

TEST REPORT

Report No.: SHE20030033-02AE

Date: 2020-6-29

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Applicant : Luna Products, LLC
Address of Applicant : 3145 TIGER RUN CT STE 110, Carlsbad, CA 92010

Product Name : Battery Camera
Model No. : YWS.1220
Sample No. : E20030033-01#02
FCC ID : 2ATK4-YWS1220

Standards : FCC CFR47 Part 15, Subpart C
RSS-Gen (Issue 5, March 2019)
RSS-247 (Issue 2, February 2017)

Date of Receipt : 2020-3-9
Date of Test : 2020-3-9~2020-6-29
Date of Issue : 2020-6-29

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.

Prepared by: Jennifer Zhou Reviewed by: jesse Approved by: Guoyou Chi
(Jennifer Zhou) (jesse) (Authorized signatory: Guoyou Chi)

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Revision Record			
Version	Date	Revisions	Revised By
1.0	2019-10-31	Original	--

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1 General Information

1.1 Testing Laboratory

Company Name	ICAS Testing Technology Services (Shanghai) Co., Ltd.
Address	155 Pingbei Rd, Minhang District, Shanghai, China
Telephone	0086 21-51682999
Fax	0086 21-54711112
Homepage	www.icasiso.com

1.2 Details of Application

Company Name	Luna Products, LLC
Address	3145 TIGER RUN CT STE 110, Carlsbad, CA 92010

1.3 Details of EUT

Product Name	Battery Camera
Brand Name	Luna Products
Model No.	YWS.1220
FCC ID	2AFIB-YWS1029
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	Internal Antenna
Antenna Gain	2.6 dBi

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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)
RSS-Gen (Issue 5, March 2019)	General Requirements for Compliance of Radio Apparatus
RSS-247 (Issue 2, February 2017)	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
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	N9020B	MY59260184	2020-07-28
Spectrum Analyzer	Rohde & Schwarz	FSV40N	101450	2021-06-24
EMI Test Receiver	Rohde & Schwarz	ESPI3	100173	2021-06-19
EMI Test Receiver	Rohde & Schwarz	ESR 7	101911	2021-06-19
V-network	SCHWARZBECK	NSLK 8127	8127-902	2021-02-20
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	100687	2020-08-22
Broadband Antenna	SCHWARZBECK	VULB9163	9163-1037	2021-06-06
Horn Antenna-18G	SCHWARZBECK	BBHA9120D	9120D-1775	2021-06-06
Loop Antenna	SCHWARZBECK	FMZB 1513	N/A	2021-03-19
Horn Antenna-40G	YINGLIAN	LB-180400-KF	N/A	2021-07-26
Test Software	BL	BL410_E	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)	MCS5

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
N/A	N/A	N/A

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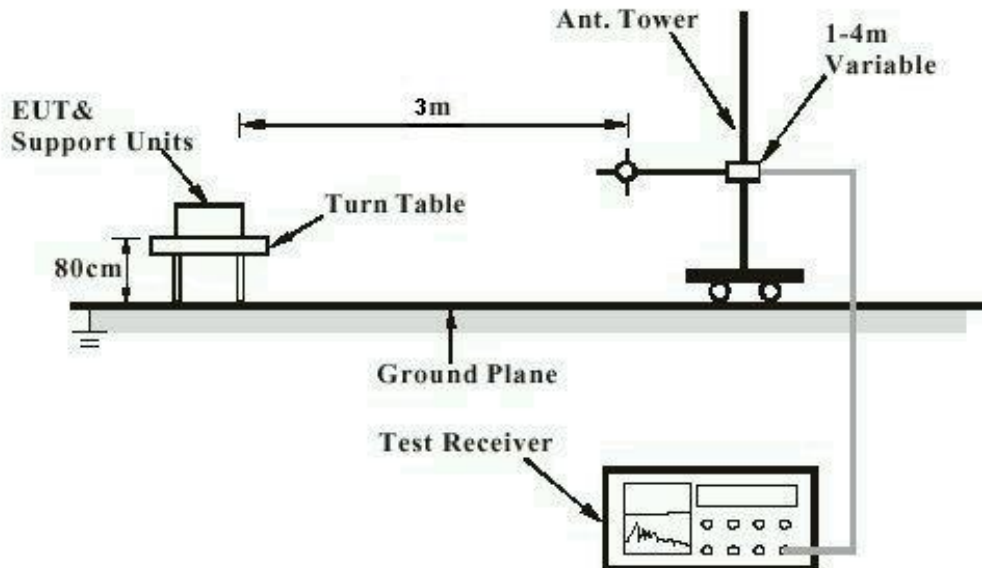
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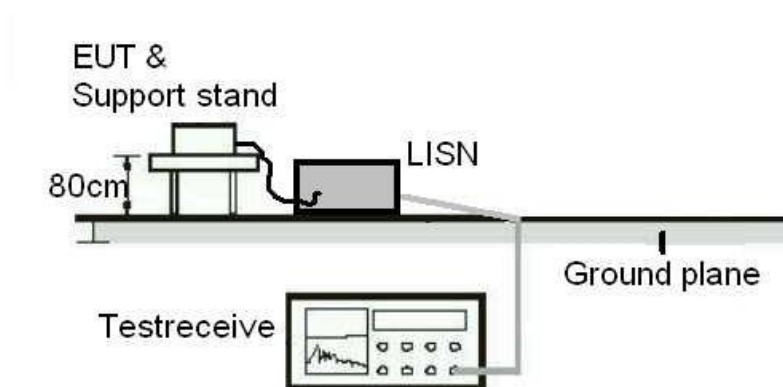
3.4 Test Setup Diagram

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



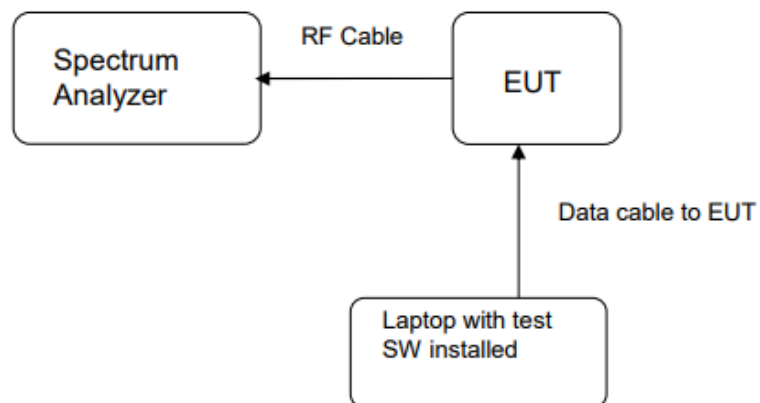
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Diagram of Measurement Equipment Configuration for Transmitter Measurement



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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
RSS-247 5.4(6)

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

According to the manufacturer declaration, the EUT has an antenna with a directional gain of **2.6** dBi. The antenna is an internal 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 and E.I.R.P

RESULT:

PASS

Test standard : FCC Part 15.247(b)(3)
RSS-247 5.4(4)
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)	Measured Peak Power		Limit (W)
		(dBm)	(mW)	
802.11b	2412	15.42	34.83	< 1
	2437	14.84	30.48	
	2462	14.82	30.34	
802.11g	2412	12.91	19.54	
	2437	12.62	18.28	
	2462	12.74	18.79	
802.11n(HT20)	2412	12.59	18.16	
	2437	12.36	17.22	
	2462	12.61	18.24	
802.11n(HT40)	2422	12.19	16.56	
	2437	12.17	16.48	
	2452	12.42	17.46	

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Table 2: E.I.R.P

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(mW)	
802.11b	2412	18.02	63.39	< 4
	2437	17.44	55.46	
	2462	17.42	55.21	
802.11g	2412	15.51	35.56	
	2437	15.22	33.27	
	2462	15.34	34.20	
802.11n(HT20)	2412	15.19	33.04	
	2437	14.96	31.33	
	2462	15.21	33.19	
802.11n(HT40)	2422	14.79	30.13	
	2437	14.77	29.99	
	2452	15.02	31.77	

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4.1.3 6dB Bandwidth and 99% Bandwidth

RESULT:

PASS

Test standard : FCC Part 15.247(a)(2)
RSS-247 5.2(1)
RSS-Gen 6.6
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: 6dB Bandwidth and 99% Bandwidth

Test Mode	Test Channel (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth Limit (MHz)
802.11b	2412	6.402	12.070	0.5
	2437	7.067	11.964	
	2462	7.750	12.099	
802.11g	2412	16.47	16.487	
	2437	16.51	16.491	
	2462	16.30	16.456	
802.11n(HT20)	2412	17.66	17.696	
	2437	17.56	17.682	
	2462	17.65	17.632	
802.11n(HT40)	2422	35.79	35.986	
	2437	35.27	35.834	
	2452	35.80	36.113	

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Figure 1: 6dB Bandwidth and 99% Bandwidth, 802.11b, 2412MHz

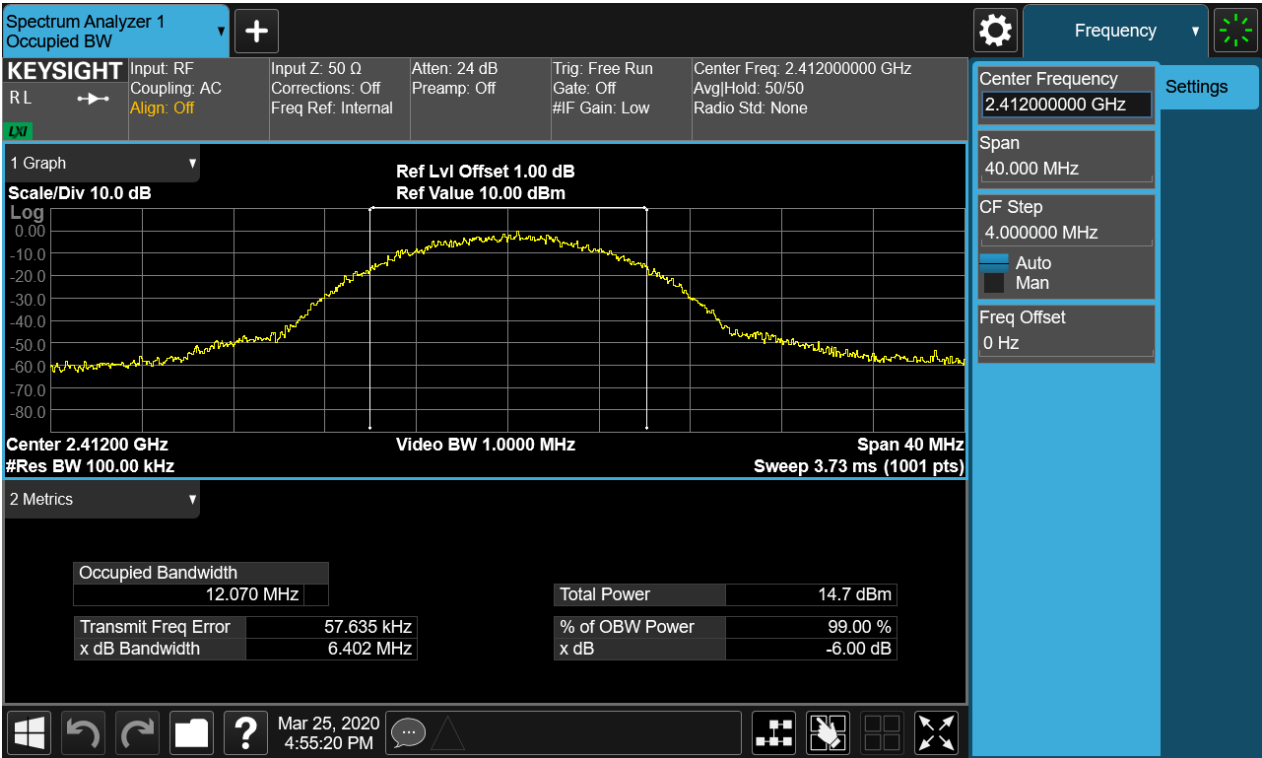
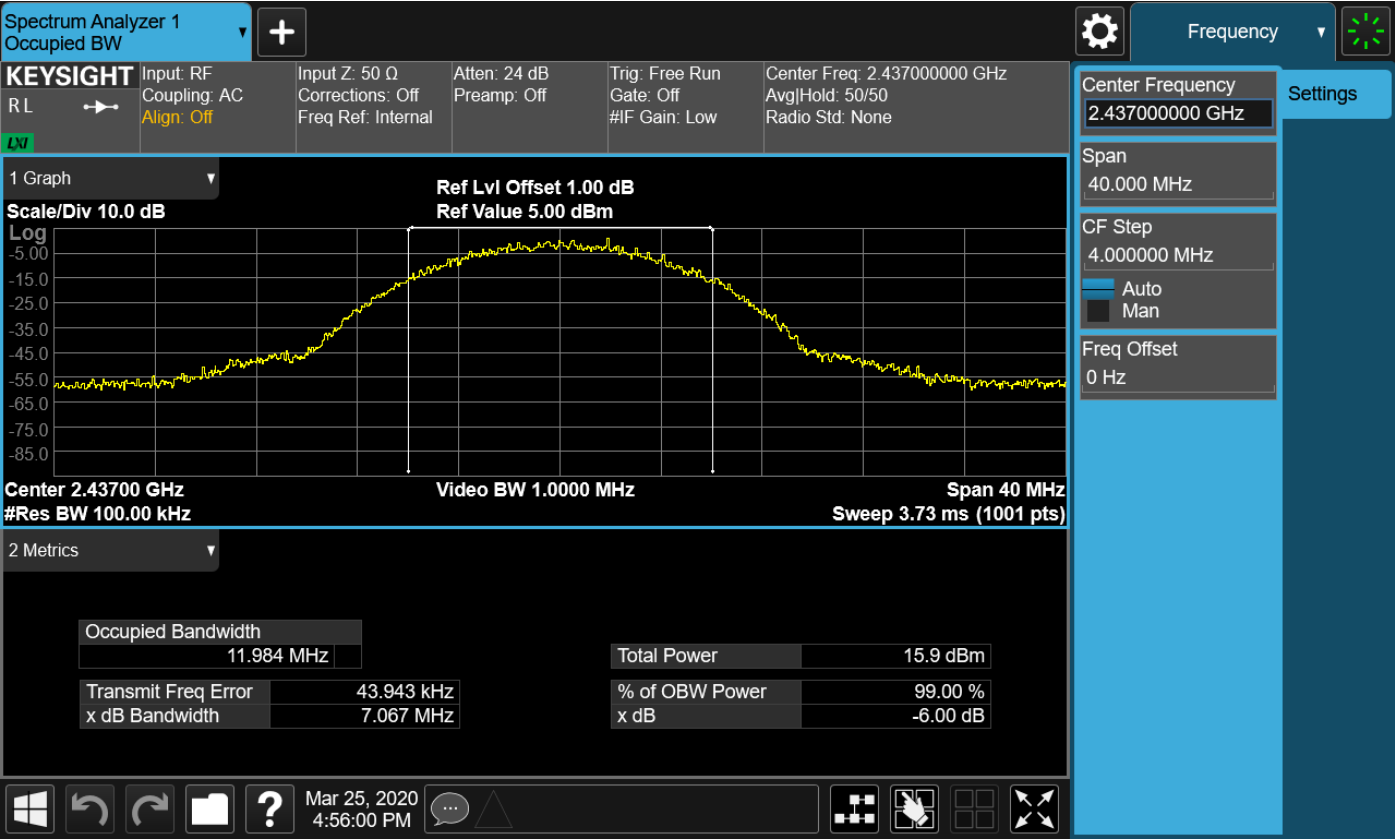


Figure 2: 6dB Bandwidth and 99% Bandwidth, 802.11b, 2437MHz

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Figure 3: 6dB Bandwidth and 99% Bandwidth, 802.11b, 2462MHz

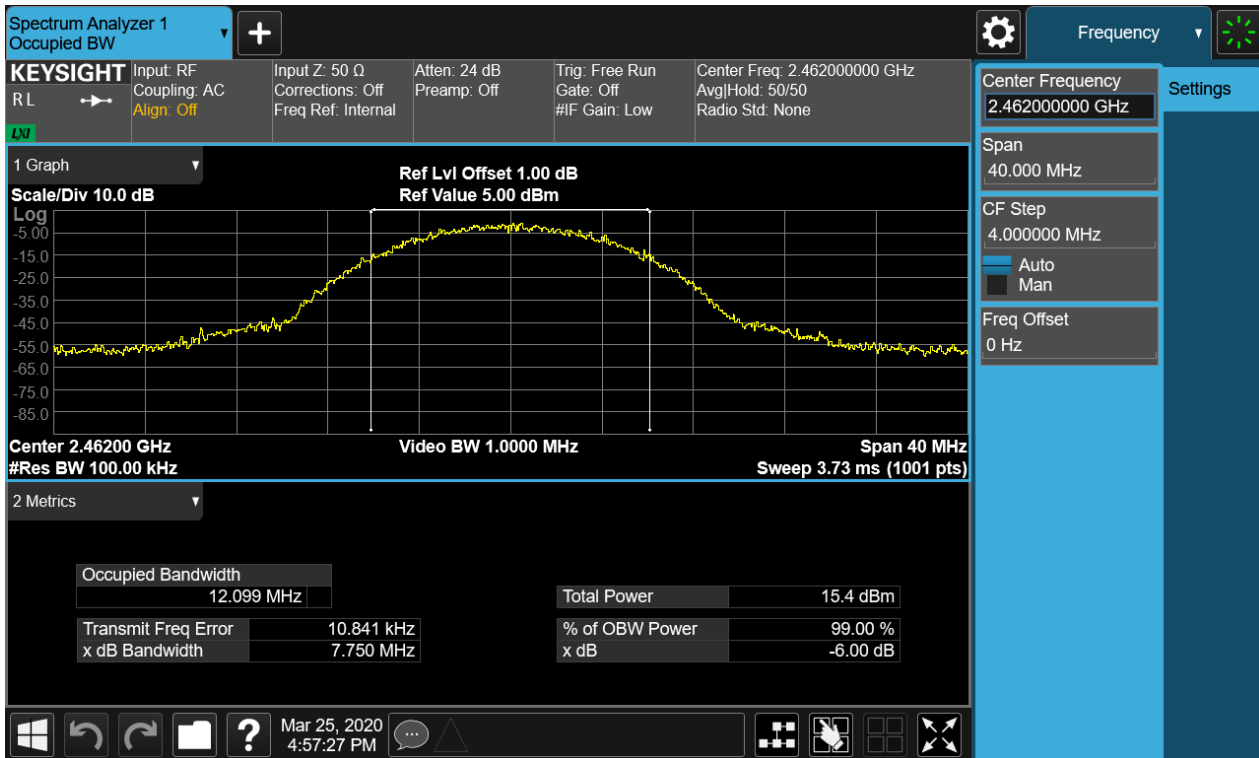
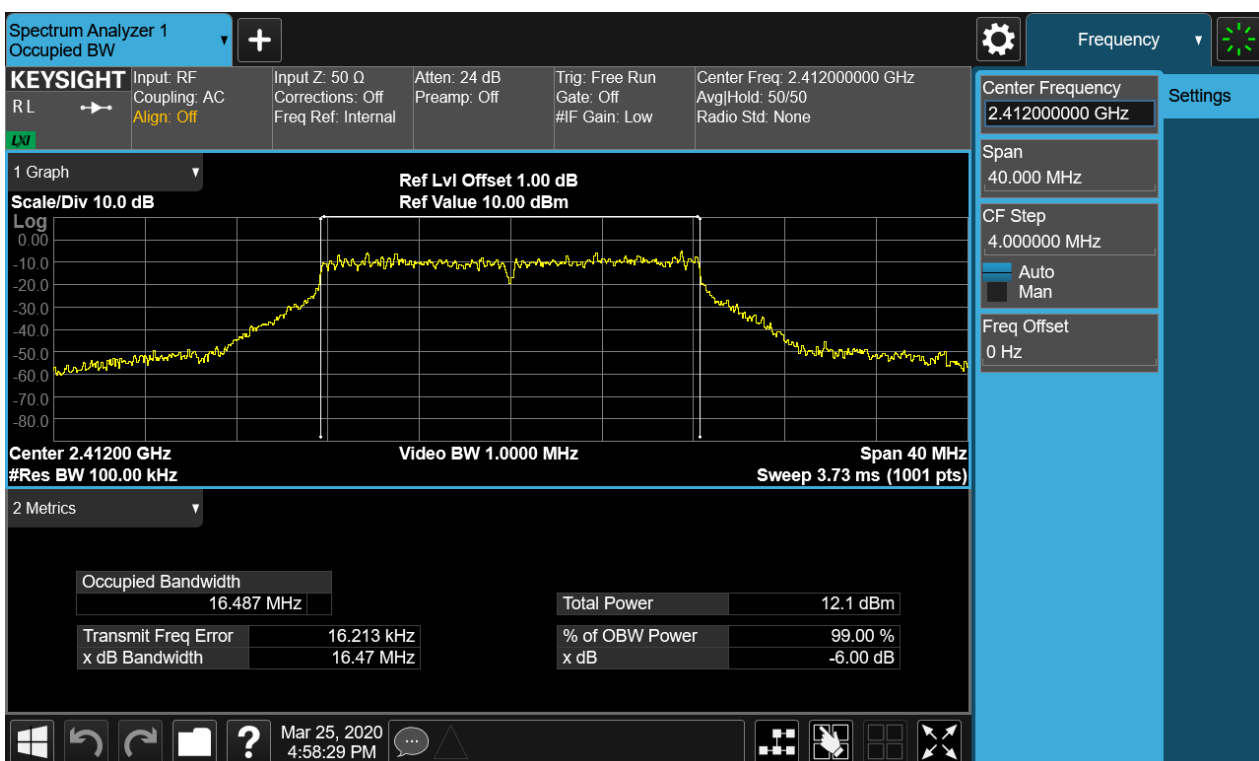


Figure 4: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2412MHz



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Figure 5: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2437MHz

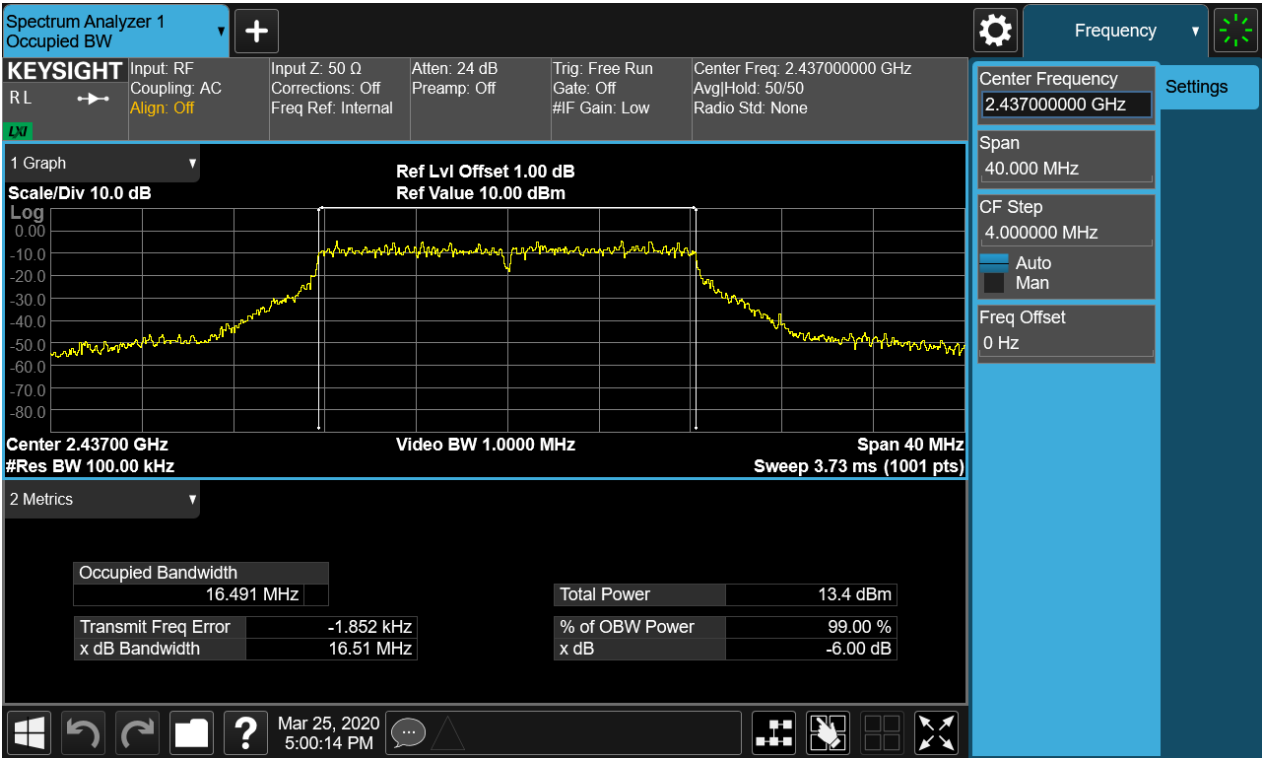
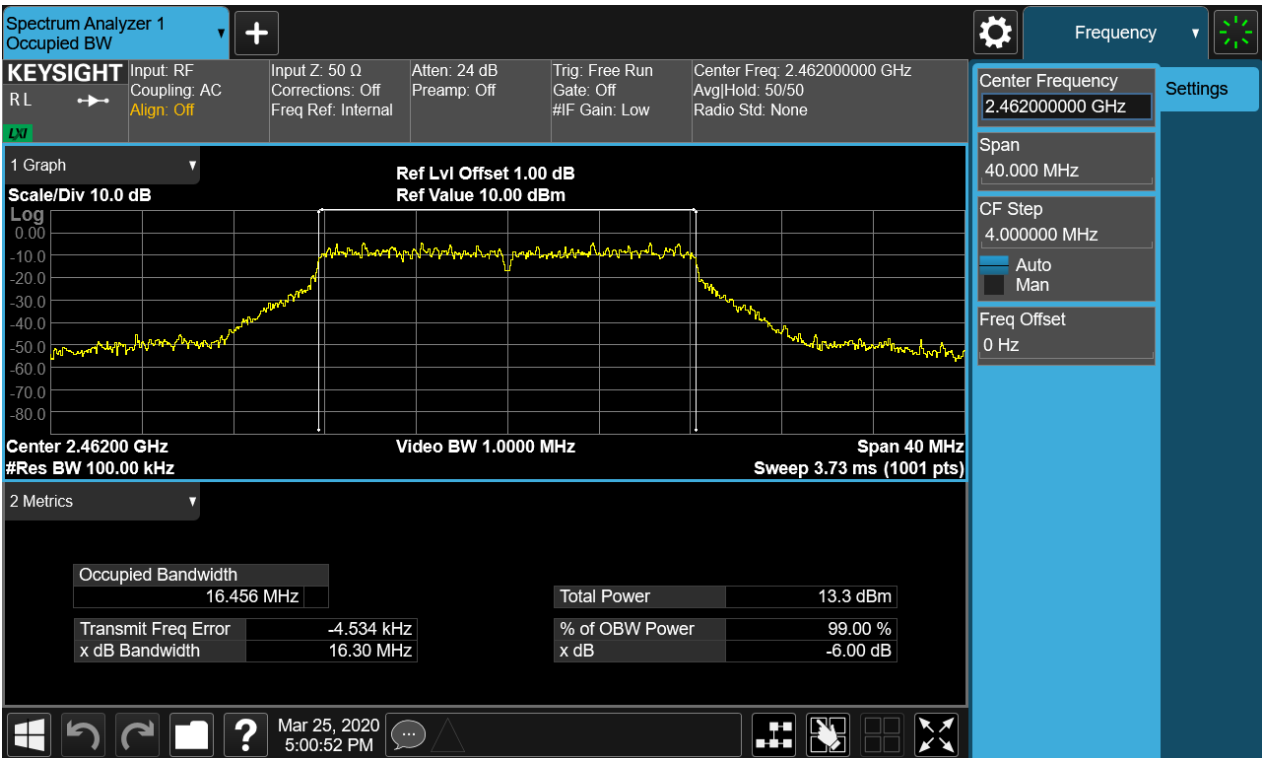


Figure 6: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2462MHz



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Figure 7: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2412MHz

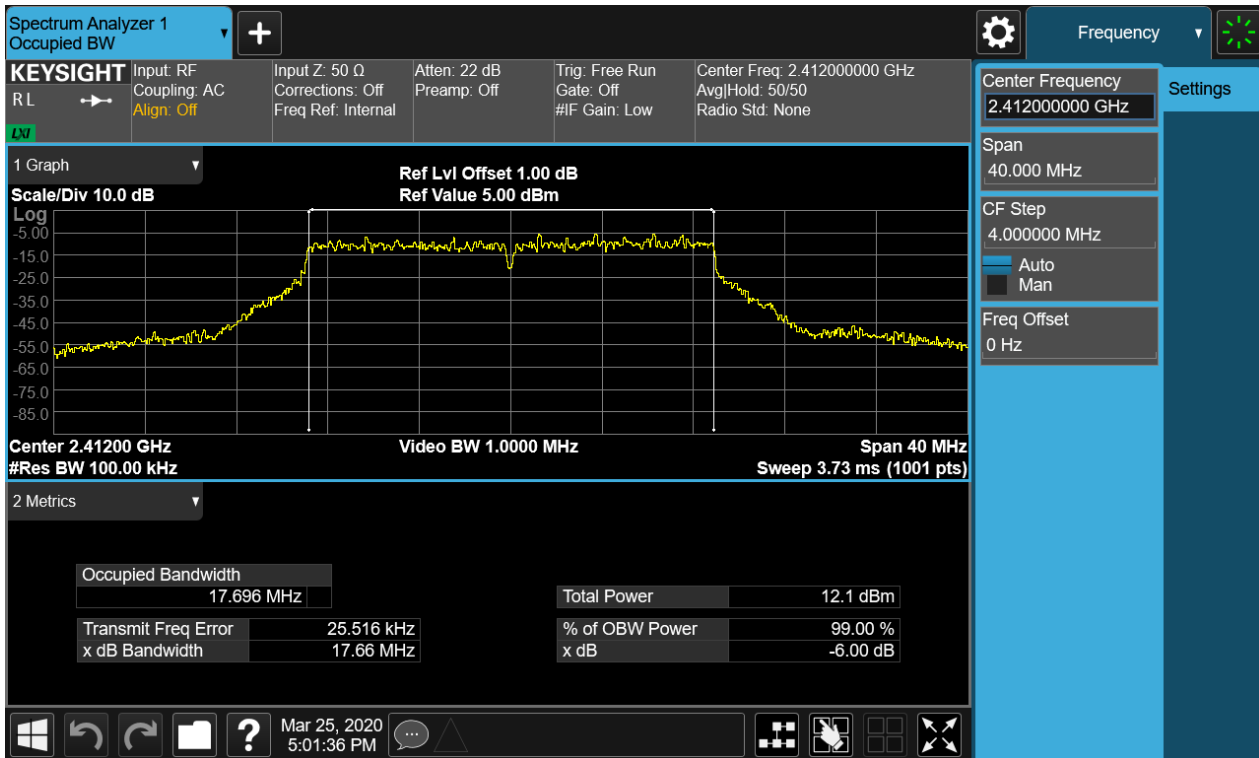
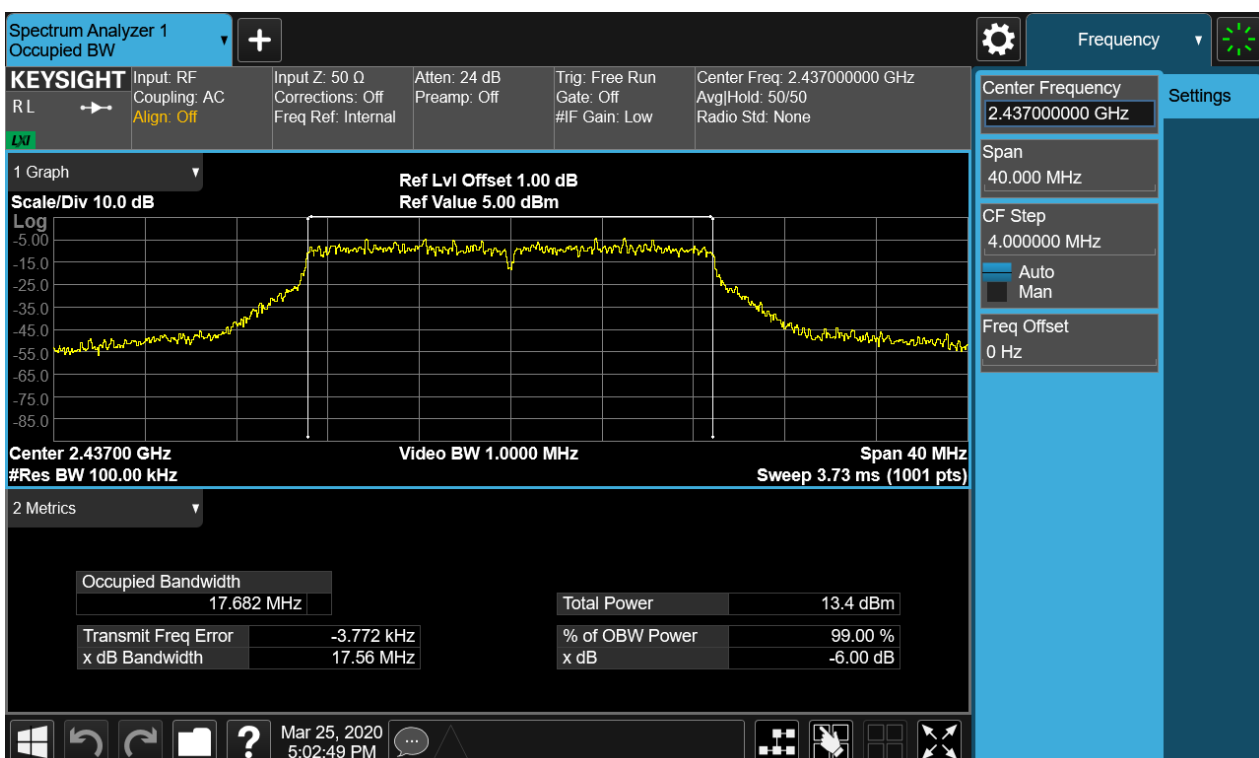


Figure 8: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2437MHz



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Figure 9: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2462MHz

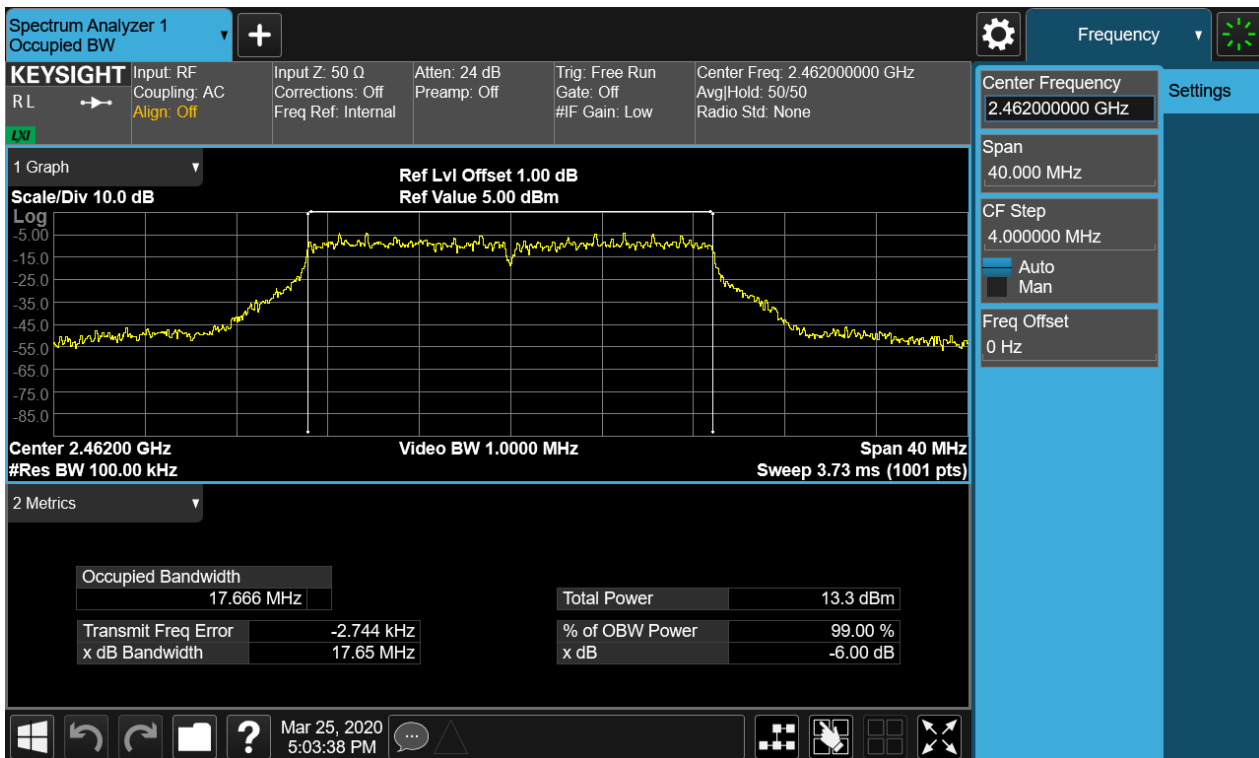


Figure 10: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 2422MHz

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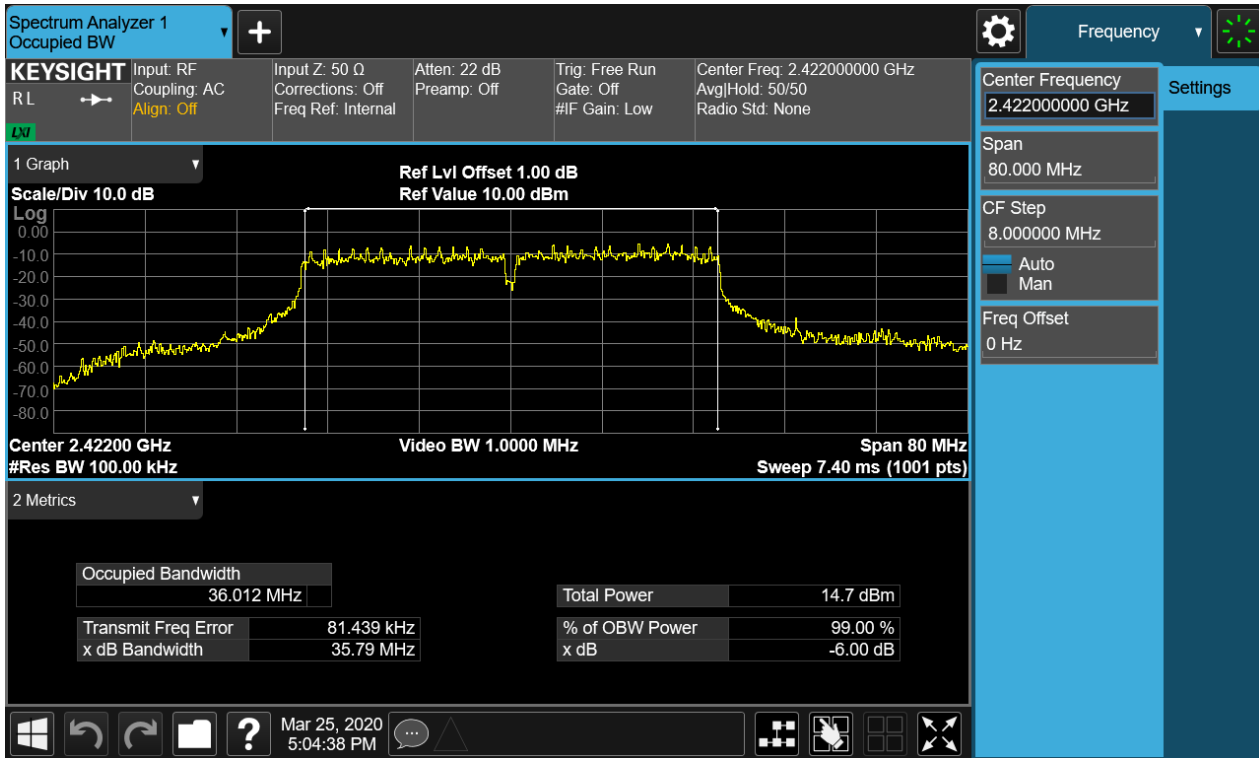
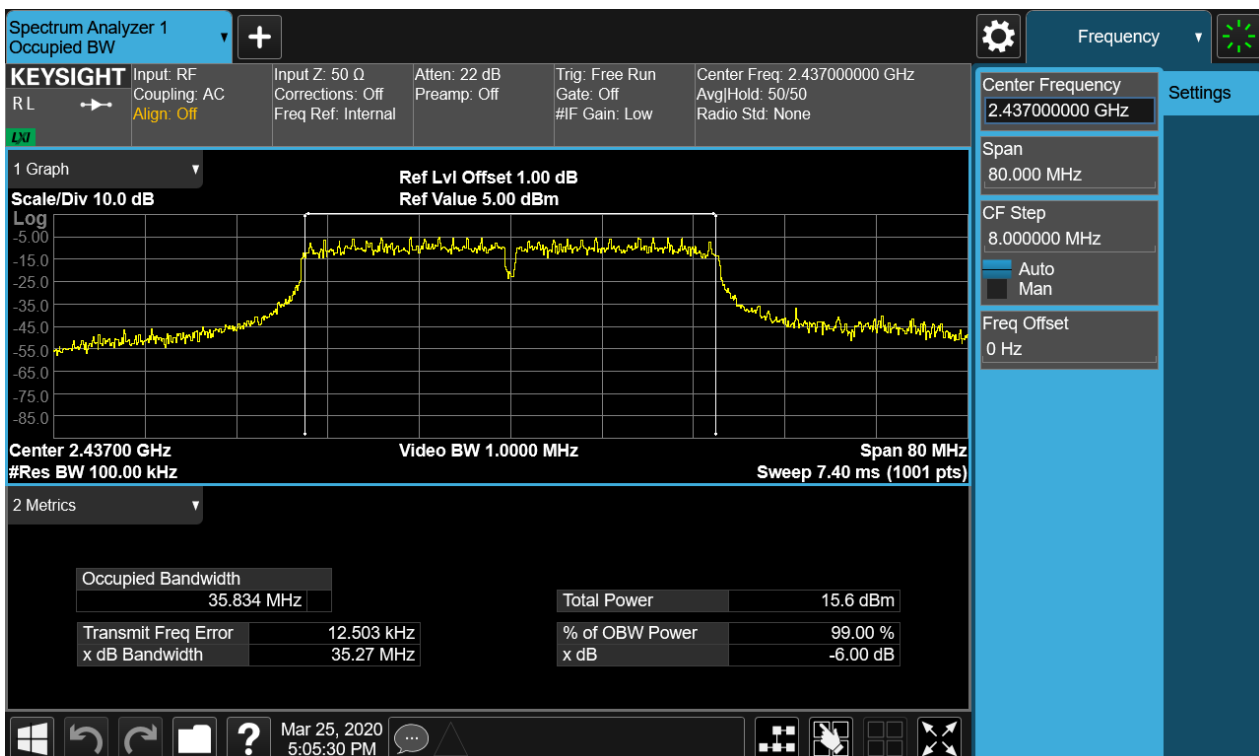


Figure 11: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 2437MHz



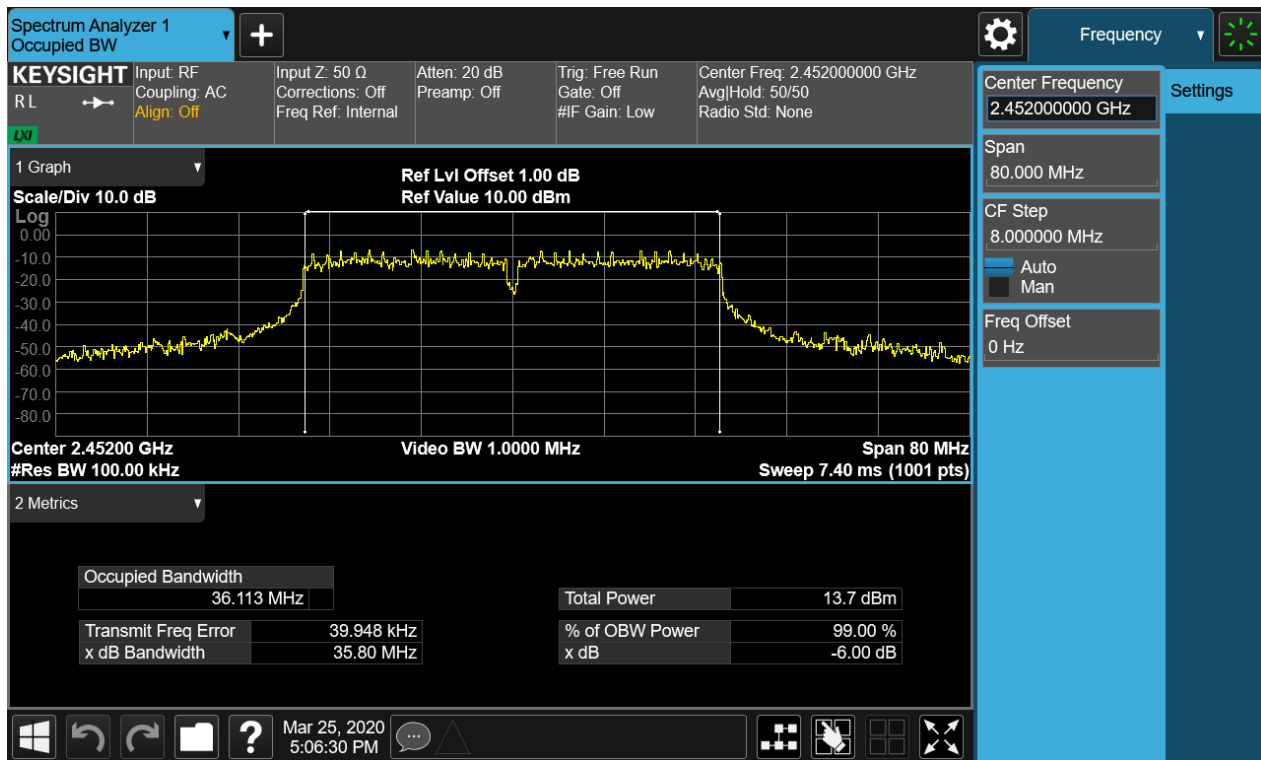
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Figure 12: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 2452MHz



4.1.4 Power Spectral Density

RESULT:

PASS

Test standard : FCC Part 15.247(e)
RSS-247 5.2(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%

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Table 4: Power Spectral Density

Test Mode	Test Channel (MHz)	Measured Result (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	2412	-12.15	8
	2437	-13.26	
	2462	-3.23	
802.11g	2412	-16.14	
	2437	-16.63	
	2462	-2.36	
802.11n(HT20)	2412	-16.52	
	2437	-16.89	
	2462	-2.87	
802.11n(HT40)	2422	-19.39	
	2437	-19.45	
	2452	-20.69	

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

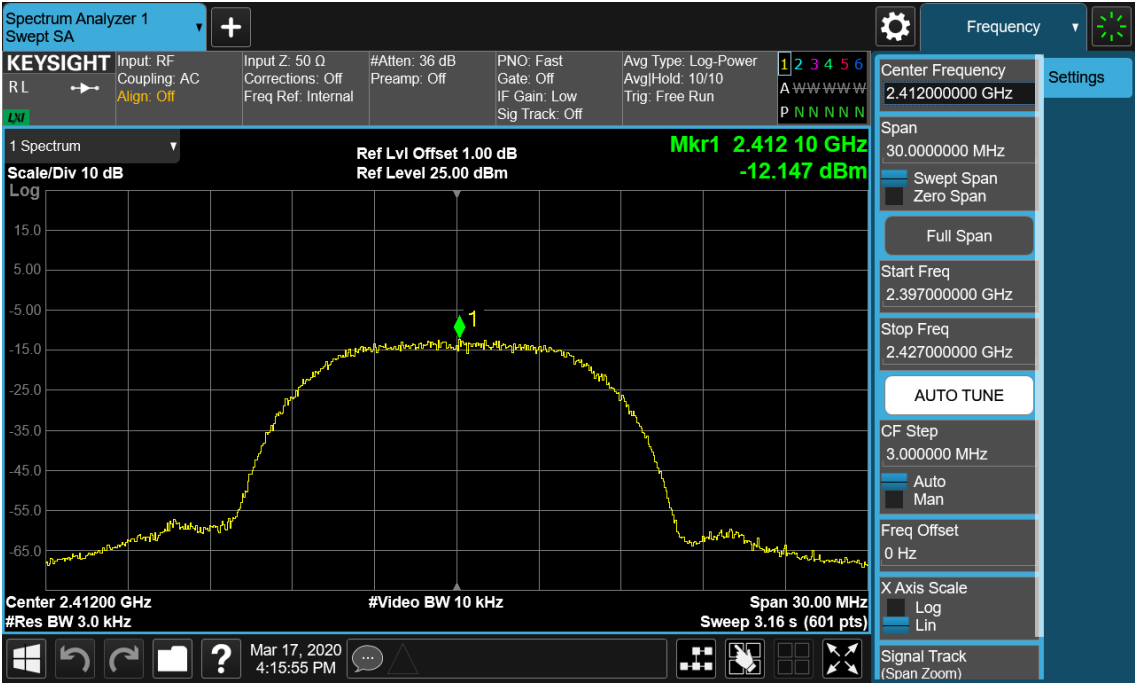
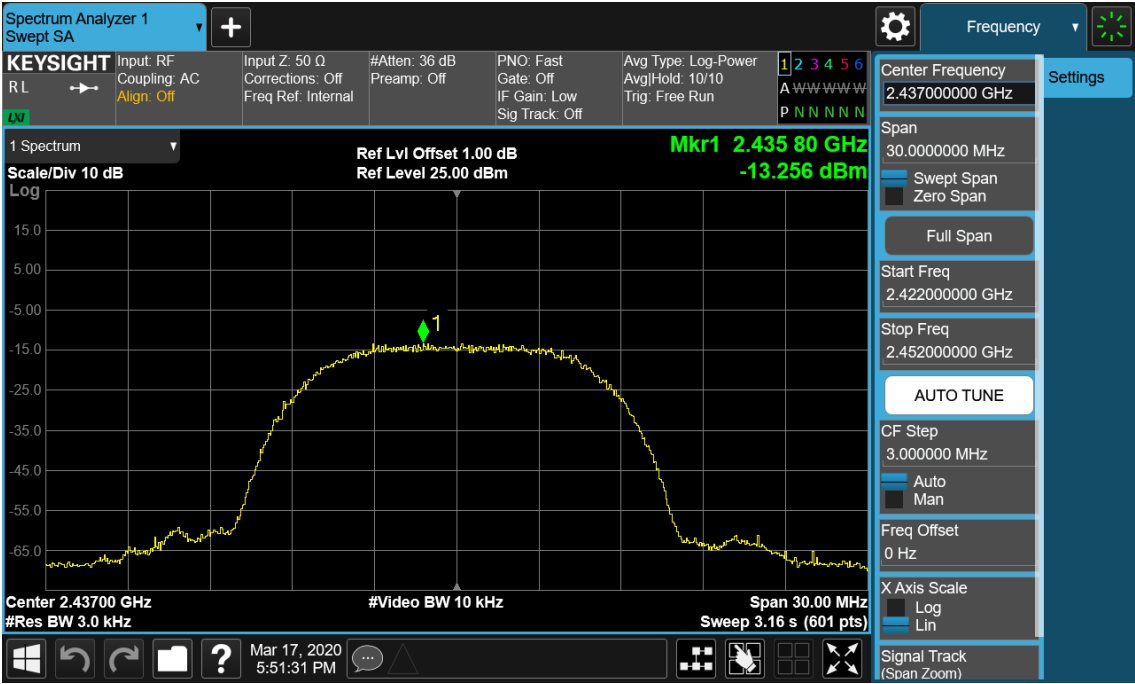


Figure 14: Power Spectral Density, 802.11b, 2437MHz



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

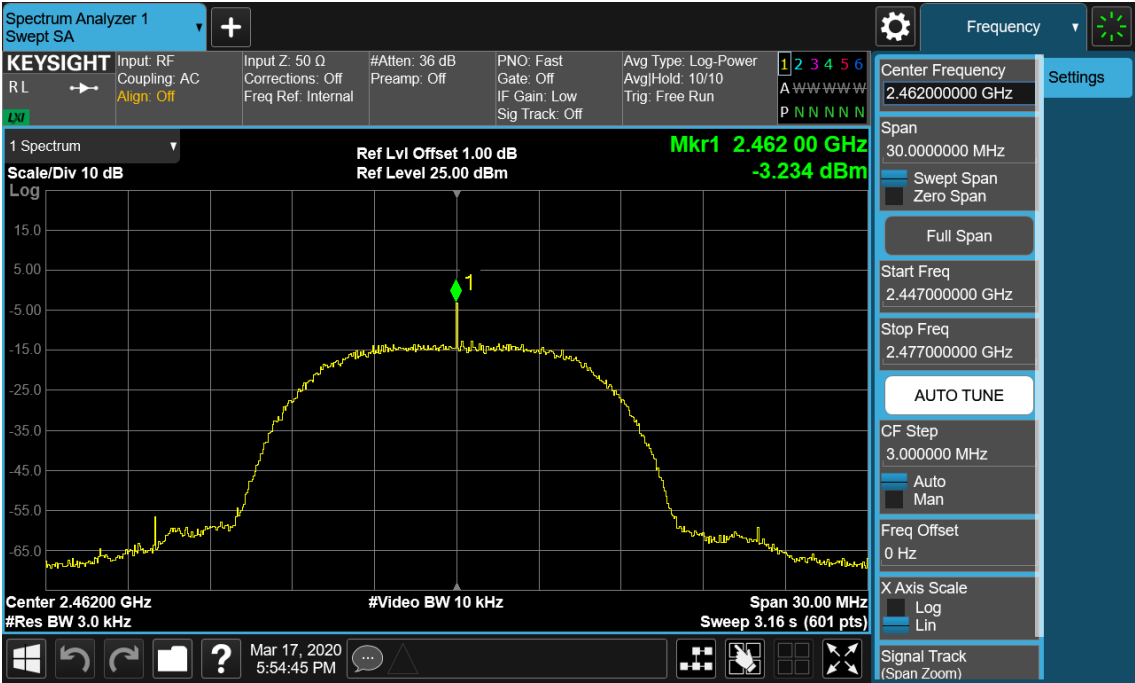
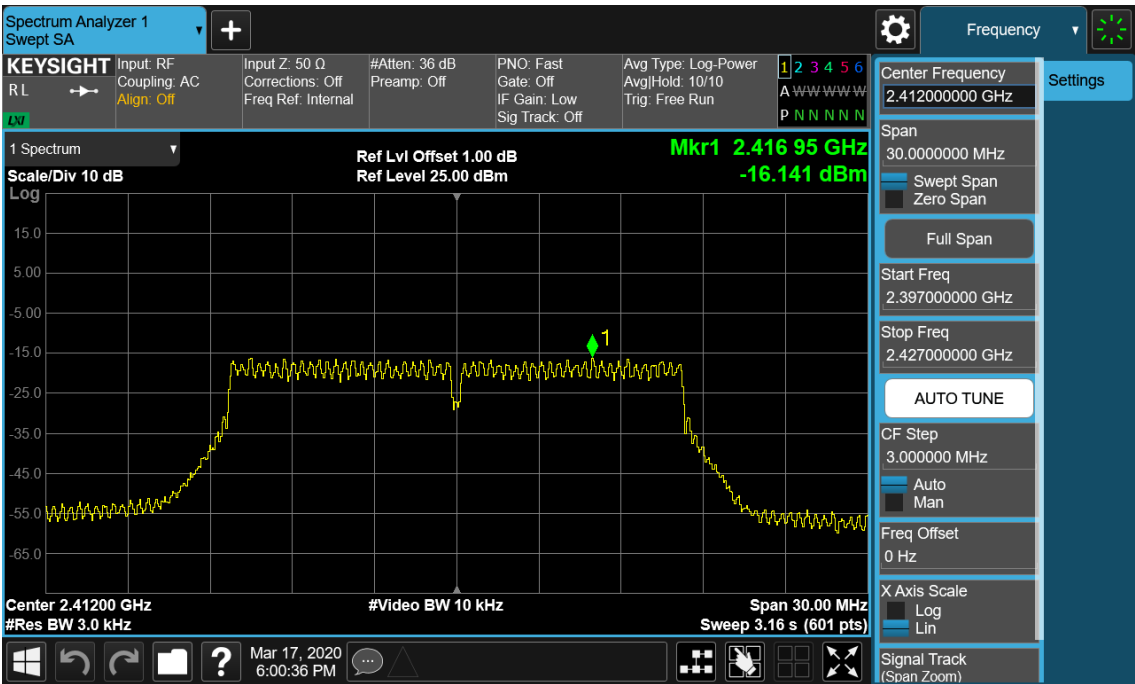


Figure 16: Power Spectral Density, 802.11g, 2412MHz



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

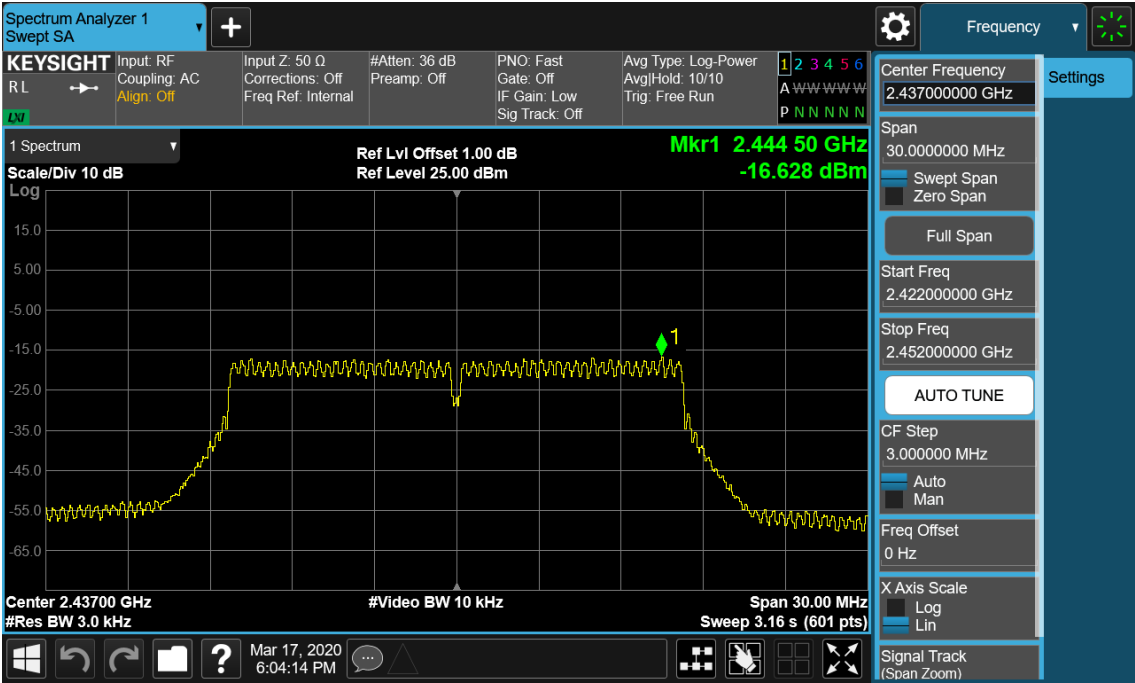
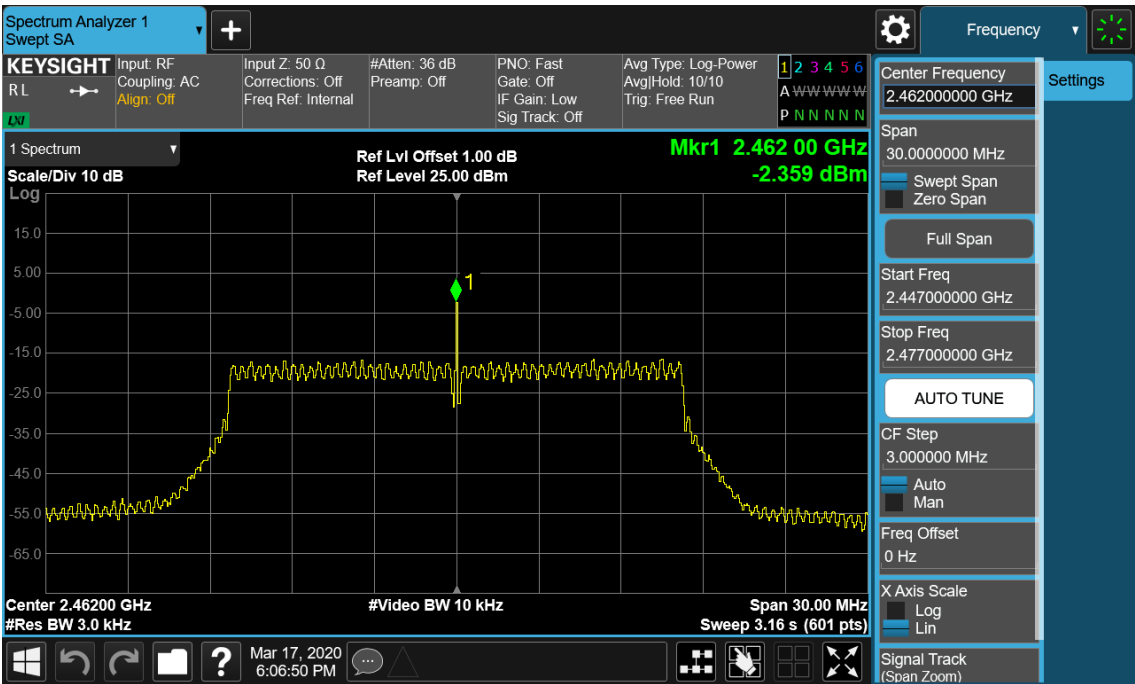


Figure 18: Power Spectral Density, 802.11g, 2462MHz



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

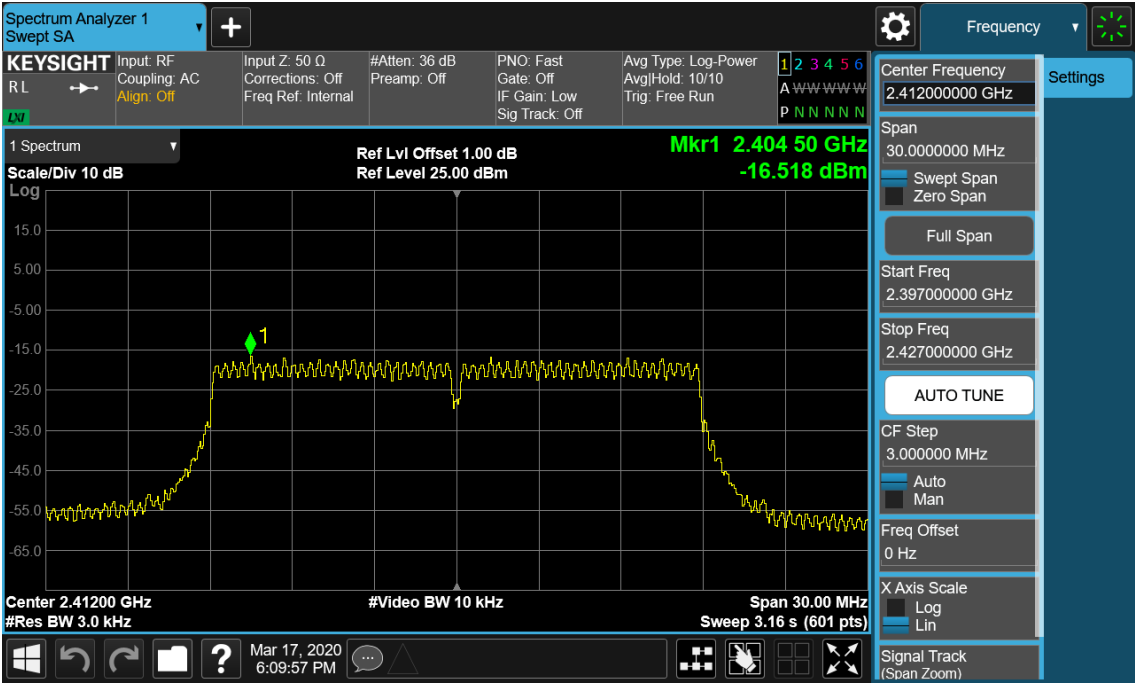
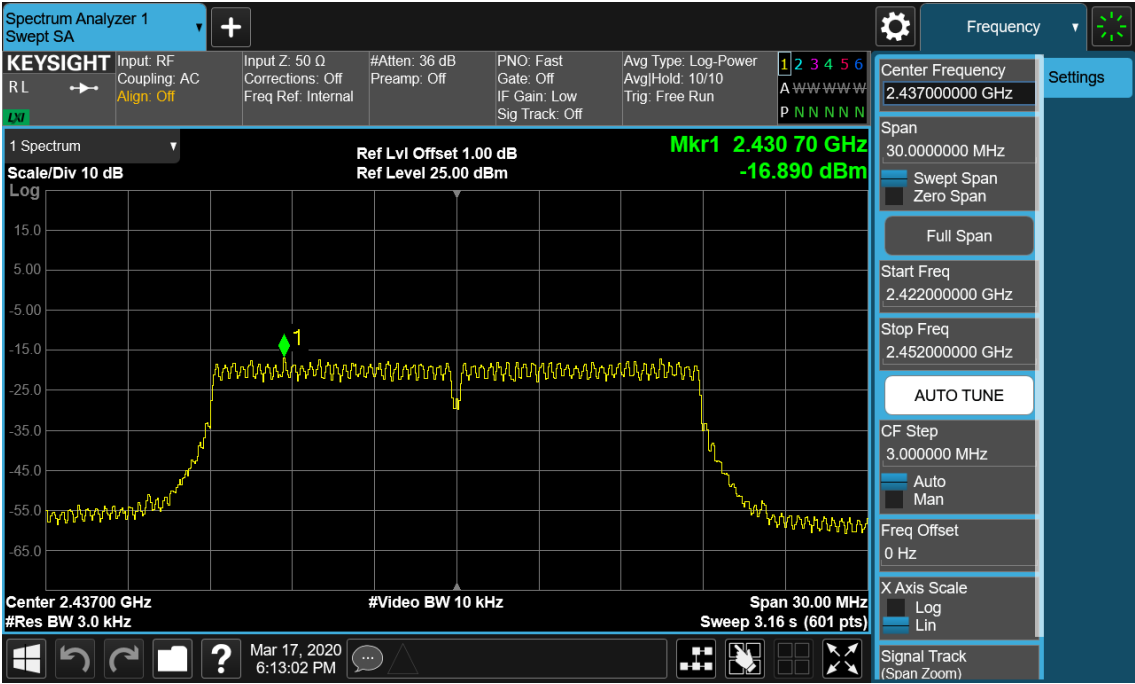


Figure 20: Power Spectral Density, 802.11n(HT20), 2437MHz



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

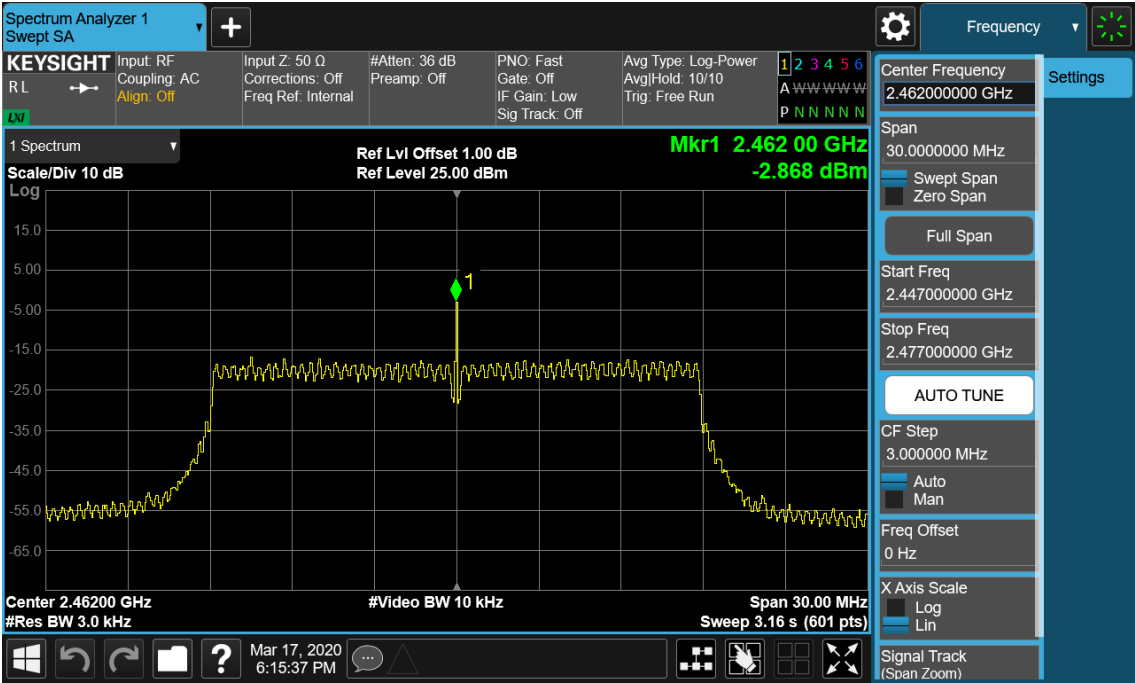
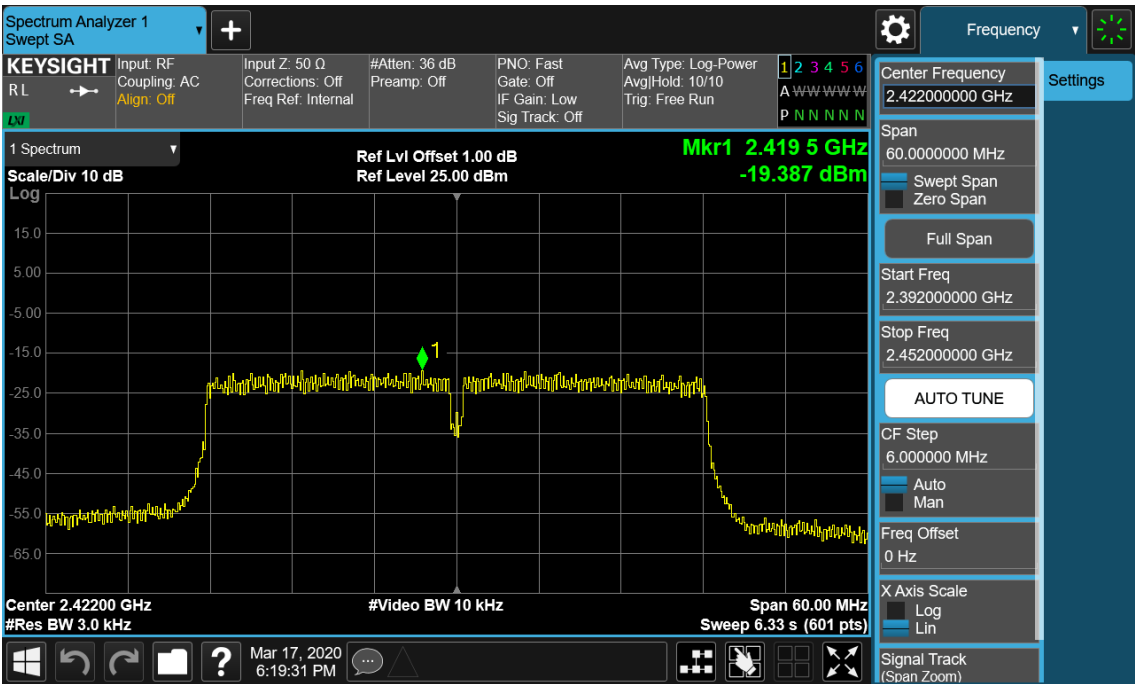


Figure 22: Power Spectral Density, 802.11n(HT40), 2422MHz



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

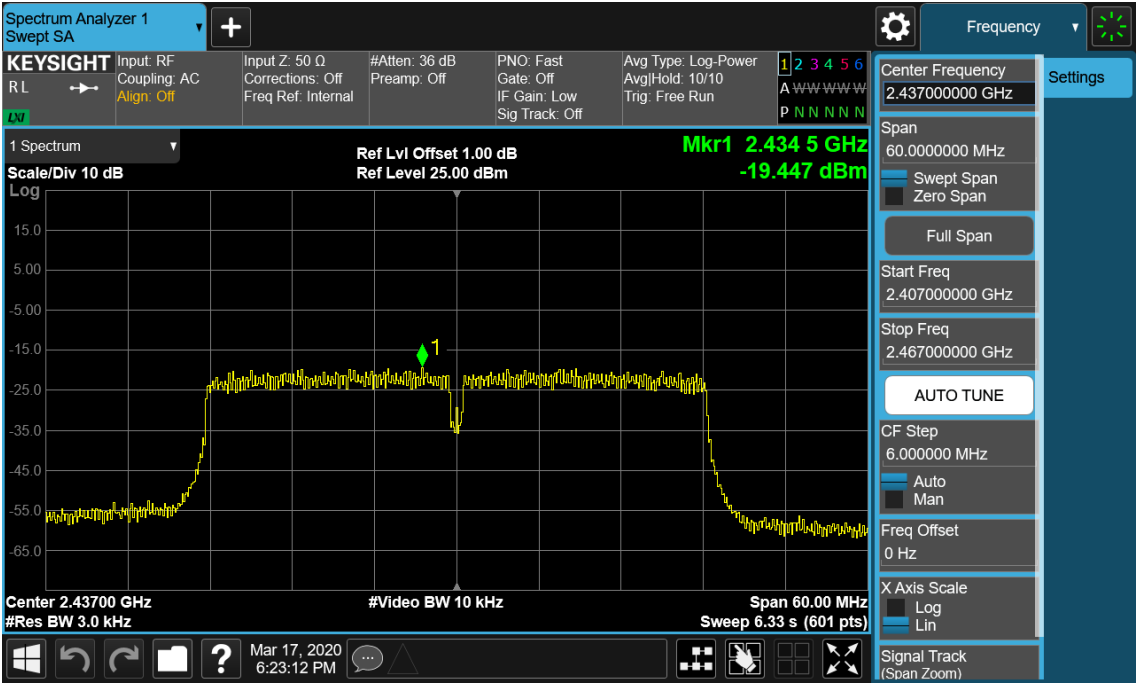
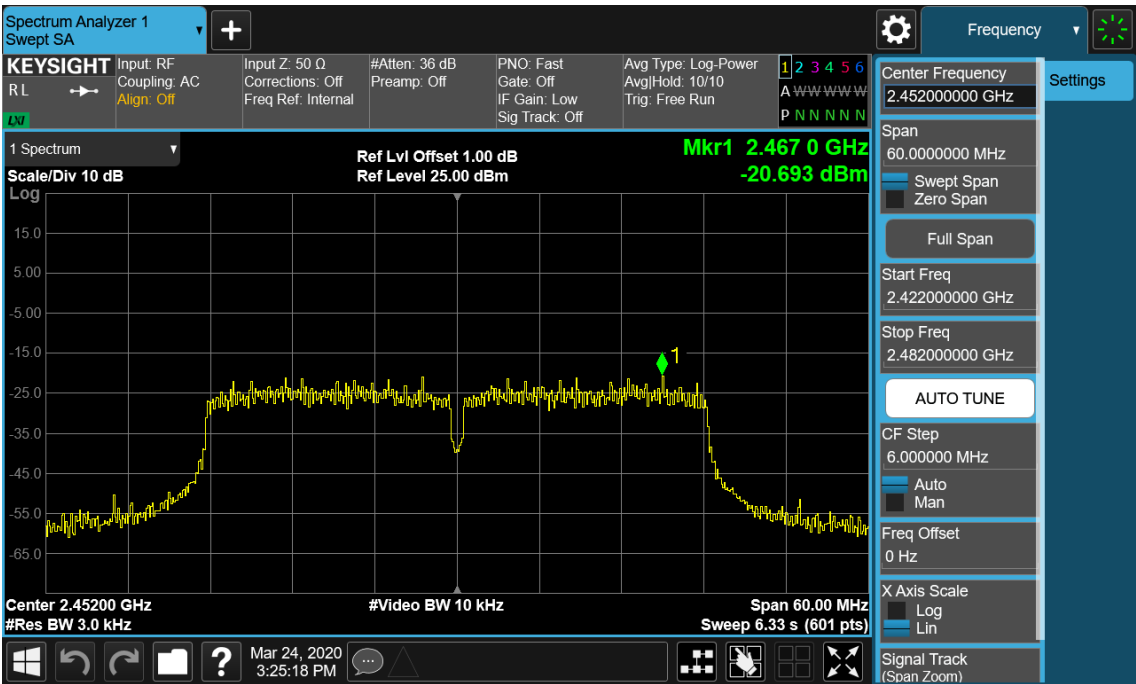


Figure 24: Power Spectral Density, 802.11n(HT40), 2452MHz



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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 RSS-247 5.5 RSS-Gen 8.9
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.

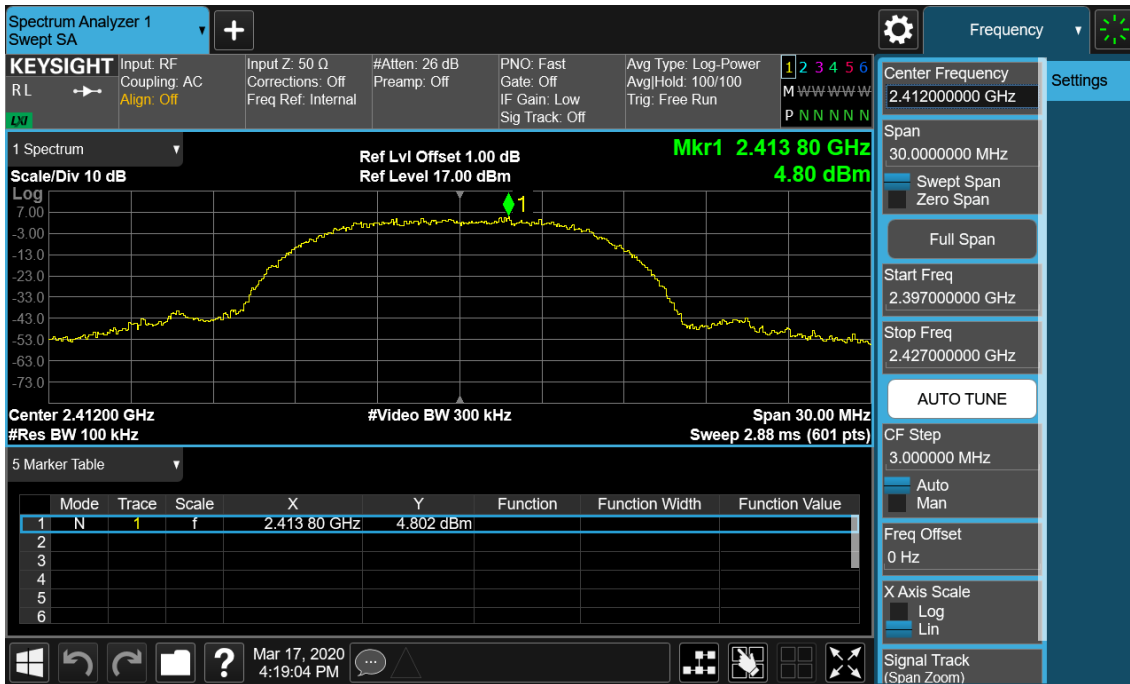
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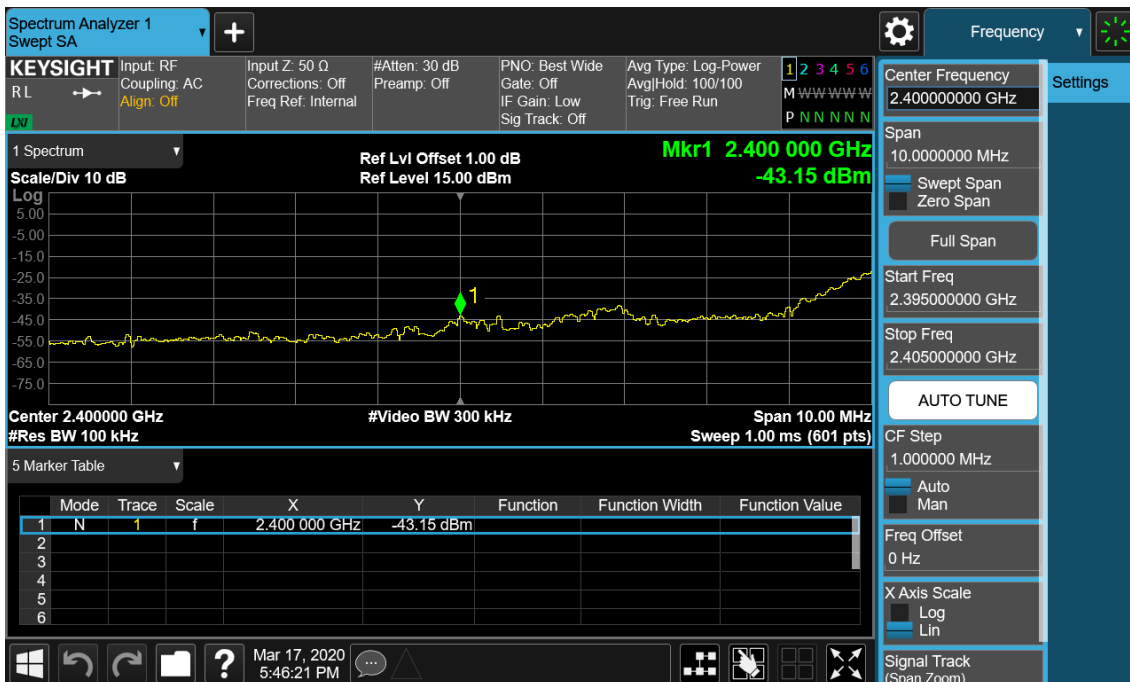
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Figure 25: Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2412MHz Carrier Level



Band Edge



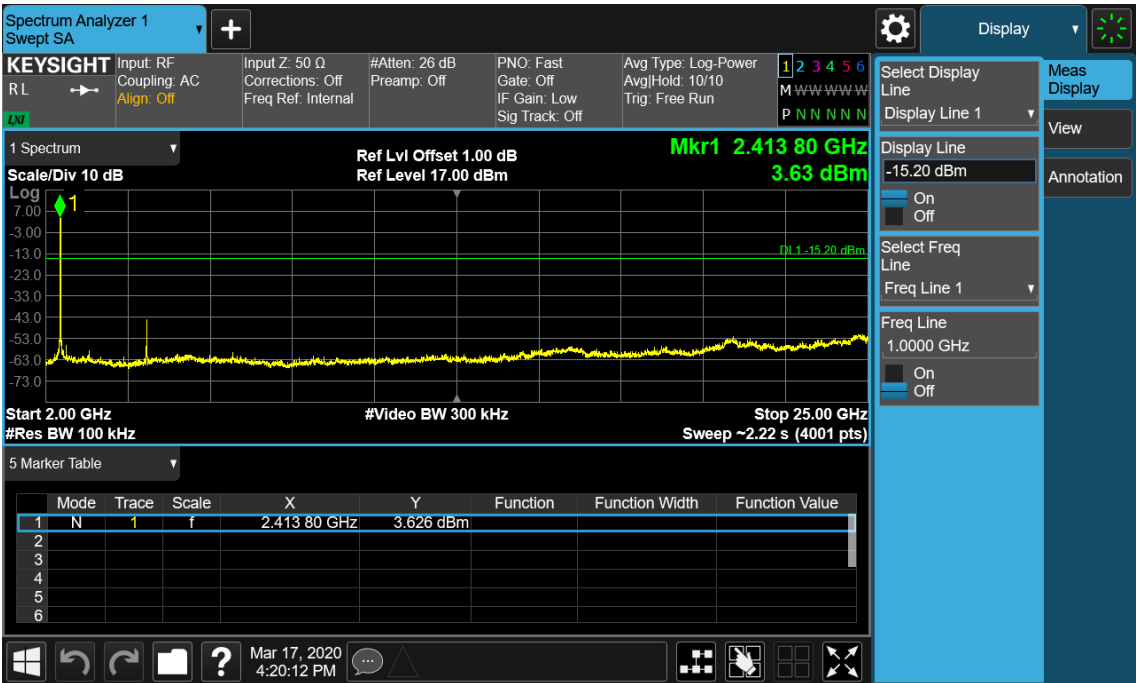
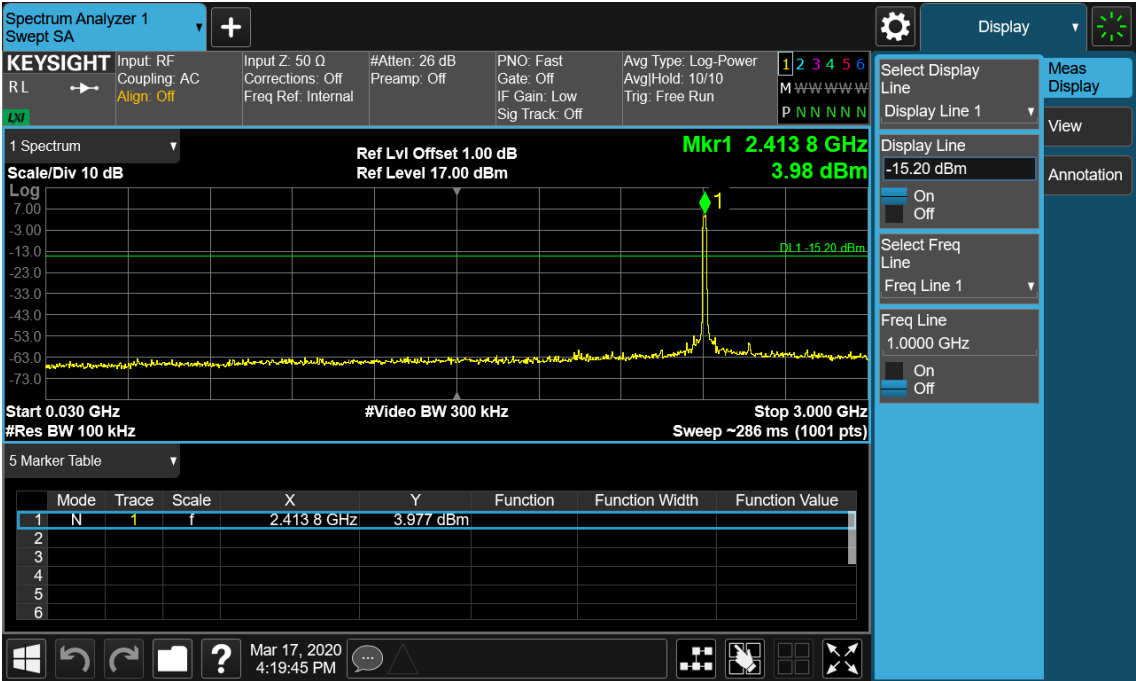
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Conducted spurious emissions 30MHz-25GHz



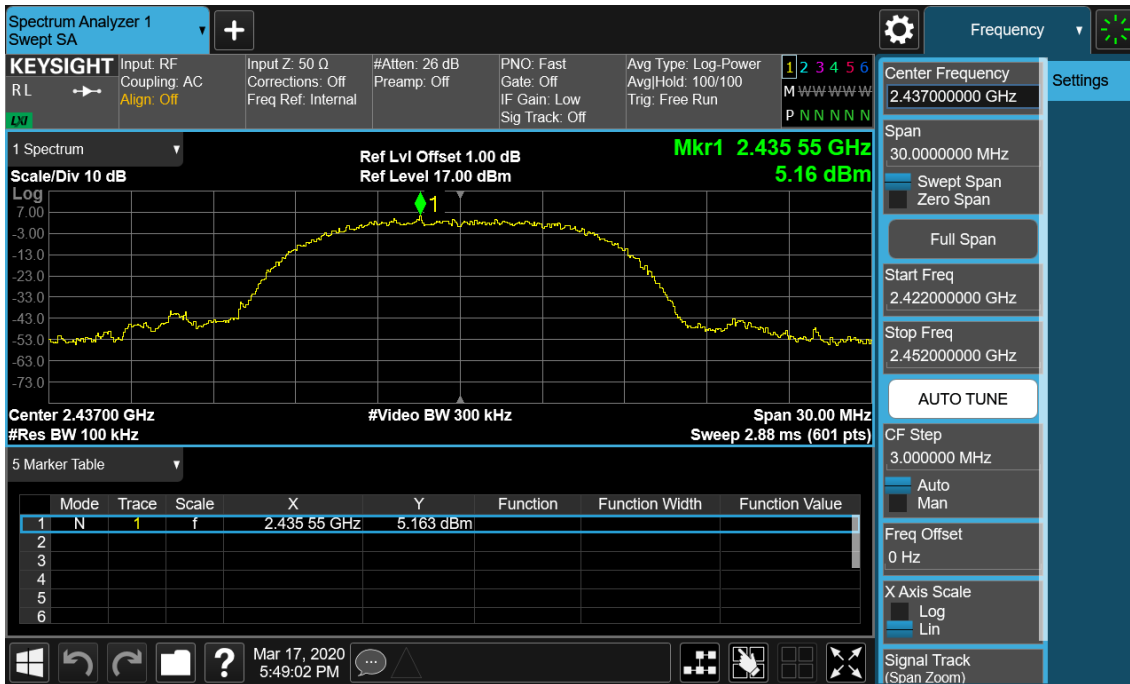
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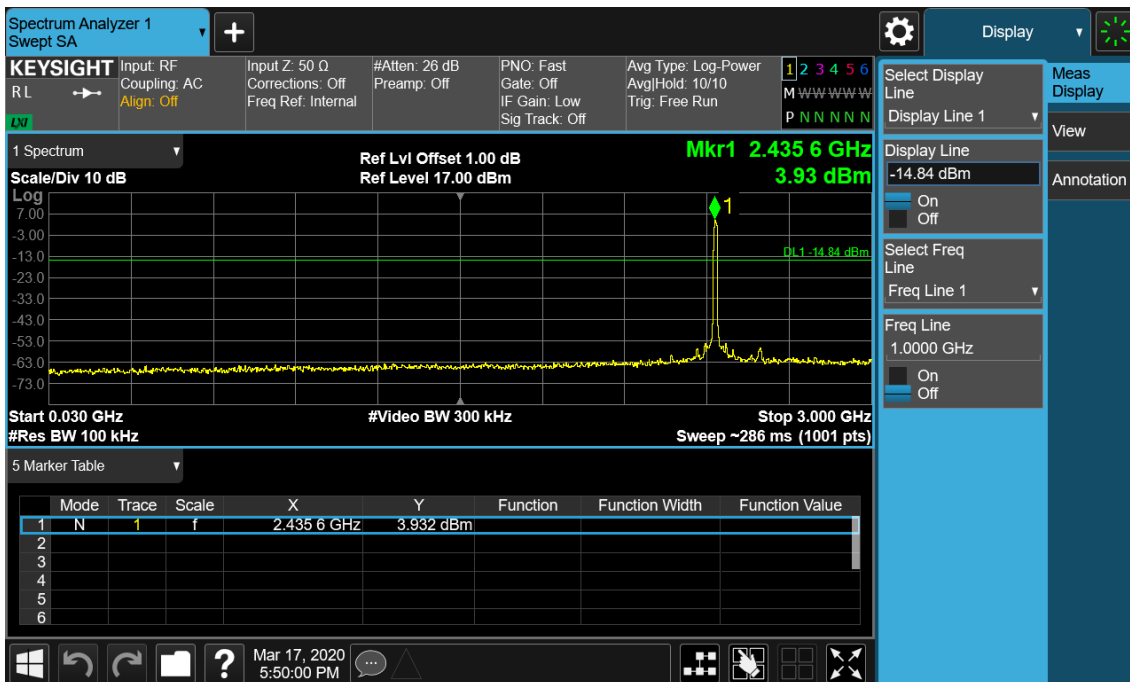
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Figure 26: Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2437MHz Carrier Level



Conducted spurious emissions 30MHz-25GHz



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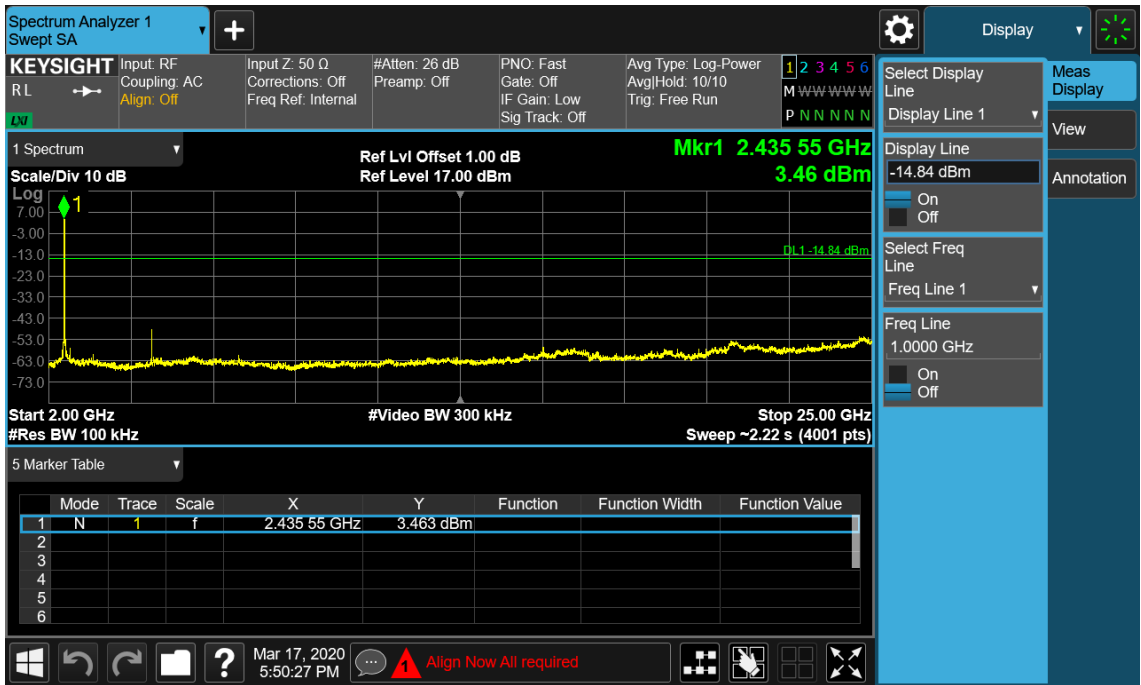
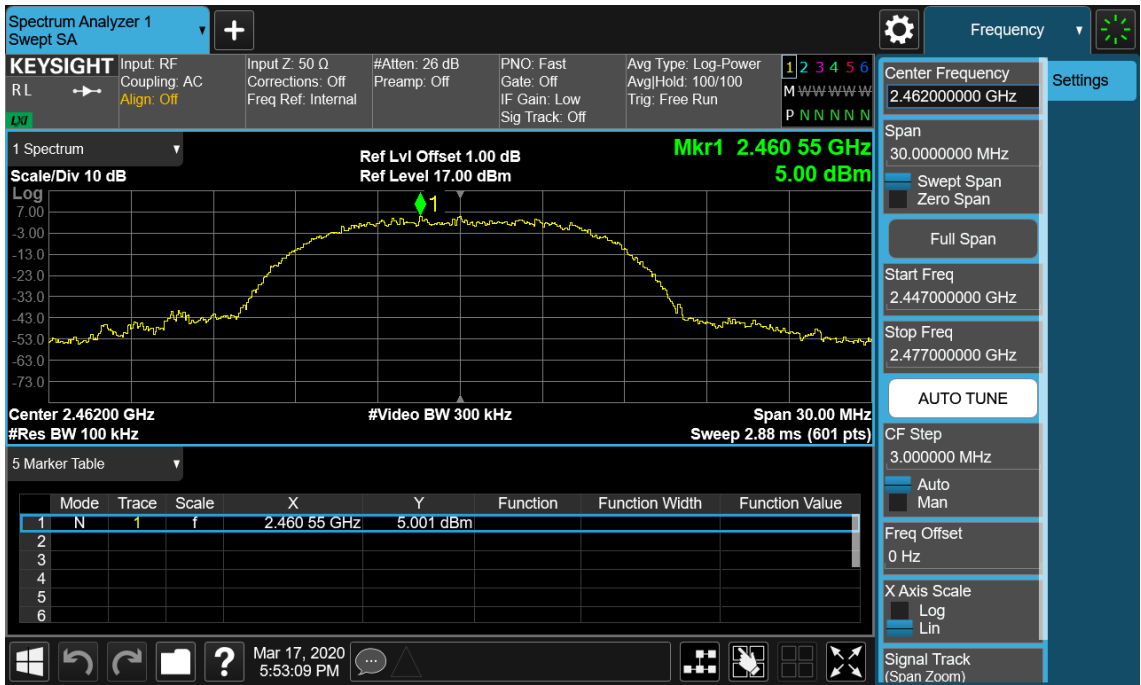


Figure 27: Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2462MHz Carrier Level



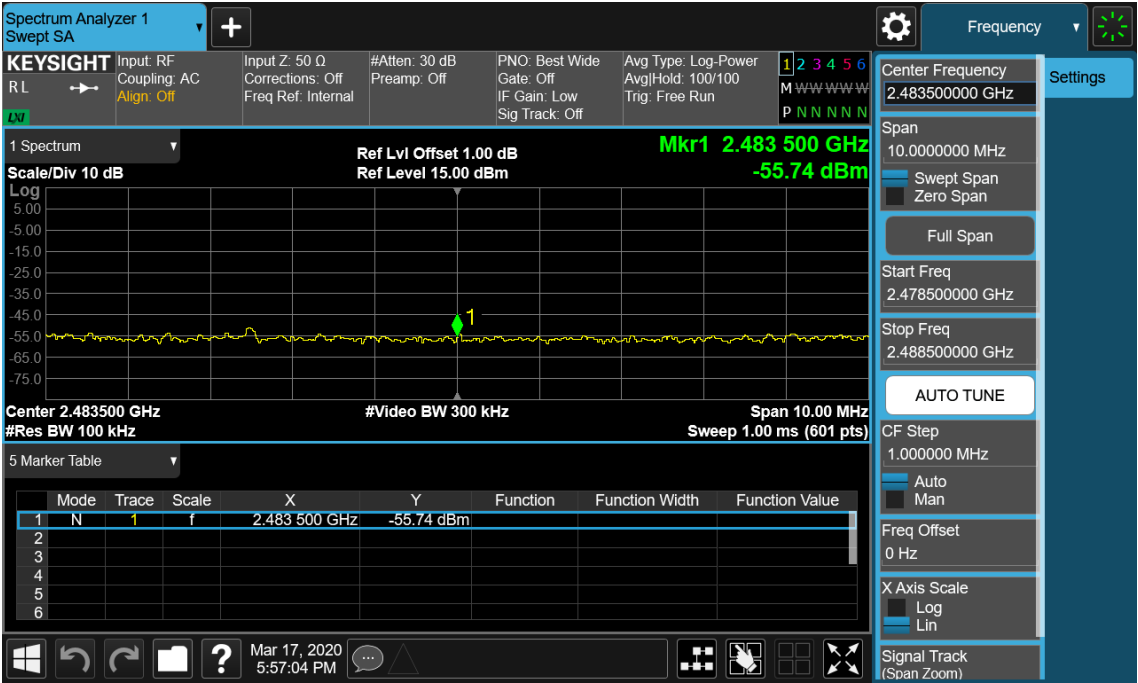
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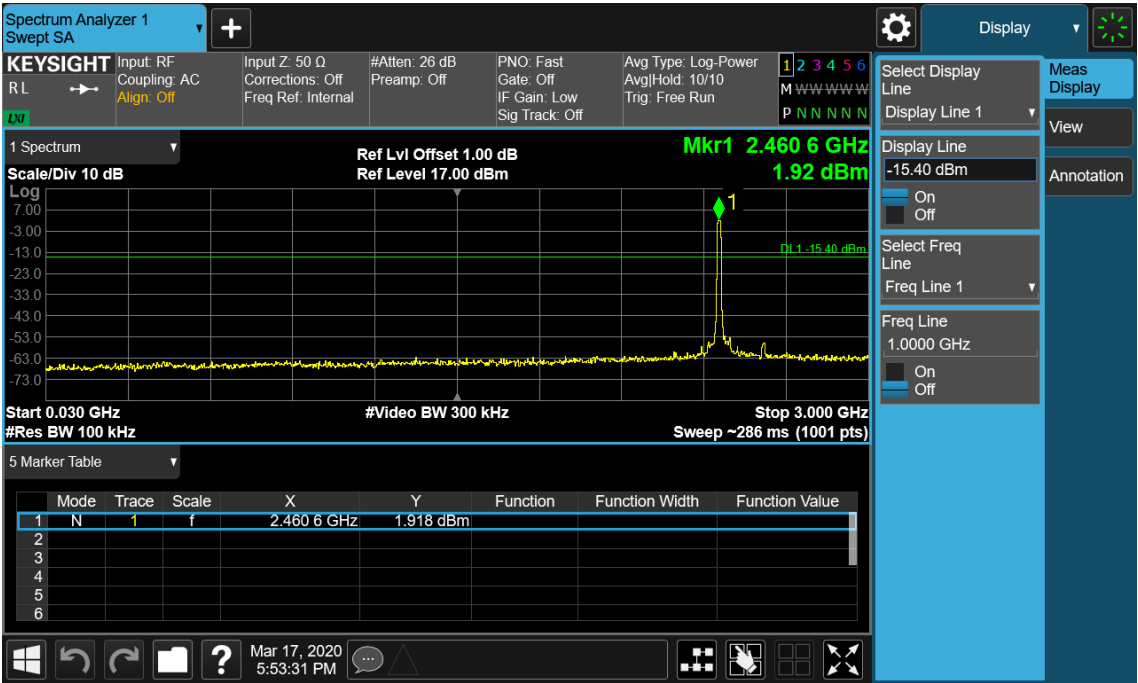
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Band Edge



Conducted spurious emissions 30MHz-25GHz

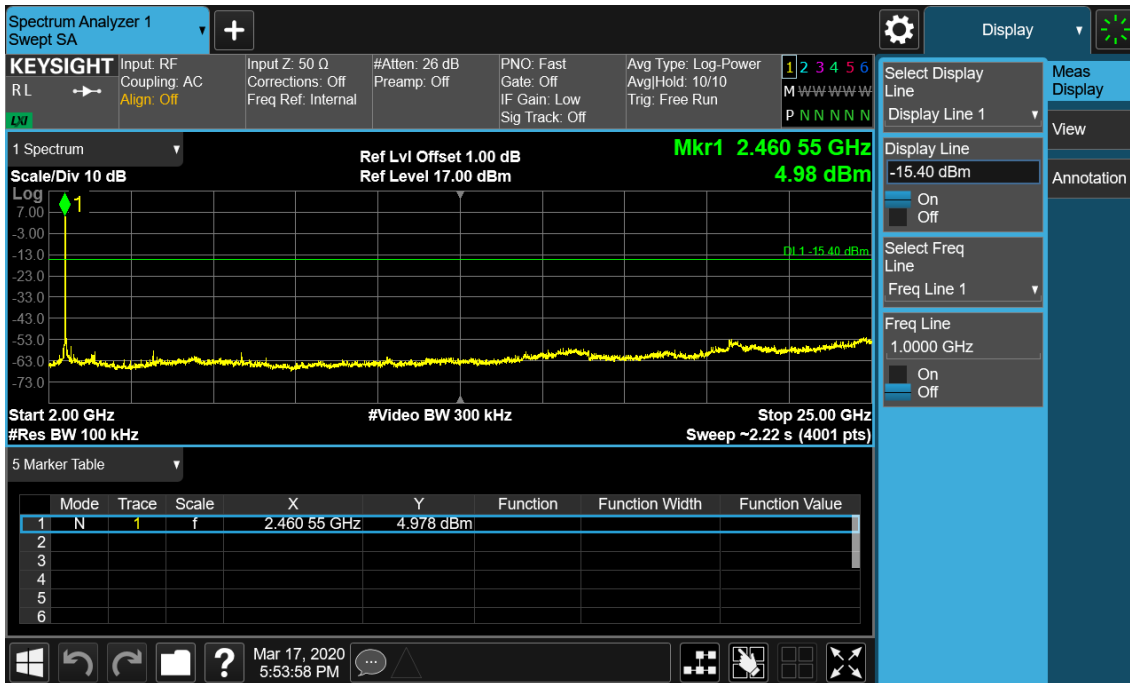


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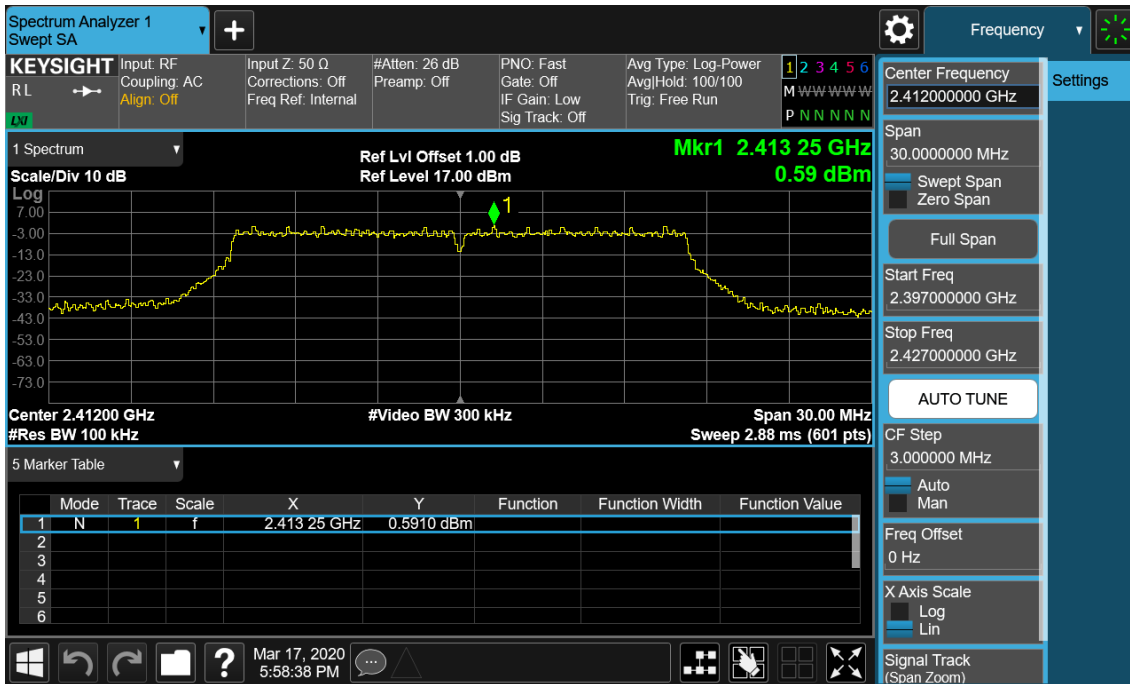
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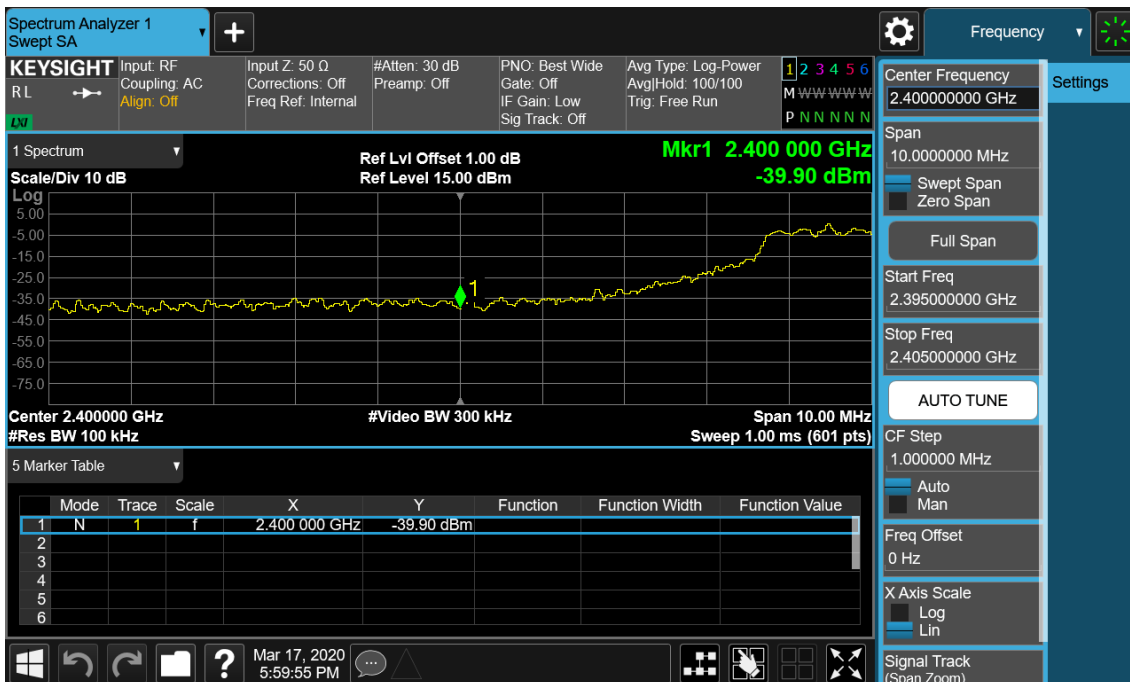
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Figure 28: Conducted Spurious Emission & Authorized-band band-edge, 802.11g, 2412MHz Carrier Level



Band Edge



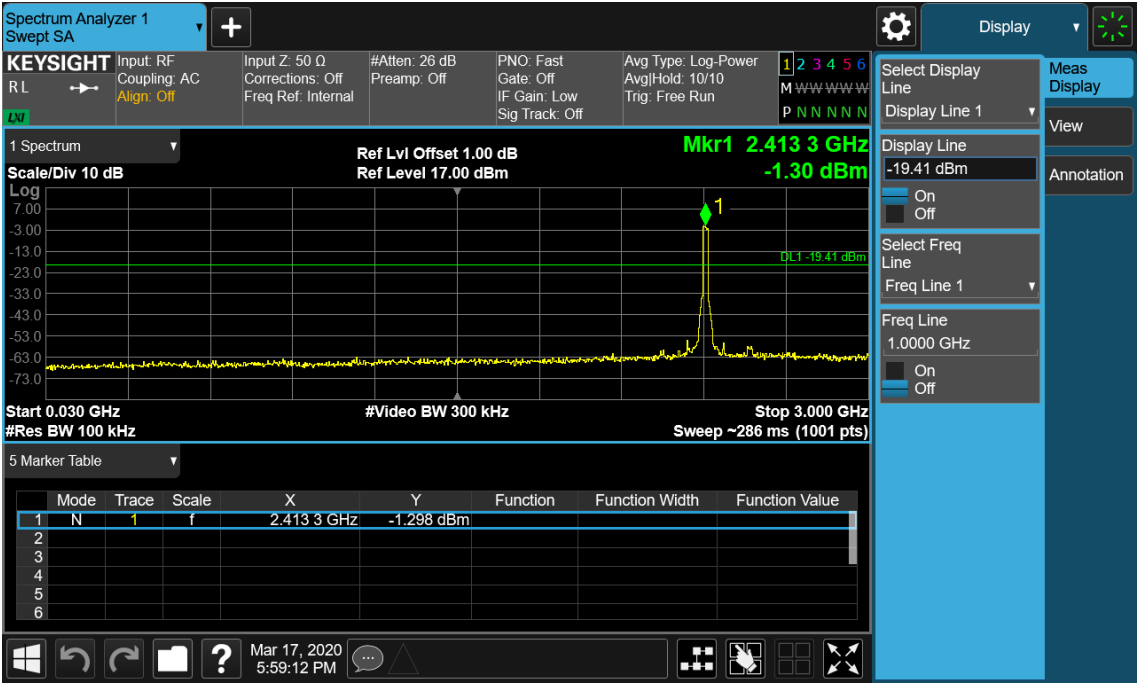
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Conducted spurious emissions 30MHz-25GHz



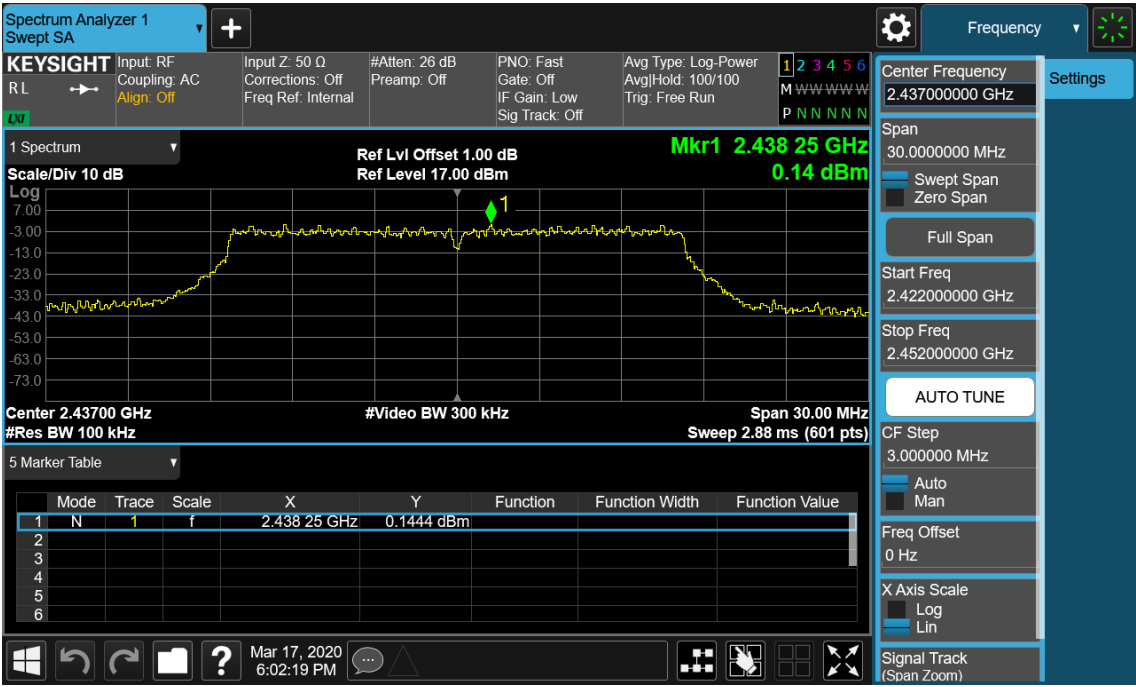
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Figure 29: Conducted Spurious Emission & Authorized-band band-edge, 802.11g, 2437MHz
Carrier Level



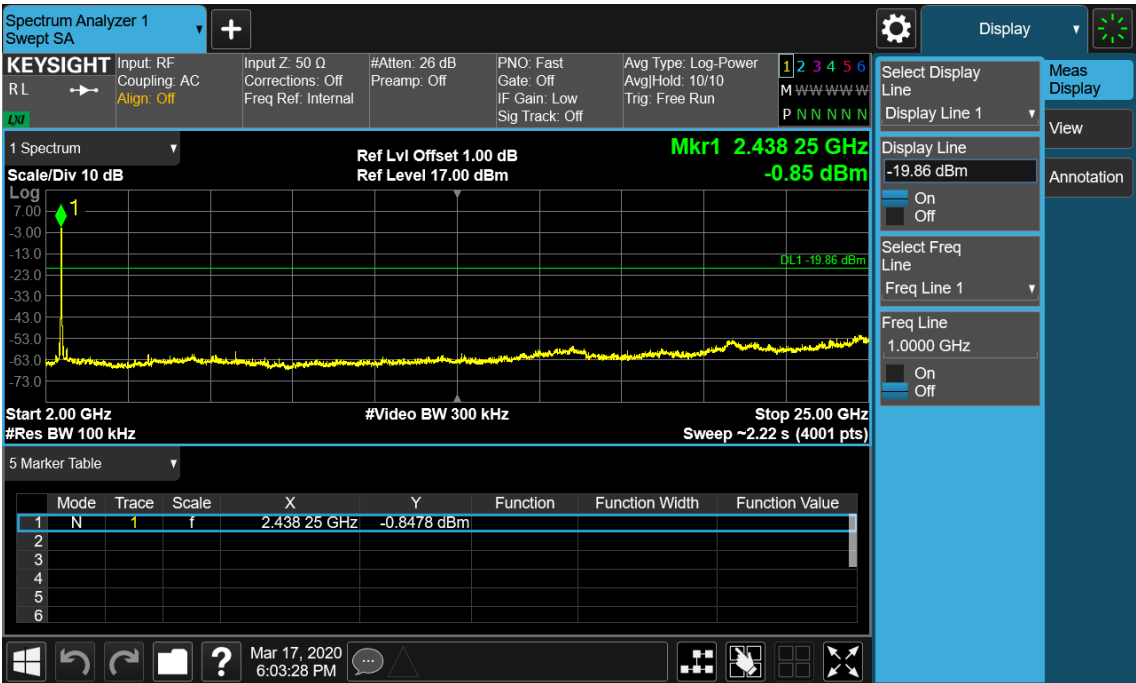
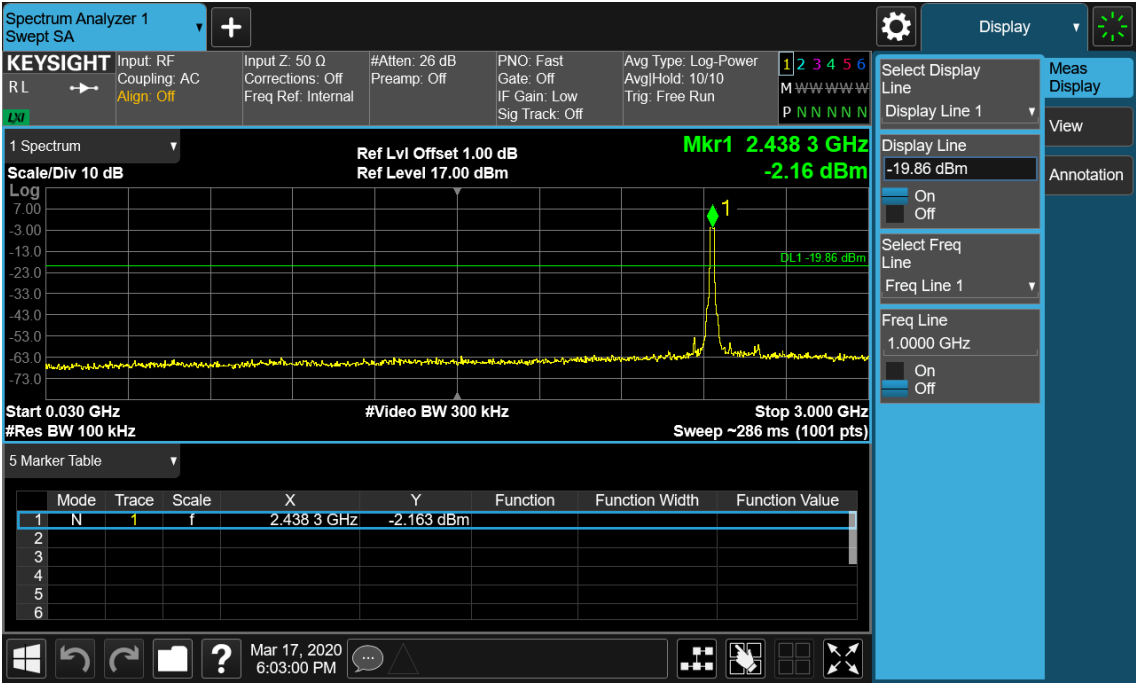
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Conducted spurious emissions 30MHz-25GHz



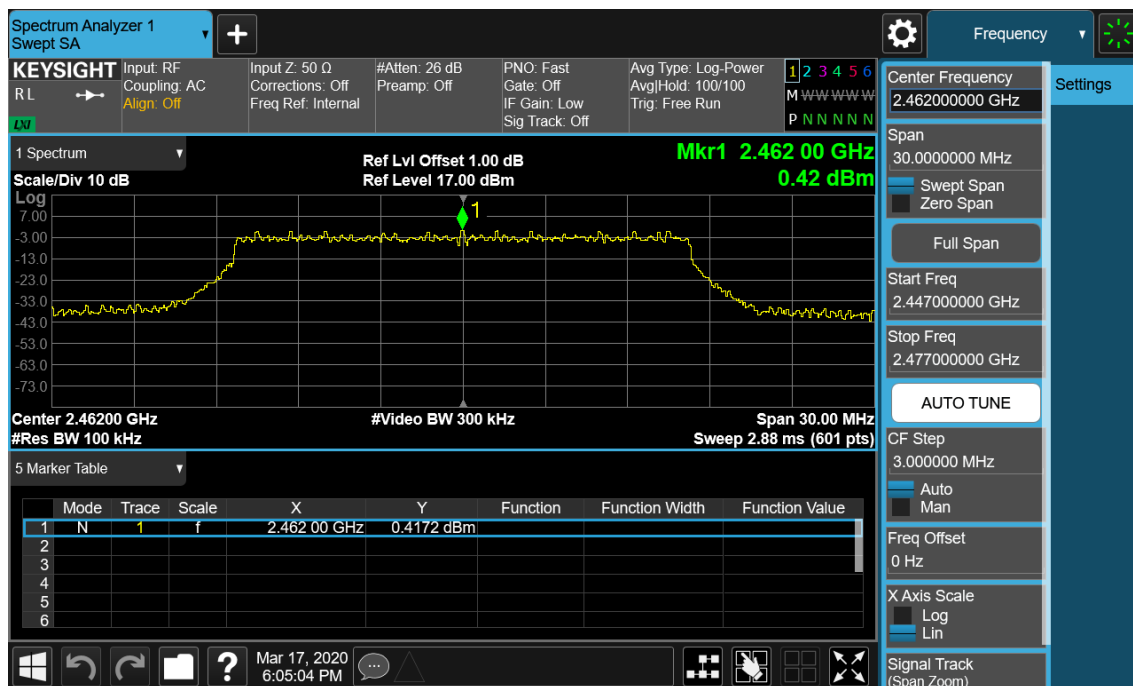
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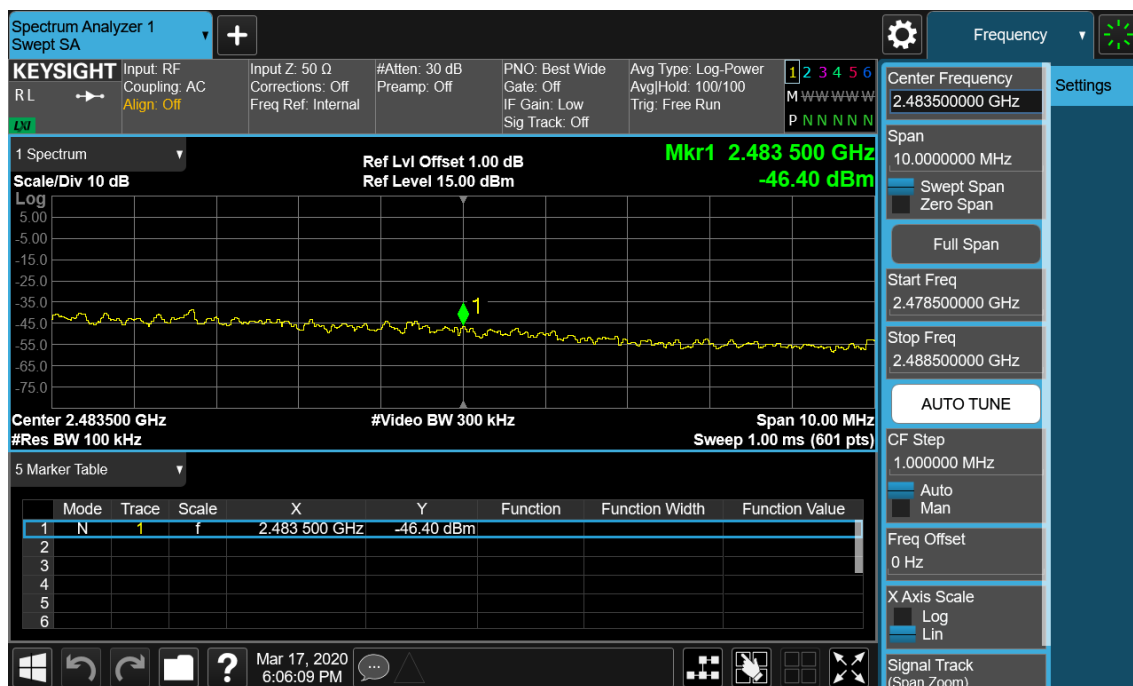
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Figure 30: Conducted Spurious Emission & Authorized-band band-edge, 802.11g, 2462MHz Carrier Level



Band Edge



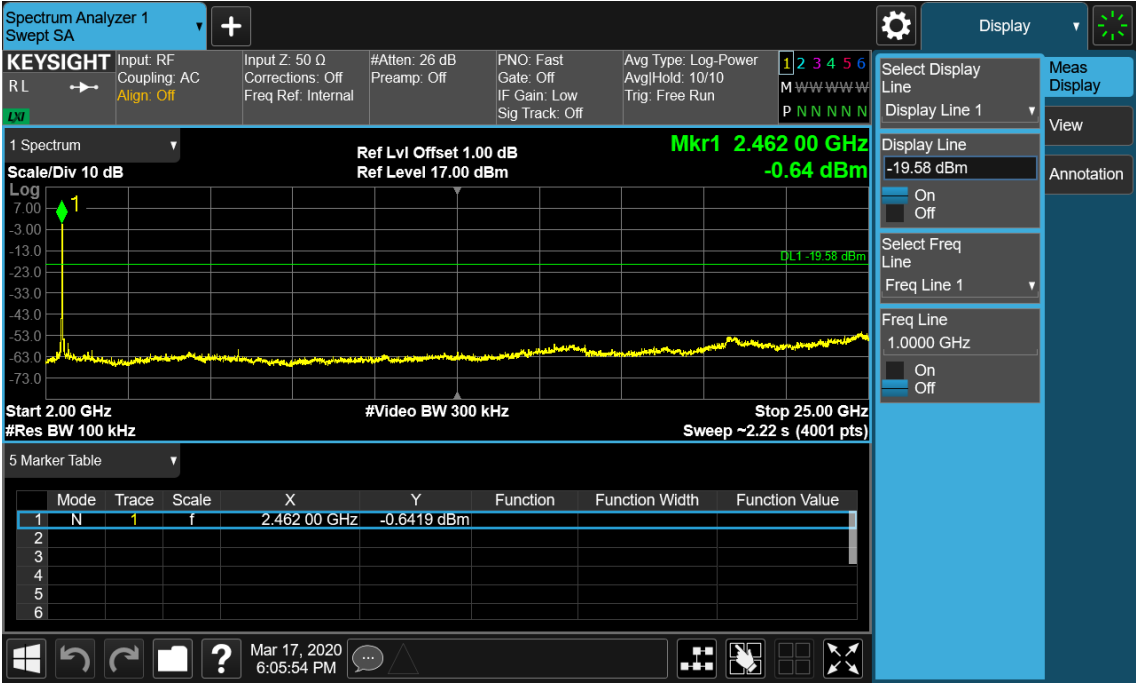
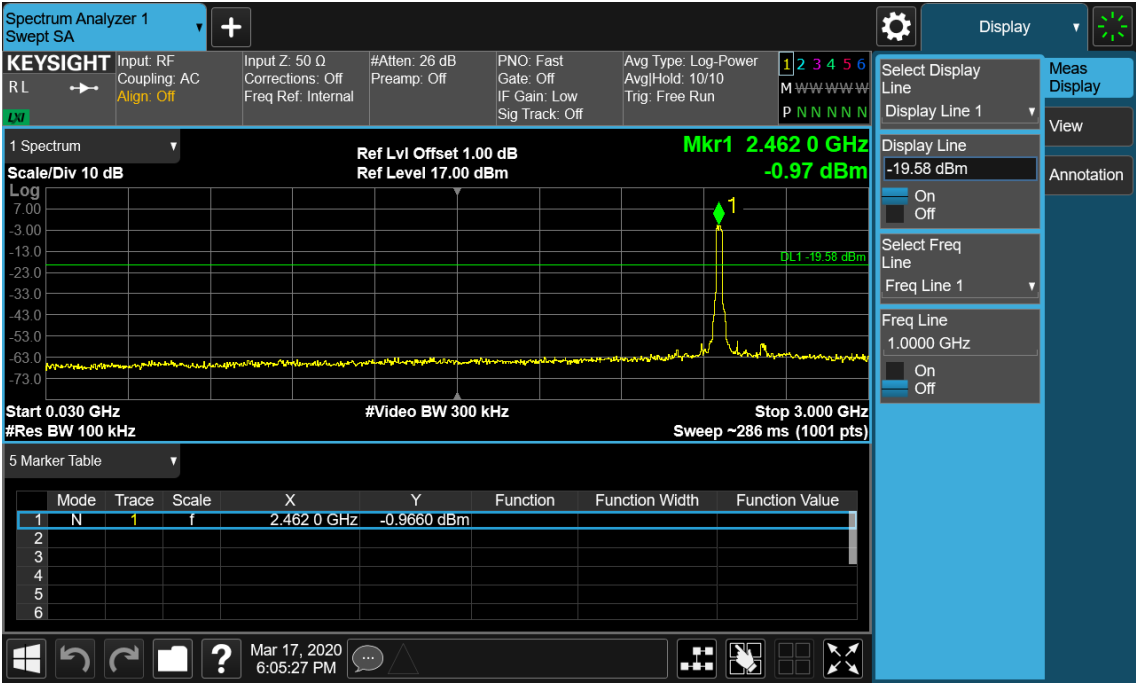
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Conducted spurious emissions 30MHz-25GHz



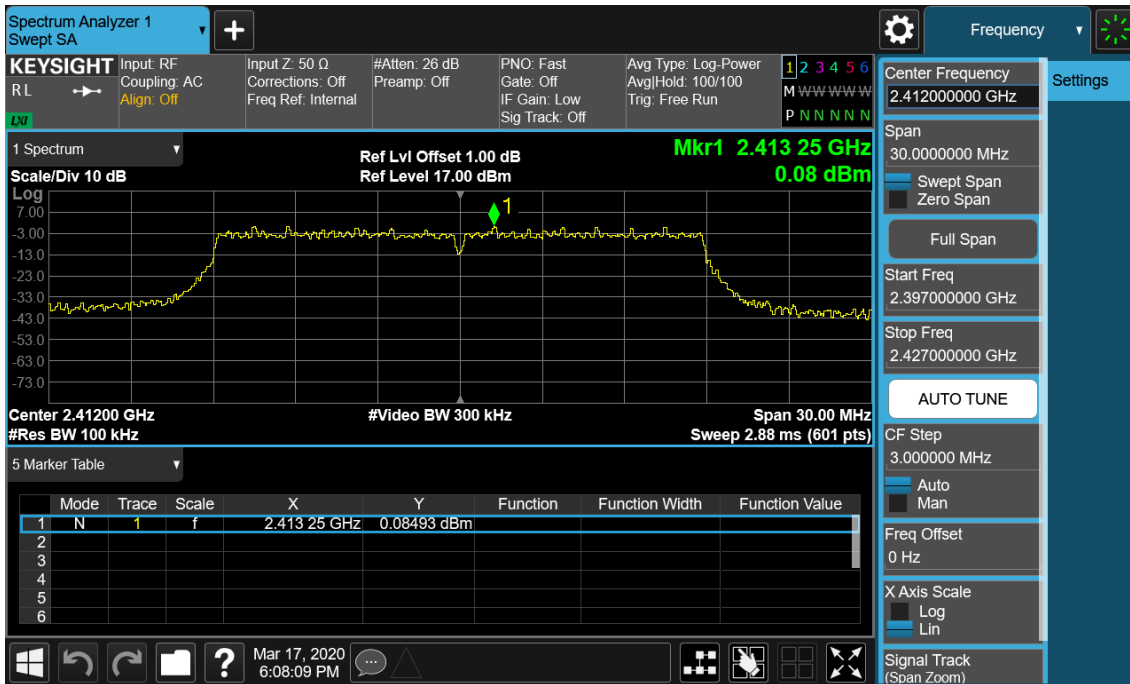
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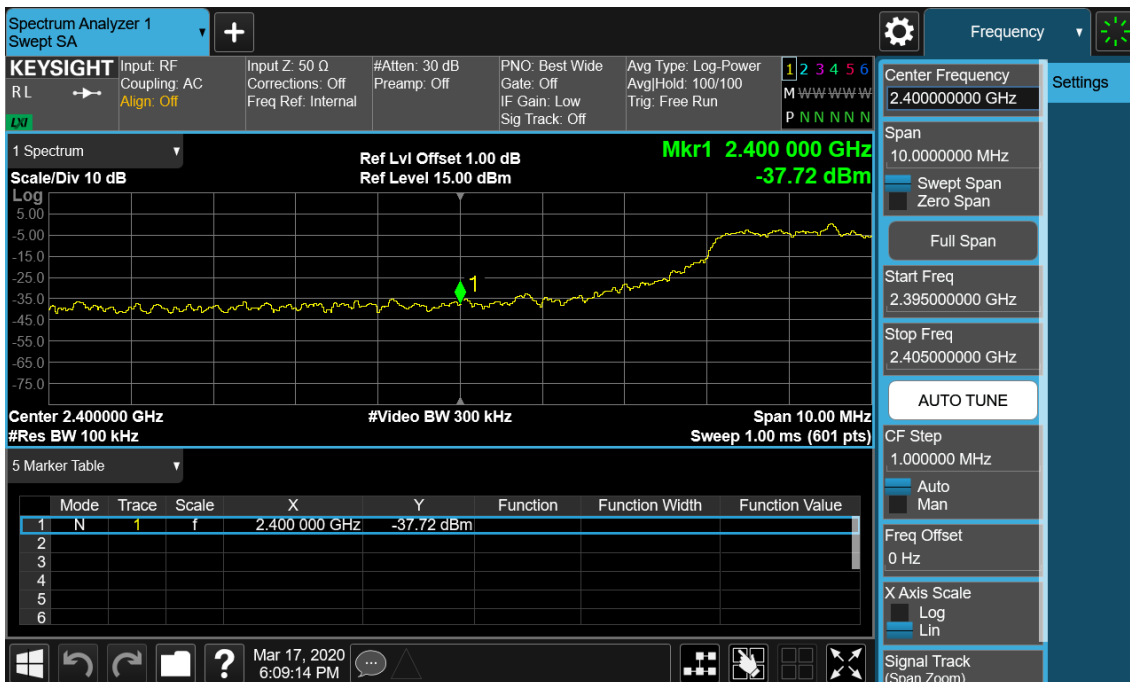
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Figure 31: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT20), 2412MHz Carrier Level



Band Edge



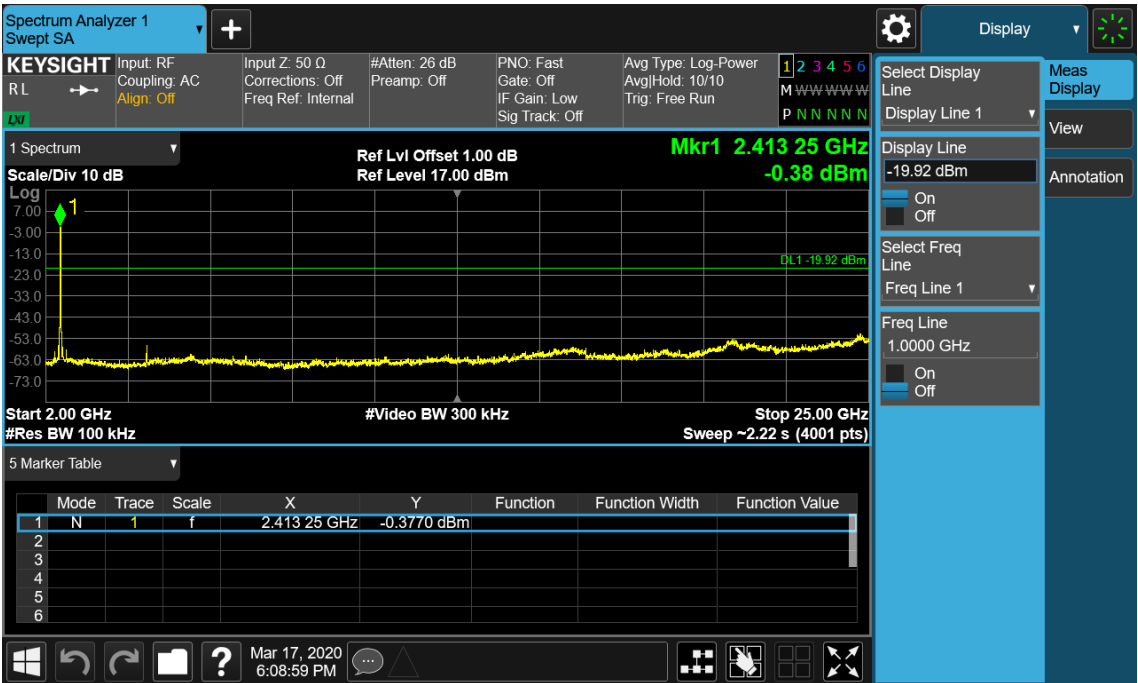
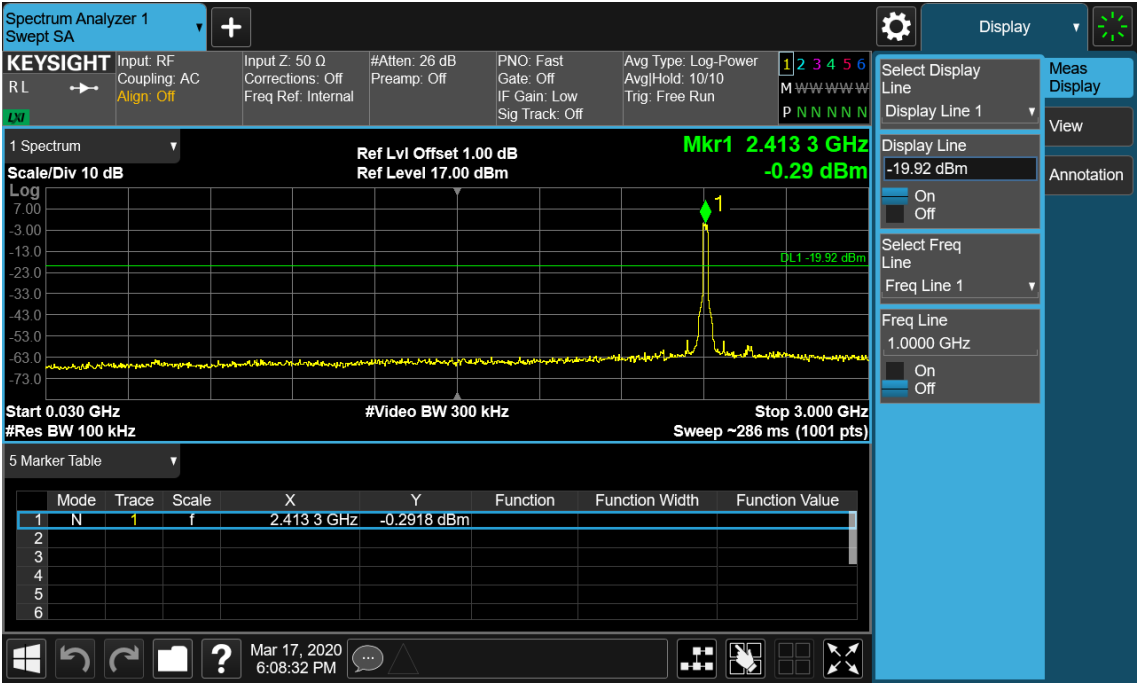
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Conducted spurious emissions 30MHz-25GHz



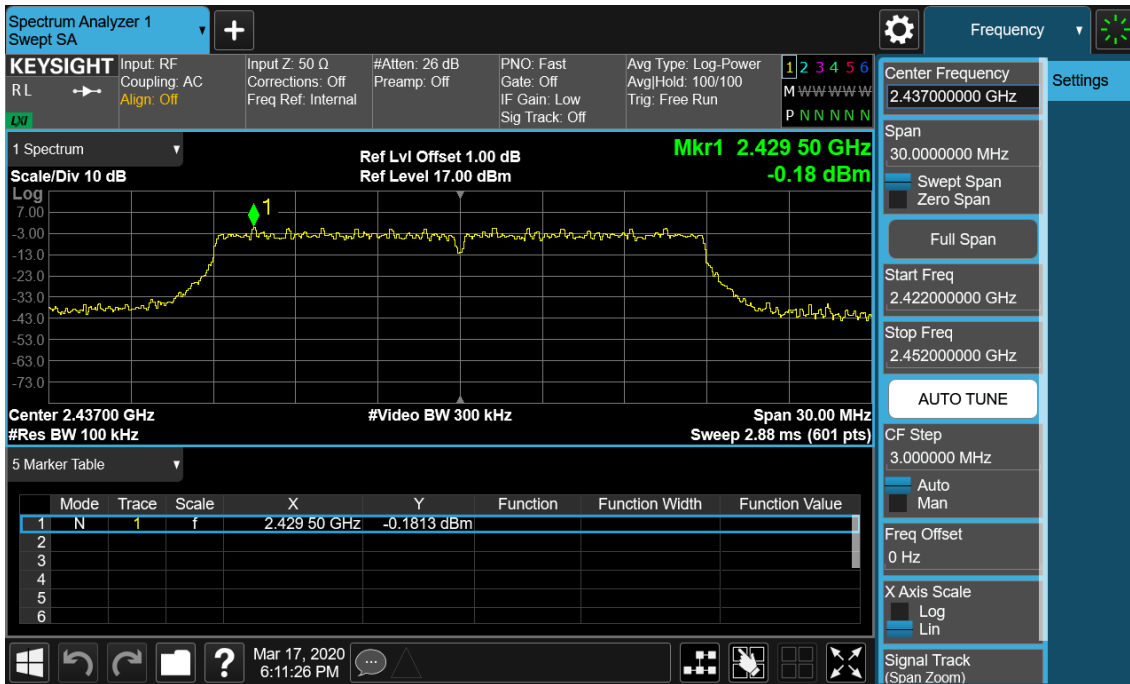
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Figure 32: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT20), 2437MHz Carrier Level



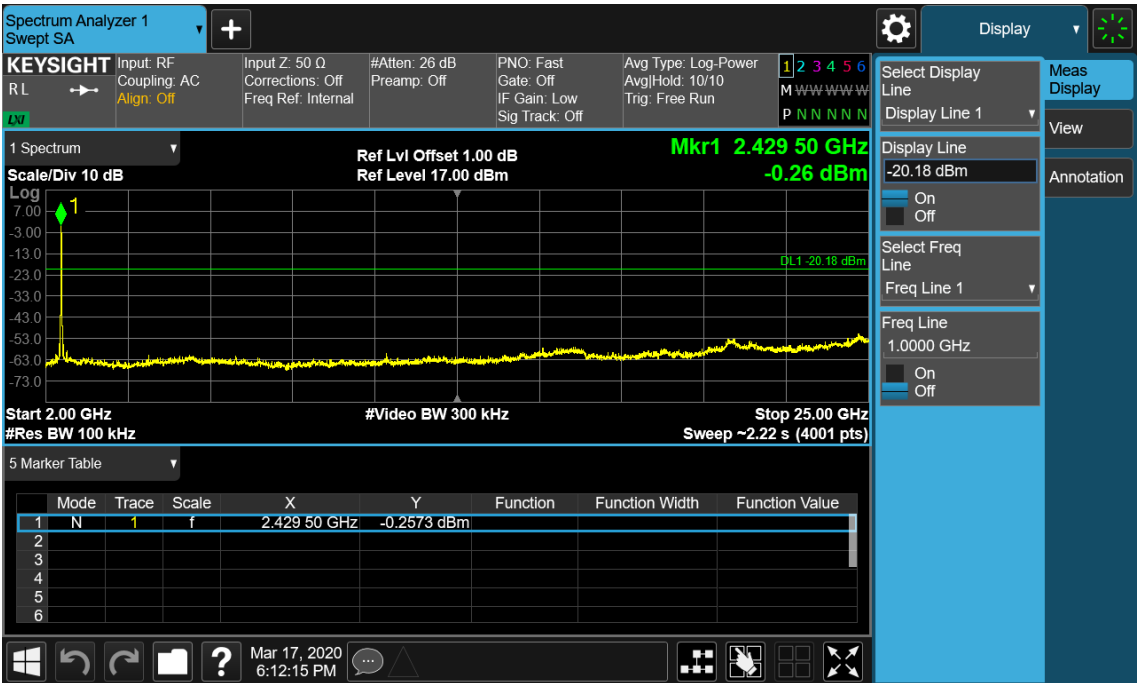
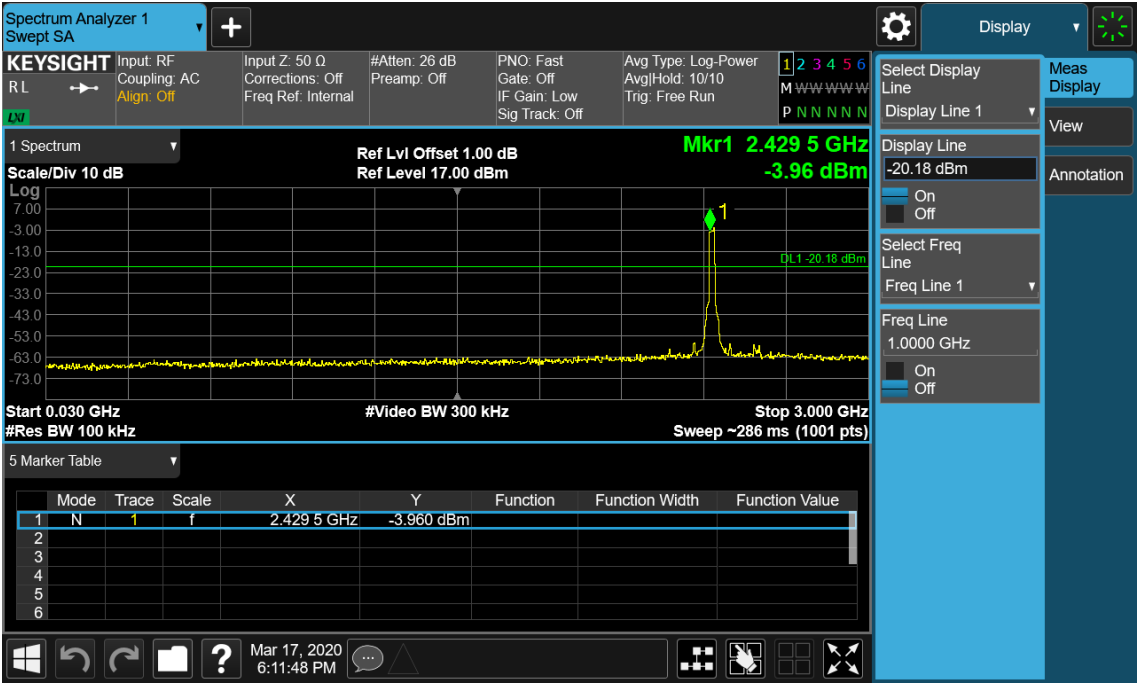
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Conducted spurious emissions 30MHz-25GHz



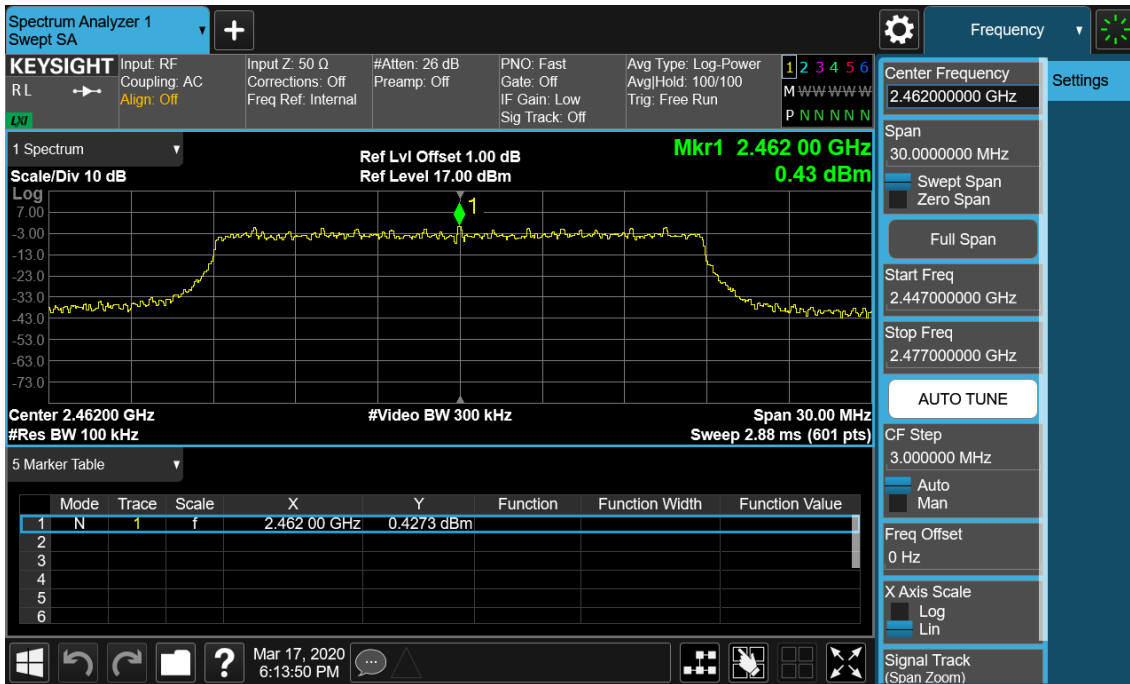
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Figure 33: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT20), 2462MHz Carrier Level



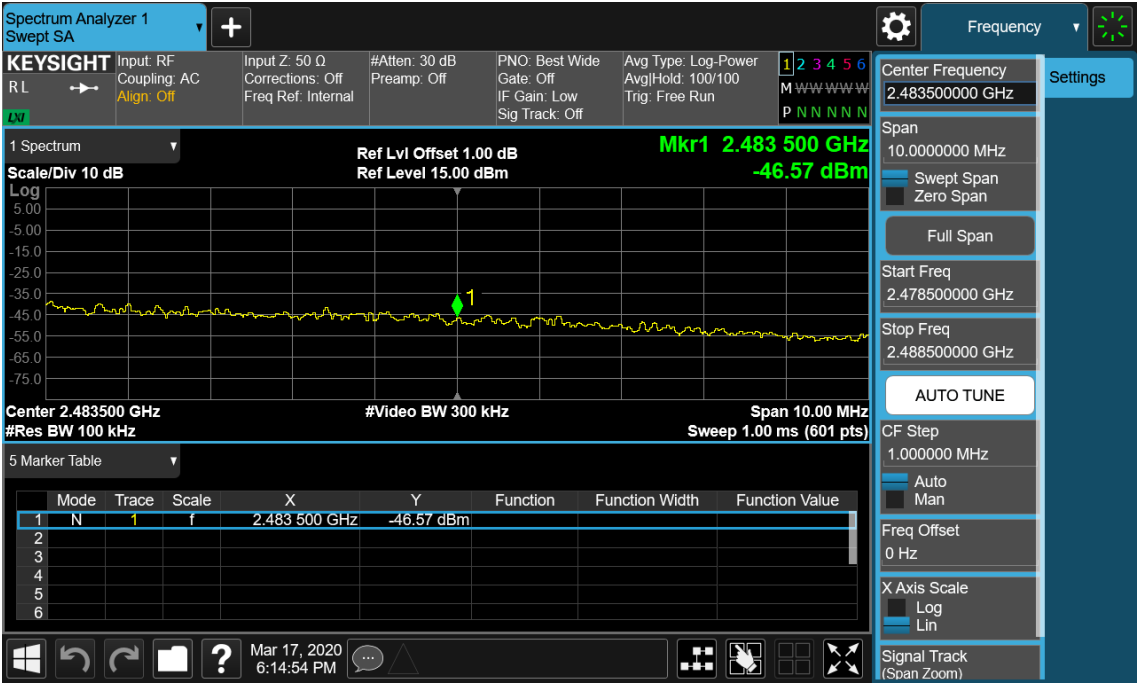
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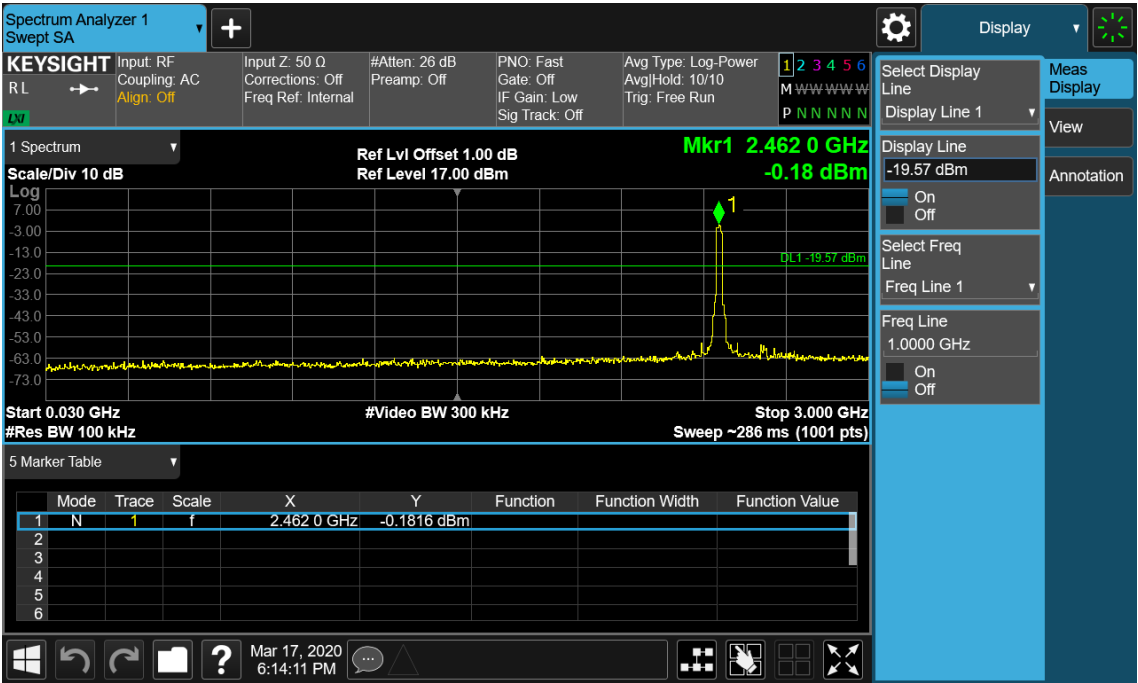
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Band Edge



Conducted spurious emissions 30MHz-25GHz

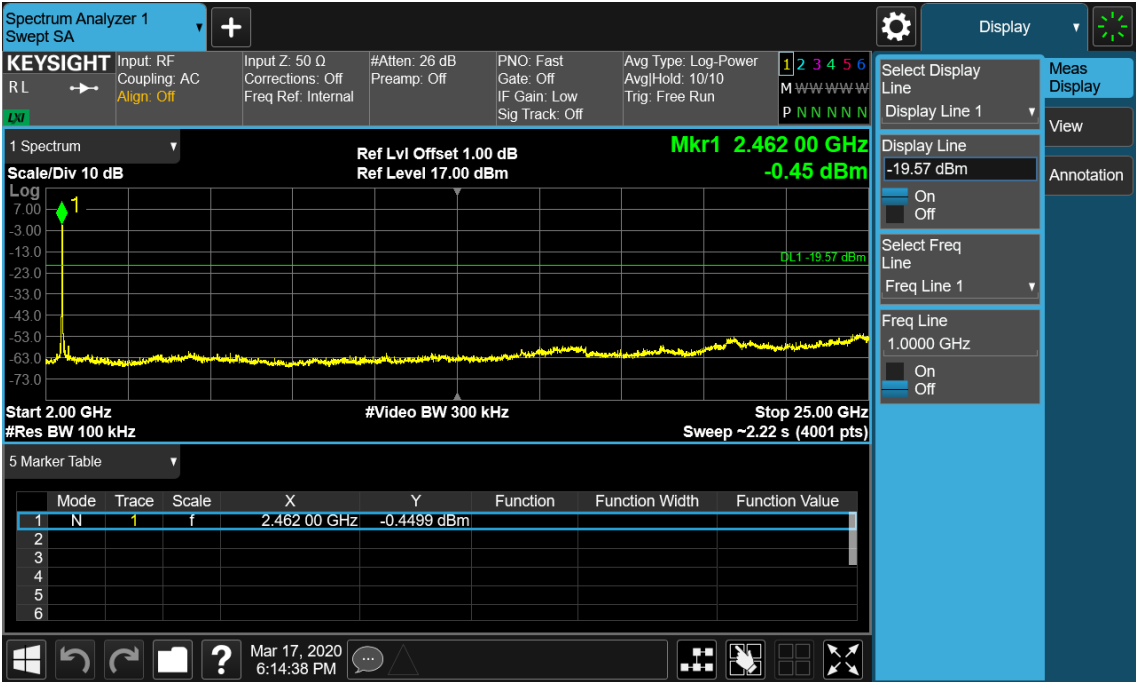


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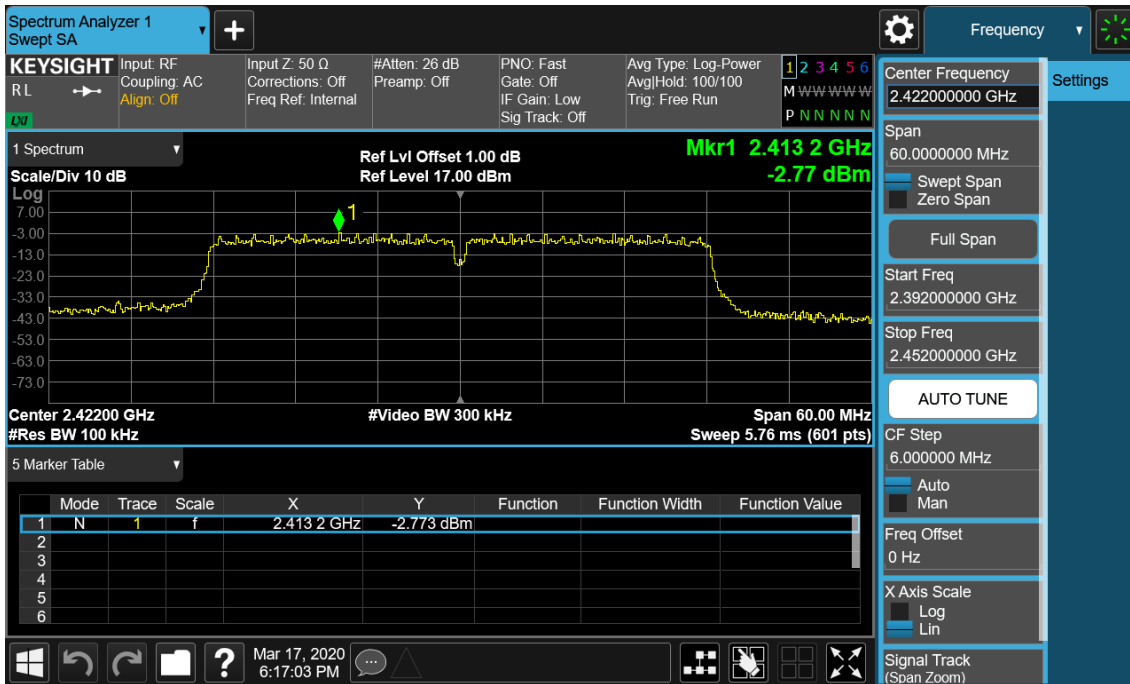
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Figure 34: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT40), 2422MHz Carrier Level



Band Edge



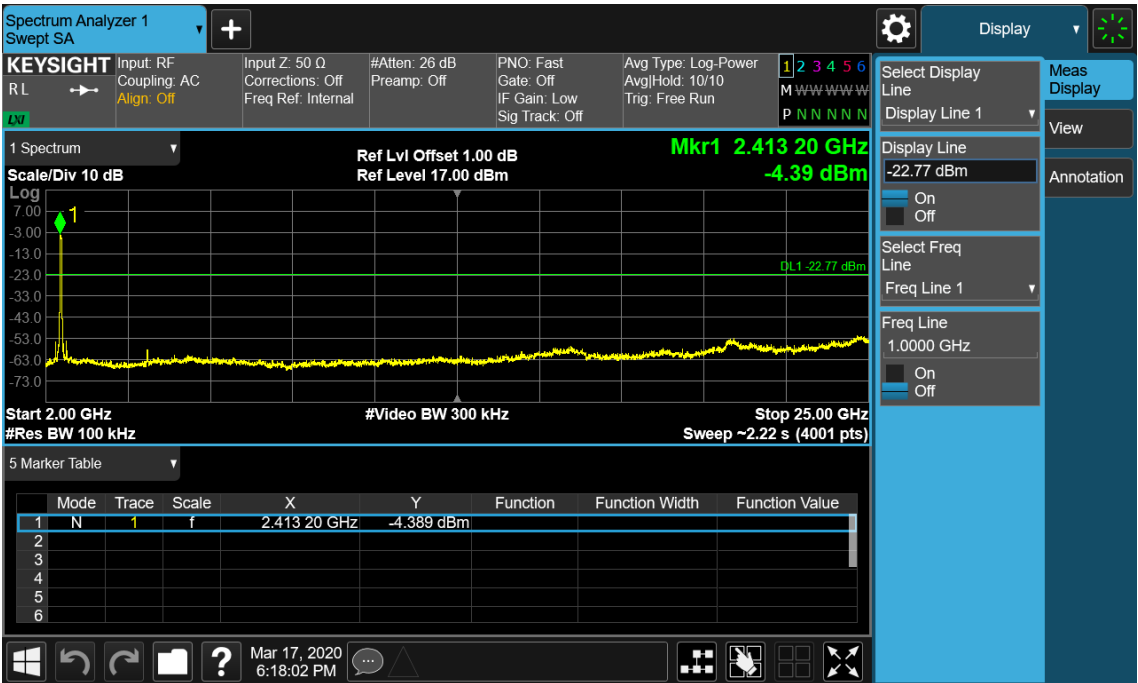
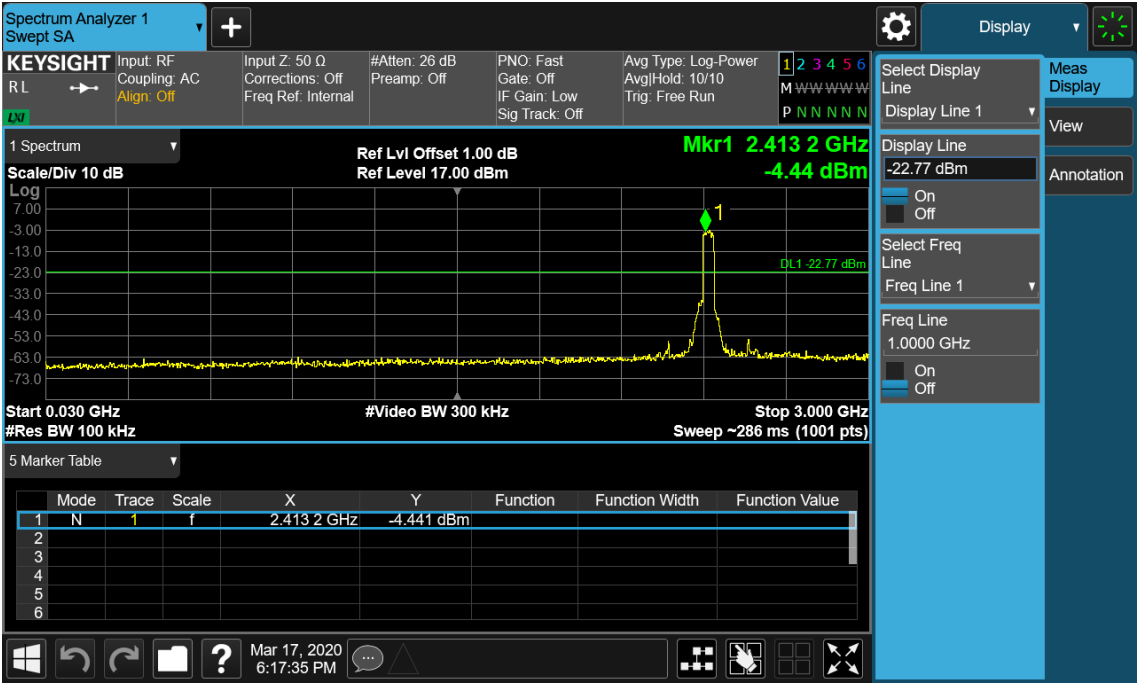
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Conducted spurious emissions 30MHz-25GHz



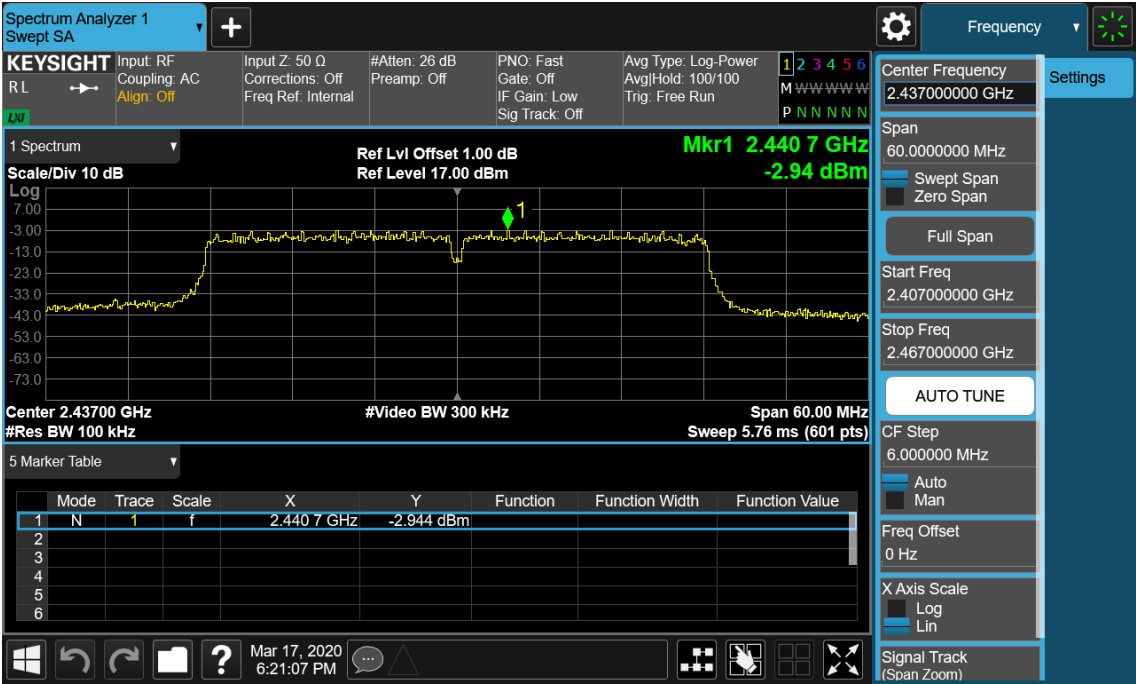
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Figure 35: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT40), 2437MHz Carrier Level



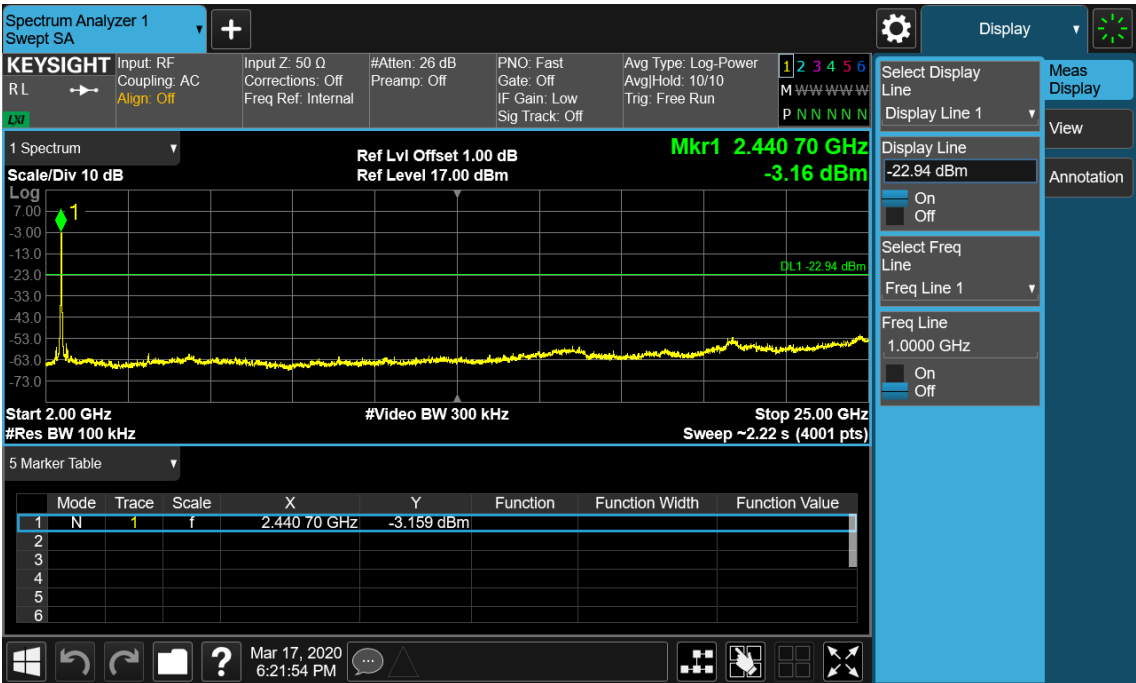
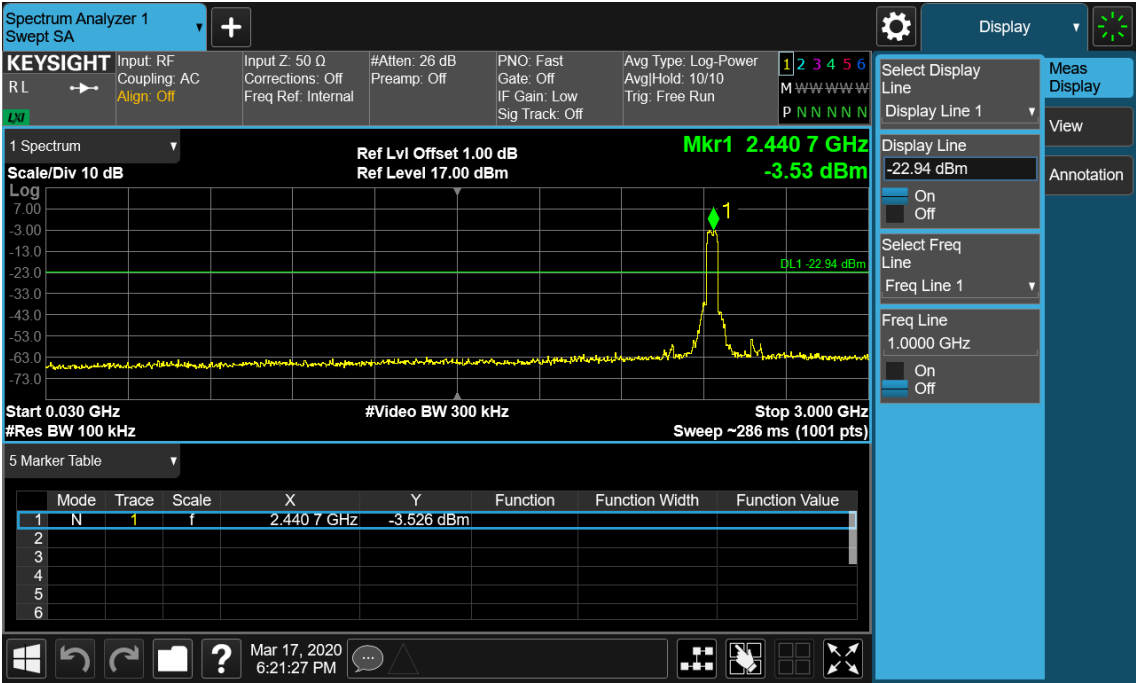
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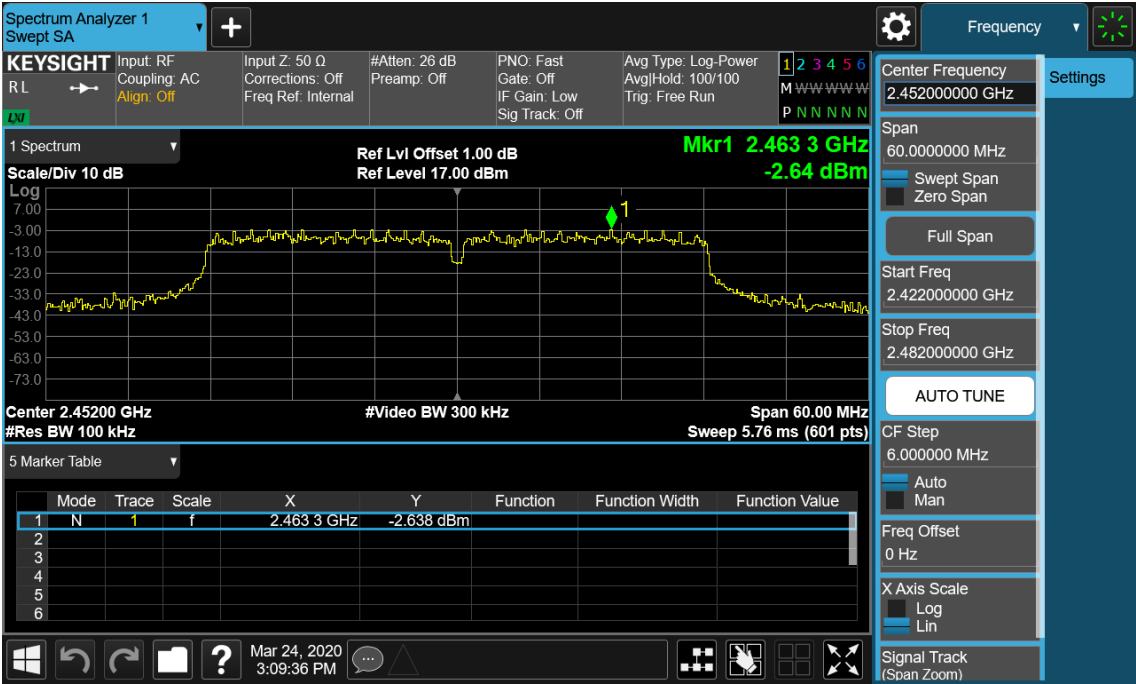
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Conducted spurious emissions 30MHz-25GHz



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Figure 36: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT40), 2452MHz Carrier Level



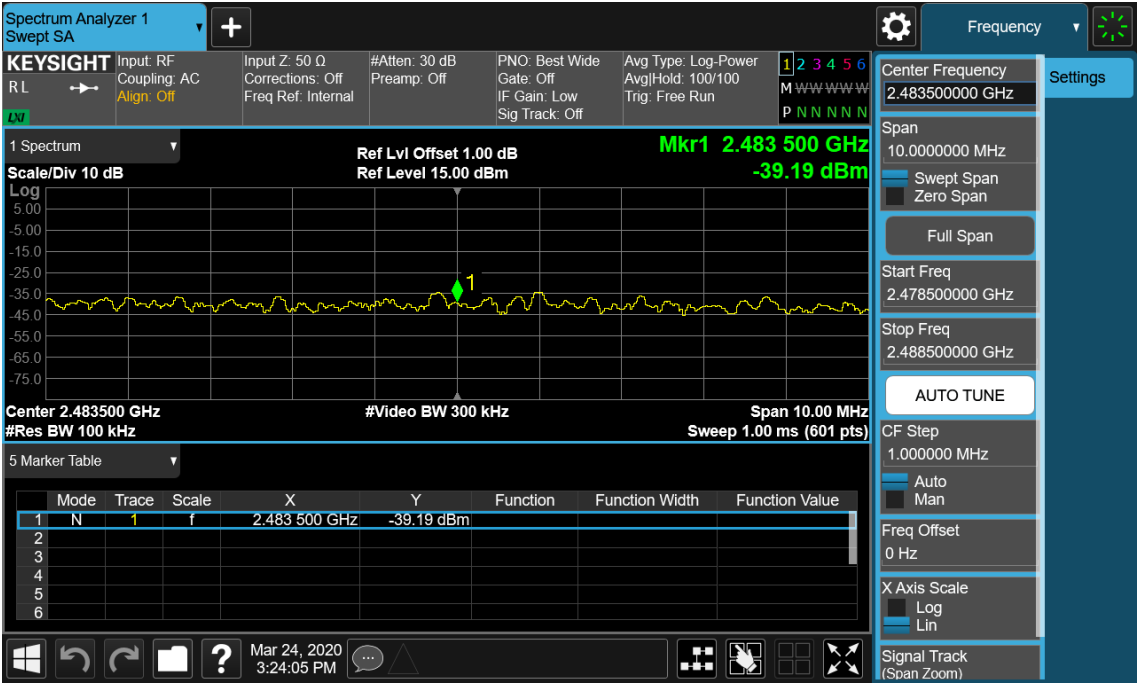
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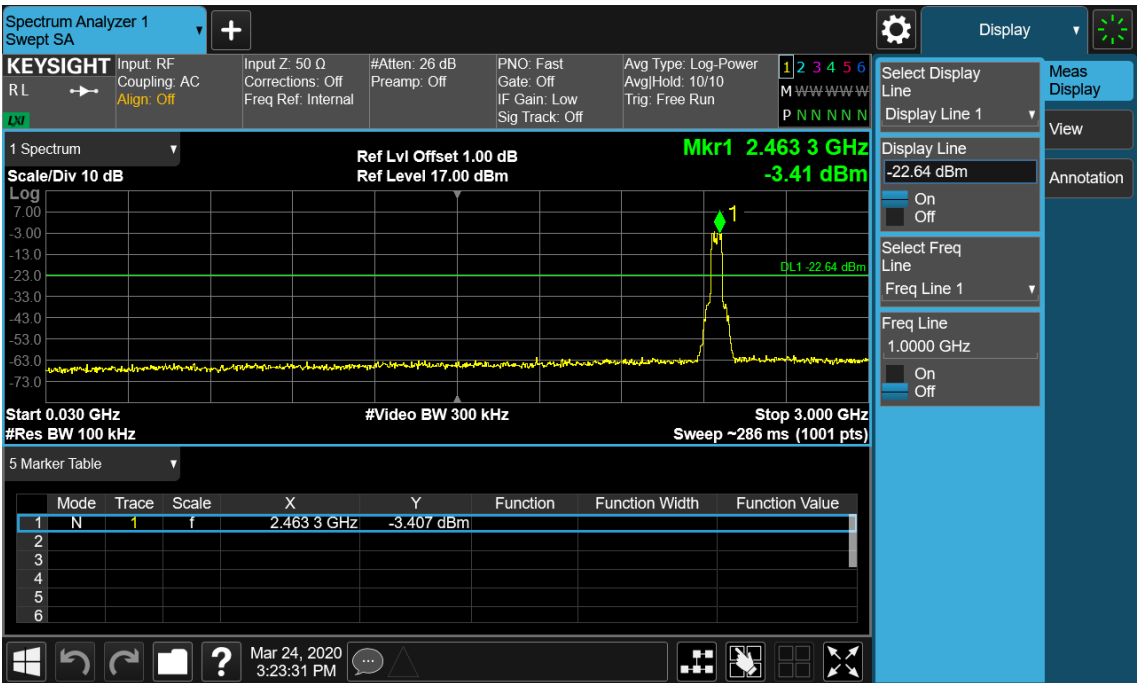
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Band Edge



Conducted spurious emissions 30MHz-25GHz



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