



REPORT No. : KH18110102W04

TEST REPORT

APPLICANT : Xiamen Padmate Technology Co.,LTD

PRODUCT NAME : Bluetooth Headset

MODEL NAME : X16

BRAND NAME : Padmate

FCC ID : 2AJEO-X16

STANDARD(S) : 47 CFR Part 15 Subpart C

TEST DATE : 2018-12-12 to 2018-12-18

ISSUE DATE : 2018-12-20

Prepared by: Lion Xiao
Lion Xiao (Project Engineer)

Approved by: Anne Liu
Anne Liu(Supervisor)

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Change History		
Issue	Date	Reason for change
1.0	2018-12-20	First edition



1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Xiamen Padmate Technology Co.,LTD
Applicant Address:	RM 201, Huli Park No.37, Industrial Zone, Tong'an District, Xiamen, China
Manufacturer:	Xiamen Padmate Technology Co.,LTD
Manufacturer Address:	RM 201, Huli Park No.37, Industrial Zone, Tong'an District, Xiamen, China

1.2. Equipment Under Test (EUT) Description

Product Name:	Bluetooth Headset
Serial No:	(N/A, marked #1 by test site)
Hardware Version:	V1.3
Software Version:	V21
Modulation Type:	Bluetooth: FHSS GFSK(1Mbps), $\pi/4$ -DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps)
Operating Frequency Range:	The frequency range used is 2402MHz – 2480MHz (79 channels, at intervals of 1MHz); The frequency block is 2400MHz to 2483.5MHz.
Bluetooth Version:	Bluetooth classic
Antenna Type:	Ceramic Antenna
Antenna Gain:	1 dBi

Note 1: The EUT contains Bluetooth Module operating at 2.4GHz ISM band; the frequencies is $F(\text{MHz})=2402+1*n$ ($0 \leq n \leq 78$). The lowest, middle, highest channel numbers of the Bluetooth Module used and tested in this report are separately 0 (2402MHz), 39 (2441MHz) and 78 (2480MHz).

Note 2: The EUT connected to the serial port of the computer with a serial communication cable, we use the dedicated software to control the EUT into the test mode.

Note 3: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.



1.3. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C for the EUT FCC ID Certification:

No	Identity	Document Title
1	47 CFR Part 15 (10-1-15 Edition)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section in CFR 47	Description	Test Date	Test Engineer	Result
1	15.203	Antenna Requirement	N/A	N/A	PASS
2	15.247(a)	Number of Hopping Frequency	Dec 12, 2018	Scott Chen	<u>PASS</u>
3	15.247(b)	Peak Output Power	Dec 12, 2018	Scott Chen	<u>PASS</u>
4	15.247(a)	20dB Bandwidth	Dec 12, 2018	Scott Chen	<u>PASS</u>
5	15.247(a)	Carrier Frequency Separation	Dec 12, 2018	Scott Chen	<u>PASS</u>
6	15.247(a)	Time of Occupancy (Dwell time)	Dec 12, 2018	Scott Chen	<u>PASS</u>
7	15.247(d)	Conducted Spurious Emission and Band Edge	Dec 12, 2018	Scott Chen	<u>PASS</u>
8	15.247(d)	Restricted Frequency Bands	Dec 18, 2018	Jinxin Huang	<u>PASS</u>
9	15.209, 15.247(d)	Radiated Emission	Dec 18, 2018	Jinxin Huang	<u>PASS</u>
10	15.207	Conducted Emission	Dec 18, 2018	Jinxin Huang	<u>PASS</u>
Note 1: The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013.					

1.4. Environmental Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86-106



2. 47 CFR Part 15C Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

2.1.2. Result: Compliant

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

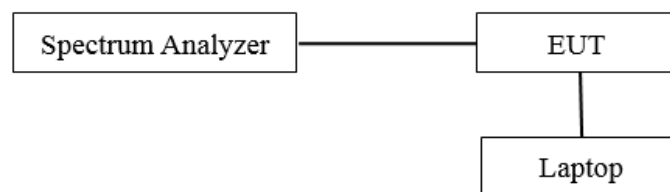
2.2. Number of Hopping Frequency

2.2.1. Requirement

According to FCC §15.247(a)(1)(iii), frequency hopping systems operating in the 2400MHz to 2483.5MHz bands shall use at least 15 hopping frequencies.

2.2.2. Test Description

A. Test Setup:



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

B. Equipments List:

Please reference ANNEX B(4).

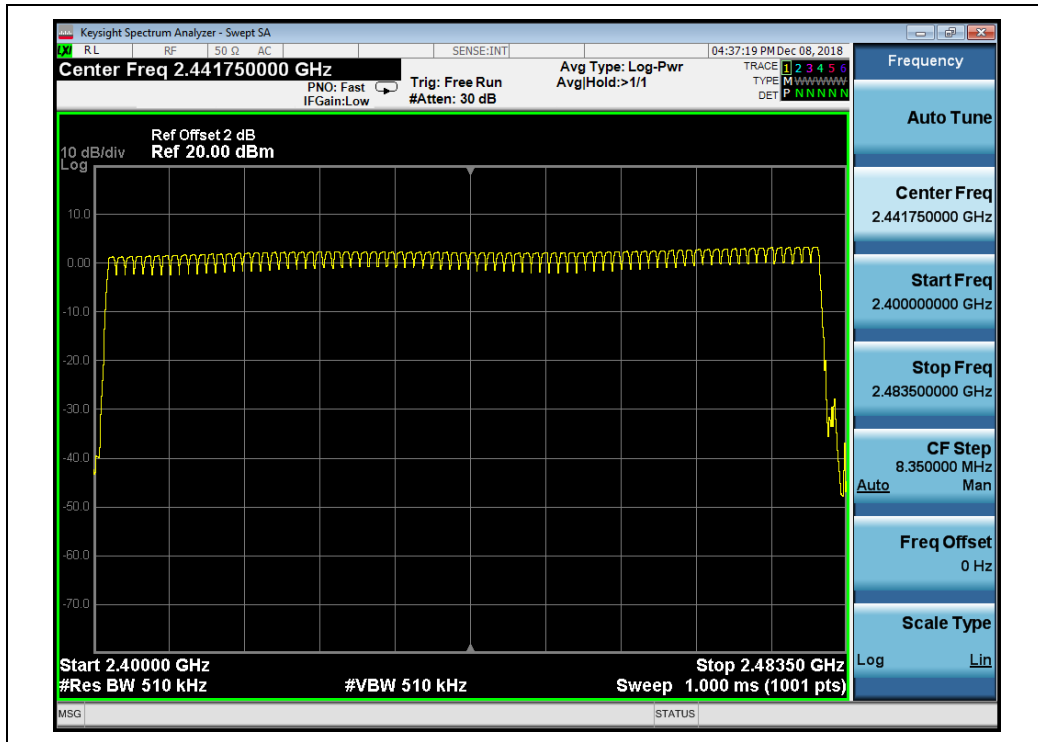
2.2.3. Test Result

The Bluetooth Module operates at hopping-on test mode; the frequencies number employed is counted to verify the Module's using the number of hopping frequency.

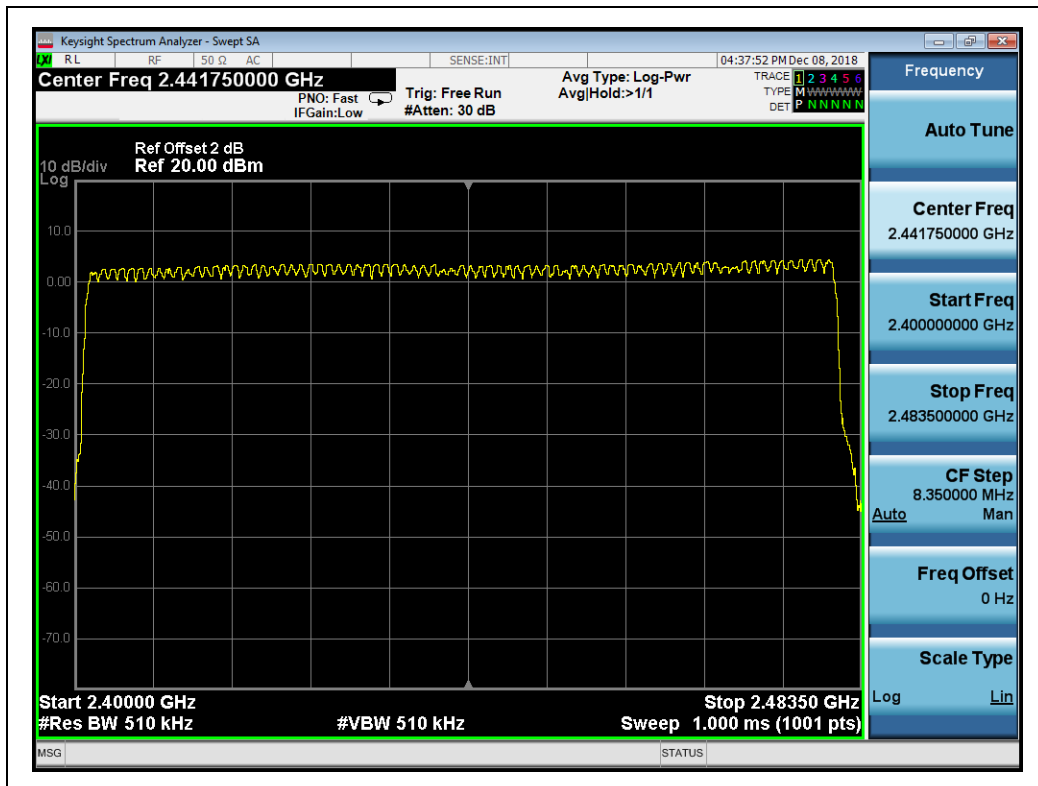
A. Test Verdict:

Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
GFSK	2400 - 2483.5	79	15	PASS
$\pi/4$ -DQPSK	2400 - 2483.5	79	15	PASS
8-DPSK	2400 - 2483.5	79	15	PASS

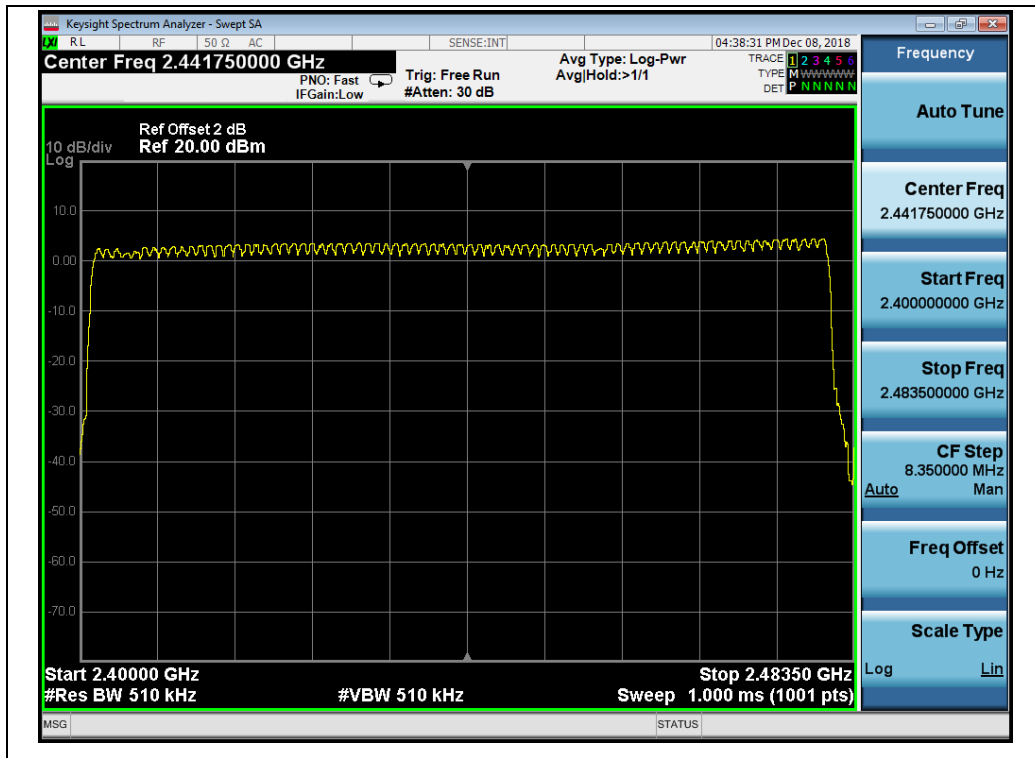
B. Test Plots:



(GFSK)



($\pi/4$ -DQPSK)



(8- DPSK)

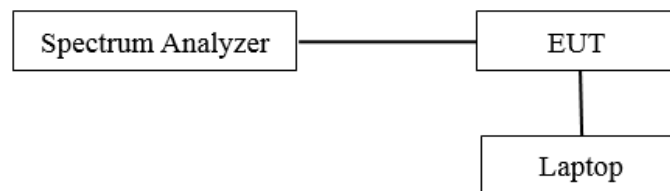
2.3. Peak Output Power

2.3.1. Requirement

According to FCC §15.247(b)(1), for frequency hopping systems that operates in the 2400MHz to 2483.5MHz band employing at least 75 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt. For all other frequency hopping systems in the 2400MHz to 2483.5MHz band, it is 0.125Watts.

2.3.2. Test Description

A. Test Setup:



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

B. Equipments List:

Please refer ANNEX B(4).

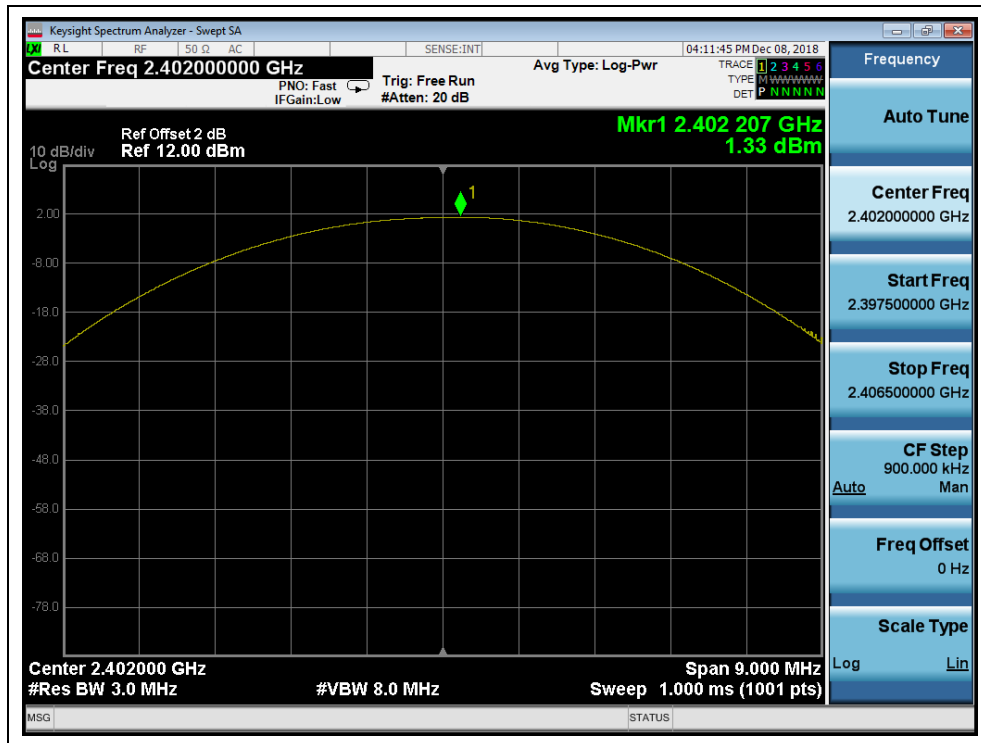
2.3.3. Test Result

The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the module.

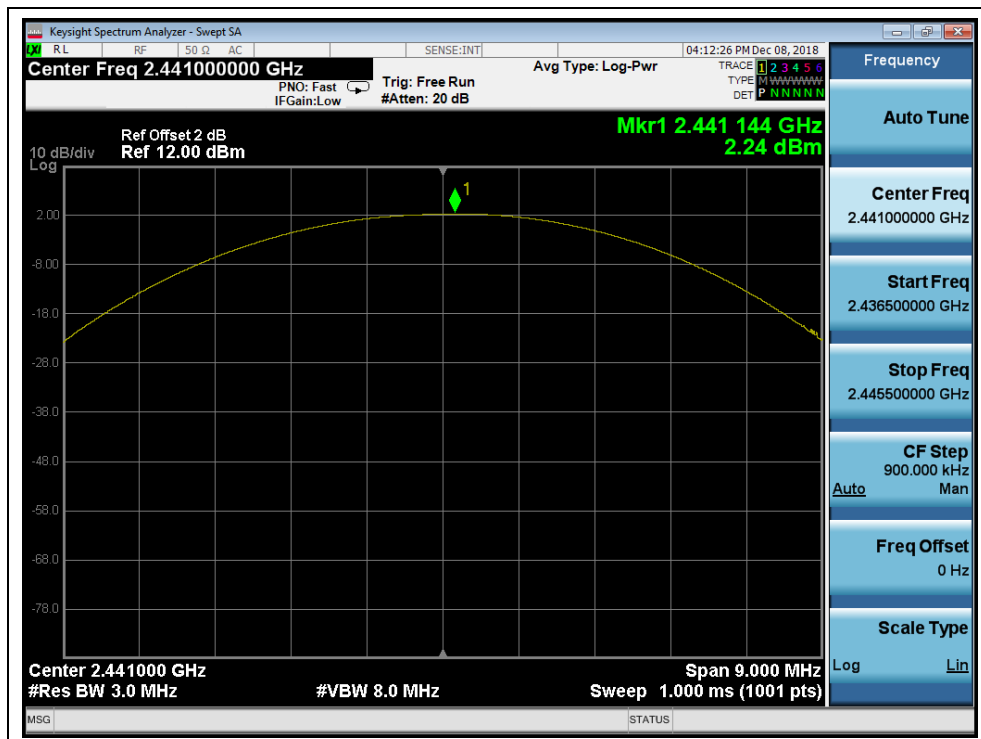
GFSK Mode

A. Test Verdict:

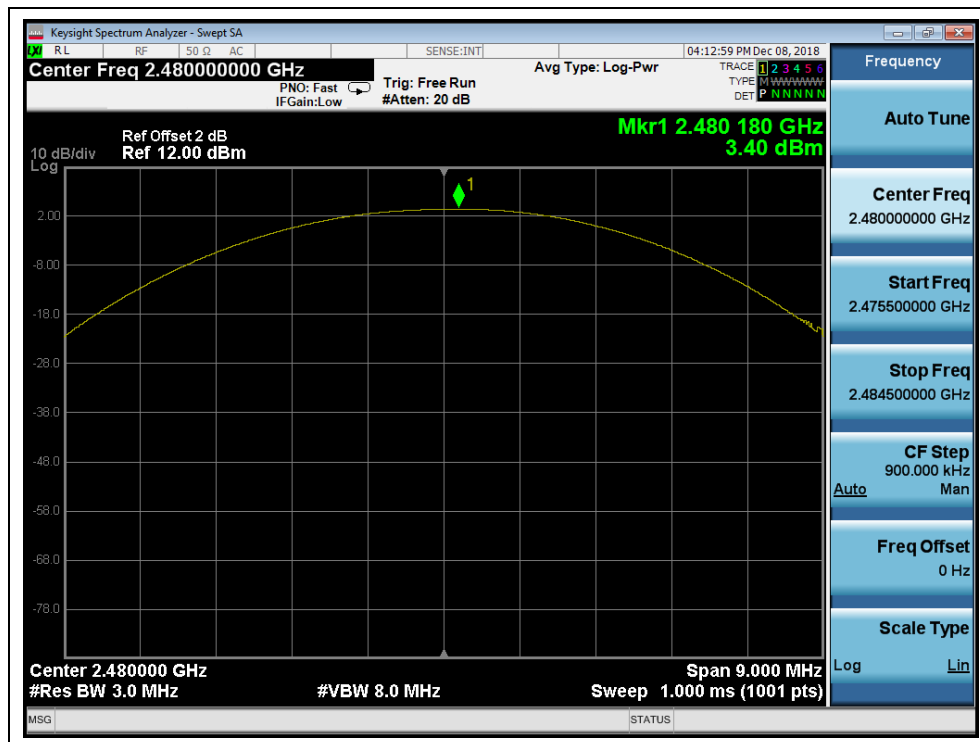
Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	1.33	0.0014	21	0.125	PASS
39	2441	2.24	0.0017			PASS
78	2480	3.40	0.0022			PASS

**B. Test Plots:**

(GFSK, Channel 0, 2402MHz)



(GFSK, Channel 39, 2441MHz)



(GFSK, Channel 78, 2480MHz)

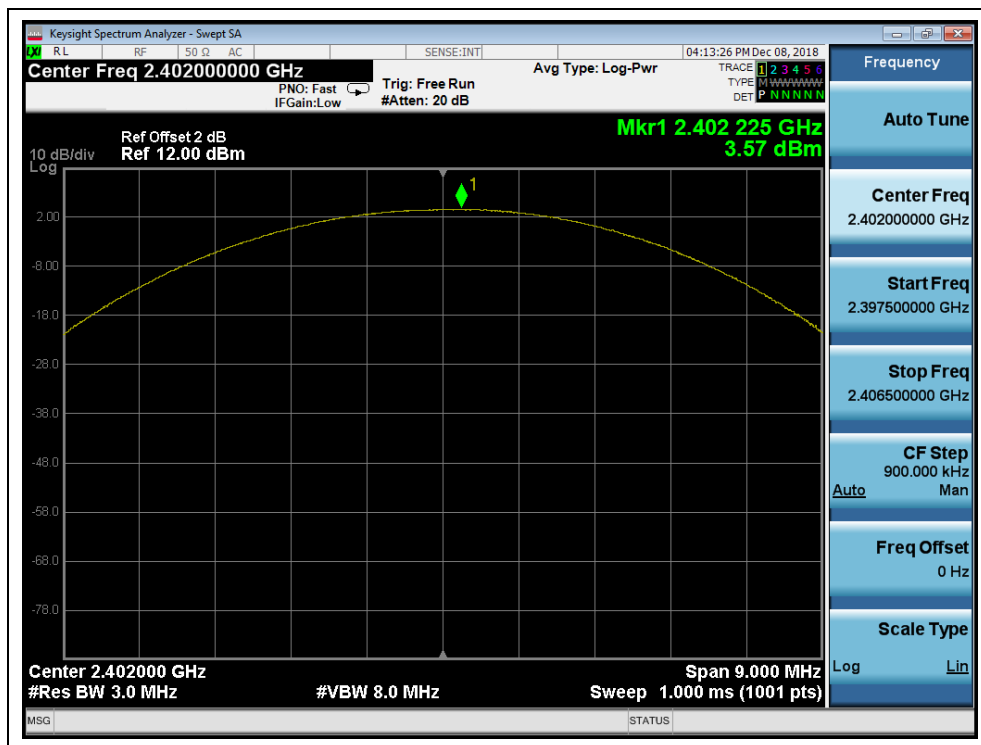


$\pi/4$ -DQPSK Mode

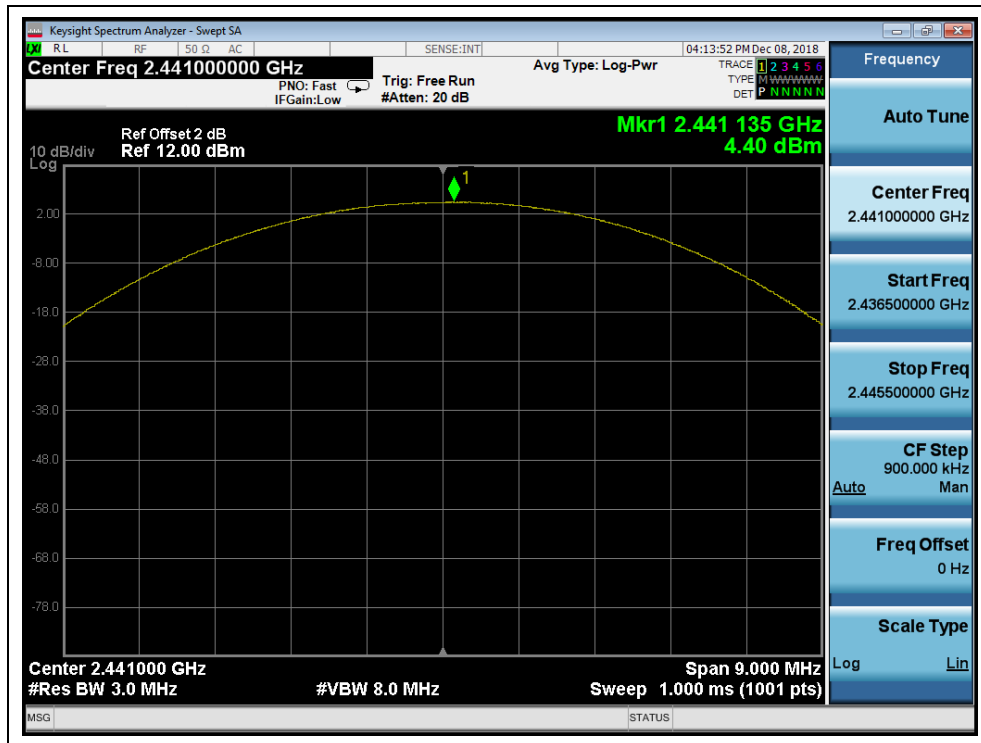
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	3.57	0.0023	21	0.125	PASS
39	2441	4.40	0.0028			PASS
78	2480	5.49	0.0035			PASS

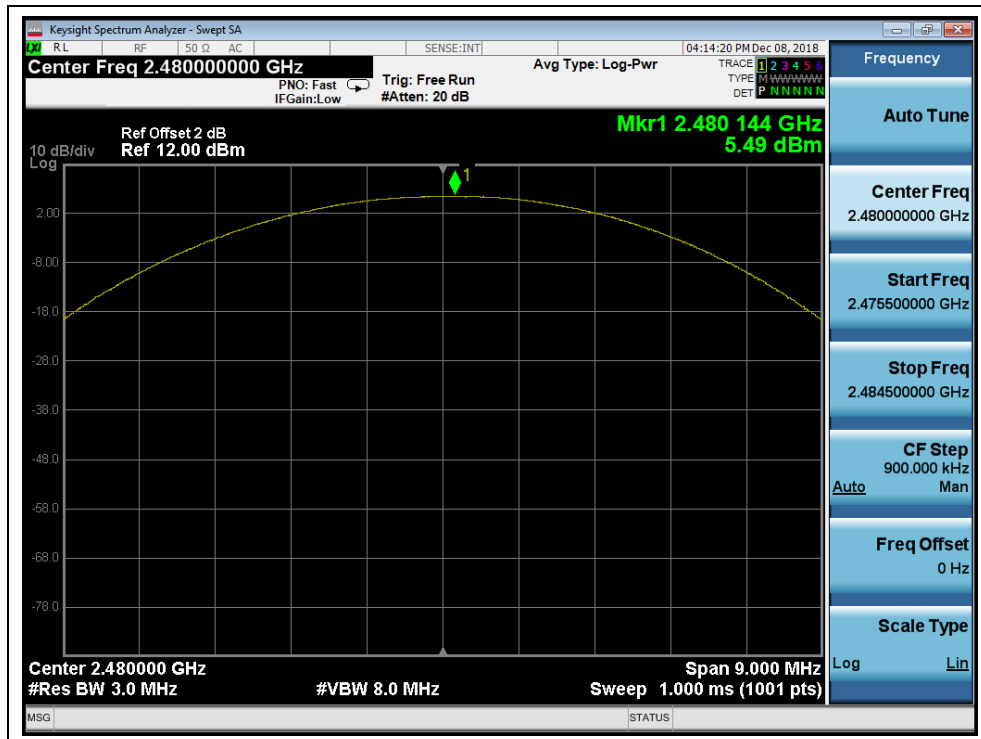
B. Test Plots:



($\pi/4$ -DQPSK, Channel 0, 2402MHz)



(π/4-DQPSK, Channel 39, 2441MHz)



(π/4-DQPSK, Channel 78, 2480MHz)

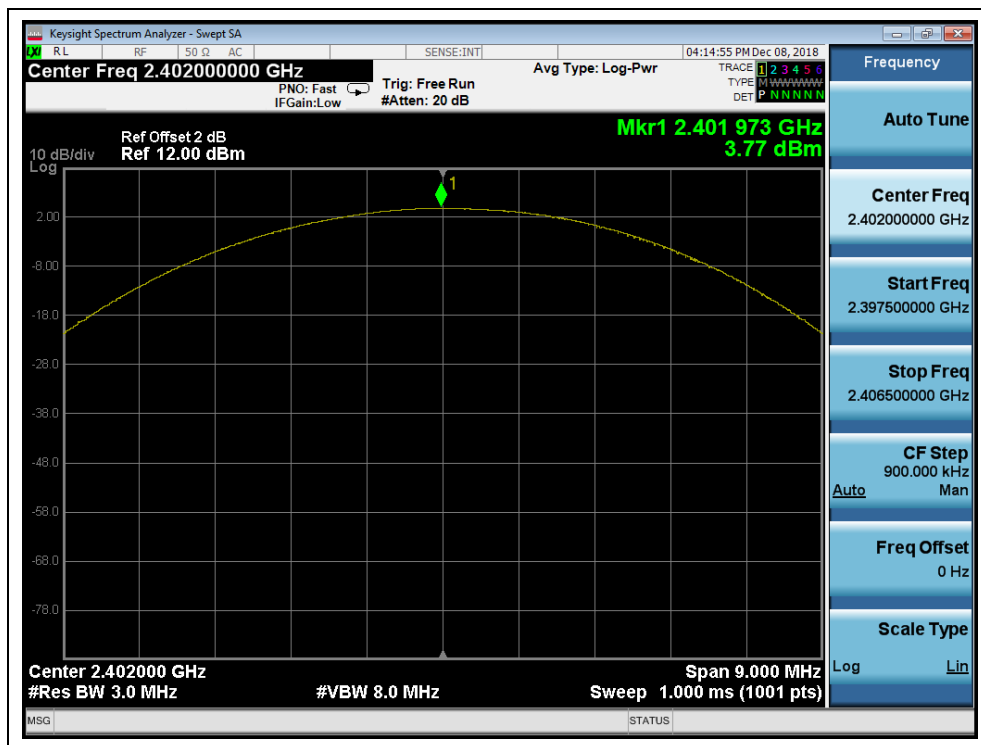


8-DPSK Mode

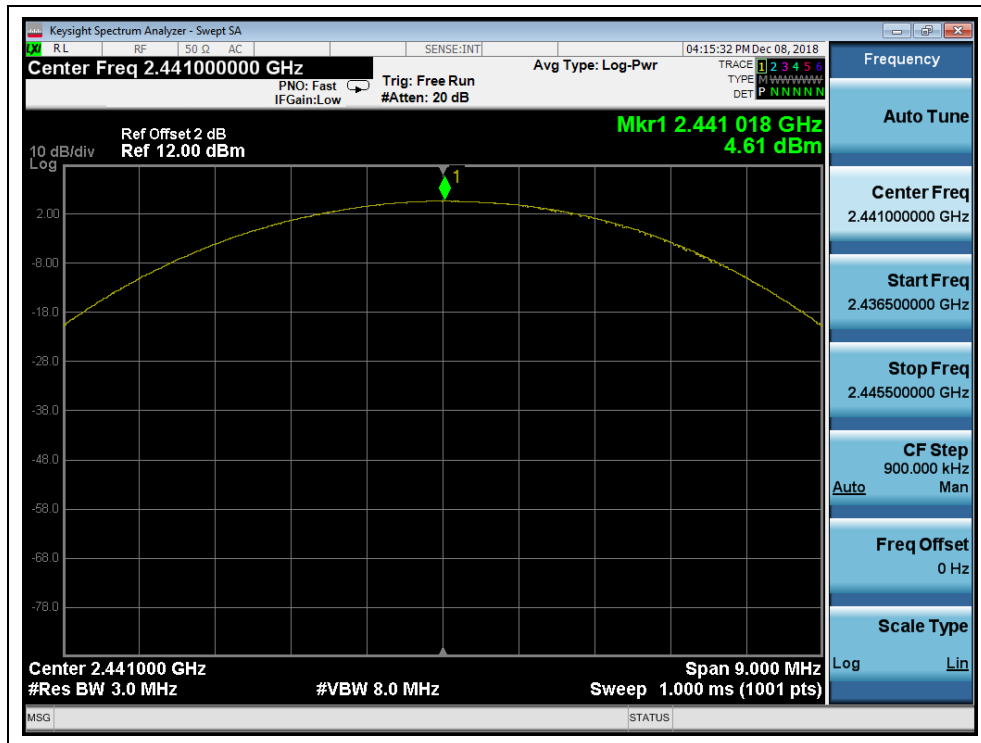
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	3.77	0.0024	21	0.125	PASS
39	2441	4.61	0.0029			PASS
78	2480	5.71	0.0037			PASS

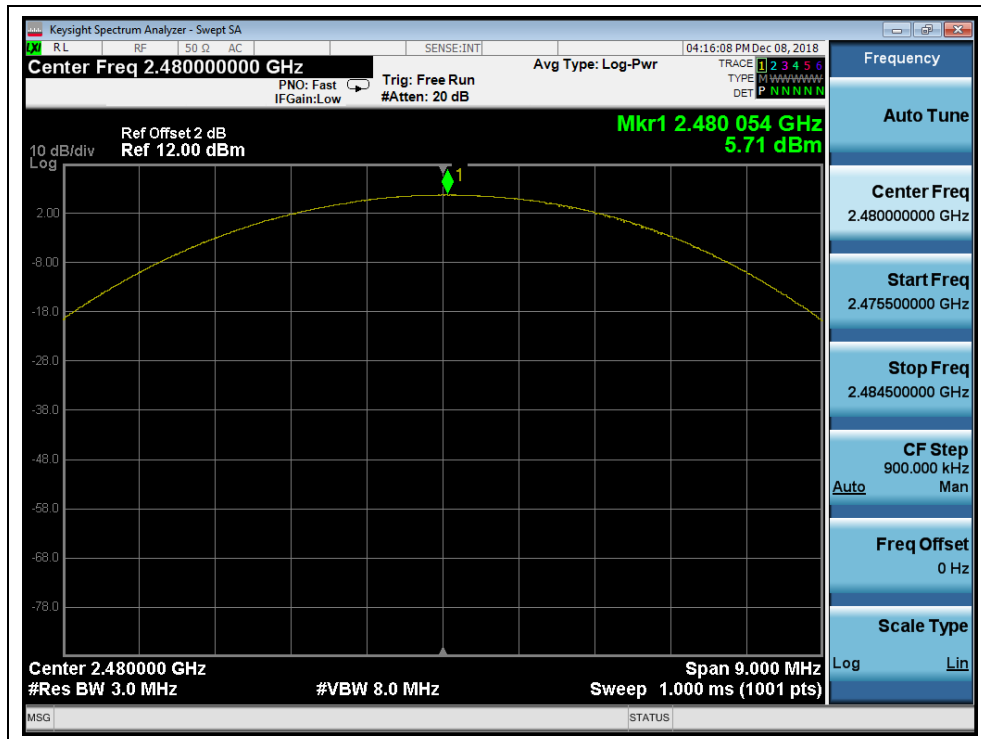
B. Test Plots:



(8-DPSK, Channel 0, 2402MHz)



(8-DPSK, Channel 39, 2441MHz)



(8-DPSK, Channel 78, 2480MHz)

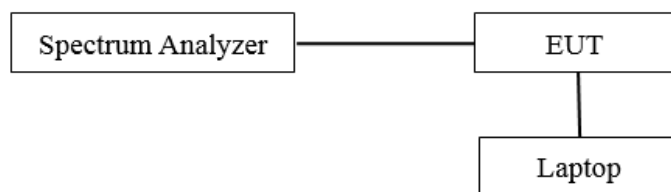
2.4. 20dB Bandwidth

2.4.1. Definition

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth ($10 \cdot \log 1\% = 20\text{dB}$) taking the total RF output power.

2.4.2. Test Description

A. Test Setup:



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

B. Equipments List:

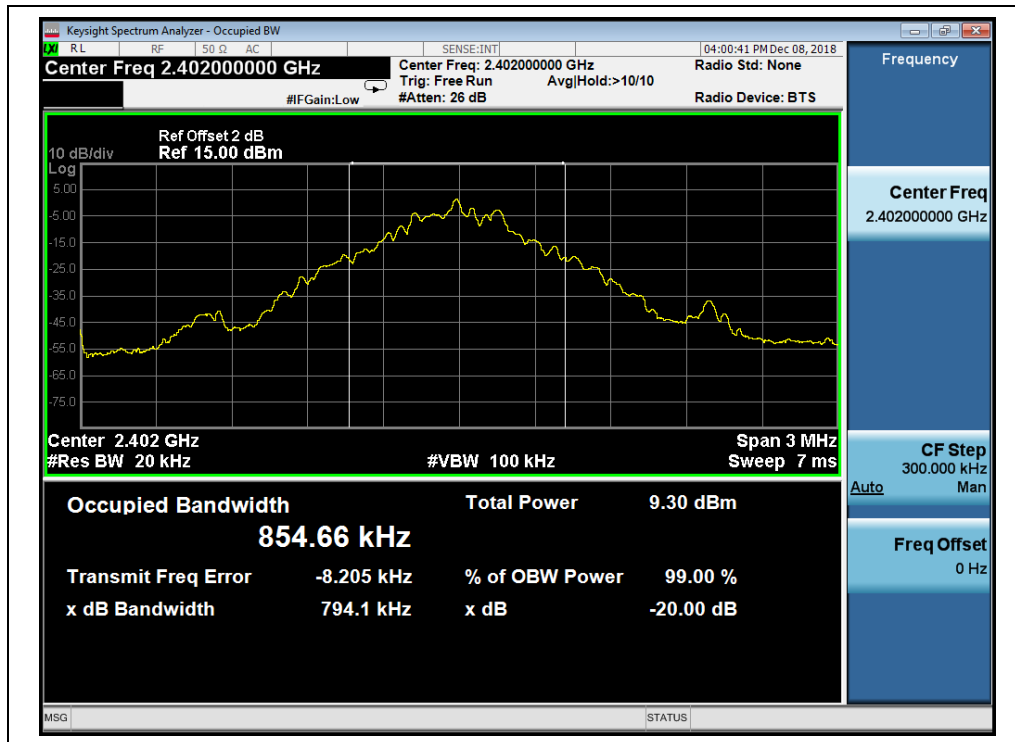
Please refer ANNEX B(4).

2.4.3. Test Result

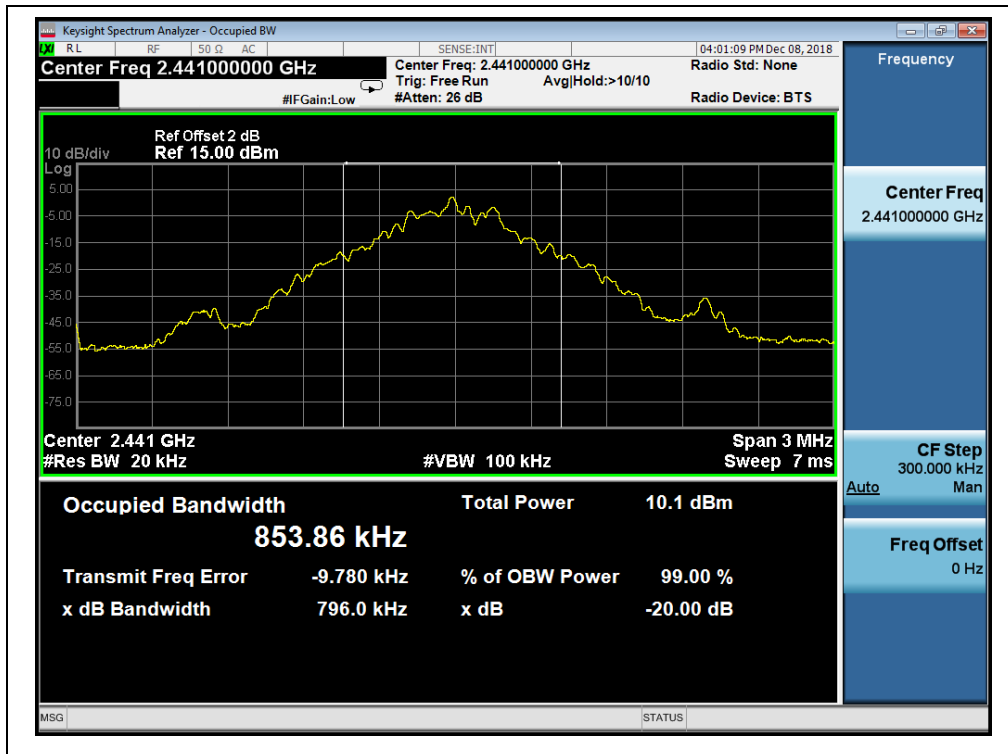
The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to record the 20dB bandwidth of the Module.

**GFSK Mode****A. Test Verdict:**

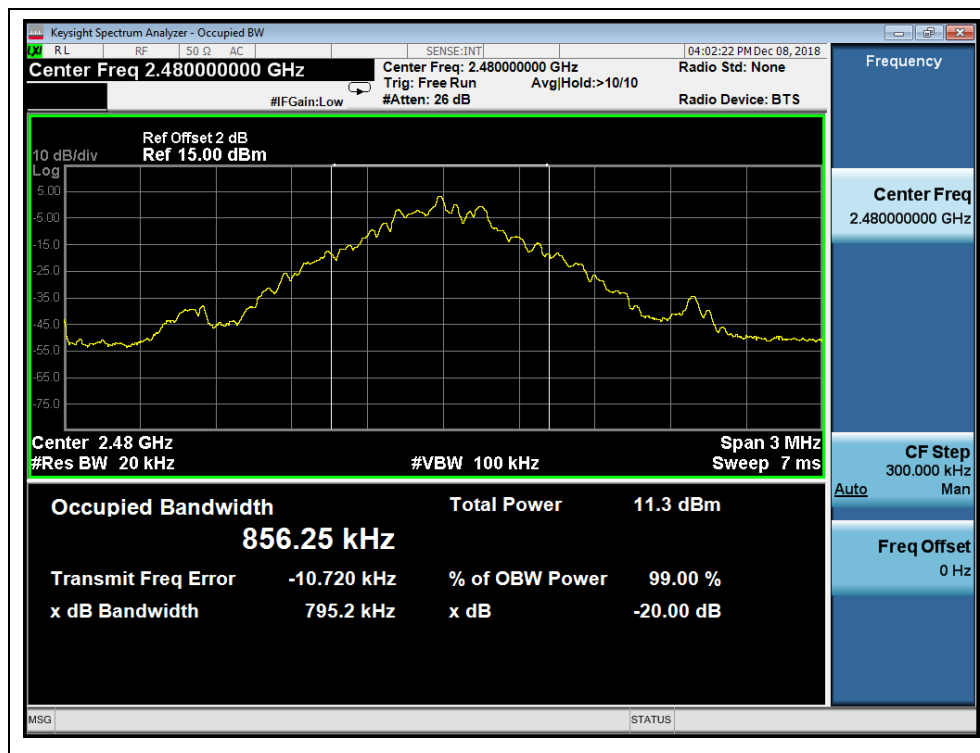
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	0.7941	PASS
39	2441	0.7960	PASS
78	2480	0.7952	PASS

B. Test Plots:

(GFSK, Channel 0, 2402MHz)



(GFSK, Channel 39, 2441MHz)



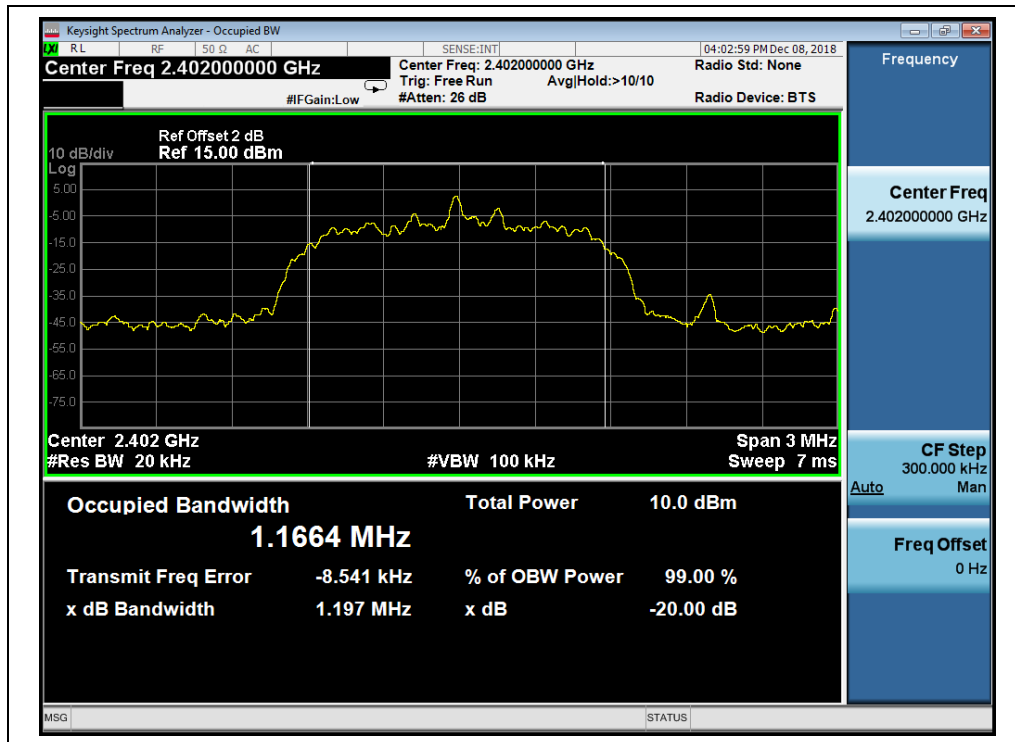
(GFSK, Channel 78, 2480MHz)

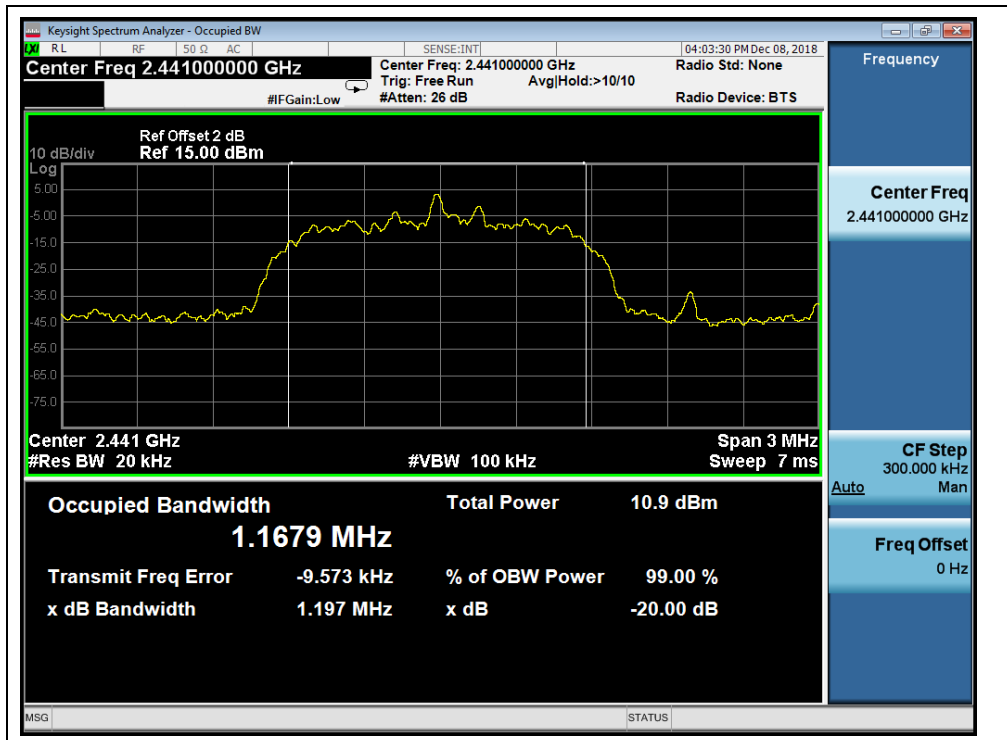
 $\pi/4$ -DQPSK Mode

A. Test Verdict:

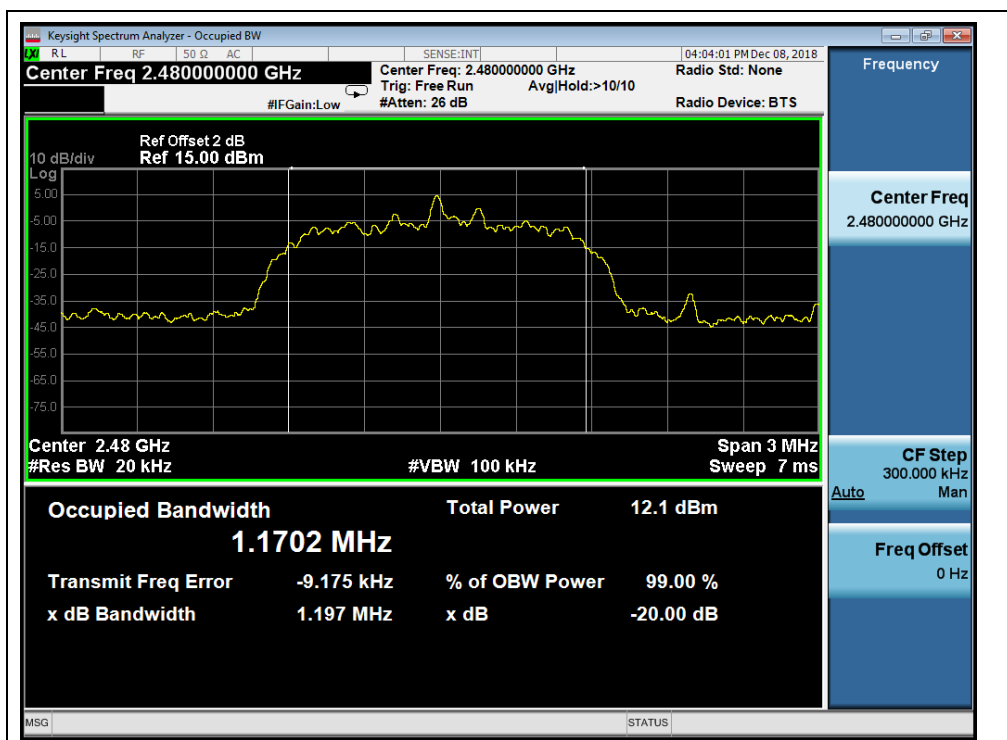
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.197	PASS
39	2441	1.197	PASS
78	2480	1.197	PASS

B. Test Plots:

 $\pi/4$ -DQPSK, Channel 0, 2402MHz)



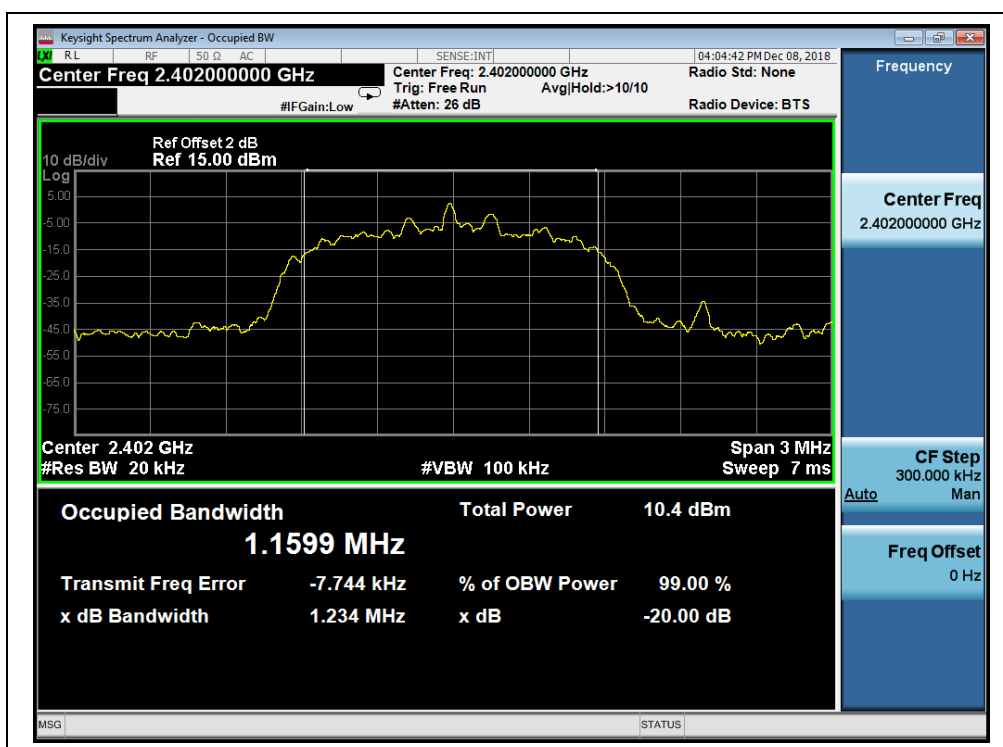
(π/4-DQPSK, Channel 39, 2441MHz)



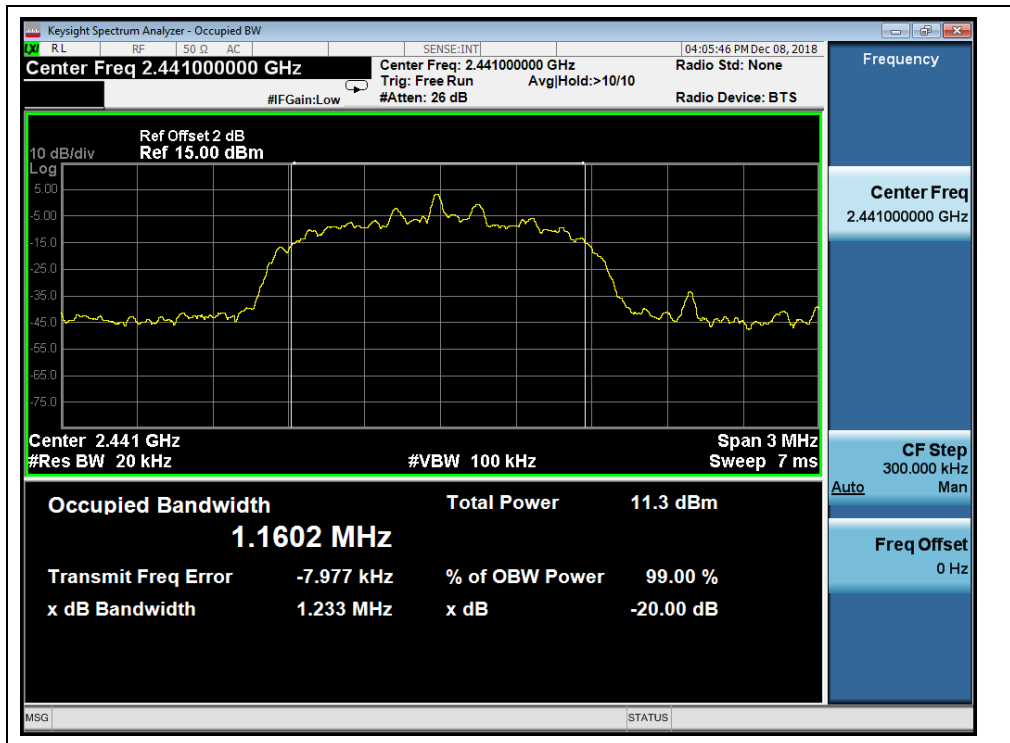
(π/4-DQPSK, Channel 78, 2480MHz)

**8-DPSK Mode****A. Test Verdict:**

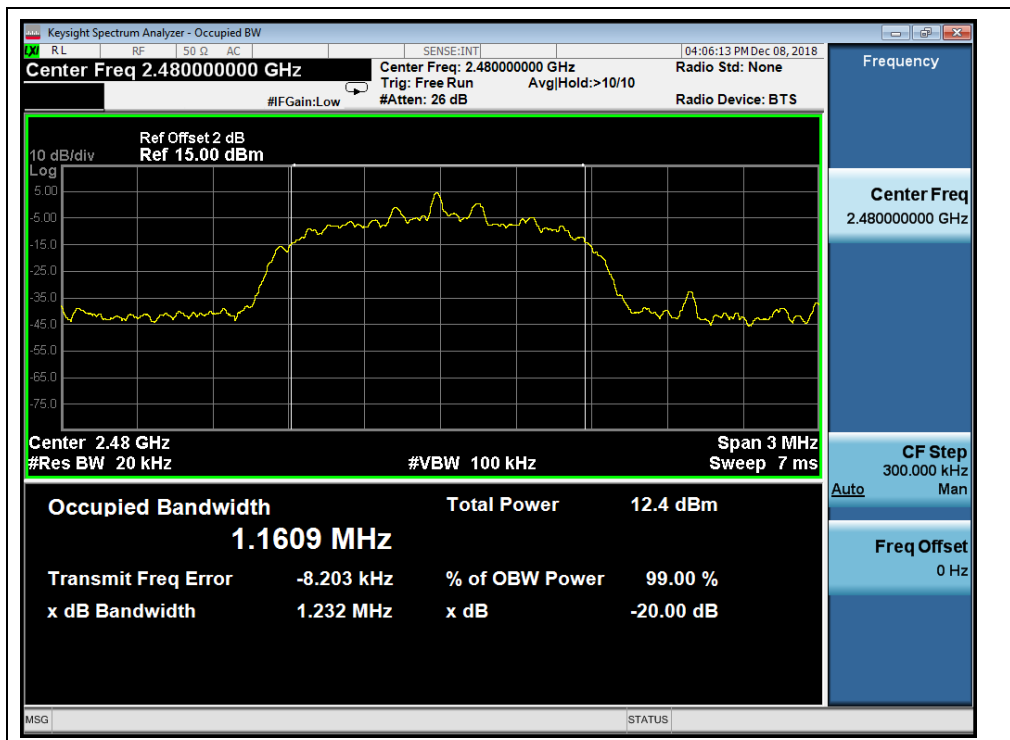
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.234	PASS
39	2441	1.233	PASS
78	2480	1.232	PASS

B. Test Plots:

(8-DPSK, Channel 0, 2402MHz)



(8-DPSK, Channel 39, 2441MHz)



(8-DPSK, Channel 78, 2480MHz)

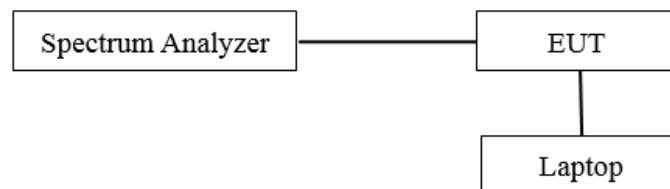
2.5. Carried Frequency Separation

2.5.1. Definition

According to FCC §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

2.5.2. Test Description

A. Test Setup:



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

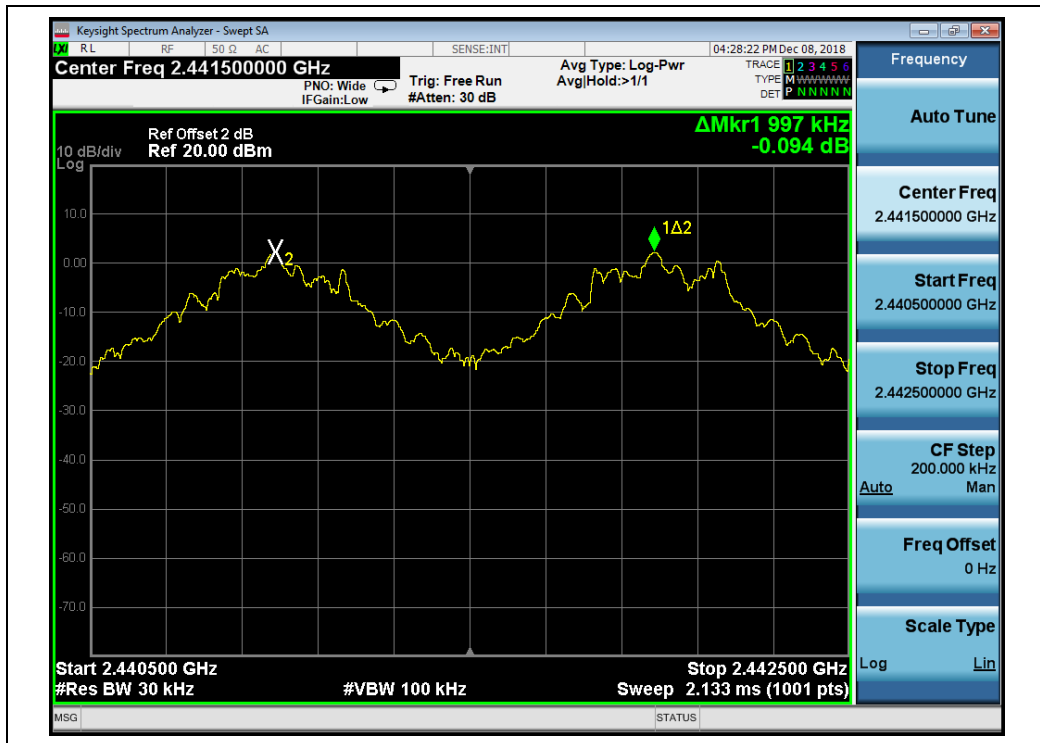
B. Equipments List:

Please refer ANNEX B(4).

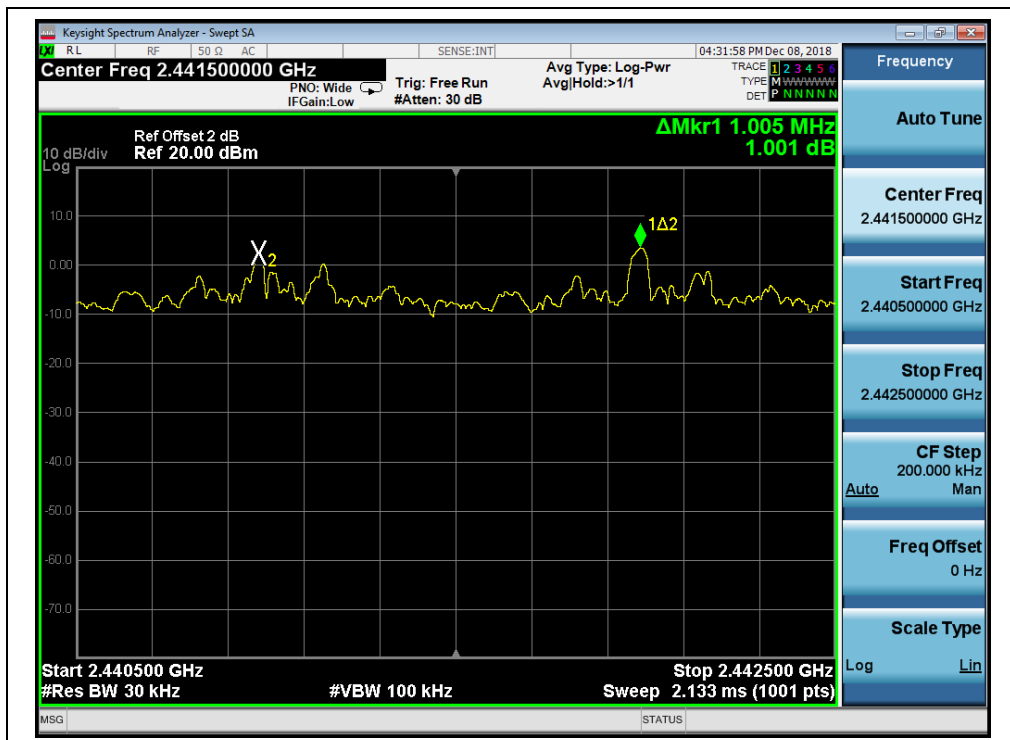
2.5.3. Test Result

The Bluetooth Module operates at hopping-on test mode. For any adjacent channels (e.g. the channel 39 and 40 as showed below), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (refer to section 2.4.4), whichever is greater. So, the verdict is PASSING.

Test Mode	Measured Channel Numbers	Carried Frequency Separation(MHz)	20dB bandwidth (MHz)	Min. Limit	Verdict
GFSK	39 and 40	0.997	0.796	two-thirds of the 20dB bandwidth	PASS
π/4-DQPSK	39 and 40	1.005	1.197		PASS
8-DPSK	39 and 40	0.993	1.233		PASS



(GFSK)



($\pi/4$ -DQPSK)



(8-DPSK)

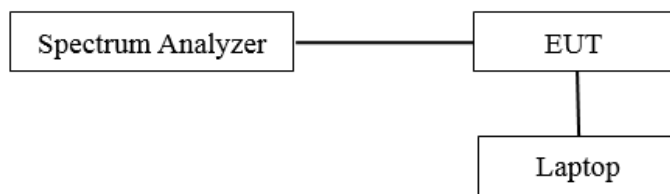
2.6. Time of Occupancy (Dwell time)

2.6.1. Requirement

According to FCC §15.247(a) (1) (iii), frequency hopping systems in the 2400 - 2483.5MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

2.6.2. Test Description

A. Test Setup:



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

The EUT was working in channel hopping; Spectrum SPAN was set as 0. Sweep was set as 0.4 * channel no.(s), the quantity of pulse was get from single sweep. In addition, the time of single pulses was tested.

$\text{Dwell time} = \text{time slot length} * \text{hop rate} / \text{number of hopping channels} * 31.6\text{s}$

$\text{Hop rate} = 1600/\text{s}$

B. Equipments List:

Please refer ANNEX B(4).



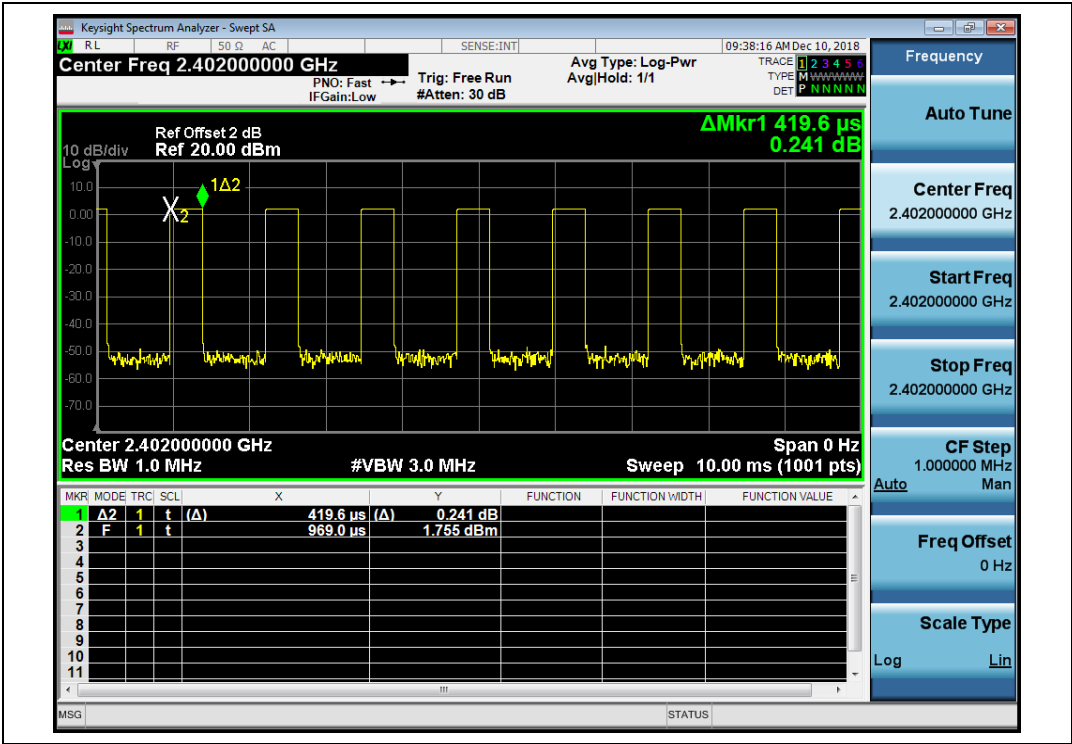
2.6.3. Test Result

GFSK Mode

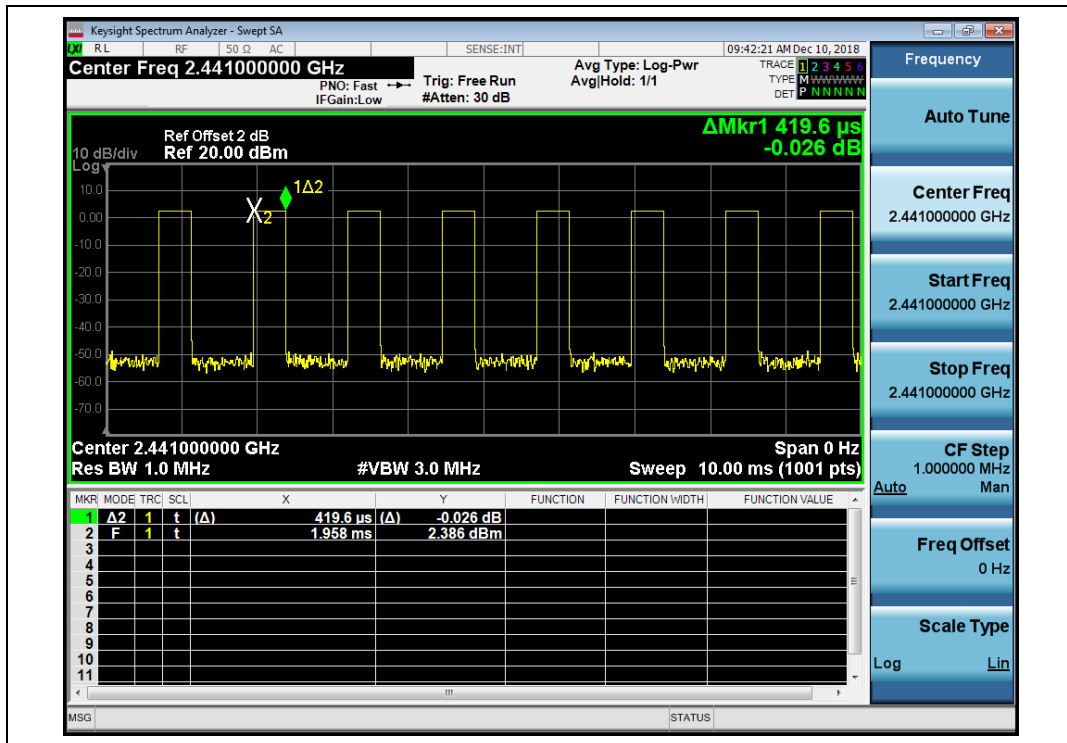
A. Test Verdict:

Mode	Frequency (MHz)	Pulse Width (ms)	Dwell Time (ms)	Limit (sec)	Verdict
DH1	2402	0.420	134.266	0.4	PASS
	2441	0.420	134.266		PASS
	2480	0.420	134.266		PASS
DH3	2402	1.668	266.933		PASS
	2441	1.678	268.531		PASS
	2480	1.678	268.531		PASS
DH5	2402	2.927	312.221		PASS
	2441	2.927	312.221		PASS
	2480	2.927	312.221		PASS

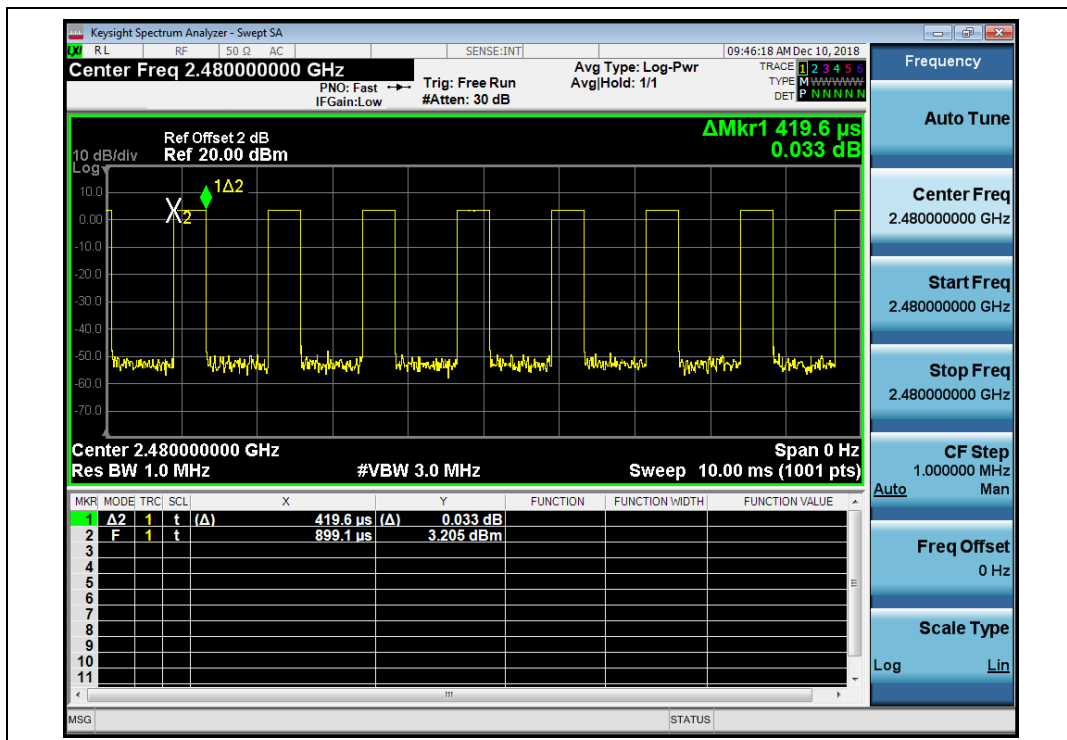
B. Test Plots:



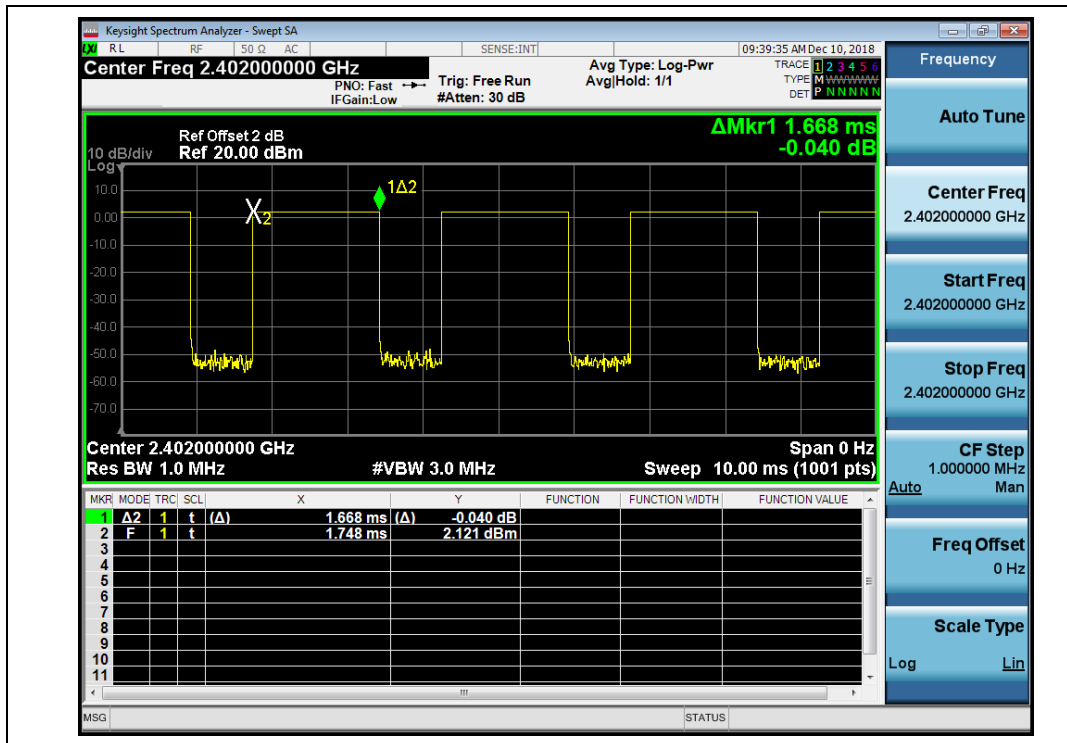
(DH1_2402MHz, GFSK)



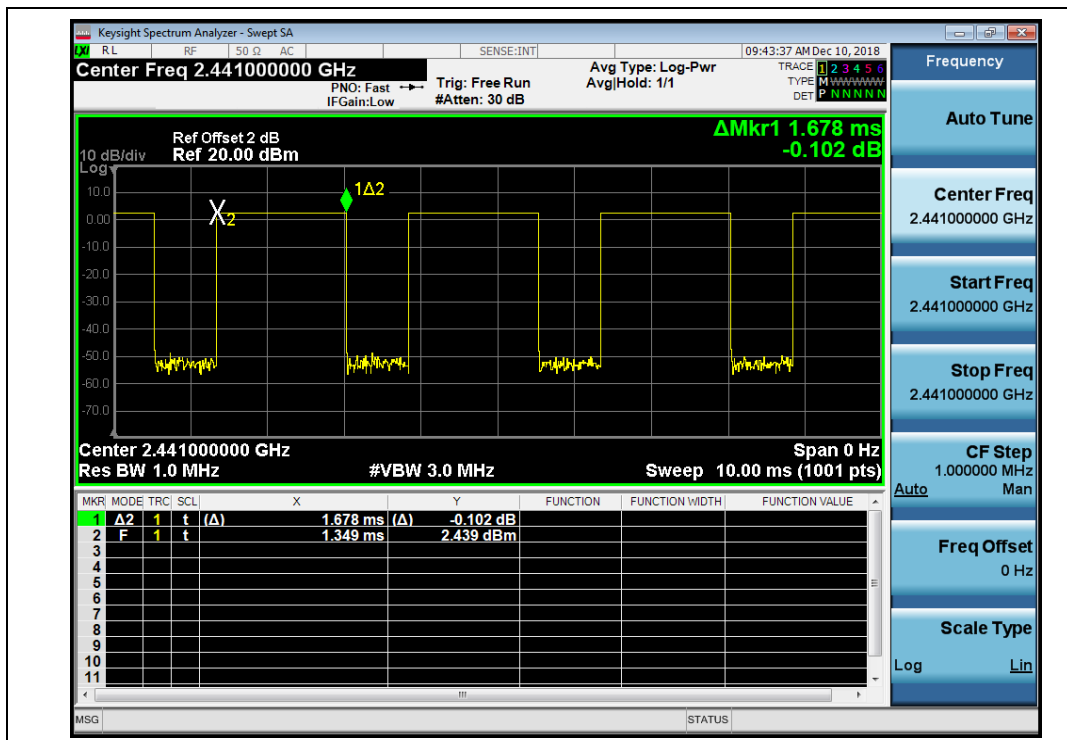
(DH1_2441M, GFSK)



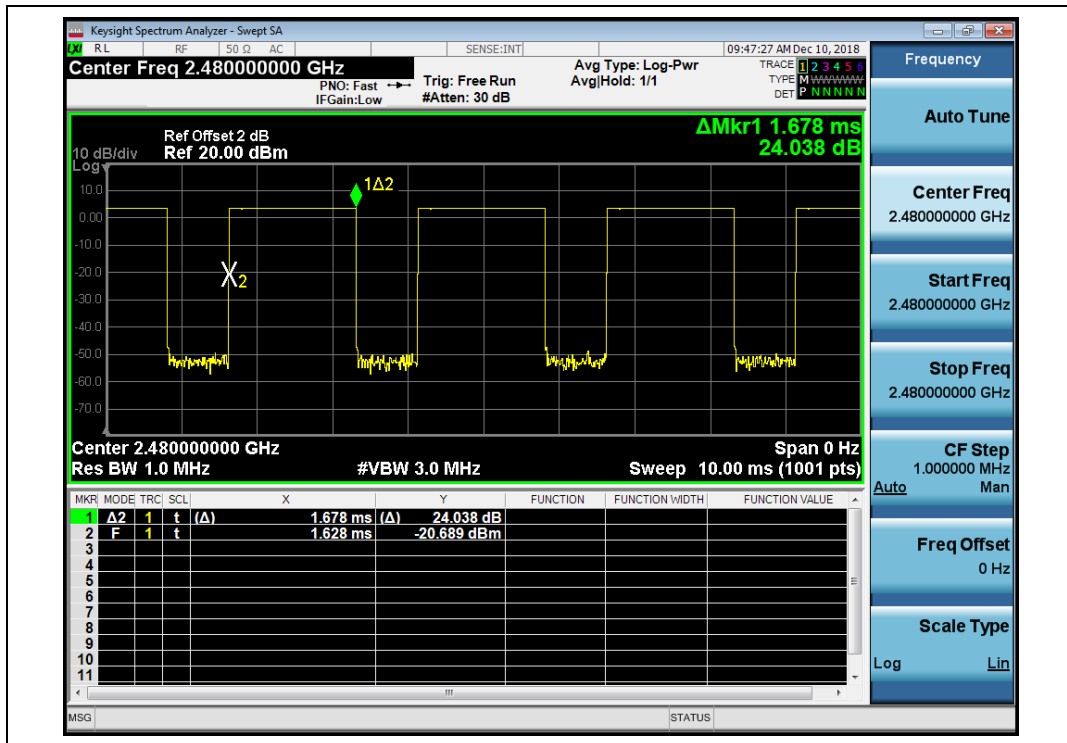
(DH1_2480M, GFSK)



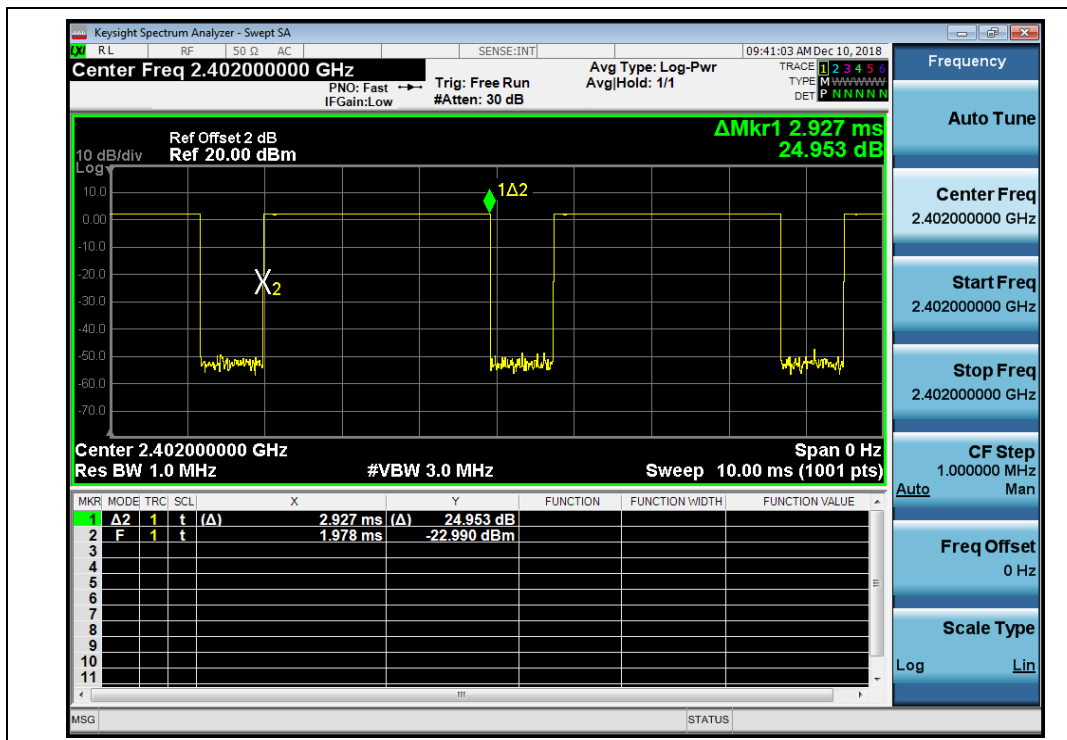
(DH3_2402M, GFSK)



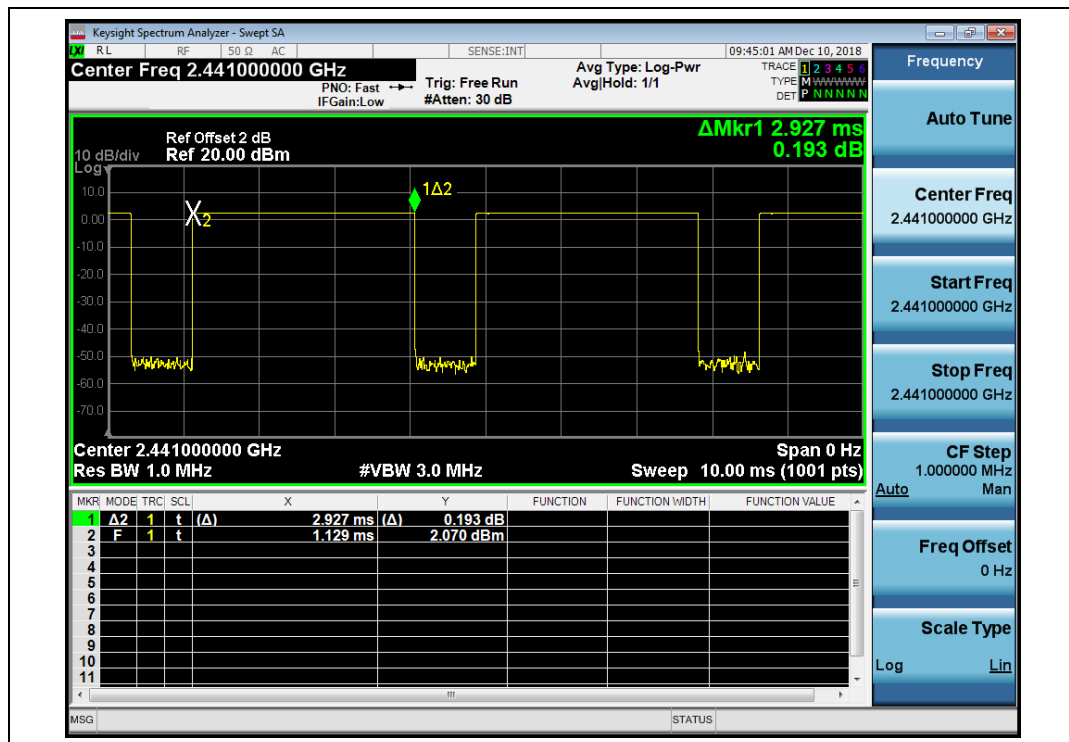
(DH3_2441M, GFSK)



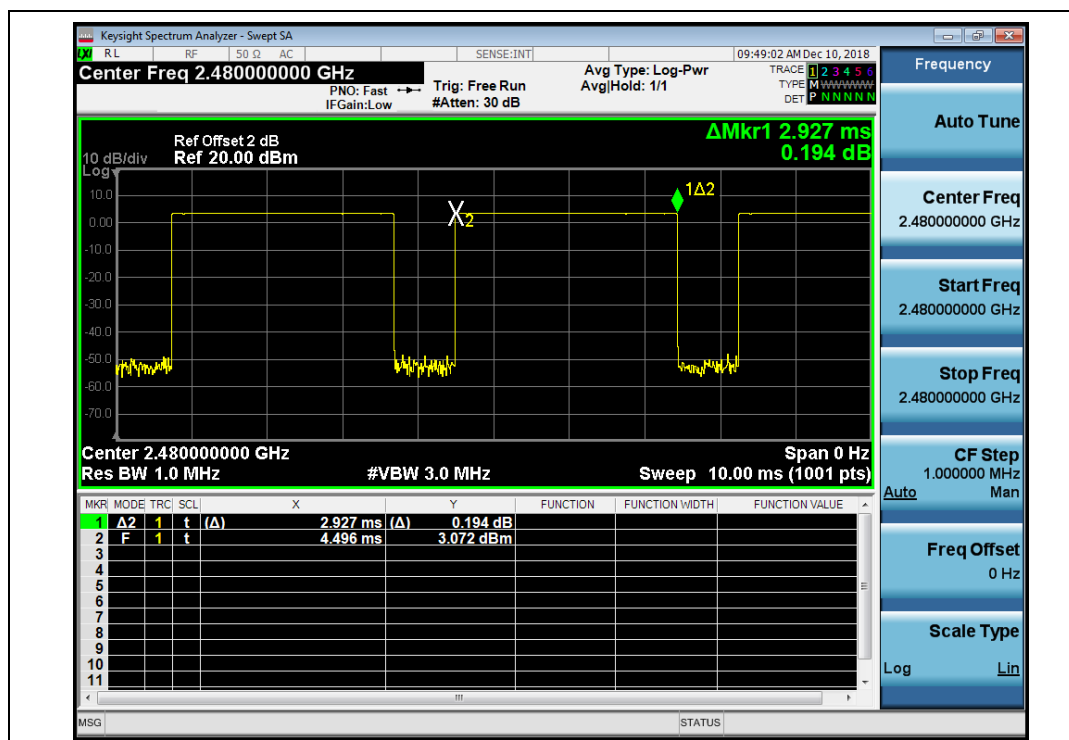
(DH3_2480M, GFSK)



(DH5_2402M, GFSK)



(DH5_2441M, GFSK)



(DH5_2480M, GFSK)

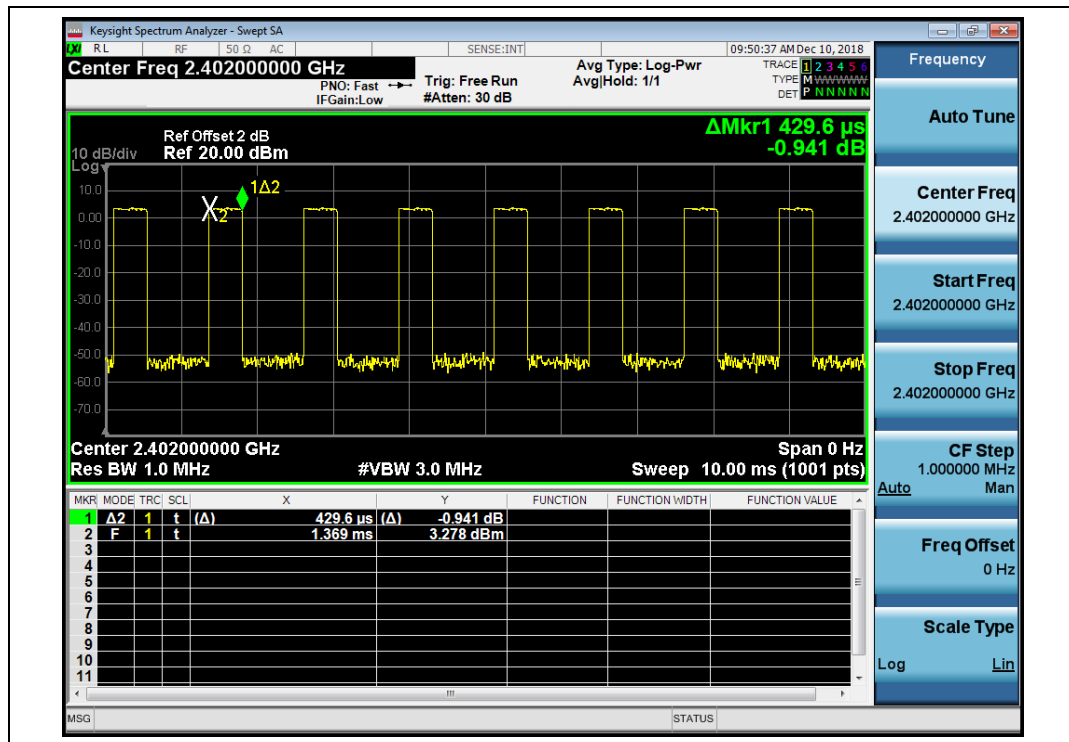


$\pi/4$ -DQPSK Mode

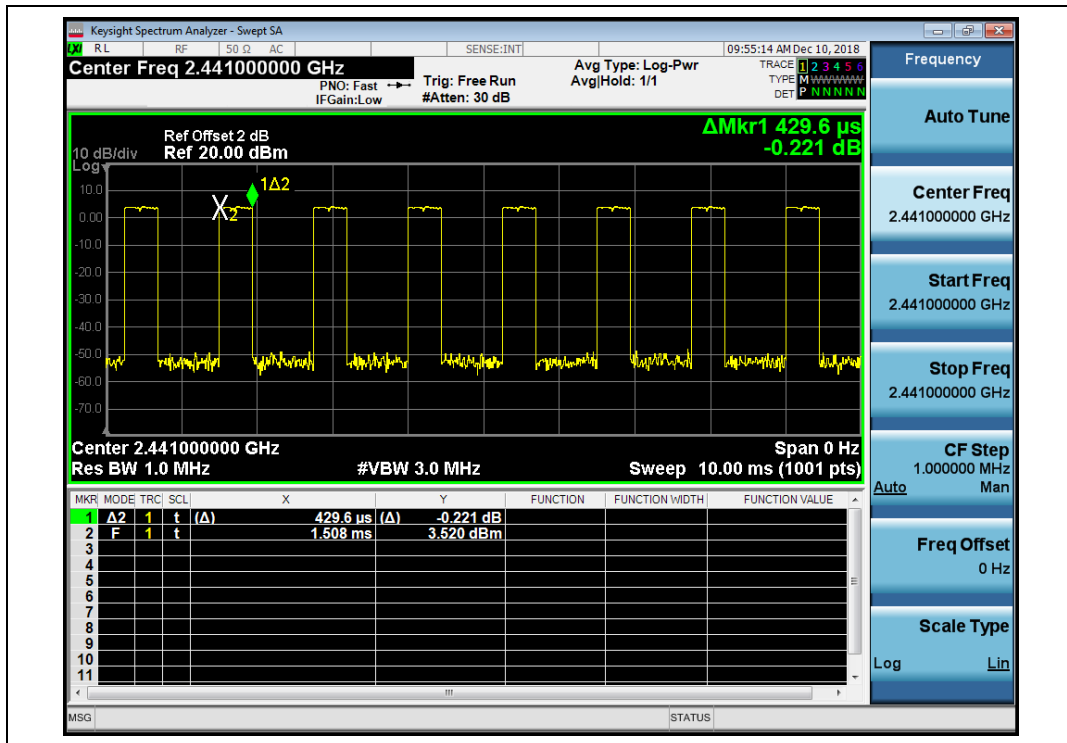
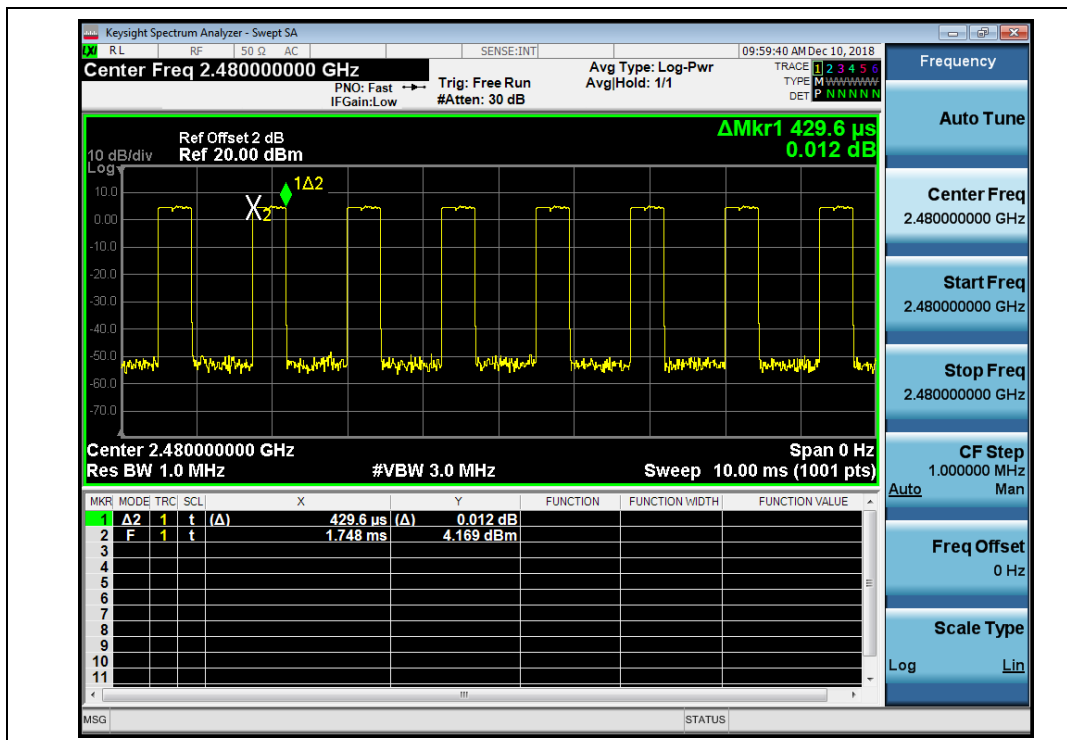
A. Test Verdict:

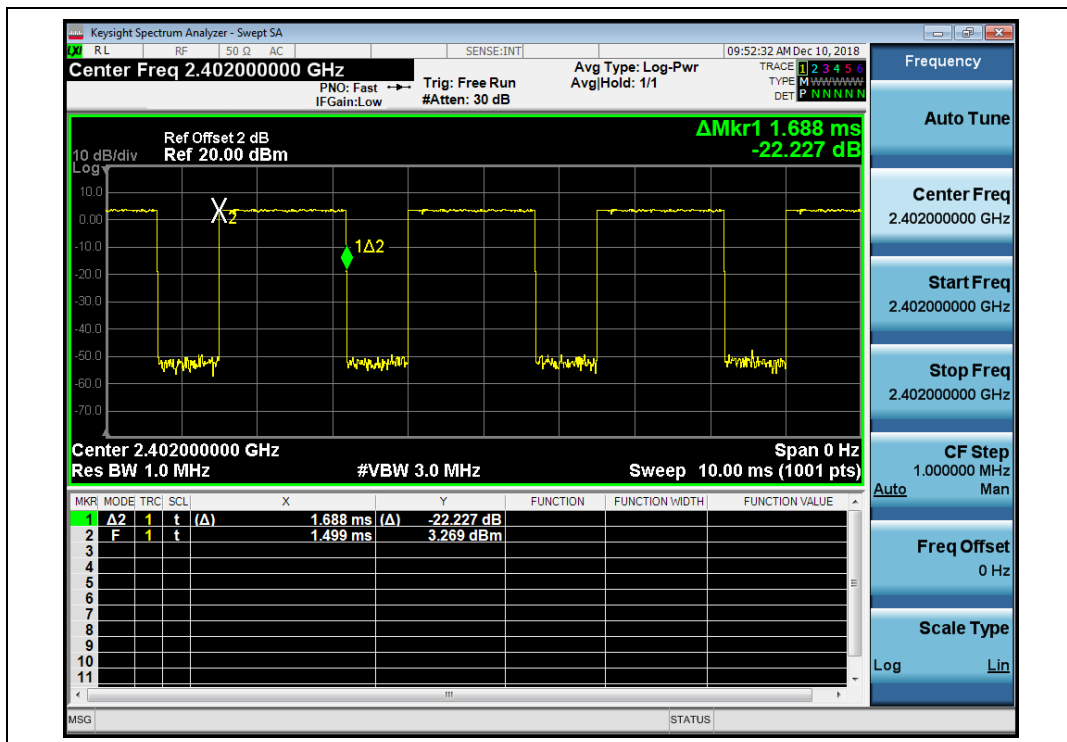
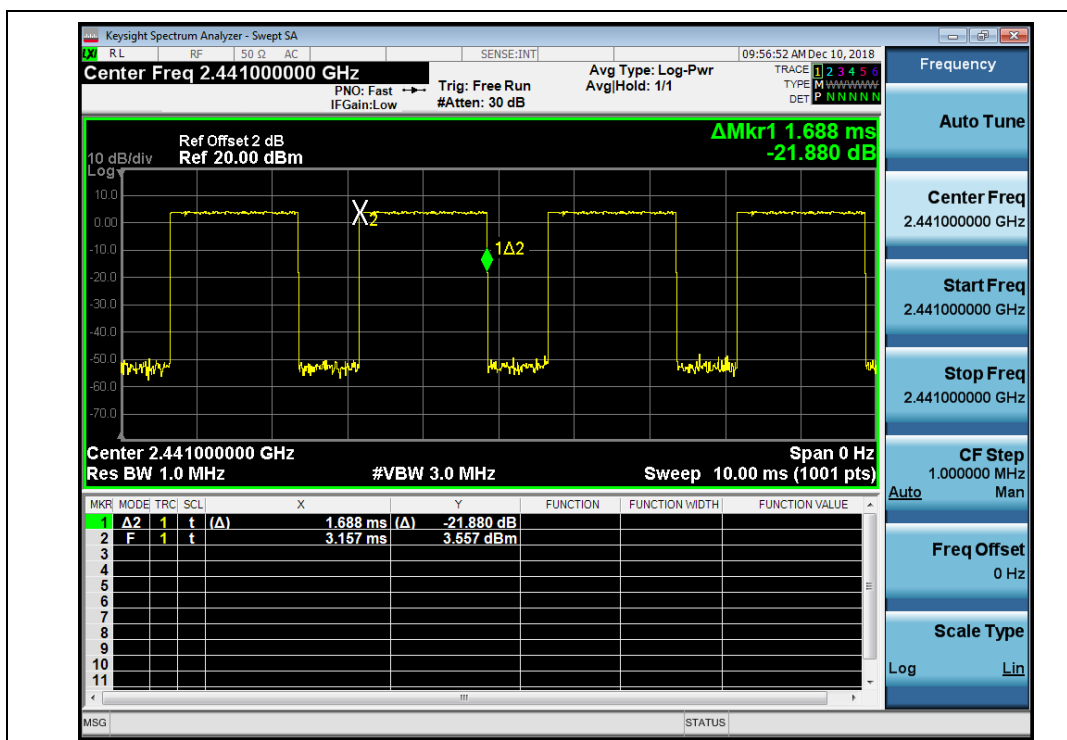
Mode	Frequency (MHz)	Pulse Width (ms)	Dwell Time (ms)	Limit (sec)	Verdict
2DH1	2402	0.430	137.463	0.4	PASS
	2441	0.430	137.463		PASS
	2480	0.430	137.463		PASS
2DH3	2402	1.688	270.130		PASS
	2441	1.688	270.130		PASS
	2480	1.678	268.531		PASS
2DH5	2402	2.927	312.221		PASS
	2441	2.927	312.221		PASS
	2480	2.927	312.221		PASS

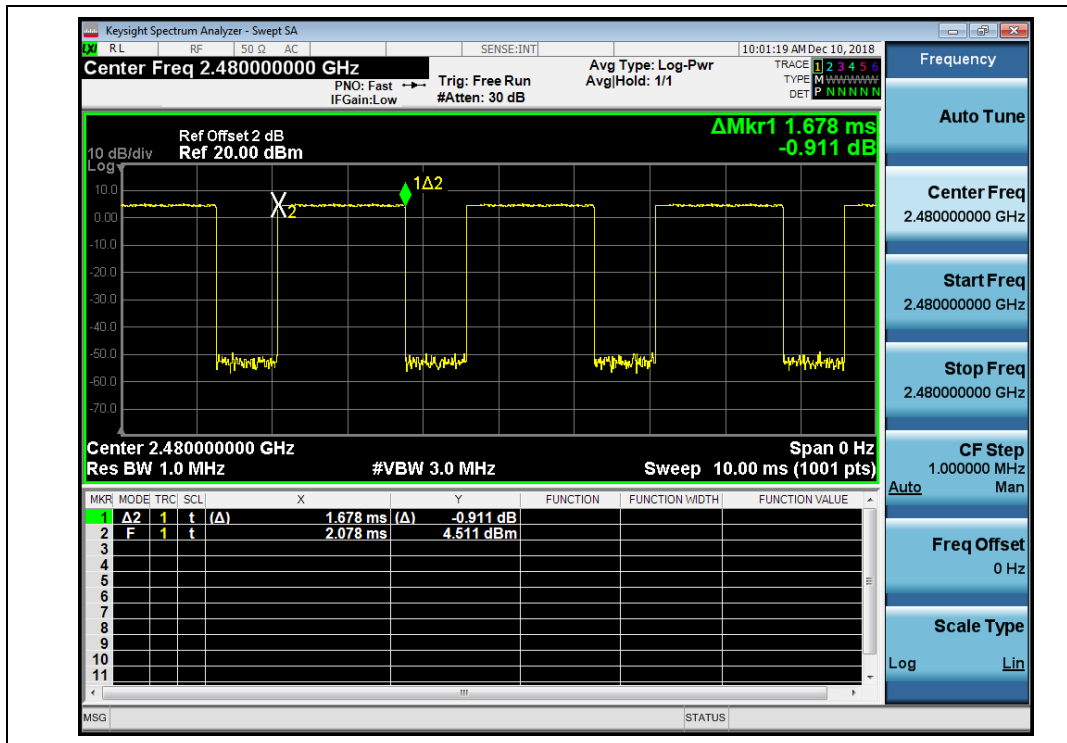
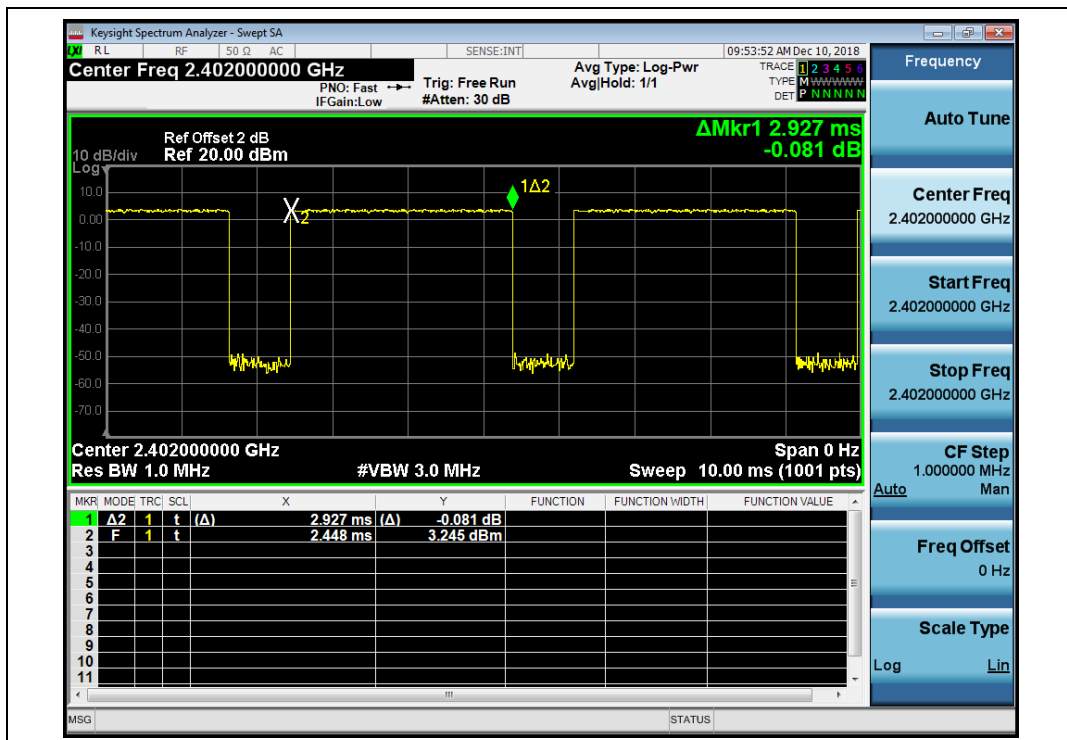
B. Test Plots:

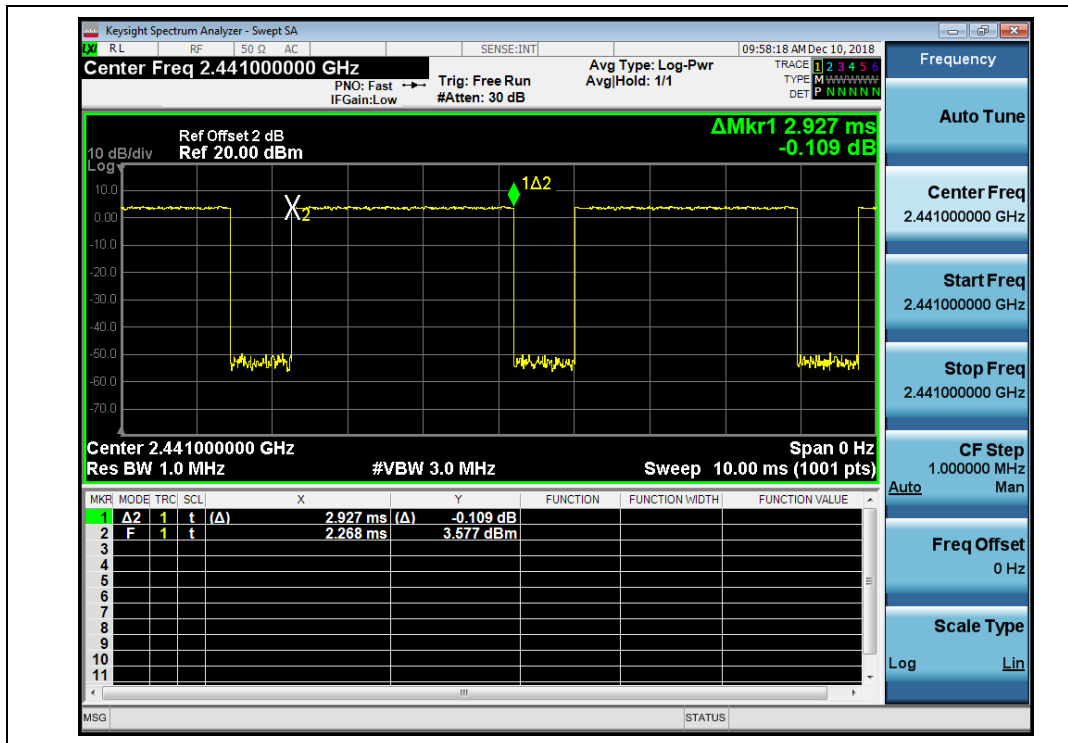
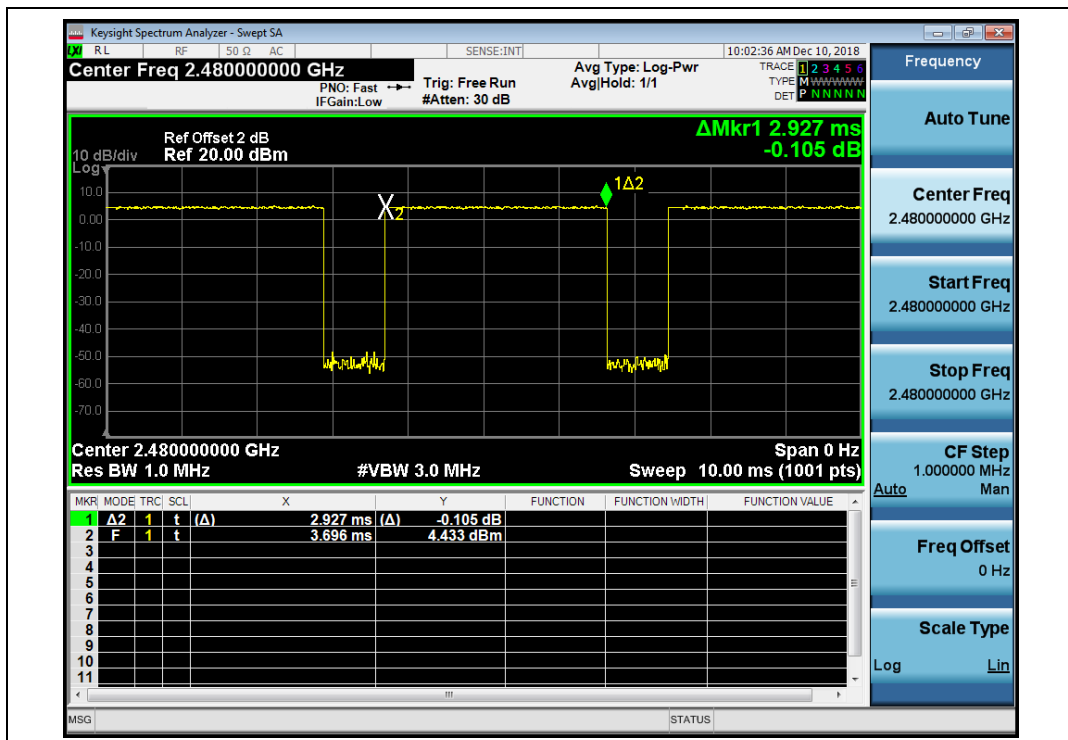


(2DH1_2402M, $\pi/4$ -DQPSK)

(2DH1_2441M, $\pi/4$ -DQPSK)(2DH1_2480M, $\pi/4$ -DQPSK)


(2DH3_2402M, $\pi/4$ -DQPSK)

(2DH3_2441M, $\pi/4$ -DQPSK)

(2DH3_2480M, $\pi/4$ -DQPSK)(2DH5_2402M, $\pi/4$ -DQPSK)


(2DH5_2441M, $\pi/4$ -DQPSK)

(2DH5_2480M, $\pi/4$ -DQPSK)

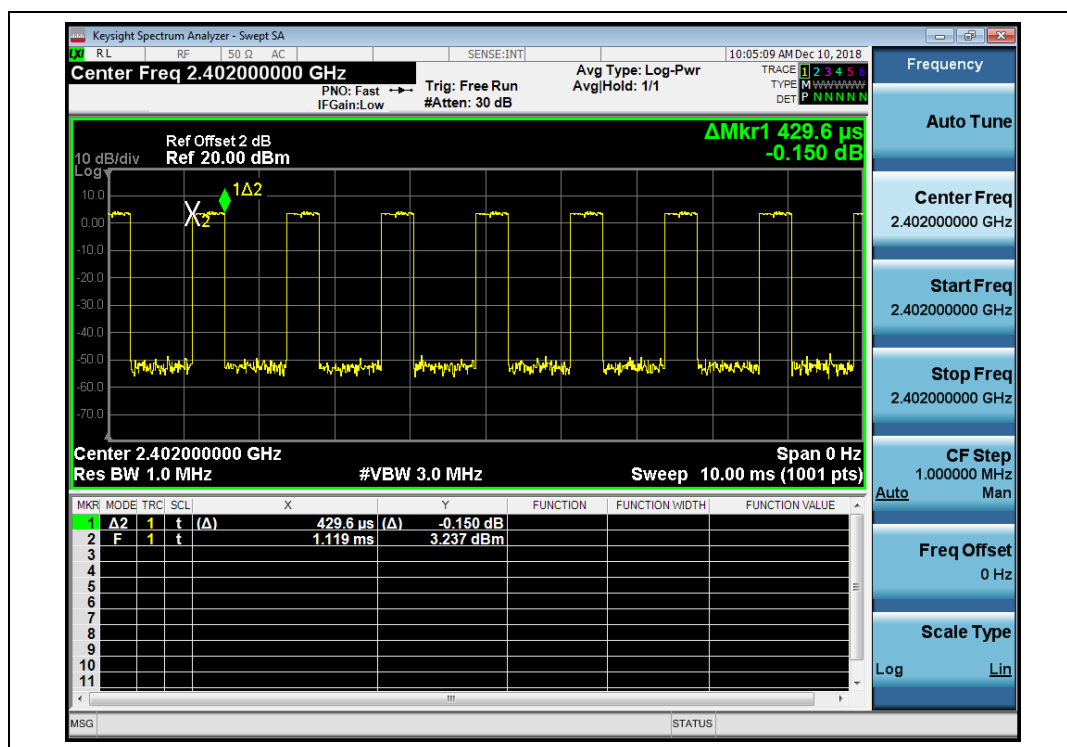


8-DPSK mode

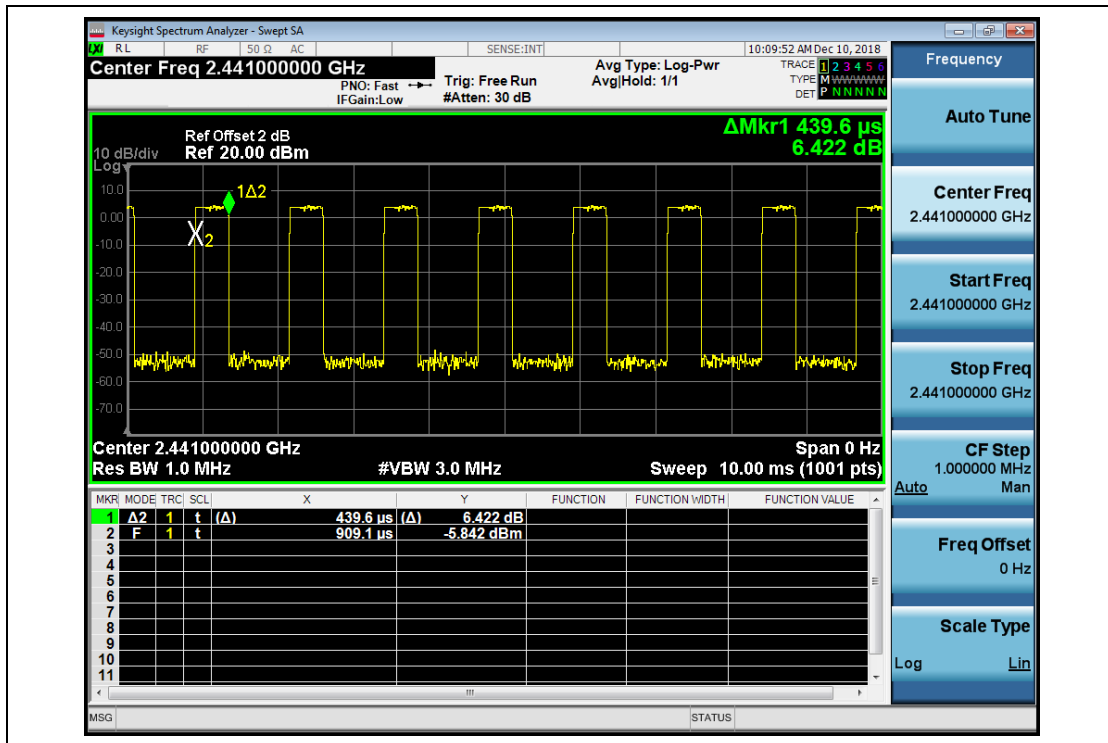
A. Test Verdict:

Mode	Frequency (MHz)	Pulse Width (ms)	Dwell Time (ms)	Limit (sec)	Verdict
3DH1	2402	0.430	137.463	0.4	PASS
	2441	0.440	140.659		PASS
	2480	0.430	137.463		PASS
3DH3	2402	1.678	268.531		PASS
	2441	1.678	268.531		PASS
	2480	1.688	270.130		PASS
3DH5	2402	2.927	312.221		PASS
	2441	2.927	312.221		PASS
	2480	2.937	313.287		PASS

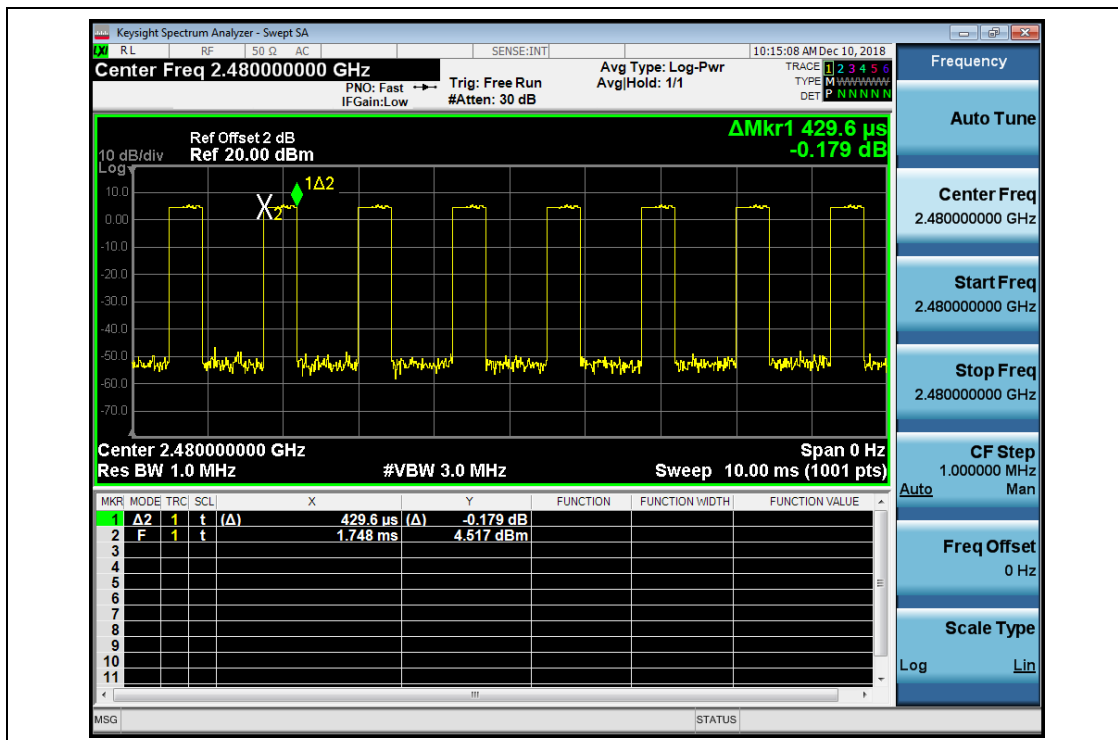
B. Test Plots:



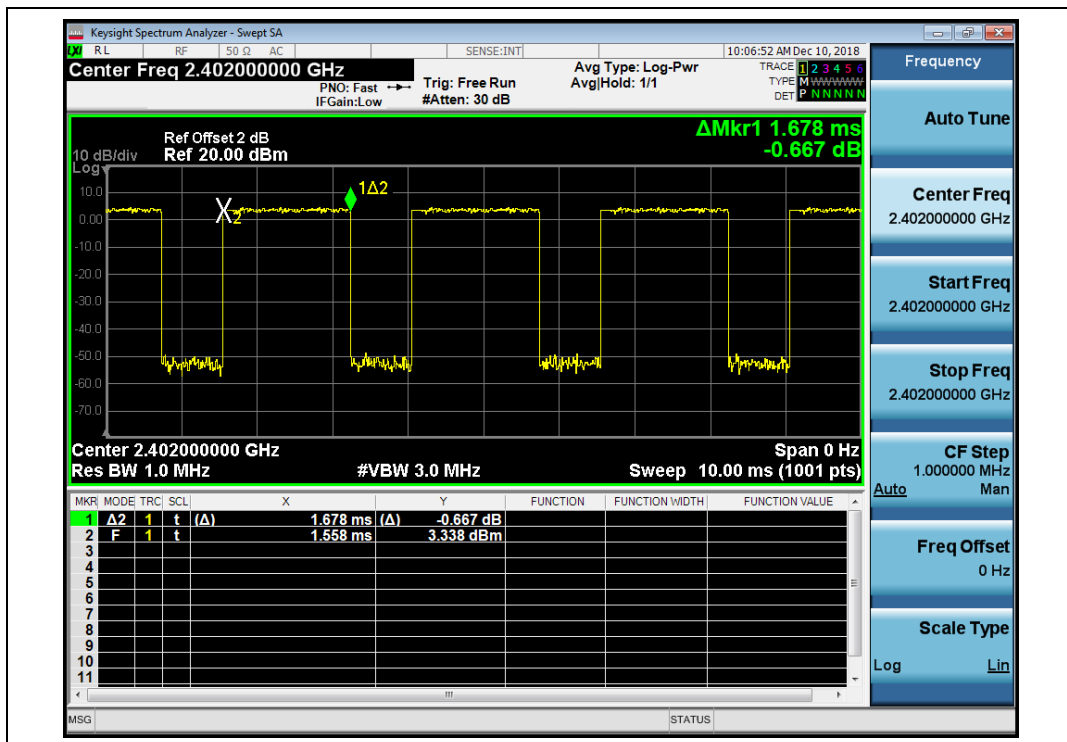
(3DH1_2402M, 8-DQPSK)



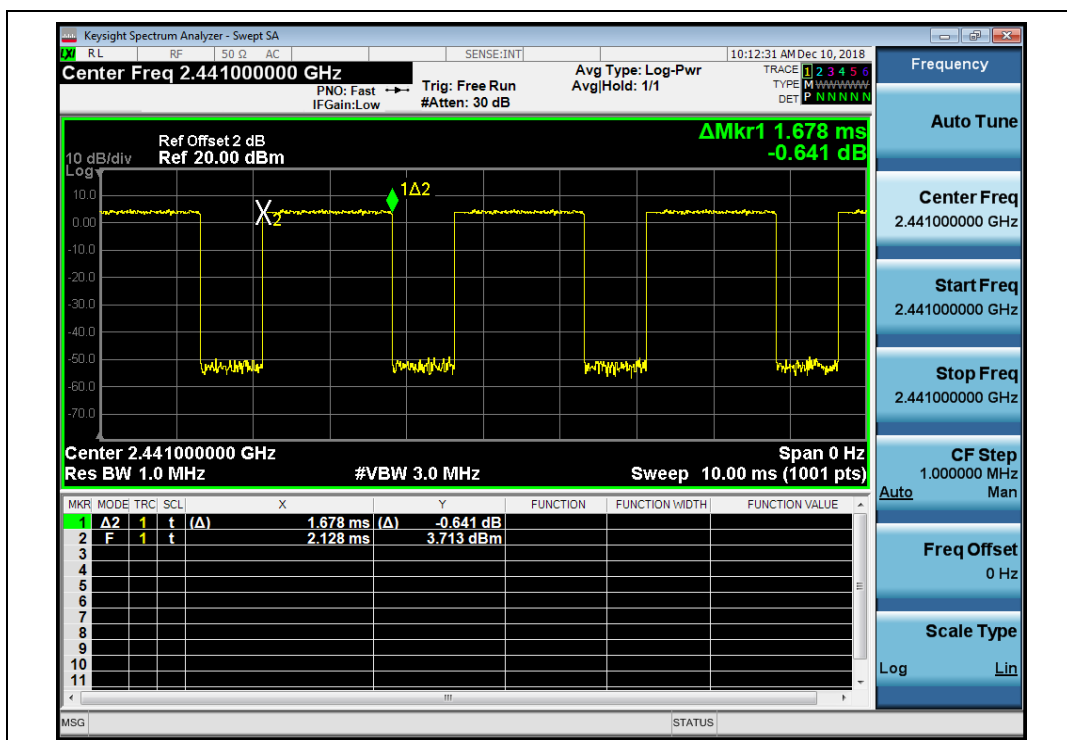
(3DH1_2441M, 8-DQPSK)



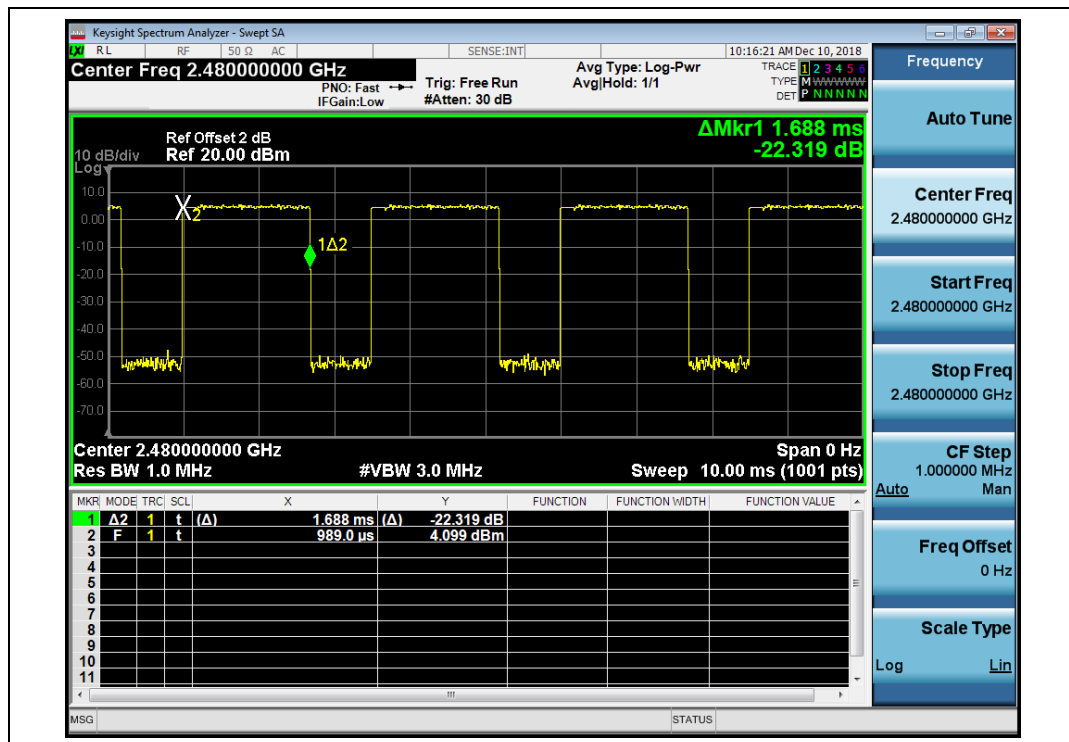
(3DH1_2480M, 8-DQPSK)



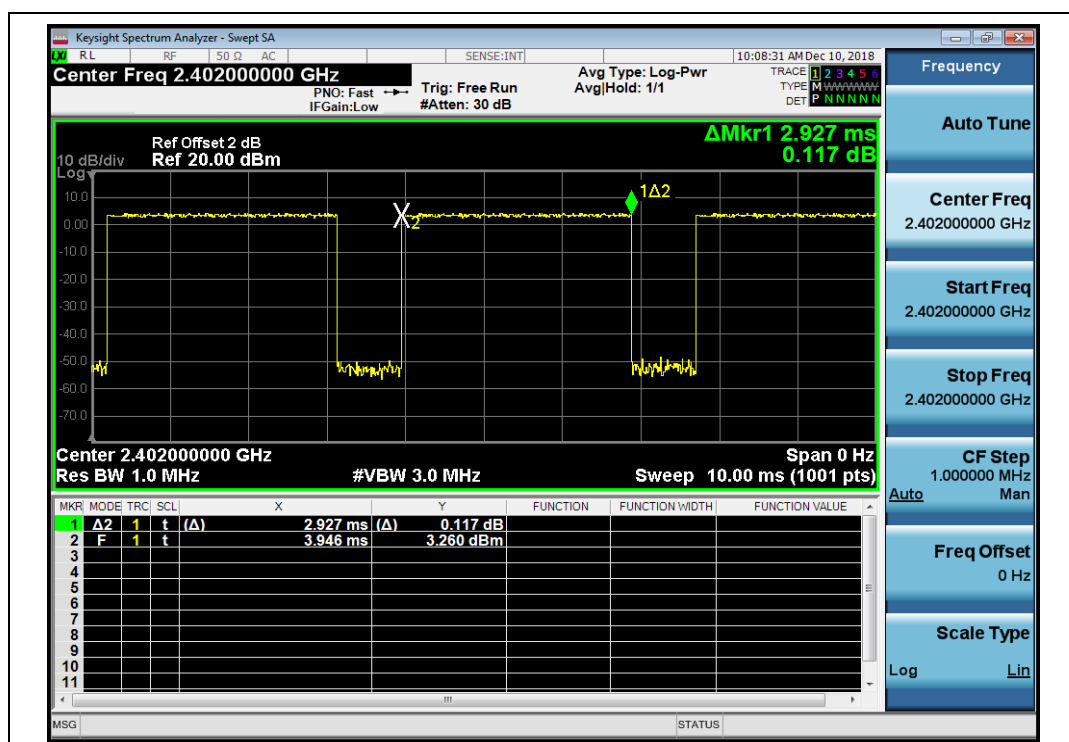
(3DH3_2402M, 8-DQPSK)



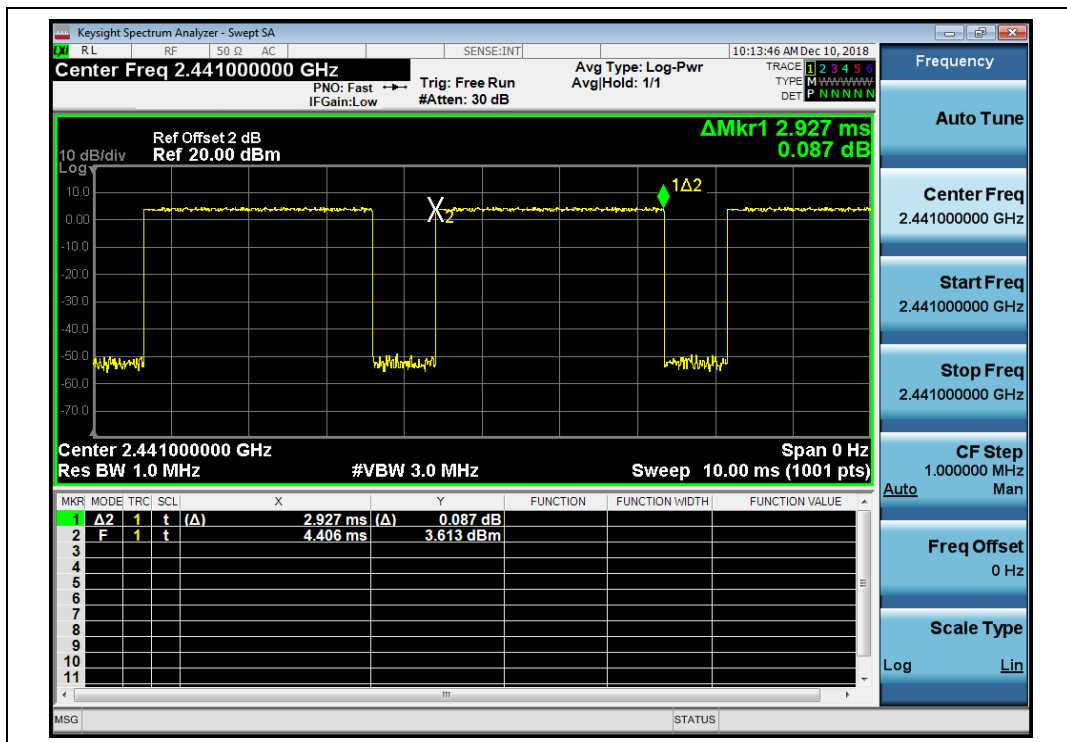
(3DH3_2441M, 8-DQPSK)



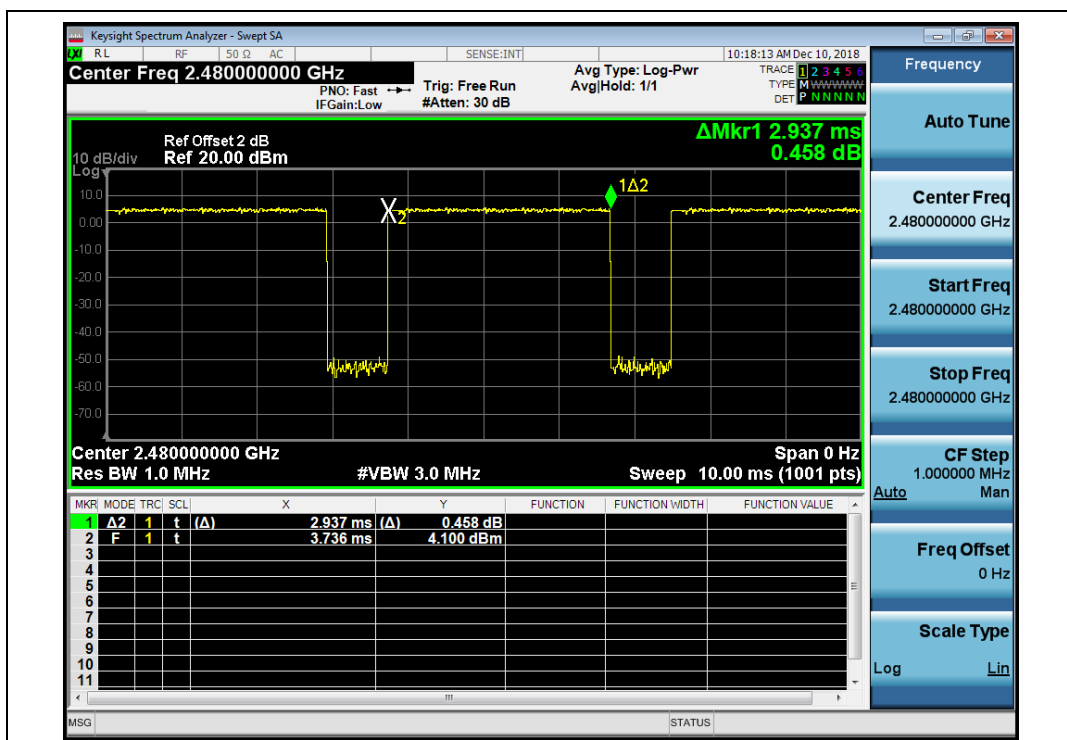
(3DH3_2480M, 8-DQPSK)



(3DH5_2402M, 8-DQPSK)



(3DH5_2441M, 8-DQPSK)



(3DH5_2480M, 8-DQPSK)

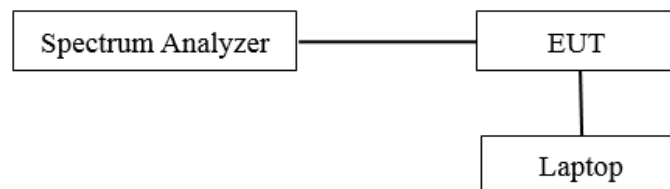
2.7. Conducted Spurious Emissions and Band Edge

2.7.1. Requirement

According to FCC §15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

2.7.2. Test Description

A. Test Setup:



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

B. Equipments List:

Please refer ANNEX B(4).

2.7.3. Test Result

The Bluetooth Module operates at hopping-off test mode. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.



GFSK Mode

A. Test Verdict:

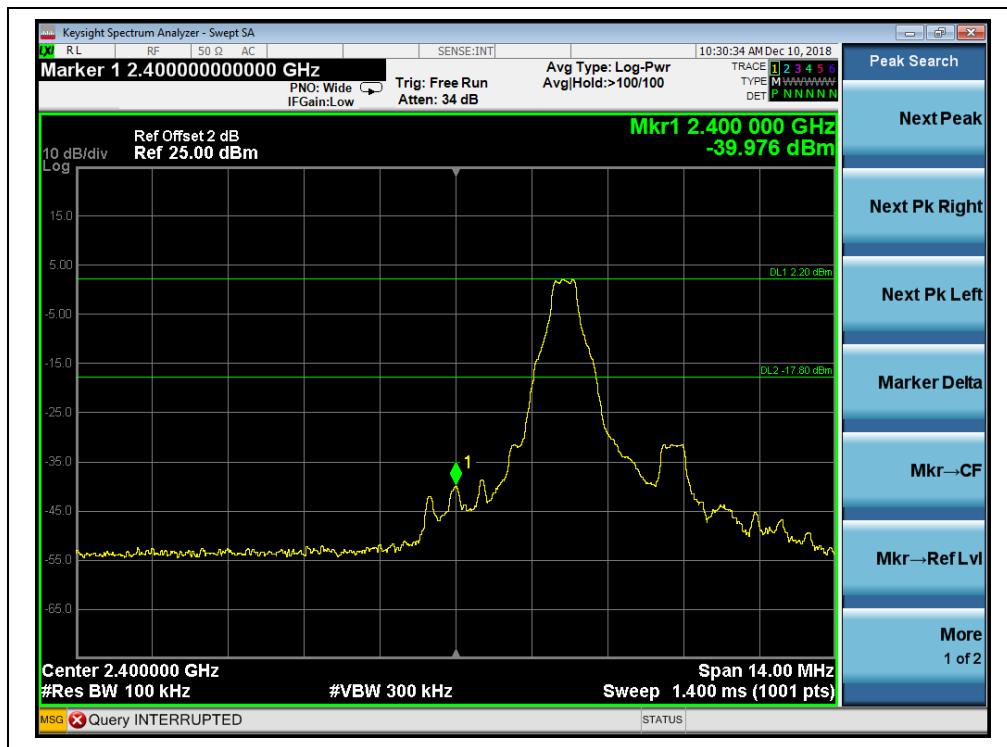
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-38.206	1.5	-18.5	PASS
39	2441	-38.029	2.4	-17.6	PASS
78	2480	-36.147	3	-17	PASS

B. Test Plots:

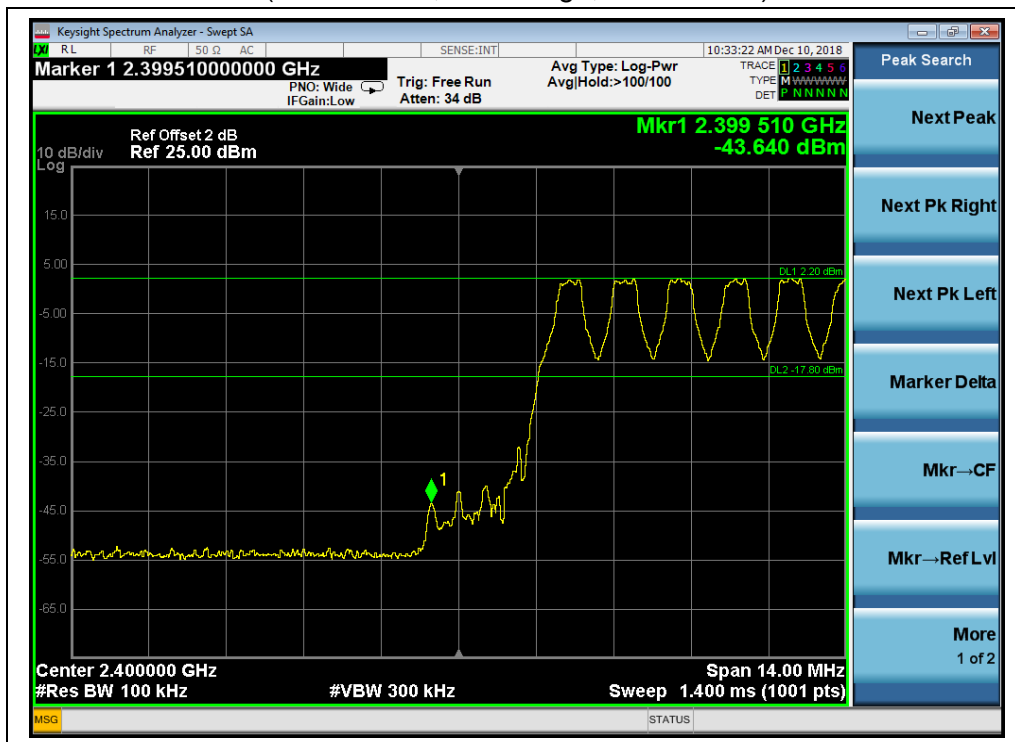
Note: The power of the Module transmitting frequency should be ignored.



(Channel = 0, 30MHz to 25GHz, GFSK Mode)



(Channel = 0, Band edge,GFSK Mode)



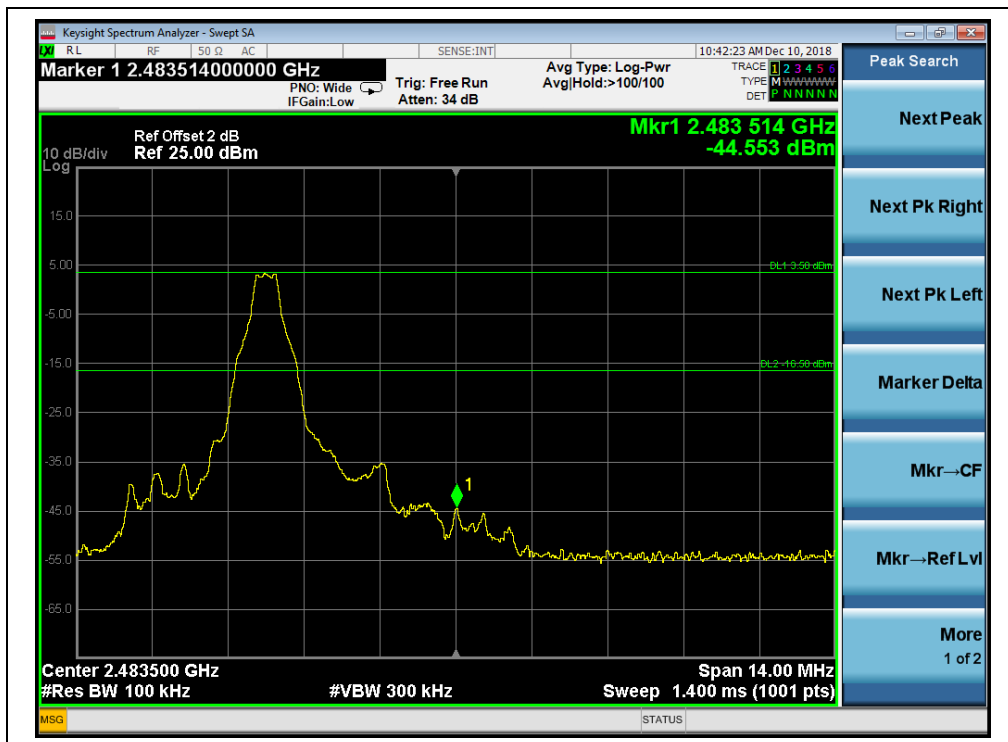
(Channel = 0, Band edge with hopping on, GFSK Mode)



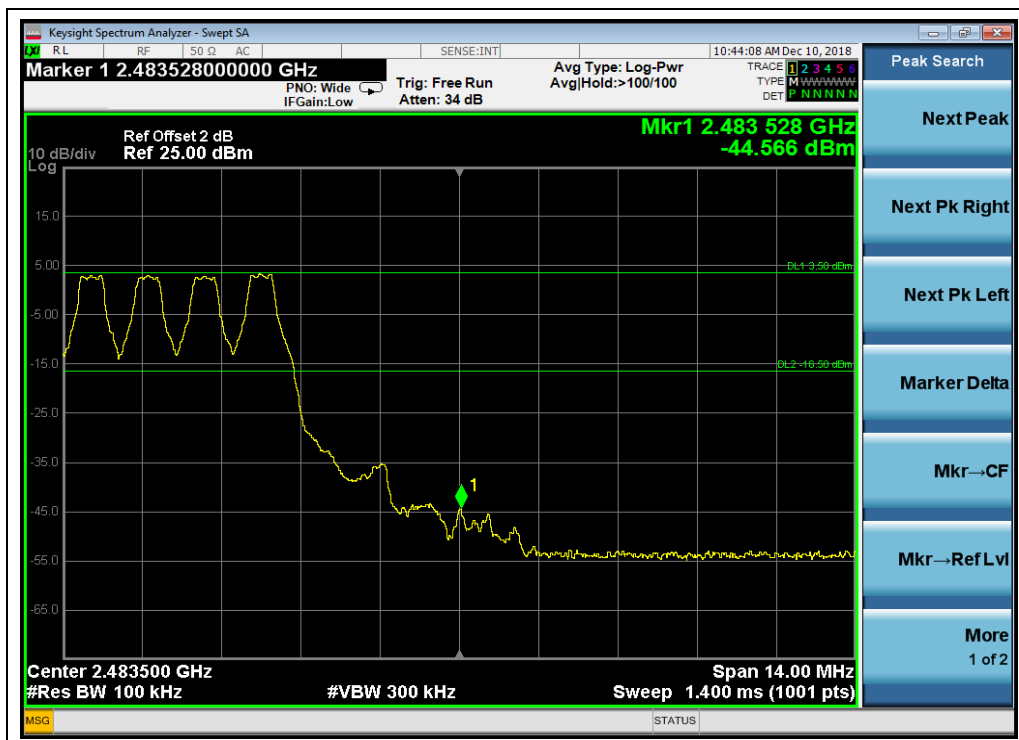
(Channel = 39, 30MHz to 25GHz, GFSK Mode)



(Channel = 78, 30MHz to 25GHz, GFSK Mode)



(Channel = 78, Band edge, GFSK Mode)



(Channel = 78, Band edge with hopping on, GFSK Mode)



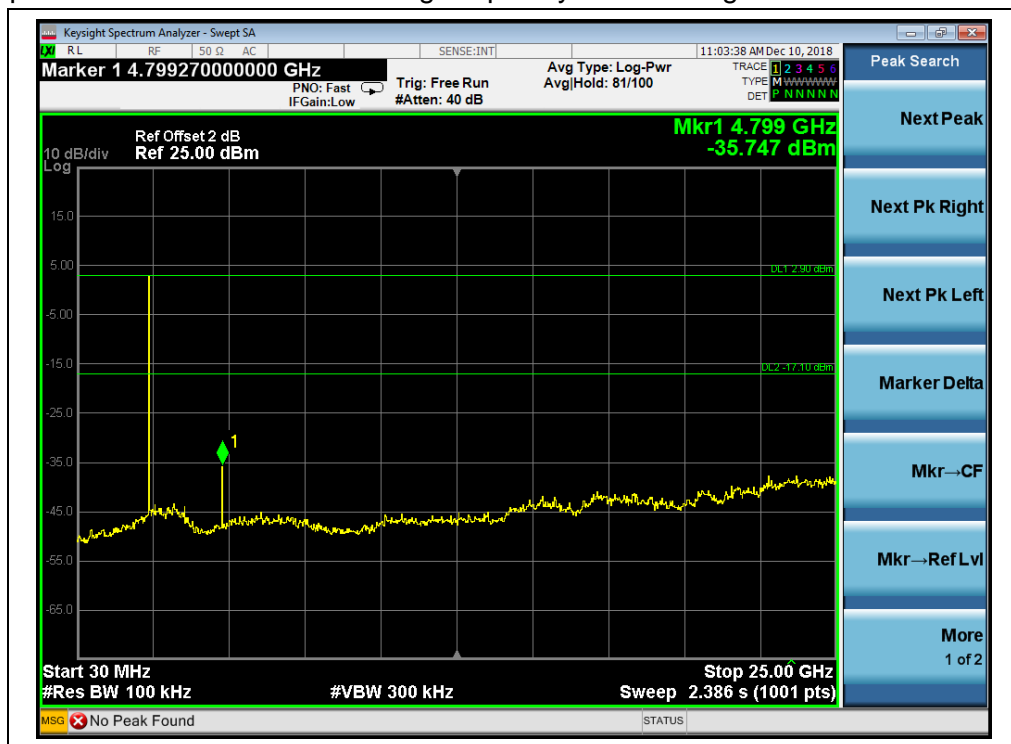
$\pi/4$ -DQPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-35.747	2.9	-17.1	PASS
39	2441	-34.739	3.7	-16.3	PASS
78	2480	-33.868	2.4	-17.6	PASS

B. Test Plots:

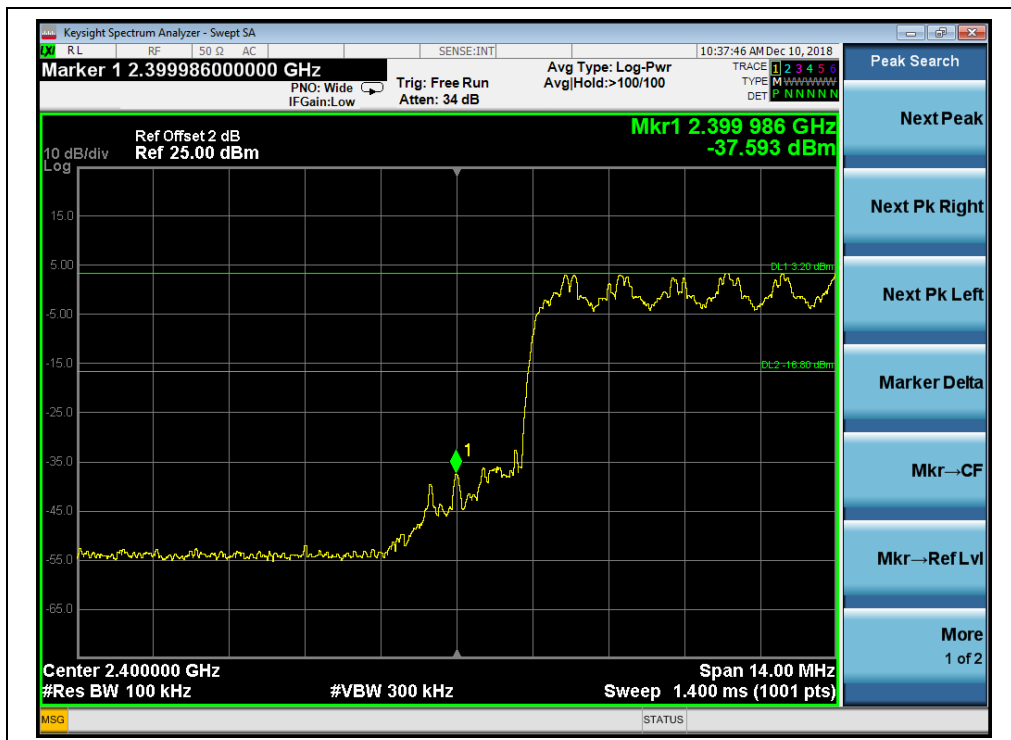
Note: the power of the Module transmitting frequency should be ignored.



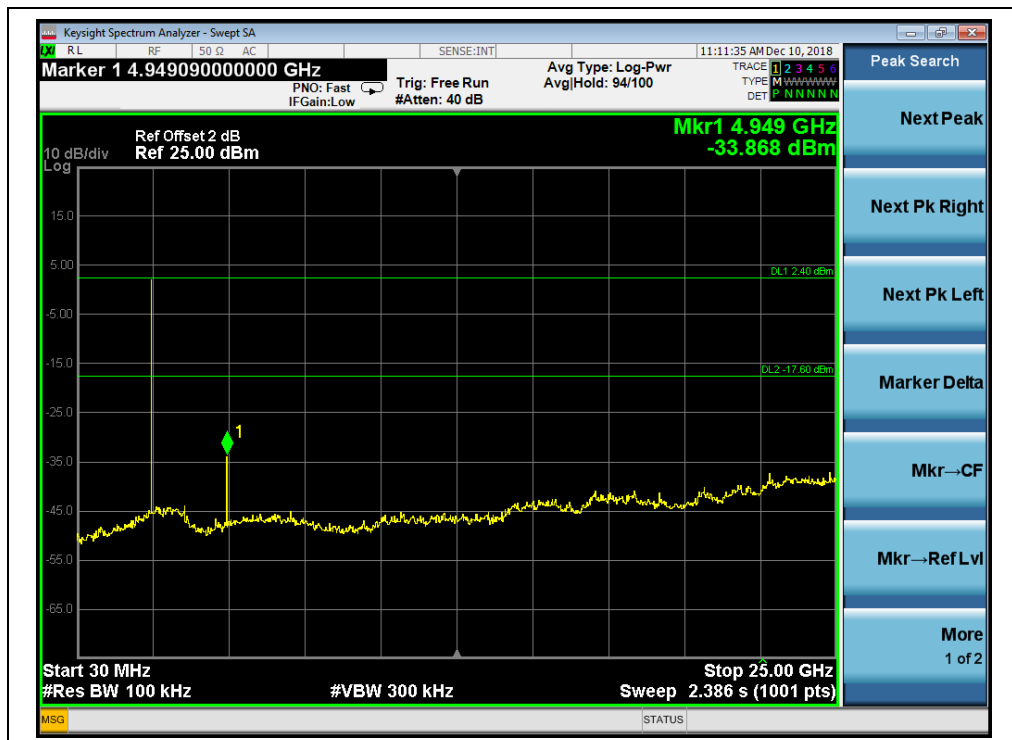
(Channel = 0, 30MHz to 25GHz, $\pi/4$ -DQPSK)

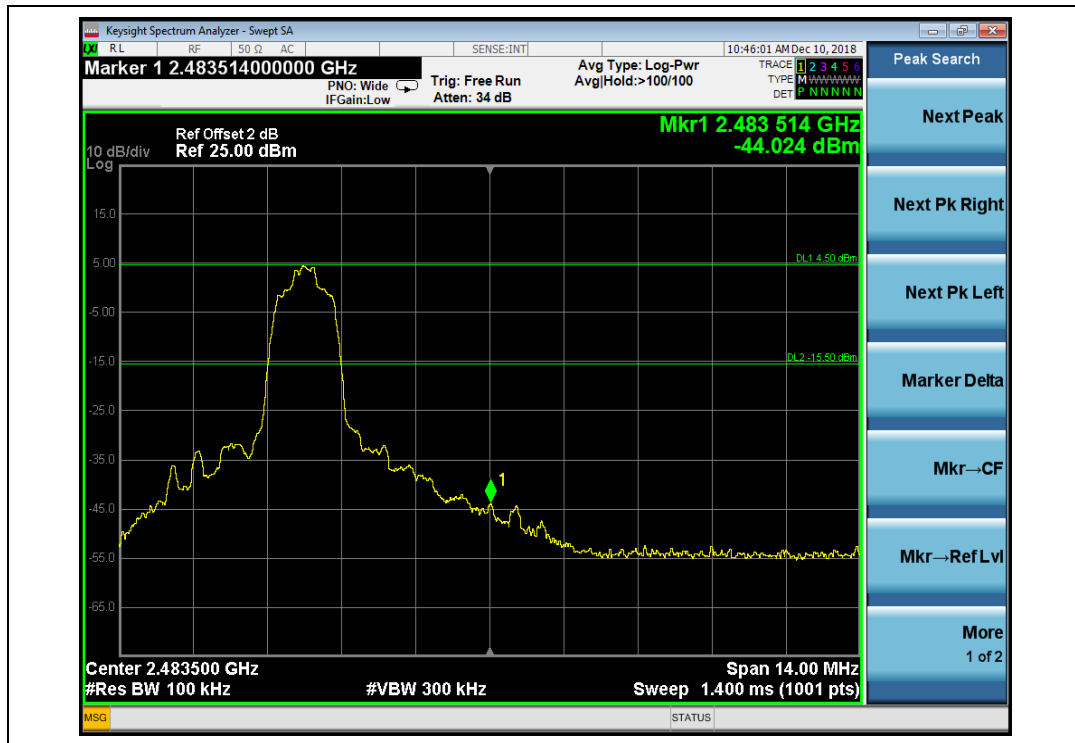
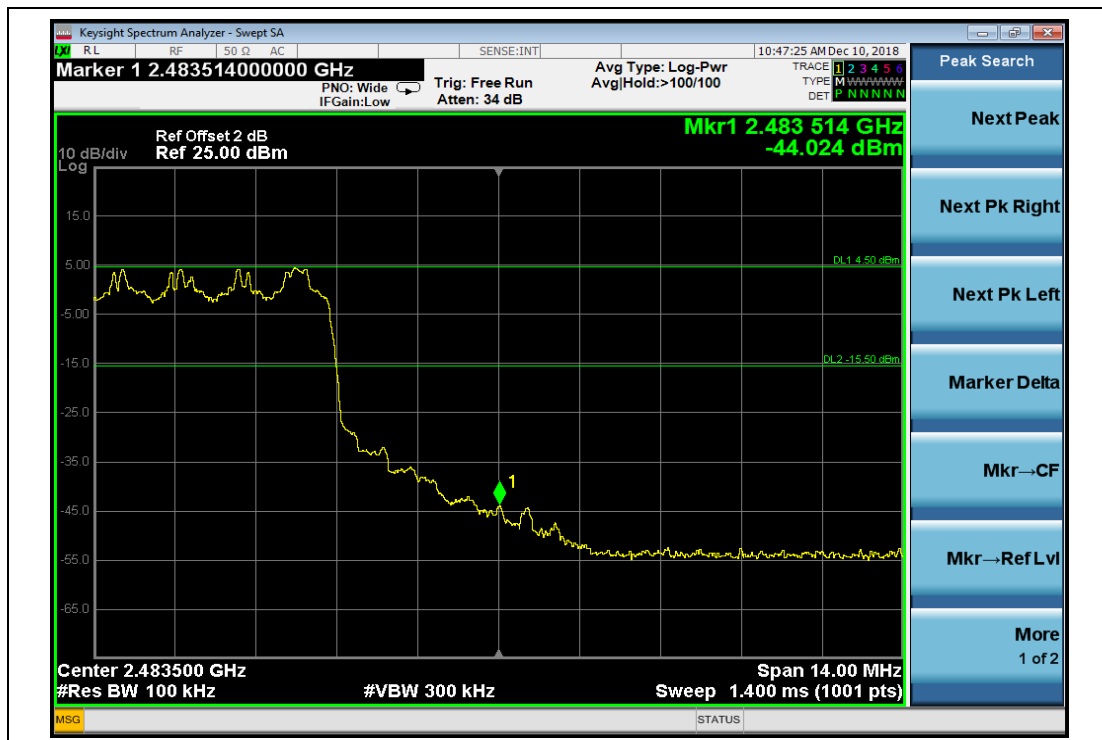


(Channel = 0, Band edge, $\pi/4$ -DQPSK)



(Channel = 0, Band edge with hopping on, $\pi/4$ -DQPSK)

(Channel = 39, 30MHz to 25GHz, $\pi/4$ -DQPSK)(Channel = 78, 30MHz to 25GHz, $\pi/4$ -DQPSK)


(Channel = 78, Band edge, $\pi/4$ -DQPSK)

(Channel = 78, Band edge with hopping on, $\pi/4$ -DQPSK)

**8-DPSK Mode****A. Test Verdict:**

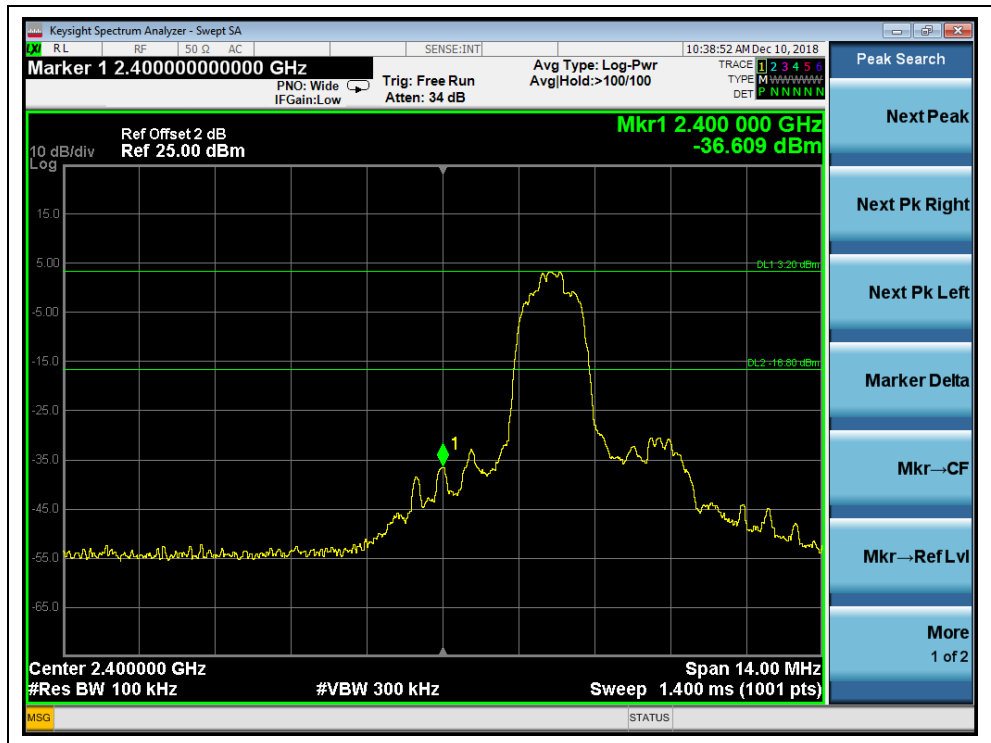
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-39.277	2.9	-17.1	PASS
39	2441	-37.215	3	-17	PASS
78	2480	-38.405	2.9	-17.1	PASS

B. Test Plots:

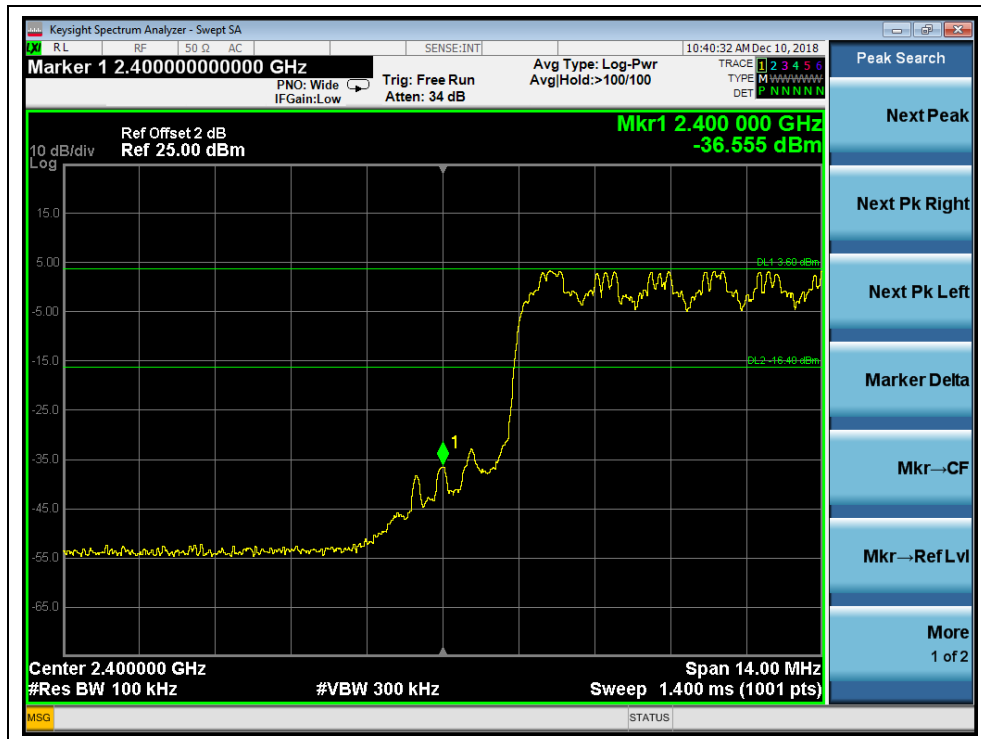
Note: the power of the Module transmitting frequency should be ignored.



(Channel = 0, 30MHz to 25GHz, 8-DPSK)



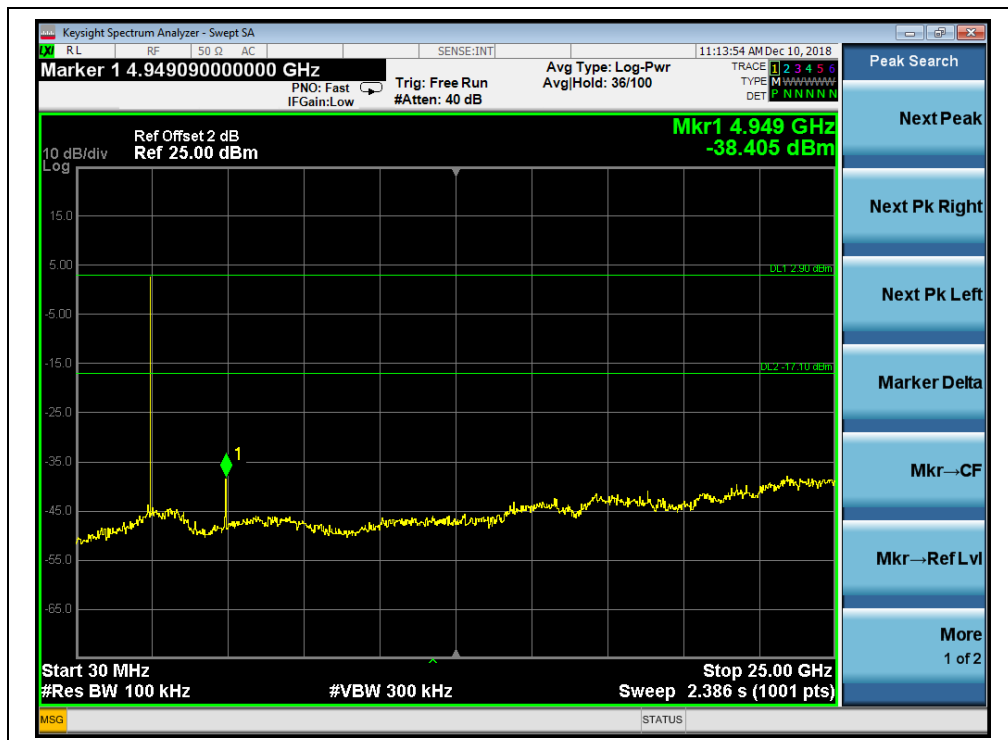
(Channel = 0, Band edge, 8-DPSK)



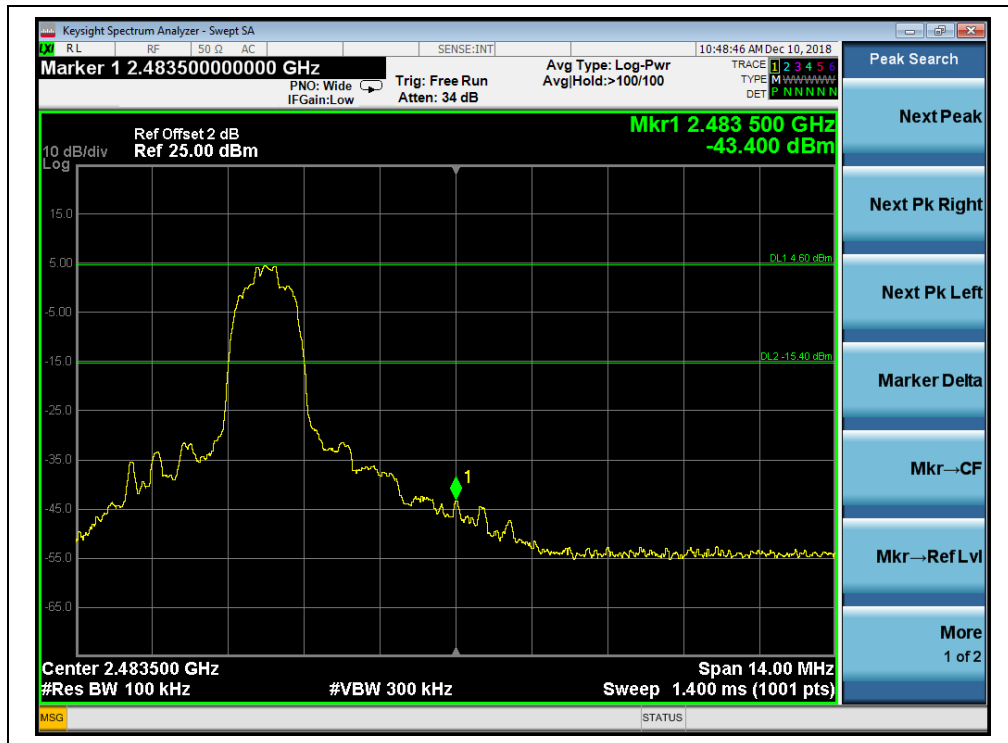
(Channel = 0, Band edge with hopping on, 8-DPSK)



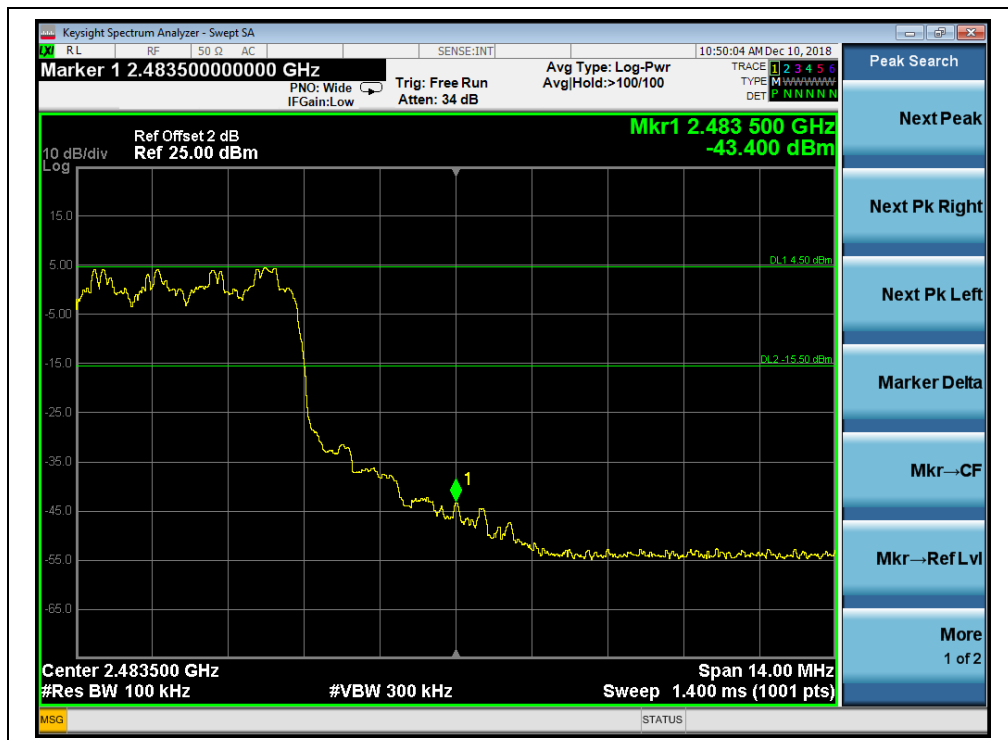
(Channel = 39, 30MHz to 25GHz, 8-DPSK)



(Channel = 78, 30MHz to 25GH, 8-DPSK)



(Channel = 78, Band edge, 8-DPSK)



(Channel = 78, Band edge with hopping on, 8-DPSK)