REPORT No.: SZ17090159W01

FCC RF TEST REPORT

APPLICANT	:	SOWAK INTERNATIONAL CO.,LTD
PRODUCT NAME	:	Bluetooth earphone
MODEL NAME	:	W1,W2,W3,W4,W5,W6,W7,W8,W9,W10
TRADE NAME	:	sowak
BRAND NAME	:	sowak
FCC ID	:	2ANS6SOWAK-W
STANDARD(S)	:	47 CFR Part 15 Subpart C
ISSUE DATE	:	2017-10-14

SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd.

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Change History		
Issue	Date	Reason for change
1.0	2017-10-14	First edition

TEST REPORT DECLARATION

Applicant	SOWAK INTERNATIONAL CO.,LTD
Applicant Address	NO,16 Renmin Dong Road Kengzi Sub-Distric Pingshan District Shenzhen Guangdong China
Manufacturer	SHENZHEN SOWAK ELECTRONIC CO,LTD
Manufacturer Address	NO,16 RENMIN DONG ROAD KENGZI SUB-DISTRICT PINGSHAN DISTRICT SHENZHEN CITY,GUANGDONG PROVINCE
Product Name	Bluetooth earphone
Model Name	W1,W2,W3,W4,W5,W6,W7,W8,W9,W10
Brand Name	sowak
HW Version	W8-IS2021
SW Version	W8-IS2021
Test Standards	47 CFR Part 15 Subpart C
Test Date	2017-09-27 to 2017-10-13
Test Result	PASS

Tested by : Li Jingzong

Li Jingzong (Test Engineer)

Approved by : Andy Yeh

Andy Yeh (Technical Director)

1. TECHNICAL INFORMATION

Note: Provide by applicant.

1.1 Applicant Information

Company:	SOWAK INTERNATIONAL CO.,LTD
Address:	NO,16 Renmin Dong Road Kengzi Sub-Distric Pingshan District Shenzhen Guangdong China

1.2 Equipment under Test (EUT) Description

Brand Name:	sowak
Trade Name:	sowak
Model Name:	W1,W2,W3,W4,W5,W6,W7,W8,W9,W10
Frequency Range:	The frequency range used is 2402MHz – 2480MHz (79 channels, at intervals of 1MHz); The frequency block is 2400MHz to 2483.5MHz.
Modulation Type:	Bluetooth: FHSS (GFSK(1Mbps), π/4-DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps))
Bluetooth Version:	Bluetooth 4.1 + EDR
Antenna Type:	Ceramic Antenna
Antenna Gain:	6.62 dBi

NOTE 1: The EUT is a Bluetooth earphone. It contains Bluetooth Module operating at 2.4GHz ISM band; the frequencies allocated for the Bluetooth Module is F(MHz)=2402+1*n (0<=n<=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: According to the designer, the model W1and model W2,W3,W4,W5,W6,W7,W8,W9,W10 are accordant in both hardware and software. These models only differ in application information. The detail difference for W2,W3,W4,W5,W6,W7,W8,W9,W10 application is as below:

1. The new additional model name is W2,W3,W4,W5,W6,W7,W8,W9,W10
2. The new brand name is sowak.

The application information of W1 is indentify except mentioned above.

NOTE 3: 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, and then use MT8852B base station to control the EUT continuous transmission.

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

1.2.1 Identification of all used EUTs

The EUT identity consists of numerical and letter characters, the letter character indicates the test sample, and the following two numerical characters indicate the software version of the test sample.

EUT Identity	Hardware Version	Software Version
01	W8-IS2021-V1.0	W8-IS2021-V1.0

1.3 Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C (Bluetooth, 2.4GHz ISM band radiators) 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	Result
1	15.203	Antenna Requirement	N/A	**PASS**
2	15.247(a)	Number of Hopping Frequency	Sep 27, 2017	**PASS**
3	15.247(b)	Peak Output Power	Sep 27, 2017	**PASS**
4	15.247(a)	20dB Bandwidth	Sep 27, 2017	**PASS**
5	15.247(a)	Carrier Frequency Separation	Sep 27, 2017	**PASS**
6	15.247(a)	Time of Occupancy (Dwell time)	Sep 27, 2017	**PASS**
7	15.247(d)	Conducted Spurious Emission	Sep 27, 2017	**PASS**
8	15.247(d)	Restricted Frequency Bands	Oct 13, 2017	**PASS**
9	15.209 15.247(d)	Radiated Emission	Oct 13, 2017	**PASS**
10	15.207	Conducted Emission	Oct 13, 2017	**PASS**

NOTE: The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013.

1.3.1 Test Environment 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.

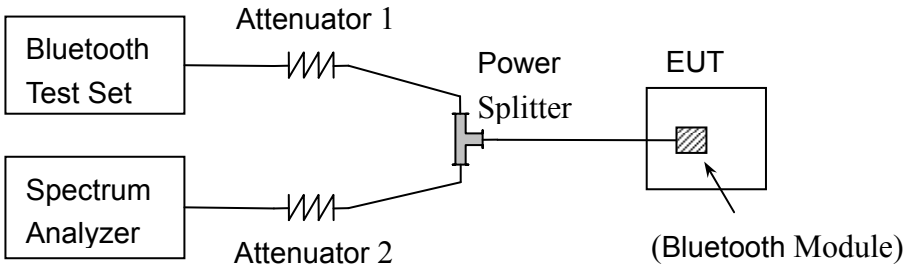
2.2 Number of Hopping Frequency

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 Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Test Set with Attenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the SS, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Please reference ANNEX A(1.5).

2.2.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = the frequency band of operation

RBW ≥ 1% of the span

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

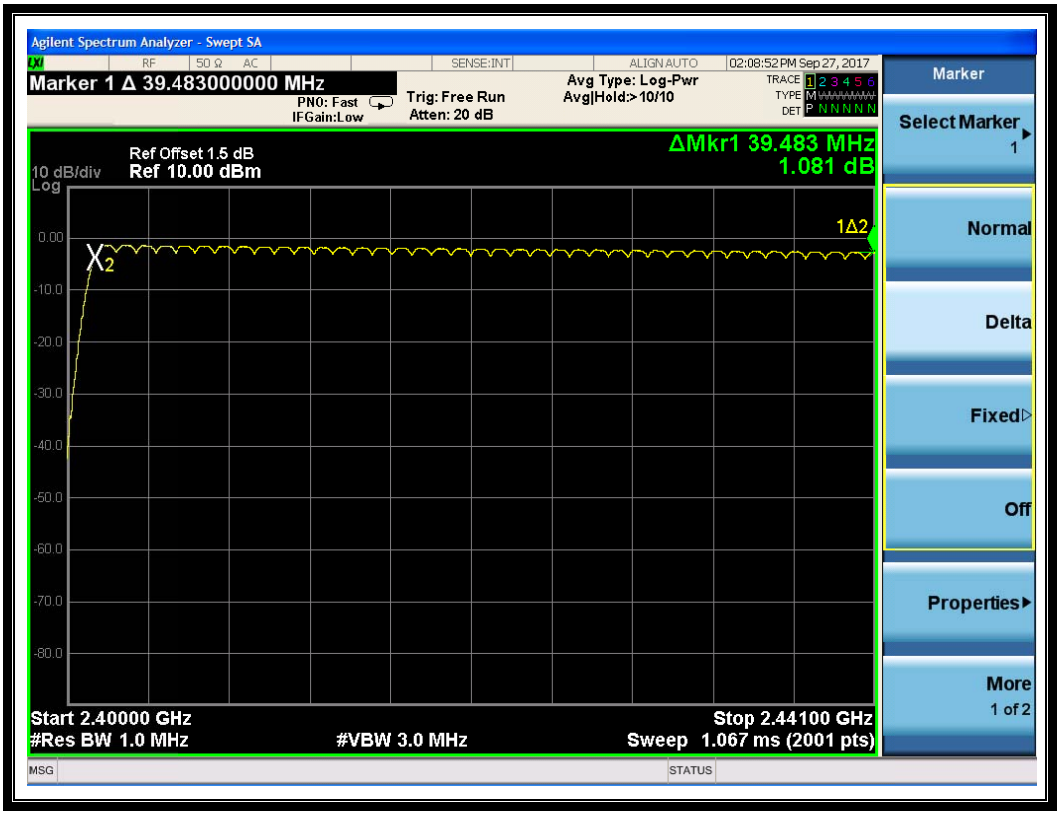
2.2.4 Test Result

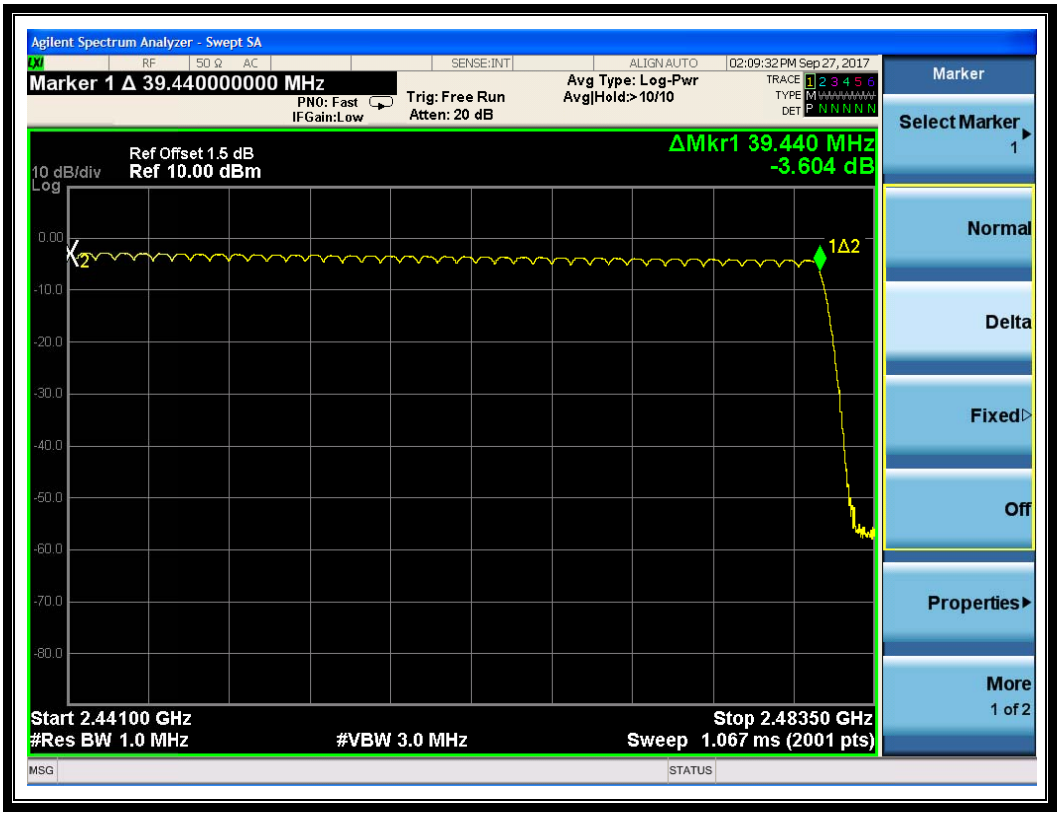
The Bluetooth Module operates at hopping-on test mode; the frequencies number employed is counted to verify the Module's using the number of hopping frequency.

A. Test Verdict:

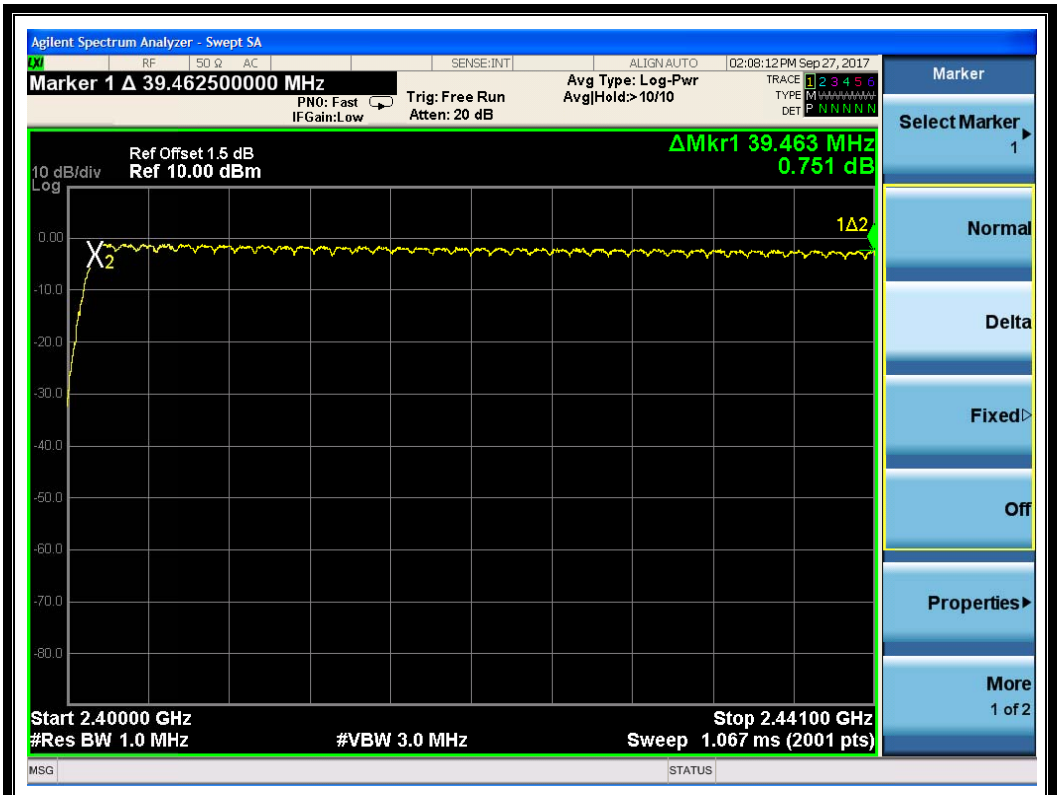
Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Refer to Plot	Verdict
GFSK	2400 - 2483.5	79	15	Plot A	PASS
π/4-DQPSK	2400 - 2483.5	79	15	Plot B	PASS
8-DPSK	2400 - 2483.5	79	15	Plot C	PASS

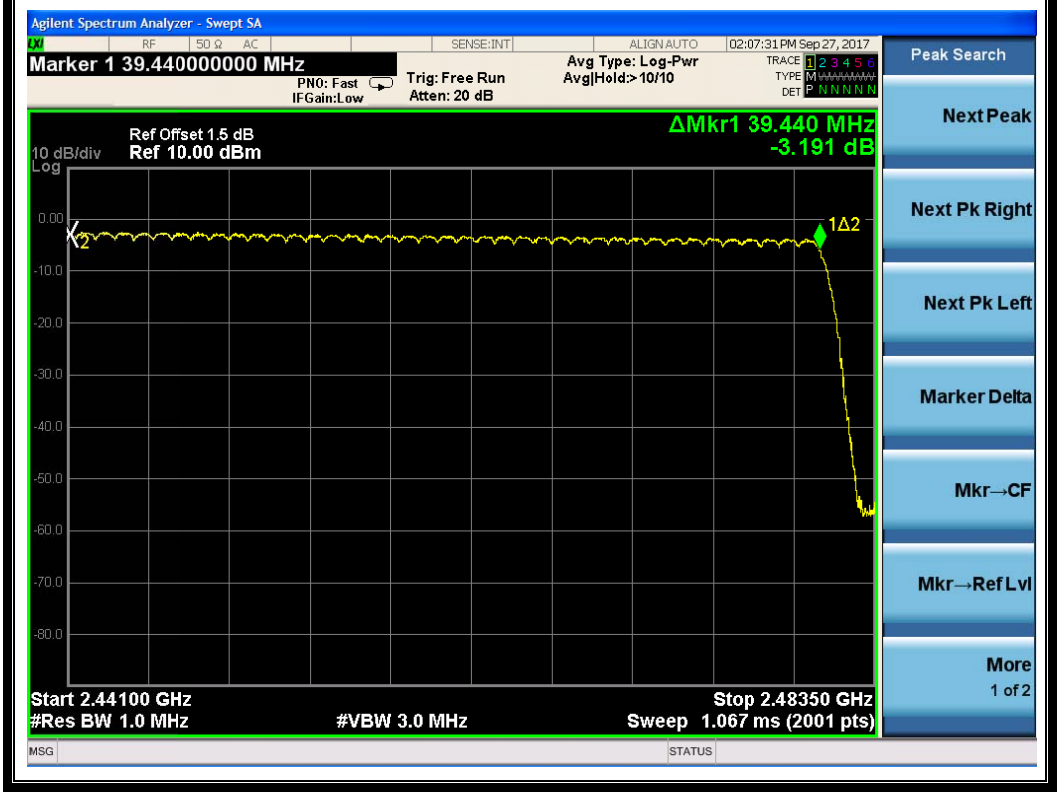
B. Test Plots:



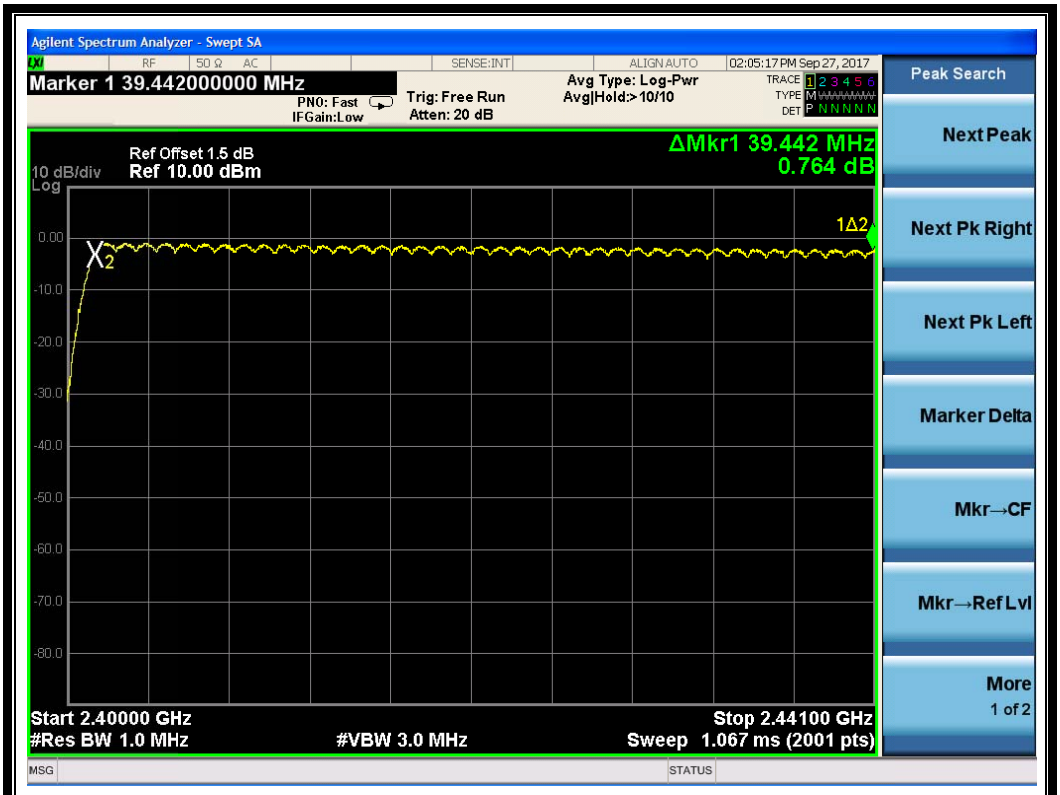

Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 39.440000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
02:09:32 PM Sep 27, 2017
Ref Offset 1.5 dB
10 dB/div
Log
Ref 10.00 dBm
ΔMkr1 39.440 MHz
-3.604 dB
1Δ2
Start 2.44100 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 2.48350 GHz
Sweep 1.067 ms (2001 pts)
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2

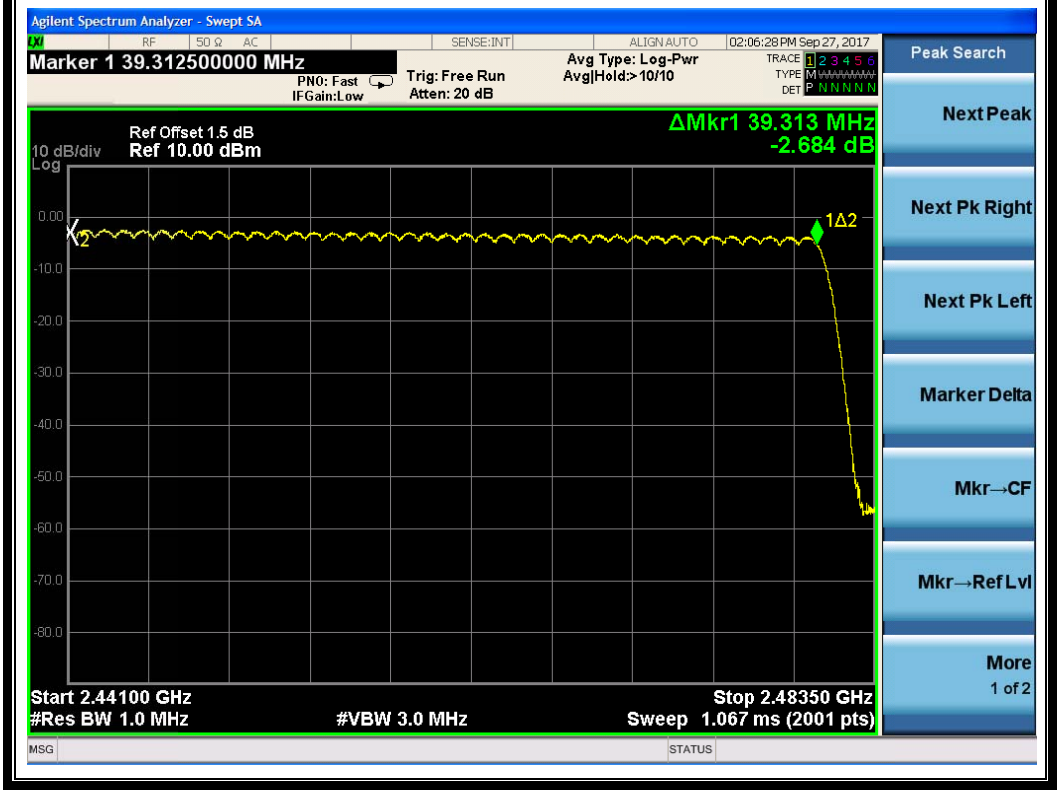
(Plot A: GFSK)





(Plot B: π/4-DQPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 39.442000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
02:05:17 PM Sep 27, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 39.442 MHz
0.764 dB
Start 2.40000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 2.44100 GHz
Sweep 1.067 ms (2001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Agilent Spectrum Analyzer - Swept SA
Marker 1 39.312500000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
02:06:28 PM Sep 27, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 39.313 MHz
-2.684 dB
Start 2.44100 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 2.48350 GHz
Sweep 1.067 ms (2001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

(Plot C: 8- DPSK)

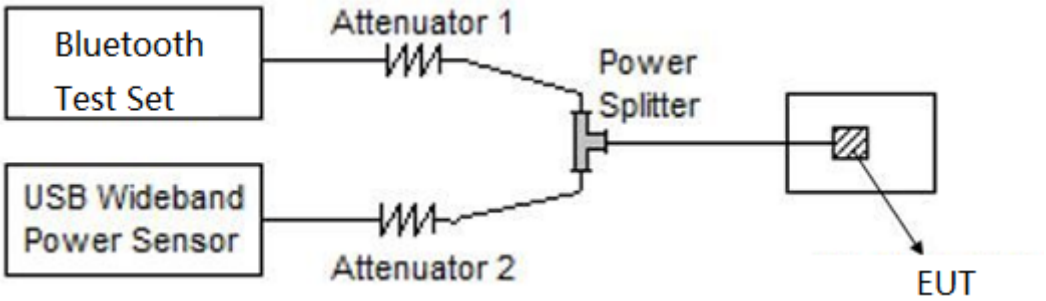
2.3 Peak Output Power

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 Bluetooth Module of the EUT is coupled to the USB Wideband Power Sensor and the Bluetooth Test Set with Attenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the SS, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Please reference ANNEX A(1.5).

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. The lowest, middle and highest channel were tested by USB Wideband Power Sensor.

2.3.3.1 GFSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	-1.34	0.00073	30	1	PASS
39	2441	-2.46	0.00057			PASS
78	2480	-4.00	0.00040			PASS

2.3.3.2 π/4-DQPSK Mode

B. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	-0.70	0.00085	20.97	0.125	PASS
39	2441	-2.08	0.00062			PASS
78	2480	-3.50	0.00045			PASS

2.3.3.3 8-DPSK Mode

C. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	-0.32	0.00093	20.97	0.125	PASS
39	2441	-1.69	0.00068			PASS
78	2480	-3.11	0.00049			PASS

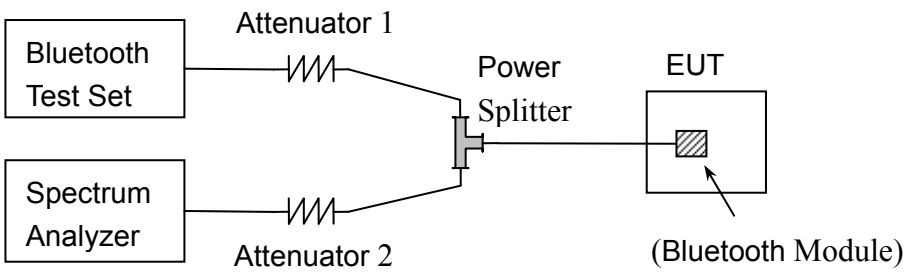
2.4 20dB Bandwidth

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*log1% = 20dB) taking the total RF output power.

2.4.2 Test Description

A. Test Setup:



The Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Test Set with Attenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the SS, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Please reference ANNEX A(1.5).

2.4.3 Test Procedure

Use the following spectrum analyzer settings:
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥ 1% of the 20 dB bandwidth
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

2.4.4 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.

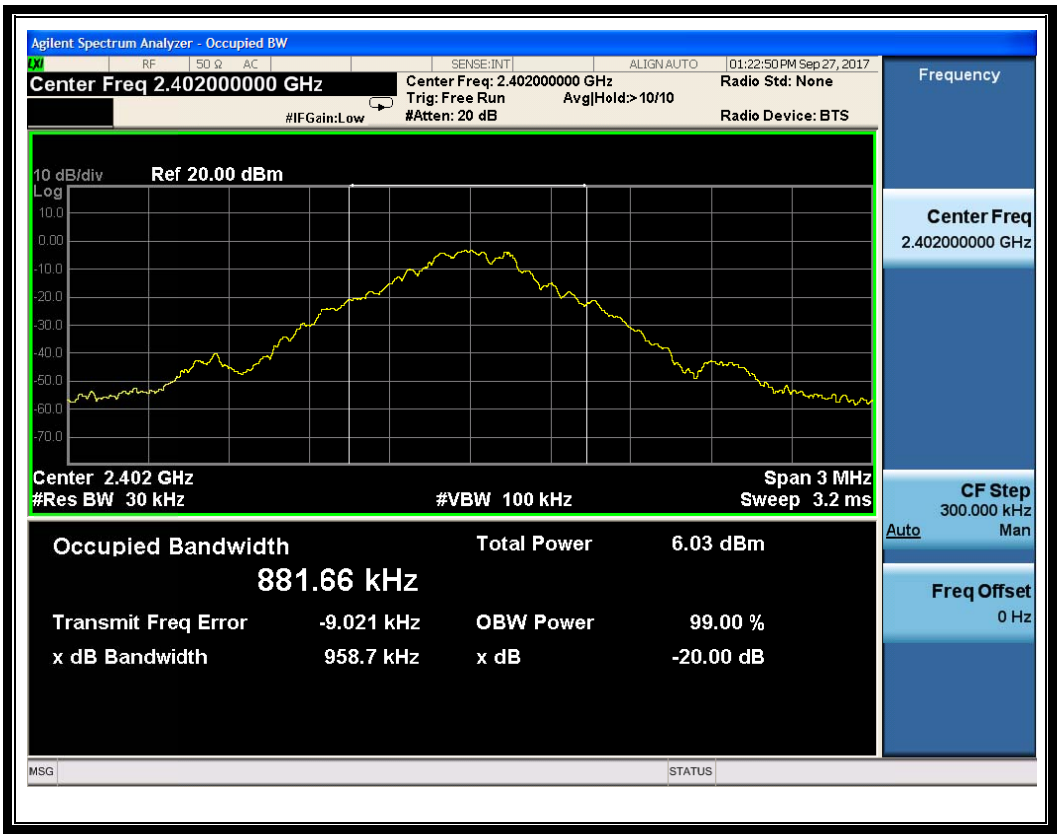
2.4.4.1 GFSK Mode

A. Test Verdict:

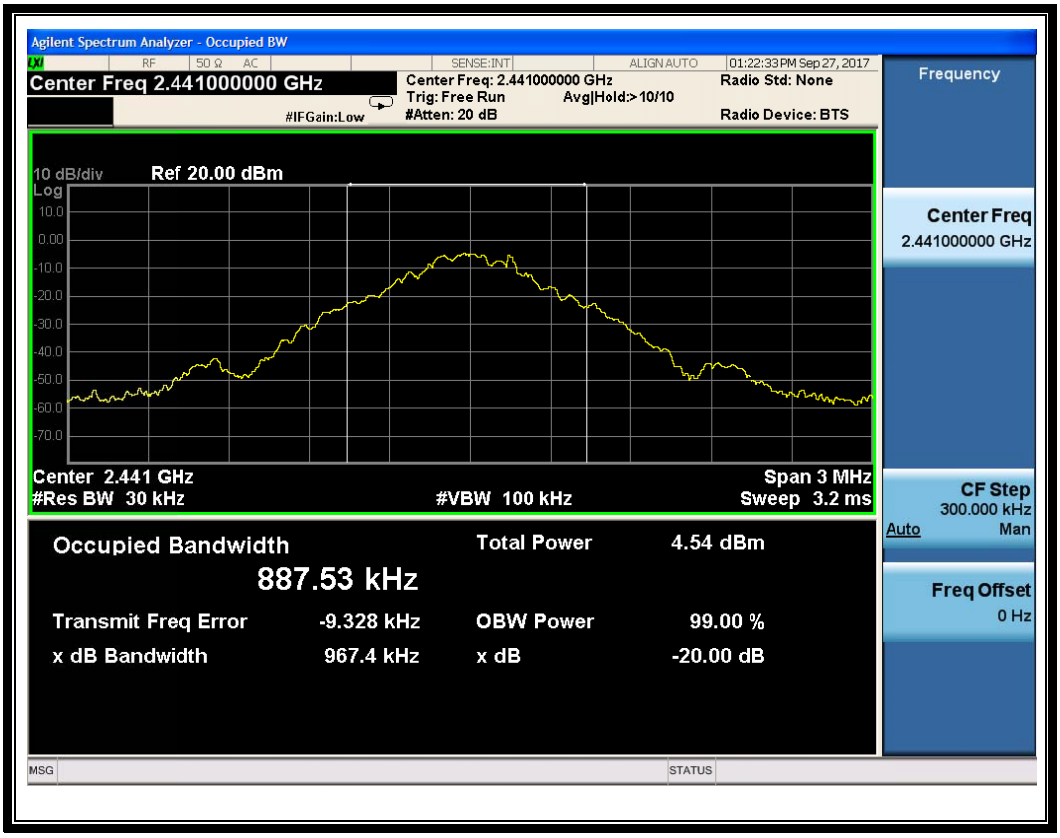
The maximum 20dB bandwidth measured is 0.9773 MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	0.9587	Plot A
39	2441	0.9674	Plot B
78	2480	0.9773	Plot C

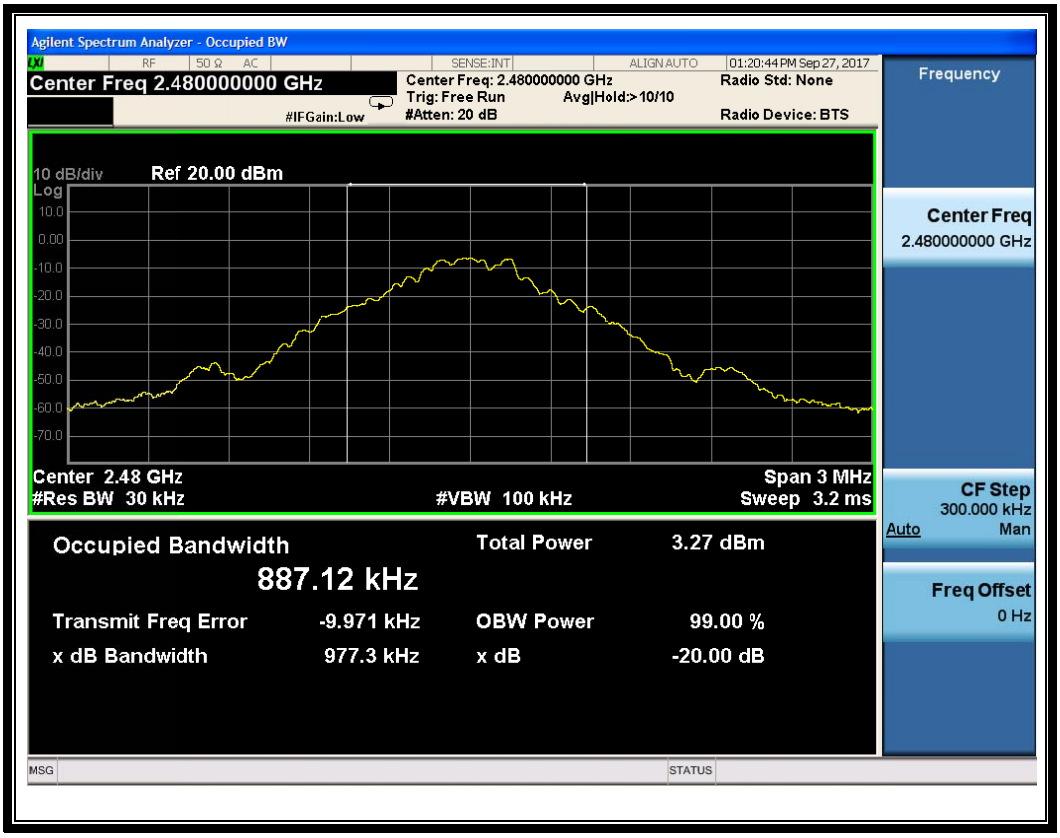
B. Test Plots:



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)

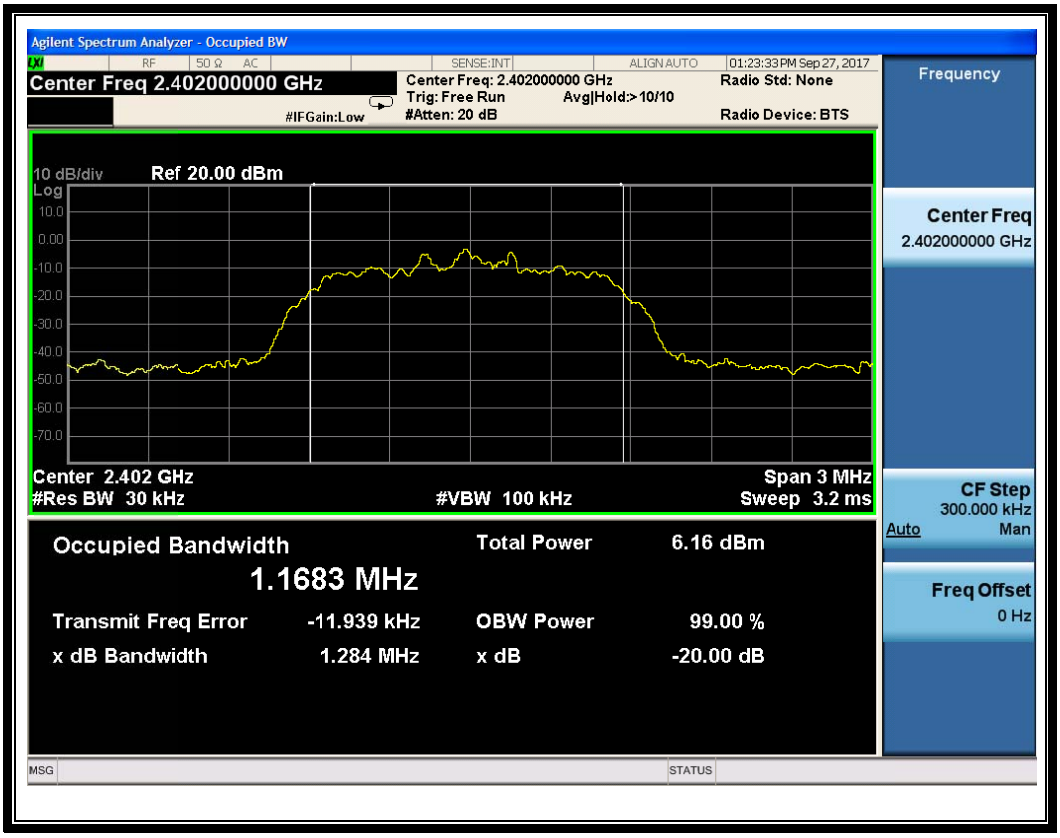
2.4.4.2 π/4-DQPSK Mode

A. Test Verdict:

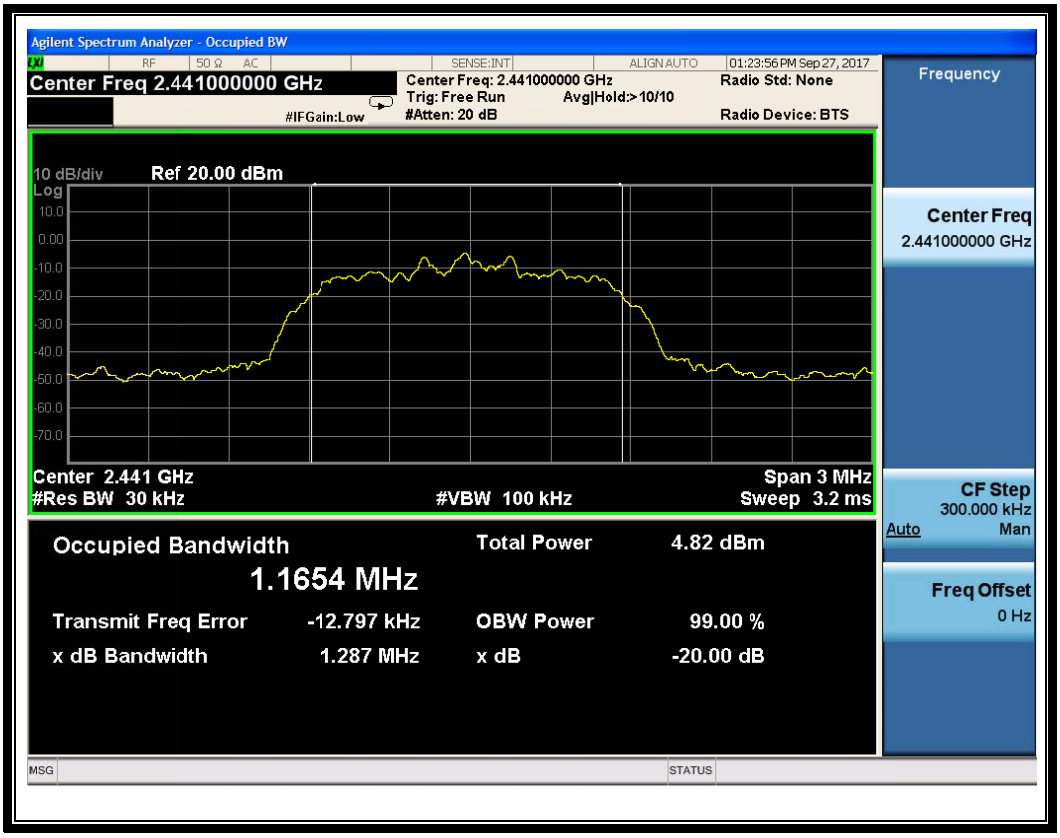
The maximum 20dB bandwidth measured is 1.311 MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.284	Plot D
39	2441	1.287	Plot E
78	2480	1.311	Plot F

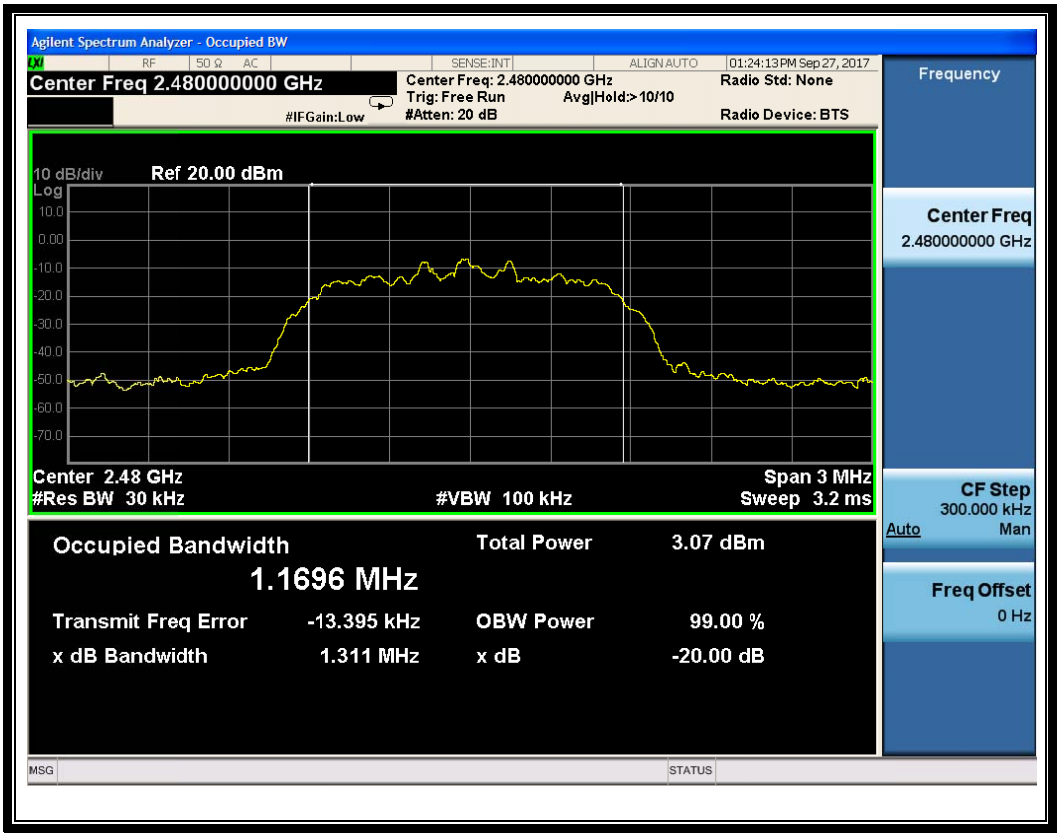
B. Test Plots:



(Plot D: Channel = 2402 @ π/4-DQPSK)



(Plot E: Channel = 2441 @ π/4-DQPSK)



(Plot F: Channel = 2480 @ π/4-DQPSK)

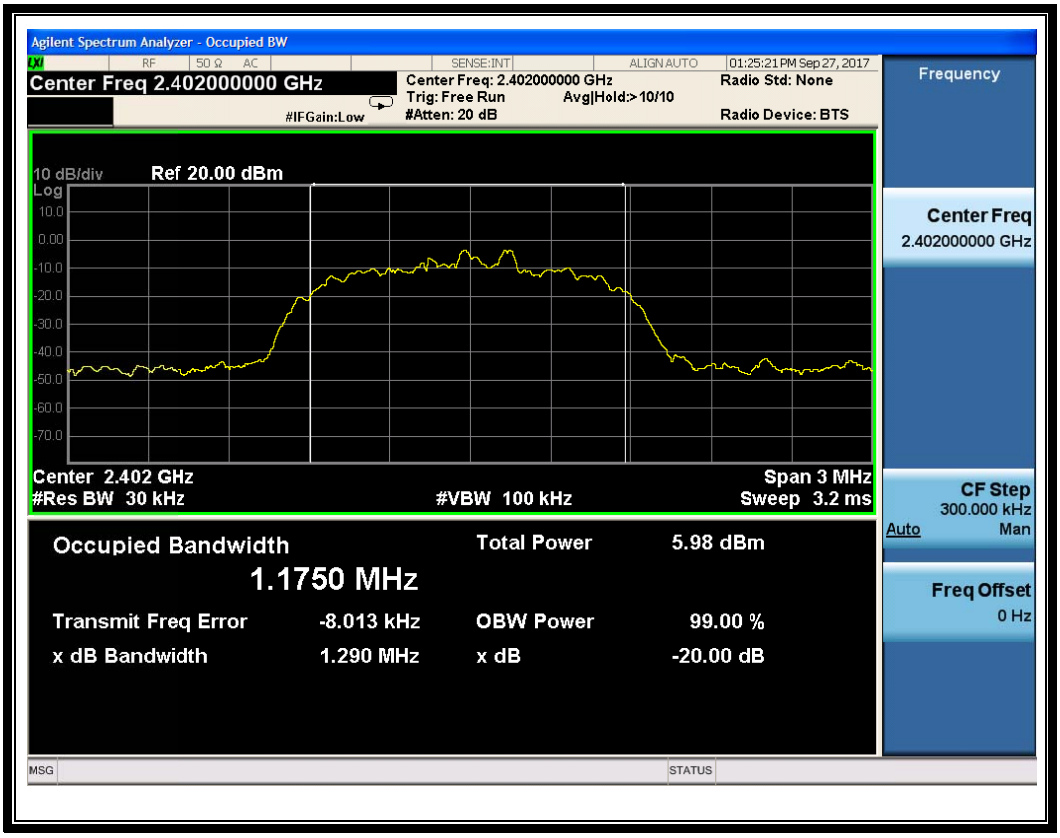
2.4.4.3 8-DPSK Mode

A. Test Verdict:

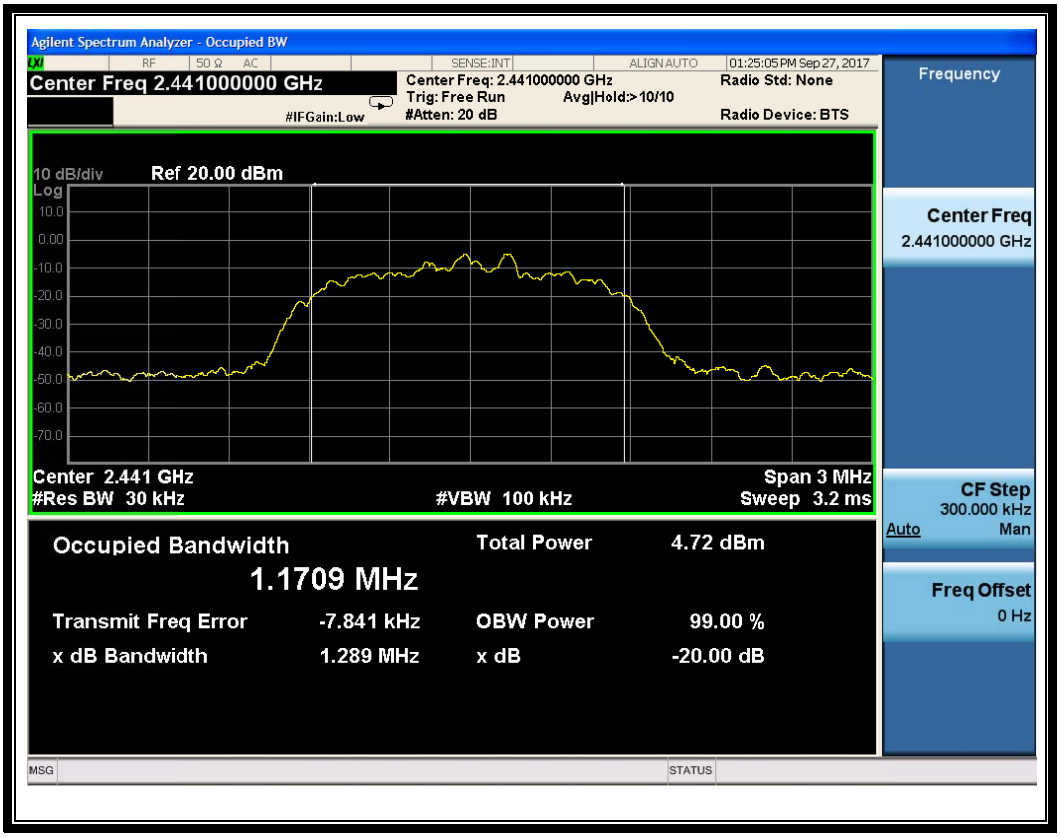
The maximum 20dB bandwidth measured is 1.290 MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.290	Plot G
39	2441	1.289	Plot H
78	2480	1.286	Plot I

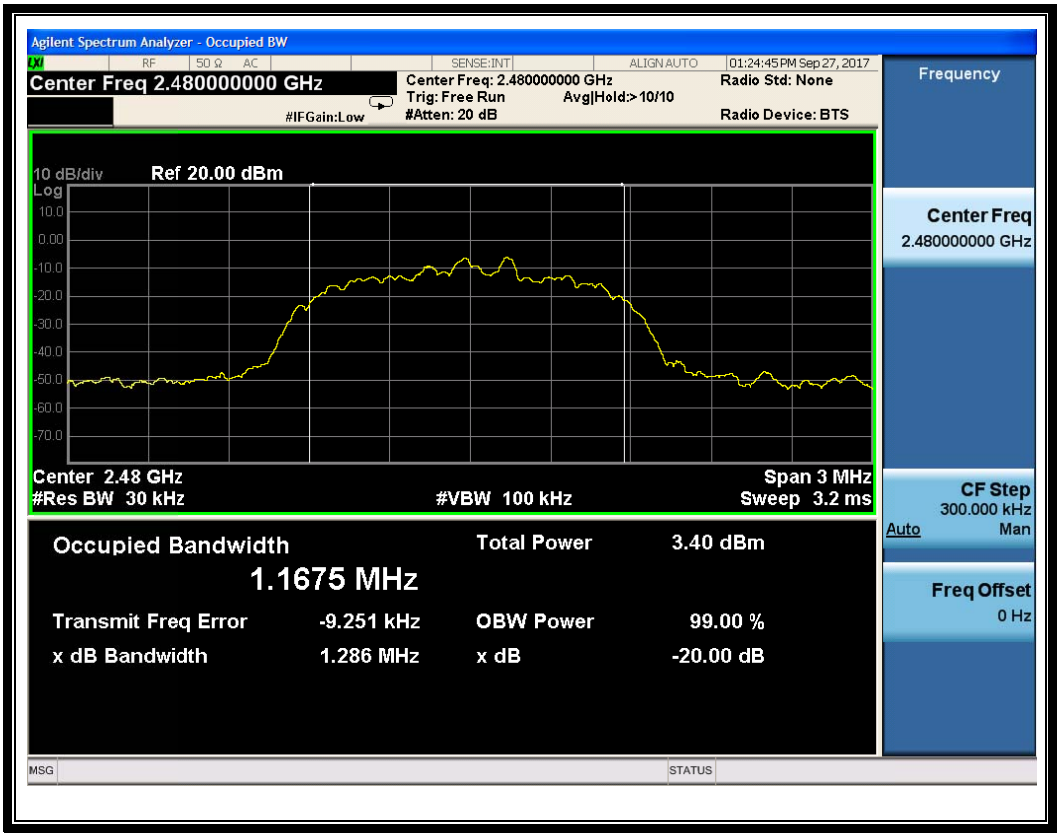
B. Test Plots:



(Plot G: Channel = 2402 @ 8-DPSK)



(Plot H: Channel = 2441 @ 8-DPSK)



(Plot I: Channel = 2480 @ 8-DPSK)

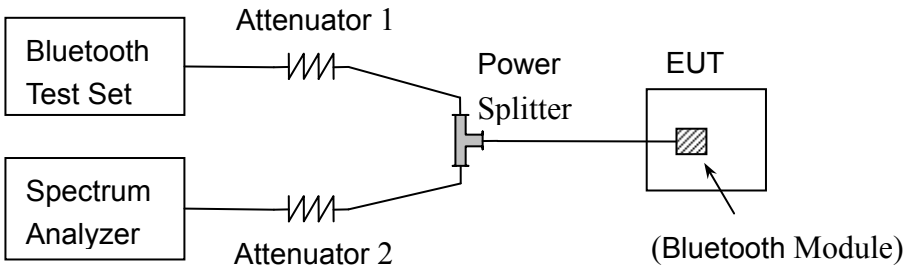
2.5 Carried Frequency Separation

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 Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Test Set with Attenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm;the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the SS, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Please reference ANNEX A(1.5).

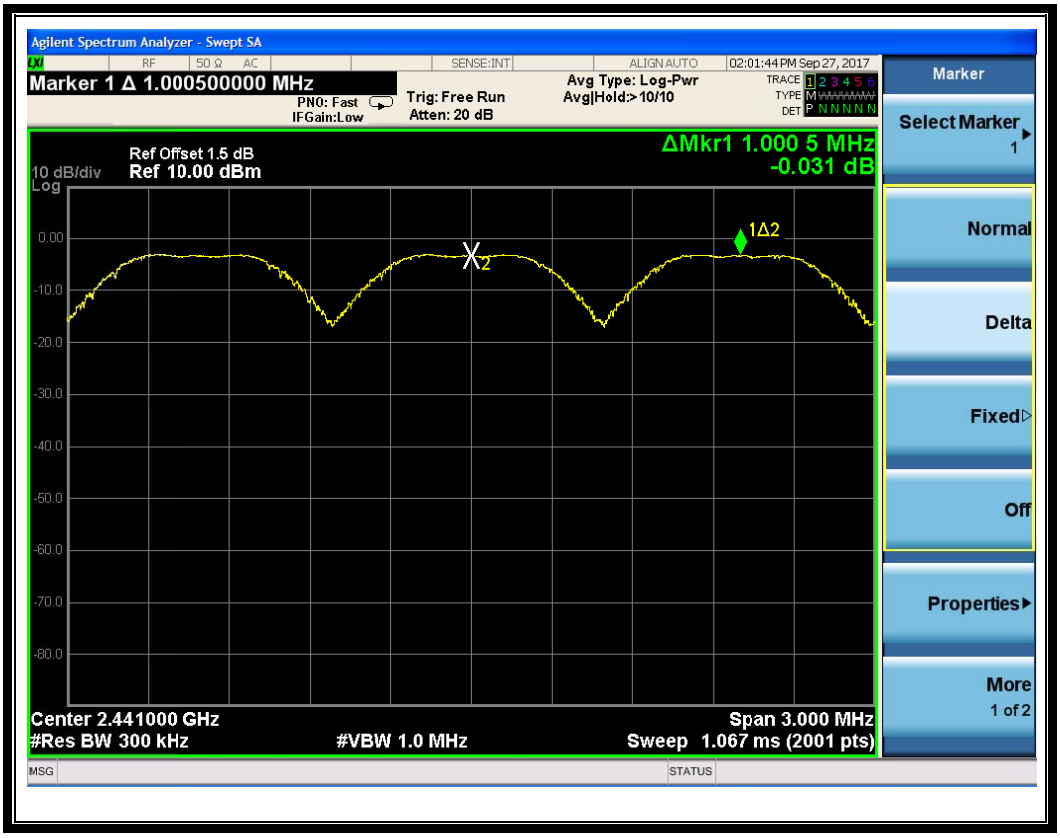
2.5.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span
Video (or Average) Bandwidth (VBW) ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

2.5.4 Test Result

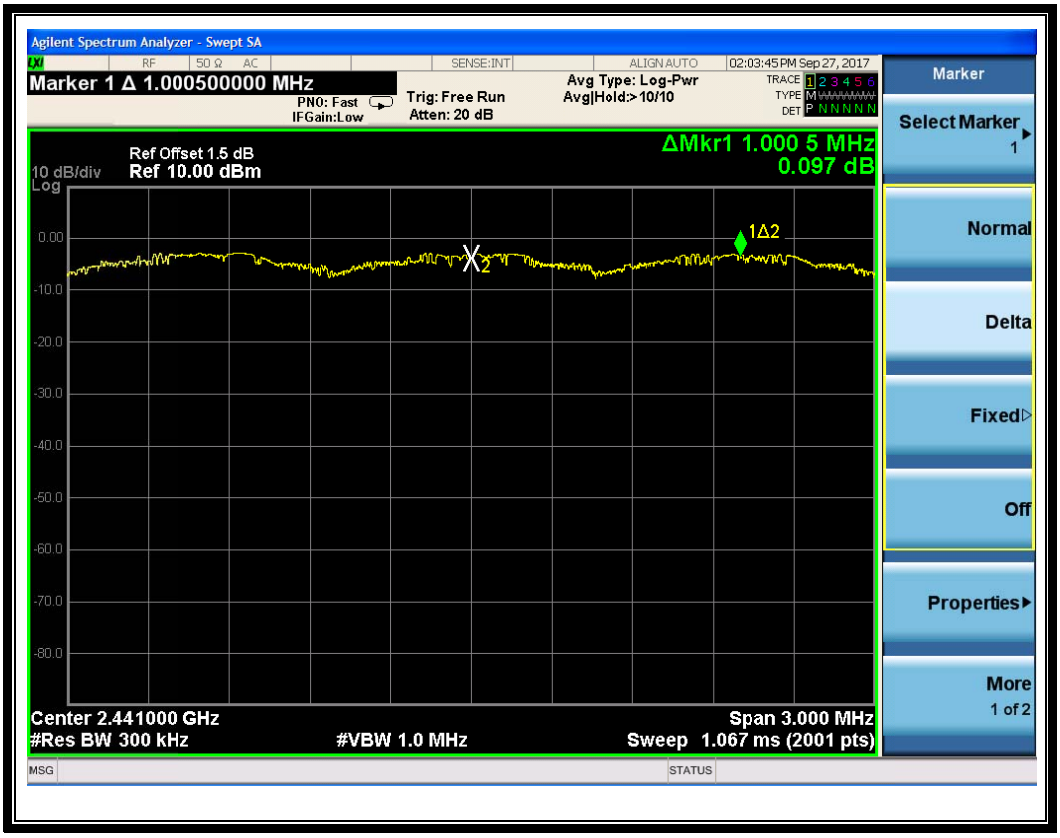
The Bluetooth Module operates at hopping-on test mode. For any adjacent channels (e.g. the channel 39 and 40 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (refer to section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

Test Mode	Measured Channel Numbers	Carried Frequency Separation	Refer to Plot	20dB bandwidth (MHz)	Min. Limit	Verdict
GFSK	39 and 40	1.002	Plot A	0.9773	20dB bandwidth	PASS
π/4-DQPSK	39 and 40	1.014	Plot B	1.311	two-thirds of the 20dB bandwidth	PASS
8-DPSK	39 and 40	1.026	Plot C	1.290		PASS



(Plot A: GFSK)

(Plot B: π/4-DQPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 1.000500000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
02:03:45 PM Sep 27, 2017
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 1.000 5 MHz
0.097 dB
1Δ2
Center 2.441000 GHz
#Res BW 300 kHz
#VBW 1.0 MHz
Span 3.000 MHz
Sweep 1.067 ms (2001 pts)
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2

(Plot C: 8-DPSK)

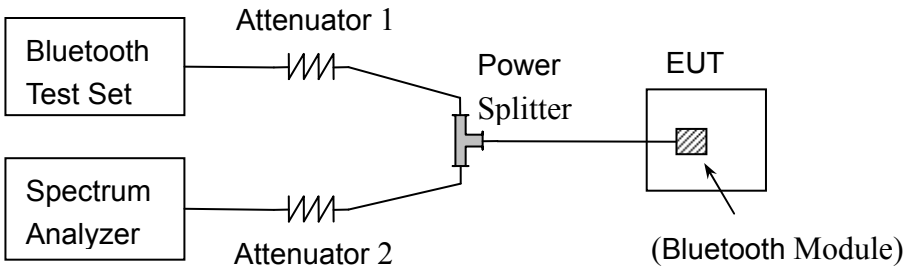
2.6 Time of Occupancy (Dwell time)

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 Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Test Set with Attenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the SS, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Please reference ANNEX A(1.5).

2.6.3 Test Procedure

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channel * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

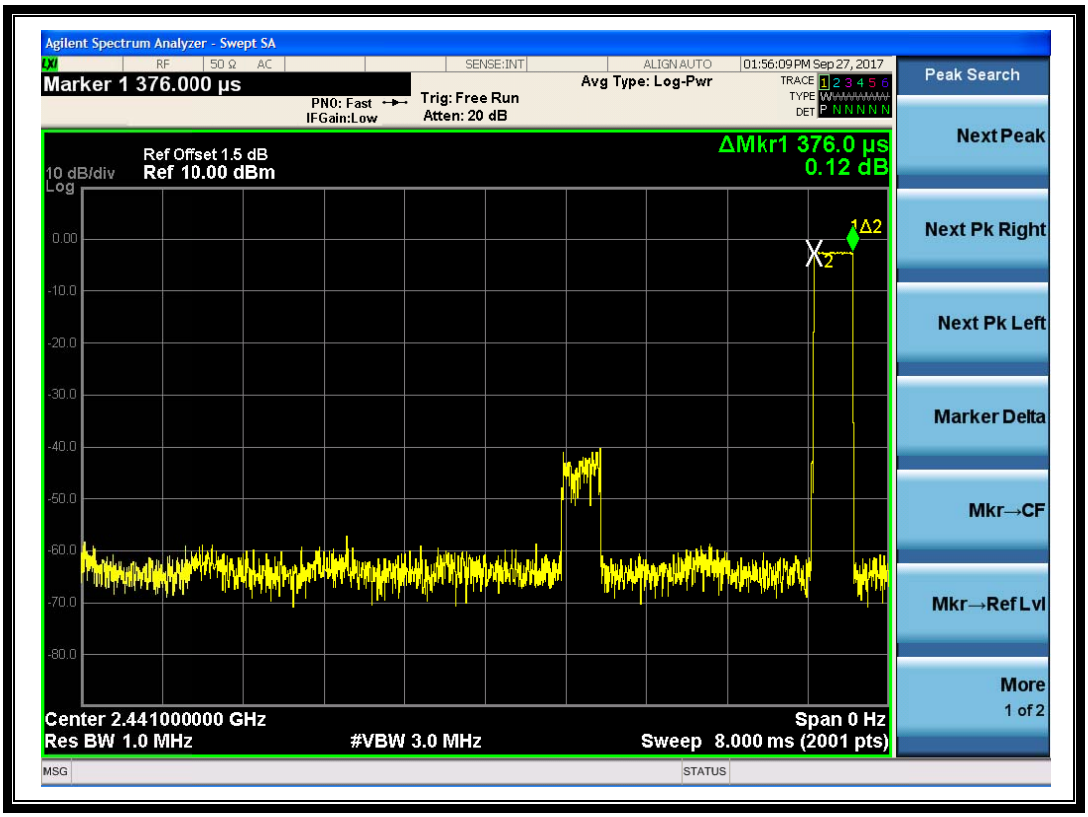
2.6.4 Test Result

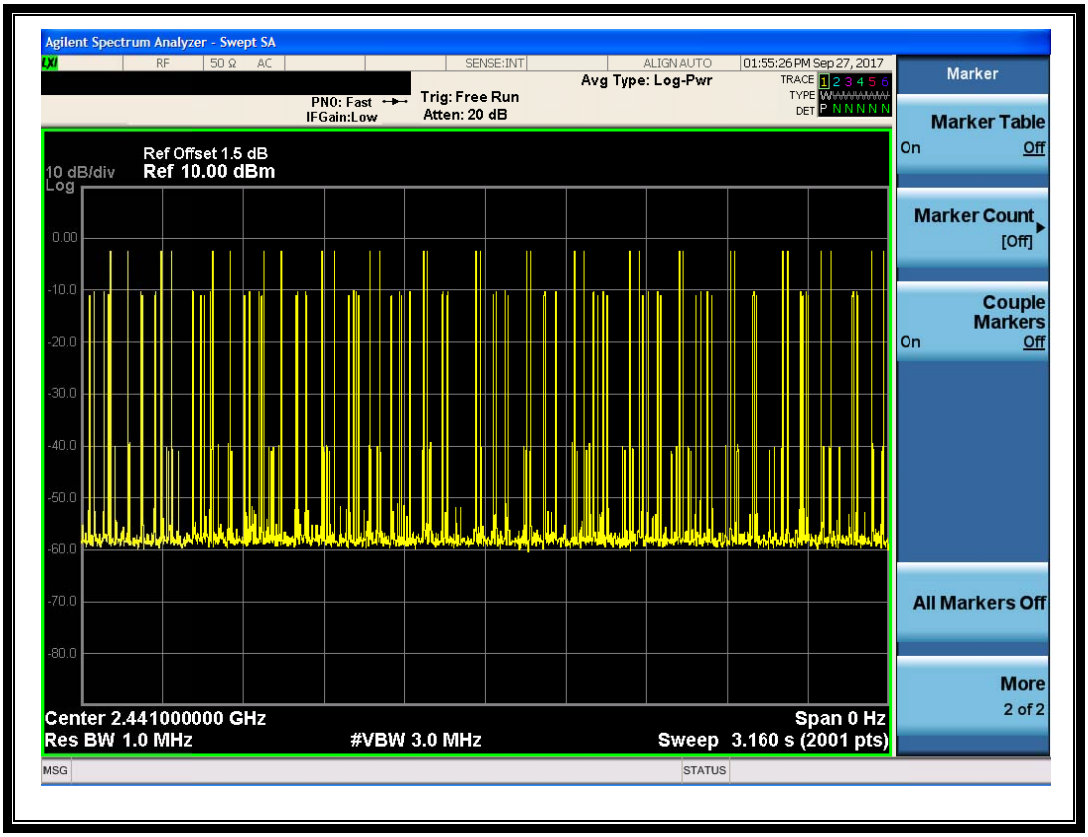
2.6.4.1 GFSK Mode

A. Test Verdict:

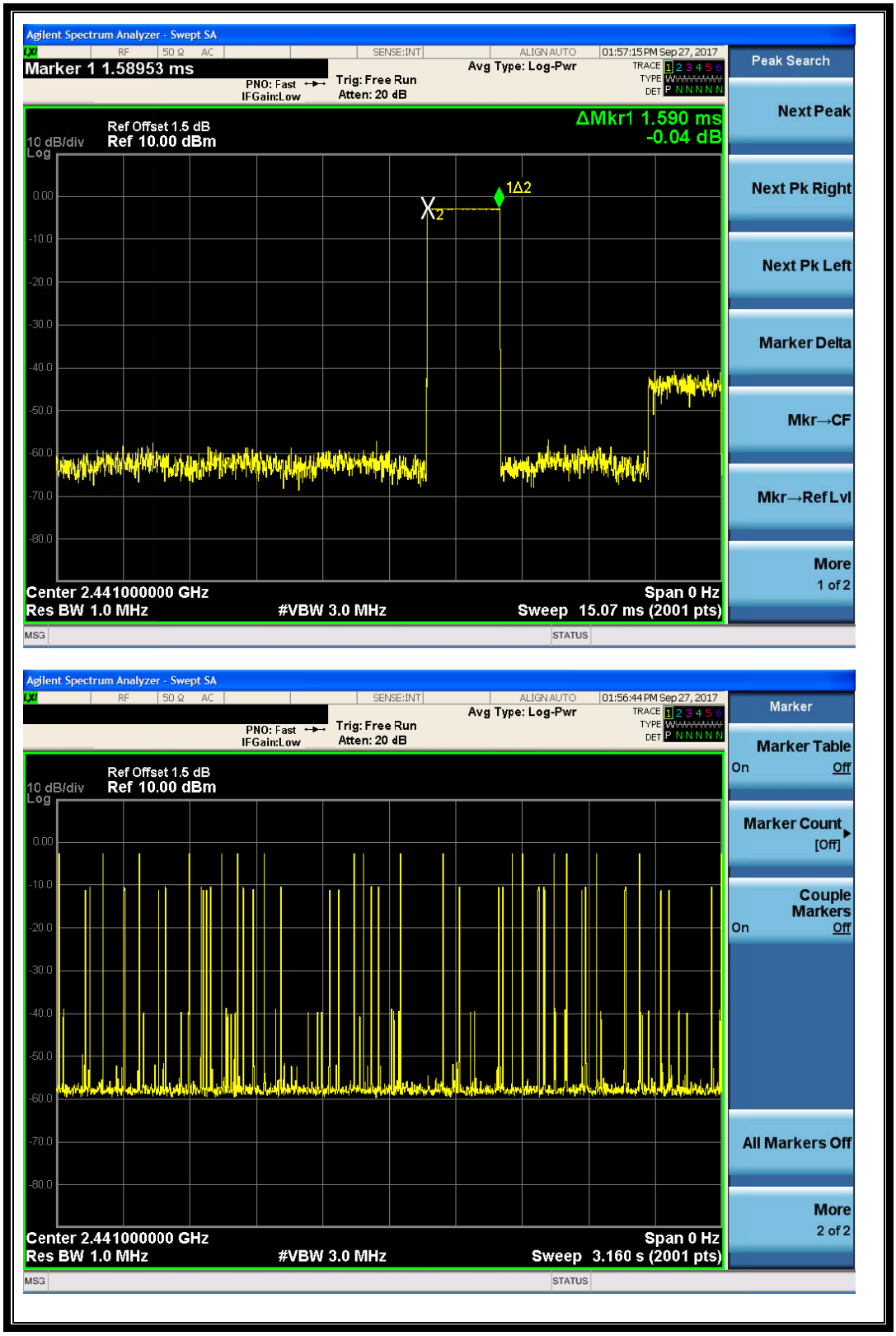
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.38	32	0.01216	0.1216	0.4	PASS
DH3	1.59	17	0.02703	0.2703		PASS
DH5	2.86	12	0.03432	0.3432		PASS

B. Test Plots:

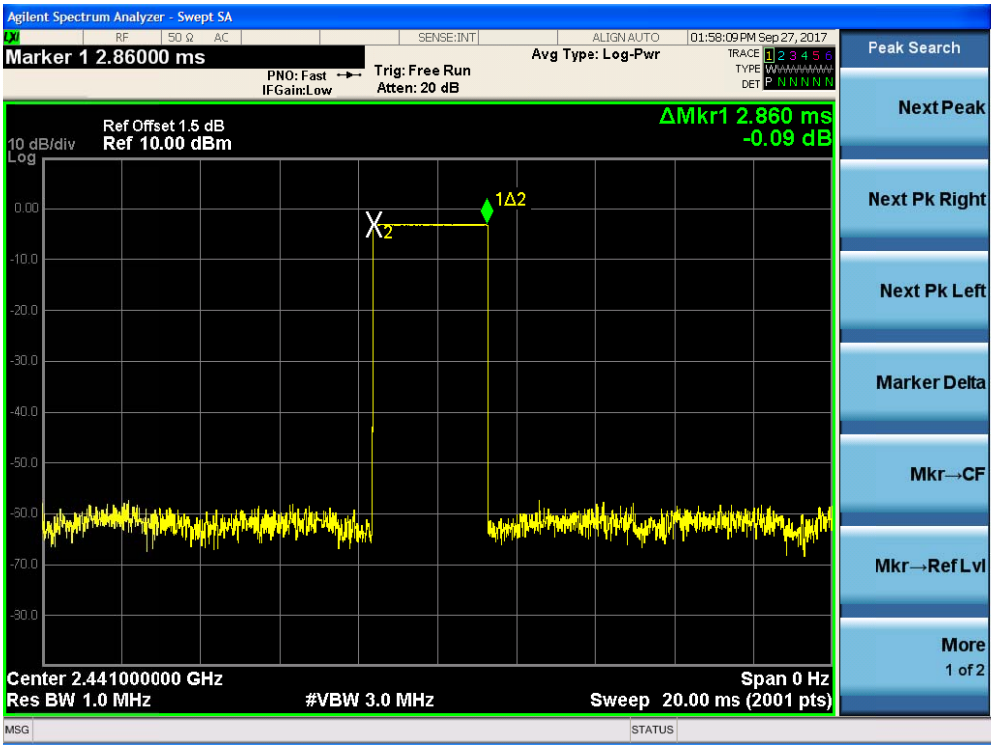


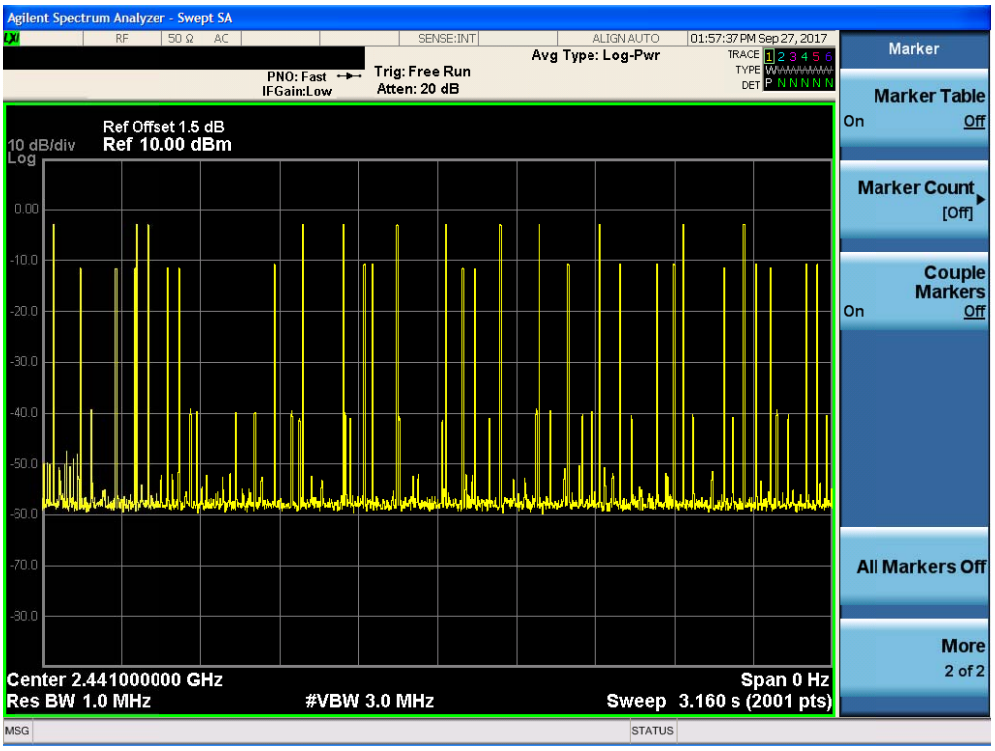


(Plot A: DH1 @ GFSK)



(Plot B: DH3 @ GFSK)





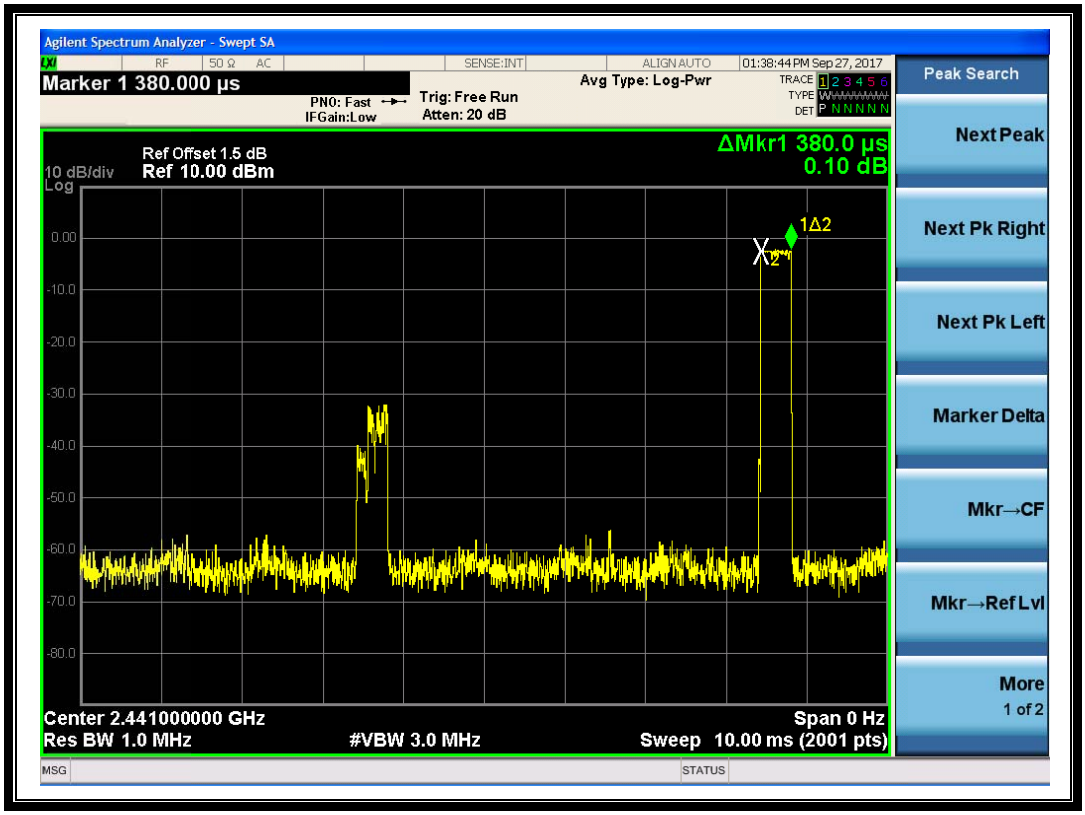
(Plot C: DH5 @ GFSK)

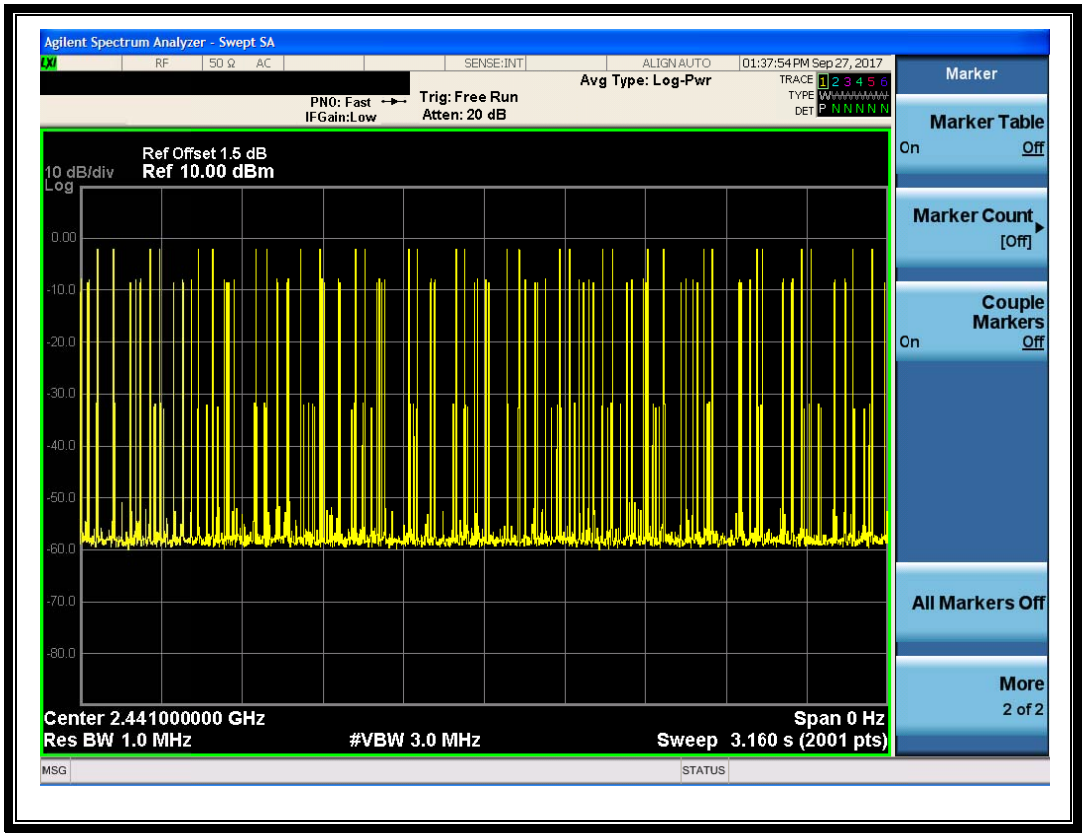
2.6.4.2 π/4-DQPSK Mode

A. Test Verdict:

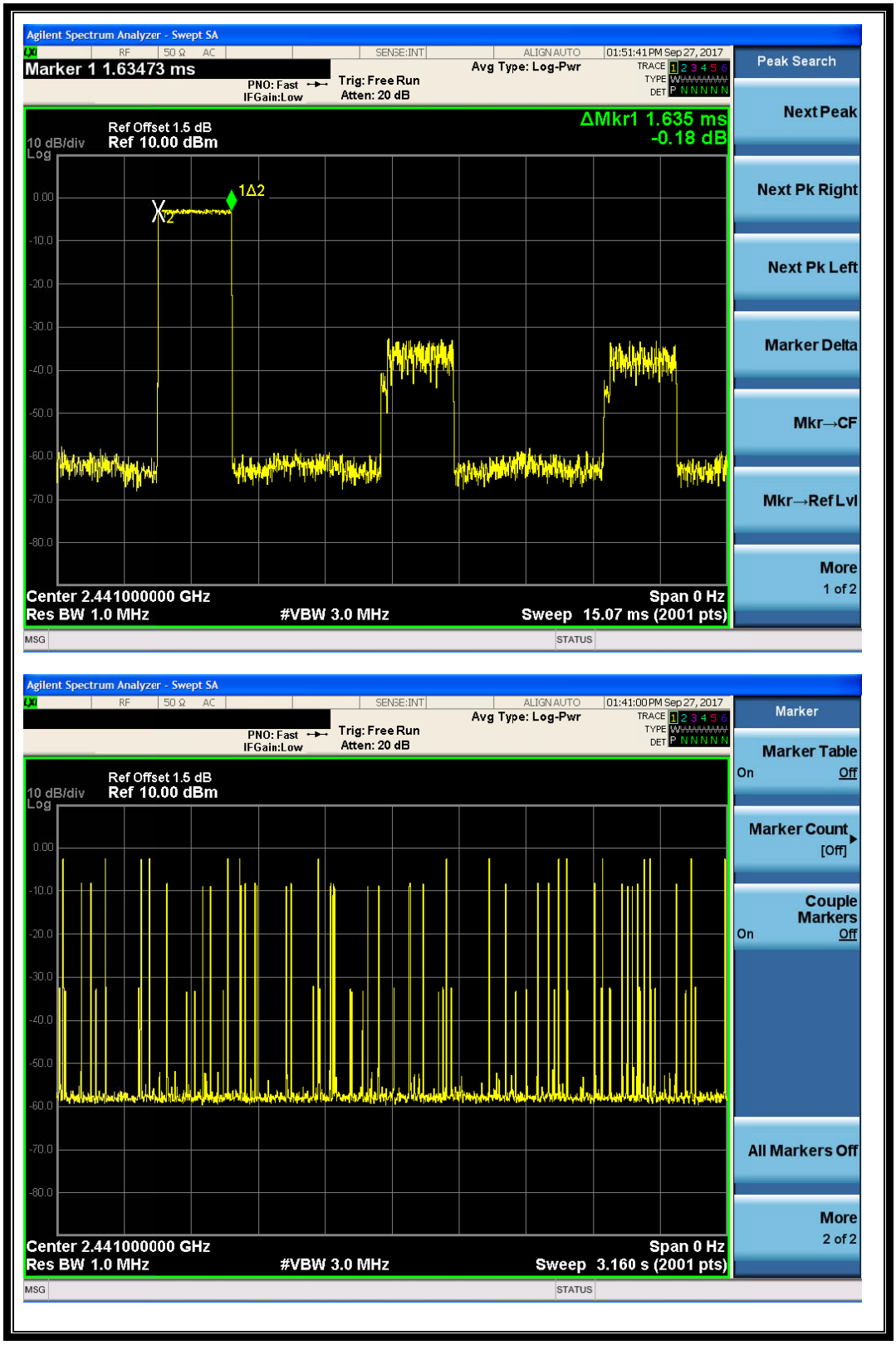
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.38	32	0.01216	0.1216	0.4	PASS
DH3	1.63	16	0.02608	0.2608		PASS
DH5	2.87	10	0.02870	0.2870		PASS

B. Test Plots:

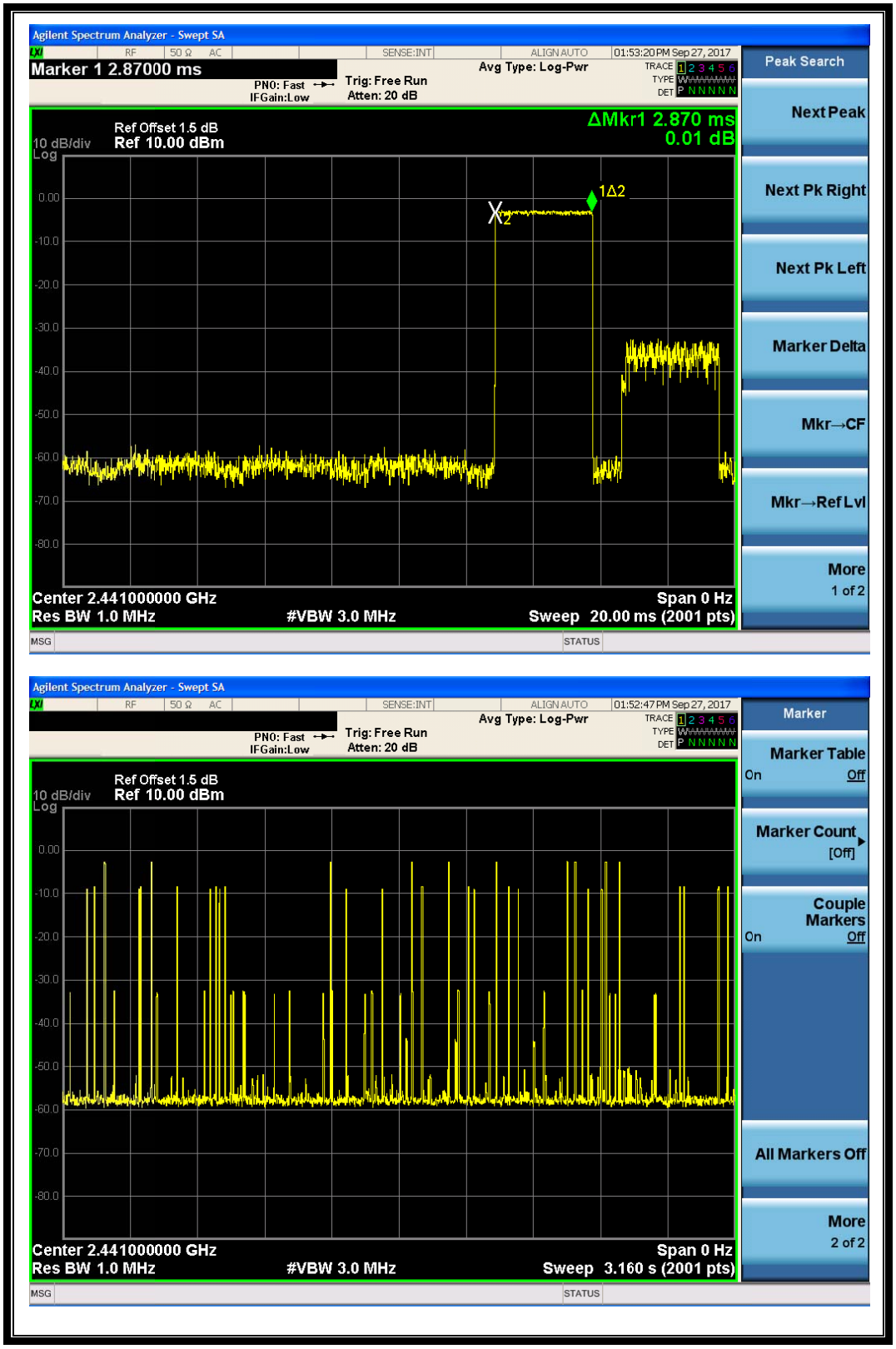




(Plot D: DH1 @ π/4-DQPSK)



(Plot E: DH3 @ π/4-DQPSK)



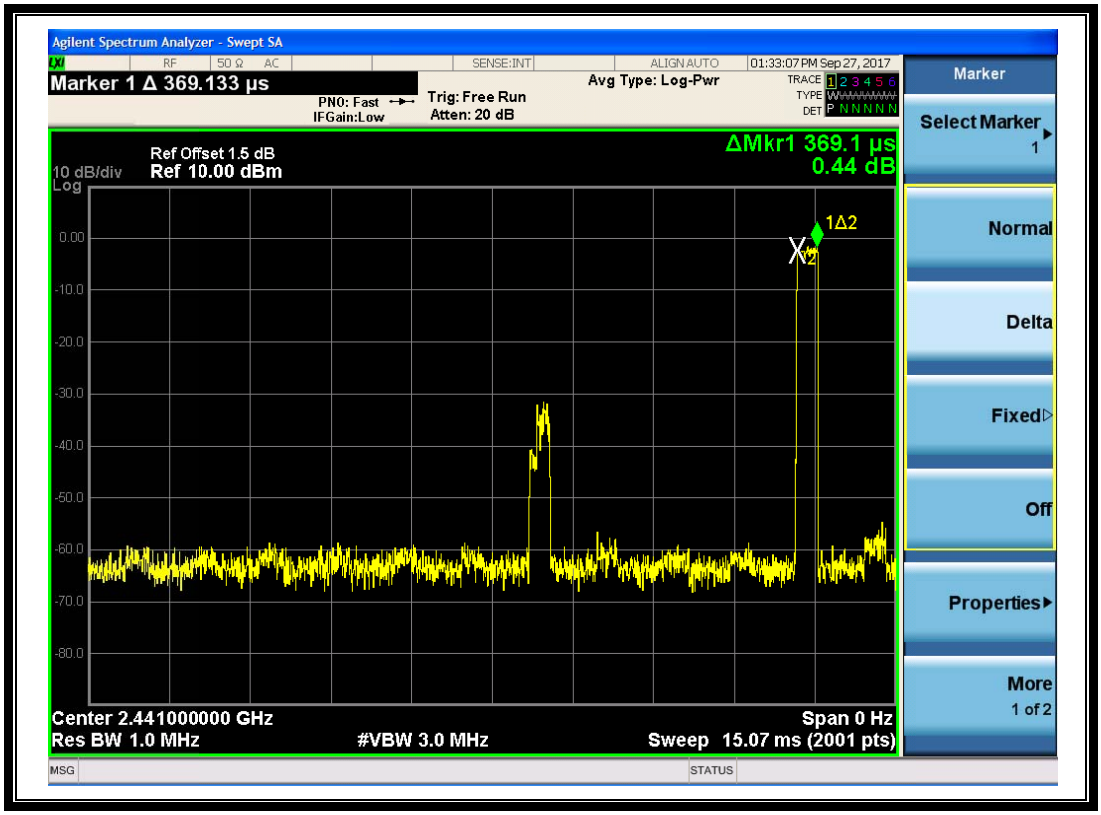
(Plot F: DH5 @ π/4-DQPSK)

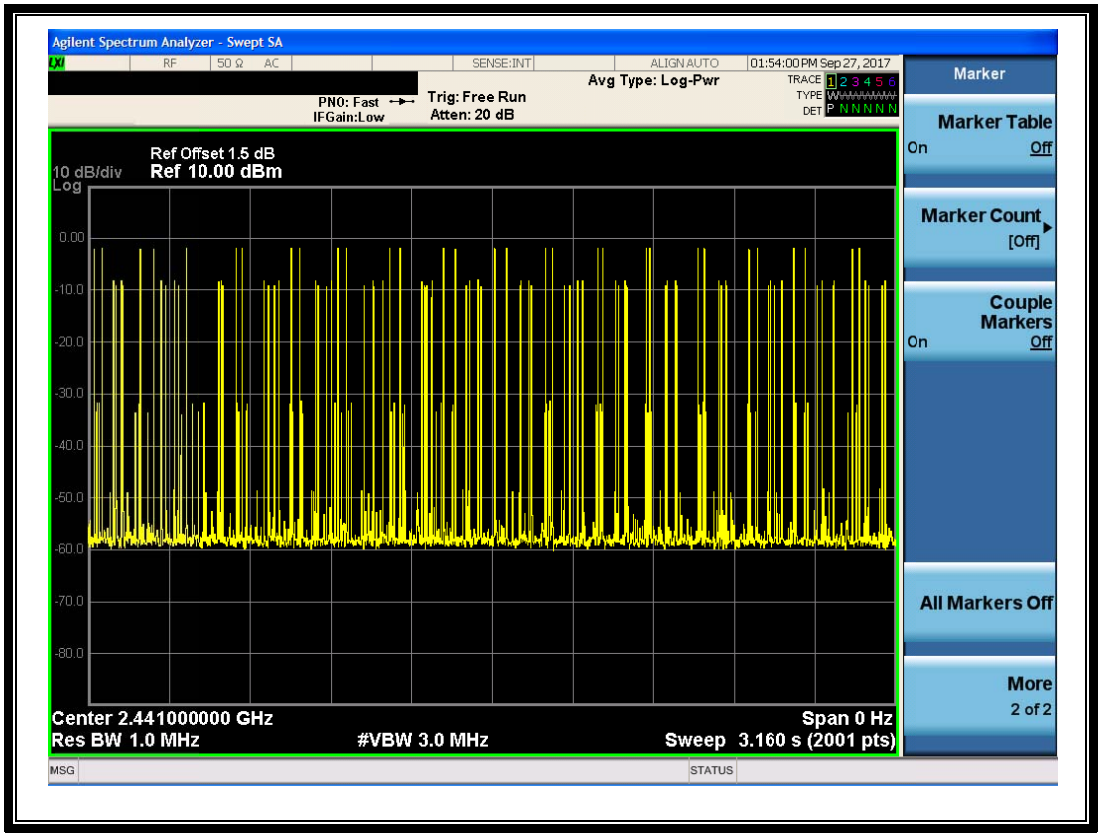
2.6.4.3 8-DPSK mode

A. Test Verdict:

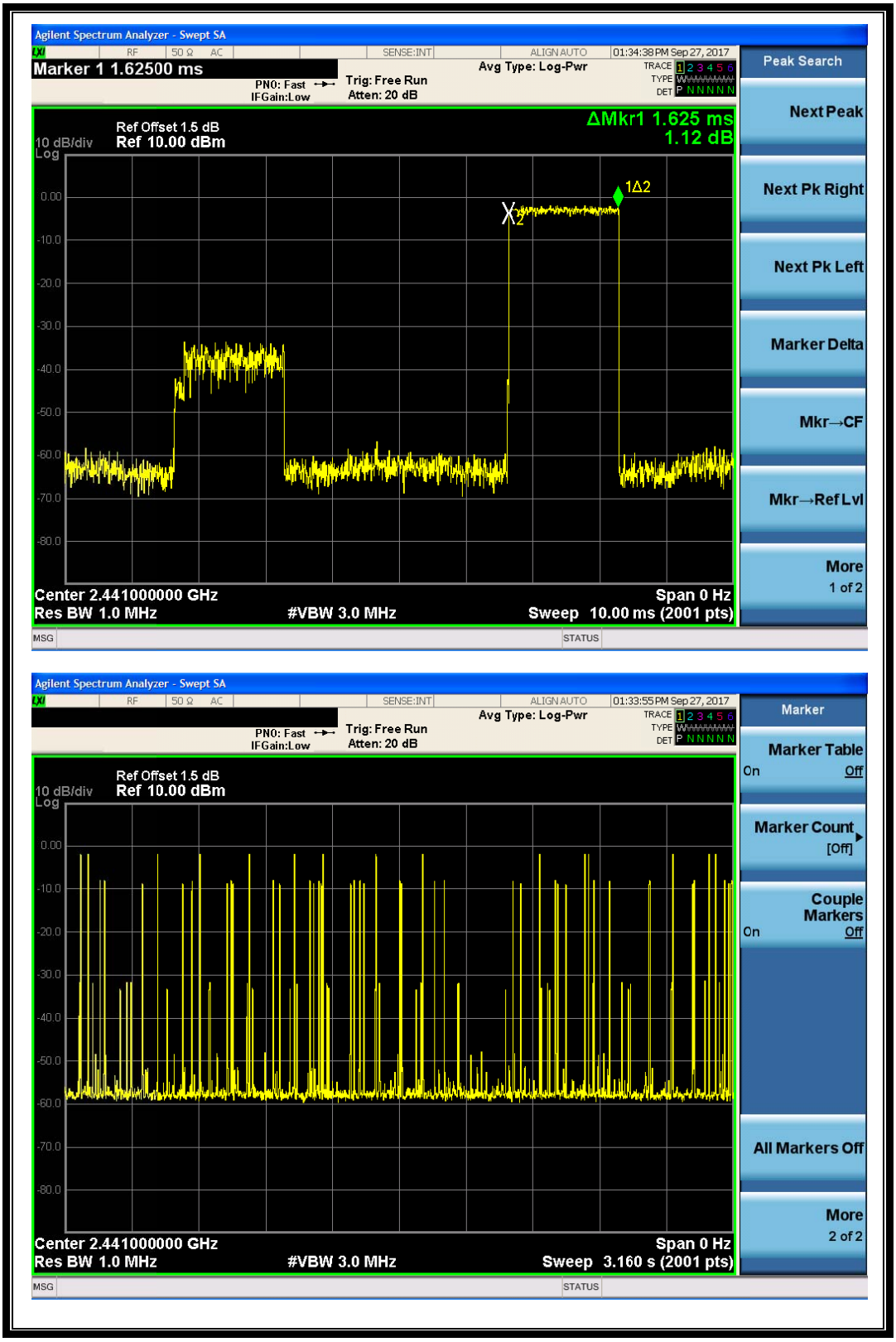
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.37	32	0.01184	0.1184	0.4	PASS
DH3	1.62	15	0.02430	0.2430		PASS
DH5	2.88	13	0.03744	0.3744		PASS

B. Test Plots:

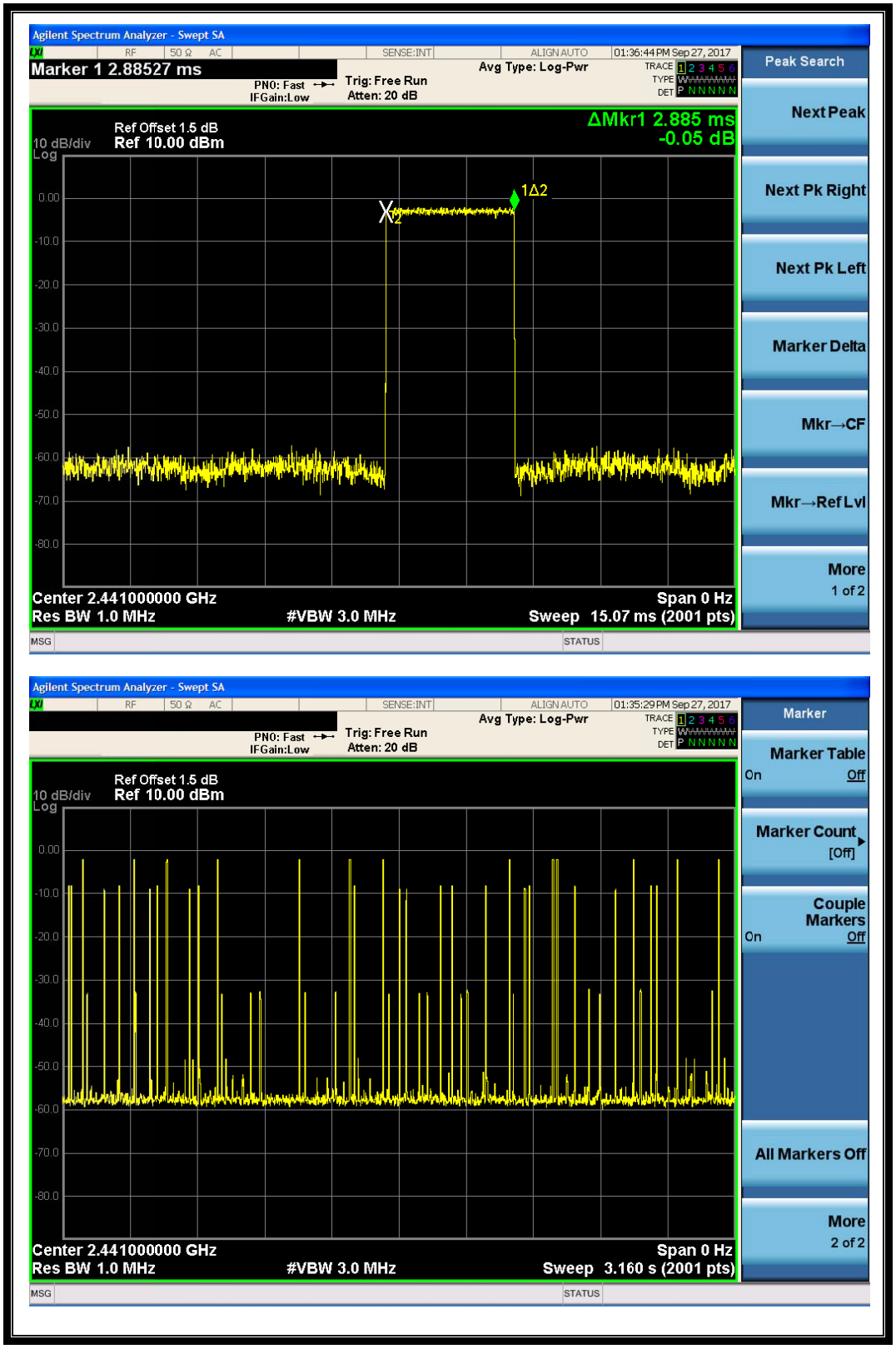




(Plot G: DH1 @ 8-DPSK)



(Plot H: DH3 @ 8-DPSK)



(Plot I: DH5 @ 8-DPSK)

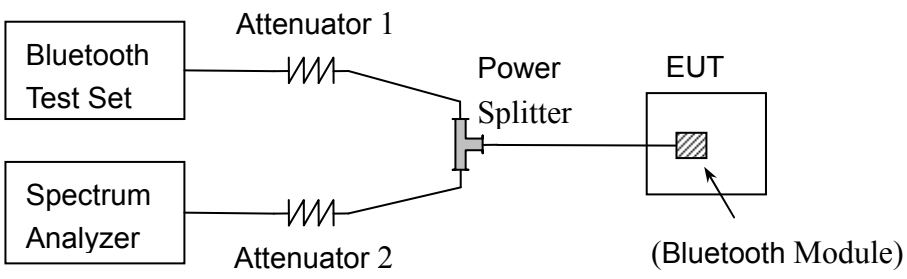
2.7 Conducted Spurious Emissions

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 Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Test Set with Attenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm;the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the SS, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Please reference ANNEX A(1.5).

2.7.3 Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

2.7.4 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.

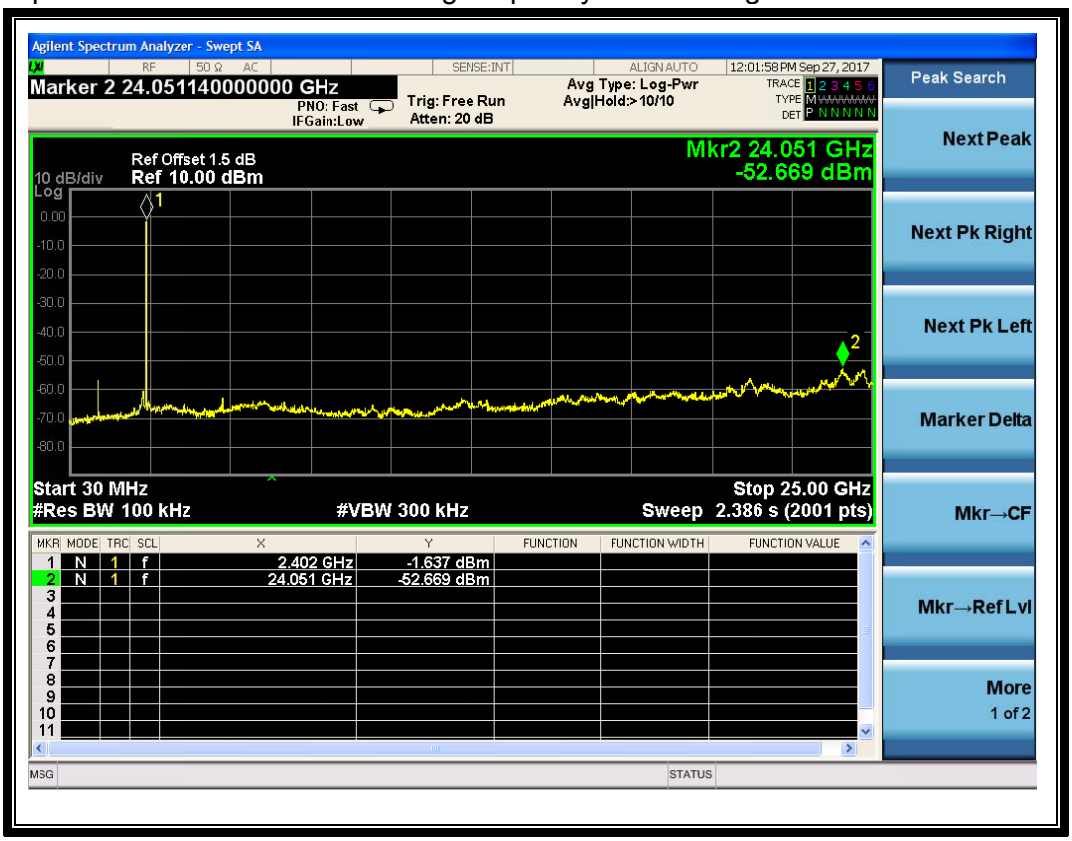
2.7.4.1 GFSK Mode

A. Test Verdict:

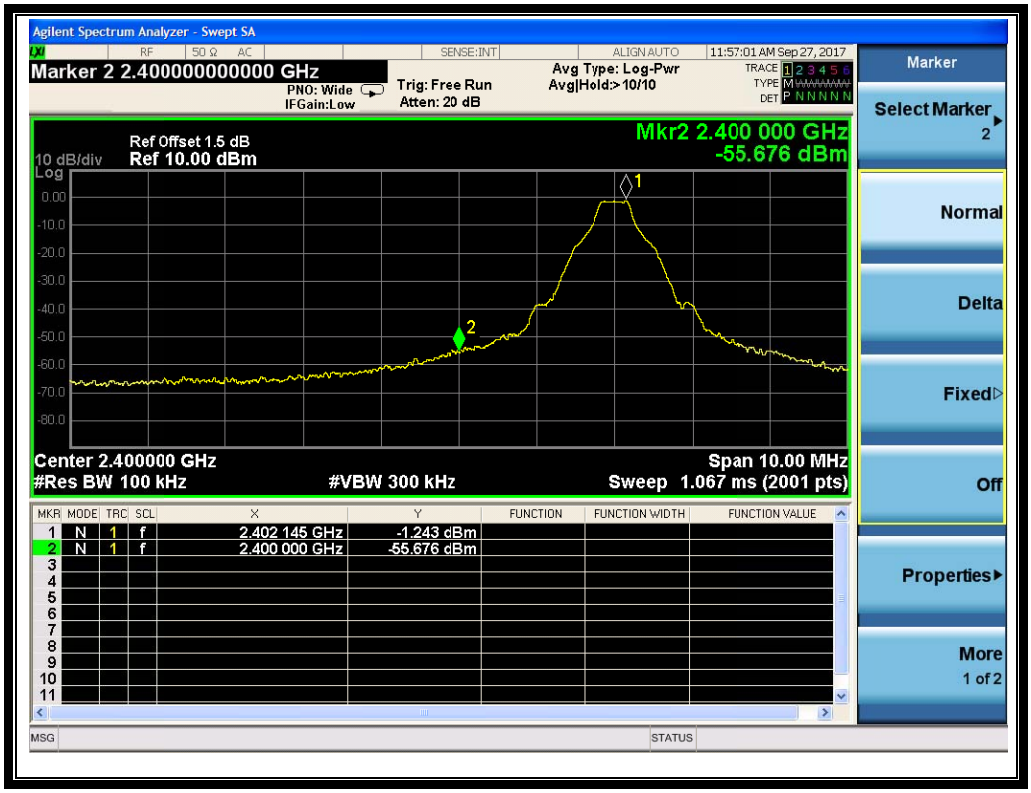
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-52.67	Plot A	-1.64	-21.64	PASS
39	2441	-52.81	Plot B	-3.48	-23.48	PASS
78	2480	-53.26	Plot C	-4.76	-24.76	PASS

B. Test Plots:

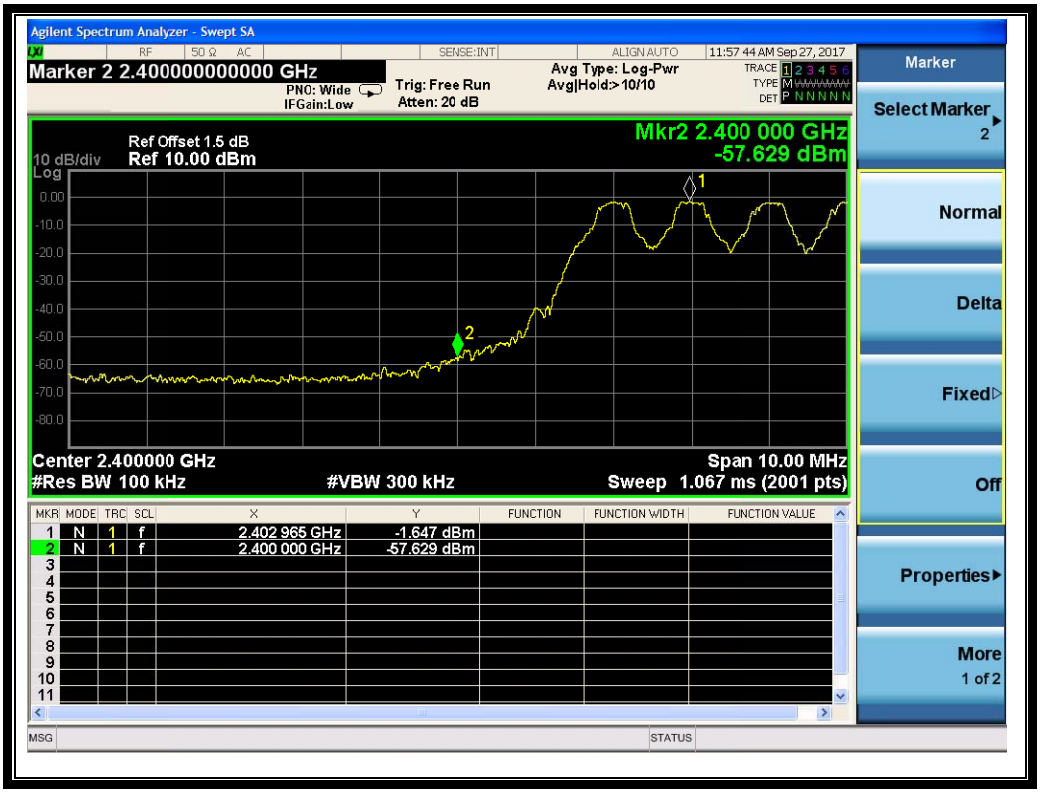
Note: the power of the Module transmitting frequency should be ignored.



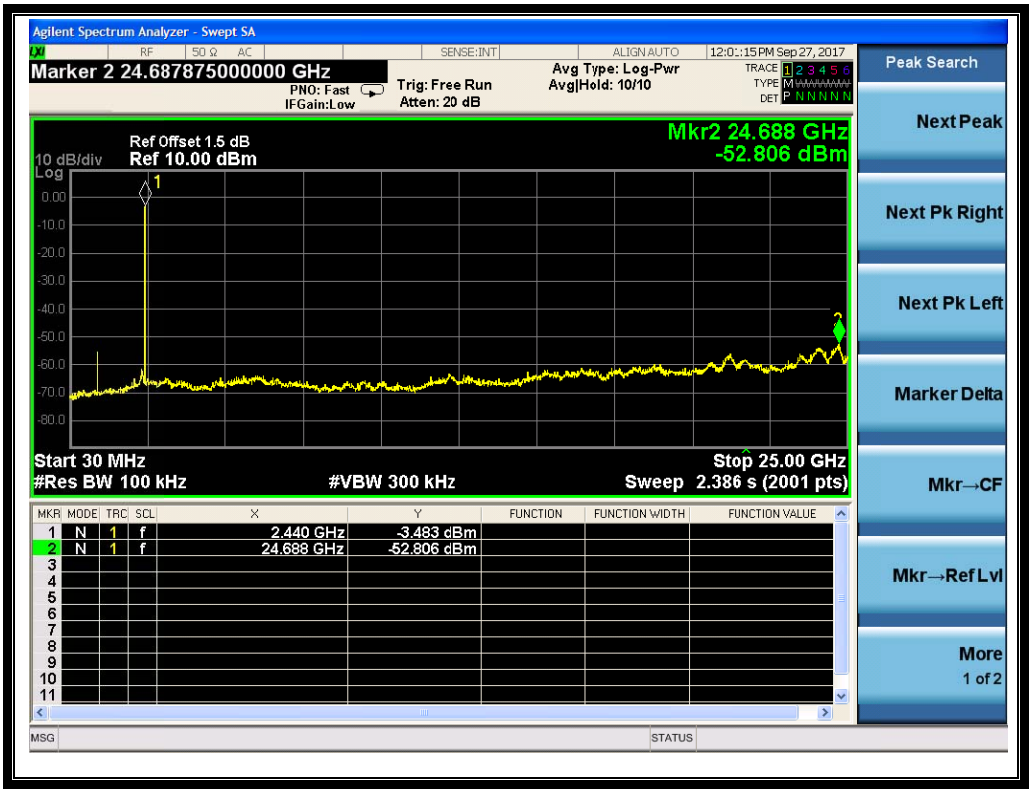
(Plot A: Channel = 0, 30MHz to 25GHz @ GFSK Mode)



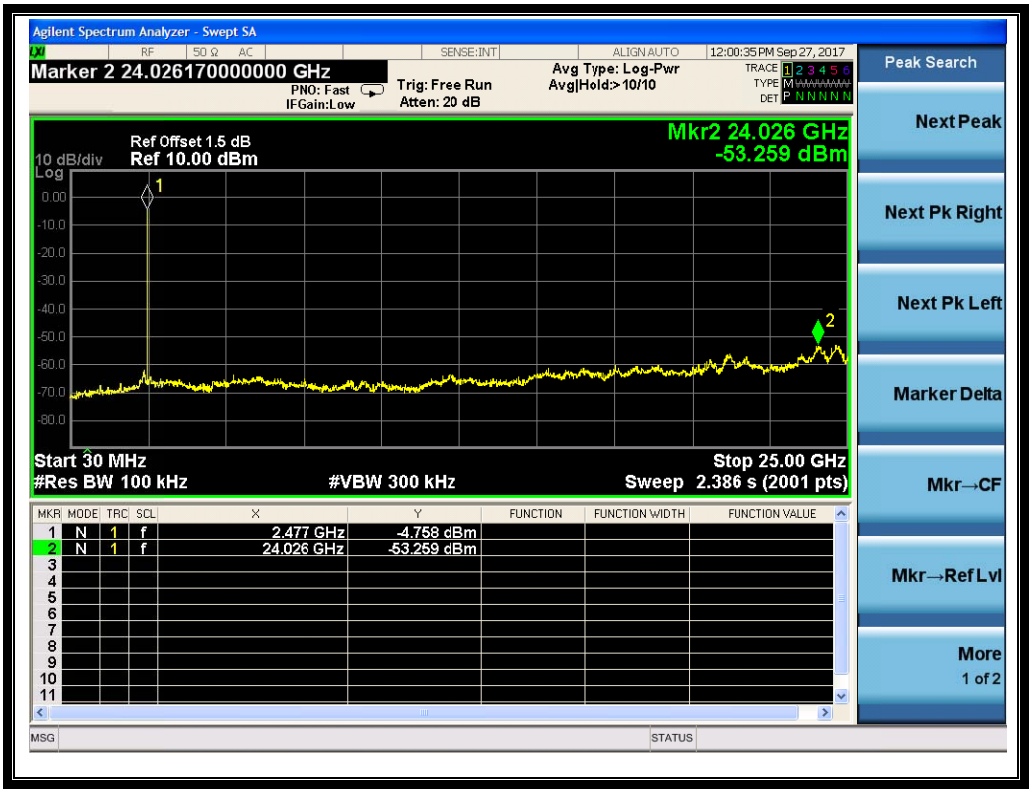
(Channel = 0, Band edge @ GFSK Mode)



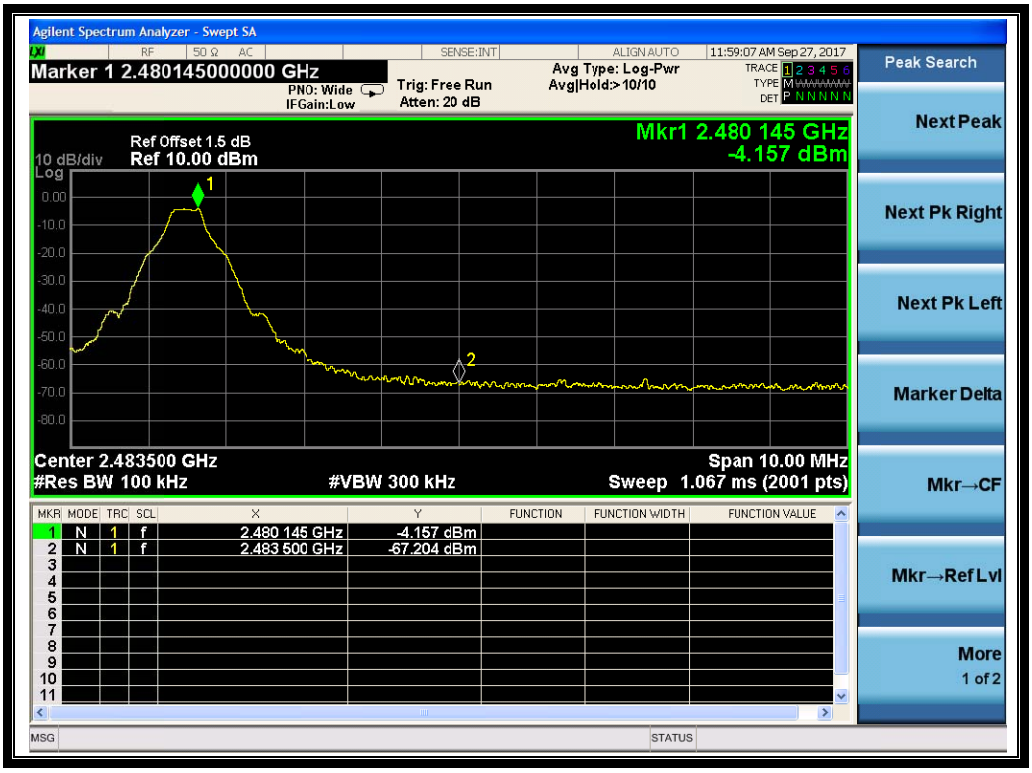
(Channel = 0, Band edge with hopping on @ GFSK Mode)



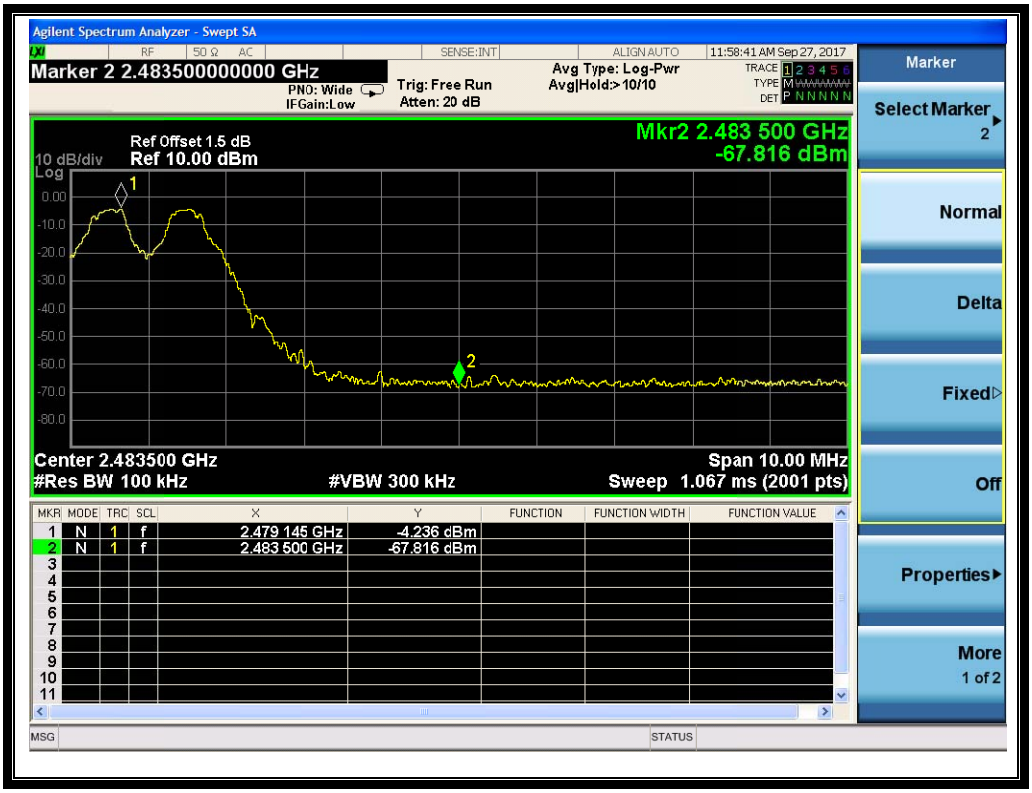
(Plot B: Channel = 39, 30MHz to 25GHz @ GFSK Mode)



(Plot C: Channel = 78, 30MHz to 25GHz @ GFSK Mode)



(Channel = 78, Band edge @ GFSK Mode)



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

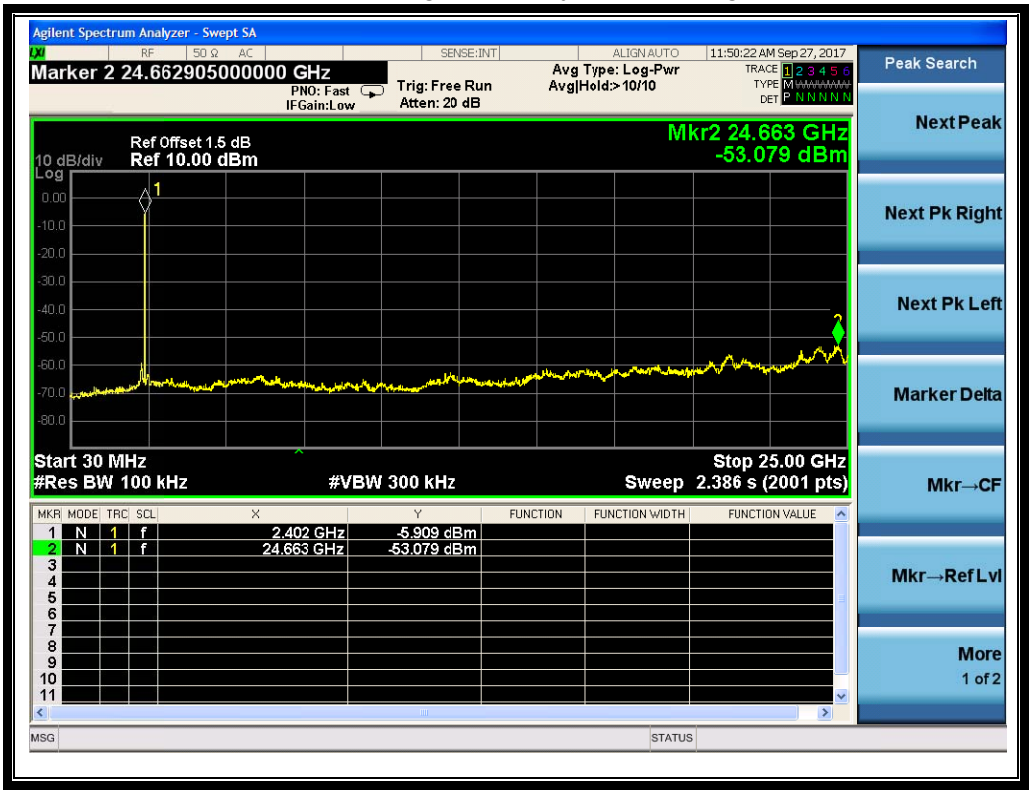
2.7.4.2 π/4-DQPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-53.08	Plot D	-5.91	-25.91	PASS
39	2441	-52.76	Plot E	-6.22	-26.22	PASS
78	2480	-52.92	Plot F	-9.18	-29.18	PASS

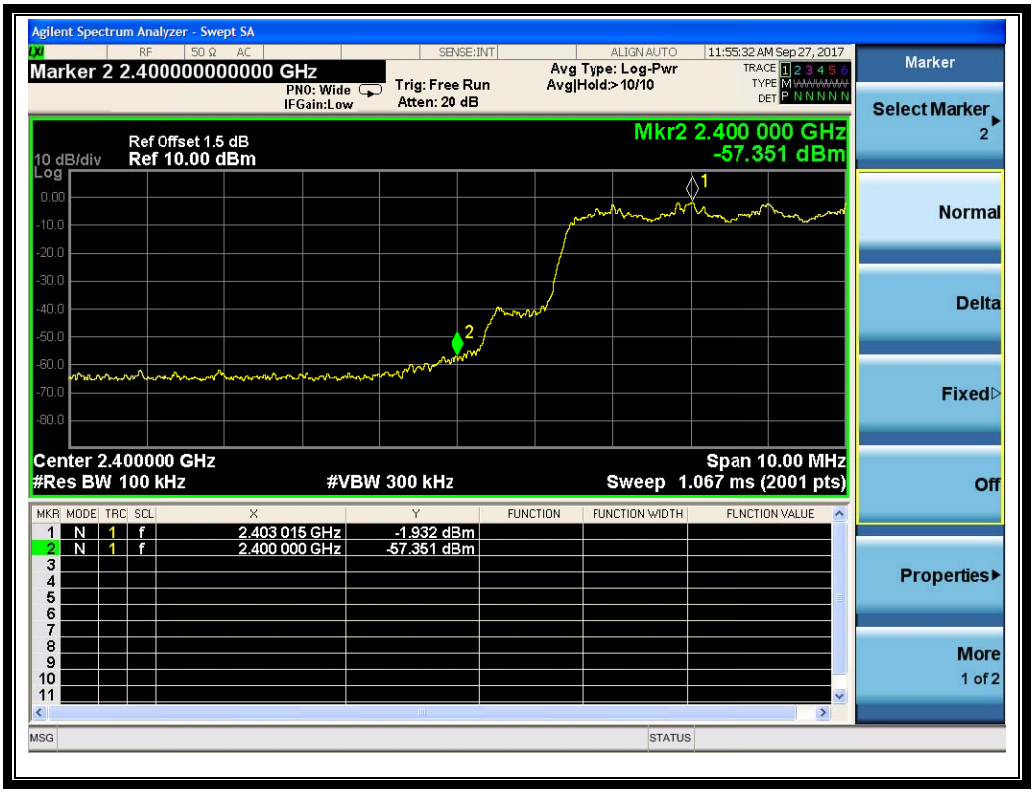
B. Test Plots:

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

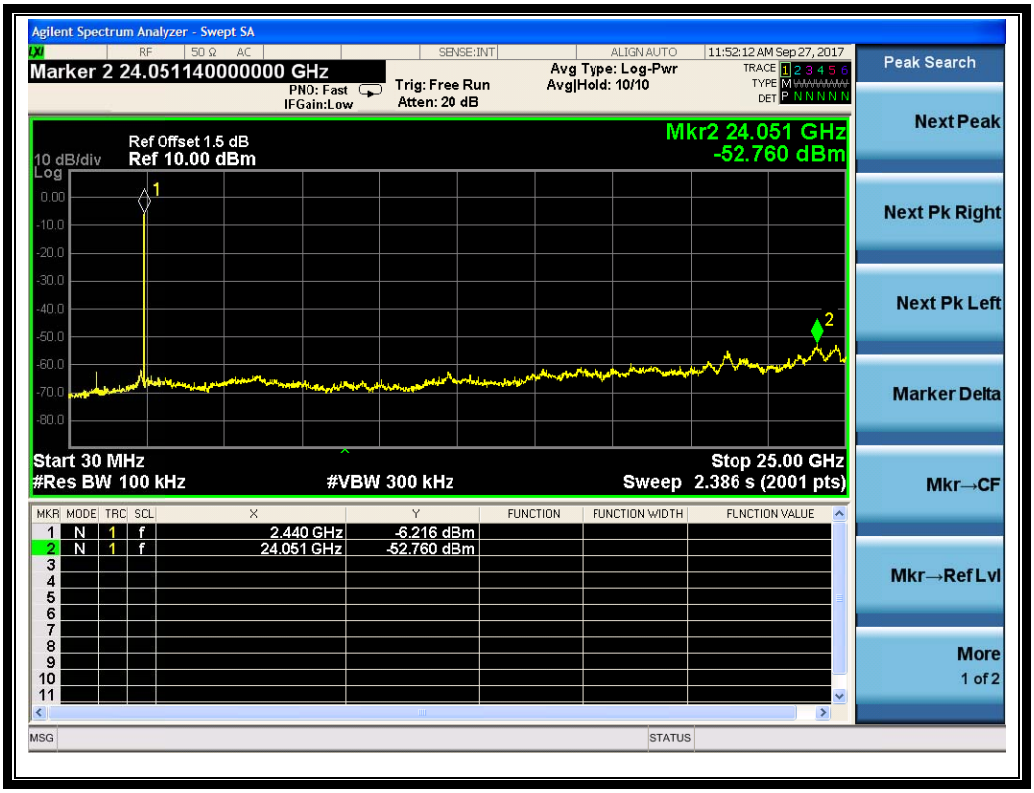


(Plot D: Channel = 0, 30MHz to 25GHz @π/4-DQPSK)

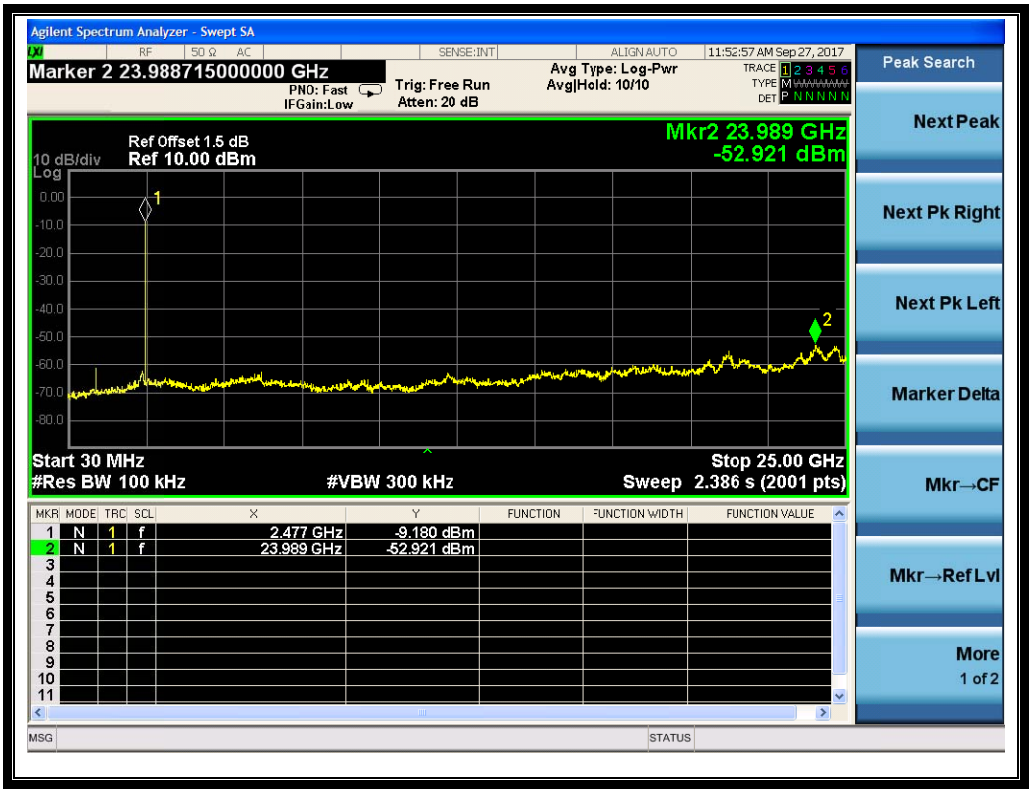
(Channel = 0, Band edge @π/4-DQPSK)



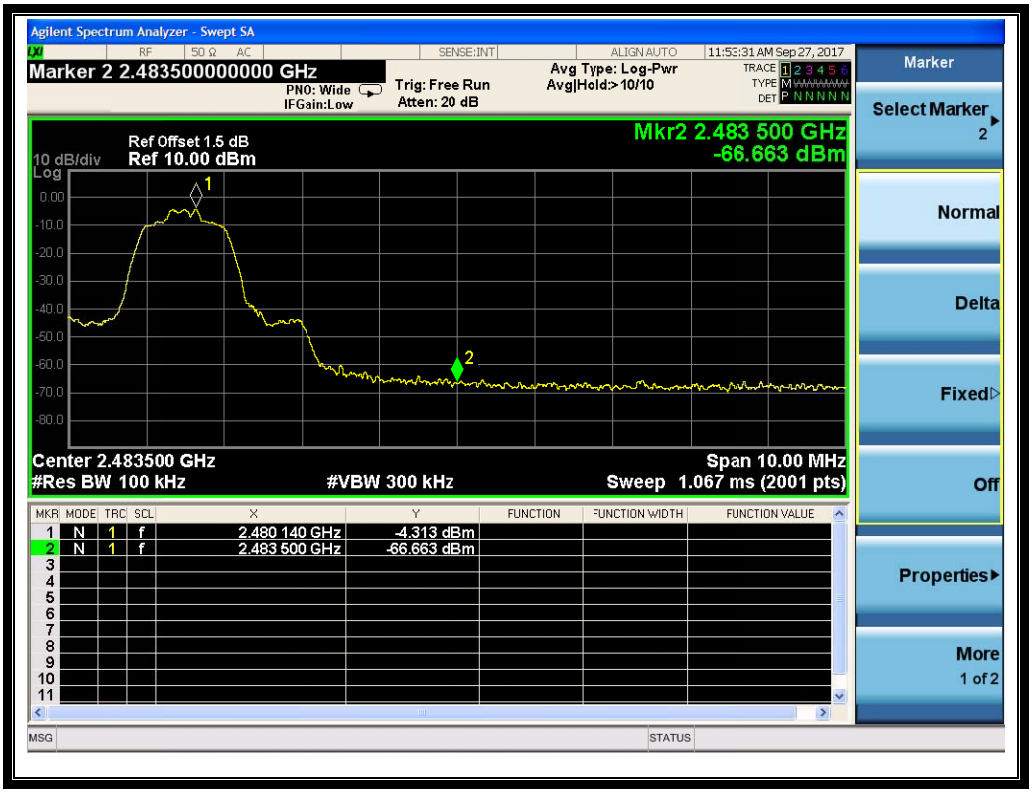
(Channel = 0, Band edge with hopping on @π/4-DQPSK)



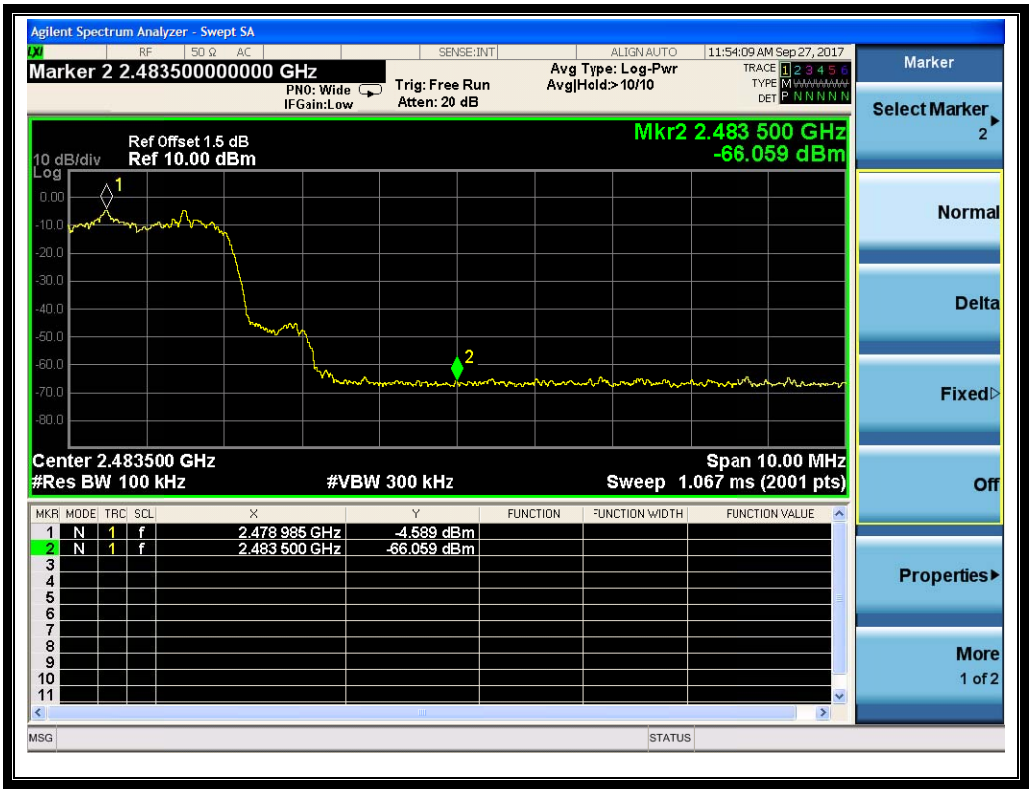
(Plot E: Channel = 39, 30MHz to 25GHz @ π/4-DQPSK)



(Plot F: Channel = 78, 30MHz to 25GHz @π/4-DQPSK)



(Channel = 78, Band edge @π/4-DQPSK)



(Channel = 78, Band edge with hopping on @ π/4-DQPSK)

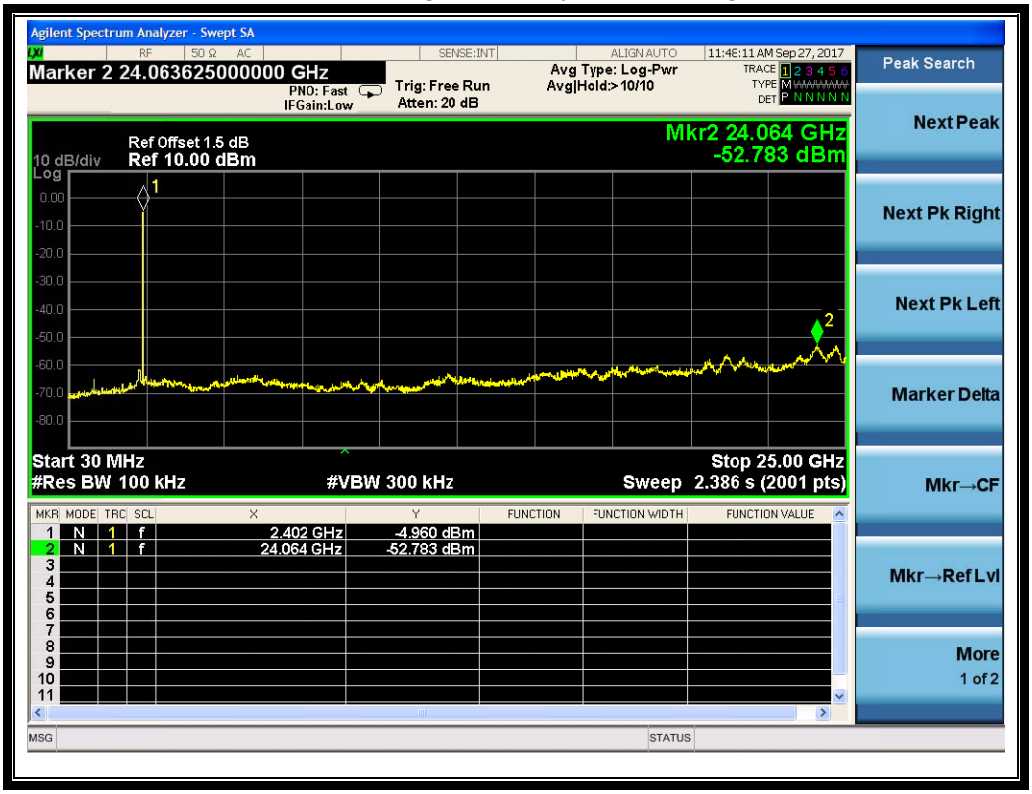
2.7.4.3 8-DPSK Mode

A. Test Verdict:

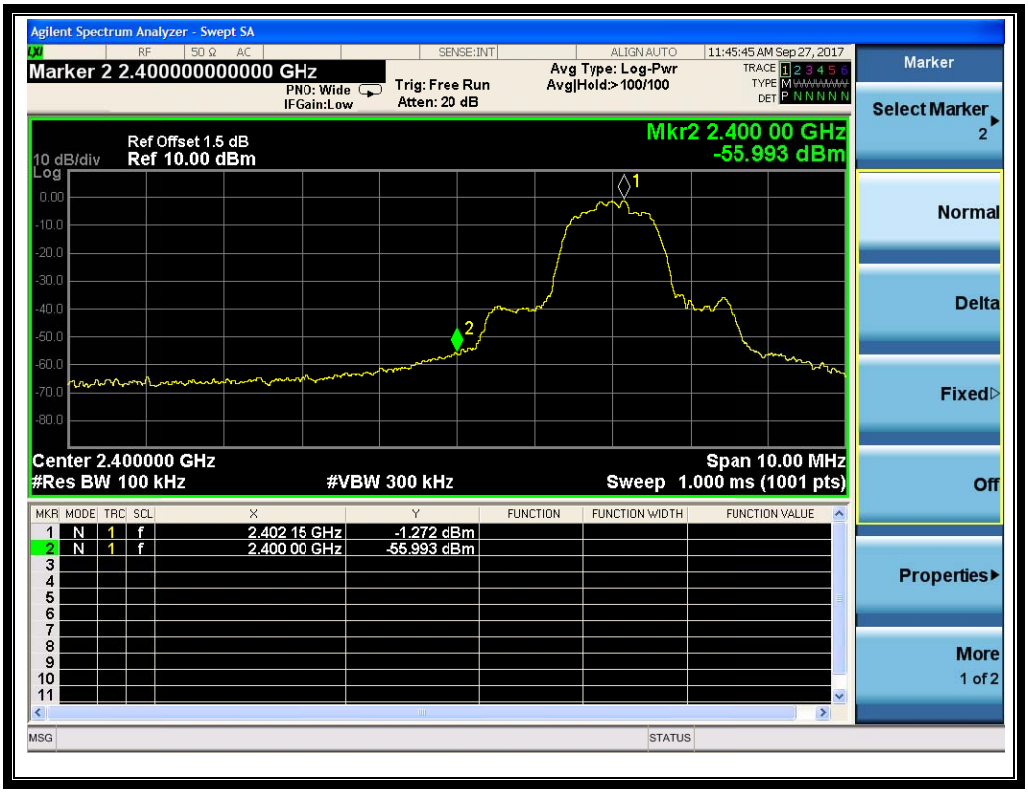
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-52.78	Plot G	-4.96	-24.96	PASS
39	2441	-52.50	Plot H	-5.74	-25.75	PASS
78	2480	-53.27	Plot I	-8.03	-28.03	PASS

B. Test Plots:

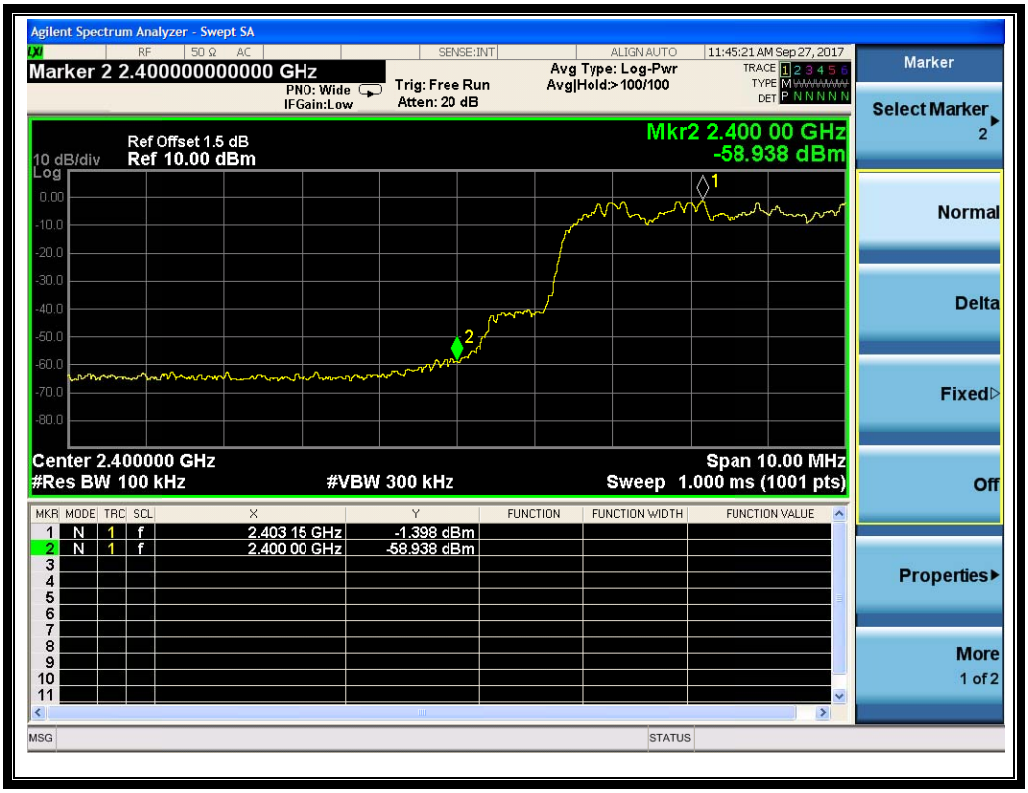
Note: the power of the Module transmitting frequency should be ignored.



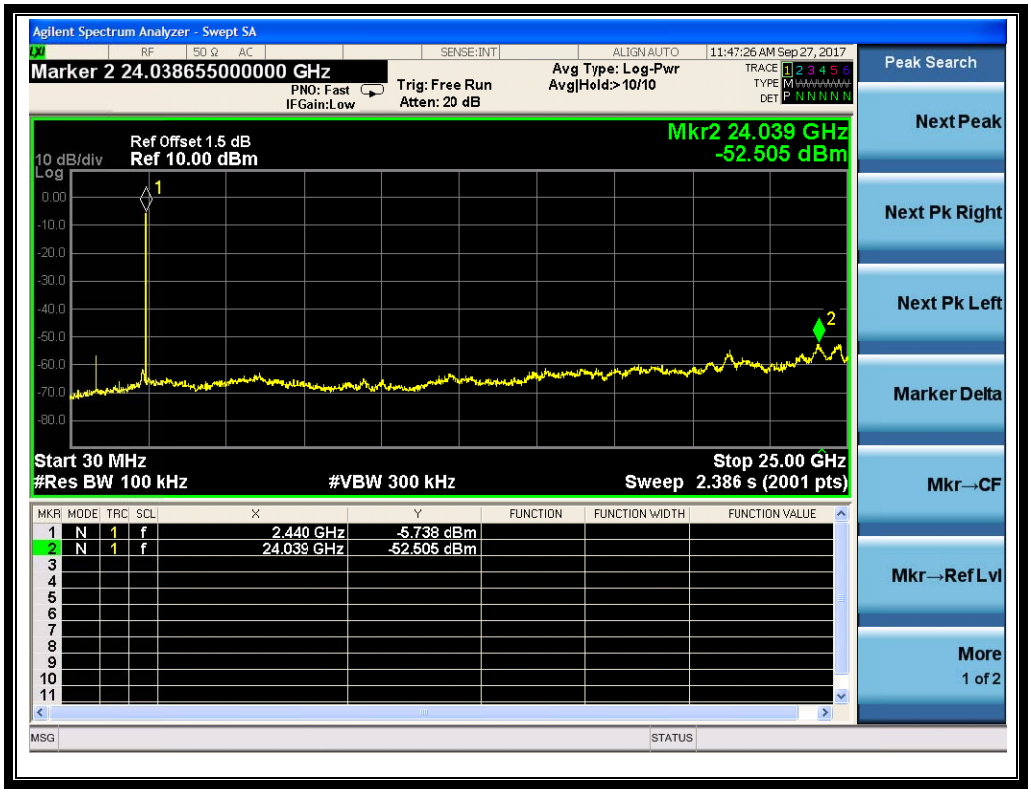
(Plot G: Channel = 0, 30MHz to 25GHz @ 8-DPSK)



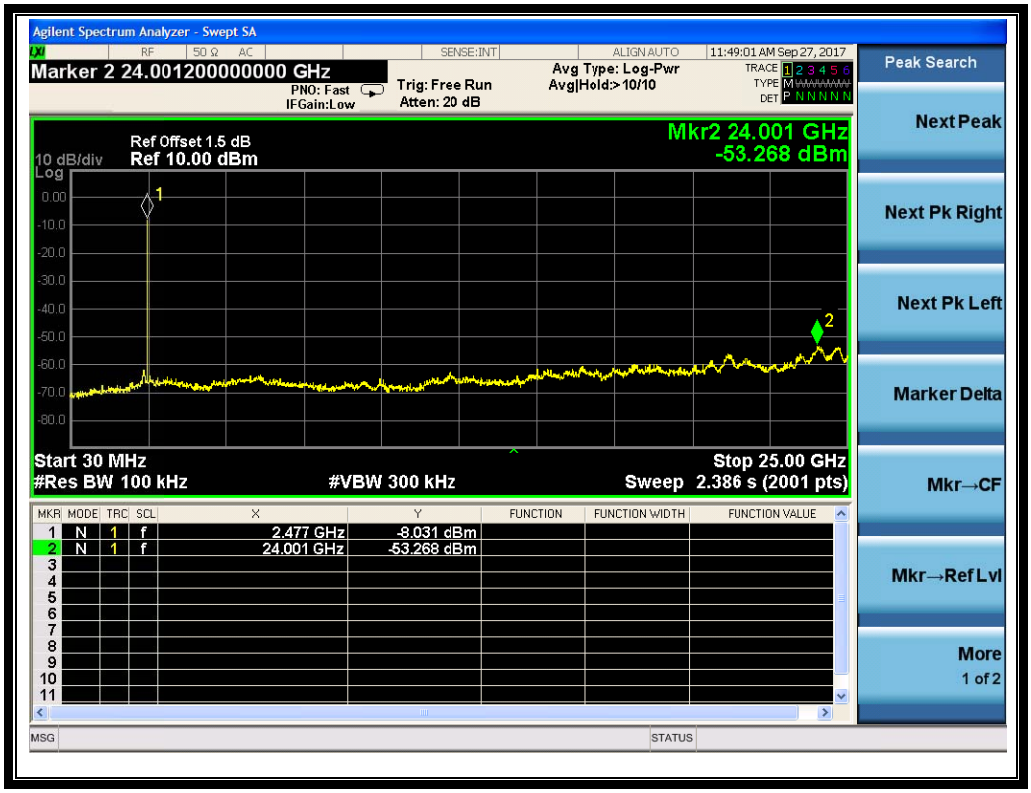
(Channel = 0, Band edge @ 8-DPSK)



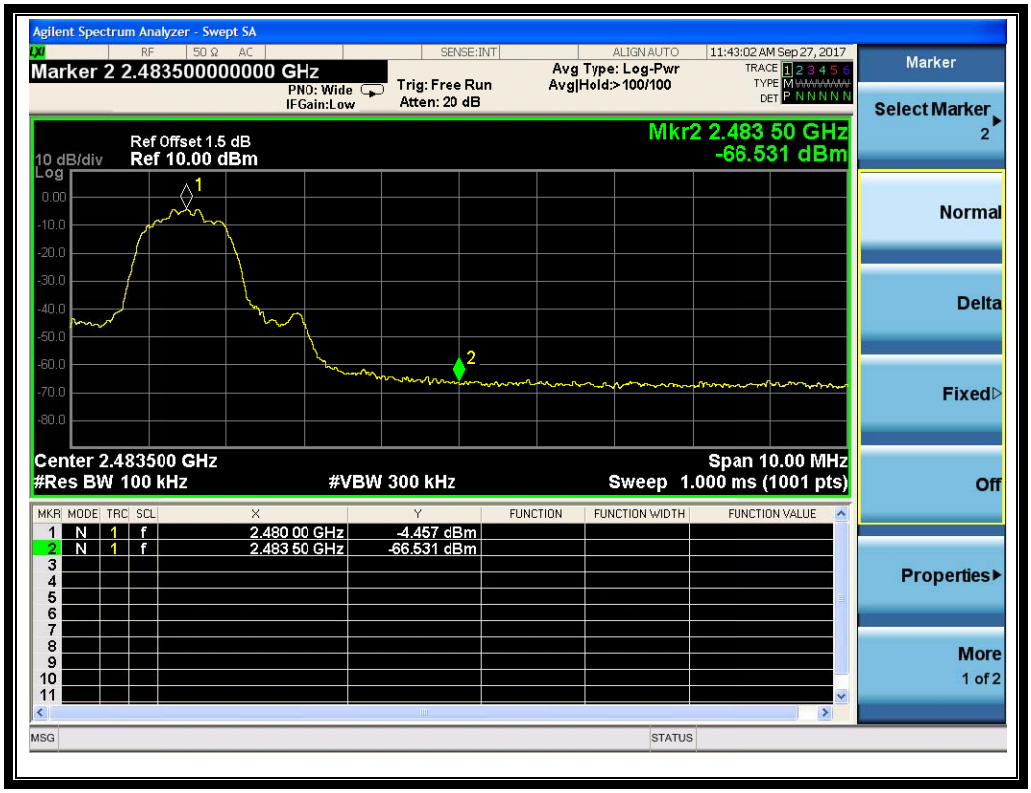
(Channel = 0, Band edge with hopping on @ 8-DPSK)



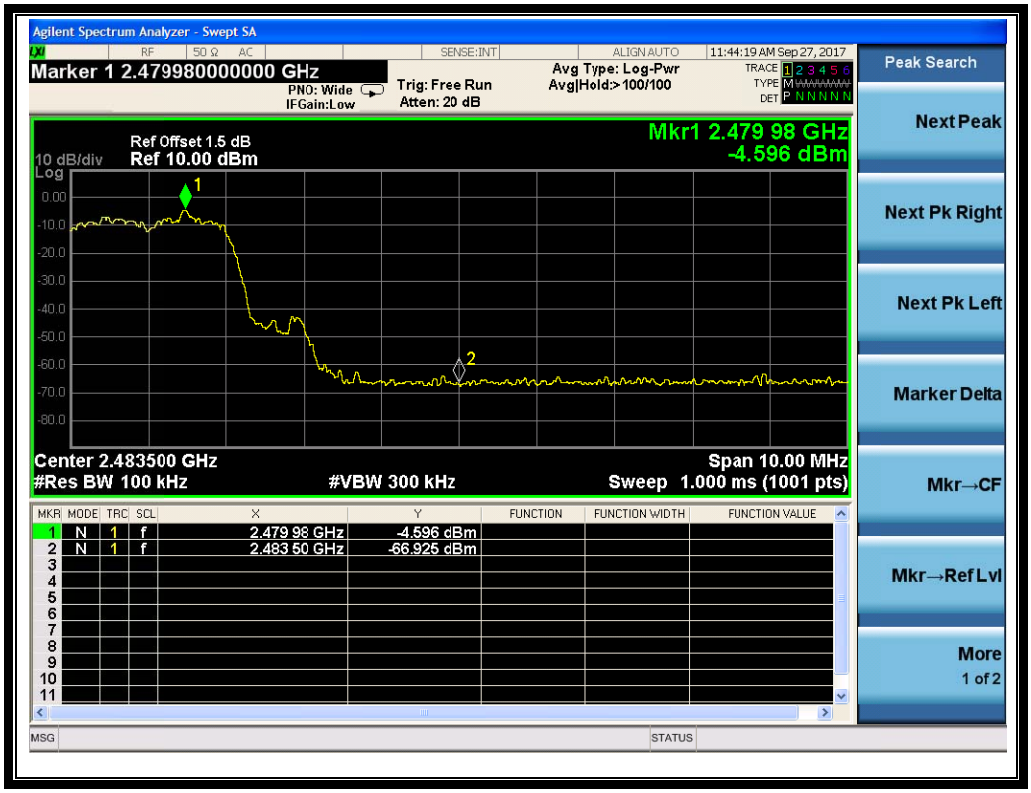
(Plot H: Channel = 39, 30MHz to 25GHz @ 8-DPSK)



(Plot I: Channel = 78, 30MHz to 25GHz @ 8-DPSK)



(Plot I.1:Channel = 78, Band edge @ 8-DPSK)



(Plot I.1:Channel = 78, Band edge with hopping on @ 8-DPSK)

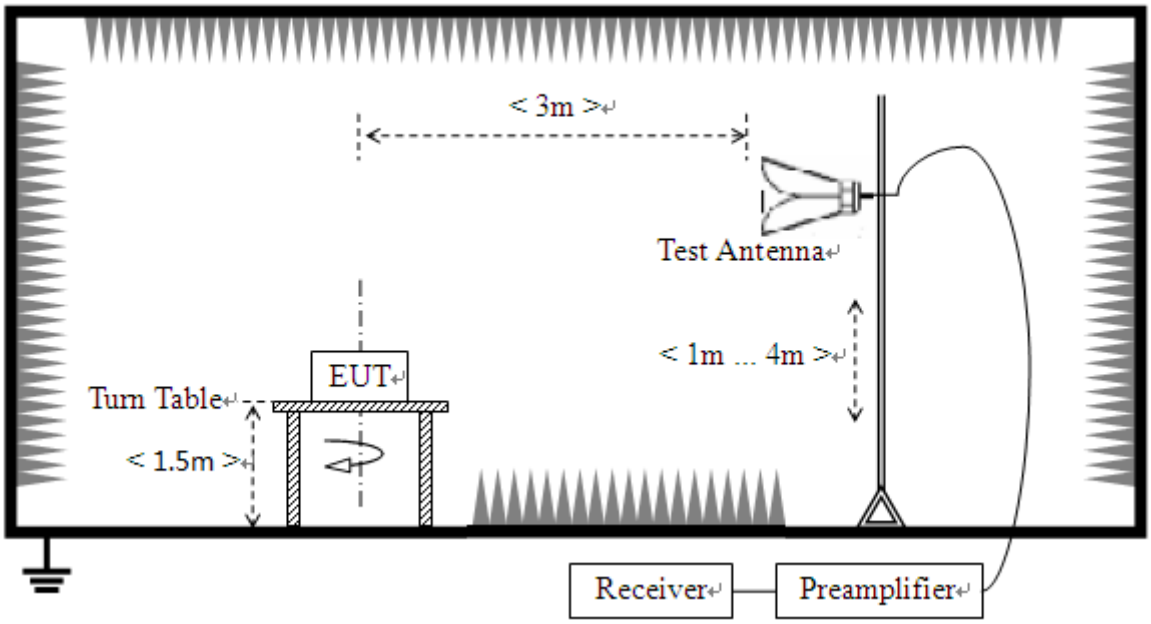
2.8 Restricted Frequency Bands

2.8.1 Requirement

According to FCC section 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, In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

2.8.2 Test Description

A. Test Setup:



The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under non hopping-on test mode transmitting 339 bytes DH5, 679 bytes 2DH5 and 1021 bytes 3DH5 packages at maximum power.
For the Test Antenna:

Horn Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

B. Equipments List:

Please reference ANNEX A(1.5).

2.8.3 Test Procedure

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1GHz, 100 KHz for f < 1GHz
VBW = 3 MHz for peak and 10Hz for average
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize.

2.8.4 Test Result

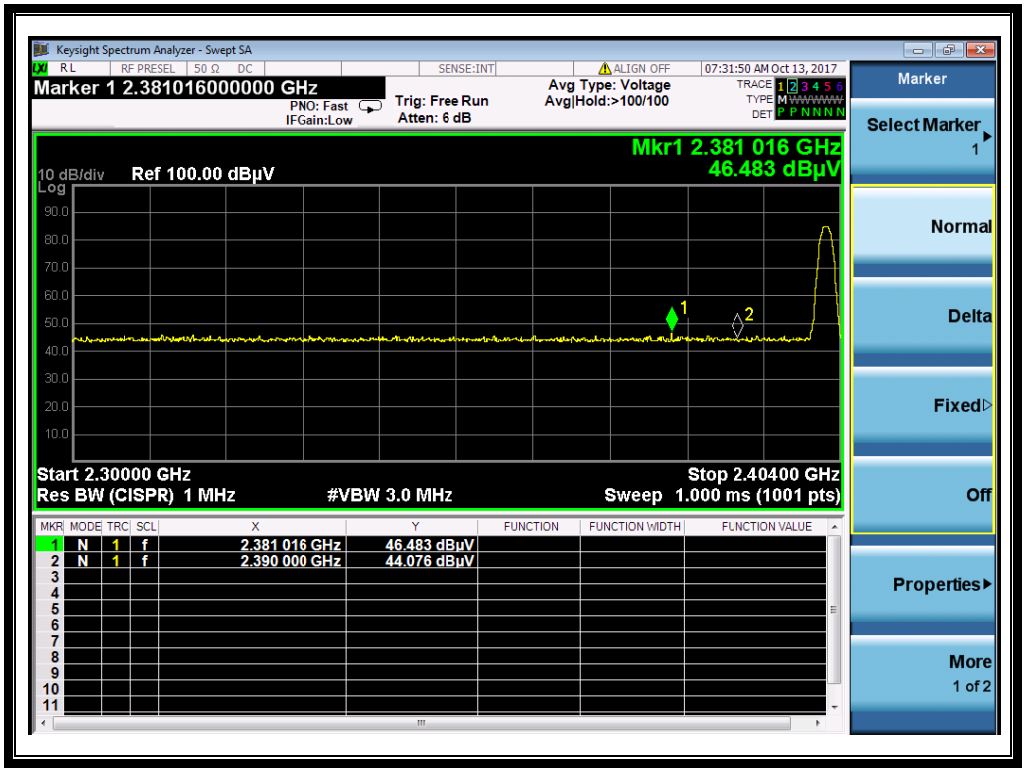
The lowest and highest channels are tested to verify Restricted Frequency Bands.
The measurement results are obtained as below:
E [dBμV/m] $=U_R + A_T + A_{Factor}$ [dB]; AT $=L_{Cable\ loss}$ [dB]$-G_{preamp}$ [dB]
AT: Total correction Factor except Antenna
UR: Receiver Reading
Gpreamp: Preamplifier Gain
AFactor: Antenna Factor at 3m
Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

2.8.4.1 GFSK Mode

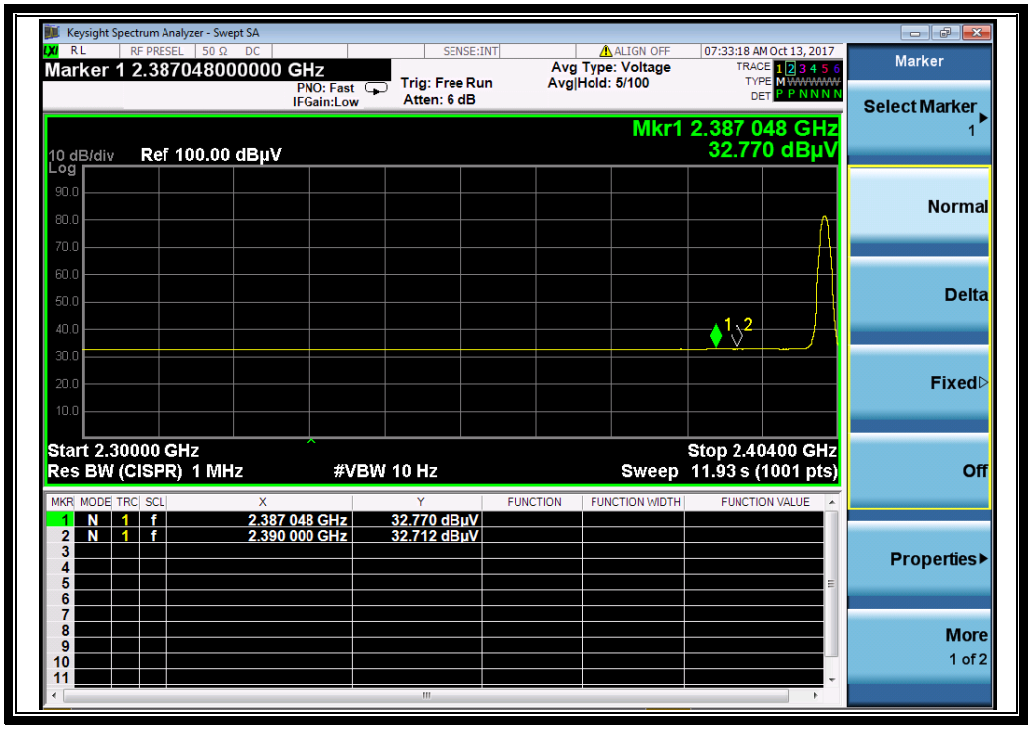
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2381.02	PK	46.48	-33.63	32.56	45.41	74	Pass
0	2387.05	AV	32.77	-33.63	32.56	31.70	54	Pass
78	2485.30	PK	44.74	-33.18	32.50	44.06	74	Pass
78	2483.79	AV	32.69	-33.18	32.50	32.01	54	Pass

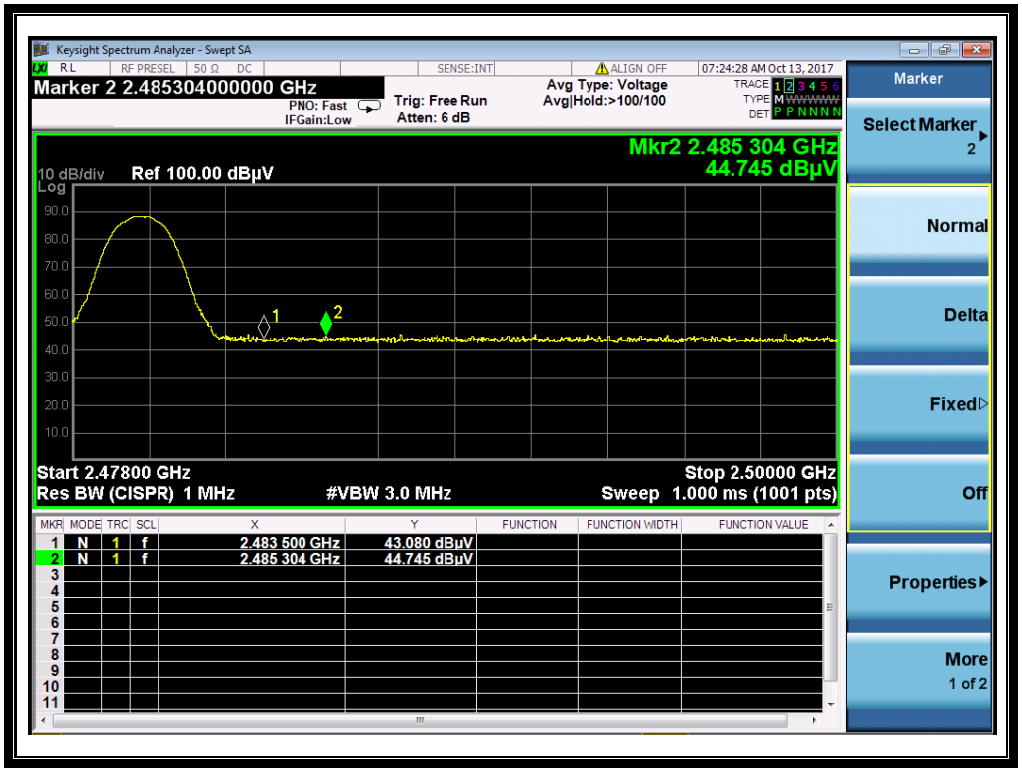
B. Test Plots:



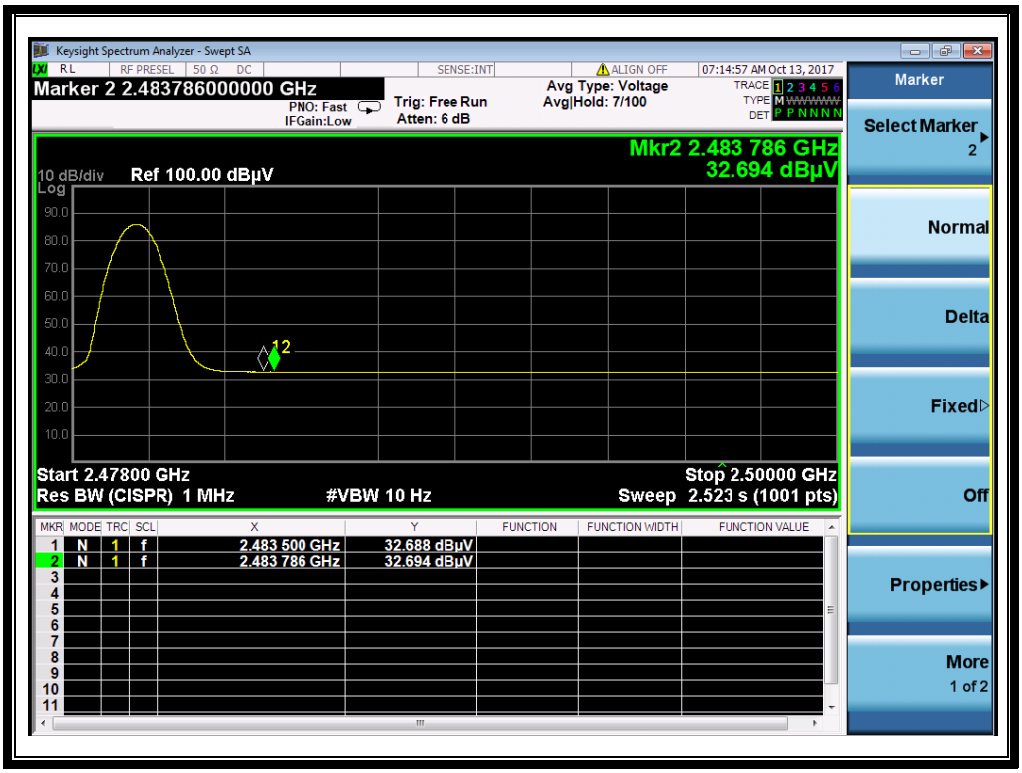
(Plot A1:Channel = 0 PEAK @ GFSK)



(Plot A2:Channel = 0 AVERAGE @ GFSK)



(Plot B1: Channel = 78 PEAK @ GFSK)



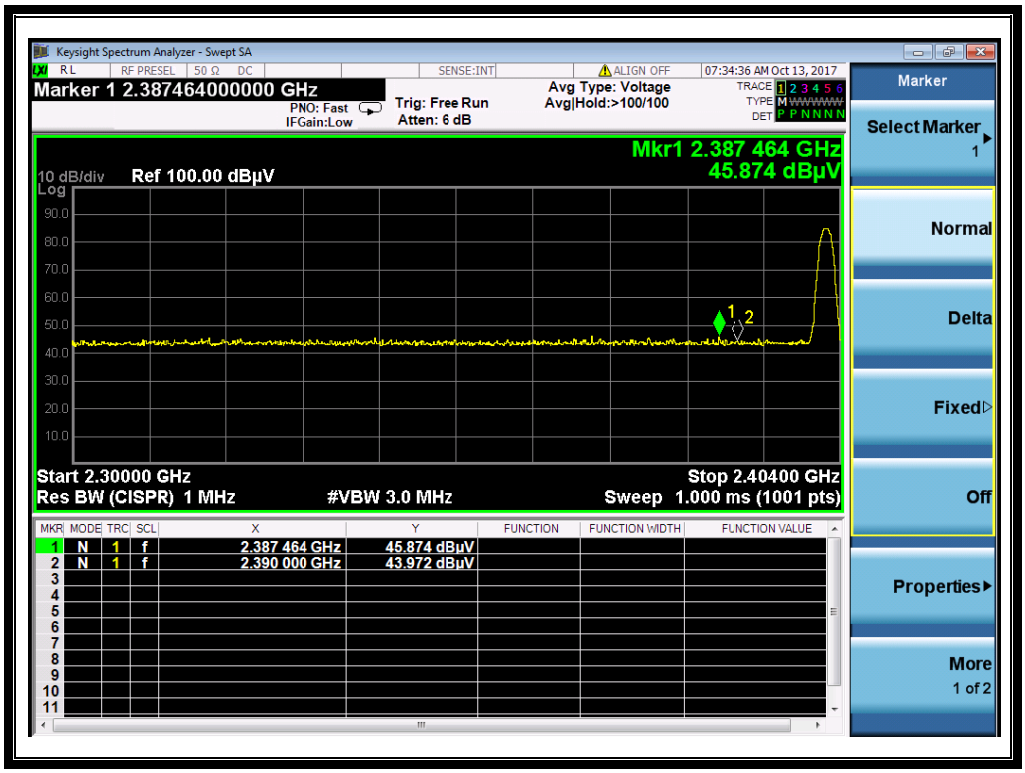
(Plot B2: Channel = 78 AVERAGE @ GFSK)

2.8.4.2 π/4-DQPSK Mode

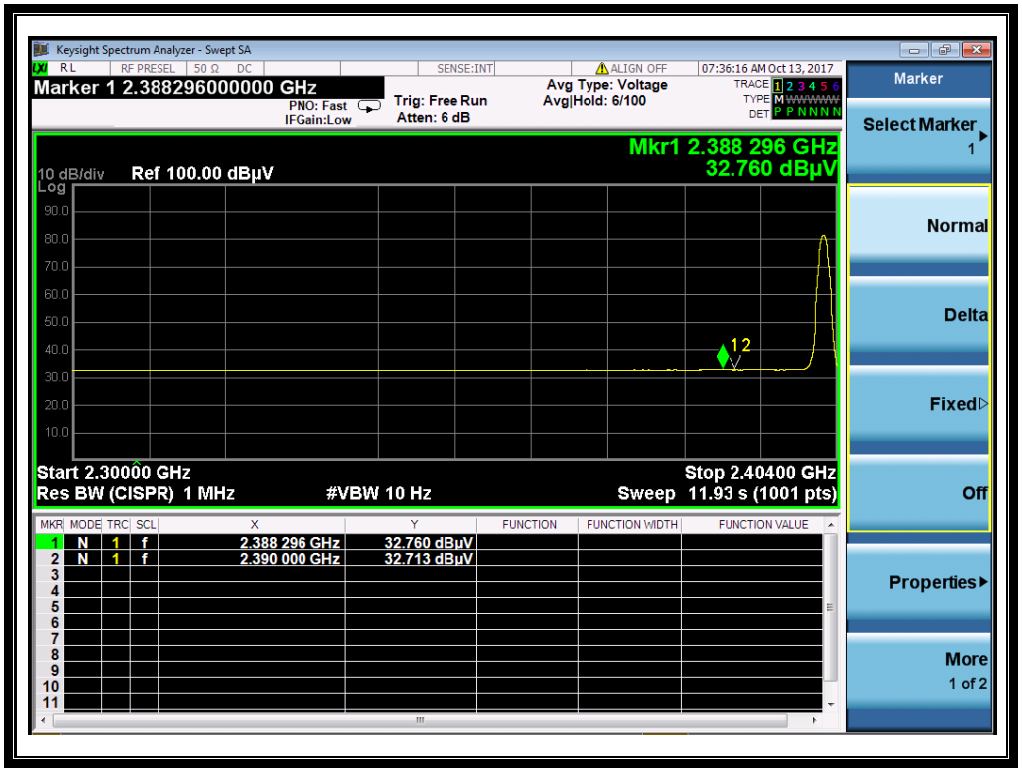
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2387.46	PK	45.87	-33.63	32.56	44.80	74	Pass
0	2388.30	AV	32.76	-33.63	32.56	31.69	54	Pass
78	2484.47	PK	45.59	-33.18	32.5	44.91	74	Pass
78	2484.14	AV	32.66	-33.18	32.5	31.98	54	Pass

B. Test Plots:

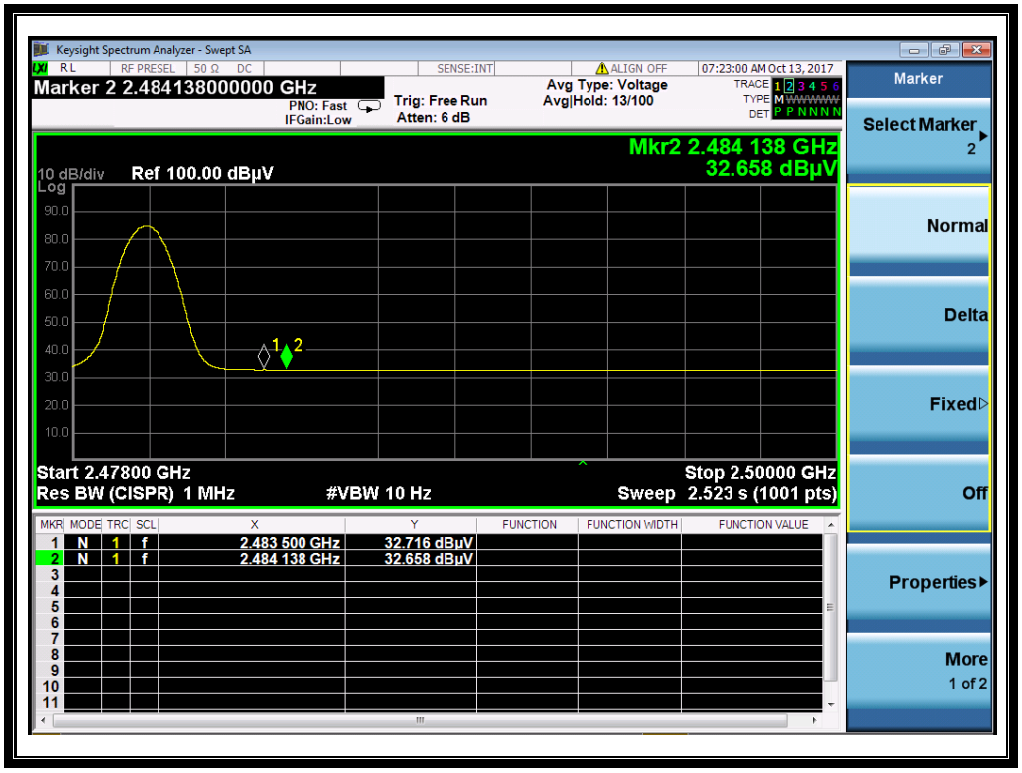


(Plot C1: Channel = 0 PEAK @ π/4-DQPSK)



(Plot C2: Channel = 0 AVERAGE @ π/4-DQPSK)

(Plot D1: Channel = 78 PEAK @ π/4-DQPSK)



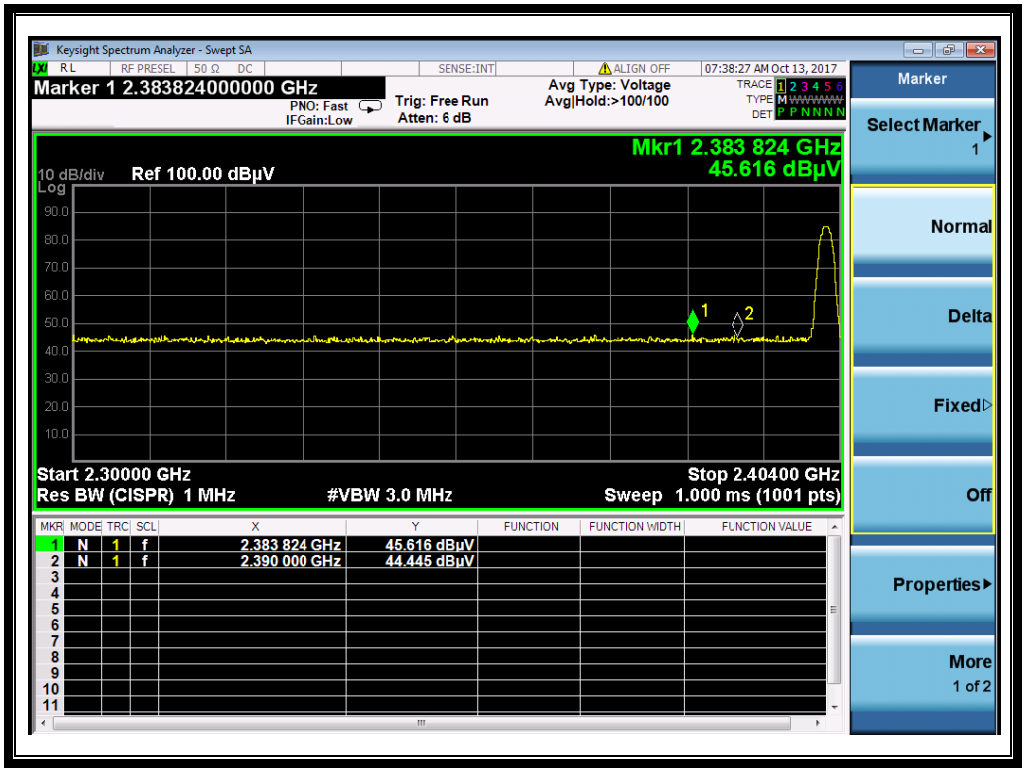
(Plot D2: Channel = 78 AVERAGE@ π/4-DQPSK)

2.8.4.3 8-DPSK Mode

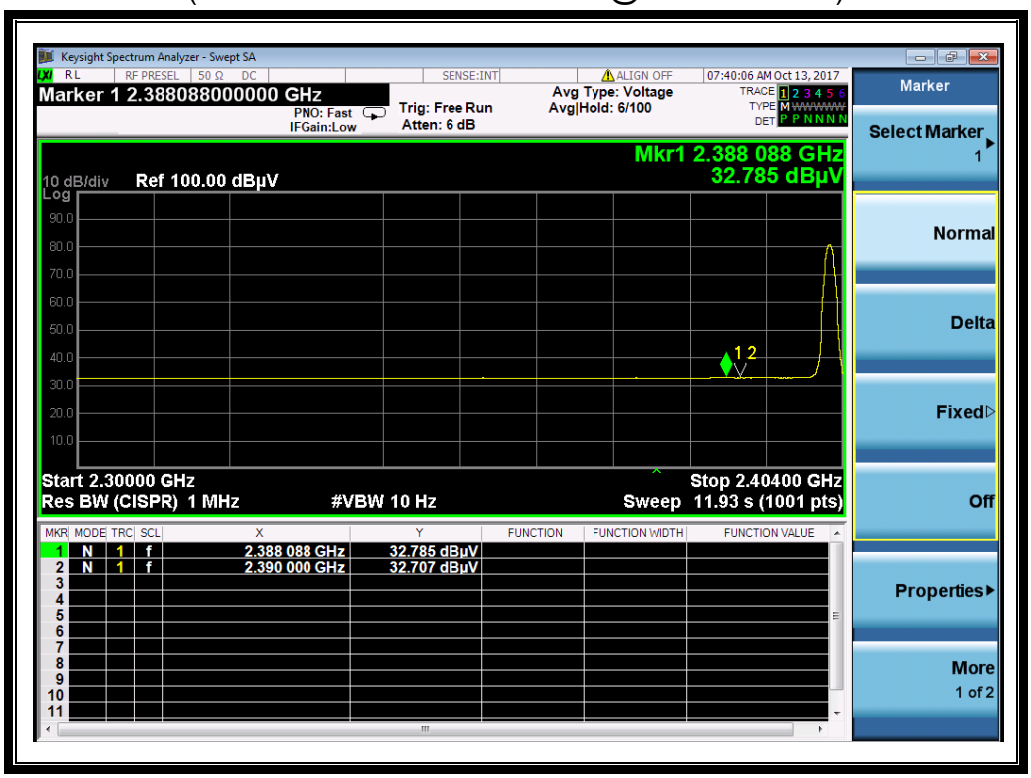
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBµV/m)	Limit (dBµV/m)	Verdict
0	2383.82	PK	45.62	-33.63	32.56	44.55	74	Pass
0	2388.09	AV	32.78	-33.63	32.56	31.71	54	Pass
78	2486.16	PK	44.67	-33.18	32.5	43.99	74	Pass
78	2483.98	AV	32.66	-33.18	32.5	31.98	54	Pass

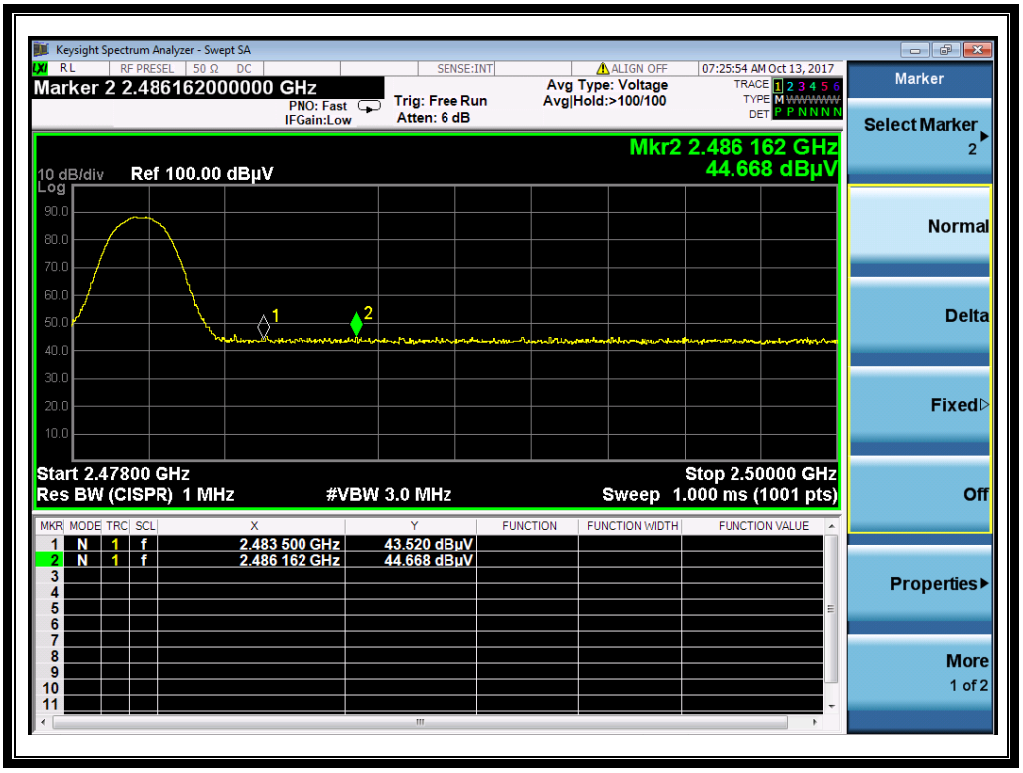
B. Test Plots:



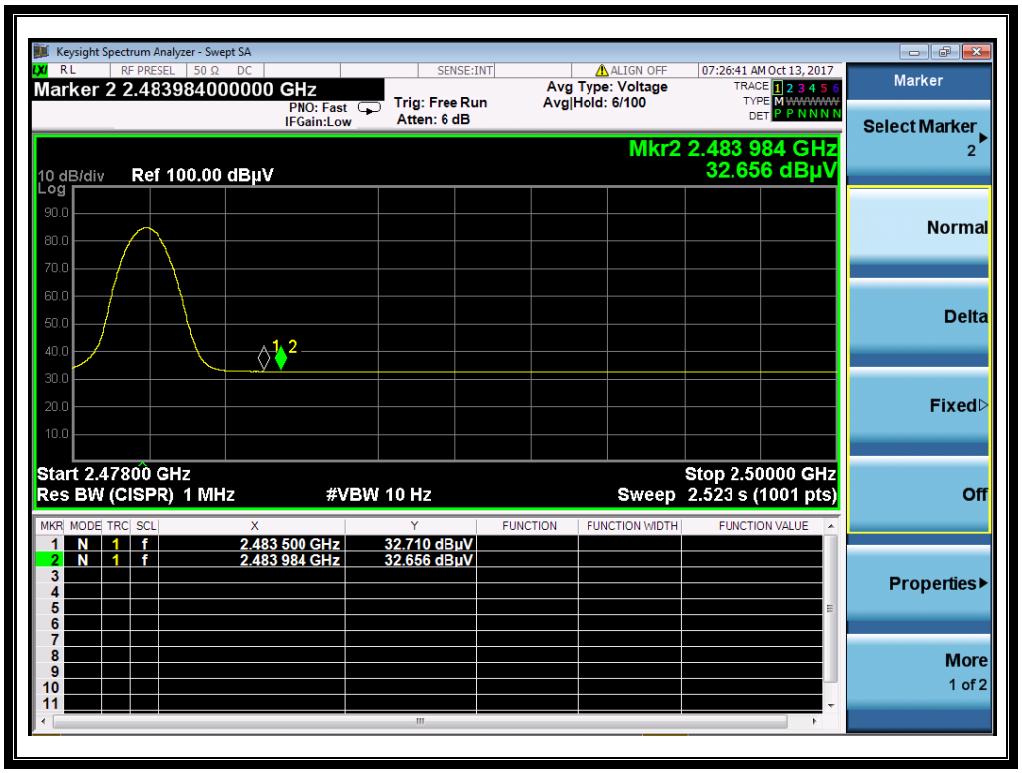
(Plot E1: Channel = 0 PEAK @ 8-DPSK Mode)



(Plot E2: Channel = 0 AVERAGE @ 8-DPSK Mode)



(Plot F1:Channel = 78 PEAK @ 8-DPSK Mode)



(Plot F2:Channel = 78 AVERAGE @ 8-DPSK Mode)

2.9 Conducted Emission

2.9.1 Requirement

According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5- 30	60	50

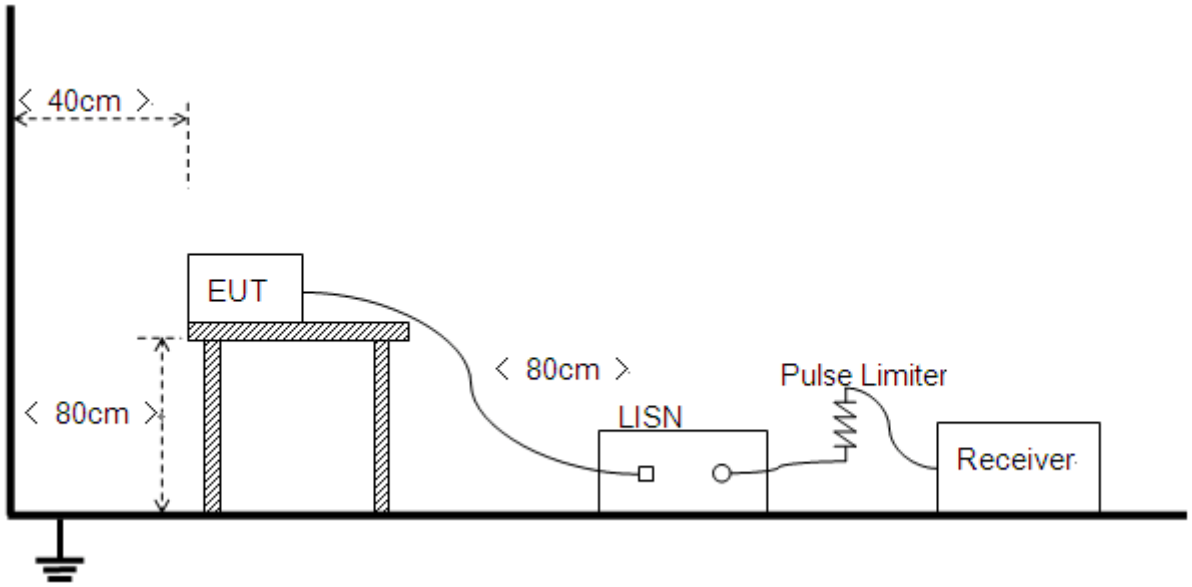
NOTE:

(a) The lower limit shall apply at the band edges.

(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.9.2 Test Description

A. Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.

The factors of the site are calibrated to correct the reading. During the measurement, the Bluetooth EUT is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under hopping-on test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Please reference ANNEX A(1.5).

2.9.3 Test Result

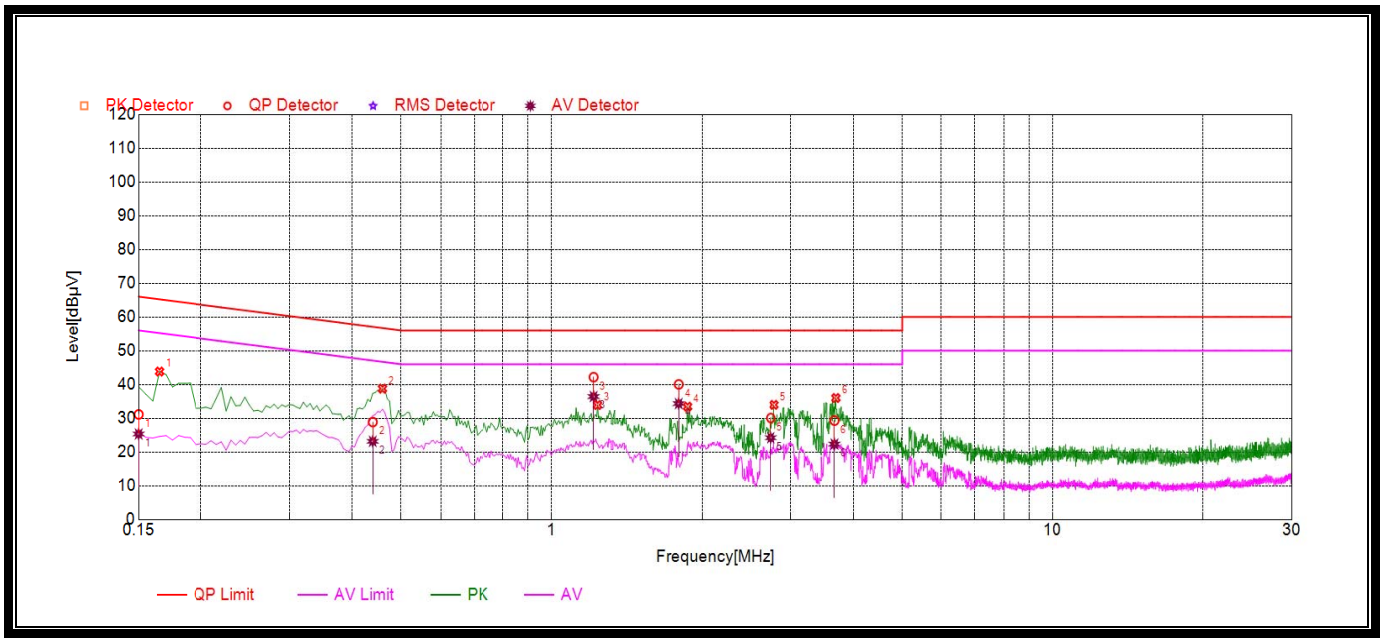
The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

A. Test setup:

The EUT configuration of the emission tests is EUT + Link.

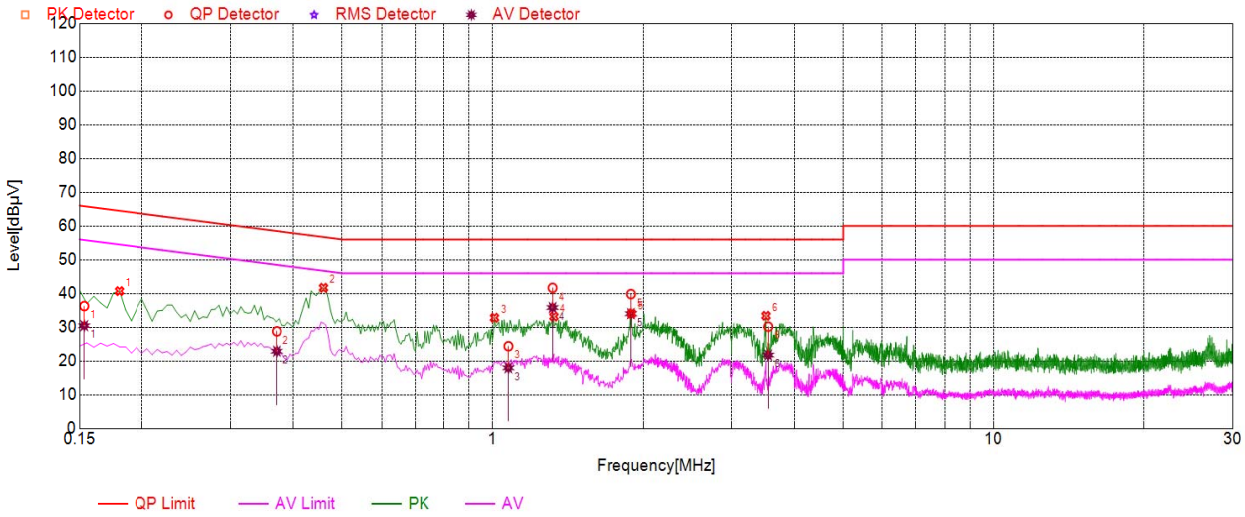
Note: The test voltage is AC 120V/60Hz.

B. Test Plots:



(Plot A: L Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.15	31.12	25.32	66.00	56.00	Line	PASS
2	0.44	28.86	23.15	57.06	47.06		PASS
3	1.213	42.16	36.41	56.00	46.00		PASS
4	1.7948	40.02	34.32	56.00	46.00		PASS
5	2.742	30.06	24.21	56.00	46.00		PASS
6	3.6708	29.29	22.33	56.00	46.00		PASS



(Plot B: N Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1532	36.25	30.44	65.82	55.82	Line	PASS
2	0.3712	28.76	22.88	58.47	48.47		PASS
3	1.0762	24.35	17.96	56.00	46.00		PASS
4	1.3168	41.65	35.82	56.00	46.00		PASS
5	1.8894	39.81	34.00	56.00	46.00		PASS
6	3.5508	30.15	21.73	56.00	46.00		PASS

2.10 Radiated Emission

2.10.1 Requirement

According to FCC section 15.247(d), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note:

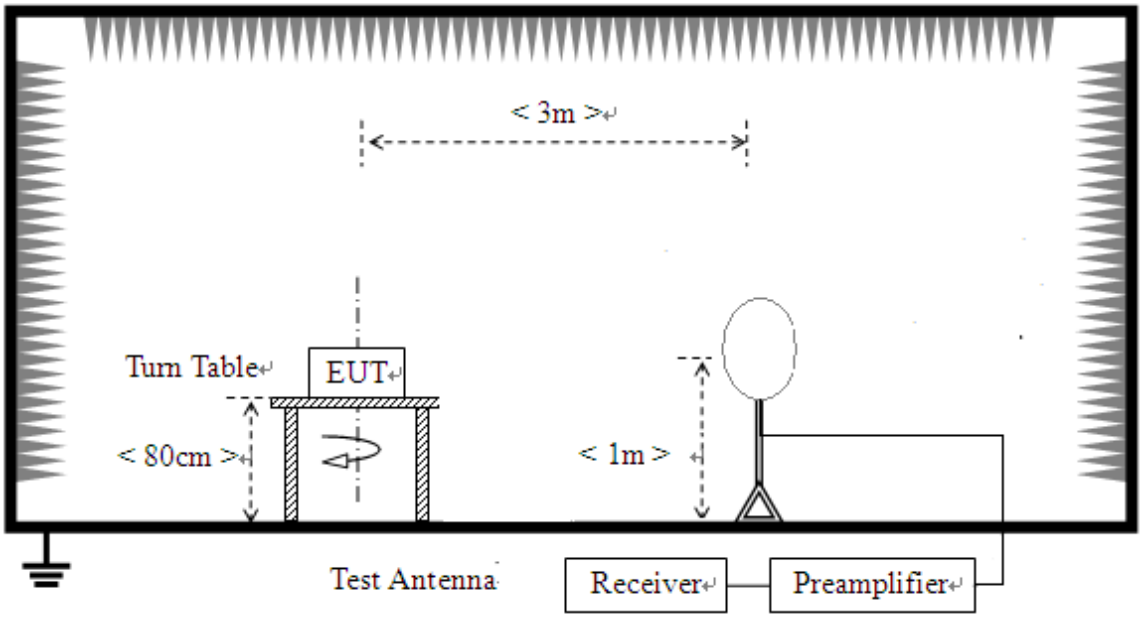
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

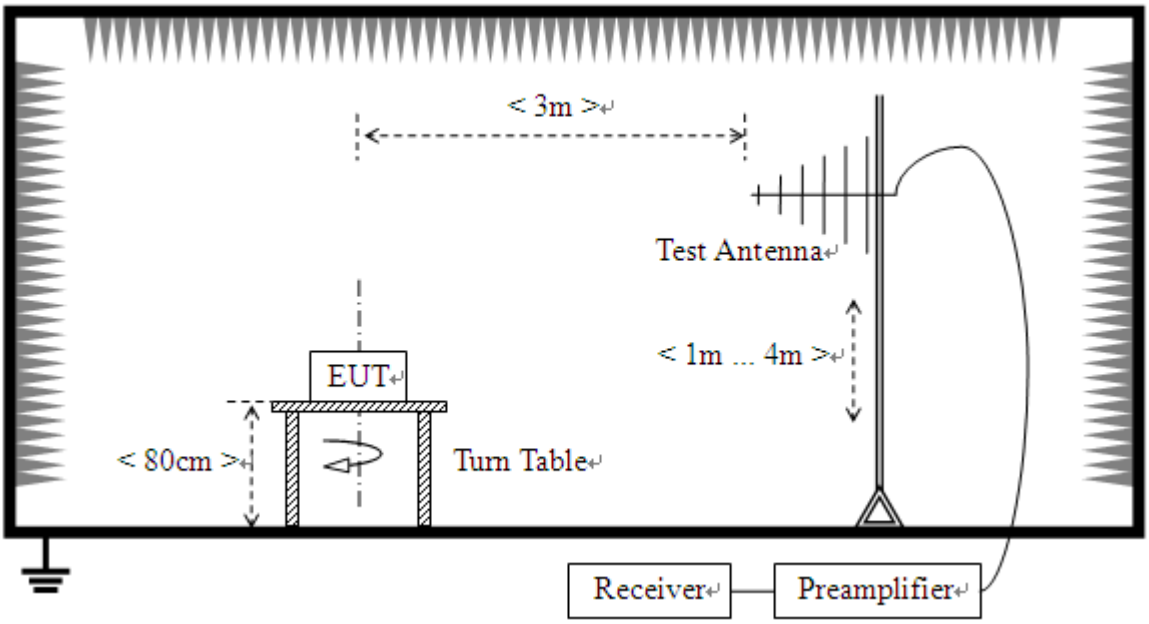
2.10.2 Test Description

A. Test Setup:

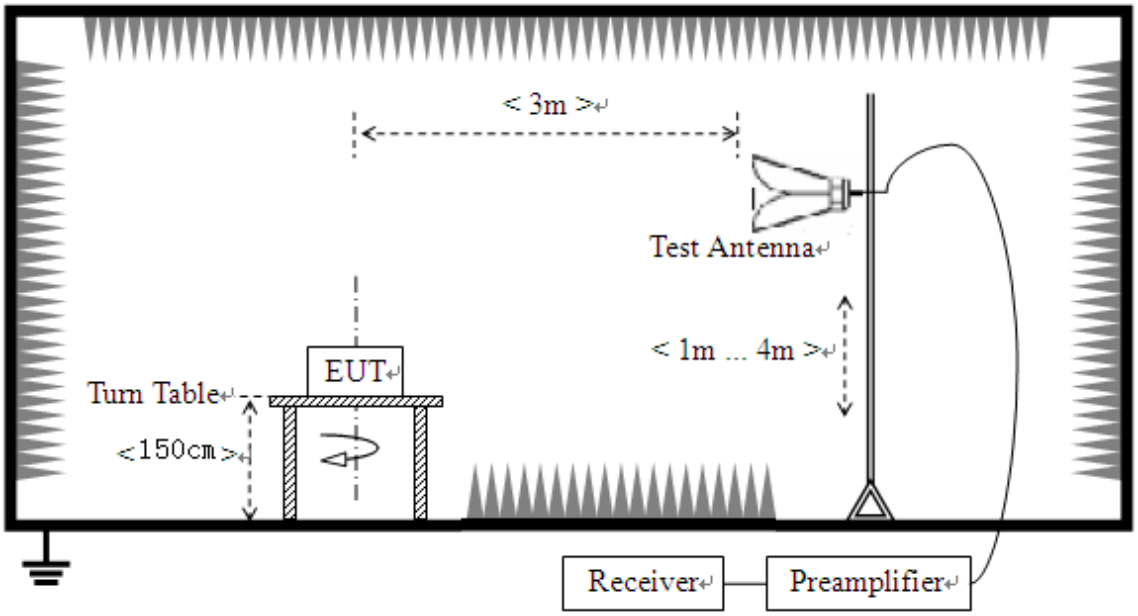
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The RF absorbing material used on the reference ground plane and on the turntable have a maximum height (thickness) of 30 cm (12 in) and have a minimum-rated attenuation of 20 dB at all frequencies from 1 GHz to 18 GHz. Test site have a minimum area of the ground plane covered with RF absorbing material as specified in Figure 6 of ANSI C63.4: 2014.

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10 (2013). For radiated emissions below or equal to 1GHz, the EUT was set-up on insulator 80cm above the Ground Plane, For radiated emissions above 1GHz, The EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10.

The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Place the test antenna at 3m away from area of the EUT, while keeping the test antenna aimed at the source of emissions at each frequency of significant

emissions, with polarization oriented for maximum response. The test antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final test antenna elevation shall be that which maximizes the emissions. The test antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. The emission levels at both horizontal and vertical polarizations should be tested.

B. Equipments List:

Please reference ANNEX A(1.5).

2.10.3 Test Procedure

Use the following spectrum analyzer settings:
Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

2.10.4 Test Result

According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:

E [dBμV/m] $=U_R + A_T + A_{Factor}$ [dB]; $A_T = L_{Cable\ loss}$ [dB]$-G_{preamp}$ [dB]

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

During the test, the total correction Factor AT and A_{Factor} were built in test software.

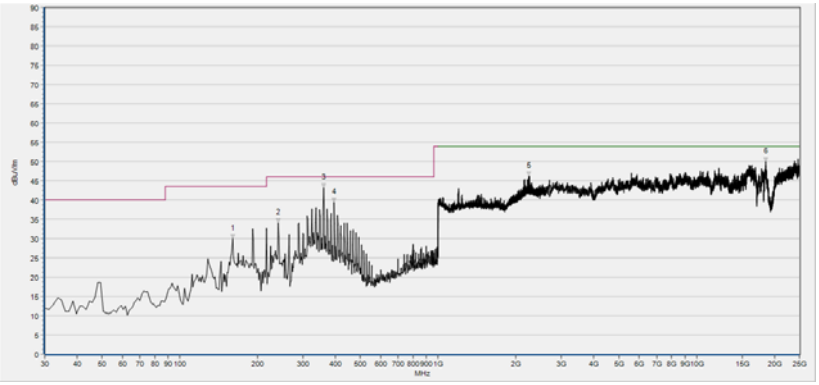
Note: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

The low frequency, which started from 9KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

2.10.4.1 GFSK Mode：

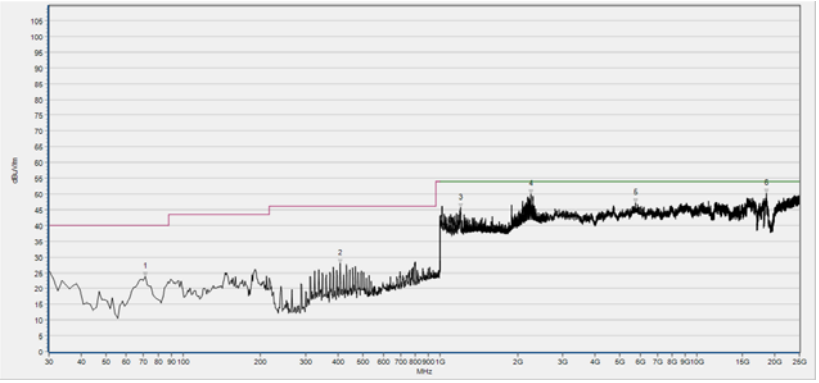
A. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 0



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
159.900	29.98	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
240.025	34.02	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
360.213	43.28	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
395.419	39.42	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2241.457	46.23	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
18462.084	49.95	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

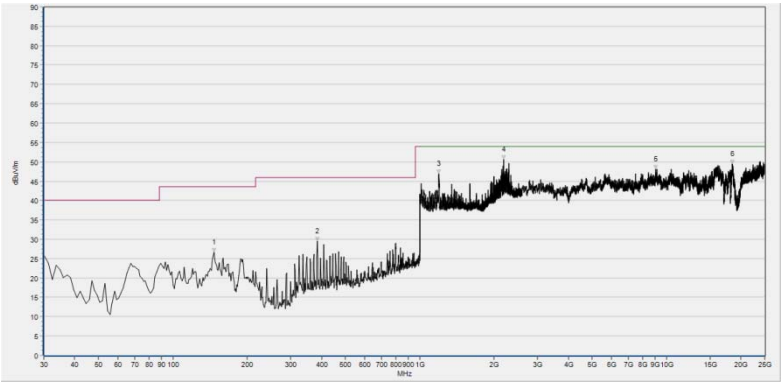
(30MHz to 25GHz, Antenna Horizontal @ GFSK, channel 0)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
71.277	23.71	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
407.559	27.95	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1197.839	45.59	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
2256.823	49.95	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
5752.864	47.24	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
18567.994	50.18	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

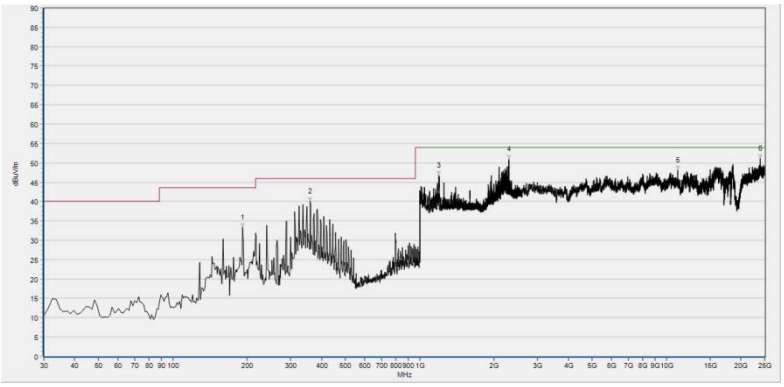
(30MHz to 25GHz, Antenna Vertical @ GFSK, channel 0)

Plot for Channel = 39



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
146.546	26.59	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
384.493	29.49	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1196.559	46.86	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
2192.797	50.60	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
9007.565	48.15	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
18462.084	49.41	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

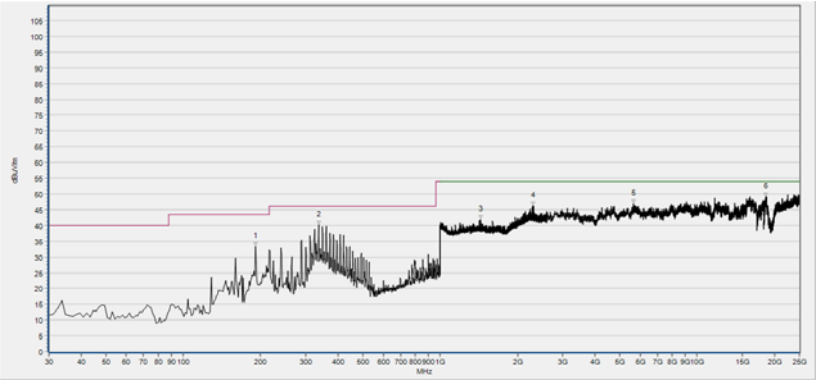
(30MHz to 25GHz, Antenna Horizontal @ GFSK, channel 39)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
191.464	33.35	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
360.213	39.98	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1193.998	46.76	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
2297.799	50.93	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
11093.181	48.07	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
23981.633	51.04	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

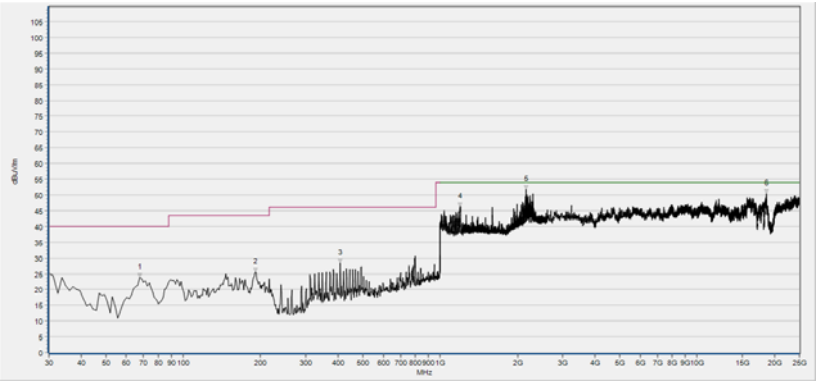
(30MHz to 25GHz, Antenna Vertical @ GFSK, channel 39)

Plot for Channel = 78



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
191.464	33.45	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
335.932	40.12	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1439.856	41.85	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
2298.439	46.31	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
5634.734	46.93	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
18531.333	49.16	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal @ GFSK, channel 78)



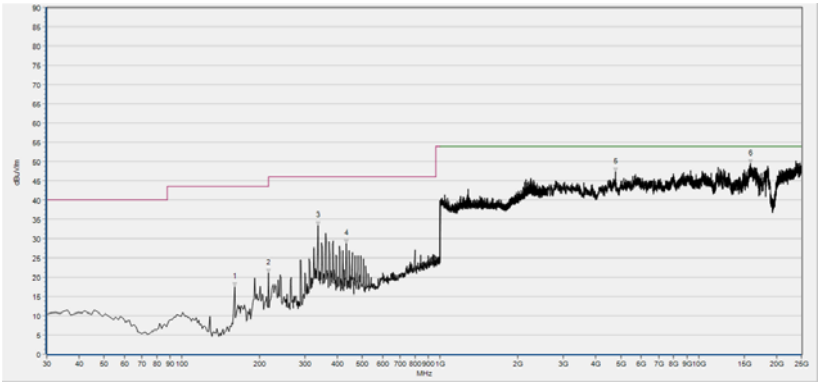
Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
67.635	23.81	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
191.464	25.46	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
407.559	28.29	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1197.199	46.36	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
2155.022	51.68	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
18551.700	50.49	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical @ GFSK, channel 78)

2.10.4.2 π/4-DQPSK Mode:

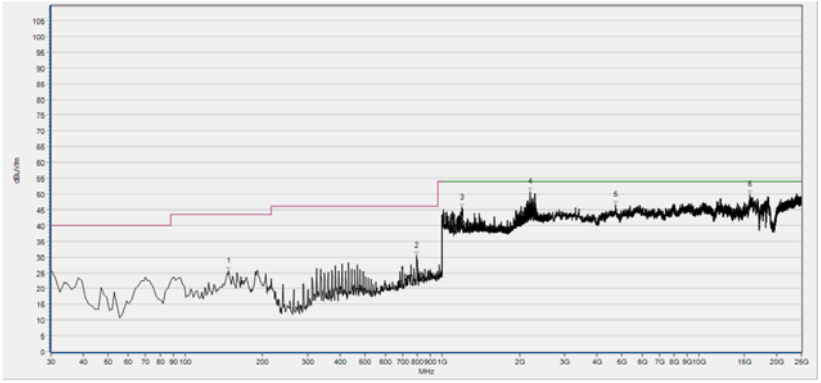
B. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 0



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
159.900	17.49	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
215.745	21.15	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
335.932	33.40	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
431.840	28.67	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
4754.865	47.39	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
15859.138	49.38	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

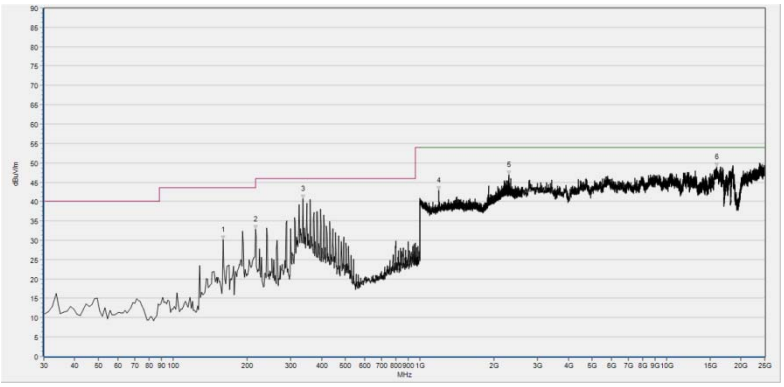
(30MHz to 25GHz, Antenna Horizontal @ π/4-DQPSK, channel 0)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
147.760	25.54	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
796.045	30.27	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1193.357	45.59	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
2197.279	50.68	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
4730.424	46.57	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
15753.228	49.78	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

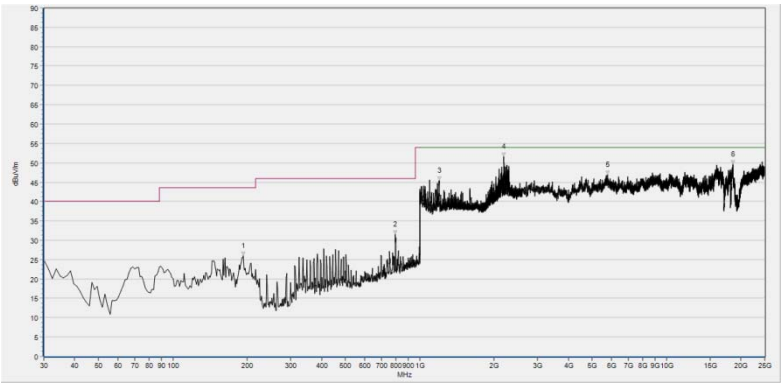
(30MHz to 25GHz, Antenna Vertical @ π/4-DQPSK, channel 0)

Plot for Channel = 39



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
159.900	30.19	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
215.745	32.77	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
335.932	40.65	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1194.638	42.88	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
2297.799	46.86	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
15997.636	49.00	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

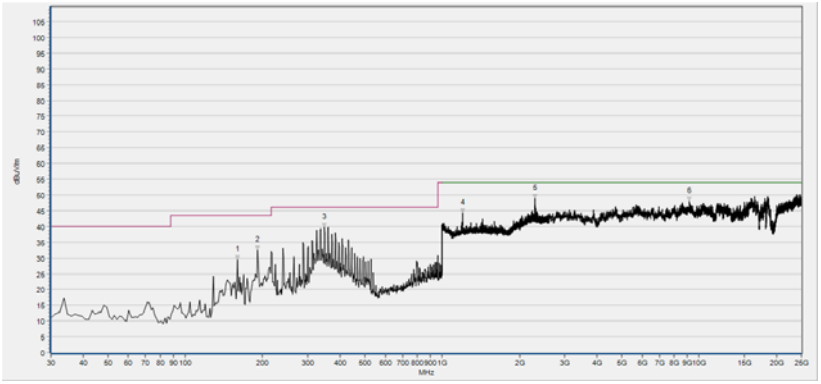
(30MHz to 25GHz, Antenna Horizontal @ π/4-DQPSK, channel 39)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
192.678	25.98	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
796.045	31.43	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1199.120	45.38	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
2193.437	51.68	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
5761.011	46.96	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
18543.553	49.64	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

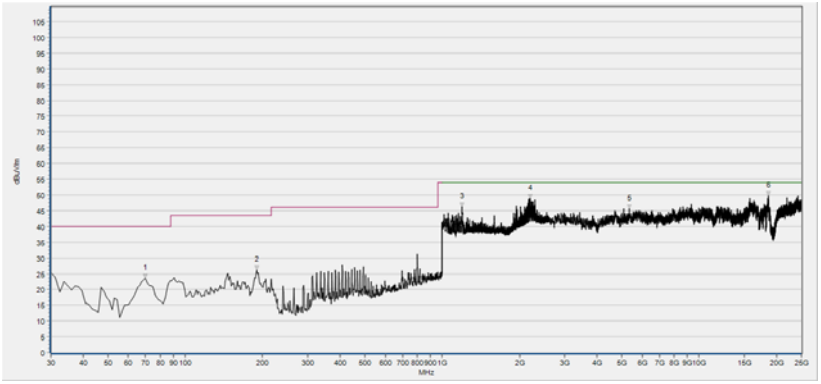
(30MHz to 25GHz, Antenna Vertical @ π/4-DQPSK, channel 39)

Plot for Channel = 78



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
159.900	29.58	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
191.464	32.60	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
348.073	39.81	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1199.120	44.28	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
2297.159	48.97	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
9166.430	48.11	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal @ π/4-DQPSK, channel 78)



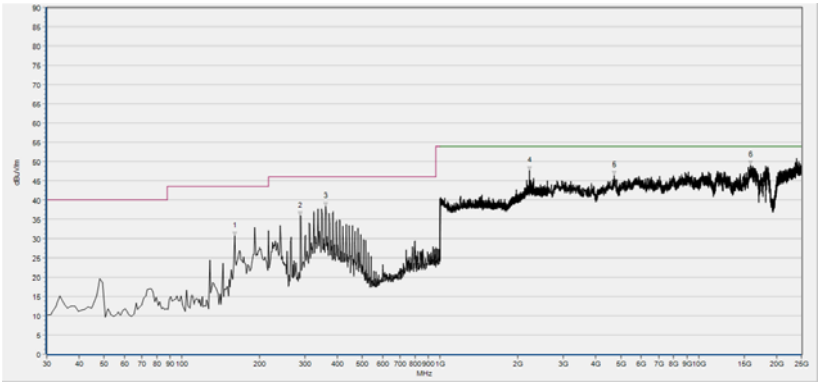
Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
70.063	23.58	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
190.250	26.20	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1195.278	46.33	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
2198.559	48.81	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
5345.517	45.60	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
18567.994	49.88	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical @ π/4-DQPSK, channel 78)

2.10.4.3 8-DPSK Mode:

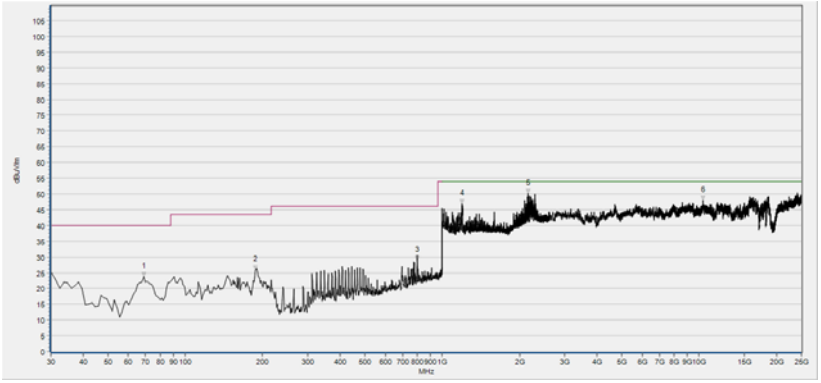
C. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 0



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
159.900	30.73	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
287.372	35.88	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
360.213	38.37	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2212.005	47.74	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
4705.983	46.51	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
15867.285	49.05	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

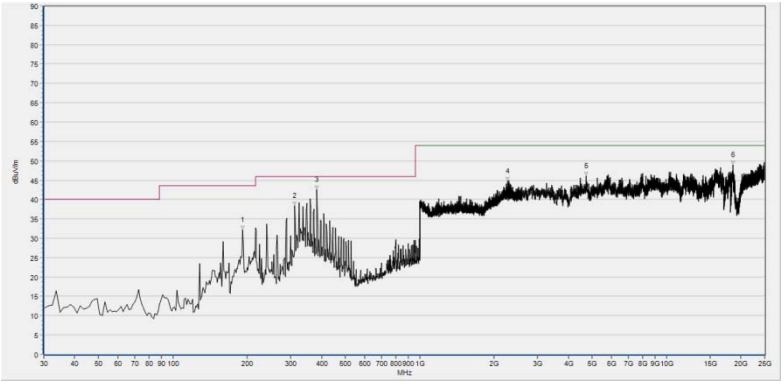
(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 0)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
68.849	23.75	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
187.822	26.00	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
798.473	29.08	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1196.559	46.97	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
2156.303	50.27	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
10359.956	48.03	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

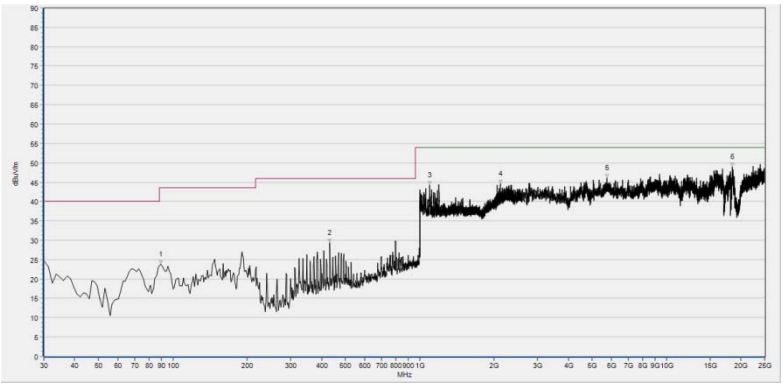
(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 0)

Plot for Channel = 39



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
191.464	32.21	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
311.652	38.43	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
383.279	42.49	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2276.030	44.77	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
4722.277	46.12	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
18576.141	48.88	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS

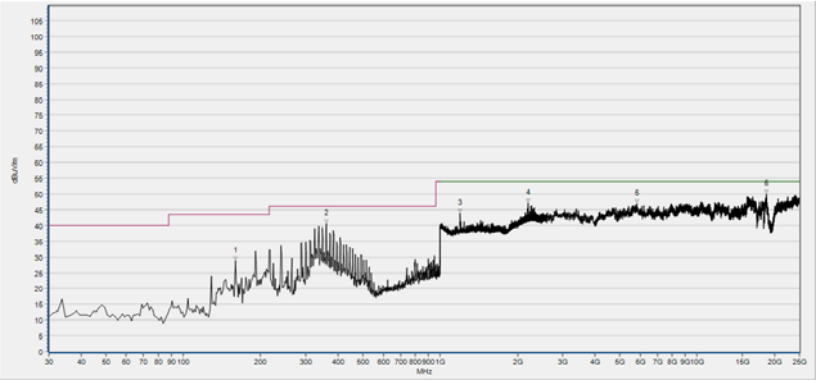
(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 39)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
89.487	23.80	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
431.840	29.30	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1099.240	44.22	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
2117.247	44.53	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
5736.570	46.09	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
18498.745	48.86	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

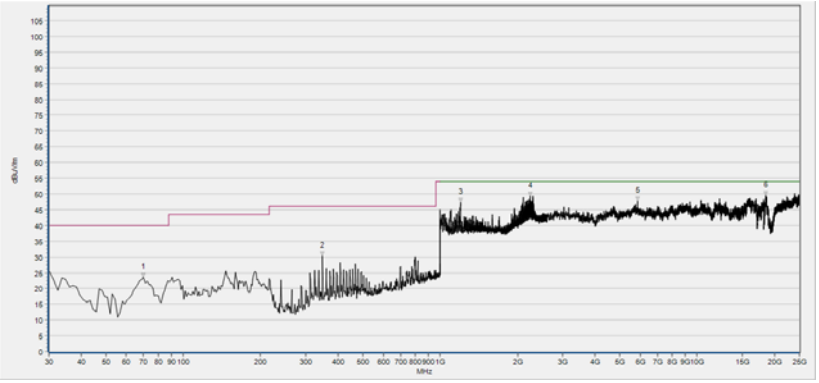
(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 39)

Plot for Channel = 78



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
159.900	28.83	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
360.213	40.55	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1197.199	43.81	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
2195.358	47.22	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
5830.260	46.95	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
18551.700	49.99	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 78)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
70.063	23.67	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
348.073	30.27	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1198.479	47.38	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
2235.054	49.38	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
5850.627	47.89	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
18458.011	49.55	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 78)

ANNEX A GENERAL INFORMATION

1.1 Identification of the Responsible Testing Laboratory

Company Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Department:	Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Responsible Test Lab Manager:	Mr. Su Feng
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

1.2 Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

1.3 Facilities and Accreditations

Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L3572.

All measurement facilities used to collect the measurement data are located at FL.3, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10-2013 and CISPR Publication 22; the FCC designation number is CN1192.

1.4 Maximum measurement uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for test performed on the EUT as specified in CISPR 16-1-2:

Test items	Uncertainty
Number of Hopping Frequency	±5%
Peak Output Power	±2.22dB
20dB Bandwidth	±5%
Carrier Frequency Separation	±5%
Time of Occupancy (Dwell time)	±5%
Conducted Spurious Emission	±2.77 dB
Restricted Frequency Bands	±5%

Radiated Emission	±2.95dB
Conducted Emission	±2.44dB

This uncertainty represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2

1.5 Test Equipments Utilized

1.5.1 Conducted Test Equipments

Conducted Test Equipment						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal. Date**	**Cal. Due**
1	Spectrum Analyzer	MY45101810	E4407B	Agilent	2017.05.24	2018.05.23
2	Power Splitter	NW521	1506A	Weinschel	2017.05.24	2018.05.23
3	Attenuator 1	(N/A.)	10dB	Resnet	2017.05.24	2018.05.23
4	Attenuator 2	(N/A.)	3dB	Resnet	2017.05.24	2018.05.23
5	EXA Signal Analzyer	MY53470836	N9010A	Agilent	2016.12.07	2017.12.06
6	Bluetooth Test Set	6K00006210	MT8852B	Anritsu	2017.05.24	2018.05.23
7	USB Wideband Power Sensor	MY54210011	U2021XA	Agilent	2017.05.24	2018.05.23
8	RF cable (30MHz-26GHz)	CB01	RF01	Morlab	N/A	N/A
9	Coaxial cable	CB02	RF02	Morlab	N/A	N/A
10	SMA connector	CN01	RF03	HUBER-SUHNER	N/A	N/A

1.5.2 Conducted Emission Test Equipments

Conducted Emission Test Equipments						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal. Date**	**Cal. Due**
1	Receiver	US44210471	E7405A	Agilent	2017.05.24	2018.05.23
2	LISN	812744	NSLK 8127	Schwarzbeck	2017.05.24	2018.05.23
3	Service Supplier	100448	CMU200	R&S	2017.05.24	2018.05.23
4	Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2017.05.24	2018.05.23
5	Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A

1.5.3 Auxiliary Test Equipment

Auxiliary Test Equipment						
No.	**Equipment Name**	**Model No.**	**Brand Name**	**Manufacturer**	**Cal.Date**	**Cal.Due Date**
1	Computer	T430i	Think Pad	Lenovo	N/A	N/A

1.5.4 Radiated Test Equipments

Radiated Test Equipments						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal. Date**	**Cal.Due Date**
1	System Simulator	GB45360846	8960-E5515C	Agilent	2017.05.17	2018.05.16
2	Receiver	MY54130016	N9038A	Agilent	2017.05.17	2018.05.16
3	Test Antenna - Bi-Log	N/A	VULB9163	Schwarzbeck	2016.12.09	2017.12.08
4	Test Antenna - Horn	9120C-384	BBHA 9120C	Schwarzbeck	2017.03.30	2018.03.29
5	Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2017.03.30	2018.03.29
6	Coaxial cable (N male) (9KHz-30MHz)	CB04	EMC04	Morlab	N/A	N/A
7	Coaxial cable (N male) (30MHz-26GHz)	CB02	EMC02	Morlab	N/A	N/A
8	Coaxial cable(N male) (30MHz-26GHz)	CB03	EMC03	Morlab	N/A	N/A
9	1-18GHz pre-Amplifier	MA02	TS-PR18	Rohde& Schwarz	2017.05.17	2018.05.16
10	18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde& Schwarz	2017.05.17	2018.05.16

1.5.5 Climate Chamber

Climate Chamber						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal.Date**	**Cal.Due Date**
1	Climate Chamber	2004012	HL4003T	Yinhe	2017.01.11	2018.01.10

1.5.6 Vibration Table

Vibration Table						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal.Date**	**Cal.Due Date**
1	Vibration Table	N/A	ACT2000-S015L	CMI-COM	2017.01.11	2018.01.10

1.5.7 Anechoic Chamber

Anechoic Chamber						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal.Date**	**Cal.Due Date**
1	Anechoic Chamber	N/A	9m*6m*6m	Changning	2017.01.11	2018.01.10

***** END OF REPORT *****