

TEST REPORT

Report No.: SHE21010036-02GE

Date: 2021-03-10

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Applicant : Wuhu Tyrehub Intelligent Technologies Co.,Ltd.
Address of Applicant : R302,B Block Yingjia Square, 2988# Gudai RD, Minhang District, Shanghai, China

Product Name : Hand-held Tire Tread Depth Intelligent Scanner
Model No. : HB04

Sample No. : E21010036-01#01
E21010036-01#02

FCC ID : 2AY2Y-HB04

Standards : FCC CFR47 Part 15, Subpart C

Date of Receipt : 2021-02-19
Date of Test : 2021-02-19 ~ 2021-03-10
Date of Issue : 2021-03-10

Remark:

This report details the results of the testing carried out on one sample, the results contained in this report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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1 General Information

1.1 Testing Laboratory

Company Name	ICAS Testing Technology Service (Shanghai) Co., Ltd.
Address	No.1298 Pingan Rd, Minhang District, Shanghai, China
Telephone	0086 21-51682999
Fax	0086 21-54711112
Homepage	www.icasiso.com

1.2 Details of Application

Company Name	Wuhu Tyrehub Intelligent Technologies Co.,Ltd.
Address	R302,B Block Yingjia Square, 2988# Gudai RD, Minhang District, Shanghai, China
Contact Person	Jingbo Zhang
Telephone	13701667015
Email	jingbo.zhang@x-treads.com

1.3 Details of EUT

Product Name	Hand-held Tire Tread Depth Intelligent Scanner
Brand Name	Tyrehub
Model No.	HB04
FCC ID	2AY2Y-HB04
Mode of Operation	WLAN 802.11b/g/n(HT20/40)
Frequency Range	2400MHz ~ 2483.5MHz
Channel Separation	5 MHz
Modulation Type	DSSS, OFDM
Antenna Type	FPC Antenna
Antenna Gain	-0.07dBi
Extreme Temperature Range	-10℃~ +50℃
Test Voltage	DC 3.85V
Hardware version	V10R01
Software version	2.0.0_2101201709_5.8.6
Test SW Version	BL410_R;BL410_E
RF power setting in TEST SW	MTK

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1.4 Test Methodology

47 CFR Part 15, Subpart C (10-1-16 Edition)	Miscellaneous Wireless Communications Services
KDB Publication 558074 D01 v05r02	15.247 Meas Guidance.
KDB Publication 662911 D01 v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band (e.g., MIMO, Smart Antenna, etc)
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Note(s):

All test items were verified and recorded according to the standards and without any addition/deviation/exclusion during the test.

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2 Test Condition

2.1 Test Facility

2.2 Environmental conditions

Temperature (°C)	18-25
Humidity (%RH)	40-65
Barometric Pressure (mbar)	960-1060

2.3 Equipment List

Name of Equipment	Manufacturer	Model	Serial No.	Cal. Due Date
Spectrum Analyzer	Keysight	N9020A	MY54101709	2021-08-23
Spectrum Analyzer	Keysight	N9020B	MY59260184	2021-08-18
Spectrum Analyzer	Rohde & Schwarz	FSV40N	101450	2021-06-08
EMI Test Receiver	Rohde & Schwarz	ESPI3	100173	2021-06-08
EMI Test Receiver	Rohde & Schwarz	ESR 7	101911	2021-06-08
V-network	SCHWARZBECK	NSLK 8127	8127-902	2021-07-28
Broadband Antenna	SCHWARZBECK	VULB9163	9163-1037	2021-06-08
Horn Antenna-18G	SCHWARZBECK	BBHA9120D	9120D-1775	2021-07-28
Loop Antenna	SCHWARZBECK	FMZB 1513	N/A	2021-11-22
Horn Antenna-40G	YINGLIAN	LB-180400-KF	N/A	2021-07-26
EMC chamber 9*6*6 (L*W*H)	CHANGNING	966	N/A	2023-06-08
Shielded Enclosure 8*5*4 (L*W*H)	CHANGNING	854	N/A	2021-06-08
Test Software	BL	BL410_E	N/A	N/A
Test Software	BL	BL410_R	N/A	N/A

2.4 Measurement Uncertainty

Parameter	Frequency	Uncertainty
Antenna Port Conducted Emission	< 1GHz	± 1.5 dB
	> 1GHz	± 1.5 dB
Radiated Emission	30 MHz – 1 GHz	± 3 dB
	> 1GHz	± 3 dB

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3 Test Set-up and Operation Modes

3.1 Details of Test Mode

Using test software was control EUT work in continuous transmitter and receiver mode. Select test channel as below:

For 802.11b/g/n (HT20)

Channel	Frequency
The lowest channel(CH1)	2412MHz
The middle channel(CH6)	2437MHz
The Highest channel(CH11)	2462MHz

For 802.11n(HT40)

Channel	Frequency
The lowest channel(CH3)	2422MHz
The middle channel(CH6)	2437MHz
The Highest channel(CH9)	2452MHz

Through Pre-scan under all rate at lowest channel, the data rate as below table described is the worst case, so we choose these data rate for test.

Type	Data rate
802.11b	5.5Mbps
802.11g	48Mbps
802.11n(20M)	MCS5
802.11n(40M)	MCS3

The basic operation modes are:

- A. On
 - 1. WLAN mode
 - a. Transmitting
 - i. Low Channel
 - ii. Middle Channel
 - iii. High Channel
 - b. Receiving
- B. Standby
- C. Off

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3.2 Special Accessories and Auxiliary Equipment

Description	Manufacturer	Model No.	Serial No.
N/A	N/A	N/A	N/A

3.3 Support Software

Description	Manufacturer	Software Name
Software	N/A	MTK

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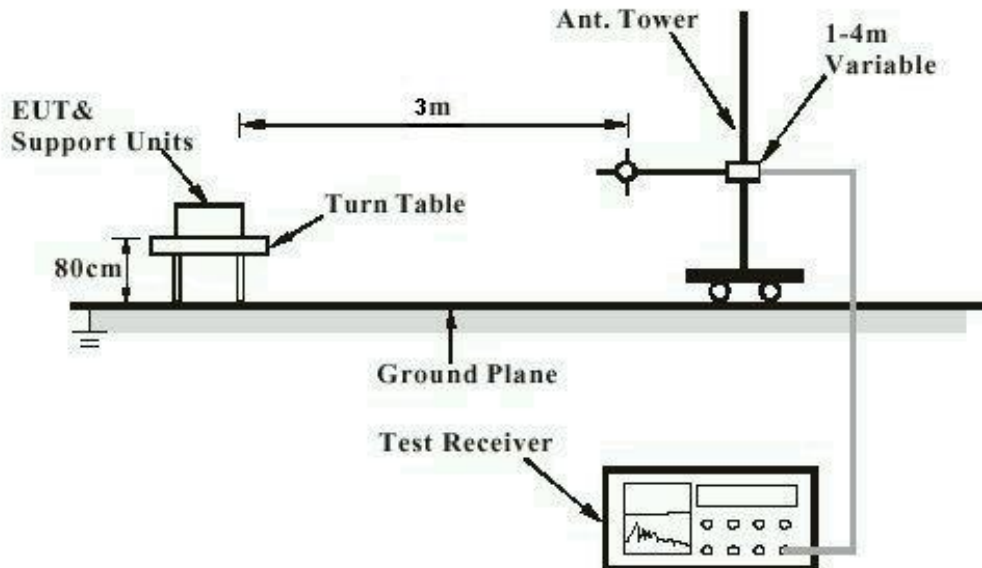
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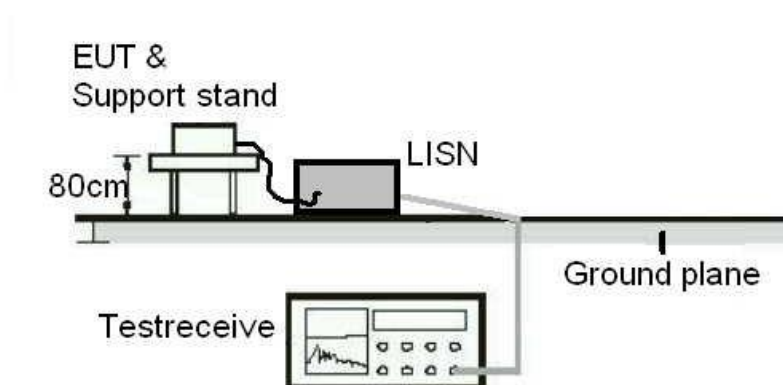
3.4 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Conduction Measurement



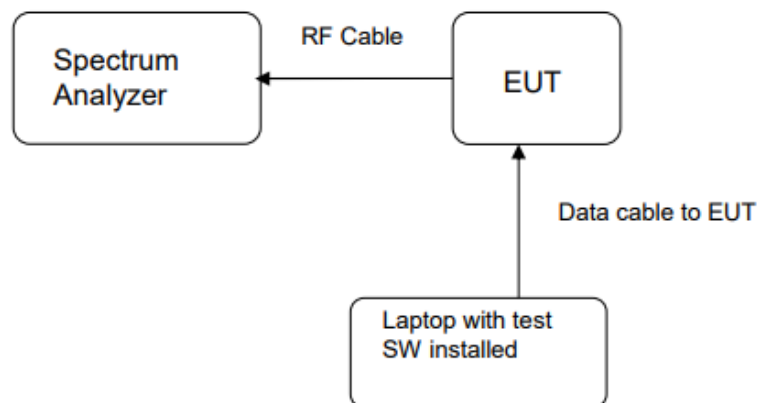
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Diagram of Measurement Equipment Configuration for Transmitter Measurement



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4 Test Results

4.1 Transmitter Requirement & Test Suites

4.1.1 Antenna Requirement

RESULT:

PASS

Test standard : FCC Part 15.247(b)(4), Part 15.203

Requirement : The use of approved antennas only with directional gains that do not exceed 6dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of -0.07dBi. The antenna is an FPC antenna with no possibility of replacement with a non-approved antenna by the end-user.

Therefore, the EUT is considered to comply with this provision.

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4.1.2 Peak Output Power

RESULT:

PASS

Test standard : FCC Part 15.247(b)(3)

Requirement : ANSI C63.10-2013, KDB 558074

Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High

Operation Mode : A.1.a

Ambient temperature : 25°C

Relative humidity : 52%

Table 1: Peak Output Power

Test Mode	Test Channel (MHz)	Peak Output Power		Limit (W)
		(dBm)	(mW)	
802.11b	2412	13.32	21.48	< 1
	2437	13.17	20.75	
	2462	13.69	23.39	
802.11g	2412	12.73	18.75	
	2437	12.74	18.79	
	2462	13.20	20.89	
802.11n(HT20)	2412	11.82	15.21	
	2437	11.64	14.59	
	2462	11.98	15.78	
802.11n(HT40)	2422	9.88	9.73	
	2437	9.52	8.95	
	2452	9.85	9.66	

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4.1.3 6dB Bandwidth

RESULT:

PASS

Test standard : FCC Part 15.247(a)(2)

Requirement : ANSI C63.10-2013, KDB 558074

Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High

Operation Mode : A.1.a

Ambient temperature : 25°C

Relative humidity : 52%

Table 2: 6dB Bandwidth and 99% Bandwidth

Test Mode	Test Channel (MHz)	6dB Bandwidth (MHz)	6 dB Bandwidth Limit (MHz)
802.11b	2412	7.716	>0.5
	2437	7.377	
	2462	7.686	
802.11g	2412	11.69	
	2437	16.32	
	2462	13.25	
802.11n(HT20)	2412	11.36	
	2437	16.99	
	2462	13.21	
802.11n(HT40)	2422	13.87	
	2437	15.84	
	2452	23.24	

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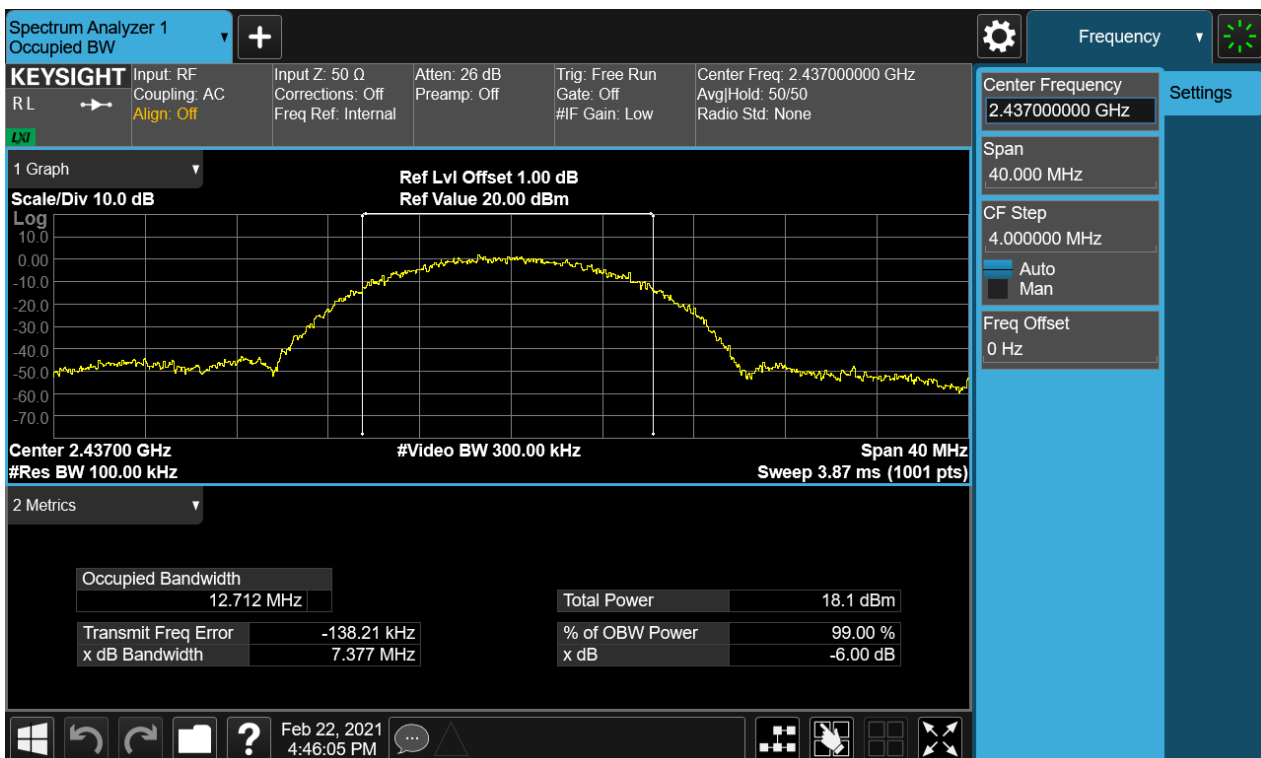
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Figure 1: 6dB Bandwidth, 802.11b, 2412MHz



Figure 2: 6dB Bandwidth, 802.11b, 2437MHz



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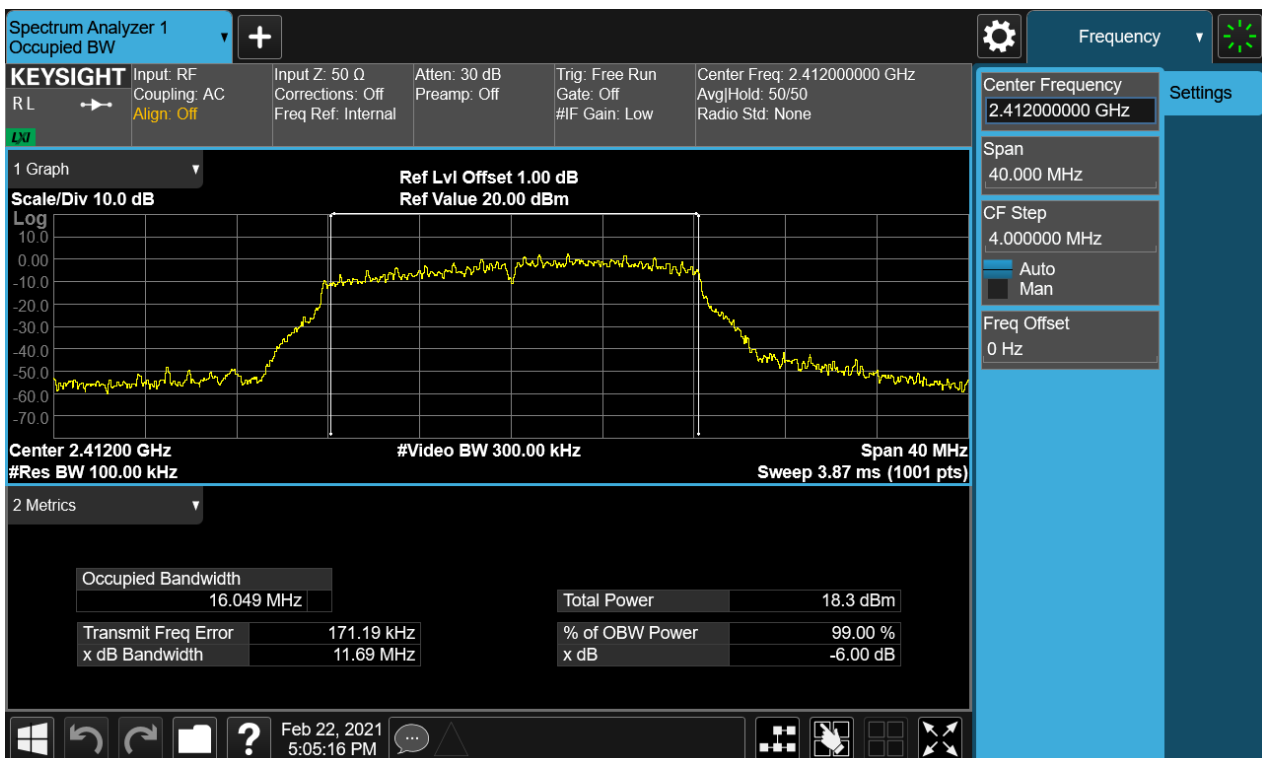
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Figure 3: 6dB Bandwidth, 802.11b, 2462MHz



Figure 4: 6dB Bandwidth, 802.11g, 2412MHz



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Figure 5: 6dB Bandwidth, 802.11g, 2437MHz

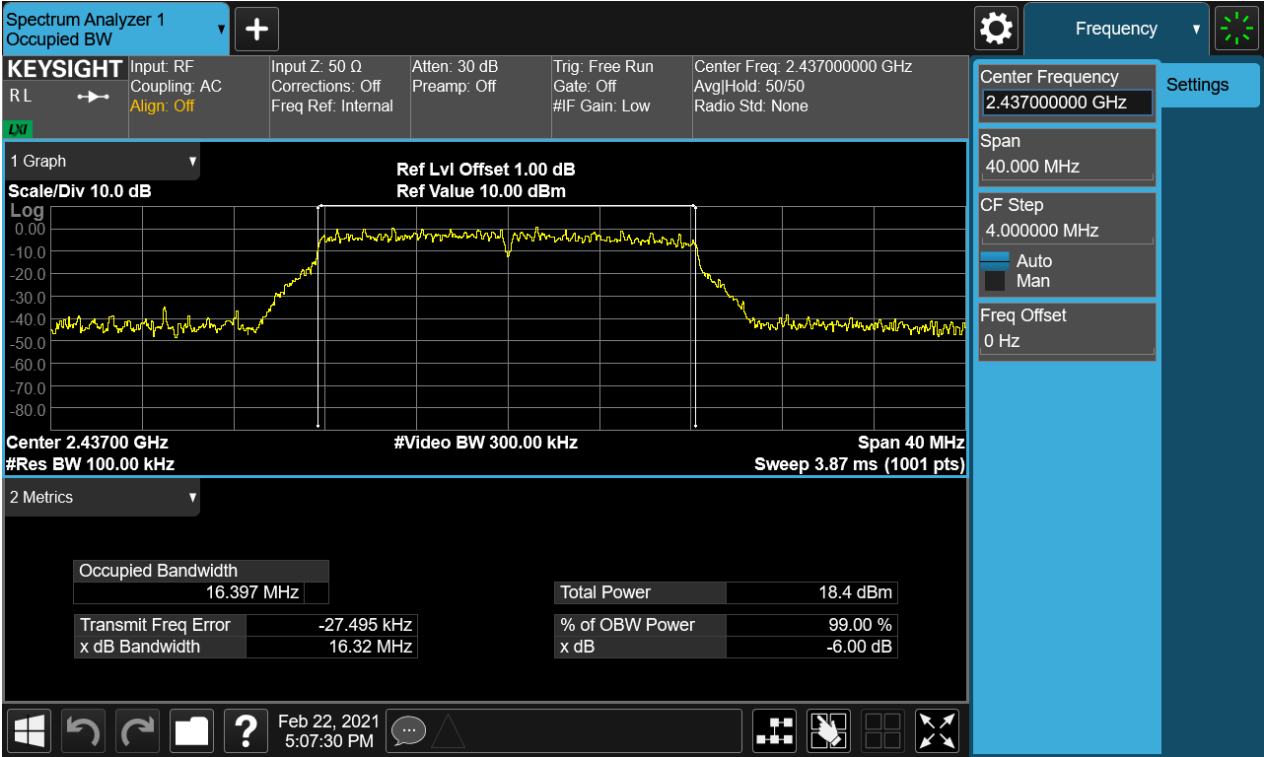
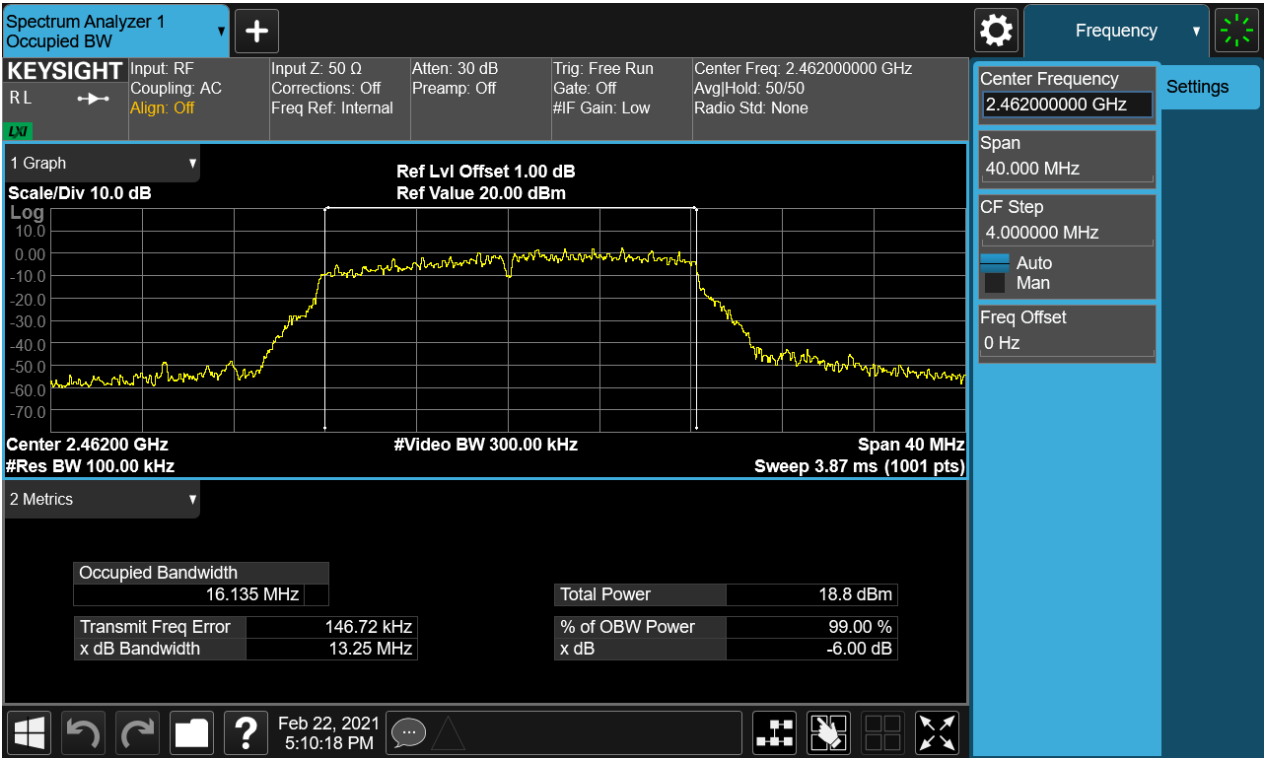


Figure 6: 6dB Bandwidth, 802.11g, 2462MHz



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Figure 7: 6dB Bandwidth, 802.11n(HT20), 2412MHz

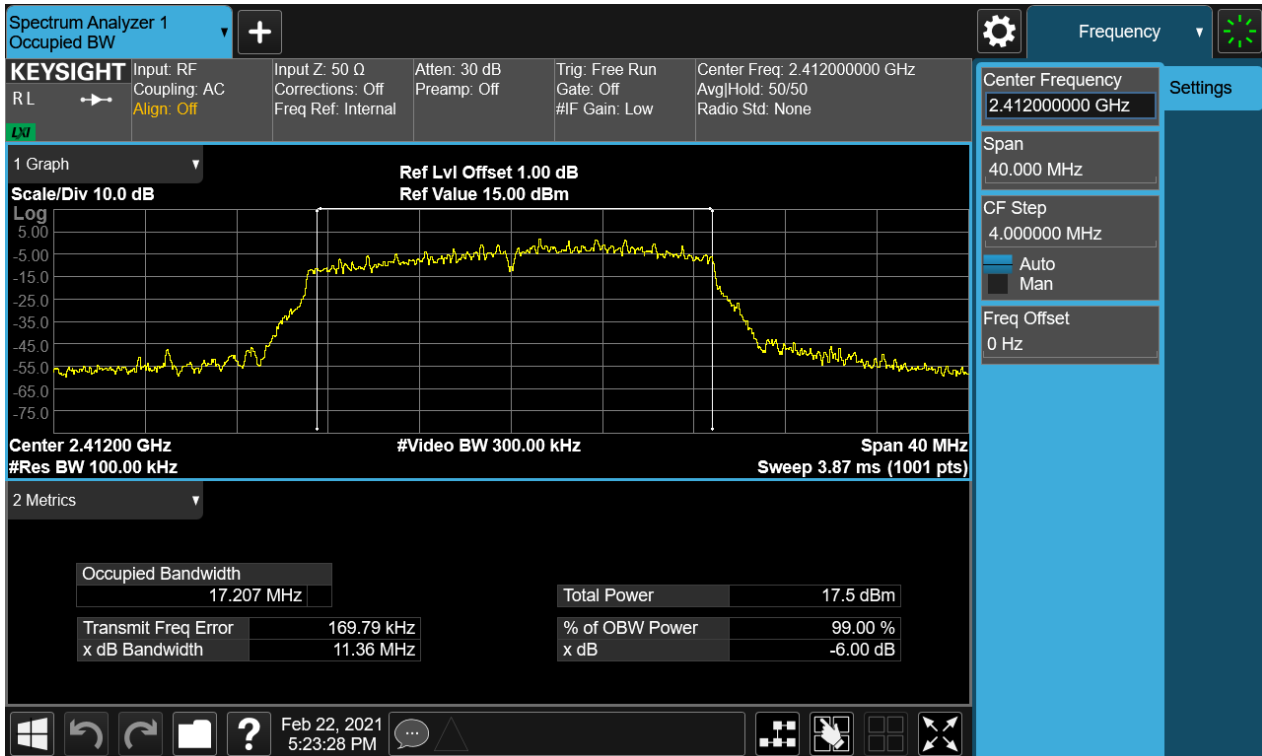
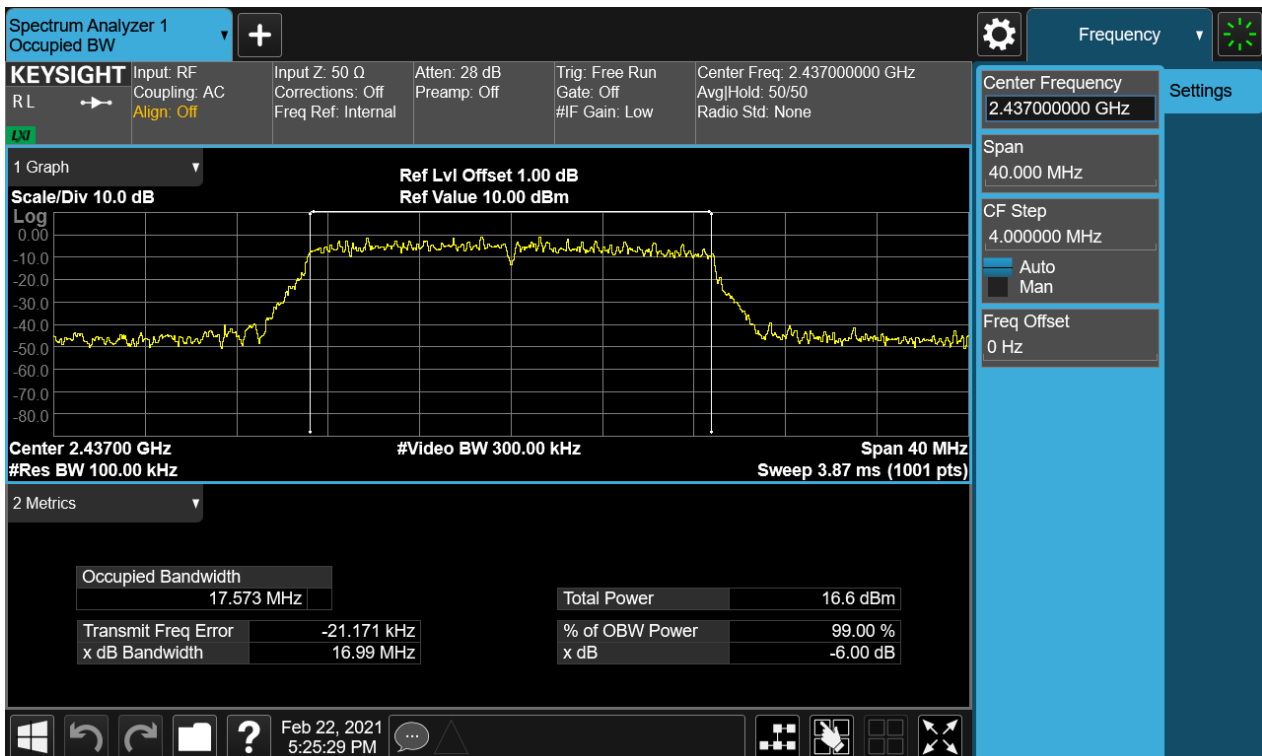


Figure 8: 6dB Bandwidth, 802.11n(HT20), 2437MHz



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Figure 9: 6dB Bandwidth, 802.11n(HT20), 2462MHz

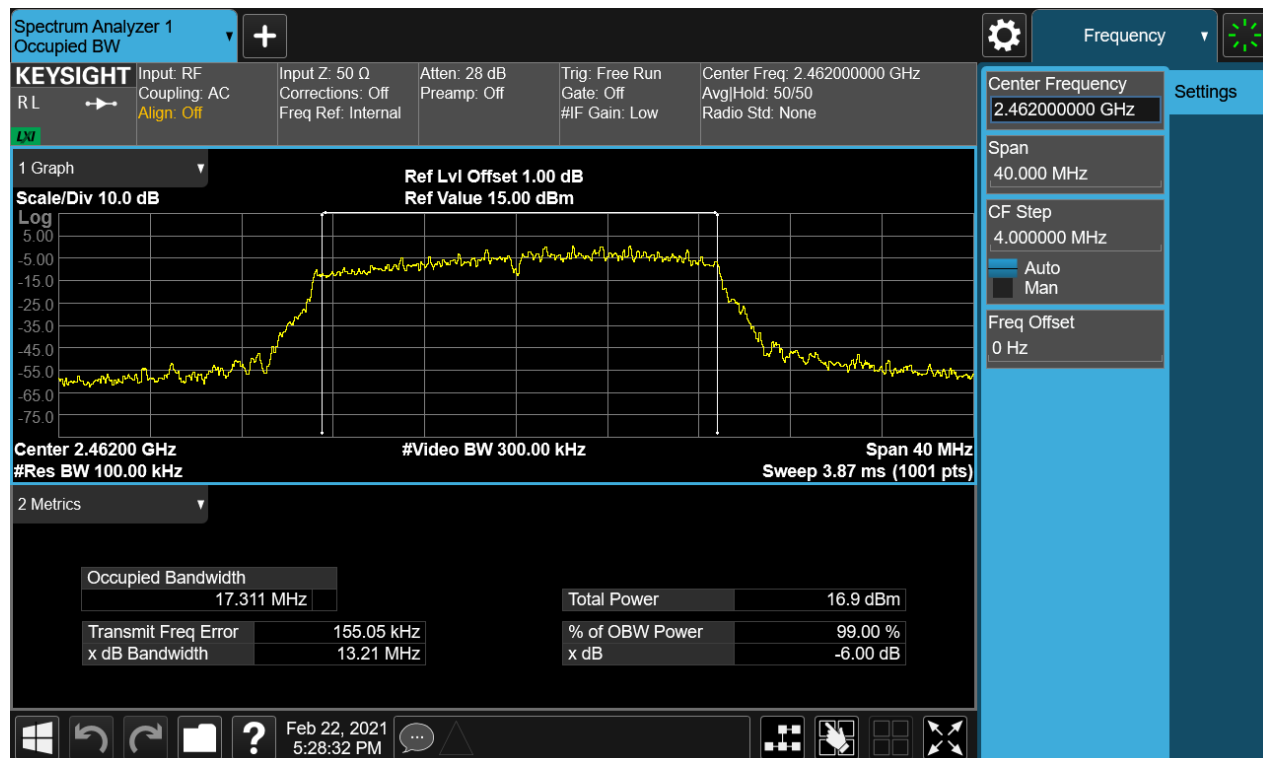
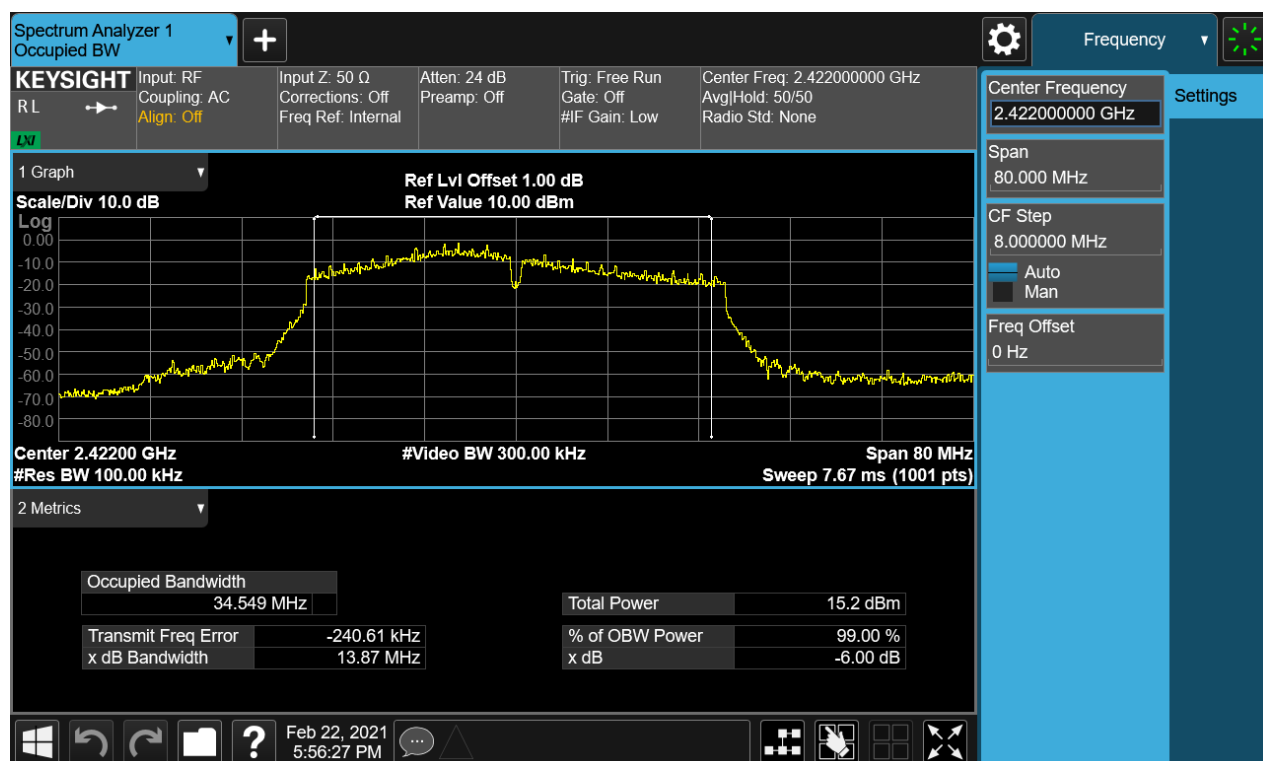


Figure 10: 6dB Bandwidth, 802.11n(HT40), 2422MHz



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Figure 11: 6dB Bandwidth, 802.11n(HT40), 2437MHz

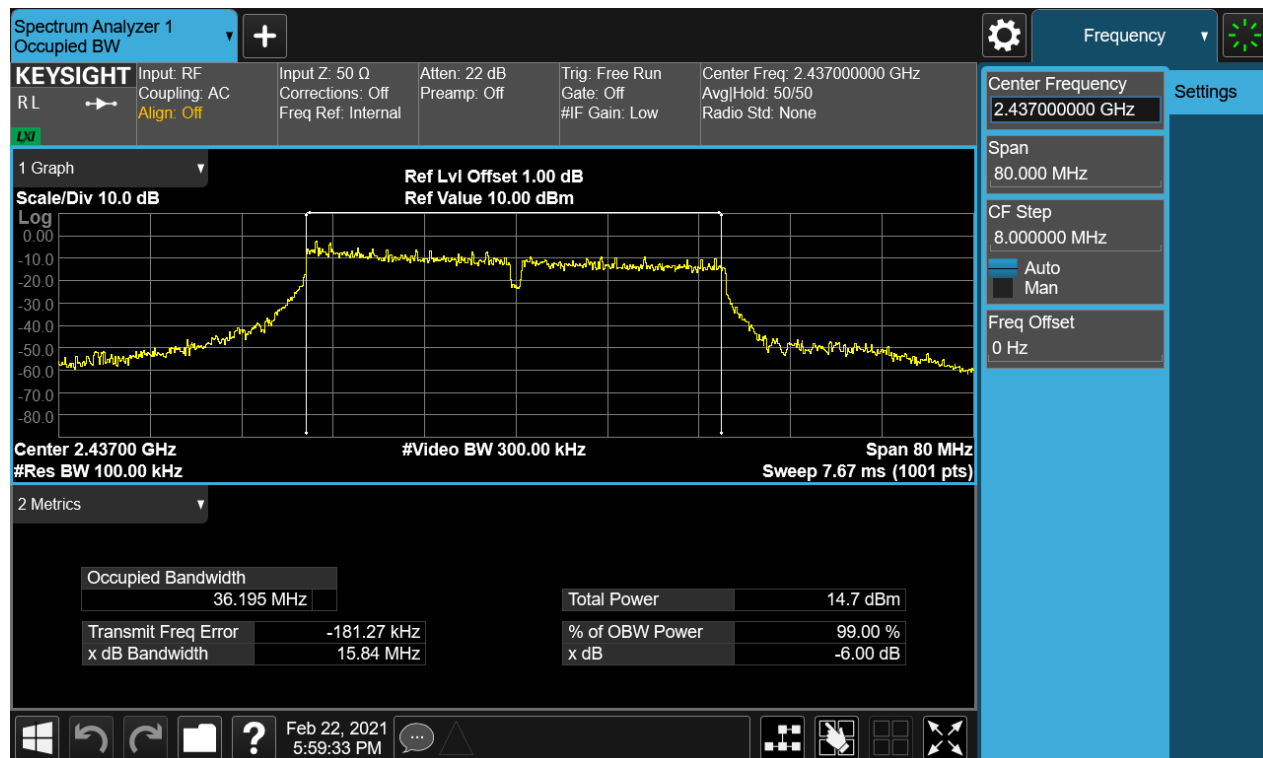
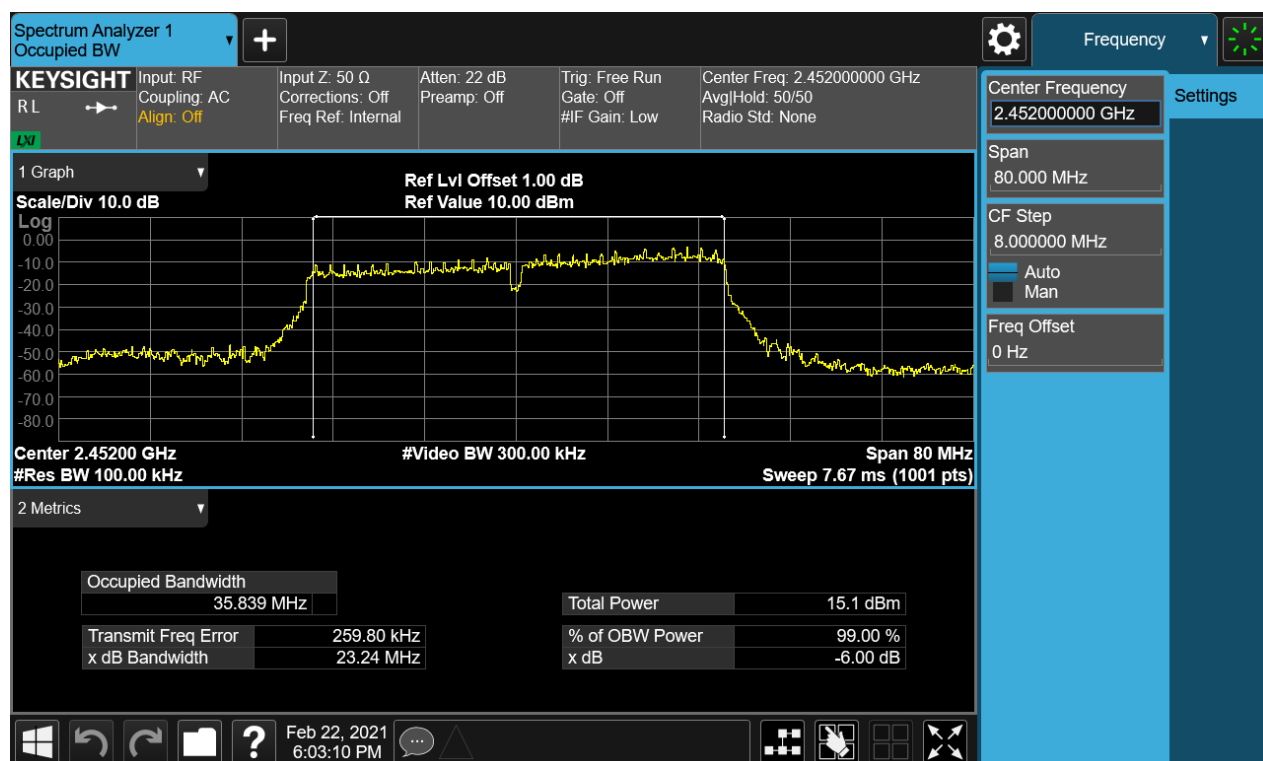


Figure 12: 6dB Bandwidth, 802.11n(HT40), 2452MHz



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4.1.4 Power Spectral Density

RESULT:

PASS

Test standard : FCC Part 15.247(e)

Requirement : ANSI C63.10-2013, KDB 558074

Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High

Operation Mode : A.1.a

Ambient temperature : 25°C

Relative humidity : 52%

Table 3: Power Spectral Density

Test Mode	Test Channel (MHz)	Measured Result (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	2412	-11.42	8
	2437	-12.29	
	2462	-10.58	
802.11g	2412	-11.76	
	2437	-13.12	
	2462	-12.62	
802.11n(HT20)	2412	-12.47	
	2437	-15.40	
	2462	-13.18	
802.11n(HT40)	2422	-14.07	
	2437	-18.14	
	2452	-17.87	

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Figure 13: Power Spectral Density, 802.11b, 2412MHz

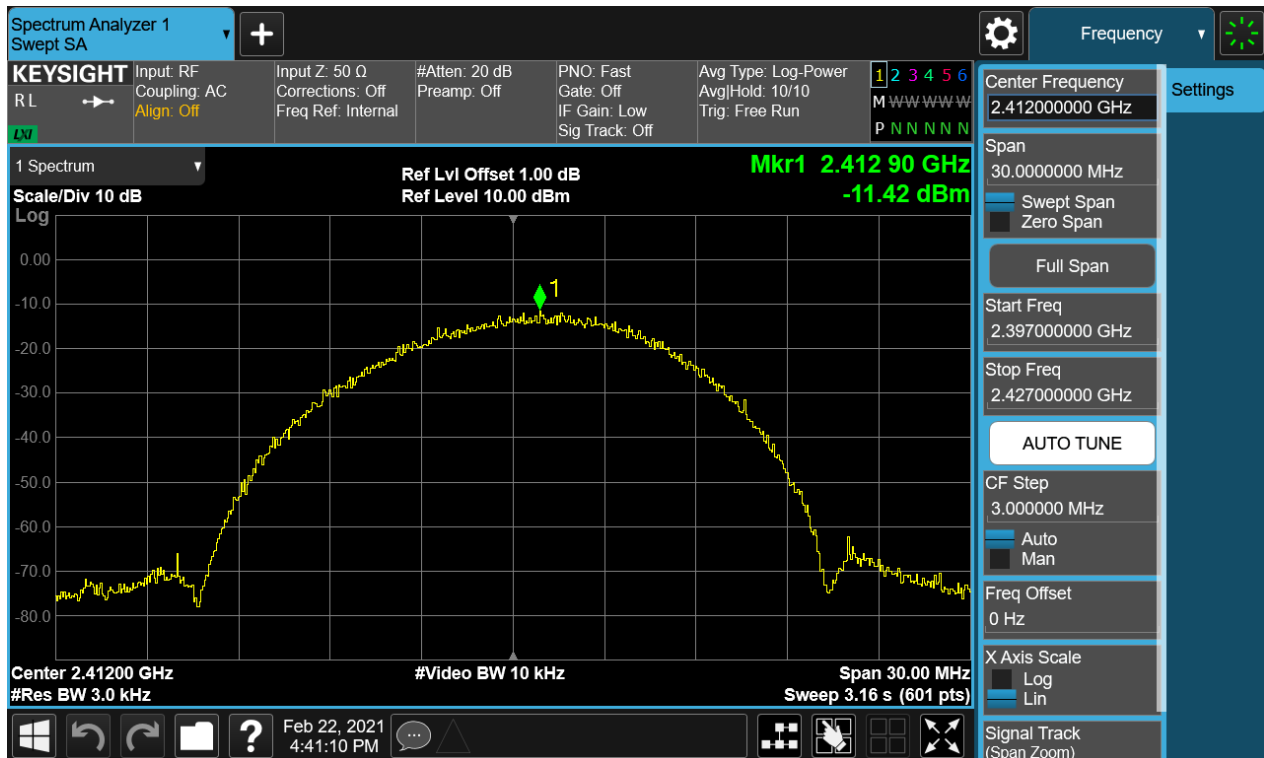
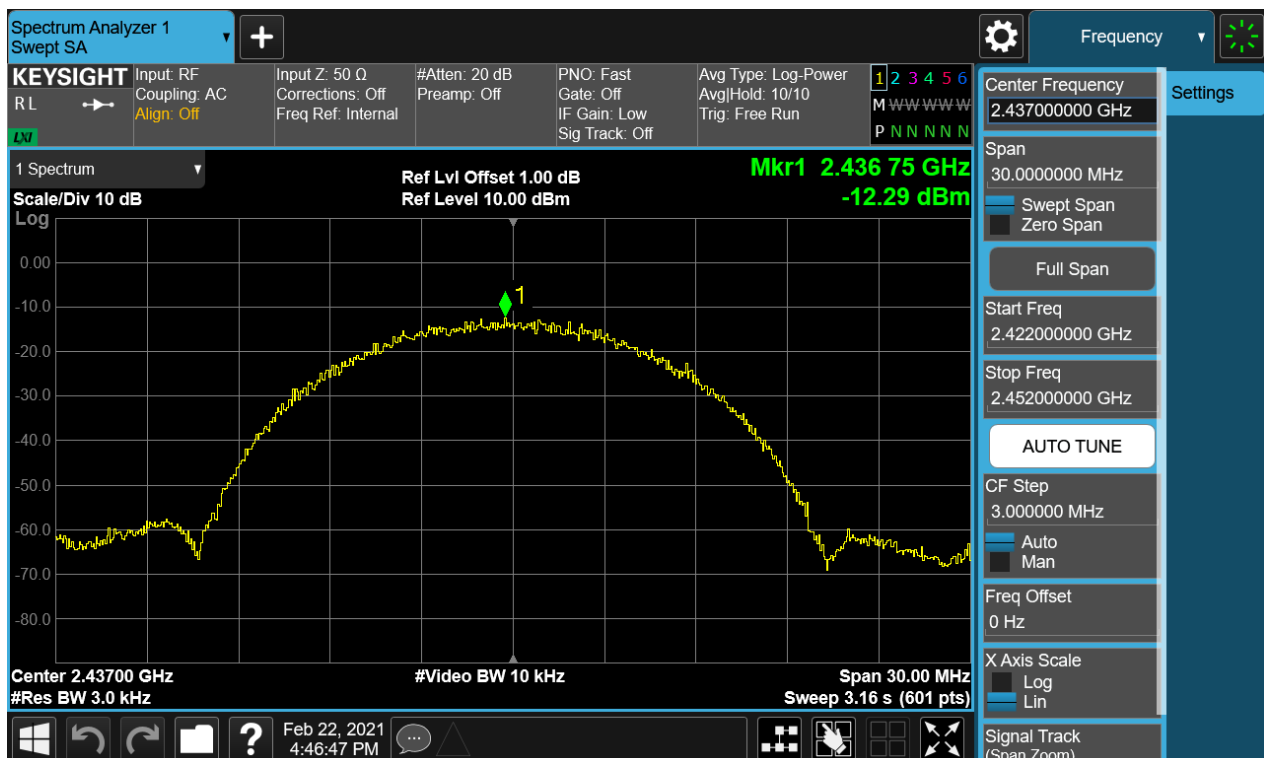


Figure 14: Power Spectral Density, 802.11b, 2437MHz



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Figure 15: Power Spectral Density, 802.11b, 2462MHz

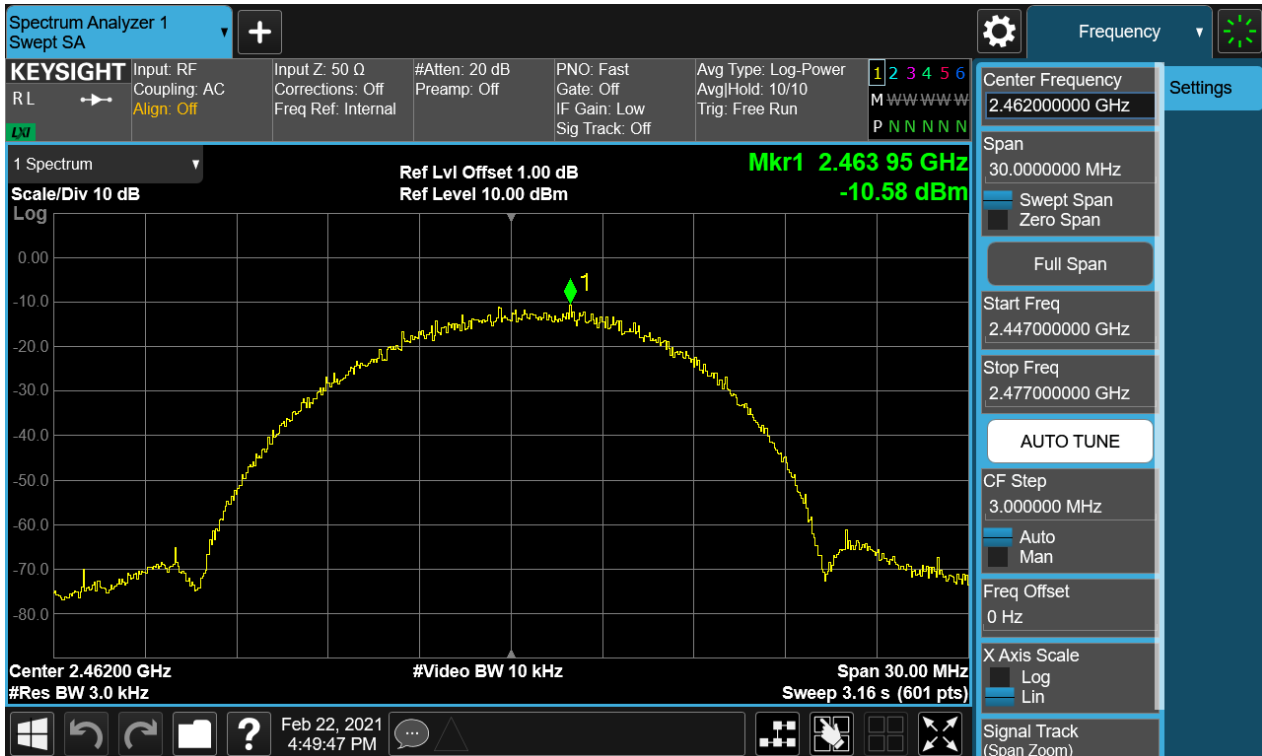
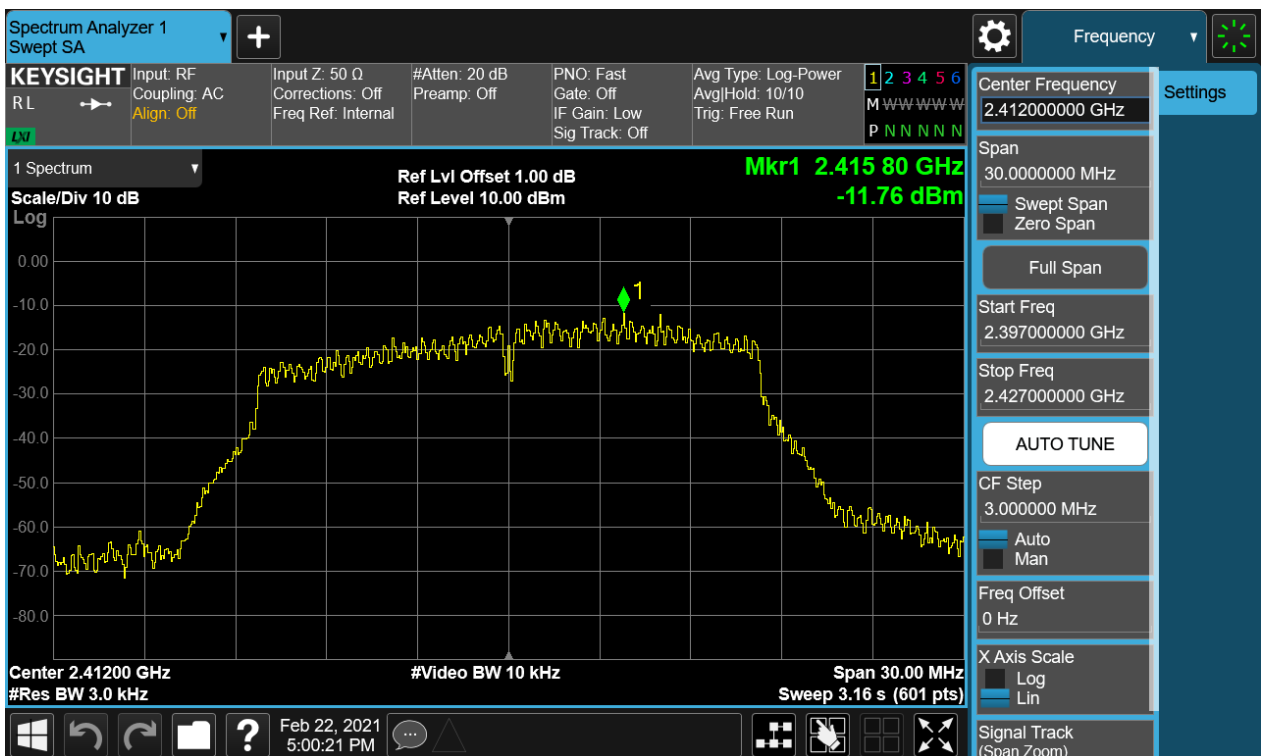


Figure 16: Power Spectral Density, 802.11g, 2412MHz



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Figure 17: Power Spectral Density, 802.11g, 2437MHz

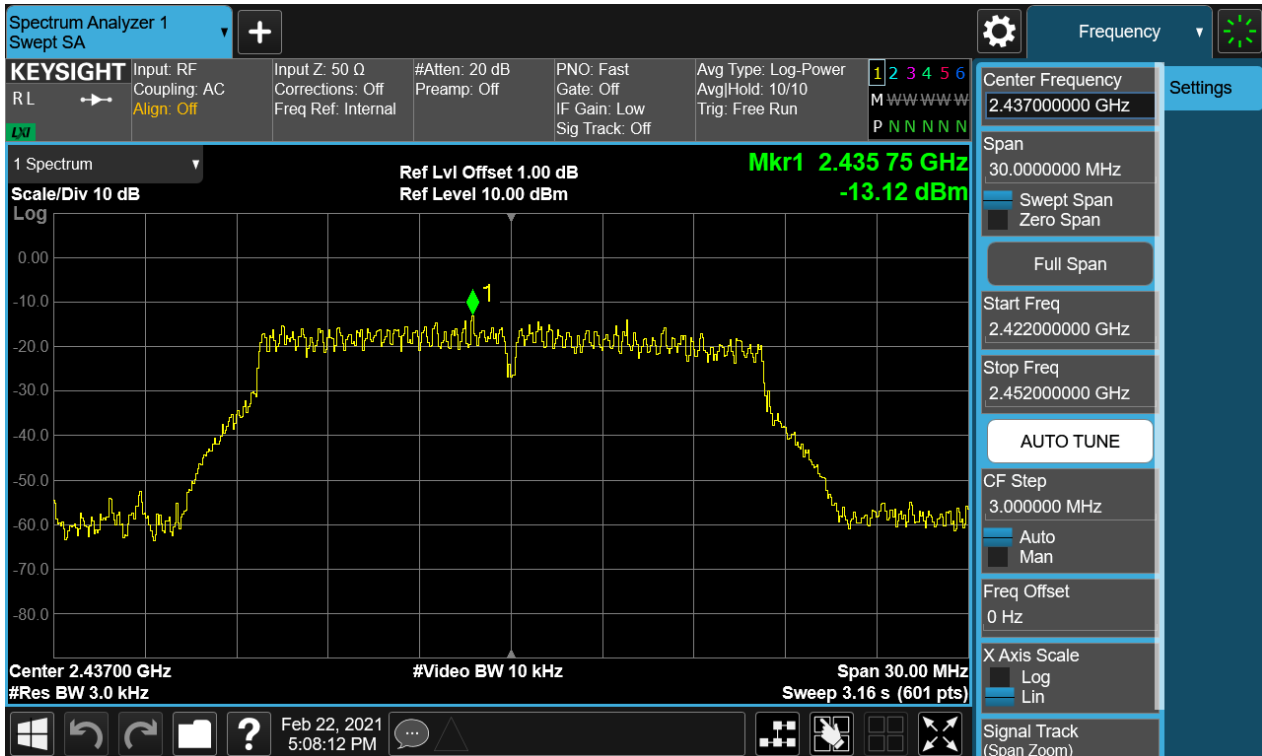
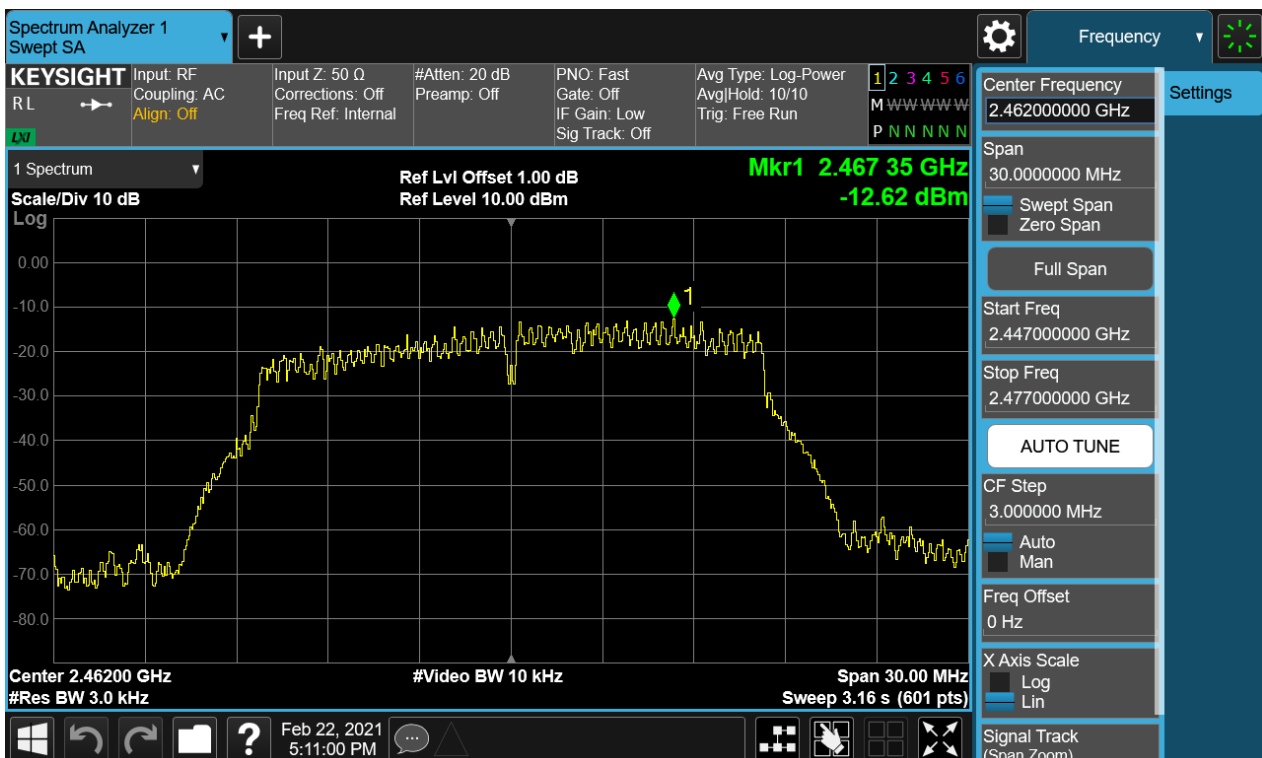


Figure 18: Power Spectral Density, 802.11g, 2462MHz



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Figure 19: Power Spectral Density, 802.11n(HT20), 2412MHz

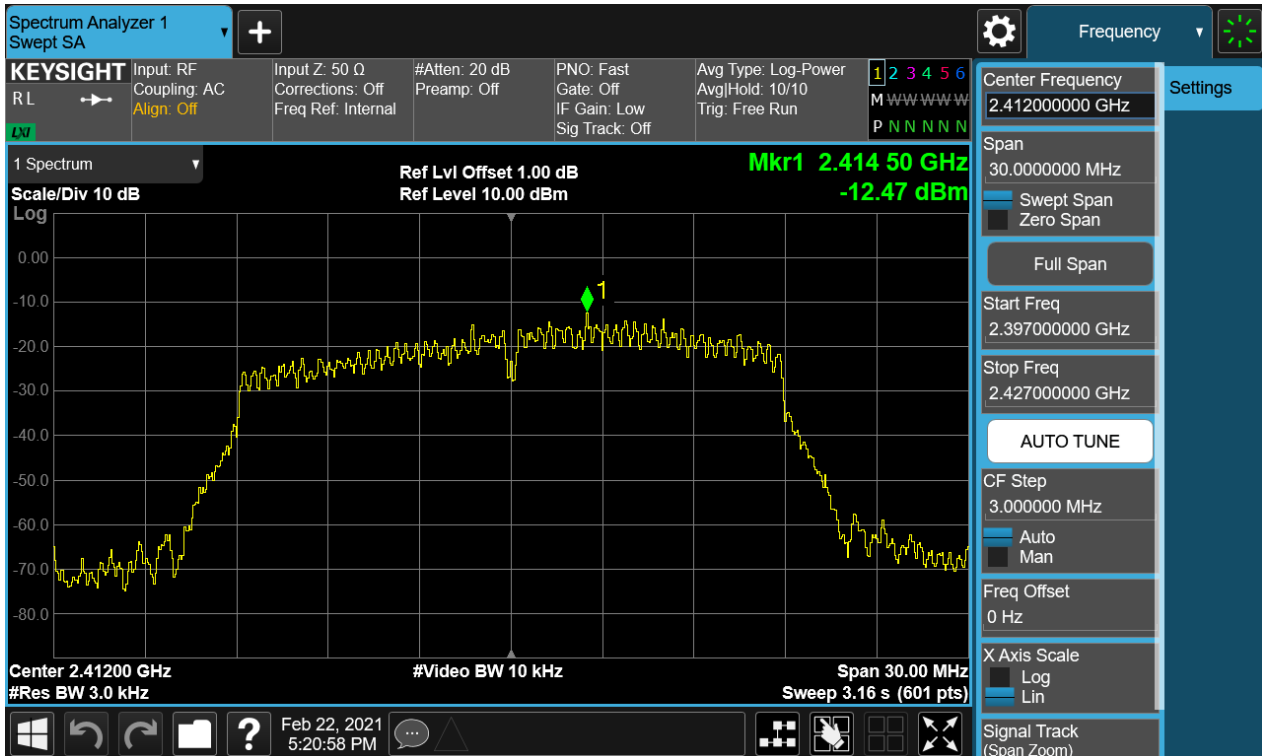
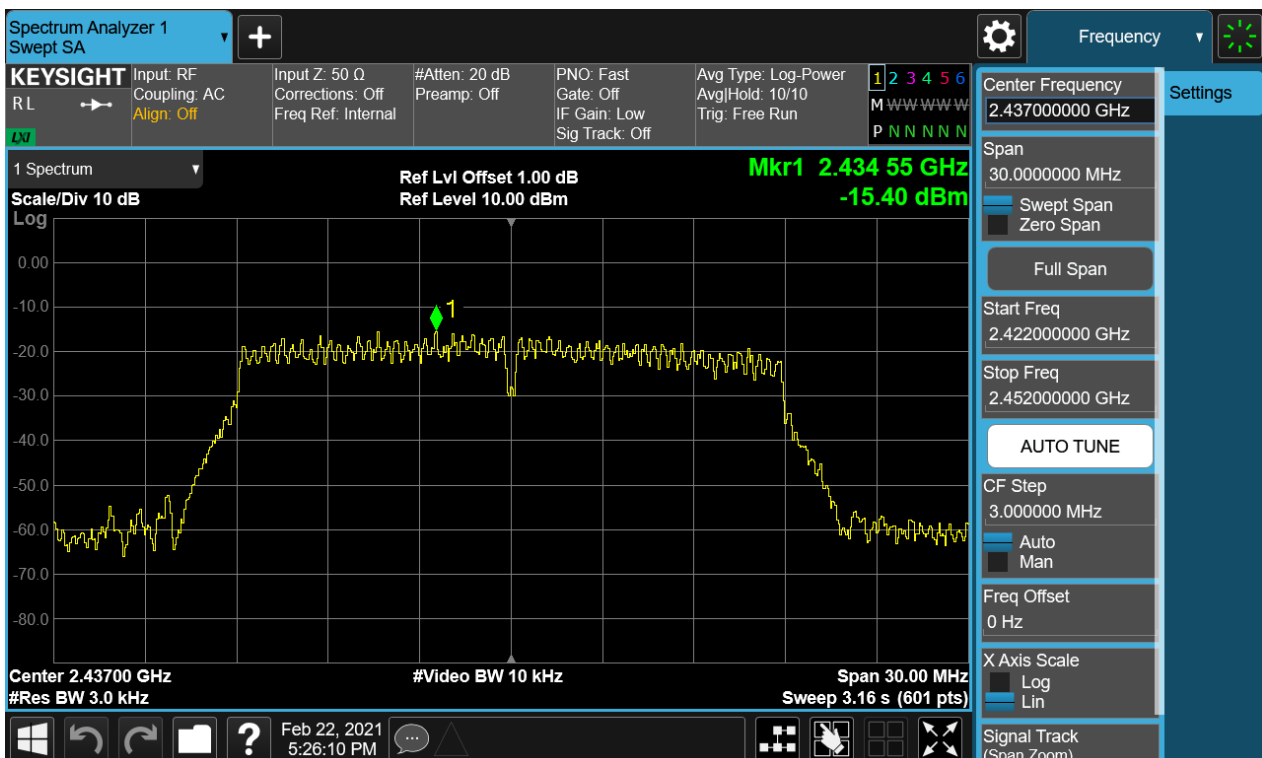


Figure 20: Power Spectral Density, 802.11n(HT20), 2437MHz



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Figure 21: Power Spectral Density, 802.11n(HT20), 2462MHz

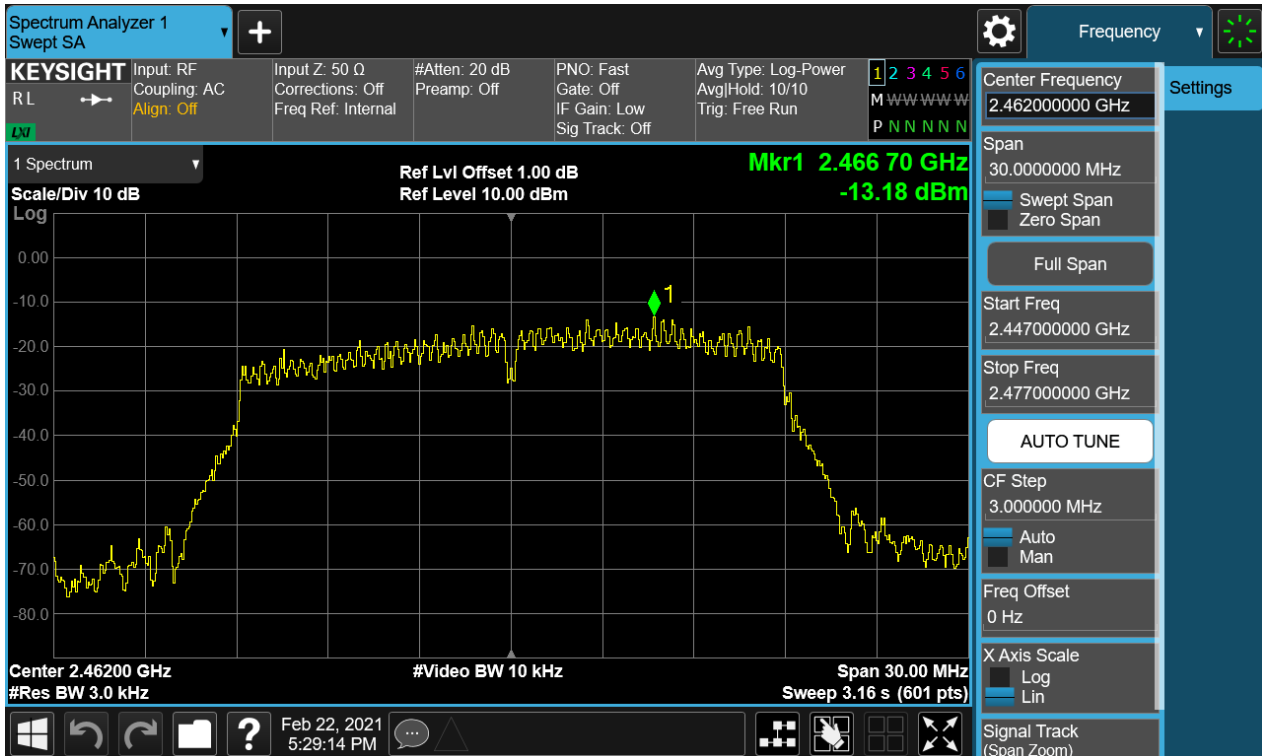
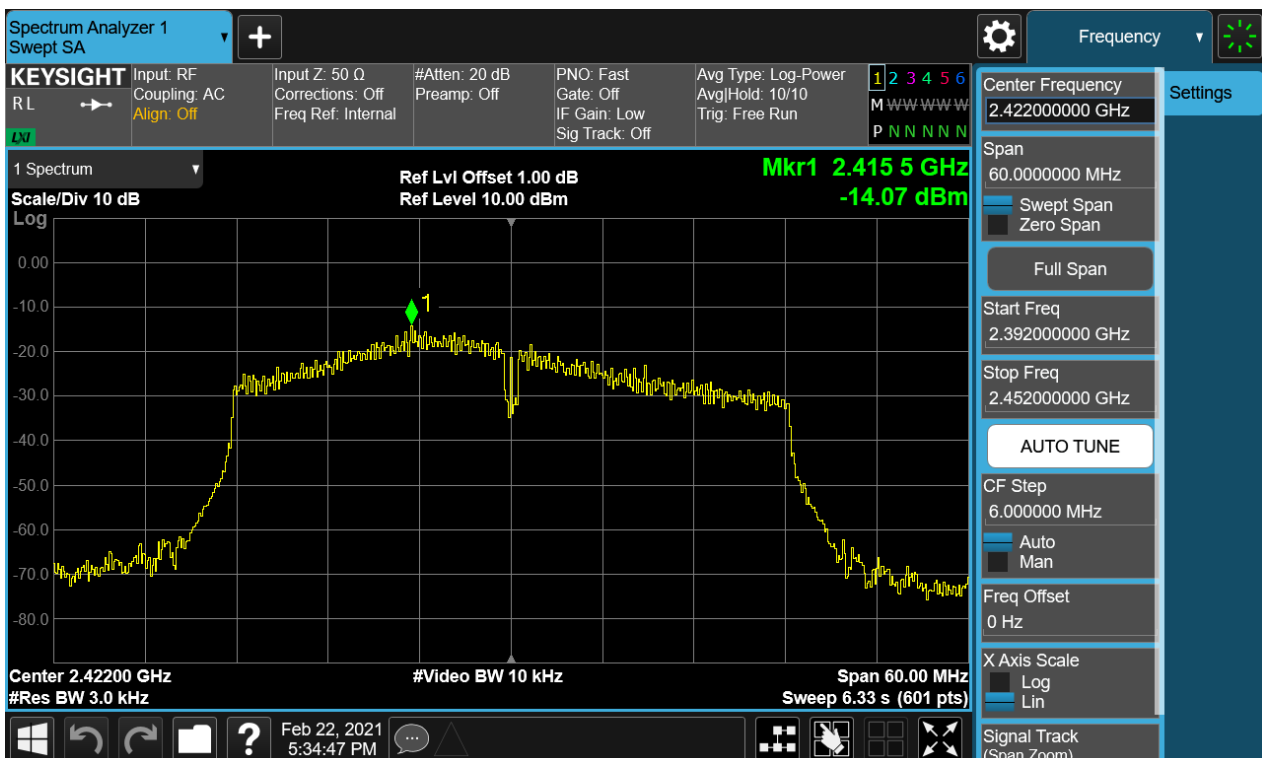


Figure 22: Power Spectral Density, 802.11n(HT40), 2422MHz



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Figure 23: Power Spectral Density, 802.11n(HT40), 2437MHz

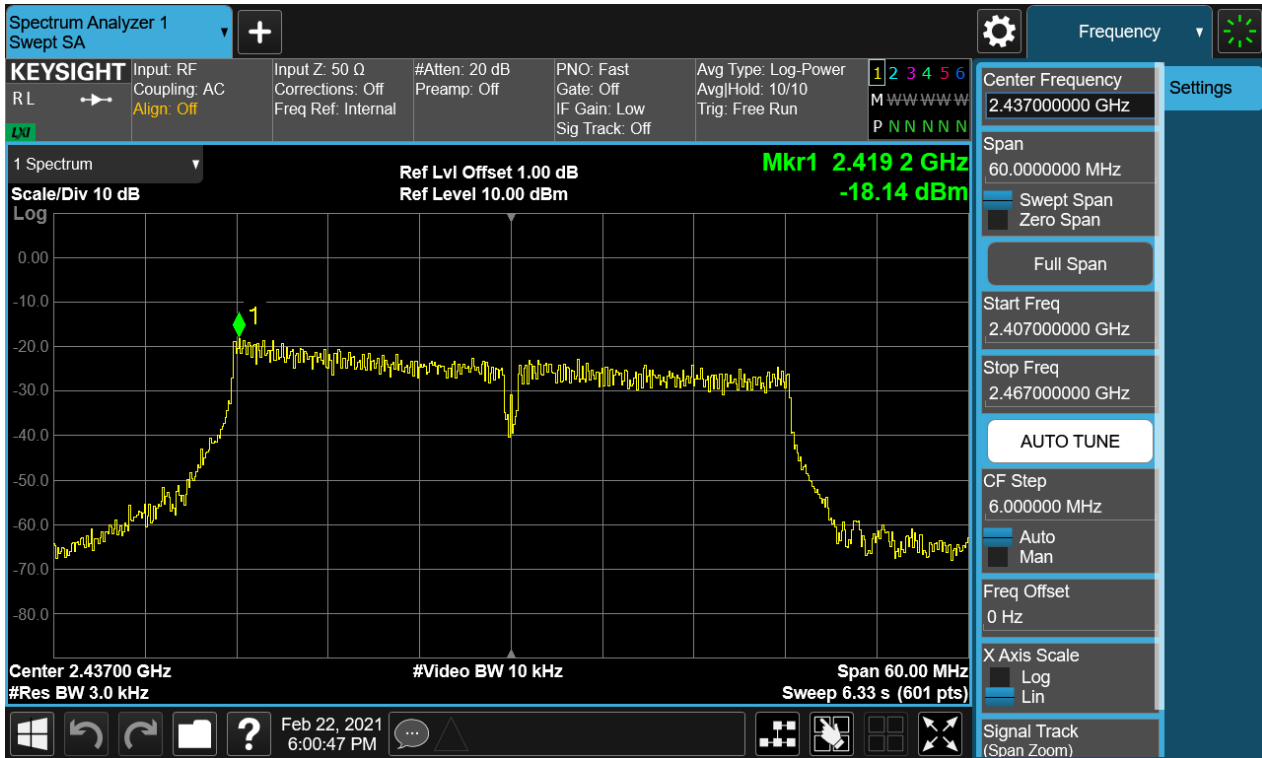
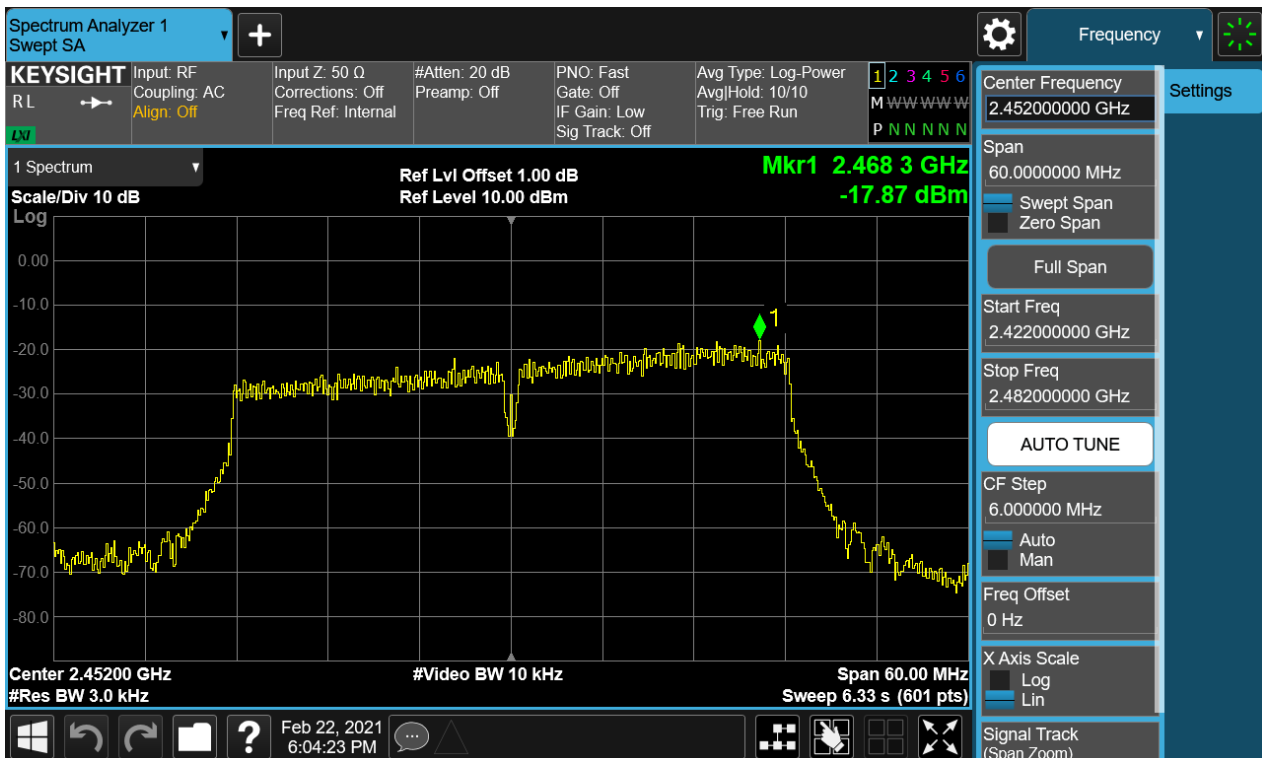


Figure 24: Power Spectral Density, 802.11n(HT40), 2452MHz



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4.1.5 Conducted Spurious Emission & Authorized-band band-edge

RESULT:

PASS

Test standard : FCC Part 15.247(d), 15.209

Requirement : ANSI C63.10-2013, KDB 558074

Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High for spurious, Low/High for Band Edge

Operation Mode : A.1.a

Ambient temperature : 25°C

Relative humidity : 52%

For details refer to following test plot.

Figure 25: Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2412MHz Carrier Level



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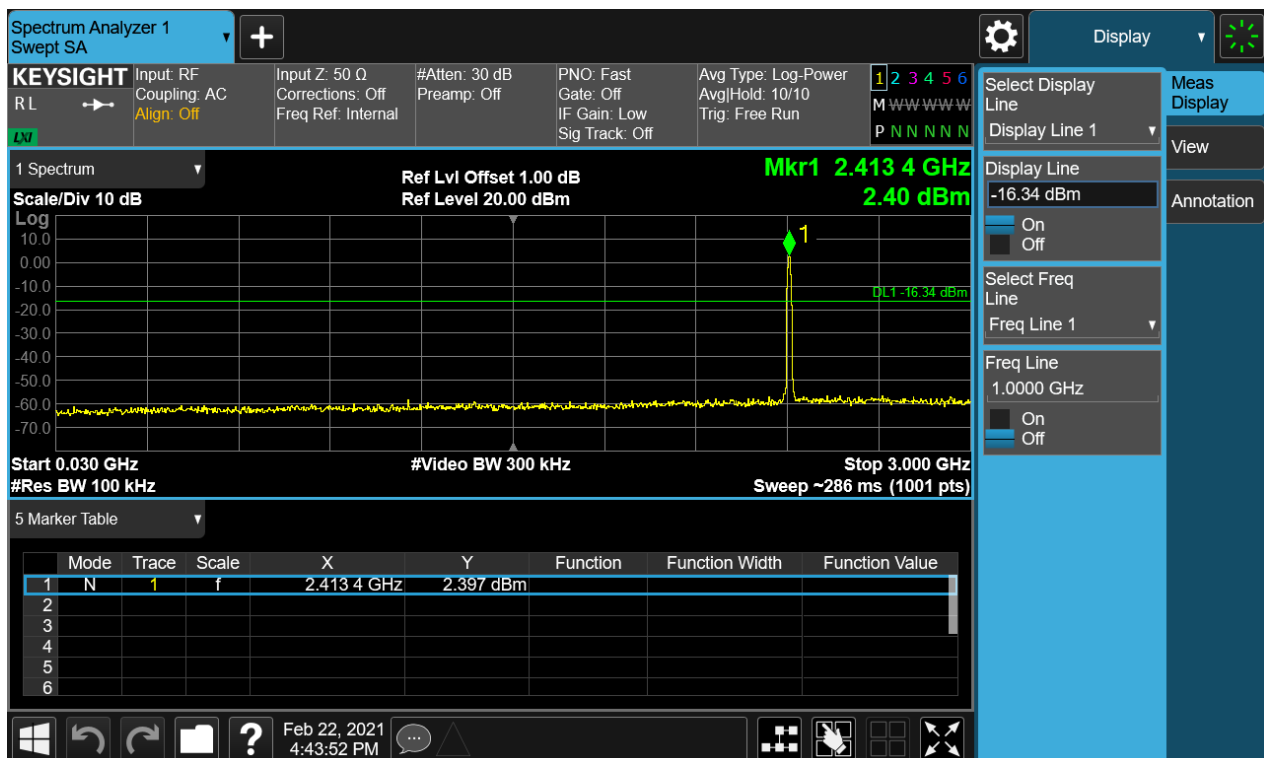
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Band Edge



Conducted spurious emissions 30MHz-25GHz



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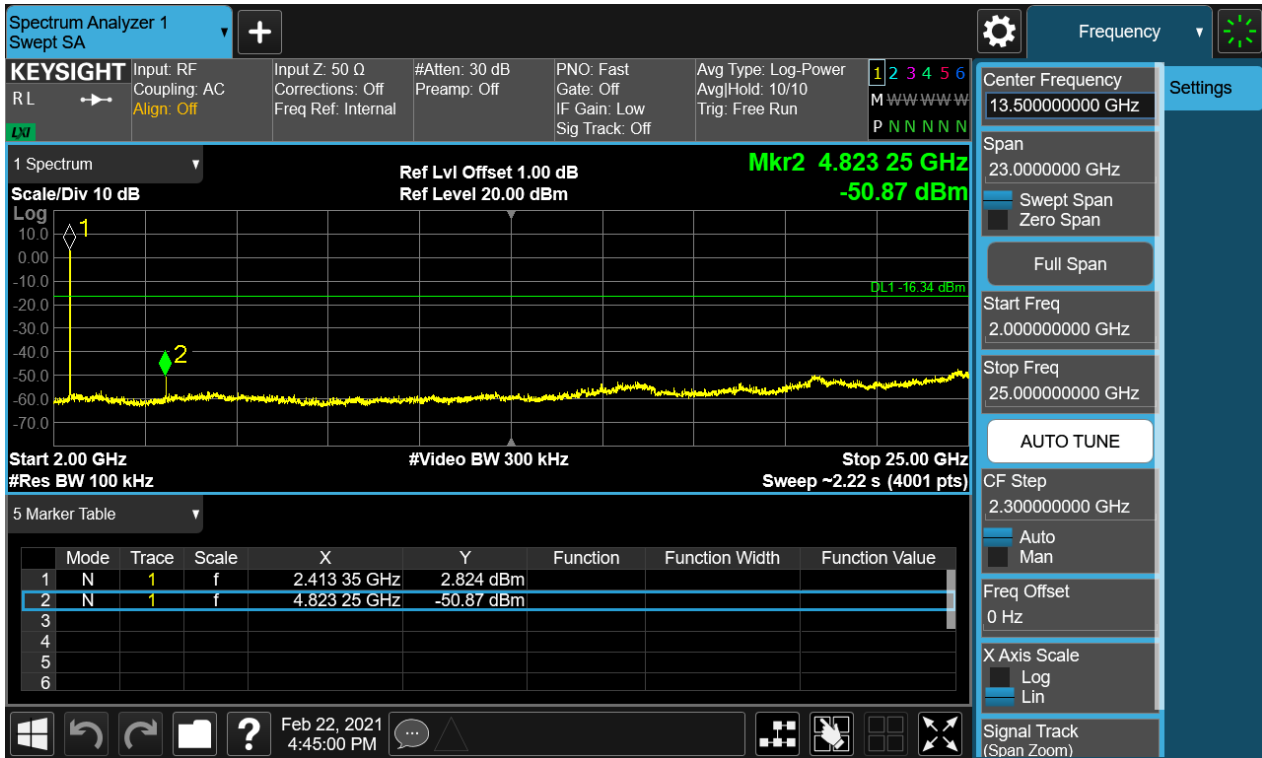
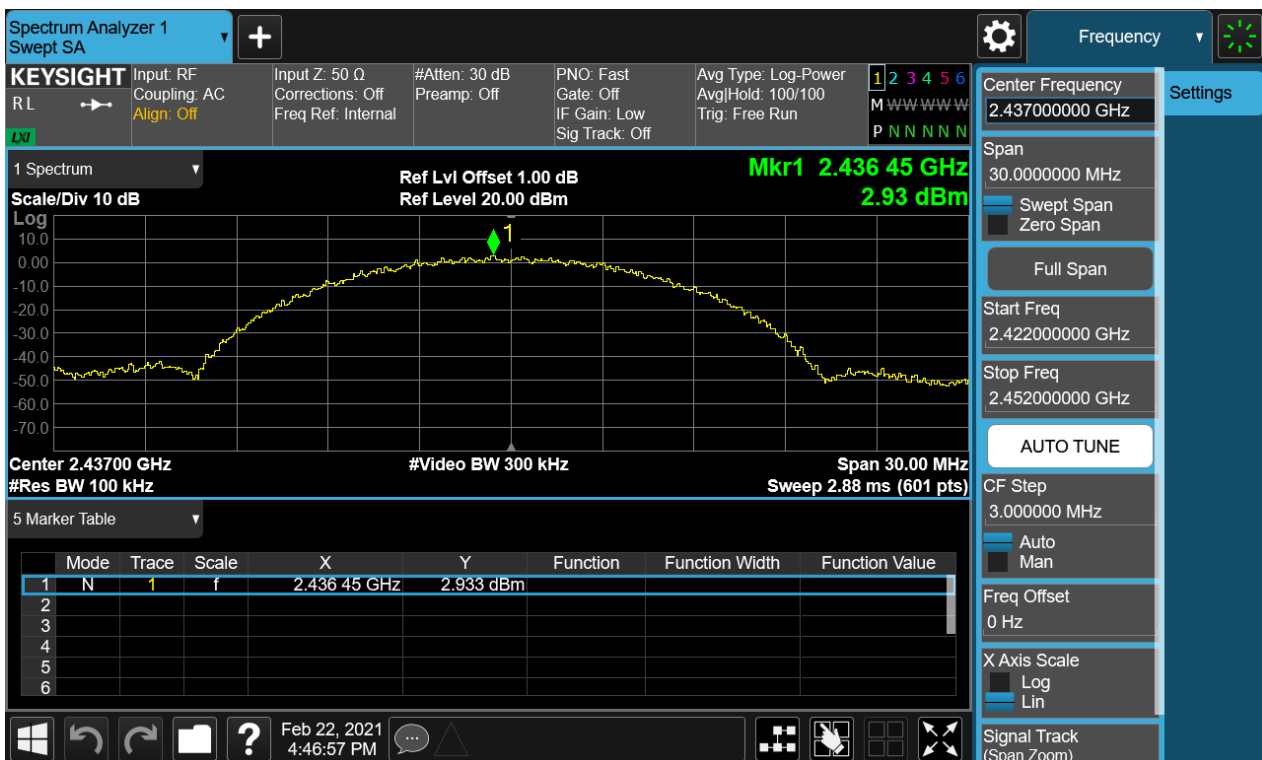


Figure 26: Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2437MHz Carrier Level



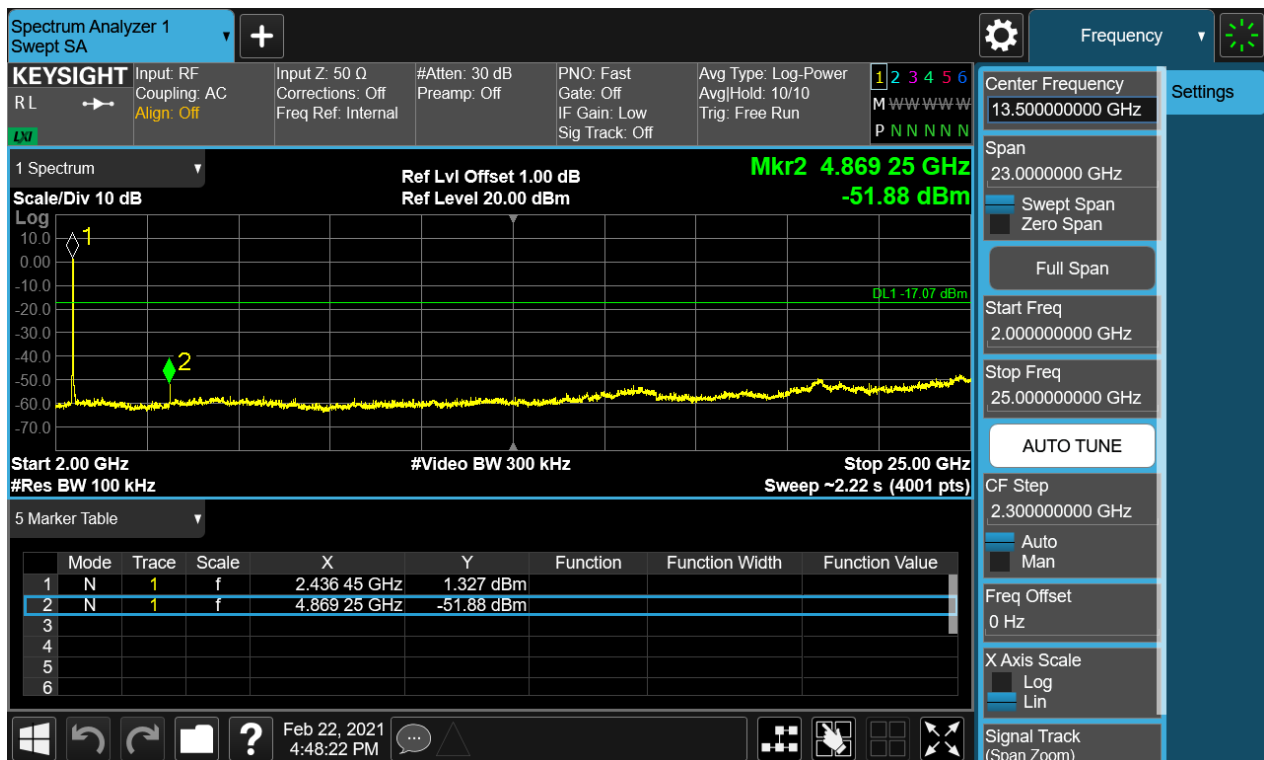
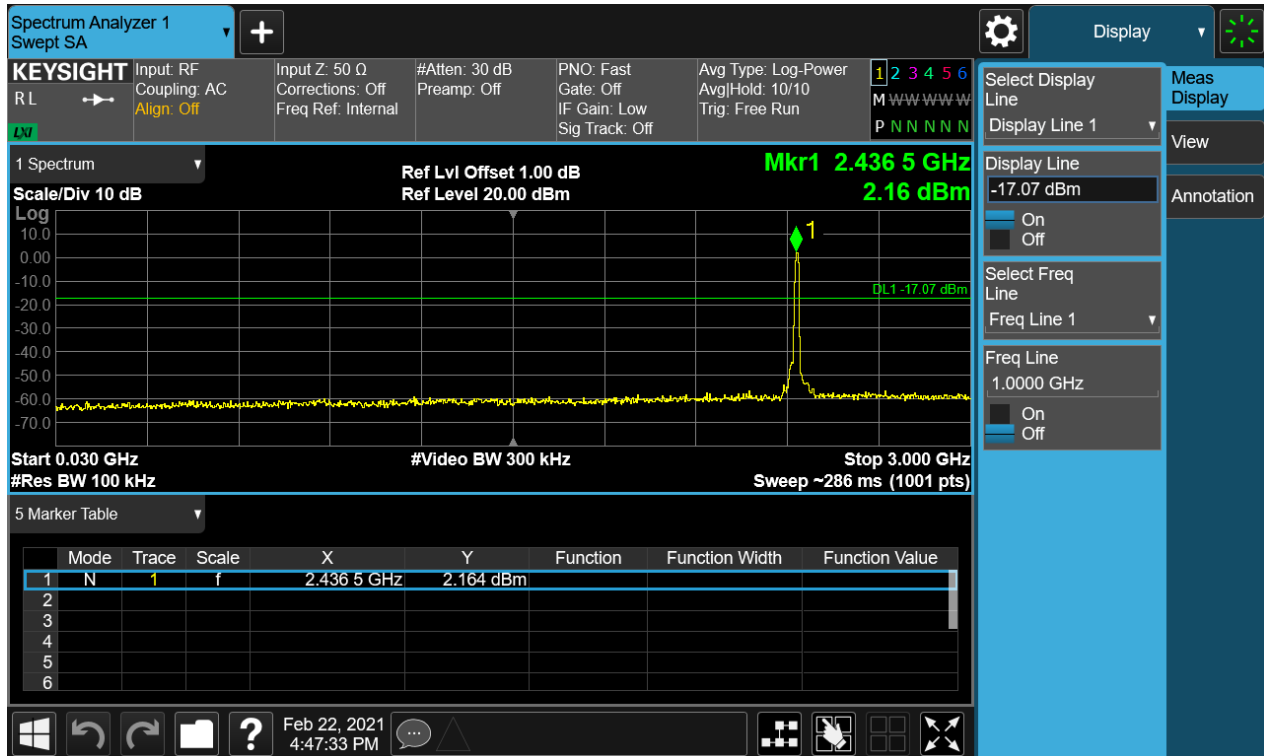
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Conducted spurious emissions 30MHz-25GHz



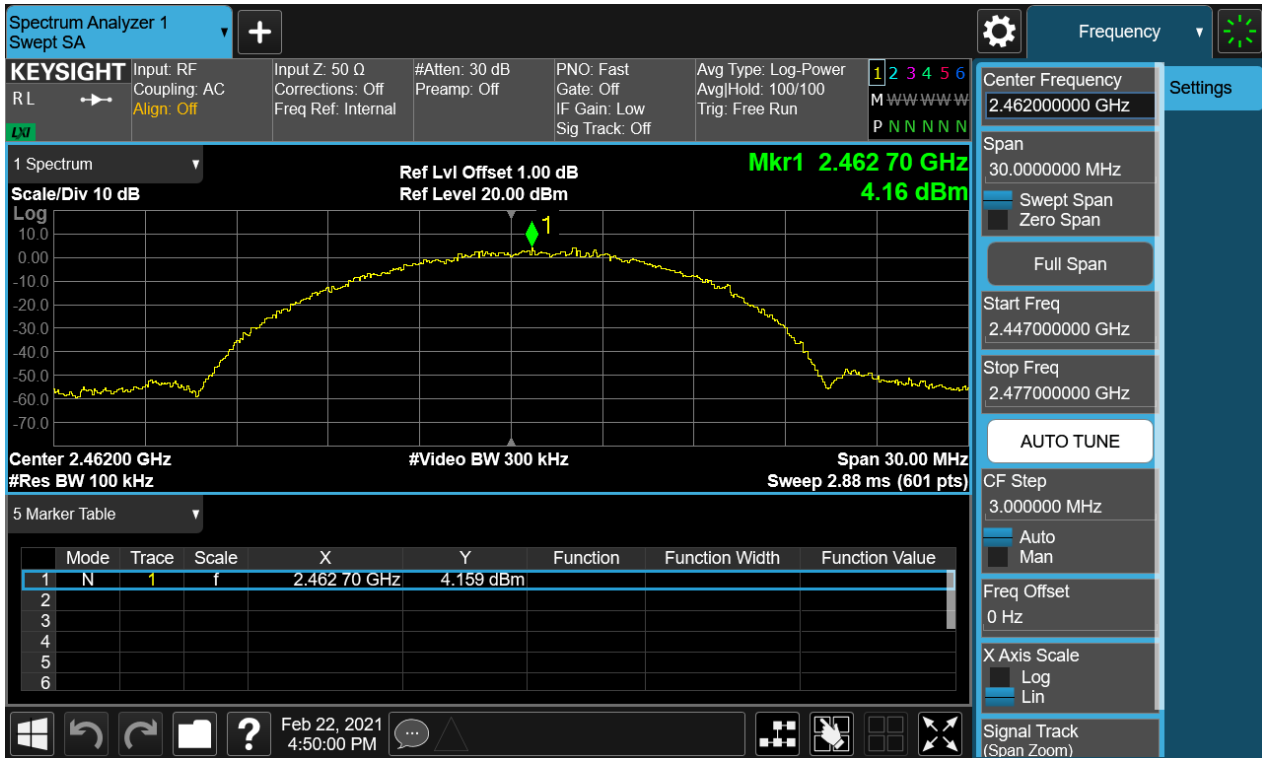
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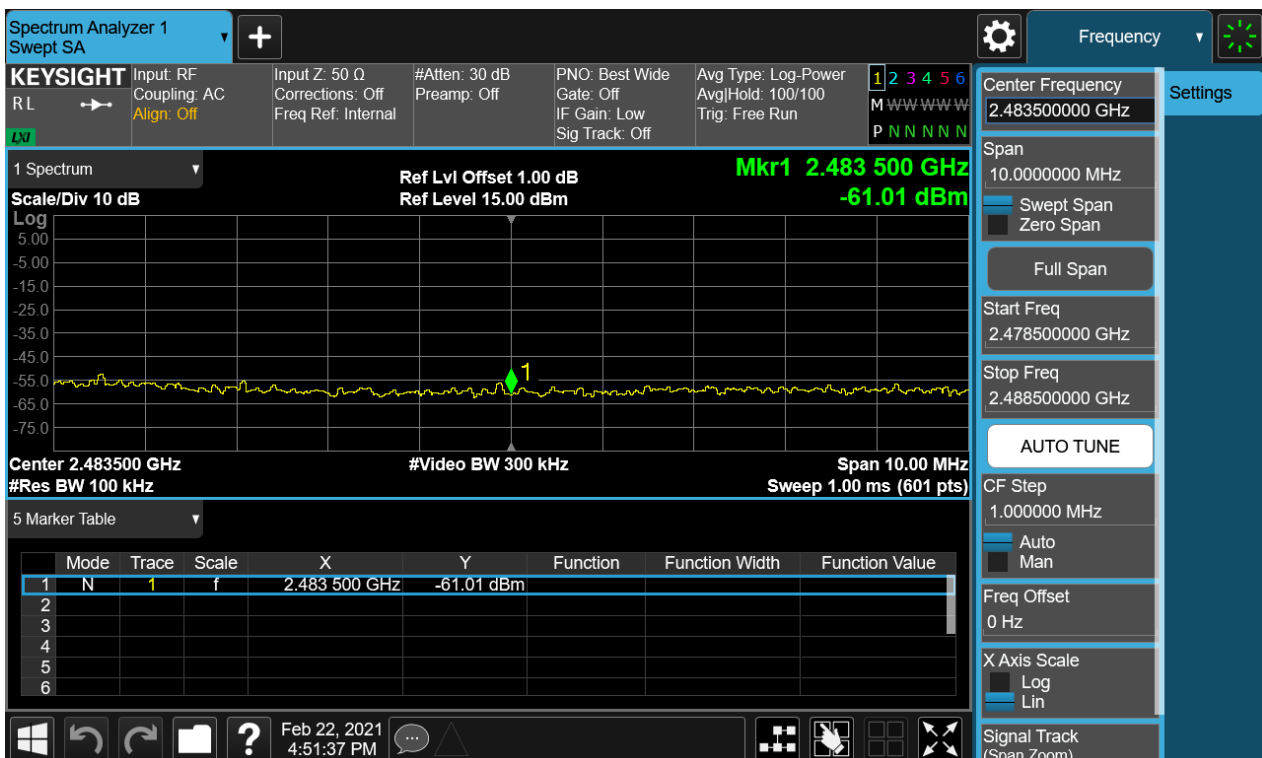
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Figure 27: Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2462MHz Carrier Level



Band Edge



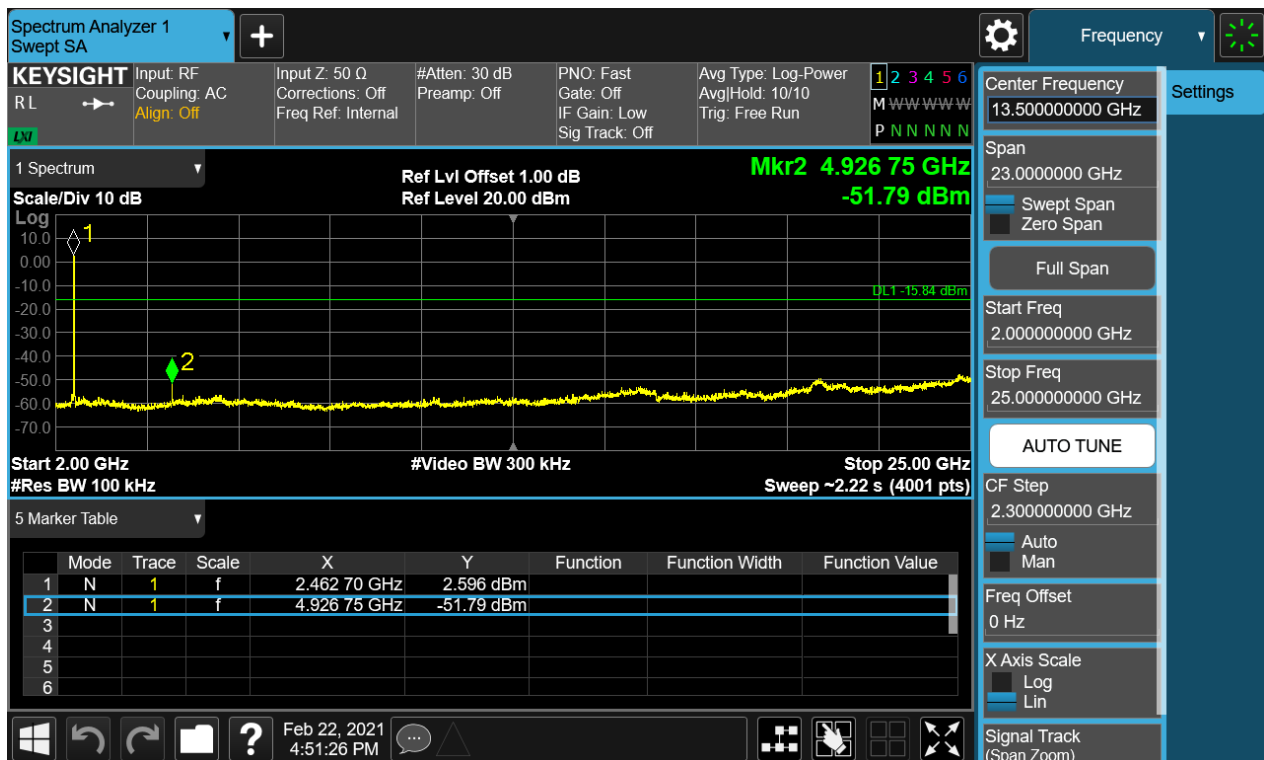
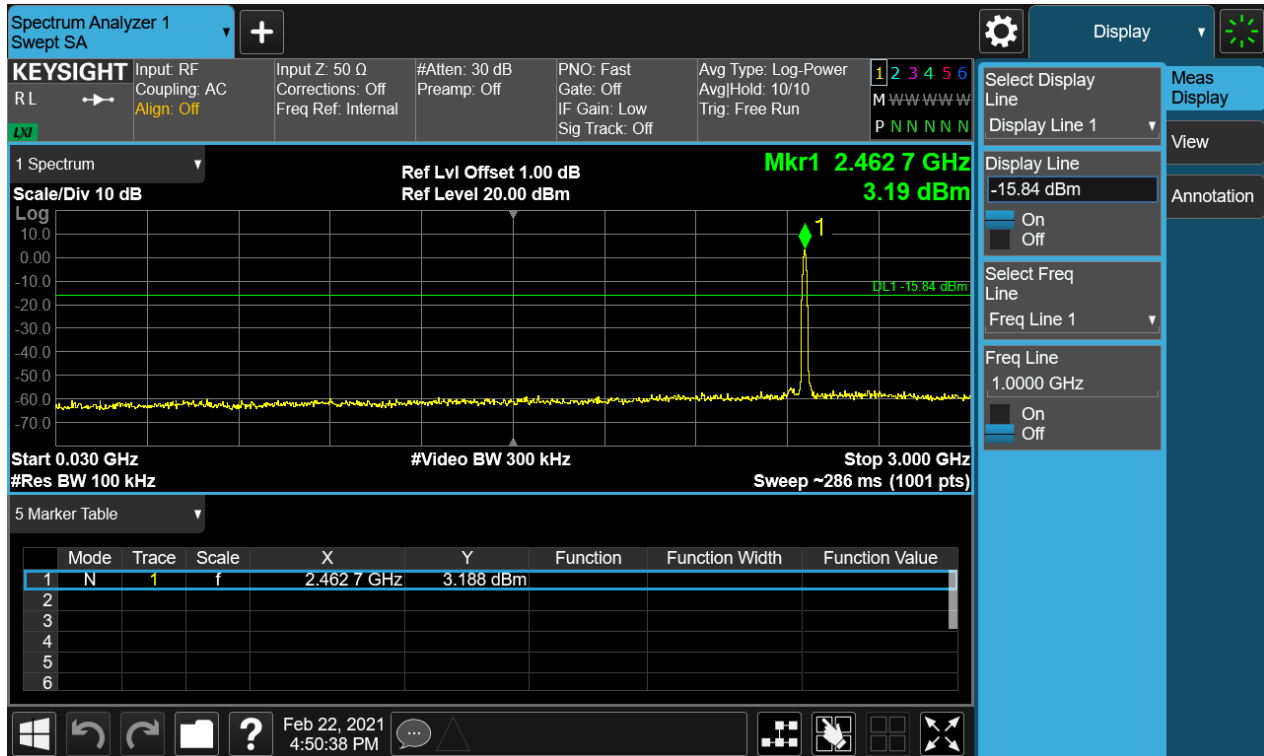
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Conducted spurious emissions 30MHz-25GHz



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Figure 28: Conducted Spurious Emission & Authorized-band band-edge, 802.11g, 2412MHz Carrier Level



Band Edge



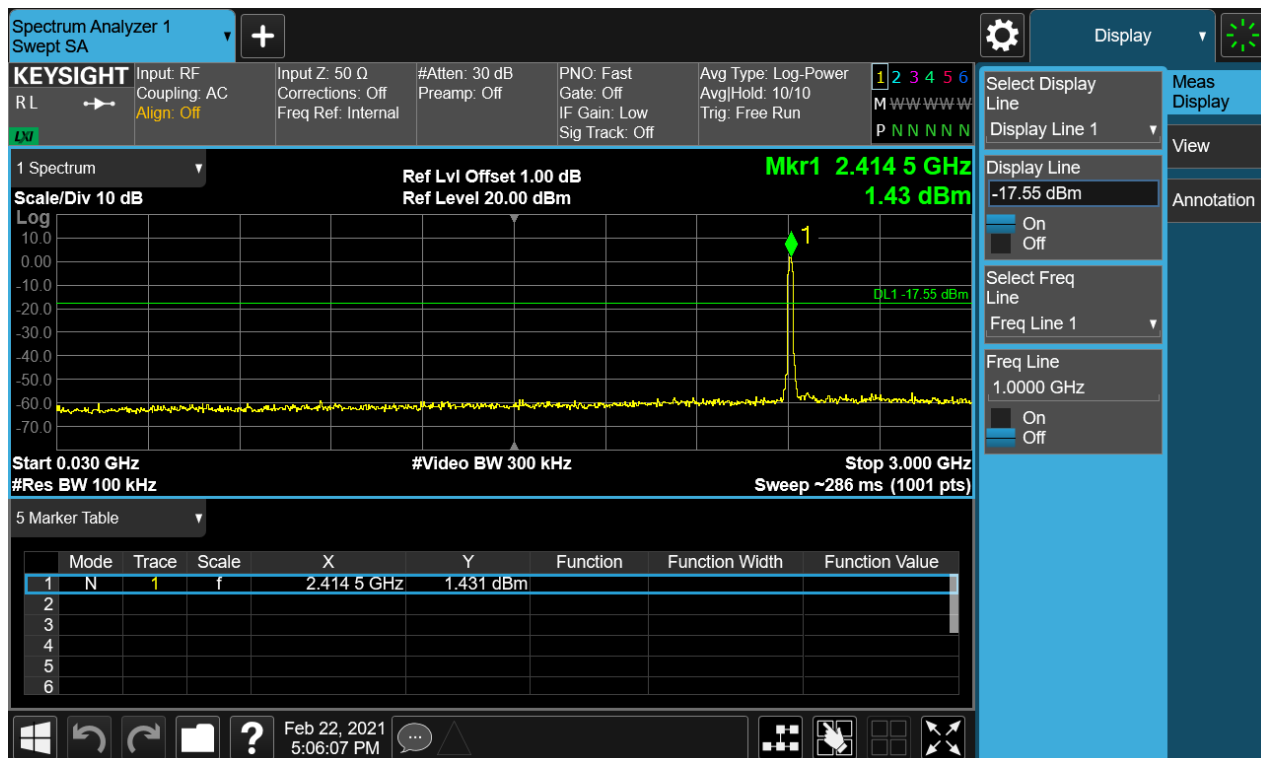
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Conducted spurious emissions 30MHz-25GHz



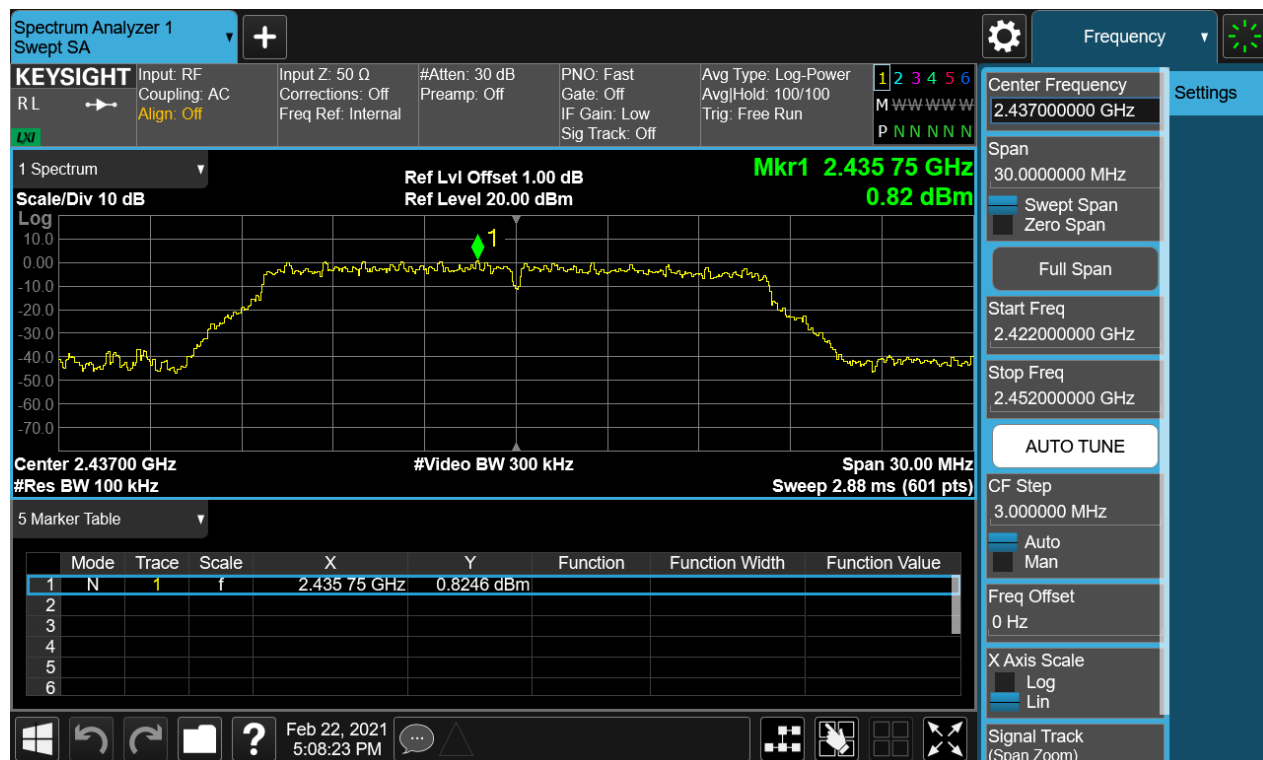
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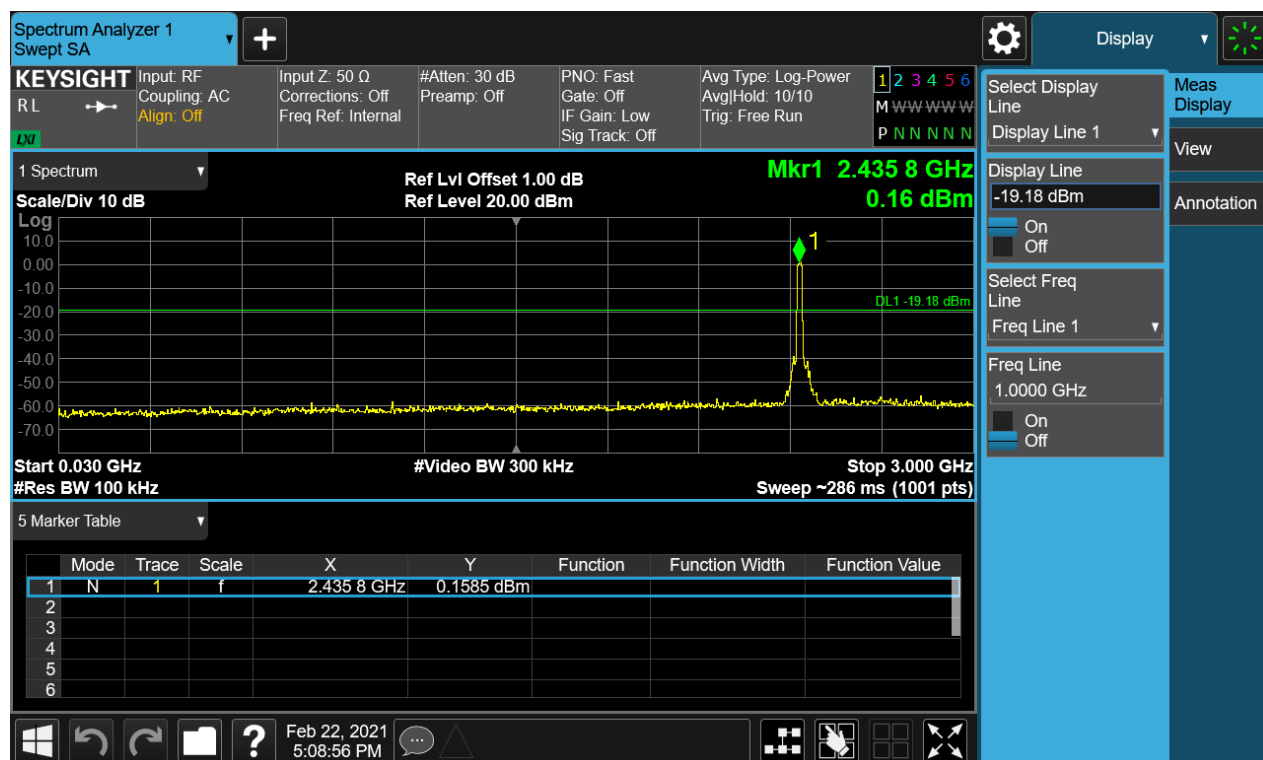
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Figure 29: Conducted Spurious Emission & Authorized-band band-edge, 802.11g, 2437MHz Carrier Level



Conducted spurious emissions 30MHz-25GHz



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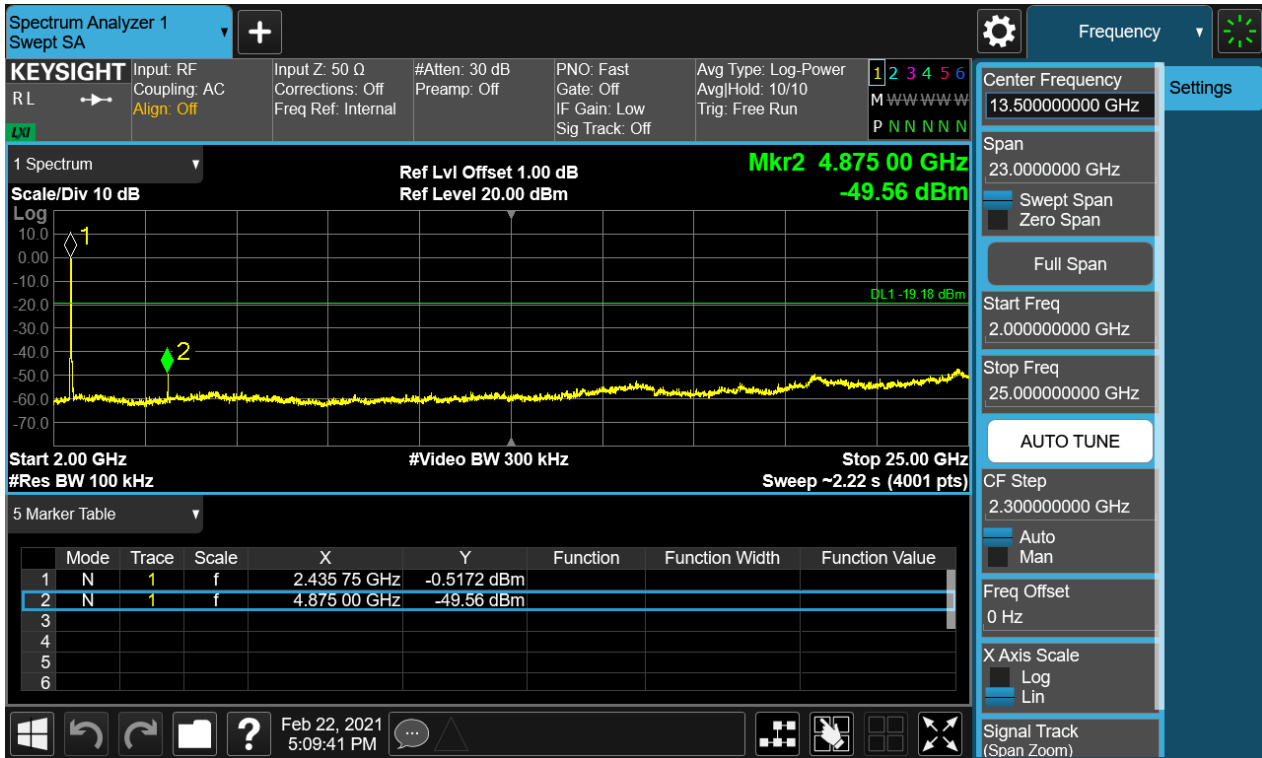


Figure 30: Conducted Spurious Emission & Authorized-band band-edge, 802.11g, 2462MHz Carrier Level



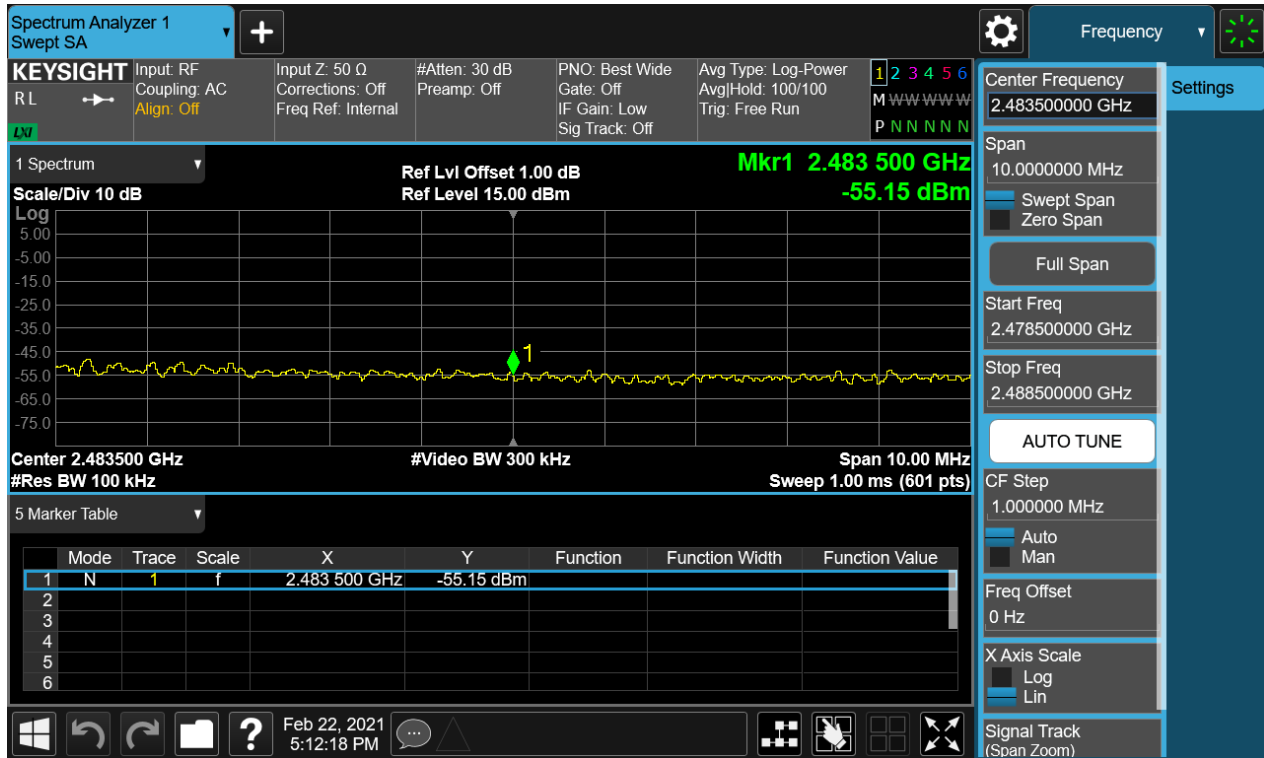
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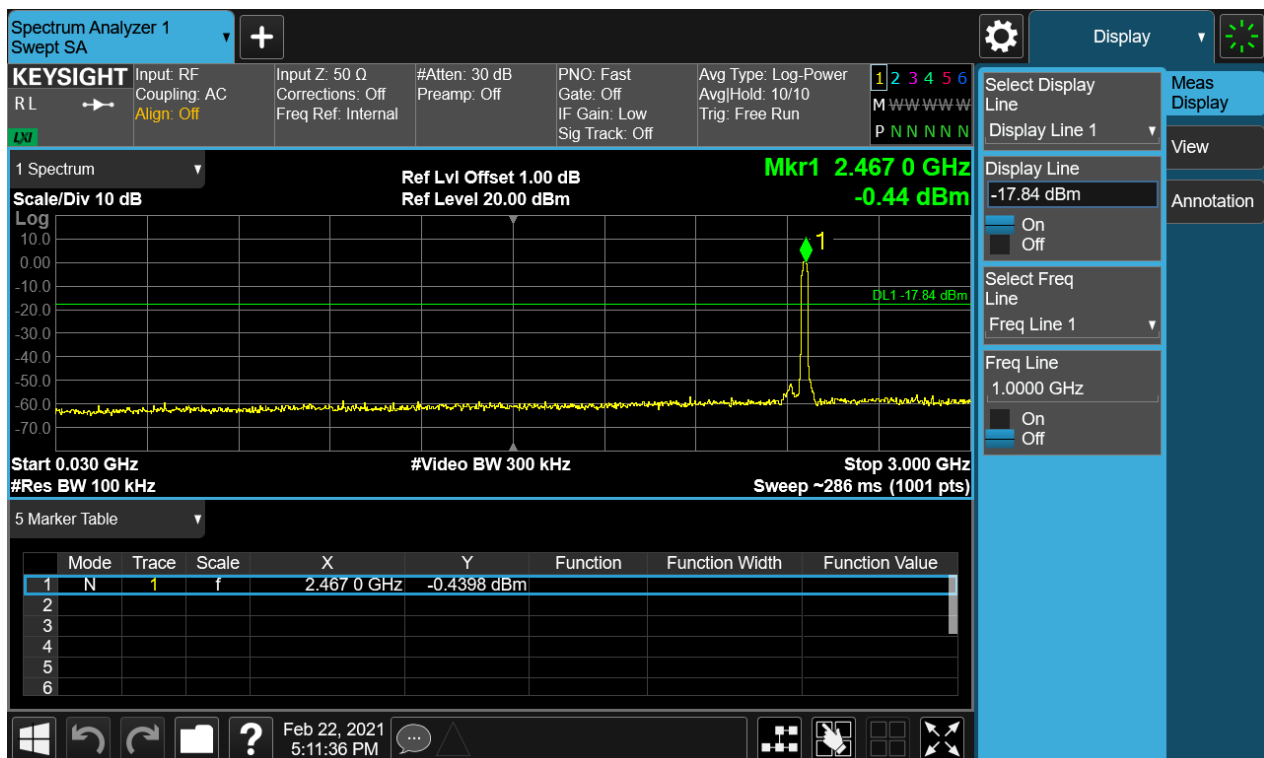
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Band Edge



Conducted spurious emissions 30MHz-25GHz



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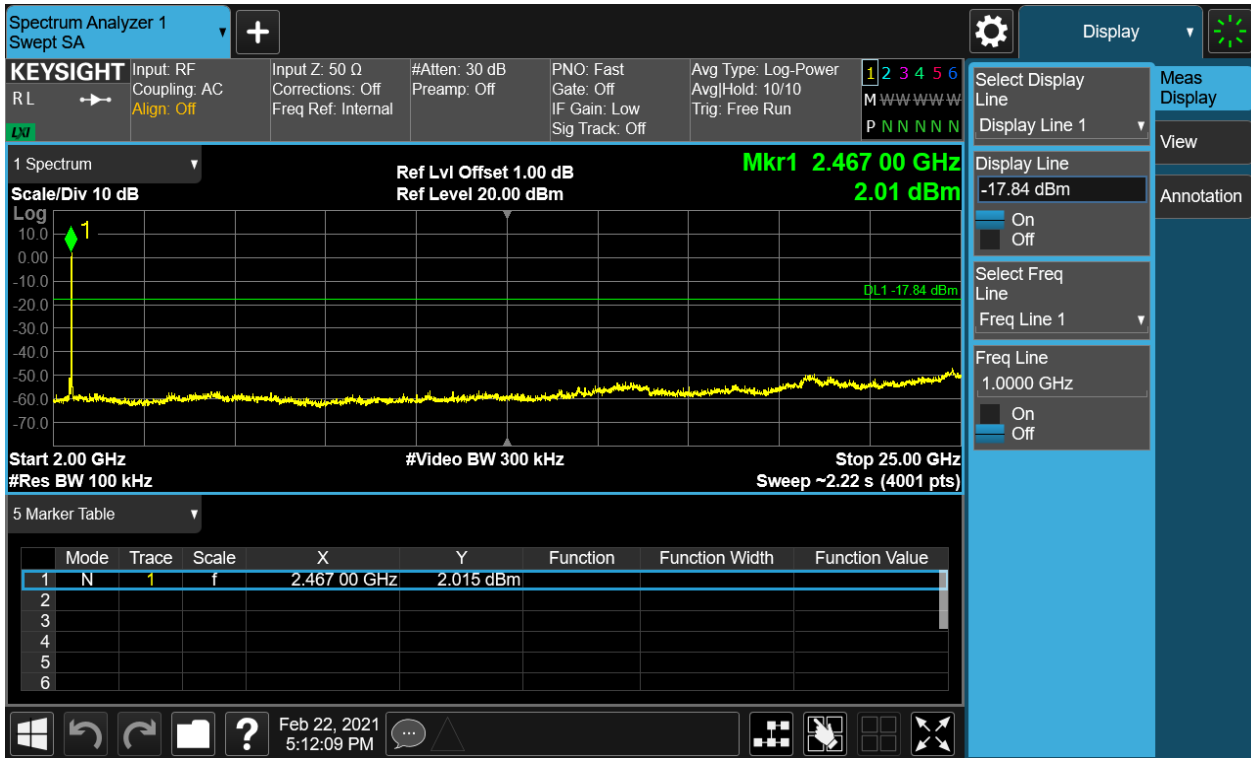
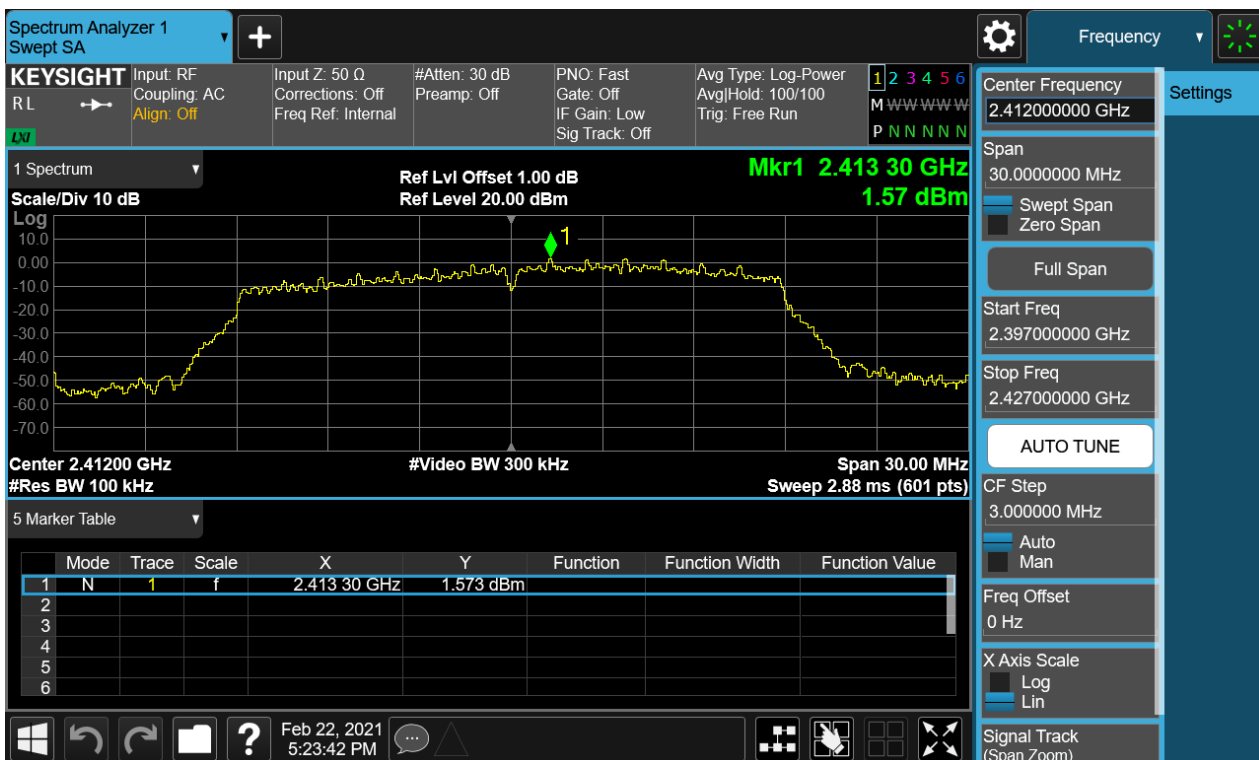


Figure 31: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT20), 2412MHz Carrier Level



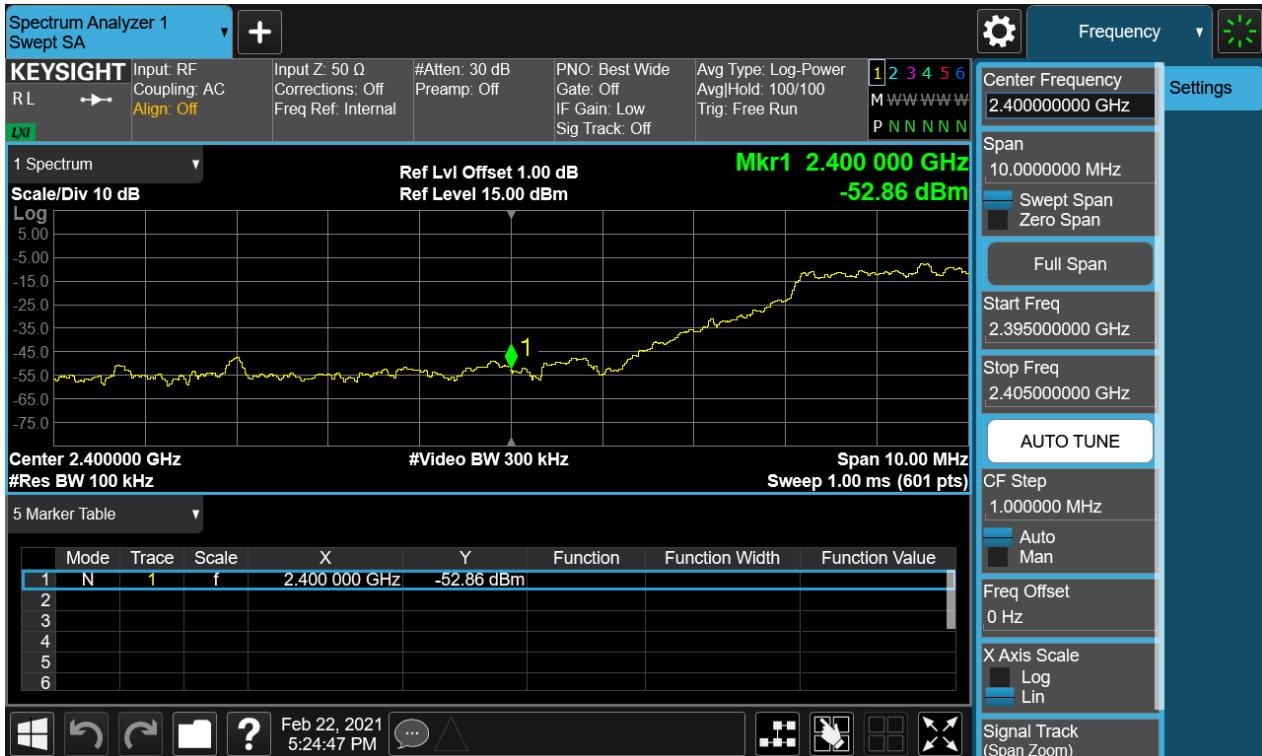
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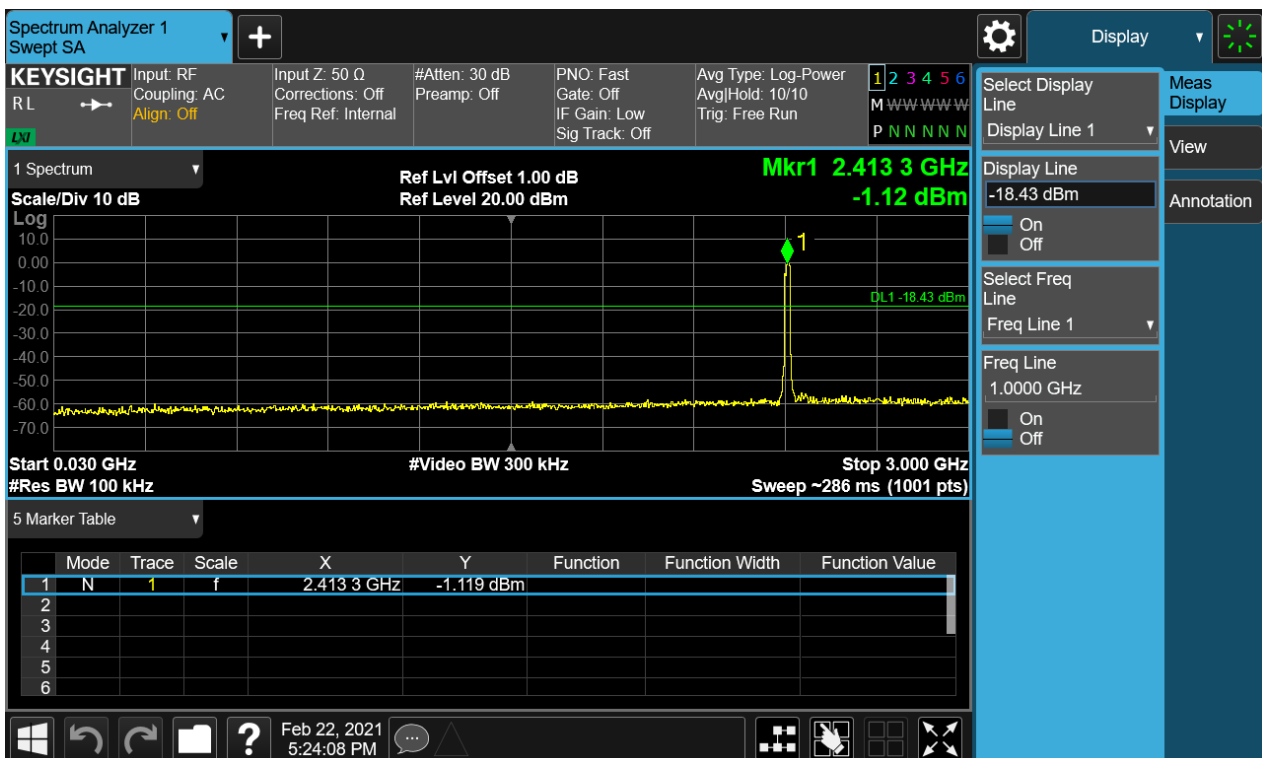
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Band Edge



Conducted spurious emissions 30MHz-25GHz



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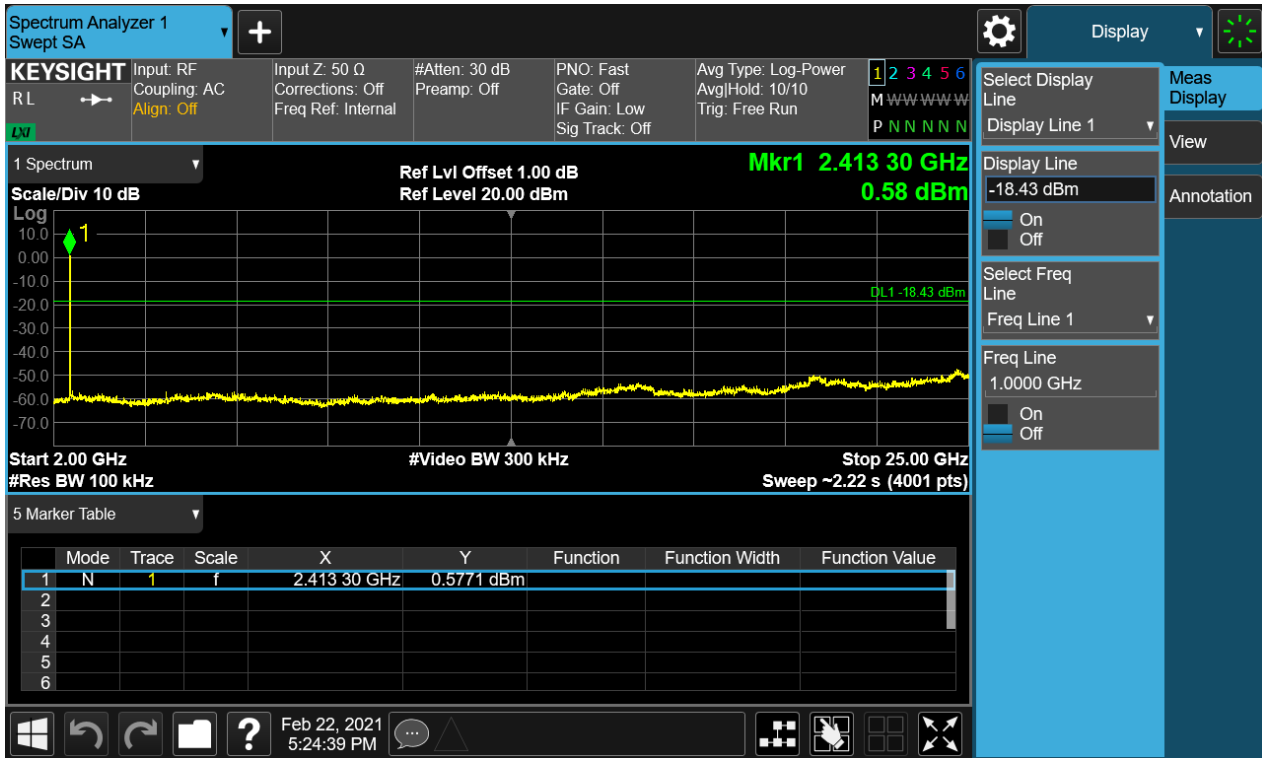
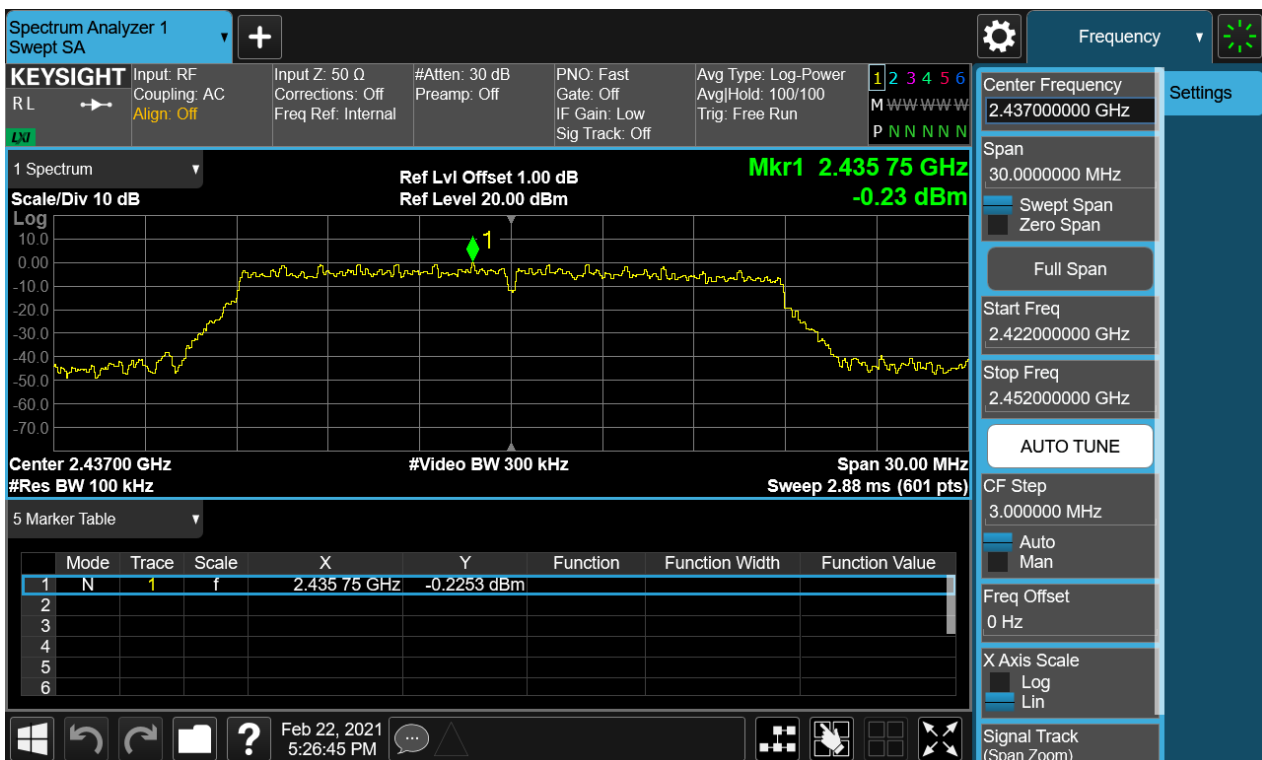


Figure 32: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT20), 2437MHz Carrier Level



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Conducted spurious emissions 30MHz-25GHz

