

TEST REPORT

Report No.: SHE20070010-02HE

Date: 2020-07-28

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Applicant : Shenzhen UniStrong Science & Technology Co.,Ltd.
Address of Applicant : B,4-4Factory, Zhengcheng Road, Fuyong Baoan District, Shenzhen, China

Product Name : Rugged windows Tablet

Model No. : UT55

Sample No. : E20070010-01#02;
E20070010-01#05

FCC ID : 2AOPD-UT55

Standards : FCC CFR47 Part 15, Subpart C
RSS-Gen (Issue 5, March 2019)
RSS-247 (Issue 2, February 2017)

Date of Receipt : 2020-07-20

Date of Test : 2020-07-20 ~ 2020-07-24

Date of Issue : 2020-07-28

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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Revision Record			
Version	Date	Revisions	Revised By
1.0	2019-11-05	Original	--

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1 General Information

1.1 Testing Laboratory

Company Name	ICAS Testing Technology Services (Shanghai) Co., Ltd.
Address	155 Pingbei Rd, Minhang District, Shanghai, China
Telephone	0086 21-51682999
Fax	0086 21-54711112
Homepage	www.icasiso.com

1.2 Details of Application

Company Name	Shenzhen UniStrong Science & Technology Co.,Ltd.
Address	B,4-4Factory, Zhengcheng Road, Fuyong Baoan District, Shenzhen, China
Contact Person	Lili Zheng
Telephone	+86-21-54467182
Email	ll.zheng@unistrong.com

1.3 Details of EUT

Product Name	Rugged windows Tablet
Brand Name	Unistrong
Model No.	UT55
FCC ID	2AOPD-UT55
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	0.94dBi
Extreme Temperature Range	-10°C ~ +55°C
Test Voltage	DC 7.6V

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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	N9020B	MY59260184	2020-07-28
Spectrum Analyzer	Rohde & Schwarz	FSV40N	101450	2021-06-24
EMI Test Receiver	Rohde & Schwarz	ESPI3	100173	2021-06-19
EMI Test Receiver	Rohde & Schwarz	ESR 7	101911	2020-06-19
V-network	SCHWARZBECK	NSLK 8127	8127-902	2021-02-20
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	100687	2020-08-22
Broadband Antenna	SCHWARZBECK	VULB9163	9163-1037	2021-06-06
Horn Antenna-18G	SCHWARZBECK	BBHA9120D	9120D-1775	2021-06-06
Loop Antenna	SCHWARZBECK	FMZB 1513	N/A	2021-03-19
Horn Antenna-40G	YINGLIAN	LB-180400-KF	N/A	2020-07-26
EMC chamber 9*6*6 (L*W*H)	CHANGNING	966	N/A	2023-06-26
Shielded Enclosure 8*5*4 (L*W*H)	CHANGNING	854	N/A	2020-08-28
Test Software	BL	BL410_E	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	Intel	DRTU

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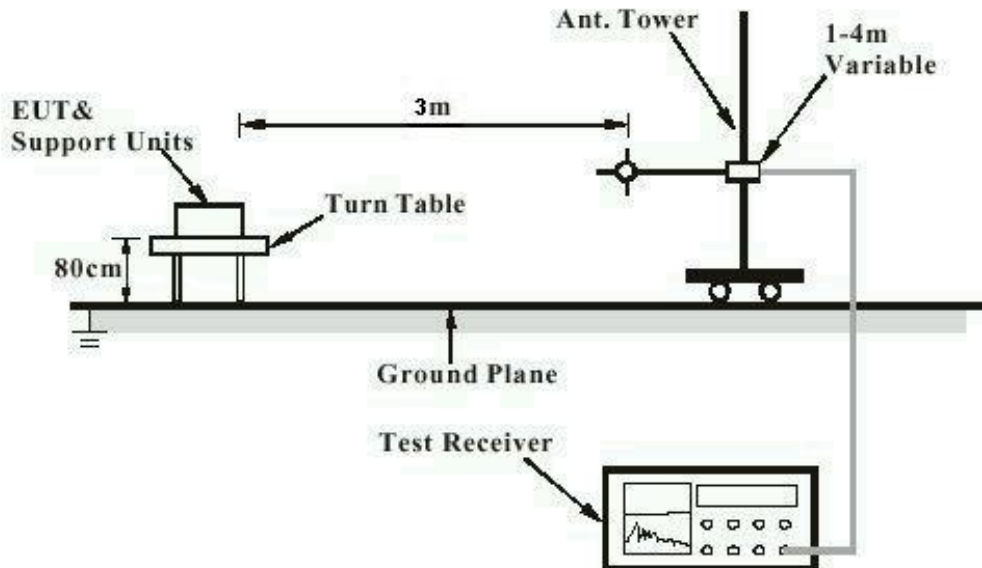
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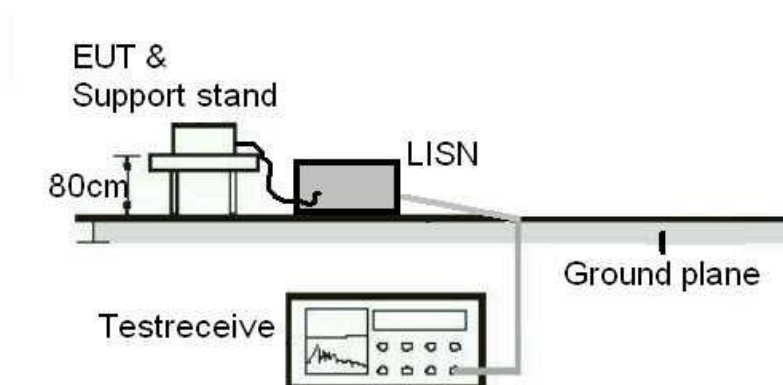
3.4 Test Setup Diagram

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



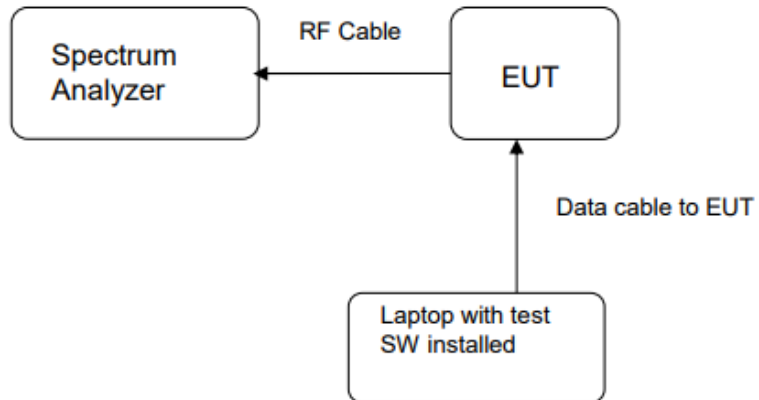
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Diagram of Measurement Equipment Configuration for Transmitter Measurement



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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 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a max gain of 0.94 dBi for BT. 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 : 23°C
Relative humidity : 52%

Table 1: Maximum Conducted Output Power

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(mW)	
GFSK	2402	2.91	1.95	< 1
	2441	3.16	2.07	
	2480	2.89	1.95	
$\pi/4$ -DQPSK	2402	4.34	2.72	< 0.125
	2441	4.51	2.82	
	2480	4.29	2.69	
8-DPSK	2402	4.59	2.88	< 0.125
	2441	4.76	2.99	
	2480	4.54	2.84	

Table 2: E.I.R.P

Test Mode	Test Channel (MHz)	E.I.R.P		Limit (W)
		(dBm)	(mW)	
GFSK	2402	3.85	2.43	< 4
	2441	4.1	2.57	
	2480	3.83	2.42	
$\pi/4$ -DQPSK	2402	5.28	3.37	
	2441	5.45	3.51	
	2480	5.23	3.33	
8-DPSK	2402	5.53	3.57	
	2441	5.7	3.72	
	2480	5.48	3.53	

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

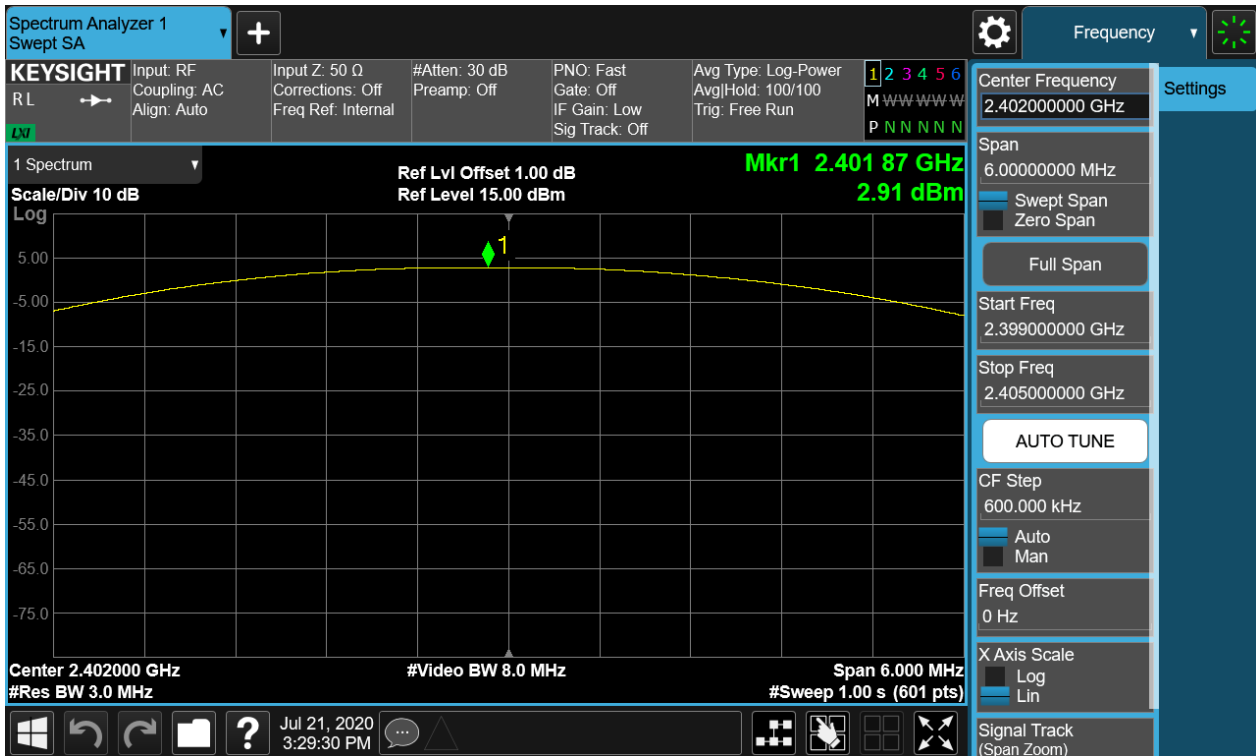
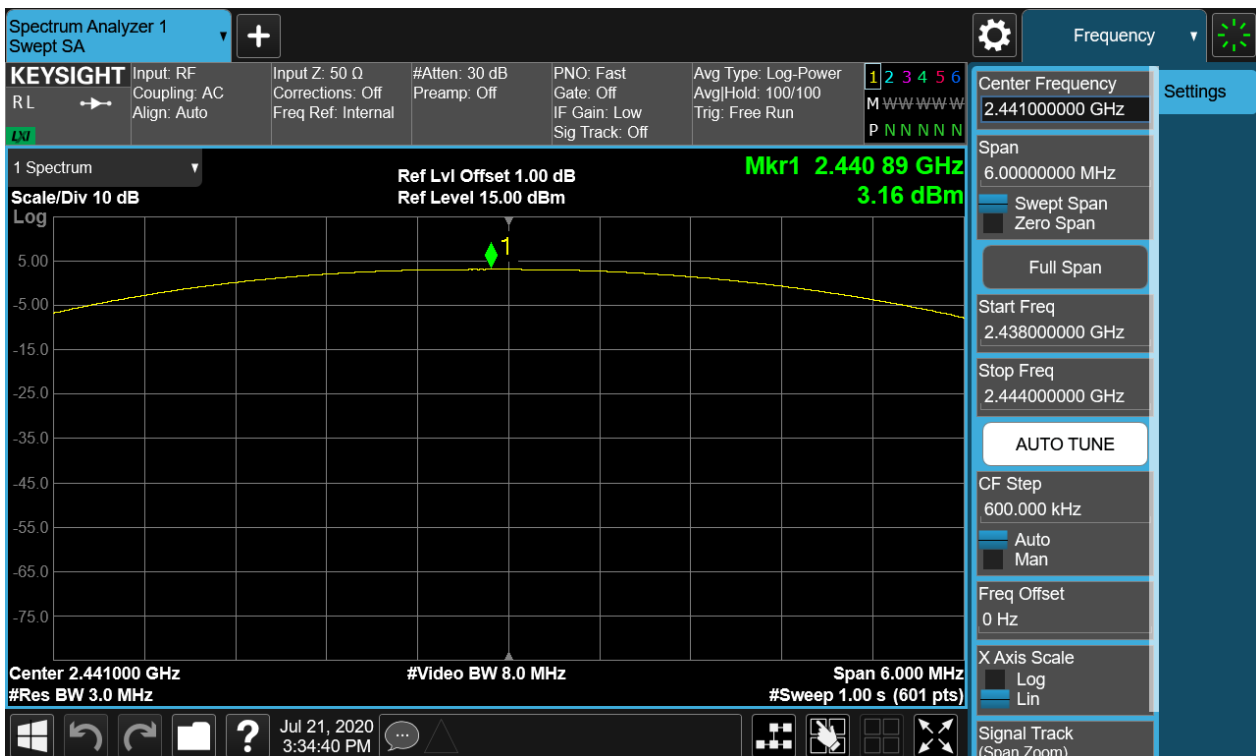


Figure 2: Maximum Conducted Output Power, 2441MHz, GFSK



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

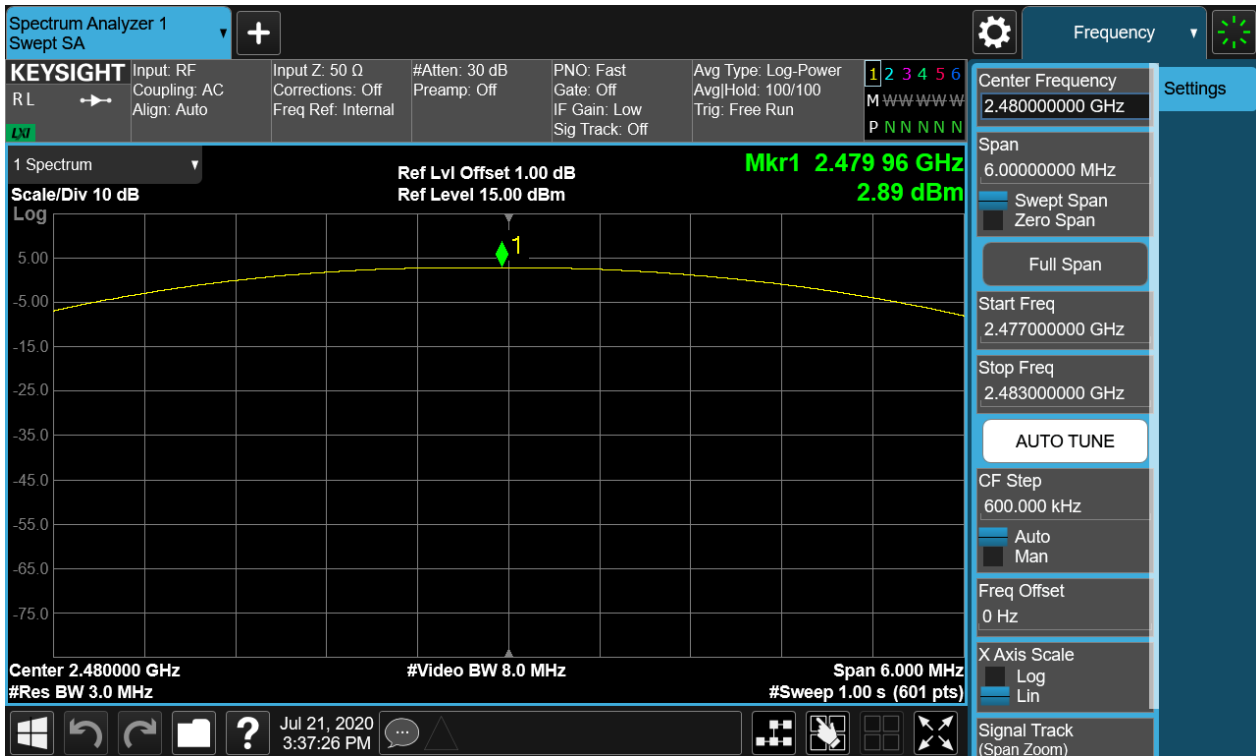
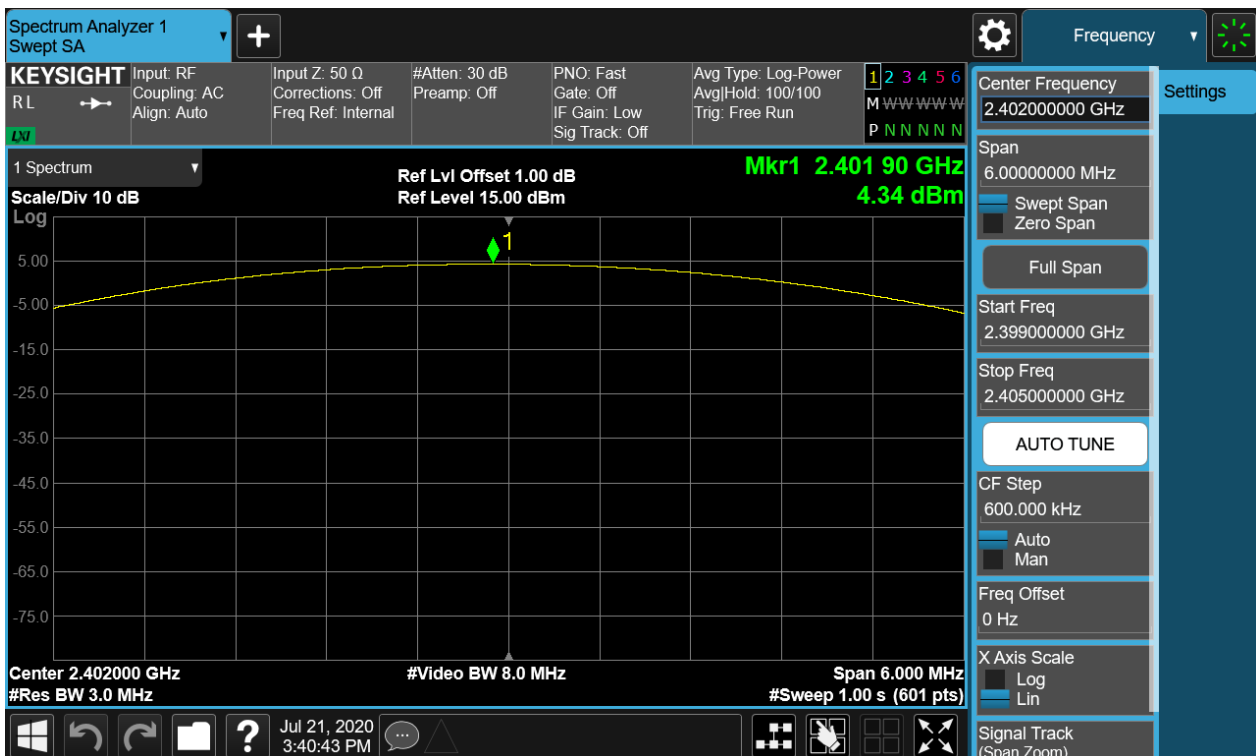


Figure 4: Maximum Conducted Output Power, 2402MHz, $\pi/4$ -DQPSK



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

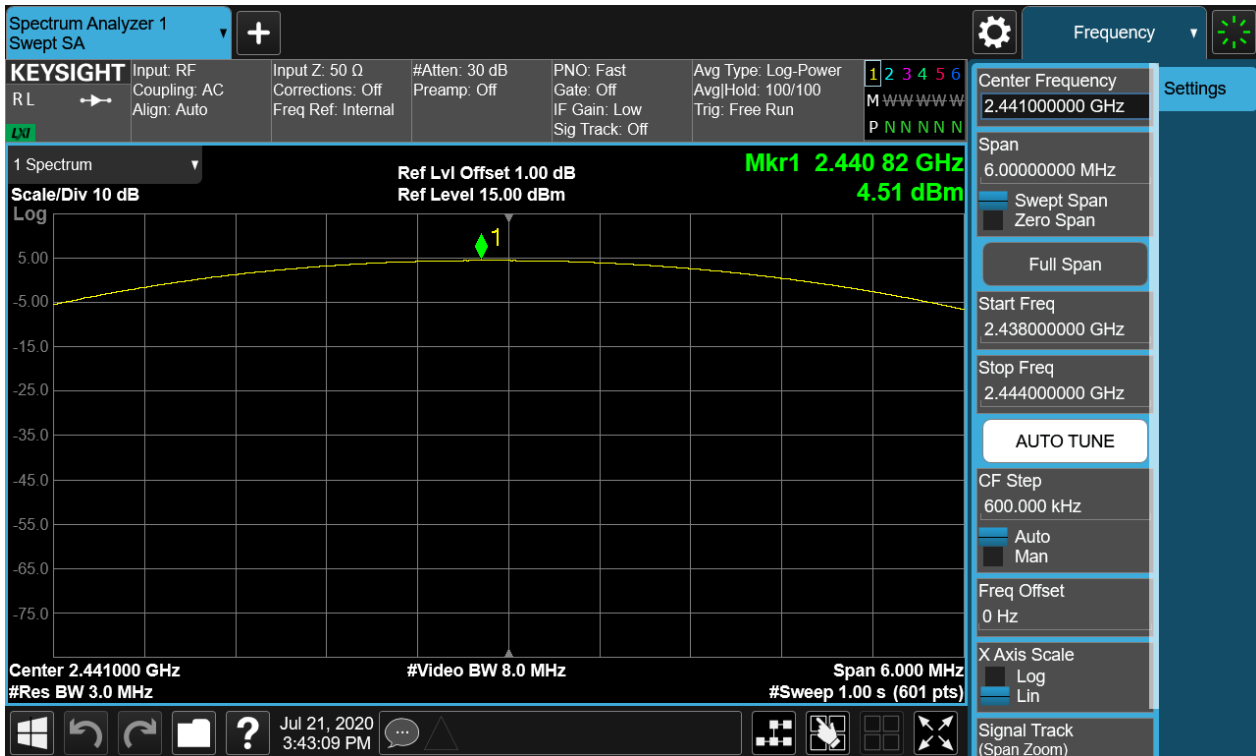
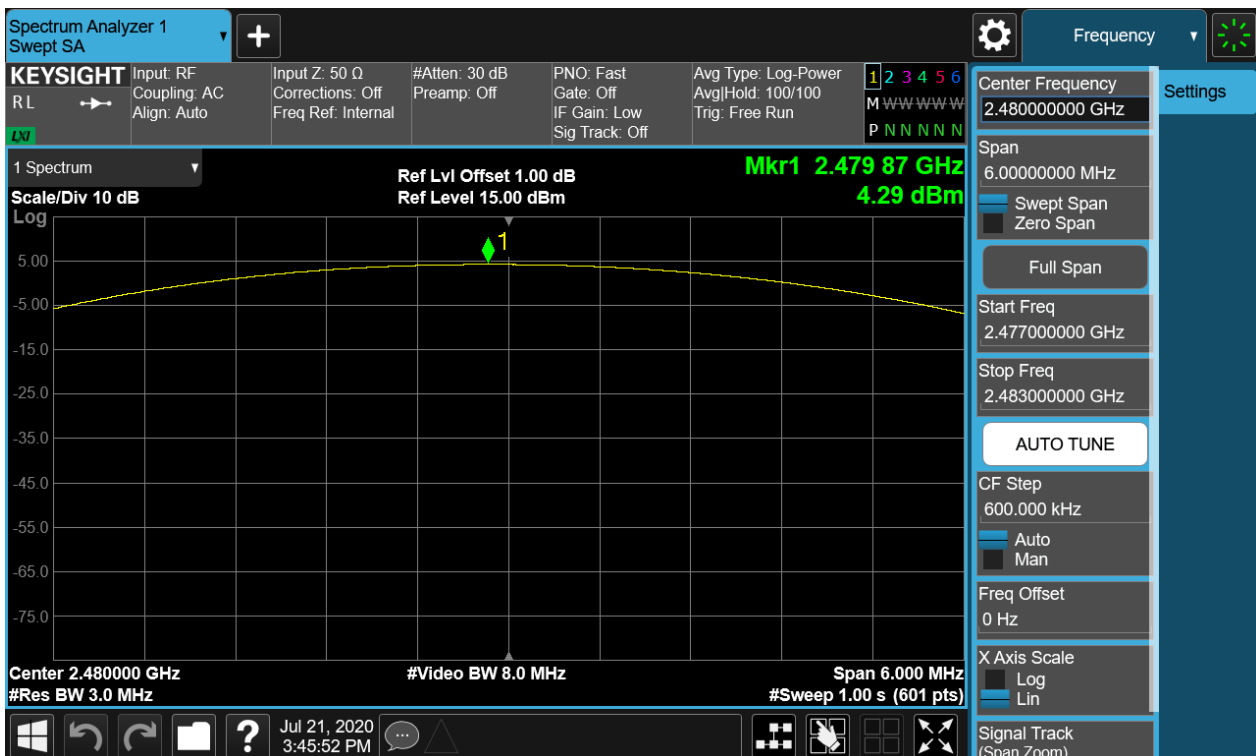


Figure 6: Maximum Conducted Output Power, 2480MHz, $\pi/4$ -DQPSK



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

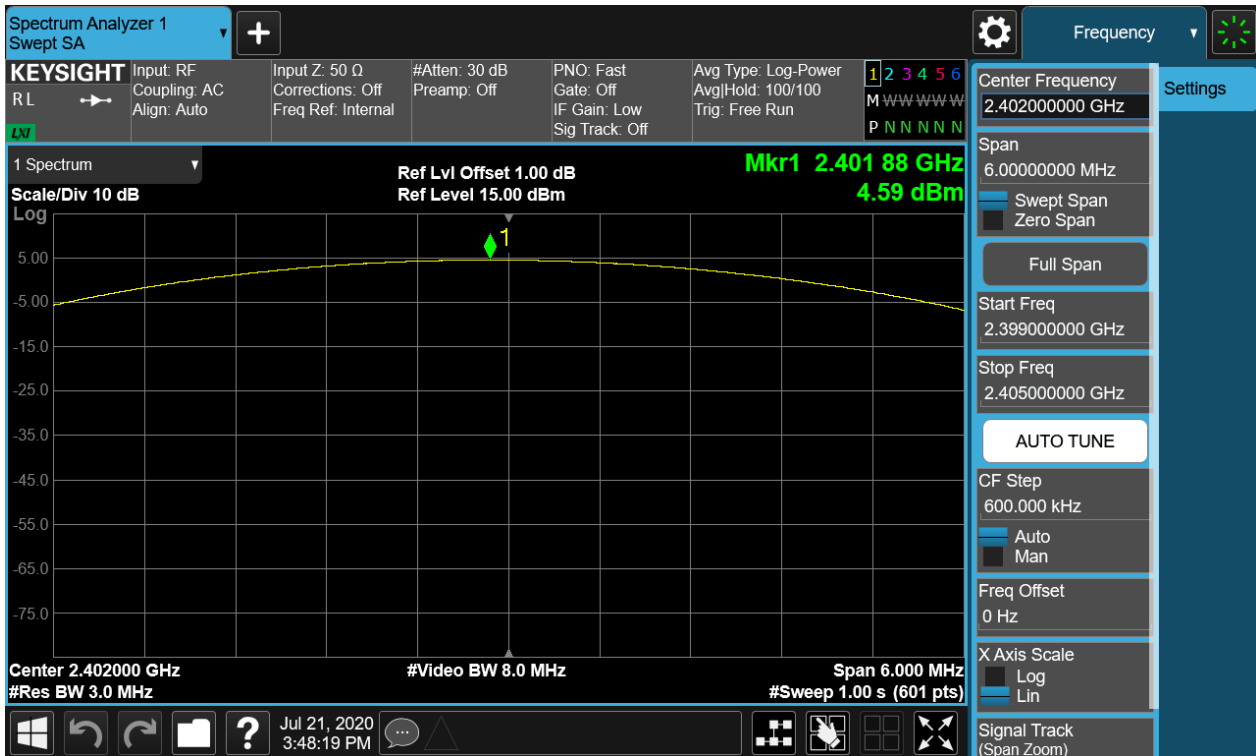
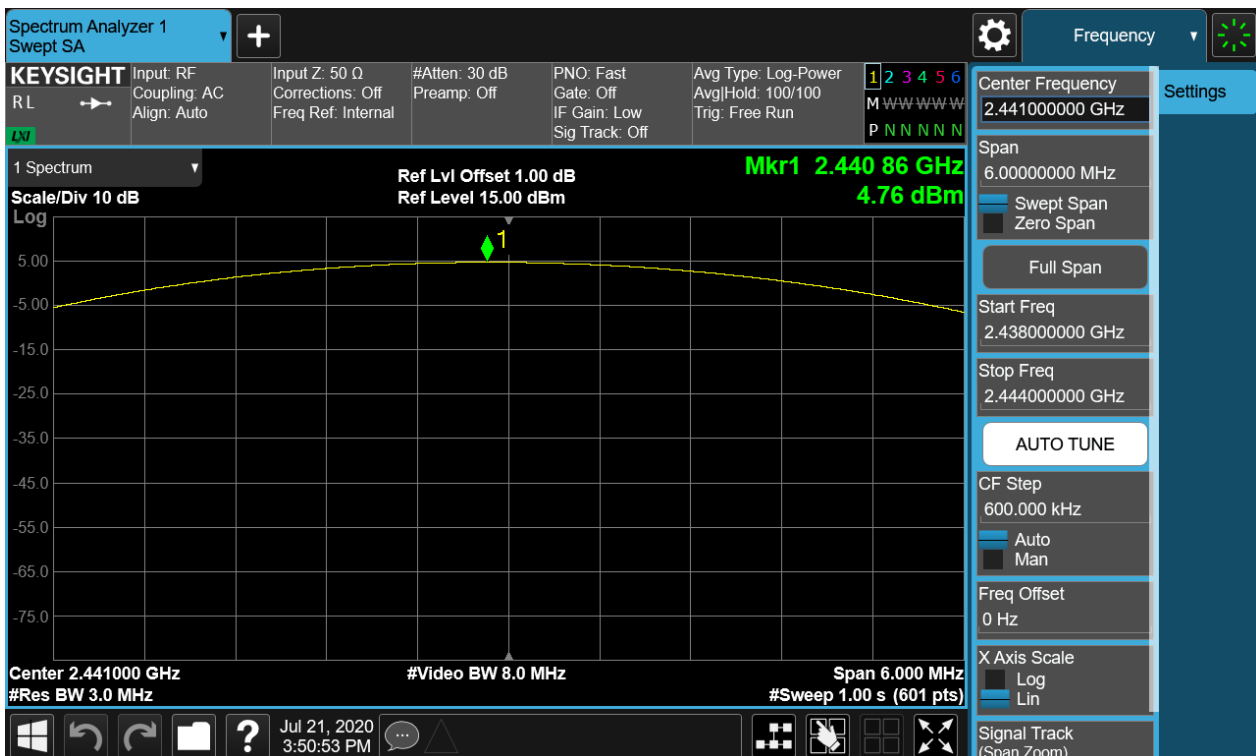


Figure 8: Maximum Conducted Output Power, 2441MHz, 8-DPSK



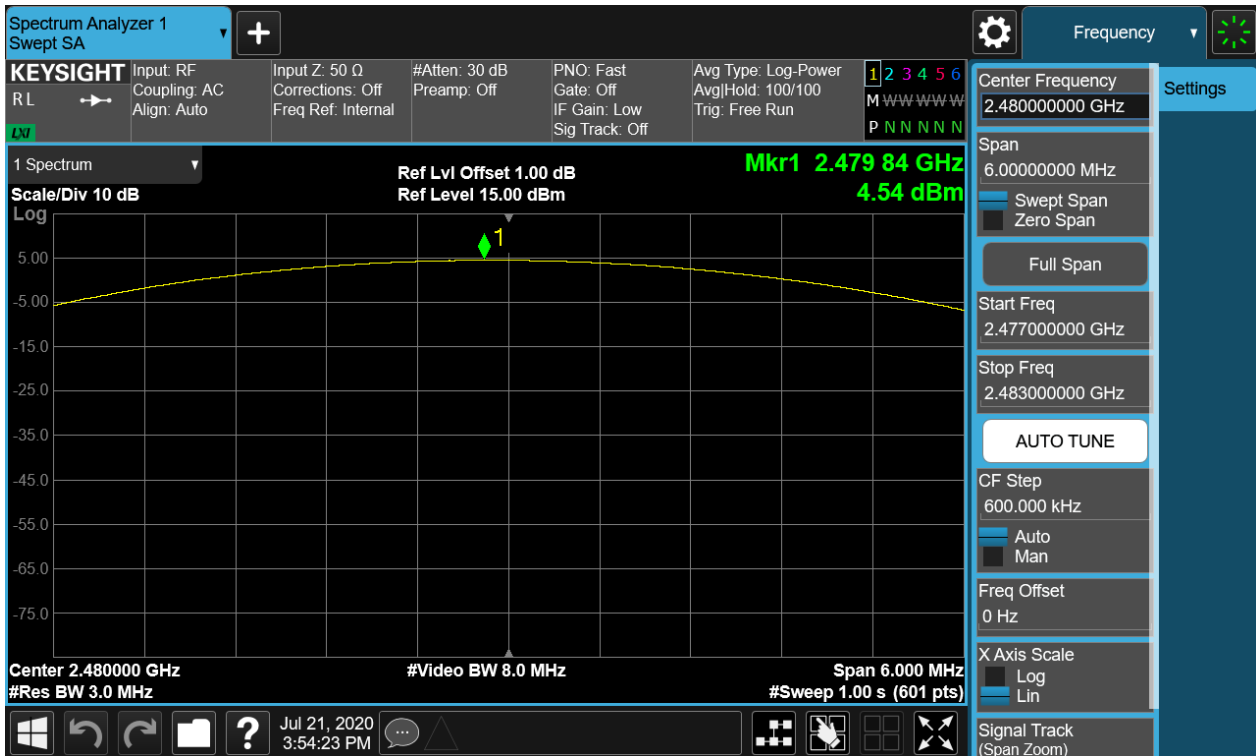
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Figure 9: Maximum Conducted Output Power, 2480MHz, 8-DPSK



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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 : 23°C
Relative humidity : 52%

Table 3: 20dB Bandwidth and 99% Bandwidth

Test Mode	Test Channel (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
GFSK	2402	0.923	0.864
	2441	0.923	0.864
	2480	0.922	0.859
8-DPSK	2402	1.435	1.357
	2441	1.412	1.358
	2480	1.412	1.358

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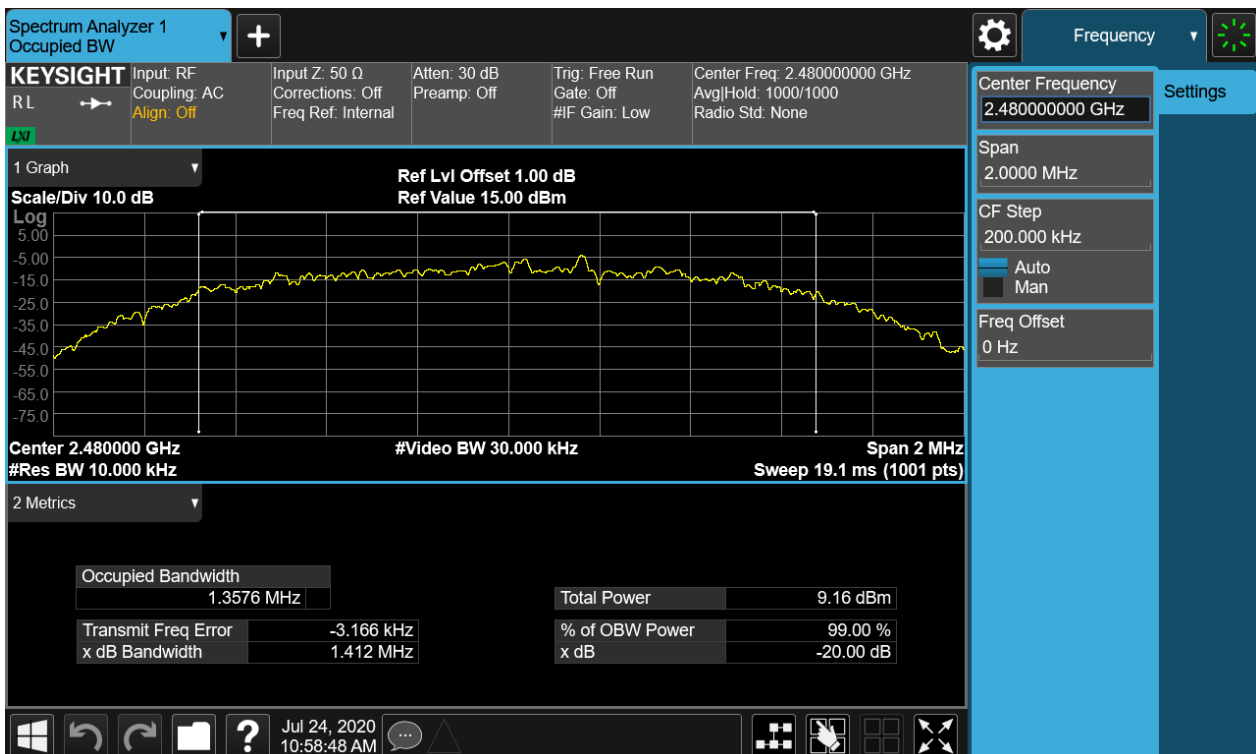
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Figure 14: 20dB Bandwidth and 99% Bandwidth, 2441MHz, 8-DPSK



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 : 23°C
Relative humidity : 52%

For details refer to following test plot.

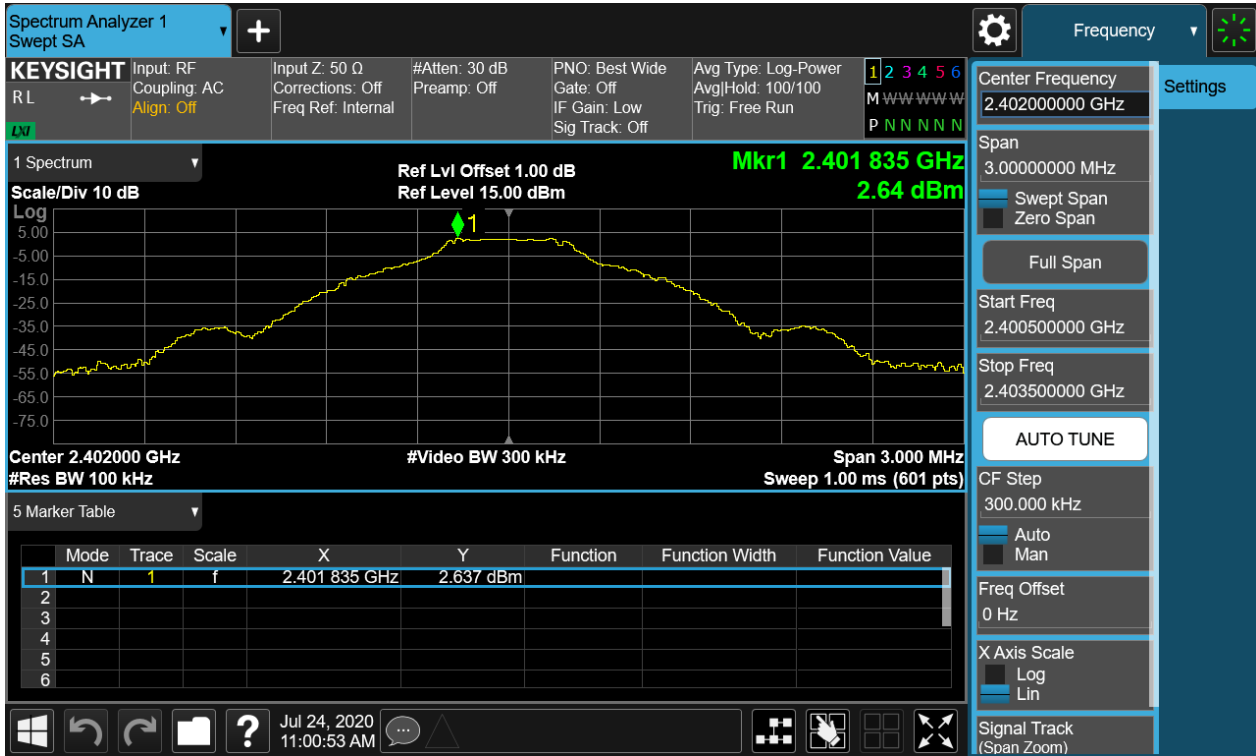
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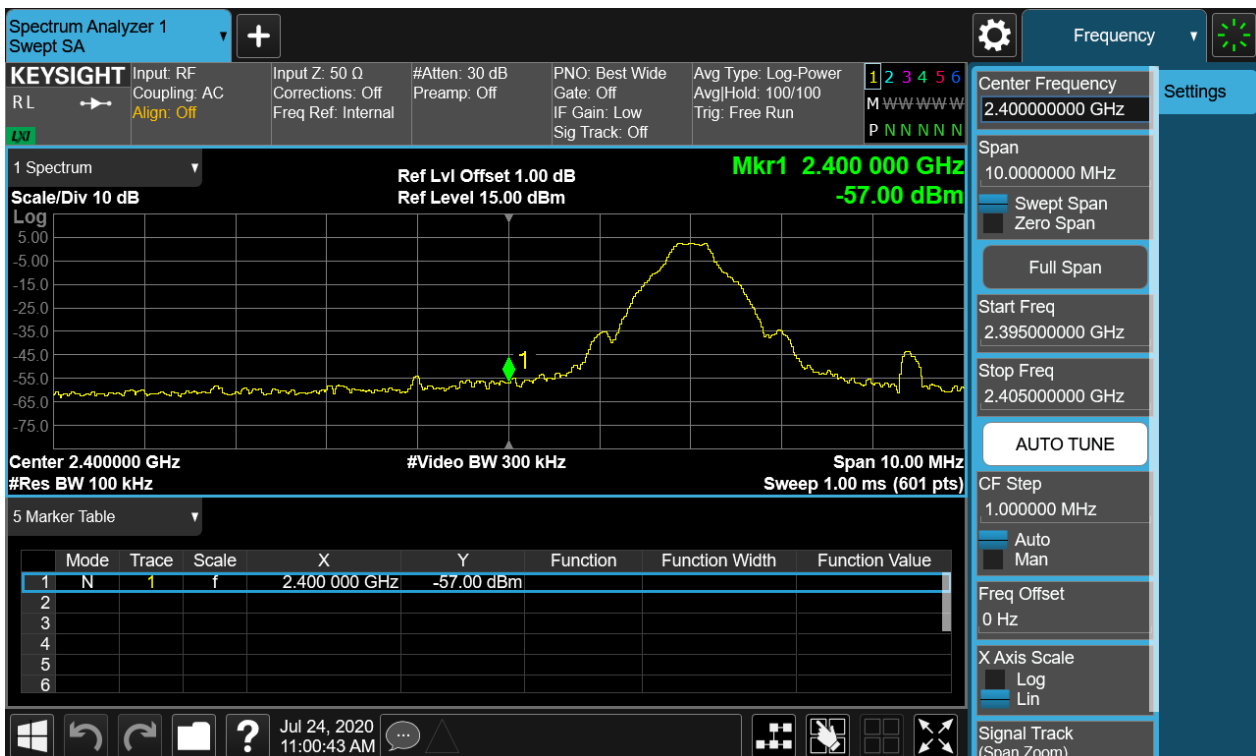
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Figure 16: Conducted Spurious Emission & Authorized-band band-edge, 2402MHz, GFSK Carrier Level



Band Edge



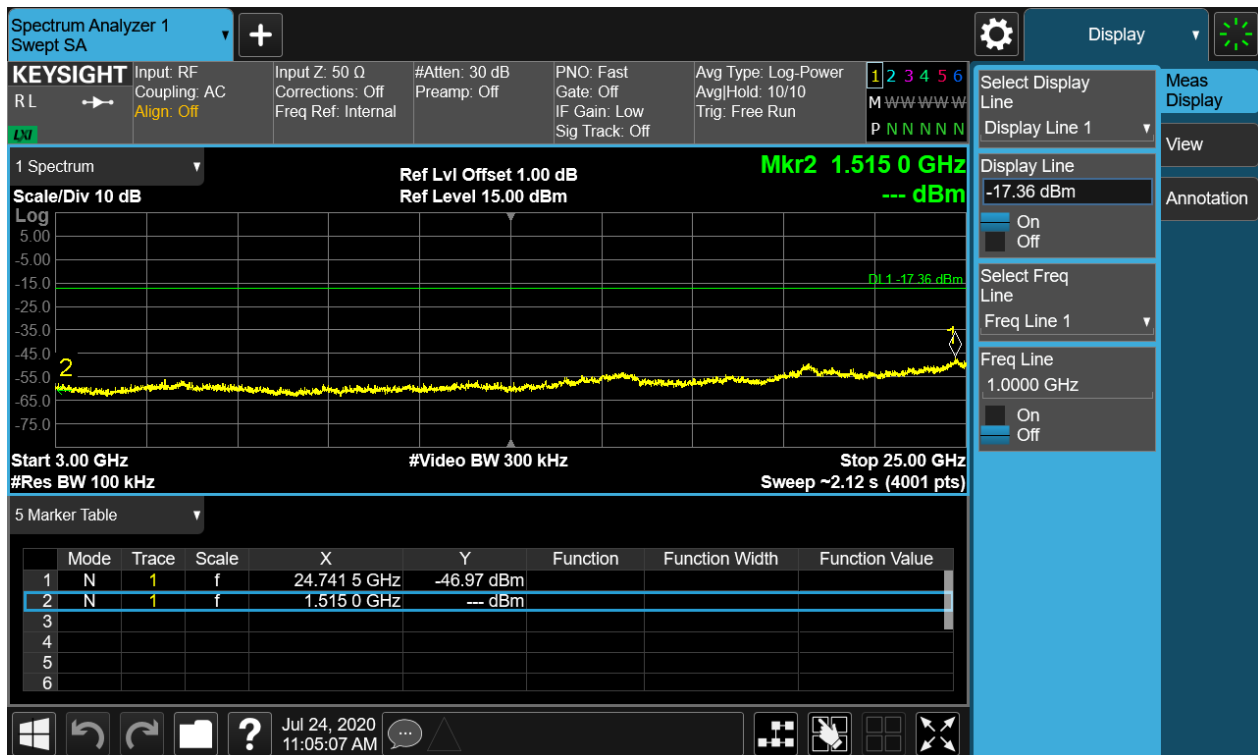
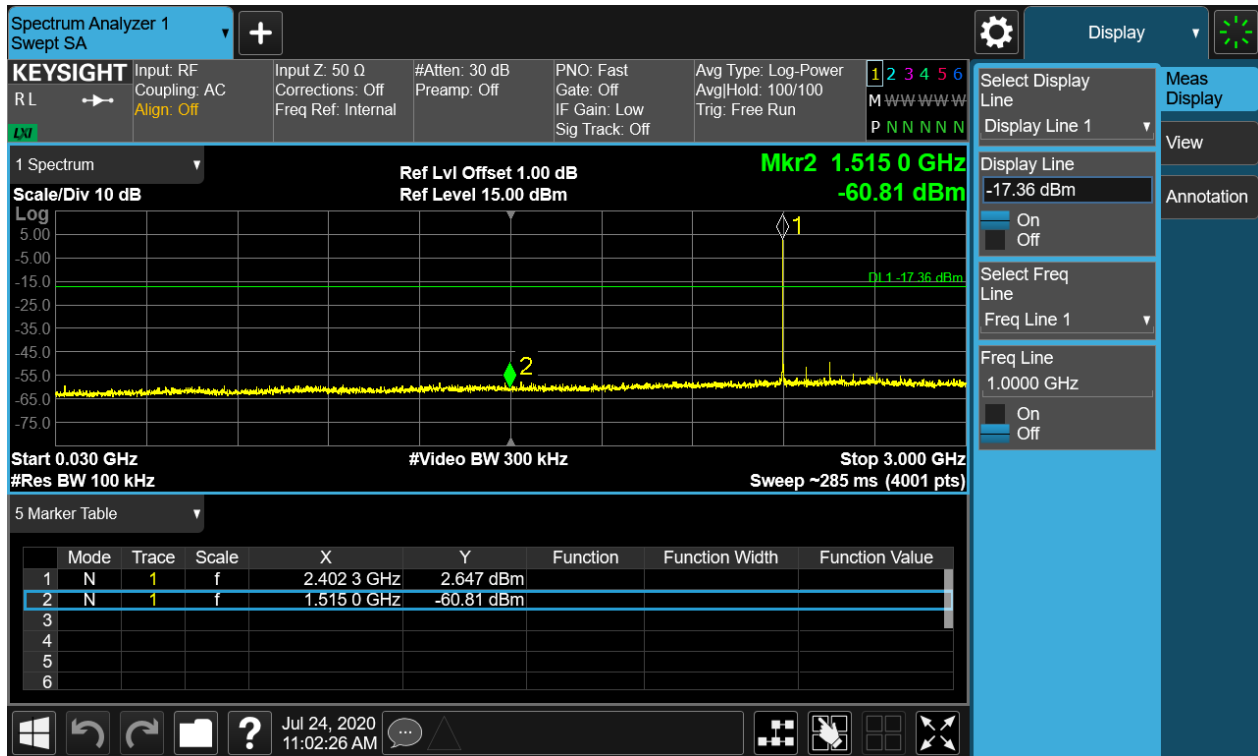
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Conducted spurious emissions 30MHz-25GHz



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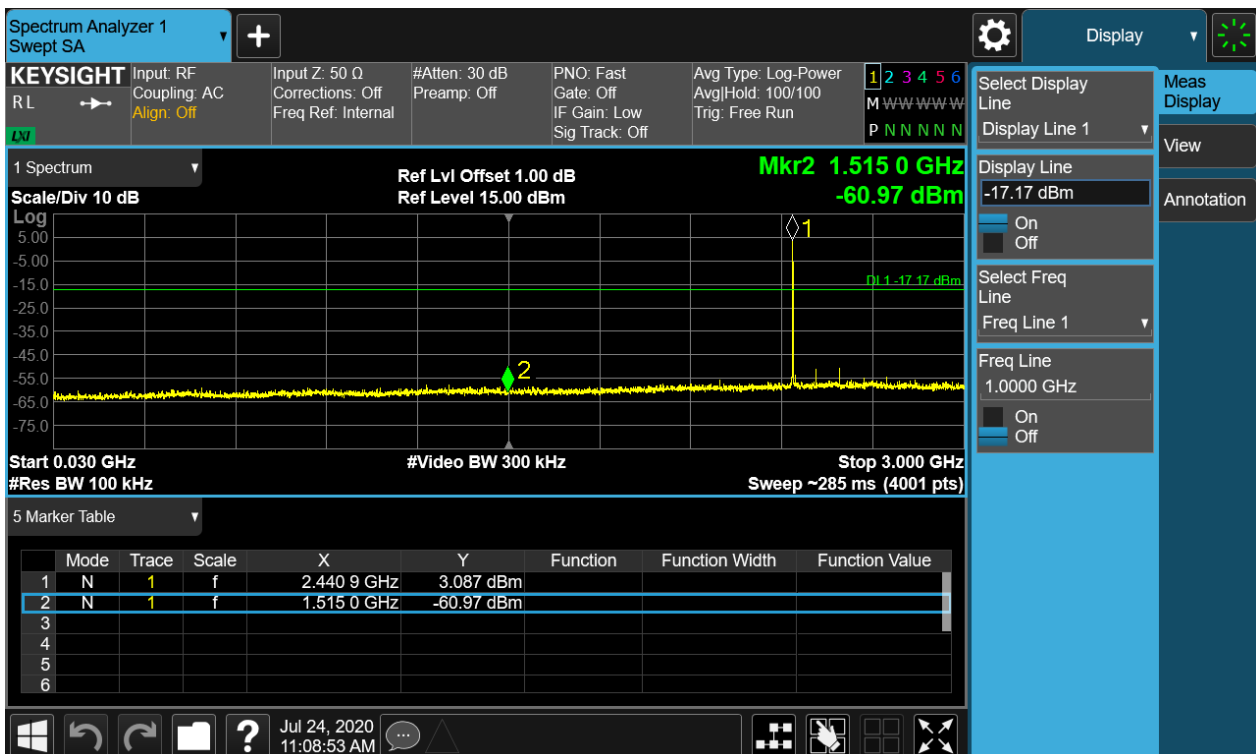
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Figure 17: Conducted Spurious Emission & Authorized-band band-edge, 2441MHz, GFSK Carrier Level



Conducted spurious emissions 30MHz-25GHz



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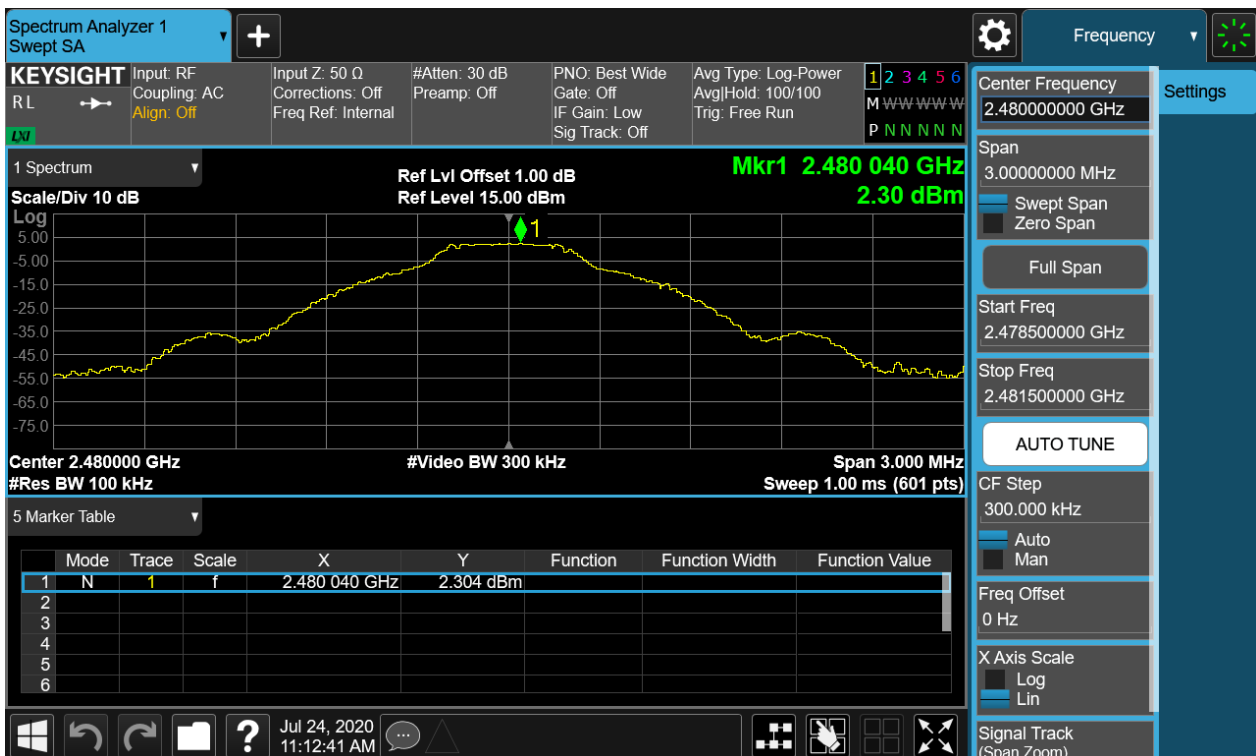
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Figure 18: Conducted Spurious Emission & Authorized-band band-edge, 2480MHz, GFSK Carrier Level



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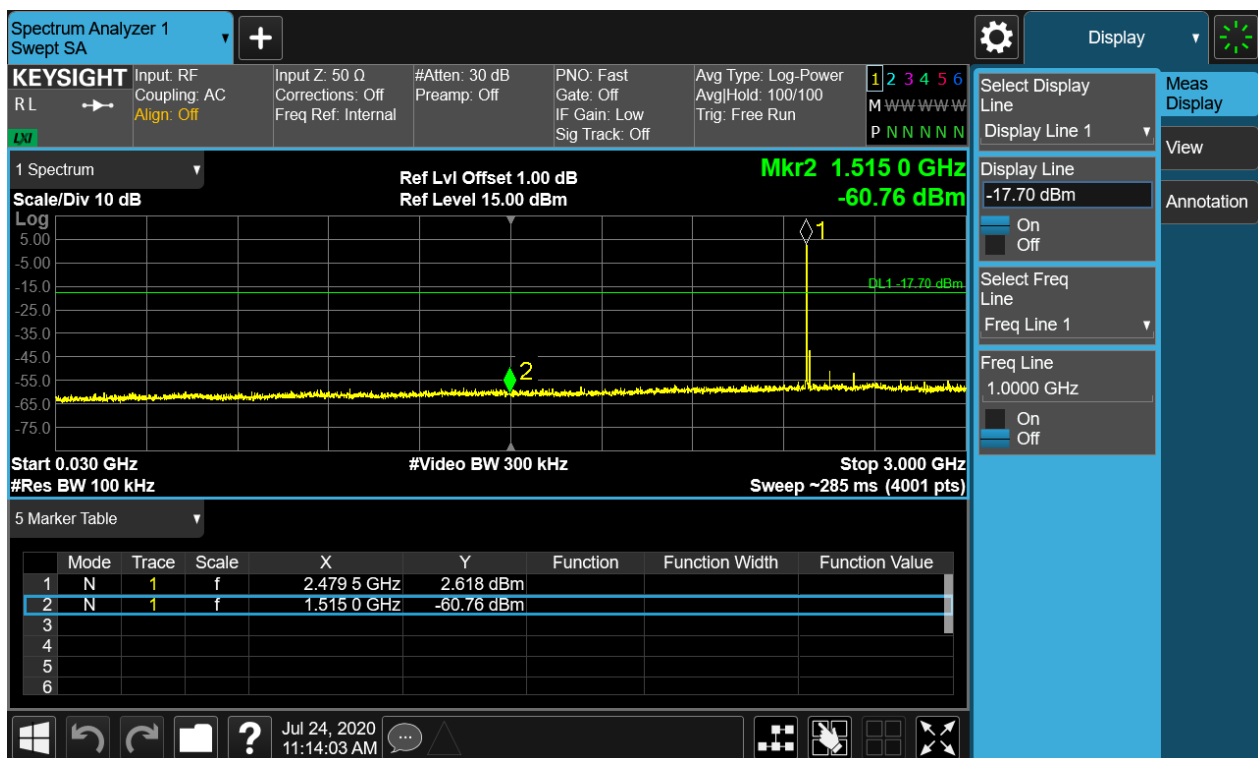
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Band Edge



Conducted spurious emissions 30MHz-25GHz



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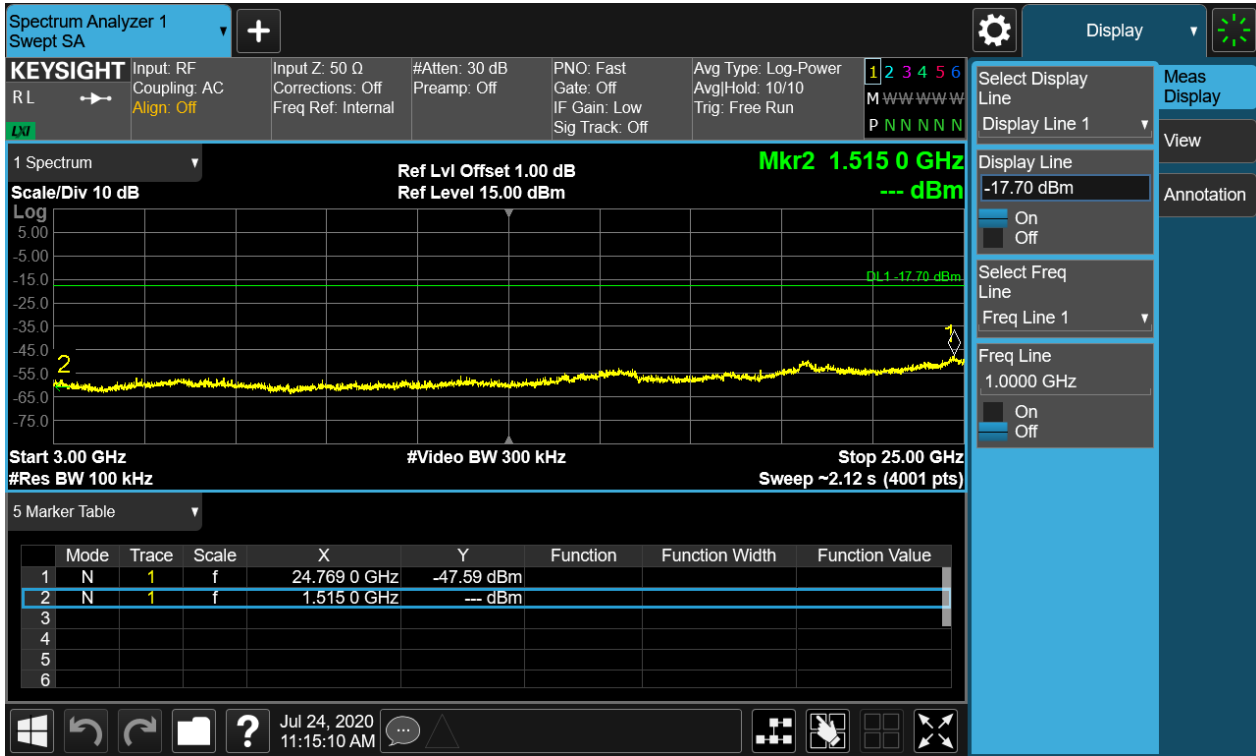
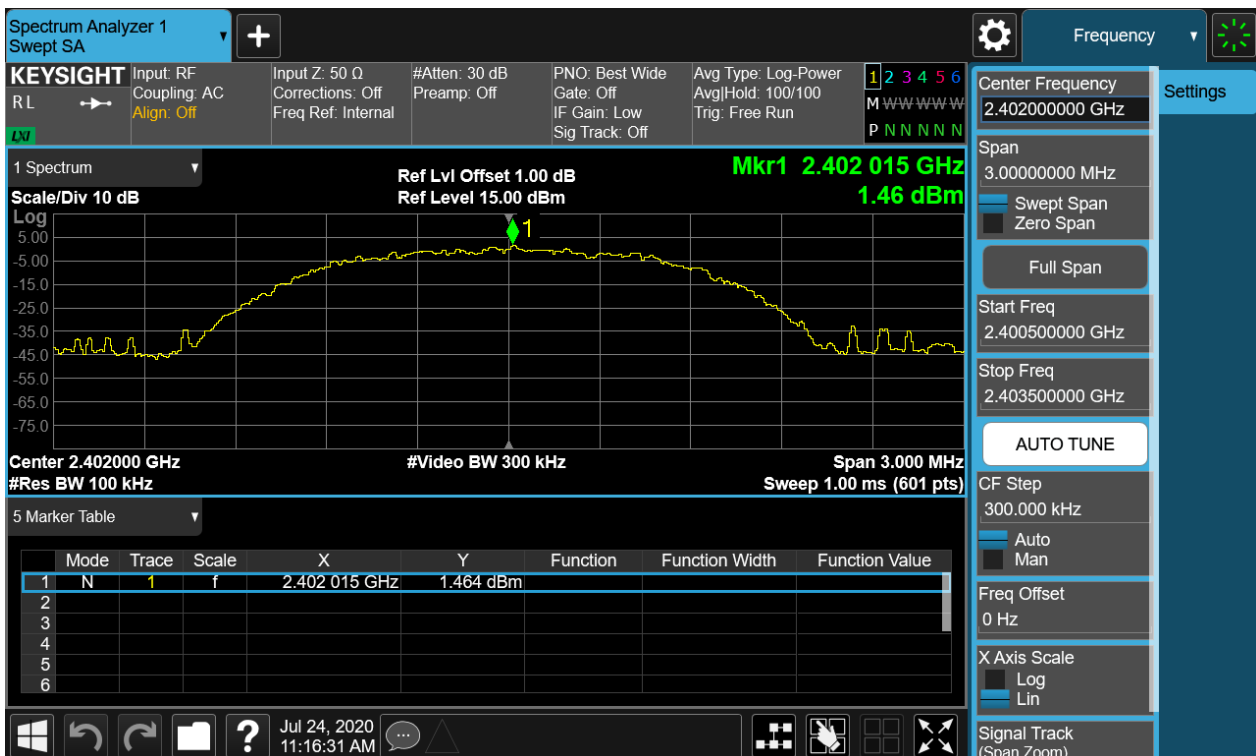


Figure 19: Conducted Spurious Emission & Authorized-band band-edge, 2402MHz, 8-DPSK Carrier Level



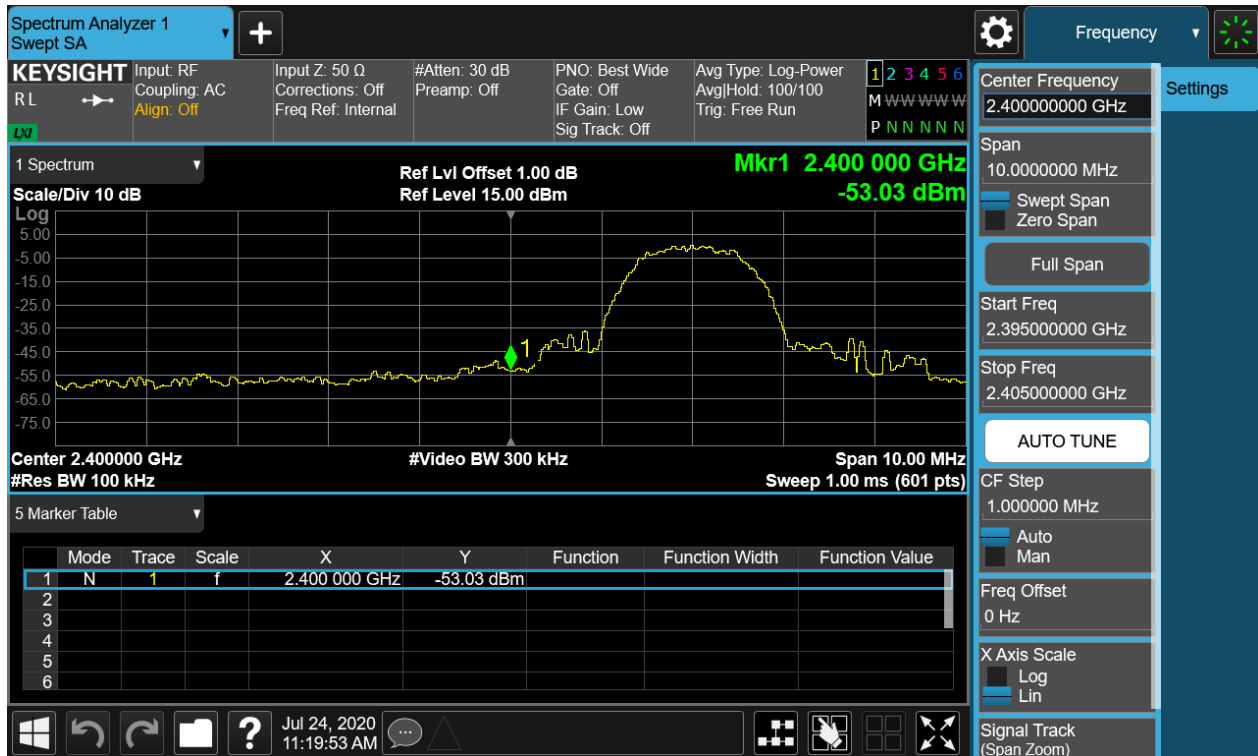
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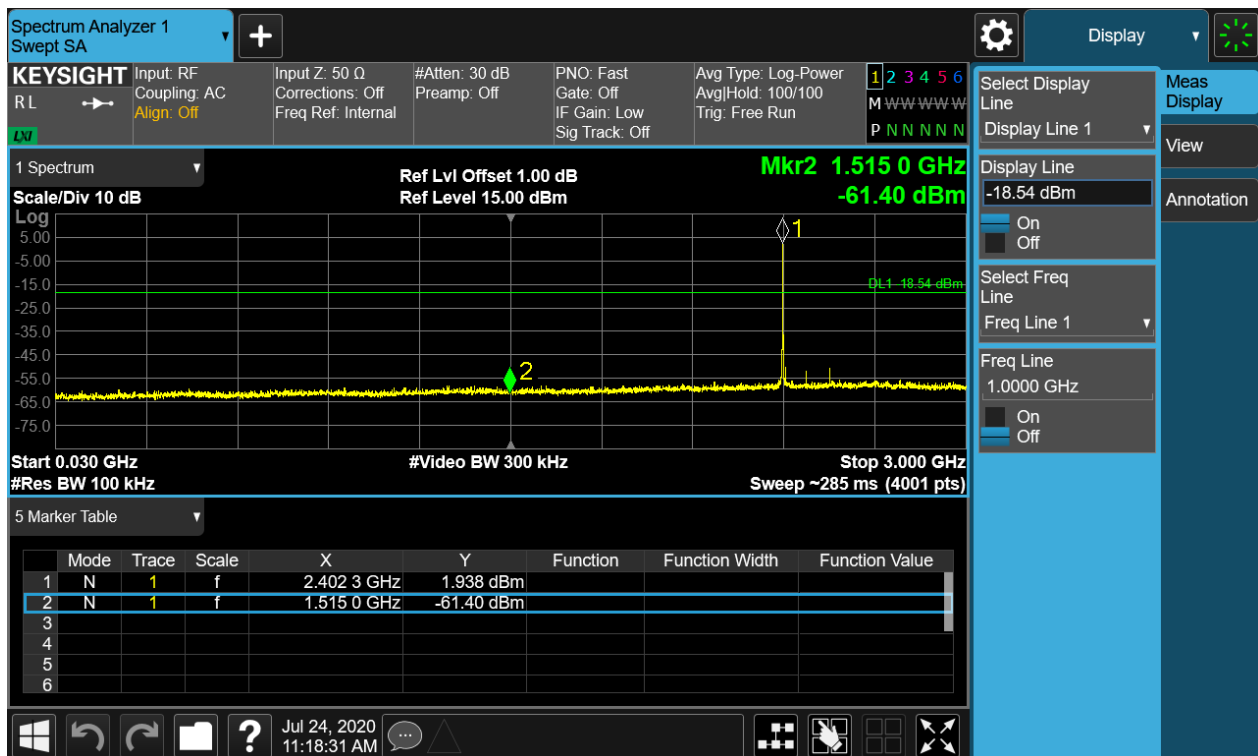
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Band Edge



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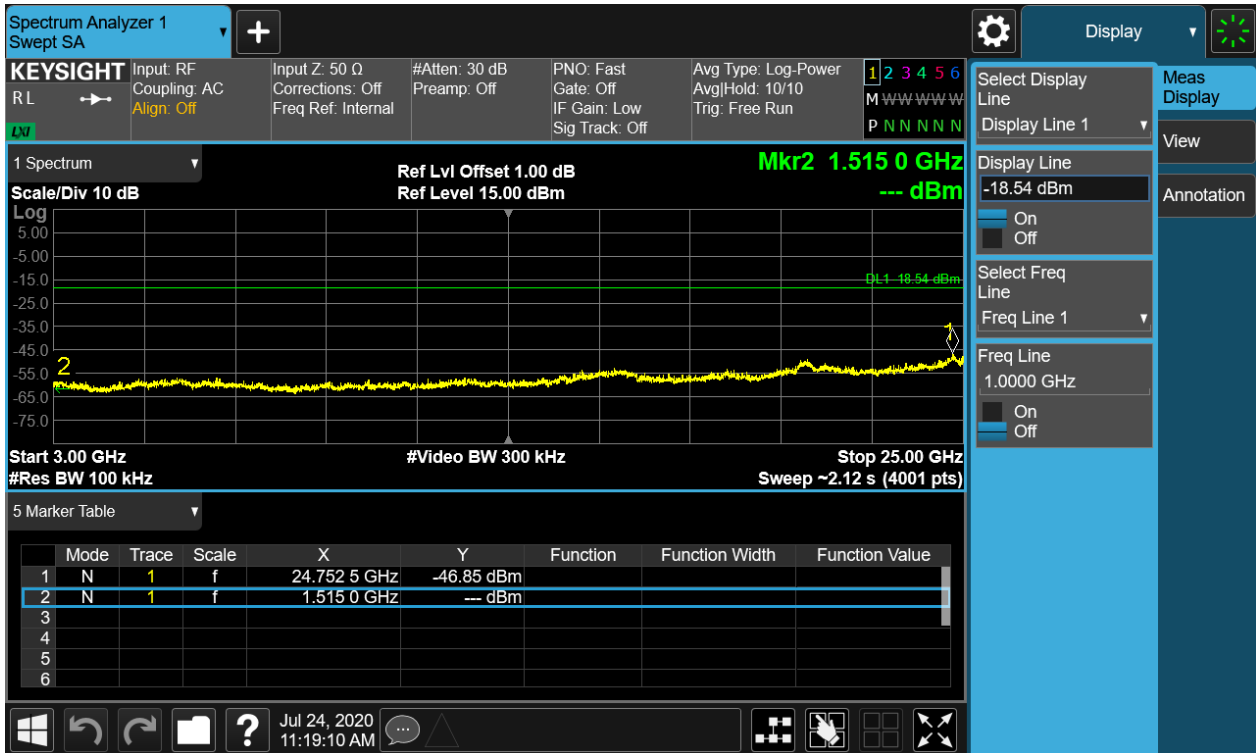
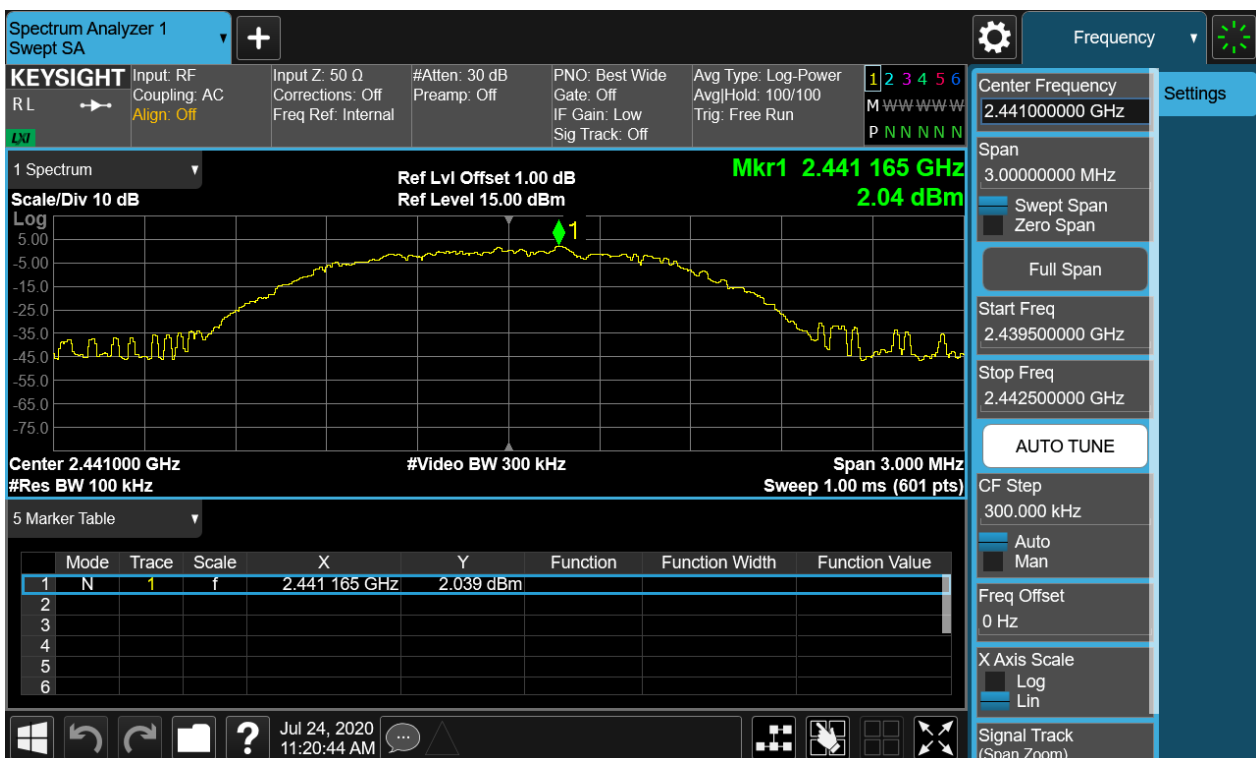


Figure 20: Conducted Spurious Emission & Authorized-band band-edge, 2441MHz, 8-DPSK Carrier Level



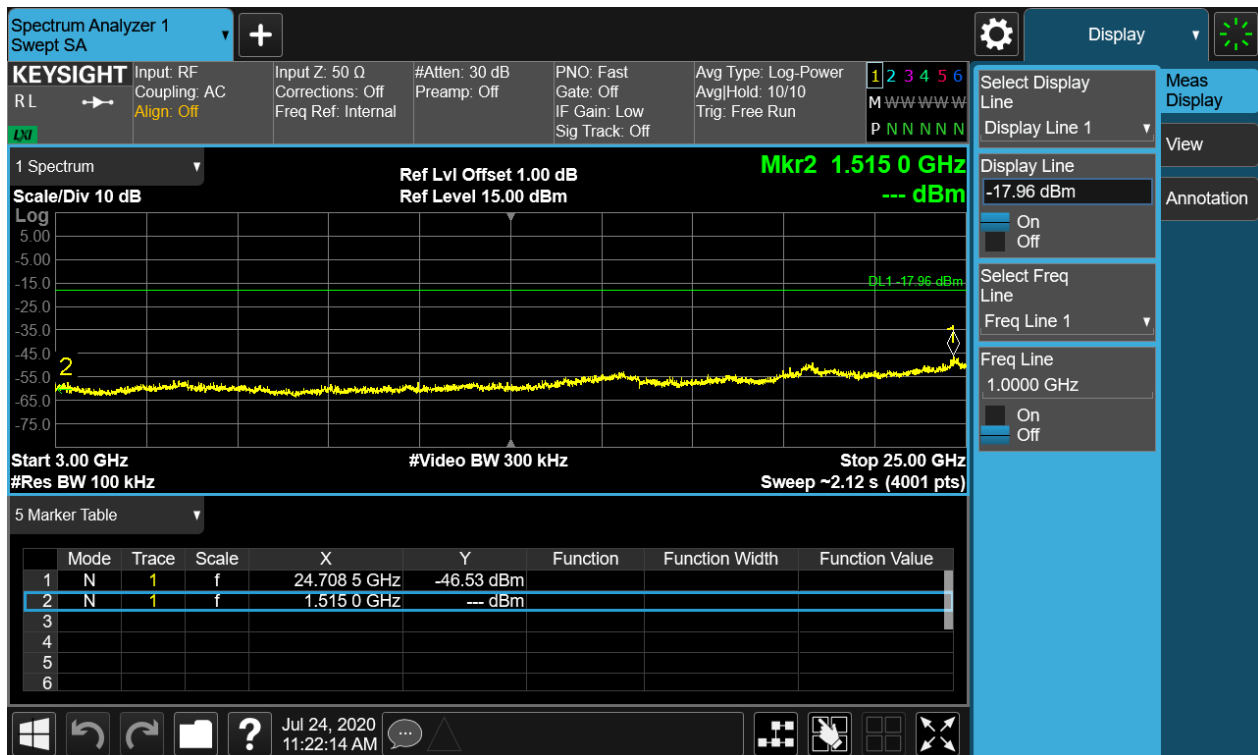
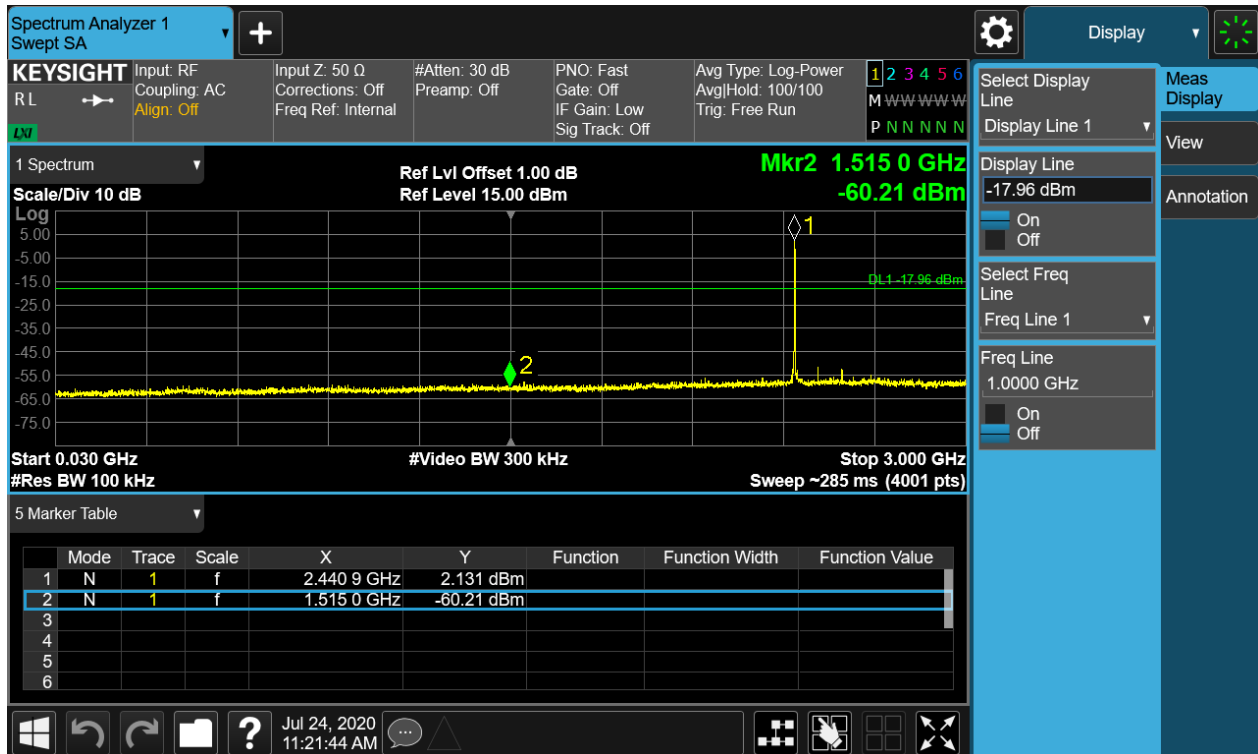
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Conducted spurious emissions 30MHz-25GHz



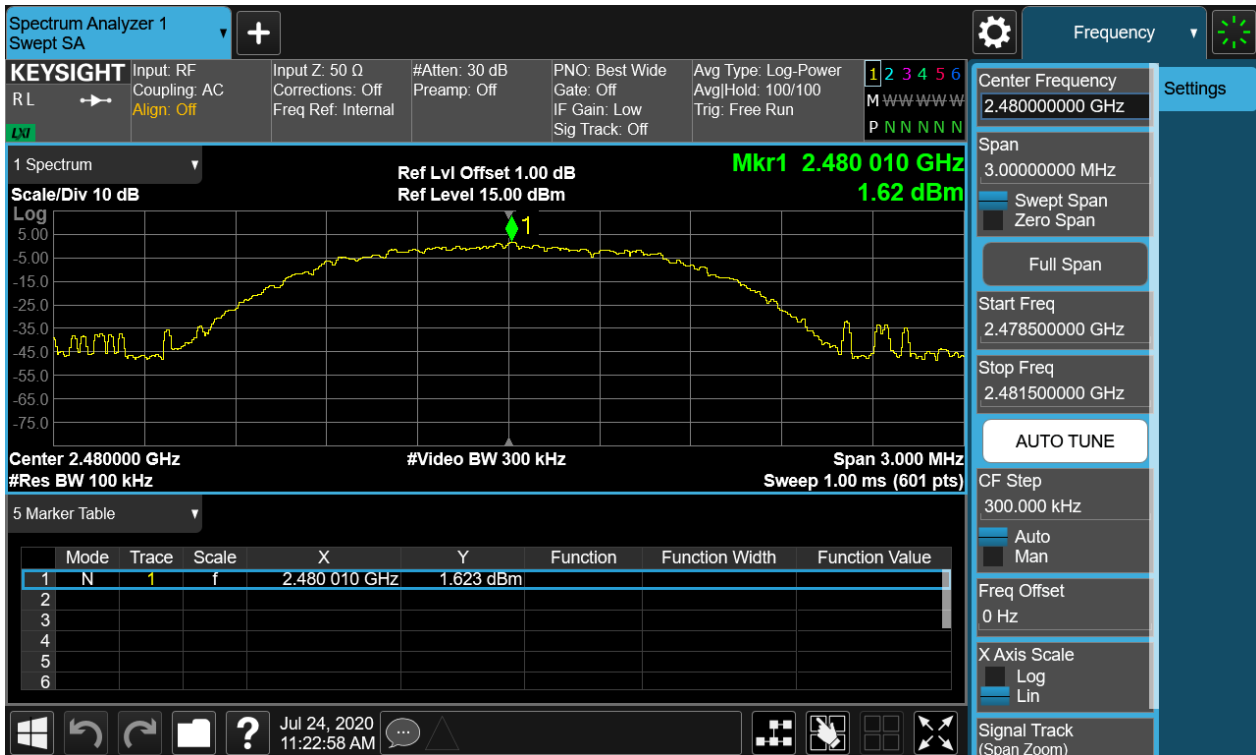
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Figure 21: Conducted Spurious Emission & Authorized-band band-edge, 2480MHz, 8-DPSK Carrier Level



Band Edge



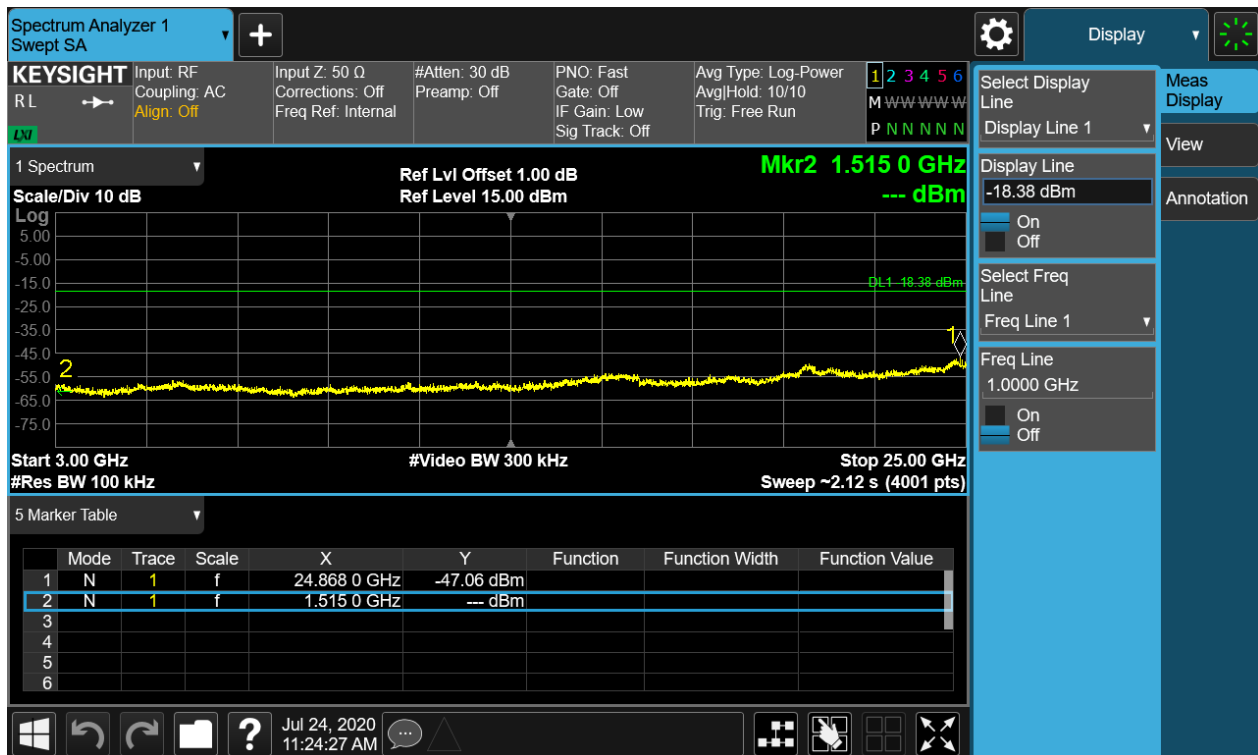
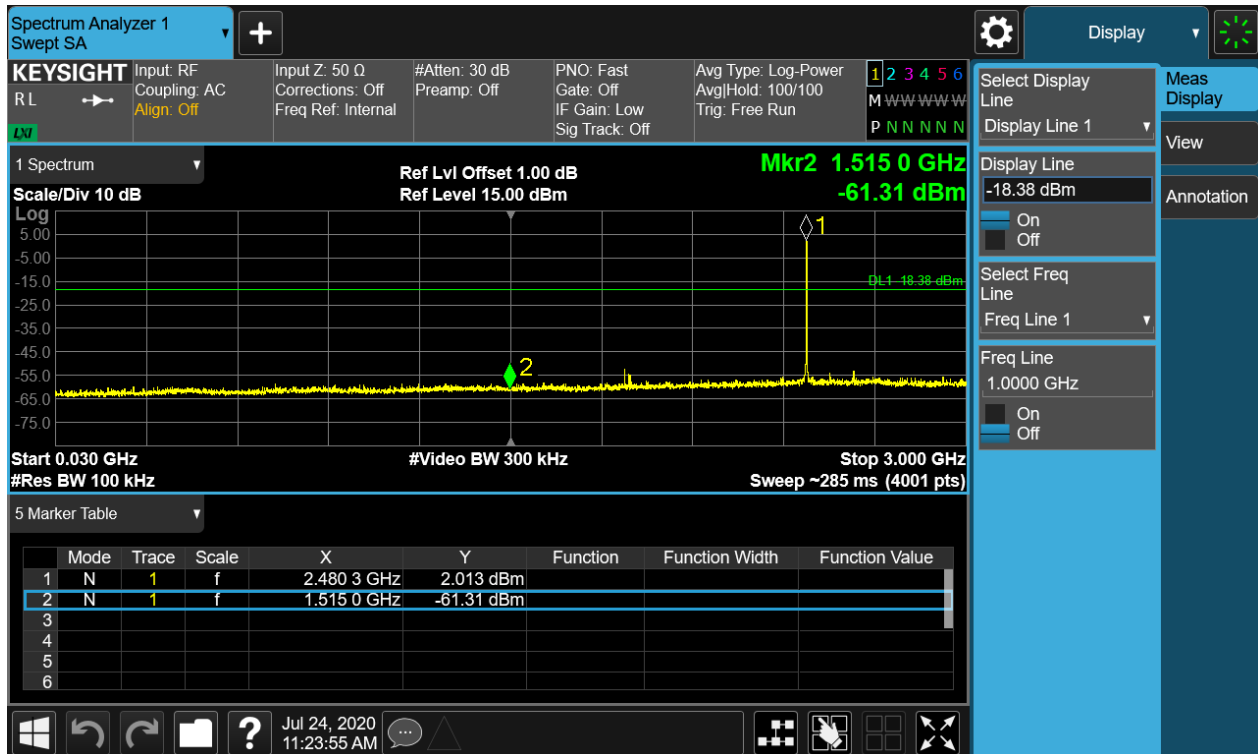
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Conducted spurious emissions 30MHz-25GHz



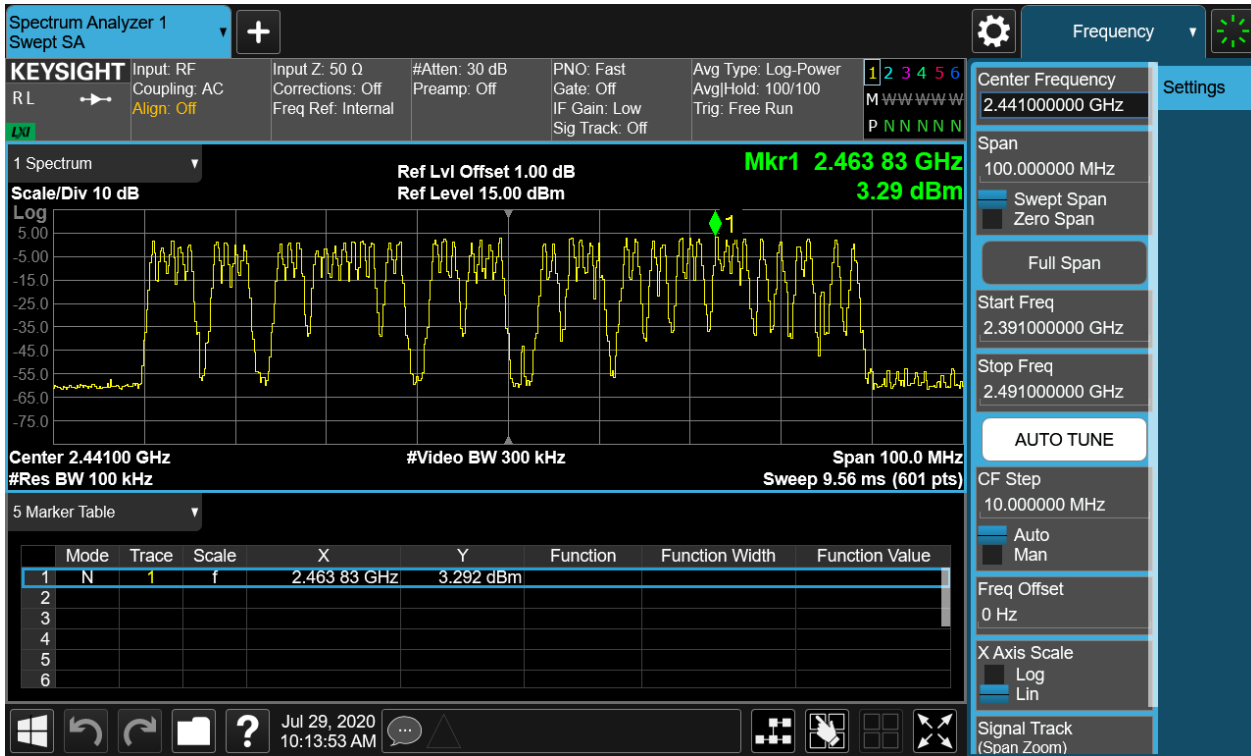
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Figure 22: Conducted Spurious Emission & Authorized-band band-edge, Hopping Mode, GFSK Carrier Level



Band Edge(Low)



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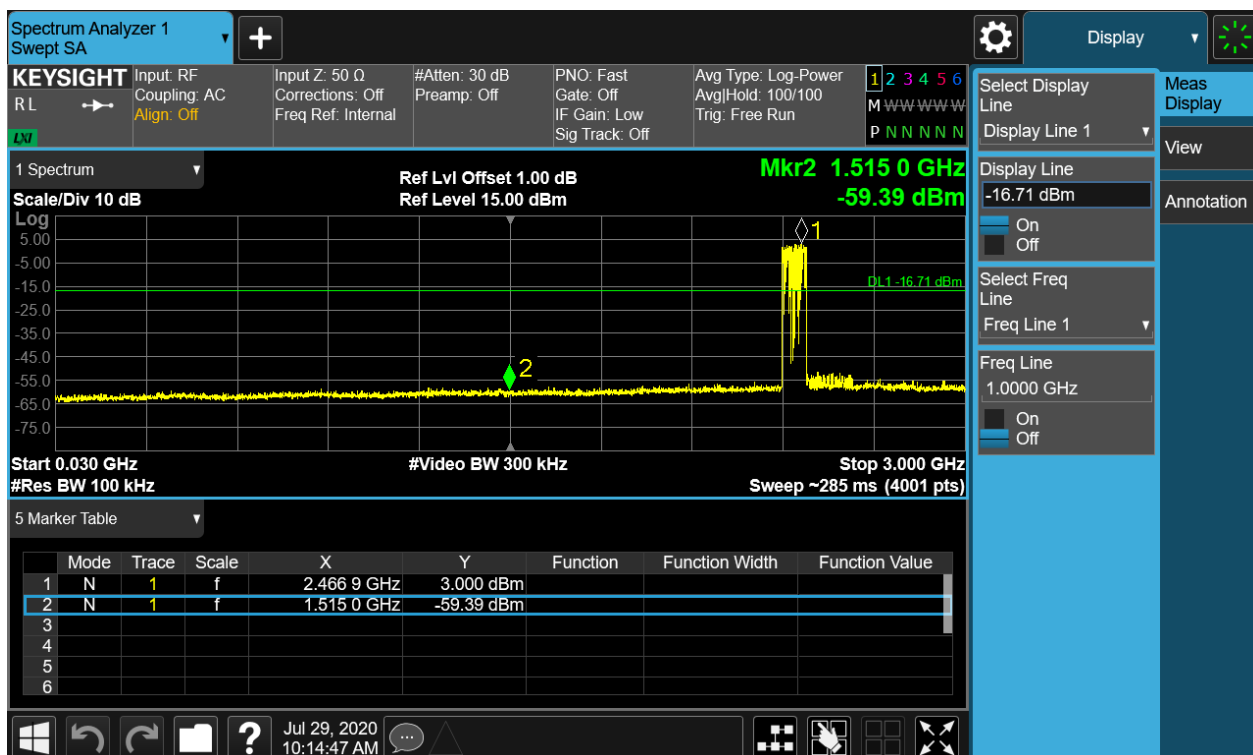
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Band Edge(High)



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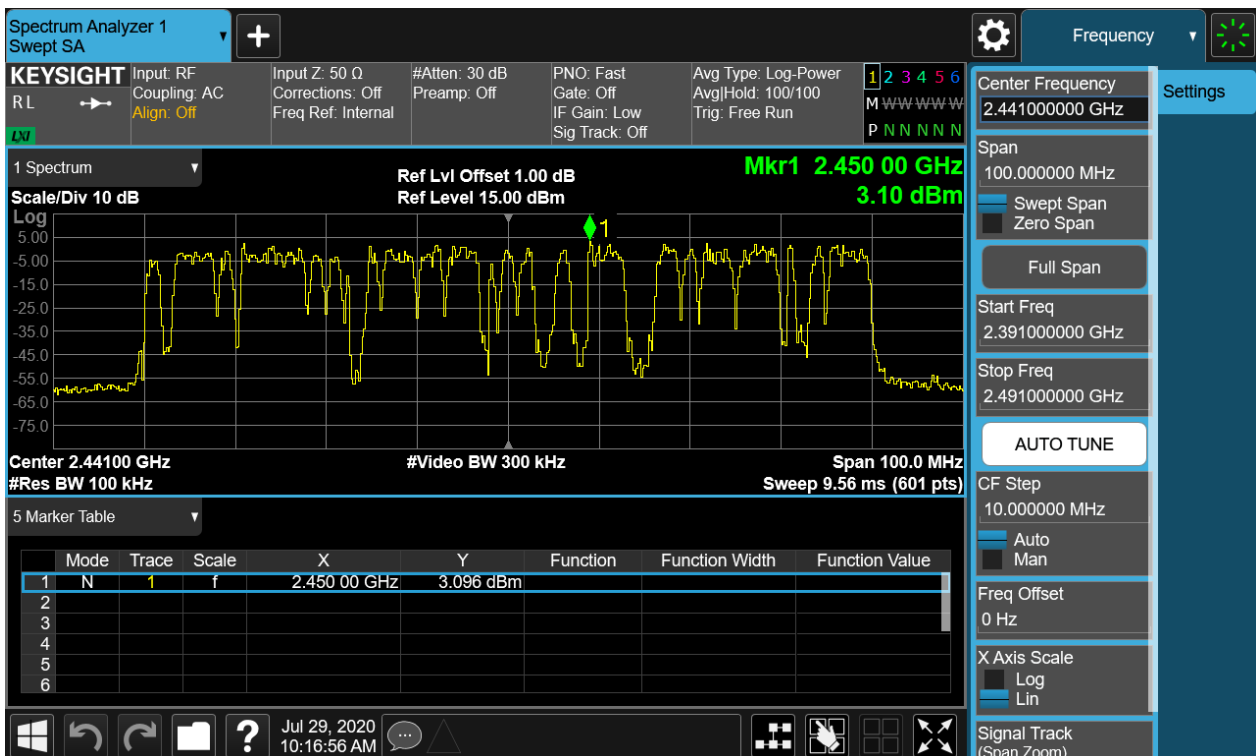
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Figure 23: Conducted Spurious Emission & Authorized-band band-edge, Hopping Mode, 8-DPSK Carrier Level



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Band Edge(Low)



Band Edge(High)



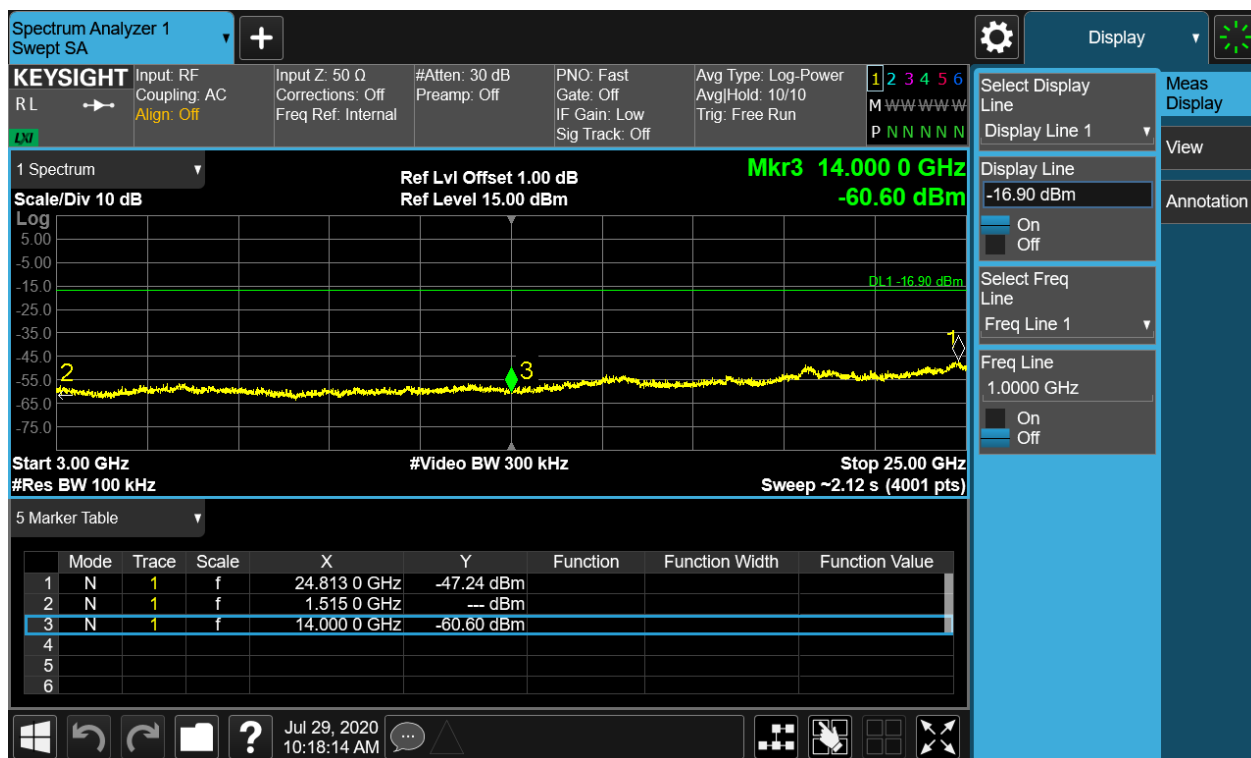
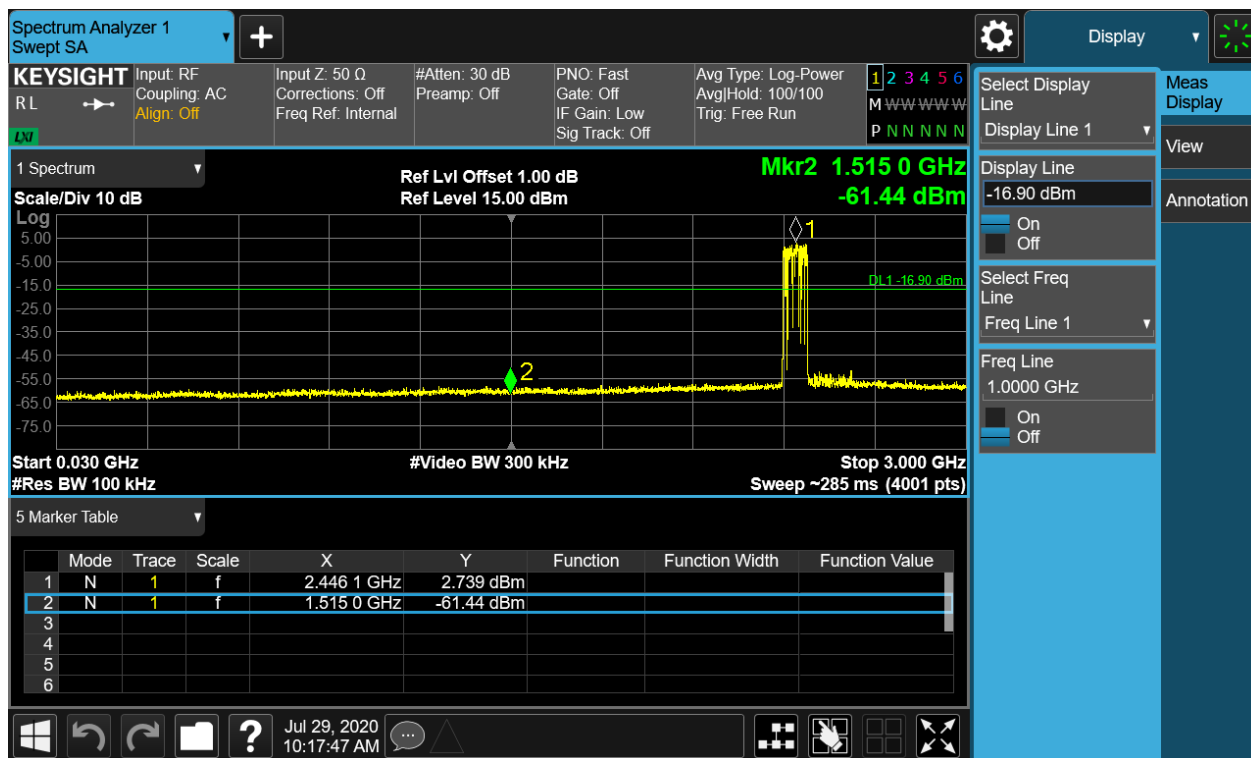
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4.1.5 Spurious Emission

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 : 23°C
Relative humidity : 52%

Notes

Test plots please refer to the annex document "BDEDR-TX EXHIBIT A of SHE20040045-02HE".

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	: 23°C
Relative humidity	: 52%

Notes

Test plots please refer to the annex document "BDEDR-TX EXHIBIT A of SHE20070010-02HE".

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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 : 23°C
Relative humidity : 52%

Table 4: Hopping Frequency Separation

Mode	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
GFSK	2441	0.291	≥ 25kHz or two-thirds of 21dB bandwidth
8-DPSK	2441	0.576	

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Figure 24: Hopping Frequency Separation, Hopping Mode, GFSK



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



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4.1.8 Number of Hopping Frequency

RESULT:

PASS

Test standard : FCC Part 15.247(a)(1)(iii)
RSS-247 5.1(4)
Requirement : ANSI C63.10-2013
Kind of test site : Shielded room

Test setup

Test Channel : Hopping
Operation Mode : A.1.a.iv
Ambient temperature : 23°C
Relative humidity : 52%

Table 5: Number of Hopping Frequency

Mode	Frequency Range	Measured Quantity of Hopping Channel	Limit
GFSK	2400 – 2483.5	79	≥15
8-DPSK	2400 – 2483.5	79	≥15

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Figure 26: Number of Hopping Frequency, Hopping Mode, GFSK

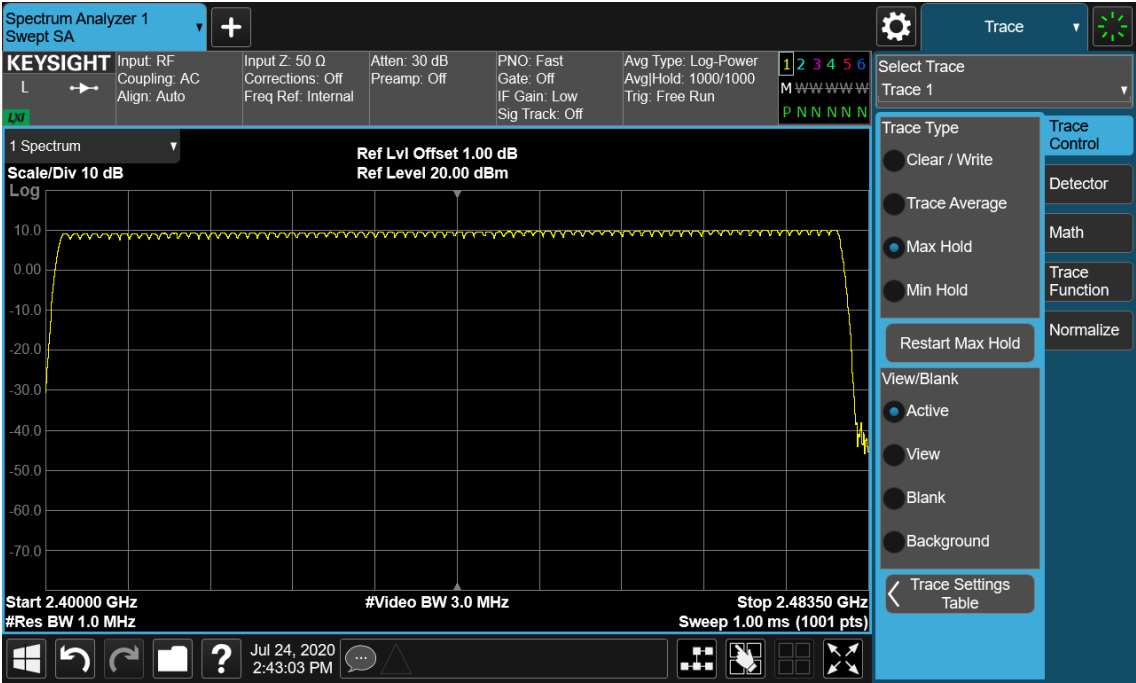
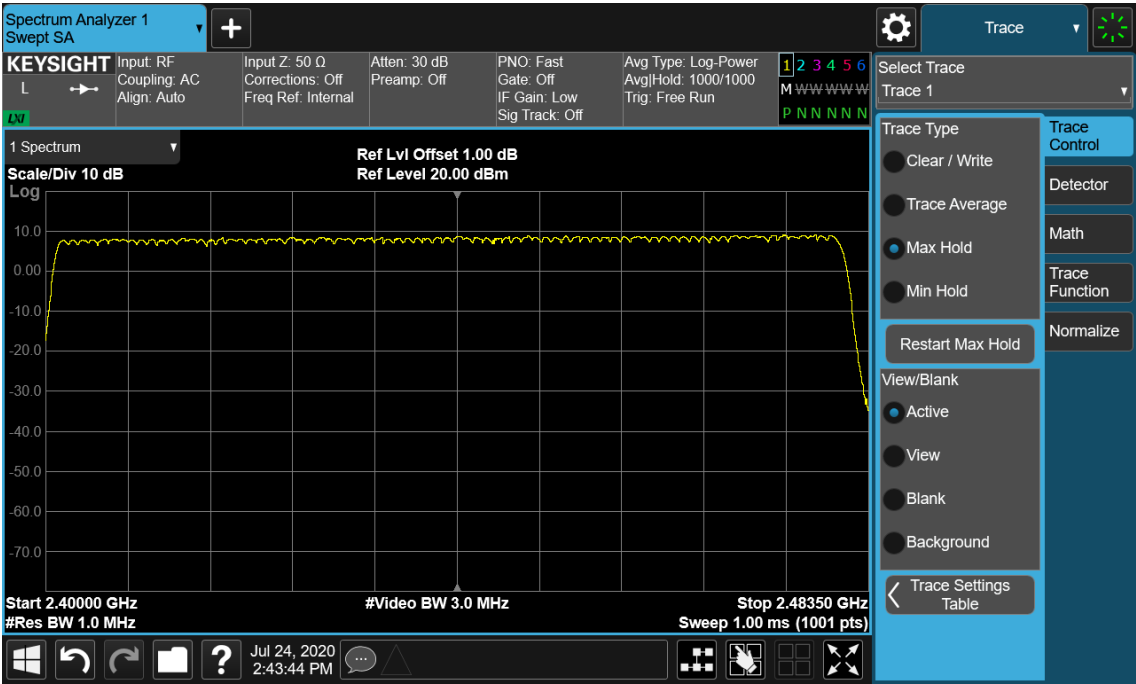


Figure 26: Number of Hopping Frequency, Hopping Mode, 8-DPSK



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4.1.9 Time of Occupancy

RESULT:

PASS

Test standard : FCC Part 15.247(a)(1)(iii)
RSS-247 5.1(4)
Requirement : ANSI C63.10-2013
Kind of test site : Shielded room

Test setup

Test Channel : Middle
Operation Mode : A.1.a
Ambient temperature : 23°C
Relative humidity : 52%

Table 6: Time of Occupancy

Mode	Packet Type	Pulse Time (ms)	Total of Dwell (ms)	Limit (s)
GFSK	DH1	0.4083	130.656	0.4
	DH3	1.6850	269.600	0.4
	DH5	3.3270	354.884	0.4
8-DPSK	DH1	0.4200	134.400	0.4
	DH3	1.6850	269.600	0.4
	DH5	2.9270	312.217	0.4

Note:

For DH1 package type:

Total of Dwell = Pulse Time*(1600/2)/Number of Hopping Frequency*Period

Period = 0.4* Number of Hopping Frequency

For DH3 package type:

Total of Dwell = Pulse Time*(1600/4)/Number of Hopping Frequency*Period

Period = 0.4* Number of Hopping Frequency

For DH5 package type:

Total of Dwell = Pulse Time*(1600/6)/Number of Hopping Frequency*Period

Period = 0.4* Number of Hopping Frequency

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Figure 28: Time of Occupancy, 2441MHz, GFSK DH1

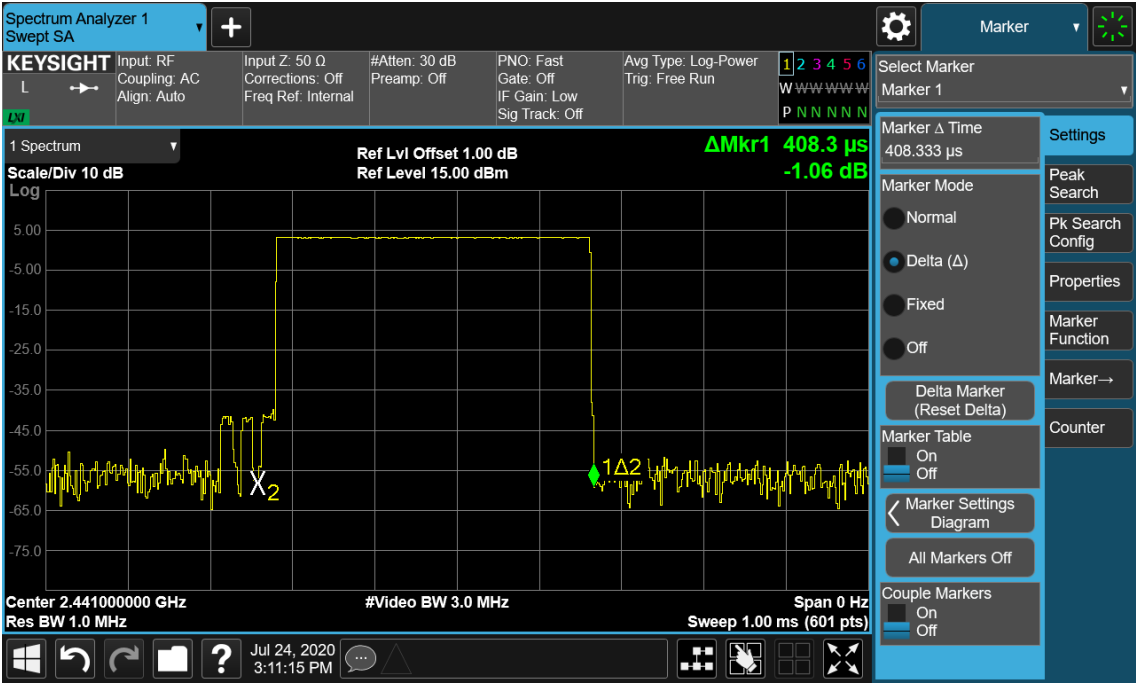
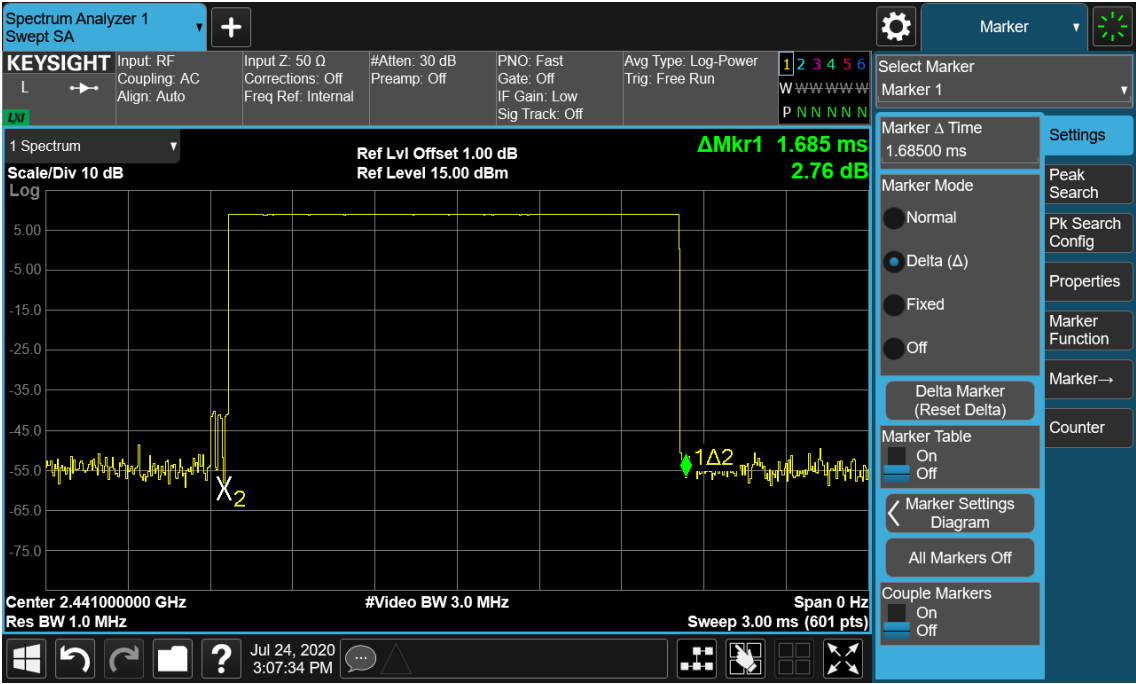


Figure 27: Time of Occupancy, 2441MHz, GFSK DH3



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Figure 30: Time of Occupancy, 2441MHz, GFSK DH5

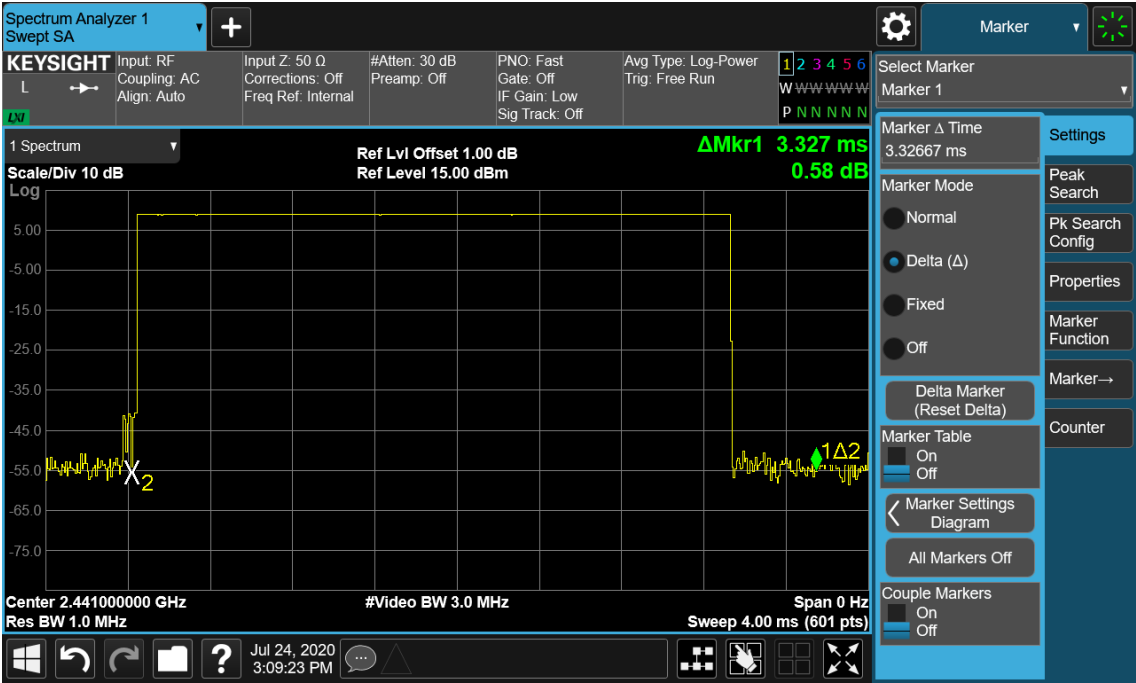
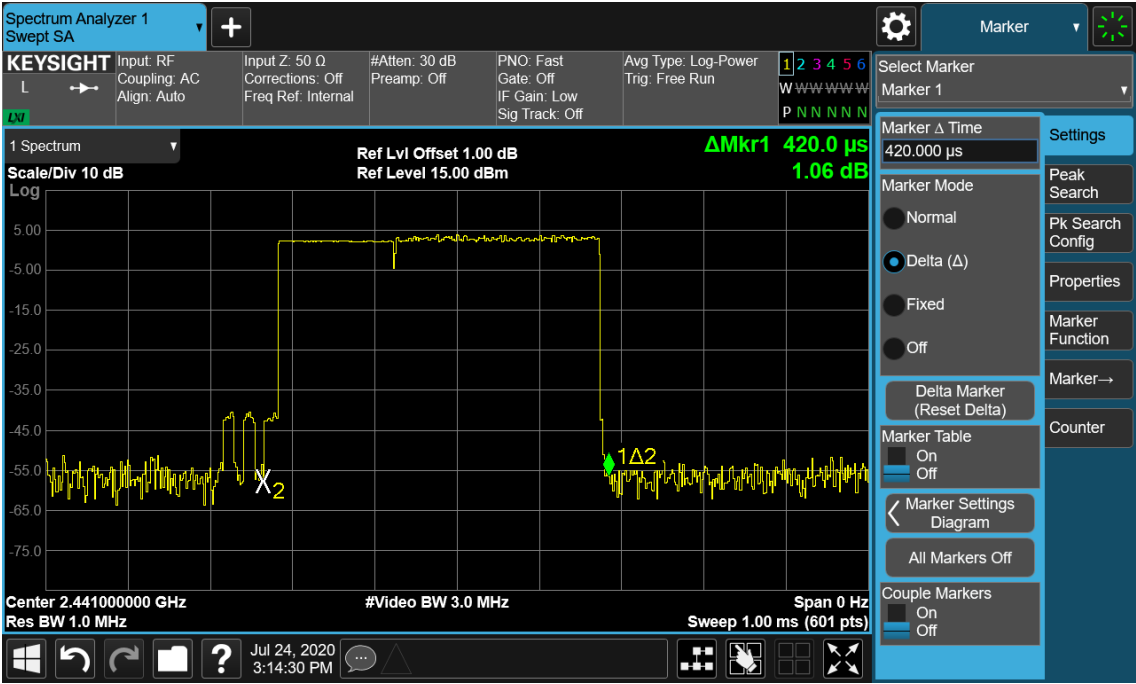


Figure 31: Time of Occupancy, 2441MHz, 8-DPSK DH1



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Figure 32: Time of Occupancy, 2441MHz, 8-DPSK DH3

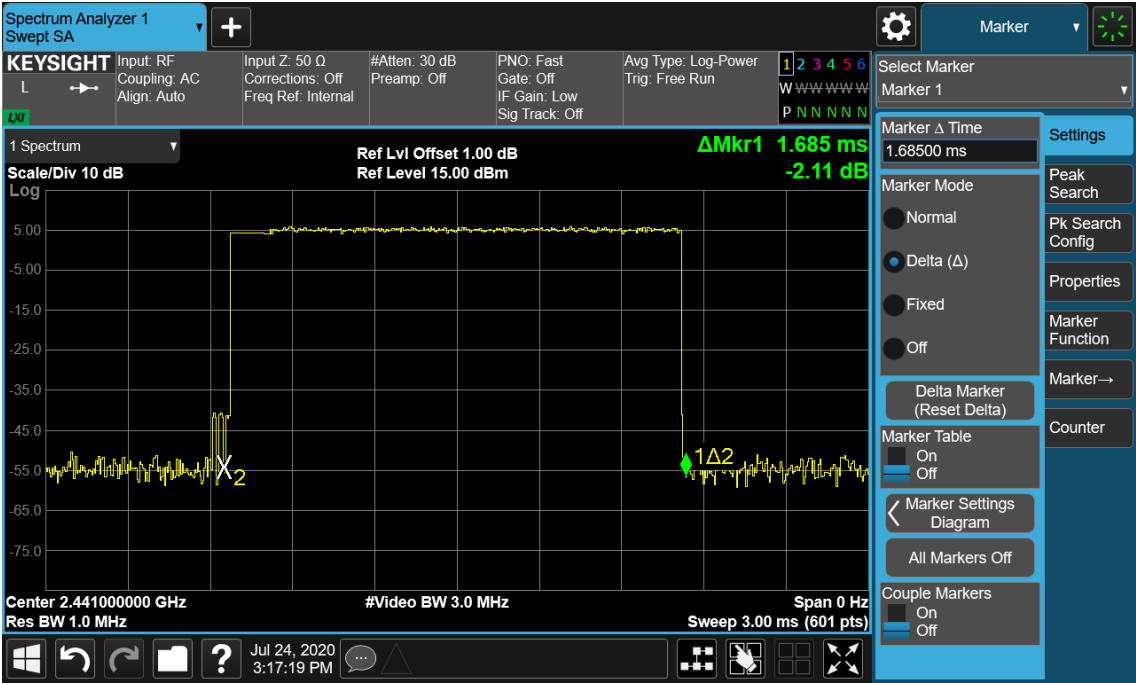
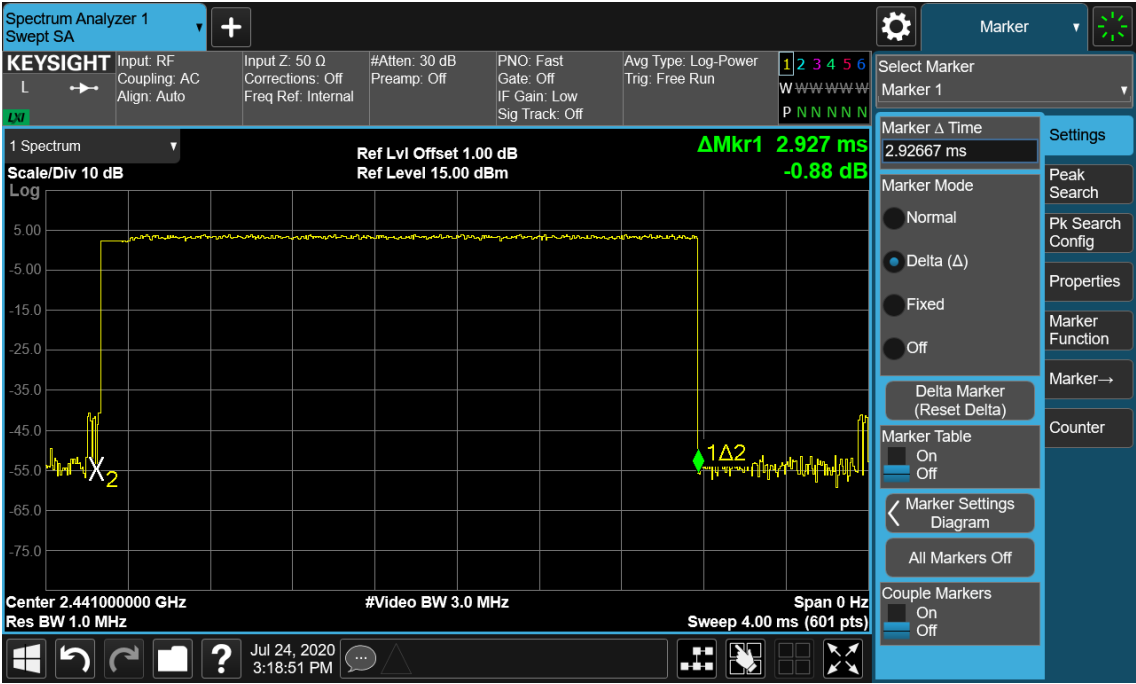


Figure 33: Time of Occupancy, 2441MHz, 8-DPSK DH5



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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) RSS-Gen 8.8
Requirement	: ANSI C63.10-2013
Kind of test site	: Shielded room

Test setup

Input Voltage	: AC 120V, 60Hz; AC 240V, 50Hz
Operation Mode	: A.1.a
Earthing	: Not Connected
Ambient temperature	: 23°C
Relative humidity	: 52%

For details refer to following test plot.

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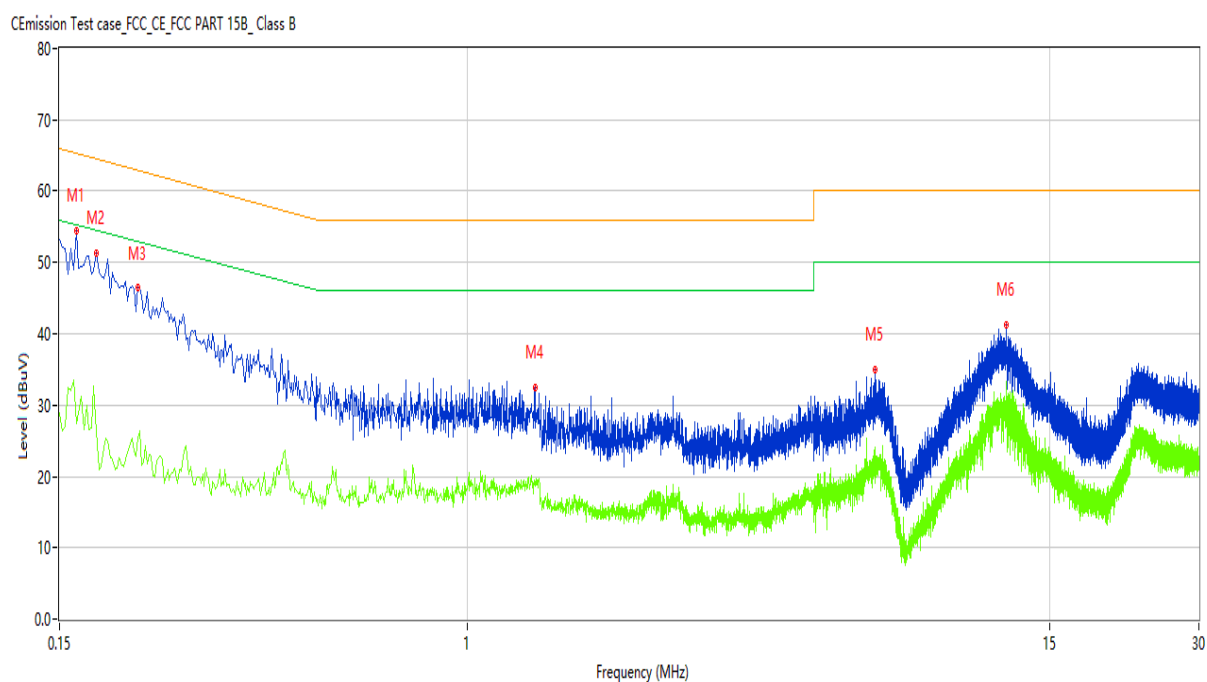
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Note:

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

Figure 34: Conducted Emission on AC Mains, L Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.158	55.08	10.15	65.57	-10.49	Peak	L	Pass
1*	0.158	48.18	10.15	65.57	-17.39	QP	L	Pass
1**	0.158	32.07	10.15	55.57	-23.50	AV	L	Pass
2	0.178	52.80	10.15	64.58	-11.78	Peak	L	Pass
2*	0.178	44.75	10.15	64.58	-19.83	QP	L	Pass
2**	0.178	26.34	10.15	54.58	-28.24	AV	L	Pass
3	0.216	48.80	10.14	62.97	-14.17	Peak	L	Pass
3*	0.216	40.55	10.14	62.97	-22.42	QP	L	Pass
3**	0.216	25.31	10.14	52.97	-27.66	AV	L	Pass
4	1.368	33.91	10.16	56.00	-22.09	Peak	L	Pass
4*	1.368	24.30	10.16	56.00	-31.70	QP	L	Pass
4**	1.368	19.09	10.16	46.00	-26.91	AV	L	Pass
5	6.664	35.27	10.30	60.00	-24.73	Peak	L	Pass
5*	6.664	28.33	10.30	60.00	-31.67	QP	L	Pass
5**	6.664	22.04	10.30	50.00	-27.96	AV	L	Pass
6	12.244	42.46	10.46	60.00	-17.54	Peak	L	Pass
6*	12.244	35.13	10.46	60.00	-24.87	QP	L	Pass
6**	12.244	32.99	10.46	50.00	-17.01	AV	L	Pass

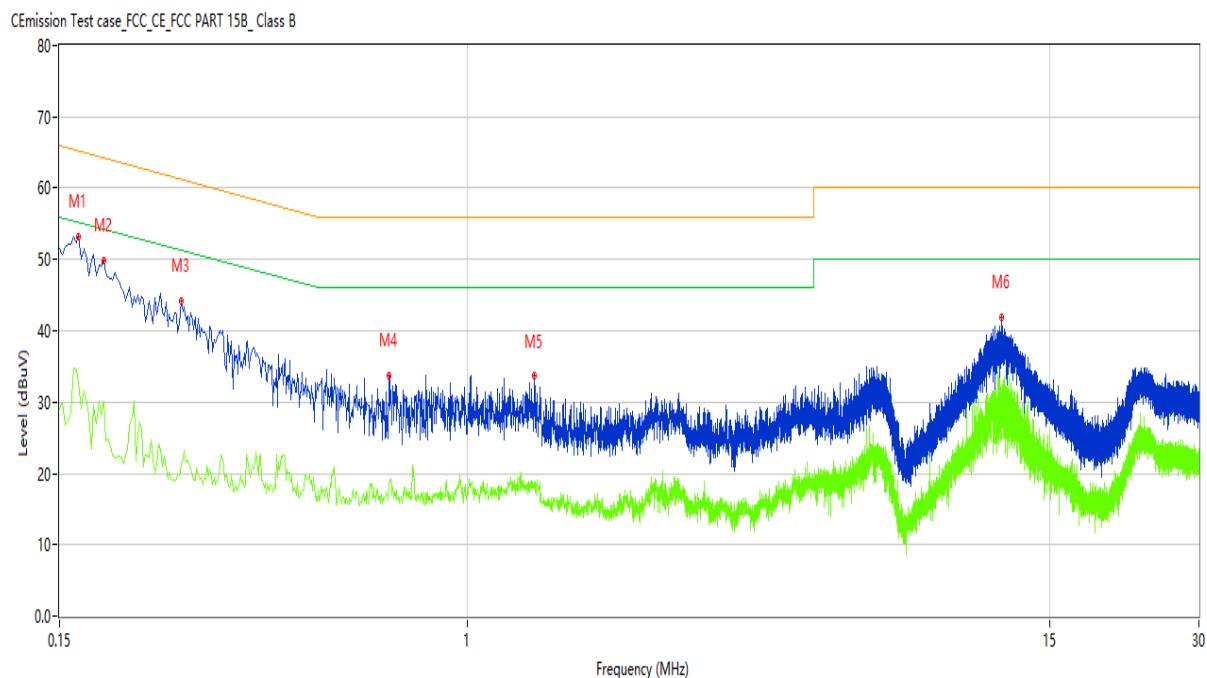
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Figure 35: Conducted Emission on AC Mains, N Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.164	54.90	10.15	65.26	-10.36	Peak	N	Pass
1*	0.164	47.89	10.15	65.26	-17.37	QP	N	Pass
1**	0.164	32.90	10.15	55.26	-22.36	AV	N	Pass
2	0.184	53.04	10.15	64.30	-11.26	Peak	N	Pass
2*	0.184	43.14	10.15	64.30	-21.16	QP	N	Pass
2**	0.184	30.22	10.15	54.30	-24.08	AV	N	Pass
3	0.264	44.44	10.14	61.30	-16.86	Peak	N	Pass
3*	0.264	35.58	10.14	61.30	-25.72	QP	N	Pass
3**	0.264	21.20	10.14	51.30	-30.10	AV	N	Pass
4	0.694	34.43	10.15	56.00	-21.57	Peak	N	Pass
4*	0.694	24.64	10.15	56.00	-31.36	QP	N	Pass
4**	0.694	18.49	10.15	46.00	-27.51	AV	N	Pass
5	1.362	33.07	10.16	56.00	-22.93	Peak	N	Pass
5*	1.362	22.67	10.16	56.00	-33.33	QP	N	Pass
5**	1.362	18.54	10.16	46.00	-27.46	AV	N	Pass
6	11.968	40.53	10.46	60.00	-19.47	Peak	N	Pass
6*	11.968	35.22	10.46	60.00	-24.78	QP	N	Pass
6**	11.968	30.81	10.46	50.00	-19.19	AV	N	Pass

End of the report