

TEST REPORT

Report No.: SH21040017-02BE

Date: 2021-05-19

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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 ~ 2021-05-19
Date of Issue : 2021-05-19

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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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	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	3.42dBi
Test Voltage	AC 120V
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	Part 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.

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1.5 Test Summary

Test Item	FCC Rules	Result
Antenna Requirement	FCC Part 15.247(b)(4), Part 15.203	PASS
Maximum Conducted Output Power	FCC Part 15.247(b)(1)	PASS
20dB Bandwidth and 99% Bandwidth	FCC Part 15.247(a)(1)	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
Hopping Frequency Separation	FCC Part 15.247(a)(1)	PASS
Number of Hopping Frequency	FCC Part 15.247(a)(1)(iii)	PASS
Time of Occupancy	FCC Part 15.247(a)(1)(iii)	PASS
Conducted Emission on AC Mains	FCC Part 15.207(a)	PASS

Note(s):

$\pi/4$ -DQPSK is the EDR 2M rate mode, 8-DPSK is the EDR 3M rate mode. The consistency of test results in $\pi/4$ -DQPSK and 8-DPSK is very high. So we chose 8-DPSK as a typical representative to appear on the report. Another we will show all the modes on the RF output power test item.

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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 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

2.3 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
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:

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	N/A	ESP

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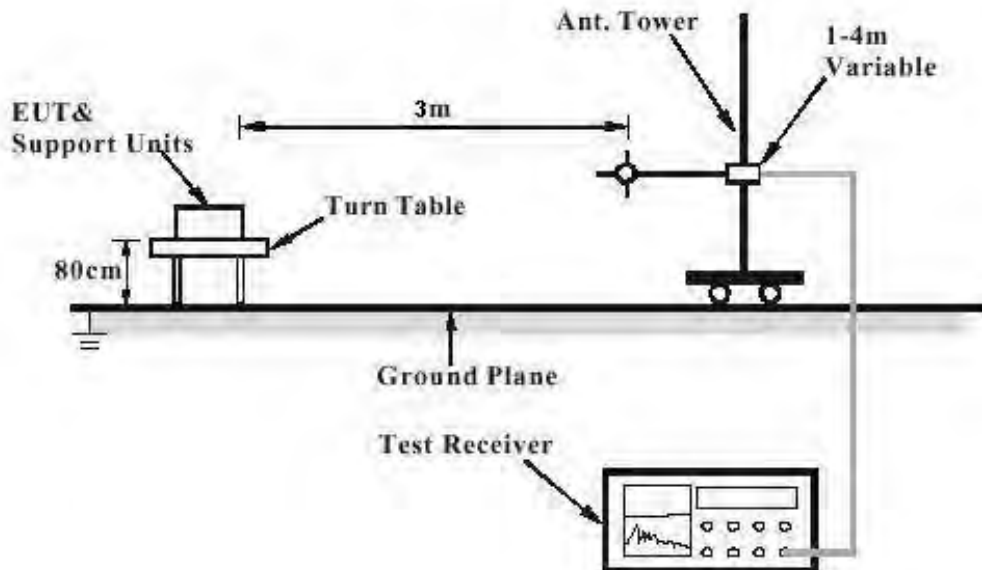
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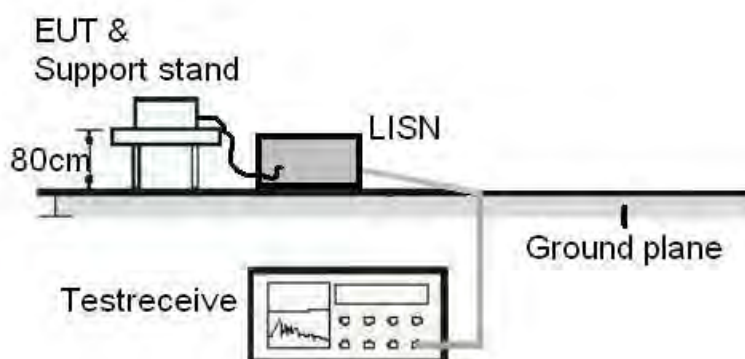
3.4 Test Setup Diagram

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



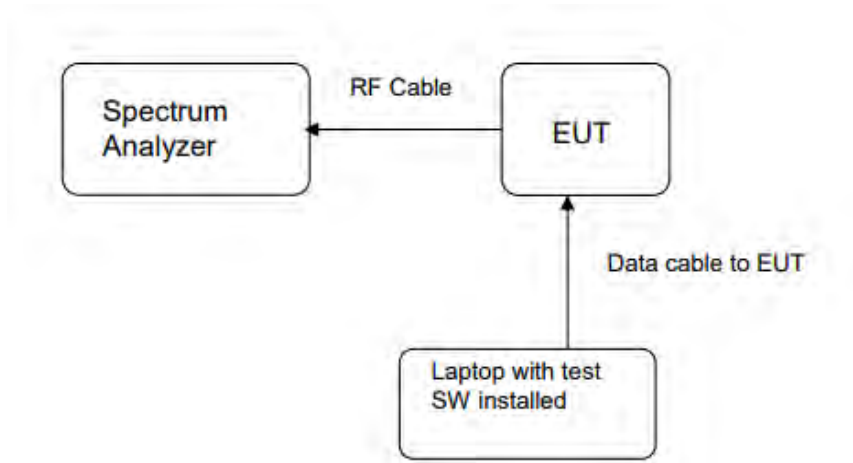
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Diagram of Measurement Equipment Configuration for Transmitter Measurement



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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 Maximum Conducted Output Power

RESULT:

PASS

Test standard : FCC Part 15.247(b)(1)
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	0.38	1.09	≤ 1
	2441	1.00	1.26	
	2480	1.09	1.29	
$\pi/4$ -DQPSK	2402	2.36	1.72	≤ 0.125
	2441	3.17	2.07	
	2480	3.26	2.12	
8-DPSK	2402	2.69	1.86	≤ 0.125
	2441	3.79	2.39	
	2480	3.96	2.49	

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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)
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 2: 20dB Bandwidth and 99% Bandwidth

Test Mode	Test Channel (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
GFSK	2402	0.940	0.827
	2441	0.939	0.828
	2480	0.938	0.824
8-DPSK	2402	1.310	1.179
	2441	1.308	1.179
	2480	1.311	1.180

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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)

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.

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



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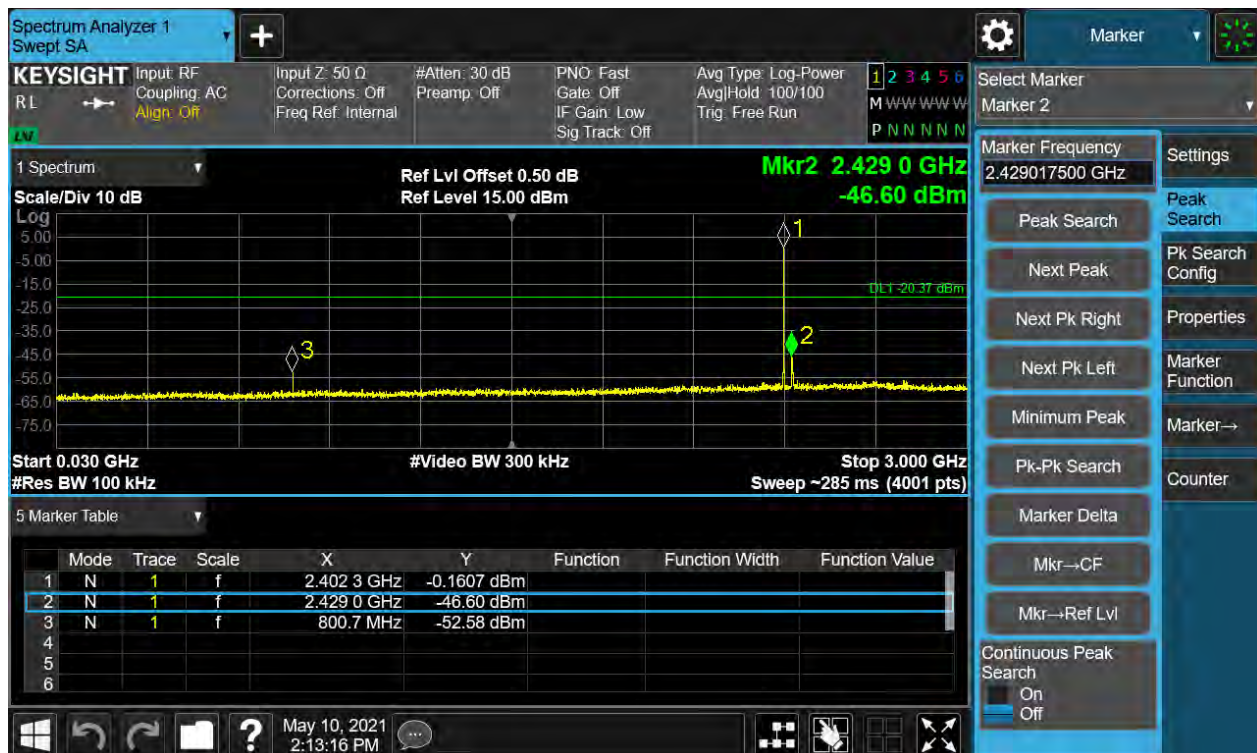
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Band Edge



Conducted spurious emissions 30MHz-25GHz



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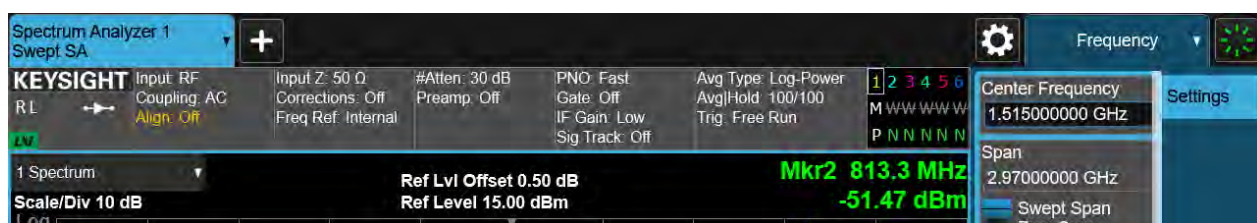
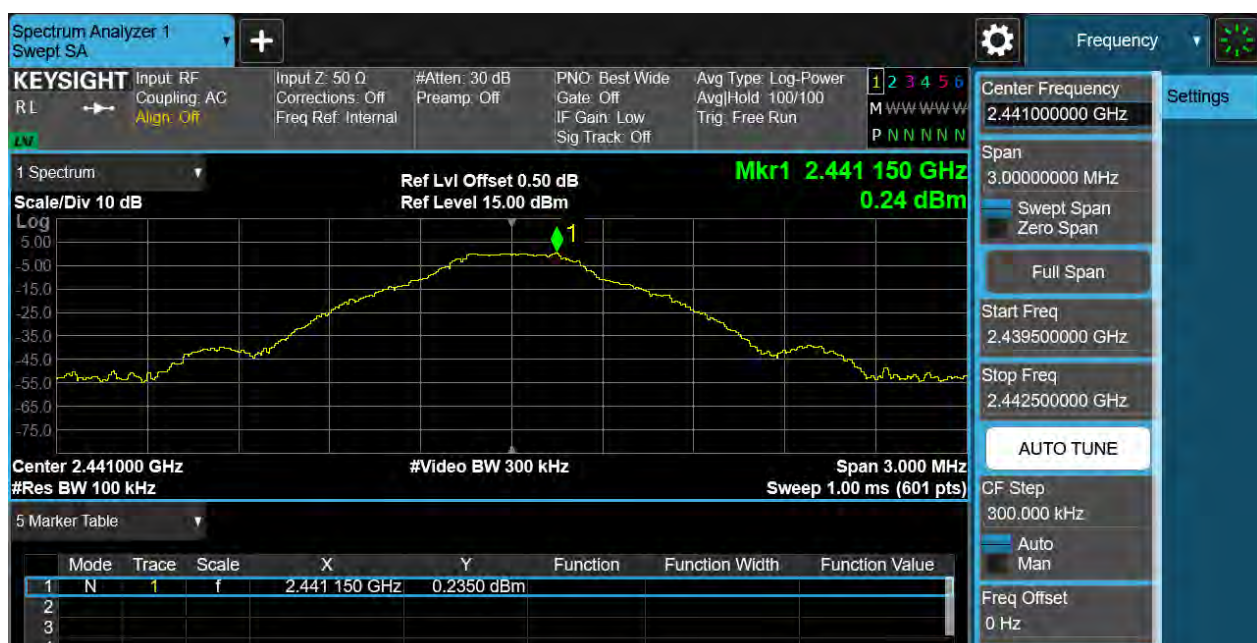
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Figure 17: Conducted Spurious Emission & Authorized-band band-edge, 2441MHz, GFSK Carrier Level



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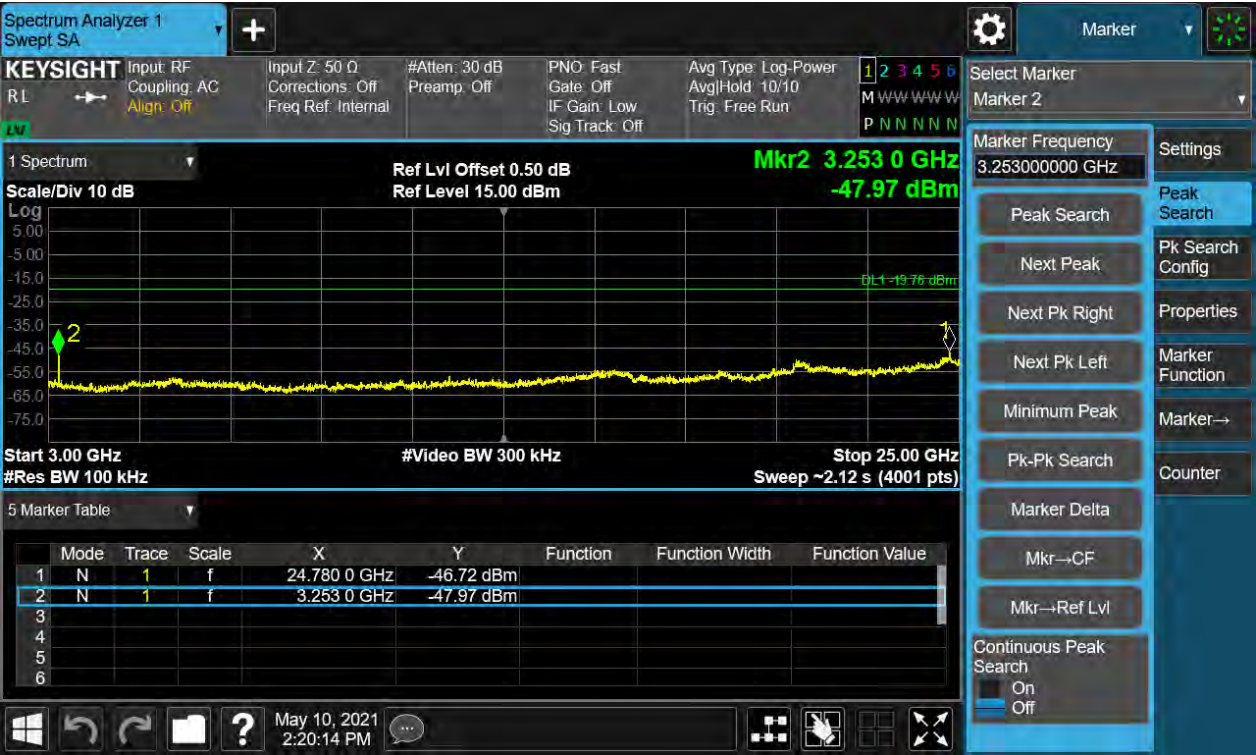


Figure 18: Conducted Spurious Emission & Authorized-band band-edge, 2480MHz, GFSK Carrier Level



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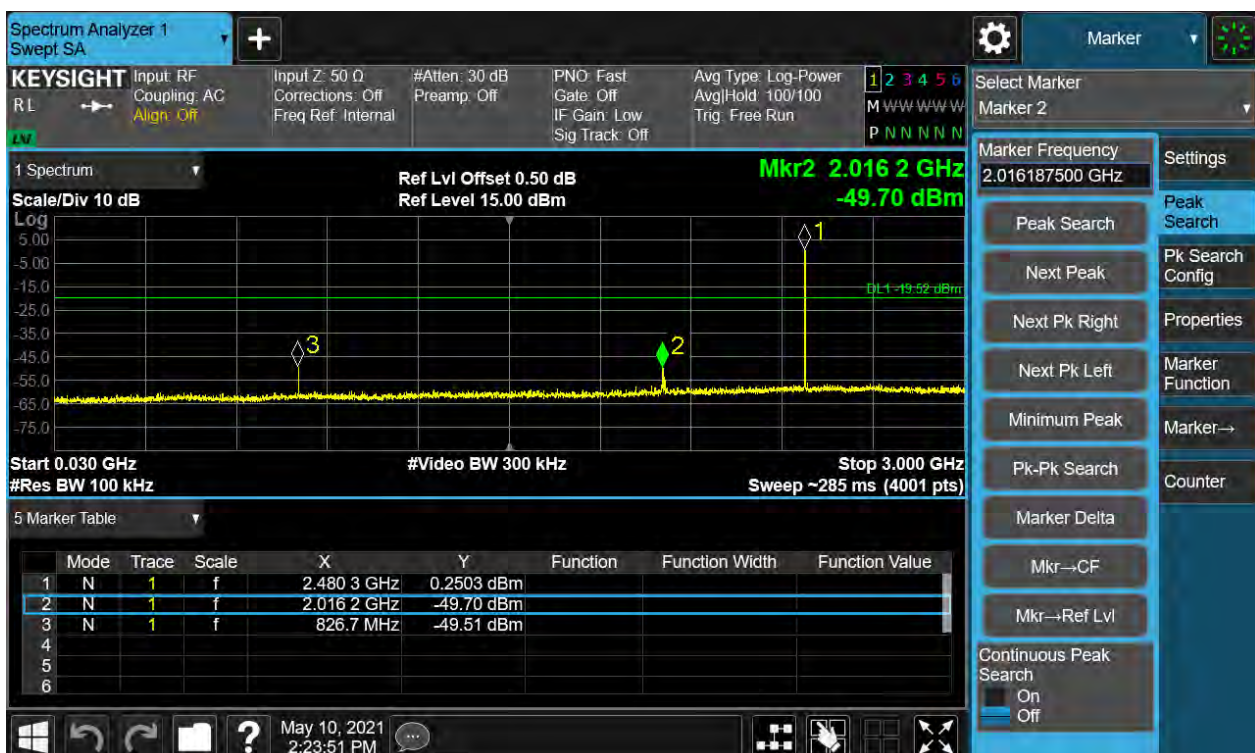
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Band Edge



Conducted spurious emissions 30MHz-25GHz



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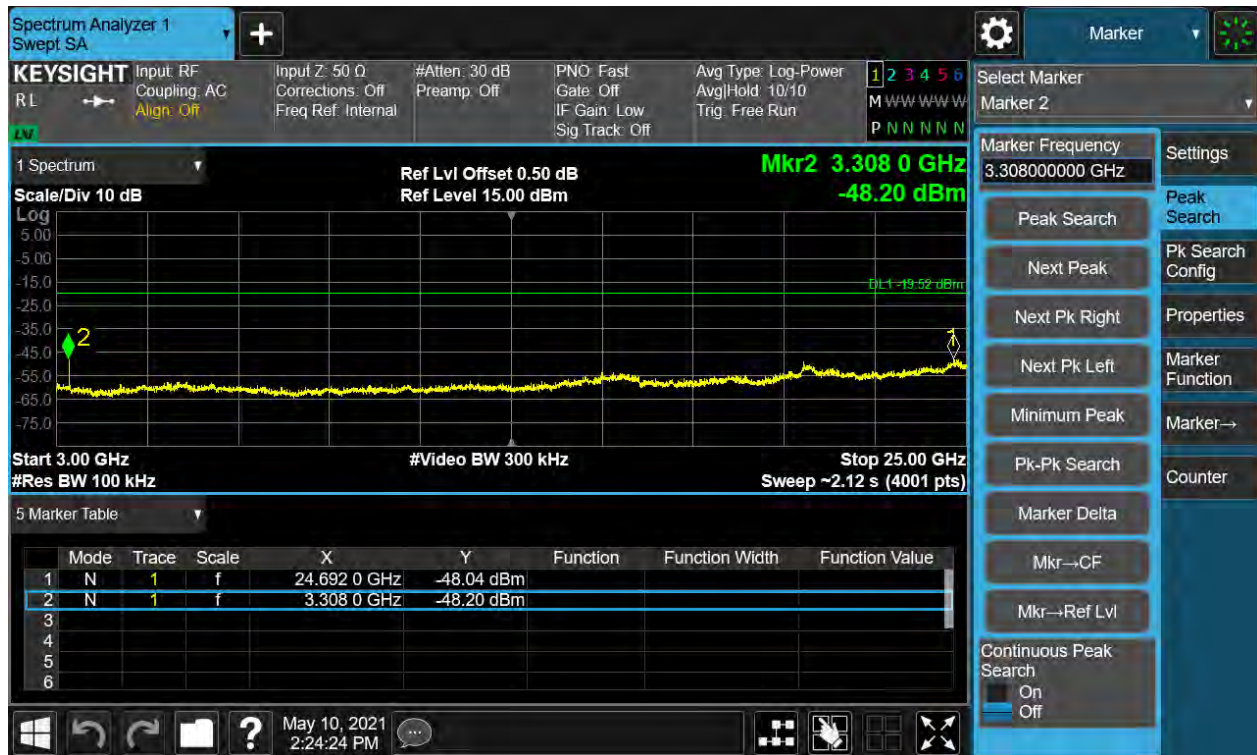


Figure 19: Conducted Spurious Emission & Authorized-band band-edge, 2402MHz, 8-DPSK Carrier Level



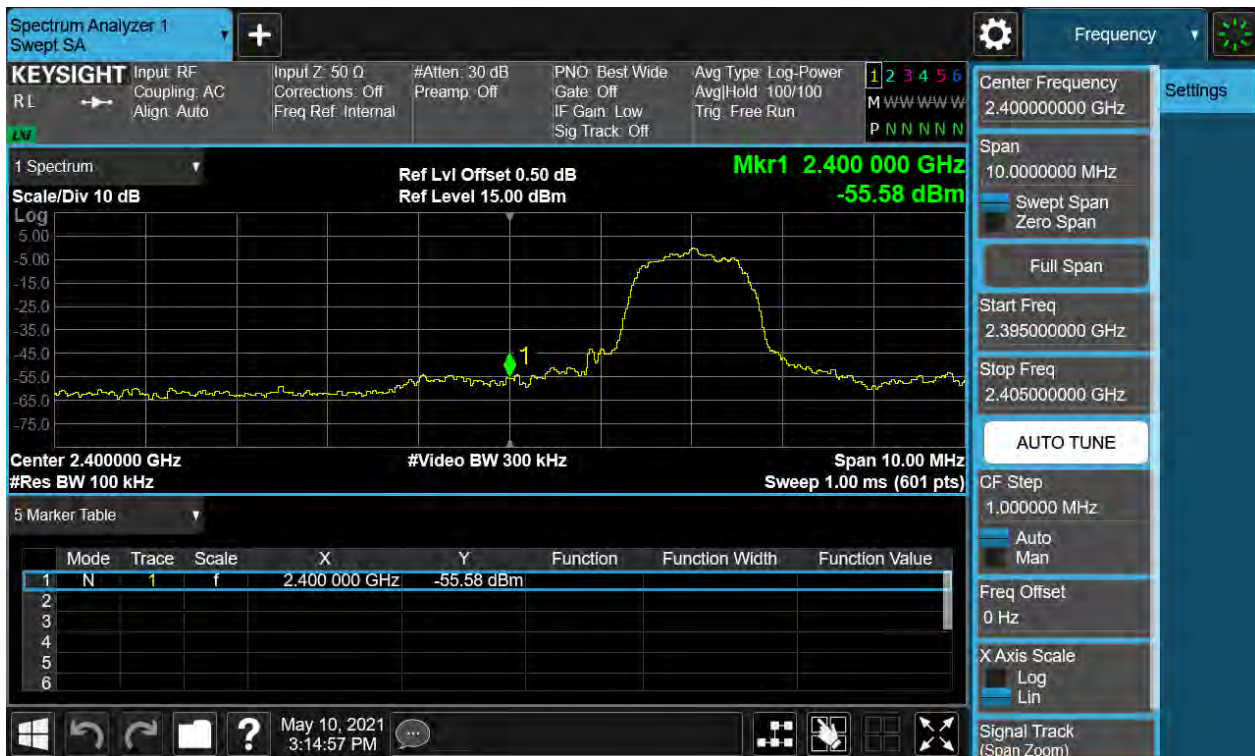
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Band Edge



Conducted spurious emissions 30MHz-25GHz



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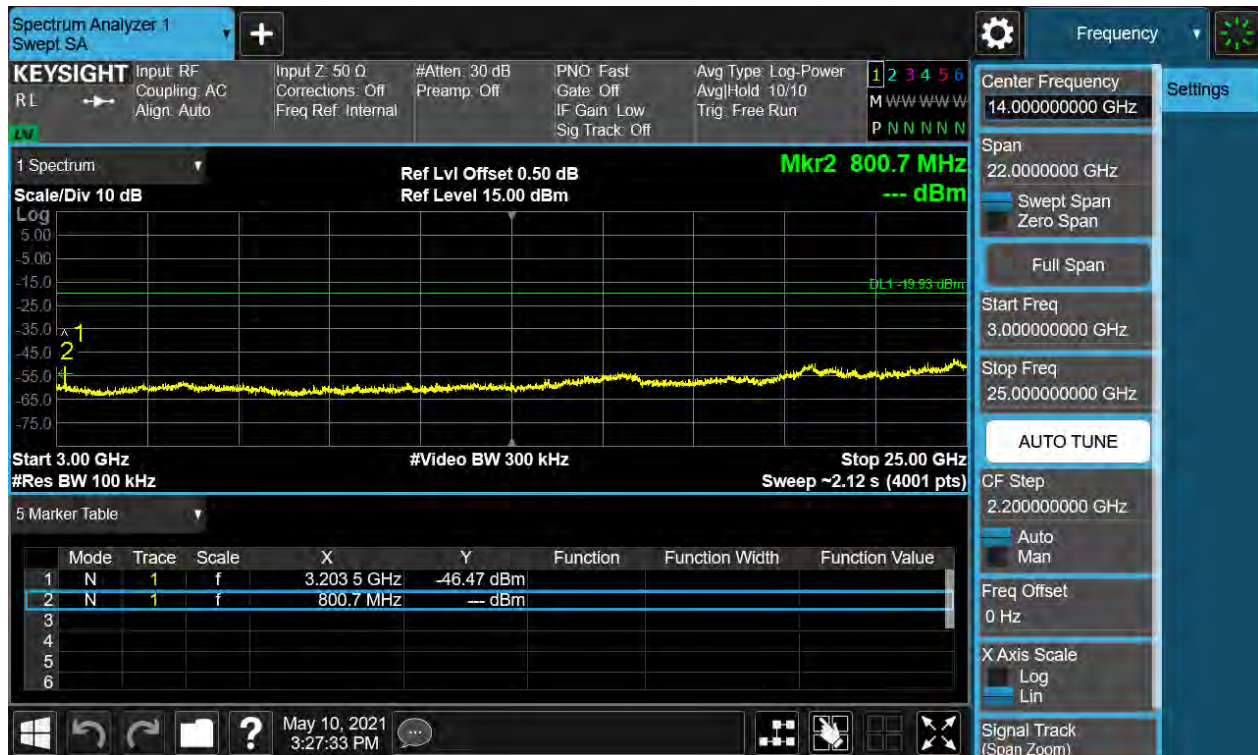


Figure 20: Conducted Spurious Emission & Authorized-band band-edge, 2441MHz, 8-DPSK Carrier Level



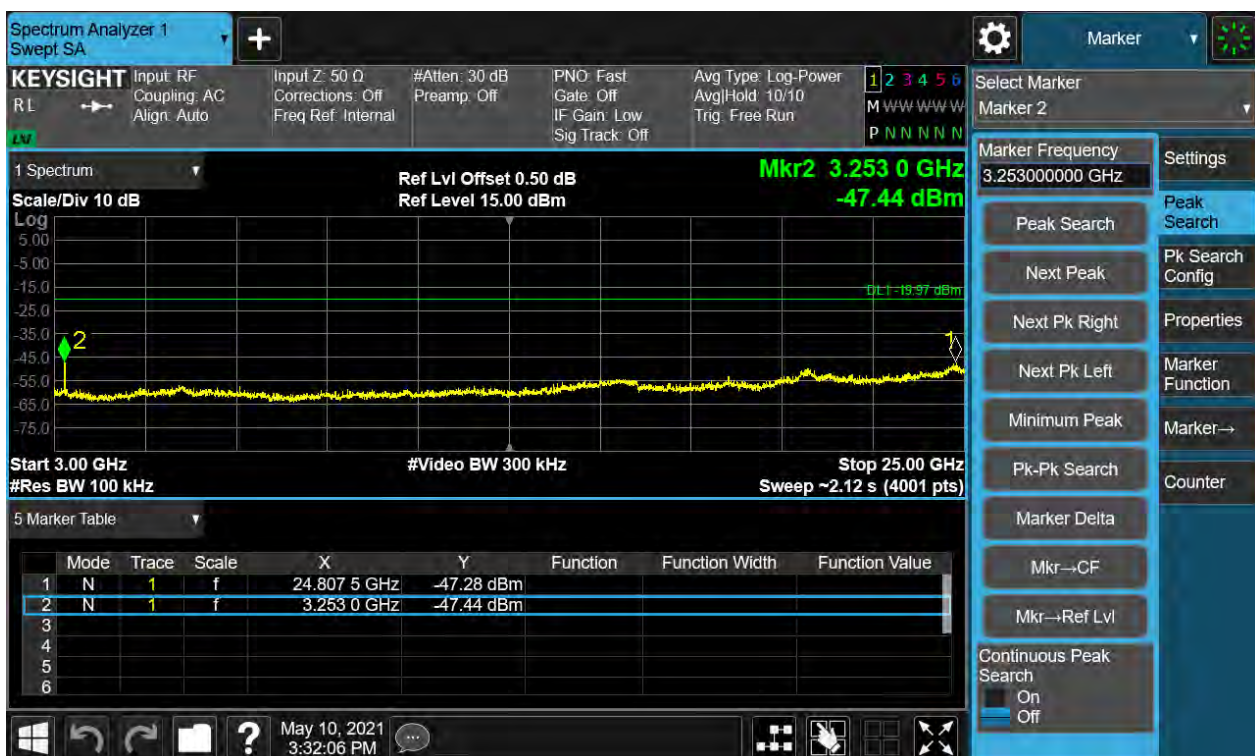
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Conducted spurious emissions 30MHz-25GHz



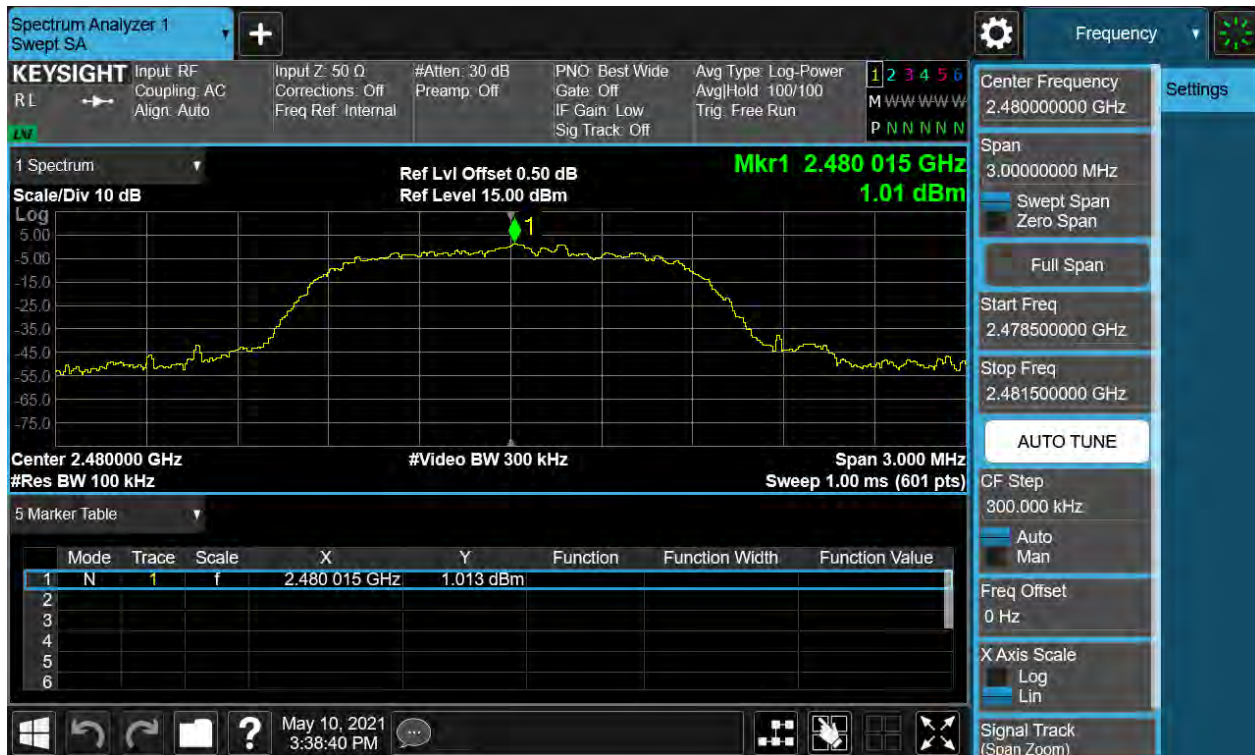
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Figure 21: Conducted Spurious Emission & Authorized-band band-edge, 2480MHz, 8-DPSK Carrier Level



Band Edge



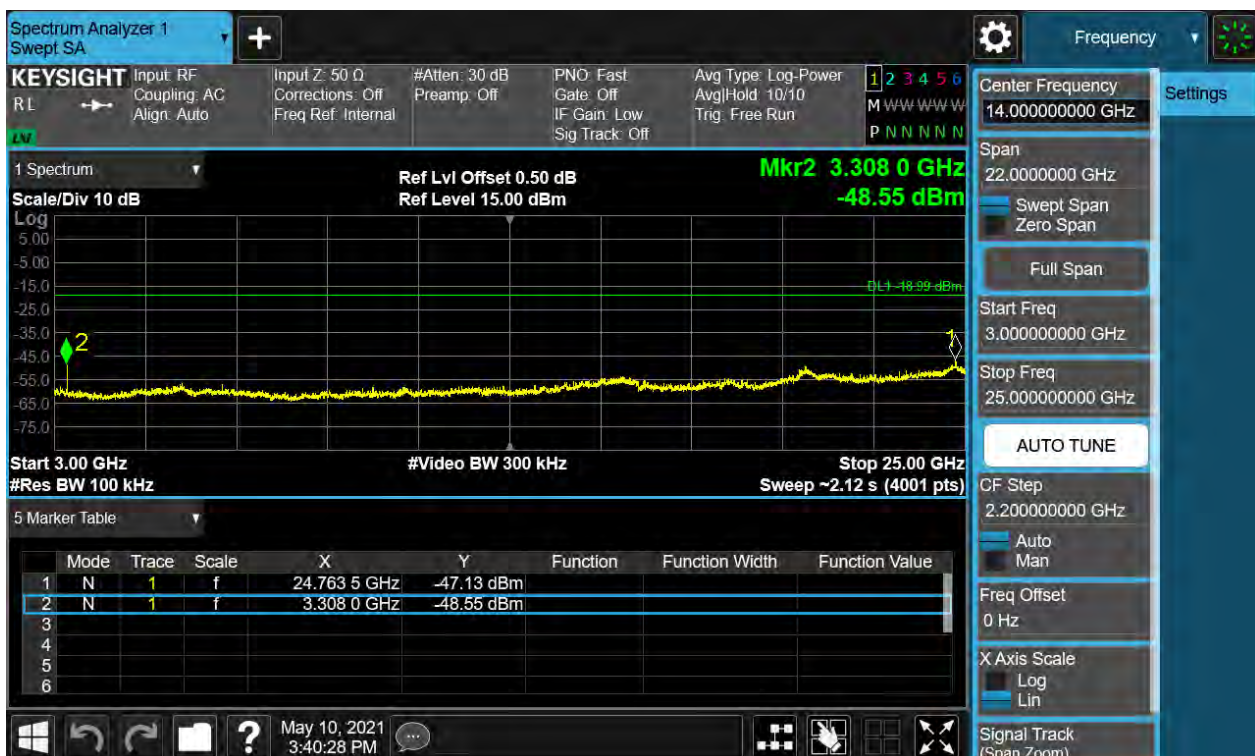
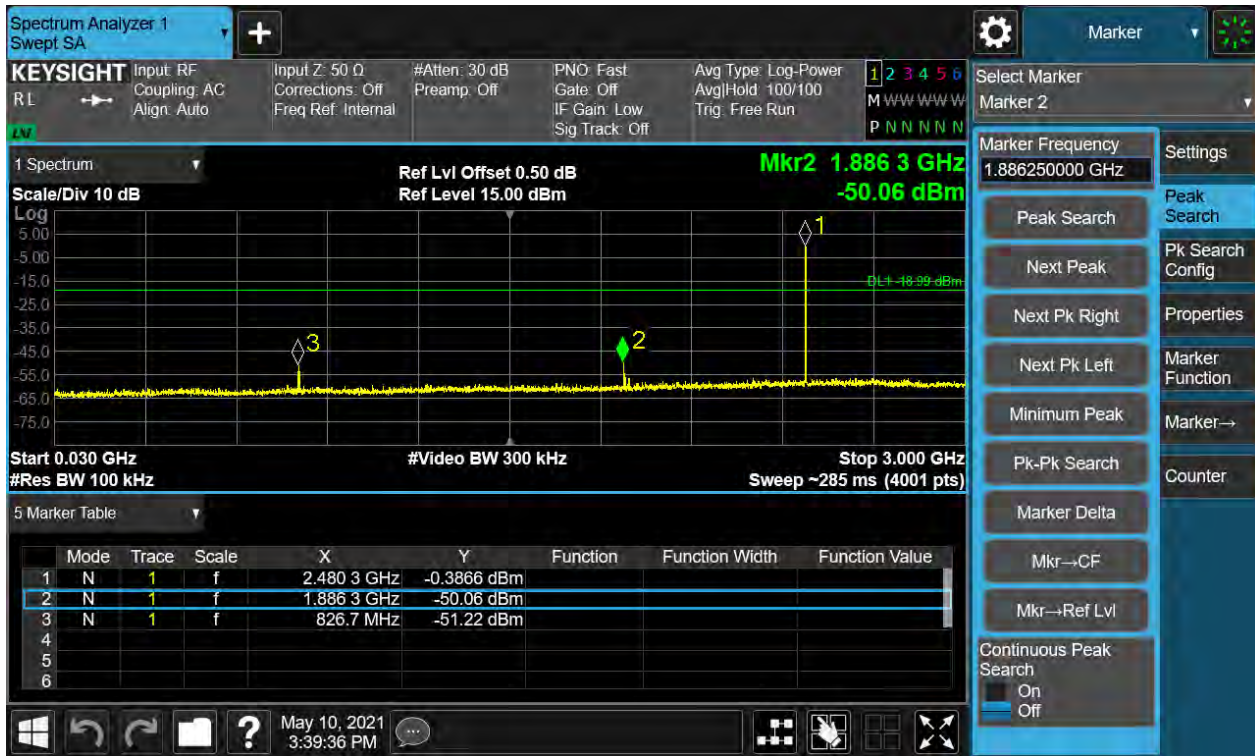
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Conducted spurious emissions 30MHz-25GHz



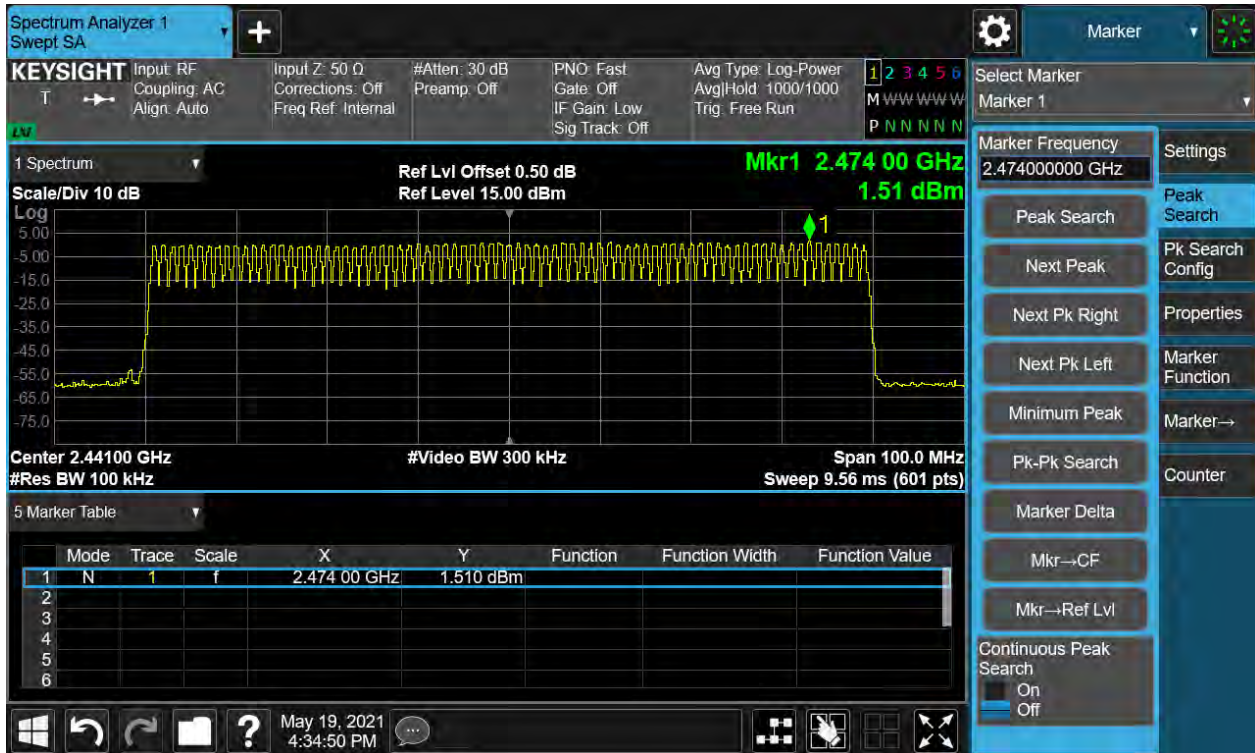
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Figure 22: Conducted Spurious Emission & Authorized-band band-edge, Hopping Mode, GFSK Carrier Level



Band Edge(Low)



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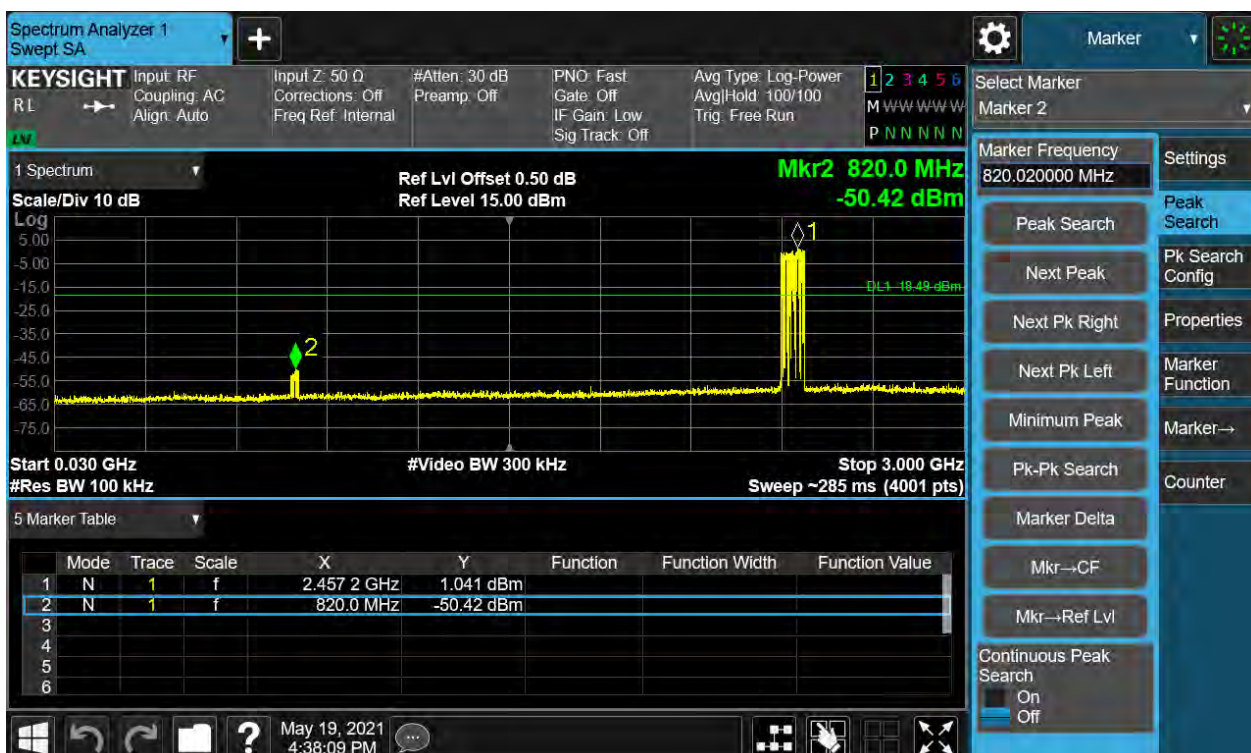
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Band Edge(High)



Conducted spurious emissions 30MHz-25GHz



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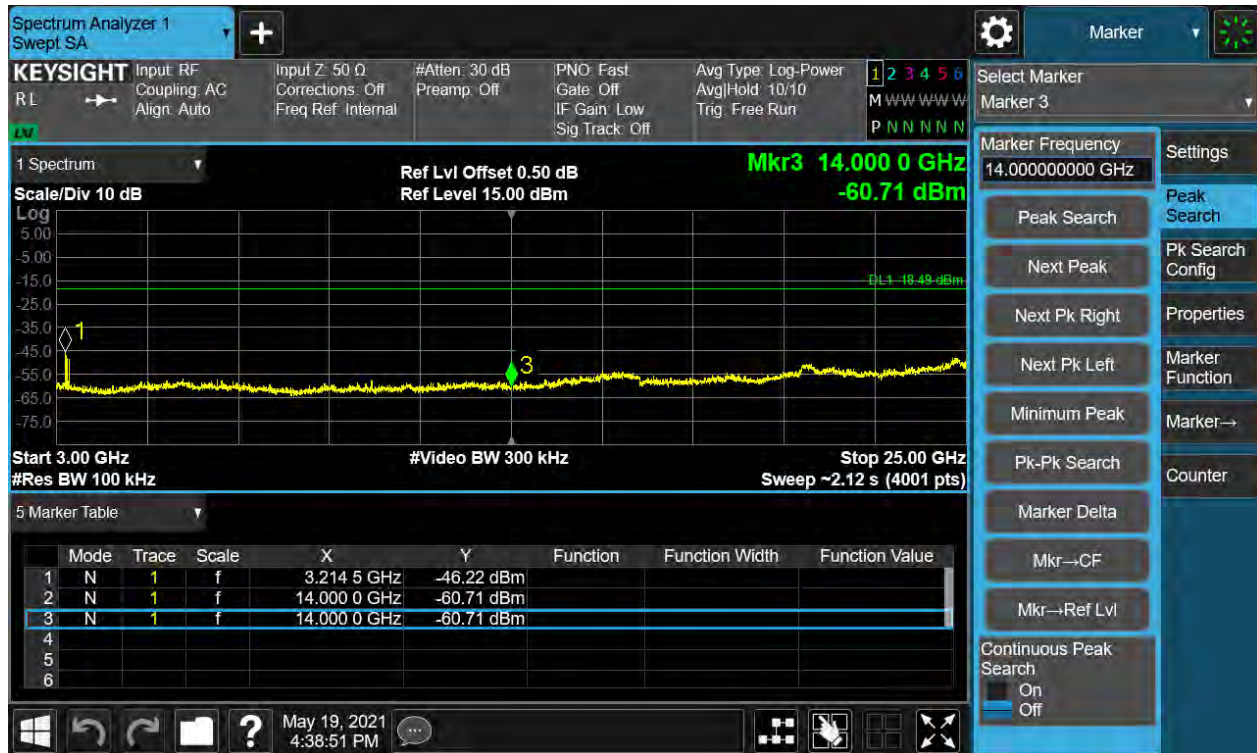
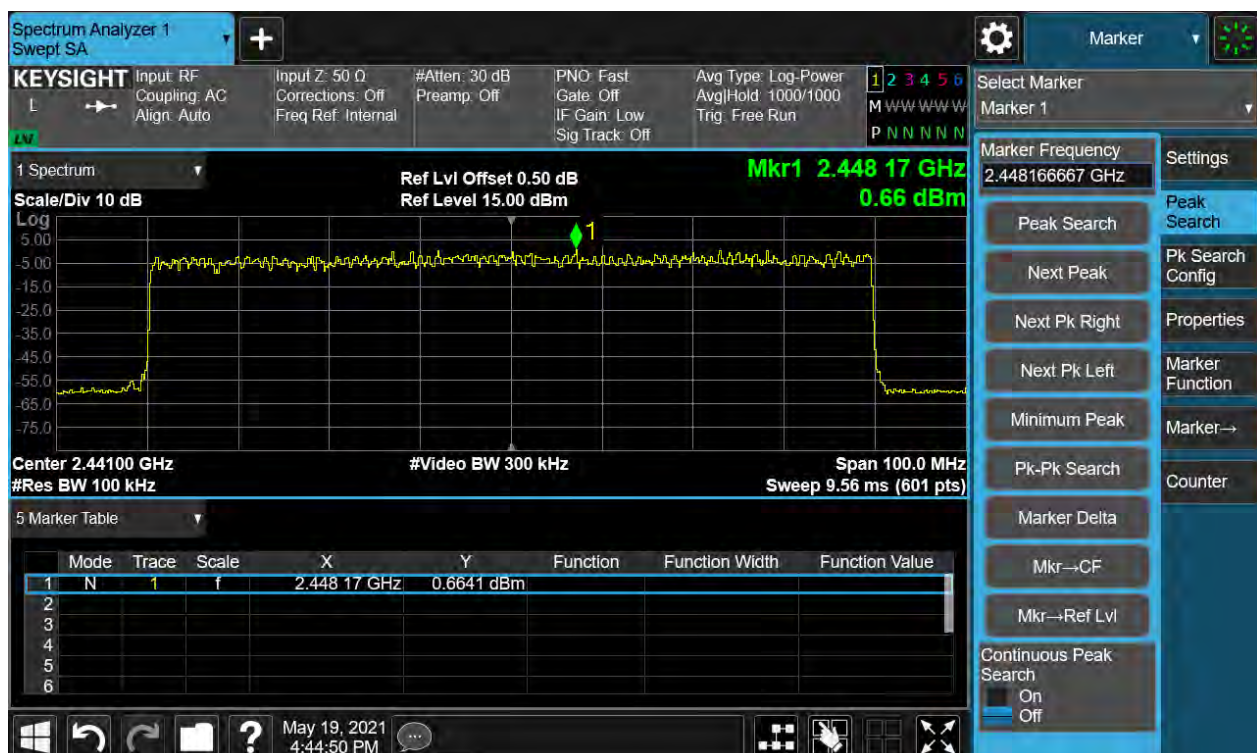


Figure 23: Conducted Spurious Emission & Authorized-band band-edge, Hopping Mode, 8-DPSK Carrier Level



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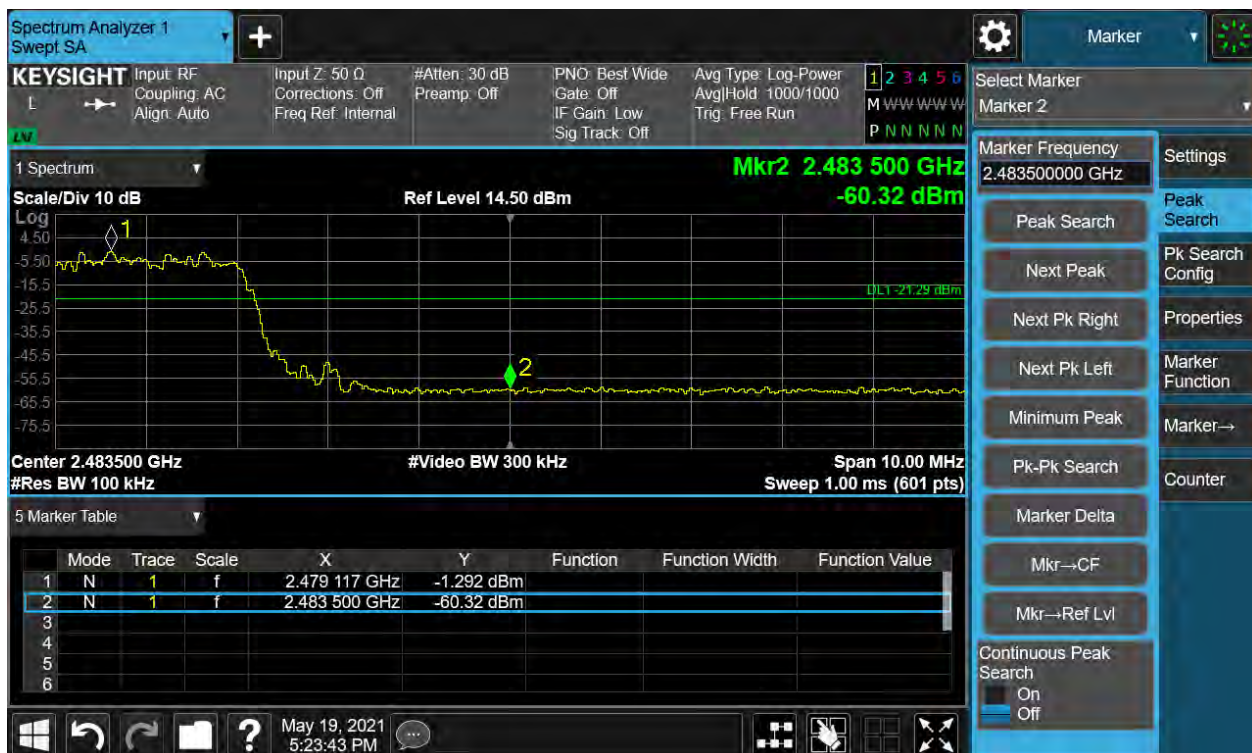
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Band Edge(Low)



Band Edge(High)



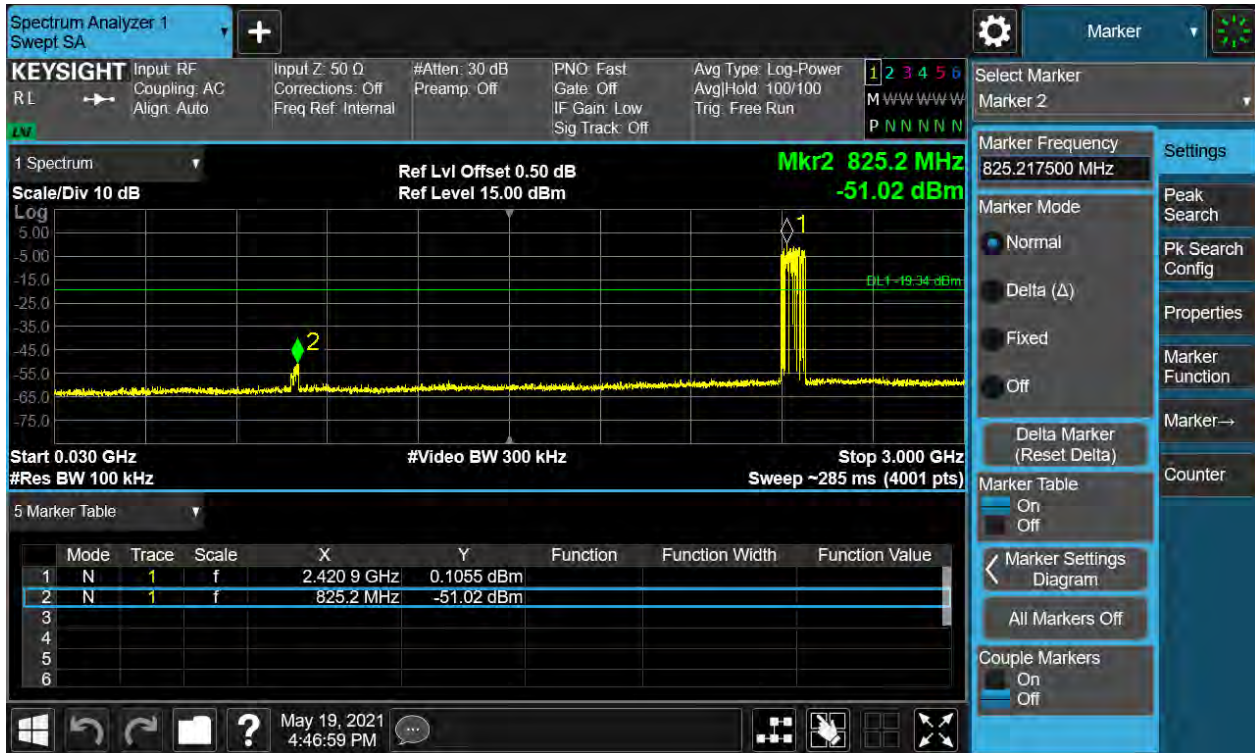
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Conducted spurious emissions 30MHz-25GHz



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4.1.5 Radiated Spurious Emission

RESULT:

PASS

Test standard	: FCC Part 15.247(d), 15.205, 15.209
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 "SHE21040017-02BE DATA BDED-R-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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4.1.6 Band Edge (Restricted-band band-edge)

RESULT:

PASS

Test standard	: FCC Part 15.247(d), 15.205, 15.209
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 "SHE21040017-02BE 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)
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 3: Hopping Frequency Separation

Mode	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
GFSK	2441	0.940	≥ 25kHz or two-thirds of 20dB bandwidth
8-DPSK	2441	0.830	

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

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Figure 24: Hopping Frequency Separation, Hopping Mode, GFSK

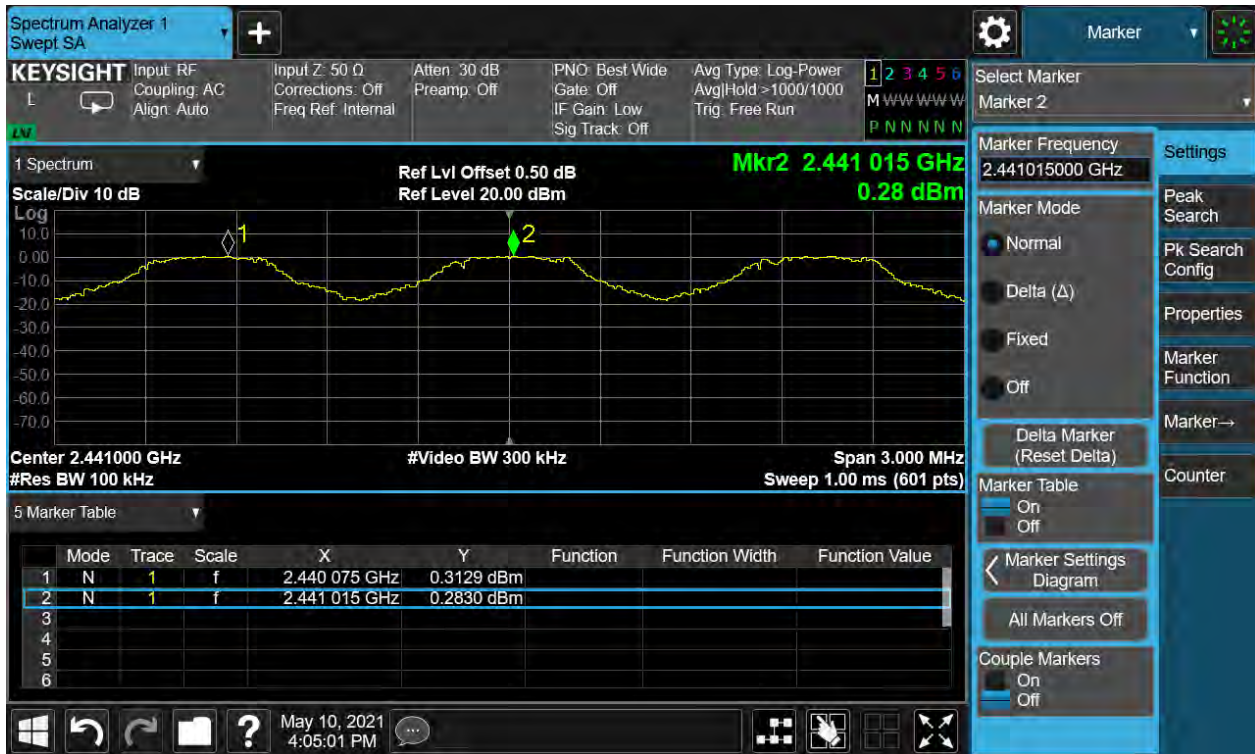
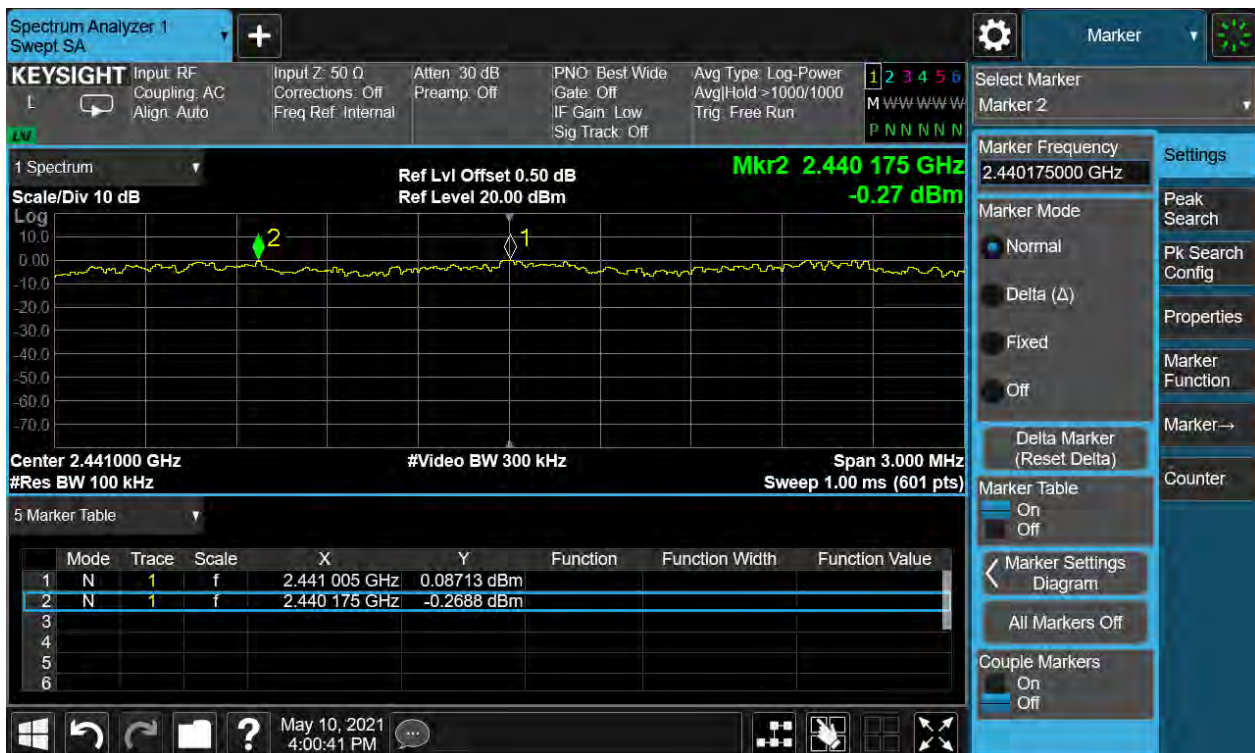


Figure 25: Hopping Frequency Separation, Hopping Mode, 8DPSK



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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 : 25C
Relative humidity : 52%

Table 2: 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

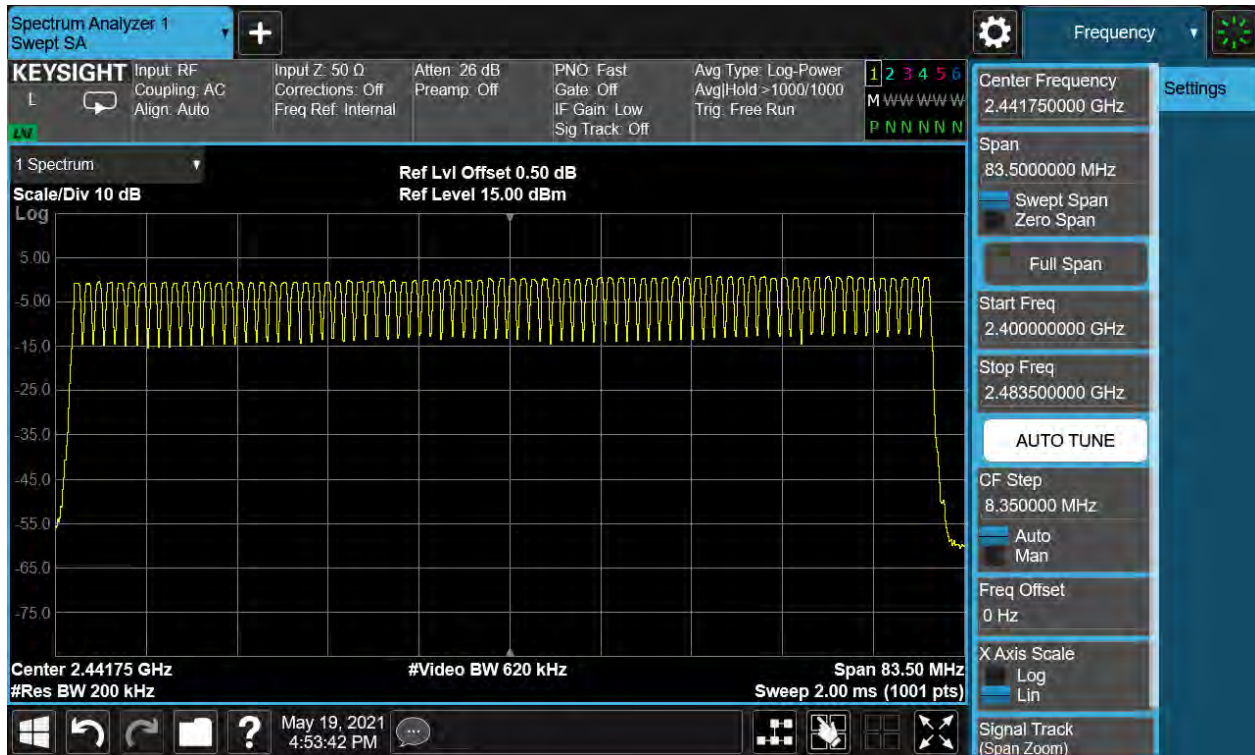
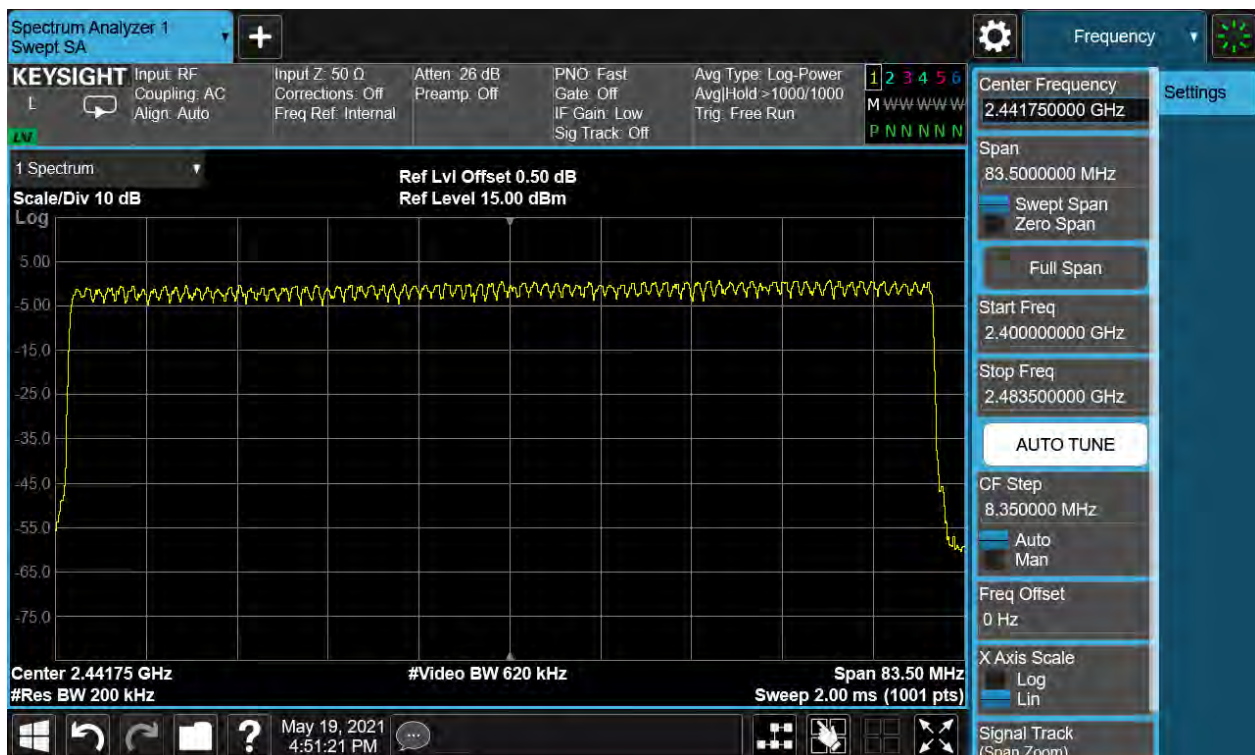


Figure 27: Number of Hopping Frequency, Hopping Mode, 8-DPSK



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4.1.9 Time of Occupancy

RESULT:

PASS

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

Test setup

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

Table 3: Time of Occupancy

Mode	Packet Type	Pulse Time (ms)	Total of Dwell (ms)	Limit (s)
GFSK	DH1	0.3833	122.656	0.4
	DH3	1.6500	264.000	0.4
	DH5	2.9000	309.333	0.4
8-DPSK	DH1	0.4033	129.056	0.4
	DH3	1.6600	265.600	0.4
	DH5	2.9070	310.080	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

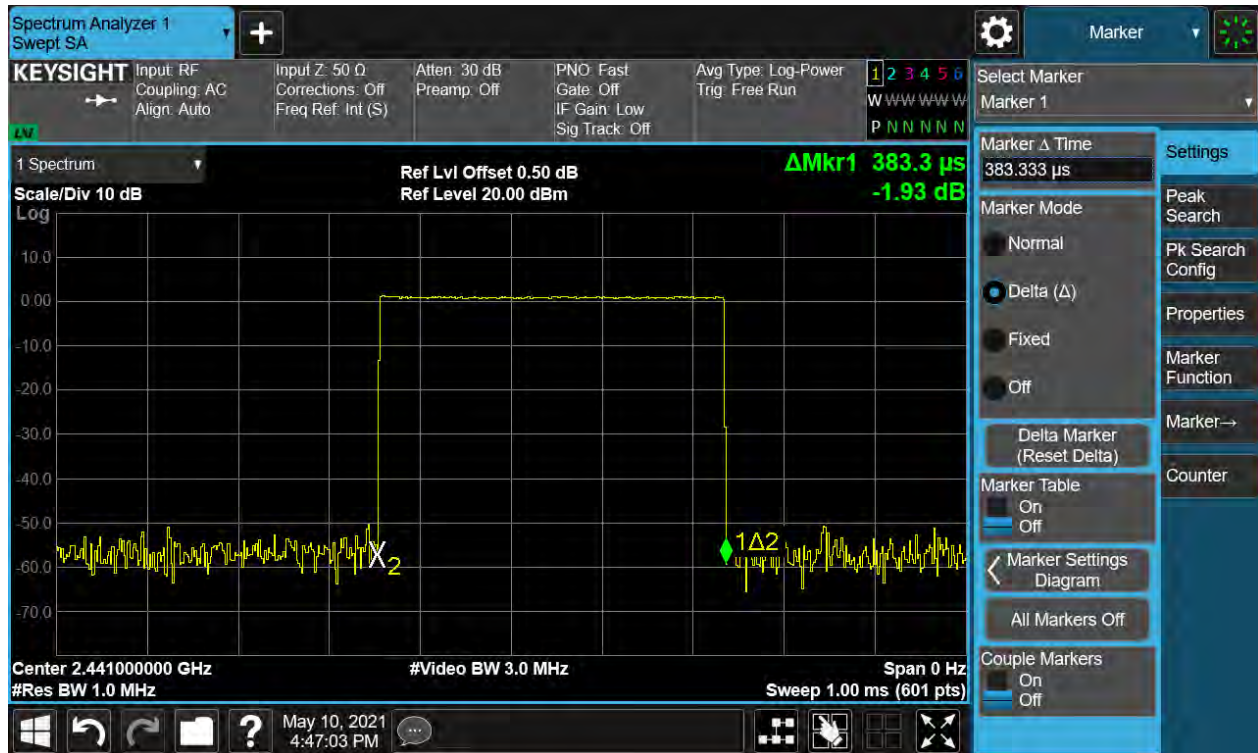
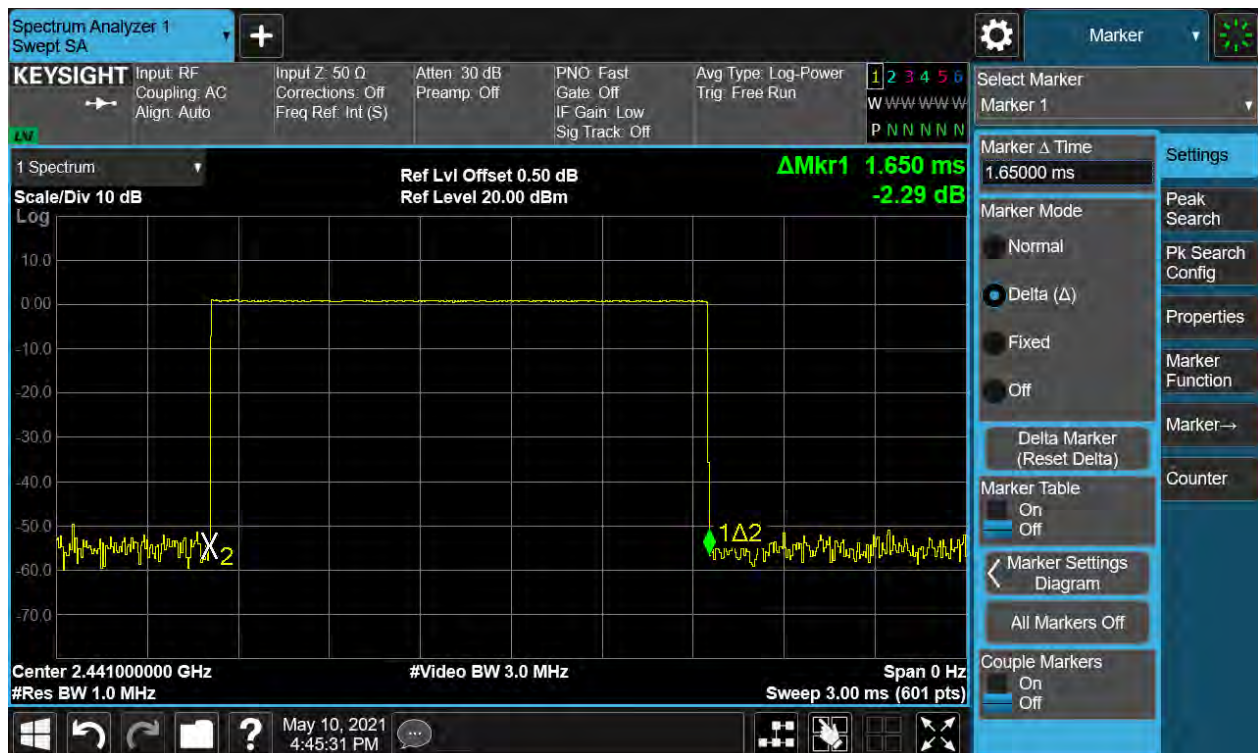


Figure 26: Time of Occupancy, 2441MHz, GFSK DH3



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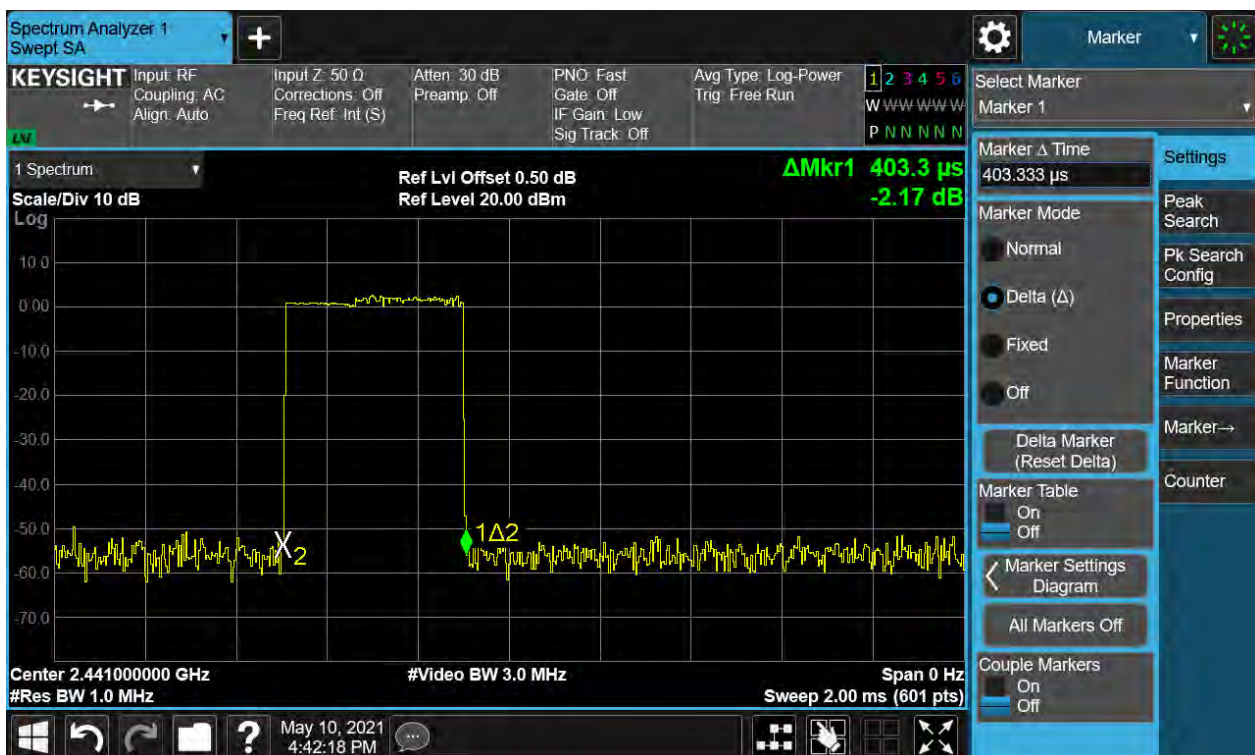
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Figure 30: Time of Occupancy, 2441MHz, GFSK DH5



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



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

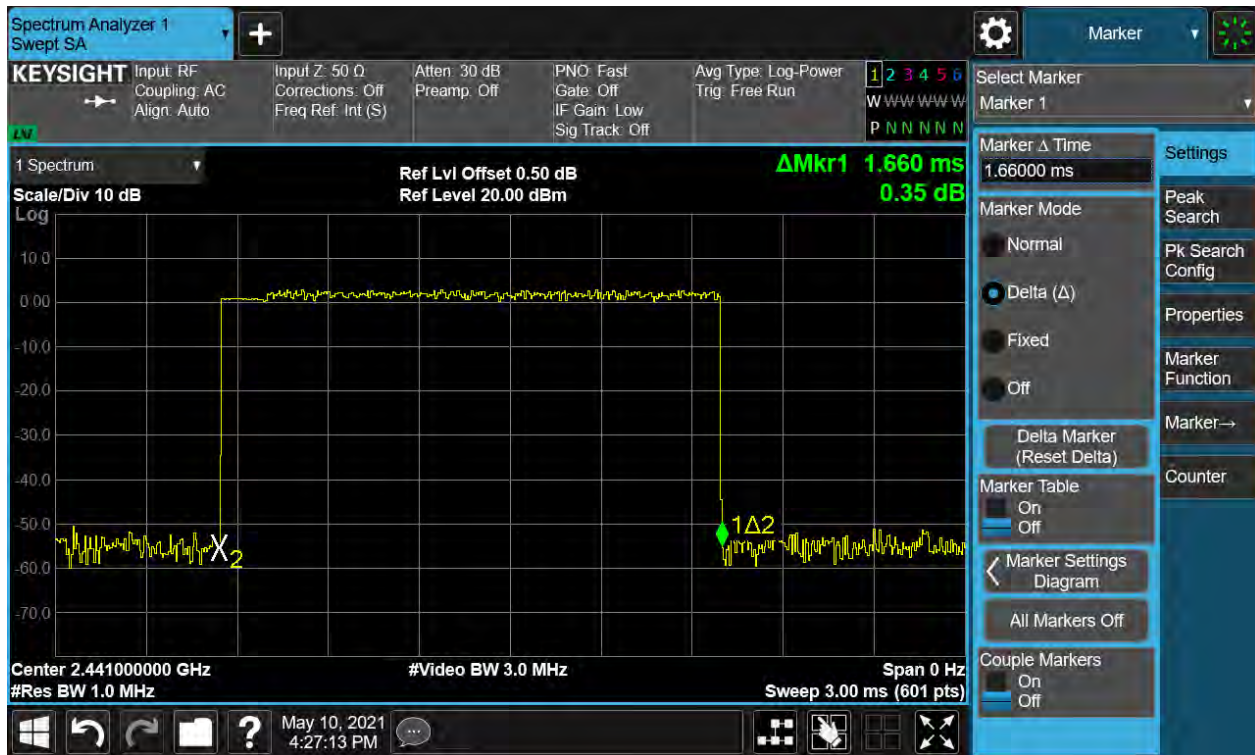
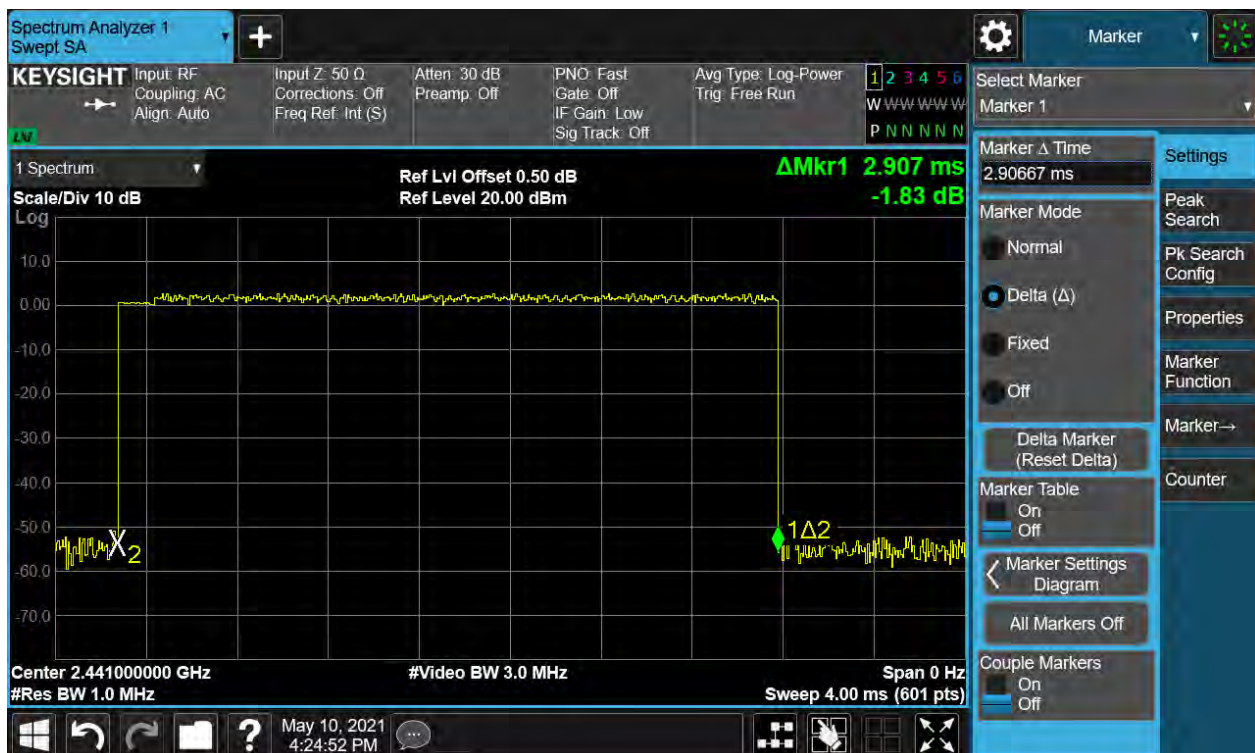


Figure 33: Time of Occupancy, 2441MHz, 8-DPSK DH5



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

Test setup

Input Voltage	: AC 120V, 60Hz
Operation Mode	: A.1.a
Earthing	: Not Connected
Ambient temperature	: 25°C
Relative humidity	: 52%

For details refer to following test plot.

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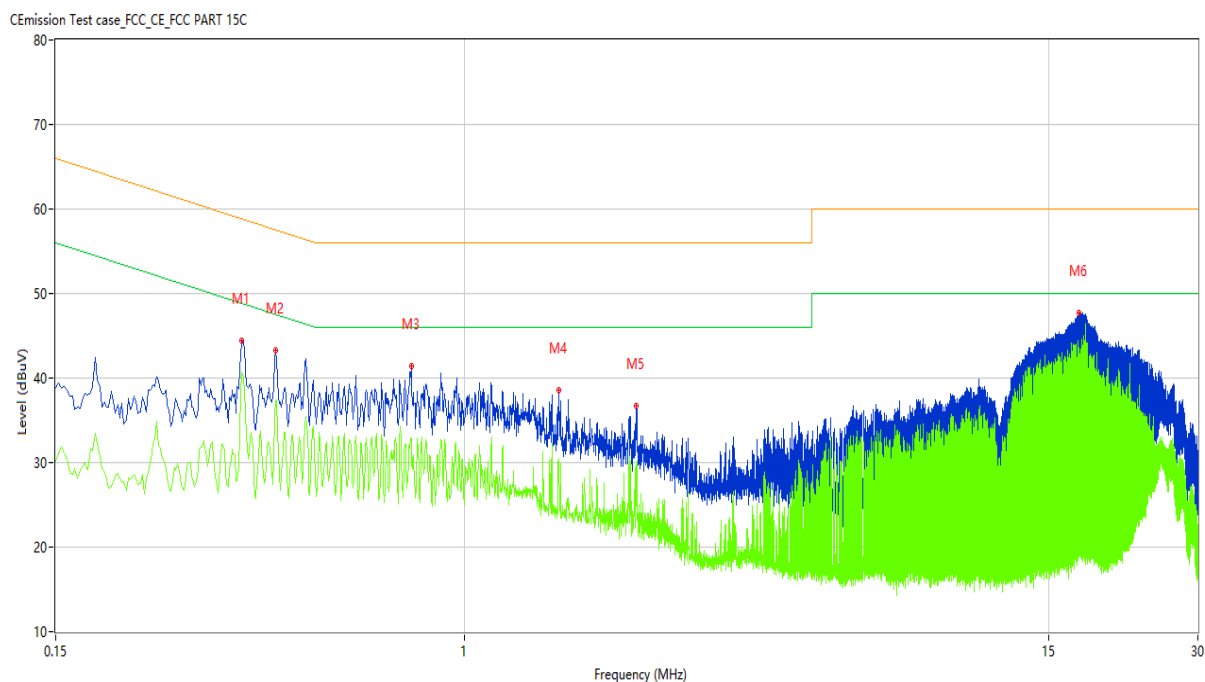
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Note:

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	0.356	44.79	9.72	58.82	-14.03	Peak	L	Pass
1*	0.356	41.73	9.72	58.82	-17.09	QP	L	Pass
1**	0.356	40.69	9.72	48.82	-8.13	AV	L	Pass
2	0.416	42.65	9.74	57.53	-14.88	Peak	L	Pass
2*	0.416	40.02	9.74	57.53	-17.51	QP	L	Pass
2**	0.416	37.18	9.74	47.53	-10.35	AV	L	Pass
3	0.780	39.01	9.75	56.00	-16.99	Peak	L	Pass
3*	0.780	33.01	9.75	56.00	-22.99	QP	L	Pass
3**	0.780	32.81	9.75	46.00	-13.19	AV	L	Pass
4	1.546	33.40	9.67	56.00	-22.60	Peak	L	Pass
4*	1.546	28.13	9.67	56.00	-27.87	QP	L	Pass
4**	1.546	30.47	9.67	46.00	-15.53	AV	L	Pass
5	2.216	34.36	9.68	56.00	-21.64	Peak	L	Pass
5*	2.216	29.39	9.68	56.00	-26.61	QP	L	Pass
5**	2.216	29.42	9.68	46.00	-16.58	AV	L	Pass
6	17.280	47.59	9.49	60.00	-12.41	Peak	L	Pass
6*	17.280	45.06	9.49	60.00	-14.94	QP	L	Pass
6**	17.280	41.41	9.49	50.00	-8.59	AV	L	Pass

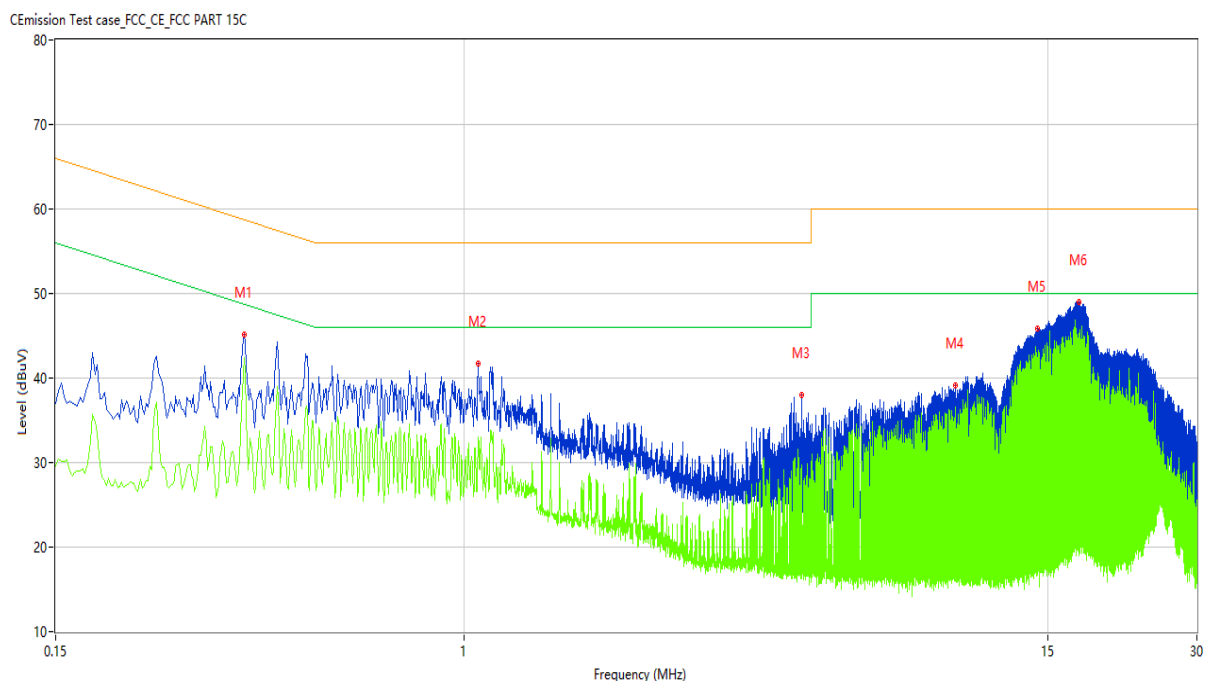
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Figure 35: Conducted Emission on AC Mains, N Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.360	44.96	9.72	58.73	-13.77	Peak	N	Pass
1*	0.360	42.44	9.72	58.73	-16.29	QP	N	Pass
1**	0.360	42.42	9.72	48.73	-6.31	AV	N	Pass
2	1.066	37.51	9.66	56.00	-18.49	Peak	N	Pass
2*	1.066	32.72	9.66	56.00	-23.28	QP	N	Pass
2**	1.066	32.07	9.66	46.00	-13.93	AV	N	Pass
3	4.792	36.99	9.70	56.00	-19.01	Peak	N	Pass
3*	4.792	29.49	9.70	56.00	-26.51	QP	N	Pass
3**	4.792	29.73	9.70	46.00	-16.27	AV	N	Pass
4	9.770	38.47	9.65	60.00	-21.53	Peak	N	Pass
4*	9.770	35.23	9.65	60.00	-24.77	QP	N	Pass
4**	9.770	36.56	9.65	50.00	-13.44	AV	N	Pass
5	14.324	45.68	9.56	60.00	-14.32	Peak	N	Pass
5*	14.324	43.33	9.56	60.00	-16.67	QP	N	Pass
5**	14.324	40.70	9.56	50.00	-9.30	AV	N	Pass
6	17.332	49.16	9.49	60.00	-10.84	Peak	N	Pass
6*	17.332	46.26	9.49	60.00	-13.74	QP	N	Pass
6**	17.332	43.66	9.49	50.00	-6.34	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