

TEST REPORT

Report No.: SHE22030040-02GE

Date: 2022-12-27

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Applicant : Handheld Group AB
Address of Applicant : Strandgatan 40, 531 60, Lidköping, Sweden

Product Name : Rugged Android Tablet ALGIZ RT10
Brand Name : Handheld
Model No. : ALGIZ RT10
Sample acquisition Method : Sent by Client

Sample No. : E22030040-01#08
E22030040-01#10

FCC ID : YY3-ART10
ISED Number : 11695A-ART10

Standards : FCC CFR47 Part 15, Subpart C
RSS-Gen (Issue 5, Amd.2-Feb 2021)
RSS-247 (Issue 2, February 2017)

Date of Receipt : 2022-06-10(E22030040-01#08)
2022-08-02(E22030040-01#10)
Date of Test : 2022-08-09 ~ 2022-10-19
Date of Issue : 2022-12-27

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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(Erik Yang)

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(Authorized signatory: Guoyou Chi)

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1 General Information

1.1 Testing Laboratory

ISED CAB identifier #	CN0081
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	Handheld Group AB
Address	Strandgatan 40, 531 60, Lidkoping, Sweden
Contact Person	Johan Hed
Telephone	+46510547170
Email	regulatory@handheldgroup.com
Manufacturer Company Name	Handheld Group AB
Address	Strandgatan 40, 531 60, Lidkoping, Sweden
Factory Company Name	Hangzhou Ymir Enterprise Co., Ltd
Address	356 Hongda Road, Xiaoshan Economic and Technological Development Zone, Hangzhou

1.3 Details of EUT

Product Name	Rugged Android Tablet ALGIZ RT10
Brand Name	Handheld
Test Model No.	ALGIZ RT10
FCC ID	YY3-ART10
ISED Number	11695A-ART10
Mode of Operation	WLAN 802.11b/g/n(HT20/40)
Frequency Range	2412MHz ~ 2462MHz
Channel Separation	5 MHz
Modulation Type	DSSS, OFDM
Number of channels	11
Antenna Type	Internal Antenna
Antenna Gain	Antenna 3: 3.50dBi Antenna 2: 2.99dBi
Directional gain	6.51(see note 4)
Extreme Temperature Range	-10°C ~ +55°C

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Test Voltage	DC 3.8V
Hardware version	V1.4
Software version	ALGIZ_RT10_V1.0
Test SW Version	BL410_R; BL410_E
RF power setting in TEST SW	802.11b: QRCT_Power level setting_14dBm 802.11g: QRCT_Power level setting_13dBm 802.11n(HT20): QRCT_Power level setting_12dBm 802.11n(HT40): QRCT_Power level setting_11dBm

Note:

1. The above information was declared by the manufacture.
2. For more details, please refer to the User's manual of the EUT.
3. There are two antenna positions in the test sample, and the test data of both antenna positions meet the requirements.
4. Directional gain = $G_{ANT} + 10 \log(N_{ANT}) = 6.51$.
5. Directional gain greater than 6dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Channel List

Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2.412GHz	5	2.432GHz	9	2.452GHz
2	2.417GHz	6	2.437GHz	10	2.457GHz
3	2.422GHz	7	2.442GHz	11	2.462GHz
4	2.427GHz	8	2.447GHz		

Note:

For 20MHz bandwidth system use Channel 1 to Channel 11

For 40MHz bandwidth system use Channel 3 to Channel 9

1.4 Test Methodology

47 CFR Part 15, Subpart C	Telecommunication-Radio Frequency Devices-Intentional Radiators
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, Amd.2-Feb 2021)	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

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during the test.

1.5 Test Summary

Test Item	FCC Rules	ISED Rules	Result
Antenna Requirement	FCC Part 15.247(b)(4), Part 15.203	RSS-247 5.4(f) RSS-GEN 6.8	PASS
Maximum peak conducted output power and E.I.R.P	FCC Part 15.247(b)(3)	RSS-247 5.4(d)	PASS
6dB Bandwidth and 99% Bandwidth	FCC Part 15.247(a)(2)	RSS-247 5.2(a) RSS-Gen 6.7	PASS
Maximum conducted output power spectral density	FCC Part 15.247(e)	RSS-247 5.2(b)	PASS
Conducted Spurious Emission & Authorized-band band-edge	FCC Part 15.247(d)	RSS-247 5.5	PASS
Radiated Emission	FCC Part 15.247(d), 15.205, 15.209	RSS-GEN 8.9	PASS
Band Edge (Restricted-band band- edge)	FCC Part 15.247(d), 15.205, 15.209	RSS-GEN 8.10	PASS
Conducted Emission on AC Mains	FCC Part 15.207(a)	RSS-Gen 8.8	PASS

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2 Test Condition

2.1 Environmental conditions

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

2.2 Equipment List

Name of Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	Keysight	N9020B	MY59260184	2022-08-02	2023-08-01
Spectrum Analyzer	Rohde & Schwarz	FSV40N	101450	2022-06-10	2023-06-09
Signal Generator	Rohde & Schwarz	SMR27	100184	2022-08-02	2023-08-01
EMI Test Receiver	Rohde & Schwarz	ESR 7	101911	2022-06-10	2023-06-09
EMI Test Receiver	Rohde & Schwarz	ESPI3	100173	2022-06-10	2023-06-09
V-network	SCHWARZBECK	NSLK8127	8127-902	2022-06-10	2023-06-09
Broadband Antenna	SCHWARZBECK	VULB9163	9163-1037	2021-06-08	2023-06-07
Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-1775	2021-06-08	2023-06-07
Loop Antenna	SCHWARZBECK	FMZB 1513	/	2022-06-10	2023-06-09
Broadband Preamplifier	SCHWARZBECK	BBV 9718	346	2022-06-10	2023-06-09
EMC chamber 9*6*6 (L*W*H)	CHANGNING	966	N/A	2022-06-10	2023-06-09
Shielded Enclosure 8*5*4 (L*W*H)	CHANGNING	854	N/A	2022-06-10	2023-06-09
Test Software	BL	BL410_E	N/A	N/A	N/A
Test Software	BL	BL410_R	N/A	N/A	N/A

2.3 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in measurement" (GUM) published by CISPR and ANSI. The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95.45%.

Parameter		Uncertainty
Antenna Port Conducted Emission	< 1GHz	± 1.5 dB
	> 1GHz	± 1.5 dB
Radiated Emission	< 1GHz	± 5.00 dB
	> 1GHz	± 4.88 dB
Conducted Emission on AC Mains	150KHz-30MHz	± 2.68 dB
Occupied Channel Bandwidth		± 5 %

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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	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

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3.2 Special Accessories and Auxiliary Equipment

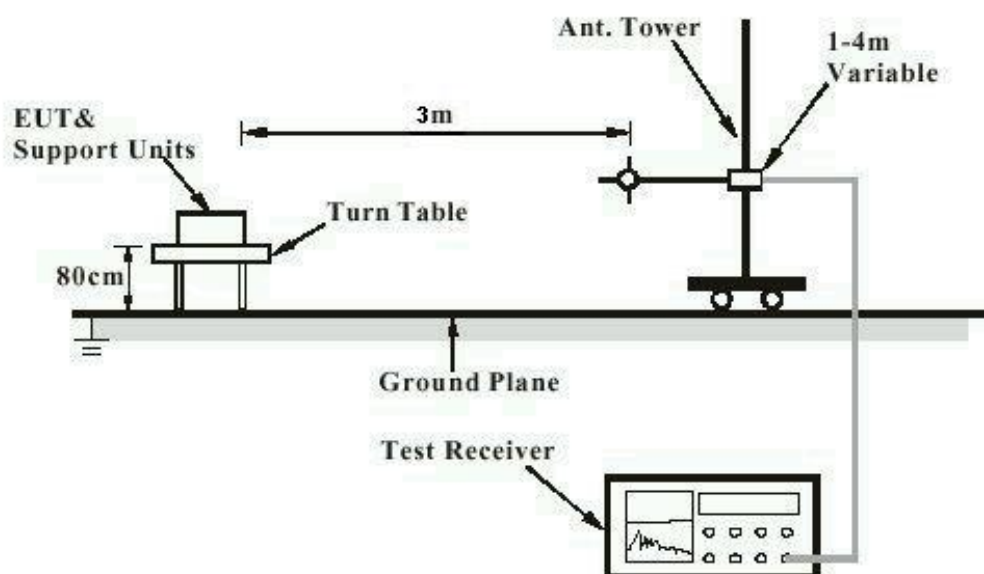
Description	Manufacturer	Model No.	Serial No.
Laptop	Lenovo	TP00083A	N/A
USB Cable	N/A	1.00m Unshielded	N/A

3.3 Support Software

Description	Manufacturer	Software Name
Software	Qualcomm	QRCT Version 4.0.00166.0

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.

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Diagram of Measurement Configuration for Conduction Test

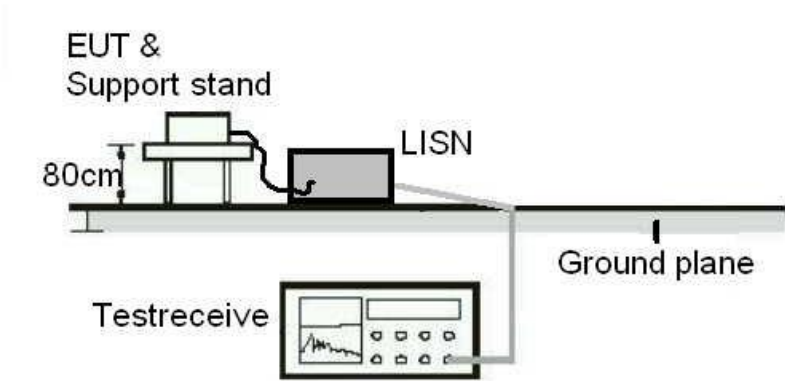
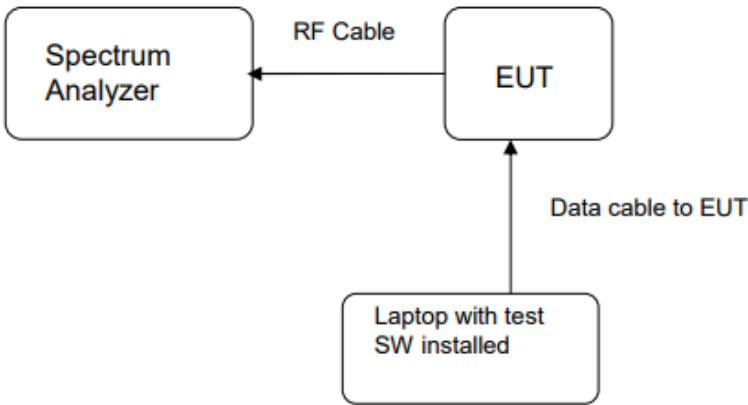


Diagram of Measurement Configuration for Transmitter Test



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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(f), RSS-GEN 6.8
Requirement	: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. In addition, if transmitting antennas of directional gain greater than 6dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6dBi.

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 6.51dBi. 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 Maximum peak conducted output power and E.I.R.P

RESULT:

PASS

Test standard : FCC Part 15.247(b)(3), RSS-247 5.4(d)
 Requirement : ANSI C63.10-2013 clause 11.9.1,
 KDB 558074 clause 8.3.1
 Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
 Operation Mode : A.1.a
 Ambient temperature : 24.9°C
 Relative humidity : 57%

Table 1: Maximum peak conducted output power

Test Mode	Test Channel (MHz)	Maximum peak conducted output power						Applicable Limit (W)
		Chain 1		Chain 2		Total Power		
		(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	
802.11b	2412	14.51	28.25	14.42	27.67	N/A	N/A	0.89
	2437	12.91	19.54	14.55	28.51	N/A	N/A	
	2462	12.93	19.63	14.90	30.90	N/A	N/A	
802.11g	2412	13.79	23.93	14.22	26.42	N/A	N/A	
	2437	12.85	19.28	14.36	27.29	N/A	N/A	
	2462	13.17	20.75	14.65	29.17	N/A	N/A	
802.11n(HT20)	2412	12.81	19.10	13.12	20.51	15.98	39.61	
	2437	11.67	14.69	13.17	20.75	15.49	35.44	
	2462	12.15	16.41	13.61	22.96	15.95	39.37	
802.11n(HT40)	2422	10.84	12.13	11.45	13.96	14.17	26.10	
	2437	10.81	12.05	11.88	15.42	14.39	27.47	
	2452	10.68	11.69	11.67	14.69	14.21	26.38	

Notes:

1. Directional gain = $G_{ANT} + 10 \log(N_{ANT}) = 6.51$.
2. $P_{out} = P_{Limit} - (G_{Tx} - 6) = 29.49 \text{ dBm} \approx 0.89 \text{ W}$.
3. 802.11b/g support SISO and 802.11n support MIMO.

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Table 2: E.I.R.P

Test Mode	Test Channel (MHz)	E.I.R.P						Applicable Limit (W)
		Antenna 3		Antenna 2		Total Power		
		(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	
802.11b	2412	18.01	63.24	17.41	55.08	N/A	N/A	4
	2437	16.41	43.75	17.54	56.75	N/A	N/A	
	2462	16.43	43.95	17.89	61.52	N/A	N/A	
802.11g	2412	17.29	53.58	17.21	52.60	N/A	N/A	
	2437	16.35	43.15	17.35	54.33	N/A	N/A	
	2462	16.67	46.45	17.64	58.08	N/A	N/A	
802.11n(HT20)	2412	16.31	42.76	16.11	40.83	19.22	83.59	
	2437	15.17	32.89	16.16	41.30	18.70	74.19	
	2462	15.65	36.73	16.6	45.71	19.16	82.44	
802.11n(HT40)	2422	14.34	27.16	14.44	27.80	17.40	54.96	
	2437	14.31	26.98	14.87	30.69	17.61	57.67	
	2452	14.18	26.18	14.66	29.24	17.44	55.42	

Notes:

1. EIRP = Conducted output power + Antenna Gain.
2. Antenna Gain (Antenna 3: 3.50dBi, Antenna 2: 2.99dBi).
3. 802.11b/g support SISO and 802.11n support MIMO.

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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(a)
RSS-Gen 6.7
Requirement : ANSI C63.10-2013 clause 11.8.1,
KDB 558074 clause 8.2
Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
Operation Mode : A.1.a
Ambient temperature : 24.9°C
Relative humidity : 57%

Table 3: 6dB Bandwidth and 99% Bandwidth

Test Mode	Test Channel (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	6dB Bandwidth Applicable Limit (MHz)
802.11b	2412	6.99	13.211	>0.5
	2437	8.98	13.628	
	2462	7.94	13.822	
802.11g	2412	16.02	16.519	
	2437	16.05	16.780	
	2462	16.32	16.728	
802.11n(HT20)	2412	13.98	17.702	
	2437	17.00	17.844	
	2462	17.66	17.915	
802.11n(HT40)	2422	35.79	36.276	
	2437	36.39	36.305	
	2452	33.95	36.038	

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Figure 1: The plots of 6dB Bandwidth, 802.11b, 2412MHz



Figure 2: The plots of 99% Bandwidth, 802.11b, 2412MHz



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Figure 3: The plots of 6dB Bandwidth, 802.11b, 2437MHz

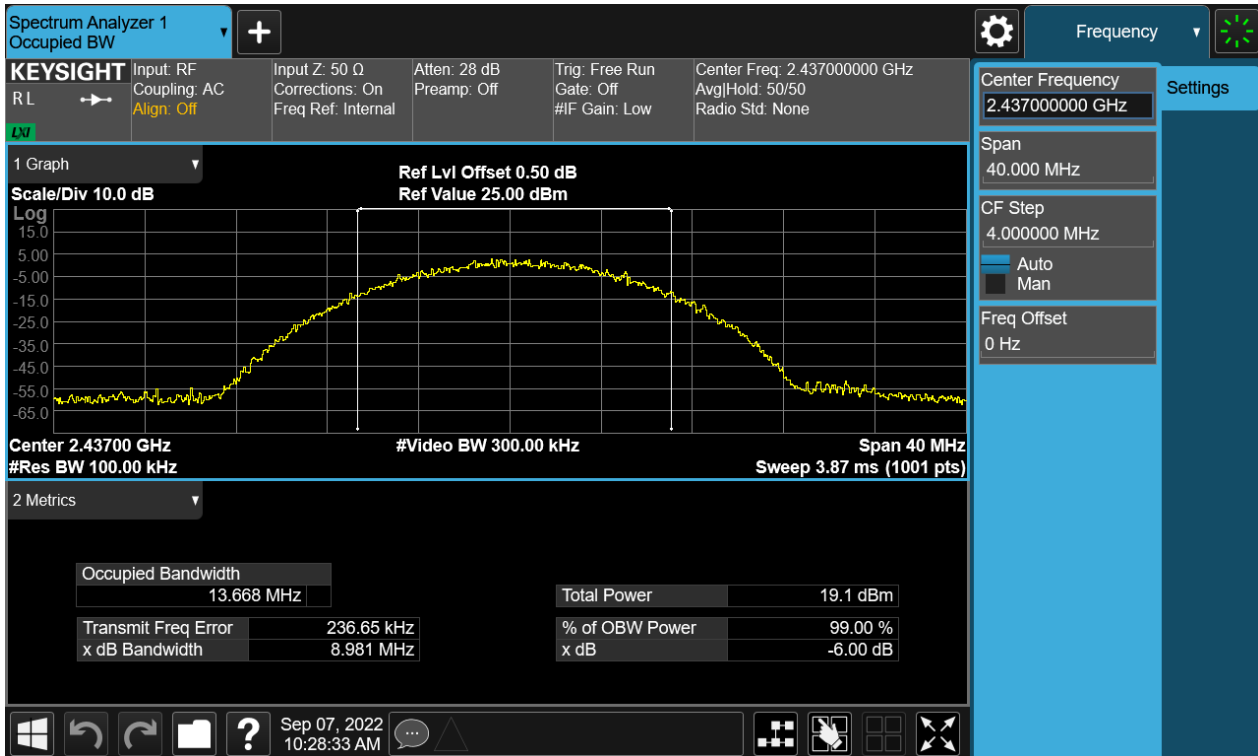


Figure 4: The plots of 99% Bandwidth, 802.11b, 2437MHz



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Figure 5: The plots of 6dB Bandwidth, 802.11b, 2462MHz



Figure 6: The plots of 99% Bandwidth, 802.11b, 2462MHz



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Figure 7: The plots of 6dB Bandwidth, 802.11g, 2412MHz

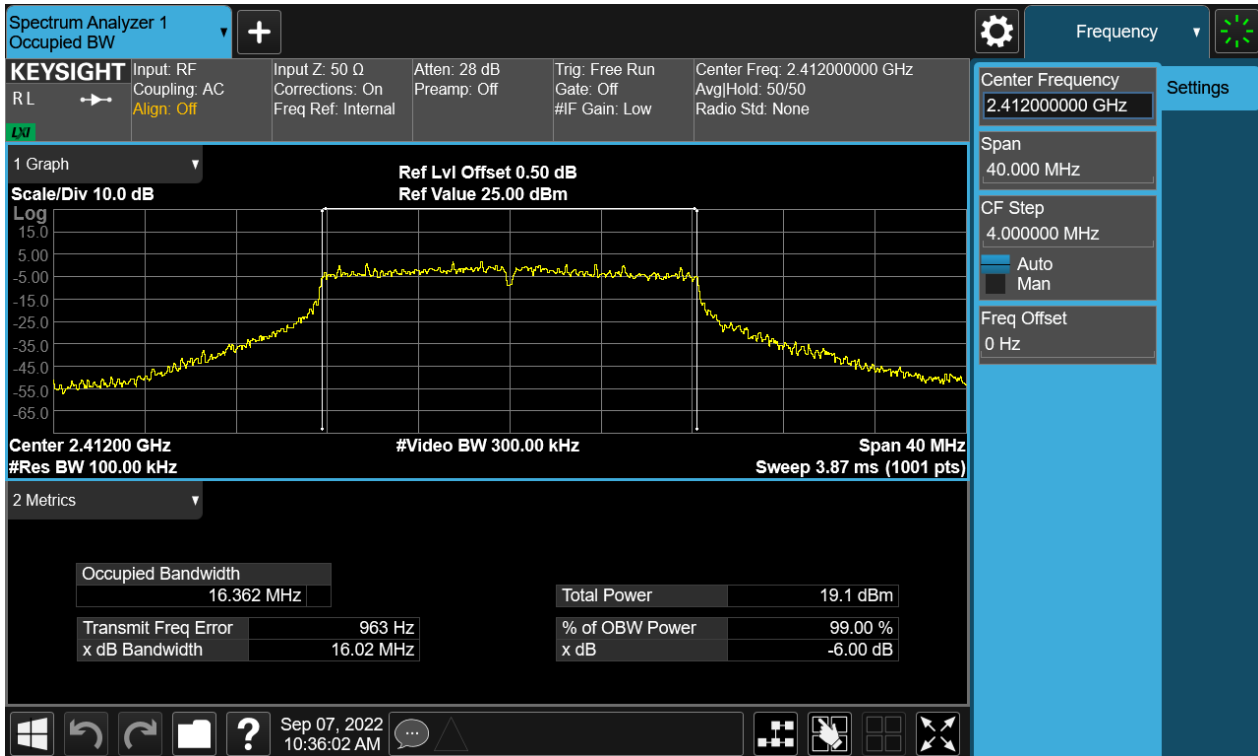
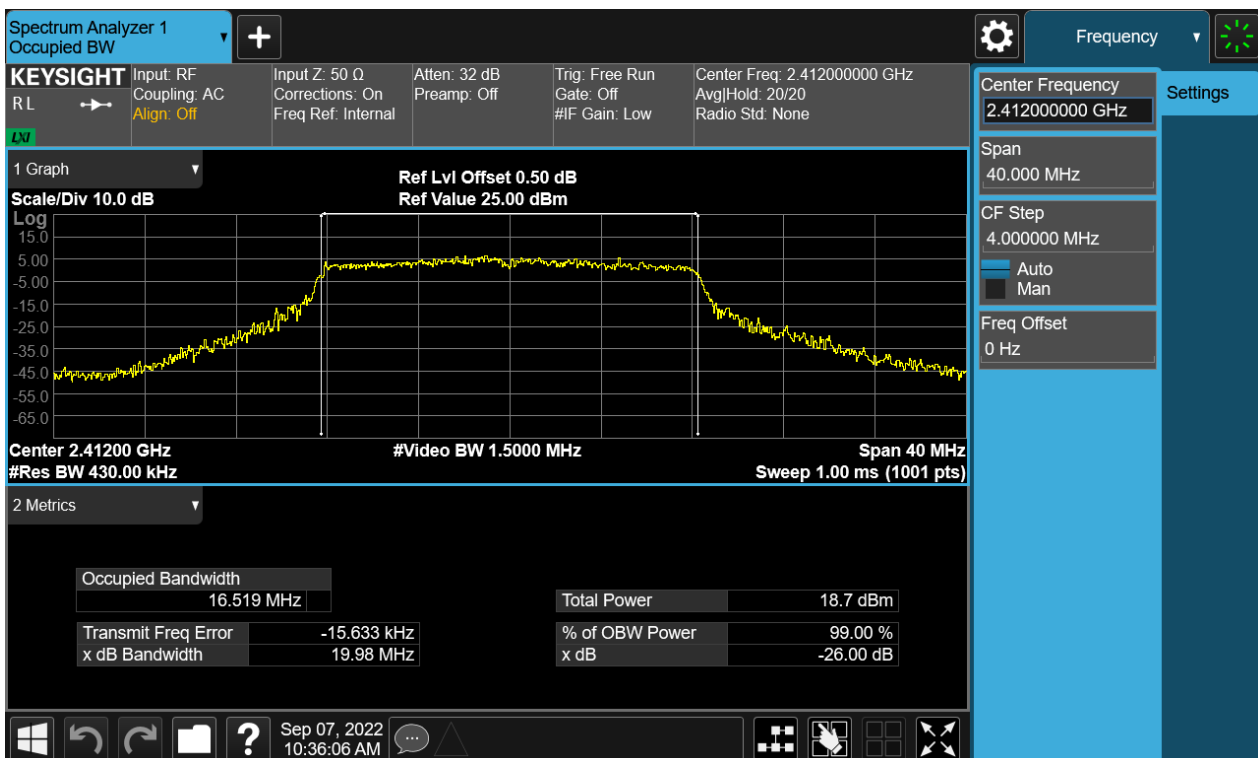


Figure 8: The plots of 99% Bandwidth, 802.11g, 2412MHz



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Figure 9: The plots of 6dB Bandwidth, 802.11g, 2437MHz

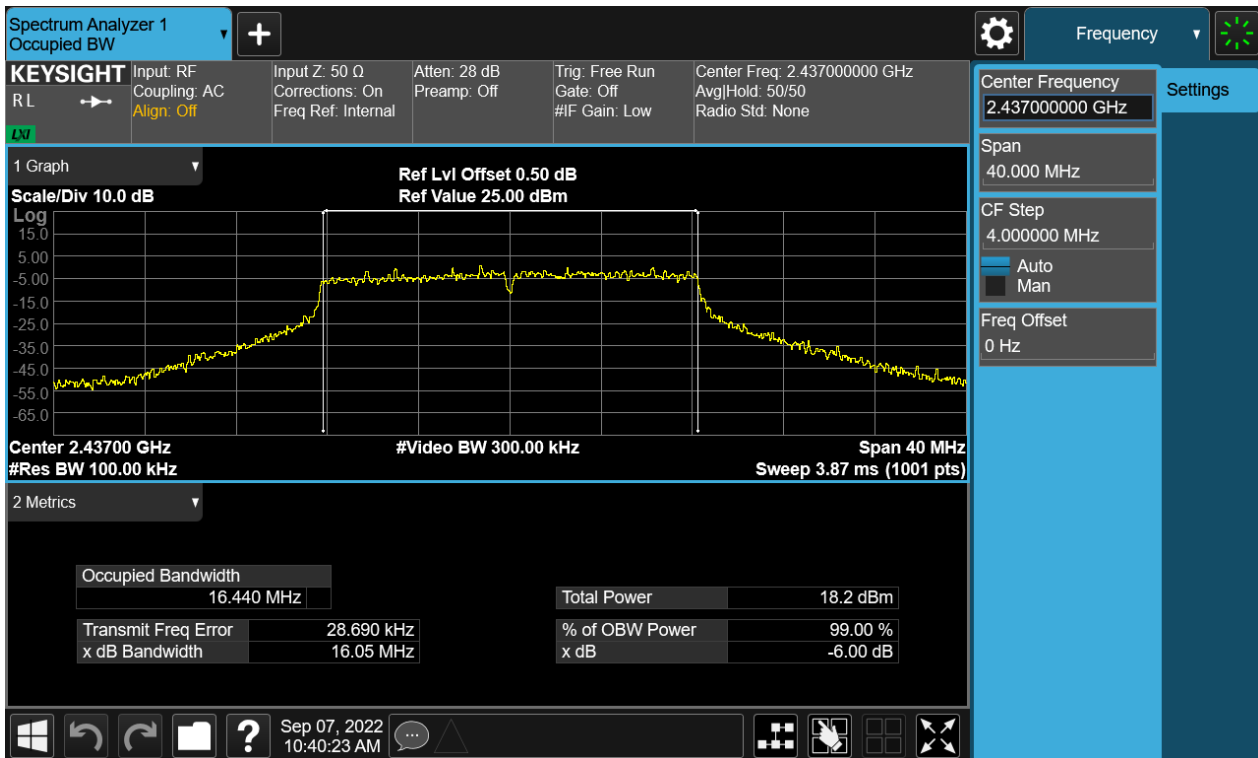
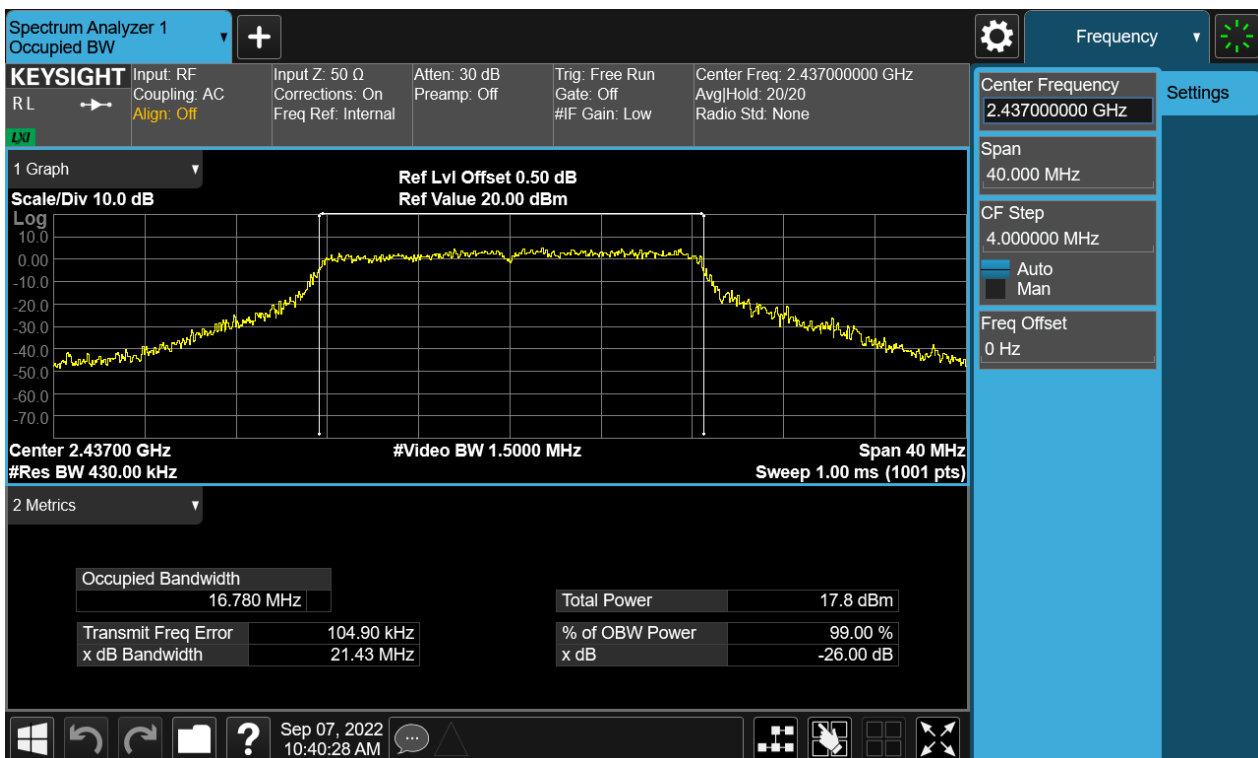


Figure10: The plots of 99% Bandwidth, 802.11g, 2437MHz



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Figure 11: The plots of 6dB Bandwidth, 802.11g, 2462MHz

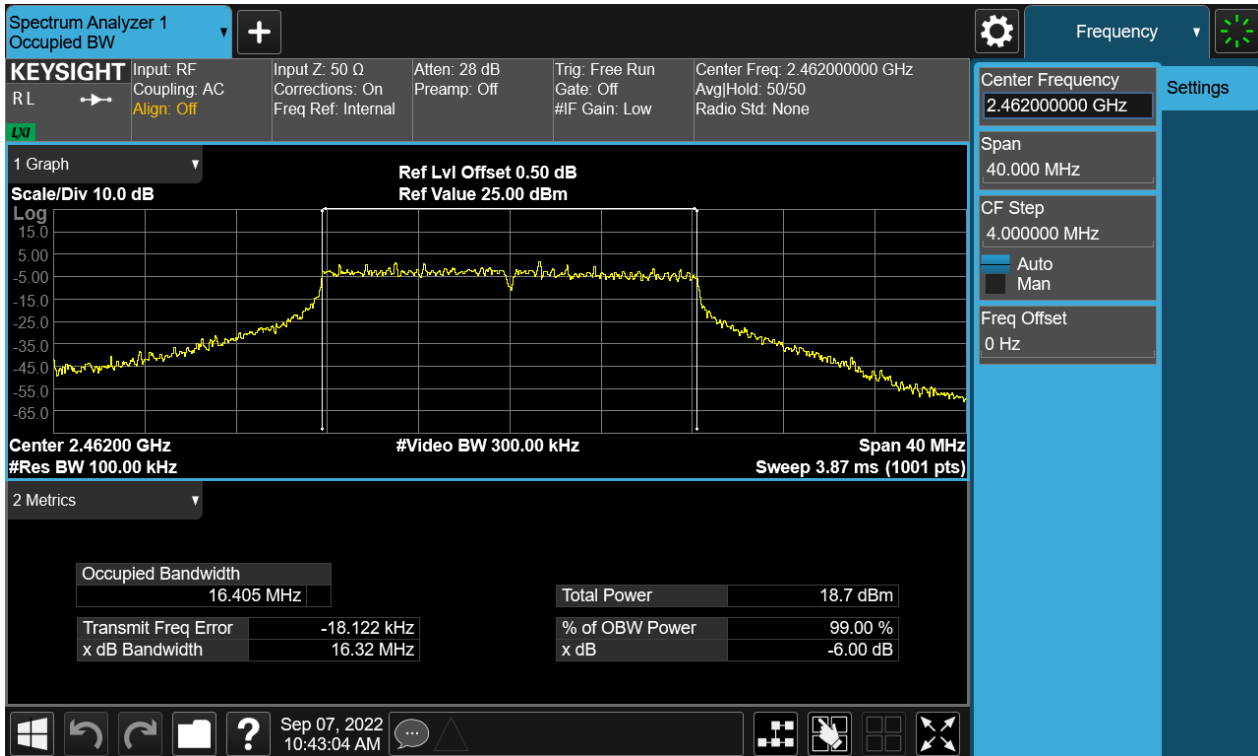
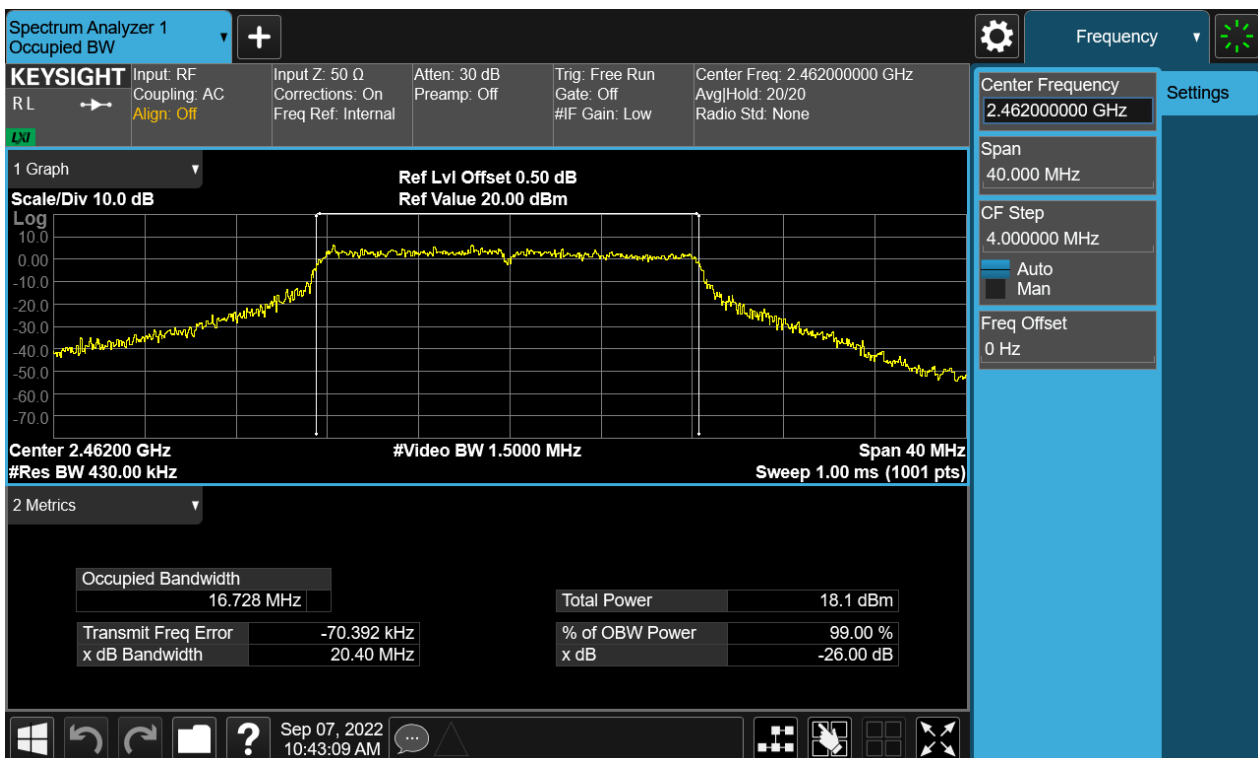


Figure 12: The plots of 99% Bandwidth, 802.11g, 2462MHz



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Figure 13: The plots of 6dB Bandwidth, 802.11n(HT20), 2412MHz

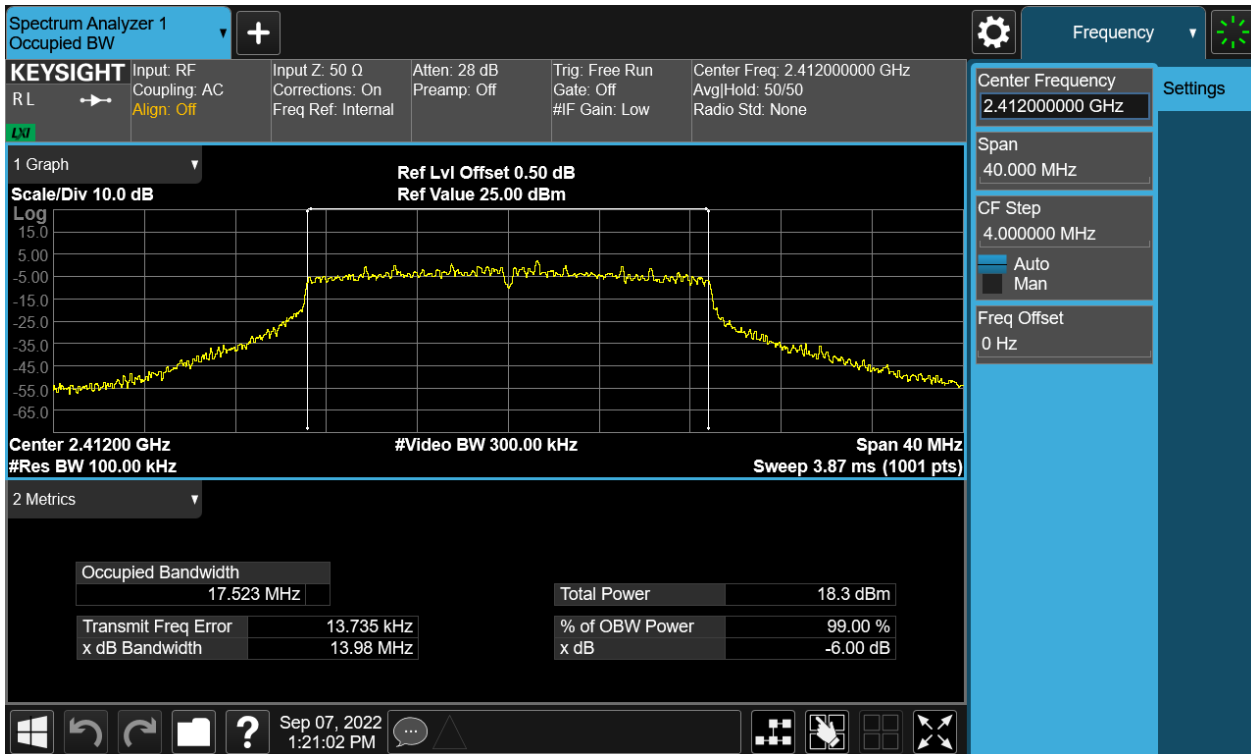


Figure 14: The plots of 99% Bandwidth, 802.11n(HT20), 2412MHz



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Figure 15: The plots of 6dB Bandwidth, 802.11n(HT20), 2437MHz

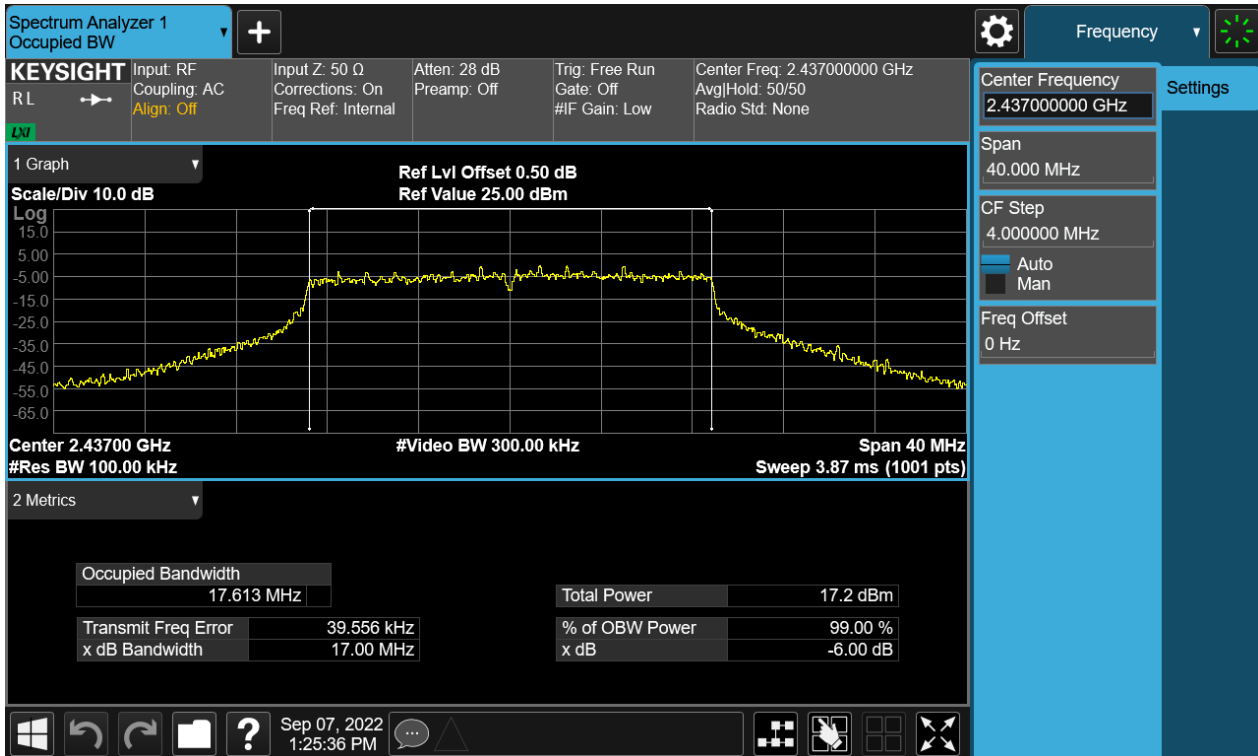
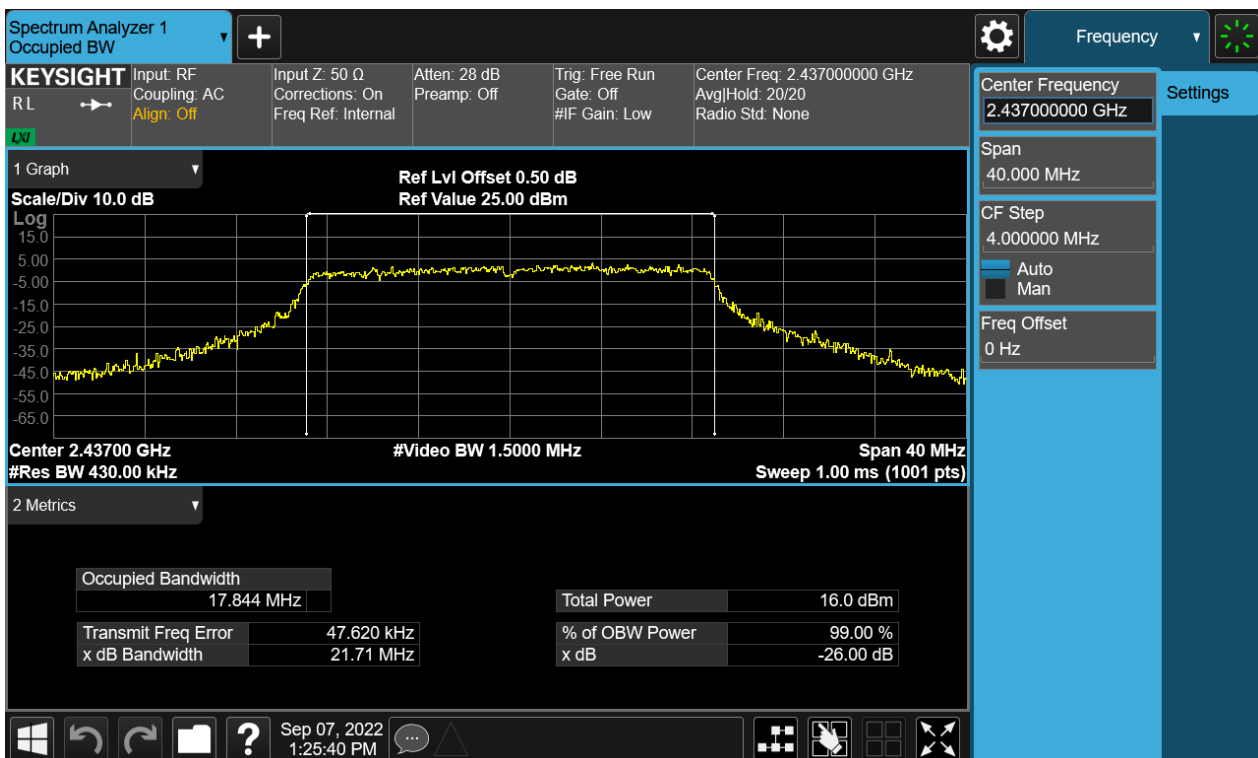


Figure 16: The plots of 99% Bandwidth, 802.11n(HT20), 2437MHz



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Figure 17: The plots of 6dB Bandwidth, 802.11n(HT20), 2462MHz

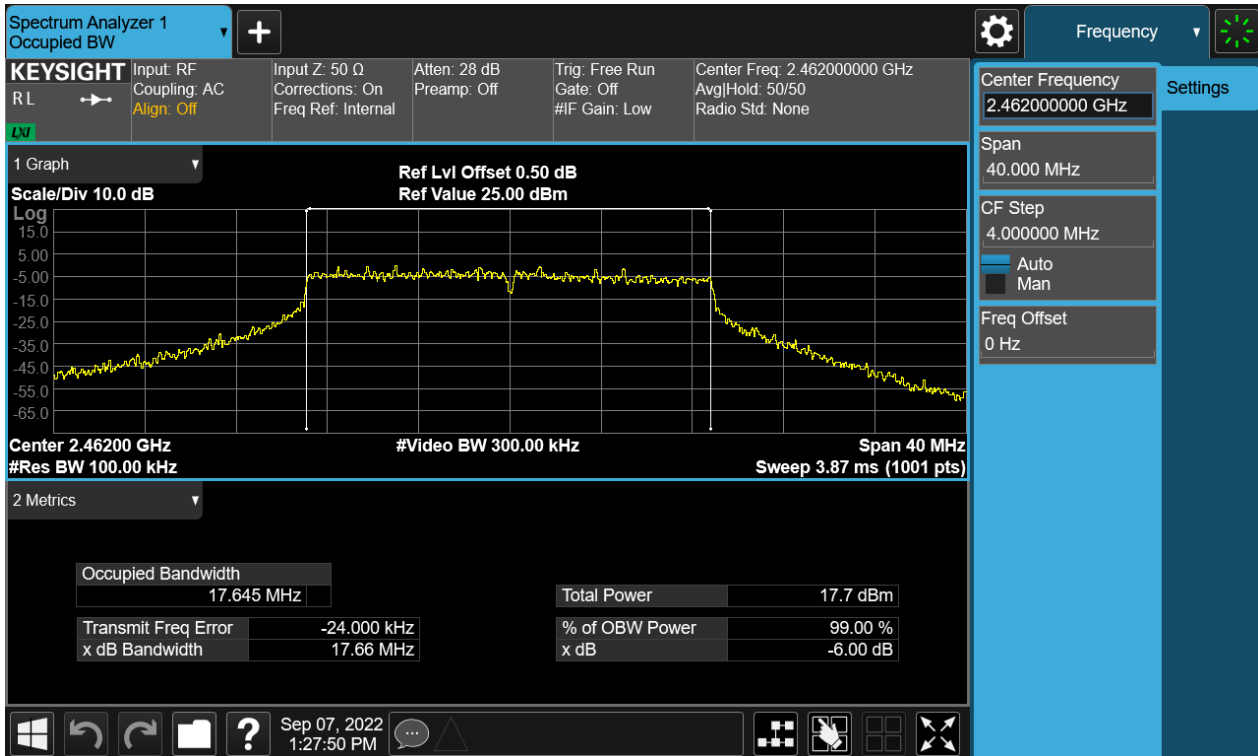


Figure 18: The plots of 99% Bandwidth, 802.11n(HT20), 2462MHz



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Figure 2: The plots of 6dB Bandwidth, 802.11n(HT40), 2422MHz

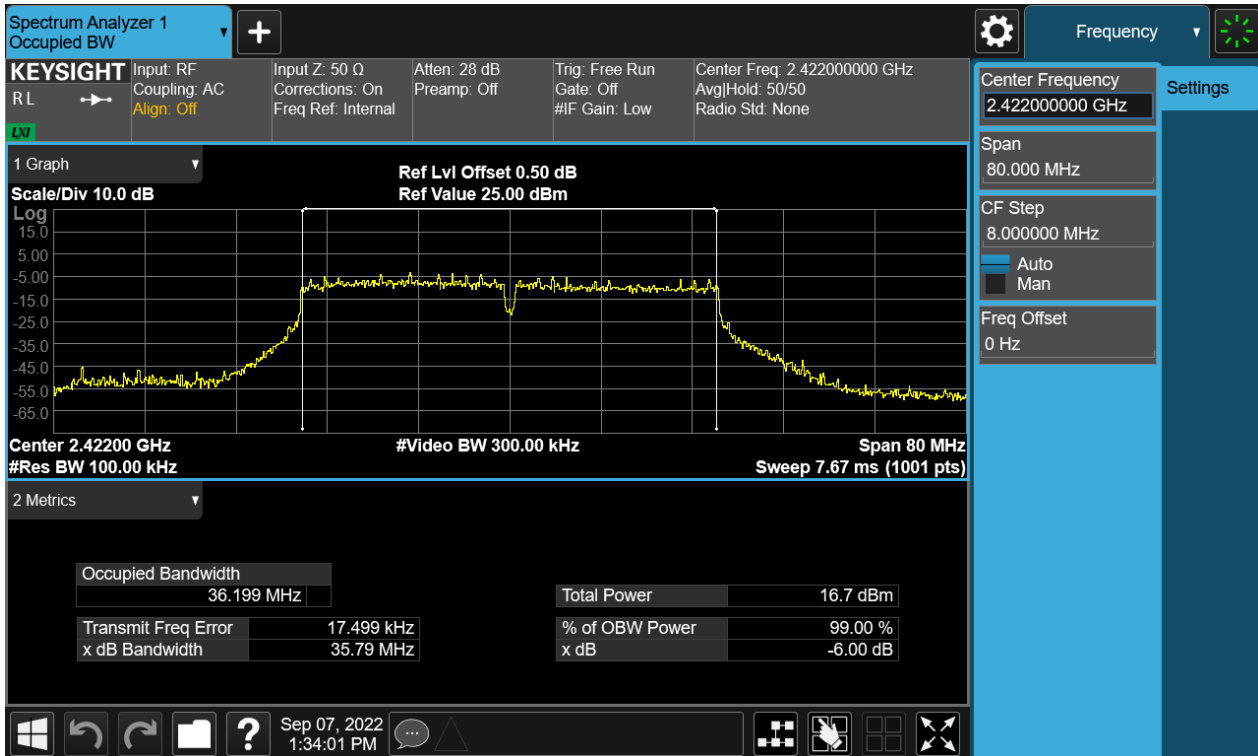
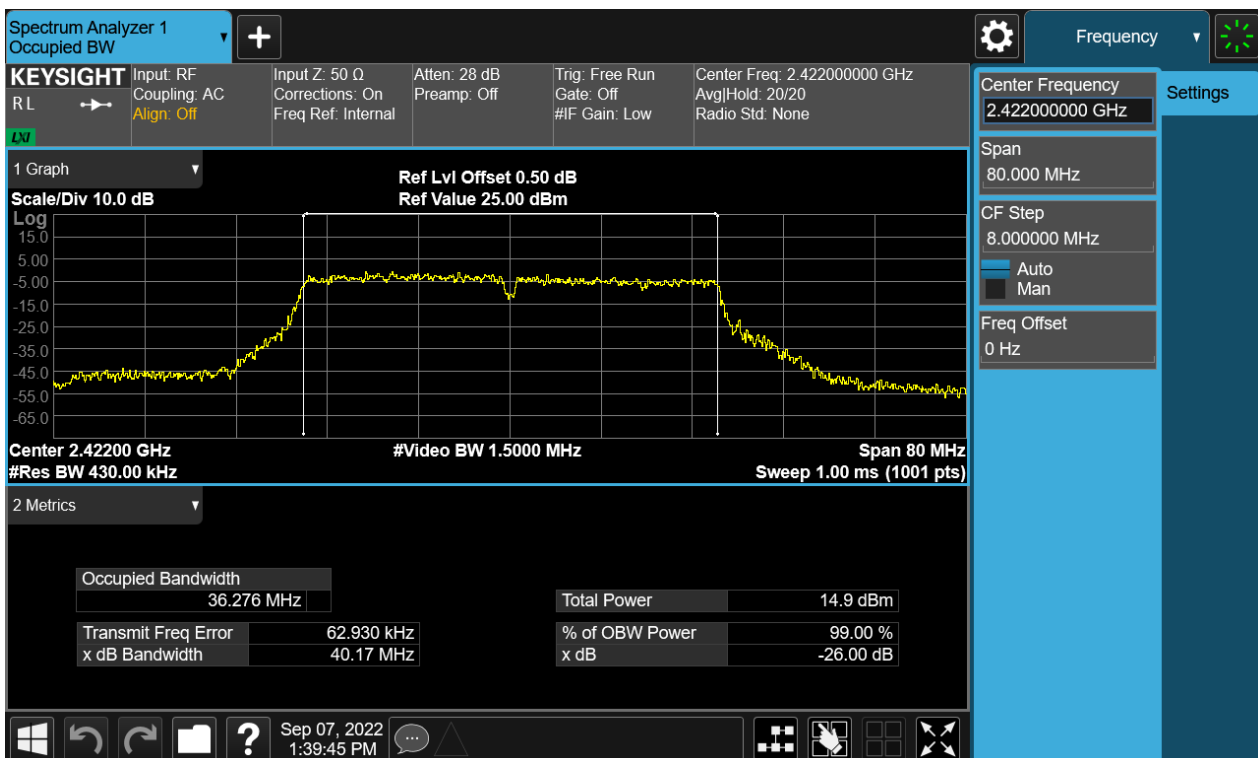


Figure 3: The plots of 99% Bandwidth, 802.11n(HT40), 2422MHz



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Figure 4: The plots of 6dB Bandwidth, 802.11n(HT40), 2437MHz

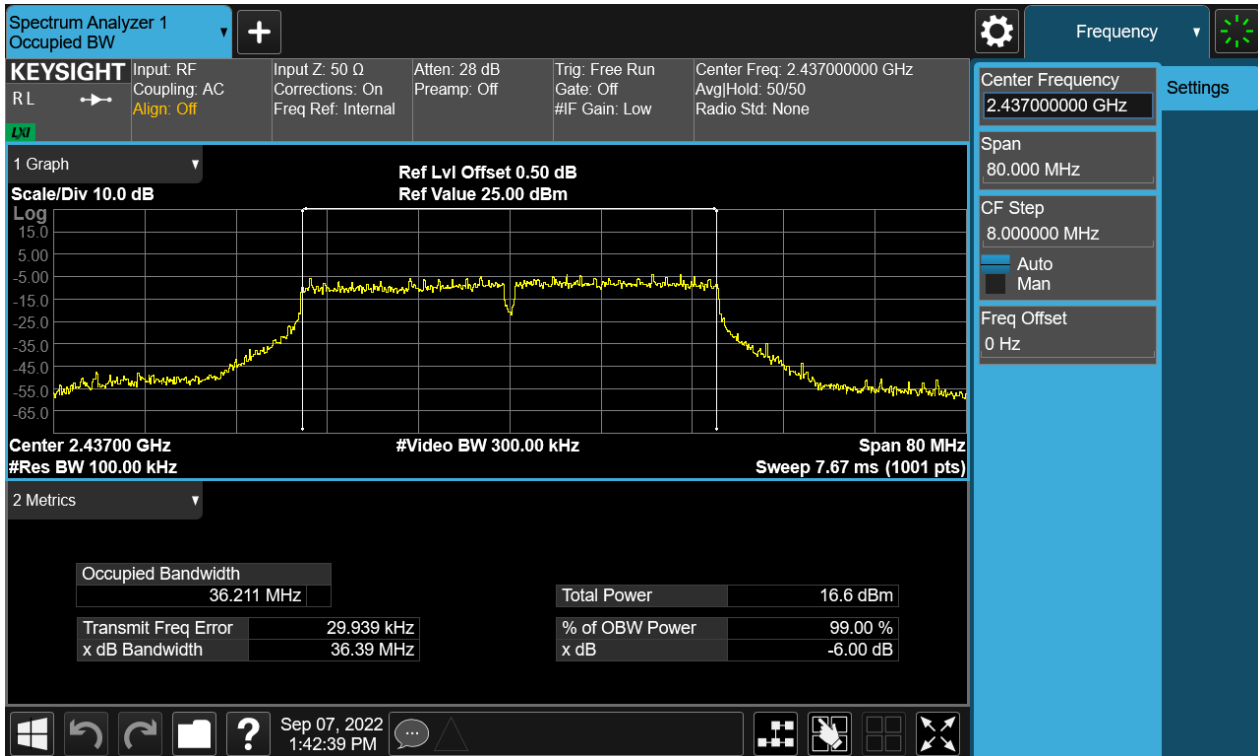
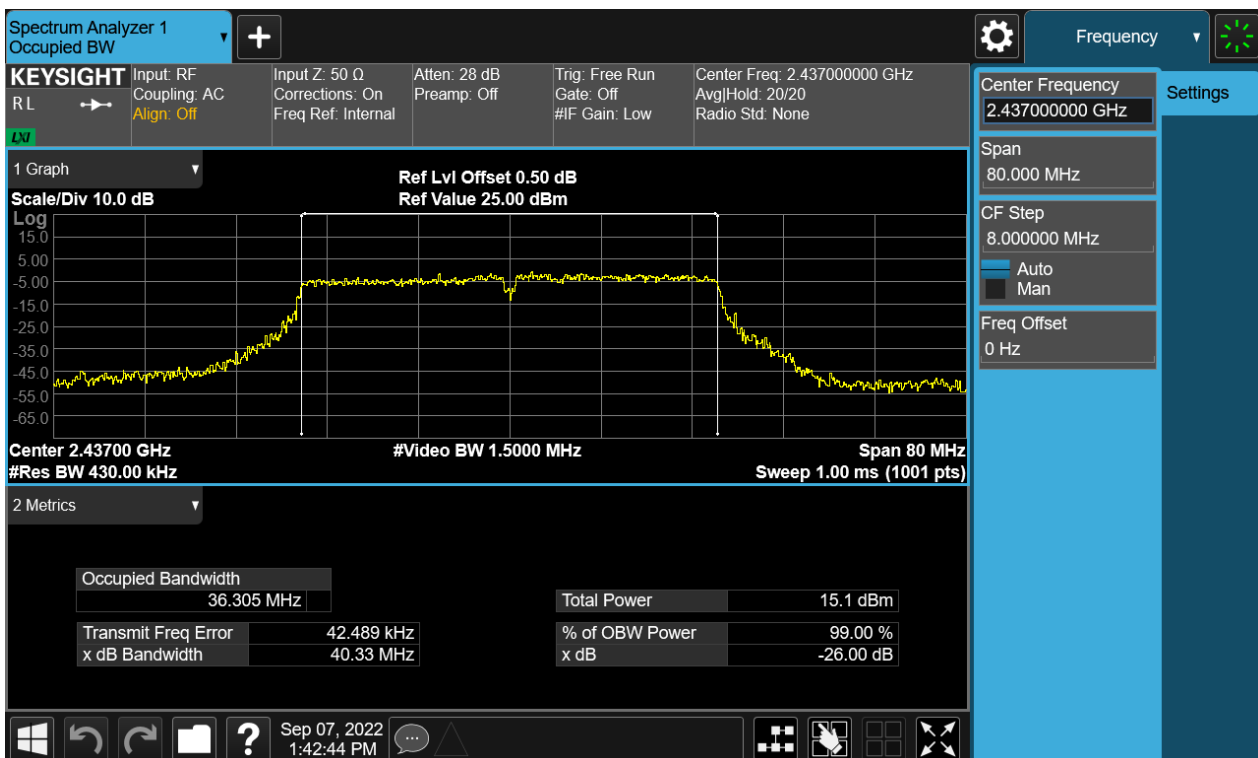


Figure 5: The plots of 99% Bandwidth, 802.11n(HT40), 2437MHz



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Figure 6: The plots of 6dB Bandwidth, 802.11n(HT40), 2452MHz

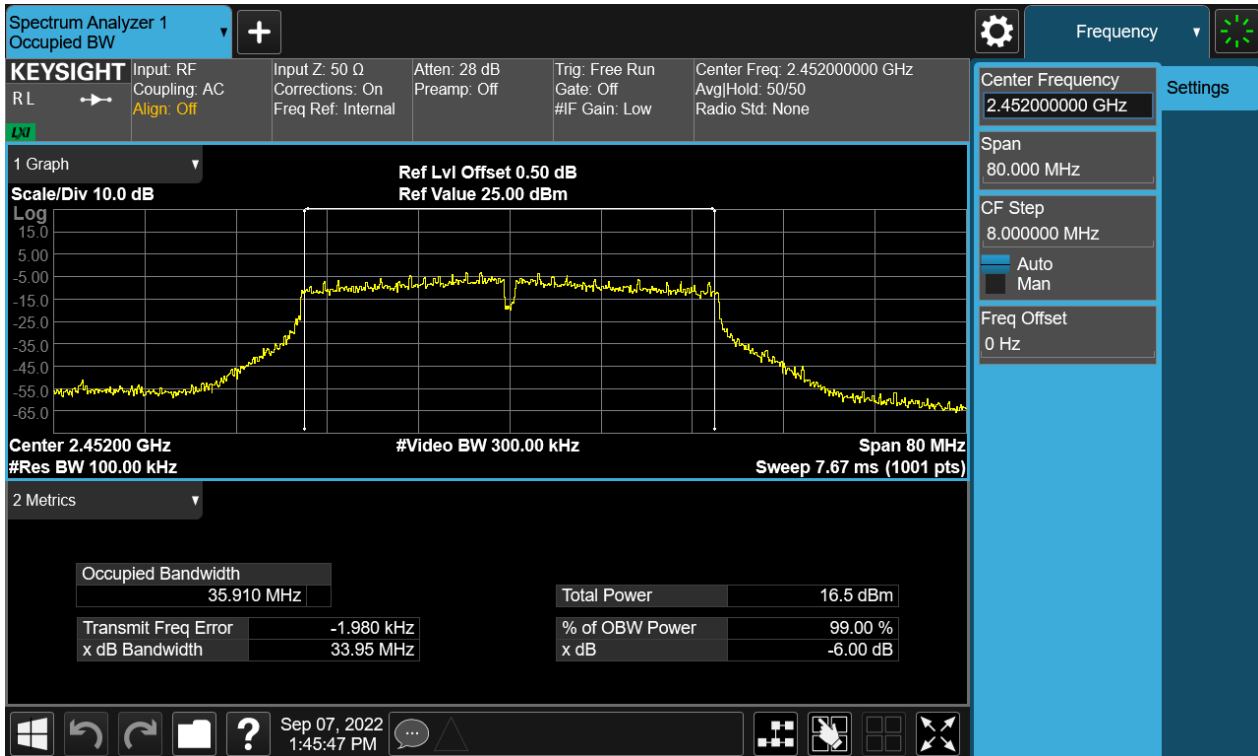
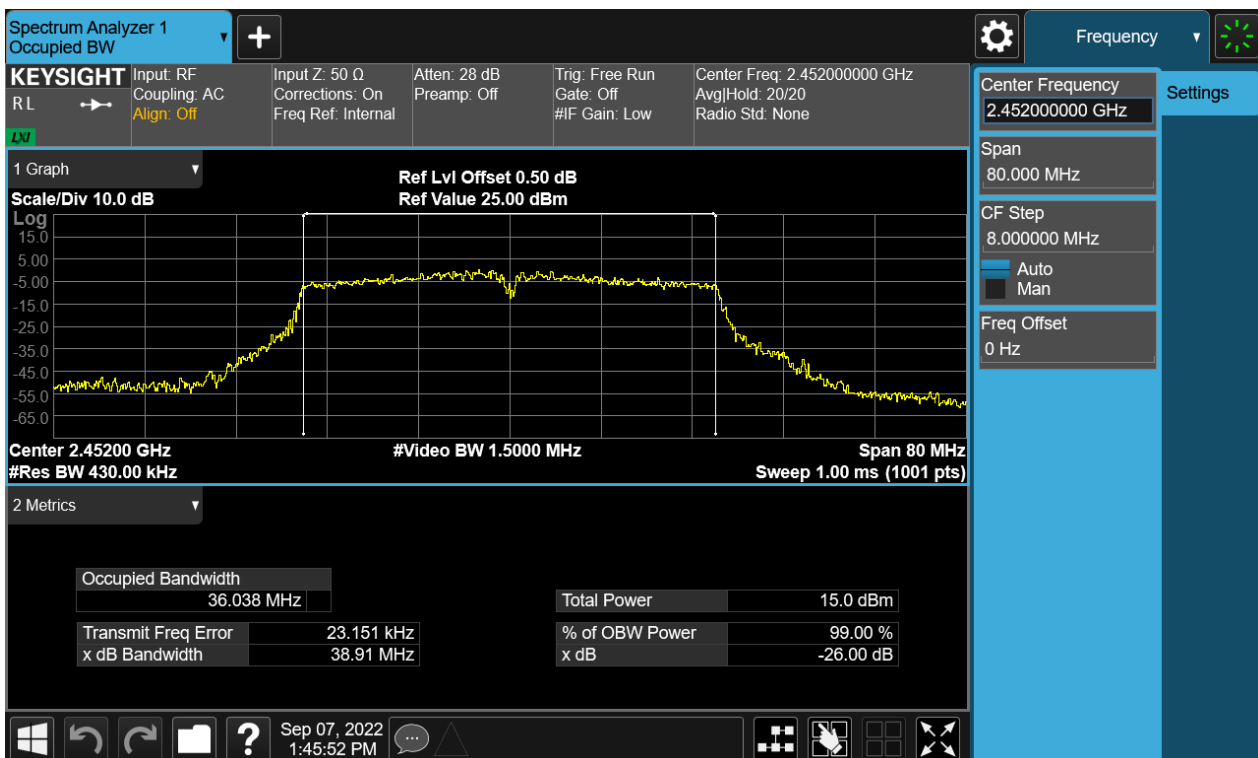


Figure 7: The plots of 99% Bandwidth, 802.11n(HT40), 2452MHz



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4.1.4 Maximum conducted output power spectral density

RESULT:

PASS

Test standard : FCC Part 15.247(e), RSS-247 5.2(b)
 Requirement : ANSI C63.10-2013 clause 11.10.2,
 KDB 558074 clause 8.4
 Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
 Operation Mode : A.1.a
 Ambient temperature : 24.9°C
 Relative humidity : 57%

Table 4: maximum peak conducted output power

Test Mode	Test Channel (MHz)	Maximum peak conducted output power			Limit (dBm/3kHz)
		Chain 1	Chain 2	Total	
		(dBm/3kHz)	(dBm/3kHz)	(dBm/3kHz)	
802.11b	2412	-7.47	-6.15	N/A	7.49
	2437	-7.51	-7.28	N/A	
	2462	-9.26	-3.13	N/A	
802.11g	2412	-11.61	-10.50	N/A	
	2437	-11.49	-11.36	N/A	
	2462	-12.57	-11.03	N/A	
802.11n(HT20)	2412	-12.65	-12.65	-9.64	
	2437	-14.44	-12.99	-10.64	
	2462	-14.28	-12.32	-10.18	
802.11n(HT40)	2422	-18.11	-17.77	-14.93	
	2437	-17.26	-17.70	-14.46	
	2452	-17.41	-17.74	-14.56	

Notes:

1. Directional gain = $G_{ANT} + 10 \log(N_{ANT}) = 6.51$.
2. $P_{Out} = P_{Limit} - (G_{Tx} - 6) = 7.49 \text{ dBm/3KHz}$
3. 802.11b/g support SISO and 802.11n support MIMO.

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Figure 8: The plots of Power Spectral Density, 802.11b, 2412MHz, Chain 1

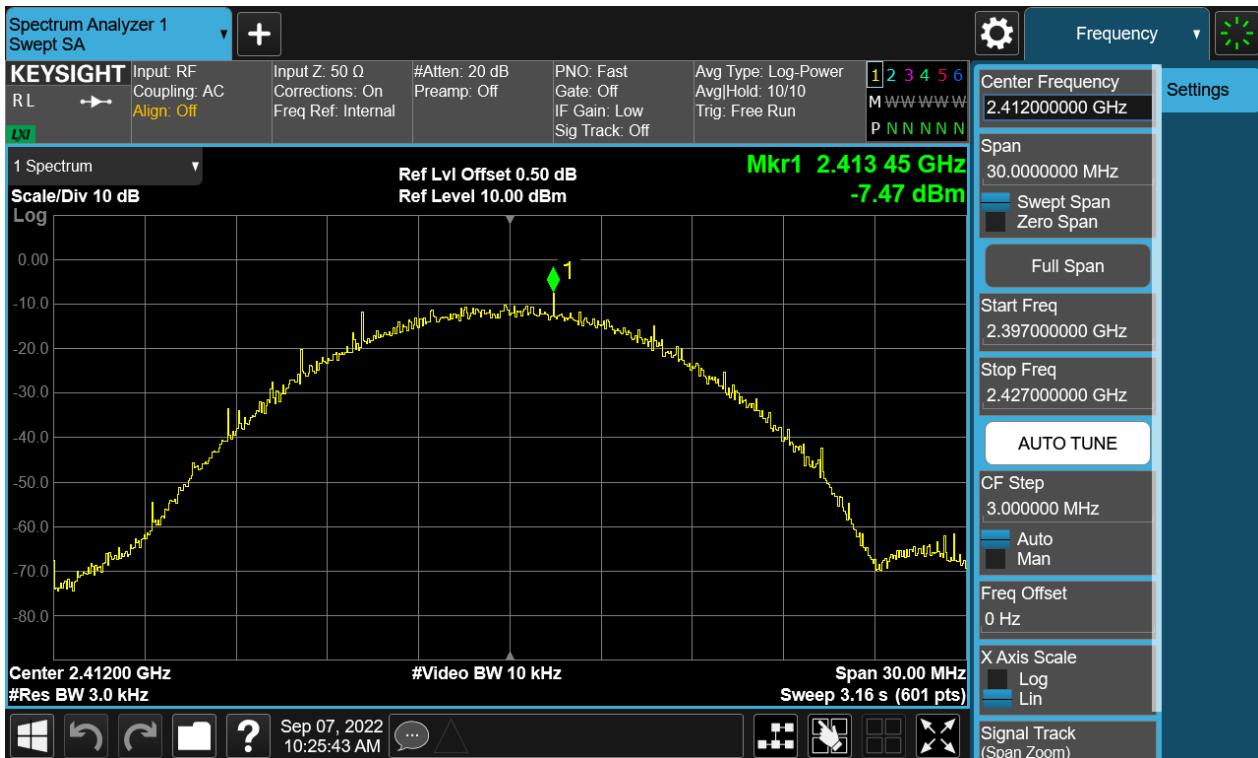


Figure 26: The plots of Power Spectral Density, 802.11b, 2437MHz, Chain 1



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Figure 9: The plots of Power Spectral Density, 802.11b, 2462MHz, Chain 1

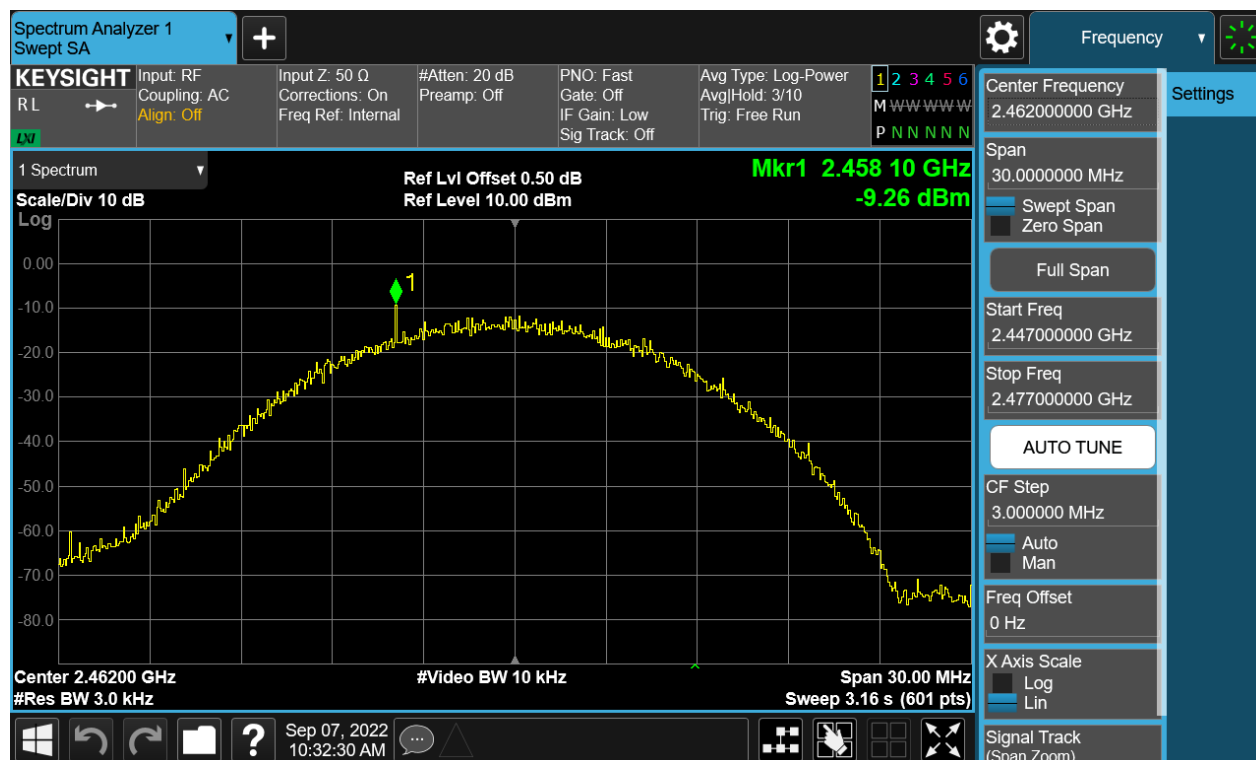
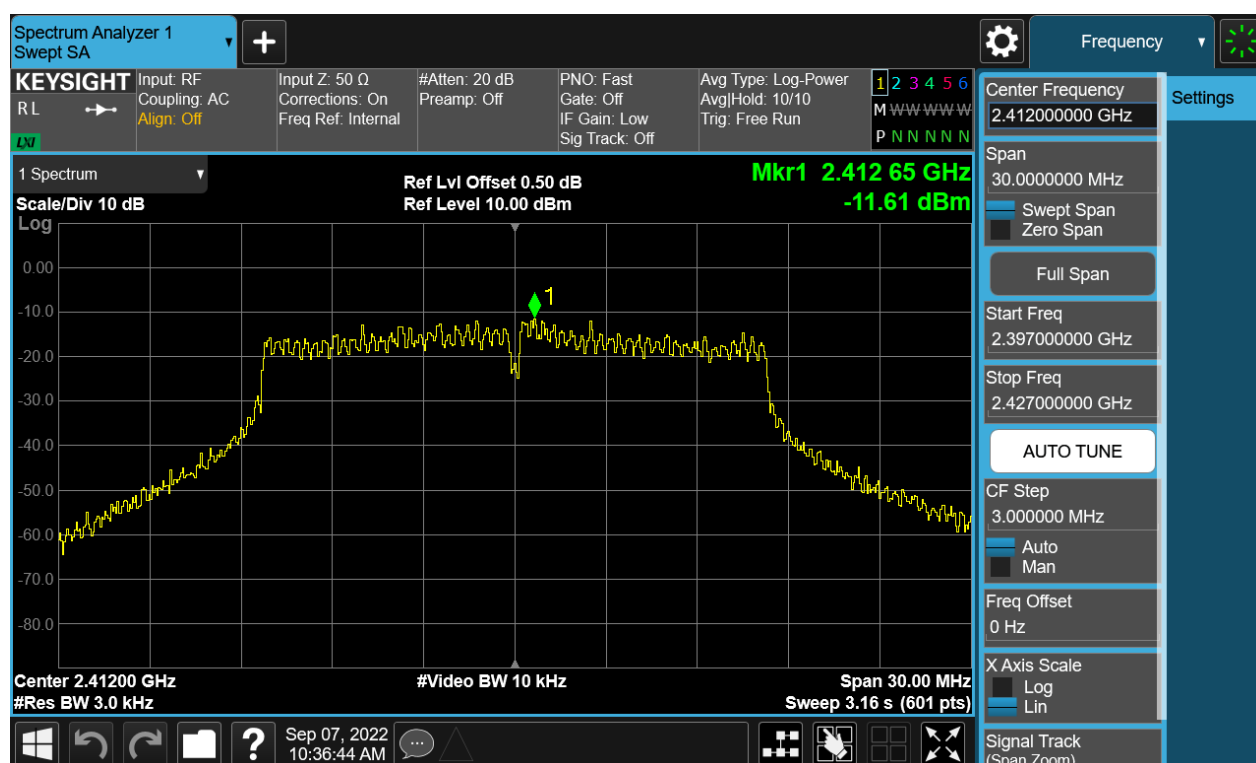


Figure 10: The plots of Power Spectral Density, 802.11g, 2412MHz, Chain 1



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Figure 29: The plots of Power Spectral Density, 802.11g, 2437MHz, Chain 1

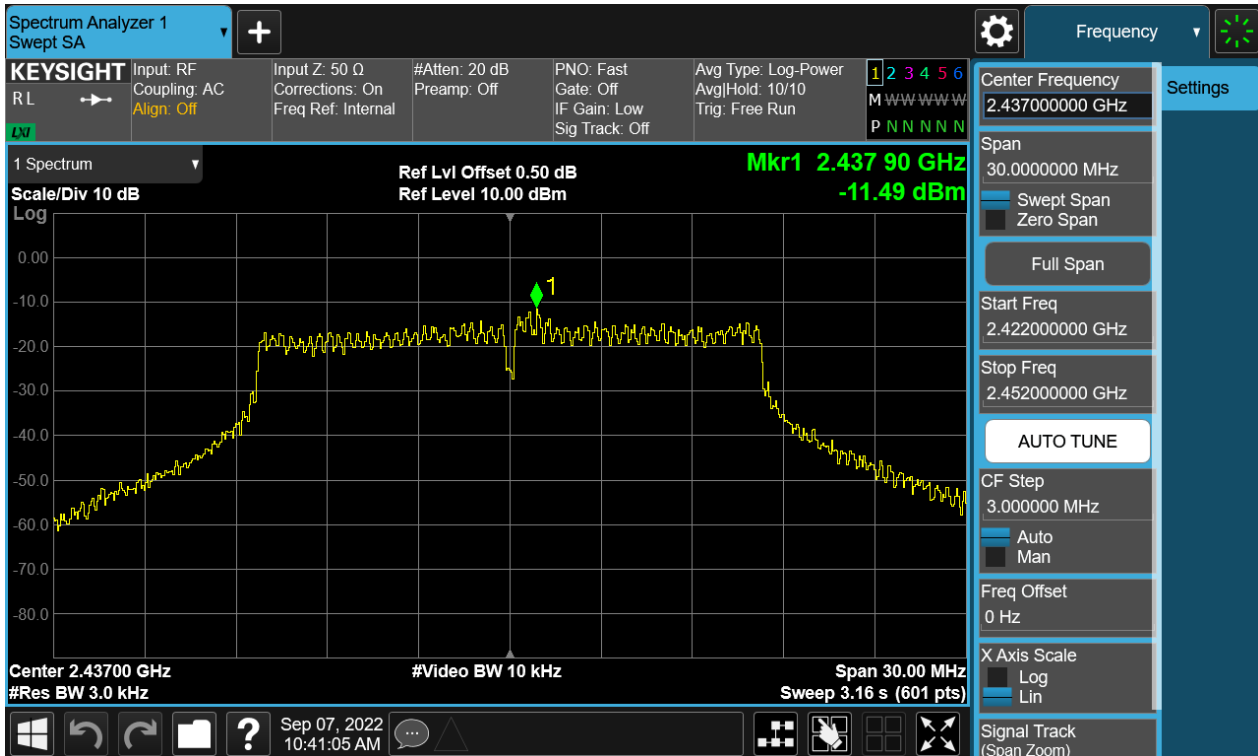
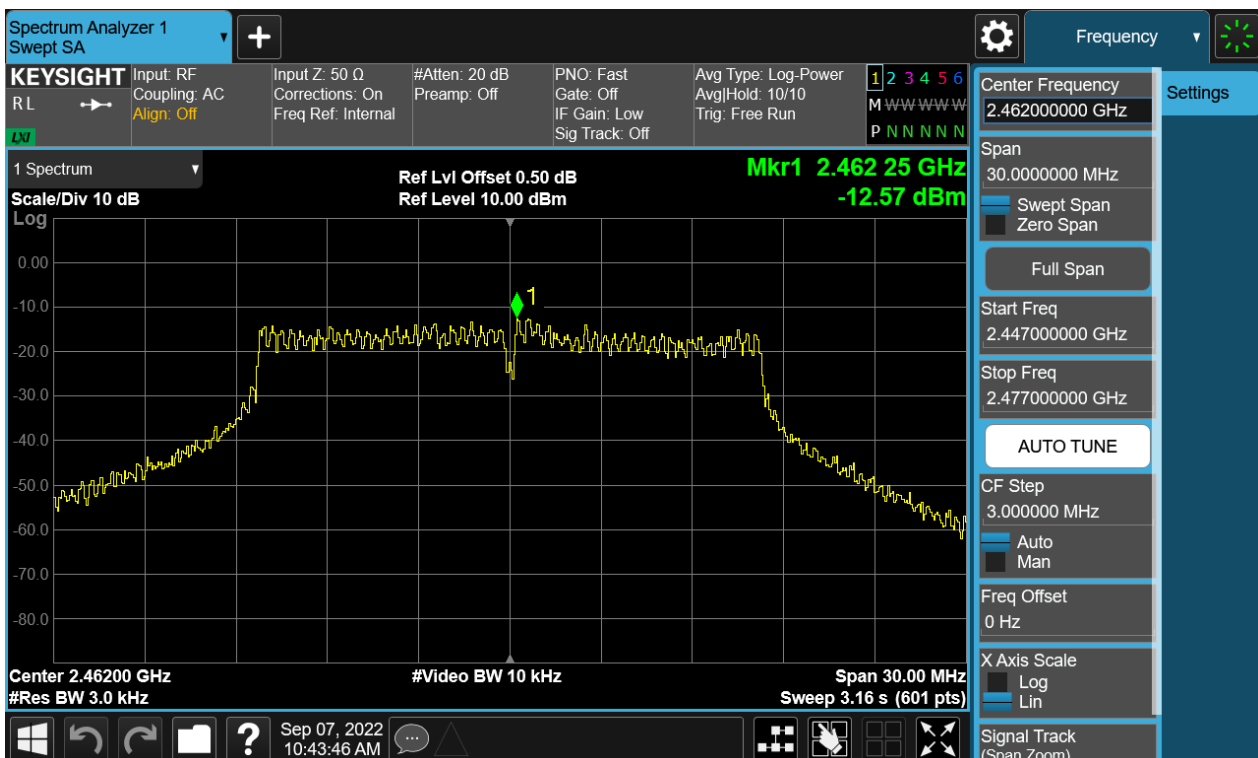


Figure 30: The plots of Power Spectral Density, 802.11g, 2462MHz, Chain 1



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Figure 31: The plots of Power Spectral Density, 802.11n(HT20), 2412MHz, Chain 1

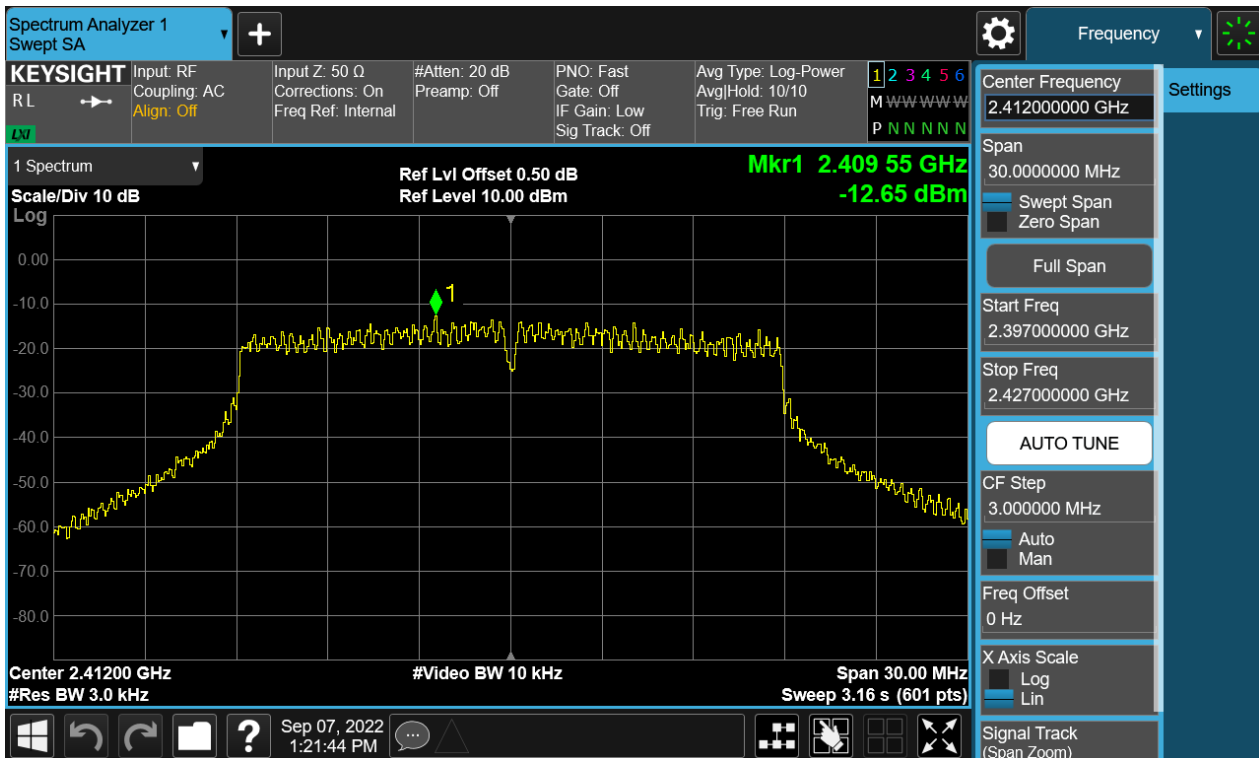
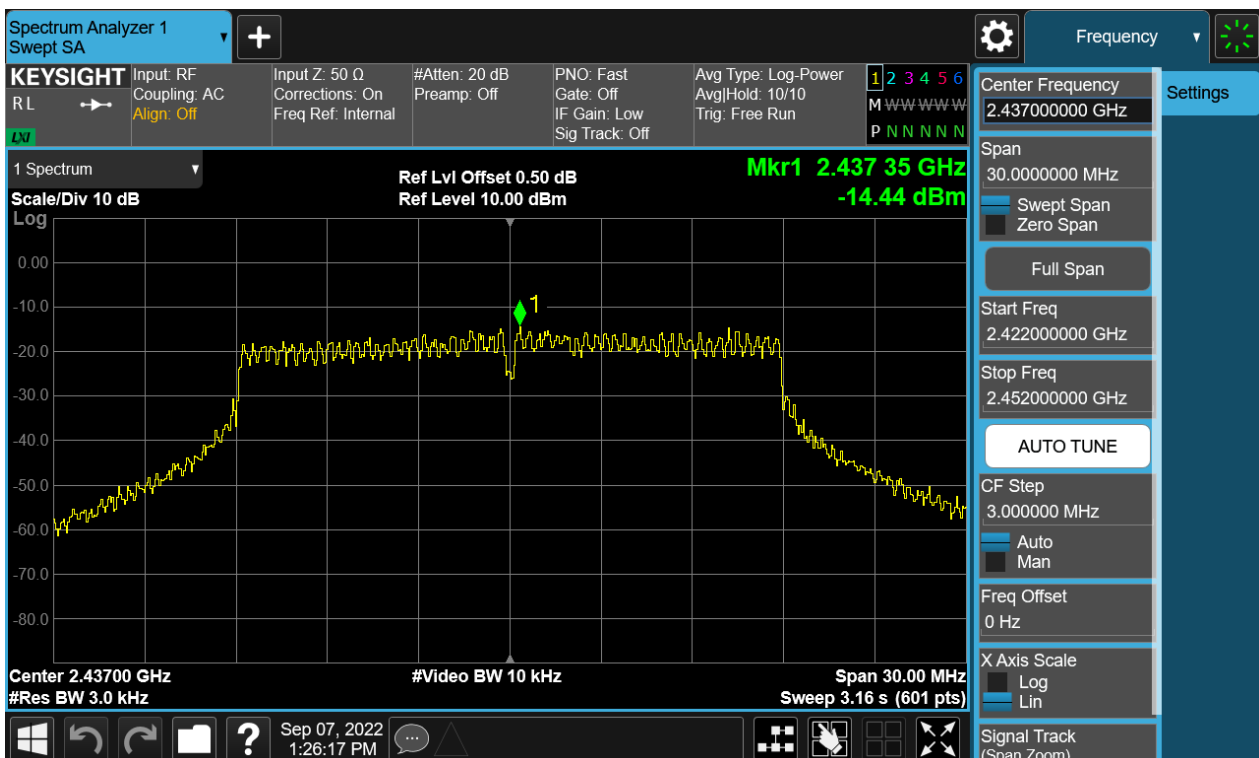


Figure 32: The plots of Power Spectral Density, 802.11n(HT20), 2437MHz, Chain 1



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Figure 33: The plots of Power Spectral Density, 802.11n(HT20), 2462MHz, Chain 1

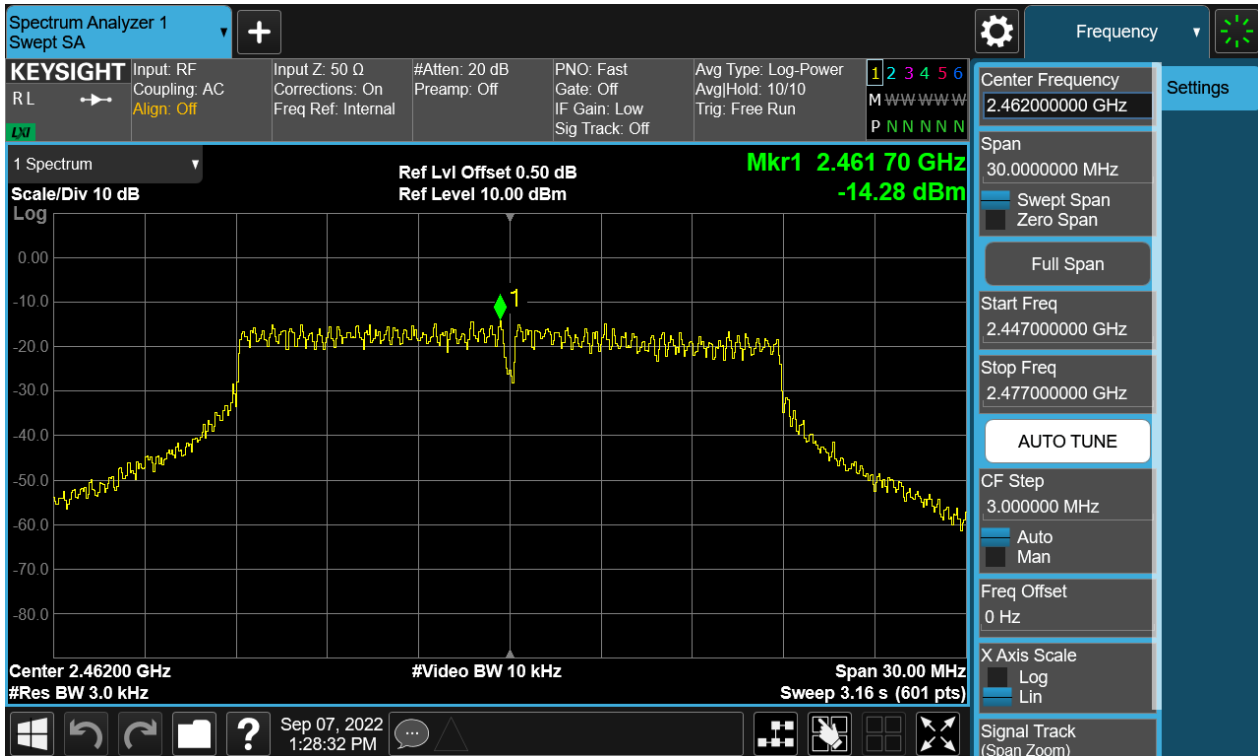
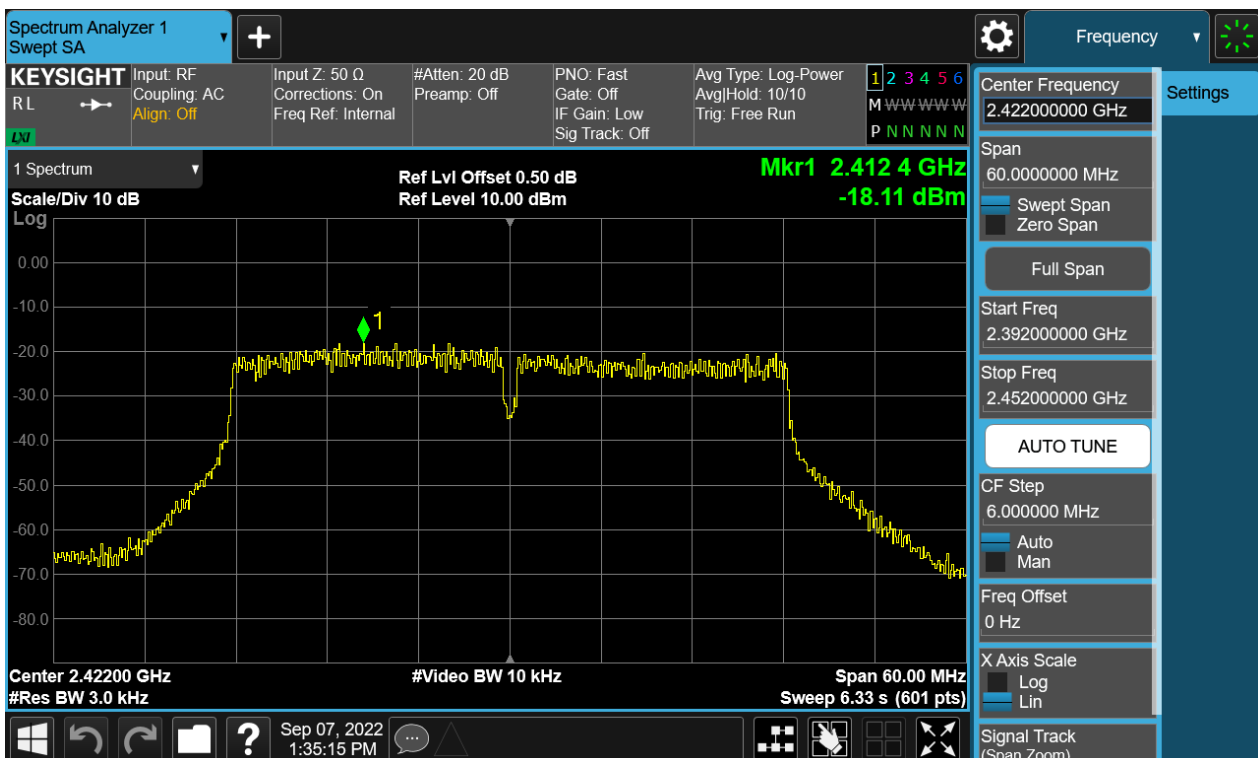


Figure 34: The plots of Power Spectral Density, 802.11n(HT40), 2422MHz, Chain 1



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Figure 115: The plots of Power Spectral Density, 802.11n(HT40), 2437MHz, Chain 1

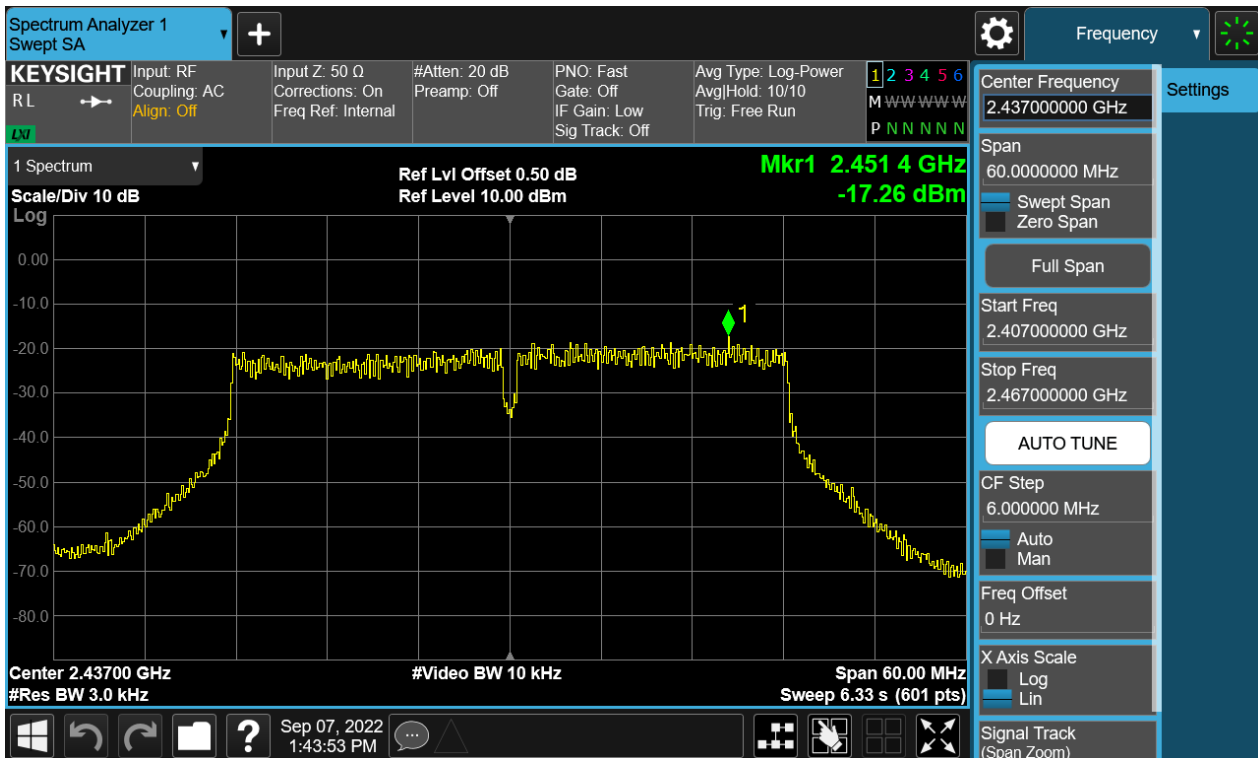
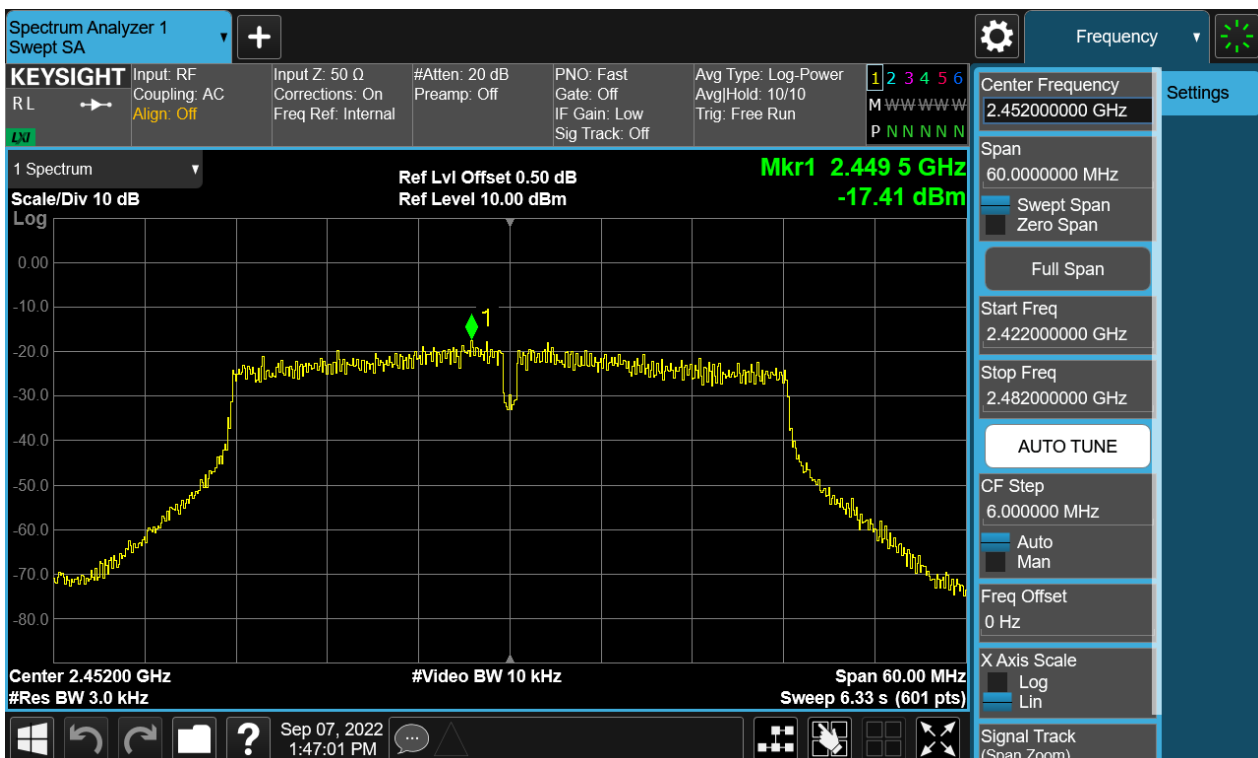


Figure 36: The plots of Power Spectral Density, 802.11n(HT40), 2452MHz, Chain 1



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Figure 37: The plots of Power Spectral Density, 802.11b, 2412MHz, Chain 2



Figure 38: The plots of Power Spectral Density, 802.11b, 2437MHz, Chain 2



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Figure 39: The plots of Power Spectral Density, 802.11b, 2462MHz, Chain 2

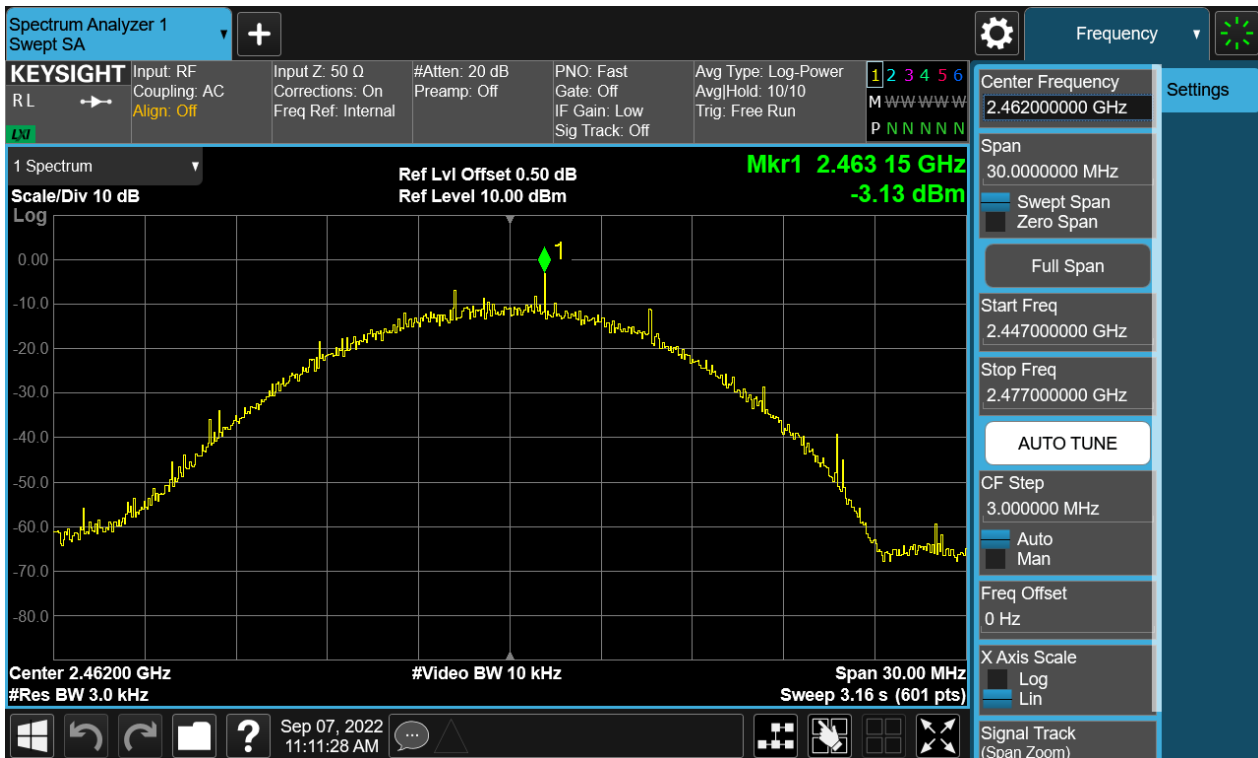
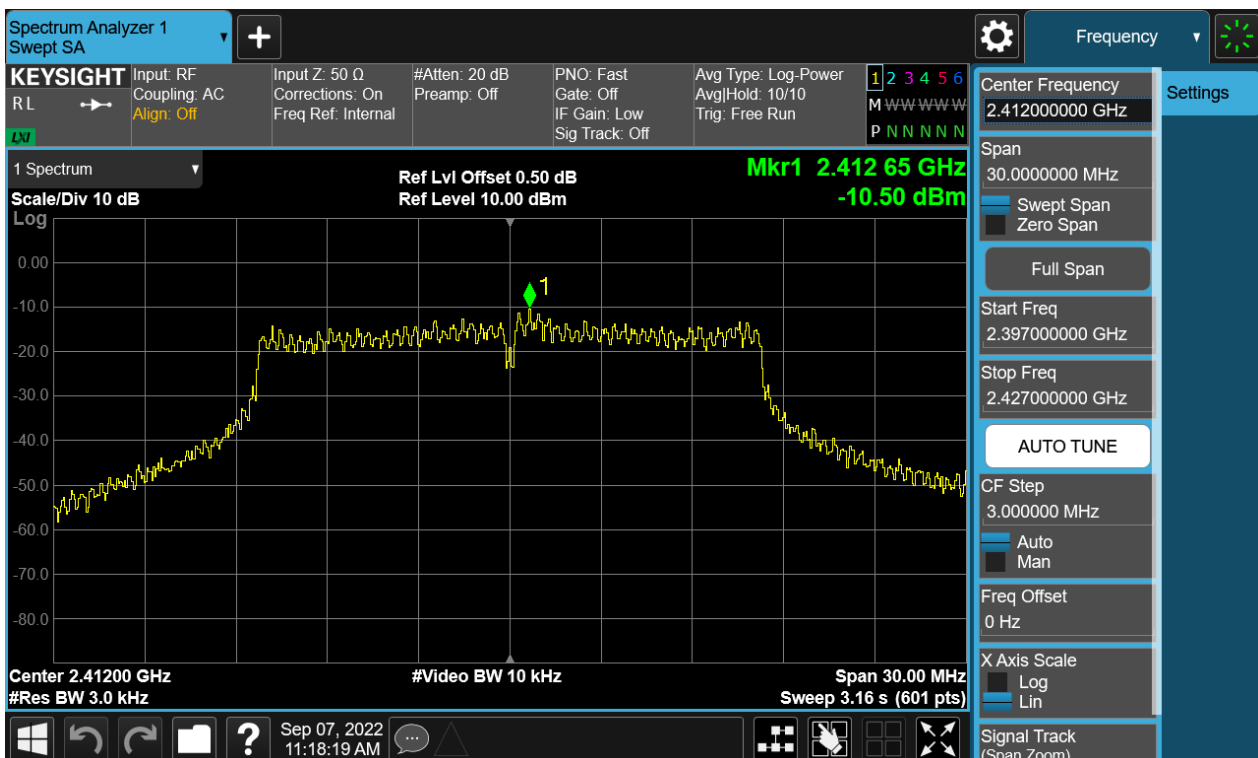


Figure 40: The plots of Power Spectral Density, 802.11g, 2412MHz, Chain 2



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Figure 41: The plots of Power Spectral Density, 802.11g, 2437MHz, Chain 2

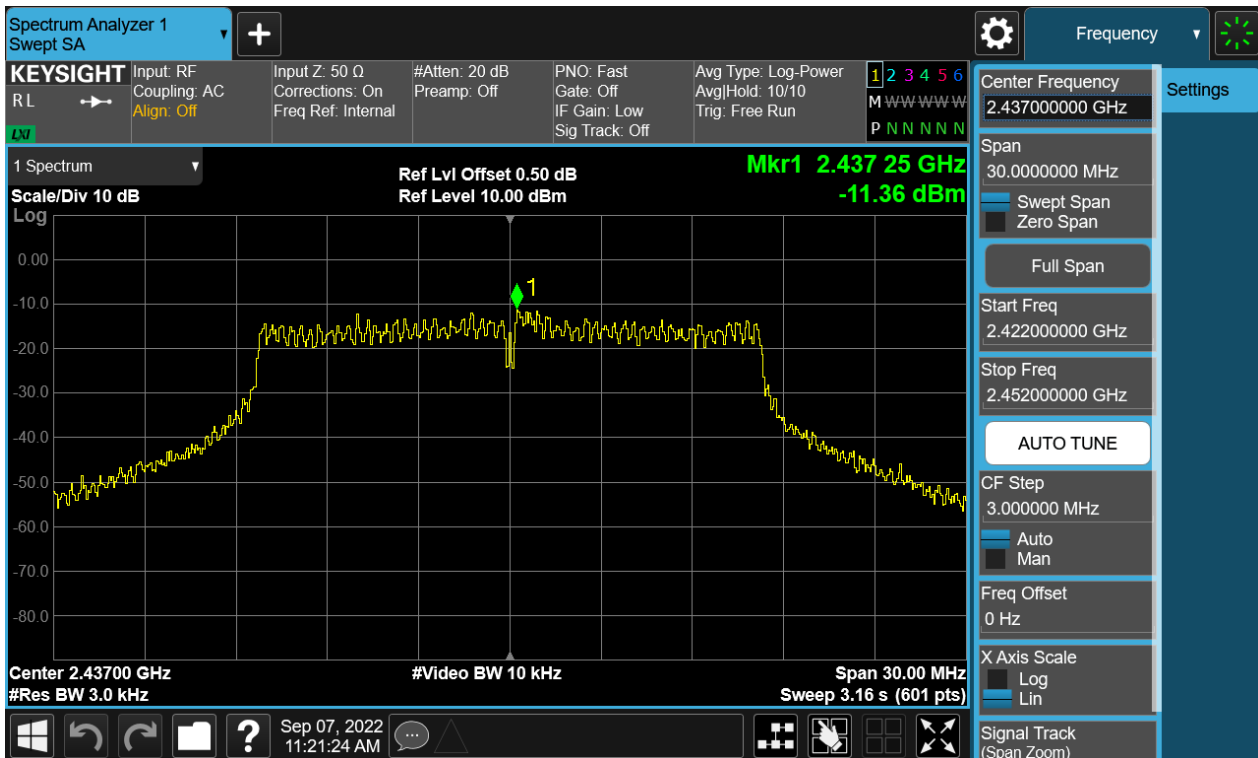
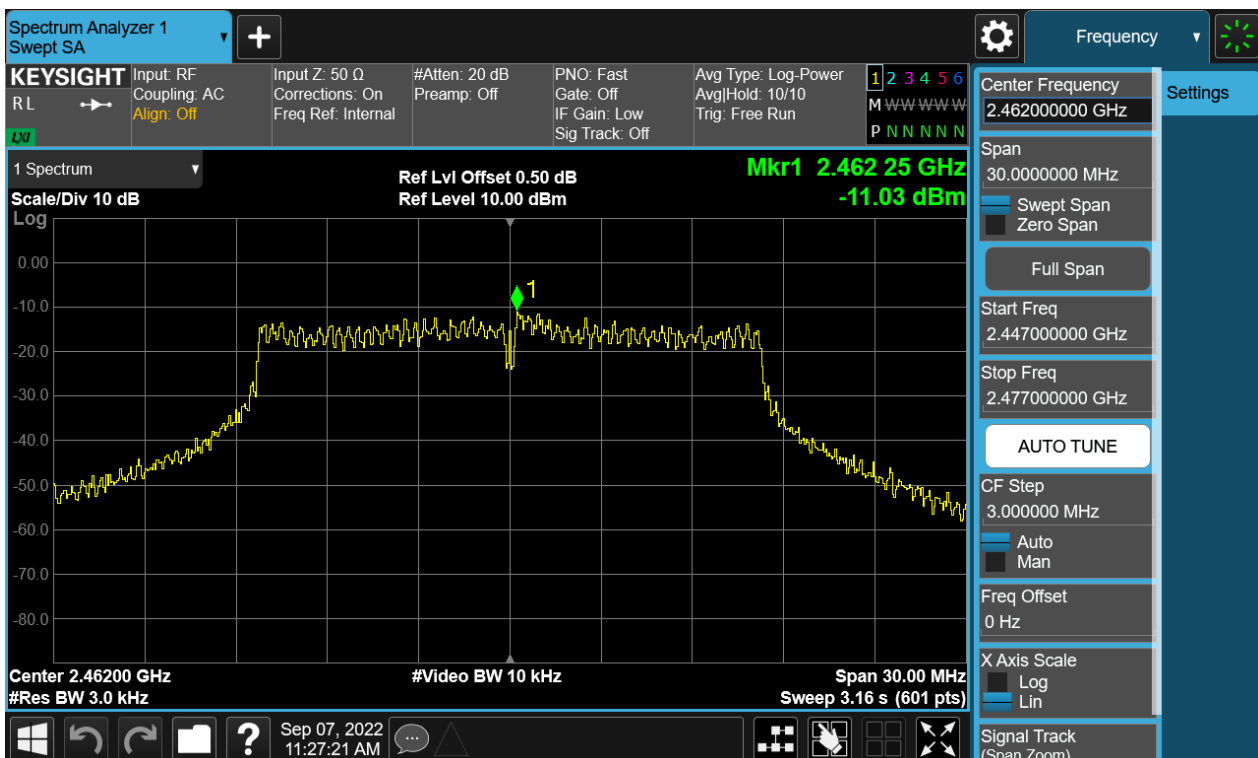


Figure 42: The plots of Power Spectral Density, 802.11g, 2462MHz, Chain 2



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Figure 43: The plots of Power Spectral Density, 802.11n(HT20), 2412MHz, Chain 2

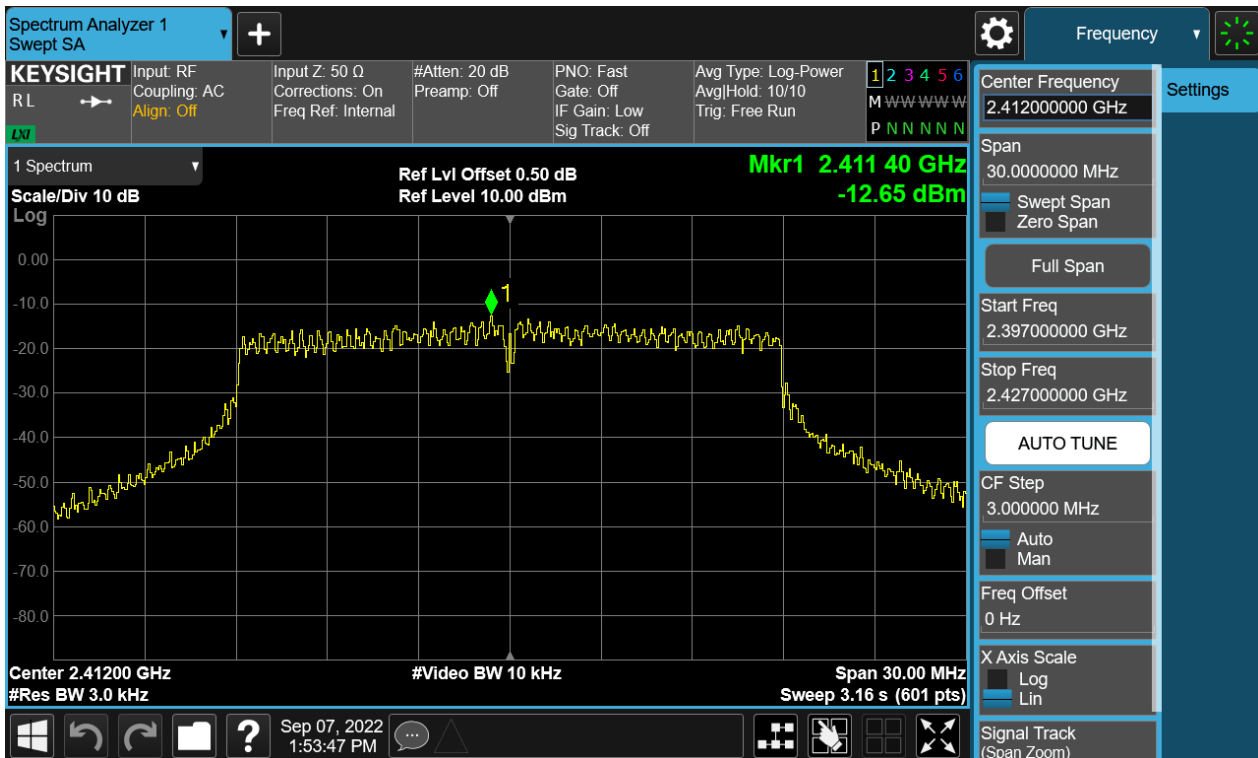
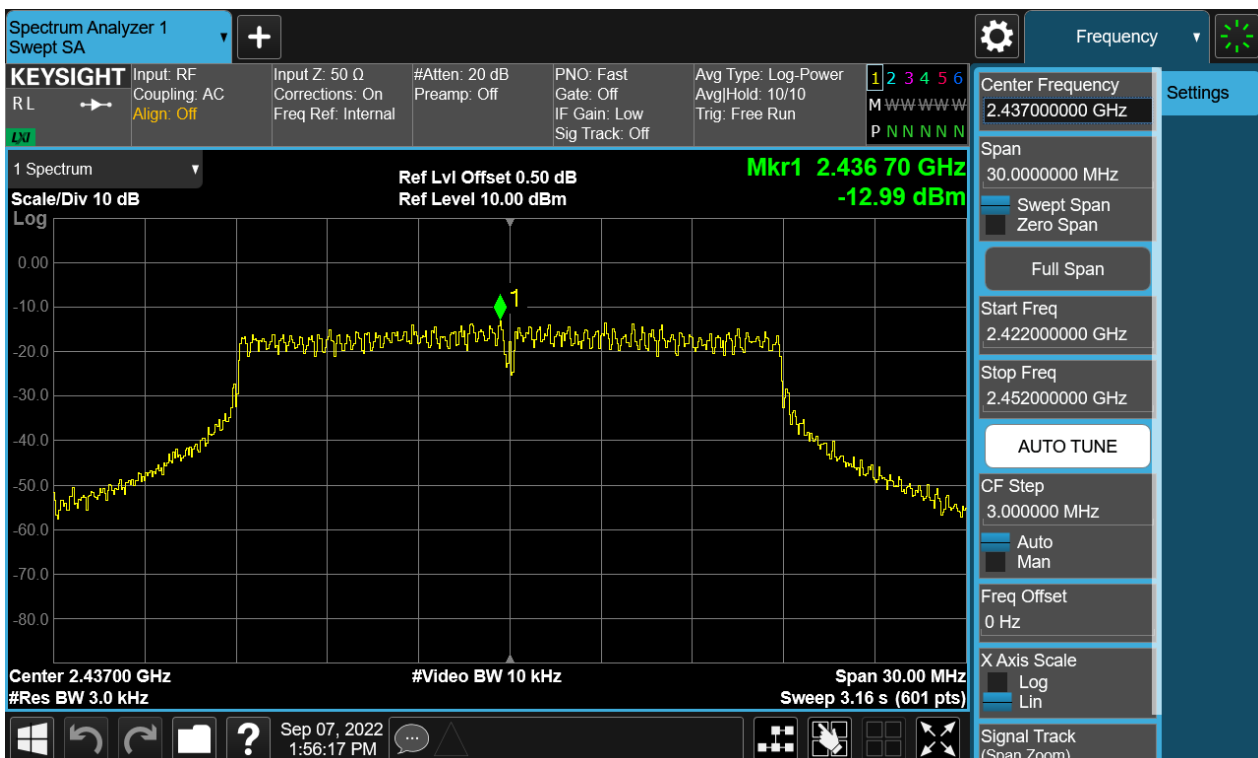


Figure 44: The plots of Power Spectral Density, 802.11n(HT20), 2437MHz, Chain 2



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Figure 45: The plots of Power Spectral Density, 802.11n(HT20), 2462MHz, Chain 2

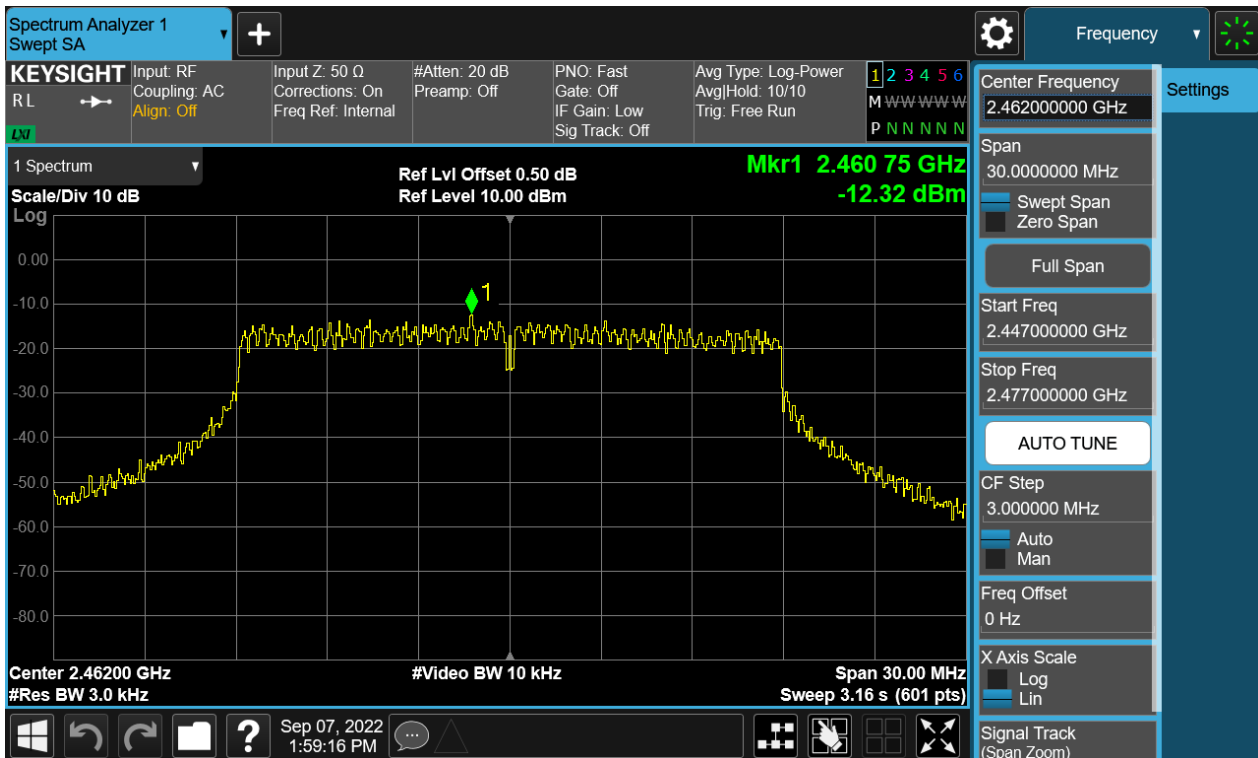
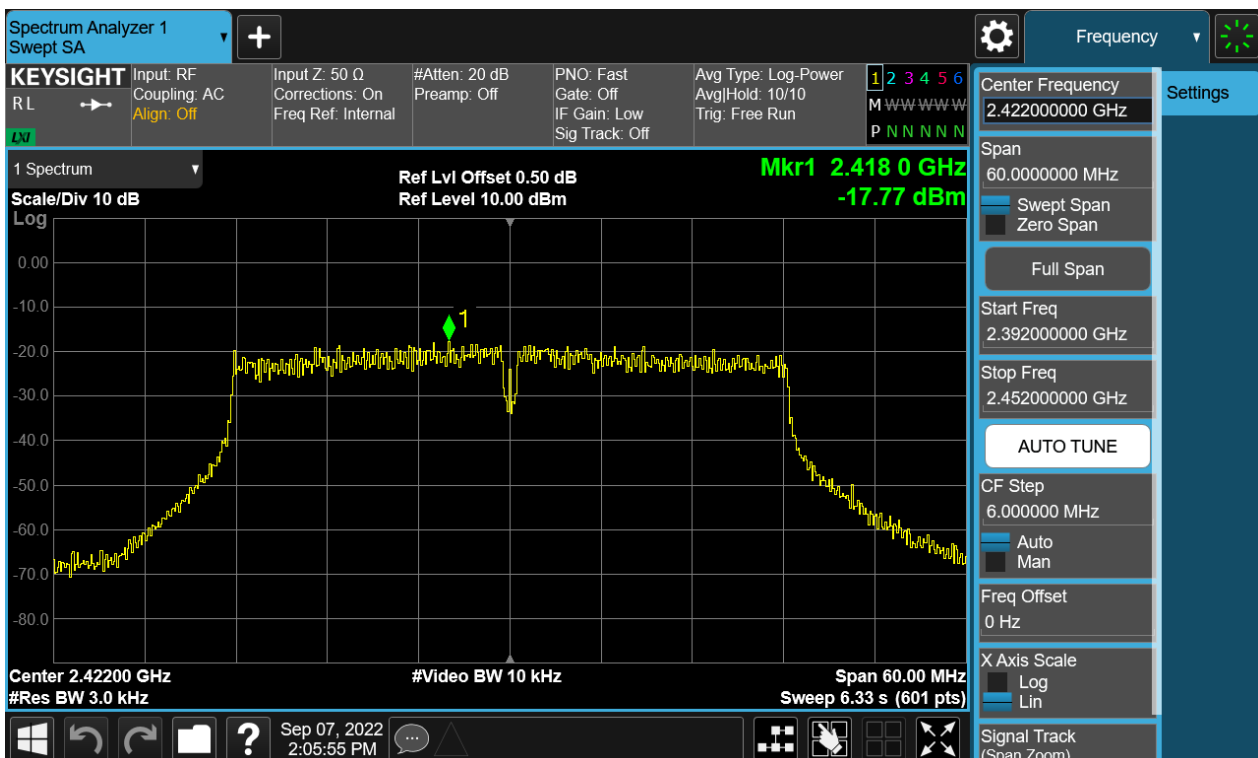


Figure 46: The plots of Power Spectral Density, 802.11n(HT40), 2422MHz, Chain 2



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Figure 47: The plots of Power Spectral Density, 802.11n(HT40), 2437MHz, Chain 2

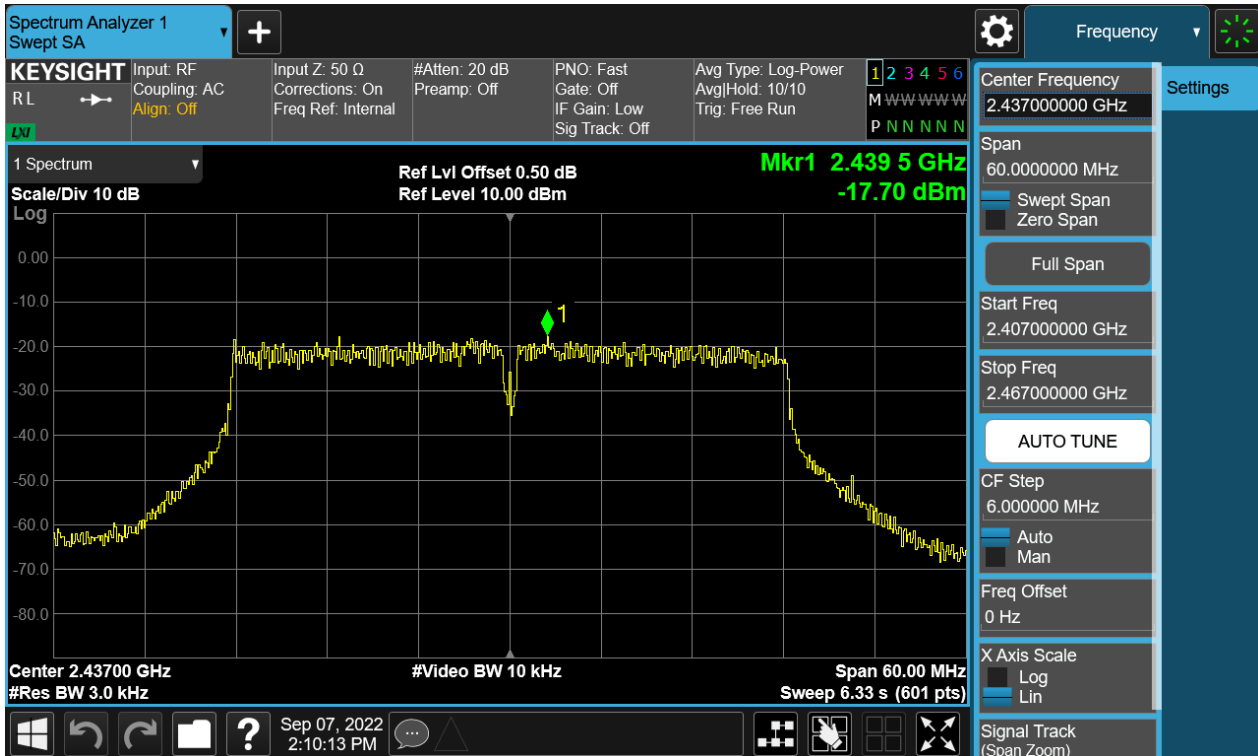
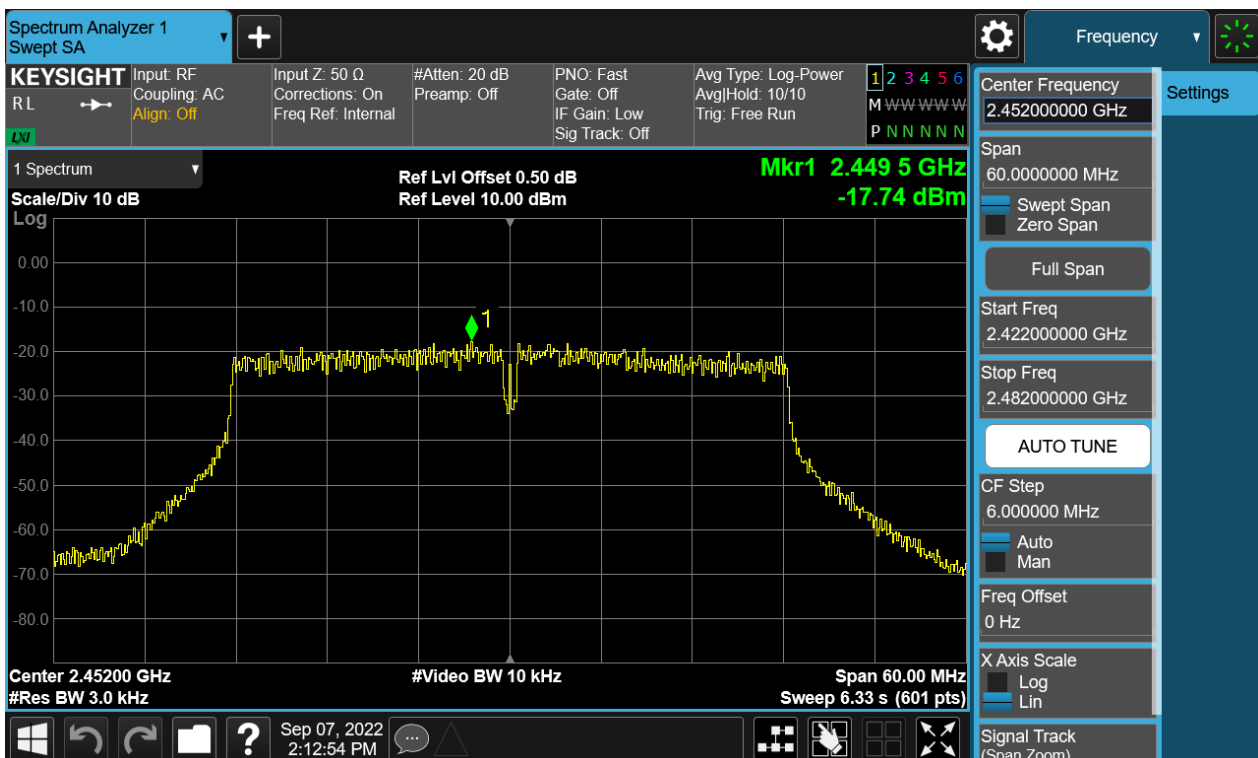


Figure 48: The plots of Power Spectral Density, 802.11n(HT40), 2452MHz, Chain 2



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4.1.5 Conducted Spurious Emission & Authorized-band band-edge

RESULT:

PASS

Test standard	: FCC Part 15.247(d), RSS-247 5.5
Requirement	: ANSI C63.10-2013 clause 11.11, KDB 558074 clause 8.5
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	: 24.9°C
Relative humidity	: 57%

Notes

1. Two transmit chains (chain 1 and chain 2) had been tested, the chain 2 was the worst case and record in the test report.
2. The spurious emission at chain 2 is more than 3dB below the limits, so the MIMO results for the spurious emissions are comply with the requirement.

For details refer to following test plot.

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Figure 49: The plots of Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2412MHz Carrier Level

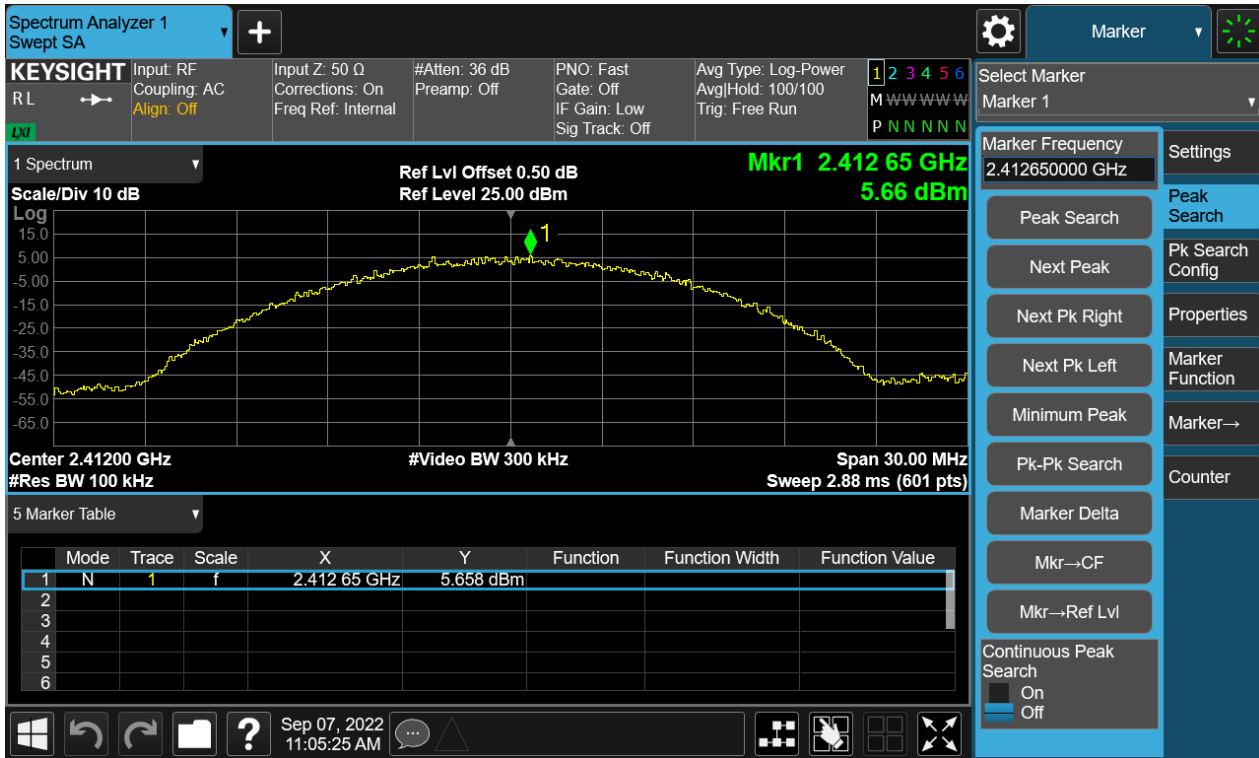


Figure 50: The plots of Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2412MHz Band Edge

