

TEST REPORT

Report No.: SHE21040017-02CE

Date: 2021-05-17

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Applicant : Home Tech Innovation, Inc
Address of Applicant : 1035 Cambridge St, Suite 11A, Cambridge, MA 02141

Product Name : Suvie Kitchen Robot
Model No. : S020M
Sample No. : E21040017-01#01
FCC ID : 2AT2K-S020M

Standards : FCC CFR47 Part 15, Subpart C

Date of Receipt : 2021-04-26
Date of Test : 2021-04-26 ~ 2021-05-17
Date of Issue : 2021-05-17

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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(Jennifer Zhou)

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Oliver Xiang

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Approved by:

Guoyou Chi

(Authorized signatory: Guoyou Chi)

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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

Applicant Company Name	Home Tech Innovation, Inc
Address	1035 Cambridge St, Suite 11A, Cambridge, MA 02141
Contact Person	Kevin Incorvia
Telephone	+1 617 800 5336
Email	kincorvia@suvie.com
Manufacturer Company Name	Home Tech Innovation, Inc
Address	1035 Cambridge St, Suite 11A, Cambridge, MA 02141

1.3 Details of EUT

Product Name	Suvie Kitchen Robot
Brand Name	Suvie
Test Model No.	S020M
FCC ID	2AT2K-S020M
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	3.42dBi
Test Voltage	AC 120V 60Hz
Hardware version	S020M1.0.1
Software version	fw
RF power setting in TEST SW	ESP

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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.
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.

1.5 Test Summary

Test Item	FCC Rules	Result
Antenna Requirement	FCC Part 15.247(b)(4), Part 15.203	PASS
Peak Output Power	FCC Part 15.247(b)(3)	PASS
6dB Bandwidth and 99% Bandwidth	FCC Part 15.247(a)(2)	PASS
Power Spectral Density	FCC Part 15.247(e)	PASS
Conducted Spurious Emission & Authorized-band band-edge	FCC Part 15.247(d)	PASS
Radiated Spurious Emission	FCC Part 15.247(d), 15.205, 15.209	PASS
Band Edge (Restricted-band band-edge)	FCC Part 15.247(d), 15.205, 15.209	PASS
Conducted Emission on AC Mains	FCC Part 15.207(a)	PASS

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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.Date	Cal. Due Date
Spectrum Analyzer	Keysight	N9020B	MY59260184	2020-08-19	2021-08-18
Spectrum Analyzer	Rohde & Schwarz	FSV40N	101450	2020-06-09	2021-06-08
EMI Test Receiver	Rohde & Schwarz	ESPI3	100173	2020-06-09	2021-06-08
EMI Test Receiver	Rohde & Schwarz	ESR 7	101911	2020-06-09	2021-06-08
V-network	SCHWARZBECK	NSLK 8127	8127-902	2020-07-29	2021-07-28
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	100687	2020-08-19	2021-08-18
Broadband Antenna	SCHWARZBECK	VULB9163	9163-1037	2020-06-09	2021-06-08
Horn Antenna-18G	SCHWARZBECK	BBHA9120D	9120D-1775	2020-07-29	2021-07-28
Loop Antenna	SCHWARZBECK	FMZB 1513	N/A	2020-11-23	2021-11-22
Horn Antenna-40G	YINGLIAN	LB-180400-KF	N/A	2020-07-27	2021-07-26
EMC chamber 9*6*6 (L*W*H)	CHANGNING	966	N/A	2020-06-09	2023-06-08
Shielded Enclosure 8*5*4 (L*W*H)	CHANGNING	854	N/A	2020-06-09	2021-06-08
Test Software	BL	BL410_E	N/A	N/A	N/A
Test Software	BL	BL410_R	N/A	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	± 3.42 dB
	> 1GHz	± 4.20 dB
Conducted Emission on AC Mains	9 kHz to 30 MHz	± 1.96 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	1Mbps
802.11g	6Mbps
802.11n(20M)	MCS0
802.11n(40M)	MCS0

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

3.3 Support Software

Description	Manufacturer	Software Name
Software	N/A	ESP

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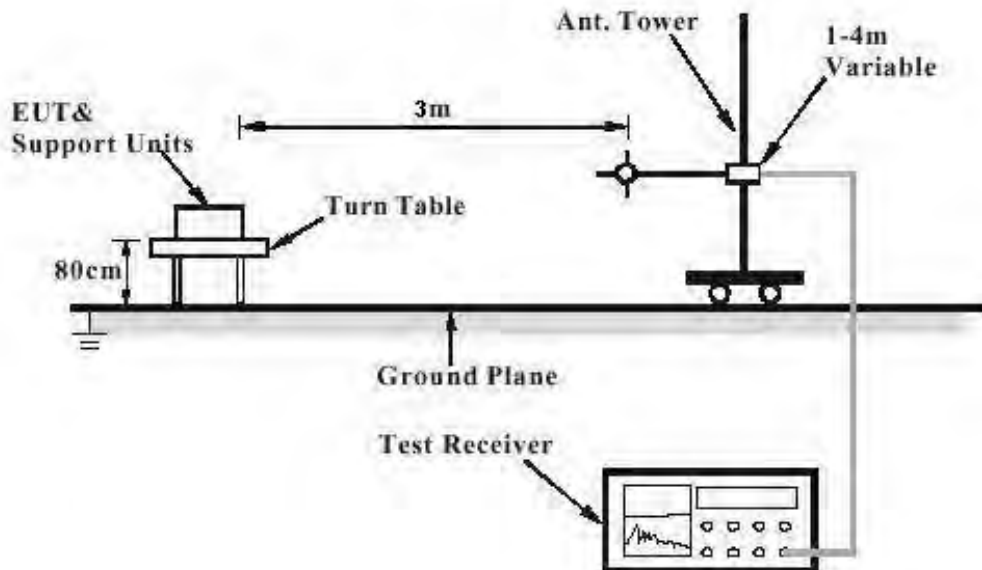
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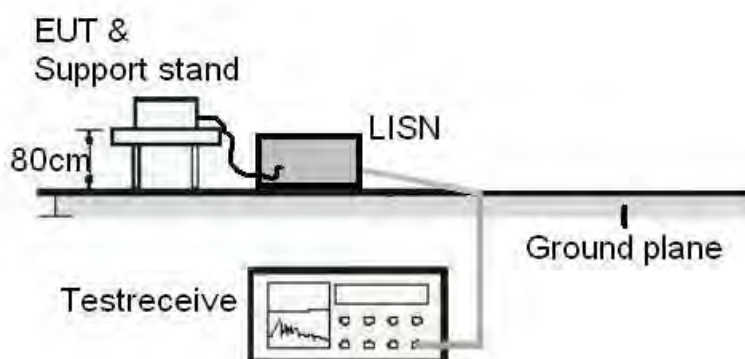
3.4 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



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

Diagram of Measurement Equipment Configuration for Conduction Measurement



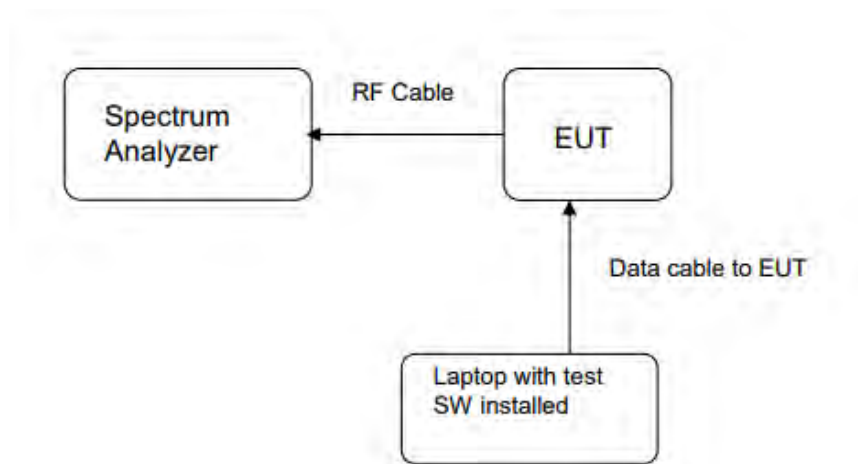
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Diagram of Measurement Equipment Configuration for Transmitter Measurement



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4 Test Results

4.1 Transmitter Requirement & Test Suites

4.1.1 Antenna Requirement

RESULT:

PASS

Test standard	: FCC Part 15.247(b)(4), Part 15.203
Requirement	: The use of approved antennas only with directional gains that do not exceed 6dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 3.42dBi. 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

RESULT:

PASS

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

Requirement : ANSI C63.10-2013, KDB 558074

Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High

Operation Mode : A.1.a

Ambient temperature : 25C

Relative humidity : 52%

Table 1: Peak Output Power

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(mW)	
802.11b	2412	17.92	61.94	< 1
	2437	17.27	53.33	
	2462	18.21	66.22	
802.11g	2412	13.95	24.83	
	2437	13.05	20.18	
	2462	14.54	28.44	
802.11n(HT20)	2412	13.32	21.48	
	2437	12.28	16.90	
	2462	13.80	23.99	
802.11n(HT40)	2422	10.51	11.25	
	2437	9.69	9.31	
	2452	10.49	11.19	

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4.1.3 6dB Bandwidth and 99% Bandwidth

RESULT:

PASS

Test standard : FCC Part 15.247(a)(2)
Requirement : ANSI C63.10-2013, KDB 558074
Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
Operation Mode : A.1.a
Ambient temperature : 25℃
Relative humidity : 52%

Table 2: 6dB Bandwidth and 99% Bandwidth

Test Mode	Test Channel (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth Limit (MHz)
802.11b	2412	8.753	13.341	≥0.5
	2437	9.924	13.161	
	2462	9.978	13.409	
802.11g	2412	16.500	16.783	
	2437	16.490	16.825	
	2462	16.510	16.864	
802.11n(HT20)	2412	17.620	17.606	
	2437	17.350	17.581	
	2462	17.600	17.634	
802.11n(HT40)	2422	36.440	36.347	
	2437	36.450	36.341	
	2452	36.450	35.365	

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



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



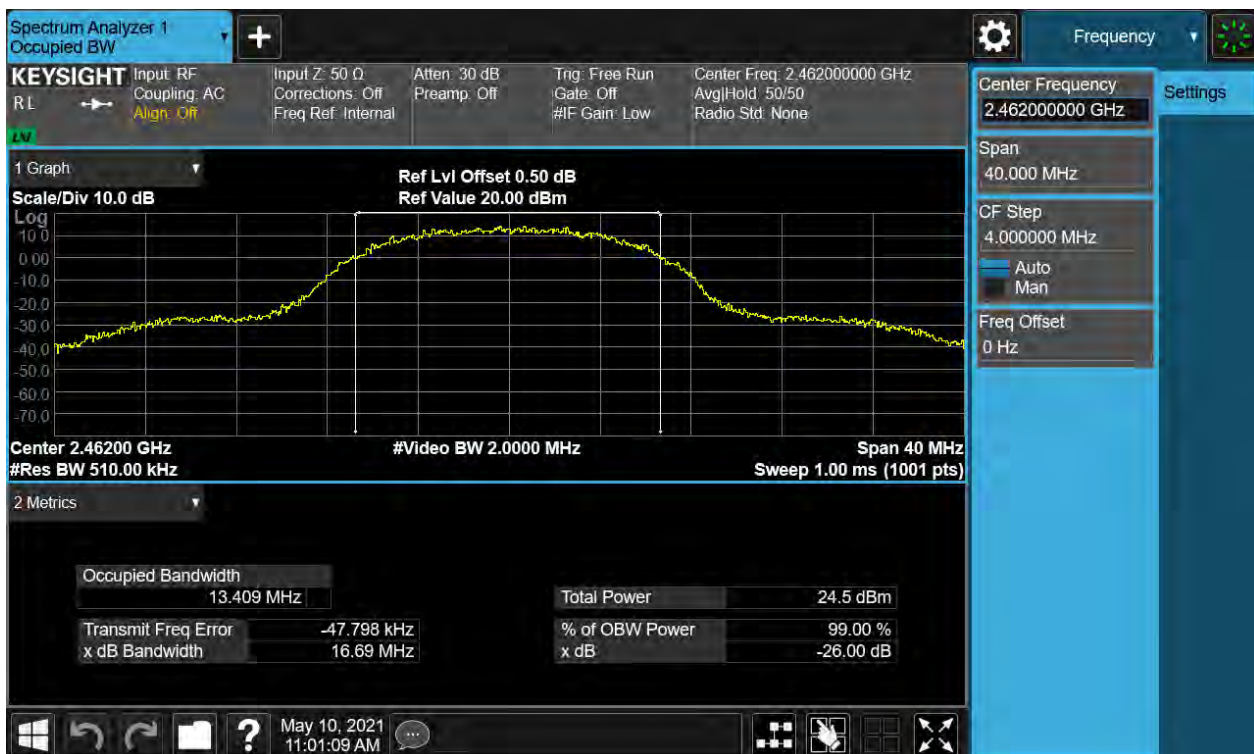
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Figure 3: 6dB Bandwidth and 99% Bandwidth, 802.11b, 2462MHz



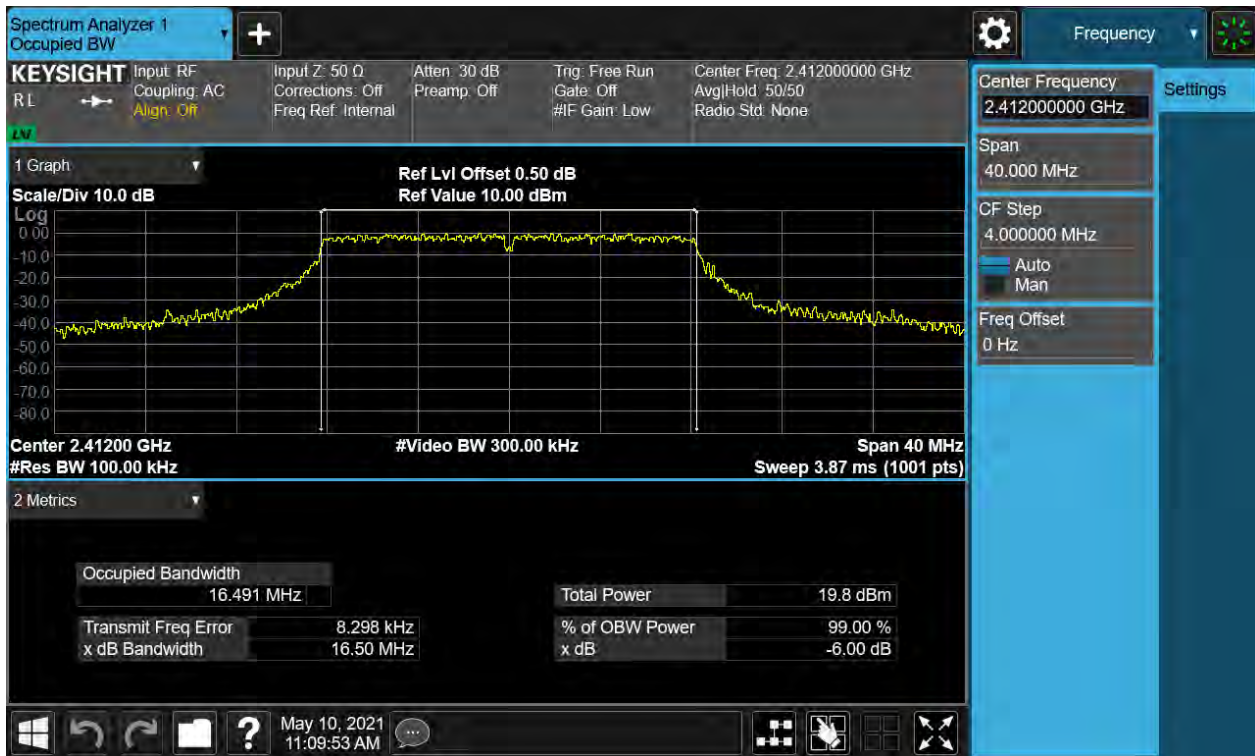
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Figure 4: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2412MHz



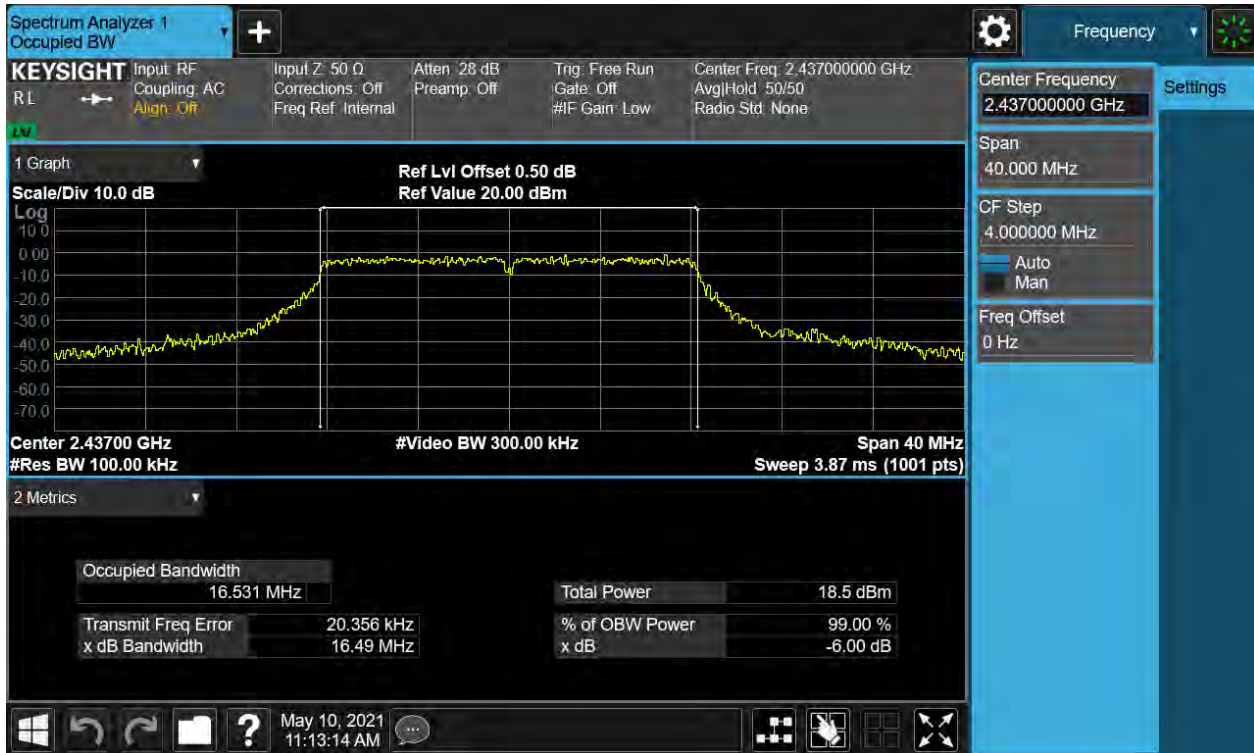
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Figure 5: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2437MHz



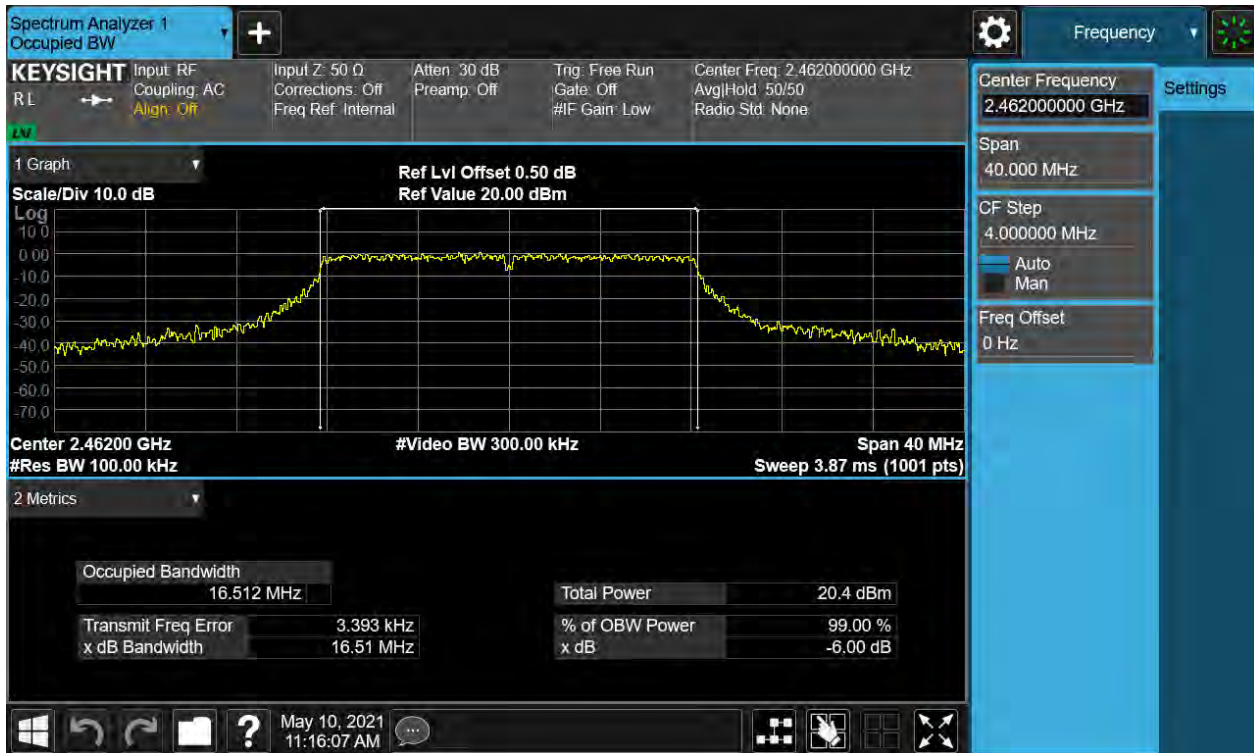
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Figure 6: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2462MHz



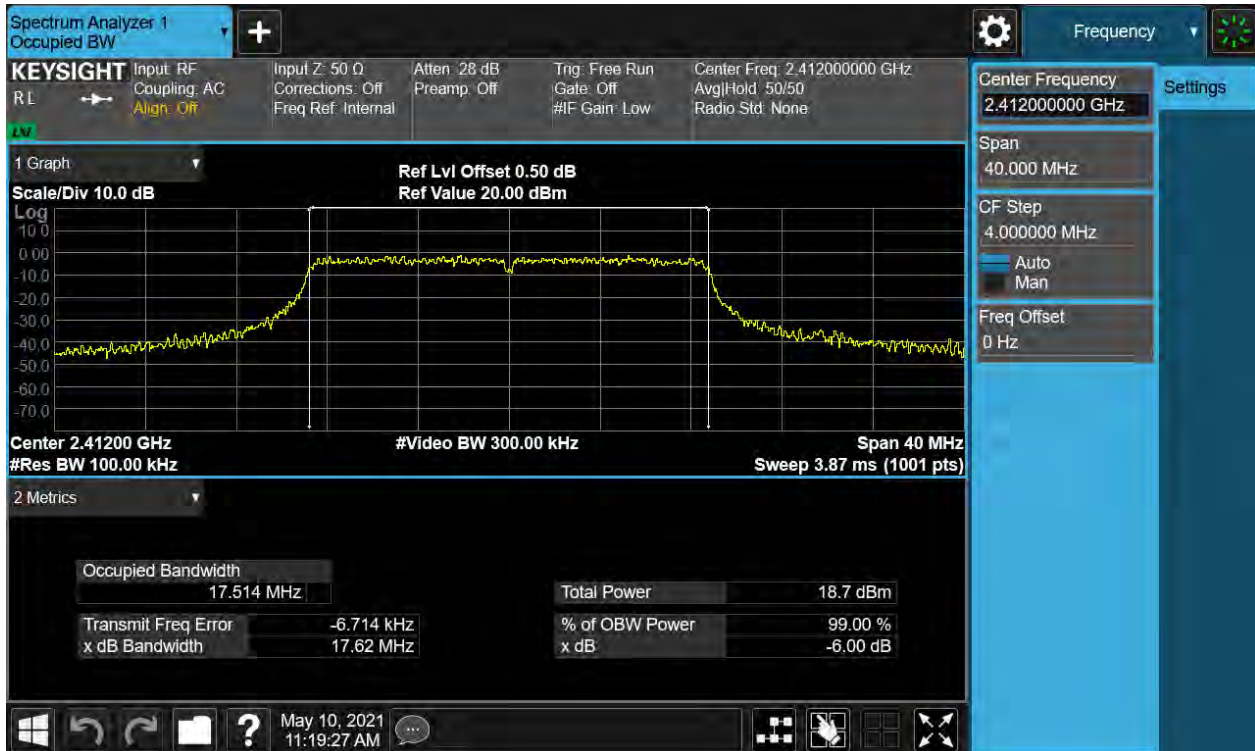
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Figure 7: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2412MHz



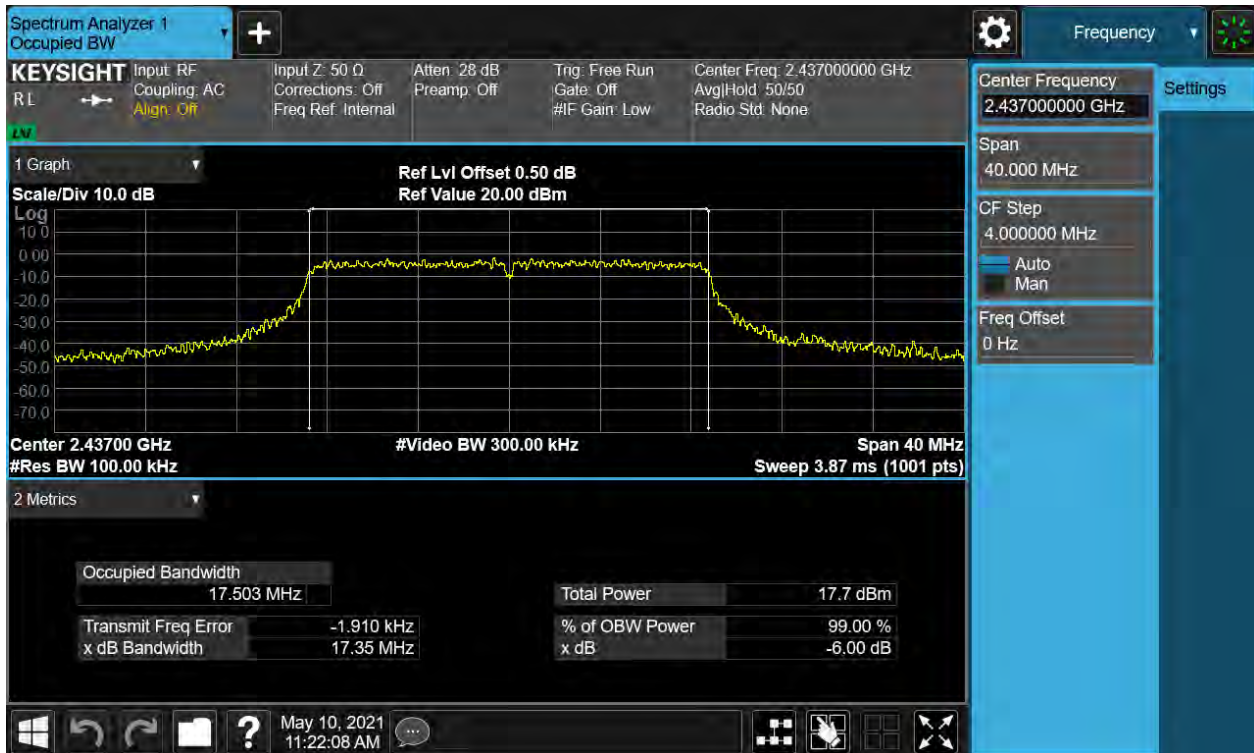
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Figure 8: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2437MHz



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



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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



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4.1.4 Power Spectral Density

RESULT:

PASS

Test standard : FCC Part 15.247(e)
Requirement : ANSI C63.10-2013, KDB 558074
Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
Operation Mode : A.1.a
Ambient temperature : 25C
Relative humidity : 52%

Table 3: Power Spectral Density

Test Mode	Test Channel (MHz)	Measured Result (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	2412	-6.90	≤ 8
	2437	-7.26	
	2462	-6.35	
802.11g	2412	-14.74	
	2437	-15.70	
	2462	-14.10	
802.11n(HT20)	2412	-15.42	
	2437	-16.31	
	2462	-14.84	
802.11n(HT40)	2422	-18.06	
	2437	-17.81	
	2452	-18.07	

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



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



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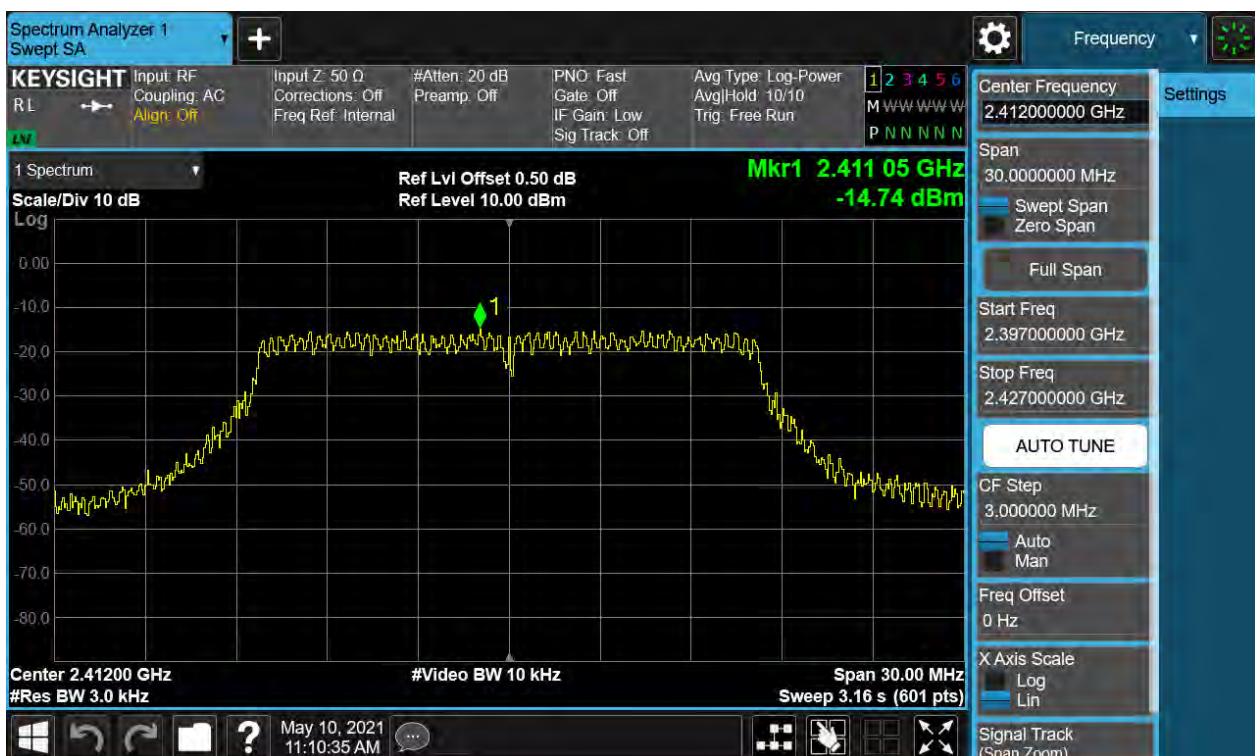
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Figure 15: Power Spectral Density, 802.11b, 2462MHz



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



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

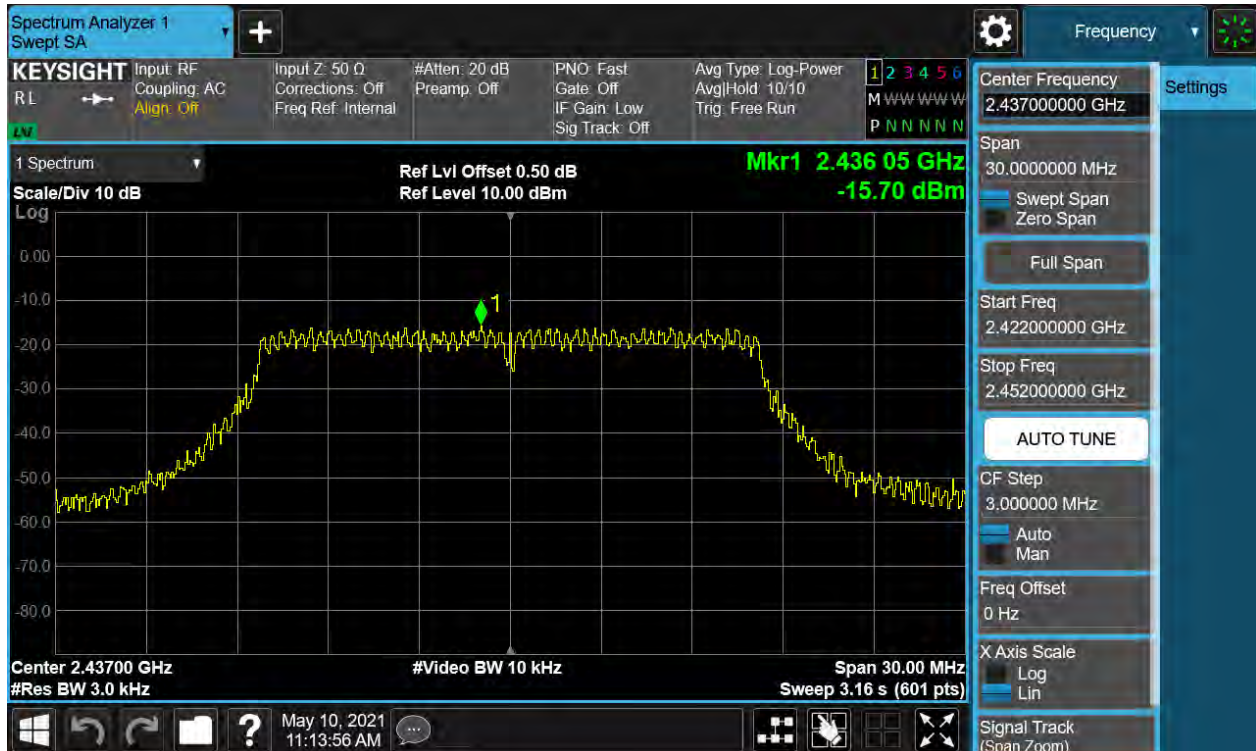
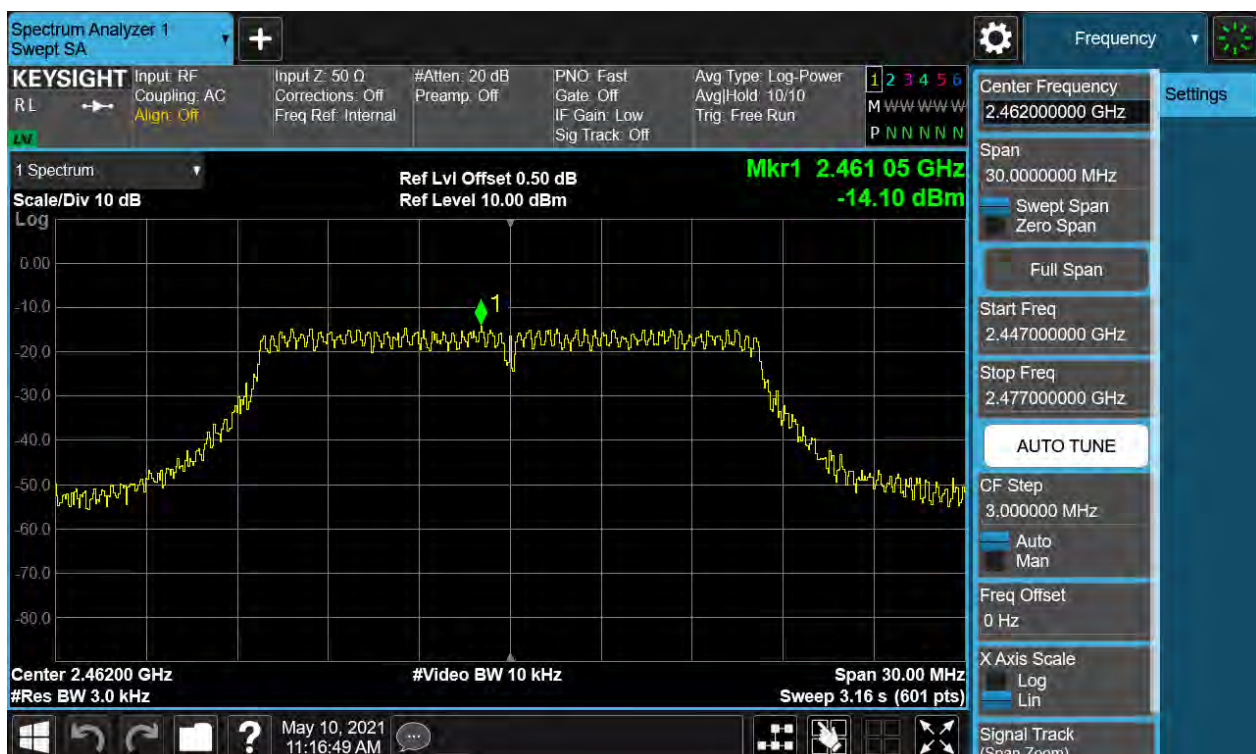


Figure 18: Power Spectral Density, 802.11g, 2462MHz



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

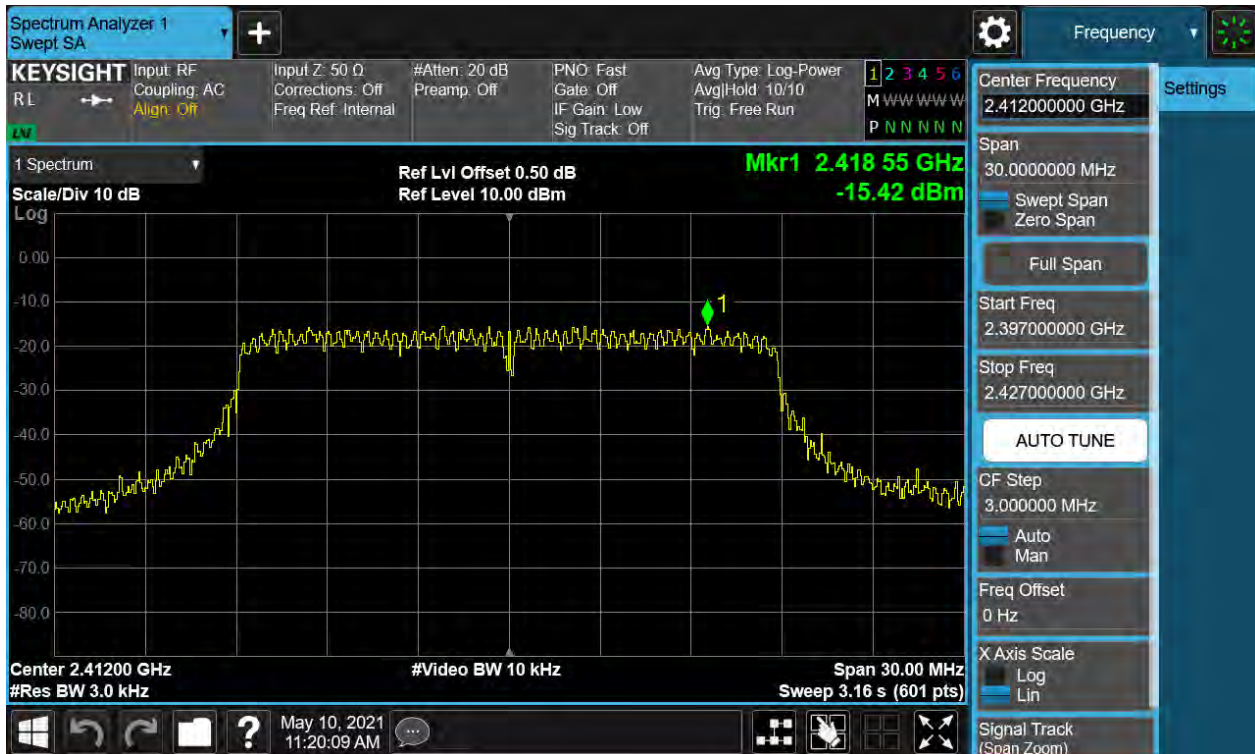
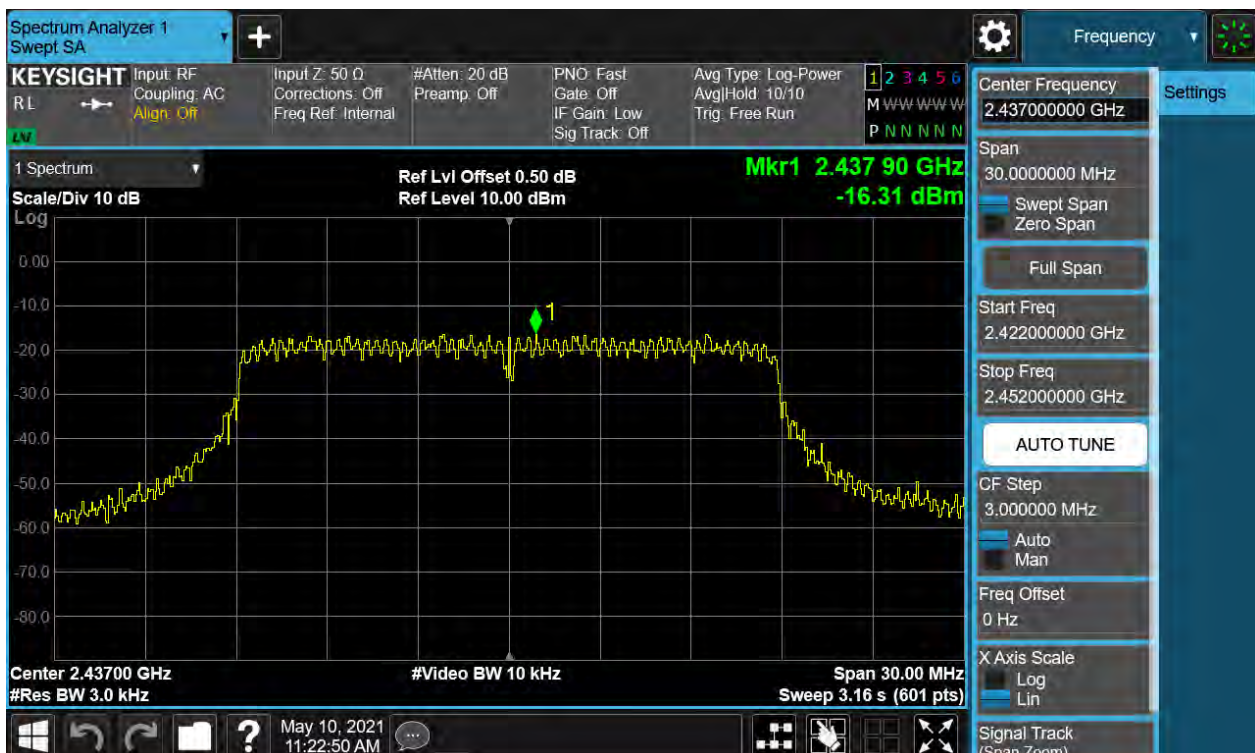


Figure 20: Power Spectral Density, 802.11n(HT20), 2437MHz



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Keysight Spectrum Analyzer 1
Swept SA

KEYSIGHT Input RF
RL Coupling: AC
Align: Off

Input Z: 50 Ω
Corrections: Off
Freq Ref: Internal

#Atten: 20 dB
Preamp: Off

PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off

Avg Type: Log-Power
Avg/Hold: 10/10
Trig: Free Run

1 2 3 4 5 6
M WWW WWW W
P NNNNN

1 Spectrum
Scale/Div 10 dB
Log

Ref Lvl Offset 0.50 dB
Ref Level 10.00 dBm

**Mkr1 2.462 65 GHz
-14.84 dBm**

Center 2.46200 GHz
#Res BW 3.0 kHz
#Video BW 10 kHz
Span 30.00 MHz
Sweep 3.16 s (601 pts)

Frequency
Settings

Center Frequency
2.462000000 GHz

Span
30.0000000 MHz
Swept Span
Zero Span
Full Span

Start Freq
2.447000000 GHz

Stop Freq
2.477000000 GHz

AUTO TUNE

CF Step
3.000000 MHz
Auto
Man

Freq Offset
0 Hz

X Axis Scale
Log
Lin

Signal Track
(Span Zoom)

Keysight Spectrum Analyzer 1
Swept SA

KEYSIGHT Input RF
RL Coupling: AC
Align: Off

Input Z: 50 Ω
Corrections: Off
Freq Ref: Internal

#Atten: 20 dB
Preamp: Off

PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off

Avg Type: Log-Power
Avg/Hold: 10/10
Trig: Free Run

1 2 3 4 5 6
M WWW WWW
P NNN NNN

Center Frequency
2.42200000 GHz

Span
60.000000 MHz
Swept Span
Zero Span
Full Span

Start Freq
2.392000000 GHz

Stop Freq
2.452000000 GHz

AUTO TUNE

CF Step
6.000000 MHz
Auto
Man

Freq Offset
0 Hz

X Axis Scale
Log
Lin

Signal Track
(Span 7.0000 MHz)

1 Spectrum
Scale/Div 10 dB
Log

Ref Lvl Offset 0.50 dB
Ref Level 10.00 dBm

Mkr1 2.422 0 GHz
-18.06 dBm

Center 2.42200 GHz
#Res BW 3.0 kHz
#Video BW 10 kHz
Span 60.00 MHz
Sweep 6.33 s (601 pts)

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

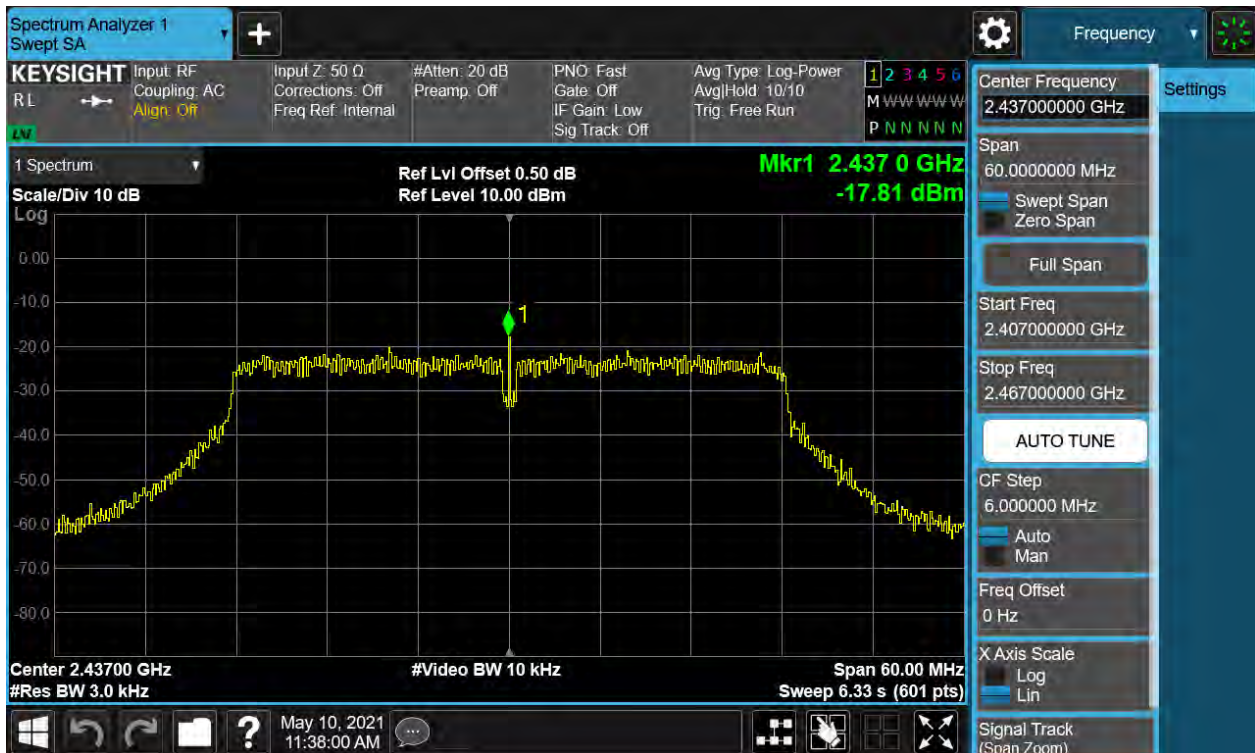
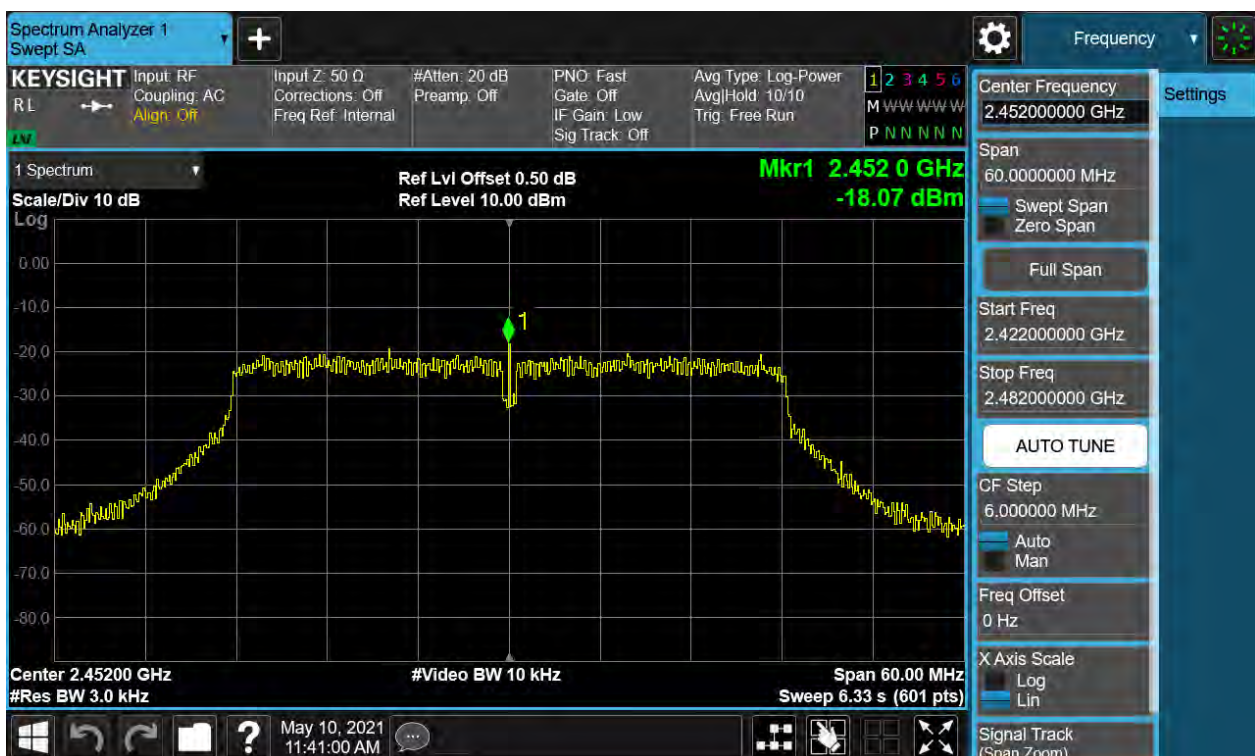


Figure 24: Power Spectral Density, 802.11n(HT40), 2452MHz



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4.1.5 Conducted Spurious Emission & Authorized-band band-edge

RESULT:

PASS

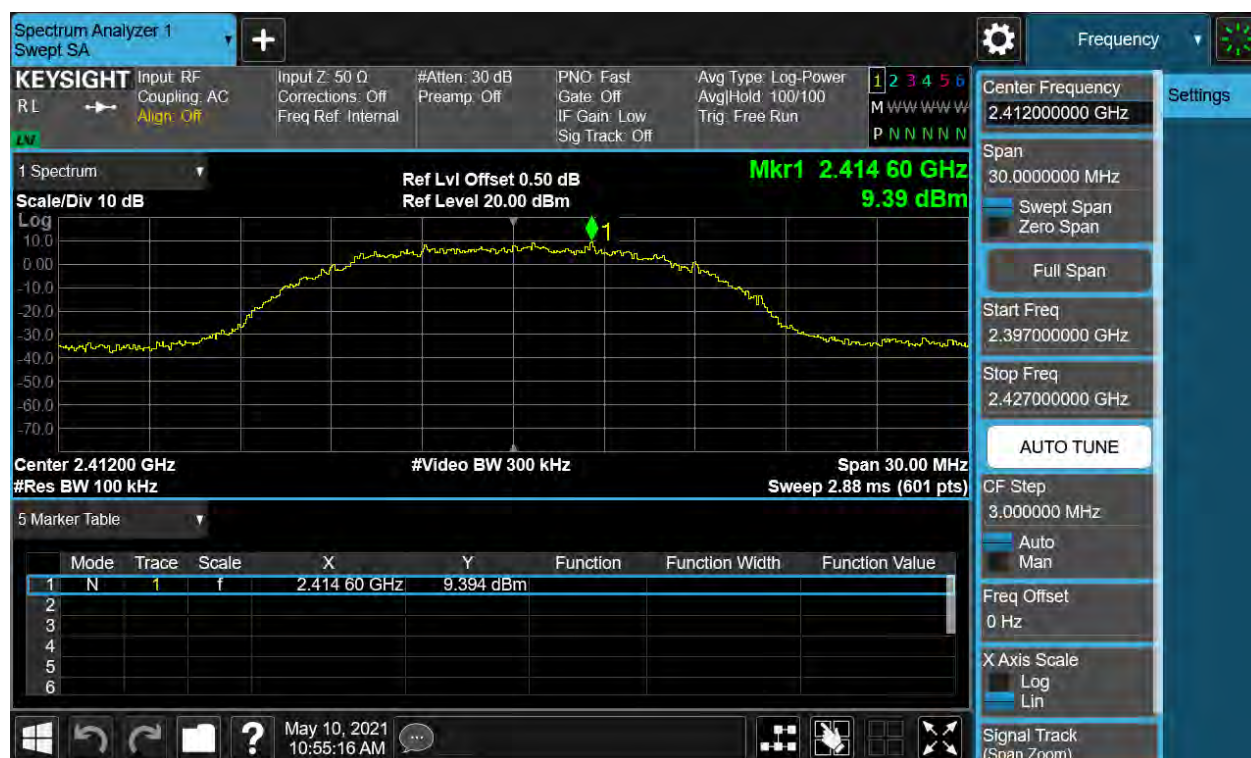
Test standard : FCC Part 15.247(d), 15.209
Requirement : ANSI C63.10-2013, KDB 558074
Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High for spurious, Low/High for Band Edge
Operation Mode : A.1.a
Ambient temperature : 25C
Relative humidity : 52%

For details refer to following test plot.

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



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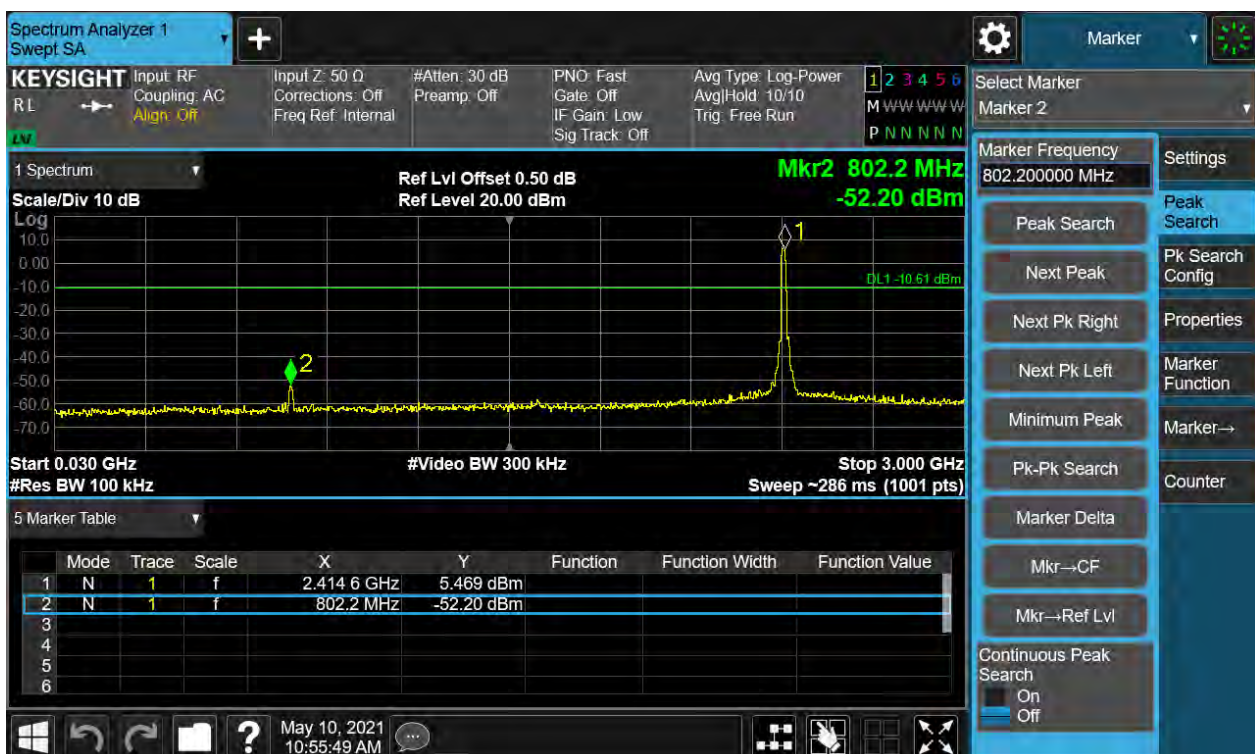
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Band Edge



Conducted spurious emissions 30MHz-25GHz



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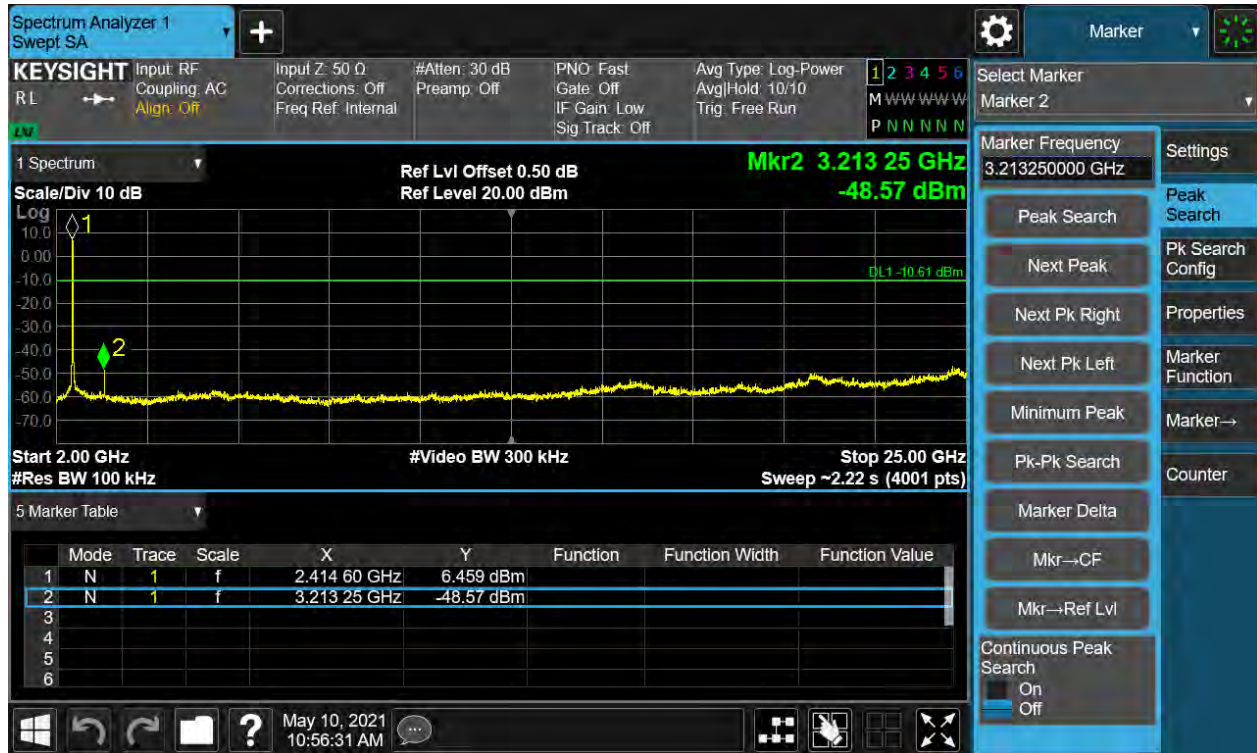
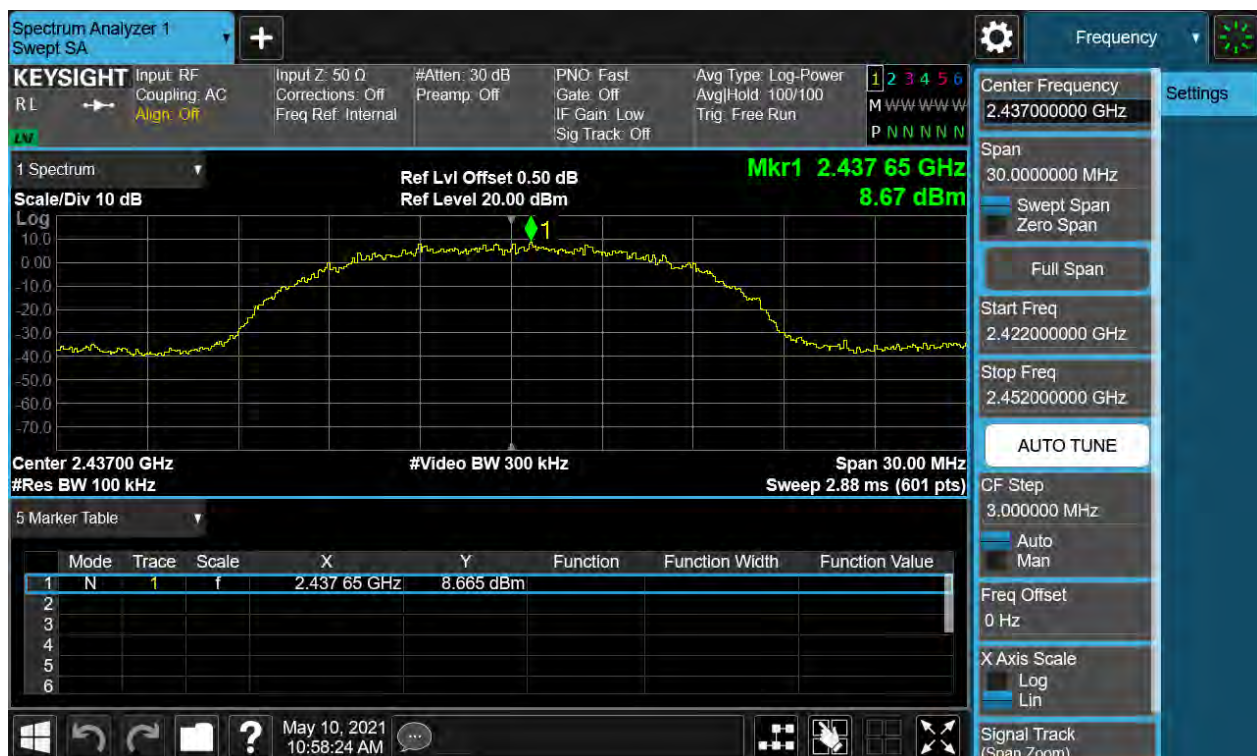


Figure 26: Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2437MHz Carrier Level



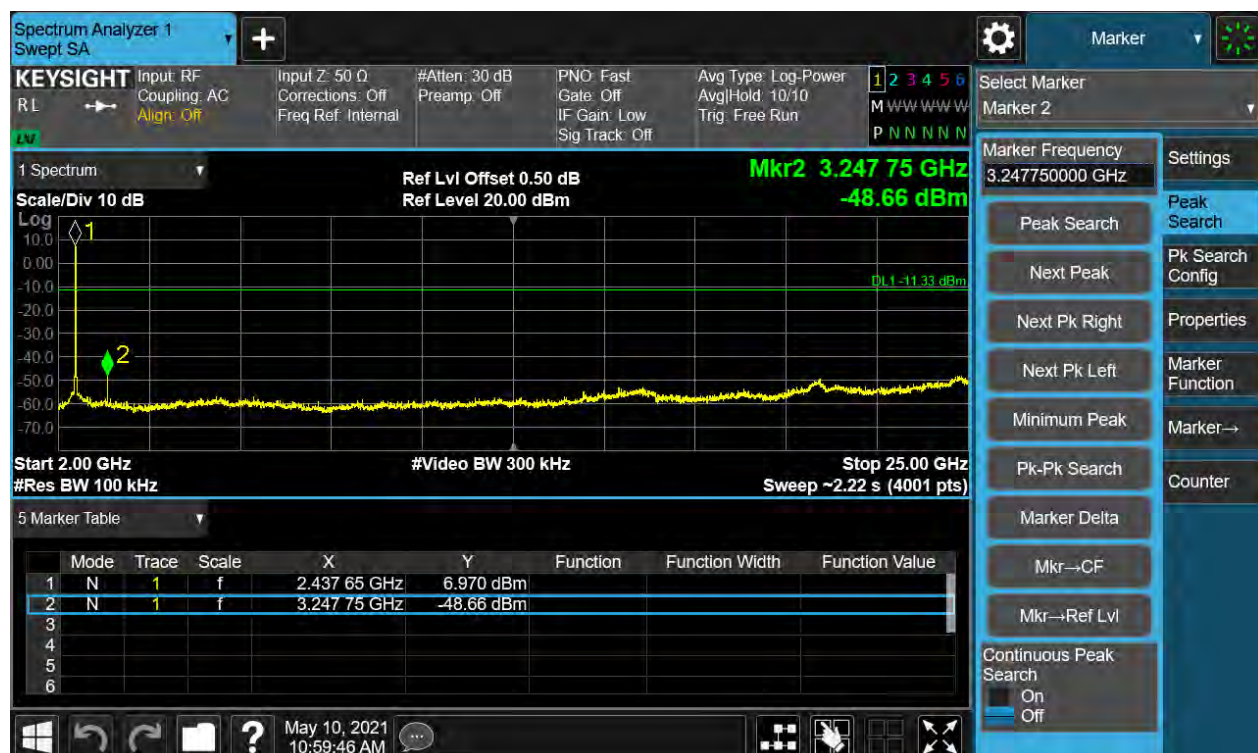
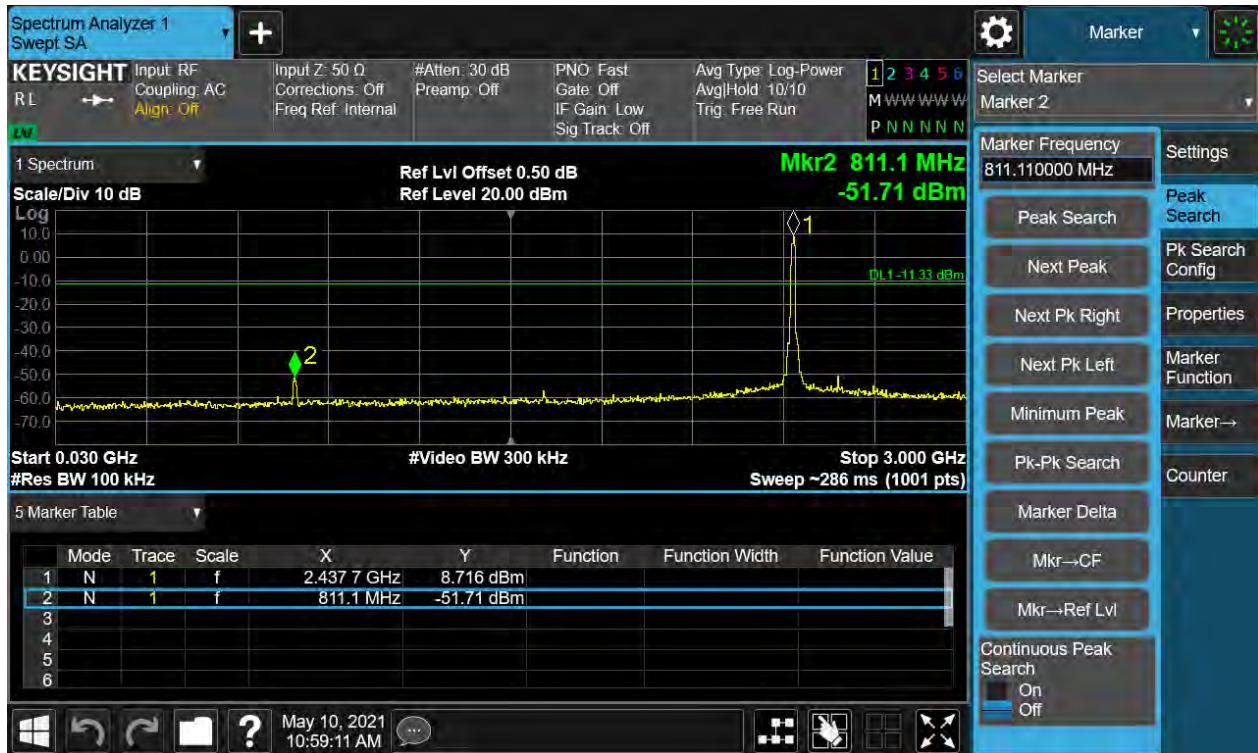
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Conducted spurious emissions 30MHz-25GHz



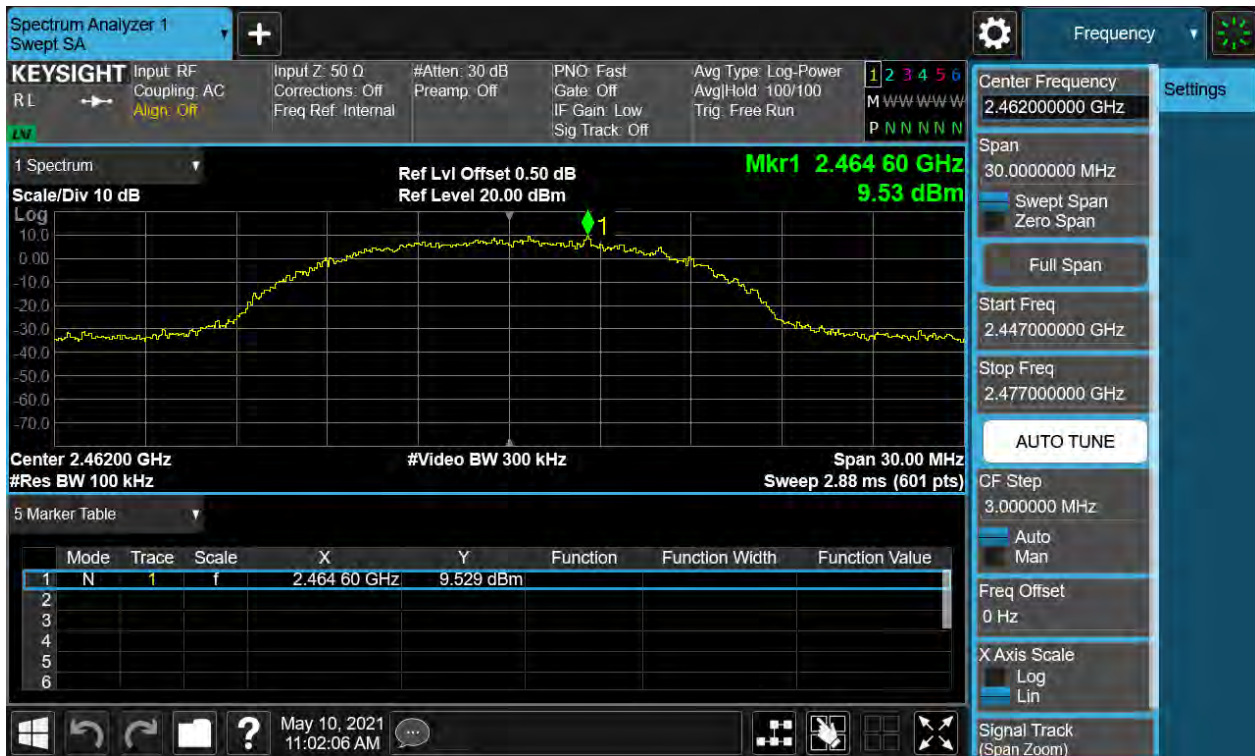
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Figure 27: Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2462MHz Carrier Level



Band Edge



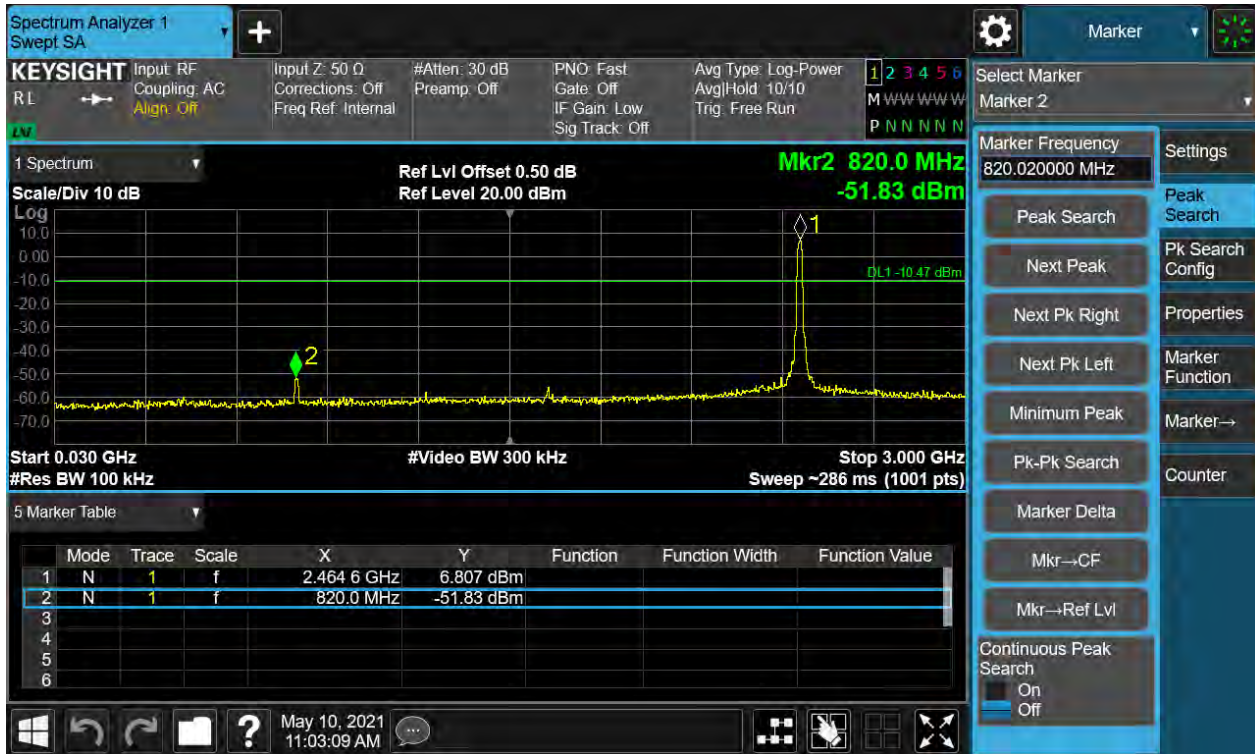
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Conducted spurious emissions 30MHz-25GHz



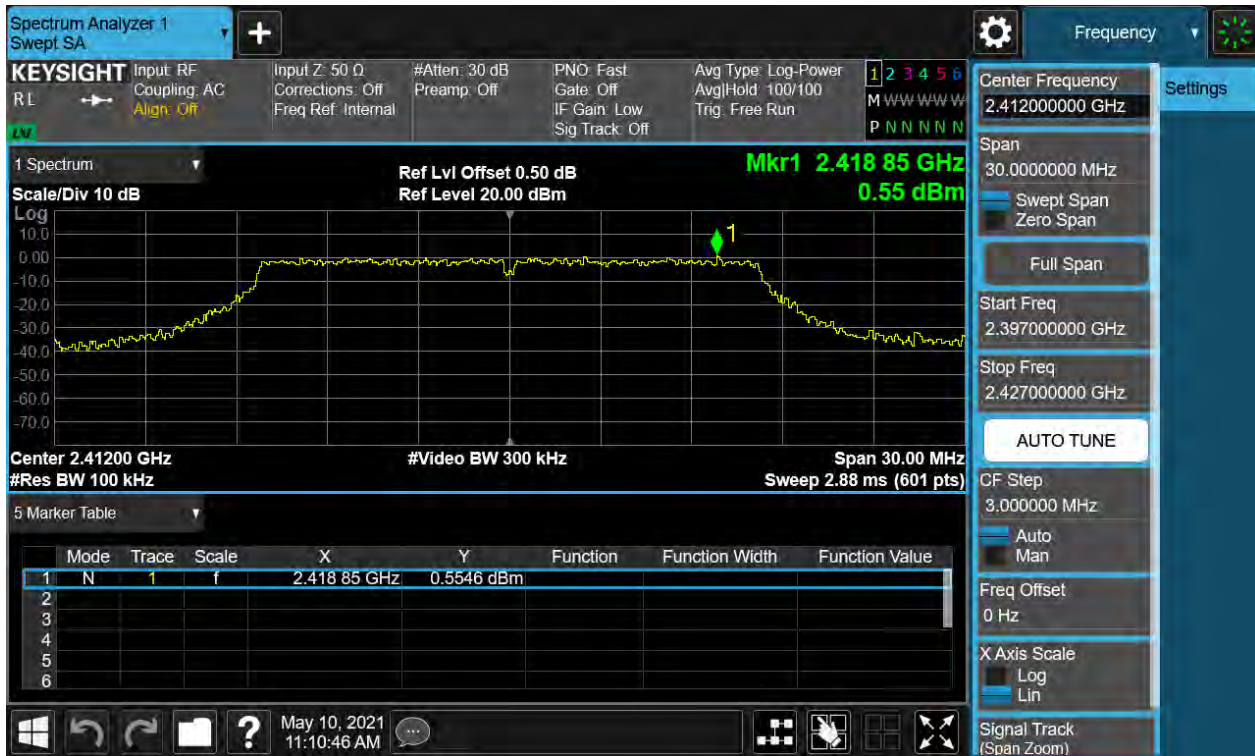
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Figure 28: Conducted Spurious Emission & Authorized-band band-edge, 802.11g, 2412MHz Carrier Level



Band Edge



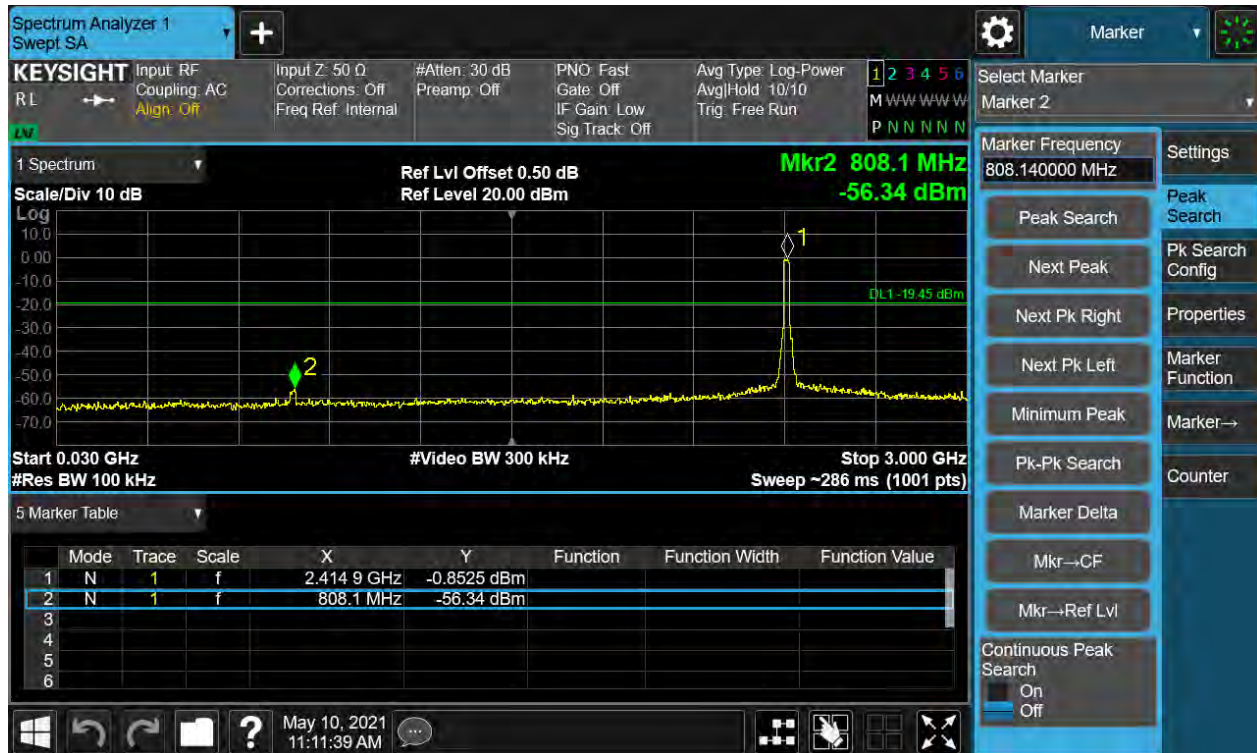
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Conducted spurious emissions 30MHz-25GHz



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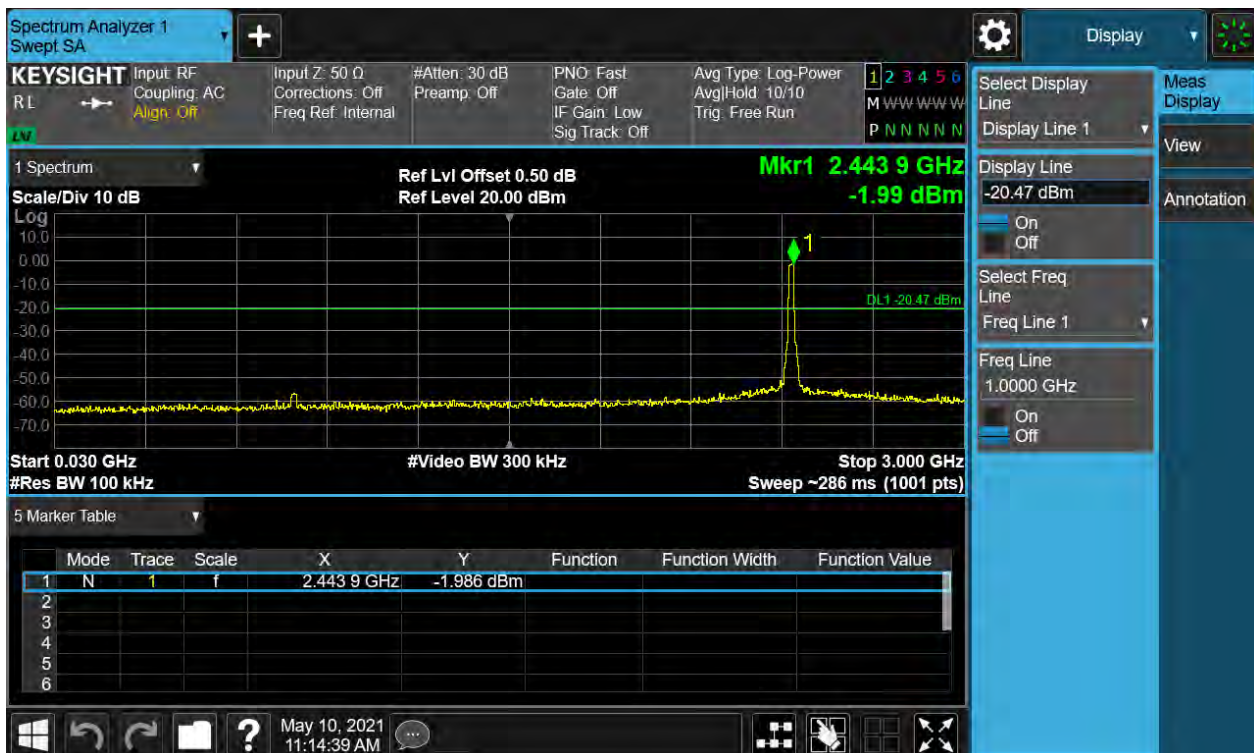
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Figure 29: Conducted Spurious Emission & Authorized-band band-edge, 802.11g, 2437MHz Carrier Level



Conducted spurious emissions 30MHz-25GHz



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



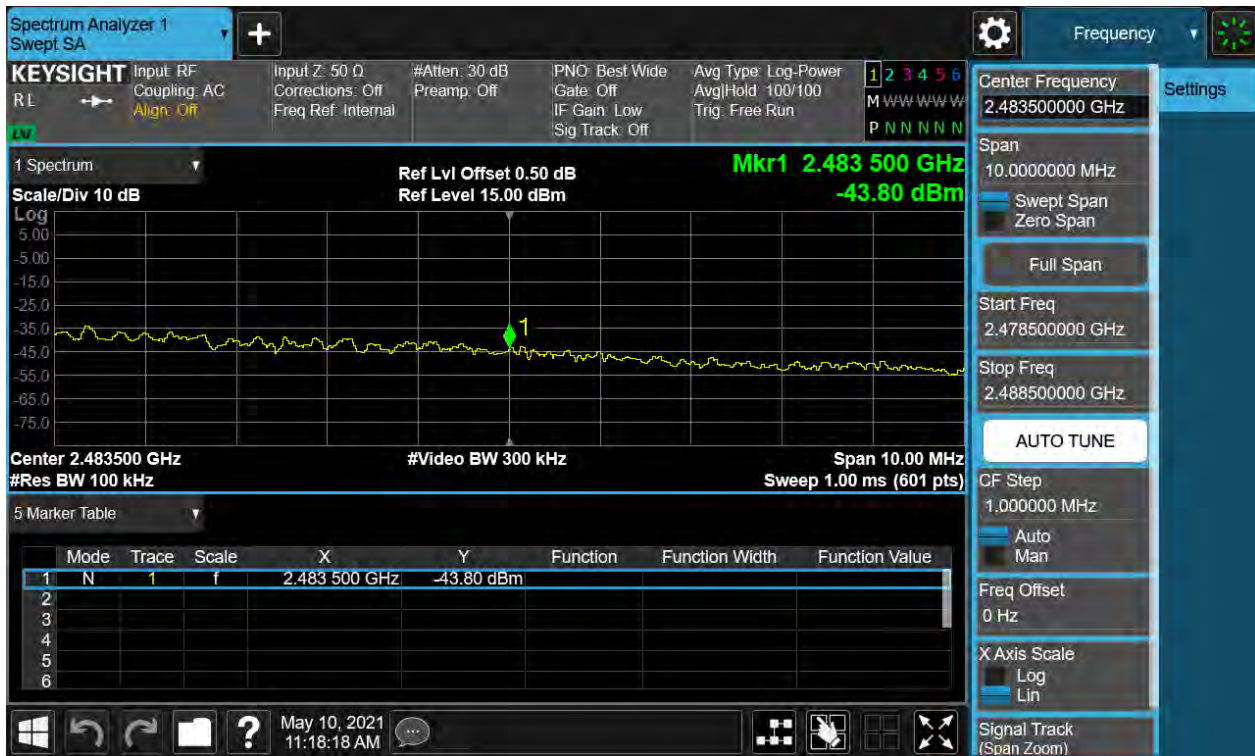
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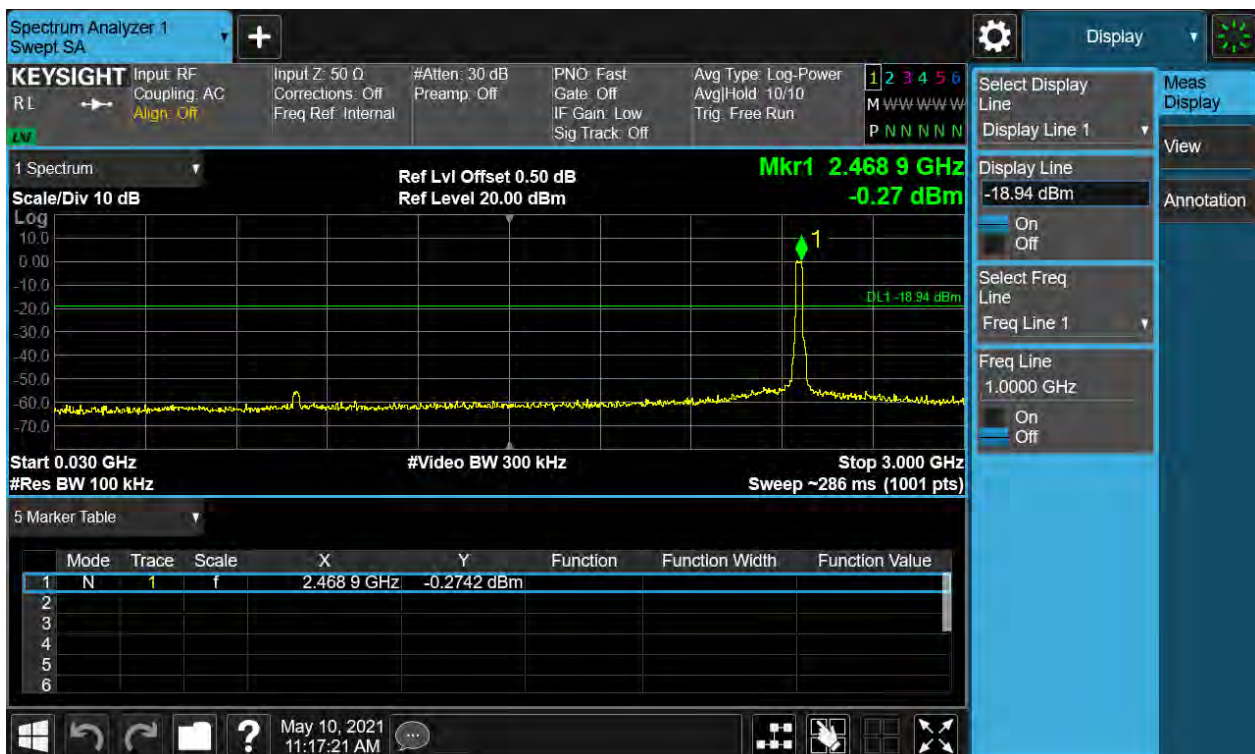
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Band Edge



Conducted spurious emissions 30MHz-25GHz



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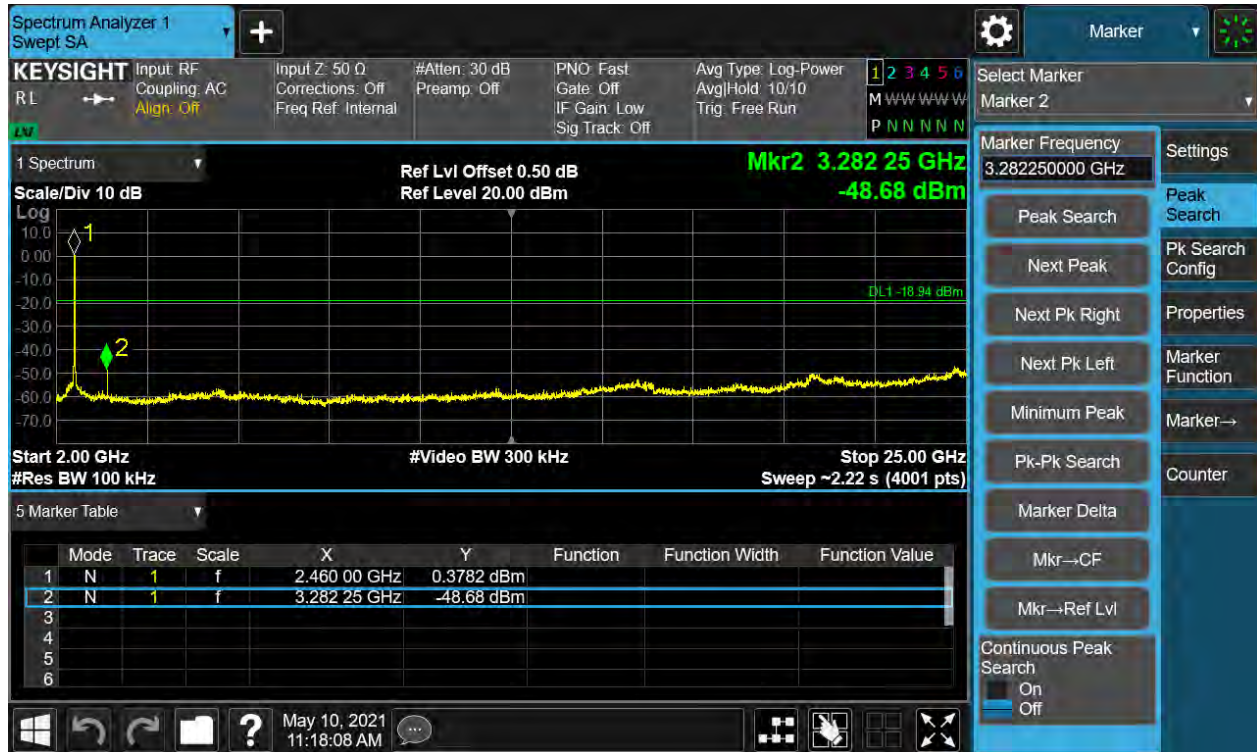
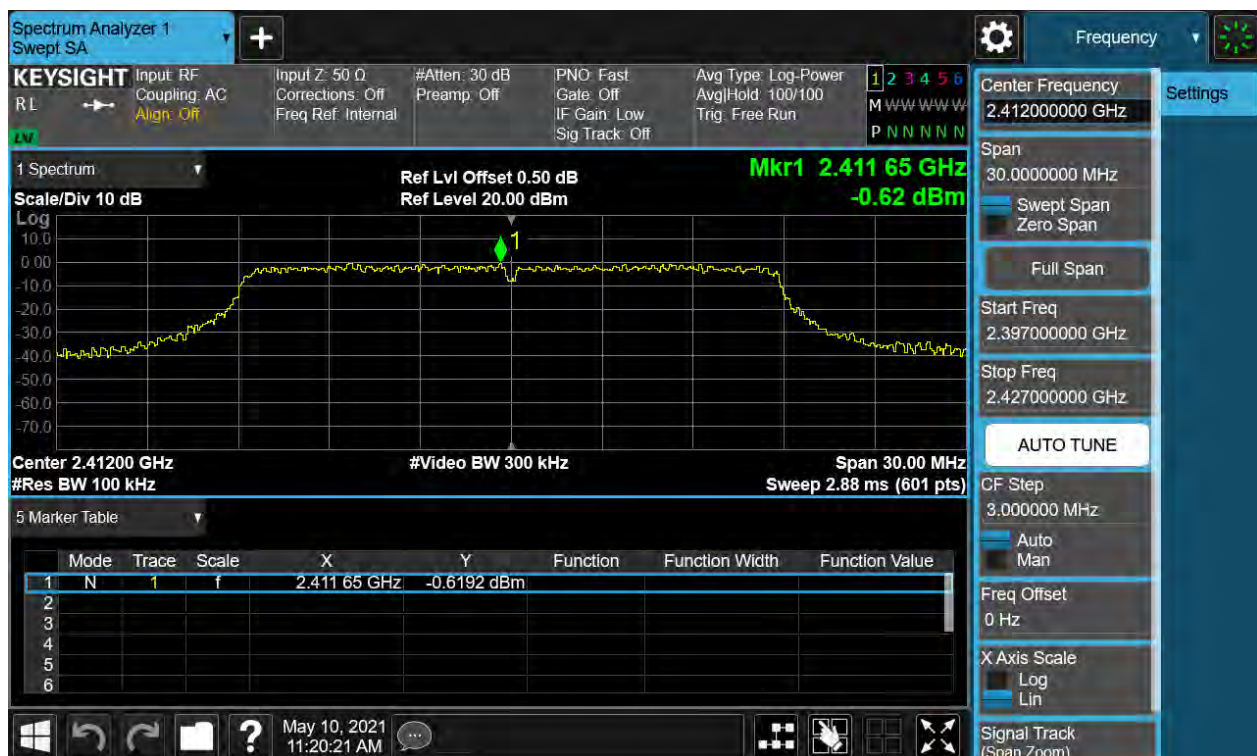


Figure 31: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT20), 2412MHz Carrier Level



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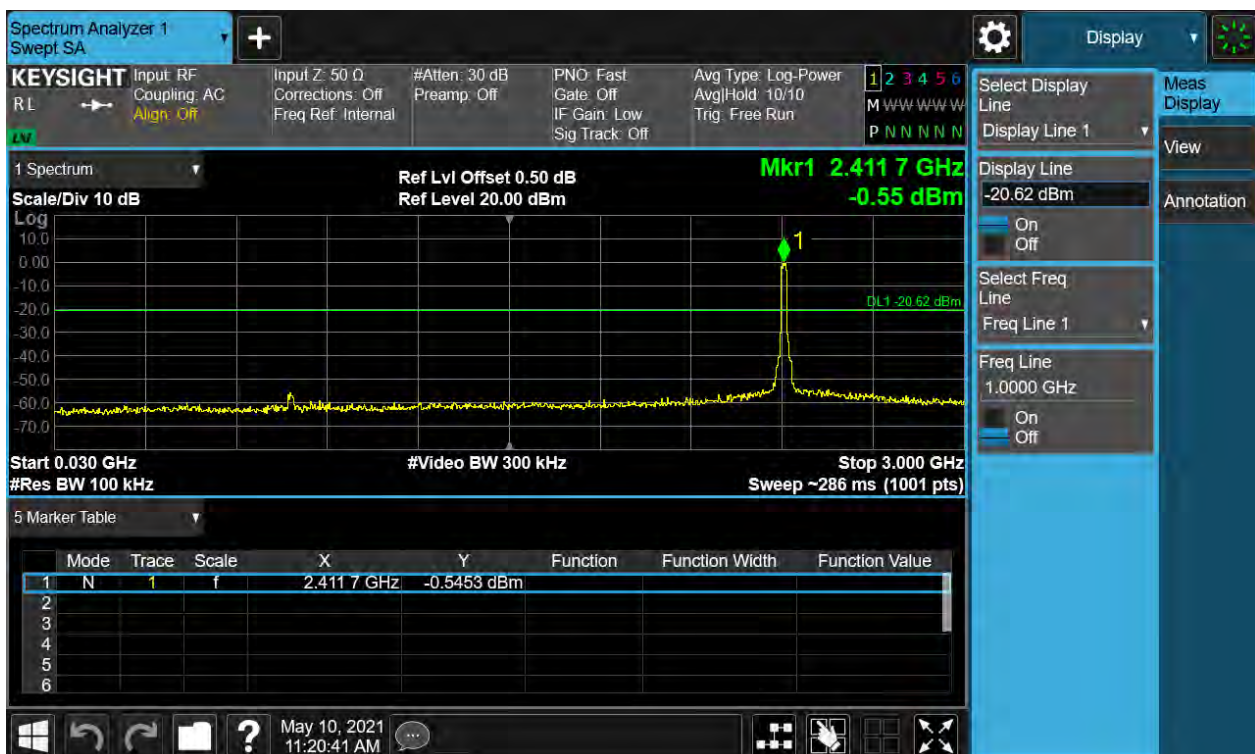
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Band Edge



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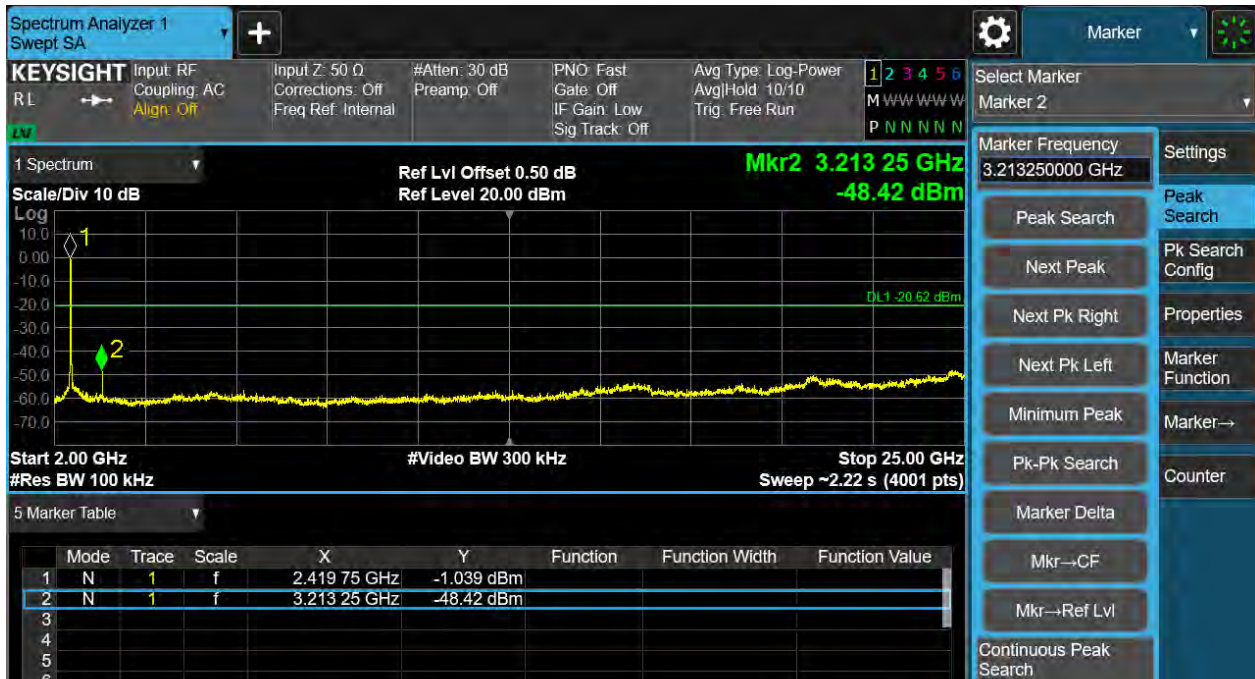


Figure 32: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT20), 2437MHz Carrier Level



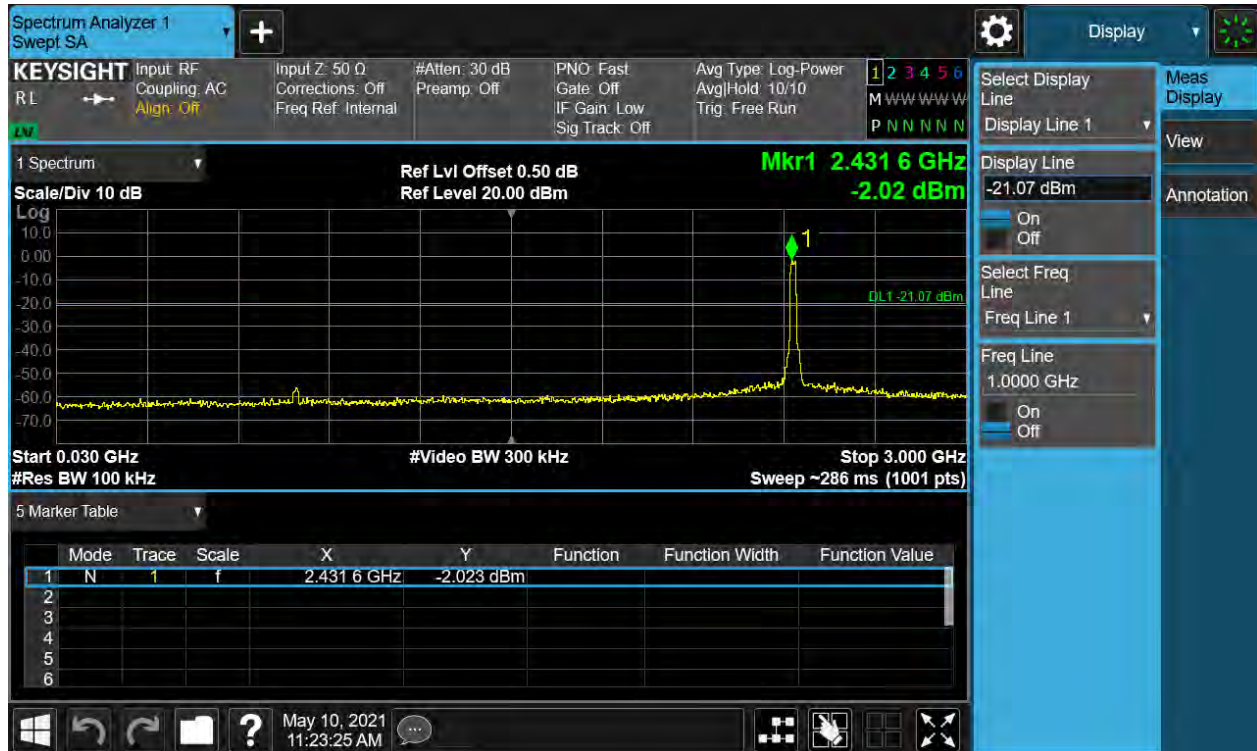
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Conducted spurious emissions 30MHz-25GHz



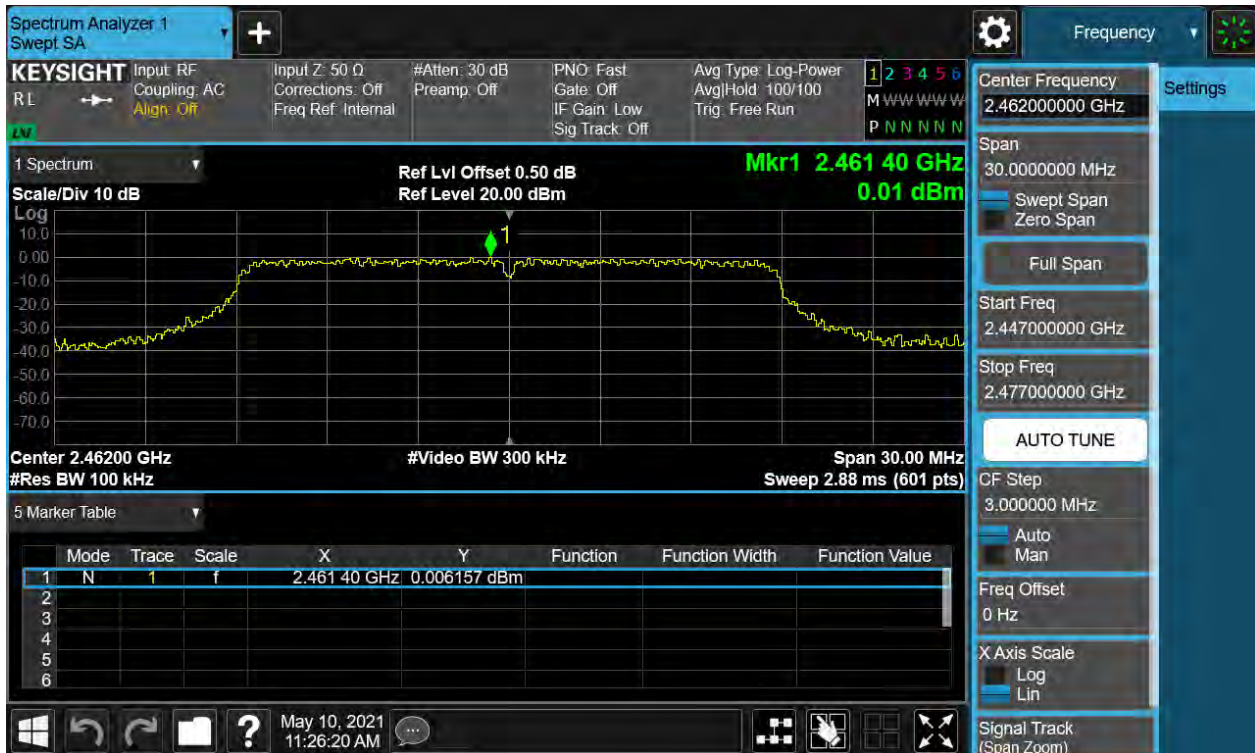
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Figure 33: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT20), 2462MHz Carrier Level



Band Edge



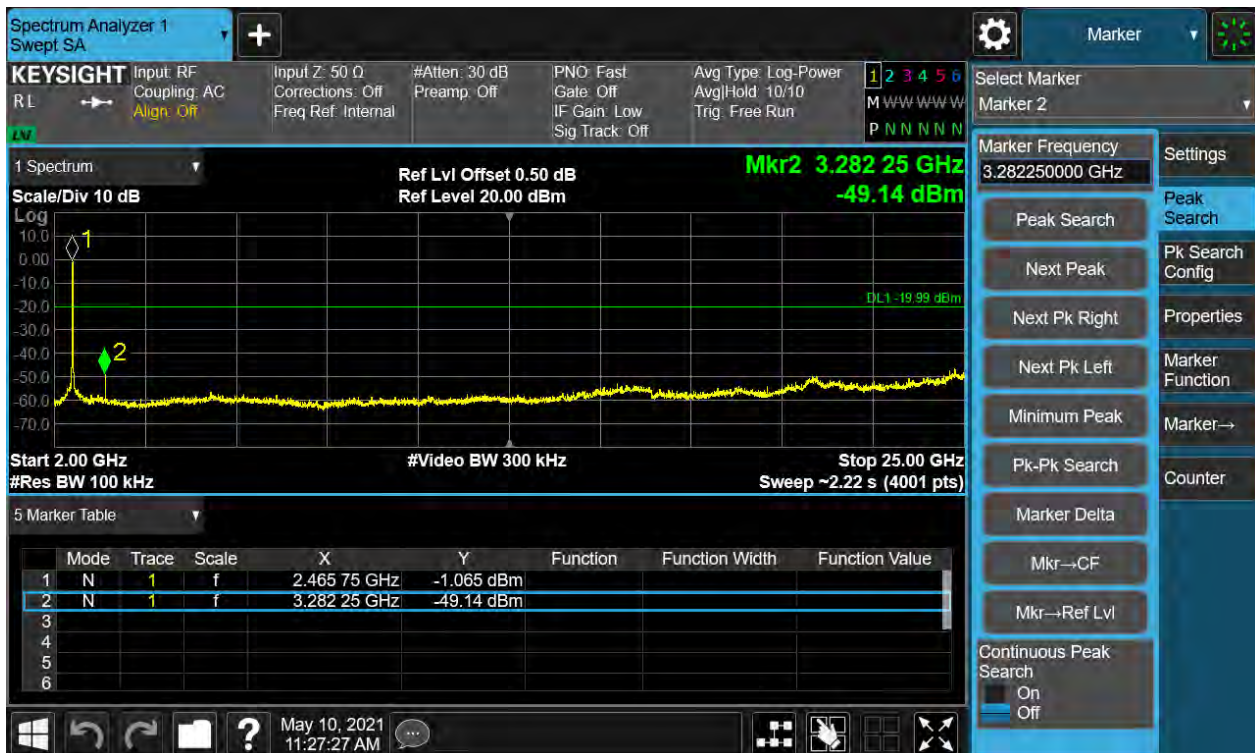
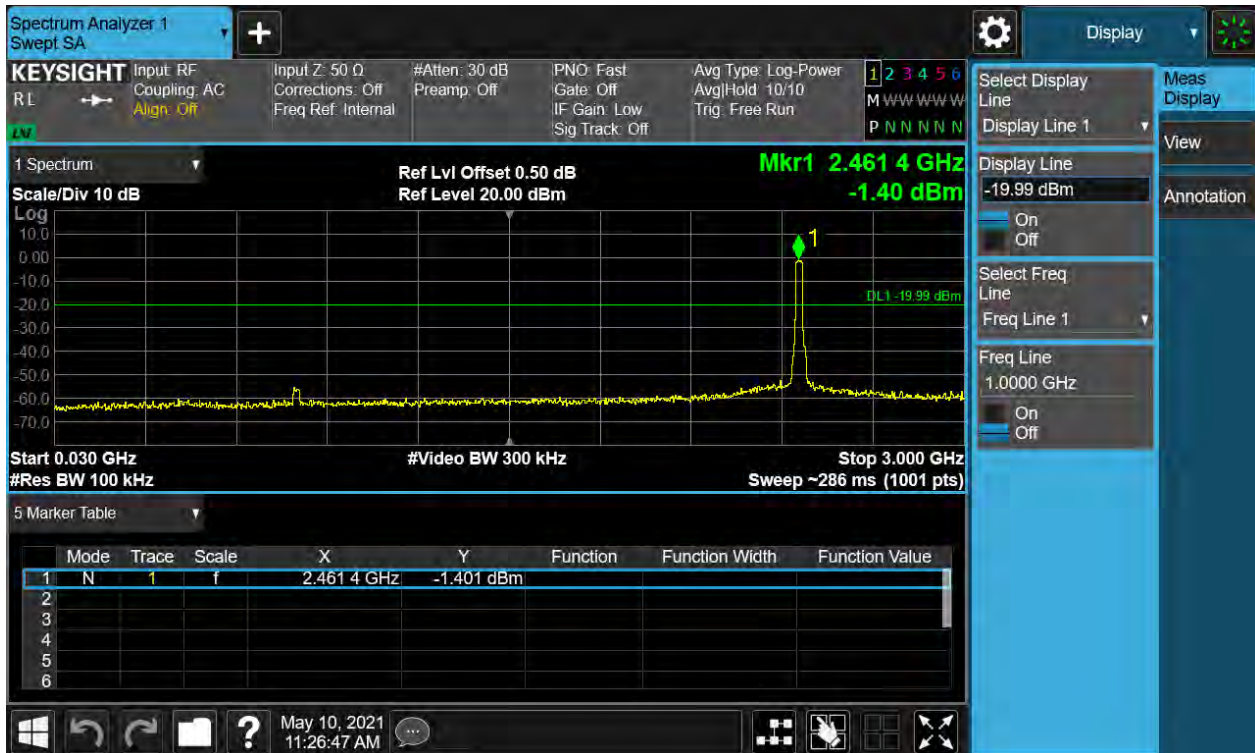
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Figure 34: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT40), 2422MHz Carrier Level



Band Edge



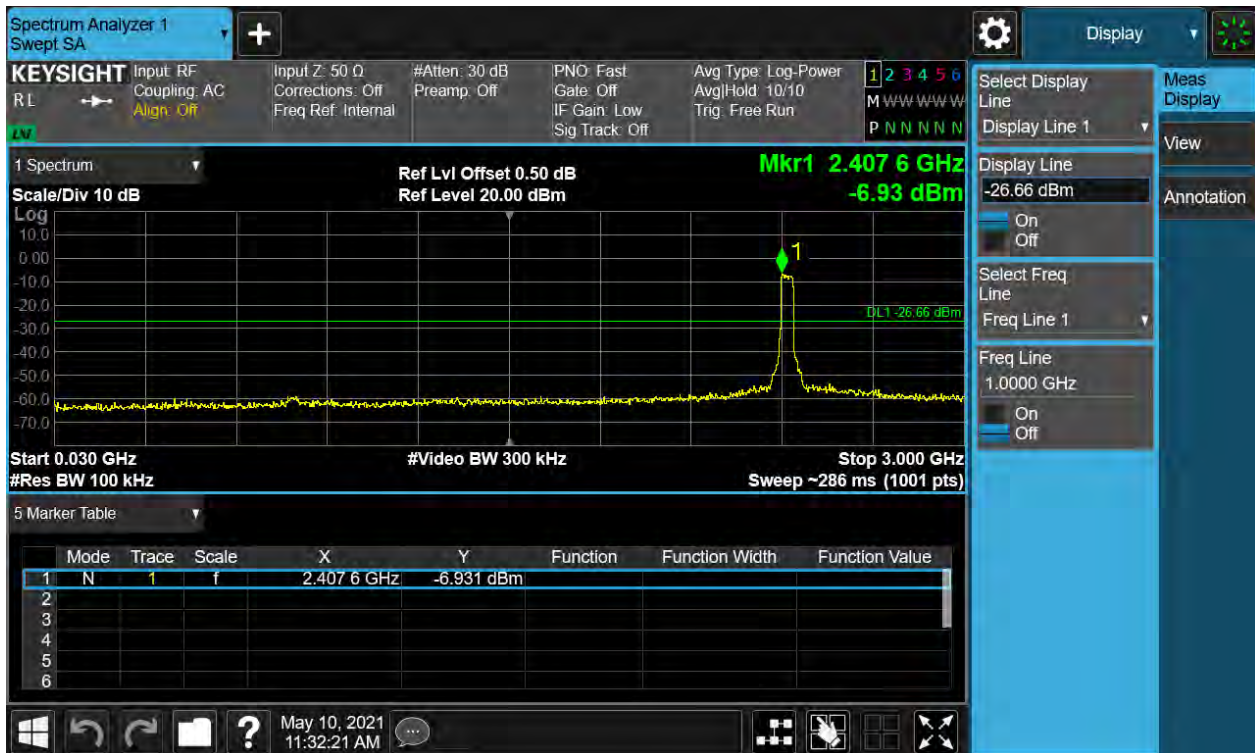
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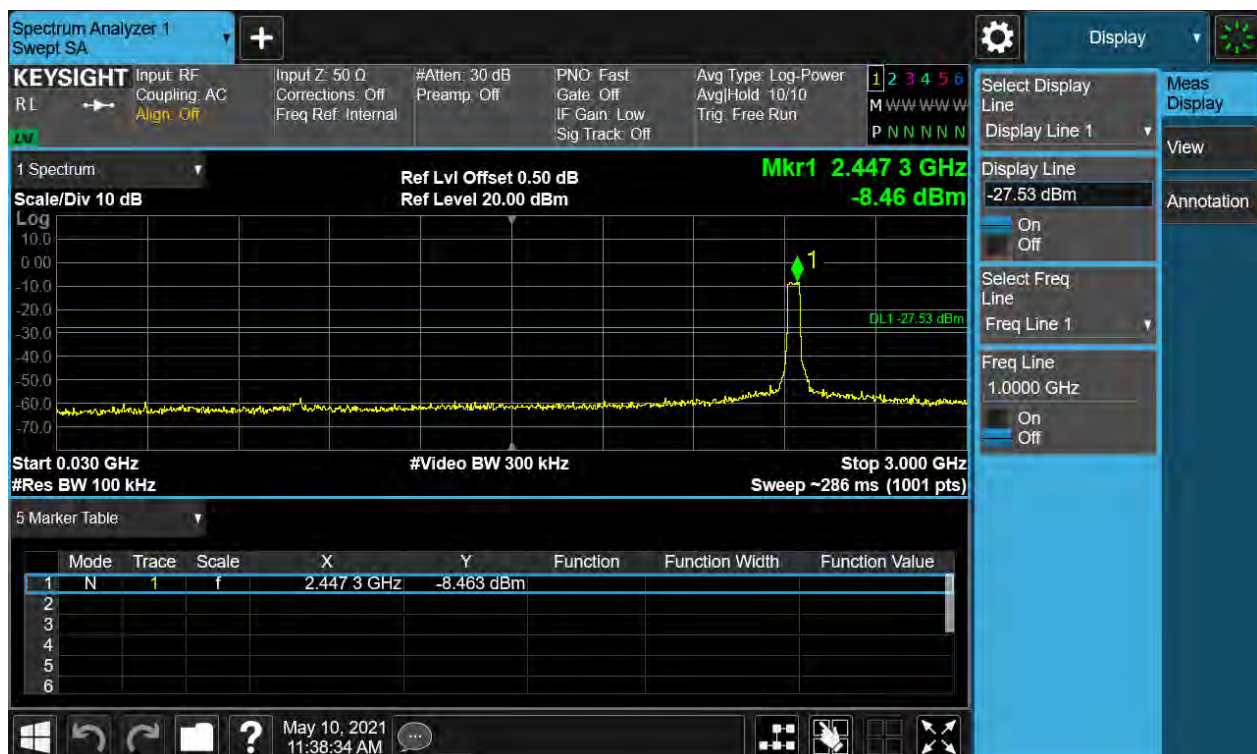
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Figure 35: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT40), 2437MHz Carrier Level



Conducted spurious emissions 30MHz-25GHz



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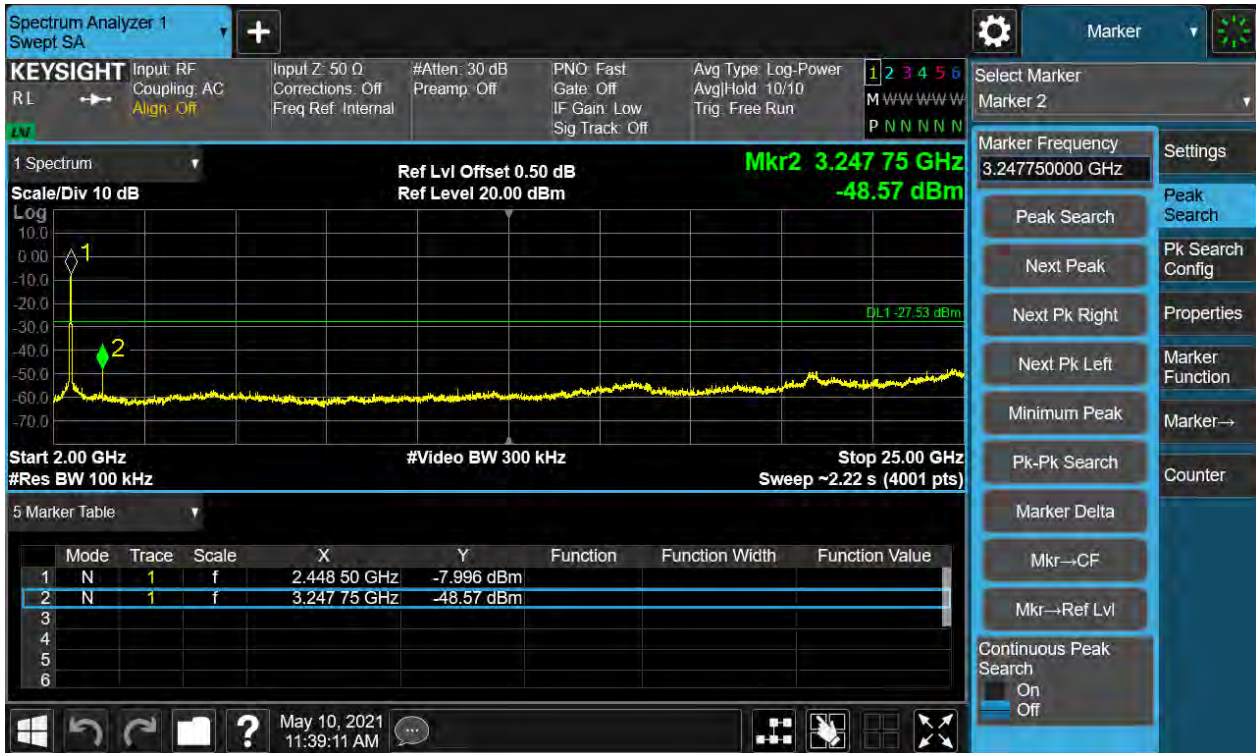


Figure 36: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT40), 2452MHz Carrier Level



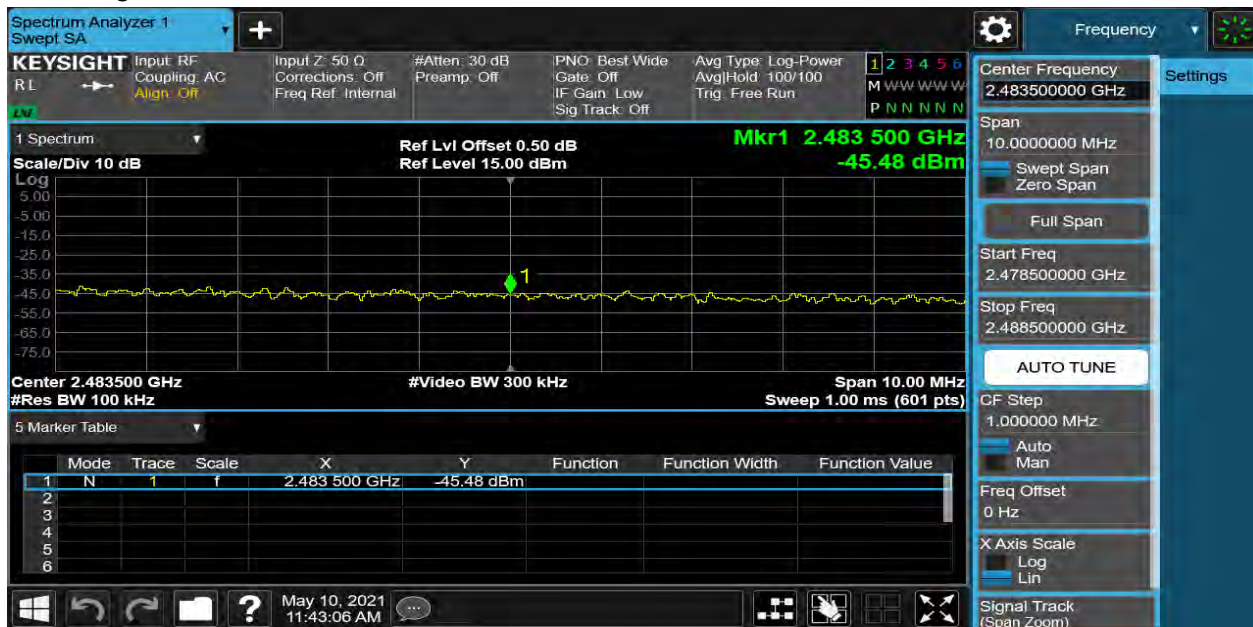
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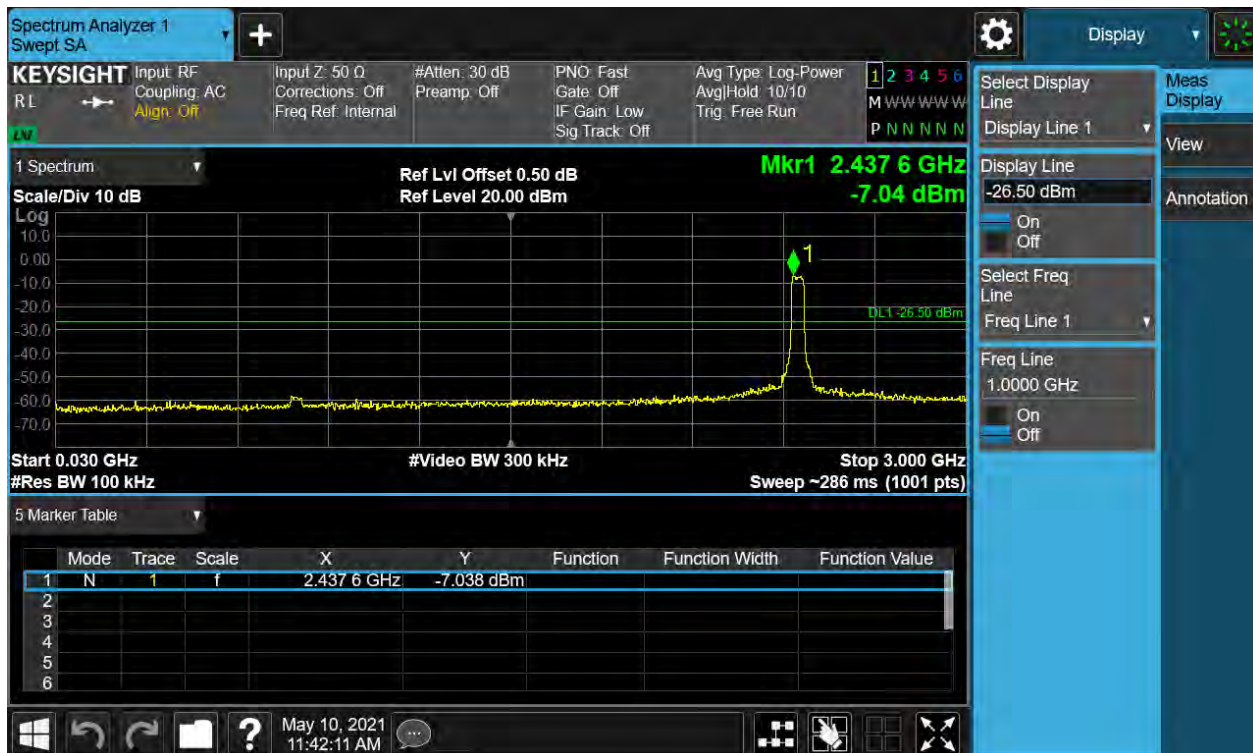
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Band Edge



Conducted spurious emissions 30MHz-25GHz



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4.1.6 Radiated Spurious Emission

RESULT:

PASS

Test standard	: FCC Part 15.247(d), 15.205, 15.209
Requirement	: ANSI C63.10-2013, KDB 558074
Kind of test site	: 3m Semi-Anechoic Chamber

Test setup

Test Channel	: Low/Middle/High
Operation Mode	: A
Ambient temperature	: 25°C
Relative humidity	: 52%

Notes

Test plots please refer to the annex document "SHE21040017-02CE DATA WIFI 2.4GHz-TX EXHIBIT A".

1. For 9 kHz ~ 30 MHz, the amplitude of spurious emissions that are attenuated by more than 20dB below the permissible. The value has no need to be reported.
2. The spurious above 18GHz is noise only and 20dB below the limit. The value has no need to be reported.
3. The EUT is working in the Normal link mode below 1 GHz.
4. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement –X, Y, and Z-plane. The X-plane results were found as the worst case and were shown in this report.

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4.1.7 Band Edge (Restricted-band band-edge)

RESULT:

PASS

Test standard	: FCC Part 15.247(d), 15.205, 15.209
Requirement	: ANSI C63.10-2013, KDB 558074
Kind of test site	: 3m Semi-Anechoic Chamber

Test setup

Test Channel	: Low/Middle/High
Operation Mode	: A.1
Ambient temperature	: 25°C
Relative humidity	: 52%

Notes:

Test plots please refer to the annex document "SHE21040017-02CE DATA WIFI 2.4GHz-TX EXHIBIT A".

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4.2 Mains Emissions

4.2.1 Conducted Emission on AC Mains

RESULT:

PASS

Test standard	: FCC Part 15.207(a)
Requirement	: ANSI C63.10-2013
Kind of test site	: Shielded room

Test setup

Input Voltage	: AC 120V, 60Hz
Operation Mode	: A
Earthing	: Not Connected
Ambient temperature	: 25C
Relative humidity	: 52%

For details refer to following test plot.

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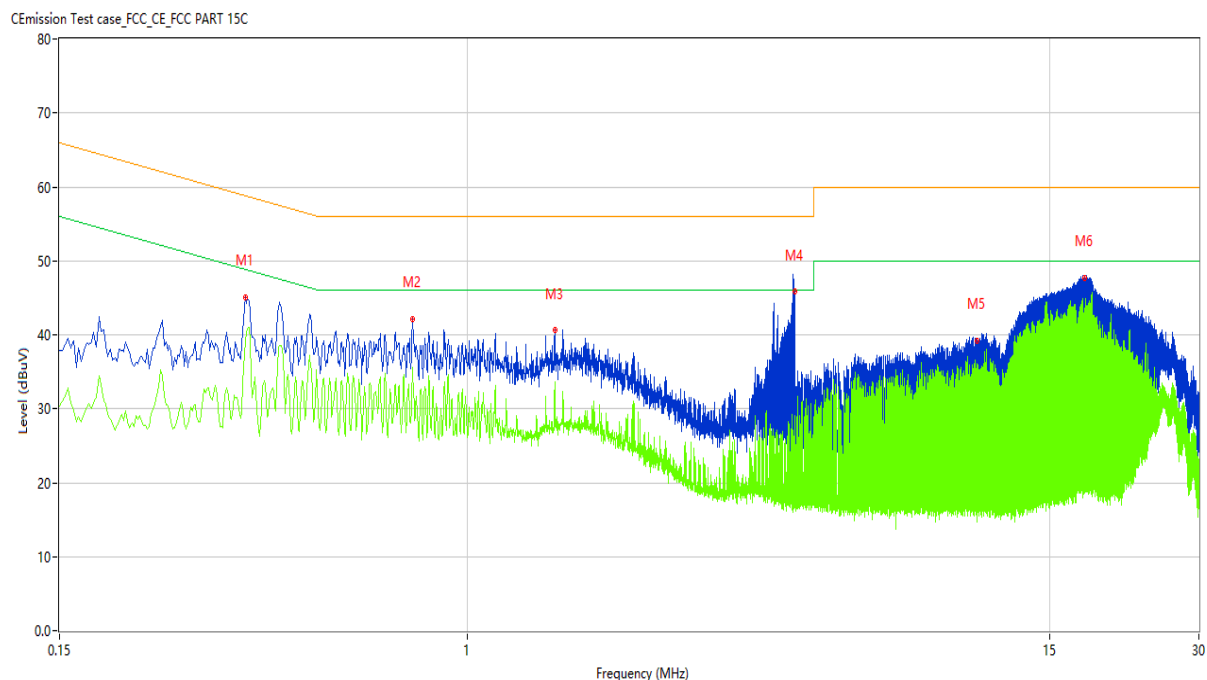
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Note: The all configurations were tested respectively, but only the worst configuration shown here.

Figure 37: Conducted Emission on AC Mains, L Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.356	44.92	9.72	58.82	-13.90	Peak	L	Pass
1*	0.356	41.49	9.72	58.82	-17.33	QP	L	Pass
1**	0.356	39.11	9.72	48.82	-9.71	AV	L	Pass
2	0.774	40.20	9.75	56.00	-15.80	Peak	L	Pass
2*	0.774	36.63	9.75	56.00	-19.37	QP	L	Pass
2**	0.774	35.59	9.75	46.00	-10.41	AV	L	Pass
3	1.500	36.95	9.67	56.00	-19.05	Peak	L	Pass
3*	1.500	32.06	9.67	56.00	-23.94	QP	L	Pass
3**	1.500	33.61	9.67	46.00	-12.39	AV	L	Pass
4	4.574	32.18	9.69	56.00	-23.82	Peak	L	Pass
4*	4.574	27.06	9.69	56.00	-28.94	QP	L	Pass
4**	4.574	22.99	9.69	46.00	-23.01	AV	L	Pass
5	10.710	38.71	9.65	60.00	-21.29	Peak	L	Pass
5*	10.710	35.73	9.65	60.00	-24.27	QP	L	Pass
5**	10.710	31.53	9.65	50.00	-18.47	AV	L	Pass
6	17.642	47.75	9.48	60.00	-12.25	Peak	L	Pass
6*	17.642	45.53	9.48	60.00	-14.47	QP	L	Pass
6**	17.642	37.19	9.48	50.00	-12.81	AV	L	Pass

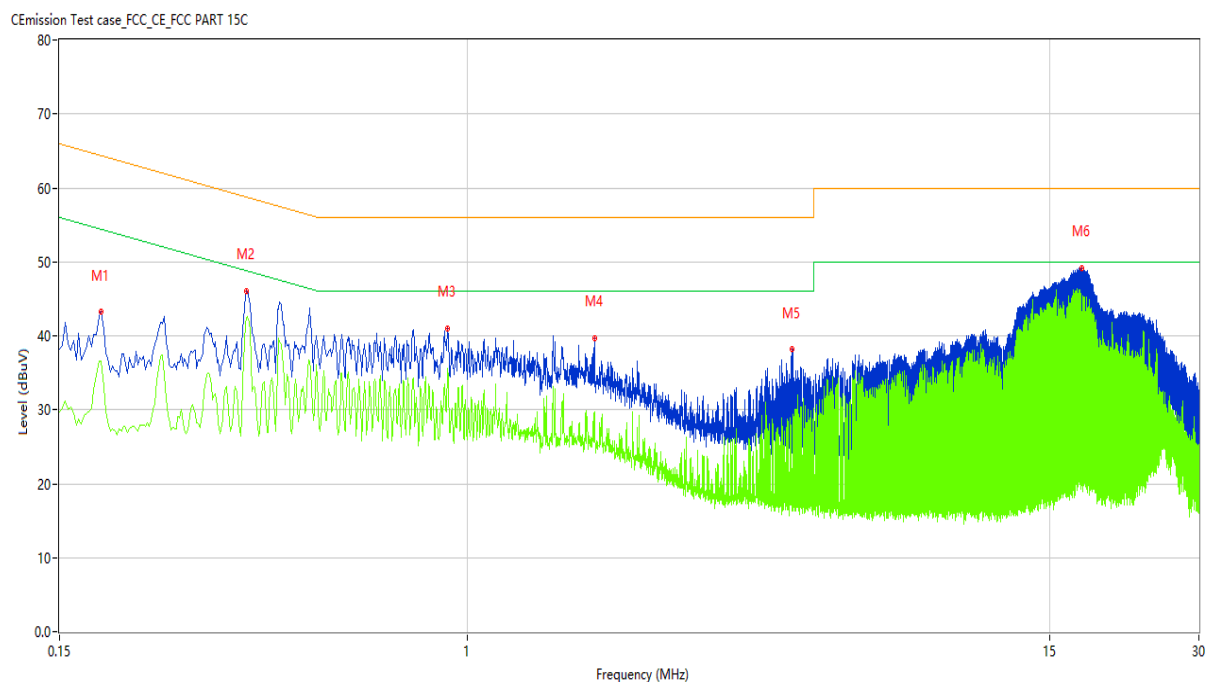
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Figure 38: Conducted Emission on AC Mains, N Phase



No.	Frequency (MHz)	Results (dBuV)		Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.182	42.17	9.66	64.39	-22.22	Peak	N	Pass
1*	0.182	38.28	9.66	64.39	-26.11	QP	N	Pass
1**	0.182	36.64	9.66	54.39	-17.75	AV	N	Pass
2	0.358	45.84	9.72	58.77	-12.93	Peak	N	Pass
2*	0.358	43.36	9.72	58.77	-15.41	QP	N	Pass
2**	0.358	42.47	9.72	48.77	-6.30	AV	N	Pass
3	0.910	38.22	9.76	56.00	-17.78	Peak	N	Pass
3*	0.910	35.15	9.76	56.00	-20.85	QP	N	Pass
3**	0.910	34.80	9.76	46.00	-11.20	AV	N	Pass
4	1.804	33.03	9.68	56.00	-22.97	Peak	N	Pass
4*	1.804	27.34	9.68	56.00	-28.66	QP	N	Pass
4**	1.804	29.78	9.68	46.00	-16.22	AV	N	Pass
5	4.532	32.37	9.69	56.00	-23.63	Peak	N	Pass
5*	4.532	27.71	9.69	56.00	-28.29	QP	N	Pass
5**	4.532	18.57	9.69	46.00	-27.43	AV	N	Pass
6	17.442	49.21	9.49	60.00	-10.79	Peak	N	Pass
6*	17.442	46.68	9.49	60.00	-13.32	QP	N	Pass
6**	17.442	41.94	9.49	50.00	-8.06	AV	N	Pass

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5 Appendixes

5.1 Photographs of the Sample



Front of the sample



Rear of the sample

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5.2 Set-up for Conducted Emissions



5.3 Set-up for Conducted RF test at Antenna Port



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5.4 Set-up for Spurious Emissions below 1GHz



5.5 Set-up for Spurious Emissions above 1GHz



End of the report