RF TEST REPORT

Applicant	Xiaomi Communications Co., Ltd.
FCC ID	2AFZZNC4L
Product	Mobile Phone
Brand	Redmi
Model	2212ARNC4L
Report No.	R2209A0813-R7V1
Issue Date	November 18, 2022

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15E (2021)**. 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*

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Version	Revision description	Issue Date
Rev.0	Initial issue of report.	November 11, 2022
Rev.1	Update data.	November 18, 2022
Note: This revised report (Report No. R2209A0813-R7V1) supersedes and replaces the previously issued report (Report No. R2209A0813-R7). Please discard or destroy the previously issued report and dispose of it accordingly.		

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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: October 9, 2022 ~ October 24, 2022
Date of Sample Received: October 8, 2022

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.

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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
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Website:	http://www.ta-shanghai.com
E-mail:	xukai@ta-shanghai.com

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2. General Description of Equipment under Test

2.1. Applicant and Manufacturer Information

Applicant	Xiaomi Communications Co., Ltd.
Applicant address	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
Manufacturer	Xiaomi Communications Co., Ltd.
Manufacturer address	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

2.2. General information

EUT Description		
Model	2212ARNC4L	
IMEI	IMEI 1: 861591060034226 IMEI 2: 861591060034234	
Hardware Version	P1.1	
Software Version	MIUI 13	
Antenna Type	PIFA Antenna	
Antenna Connector	A permanently attached antenna (meet with the standard FCC Part 15.203 requirement)	
Antenna Gain	U-NII-1	0.2 dBi
	U-NII-2A	-0.2 dBi
	U-NII-2C	0.2 dBi
	U-NII-3	-0.5 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/n (HT20/HT40) : OFDM 802.11ac (VHT20/VHT40/VHT80): OFDM	
Max. Output Power	15.91 dBm	
Testing temperature range:	-20 ° C to 50° C	
Operating temperature range:	0 ° C to 40 ° C	
Operating voltage range:	3.65 V to 4.20 V	
State DC voltage:	3.85 V	
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.		

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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.

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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 (2021) Unlicensed National Information Infrastructure Devices

ANSI C63.10-2013

Reference standard:

KDB 789033 D02 General UNII Test Procedures New Rules v02r01

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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 (X axis) and the worst case was recorded.

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

Worst-case data rates are shown as following table.

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

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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
		80 MHz	106	5530MHz
			122	5610MHz
	U-NII-3	20 MHz	144	5720MHz
			149	5745MHz
			153	5765MHz
			157	5785MHz

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			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				

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5. Test Case Results

5.1. Occupied Bandwidth

Ambient condition

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

Method of Measurement

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

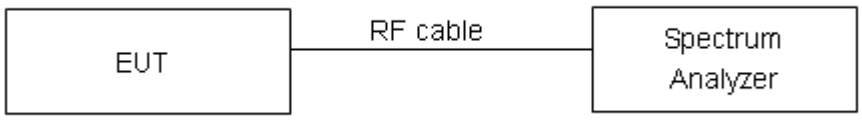
For U-NII-1/U-NII-2A/U-NII-2C, set RBW ≈1% OCB kHz, VBW ≥ 3 × RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the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

For U-NII-3, Set RBW = 100 kHz, VBW ≥ 3 × RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

Use the 99 % power bandwidth function of the instrument

Test Setup



Limits

Rule FCC Part §15.407(e)

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 936 Hz.

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Test Results:

U-NII-1

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5180	16.540	20.15	PASS
	5200	16.493	20.45	PASS
	5240	16.550	19.99	PASS
802.11n HT20	5180	17.623	20.59	PASS
	5200	17.617	20.46	PASS
	5240	17.634	20.50	PASS
802.11n HT40	5190	35.992	40.39	PASS
	5230	36.009	40.01	PASS
802.11ac VHT20	5180	17.611	20.34	PASS
	5200	17.580	20.47	PASS
	5240	17.605	20.48	PASS
802.11ac VHT40	5190	35.975	40.16	PASS
	5230	36.010	40.08	PASS
802.11ac VHT80	5210	75.242	79.83	PASS

U-NII-2A

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5260	16.506	20.17	PASS
	5300	16.504	20.28	PASS
	5320	16.546	20.10	PASS
802.11n HT20	5260	17.611	20.34	PASS
	5300	17.618	20.44	PASS
	5320	17.595	20.66	PASS
802.11n HT40	5270	35.942	40.30	PASS
	5310	36.025	40.05	PASS
802.11ac VHT20	5260	17.601	20.56	PASS
	5300	17.625	20.54	PASS
	5320	17.591	20.60	PASS
802.11ac VHT40	5270	35.926	40.01	PASS
	5310	36.009	40.49	PASS
802.11ac VHT80	5290	75.352	79.75	PASS

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U-NII-2C

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5500	16.511	19.98	PASS
	5520	16.529	20.29	PASS
	5600	16.530	20.96	PASS
	5680	16.518	20.33	PASS
	5700	16.531	20.06	PASS
	5720	16.479	20.20	PASS
802.11n HT20	5500	17.614	20.60	PASS
	5600	17.625	20.61	PASS
	5680	17.620	20.67	PASS
	5700	17.612	20.46	PASS
	5720	17.584	20.51	PASS
802.11n HT40	5510	36.003	40.40	PASS
	5590	36.008	40.16	PASS
	5670	35.985	40.26	PASS
802.11ac VHT20	5500	17.604	20.57	PASS
	5600	17.582	20.36	PASS
	5700	17.639	20.61	PASS
	5720	17.594	20.45	PASS
802.11ac VHT40	5510	35.957	40.09	PASS
	5590	35.955	40.06	PASS
	5670	35.966	39.79	PASS
802.11ac VHT80	5610	75.377	79.67	PASS

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U-NII-3

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11a	5720	16.543	15.12	500	PASS
	5745	16.591	15.44	500	PASS
	5785	16.506	15.07	500	PASS
	5825	16.560	15.02	500	PASS
802.11n HT20	5720	17.594	13.87	500	PASS
	5745	17.637	15.03	500	PASS
	5785	17.629	13.82	500	PASS
	5825	17.618	16.27	500	PASS
802.11n HT40	5755	36.006	35.10	500	PASS
	5795	36.005	35.10	500	PASS
802.11ac VHT20	5720	17.602	15.11	500	PASS
	5745	17.627	15.91	500	PASS
	5785	17.597	14.75	500	PASS
	5825	17.631	14.14	500	PASS
802.11ac VHT40	5755	35.987	32.63	500	PASS
	5795	35.974	35.09	500	PASS
802.11ac VHT80	5775	75.197	75.11	500	PASS

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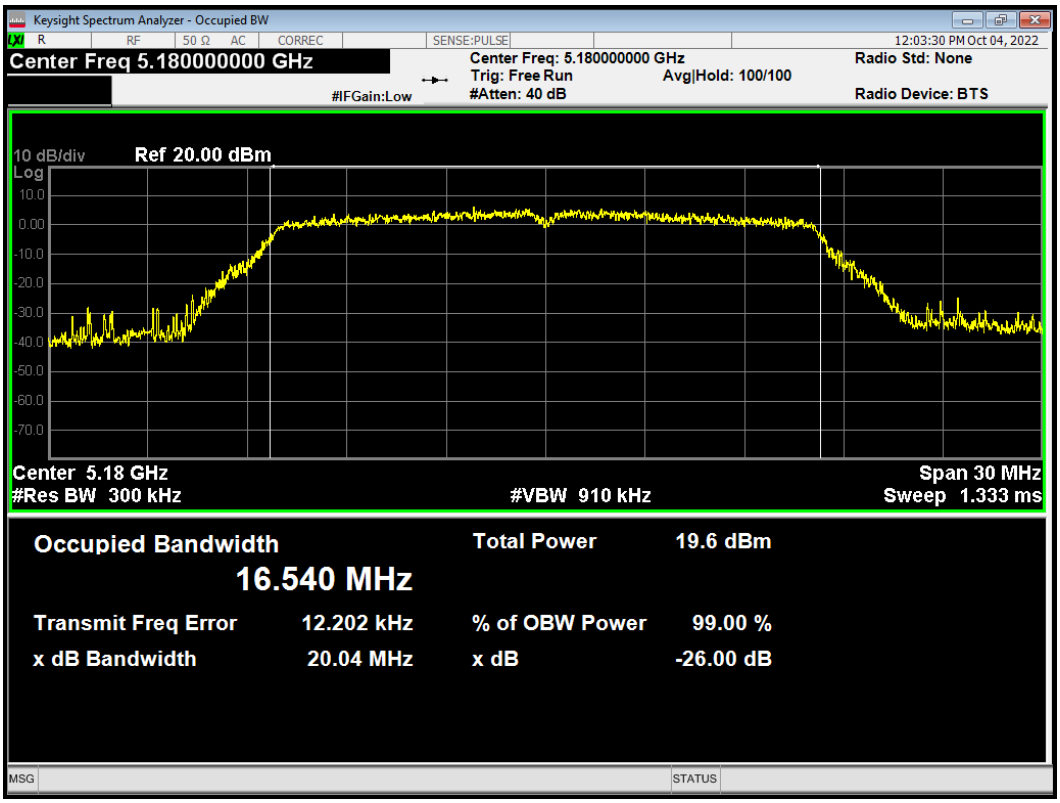
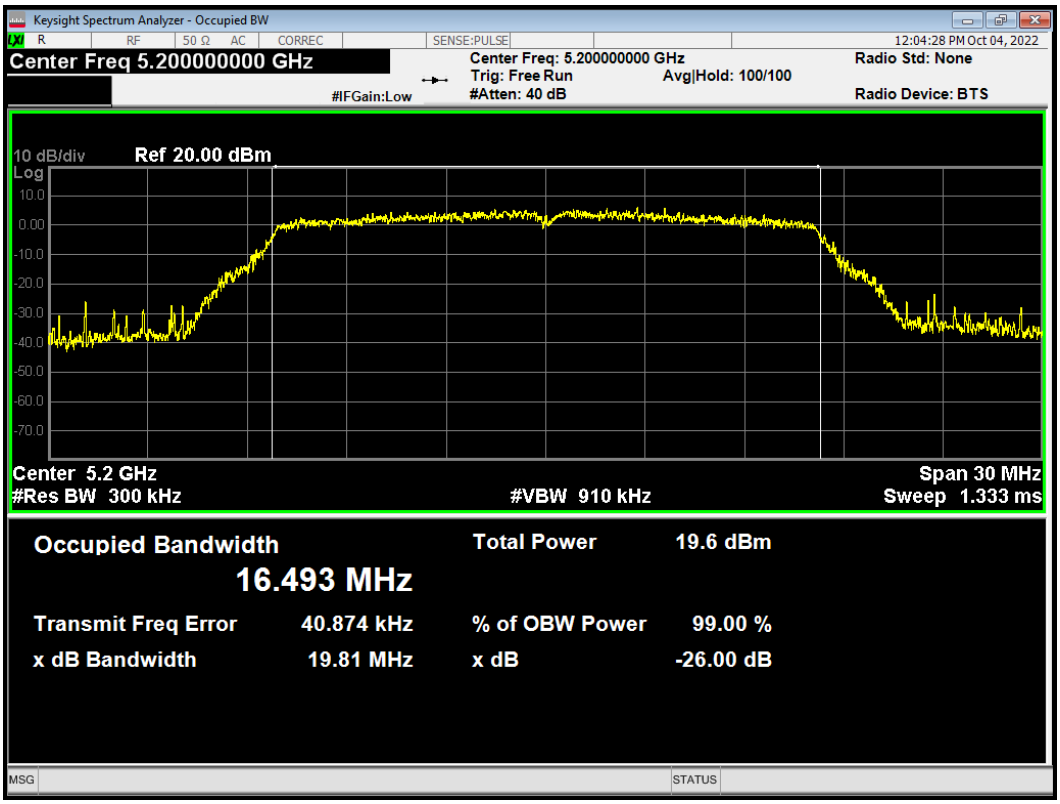
U-NII-1

99% bandwidth

OBW 802.11a 5180MHz



OBW 802.11a 5200MHz



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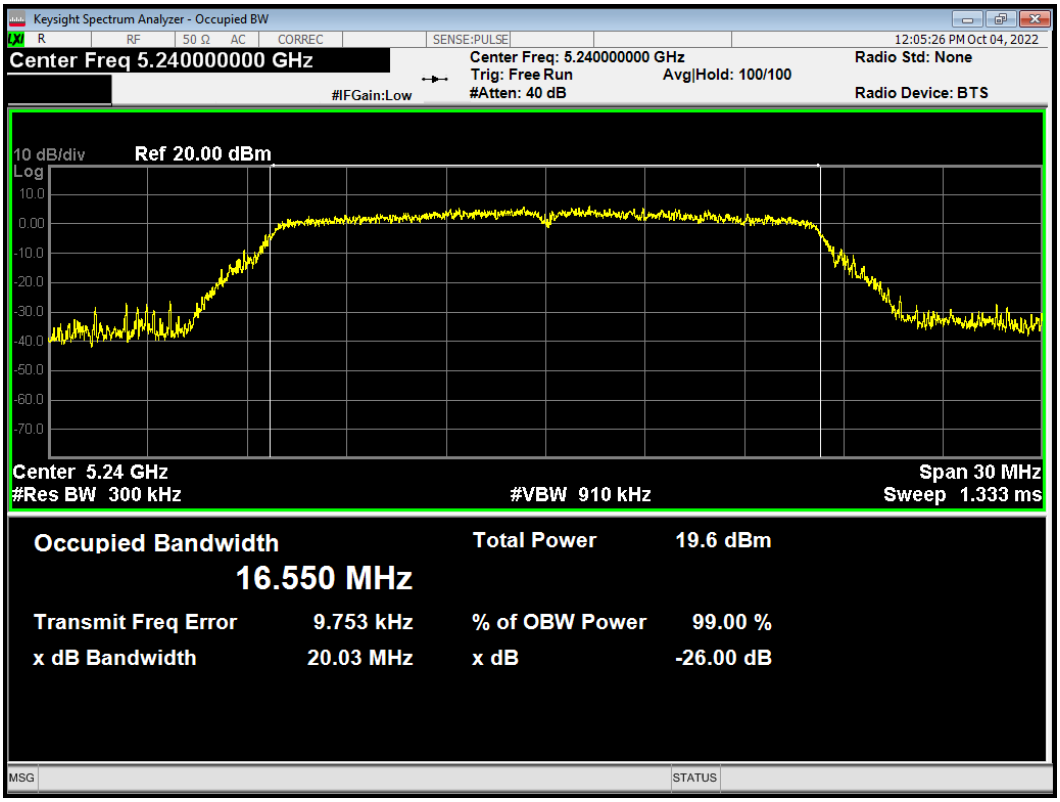
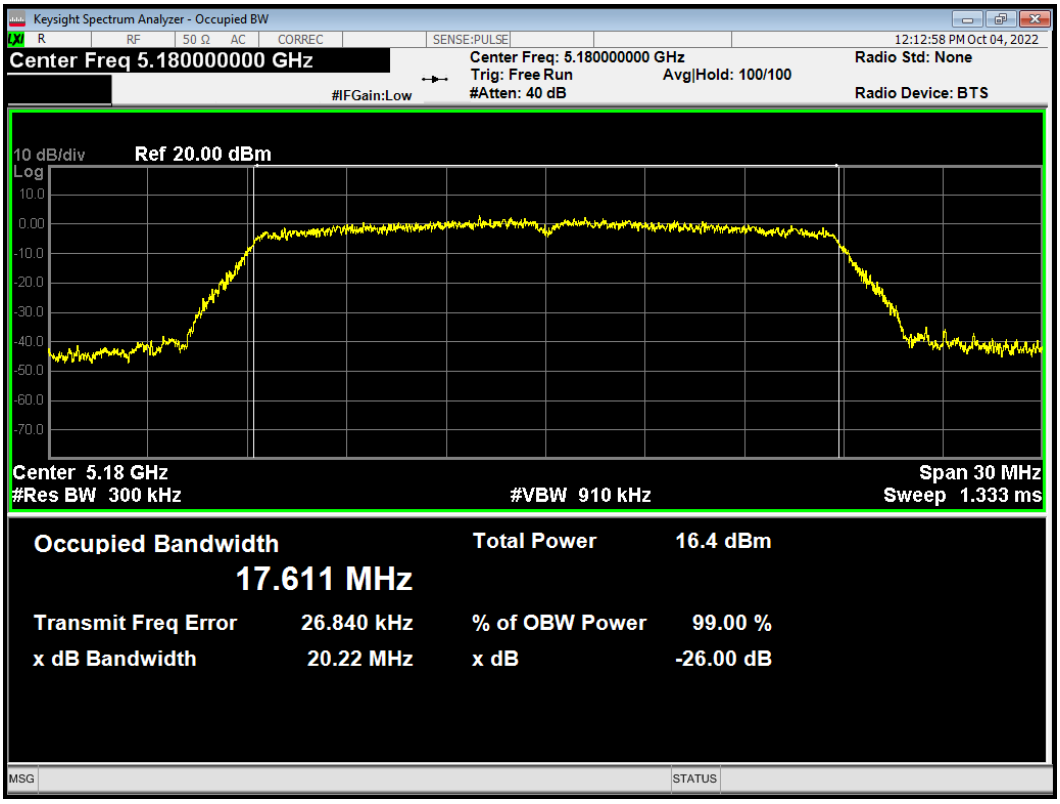
OBW 802.11a 5240MHz



OBW 802.11ac (VHT20) 5180MHz



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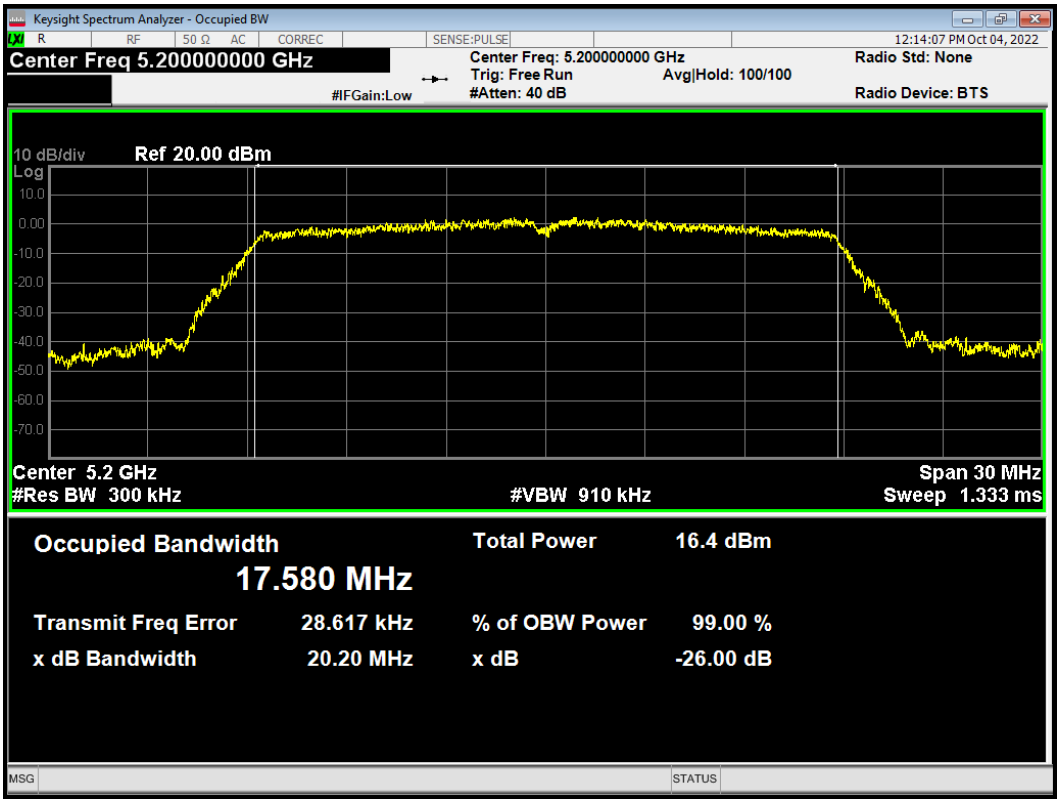
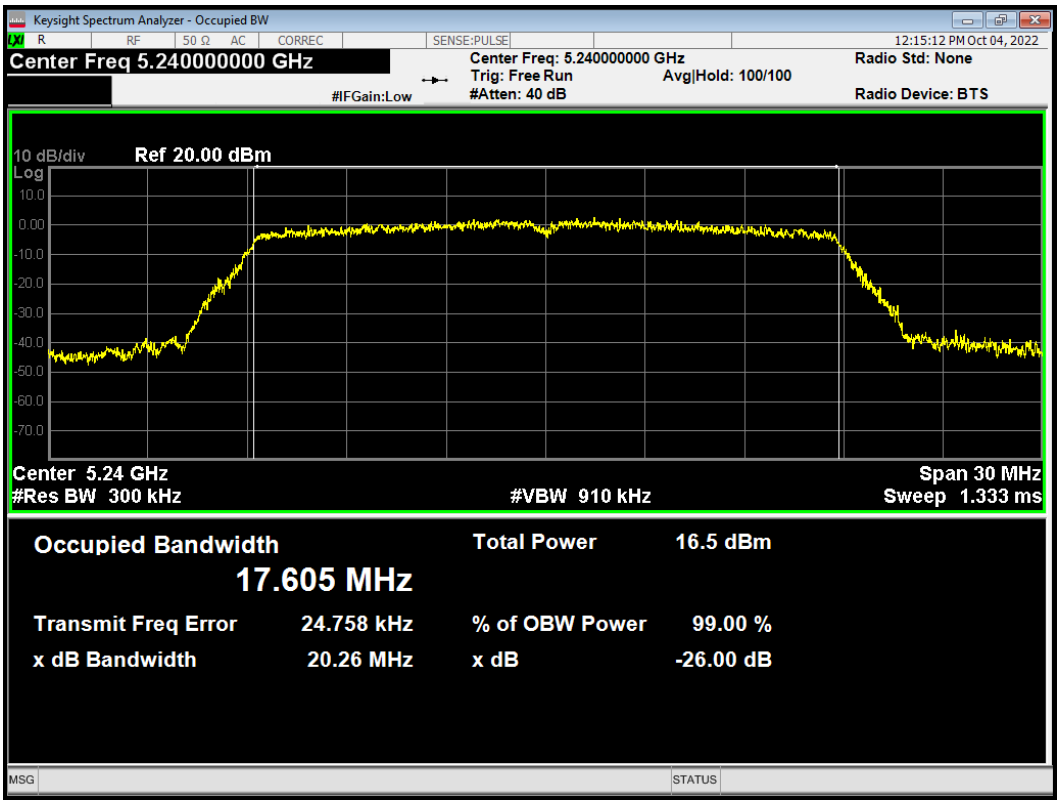
OBW 802.11ac (VHT20) 5200MHz



OBW 802.11ac (VHT20) 5240MHz



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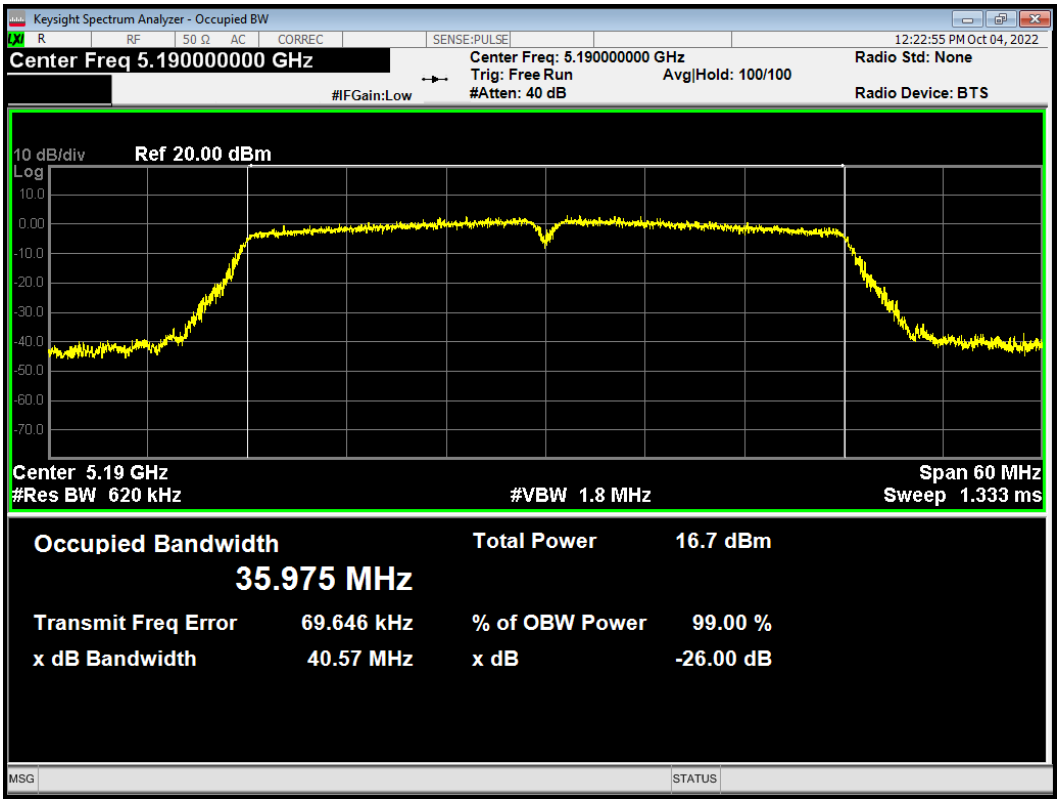
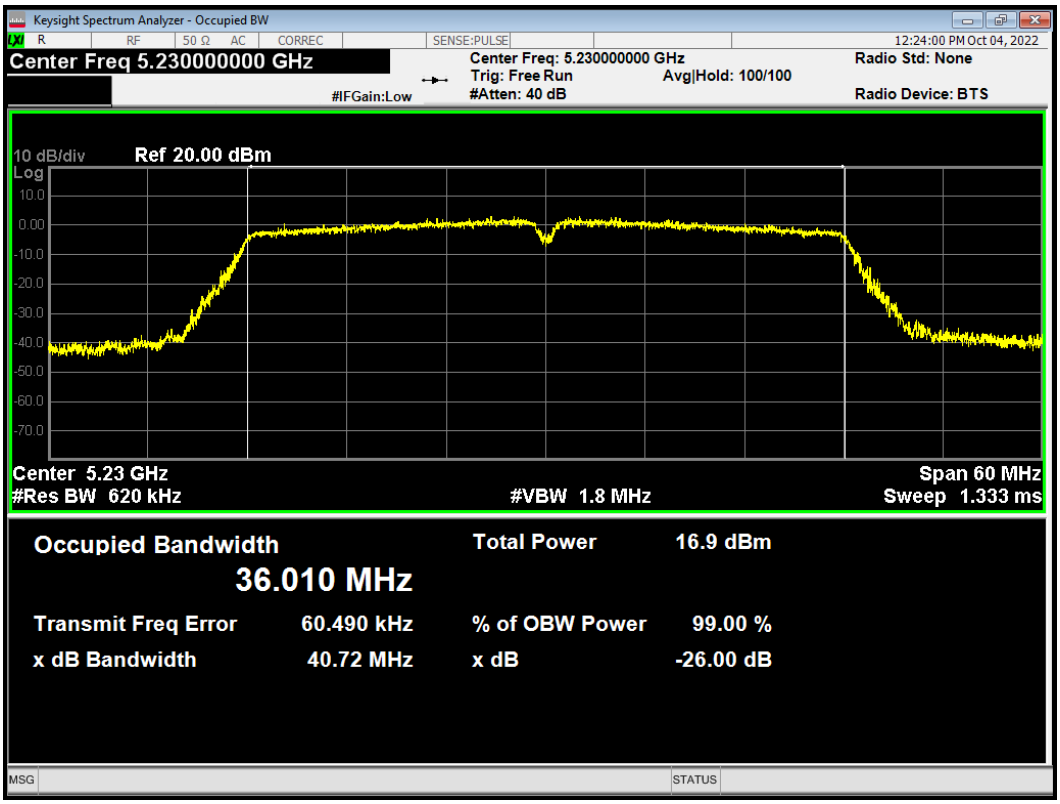
OBW 802.11ac (VHT40) 5190MHz



OBW 802.11ac (VHT40) 5230MHz



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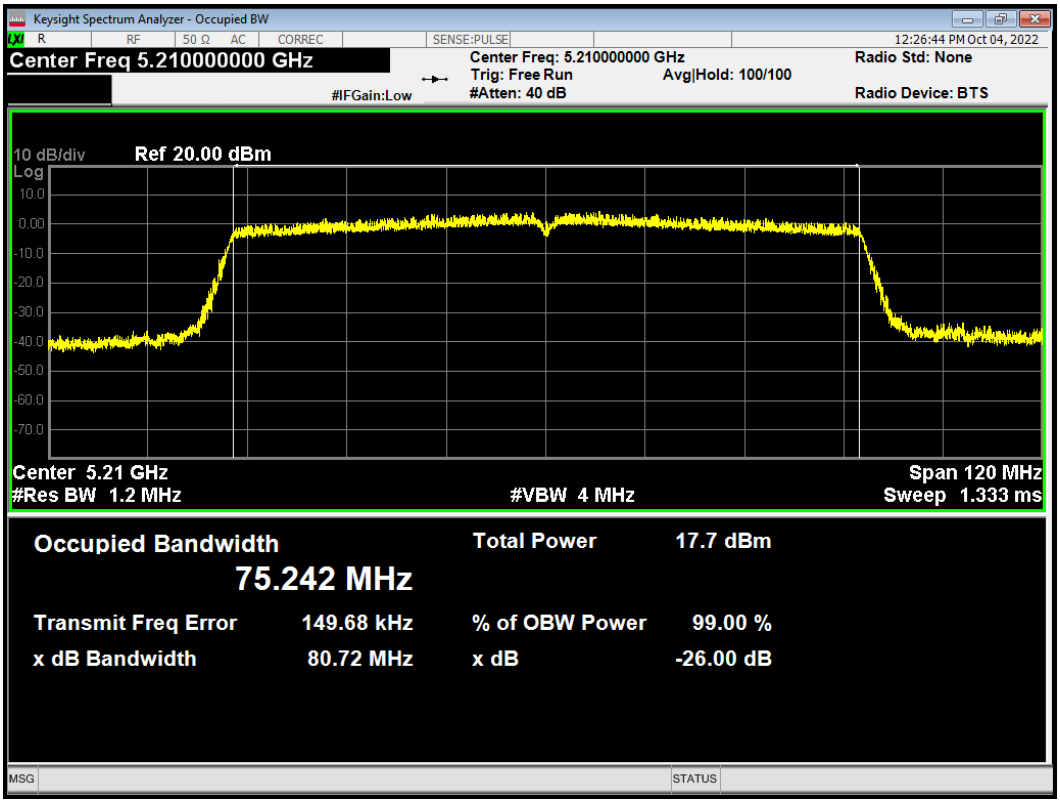
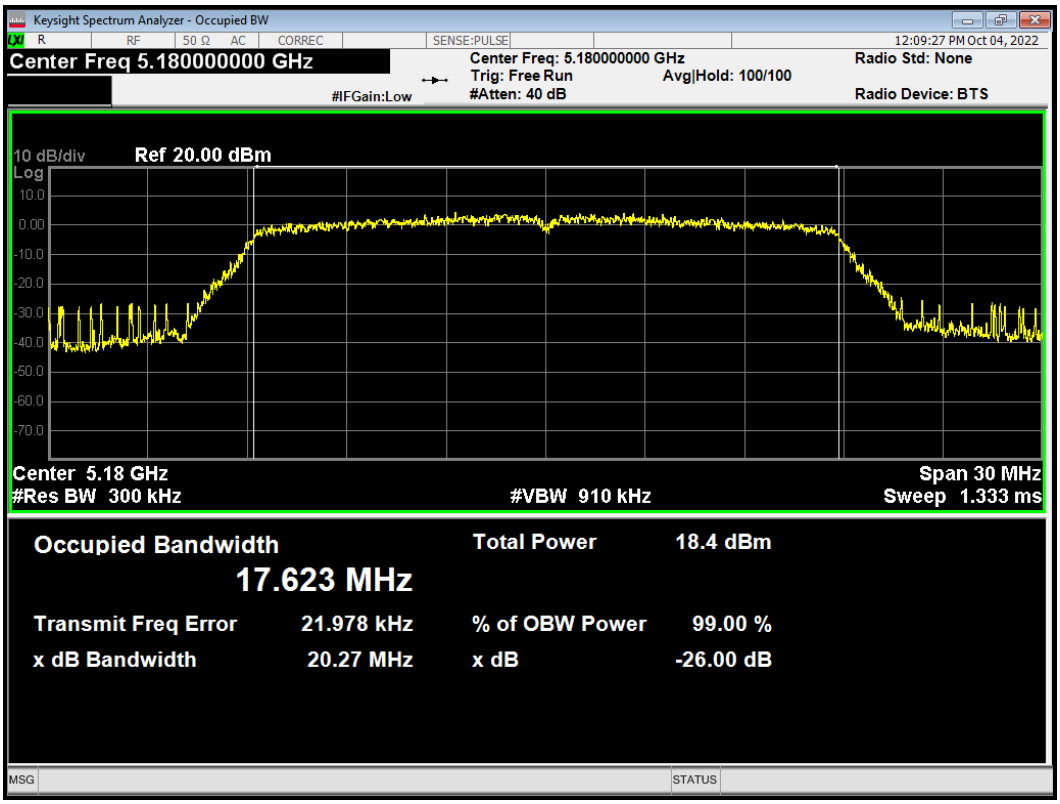
OBW 802.11ac (VHT80) 5210MHz



OBW 802.11n (HT20) 5180MHz



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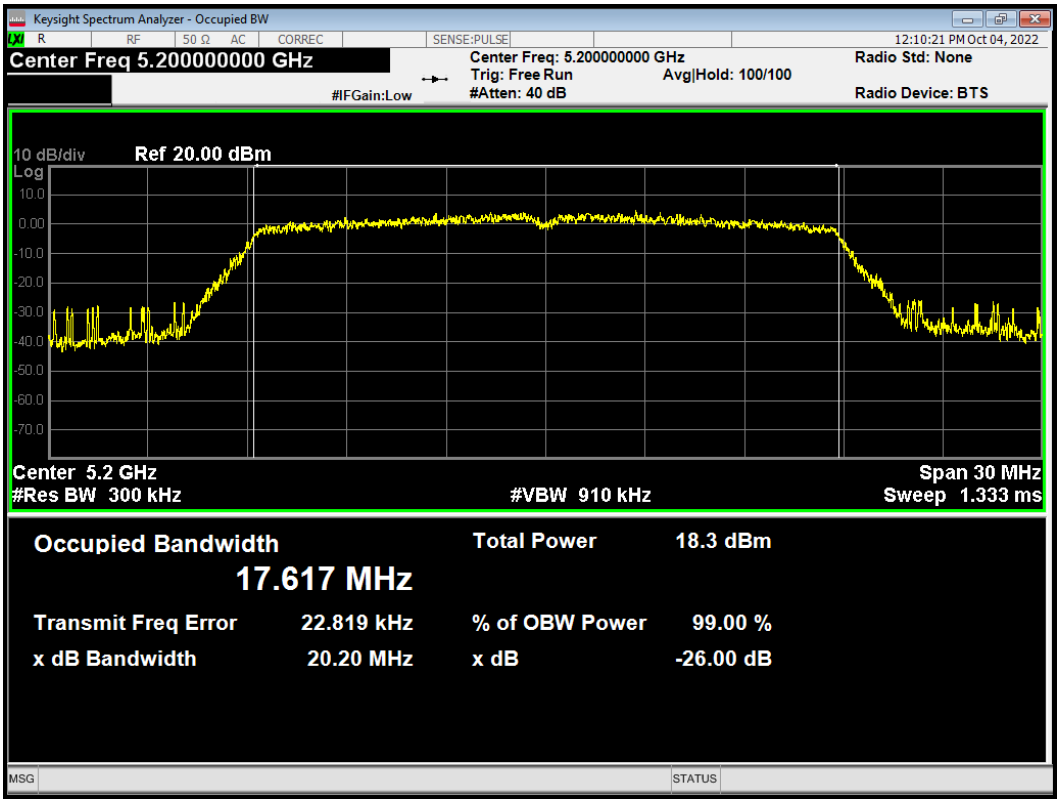
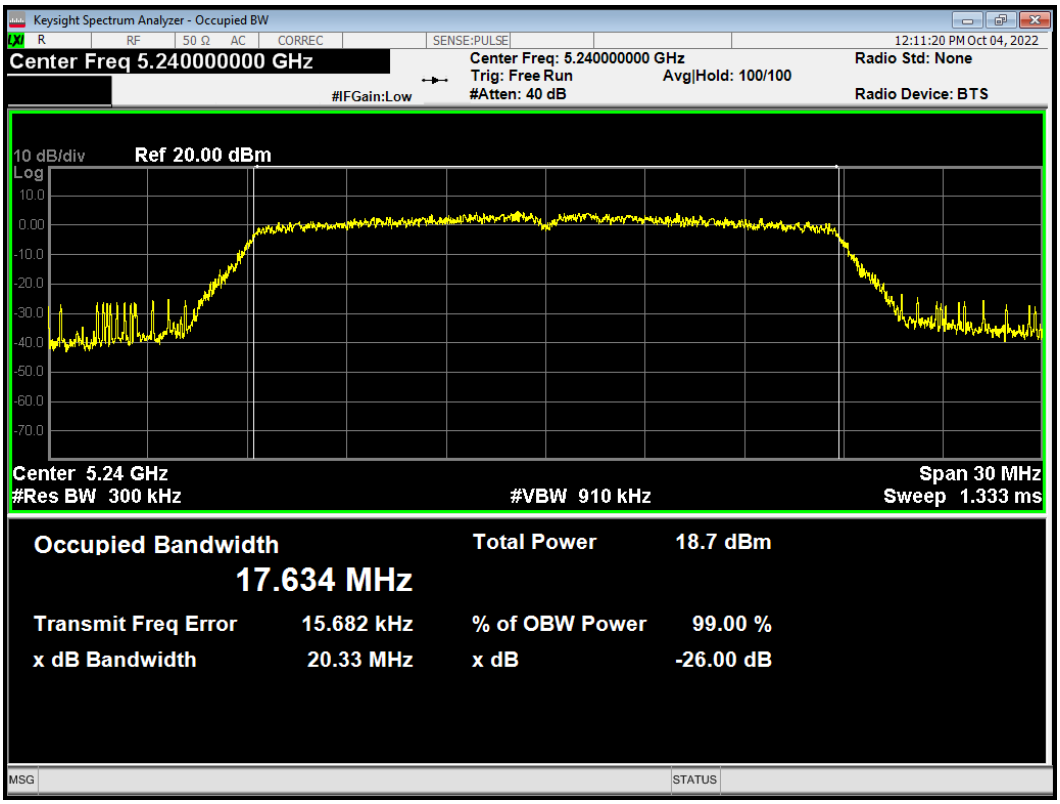
OBW 802.11n (HT20) 5200MHz



OBW 802.11n (HT20) 5240MHz



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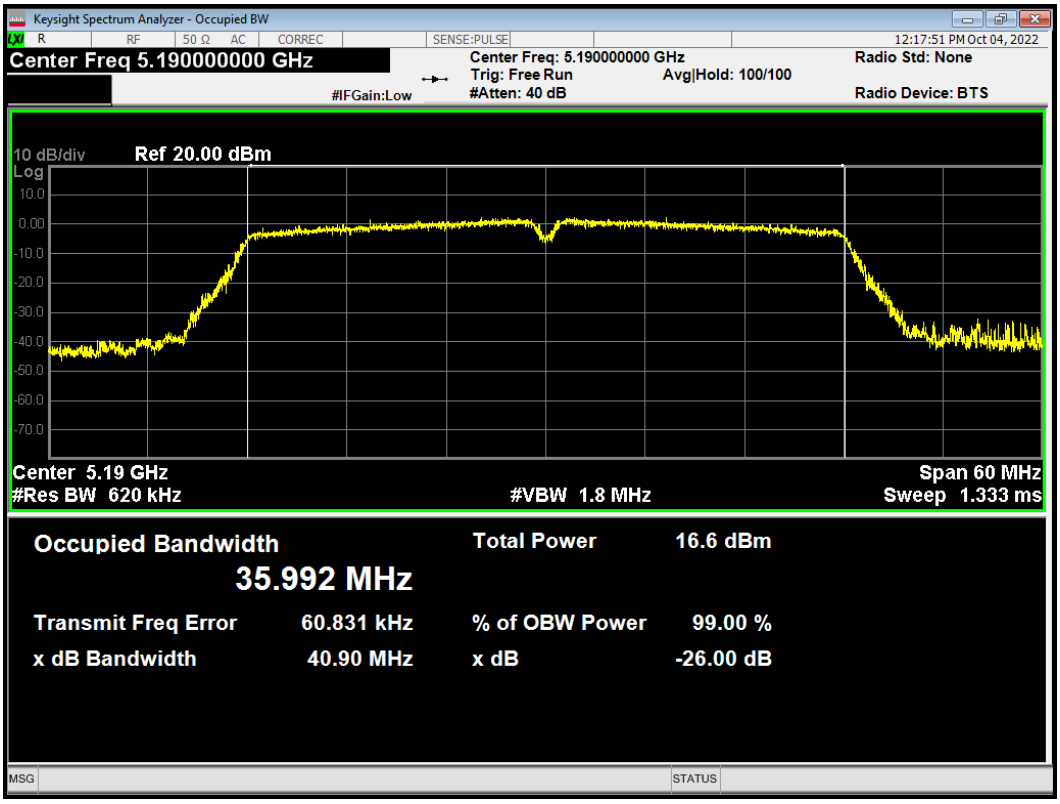
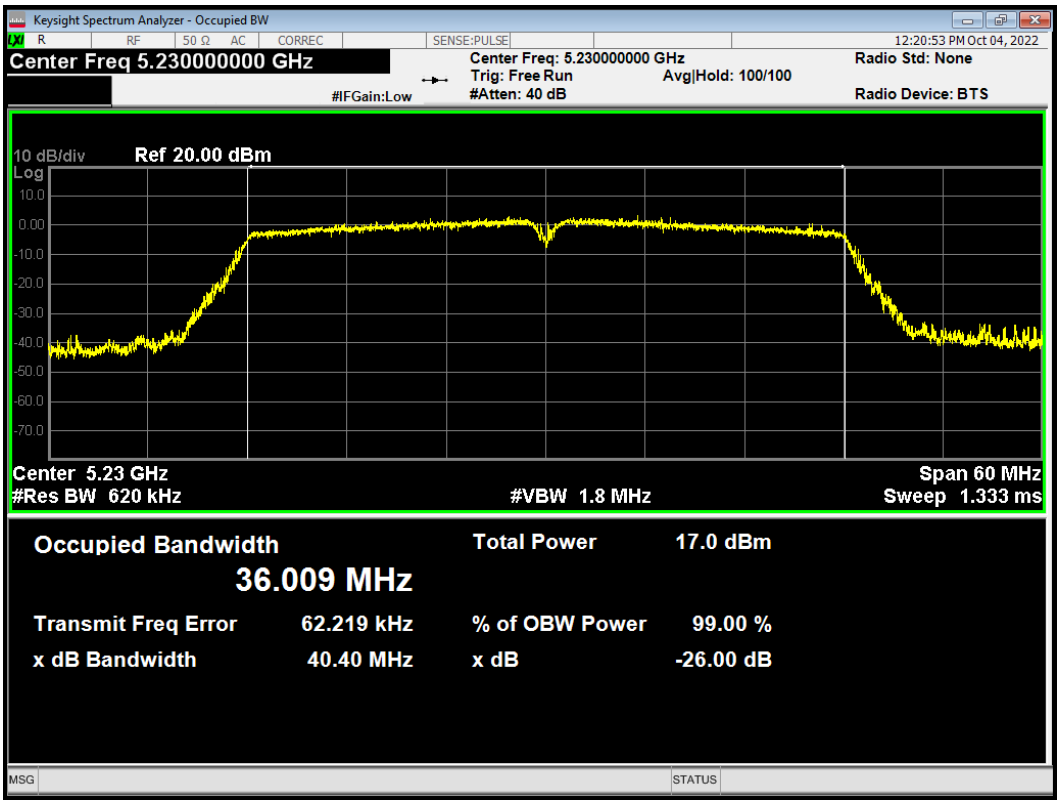
OBW 802.11n (HT40) 5190MHz



OBW 802.11n (HT40) 5230MHz



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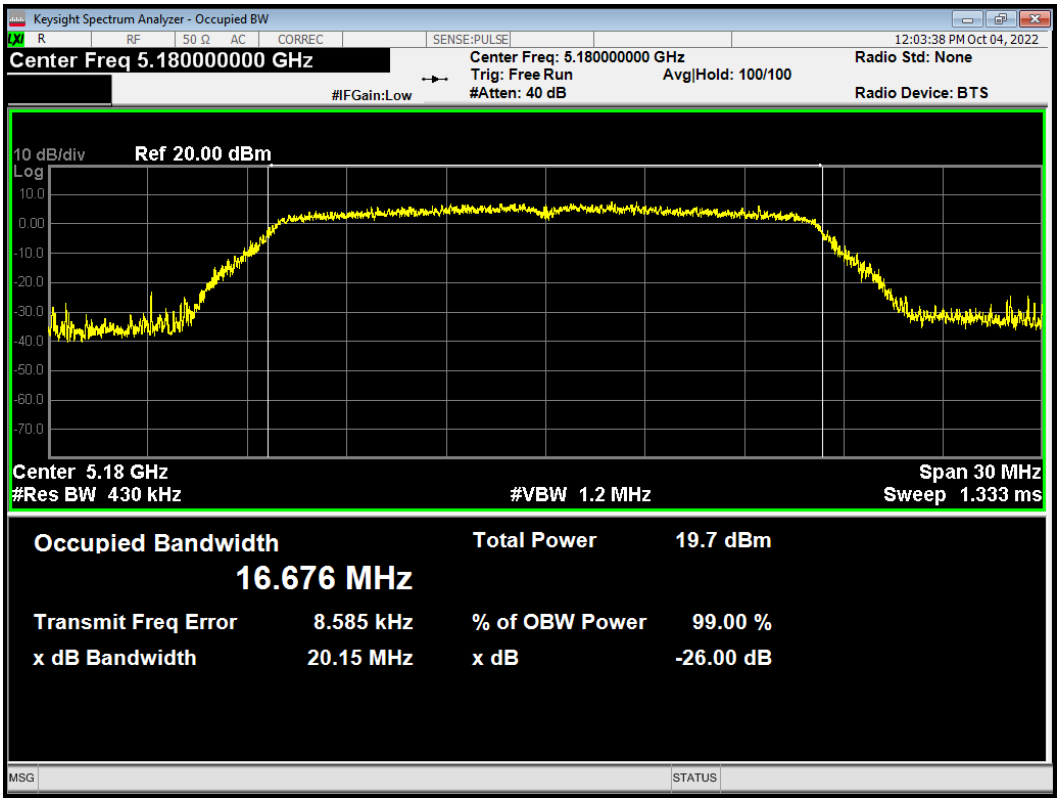
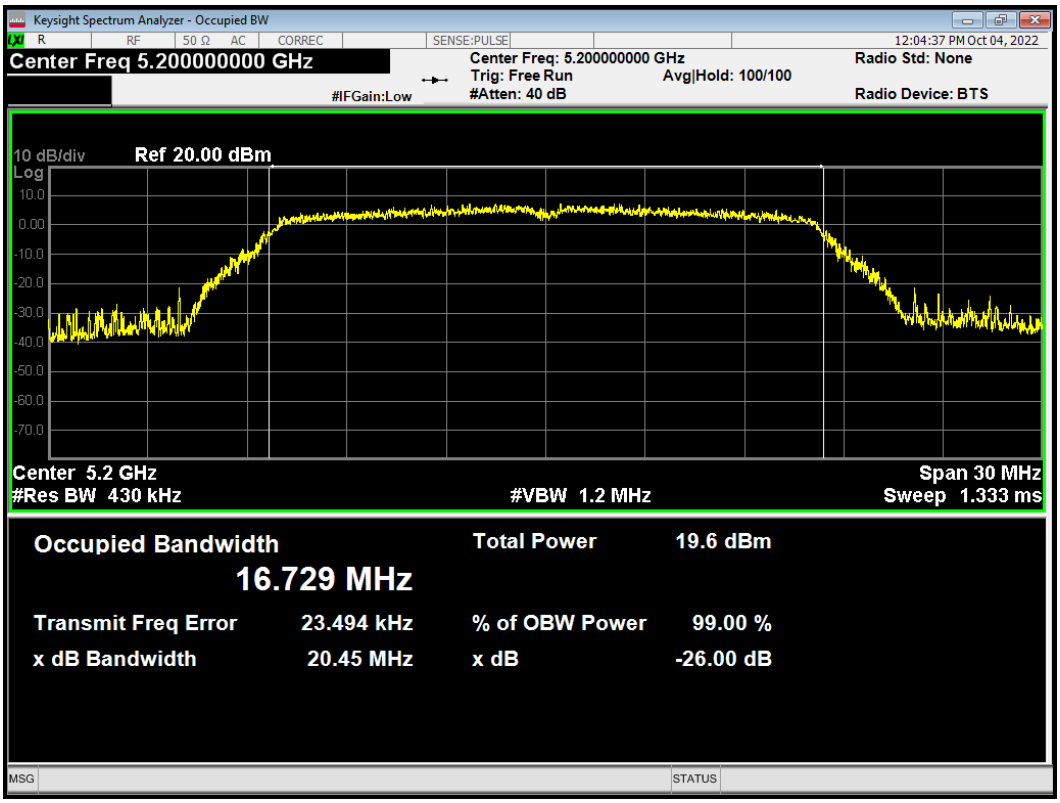
Minimum -26 dB bandwidth

-26dB Bandwidth 802.11a 5180MHz



-26dB Bandwidth 802.11a 5200MHz



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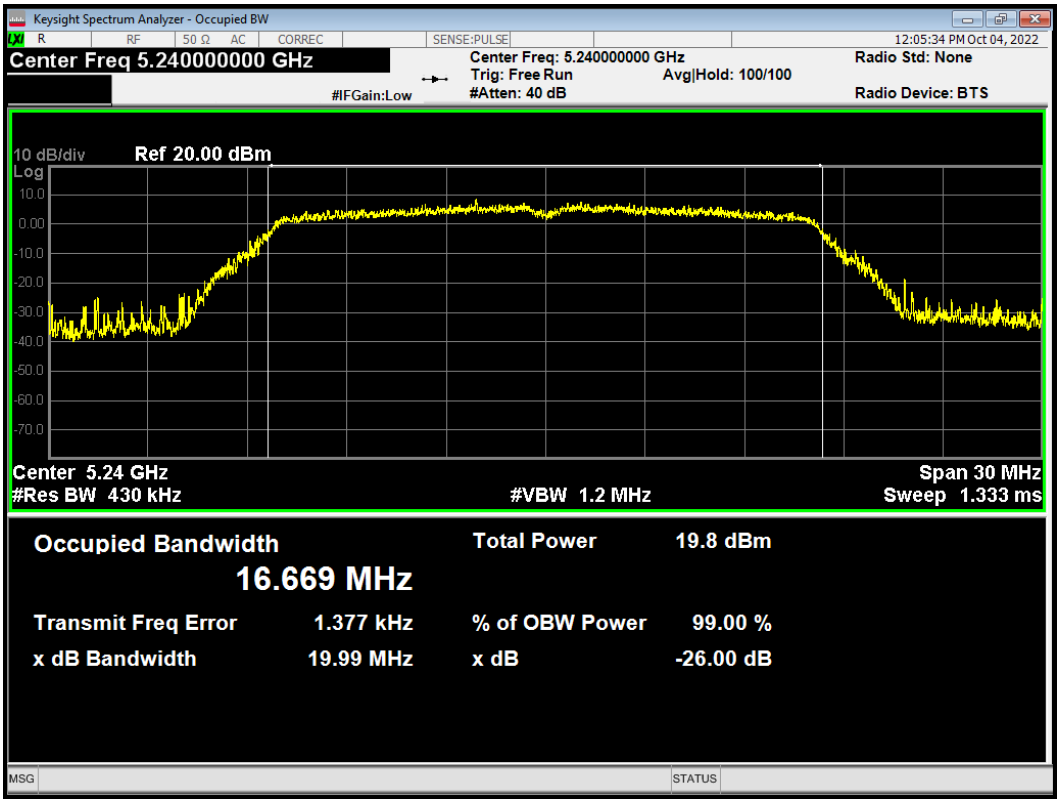
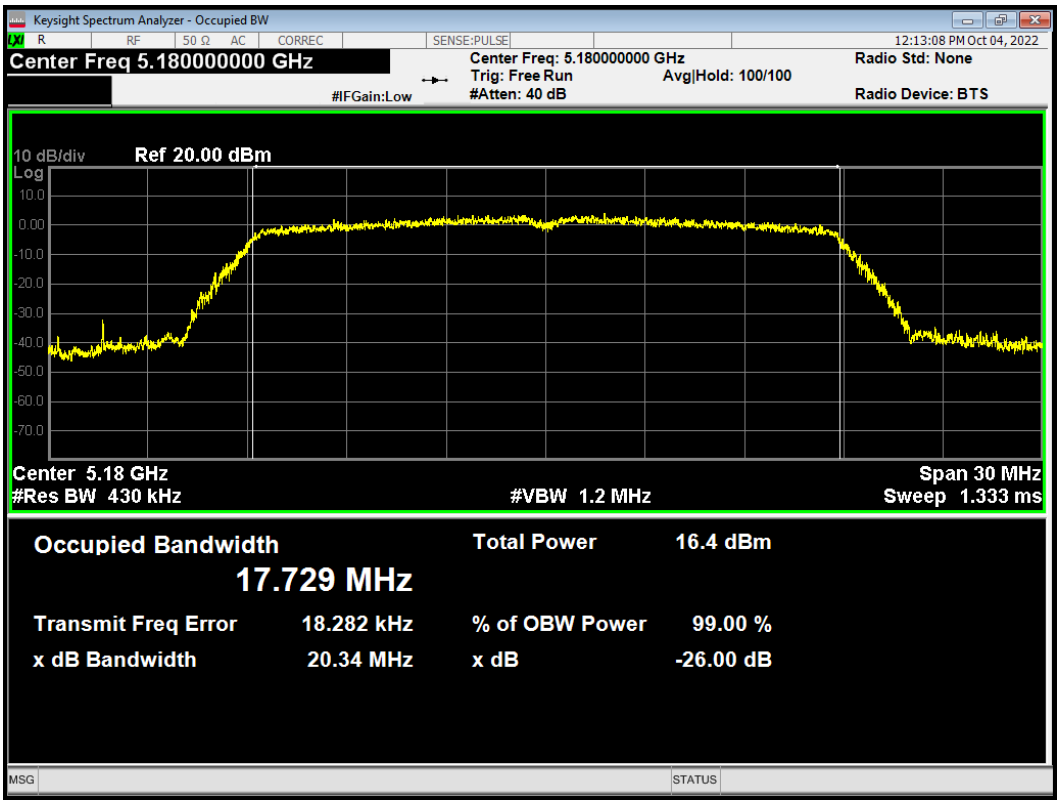
-26dB Bandwidth 802.11a 5240MHz



-26dB Bandwidth 802.11ac (VHT20) 5180MHz



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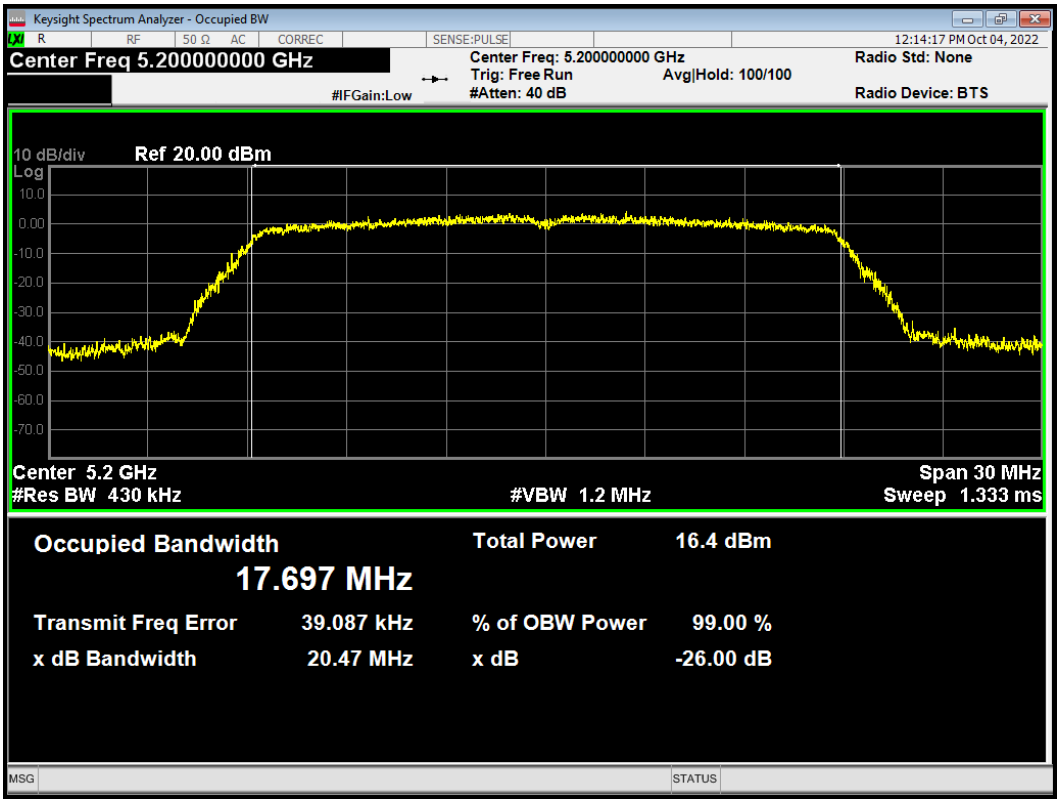
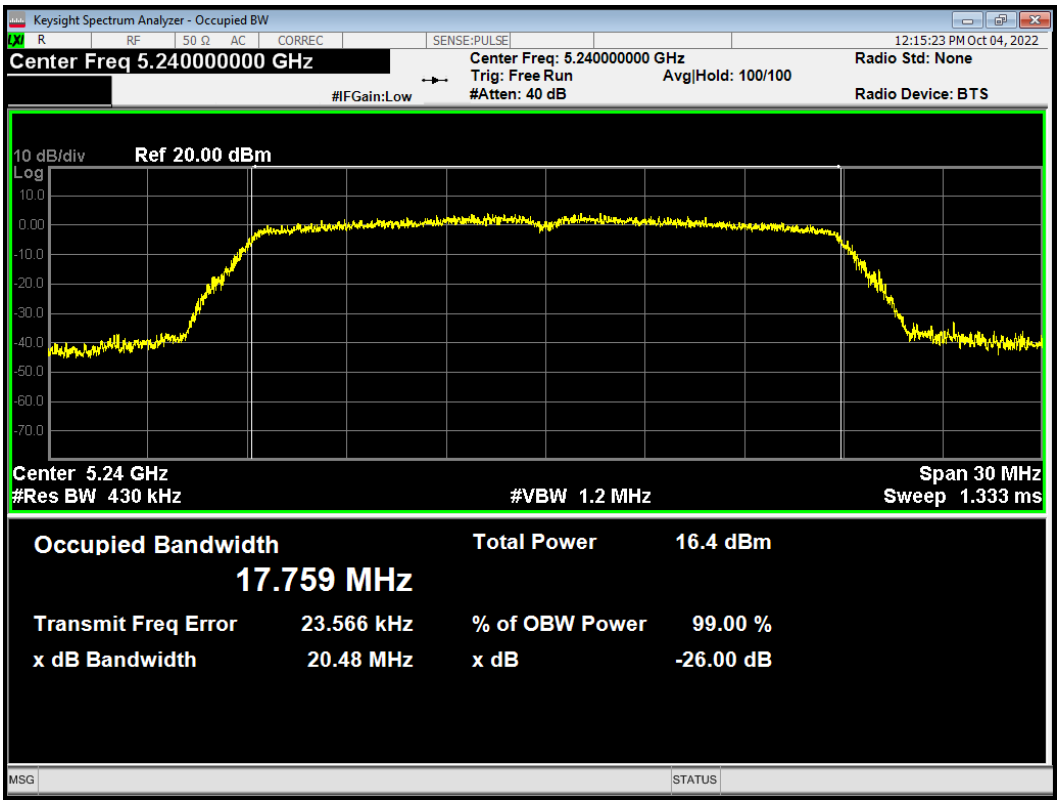
-26dB Bandwidth 802.11ac (VHT20) 5200MHz



-26dB Bandwidth 802.11ac (VHT20) 5240MHz



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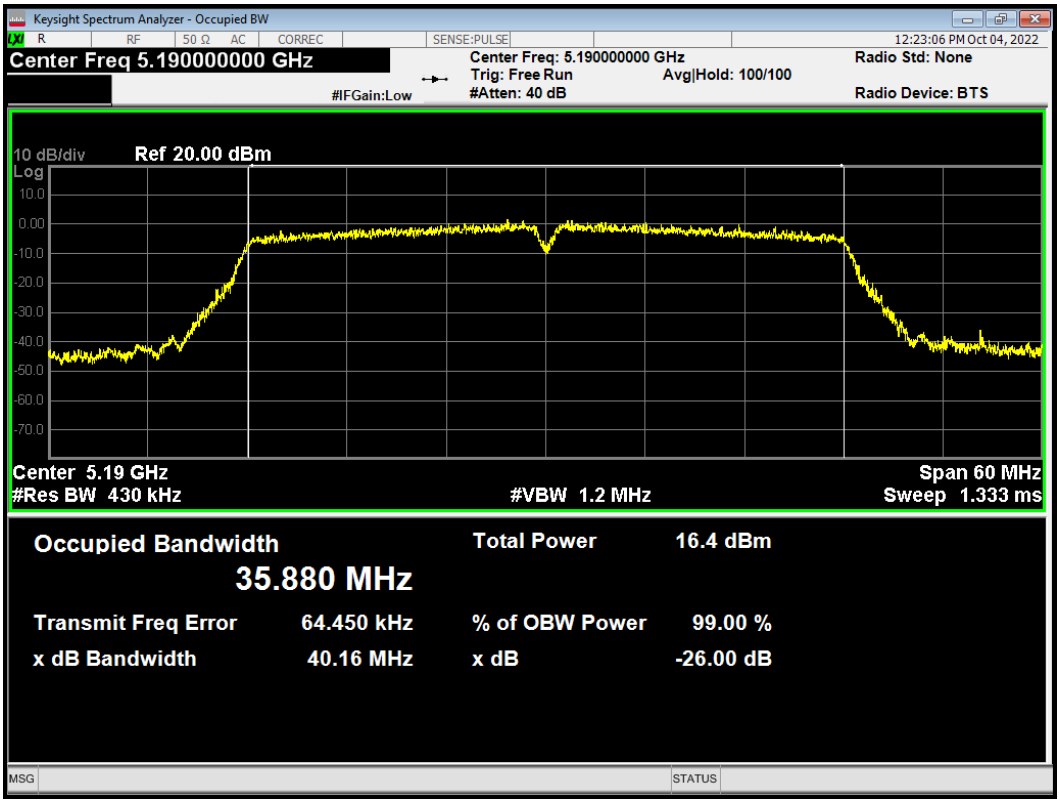
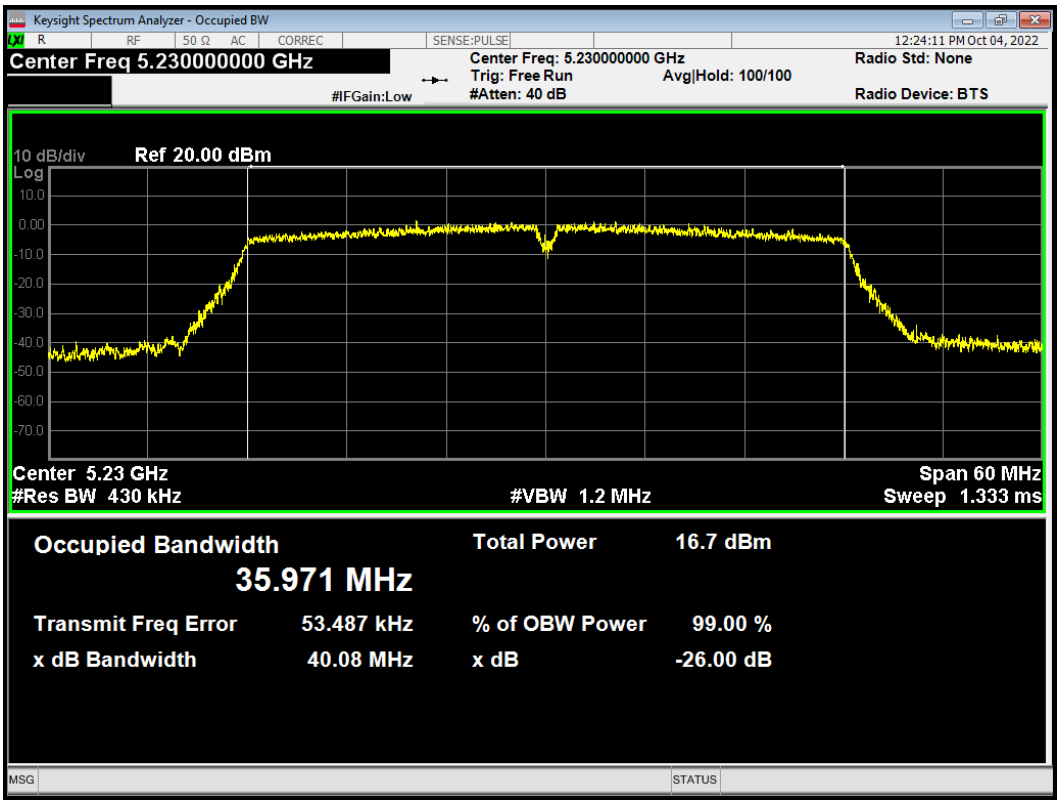
-26dB Bandwidth 802.11ac (VHT40) 5190MHz



-26dB Bandwidth 802.11ac (VHT40) 5230MHz



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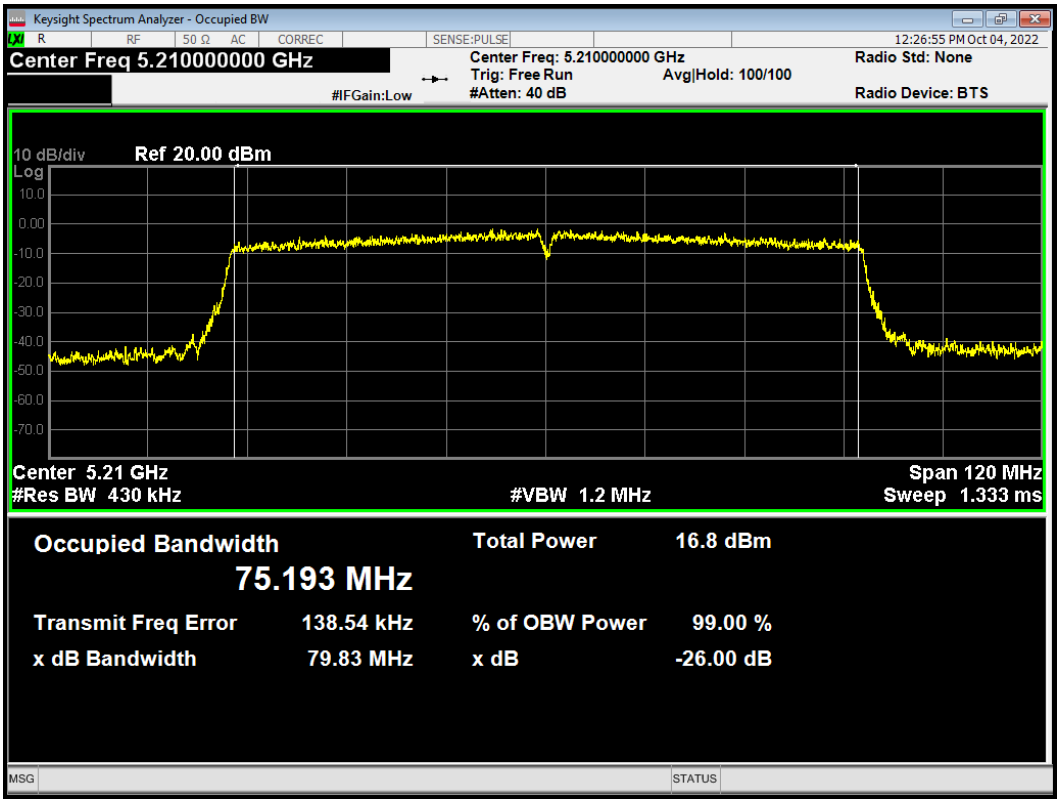
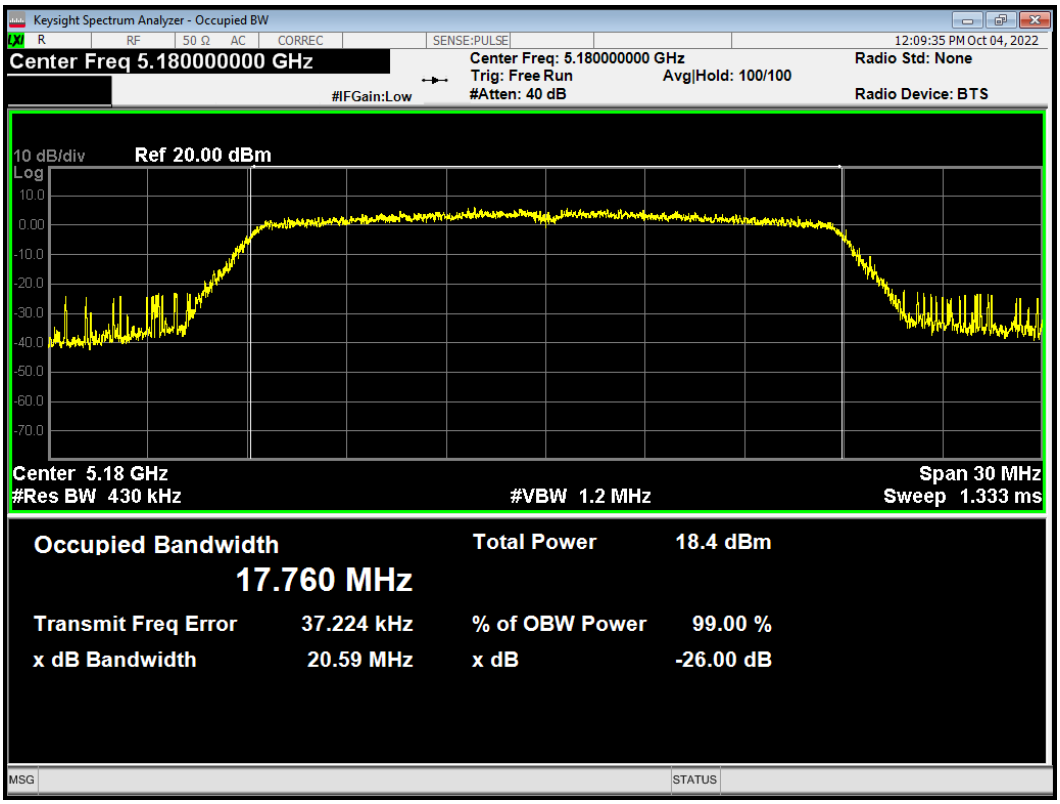
-26dB Bandwidth 802.11ac (VHT80) 5210MHz



-26dB Bandwidth 802.11n (HT20) 5180MHz



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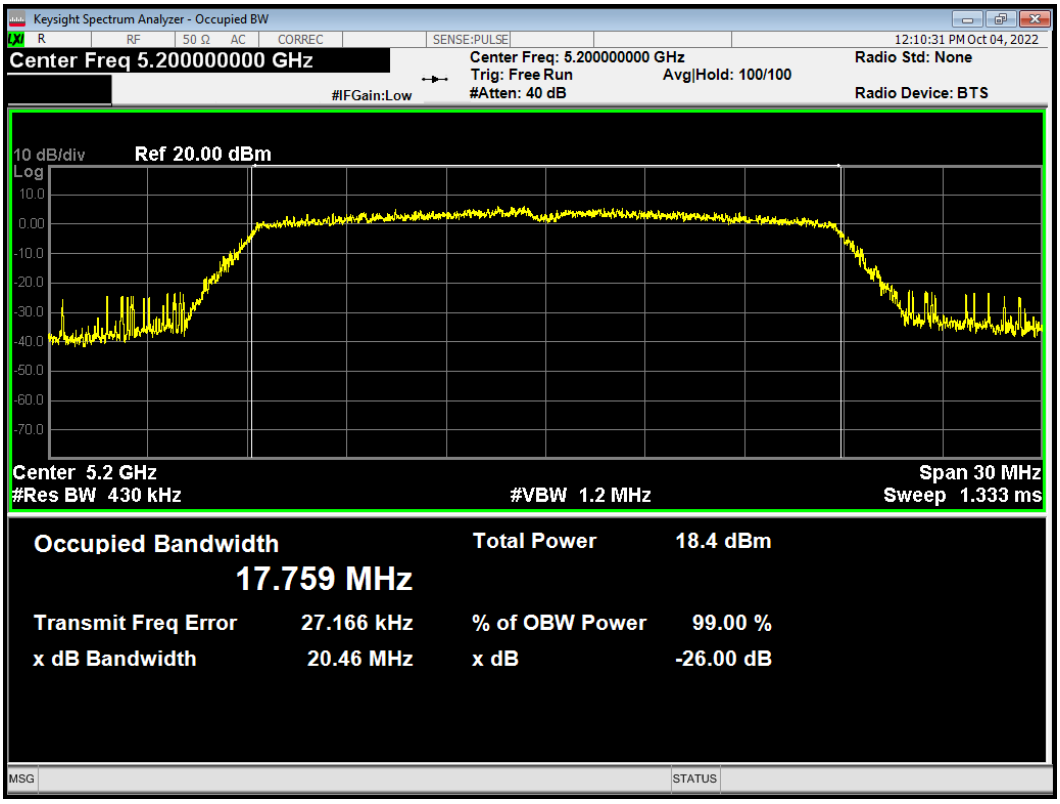
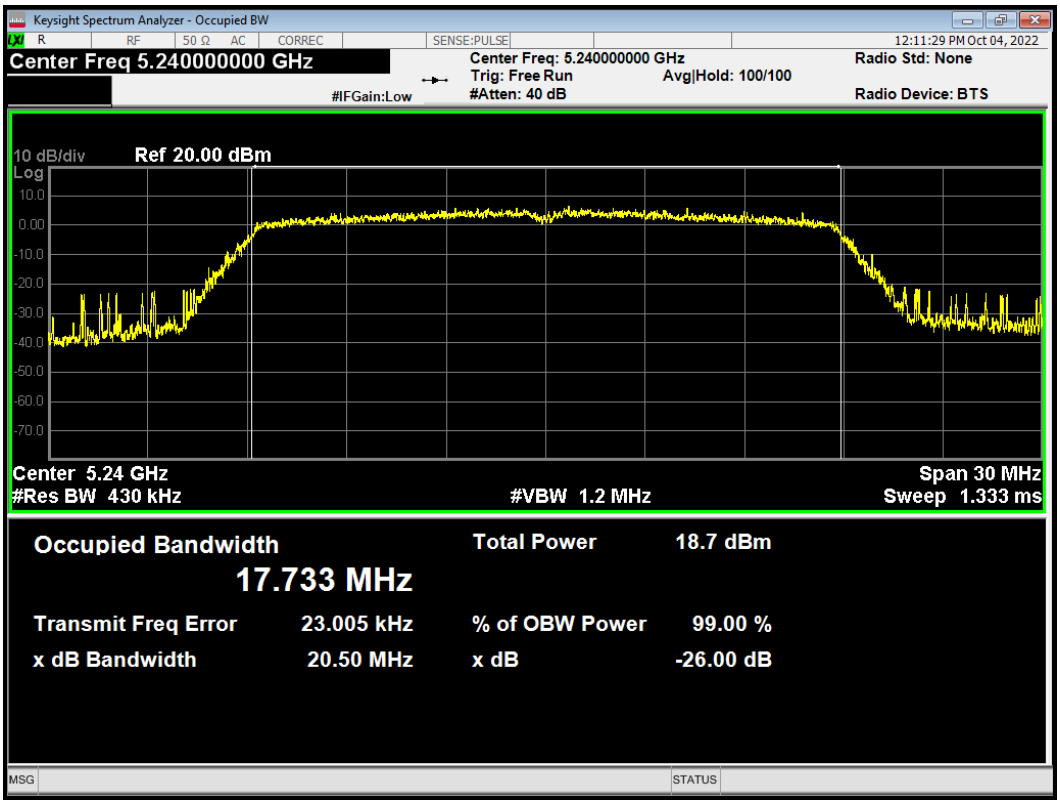
-26dB Bandwidth 802.11n (HT20) 5200MHz



-26dB Bandwidth 802.11n (HT20) 5240MHz



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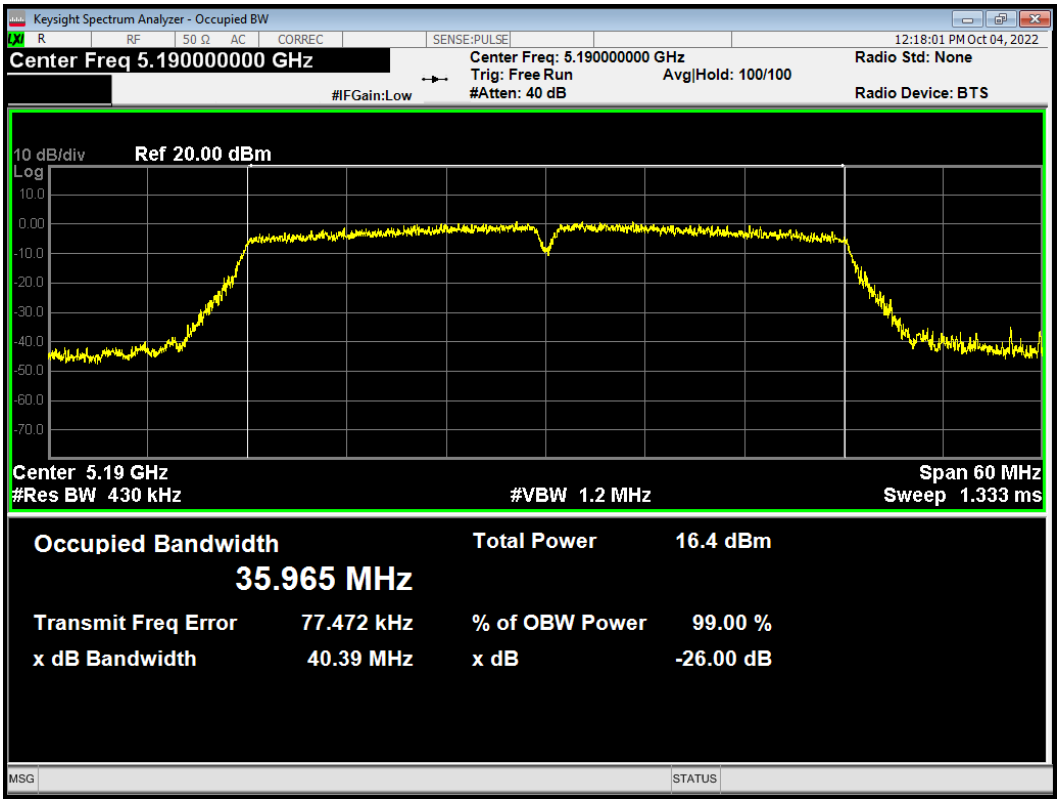
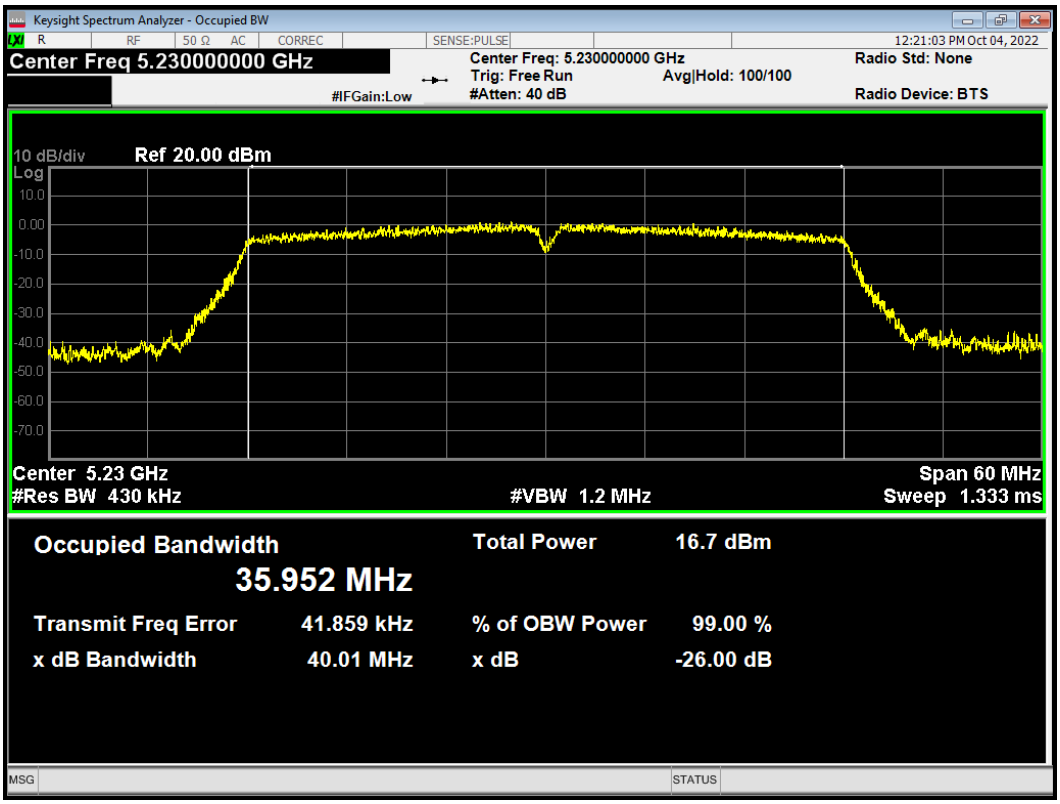
-26dB Bandwidth 802.11n (HT40) 5190MHz



-26dB Bandwidth 802.11n (HT40) 5230MHz



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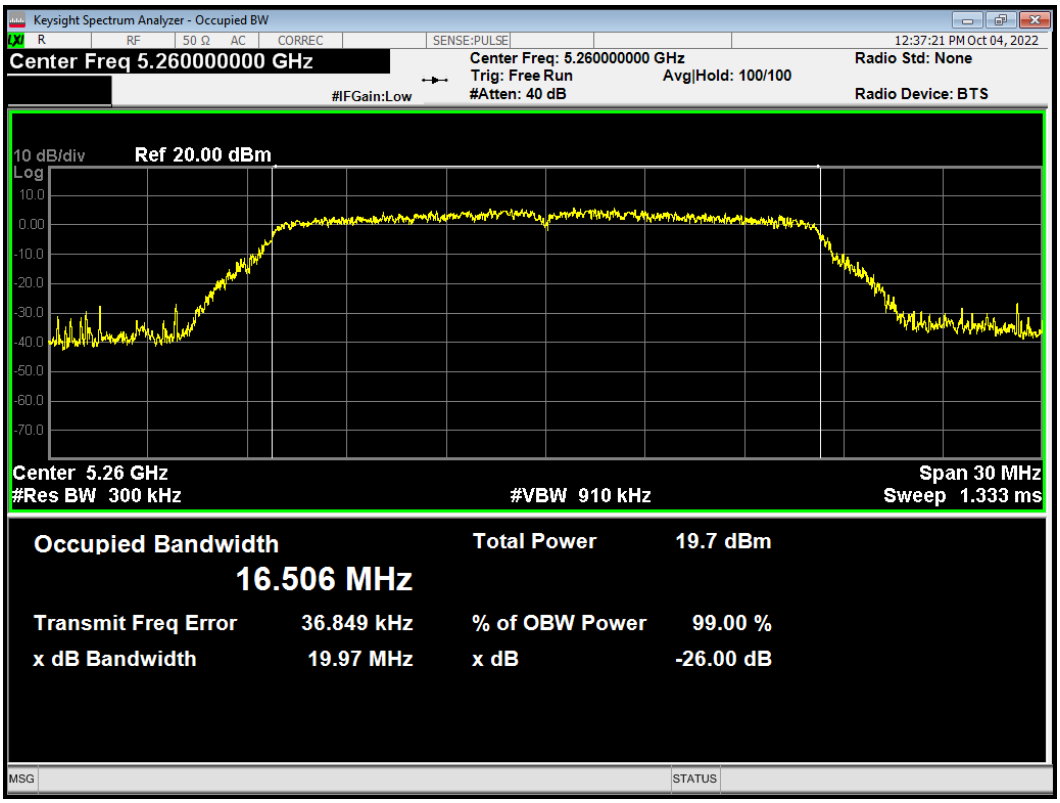
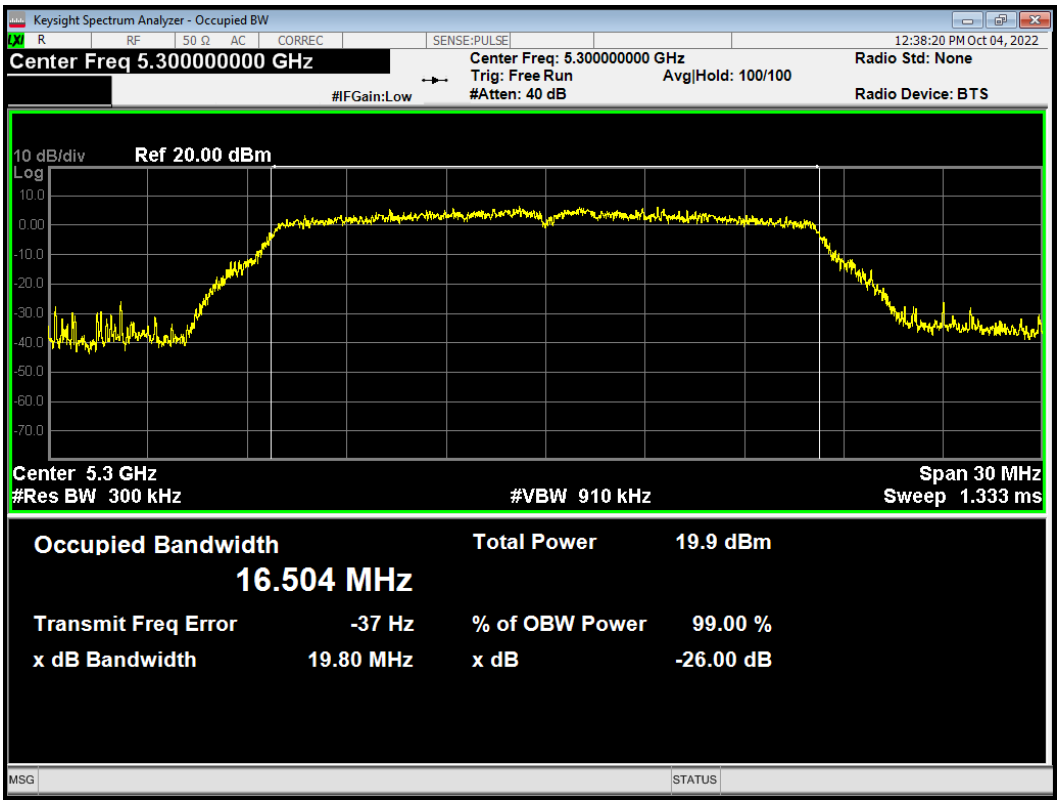
U-NII-2A

99% bandwidth

OBW 802.11a 5260MHz



OBW 802.11a 5300MHz



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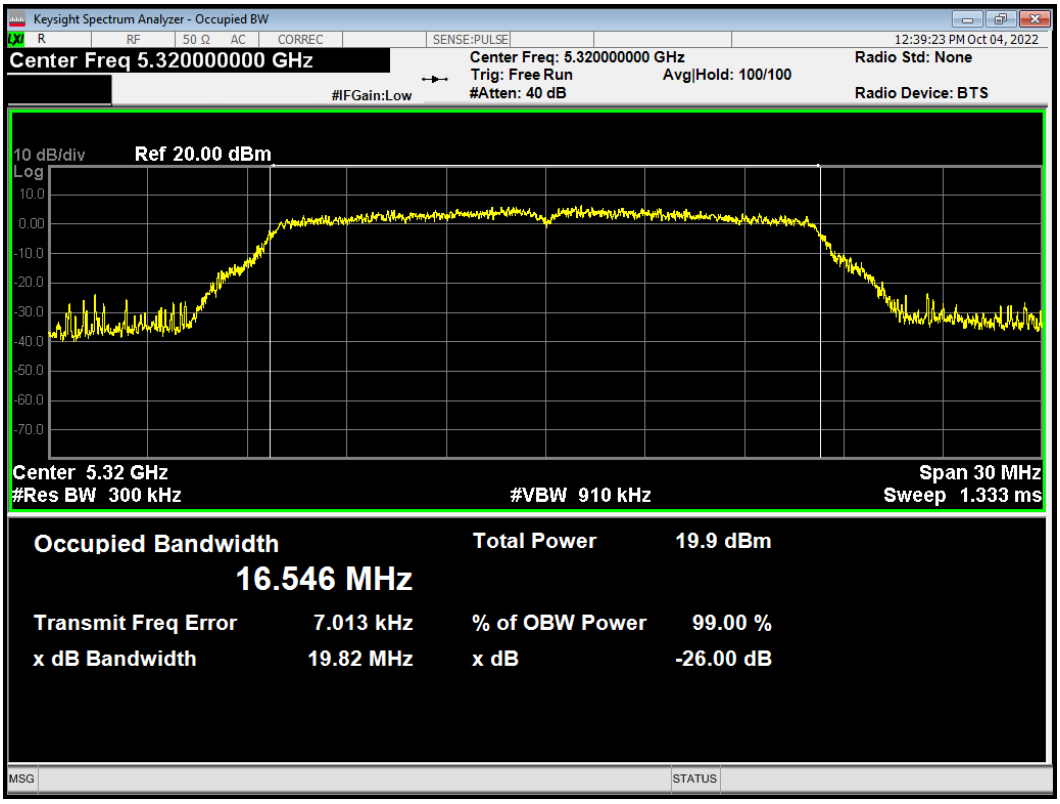
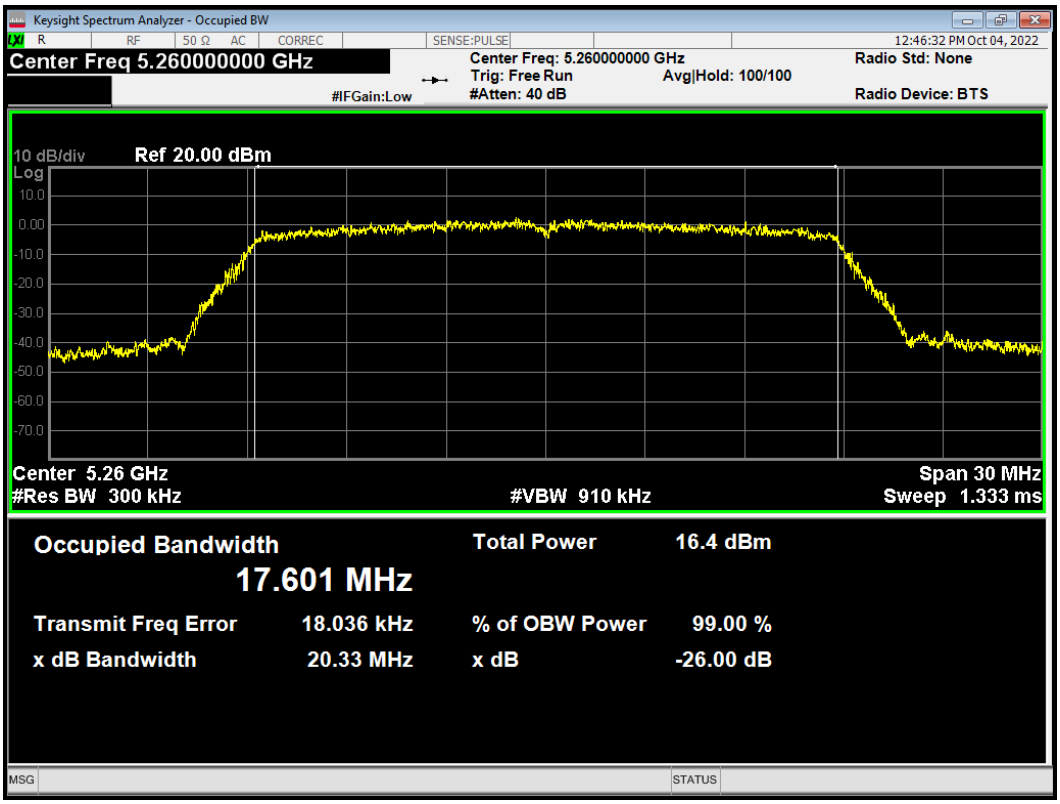
OBW 802.11a 5320MHz



OBW 802.11ac (VHT20) 5260MHz



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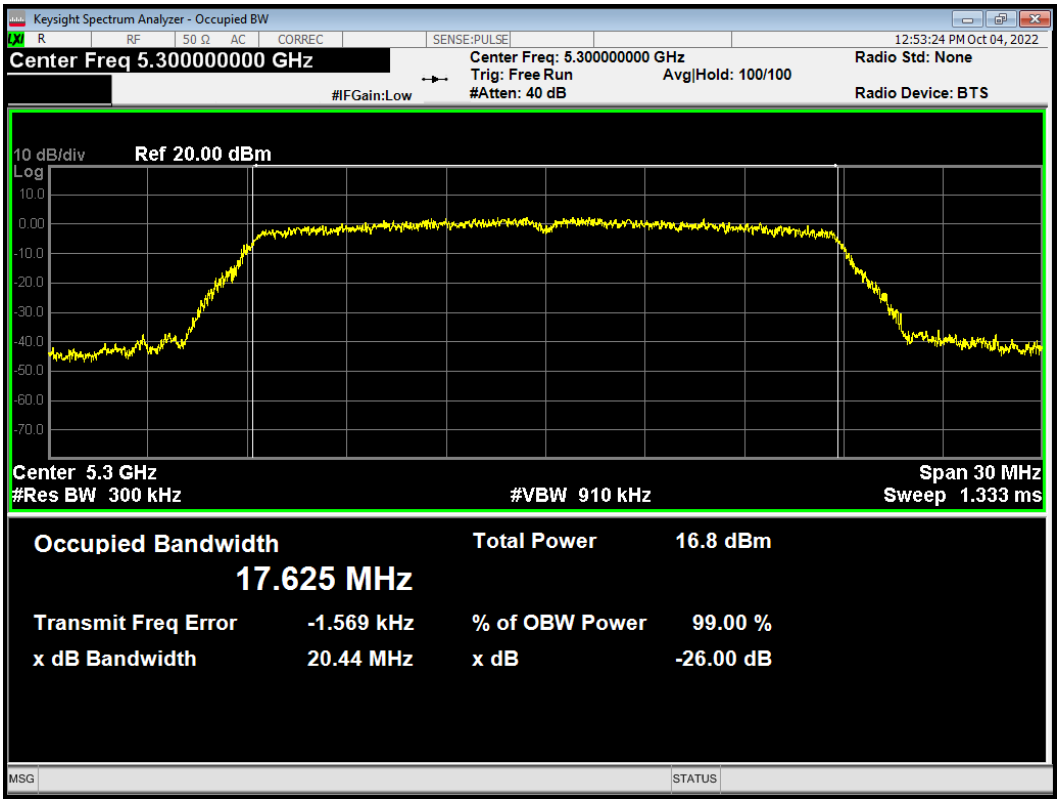
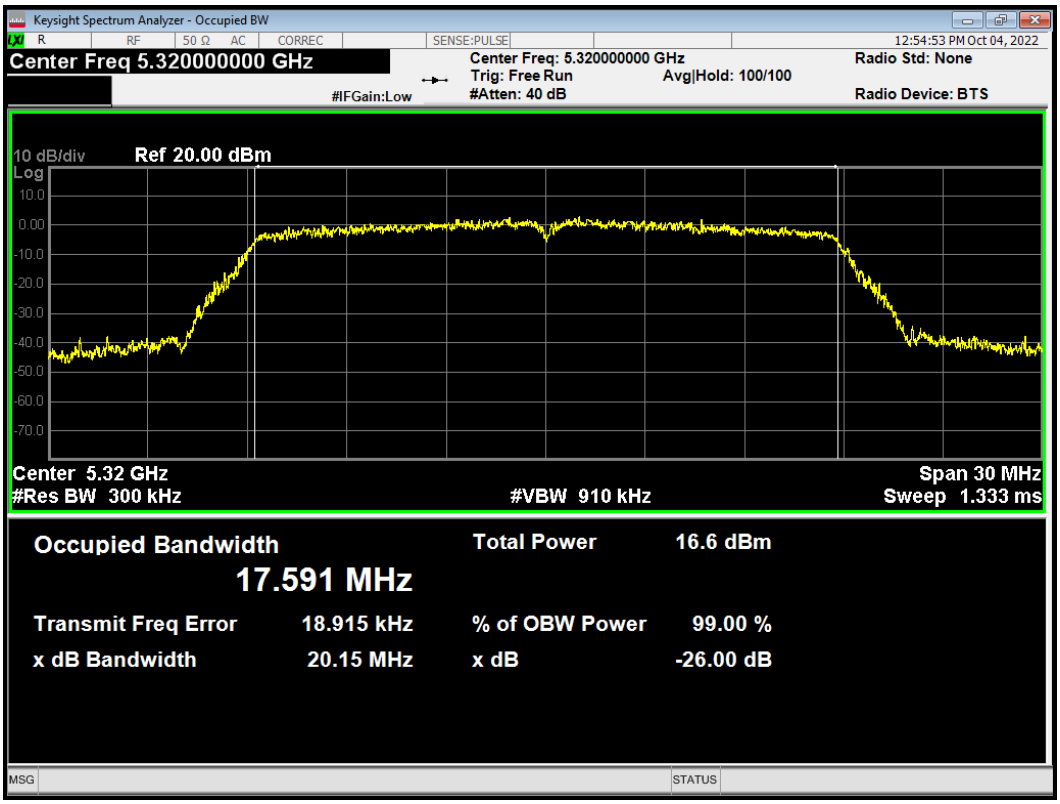
OBW 802.11ac (VHT20) 5300MHz



OBW 802.11ac (VHT20) 5320MHz



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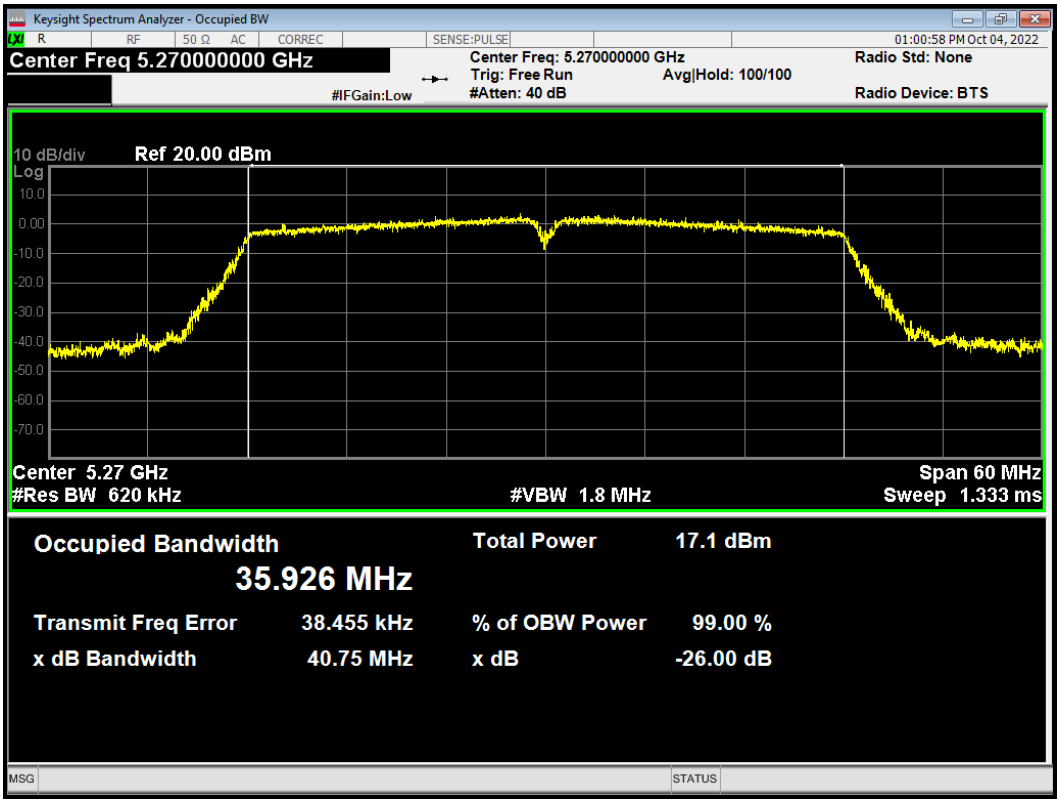
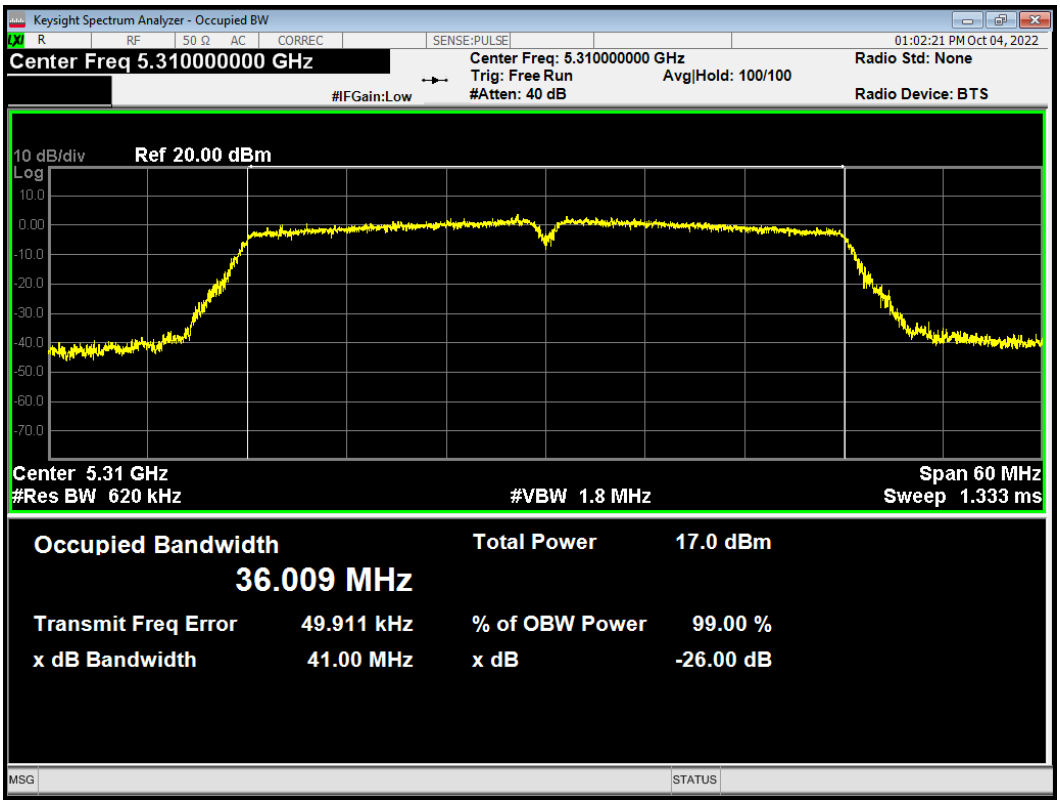
OBW 802.11ac (VHT40) 5270MHz



OBW 802.11ac (VHT40) 5310MHz



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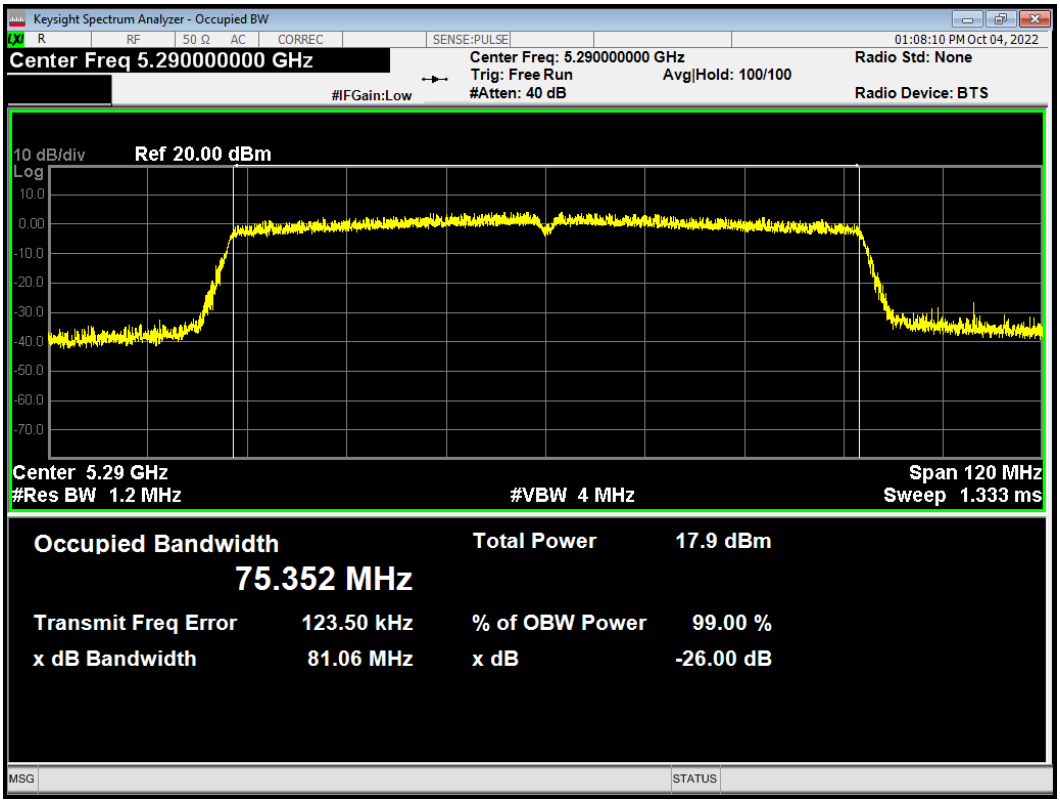
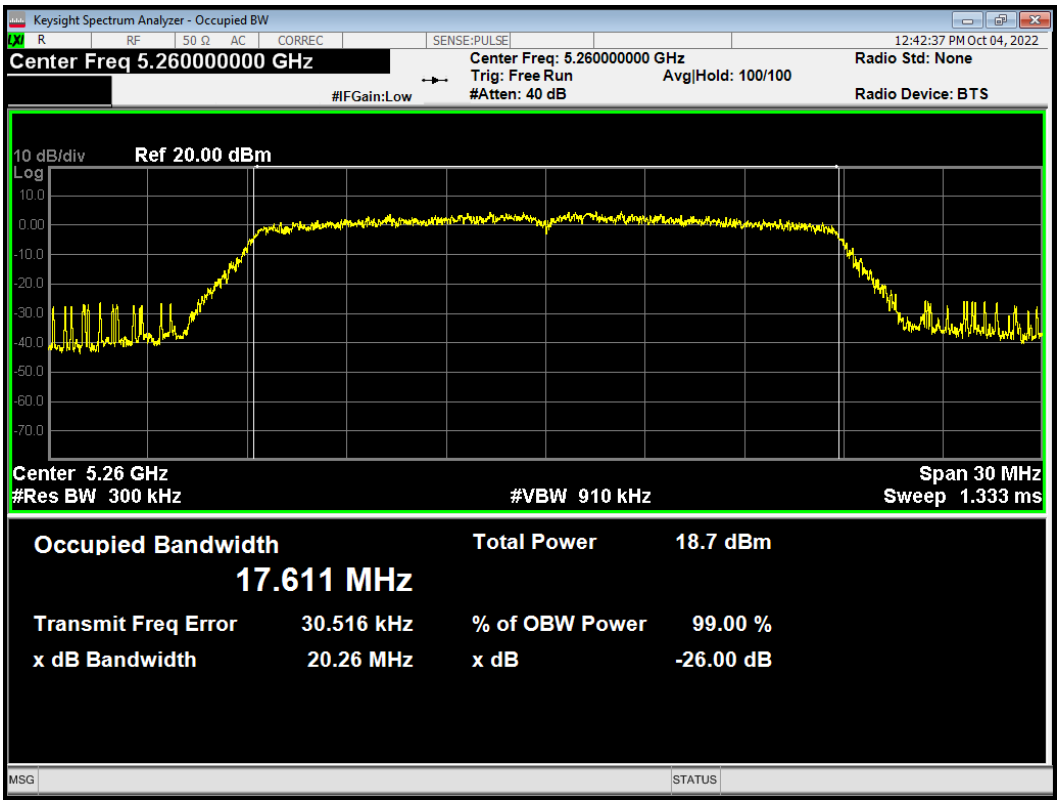
OBW 802.11ac (VHT80) 5290MHz



OBW 802.11n (HT20) 5260MHz



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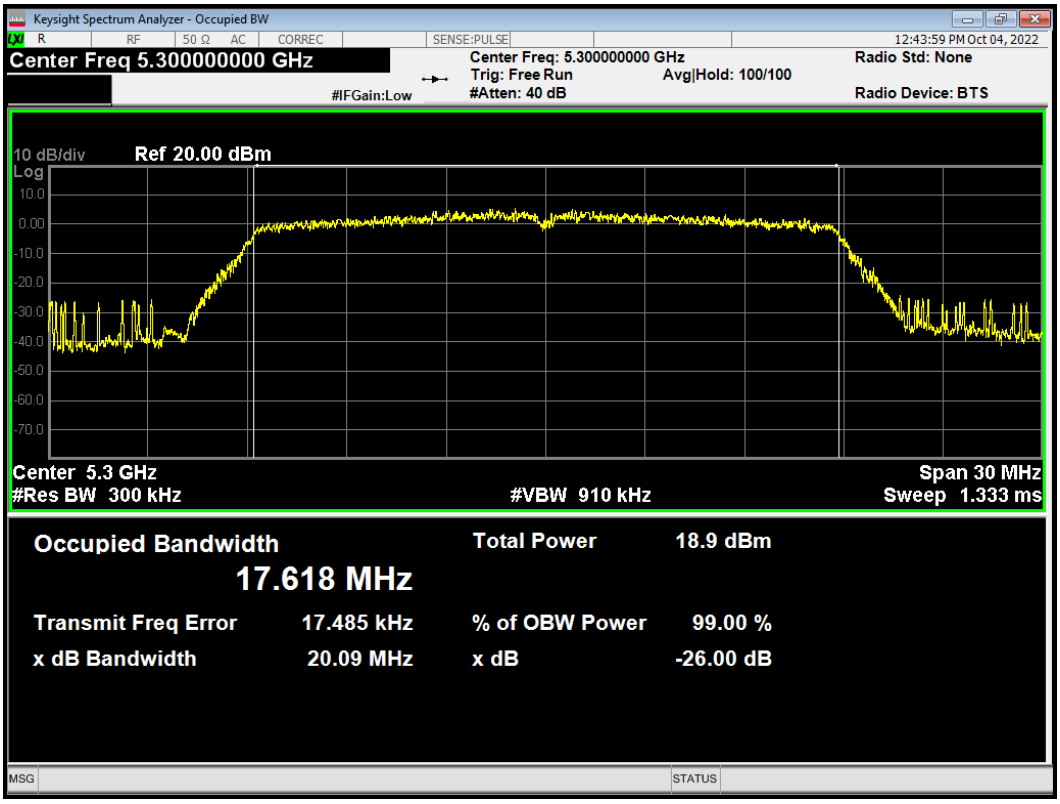
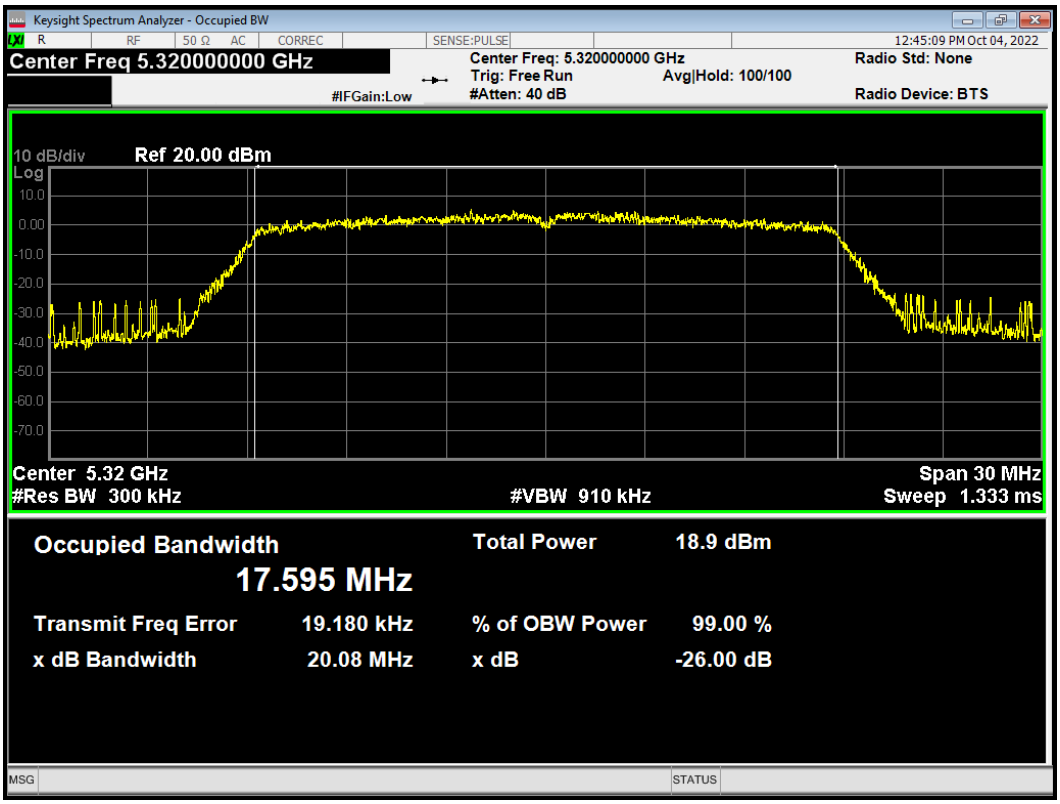
OBW 802.11n (HT20) 5300MHz



OBW 802.11n (HT20) 5320MHz



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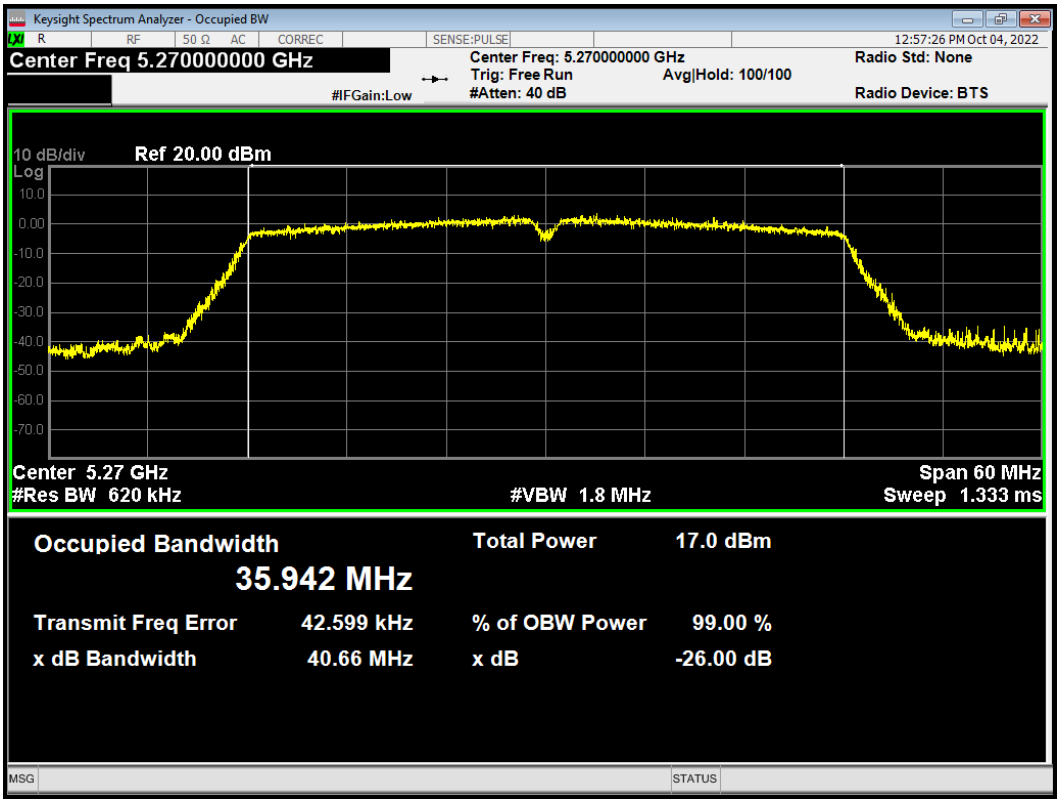
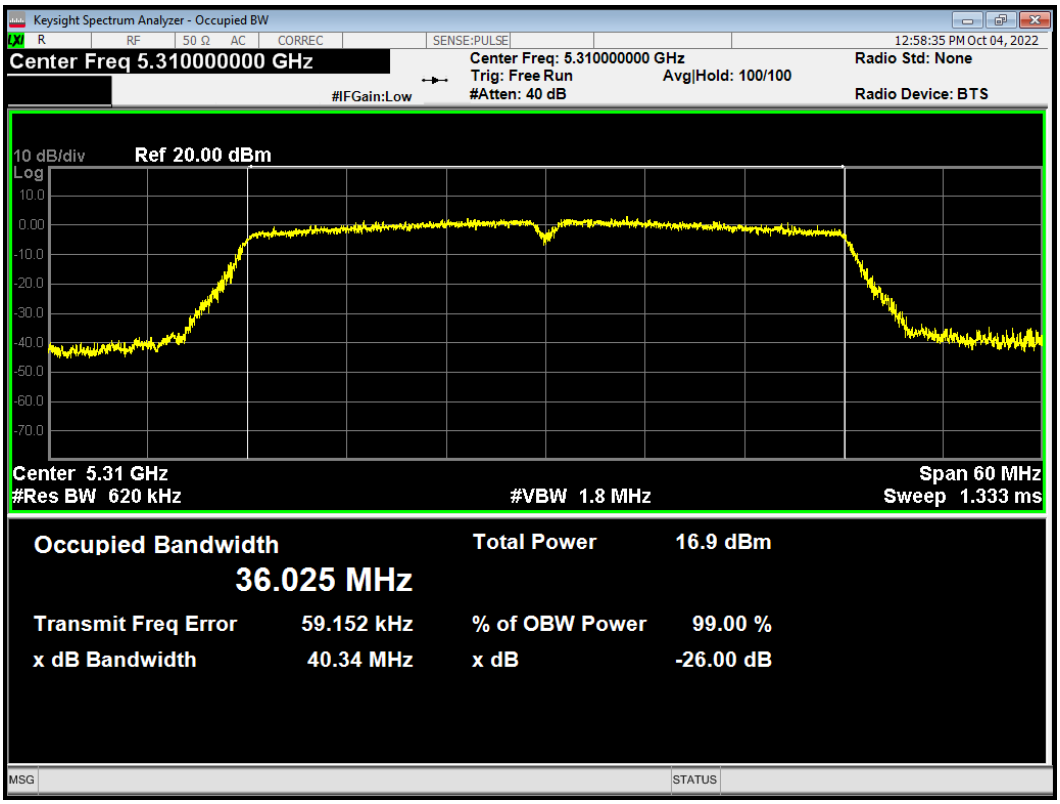
OBW 802.11n (HT40) 5270MHz



OBW 802.11n (HT40) 5310MHz



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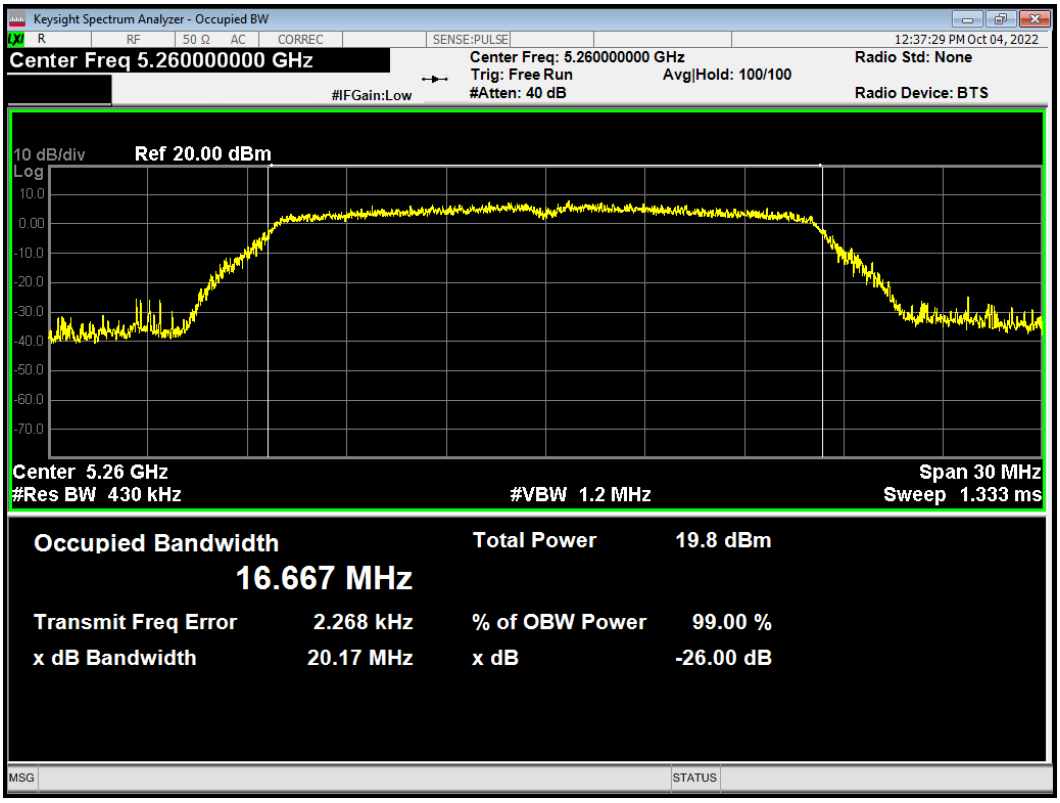
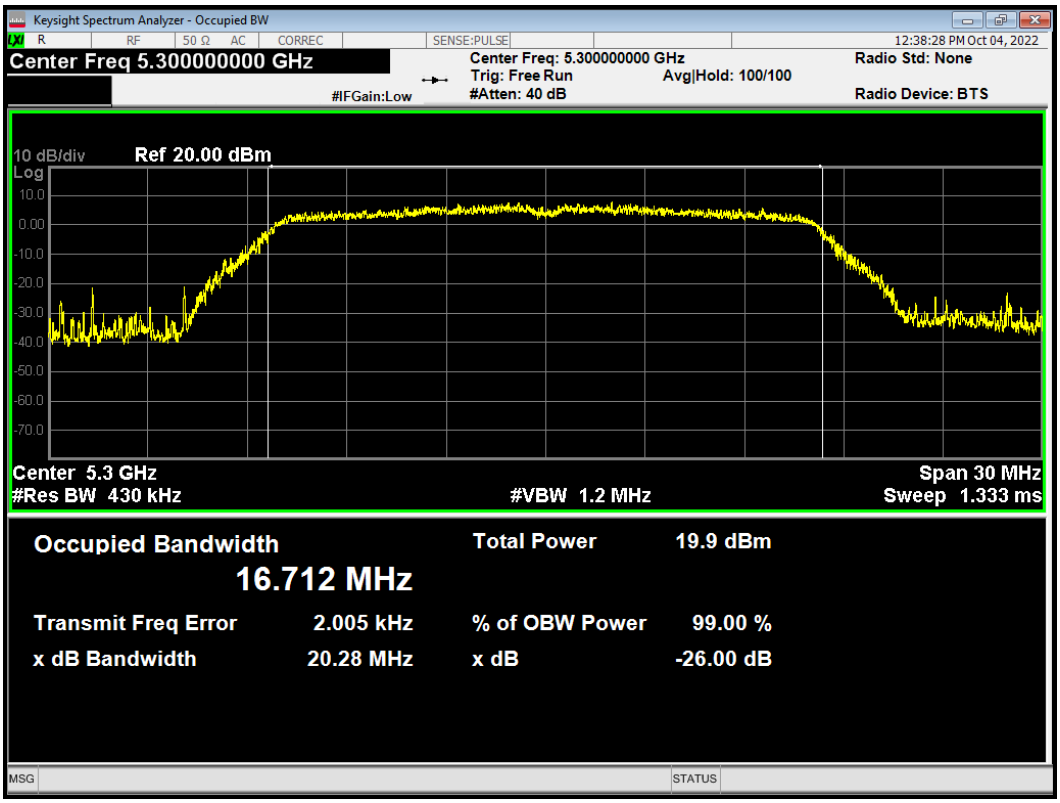
Minimum -26 dB bandwidth

-26dB Bandwidth 802.11a 5260MHz



-26dB Bandwidth 802.11a 5300MHz



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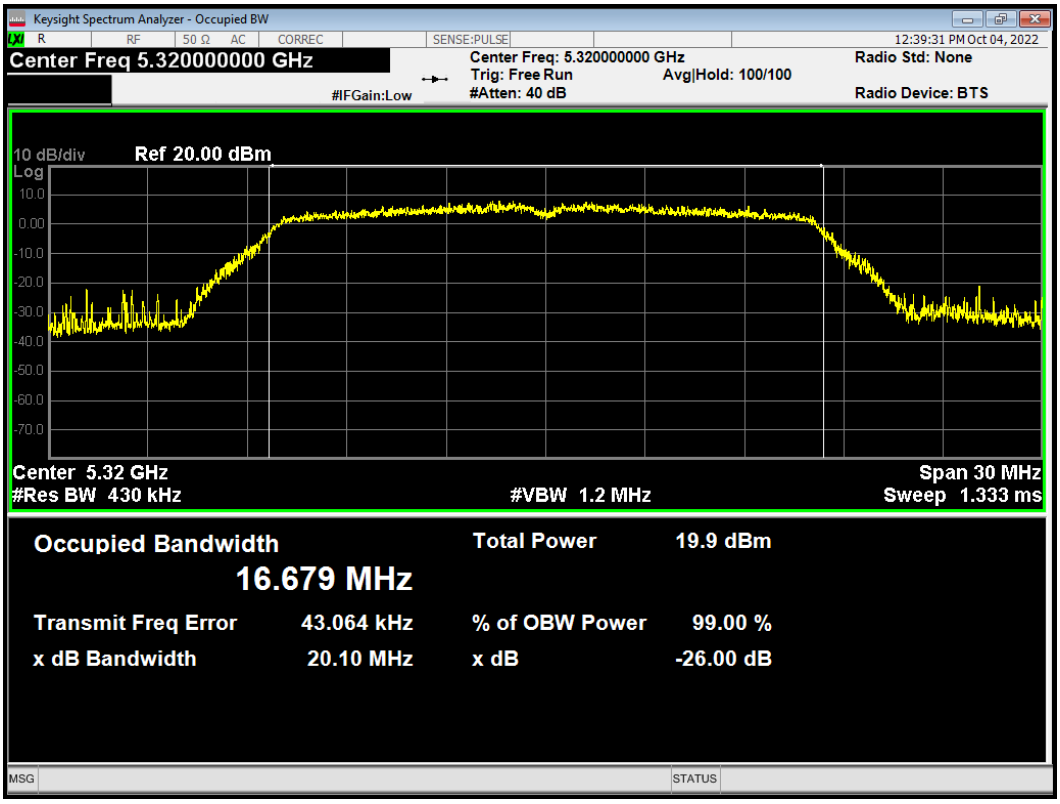
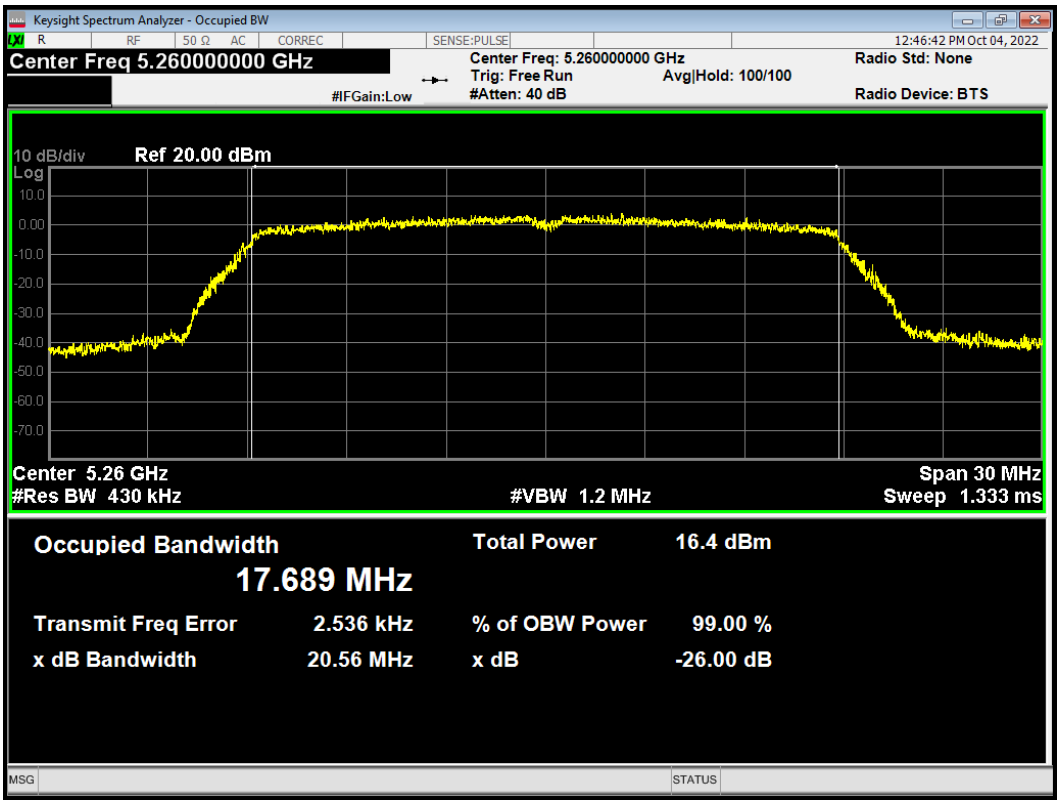
-26dB Bandwidth 802.11a 5320MHz



-26dB Bandwidth 802.11ac (VHT20) 5260MHz



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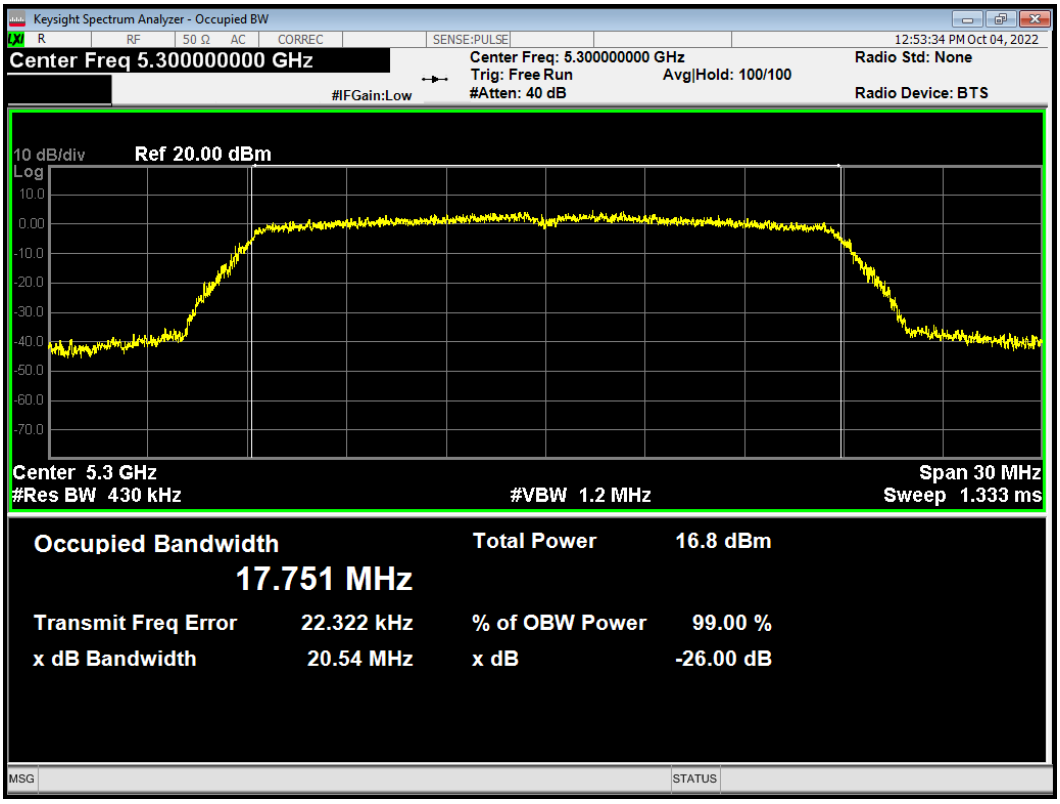
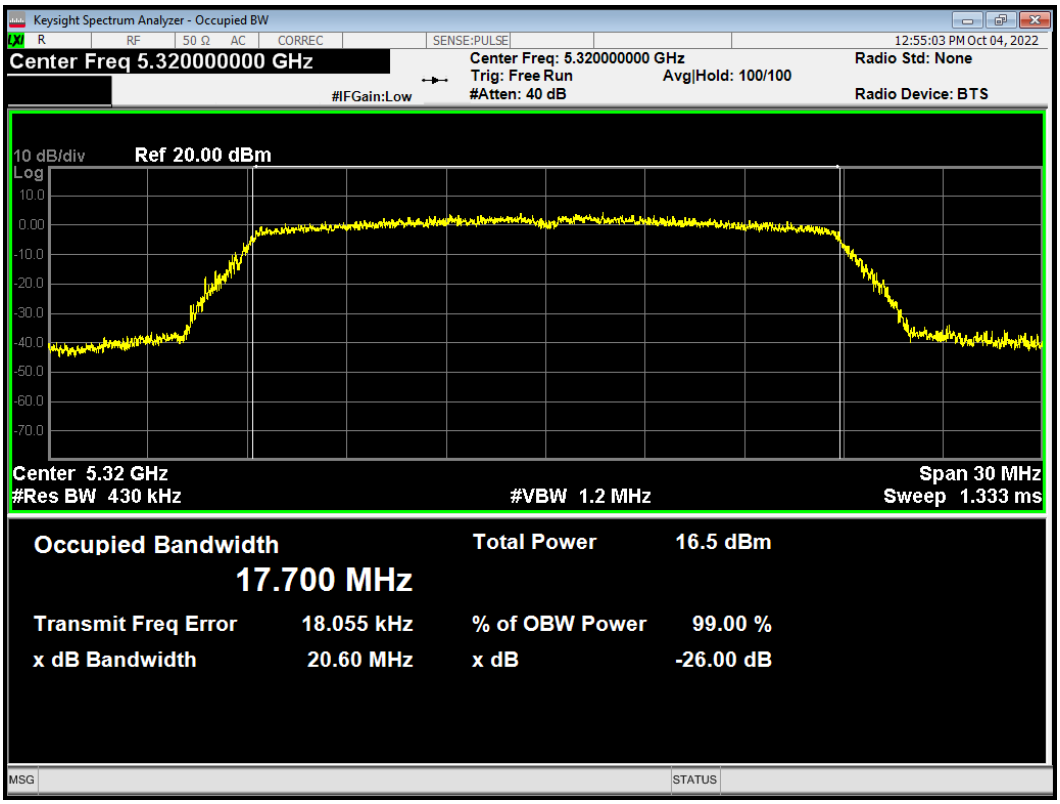
-26dB Bandwidth 802.11ac (VHT20) 5300MHz



-26dB Bandwidth 802.11ac (VHT20) 5320MHz



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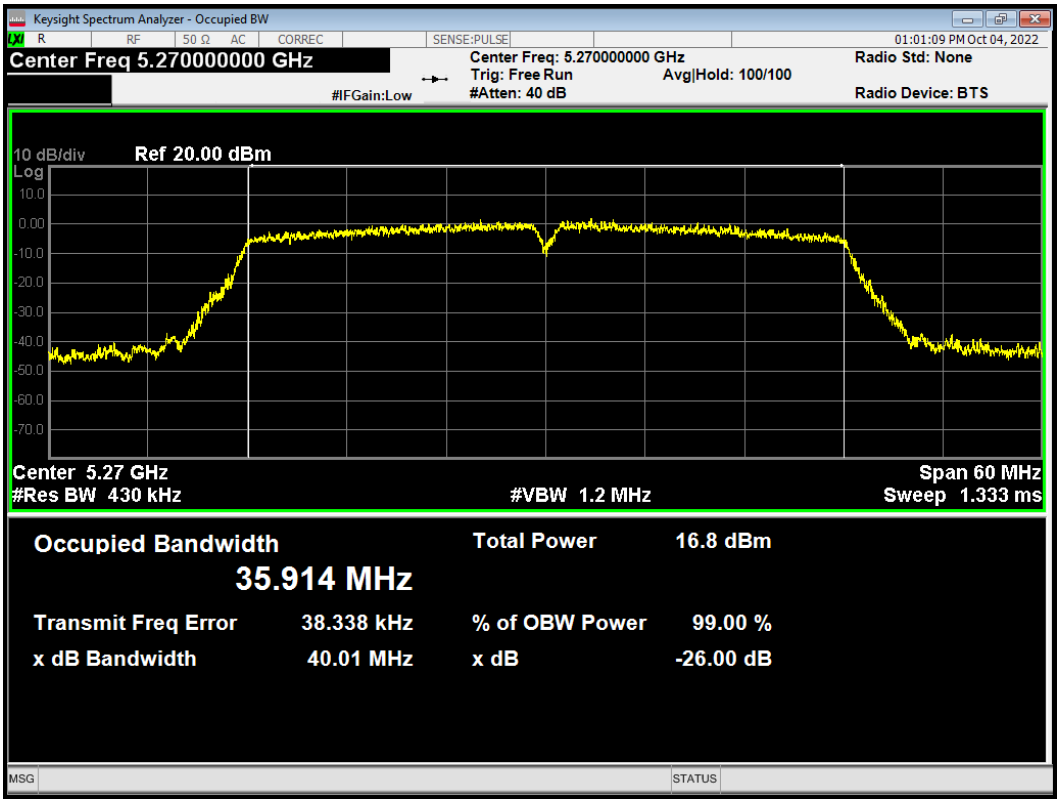
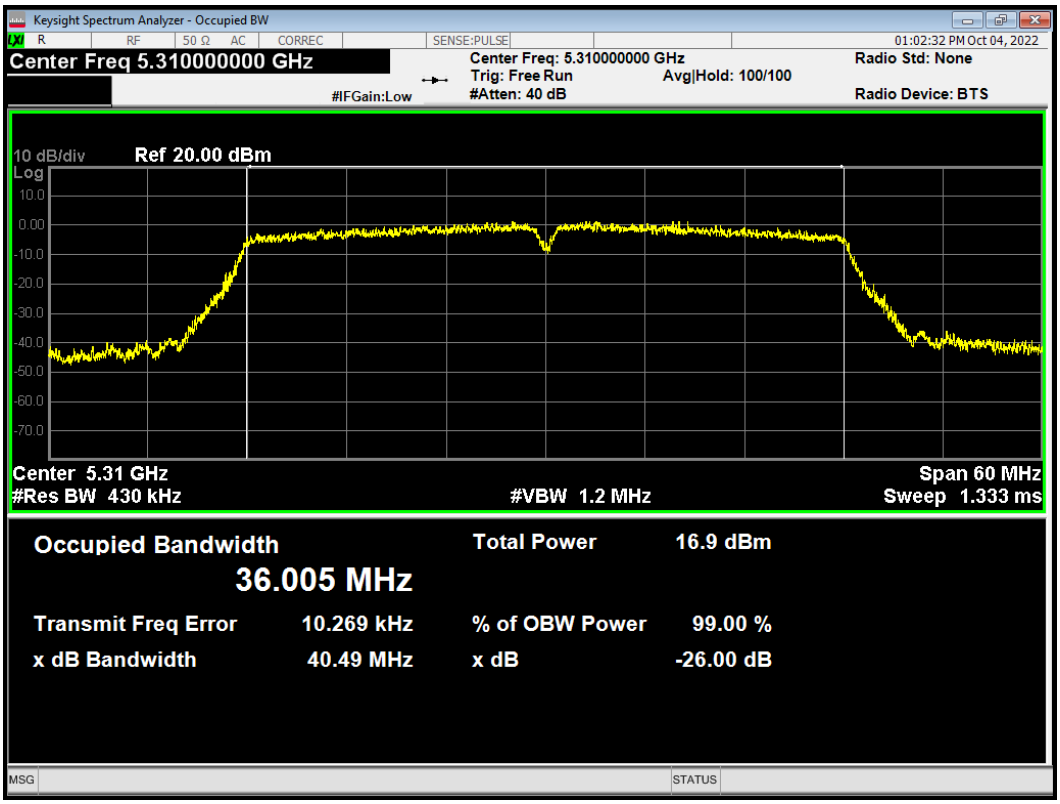
-26dB Bandwidth 802.11ac (VHT40) 5270MHz



-26dB Bandwidth 802.11ac (VHT40) 5310MHz



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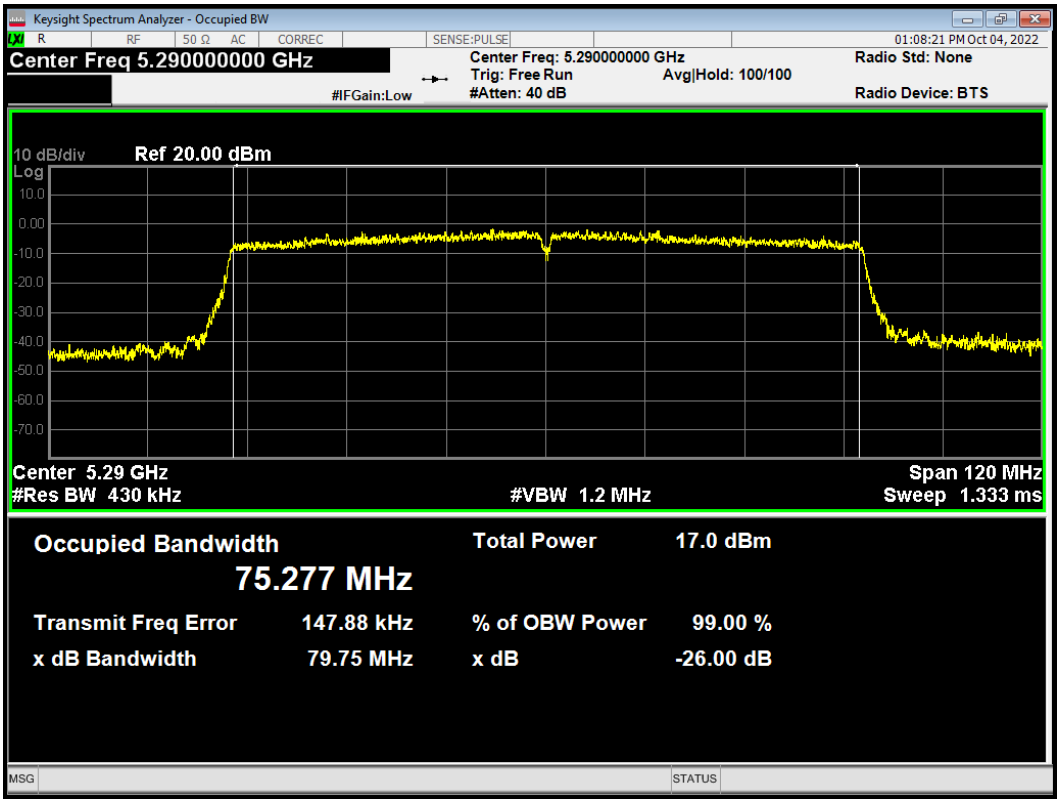
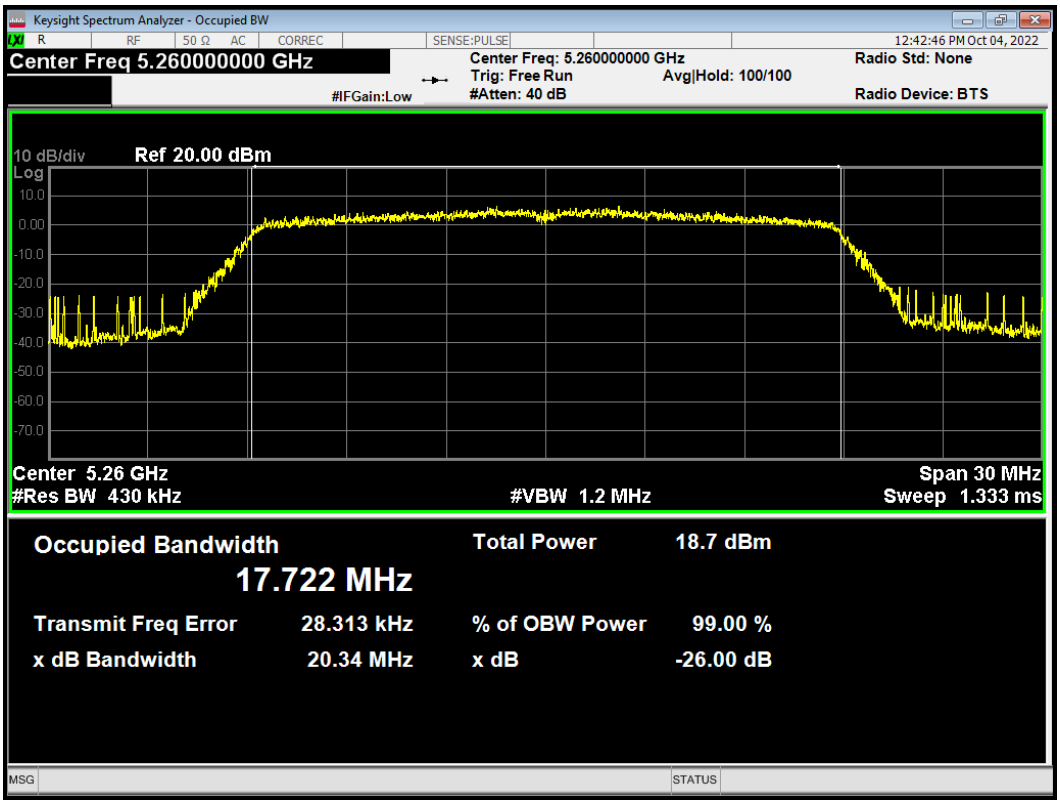
-26dB Bandwidth 802.11ac (VHT80) 5290MHz



-26dB Bandwidth 802.11n (HT20) 5260MHz



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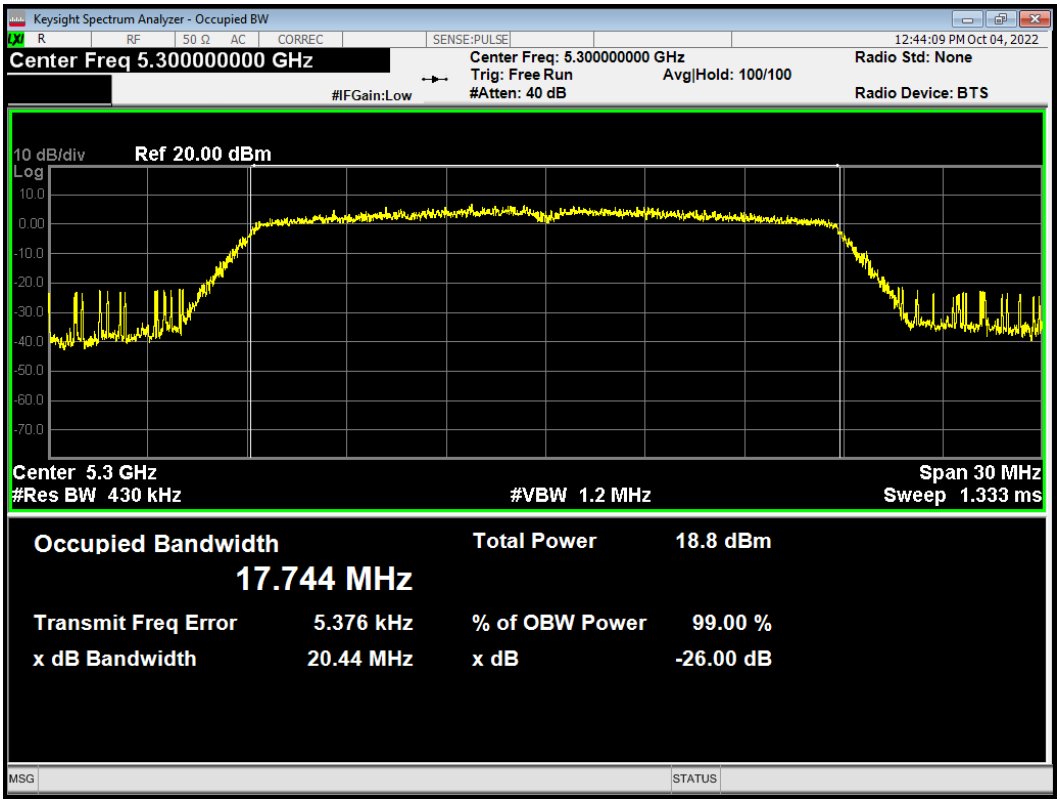
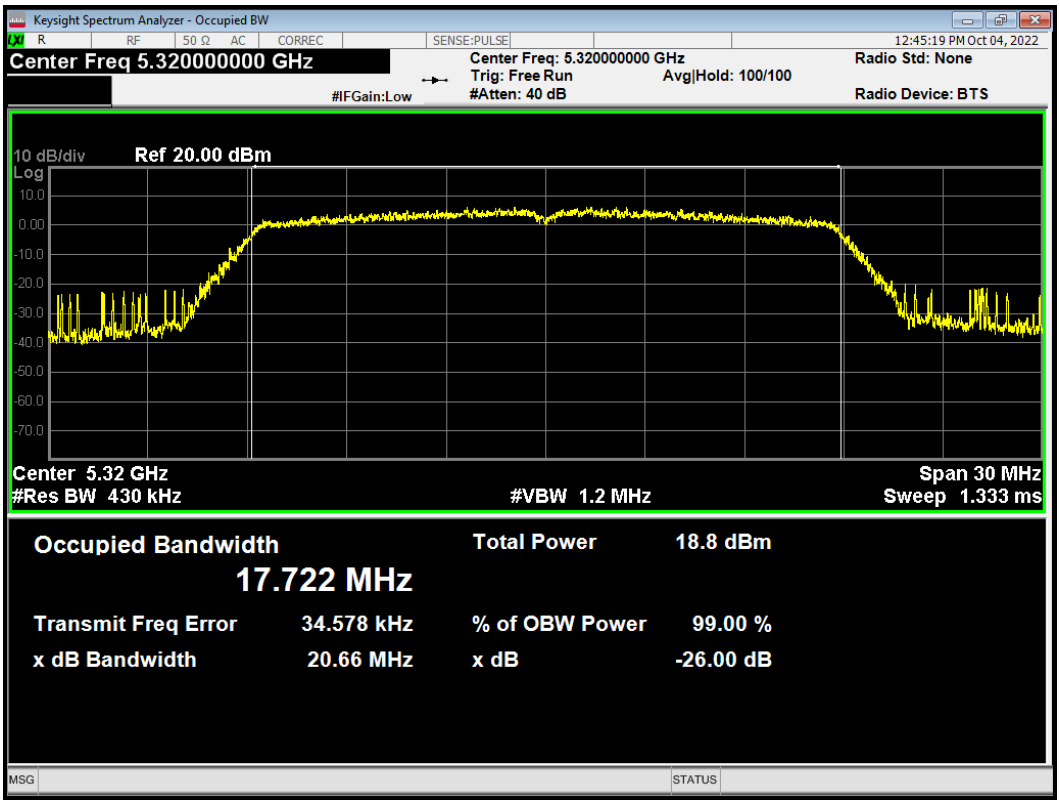
-26dB Bandwidth 802.11n (HT20) 5300MHz



-26dB Bandwidth 802.11n (HT20) 5320MHz



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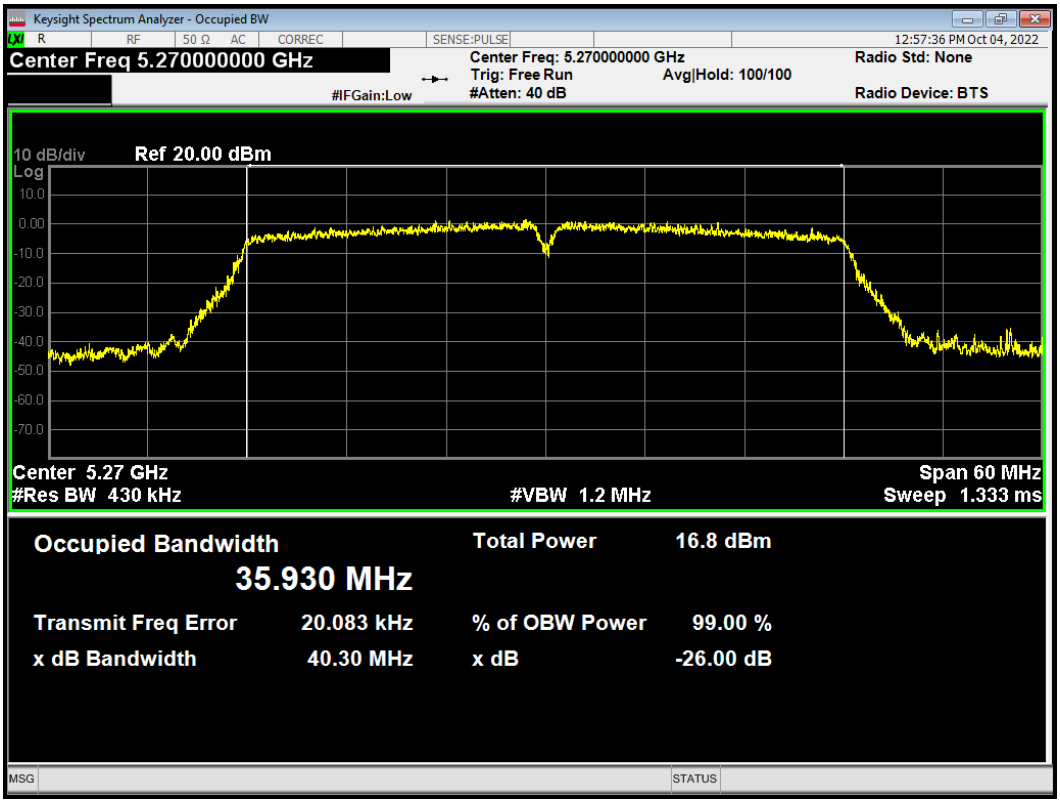
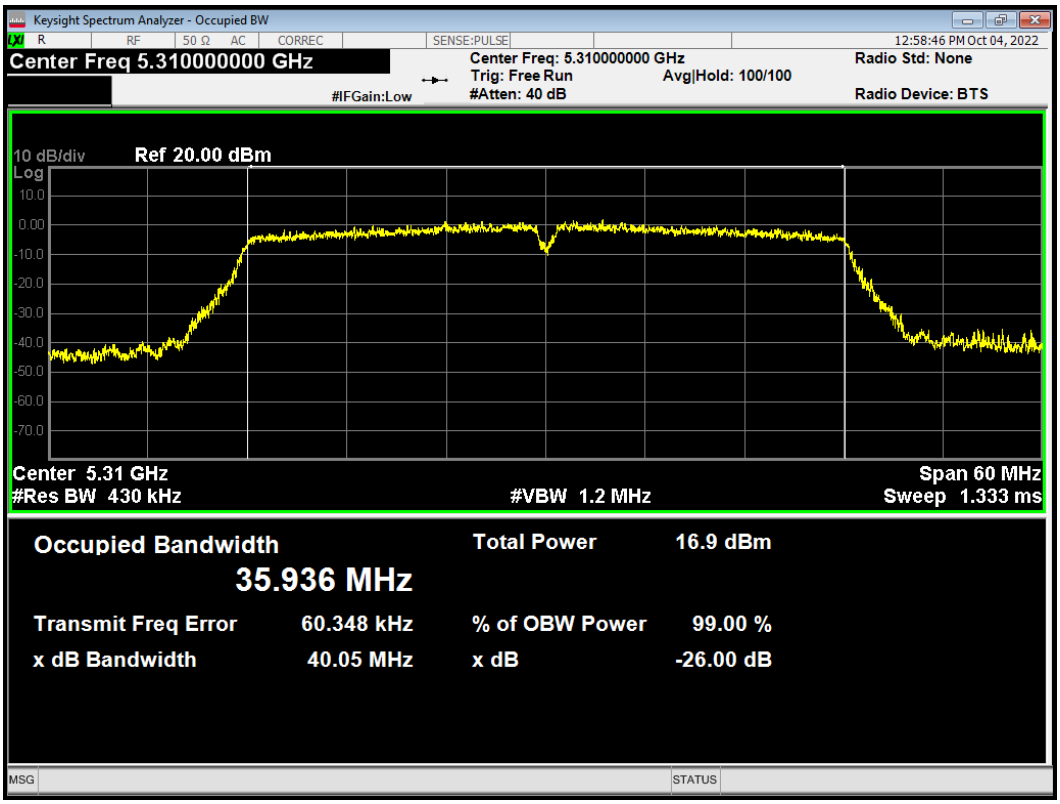
-26dB Bandwidth 802.11n (HT40) 5270MHz



-26dB Bandwidth 802.11n (HT40) 5310MHz



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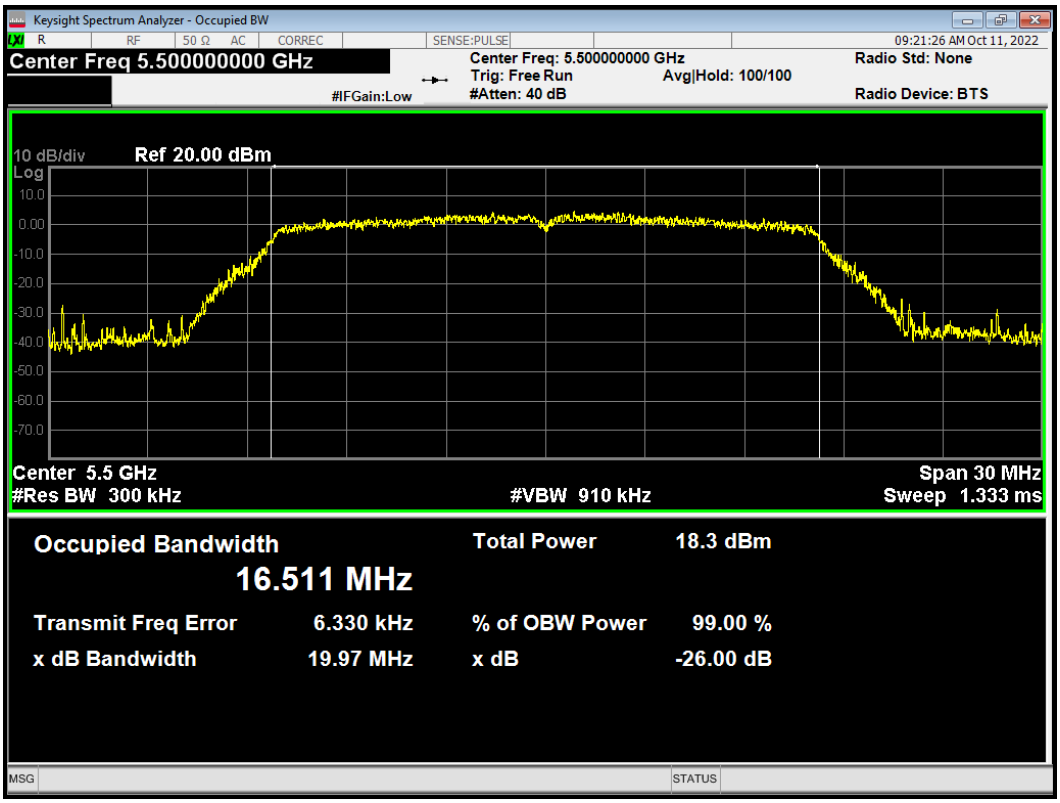
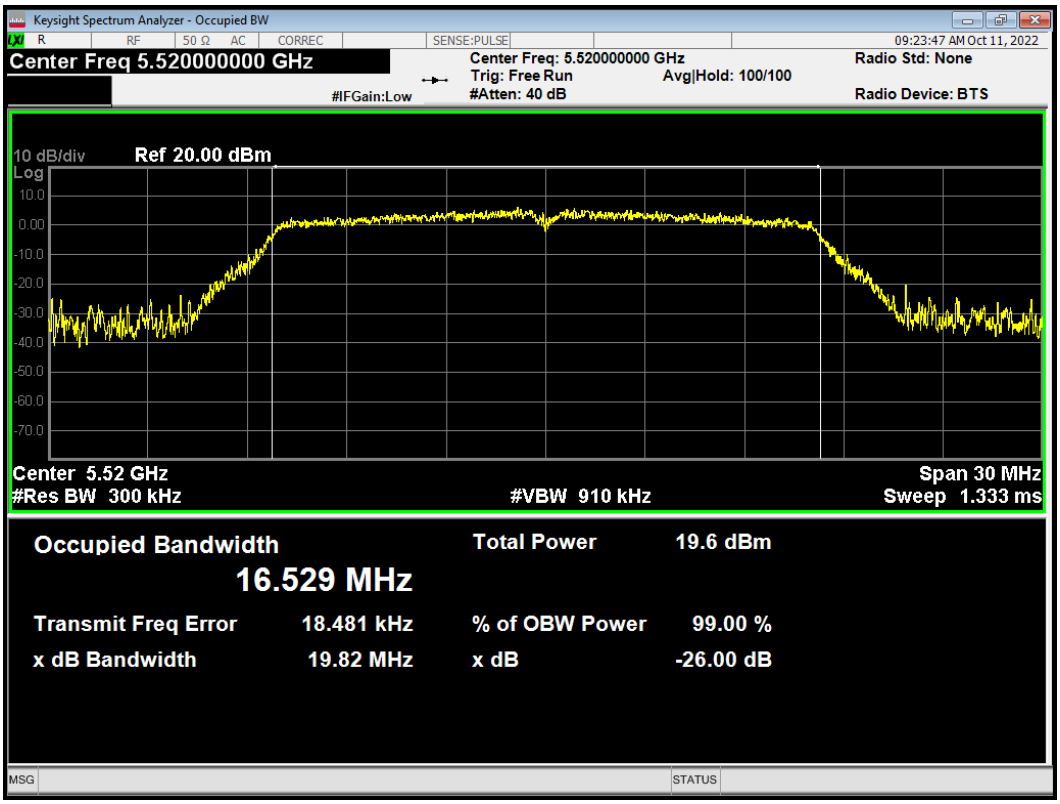
U-NII-2C

99% bandwidth

OBW 802.11a 5500MHz



OBW 802.11a 5520MHz



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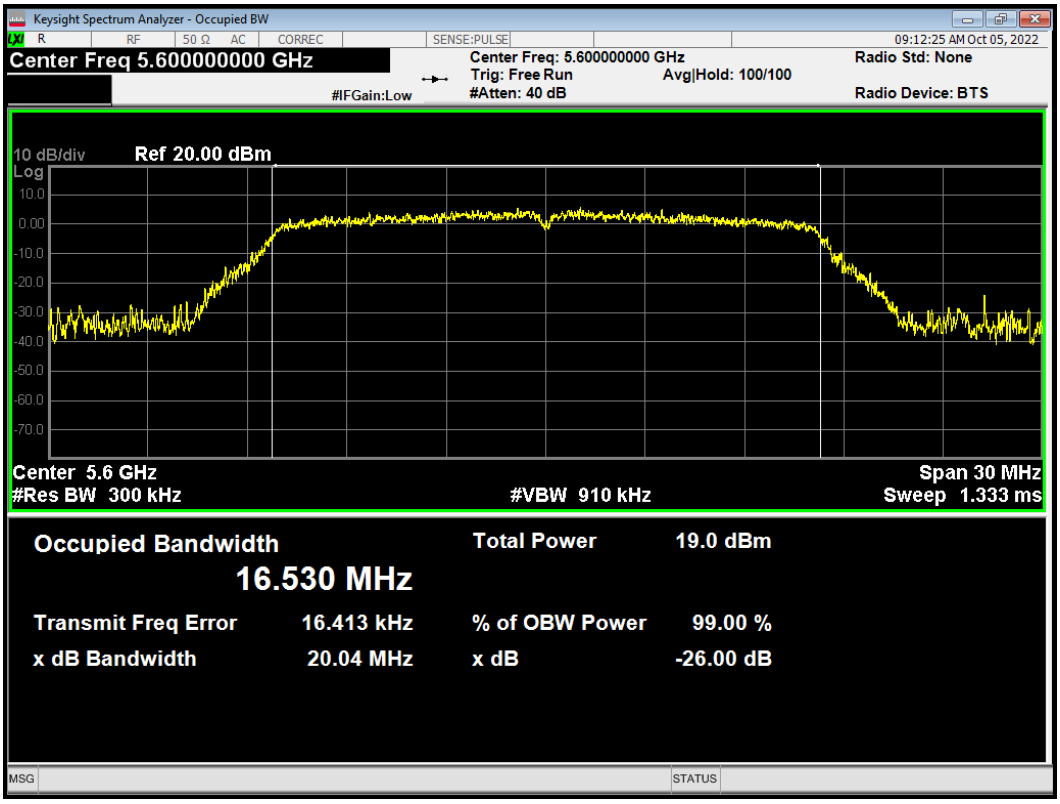
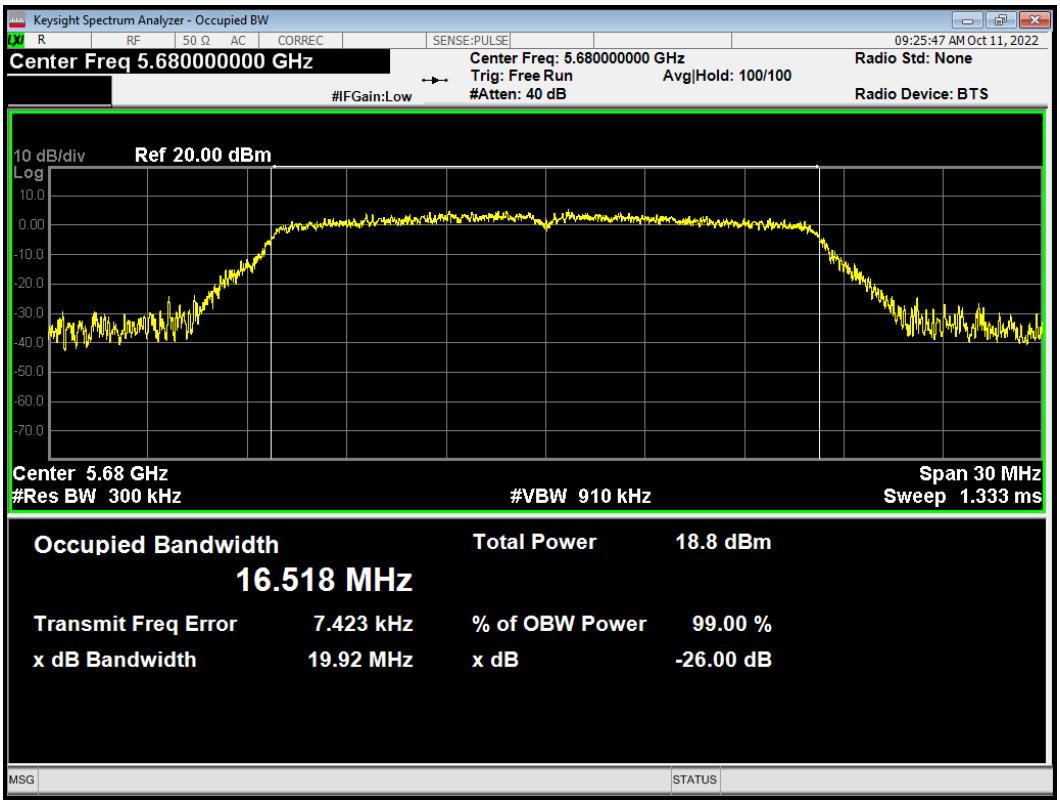
OBW 802.11a 5600MHz



OBW 802.11a 5680MHz



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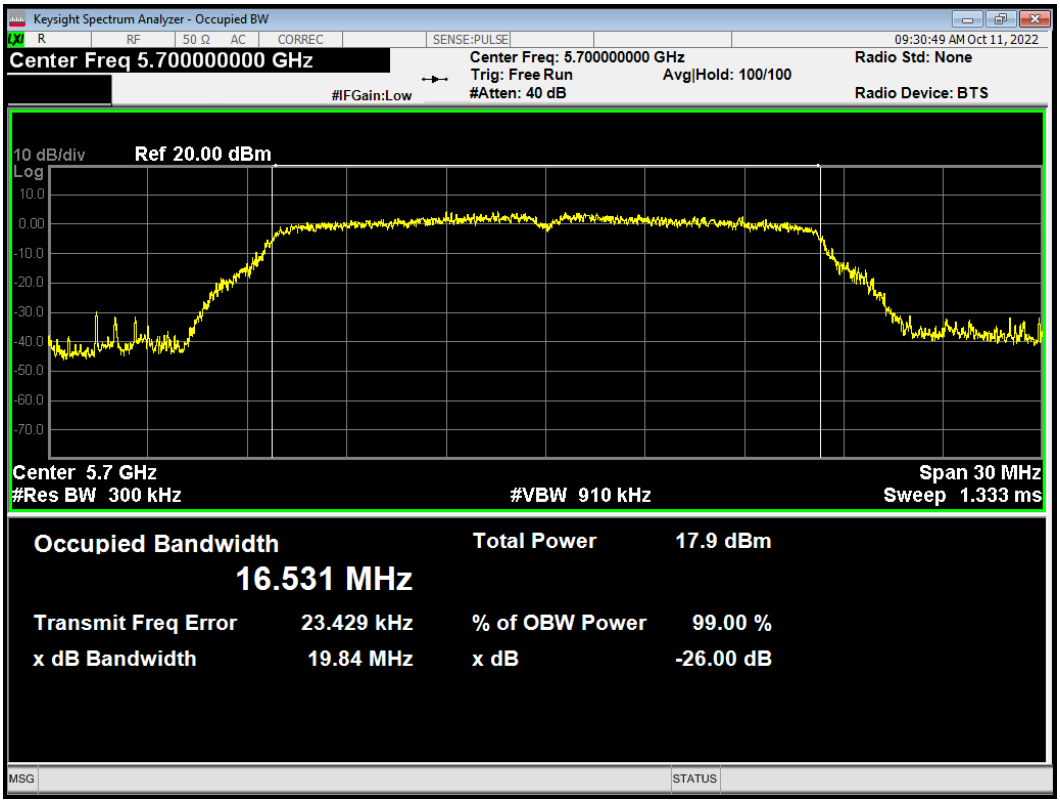
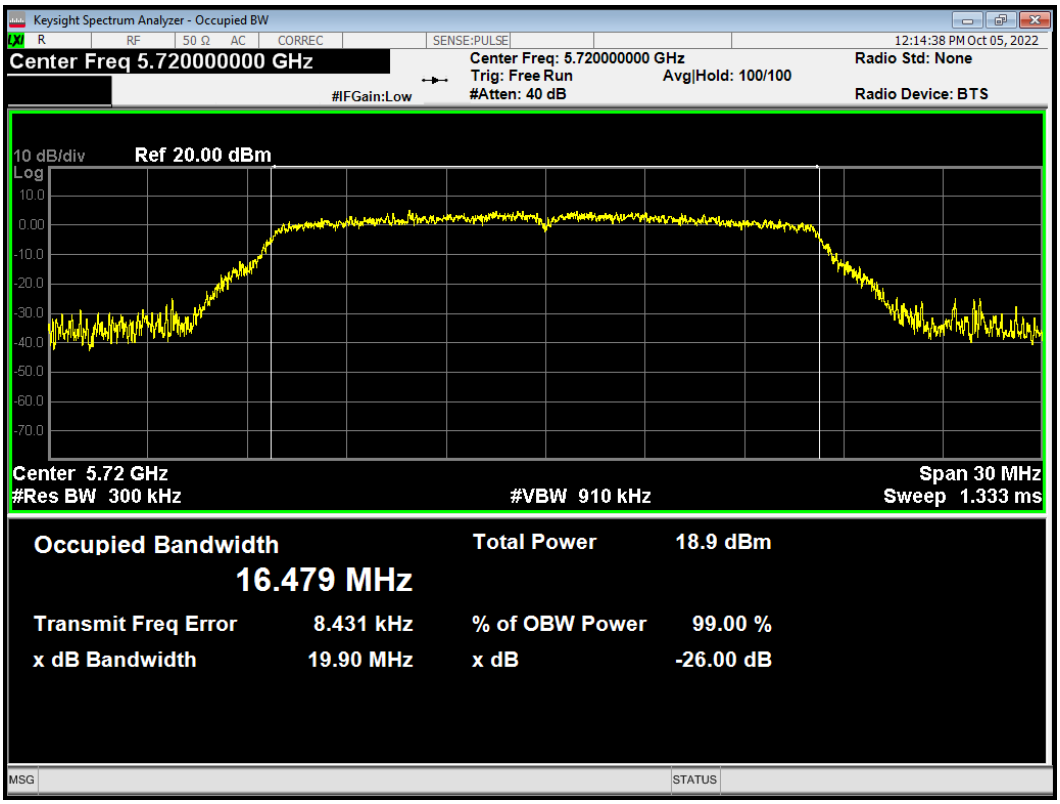
OBW 802.11a 5700MHz



OBW 802.11a 5720MHz



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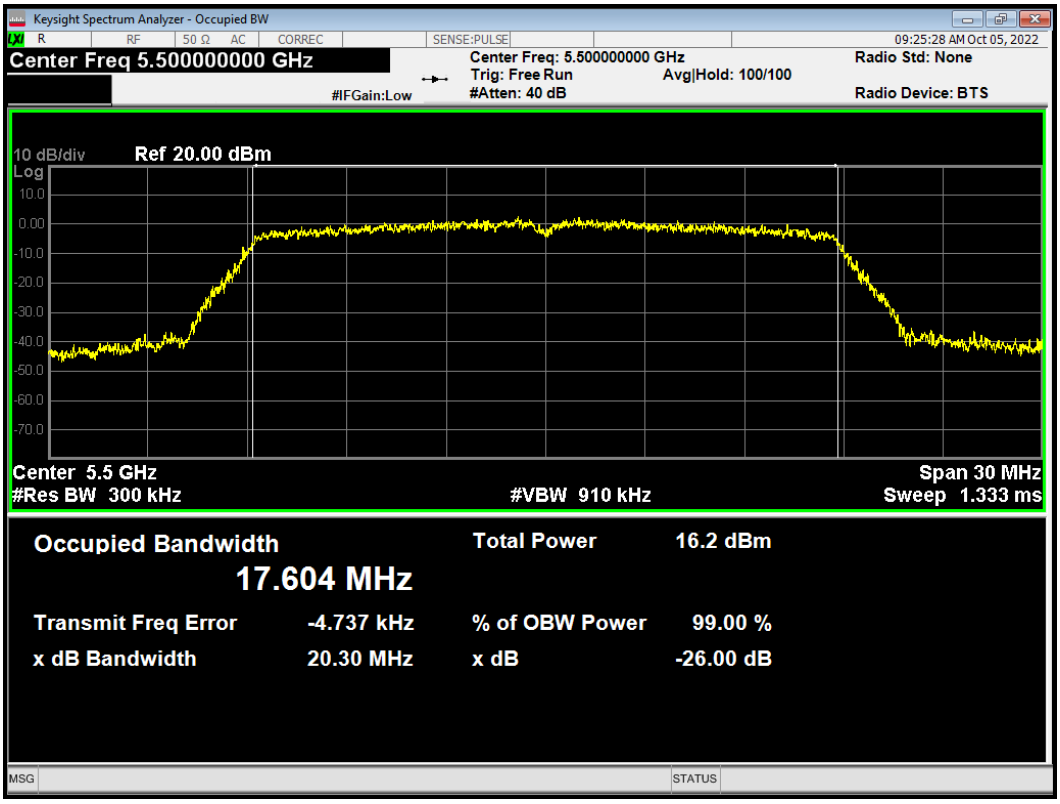
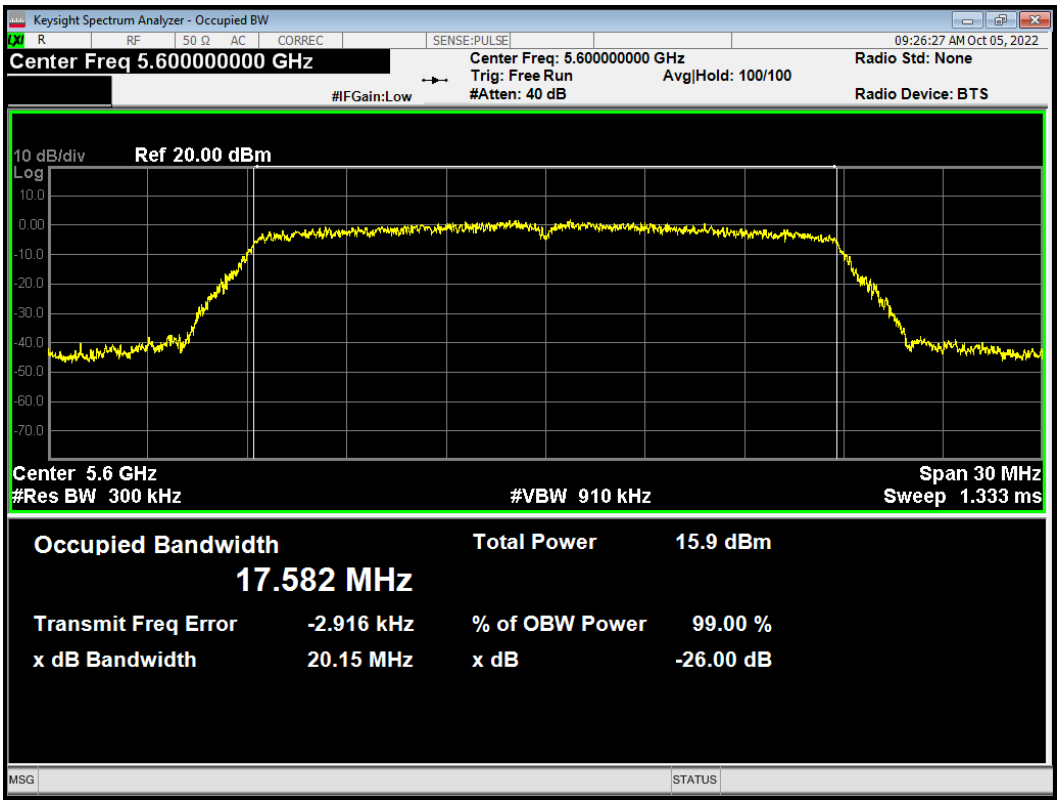
OBW 802.11ac (VHT20) 5500MHz



OBW 802.11ac (VHT20) 5600MHz



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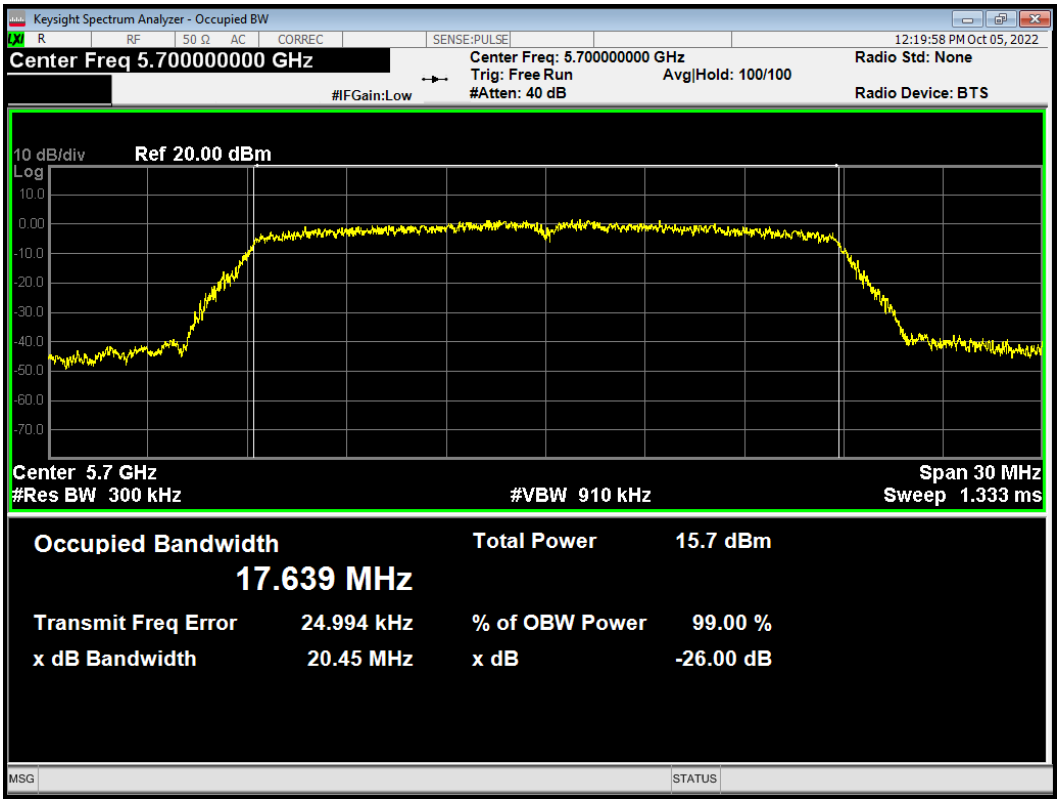
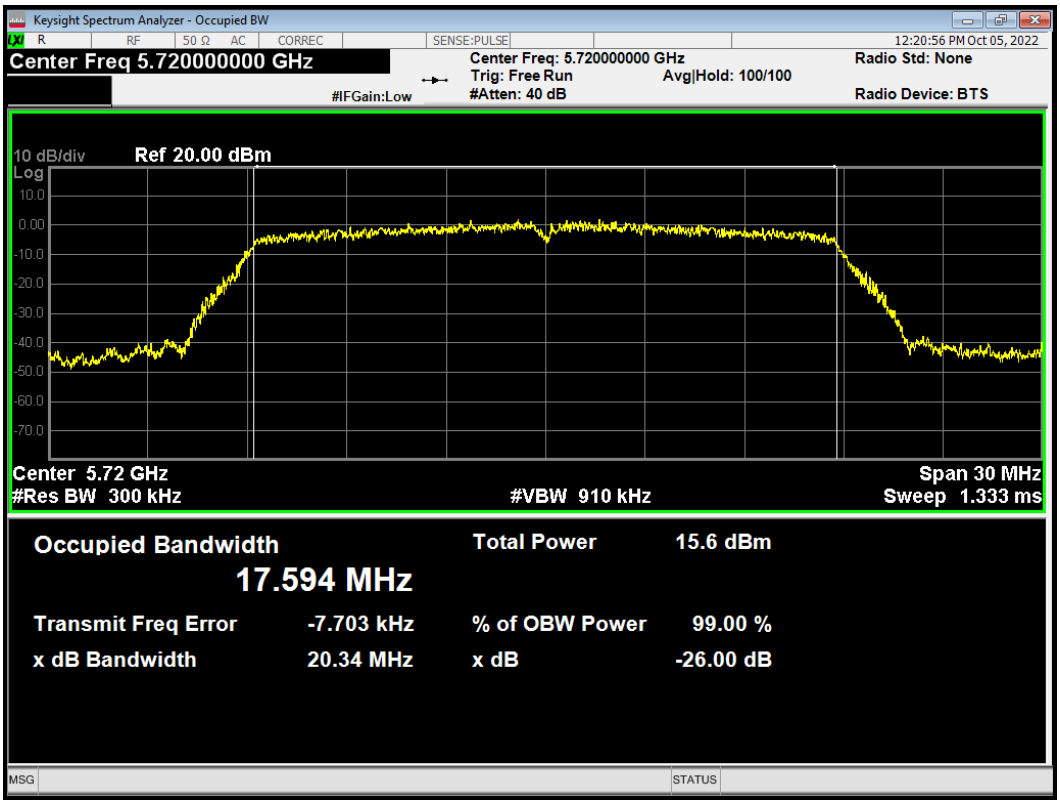
OBW 802.11ac (VHT20) 5700MHz



OBW 802.11ac (VHT20) 5720MHz



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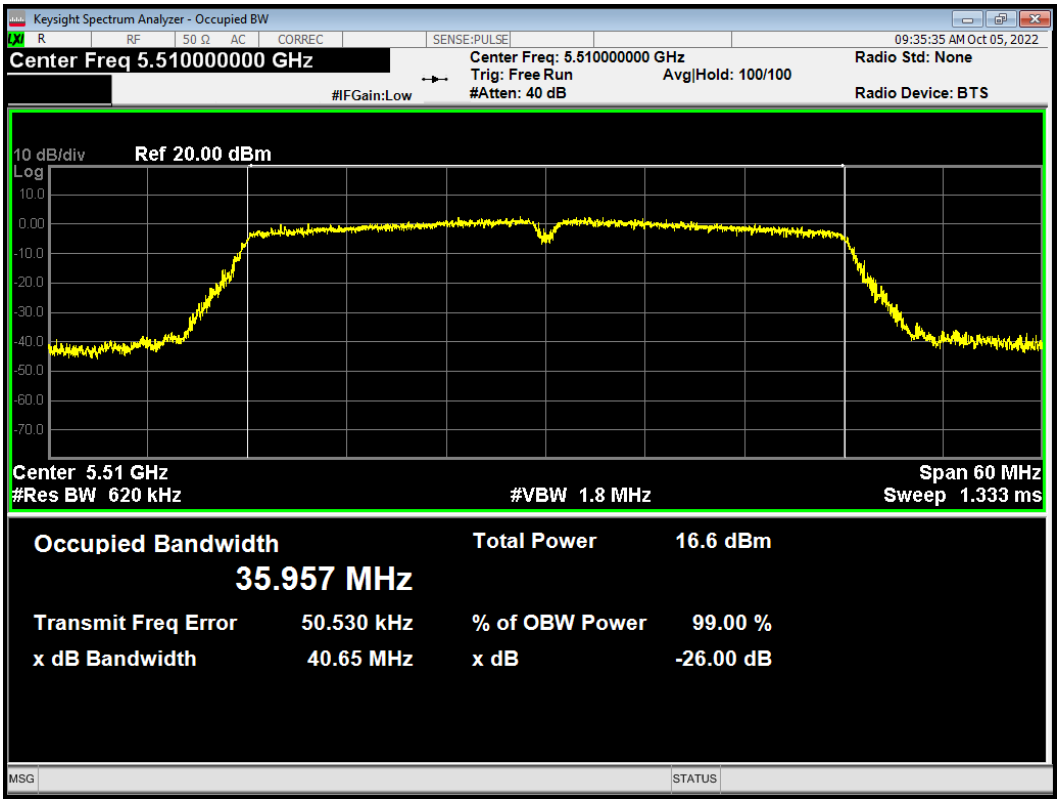
OBW 802.11ac (VHT40) 5510MHz



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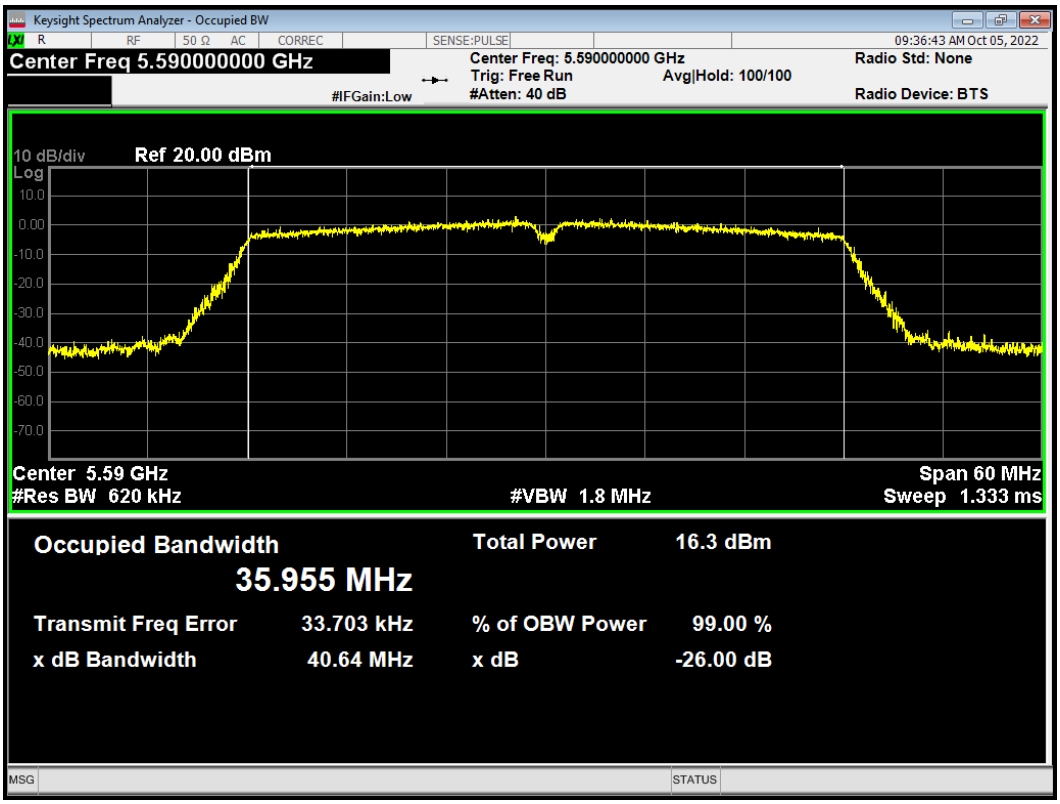

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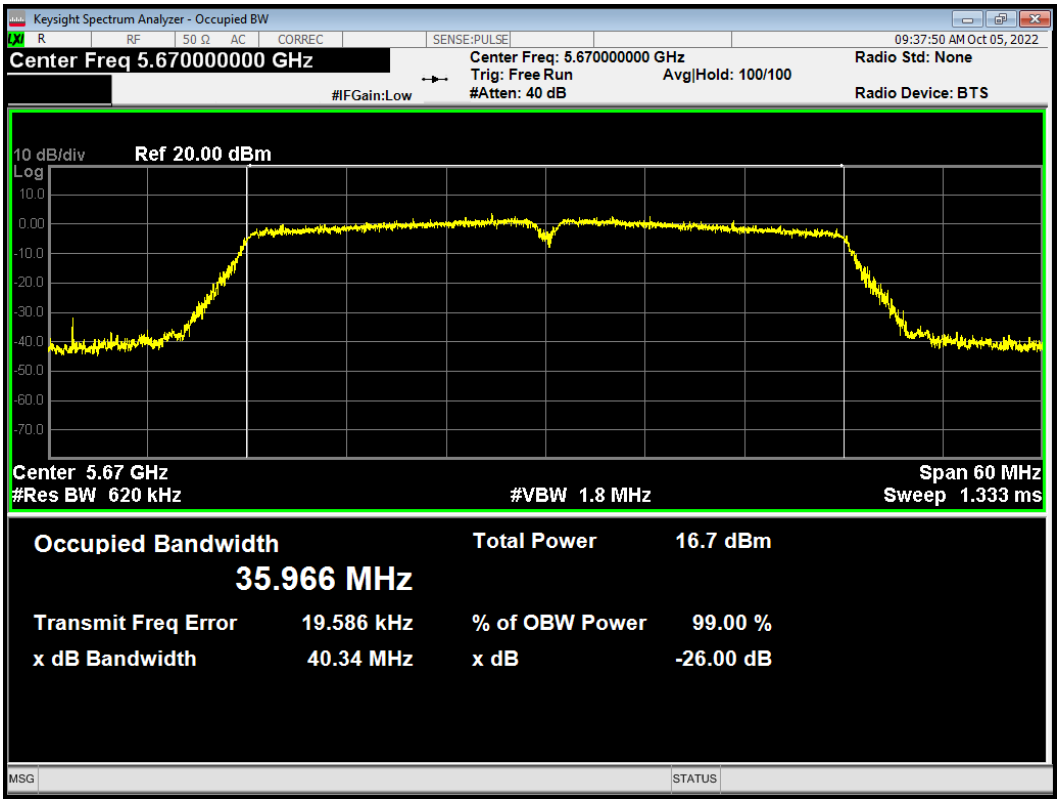
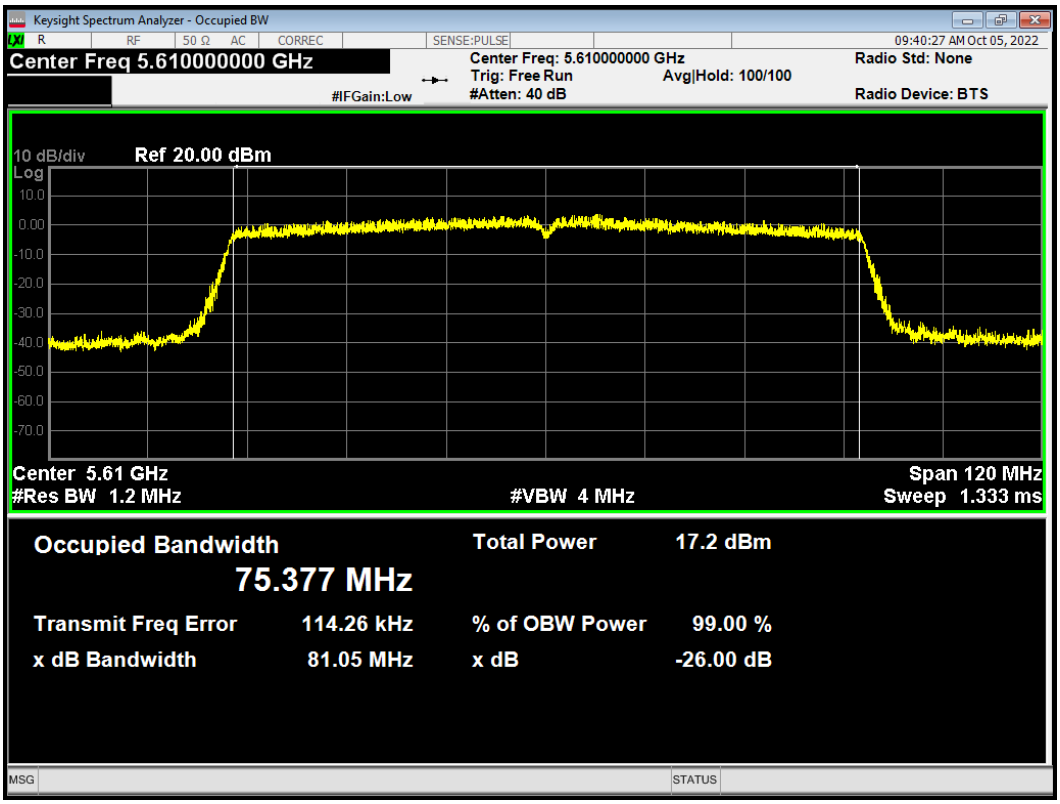
OBW 802.11ac (VHT40) 5670MHz



OBW 802.11ac (VHT80) 5610MHz



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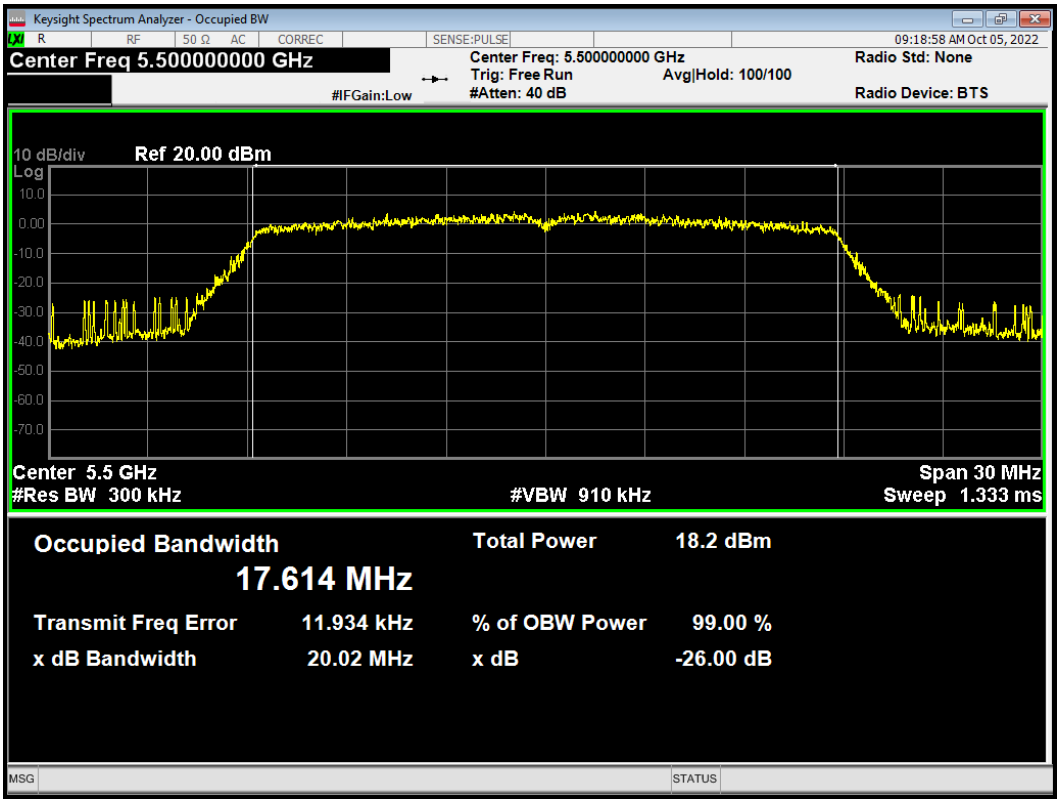
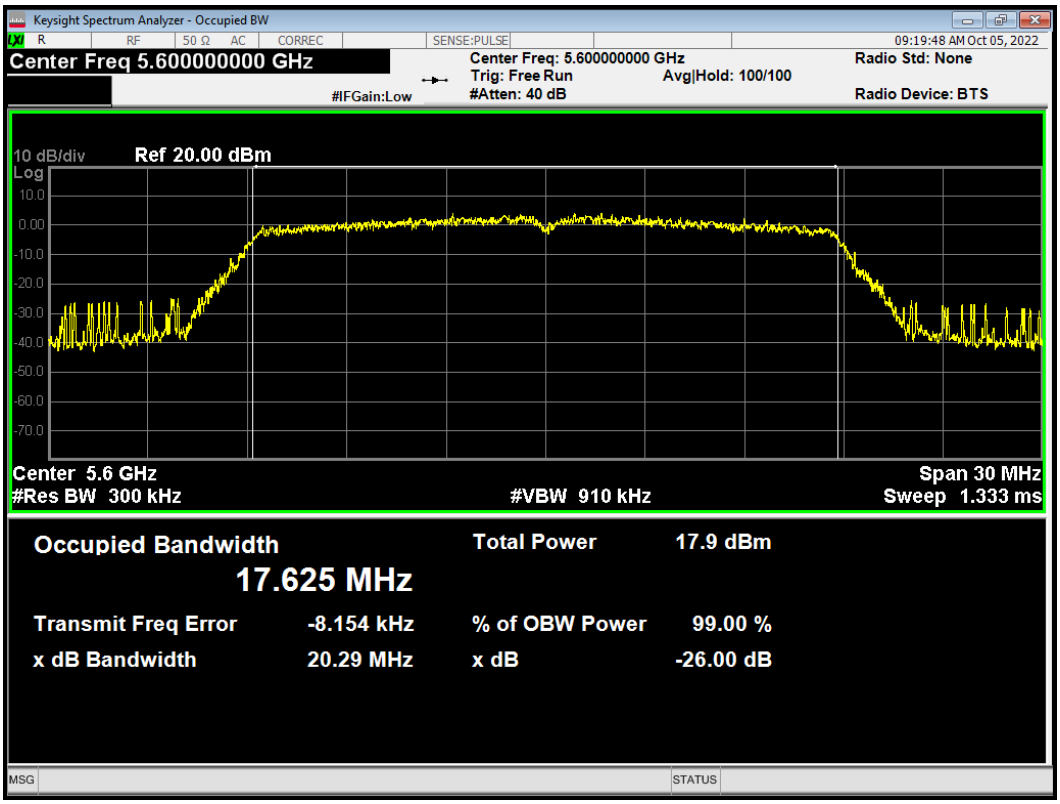
OBW 802.11n (HT20) 5500MHz



OBW 802.11n (HT20) 5600MHz



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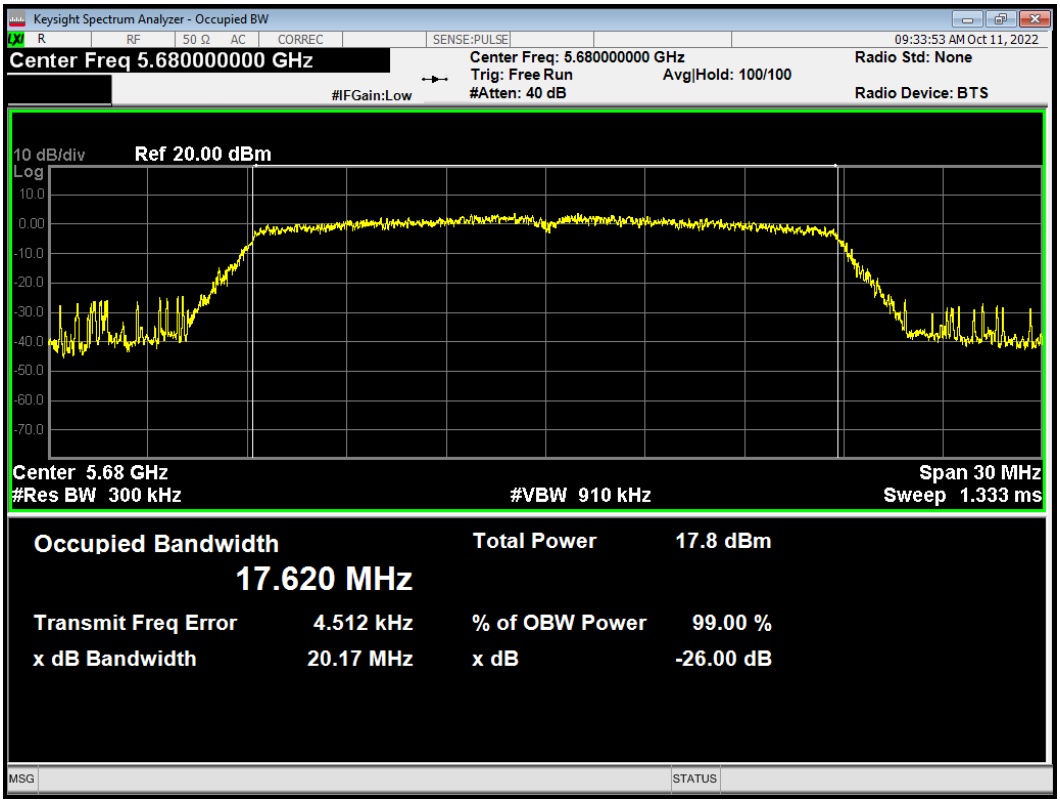
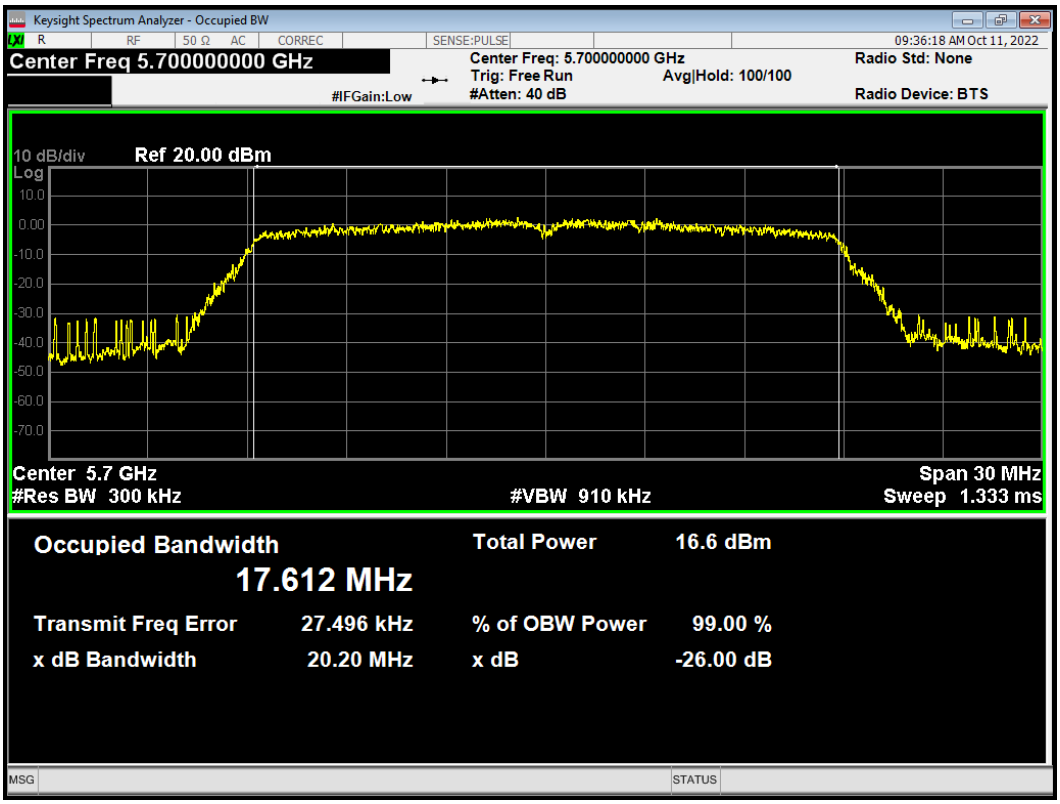
OBW 802.11n (HT20) 5680MHz



OBW 802.11n (HT20) 5700MHz



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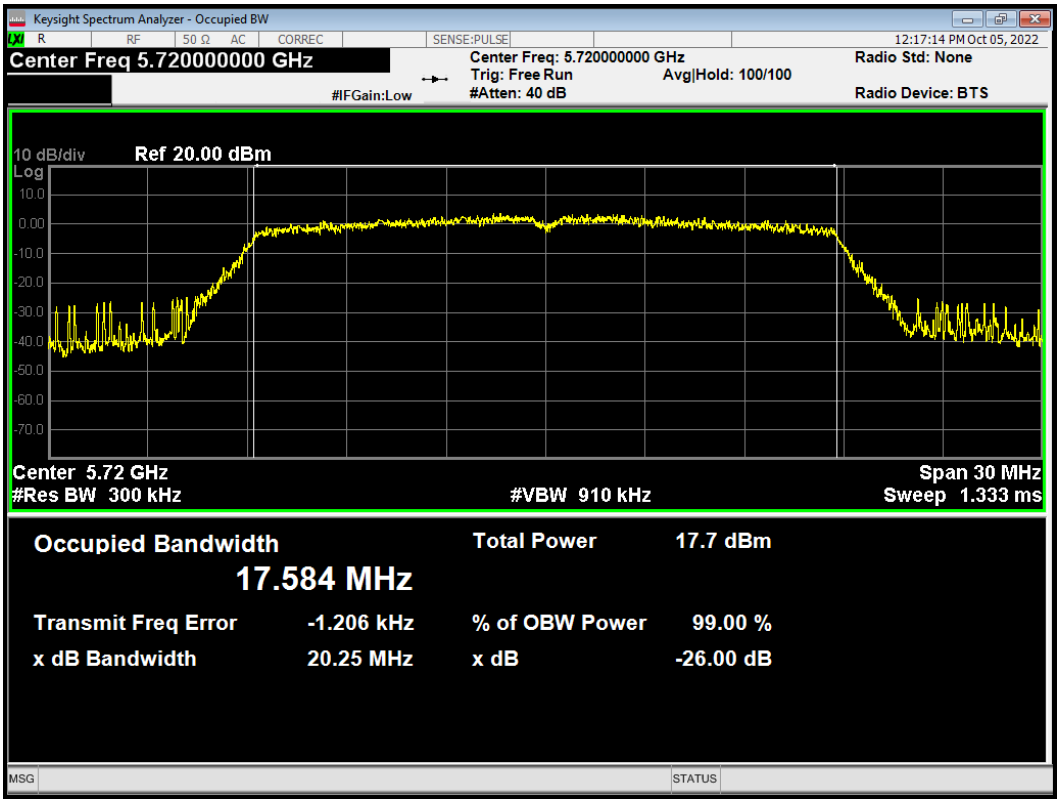
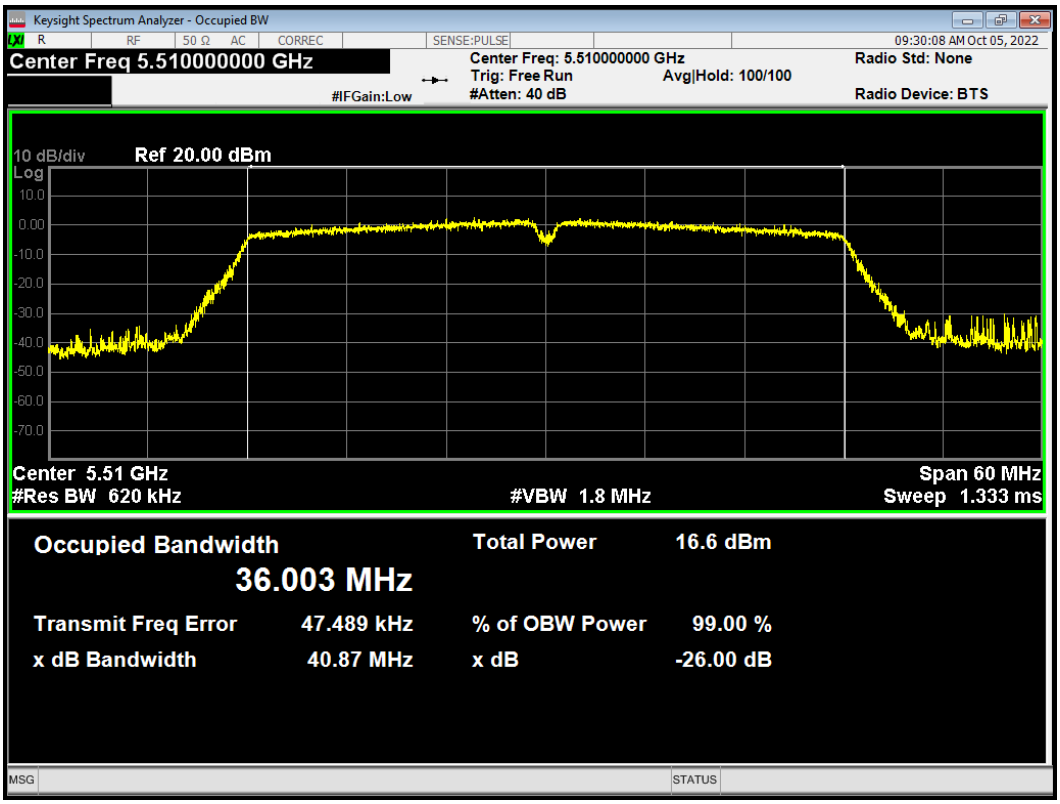
OBW 802.11n (HT20) 5720MHz



OBW 802.11n (HT40) 5510MHz



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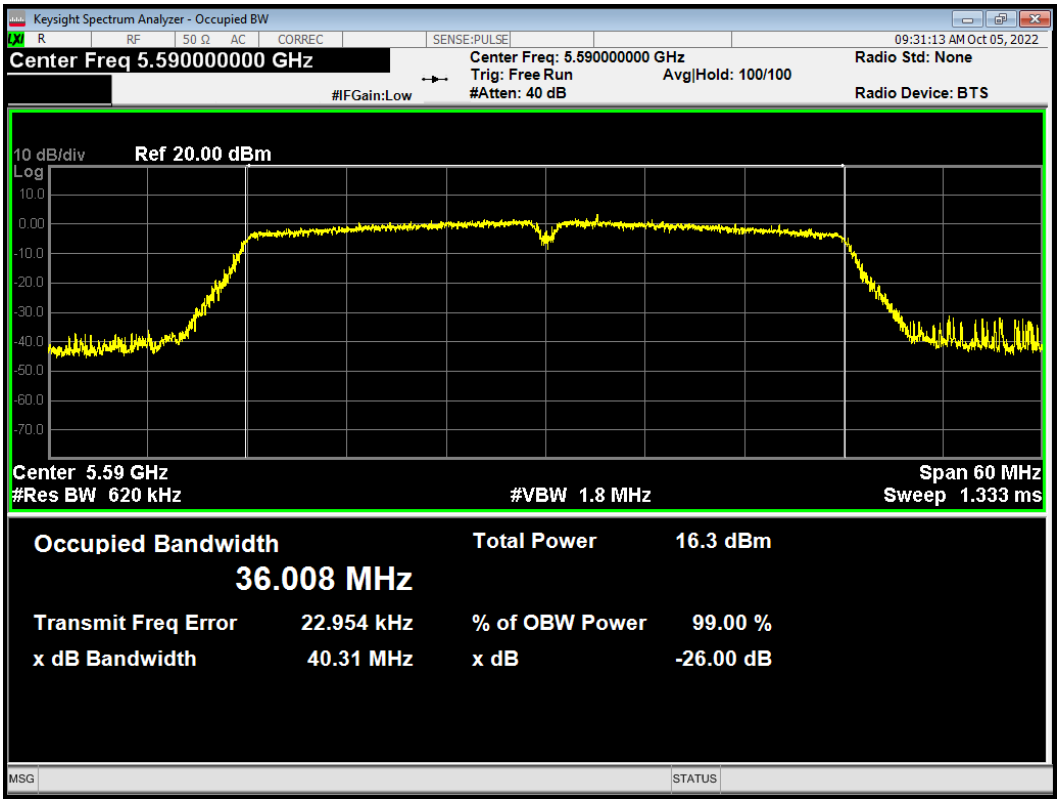
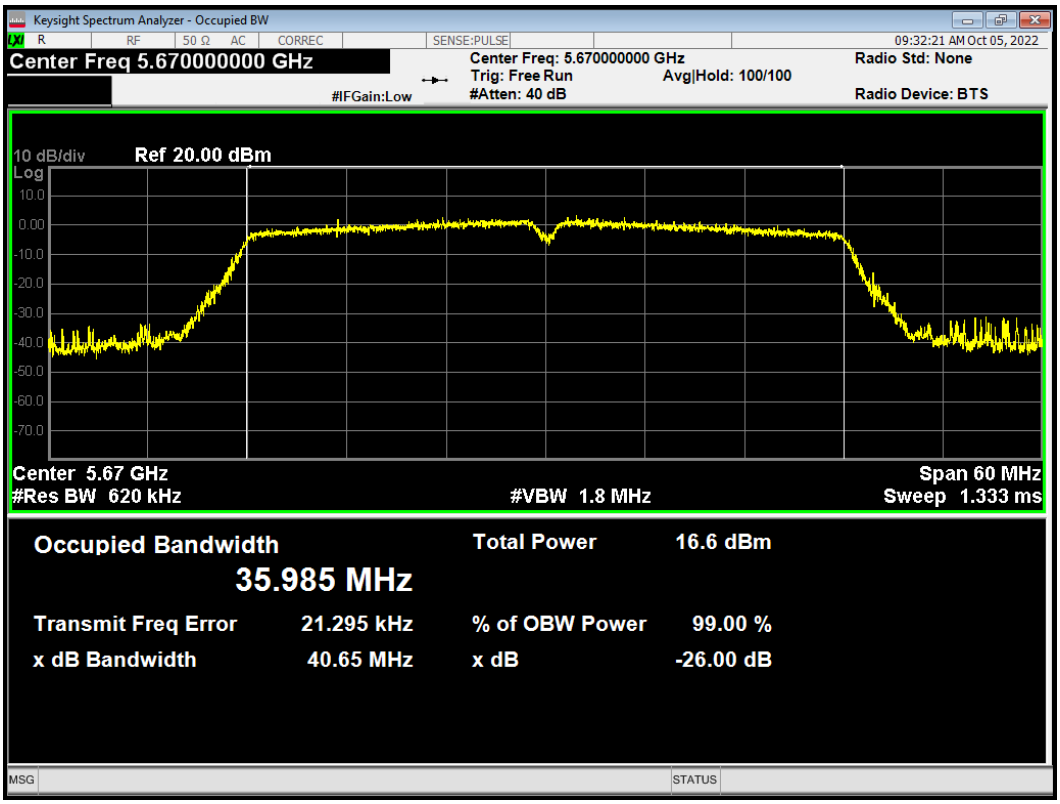
OBW 802.11n (HT40) 5590MHz



OBW 802.11n (HT40) 5670MHz



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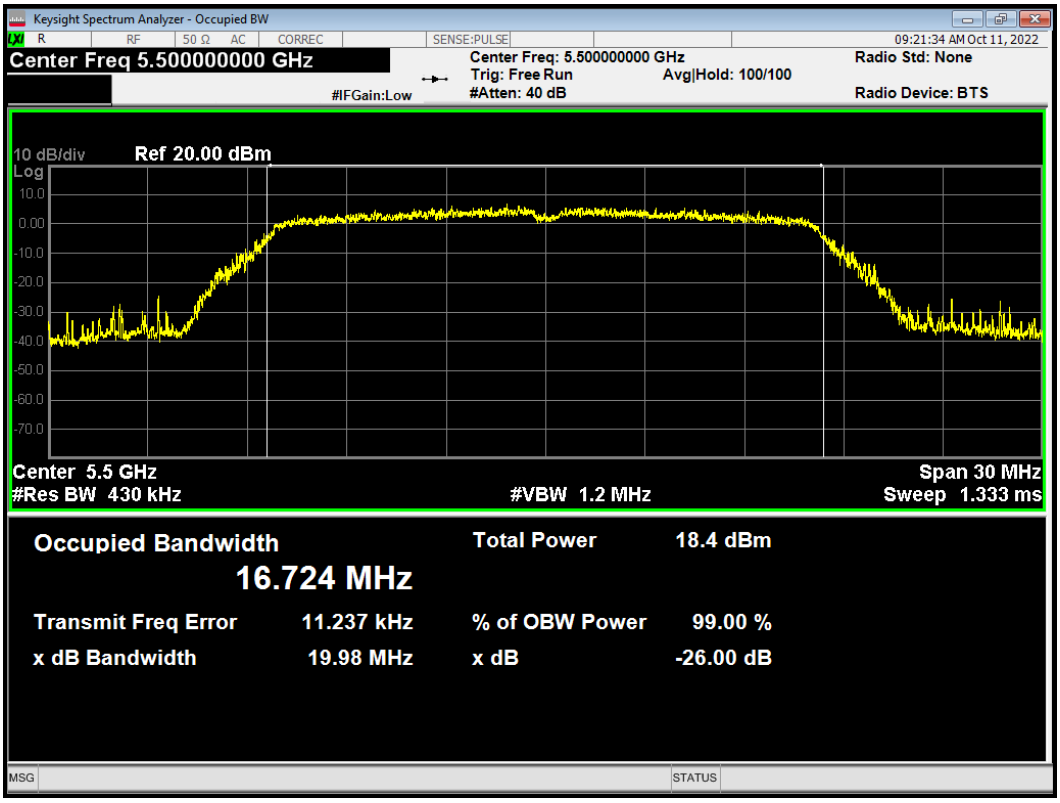
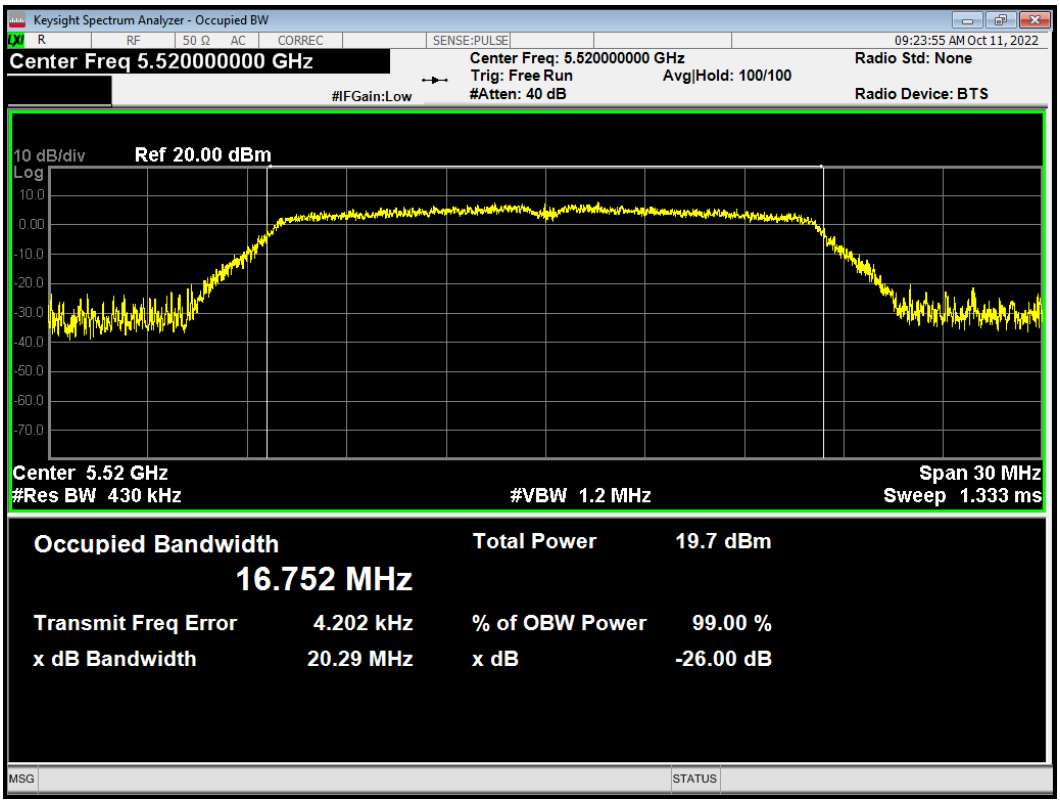
Minimum -26 dB bandwidth

-26dB Bandwidth 802.11a 5500MHz



-26dB Bandwidth 802.11a 5520MHz



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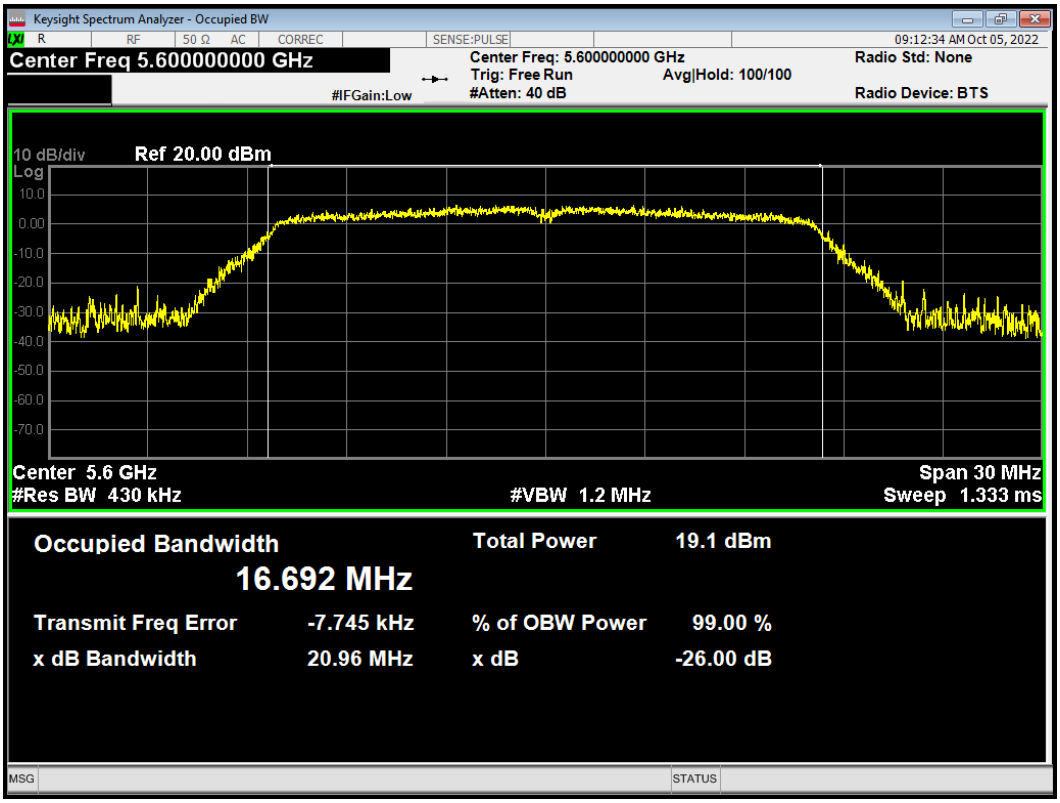
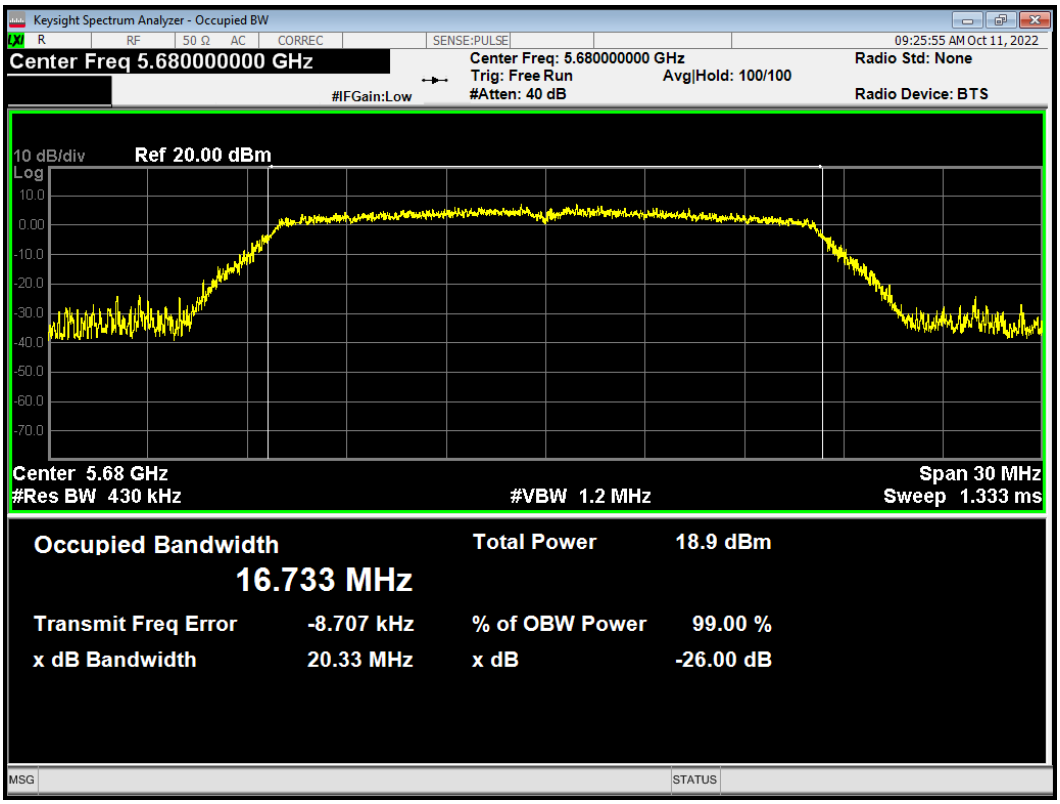
-26dB Bandwidth 802.11a 5600MHz



-26dB Bandwidth 802.11a 5680MHz



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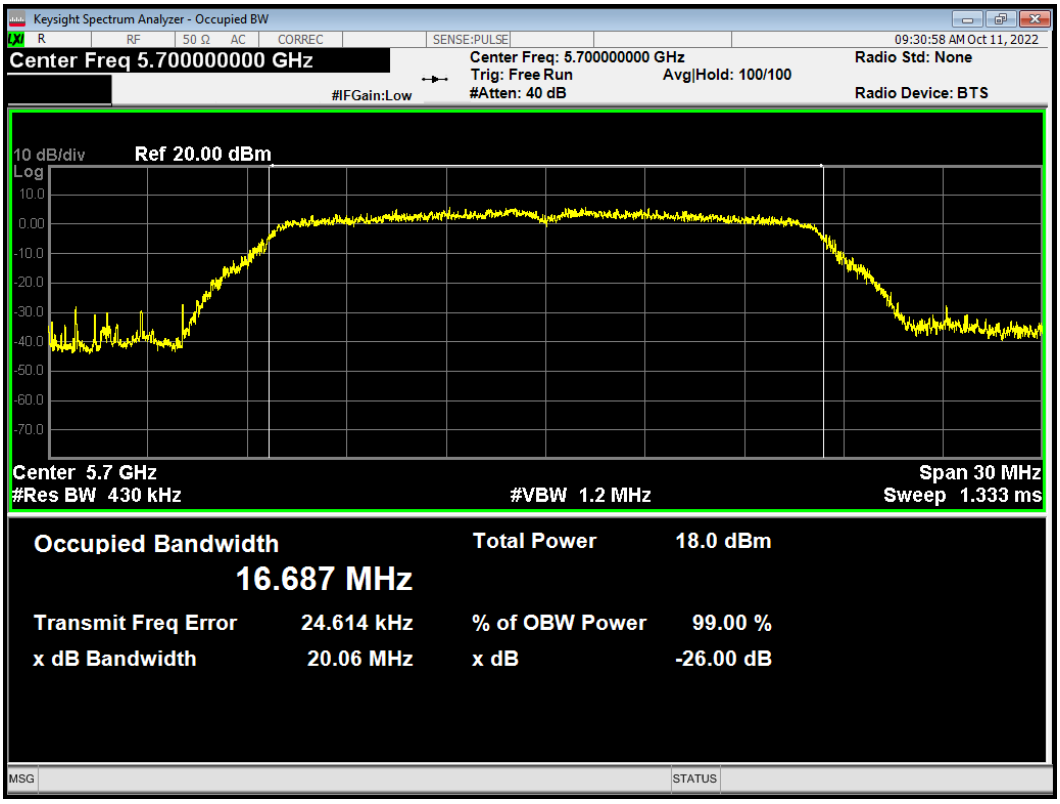
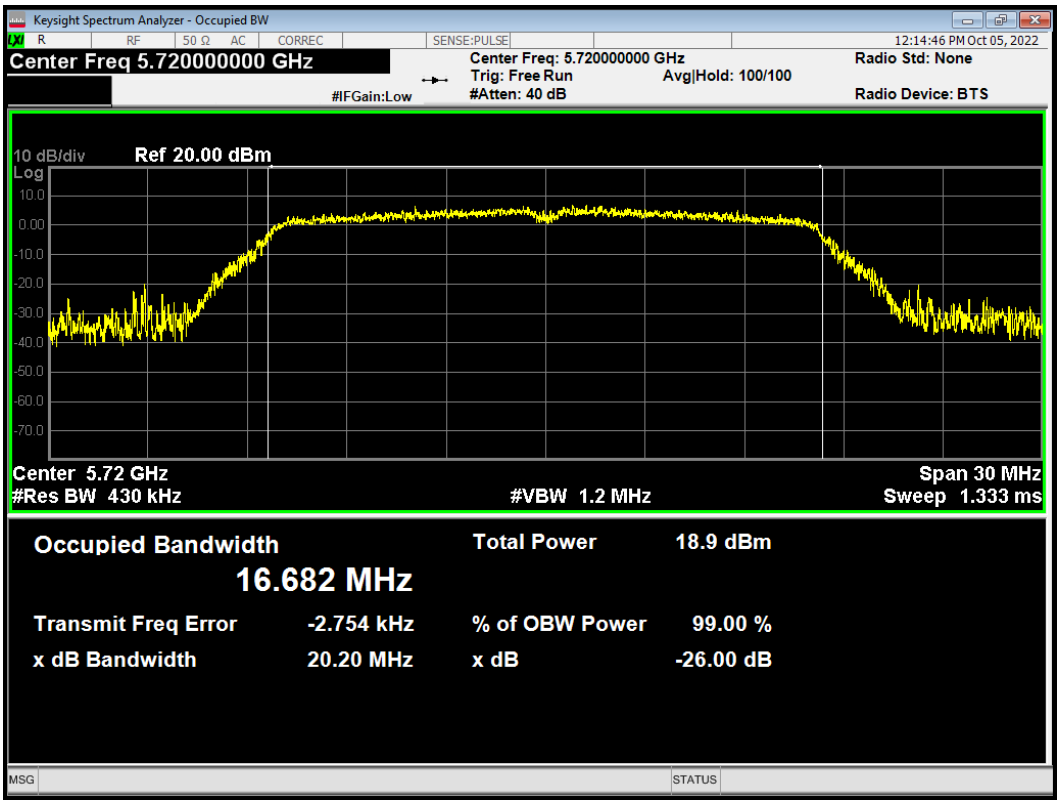
-26dB Bandwidth 802.11a 5700MHz



-26dB Bandwidth 802.11a 5720MHz



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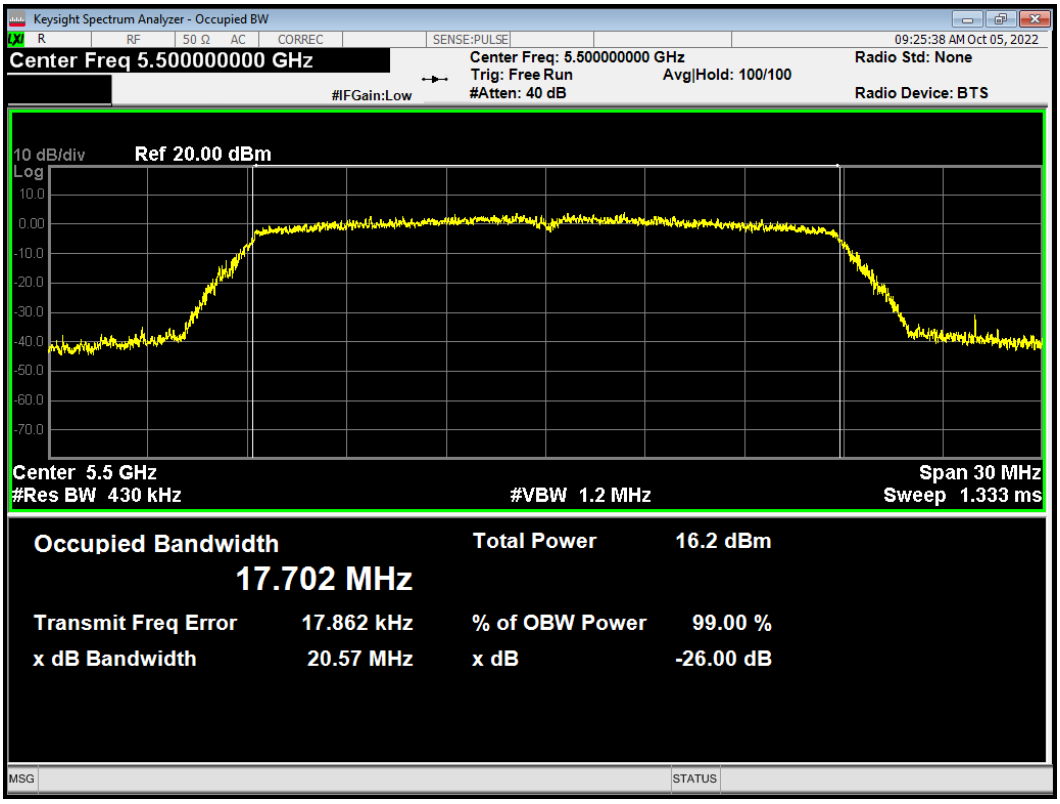
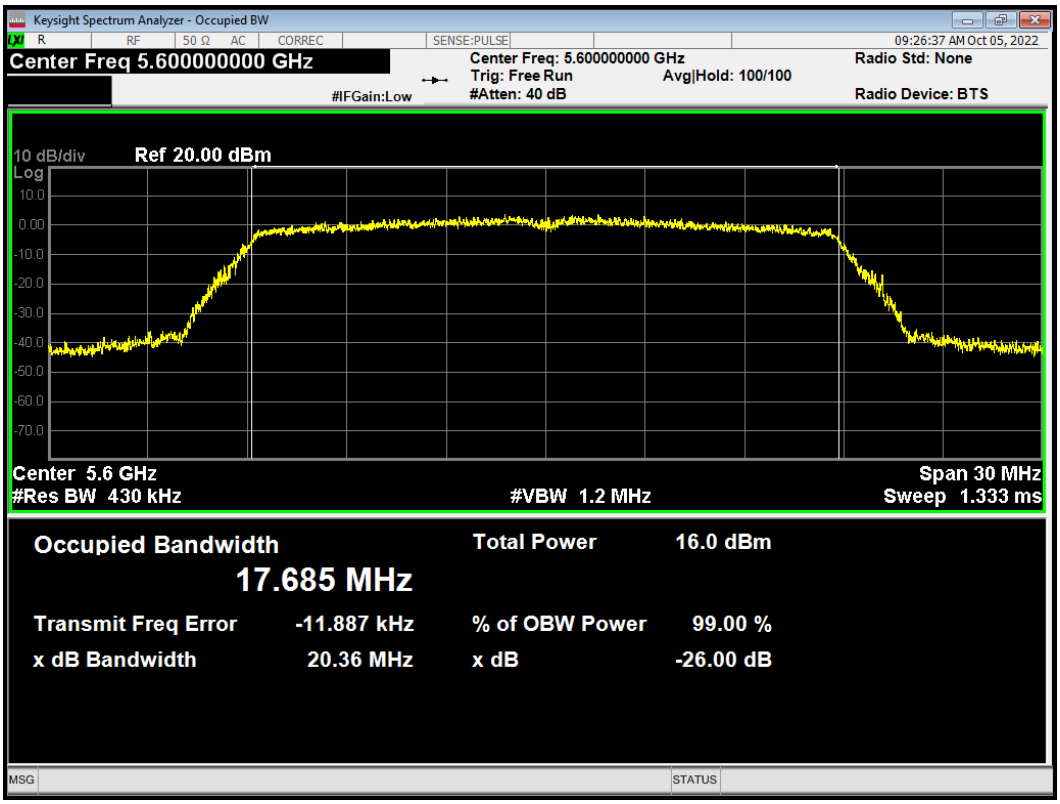
-26dB Bandwidth 802.11ac (VHT20) 5500MHz



-26dB Bandwidth 802.11ac (VHT20) 5600MHz



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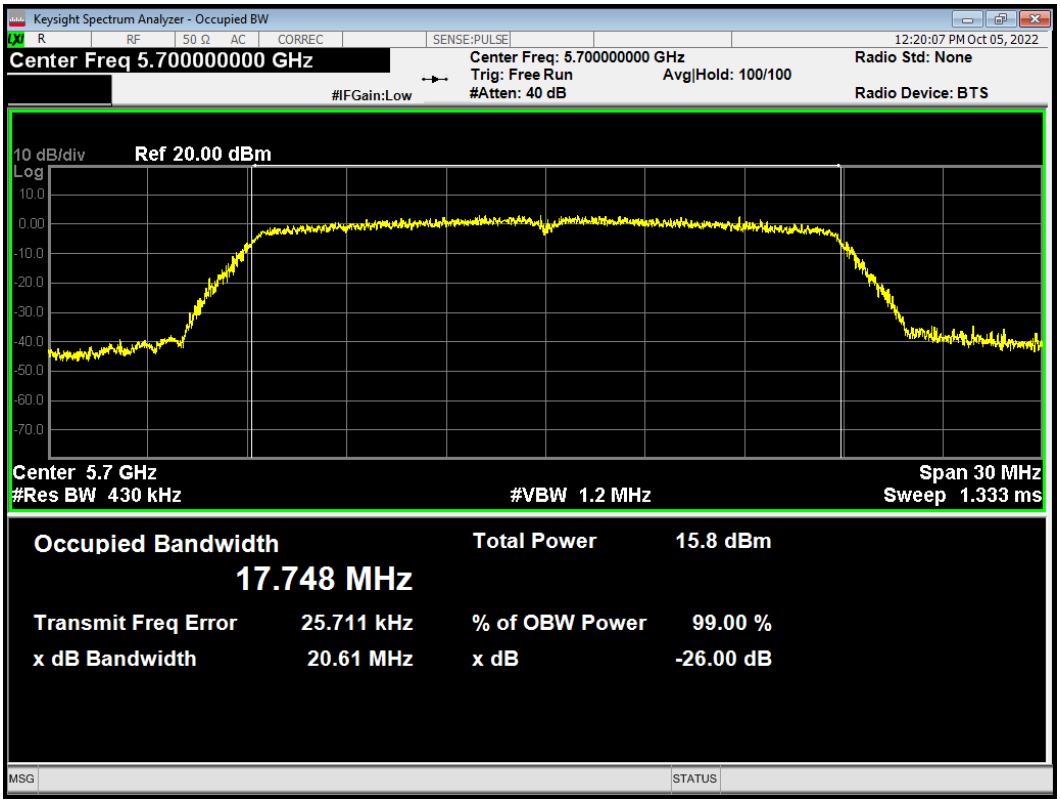
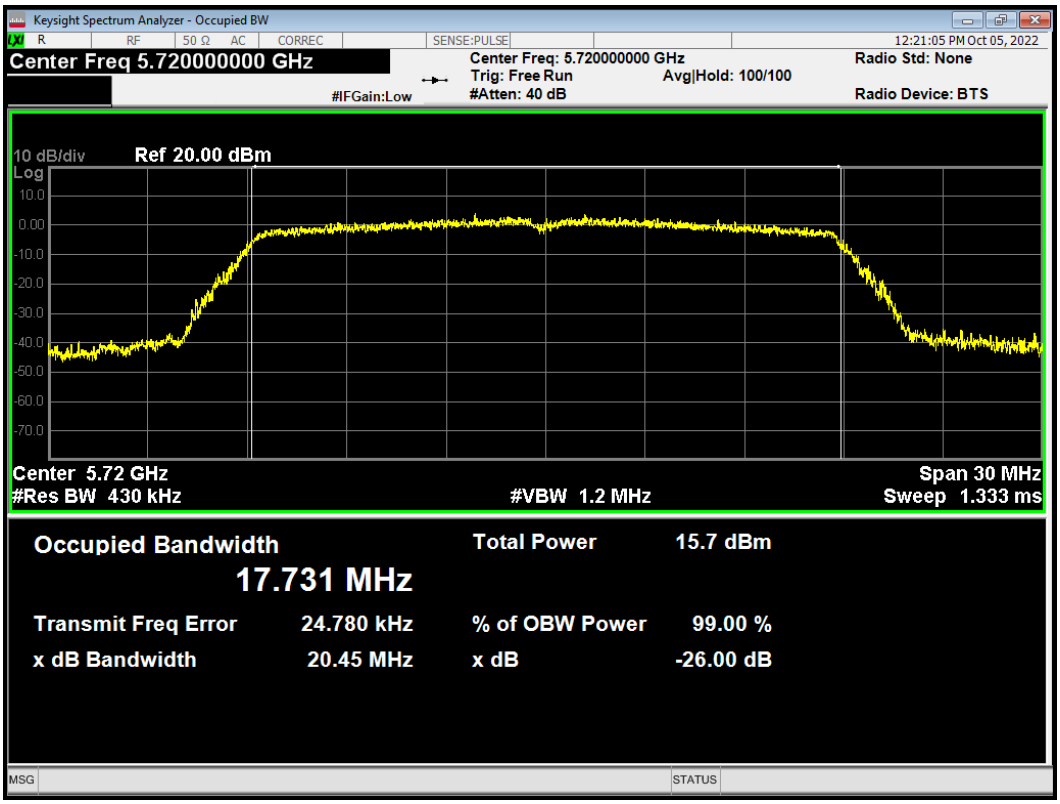
-26dB Bandwidth 802.11ac (VHT20) 5700MHz



-26dB Bandwidth 802.11ac (VHT20) 5720MHz



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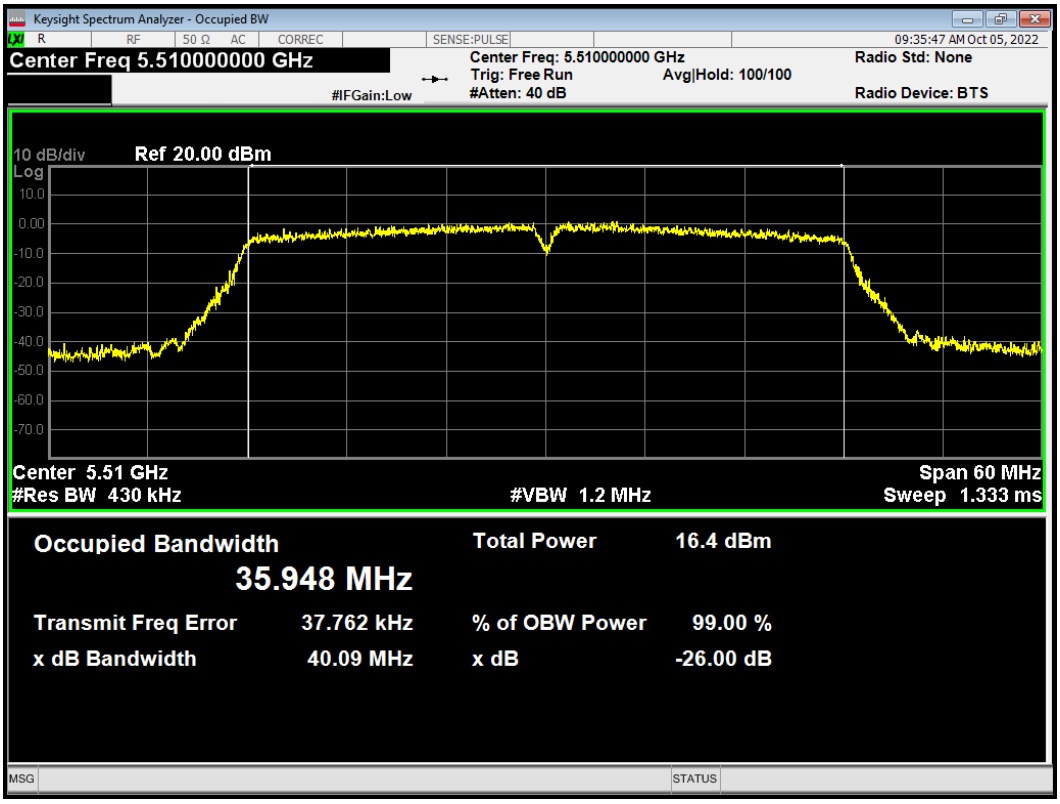
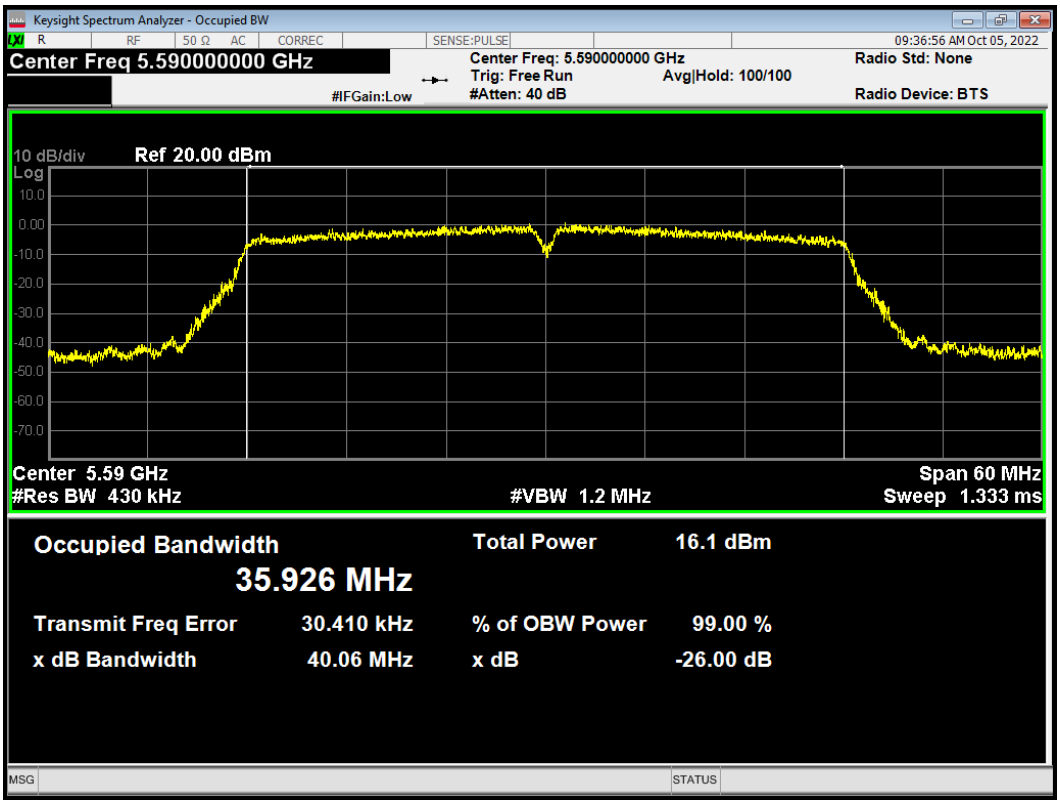
-26dB Bandwidth 802.11ac (VHT40) 5510MHz



-26dB Bandwidth 802.11ac (VHT40) 5590MHz



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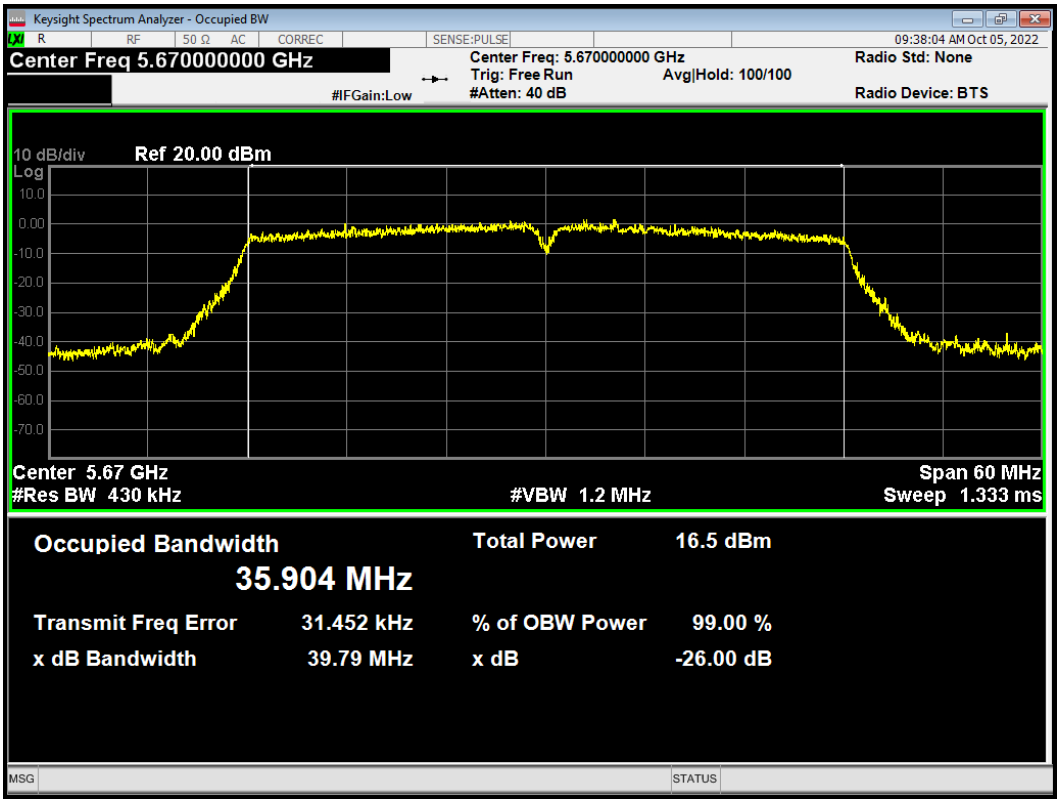
-26dB Bandwidth 802.11ac (VHT40) 5670MHz



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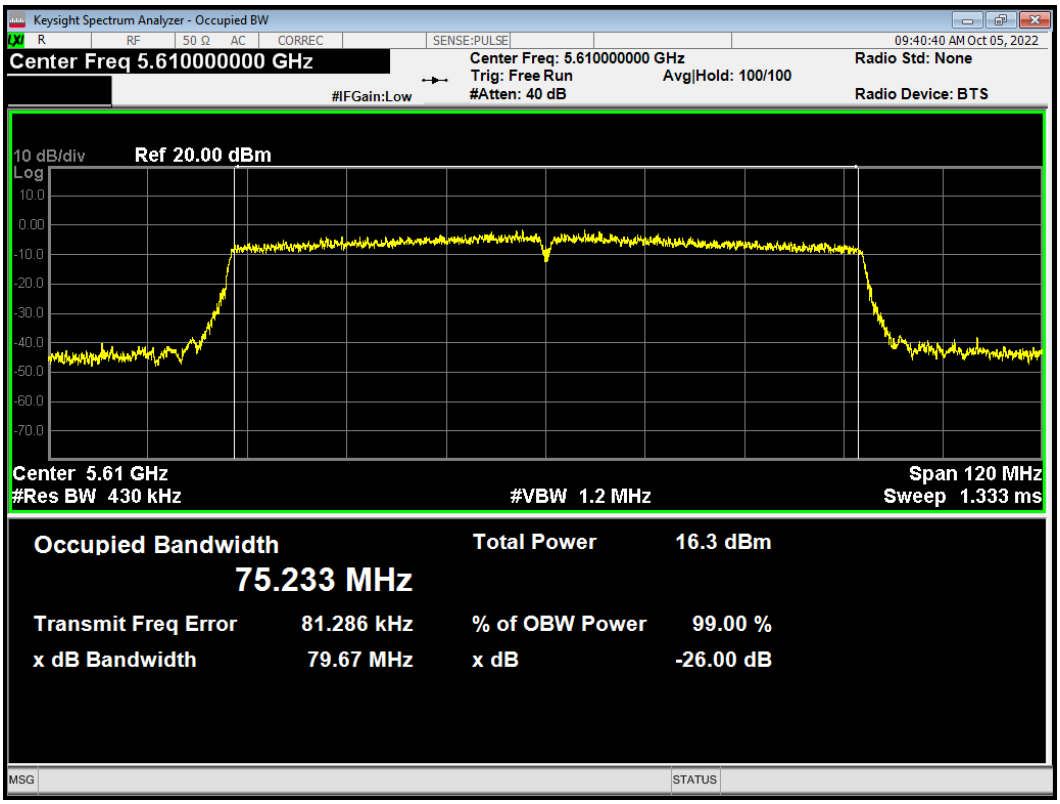

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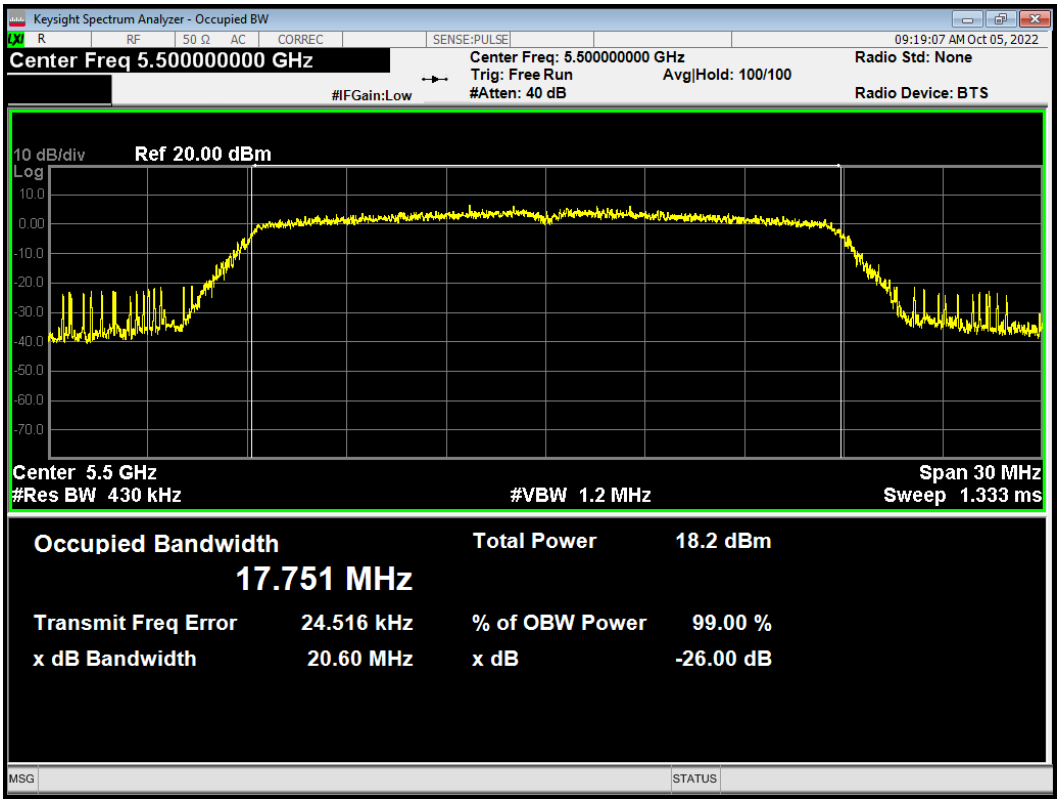
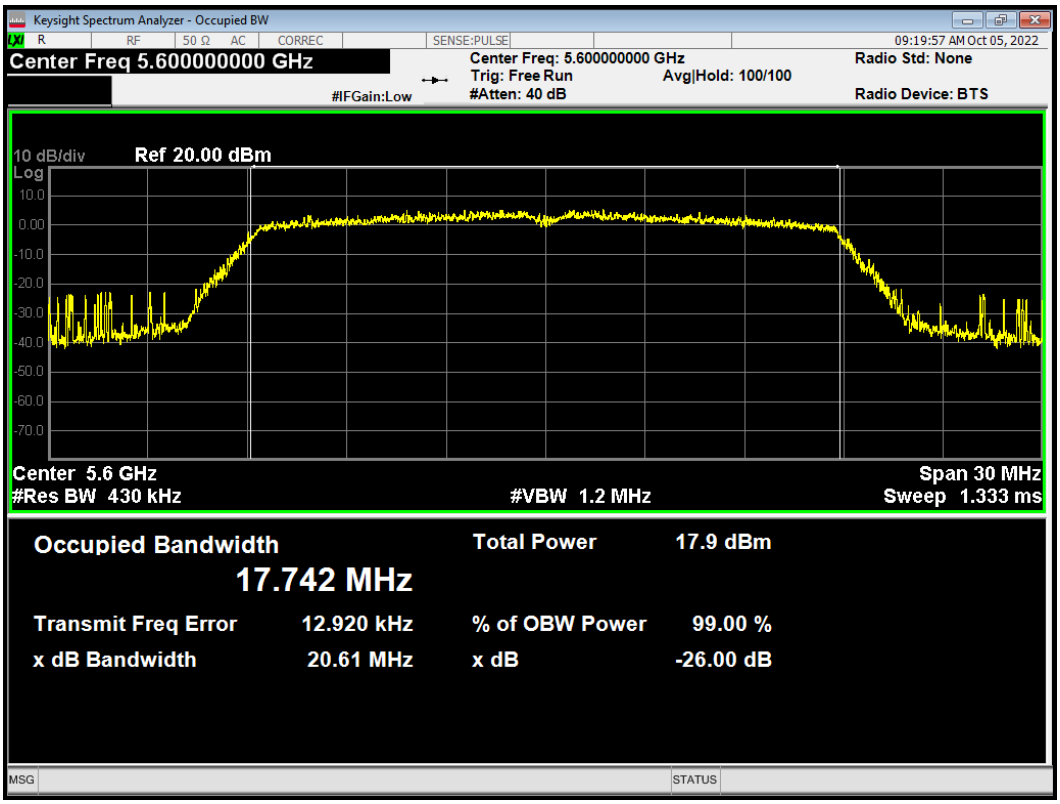
-26dB Bandwidth 802.11n (HT20) 5500MHz



-26dB Bandwidth 802.11n (HT20) 5600MHz



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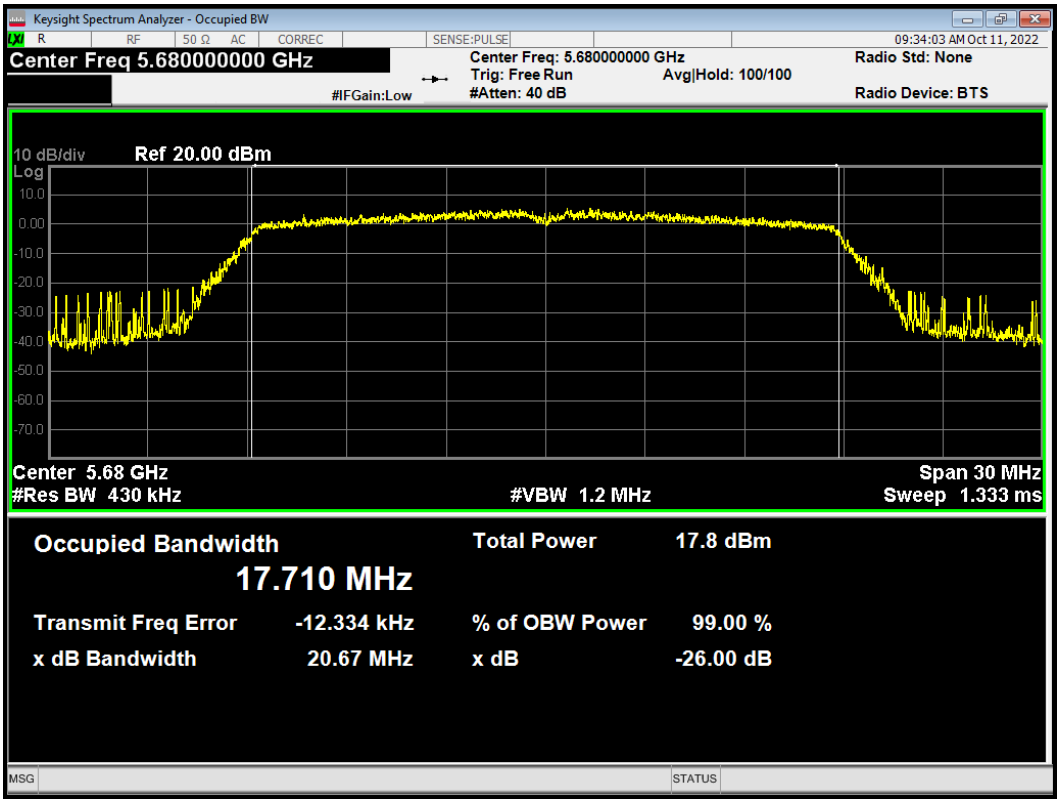
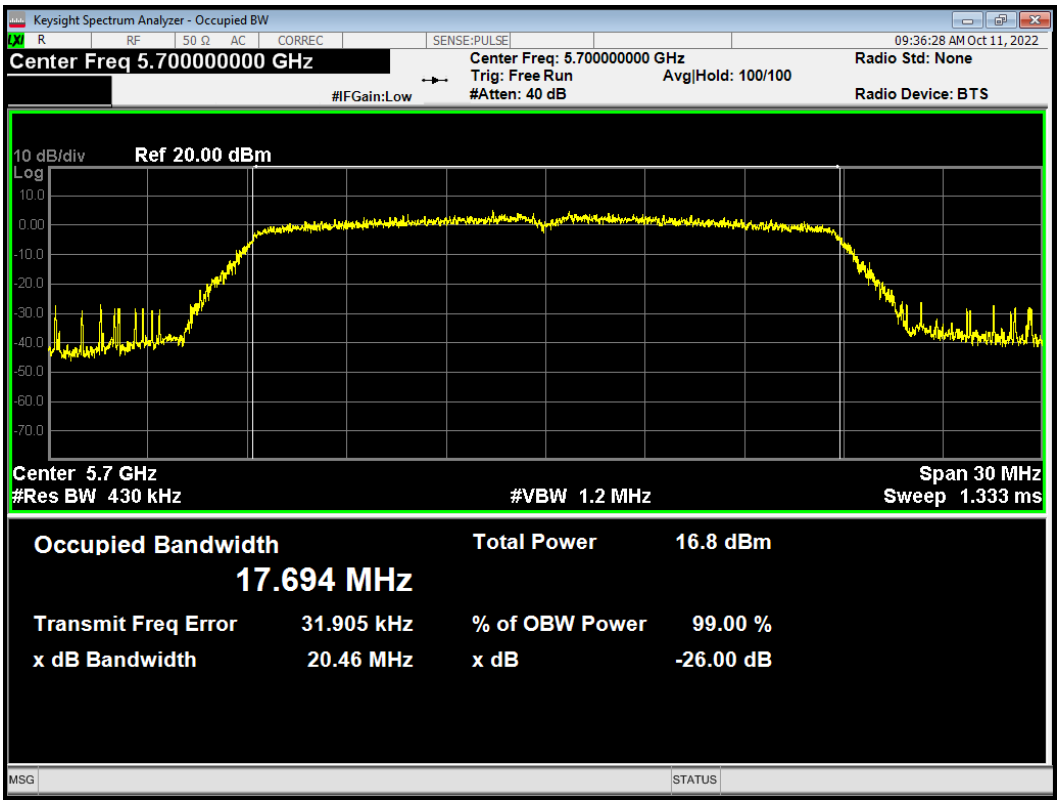
-26dB Bandwidth 802.11n (HT20) 5680MHz



-26dB Bandwidth 802.11n (HT20) 5700MHz



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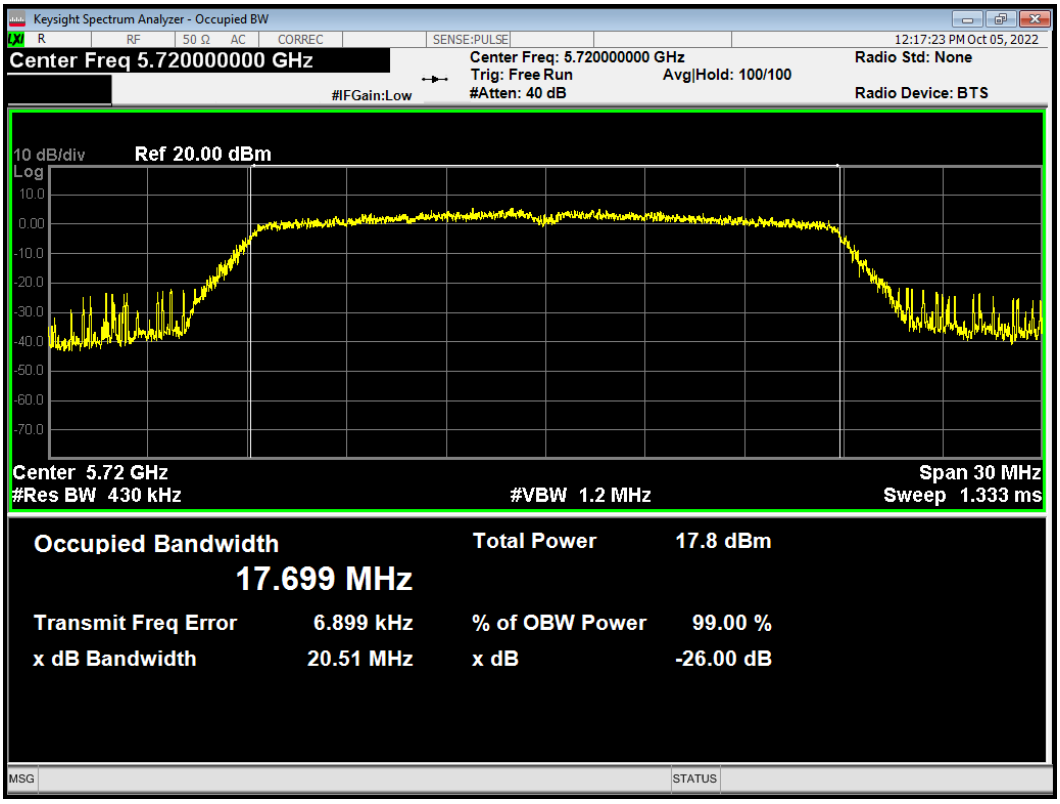
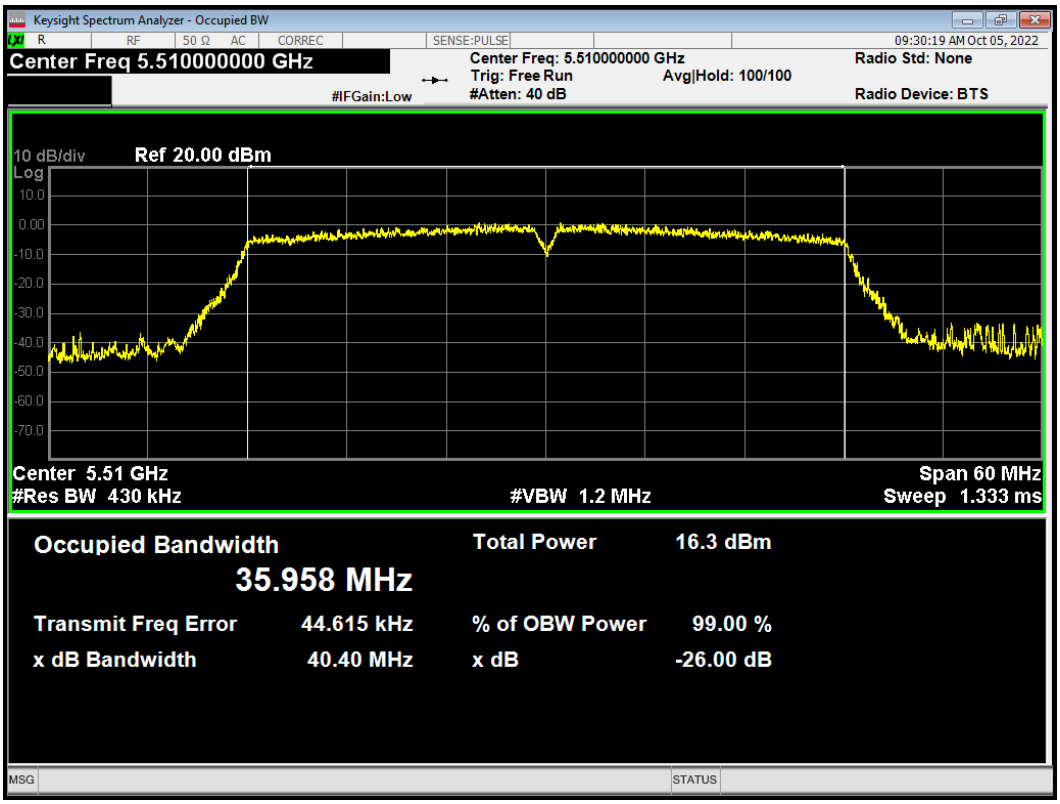
-26dB Bandwidth 802.11n (HT20) 5720MHz



-26dB Bandwidth 802.11n (HT40) 5510MHz



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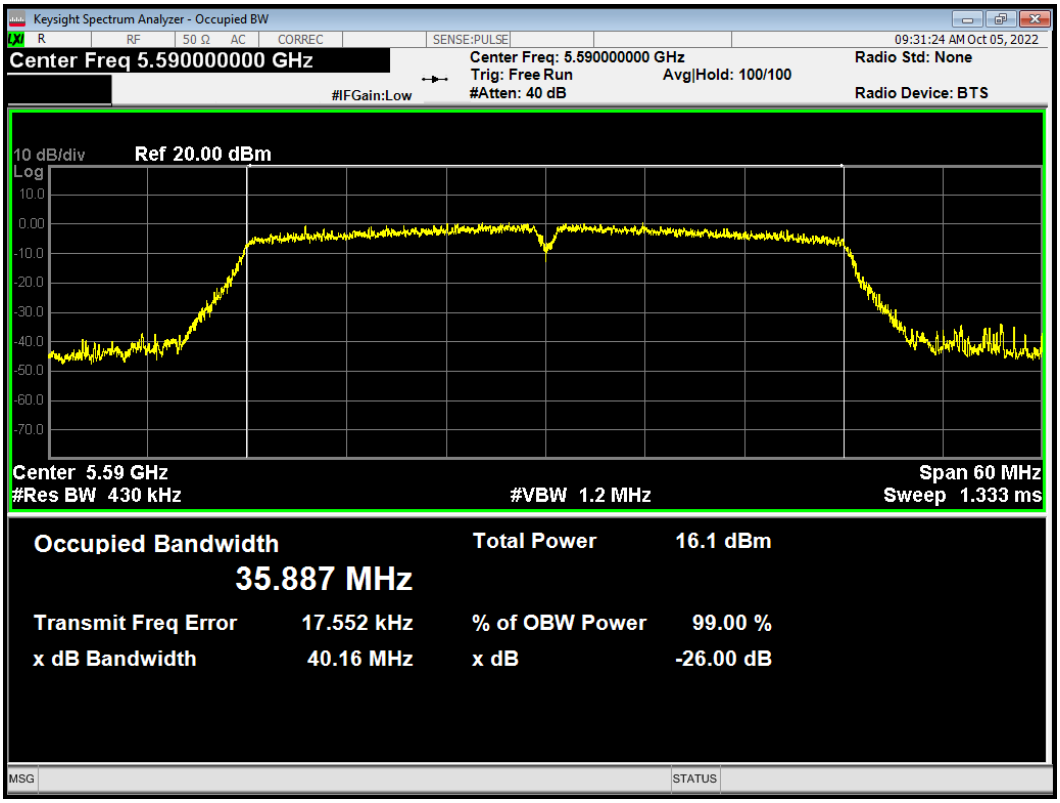
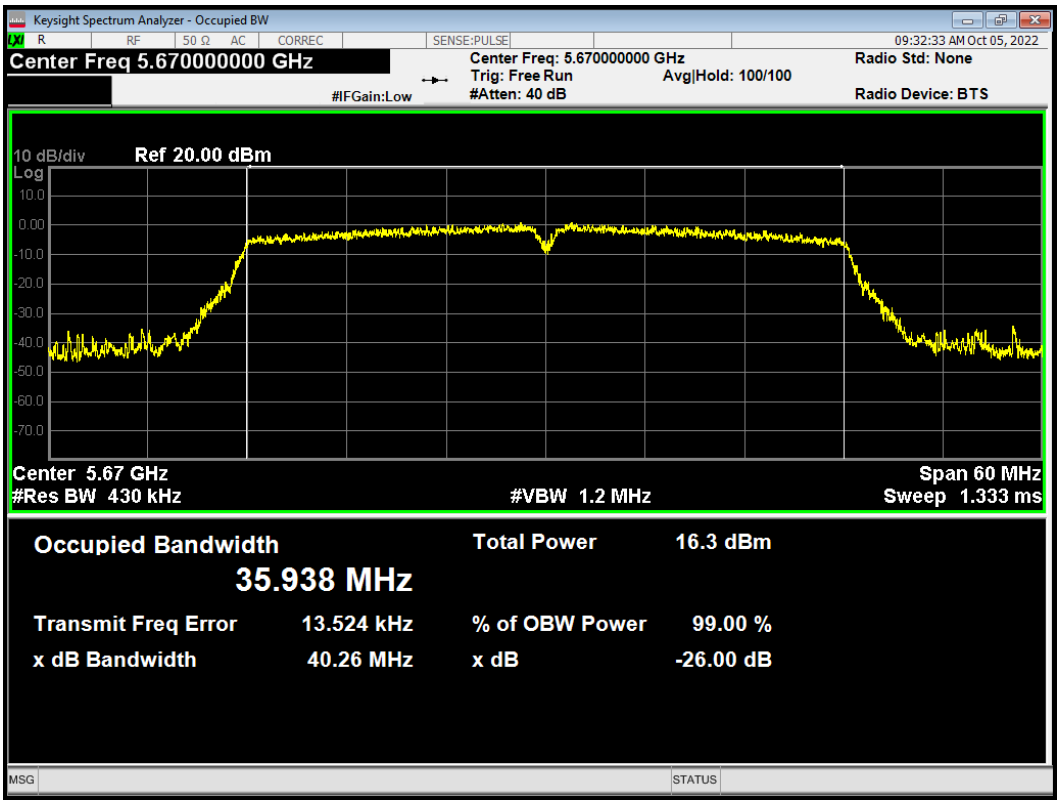
-26dB Bandwidth 802.11n (HT40) 5590MHz



-26dB Bandwidth 802.11n (HT40) 5670MHz



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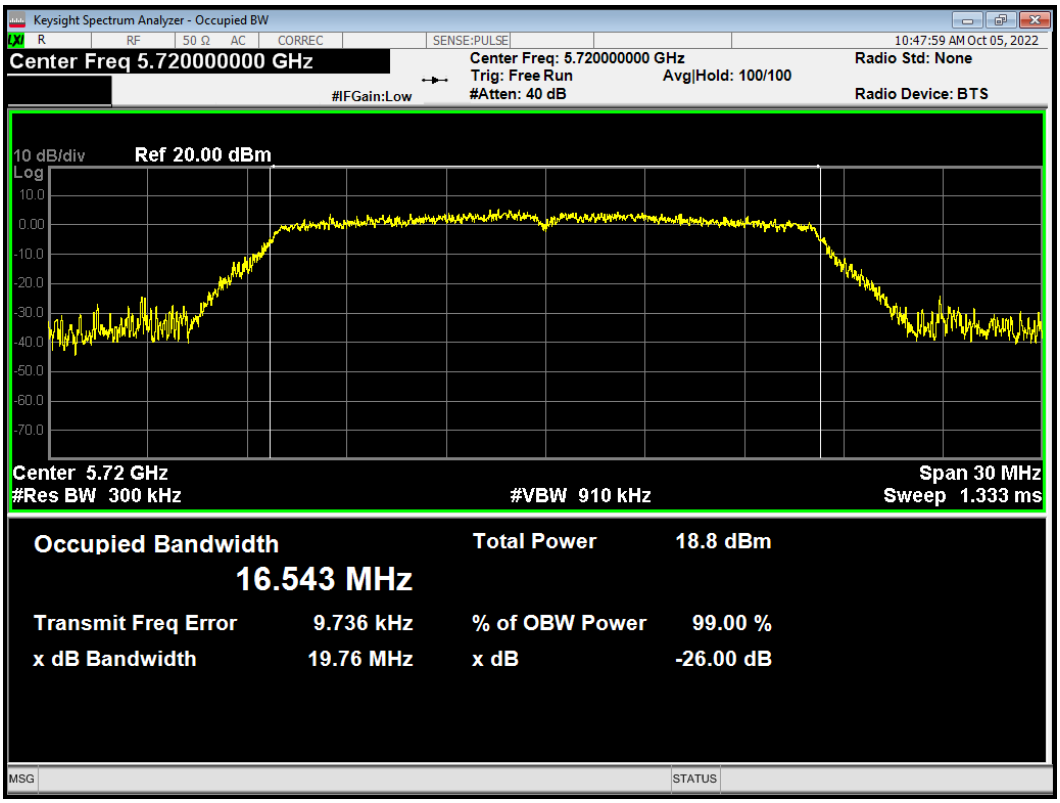
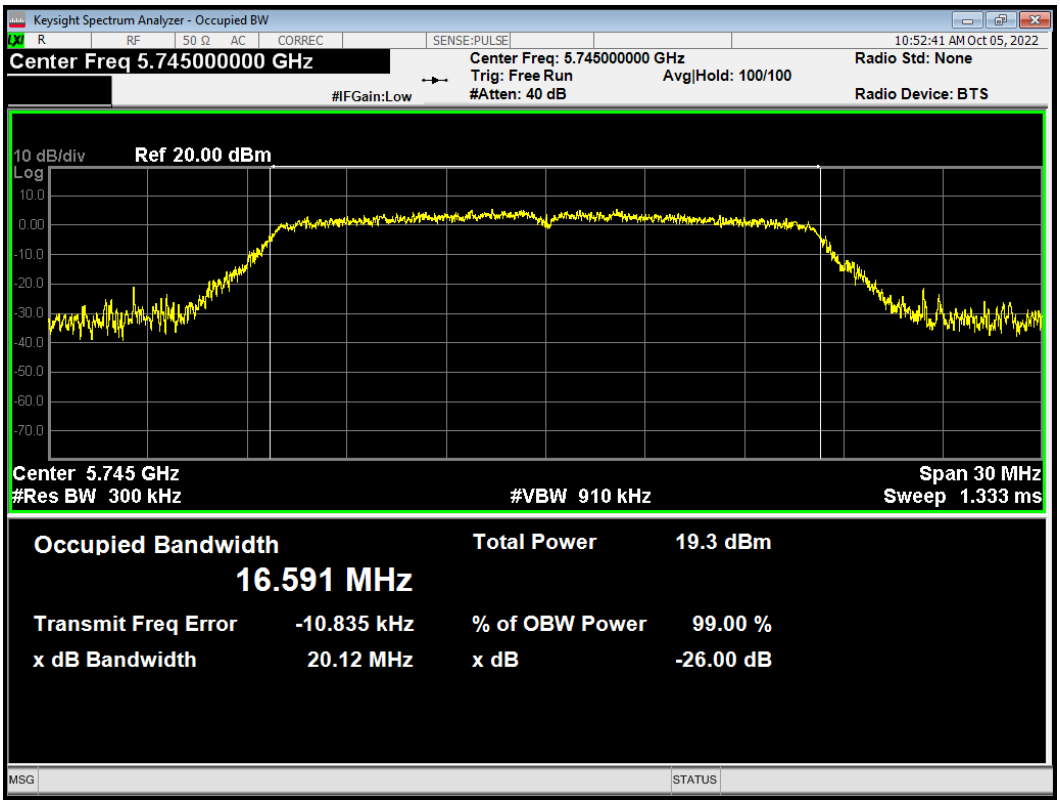
U-NII-3

99% bandwidth

OBW 802.11a 5720MHz



OBW 802.11a 5745MHz



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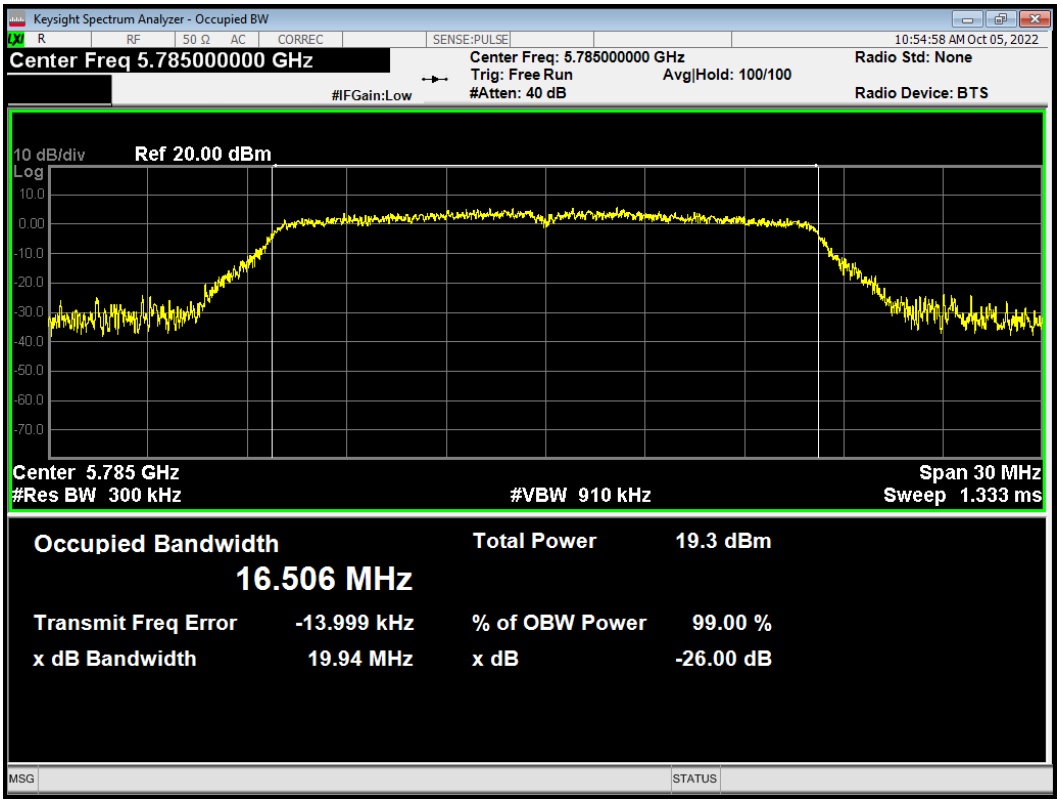
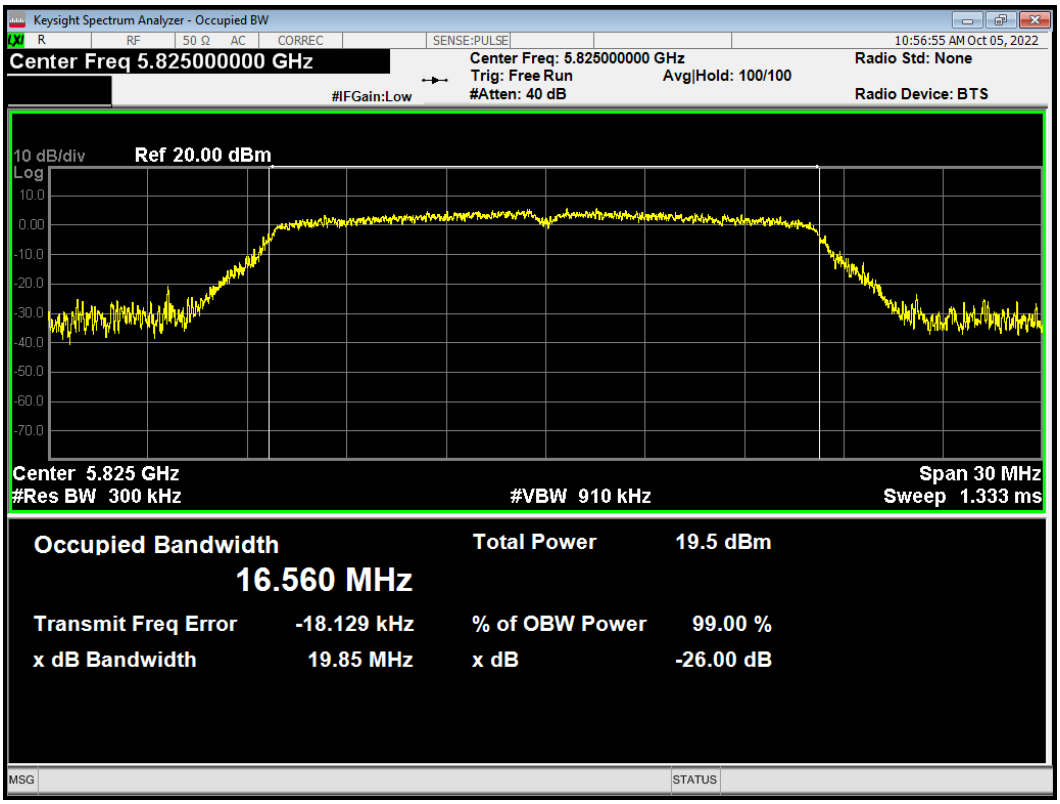
OBW 802.11a 5785MHz



OBW 802.11a 5825MHz



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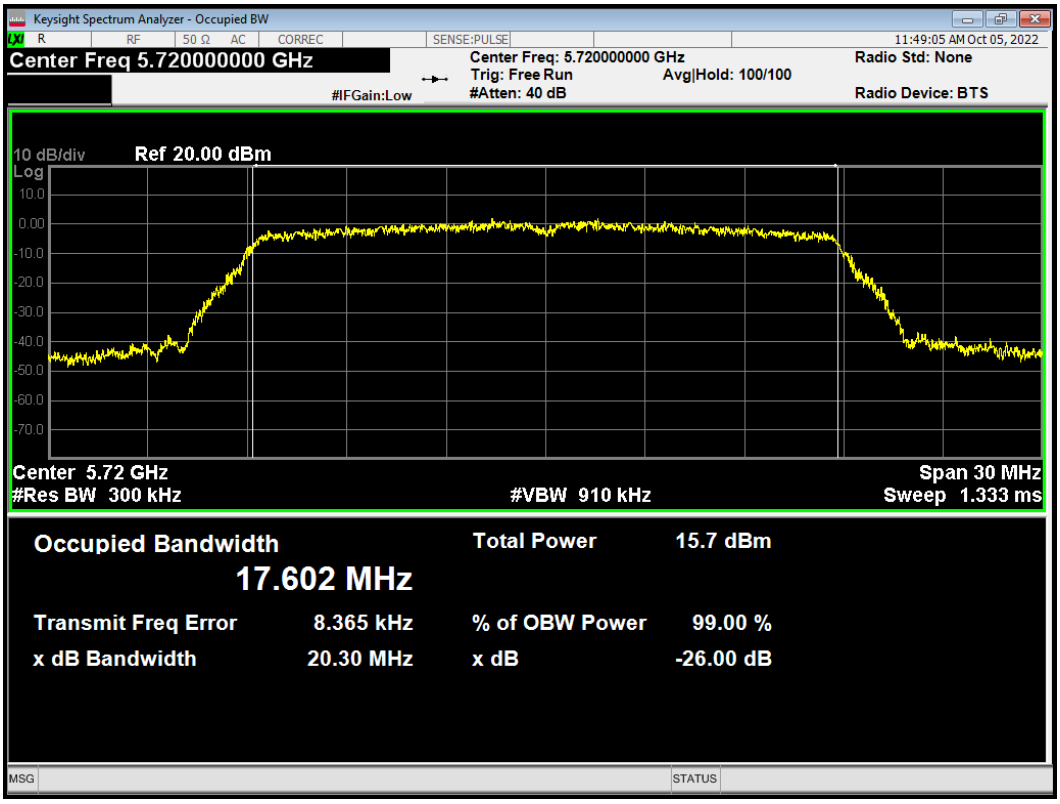
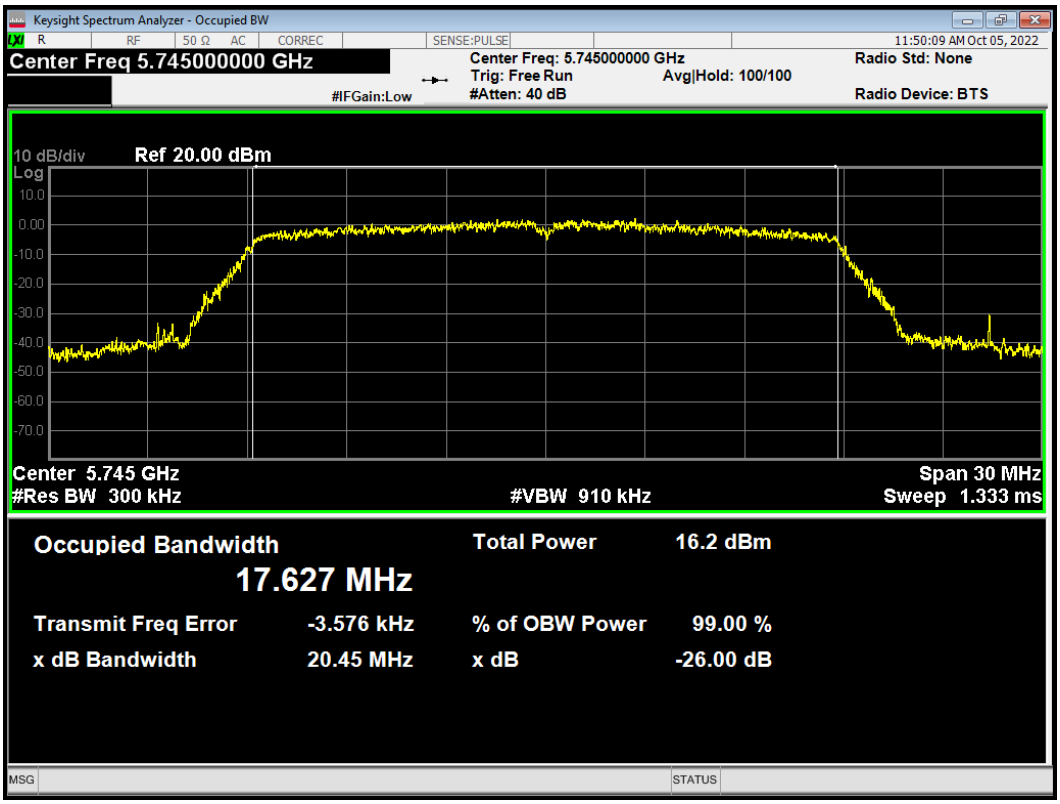
OBW 802.11ac (VHT20) 5720MHz



OBW 802.11ac (VHT20) 5745MHz



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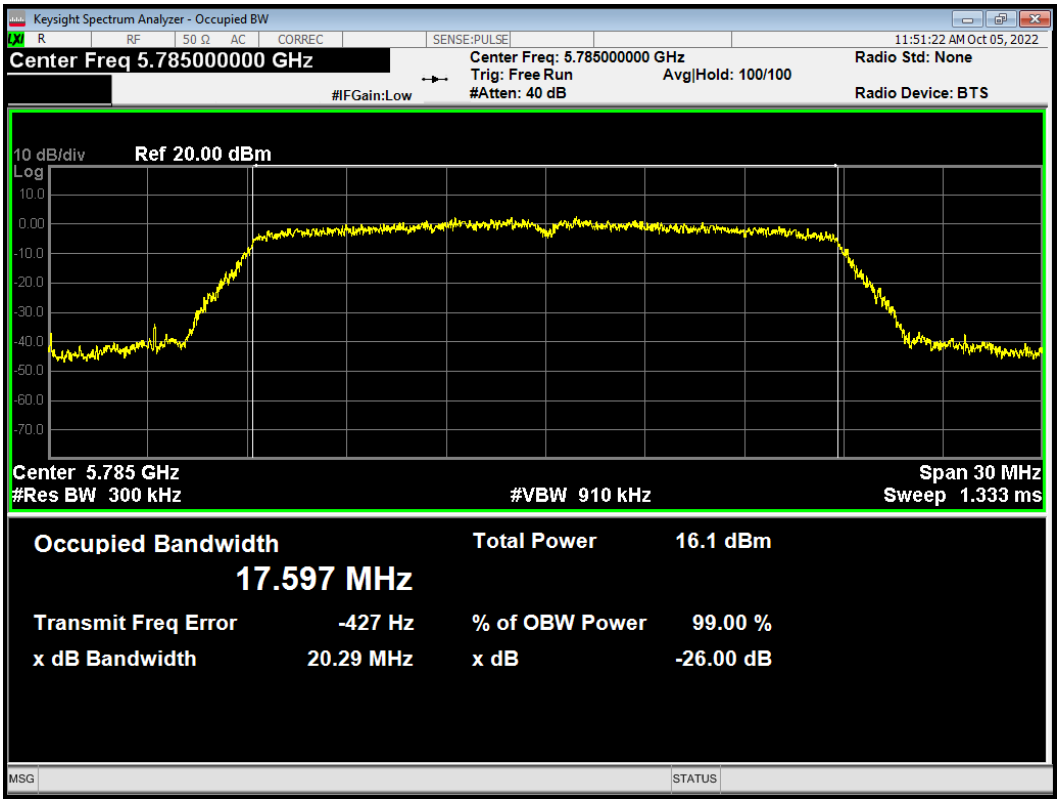
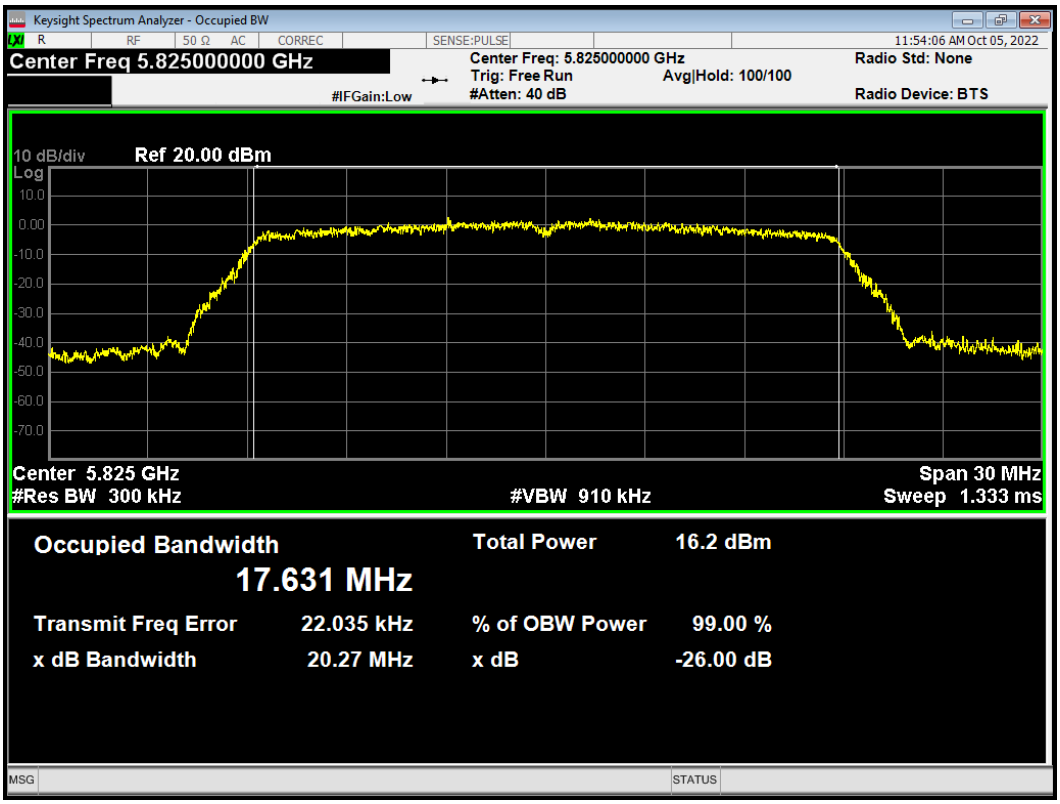
OBW 802.11ac (VHT20) 5785MHz



OBW 802.11ac (VHT20) 5825MHz



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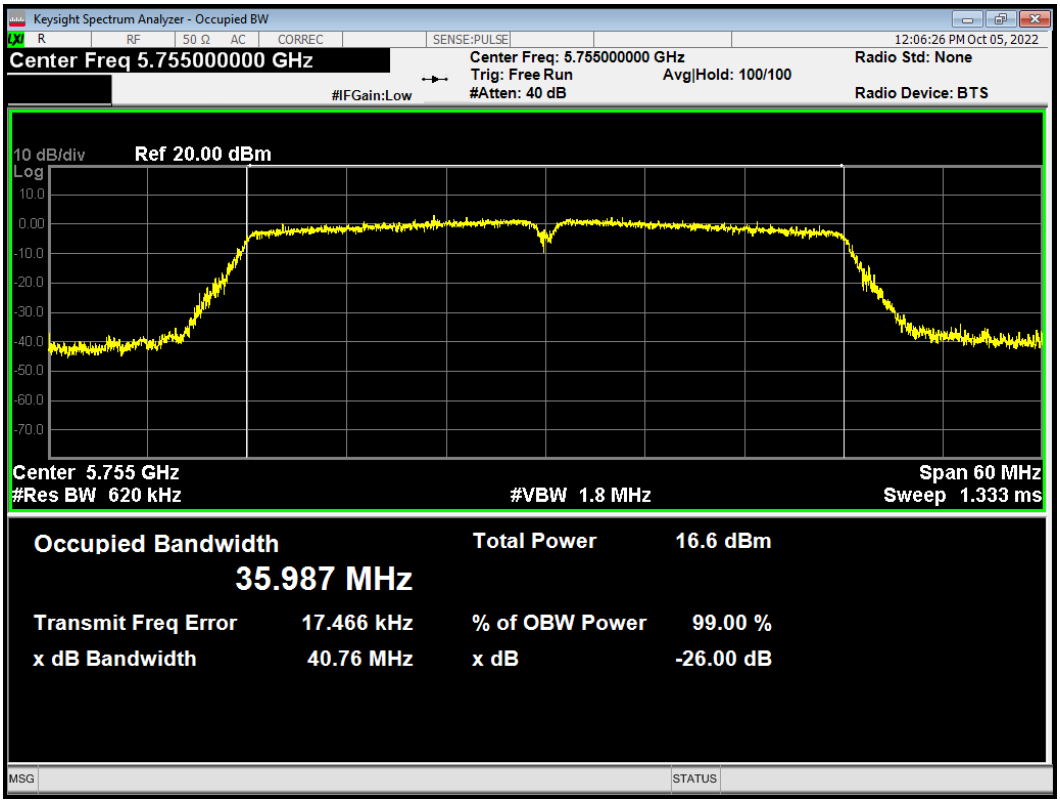
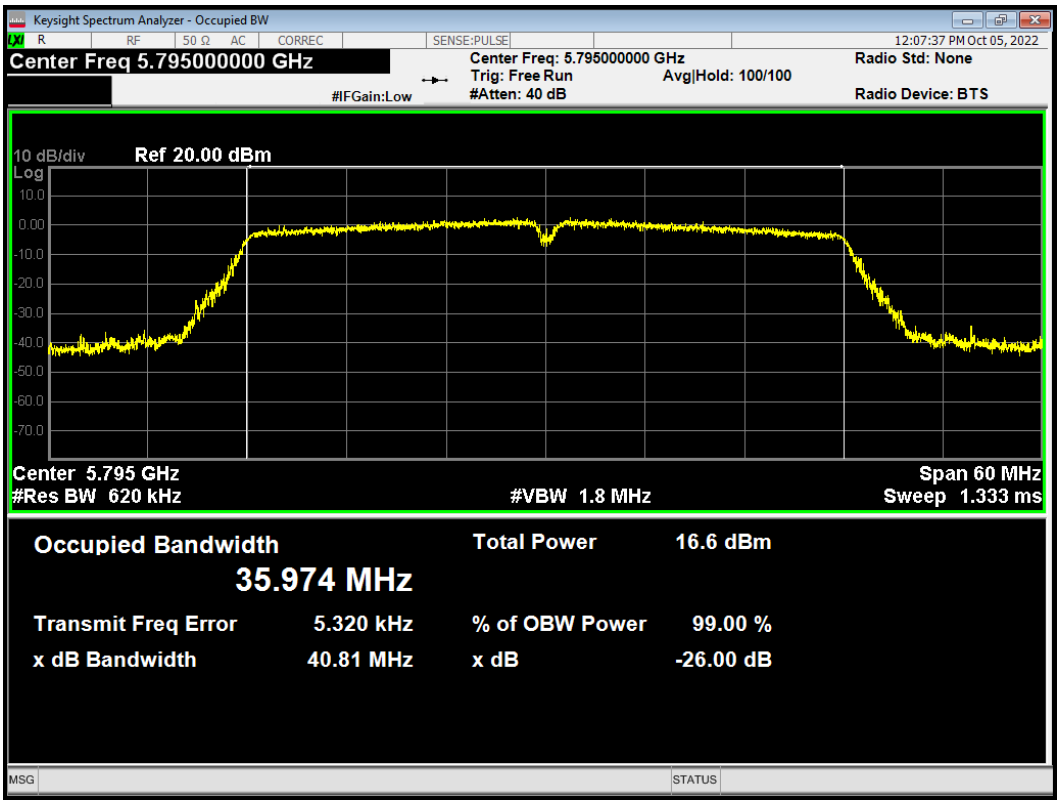
OBW 802.11ac (VHT40) 5755MHz



OBW 802.11ac (VHT40) 5795MHz



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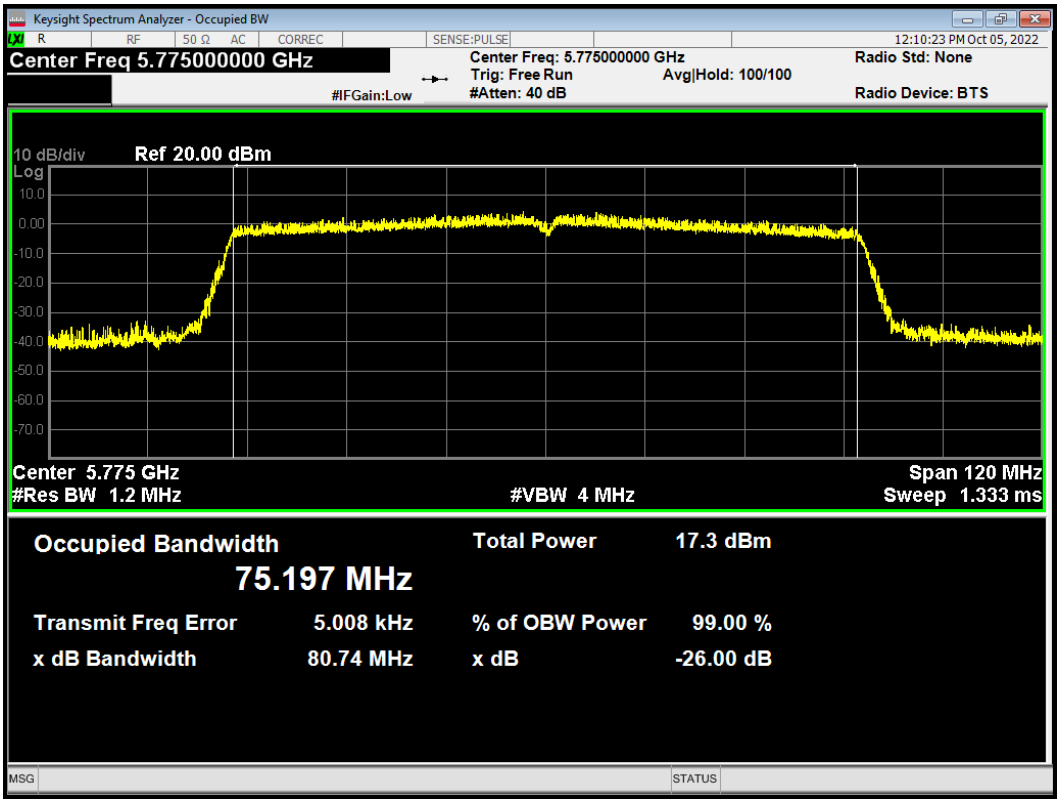
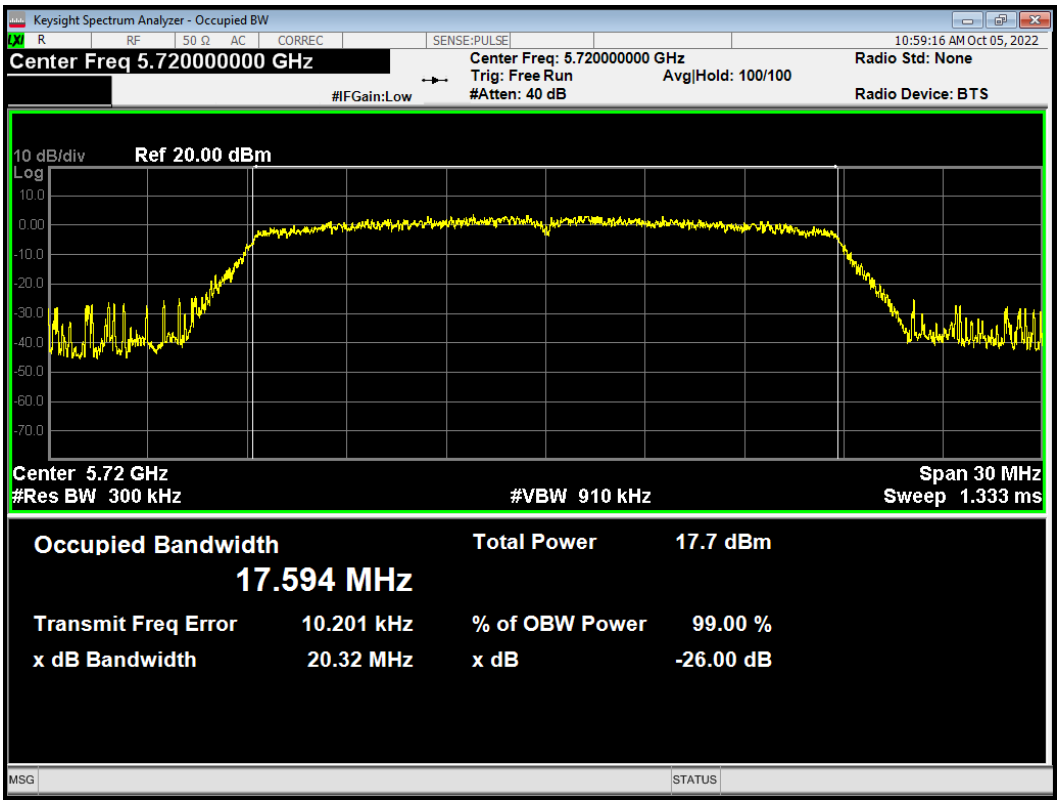
OBW 802.11ac (VHT80) 5775MHz



OBW 802.11n (HT20) 5720MHz



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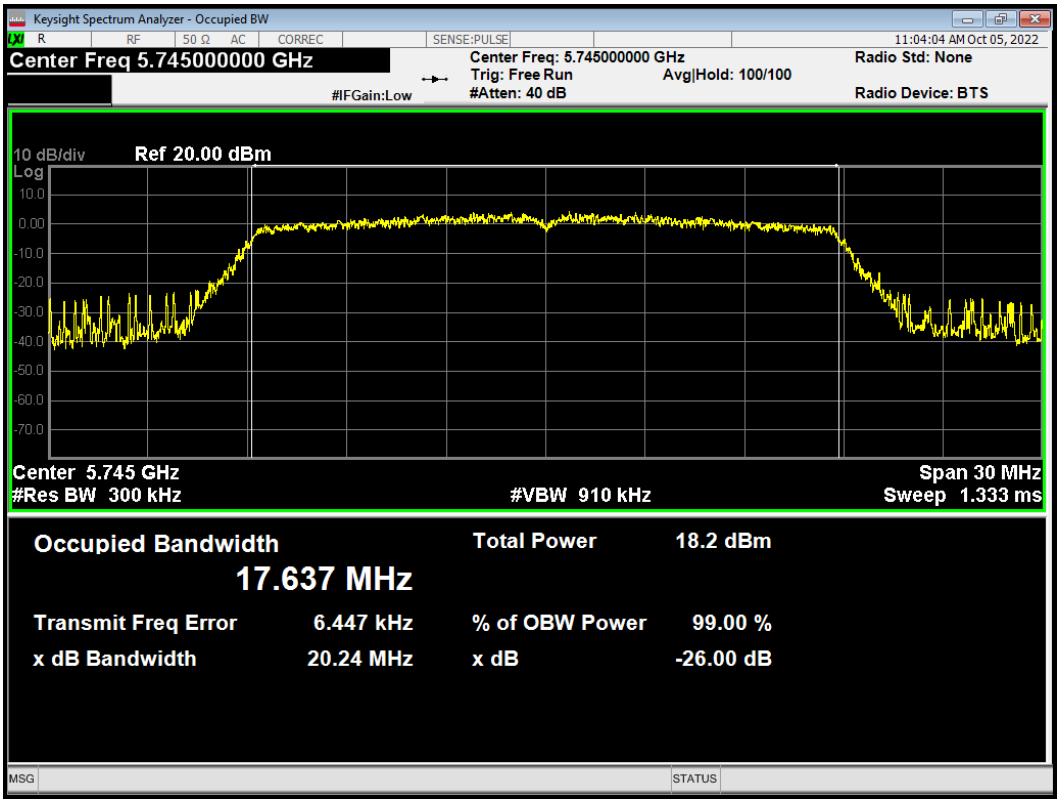
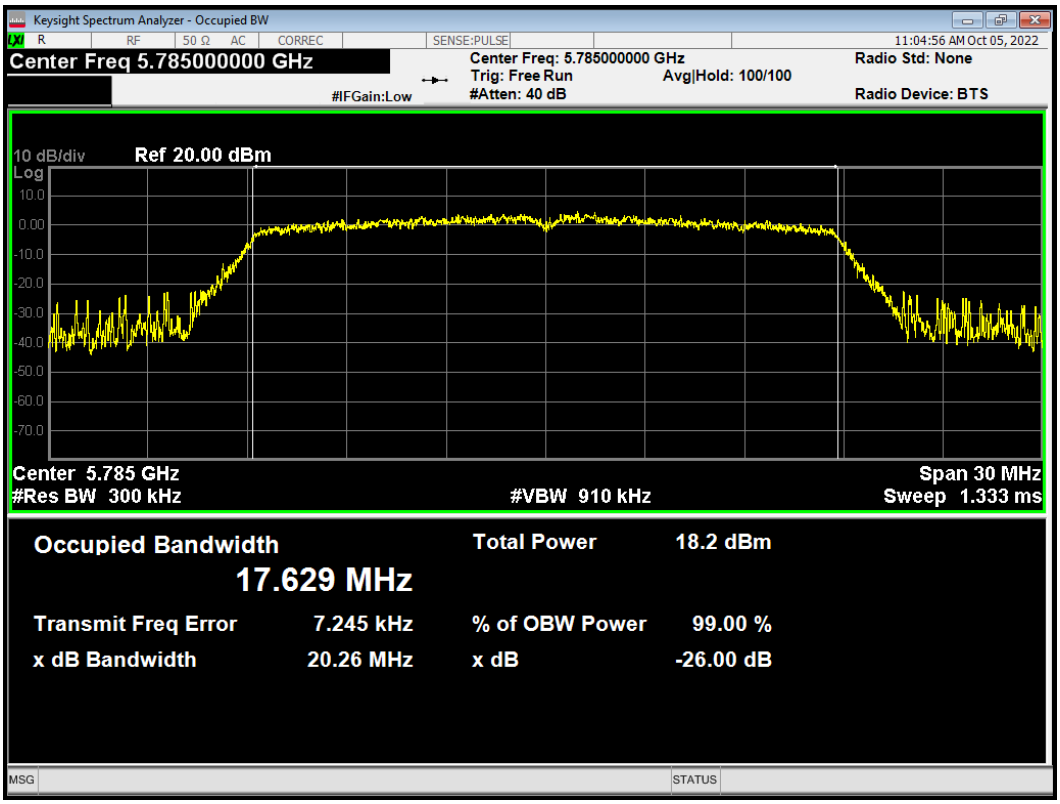
OBW 802.11n (HT20) 5745MHz



OBW 802.11n (HT20) 5785MHz



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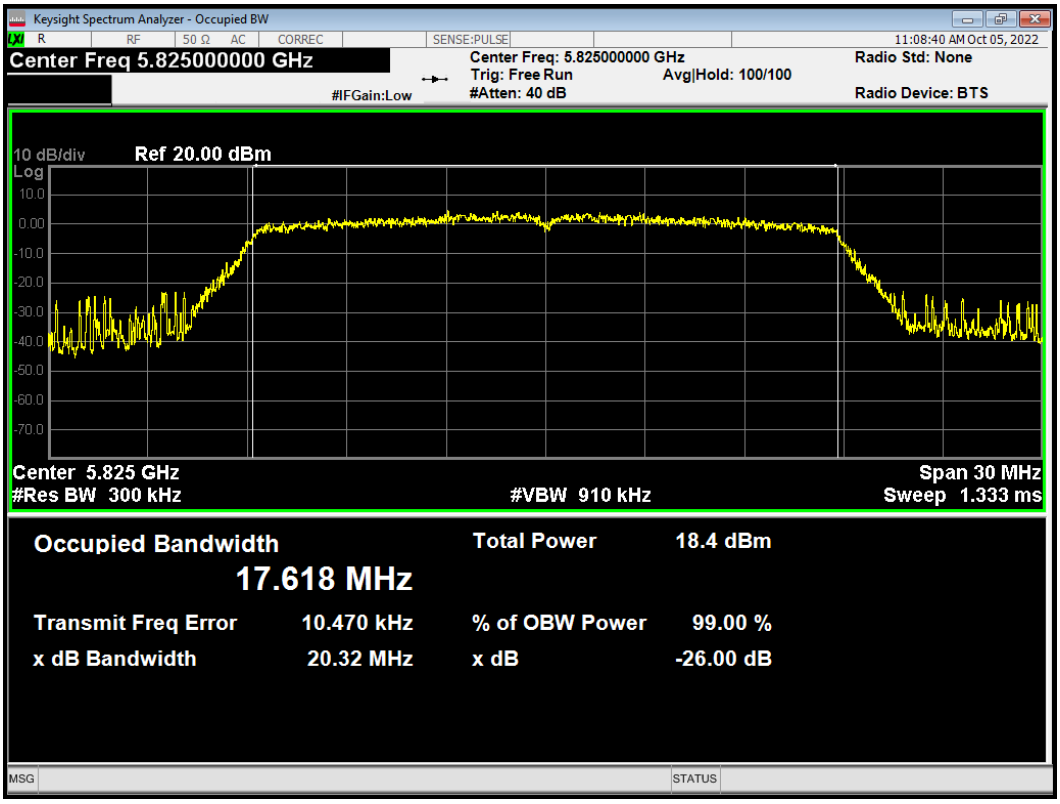
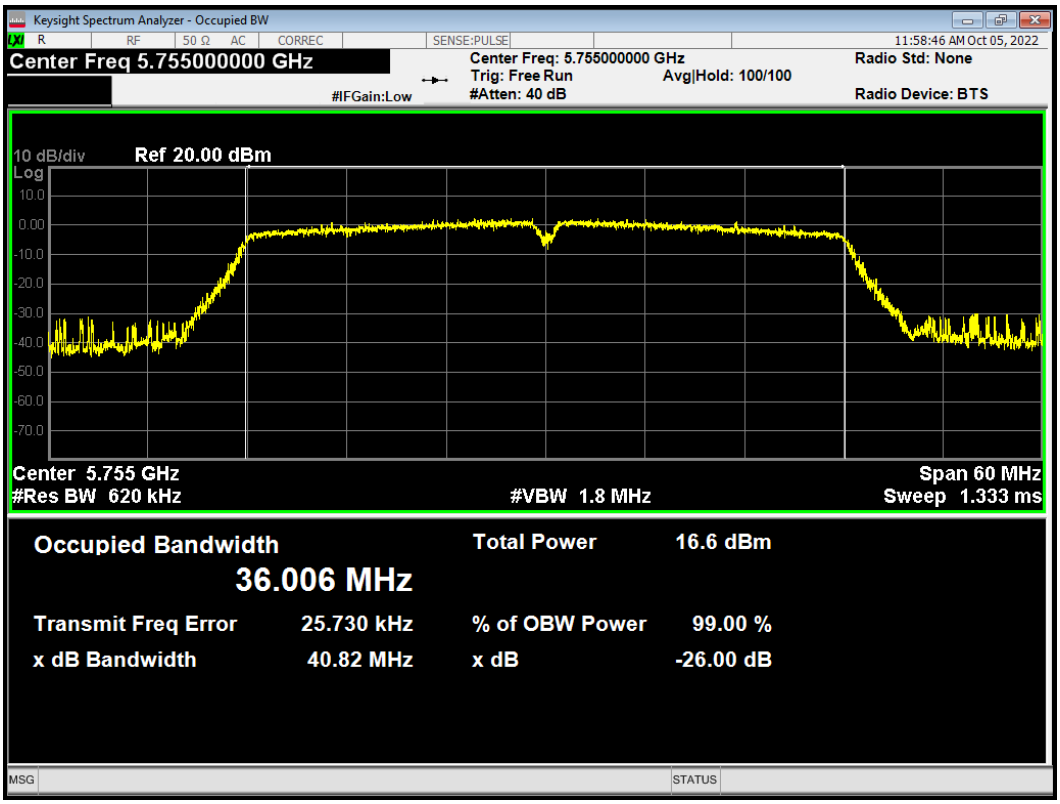
OBW 802.11n (HT20) 5825MHz



OBW 802.11n (HT40) 5755MHz



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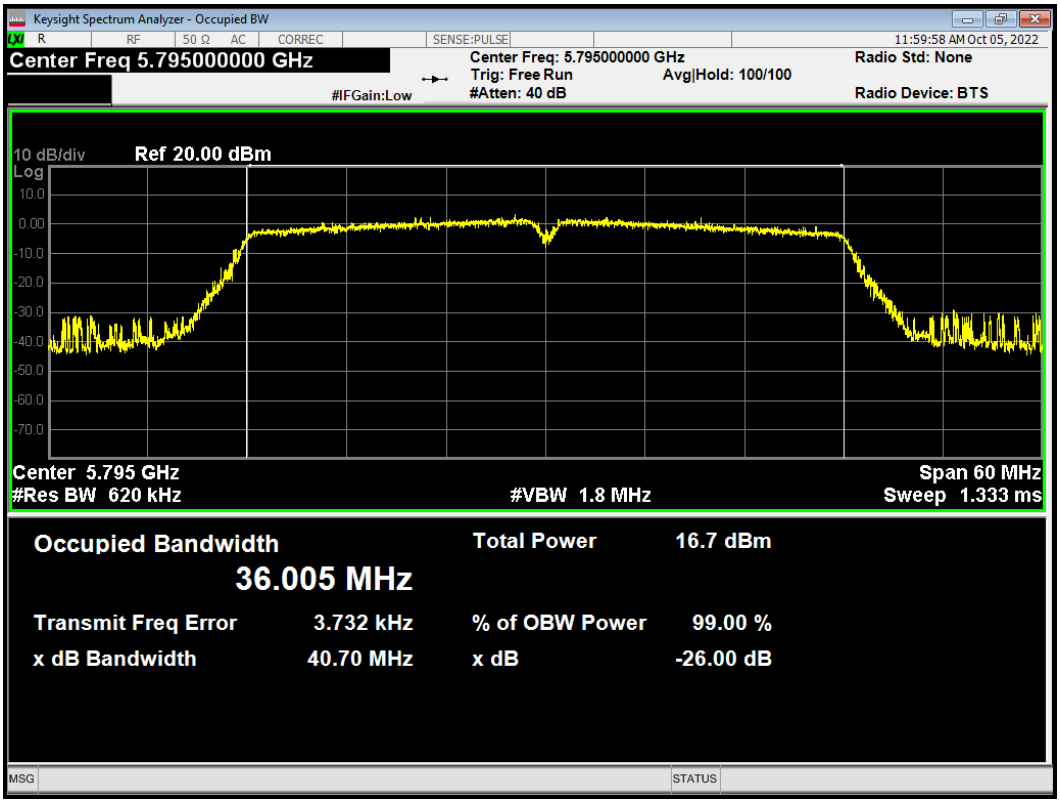
OBW 802.11n (HT40) 5795MHz



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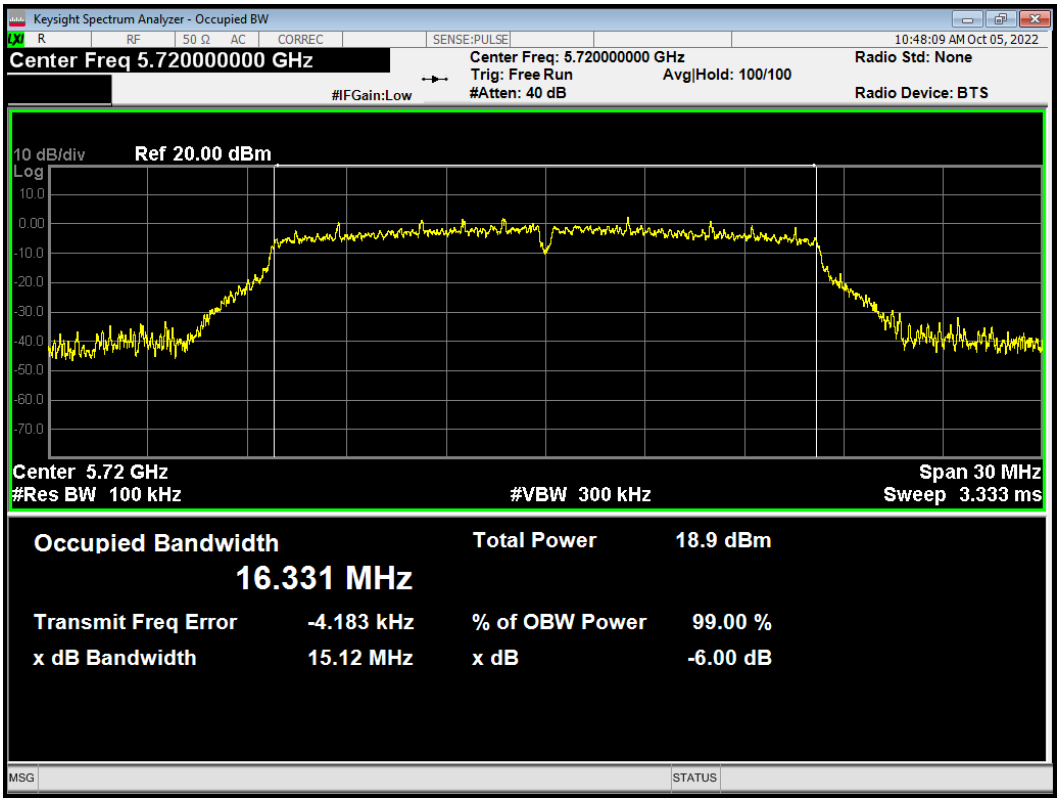
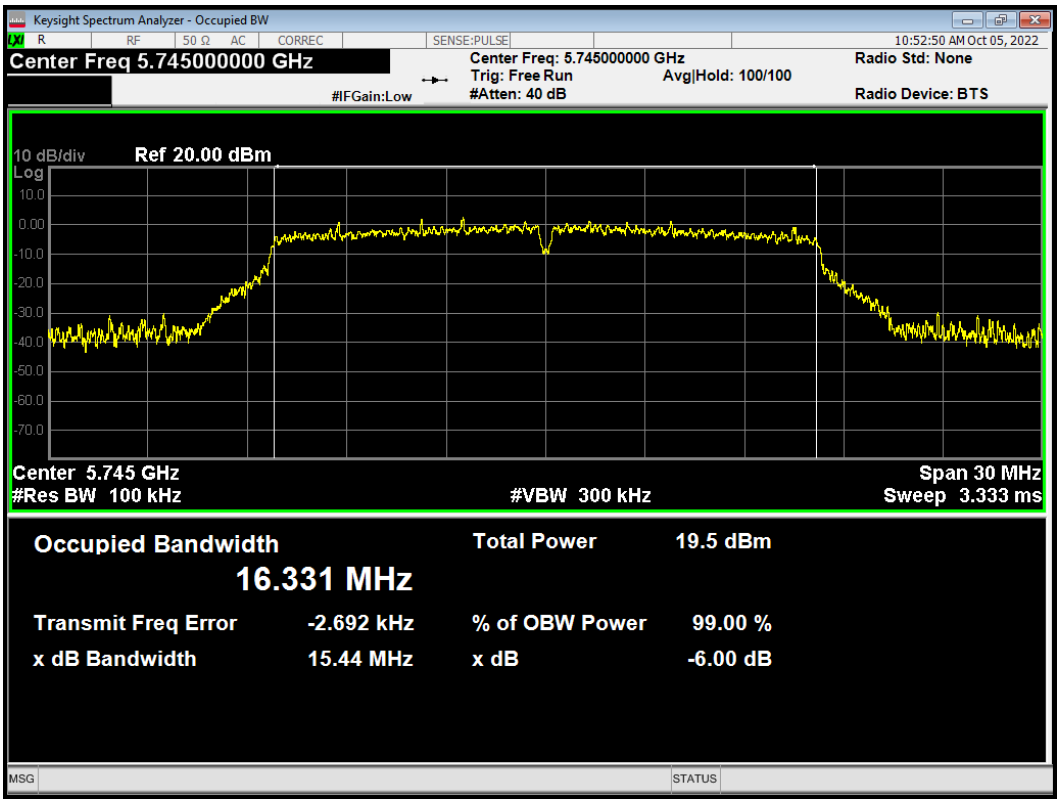
Minimum 6 dB bandwidth

-6dB Bandwidth 802.11a 5720MHz



-6dB Bandwidth 802.11a 5745MHz



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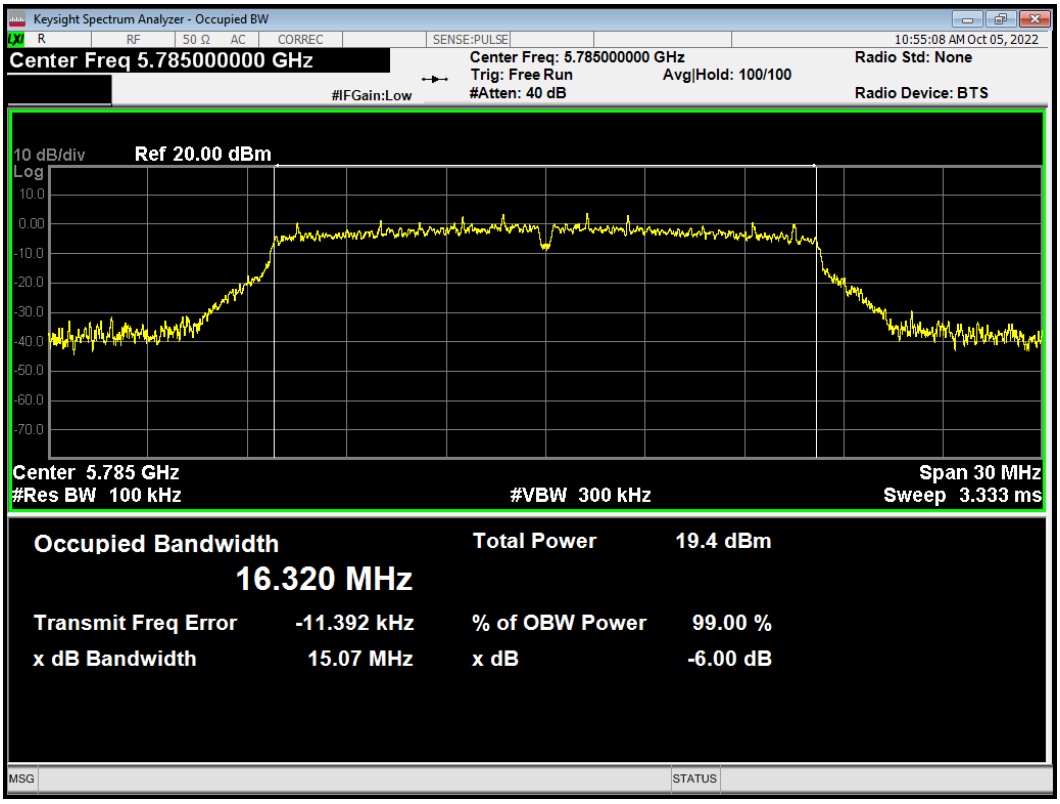
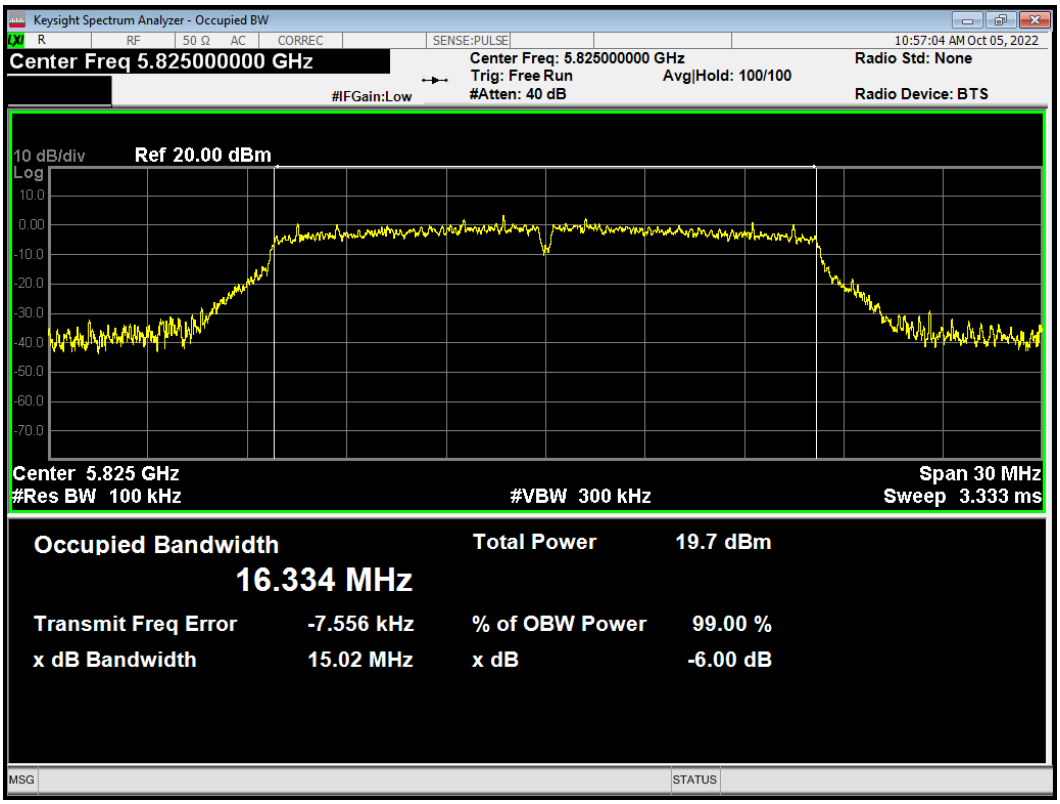
-6dB Bandwidth 802.11a 5785MHz



-6dB Bandwidth 802.11a 5825MHz



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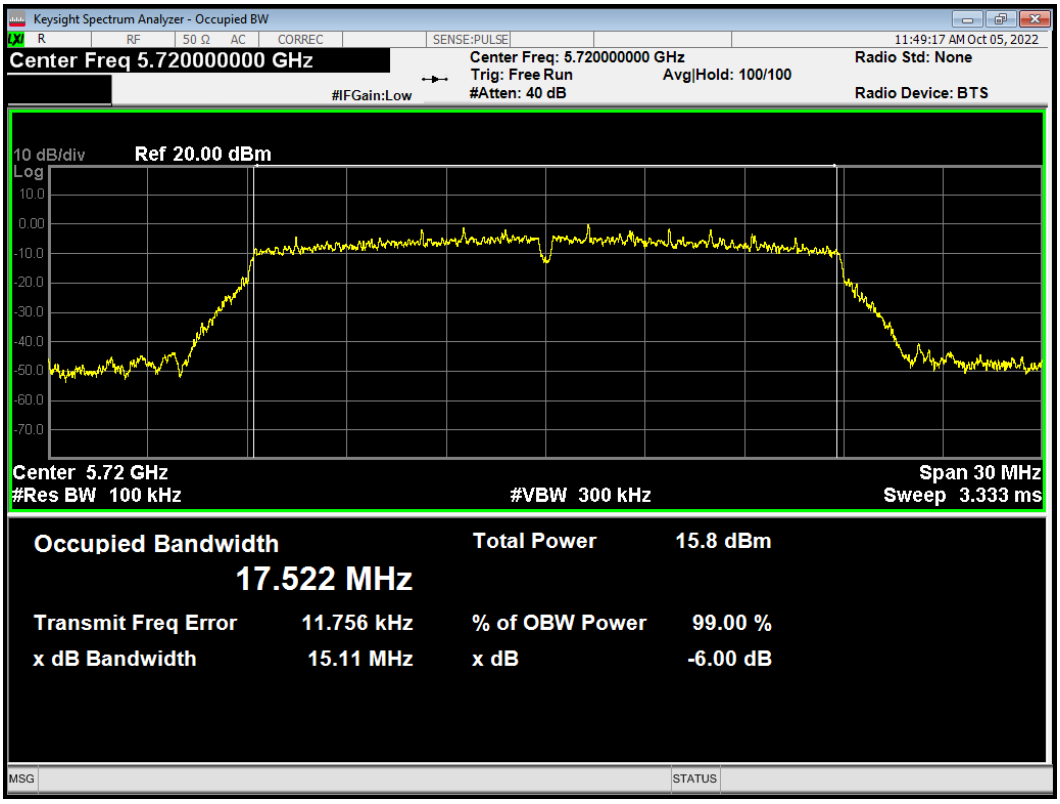
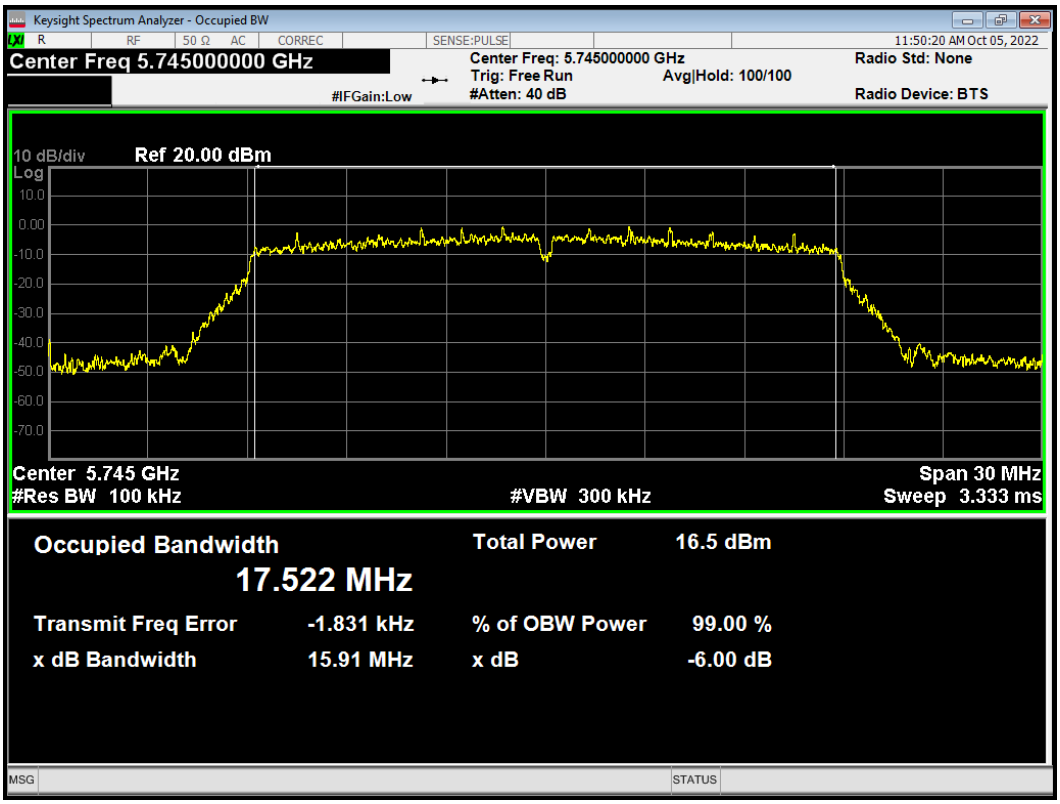
-6dB Bandwidth 802.11ac (VHT20) 5720MHz



-6dB Bandwidth 802.11ac (VHT20) 5745MHz



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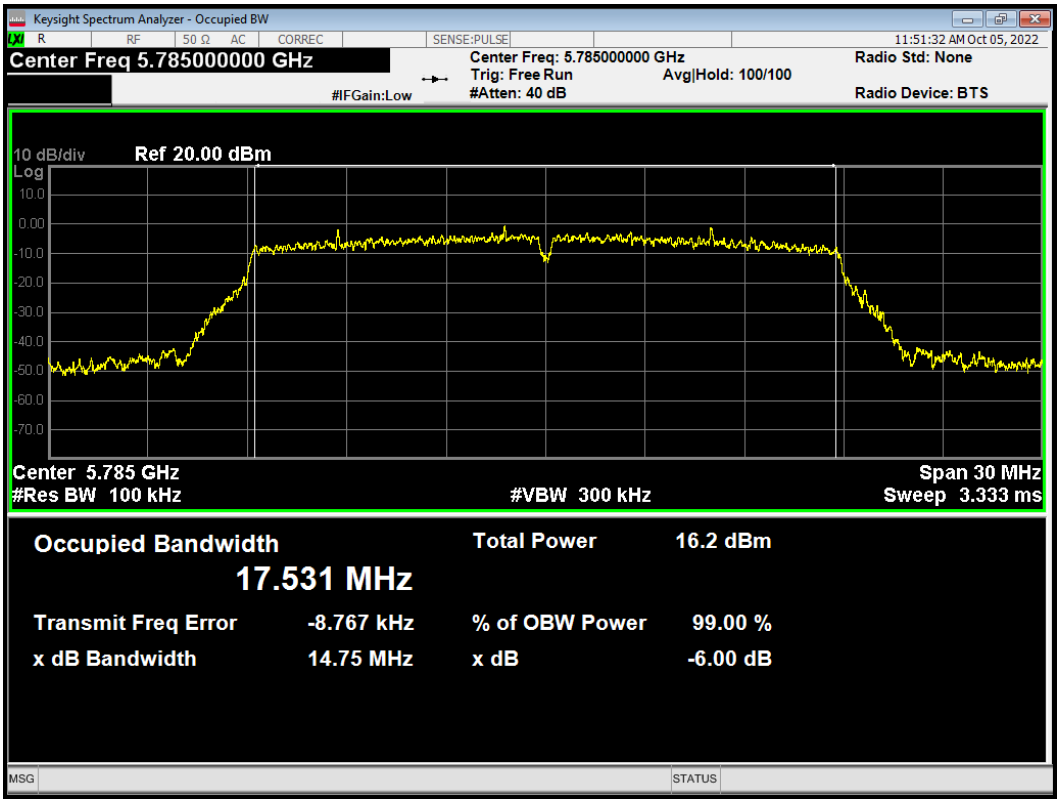
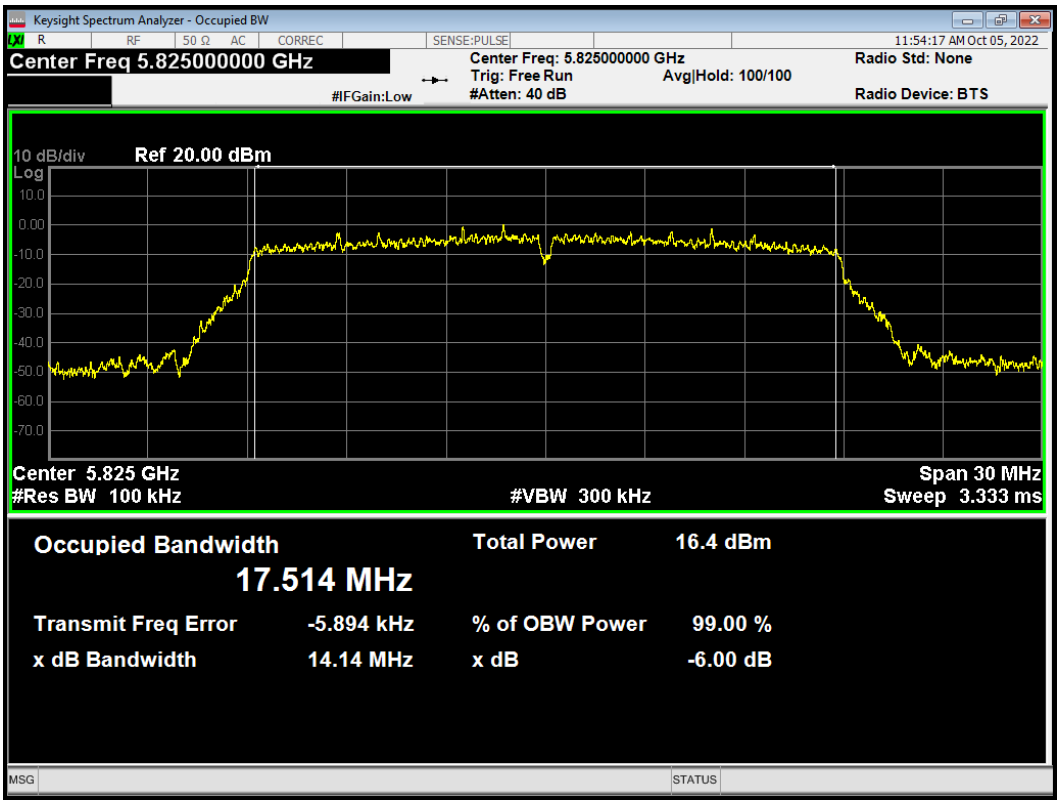
-6dB Bandwidth 802.11ac (VHT20) 5785MHz



-6dB Bandwidth 802.11ac (VHT20) 5825MHz



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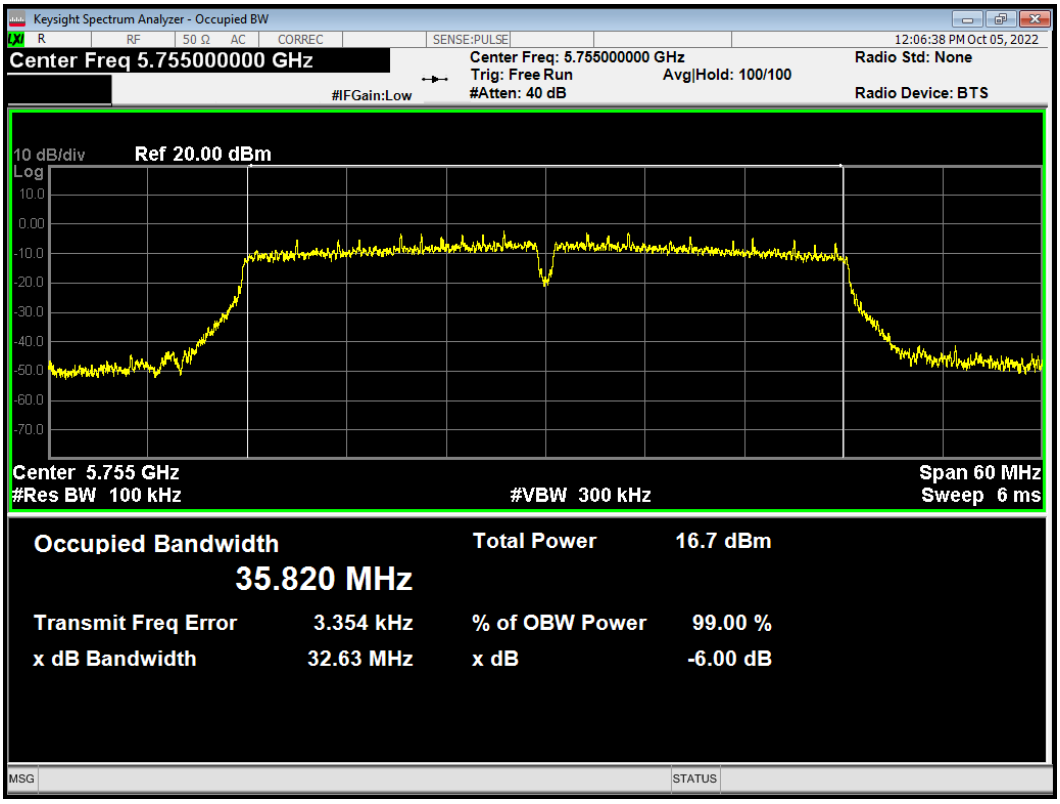
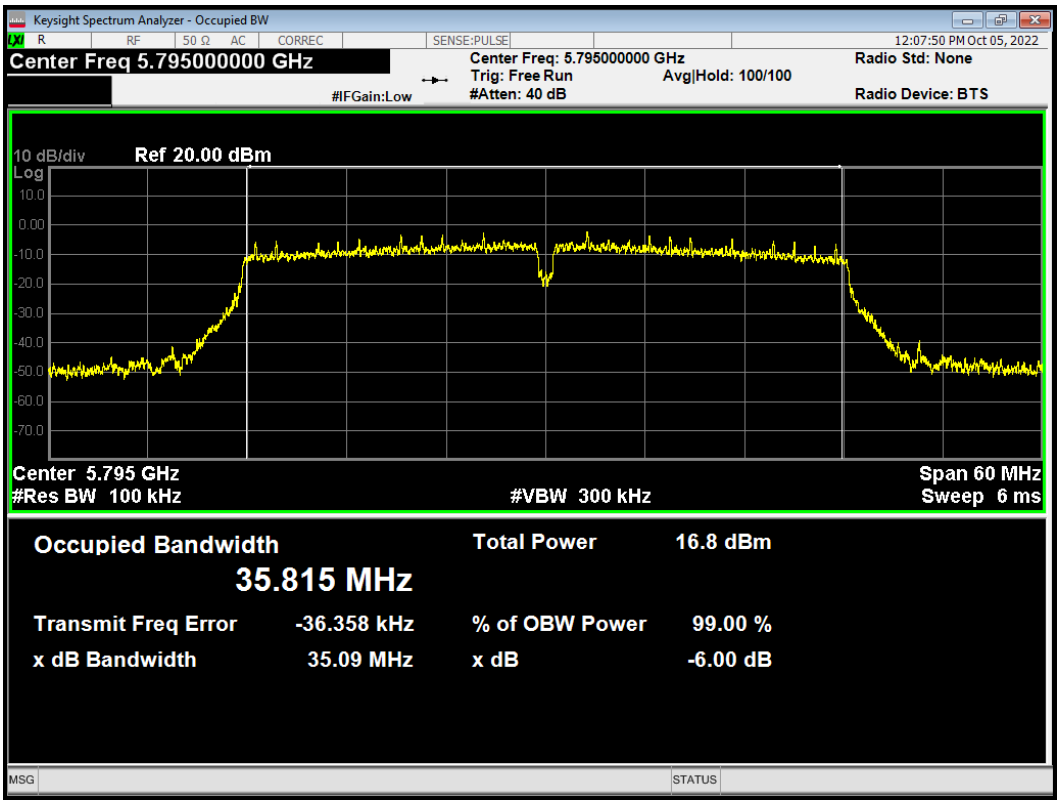
-6dB Bandwidth 802.11ac (VHT40) 5755MHz



-6dB Bandwidth 802.11ac (VHT40) 5795MHz



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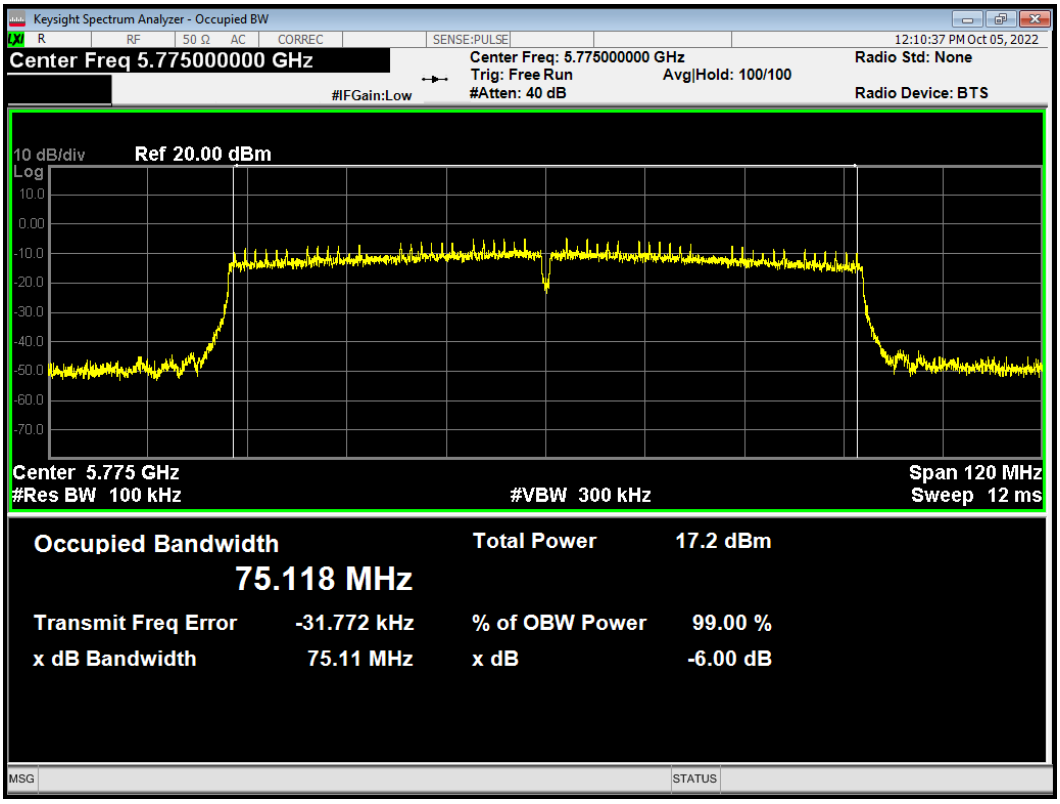
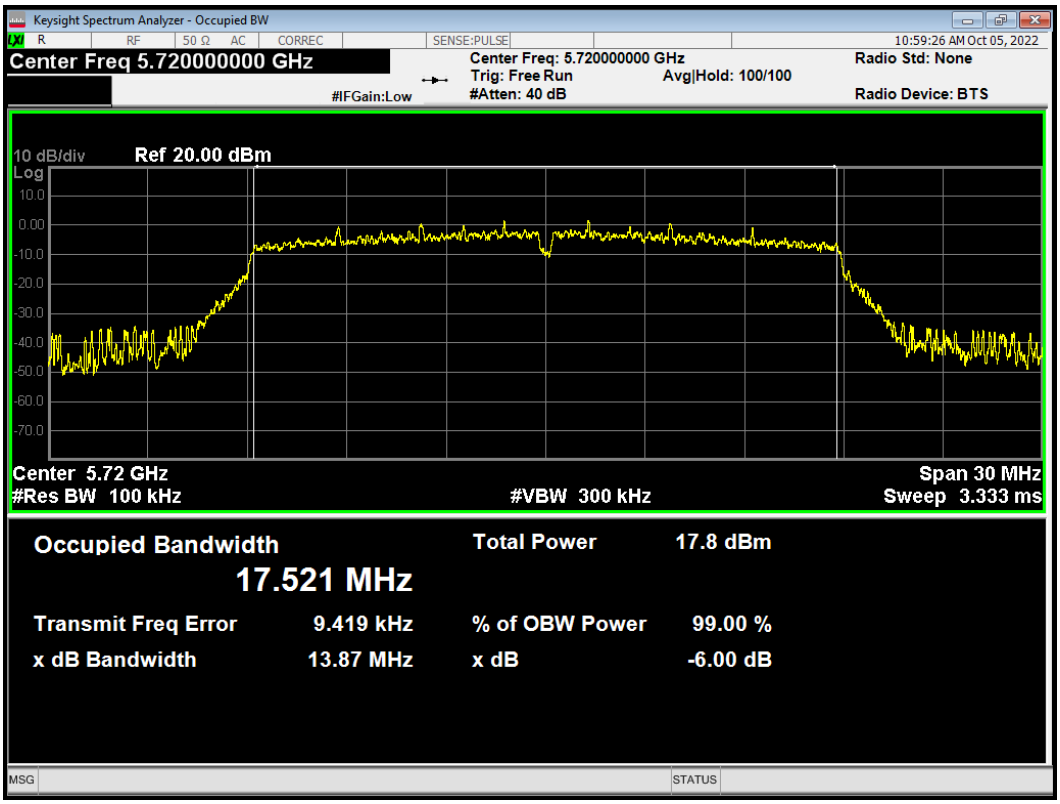
-6dB Bandwidth 802.11ac (VHT80) 5775MHz



-6dB Bandwidth 802.11n (HT20) 5720MHz



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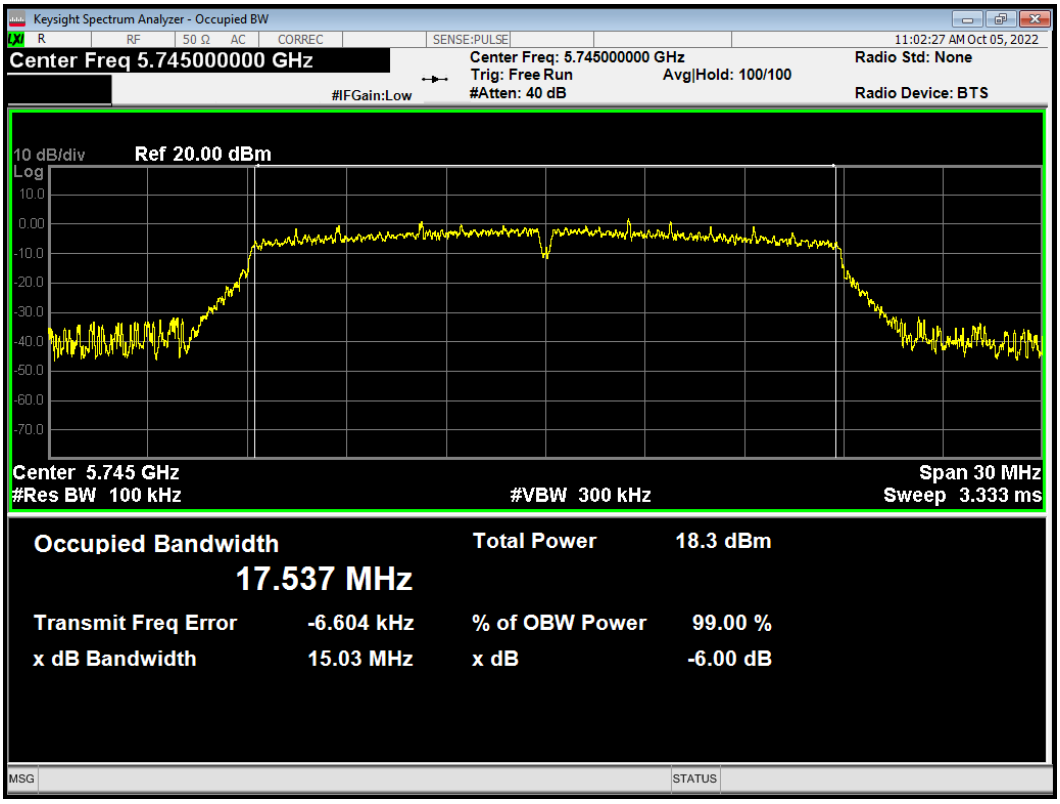
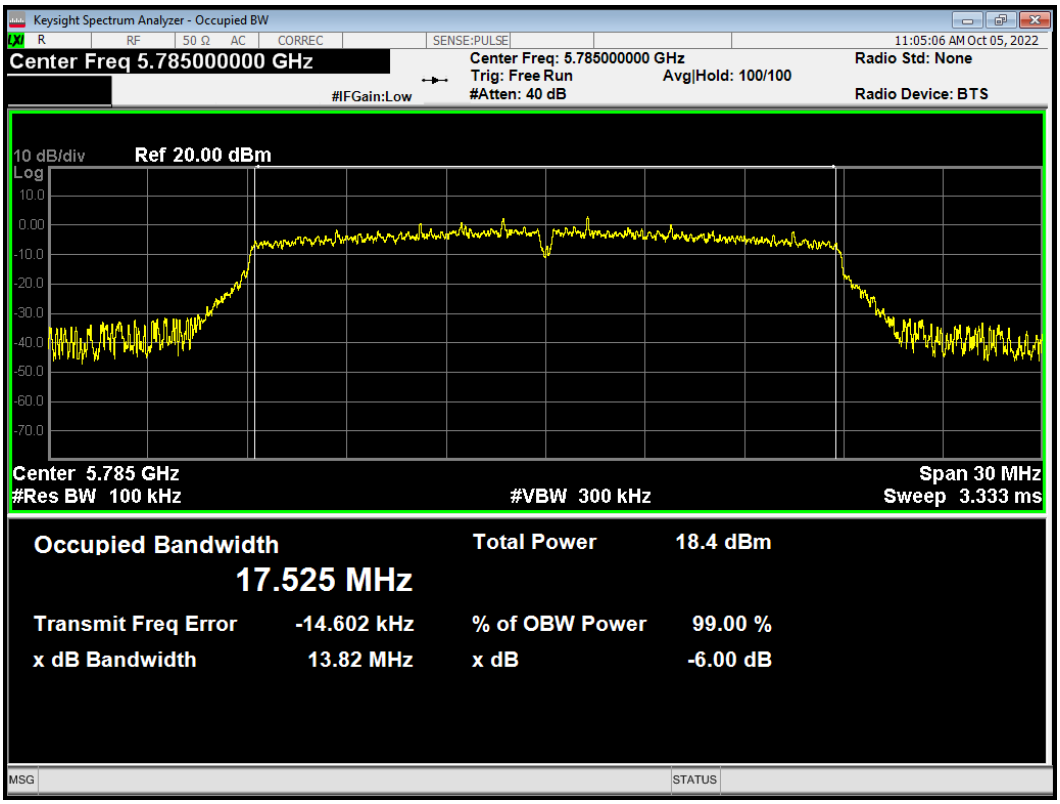
-6dB Bandwidth 802.11n (HT20) 5745MHz



-6dB Bandwidth 802.11n (HT20) 5785MHz



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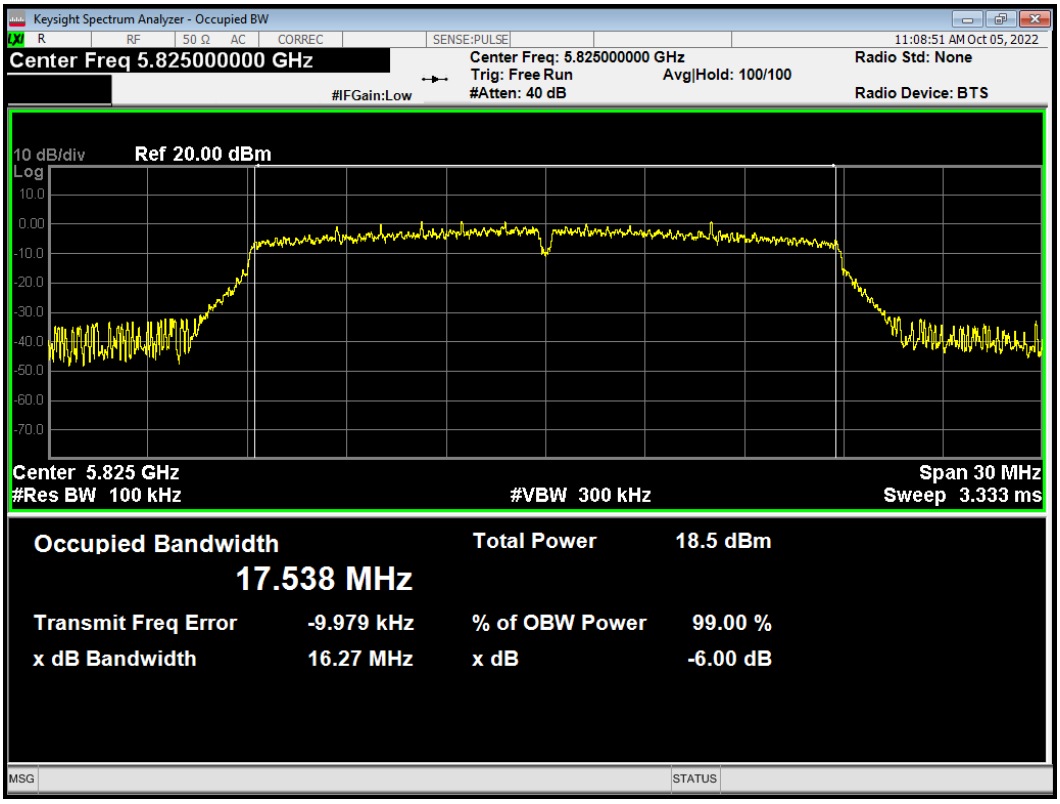
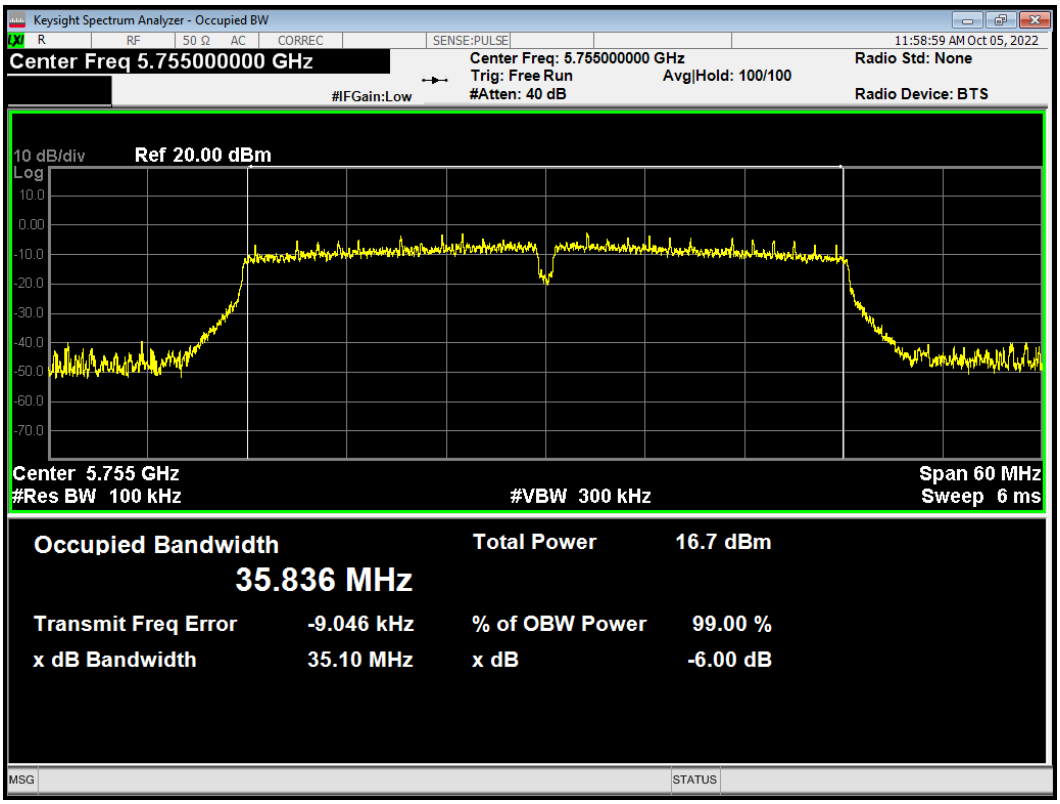
-6dB Bandwidth 802.11n (HT20) 5825MHz



-6dB Bandwidth 802.11n (HT40) 5755MHz



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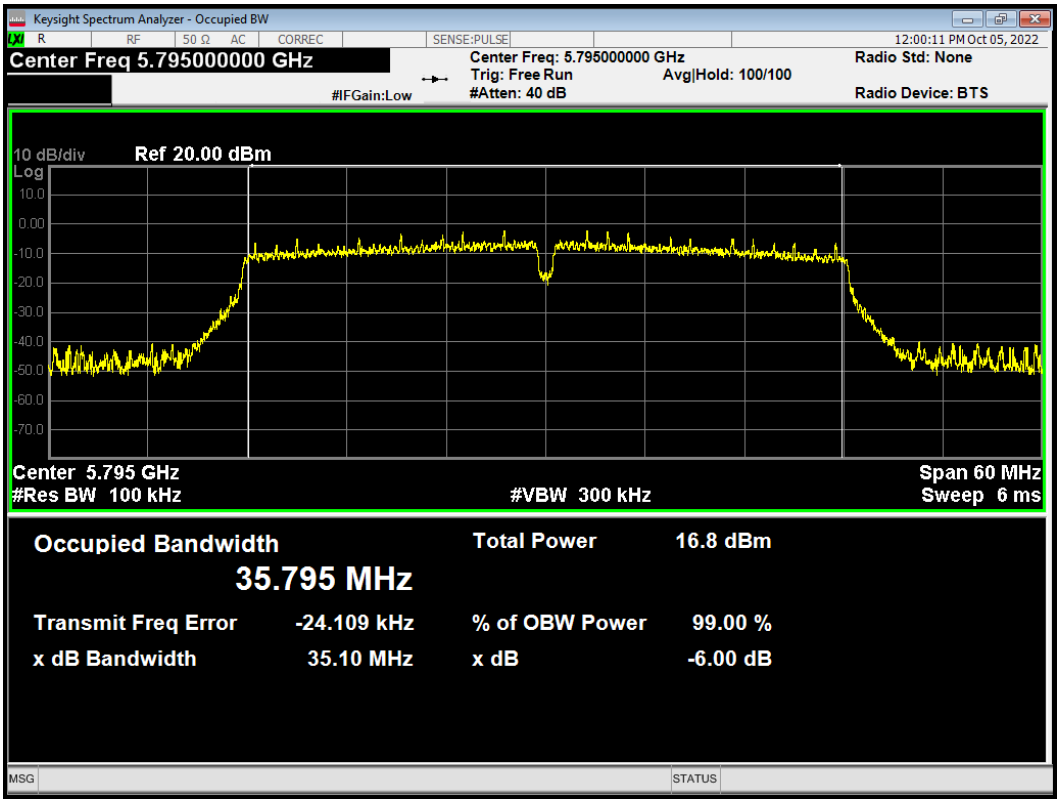
-6dB Bandwidth 802.11n (HT40) 5795MHz



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5.2. Average Power Output

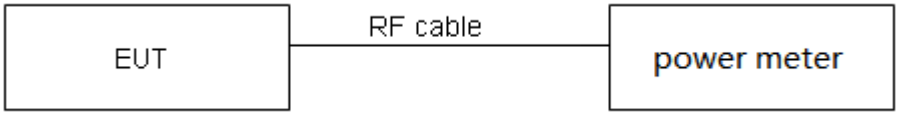
Ambient condition

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

Methods of Measurement

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

Test Setup



Limits

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

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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.

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Test Results

Mode	Duty cycle	Duty cycle correction Factor(dB)
802.11a	0.97	0.13
802.11n HT20	0.97	0.14
802.11n HT40	0.94	0.28
802.11ac VHT20	0.97	0.14
802.11ac VHT40	0.94	0.27
802.11ac VHT80	0.89	0.53
Note: when Duty cycle≥0.98, Duty cycle correction Factor not required.		

Power Index								
Channel	802.11a	802.11n HT20	802.11ac VHT20	Channel	802.11n HT40	802.11ac VHT40	Channel	802.11ac VHT80
CH36	17	16	14	CH38	14	14	CH42	14
CH40	17	16	14	CH46	14	14	/	/
CH48	17	16	14	/	/	/	/	/
CH52	17	16	14	CH54	14	14	CH58	14
CH60	17	16	14	CH62	14	14	/	/
CH64	17	16	14	/	/	/	/	/
CH100	16	16	14	CH102	14	14	/	/
CH104	17	/	/	/	/	/	/	/
CH120	17	16	14	CH118	14	14	CH122	14
CH136	17	16	/	/	/	/	/	/
CH140	16	15	14	CH134	14	14	/	/
CH144	17	16	14	/	/	/	/	/
CH149	17	16	14	CH151	14	14	CH155	14
CH157	17	16	14	CH159	14	14	/	/
CH165	17	16	14	/	/	/	/	/

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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	20.17	24.05>24	24.00
		60/5300	20.28	24.07>24	24.00
		64/5320	20.10	24.03>24	24.00
	802.11n HT20	52/5260	20.34	24.08>24	24.00
		60/5300	20.44	24.10>24	24.00
		64/5320	20.66	24.15>24	24.00
	802.11n HT40	54/5270	40.30	27.05>24	24.00
		62/5310	40.05	27.03>24	24.00
	802.11ac VHT20	52/5260	20.56	24.13>24	24.00
		60/5300	20.54	24.13>24	24.00
		64/5320	20.60	24.14>24	24.00
	802.11ac VHT40	54/5270	40.01	27.02>24	24.00
		62/5310	40.49	27.07>24	24.00
	802.11ac VHT80	58/5290	79.75	30.02>24	24.00
U-NII-2C	802.11a	100/5500	19.98	24.01>24	24.00
		104/5520	20.29	24.07>24	24.00
		120/5600	20.96	24.21>24	24.00
		136/5680	20.33	24.08>24	24.00
		140/5700	20.06	24.02>24	24.00
		144/5720	20.20	24.05>24	24.00
	802.11n HT20	100/5500	20.60	24.14>24	24.00
		120/5600	20.61	24.14>24	24.00
		136/5680	20.67	24.15>24	24.00
		140/5700	20.46	24.11>24	24.00
		144/5720	20.51	24.12>24	24.00
	802.11n HT40	102/5510	40.40	27.06>24	24.00
		118/5590	40.16	27.04>24	24.00
		134/5670	40.26	27.05>24	24.00
	802.11ac VHT20	100/5500	20.57	24.13>24	24.00
		120/5600	20.36	24.09>24	24.00
		140/5700	20.61	24.14>24	24.00
		144/5720	20.45	24.11>24	24.00
	802.11ac VHT40	102/5510	40.09	27.03>24	24.00
		118/5590	40.06	27.03>24	24.00
		134/5670	39.79	27.00>24	24.00
	802.11ac VHT80	122/5610	79.67	30.01>24	24.00
Note: 250mW=24dBm					

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U-NII-1

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	36/5180	15.44	15.57	24	PASS
	40/5200	15.48	15.61	24	PASS
	48/5240	15.58	15.71	24	PASS
802.11n HT20	36/5180	14.17	14.31	24	PASS
	40/5200	14.17	14.31	24	PASS
	48/5240	14.49	14.63	24	PASS
802.11n HT40	38/5190	11.98	12.26	24	PASS
	46/5230	12.22	12.50	24	PASS
802.11ac VHT20	36/5180	12.12	12.26	24	PASS
	40/5200	12.15	12.29	24	PASS
	48/5240	12.25	12.39	24	PASS
802.11ac VHT40	38/5190	11.96	12.23	24	PASS
	46/5230	12.23	12.50	24	PASS
802.11ac VHT80	42/5210	11.98	12.51	24	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

U-NII-2A

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	52/5260	15.49	15.62	24.00	PASS
	60/5300	15.71	15.84	24.00	PASS
	64/5320	15.78	15.91	24.00	PASS
802.11n HT20	52/5260	14.30	14.44	24.00	PASS
	60/5300	14.62	14.76	24.00	PASS
	64/5320	14.55	14.69	24.00	PASS
802.11n HT40	54/5270	12.43	12.71	24.00	PASS
	62/5310	12.31	12.59	24.00	PASS
802.11ac VHT20	52/5260	12.24	12.38	24.00	PASS
	60/5300	12.60	12.74	24.00	PASS
	64/5320	12.35	12.49	24.00	PASS
802.11ac VHT40	54/5270	12.41	12.68	24.00	PASS
	62/5310	12.29	12.57	24.00	PASS
802.11ac VHT80	58/5290	12.25	12.78	24.00	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

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U-NII-2C

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	100/5500	14.29	14.42	24.00	PASS
	104/5520	15.44	15.57	24.00	PASS
	120/5600	14.74	14.88	24.00	PASS
	136/5680	14.82	14.95	24.00	PASS
	140/5700	13.85	13.99	24.00	PASS
	144/5720	14.08	14.22	24.00	PASS
802.11n HT20	100/5500	14.02	14.16	24.00	PASS
	120/5600	13.64	13.78	24.00	PASS
	136/5680	13.61	13.74	24.00	PASS
	140/5700	12.65	12.79	24.00	PASS
	144/5720	12.84	12.97	24.00	PASS
802.11n HT40	102/5510	11.94	12.22	24.00	PASS
	118/5590	11.66	11.94	24.00	PASS
	134/5670	11.93	12.21	24.00	PASS
802.11ac VHT20	100/5500	12.04	12.17	24.00	PASS
	120/5600	11.46	11.60	24.00	PASS
	140/5700	11.47	11.60	24.00	PASS
	144/5720	10.79	10.93	24.00	PASS
802.11ac VHT40	102/5510	11.93	12.20	24.00	PASS
	118/5590	11.67	11.95	24.00	PASS
	134/5670	11.94	12.21	24.00	PASS
802.11ac VHT80	122/5610	11.38	11.91	24.00	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

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U-NII-3

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	144/5720	6.28	6.41	30	PASS
	149/5745	15.24	15.37	30	PASS
	157/5785	15.09	15.22	30	PASS
	165/5825	15.41	15.54	30	PASS
802.11n HT20	144/5720	5.46	5.59	30	PASS
	149/5745	14.05	14.19	30	PASS
	157/5785	14.13	14.27	30	PASS
	165/5825	14.16	14.30	30	PASS
802.11n HT40	151/5755	11.91	12.19	30	PASS
	159/5795	11.80	12.09	30	PASS
802.11ac VHT20	144/5720	3.89	4.03	30	PASS
	149/5745	12.32	12.46	30	PASS
	157/5785	11.98	12.11	30	PASS
	165/5825	12.38	12.51	30	PASS
802.11ac VHT40	151/5755	11.96	12.23	30	PASS
	159/5795	11.80	12.07	30	PASS
802.11ac VHT80	155/5775	11.66	12.19	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

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5.3. Frequency Stability

Ambient condition

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

Method of Measurement

1. Frequency stability with respect to ambient temperature

a) Supply the EUT with a nominal ac voltage or install a new or fully charged battery in the EUT. If possible, a dummy load shall be connected to the EUT because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, then the EUT shall be placed in the center of the chamber with the antenna adjusted to the shortest length possible. Turn ON the EUT and tune it to one of the number of frequencies shown in 5.6.

b) Couple the unlicensed wireless device output to the measuring instrument by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away), or by connecting a dummy load to the measuring instrument, through an attenuator if necessary.

c) Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).

d) Turn the EUT OFF and place it inside the environmental temperature chamber. For devices that have oscillator heaters, energize only the heater circuit.

e) Set the temperature control on the chamber to the highest specified in the regulatory requirements for the type of device and allow the oscillator heater and the chamber temperature to stabilize.

f) While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

g) Measure the frequency at each of frequencies specified in 5.6.

h) Switch OFF the EUT but do not switch OFF the oscillator heater.

i) Lower the chamber temperature by not more that 10°C, and allow the temperature inside the chamber to stabilize.

j) Repeat step f) through step i) down to the lowest specified temperature.

2. Frequency stability when varying supply voltage

Unless otherwise specified, these tests shall be made at ambient room temperature (+15°C to +25 °C). An antenna shall be connected to the antenna output terminals of the EUT if possible. If the EUT is equipped with or uses an adjustable-length antenna, then it shall be fully extended.

a) Supply the EUT with nominal voltage or install a new or fully charged battery in the EUT. Turn ON the EUT and couple its output to a frequency counter or other frequency-measuring instrument.

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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

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Test Results

Voltage (V)	Temperature (°C)	U-NII-1 Test Results			
		5200MHz			
		1min	2min	5min	10min
3.85 V	-20	5199.997683	5199.990353	5199.986901	5199.986704
3.85 V	-10	5200.002367	5199.981287	5199.983716	5199.978906
3.85 V	0	5199.996486	5199.979064	5199.979064	5199.974008
3.85 V	10	5199.986986	5199.975733	5199.971948	5199.971907
3.85 V	20	5199.981470	5199.972005	5199.967563	5199.970330
3.85 V	30	5199.976732	5199.962165	5199.962794	5199.965460
3.85 V	40	5199.967457	5199.954222	5199.955975	5199.961552
3.85 V	50	5199.961546	5199.946680	5199.946423	5199.953501
3.65 V	20	5199.957629	5199.939572	5199.941828	5199.944561
4.20V	20	5199.948198	5199.937133	5199.935682	5199.938402
Max. ΔMHz		-0.051802	-0.062867	-0.064318	-0.061598
PPM		-9.961995	-12.089778	-12.368842	-11.845844

Voltage (V)	Temperature (°C)	U-NII-2A Test Results			
		5300MHz			
		1min	2min	5min	10min
3.85 V	-20	5300.007413	5300.003261	5299.996100	5299.993532
3.85 V	-10	5300.000779	5299.998060	5299.989587	5299.983572
3.85 V	0	5299.996680	5299.994502	5299.982835	5299.978059
3.85 V	10	5299.991728	5299.985554	5299.977814	5299.975766
3.85 V	20	5299.991531	5299.977681	5299.977004	5299.970334
3.85 V	30	5299.989457	5299.975616	5299.976947	5299.964334
3.85 V	40	5299.980354	5299.966413	5299.971992	5299.961537
3.85 V	50	5299.973818	5299.966333	5299.966109	5299.953968
3.65 V	20	5299.967940	5299.963312	5299.964489	5299.947377
4.20V	20	5299.966234	5299.962842	5299.957676	5299.941299
Max. ΔMHz		-0.033766	-0.037158	-0.042324	-0.058701
PPM		-6.370884	-7.011030	-7.985705	-11.075671

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Voltage (V)	Temperature (°C)	U-NII-2C Test Results			
		5580MHz			
		1min	2min	5min	10min
3.85 V	-20	5580.005301	5579.997390	5579.987601	5579.984620
3.85 V	-10	5580.001630	5579.991777	5579.982678	5579.981614
3.85 V	0	5579.993599	5579.991167	5579.977448	5579.979294
3.85 V	10	5579.990783	5579.991065	5579.974950	5579.978365
3.85 V	20	5579.984497	5579.984970	5579.968986	5579.974649
3.85 V	30	5579.980508	5579.983803	5579.968894	5579.971493
3.85 V	40	5579.971502	5579.976961	5579.968062	5579.967878
3.85 V	50	5579.969197	5579.975171	5579.965390	5579.966696
3.65 V	20	5579.963541	5579.966805	5579.963899	5579.966414
4.20V	20	5579.960017	5579.965006	5579.954687	5579.960958
Max. ΔMHz		-0.039983	-0.034994	-0.045313	-0.039042
PPM		-7.165459	-6.271331	-8.120567	-6.996695

Voltage (V)	Temperature (°C)	U-NII-3 Test Results			
		5785MHz			
		1min	2min	5min	10min
3.85 V	-20	5785.007936	5785.005418	5784.998383	5784.988589
3.85 V	-10	5785.005285	5785.002362	5784.995523	5784.982515
3.85 V	0	5785.002371	5785.000745	5784.995183	5784.979434
3.85 V	10	5784.995039	5784.993842	5784.989297	5784.978321
3.85 V	20	5784.985200	5784.987768	5784.979513	5784.974933
3.85 V	30	5784.978874	5784.985576	5784.979169	5784.968859
3.85 V	40	5784.977384	5784.979462	5784.975136	5784.965251
3.85 V	50	5784.970296	5784.977907	5784.967757	5784.960884
3.65 V	20	5784.961673	5784.969436	5784.965142	5784.952674
4.20V	20	5784.955586	5784.963626	5784.963892	5784.945482
Max. ΔMHz		-0.044414	-0.036374	-0.036108	-0.054518
PPM		-7.677506	-6.287661	-6.241650	-9.423981

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5.4. Power Spectral Density

Ambient condition

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

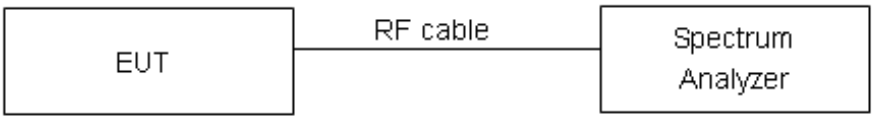
Method of Measurement

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

Set RBW = 1MHz, VBW =3MHz for the band 5.150-5.250GHz, 5.250-5.350GHz, 5.470-5.725GHz.
Set RBW = 470kHz, VBW =1.5MHz for the band 5.725-5.850GHz

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

Test setup



Limits

Rule FCC Part 15.407(a)(1)/ Part 15.407(a)(2) / Part 15.407(a)(3)
For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500kHz band. If transmittingantennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the

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amount in dB that the directional gain of the antenna exceeds 6 dBi.

Frequency Bands/MHz	Limits
5150-5250	11dBm/MHz
5.25-5.35 GHz and 5.47-5.725 GHz	11dBm/MHz
5725-5850	30dBm/500kHz

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.75dB.

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Test Results:

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

U-NII-1

Mode	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	36	5.71	5.84	11	PASS
	40	5.64	5.77	11	PASS
	48	5.84	5.97	11	PASS
802.11n HT20	36	4.53	4.67	11	PASS
	40	4.55	4.69	11	PASS
	48	4.70	4.84	11	PASS
802.11n HT40	38	-0.94	-0.66	11	PASS
	46	-0.25	0.03	11	PASS
802.11ac VHT20	36	2.21	2.35	11	PASS
	40	2.35	2.49	11	PASS
	48	2.48	2.62	11	PASS
802.11ac VHT40	38	-0.80	-0.53	11	PASS
	46	-0.58	-0.31	11	PASS
802.11ac VHT80	42	-3.77	-3.24	11	PASS

U-NII-2A

Mode	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	52	5.70	5.83	11	PASS
	60	5.95	6.08	11	PASS
	64	6.03	6.16	11	PASS
802.11n HT20	52	4.63	4.77	11	PASS
	60	5.20	5.34	11	PASS
	64	4.69	4.83	11	PASS
802.11n HT40	54	-0.35	-0.07	11	PASS
	62	-0.37	-0.09	11	PASS
802.11ac VHT20	52	2.54	2.68	11	PASS
	60	2.76	2.90	11	PASS
	64	2.53	2.67	11	PASS

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802.11ac VHT40	54	-0.19	0.08	11	PASS
	62	-0.34	-0.07	11	PASS
802.11ac VHT80	58	-3.79	-3.26	11	PASS

U-NII-2C

Mode	Channel Number	Read Value (dBm /MHz)	Power Spectral Density (dBm /MHz)	Limit (dBm /MHz)	Conclusion
802.11a	100	4.81	4.94	11	PASS
	104	6.09	6.22	11	PASS
	420	5.21	5.34	11	PASS
	436	5.29	5.42	11	PASS
	140	4.01	4.14	11	PASS
	144	5.55	5.68	11	PASS
802.11n HT20	100	4.14	4.28	11	PASS
	120	3.54	3.68	11	PASS
	136	3.96	4.10	11	PASS
	140	3.13	3.27	11	PASS
	144	3.91	4.05	11	PASS
802.11n HT40	102	-0.75	-0.47	11	PASS
	118	-1.27	-0.99	11	PASS
	134	-0.69	-0.41	11	PASS
802.11ac VHT20	100	2.07	2.21	11	PASS
	120	1.80	1.94	11	PASS
	140	1.69	1.83	11	PASS
	144	1.59	1.73	11	PASS
802.11ac VHT40	102	-0.69	-0.42	11	PASS
	118	-1.31	-1.04	11	PASS
	134	-0.17	0.10	11	PASS
802.11ac VHT80	122	-4.56	-4.03	11	PASS

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Mode	Channel Number	Read Value (dBm/470kHz)	Power Spectral Density (dBm/500kHz)	Limit (dBm/500kHz)	Conclusion
802.11a	144	-0.44	-0.04	30	PASS
	149	2.32	2.72	30	PASS
	157	2.17	2.57	30	PASS
	165	2.73	3.13	30	PASS
802.11n HT20	144	-1.70	-1.29	30	PASS
	149	0.92	1.33	30	PASS
	157	0.88	1.29	30	PASS
	165	0.90	1.31	30	PASS
802.11n HT40	151	-4.01	-3.46	30	PASS
	159	-4.49	-3.94	30	PASS
802.11ac VHT20	144	-3.85	-3.44	30	PASS
	149	-1.06	-0.65	30	PASS
	157	-1.33	-0.92	30	PASS
	165	-0.96	-0.55	30	PASS
802.11ac VHT40	151	-4.23	-3.69	30	PASS
	159	-4.49	-3.95	30	PASS
802.11ac VHT80	155	-7.36	-6.56	30	PASS
Note: PSD=Read Value+Duty cycle correction factor +10*log(500/470)					

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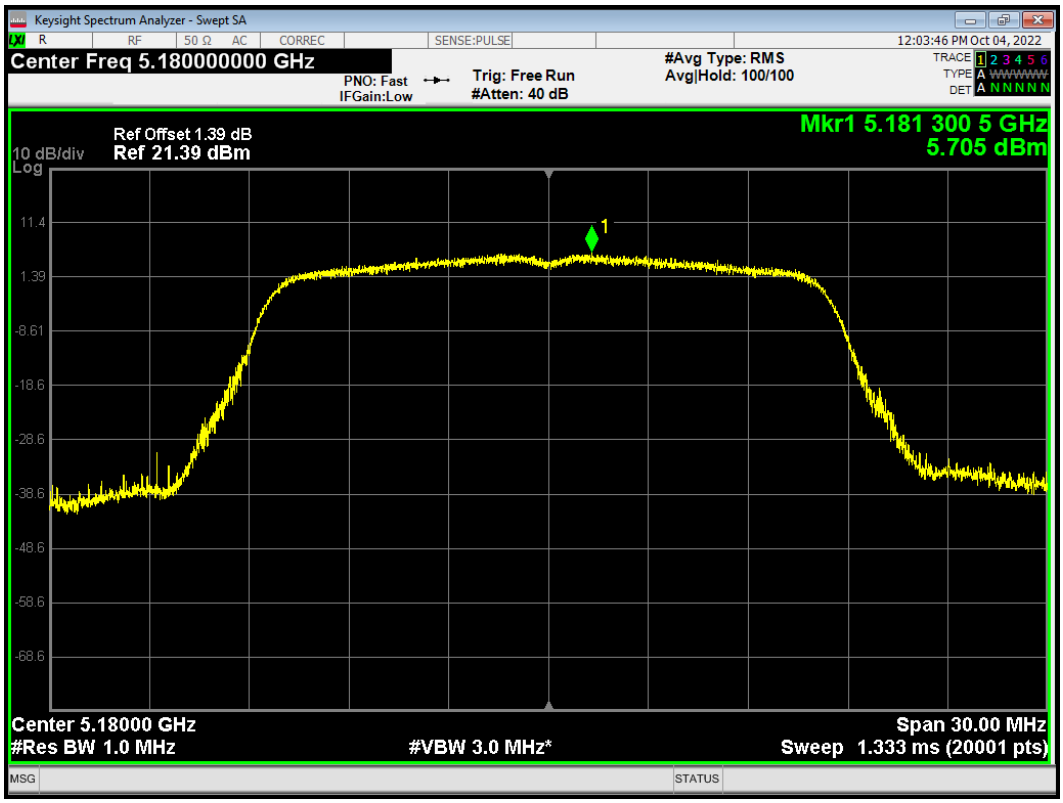
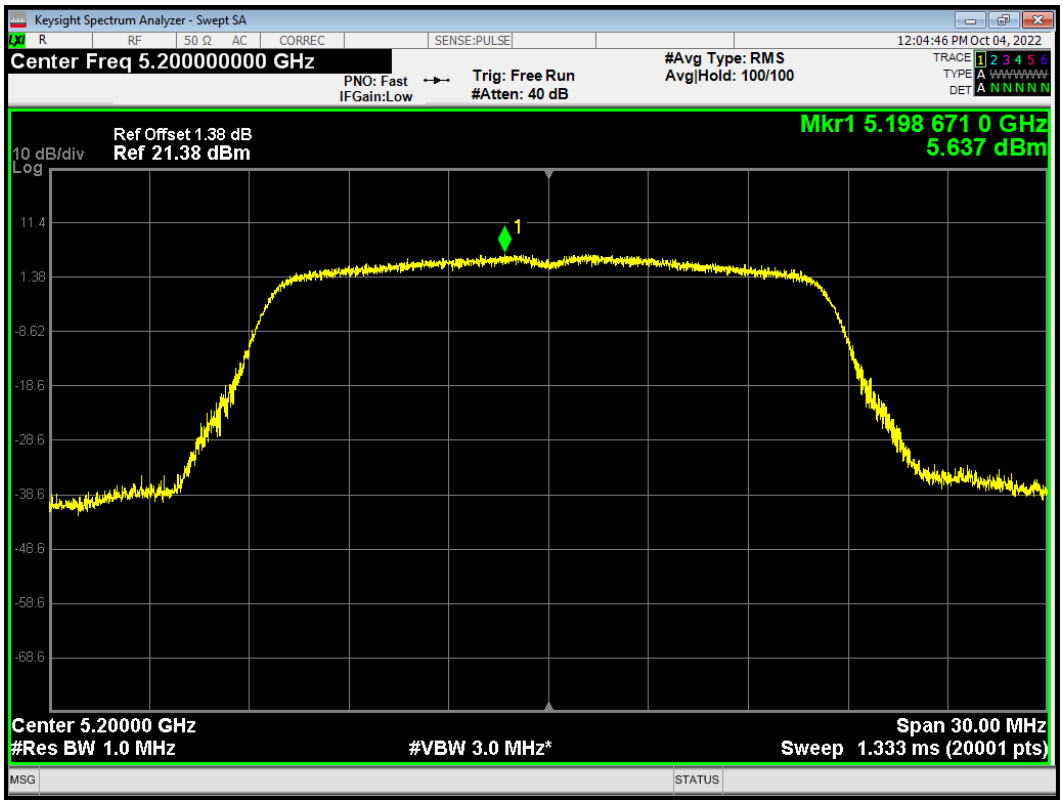
U-NII-1

PSD 802.11a 5180MHz



PSD 802.11a 5200MHz



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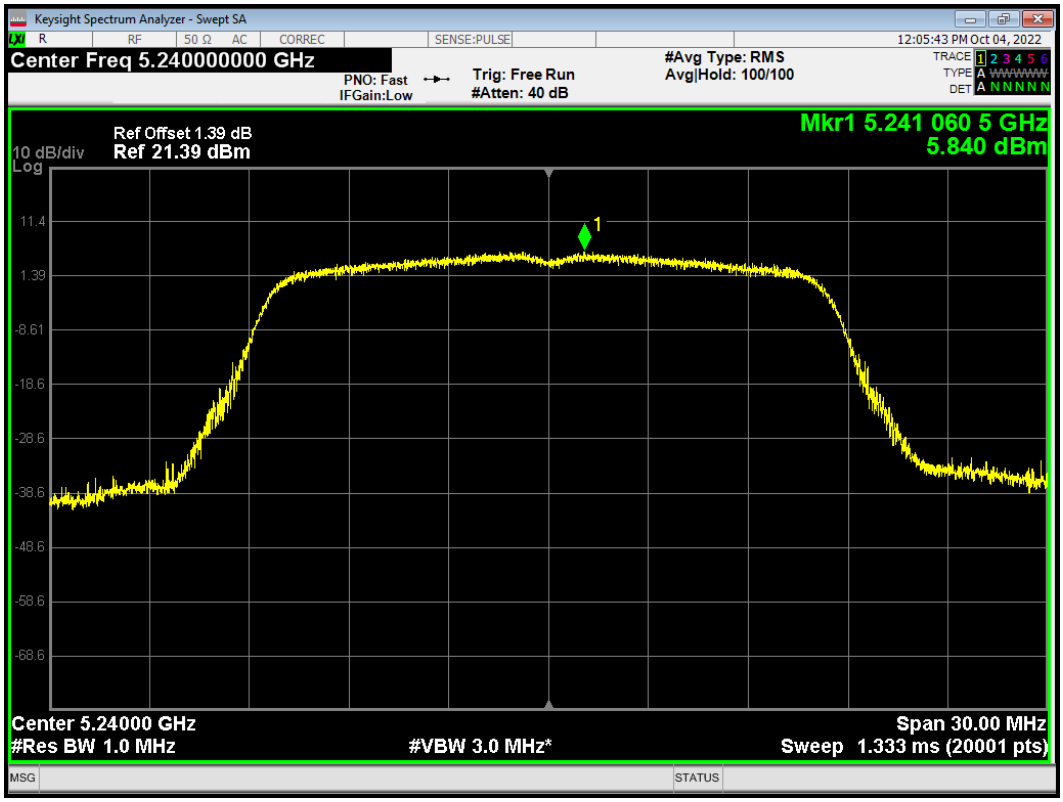
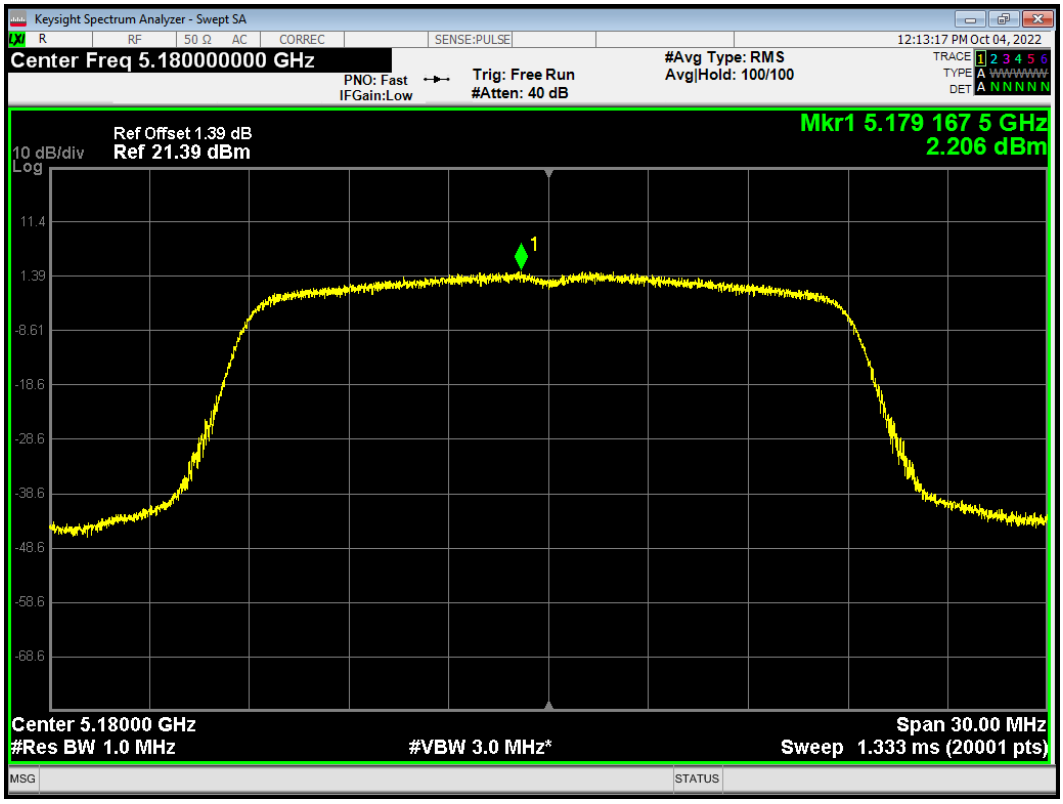
PSD 802.11a 5240MHz



PSD 802.11ac (VHT20) 5180MHz



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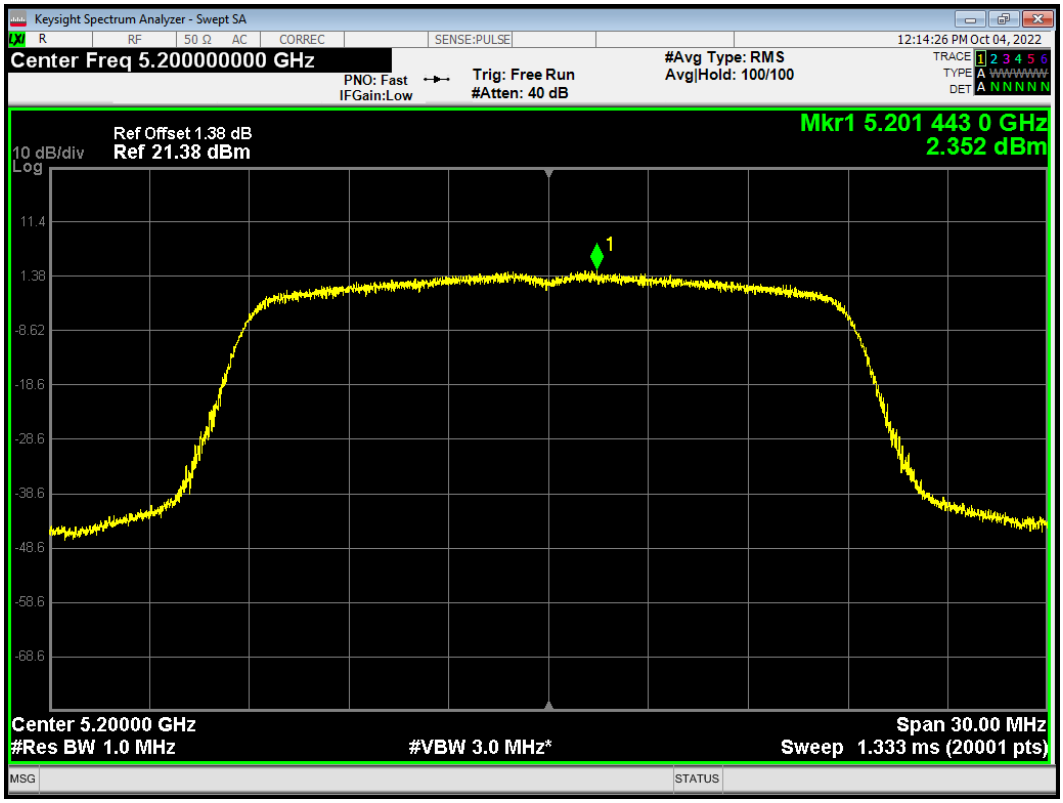
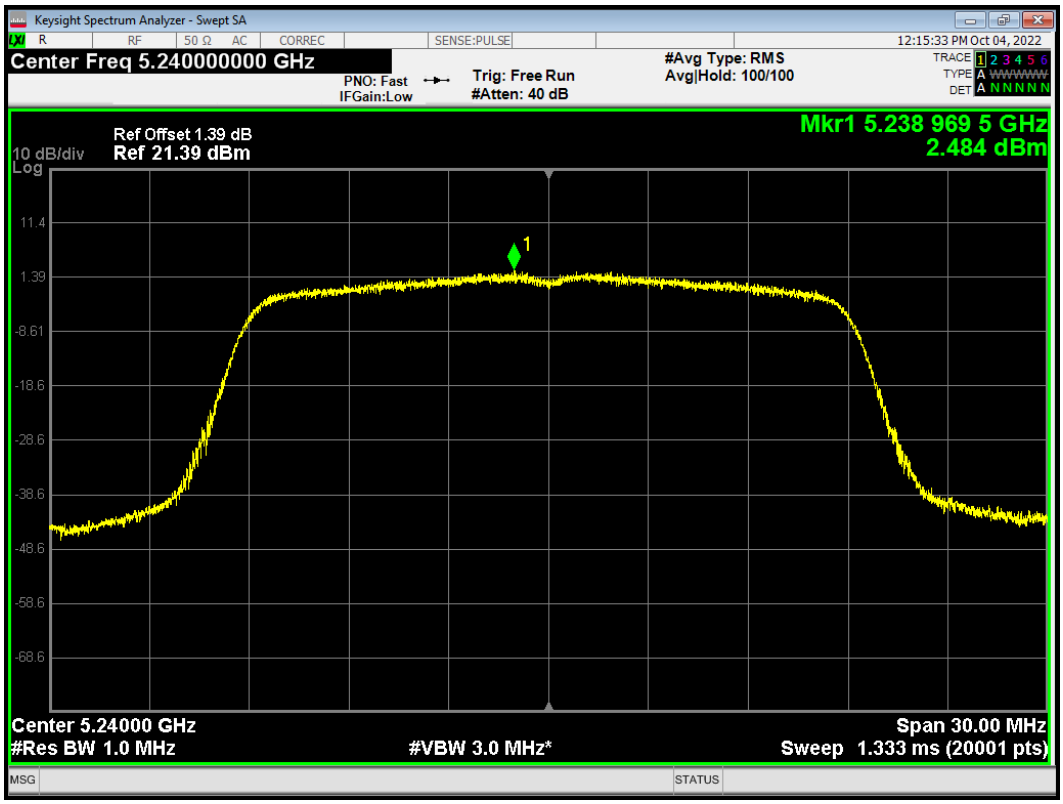
PSD 802.11ac (VHT20) 5200MHz



PSD 802.11ac (VHT20) 5240MHz



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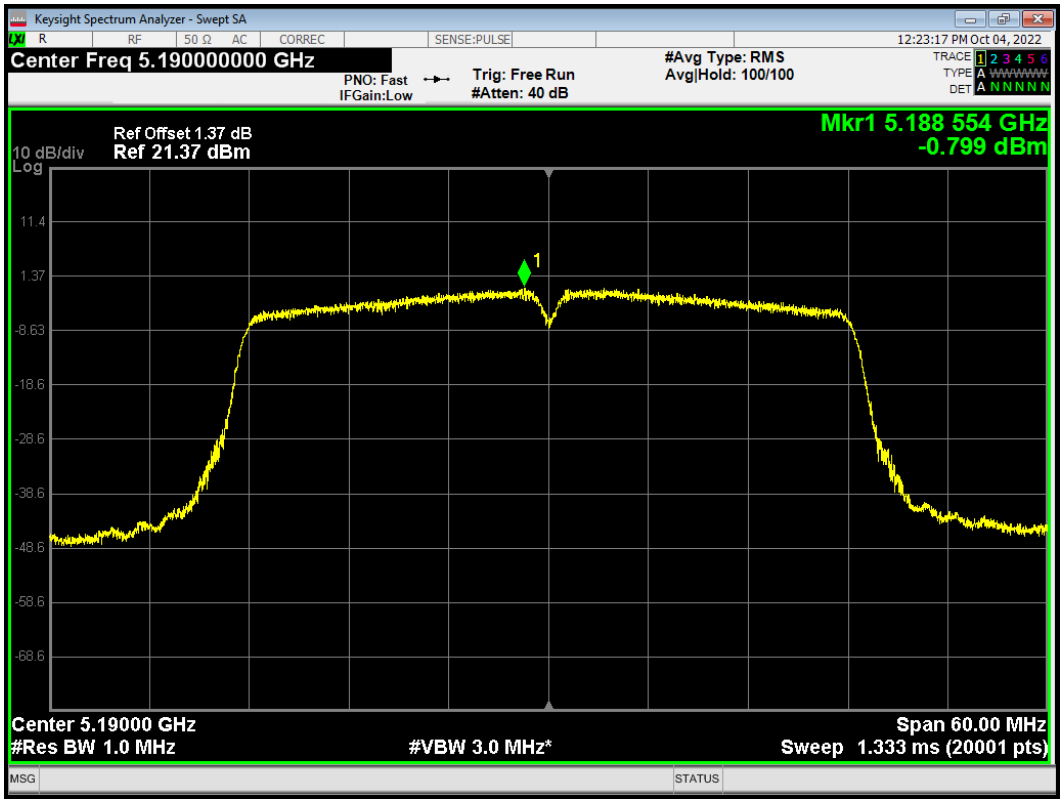
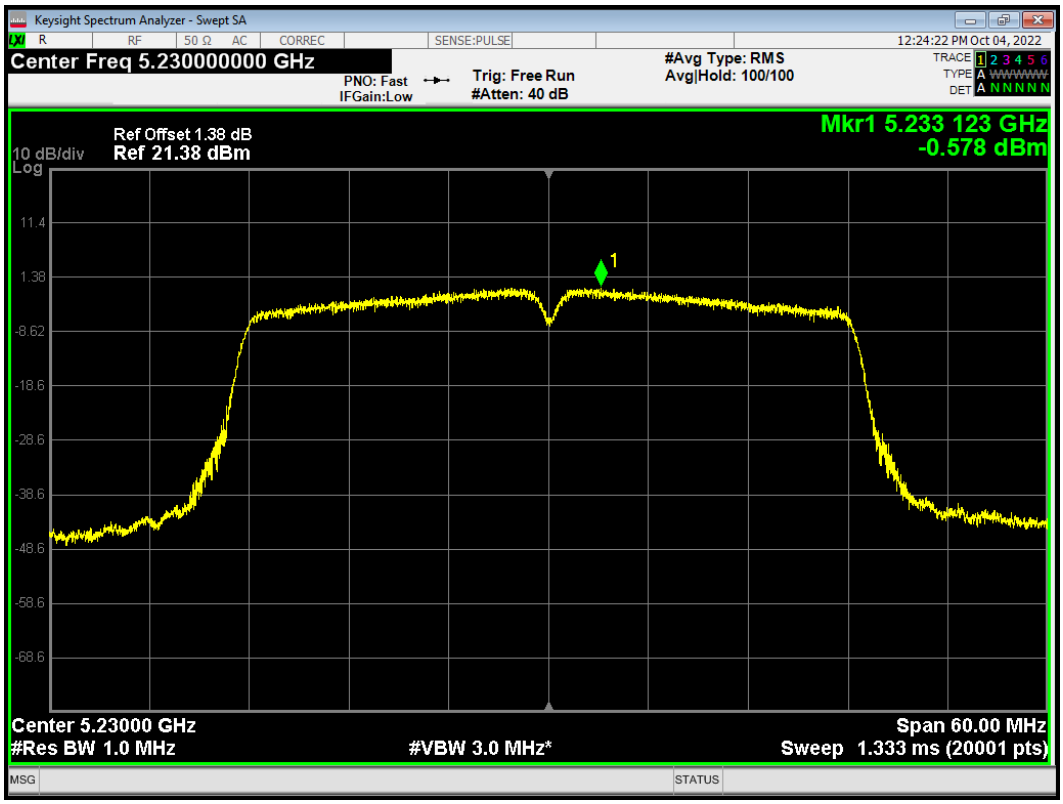
PSD 802.11ac (VHT40) 5190MHz



PSD 802.11ac (VHT40) 5230MHz



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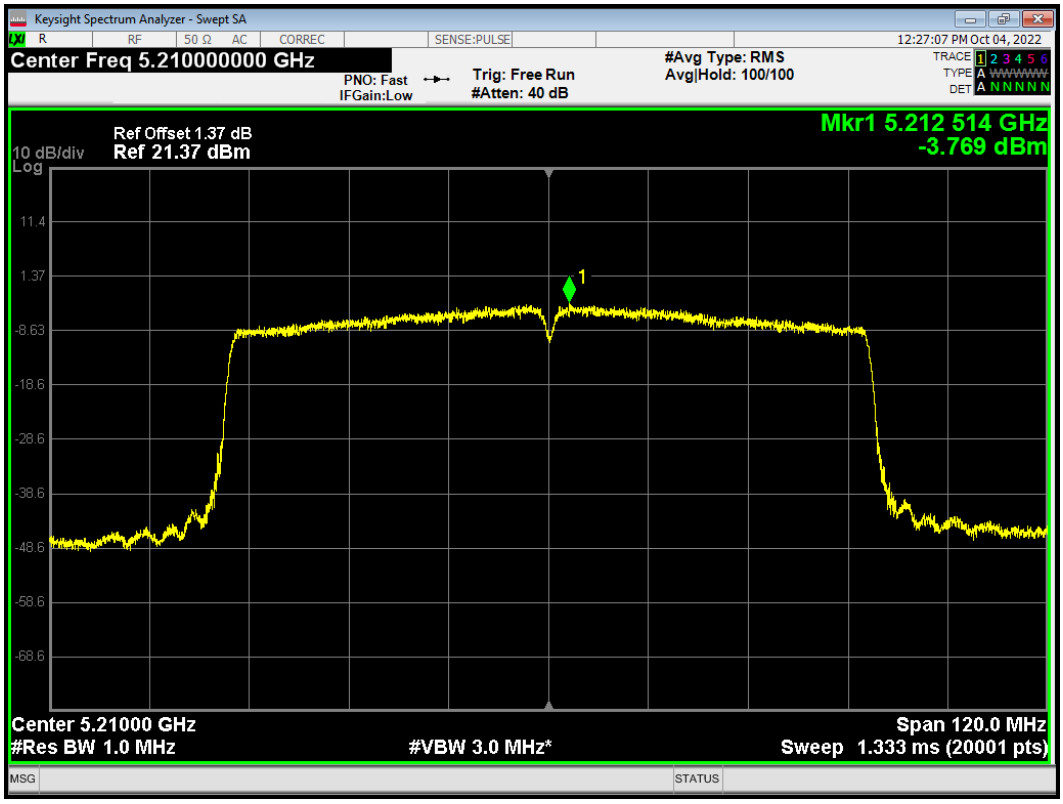
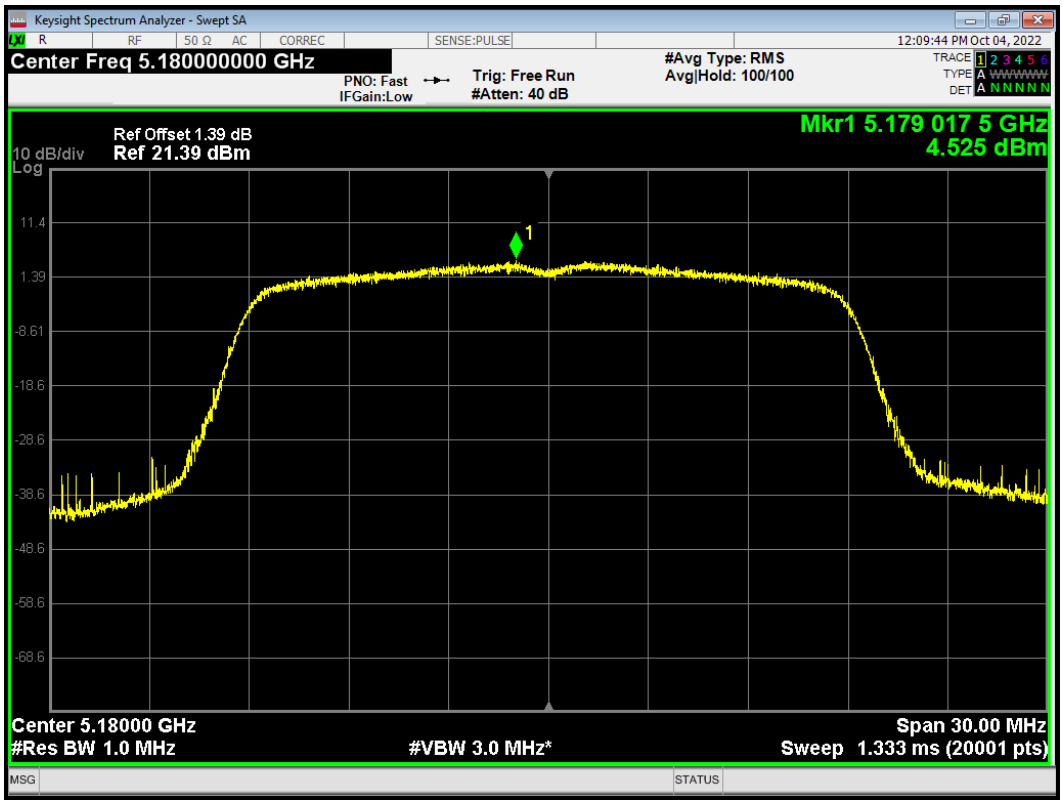
PSD 802.11ac (VHT80) 5210MHz



PSD 802.11n (HT20) 5180MHz



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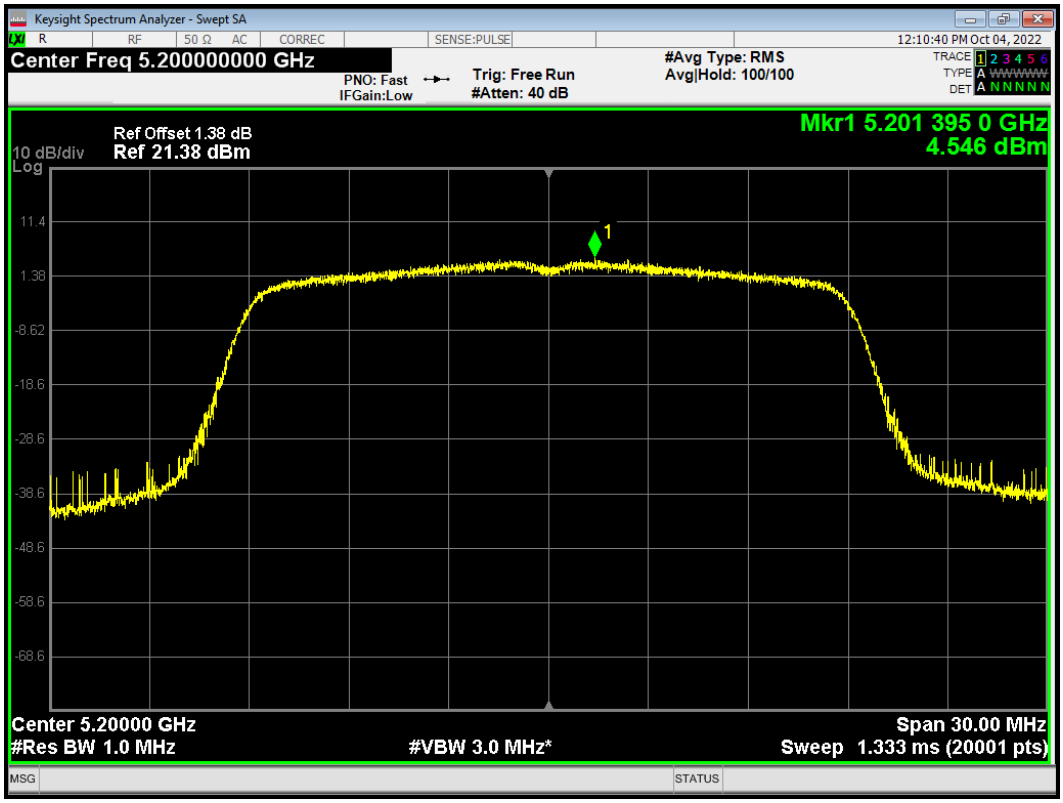
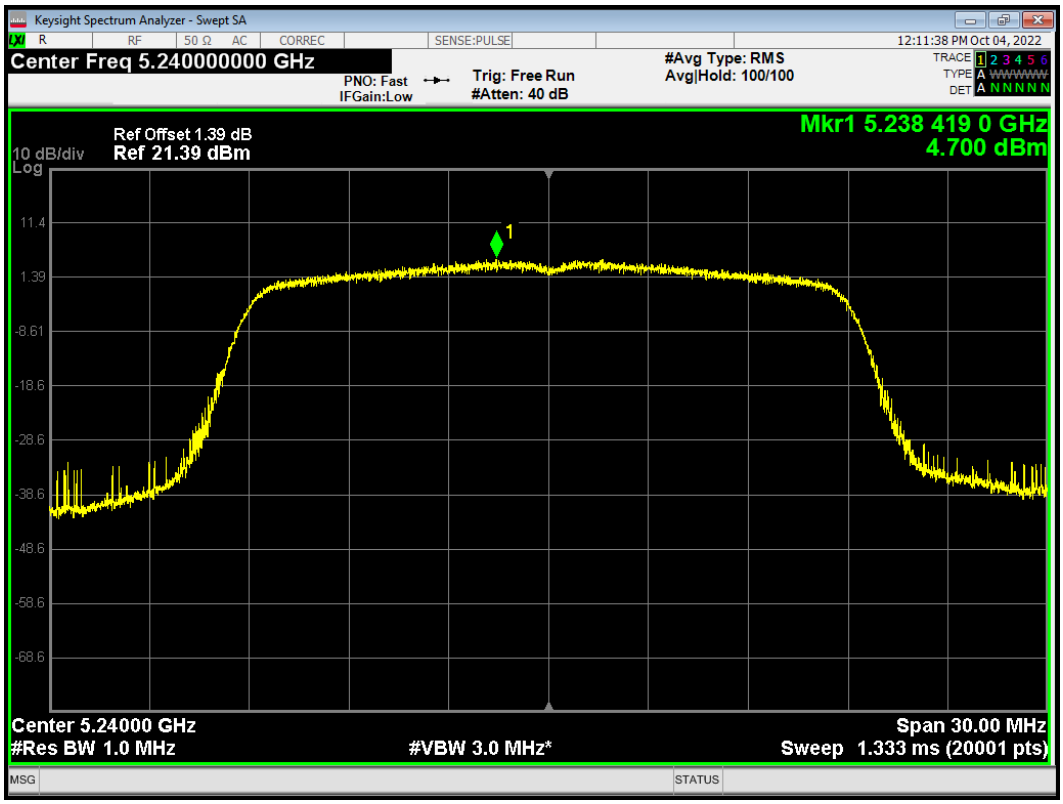
PSD 802.11n (HT20) 5200MHz



PSD 802.11n (HT20) 5240MHz



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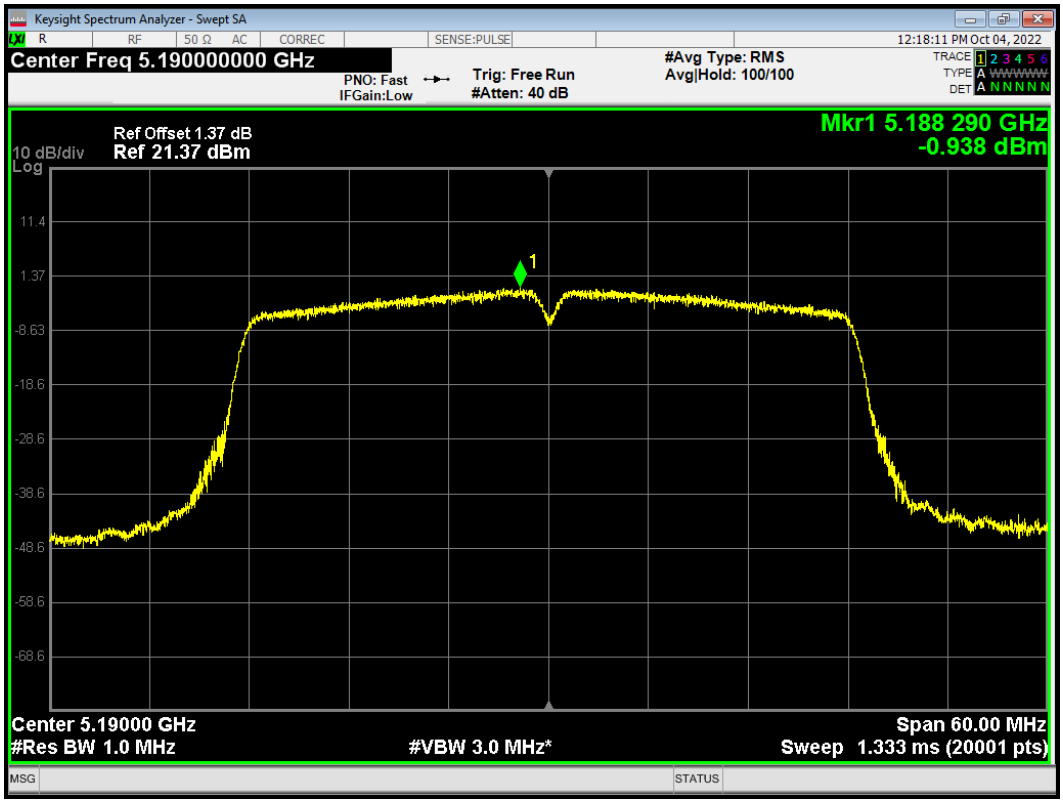
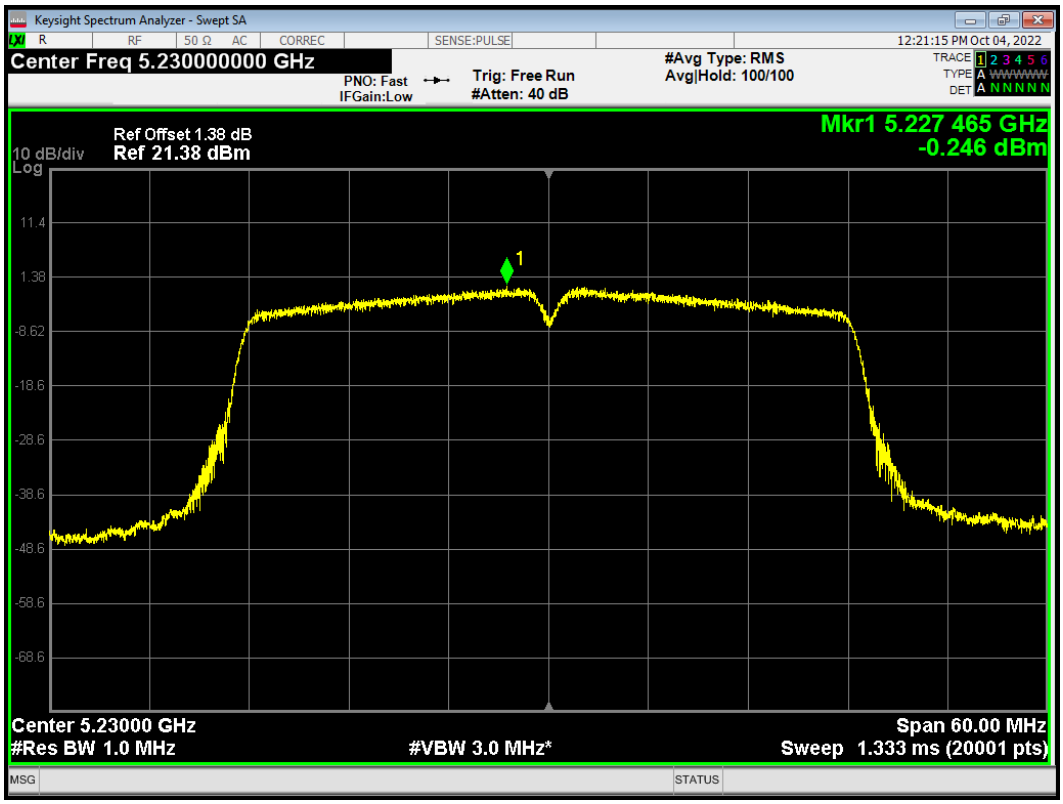
PSD 802.11n (HT40) 5190MHz



PSD 802.11n (HT40) 5230MHz



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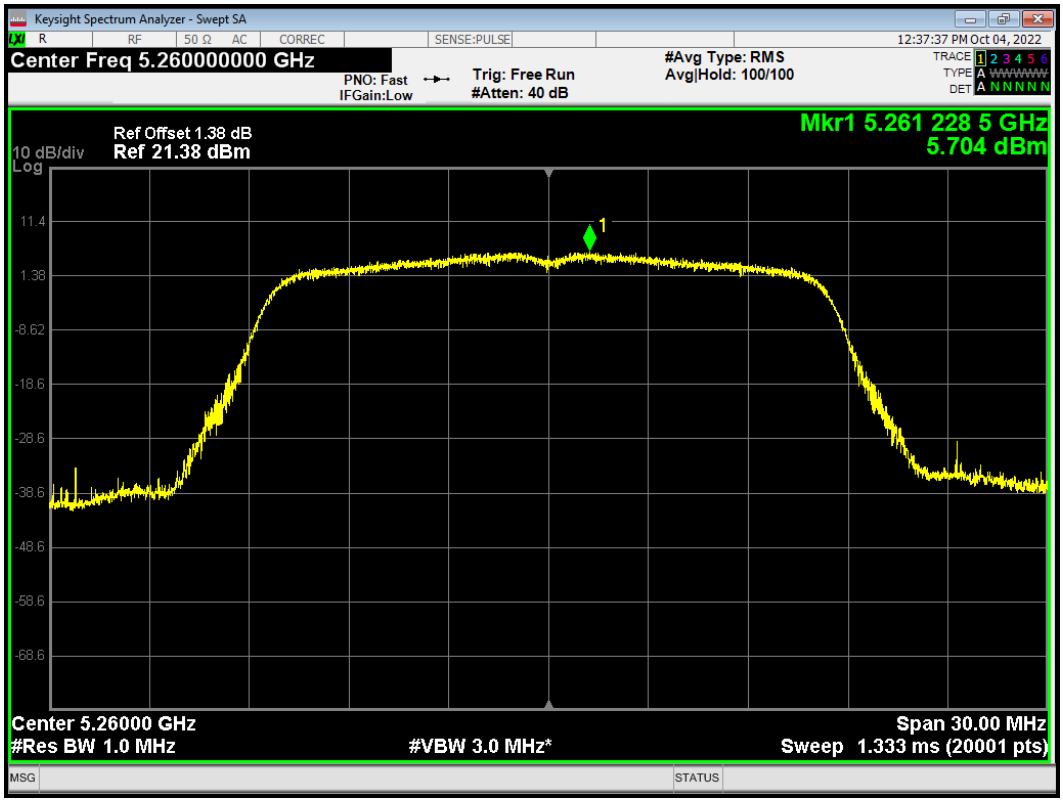
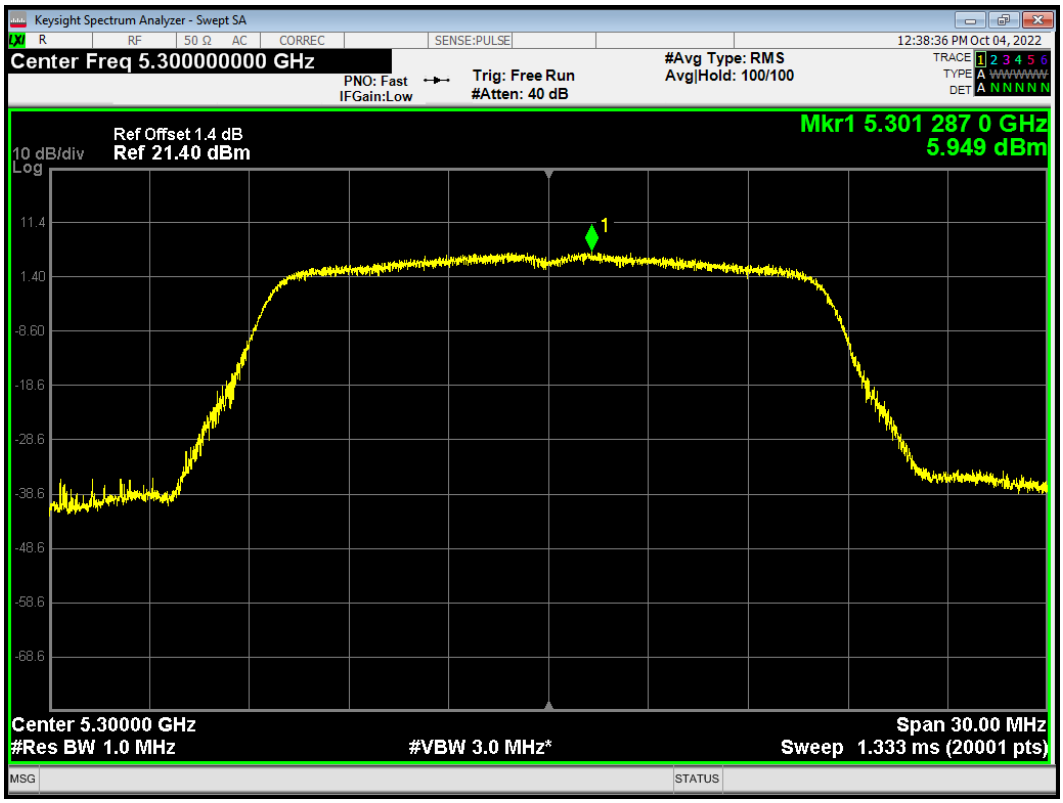
U-NII-2A

PSD 802.11a 5260MHz



PSD 802.11a 5300MHz



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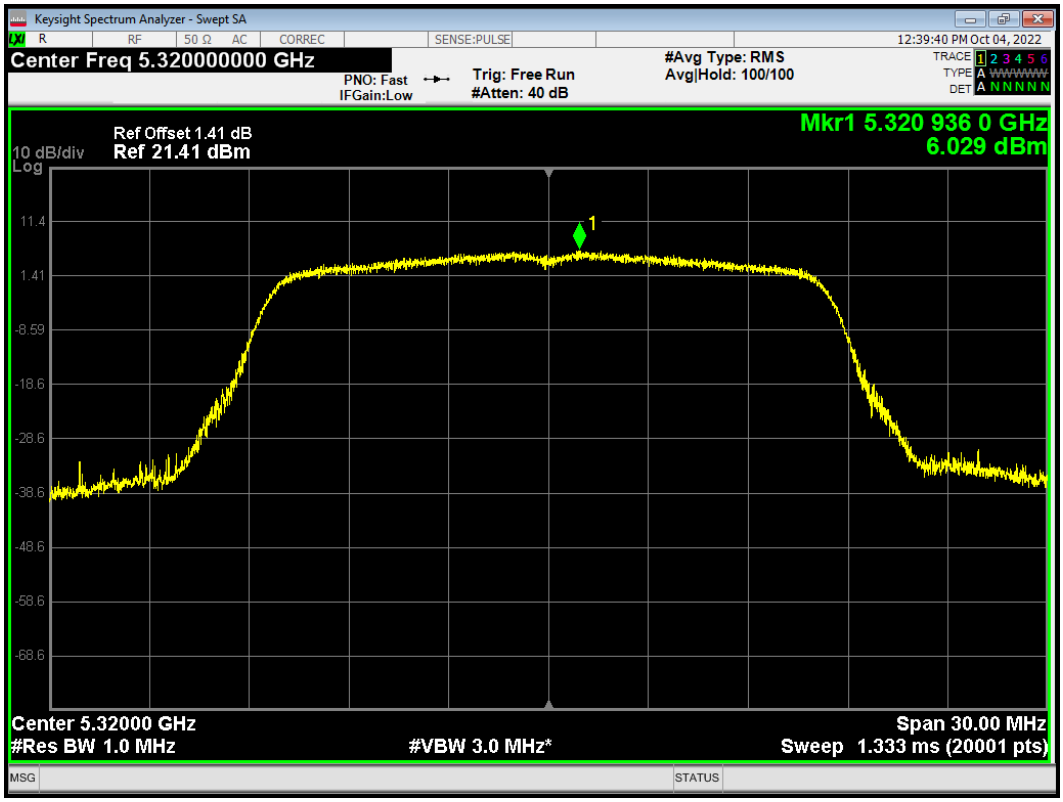
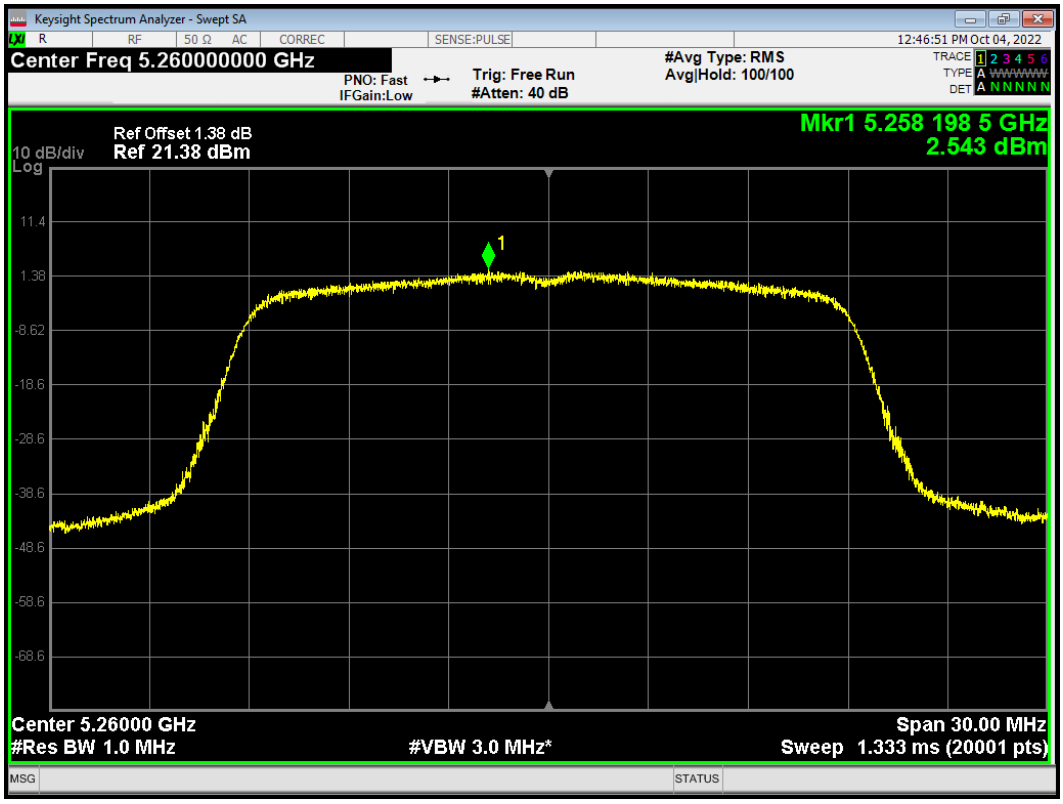
PSD 802.11a 5320MHz



PSD 802.11ac (VHT20) 5260MHz



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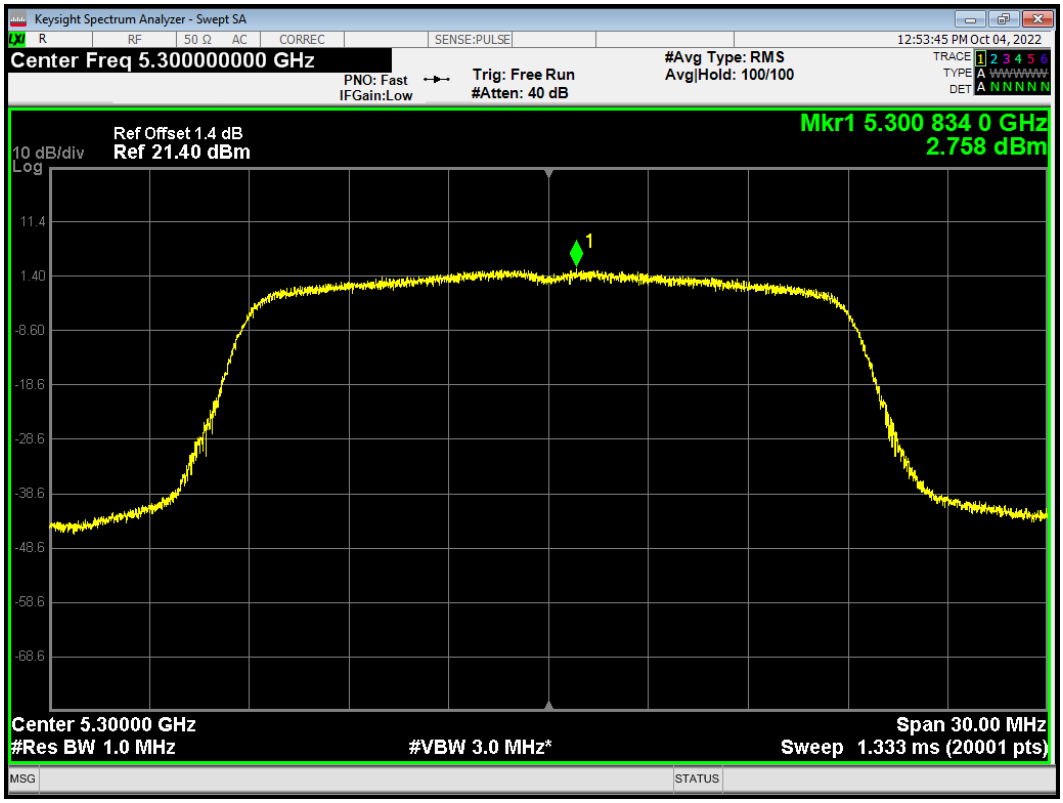
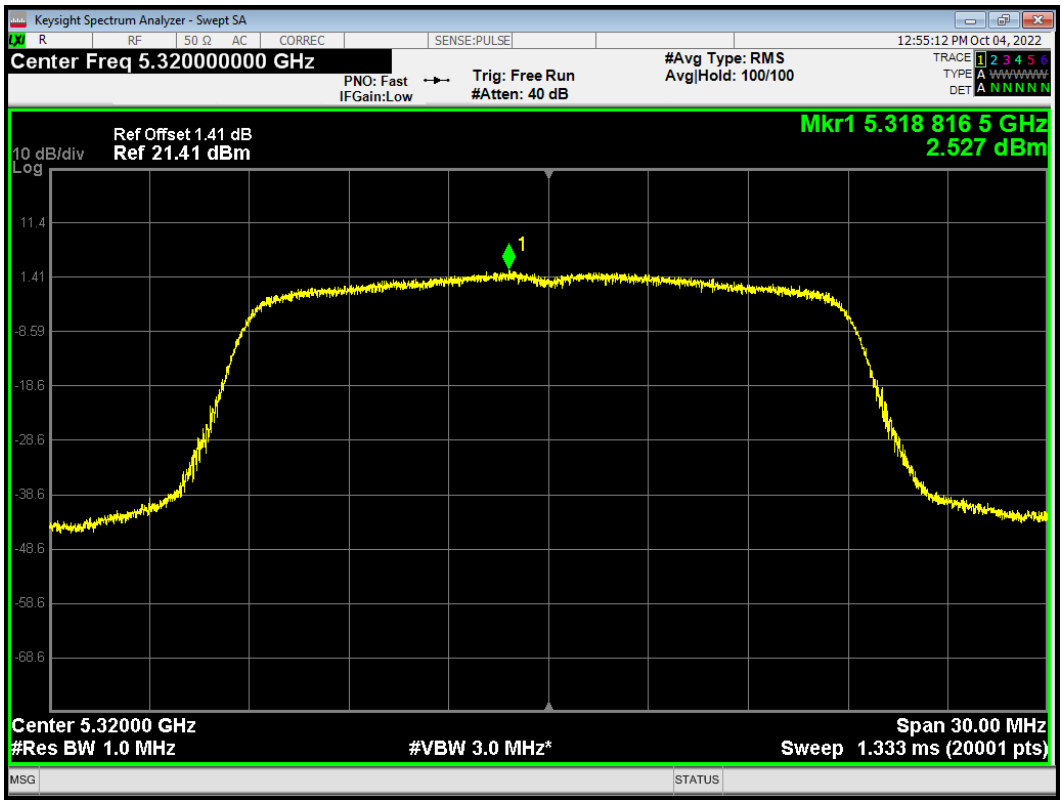
PSD 802.11ac (VHT20) 5300MHz



PSD 802.11ac (VHT20) 5320MHz



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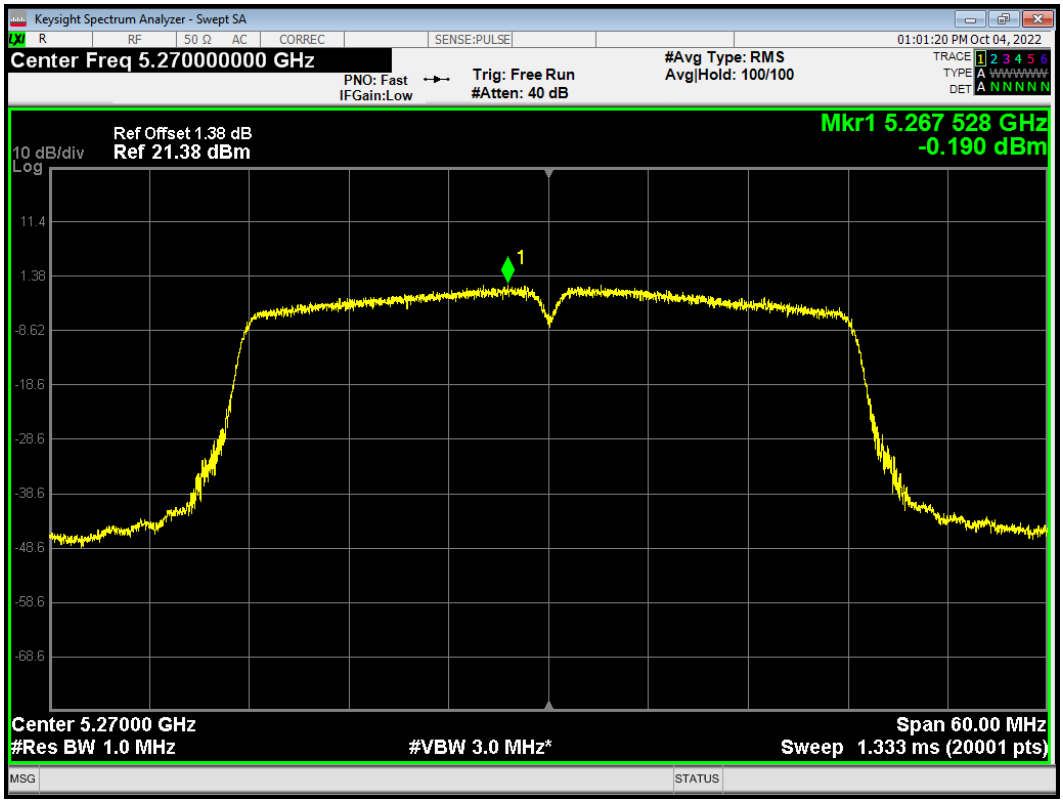
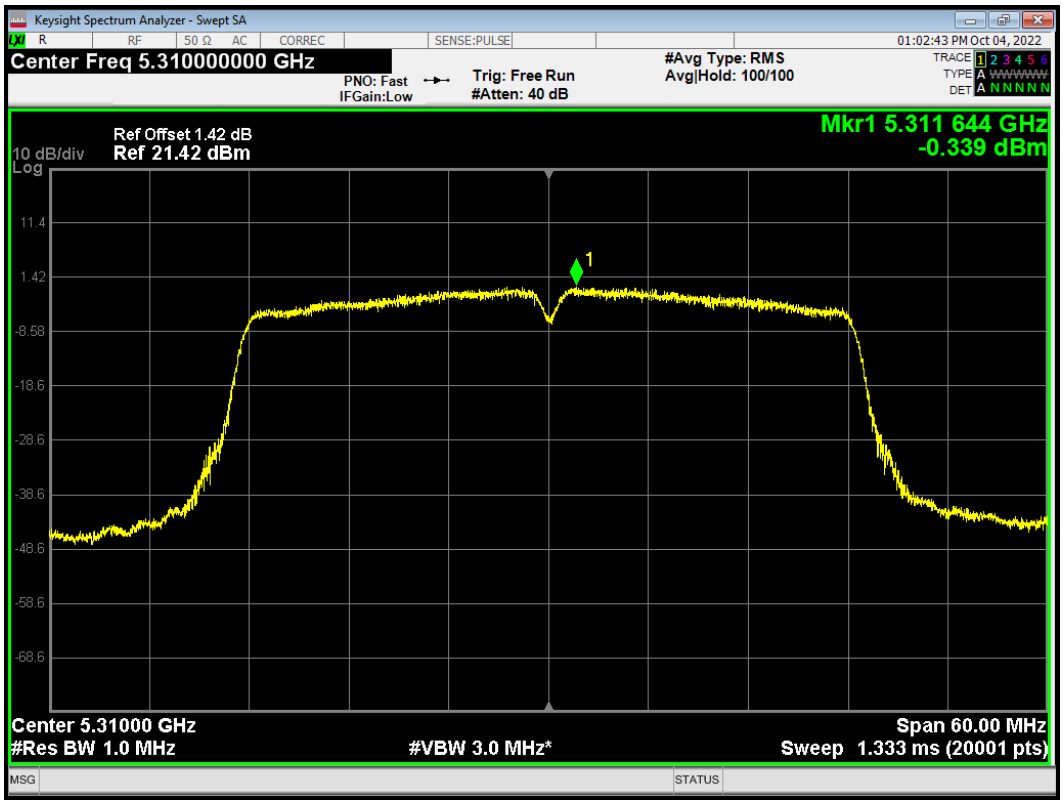
PSD 802.11ac (VHT40) 5270MHz



PSD 802.11ac (VHT40) 5310MHz



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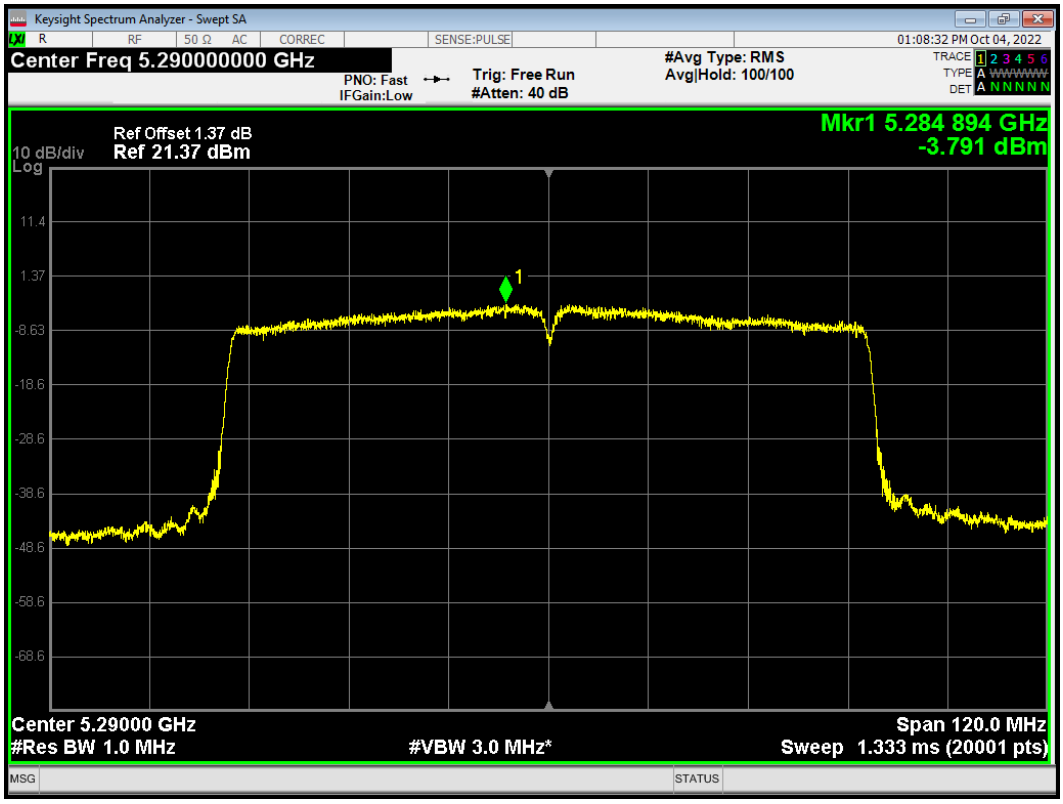
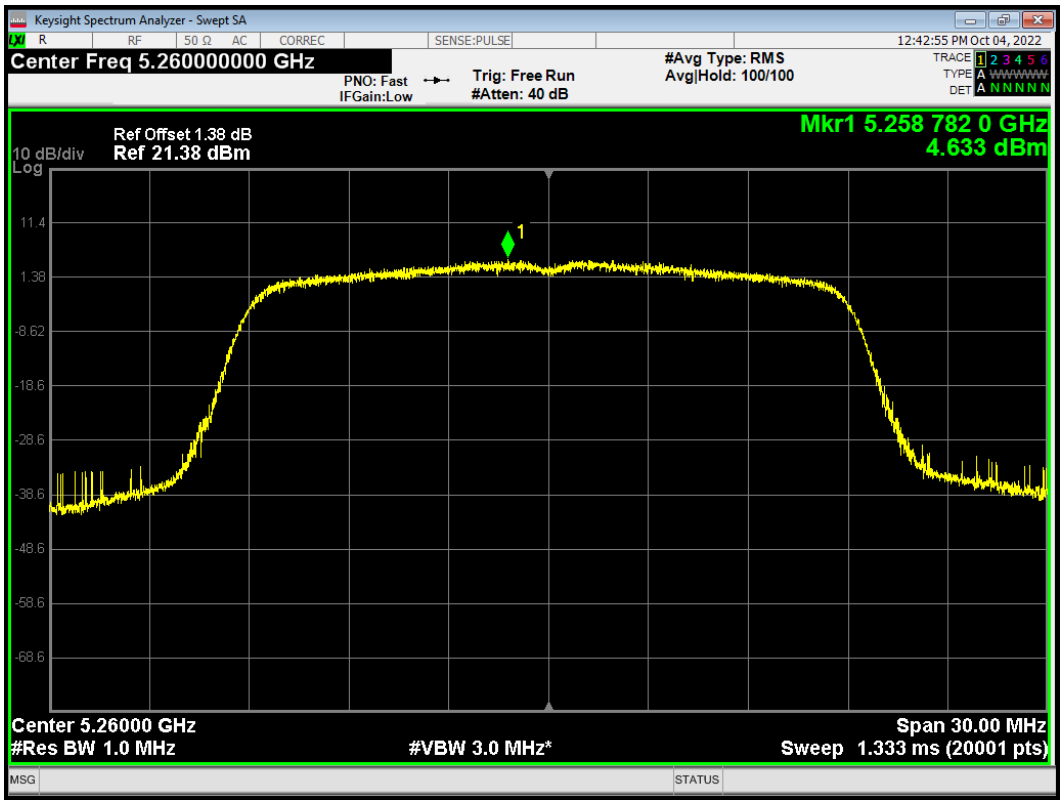
PSD 802.11ac (VHT80) 5290MHz



PSD 802.11n (HT20) 5260MHz



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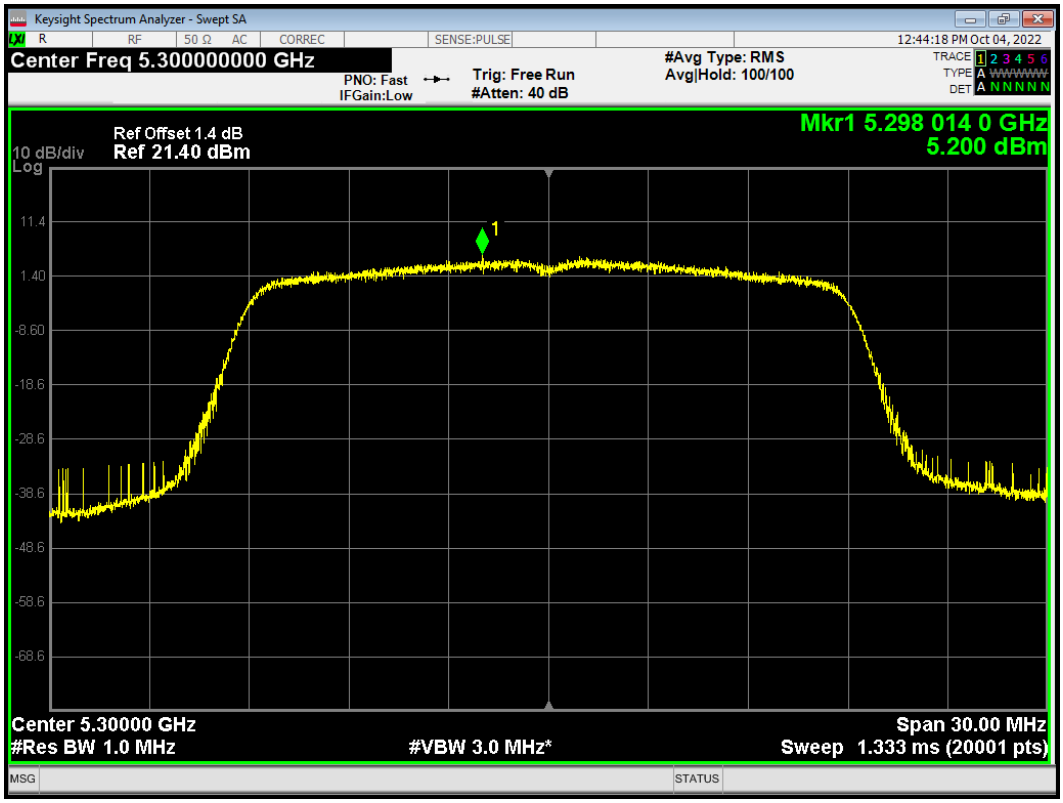
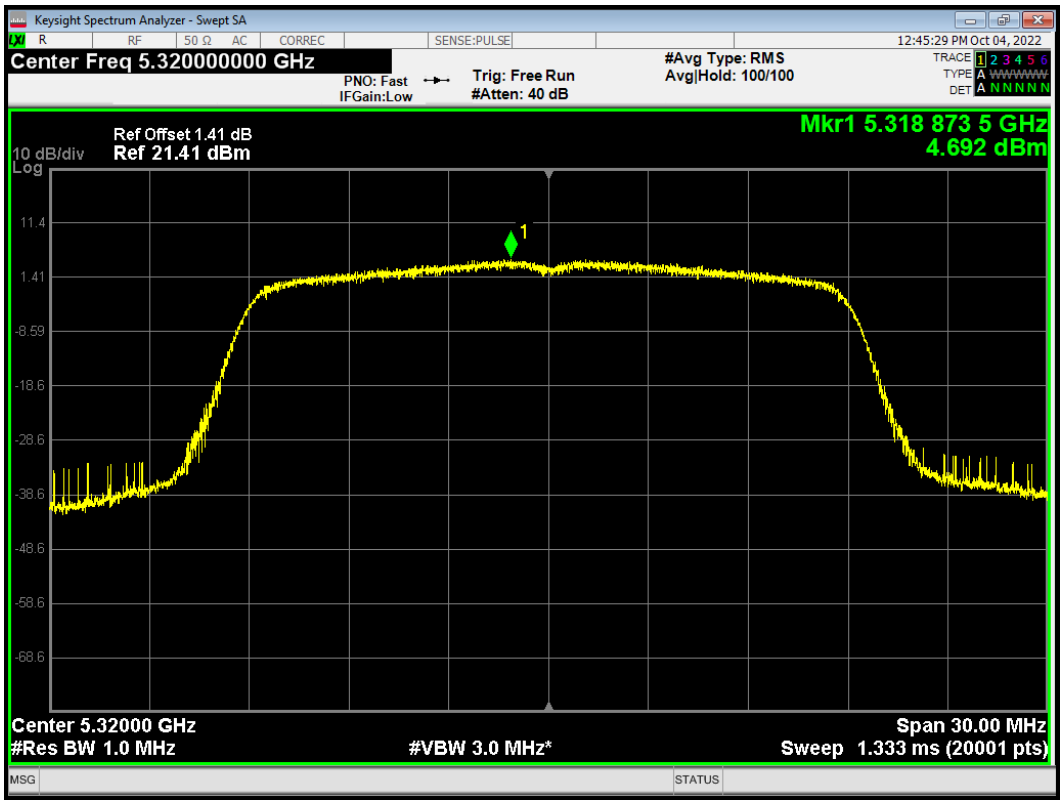
PSD 802.11n (HT20) 5300MHz



PSD 802.11n (HT20) 5320MHz



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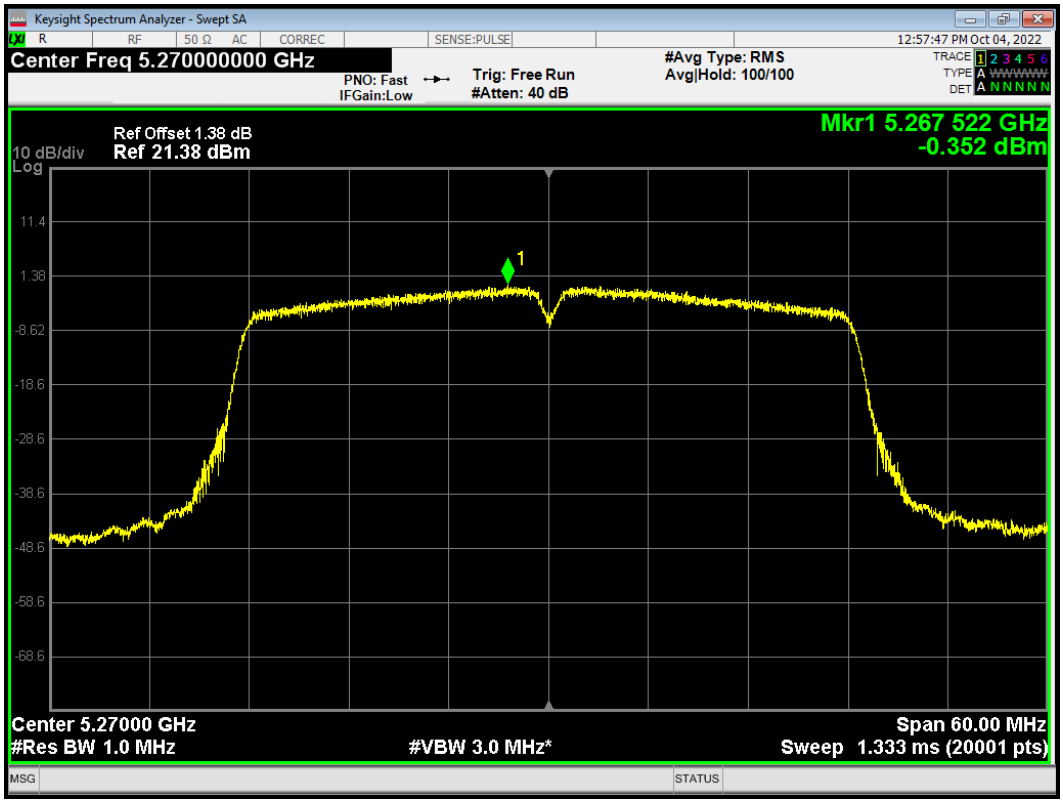
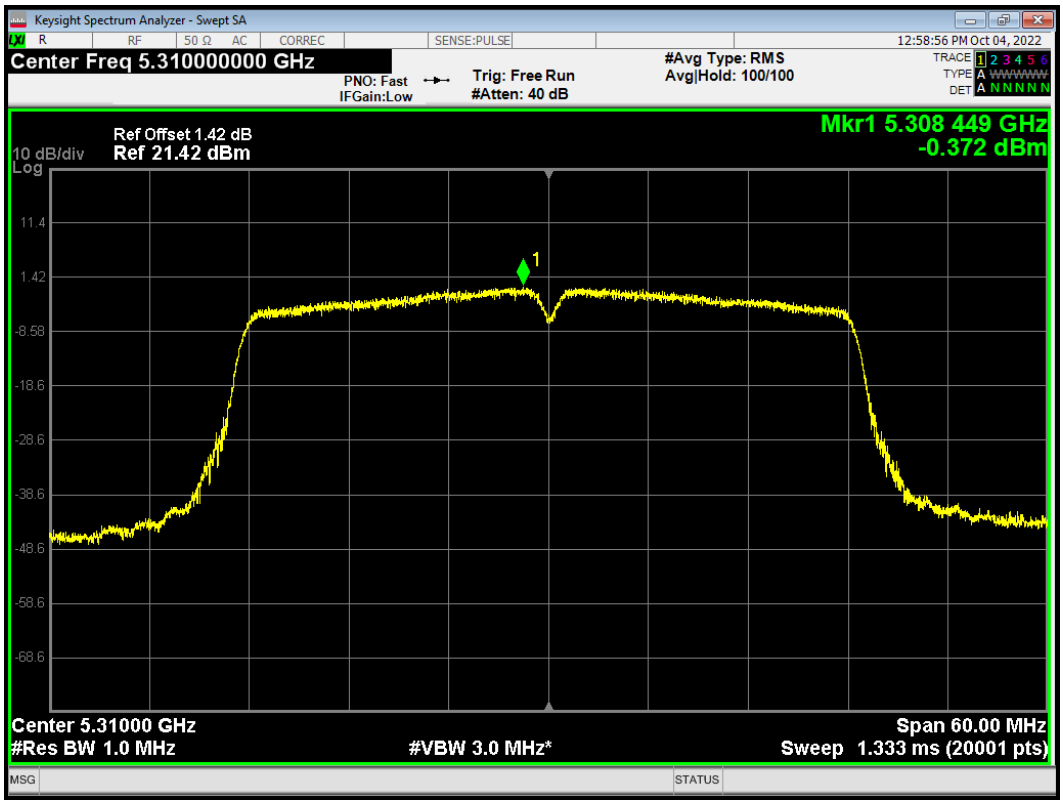
PSD 802.11n (HT40) 5270MHz



PSD 802.11n (HT40) 5310MHz



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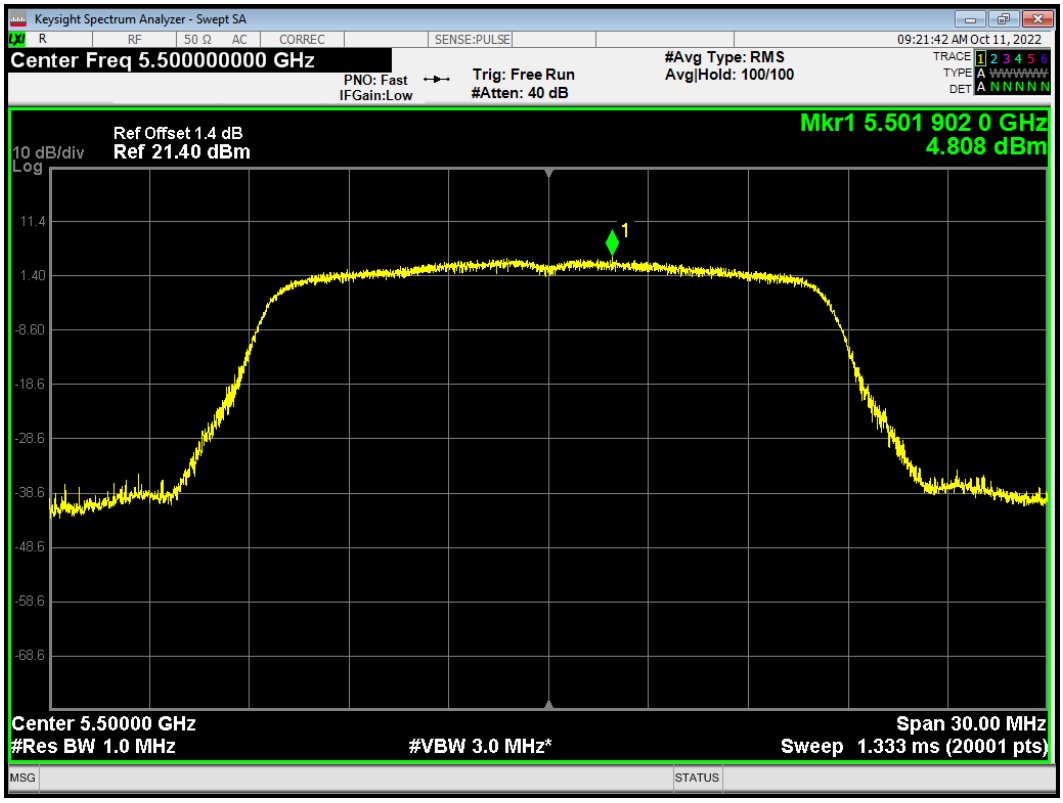
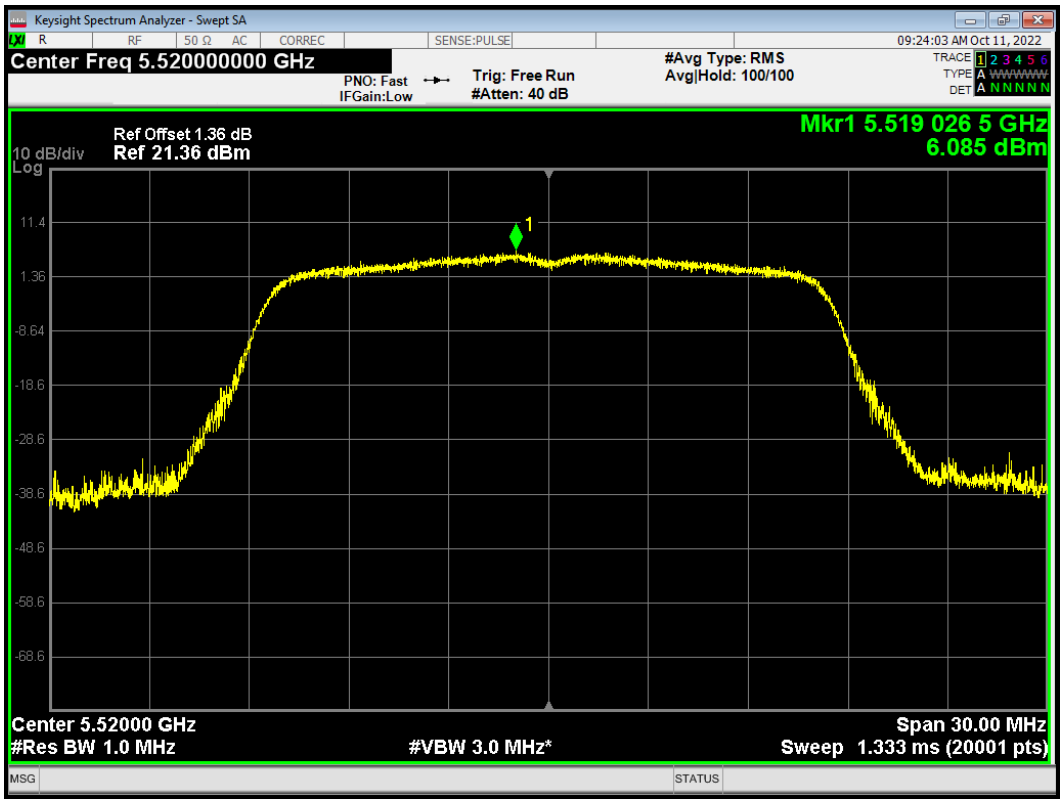
U-NII-2C

PSD 802.11a 5500MHz



PSD 802.11a 5520MHz



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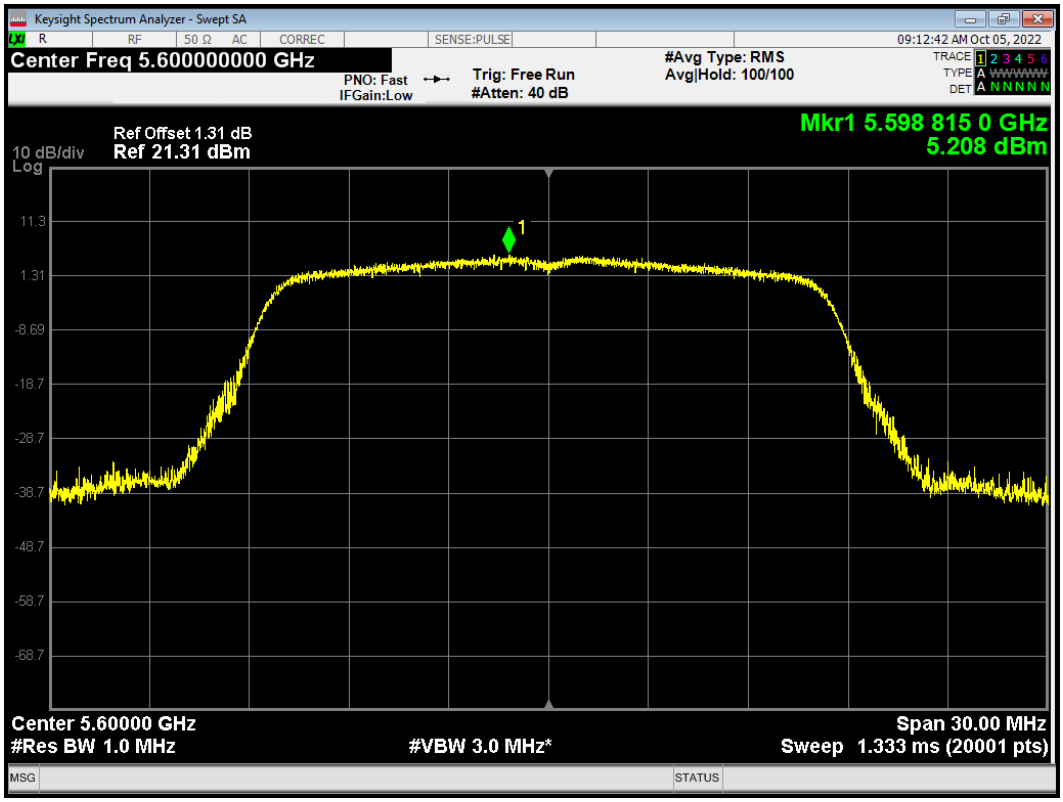
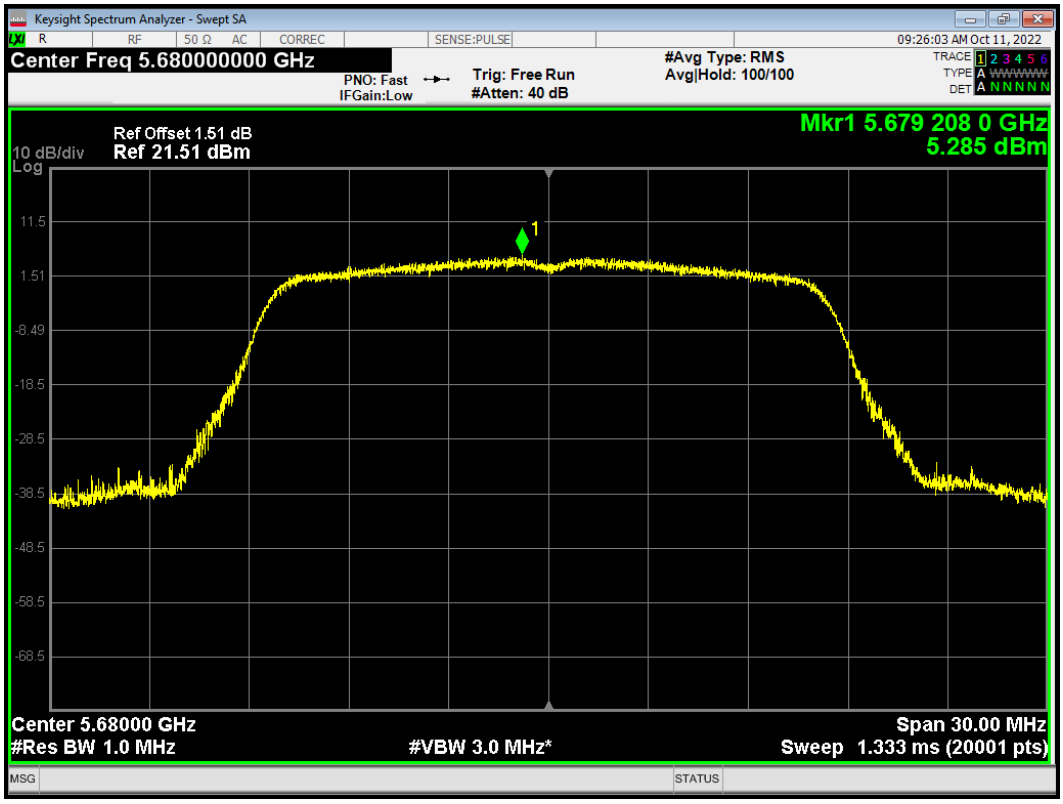
PSD 802.11a 5600MHz



PSD 802.11a 5680MHz



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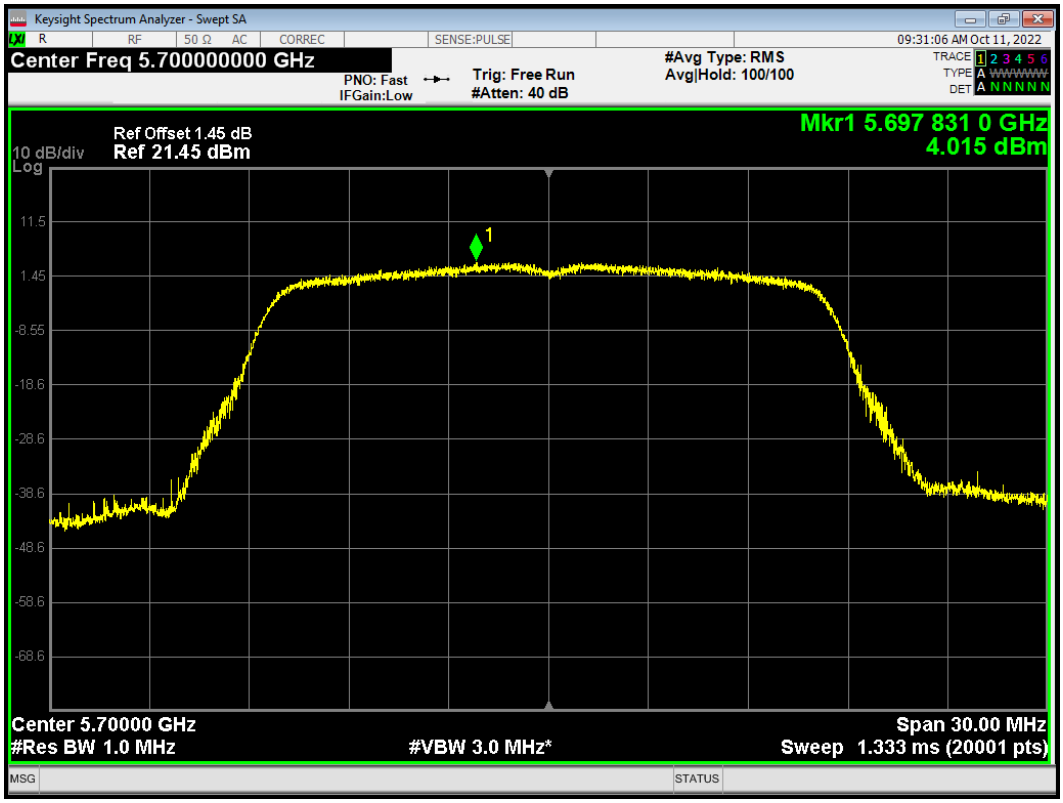
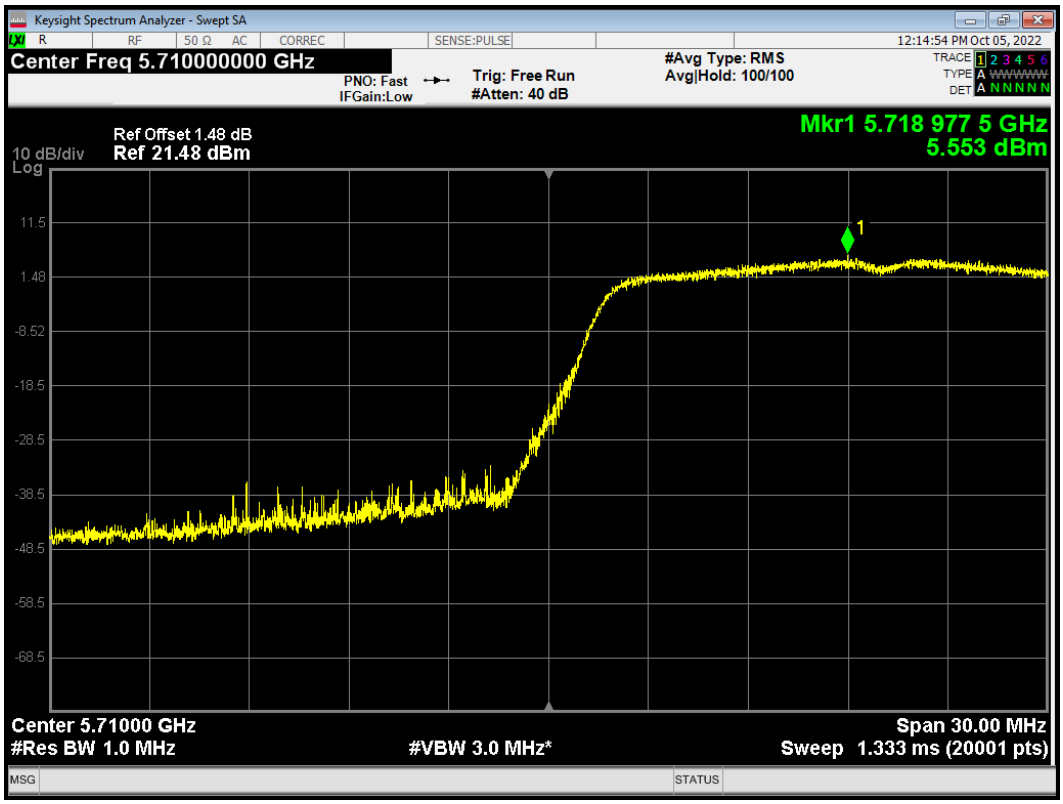
PSD 802.11a 5700MHz



PSD 802.11a 5720MHz



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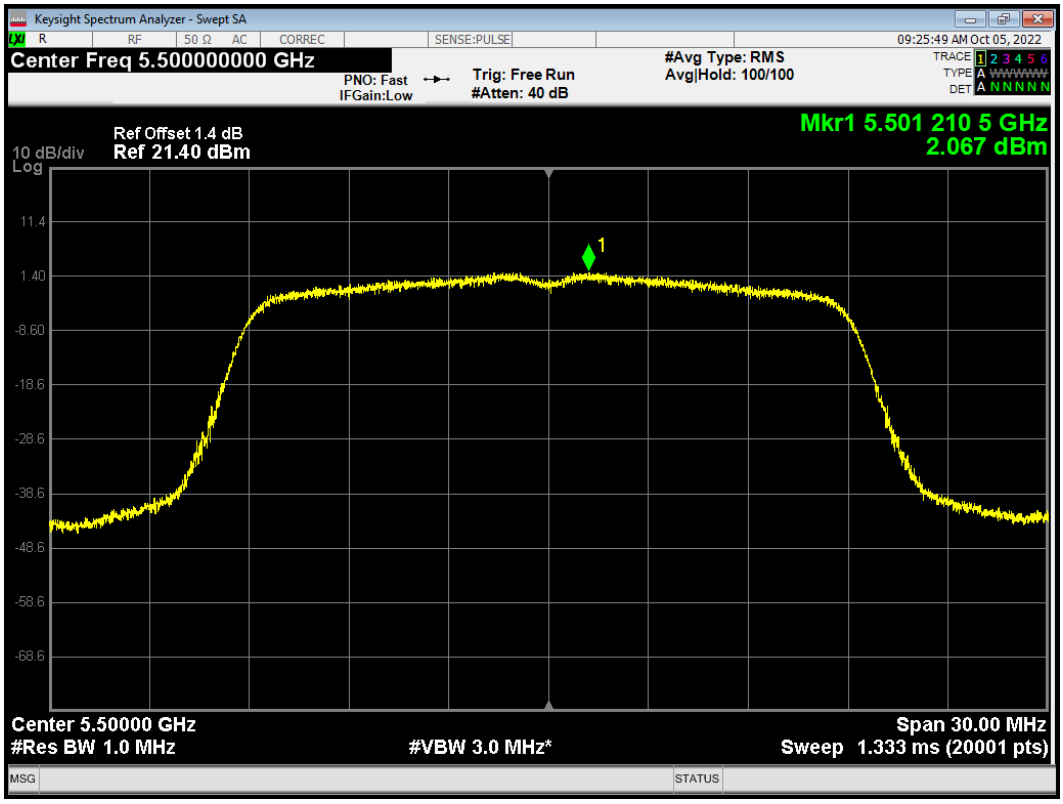
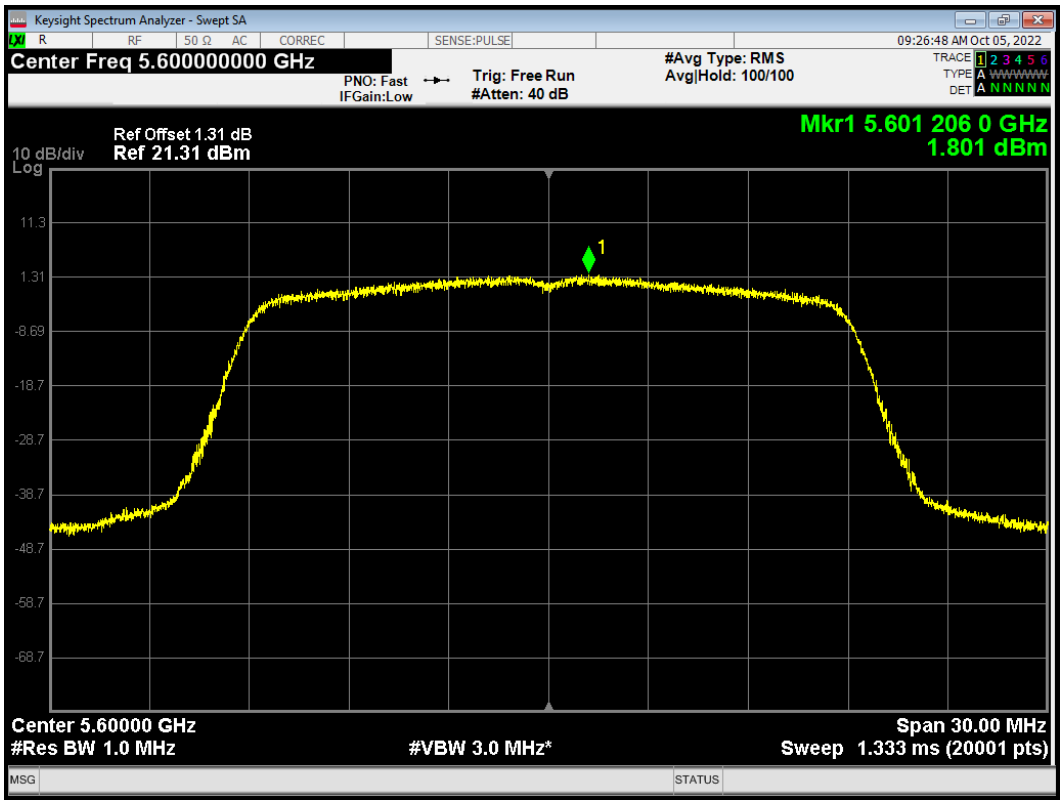
PSD 802.11ac (VHT20) 5500MHz



PSD 802.11ac (VHT20) 5600MHz



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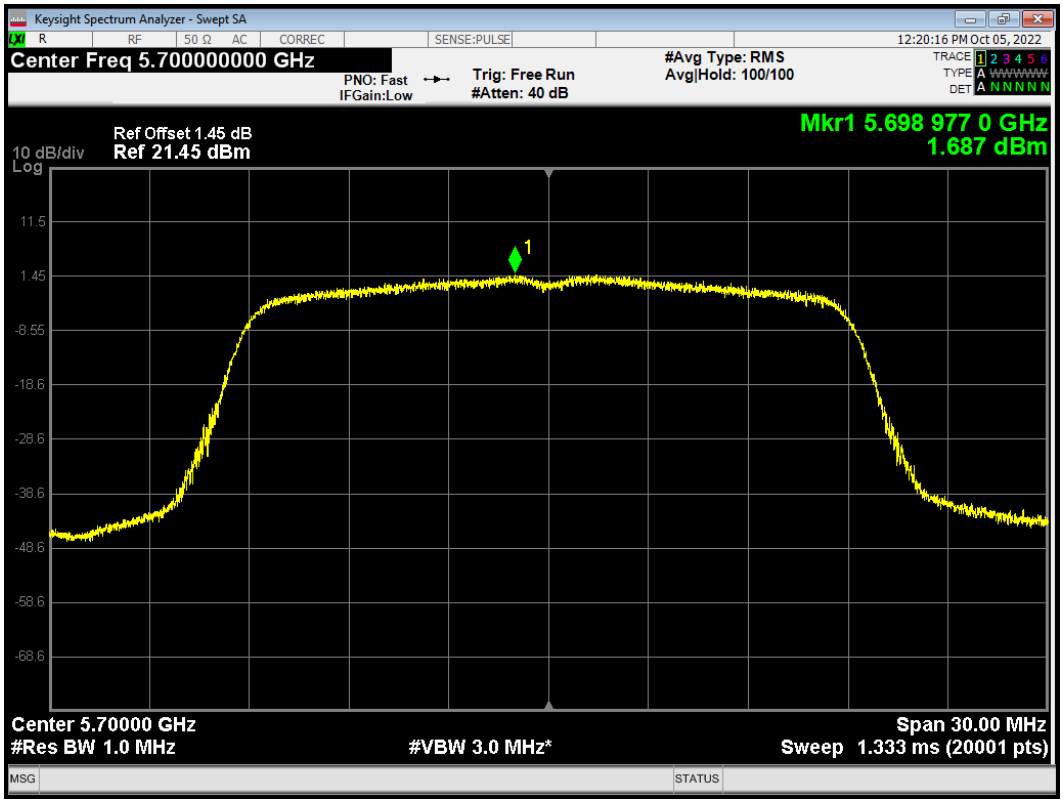
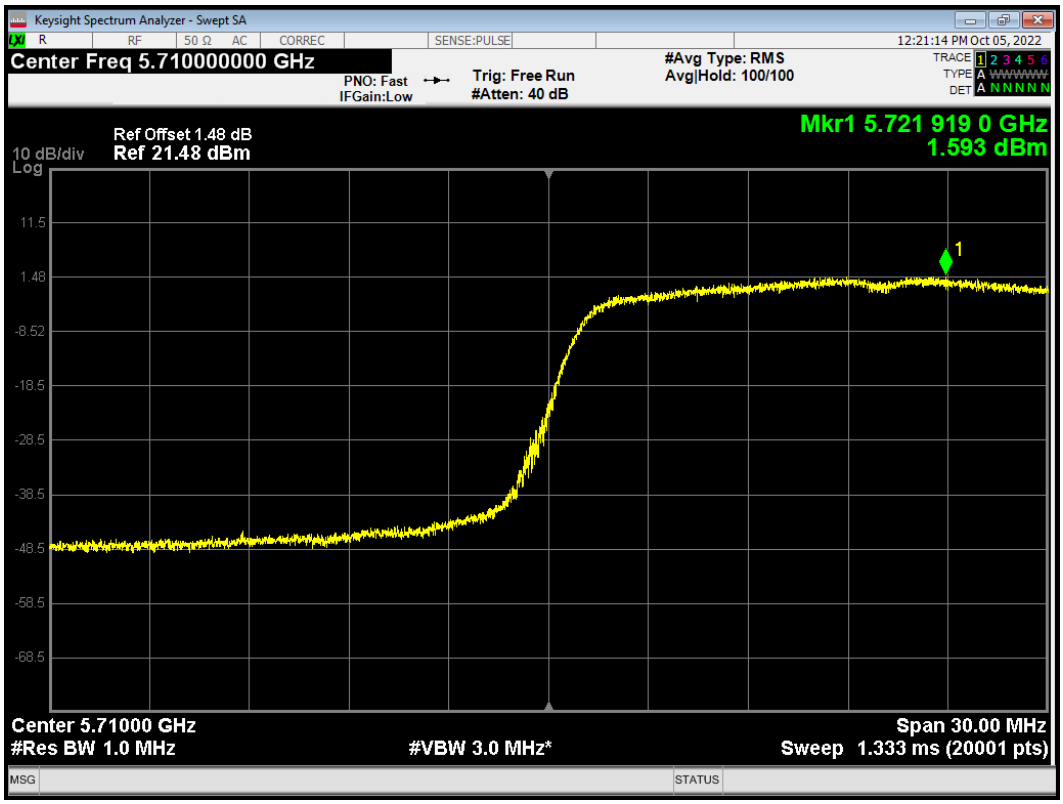
PSD 802.11ac (VHT20) 5700MHz



PSD 802.11ac(VHT20) 5720MHz



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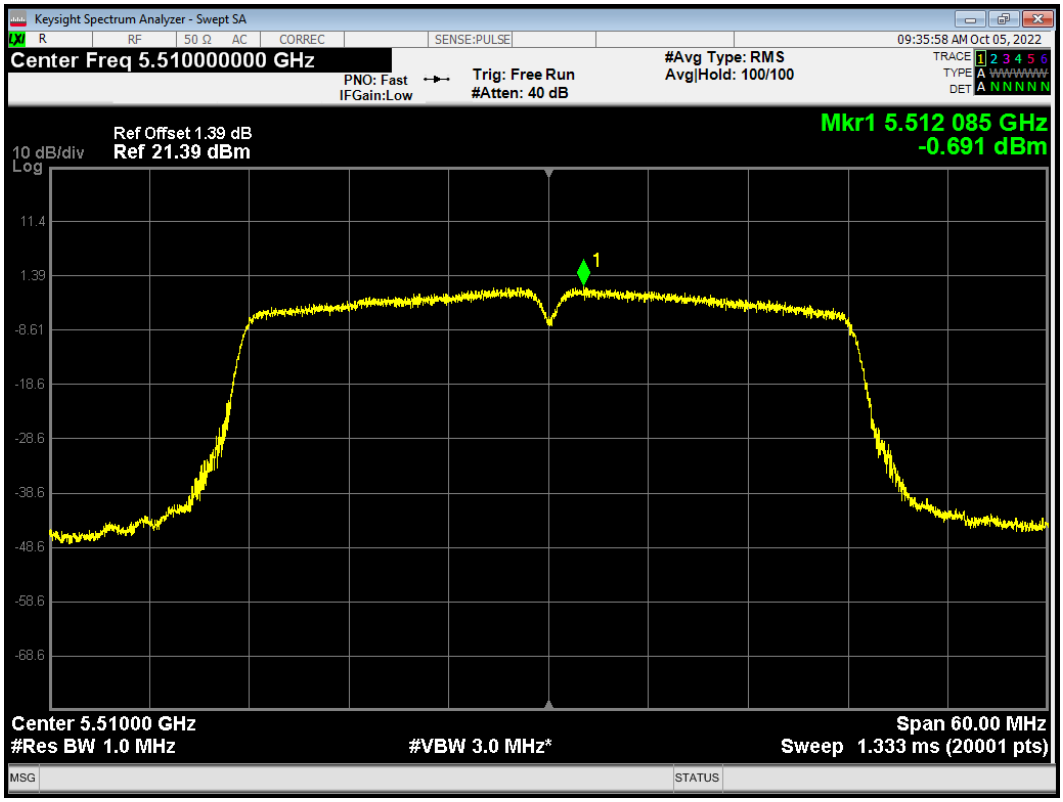
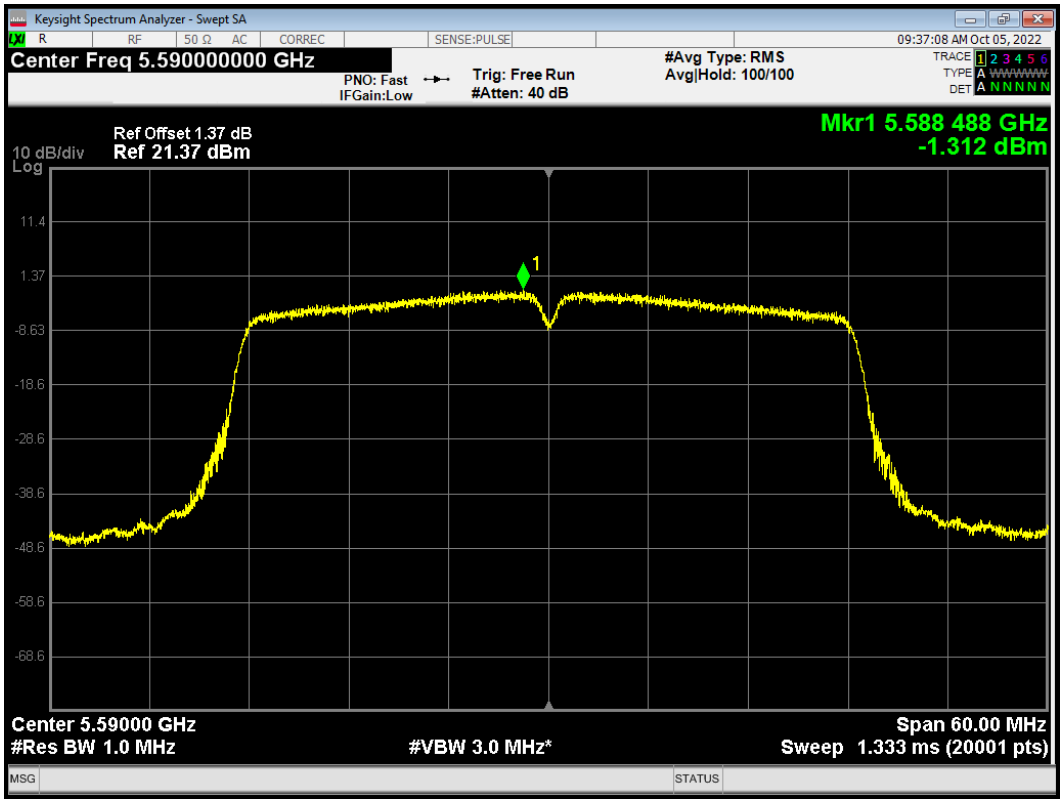
PSD 802.11ac (VHT40) 5510MHz



PSD 802.11ac (VHT40) 5590MHz



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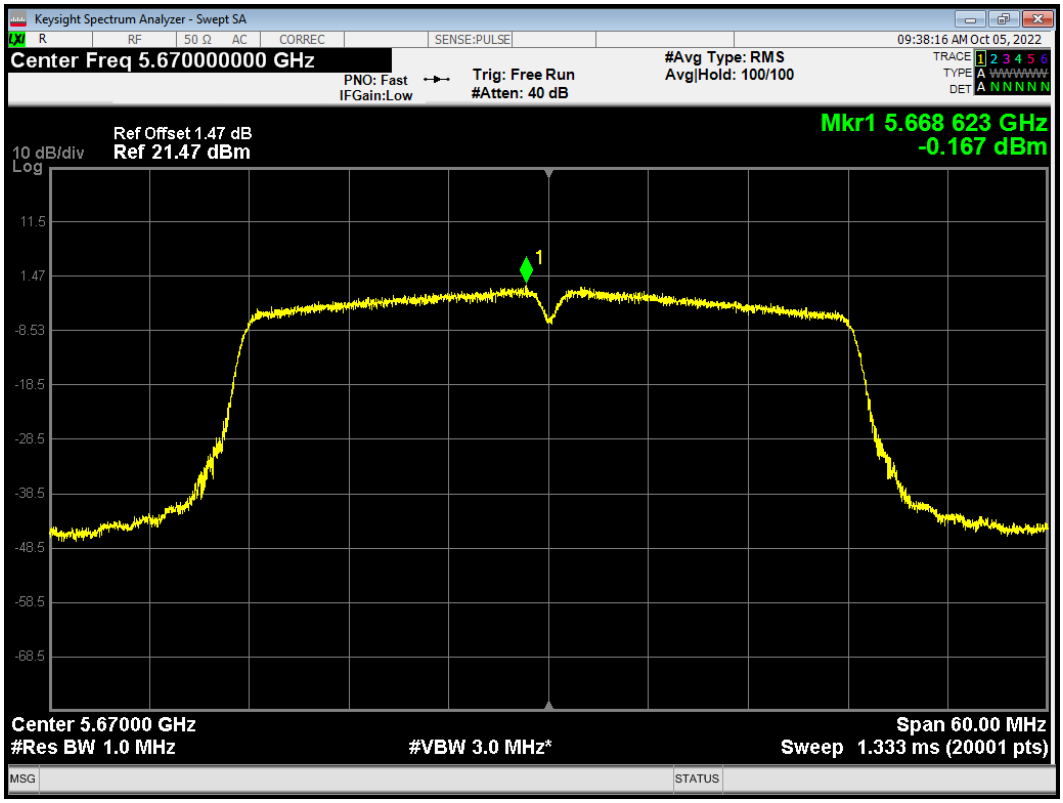
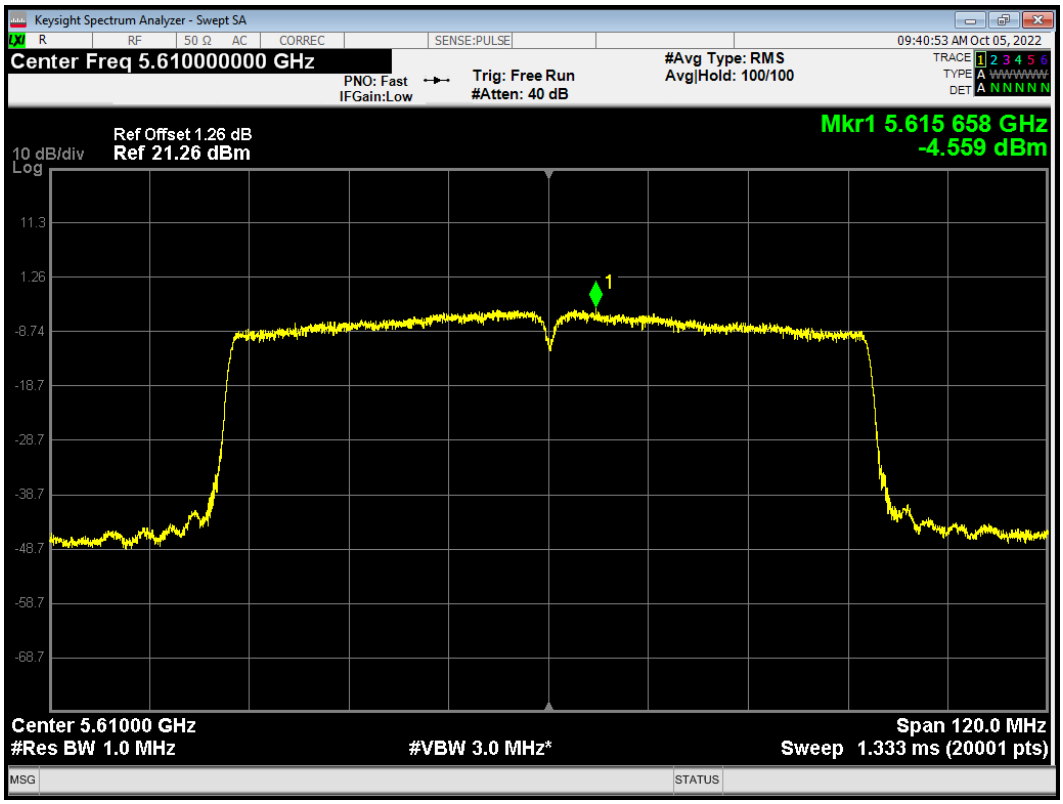
PSD 802.11ac (VHT40) 5670MHz



PSD 802.11ac (VHT80) 5610MHz



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