FCC Test Report

Report No.: AGC03570210901FE05

FCC ID	:	2A2CY-HCYS002
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	AX1800 Dual-Band Whole Home Mesh Wi-Fi6 System
BRAND NAME	:	ROCK, rock space, one2ten
MODEL NAME	:	RSD0624
APPLICANT	:	Shenzhen Hechuang Yousu Trade co., Ltd
DATE OF ISSUE	:	Oct. 18, 2021
STANDARD(S) **TEST PROCEDURE(S)**	:	FCC Part 15.247
REPORT VERSION	:	V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Oct. 18, 2021	Valid	Initial Release

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1. VERIFICATION OF CONFORMITY

Applicant	Shenzhen Hechuang Yousu Trade co., Ltd
Address	Room F, Floor 16, Block A, Zhongguan Shidai Square, No.4168 Liuxian Road, Pingshan Community, Taoyuan Street, Nanshan District, Shenzhen, Guangdong, China
manufacturer	Shenzhen Hechuang Yousu Trade co., Ltd
Address	Room F, Floor 16, Block A, Zhongguan Shidai Square, No.4168 Liuxian Road, Pingshan Community, Taoyuan Street, Nanshan District, Shenzhen, Guangdong, China
Factory	Shenzhen Hechuang Yousu Trade co., Ltd
Address	Room F, Floor 16, Block A, Zhongguan Shidai Square, No.4168 Liuxian Road, Pingshan Community, Taoyuan Street, Nanshan District, Shenzhen, Guangdong, China
Product Designation	AX1800 Dual-Band Whole Home Mesh Wi-Fi6 System
Brand Name	ROCK, rock space, one2ten
Test Model	RSD0624
Date of test	Sep. 23, 2021 to Oct. 15, 2021
Deviation	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BGN/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rules Part 15.247.

Prepared By	Eder Zhan Eder Zhan (Project Engineer)	Oct. 15, 2021
Reviewed By	Calvin Liu Calvin Liu (Reviewer)	Oct. 18, 2021
Approved By	Max Zhang Max Zhang (Authorized Officer)	Oct. 18, 2021

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as “AX1800 Dual-Band Whole Home Mesh Wi-Fi6 System”. It is designed by way of utilizing the DSSS and OFDM /OFDMA technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	2.412 GHz～2.462GHz
Output Power (Average)	IEEE 802.11b:14.22dBm; IEEE 802.11g:14.06dBm; IEEE 802.11n(HT20):13.45dBm; IEEE 802.11n(40):13.38dBm; IEEE 802.11ax(HE20):11.54dBm; IEEE 802.11ax(HE40):11.06dBm
Output Power (Peak)	IEEE 802.11b:16.69dBm; IEEE 802.11g:21.80dBm; IEEE 802.11n(HT20):21.05dBm; IEEE 802.11n(HT40):21.15dBm; IEEE 802.11ax(HE20):21.38dBm; IEEE 802.11ax(HE40):20.64dBm
Modulation	802.11b: (DQPSK, DBPSK, CCK) DSSS 802.11g/n: (64-QAM, 16-QAM, QPSK, BPSK) OFDM 802.11ax: (1024-QAM,256-QAM,64-QAM, 16-QAM, QPSK, BPSK) OFDMA
Number of channels	11
Hardware Version	V1.0
Software Version	V1.3
Antenna Designation	PCB antenna (Comply with requirements of the FCC part 15.203)
Antenna Gain	Refer to Chapter 2.9 of the report.
Power Supply	DC 12V by adapter

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2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
2400~2483.5MHZ	1	2412 MHZ
	2	2417 MHZ
	3	2422 MHZ
	4	2427 MHZ
	5	2432 MHZ
	6	2437 MHZ
	7	2442 MHZ
	8	2447 MHZ
	9	2452 MHZ
	10	2457 MHZ
	11	2462 MHZ

Note: For 20MHZ bandwidth system use Channel 1 to Channel 11. For 40MHZ bandwidth system use Channel 3 to Channel 9

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2.3. IEEE 802.11N MODULATION SCHEME

MCS Index	Nss	Modulation	R	NBPSC	NCBPS		NDBPS		Data rate(Mbps)	
									800nsGI	
					20MHz	40MHz	20MHz	40MHz	20MHz	40MHz
0	1	BPSK	1/2	1	52	108	26	54	6.5	13.5
1	1	QPSK	1/2	2	104	216	52	108	13.0	27.0
2	1	QPSK	3/4	2	104	216	78	162	19.5	40.5
3	1	16-QAM	1/2	4	208	432	104	216	26.0	54.0
4	1	16-QAM	3/4	4	208	432	156	324	39.0	81.0
5	1	64-QAM	2/3	6	312	648	208	432	52.0	108.0
6	1	64-QAM	3/4	6	312	648	234	489	58.5	121.5
7	1	64-QAM	5/6	6	312	648	260	540	65.0	135.0
9	1	256-QAM	5/6	10	312	648	260	540	78	180
10	1	1024-QAM	5/6	10	312	648	260	540	143.4	286.8

Symbol	Explanation
NSS	Number of spatial streams
R	Code rate
NBPSC	Number of coded bits per single carrier
NCBPS	Number of coded bits per symbol
NDBPS	Number of data bits per symbol
GI	Guard interval

2.4. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2A2CY-HCYS002** filing to comply with the FCC Part 15 requirements.

2.5. TEST METHODOLOGY

KDB 558074 D01 15.247 Meas Guidance v05: Guidance for compliance measurements on Digital transmissio n system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules
ANSI C63.10:2013: American National Standard for Testing Unlicensed Wireless Devices

2.6. SPECIAL ACCESSORIES

Refer to section 5.2.

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2.7. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

2.8. ANTENNA REQUIREMENT

This intentional radiator is designed with a permanently attached antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device.
For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

2.9. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna Type	Frequency Band (MHz)	TX Paths	Bandwidth (MHz)	Max Peak Gain (dBi)		Max Directional Gain (dBi)
				Ant 1	Ant 2	
2.4GWIFI PCB Antenna List (2.4GHz 2*2 MIMO)						
PCB Antenna	2400~2483.5	2	20, 40	5	5	8.01

Note 1: The EUT supports Cyclic Delay Diversity (CDD) technology for 802.11n mode.

Note 2: The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.

If all antennas have the same gain, G_{ANT}, Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

- For power spectral density (PSD) measurements on devices:

  Array Gain = 10 log (N_{ANT}/ N_{SS}) dB = 3.01;

- For power measurements on IEEE 802.1devices:

  Array Gain = 0 dB for $N_{ANT} \leq 4$;

  Array Gain = 0 dB (i.e., no array gain) for channel widths ≥40 MHz for any N_{ANT};

  Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less, for 20 MHz channel widths with $N_{ANT} \geq 5$.

If antenna gains are not equal, Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain..

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3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Item	Measurement Uncertainty
Uncertainty of Conducted Emission for AC Port	U_c = ±3.1 dB
Uncertainty of Radiated Emission below 1GHz	U_c = ±4.0 dB
Uncertainty of Radiated Emission above 1GHz	U_c = ±4.8 dB
Uncertainty of total RF power, conducted	U_c = ±0.8 dB
Uncertainty of RF power density, conducted	U_c = ±2.6 dB
Uncertainty of spurious emissions, conducted	U_c = ±2 %
Uncertainty of Occupied Channel Bandwidth	U_c = ±2 %

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4. DESCRIPTION OF TEST MODES

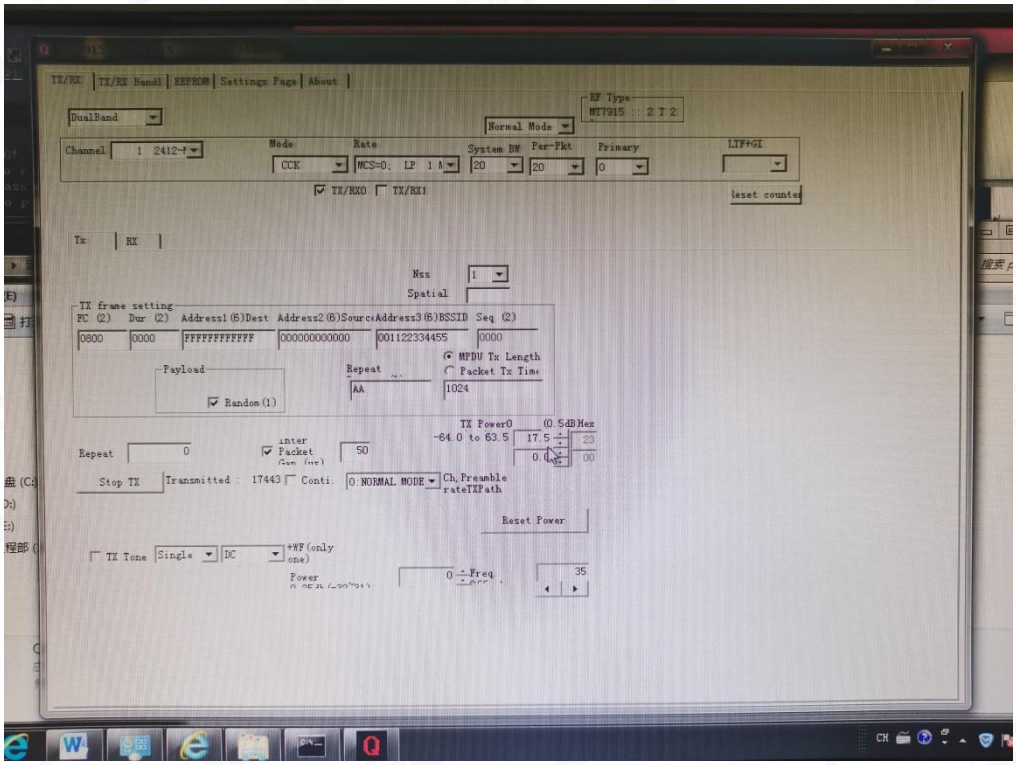
NO.	TEST MODE DESCRIPTION
1	Low channel transmitting (TX)
2	Middle channel transmitting (TX)
3	High channel transmitting (TX)

Note:
Transmit by 802.11b with Date rate (1/2/5.5/11)
Transmit by 802.11g with Date rate (6/9/12/18/24/36/48/54)
Transmit by 802.11n (20MHz) with Date rate (6.5/13/19.5/26/39/52/58.5/65)
Transmit by 802.11n (40MHz) with Date rate (13.5/27/40.5/54/81/108/121.5/135)
Transmit by 802.11ax (20MHz) with Date rate (up to 574Mbps)
Transmit by 802.11ax (40MHz) with Date rate (up to 574Mbps)
The test channel for 20MHZ bandwidth system is channel 1, 6 and 11.
The test channel for 40MHZ bandwidth system is channel 3, 6 and 9.

Note:

1. The EUT has been set to operate continuously on the lowest, middle and highest operation frequency Individually, and the EUT is operating at its maximum duty cycle>or equal 98%
2. All modes under which configure applicable have been tested and the worst mode test data recording in the test report, if no other mode data.

Software Setting



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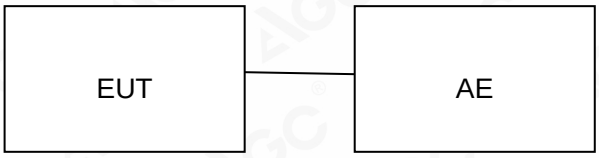
5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Configure:



5.2. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	AX1800 Dual-Band Whole Home Mesh Wi-Fi6 System	RSD0624	2A2CY-HCYS002	EUT
2	PC	Nbl-WAQ9R	--	AE
3	PC adapter	MDY-08-ES	--	AE
4	Adapter	ZL-PCB0100020502000	--	AE

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.247	Output Power	Compliant
§15.247	6 dB Bandwidth	Compliant
§15.247	Conducted Spurious Emission	Compliant
§15.247	Maximum Conducted Output Power Spectral Density	Compliant
§15.209	Radiated Emission	Compliant
§15.247	Band Edges	Compliant
§15.207	Line Conduction Emission	Compliant

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6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

TEST EQUIPMENT OF CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	May 15, 2021	May 14, 2022
LISN	R&S	ESH2-Z5	100086	Jun. 09, 2021	Jun. 08, 2022
Test software	R&S	ES-K1(Ver.V1.71)	N/A	N/A	N/A

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	May 15, 2021	May 14, 2022
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 07, 2020	Dec. 06, 2021
Power sensor	R&S	URV5-Z4	100124	May 22, 2020	May 21, 2022
2.4GHz Fliter	Micro-tronics	087	N/A	Mar. 23, 2020	Mar. 22, 2022
Attenuator	Weinachel Corp	58-30-33	N/A	Sep. 03, 2020	Sep. 02, 2022
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Oct. 09, 2019	Oct. 08, 2021
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	00034609	May 22, 2020	May 21, 2022
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	Apr. 23, 2021	Apr. 22, 2022
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Sep. 03, 2020	Sep. 02, 2022
ANTENNA	SCHWARZBECK	VULB9168	D69250	Jan. 08, 2020	Jan. 07, 2023
Test software	Tonscend	JS32-RE (Ver.2.5)	N/A	N/A	N/A

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7. OUTPUT POWER

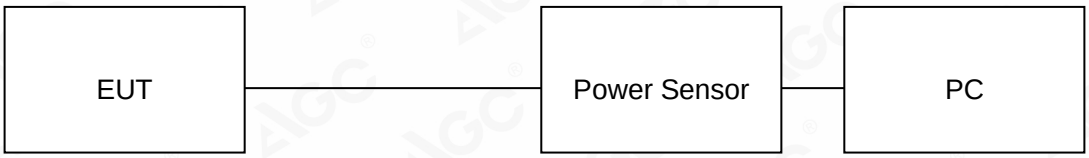
7.1. MEASUREMENT PROCEDURE

For average power test:

1. Connect EUT RF output port to power sensor through an RF attenuator.
2. Connect the power sensor to the PC.
3. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
4. Record the maximum power from the software.

Note：The EUT was tested according to ANSI C63.10 (2013) for compliance to FCC 47CFR 15.247 requirements.

7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



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7.3. LIMITS AND MEASUREMENT RESULT

Test Data of Conducted Output Power-antenna 1					
Test Mode	Test Channel (MHz)	Average Power (dBm)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
802.11b	2412	14.05	16.38	≤30	Pass
	2437	14.22	16.69	≤30	Pass
	2462	13.88	16.47	≤30	Pass
802.11g	2412	14.06	21.80	≤30	Pass
	2437	13.43	21.10	≤30	Pass
	2462	13.21	20.88	≤30	Pass
802.11n-HT20	2412	13.45	21.05	≤30	Pass
	2437	12.82	20.32	≤30	Pass
	2462	12.58	20.10	≤30	Pass
802.11n-HT40	2422	13.38	21.15	≤30	Pass
	2437	12.99	20.80	≤30	Pass
	2452	12.78	20.56	≤30	Pass
802.11ax-HE20	2412	11.54	21.38	≤30	Pass
	2437	10.81	20.58	≤30	Pass
	2462	10.38	20.12	≤30	Pass
802.11ax-HE40	2422	10.82	20.42	≤30	Pass
	2437	10.87	20.37	≤30	Pass
	2452	10.61	20.23	≤30	Pass

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Test Data of Conducted Output Power-antenna 2					
Test Mode	Test Channel (MHz)	Average Power (dBm)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
802.11b	2412	13.37	15.85	≤30	Pass
	2437	13.36	15.91	≤30	Pass
	2462	12.87	15.40	≤30	Pass
802.11g	2412	12.92	20.67	≤30	Pass
	2437	12.09	19.80	≤30	Pass
	2462	11.63	19.37	≤30	Pass
802.11n-HT20	2412	12.32	19.85	≤30	Pass
	2437	11.94	19.52	≤30	Pass
	2462	10.99	18.54	≤30	Pass
802.11n-HT40	2422	12.09	19.89	≤30	Pass
	2437	11.05	18.93	≤30	Pass
	2452	10.73	18.58	≤30	Pass
802.11ax-HE20	2412	10.70	20.53	≤30	Pass
	2437	10.04	19.96	≤30	Pass
	2462	10.09	19.89	≤30	Pass
802.11ax-HE40	2422	11.06	20.64	≤30	Pass
	2437	10.63	20.19	≤30	Pass
	2452	10.33	20.00	≤30	Pass

Test Data of Conducted Output Power-antenna 1+2					
Test Mode	Test Channel (MHz)	Average Power (dBm)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
802.11n-HT20	2412	15.93	23.50	≤30	Pass
	2437	15.41	22.95	≤30	Pass
	2462	14.87	22.40	≤30	Pass
802.11n-HT40	2422	15.79	23.58	≤30	Pass
	2437	15.14	22.98	≤30	Pass
	2452	14.89	22.69	≤30	Pass
802.11ax-HE20	2412	14.15	23.99	≤30	Pass
	2437	13.45	23.29	≤30	Pass
	2462	13.25	23.02	≤30	Pass
802.11ax-HE40	2422	13.95	23.54	≤30	Pass
	2437	13.76	23.29	≤30	Pass
	2452	13.48	23.13	≤30	Pass

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8. BANDWIDTH

8.1. MEASUREMENT PROCEDURE

6dB bandwidth:

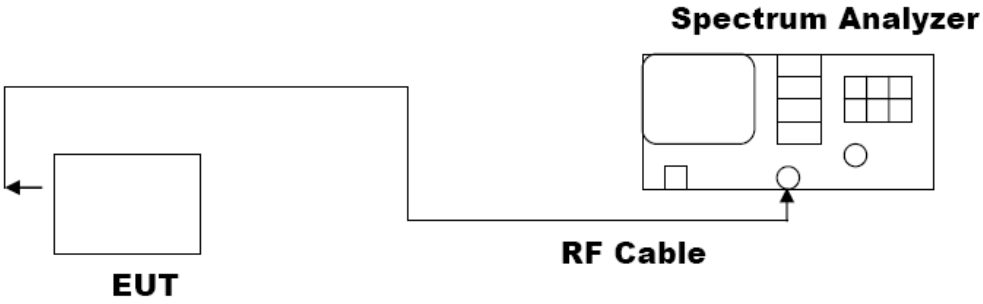
1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 kHz, VBW≥3×RBW.
4. Set SPA Trace 1 Max hold, then View.

Occupied bandwidth:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hoping channel
   The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW; Sweep = auto; Detector function = peak
4. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



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8.3. LIMITS AND MEASUREMENT RESULTS

Test Data of Occupied Bandwidth and DTS Bandwidth-antenna 1					
Test Mode	Test Channel (MHz)	99% Occupied Bandwidth (MHz)	-6dB Bandwidth (MHz)	Limits (MHz)	Pass or Fail
802.11b	2412	12.705	7.593	≥0.5	Pass
	2437	12.790	8.064	≥0.5	Pass
	2462	12.743	8.057	≥0.5	Pass
802.11g	2412	16.474	15.12	≥0.5	Pass
	2437	16.493	15.13	≥0.5	Pass
	2462	16.473	15.12	≥0.5	Pass
802.11n-HT20	2412	17.557	15.11	≥0.5	Pass
	2437	17.570	15.12	≥0.5	Pass
	2462	17.549	15.14	≥0.5	Pass
802.11n-HT40	2422	35.920	35.10	≥0.5	Pass
	2437	35.956	35.11	≥0.5	Pass
	2452	35.972	35.11	≥0.5	Pass
802.11ax-HE20	2412	18.815	18.40	≥0.5	Pass
	2437	18.963	18.32	≥0.5	Pass
	2462	19.037	18.42	≥0.5	Pass
802.11ax-HE40	2422	37.525	37.57	≥0.5	Pass
	2437	37.575	36.30	≥0.5	Pass
	2452	37.617	37.73	≥0.5	Pass

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Test Data of Occupied Bandwidth and DTS Bandwidth-antenna 2					
Test Mode	Test Channel (MHz)	99% Occupied Bandwidth (MHz)	-6dB Bandwidth (MHz)	Limits (MHz)	Pass or Fail
802.11b	2412	12.714	8.062	≥0.5	Pass
	2437	12.804	8.031	≥0.5	Pass
	2462	12.770	8.056	≥0.5	Pass
802.11g	2412	16.450	15.12	≥0.5	Pass
	2437	16.443	15.12	≥0.5	Pass
	2462	16.457	15.12	≥0.5	Pass
802.11n-HT20	2412	17.563	15.11	≥0.5	Pass
	2437	17.557	15.12	≥0.5	Pass
	2462	17.570	15.12	≥0.5	Pass
802.11n-HT40	2422	35.964	35.10	≥0.5	Pass
	2437	35.952	35.10	≥0.5	Pass
	2452	35.975	35.11	≥0.5	Pass
802.11ax-HE20	2412	18.773	18.31	≥0.5	Pass
	2437	18.995	18.54	≥0.5	Pass
	2462	19.039	18.51	≥0.5	Pass
802.11ax-HE40	2422	37.563	36.30	≥0.5	Pass
	2437	37.551	37.13	≥0.5	Pass
	2452	37.598	37.64	≥0.5	Pass

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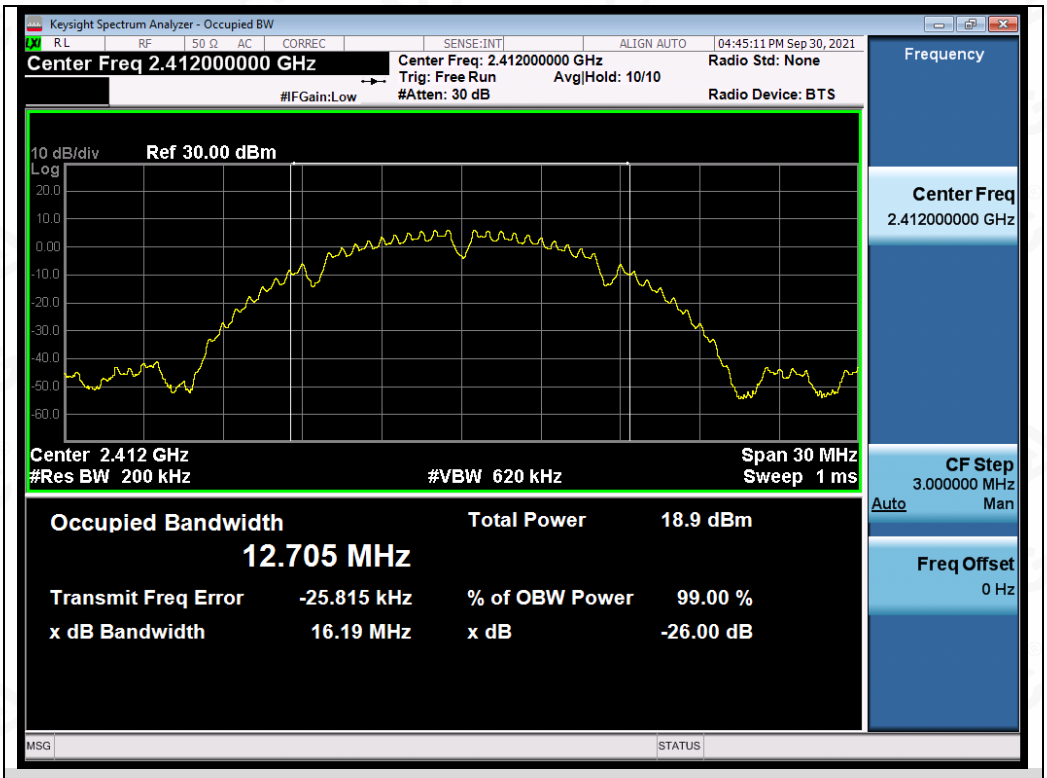
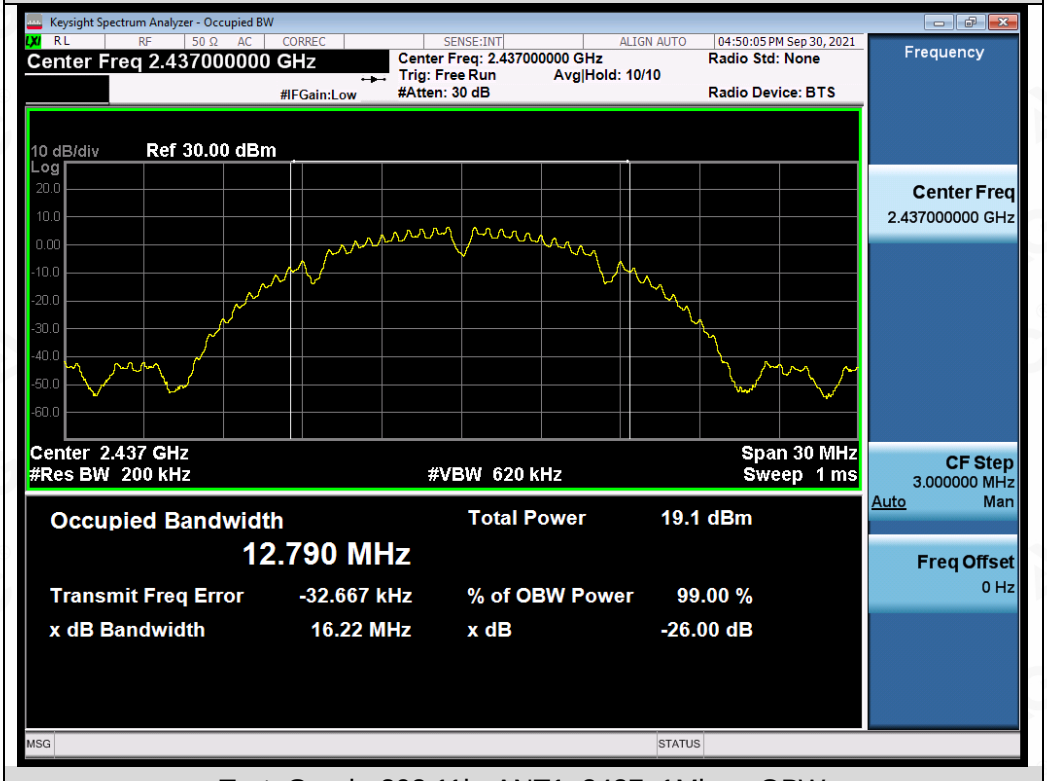
Test Graphs of Occupied Bandwidth



Test_Graph_802.11b_ANT1_2412_1Mbps_OBW



Test_Graph_802.11b_ANT1_2437_1Mbps_OBW

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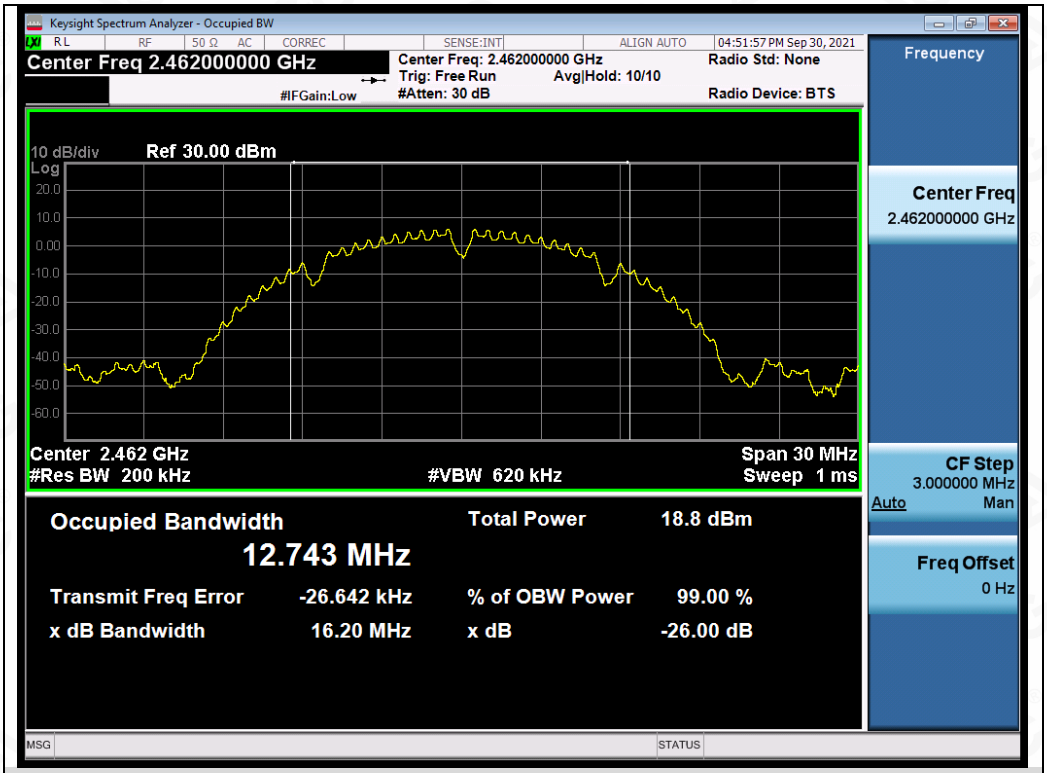
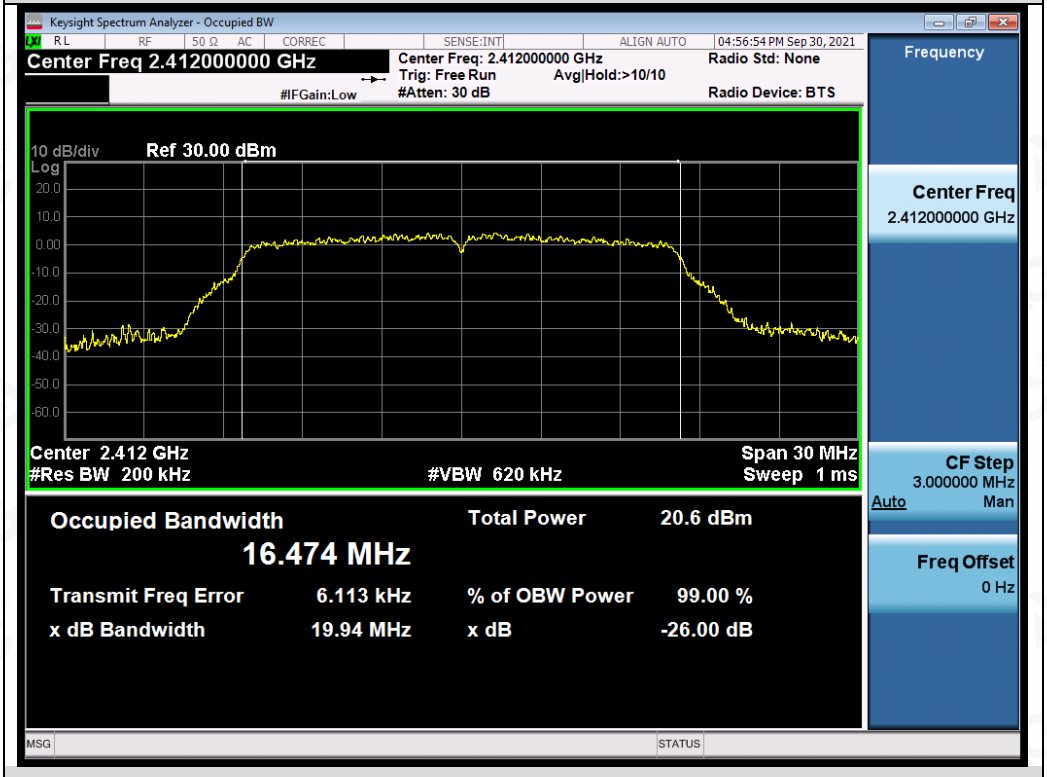


Test_Graph_802.11b_ANT1_2462_1Mbps_OBW



Test_Graph_802.11g_ANT1_2412_6Mbps_OBW

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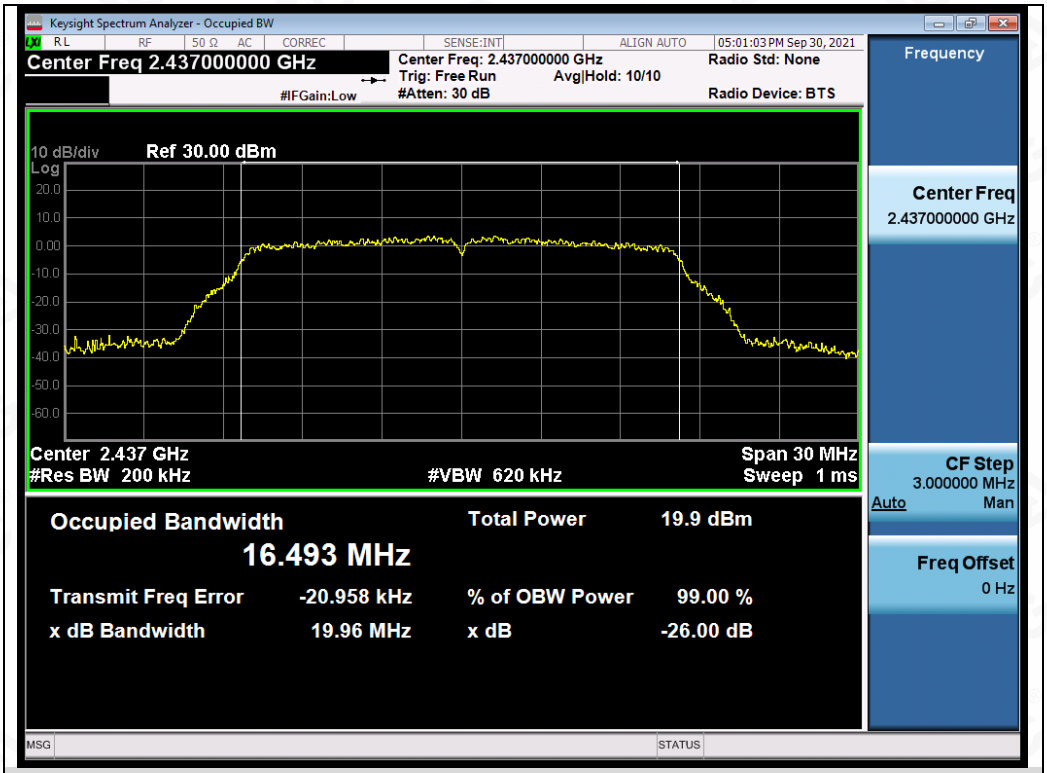
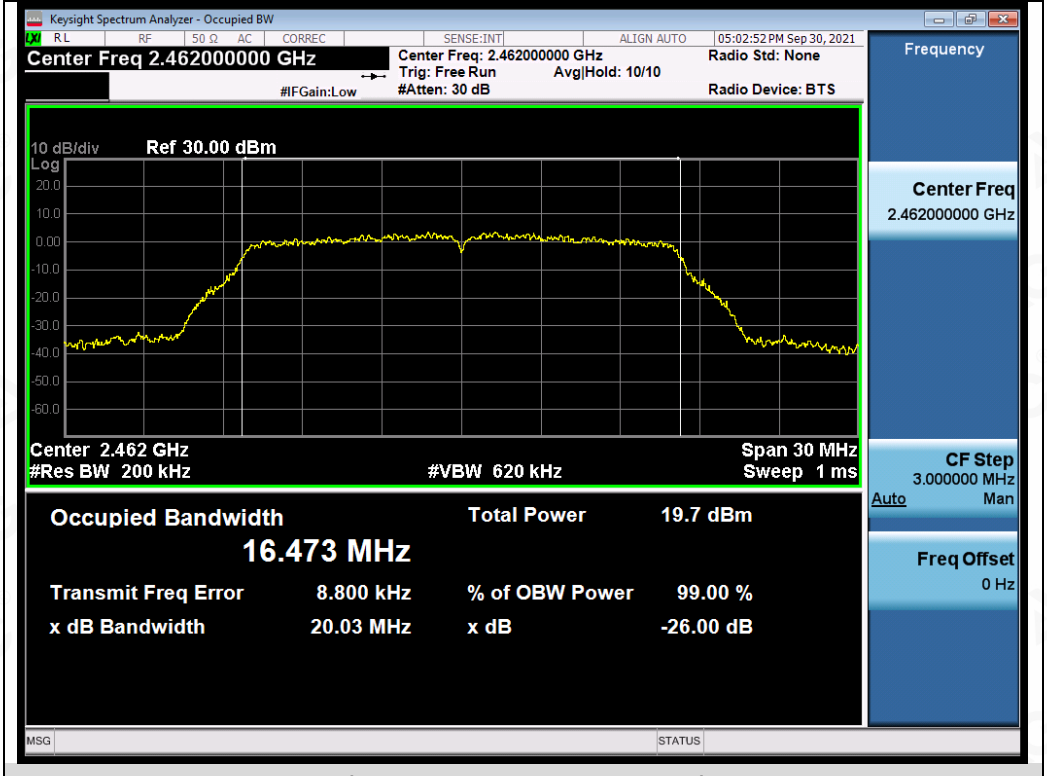


Test_Graph_802.11g_ANT1_2437_6Mbps_OBW



Test_Graph_802.11g_ANT1_2462_6Mbps_OBW

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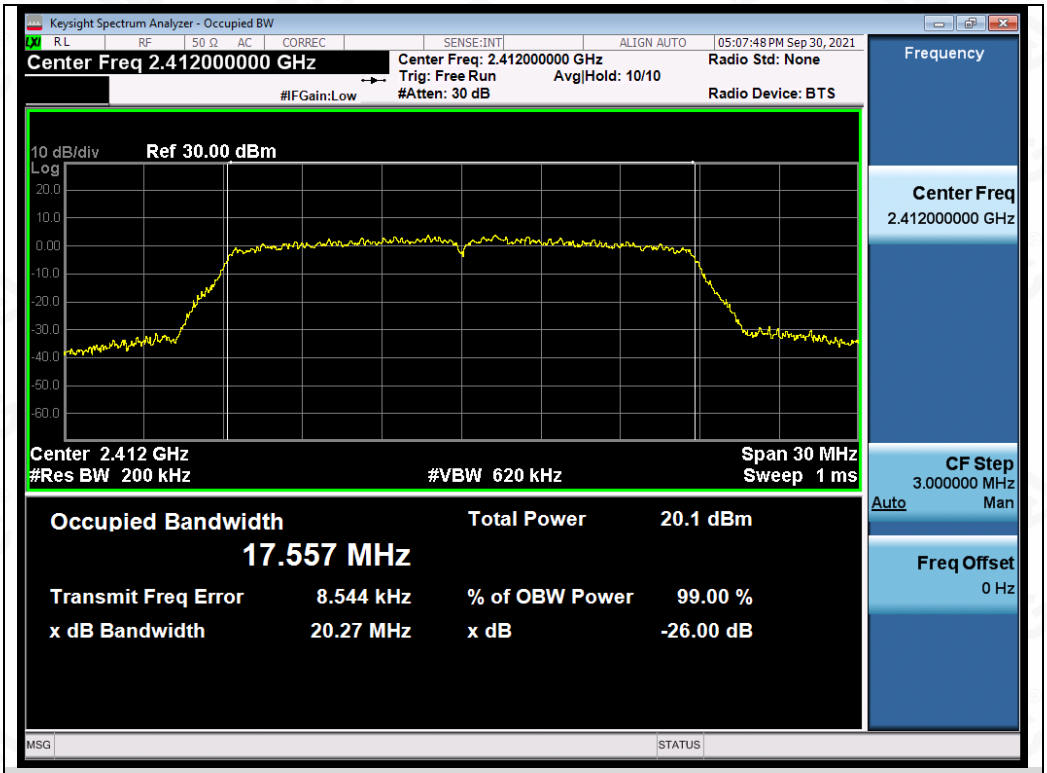

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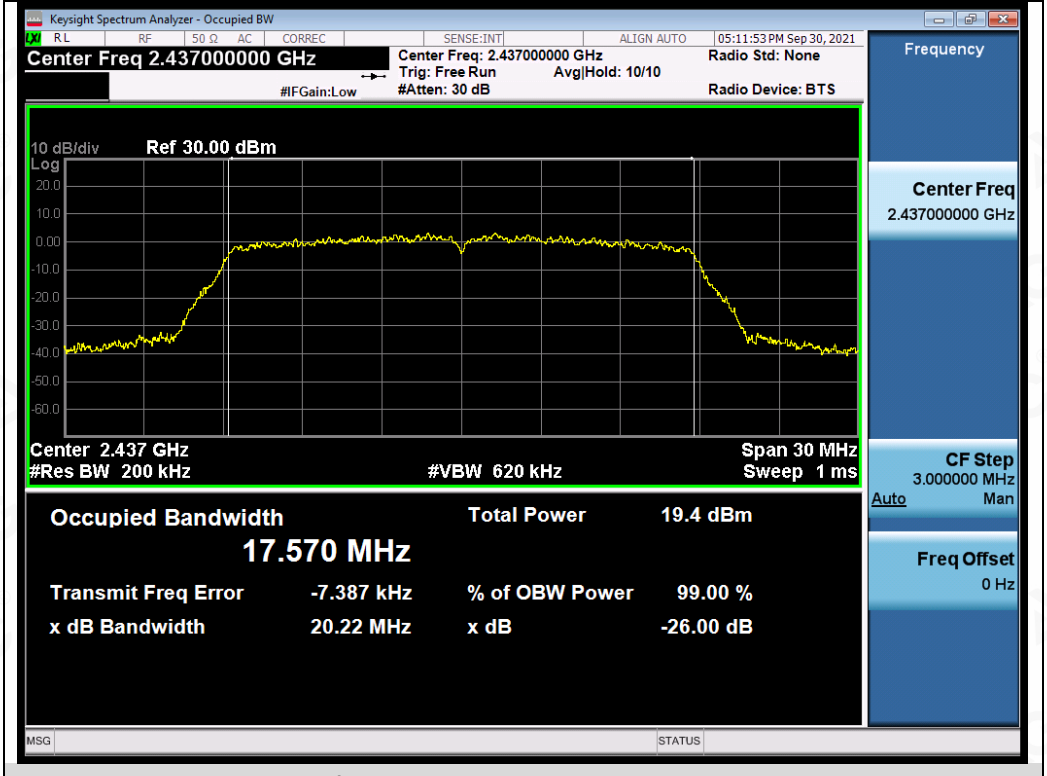

Test_Graph_802.11n20_ANT1_2437_MCS0_OBW

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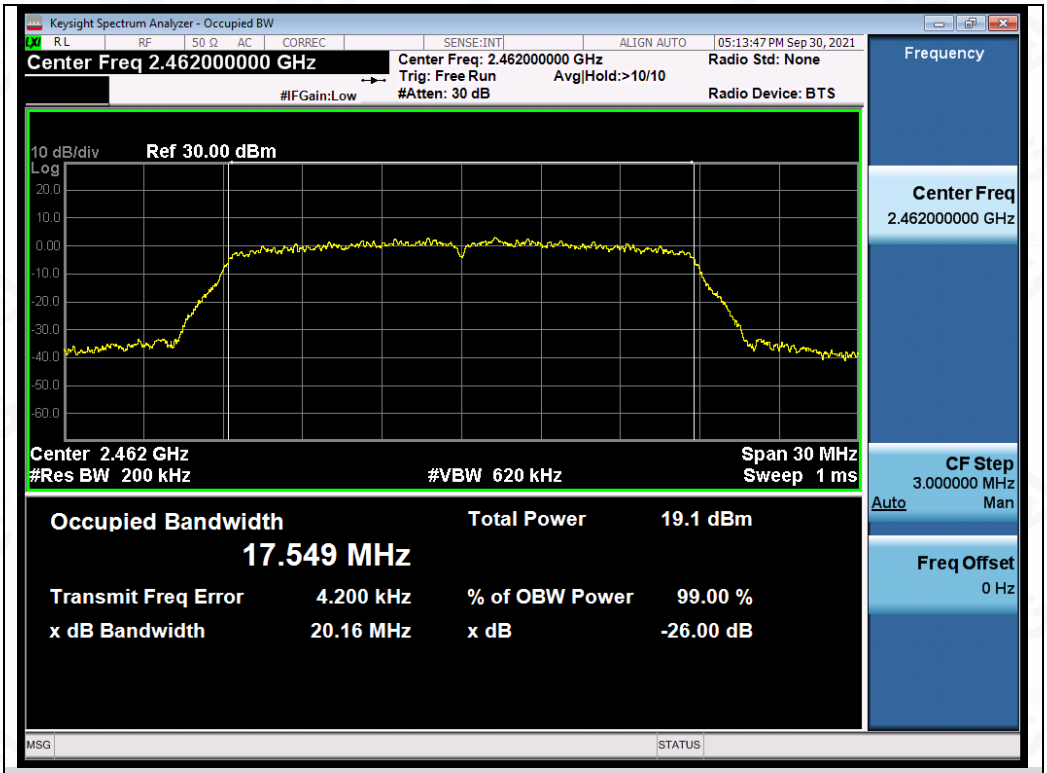

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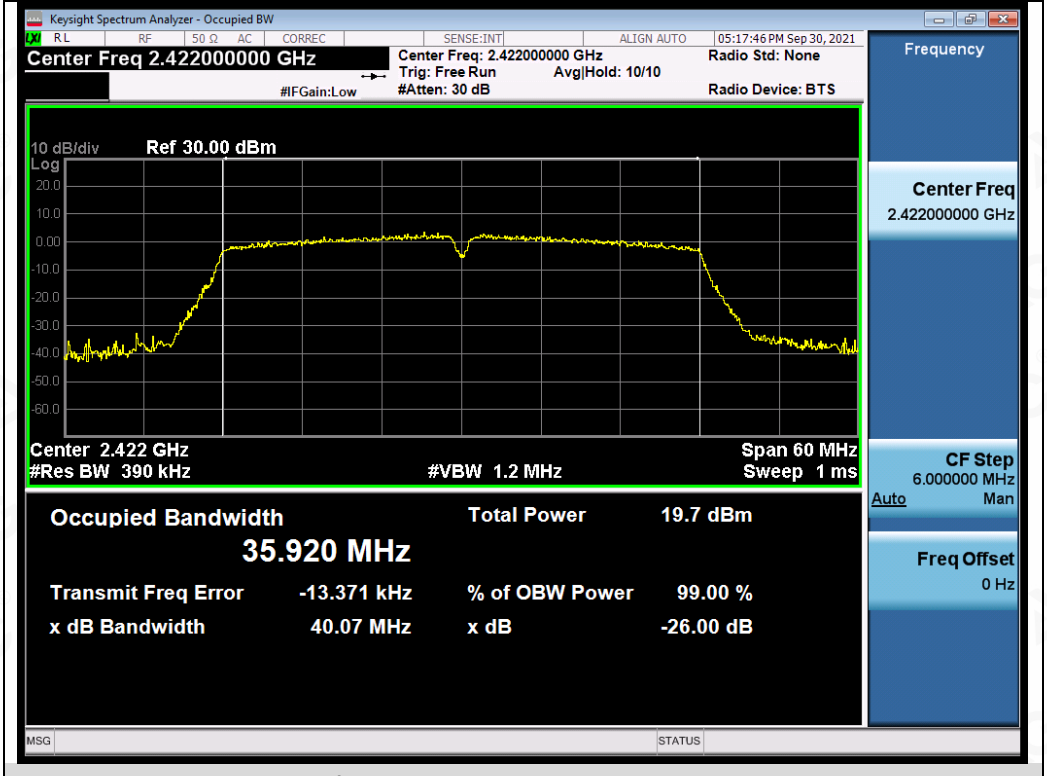

Test_Graph_802.11n40_ANT1_2422_MCS0_OBW

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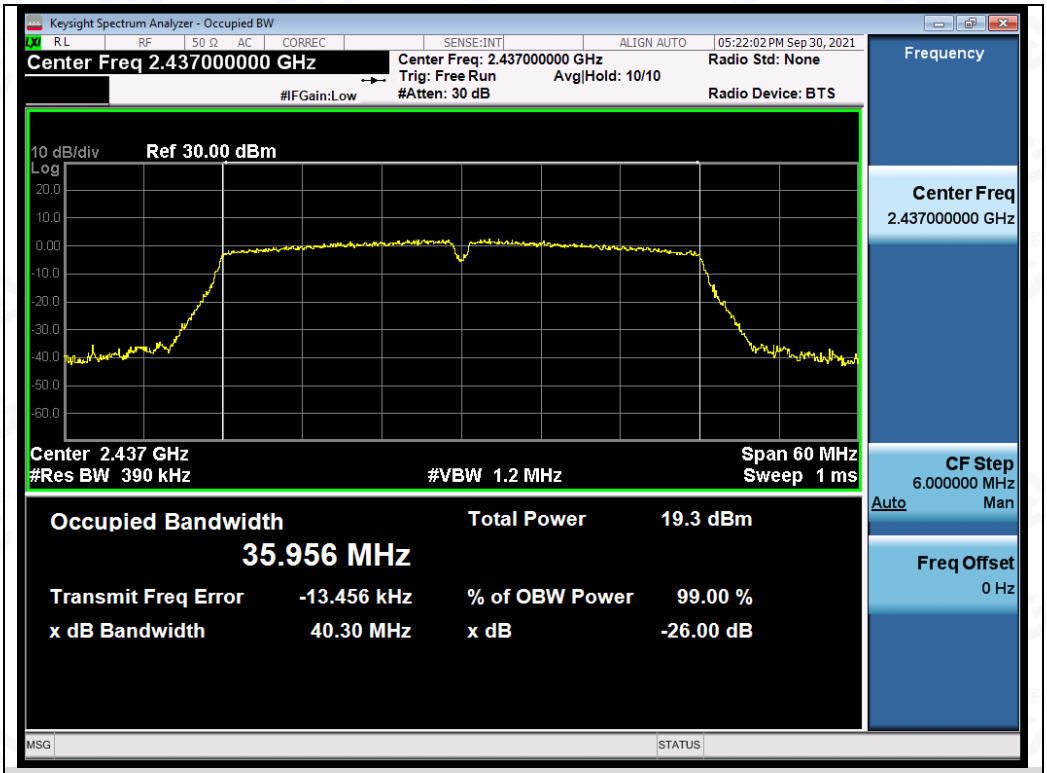
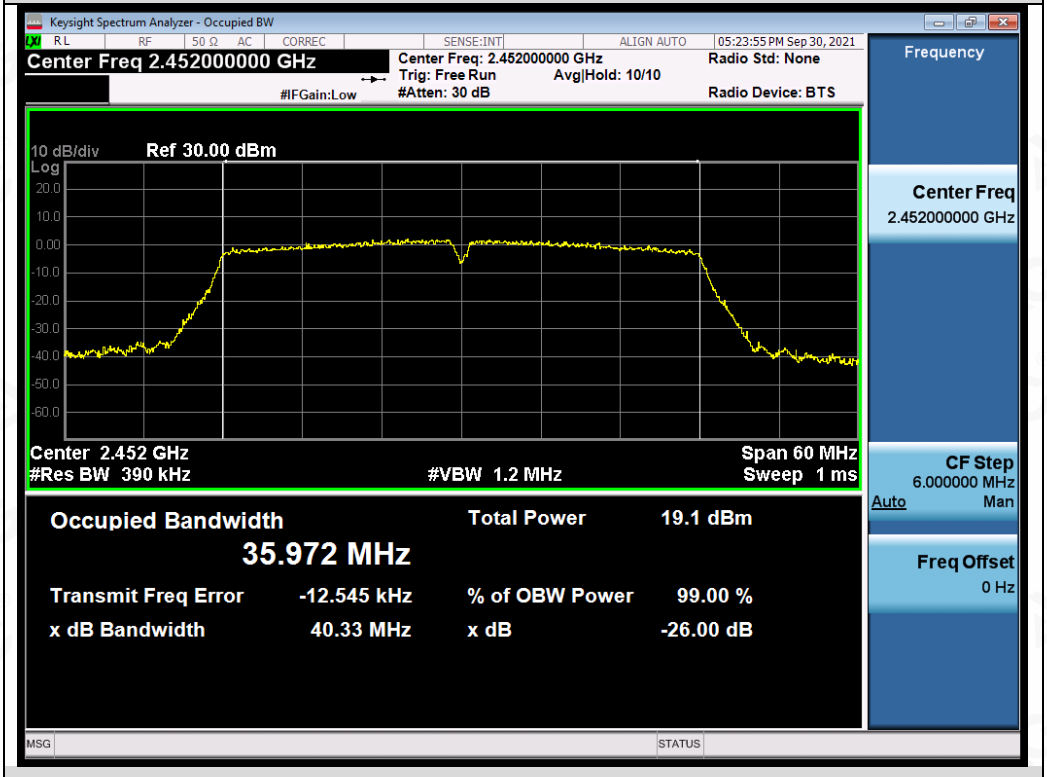


Test_Graph_802.11n40_ANT1_2437_MCS0_OBW



Test_Graph_802.11n40_ANT1_2452_MCS0_OBW

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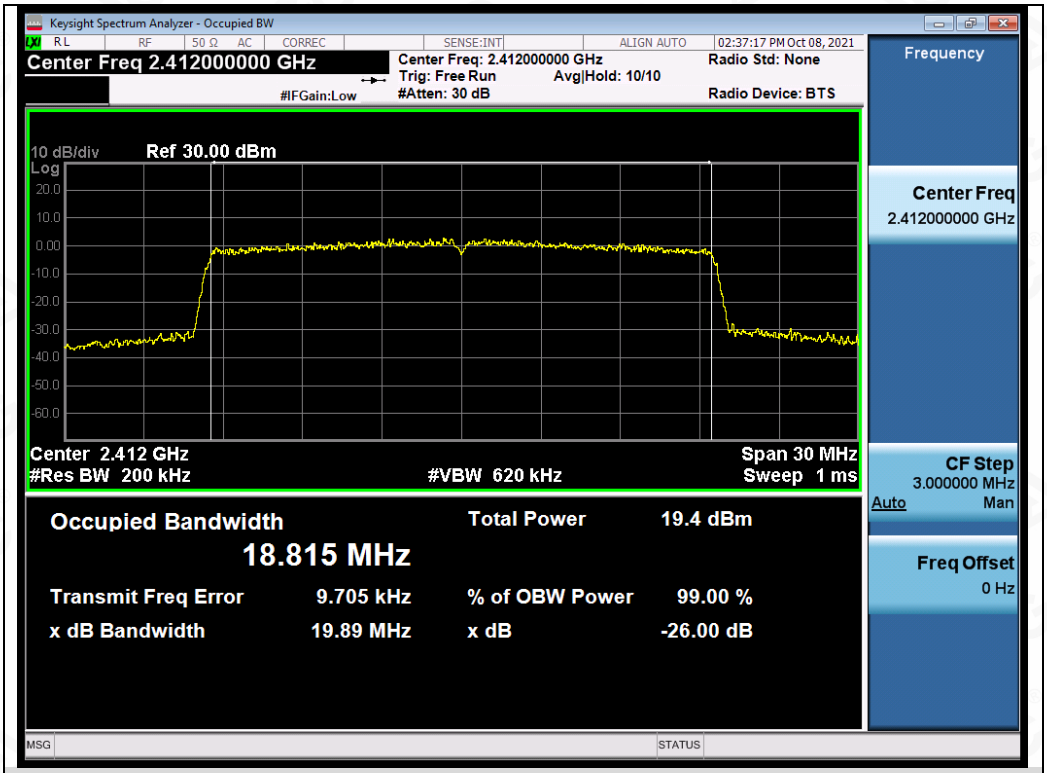

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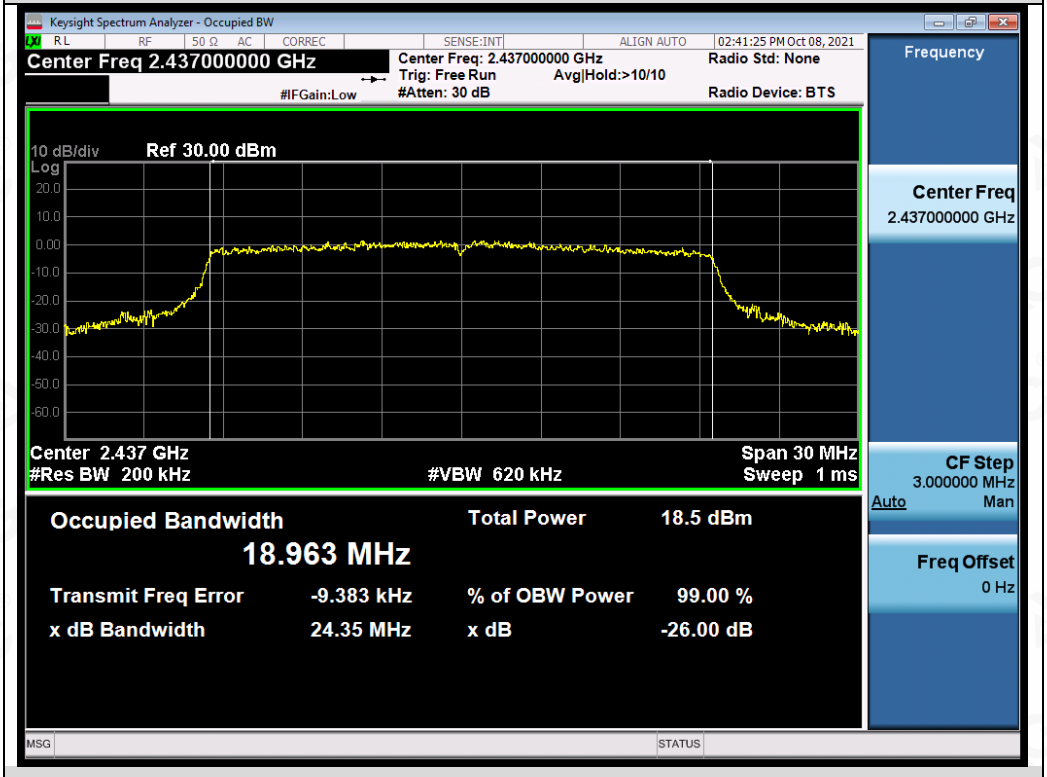

Test_Graph_802.11ax20_ANT1_2437_MCS0_OBW

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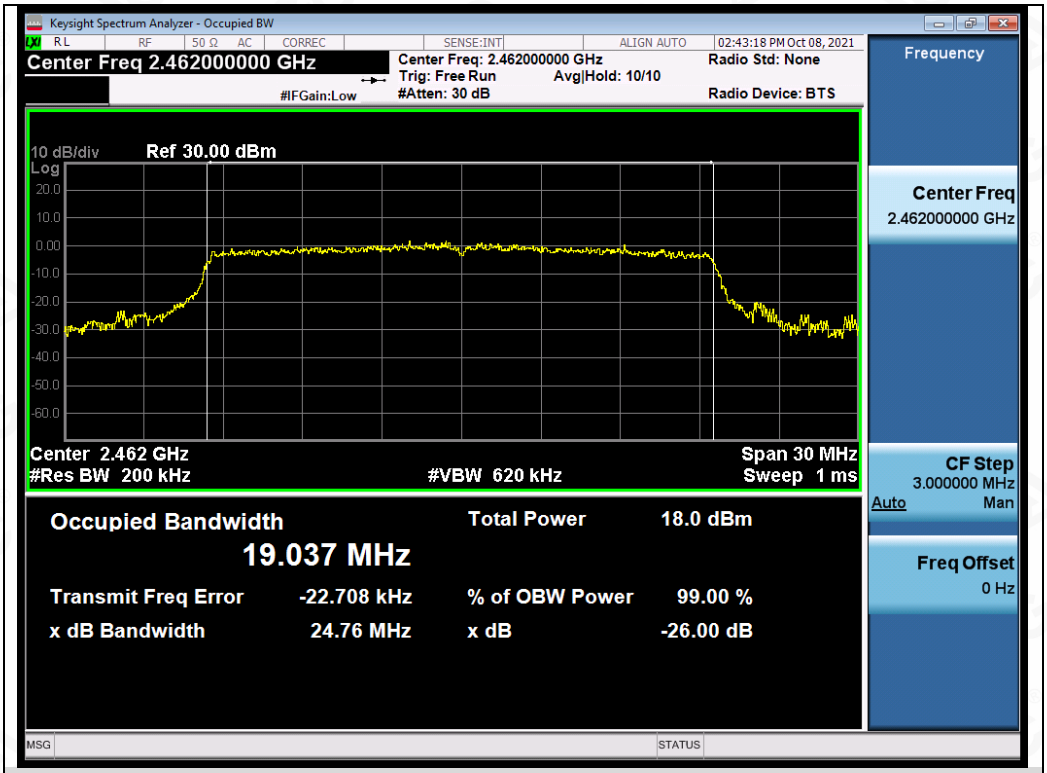
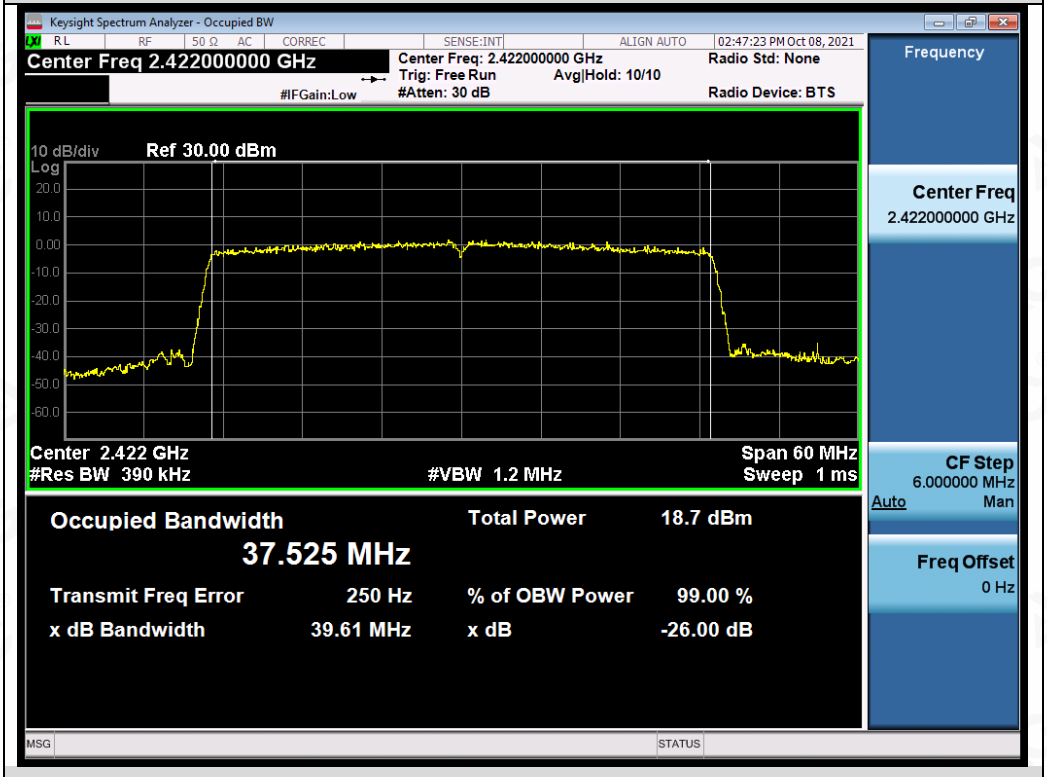


Test_Graph_802.11ax20_ANT1_2462_MCS0_OBW



Test_Graph_802.11ax40_ANT1_2422_MCS0_OBW

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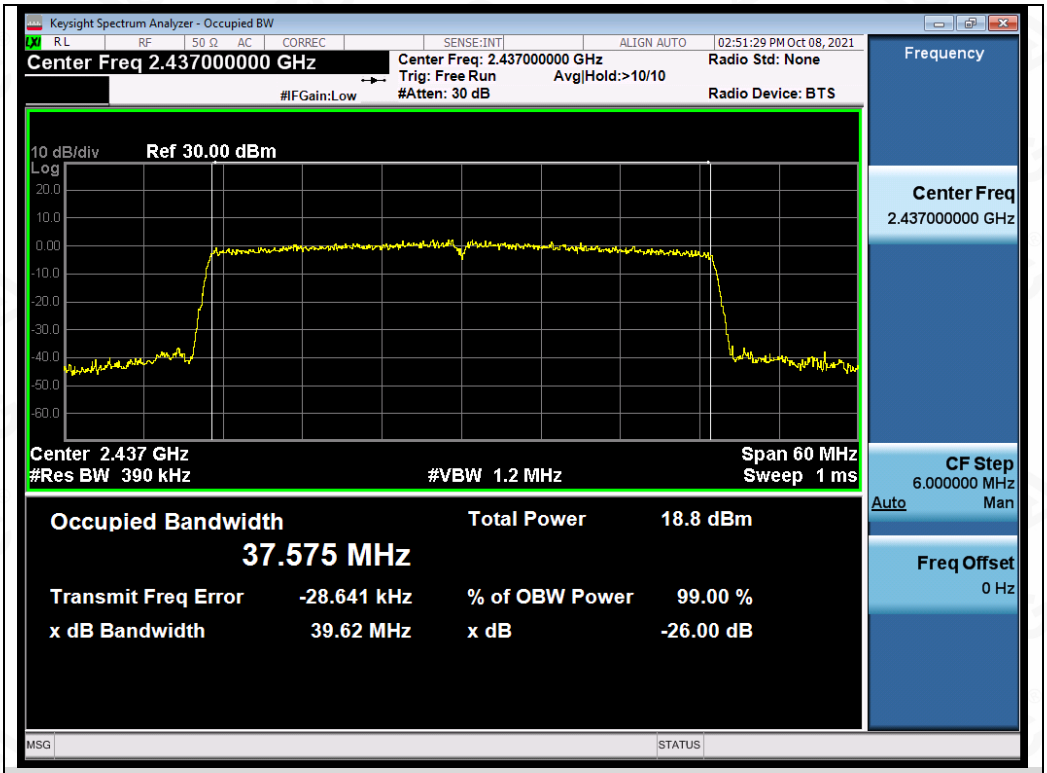

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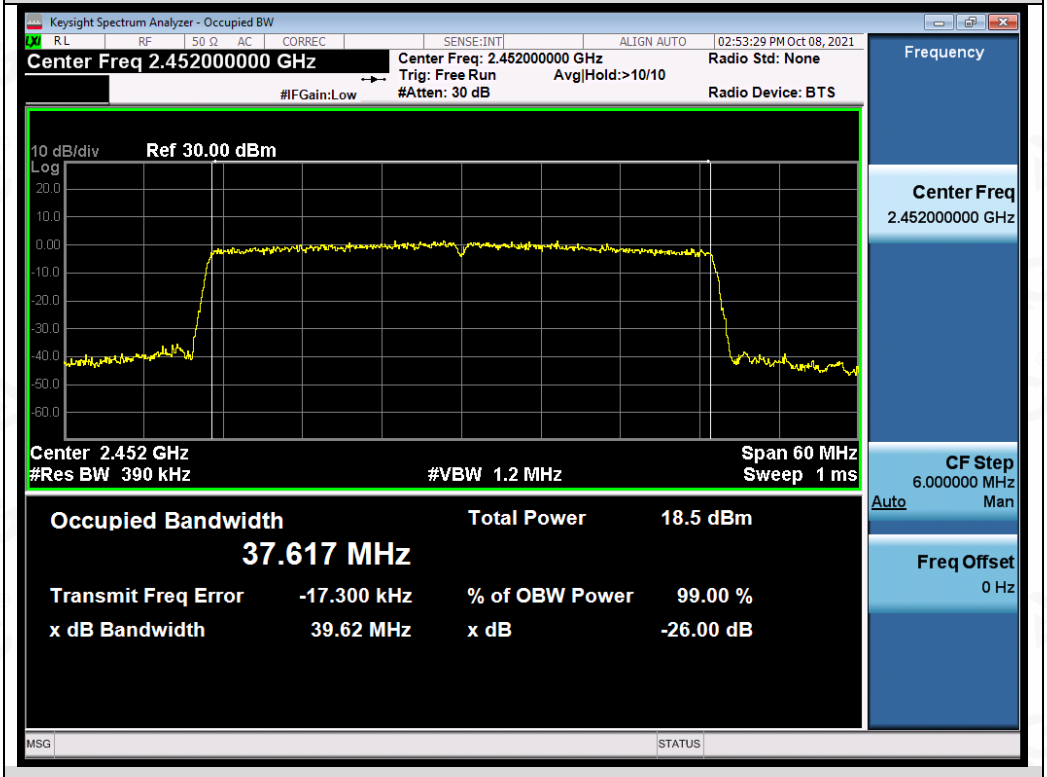

Test_Graph_802.11ax40_ANT1_2452_MCS0_OBW

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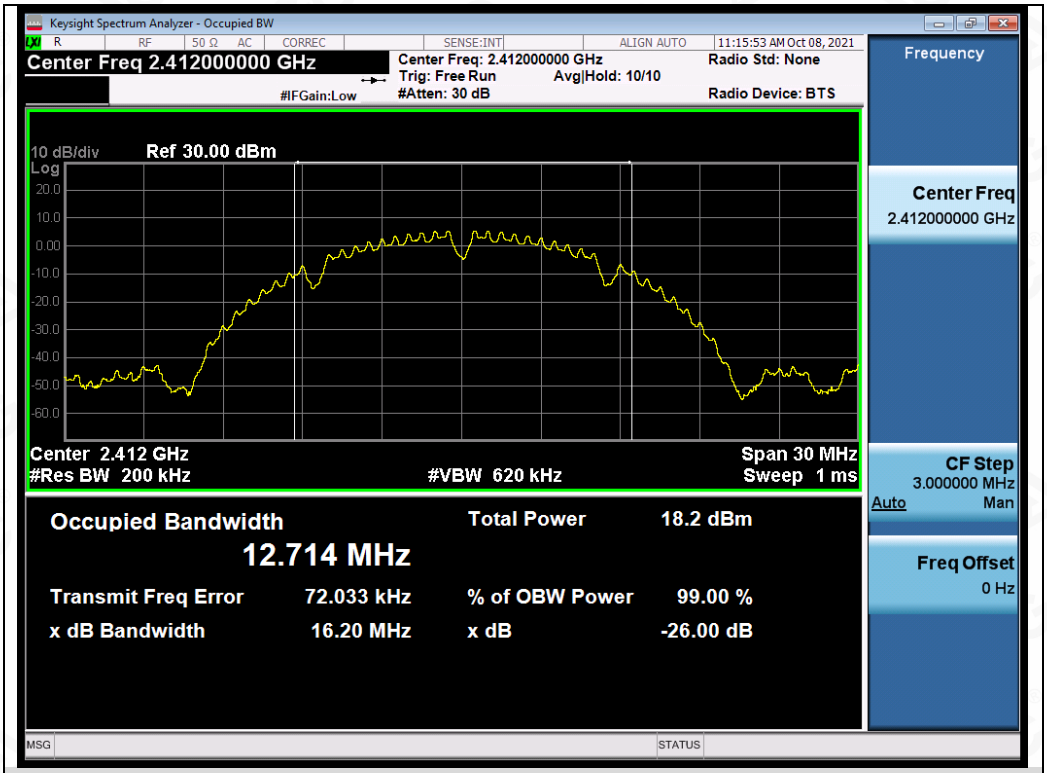
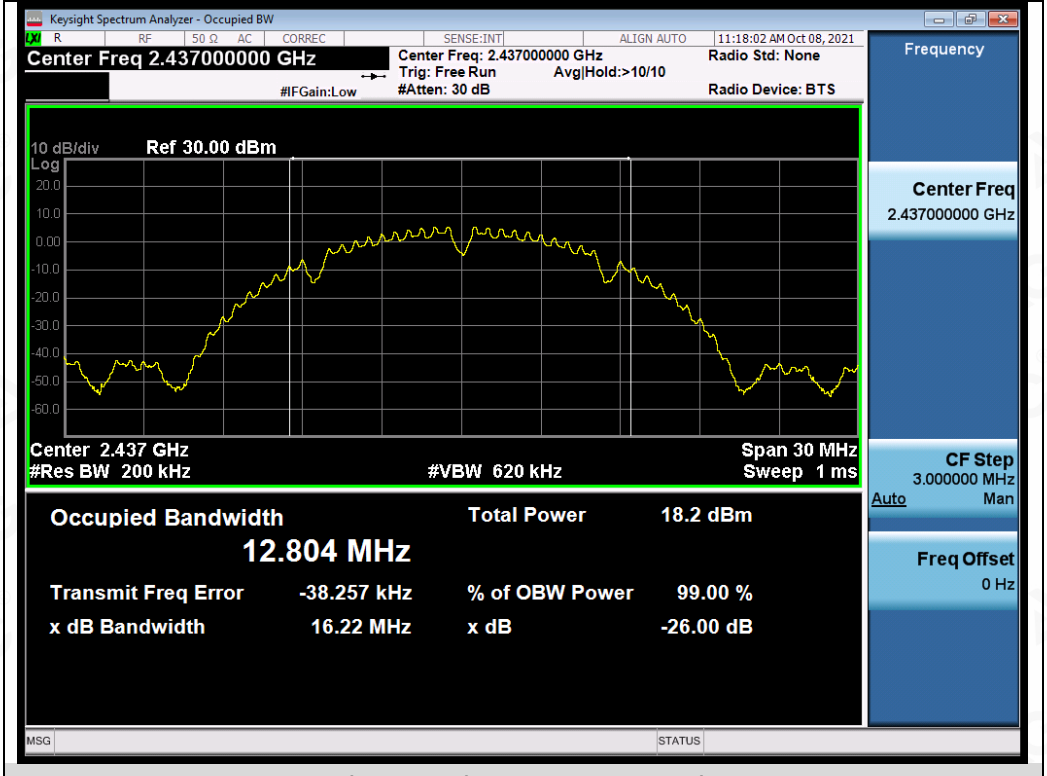


Test_Graph_802.11b_ANT2_2412_1Mbps_OBW



Test_Graph_802.11b_ANT2_2437_1Mbps_OBW

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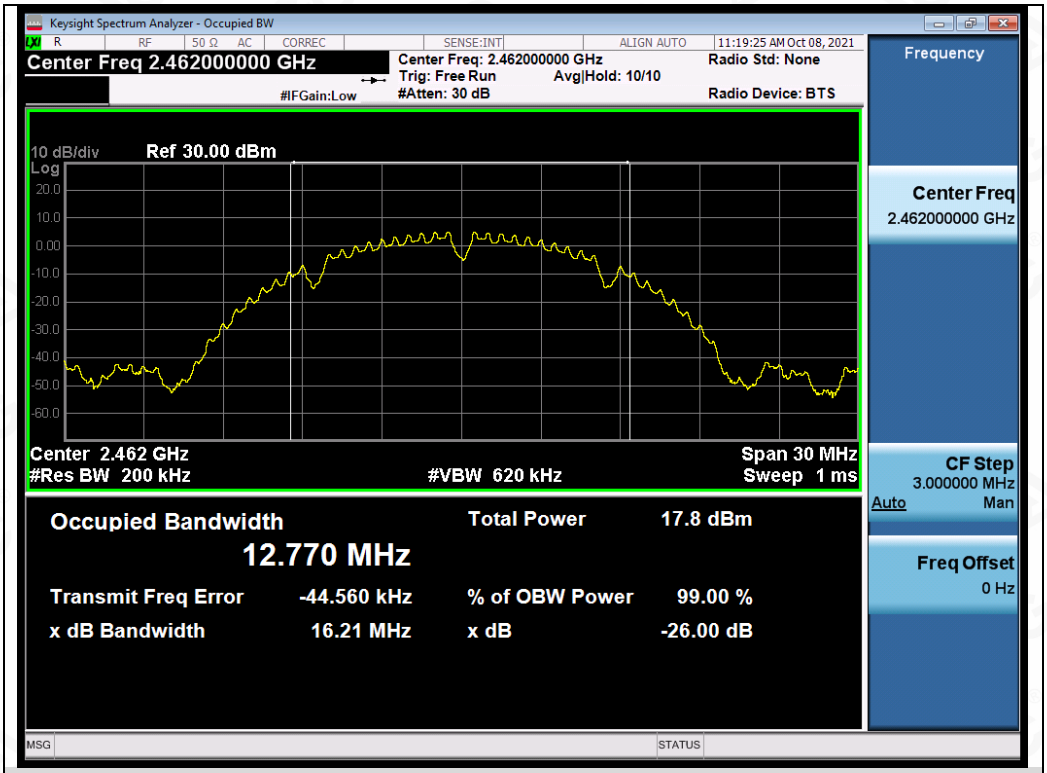
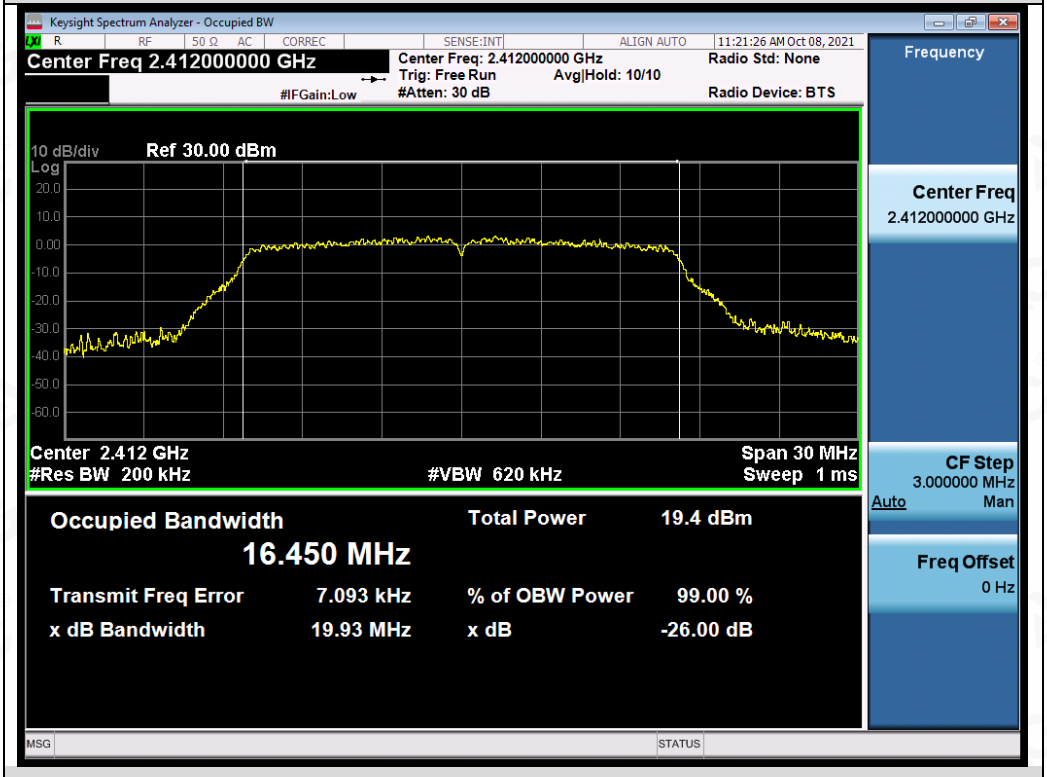


Test_Graph_802.11b_ANT2_2462_1Mbps_OBW



Test_Graph_802.11g_ANT2_2412_6Mbps_OBW

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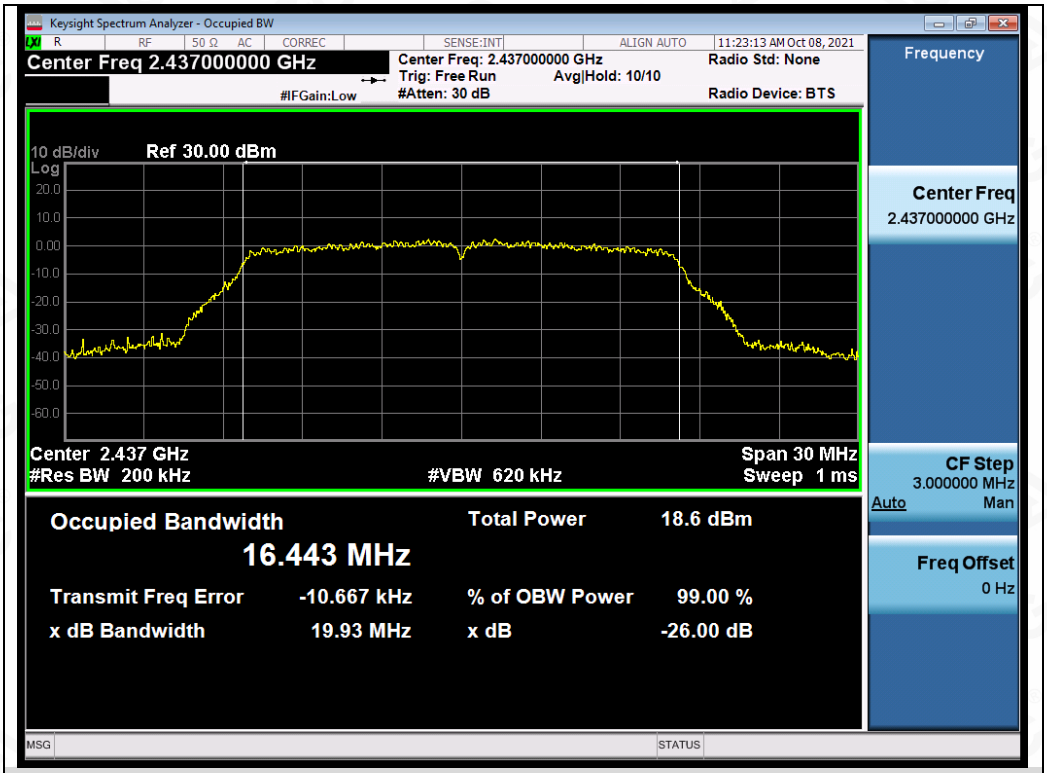

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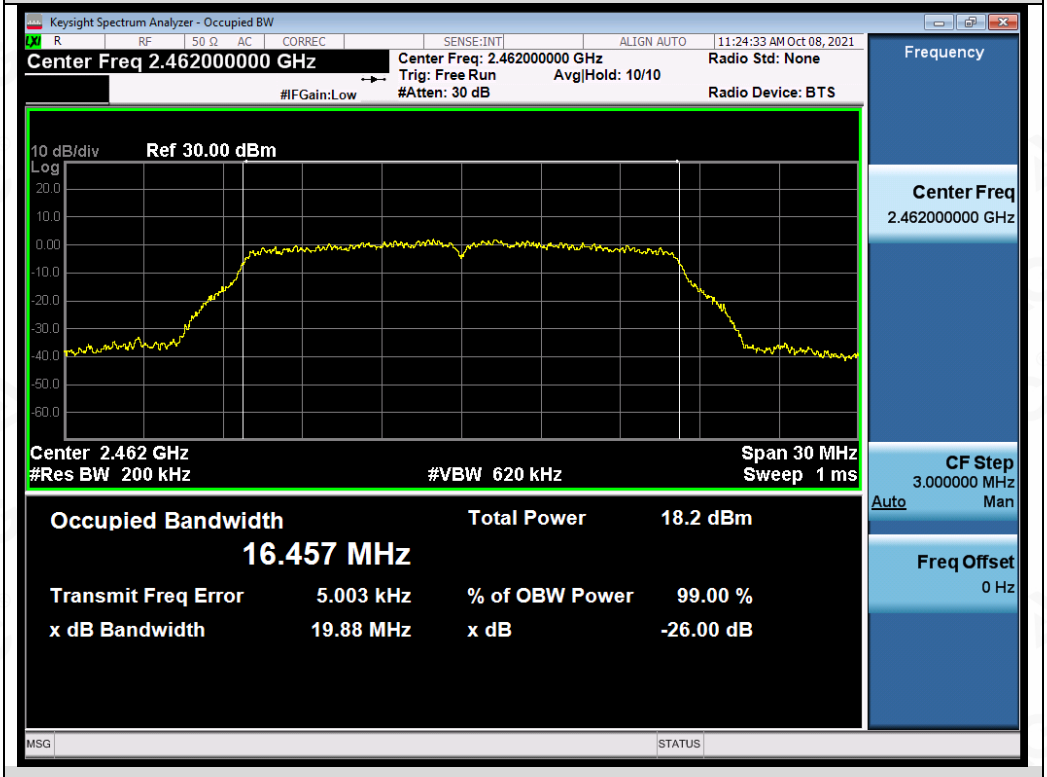

Test_Graph_802.11g_ANT2_2462_6Mbps_OBW

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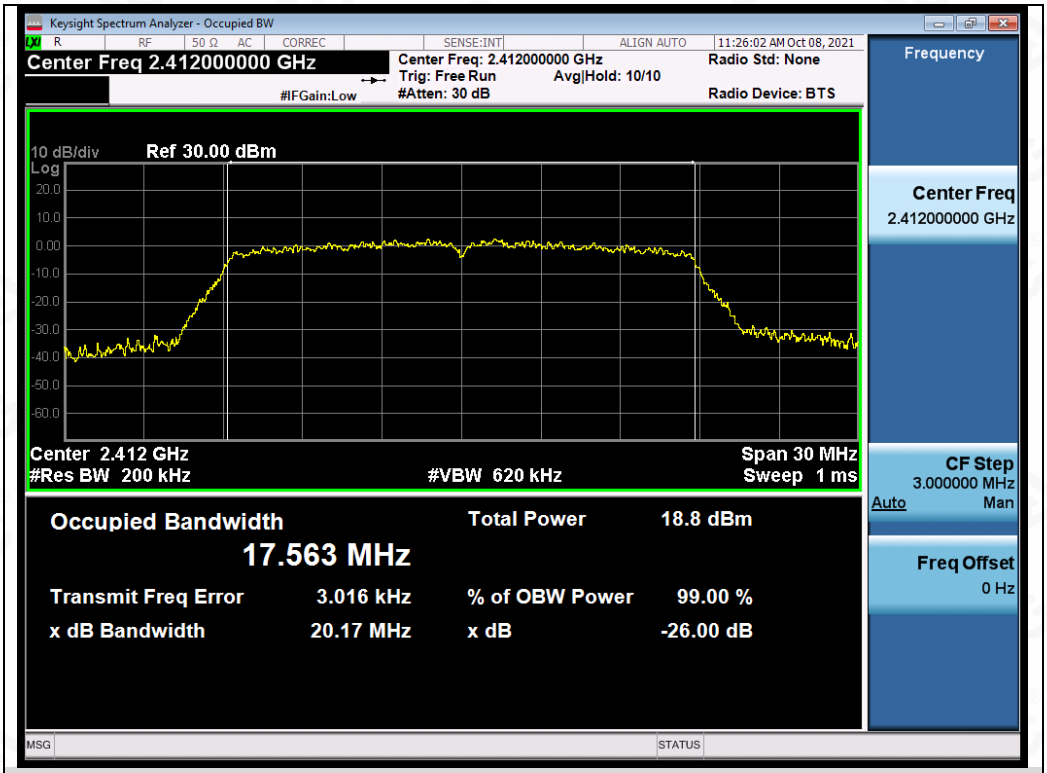
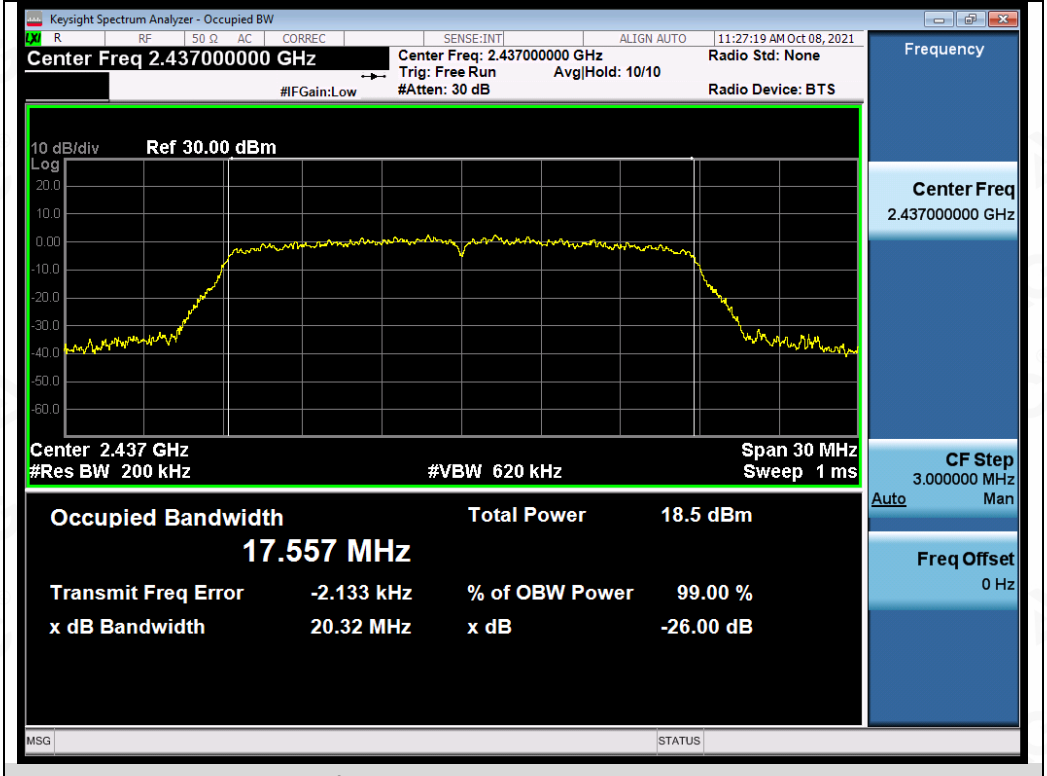


Test_Graph_802.11n20_ANT2_2412_MCS0_OBW



Test_Graph_802.11n20_ANT2_2437_MCS0_OBW

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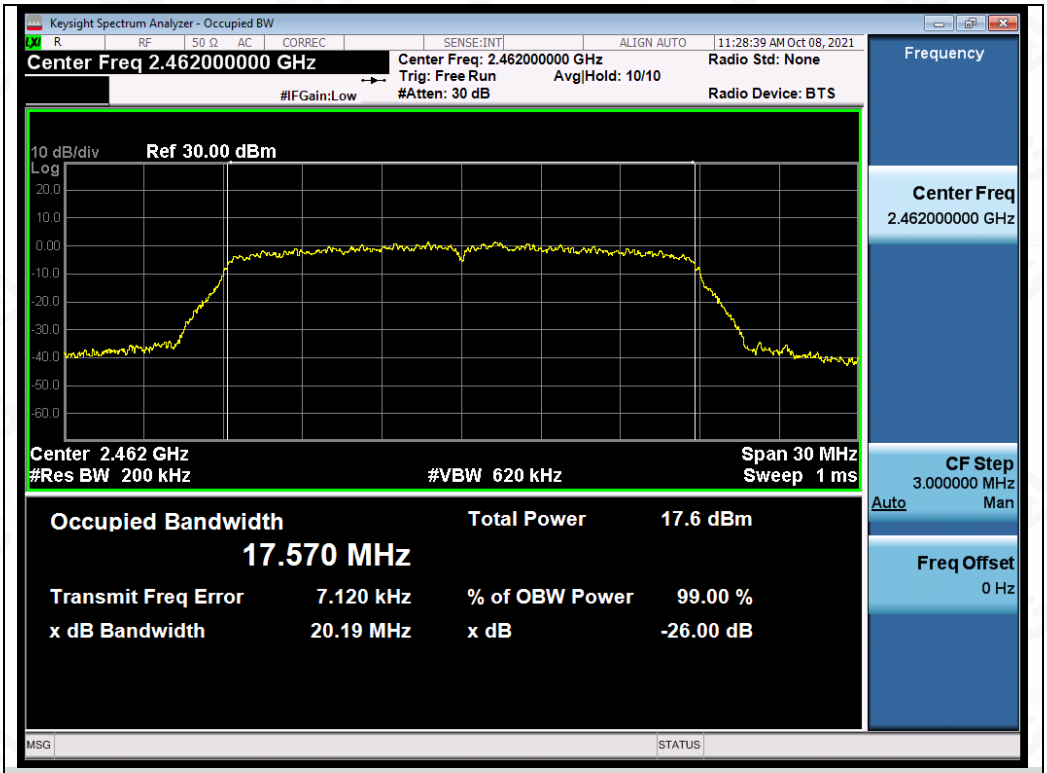

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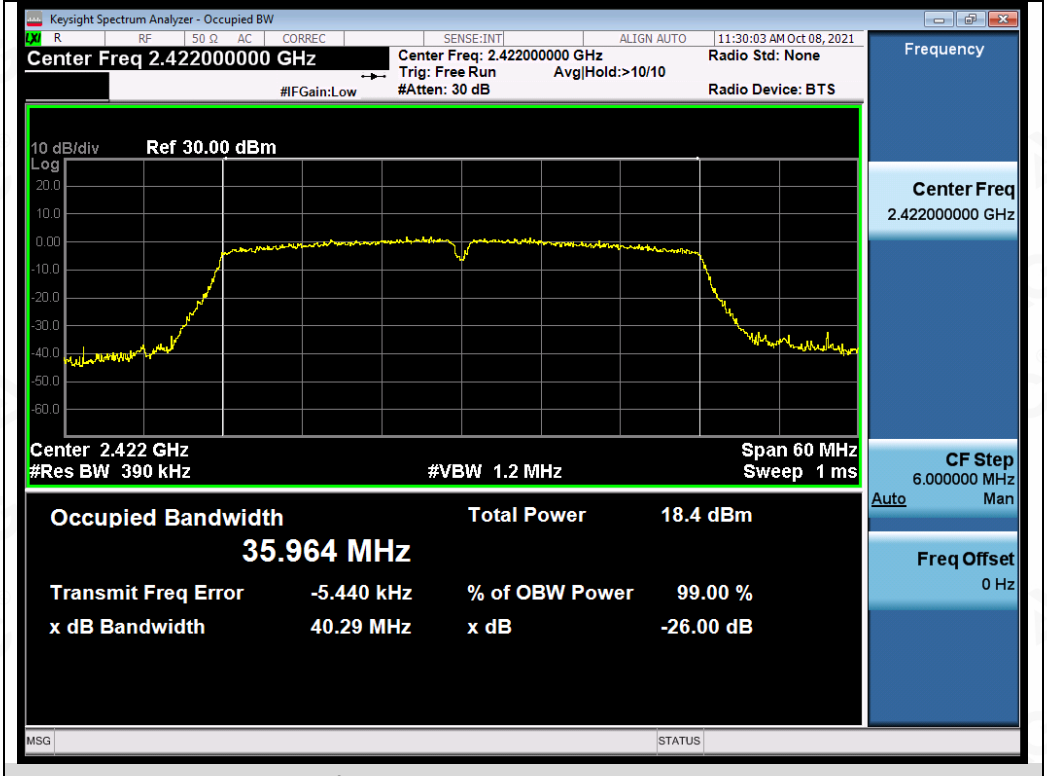

Test_Graph_802.11n40_ANT2_2422_MCS0_OBW

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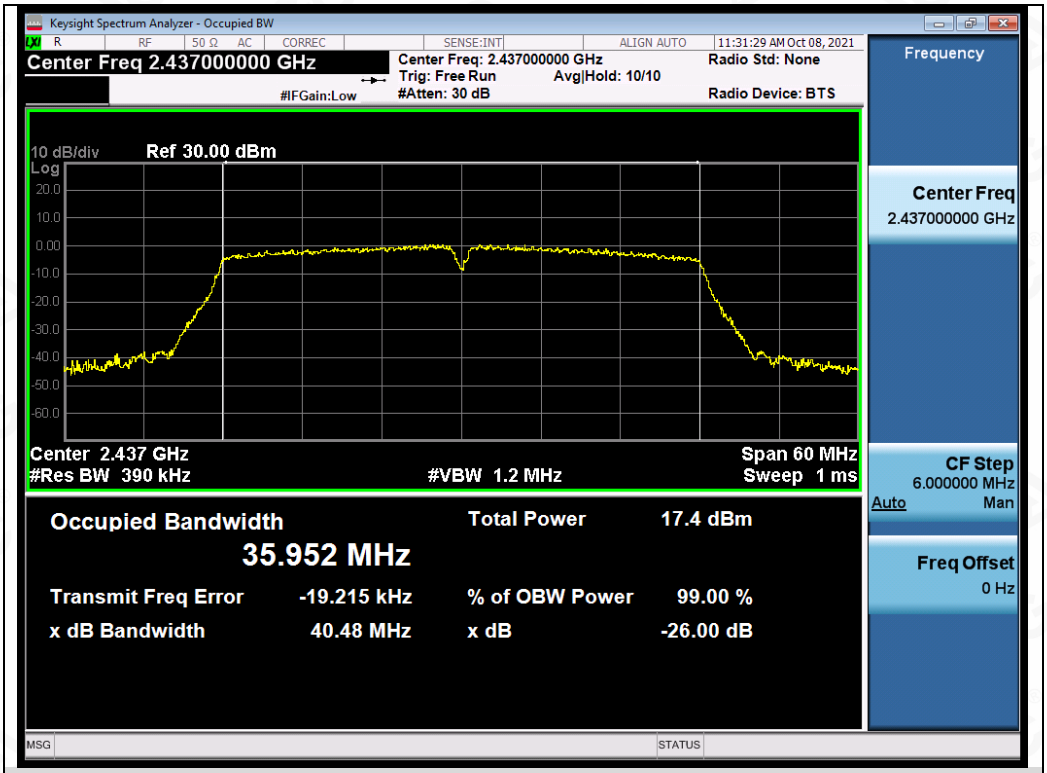

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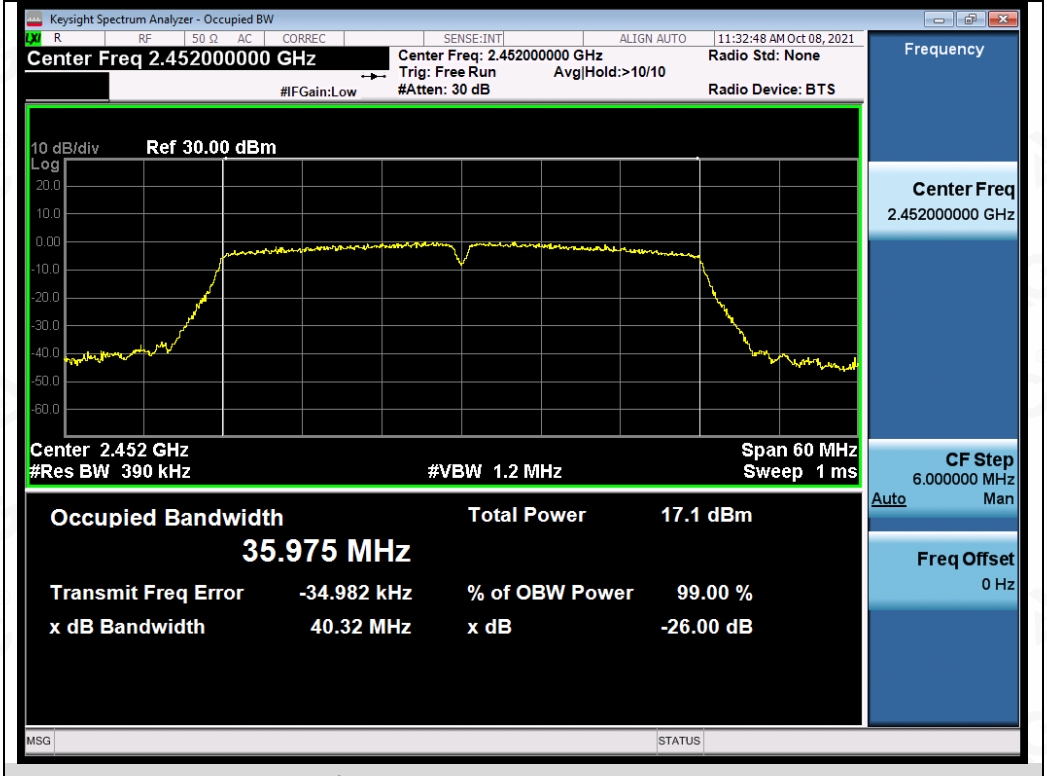

Test_Graph_802.11n40_ANT2_2452_MCS0_OBW

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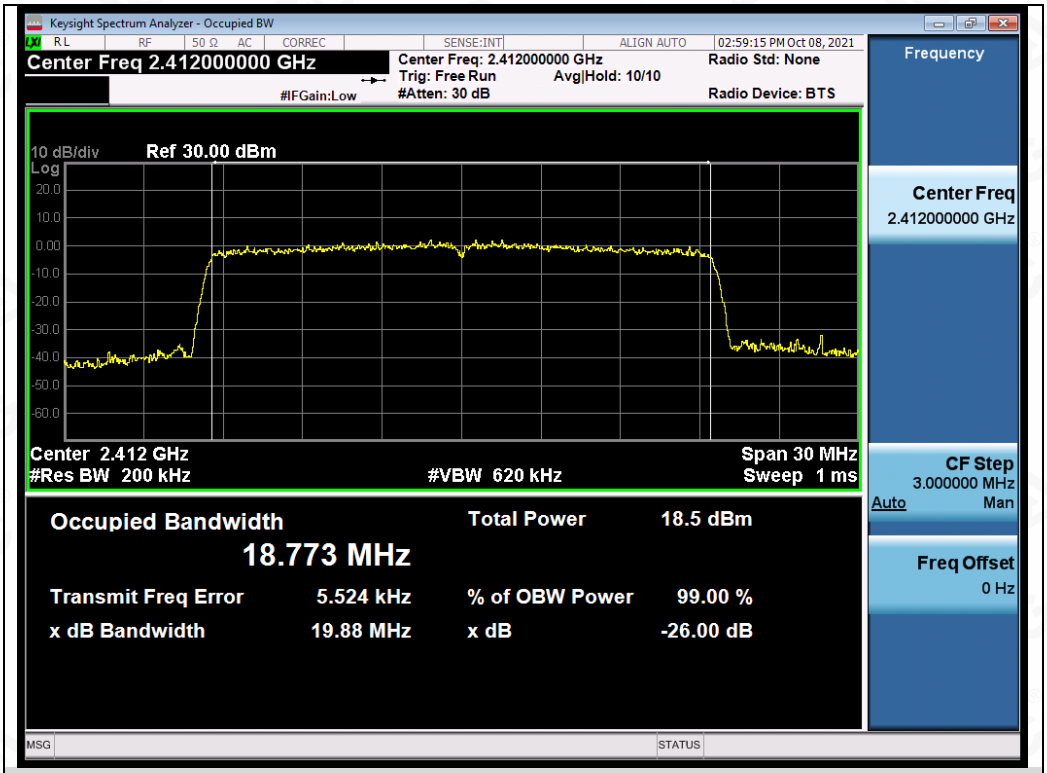
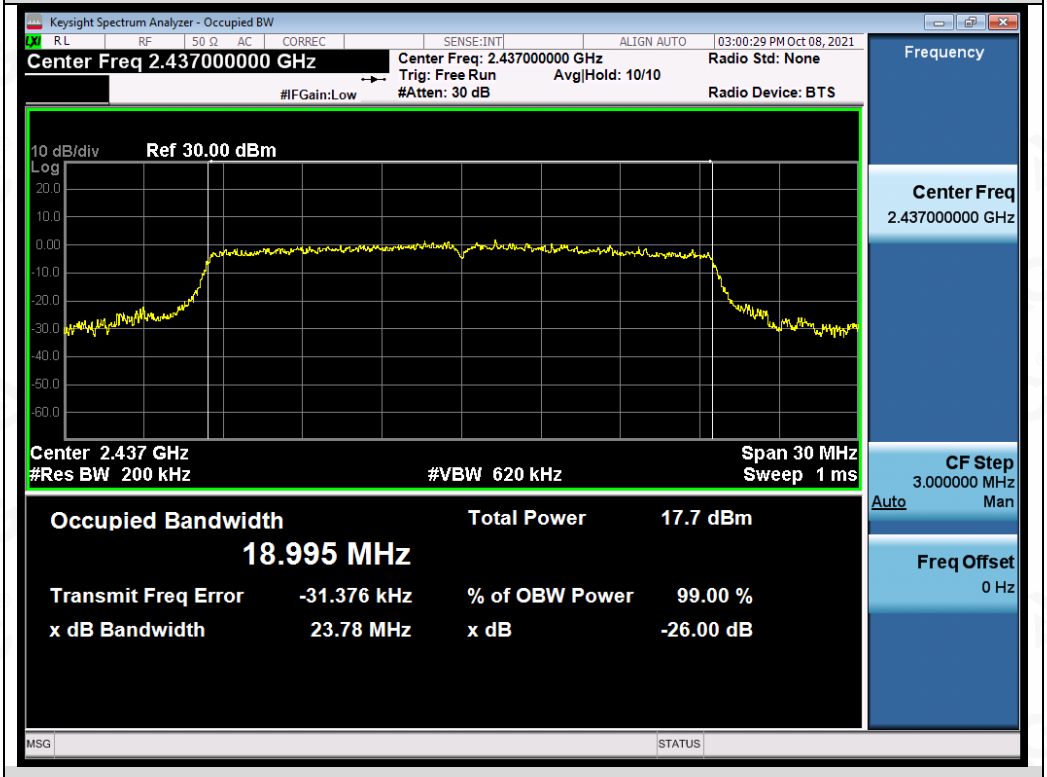


Test_Graph_802.11ax20_ANT2_2412_MCS0_OBW



Test_Graph_802.11ax20_ANT2_2437_MCS0_OBW

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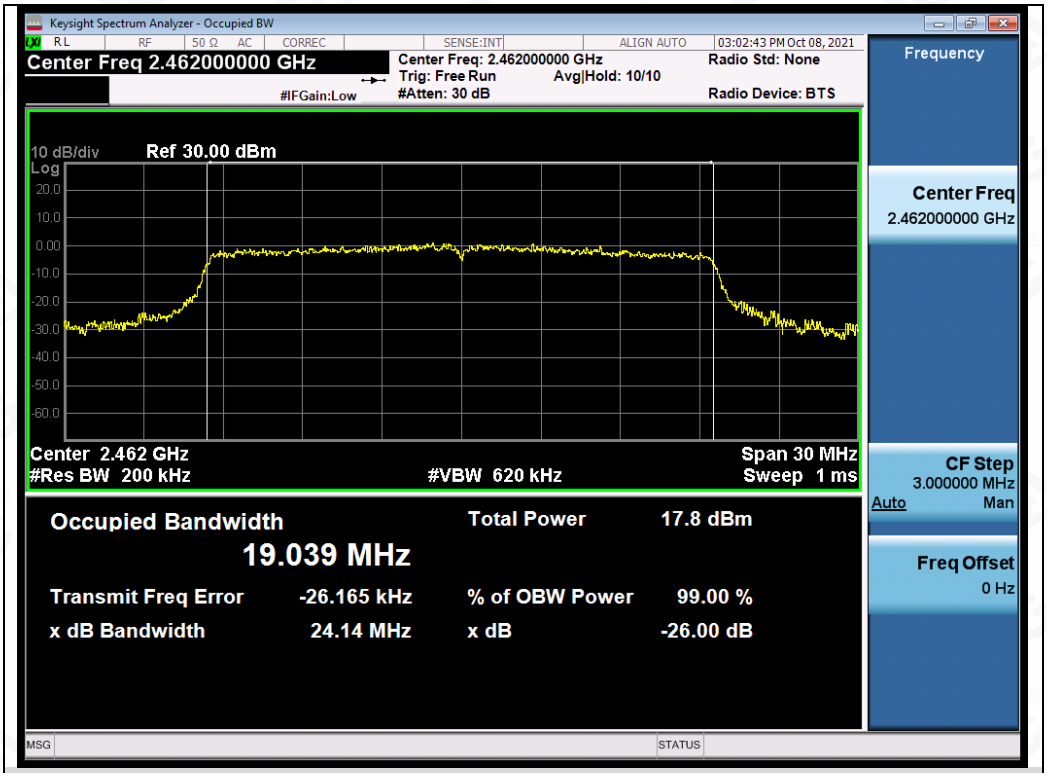

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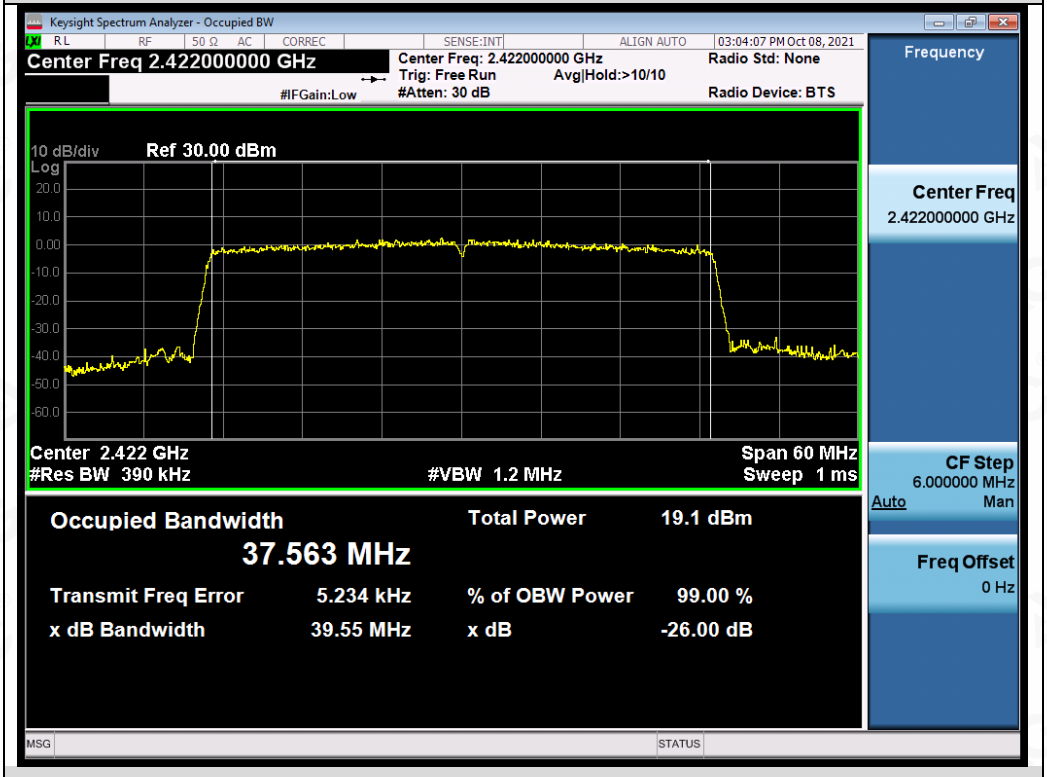

Test_Graph_802.11ax40_ANT2_2422_MCS0_OBW

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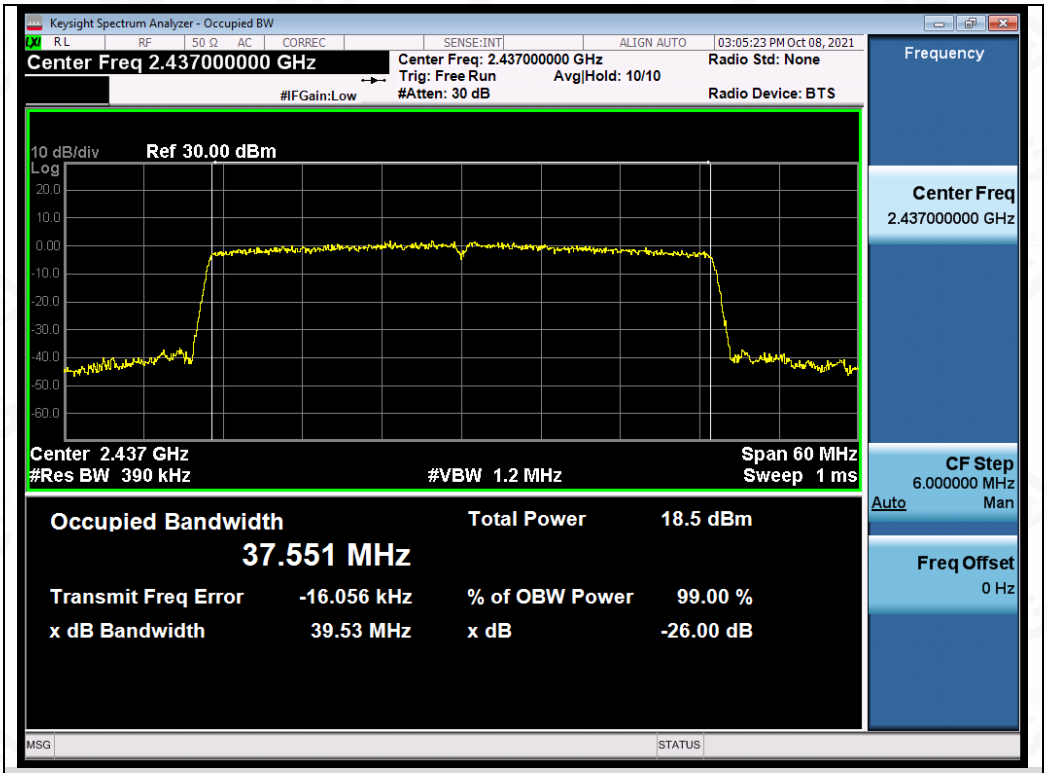

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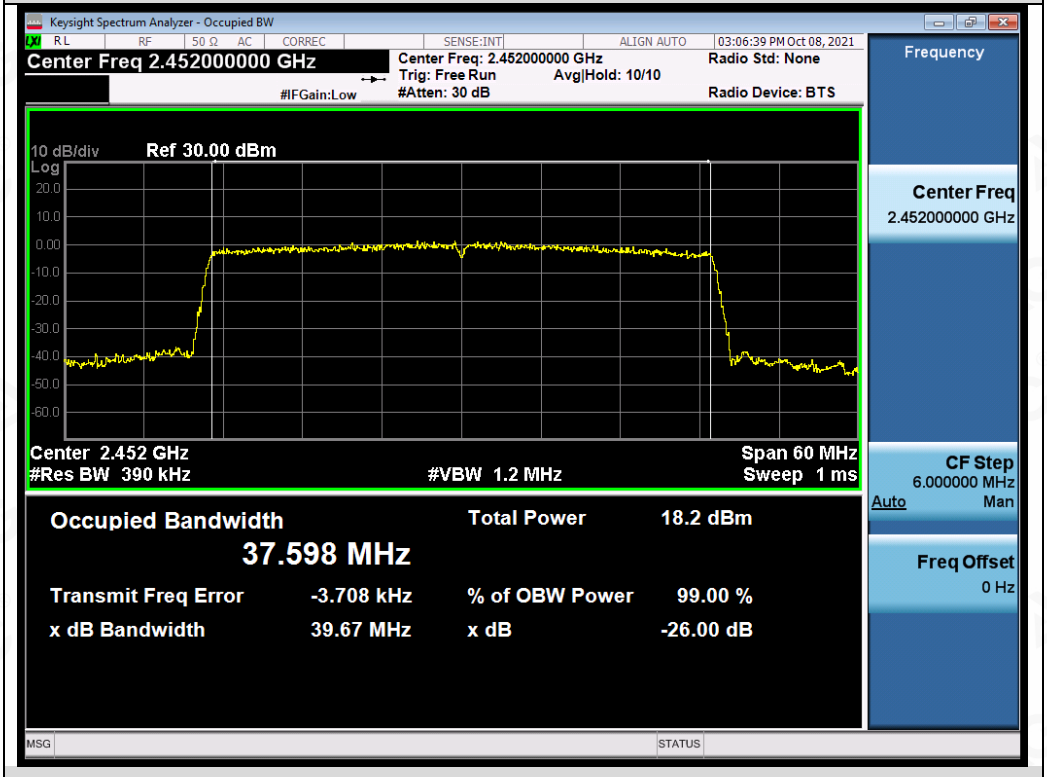

Test_Graph_802.11ax40_ANT2_2452_MCS0_OBW

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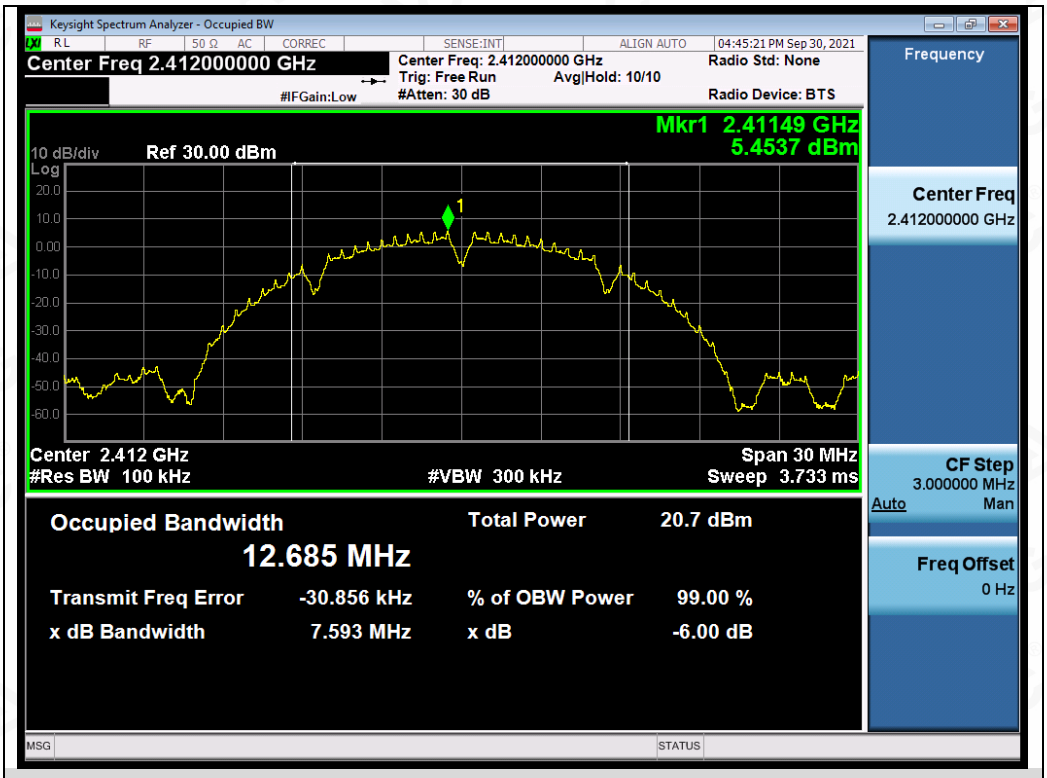
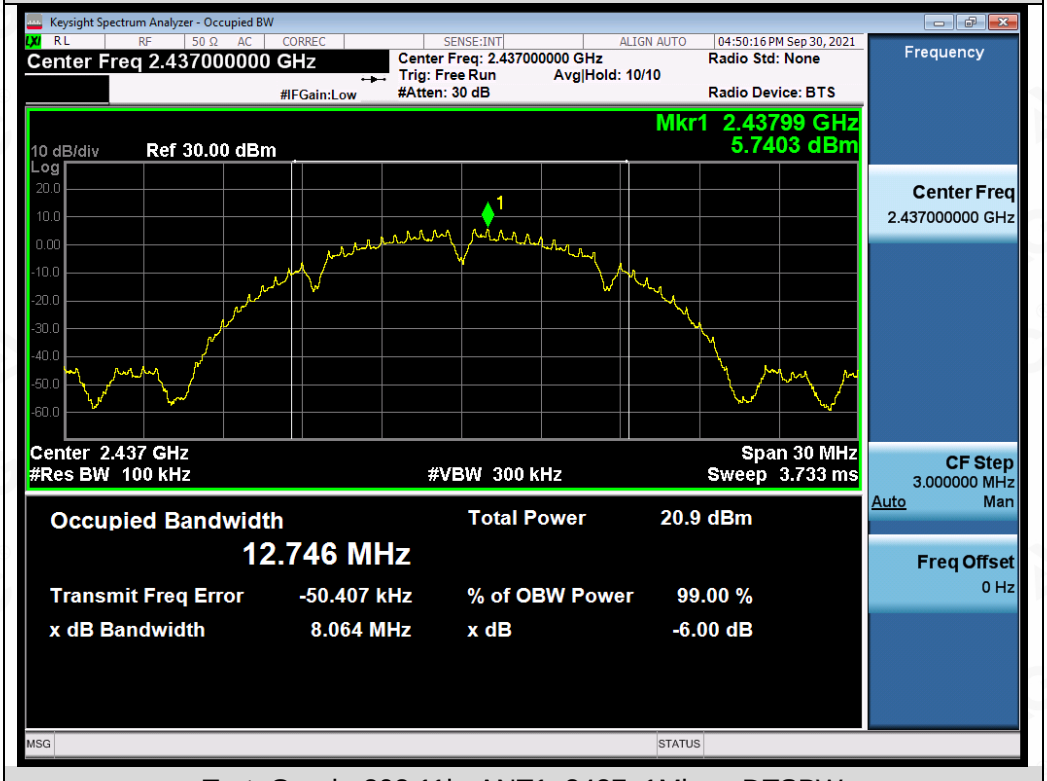
Test Graphs of DTS Bandwidth



Test_Graph_802.11b_ANT1_2412_1Mbps_DTSBW



Test_Graph_802.11b_ANT1_2437_1Mbps_DTSBW

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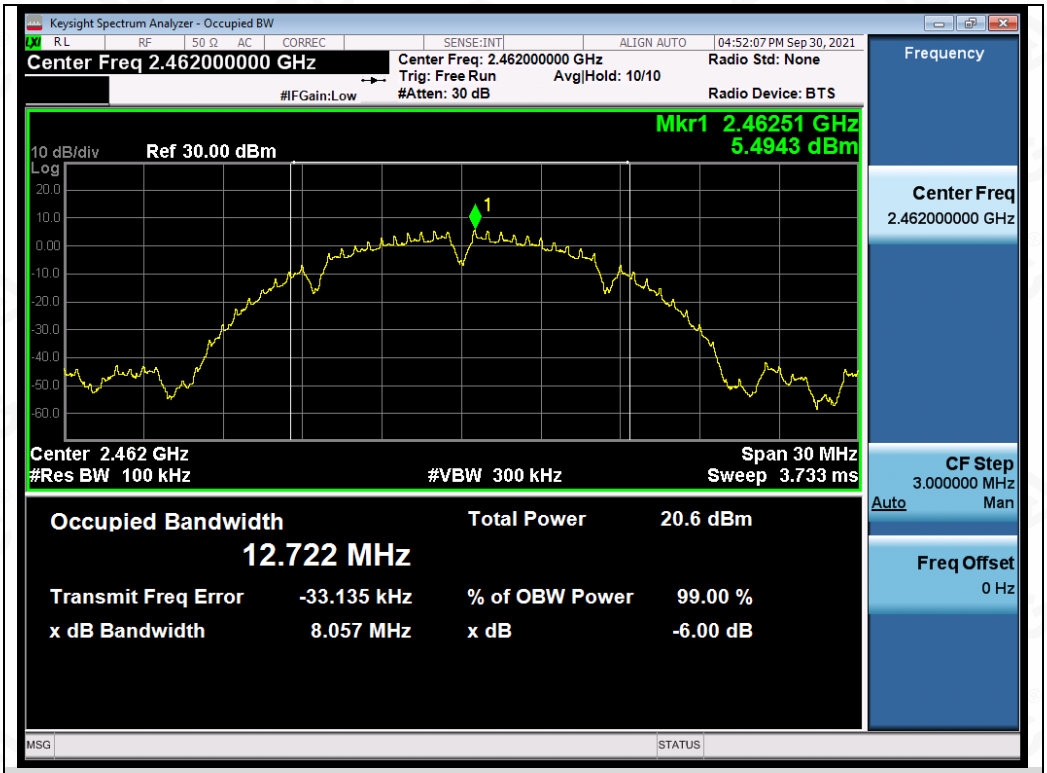
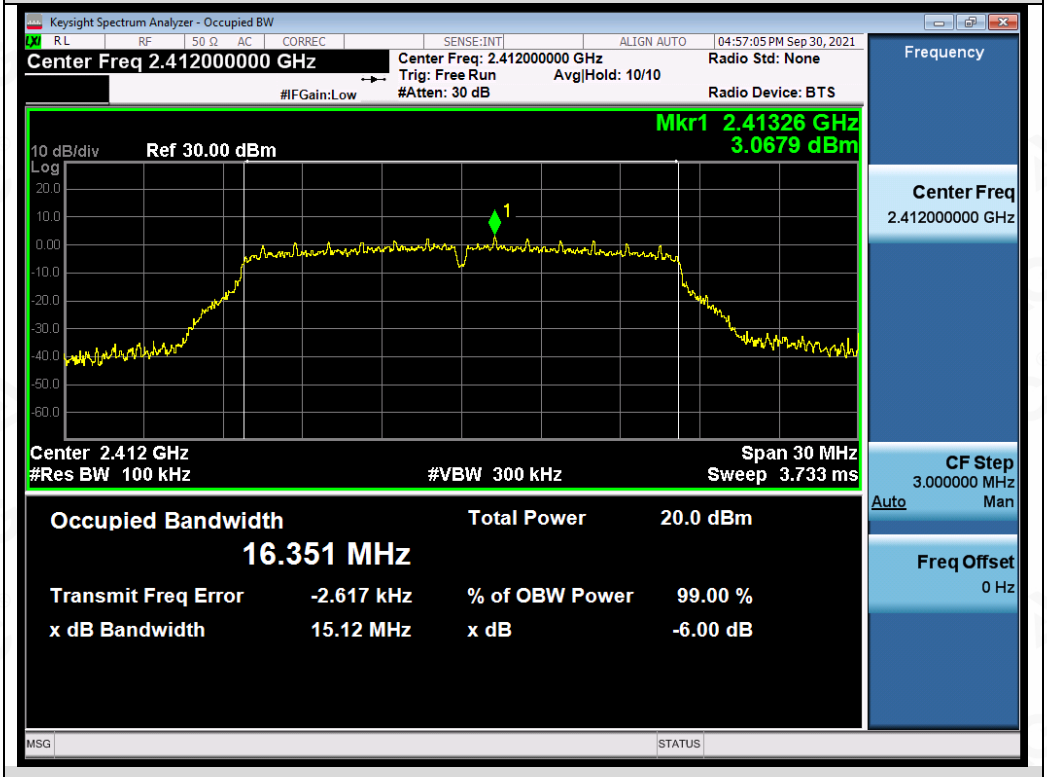


Test_Graph_802.11b_ANT1_2462_1Mbps_DTSBW



Test_Graph_802.11g_ANT1_2412_6Mbps_DTSBW

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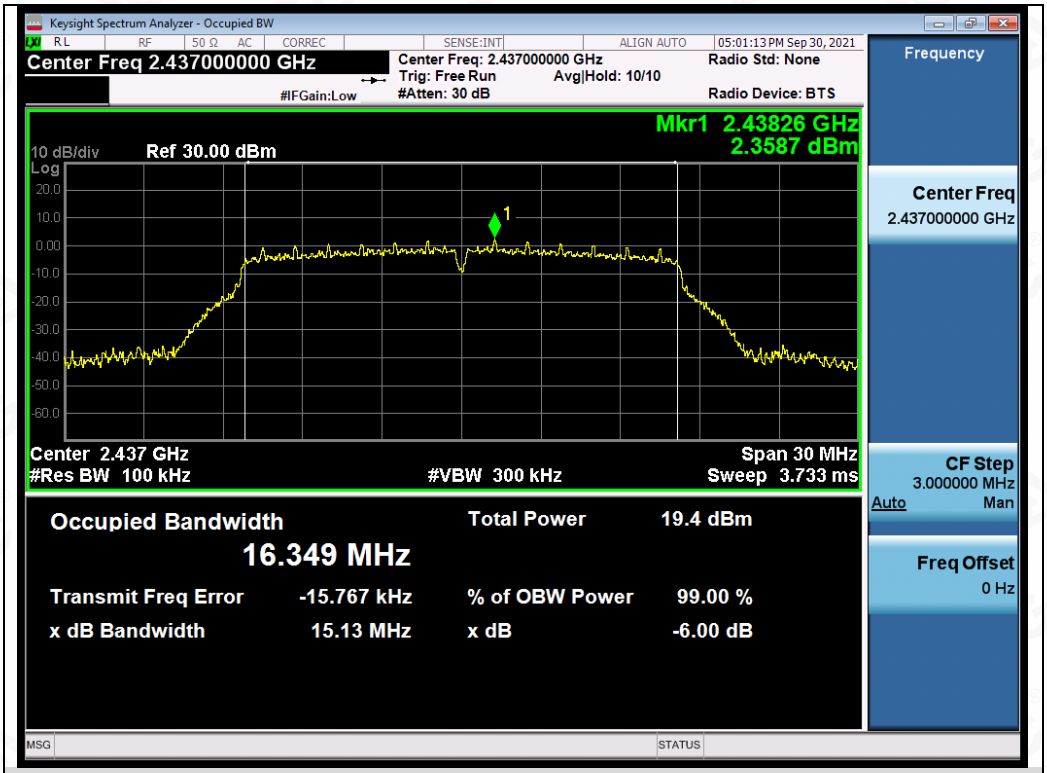
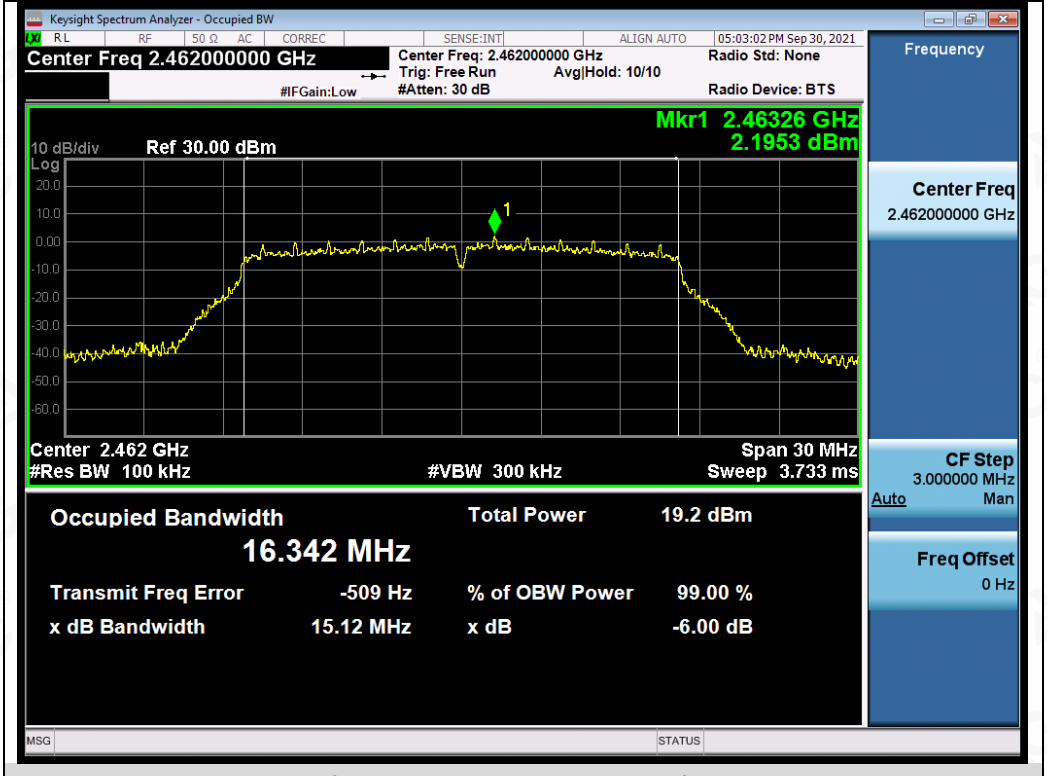


Test_Graph_802.11g_ANT1_2437_6Mbps_DTSBW



Test_Graph_802.11g_ANT1_2462_6Mbps_DTSBW

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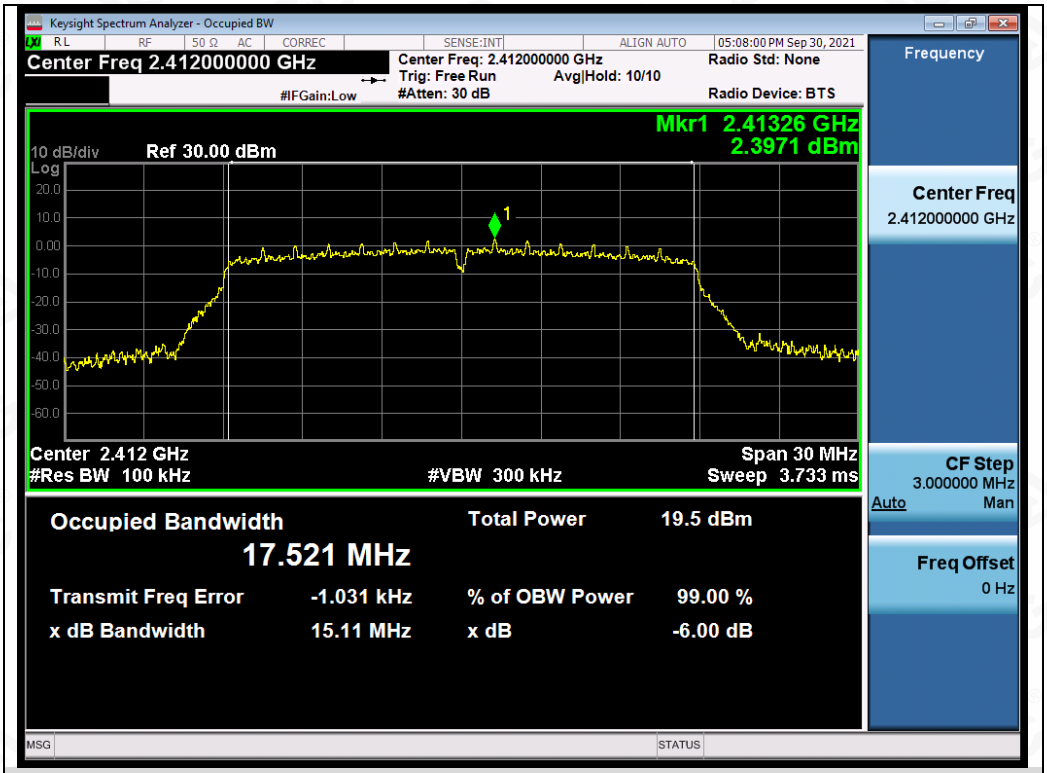
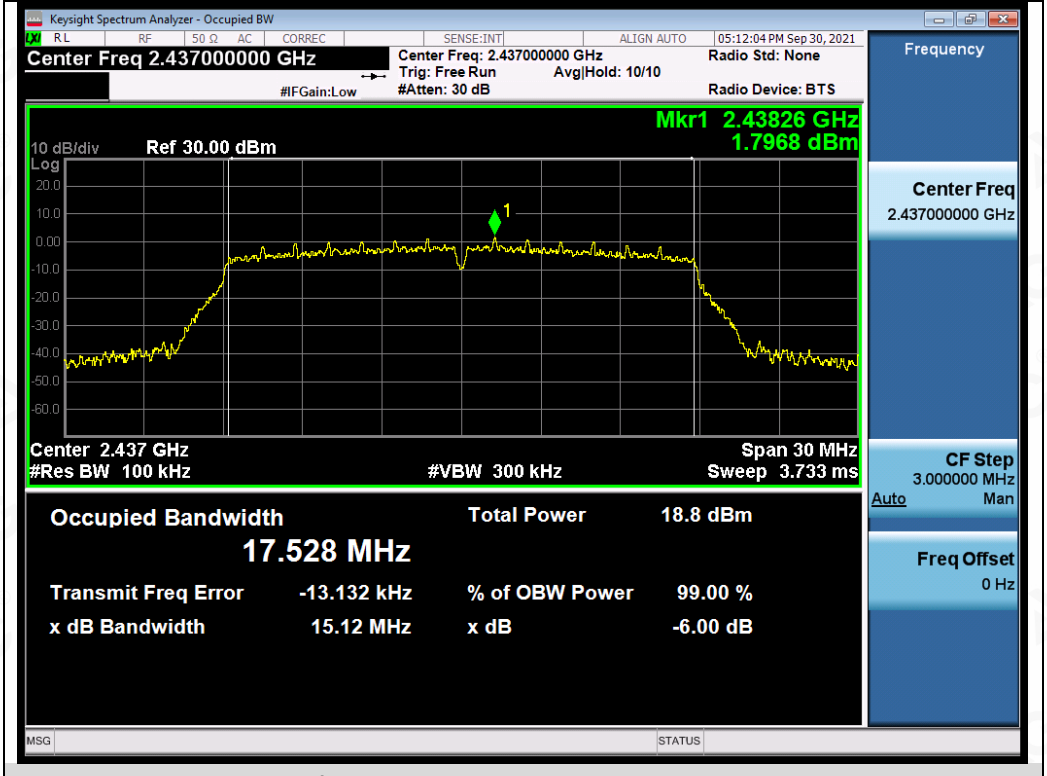


Test_Graph_802.11n20_ANT1_2412_MCS0_DTSBW



Test_Graph_802.11n20_ANT1_2437_MCS0_DTSBW

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