TEST REPORT

Applicant:	CTOUCH Europe B.V.
Address of Applicant:	Achtseweg Zuid 153R, 5651 GW Eindhoven, Nederlands
Manufacturer	CTOUCH Europe B.V.
Address of Manufacturer:	Achtseweg Zuid 153R, 5651 GW Eindhoven, Nederlands

Equipment Under Test (EUT)

Product Name:	WIFI6 MODULE
Model No.:	MT7921AU-FRX
Trade Mark:	CTOUCH
FCC ID:	2APQQ-MT7921AU-FRX
Applicable standards:	**FCC CFR Title 47 Part 15 Subpart C Section 15.247** **ANSI C63.10:2013**
Date of sample receipt:	December 6, 2022
Date of Test:	December 19~January 13, 2023
Date of report issued:	January 13, 2023
Test Result :	**PASS ***

*** In the configuration tested, the EUT complied with the standards specified above.**

Authorized Signature:

Robinson Luo
Laboratory Manager

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

2 Version

Version No.	Date	Description
00	*2023-1-13*	*Original*

Prepared By: ***Date:*** *2023-1-13*

Project Engineer

Check By: ***Date:*** *2023-1-13*

Reviewer

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4 Test Summary

Test Item	Section	Result
Antenna requirement	FCC part 15.203/15.247 (b)(4)	Pass
AC Power Line Conducted Emission	FCC part 15.207	Not Applicable
Conducted Peak Output Power	FCC part 15.247 (b)(3)	Pass
Channel Bandwidth & 99% OCB	FCC part 15.247 (a)(2)	Pass
Power Spectral Density	FCC part 15.247 (e)	Pass
Band Edge	FCC part 15.247(d)	Pass
Spurious Emission	FCC part 15.205/15.209	Pass

Remark: Test according to ANSI C63.10:2013.

Pass: The EUT complies with the essential requirements in the standard.

Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	1×10^{-7}
2	Duty cycle	0.37%
3	Occupied Bandwidth	3%
4	RF conducted power	0.75dB
5	RF power density	3dB
6	Conducted Spurious emissions	2.58dB
7	AC Power Line Conducted Emission	3.44dB (0.15MHz ~ 30MHz)
8	Radiated Spurious emission test	3.1dB (9kHz-30MHz)
		3.8039dB (30MHz-200MHz)
		3.9679dB (200MHz-1GHz)
		4.29dB (1GHz-18GHz)
		3.30dB (18GHz-40GHz)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.		

5 General Information

5.1 General Description of EUT

Product Name:	WIFI6 MODULE
Model No.:	MT7921AU-FRX
Serial No.:	C43CB0DCFA64
Hardware version:	V1.0
Software version:	V1.0
Test sample(s) ID:	GTSL202212000237-1
Sample(s) Status	Engineer sample
Operation Frequency:	802.11b/802.11g/802.11n(HT20)/ 802.11ax(HE20): 2412MHz~2462MHz 802.11n(HT40)/802.11ax(HE40): 2422MHz~2452MHz
Channel numbers:	802.11b/802.11g /802.11n(HT20)/802.11ax(HE20): 11 802.11n(HT40)/802.11ax(HE40):7
Channel separation:	5MHz
Modulation technology:	802.11b: DSSS 802.11g/802.11n(HT20)/802.11n(HT40): OFDM 802.11ax(HE20)/802.11ax(HE40): OFDMA Beamforming: 802.11b/g/n/ax (802.11ax mode only support Full RU)
Antenna Type:	External Antenna
Antenna gain:	ANTA:4.82dBi ANTB:4.82dBi Beamforming technology: (PSD directional gain=7.83dBi, Power directional gain=7.83dBi)
Beamforming Factor	0 dB by manufacturer's declaration
Power Supply:	DC 3.3V

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Test channel	**Frequency (MHz)**	
	802.11b/802.11g/802.11n(HT20)/ 802.11ax(HE20)	802.11n(HT40)/ 802.11ax(HE40)
Lowest channel	2412MHz	2422MHz
Middle channel	2437MHz	2437MHz
Highest channel	2462MHz	2452MHz

Test Item	Software	Description
Conducted RF Testing and Radiated testing	MP_AX	Set the EUT to different modulation and channel

Output power setting table:

Test Mode	Set Tx Output Power	Data Rate
802.11b-Beamforming	7	1Mbps
802.11g-Beamforming	7	54Mbps
802.11n(HT20)-Beamforming	7	MCS7
802.11n(HT40)-Beamforming	7	MCS7
802.11ax(HE20)-Beamforming	5	MCS7
802.11ax(HE40)-Beamforming	5	MCS7

5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode
Remark: During the test, the dutycycle >98%, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data. New battery is used during all test.	

5.3 Description of Support Units

Notebook PC Mode Number: KPL-W00

5.4 Deviation from Standards

None.

5.5 Abnormalities from Standard Conditions

None.

5.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

● **FCC—Registration No.: 381383**

Designation Number: CN5029

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files.

● **IC —Registration No.: 9079A**

CAB identifier: CN0091

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

● **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

5.7 Test Location

All tests were performed at:
Global United Technology Services Co., Ltd. Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102 Tel: 0755-27798480 Fax: 0755-27798960

5.8 Additional Instructions

Test Software	Special test command provided by manufacturer
Power level setup	Default

6 Test Instruments list

Radiated Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July 02, 2020	July 01, 2025
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	April 22, 2022	April 21, 2023
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9168	GTS640	March 21, 2022	March 20, 2023
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June 12, 2022	June 11, 2023
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June 23, 2022	June 22, 2023
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	April 22, 2022	April 21, 2023
9	Coaxial Cable	GTS	N/A	GTS211	April 22, 2022	April 21, 2023
10	Coaxial cable	GTS	N/A	GTS210	April 22, 2022	April 21, 2023
11	Coaxial Cable	GTS	N/A	GTS212	April 22, 2022	April 21, 2023
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	April 22, 2022	April 21, 2023
13	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June 23, 2022	June 22, 2023
14	Band filter	Amindeon	82346	GTS219	June 23, 2022	June 22, 2023
15	Power Meter	Anritsu	ML2495A	GTS540	June 23, 2022	June 22, 2023
16	Power Sensor	Anritsu	MA2411B	GTS541	June 23, 2022	June 22, 2023
17	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	April 22, 2022	April 21, 2023
18	Splitter	Agilent	11636B	GTS237	June 23, 2022	June 22, 2023
19	Loop Antenna	ZHINAN	ZN30900A	GTS534	Nov. 29, 2022	Nov. 28, 2023
20	Broadband Preamplifier	SCHWARZBECK	BBV9718	GTS535	April 22, 2022	April 21, 2023
21	Breitband hornantenna	SCHWARZBECK	BBHA 9170	GTS579	Oct. 16, 2022	Oct. 15, 2023
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 16, 2022	Oct. 15, 2023
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 16, 2022	Oct. 15, 2023
24	PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	GTS578	June 23, 2022	June 22, 2023
25	Amplifier(1GHz-26.5GHz)	HP	8449B	GTS601	April 22, 2022	April 21, 2023

RF Conducted Test:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	MXA Signal Analyzer	Agilent	N9020A	GTS566	April 22, 2022	April 21, 2023
2	EMI Test Receiver	R&S	ESCI 7	GTS552	April 22, 2022	April 21, 2023
3	Spectrum Analyzer	Agilent	E4440A	GTS536	April 22, 2022	April 21, 2023
4	MXG vector Signal Generator	Agilent	N5182A	GTS567	April 22, 2022	April 21, 2023
5	ESG Analog Signal Generator	Agilent	E4428C	GTS568	April 22, 2022	April 21, 2023
6	USB RF Power Sensor	DARE	RPR3006W	GTS569	April 22, 2022	April 21, 2023
7	RF Switch Box	Shongyi	RFSW3003328	GTS571	April 22, 2022	April 21, 2023
8	Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	GTS572	April 22, 2022	April 21, 2023

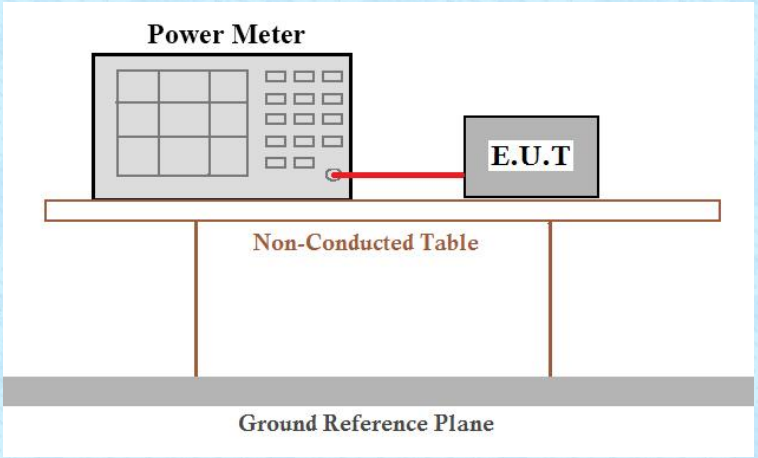
General used equipment:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	April 25, 2022	April 24, 2023
2	Barometer	KUMAO	SF132	GTS647	July 26, 2022	July 25, 2023

7 Test results and Measurement Data

7.1 Antenna requirement

Standard requirement:	**FCC Part15 C Section 15.203 /247(b) (4)**
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. **15.247(b)(4) requirement:** (4) The conducted output power limit specified in paragraph (b) of this sec-tion is based on the use of antennas with directional gains that do not ex-ceed 6 dBi. Except as shown in para-graph (c) of this section, if transmit-ting antennas of directional gain great-er than 6 dBi are used, the conducted output power from the intentional ra-diator shall be reduced below the stat-ed values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appro-priate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
EUT Antenna:	
The antenna is External Antenna, the best case gain of the antenna is 4.82dBi, reference to the appendix II for details	

7.2 Conducted Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 15.247 Meas Guidance v05r02
Limit:	30dBm
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Output Power:

802.11b mode						
CH No.	Frequency (MHz)	Output Power (dBm)			Limit (dBm)	Result
		ANT A	ANT B	ANT A+B		
01	2412	12.328	11.397	14.898	28.17	Pass
06	2437	12.347	11.544	14.974		
11	2462	11.318	11.561	14.451		
802.11g mode						
CH No.	Frequency (MHz)	Output Power (dBm)			Limit (dBm)	Result
		ANT A	ANT B	ANT A+B		
03	2412	14.978	15.134	18.183	28.17	Pass
06	2437	14.702	14.25	17.934		
09	2462	15.038	14.244	17.672		
802.11 n(HT20) mode						
CH No.	Frequency (MHz)	Output Power (dBm)			Limit (dBm)	Result
		ANT A	ANT B	ANT A+B		
01	2412	13.918	14.244	17.094	28.17	Pass
06	2437	13.834	14.195	17.029		
11	2462	13.976	13.364	16.691		
802.11 n(HT40) mode						
CH No.	Frequency (MHz)	Output Power (dBm)			Limit (dBm)	Result
		ANT A	ANT B	ANT A+B		
03	2422	14.829	15.182	18.019	28.17	Pass
06	2437	14.683	15.177	17.947		
09	2452	14.666	14.233	17.465		

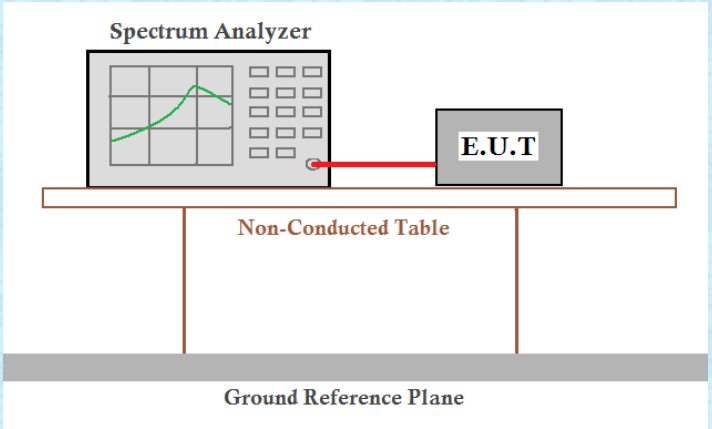
802.11 ax(HE20) mode						
CH No.	Frequency (MHz)	Output Power (dBm)			Limit (dBm)	Result
		ANT A	ANT B	ANT A+B		
01	2412	11.739	12.377	15.08	28.17	Pass
06	2437	11.687	12.351	15.042		
11	2462	11.866	12.178	15.035		
802.11 ax(HE40) mode						
CH No.	Frequency (MHz)	Output Power (dBm)			Limit (dBm)	Result
		ANT A	ANT B	ANT A+B		
03	2422	12.707	11.789	15.283	28.17	Pass
06	2437	12.435	11.654	15.072		
09	2452	11.436	11.911	14.69		

Note:

Power directional gain=7.83dBi, So Limit=30-1.83=28.17dBm

Beamforming Factor is 0 dB, and the results are unchanged

7.3 Channel Bandwidth & 99% Occupy Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 15.247 Meas Guidance v05r02
Limit:	>500kHz
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Test Channel	Channel Bandwidth (MHz)								Limit(kHz)	Result
	802.11b		802.11g		802.11n(HT20)		802.11n(HT40)			
	ANT A	ANT B	ANT A	ANT B	ANT A	ANT B	ANT A	ANT B		
Lowest	7.99	8.06	16.32	15.01	15.03	15.02	35.06	35.02	>500	Pass
Middle	7.58	7.08	16.04	15.09	16.87	15.7	32.62	32.53		
Highest	7.58	8.06	15.66	16.04	16.25	16.9	33.76	35.03		

Test Channel	Channel Bandwidth (MHz)				Limit(kHz)	Result
	802.11ax(HE20)		802.11ax(HE40)			
	ANT A	ANT B	ANT A	ANT B		
Lowest	16.4	16.54	35.5	36.38	>500	Pass
Middle	16.98	15.17	36.28	36.5		
Highest	16.13	16.93	35.83	35.06		

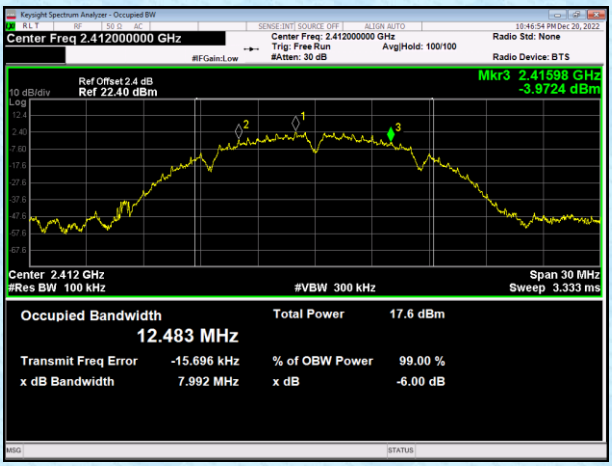
Test Channel	99% Occupy Bandwidth (MHz)								Result
	802.11b		802.11g		802.11n(HT20)		802.11n(HT40)		
	ANT A	ANT B	ANT A	ANT B	ANT A	ANT B	ANT A	ANT B	
Lowest	12.482	12.54	16.363	16.382	17.528	17.533	35.959	35.943	Pass
Middle	12.528	12.545	16.625	16.681	17.785	17.797	35.929	35.908	
Highest	12.451	12.485	16.588	16.635	17.719	17.804	36.006	35.958	

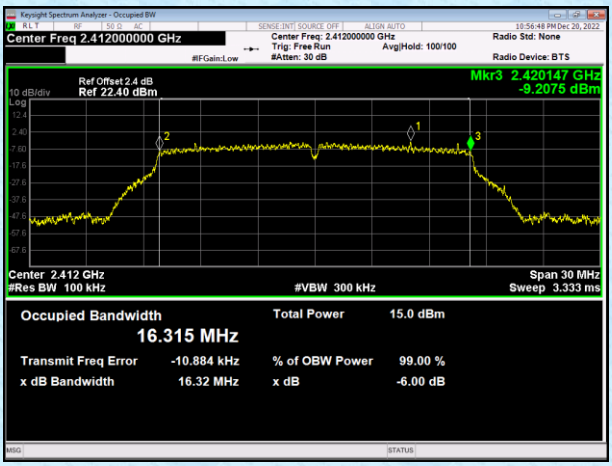
Test Channel	99% Occupy Bandwidth (MHz)				Result
	802.11ax(HE20)		802.11ax(HE40)		
	ANT A	ANT B	ANT A	ANT B	
Lowest	18.756	18.785	37.494	37.574	Pass
Middle	18.876	18.879	37.582	37.61	
Highest	18.914	18.875	37.61	37.564	

Test plot as follows:

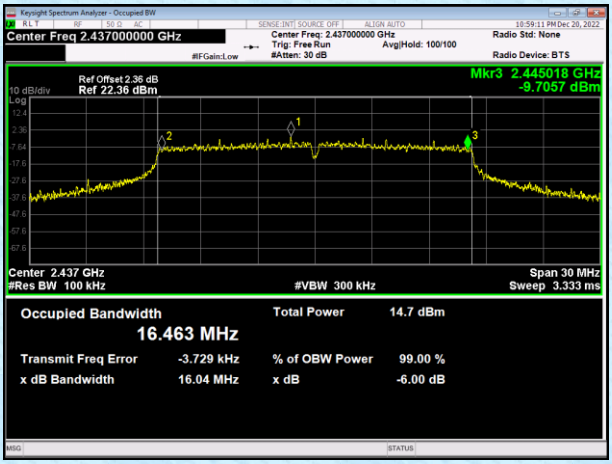
-6dB BW(ANT A):

Test mode:	802.11b	Test mode:	802.11g

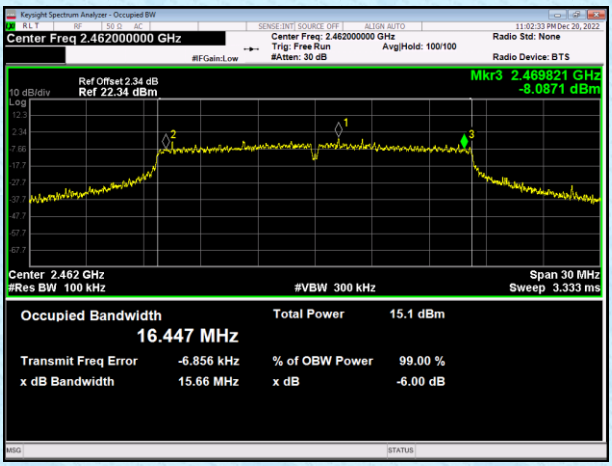




Lowest channel

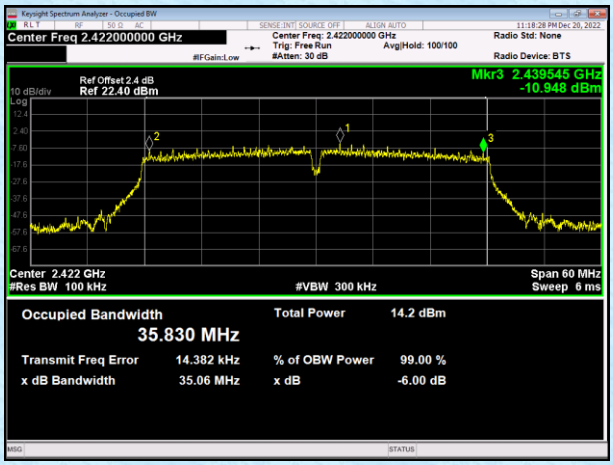


Middle channel

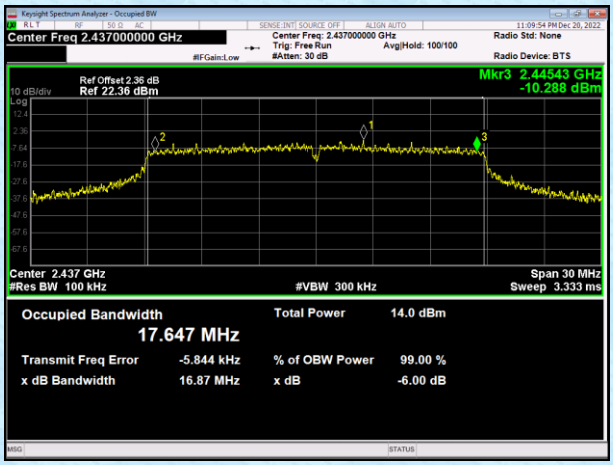


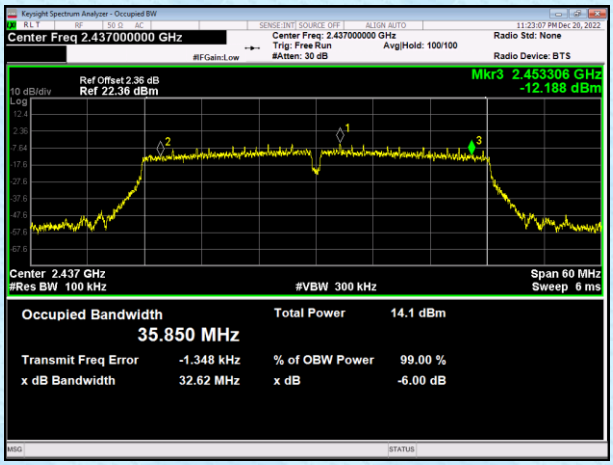
Highest channel

Test mode:	802.11n(HT20)	Test mode:	802.11n(HT40)

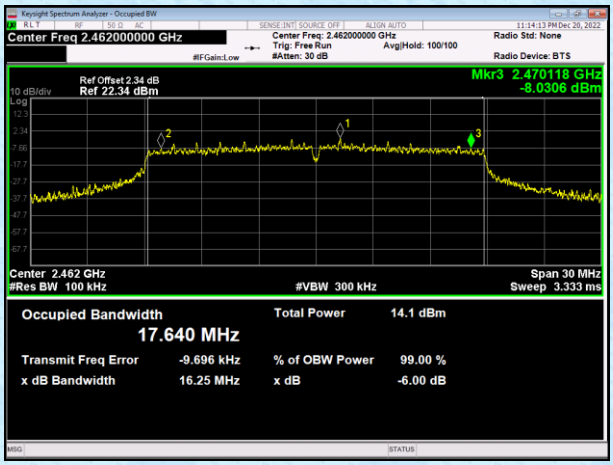


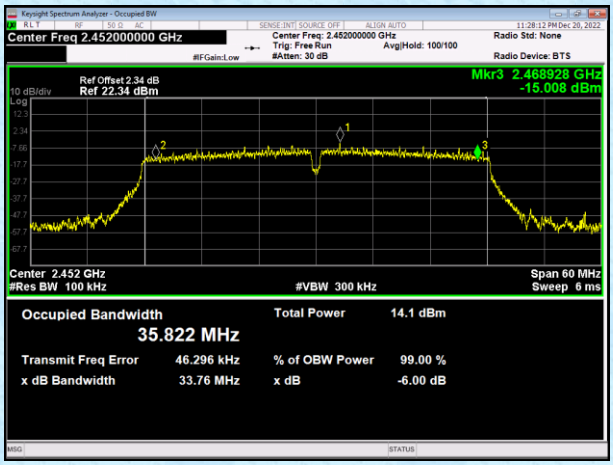
Lowest channel





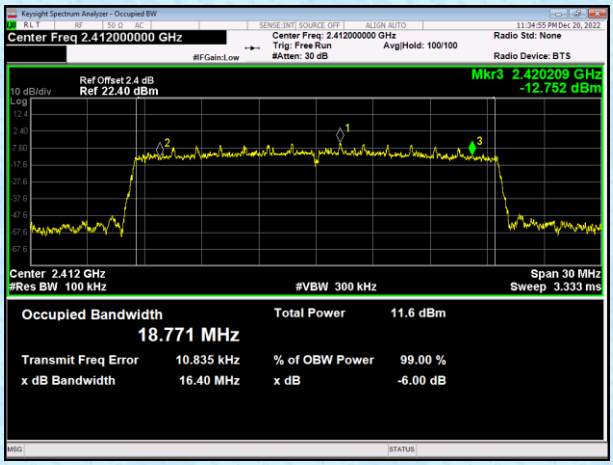
Middle channel

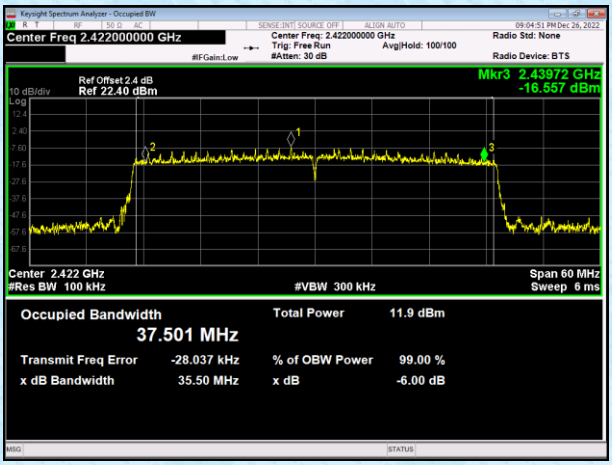




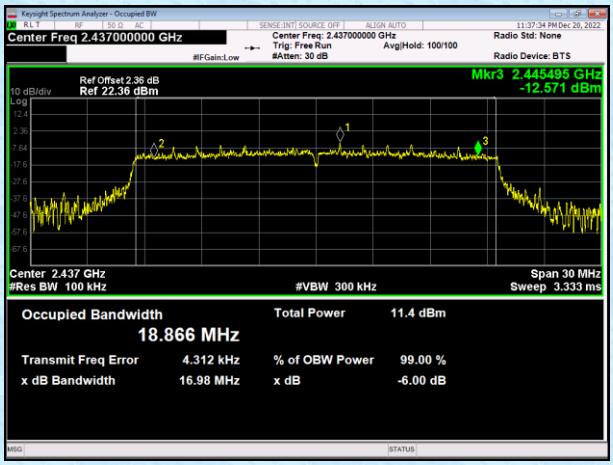
Highest channel

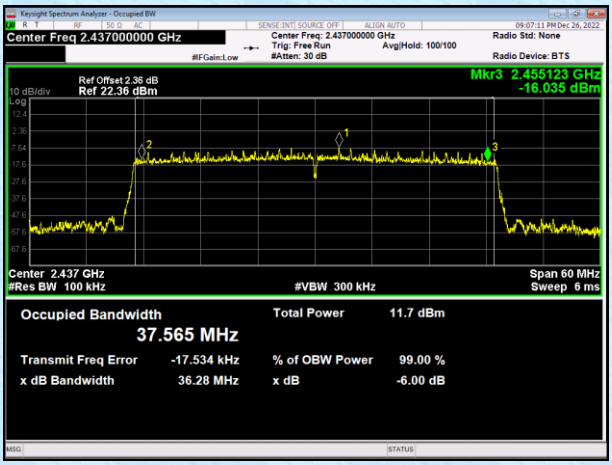
Test mode:	802.11ax(HE20)	Test mode:	802.11ax(HE40)



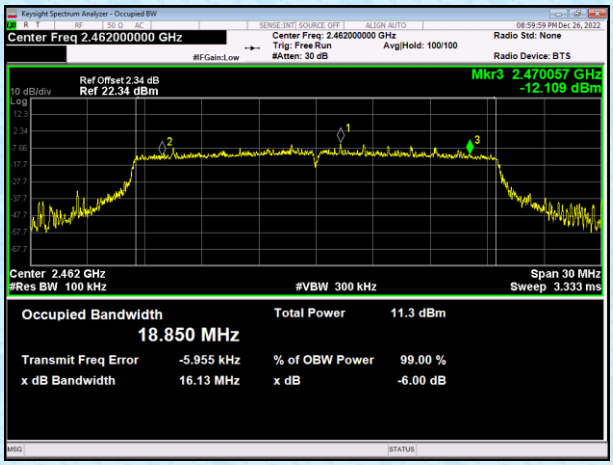


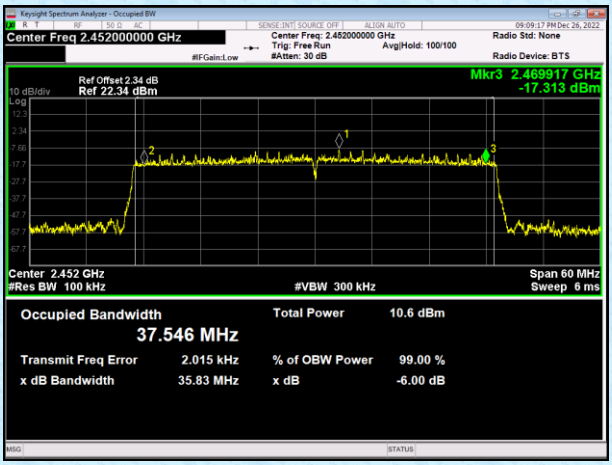
Lowest channel





Middle channel

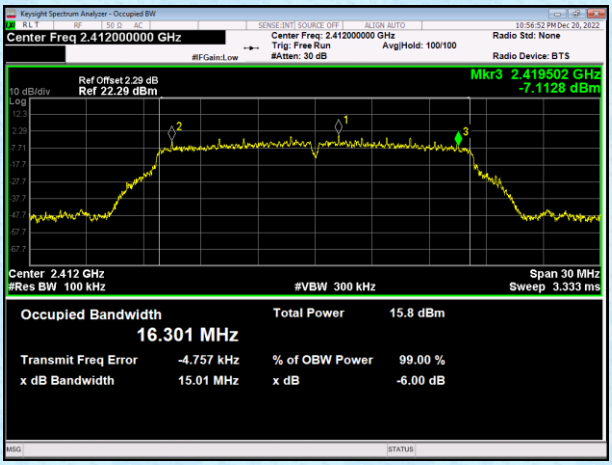




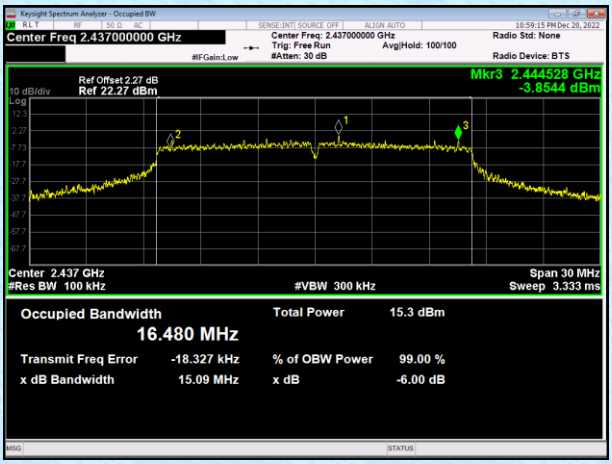
Highest channel

-6dB BW (ANT B):

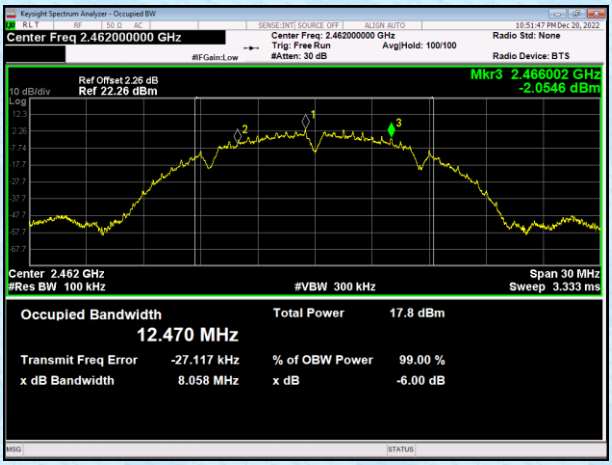
Test mode:	802.11b	Test mode:	802.11g

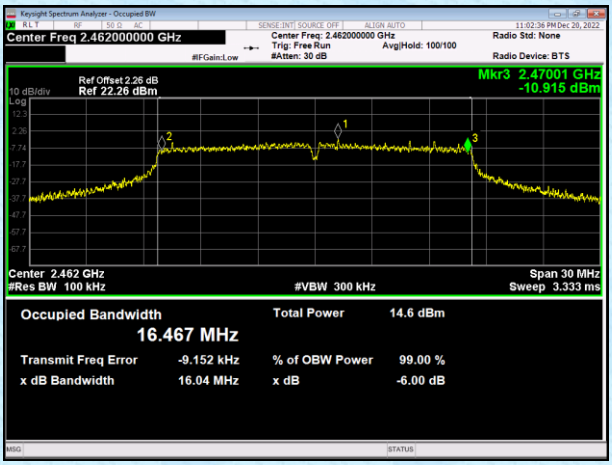


Lowest channel



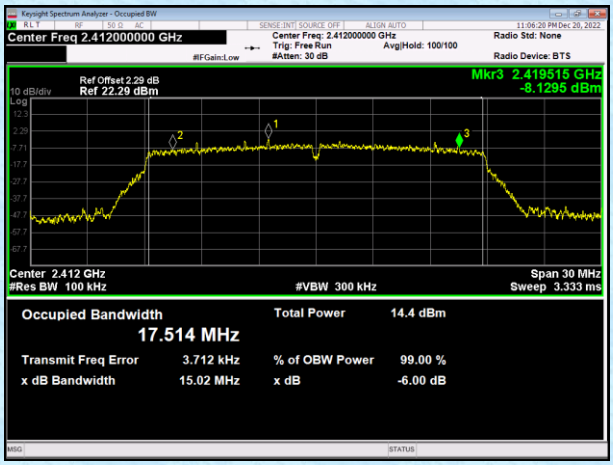
Middle channel

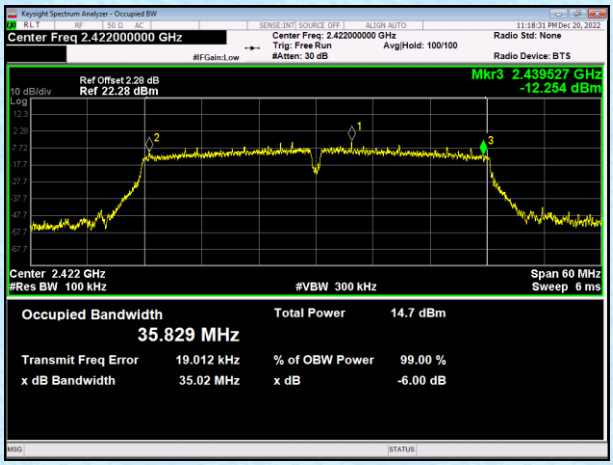




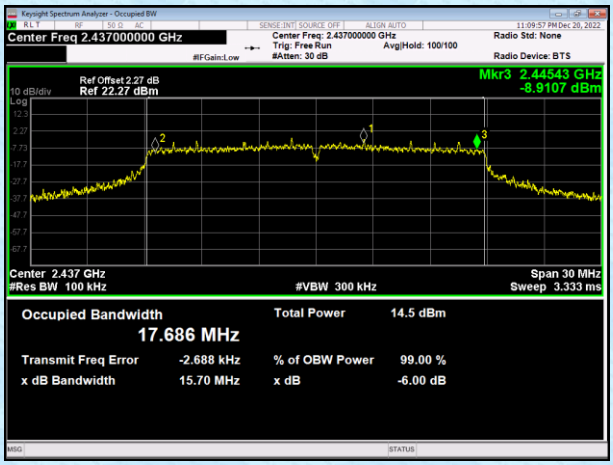
Highest channel

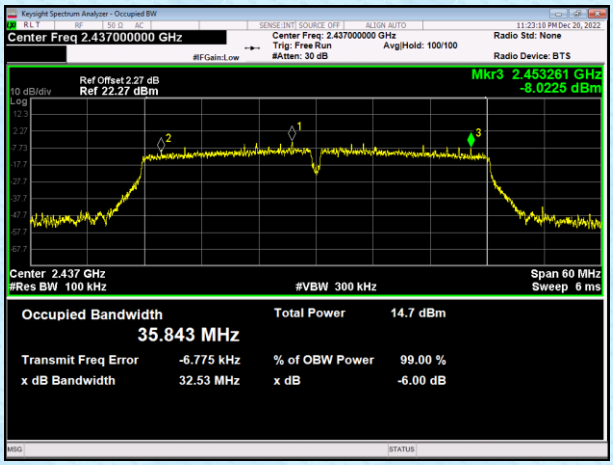
Test mode:	802.11n(HT20)	Test mode:	802.11n(HT40)



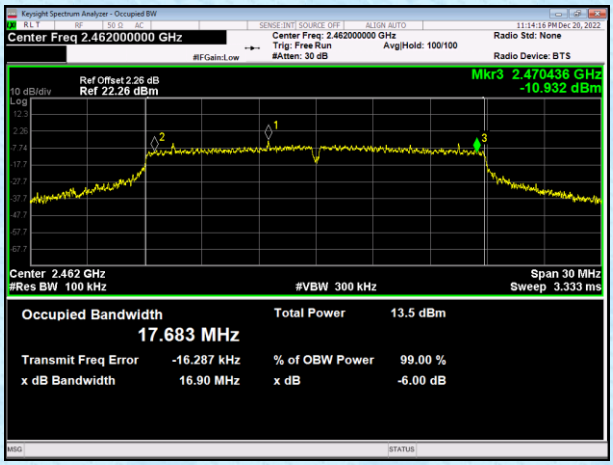


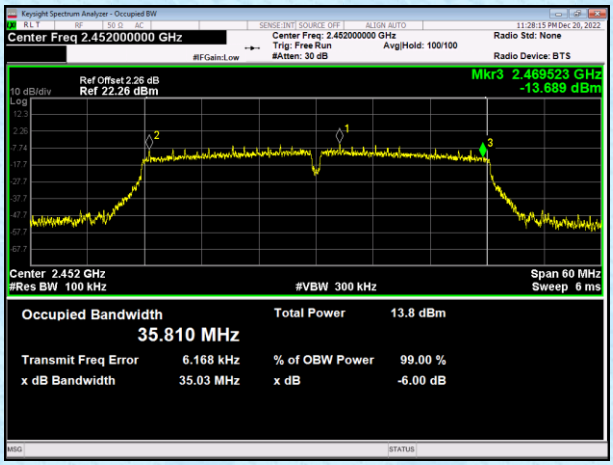
Lowest channel





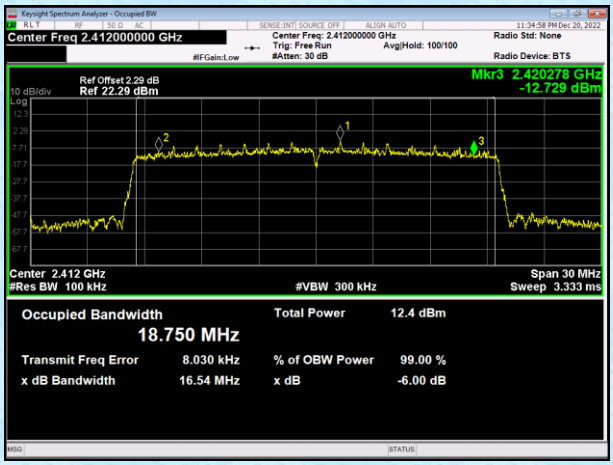
Middle channel

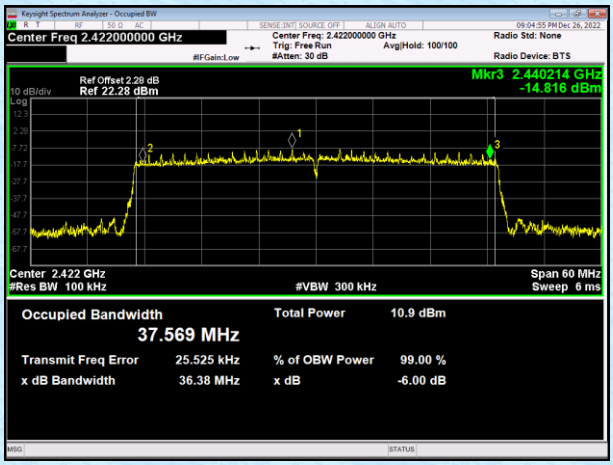




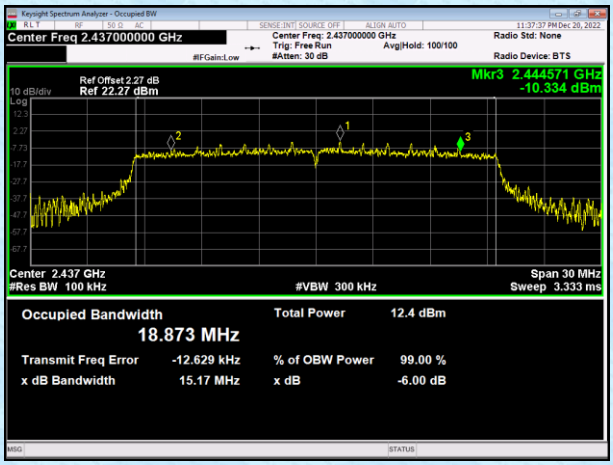
Highest channel

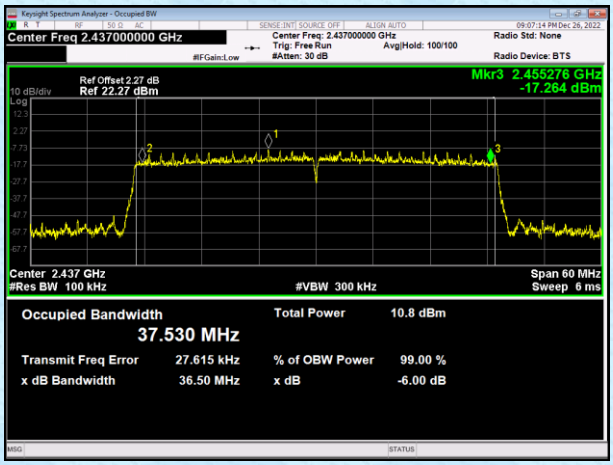
Test mode:	802.11ax(HE20)	Test mode:	802.11ax(HE40)



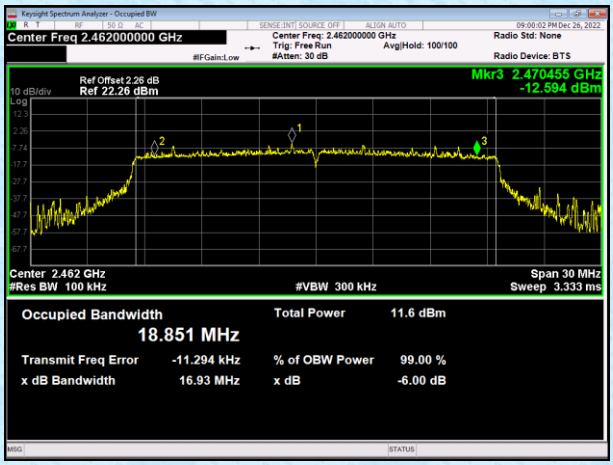


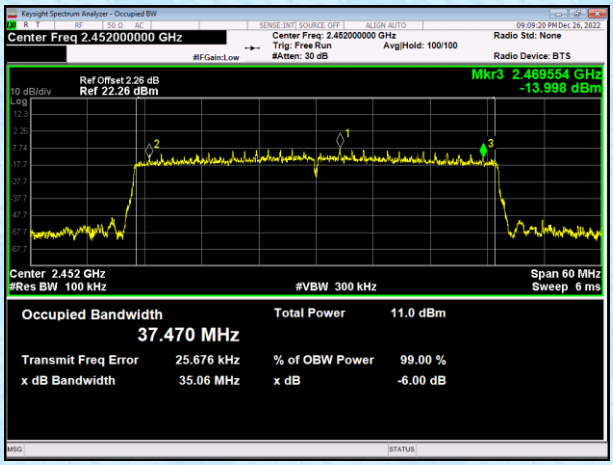
Lowest channel





Middle channel

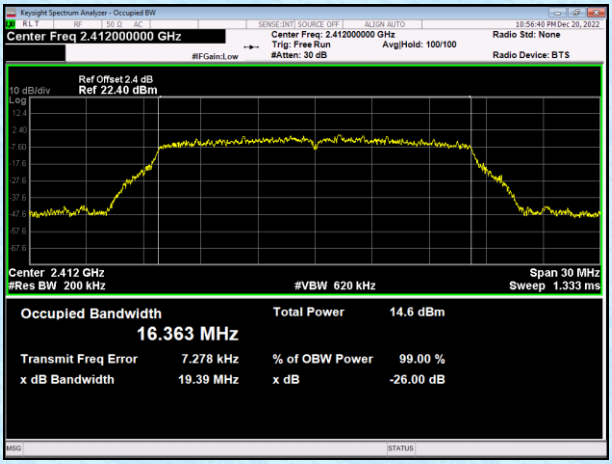




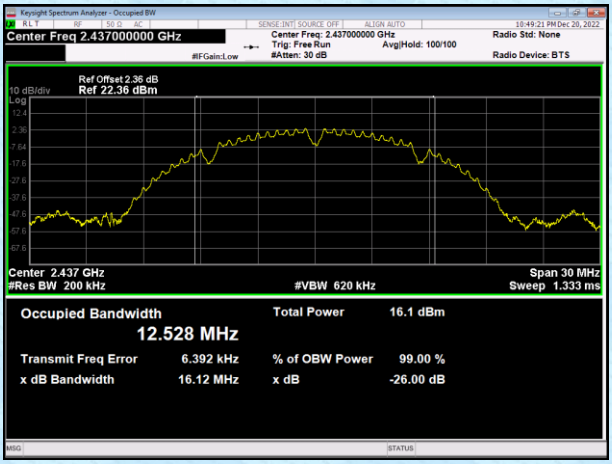
Highest channel

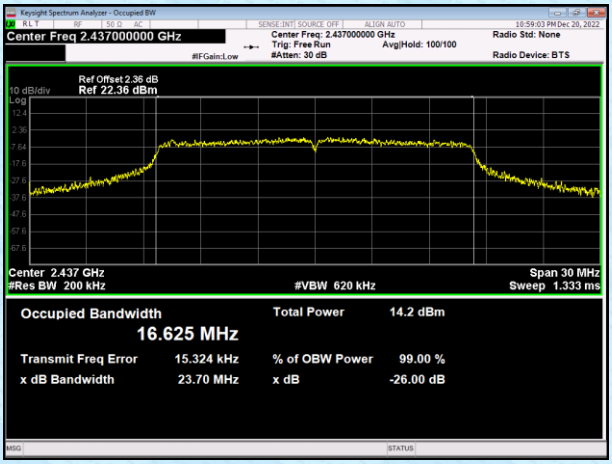
99% BW (ANT A):

Test mode:	802.11b	Test mode:	802.11g

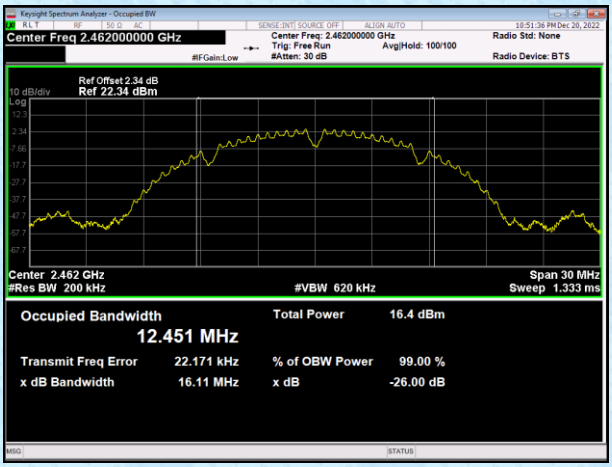


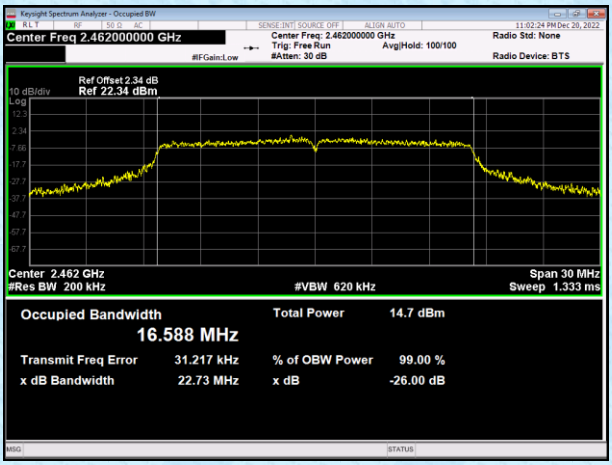
Lowest channel





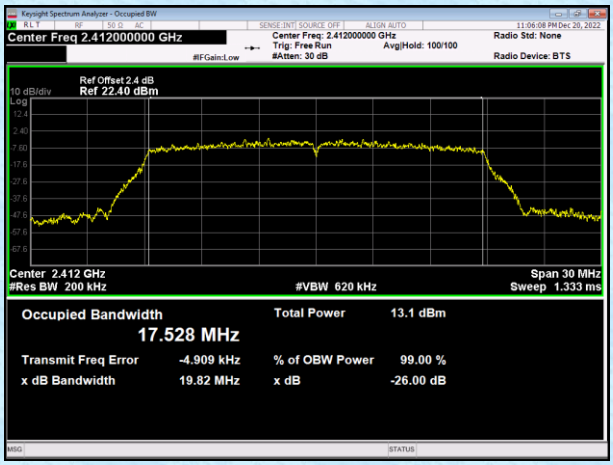
Middle channel

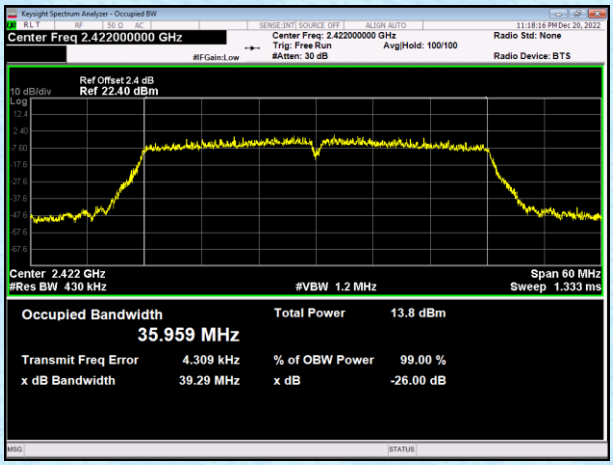




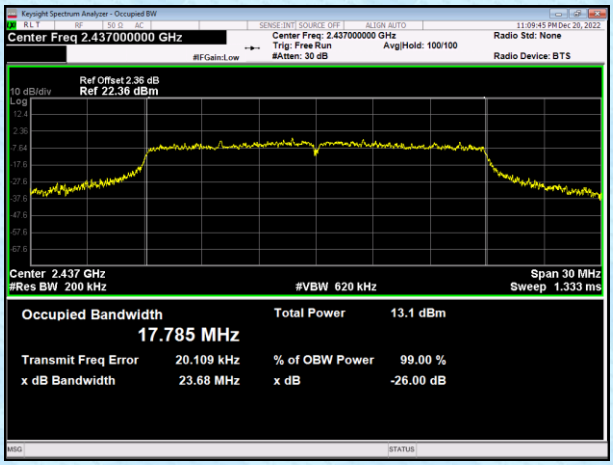
Highest channel

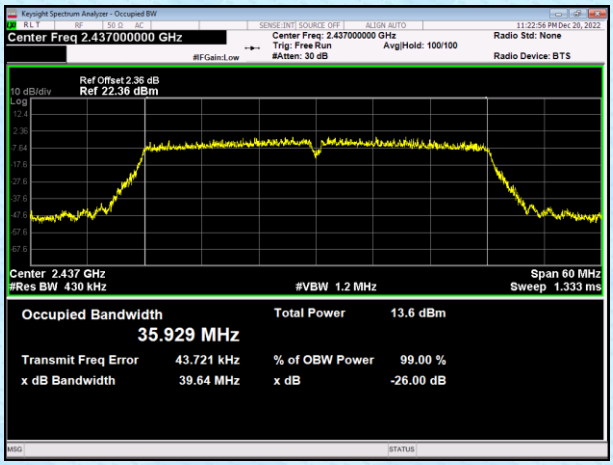
Test mode:	802.11n(HT20)	Test mode:	802.11n(HT40)



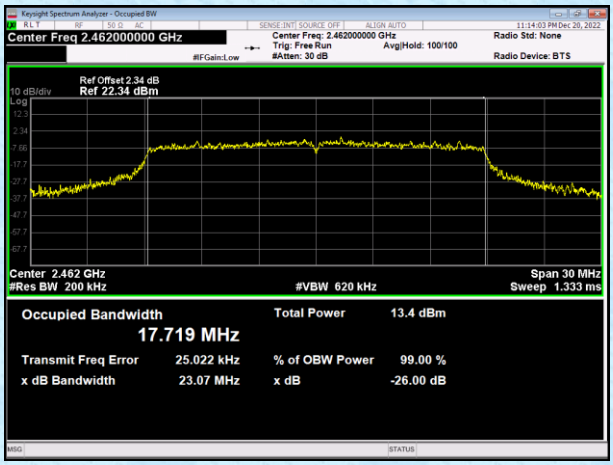


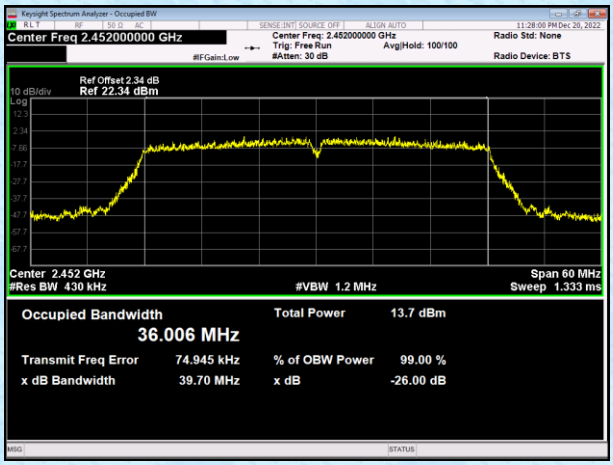
Lowest channel





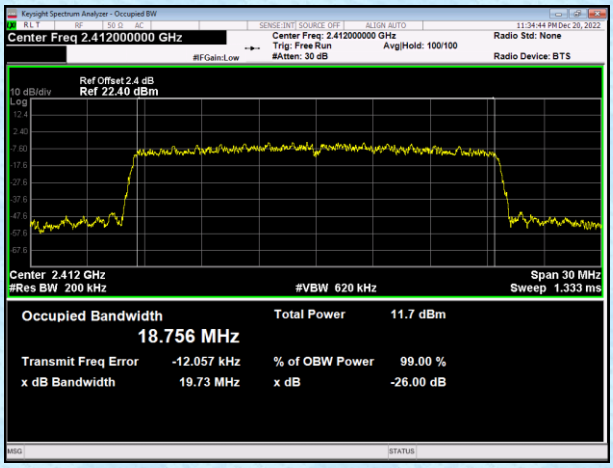
Middle channel

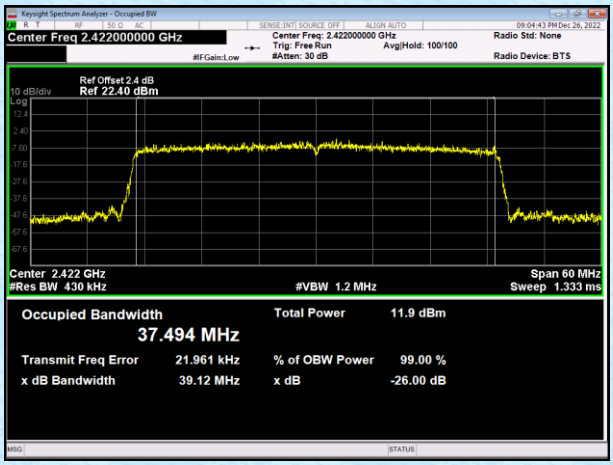




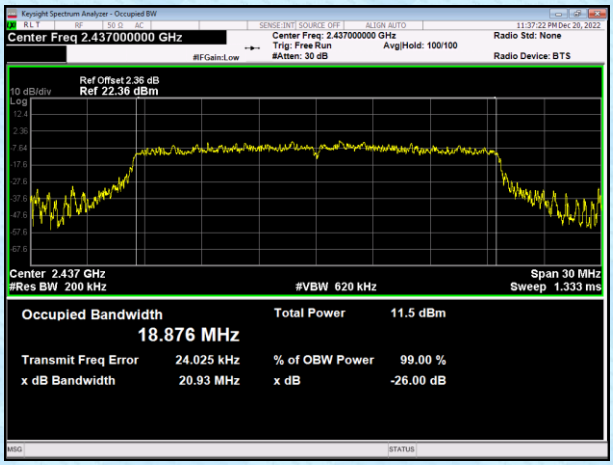
Highest channel

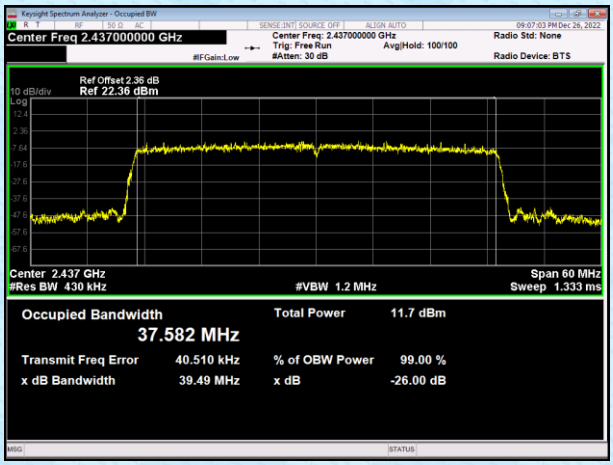
Test mode:	802.11ax(HE20)	Test mode:	802.11ax(HE40)



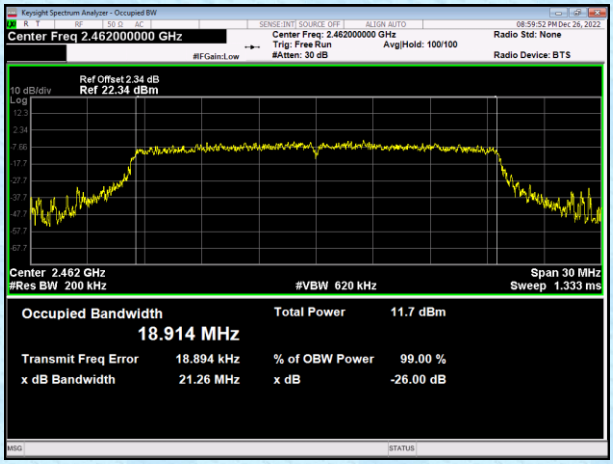


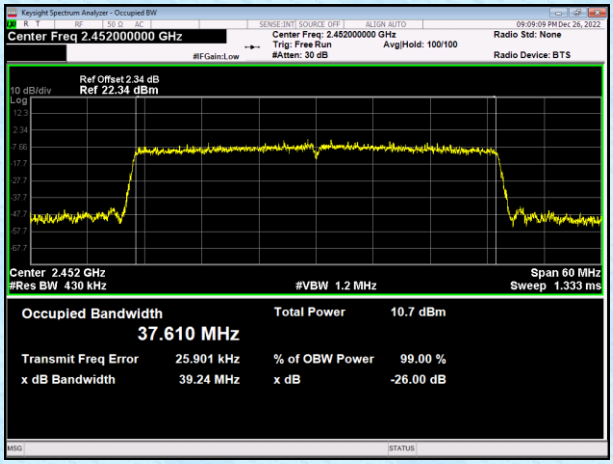
Lowest channel





Middle channel

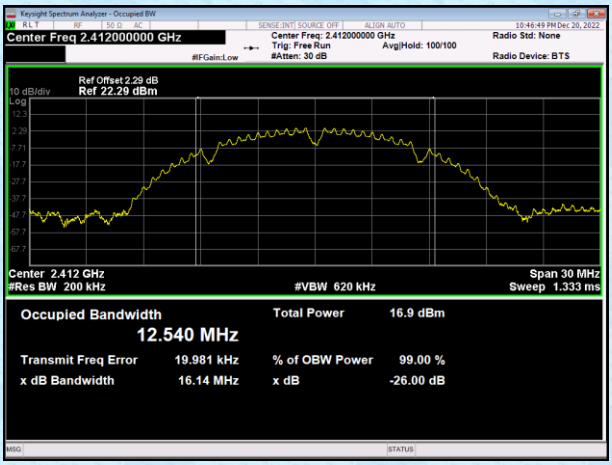


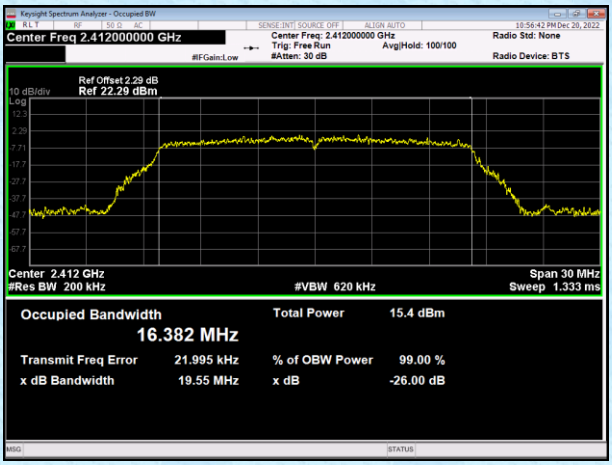


Highest channel

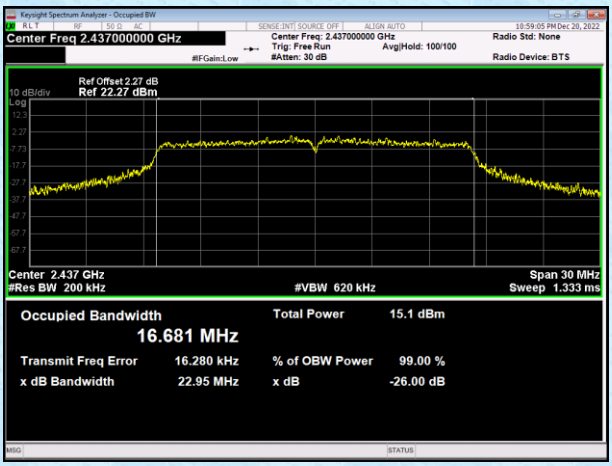
99% BW (ANT B):

Test mode:	802.11b	Test mode:	802.11g

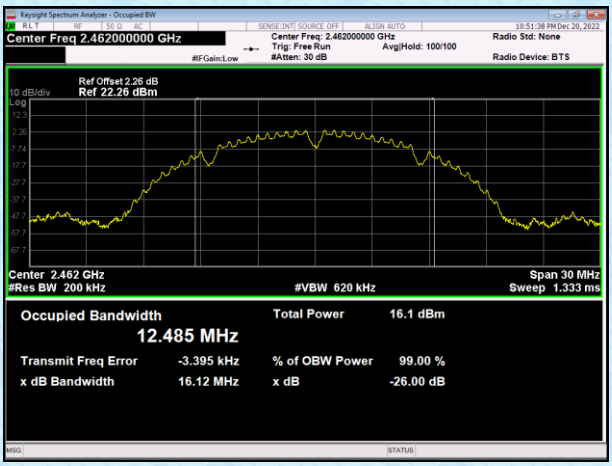


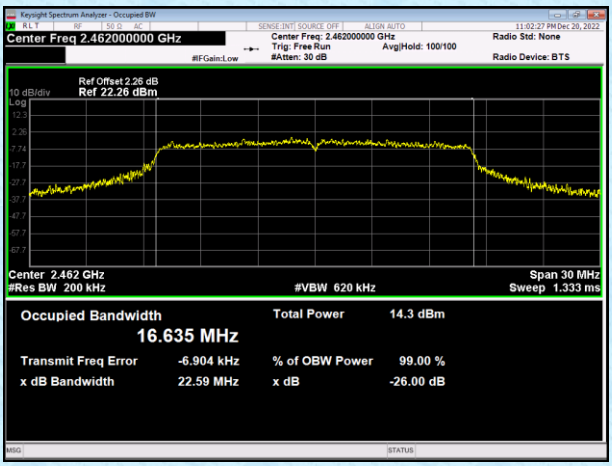


Lowest channel



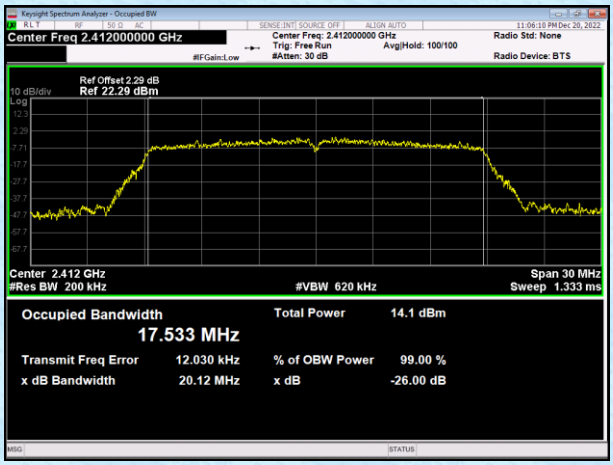
Middle channel

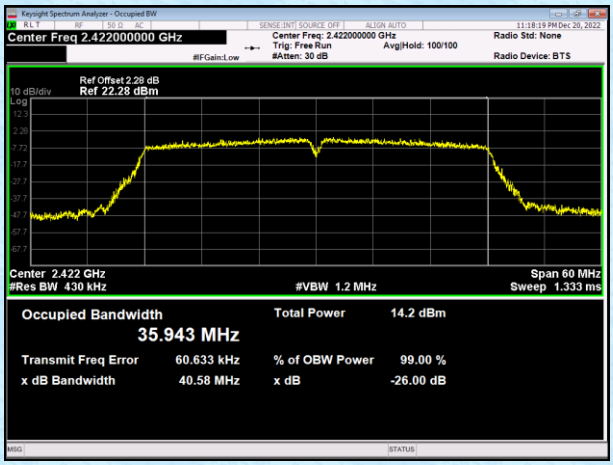




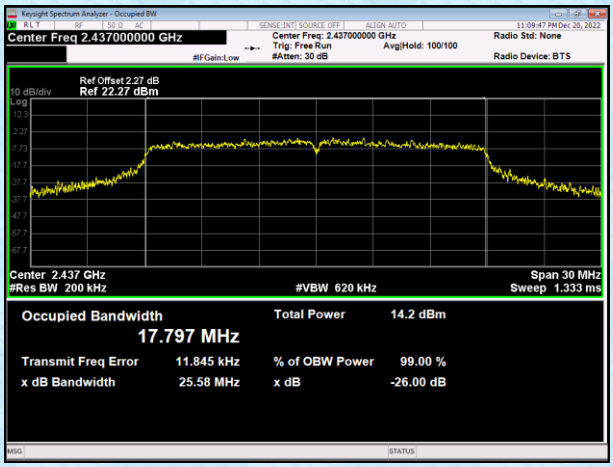
Highest channel

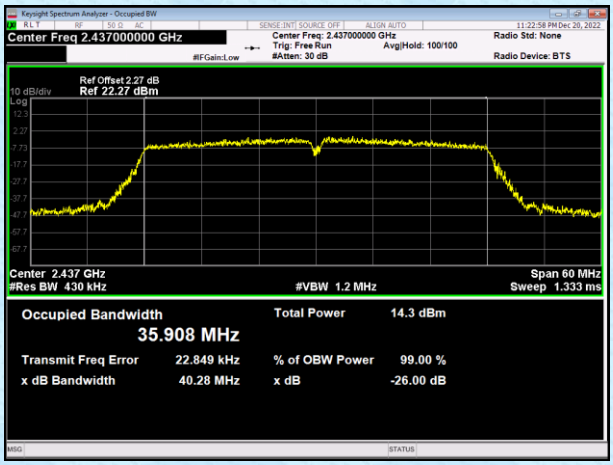
Test mode:	802.11n(HT20)	Test mode:	802.11n(HT40)



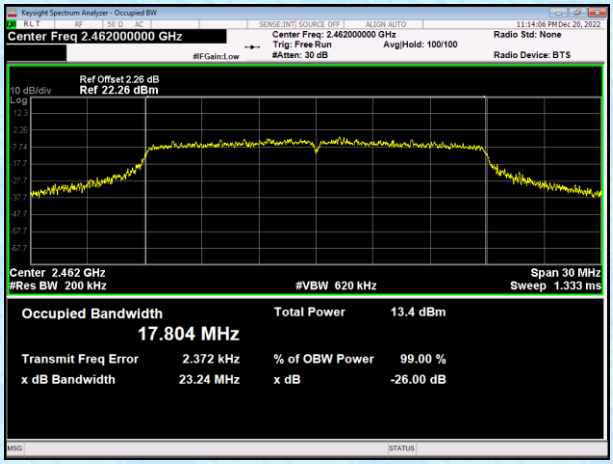


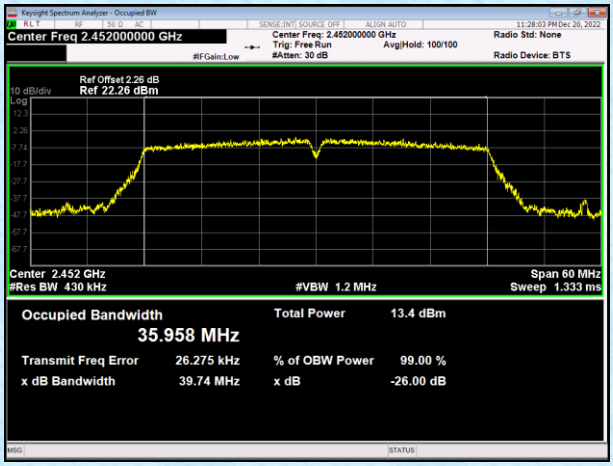
Lowest channel





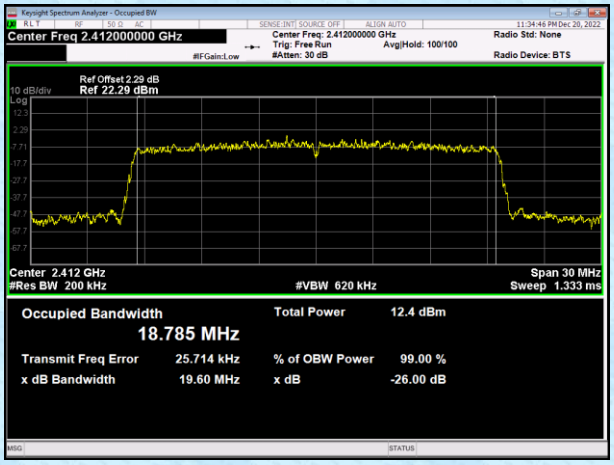
Middle channel

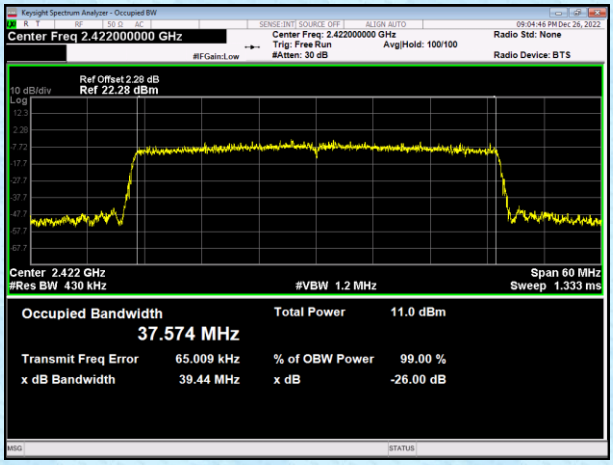




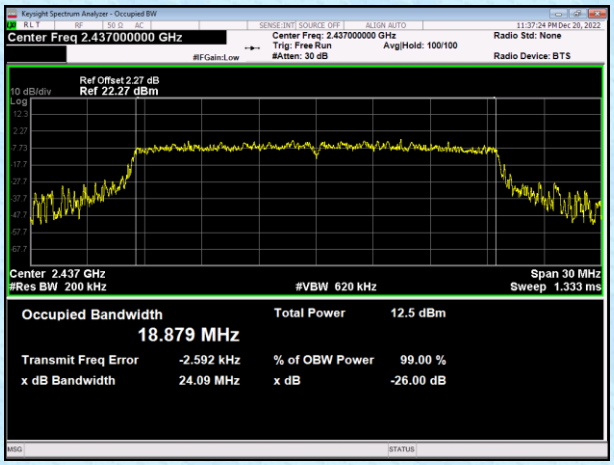
Highest channel

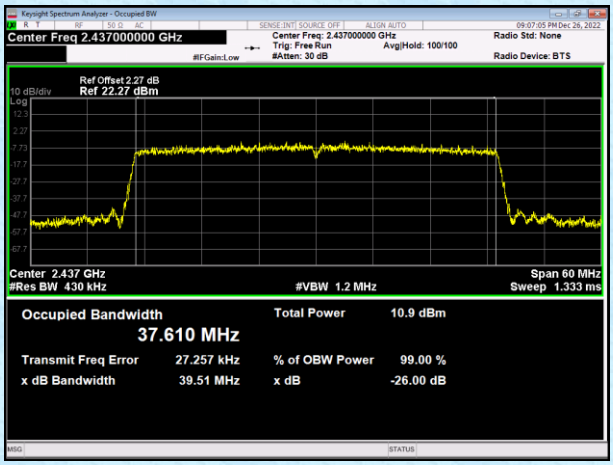
Test mode:	802.11ax(HE20)	Test mode:	802.11ax(HE40)



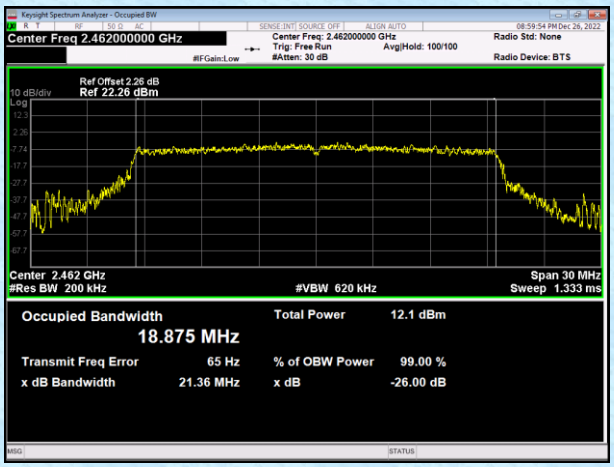


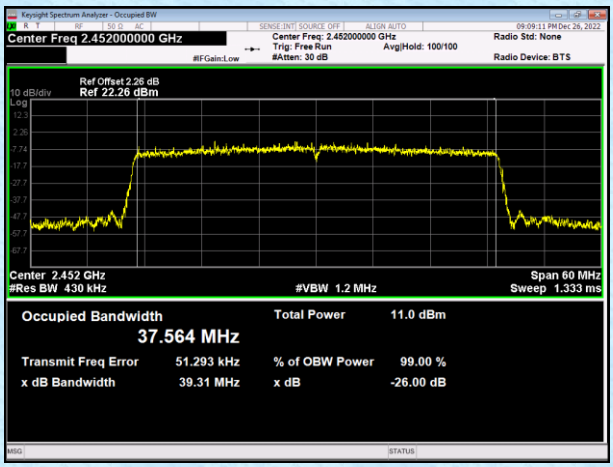
Lowest channel





Middle channel





Highest channel