

TEST REPORT

Report No.: SHE20090007-02HE

Date: 2021-04-09

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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	Bluetooth BR/EDR
Frequency Range	2400MHz ~ 2483.5MHz
Number of Channels	79 (at intervals of 1 MHz)
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Antenna Type	Internal Antenna
Antenna Gain	3.23dBi
Extreme Temperature Range	-20°C ~ +55°C
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

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1.4 Test Methodology

47 CFR Part 15, Subpart C (10-1-16 Edition)	Miscellaneous Wireless Communications Services
FCC PUBLIC NOTICE DA 00-705 (Mar.30, 2000)	Filling and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
RSS-Gen (Issue 5, March 2019)	General Requirements for Compliance of Radio Apparatus
RSS-247 (Issue 2, February 2017)	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Note(s):

All test items were verified and recorded according to the standards and without any addition/deviation/exclusion during the test.

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2 Test Condition

2.1 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. 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

2.3 Measurement Uncertainty

Parameter	Frequency	Uncertainty
Antenna Port Conducted Emission	< 1GHz	± 1.5 dB
	> 1GHz	± 1.5 dB
Radiated Emission	30 MHz – 1 GHz	± 3 dB
	> 1GHz	± 3 dB

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3 Test Set-up and Operation Modes

3.1 Details of Test Mode

Using test software was control EUT work in continuous transmitter and receiver mode. Select test channel as below:

Channel	Frequency
The lowest channel(CH0)	2402MHz
The middle channel(CH39)	2441MHz
The Highest channel(CH78)	2480MHz

The basic operation modes are:

- A. On
 - 1. BR/EDR mode
 - a. Transmitting
 - i. Low Channel
 - ii. Middle Channel
 - iii. High Channel
 - iv. Hopping mode
 - b. Receiving
 - 2. Normal working with Bluetooth on
- 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

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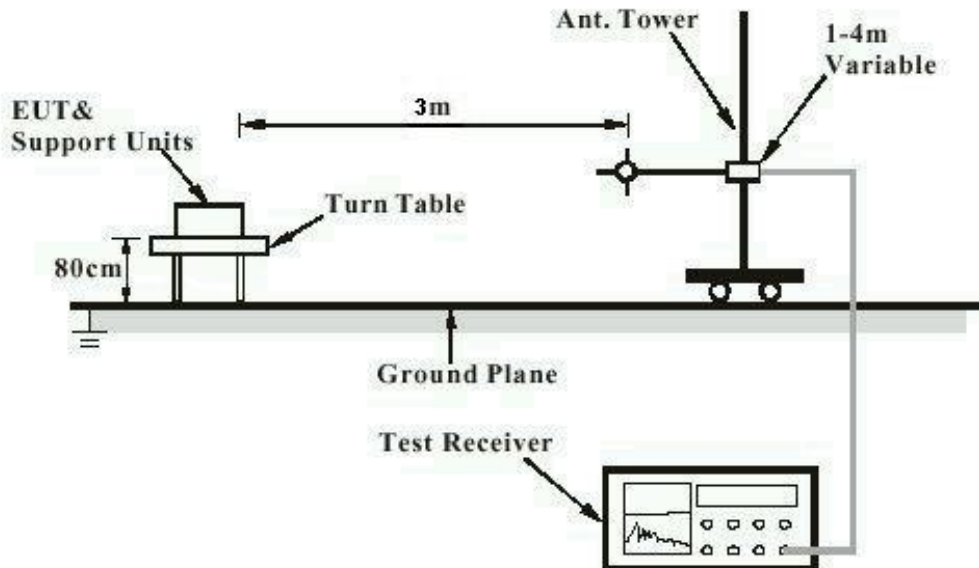
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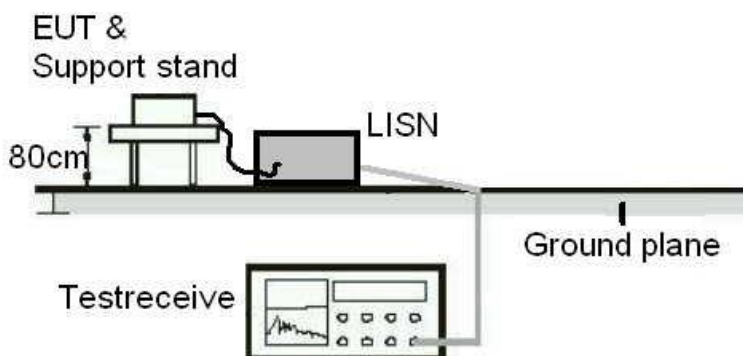
3.4 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



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

Diagram of Measurement Equipment Configuration for Conduction Measurement



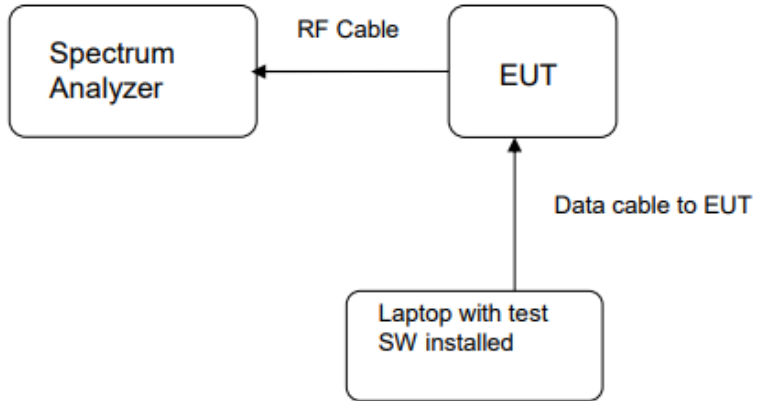
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Diagram of Measurement Equipment Configuration for Transmitter Measurement



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4 Test Results

4.1 Transmitter Requirement & Test Suites

4.1.1 Antenna Requirement

RESULT:

PASS

Test standard : FCC Part 15.247(b)(4), Part 15.203
RSS-247 5.4(6)

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

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4.1.2 Maximum Conducted Output Power and E.I.R.P

RESULT:

PASS

Test standard : FCC Part 15.247(b)(1)
 RSS-247 5.4(2)
 Requirement : ANSI C63.10-2013
 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: Maximum Conducted Output Power

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(mW)	
GFSK	2402	9.19	8.30	< 1
	2441	9.97	9.93	
	2480	9.90	9.77	
$\pi/4$ -DQPSK	2402	9.04	8.02	< 0.125
	2441	9.80	9.55	
	2480	9.84	9.64	
8-DPSK	2402	9.32	8.55	< 0.125
	2441	10.11	10.26	
	2480	10.09	10.21	

Table 2: E.I.R.P

Test Mode	Test Channel (MHz)	E.I.R.P		Limit (W)
		(dBm)	(mW)	
GFSK	2402	12.42	17.46	< 4
	2441	13.20	20.89	
	2480	13.13	20.56	
$\pi/4$ -DQPSK	2402	12.27	16.87	
	2441	13.03	20.09	
	2480	13.07	20.28	
8-DPSK	2402	12.55	17.99	
	2441	13.34	21.58	
	2480	13.32	21.48	

Note: The antenna gain is 3.23dBi

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Figure 1: Maximum Conducted Output Power, 2402MHz, GFSK

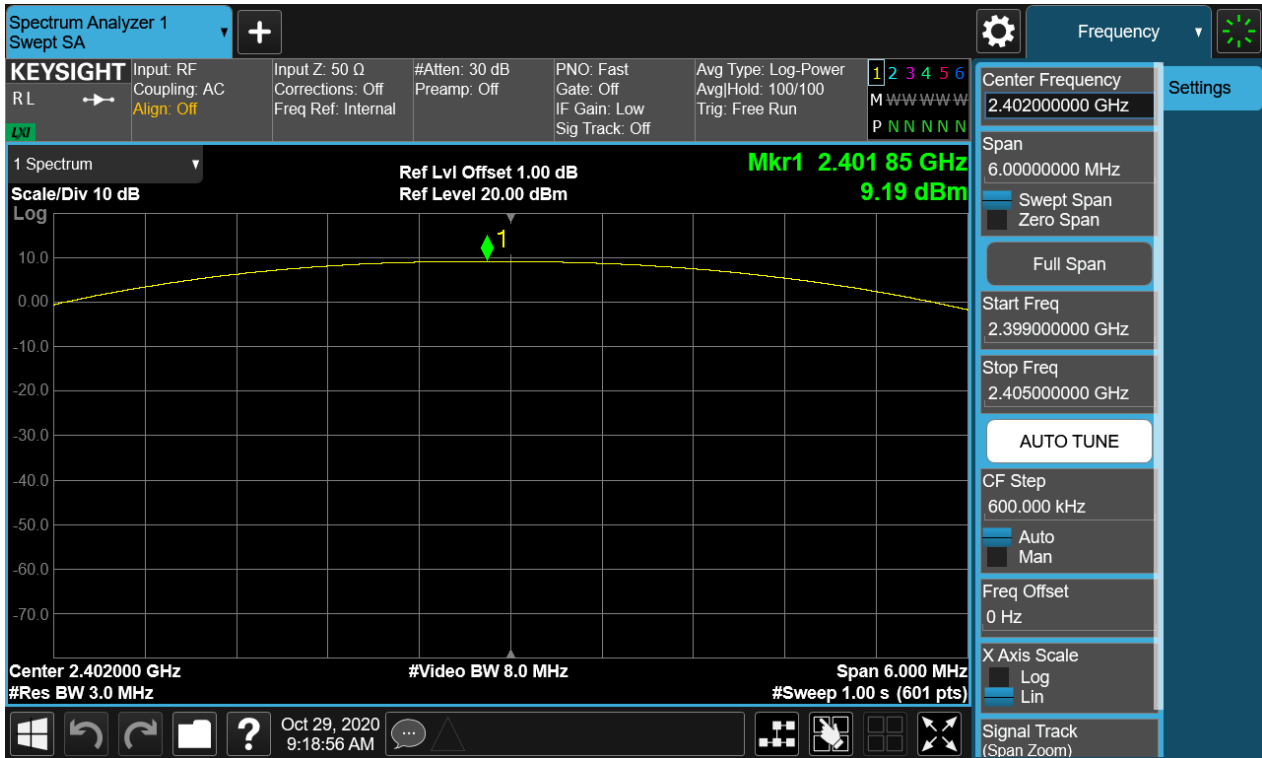
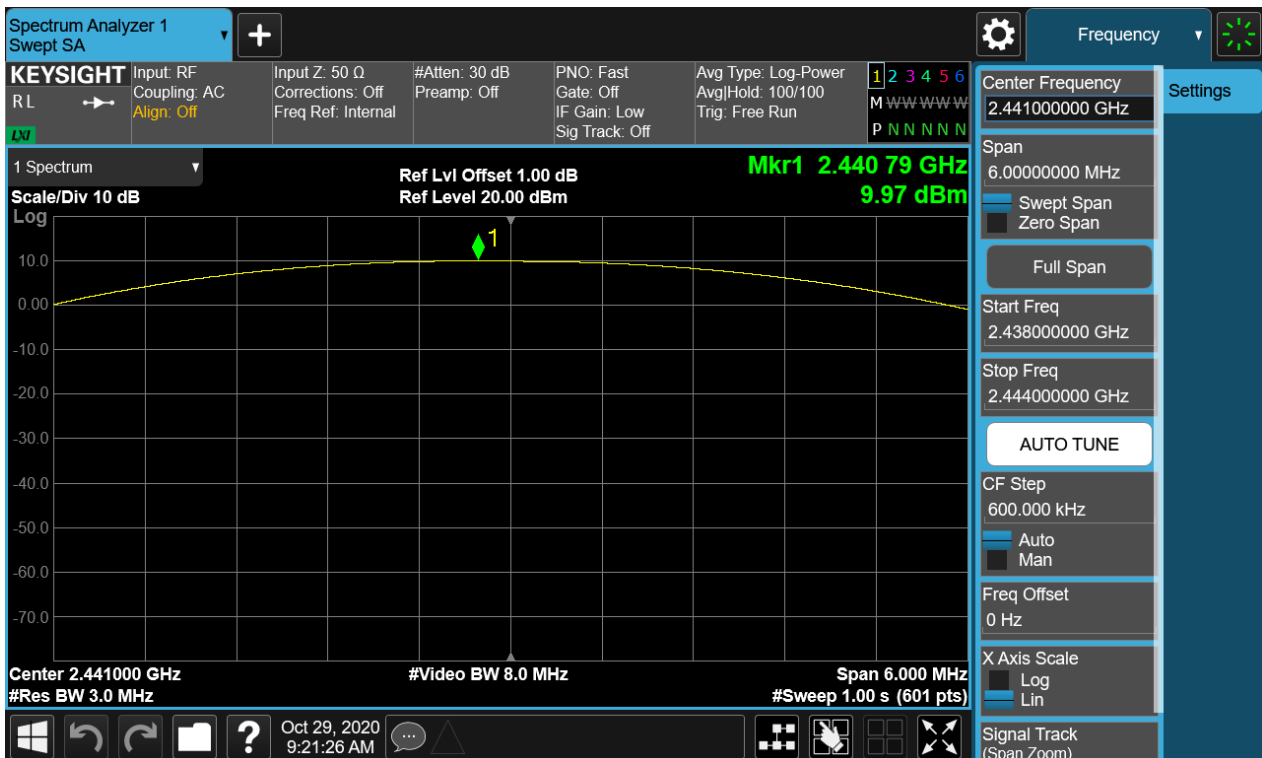


Figure 2: Maximum Conducted Output Power, 2441MHz, GFSK



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Figure 3: Maximum Conducted Output Power, 2480MHz, GFSK

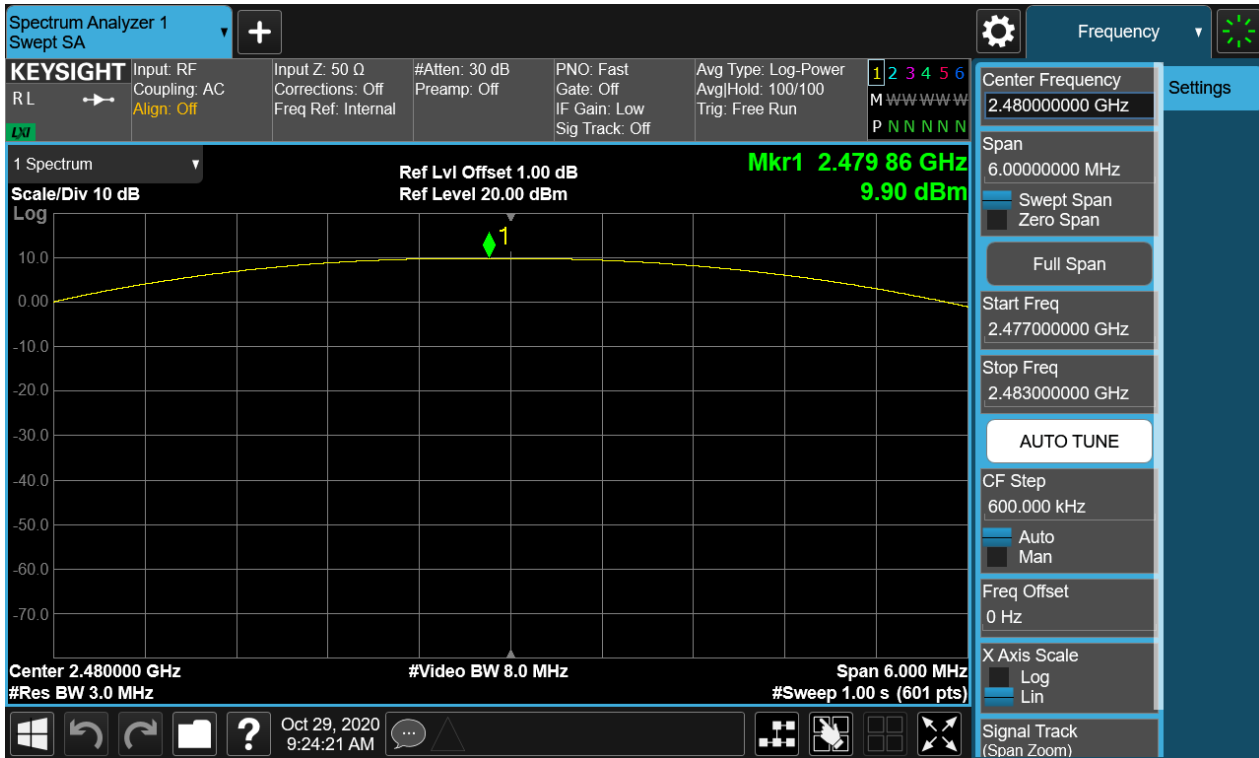
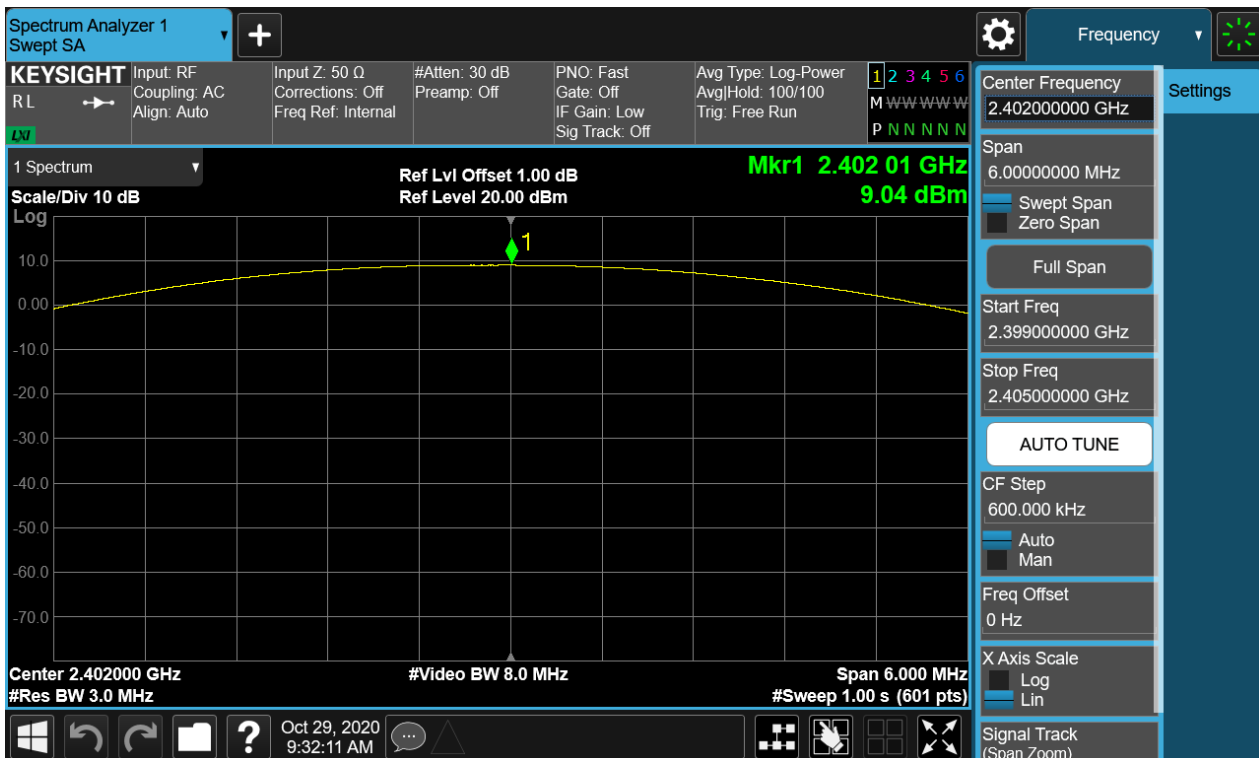


Figure 4: Maximum Conducted Output Power, 2402MHz, $\pi/4$ -DQPSK



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Figure 5: Maximum Conducted Output Power, 2441MHz, $\pi/4$ -DQPSK

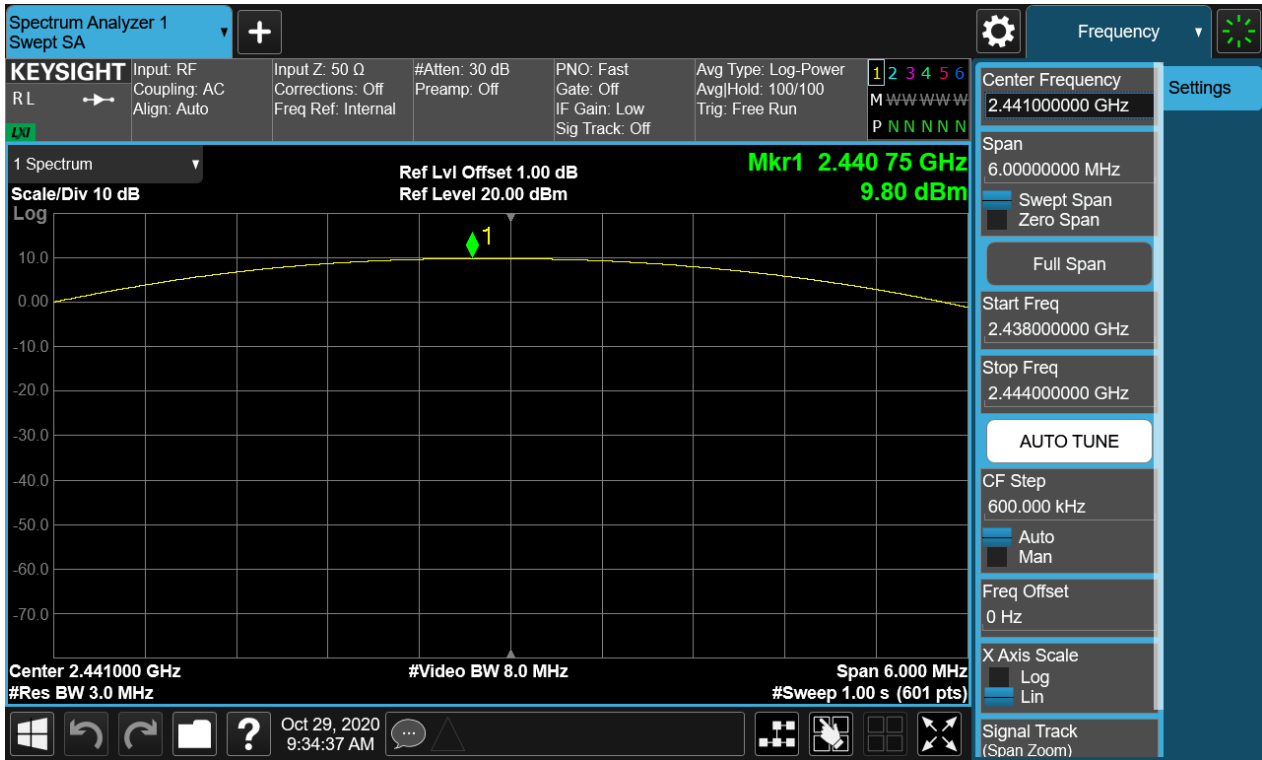
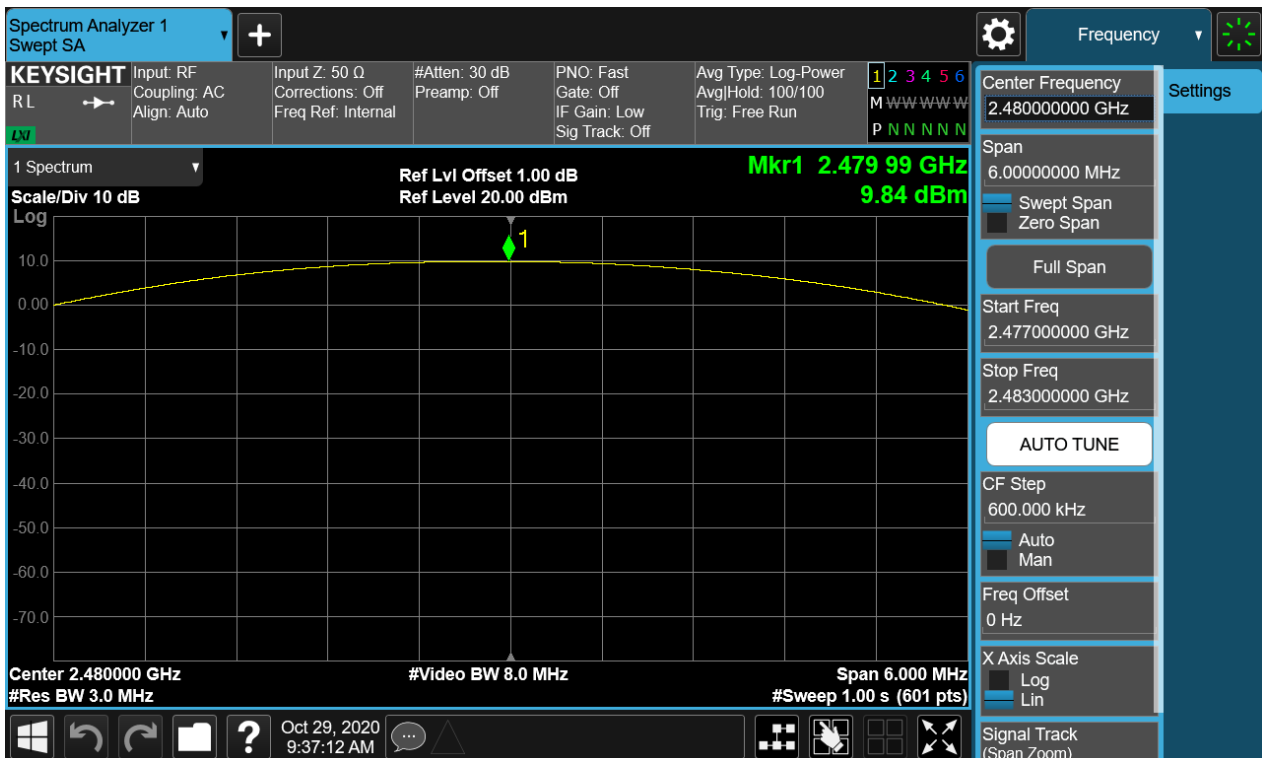


Figure 6: Maximum Conducted Output Power, 2480MHz, $\pi/4$ -DQPSK



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Figure 7: Maximum Conducted Output Power, 2402MHz, 8-DPSK

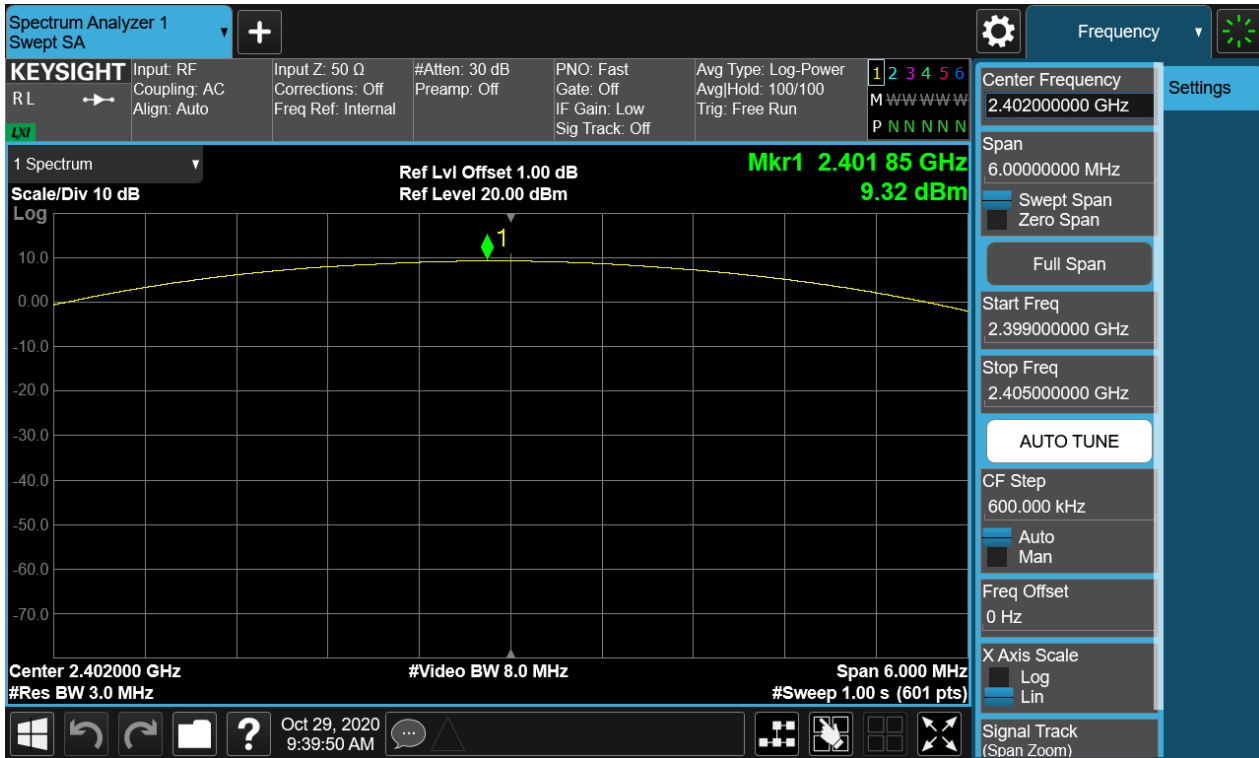
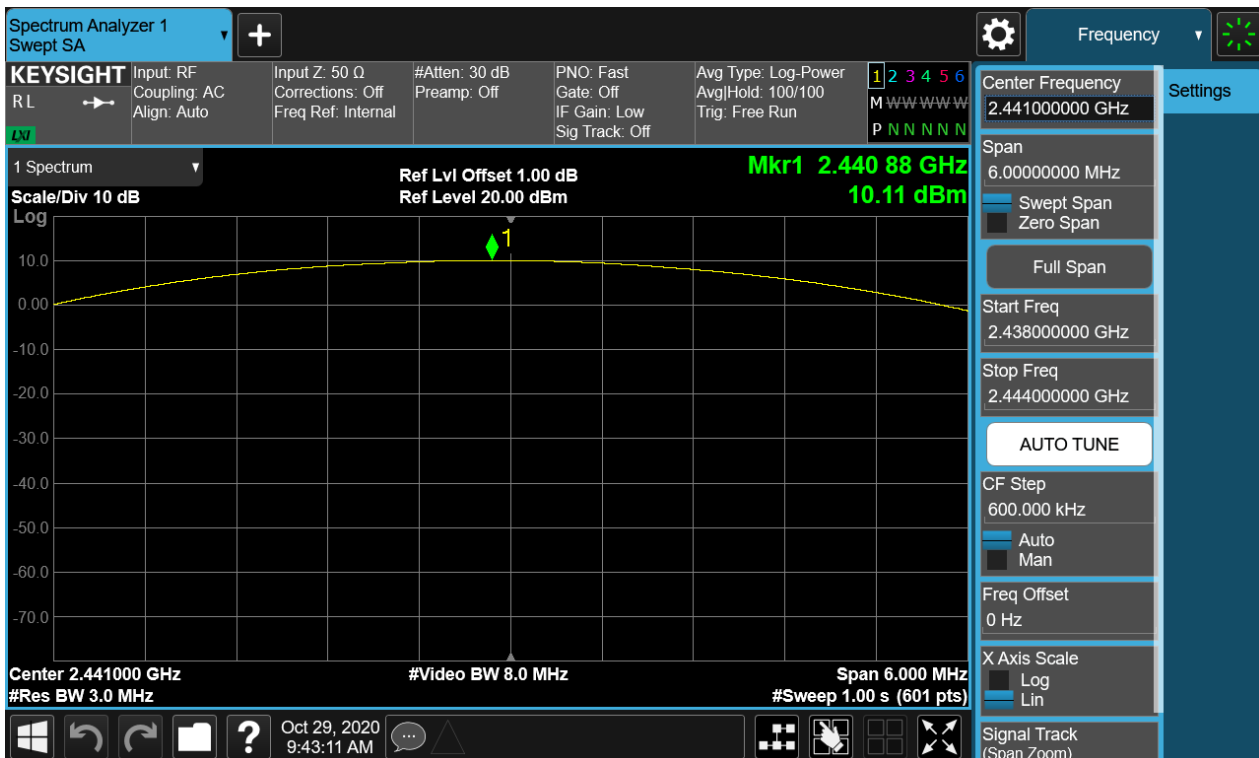


Figure 8: Maximum Conducted Output Power, 2441MHz, 8-DPSK



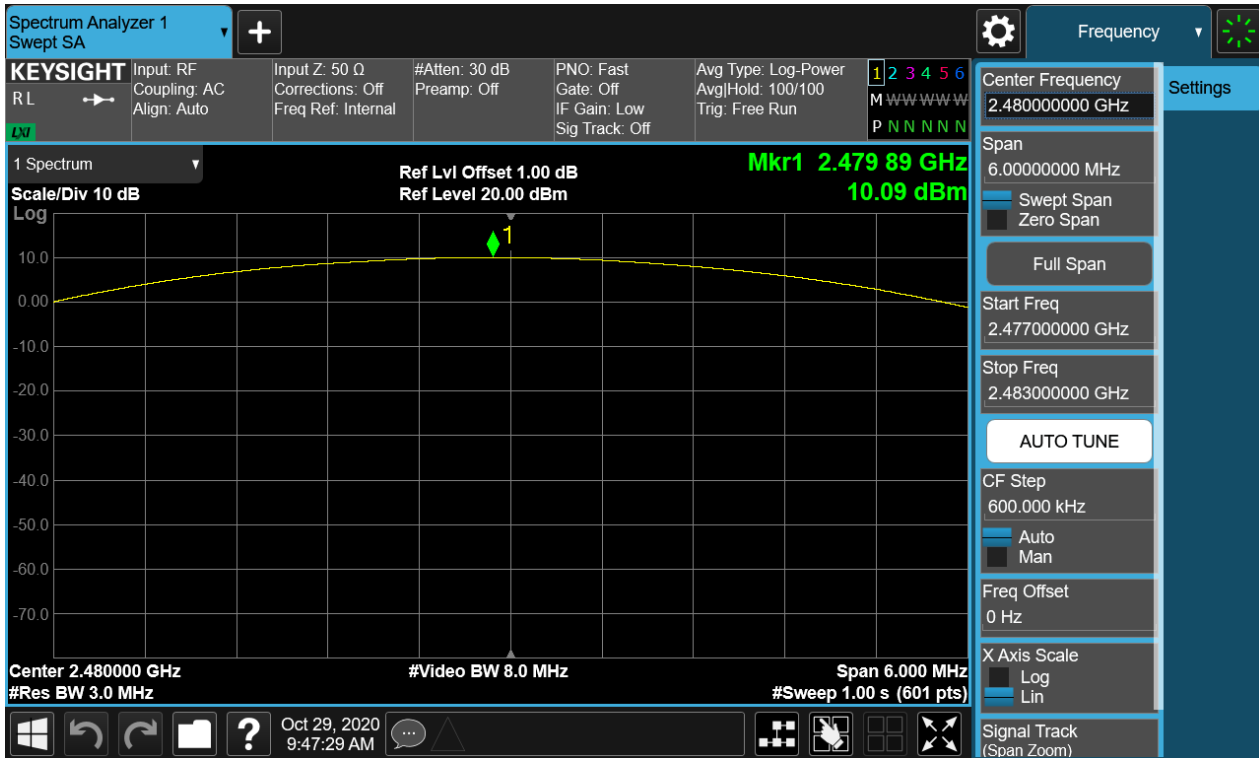
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Figure 9: Maximum Conducted Output Power, 2480MHz, 8-DPSK



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4.1.3 20dB Bandwidth and 99% Bandwidth

RESULT:

PASS

Test standard : FCC Part 15.247(a)(1)
RSS-247 5.1(1)
RSS-Gen 6.7
Requirement : ANSI C63.10-2013
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: 20dB Bandwidth and 99% Bandwidth

Test Mode	Test Channel (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
GFSK	2402	1.047	0.973
	2441	1.010	0.912
	2480	1.007	0.913
8-DPSK	2402	1.294	1.180
	2441	1.295	1.181
	2480	1.293	1.178

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Figure 10: 20dB Bandwidth and 99% Bandwidth, 2402MHz, GFSK



Figure 11: 20dB Bandwidth and 99% Bandwidth, 2441MHz, GFSK



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Figure 12: 20dB Bandwidth and 99% Bandwidth, 2480MHz, GFSK

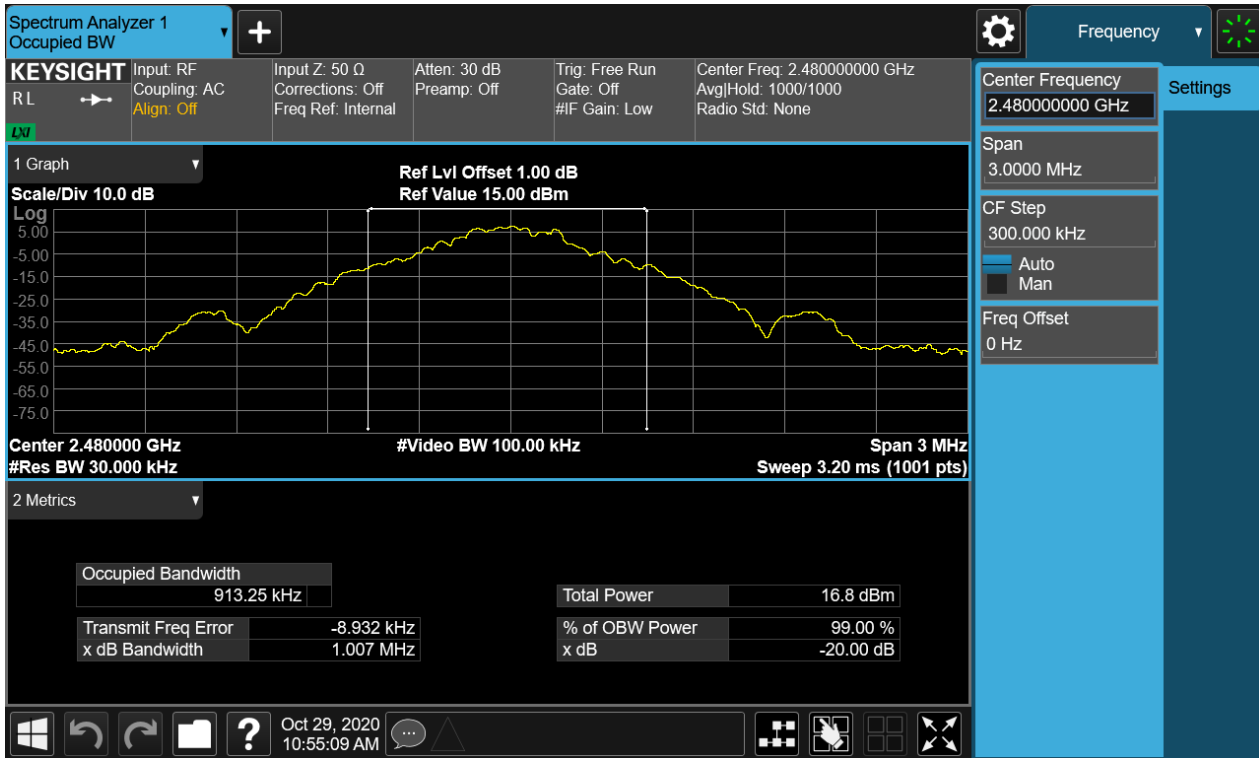
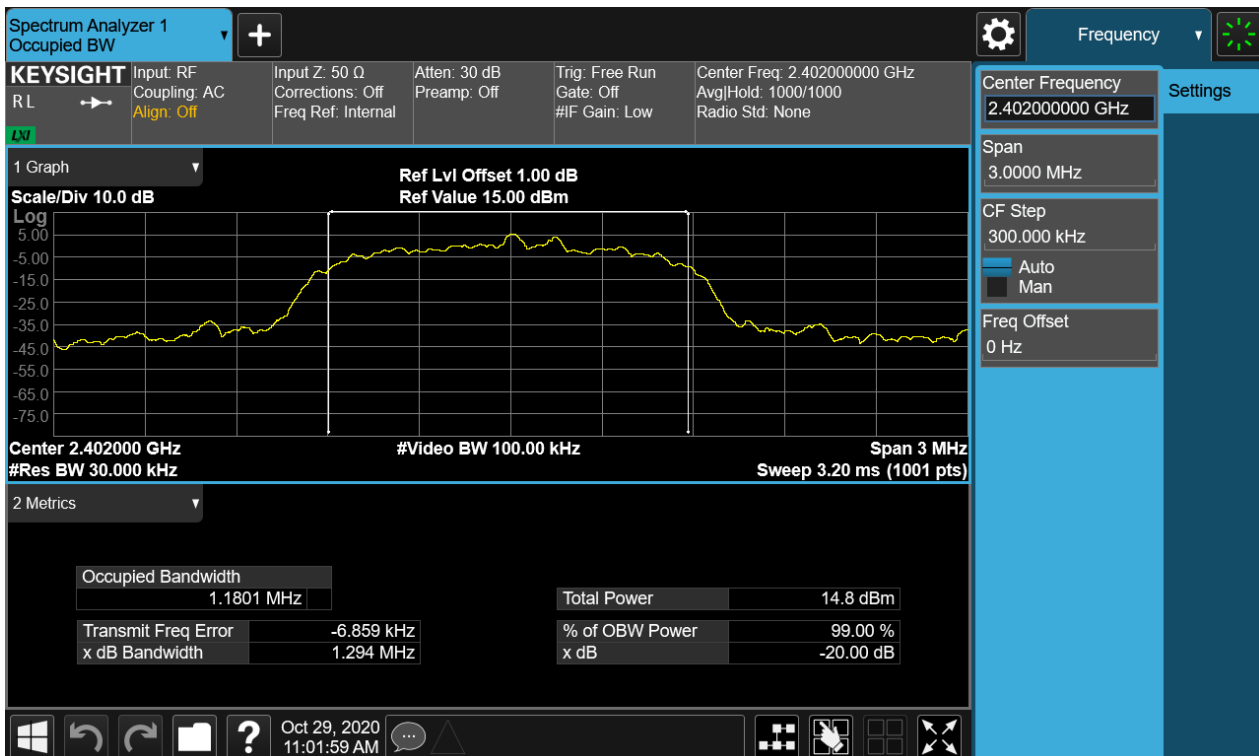


Figure 13: 20dB Bandwidth and 99% Bandwidth, 2402MHz, 8-DPSK



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Figure 14: 20dB Bandwidth and 99% Bandwidth, 2441MHz, 8-DPSK

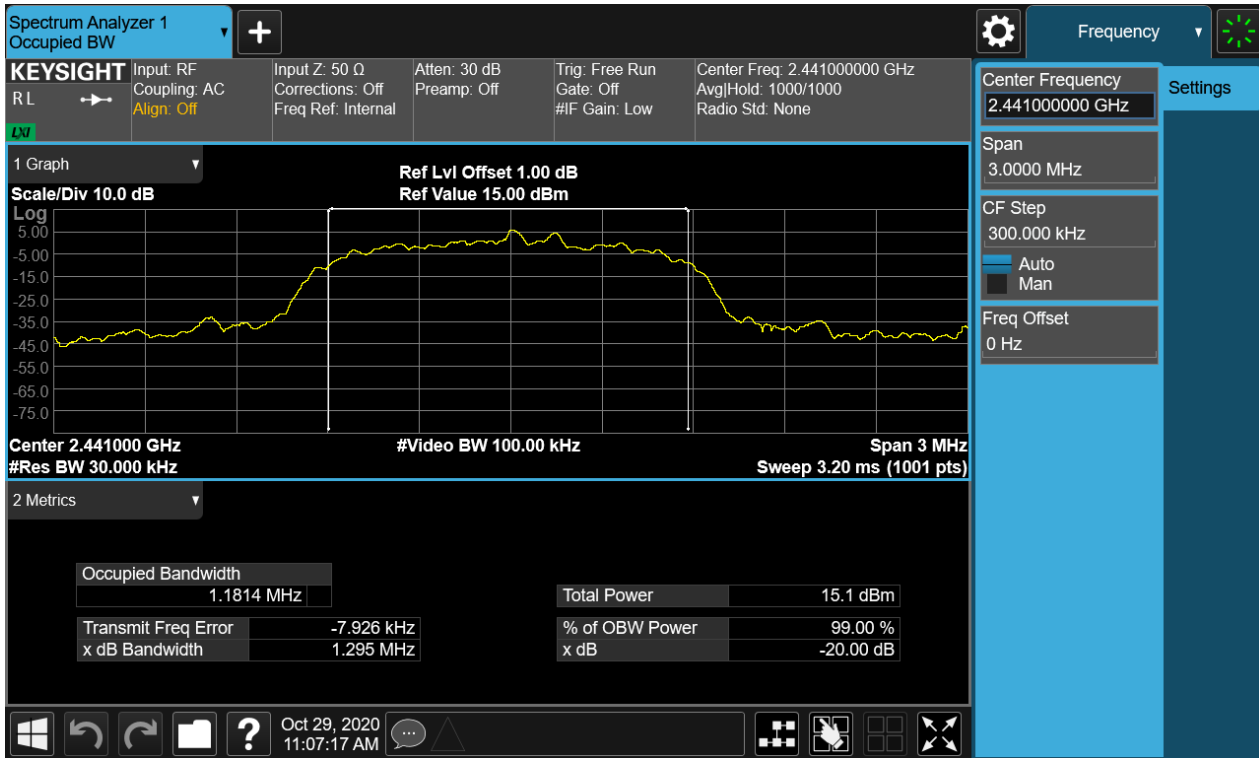
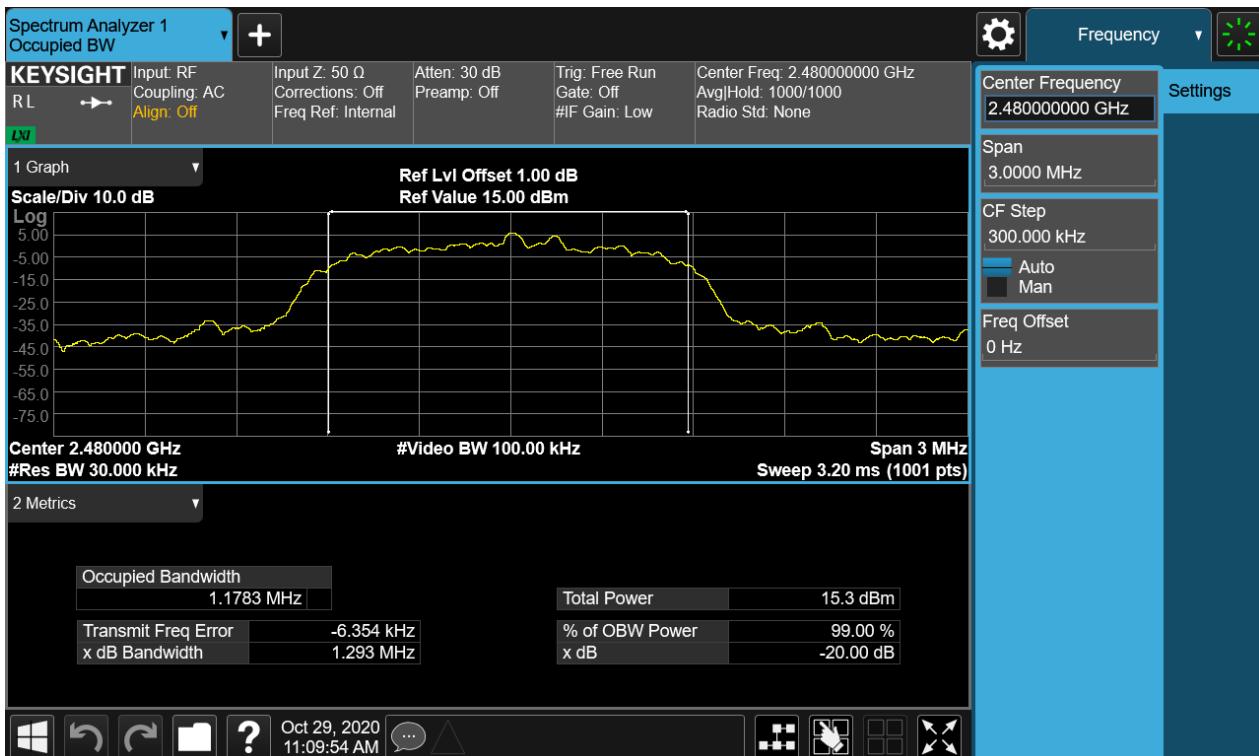


Figure 15: 20dB Bandwidth and 99% Bandwidth, 2480MHz, 8-DPSK



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4.1.4 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
Kind of test site : Shielded room

Test setup

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

For details refer to following test plot.

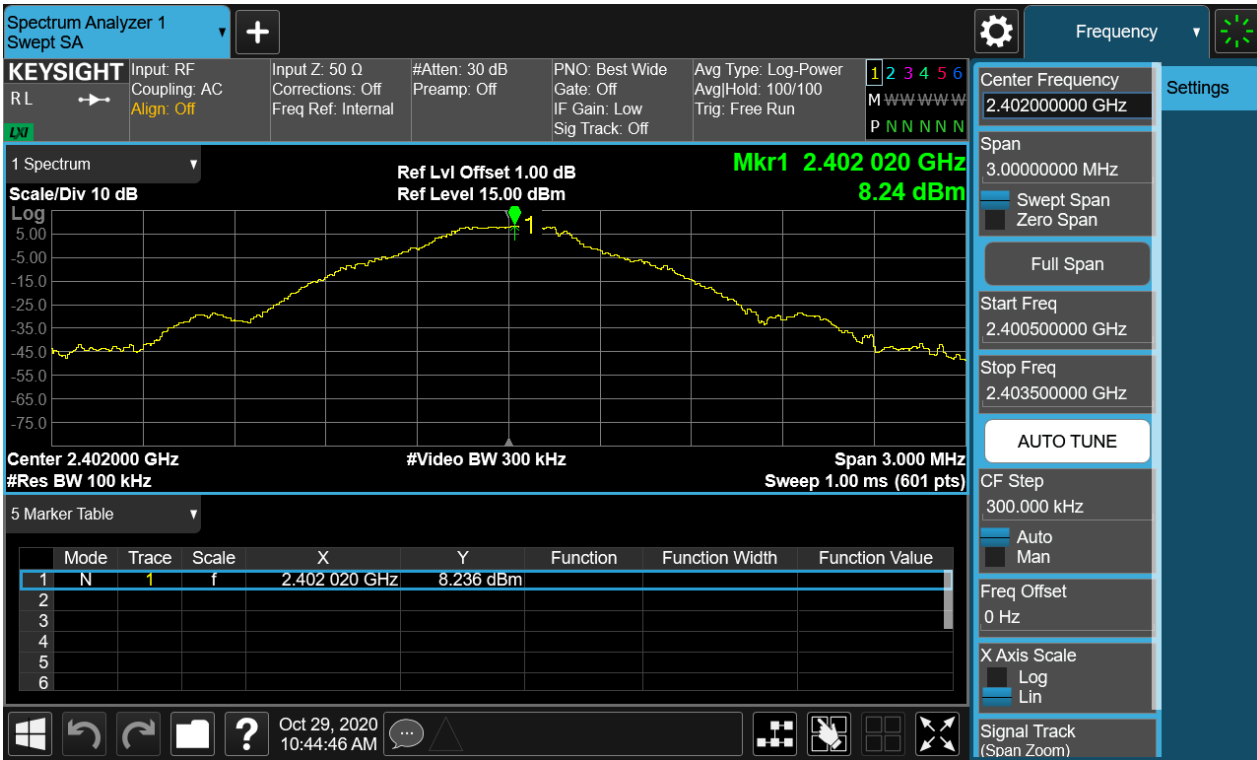
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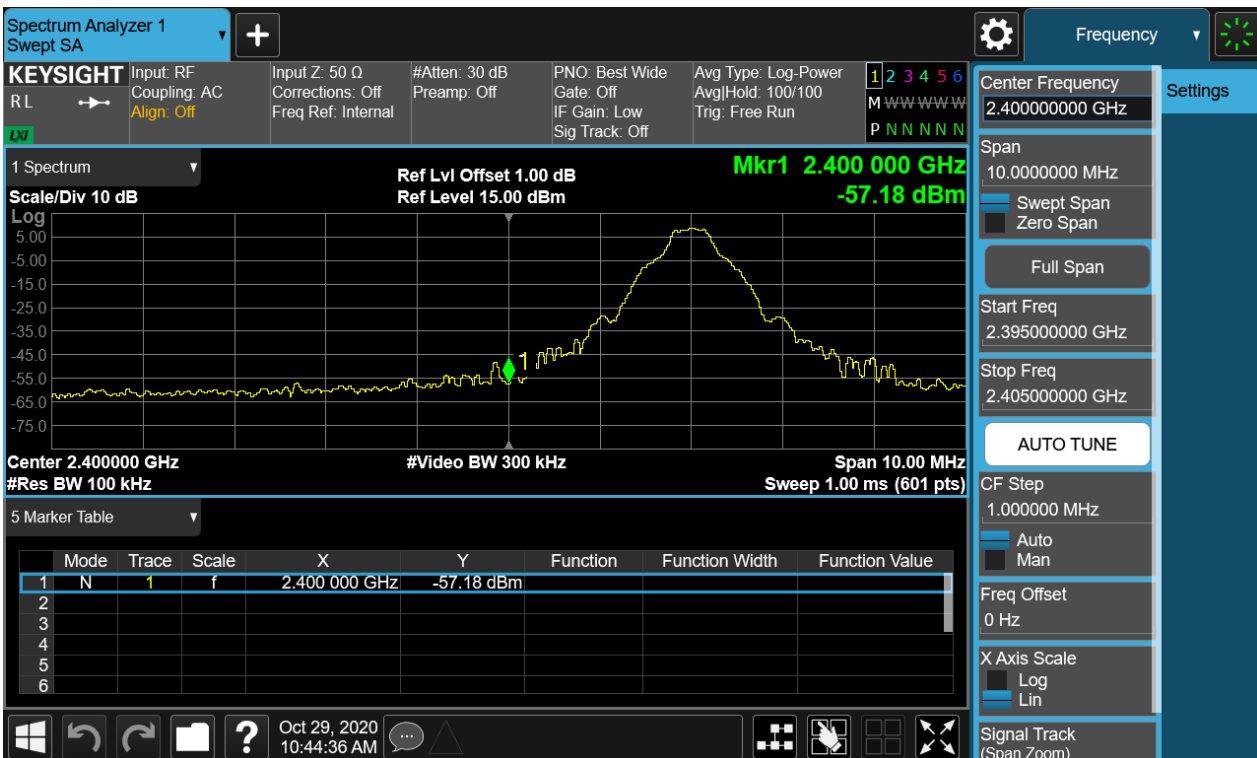
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Figure 16: Conducted Spurious Emission & Authorized-band band-edge, 2402MHz, GFSK Carrier Level



Band Edge



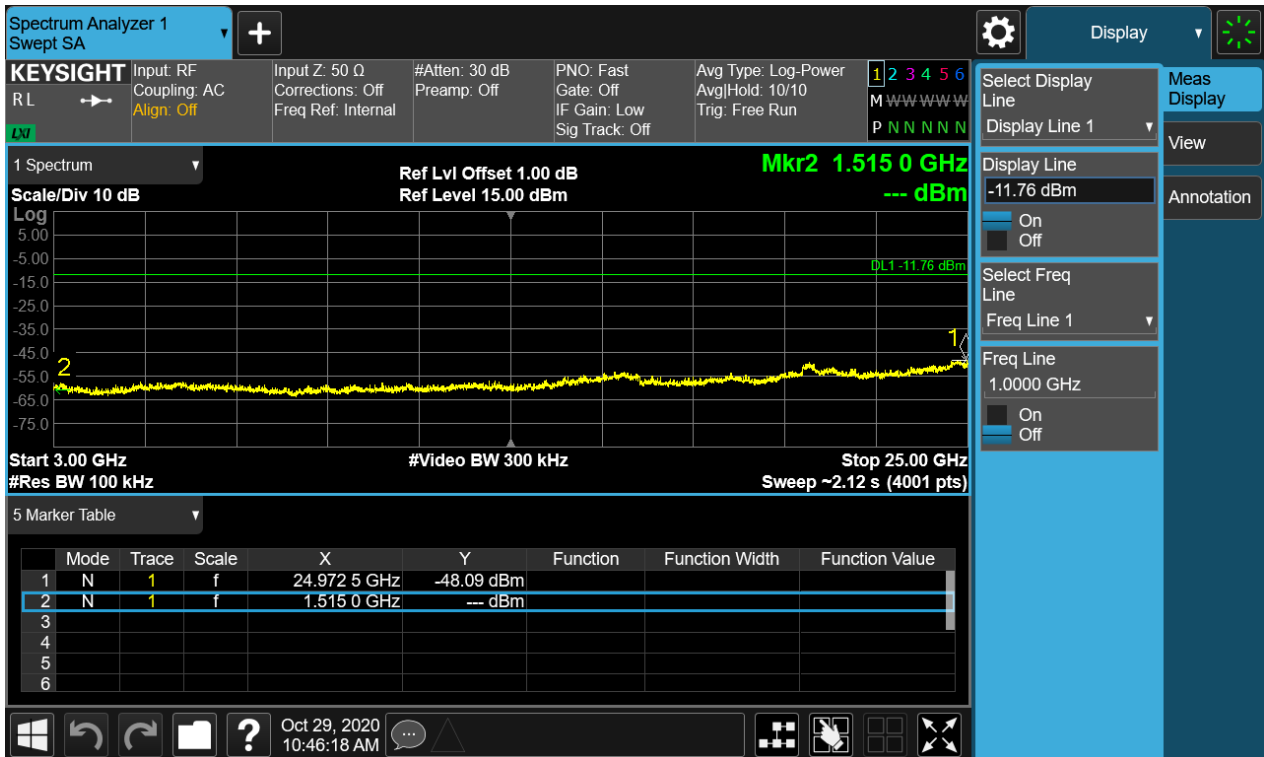
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Conducted spurious emissions 30MHz-25GHz



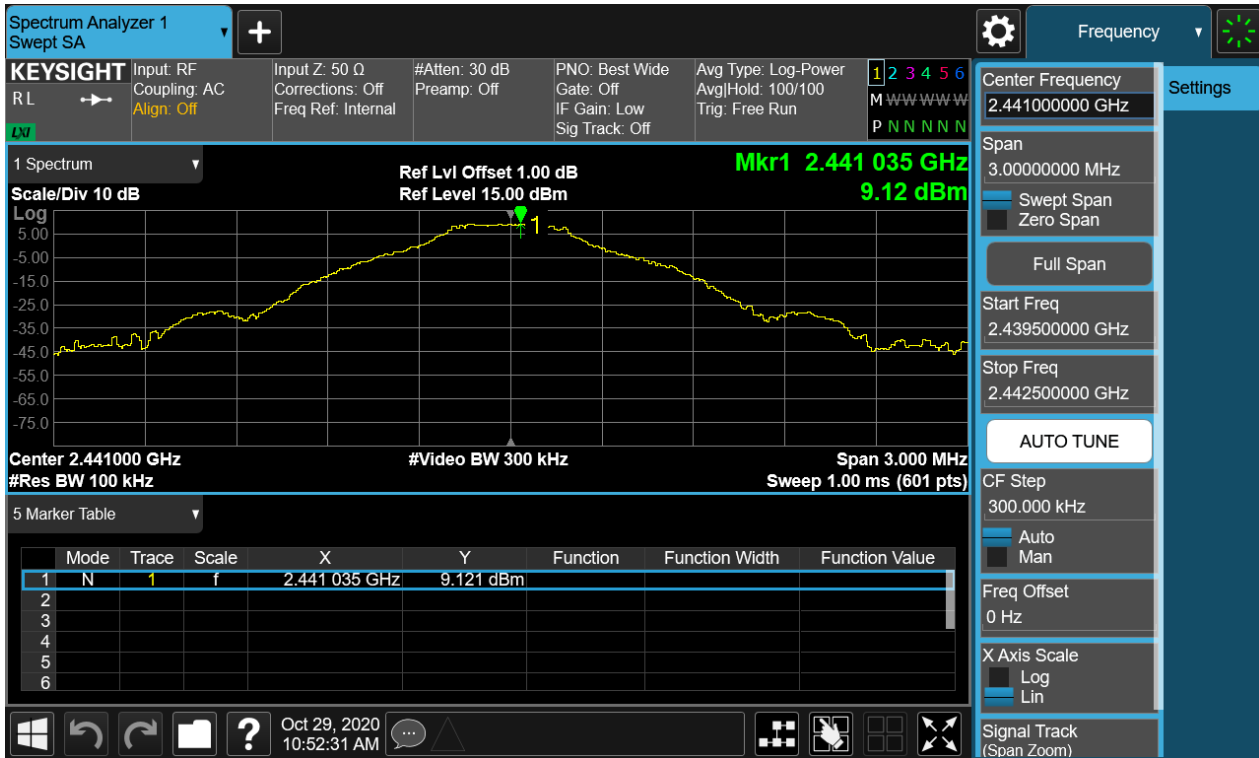
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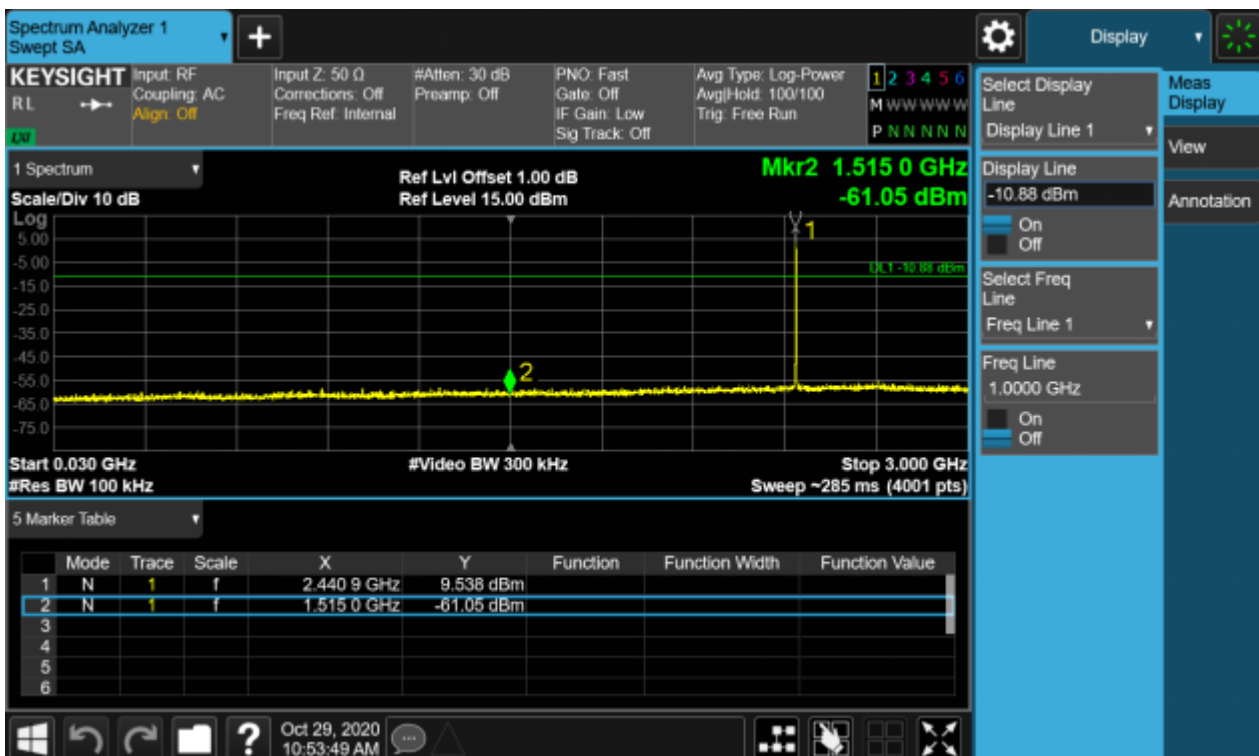
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Figure 17: Conducted Spurious Emission & Authorized-band band-edge, 2441MHz, GFSK Carrier Level



Conducted spurious emissions 30MHz-25GHz



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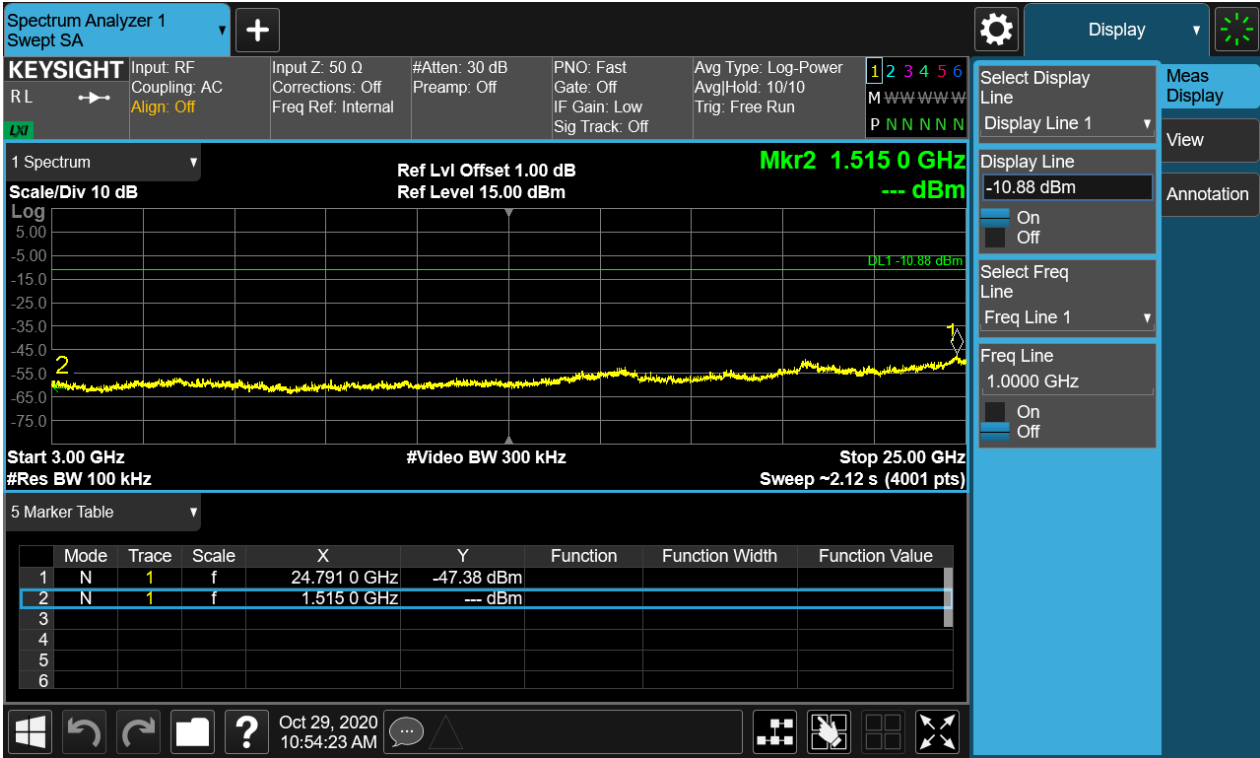
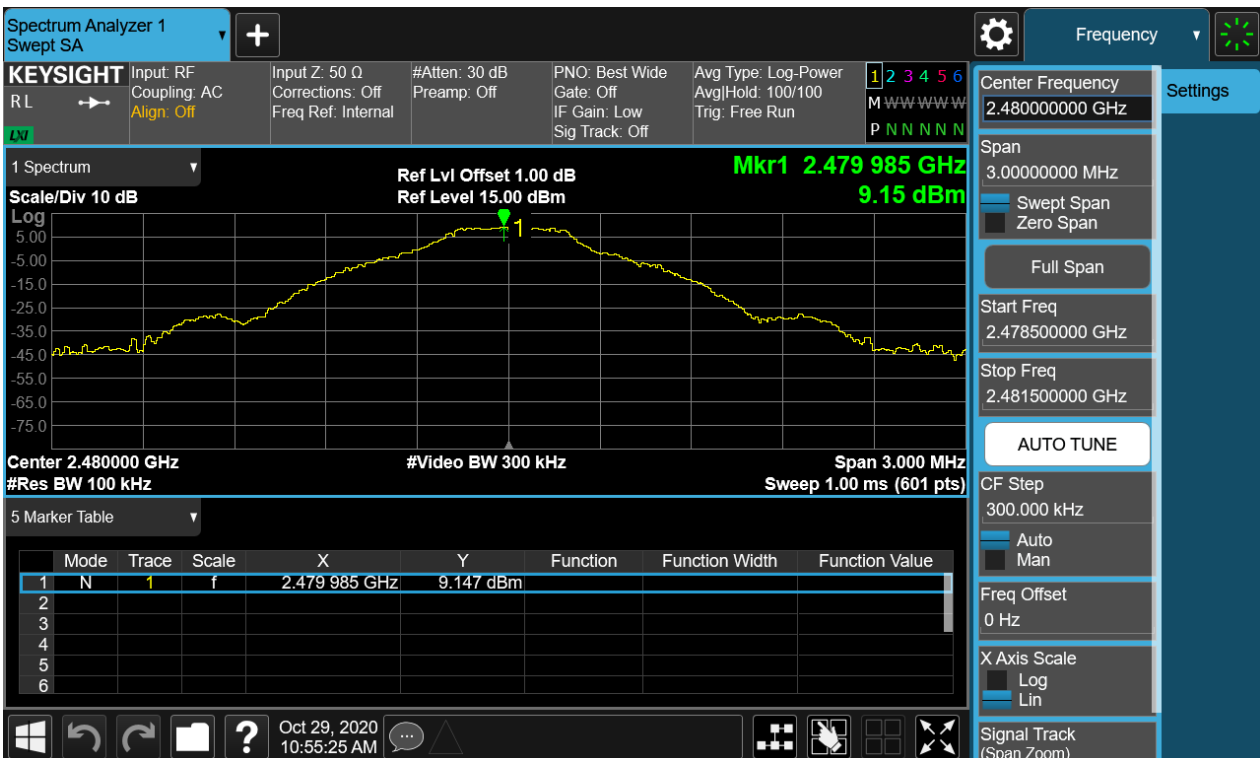


Figure 18: Conducted Spurious Emission & Authorized-band band-edge, 2480MHz, GFSK Carrier Level



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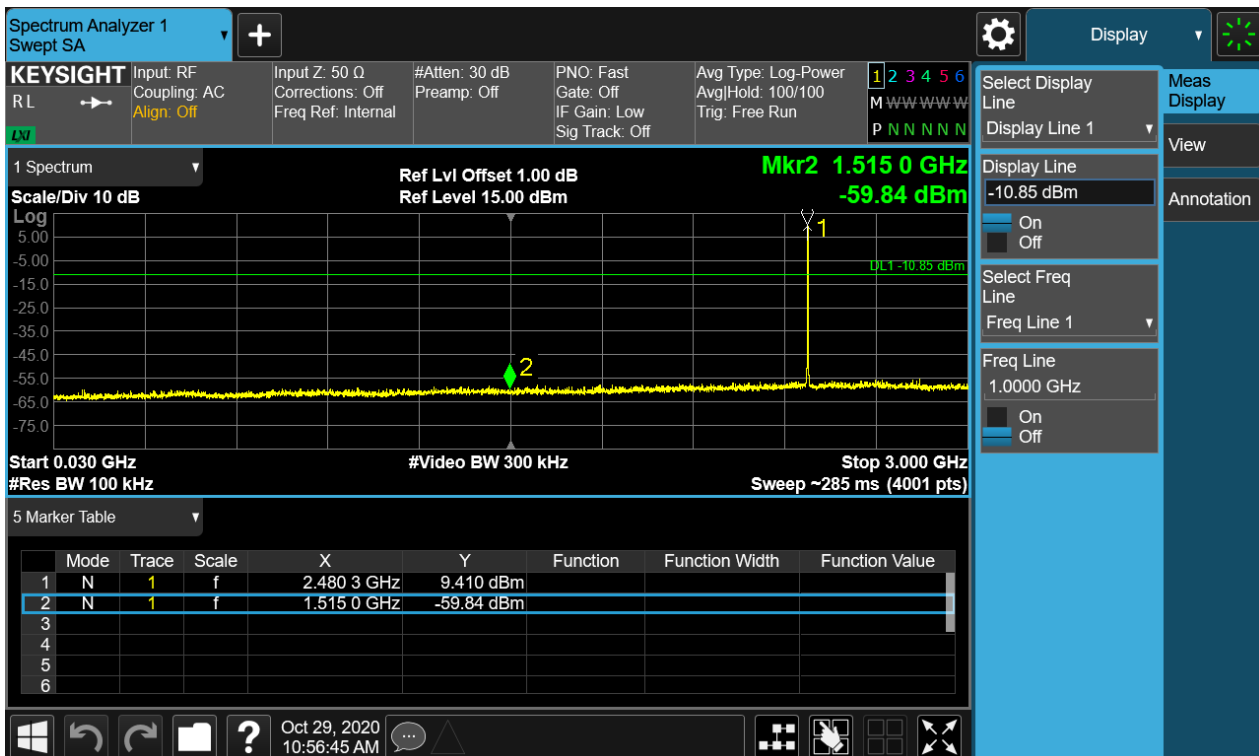
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Band Edge



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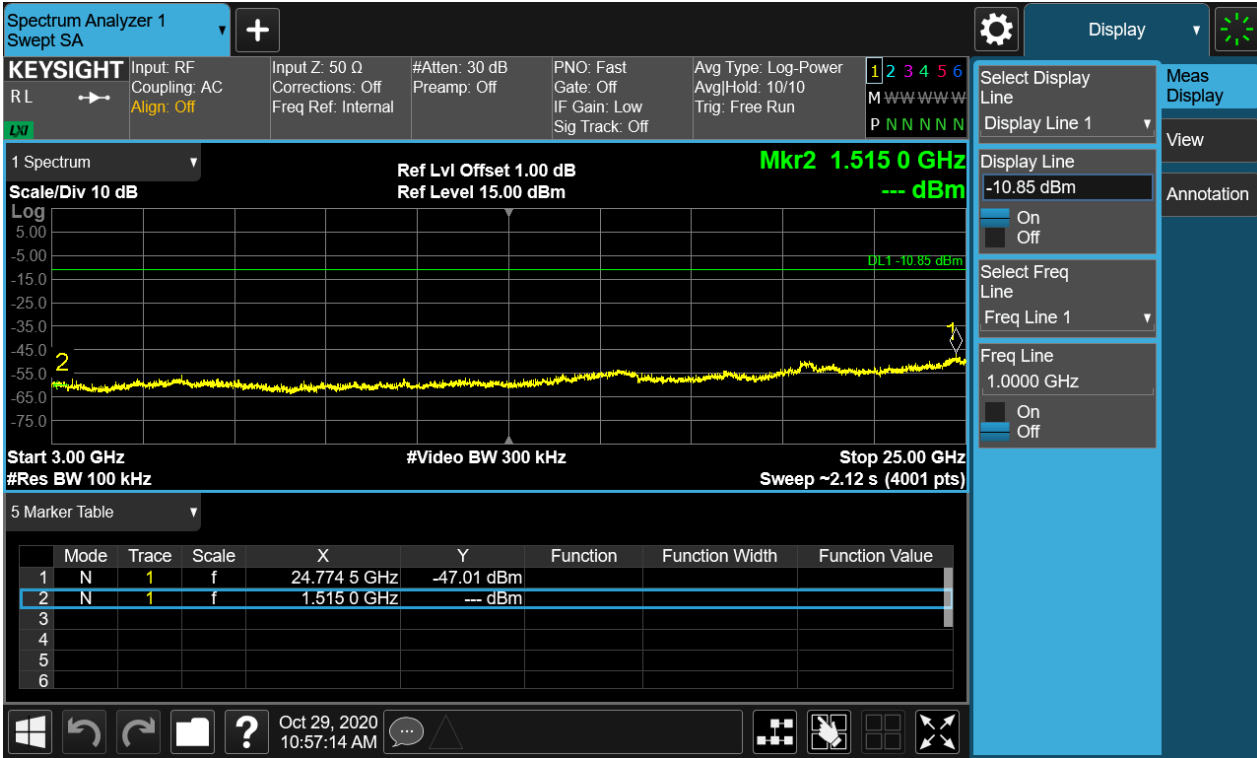
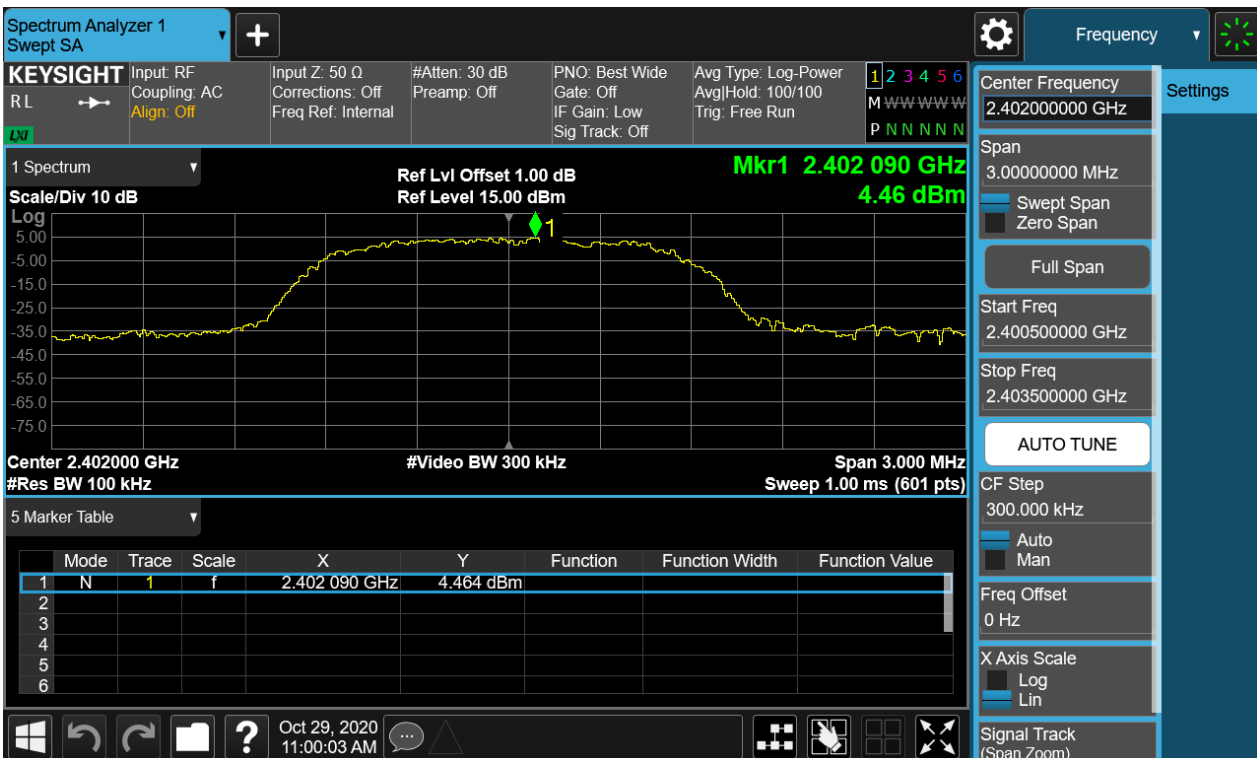


Figure 19: Conducted Spurious Emission & Authorized-band band-edge, 2402MHz, 8-DPSK Carrier Level



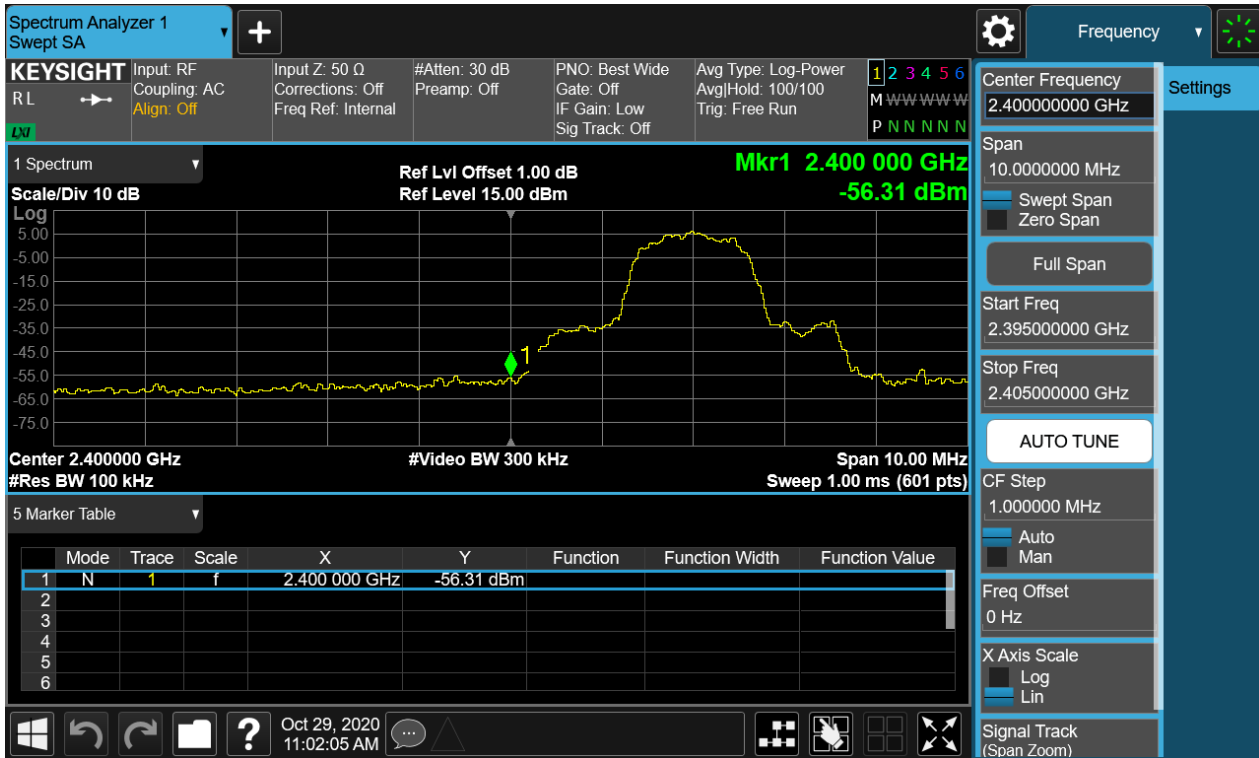
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Band Edge



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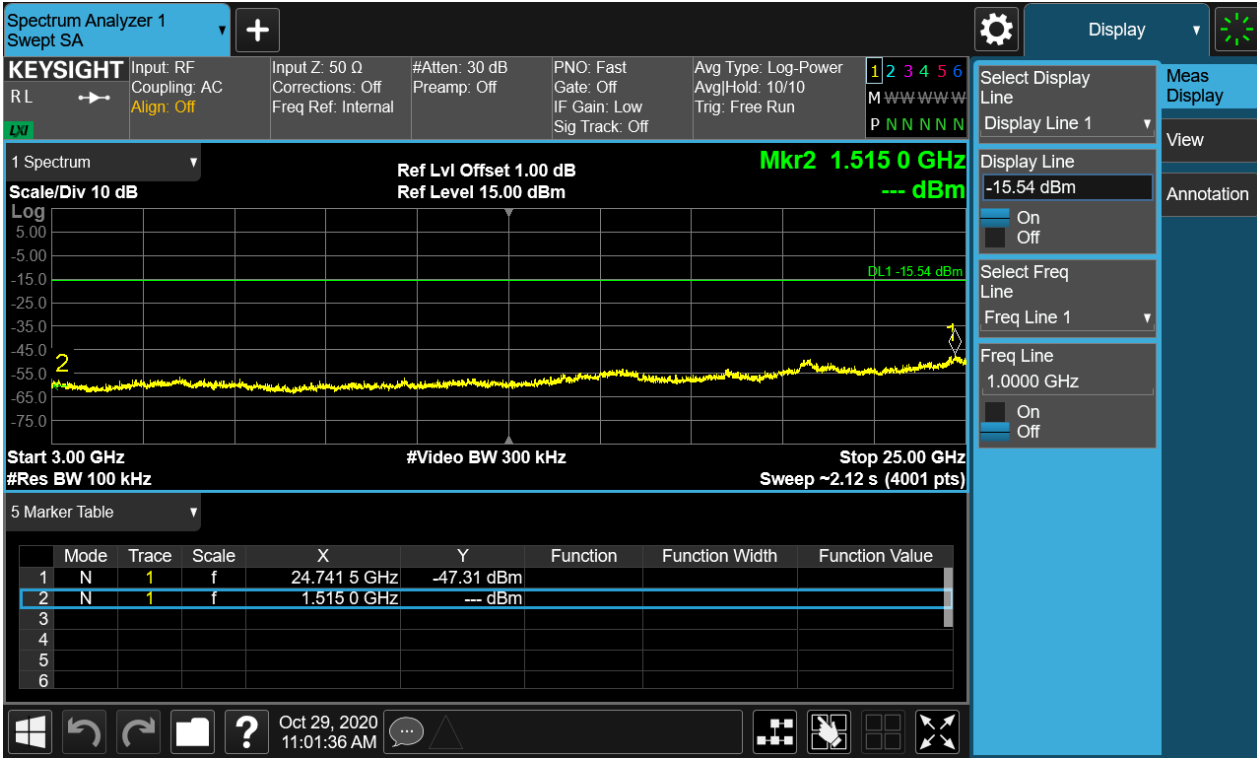
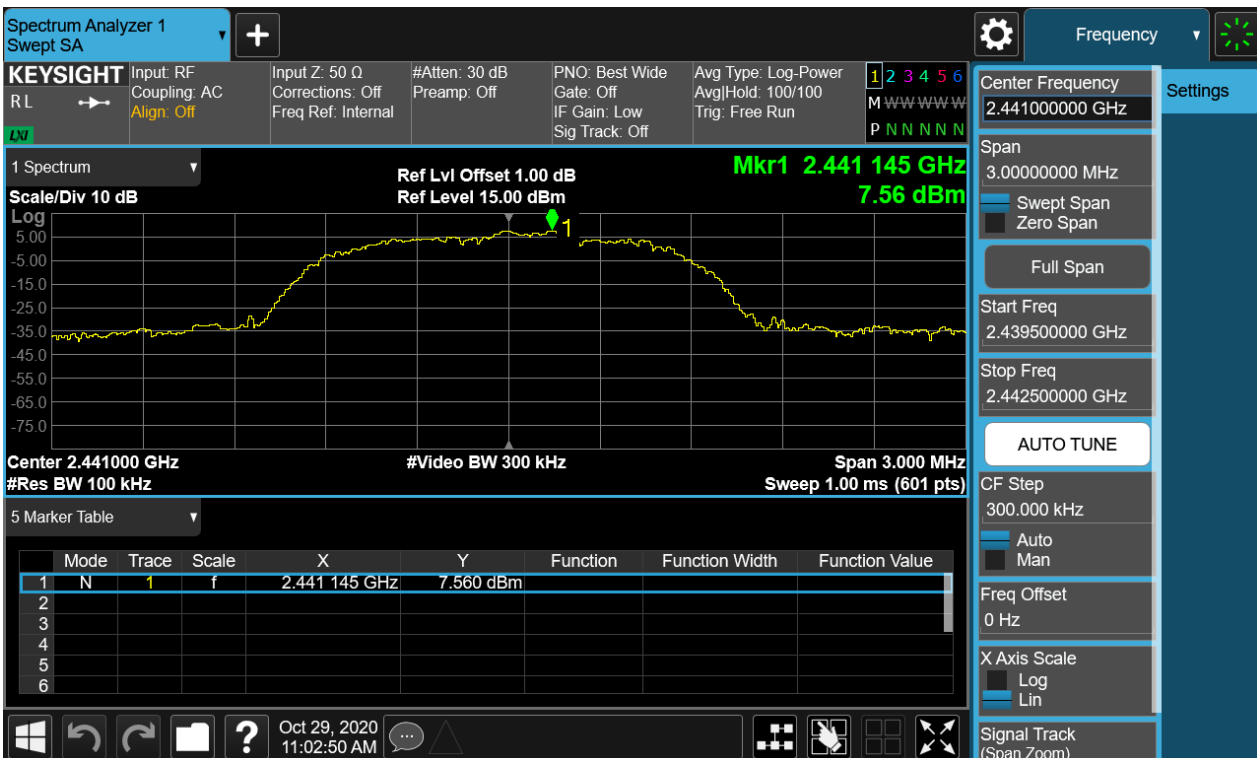


Figure 20: Conducted Spurious Emission & Authorized-band band-edge, 2441MHz, 8-DPSK Carrier Level



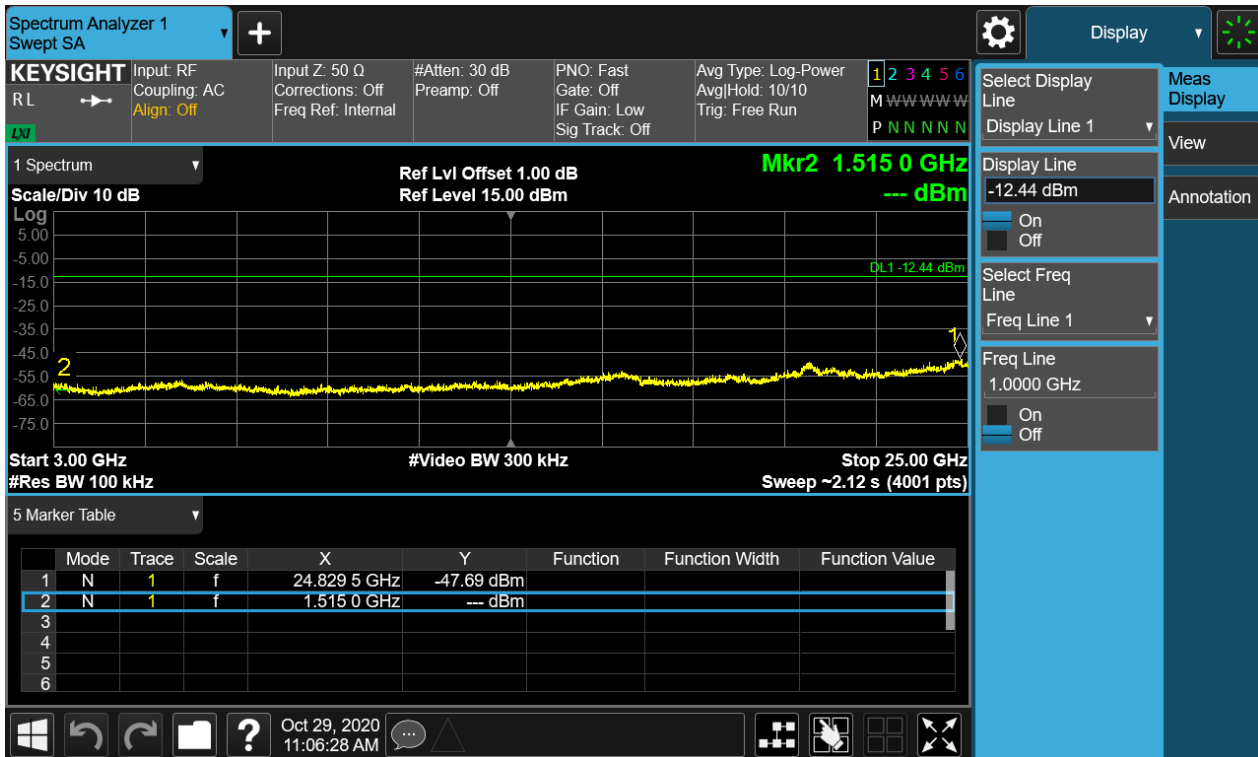
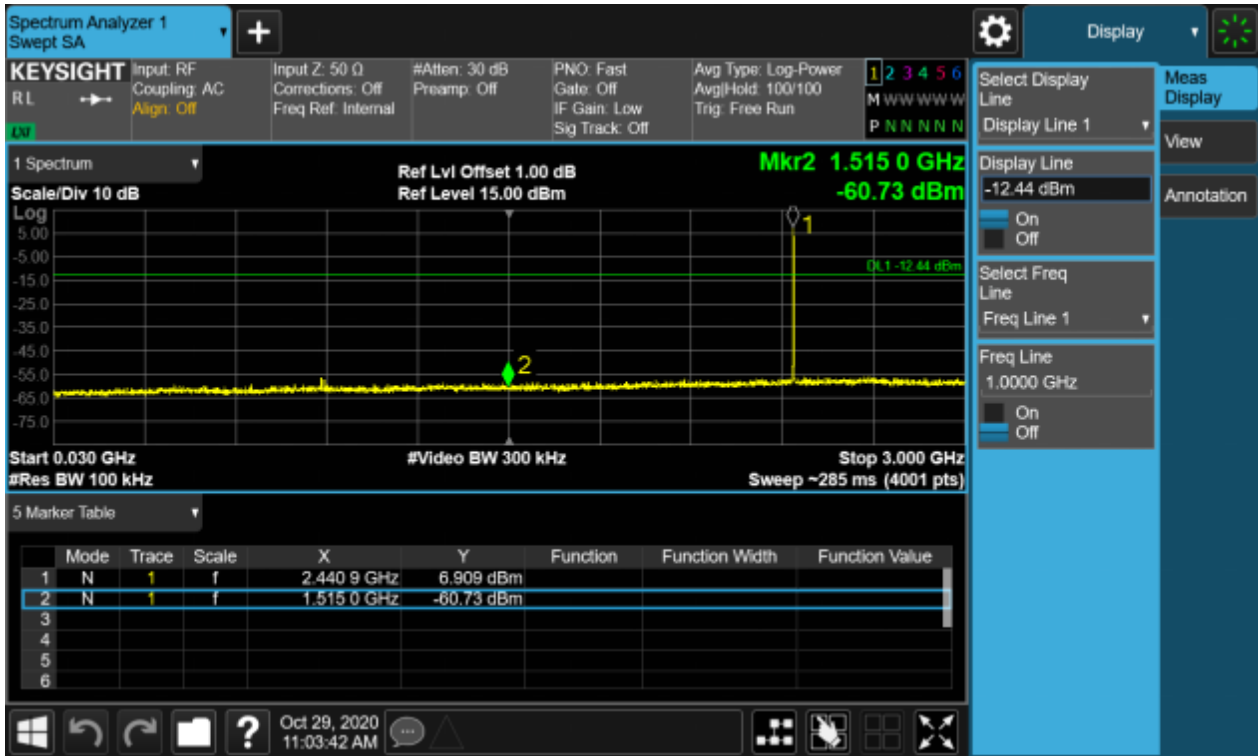
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Conducted spurious emissions 30MHz-25GHz



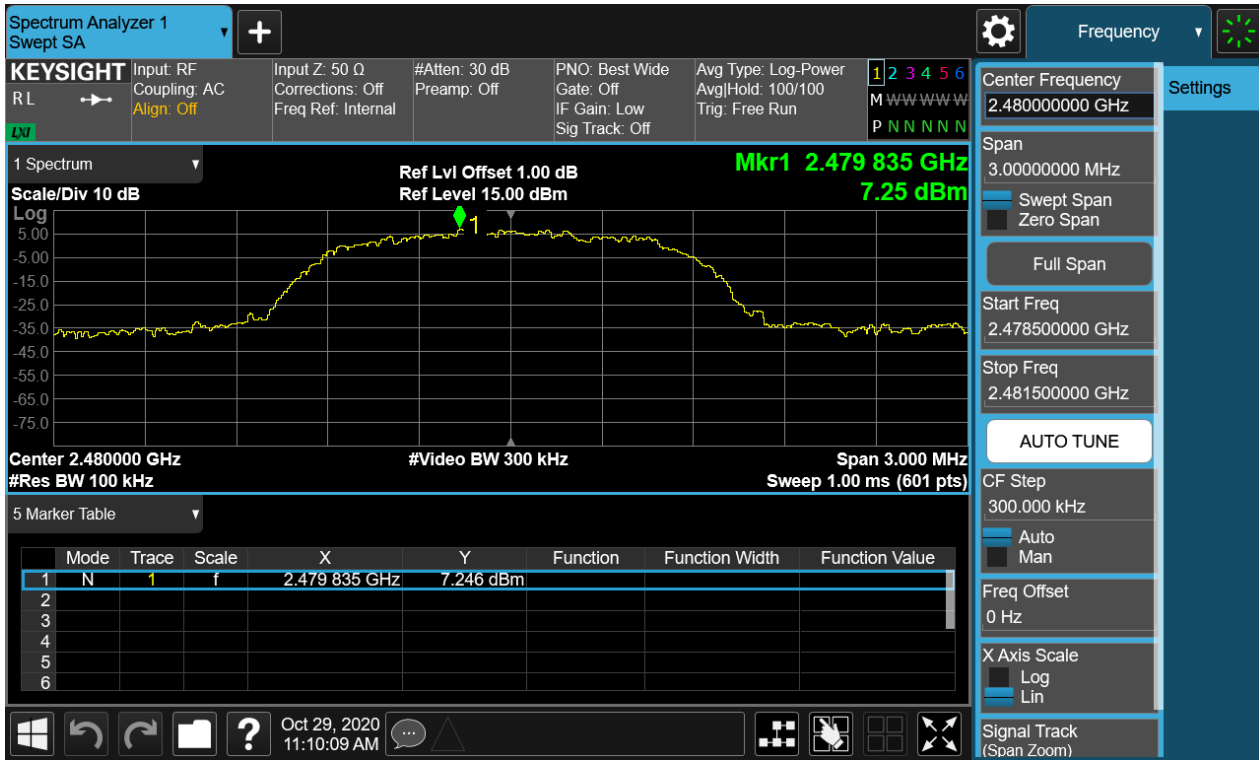
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Figure 21: Conducted Spurious Emission & Authorized-band band-edge, 2480MHz, 8-DPSK Carrier Level



Band Edge



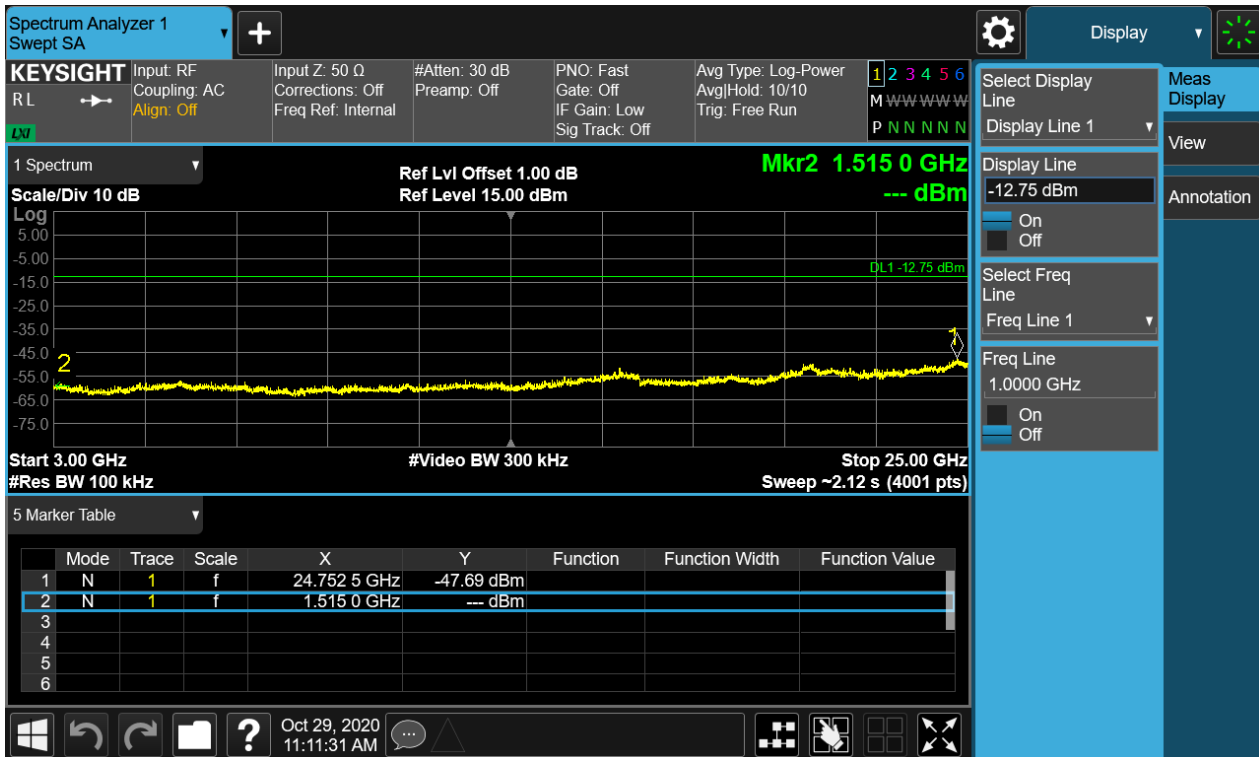
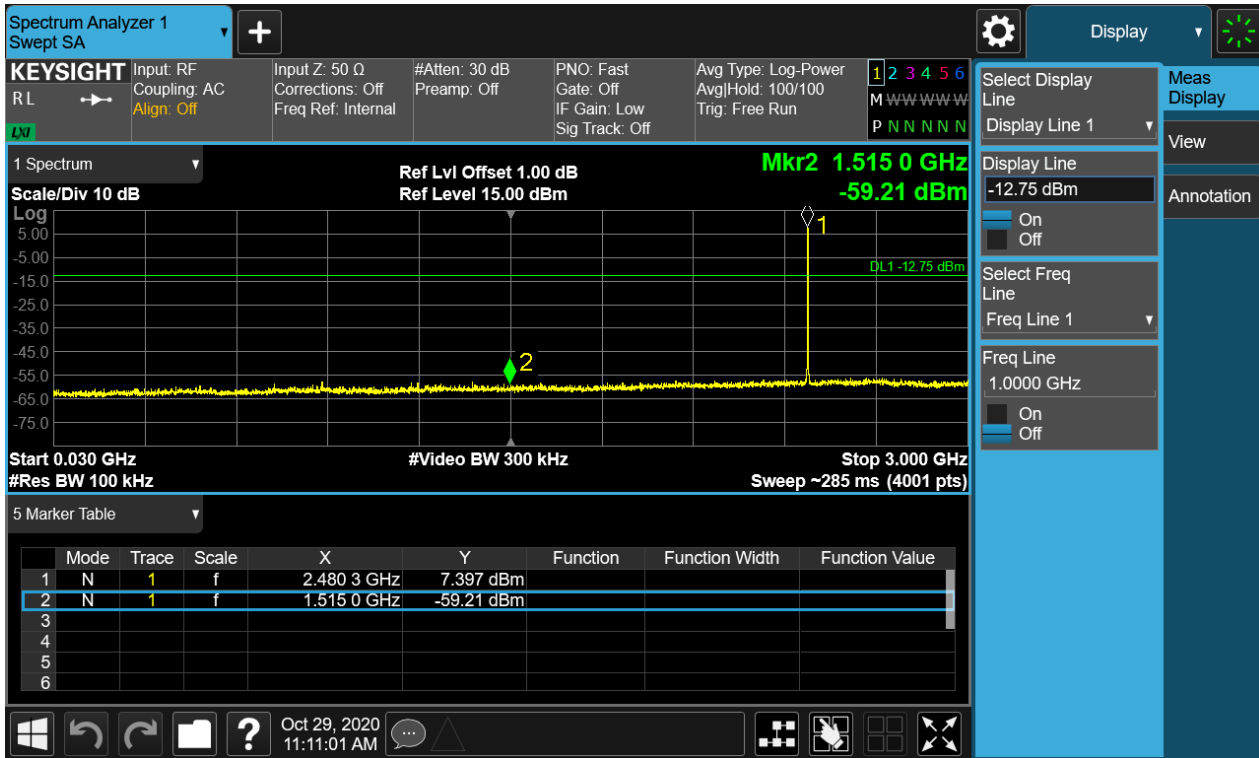
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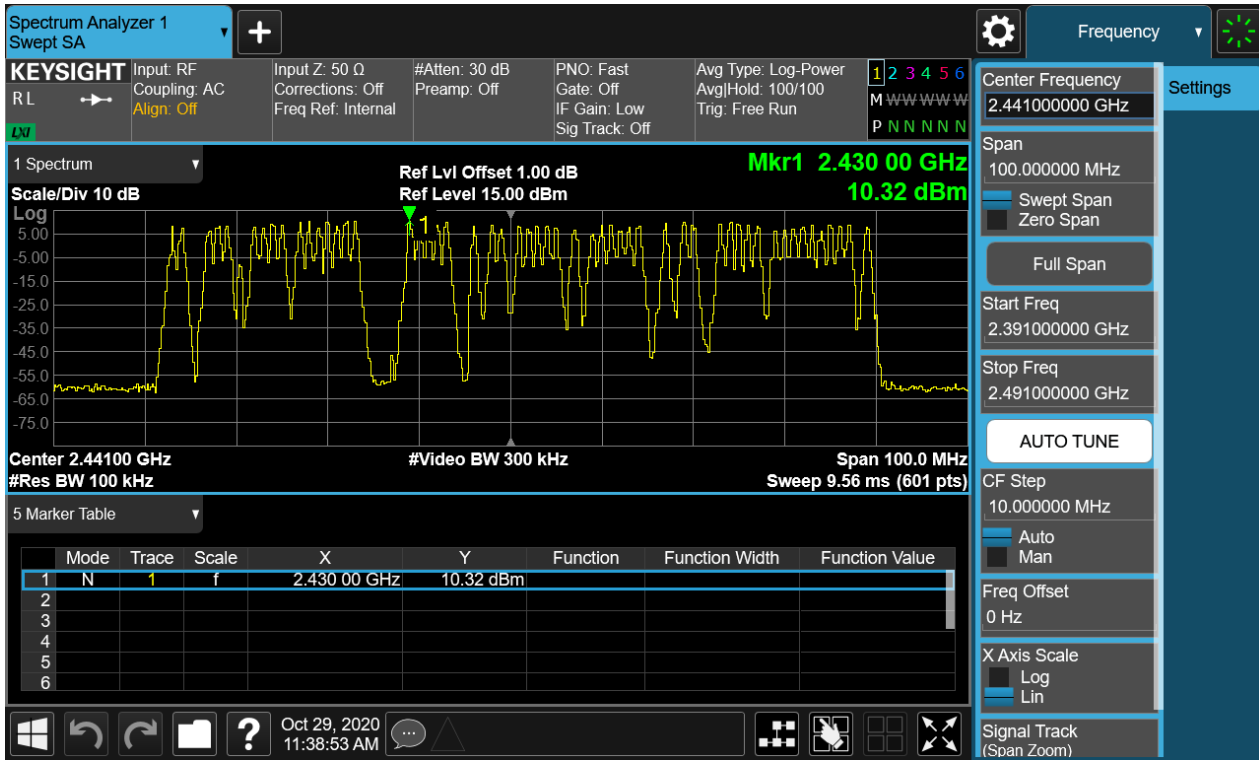
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Figure 22: Conducted Spurious Emission & Authorized-band band-edge, Hopping Mode, GFSK Carrier Level



Band Edge(Low)



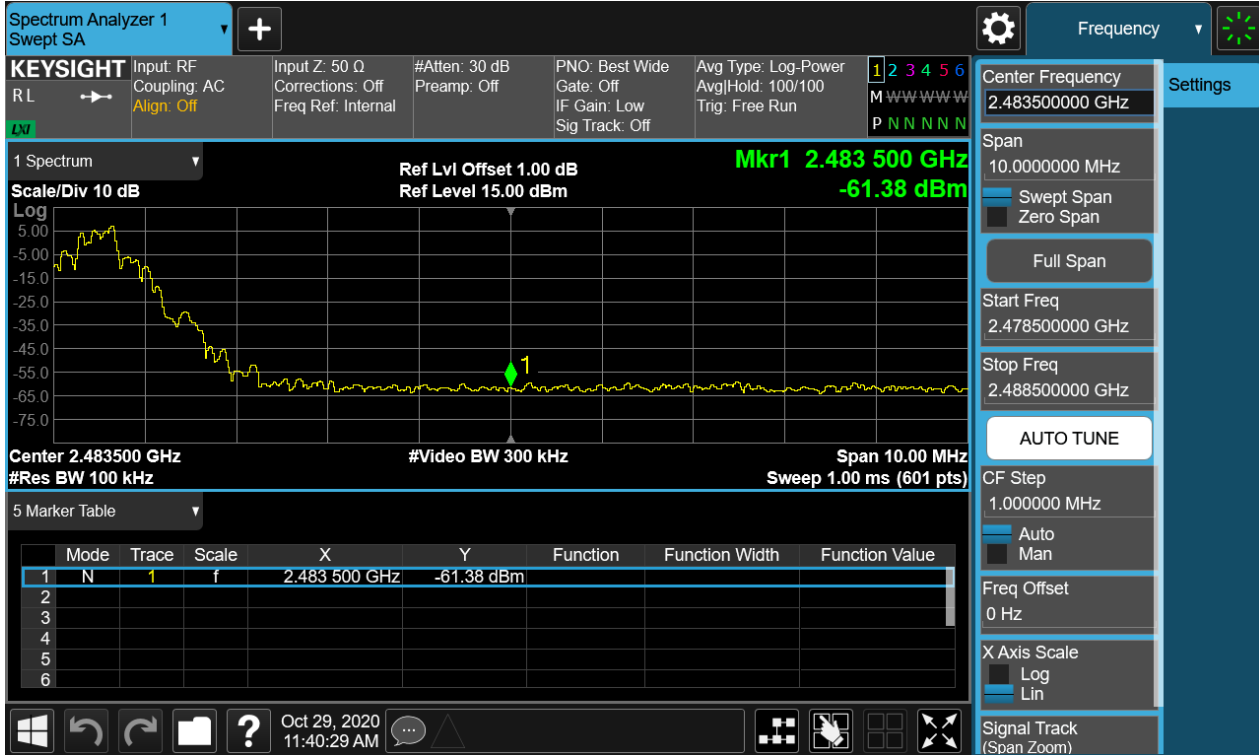
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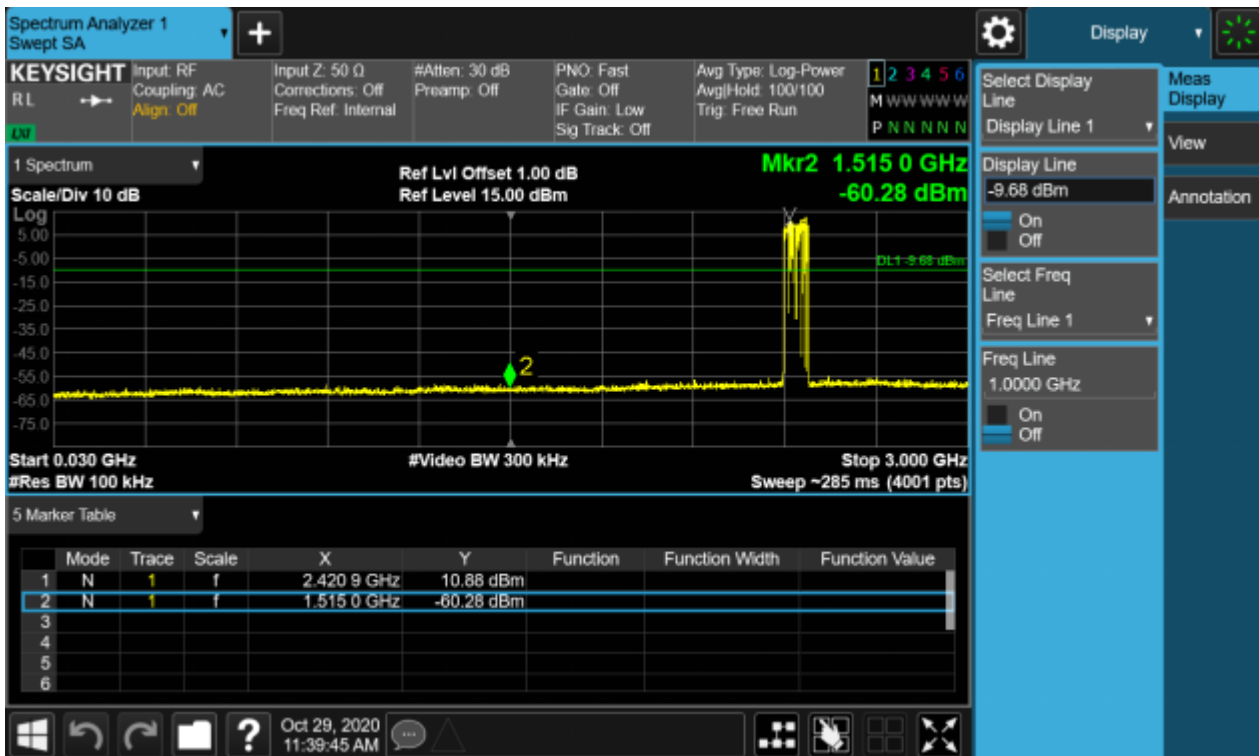
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Band Edge(High)



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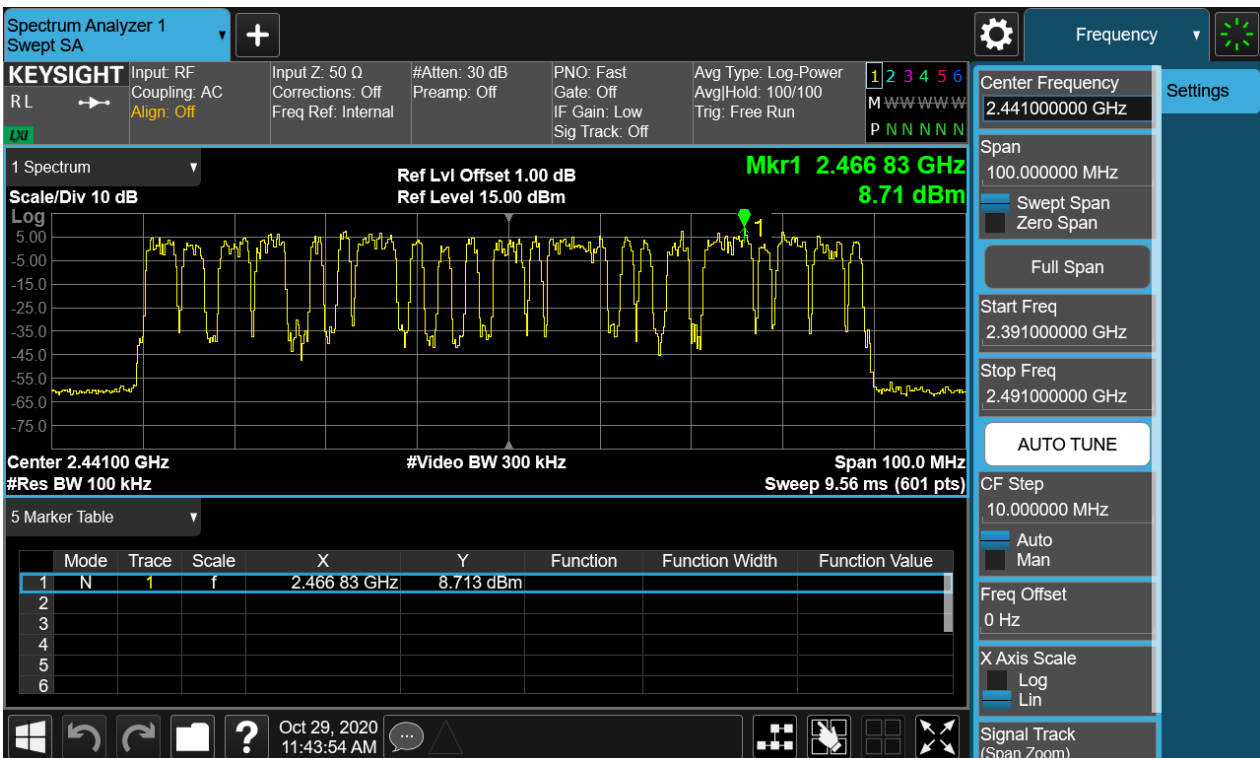
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Figure 23: Conducted Spurious Emission & Authorized-band band-edge, Hopping Mode, 8-DPSK Carrier Level



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Band Edge(Low)



Band Edge(High)



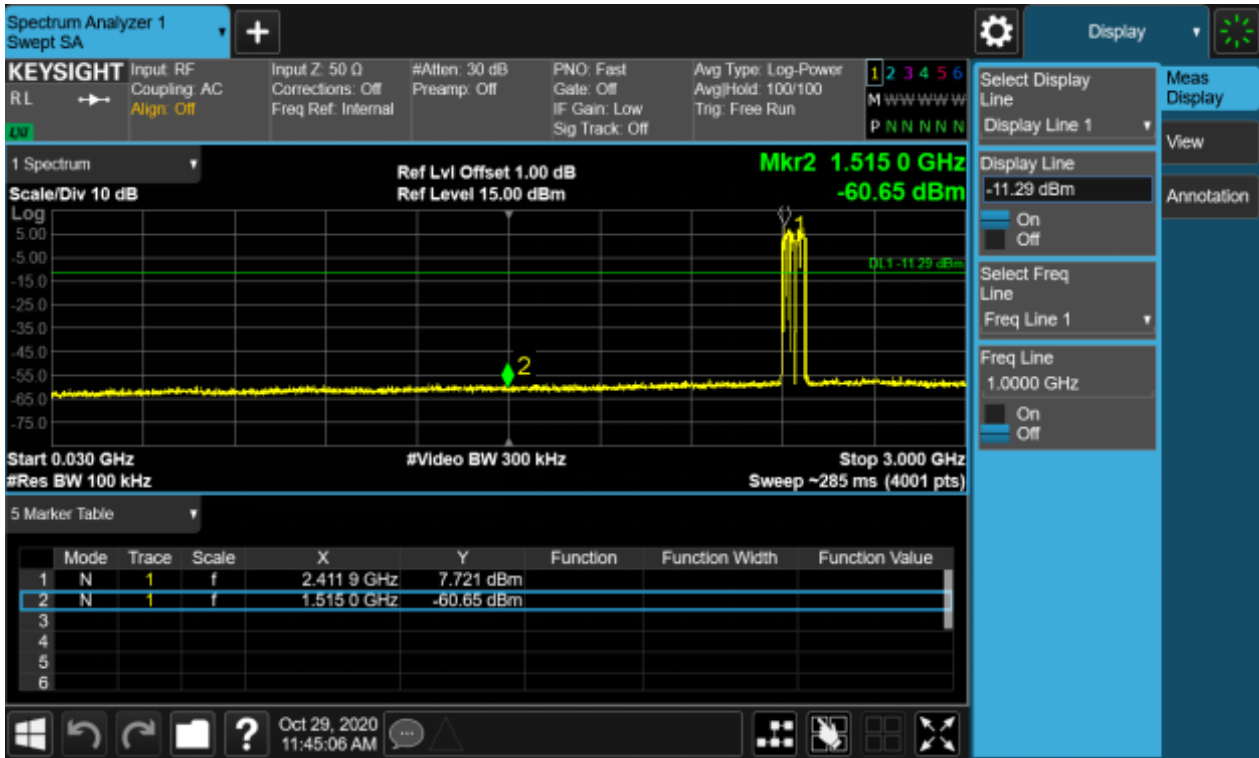
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4.1.5 Spurious Emission

RESULT:

PASS

Test standard : FCC Part 15.247(d), 15.205, 15.209
RSS-247 5.5
Requirement : ANSI C63.10-2013
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 "SHE20090007-02HE DATA BDEDR-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.

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4.1.6 Band Edge (Restricted-band band-edge)

RESULT:

PASS

Test standard : FCC Part 15.247(d), 15.205, 15.209
RSS-247 5.5
Requirement : ANSI C63.10-2013
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 "SHE20090007-02HE DATA BDED-R-TX EXHIBIT A".

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4.1.7 Hopping Frequency Separation

RESULT:

PASS

Test standard : FCC Part 15.247(a)(1)
RSS-247 5.1(2)
Requirement : ANSI C63.10-2013
Kind of test site : Shielded room

Test setup

Test Channel : Hopping
Operation Mode : A.1.a.iv
Ambient temperature : 25°C
Relative humidity : 52%

Table 4: Hopping Frequency Separation

Mode	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
GFSK	2441	1.130	≥ 25kHz or two-thirds of 20dB bandwidth
8-DPSK	2441	1.080	

*Note: The systems operate with an output power no greater than 125mW.

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Figure 24: Hopping Frequency Separation, Hopping Mode, GFSK

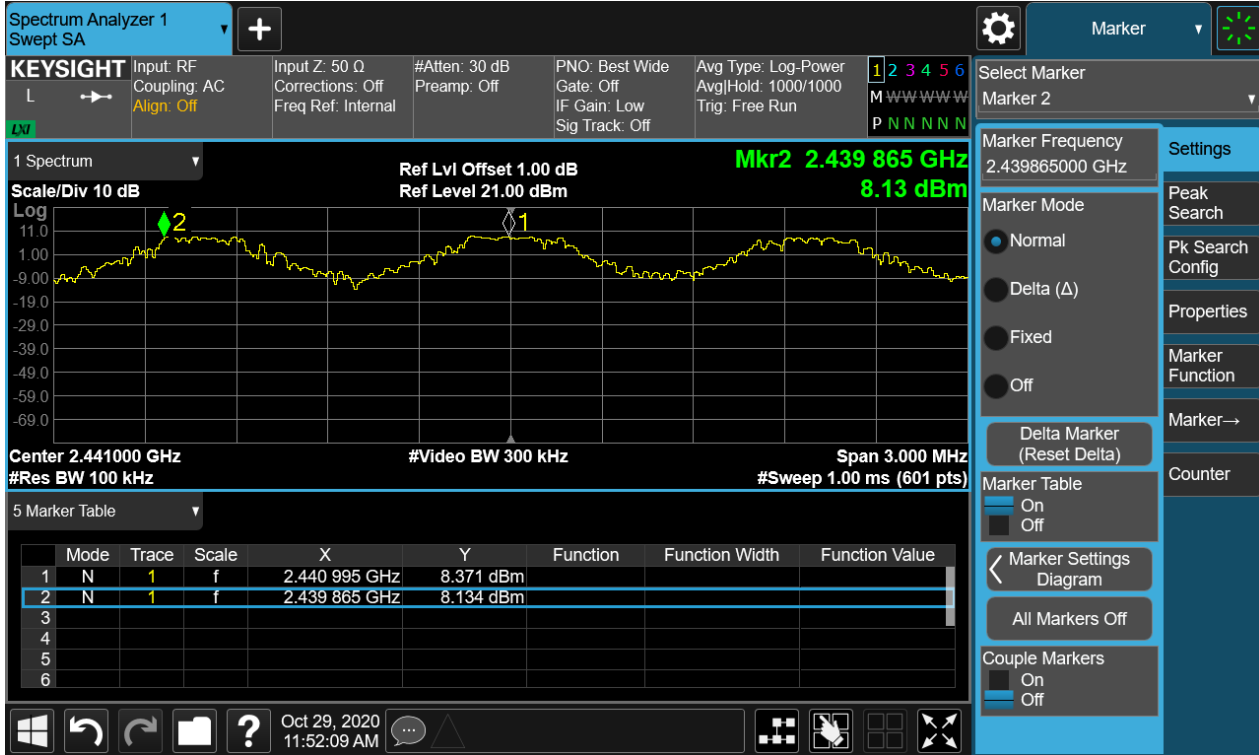


Figure 25: Hopping Frequency Separation, Hopping Mode, 8DPSK

