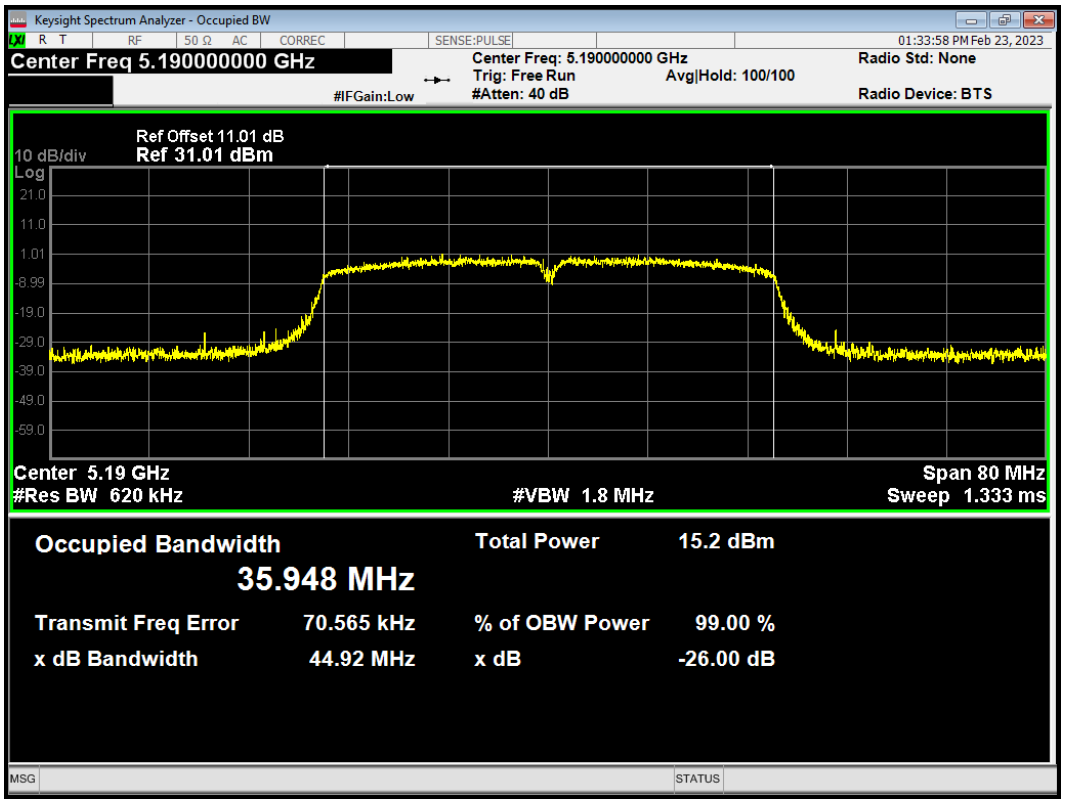
OBW 802.11ac (VHT20) 5200MHz



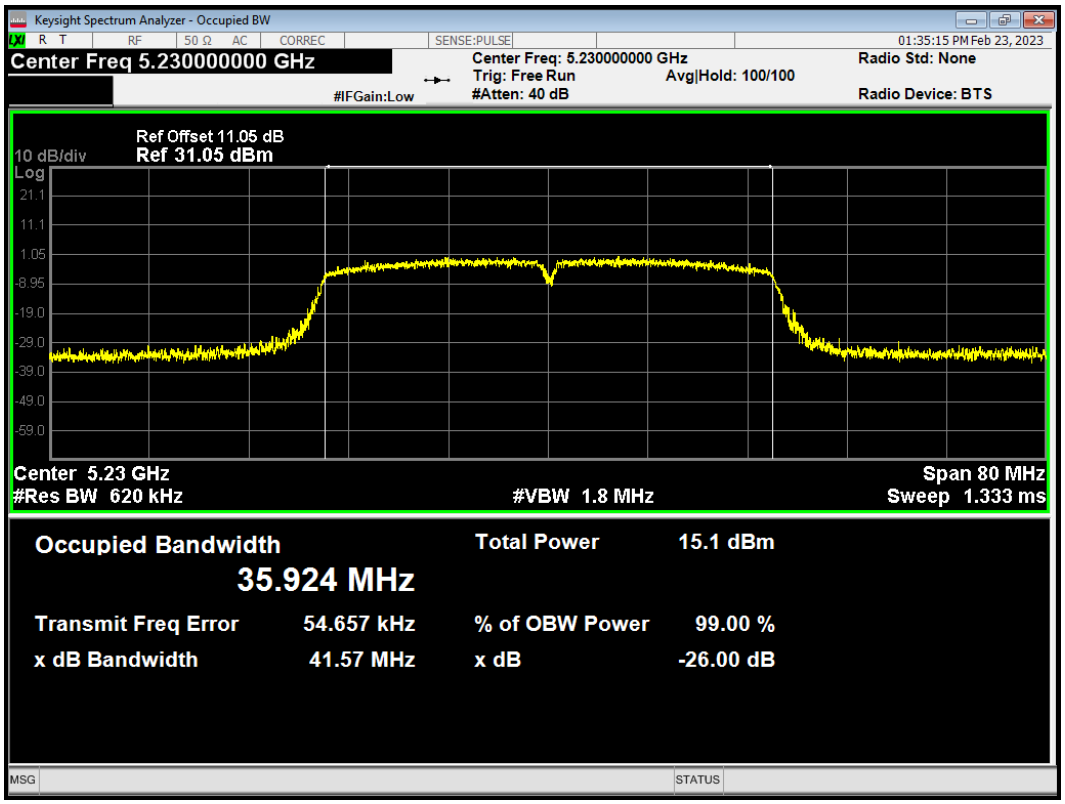
OBW 802.11ac (VHT20) 5240MHz



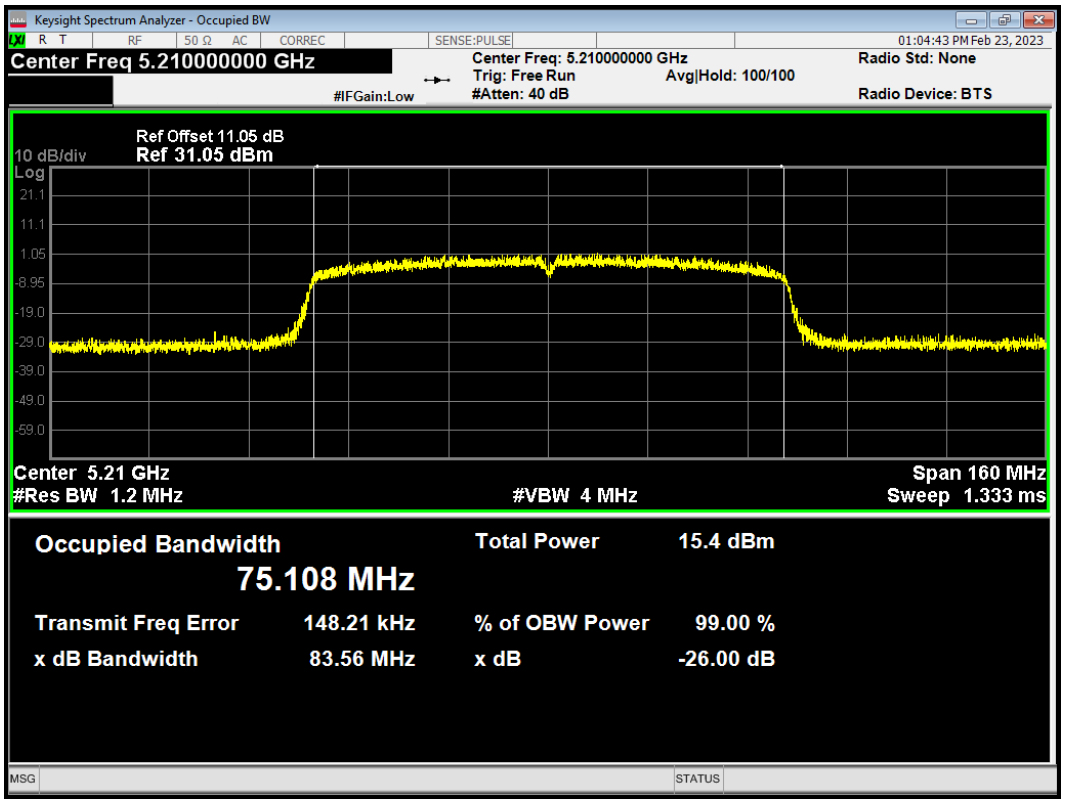
OBW 802.11ac (VHT40) 5190MHz



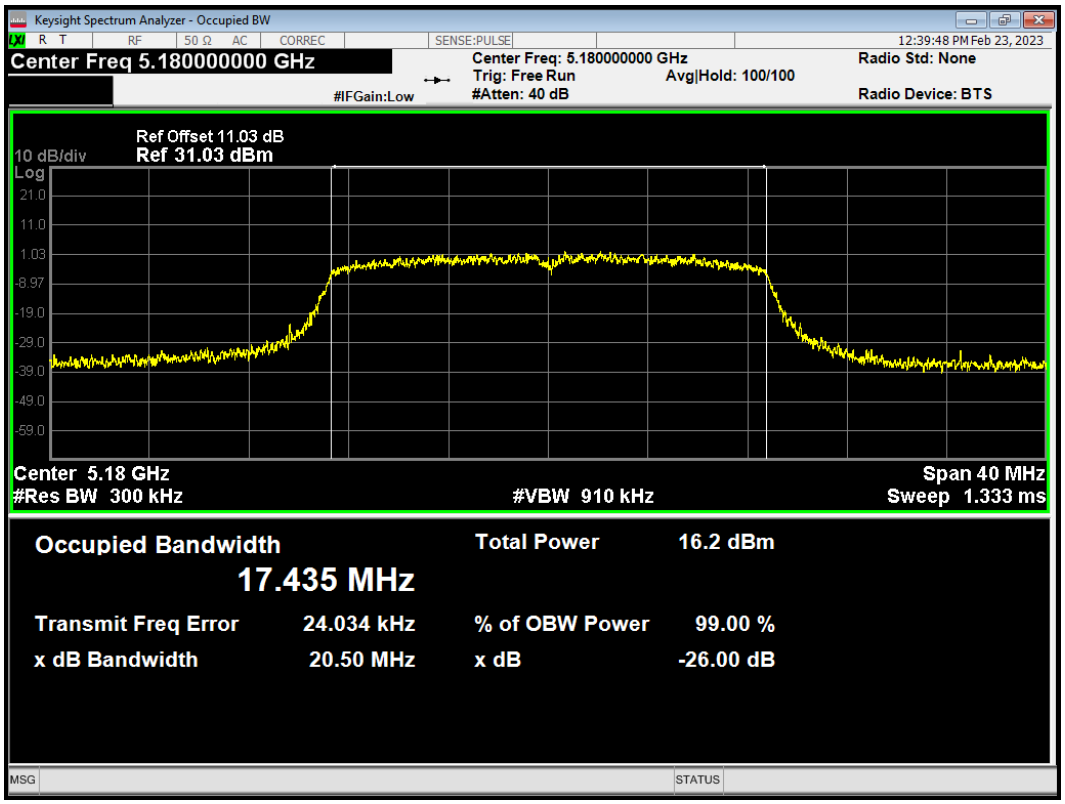
OBW 802.11ac (VHT40) 5230MHz



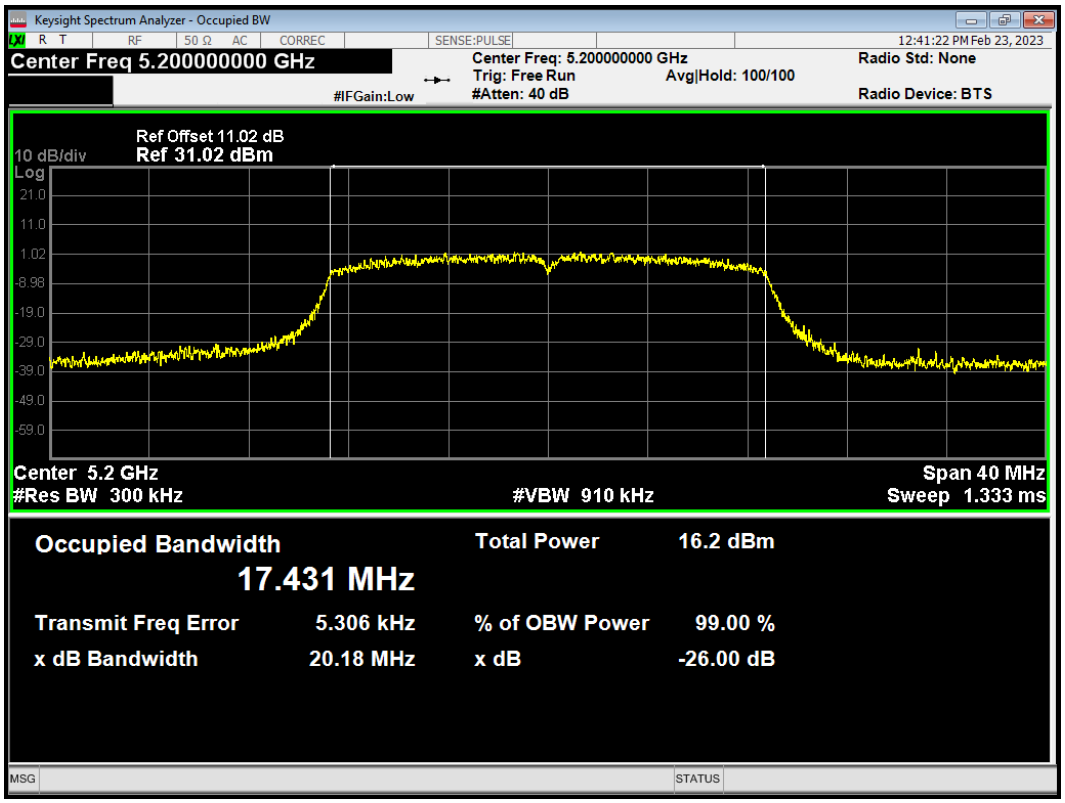
OBW 802.11ac (VHT80) 5210MHz



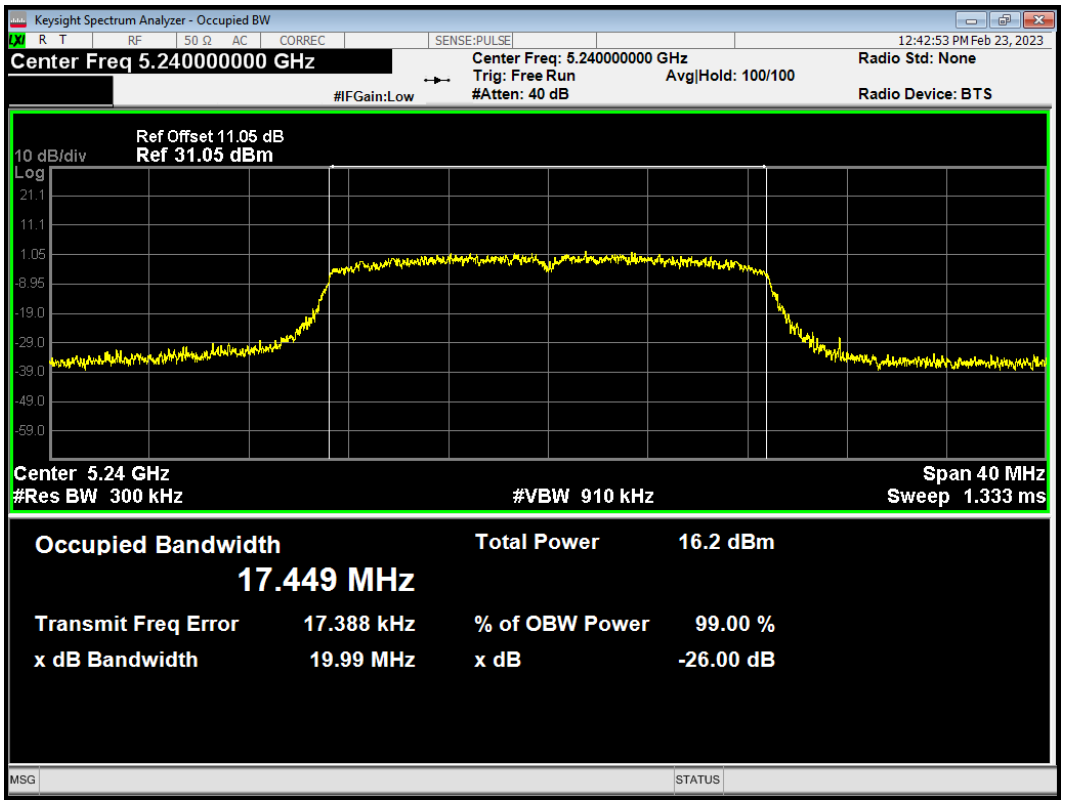
OBW 802.11n (HT20) 5180MHz



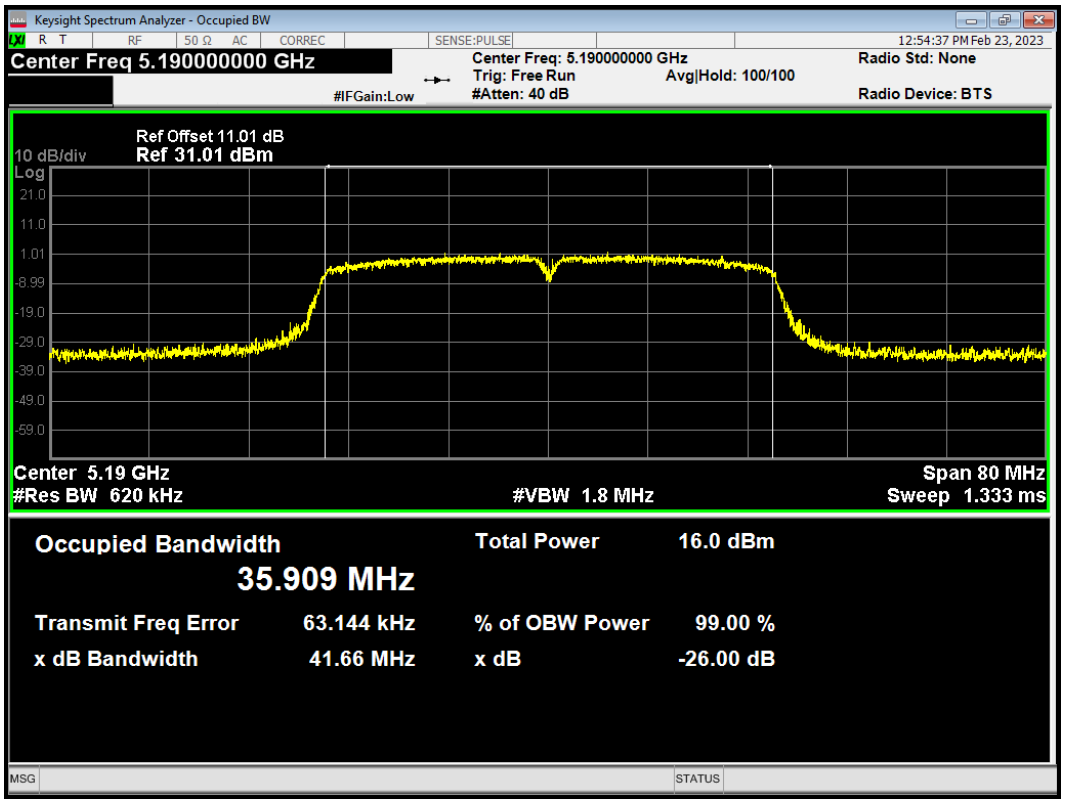
OBW 802.11n (HT20) 5200MHz



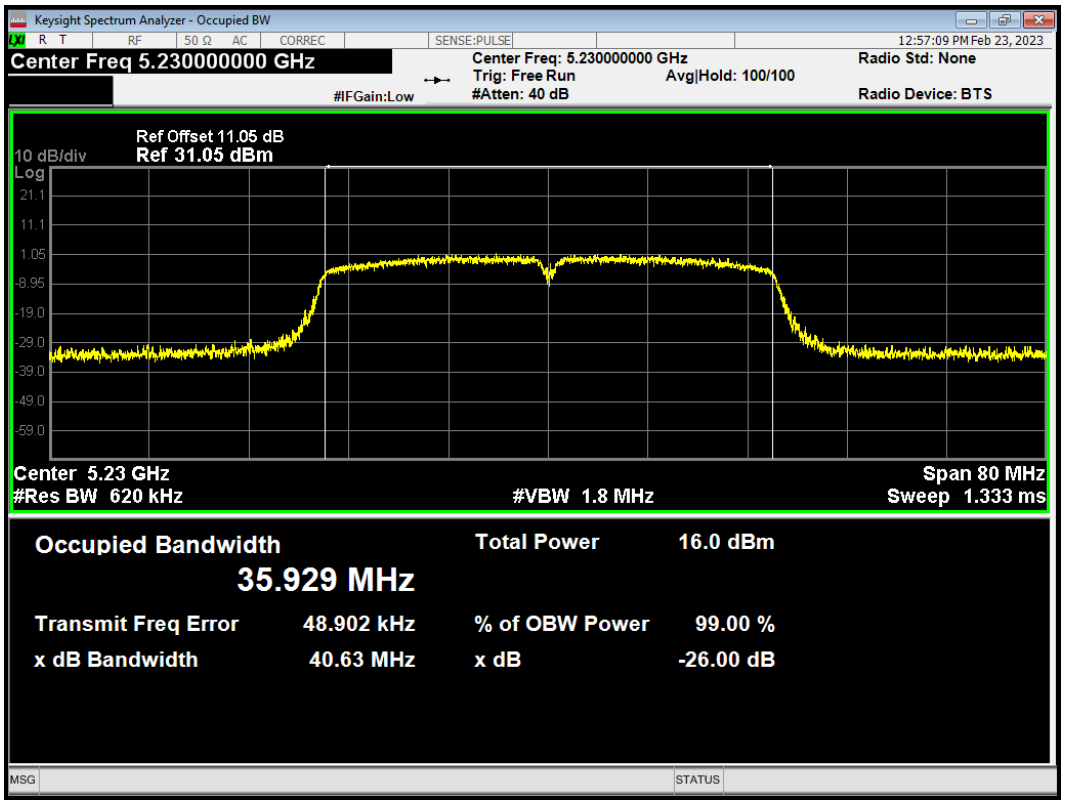
OBW 802.11n (HT20) 5240MHz



OBW 802.11n (HT40) 5190MHz

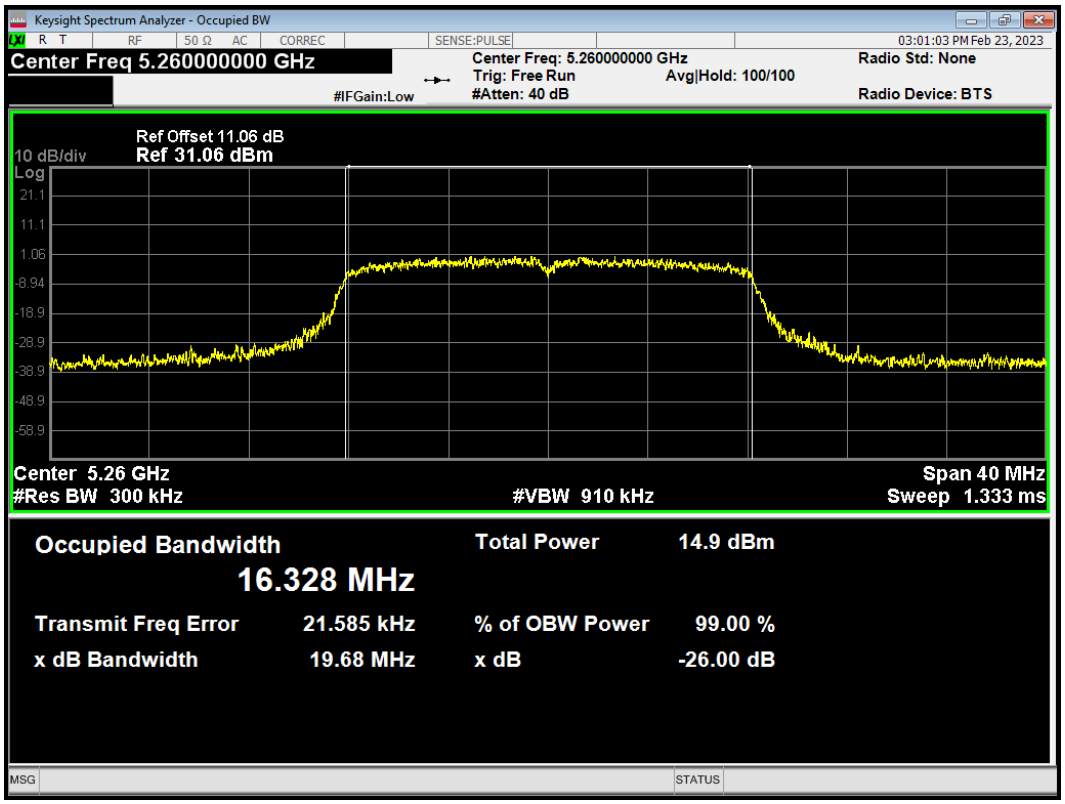


OBW 802.11n (HT40) 5230MHz

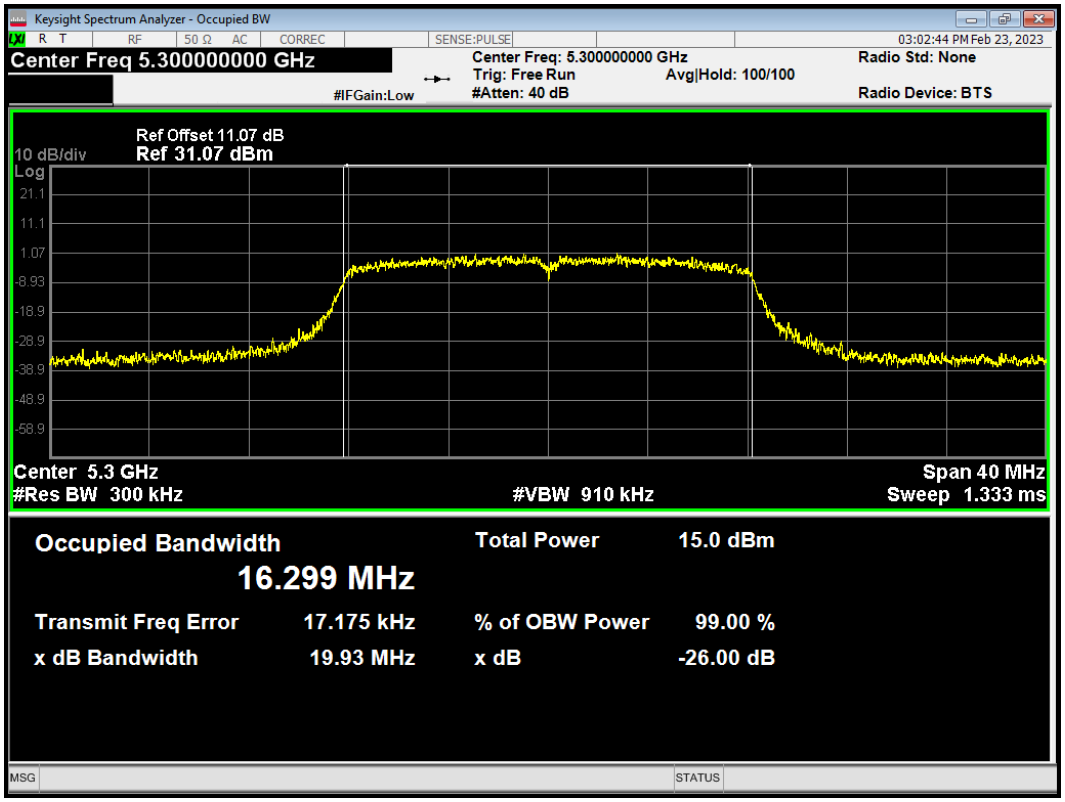


U-NII-2A

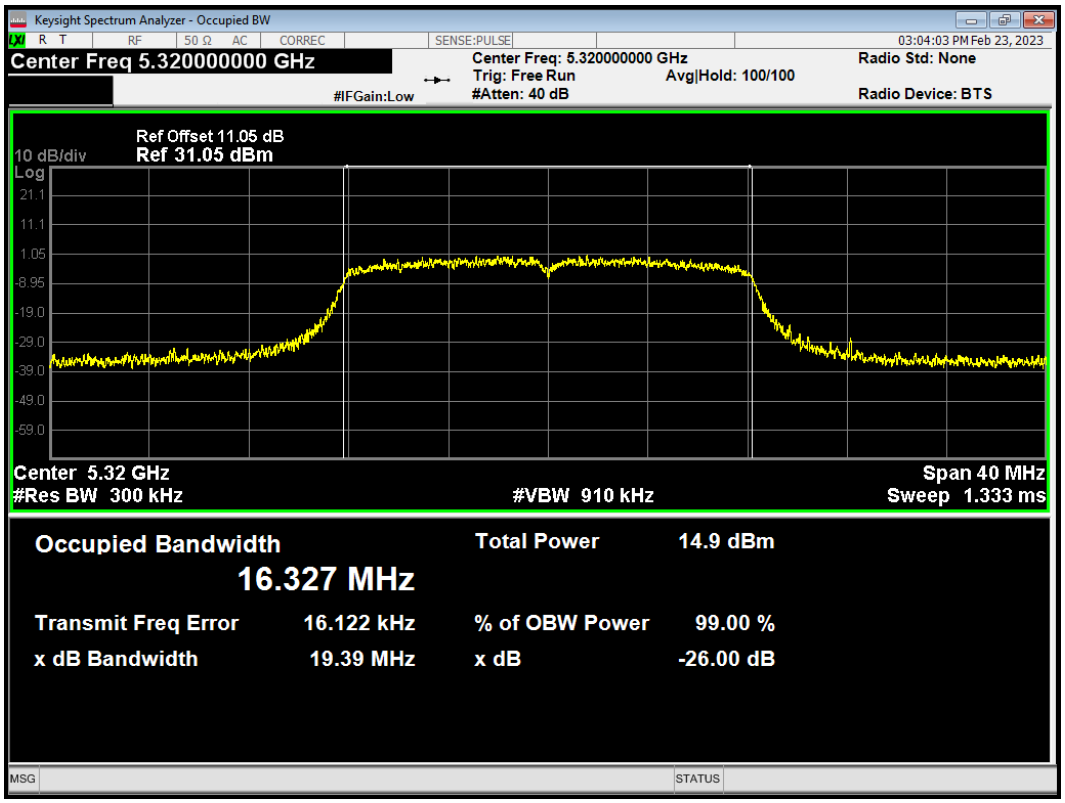
OBW 802.11a 5260MHz



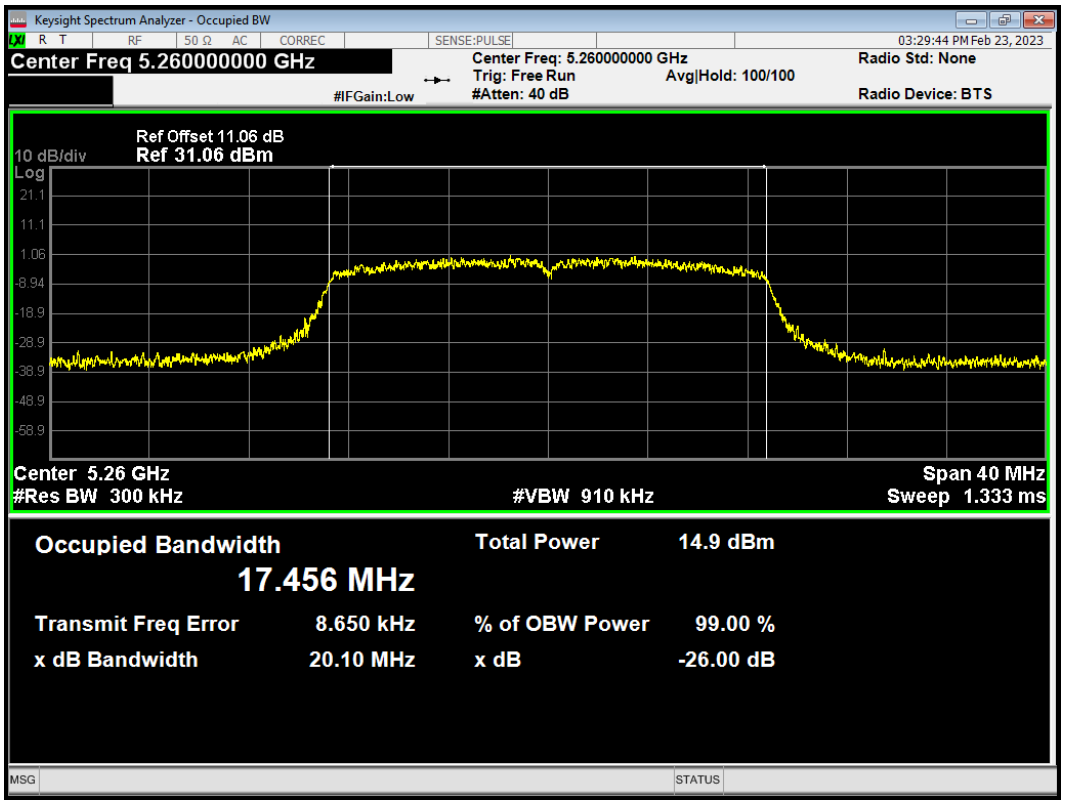
OBW 802.11a 5300MHz



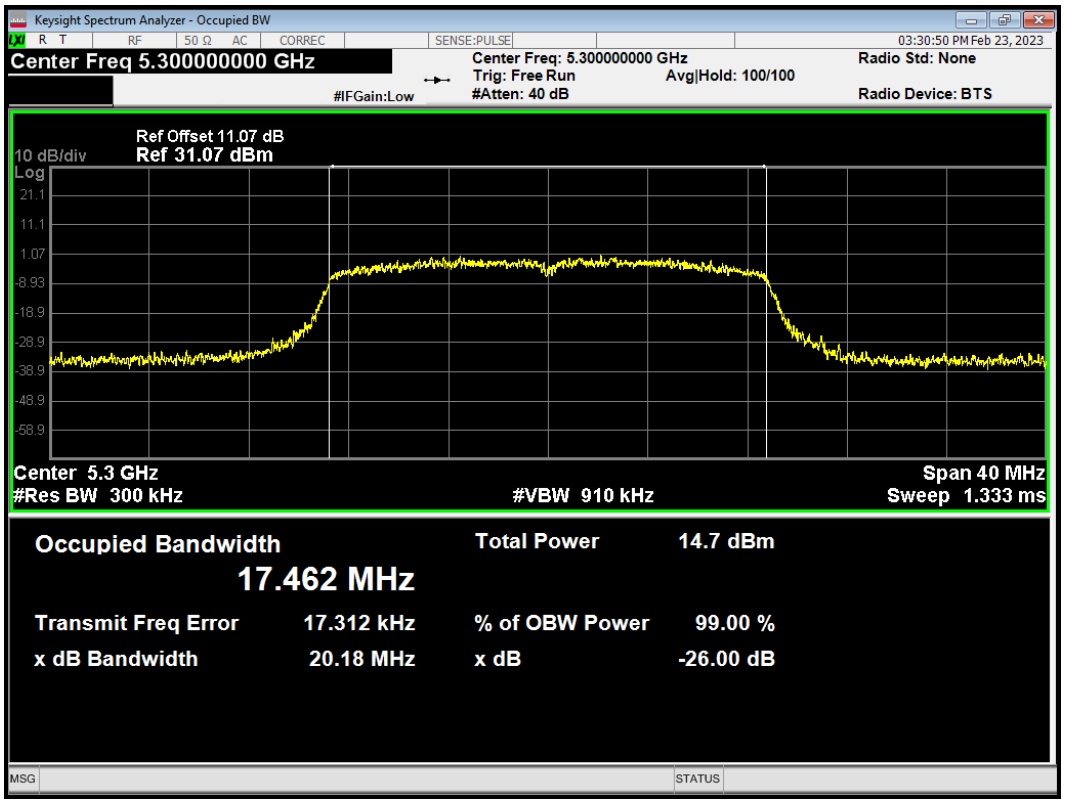
OBW 802.11a 5320MHz



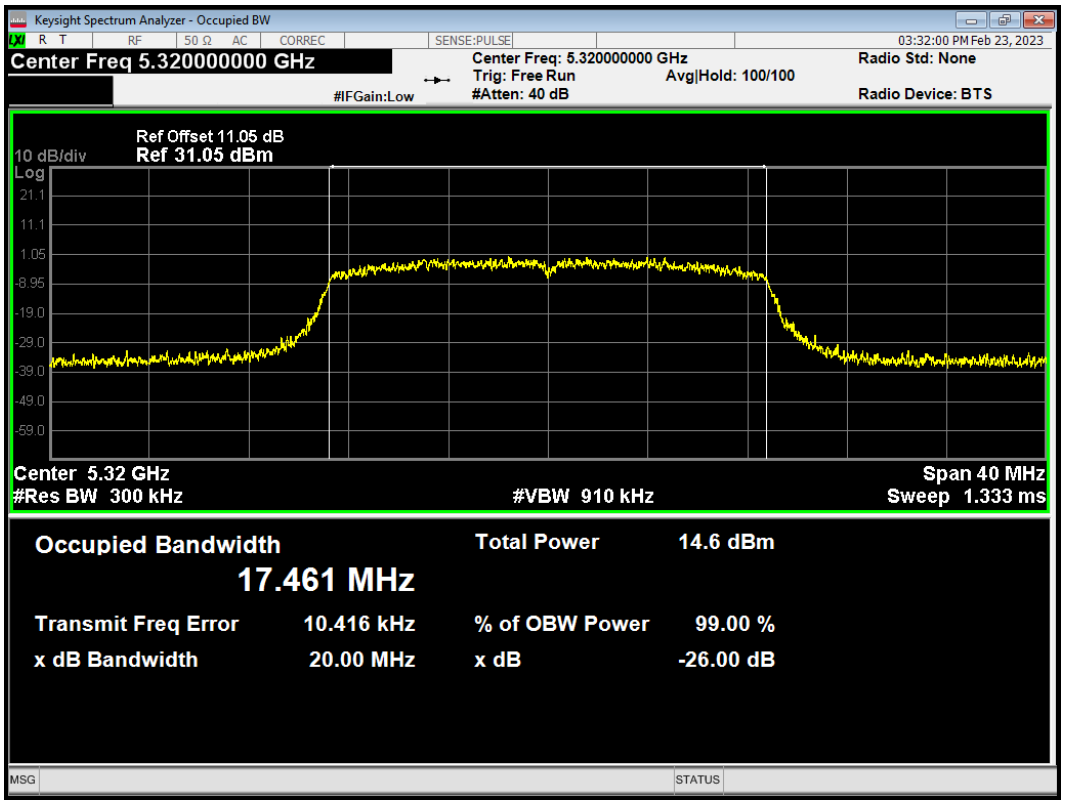
OBW 802.11ac (VHT20) 5260MHz



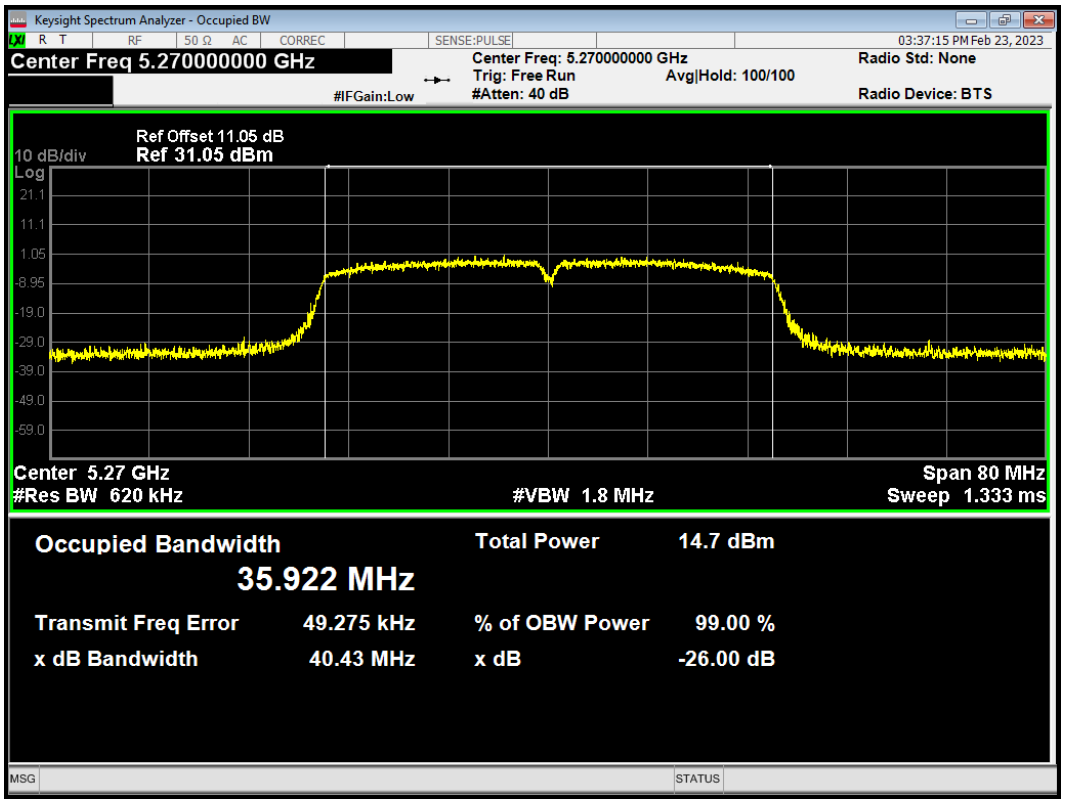
OBW 802.11ac (VHT20) 5300MHz



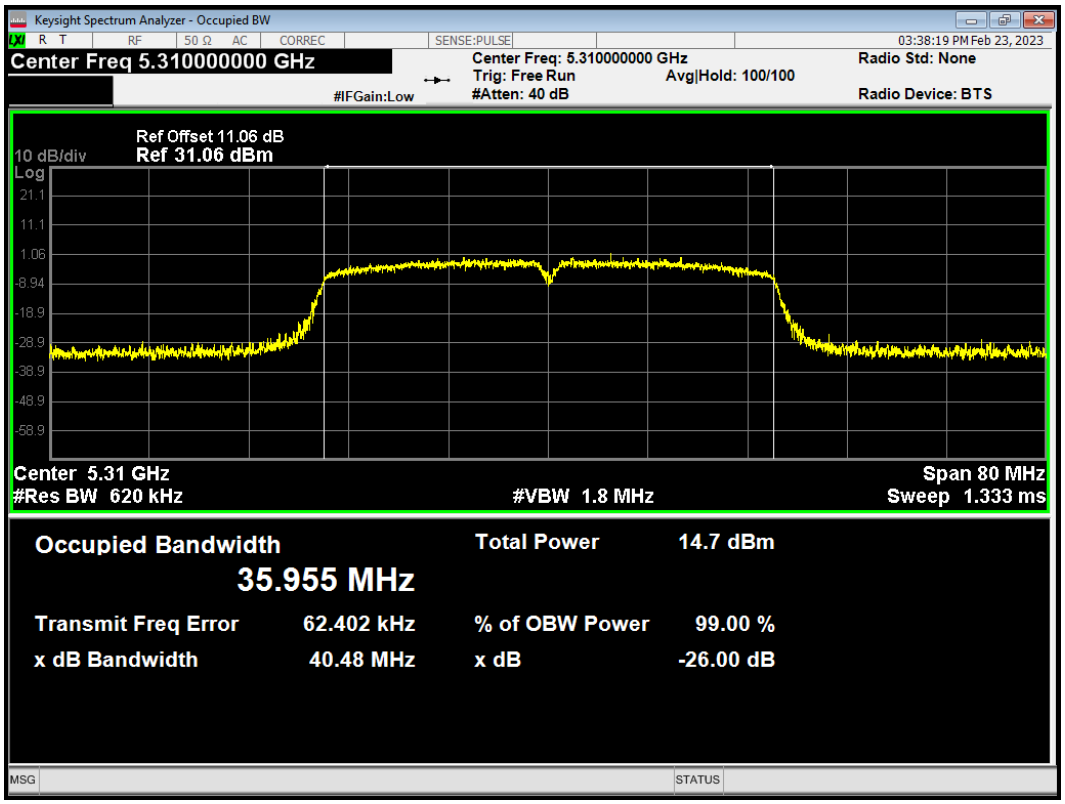
OBW 802.11ac (VHT20) 5320MHz



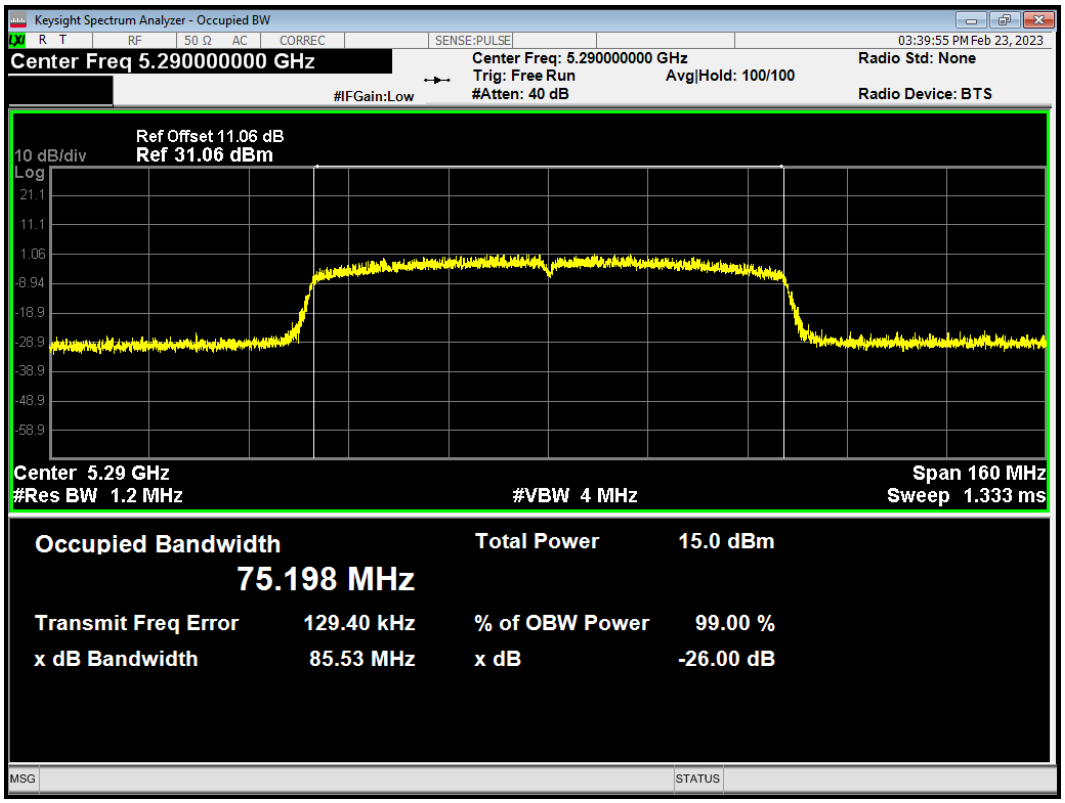
OBW 802.11ac (VHT40) 5270MHz



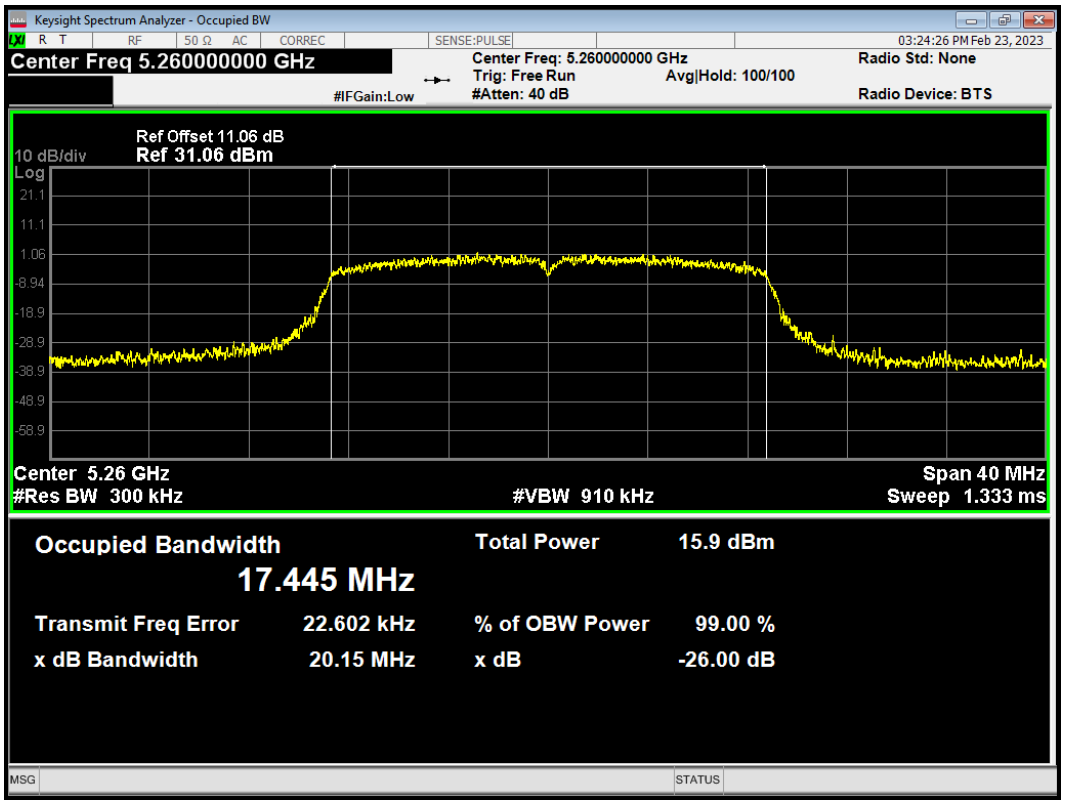
OBW 802.11ac (VHT40) 5310MHz



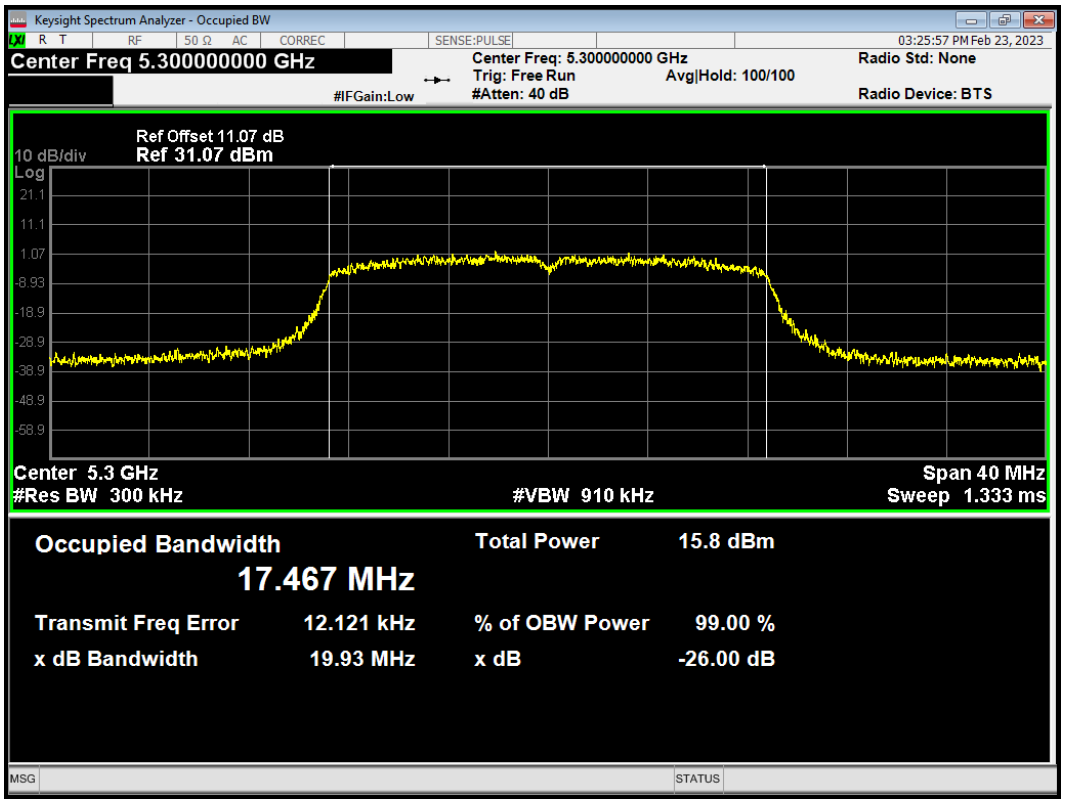
OBW 802.11ac (VHT80) 5290MHz



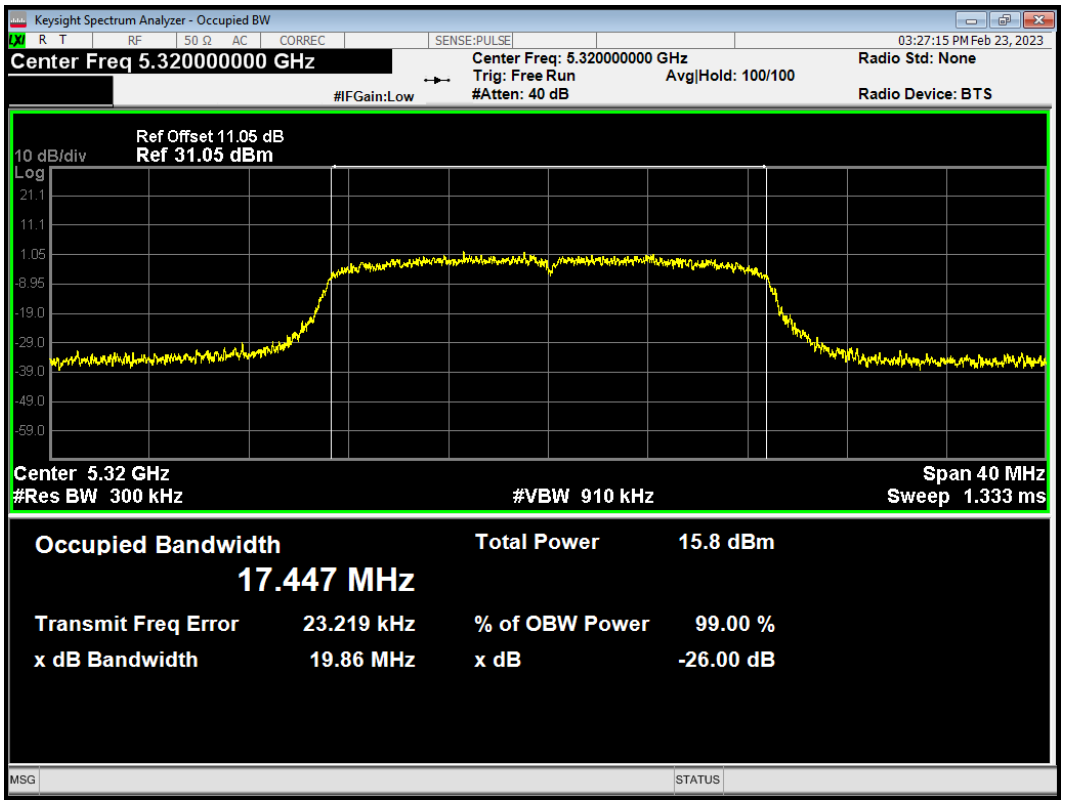
OBW 802.11n (HT20) 5260MHz



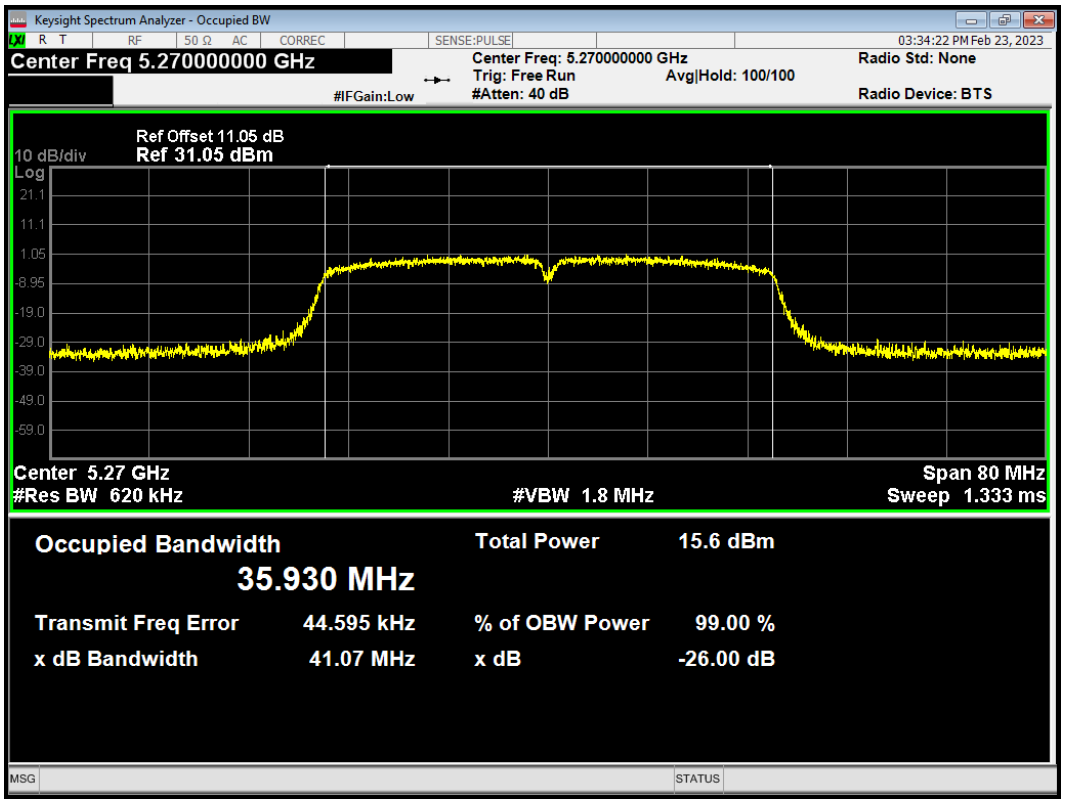
OBW 802.11n (HT20) 5300MHz



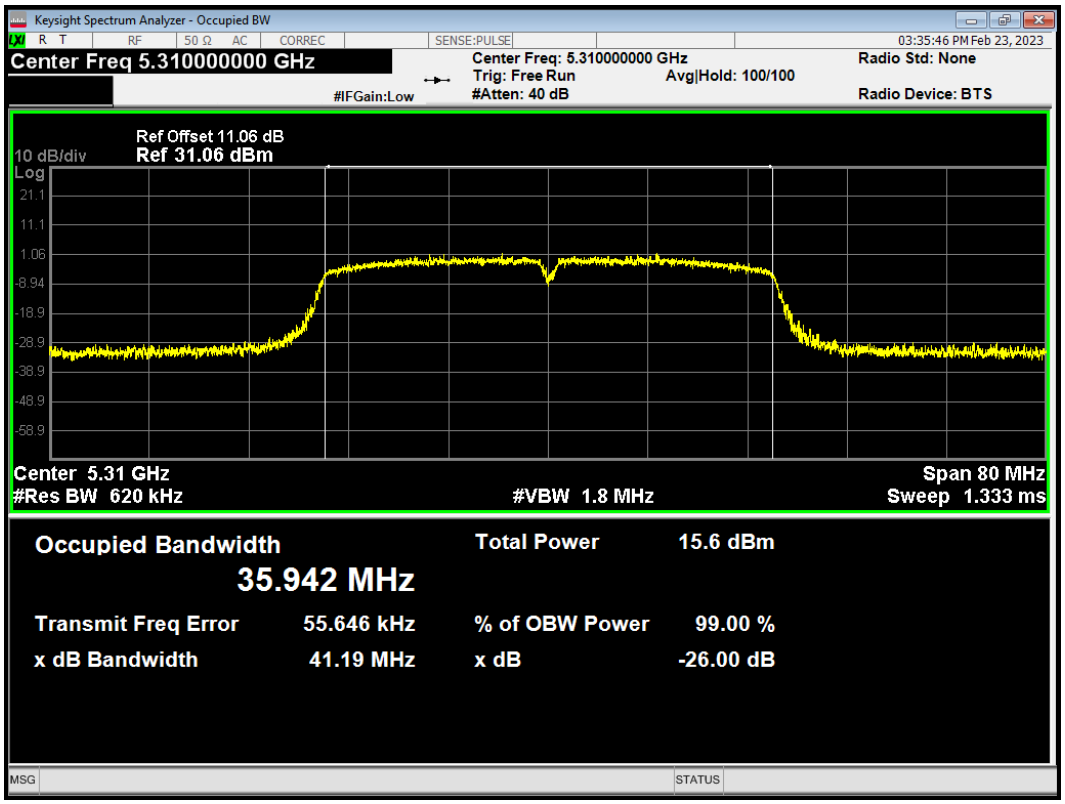
OBW 802.11n (HT20) 5320MHz



OBW 802.11n (HT40) 5270MHz

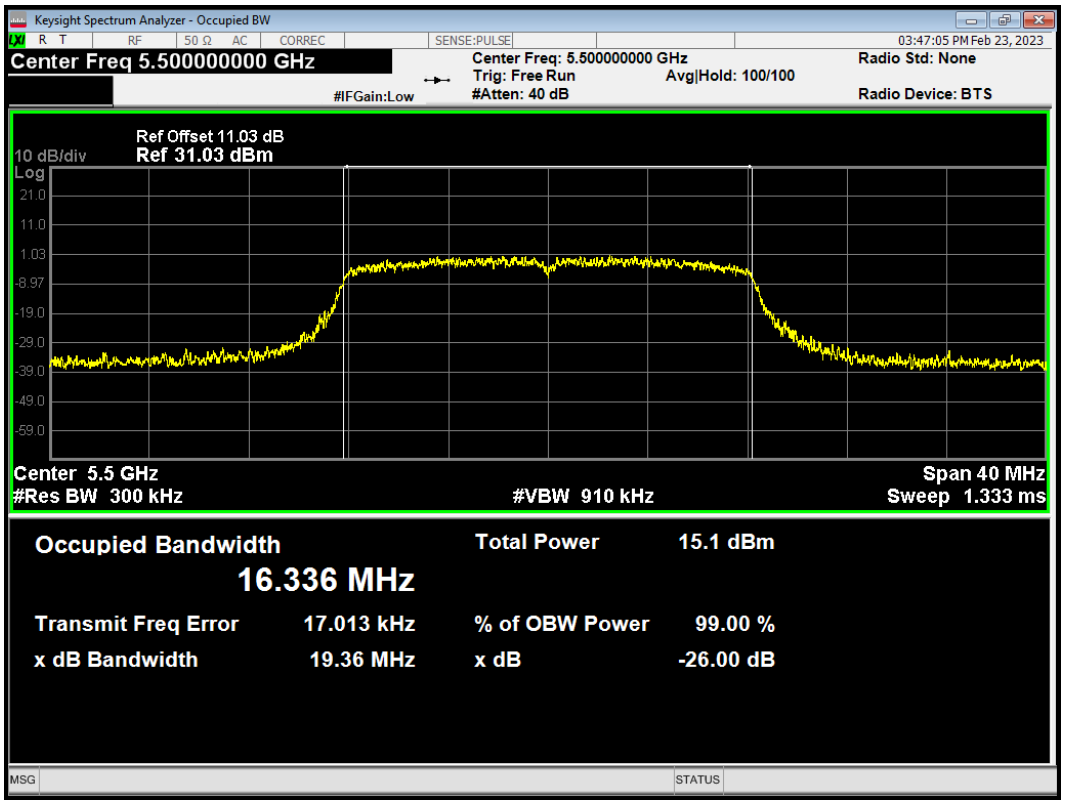


OBW 802.11n (HT40) 5310MHz

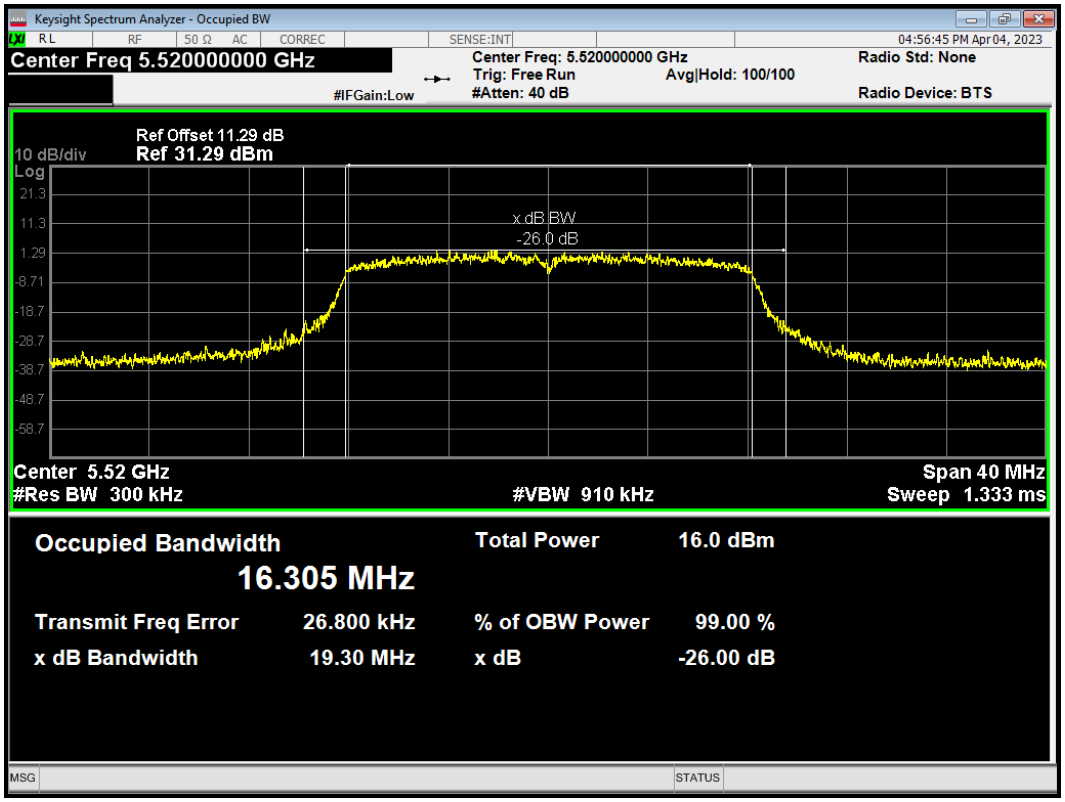


U-NII-2C

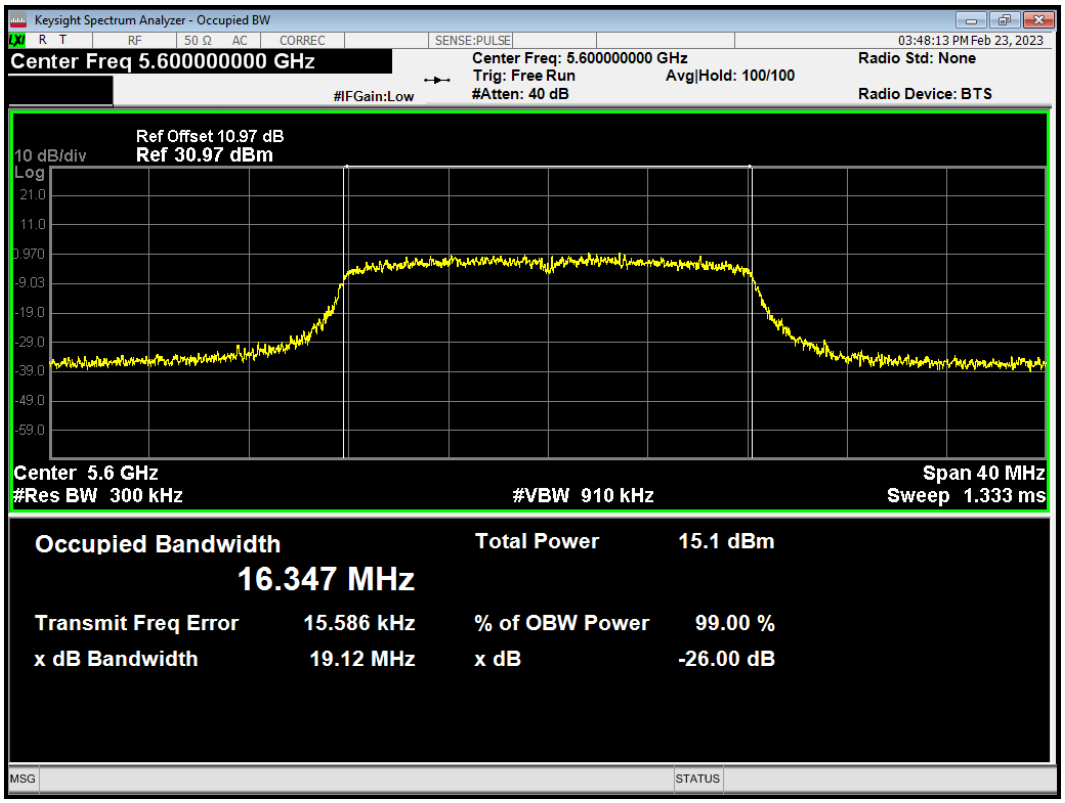
OBW 802.11a 5500MHz



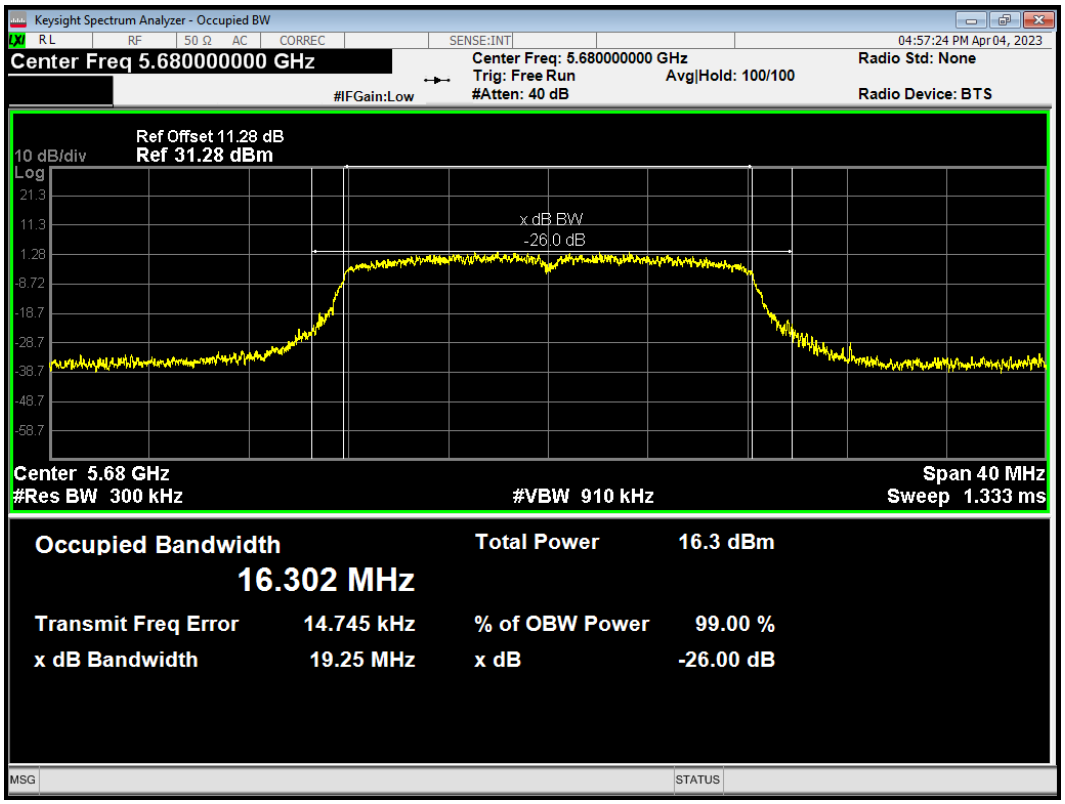
OBW 802.11a 5520MHz



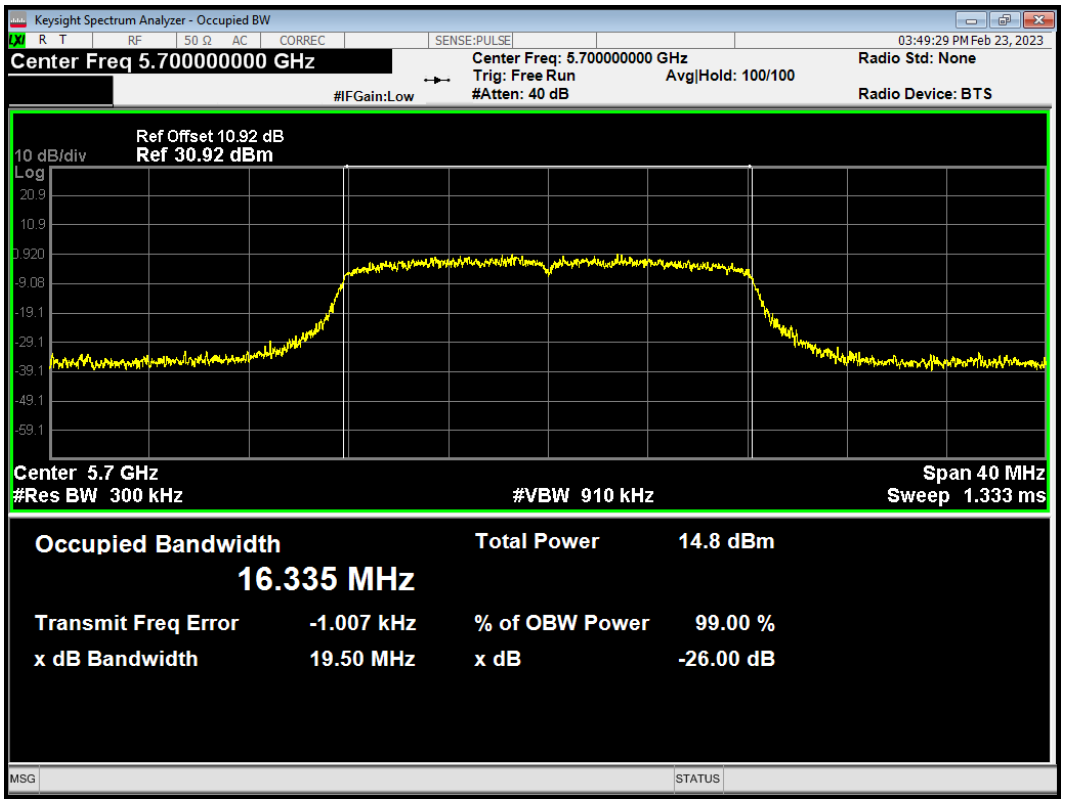
OBW 802.11a 5600MHz



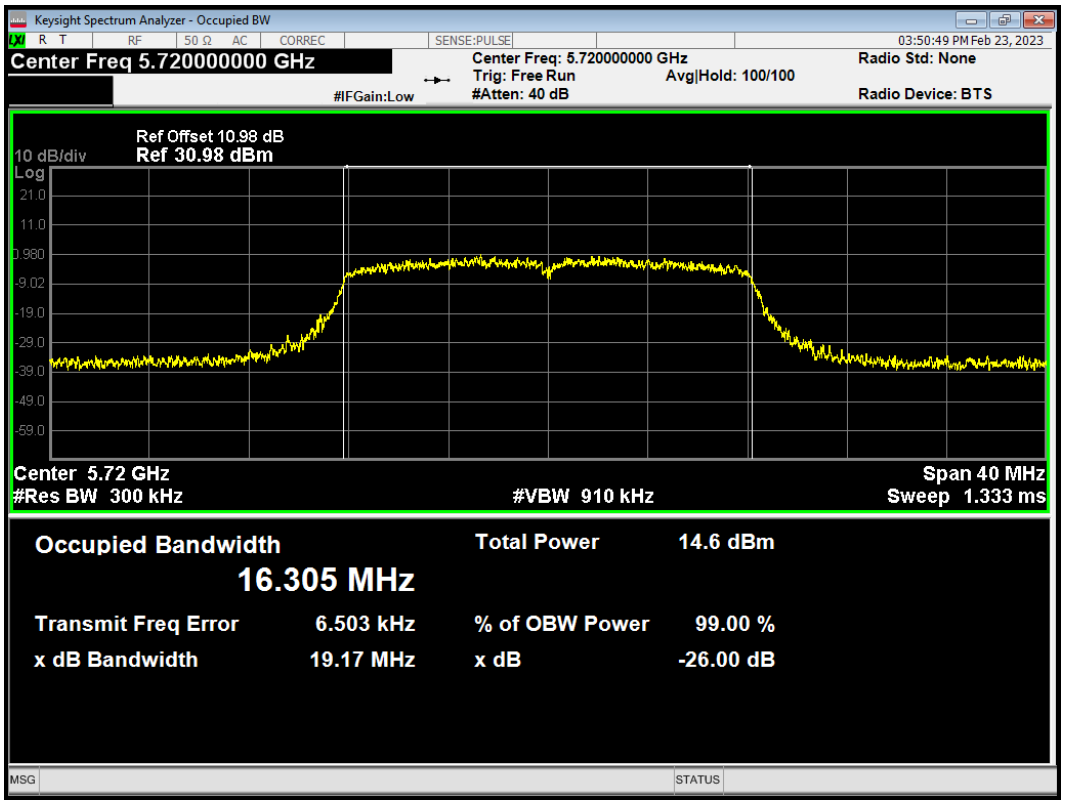
OBW 802.11a 5680MHz



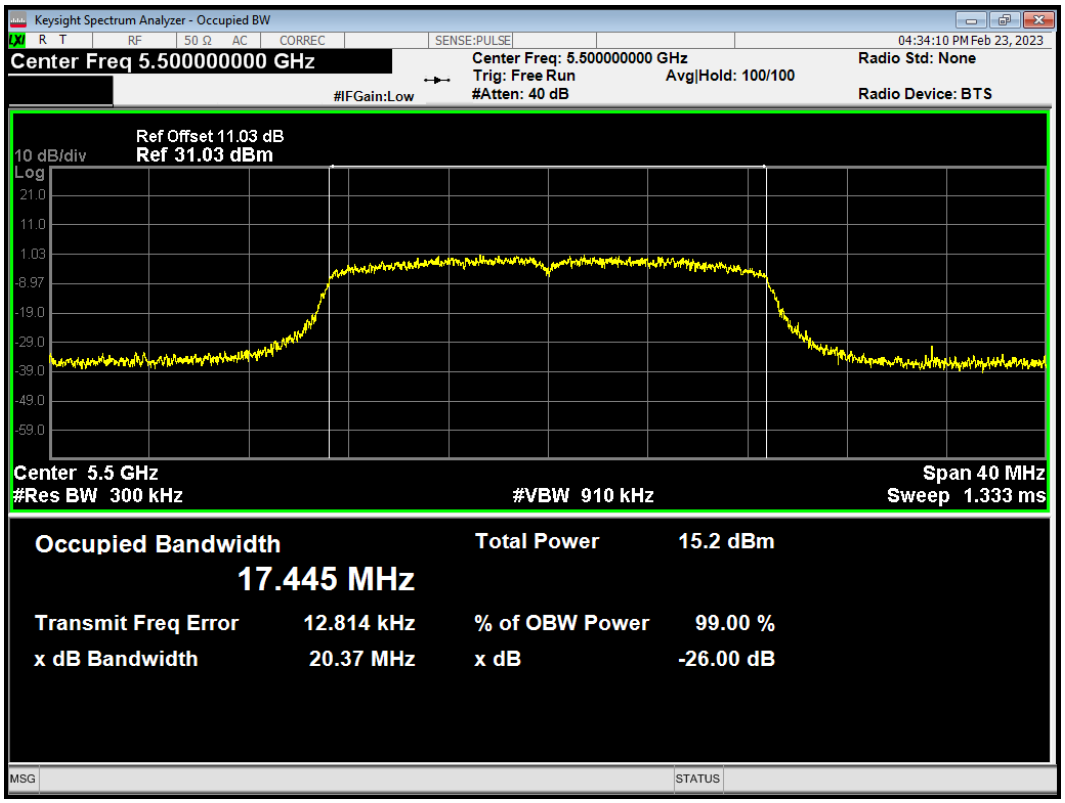
OBW 802.11a 5700MHz



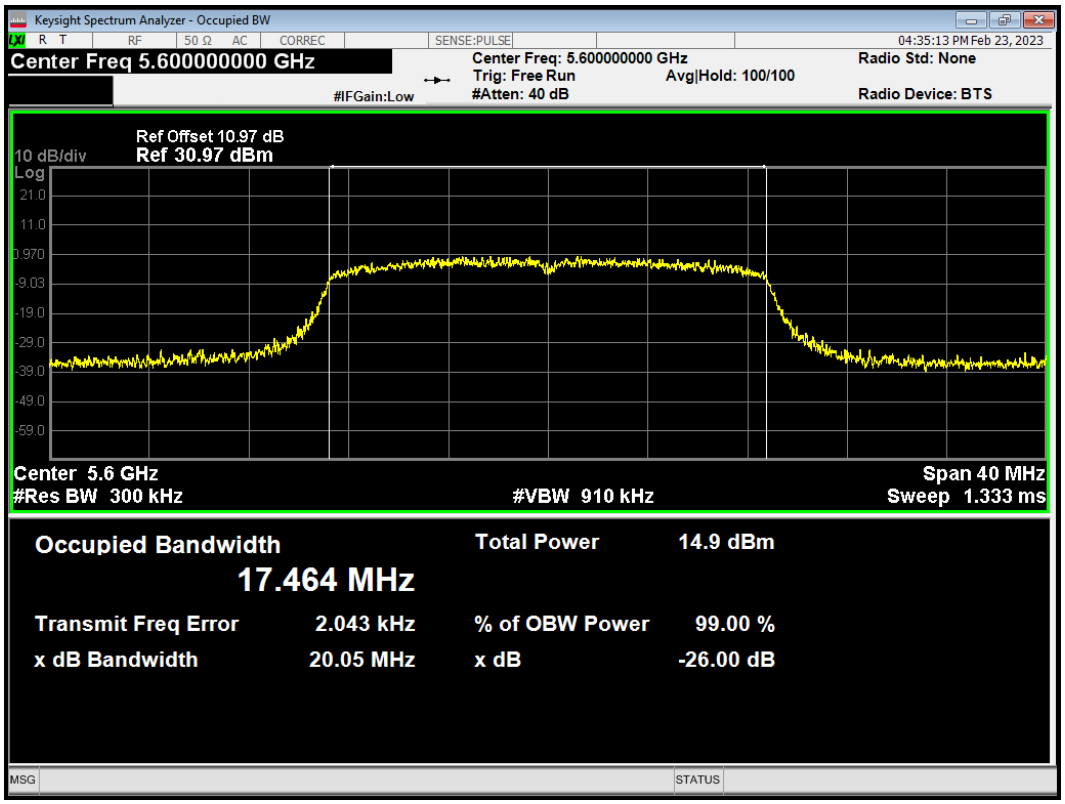
OBW 802.11a 5720MHz



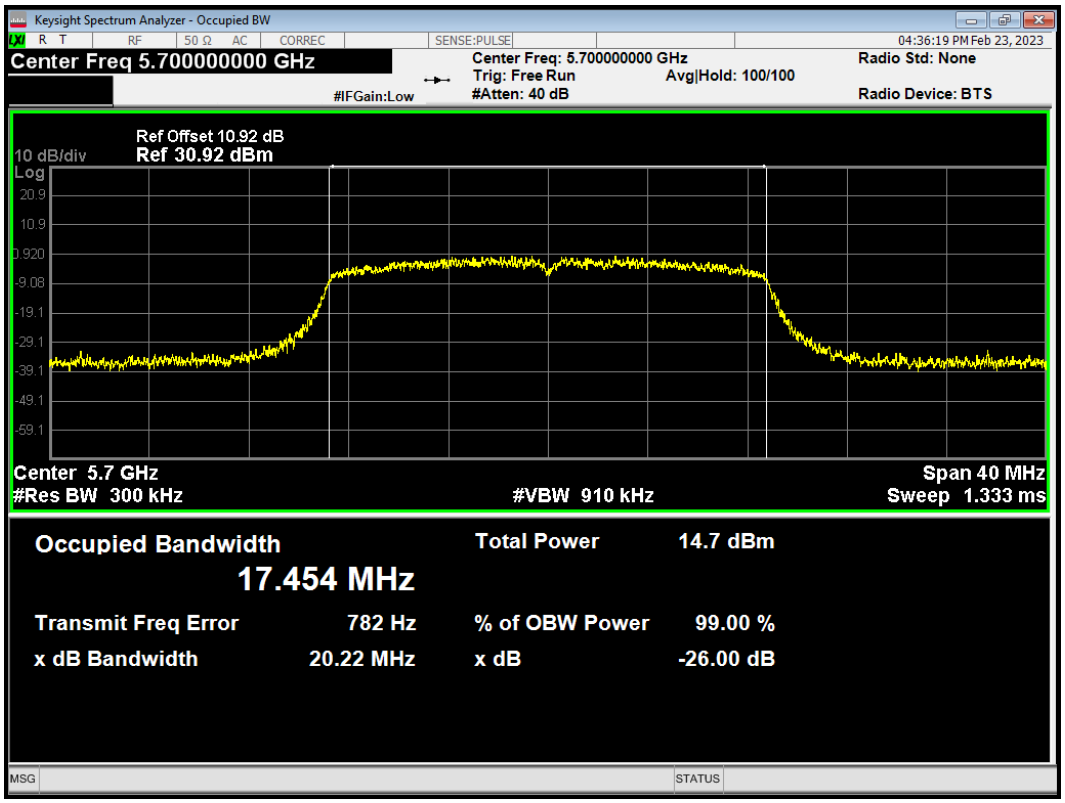
OBW 802.11ac (VHT20) 5500MHz



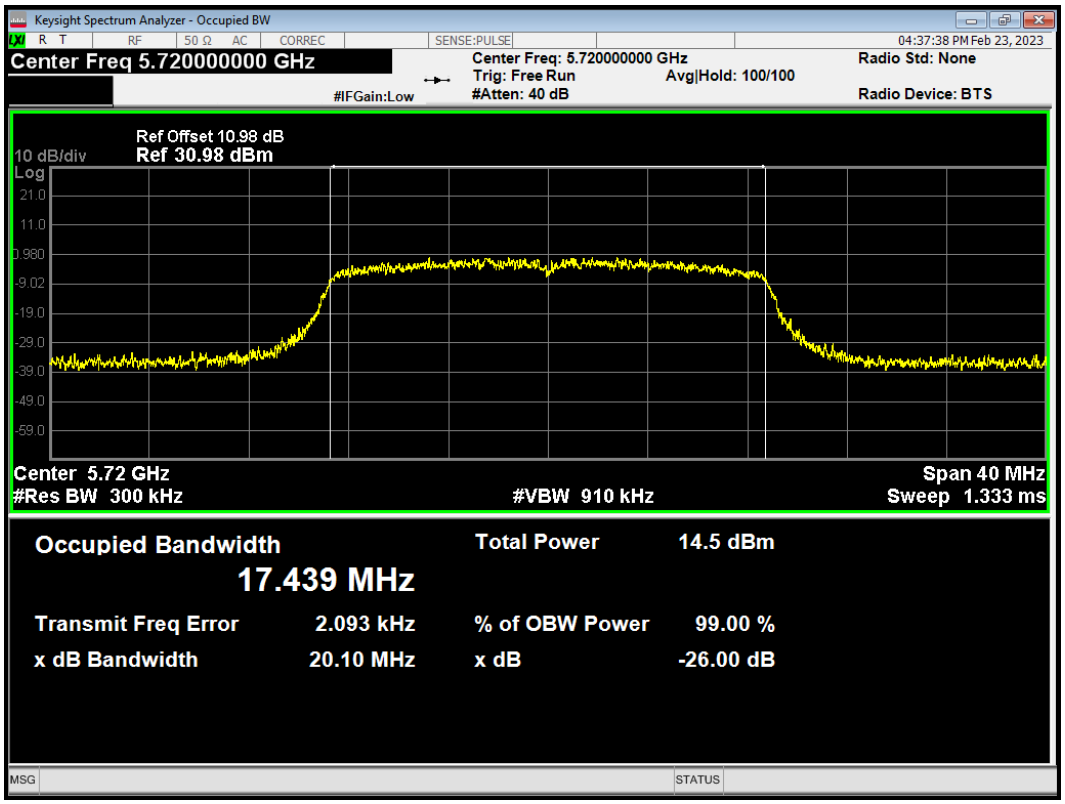
OBW 802.11ac (VHT20) 5600MHz



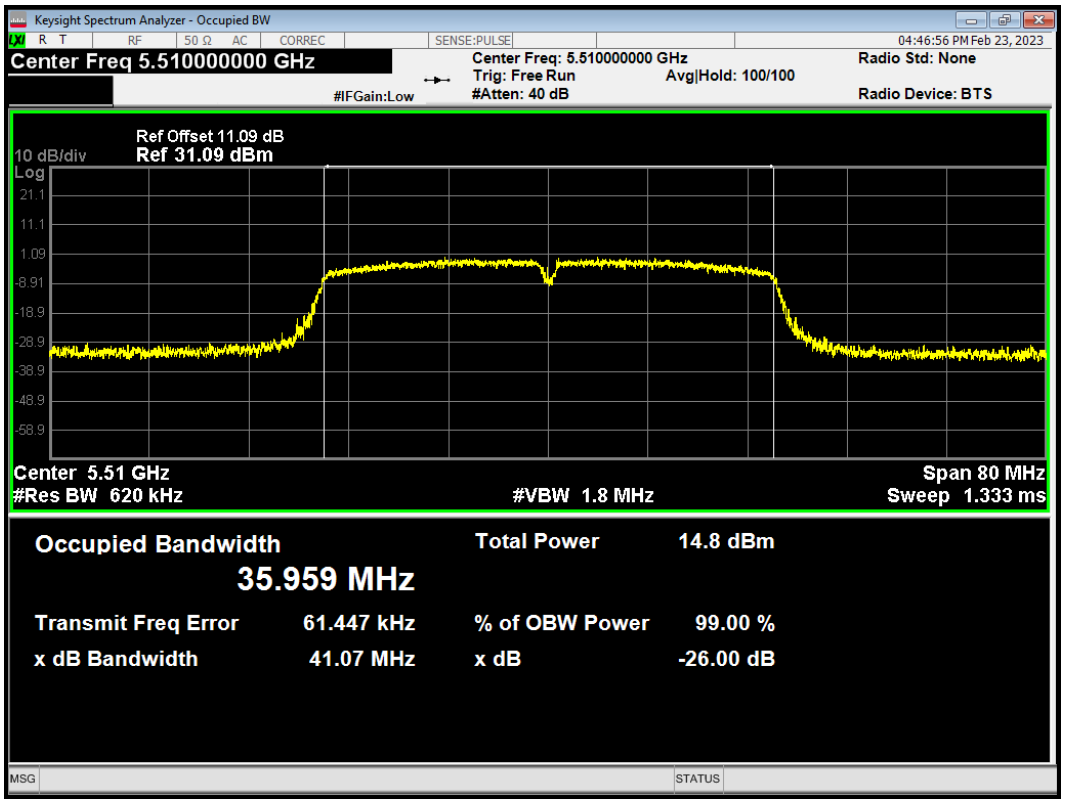
OBW 802.11ac (VHT20) 5700MHz



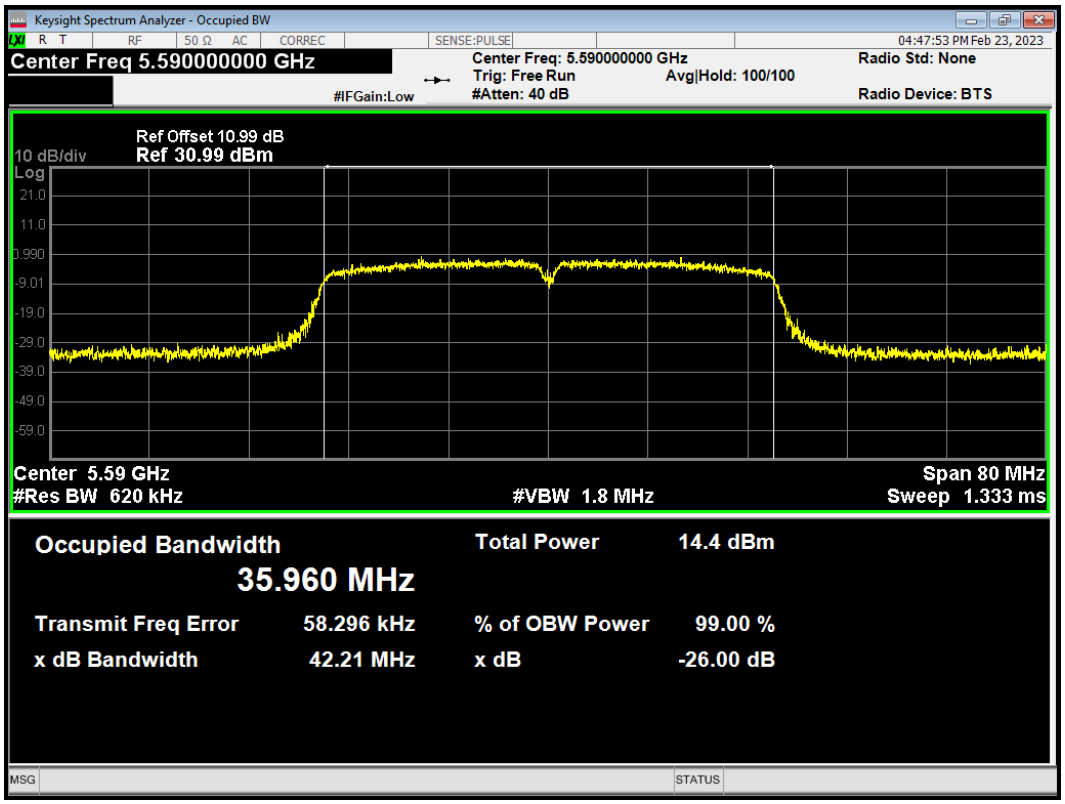
OBW 802.11ac (VHT20) 5720MHz



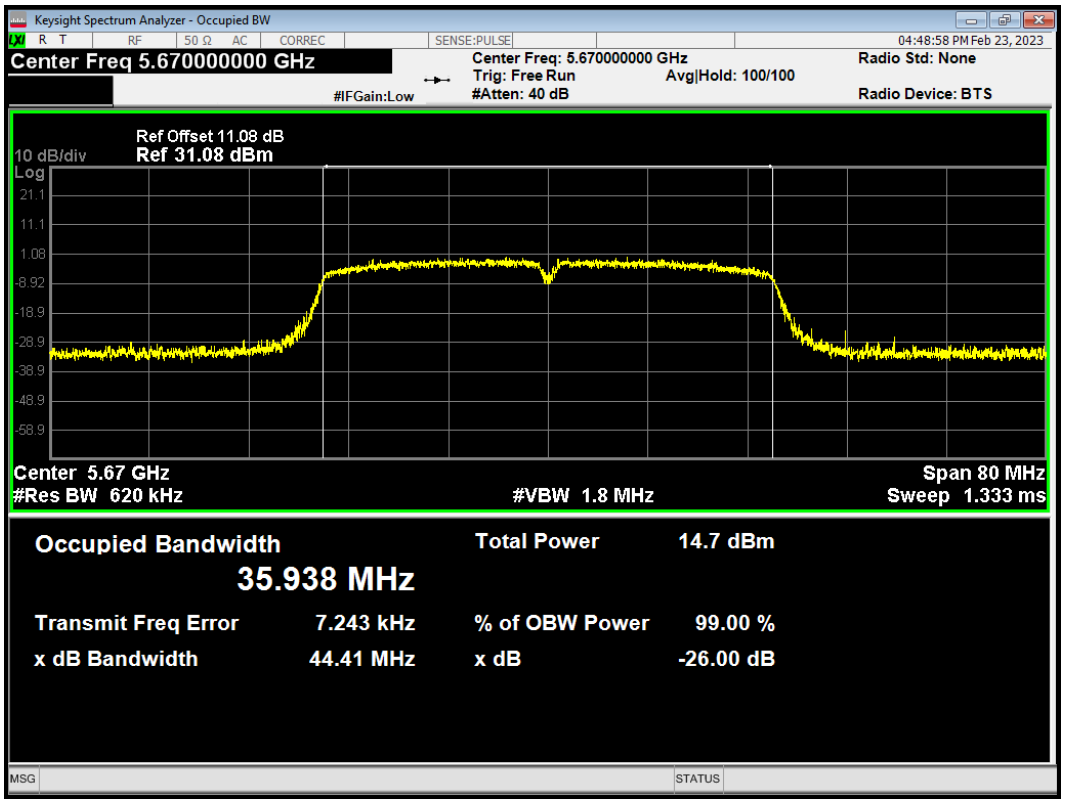
OBW 802.11ac (VHT40) 5510MHz



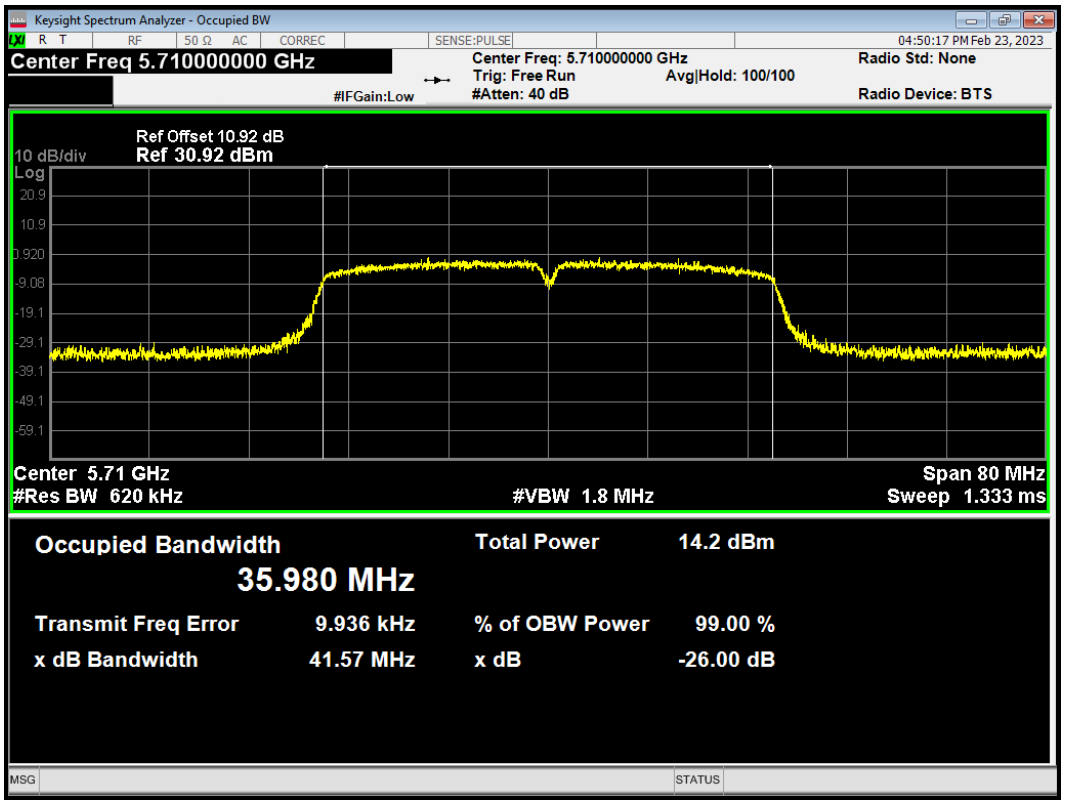
OBW 802.11ac (VHT40) 5590MHz



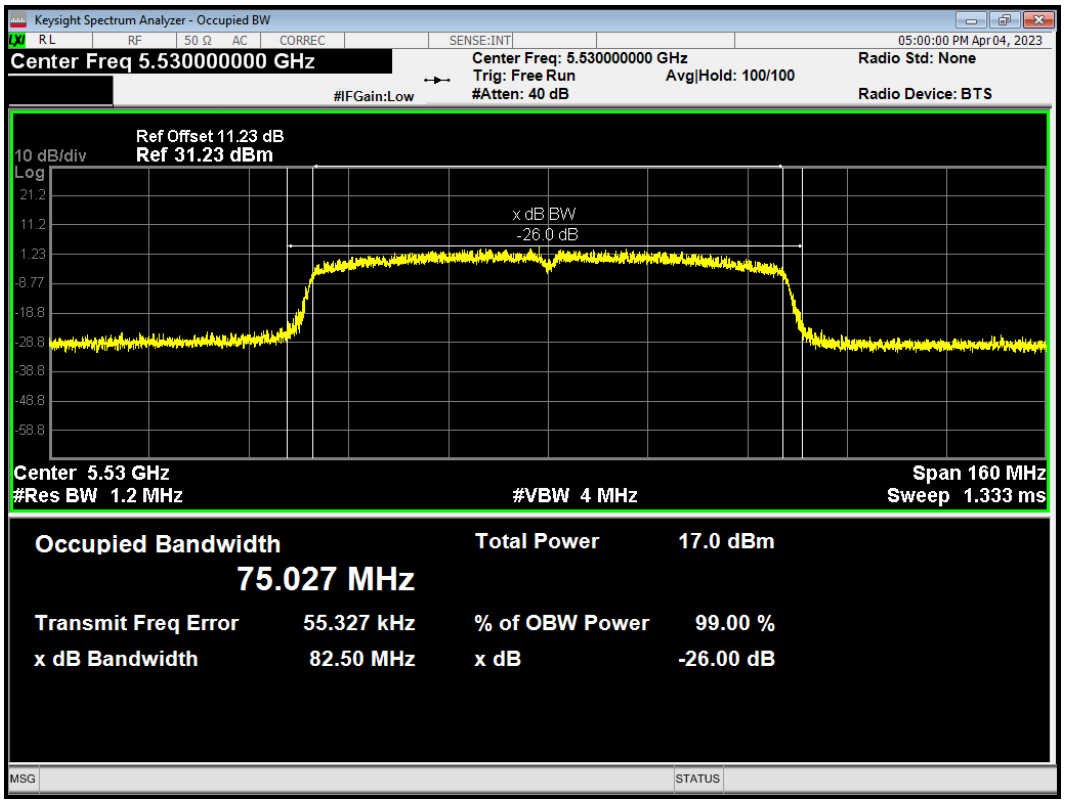
OBW 802.11ac (VHT40) 5670MHz



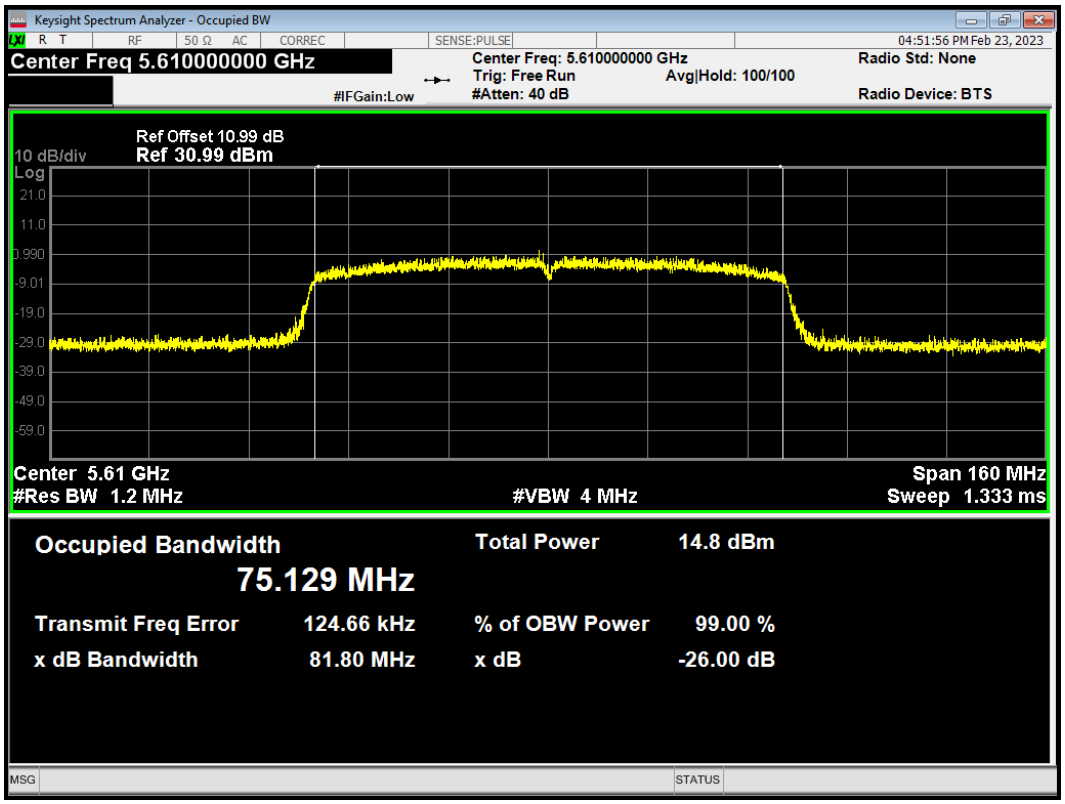
OBW 802.11ac (VHT40) 5710MHz



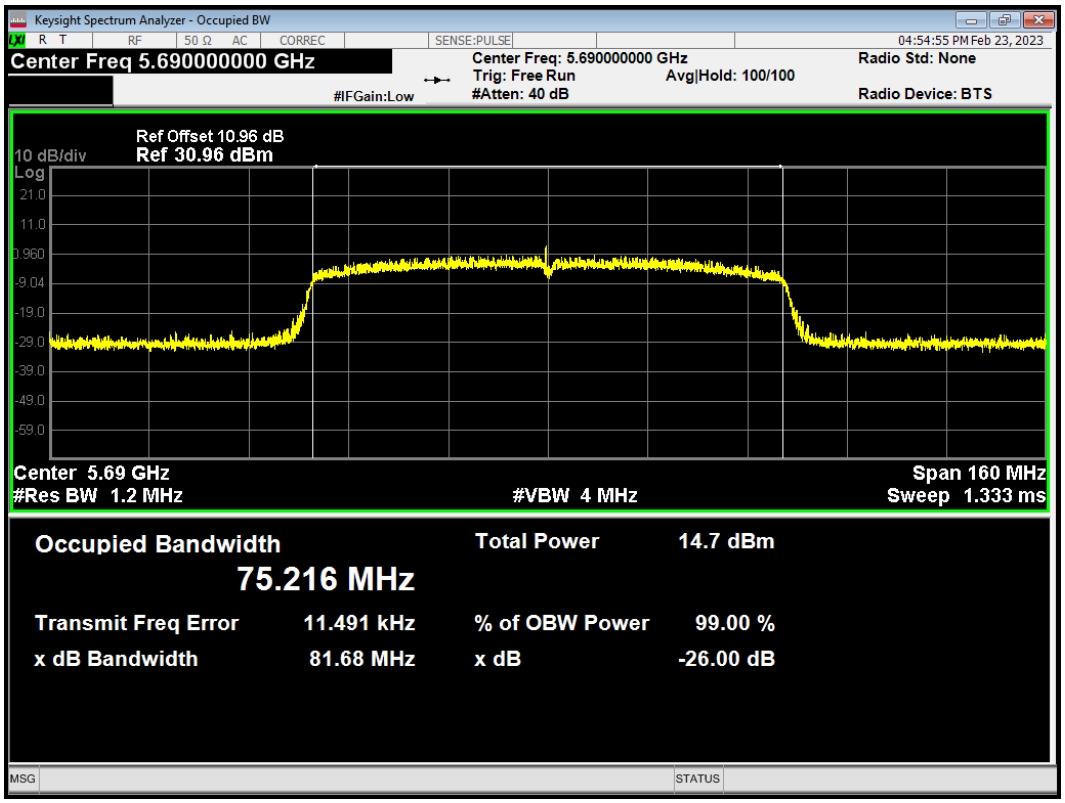
OBW 802.11ac (VHT80) 5530MHz



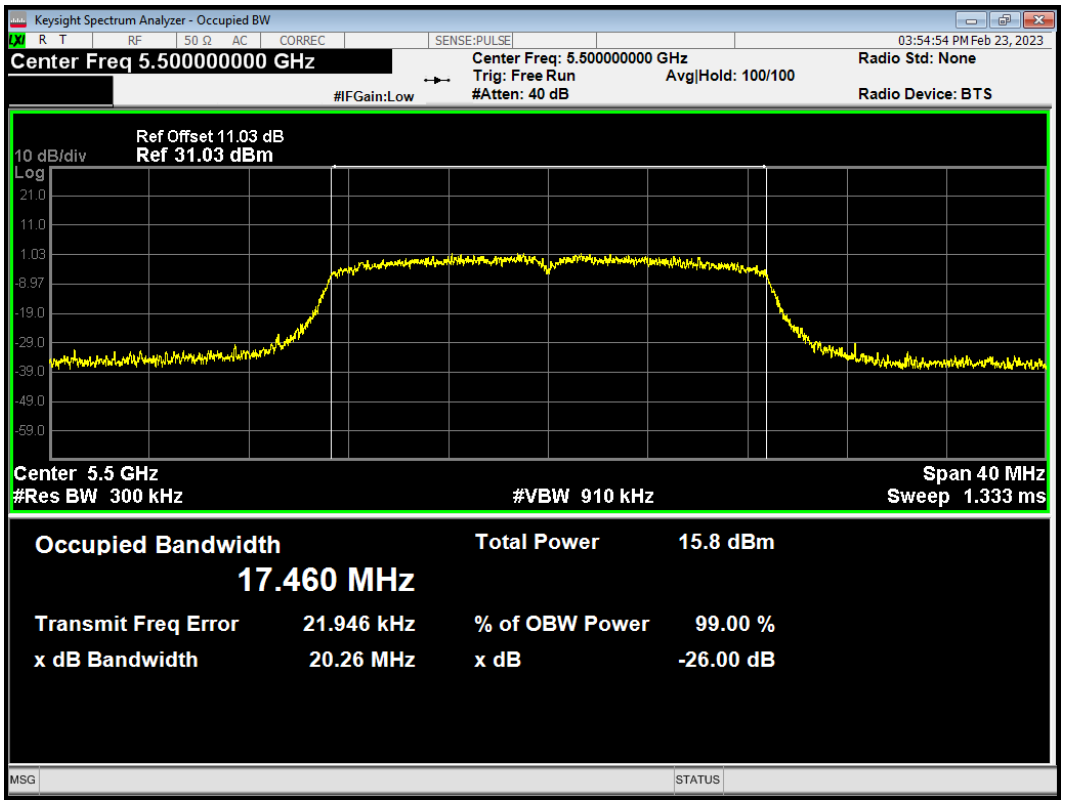
OBW 802.11ac (VHT80) 5610MHz



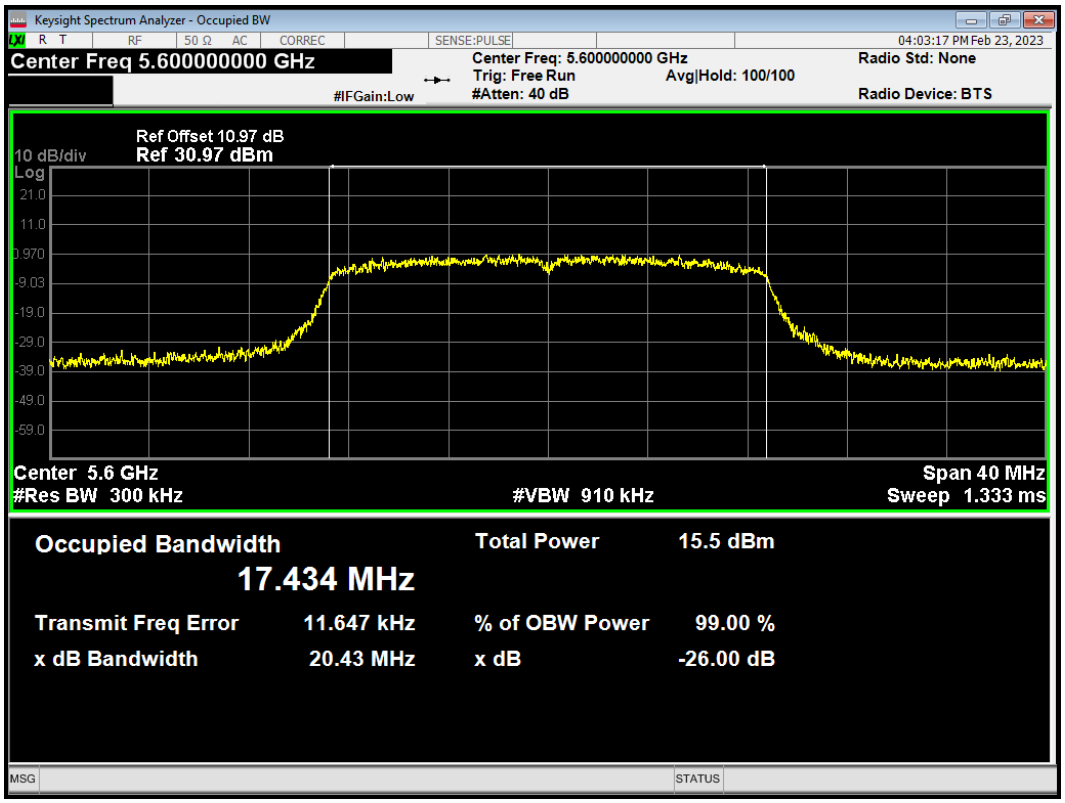
OBW 802.11ac (VHT80) 5690MHz



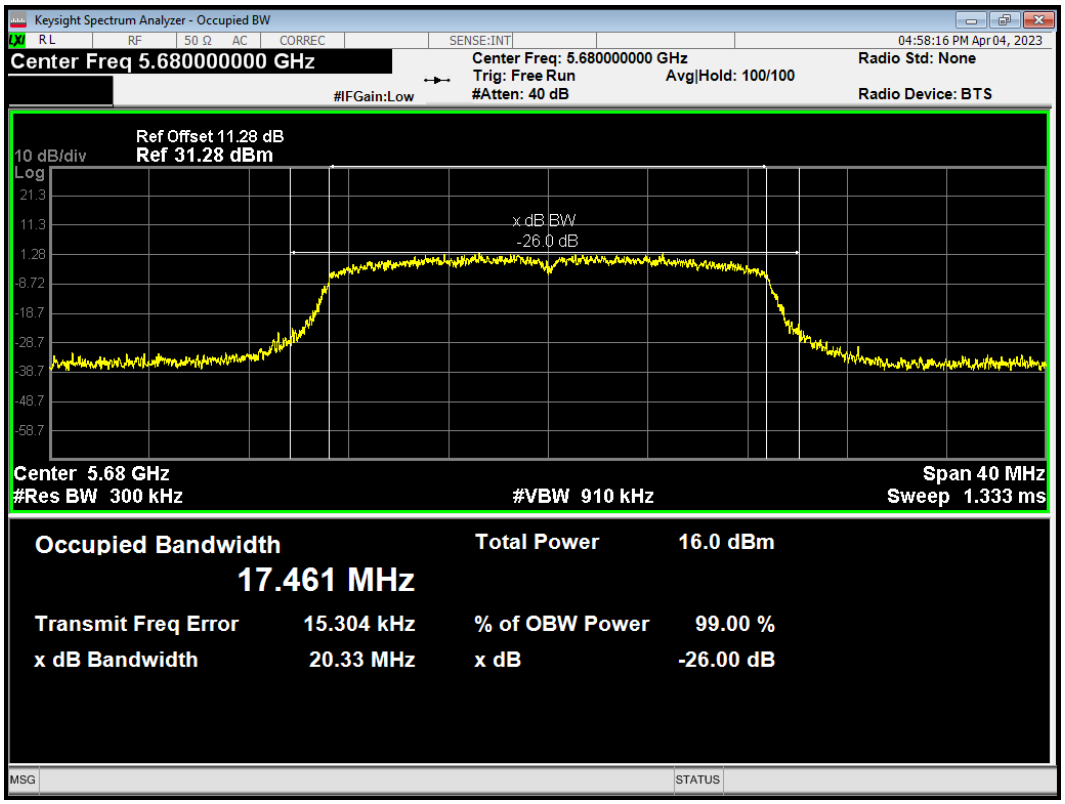
OBW 802.11n (HT20) 5500MHz



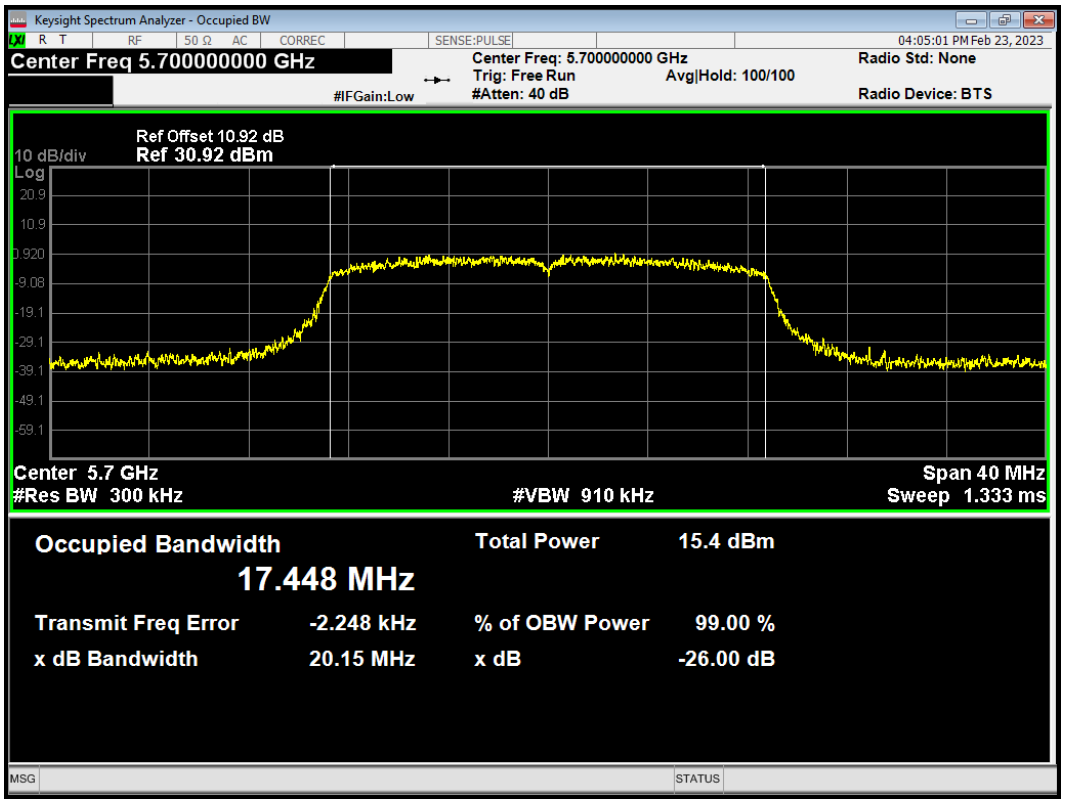
OBW 802.11n (HT20) 5600MHz



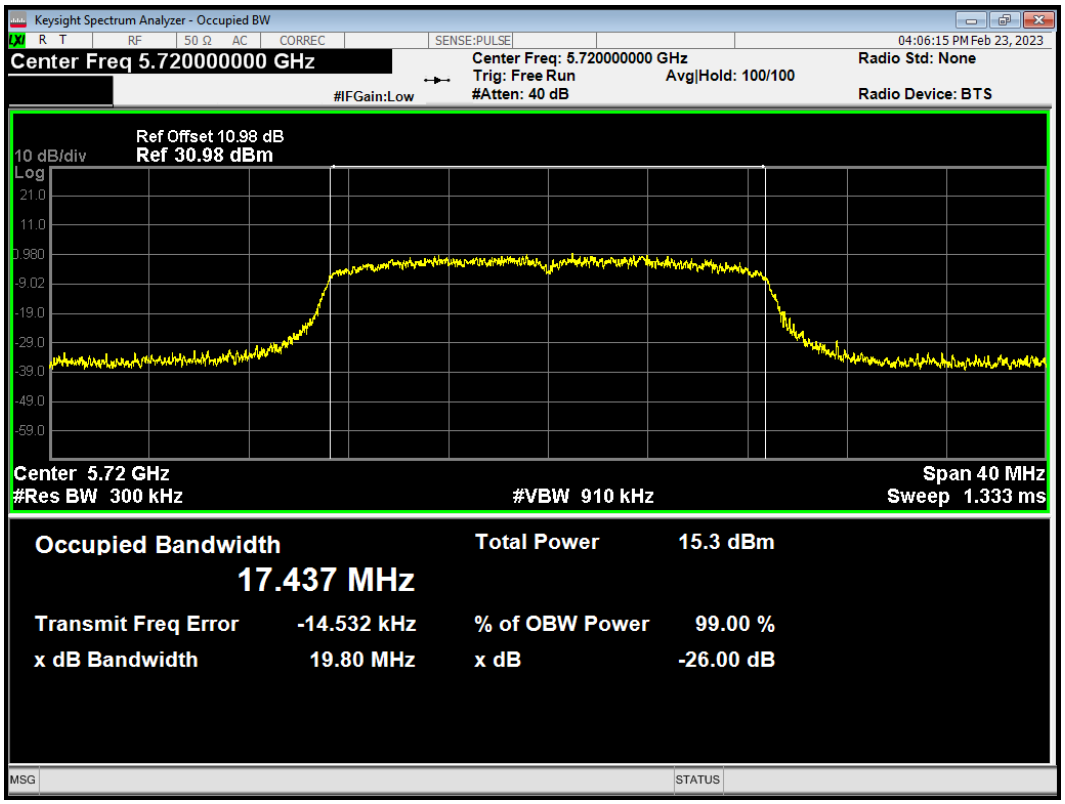
OBW 802.11n (HT20) 5680MHz



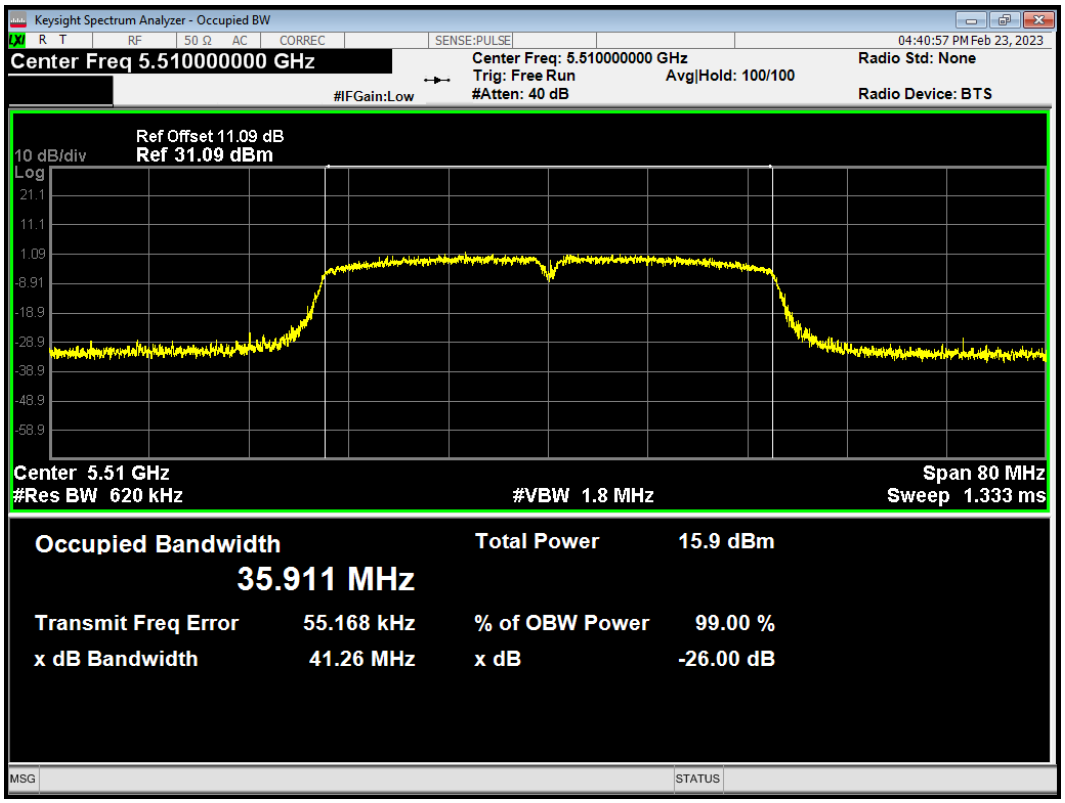
OBW 802.11n (HT20) 5700MHz



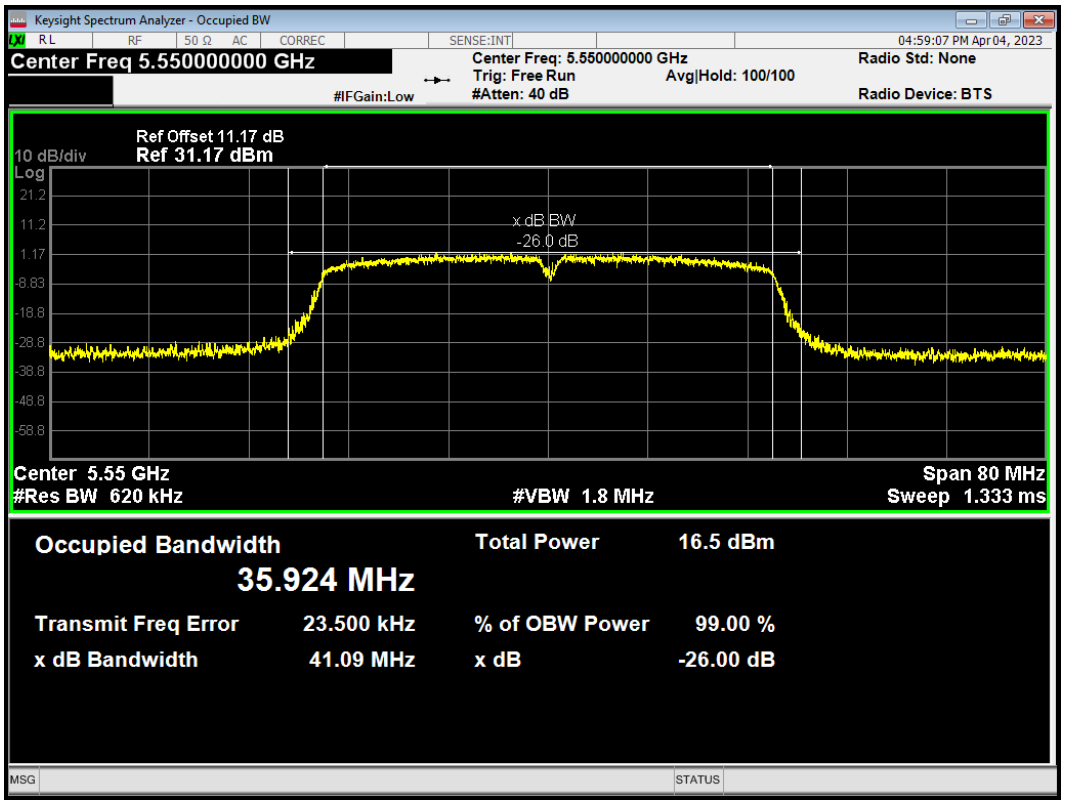
OBW 802.11n (HT20) 5720MHz



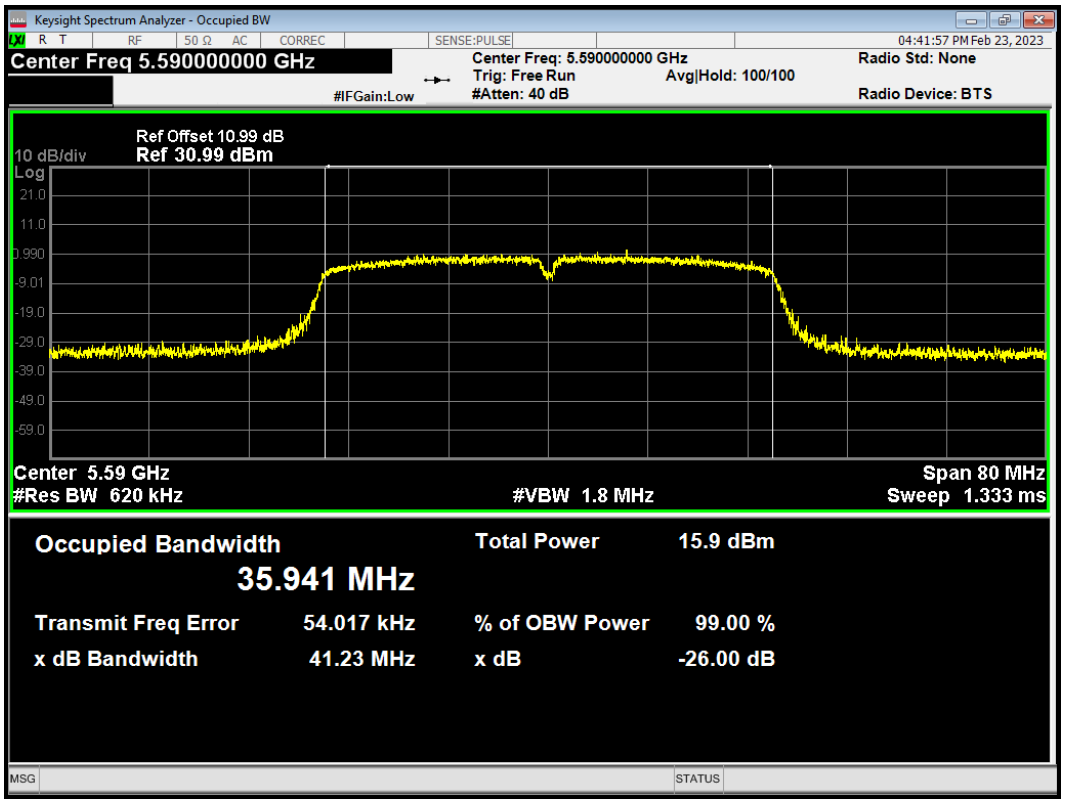
OBW 802.11n (HT40) 5510MHz



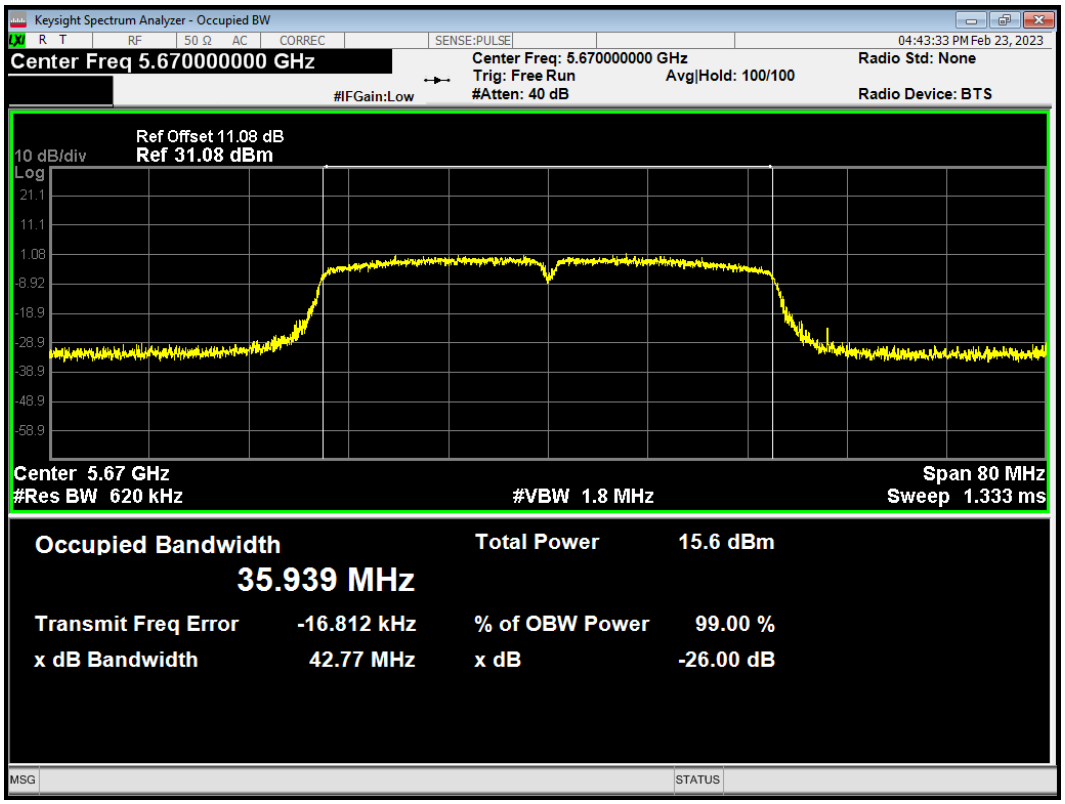
OBW 802.11n (HT40) 5550MHz



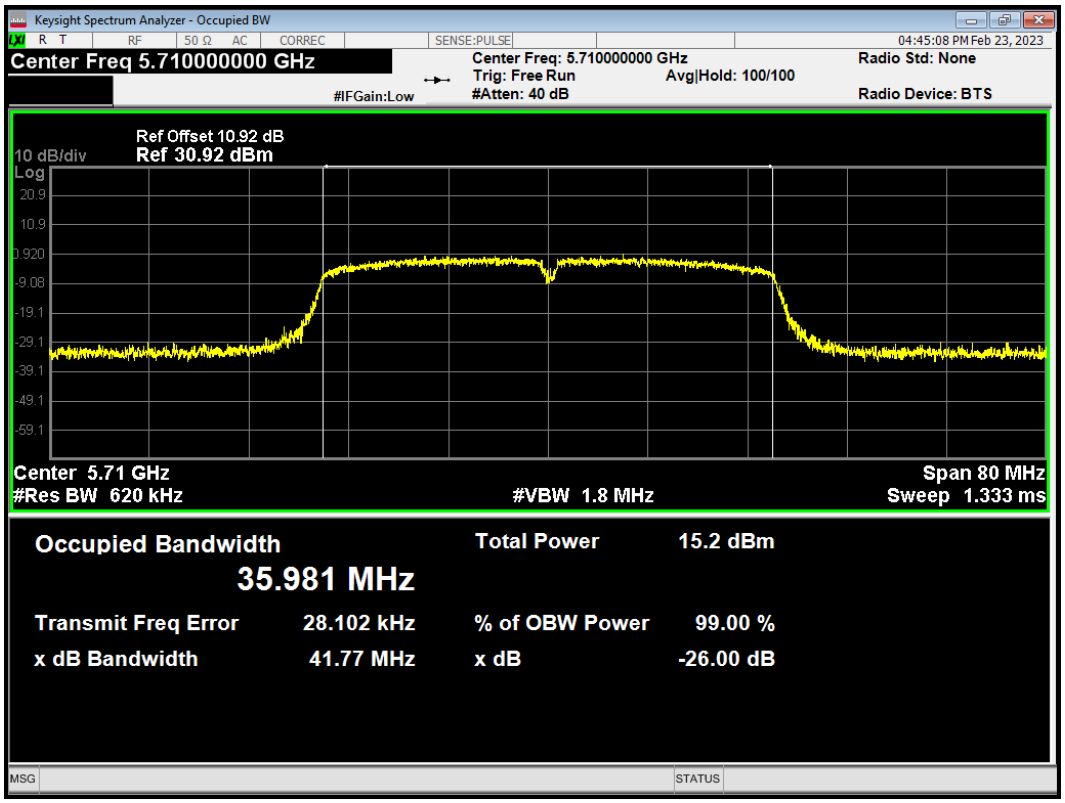
OBW 802.11n (HT40) 5590MHz



OBW 802.11n (HT40) 5670MHz

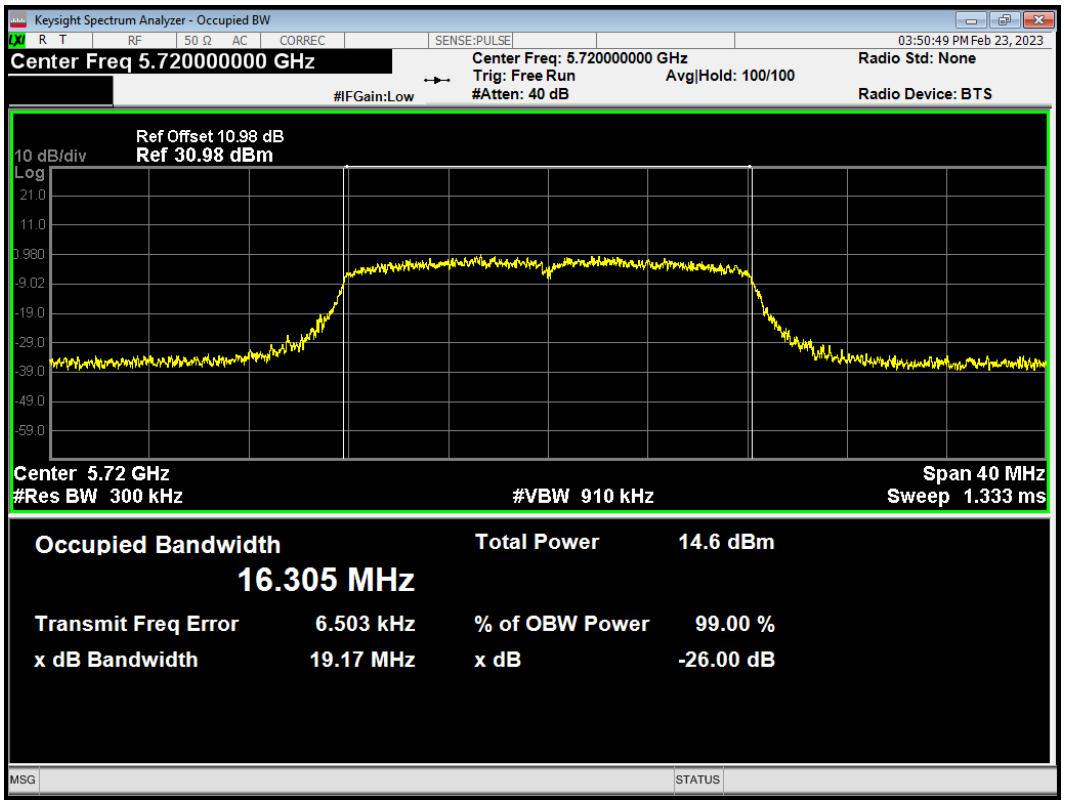


OBW 802.11n (HT40) 5710MHz

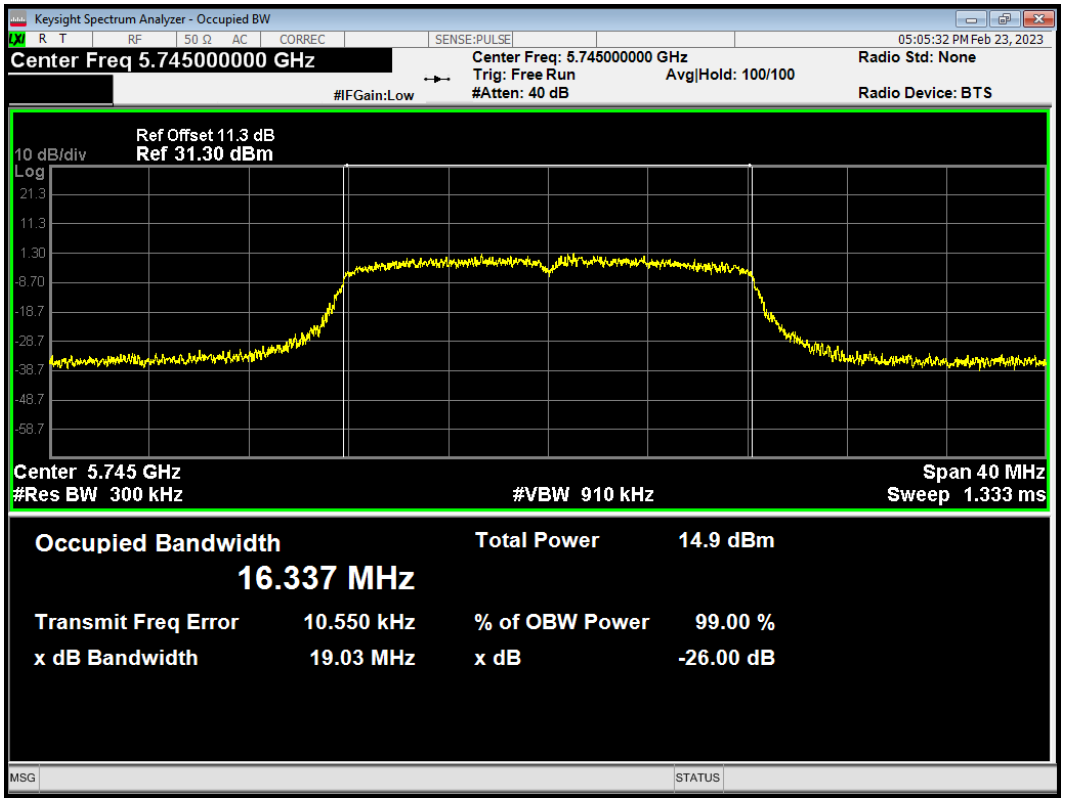


U-NII-3

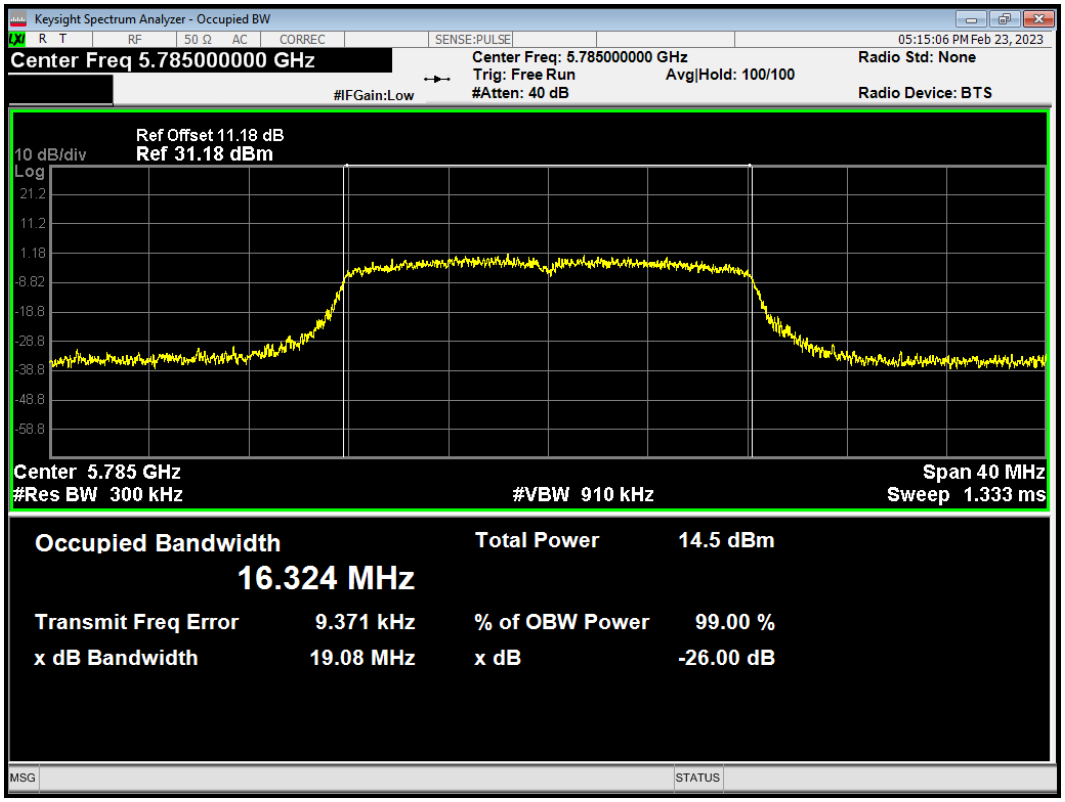
OBW 802.11a 5720MHz



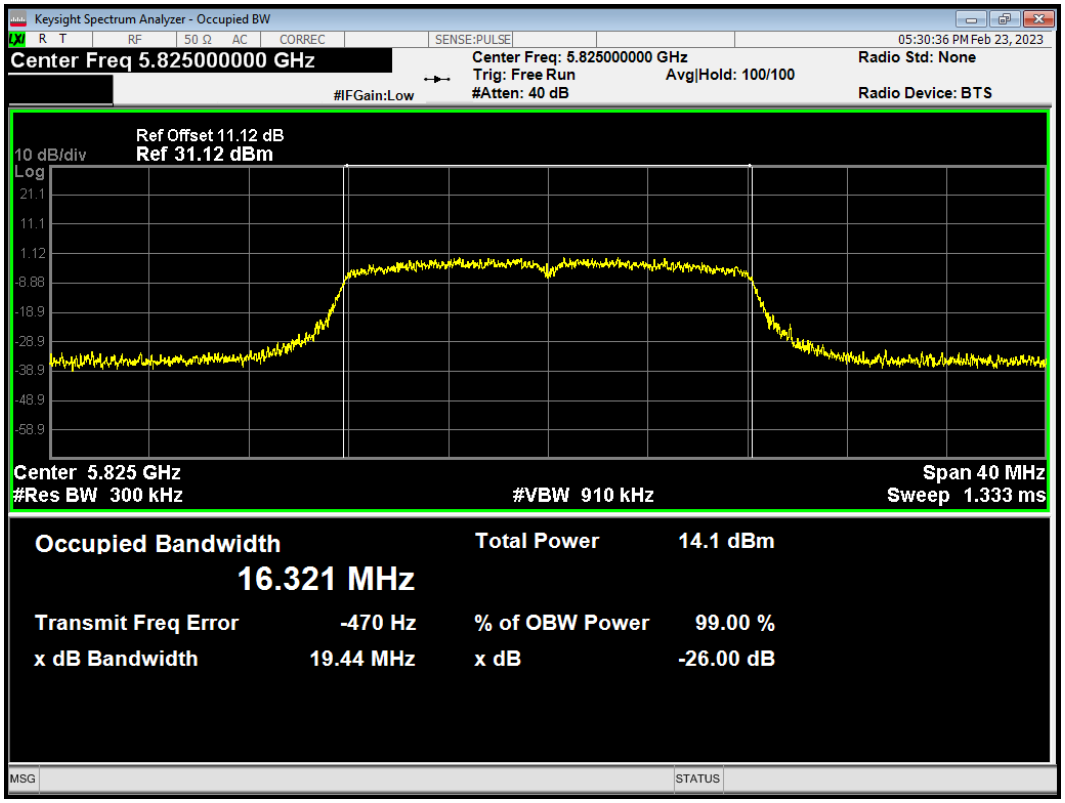
OBW 802.11a 5745MHz



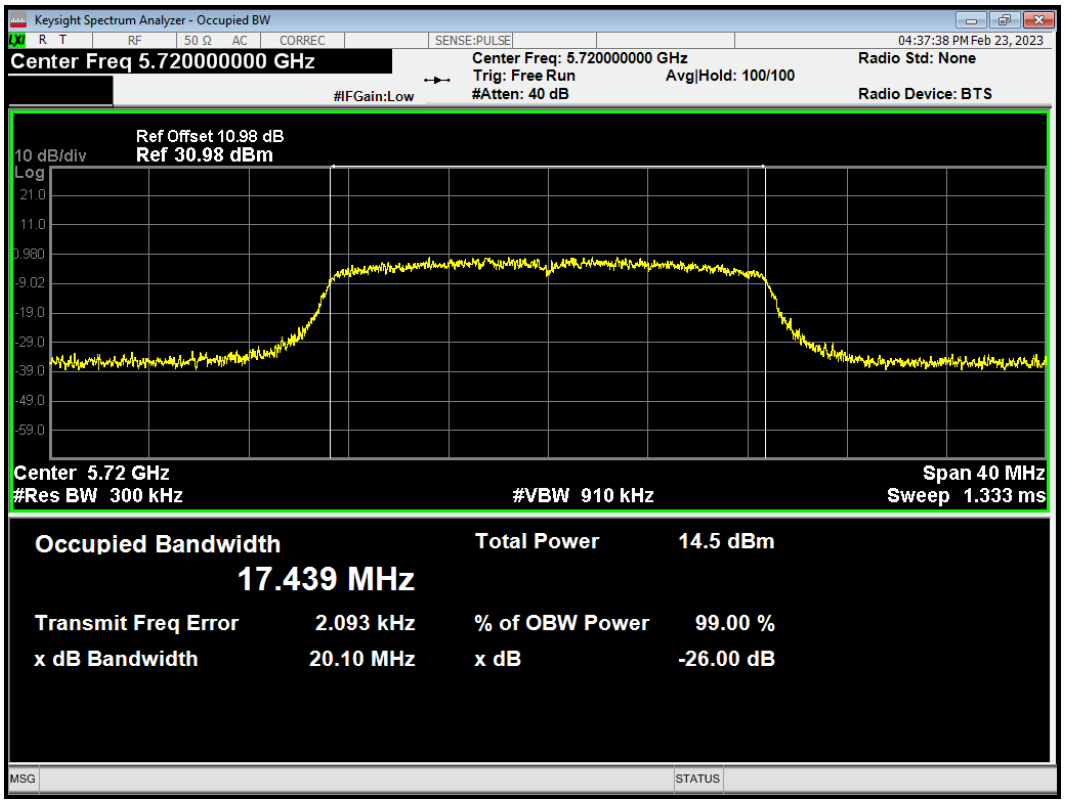
OBW 802.11a 5785MHz



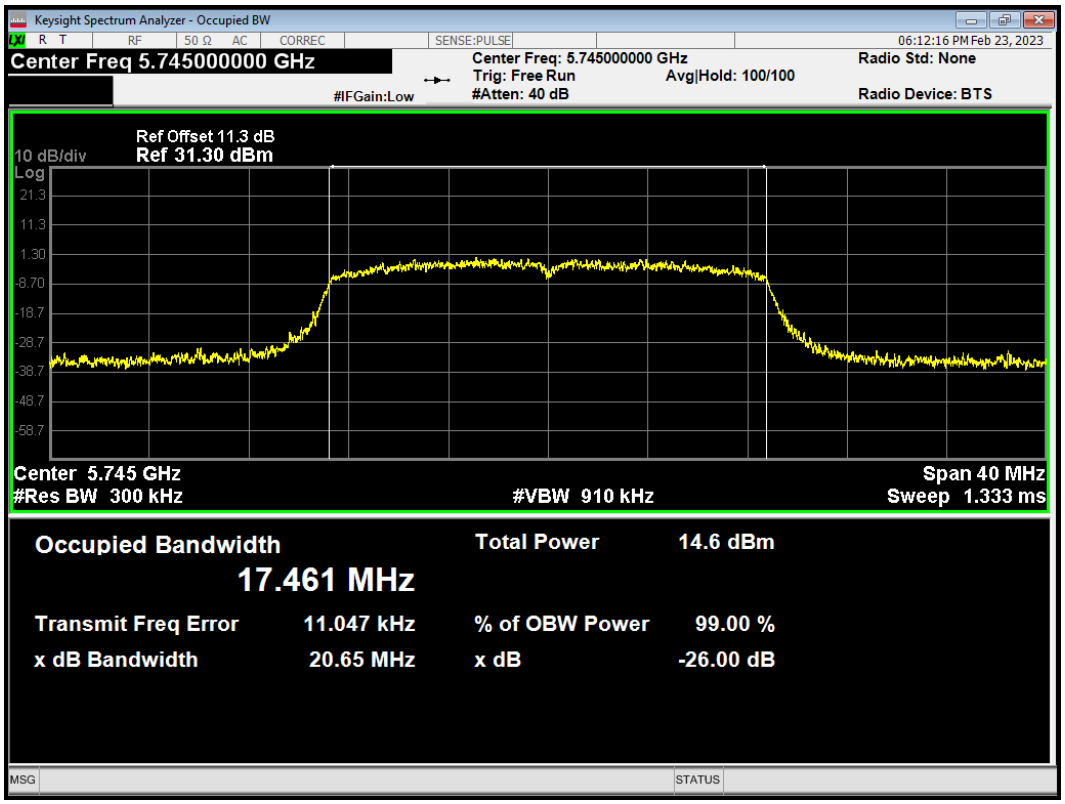
OBW 802.11a 5825MHz



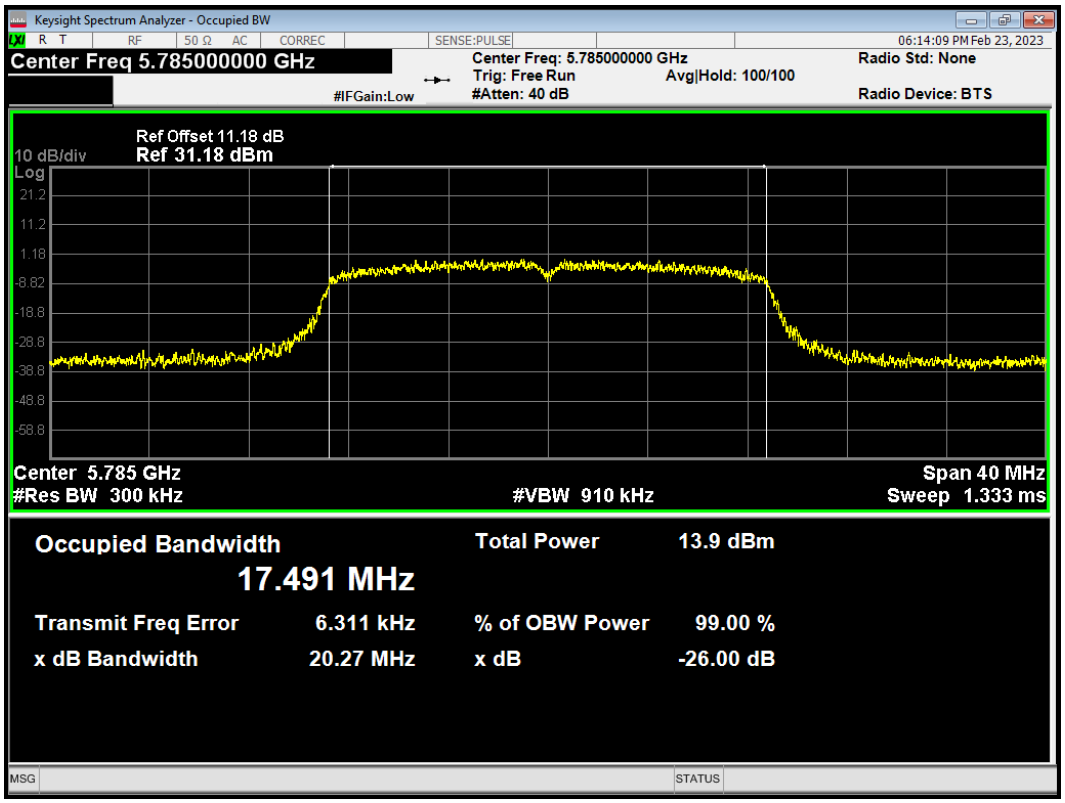
OBW 802.11ac (VHT20) 5720MHz



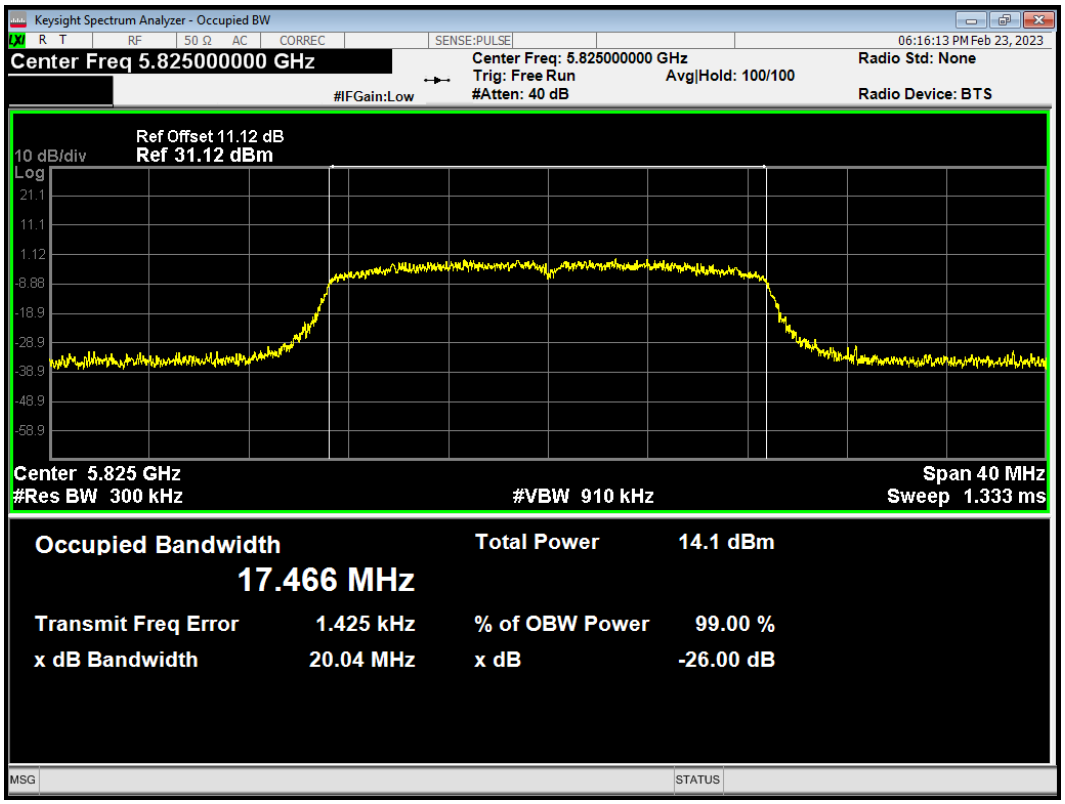
OBW 802.11ac (VHT20) 5745MHz



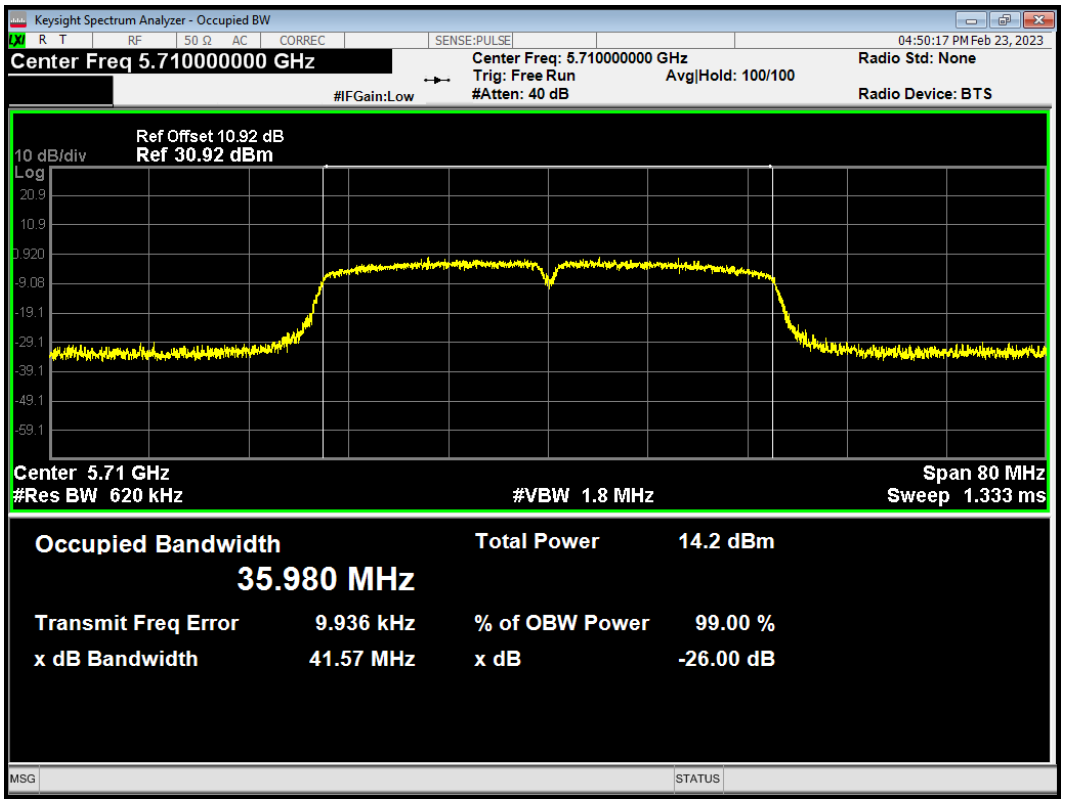
OBW 802.11ac (VHT20) 5785MHz



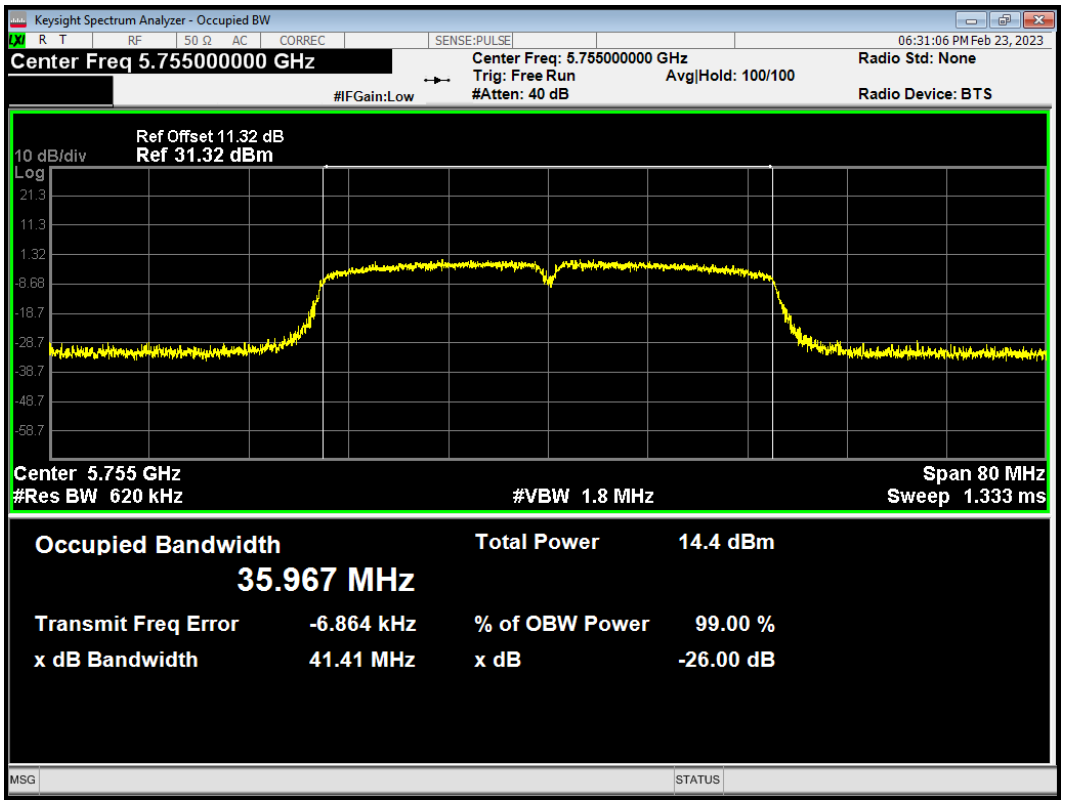
OBW 802.11ac (VHT20) 5825MHz



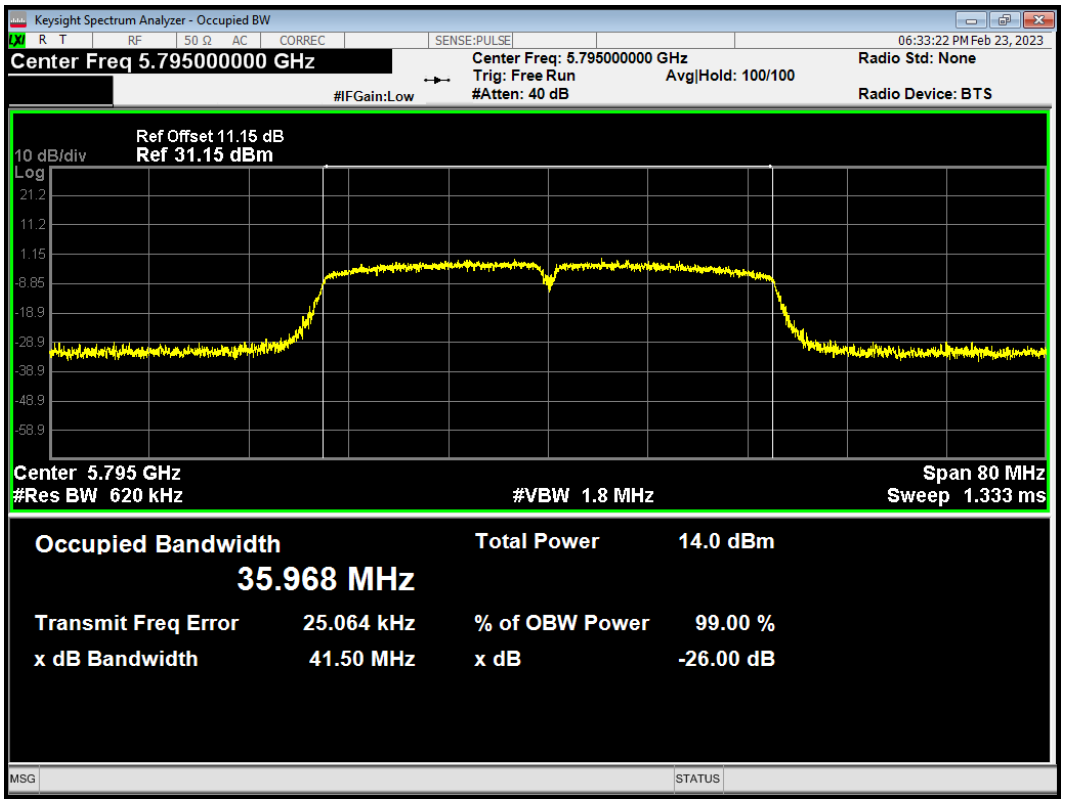
OBW 802.11ac (VHT40) 5710MHz



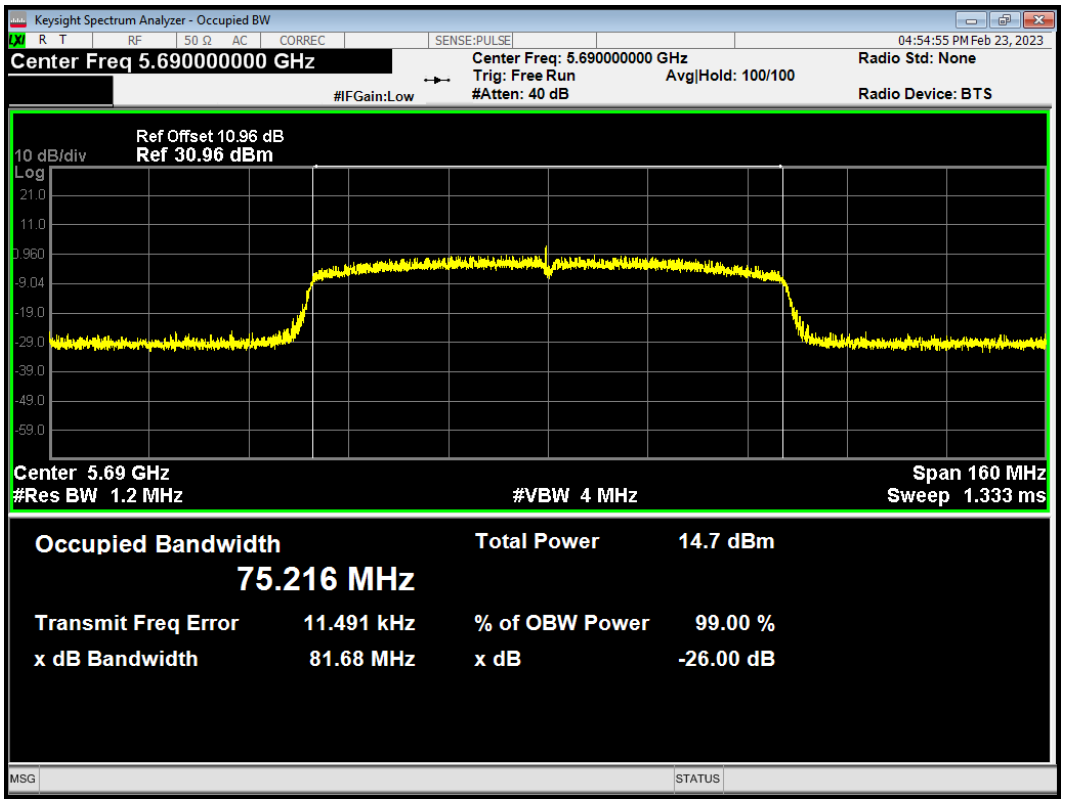
OBW 802.11ac (VHT40) 5755MHz



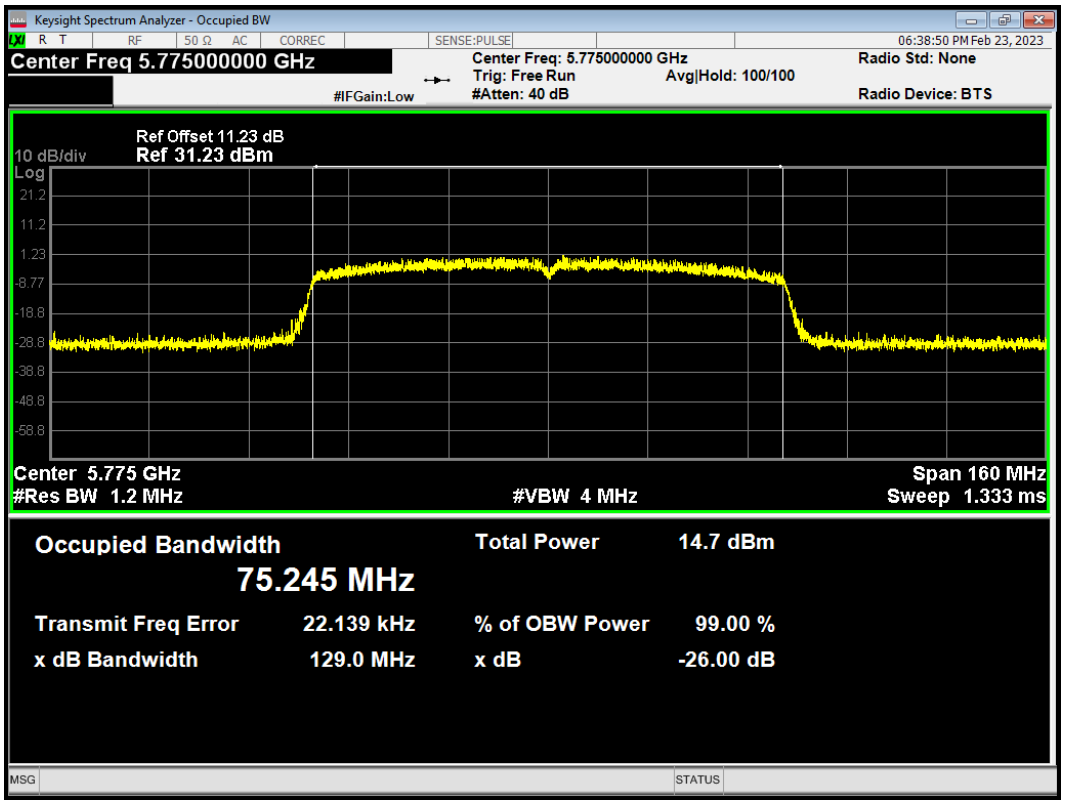
OBW 802.11ac (VHT40) 5795MHz



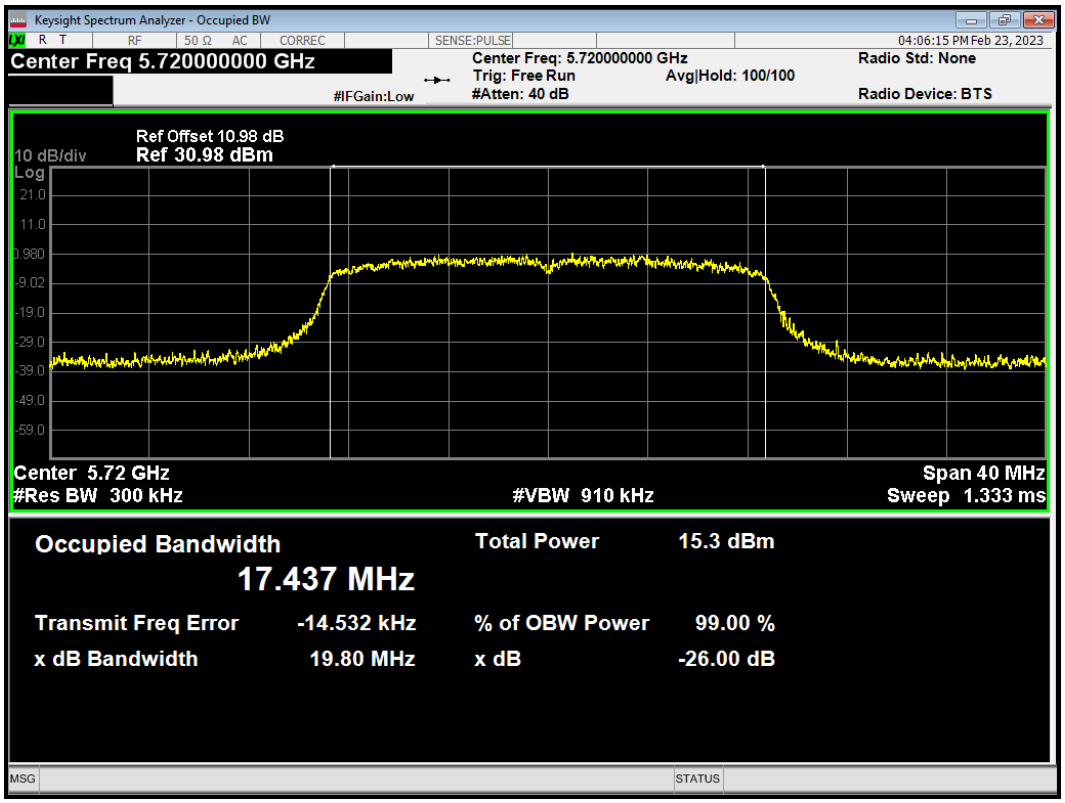
OBW 802.11ac (VHT80) 5690MHz



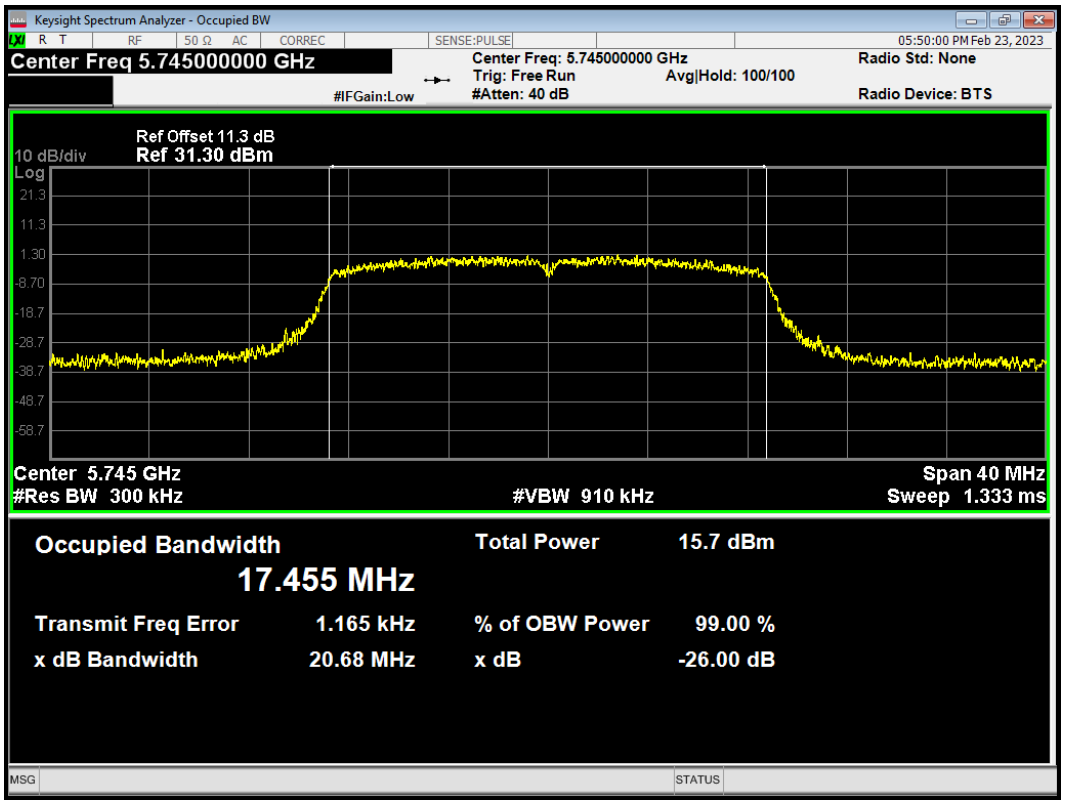
OBW 802.11ac (VHT80) 5775MHz



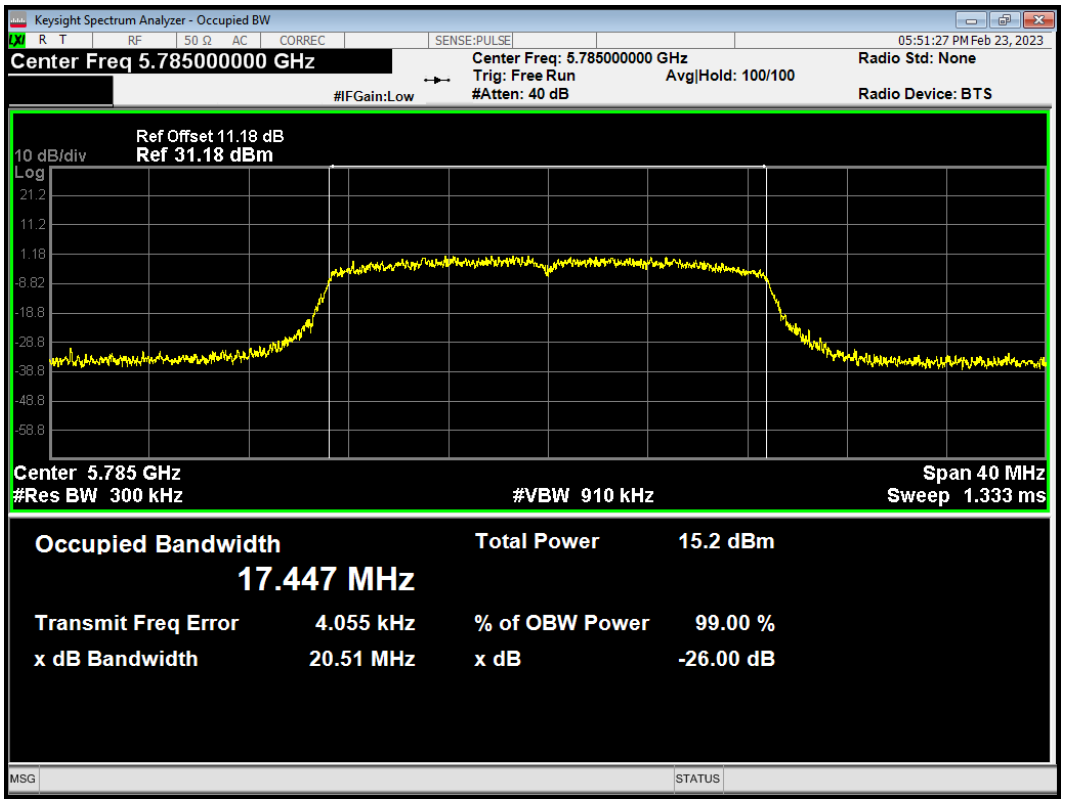
OBW 802.11n (HT20) 5720MHz



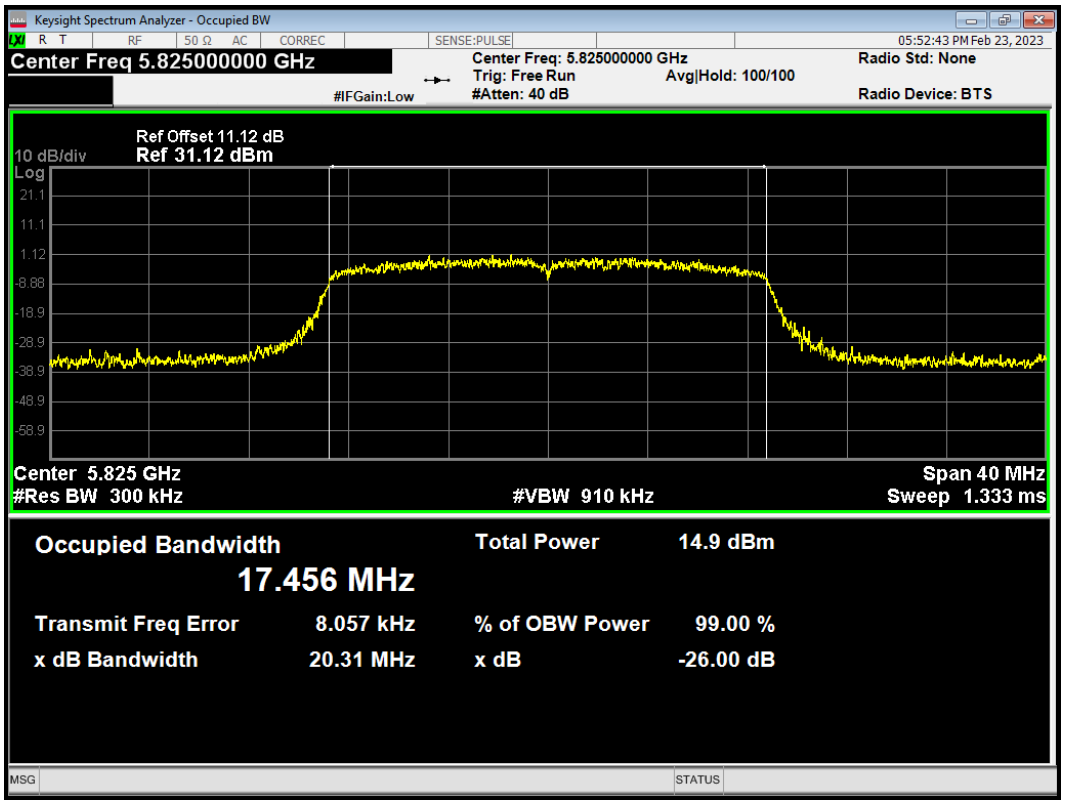
OBW 802.11n (HT20) 5745MHz



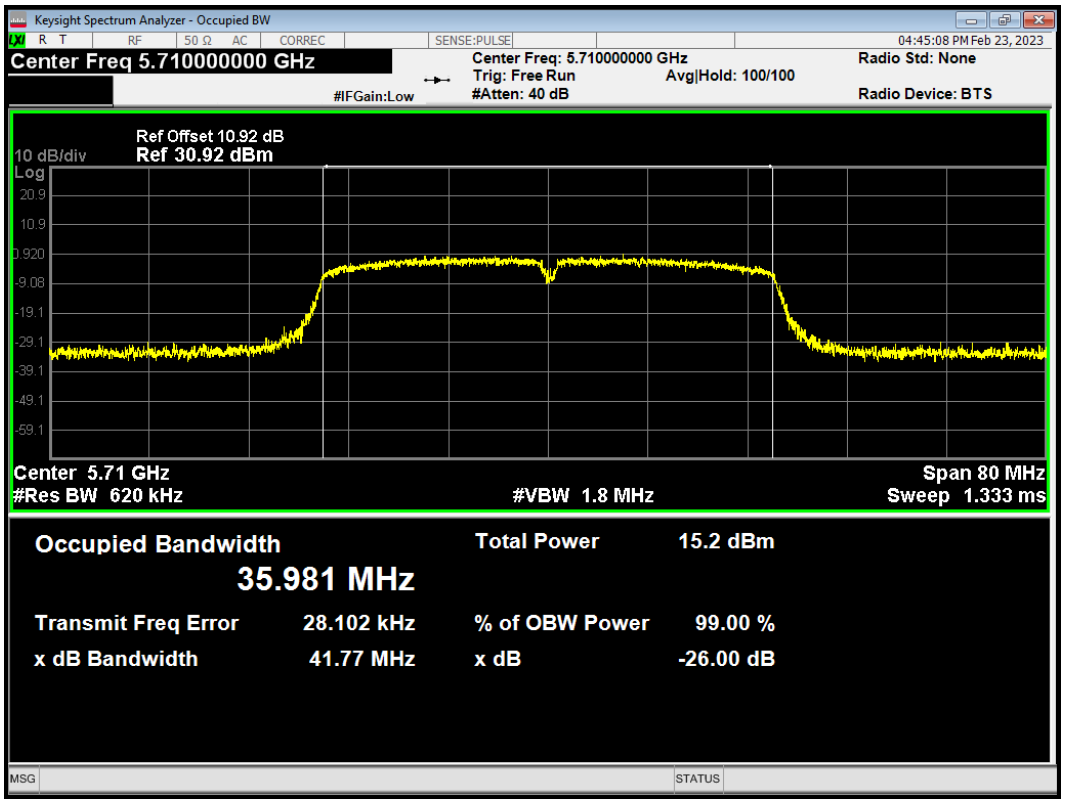
OBW 802.11n (HT20) 5785MHz



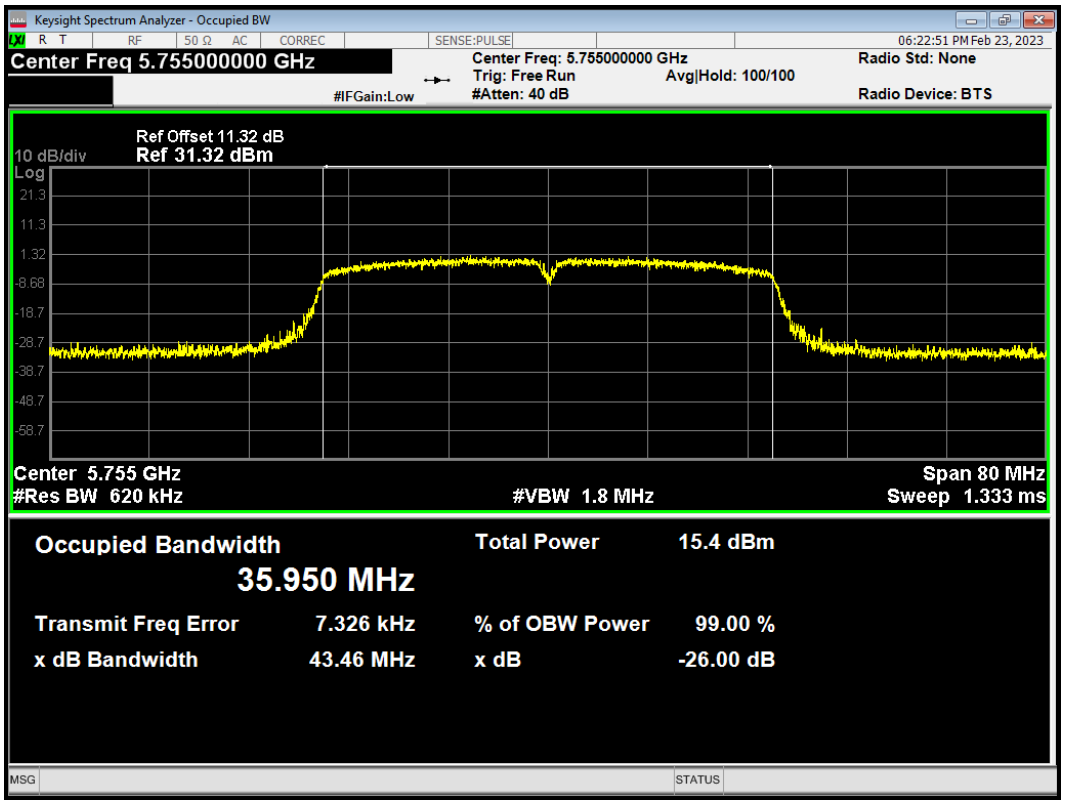
OBW 802.11n (HT20) 5825MHz



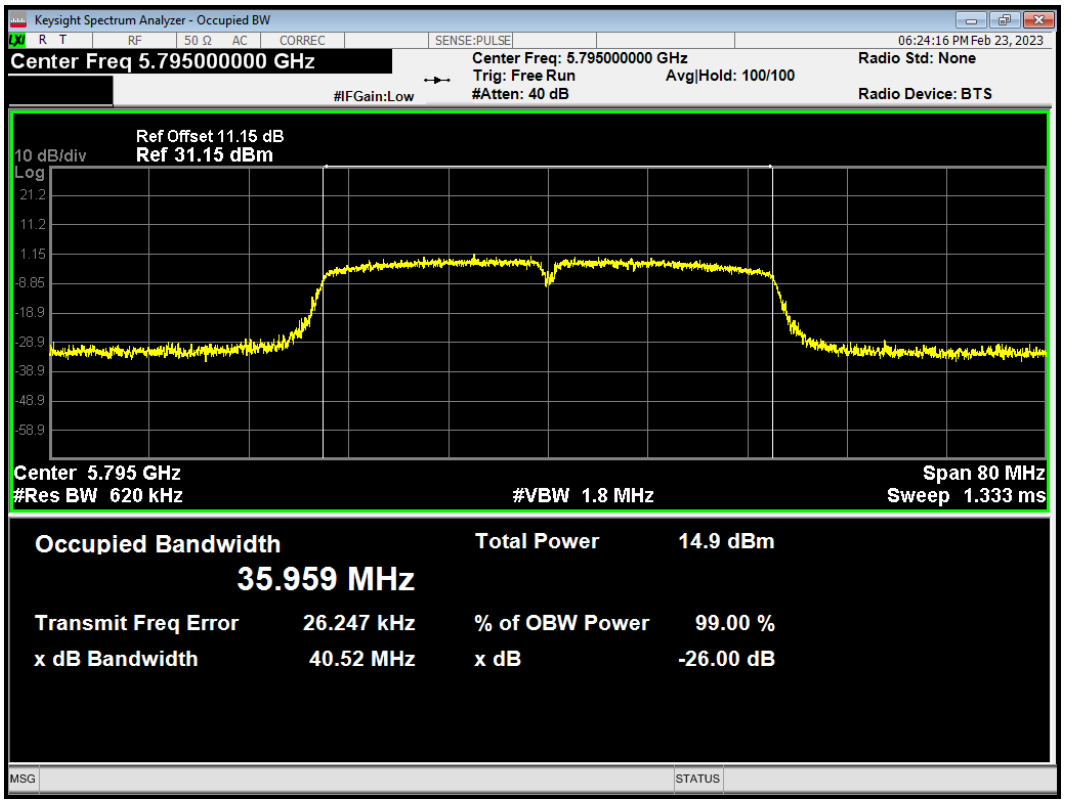
OBW 802.11n (HT40) 5710MHz



OBW 802.11n (HT40) 5755MHz



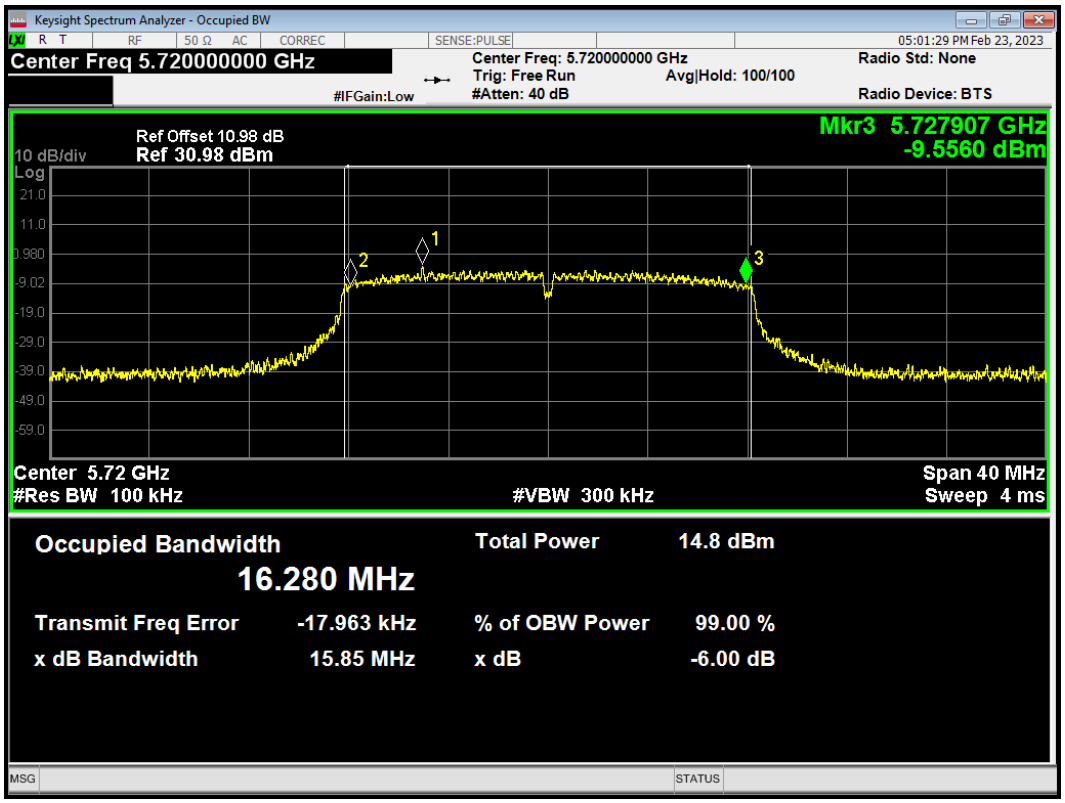
OBW 802.11n (HT40) 5795MHz



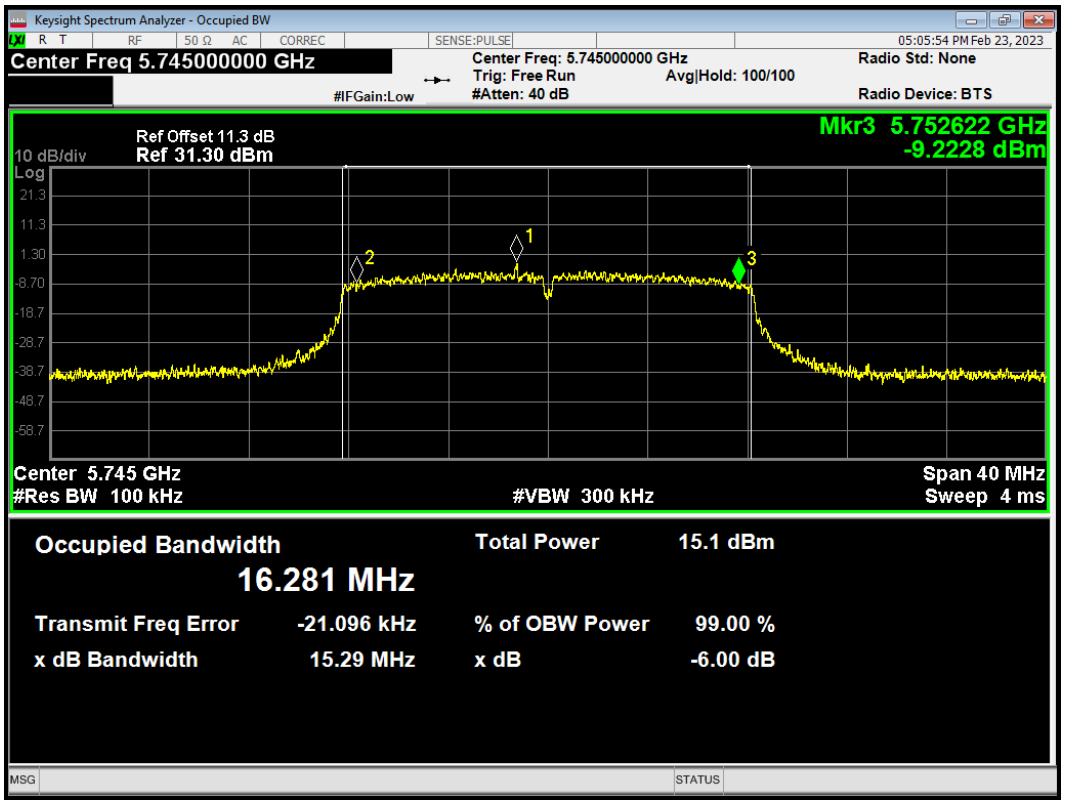
Minimum 6 dB bandwidth

U-NII-3

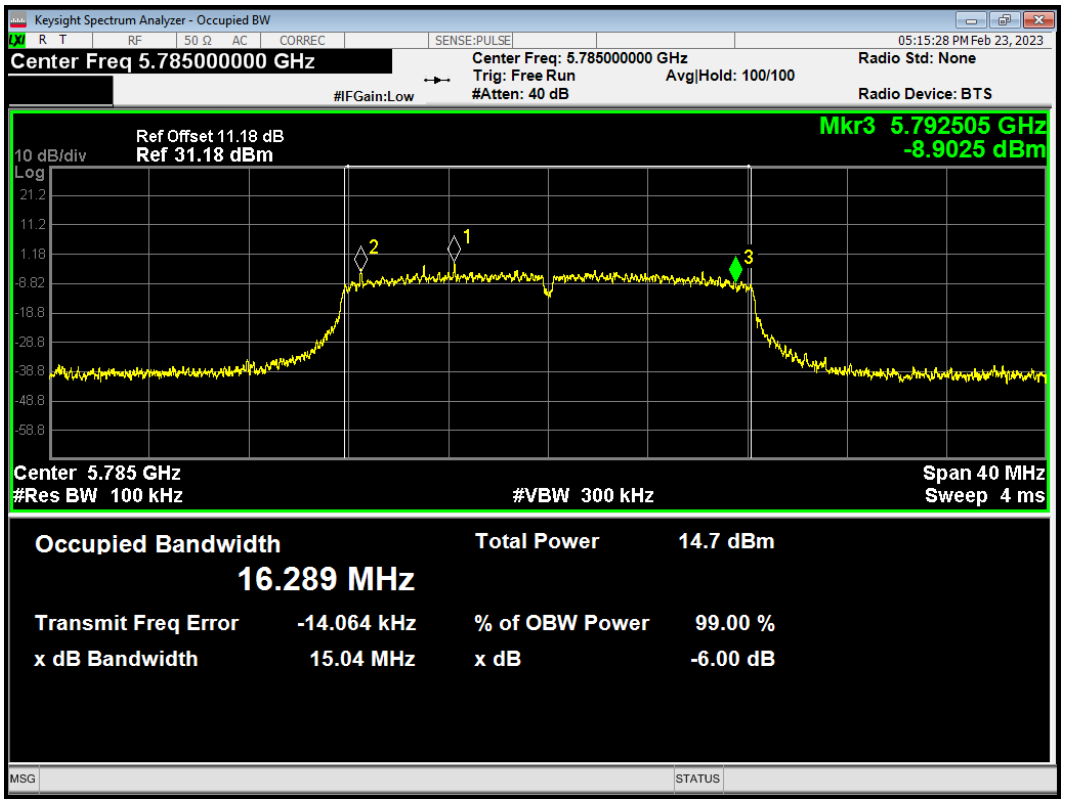
-6dB Bandwidth 802.11a 5720MHz



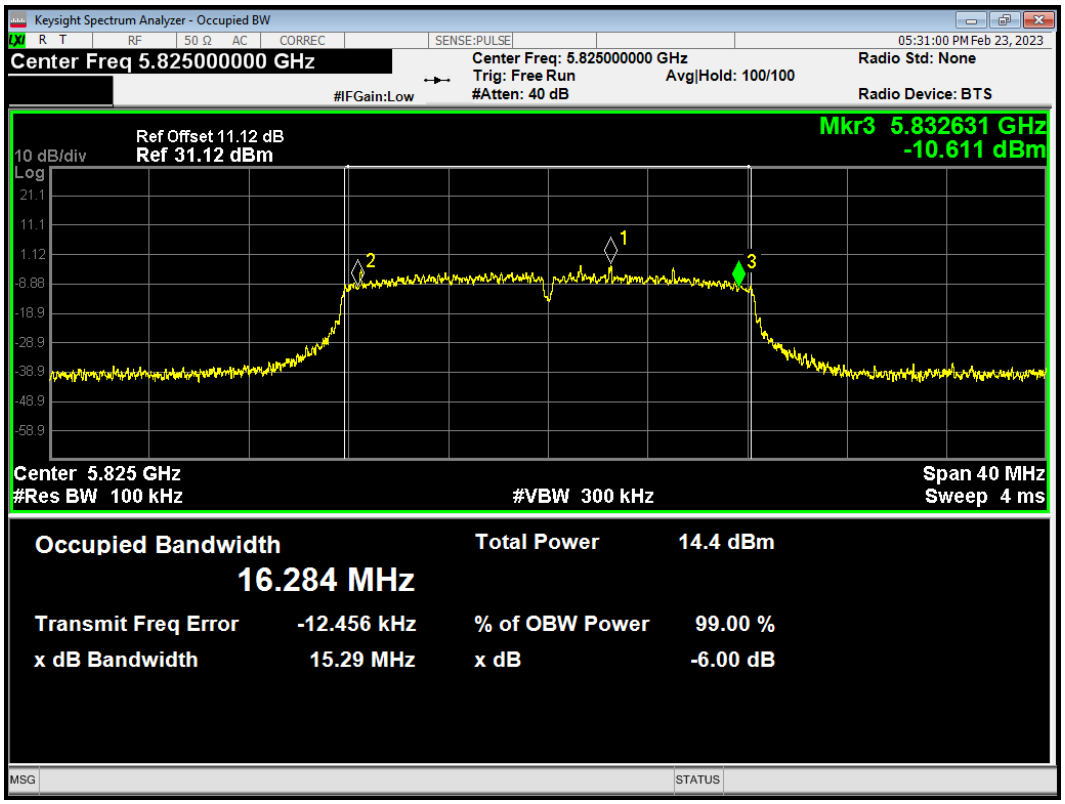
-6dB Bandwidth 802.11a 5745MHz



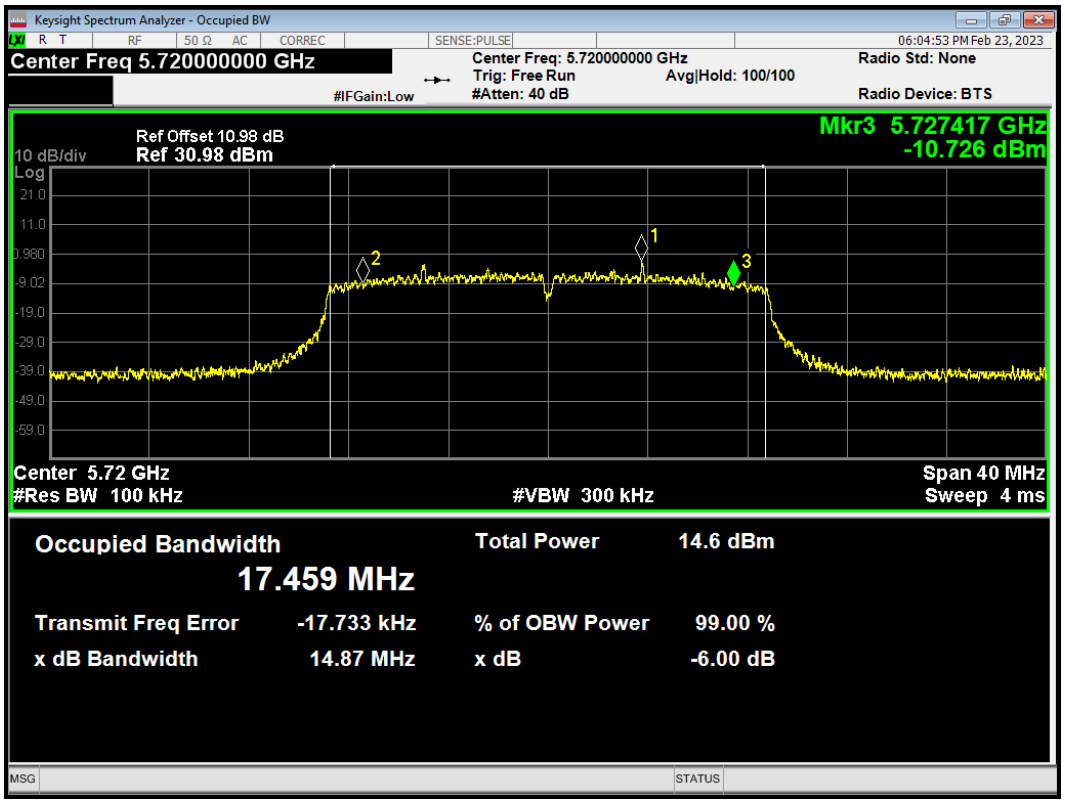
-6dB Bandwidth 802.11a 5785MHz



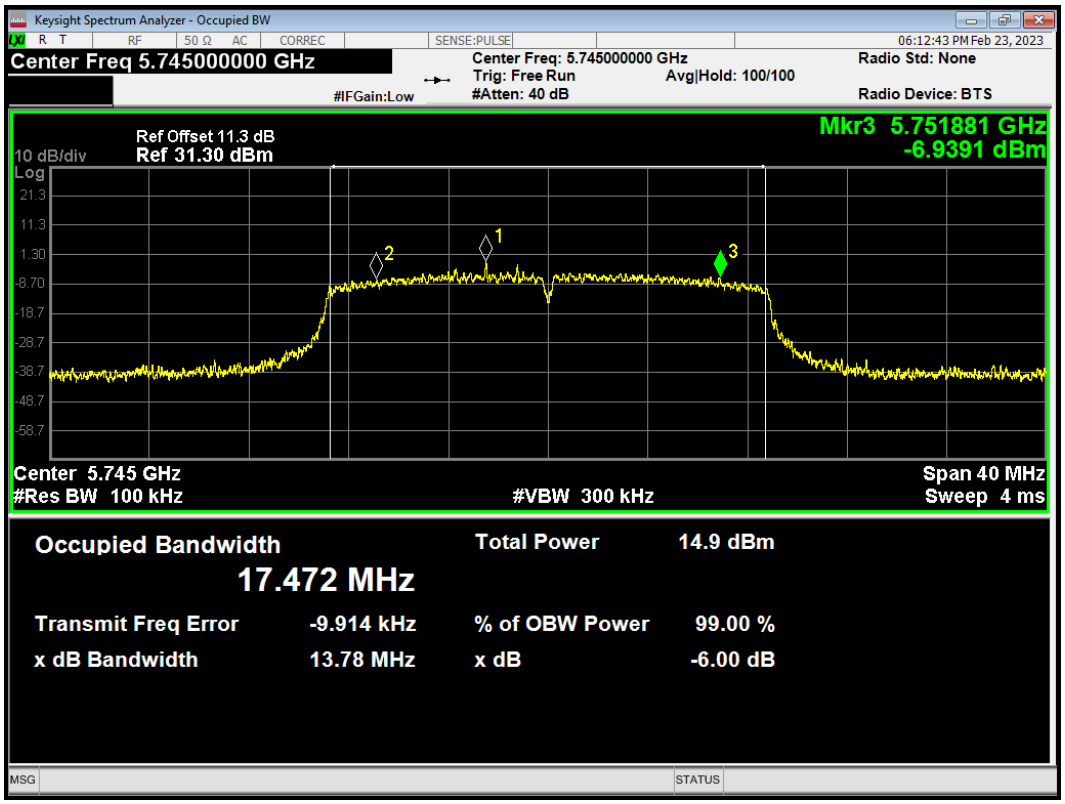
-6dB Bandwidth 802.11a 5825MHz



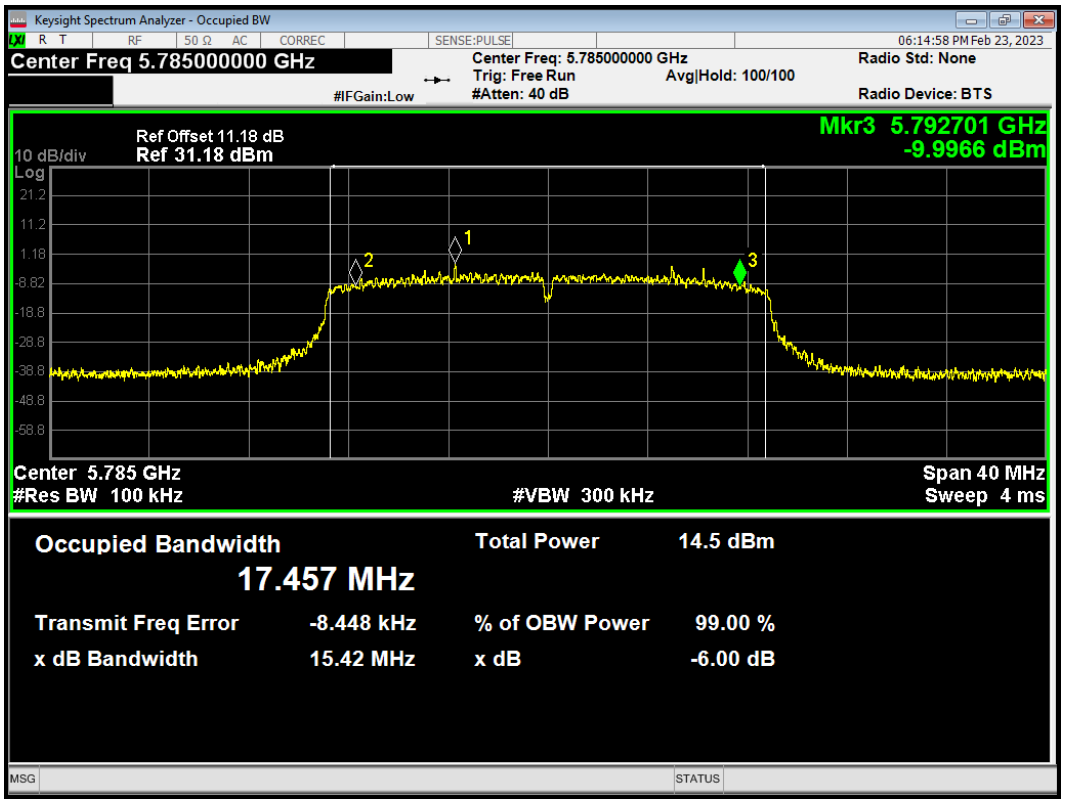
-6dB Bandwidth 802.11ac (VHT20) 5720MHz



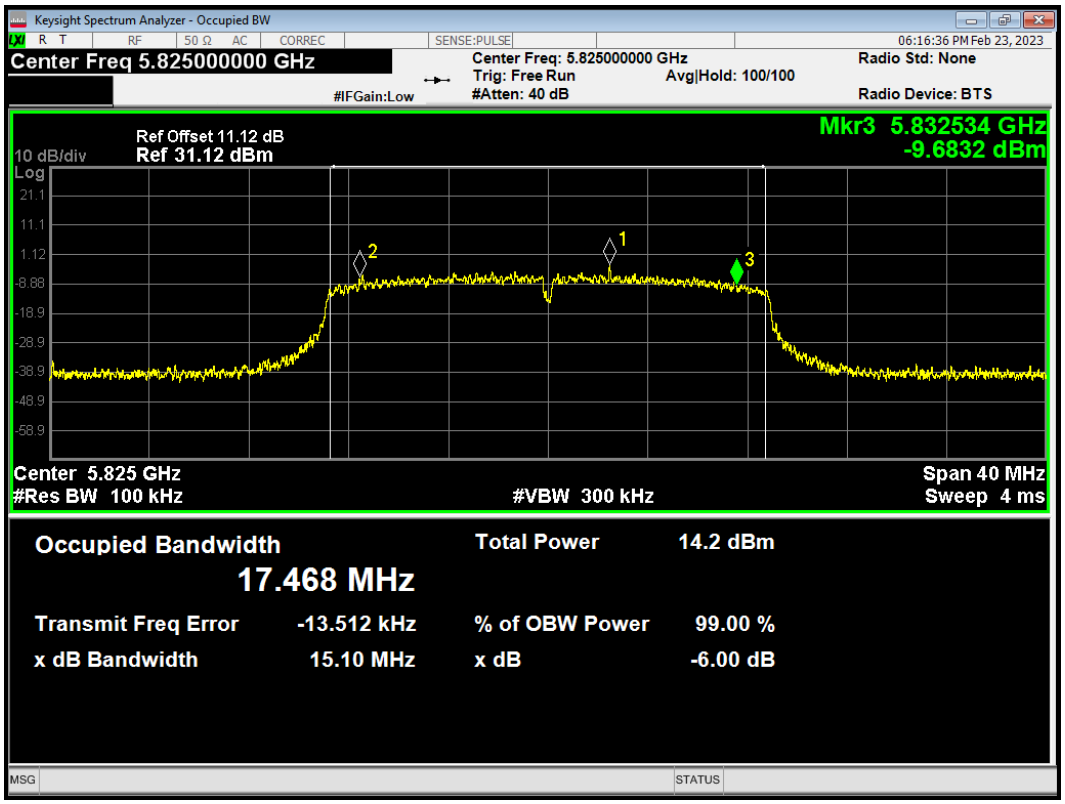
-6dB Bandwidth 802.11ac (VHT20) 5745MHz



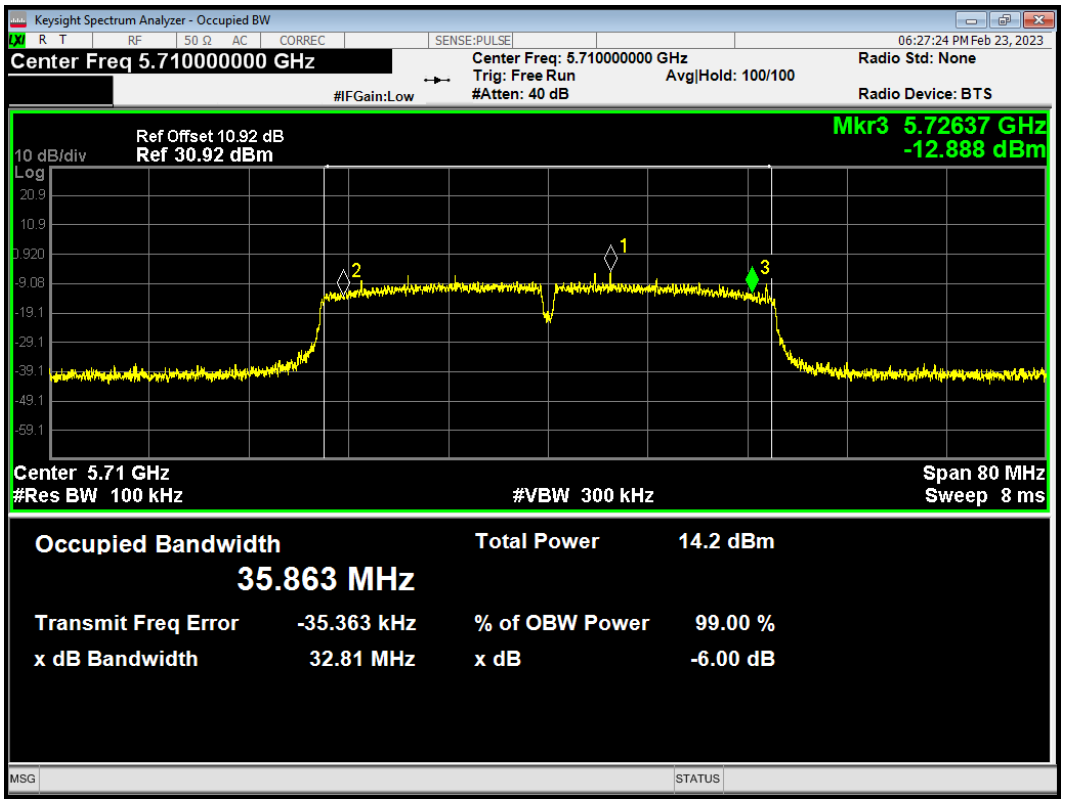
-6dB Bandwidth 802.11ac (VHT20) 5785MHz



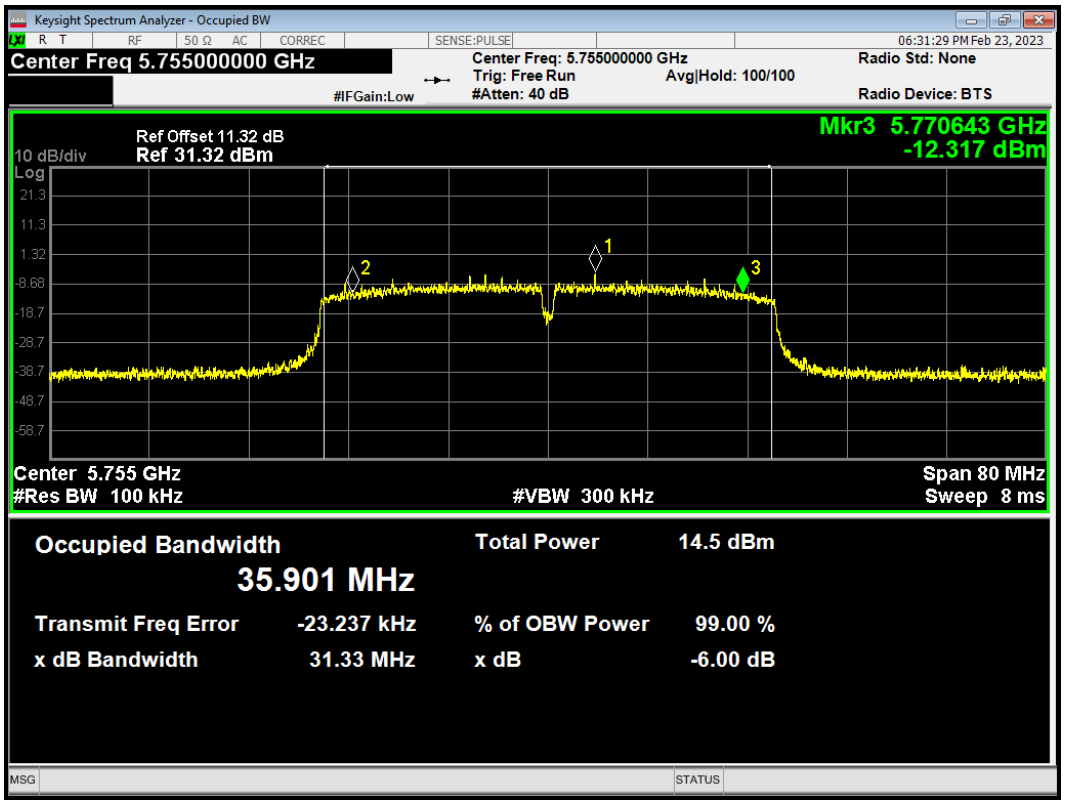
-6dB Bandwidth 802.11ac (VHT20) 5825MHz



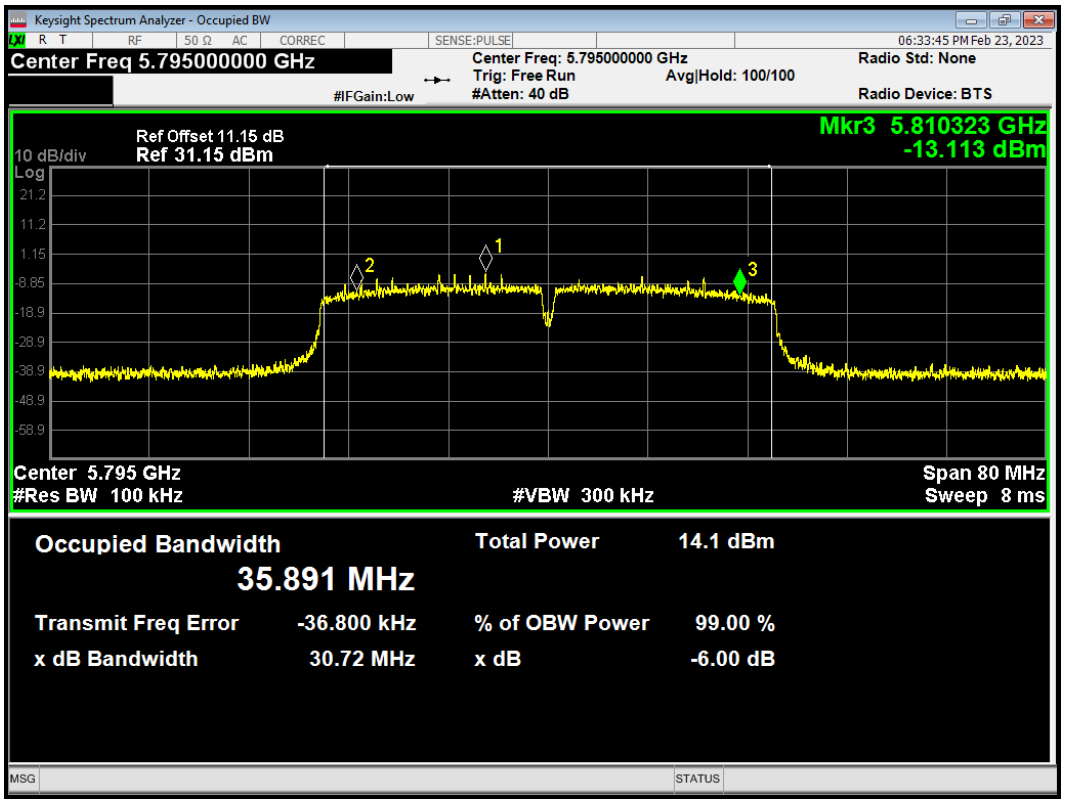
-6dB Bandwidth 802.11ac (VHT40) 5710MHz



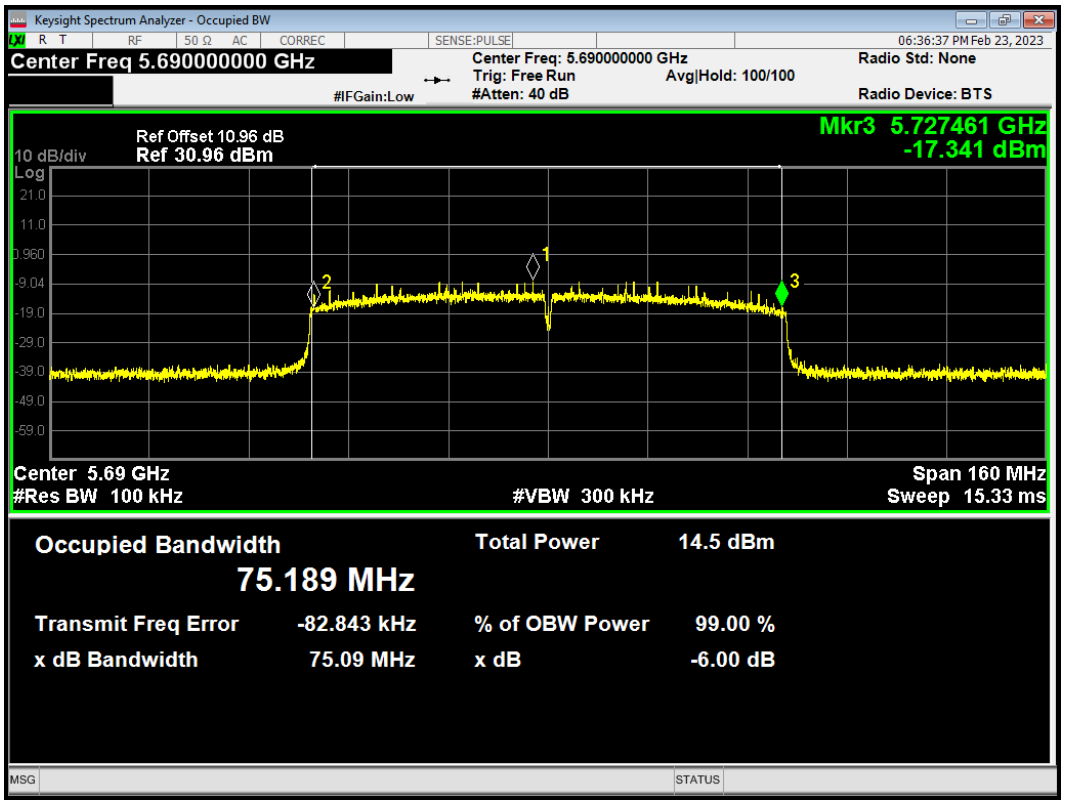
-6dB Bandwidth 802.11ac (VHT40) 5755MHz



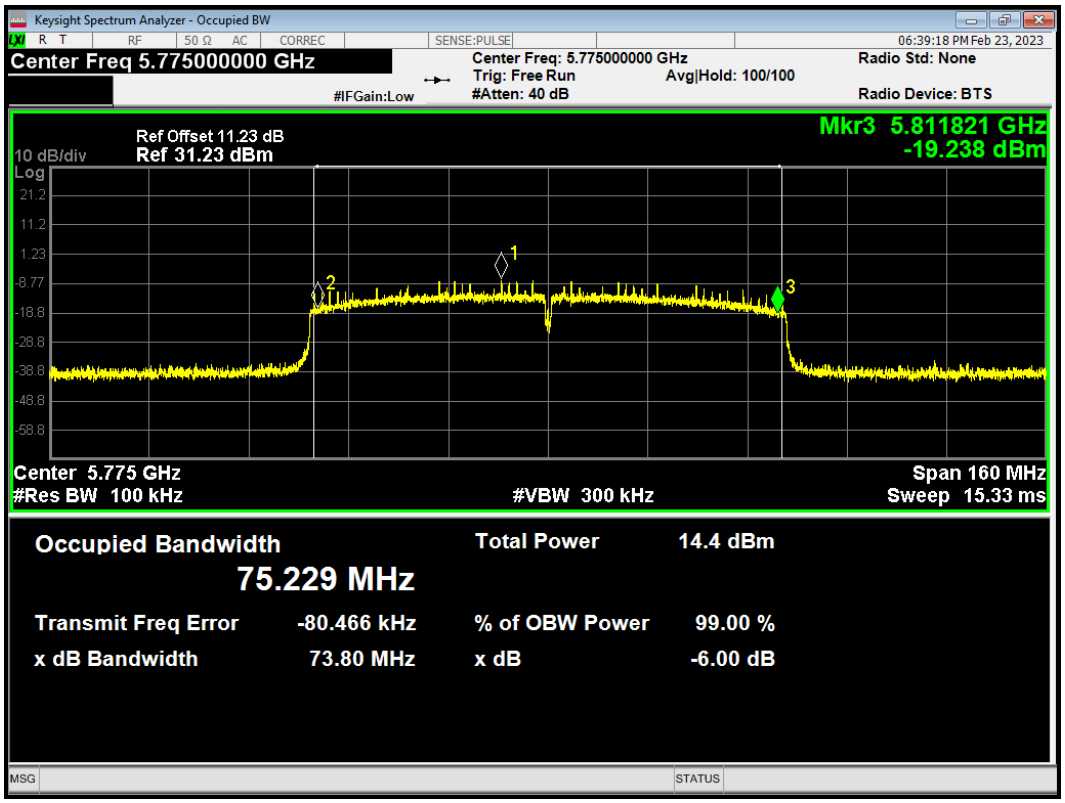
-6dB Bandwidth 802.11ac (VHT40) 5795MHz



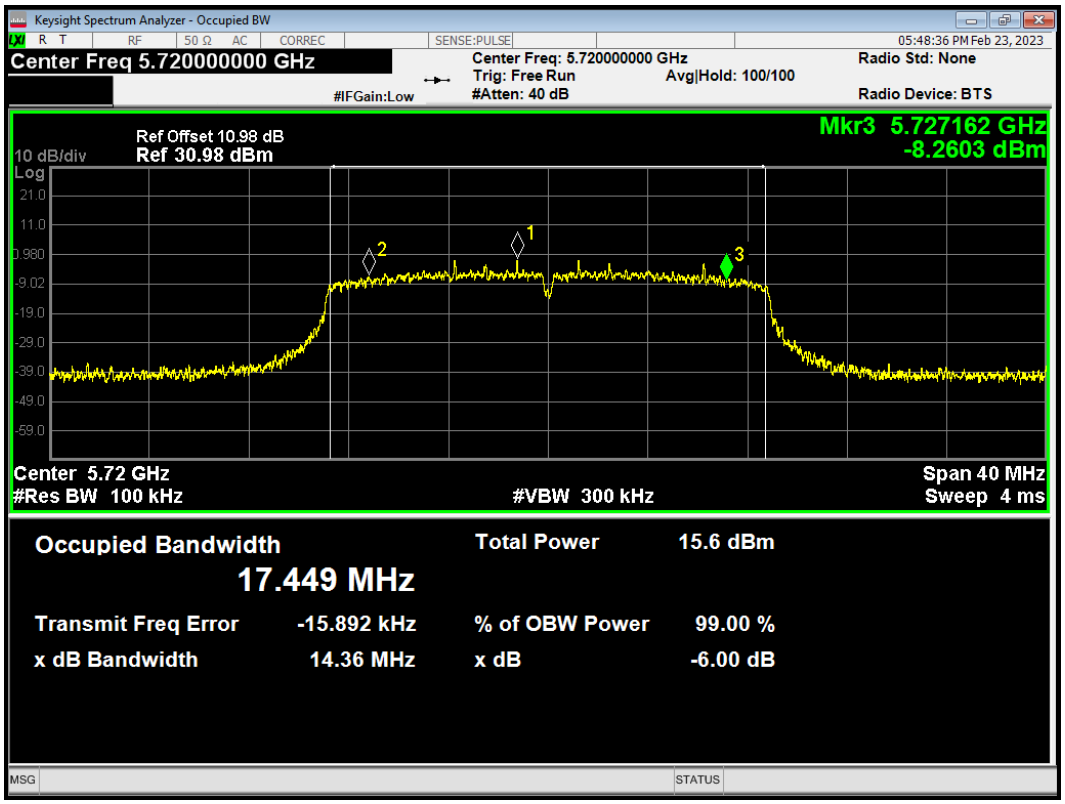
-6dB Bandwidth 802.11ac (VHT80) 5690MHz



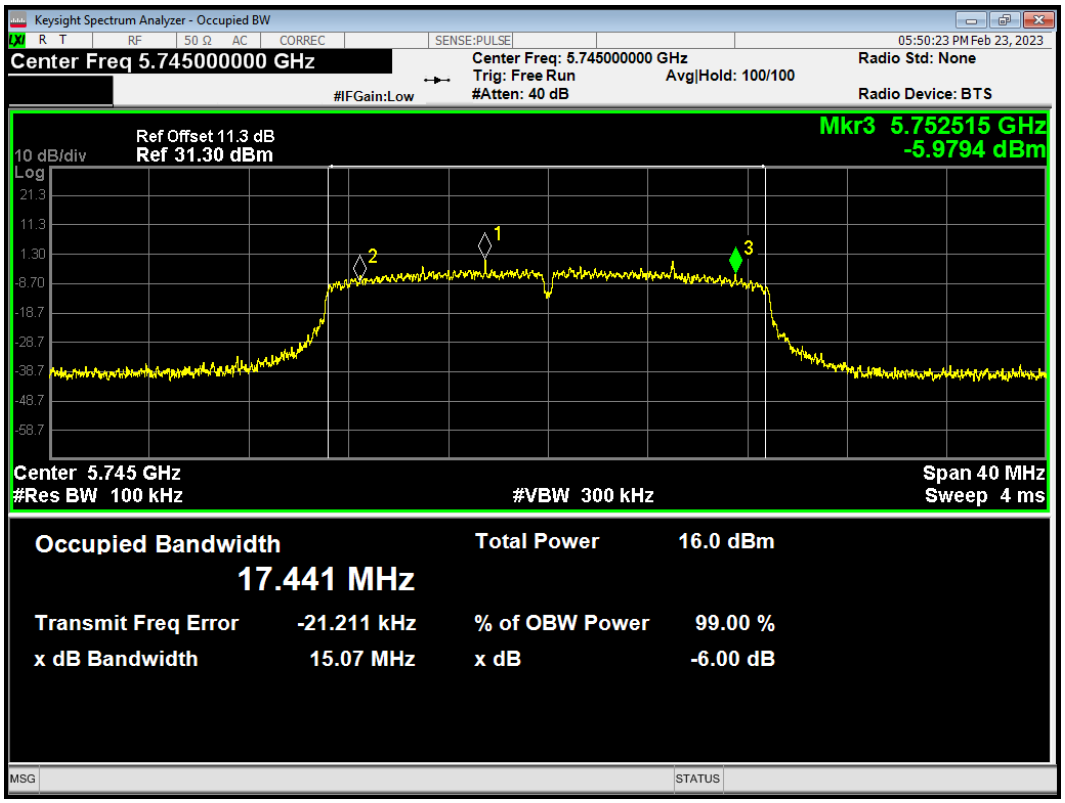
-6dB Bandwidth 802.11ac (VHT80) 5775MHz



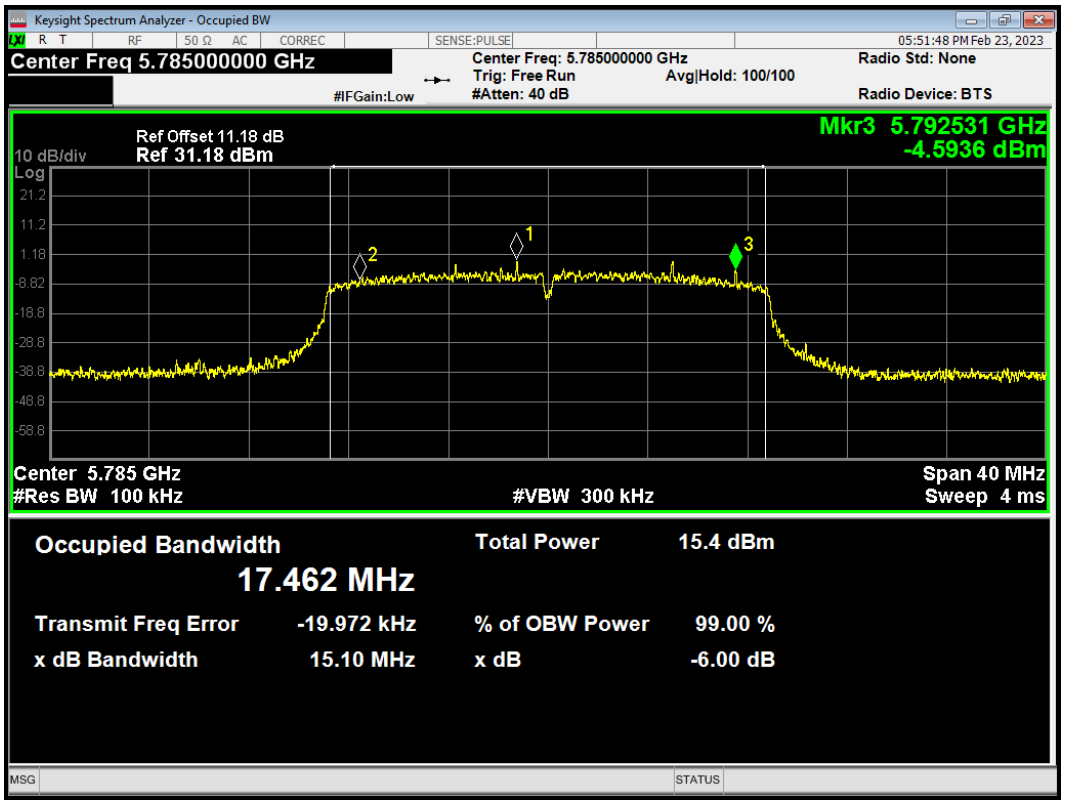
-6dB Bandwidth 802.11n (HT20) 5720MHz



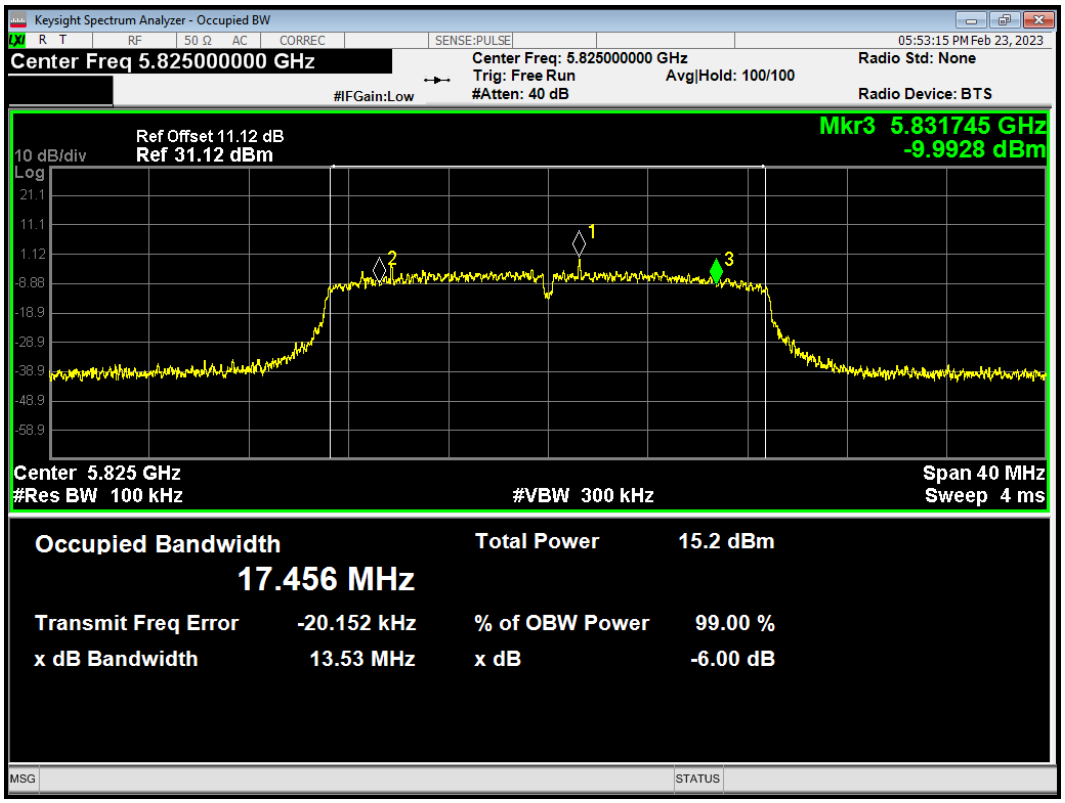
-6dB Bandwidth 802.11n (HT20) 5745MHz



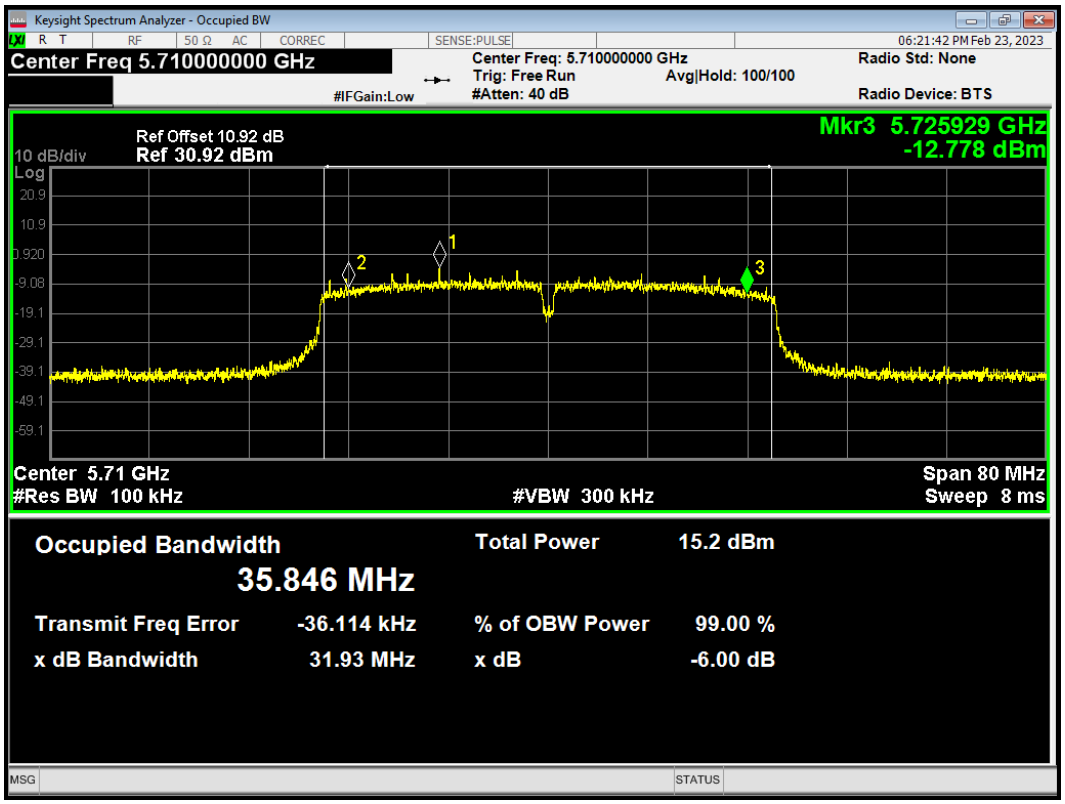
-6dB Bandwidth 802.11n (HT20) 5785MHz



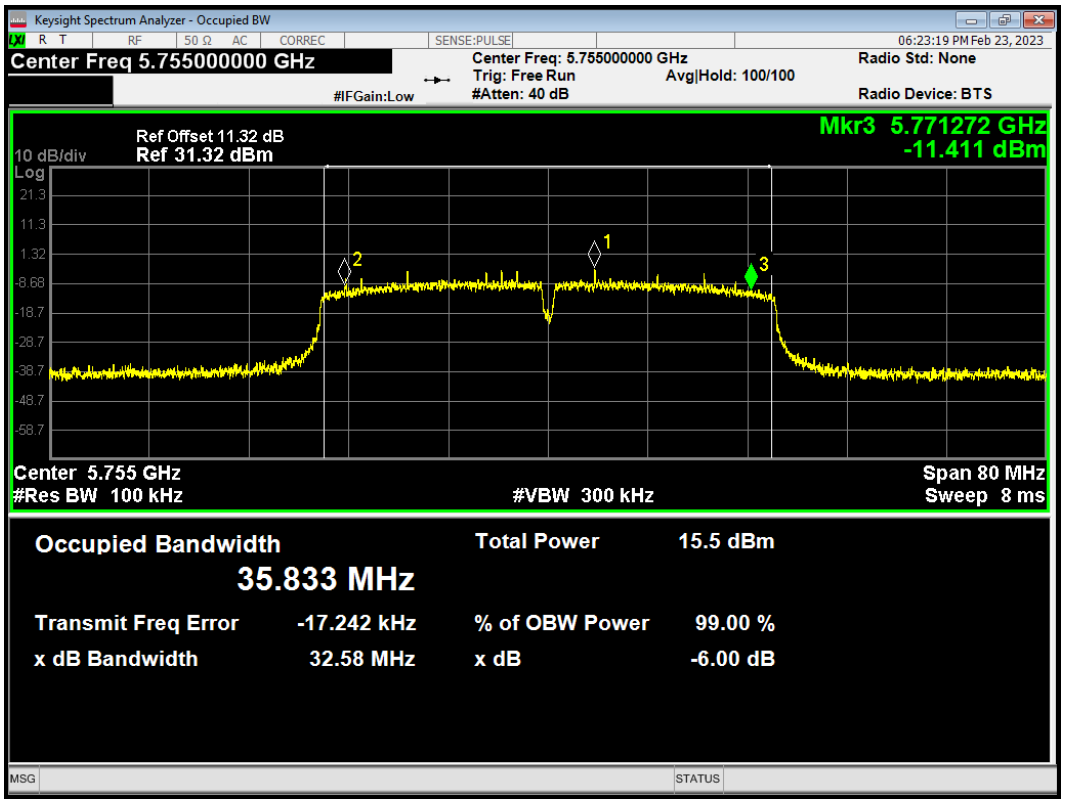
-6dB Bandwidth 802.11n (HT20) 5825MHz



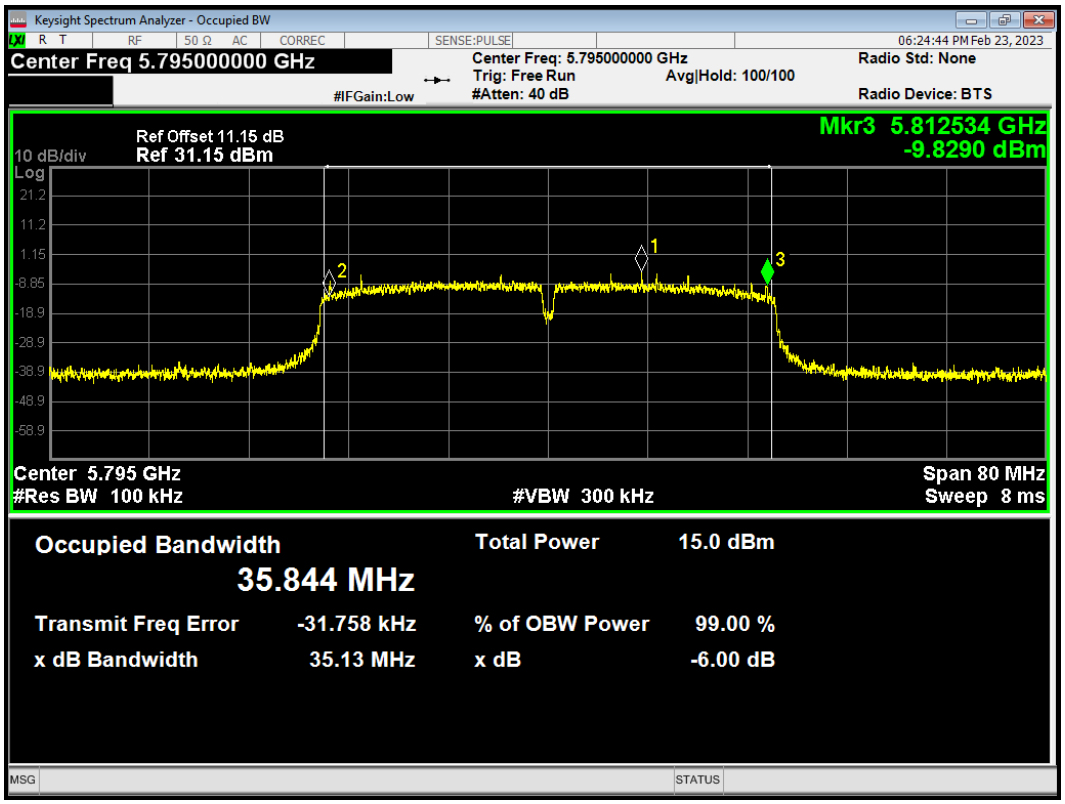
-6dB Bandwidth 802.11n (HT40) 5710MHz



-6dB Bandwidth 802.11n (HT40) 5755MHz



-6dB Bandwidth 802.11n (HT40) 5795MHz



5.2. Average Power Output

Ambient condition

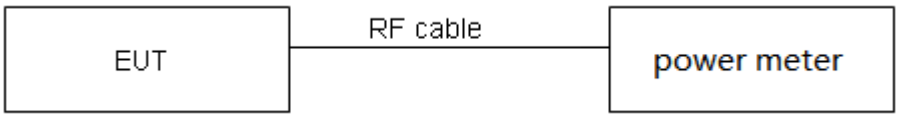
Temperature	Relative humidity
20°C ~25°C	45%~50%

Methods of Measurement

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

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

Test Setup



Limits

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

density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 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	Duty cycle	Duty cycle correction Factor(dB)
802.11a	0.971	0.13
802.11n HT20	0.974	0.11
802.11n HT40	0.954	0.20
802.11ac VHT20	0.979	0.09
802.11ac VHT40	0.948	0.23
802.11ac VHT80	0.903	0.45
Note: when Duty cycle⩾0.98, Duty cycle correction Factor not required.		

Antenna 1

Power Index								
Channel	802.11a	802.11n HT20	802.11ac VHT20	Channel	802.11n HT40	802.11ac VHT40	Channel	802.11ac VHT80
CH36	13	14	13	CH38	10	12	CH42	6
CH40	13	14	13	CH46	13	12	/	/
CH48	13	14	13	/	/	/	/	/
CH52	13	14	13	CH54	13	12	CH58	10
CH60	13	14	13	CH62	13	12	/	/
CH64	13	14	13	/	/	/	/	/
CH100	12	14	13	CH102	10	12	CH106	10
CH104	13	/	/	CH110	13	/	/	/
CH120	13	14	13	CH118	13	12	CH122	12
CH136	13	14	/	/	/	/	/	/
CH140	11	11	13	CH134	13	12	CH138	12
CH144	13	14	13	CH142	13	12	/	/
CH149	13	14	13	CH151	13	12	CH155	12
CH157	13	14	13	CH159	13	12	/	/
CH165	13	14	13	/	/	/	/	/

Antenna 2

Power Index								
Channel	802.11a	802.11n HT20	802.11ac VHT20	Channel	802.11n HT40	802.11ac VHT40	Channel	802.11ac VHT80
CH36	13	14	13	CH38	10	12	CH42	6
CH40	13	14	13	CH46	13	12	/	/
CH48	13	14	13	/	/	/	/	/
CH52	13	14	13	CH54	13	12	CH58	10
CH60	13	14	13	CH62	13	12	/	/
CH64	13	14	13	/	/	/	/	/
CH100	12	14	13	CH102	10	12	CH106	10
CH104	13	/	/	CH110	13	/	/	/
CH120	13	14	13	CH118	13	12	CH122	12
CH136	13	14	/	/	/	/	/	/
CH140	11	11	13	CH134	13	12	CH138	12
CH144	13	14	13	CH142	13	12	/	/
CH149	13	14	13	CH151	13	12	CH155	12
CH157	13	14	13	CH159	13	12	/	/
CH165	13	14	13	/	/	/	/	/

CDD/MIMO

Power Index								
Channel	802.11a	802.11n HT20	802.11ac VHT20	Channel	802.11n HT40	802.11ac VHT40	Channel	802.11ac VHT80
CH36	13	14	13	CH38	10	12	CH42	6
CH40	13	14	13	CH46	13	12	/	/
CH48	13	14	13	/	/	/	/	/
CH52	13	14	13	CH54	13	12	CH58	10
CH60	13	14	13	CH62	13	12	/	/
CH64	13	14	13	/	/	/	/	/
CH100	12	14	13	CH102	10	12	CH106	10
CH104	13	/	/	CH110	13	/	/	/
CH120	13	14	13	CH118	13	12	CH122	12
CH136	13	14	/	/	/	/	/	/
CH140	11	11	13	CH134	13	12	CH138	12
CH144	13	14	13	CH142	13	12	/	/
CH149	13	14	13	CH151	13	12	CH155	12
CH157	13	14	13	CH159	13	12	/	/
CH165	13	14	13	/	/	/	/	/

Test Mode		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	19.68	23.94<24	23.94
		60/5300	19.93	23.99<24	23.99
		64/5320	19.39	23.88<24	23.88
	802.11n HT20	52/5260	20.15	24.04>24	24.00
		60/5300	19.93	24.00>24	24.00
		64/5320	19.86	23.98<24	23.98
	802.11n HT40	54/5270	41.07	27.14>24	24.00
		62/5310	41.19	27.15>24	24.00
	802.11ac VHT20	52/5260	20.10	24.03>24	24.00
		60/5300	20.18	24.05>24	24.00
		64/5320	20.00	24.01>24	24.00
	802.11ac VHT40	54/5270	40.43	27.07>24	24.00
		62/5310	40.48	27.07>24	24.00
	802.11ac VHT80	58/5290	85.53	30.32>24	24.00
U-NII-2C	802.11a	100/5500	19.36	23.87<24	23.87
		104/5520	19.30	23.85<24	23.85
		120/5600	19.12	23.81<24	23.81
		136/5680	19.25	23.84<24	23.84
		140/5700	19.50	23.90<24	23.90
		144/5720	19.17	23.83<24	23.83
	802.11n HT20	100/5500	20.26	24.07>24	24.00
		120/5600	20.43	24.10>24	24.00
		136/5680	20.33	24.08>24	24.00
		140/5700	20.15	24.04>24	24.00
		144/5720	19.80	23.97<24	23.97
	802.11n HT40	102/5510	41.26	27.15>24	24.00
		110/5550	41.09	27.14>24	24.00
		118/5590	41.23	27.15>24	24.00
		134/5670	42.77	27.31>24	24.00
		142/5710	41.77	27.21>24	24.00
	802.11ac	100/5500	20.37	24.09>24	24.00

	VHT20	120/5600	20.05	24.02>24	24.00
		140/5700	20.22	24.06>24	24.00
		144/5720	20.10	24.03>24	24.00
	802.11ac VHT40	102/5510	41.07	27.14>24	24.00
		118/5590	42.21	27.25>24	24.00
		134/5670	44.41	27.47>24	24.00
		142/5710	41.57	27.19>24	24.00
	802.11ac VHT80	106/5530	82.50	30.16>24	24.00
		122/5610	81.80	30.13>24	24.00
		138/5690	81.68	30.12>24	24.00
Note: 250mW=24dBm					

U-NII-1

Antenna 1

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	36/5180	11.20	11.33	30	PASS
	40/5200	11.04	11.17	30	PASS
	48/5240	10.98	11.11	30	PASS
802.11n HT20	36/5180	11.80	11.91	30	PASS
	40/5200	11.87	11.98	30	PASS
	48/5240	11.74	11.85	30	PASS
802.11n HT40	38/5190	8.23	8.43	30	PASS
	46/5230	11.19	11.39	30	PASS
802.11ac VHT20	36/5180	10.81	10.90	30	PASS
	40/5200	10.80	10.89	30	PASS
	48/5240	10.77	10.86	30	PASS
802.11ac VHT40	38/5190	10.28	10.51	30	PASS
	46/5230	10.29	10.52	30	PASS
802.11ac VHT80	42/5210	3.40	3.85	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

Antenna 2

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	36/5180	11.50	11.63	30	PASS
	40/5200	11.69	11.82	30	PASS
	48/5240	11.43	11.56	30	PASS
802.11n HT20	36/5180	12.21	12.32	30	PASS
	40/5200	12.46	12.57	30	PASS
	48/5240	12.12	12.23	30	PASS
802.11n HT40	38/5190	8.81	9.01	30	PASS
	46/5230	11.61	11.81	30	PASS
802.11ac VHT20	36/5180	11.24	11.33	30	PASS
	40/5200	11.44	11.53	30	PASS
	48/5240	11.17	11.26	30	PASS
802.11ac VHT40	38/5190	10.70	10.93	30	PASS
	46/5230	10.65	10.88	30	PASS
802.11ac VHT80	42/5210	4.28	4.73	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

U-NII-2A

Antenna 1

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	52/5260	10.92	11.05	23.94	PASS
	60/5300	10.88	11.01	23.99	PASS
	64/5320	10.79	10.92	23.88	PASS
802.11n HT20	52/5260	11.73	11.84	24.00	PASS
	60/5300	11.62	11.73	24.00	PASS
	64/5320	11.56	11.67	23.98	PASS
802.11n HT40	54/5270	11.09	11.29	24.00	PASS
	62/5310	11.06	11.26	24.00	PASS
802.11ac VHT20	52/5260	10.66	10.75	24.00	PASS
	60/5300	10.59	10.68	24.00	PASS
	64/5320	10.58	10.67	24.00	PASS
802.11ac VHT40	54/5270	10.11	10.34	24.00	PASS
	62/5310	10.09	10.32	24.00	PASS
802.11ac VHT80	58/5290	7.63	8.08	24.00	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

Antenna 2

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	52/5260	11.25	11.38	23.94	PASS
	60/5300	11.01	11.14	23.99	PASS
	64/5320	10.81	10.94	23.88	PASS
802.11n HT20	52/5260	12.06	12.17	24.00	PASS
	60/5300	11.84	11.95	24.00	PASS
	64/5320	11.59	11.70	23.98	PASS
802.11n HT40	54/5270	11.45	11.65	24.00	PASS
	62/5310	11.24	11.44	24.00	PASS
802.11ac VHT20	52/5260	11.13	11.22	24.00	PASS
	60/5300	10.79	10.88	24.00	PASS
	64/5320	10.61	10.70	24.00	PASS
802.11ac VHT40	54/5270	10.42	10.65	24.00	PASS
	62/5310	10.23	10.46	24.00	PASS
802.11ac VHT80	58/5290	7.91	8.36	24.00	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

U-NII-2C

Antenna 1

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	100/5500	9.50	9.63	23.87	PASS
	104/5520	10.38	10.51	23.85	PASS
	120/5600	10.42	10.55	23.81	PASS
	136/5680	10.60	10.73	23.84	PASS
	140/5700	8.51	8.64	23.90	PASS
	144/5720	9.71	9.84	23.83	PASS
802.11n HT20	100/5500	11.39	11.50	24.00	PASS
	120/5600	11.08	11.19	24.00	PASS
	136/5680	11.30	11.41	24.00	PASS
	140/5700	8.28	8.39	24.00	PASS
	144/5720	10.40	10.51	23.97	PASS
802.11n HT40	102/5510	7.85	8.05	24.00	PASS
	110/5550	10.38	10.58	24.00	PASS
	118/5590	10.57	10.77	24.00	PASS
	134/5670	10.80	11.00	24.00	PASS
	142/5710	10.45	10.65	24.00	PASS
802.11ac VHT20	100/5500	10.43	10.52	24.00	PASS
	120/5600	10.13	10.22	24.00	PASS
	140/5700	10.33	10.42	24.00	PASS
	144/5720	9.38	9.47	24.00	PASS
802.11ac VHT40	102/5510	9.96	10.19	24.00	PASS
	118/5590	9.59	9.82	24.00	PASS
	134/5670	9.86	10.09	24.00	PASS
	142/5710	9.46	9.69	24.00	PASS
802.11ac VHT80	106/5530	7.33	7.78	24.00	PASS
	122/5610	9.26	9.71	24.00	PASS
	138/5690	9.33	9.78	24.00	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

Antenna 2

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	100/5500	8.84	8.97	23.87	PASS
	104/5520	9.75	9.88	23.85	PASS
	120/5600	9.12	9.25	23.81	PASS
	136/5680	9.34	9.47	23.84	PASS
	140/5700	7.39	7.52	23.90	PASS
	144/5720	8.45	8.58	23.83	PASS
802.11n HT20	100/5500	10.62	10.73	24.00	PASS
	120/5600	9.79	9.90	24.00	PASS
	136/5680	10.09	10.20	24.00	PASS
	140/5700	7.14	7.25	24.00	PASS
	144/5720	9.15	9.26	23.97	PASS
802.11n HT40	102/5510	7.09	7.29	24.00	PASS
	110/5550	9.41	9.61	24.00	PASS
	118/5590	9.40	9.60	24.00	PASS
	134/5670	9.55	9.75	24.00	PASS
	142/5710	9.26	9.46	24.00	PASS
802.11ac VHT20	100/5500	9.65	9.74	24.00	PASS
	120/5600	8.91	9.00	24.00	PASS
	140/5700	9.08	9.17	24.00	PASS
	144/5720	8.15	8.24	24.00	PASS
802.11ac VHT40	102/5510	9.25	9.48	24.00	PASS
	118/5590	8.47	8.70	24.00	PASS
	134/5670	8.60	8.83	24.00	PASS
	142/5710	8.25	8.48	24.00	PASS
802.11ac VHT80	106/5530	6.45	6.90	24.00	PASS
	122/5610	7.95	8.40	24.00	PASS
	138/5690	8.01	8.46	24.00	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

U-NII-3

Antenna 1

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	144/5720	2.54	2.67	30	PASS
	149/5745	10.52	10.65	30	PASS
	157/5785	10.45	10.58	30	PASS
	165/5825	10.11	10.24	30	PASS
802.11n HT20	144/5720	3.54	3.65	30	PASS
	149/5745	11.27	11.38	30	PASS
	157/5785	11.22	11.33	30	PASS
	165/5825	10.89	11.00	30	PASS
802.11n HT40	142/5710	-1.84	-1.64	30	PASS
	151/5755	10.79	10.99	30	PASS
	159/5795	10.61	10.81	30	PASS
802.11ac VHT20	144/5720	2.63	2.72	30	PASS
	149/5745	10.40	10.49	30	PASS
	157/5785	10.17	10.26	30	PASS
	165/5825	9.87	9.96	30	PASS
802.11ac VHT40	142/5710	-2.85	-2.62	30	PASS
	151/5755	9.79	10.02	30	PASS
	159/5795	9.67	9.90	30	PASS
802.11ac VHT80	138/5690	-7.75	-7.30	30	PASS
	155/5775	9.07	9.52	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

Antenna 2

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	144/5720	1.26	1.39	30	PASS
	149/5745	9.01	9.14	30	PASS
	157/5785	8.72	8.85	30	PASS
	165/5825	8.96	9.09	30	PASS
802.11n HT20	144/5720	1.93	2.04	30	PASS
	149/5745	9.52	9.63	30	PASS
	157/5785	9.33	9.44	30	PASS
	165/5825	9.59	9.70	30	PASS
802.11n HT40	142/5710	-3.09	-2.89	30	PASS
	151/5755	9.14	9.34	30	PASS
	159/5795	8.99	9.19	30	PASS
802.11ac VHT20	144/5720	1.33	1.42	30	PASS
	149/5745	8.81	8.90	30	PASS
	157/5785	8.71	8.80	30	PASS
	165/5825	8.59	8.68	30	PASS
802.11ac VHT40	142/5710	-4.40	-4.17	30	PASS
	151/5755	8.13	8.36	30	PASS
	159/5795	7.76	7.99	30	PASS
802.11ac VHT80	138/5690	-9.16	-8.71	30	PASS
	155/5775	7.55	8.00	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

CDD/MIMO

U-NII-1

Test Mode	Channel/ Frequency (MHz)	Antenna 1		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)			
U-NII-1 802.11a	36/5180	11.04	11.17	11.48	11.61	14.41	30.00	PASS
	40/5200	11.02	11.15	11.58	11.71	14.45	30.00	PASS
	48/5240	10.97	11.10	11.06	11.19	14.16	30.00	PASS
802.11n HT20	36/5180	11.92	12.03	12.28	12.39	15.22	30.00	PASS
	40/5200	11.91	12.02	12.41	12.52	15.29	30.00	PASS
	48/5240	11.70	11.81	11.91	12.02	14.92	30.00	PASS
802.11n HT40	38/5190	7.90	8.10	8.87	9.07	11.62	30.00	PASS
	46/5230	11.20	11.40	11.36	11.56	14.49	30.00	PASS
802.11ac VHT20	36/5180	10.80	10.89	11.23	11.32	14.12	30.00	PASS
	40/5200	10.76	10.85	11.34	11.43	14.16	30.00	PASS
	48/5240	10.67	10.76	10.83	10.92	13.85	30.00	PASS
802.11ac VHT40	38/5190	10.27	10.50	10.65	10.88	13.71	30.00	PASS
	46/5230	10.21	10.44	10.37	10.60	13.53	30.00	PASS
802.11ac VHT80	42/5210	3.22	3.67	4.23	4.68	7.21	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 Nss=1.According to KDB 662911 D01 Multiple Transmitter Output v02r01 F)2)f)(ii): If antenna gains are not equal, the user may use either of the following methods to calculate directional gain, provided that each transmit antenna is driven by only one spatial stream: Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain.
Directional gain = $G_{ANT\ MAX}$ + 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 = $G_{ANT\ MAX}$ + Array Gain = 5.4 +0= 5.4 dBi<6dBi. So the power limit is 24dBm.

U-NII-2A

Test Mode	Channel/ Frequency (MHz)	Antenna 1		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)			
U-NII-1 802.11a	52/5260	10.79	10.92	10.77	10.90	13.92	23.94	PASS
	60/5300	10.73	10.86	10.44	10.57	13.73	23.99	PASS
	64/5320	10.75	10.88	10.42	10.55	13.73	23.88	PASS
802.11n HT20	52/5260	11.64	11.75	11.68	11.79	14.78	24.00	PASS
	60/5300	11.59	11.70	11.28	11.39	14.56	24.00	PASS
	64/5320	11.63	11.74	11.20	11.31	14.54	23.98	PASS
802.11n HT40	54/5270	10.97	11.17	10.95	11.15	14.17	24.00	PASS
	62/5310	10.96	11.16	10.78	10.98	14.08	24.00	PASS
802.11ac VHT20	52/5260	10.61	10.70	10.63	10.72	13.72	24.00	PASS
	60/5300	10.57	10.66	10.25	10.34	13.51	24.00	PASS
	64/5320	10.50	10.59	10.26	10.35	13.48	24.00	PASS
802.11ac VHT40	54/5270	10.07	10.30	9.90	10.13	13.23	24.00	PASS
	62/5310	10.05	10.28	9.82	10.05	13.18	24.00	PASS
802.11ac VHT80	58/5290	7.06	7.51	7.80	8.25	10.91	24.00	PASS

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

U-NII-2C

Test Mode	Channel/ Frequency (MHz)	Antenna 1		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)			
U-NII-1 802.11a	100/5500	9.03	9.16	8.34	8.47	11.84	23.87	PASS
	104/5520	9.93	10.06	9.40	9.53	12.81	23.85	PASS
	120/5600	10.31	10.44	9.45	9.58	13.04	23.81	PASS
	136/5680	9.73	9.86	8.98	9.11	12.51	23.84	PASS
	140/5700	7.54	7.67	7.03	7.16	10.43	23.90	PASS
	144/5720	9.63	9.76	8.41	8.54	12.20	23.83	PASS
802.11n HT20	100/5500	11.44	11.55	10.06	10.17	13.92	24.00	PASS
	120/5600	11.06	11.17	10.25	10.36	13.79	24.00	PASS
	136/5680	10.48	10.59	9.75	9.86	13.25	24.00	PASS
	140/5700	7.26	7.37	6.82	6.93	10.17	24.00	PASS
	144/5720	10.27	10.38	9.04	9.15	12.82	23.97	PASS
802.11n HT40	102/5510	7.25	7.45	6.73	6.93	10.21	24.00	PASS
	110/5550	9.73	9.93	9.35	9.55	12.75	24.00	PASS
	118/5590	10.51	10.71	9.67	9.87	13.32	24.00	PASS
	134/5670	10.71	10.91	9.50	9.70	13.35	24.00	PASS
	142/5710	10.29	10.49	9.10	9.30	12.95	24.00	PASS
802.11ac VHT20	100/5500	10.39	10.48	9.05	9.14	12.87	24.00	PASS
	120/5600	10.00	10.09	9.20	9.29	12.72	24.00	PASS
	140/5700	10.23	10.32	8.97	9.06	12.75	24.00	PASS
	144/5720	9.30	9.39	8.09	8.18	11.84	24.00	PASS
802.11ac VHT40	102/5510	9.84	10.07	8.71	8.94	12.55	24.00	PASS
	118/5590	9.46	9.69	8.74	8.97	12.35	24.00	PASS
	134/5670	9.71	9.94	8.53	8.76	12.40	24.00	PASS
	142/5710	9.34	9.57	8.14	8.37	12.02	24.00	PASS
802.11ac VHT80	106/5530	6.76	7.21	6.59	7.04	10.14	24.00	PASS
	122/5610	9.12	9.57	8.18	8.63	12.13	24.00	PASS
	138/5690	9.28	9.73	7.91	8.36	12.11	24.00	PASS

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

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

U-NII-3

Test Mode	Channel/ Frequency (MHz)	Antenna 1		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)			
U-NII-1 802.11a	144/5720	2.39	2.52	1.24	1.37	5.00	30.00	PASS
	149/5745	10.44	10.57	8.98	9.11	12.91	30.00	PASS
	157/5785	10.13	10.26	8.92	9.05	12.71	30.00	PASS
	165/5825	10.02	10.15	8.76	8.89	12.57	30.00	PASS
802.11n HT20	144/5720	3.39	3.50	2.25	2.36	5.98	30.00	PASS
	149/5745	11.15	11.26	9.76	9.87	13.63	30.00	PASS
	157/5785	11.09	11.20	9.70	9.81	13.57	30.00	PASS
	165/5825	10.82	10.93	9.52	9.63	13.34	30.00	PASS
802.11n HT40	142/5710	-1.92	-1.72	-3.16	-2.96	0.72	30.00	PASS
	151/5755	10.23	10.43	8.94	9.14	12.84	30.00	PASS
	159/5795	10.48	10.68	9.12	9.32	13.06	30.00	PASS
802.11ac VHT20	144/5720	2.51	2.60	1.20	1.29	5.00	30.00	PASS
	149/5745	9.99	10.08	8.80	8.89	12.53	30.00	PASS
	157/5785	10.11	10.20	8.64	8.73	12.54	30.00	PASS
	165/5825	9.85	9.94	8.57	8.66	12.36	30.00	PASS
802.11ac VHT40	142/5710	-3.01	-2.78	-4.05	-3.82	-0.26	30.00	PASS
	151/5755	9.71	9.94	8.35	8.58	12.33	30.00	PASS
	159/5795	9.59	9.82	8.14	8.37	12.16	30.00	PASS
802.11ac VHT80	138/5690	-7.80	-7.35	-8.79	-8.34	-4.81	30.00	PASS
	155/5775	9.10	9.55	7.77	8.22	11.95	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 $N_{ss}=1$. According to KDB 662911 D01 Multiple Transmitter Output v02r01 F)2)f)(ii): If antenna gains are not equal, the user may use either of the following methods to calculate directional gain, provided that each transmit antenna is driven by only one spatial stream: Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain.
Directional gain = $G_{ANT\ MAX}$ + 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 = $G_{ANT\ MAX}$ + Array Gain = 5.4 +0= 5.4 dBi<6dBi. So the power limit is 30dBm.

5.3. Frequency Stability

Ambient condition

Temperature	Relative humidity
20°C ~25°C	45%~50%

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	5200.000590	5199.994353	5199.987341	5199.979748
3.3	-10	5199.997448	5199.984545	5199.977980	5199.970738
3.3	0	5199.989172	5199.981294	5199.977684	5199.965812
3.3	10	5199.980864	5199.975876	5199.971845	5199.961629
3.3	20	5199.976184	5199.971965	5199.964278	5199.959694
3.3	30	5199.969639	5199.971320	5199.956312	5199.954499
3.3	40	5199.967211	5199.970309	5199.953190	5199.944977
3.3	50	5199.959656	5199.969096	5199.951175	5199.944289
3.14	20	5199.958261	5199.967622	5199.944697	5199.934619
3.46	20	5199.949492	5199.965216	5199.944588	5199.926017
Max. ΔMHz		-0.050508	-0.034784	-0.055412	-0.073983
PPM		-9.713128	-6.689259	-10.656076	-14.227491

Voltage (V)	Temperature (°C)	U-NII-2A Test Results			
		5300MHz			
		1min	2min	5min	10min
3.3	-20	5299.998591	5299.997984	5299.997410	5299.993286
3.3	-10	5299.996260	5299.988576	5299.995528	5299.989602
3.3	0	5299.993824	5299.986970	5299.991292	5299.982441
3.3	10	5299.988861	5299.984212	5299.987362	5299.977456
3.3	20	5299.983431	5299.974343	5299.980784	5299.972634
3.3	30	5299.977407	5299.973422	5299.978482	5299.972324
3.3	40	5299.974058	5299.969786	5299.977933	5299.964777
3.3	50	5299.967218	5299.968081	5299.968267	5299.957636
3.14	20	5299.958811	5299.966010	5299.965741	5299.950729
3.46	20	5299.949808	5299.956556	5299.964268	5299.945616
Max. ΔMHz		-0.050192	-0.043444	-0.035732	-0.054384
PPM		-9.470265	-8.196963	-6.741898	-10.261121

Voltage (V)	Temperature (°C)	U-NII-2C Test Results			
		5580MHz			
		1min	2min	5min	10min
3.3	-20	5579.990704	5579.985351	5579.975456	5579.966589
3.3	-10	5579.984304	5579.983197	5579.969931	5579.962332
3.3	0	5579.974582	5579.981244	5579.964020	5579.958978
3.3	10	5579.967869	5579.981105	5579.962795	5579.958477
3.3	20	5579.966464	5579.977054	5579.953092	5579.956784
3.3	30	5579.959049	5579.973909	5579.949263	5579.949415
3.3	40	5579.955987	5579.969016	5579.940284	5579.945658
3.3	50	5579.950271	5579.962796	5579.938820	5579.945421
3.14	20	5579.942391	5579.962179	5579.930759	5579.942979
3.46	20	5579.935389	5579.953516	5579.926428	5579.938981
Max. ΔMHz		-0.064611	-0.046484	-0.073572	-0.061019
PPM		-11.579106	-8.330473	-13.185009	-10.935369

Voltage (V)	Temperature (°C)	U-NII-3 Test Results			
		5785MHz			
		1min	2min	5min	10min
3.3	-20	5784.999717	5784.990998	5784.990830	5784.984902
3.3	-10	5784.998967	5784.987776	5784.990149	5784.977195
3.3	0	5784.991914	5784.985050	5784.980593	5784.977004
3.3	10	5784.983640	5784.978338	5784.977411	5784.967346
3.3	20	5784.978219	5784.970075	5784.974510	5784.961111
3.3	30	5784.976584	5784.967087	5784.968405	5784.953582
3.3	40	5784.972350	5784.959763	5784.963696	5784.949566
3.3	50	5784.969919	5784.952856	5784.954386	5784.944220
3.14	20	5784.960793	5784.948270	5784.949007	5784.940809
3.46	20	5784.957445	5784.945467	5784.940831	5784.939111
Max. ΔMHz		-0.042555	-0.054533	-0.059169	-0.060889
PPM		-7.356176	-9.426694	-10.227920	-10.525323

5.4. Power Spectral Density

Ambient condition

Temperature	Relative humidity
20°C ~25°C	45%~50%

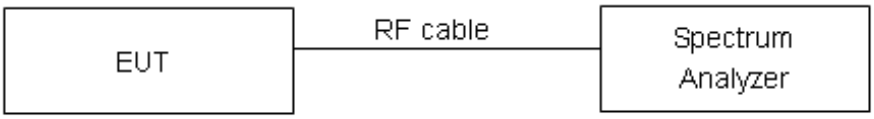
Method of Measurement

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	17dBm/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

Antenna 1

Mode	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	36	1.11	1.24	17	PASS
	40	0.81	0.94	17	PASS
	48	0.88	1.01	17	PASS
802.11n HT20	36	1.50	1.61	17	PASS
	40	1.59	1.70	17	PASS
	48	1.53	1.64	17	PASS
802.11n HT40	38	-5.07	-4.87	17	PASS
	46	-2.12	-1.92	17	PASS
802.11ac VHT20	36	0.69	0.78	17	PASS
	40	0.49	0.58	17	PASS
	48	0.39	0.48	17	PASS
802.11ac VHT40	38	-2.83	-2.60	17	PASS
	46	-3.11	-2.88	17	PASS
802.11ac VHT80	42	-13.21	-12.76	17	PASS

Antenna 2

Mode	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	36	1.38	1.51	17	PASS
	40	1.88	2.01	17	PASS
	48	1.31	1.44	17	PASS
802.11n HT20	36	1.89	2.00	17	PASS
	40	2.24	2.35	17	PASS
	48	1.90	2.01	17	PASS
802.11n HT40	38	-4.63	-4.43	17	PASS
	46	-1.55	-1.35	17	PASS
802.11ac VHT20	36	0.96	1.05	17	PASS
	40	1.48	1.57	17	PASS
	48	1.12	1.21	17	PASS
802.11ac VHT40	38	-2.62	-2.39	17	PASS
	46	-2.34	-2.11	17	PASS
802.11ac VHT80	42	-12.03	-11.58	17	PASS

U-NII-2A

Antenna 1

Mode	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	52	0.71	0.84	11	PASS
	60	1.04	1.17	11	PASS
	64	0.94	1.07	11	PASS
802.11n HT20	52	1.50	1.61	11	PASS
	60	1.57	1.68	11	PASS
	64	1.27	1.38	11	PASS
802.11n HT40	54	-2.07	-1.87	11	PASS
	62	-2.36	-2.16	11	PASS
802.11ac VHT20	52	0.34	0.43	11	PASS
	60	0.34	0.43	11	PASS
	64	0.74	0.83	11	PASS
802.11ac VHT40	54	-3.01	-2.78	11	PASS
	62	-3.12	-2.89	11	PASS
802.11ac VHT80	58	-8.68	-8.23	11	PASS

Antenna 2

Mode	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	52	1.42	1.55	11	PASS
	60	1.00	1.13	11	PASS
	64	0.91	1.04	11	PASS
802.11n HT20	52	1.95	2.06	11	PASS
	60	1.66	1.77	11	PASS
	64	1.43	1.54	11	PASS
802.11n HT40	54	-1.98	-1.78	11	PASS
	62	-1.94	-1.74	11	PASS
802.11ac VHT20	52	1.35	1.44	11	PASS
	60	0.58	0.67	11	PASS
	64	0.41	0.50	11	PASS
802.11ac VHT40	54	-2.89	-2.66	11	PASS
	62	-2.72	-2.49	11	PASS
802.11ac VHT80	58	-8.29	-7.84	11	PASS

U-NII-2C

Antenna 1

Mode	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	100	-0.40	-0.27	11	PASS
	104	0.44	0.57	11	PASS
	120	0.40	0.53	11	PASS
	136	0.55	0.68	11	PASS
	140	-1.58	-1.45	11	PASS
	144	0.49	0.62	11	PASS
802.11n HT20	100	1.30	1.41	11	PASS
	120	0.88	0.99	11	PASS
	136	1.21	1.32	11	PASS
	140	-1.78	-1.67	11	PASS
	144	0.99	1.10	11	PASS
802.11n HT40	102	-5.55	-5.35	11	PASS
	110	-2.98	-2.78	11	PASS
	118	-2.95	-2.75	11	PASS
	134	-2.77	-2.57	11	PASS
	142	-2.62	-2.42	11	PASS
802.11ac VHT20	100	0.23	0.32	11	PASS
	120	-0.03	0.06	11	PASS
	140	0.29	0.38	11	PASS
	144	-0.03	0.06	11	PASS
802.11ac VHT40	102	-2.89	-2.66	11	PASS
	118	-3.74	-3.51	11	PASS
	134	-3.47	-3.24	11	PASS
	142	-3.43	-3.20	11	PASS
802.11ac VHT80	106	-8.90	-8.45	11	PASS
	122	-7.03	-6.58	11	PASS
	128	-7.05	-6.60	11	PASS

Antenna 2

Mode	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	100	-1.19	-1.06	11	PASS
	104	-0.36	-0.23	11	PASS
	120	-1.02	-0.89	11	PASS
	136	-0.40	-0.27	11	PASS
	140	-2.60	-2.47	11	PASS
	144	-0.92	-0.79	11	PASS
802.11n HT20	100	0.34	0.45	11	PASS
	120	-0.03	0.08	11	PASS
	136	-0.02	0.09	11	PASS
	140	-2.79	-2.68	11	PASS
	144	-0.20	-0.09	11	PASS
802.11n HT40	102	-6.20	-6.00	11	PASS
	110	-3.95	-3.75	11	PASS
	118	-3.91	-3.71	11	PASS
	134	-3.62	-3.42	11	PASS
	142	-3.74	-3.54	11	PASS
802.11ac VHT20	100	-0.76	-0.67	11	PASS
	120	-1.32	-1.23	11	PASS
	140	-0.78	-0.69	11	PASS
	144	-1.09	-1.00	11	PASS
802.11ac VHT40	102	-3.95	-3.72	11	PASS
	118	-4.93	-4.70	11	PASS
	134	-4.82	-4.59	11	PASS
	142	-4.65	-4.42	11	PASS
802.11ac VHT80	106	-9.68	-9.23	11	PASS
	122	-8.11	-7.66	11	PASS
	128	-8.03	-7.58	11	PASS