TEST REPORT

Applicant	:	Sonim Technologies, Inc.
Address of Applicant	:	6836 Bee Cave Road, Building 1, Suite 279, Austin, Texas 78746, USA
Product Name	:	Rugged Smart Phone
Model No.	:	RS60
Sample No.	:	E20090007-01#01 E20090007-01#12
FCC ID	:	WYPRS60
ISED Number	:	8090A-RS60
Standards	:	FCC CFR47 Part 15, Subpart C RSS-Gen (Issue 5, March 2019) RSS-247 (Issue 2, February 2017)
Date of Receipt	:	2020-09-29
Date of Test	:	2020-10-14 ~ 2021-03-04
Date of Issue	:	2021-04-09

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 (Jennifer Zhou) Reviewed by: Oliver Xiang (Oliver Xiang) Approved by: Guoyou Chi (Authorized signatory: Guoyou Chi)

TEST 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	Sonim Technologies, Inc.
Address	6836 Bee Cave Road, Building 1, Suite 279, Austin, Texas 78746, USA
Contact Person	Avena.Xu
Telephone	1-650-378-8100
Email	avena.xu@sonimtech.com

1.3 Details of EUT

Product Name	Rugged Smart Phone
Brand Name	Sonim
Model No.	RS60
FCC ID	WYPRS60
ISED Number	8090A-RS60
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	3.23dBi
Extreme Temperature Range	-20℃~ +55℃
Test Voltage	DC 3.8V
Hardware version	V1.0
Software version	60.0.0-01-10.0.0-00.01.01
Test SW Version	BL410_R;BL410_E
RF power setting in TEST SW	QRCT

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.

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	MY59260184	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

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	11Mbps
802.11g	54Mbps
802.11n(20M)	MCS3
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

3.2 Special Accessories and Auxiliary Equipment

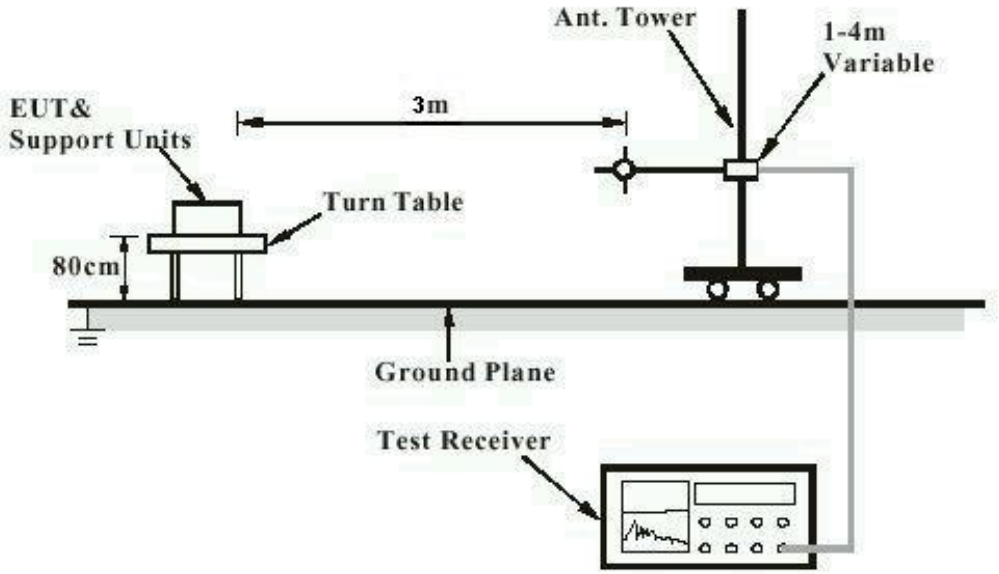
Description	Manufacturer	Model No.	Serial No.
Laptop	Lenovo	TP00083A	N/A

3.3 Support Software

Description	Manufacturer	Software Name
Software	Qualcomm	QRCT

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

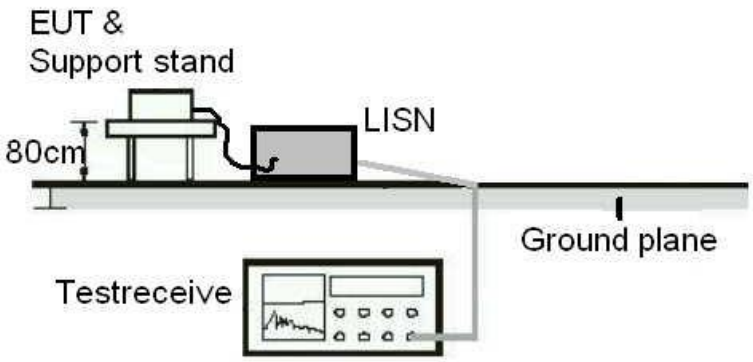
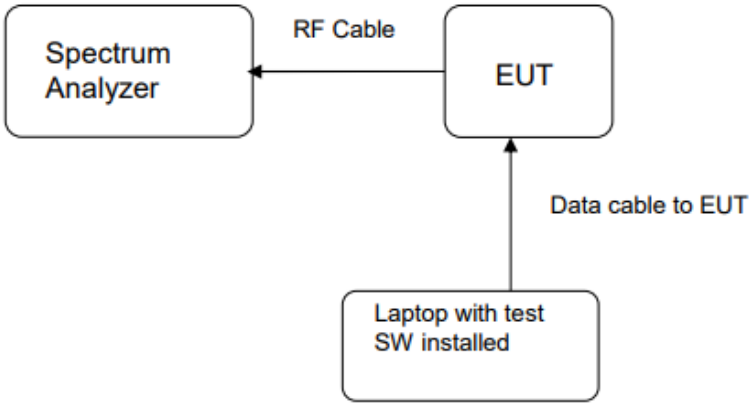


Diagram of Measurement Equipment Configuration for Transmitter Measurement



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 6dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 3.23dBi. 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.

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	Peak Output Power		Limit (W)
		(dBm)	(dBm)	(mW)	
802.11b	2412	12.41	12.49	17.74	< 1
	2437	11.20	11.28	13.43	
	2462	12.02	12.10	16.22	
802.11g	2412	12.27	12.74	18.79	
	2437	10.97	11.44	13.93	
	2462	11.87	12.34	17.14	
802.11n(HT20)	2412	11.34	11.74	14.93	
	2437	9.34	9.74	9.42	
	2462	10.22	10.62	11.53	
802.11n(HT40)	2422	11.38	12.47	17.66	
	2437	11.90	12.99	19.91	
	2452	9.87	10.96	12.47	

Table 2: E.I.R.P

Test Mode	Test Channel (MHz)	E.I.R.P		Limit (W)
		(dBm)	(mW)	
802.11b	2412	15.72	37.33	< 4
	2437	14.51	28.25	
	2462	15.33	34.12	
802.11g	2412	15.97	39.54	
	2437	14.67	29.31	
	2462	15.57	36.06	
802.11n(HT20)	2412	14.97	31.41	
	2437	12.97	19.82	
	2462	13.85	24.27	
802.11n(HT40)	2422	15.7	37.15	
	2437	16.22	41.88	
	2452	14.19	26.24	

Notes：

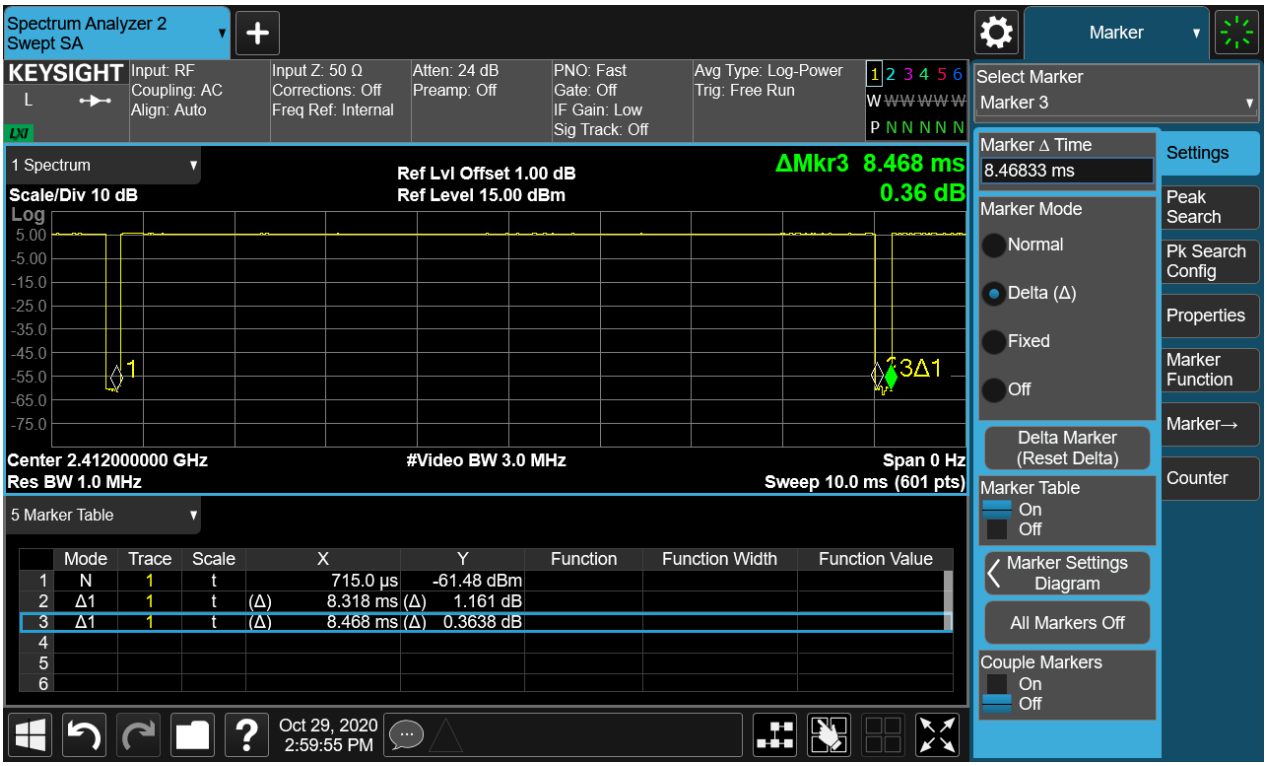
Peak Output Power = Measured Conducted peak power +duty cycle factor

EIRP = Peak Output Power + Antenna Gain(3.23dBi)

Duty cycle factor =10*log(1/duty cycle)

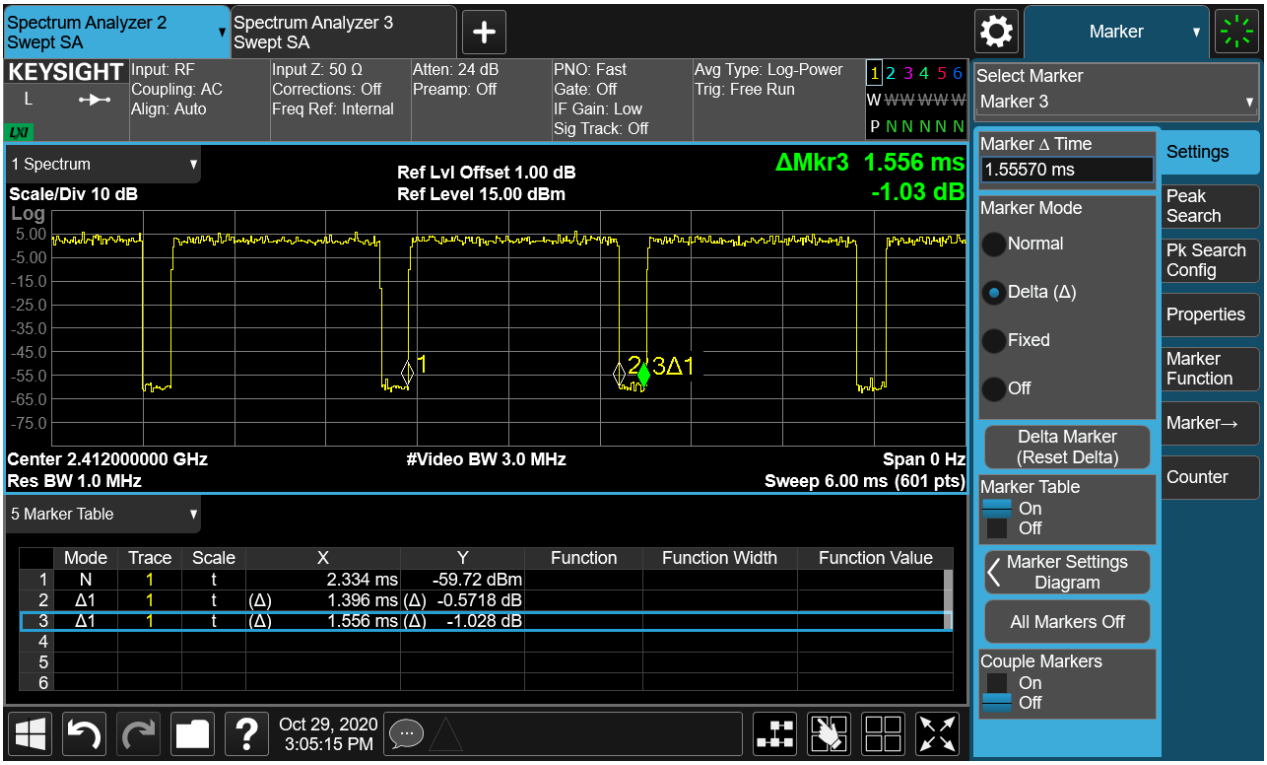
802.11b > 98%

Duty cycle factor =10*log(1/duty cycle)=0.08



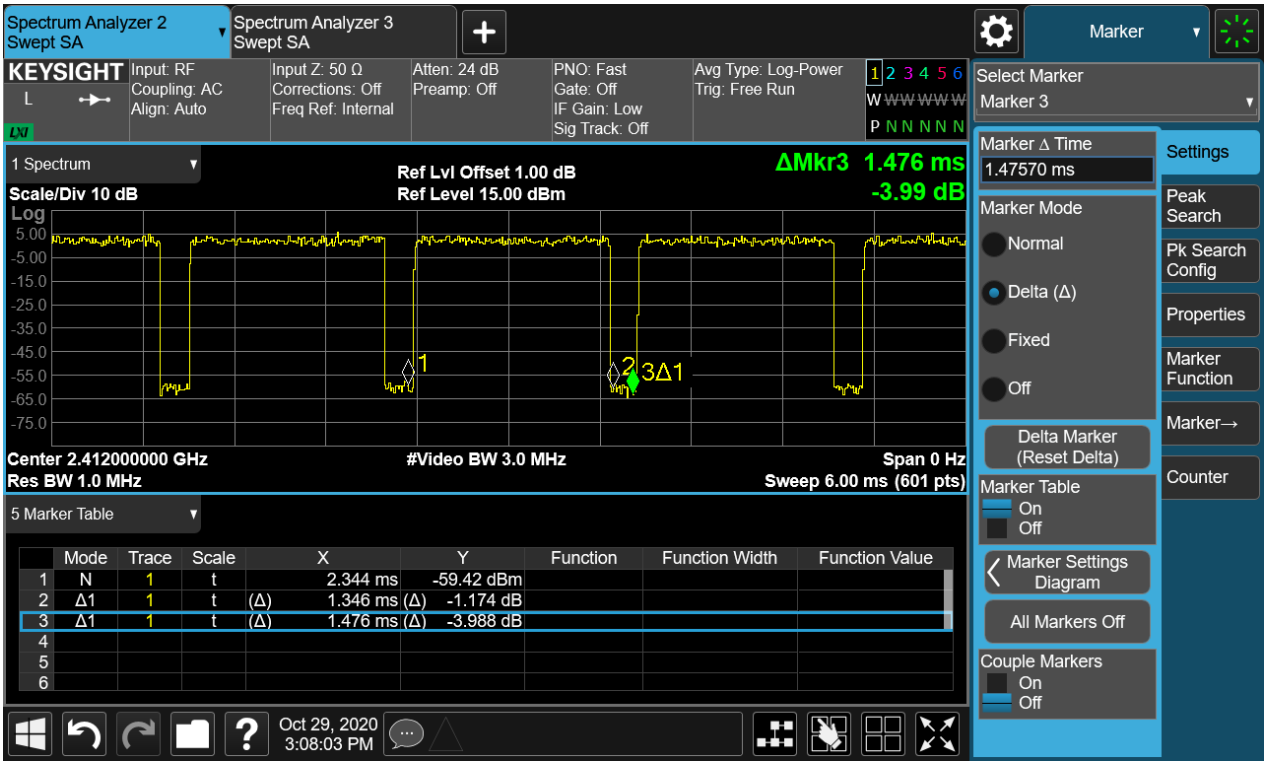
802.11g <98%

Duty cycle factor =10*log(1/duty cycle)=0.47



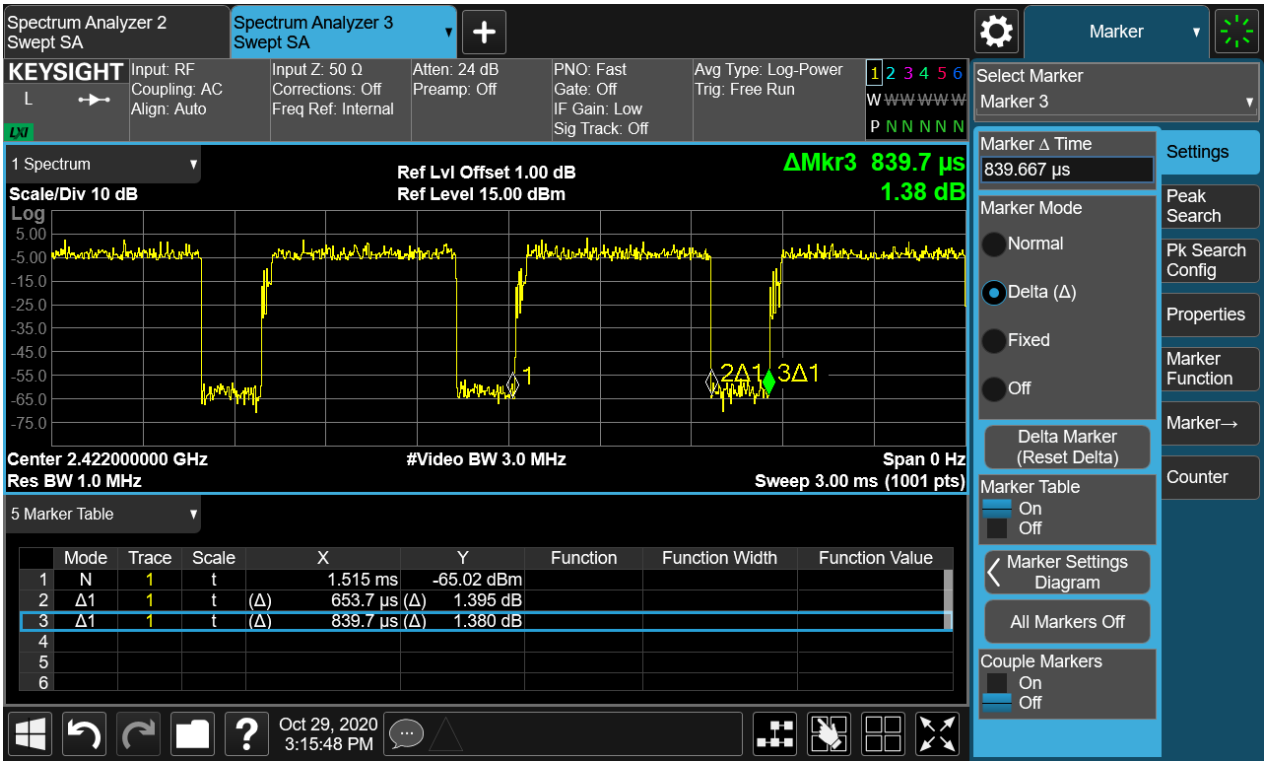
802.11n20<98%

Duty cycle factor =10*log(1/duty cycle)=0.40



802.11n40<98%

Duty cycle factor =10*log(1/duty cycle)=1.09



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

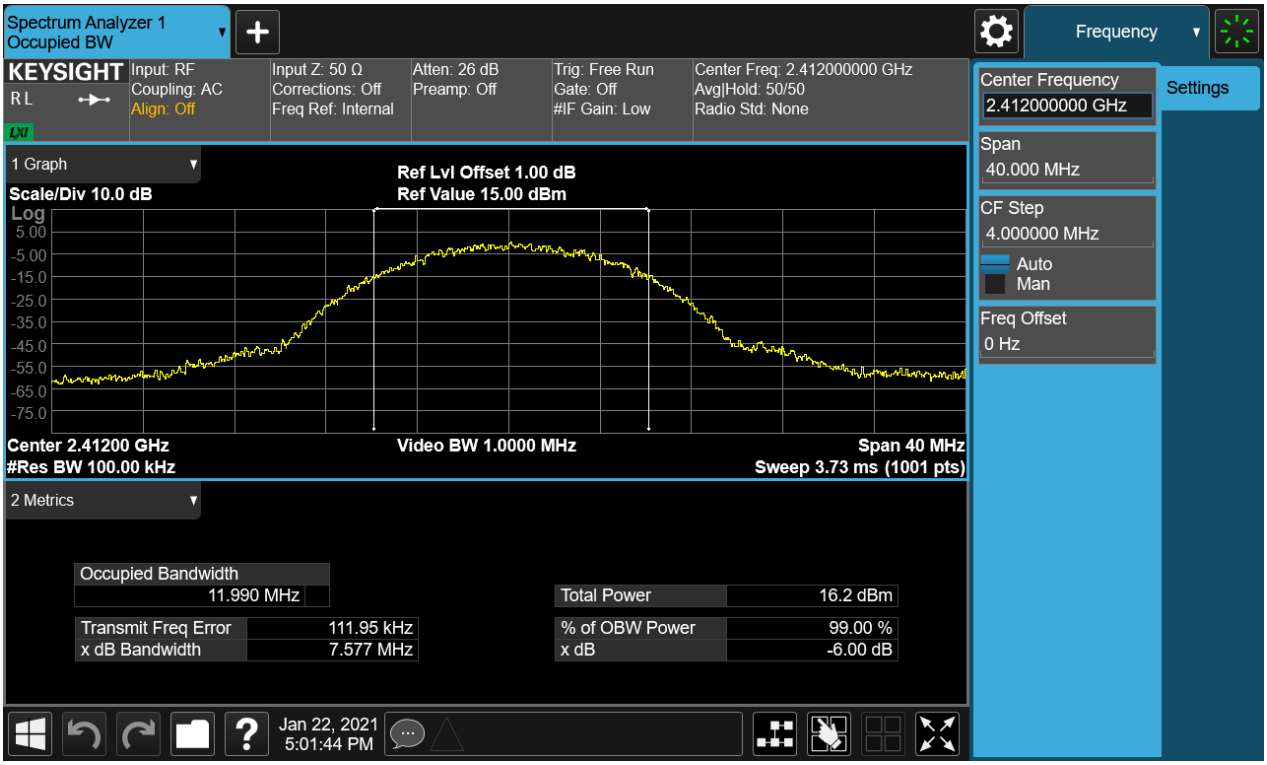
Test setup

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	7.577	12.031	>0.5
	2437	7.393	11.916	
	2462	7.629	11.939	
802.11g	2412	16.478	17.144	
	2437	16.455	17.183	
	2462	16.439	16.993	
802.11n(HT20)	2412	17.629	18.189	
	2437	17.708	18.227	
	2462	17.613	18.217	
802.11n(HT40)	2422	35.444	36.052	
	2437	35.218	36.185	
	2452	35.501	36.185	

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



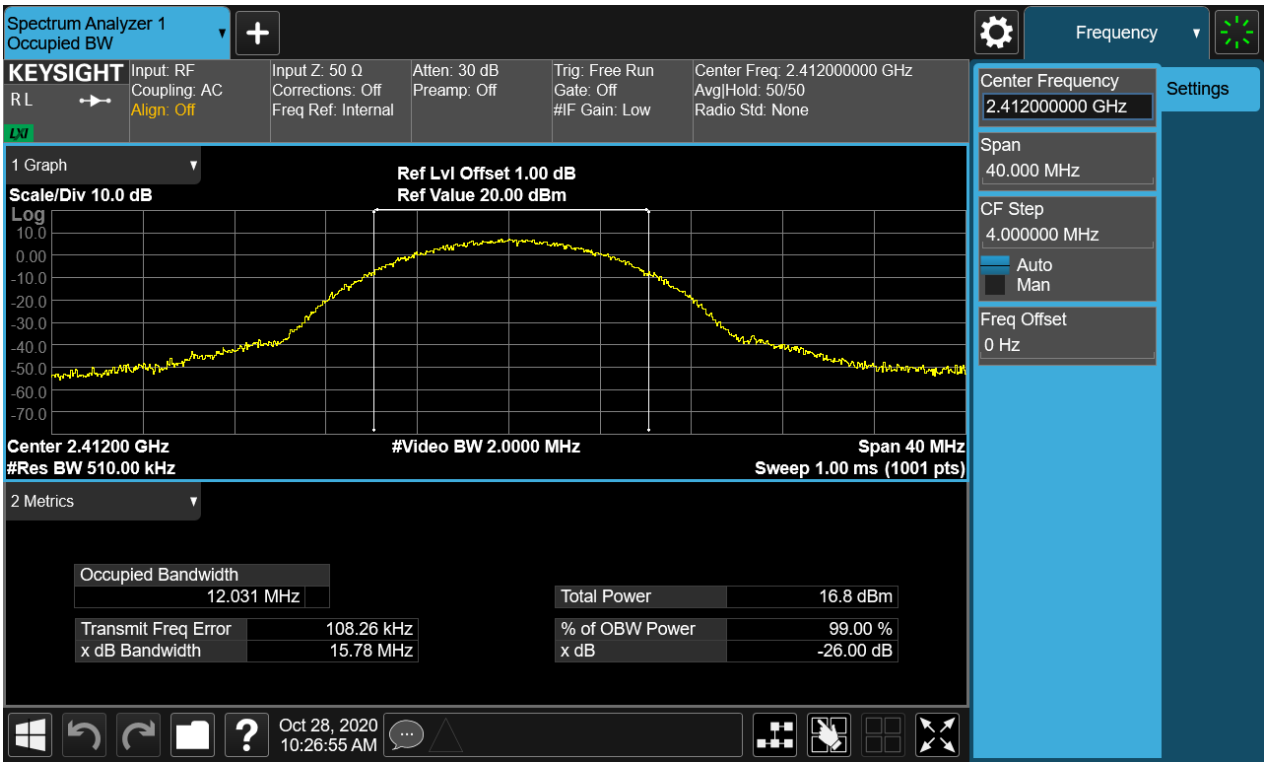
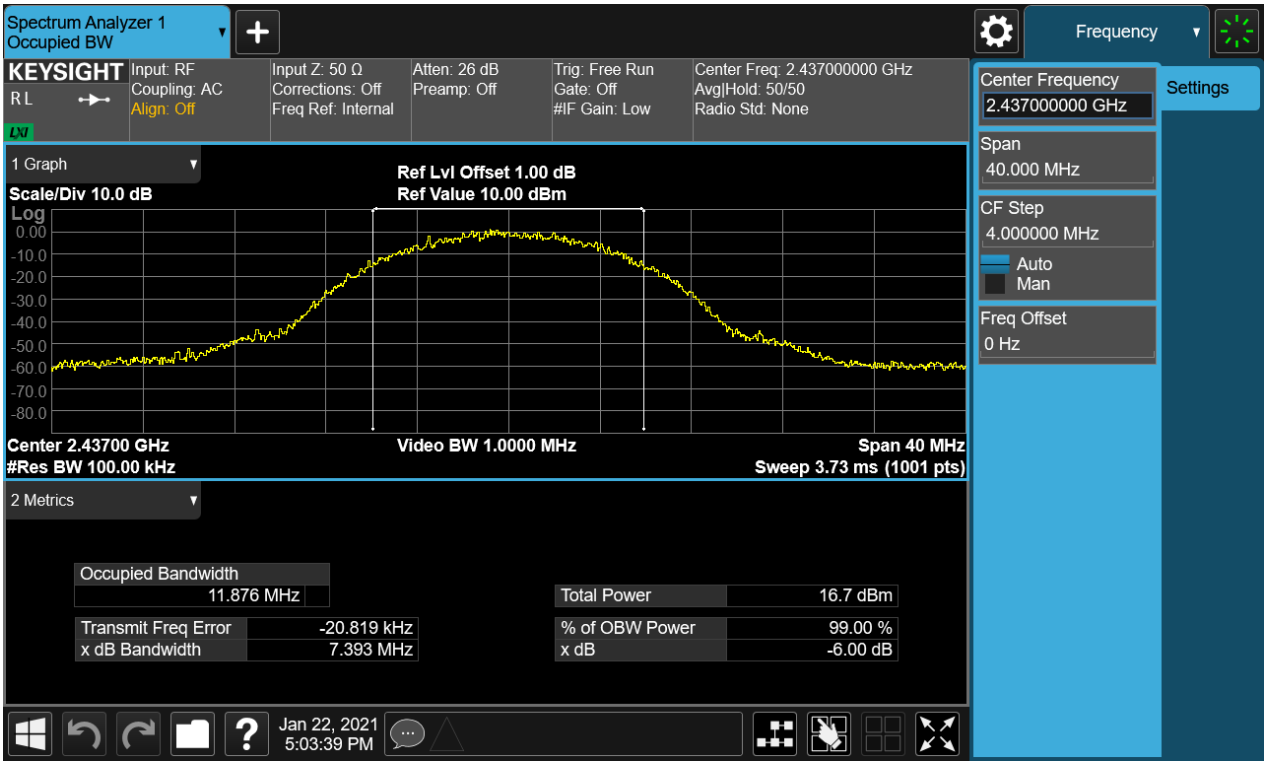


Figure 2: 6dB Bandwidth and 99% Bandwidth, 802.11b, 2437MHz



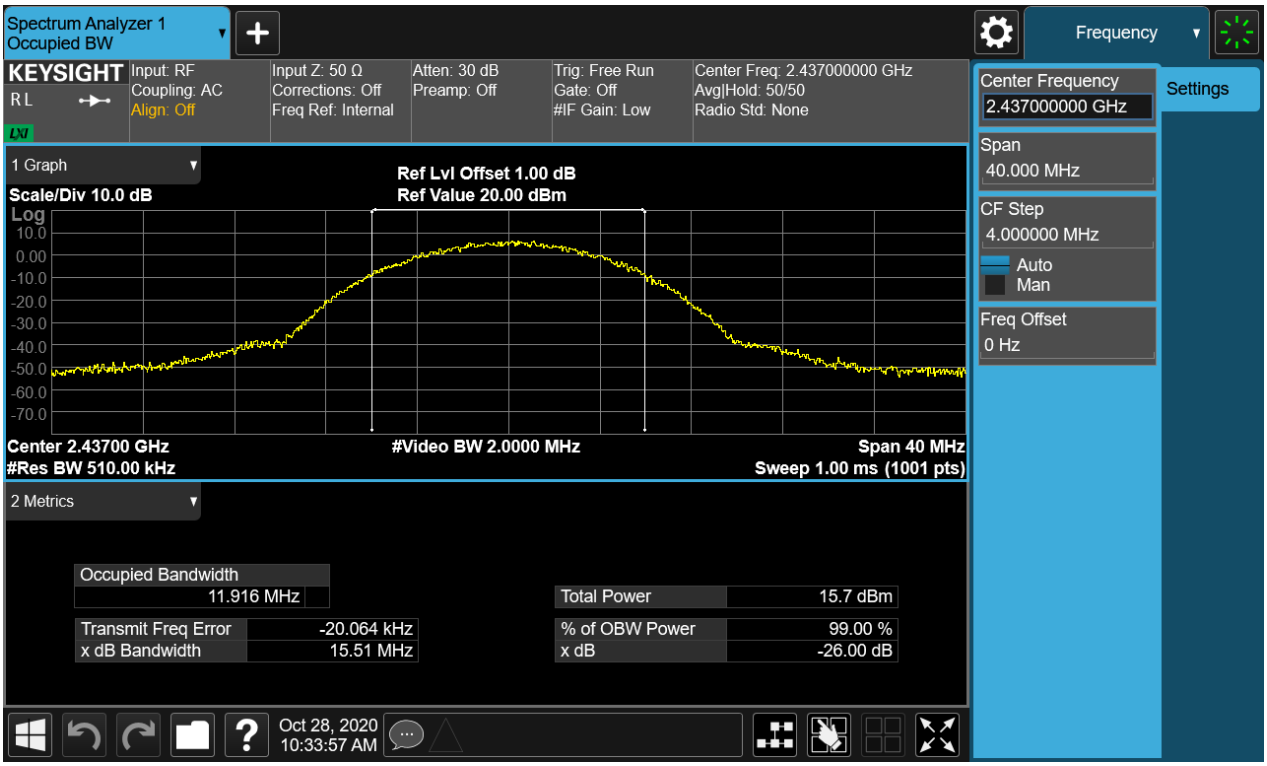


Figure 3: 6dB Bandwidth and 99% Bandwidth, 802.11b, 2462MHz

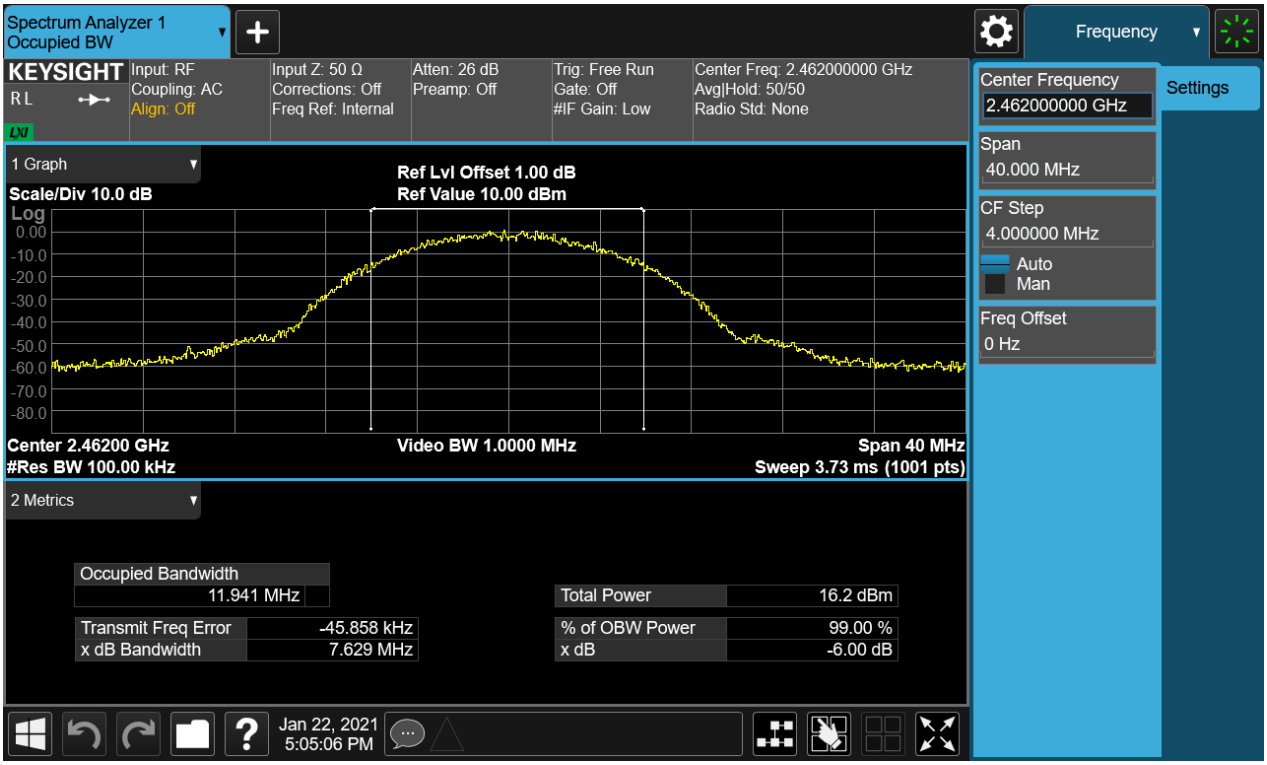


Figure 4: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2412MHz

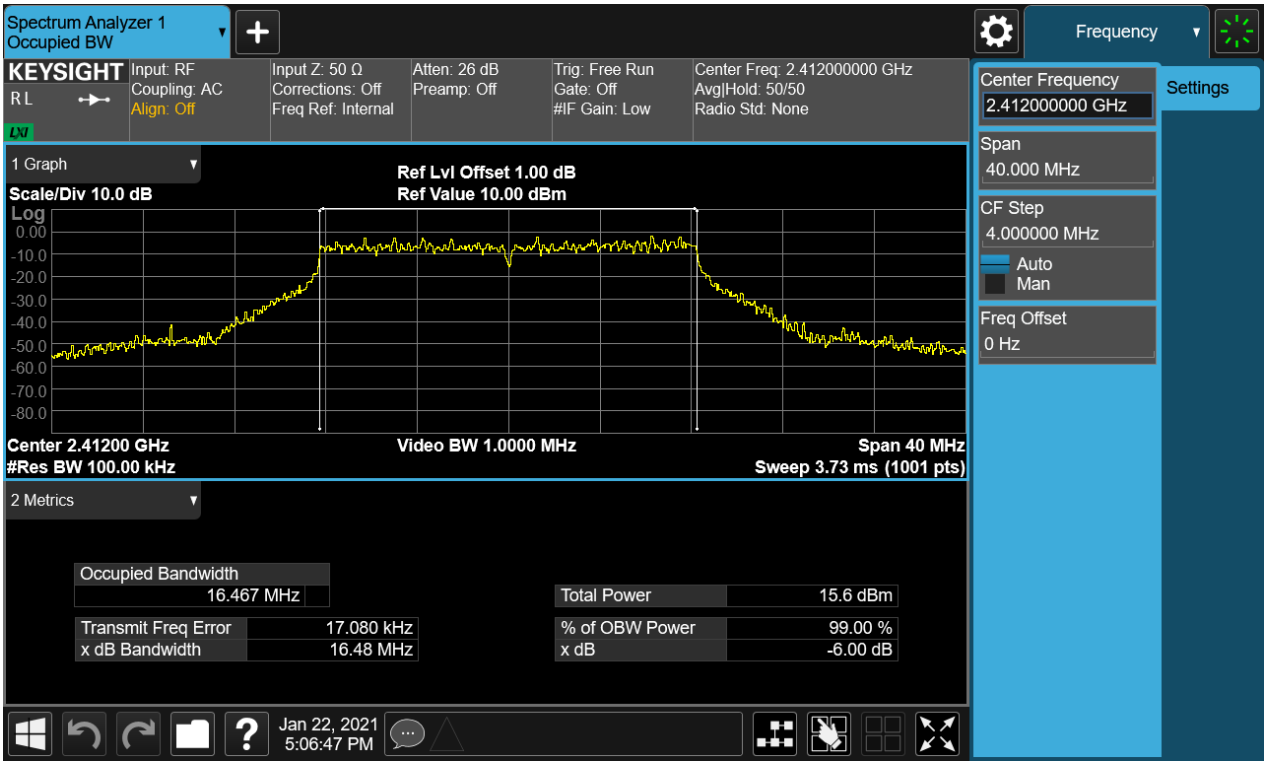
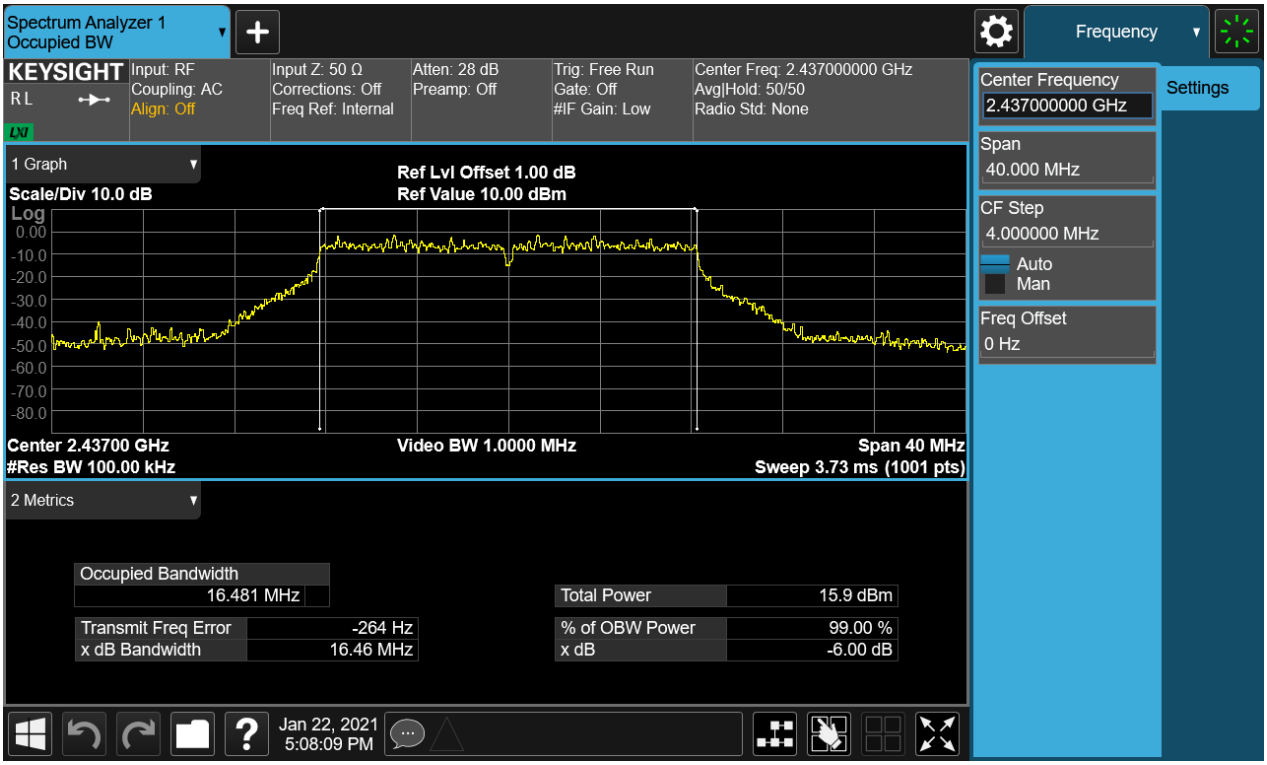


Figure 5: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2437MHz



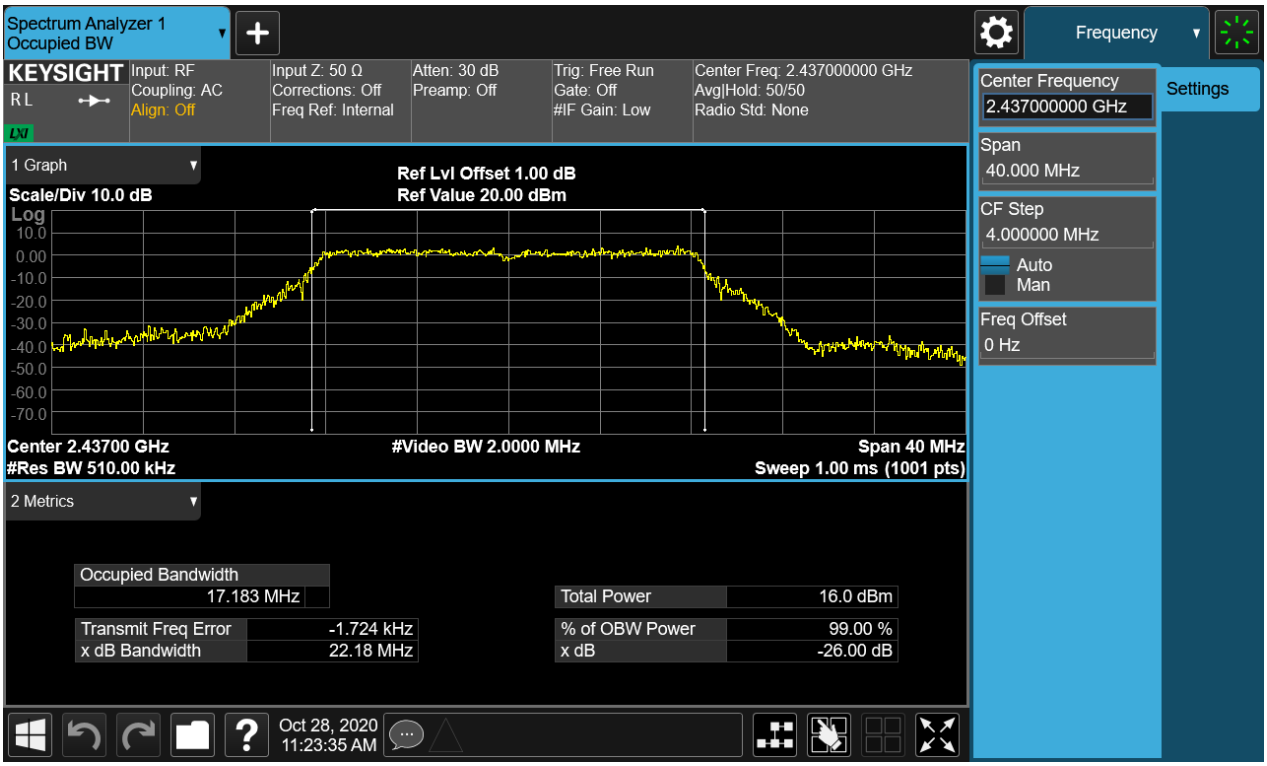
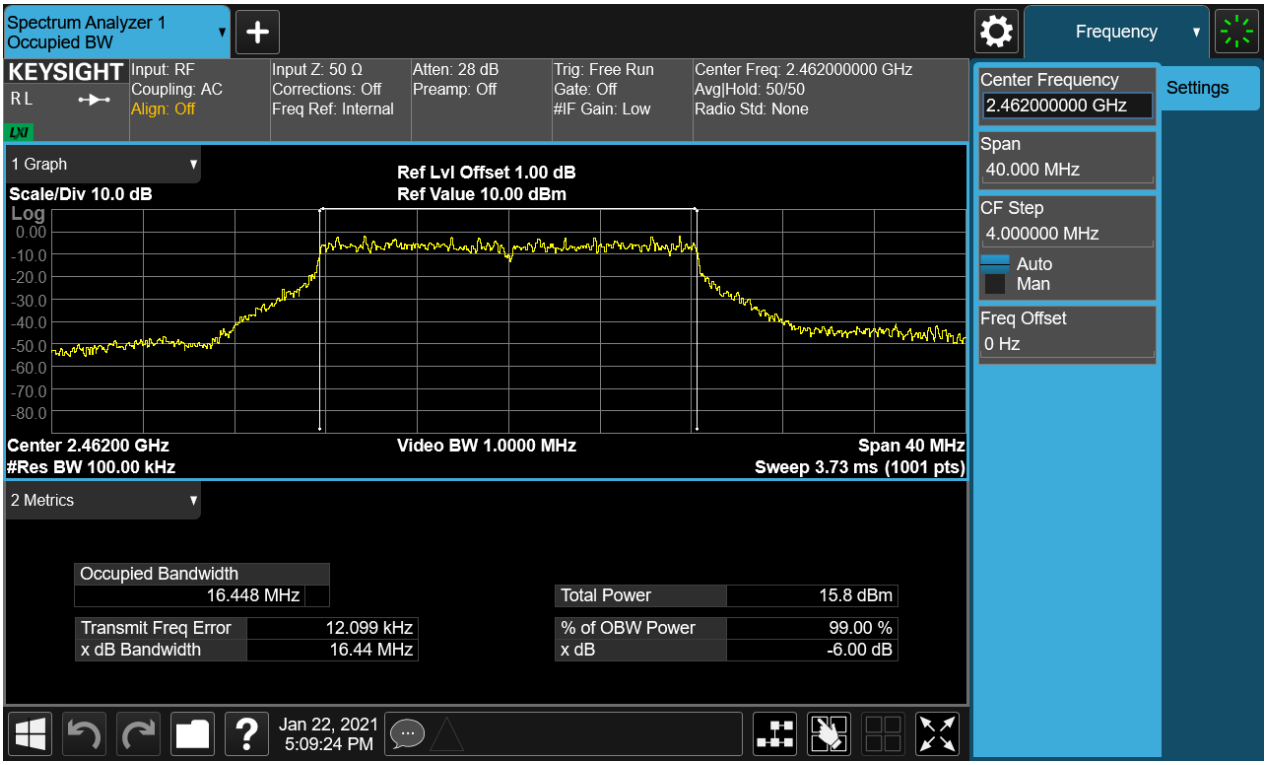


Figure 6: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2462MHz



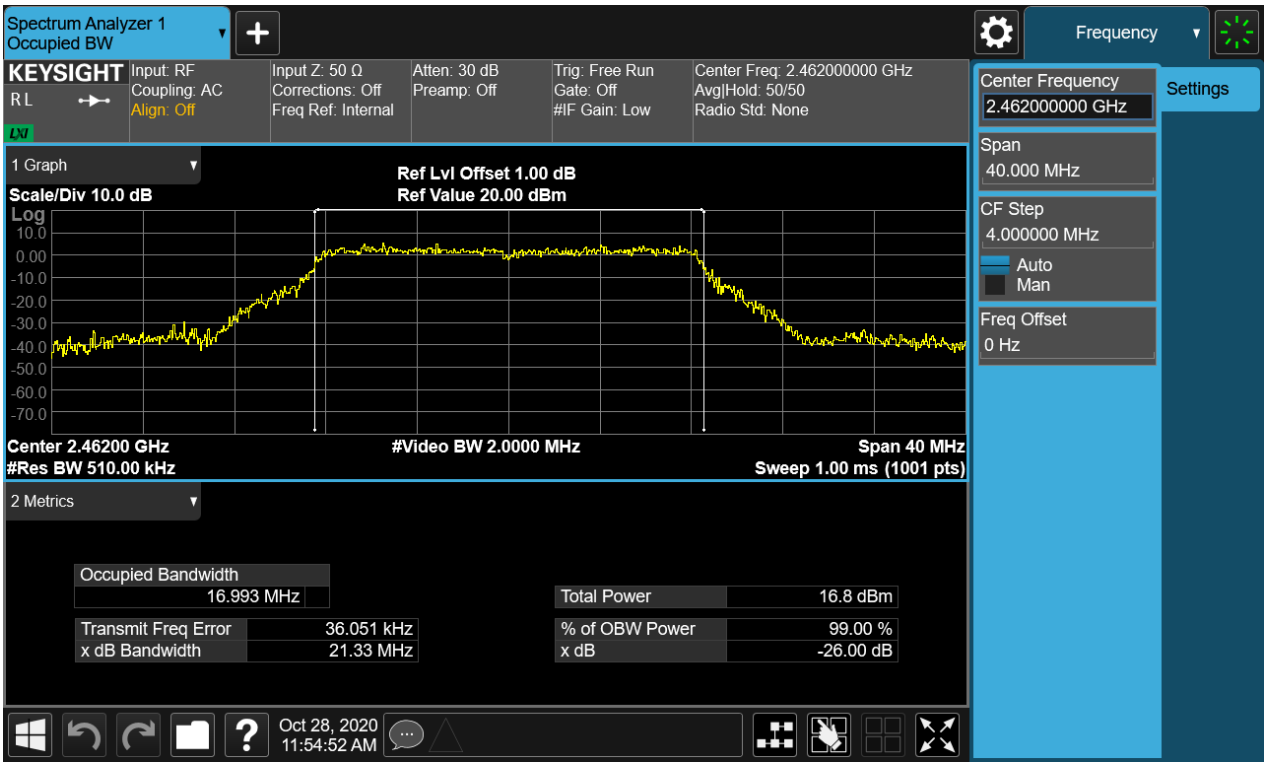
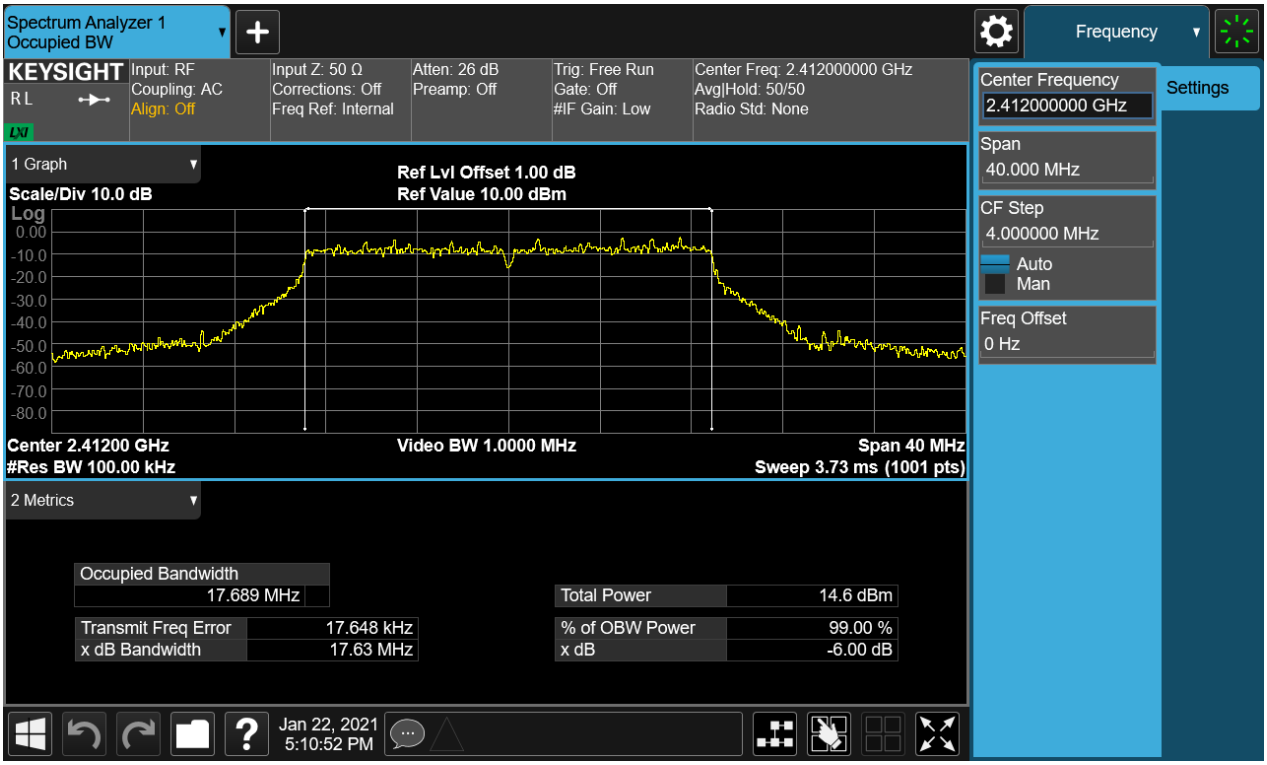


Figure 7: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2412MHz



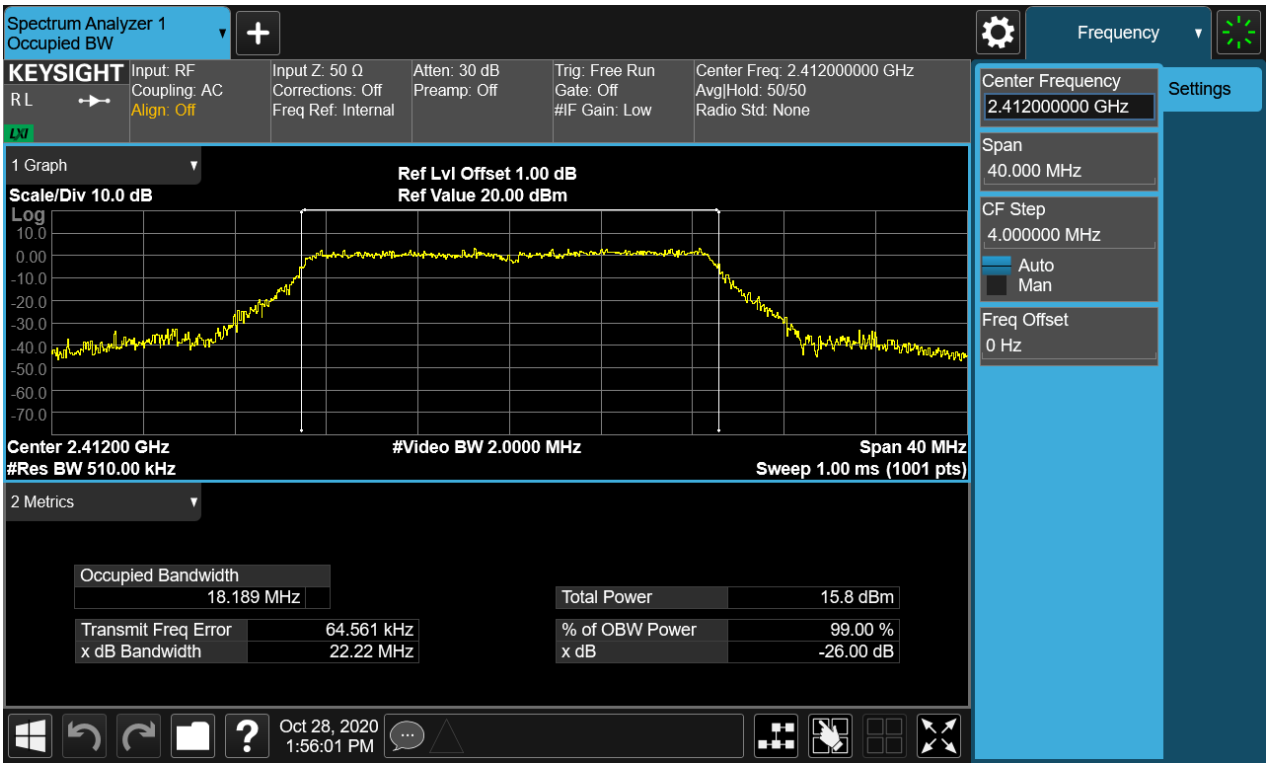
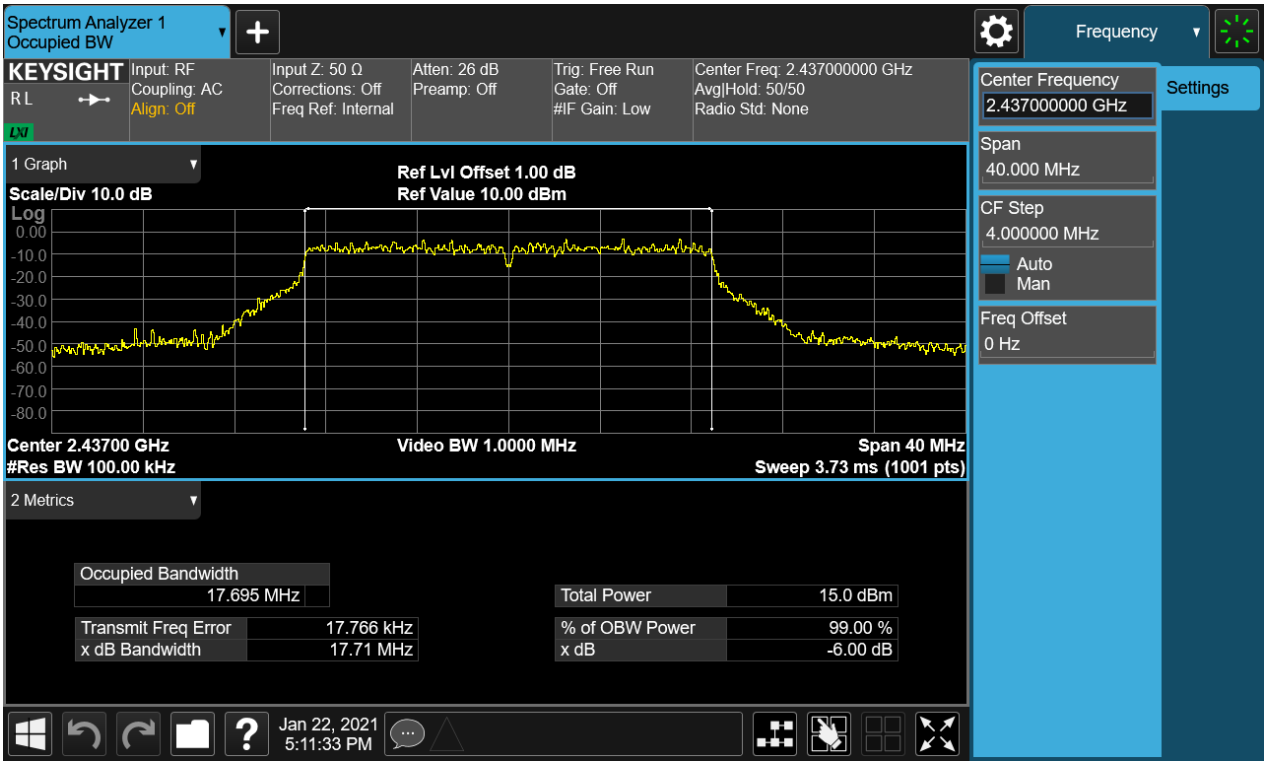


Figure 8: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2437MHz



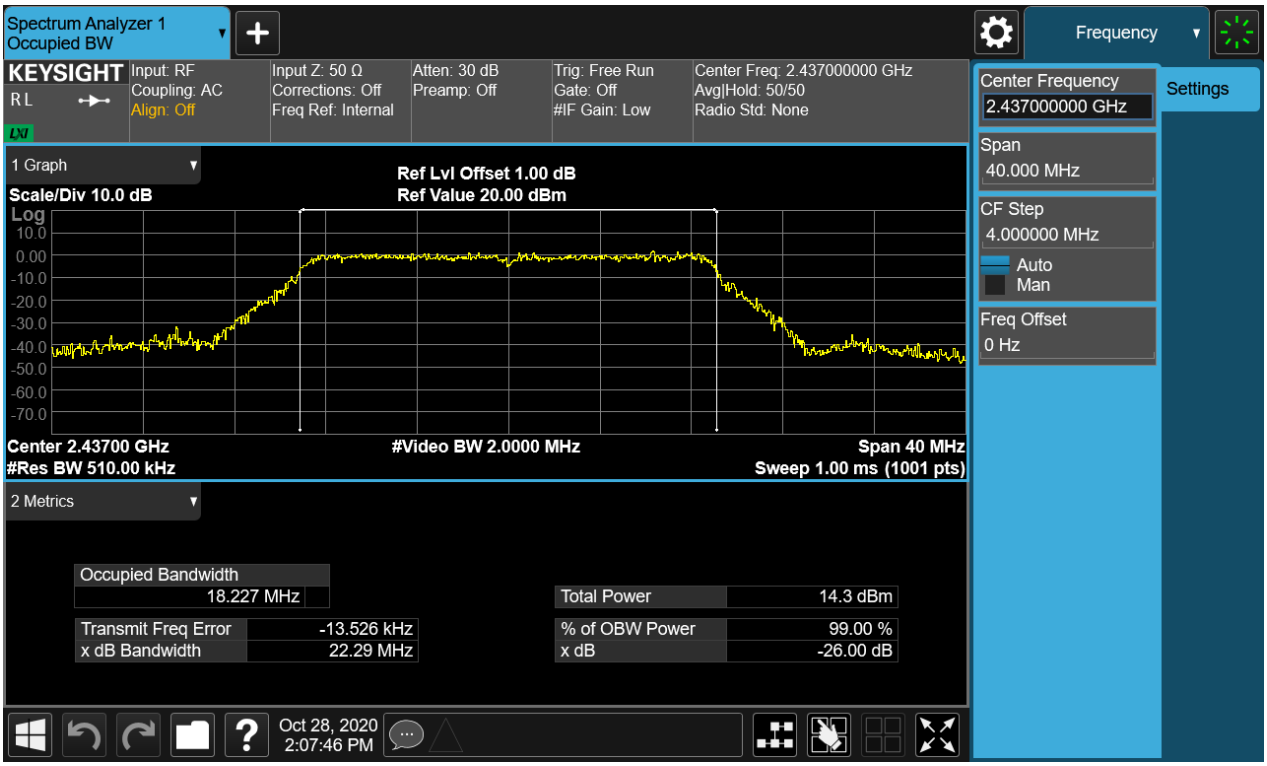
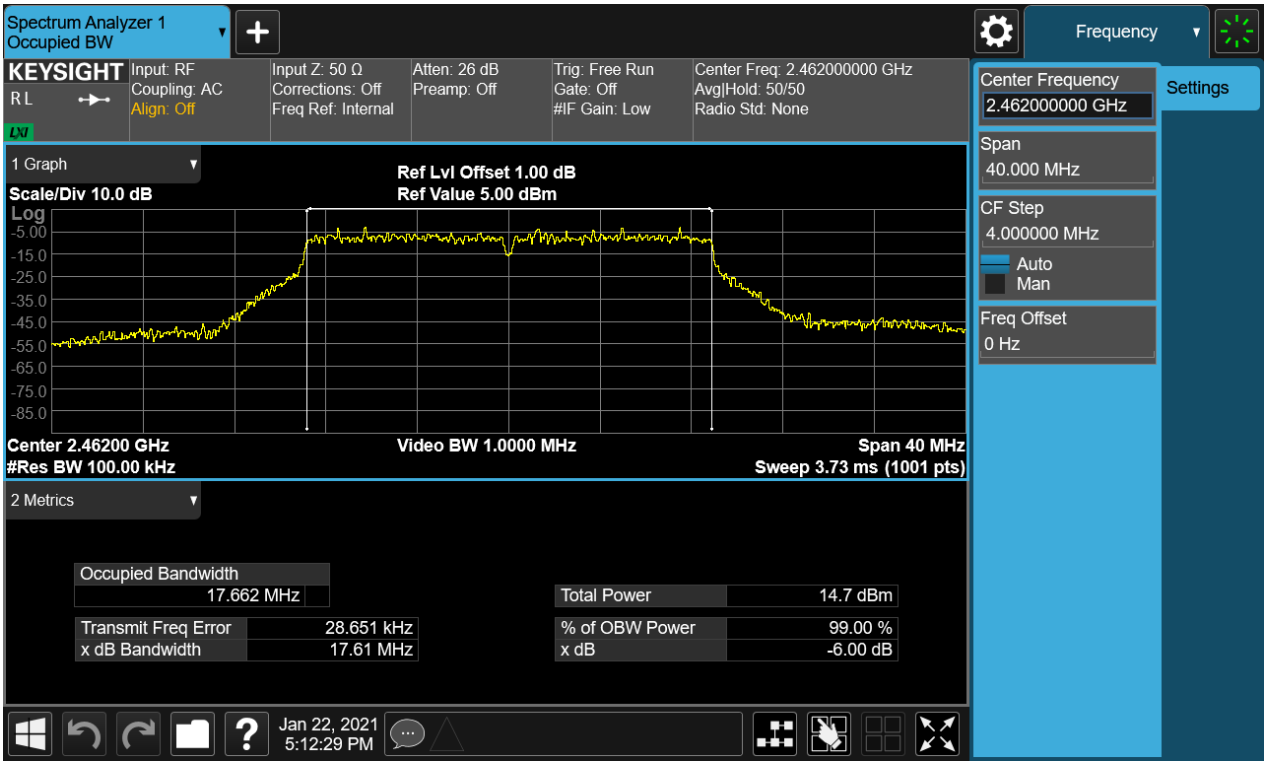


Figure 9: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2462MHz



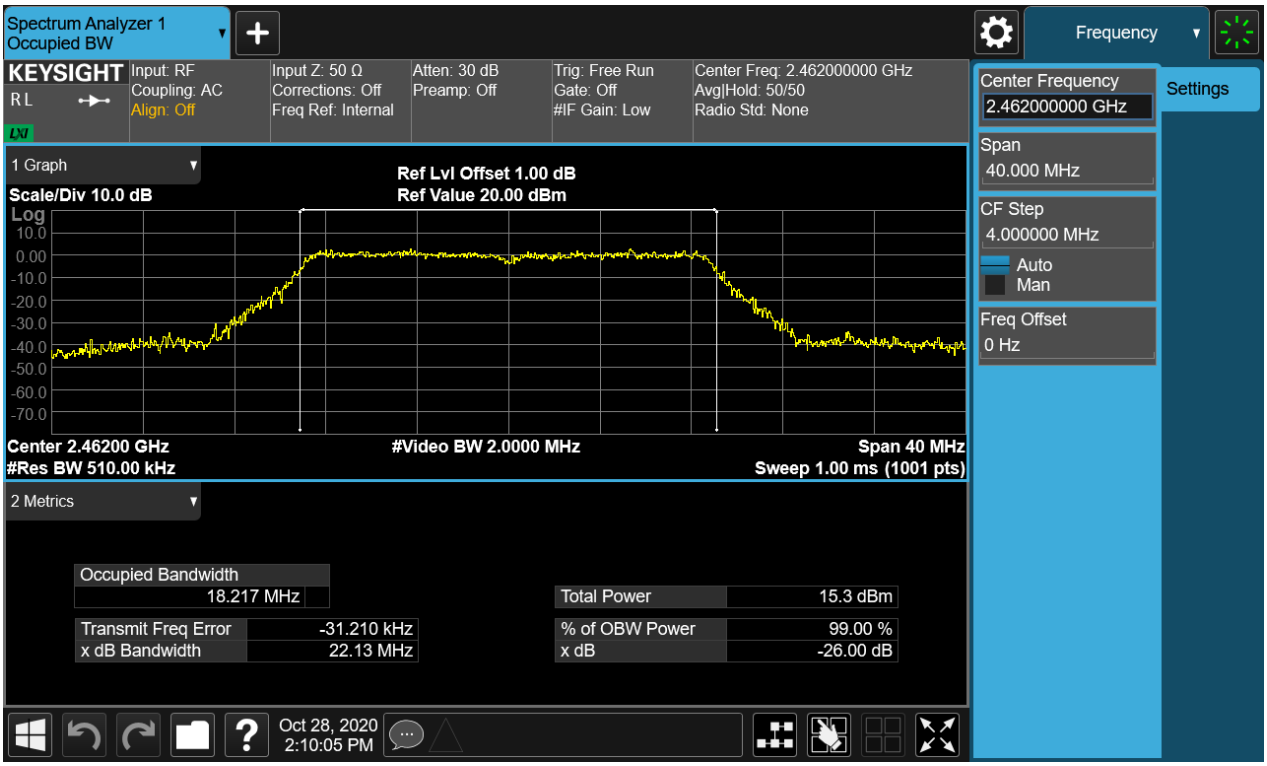
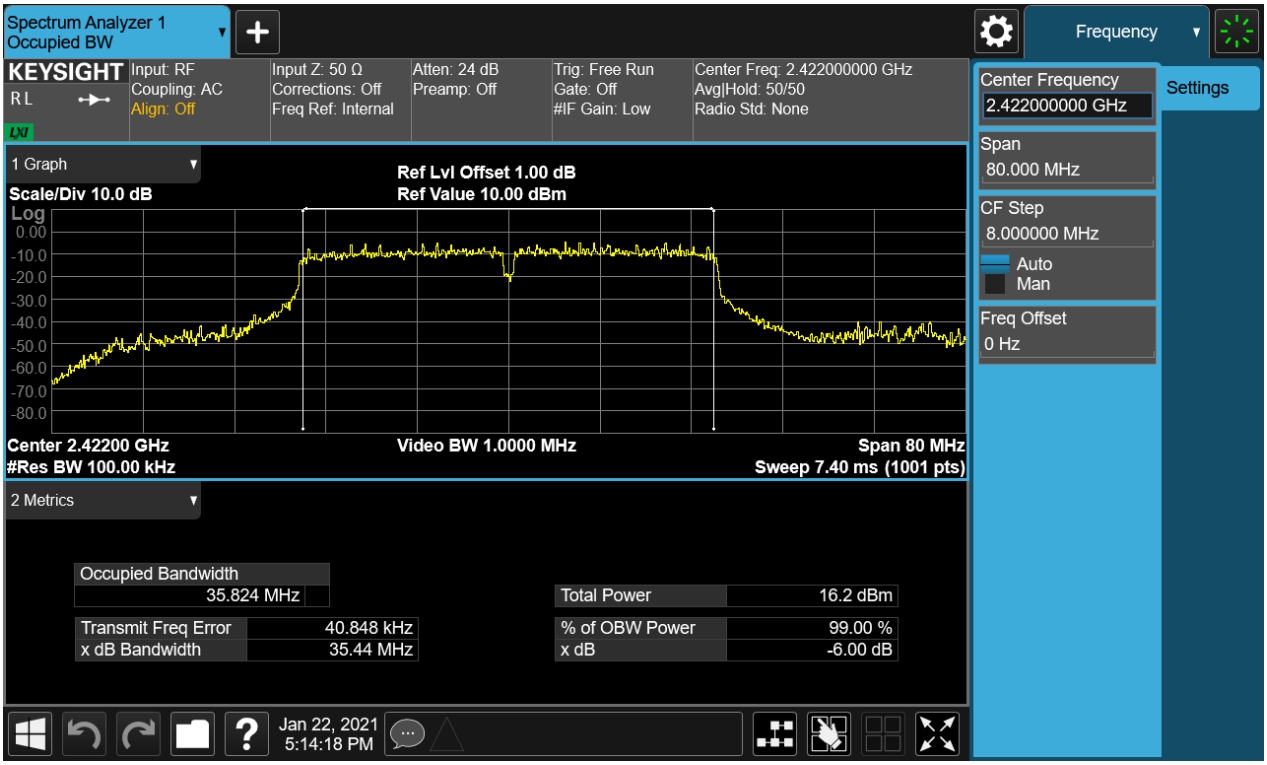


Figure 10: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 2422MHz



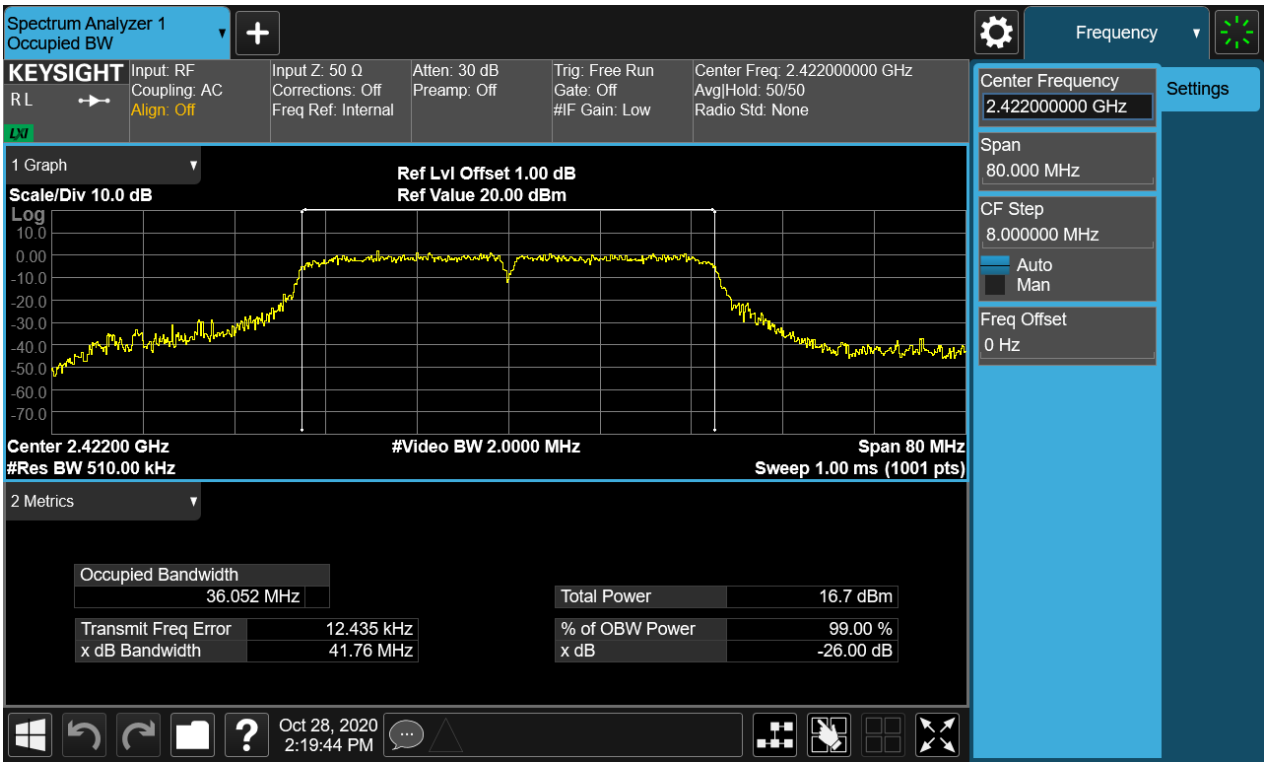
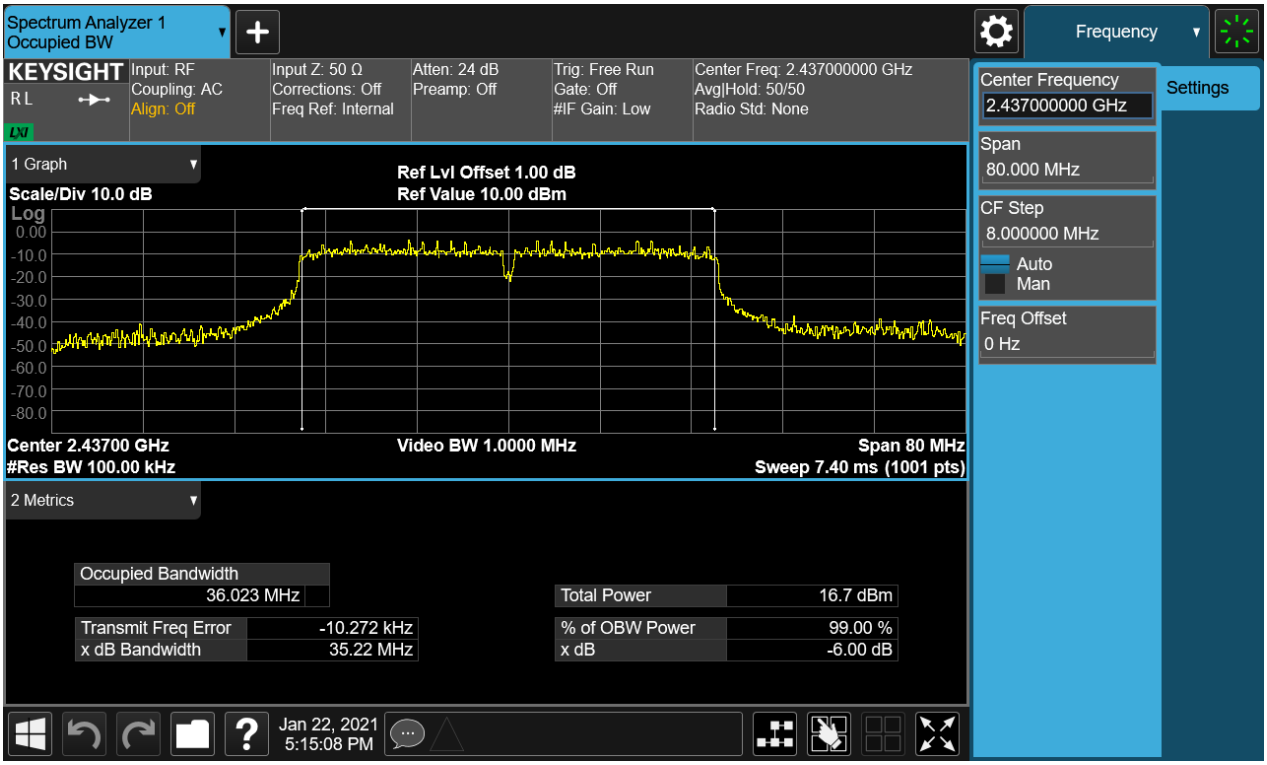


Figure 11: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 2437MHz



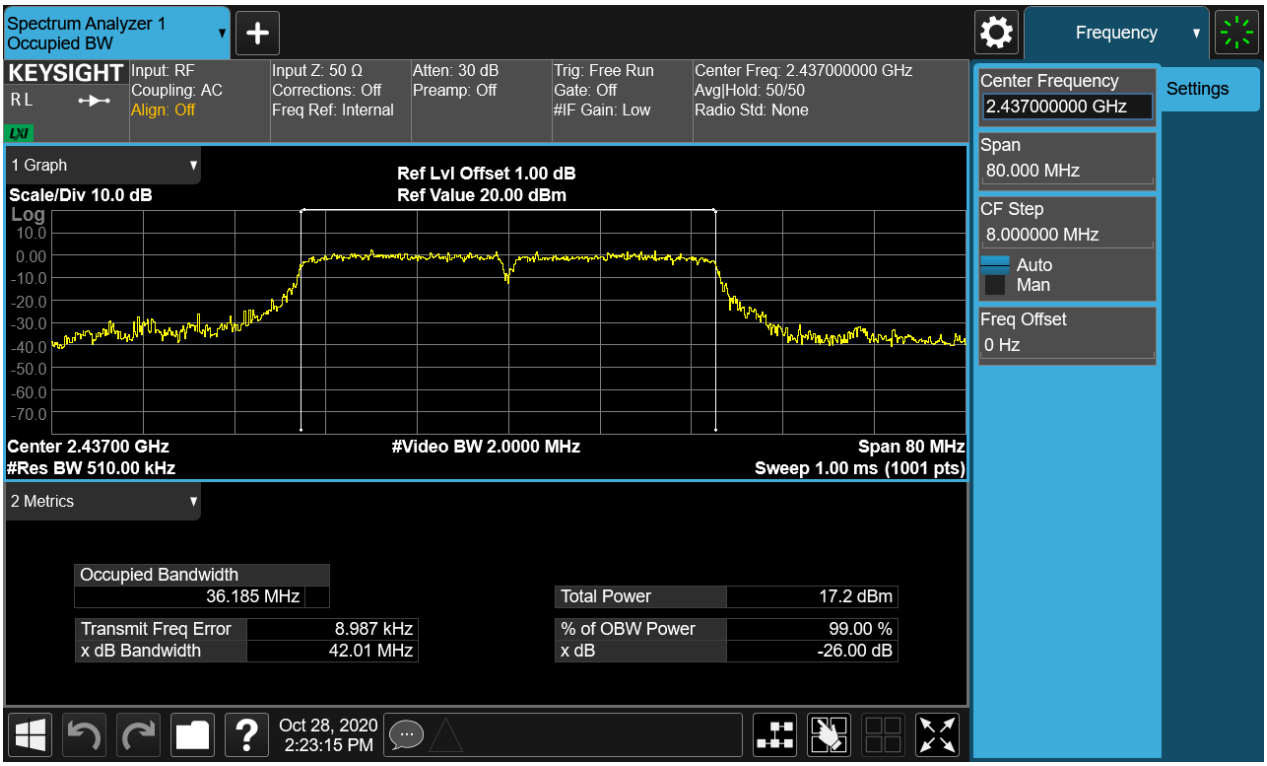
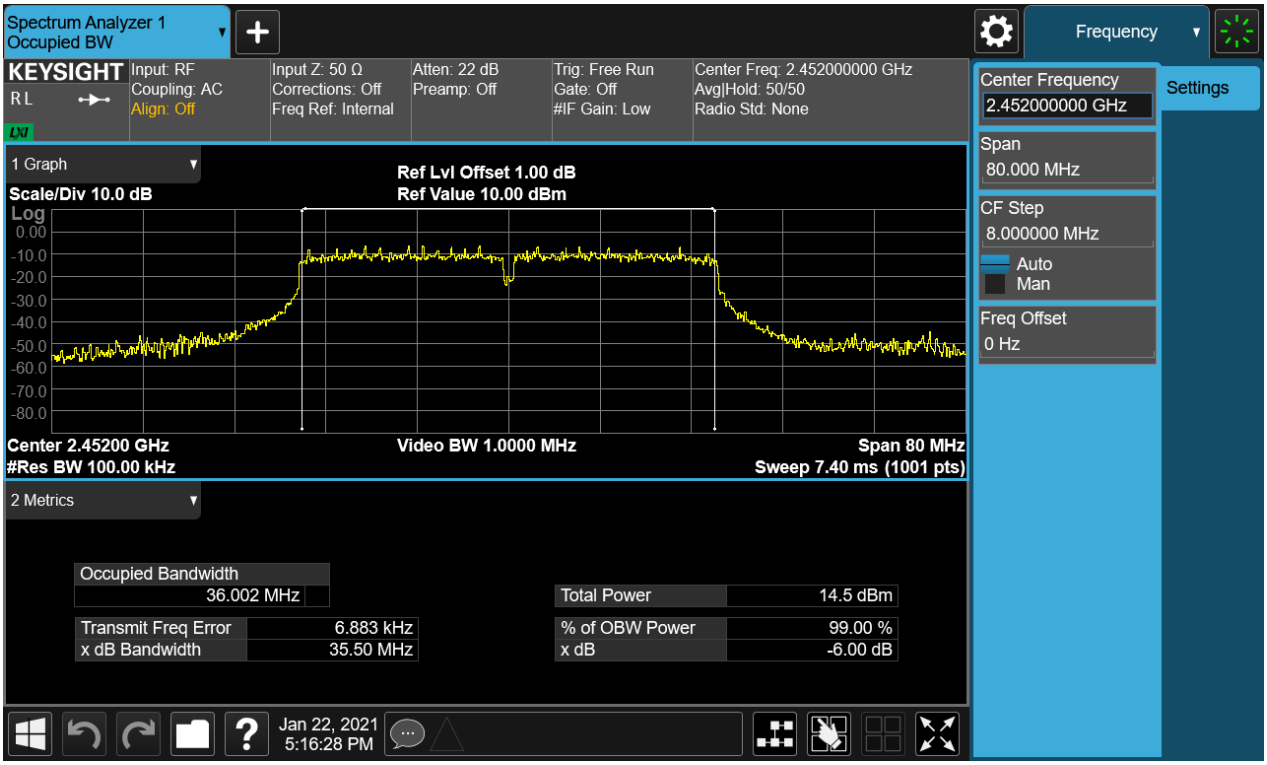
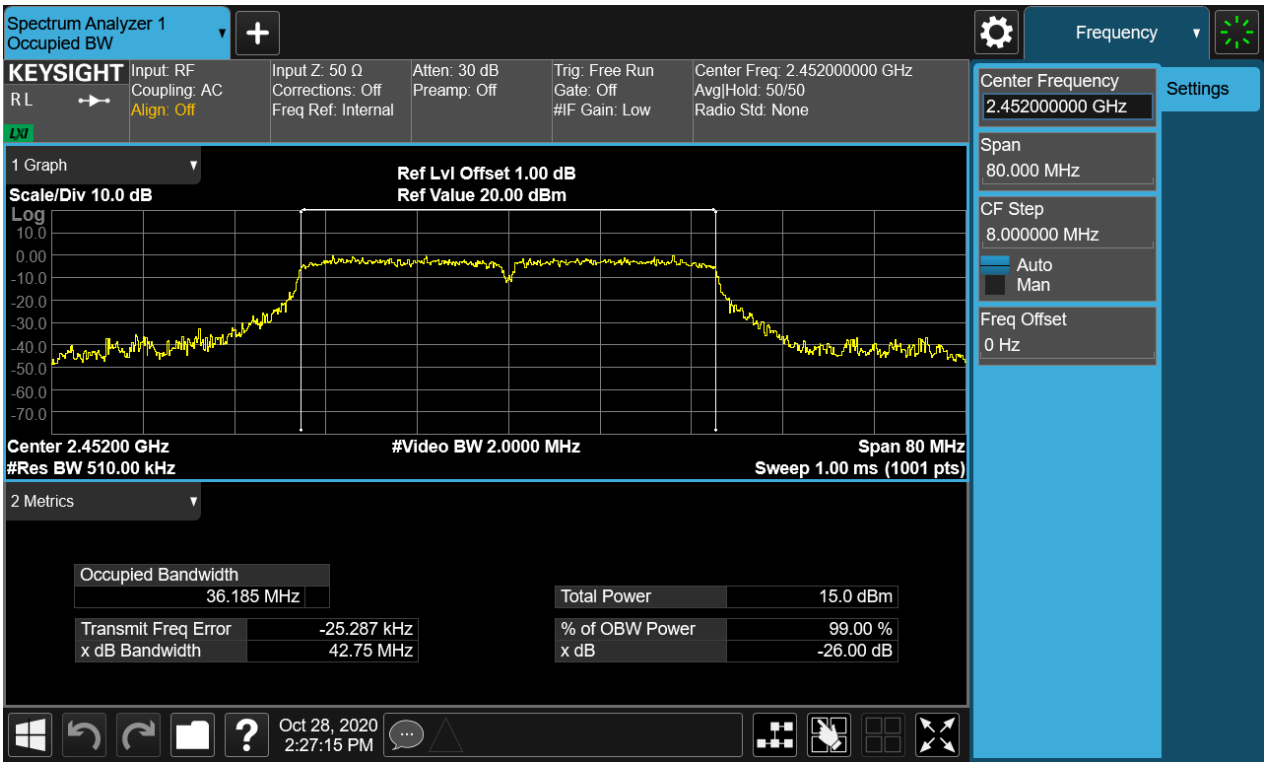


Figure 12: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 2452MHz





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%

Table 4: Power Spectral Density

Test Mode	Test Channel (MHz)	Measured Result (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	2412	-11.93	8
	2437	-13.28	
	2462	-11.45	
802.11g	2412	-15.23	
	2437	-16.57	
	2462	-15.57	
802.11n(HT20)	2412	-15.52	
	2437	-18.20	
	2462	-16.66	
802.11n(HT40)	2422	-18.58	
	2437	-16.83	
	2452	-20.55	

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

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

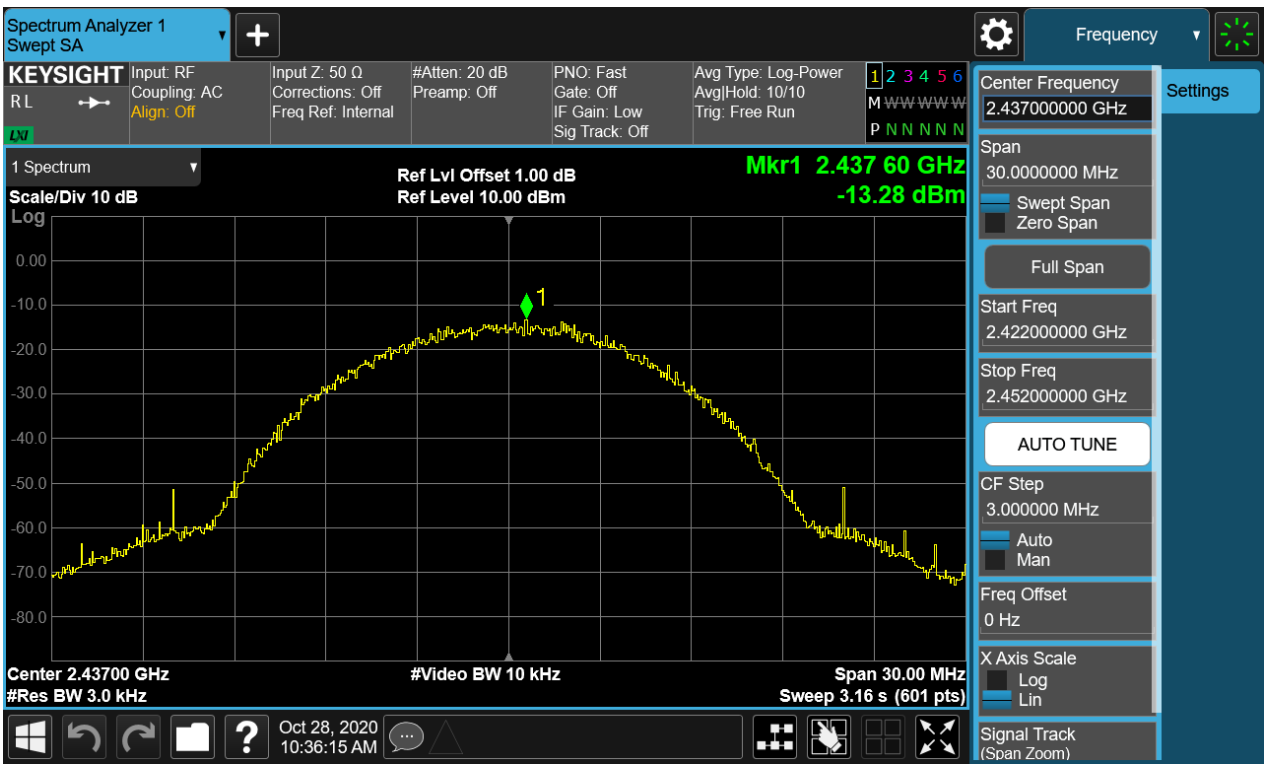


Figure 15: Power Spectral Density, 802.11b, 2462MHz

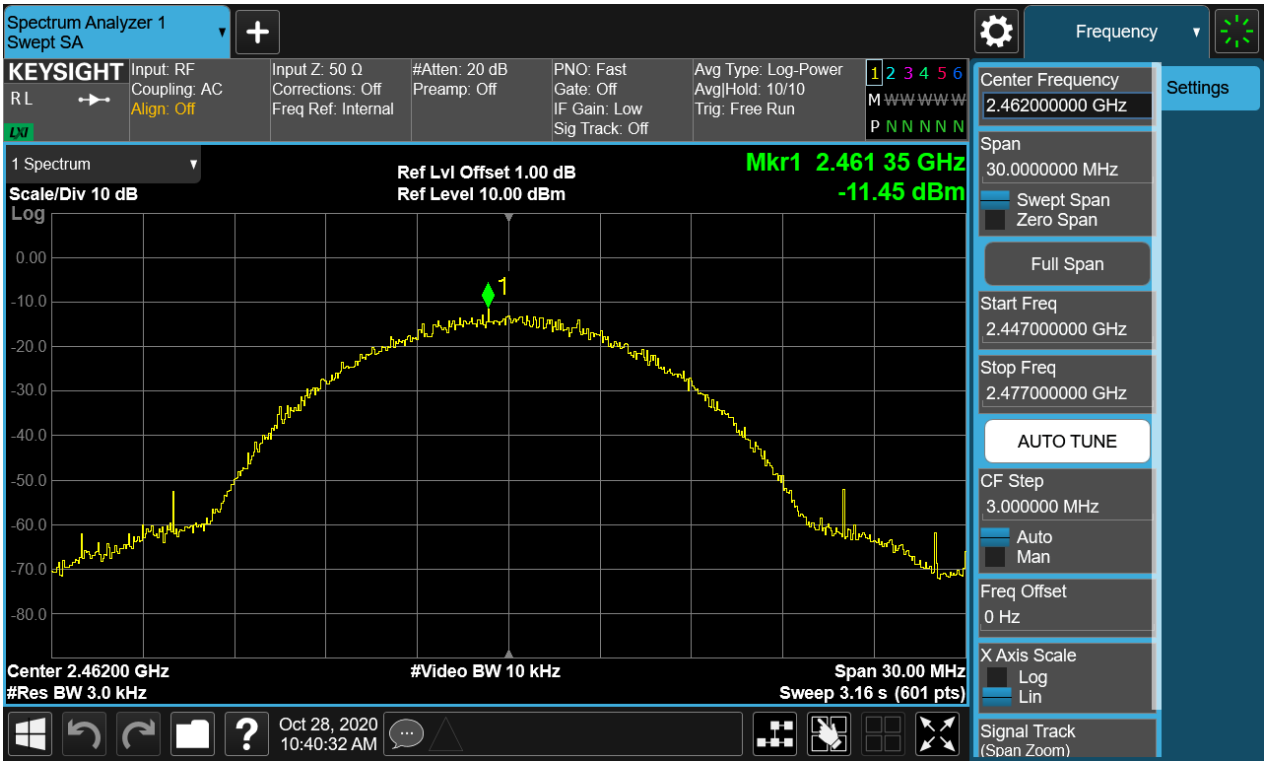


Figure 16: Power Spectral Density, 802.11g, 2412MHz

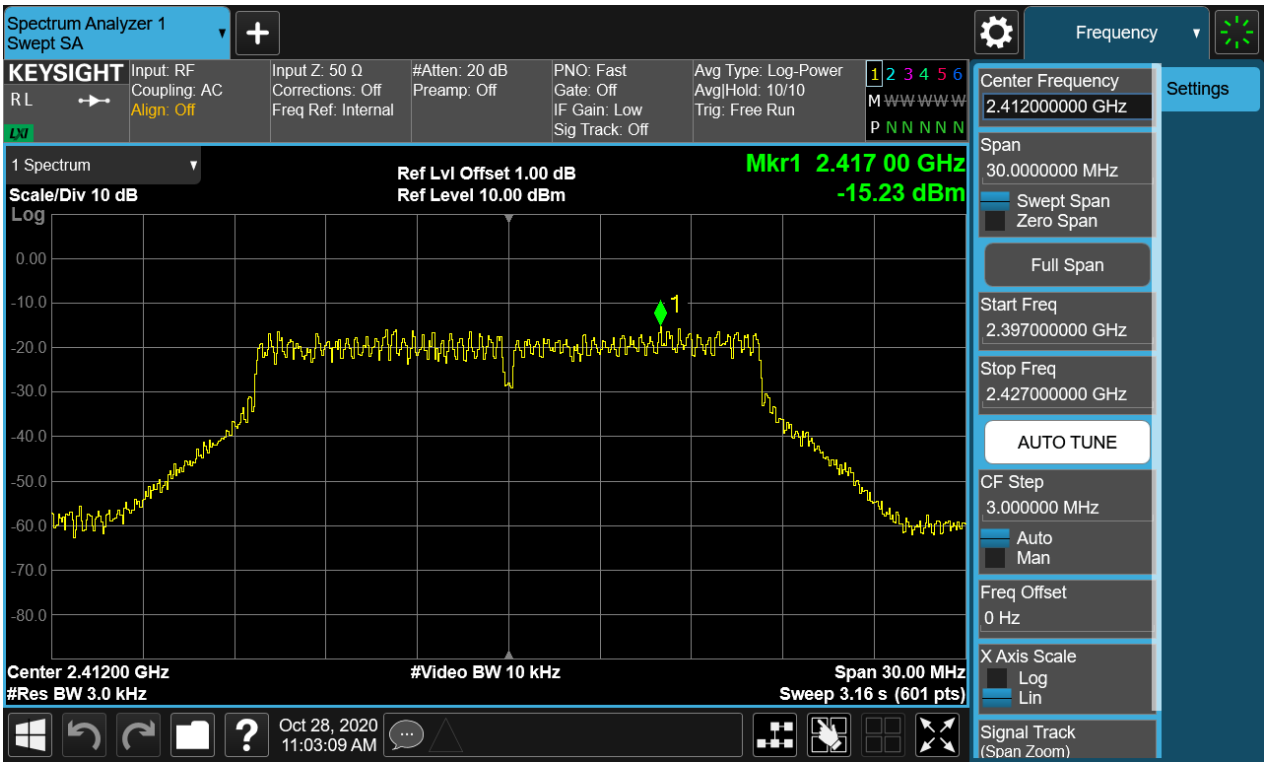


Figure 17: Power Spectral Density, 802.11g, 2437MHz

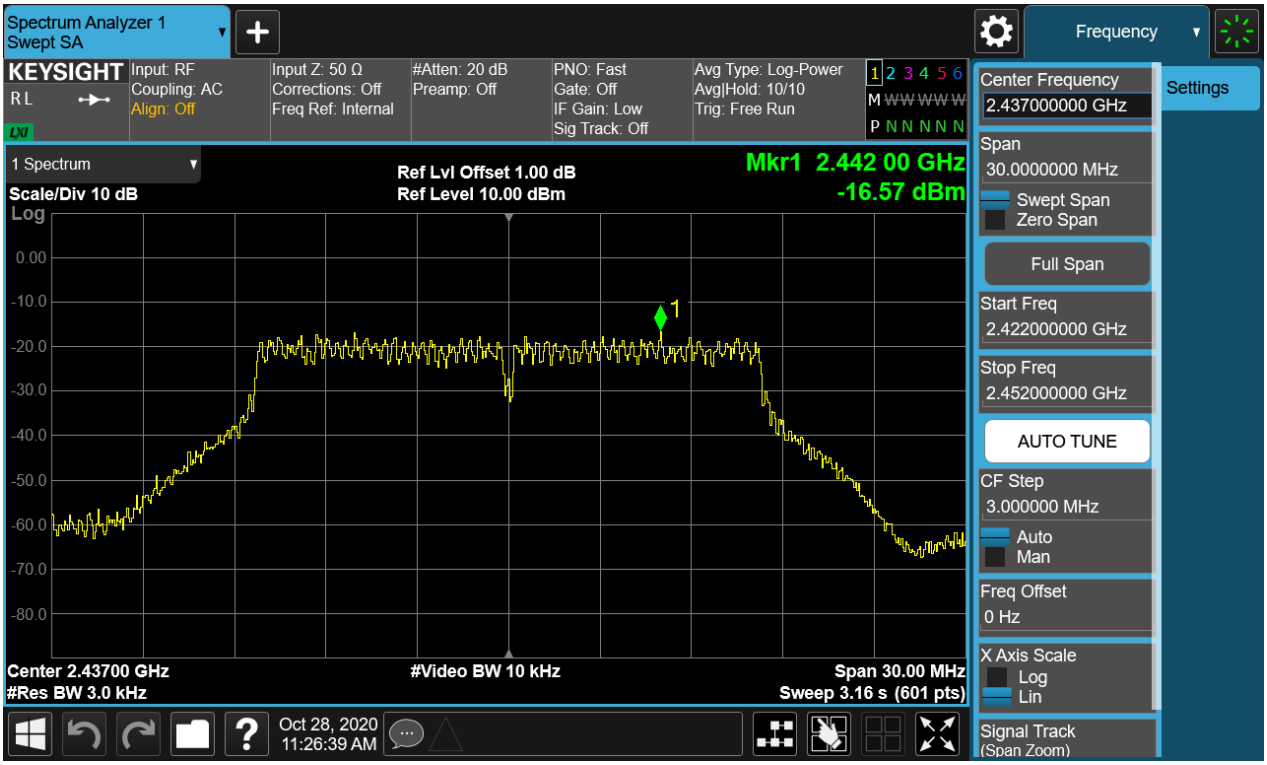


Figure 18: Power Spectral Density, 802.11g, 2462MHz

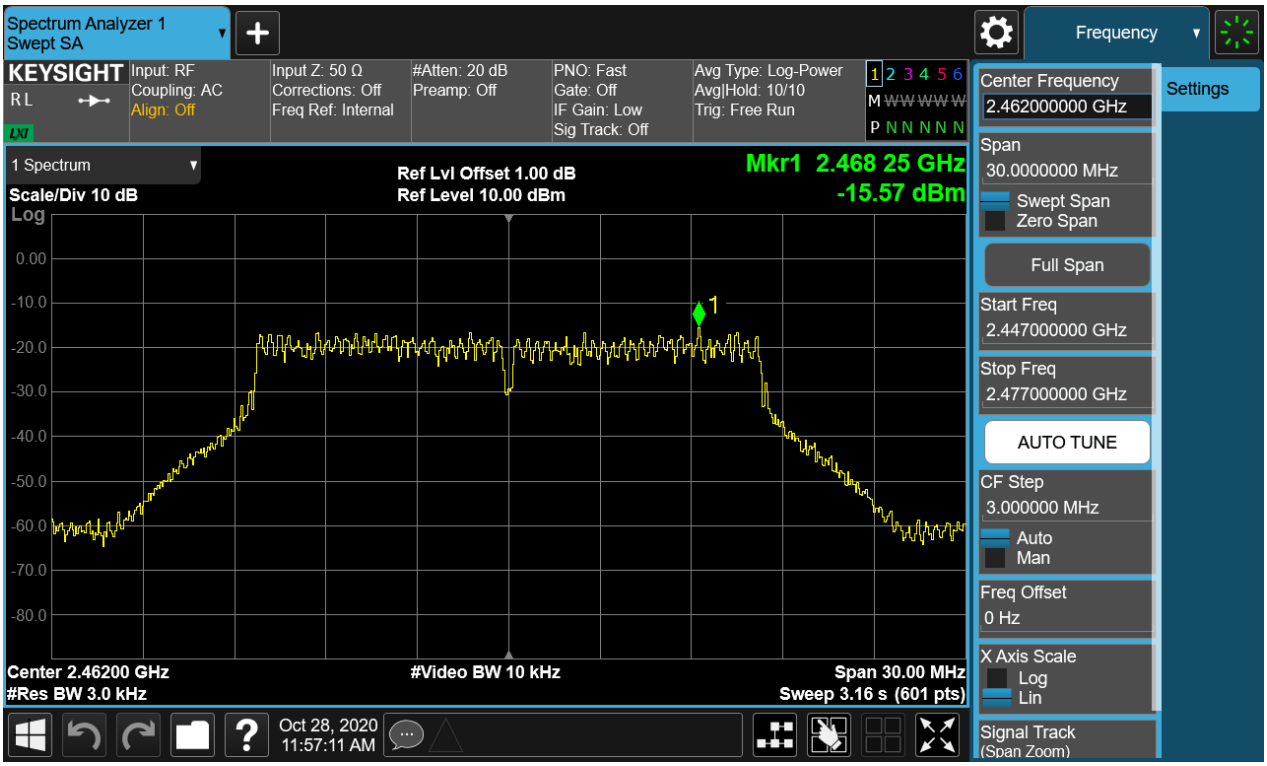


Figure 19: Power Spectral Density, 802.11n(HT20), 2412MHz

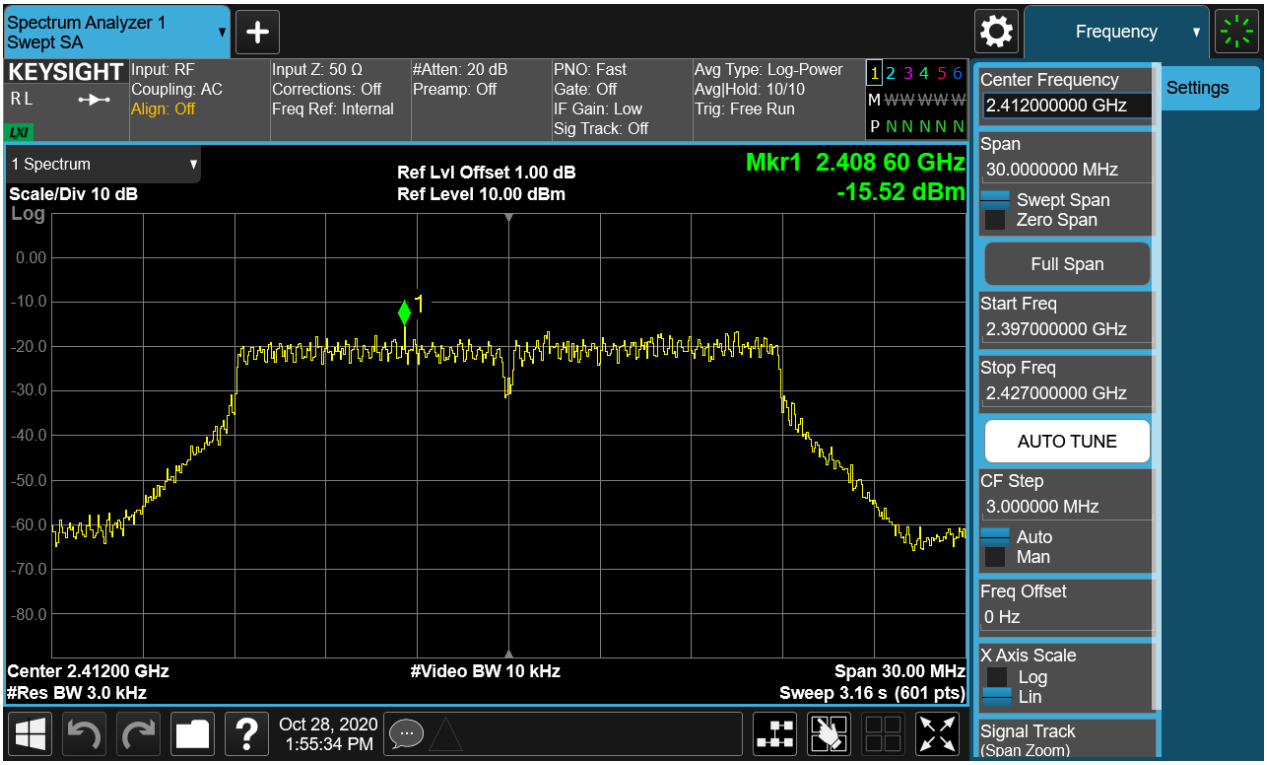


Figure 20: Power Spectral Density, 802.11n(HT20), 2437MHz

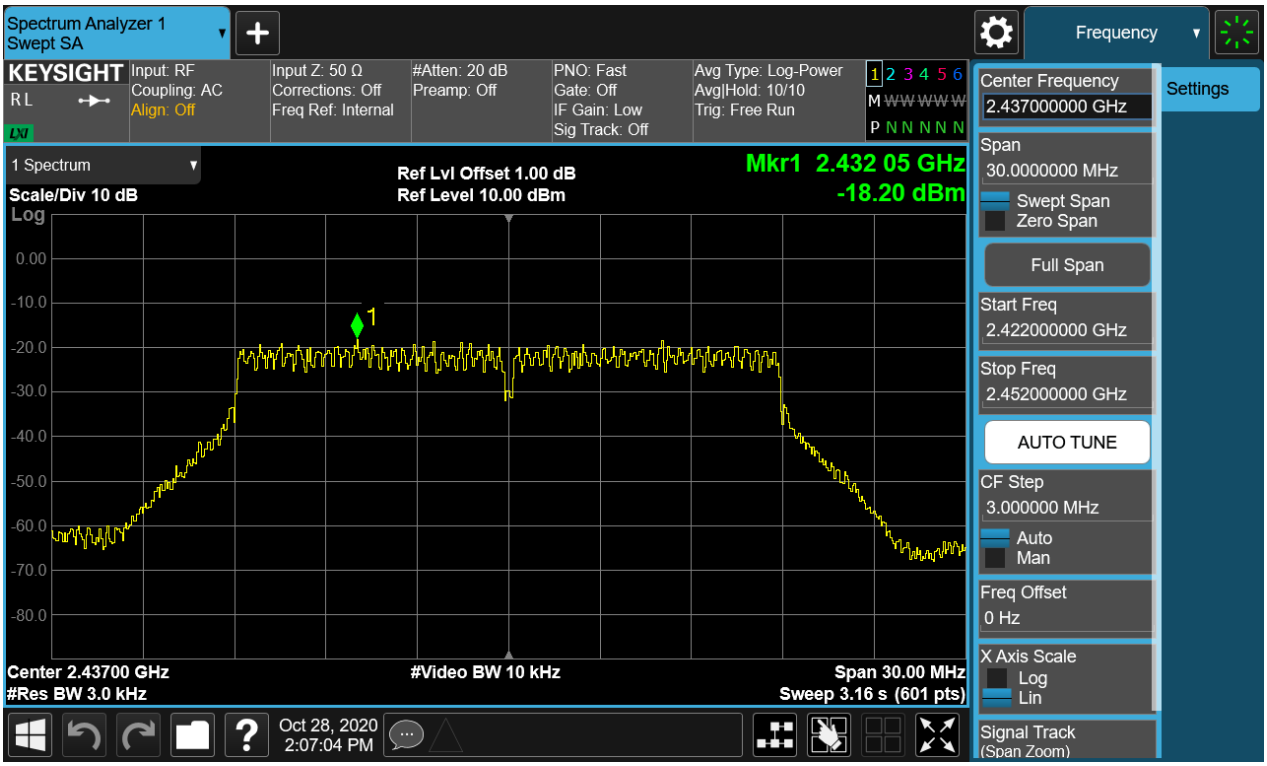


Figure 21: Power Spectral Density, 802.11n(HT20), 2462MHz

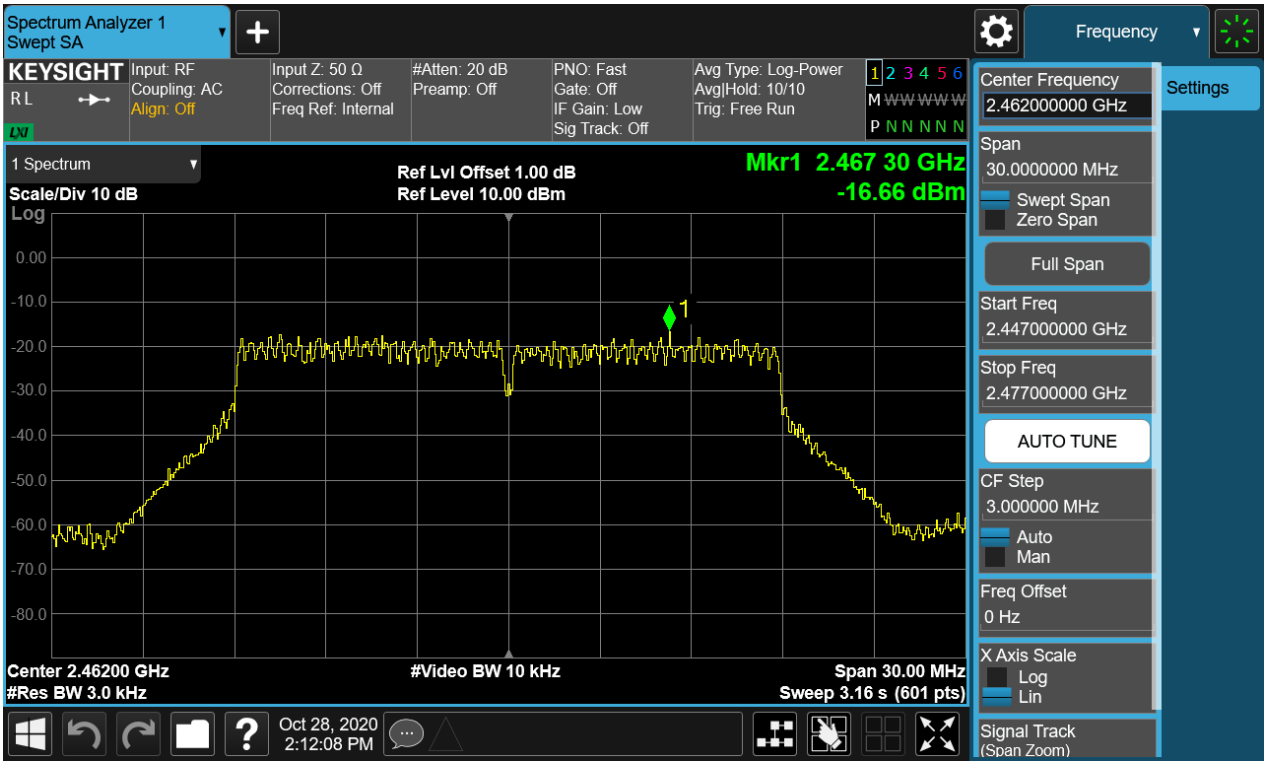


Figure 22: Power Spectral Density, 802.11n(HT40), 2422MHz

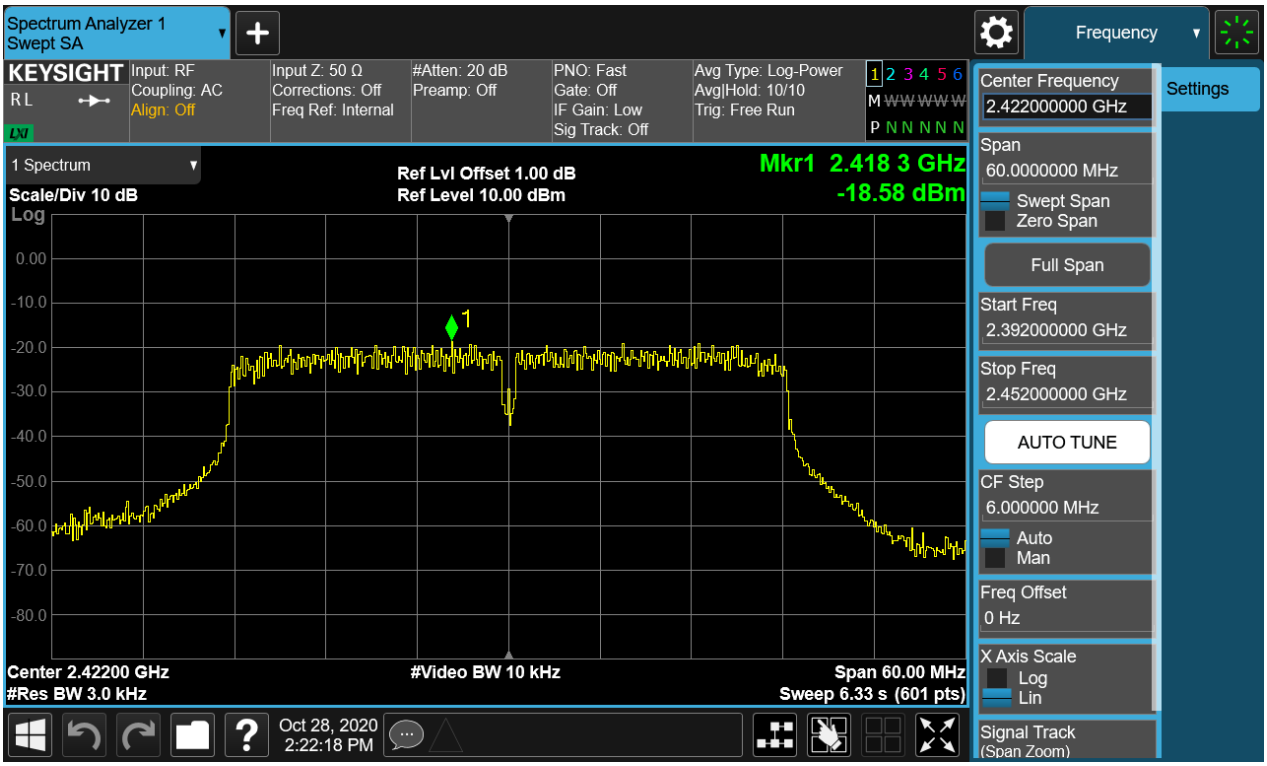


Figure 23: Power Spectral Density, 802.11n(HT40), 2437MHz

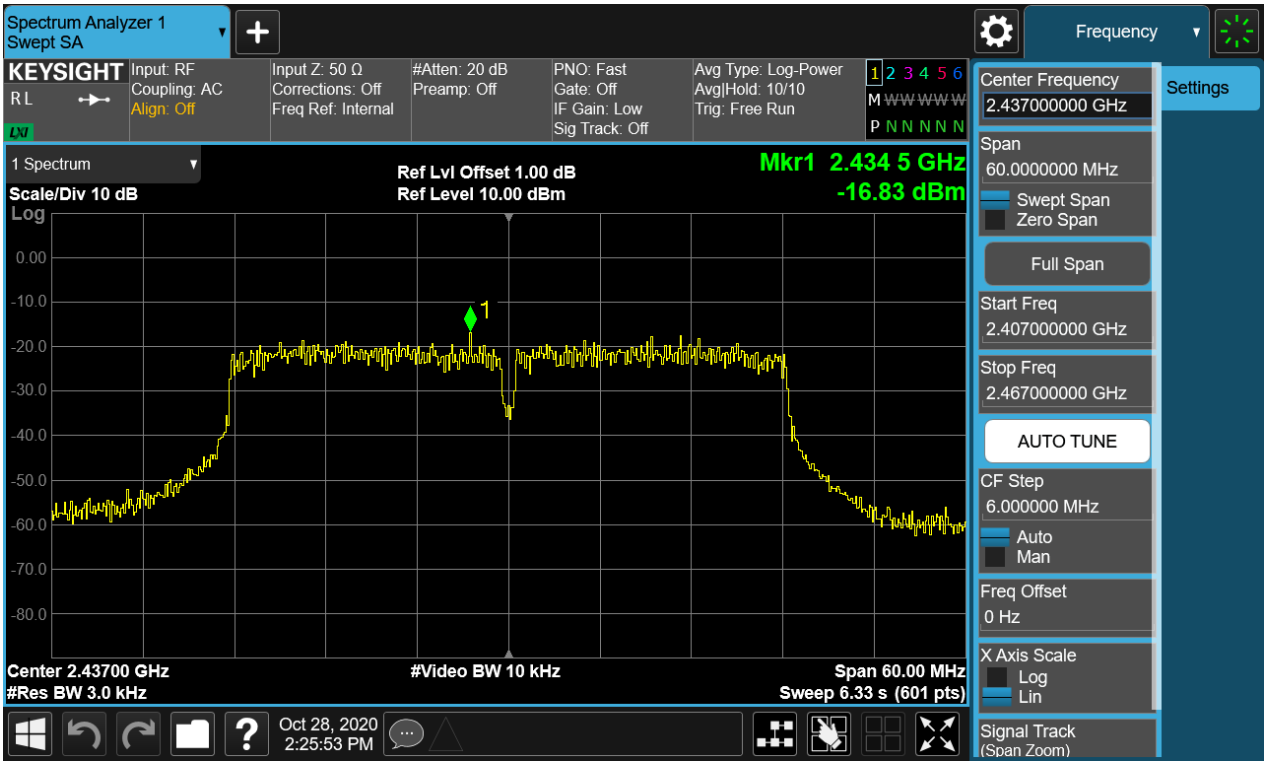
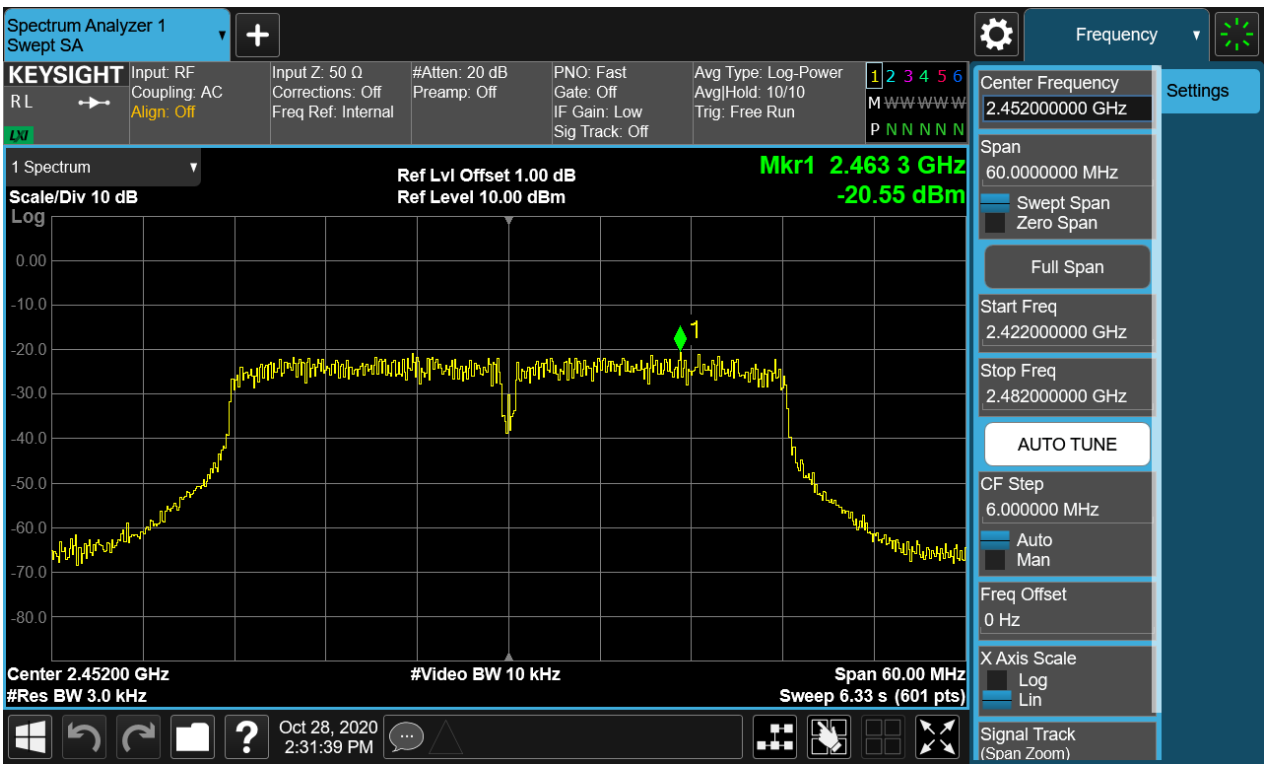


Figure 24: Power Spectral Density, 802.11n(HT40), 2452MHz



4.1.5 Conducted Spurious Emission & Authorized-band band-edge

RESULT: **PASS**

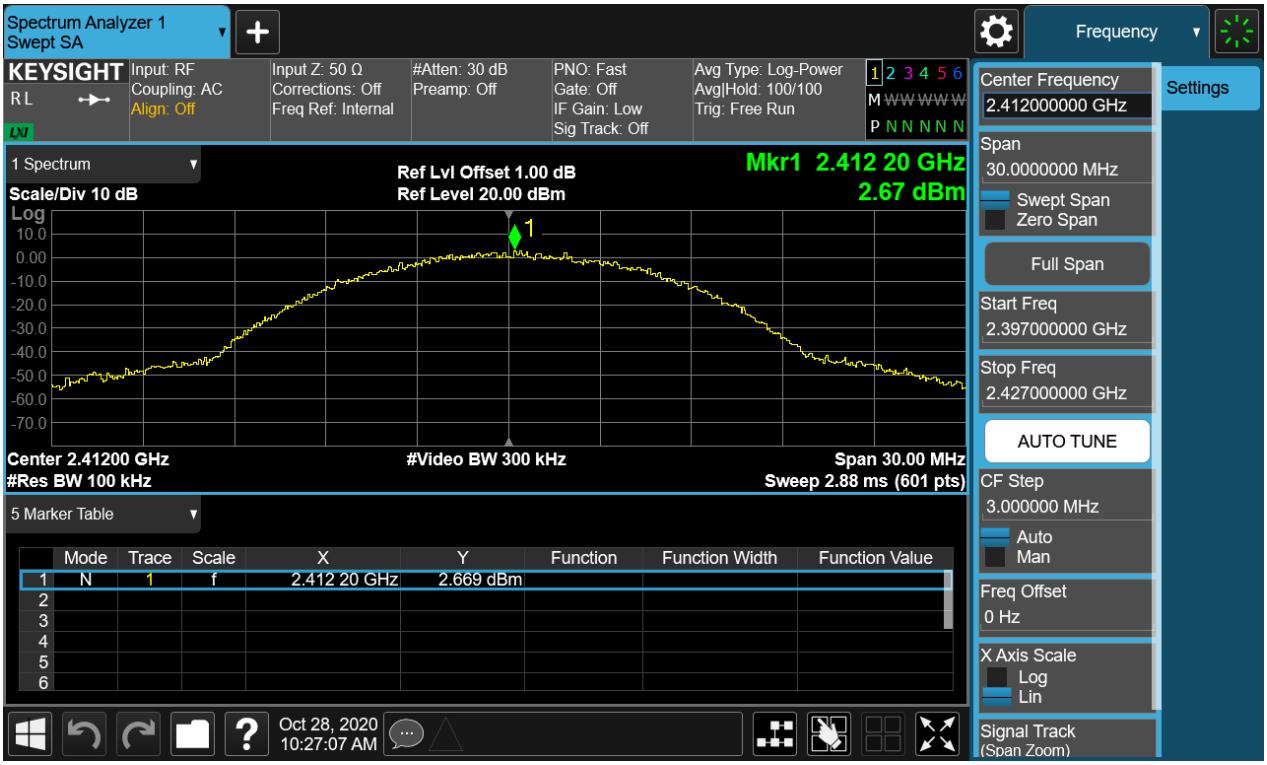
Test standard	:	FCC Part 15.247(d), 15.209 RSS-247 5.5 RSS-Gen 8.9
Requirement	:	ANSI C63.10-2013, KDB 558074
Kind of test site	:	Shielded room

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%

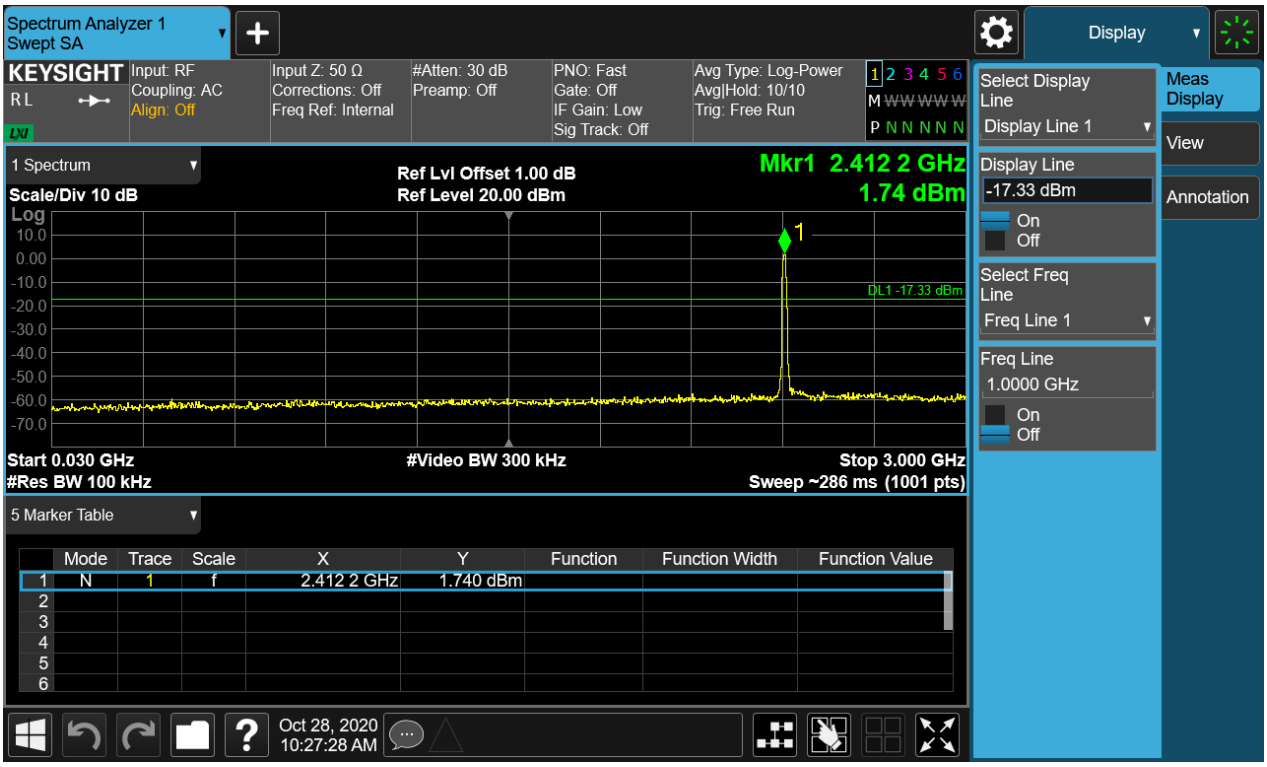
For details refer to following test plot.

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



Band Edge

Conducted spurious emissions 30MHz-25GHz



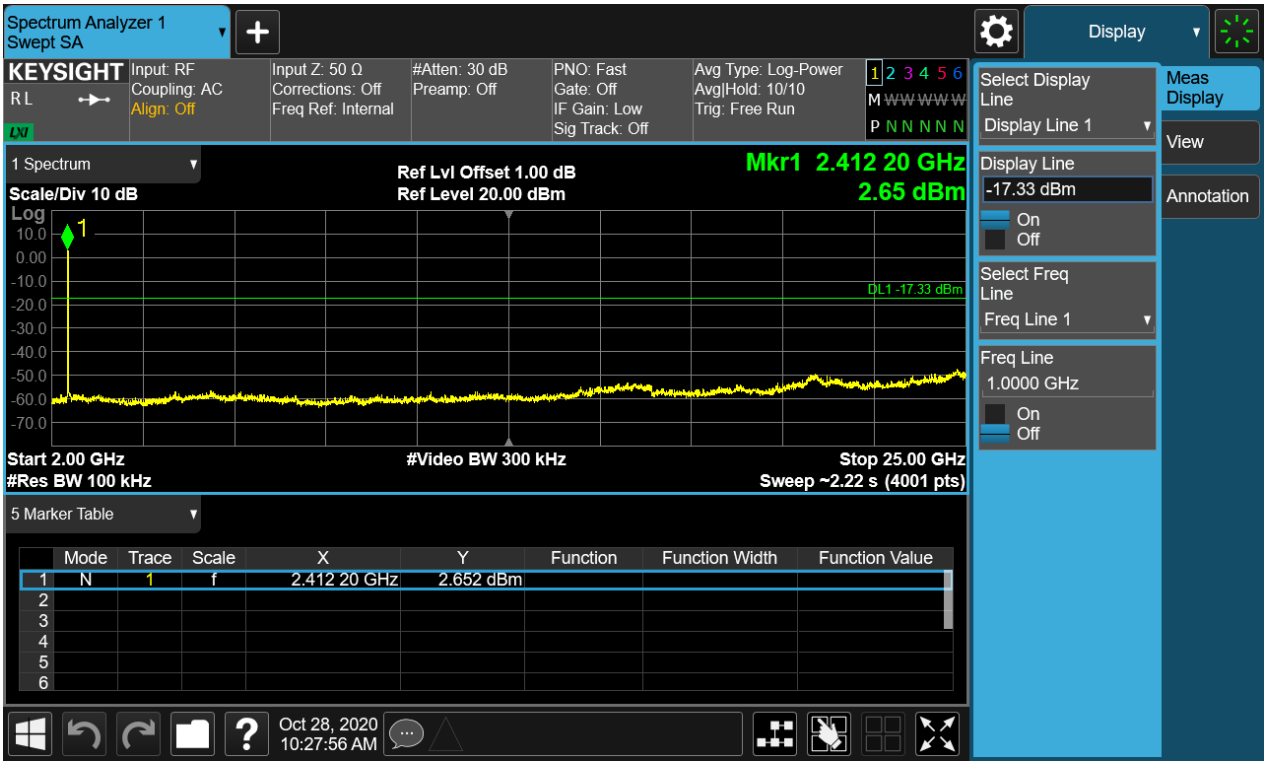
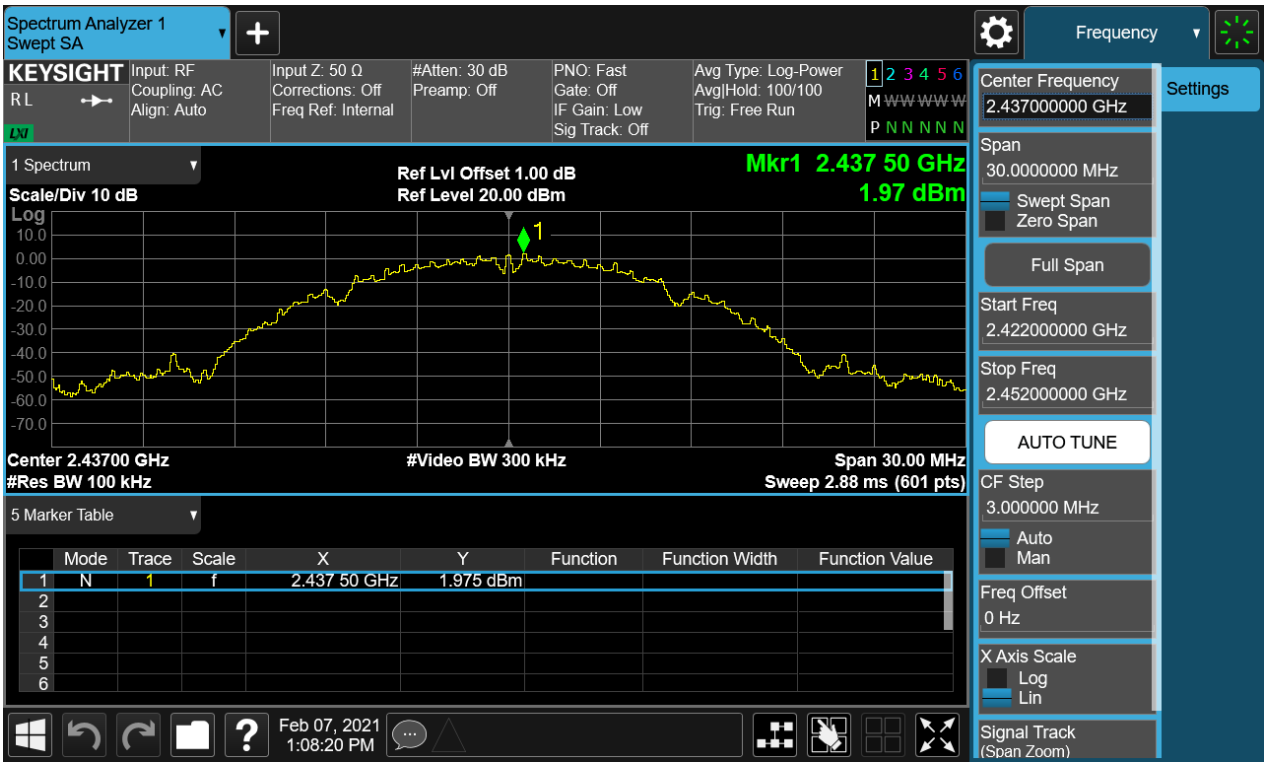
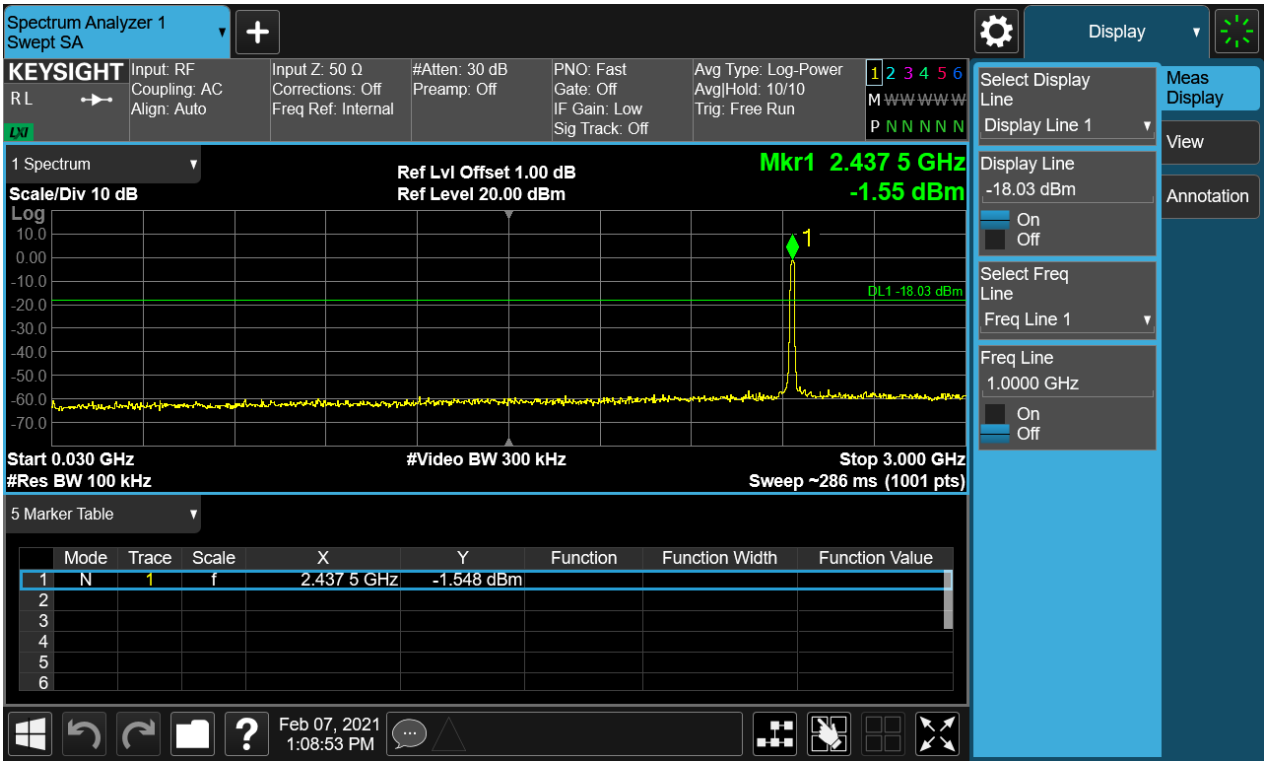


Figure 26: Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2437MHz Carrier Level



Conducted spurious emissions 30MHz-25GHz



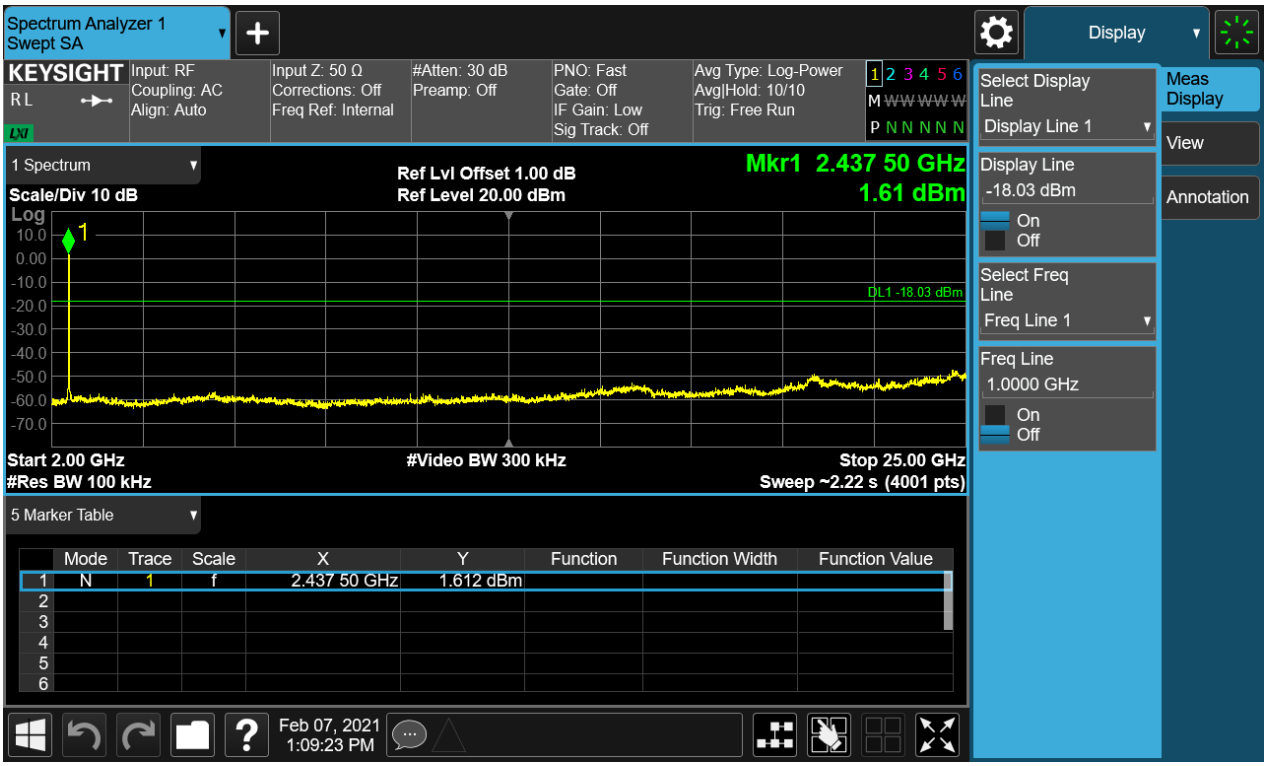
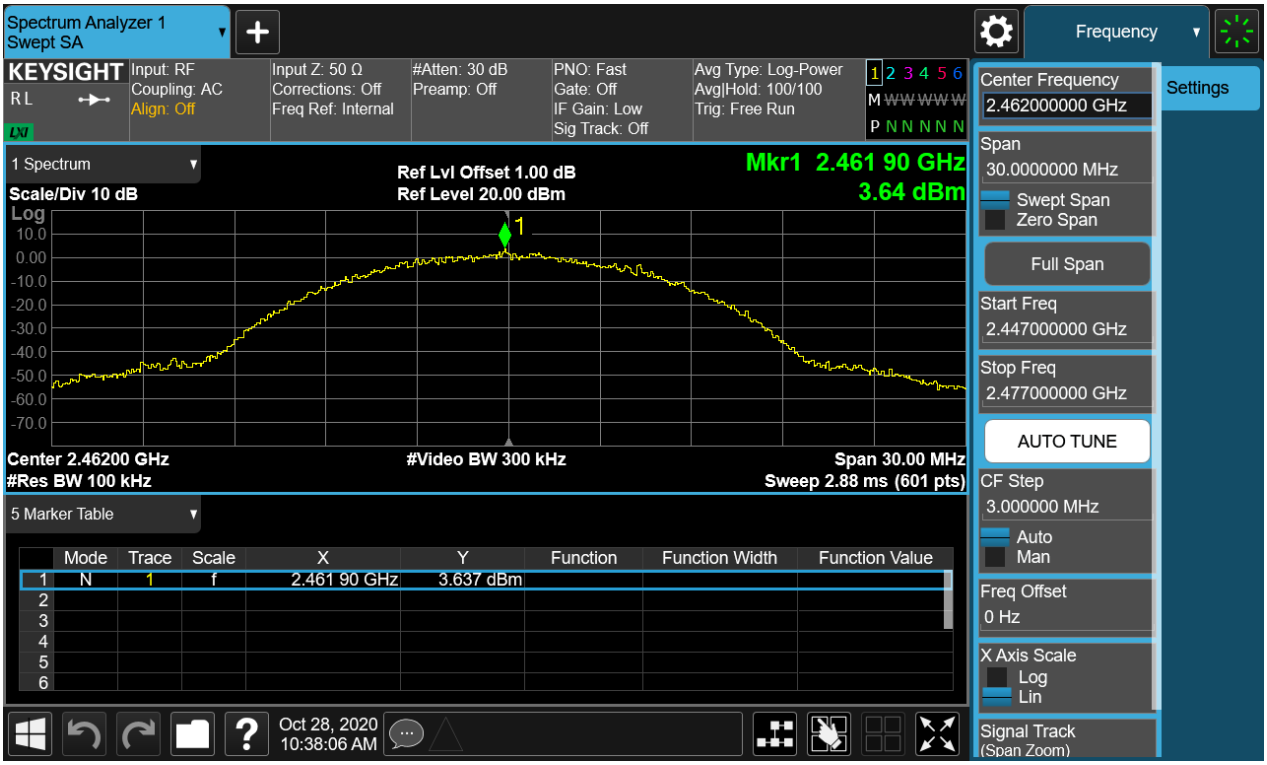
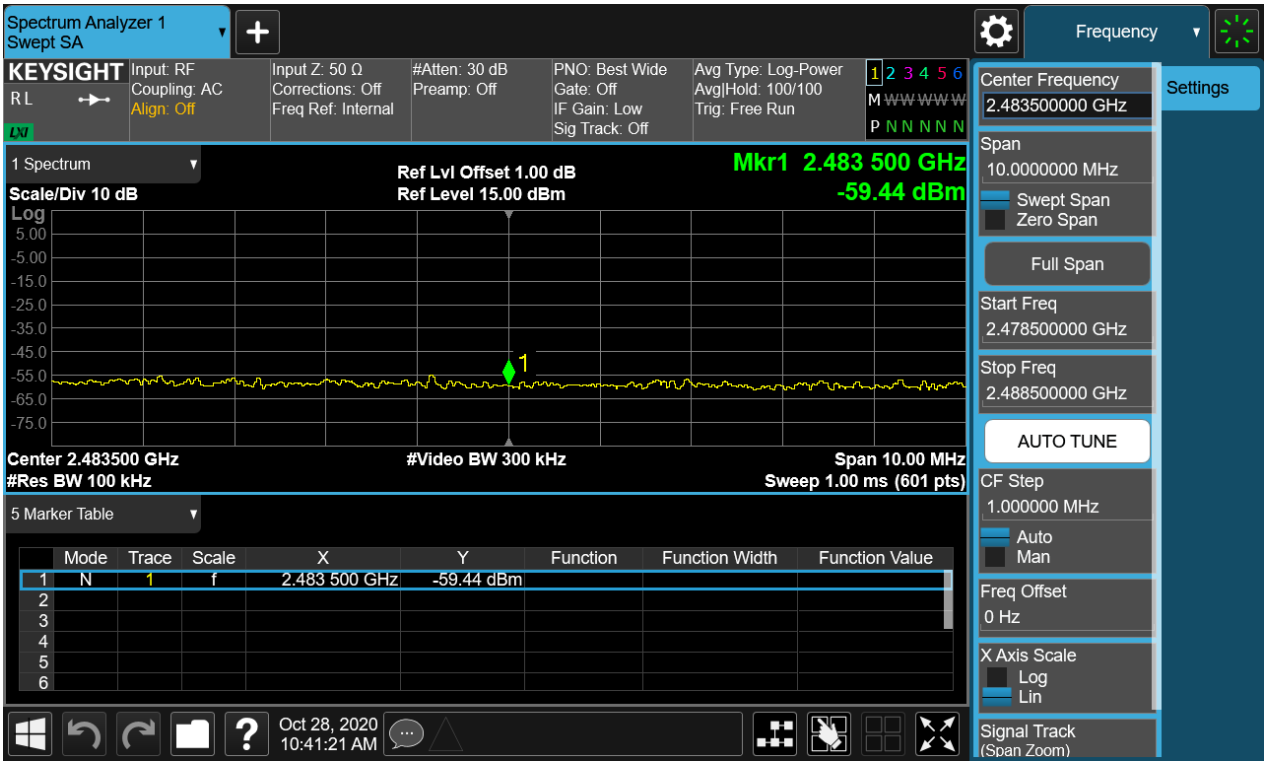


Figure 27: Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2462MHz

Carrier Level



Band Edge



Conducted spurious emissions 30MHz-25GHz