TEST REPORT

Applicant	:	Trimble Europe BV.
Address of Applicant	:	Industrieweg 187a, 5683 CC Best, Netherlands
Product Name	:	Rugged Smart Phone
Model No.	:	TDC600_2, MobileMapper60_2
Sample No.	:	E20100017-01 #16 E20100017-01 #01
FCC ID	:	NZI-11705920
ISED Number	:	9288A-11705920
Standards	:	FCC CFR47 Part 15, Subpart C RSS-Gen (Issue 5, March 2019) RSS-247 (Issue 2, February 2017)
Date of Receipt	:	2021-01-26
Date of Test	:	2021-01-26 ~ 2021-03-15
Date of Issue	:	2021-03-15

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)

Contents

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

Applicant Company Name	Trimble Europe BV.
Address	Industrieweg 187a, 5683 CC Best, Netherlands
Contact Person	Joel Hamberg Magnusson
Telephone	+46764953125
Email	joel_hambergmagnusson@trimble.com
Manufacturer Company Name	Trimble Europe BV.
Address	Industrieweg 187a, 5683 CC Best, Netherlands
Factory Company Name	Shenzhen UniStrong Science & Technology Co., Ltd.
Address	B,4-4Factory, Zhengcheng Road, FuyongBaoan District, Shenzhen, China

1.3 Details of EUT

Product Name	Rugged Smart Phone
Brand Name	Trimble, Spectra Geospatial
Test Model No.	TDC600_2
Series Model No.	TDC600_2; MobileMapper60_2
Description of Model name differentiation	All model are same with electrical paramters and Internal circuit structure,but only different on model name,brand name and colors and software version.
FCC ID	NZI-11705920
ISED Number	9288A-11705920
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	3.14dBi
Extreme Temperature Range	-20℃~ +55℃
Test Voltage	DC 3.8V
Hardware version	V1.0
Software version	TDC600_2.53.10.14 (model:TDC600_2) MM60_2.53.10.05 (model: MobileMapper60_2)
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	5.5Mbps
802.11g	24Mbps
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

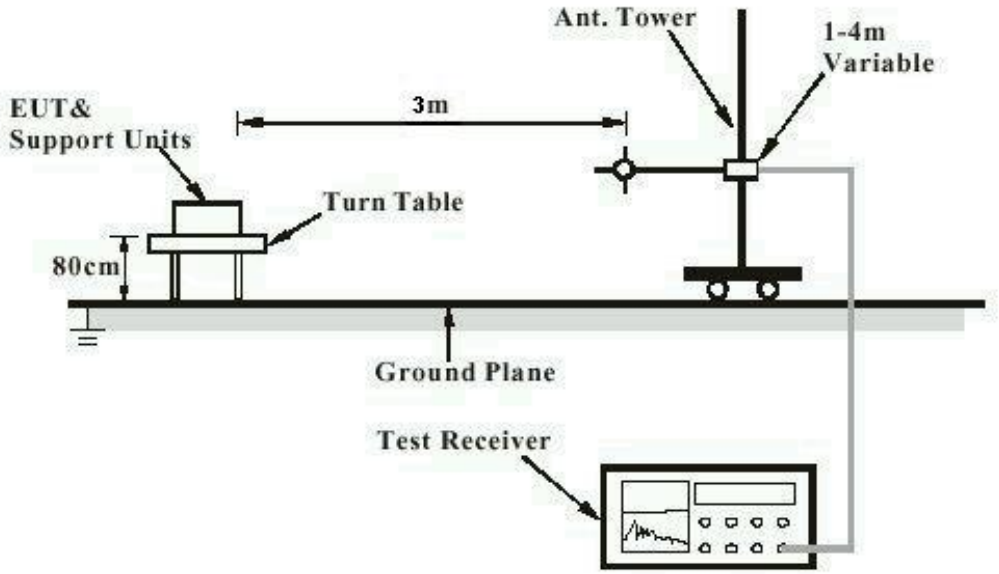
Description	Manufacturer	Model No.	Serial No.
Laptop	Lenovo	TP00083A	N/A

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

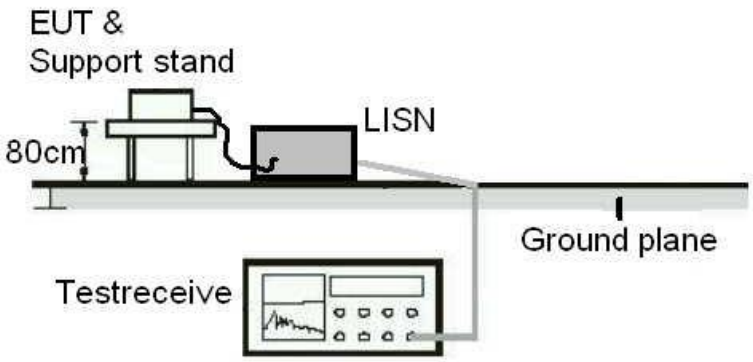
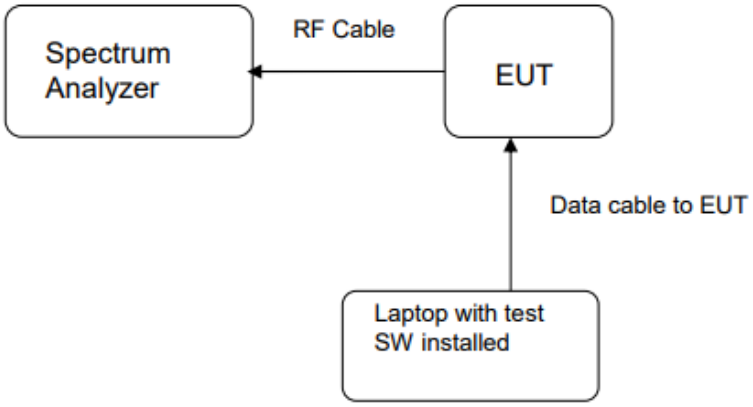


Diagram of Measurement Equipment Configuration for Transmitter Measurement



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 3.14dBi. 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	:	23°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	12.45	12.85	19.28	< 1
	2437	10.38	10.78	11.97	
	2462	11.57	11.97	15.74	
802.11g	2412	12.03	13.86	24.32	
	2437	10.09	11.92	15.56	
	2462	11.11	12.94	19.68	
802.11n(HT20)	2412	11.21	13.06	20.23	
	2437	9.20	11.05	12.74	
	2462	10.18	12.03	15.96	
802.11n(HT40)	2422	10.20	13.18	20.80	
	2437	10.72	13.70	23.44	
	2452	9.50	12.48	17.70	

Table 2: E.I.R.P

Test Mode	Test Channel (MHz)	E.I.R.P		Limit (W)
		(dBm)	(mW)	
802.11b	2412	15.99	39.72	< 4
	2437	13.92	24.66	
	2462	15.11	32.43	
802.11g	2412	17.00	50.12	
	2437	15.06	32.06	
	2462	16.08	40.55	
802.11n(HT20)	2412	16.20	41.69	
	2437	14.19	26.24	
	2462	15.17	32.89	
802.11n(HT40)	2422	16.32	42.85	
	2437	16.84	48.31	
	2452	15.62	36.48	

Notes：

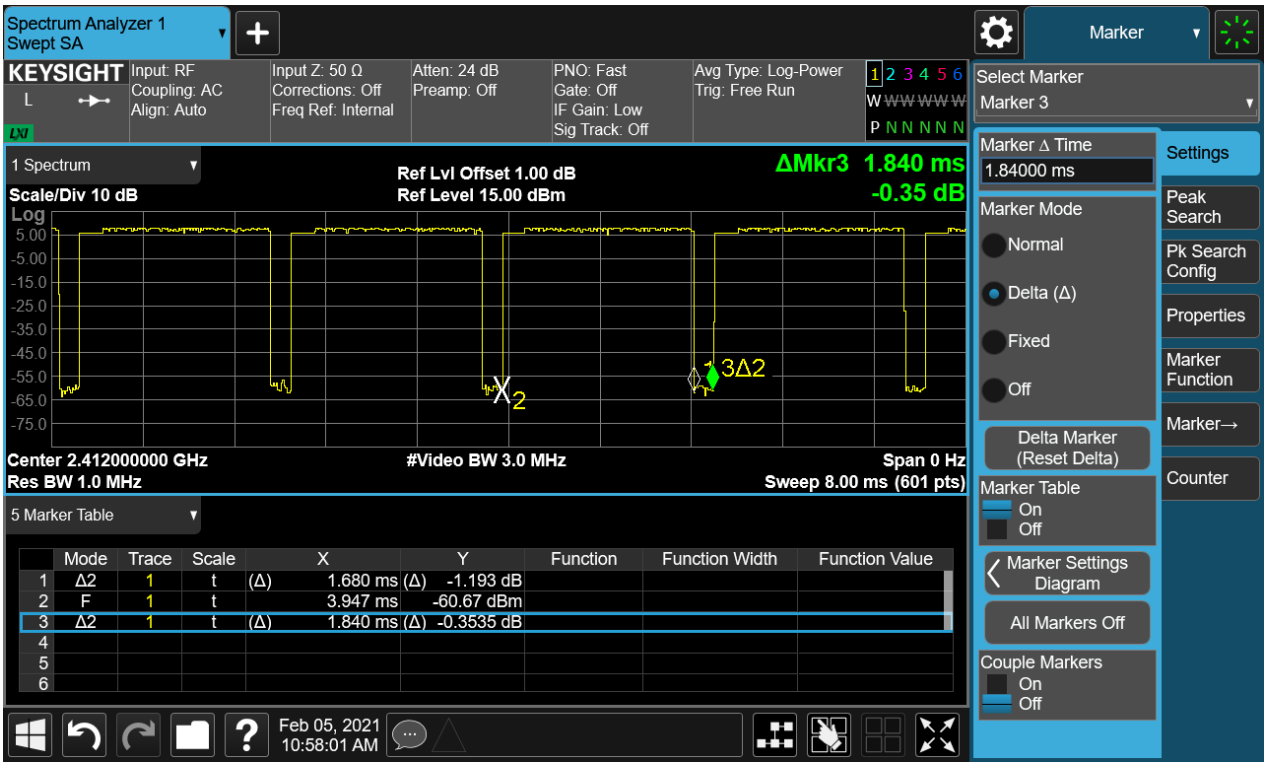
Peak Output Power = Measured Conducted peak power +duty cycle factor

EIRP = Peak Output Power + Antenna Gain(3.14dBi)

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

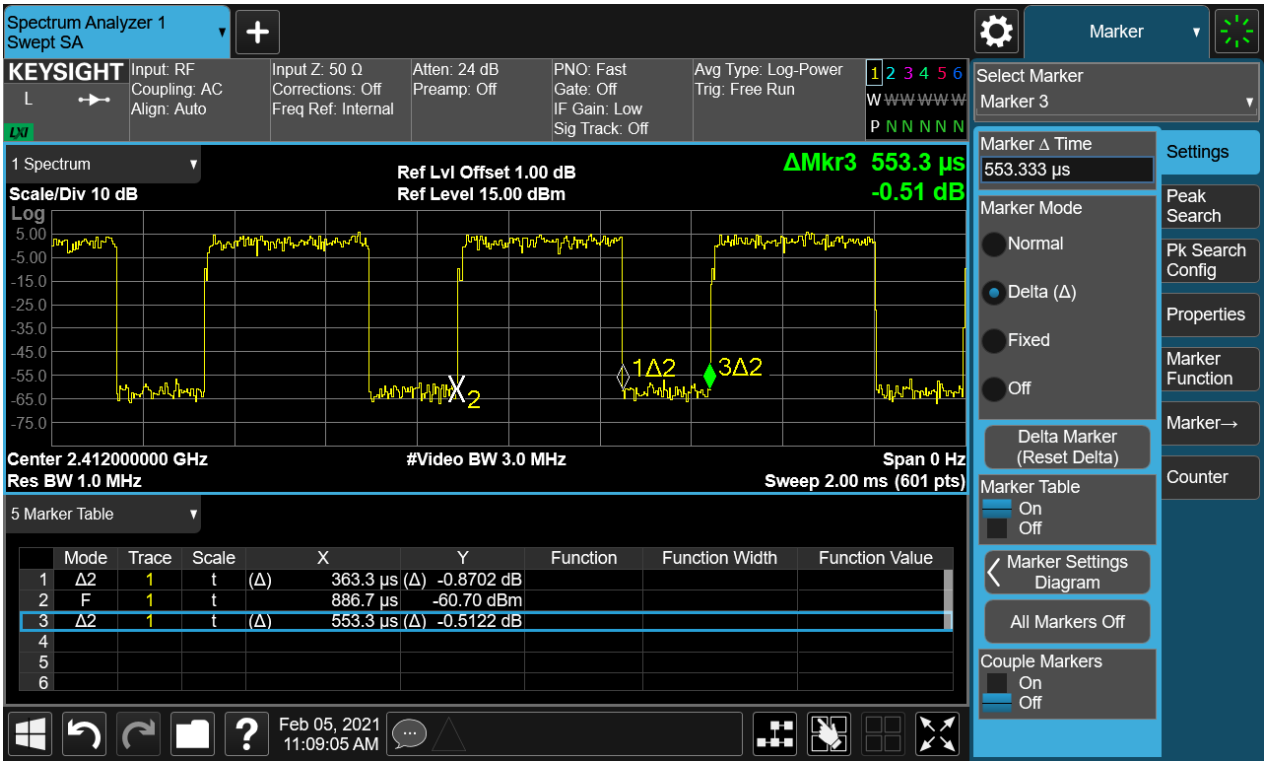
802.11b < 98%

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



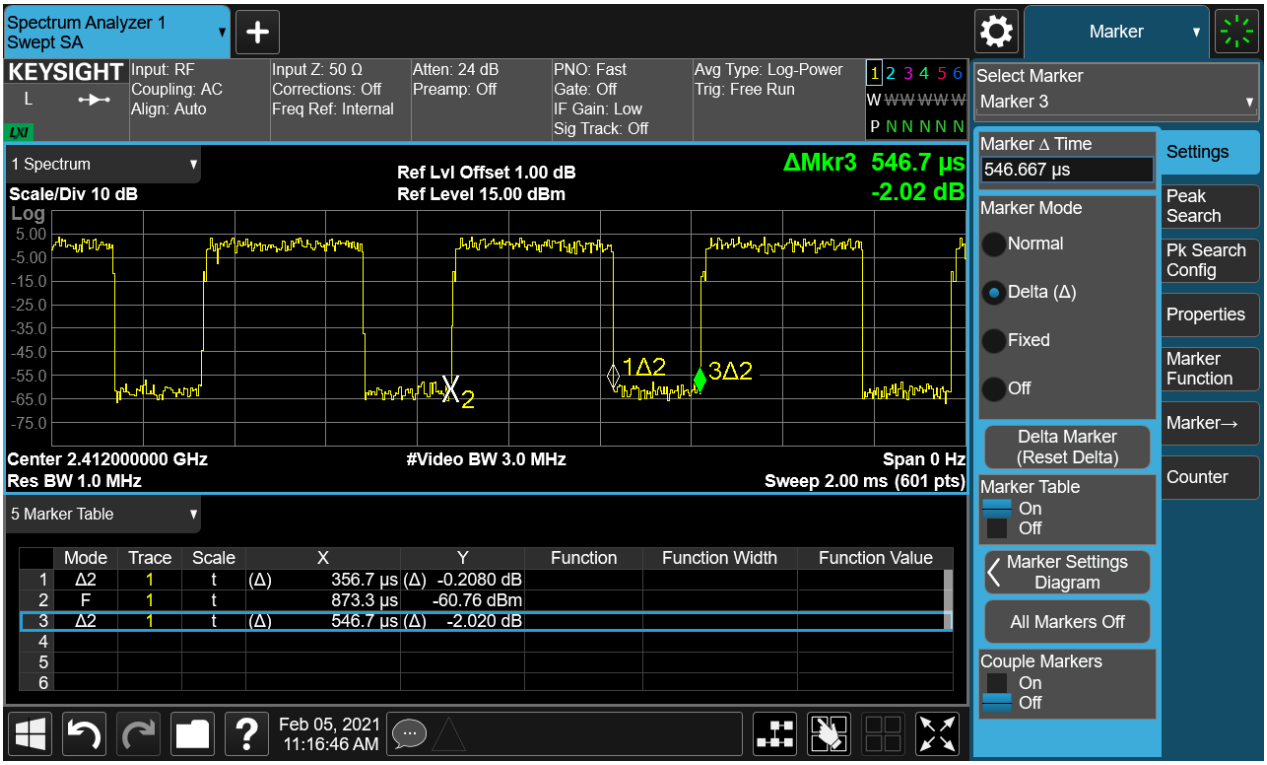
802.11g <98%

Duty cycle factor =10*log(1/duty cycle)=1.83



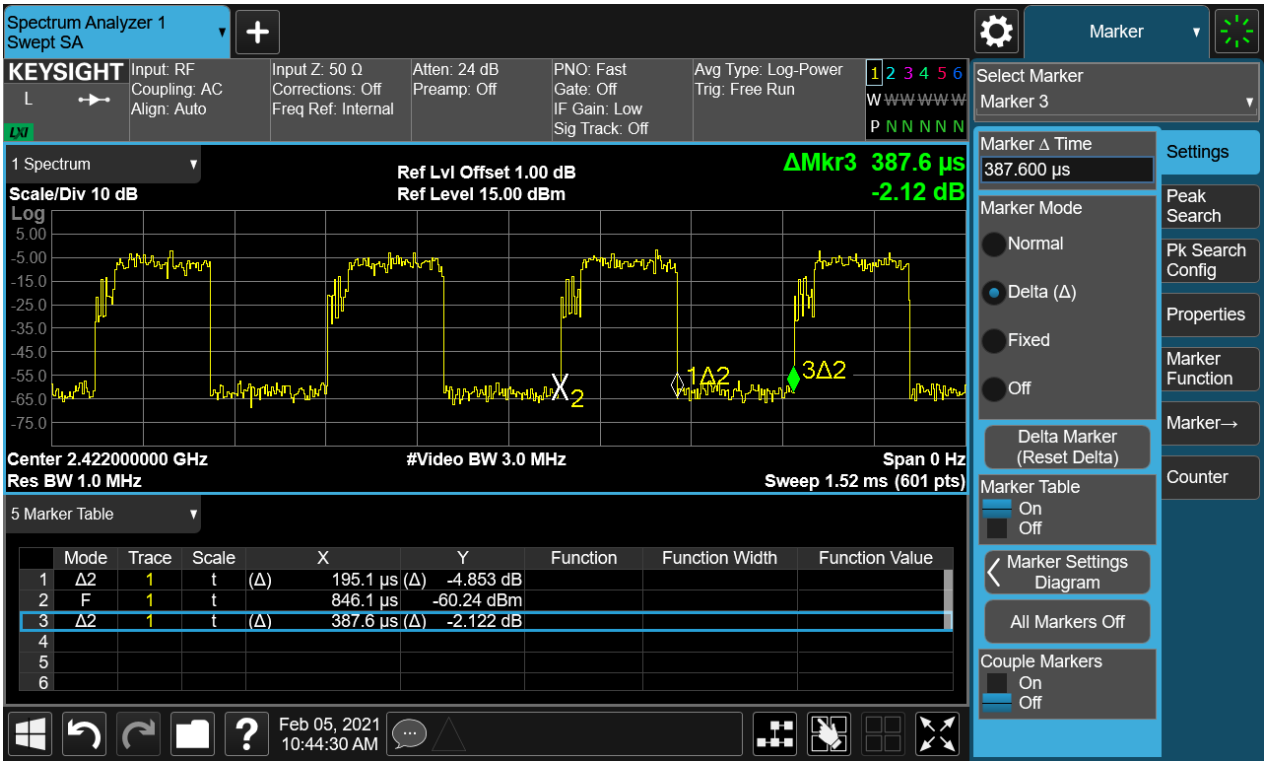
802.11n20<98%

Duty cycle factor =10*log(1/duty cycle)=1.85



802.11n40<98%

Duty cycle factor =10*log(1/duty cycle)=2.98



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 : 23°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	6.665	11.947	⩾0.5
	2437	7.847	11.994	
	2462	6.542	11.928	
802.11g	2412	16.46	17.138	
	2437	16.52	17.206	
	2462	16.43	17.048	
802.11n(HT20)	2412	17.63	18.179	
	2437	17.70	18.067	
	2462	17.66	18.002	
802.11n(HT40)	2422	35.22	36.175	
	2437	35.46	36.128	
	2452	35.15	35.961	

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

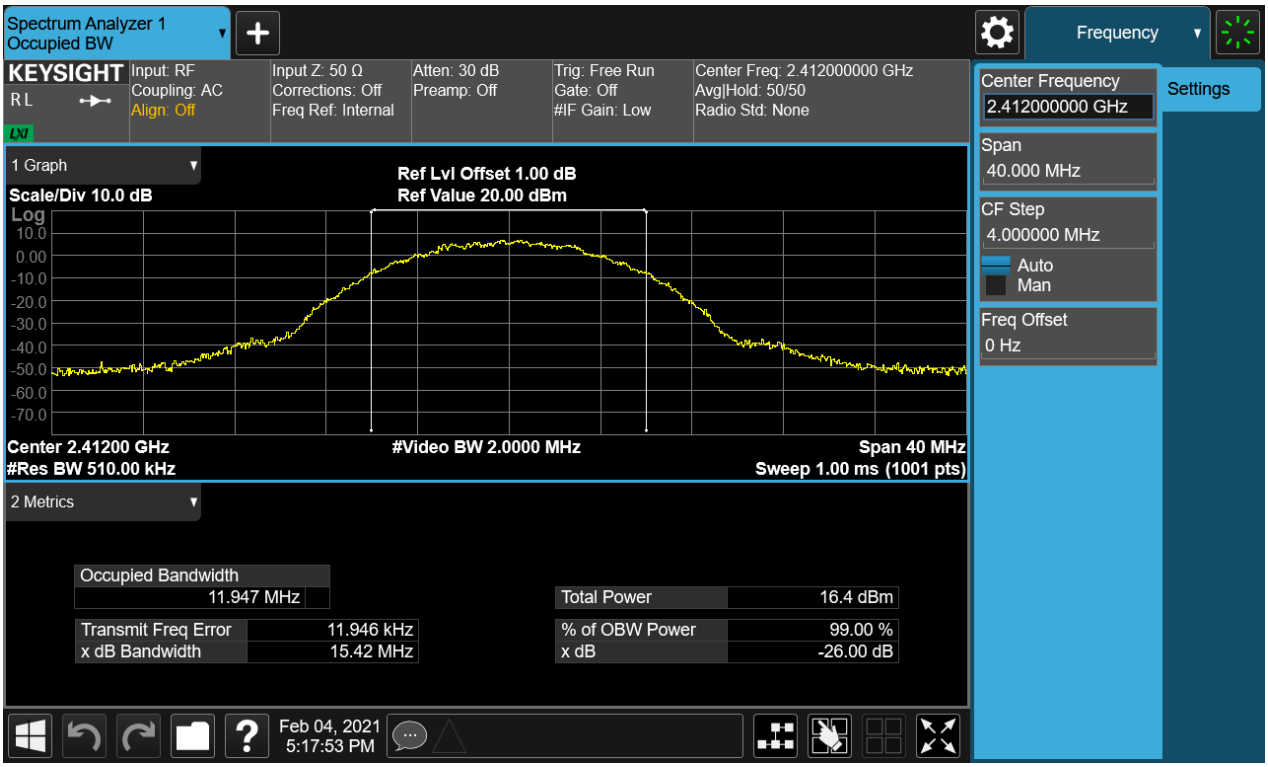
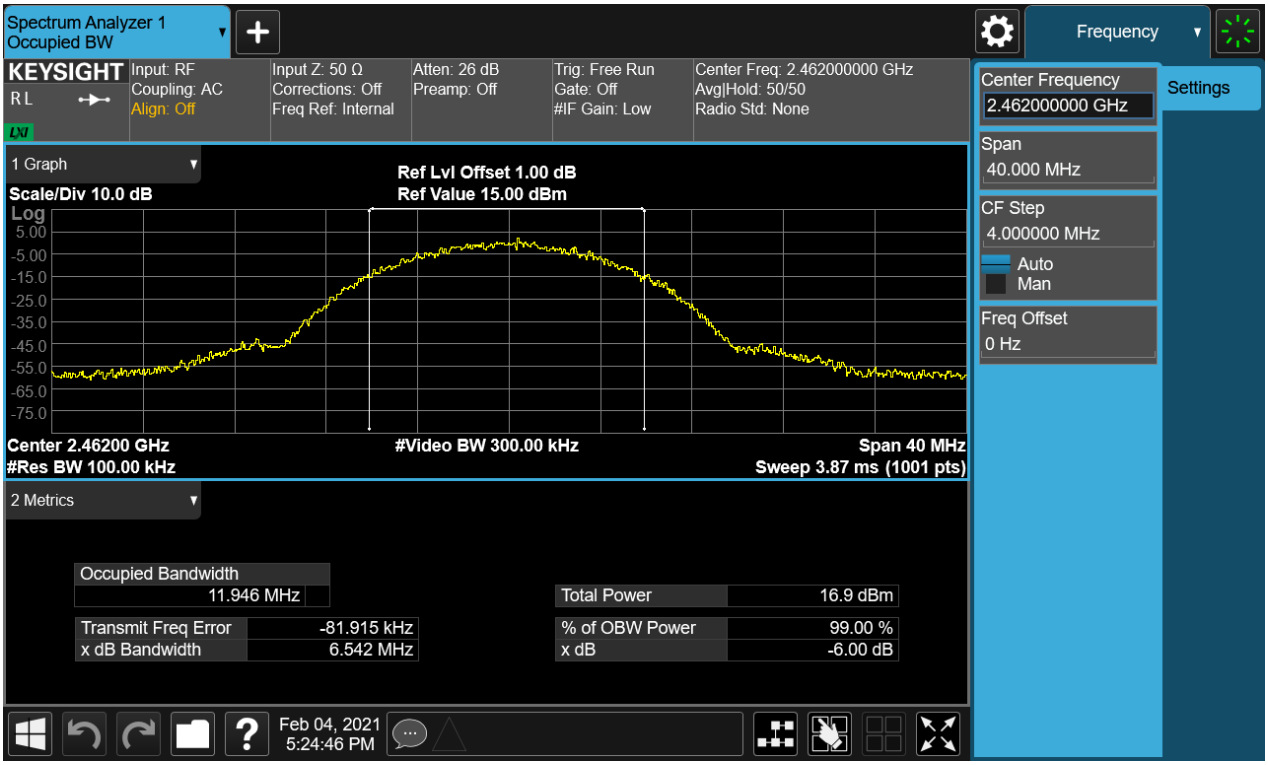


Figure 2: 6dB Bandwidth and 99% Bandwidth, 802.11b, 2437MHz

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



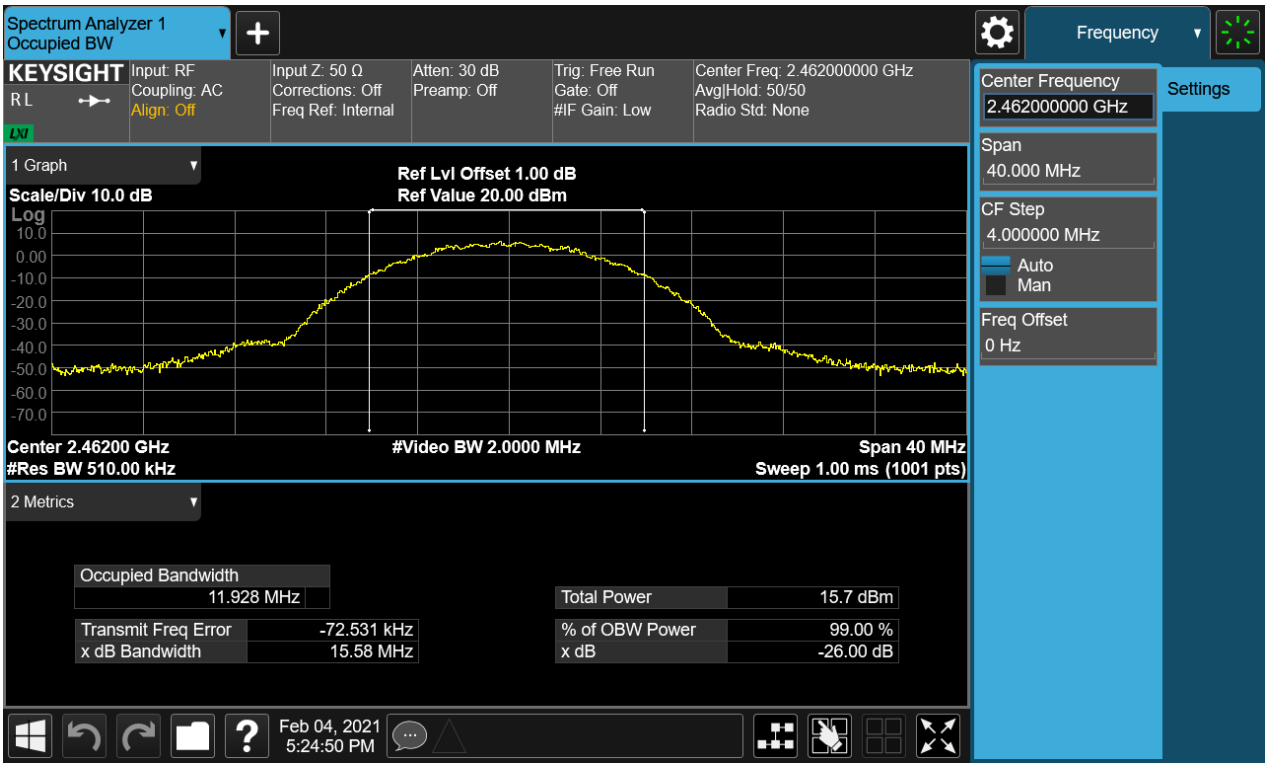


Figure 4: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2412MHz

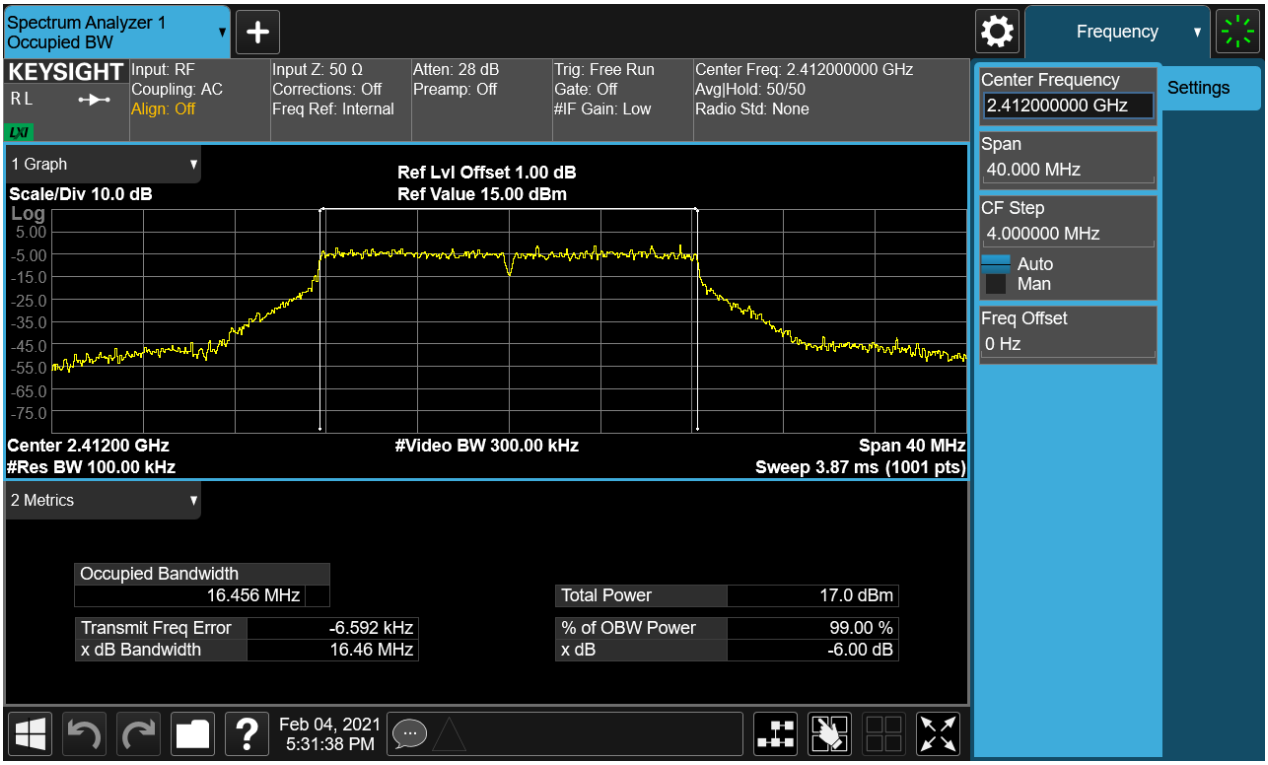


Figure 5: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2437MHz

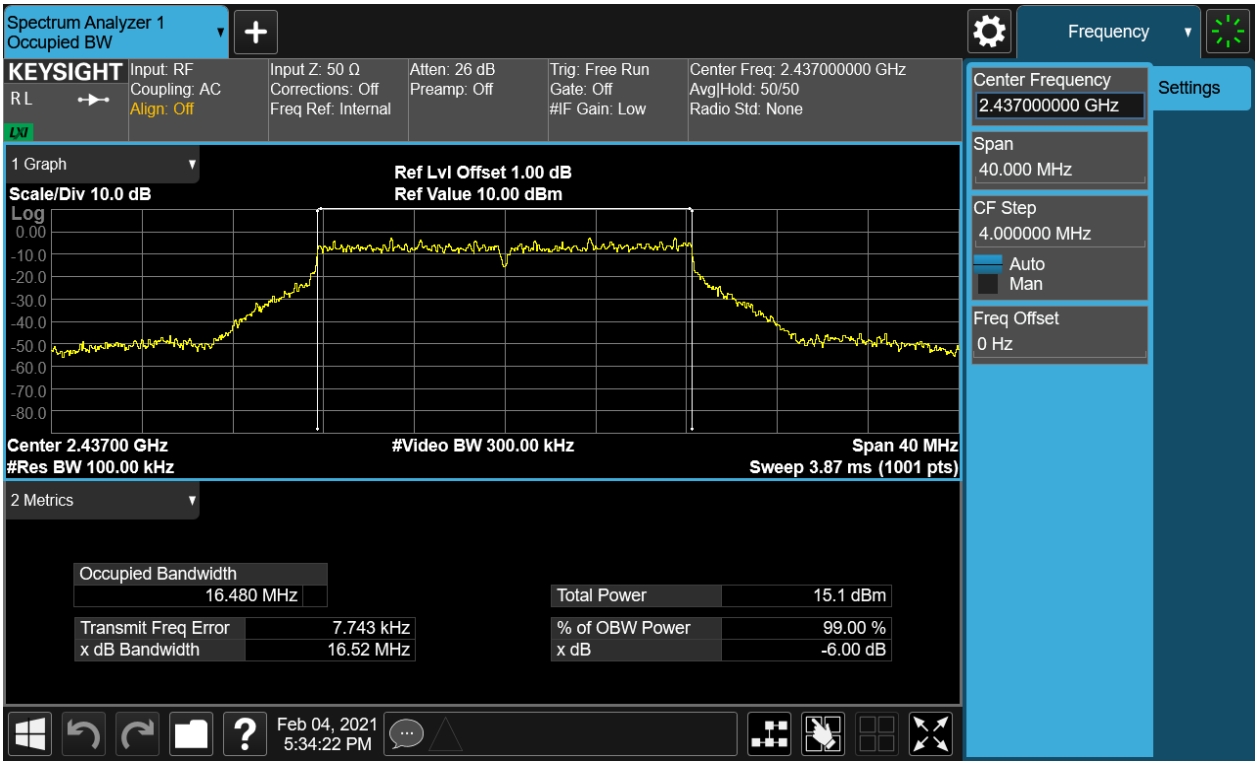
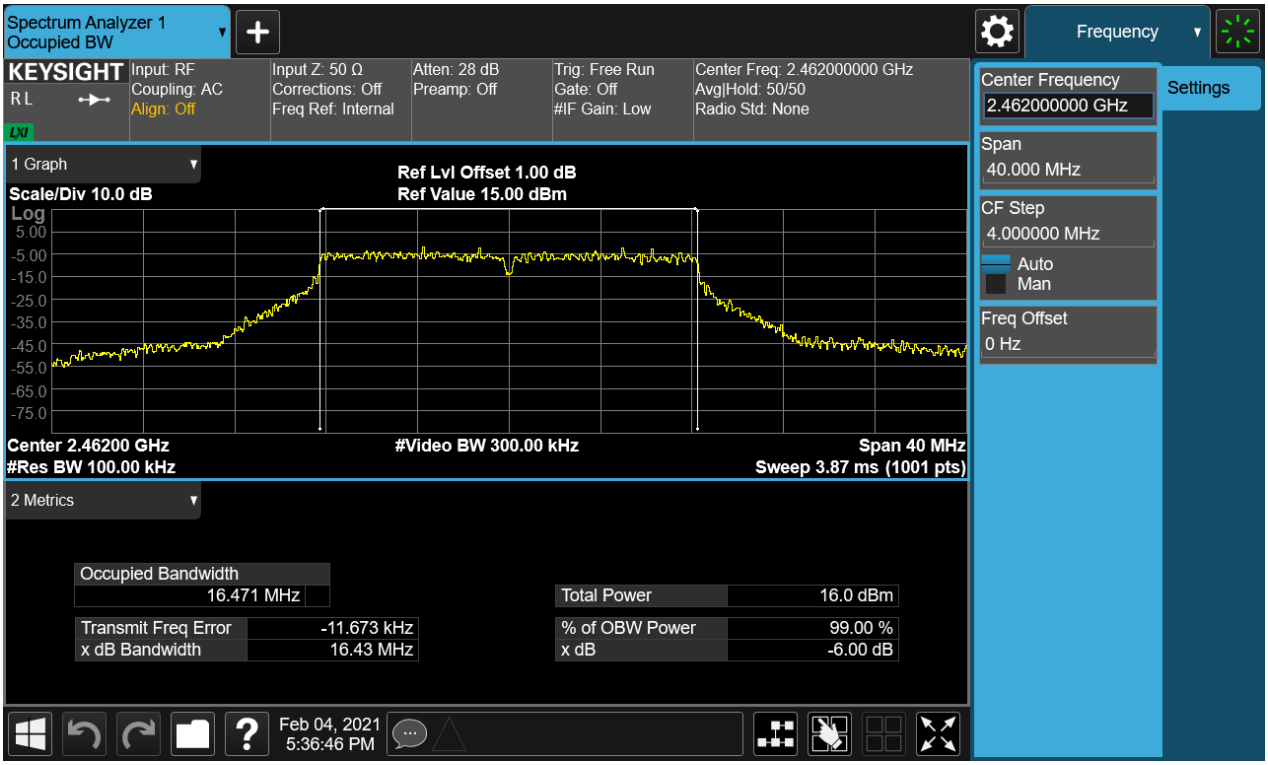


Figure 6: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2462MHz



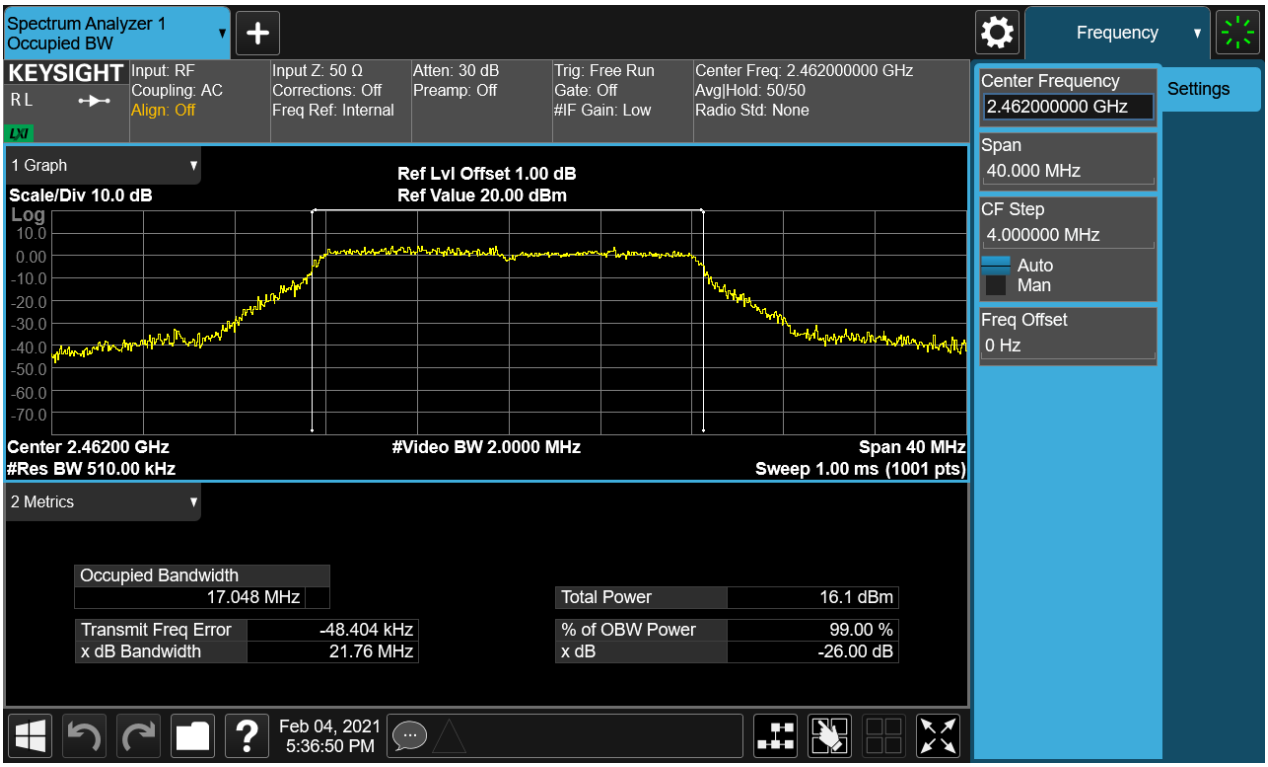
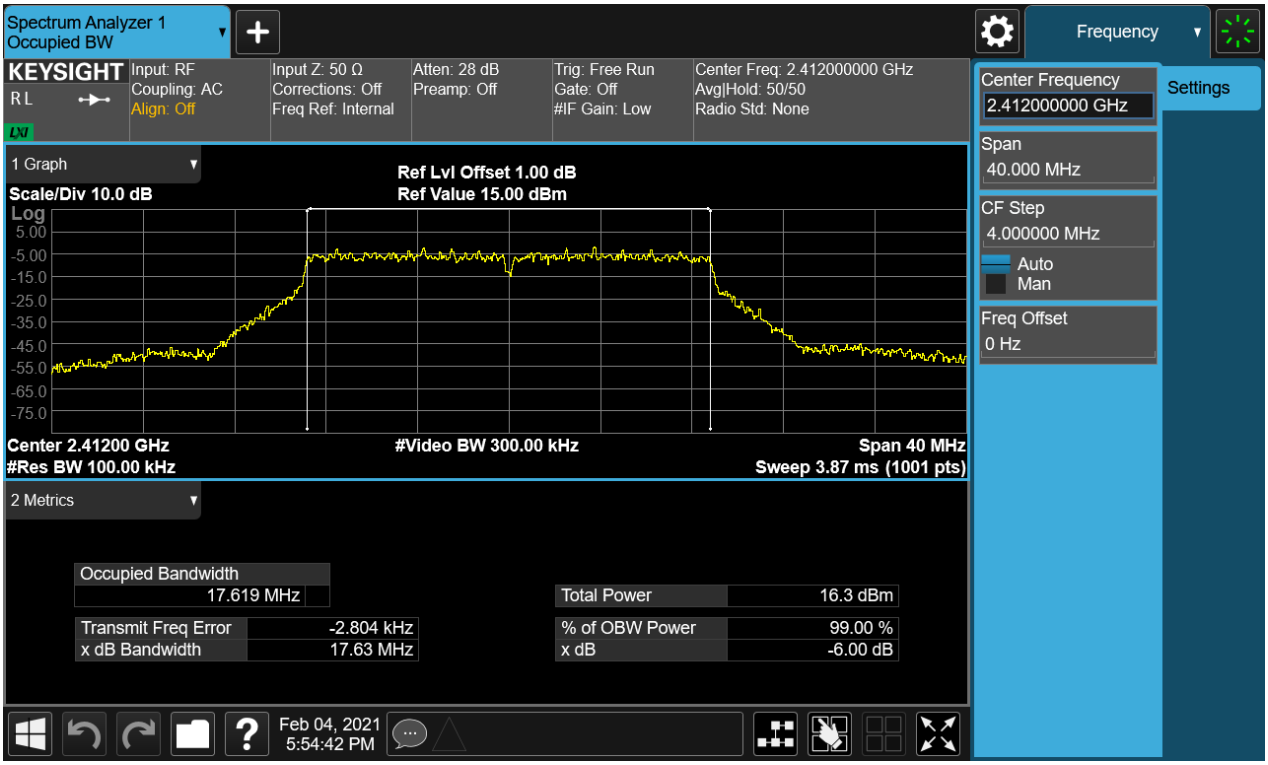


Figure 7: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2412MHz



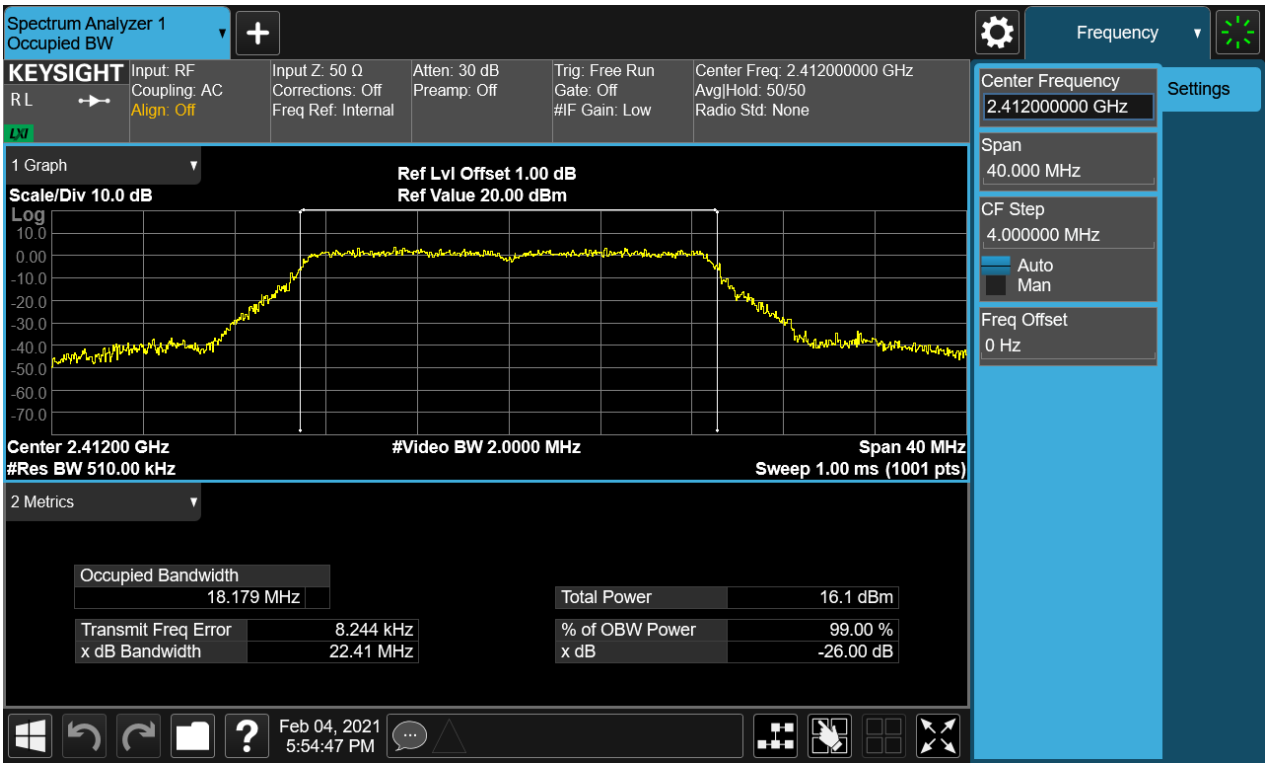
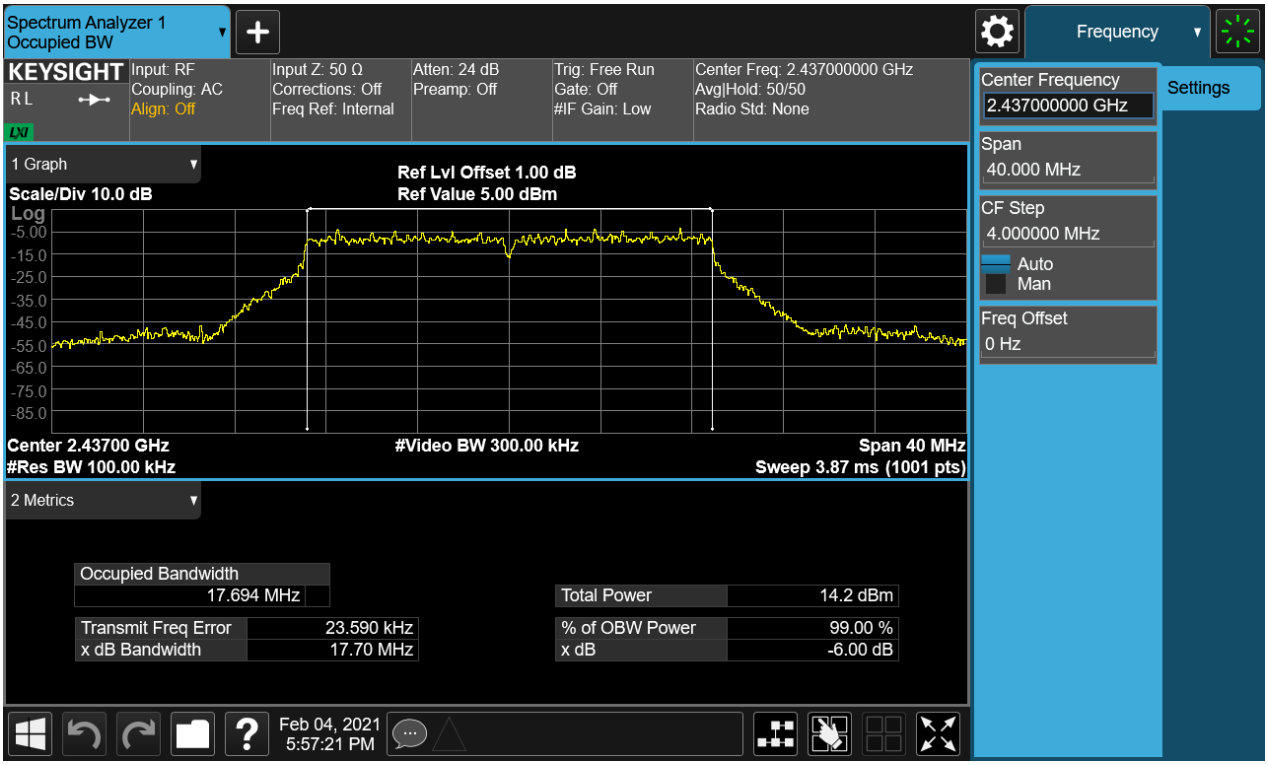


Figure 8: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2437MHz



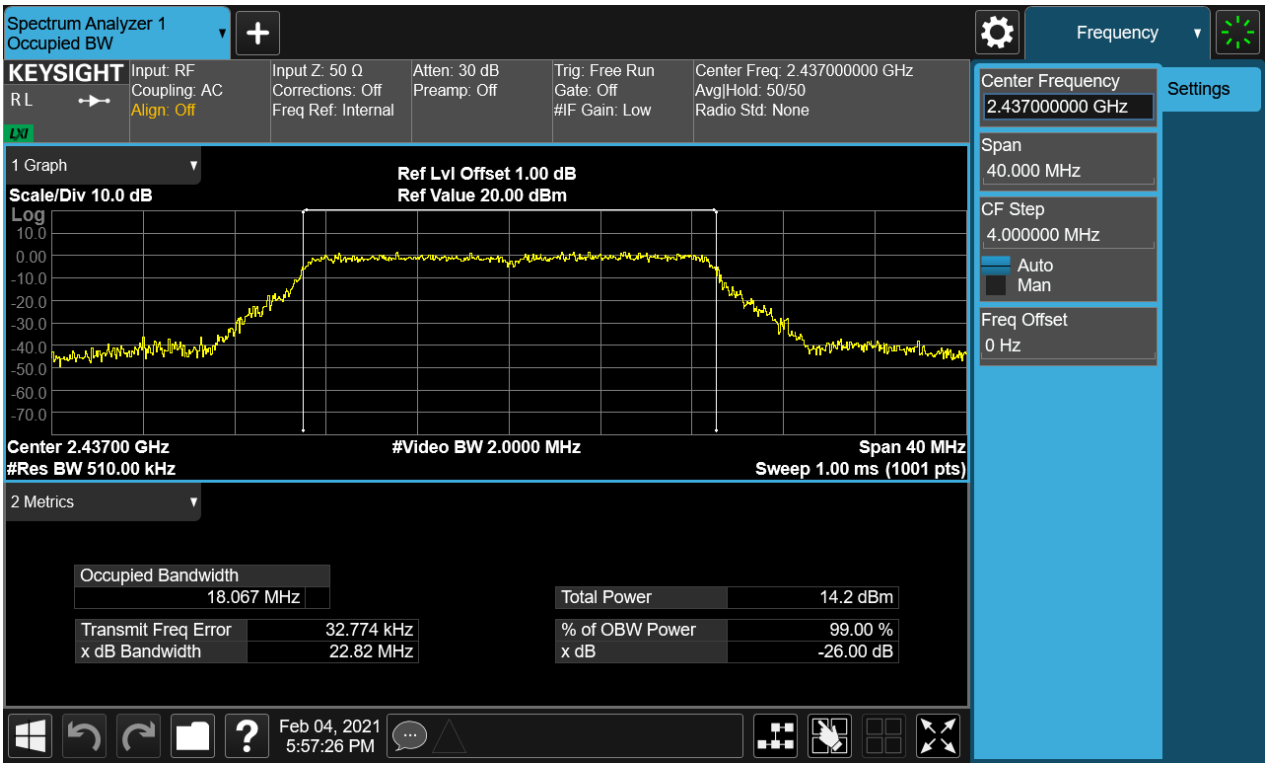


Figure 9: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2462MHz

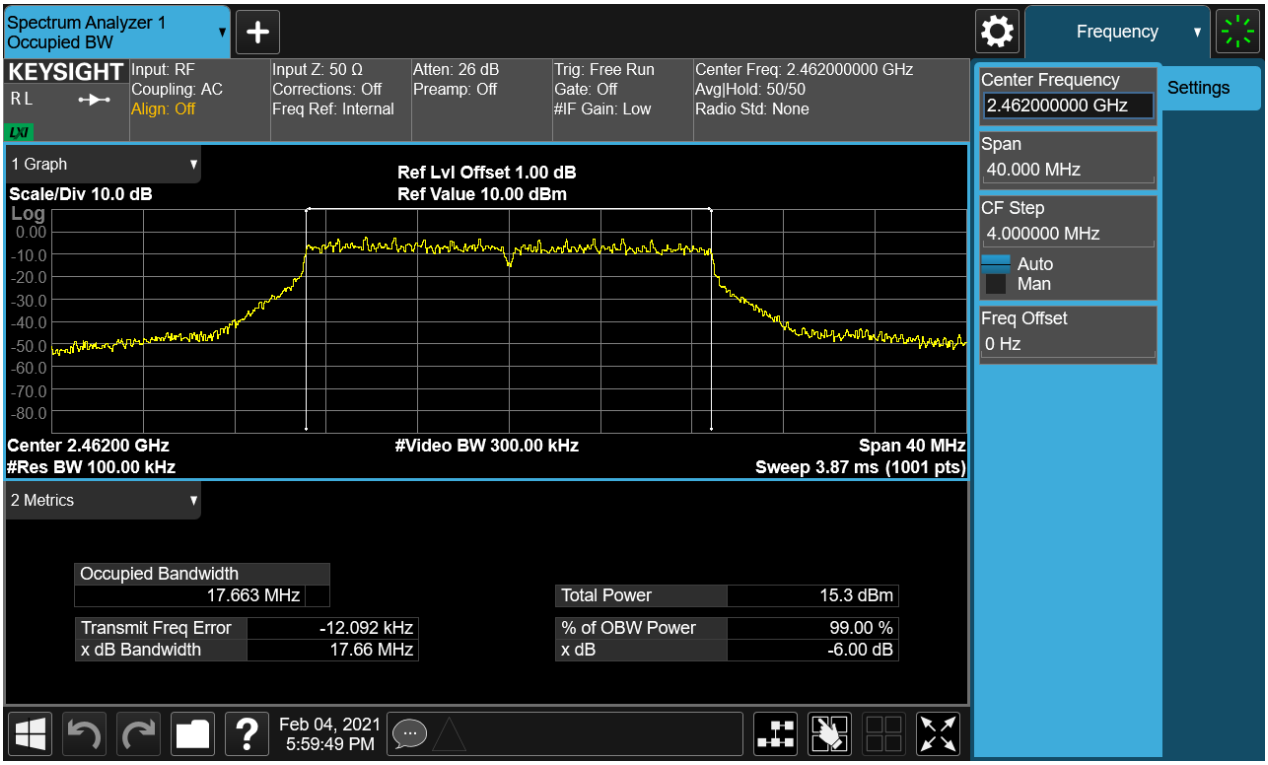
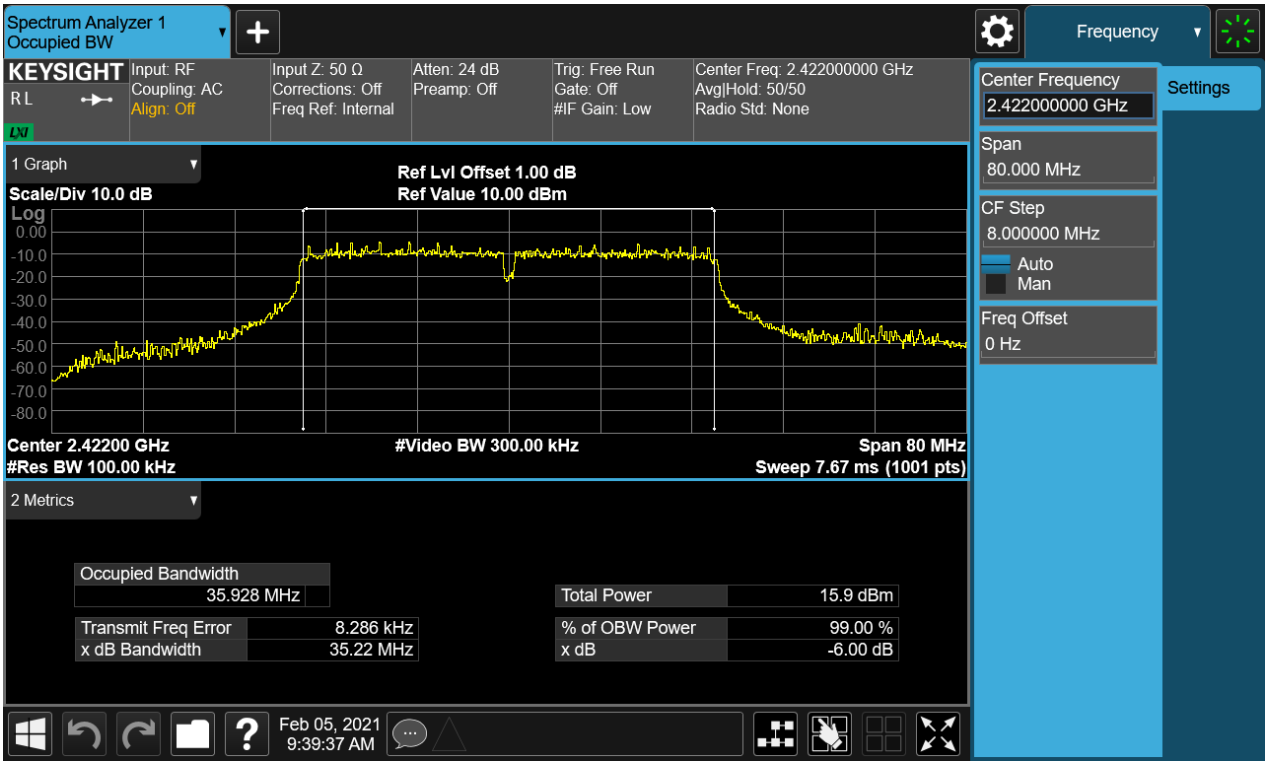


Figure 10: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 2422MHz



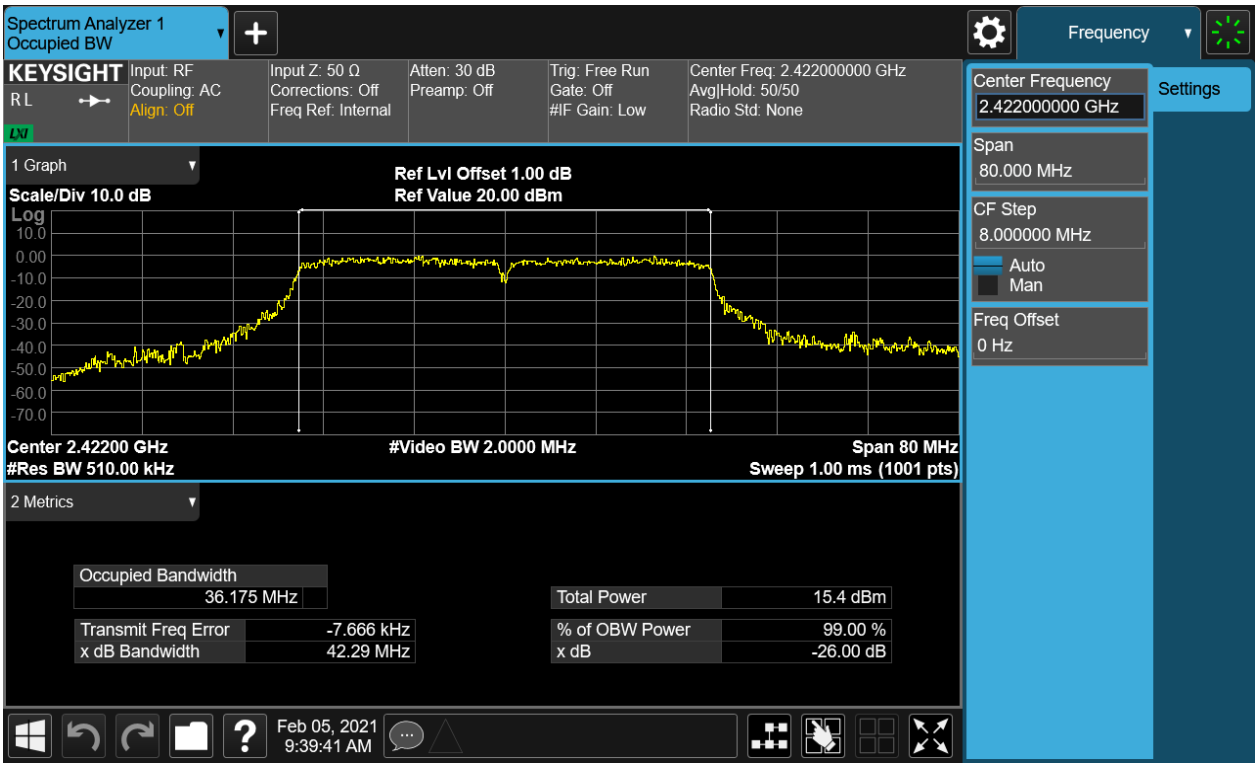
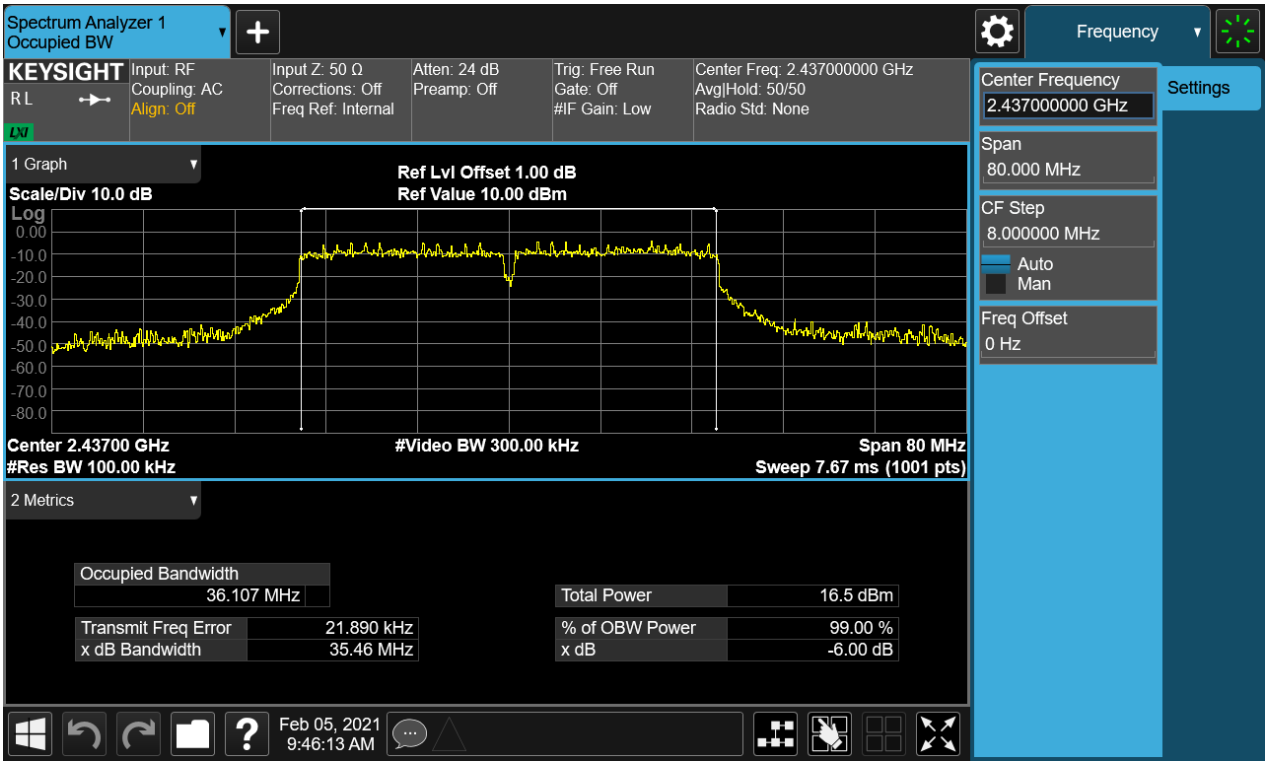


Figure 11: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 2437MHz



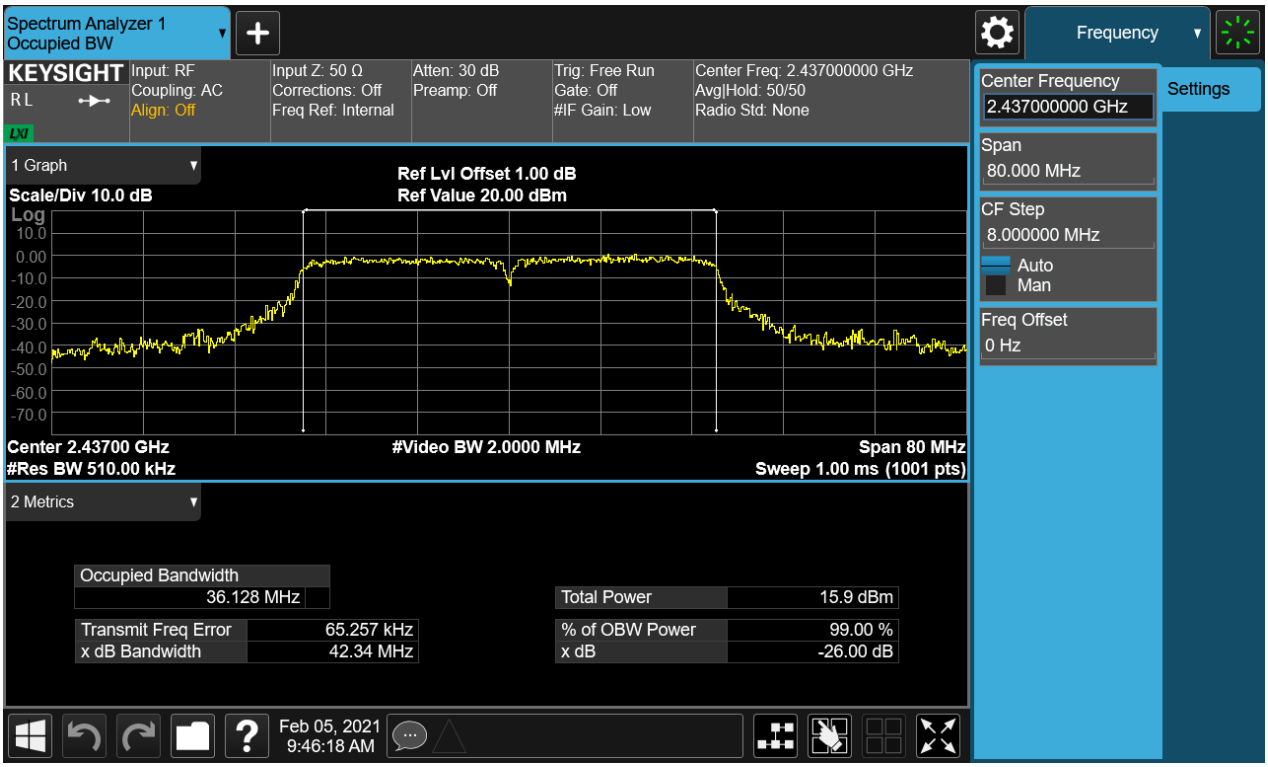
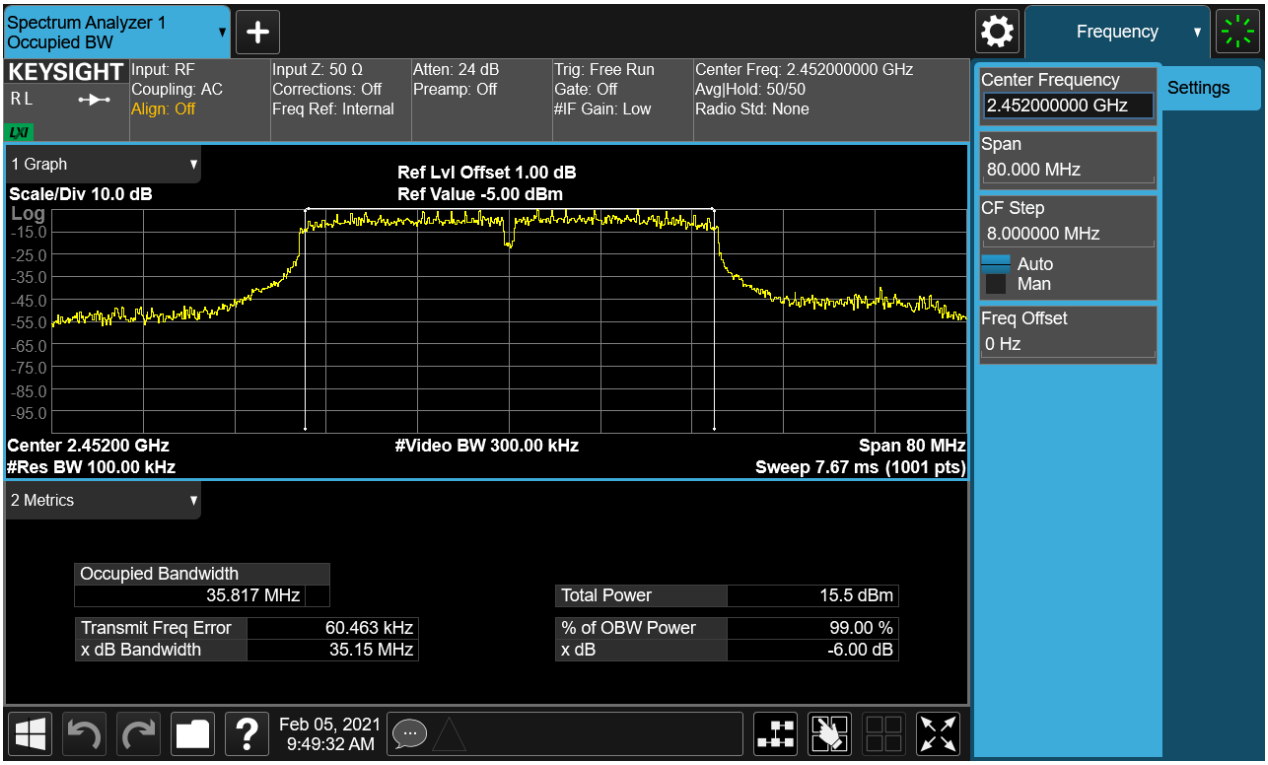
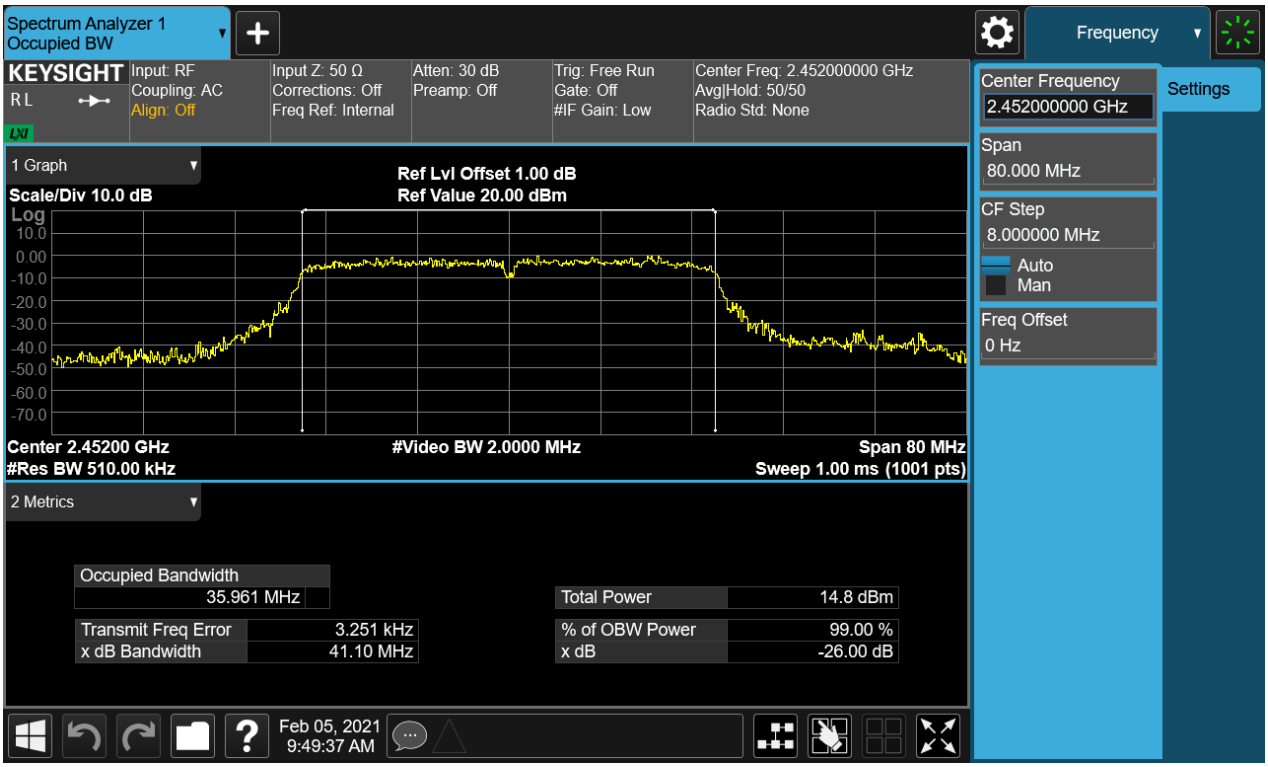


Figure 12: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 2452MHz





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 : 23°C
Relative humidity : 52%

Table 4: Power Spectral Density

Test Mode	Test Channel (MHz)	Measured Result (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	2412	-11.63	8
	2437	-13.55	
	2462	-12.32	
802.11g	2412	-14.49	
	2437	-15.87	
	2462	-14.96	
802.11n(HT20)	2412	-16.34	
	2437	-17.71	
	2462	-16.51	
802.11n(HT40)	2422	-18.97	
	2437	-19.04	
	2452	-20.30	

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

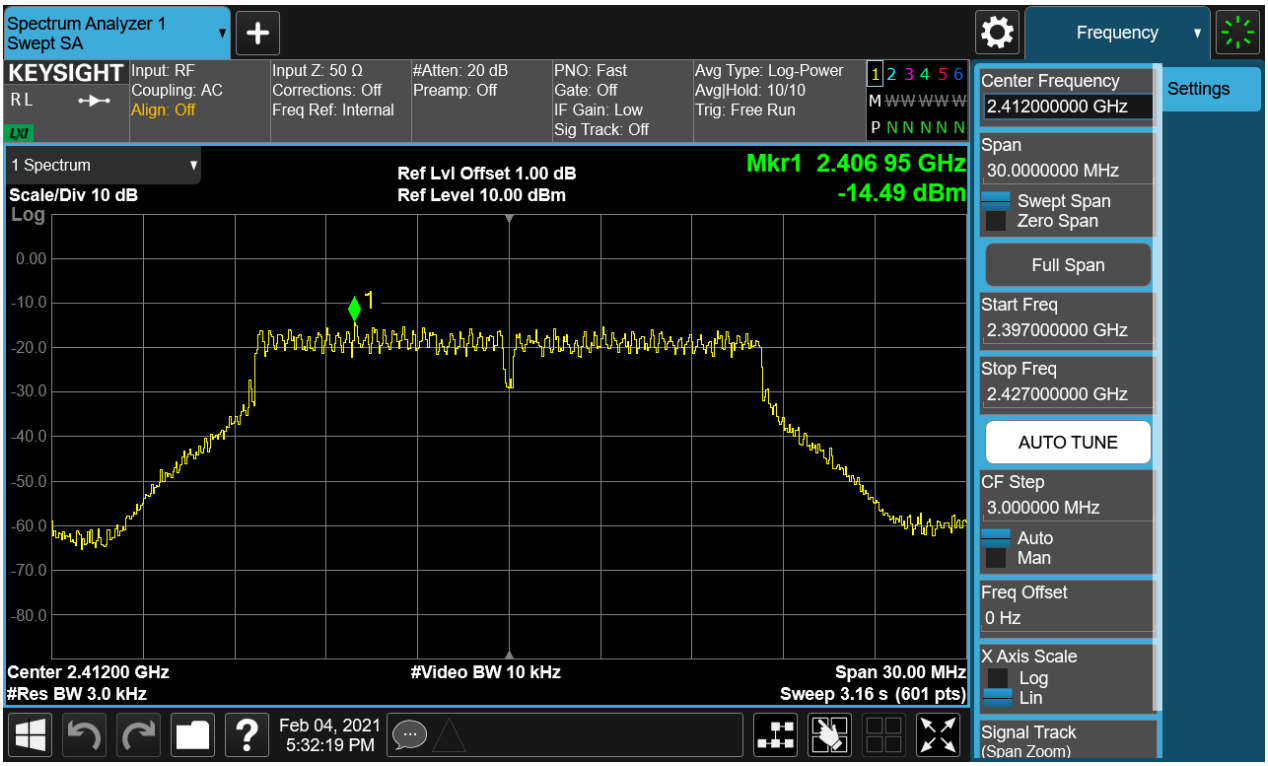


Figure 17: Power Spectral Density, 802.11g, 2437MHz

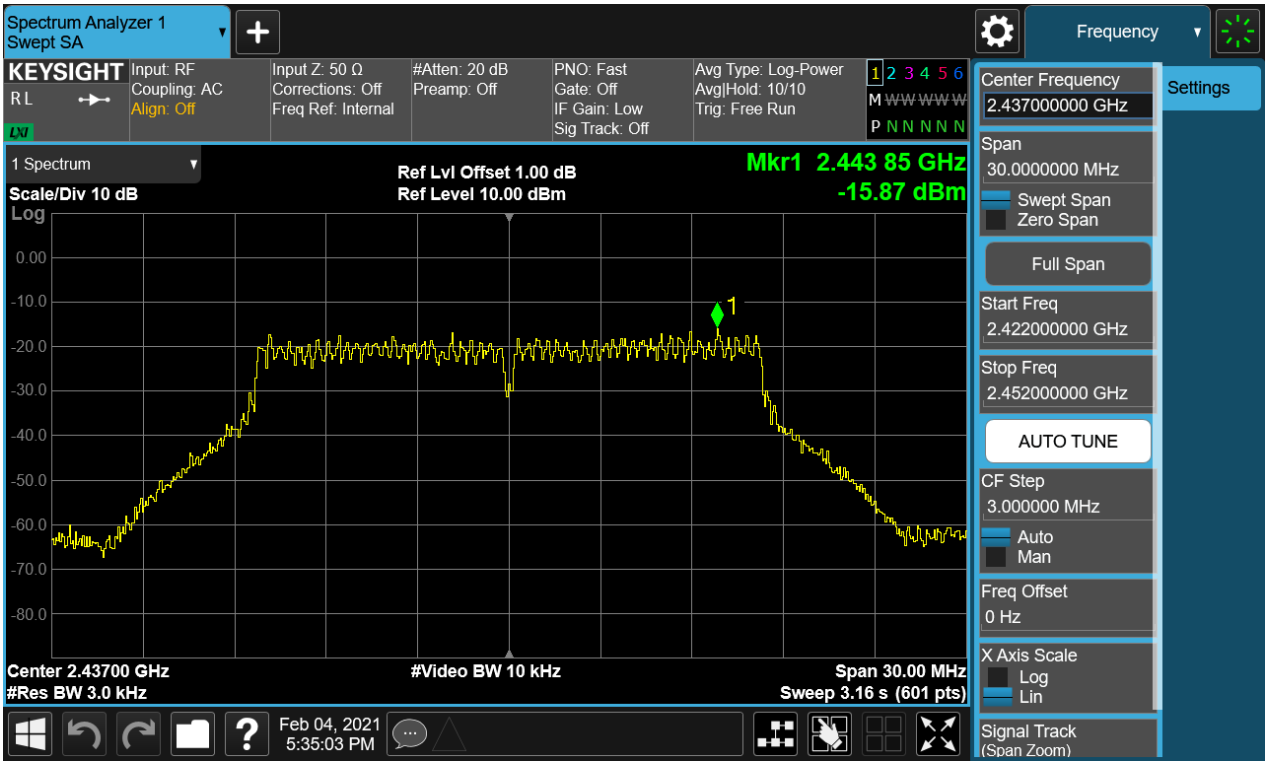


Figure 18: Power Spectral Density, 802.11g, 2462MHz

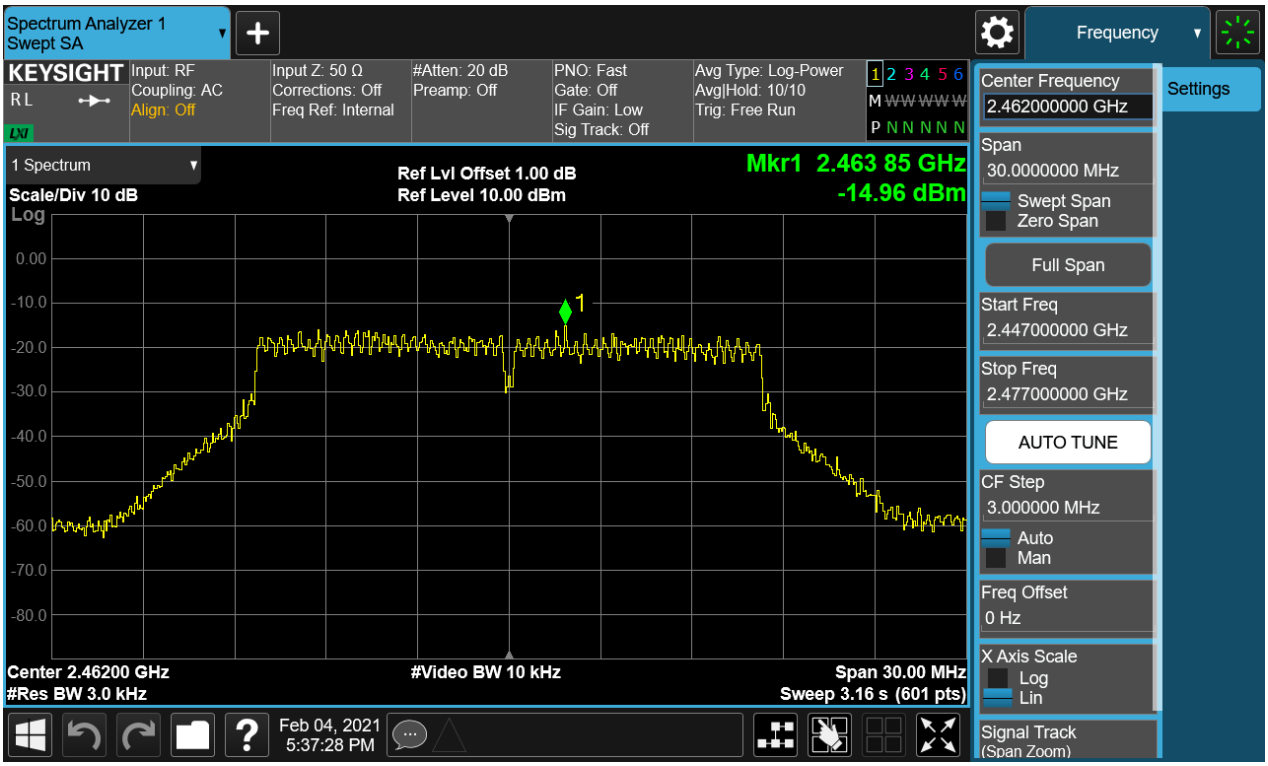


Figure 19: Power Spectral Density, 802.11n(HT20), 2412MHz

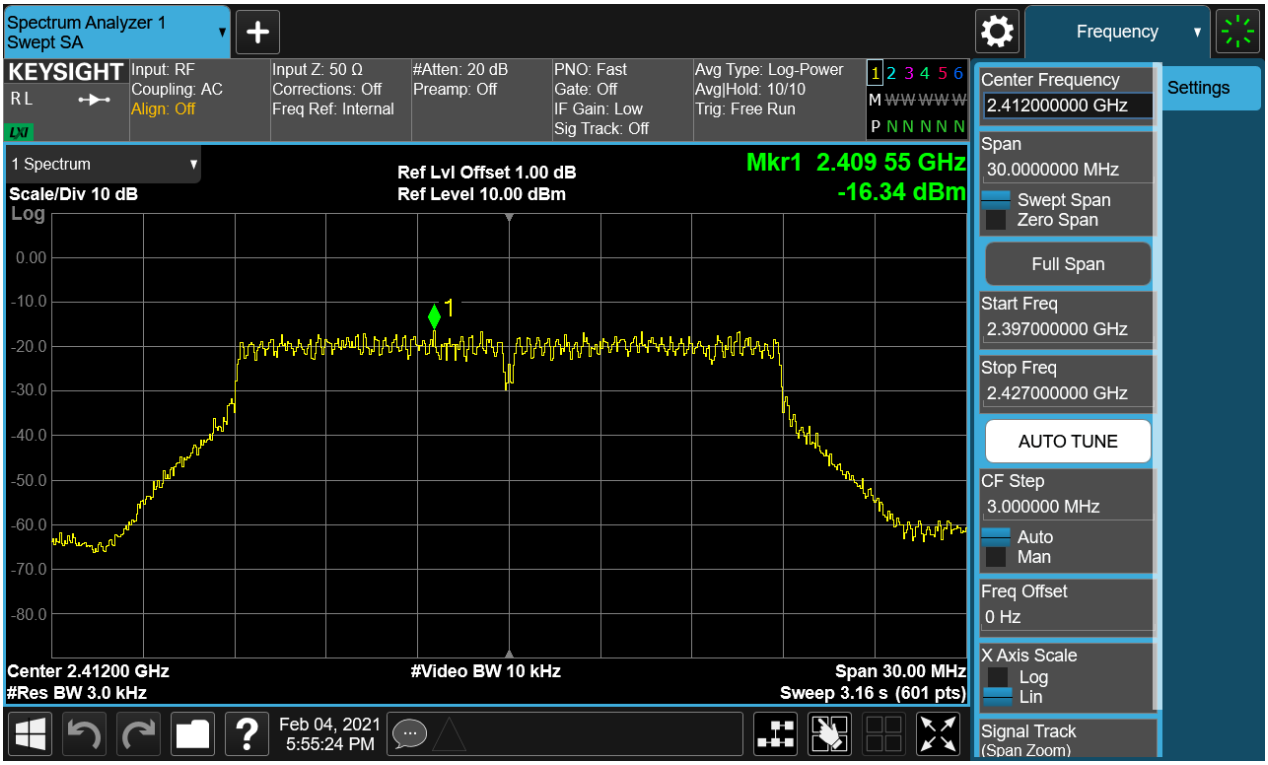


Figure 20: Power Spectral Density, 802.11n(HT20), 2437MHz

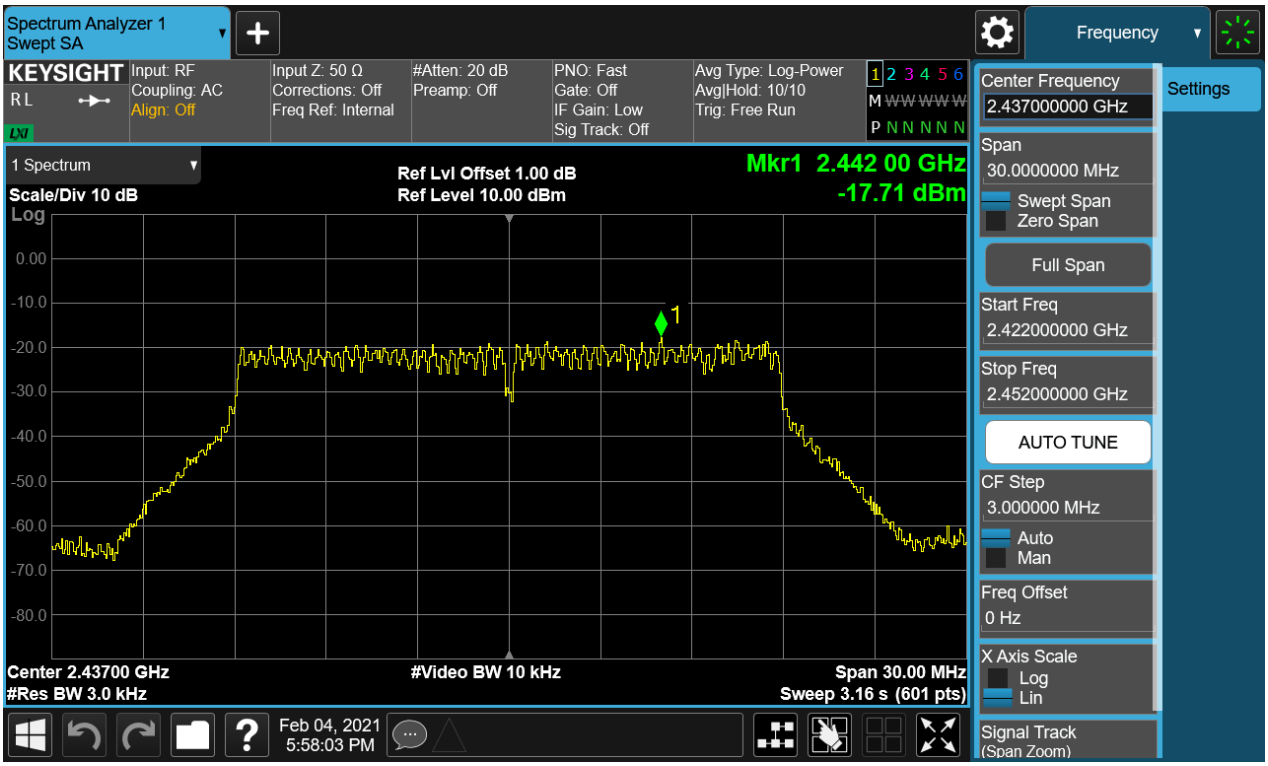


Figure 21: Power Spectral Density, 802.11n(HT20), 2462MHz

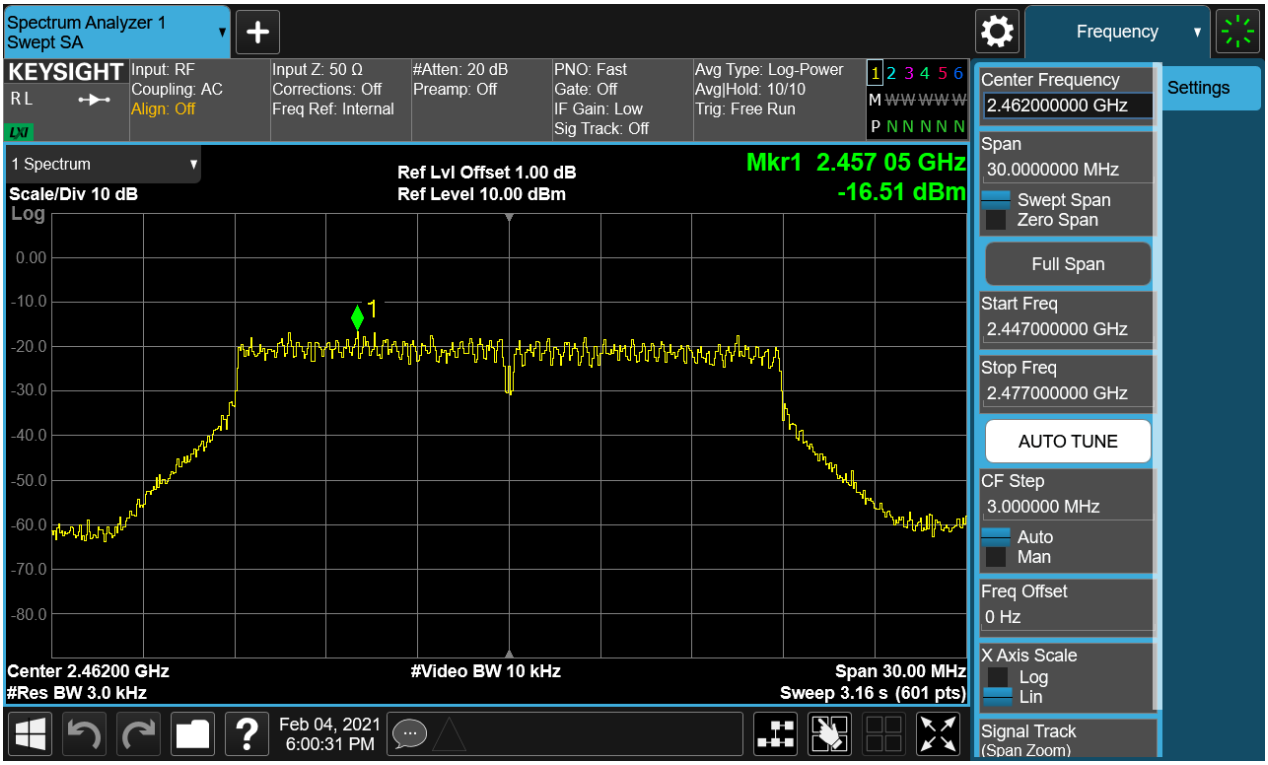


Figure 22: Power Spectral Density, 802.11n(HT40), 2422MHz