

RF TEST REPORT

Applicant	Quectel Wireless Solutions Company Limited
FCC ID	XMR2023FCS960KN
Product	Wi-Fi & Bluetooth Module
Brand	Quectel
Model	FCS960K-N
Report No.	R2308A0883-R3V2
Issue Date	March 27, 2024

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15E (2023)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Prepared by: Zhu Chentao

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

1. Test Laboratory	5
1.1. Notes of the test report	5
1.2. Test facility	5
1.3. Testing Location.....	5
2. General Description of Equipment under Test	6
2.1. Applicant and Manufacturer Information	6
2.2. General information	6
3. Applied Standards	8
4. Test Configuration	9
5. Test Case Results	11
5.1. Occupied Bandwidth	11
5.2. Average Power Output	74
5.3. Frequency Stability	83
5.4. Power Spectral Density	87
5.5. Unwanted Emission	138
5.6. Conducted Emission	272
6. Main Test Instruments	274
ANNEX A: The EUT Appearance.....	275
ANNEX B: Test Setup Photos	276

Version	Revision Description	Issue Date
Rev.0	Initial issue of report.	March 12, 2024
Rev.1	Update description.	March 20, 2024
Rev.2	Update data.	March 27, 2024
Note: This revised report (Report No.: R2308A0883-R3V2) supersedes and replaces the previously issued report (Report No.: R2308A0883-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	NA
Date of Testing: January 9, 2024 ~ March 26, 2024 Date of Sample Received: August 28, 2023			
Note: PASS: The EUT complies with the essential requirements in the standard. NA = Not Applicable. 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:	https://www.eurofins.com/electrical-and-electronics
E-mail:	Kain.Xu@cpt.eurofinscn.com

2. General Description of Equipment under Test

2.1. Applicant and Manufacturer Information

Applicant	Quectel Wireless Solutions Company Limited
Applicant address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233
Manufacturer	Quectel Wireless Solutions Company Limited
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	FCS960K-N
IMEI	Conducted: P1D23C804002063 Radiated: E1N23G40F000056
Hardware Version	R1.0
Software Version	NA
Power Supply	External power supply
Antenna Type	External Antenna
Antenna Connector	RP SMA Male (meet with the standard FCC Part 15.203 requirement)
Antenna Gain	U-NII-1: 1.14 dBi U-NII-2A: 1.00 dBi U-NII-2C: 0.60 dBi U-NII-3: 0.95 dBi
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: OFDM 802.11n (HT20/HT40): OFDM 802.11ac (VHT20/VHT40): OFDM 802.11ax (HE20/HE40): OFDM (Only Support Full Ru)
Max. Output Power	17.07 dBm
Testing temperature range	-30 ° C to 50° C
Operating temperature range	-20 ° C to 80° C
Operating voltage range	3.0 V to 3.6 V
State AC voltage	3.3 V
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.

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 (2023) 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 (vertical), lie-down position (horizontal). The worst emission was found in stand-up position (vertical) 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
802.11ax HE20	MCS0
802.11ax HE40	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
	U-NII-2A	20 MHz	52	5260MHz
			56	5280MHz
			60	5300MHz
			64	5320MHz
		40 MHz	54	5270MHz
			62	5310MHz
	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
	U-NII-3	20 MHz	149	5745MHz
			153	5765MHz
			157	5785MHz
			161	5805MHz
			165	5825MHz
		40 MHz	151	5755MHz
			159	5795MHz
Does this device support TPC Function? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
Does this device support TDWR Band? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				

5. Test Case Results

5.1. Occupied Bandwidth

Ambient condition

Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

Method of Measurement

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

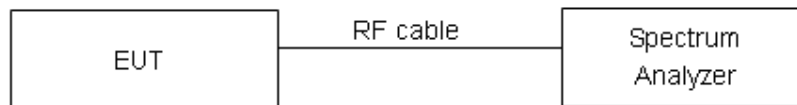
For U-NII-1/U-NII-2A/U-NII-2C, set RBW $\approx 1\%$ OCB kHz, VBW $\geq 3 \times$ RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum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

For U-NII-3, Set RBW = 100 kHz, VBW $\geq 3 \times$ 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

For U-NII-1/U-NII-2A/U-NII-2C

No specific occupied bandwidth requirements in Part 15.407.

For U-NII-3

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	16.92	25.60	PASS
	5200	16.91	25.10	PASS
	5240	16.93	24.19	PASS
802.11n HT20	5180	18.07	26.88	PASS
	5200	18.06	25.88	PASS
	5240	18.07	26.02	PASS
802.11n HT40	5190	36.57	46.37	PASS
	5230	36.56	45.80	PASS
802.11ac VHT20	5180	18.10	25.55	PASS
	5200	18.09	26.16	PASS
	5240	18.03	26.47	PASS
802.11ac VHT40	5190	36.58	48.10	PASS
	5230	36.60	46.57	PASS
802.11ax HE20	5180	19.12	26.27	PASS
	5200	19.11	24.81	PASS
	5240	19.12	25.57	PASS
802.11ax HE40	5190	37.96	45.72	PASS
	5230	37.93	45.19	PASS

U-NII-2A

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5260	16.84	24.46	PASS
	5300	16.86	25.60	PASS
	5320	16.89	26.00	PASS
802.11n HT20	5260	18.10	27.09	PASS
	5300	18.09	27.01	PASS
	5320	18.08	26.71	PASS
802.11n HT40	5270	36.63	48.97	PASS
	5310	36.54	46.39	PASS
802.11ac VHT20	5260	18.12	27.09	PASS
	5300	18.10	26.77	PASS
	5320	18.11	26.66	PASS
802.11ac VHT40	5270	36.62	46.97	PASS
	5310	36.60	46.53	PASS
802.11ax HE20	5260	19.16	25.51	PASS
	5300	19.10	24.24	PASS
	5320	19.07	25.38	PASS
802.11ax HE40	5270	37.97	45.51	PASS
	5310	37.93	44.17	PASS

U-NII-2C

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5500	16.99	25.38	PASS
	5600	16.96	25.67	PASS
	5700	17.05	25.01	PASS
	5720	17.03	25.60	PASS
802.11n HT20	5500	18.28	25.94	PASS
	5600	18.27	27.55	PASS
	5700	18.26	27.34	PASS
	5720	18.22	27.34	PASS
802.11n HT40	5510	36.82	47.73	PASS
	5590	36.82	49.20	PASS
	5670	36.82	50.83	PASS
	5710	36.79	52.88	PASS
802.11ac VHT20	5500	18.27	25.75	PASS
	5600	18.22	26.89	PASS
	5700	18.25	27.08	PASS
	5720	18.21	26.66	PASS
802.11ac VHT40	5510	36.78	47.63	PASS
	5590	36.81	48.08	PASS
	5670	36.84	47.50	PASS
	5710	36.82	47.06	PASS
802.11ax HE20	5500	19.23	26.33	PASS
	5600	19.20	26.55	PASS
	5700	19.20	25.87	PASS
	5720	19.26	25.59	PASS
802.11ax HE40	5510	38.06	46.87	PASS
	5590	38.13	46.73	PASS
	5670	38.15	45.27	PASS
	5710	38.11	45.32	PASS

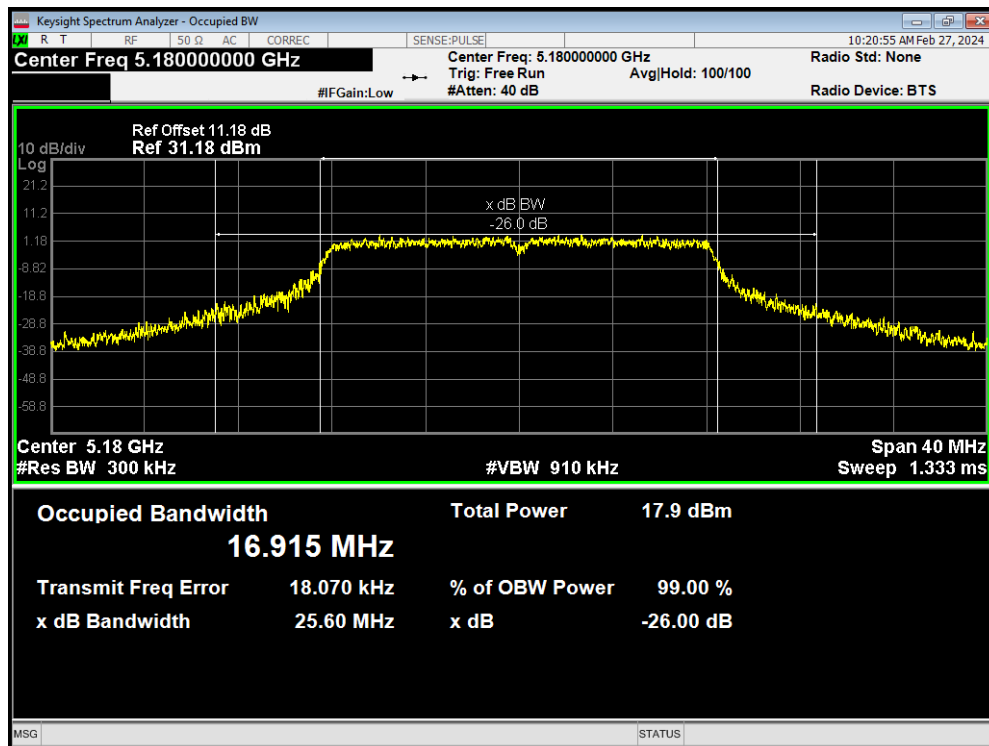
U-NII-3

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11a	5720	17.05	16.40	500	PASS
	5745	17.05	16.36	500	PASS
	5785	17.04	16.35	500	PASS
	5825	17.00	16.35	500	PASS
802.11n HT20	5720	18.23	17.61	500	PASS
	5745	18.29	17.61	500	PASS
	5785	18.27	17.67	500	PASS
	5825	18.20	17.61	500	PASS
802.11n HT40	5710	36.82	36.36	500	PASS
	5755	36.84	36.35	500	PASS
	5795	36.84	36.38	500	PASS
802.11ac VHT20	5720	18.28	17.70	500	PASS
	5745	18.29	17.59	500	PASS
	5785	18.26	17.60	500	PASS
	5825	18.25	17.64	500	PASS
802.11ac VHT40	5710	36.78	36.35	500	PASS
	5755	36.86	36.36	500	PASS
	5795	36.88	36.36	500	PASS
802.11ax HE20	5720	19.18	18.97	500	PASS
	5745	19.24	18.98	500	PASS
	5785	19.23	18.98	500	PASS
	5825	19.23	18.92	500	PASS
802.11ax HE40	5710	38.07	38.05	500	PASS
	5755	38.08	37.96	500	PASS
	5795	38.12	38.01	500	PASS

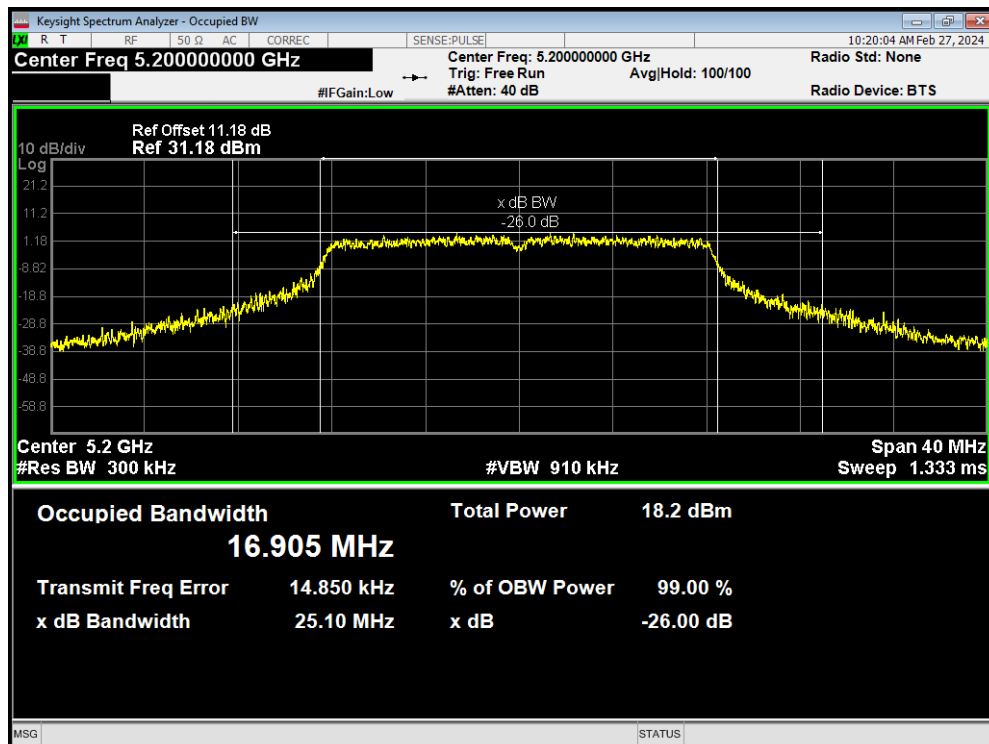
99% bandwidth

U-NII-1

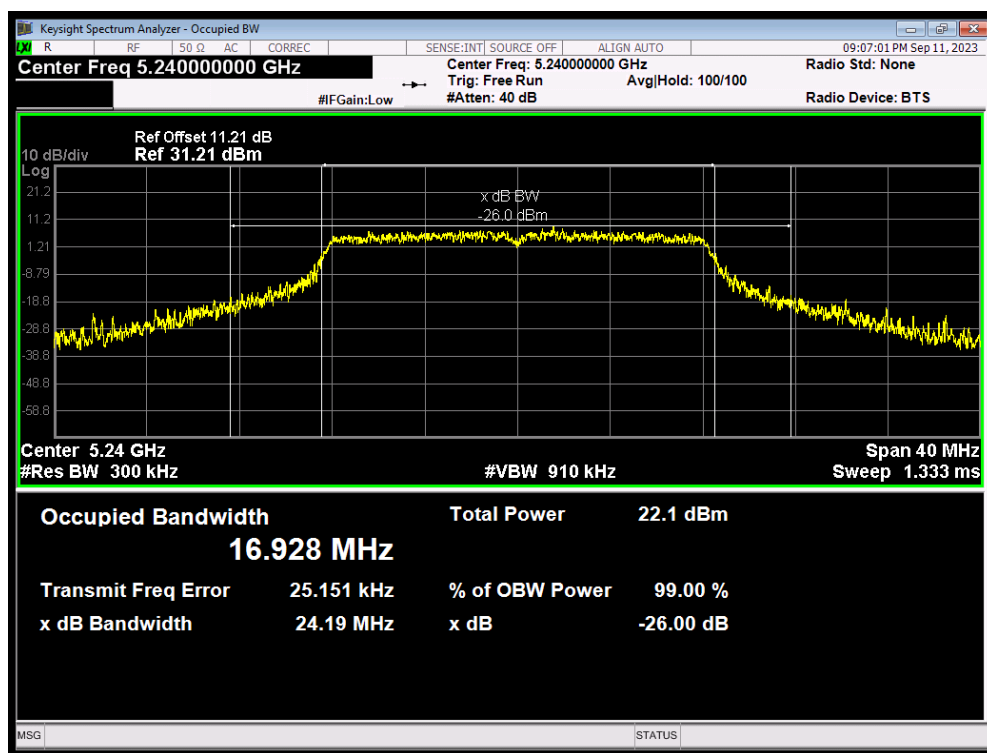
OBW 802.11a 5180MHz



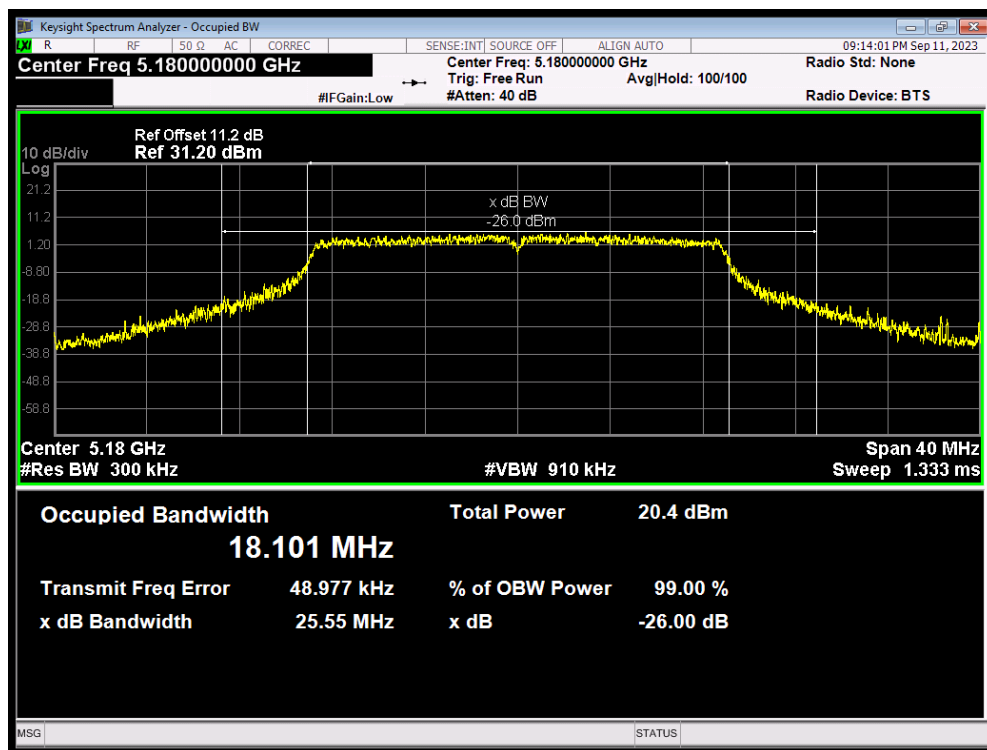
OBW 802.11a 5200MHz



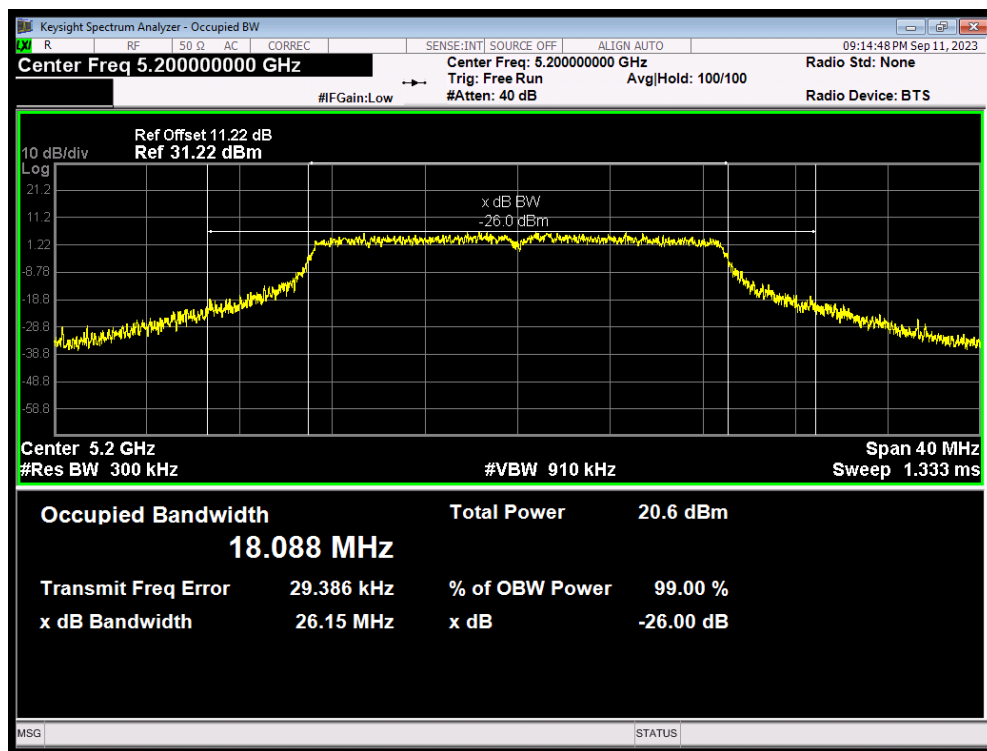
OBW 802.11a 5240MHz



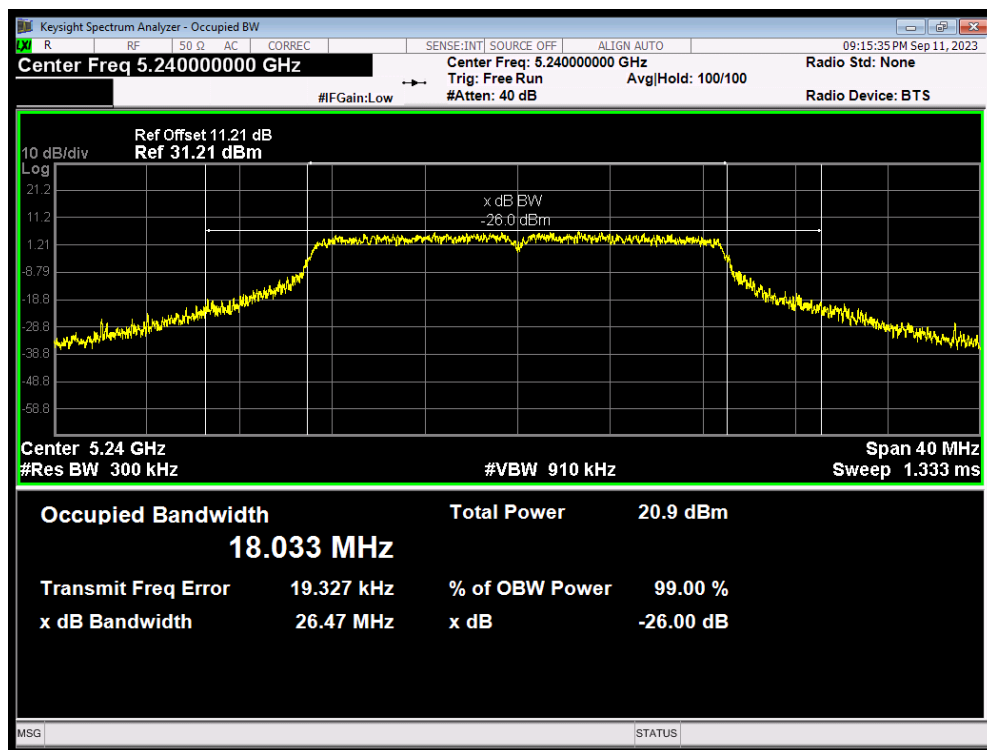
OBW 802.11ac(VHT20) 5180MHz



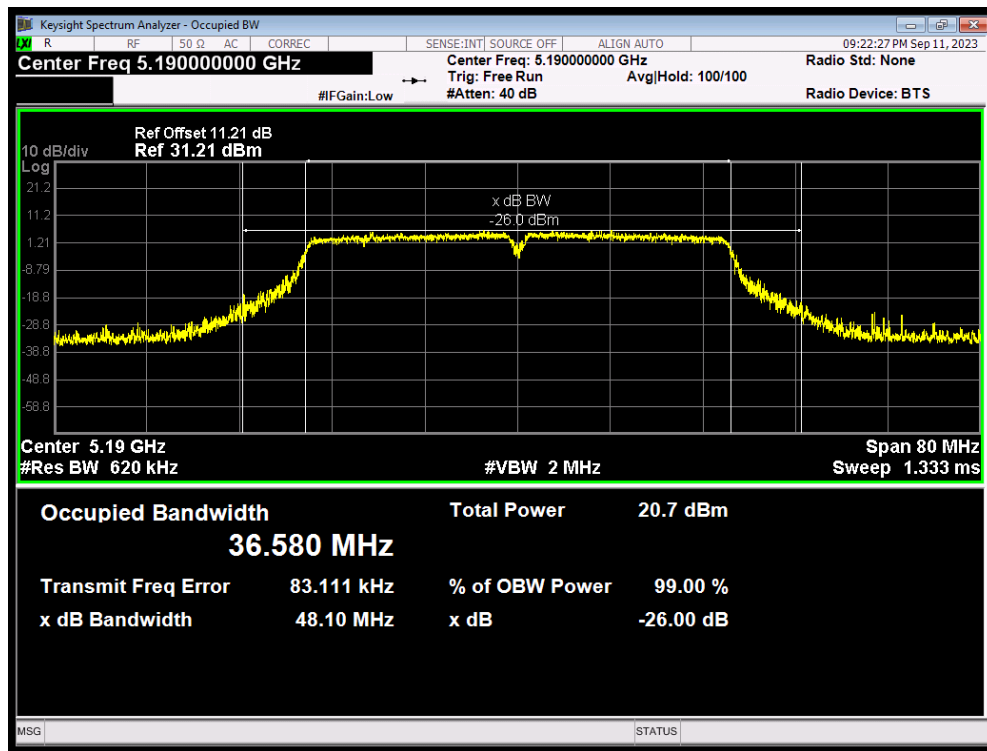
OBW 802.11ac(VHT20) 5200MHz



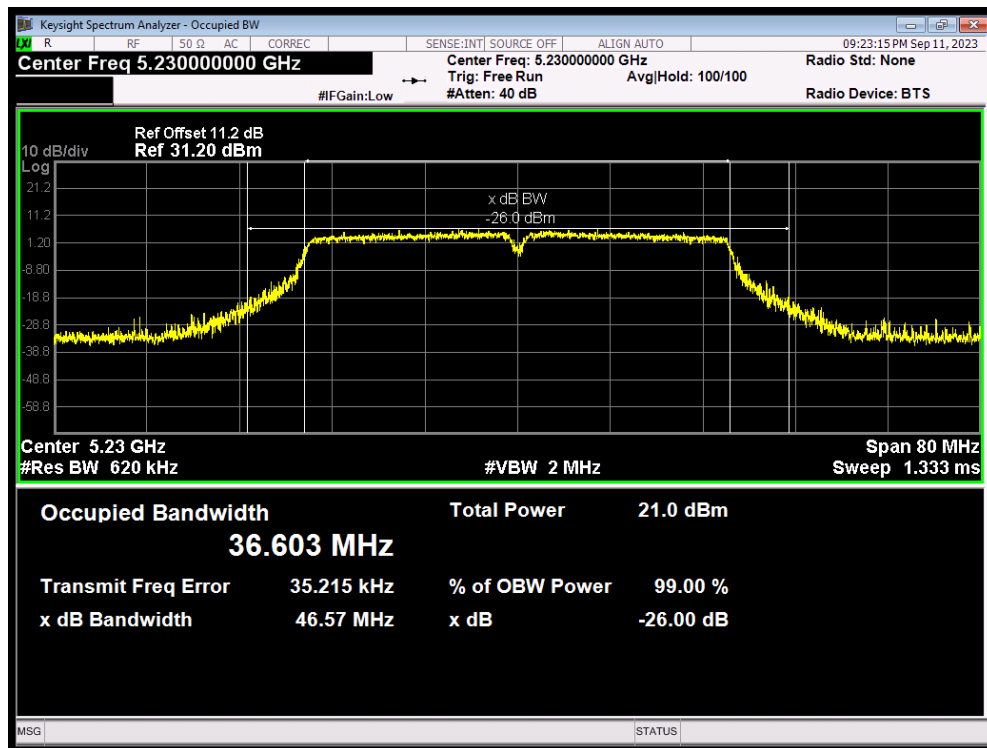
OBW 802.11ac(VHT20) 5240MHz



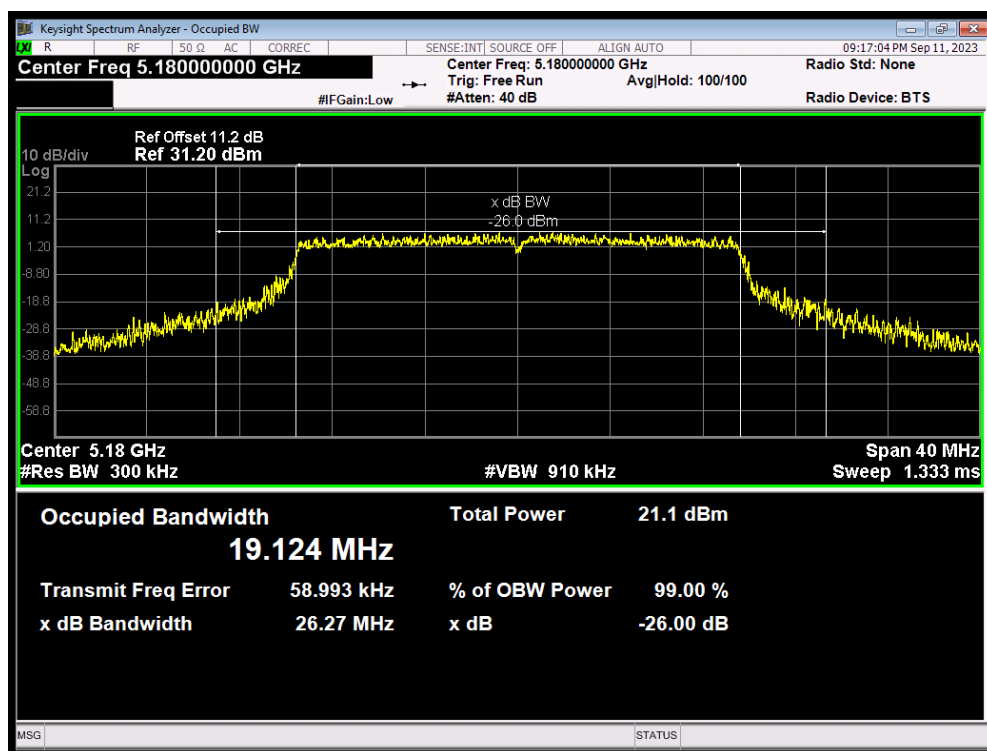
OBW 802.11ac(VHT40) 5190MHz



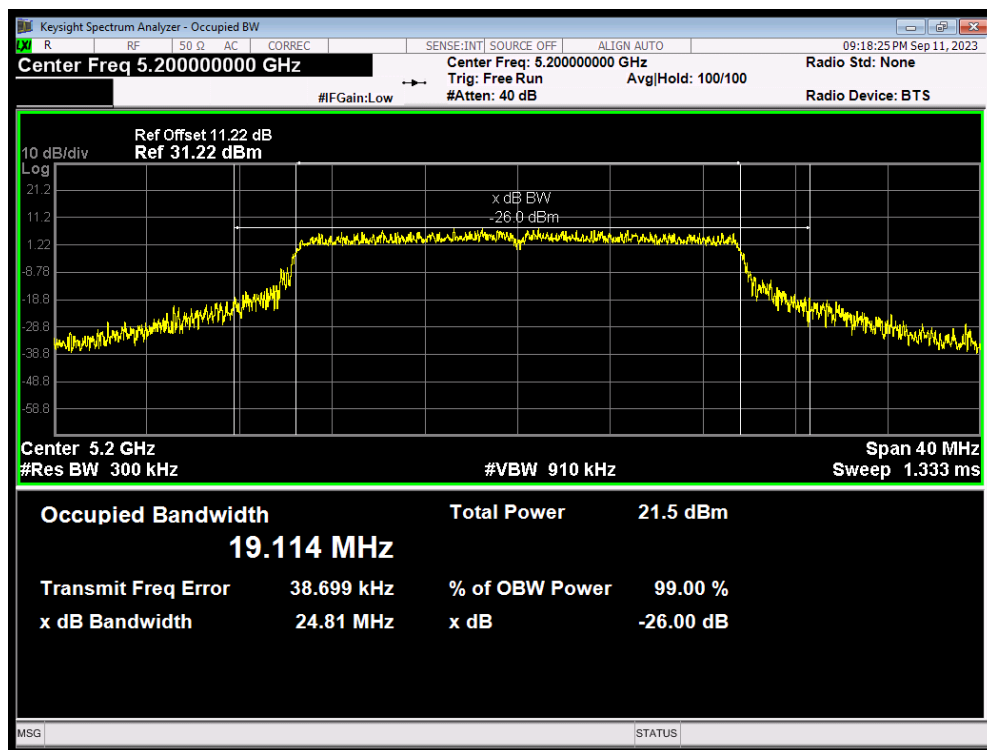
OBW 802.11ac(VHT40) 5230MHz



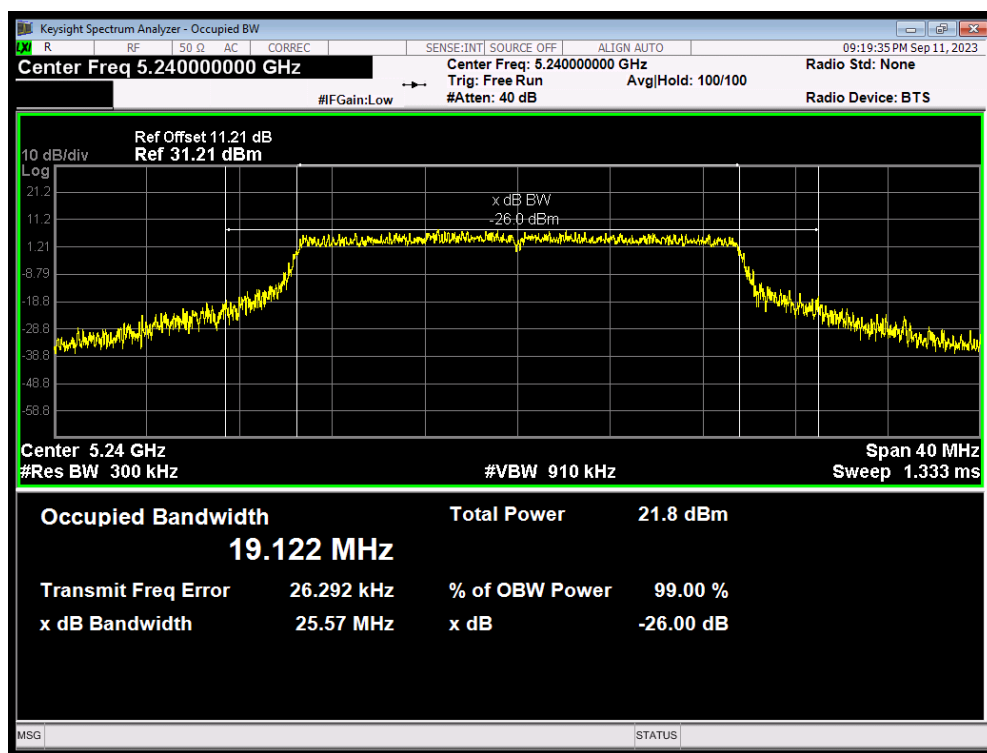
OBW 802.11ax(HE20) 5180MHz



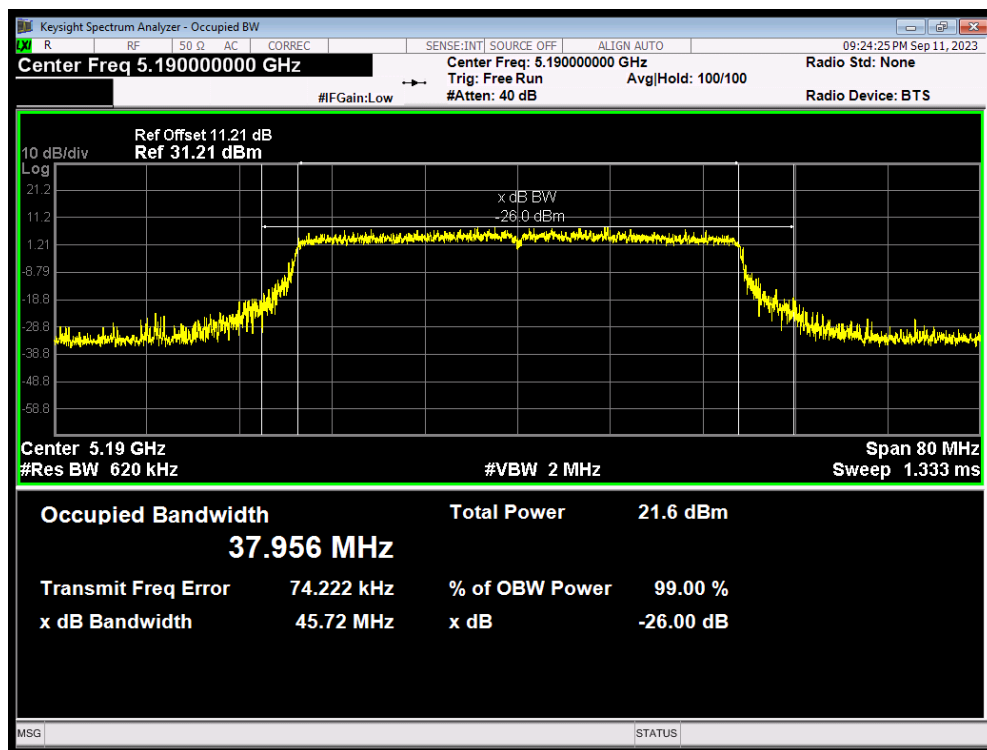
OBW 802.11ax(HE20) 5200MHz



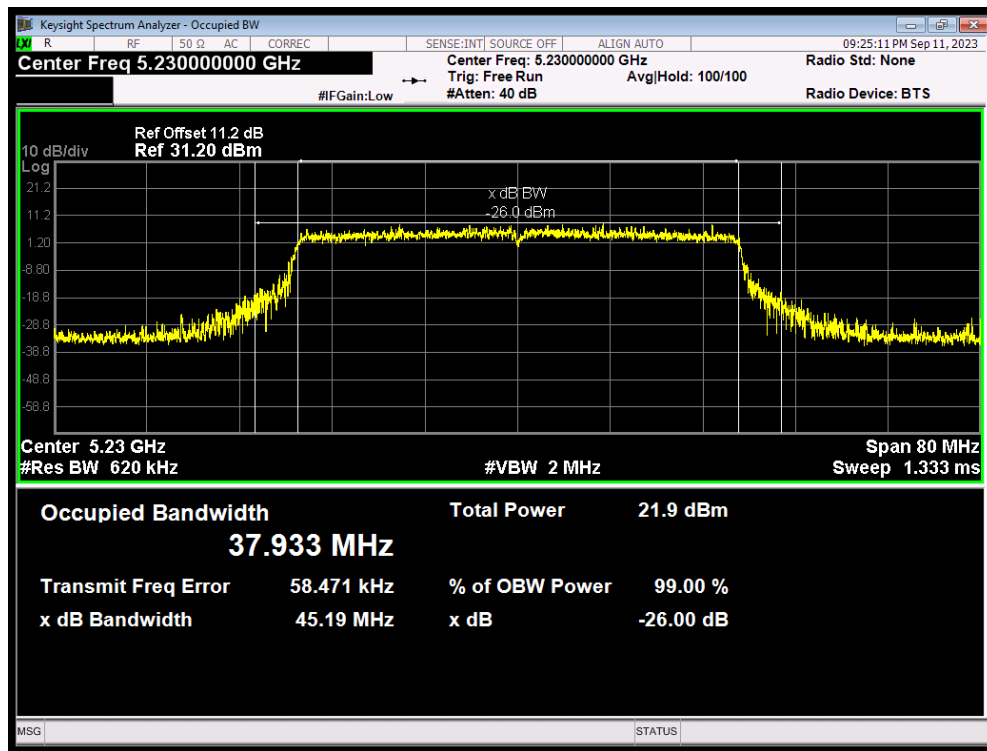
OBW 802.11ax(HE20) 5240MHz



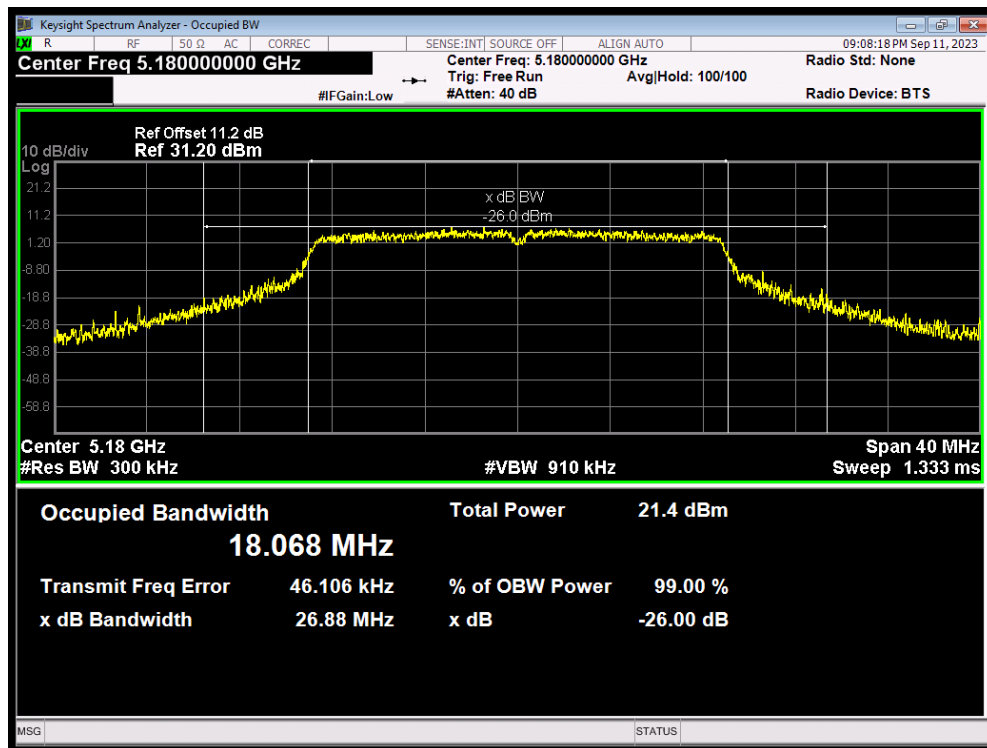
OBW 802.11ax(HE40) 5190MHz



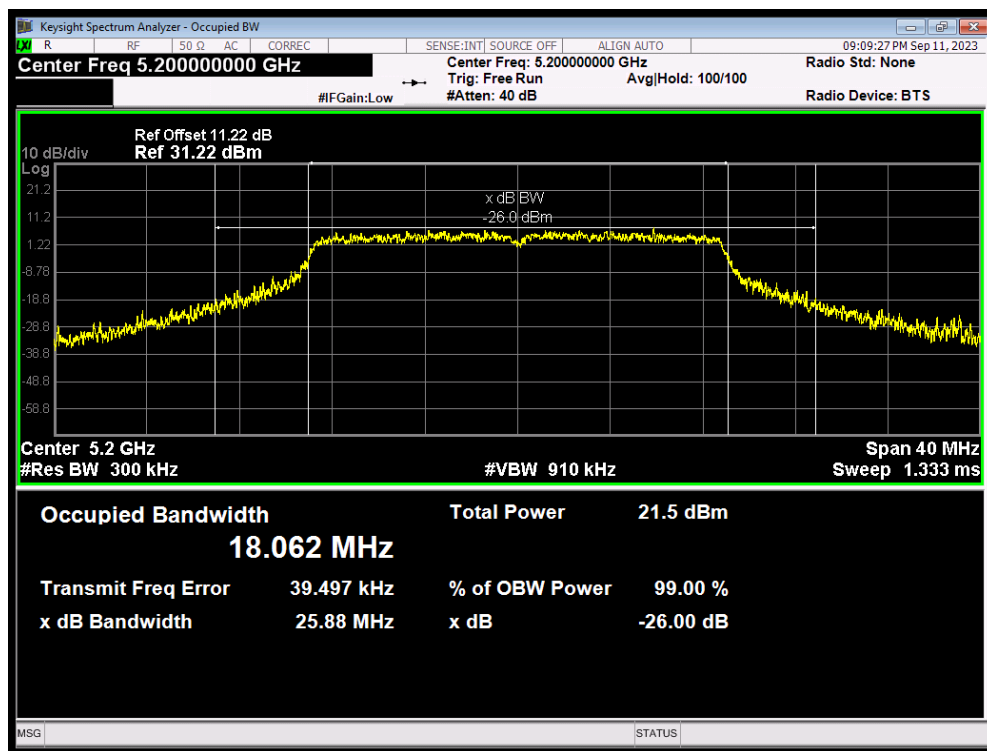
OBW 802.11ax(HE40) 5230MHz



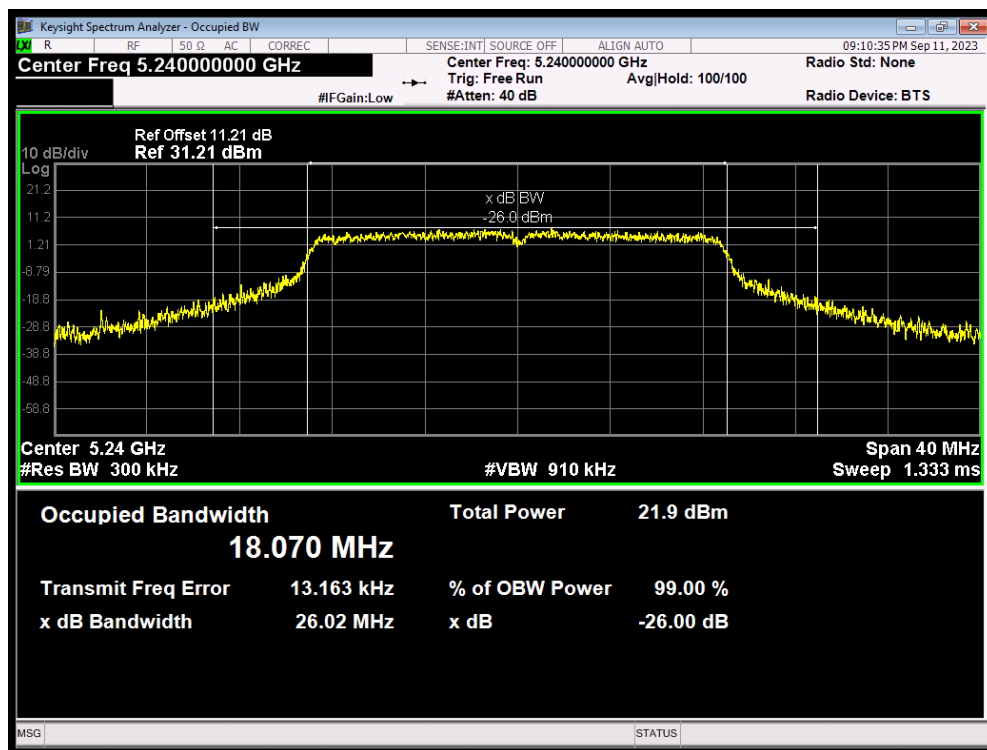
OBW 802.11n(HT20) 5180MHz



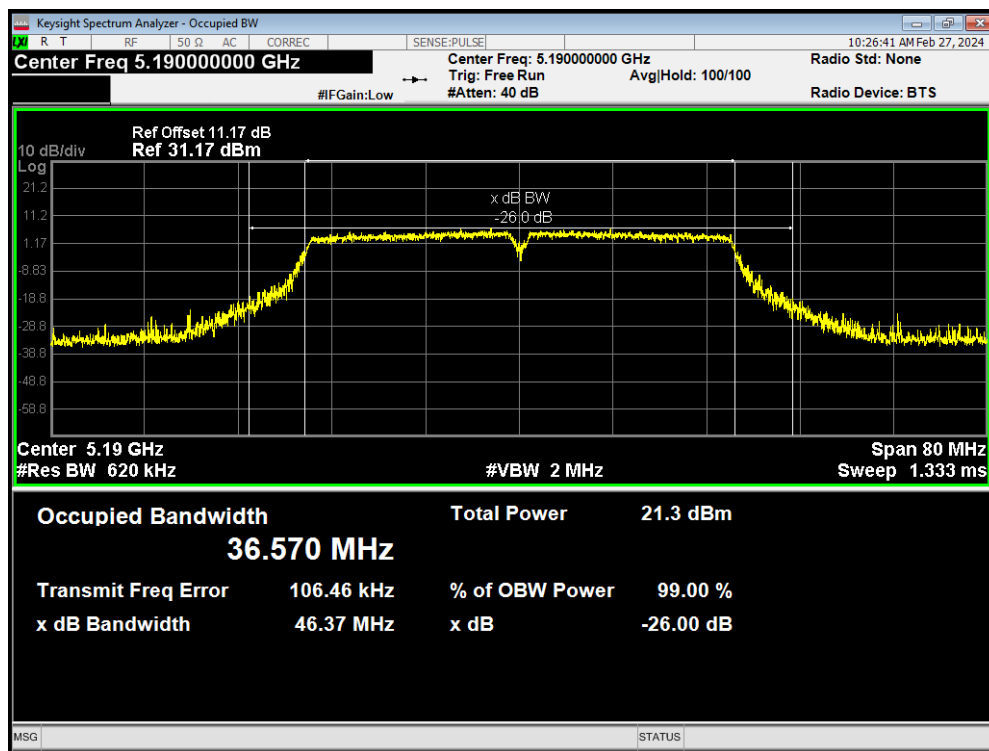
OBW 802.11n(HT20) 5200MHz



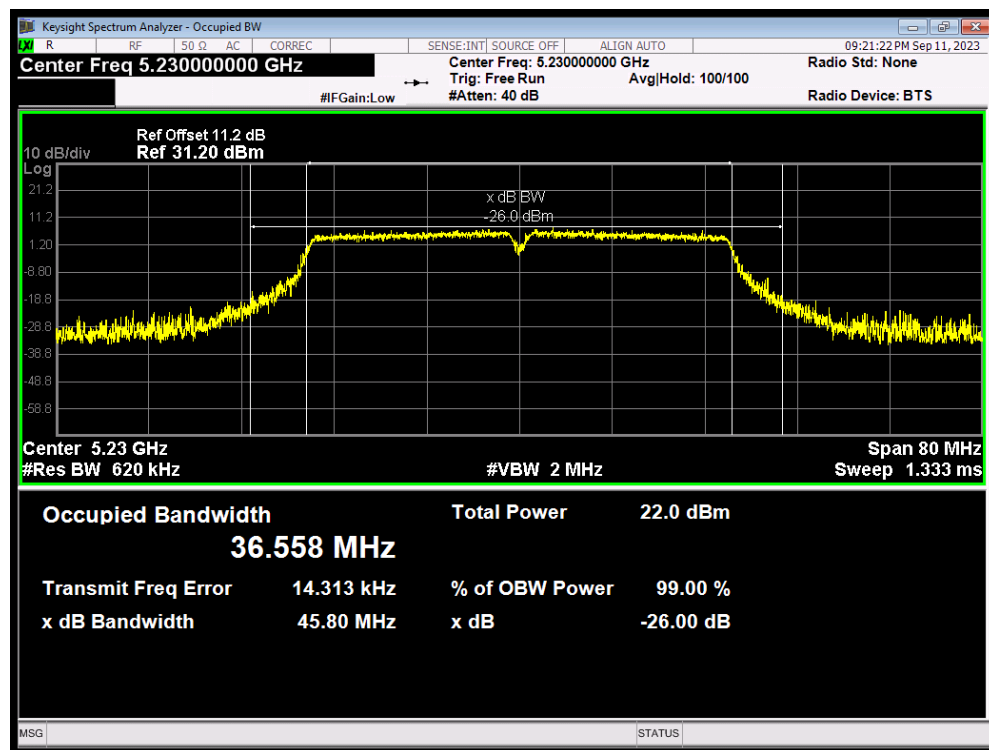
OBW 802.11n(HT20) 5240MHz



OBW 802.11n(HT40) 5190MHz

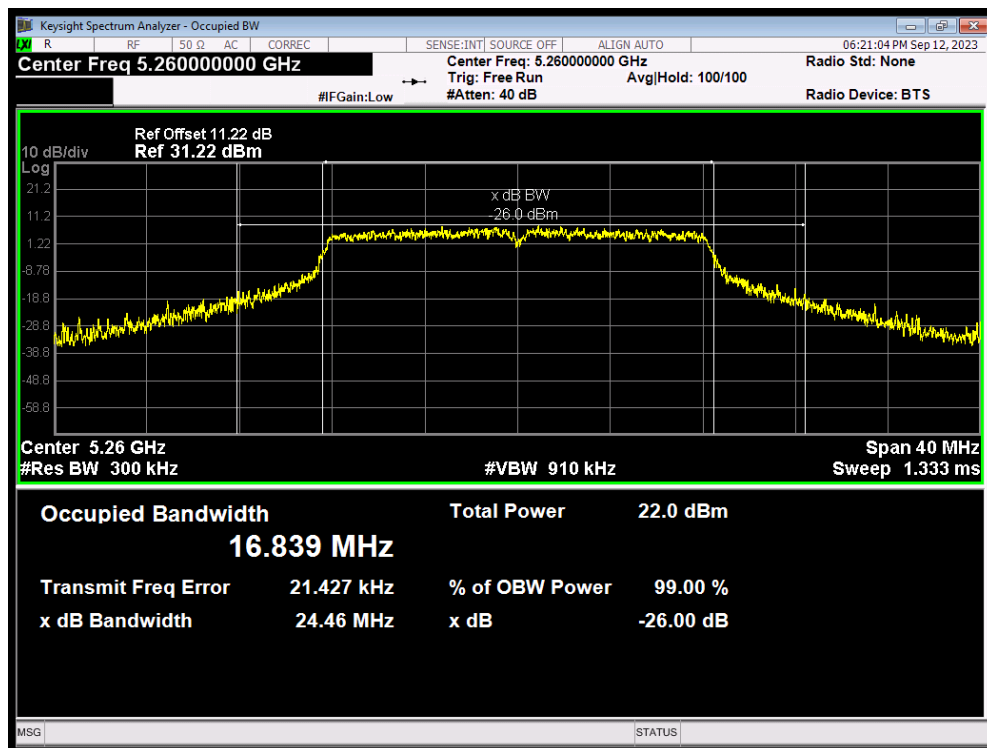


OBW 802.11n(HT40) 5230MHz

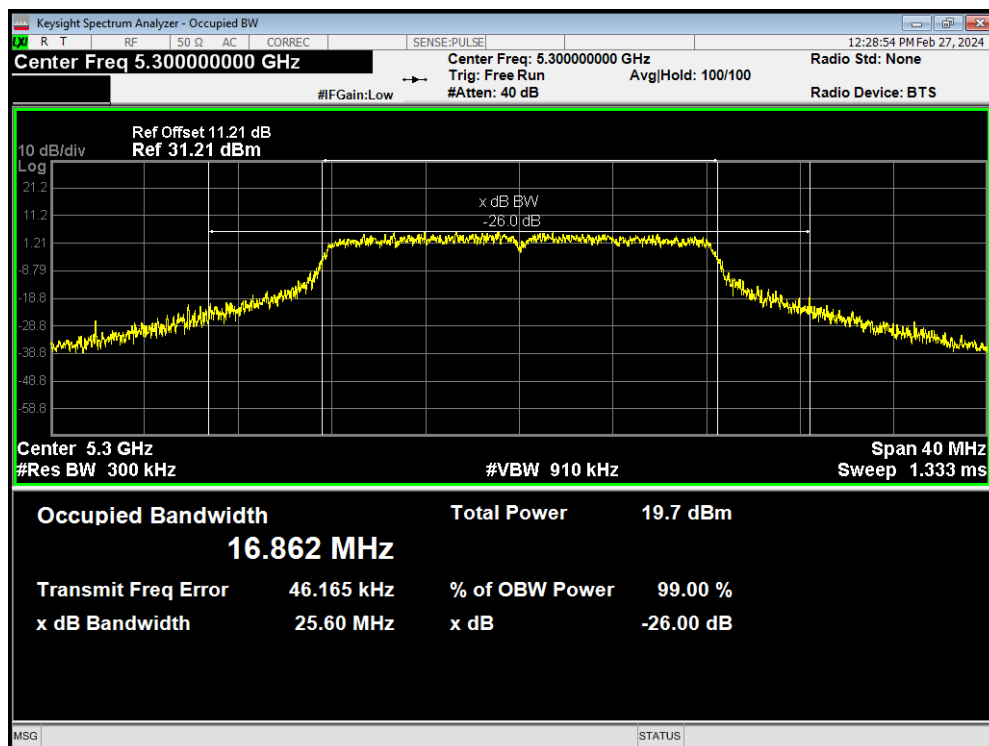


U-NII-2A

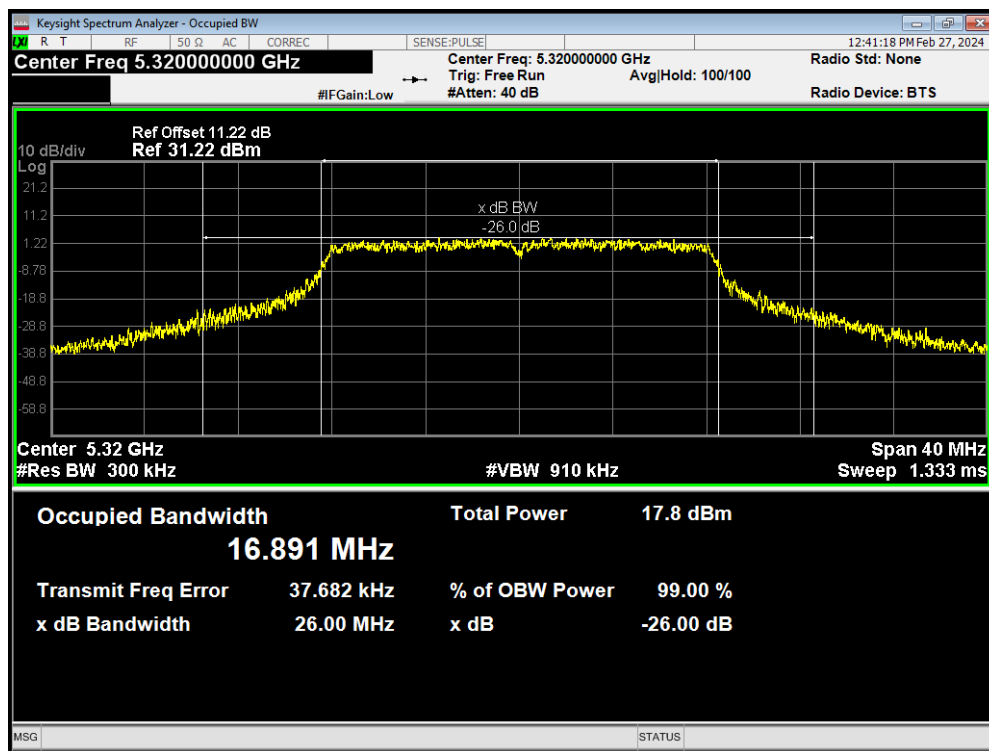
OBW 802.11a 5260MHz



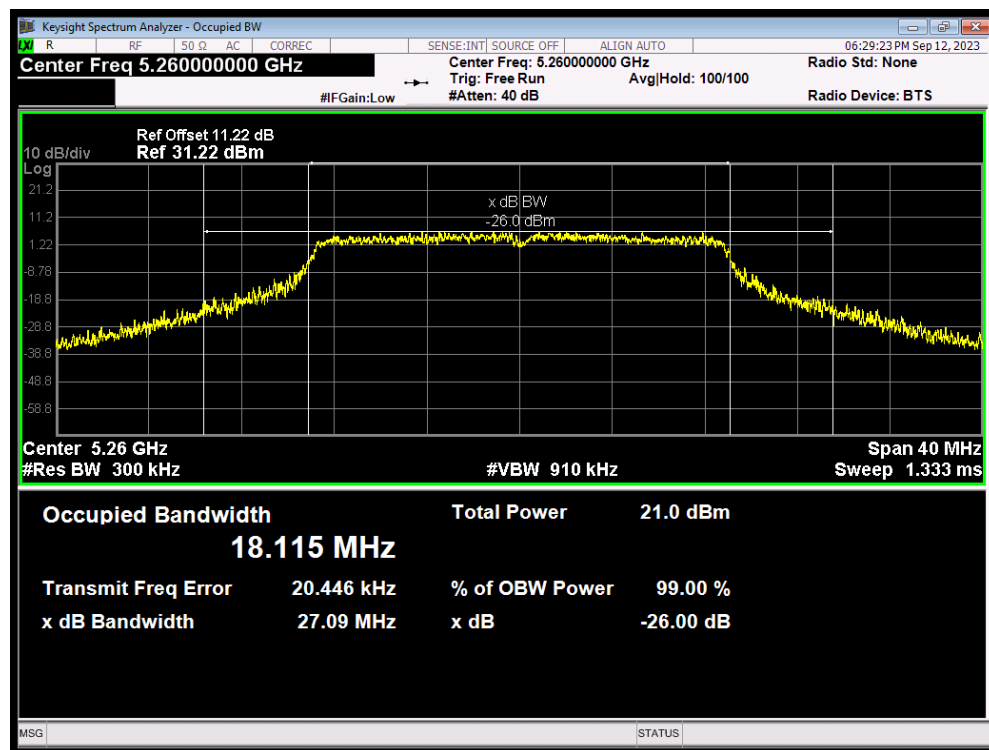
OBW 802.11a 5300MHz



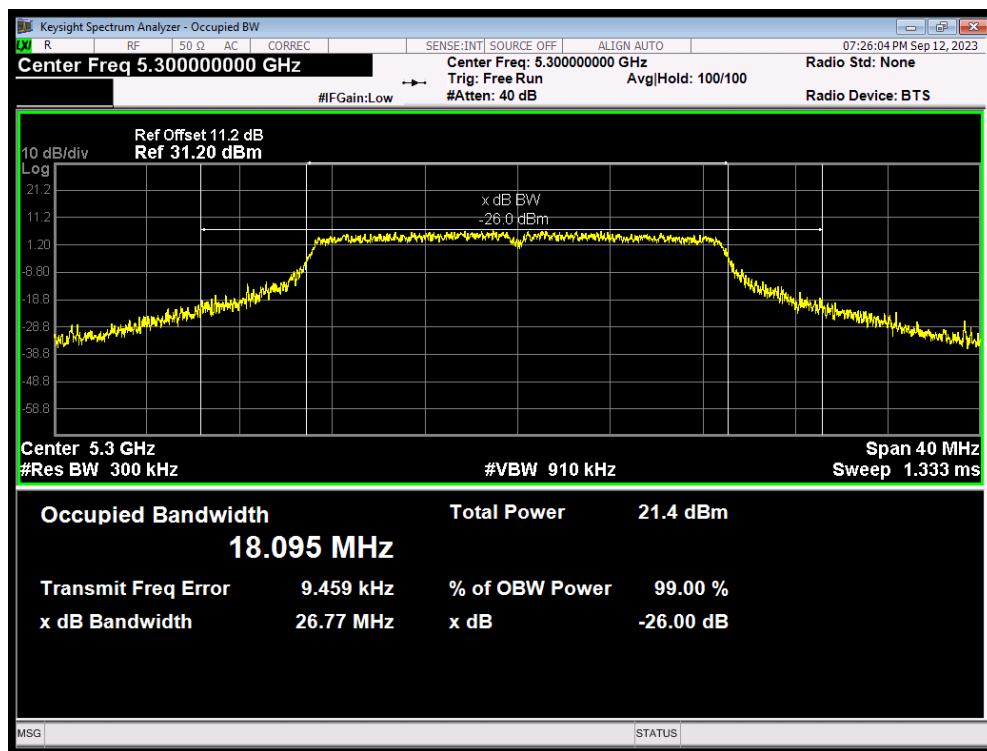
OBW 802.11a 5320MHz



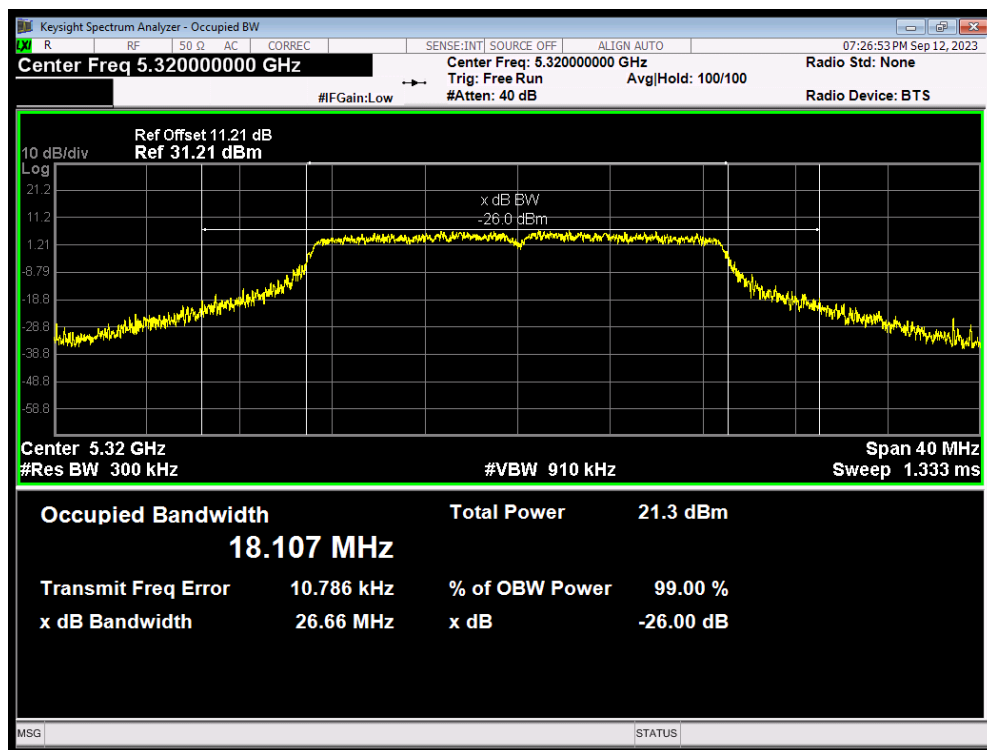
OBW 802.11ac(VHT20) 5260MHz



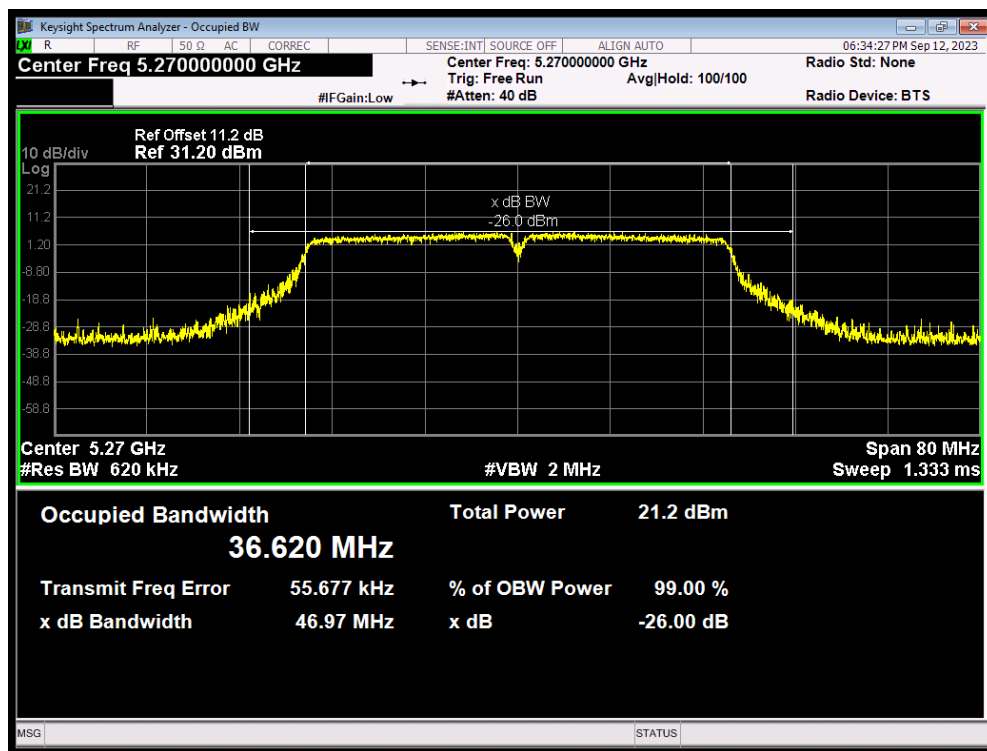
OBW 802.11ac(VHT20) 5300MHz



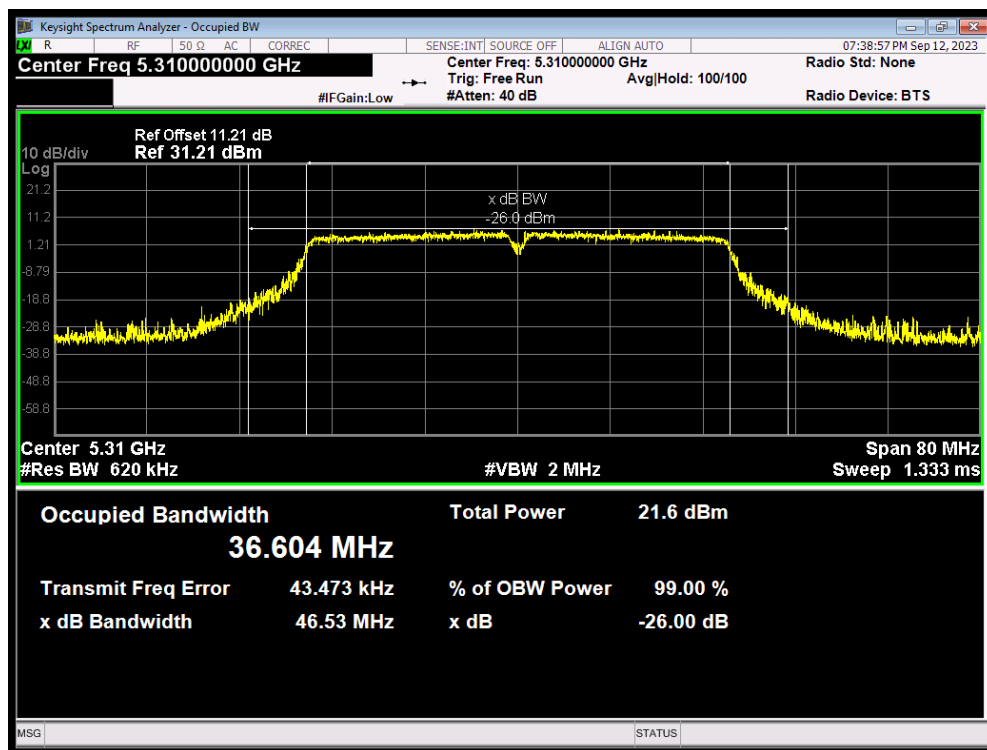
OBW 802.11ac(VHT20) 5320MHz



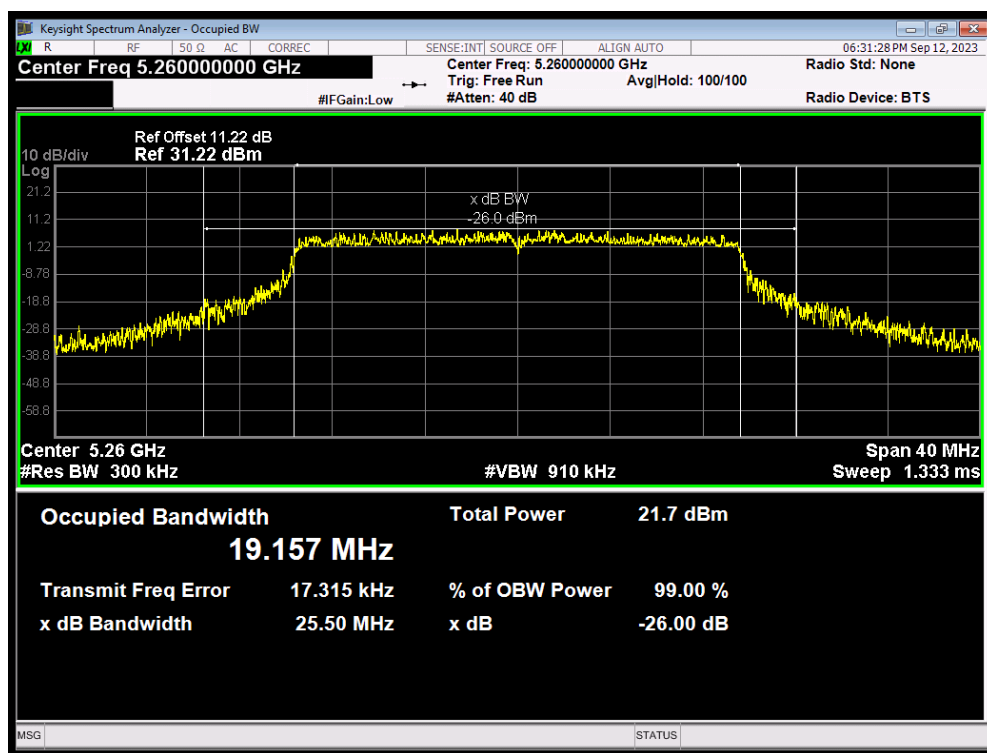
OBW 802.11ac(VHT40) 5270MHz



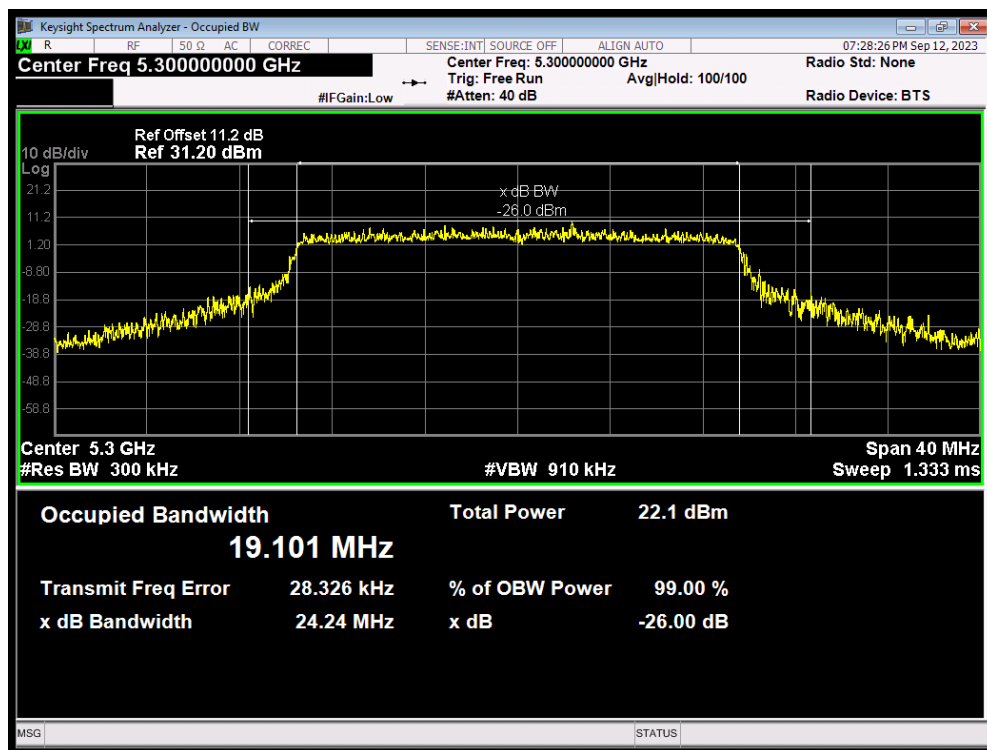
OBW 802.11ac(VHT40) 5310MHz



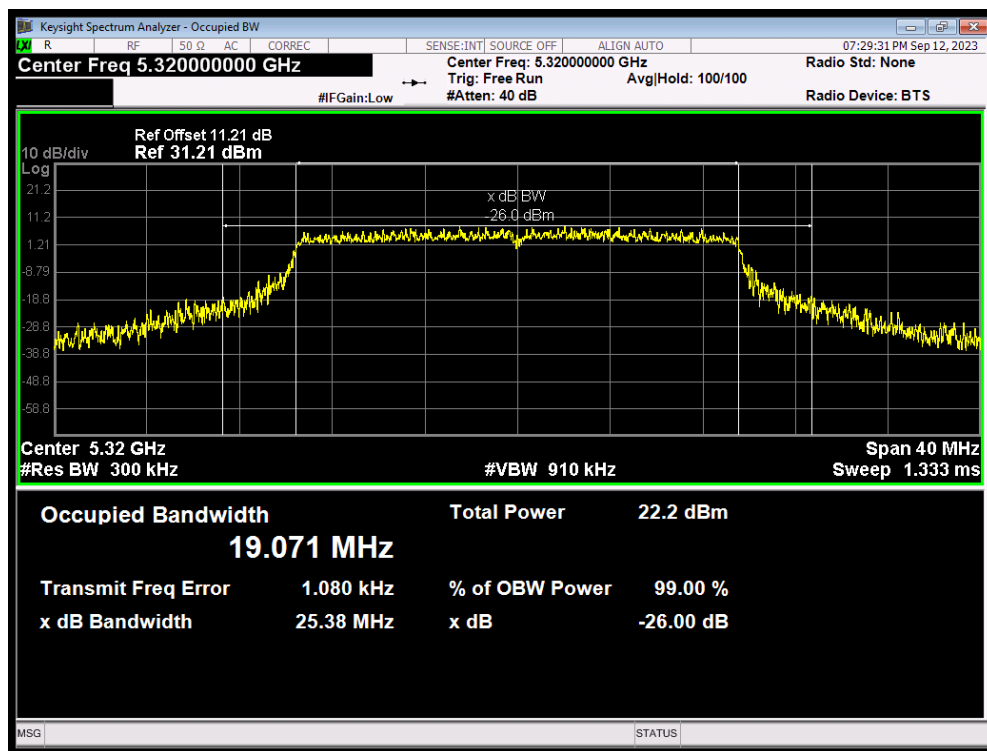
OBW 802.11ax(HE20) 5260MHz



OBW 802.11ax(HE20) 5300MHz



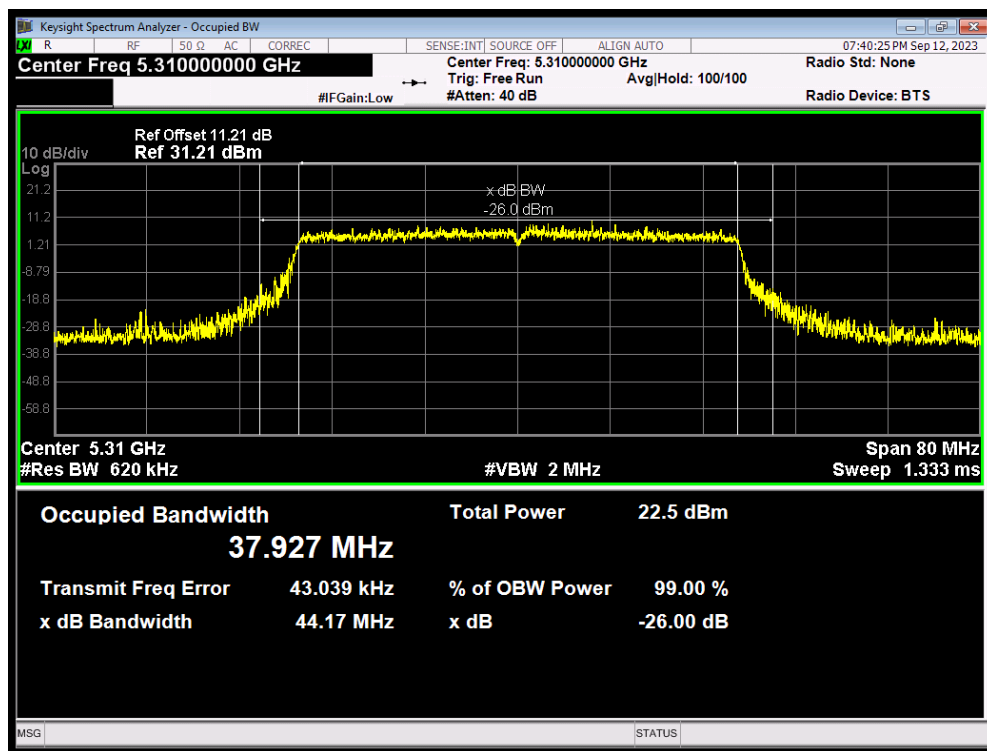
OBW 802.11ax(HE20) 5320MHz



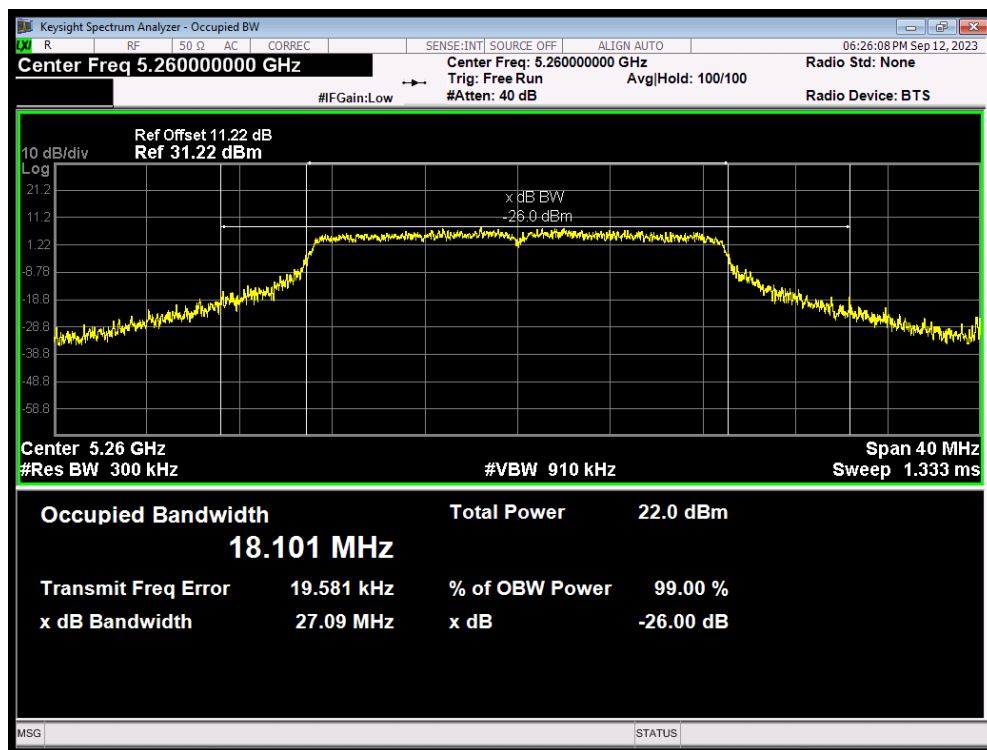
OBW 802.11ax(HE40) 5270MHz



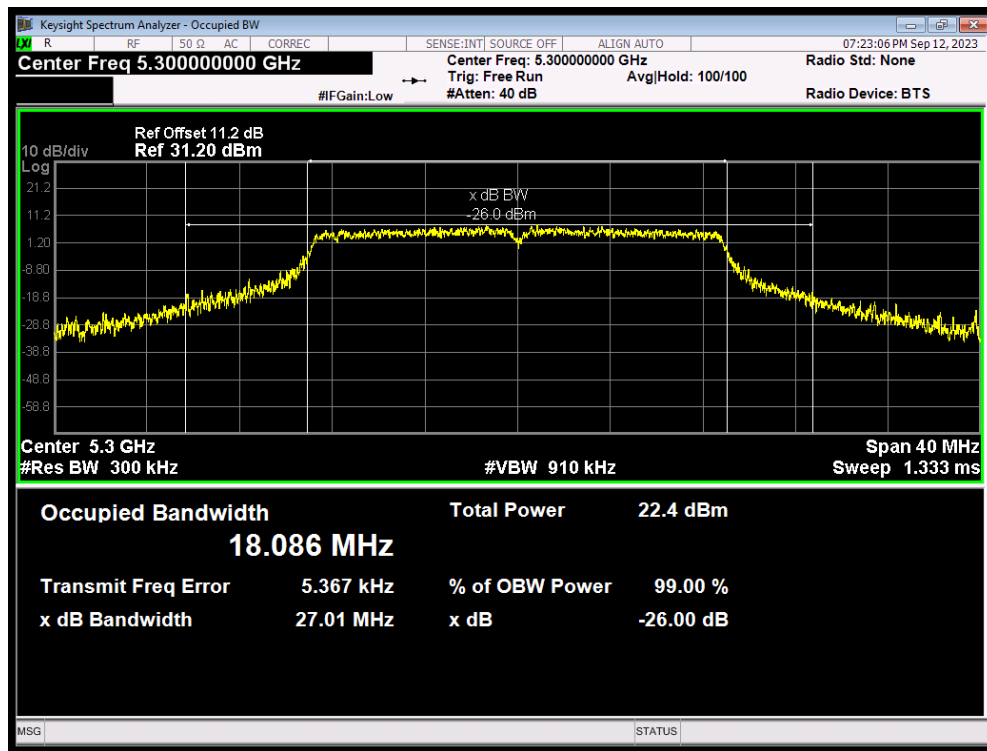
OBW 802.11ax(HE40) 5310MHz



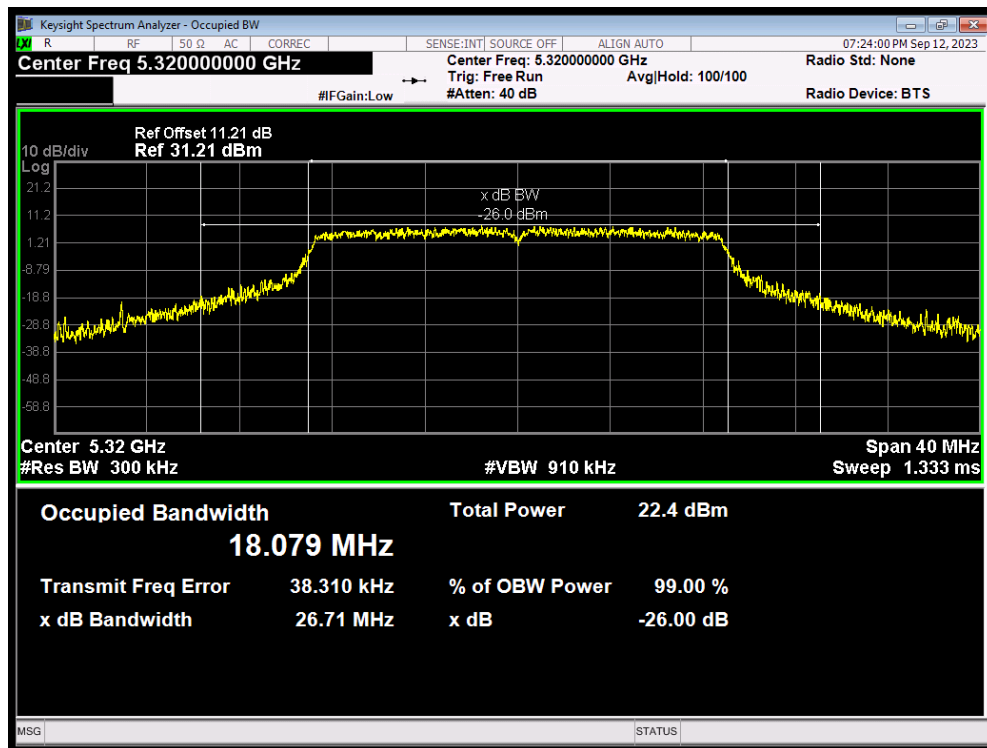
OBW 802.11n(HT20) 5260MHz



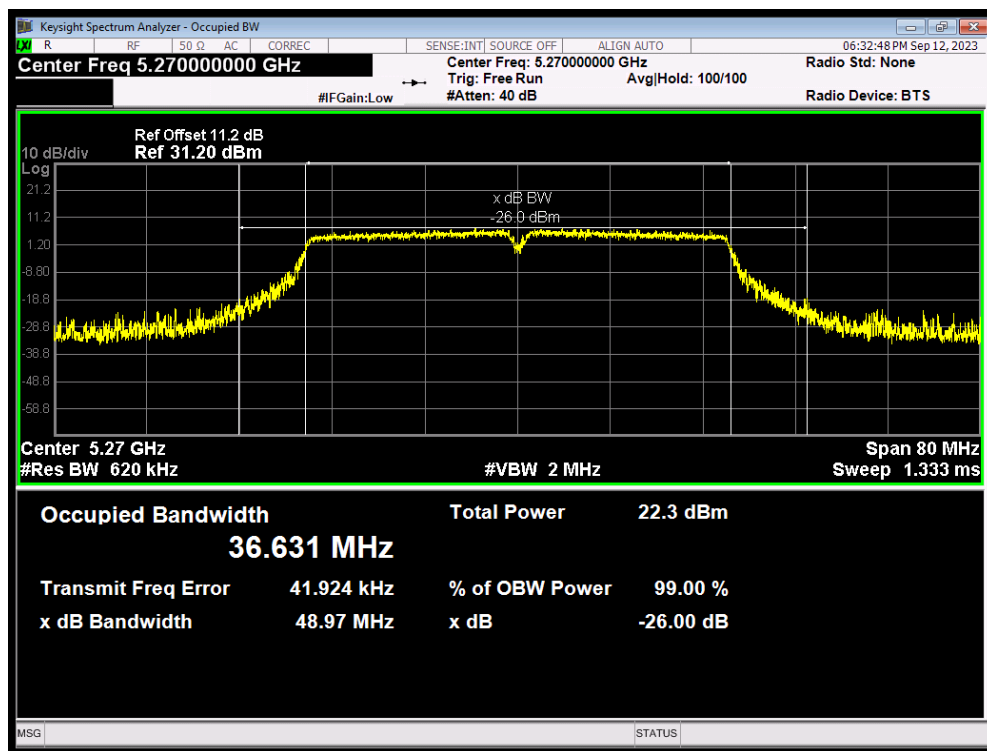
OBW 802.11n(HT20) 5300MHz



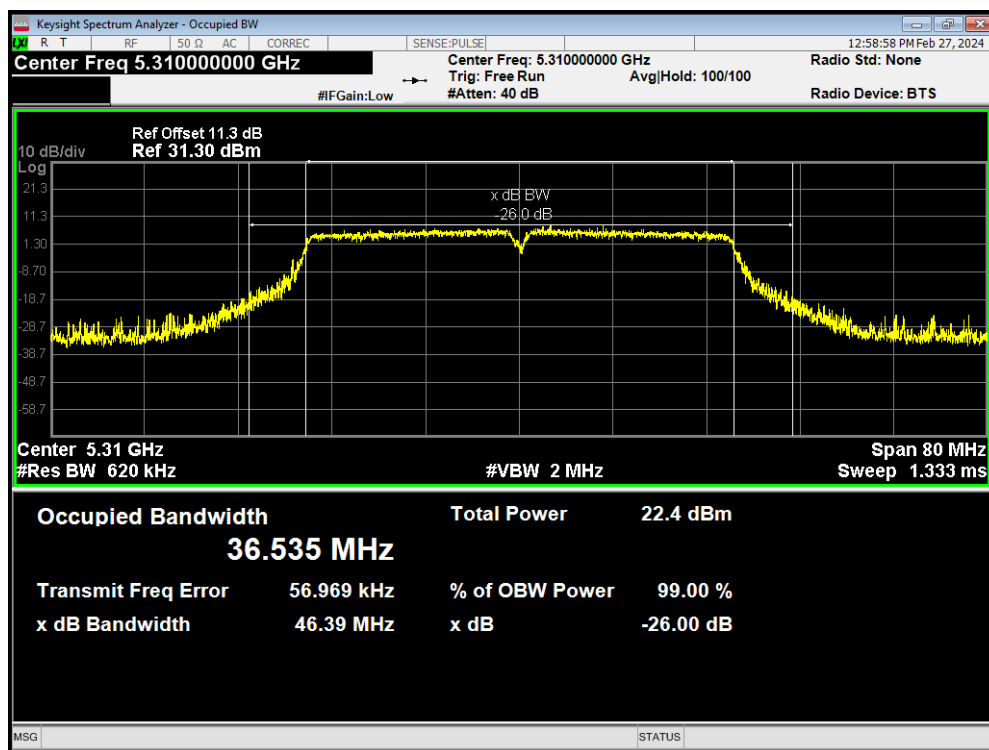
OBW 802.11n(HT20) 5320MHz



OBW 802.11n(HT40) 5270MHz

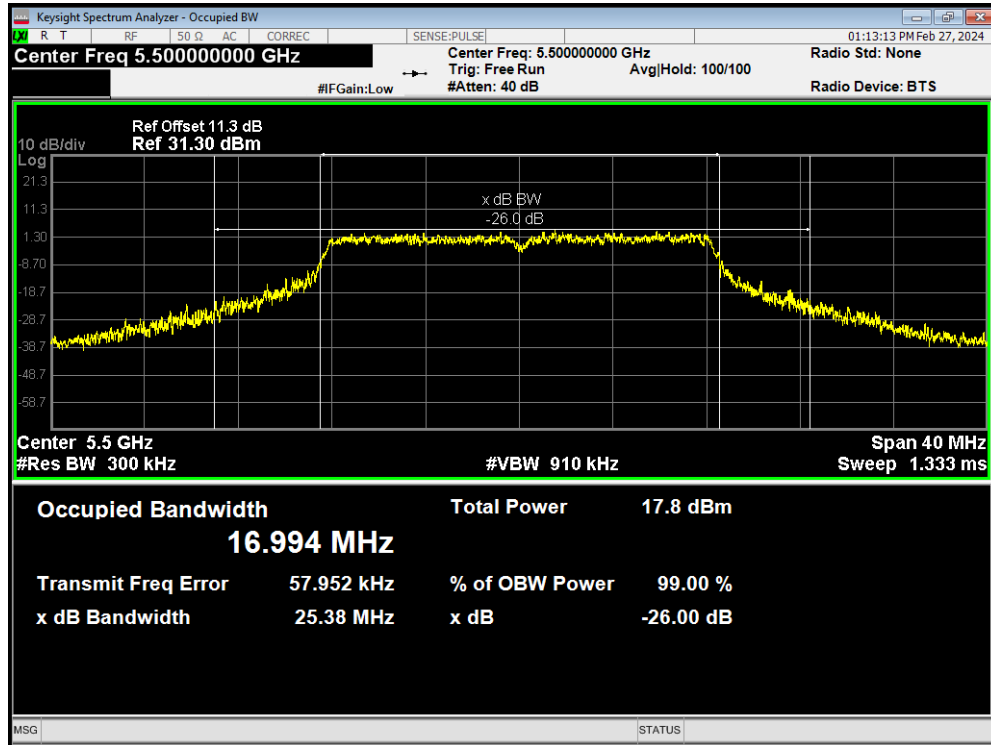


OBW 802.11n(HT40) 5310MHz

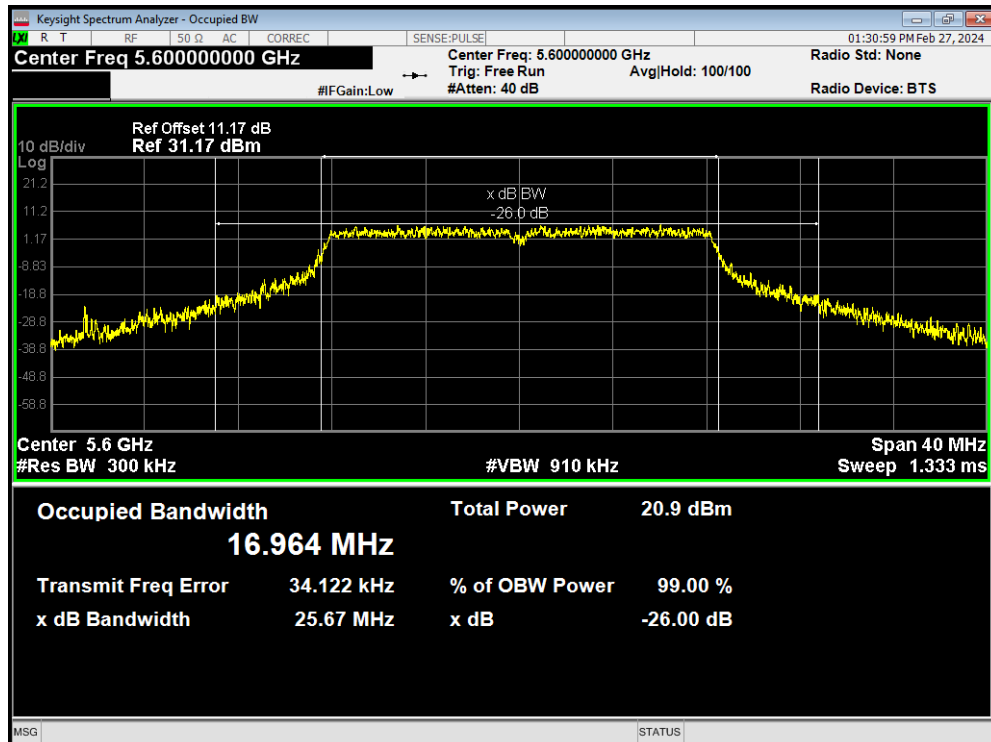


U-NII-2C

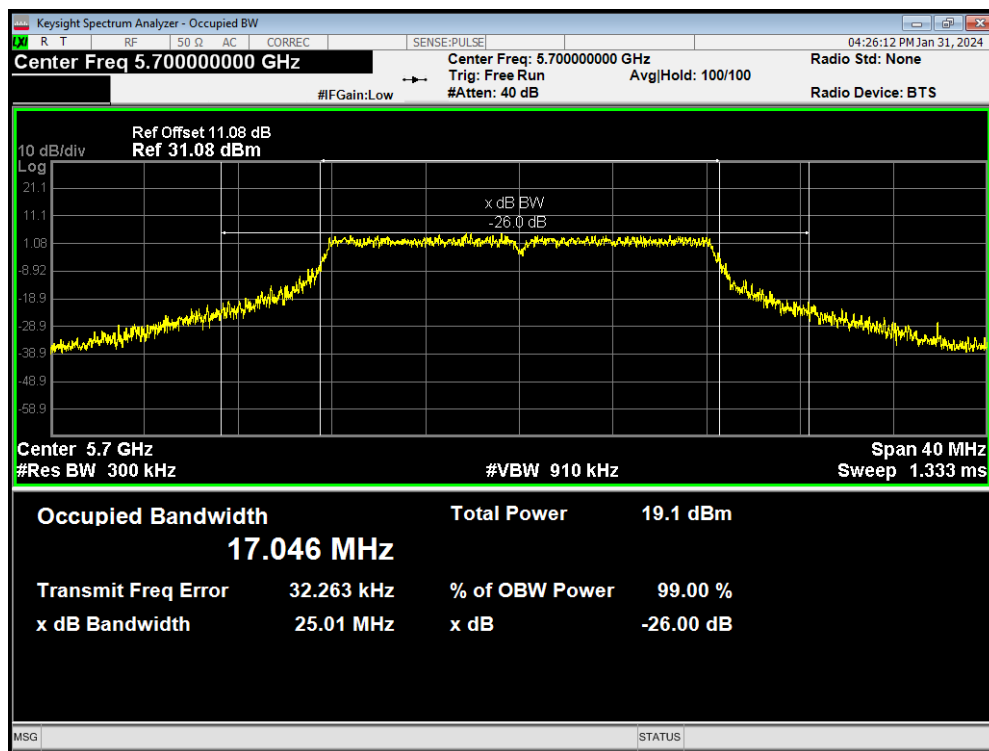
OBW 802.11a 5500MHz



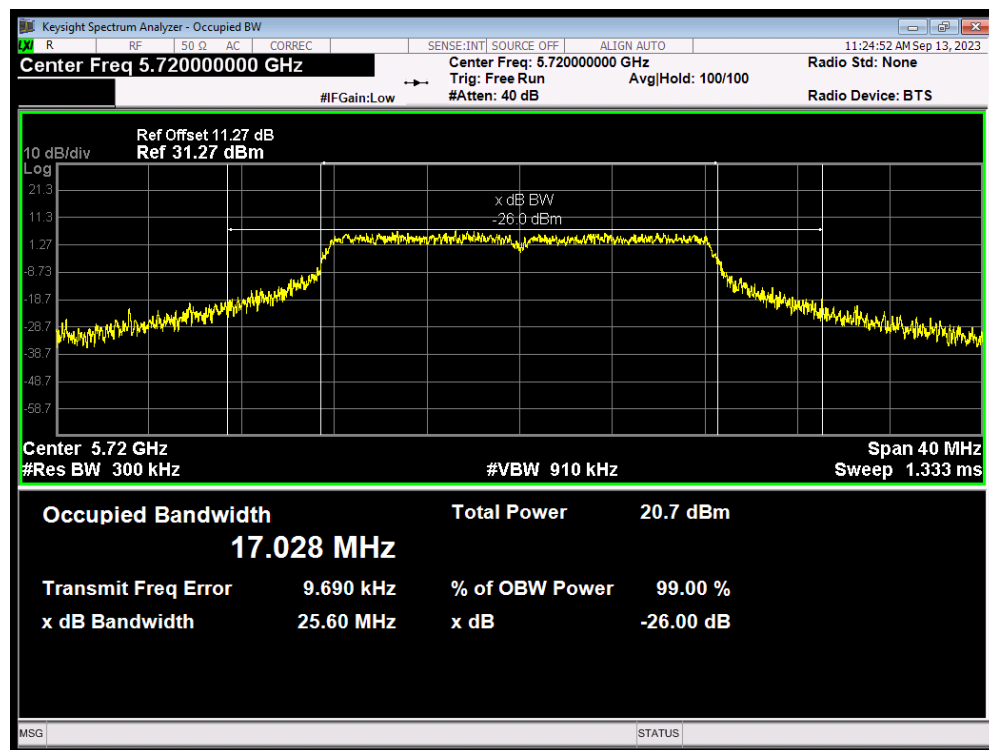
OBW 802.11a 5600MHz



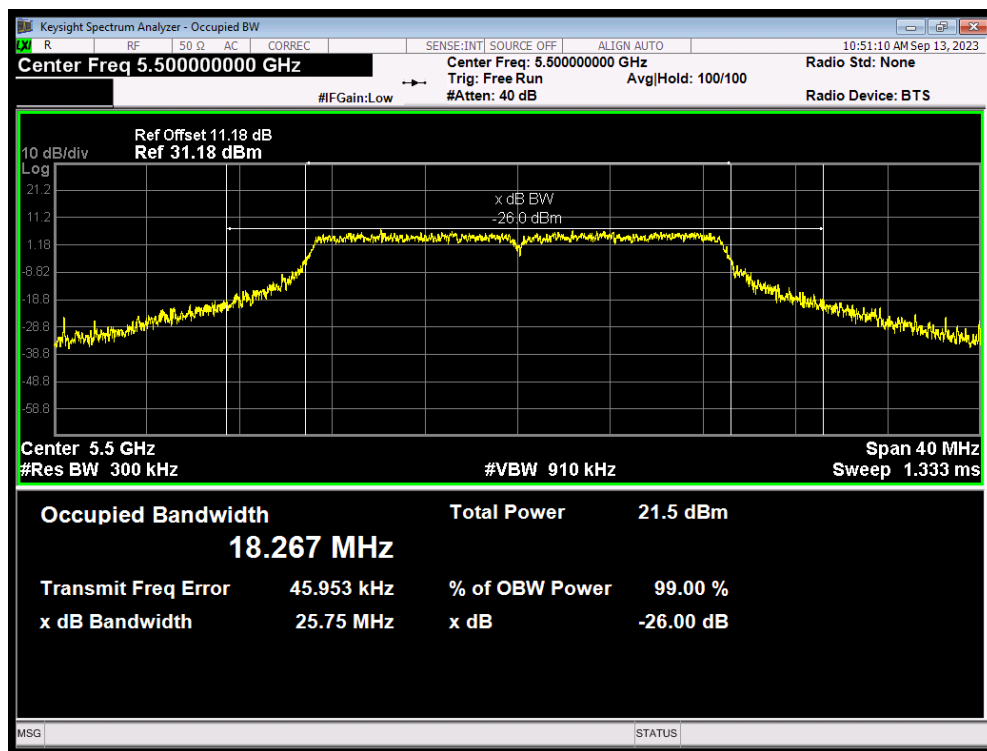
OBW 802.11a 5700MHz



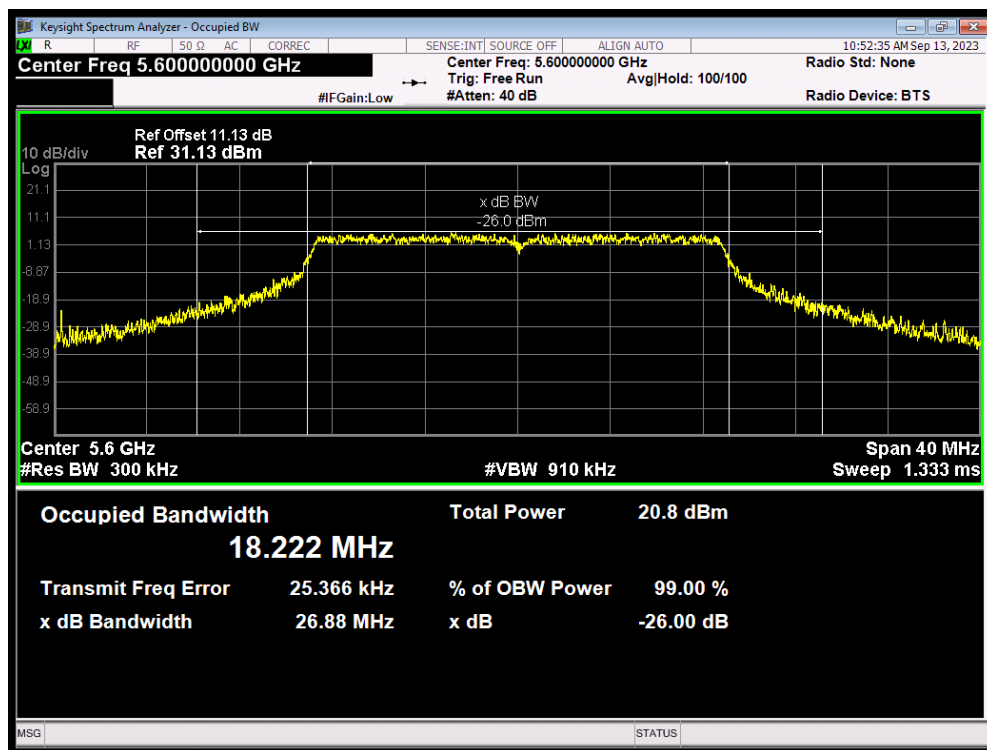
OBW 802.11a 5720MHz



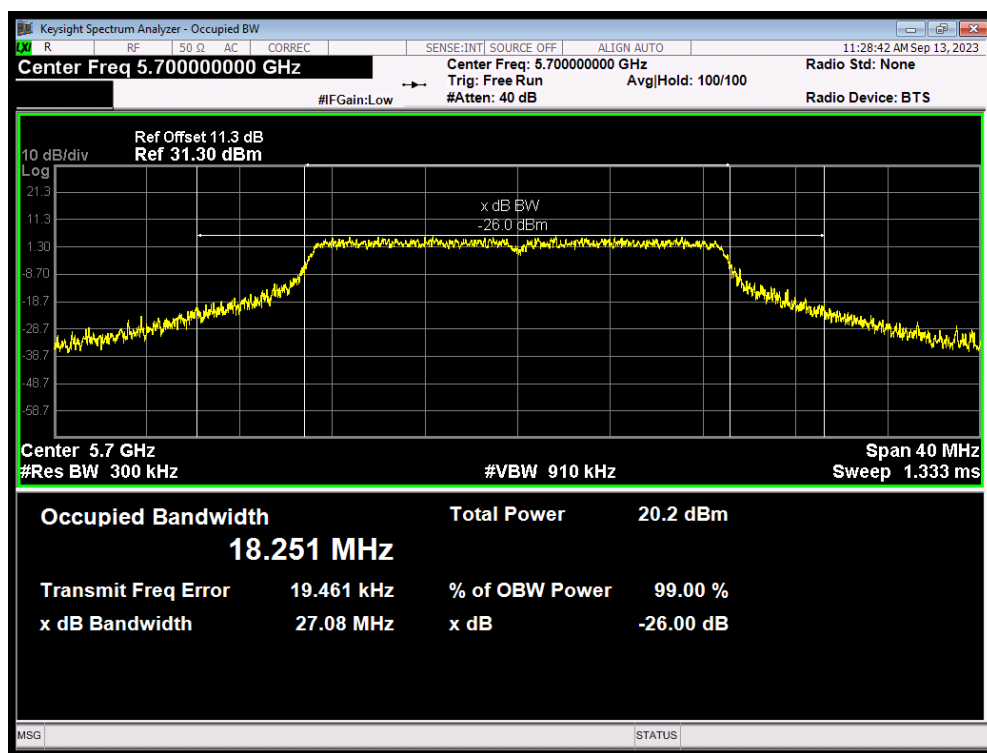
OBW 802.11ac(VHT20) 5500MHz



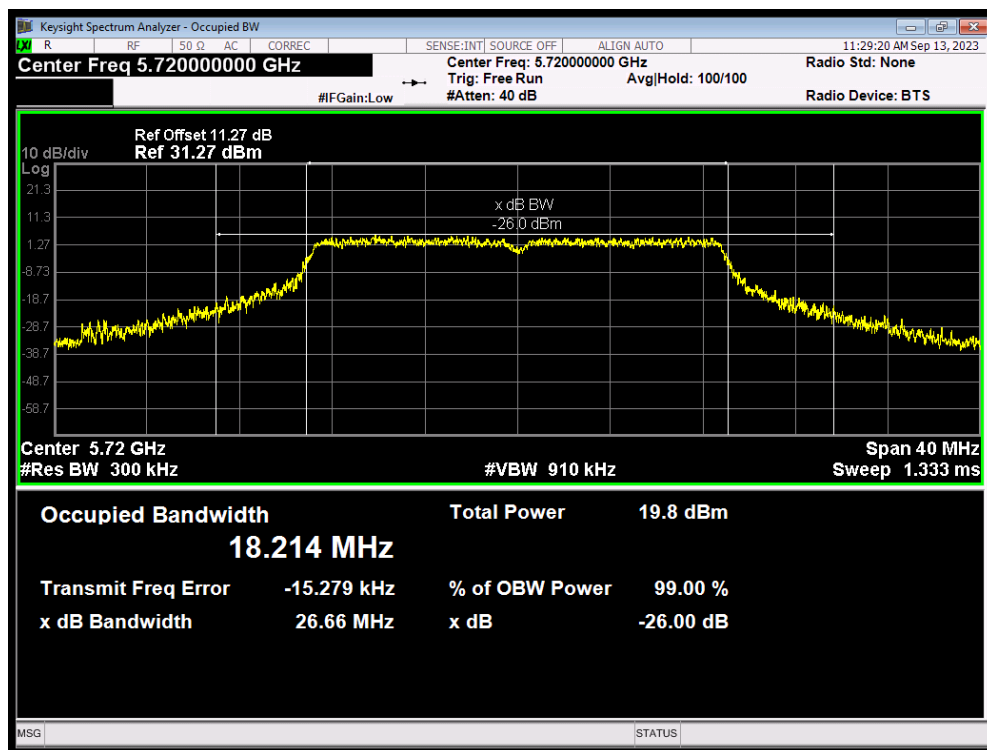
OBW 802.11ac(VHT20) 5600MHz



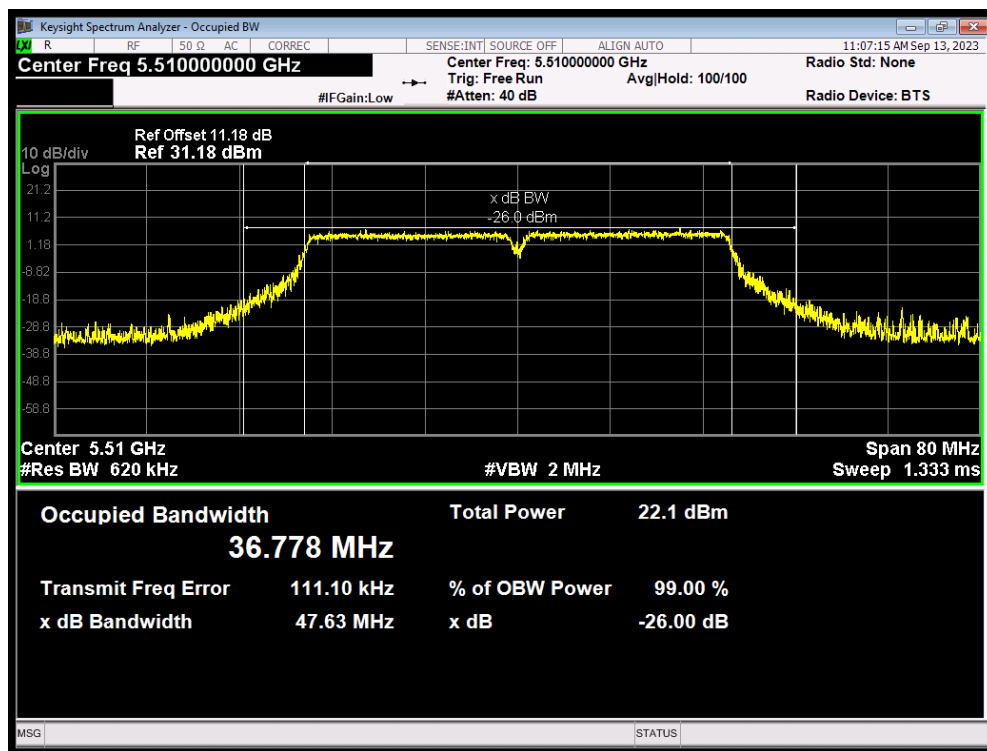
OBW 802.11ac(VHT20) 5700MHz



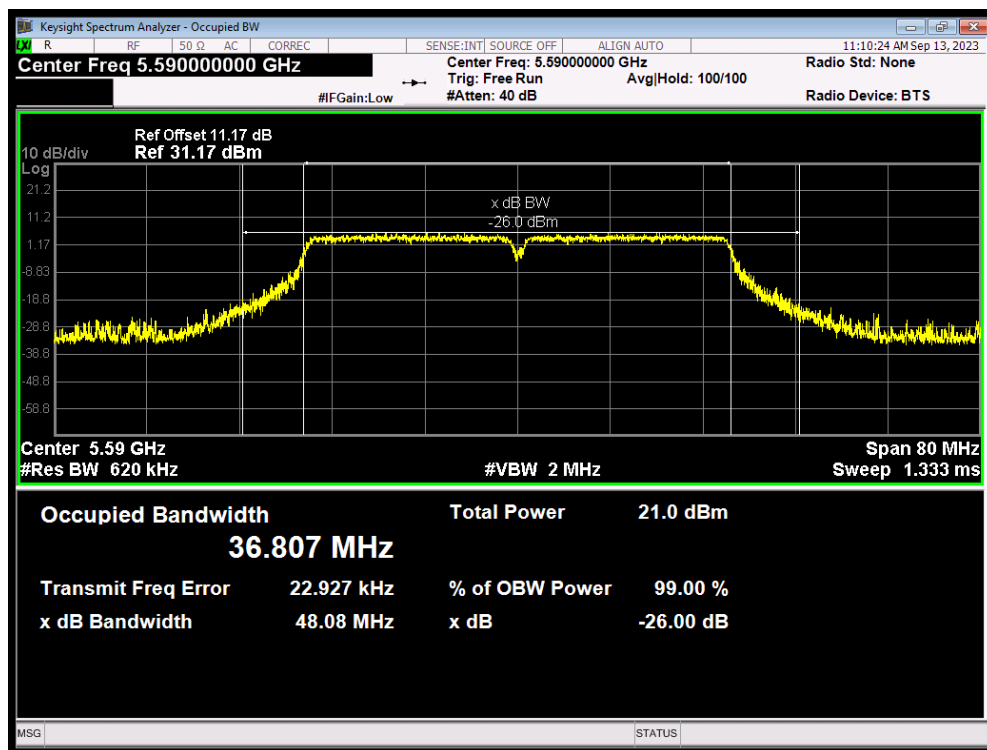
OBW 802.11ac(VHT20) 5720MHz



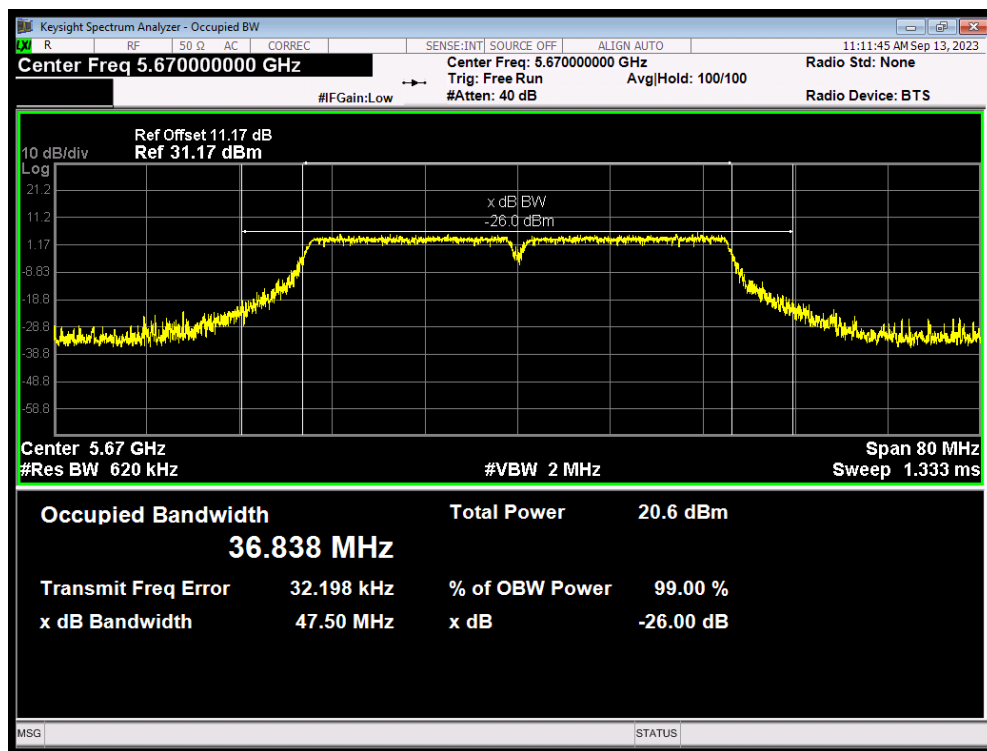
OBW 802.11ac(VHT40) 5510MHz



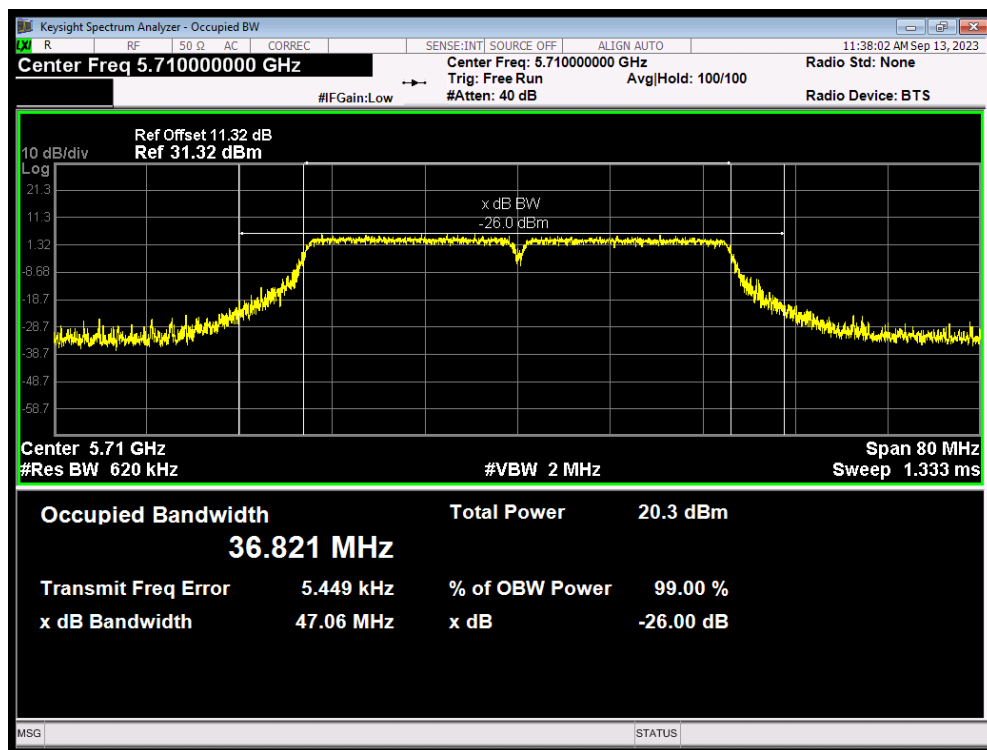
OBW 802.11ac(VHT40) 5590MHz



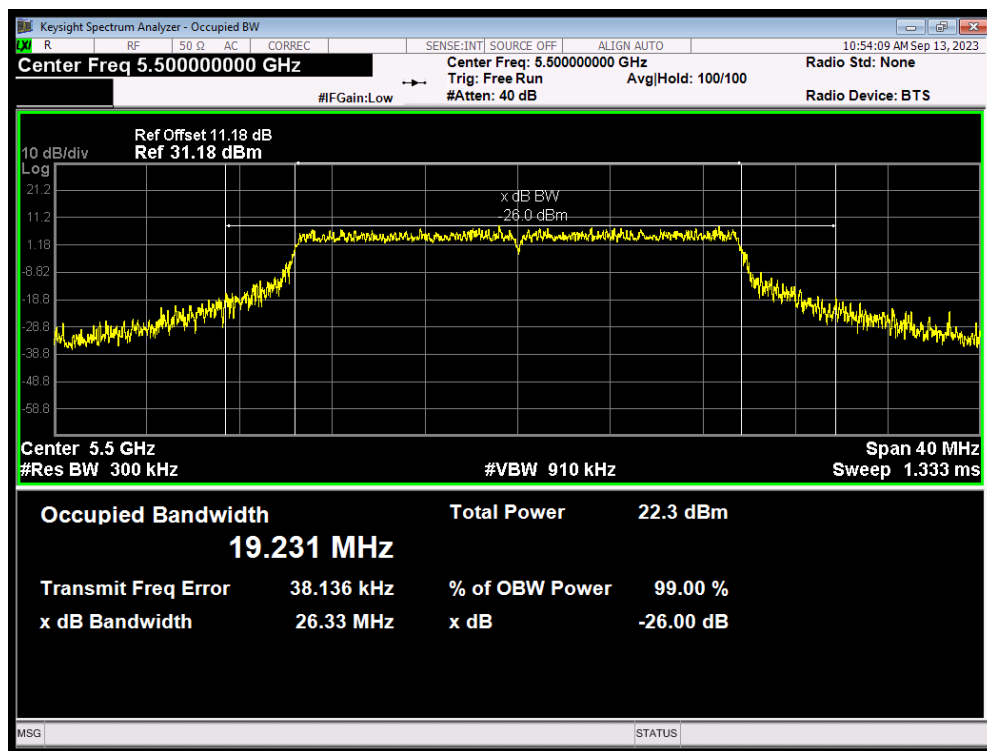
OBW 802.11ac(VHT40) 5670MHz



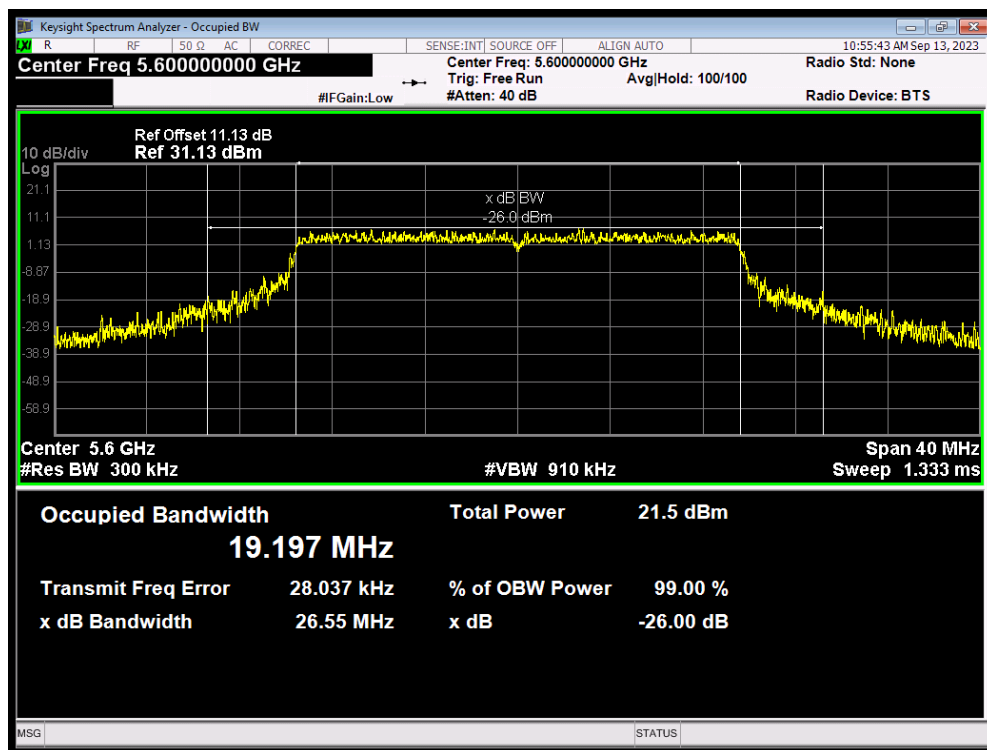
OBW 802.11ac(VHT40) 5710MHz



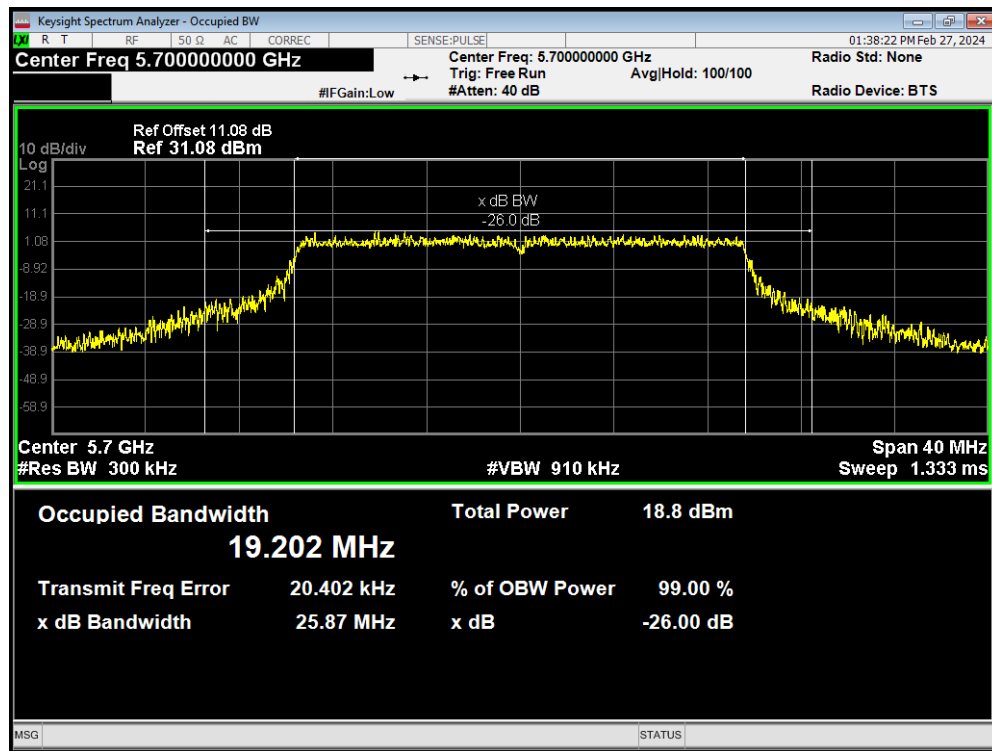
OBW 802.11ax(HE20) 5500MHz



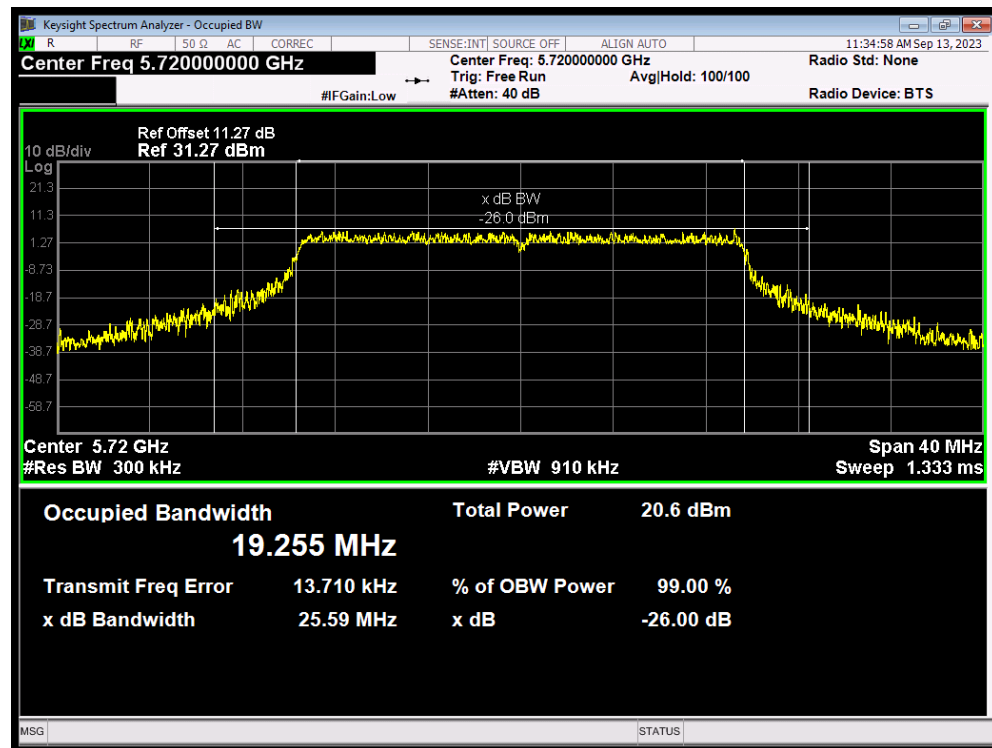
OBW 802.11ax(HE20) 5600MHz



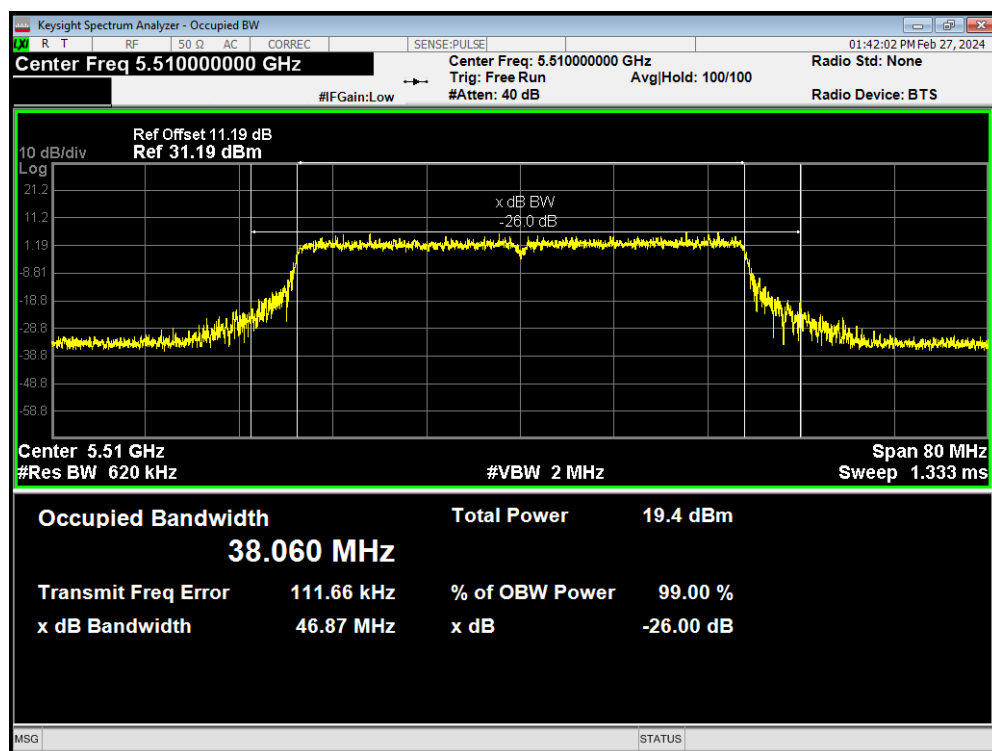
OBW 802.11ax(HE20) 5700MHz



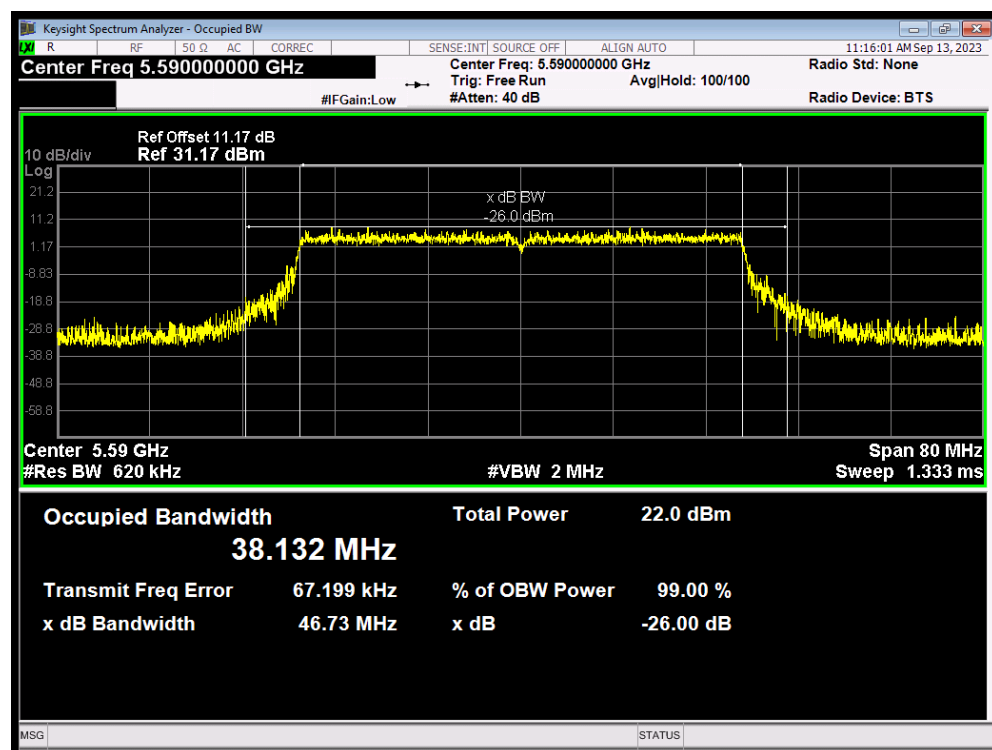
OBW 802.11ax(HE20) 5720MHz



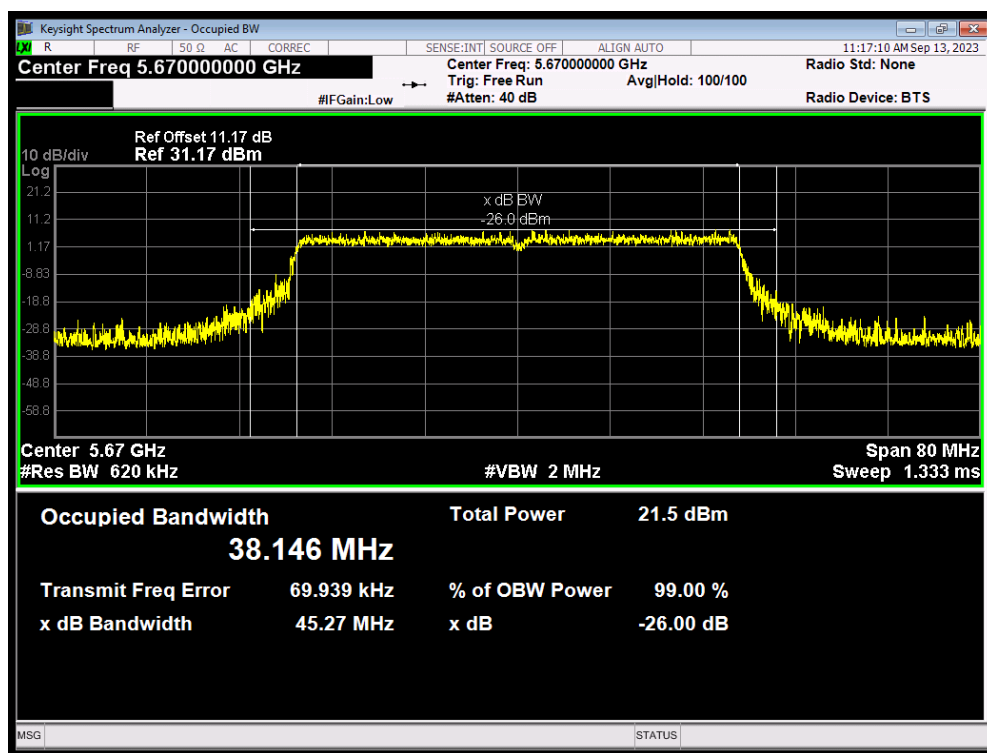
OBW 802.11ax(HE40) 5510MHz



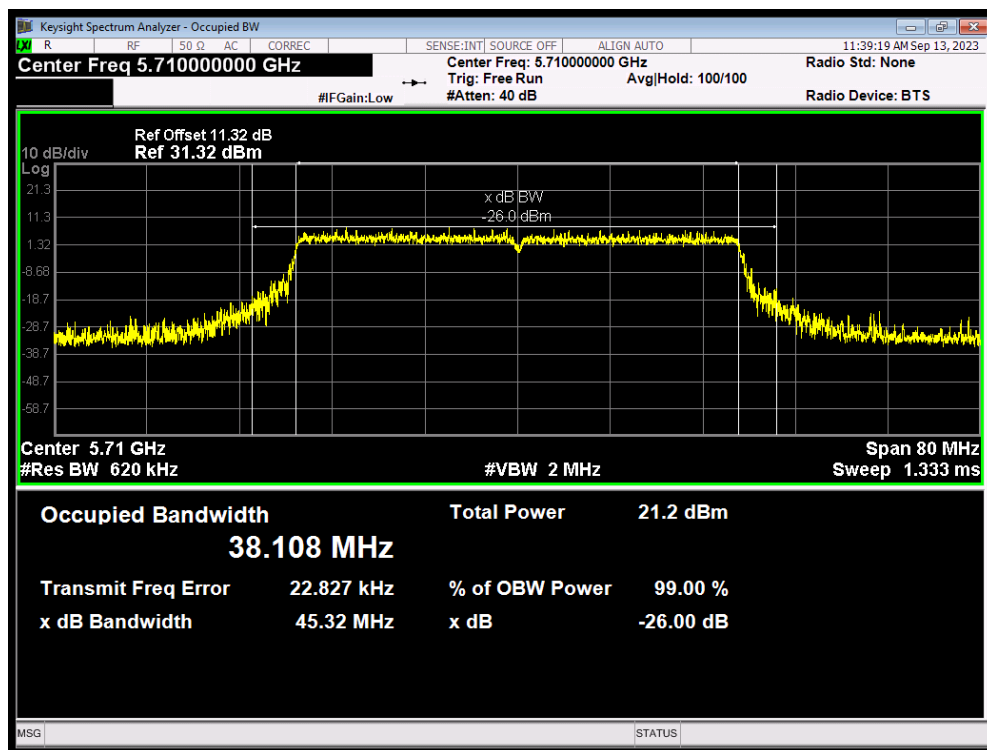
OBW 802.11ax(HE40) 5590MHz



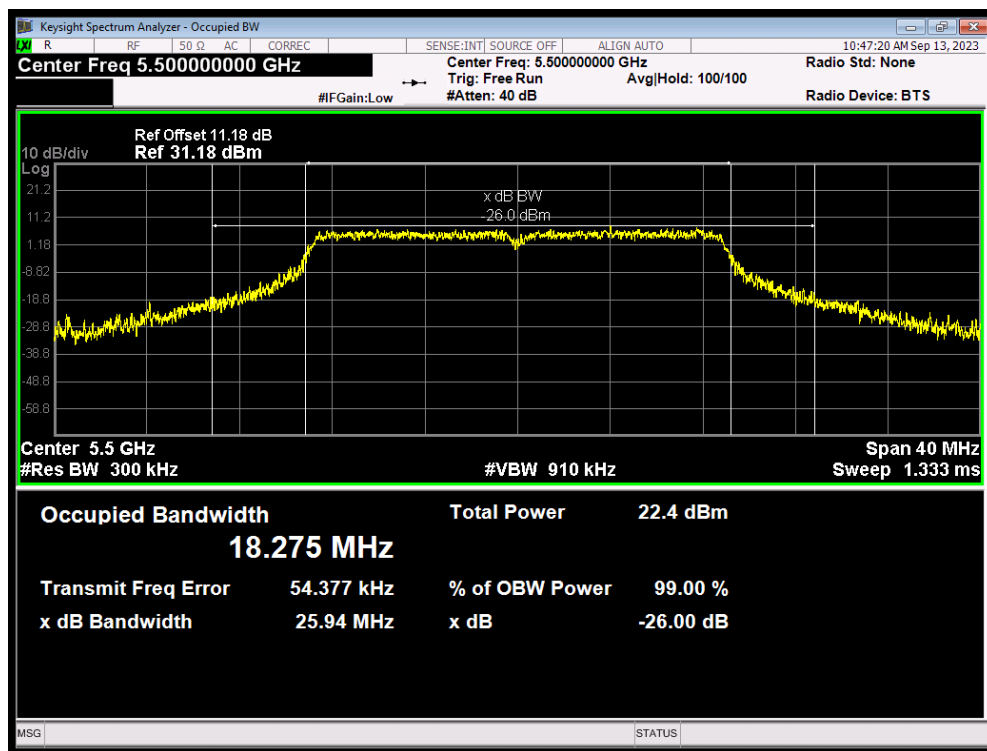
OBW 802.11ax(HE40) 5670MHz



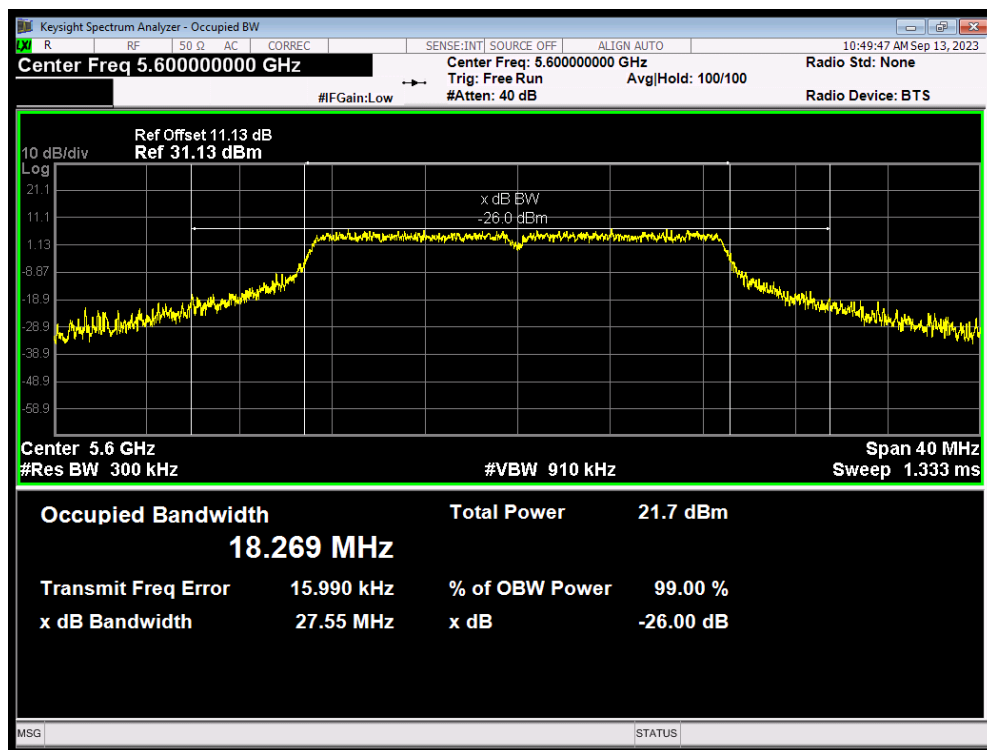
OBW 802.11ax(HE40) 5710MHz



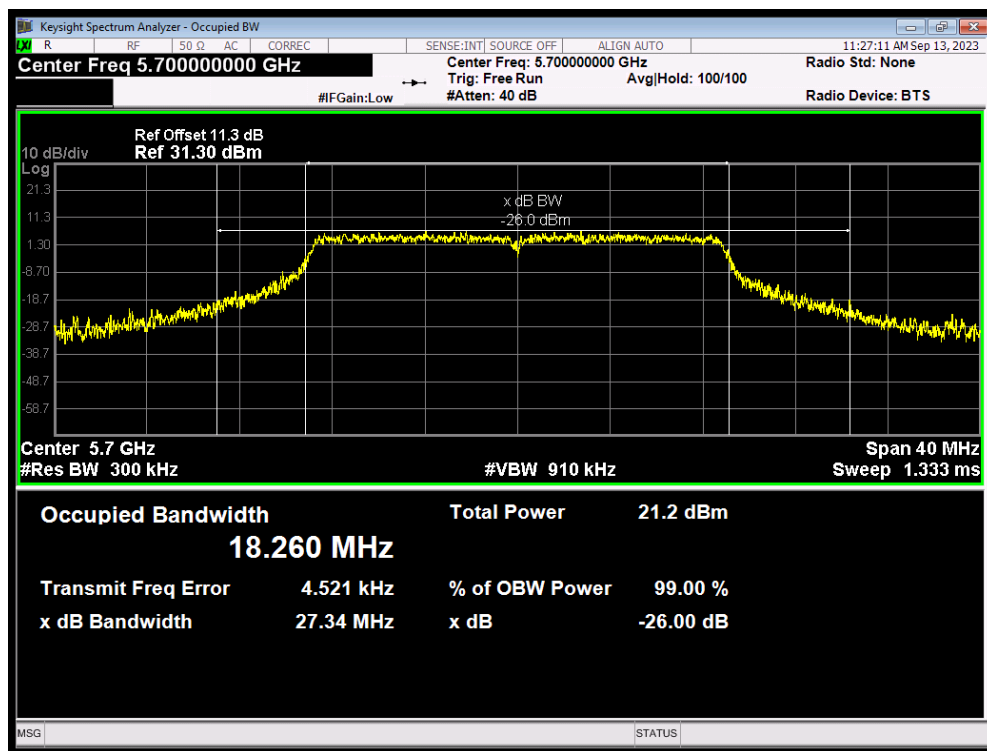
OBW 802.11n(HT20) 5500MHz



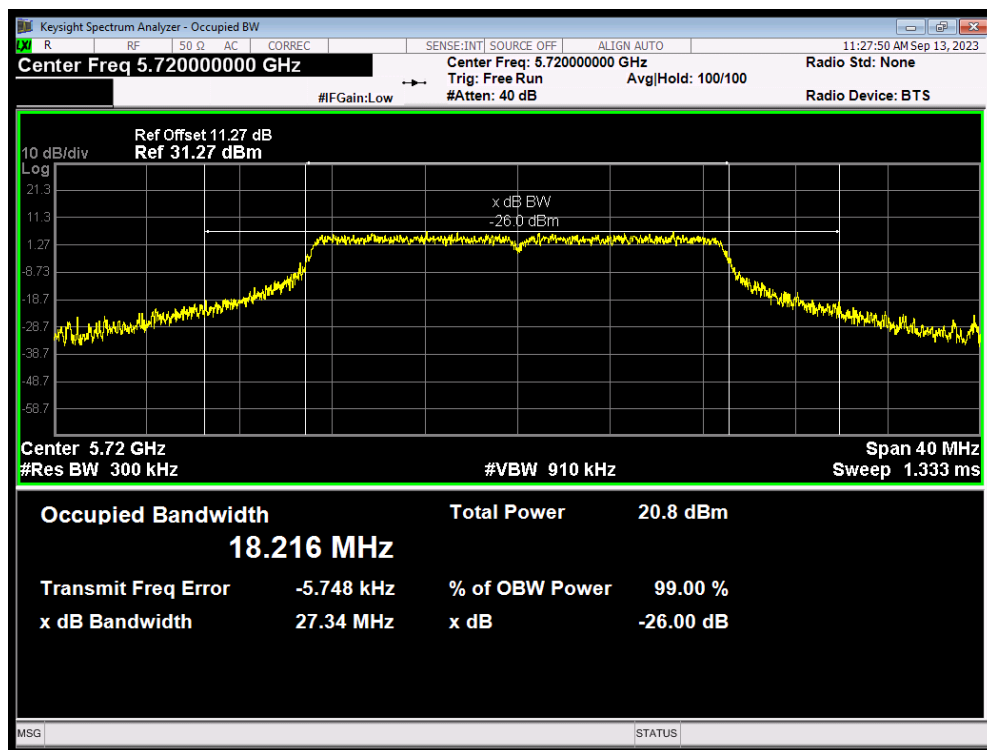
OBW 802.11n(HT20) 5600MHz



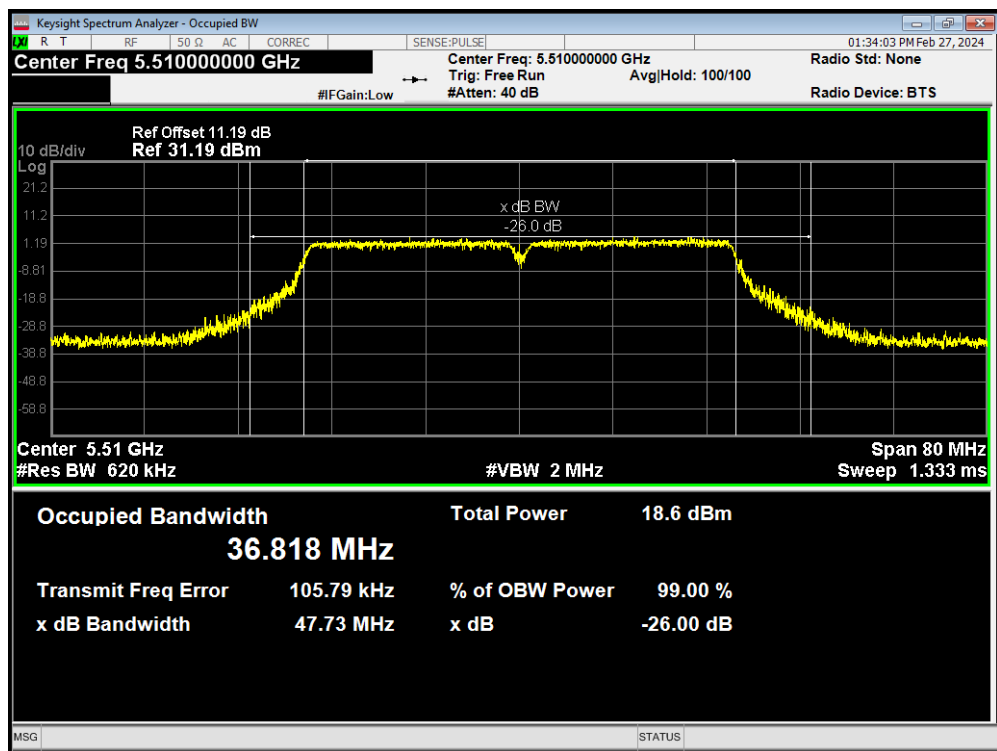
OBW 802.11n(HT20) 5700MHz



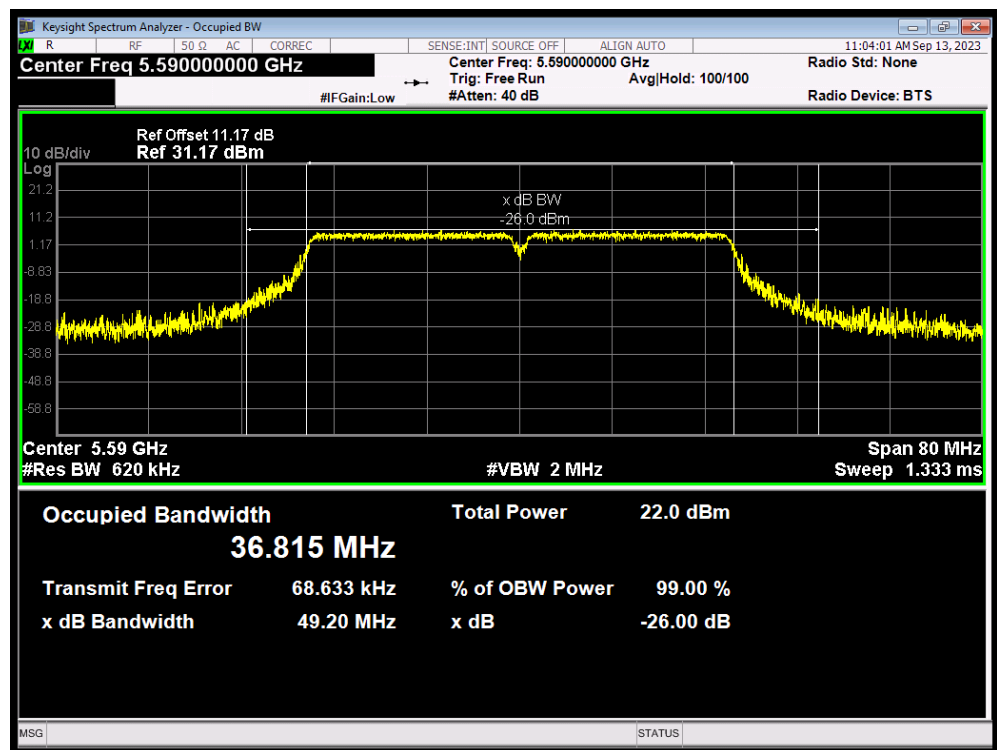
OBW 802.11n(HT20) 5720MHz



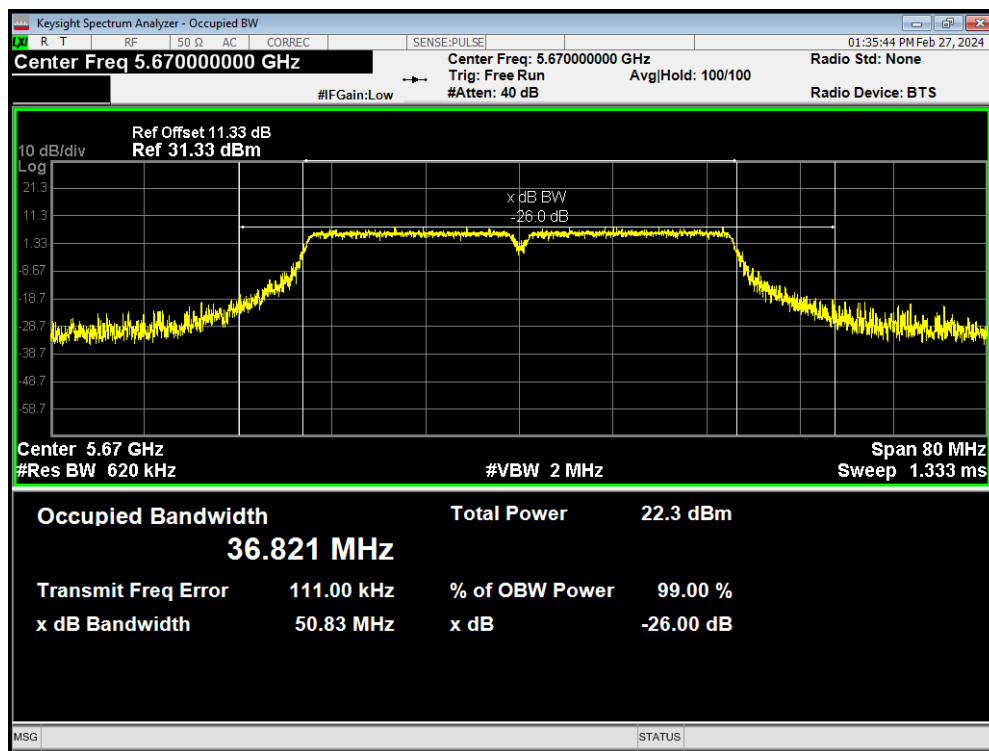
OBW 802.11n(HT40) 5510MHz



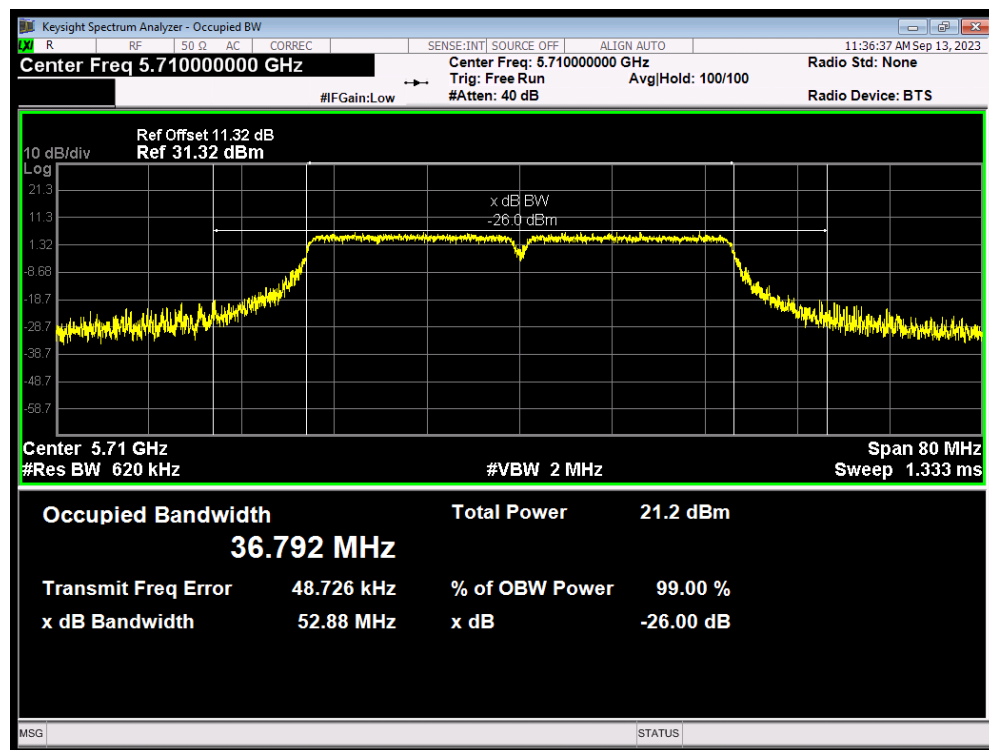
OBW 802.11n(HT40) 5590MHz



OBW 802.11n(HT40) 5670MHz

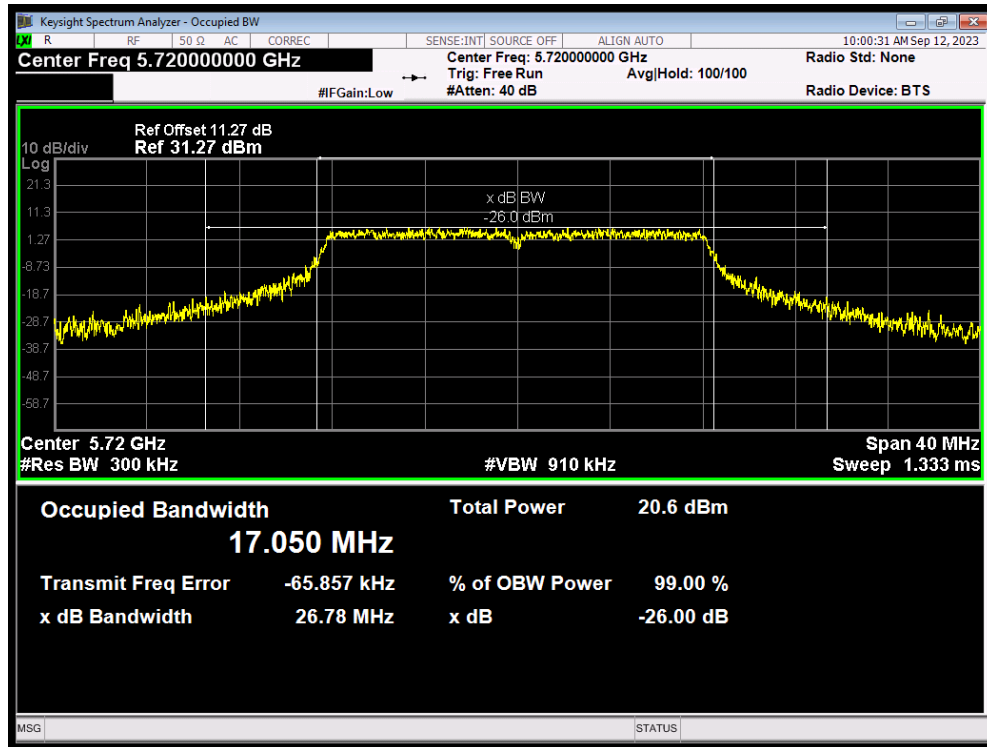


OBW 802.11n(HT40) 5710MHz

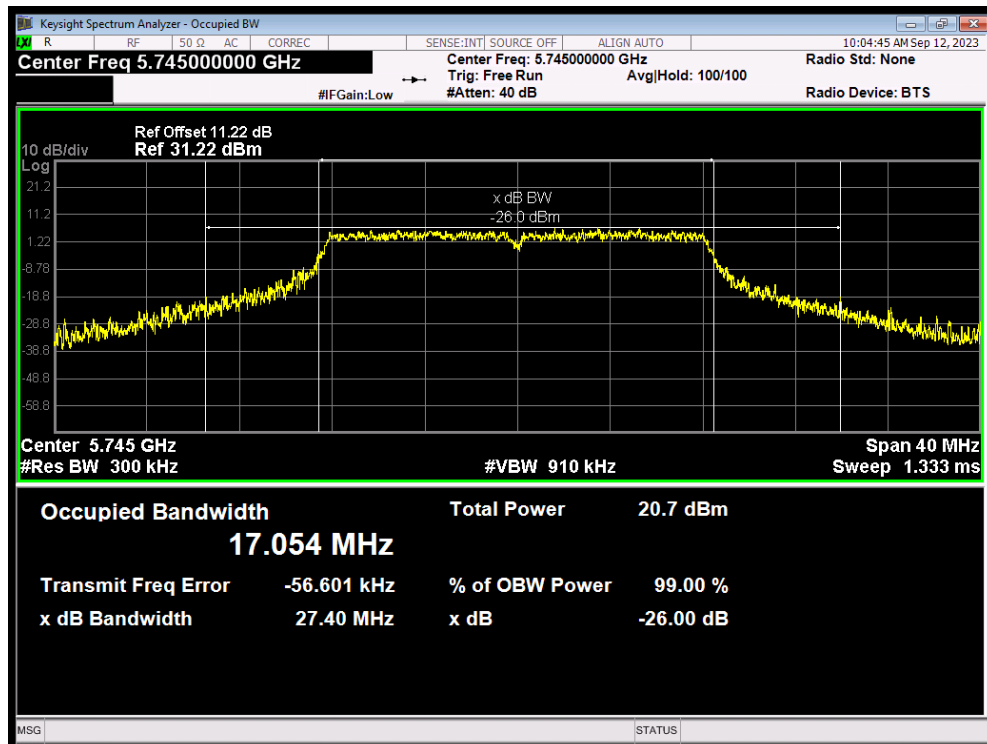


U-NII-3

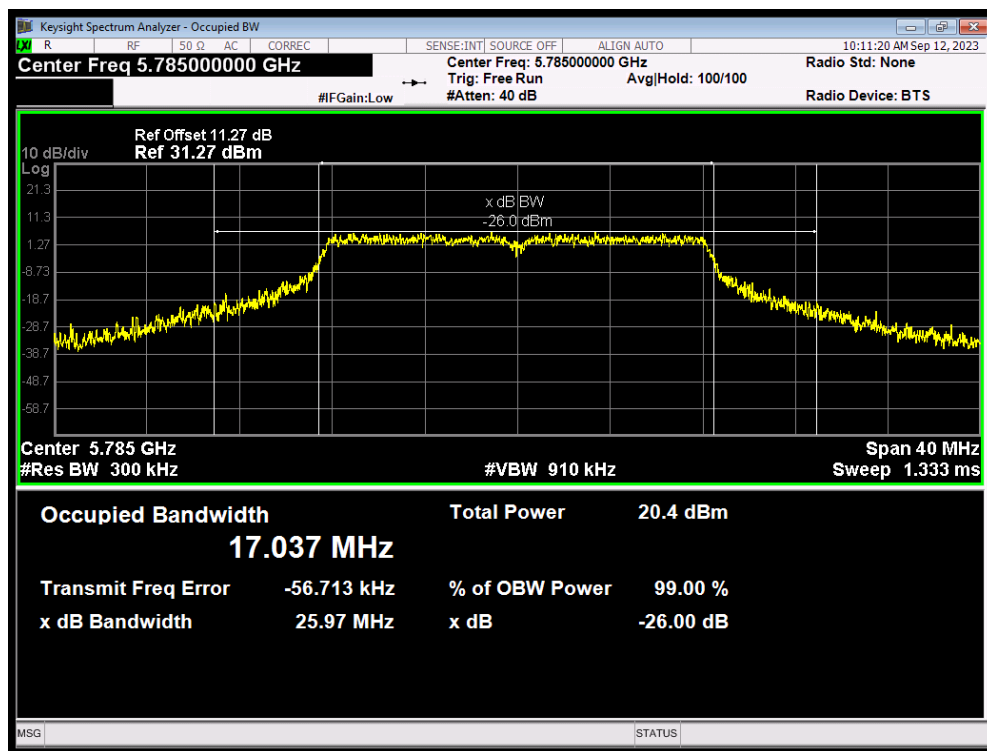
OBW 802.11a 5720MHz



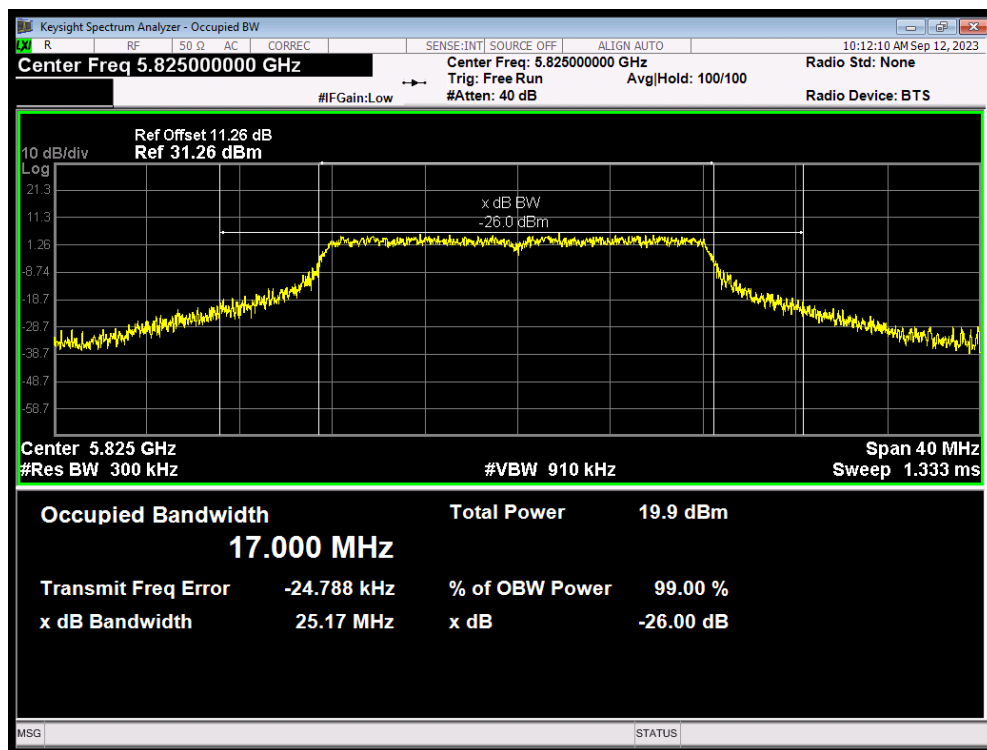
OBW 802.11a 5745MHz



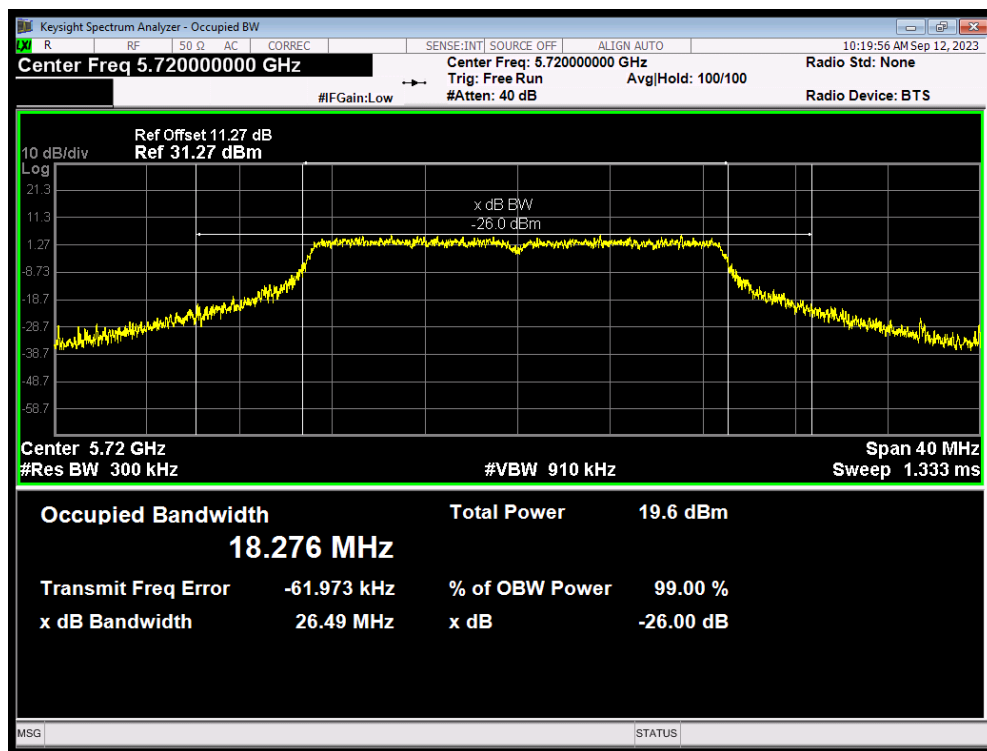
OBW 802.11a 5785MHz



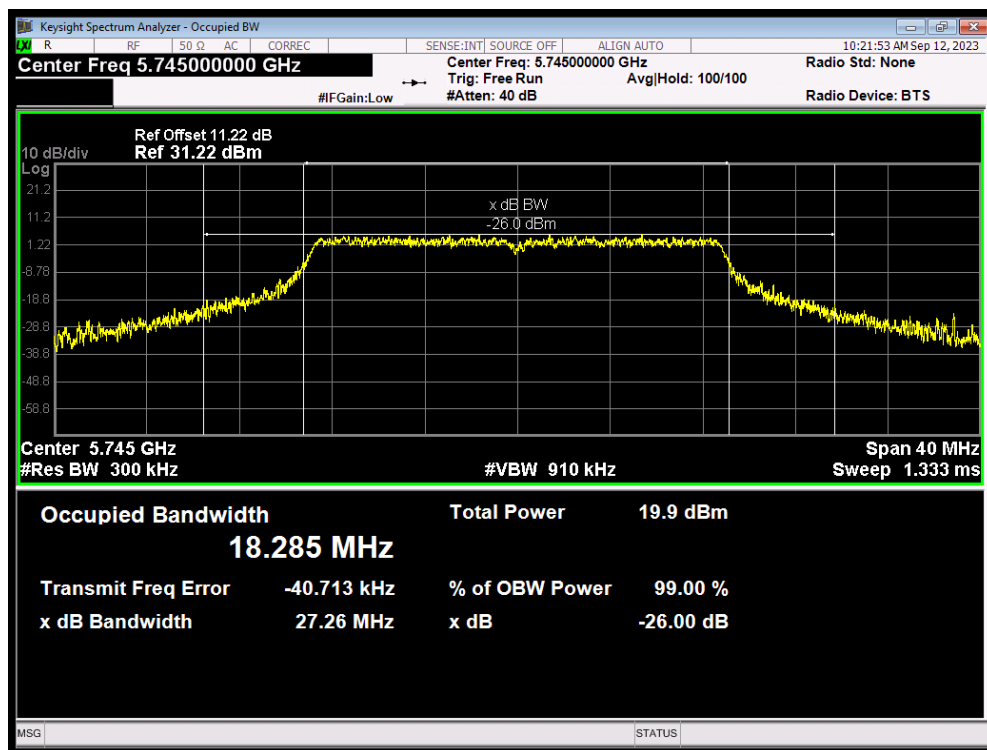
OBW 802.11a 5825MHz



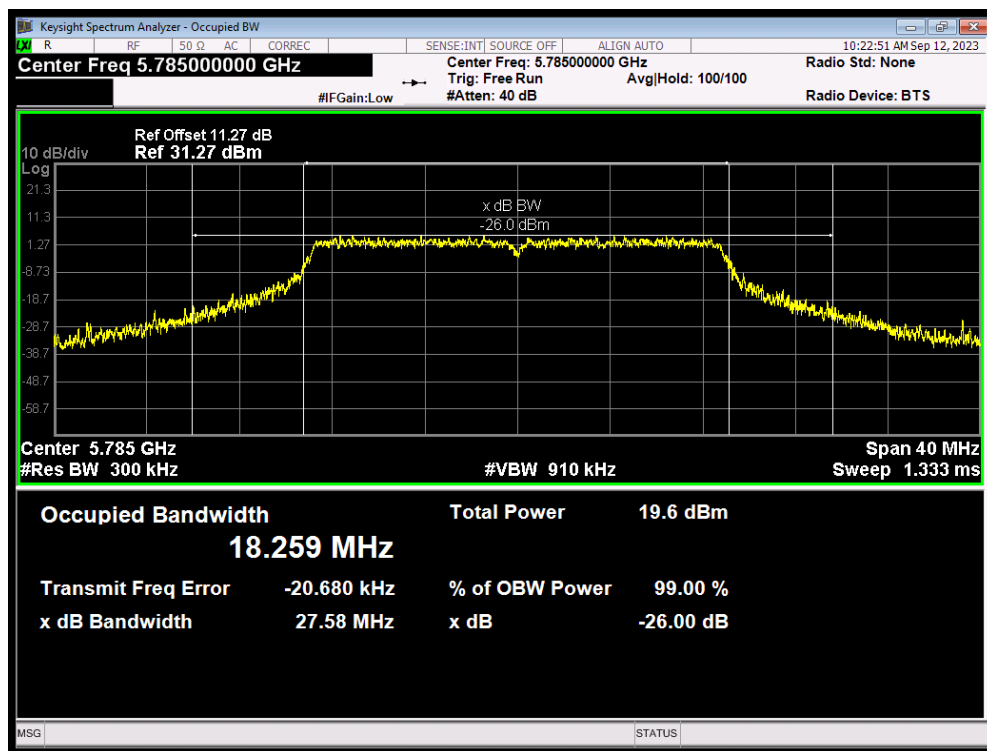
OBW 802.11ac(VHT20) 5720MHz



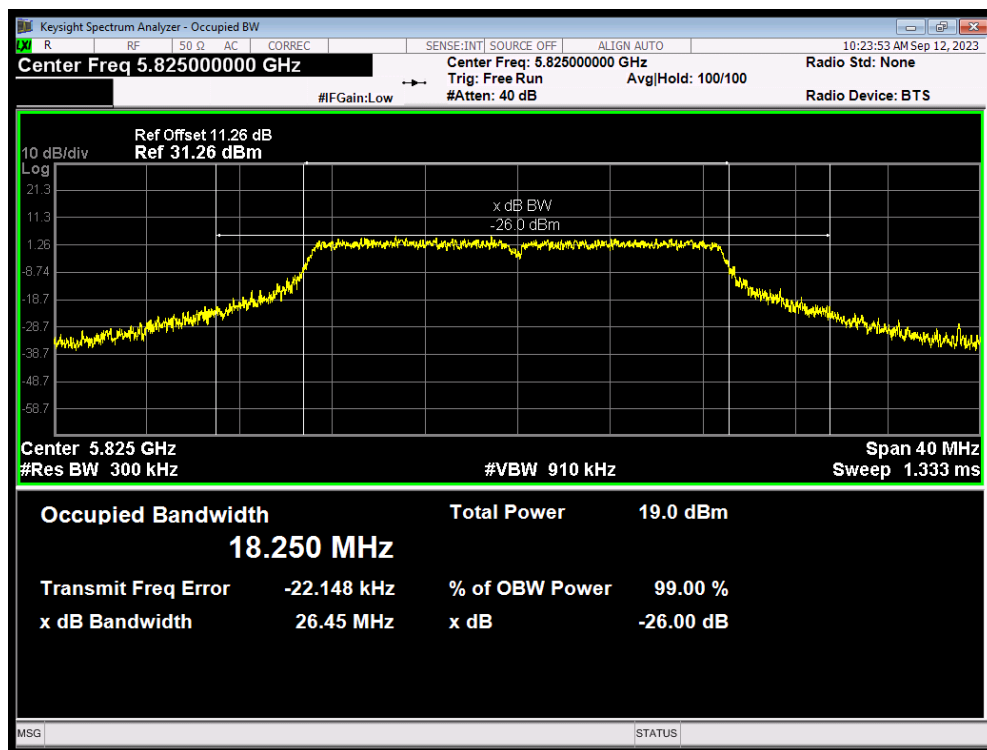
OBW 802.11ac(VHT20) 5745MHz



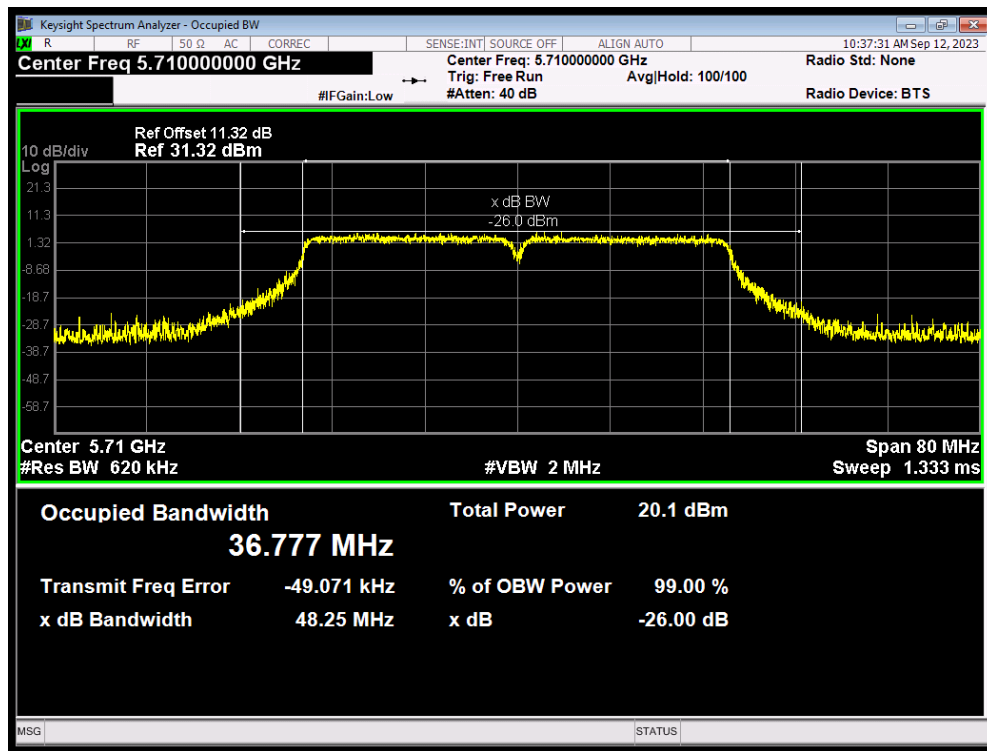
OBW 802.11ac(VHT20) 5785MHz



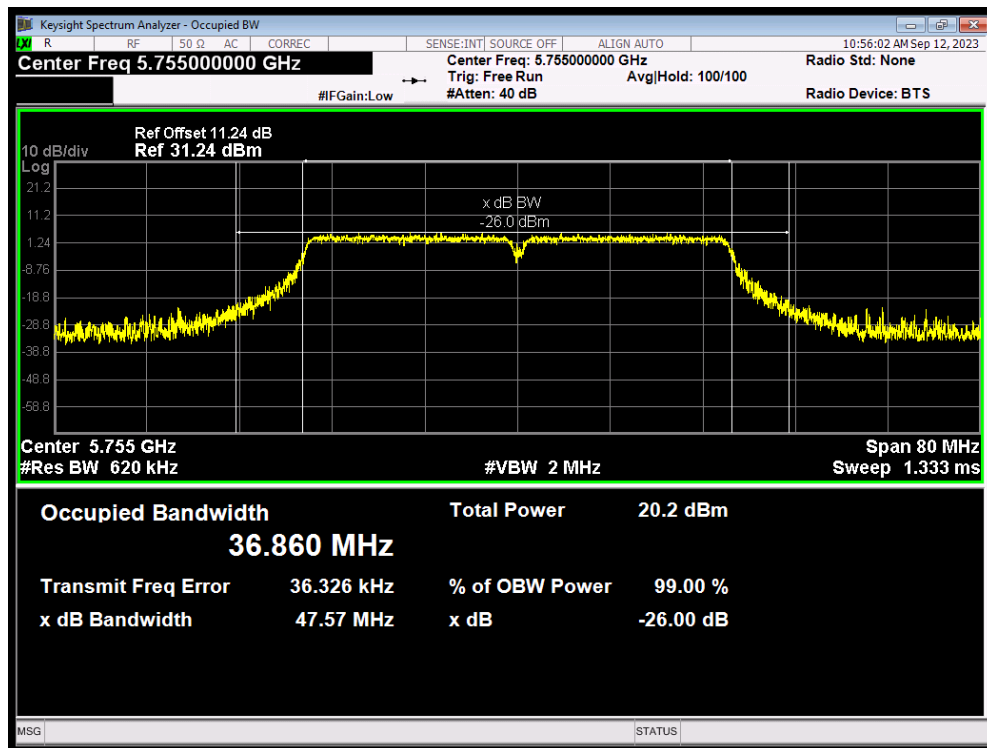
OBW 802.11ac(VHT20) 5825MHz



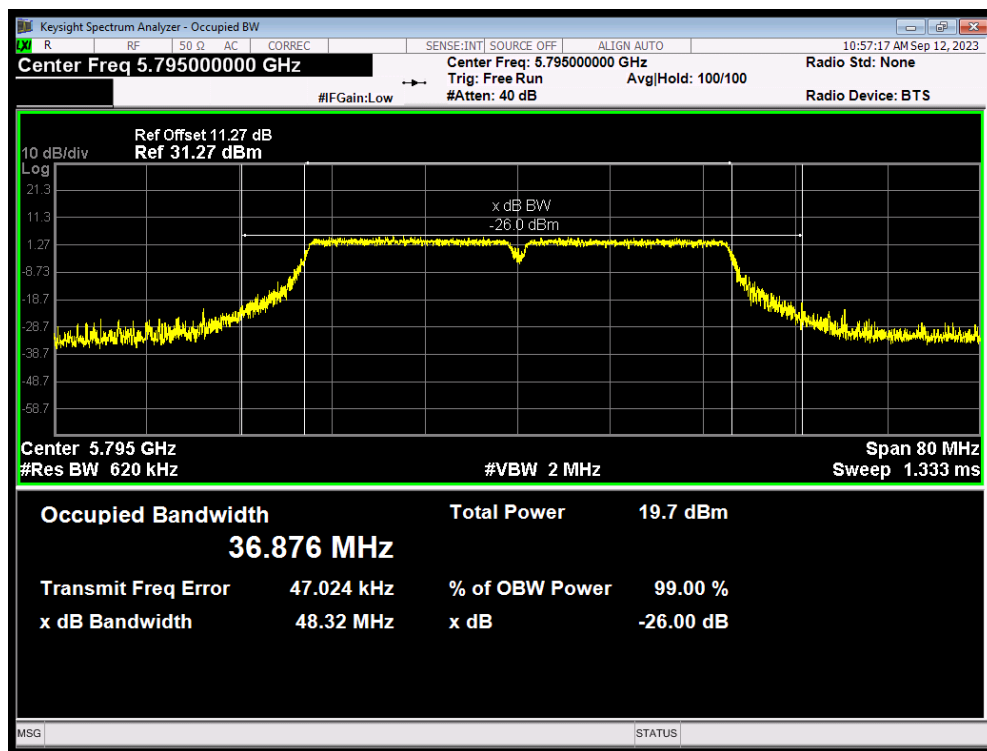
OBW 802.11ac(VHT40) 5710MHz



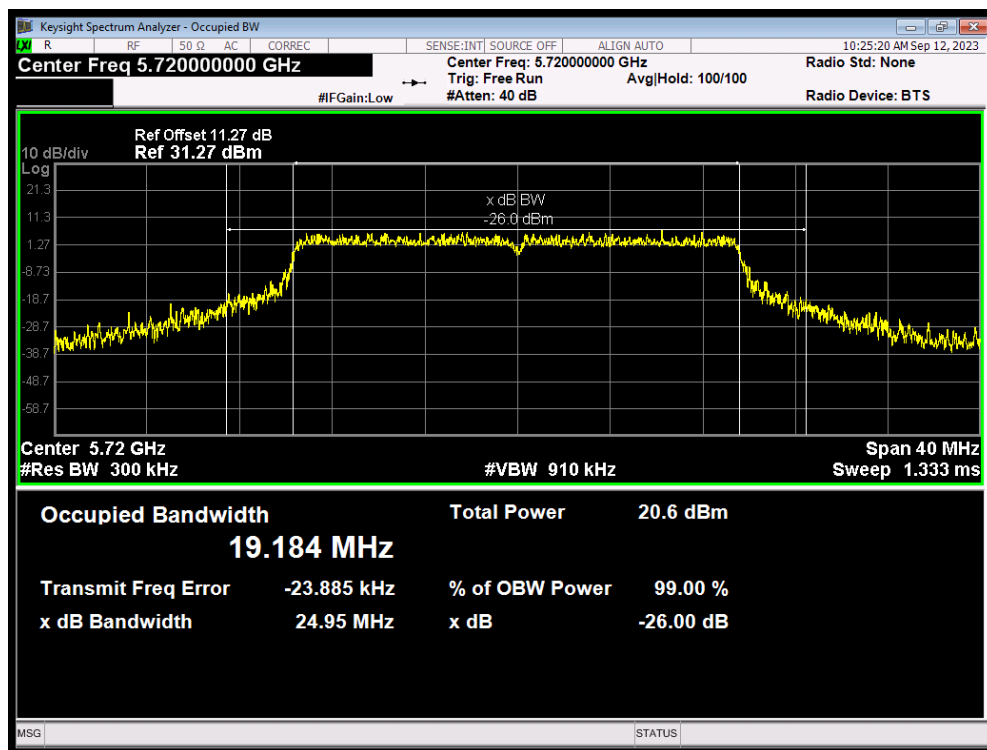
OBW 802.11ac(VHT40) 5755MHz



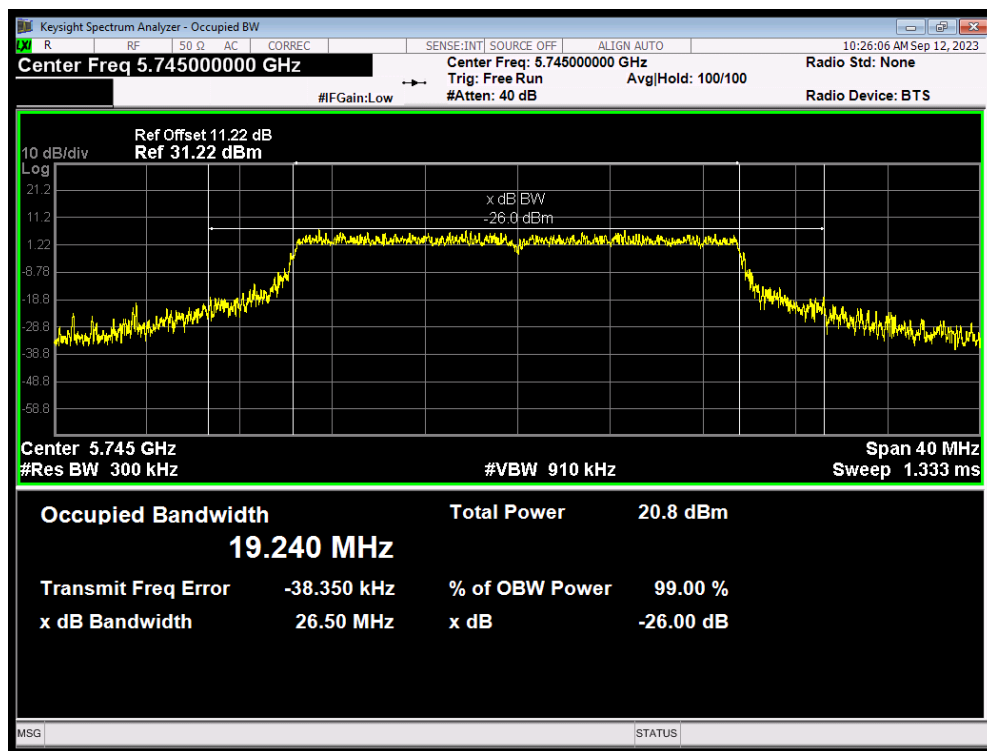
OBW 802.11ac(VHT40) 5795MHz



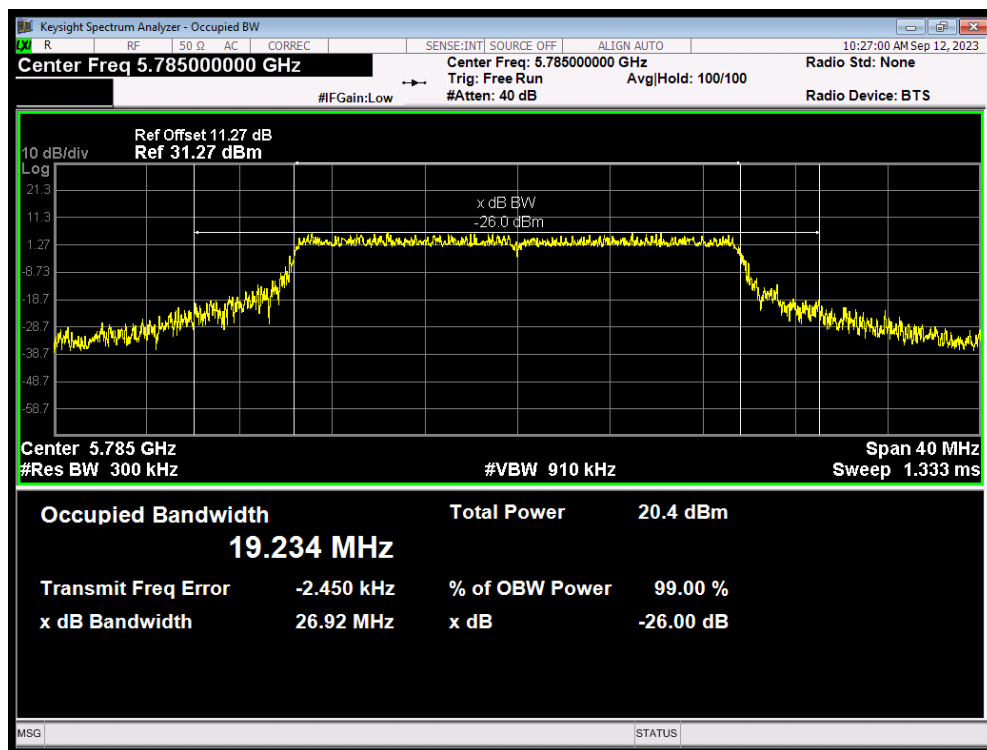
OBW 802.11ax(HE20) 5720MHz



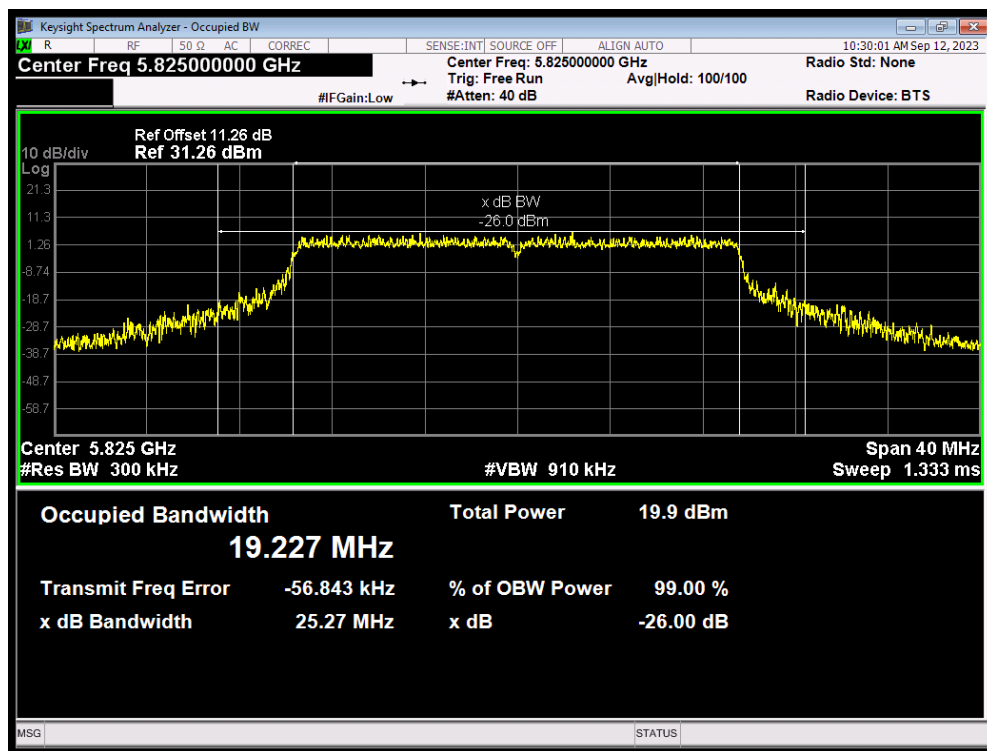
OBW 802.11ax(HE20) 5745MHz



OBW 802.11ax(HE20) 5785MHz



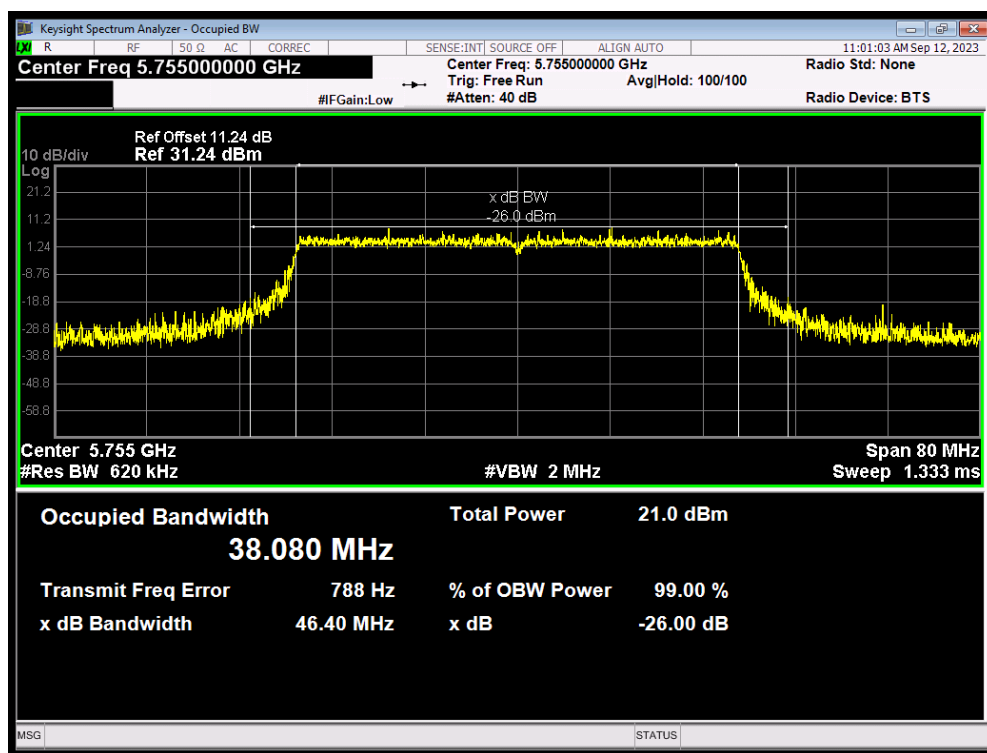
OBW 802.11ax(HE20) 5825MHz



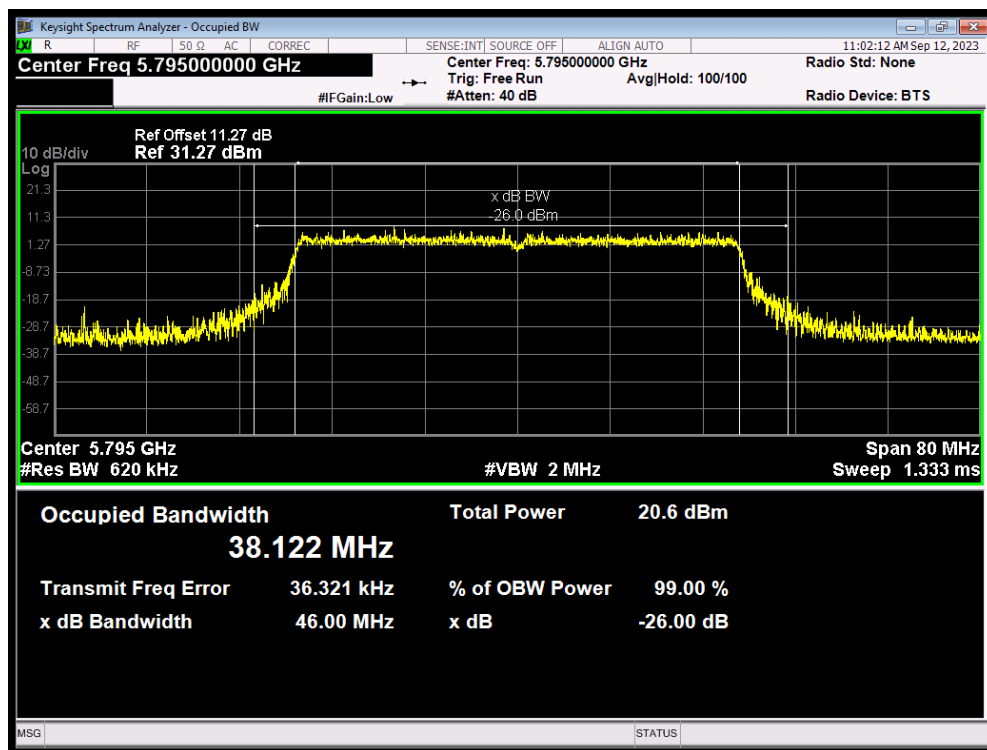
OBW 802.11ax(HE40) 5710MHz



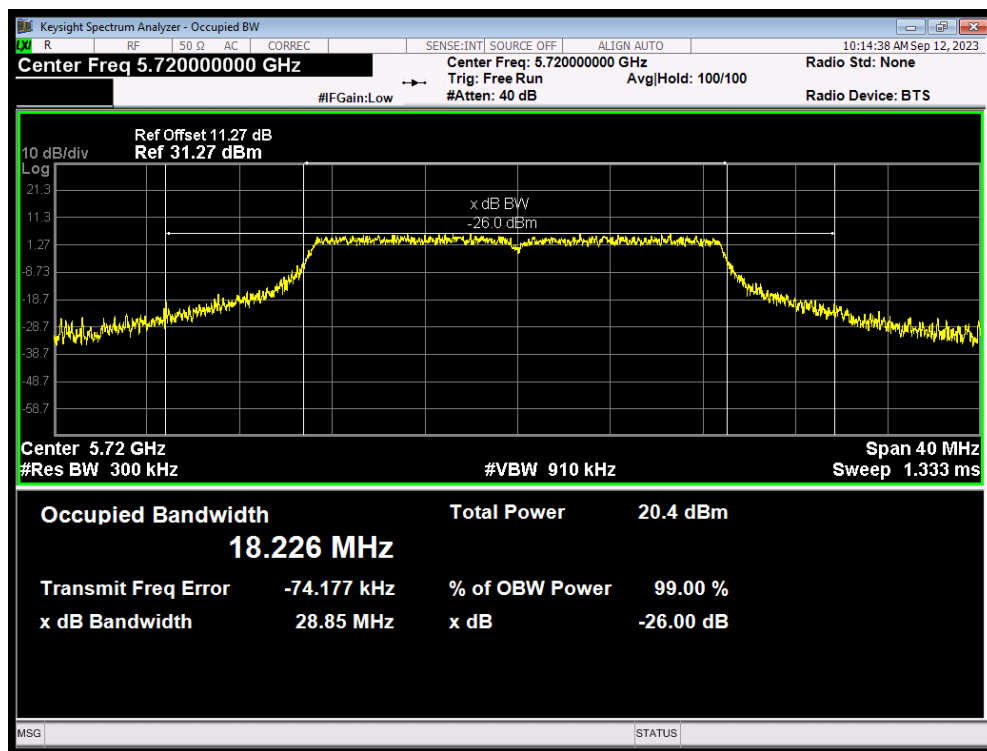
OBW 802.11ax(HE40) 5755MHz



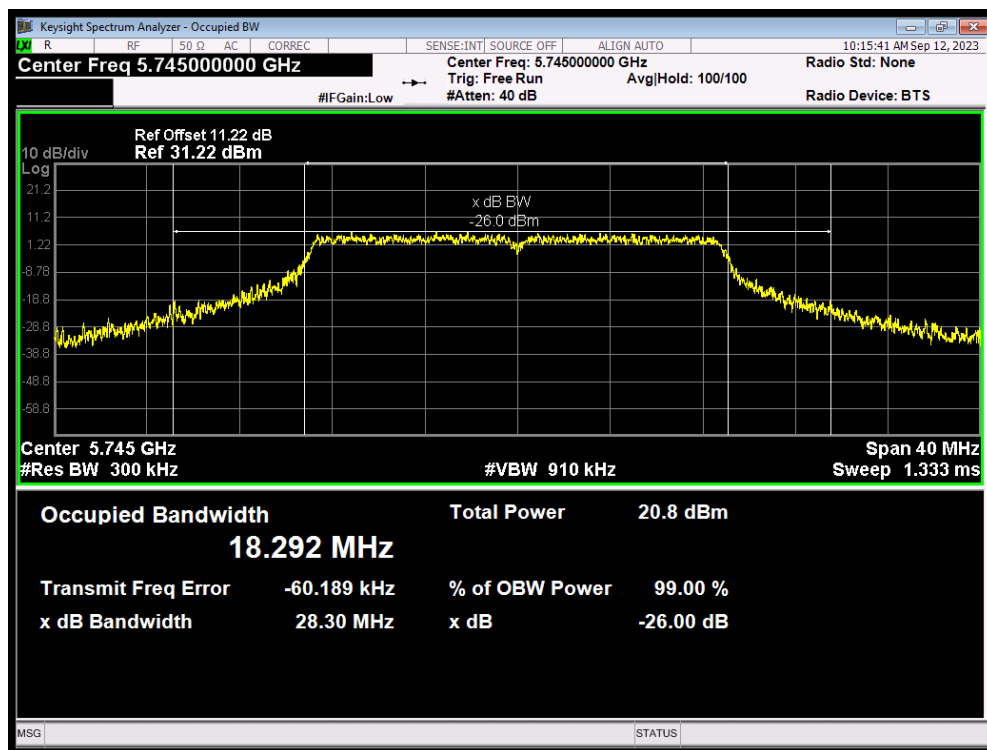
OBW 802.11ax(HE40) 5795MHz



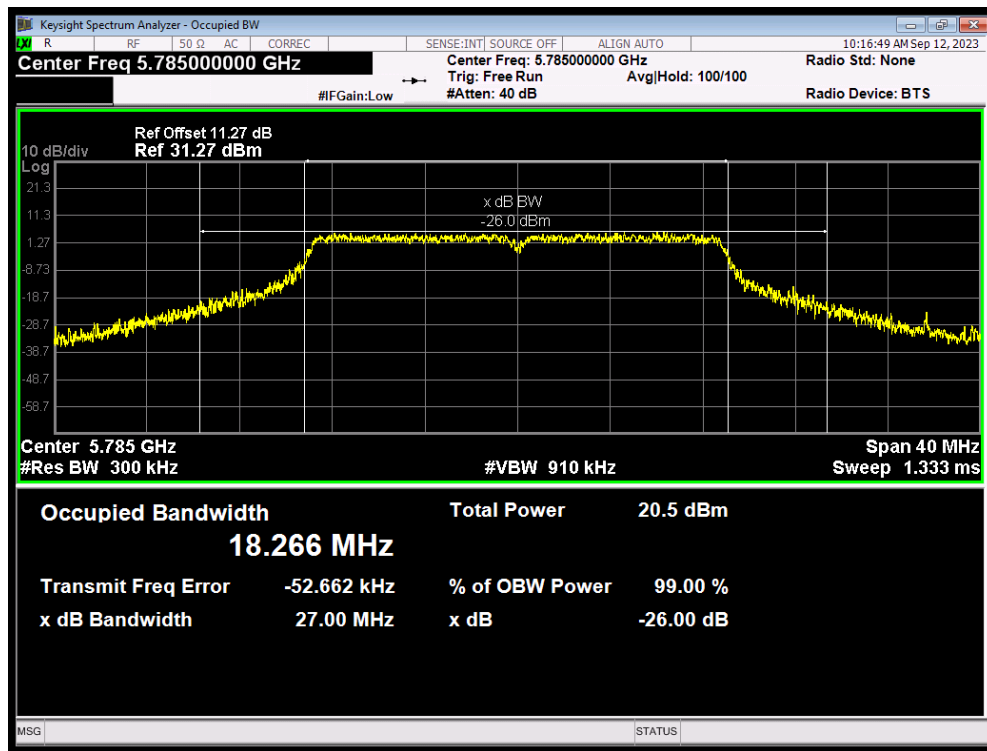
OBW 802.11n(HT20) 5720MHz



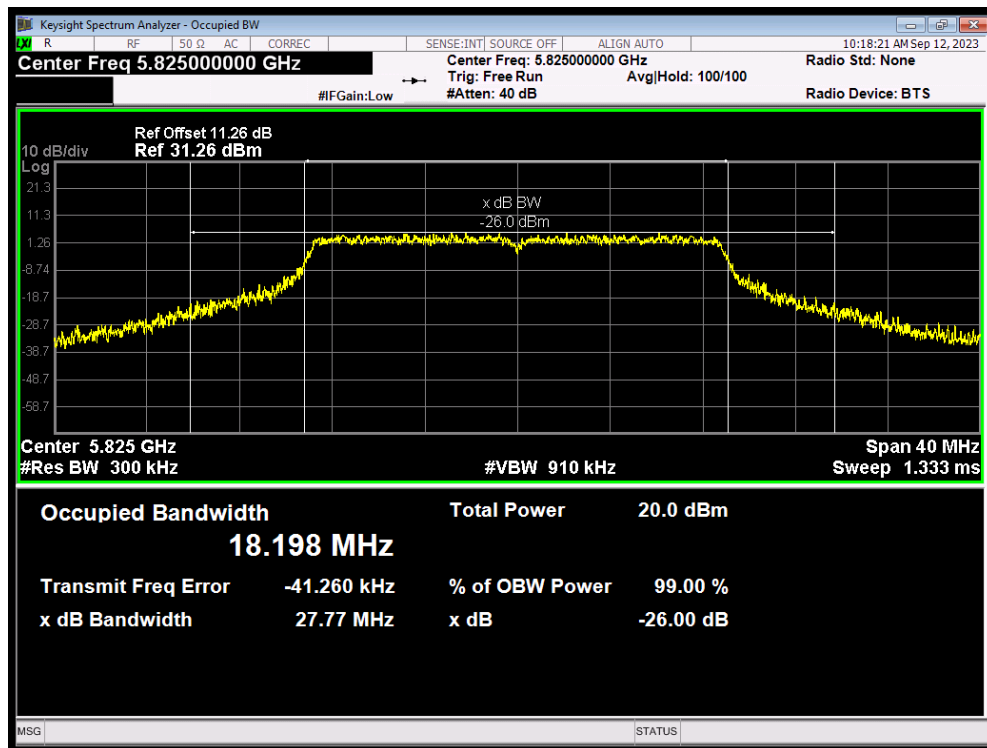
OBW 802.11n(HT20) 5745MHz



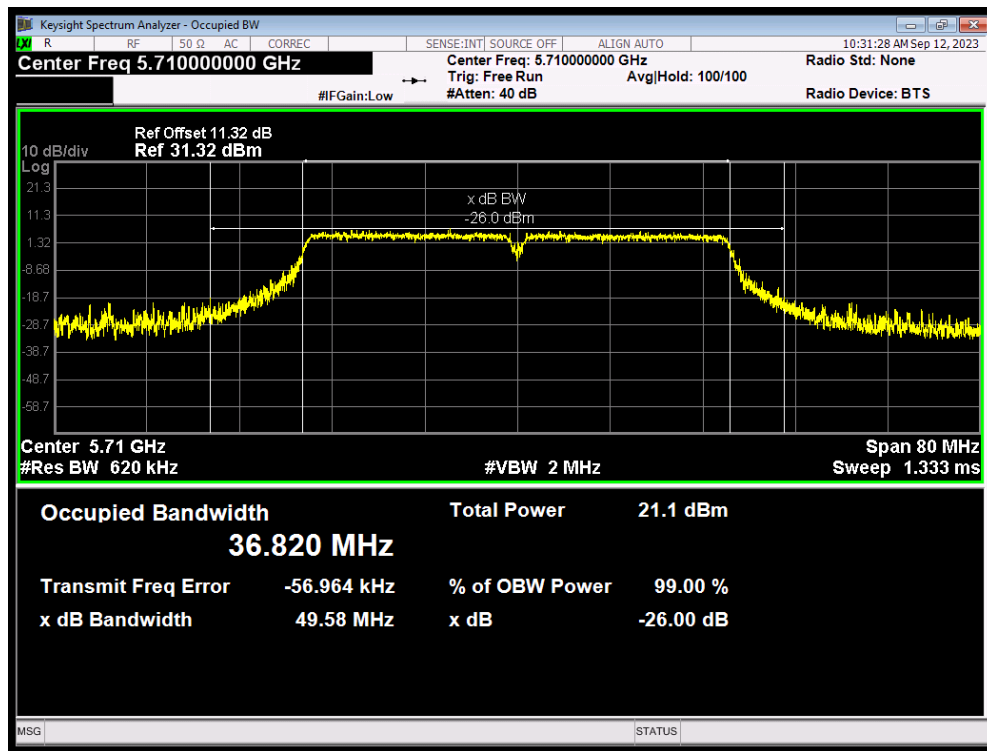
OBW 802.11n(HT20) 5785MHz



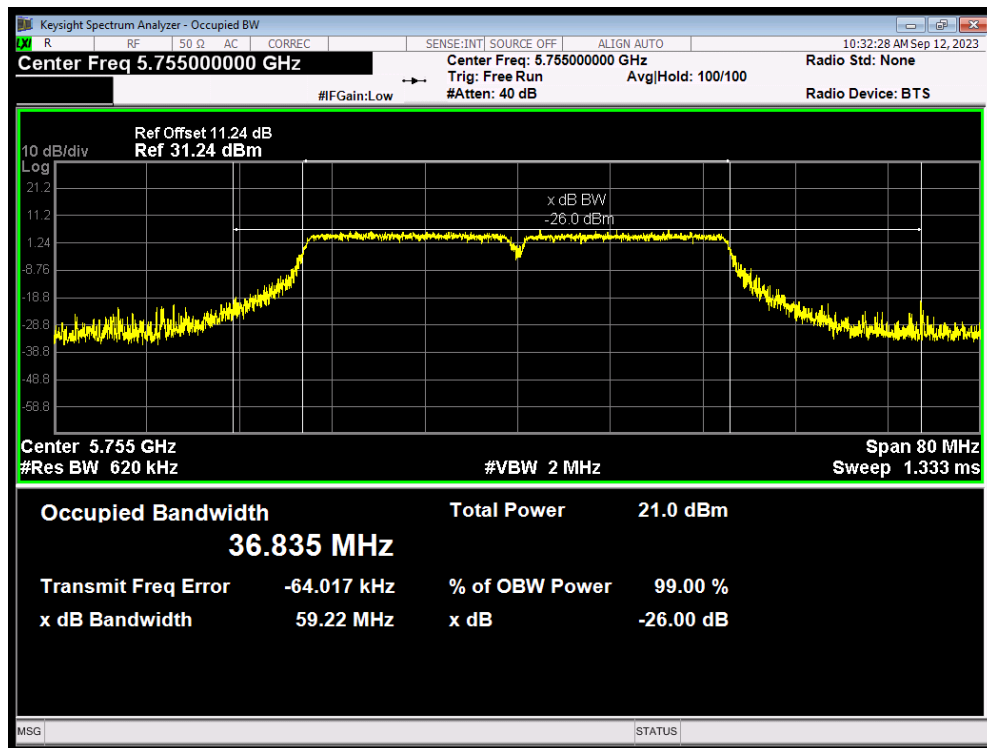
OBW 802.11n(HT20) 5825MHz



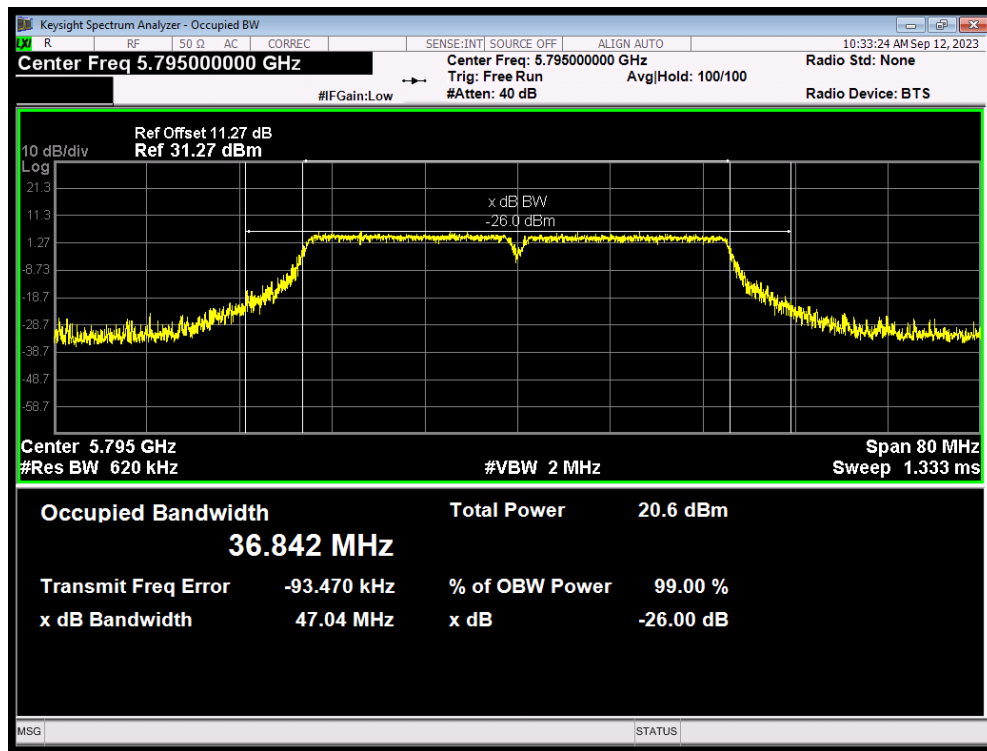
OBW 802.11n(HT40) 5710MHz



OBW 802.11n(HT40) 5755MHz



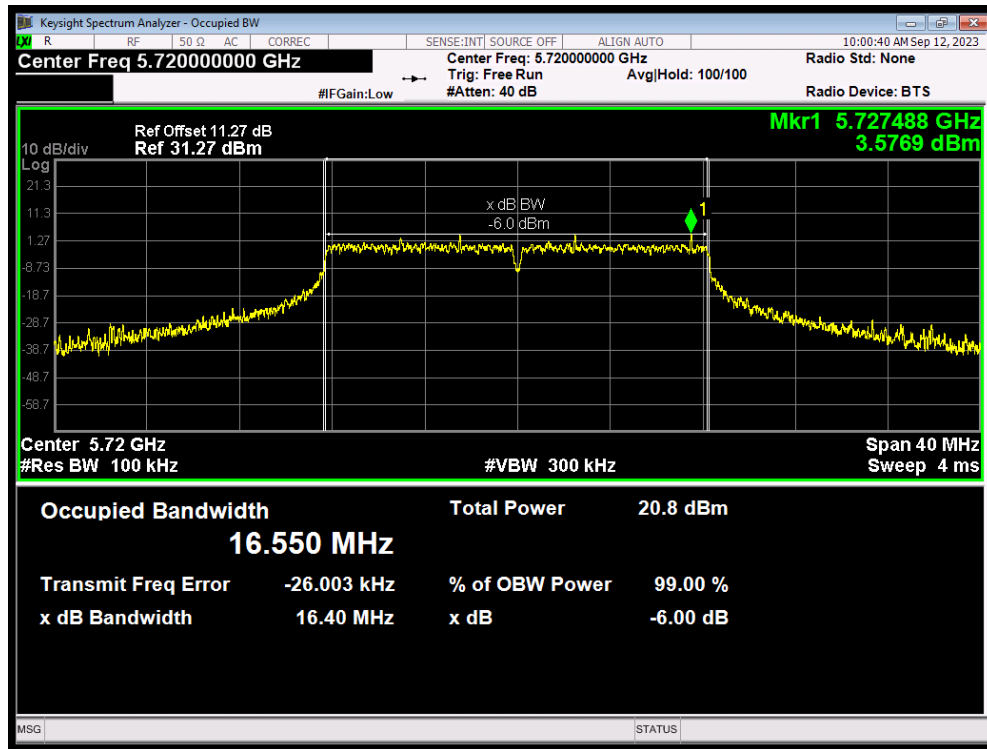
OBW 802.11n(HT40) 5795MHz



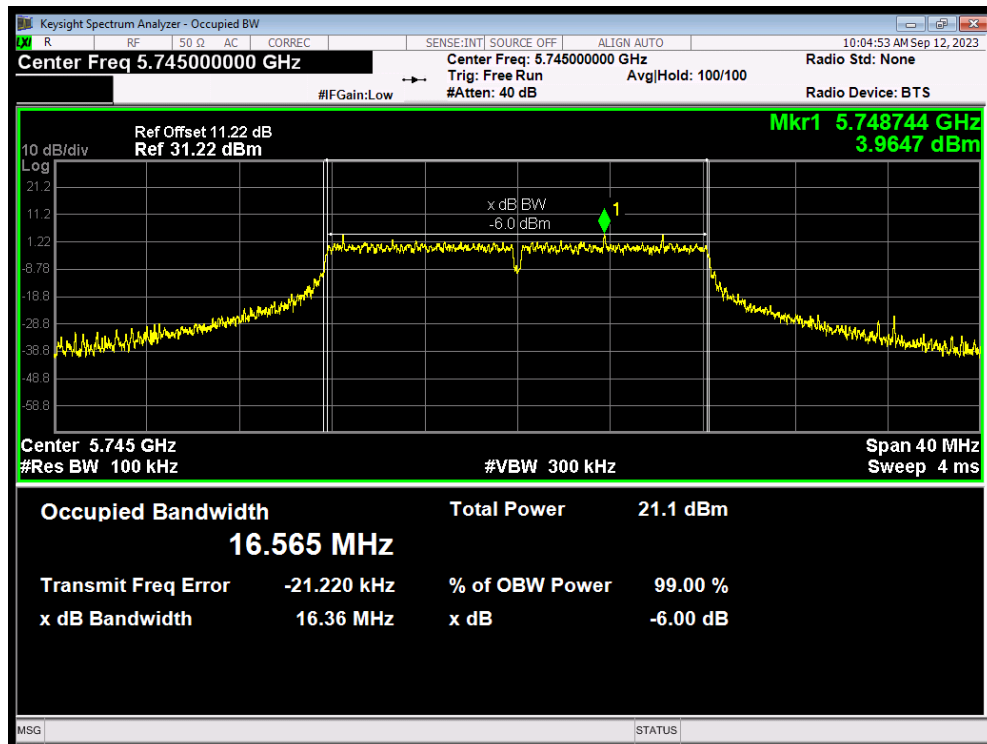
Minimum 6 dB bandwidth

U-NII-3

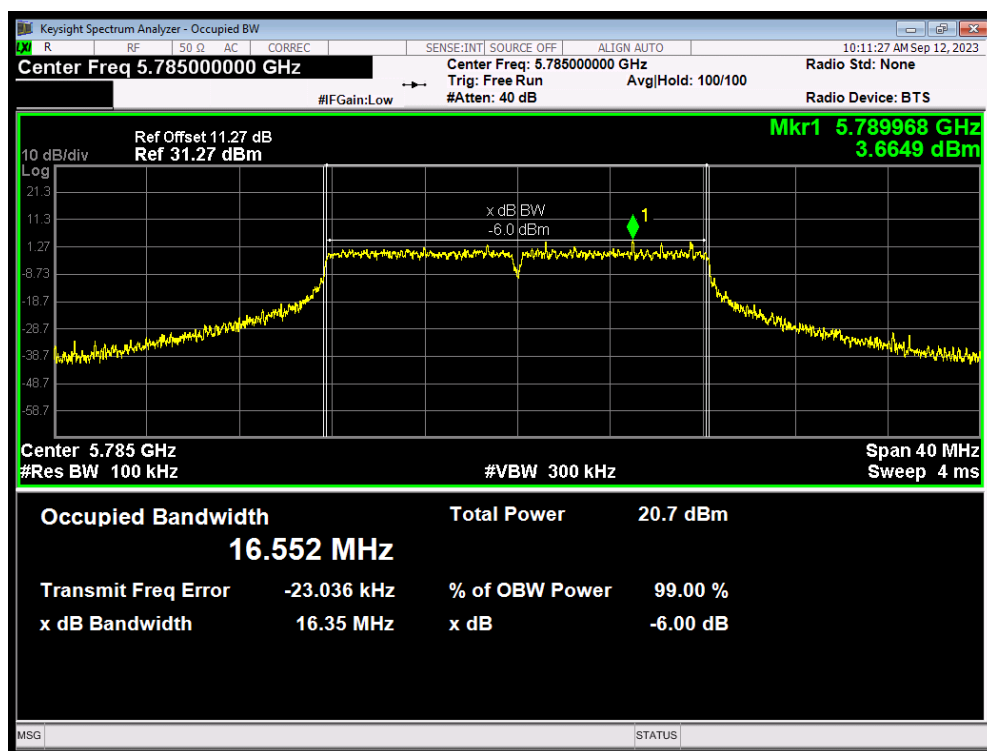
-6dB Bandwidth 802.11a 5720MHz



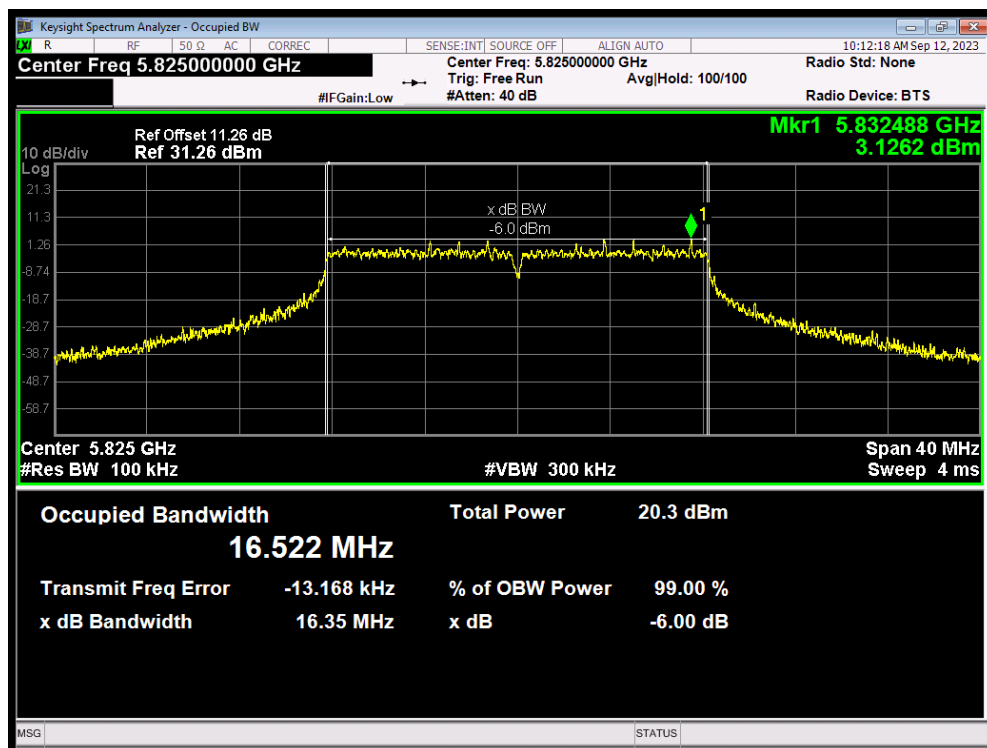
-6dB Bandwidth 802.11a 5745MHz



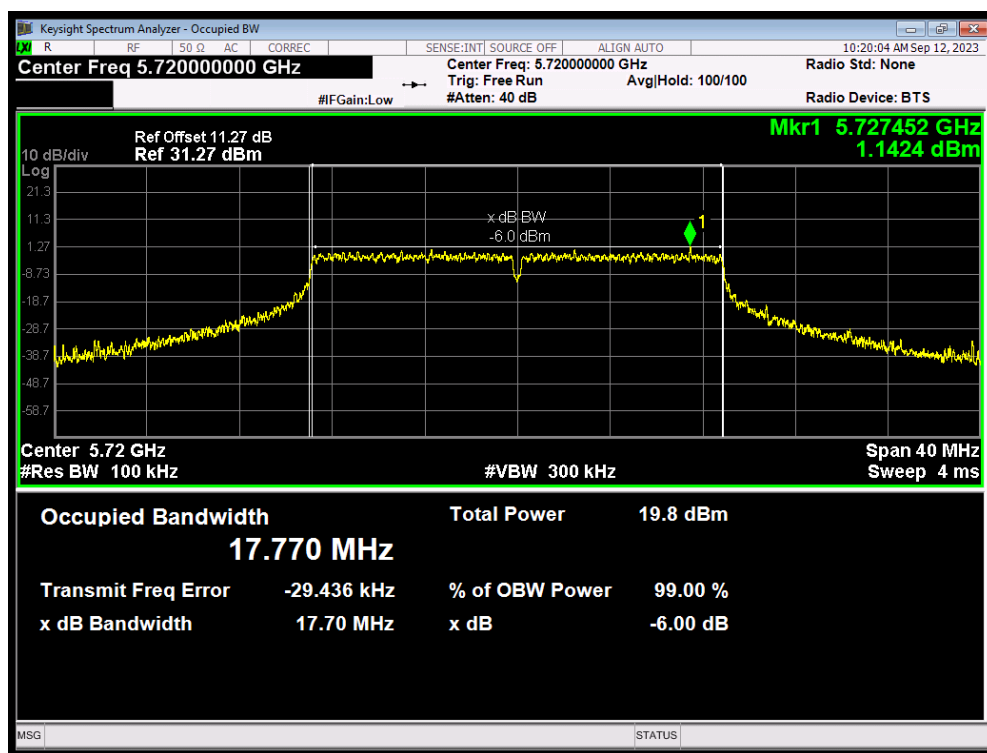
-6dB Bandwidth 802.11a 5785MHz



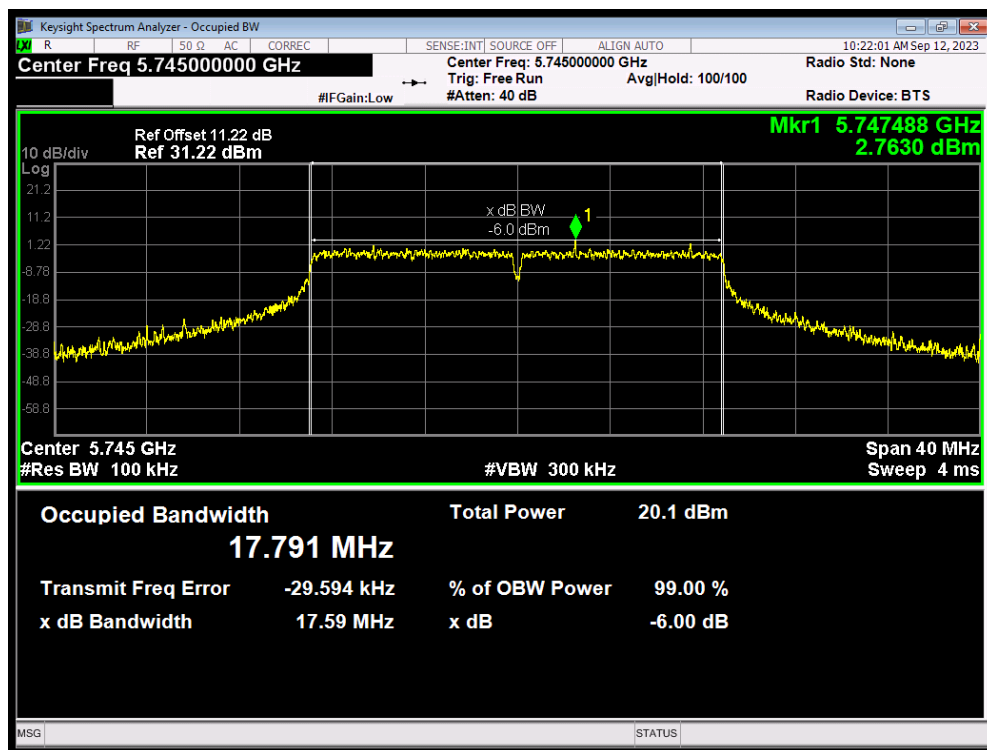
-6dB Bandwidth 802.11a 5825MHz



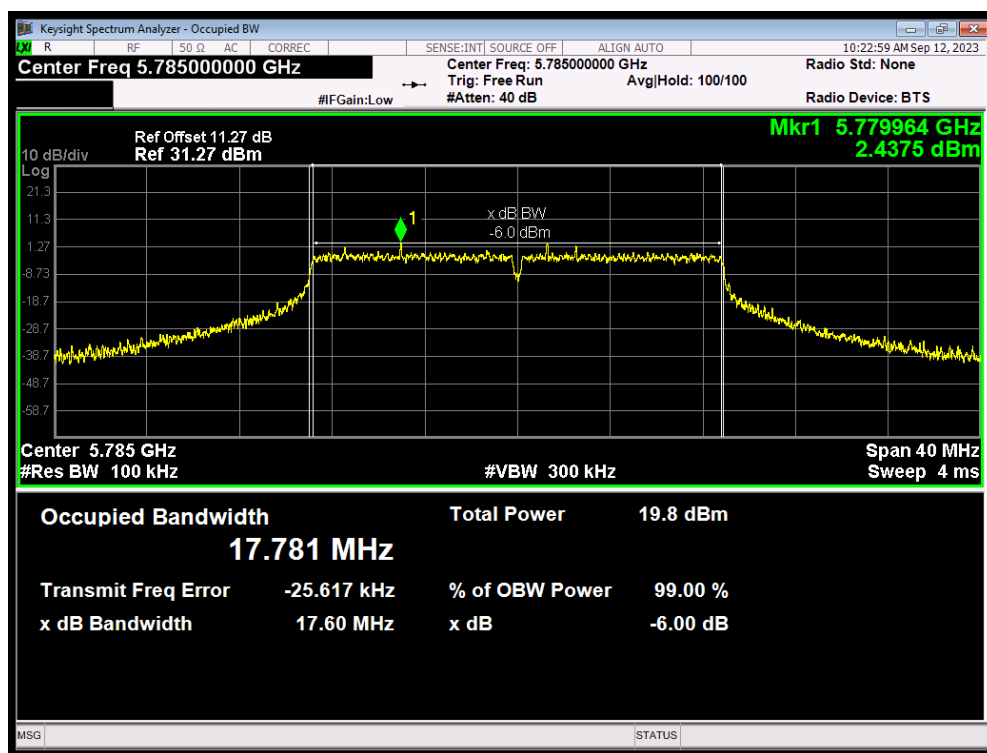
-6dB Bandwidth 802.11ac(VHT20) 5720MHz



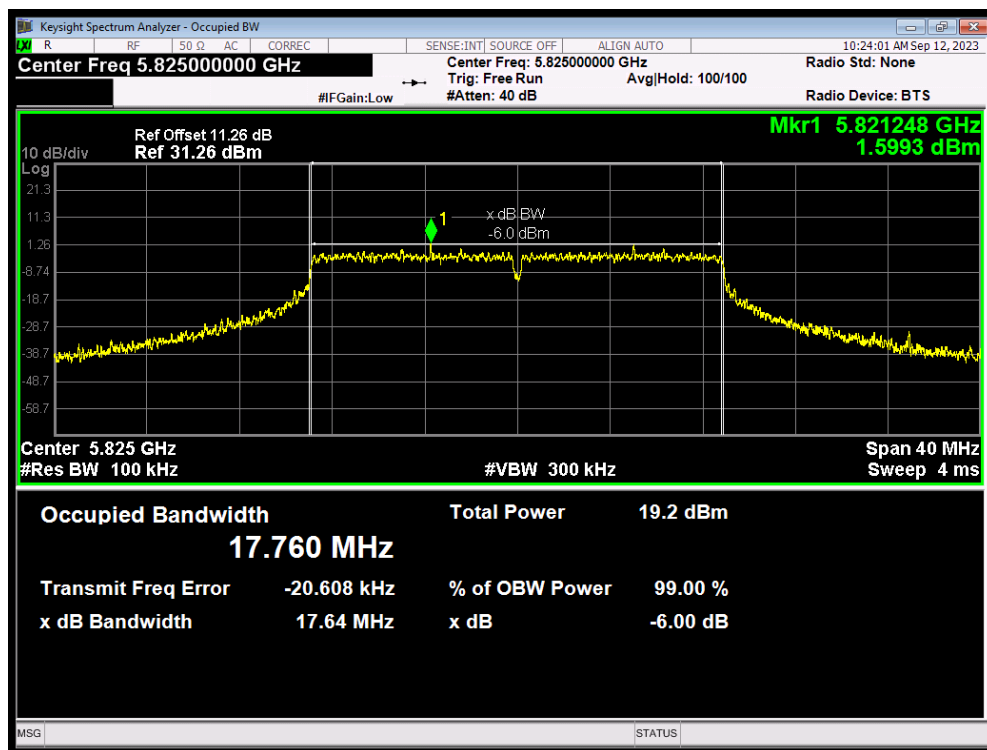
-6dB Bandwidth 802.11ac(VHT20) 5745MHz



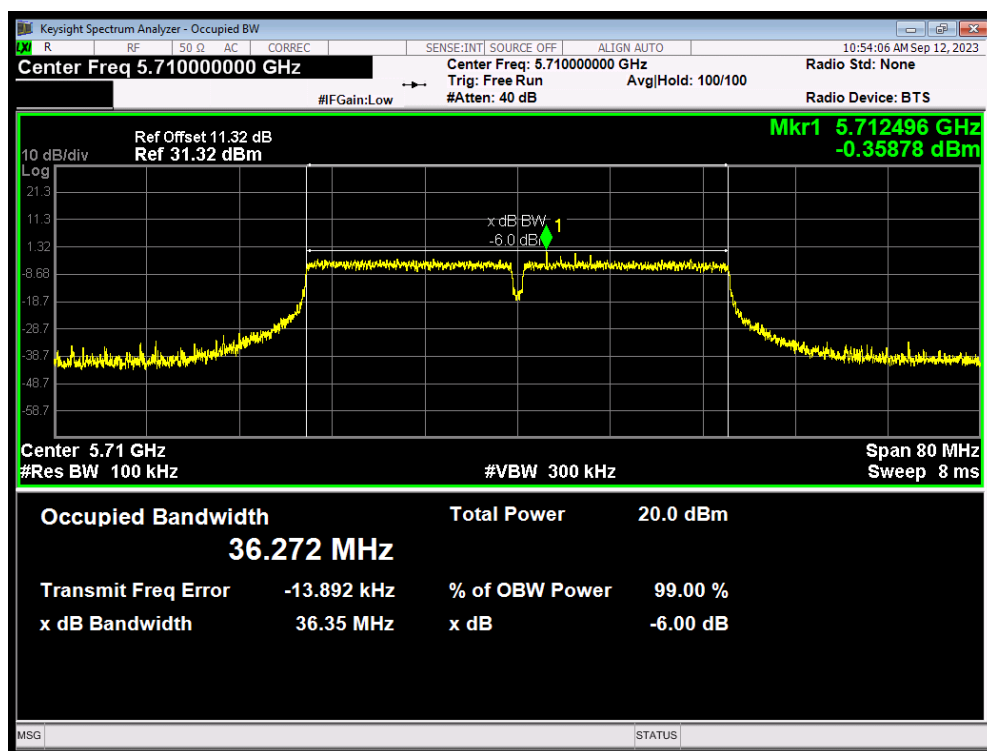
-6dB Bandwidth 802.11ac(VHT20) 5785MHz



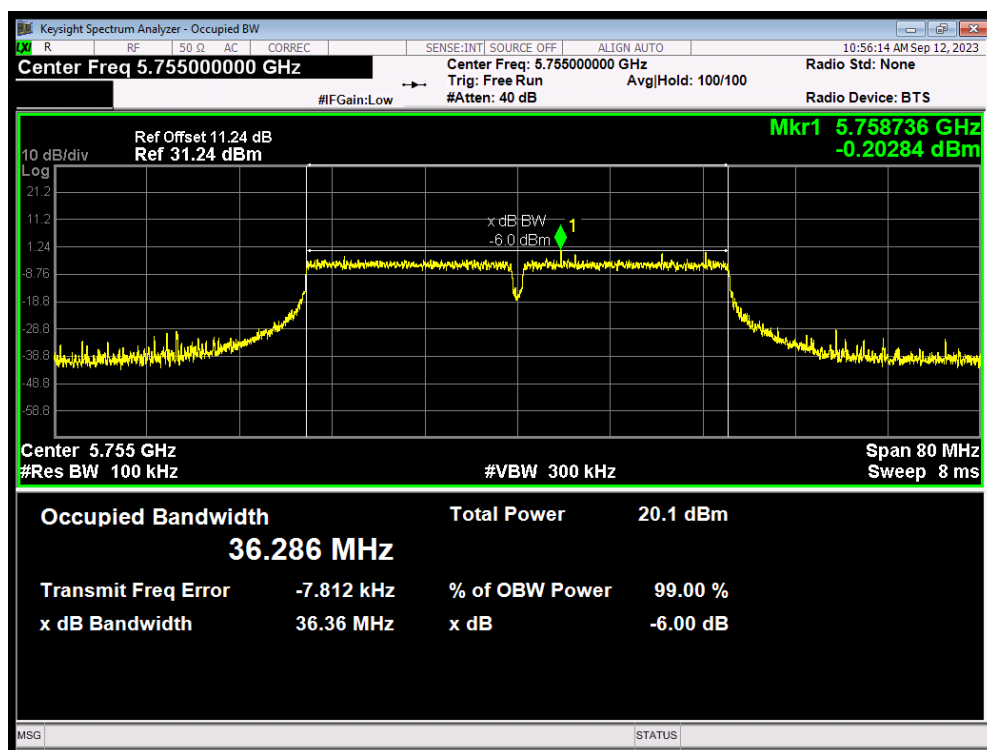
-6dB Bandwidth 802.11ac(VHT20) 5825MHz



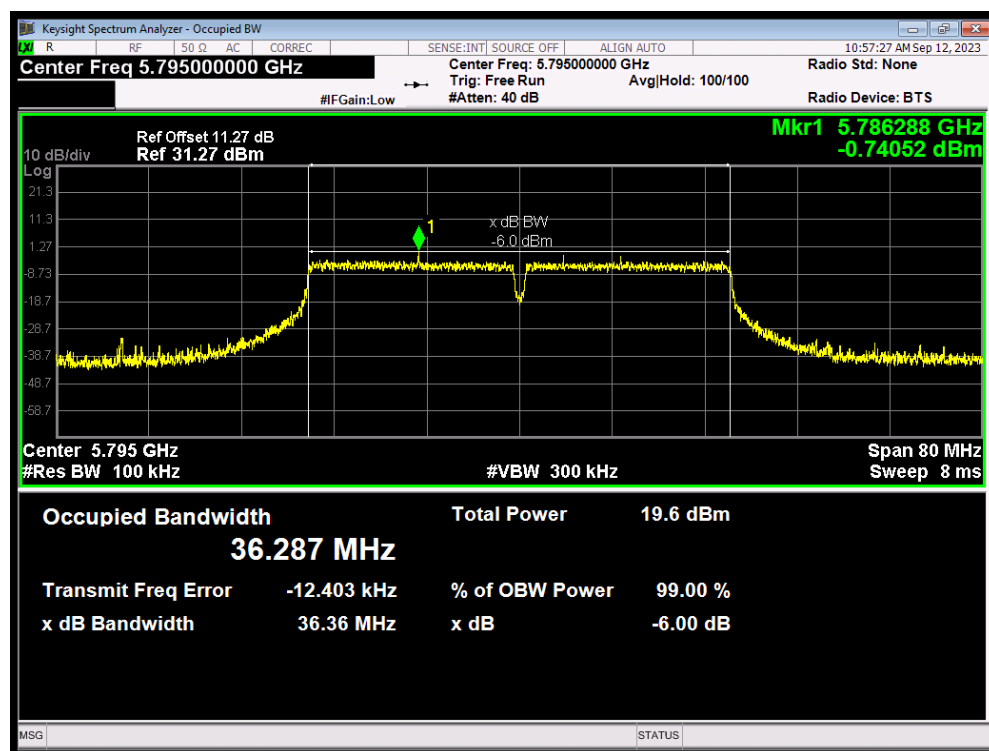
-6dB Bandwidth 802.11ac(VHT40) 5710MHz



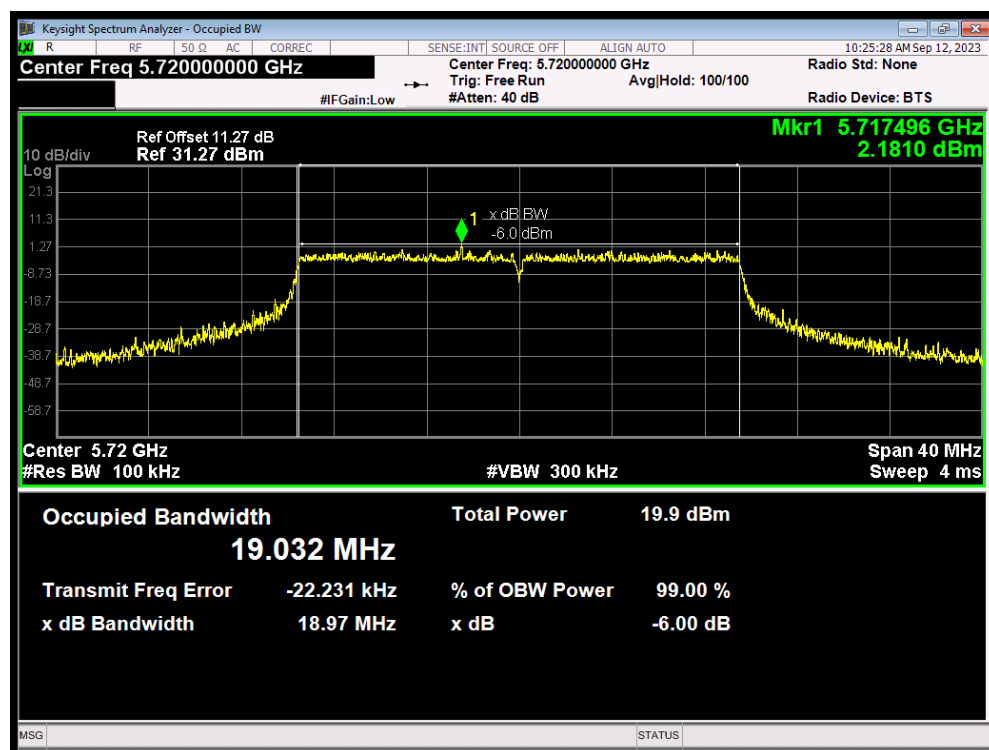
-6dB Bandwidth 802.11ac(VHT40) 5755MHz



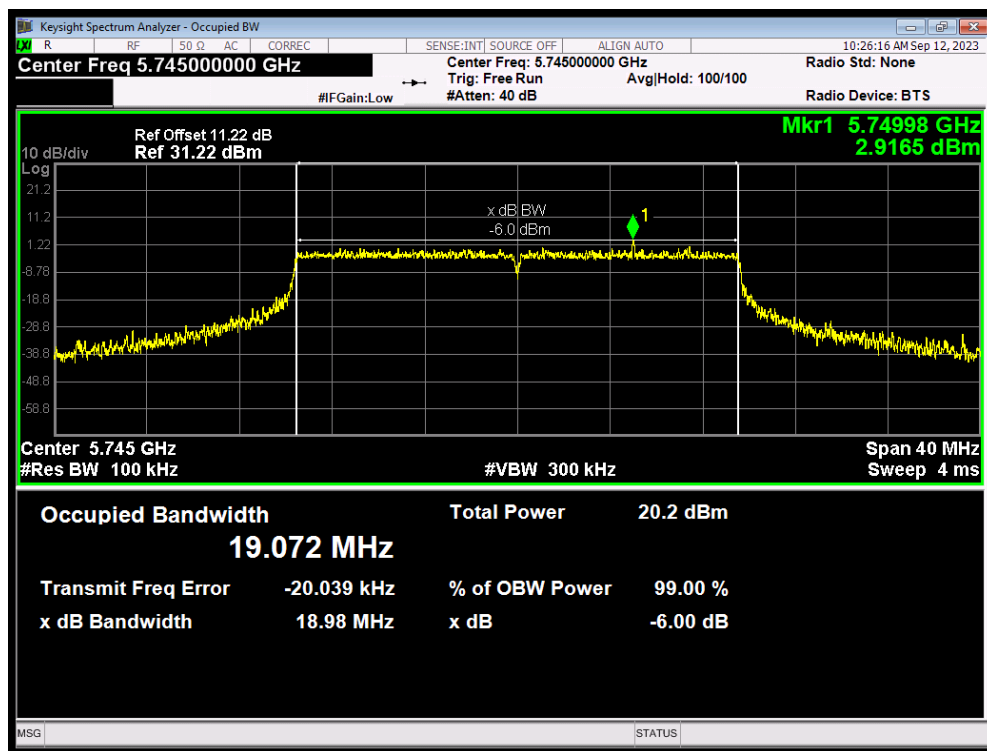
-6dB Bandwidth 802.11ac(VHT40) 5795MHz



-6dB Bandwidth 802.11ax(HE20) 5720MHz



-6dB Bandwidth 802.11ax(HE20) 5745MHz



-6dB Bandwidth 802.11ax(HE20) 5785MHz

