RF TEST REPORT

Applicant	iRay Technology Co., Ltd.
FCC ID	2ACHK-01070840
Product	Wireless Digital Flat Panel Detector
Brand	iRayTechnology
Model	NDT1013LA
Report No.	R2311A1189-R1V1
Issue Date	June 7, 2024

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

Zhu Chentao

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Approved by: Xu Kai

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TABLE OF CONTENT

Version	Revision Description	Issue Date
Rev.0	Initial issue of report.	May 30, 2024
Rev.1	Update information.	June 7, 2024
Note: This revised report (Report No.: R2311A1189-R1V1) supersedes and replaces the previously issued report (Report No.: R2311A1189-R1). Please discard or destroy the previously issued report and dispose of it accordingly.		

Summary of Measurement Results

Number	Test Case	Clause in FCC rules	Verdict
1	Maximum output power	15.247(b)(3)	PASS
2	99% Bandwidth and 6dB Bandwidth	15.247(a)(2) C63.10 6.9	PASS
3	Power spectral density	15.247(e)	PASS
4	Band Edge	15.247(d)	PASS
5	Spurious RF Conducted Emissions	15.247(d)	PASS
6	Unwanted Emissions	15.247(d), 15.205, 15.209	PASS
7	Conducted Emissions	15.207	PASS
Date of Testing: January 9, 2024 ~ April 29, 2024 Date of Sample Received: November 2, 2023			
Note: All indications of Pass/Fail in this report are opinions expressed by Eurofins TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

1. Test Laboratory

1.1. Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **Eurofins 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)

Eurofins TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

A2LA (Certificate Number: 3857.01)

Eurofins TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

1.3. Testing Location

Company:	Eurofins TA Technology (Shanghai) Co., Ltd.
Address:	Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
City:	Shanghai
Post code:	201201
Country:	P. R. China
Contact:	Xu Kai
Telephone:	+86-021-50791141/2/3
Fax:	+86-021-50791141/2/3-8000
Website:	https://www.eurofins.com/electrical-and-electronics
E-mail:	Kain.Xu@cpt.eurofinscn.com

2. General Description of Equipment Under Test

2.1. Applicant and Manufacturer Information

Applicant	iRay Technology Co., Ltd.
Applicant address	RM 202, Building 7, No. 590, Ruiqing RD.,Pudong, Shanghai, China
Manufacturer	iRay Technology Co., Ltd.
Manufacturer address	RM 202, Building 7, No. 590, Ruiqing RD.,Pudong, Shanghai, China

2.2. General Information

EUT Description	
Model	NDT1013LA
SN	FX661304TA08230001X
Hardware Version	ARM: Core: 2.5.5.xx Kernel: 1.0.45.xx FPGA: main: 2.10.8.xx MCU: 2.10.1.xx
Software Version	4.4.6.xxxxx
Power Supply	DC 11.55V from battery or DC 24V from Adapter.
Antenna Type	Internal Antenna
Antenna Connector	A permanently attached antenna (meet with the standard FCC Part 15.203 requirement)
Antenna Gain	Antenna 1: -0.27 dBi Antenna 2: 4.42 dBi
Additional Beamforming Gain	NA
Direction Gain	Power: 4.42 dBi PSD: 7.43 dBi
Operating Frequency Range(s)	802.11b/g/n(HT20)/ax(HE20): 2412 ~ 2462 MHz 802.11n(HT40)/ax(HE40): 2422 ~ 2452 MHz
Modulation Type	802.11b: DSSS 802.11g/n: OFDM 802.11ax: OFDM
Max. Output Power	22.23 dBm
EUT Accessory	
Adapter	Manufacturer: Shenzhen Longxc Power Supply Co., LTD. Model: LXCP61-024300 Input: 100-240V 1.5A Output: 24V⎓ 3.0A
Battery	Manufacturer: iRay Technology Taicang Ltd.

	Model: BATTERY-KX DC 11.55V, 4700mAh
Control-box-SM	Model: 02061227
Auxiliary test equipment	
PC	Manufacturer: DELL Model: Latitude 3301(SN: DR6DJW2)
Note: 1. The EUT is sent from the applicant to Eurofins TA and the information of the EUT is declared by the applicant.	

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 15C (2023) Radio Frequency Devices

ANSI C63.10-2013

Reference standard:

KDB 558074 D01 15.247 Meas Guidance v05r02

KDB 662911 D01 Multiple Transmitter Output v02r01

4. Test Configuration

Test Mode

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

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (Y axis) and the loop antenna is vertical, the others are vertical and horizontal. 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.

Test Mode	Data Rate		
	Antenna 1	Antenna 2	MIMO
802.11b	1 Mbps	1 Mbps	/
802.11g	6 Mbps	6 Mbps	/
802.11n HT20	MCS0	MCS0	MCS8
802.11n HT40	MCS0	MCS0	MCS8
802.11ax HE20	MCS0	MCS0	MCS0
802.11ax HE40	MCS0	MCS0	MCS0

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

Test Cases	Antenna 1	Antenna 2	MIMO
Maximum output power	O	O	802.11n HT20/40 802.11ax HE20/40
6dB Bandwidth	802.11b/g	-	802.11n HT20/40 802.11ax HE20/40
Band Edge	802.11b/g	-	802.11n HT20/40 802.11ax HE20/40
Power Spectral Density	O	O	802.11n HT20/40 802.11ax HE20/40
Spurious RF Conducted Emissions	802.11b/g	-	802.11n HT20/40 802.11ax HE20/40
Unwanted Emissions	-	802.11b/g	802.11n HT20/40 802.11ax HE20/40
Conducted Emission	-	-	802.11ax HE20
Note: “O”: test all bands			

5. Test Case Results

5.1. Maximum output power

Ambient Condition

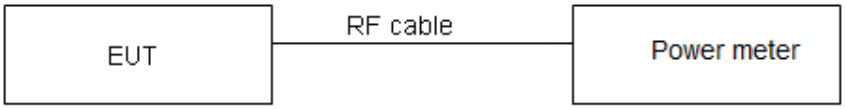
Temperature	Relative humidity
15°C ~ 35°C	20% ~ 80%

Methods of Measurement

During the process of the testing, The EUT was connected to Power meter with a known loss. The EUT is max power transmission with proper modulation.

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

Test Setup



Limits

Rule Part 15.247 (b) (3) specifies that " For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz: 1 Watt."

Average Output Power	≤ 1W (30dBm)

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.44 dB.

Test Results

Antenna Power Index							
Channel	**802.11b**	**802.11g**	**802.11n HT20**	**802.11ax HE20**	**Channel**	**802.11n HT40**	**802.11ax HE40**
CH1	18	12	12	12	**CH3**	12	10
CH6	18	12	12	15	**CH6**	13	15
CH11	18	12	12	13	**CH9**	11	10

Test Mode	Duty cycle	Duty cycle correction Factor (dB)
802.11b	0.989	0.000
802.11g	0.934	0.300
802.11n HT20	0.979	0.090
802.11n HT40	0.958	0.190
802.11ax HE20	0.612	2.130
802.11ax HE40	0.868	0.620
Note: when Duty cycle⩾0.98, Duty cycle correction Factor not required.		

SISO Antenna 1

Test Mode	Carrier frequency (MHz) / Channel	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11b	2412/CH 1	19.63	19.63	30	PASS
	2437/CH 6	19.94	19.94	30	PASS
	2462/CH11	20.16	20.16	30	PASS
802.11g	2412/CH 1	13.78	14.08	30	PASS
	2437/CH 6	14.26	14.56	30	PASS
	2462/CH11	14.76	15.06	30	PASS
802.11n HT20	2412/CH 1	14.12	14.21	30	PASS
	2437/CH 6	14.70	14.79	30	PASS
	2462/CH11	14.98	15.07	30	PASS
802.11n HT40	2422/CH3	14.06	14.25	30	PASS
	2437/CH6	15.48	15.67	30	PASS
	2452/CH9	13.57	13.76	30	PASS
802.11ax HE20	2412/CH 1	13.88	16.01	30	PASS
	2437/CH 6	17.38	19.51	30	PASS
	2462/CH11	15.99	18.12	30	PASS
802.11ax HE40	2422/CH3	12.19	12.81	30	PASS
	2437/CH6	17.48	18.10	30	PASS
	2452/CH9	12.62	13.24	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

SISO Antenna 2

Test Mode	Carrier frequency (MHz) / Channel	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11b	2412/CH 1	19.71	19.71	30	PASS
	2437/CH 6	19.96	19.96	30	PASS
	2462/CH11	20.13	20.13	30	PASS
802.11g	2412/CH 1	13.81	14.11	30	PASS
	2437/CH 6	14.20	14.50	30	PASS
	2462/CH11	14.51	14.81	30	PASS
802.11n HT20	2412/CH 1	14.19	14.28	30	PASS
	2437/CH 6	14.60	14.69	30	PASS
	2462/CH11	14.78	14.87	30	PASS
802.11n HT40	2422/CH3	14.10	14.29	30	PASS
	2437/CH6	15.42	15.61	30	PASS
	2452/CH9	13.61	13.80	30	PASS
802.11ax HE20	2412/CH 1	12.41	14.54	30	PASS
	2437/CH 6	17.86	19.99	30	PASS
	2462/CH11	16.01	18.14	30	PASS
802.11ax HE40	2422/CH3	12.52	13.14	30	PASS
	2437/CH6	17.86	18.48	30	PASS
	2452/CH9	13.01	13.63	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

MIMO

Test Mode	Carrier frequency (MHz) / Channel	MIMO Antenna 1		MIMO Antenna 2		Total Power (dBm)	Limit (dBm)	Conclusion
		Average Power Measured (dBm)	Average Power with duty factor (dBm)	Average Power Measured (dBm)	Average Power with duty factor (dBm)			
802.11n HT20	2412/CH 1	13.83	13.92	15.74	15.83	17.99	30	PASS
	2437/CH 6	14.15	14.24	15.31	15.40	17.87	30	PASS
	2462/CH11	14.86	14.95	14.62	14.71	17.84	30	PASS
802.11n HT40	2422/CH3	13.85	14.04	15.34	15.53	17.86	30	PASS
	2437/CH6	15.28	15.47	15.89	16.08	18.79	30	PASS
	2452/CH9	13.34	13.53	14.27	14.46	17.03	30	PASS
802.11ax HE20	2412/CH 1	13.66	15.79	14.09	16.22	19.02	30	PASS
	2437/CH 6	17.13	19.26	17.05	19.18	22.23	30	PASS
	2462/CH11	15.73	17.86	15.36	17.49	20.69	30	PASS
802.11ax HE40	2422/CH3	12.02	12.64	12.23	12.85	15.76	30	PASS
	2437/CH6	17.21	17.83	17.11	17.73	20.79	30	PASS
	2452/CH9	12.45	13.07	12.62	13.24	16.17	30	PASS

Note: 1. Average Power with duty factor = Average Power Measured +Duty cycle correction factor

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

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

3. According to KDB 662911 D01 Multiple Transmitter Output v02r01 F)2)f)(ii): If antenna gains are not equal, the user may use either of the following methods to calculate directional gain, provided that each transmit antenna is driven by only one spatial stream: Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain.

Directional gain = $G_{ANT\ MAX}$ + Array Gain,

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

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

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

So directional gain = $G_{ANT\ MAX}$ + Array Gain = 4.42 + 0 = 4.42 dBi < 6dBi. So the power limit is 30dBm.

5.2. 99% Bandwidth and 6dB Bandwidth

Ambient Condition

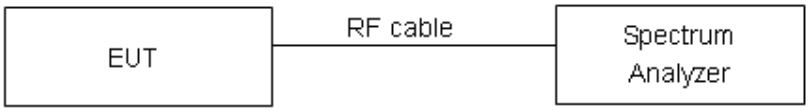
Temperature	Relative humidity
15°C ~ 35°C	20% ~ 80%

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. RBW is set to 100 kHz; VBW is set to 300 kHz on spectrum analyzer.
Dector=Peak, Trace mode=max hold.

The EUT was connected to the spectrum analyzer through a known loss cable. The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value.

Test Setup



Limits

Rule Part 15.247 (a) (2) specifies that “Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.”

minimum 6 dB bandwidth	≥ 500 kHz

Measurement Uncertainty

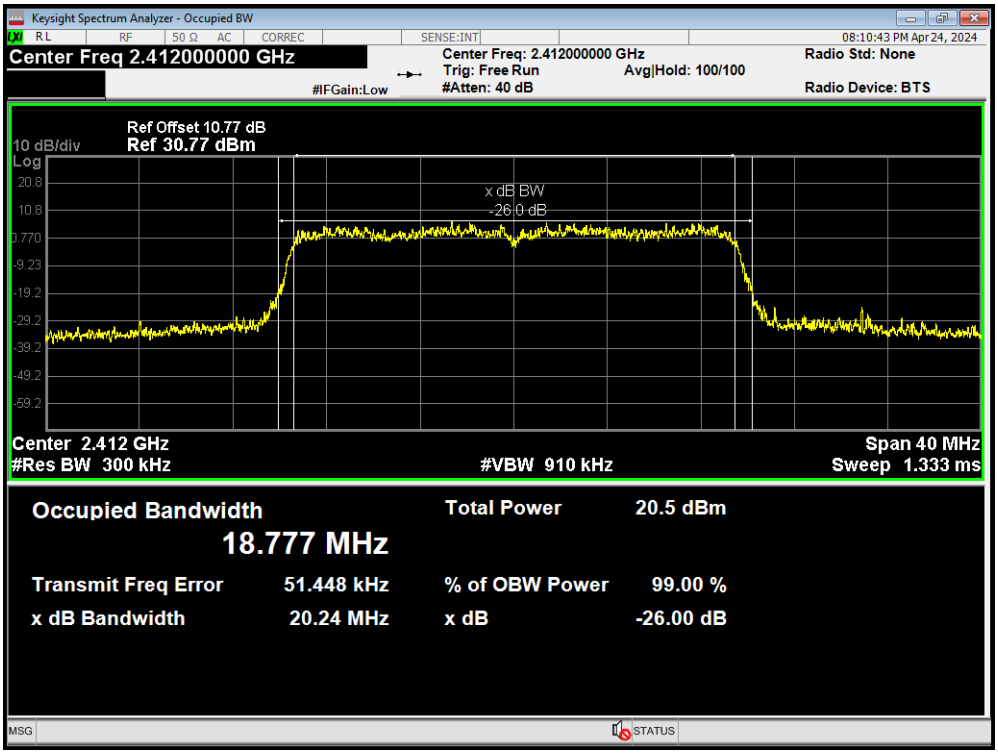
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 936 Hz.

Test Results:

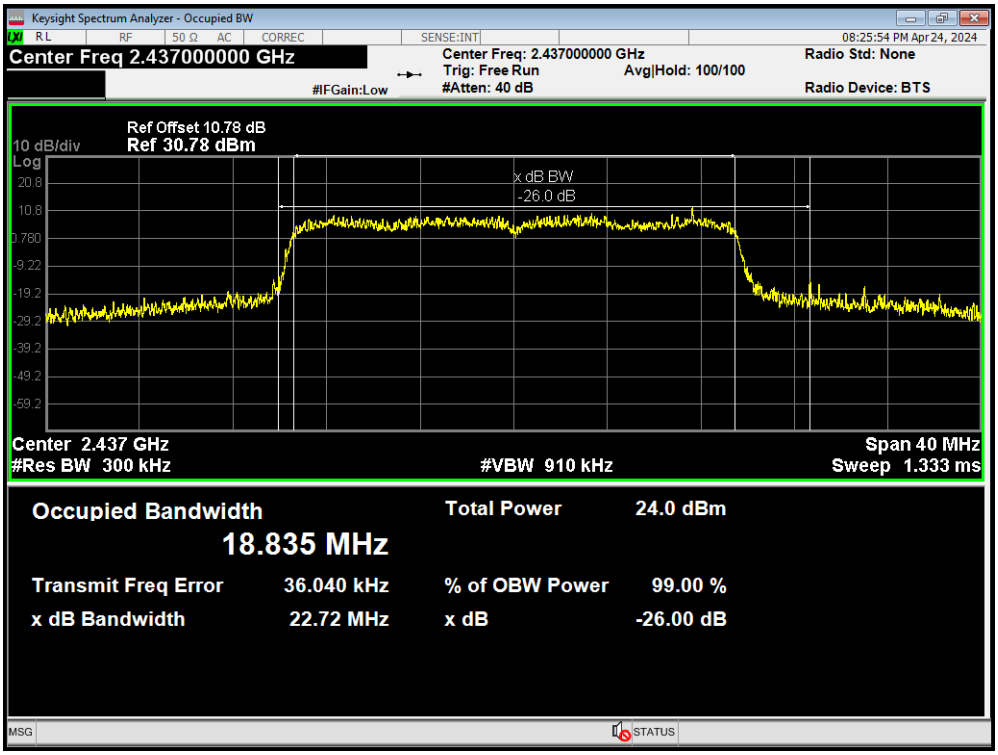
Test Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11b	2412	13.342	10.062	500	PASS
	2437	13.566	10.042	500	PASS
	2462	13.663	10.054	500	PASS
802.11g	2412	16.706	16.393	500	PASS
	2437	16.727	16.336	500	PASS
	2462	16.695	16.353	500	PASS
802.11n HT20	2412	17.692	17.621	500	PASS
	2437	17.703	17.542	500	PASS
	2462	17.719	17.563	500	PASS
802.11n HT40	2422	36.201	35.950	500	PASS
	2437	36.176	35.411	500	PASS
	2452	36.199	35.690	500	PASS
802.11ax HE20	2412	18.777	18.191	500	PASS
	2437	18.835	18.060	500	PASS
	2462	18.795	18.126	500	PASS
802.11ax HE40	2422	37.554	37.053	500	PASS
	2437	37.649	36.217	500	PASS
	2452	37.676	36.426	500	PASS

99%bandwidth

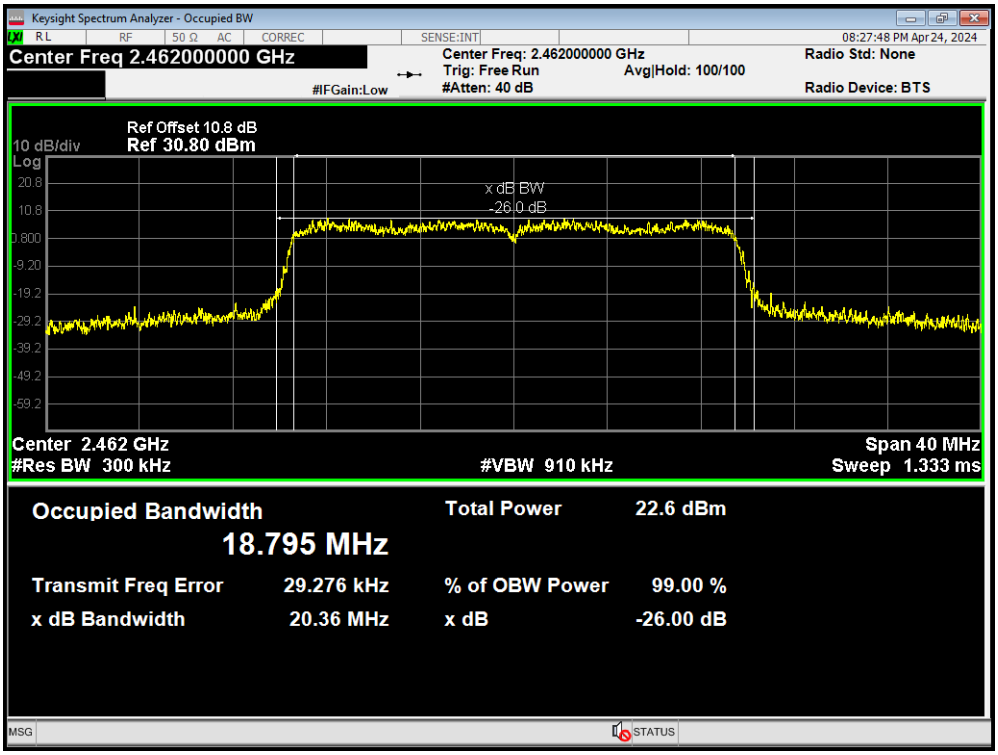
OBW 802.11ax(HE20) 2412MHz



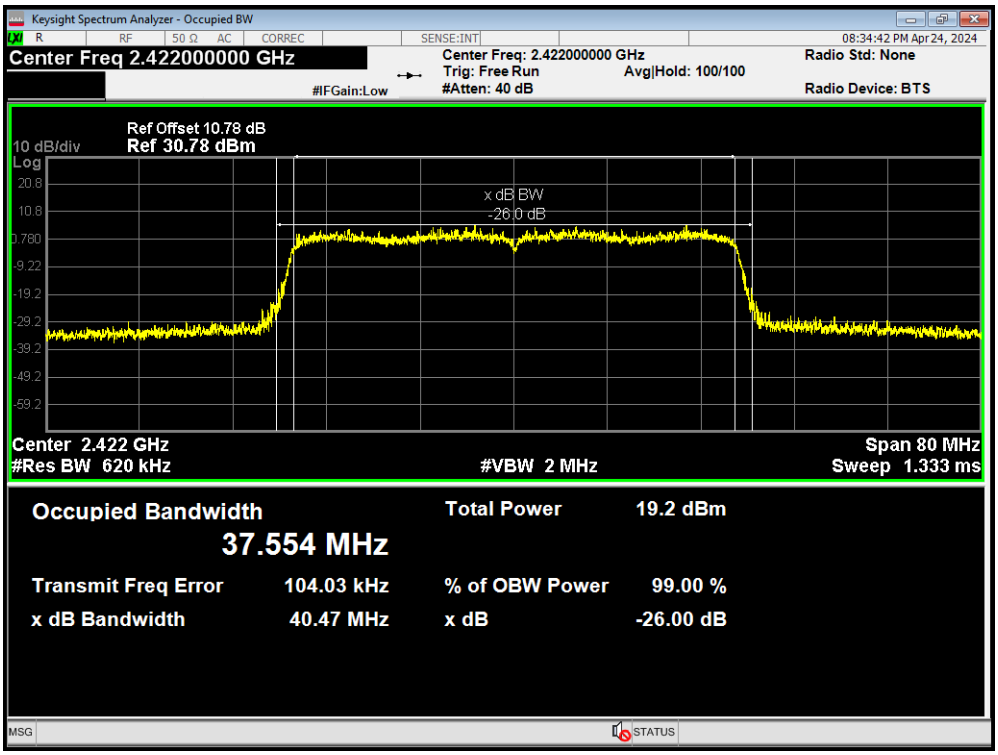
OBW 802.11ax(HE20) 2437MHz



OBW 802.11ax(HE20) 2462MHz



OBW 802.11ax(HE40) 2422MHz



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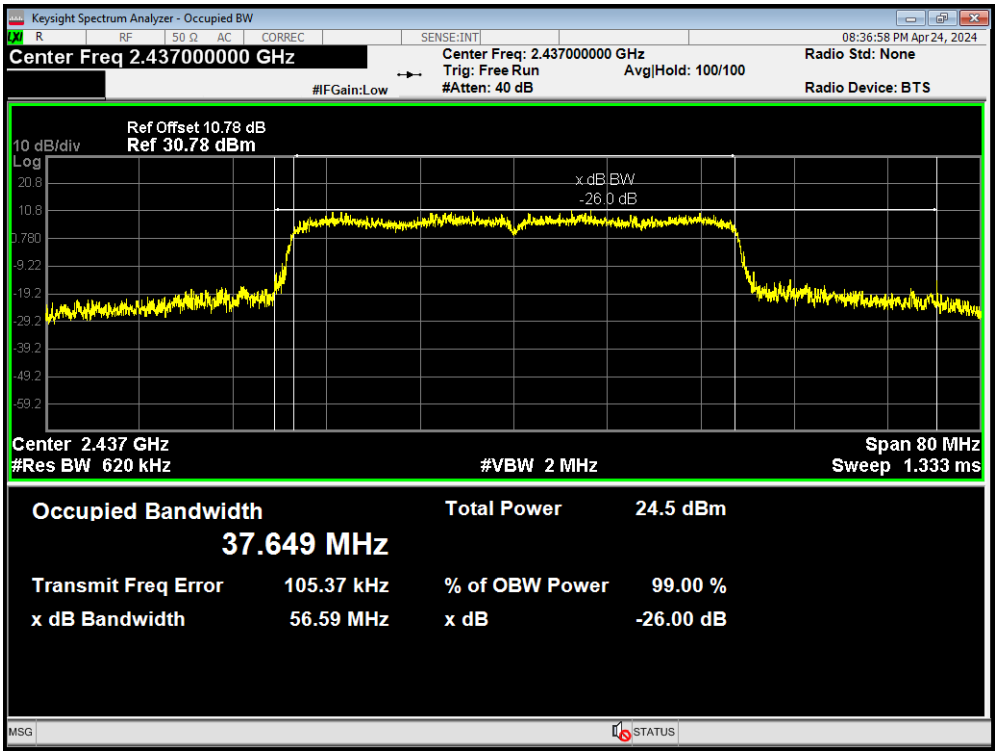
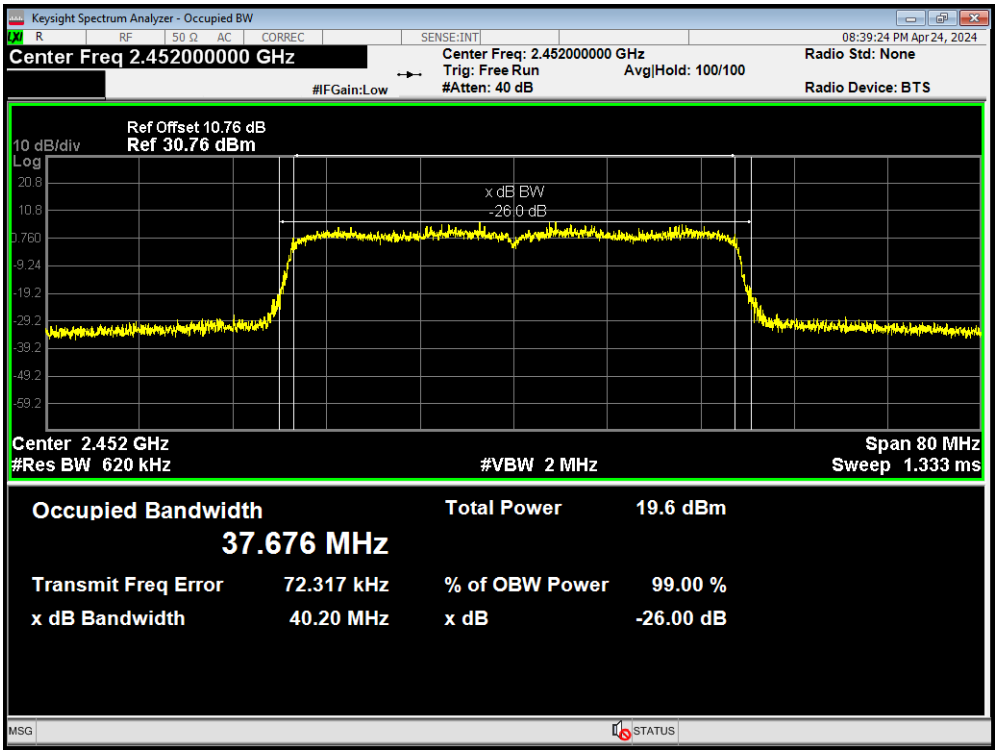
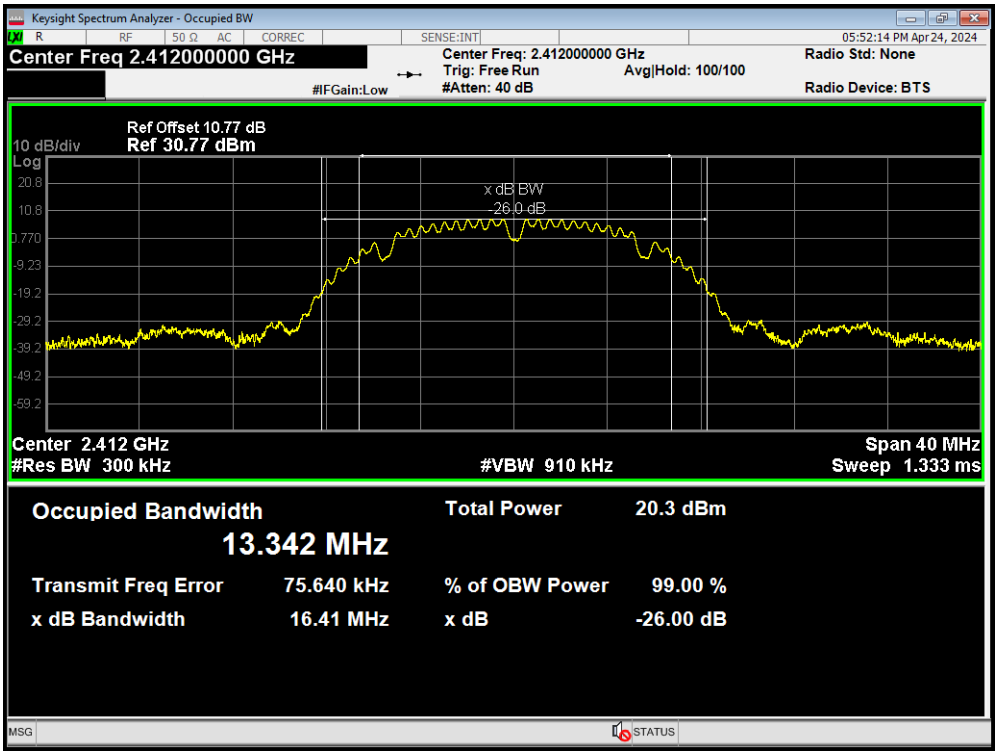


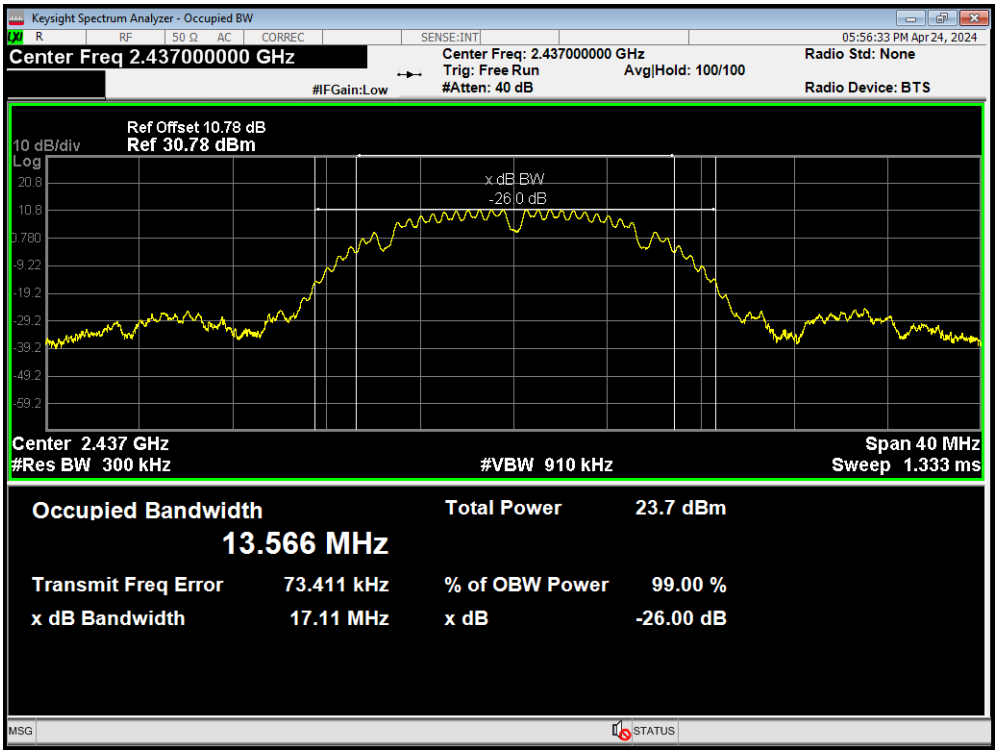
OBW 802.11ax(HE40) 2452MHz



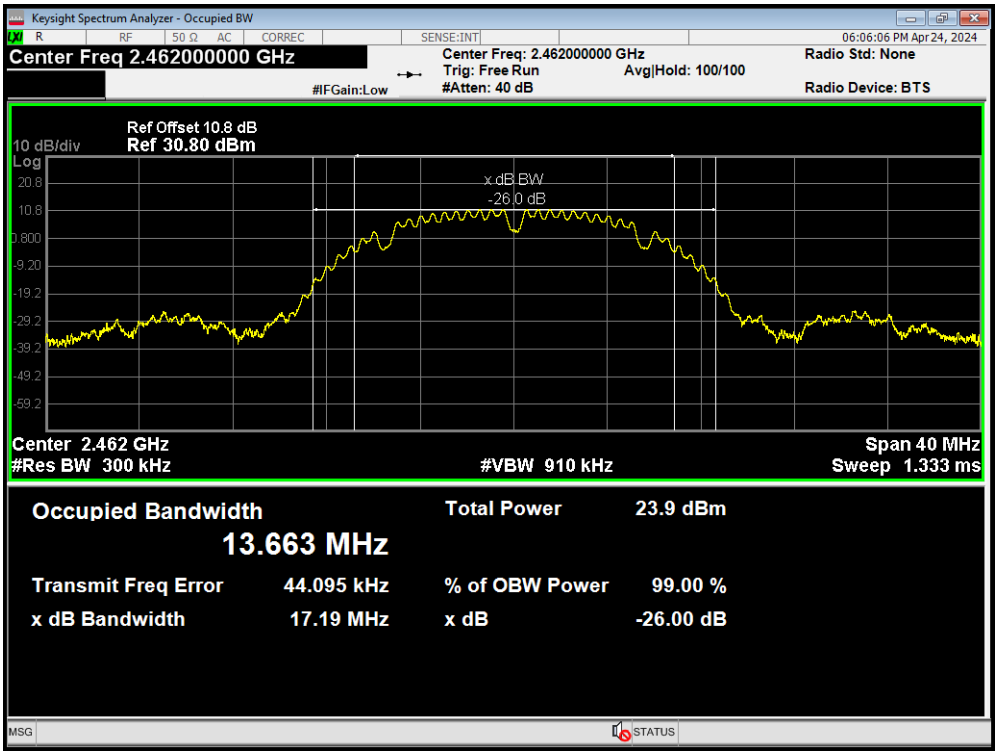
OBW 802.11b 2412MHz



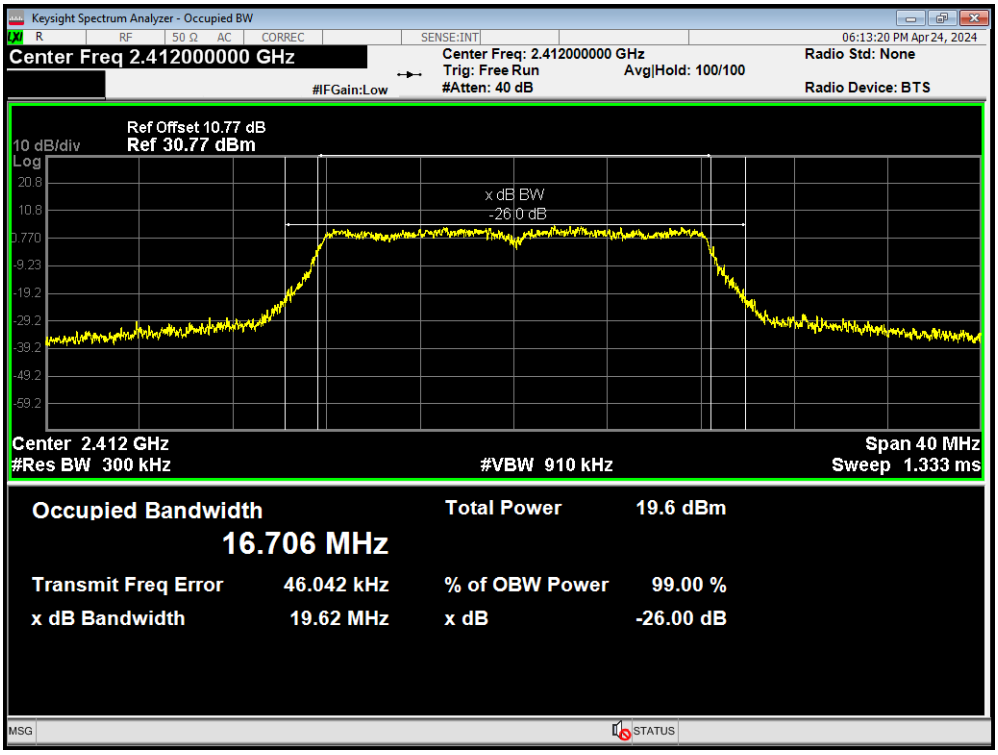
OBW 802.11b 2437MHz



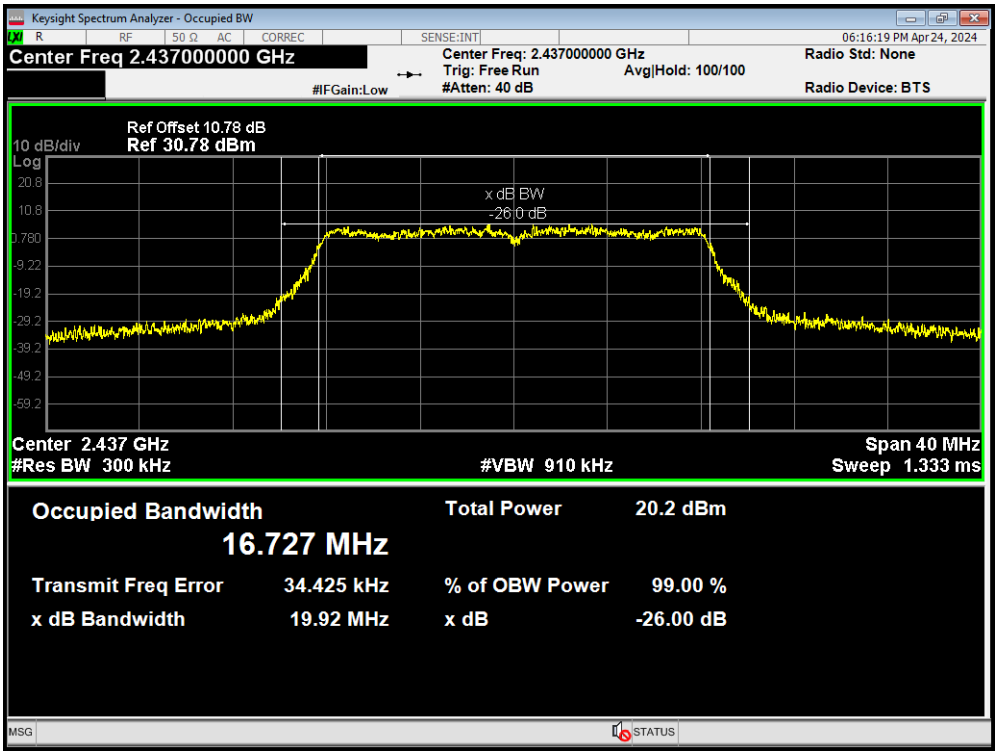
OBW 802.11b 2462MHz



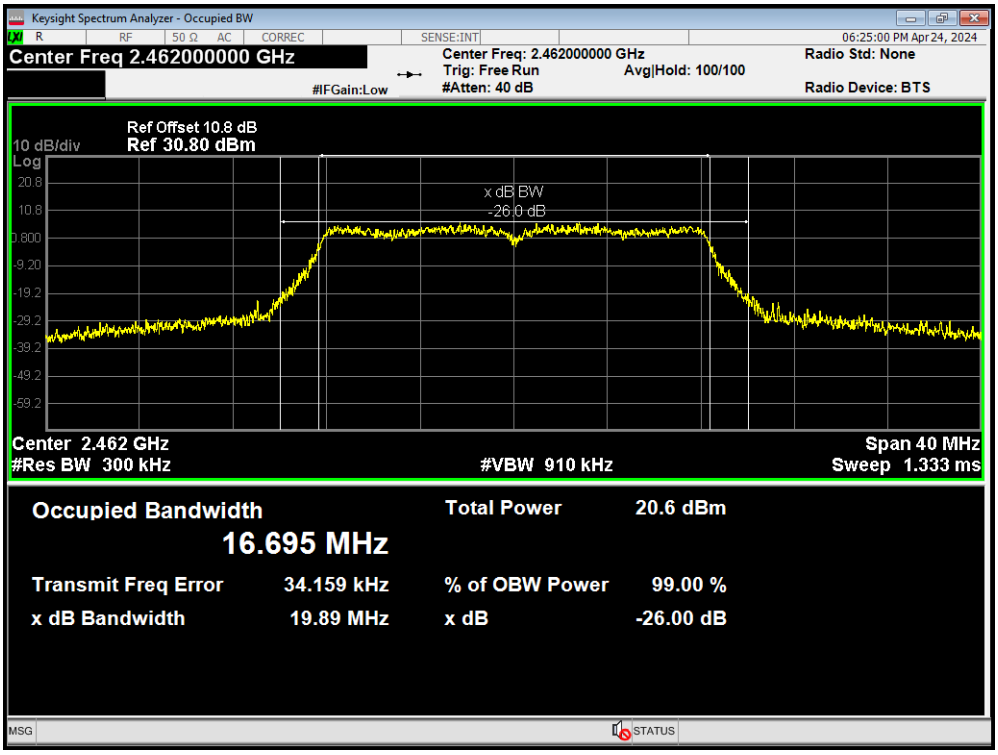
OBW 802.11g 2412MHz



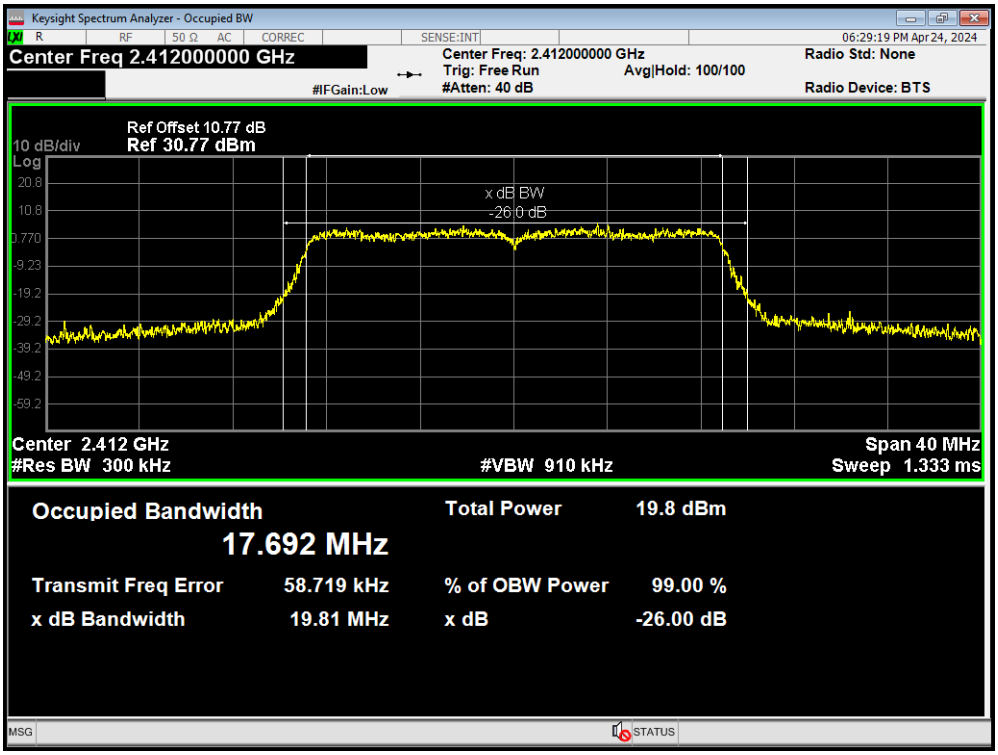
OBW 802.11g 2437MHz



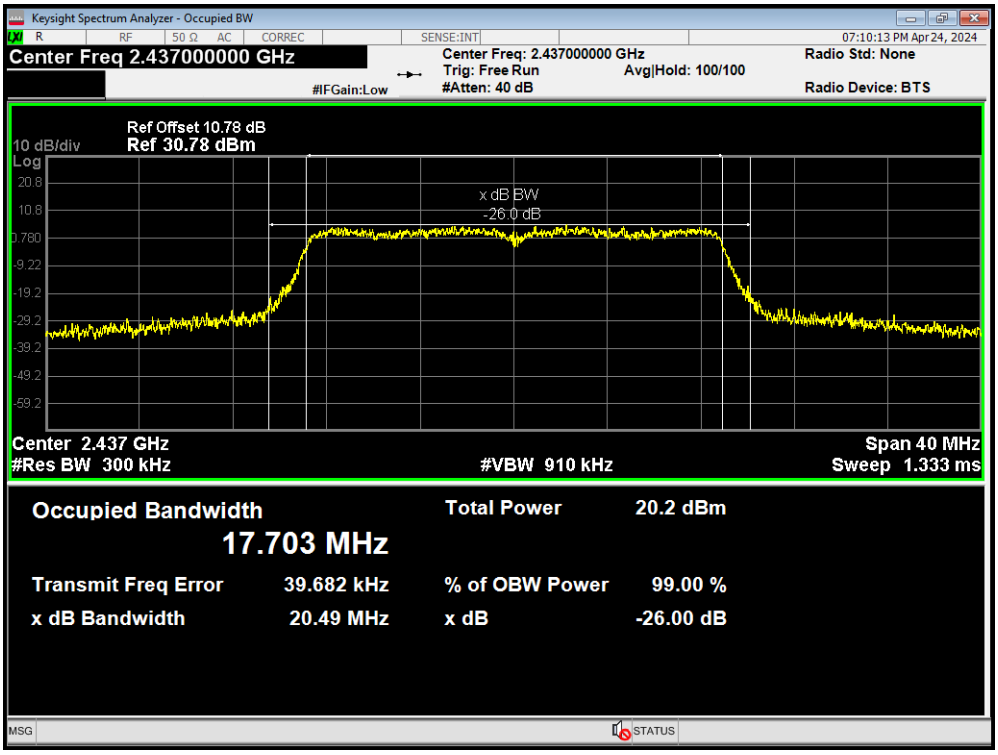
OBW 802.11g 2462MHz



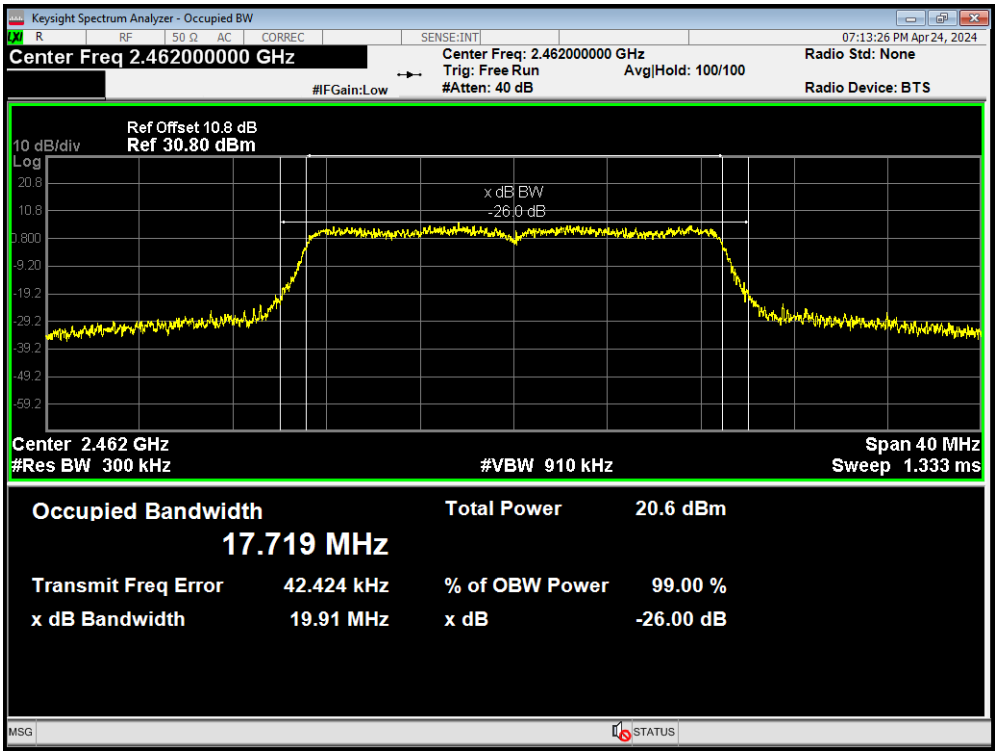
OBW 802.11n(HT20) 2412MHz



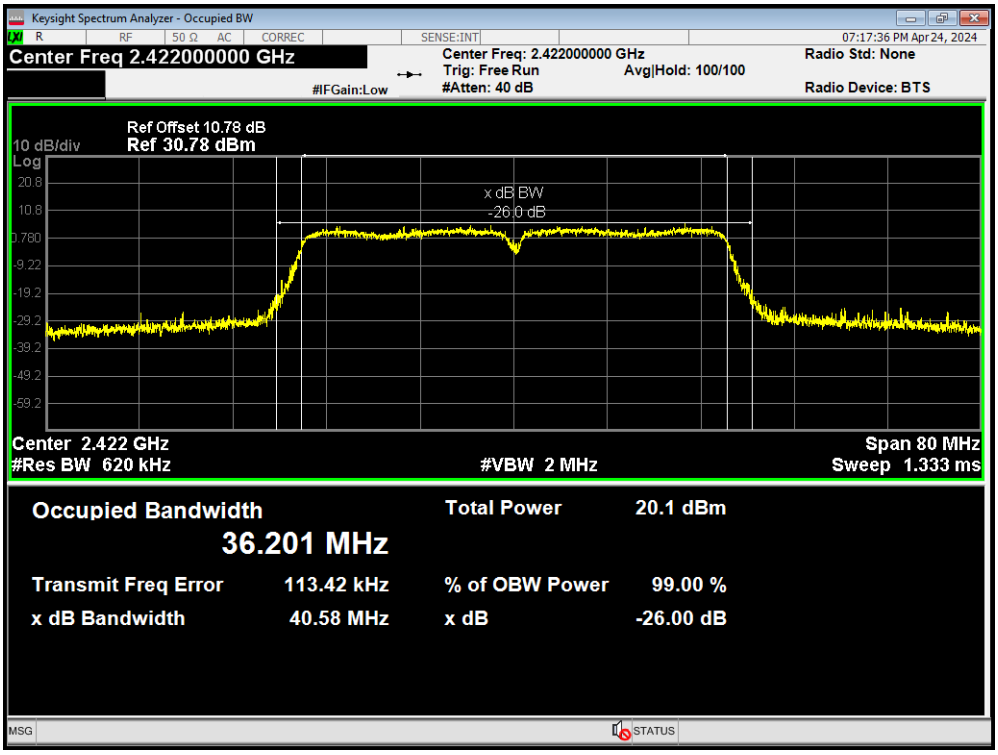
OBW 802.11n(HT20) 2437MHz



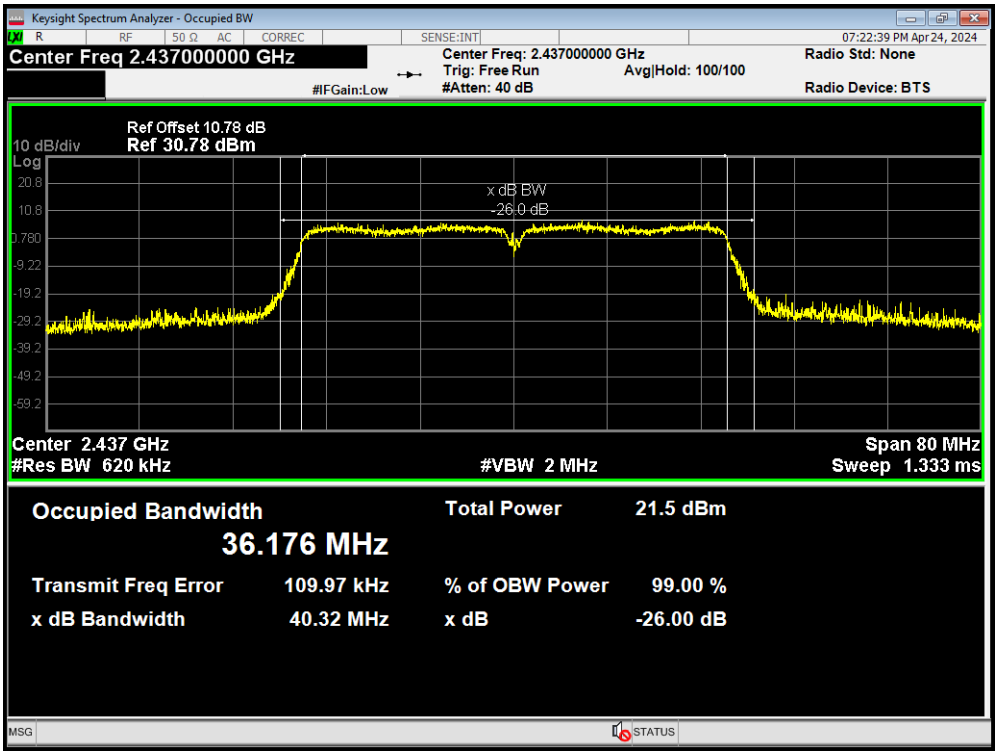
OBW 802.11n(HT20) 2462MHz



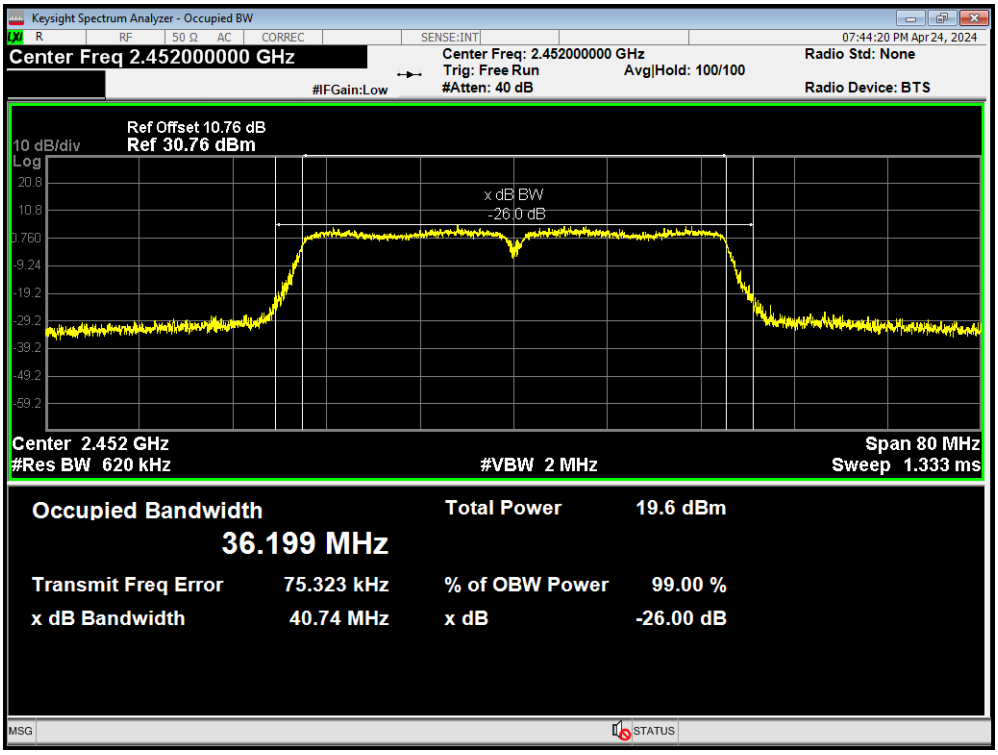
OBW 802.11n(HT40) 2422MHz



OBW 802.11n(HT40) 2437MHz

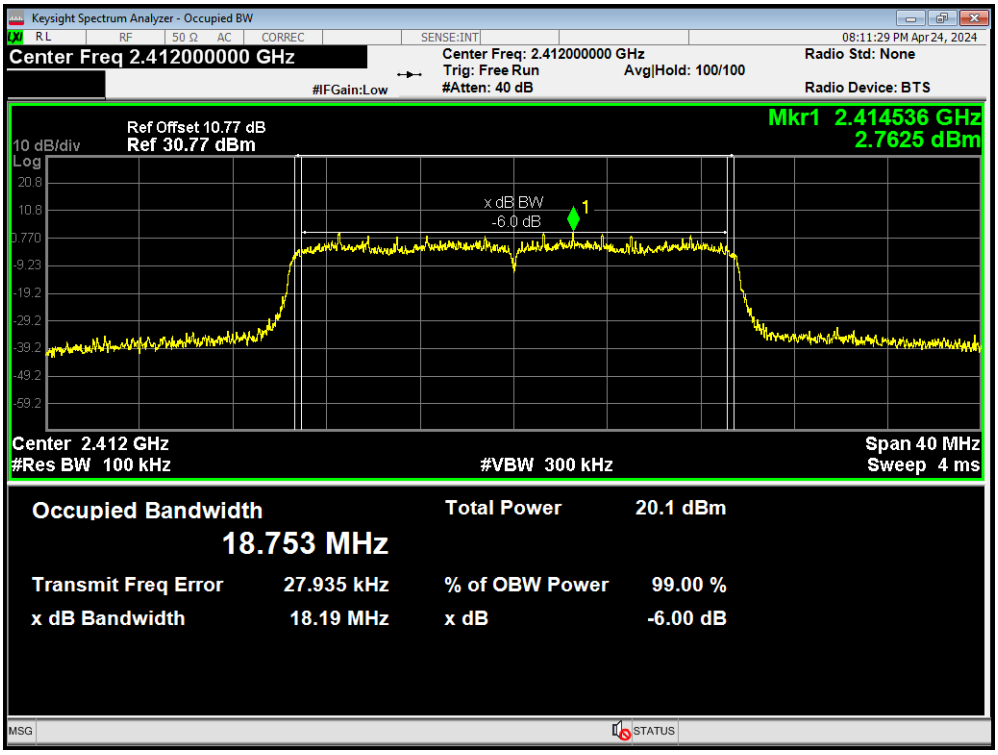


OBW 802.11n(HT40) 2452MHz

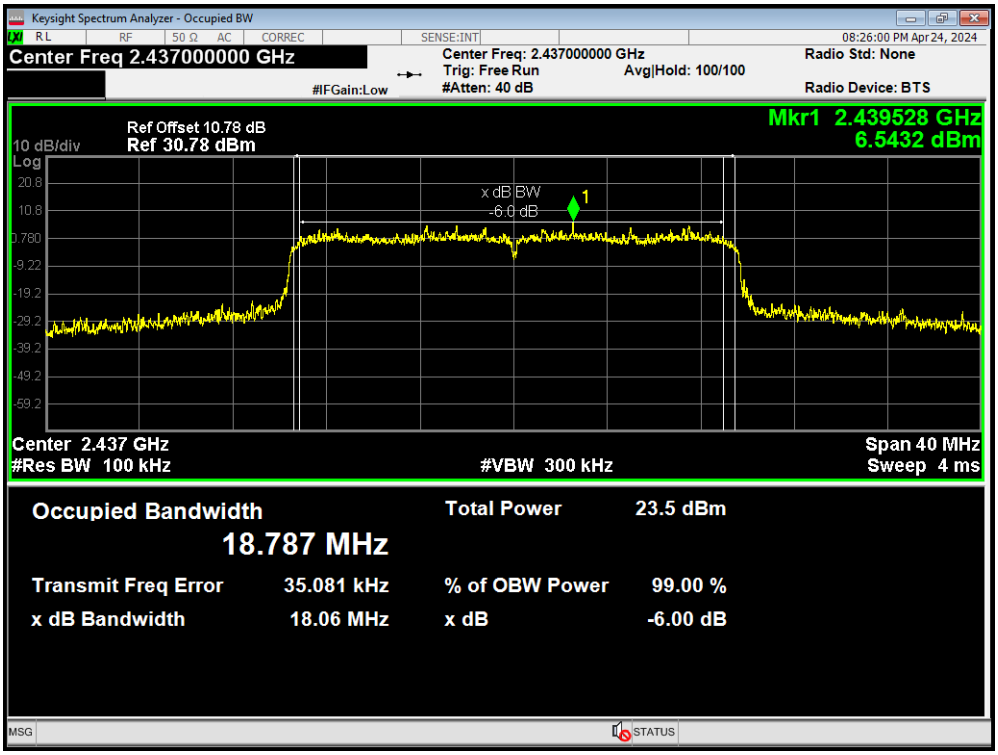


6 dB bandwidth

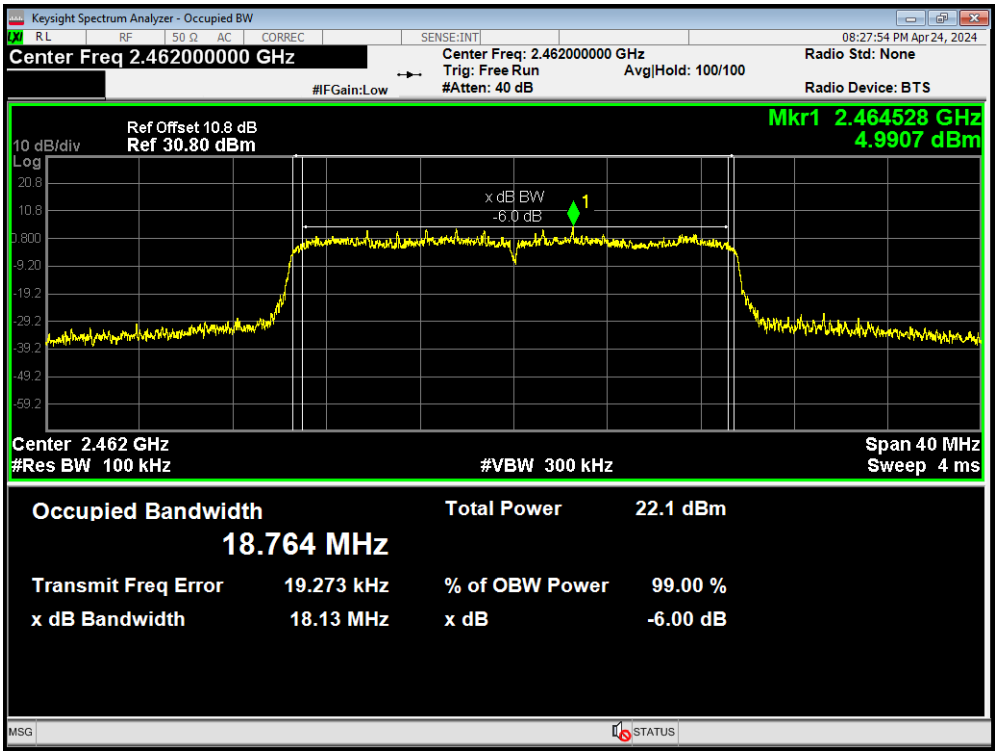
-6dB Bandwidth 802.11ax(HE20) 2412MHz



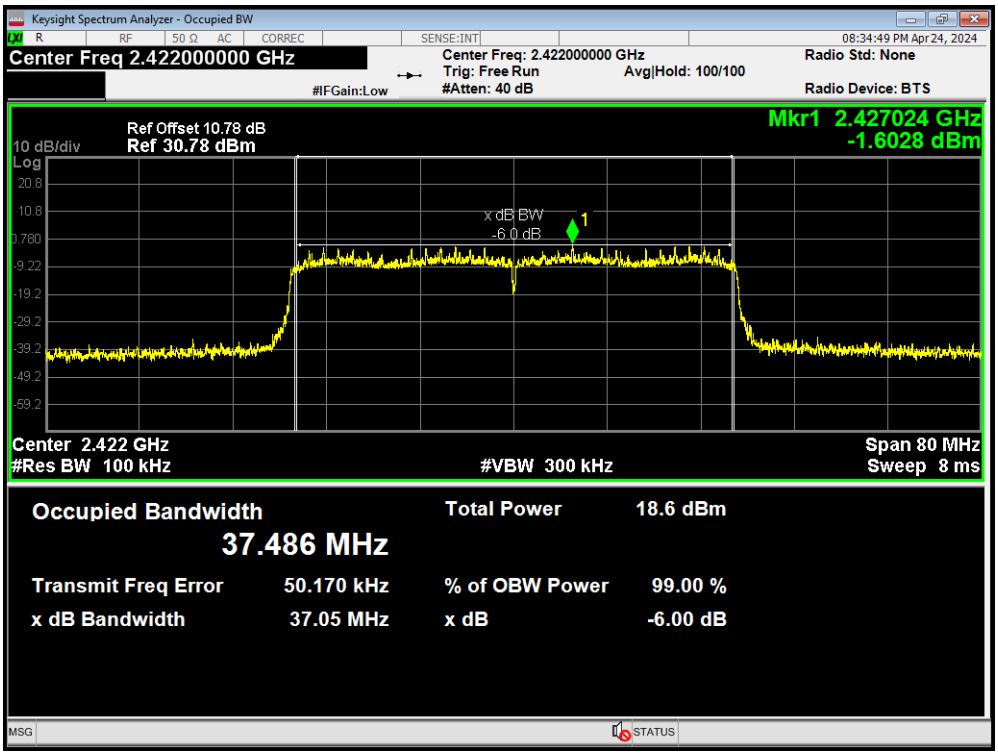
-6dB Bandwidth 802.11ax(HE20) 2437MHz



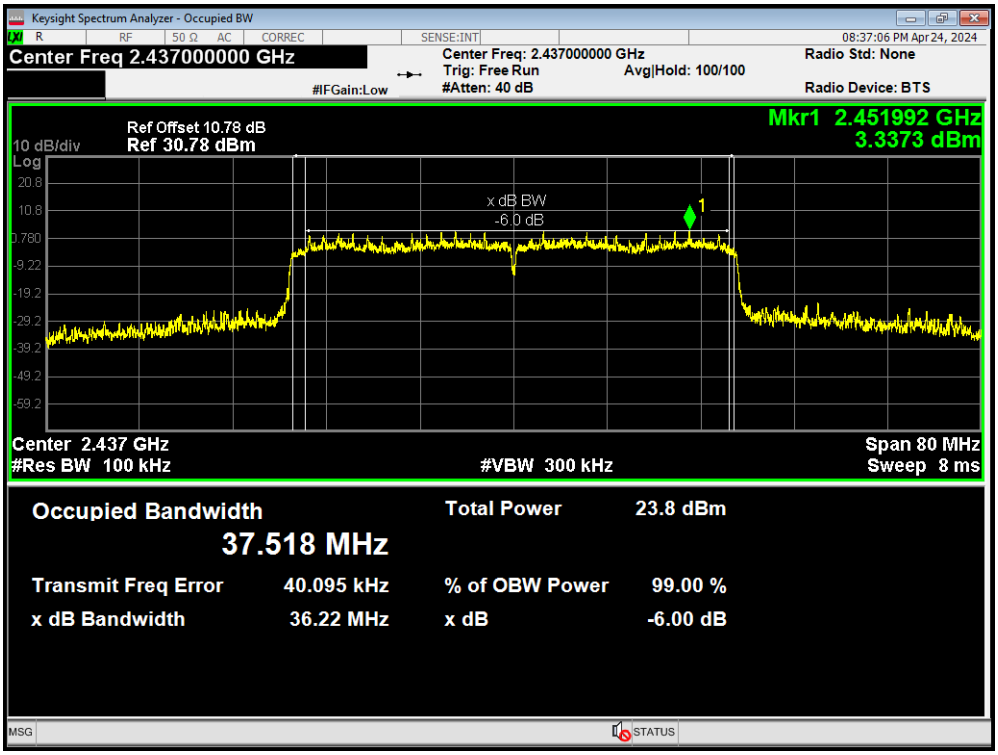
-6dB Bandwidth 802.11ax(HE20) 2462MHz



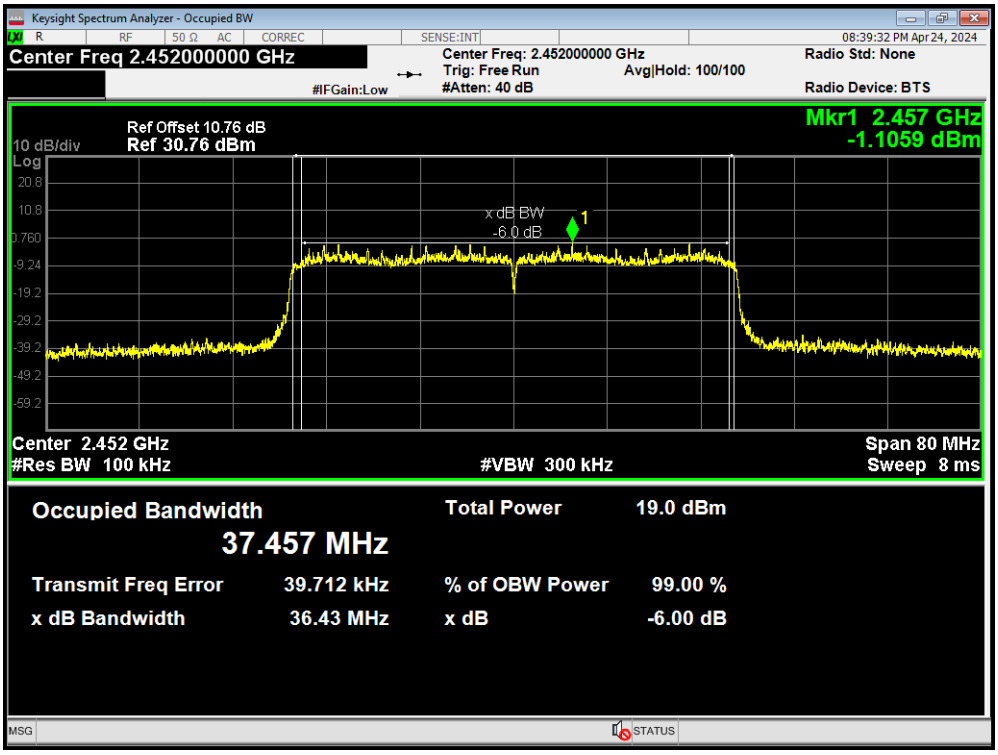
-6dB Bandwidth 802.11ax(HE40) 2422MHz



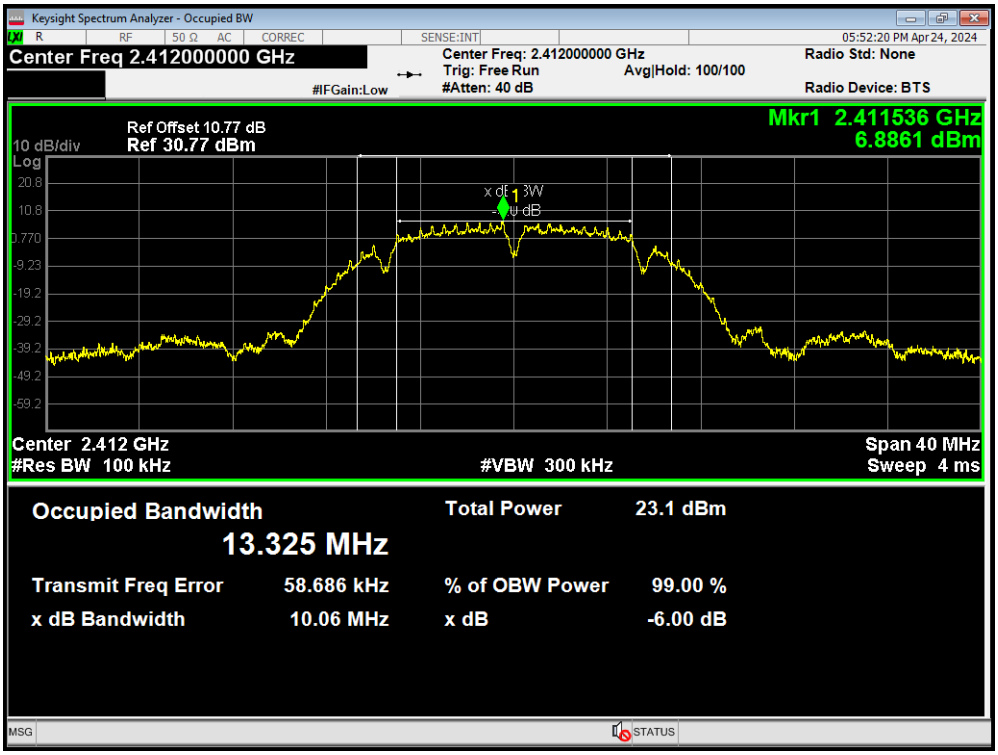
-6dB Bandwidth 802.11ax(HE40) 2437MHz



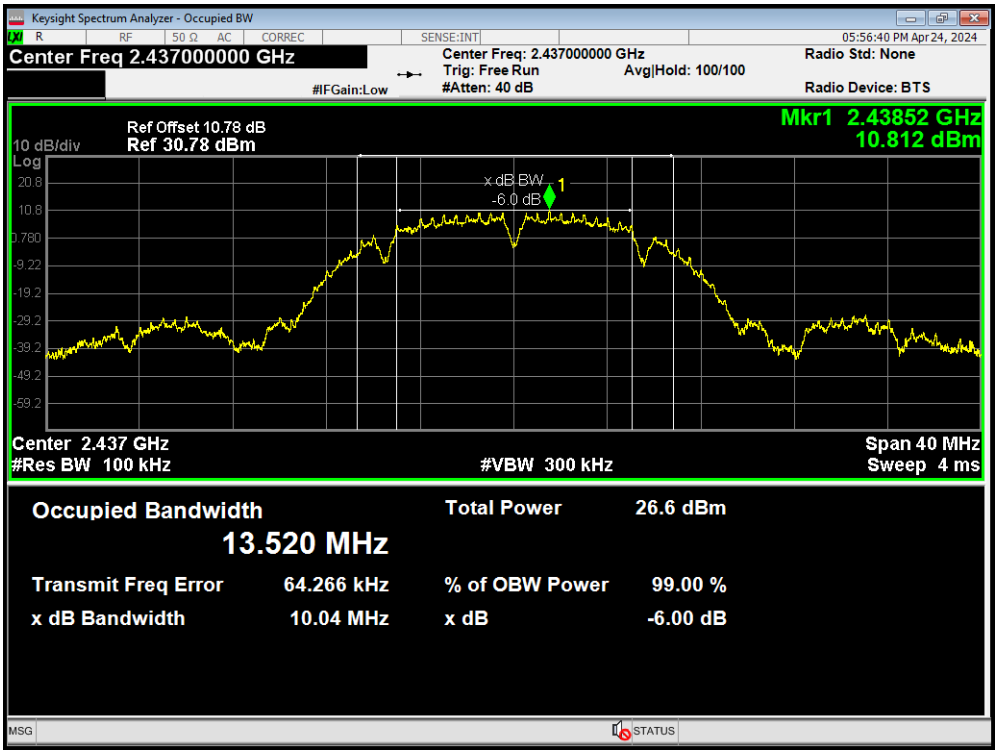
-6dB Bandwidth 802.11ax(HE40) 2452MHz



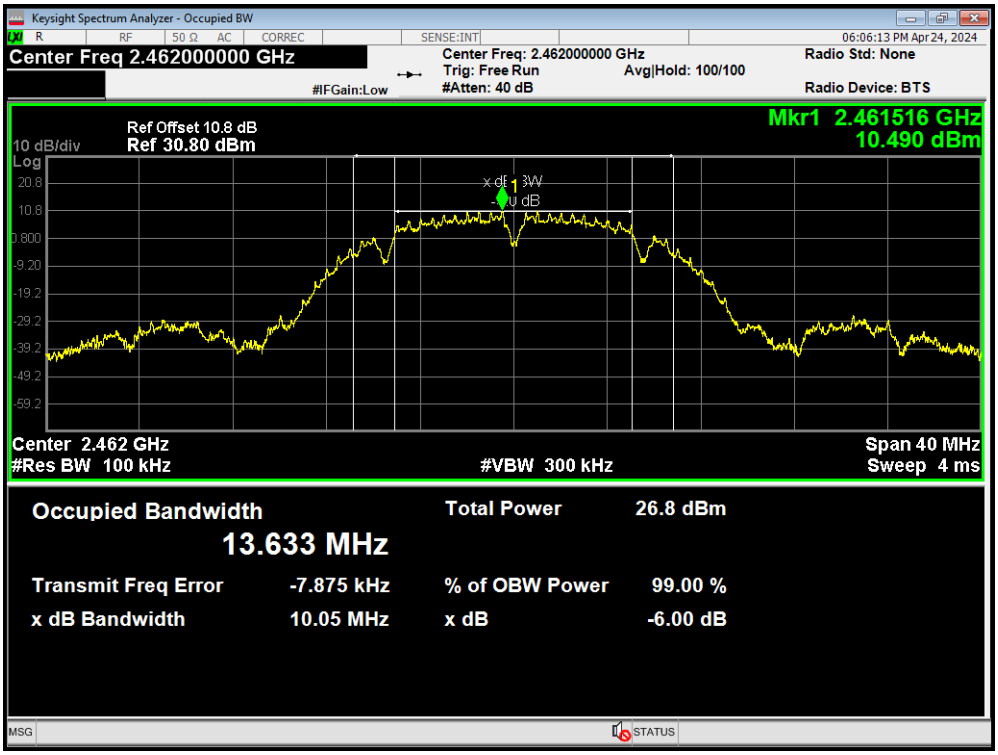
-6dB Bandwidth 802.11b 2412MHz



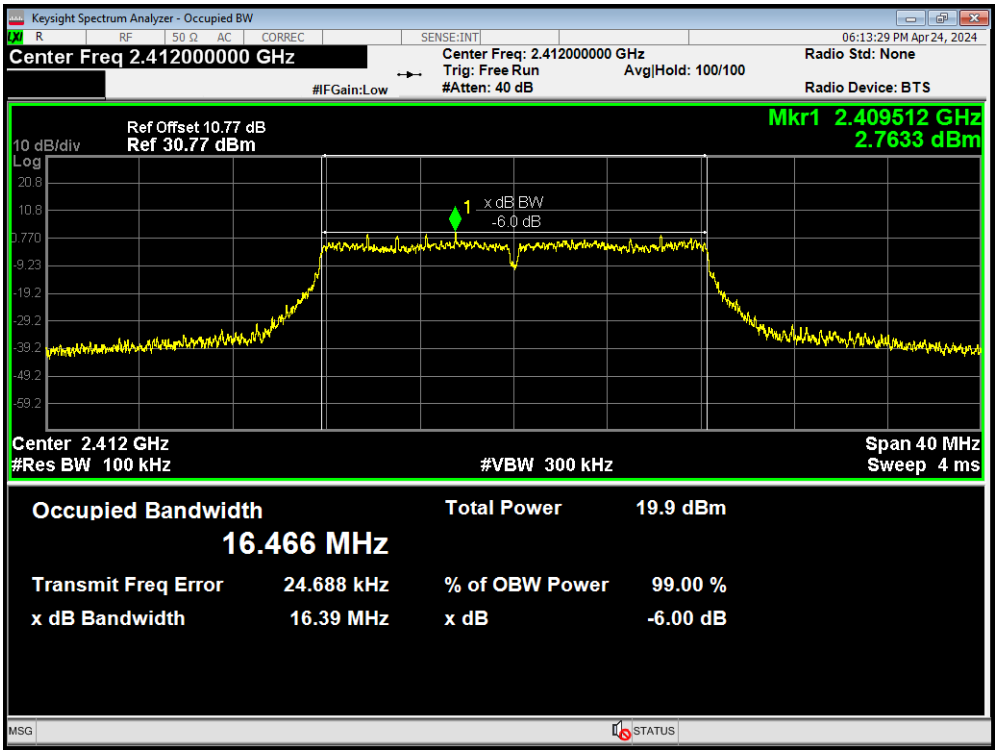
-6dB Bandwidth 802.11b 2437MHz



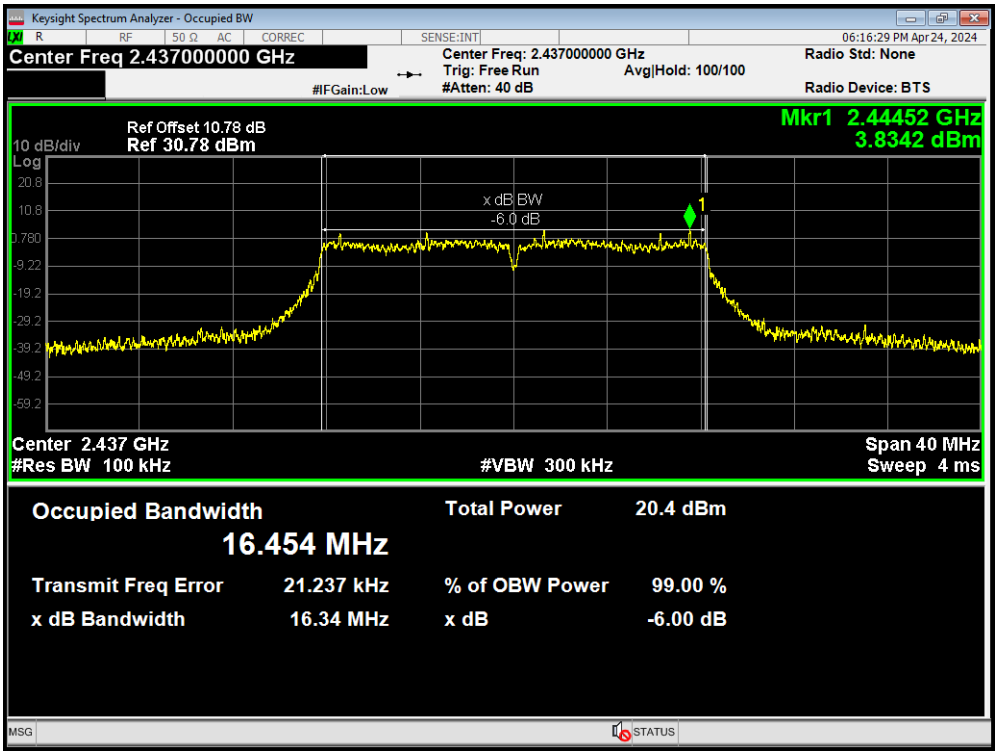
-6dB Bandwidth 802.11b 2462MHz



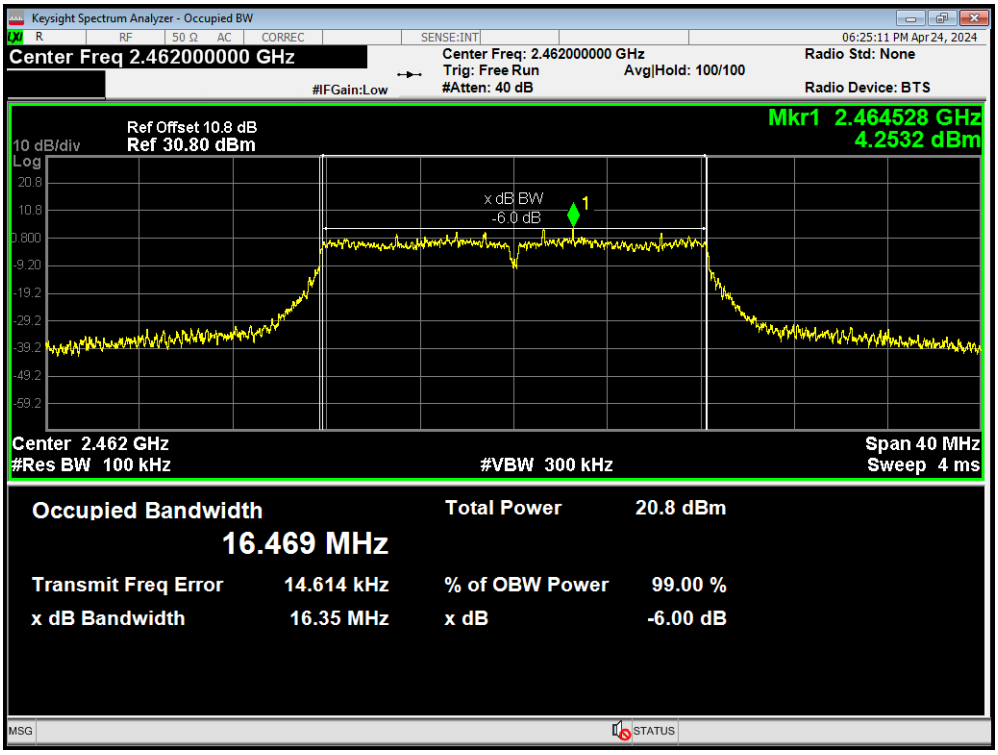
-6dB Bandwidth 802.11g 2412MHz



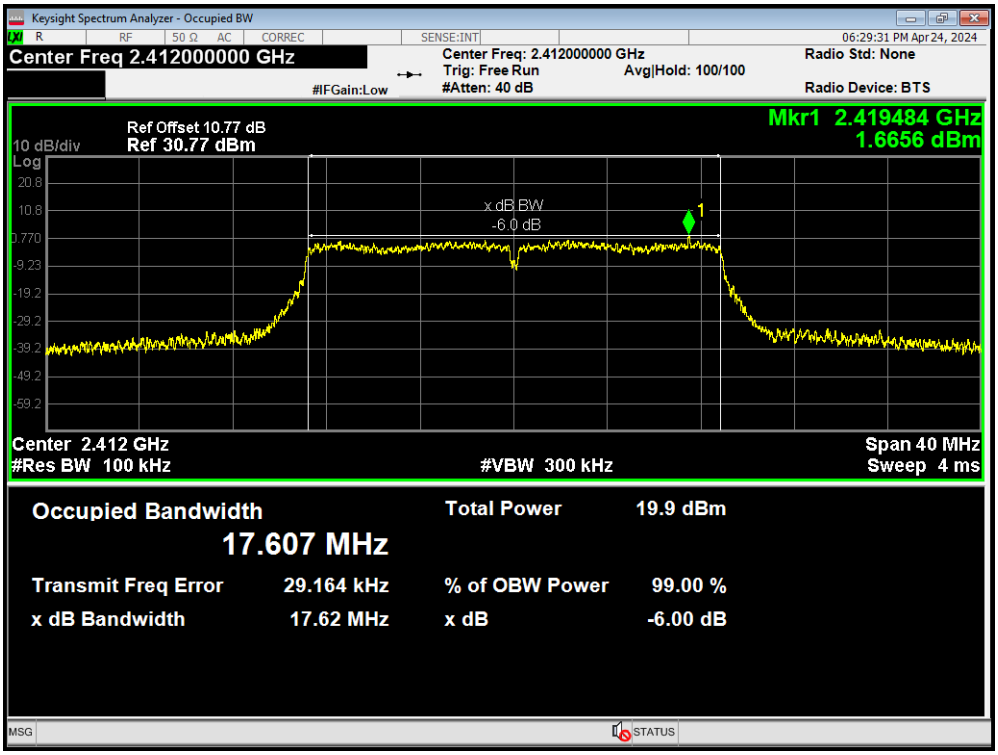
-6dB Bandwidth 802.11g 2437MHz



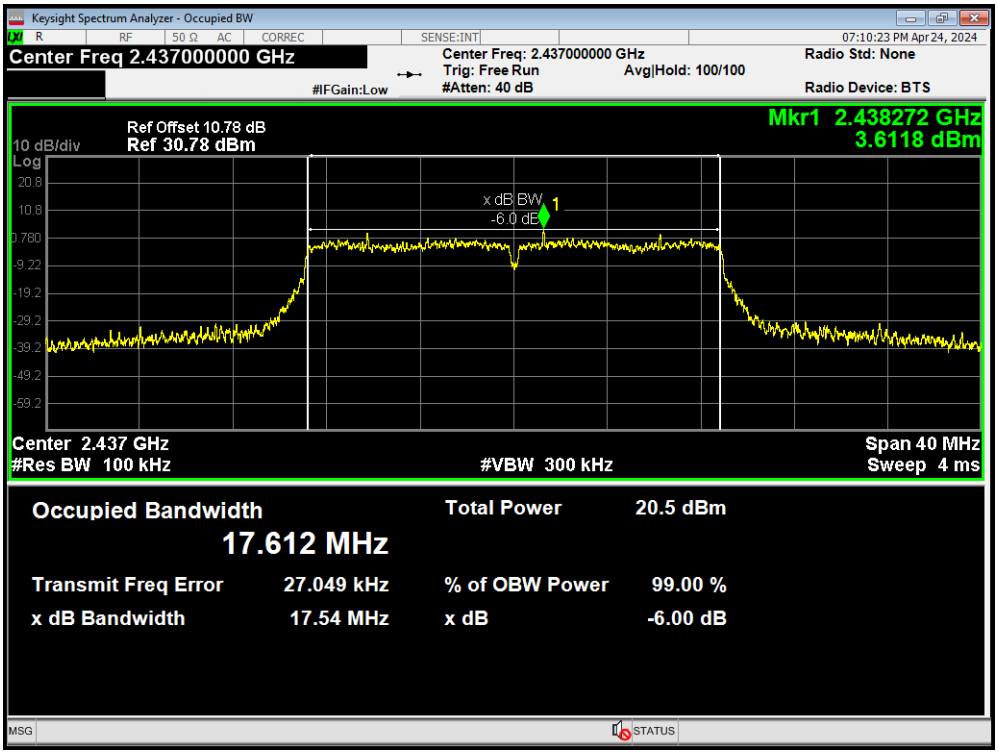
-6dB Bandwidth 802.11g 2462MHz



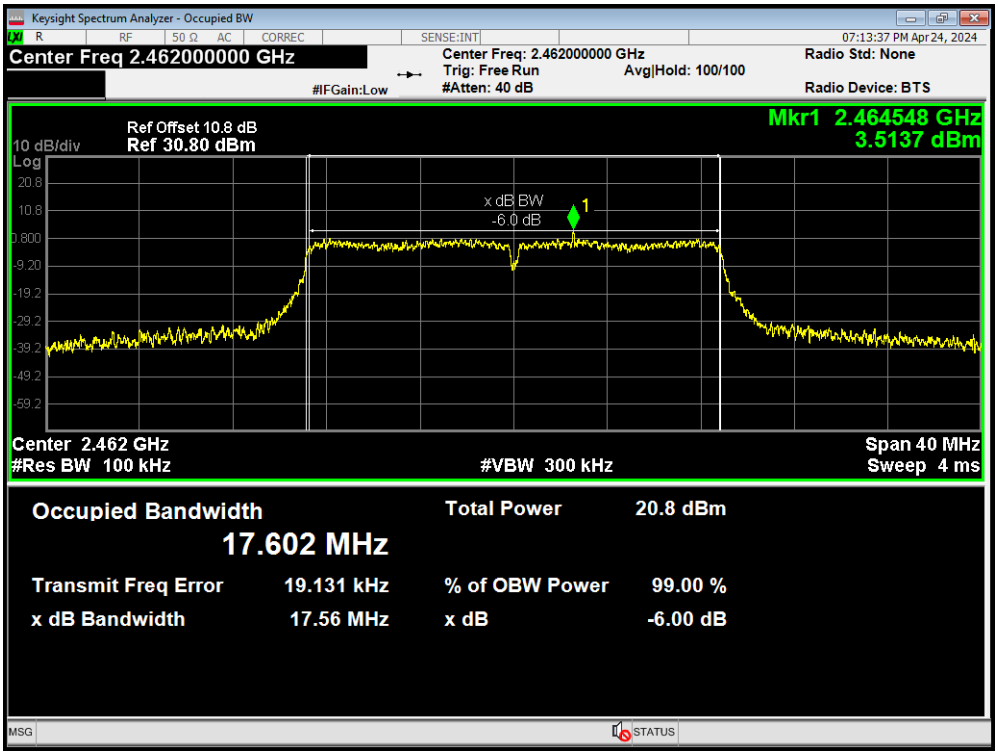
-6dB Bandwidth 802.11n(HT20) 2412MHz



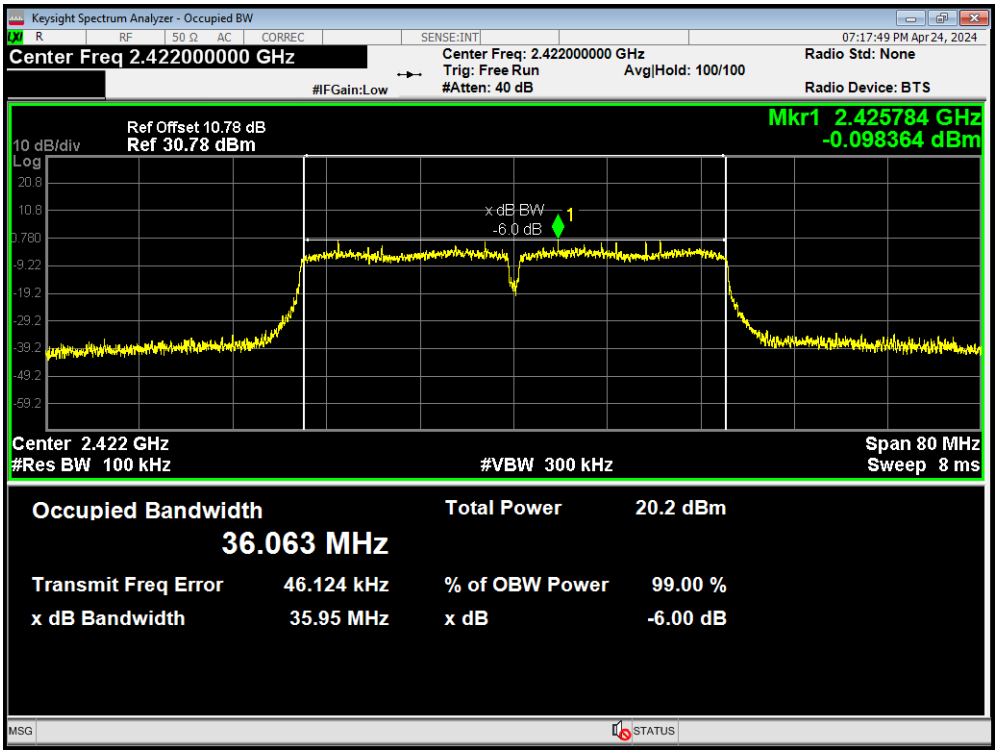
-6dB Bandwidth 802.11n(HT20) 2437MHz



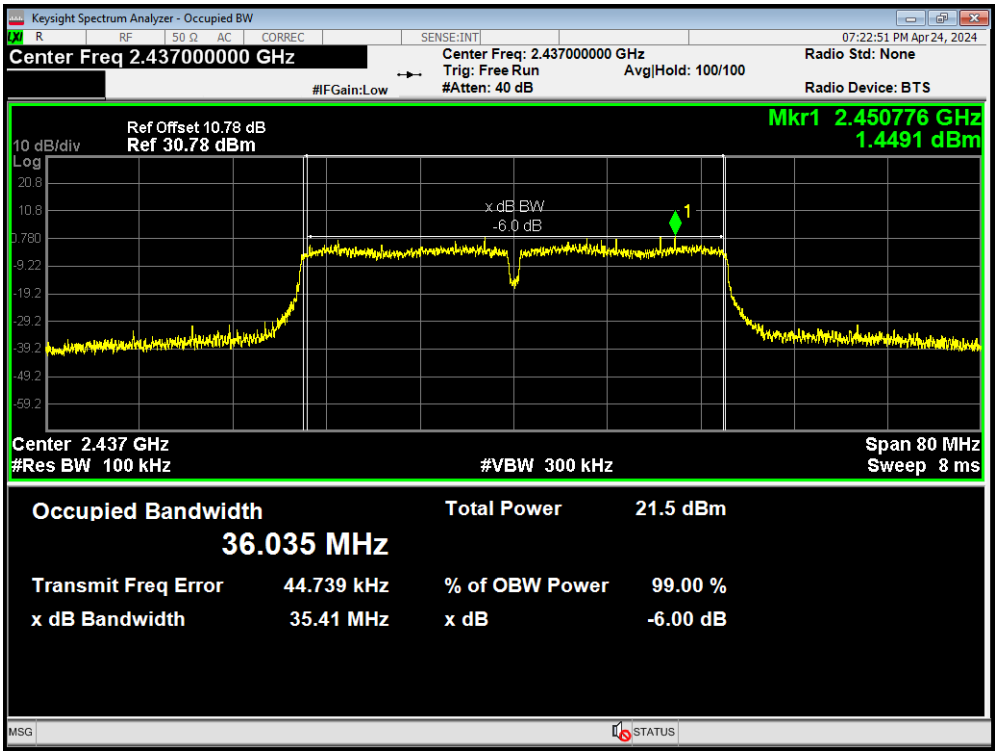
-6dB Bandwidth 802.11n(HT20) 2462MHz



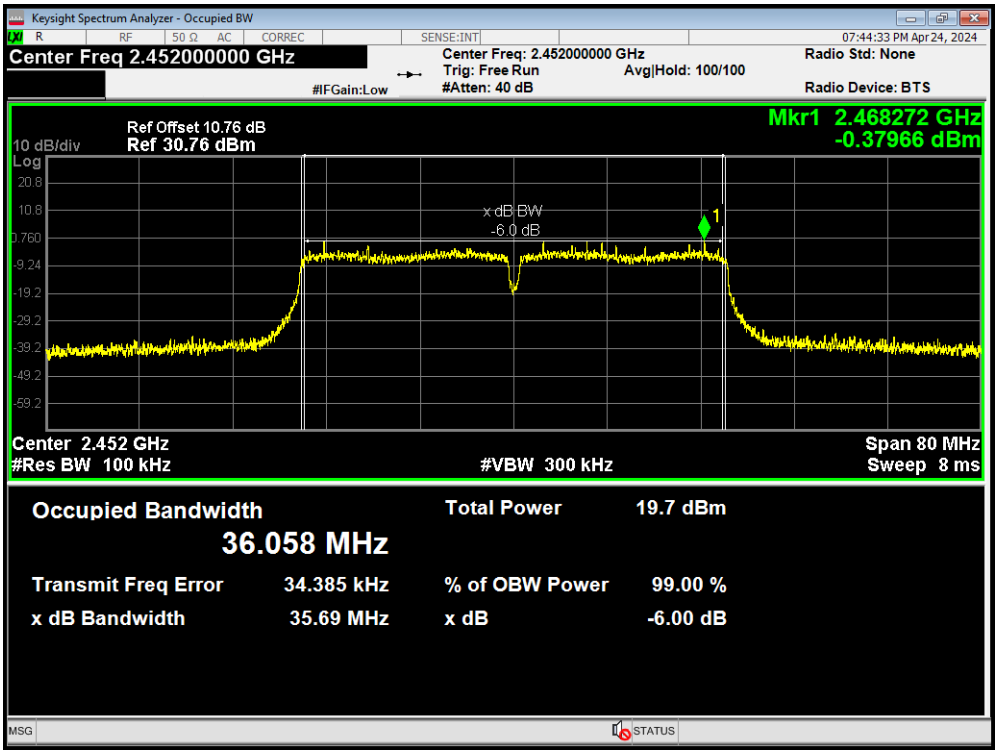
-6dB Bandwidth 802.11n(HT40) 2422MHz



-6dB Bandwidth 802.11n(HT40) 2437MHz



-6dB Bandwidth 802.11n(HT40) 2452MHz



5.3. Band Edge

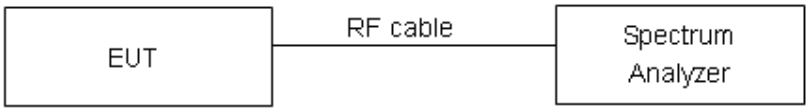
Ambient Condition

Temperature	Relative humidity
15°C ~ 35°C	20% ~ 80%

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable the band edge of the lowest and highest channels were measured. The peak detector is used and RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer. Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

Rule Part 15.247(d) specifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.” If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.”

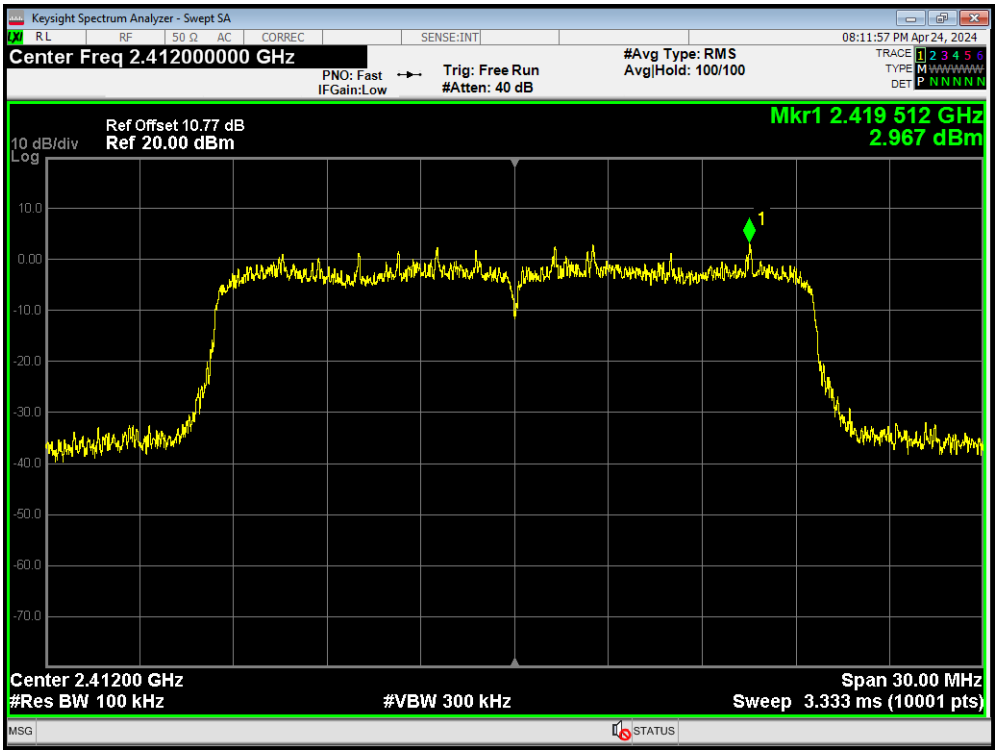
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96.

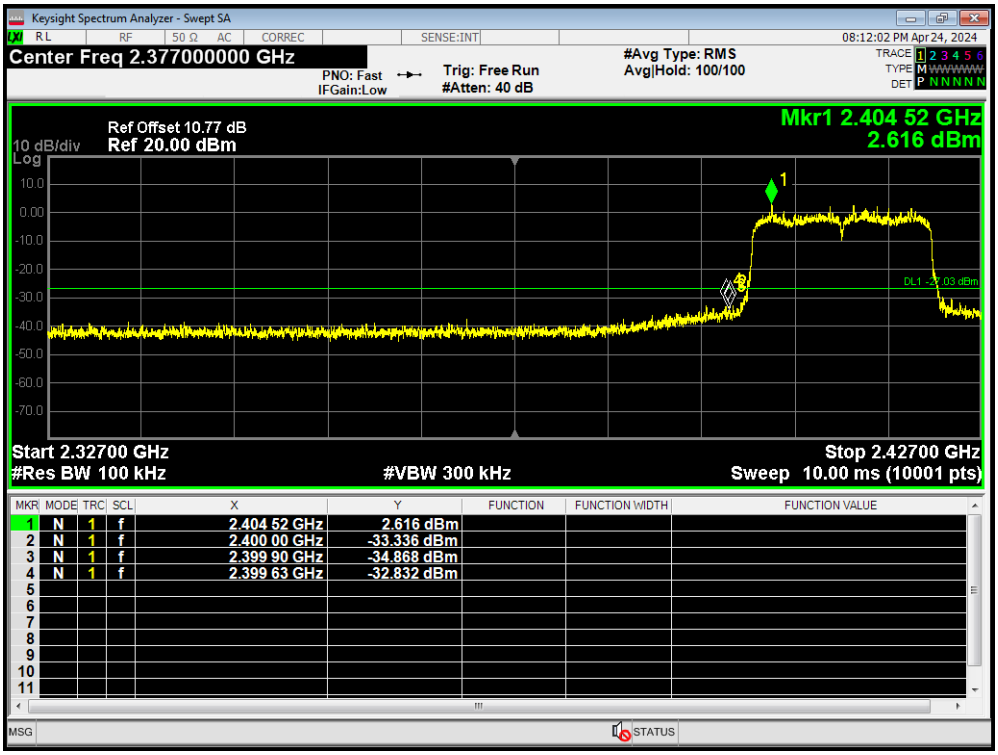
Frequency	Uncertainty
2GHz-3GHz	1.407 dB

Test Results: PASS

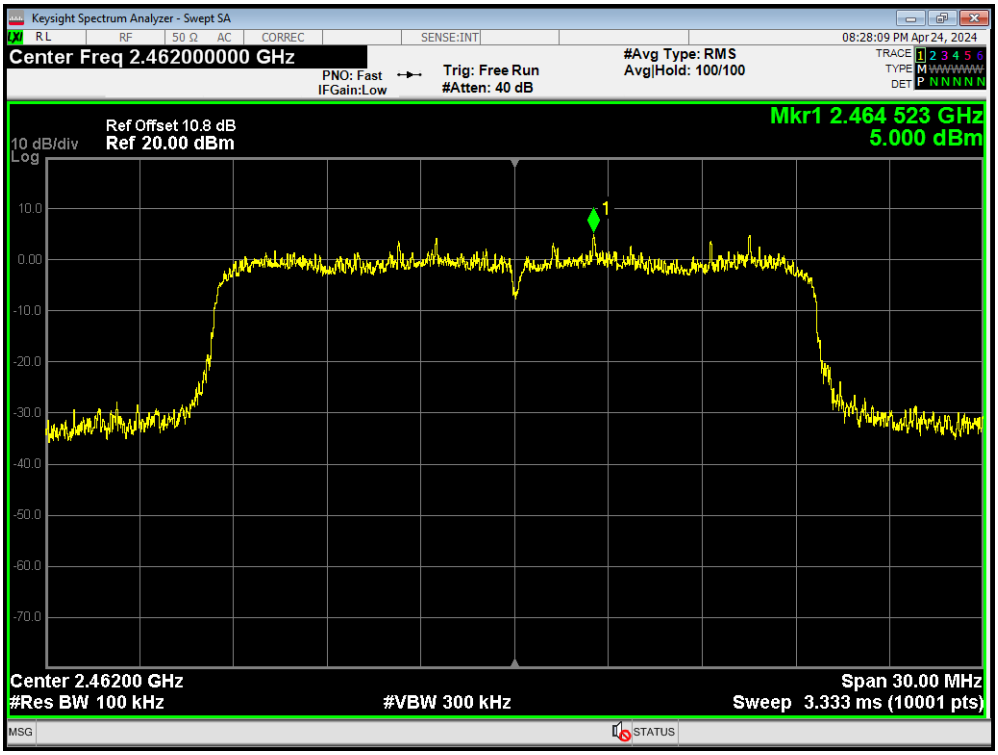
Band Edge 802.11ax(HE20) 2412MHz Ref



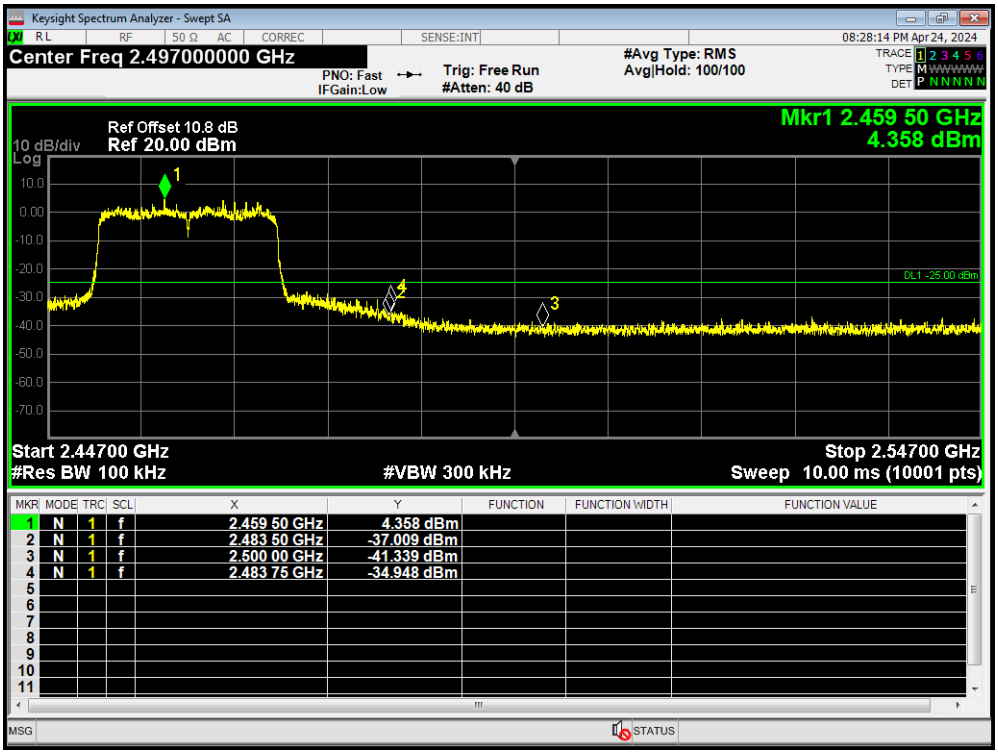
Band Edge 802.11ax(HE20) 2412MHz Emission



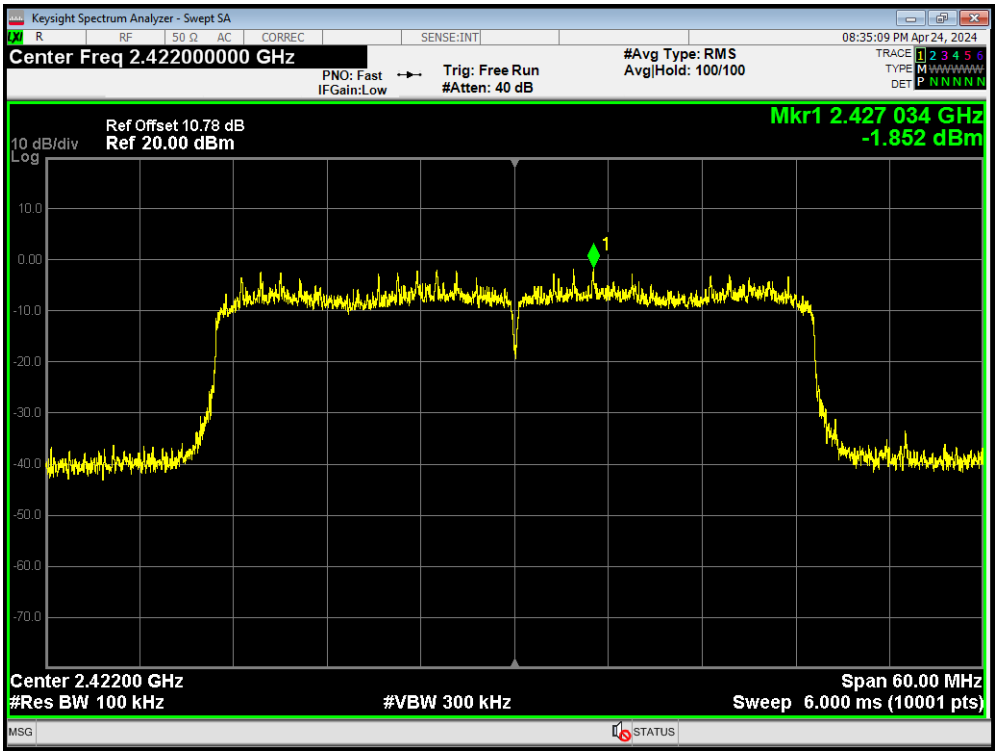
Band Edge 802.11ax(HE20) 2462MHz Ref



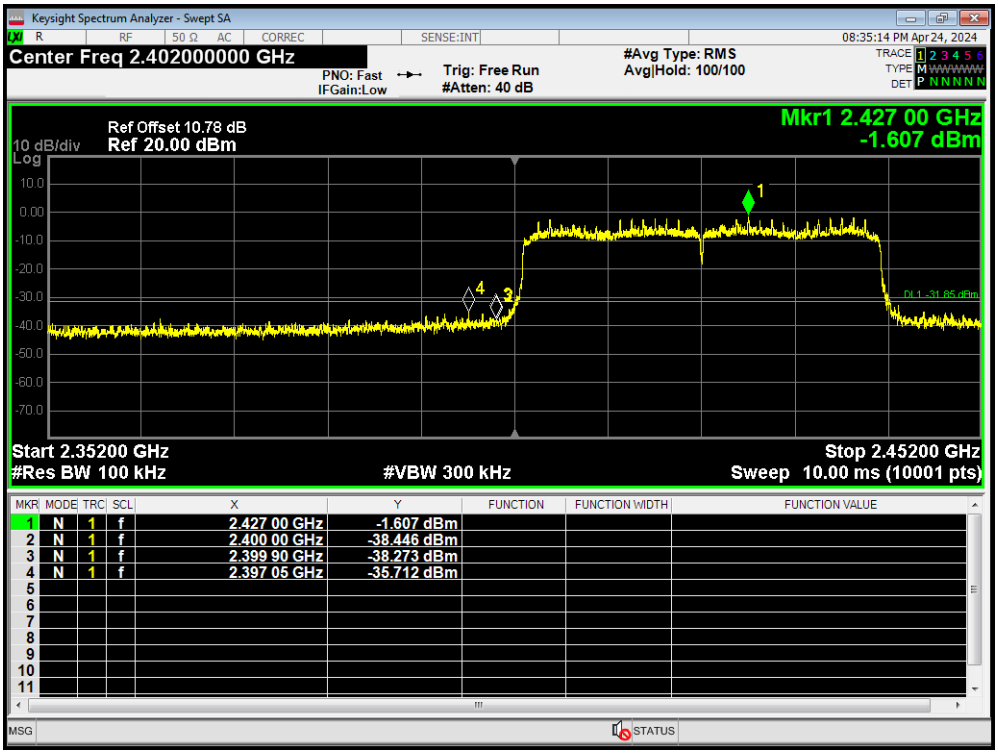
Band Edge 802.11ax(HE20) 2462MHz Emission



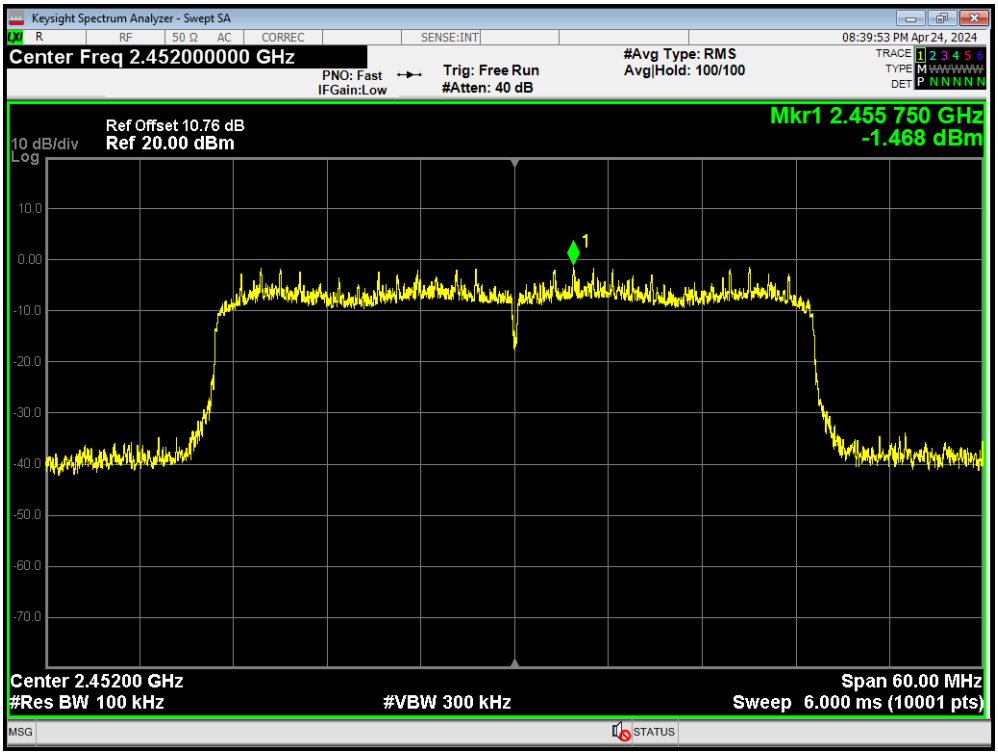
Band Edge 802.11ax(HE40) 2422MHz Ref



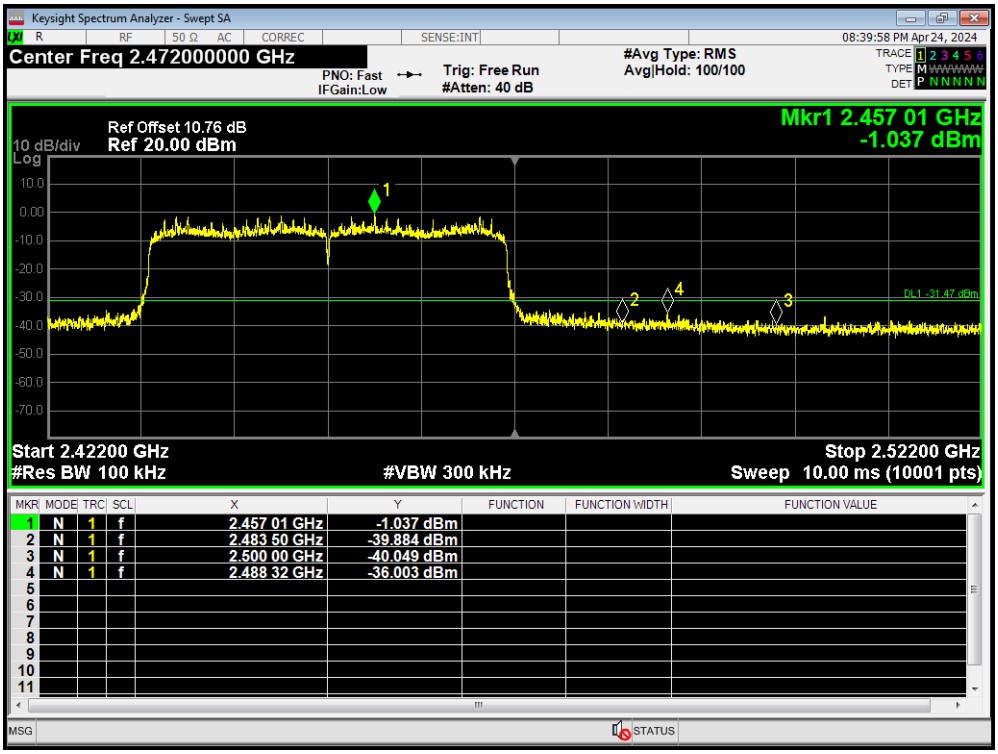
Band Edge 802.11ax(HE40) 2422MHz Emission



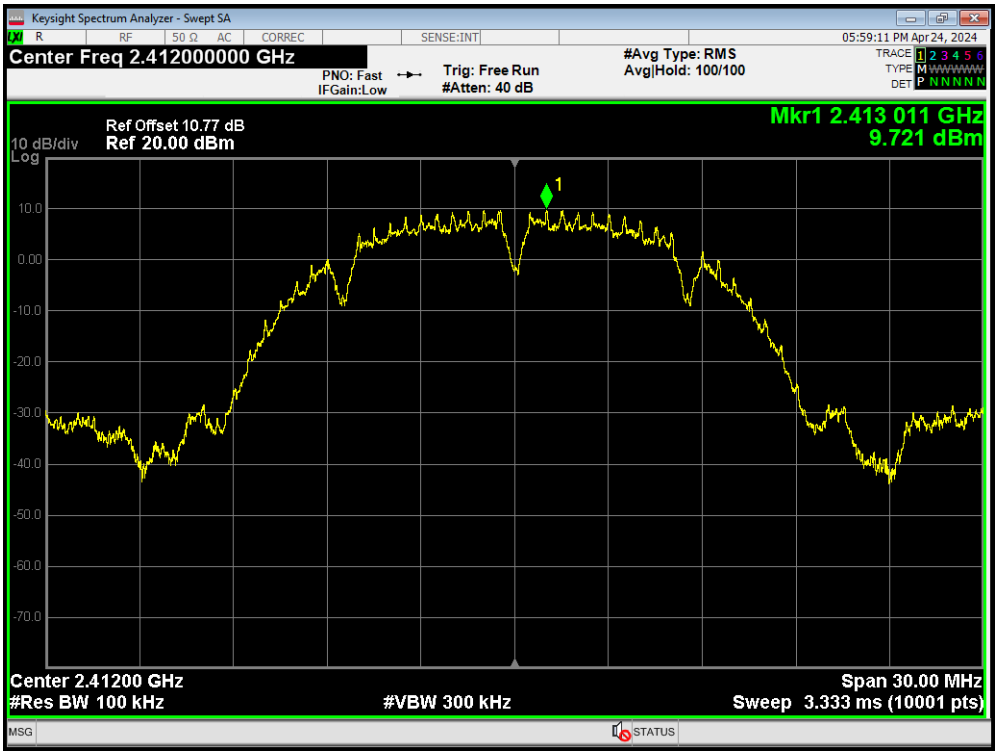
Band Edge 802.11ax(HE40) 2452MHz Ref



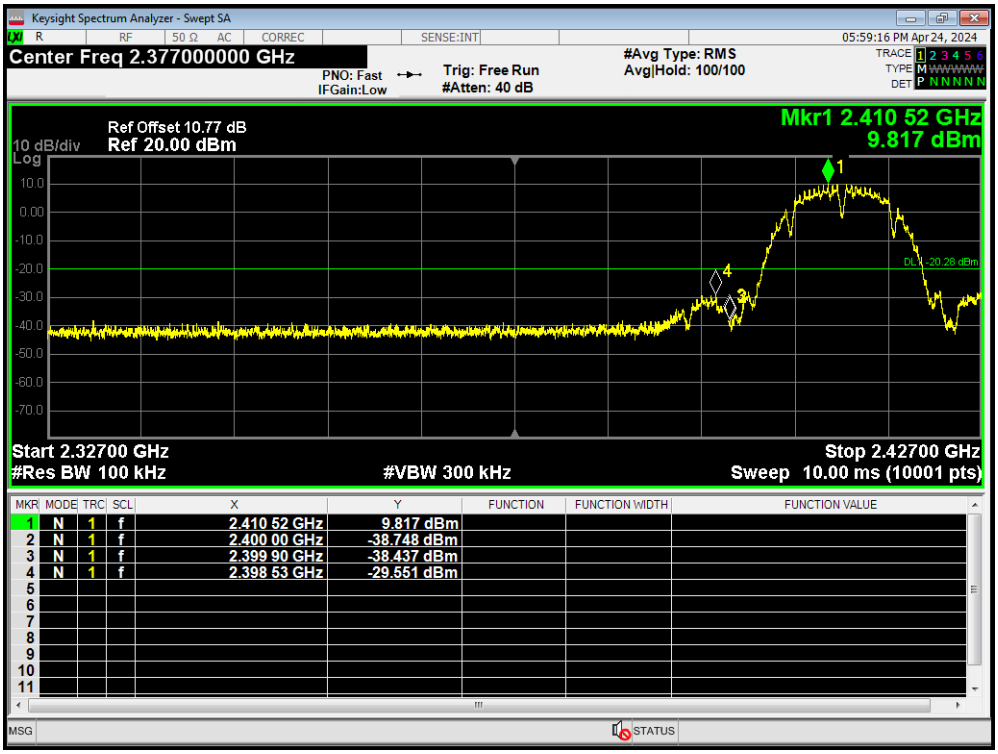
Band Edge 802.11ax(HE40) 2452MHz Emission



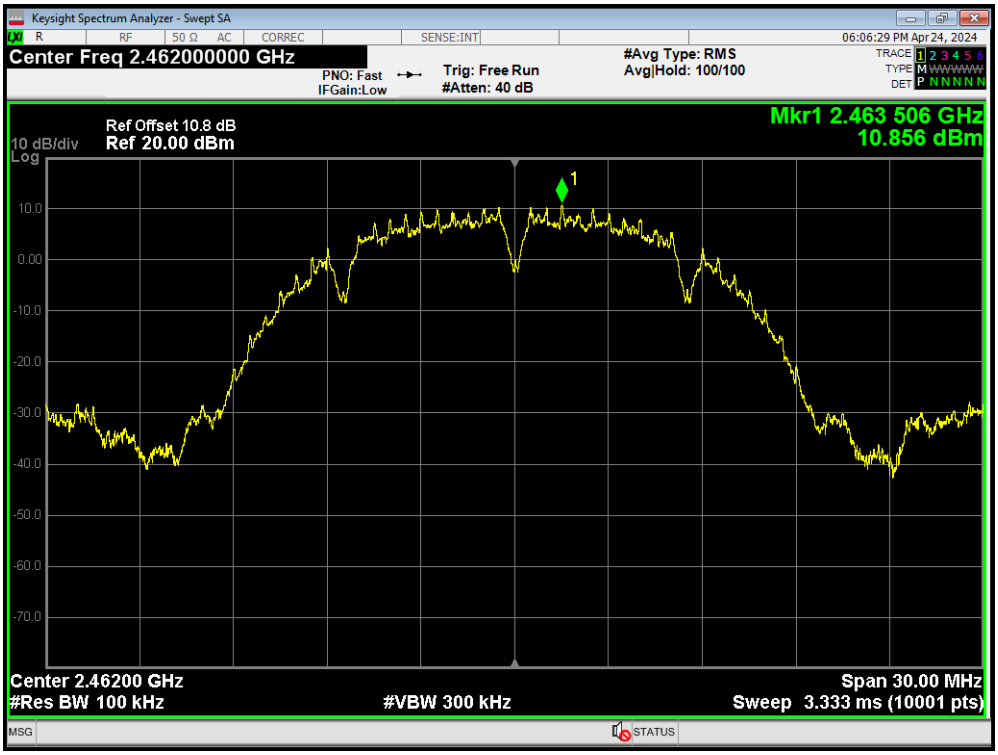
Band Edge 802.11b 2412MHz Ref



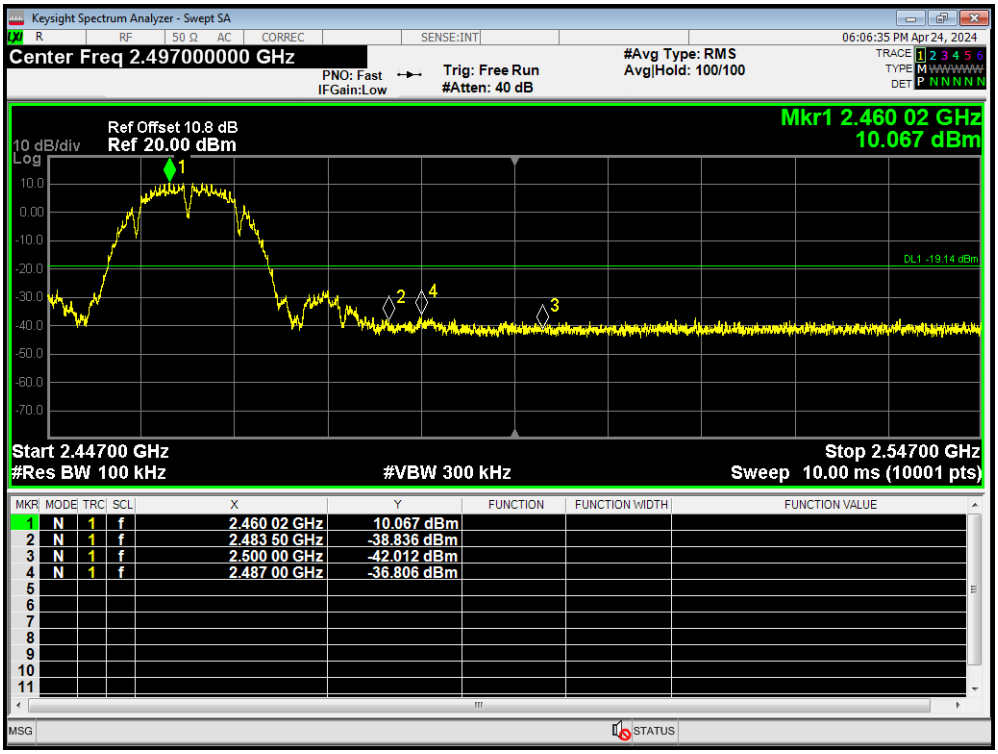
Band Edge 802.11b 2412MHz Emission



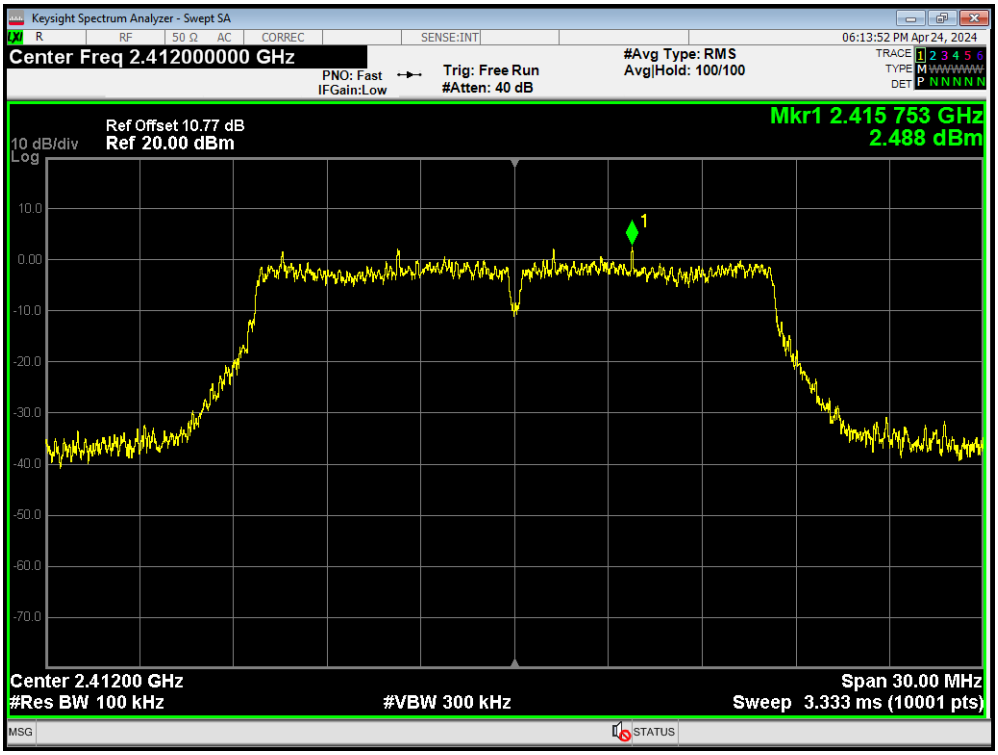
Band Edge 802.11b 2462MHz Ref



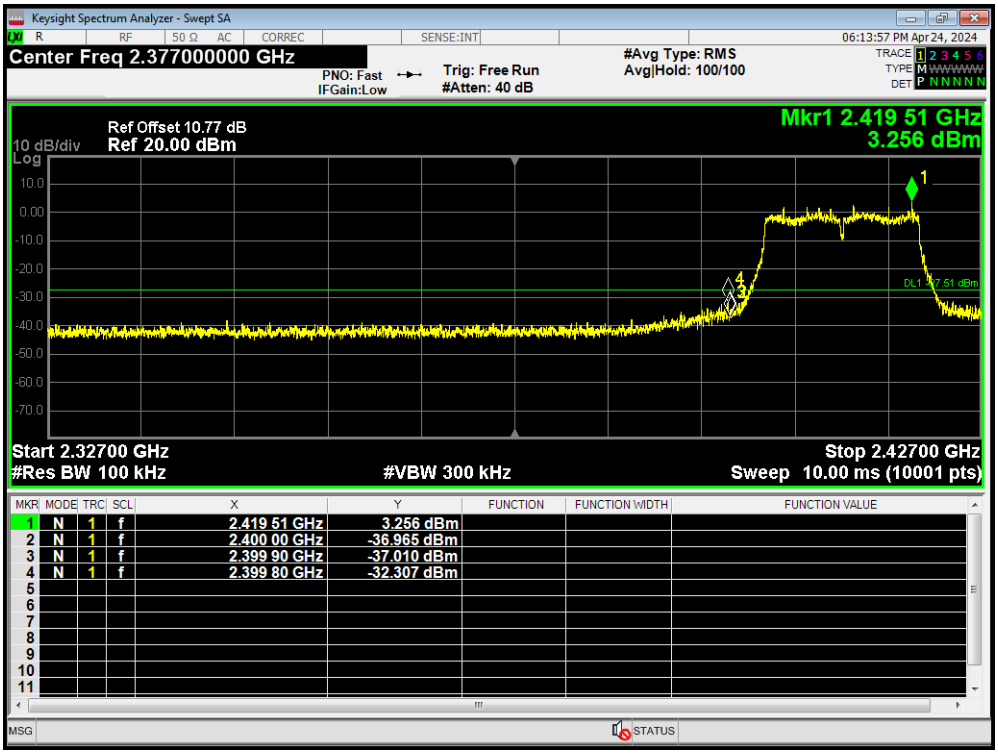
Band Edge 802.11b 2462MHz Emission



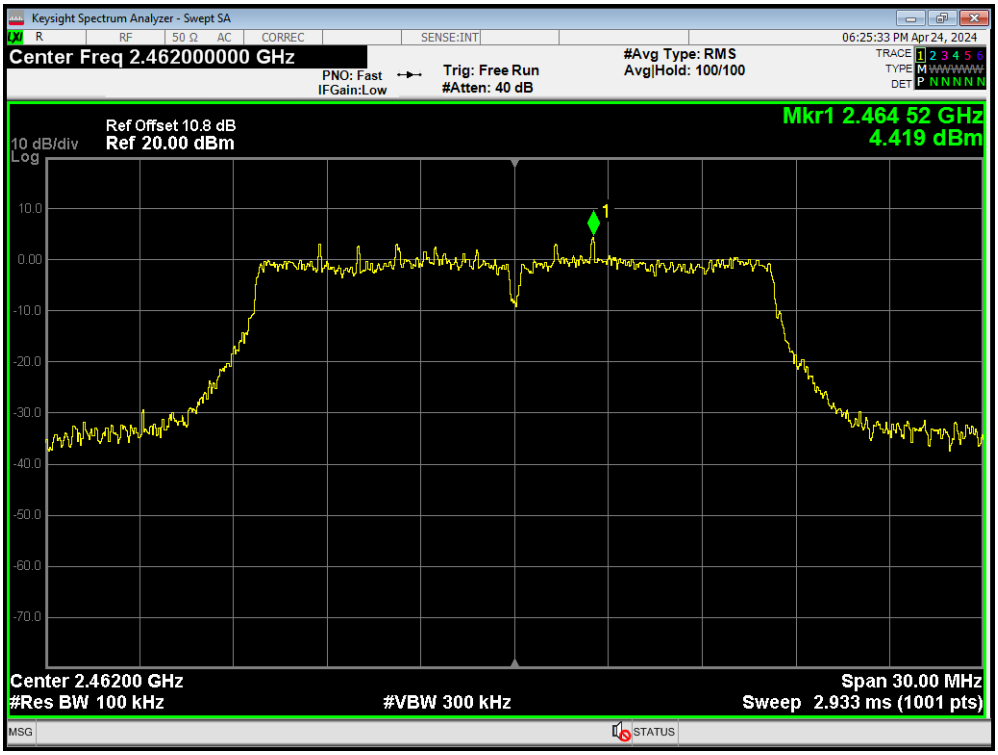
Band Edge 802.11g 2412MHz Ref



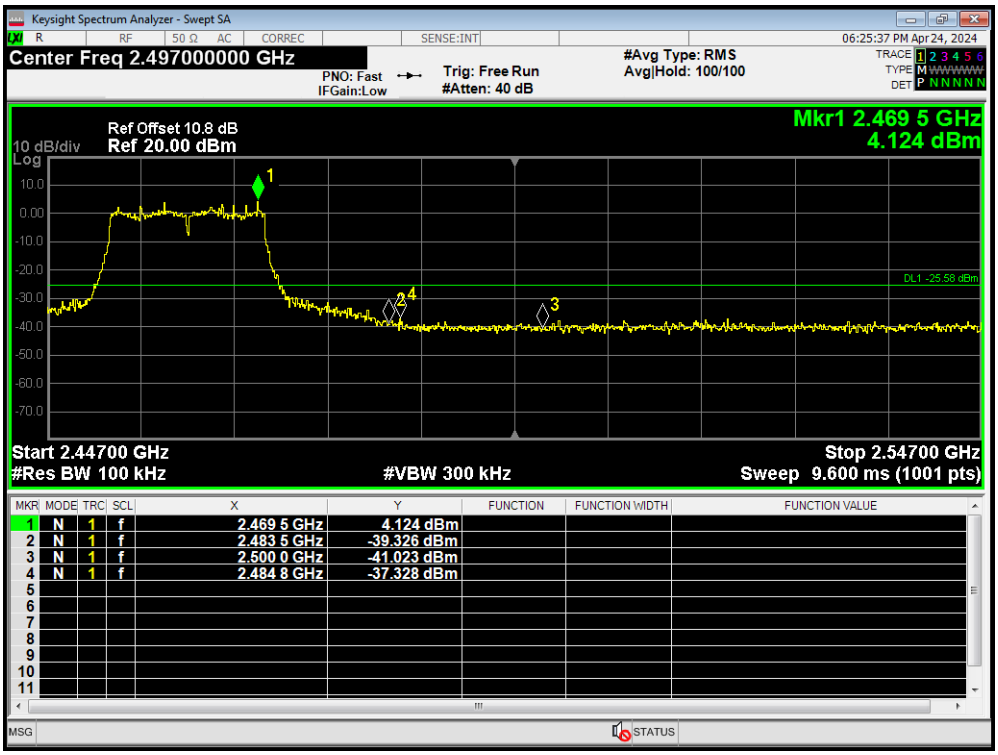
Band Edge 802.11g 2412MHz Emission



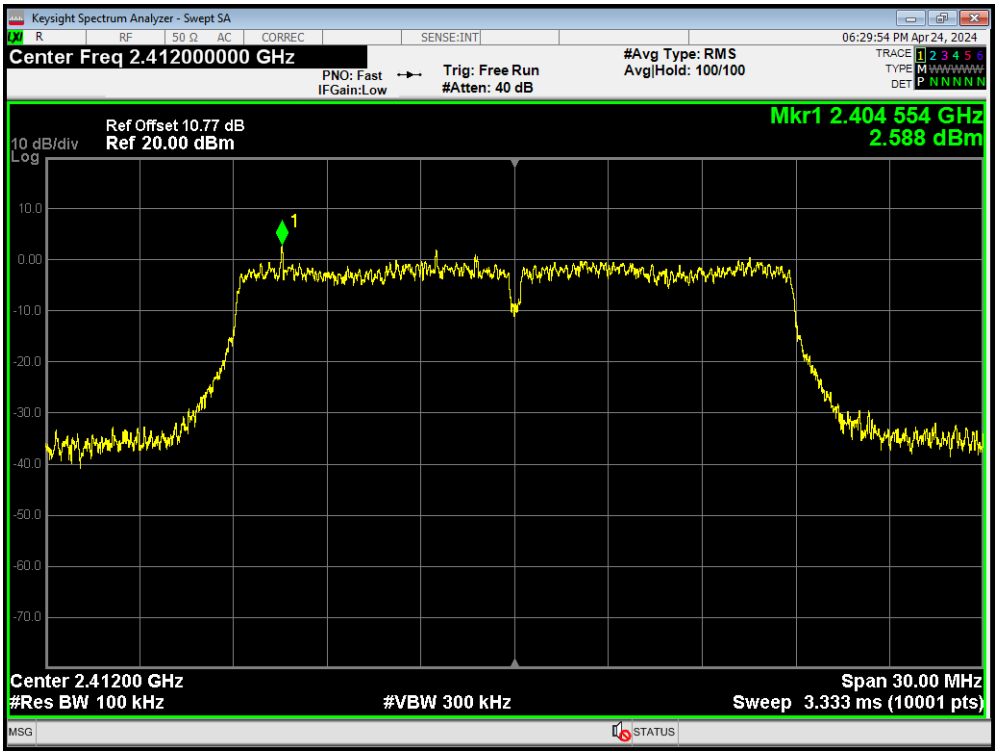
Band Edge 802.11g 2462MHz Ref



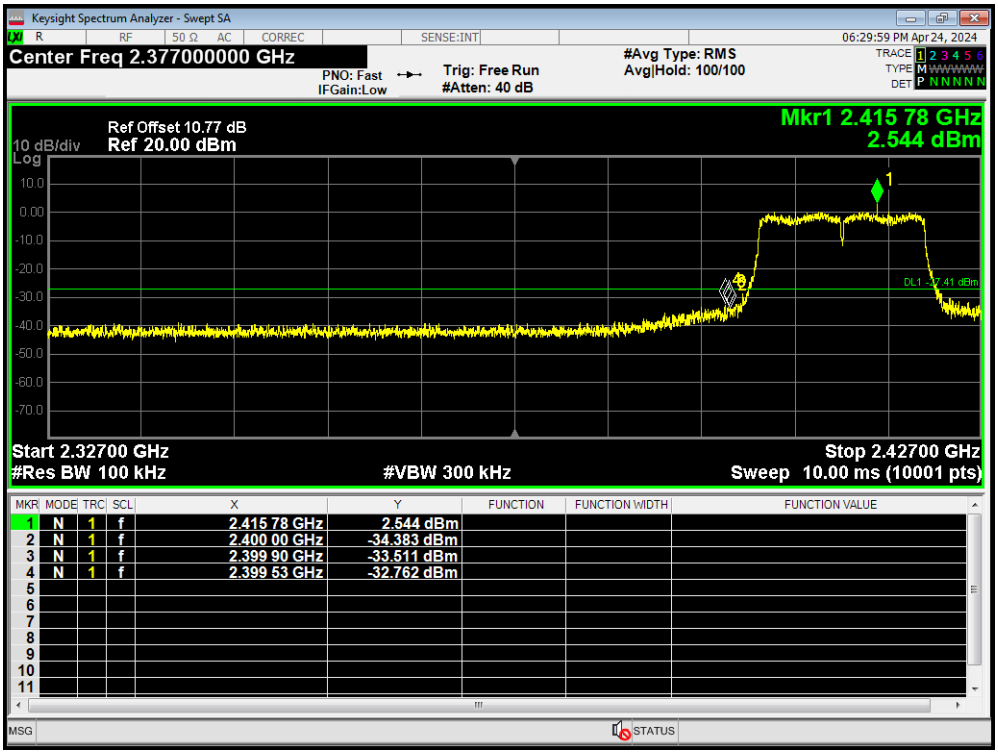
Band Edge 802.11g 2462MHz Emission



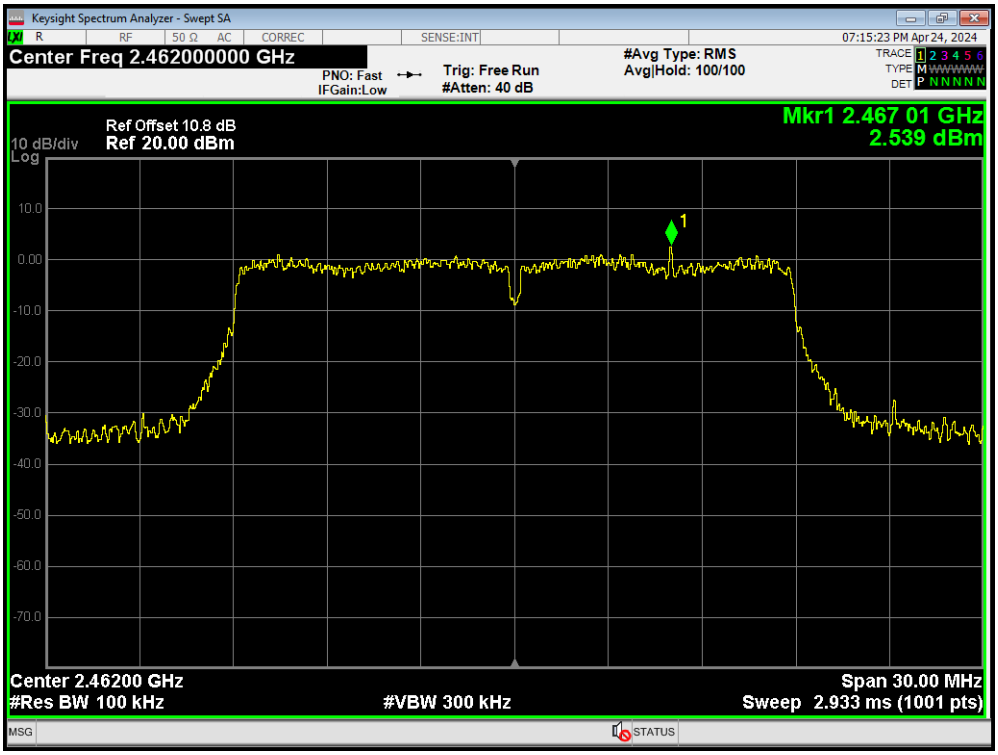
Band Edge 802.11n(HT20) 2412MHz Ref



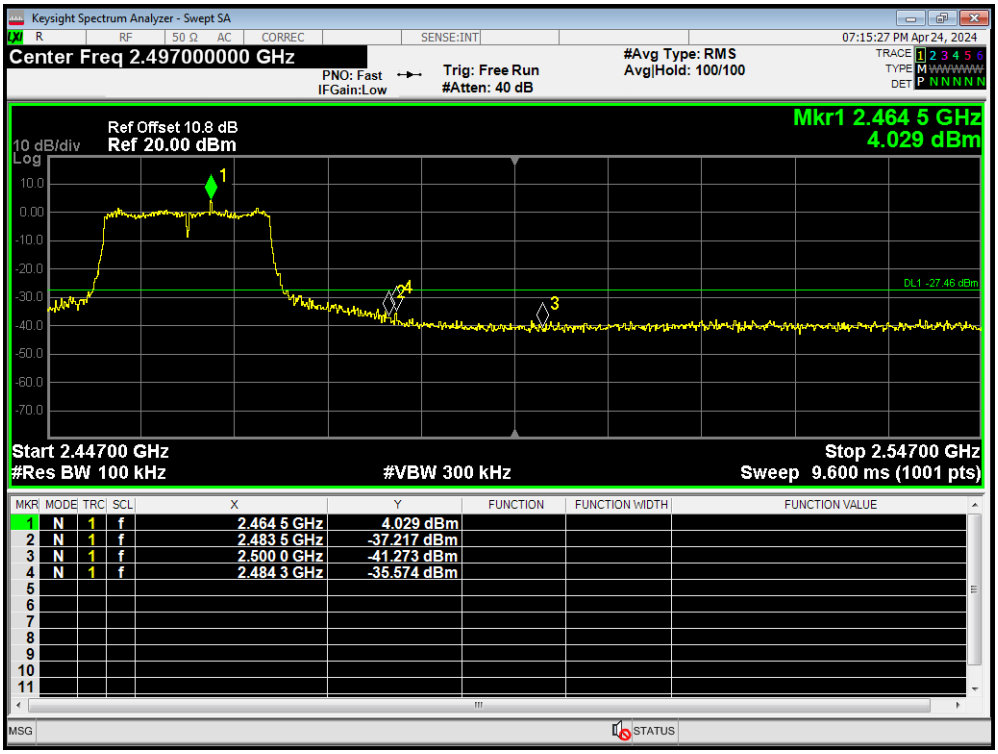
Band Edge 802.11n(HT20) 2412MHz Emission



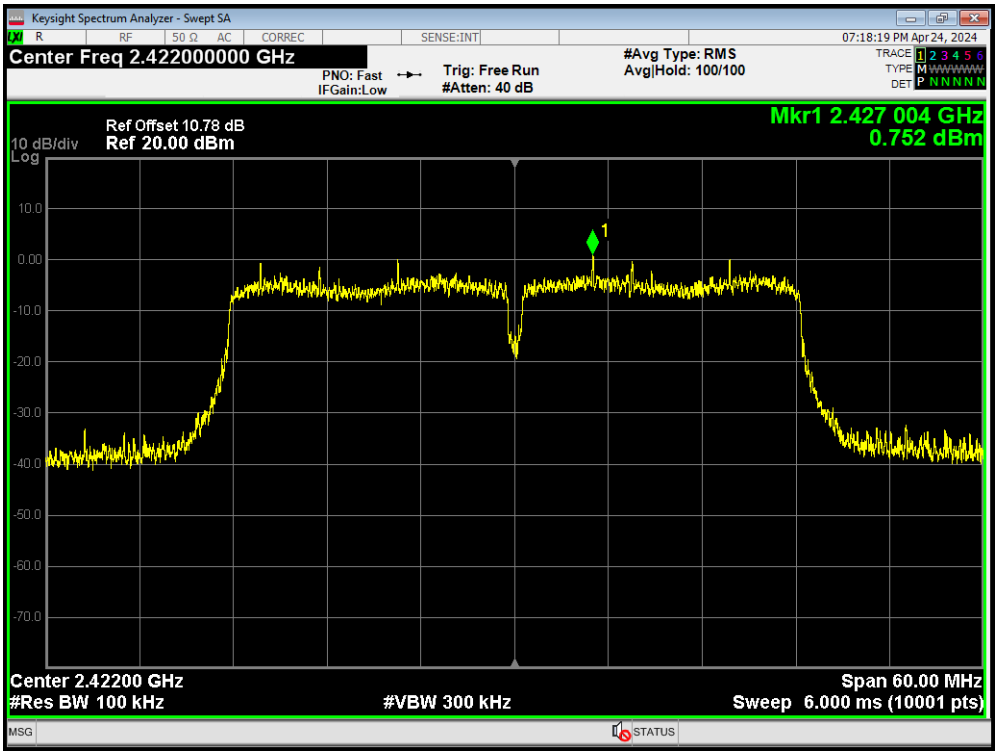
Band Edge 802.11n(HT20) 2462MHz Ref



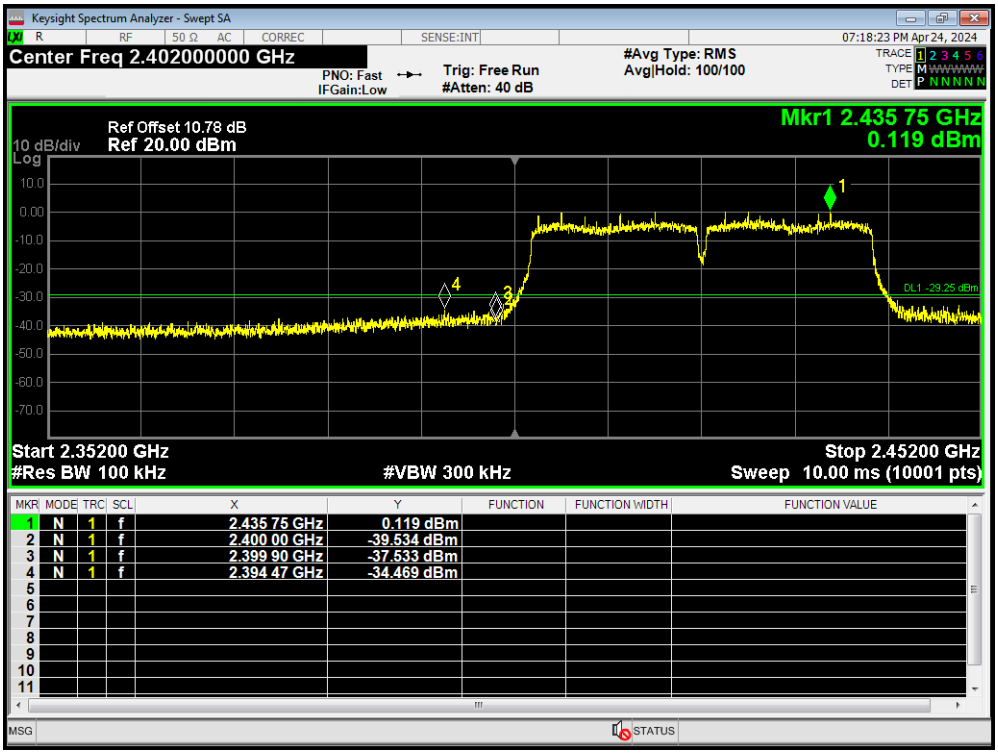
Band Edge 802.11n(HT20) 2462MHz Emission



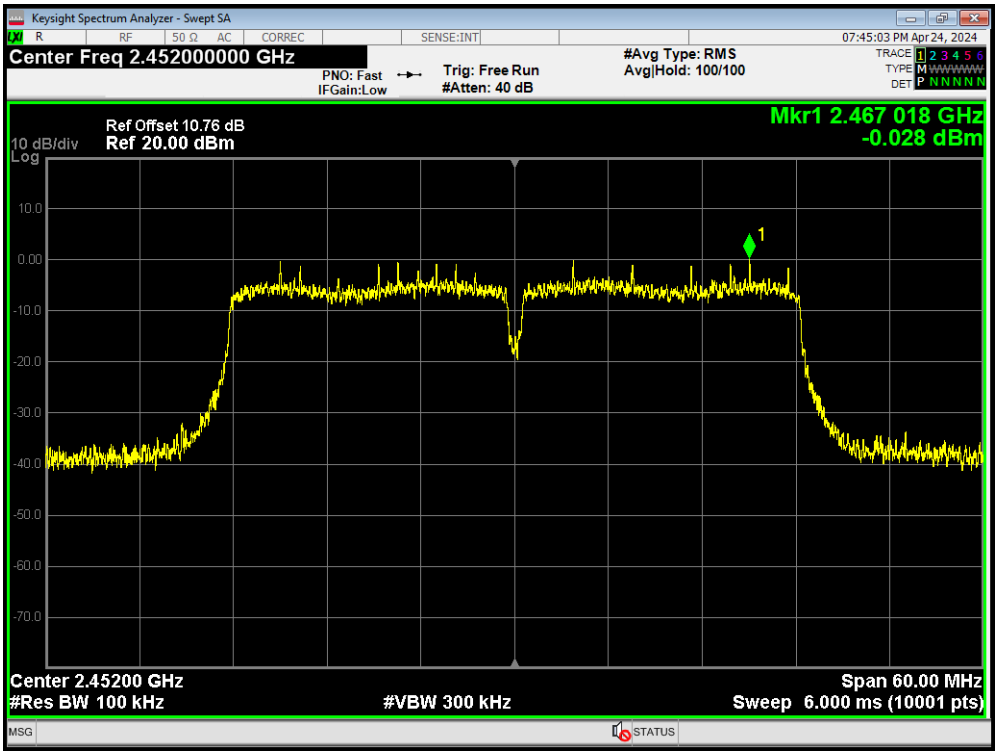
Band Edge 802.11n(HT40) 2422MHz Ref



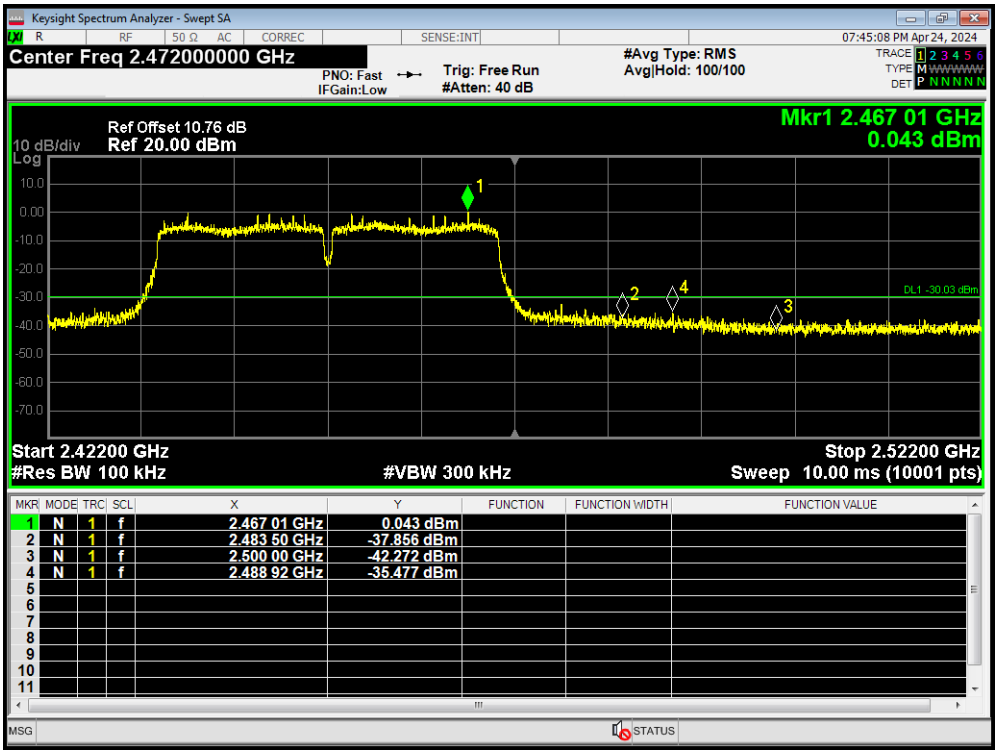
Band Edge 802.11n(HT40) 2422MHz Emission



Band Edge 802.11n(HT40) 2452MHz Ref



Band Edge 802.11n(HT40) 2452MHz Emission



5.4. Power Spectral Density

Ambient Condition

Temperature	Relative humidity
15°C ~ 35°C	20% ~ 80%

Method of Measurement

During the process of the testing, The EUT was connected to Spectrum Analyzer with a known loss. The EUT is max power transmission with proper modulation.

Method AVGPSD-1 was used for this test.

a) Set instrument center frequency to DTS channel center frequency

b) Set span to at least 1.5 times the OBW

c) Set RBW to:3kHz≤RBW≤100kHz

d) Set VBW≥[3x RBW]

e) Detector=power averaging (rms) or sample detector (when rms not available)

f) Ensure that the number of measurement points in the sweep ≥ [2 X span/RBW]

g) Sweep time auto couple

h) Employ trace averaging (rms) mode over a minimum of 100 traces

i) Use the peak marker function to determine the maximum amplitude level.

j) If the measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced)

Method AVGPSD-2 was used for this test.

a) Measure the duty cycle (D)of the transmitter output signal as described in 11.6

b) Set instrument center frequency to DTS channel center frequency

c) Set span to at least 1.5 times the OBW

d) Set RBW to:3kHz≤RBW≤100kHz

e) Set VBW≥[3x RBW]

f) Detector= power averaging (rms) or sample detector (when rms not available)

g) Ensure that the number of measurement points in the sweep ≥ [2 X span/RBW]

h) Sweep time =auto couple

i) Do not use sweep triggering; allow sweep to "free run”

j) Employ trace averaging (rms) mode over a minimum of 100 traces

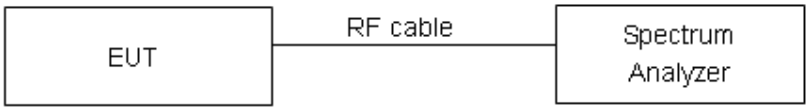
k) Use the peak marker function to determine the maximum amplitude level

l) Add [10 log(1/ D)], where D is the duty cycle measured in step a), to the measured PSD to compute the average PSD during the actual transmission time

m) If measured value exceeds requirement specified by regulatory agency then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced)

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

Test setup



Limits

Rule Part 15.247(e) specifies that" For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. ''

Limits	≤ 8 dBm / 3kHz

Measurement Uncertainty

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

Test Results:

SISO Antenna 1

Test Mode	Carrier frequency (MHz) / Channel	Read Value (dBm / 30kHz)	Power Spectral Density (dBm / 3kHz)	Limit (dBm / 3kHz)	Conclusion
802.11b	2412/CH 1	-2.82	-12.82	8	PASS
	2437/CH 6	-2.55	-12.55	8	PASS
	2462/CH11	-2.33	-12.33	8	PASS
802.11g	2412/CH 1	-10.06	-19.76	8	PASS
	2437/CH 6	-9.32	-19.02	8	PASS
	2462/CH11	-9.30	-19.00	8	PASS
802.11n HT20	2412/CH 1	-9.96	-19.87	8	PASS
	2437/CH 6	-9.99	-19.90	8	PASS
	2462/CH11	-9.74	-19.65	8	PASS
802.11n HT40	2422/CH3	-13.12	-22.93	8	PASS
	2437/CH6	-11.70	-21.51	8	PASS
	2452/CH9	-13.74	-23.55	8	PASS
802.11ax HE20	2412/CH 1	-11.25	-19.12	8	PASS
	2437/CH 6	-7.78	-15.65	8	PASS
	2462/CH11	-7.76	-15.63	8	PASS
802.11ax HE40	2422/CH3	-14.99	-24.37	8	PASS
	2437/CH6	-9.75	-19.13	8	PASS
	2452/CH9	-14.21	-23.59	8	PASS
Note: Power Spectral Density (dBm/3kHz) =Read Value+Duty cycle correction factor + 10*log10(3/30)					

SISO Antenna 2

Test Mode	Carrier frequency (MHz) / Channel	Read Value (dBm / 30kHz)	Power Spectral Density (dBm / 3kHz)	Limit (dBm / 3kHz)	Conclusion
802.11b	2412/CH 1	-2.82	-12.82	8	PASS
	2437/CH 6	-2.61	-12.61	8	PASS
	2462/CH11	-2.12	-12.12	8	PASS
802.11g	2412/CH 1	-10.03	-19.73	8	PASS
	2437/CH 6	-9.59	-19.29	8	PASS
	2462/CH11	-9.72	-19.42	8	PASS
802.11n HT20	2412/CH 1	-10.22	-20.13	8	PASS
	2437/CH 6	-9.90	-19.81	8	PASS
	2462/CH11	-8.87	-18.78	8	PASS
802.11n HT40	2422/CH3	-12.86	-22.67	8	PASS
	2437/CH6	-11.90	-21.71	8	PASS
	2452/CH9	-13.65	-23.46	8	PASS
802.11ax HE20	2412/CH 1	-12.43	-20.30	8	PASS
	2437/CH 6	-7.30	-15.17	8	PASS
	2462/CH11	-8.44	-16.31	8	PASS
802.11ax HE40	2422/CH3	-14.50	-23.88	8	PASS
	2437/CH6	-8.92	-18.30	8	PASS
	2452/CH9	-14.10	-23.48	8	PASS
Note: Power Spectral Density (dBm/3kHz) =Read Value+Duty cycle correction factor + 10*log10(3/30)					

MIMO

Test Mode	Carrier frequency (MHz)/ Channel	Power Spectral Density				Total PSD (dBm / 3kHz)	Limit (dBm / 3kHz)	Conclusion
		Antenna 1		Antenna 2				
		Read Value (dBm / 30kHz)	Power Spectral Density (dBm / 3kHz)	Read Value (dBm / 30kHz)	Power Spectral Density (dBm / 3kHz)			
802.11n HT20	2412/CH 1	-10.35	-9.91	-8.66	-9.91	-6.90	6.57	PASS
	2437/CH 6	-10.08	-9.91	-8.76	-9.91	-6.90	6.57	PASS
	2462/CH11	-9.65	-9.91	-9.94	-9.91	-6.90	6.57	PASS
802.11n HT40	2422/CH3	-13.46	-9.81	-11.64	-9.81	-6.80	6.57	PASS
	2437/CH6	-11.82	-9.81	-11.69	-9.81	-6.80	6.57	PASS
	2452/CH9	-14.16	-9.81	-12.69	-9.81	-6.80	6.57	PASS
802.11ax HE20	2412/CH 1	-11.26	-7.87	-11.43	-7.87	-4.86	6.57	PASS
	2437/CH 6	-7.52	-7.87	-7.60	-7.87	-4.86	6.57	PASS
	2462/CH11	-9.63	-7.87	-9.96	-7.87	-4.86	6.57	PASS
802.11ax HE40	2422/CH3	-14.28	-9.38	-15.17	-9.38	-6.37	6.57	PASS
	2437/CH6	-9.72	-9.38	-10.58	-9.38	-6.37	6.57	PASS
	2452/CH9	-14.13	-9.38	-14.88	-9.38	-6.37	6.57	PASS

Note: 1. Power Spectral Density (dBm/3kHz) =Read Value+Duty cycle correction factor + 10*LOG10(3 / 30)

2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density=10log($10^{(\text{PSD antenna1 in dBm/10})}+10^{(\text{PSD antenna2 in dBm/10})}$)

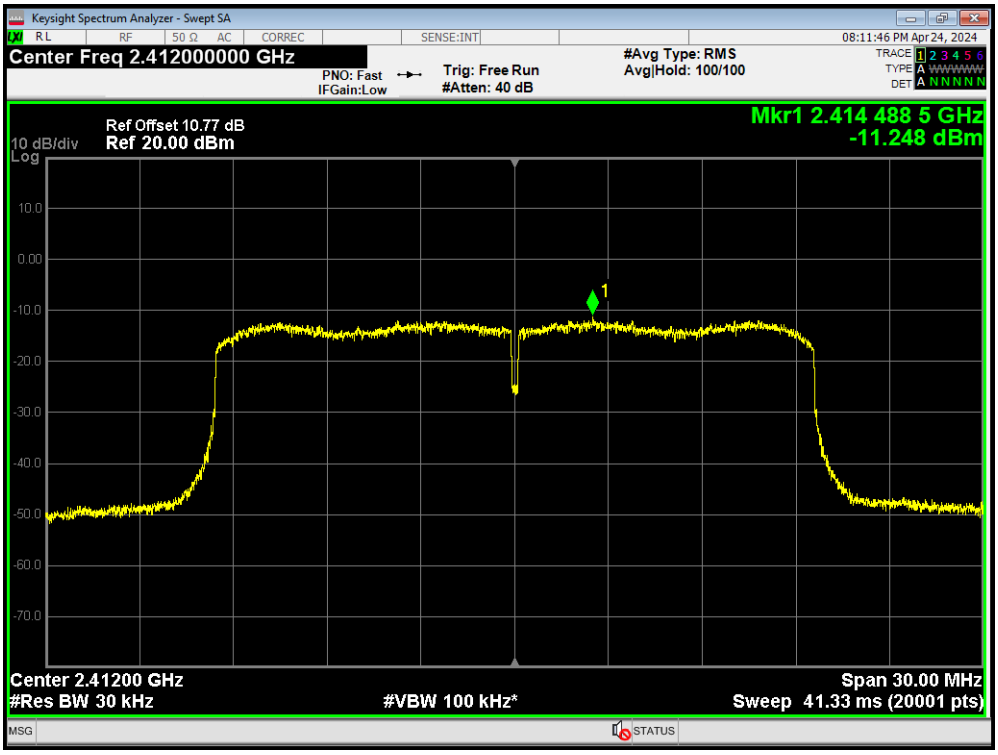
3. According to KDB 662911 D01 Multiple Transmitter Output v02r01 F)2)f)(ii): If antenna gains are not equal, the user may use either of the following methods to calculate directional gain, provided that each transmit antenna is driven by only one spatial stream: Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain.

Directional gain = $G_{ANT\ MAX}$ + Array Gain. For PSD measurements on all devices, Array Gain=10log(Nant/Nss)dB, so directional gain=$G_{ANT\ MAX}$+Array Gain=4.42 +10log(2/1)=7.43 >6dBi.

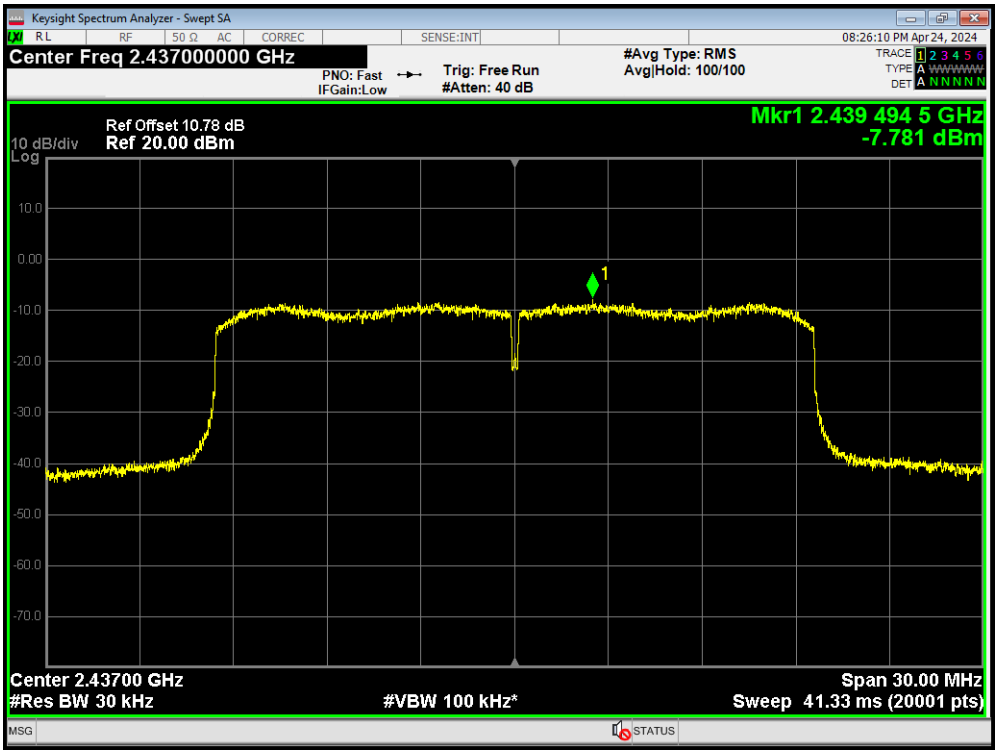
So the PSD limit is 8-(directional gain - 6) dBm=6.57 dBm

SISO Antenna 1

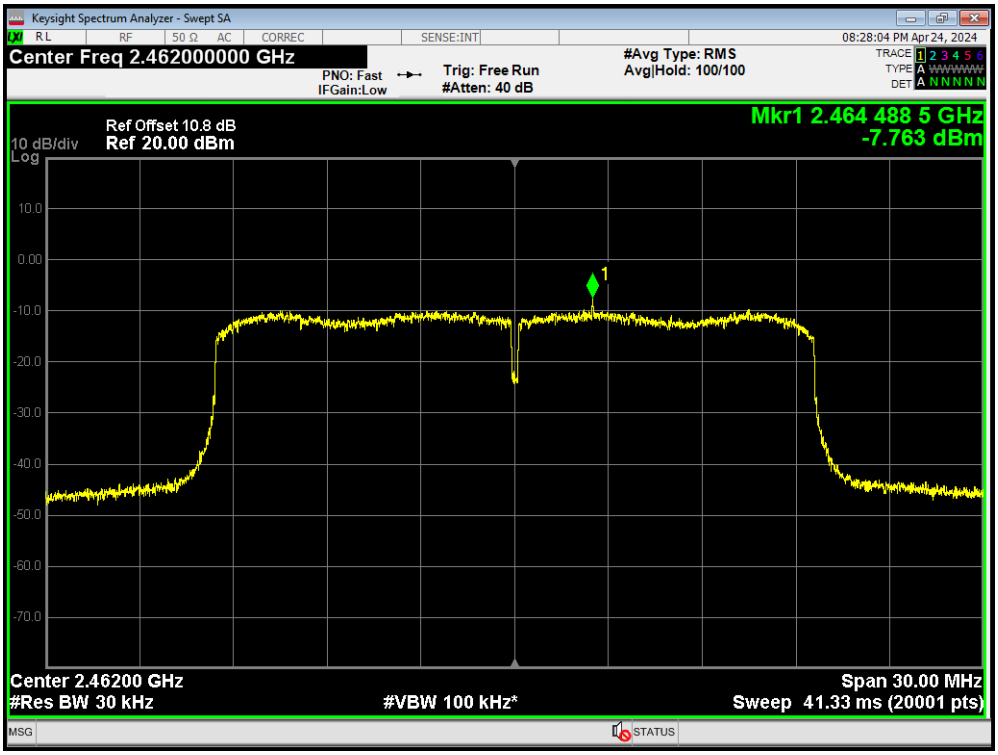
PSD 802.11ax(HE20) 2412MHz



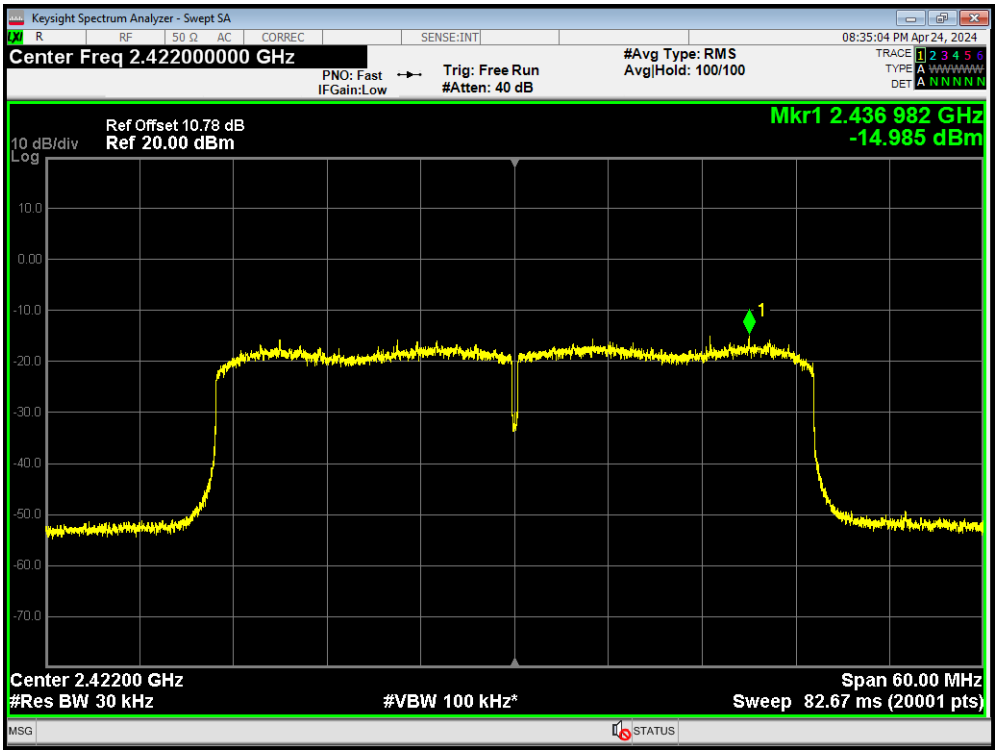
PSD 802.11ax(HE20) 2437MHz



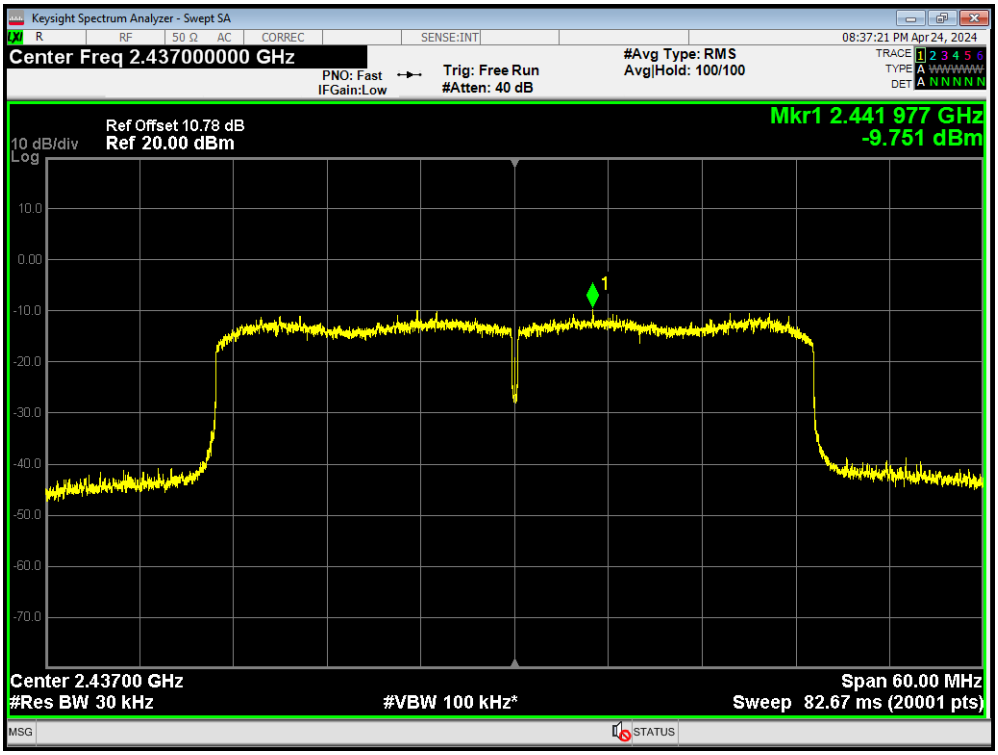
PSD 802.11ax(HE20) 2462MHz



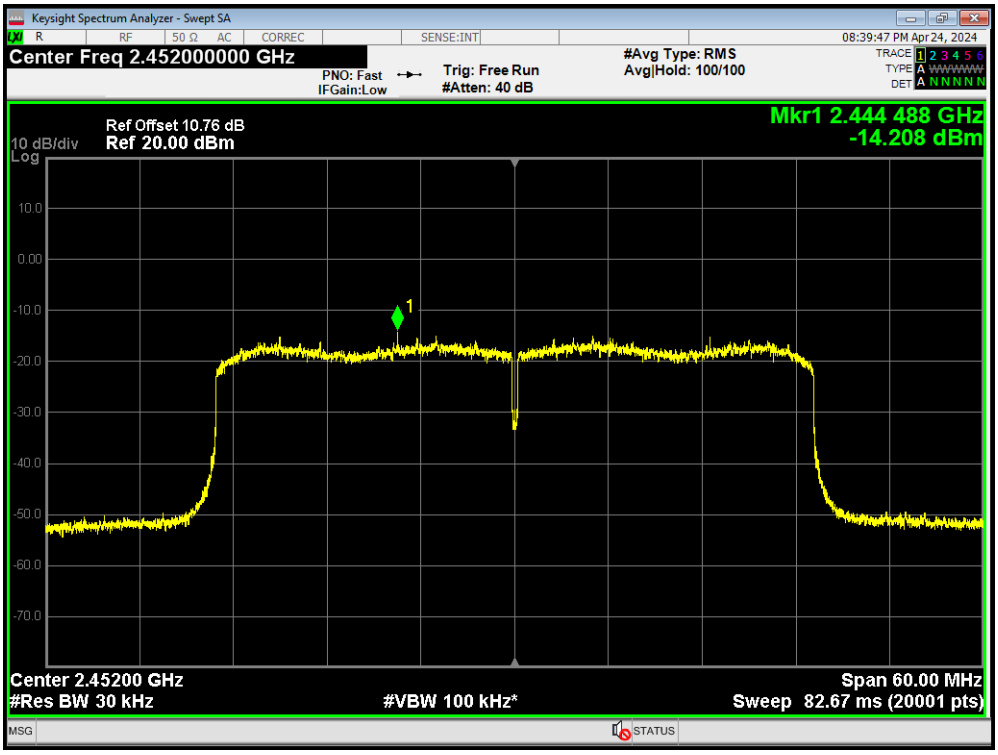
PSD 802.11ax(HE40) 2422MHz



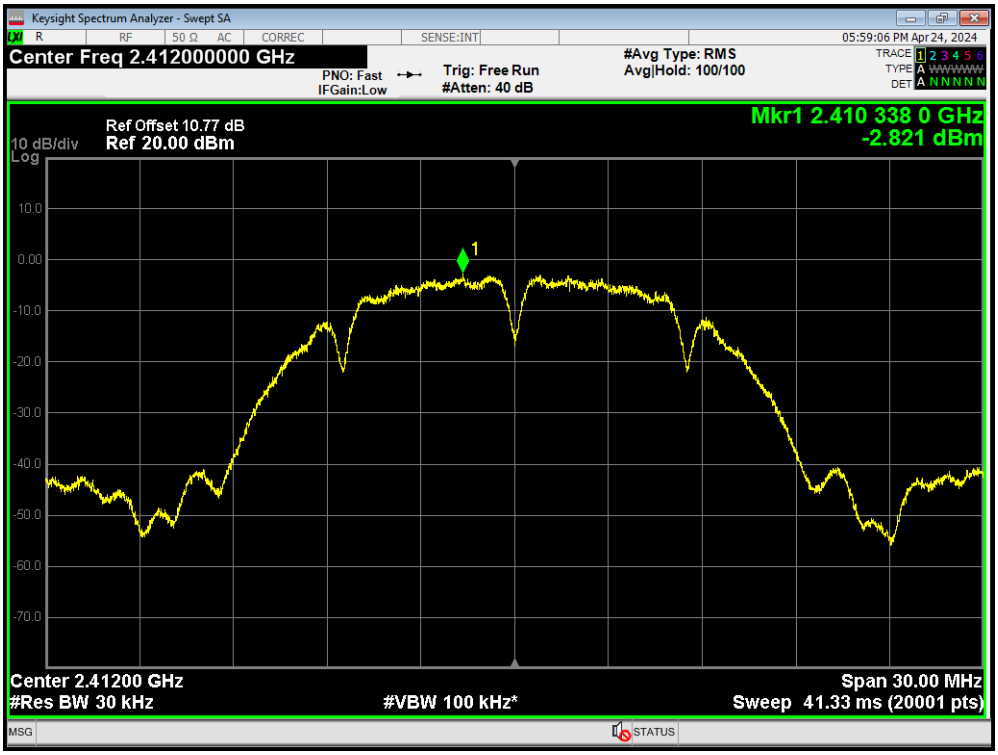
PSD 802.11ax(HE40) 2437MHz



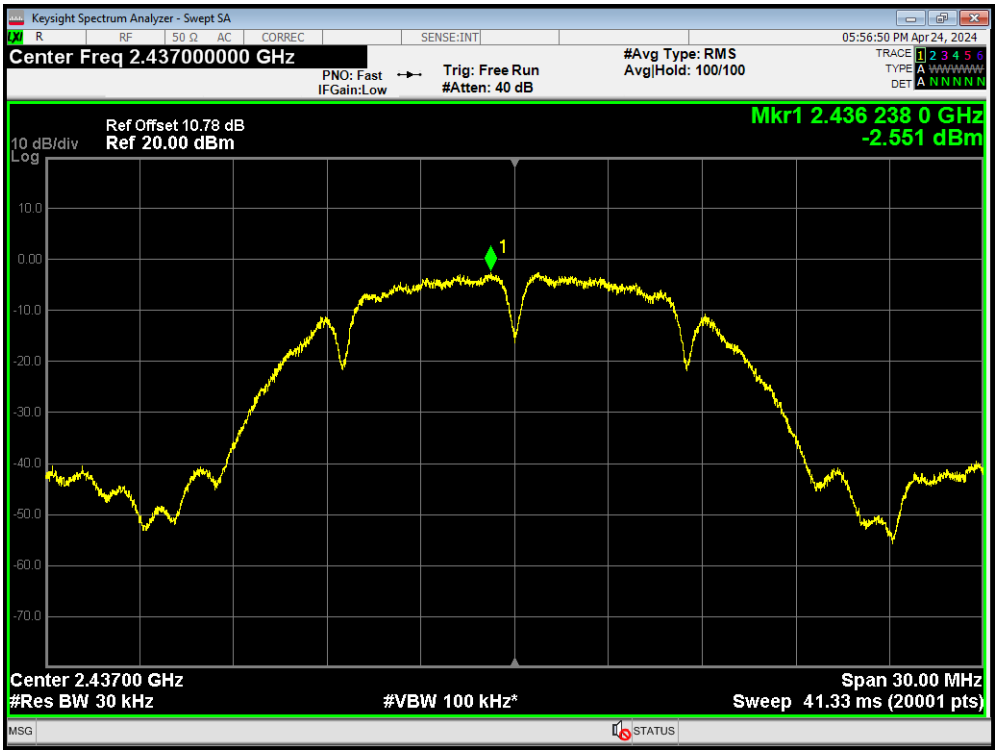
PSD 802.11ax(HE40) 2452MHz



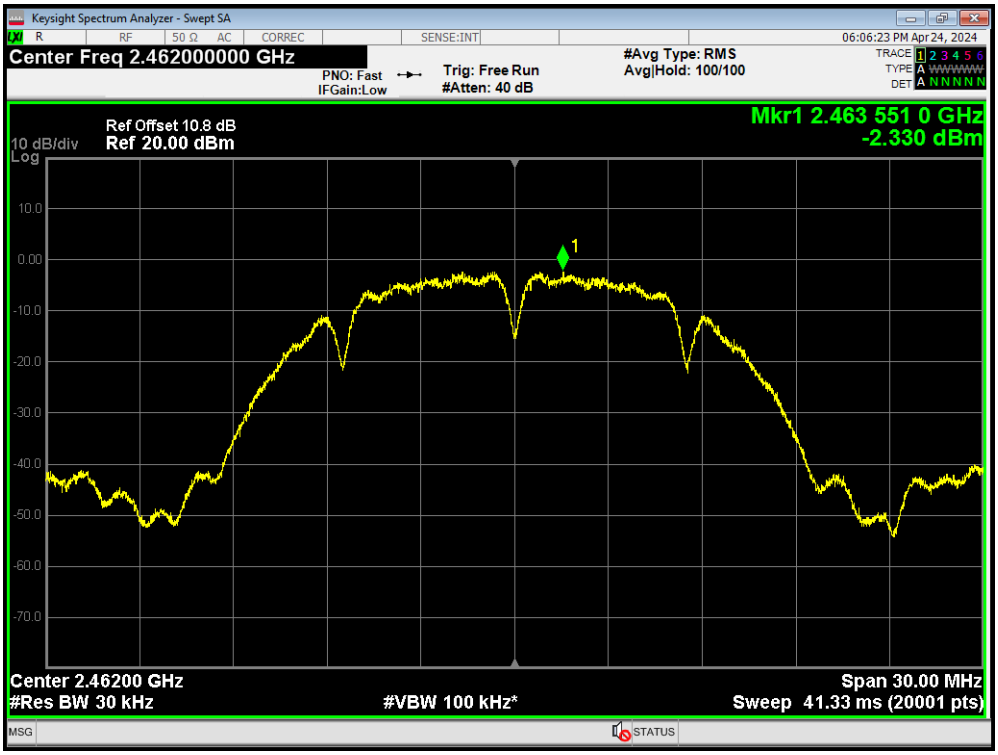
PSD 802.11b 2412MHz



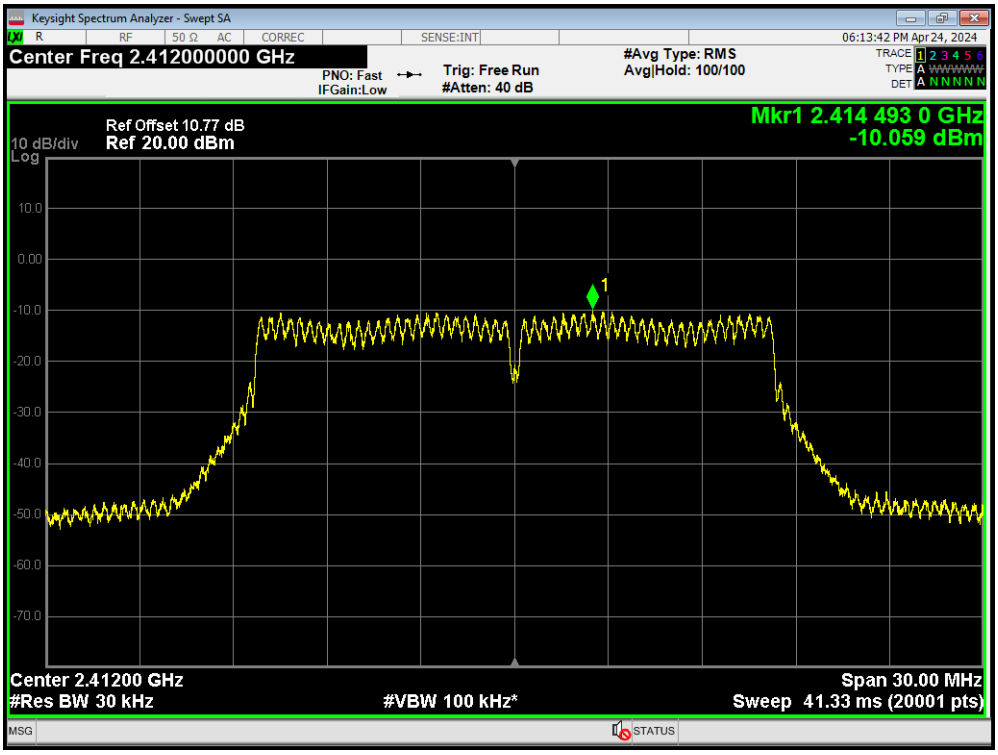
PSD 802.11b 2437MHz



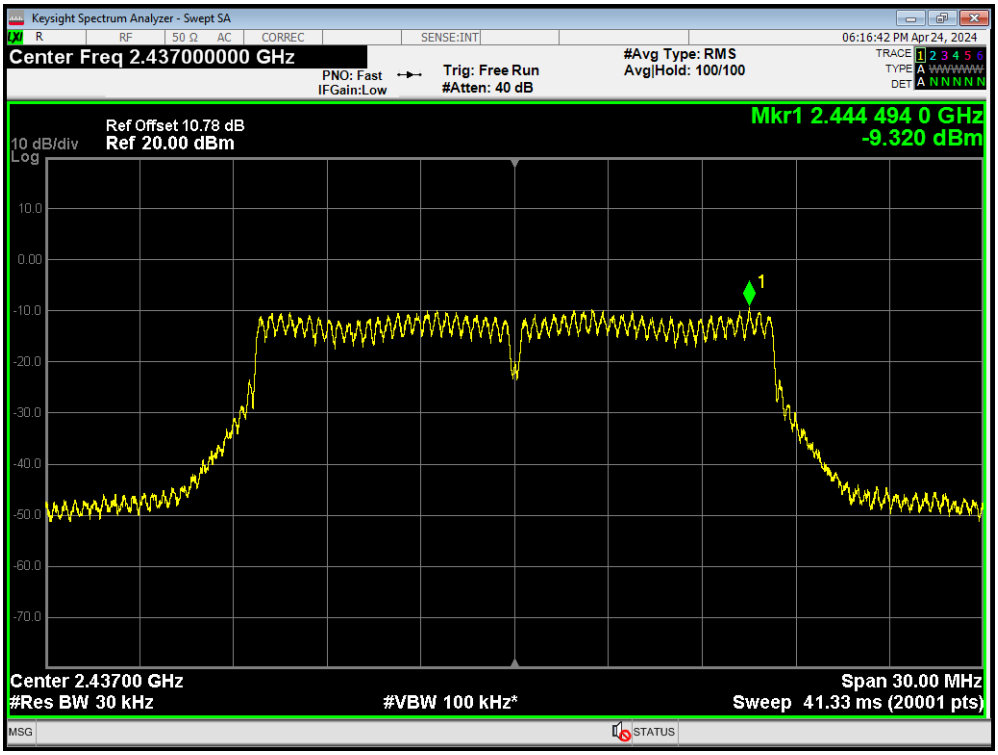
PSD 802.11b 2462MHz



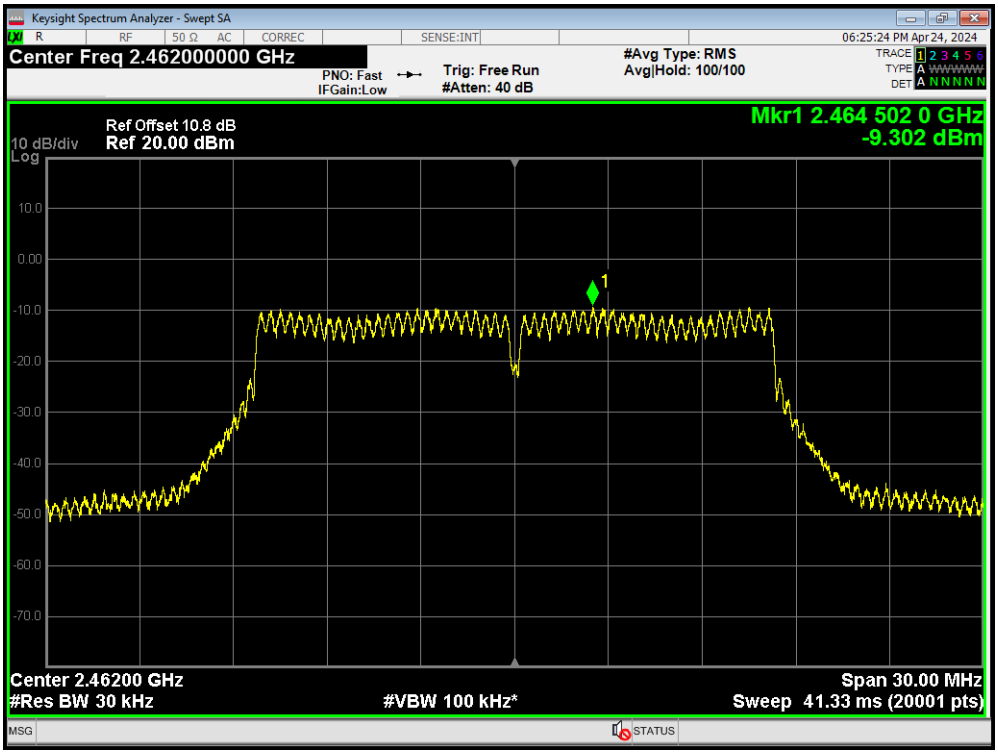
PSD 802.11g 2412MHz



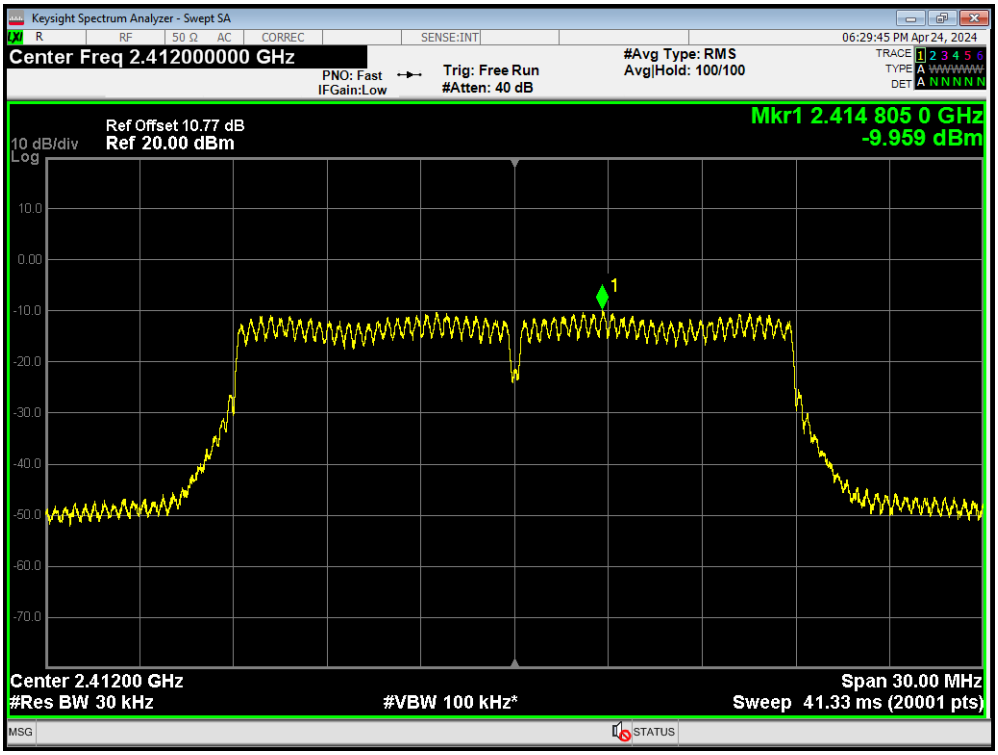
PSD 802.11g 2437MHz



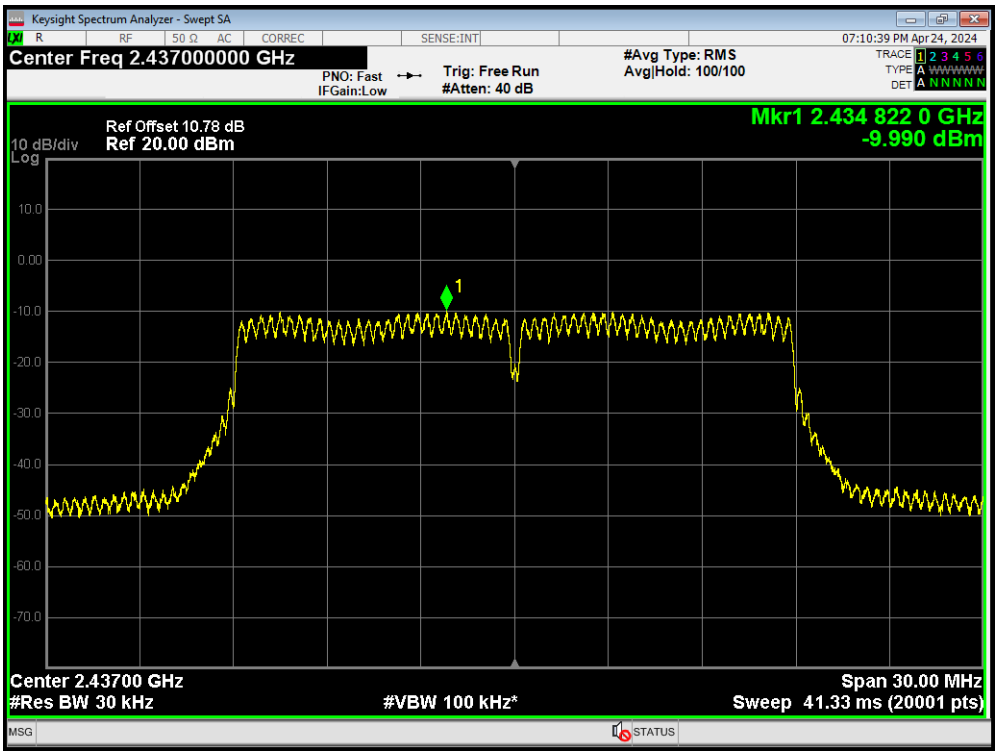
PSD 802.11g 2462MHz



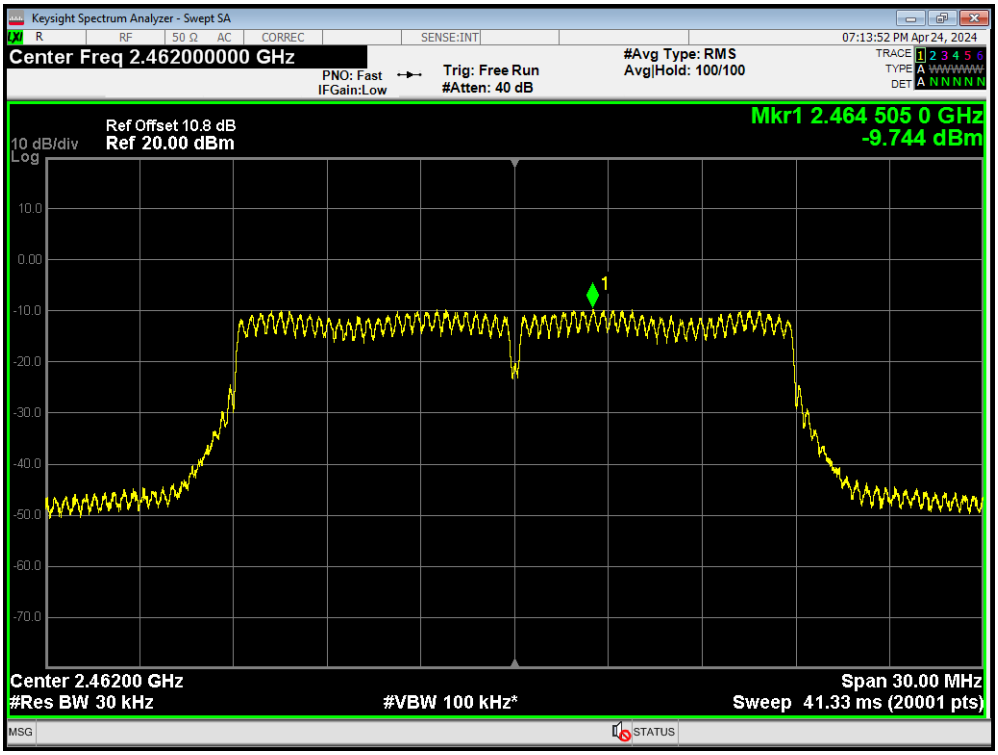
PSD 802.11n(HT20) 2412MHz



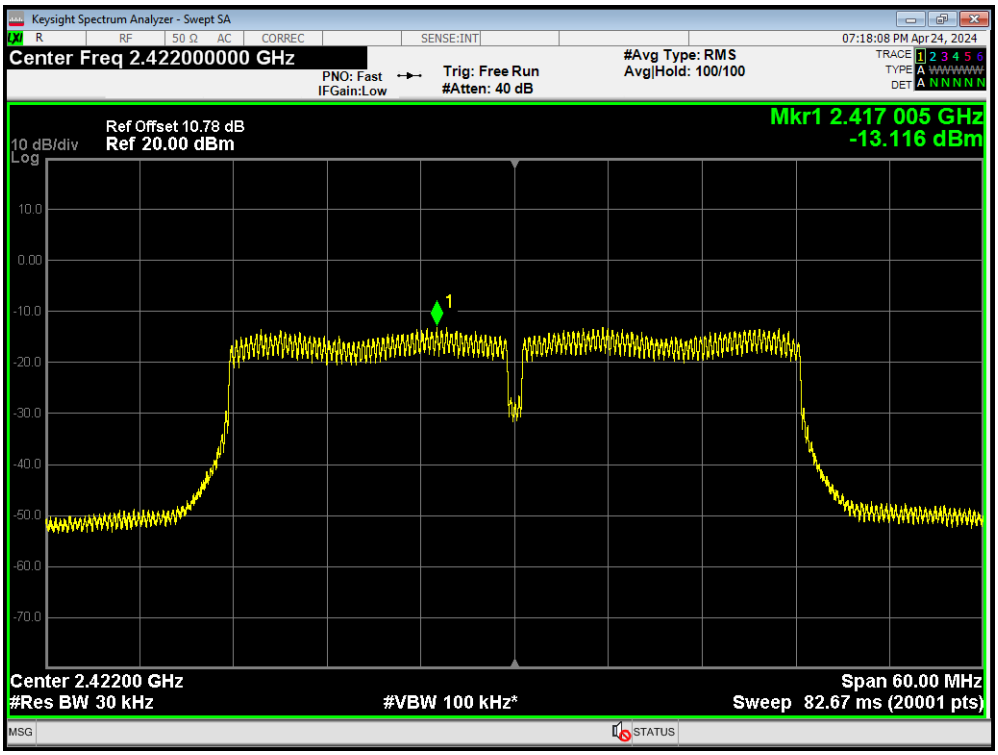
PSD 802.11n(HT20) 2437MHz



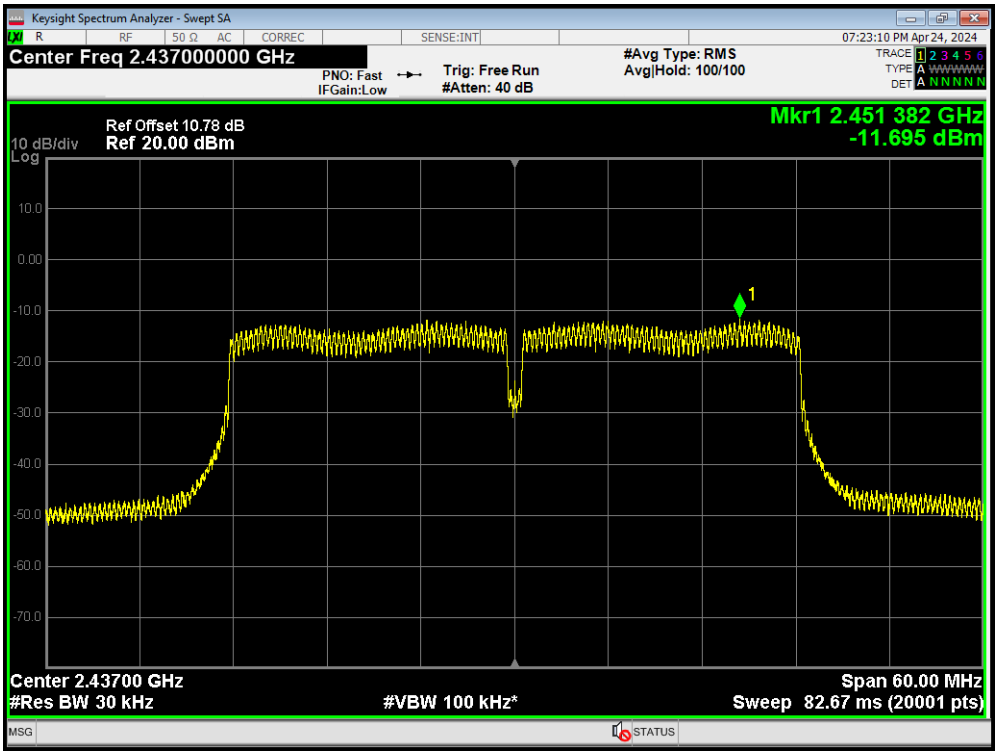
PSD 802.11n(HT20) 2462MHz



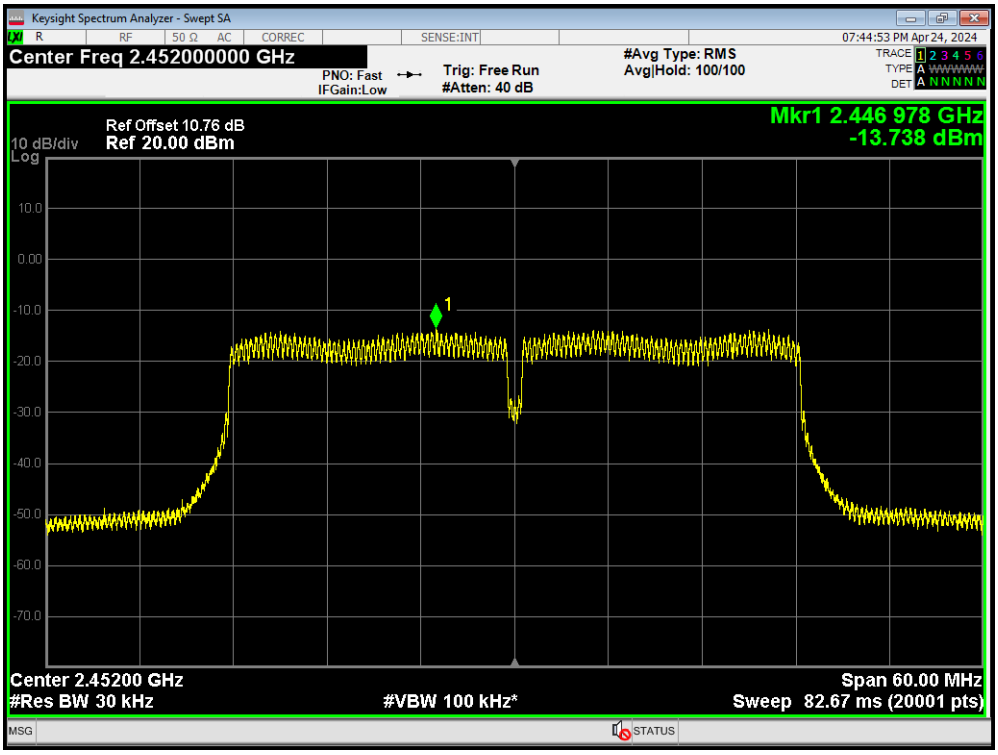
PSD 802.11n(HT40) 2422MHz



PSD 802.11n(HT40) 2437MHz

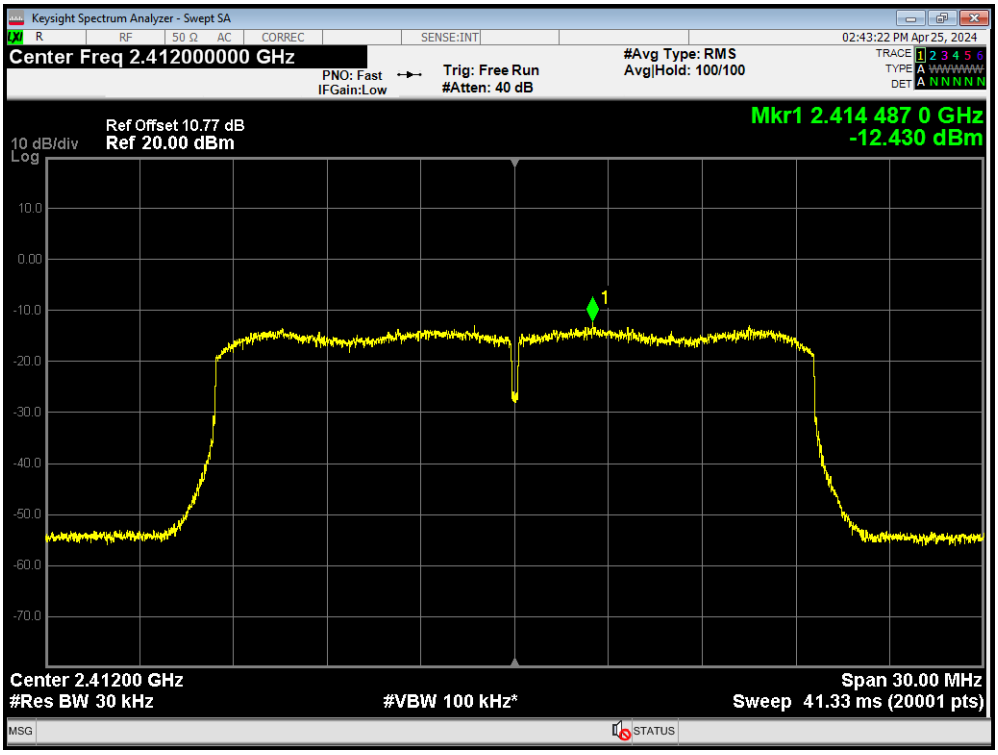


PSD 802.11n(HT40) 2452MHz

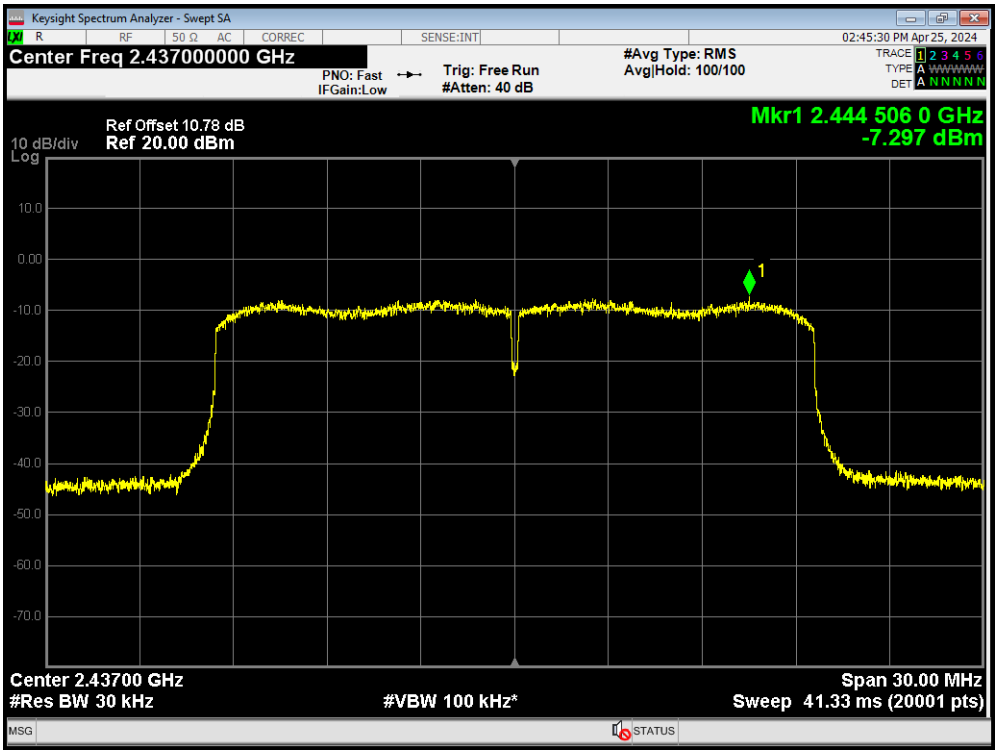


SISO Antenna 2

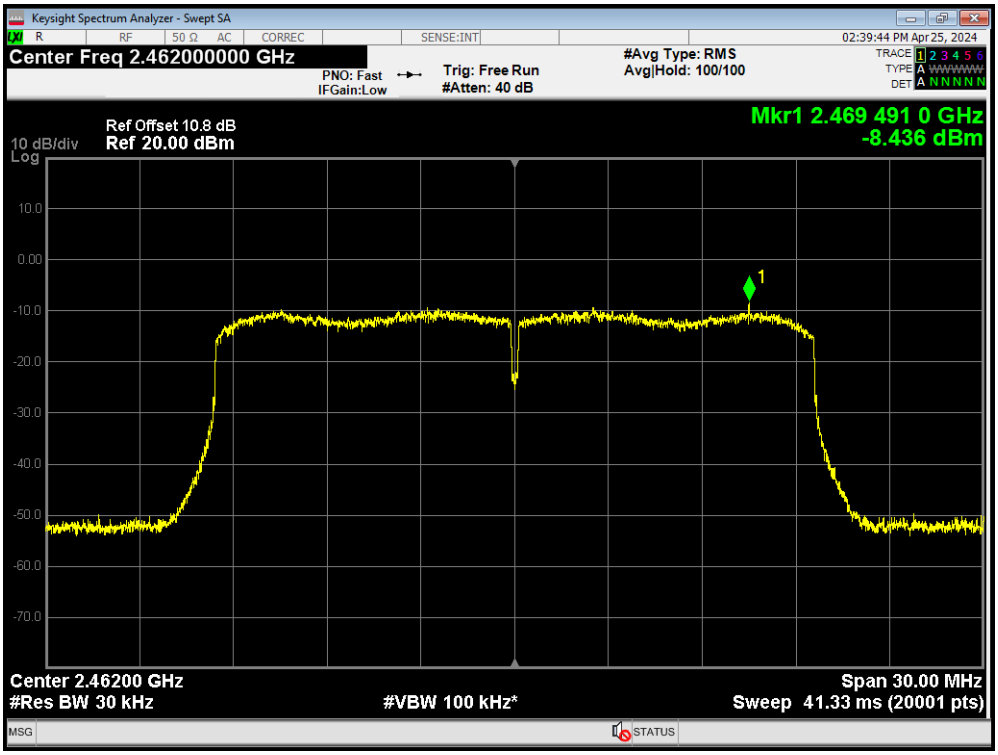
PSD 802.11ax(HE20) 2412MHz



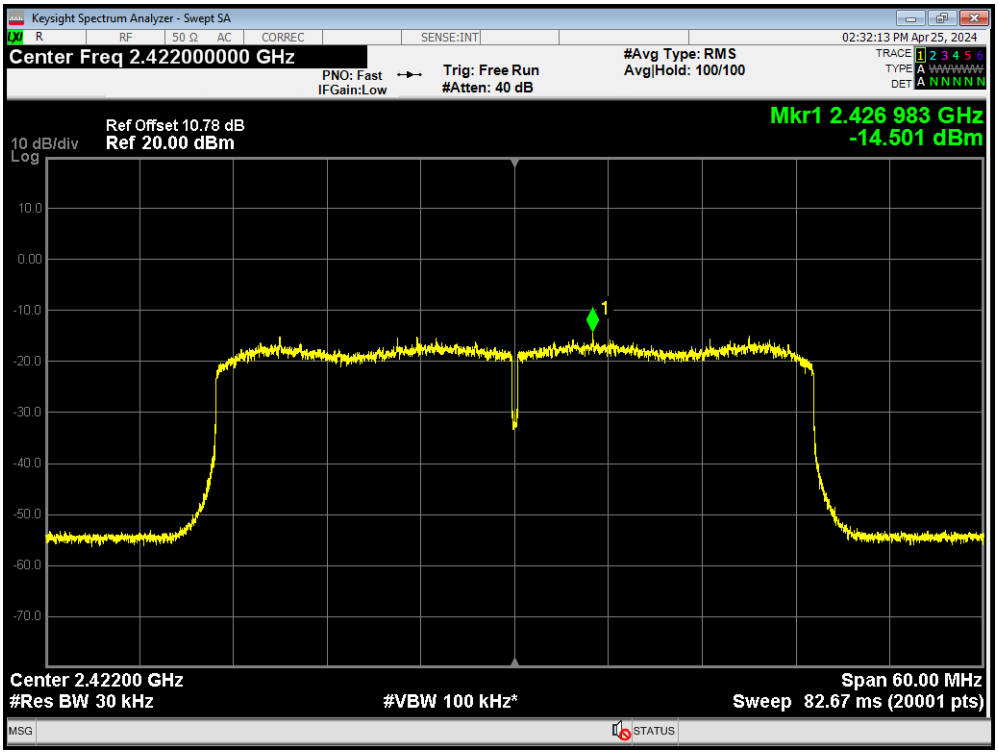
PSD 802.11ax(HE20) 2437MHz



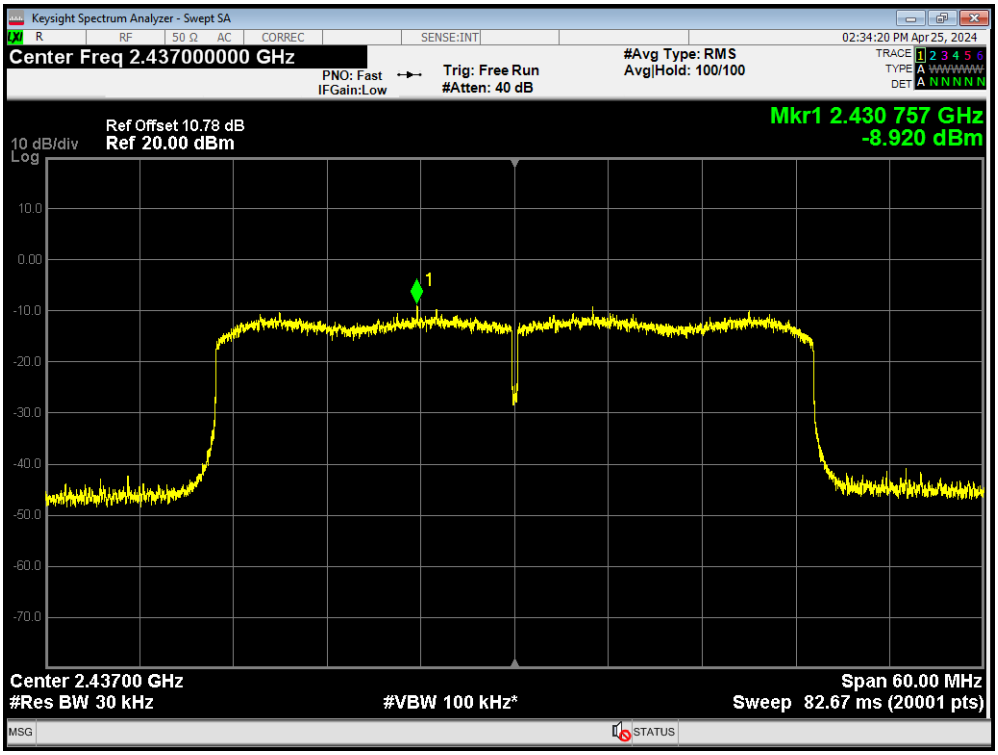
PSD 802.11ax(HE20) 2462MHz



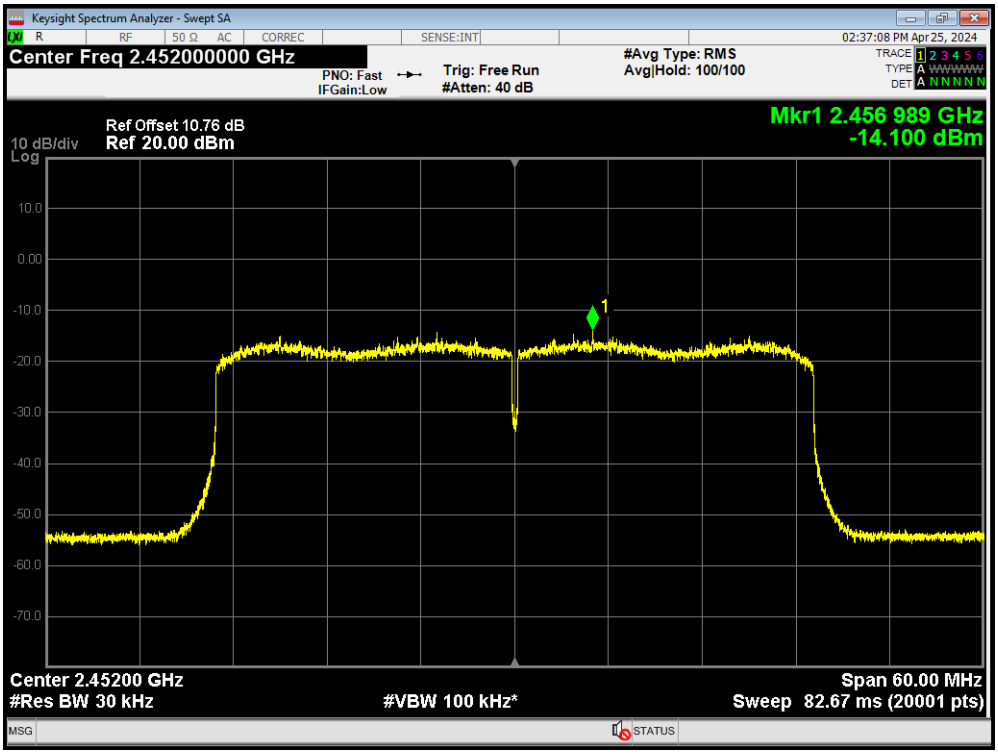
PSD 802.11ax(HE40) 2422MHz



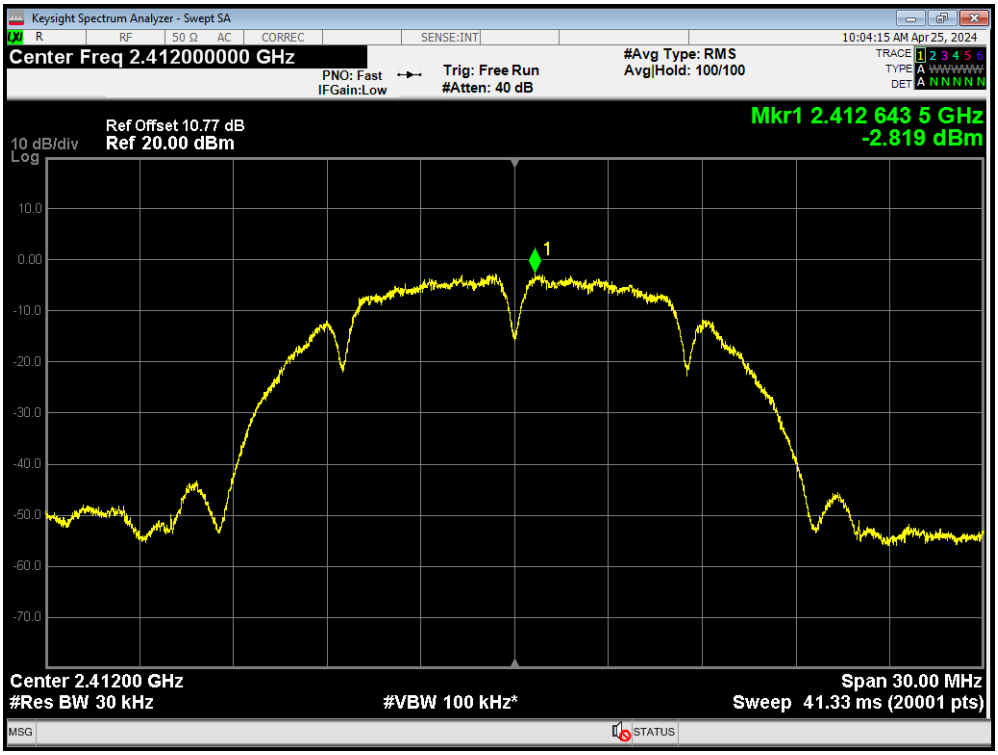
PSD 802.11ax(HE40) 2437MHz



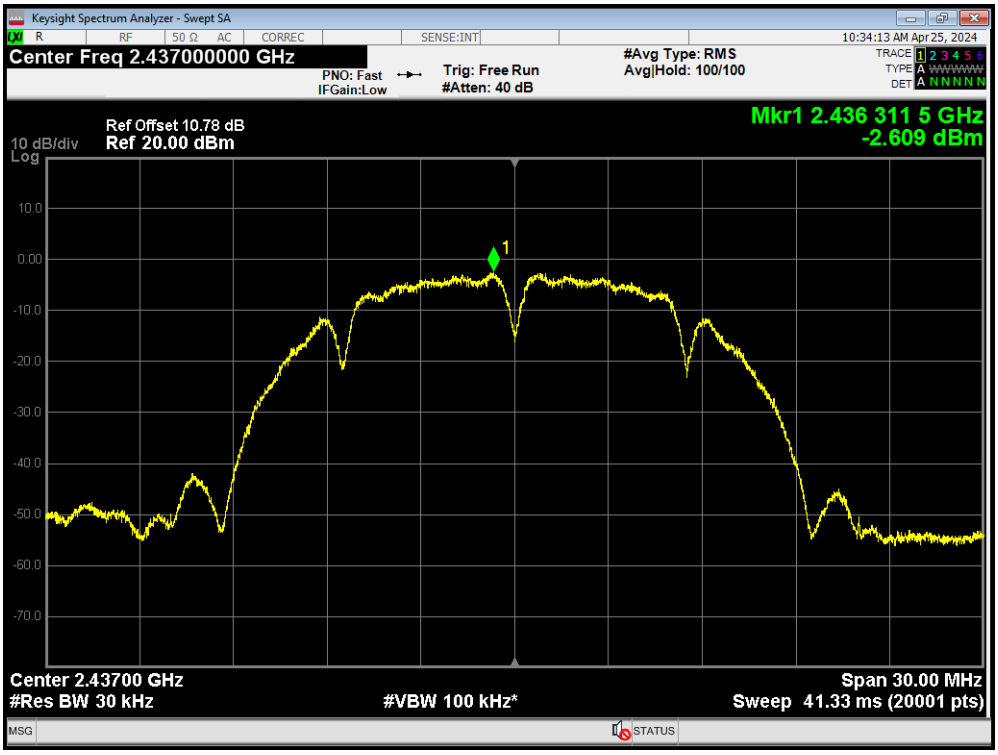
PSD 802.11ax(HE40) 2452MHz



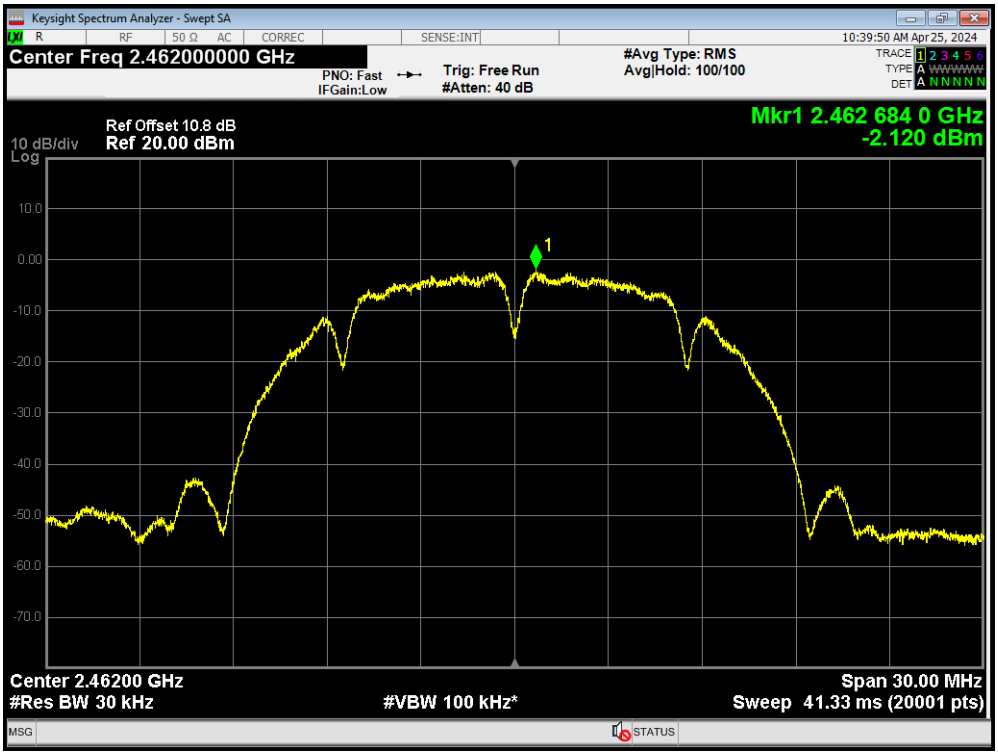
PSD 802.11b 2412MHz



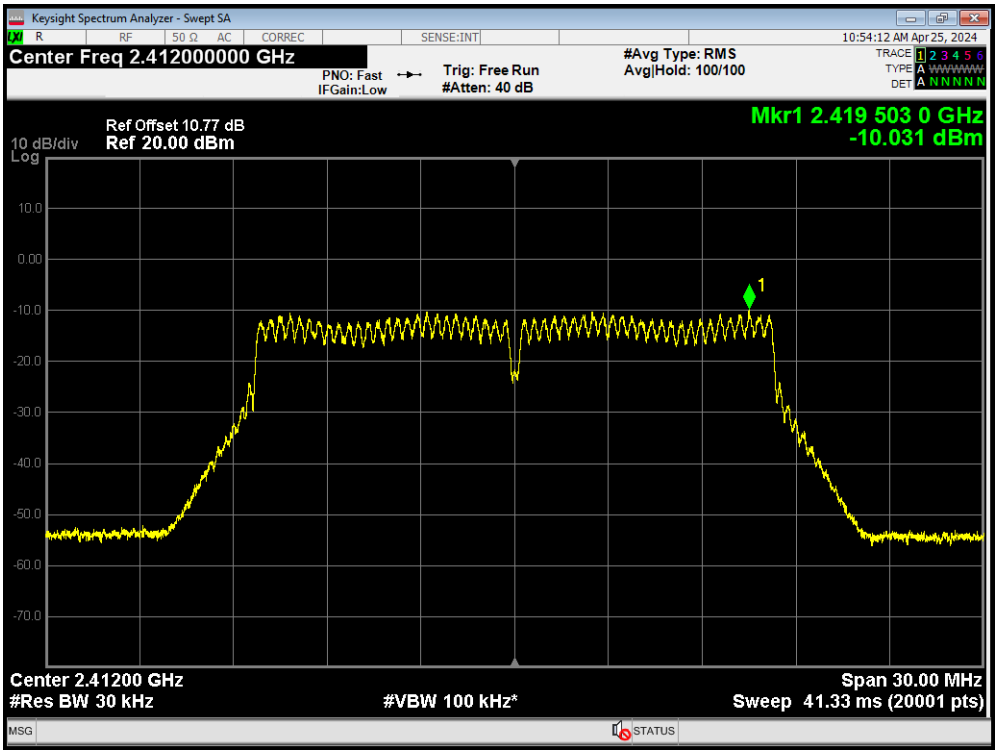
PSD 802.11b 2437MHz



PSD 802.11b 2462MHz



PSD 802.11g 2412MHz



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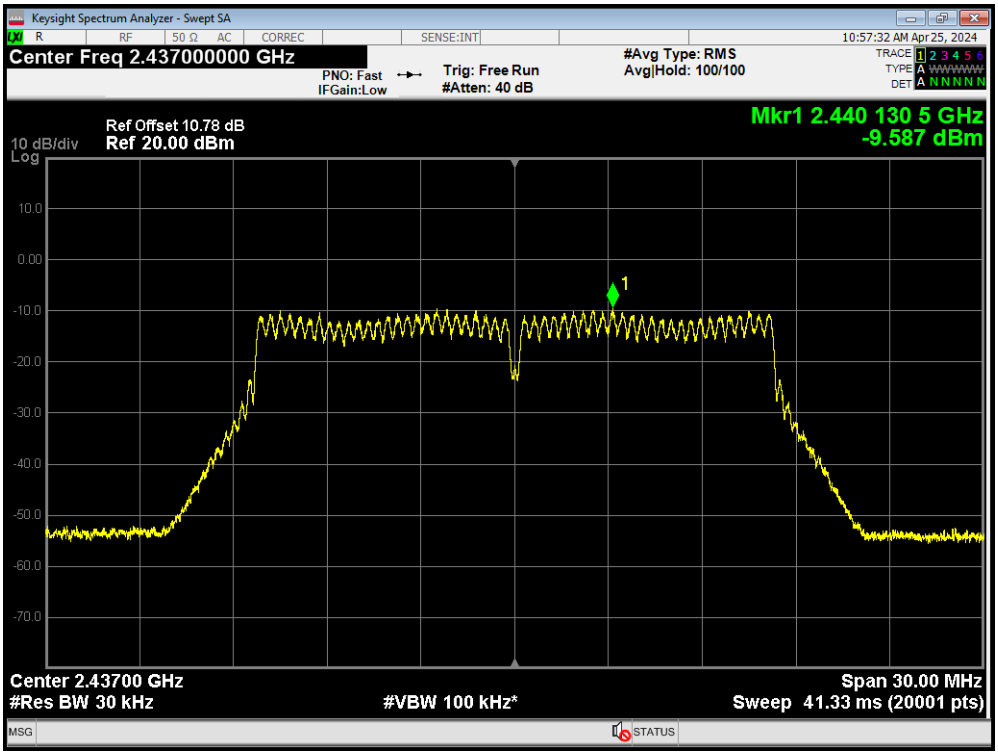
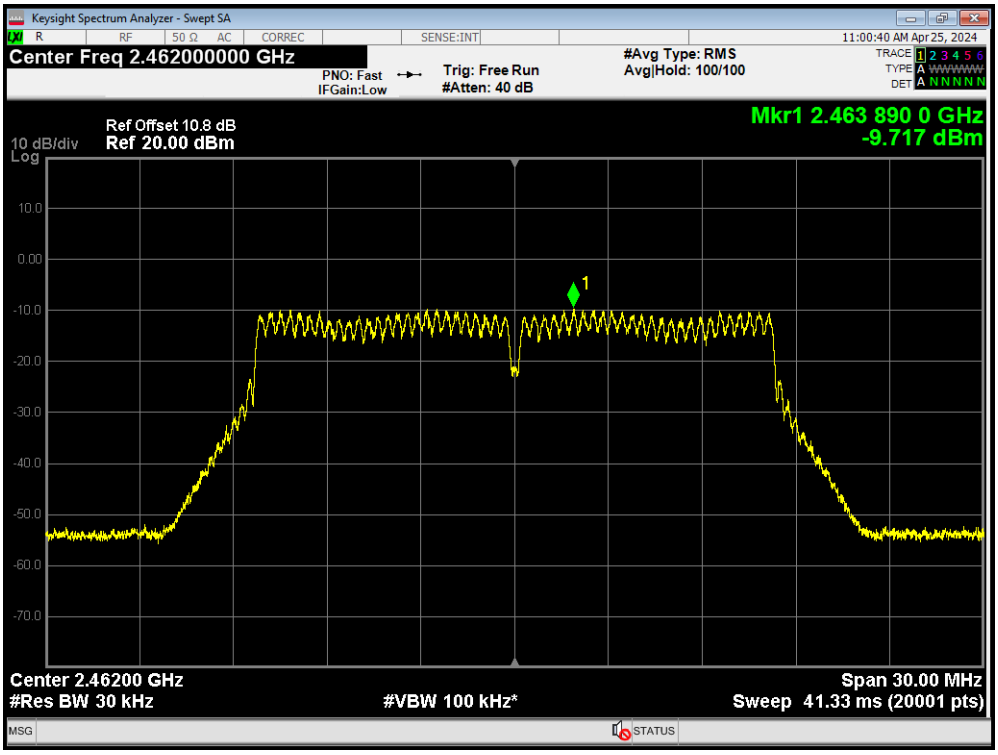
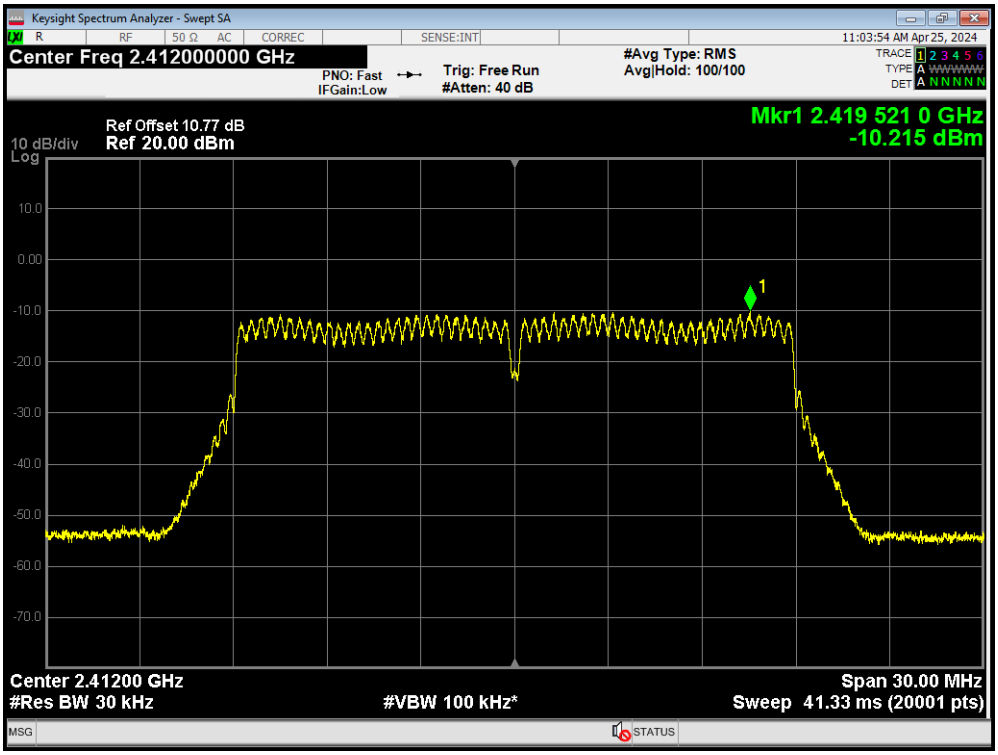


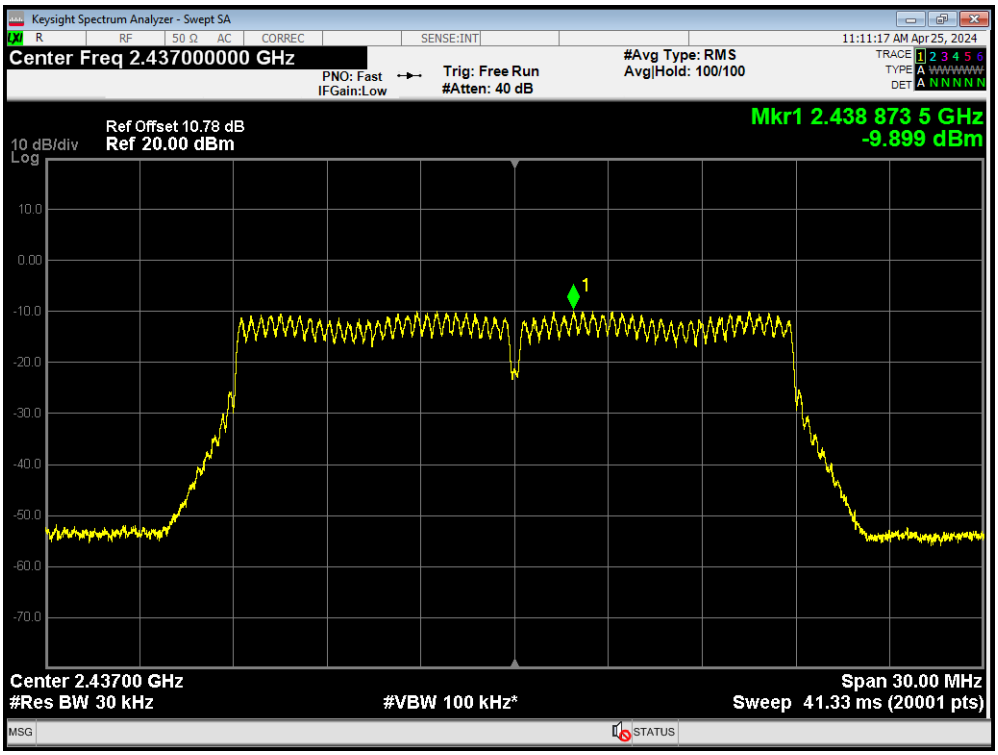
PSD 802.11g 2462MHz



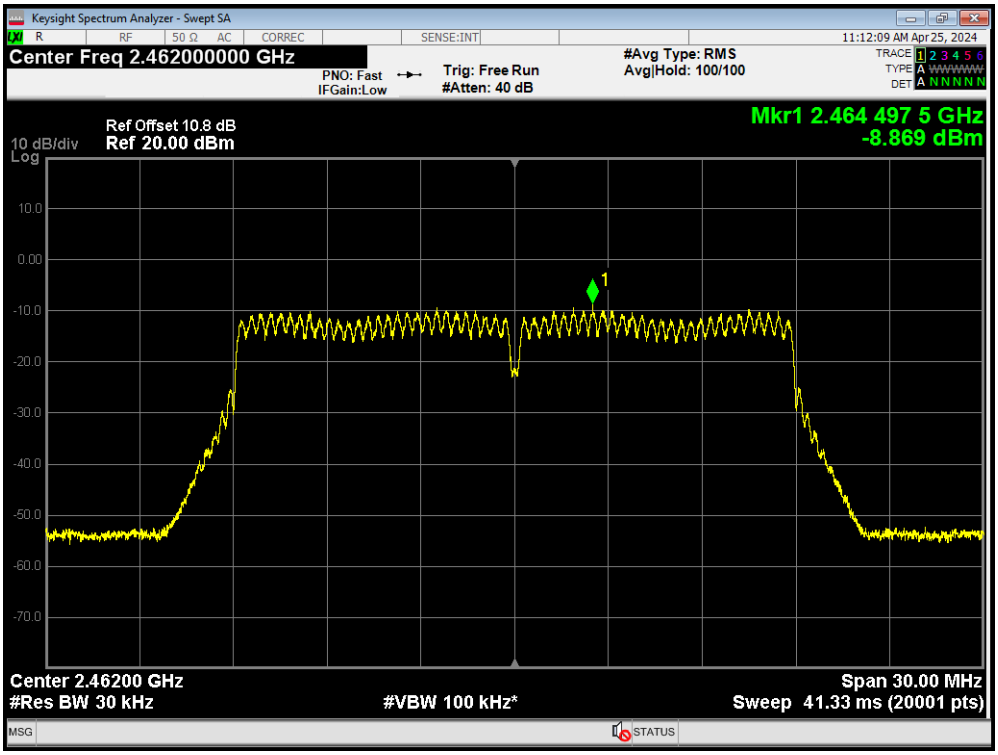
PSD 802.11n(HT20) 2412MHz



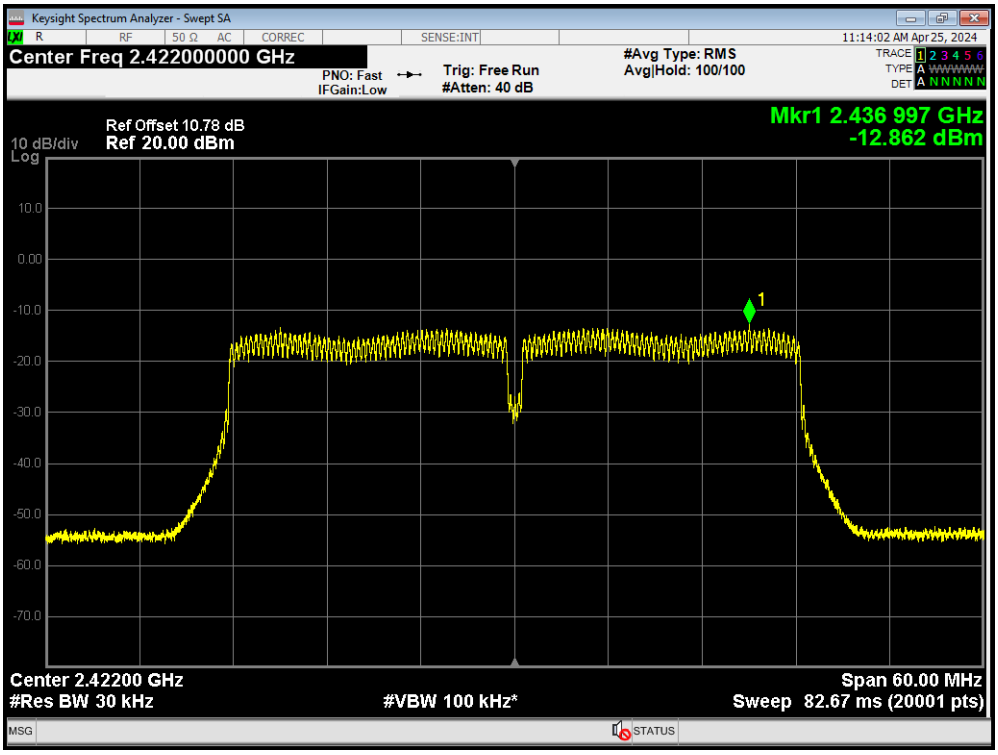
PSD 802.11n(HT20) 2437MHz



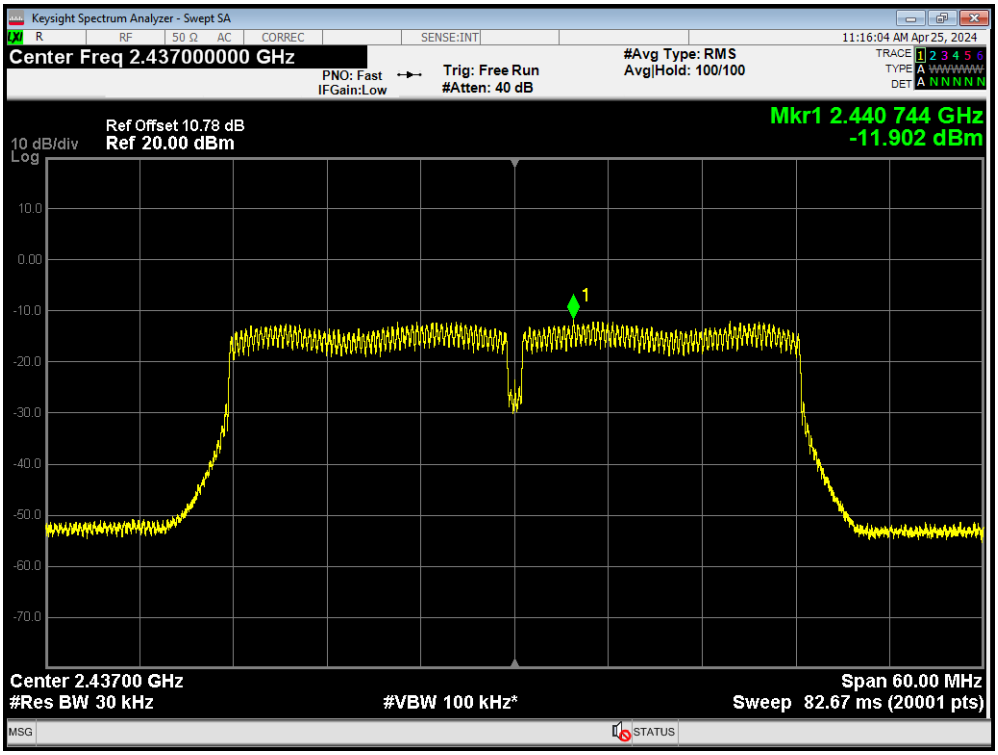
PSD 802.11n(HT20) 2462MHz



PSD 802.11n(HT40) 2422MHz



PSD 802.11n(HT40) 2437MHz



PSD 802.11n(HT40) 2452MHz