REPORT No . : SZ17110202W02

TEST REPORT

APPLICANT	:	Thundercomm Technology Co., Ltd.
PRODUCT NAME	:	Thundersoft TurboX S820 SOM
MODEL NAME	:	S820
BRAND NAME	:	TurboX
FCC ID	:	2AOHHTURBOXSOMS820
STANDARD(S)	:	47 CFR Part 15 Subpart C
TEST DATE	:	2017-12-05 to 2018-01-15
ISSUE DATE	:	2018-01-17

Tested by: Tu Ya'nan

Tu Ya'nan (Test Engineer)

Approved by: Andy Yeh

Andy Yeh (Technical Director)

MORLAB

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DIRECTORY

Change History		
Issue	**Date**	**Reason for change**
1.0	2017-12-19	First edition
2.0	2018-01-17	Second edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Thundercomm Technology Co., Ltd.
Applicant Address:	4F,Taixiang Building, 1A Longxiang Rd., Haidian Dist.,Beijing,100191,P.R.China
Manufacturer:	Thundercomm Technology Co., Ltd.
Manufacturer Address:	4F,Taixiang Building, 1A Longxiang Rd., Haidian Dist.,Beijing,100191,P.R.China

1.2. Equipment Under Test (EUT) Description

Product Name:	Thundersoft TurboX S820 SOM
Serial No:	(N/A, marked #1 by test site)
Hardware Version:	Dolphin_V23
Software Version:	N/A
Modulation Type:	Bluetooth: FHSS (GFSK(1Mbps), π/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 4.2(BR/EDR)
Antenna Type:	FPC Antenna **Note3**
Antenna Gain:	4 dBi **Note3**

Note 1: The EUT contains Bluetooth Module operating at 2.4GHz ISM band; the frequencies 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: The EUT has 2 antenna ports (Ant port0/Ant port1), only the antenna ports 0 supports Bluetooth transmitter.

Note 3: The product will not sell with antenna. The antennas we use for all radiated test were just for test, the antenna type is FPC antenna and the antenna gain is 4 dBi. For more detailed, please refer to the Internal Photos.

Note 4: 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.

Note 5: 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 (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	Test Engineer	Result
1	15.203	Antenna Requirement	N/A	N/A	PASS
2	15.247(a)	Number of Hopping Frequency	Dec 05, 2017	Tu Ya'nan	PASS
3	15.247(b)	Peak Output Power	Dec 05, 2017	Tu Ya'nan	PASS
4	15.247(a)	20dB Bandwidth	Dec 05, 2017	Tu Ya'nan	PASS
5	15.247(a)	Carrier Frequency Separation	Dec 05, 2017	Tu Ya'nan	PASS
6	15.247(a)	Time of Occupancy (Dwell time)	Dec 05, 2017 Jan 15, 2018	Tu Ya'nan	PASS
7	15.247(d)	Conducted Spurious Emission	Dec 05, 2017	Tu Ya'nan	PASS
8	15.247(d)	Restricted Frequency Bands	Dec 11, 2017	Wang Dalong	PASS
9	15.209, 15.247(d)	Radiated Emission	Dec 12, 2017	Wang Dalong	PASS
10	15.207	Conducted Emission	Dec 12, 2017	Wang Dalong	PASS

Note: 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.

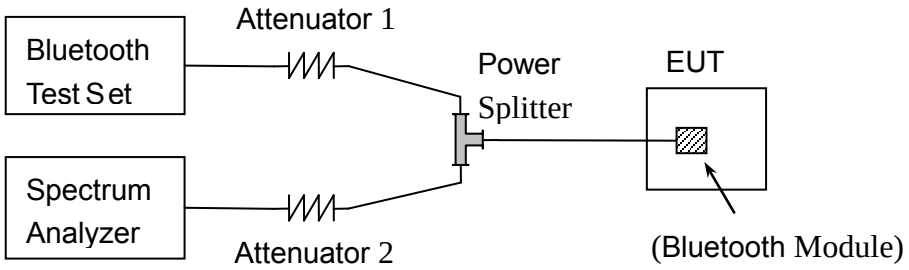
2.2. Number of Hopping Frequency

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 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

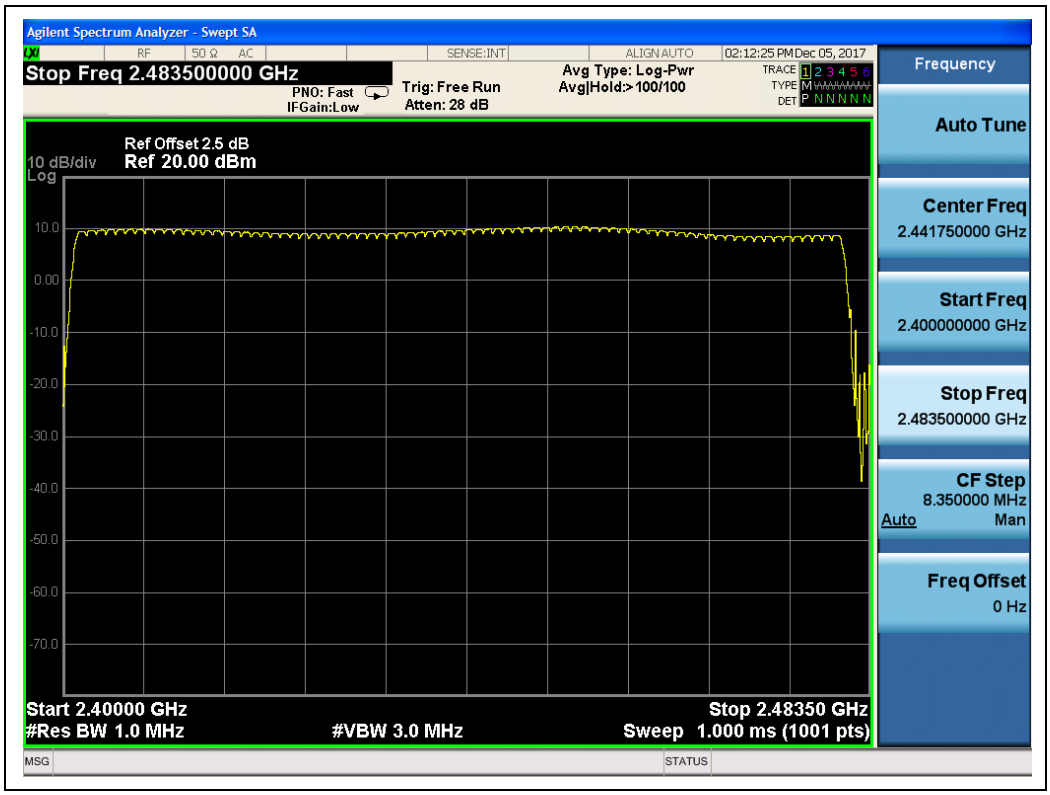
2.2.4. Test Result

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.

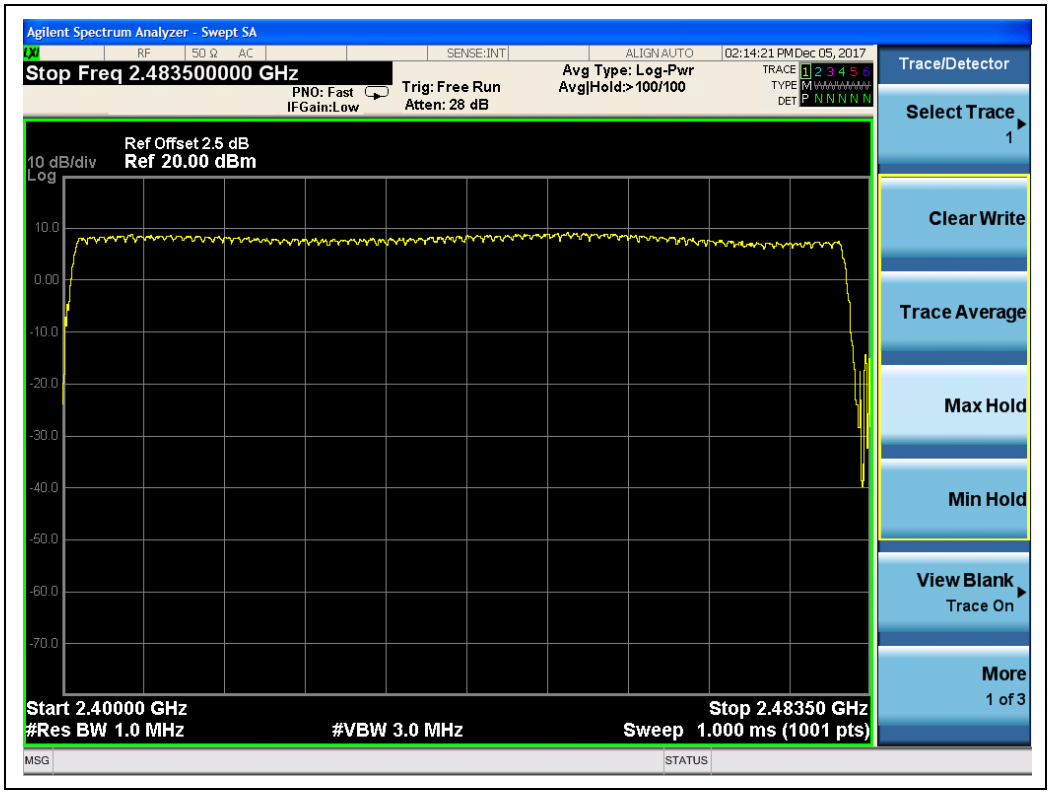
A. Test Verdict:

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

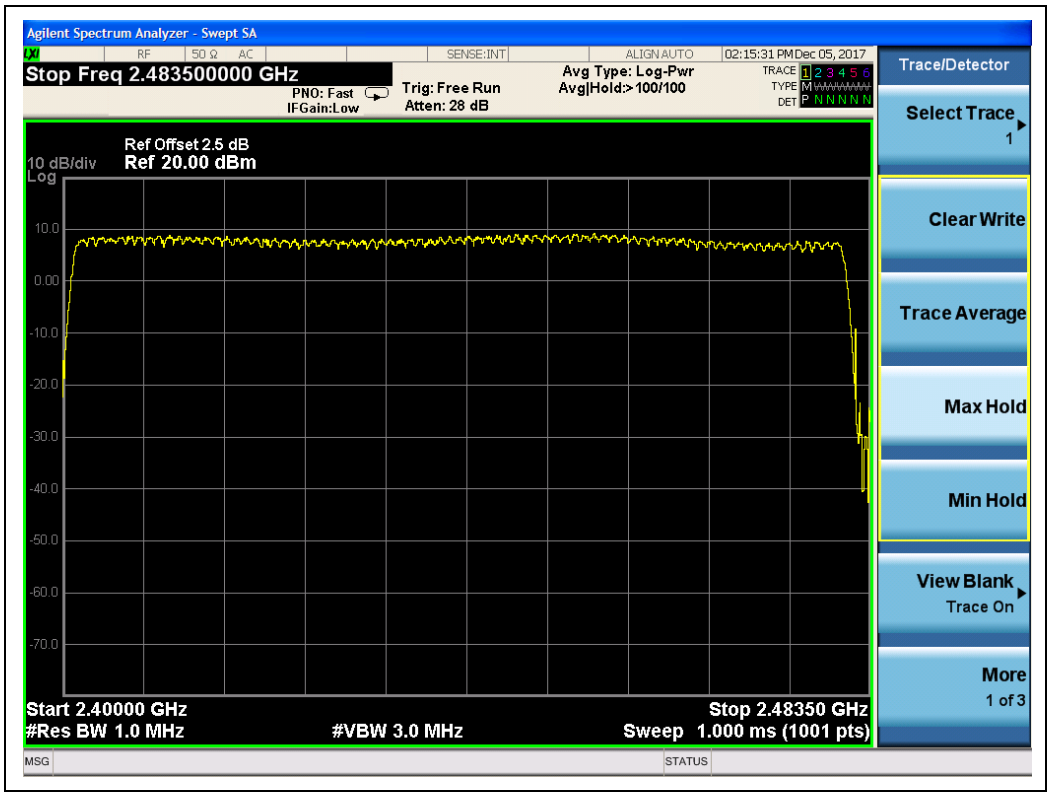
B. Test Plots:



(Plot A: GFSK)



(Plot B: π/4-DQPSK)



(Plot C: 8- DPSK)

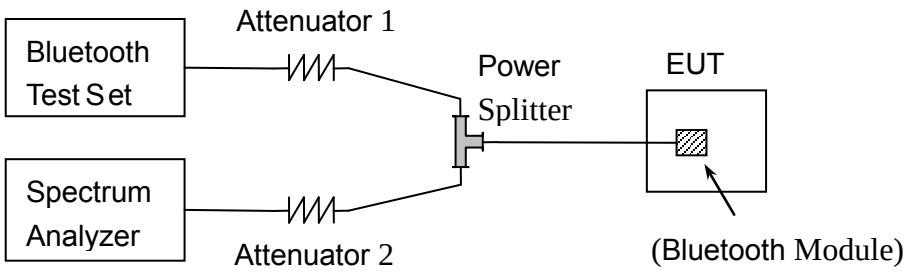
2.3. Peak Output Power

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 r adiator s hall not ex ceed 1 Watt. Fo r al l ot her frequency h opping s ystems i n 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 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).

2.3.3. Test Result

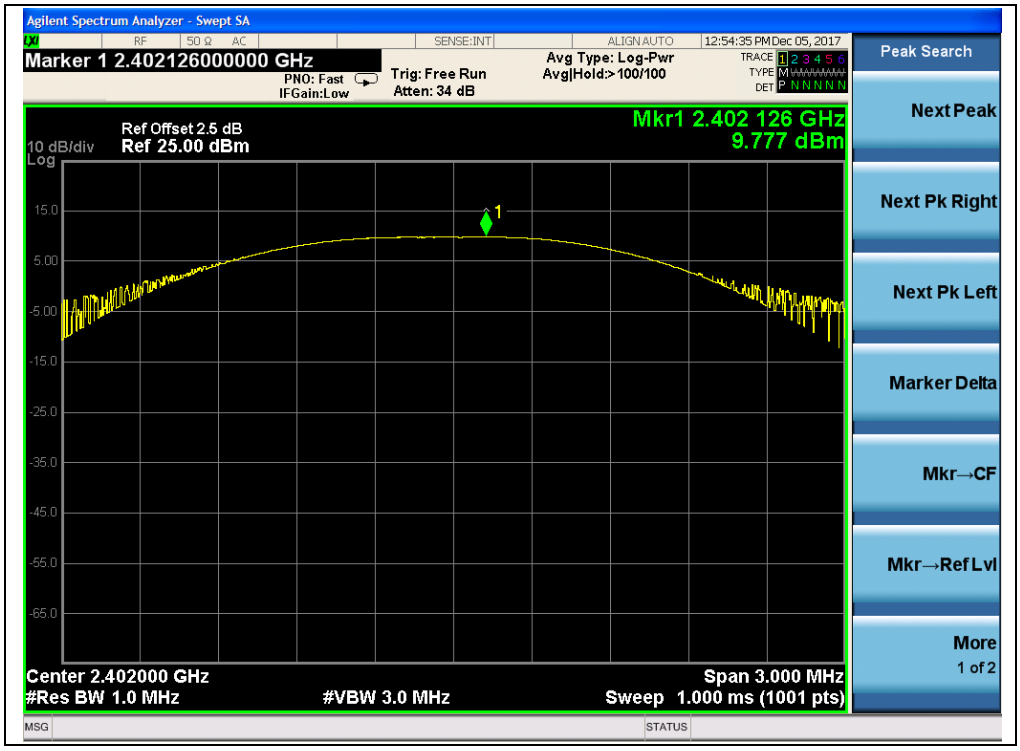
The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the module. The lowest, middle and highest channel were tested by USB Wideband Power Sensor.

2.3.3.1 GFSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Refer to Plot	Limit		Verdict
		dBm	W		dBm	W	
0	2402	9.78	0.00951	Plot A1	30	1	PASS
39	2441	10.01	0.01002	Plot A2			PASS
78	2480	8.90	0.00776	Plot A3			PASS

B. Test Plots:



(Plot A1:Channel 0, 2402MHz)

(Plot A2:Channel 19, 2440MHz)

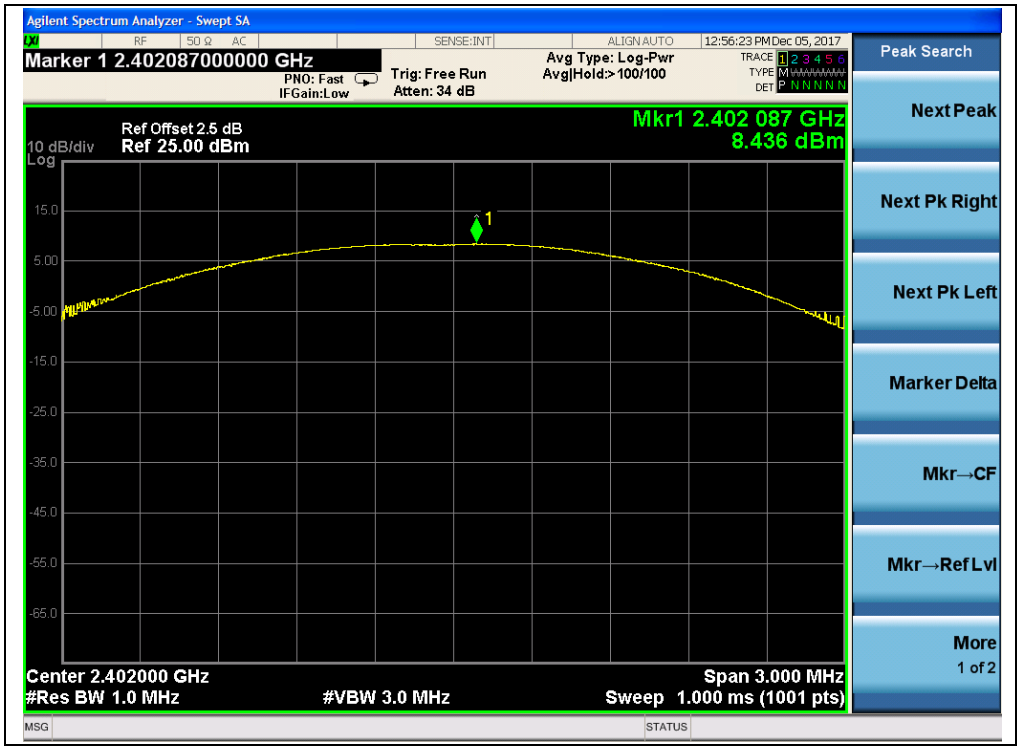
(Plot A3:Channel 39, 2480MHz)

2.3.3.2 π/4-DQPSK Mode

A. Test Verdict:

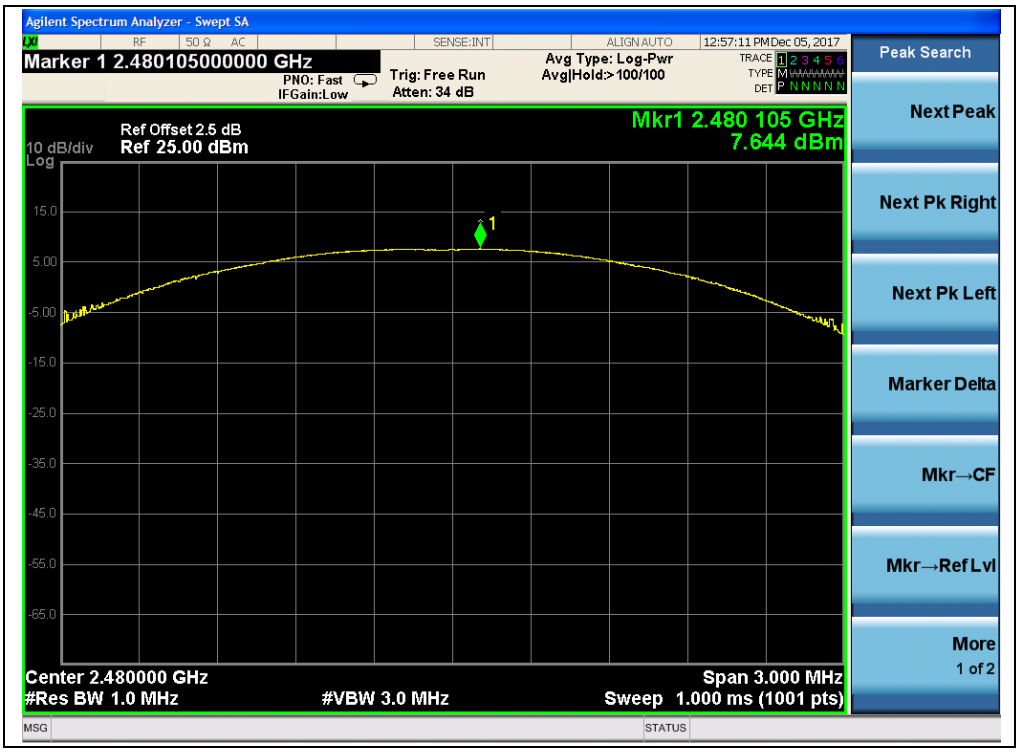
Channel	Frequency (MHz)	Measured Output Peak Power		Refer to Plot	Limit		Verdict
		dBm	W		dBm	W	
0	2402	8.44	0.00698	Plot B1	30	1	PASS
39	2441	8.70	0.00741	Plot B2			PASS
78	2480	7.64	0.00581	Plot B3			PASS

B. Test Plots:



(Plot B1: Channel 0, 2402MHz)

(Plot B2: Channel 19, 2440MHz)



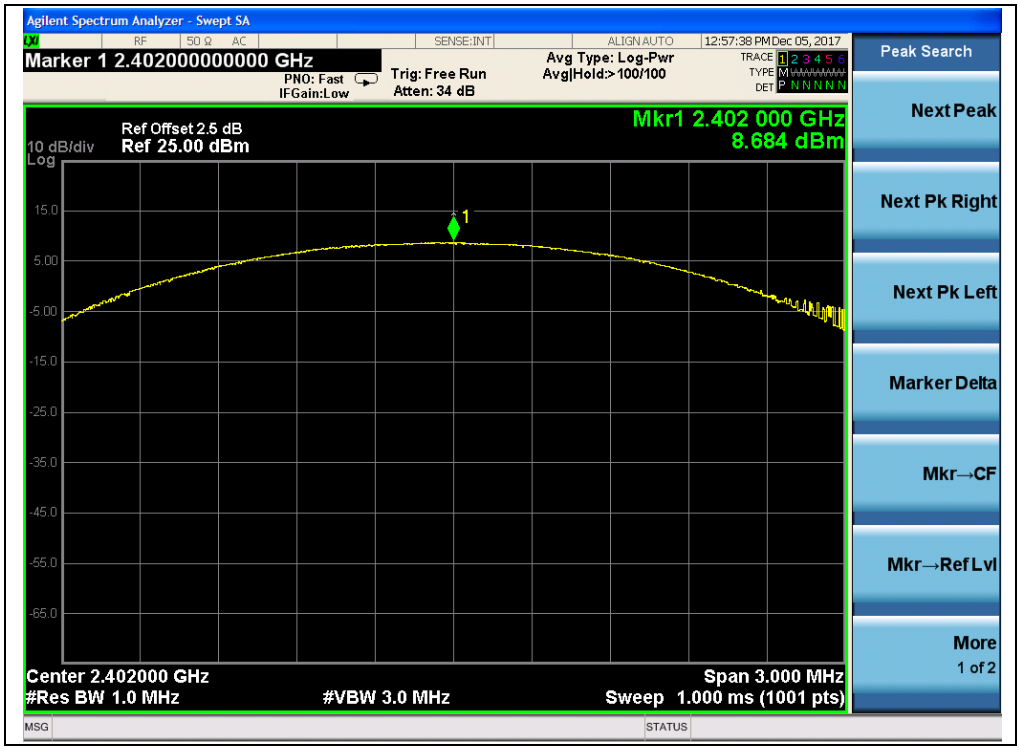
(Plot B3: Channel 39, 2480MHz)

2.3.3.3 8-DPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Refer to Plot	Limit		Verdict
		dBm	W		dBm	W	
0	2402	8.68	0.00738	Plot C1	30	1	PASS
39	2441	8.92	0.00780	Plot C2			PASS
78	2480	7.90	0.00617	Plot C3			PASS

B. Test Plots:



(Plot C1: Channel 0, 2402MHz)

(Plot C2: Channel 19, 2440MHz)

(Plot C3: Channel 39, 2480MHz)

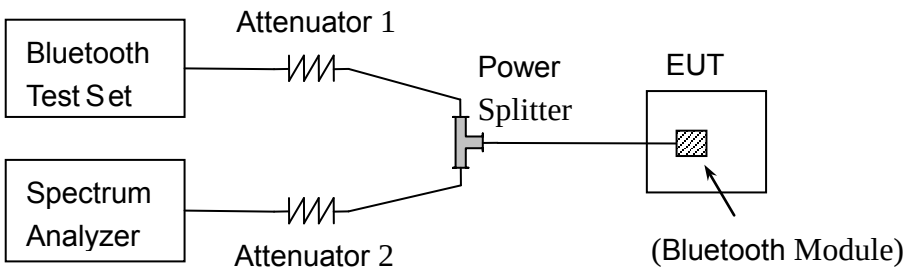
2.4. 20dB Bandwidth

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

2.4.2. Test Description

A. Test Setup:



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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

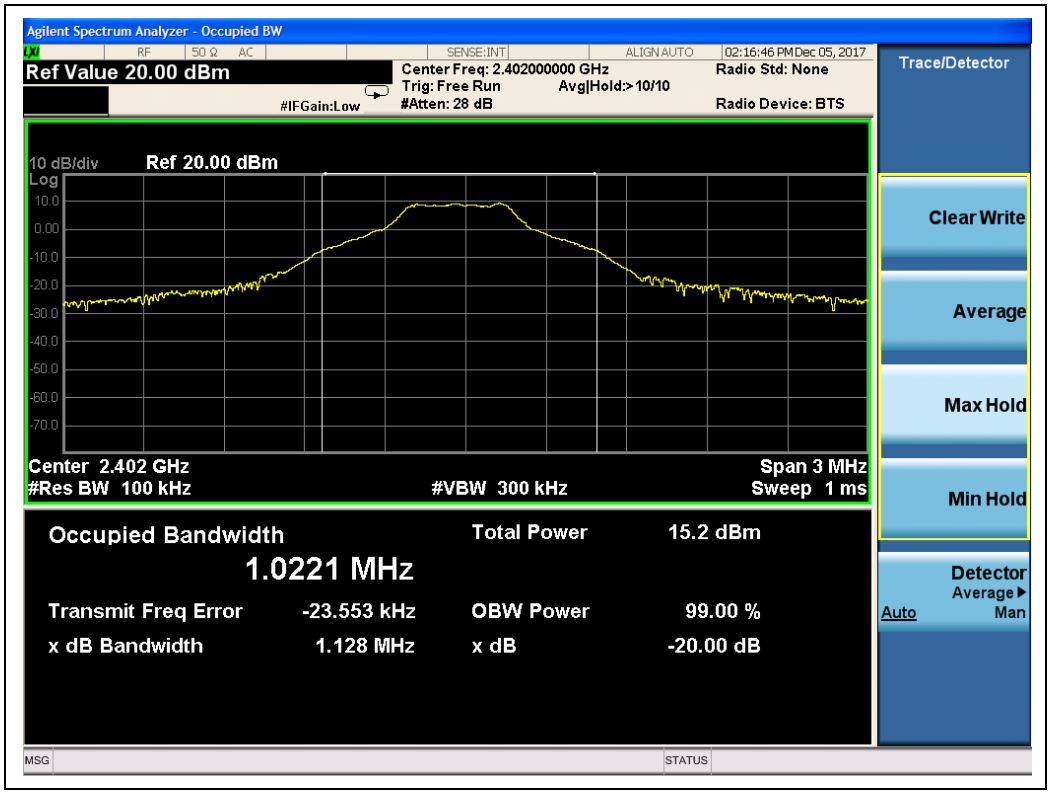
The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to record the 20dB bandwidth of the Module.

2.4.4.1 GFSK Mode

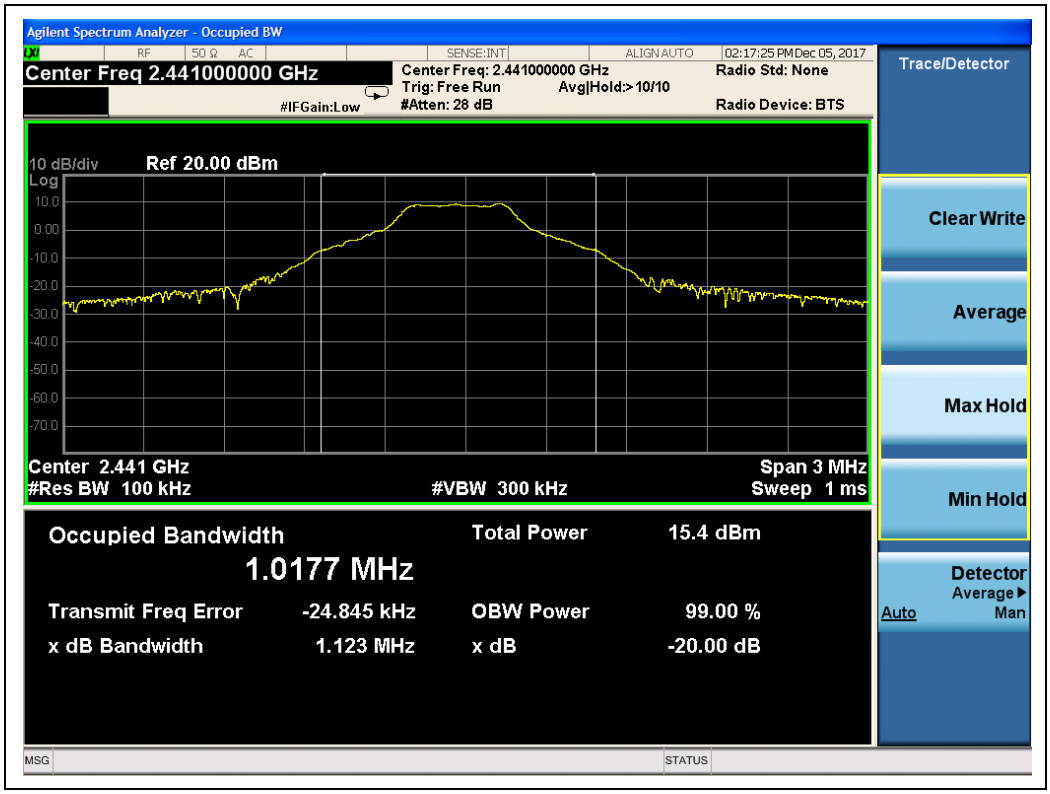
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.128	Plot A1
39	2441	1.123	Plot A2
78	2480	1.131	Plot A3

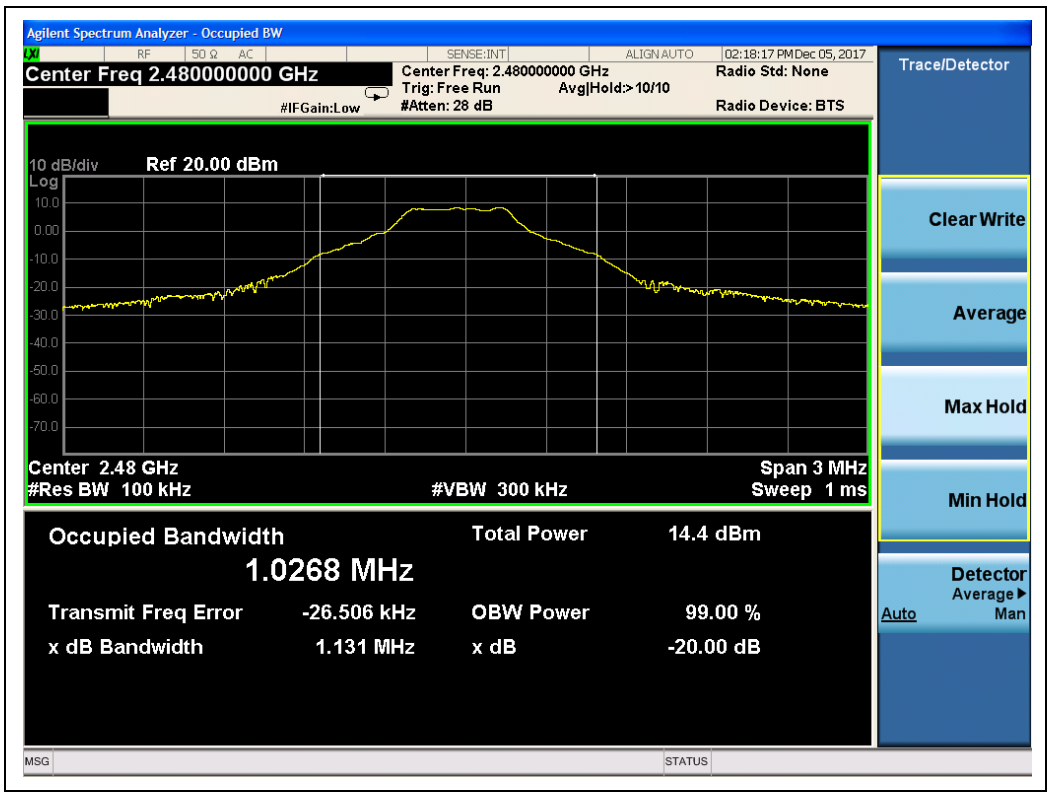
B. Test Plots:



(Plot A1:Channel = 2402 @ GFSK)



(Plot A2:Channel = 2441 @ GFSK)



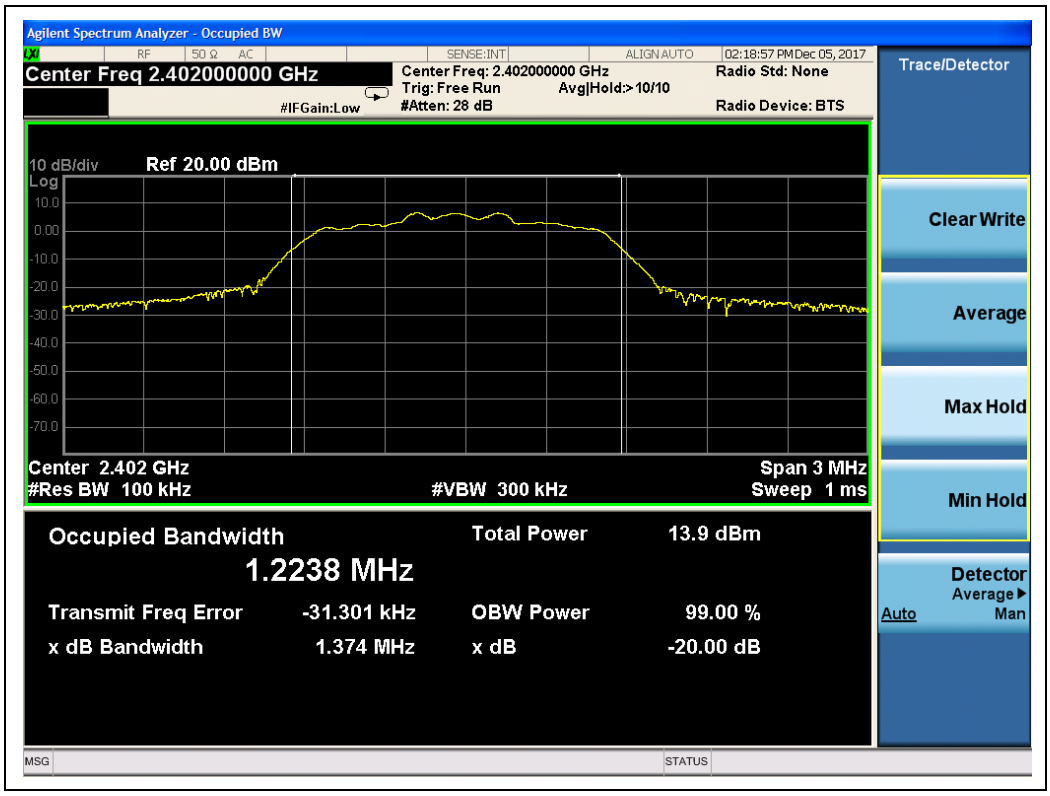
(Plot A3: Channel = 2480 @ GFSK)

2.4.4.2 π/4-DQPSK Mode

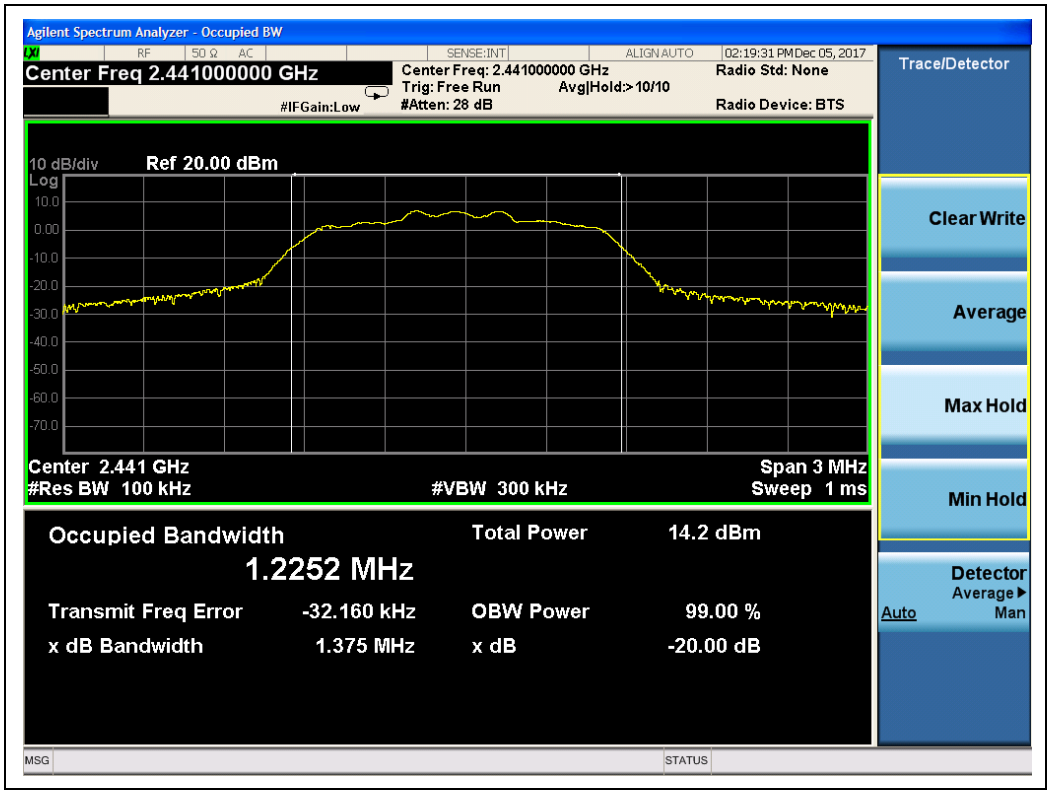
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.374	Plot B1
39	2441	1.375	Plot B2
78	2480	1.368	Plot B3

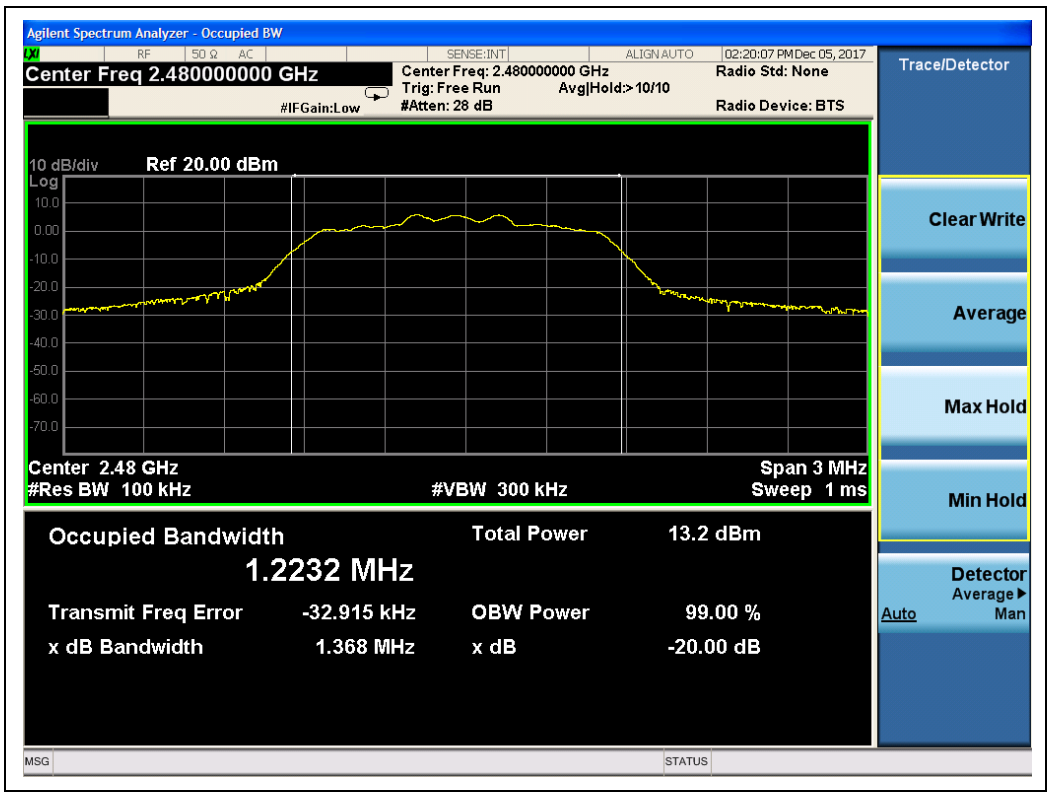
B. Test Plots:



(Plot B1: Channel = 2402 @ π/4-DQPSK)



(Plot B2: Channel = 2441 @ π/4-DQPSK)



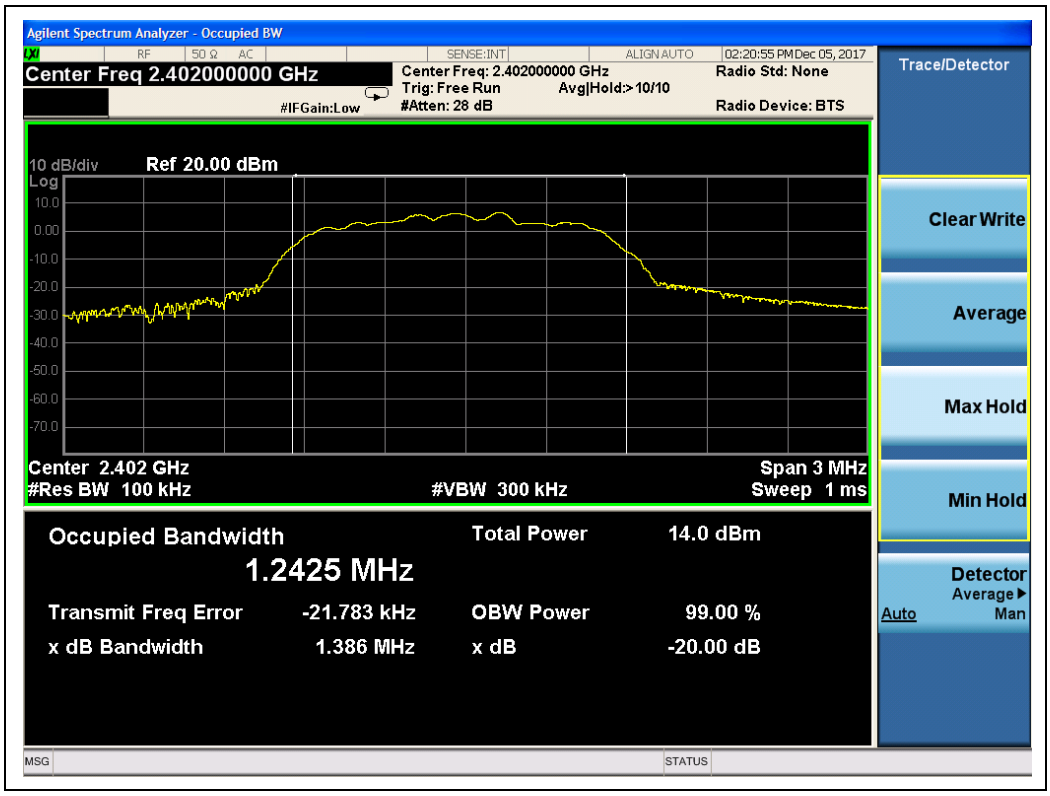
(Plot B3: Channel = 2480 @ π/4-DQPSK)

2.4.4.3 8-DPSK Mode

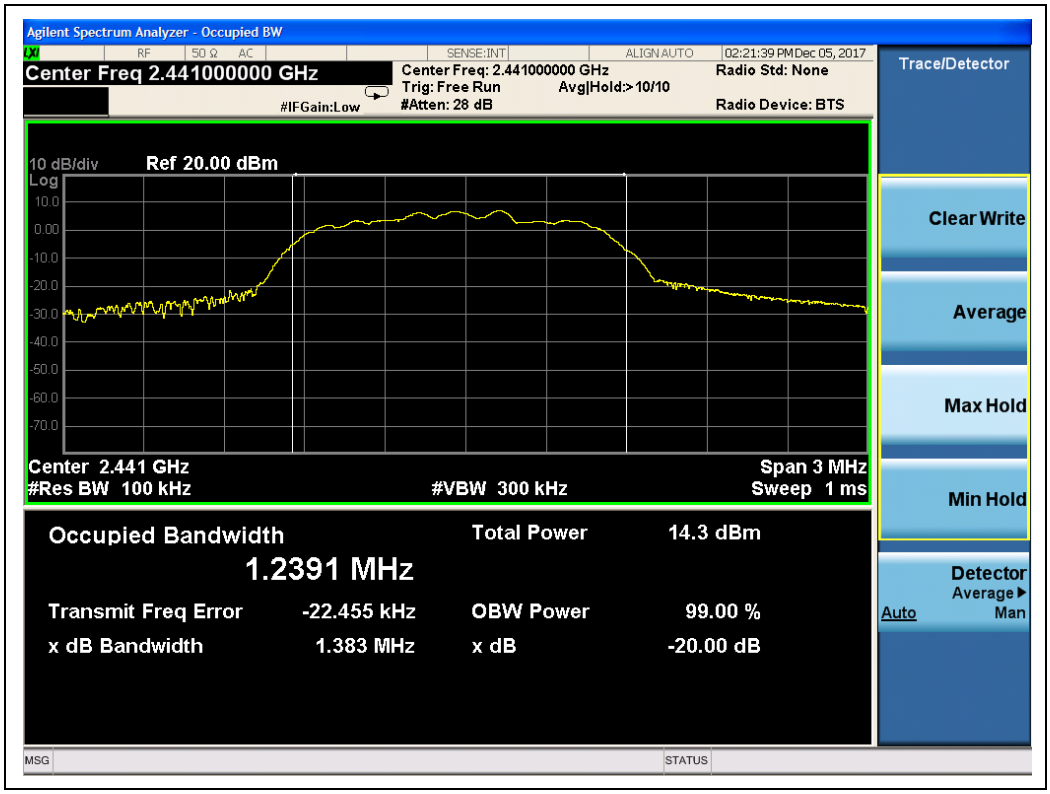
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.386	Plot C1
39	2441	1.383	Plot C2
78	2480	1.378	Plot C3

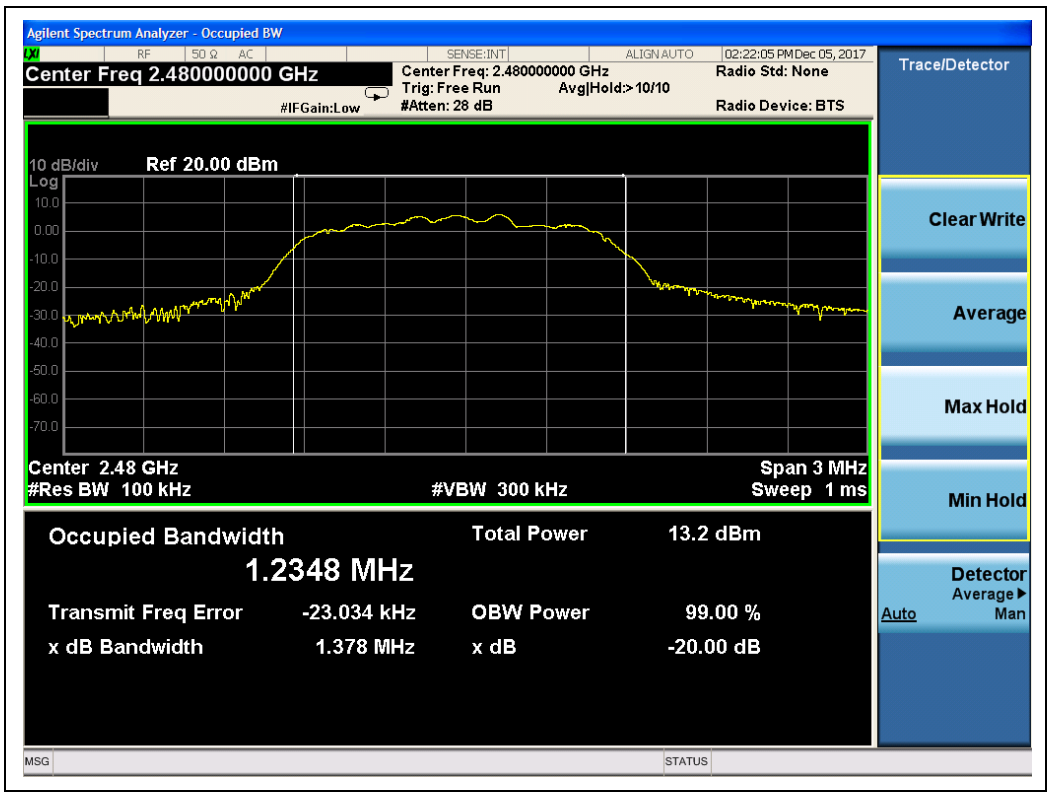
B. Test Plots:



(Plot C1: Channel = 2402 @ 8-DPSK)



(Plot C2: Channel = 2441 @ 8-DPSK)



(Plot C3: Channel = 2480 @ 8-DPSK)

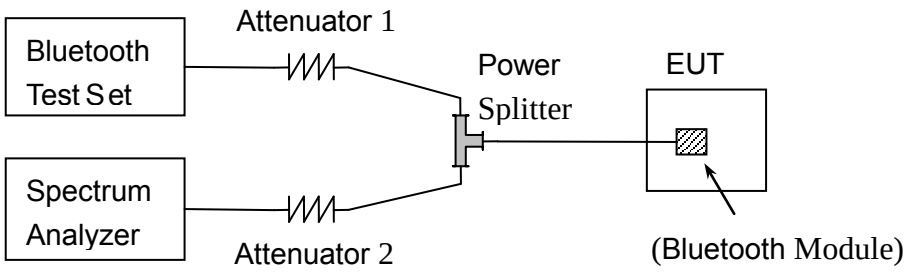
2.5. Carried Frequency Separation

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).

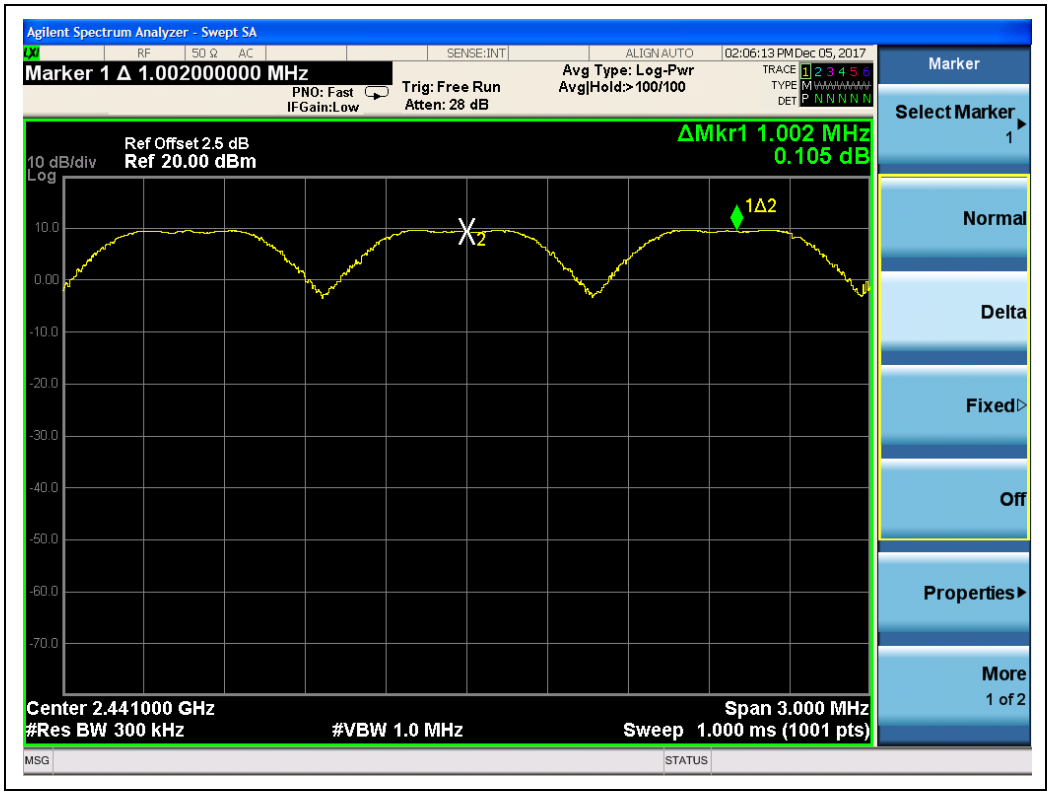
2.5.3. Test Procedure

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.

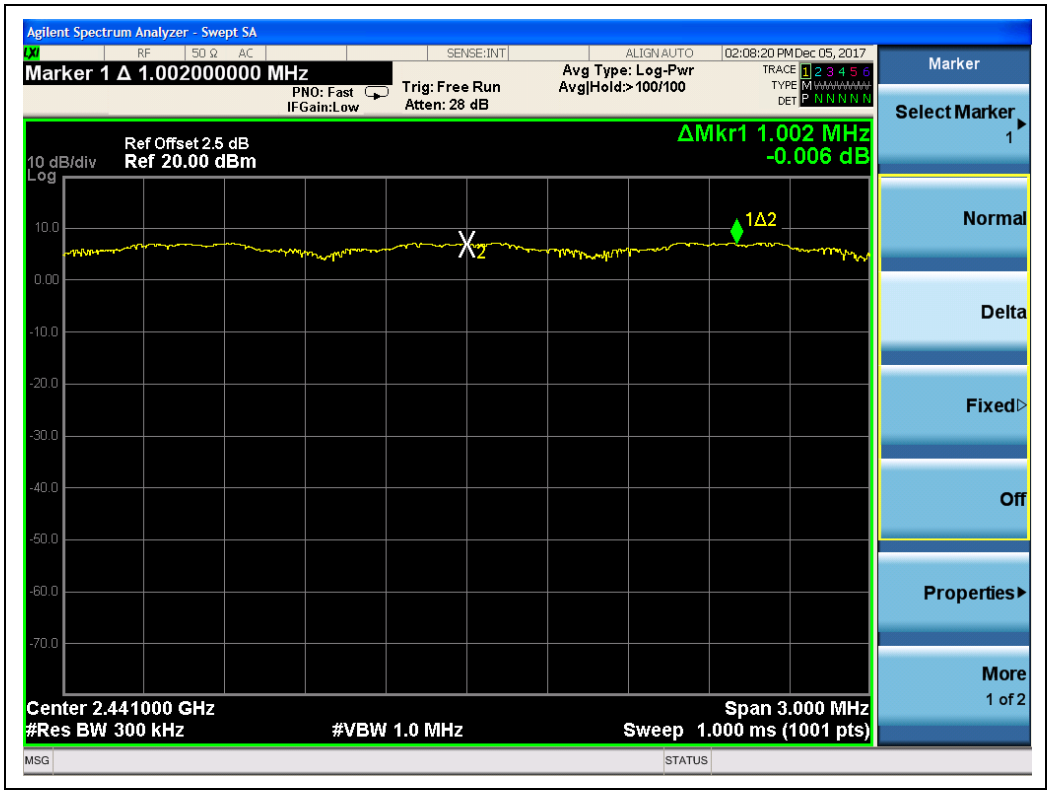
2.5.4. Test Result

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	1.123	two-thirds of the 20dB bandwidth	PASS
π/4-DQPSK	39 and 40	1.002	Plot B	1.368		PASS
8-DPSK	39 and 40	1.002	Plot C	1.378		PASS



(Plot A: GFSK)



(Plot B: π/4-DQPSK)

(Plot C: 8-DPSK)

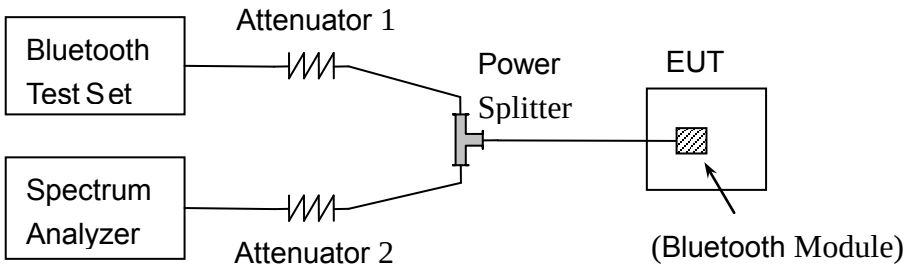
2.6. Time of Occupancy (Dwell time)

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:



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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.

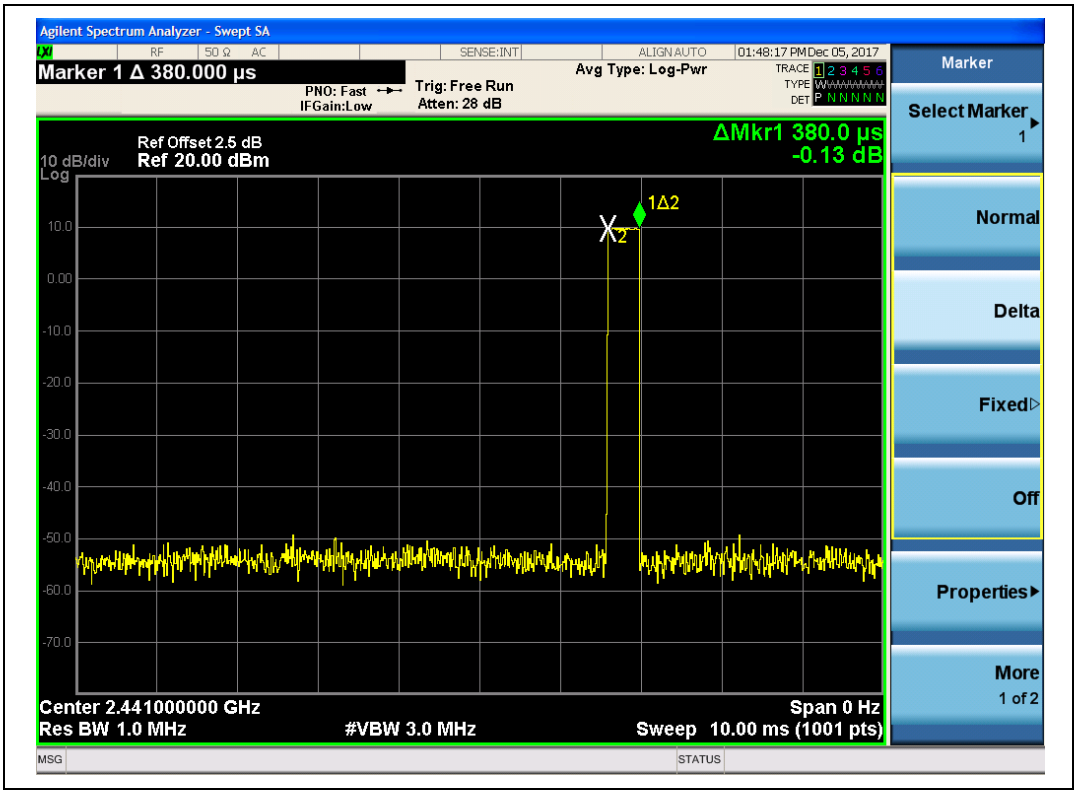
2.6.4. Test Result

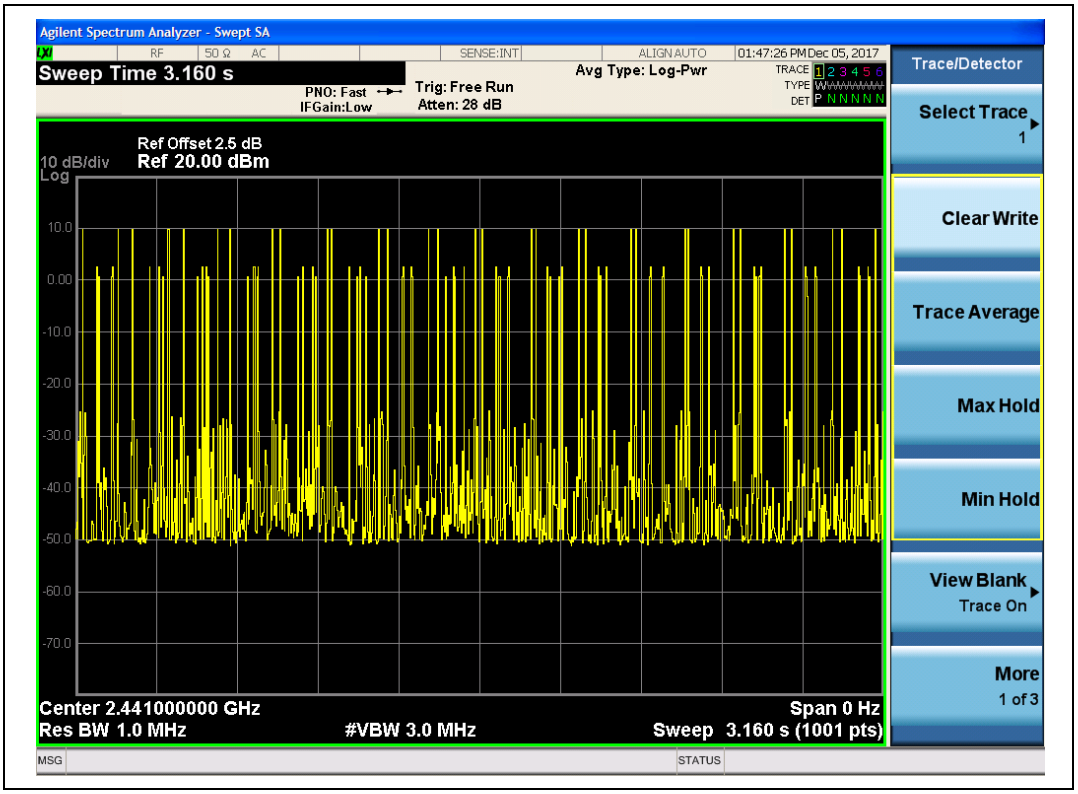
2.6.4.1 GFSK Mode

A. Test Verdict:

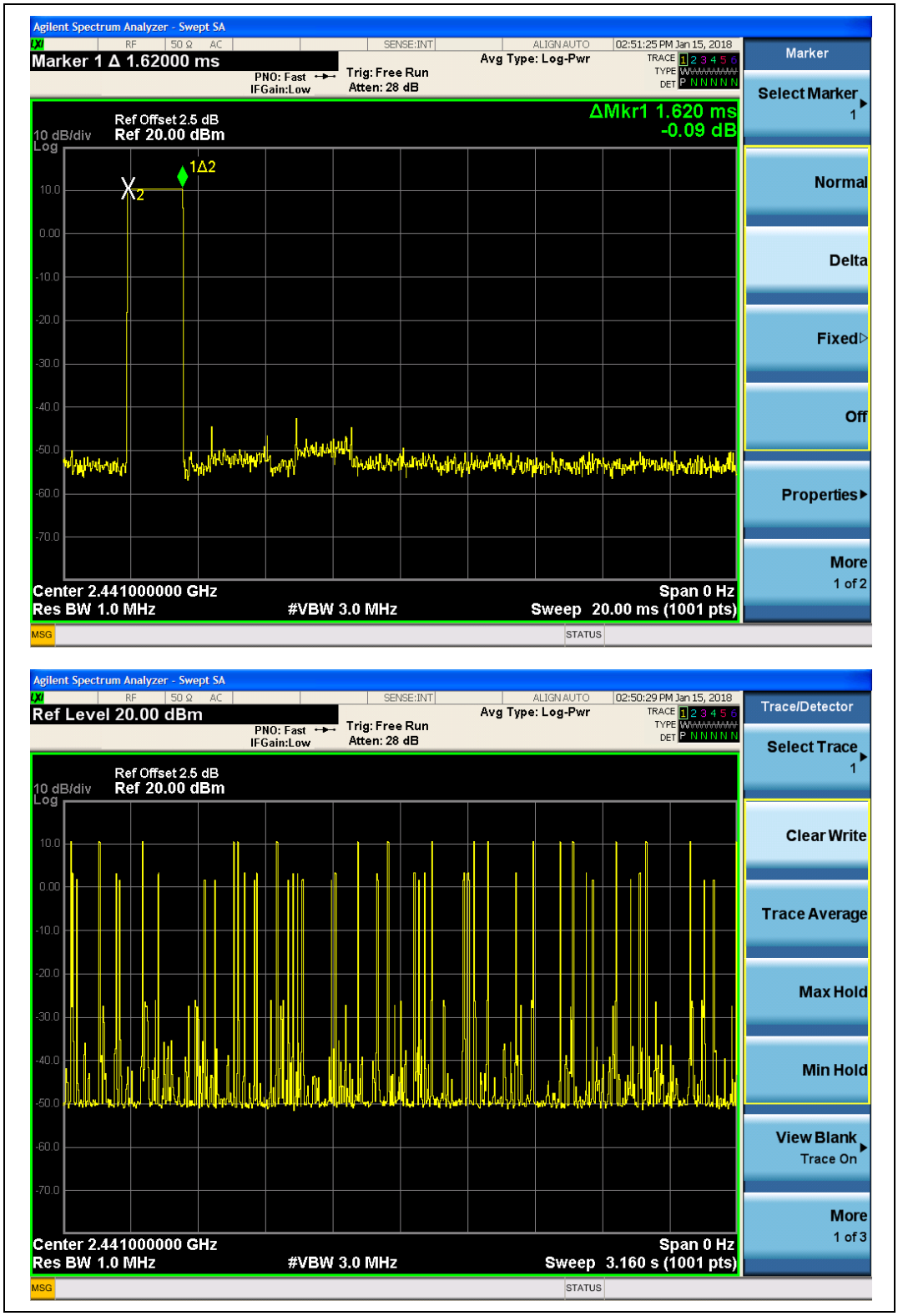
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.38	32	0.01216	0.1216	0.4	PASS
DH3	1.62	17	0.02754	0.2754		PASS
DH5	2.88	10	0.02880	0.2880		PASS

B. Test Plots:

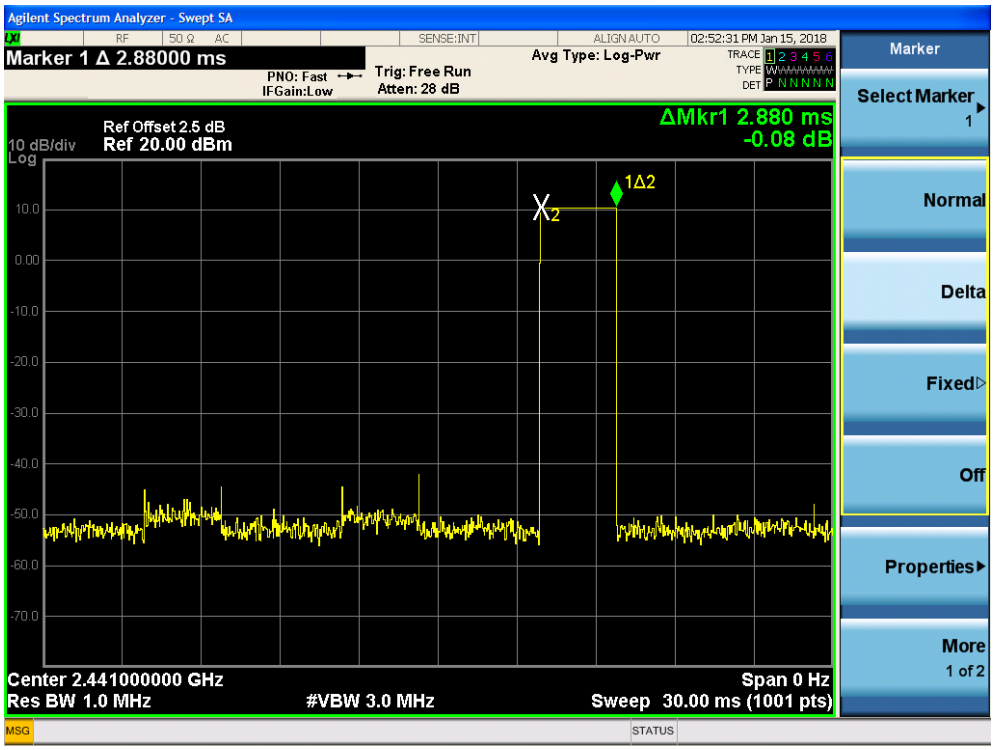


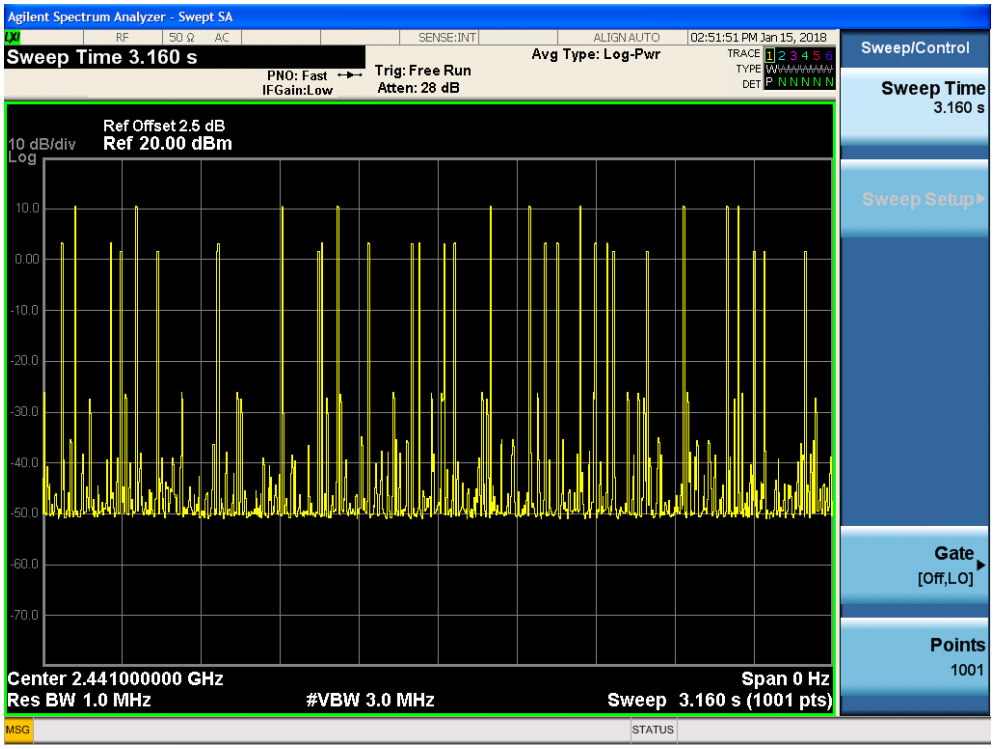

Agilent Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
01:47:26 PM Dec 05, 2017
Sweep Time 3.160 s
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W
DET P N N N N N
Ref Offset 2.5 dB
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)
MSG
STATUS
Trace/Detector
Select Trace 1
Clear Write
Trace Average
Max Hold
Min Hold
View Blank Trace On
More 1 of 3

(DH1 @ GFSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 1.62000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
02:51:25 PM Jan 15, 2018
Ref Offset 2.5 dB
10 dB/div
Log
Ref 20.00 dBm
ΔMkr1 1.620 ms
-0.09 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 ms (1001 pts)
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2
Agilent Spectrum Analyzer - Swept SA
Ref Level 20.00 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
02:50:29 PM Jan 15, 2018
Ref Offset 2.5 dB
10 dB/div
Log
Ref 20.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)
Trace/Detector
Select Trace
Clear Write
Trace Average
Max Hold
Min Hold
View Blank
Trace On
More
1 of 3

(DH3 @ GFSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 2.88000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
02:52:31 PM Jan 15, 2018
Ref Offset 2.5 dB
10 dB/div
Log
Ref 20.00 dBm
ΔMkr1 2.880 ms
-0.08 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 30.00 ms (1001 pts)
Marker
Select Marker
1
Normal
Delta
Fixed
Off
Properties
More
1 of 2
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Sweep Time 3.160 s
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
02:51:51 PM Jan 15, 2018
Ref Offset 2.5 dB
10 dB/div
Log
Ref 20.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)
Sweep/Control
Sweep Time
3.160 s
Sweep Setup
Gate
[Off,LO]
Points
1001
MSG
STATUS

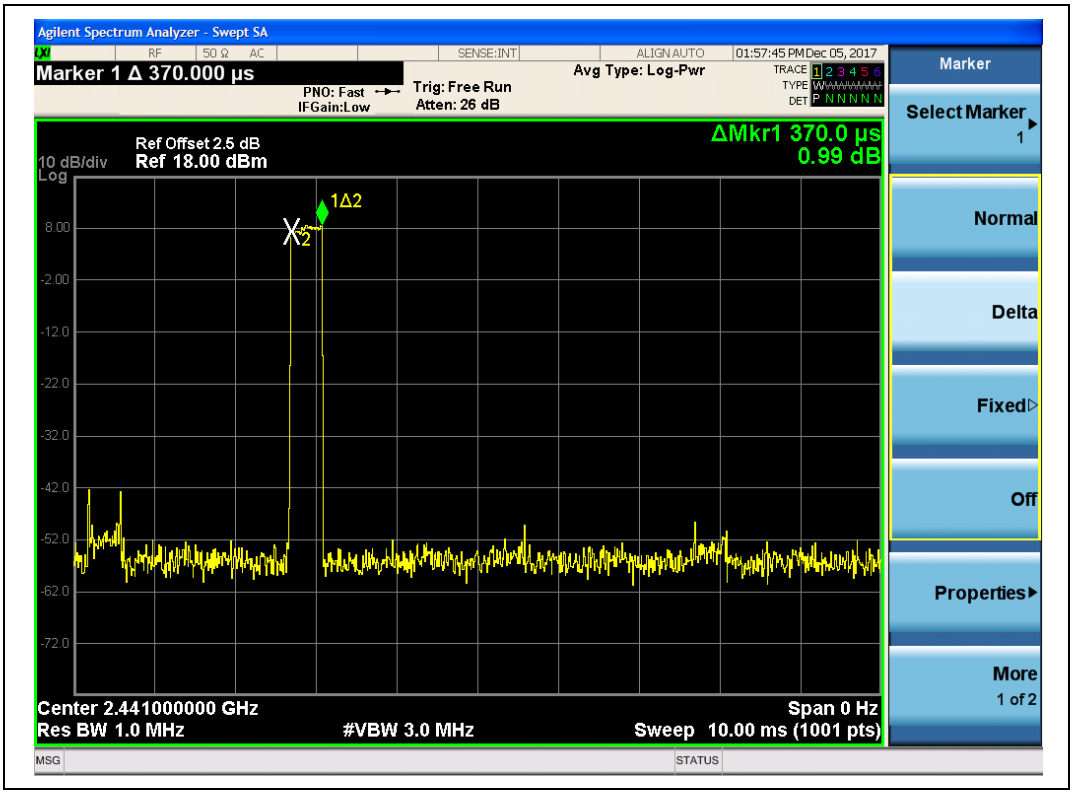
(DH5 @ GFSK)

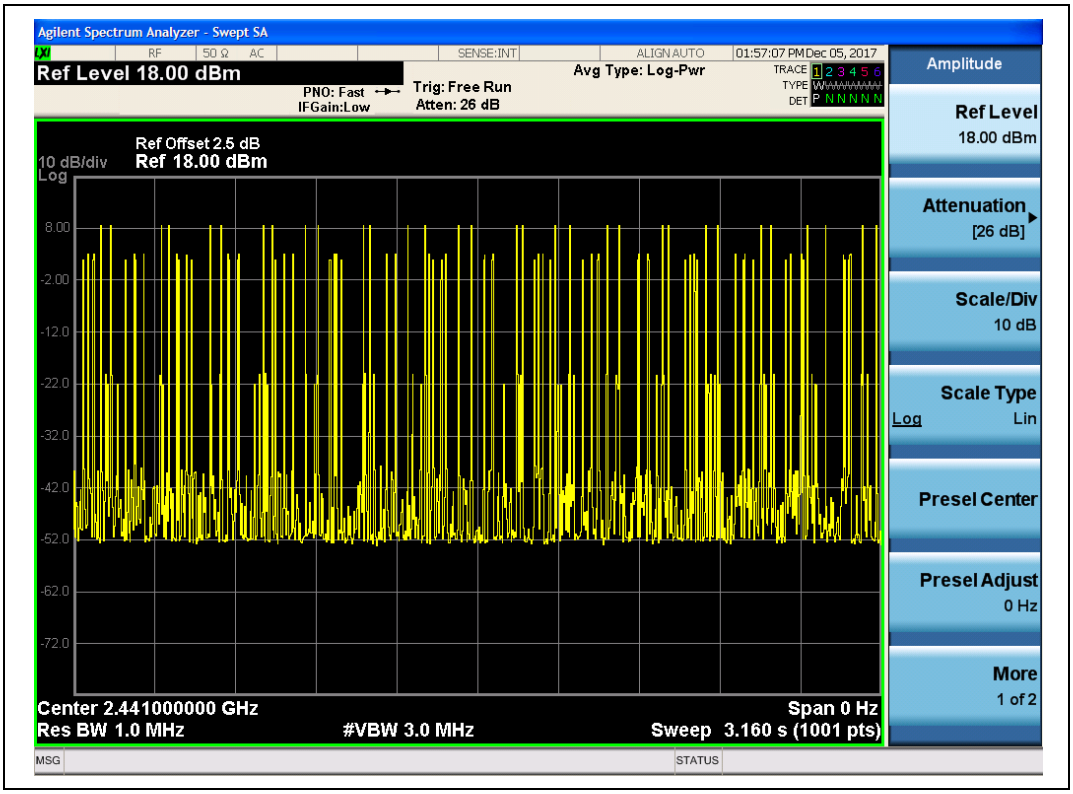
2.6.4.2 π/4-DQPSK Mode

A. Test Verdict:

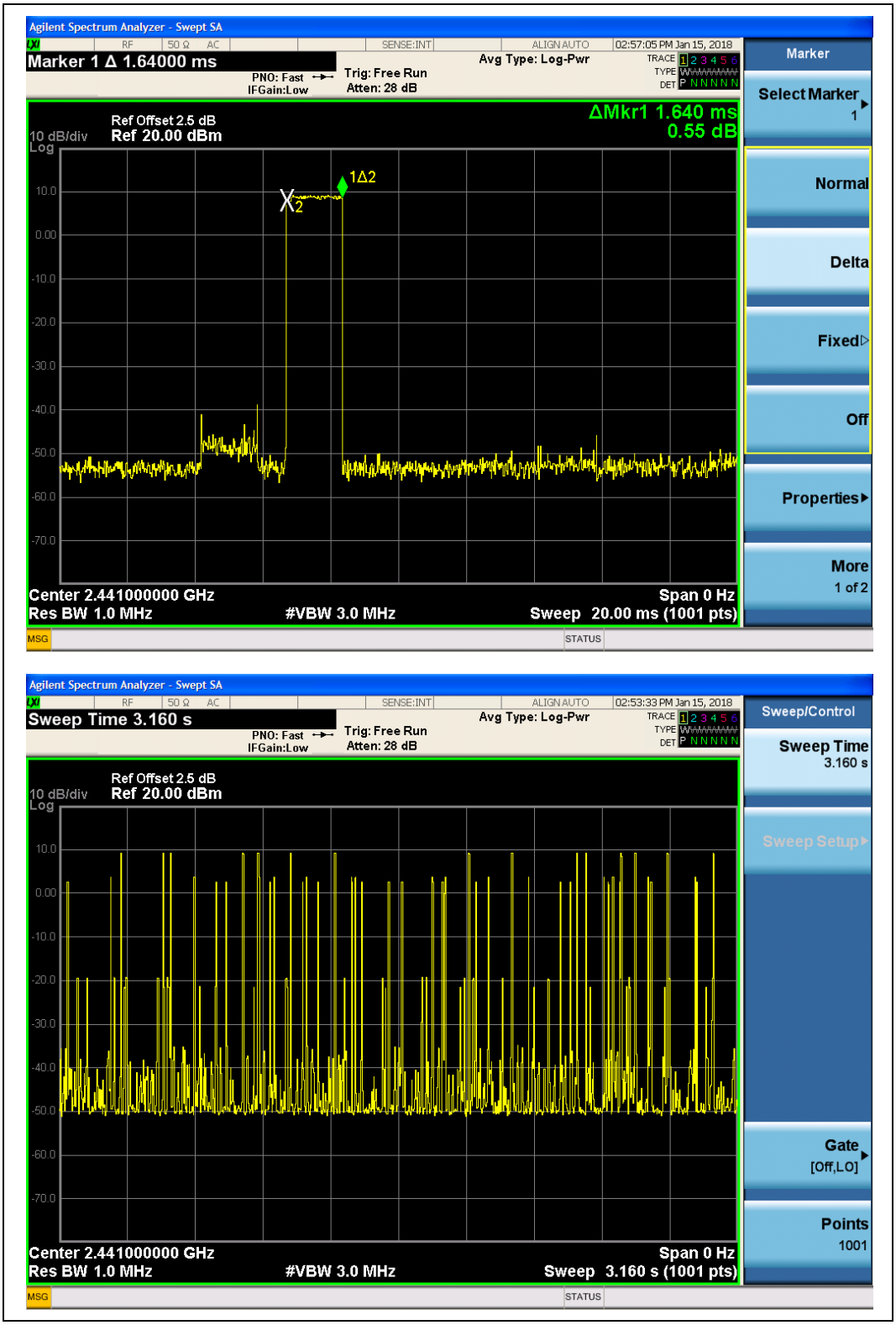
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.37	32	0.01184	0.1184	0.4	PASS
DH3	1.64	15	0.02460	0.2460		PASS
DH5	2.88	8	0.02304	0.2304		PASS

B. Test Plots:

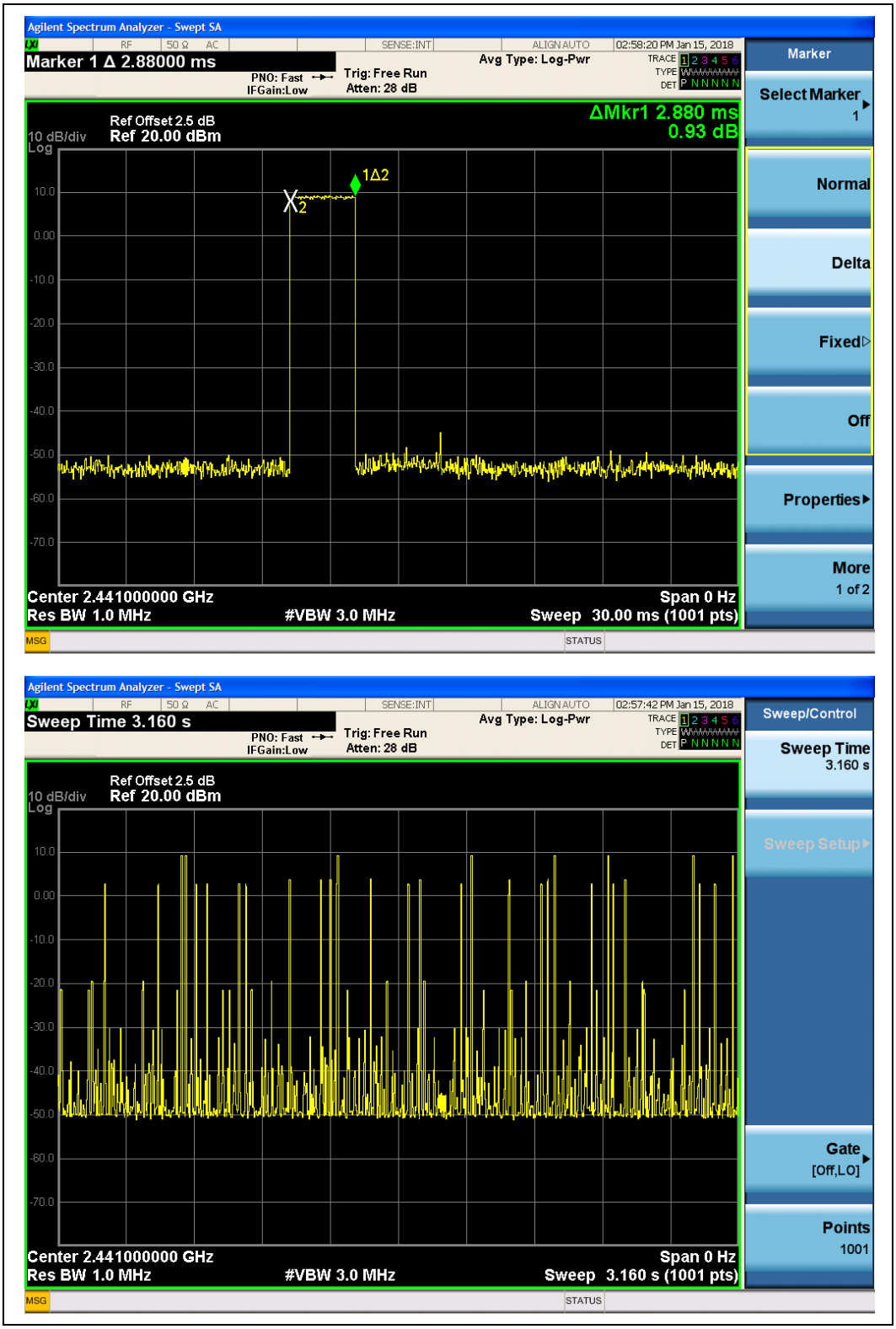



Agilent Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
01:57:07 PM Dec 05, 2017
Ref Level 18.00 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE WWWWW
DET P N N N N N
Ref Offset 2.5 dB
10 dB/div
Log
Ref 18.00 dBm
8.00
-2.00
-12.0
-22.0
-32.0
-42.0
-52.0
-62.0
-72.0
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)
MSG
STATUS
Amplitude
Ref Level
18.00 dBm
Attenuation
[26 dB]
Scale/Div
10 dB
Scale Type
Log
Lin
Presel Center
Presel Adjust
0 Hz
More
1 of 2

(DH1 @ π/4-DQPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 1.64000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
02:57:05 PM Jan 15, 2018
Ref Offset 2.5 dB
10 dB/div
Log
Ref 20.00 dBm
ΔMkr1 1.640 ms
0.55 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 ms (1001 pts)
Marker
Select Marker
1
Normal
Delta
Fixed
Off
Properties
More
1 of 2
Agilent Spectrum Analyzer - Swept SA
Sweep Time 3.160 s
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
02:53:33 PM Jan 15, 2018
Ref Offset 2.5 dB
10 dB/div
Log
Ref 20.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)
Sweep/Control
Sweep Time
3.160 s
Sweep Setup
Gate
[Off,LO]
Points
1001

(DH3 @ π/4-DQPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 2.88000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
02:58:20 PM Jan 15, 2018
Ref Offset 2.5 dB
10 dB/div
Log
Ref 20.00 dBm
ΔMkr1 2.880 ms
0.93 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 30.00 ms (1001 pts)
Marker
Select Marker
1
Normal
Delta
Fixed
Off
Properties
More
1 of 2
MSG
STATUS
Agilent Spectrum Analyzer - Swept SA
Sweep Time 3.160 s
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
02:57:42 PM Jan 15, 2018
Ref Offset 2.5 dB
10 dB/div
Log
Ref 20.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)
Sweep/Control
Sweep Time
3.160 s
Sweep Setup
Gate
[Off,LO]
Points
1001
MSG
STATUS

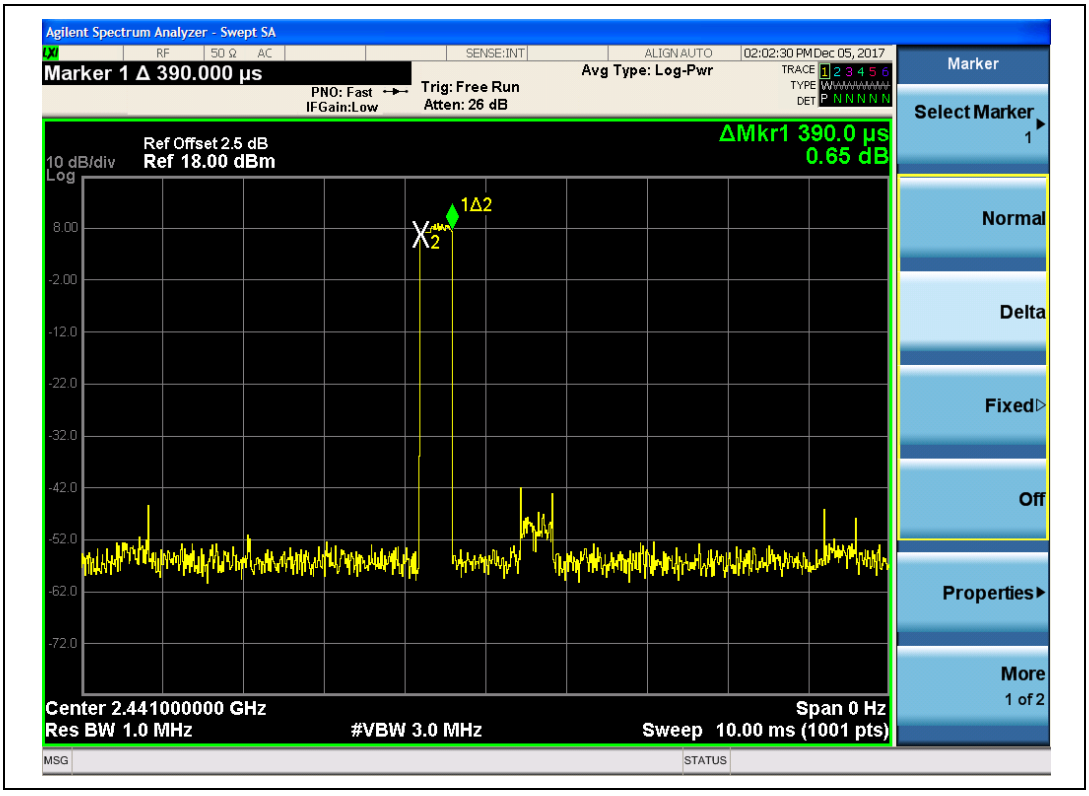
(DH5 @ π/4-DQPSK)

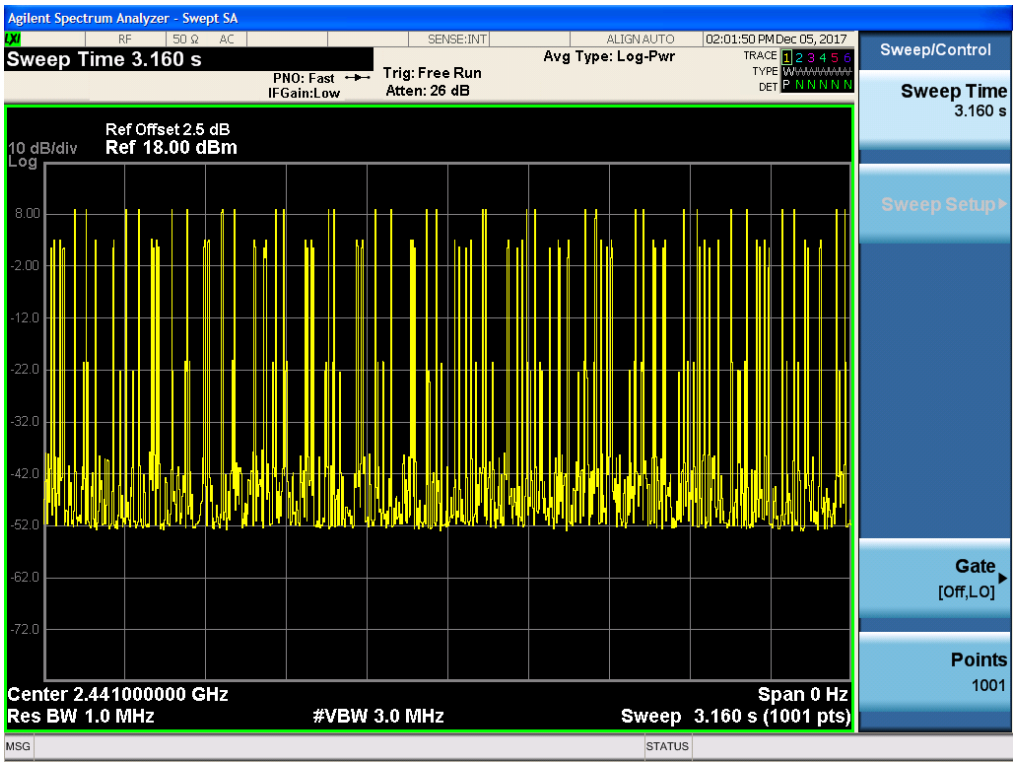
2.6.4.3 8-DPSK mode

A. Test Verdict:

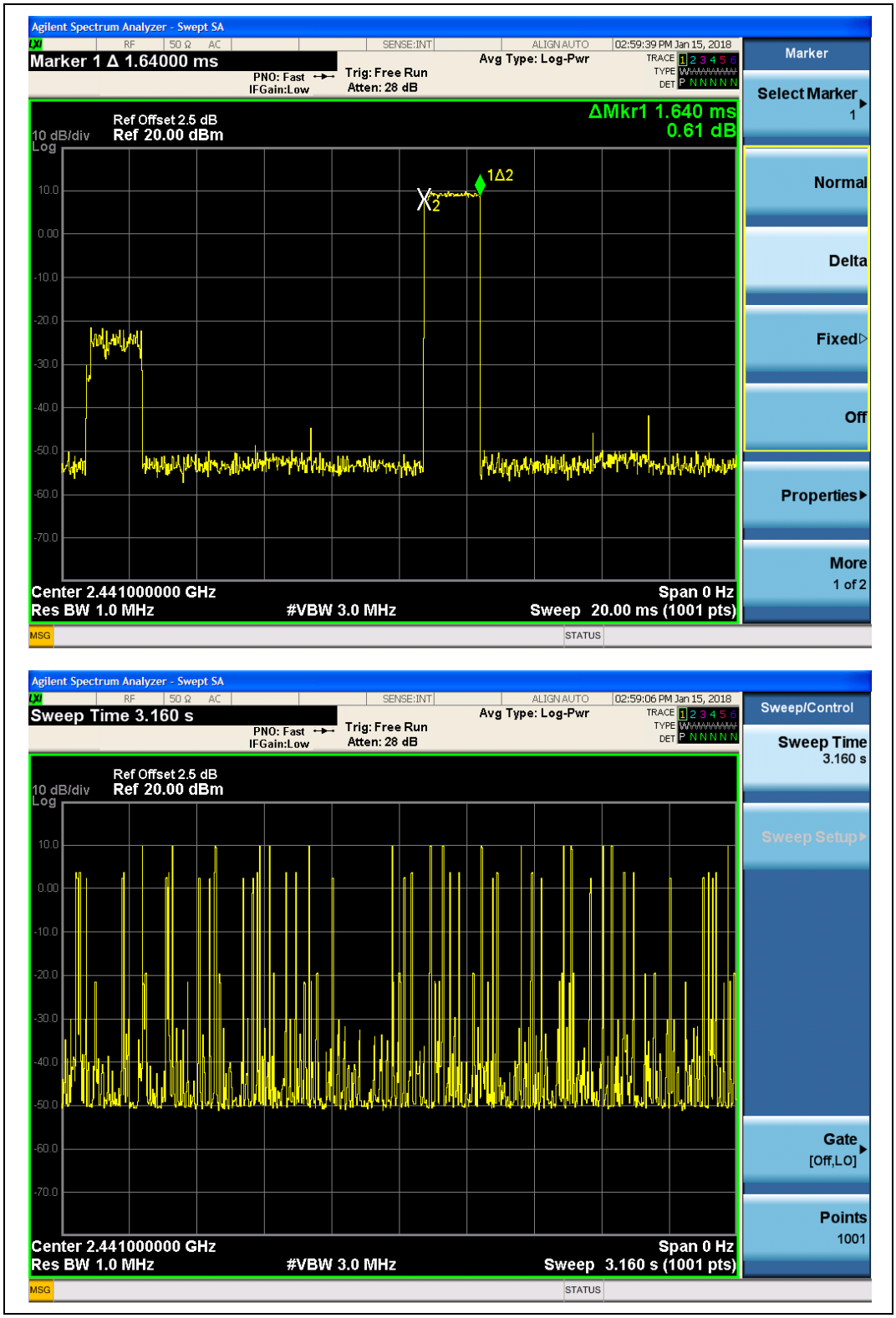
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.39	32	0.01248	0.1248	0.4	PASS
DH3	1.64	16	0.02624	0.2624		PASS
DH5	2.88	13	0.03744	0.3744		PASS

B. Test Plots:

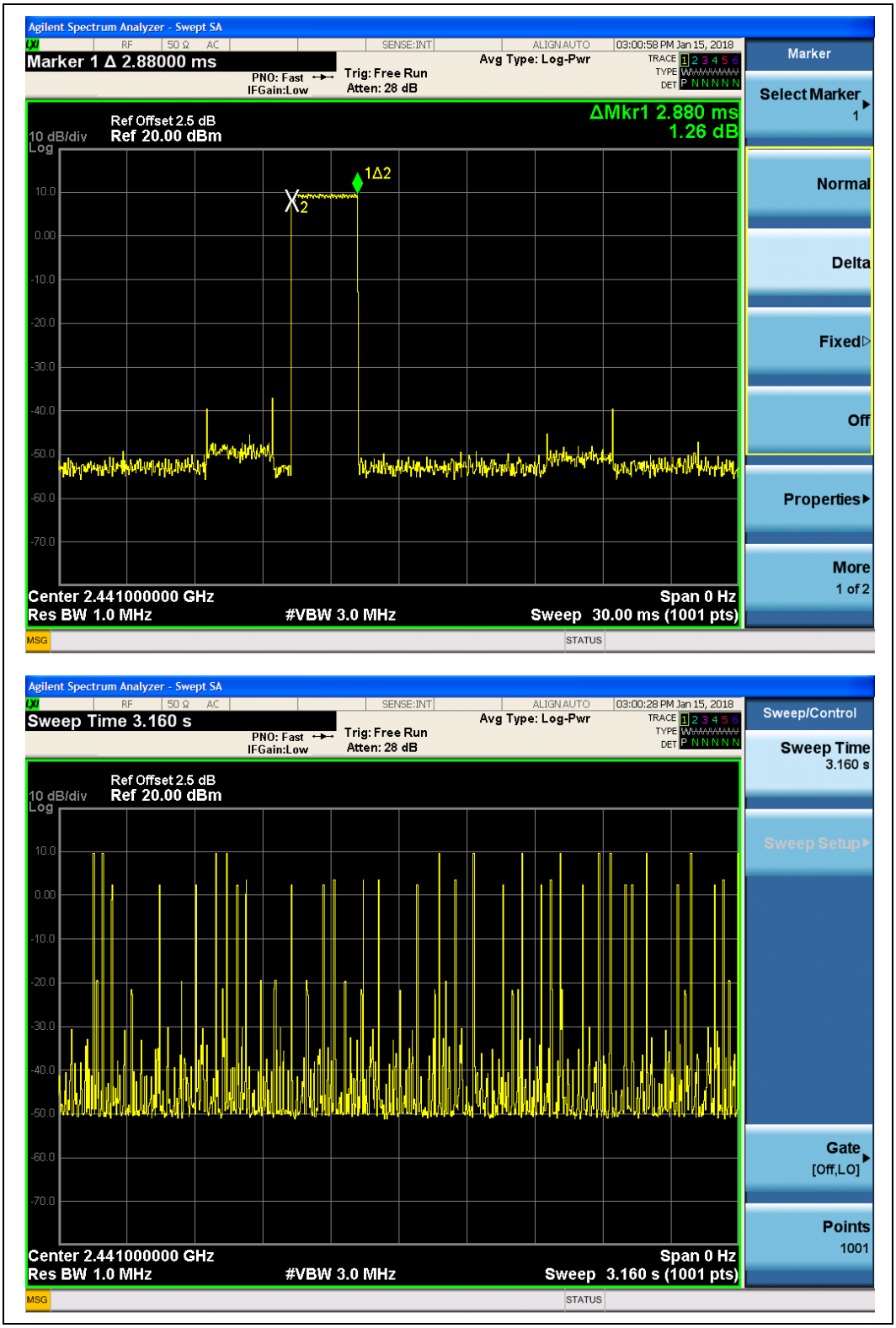



Agilent Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
02:01:50 PM Dec 05, 2017
Sweep Time 3.160 s
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 26 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE WWWWW
DET P N N N N N
Ref Offset 2.5 dB
10 dB/div
Log
Ref 18.00 dBm
8.00
-2.00
-12.0
-22.0
-32.0
-42.0
-52.0
-62.0
-72.0
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)
Sweep/Control
Sweep Time
3.160 s
Sweep Setup
Gate
[Off,LO]
Points
1001
MSG
STATUS

(DH1 @ 8-DPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 1.64000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
02:59:39 PM Jan 15, 2018
Ref Offset 2.5 dB
10 dB/div
Log
Ref 20.00 dBm
ΔMkr1 1.640 ms
0.61 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 ms (1001 pts)
Marker
Select Marker
1
Normal
Delta
Fixed
Off
Properties
More
1 of 2
MSG
STATUS
Agilent Spectrum Analyzer - Swept SA
Sweep Time 3.160 s
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
02:59:06 PM Jan 15, 2018
Ref Offset 2.5 dB
10 dB/div
Log
Ref 20.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)
Sweep/Control
Sweep Time
3.160 s
Sweep Setup
Gate
[Off,LO]
Points
1001
MSG
STATUS

(DH3 @ 8-DPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 2.88000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
03:00:58 PM Jan 15, 2018
Ref Offset 2.5 dB
10 dB/div
Log
Ref 20.00 dBm
ΔMkr1 2.880 ms
1.26 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 30.00 ms (1001 pts)
Marker
Select Marker
1
Normal
Delta
Fixed
Off
Properties
More
1 of 2
MSG
STATUS
Agilent Spectrum Analyzer - Swept SA
Sweep Time 3.160 s
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
03:00:28 PM Jan 15, 2018
Ref Offset 2.5 dB
10 dB/div
Log
Ref 20.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)
Sweep/Control
Sweep Time
3.160 s
Sweep Setup
Gate
[Off,LO]
Points
1001
MSG
STATUS

(DH5 @ 8-DPSK)

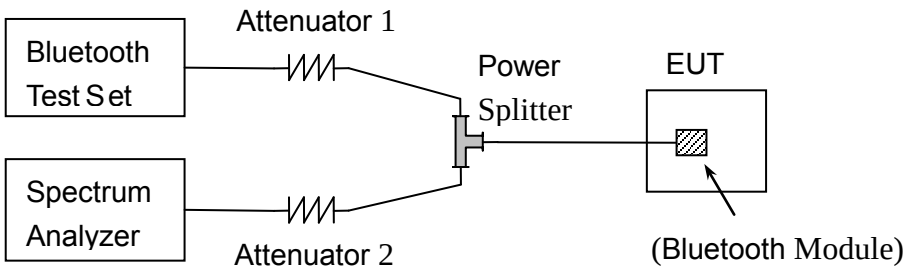
2.7. Conducted Spurious Emissions

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 100 kHz 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.

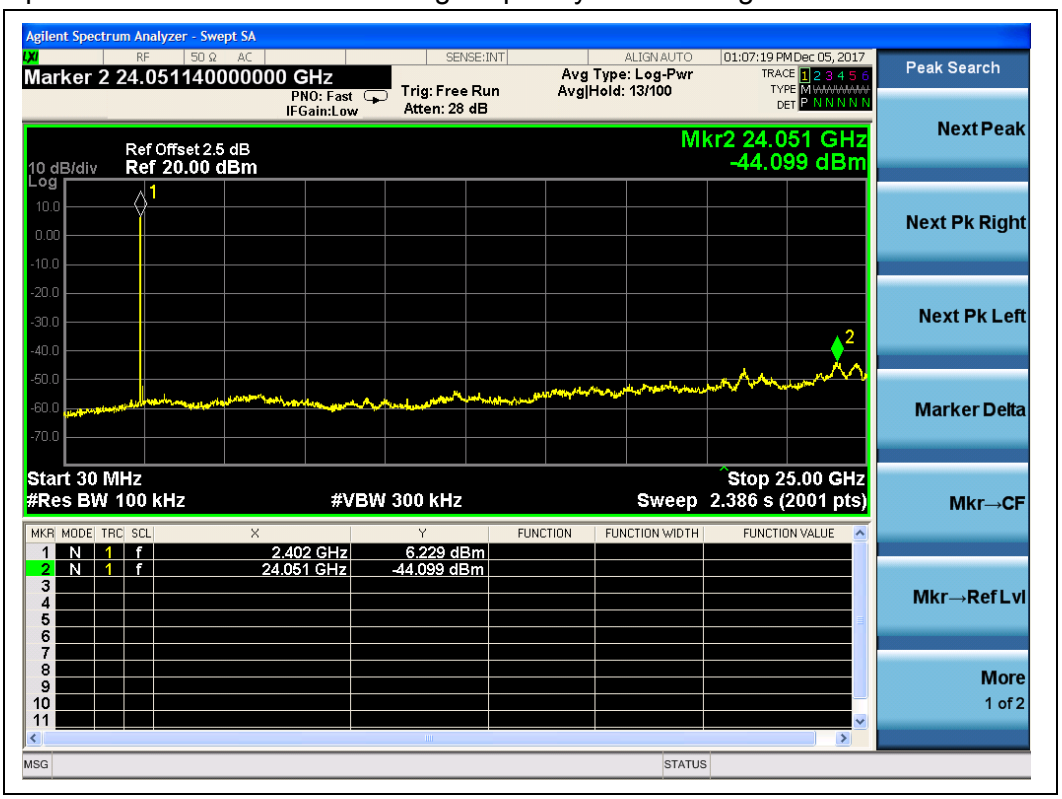
2.7.4.1 GFSK Mode

A. Test Verdict:

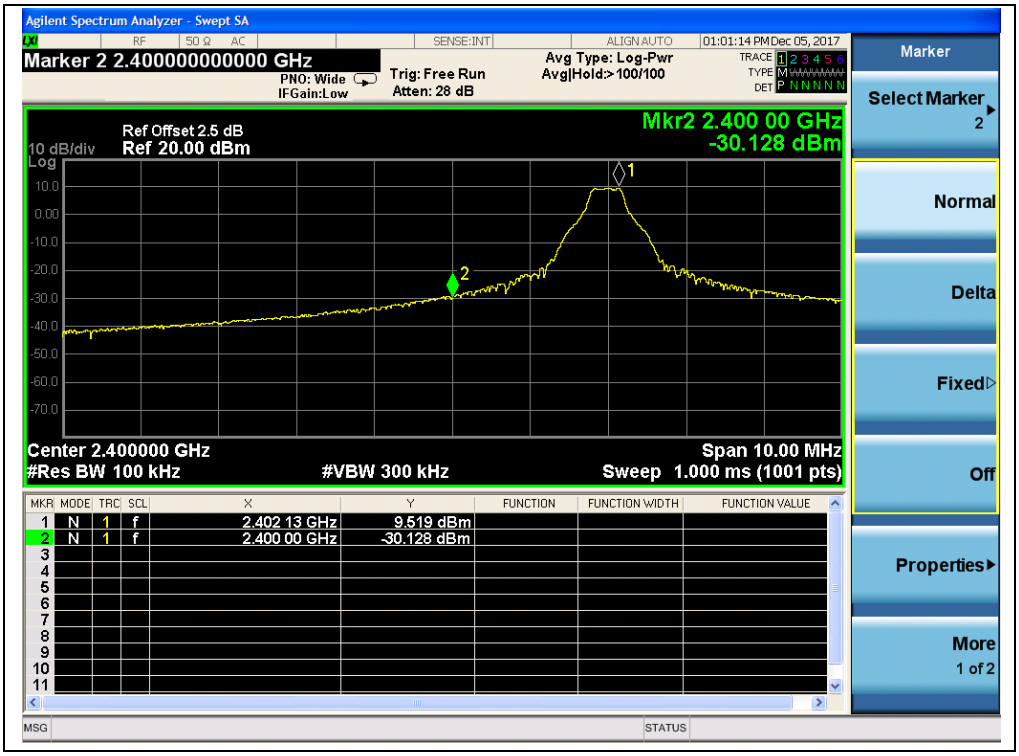
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-44.10	Plot A1	6.23	-13.77	PASS
39	2441	-47.66	Plot A2	8.30	-11.70	PASS
78	2480	-43.70	Plot A3	7.49	-12.51	PASS

B. Test Plots:

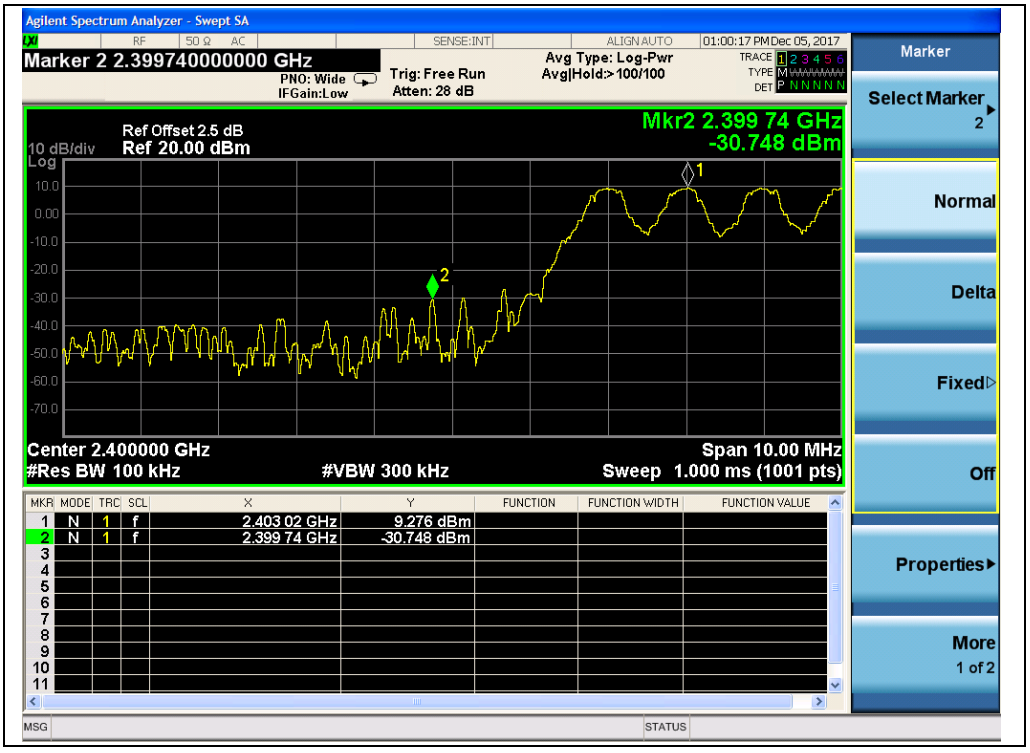
Note: the power of the Module transmitting frequency should be ignored.



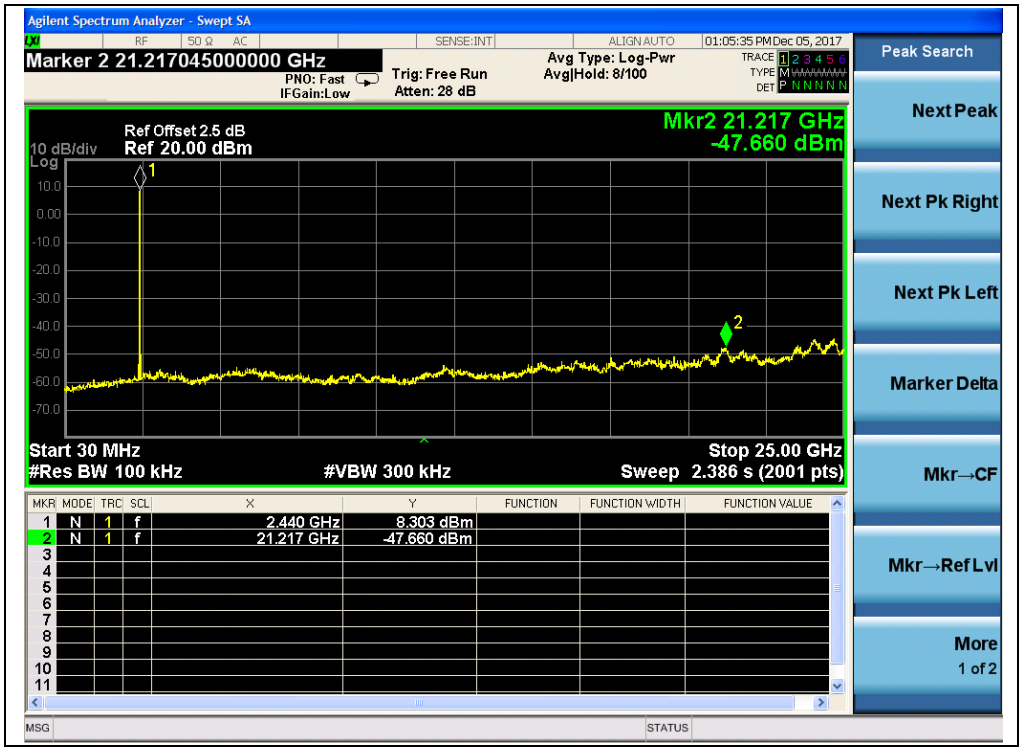
(Plot A1:Channel = 0, 30MHz to 25GHz @ GFSK Mode)



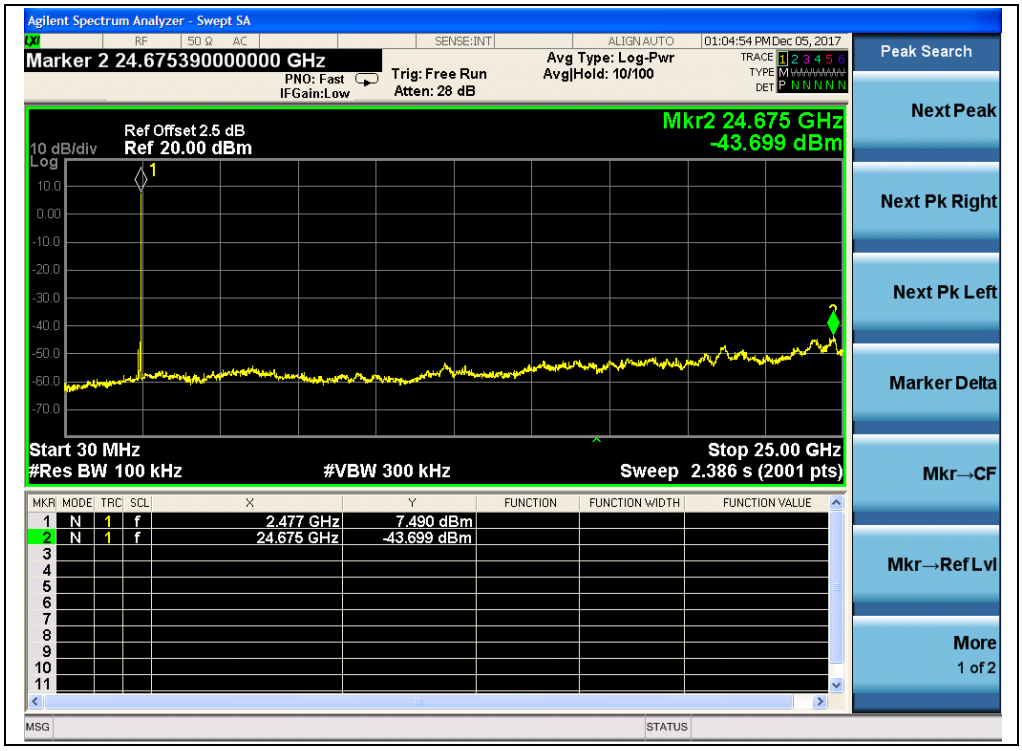
(Channel = 0, Band edge @ GFSK Mode)



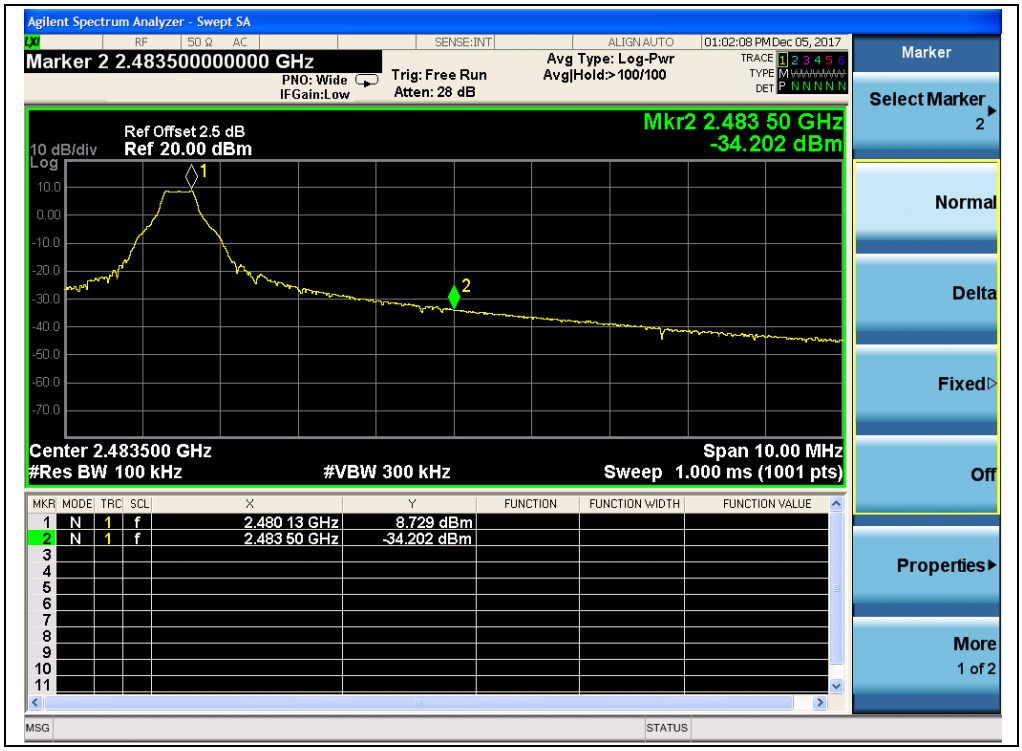
(Channel = 0, Band edge with hopping on @ GFSK Mode)



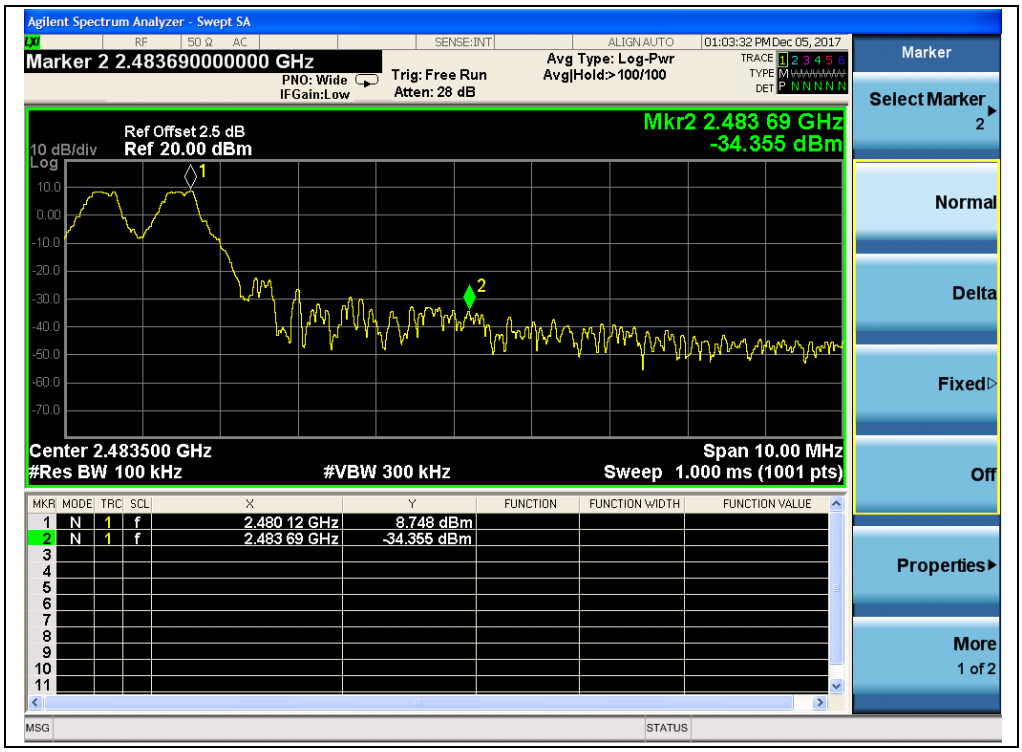
(Plot A2:Channel = 39, 30MHz to 25GHz @ GFSK Mode)



(Plot A1:Channel = 78, 30MHz to 25GHz @ GFSK Mode)



(Channel = 78, Band edge @ GFSK Mode)



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

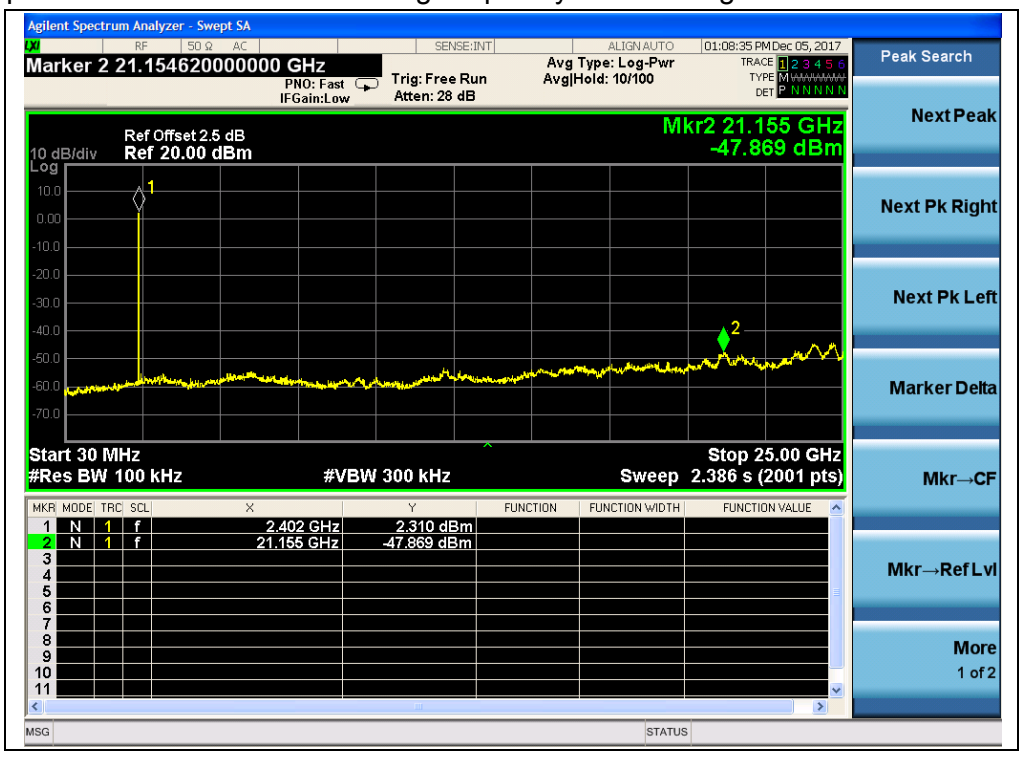
2.7.4.2 π/4-DQPSK Mode

A. Test Verdict:

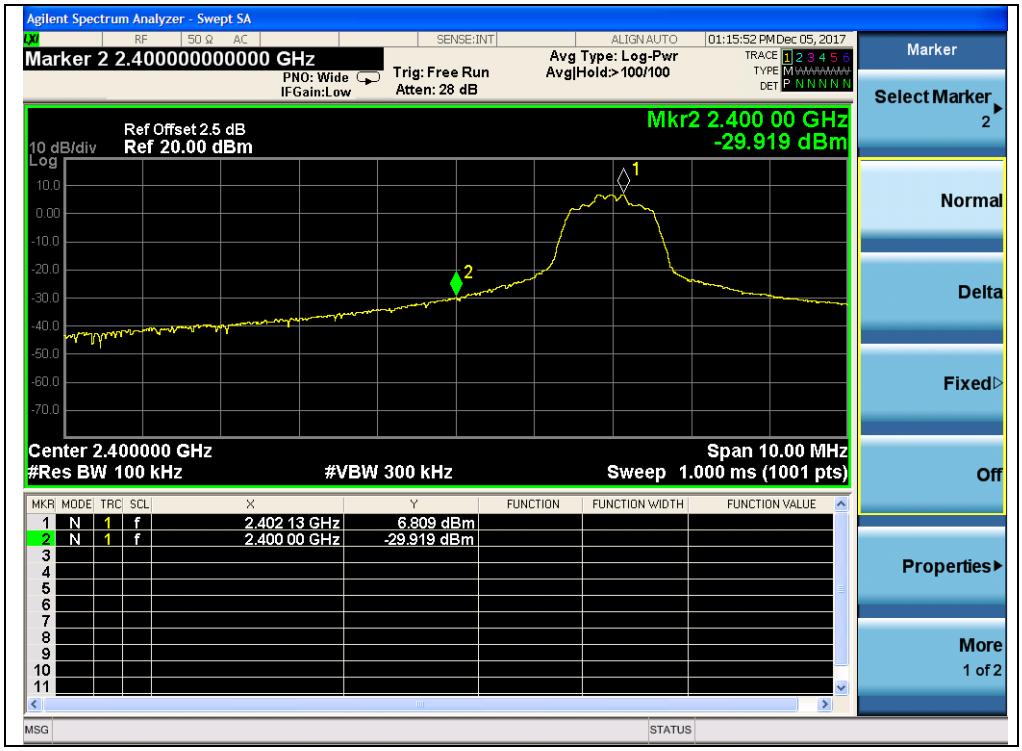
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-47.87	Plot B1	2.31	-17.69	PASS
39	2441	-43.99	Plot B2	1.84	-18.16	PASS
78	2480	-43.54	Plot B3	3.48	-16.52	PASS

B. Test Plots:

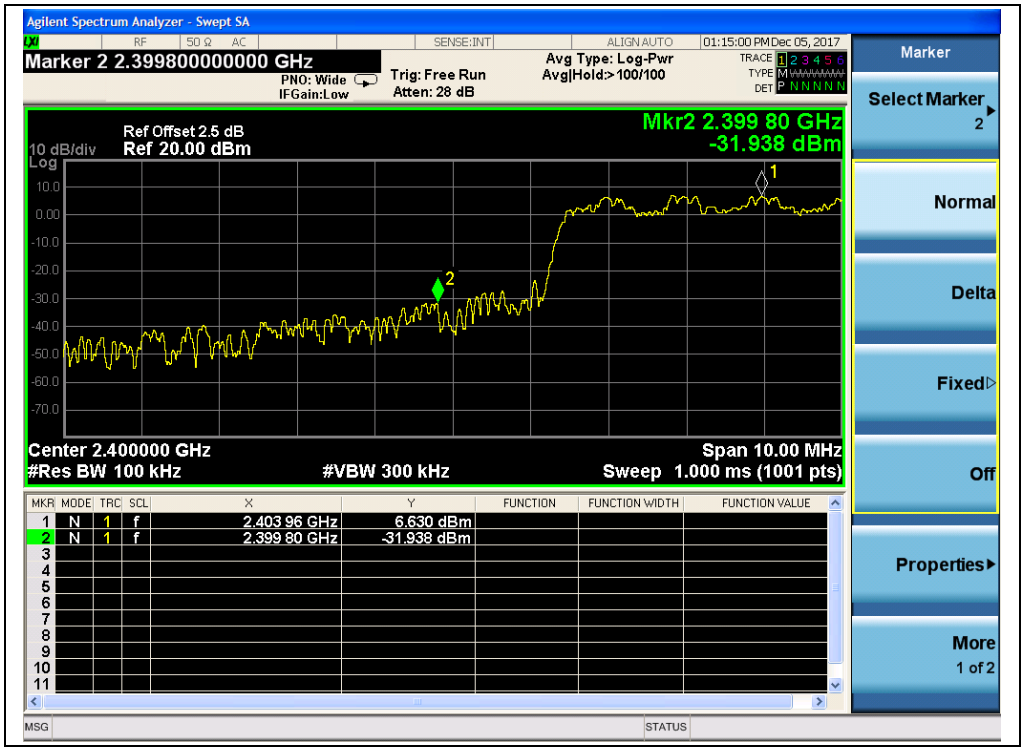
Note: the power of the Module transmitting frequency should be ignored.



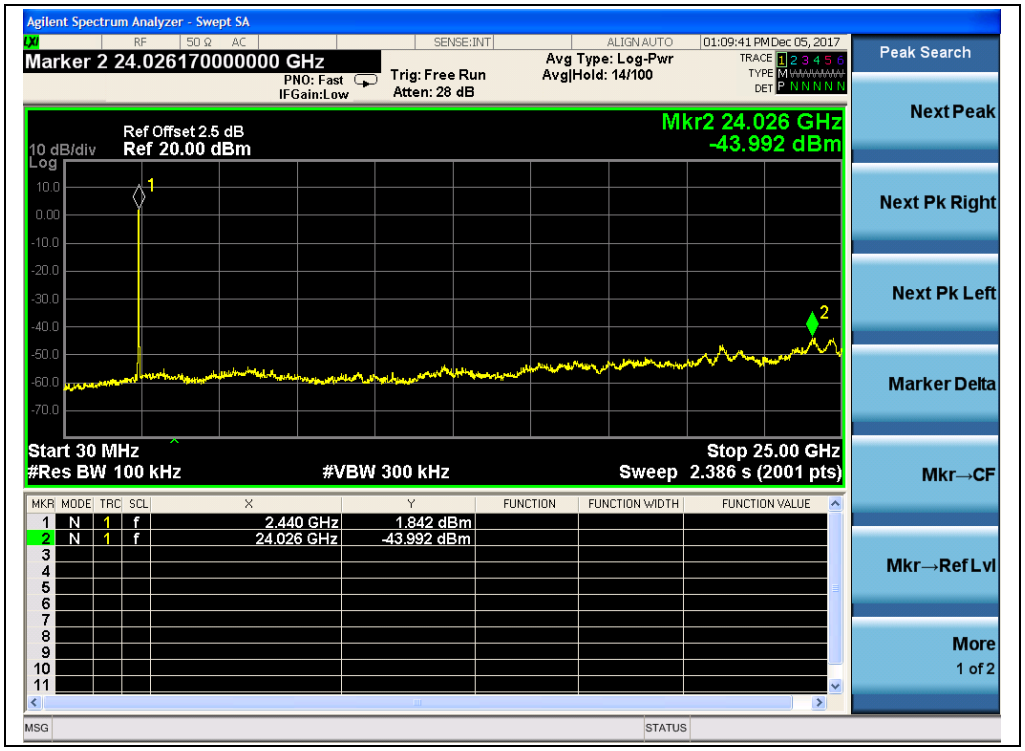
(Plot B1: Channel = 0, 30MHz to 25GHz @π/4-DQPSK)



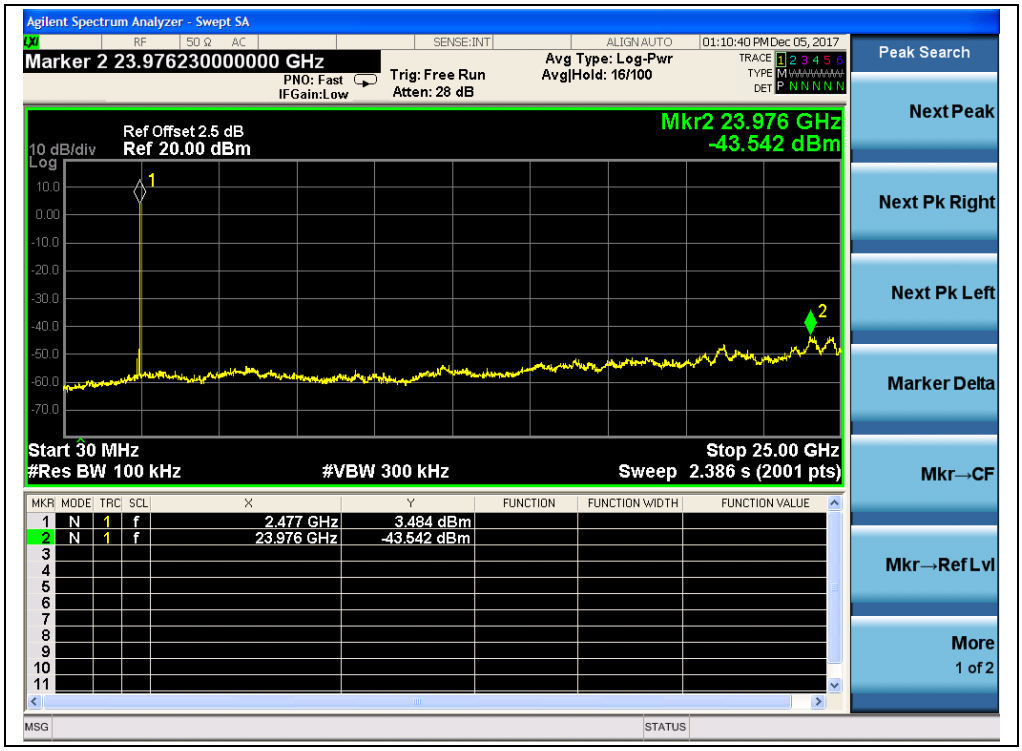
(Channel = 0, Band edge @π/4-DQPSK)



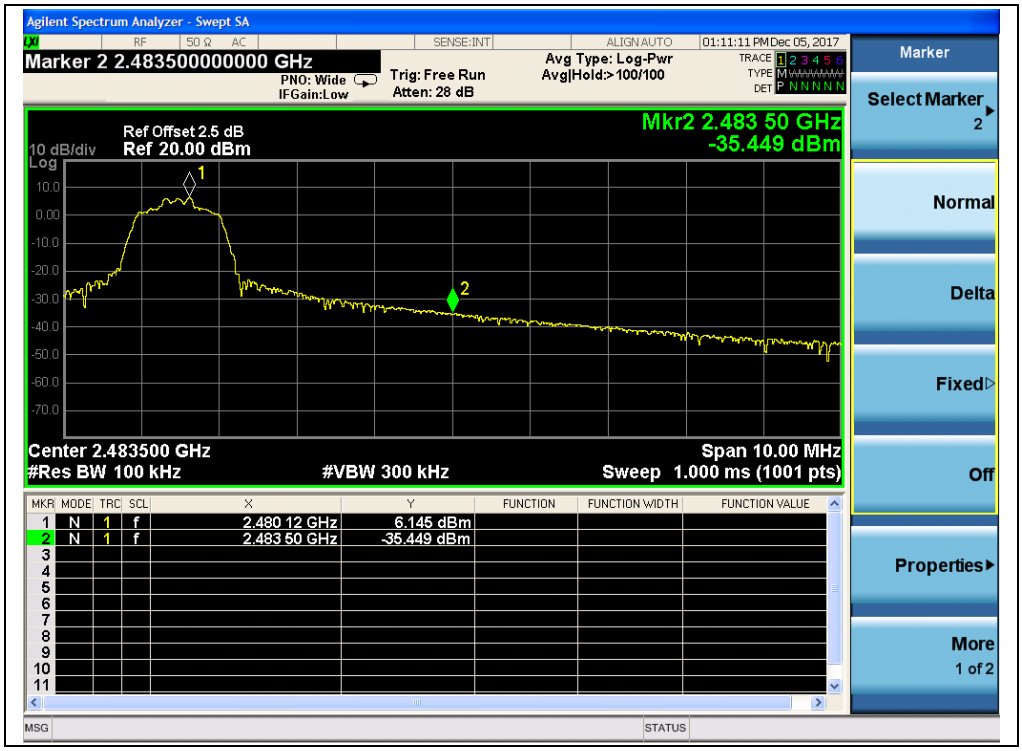
(Channel = 0, Band edge with hopping on @π/4-DQPSK)



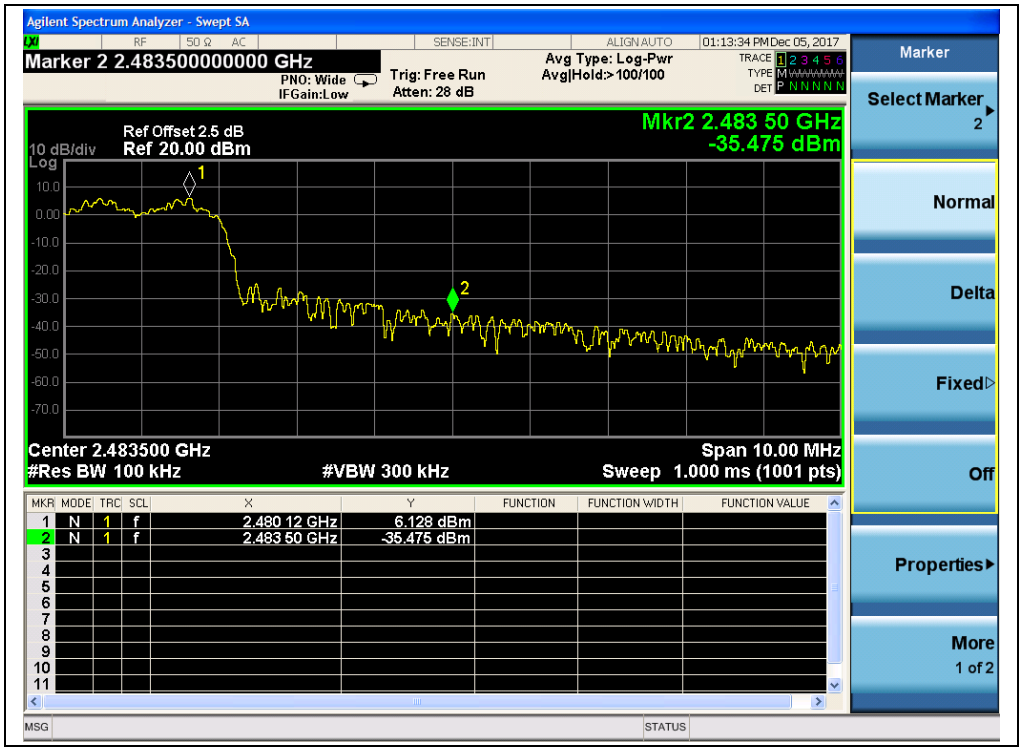
(Plot B2: Channel = 39, 30MHz to 25GHz @ π/4-DQPSK)



(Plot B3: 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)

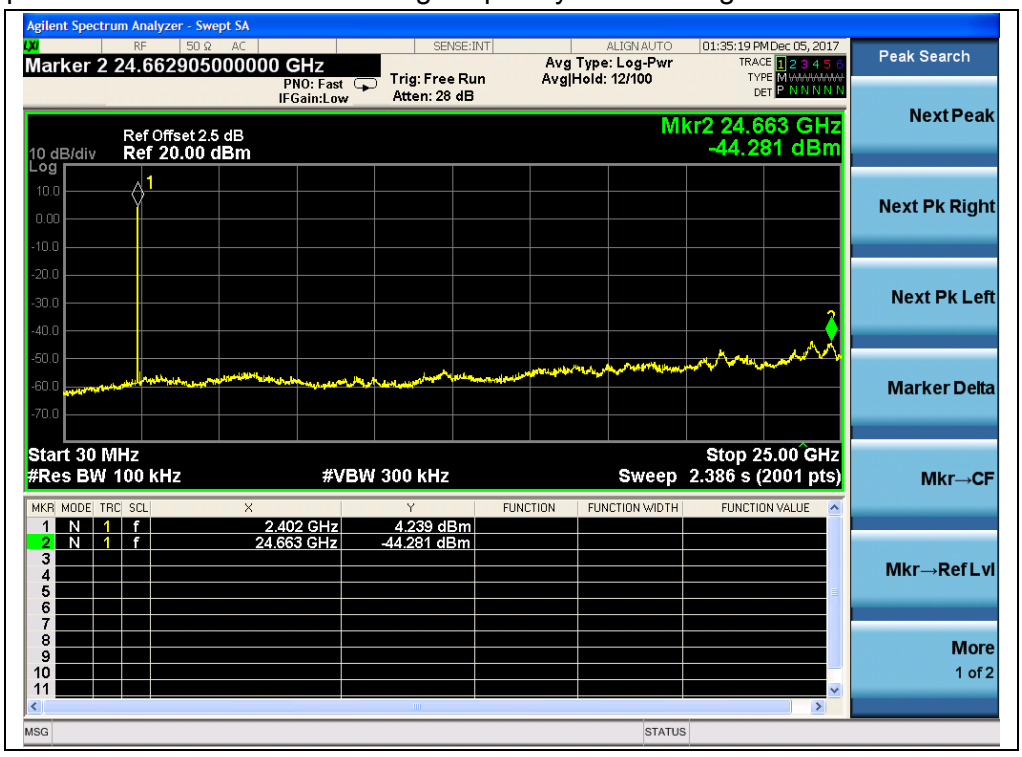
2.7.4.3 8-DPSK Mode

A. Test Verdict:

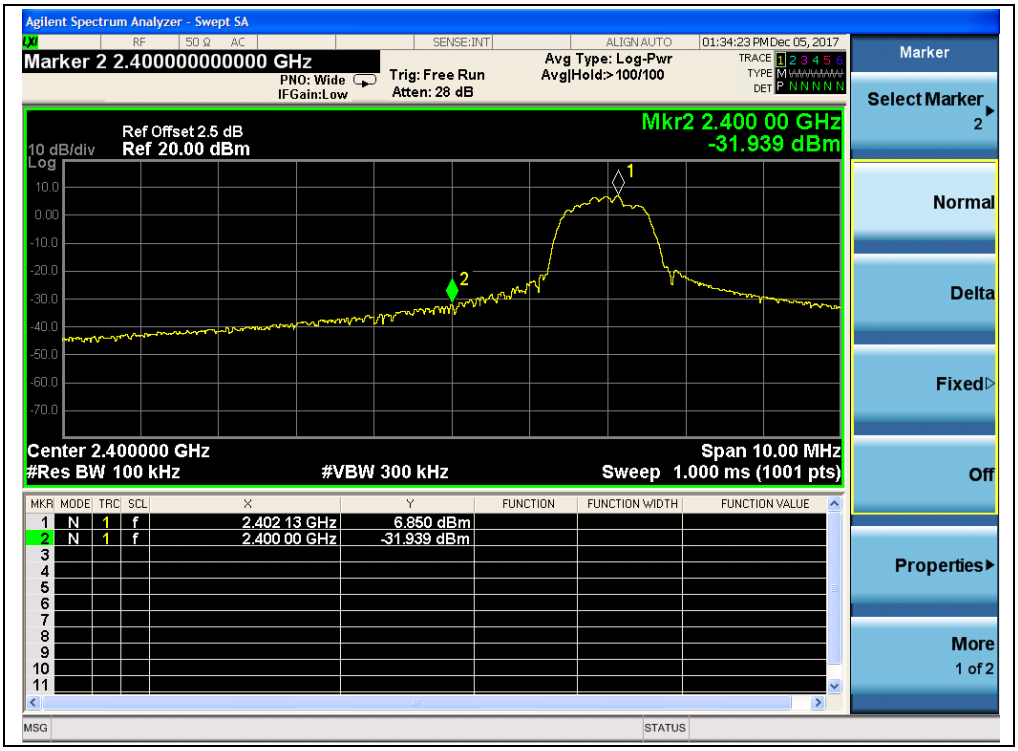
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-44.28	Plot C1	4.24	-15.76	PASS
39	2441	-43.32	Plot C2	3.59	-16.41	PASS
78	2480	-43.63	Plot C3	2.88	-17.12	PASS

B. Test Plots:

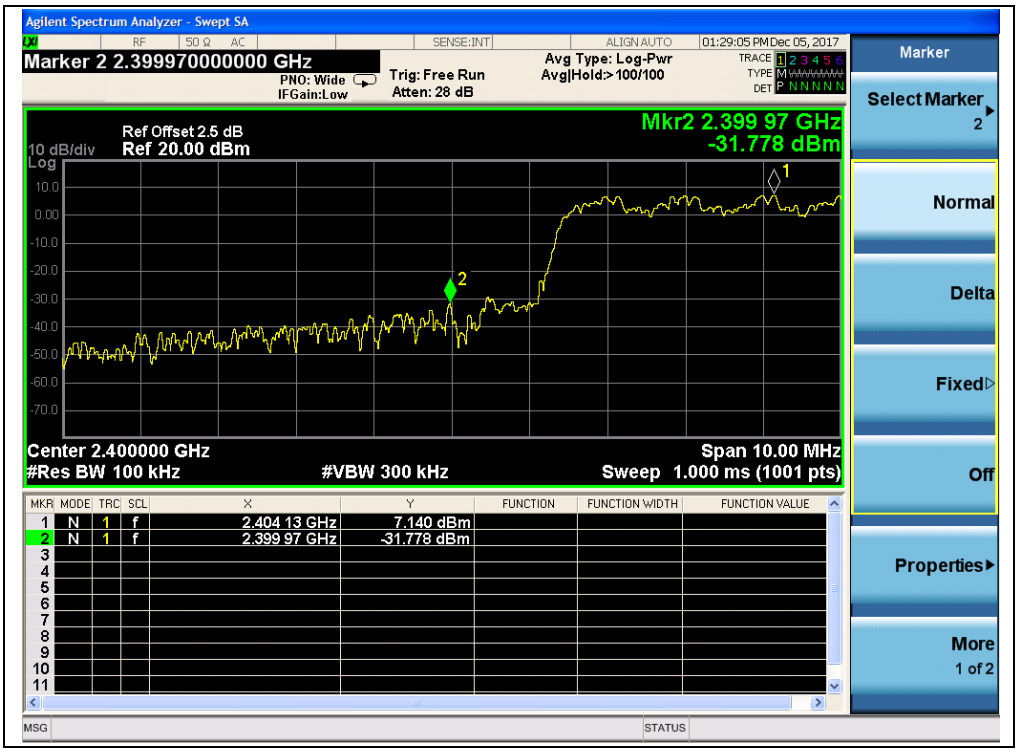
Note: the power of the Module transmitting frequency should be ignored.



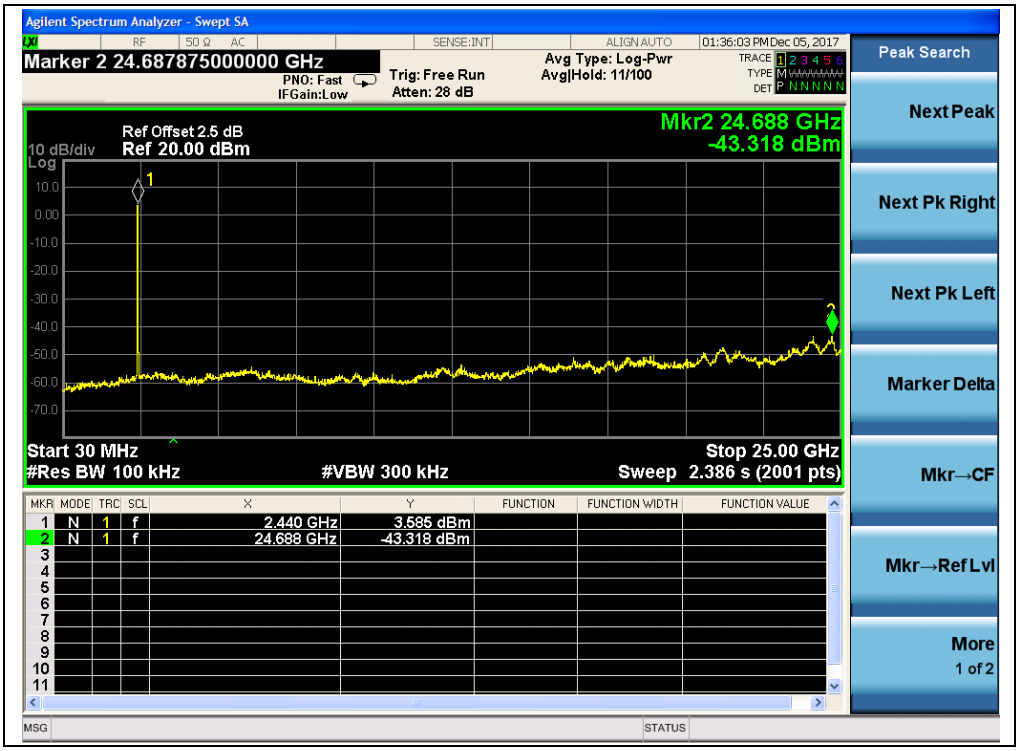
(Plot G: Channel = 0, 30MHz to 25GHz @ 8-DPSK)



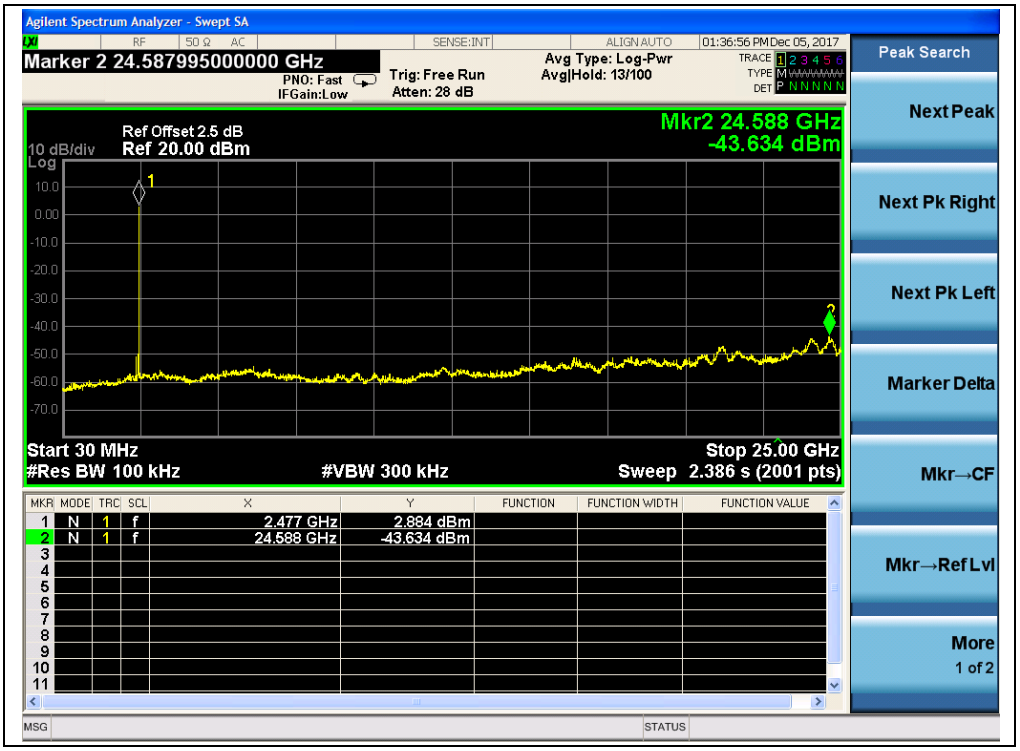
(Channel = 0, Band edge @ 8-DPSK)



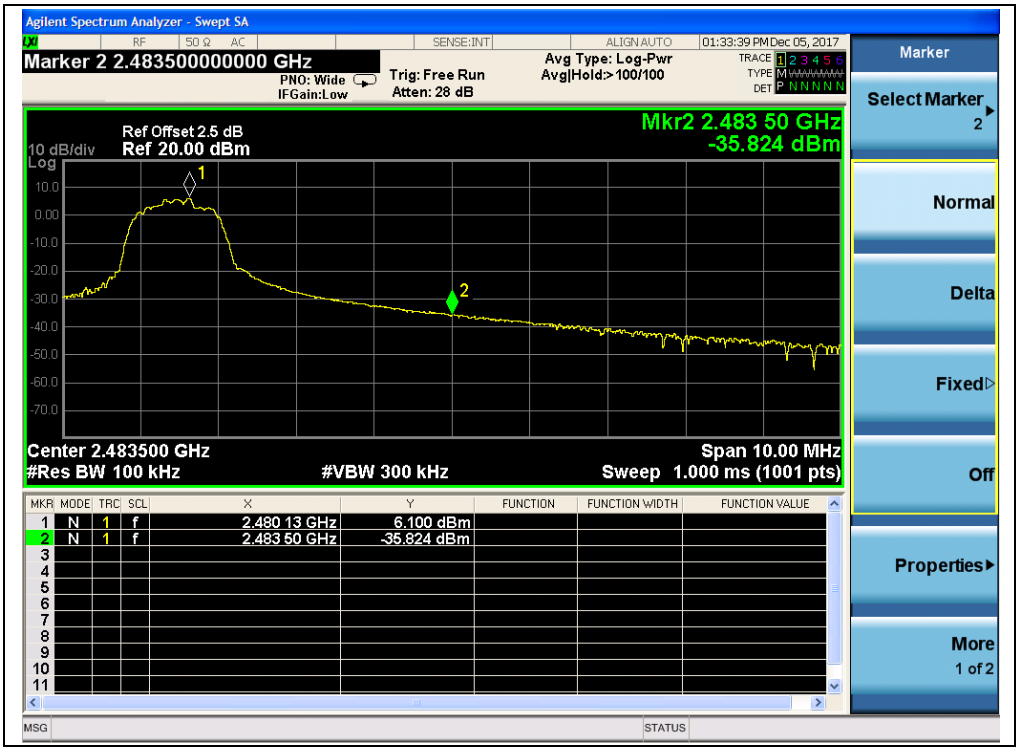
(Channel = 0, Band edge with hopping on @ 8-DPSK)



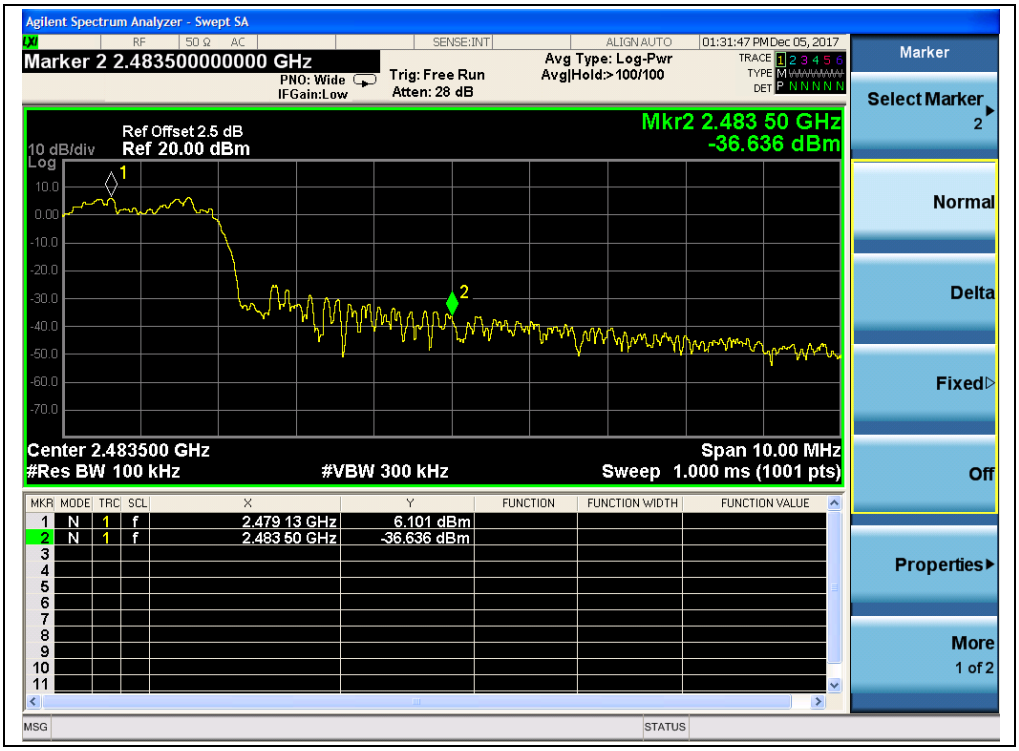
(Plot H: Channel = 39, 30MHz to 25GHz @ 8-DPSK)



(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)

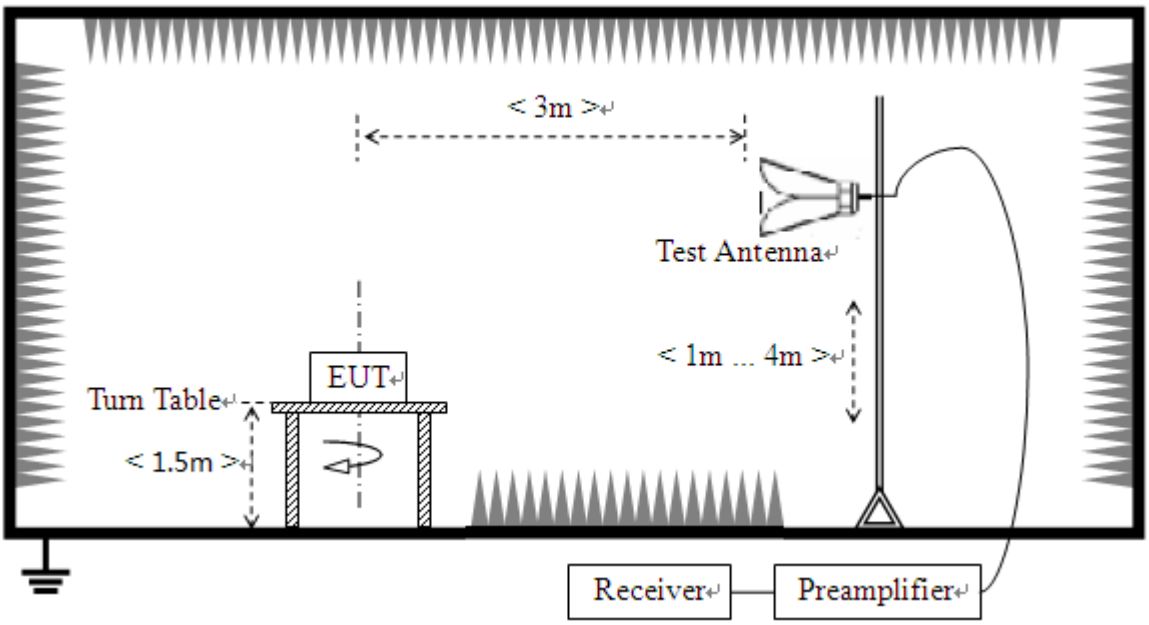
2.8. Restricted Frequency Bands

2.8.1. Requirement

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which t he s pread s pectrum o r di gitally m odulated i ntentional r adiator is oper ating, the r adio 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 t he E UT is activated and c ontrolled by the B luetooth S ervice S upplier (SS) v ia a Common Antenna, and i s set to operate under non hopping-on test mode transmitting 339 by tes 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

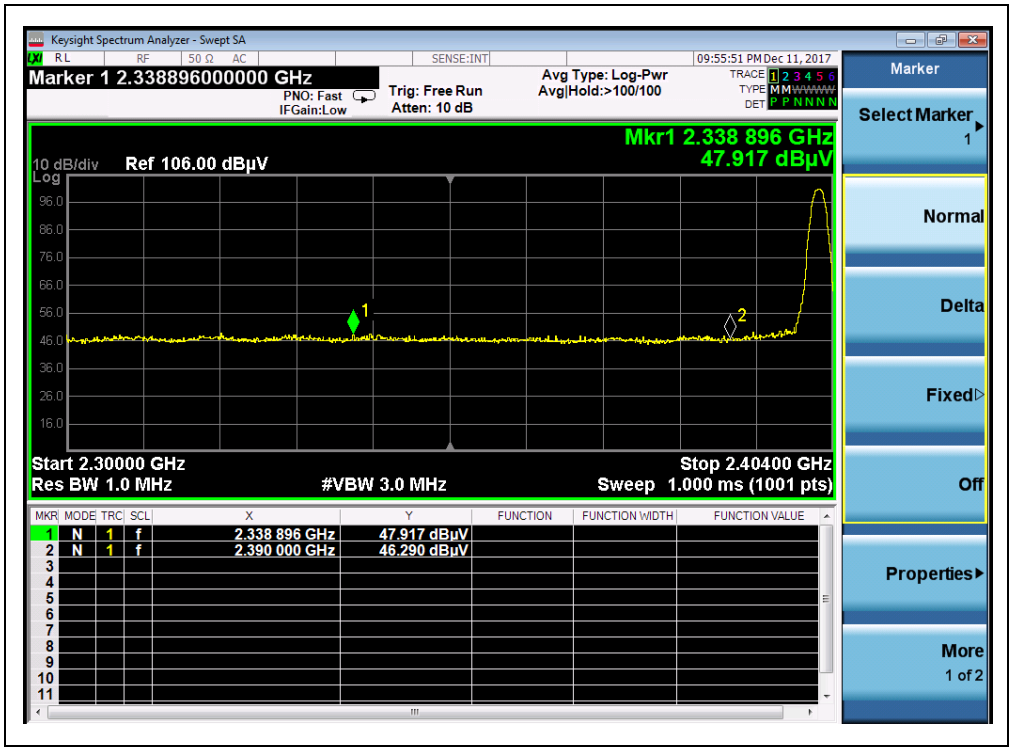
The lowest and highest channels are tested to verify Restricted Frequency Bands.
The measurement results are obtained as below:
E [dBμV/m] =U_R + A_T + A_{Factor} [dB]; AT =$L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
AT: Total correction Factor except Antenna
UR: Receiver Reading
Gpreamp: Preamplifier Gain
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

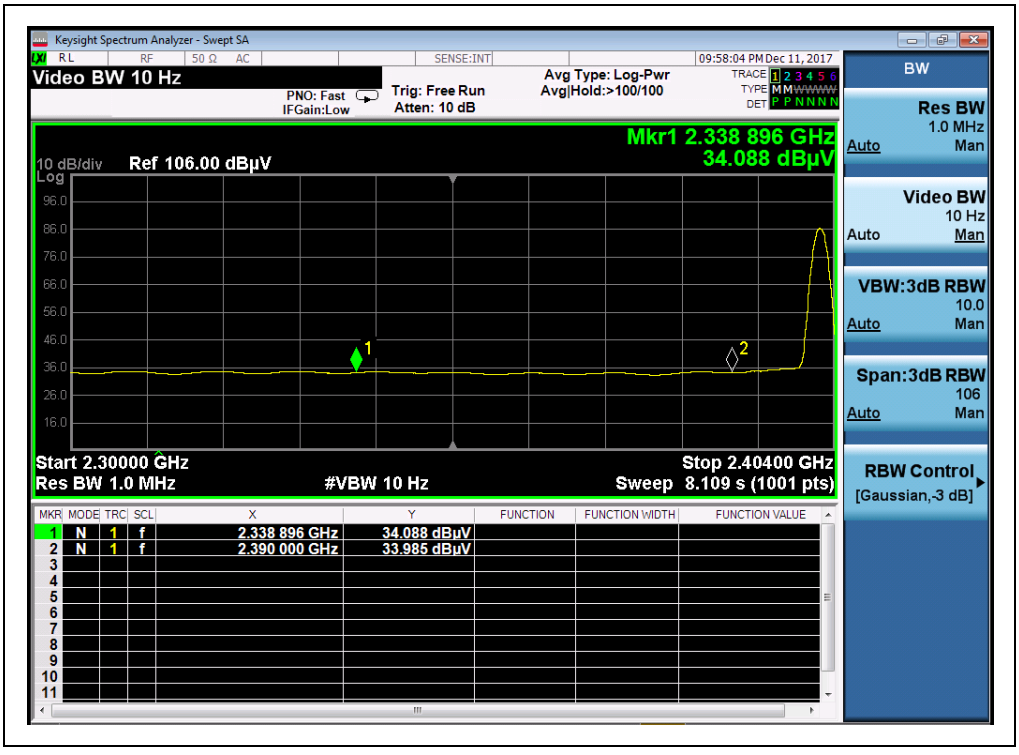
A. Test Verdict:

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	2338.90	PK	47.92	-32.81	40.3	55.41	74	Pass
0	2338.90	AV	34.09	-32.81	40.3	41.58	54	Pass
78	2485.96	PK	50.73	-32.81	40.3	58.22	74	Pass
78	2485.96	AV	34.64	-32.81	40.3	42.13	54	Pass

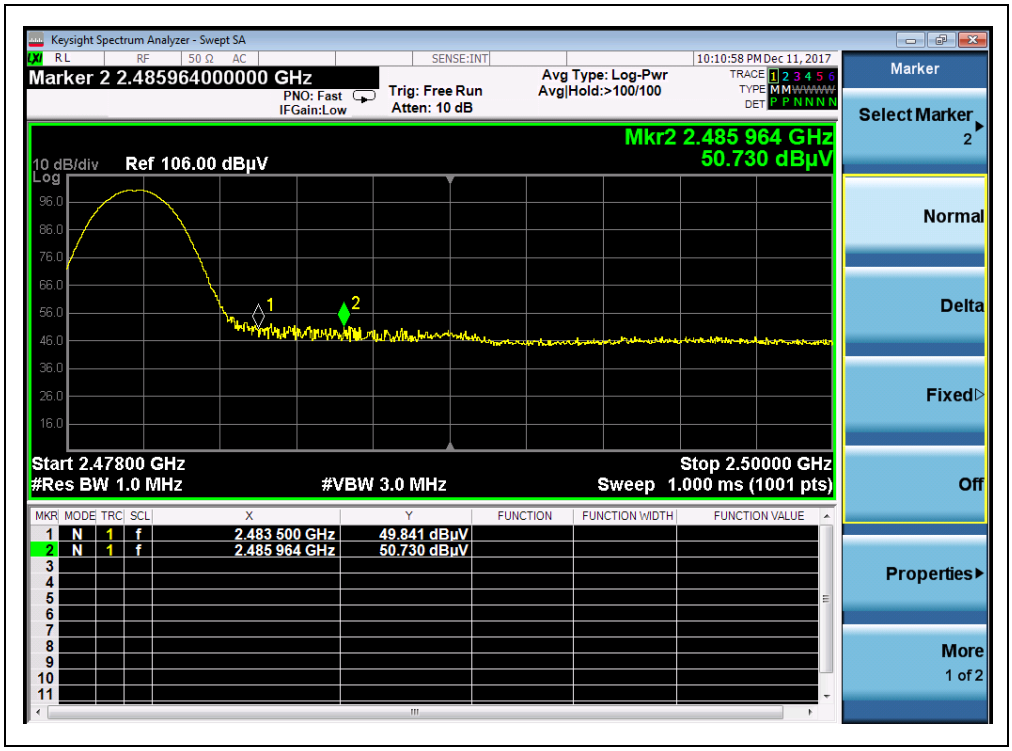
B. Test Plots:



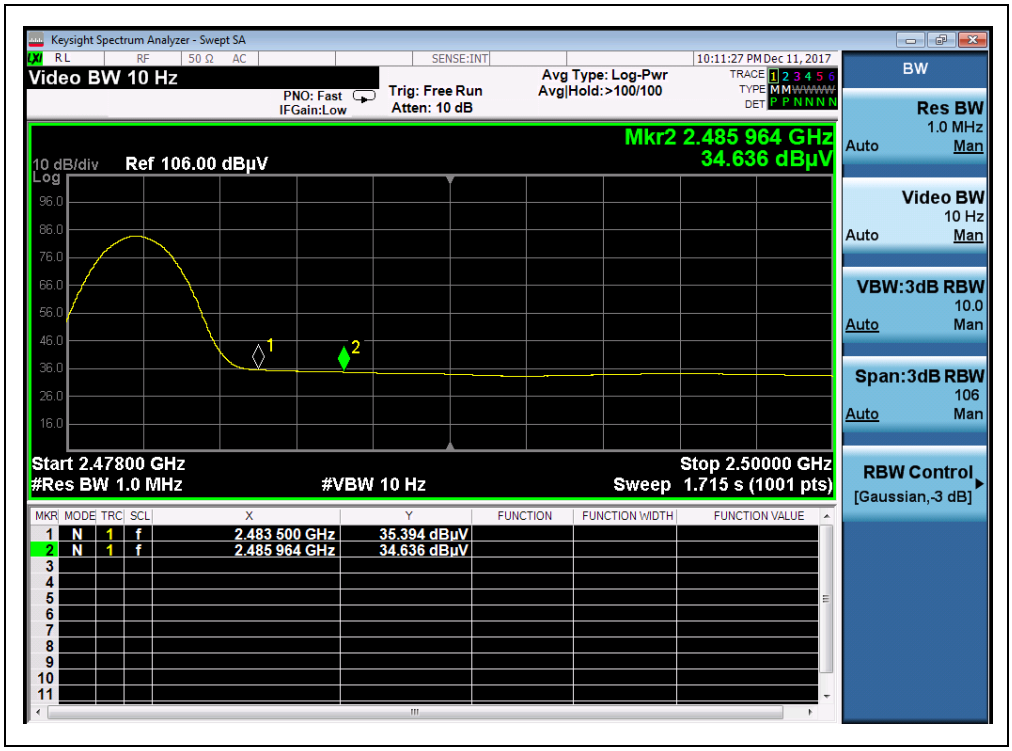
(Channel = 0 PEAK @ GFSK)



(Channel = 0 AVERAGE @ GFSK)



(Channel = 78 PEAK @ GFSK)



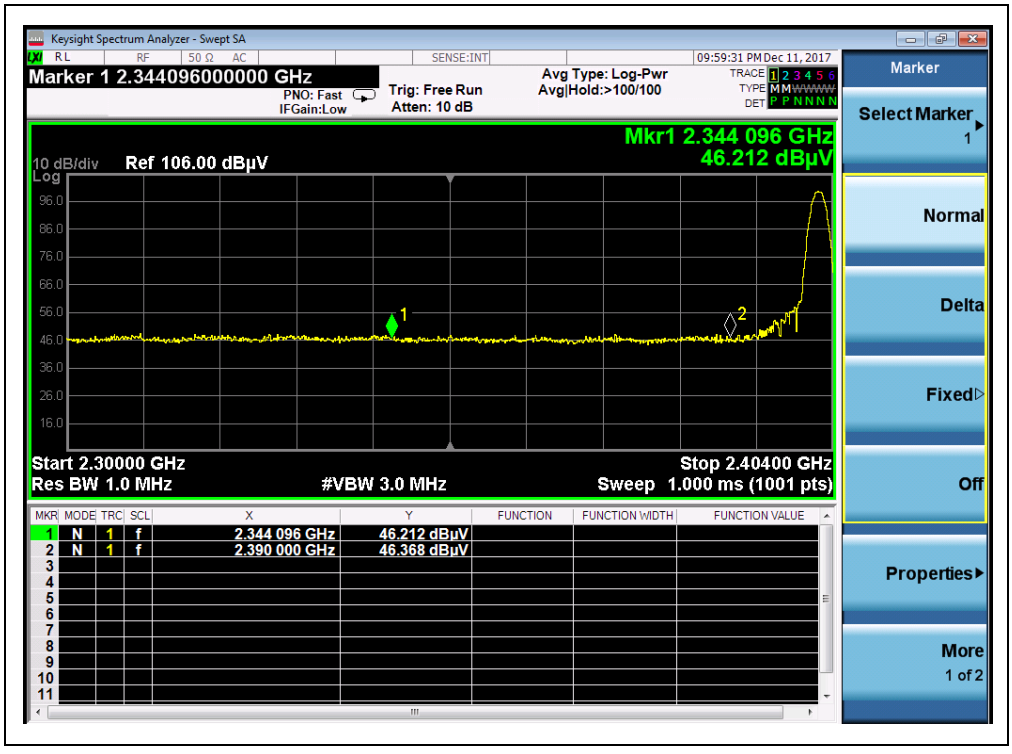
(Channel = 78 AVERAGE @ GFSK)

2.8.4.2 π/4-DQPSK Mode

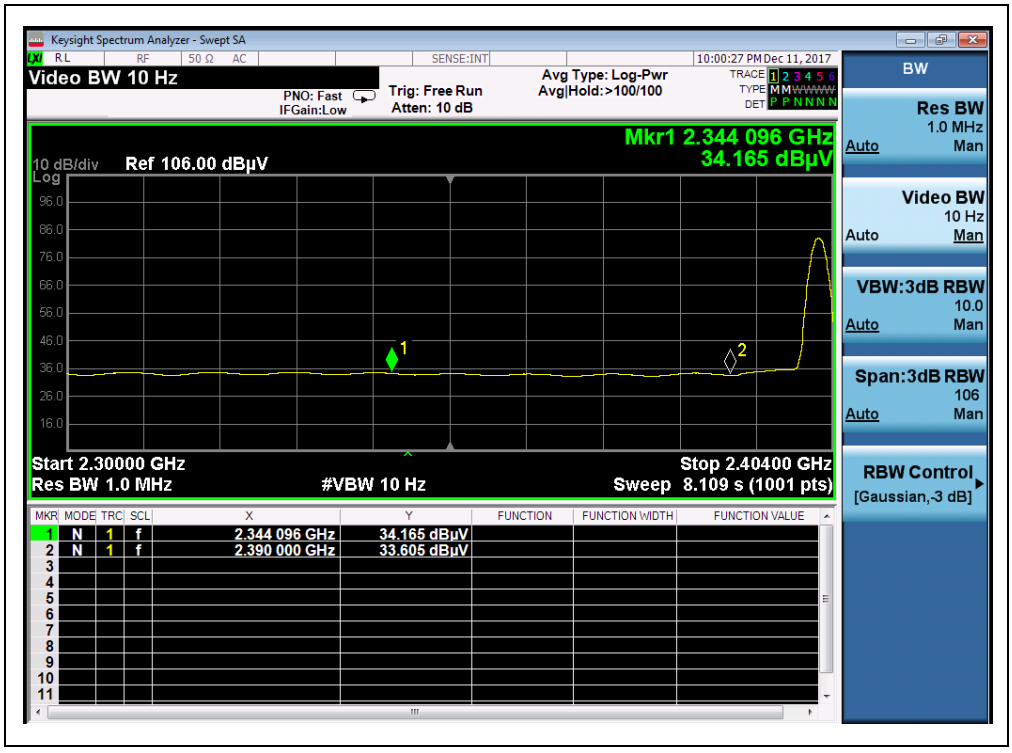
A. Test Verdict:

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	2344.10	PK	46.21	-32.81	40.3	53.70	74	Pass
0	2344.10	AV	34.17	-32.81	40.3	41.66	54	Pass
78	2485.77	PK	50.02	-32.81	40.3	57.51	74	Pass
78	2485.24	AV	34.84	-32.81	40.3	42.33	54	Pass

B. Test Plots:

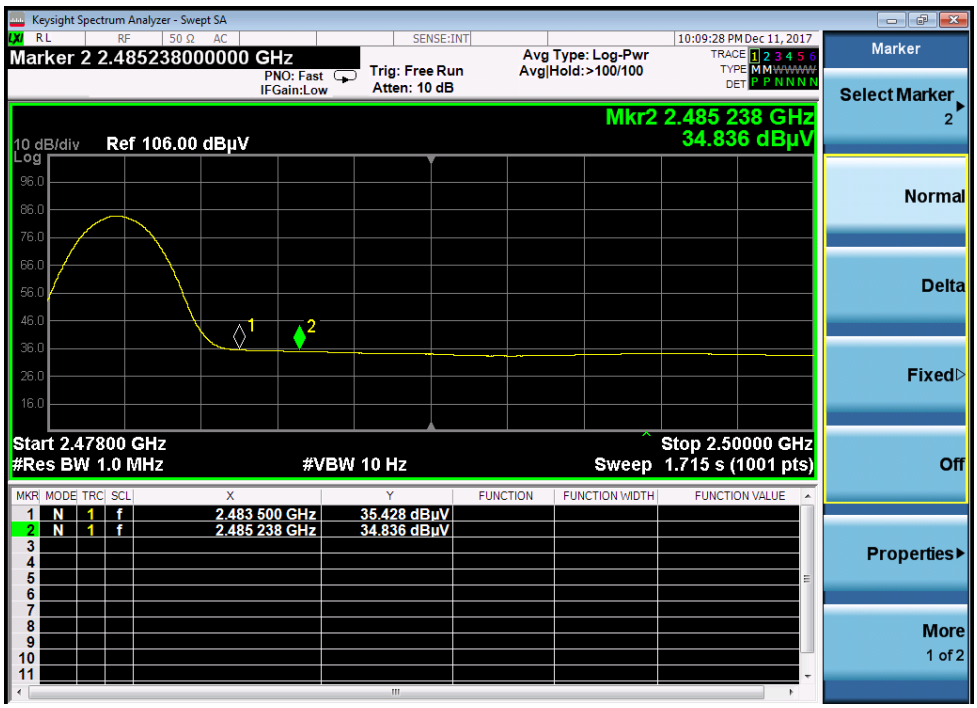


(Channel = 0 PEAK @ π/4-DQPSK)



(Channel = 0 AVERAGE @ π/4-DQPSK)

(Channel = 78 PEAK @ π/4-DQPSK)



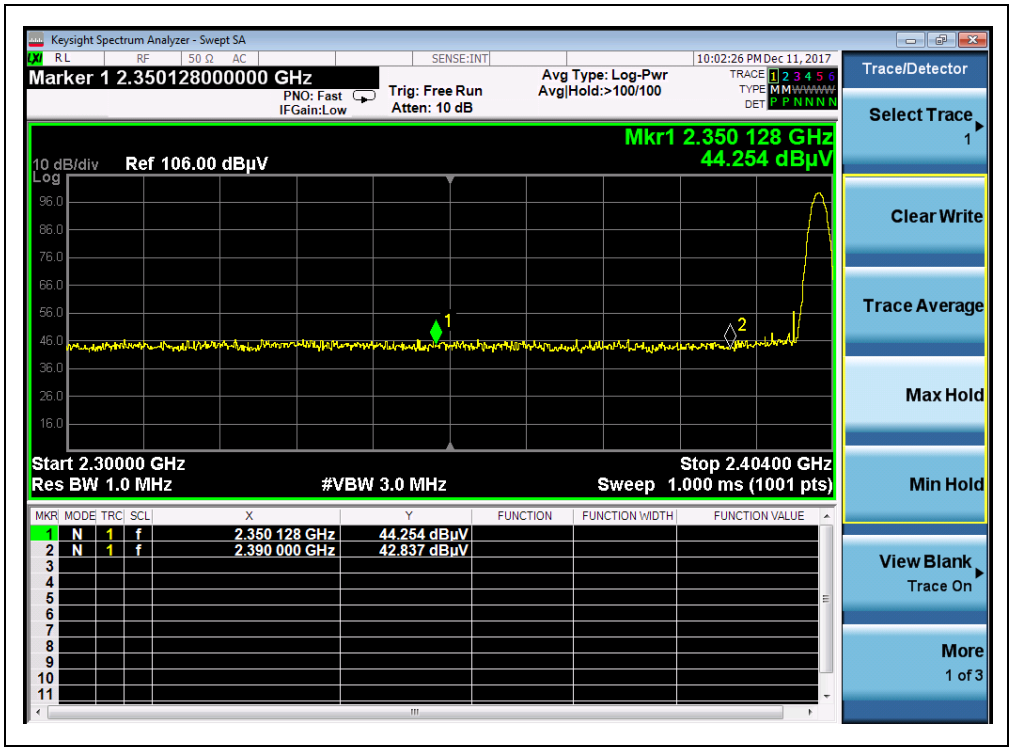
(Channel = 78 AVERAGE@ π/4-DQPSK)

2.8.4.3 8-DPSK Mode

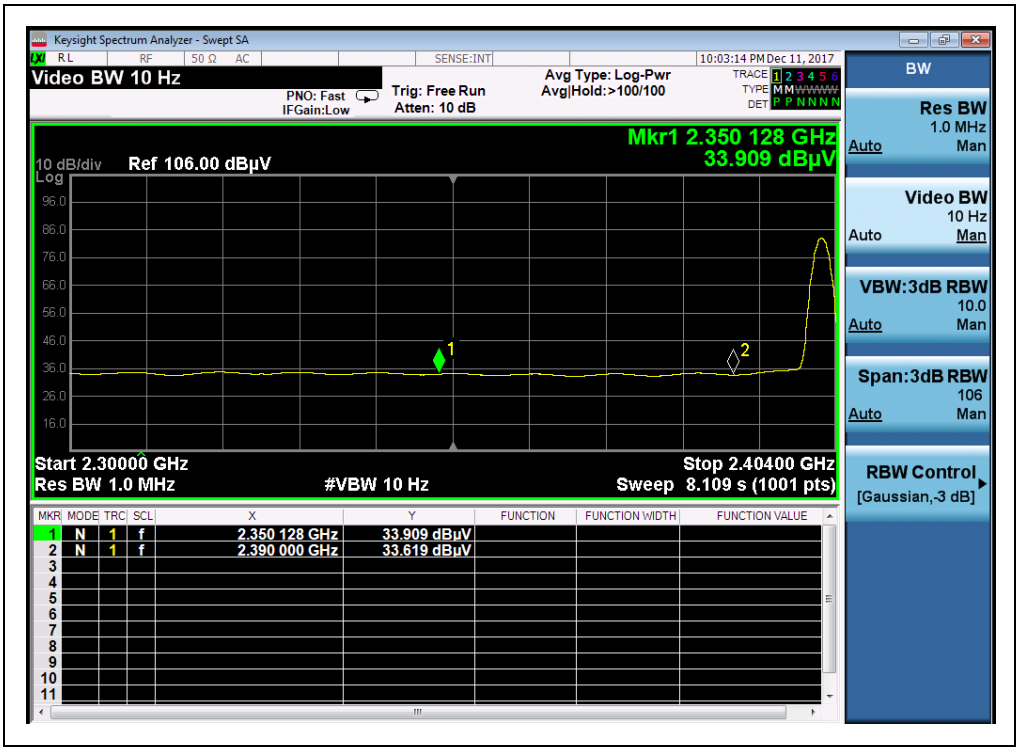
A. Test Verdict:

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	2350.13	PK	44.25	-32.81	40.3	51.74	74	Pass
0	2350.03	AV	33.91	-32.81	40.3	41.40	54	Pass
78	2487.86	PK	51.05	-32.81	40.3	58.54	74	Pass
78	2487.86	AV	34.09	-32.81	40.3	41.58	54	Pass

B. Test Plots:

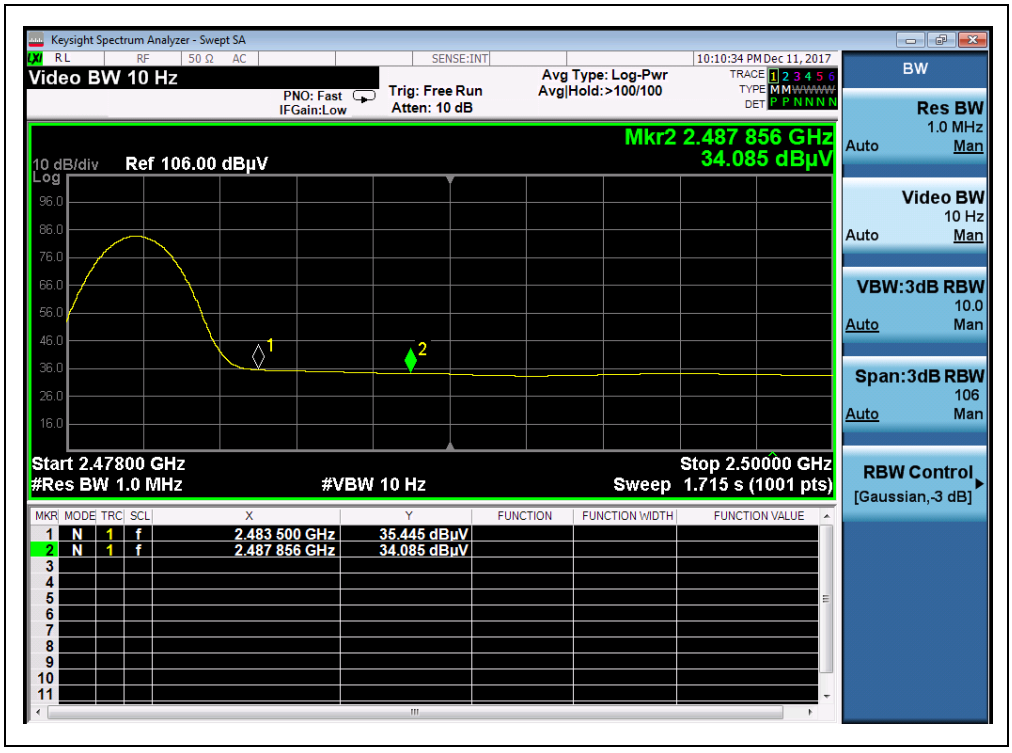


(Channel = 0 PEAK @ 8-DPSK Mode)



(Channel = 0 AVERAGE @ 8-DPSK Mode)

(Channel = 78 PEAK @ 8-DPSK Mode)



(Channel = 78 AVERAGE @ 8-DPSK Mode)

2.9. Conducted Emission

2.9.1. Requirement

According to RSS-GEN section 8.8, 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 r ange (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

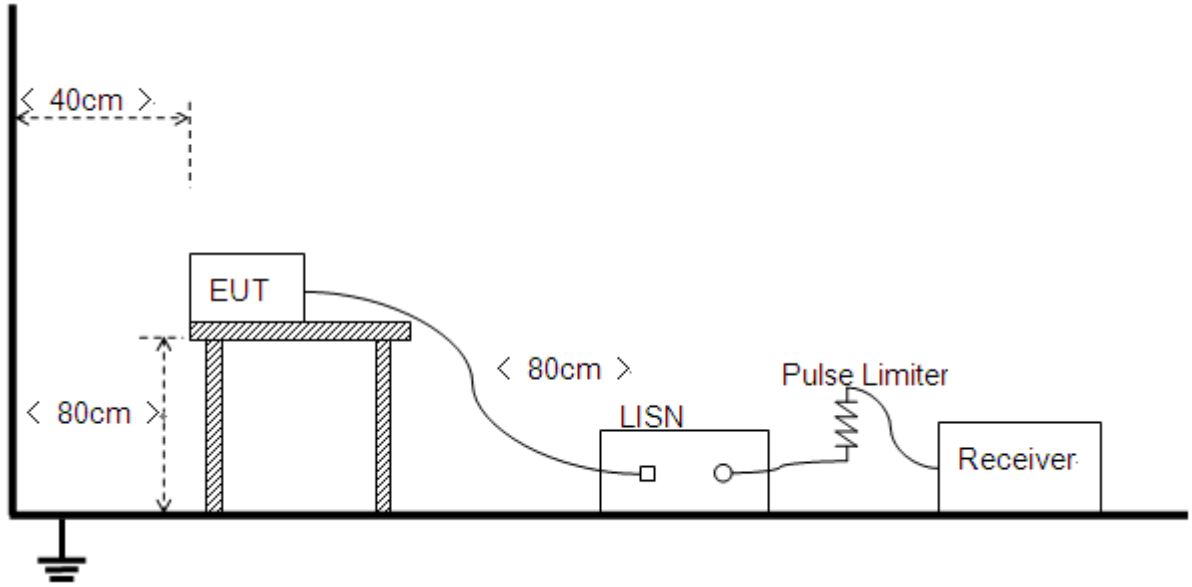
NOTE:

(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 T able-top E UT w as pl aced upon a non -metallic t able 0. 8m above t he ho rizontal m etal reference ground pl ane. E UT w as c onnected t o LI SN and L ISN w as c onnected t o r eference 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

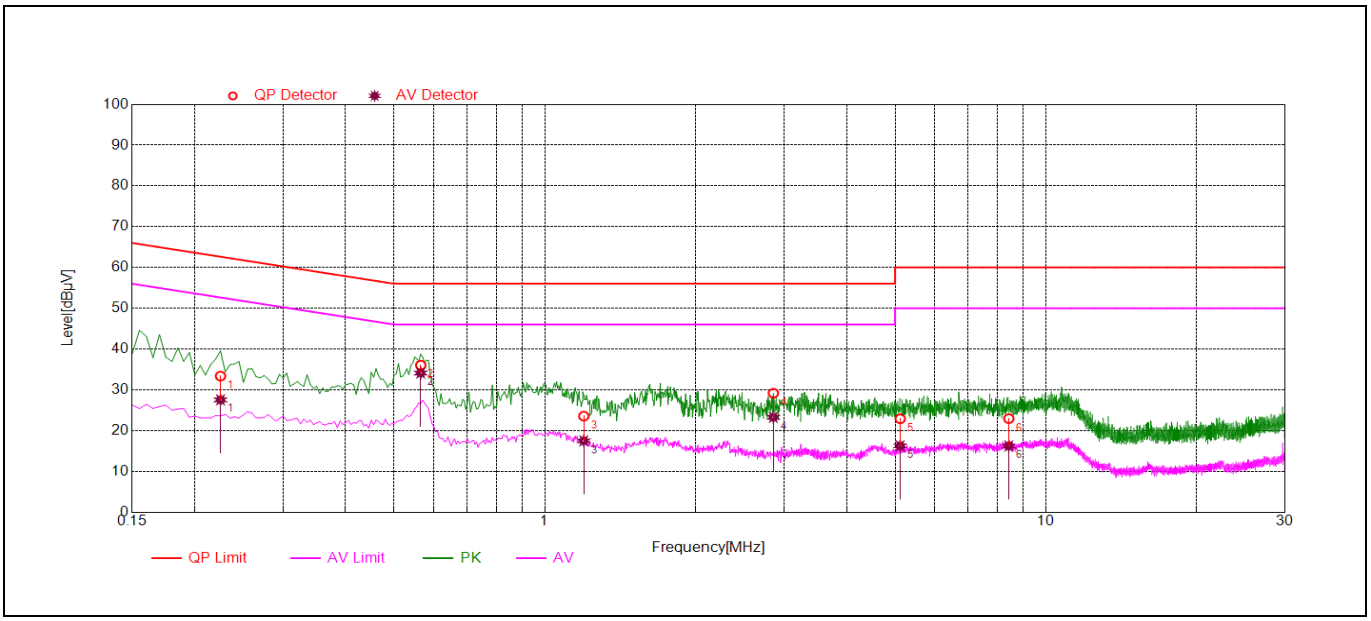
The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT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

A. Test setup:

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

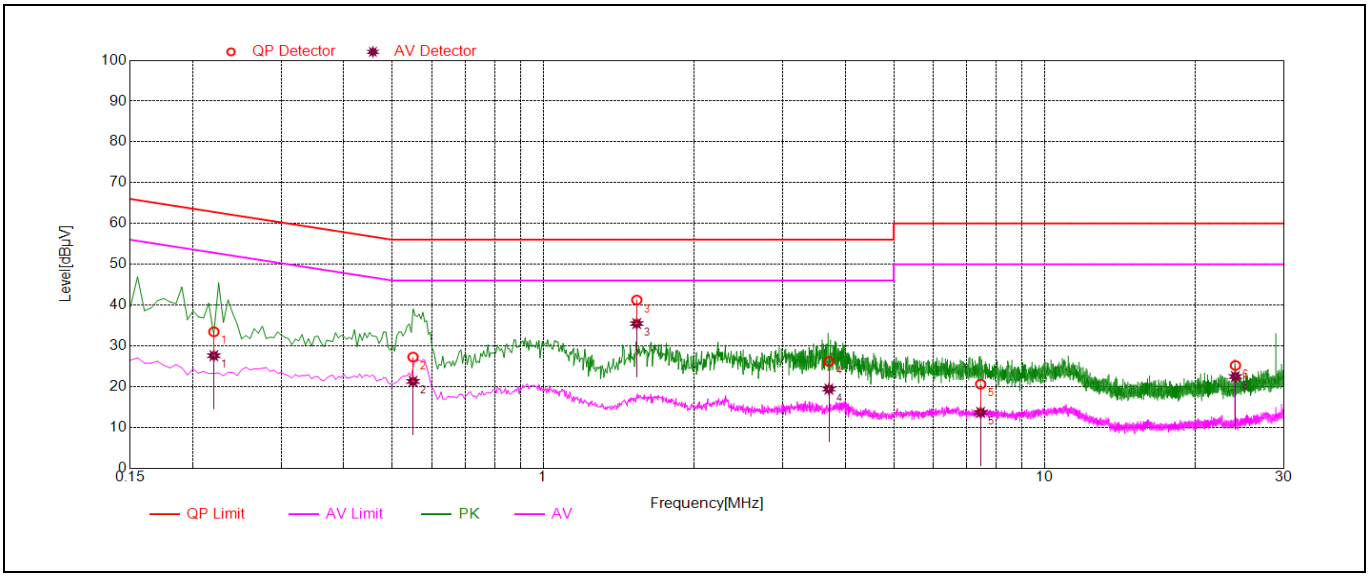
Note: The test voltage is AC 120V/60Hz.

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	0.23	33.36	27.53	62.63	52.63	Line	PASS
2	0.54	36.05	34.11	56.00	46.00		PASS
3	1.20	23.55	17.48	56.00	46.00		PASS
4	2.86	29.15	23.27	56.00	46.00		PASS
5	5.12	22.91	16.27	60.00	50.00		PASS
6	8.44	22.93	16.21	60.00	50.00		PASS



(Plot B: N Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.22	33.43	27.57	62.81	52.81	Neutral	PASS
2	0.55	27.24	21.27	56.00	46.00		PASS
3	1.54	41.22	35.45	56.00	46.00		PASS
4	3.71	26.16	19.38	56.00	46.00		PASS
5	7.45	20.59	13.67	60.00	50.00		PASS
6	24.02	25.18	22.45	60.00	50.00		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:

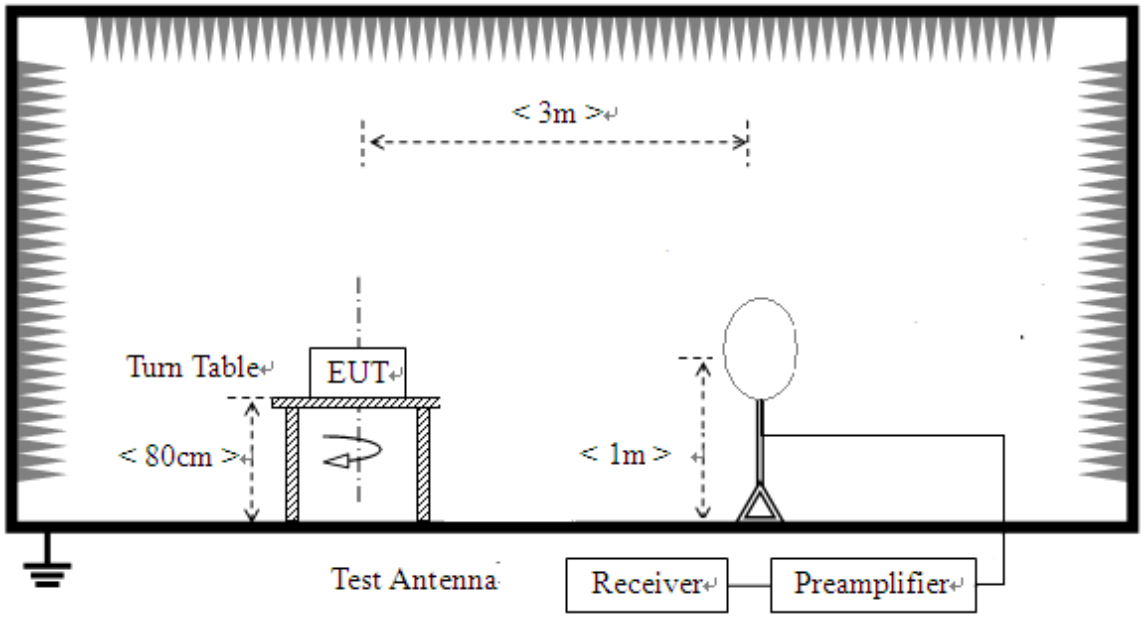
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength 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)

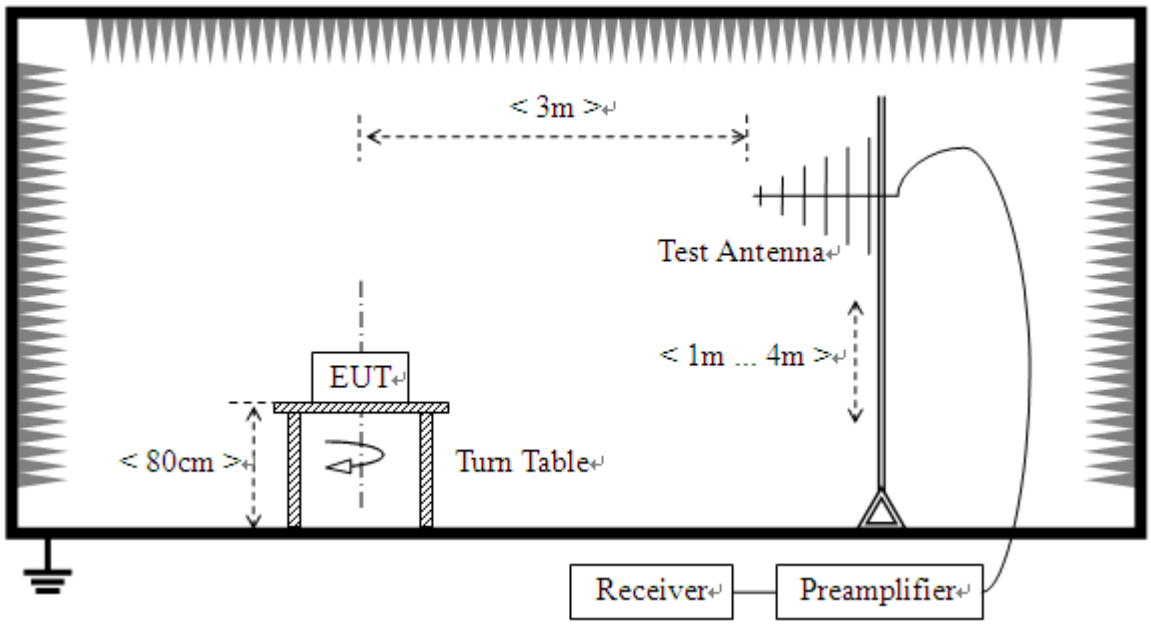
2.10.2. Test Description

A. Test Setup:

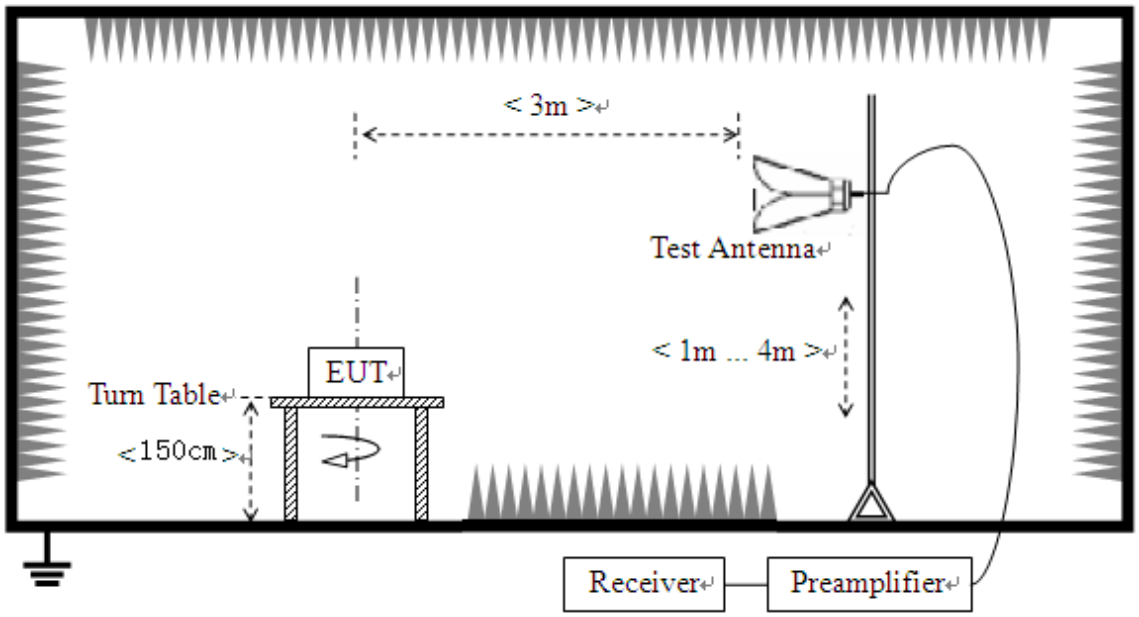
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The R F abs orbing m aterial us ed on t he reference gr ound pl ane and o n t he t urntable hav e 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.

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 s et-up on i nsulator 150cm above t he Ground P lane. The s et-up and test m ethods w ere 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:

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

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

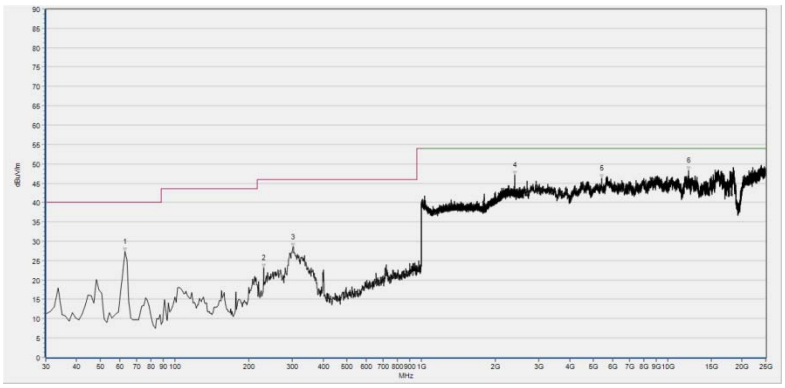
During the test, the total correction Factor AT and A_{Factor} were built in test software.

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.

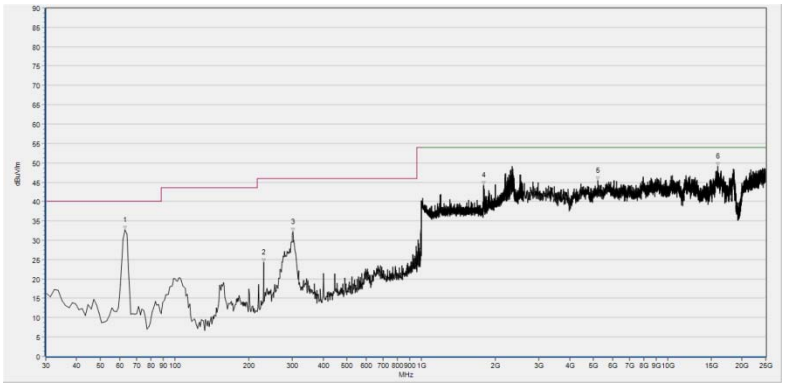
2.10.4.1 GFSK Mode:

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
62.778	27.33	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
229.099	23.07	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
301.940	28.45	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2401.521	47.07	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
5390.326	46.33	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
12156.356	48.19	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

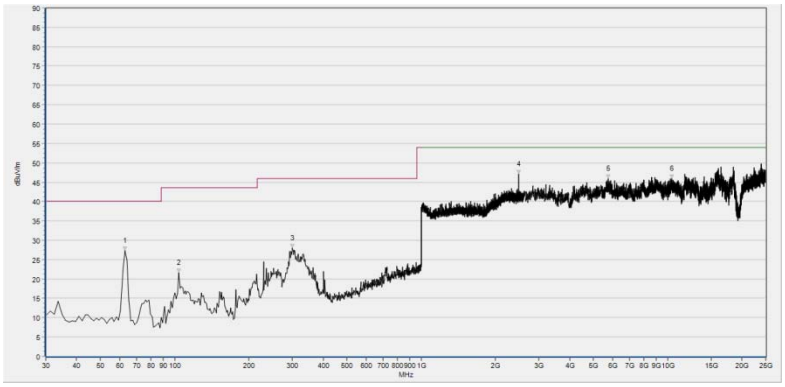
(30MHz to 25GHz, Antenna Horizontal @ GFSK, channel 0)



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
62.778	32.62	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
229.099	24.35	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
301.940	32.10	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1792.637	44.30	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
5219.240	45.36	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
16009.856	49.03	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

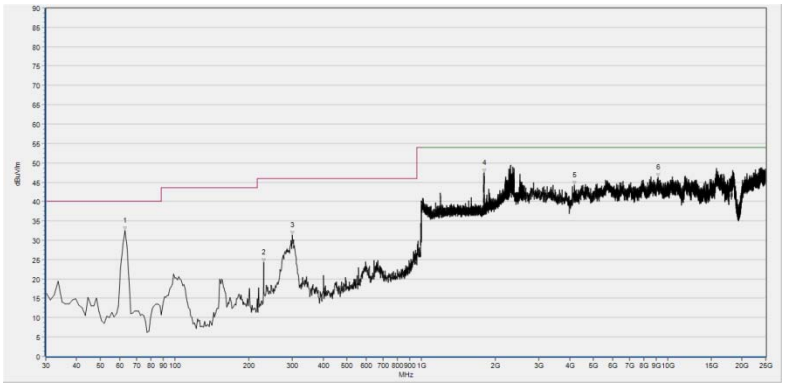
(30MHz to 25GHz, Antenna Vertical @ GFSK, channel 0)

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
62.778	27.32	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
104.055	21.54	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
300.726	27.95	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2479.632	47.07	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
5736.570	45.87	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
10368.103	46.00	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

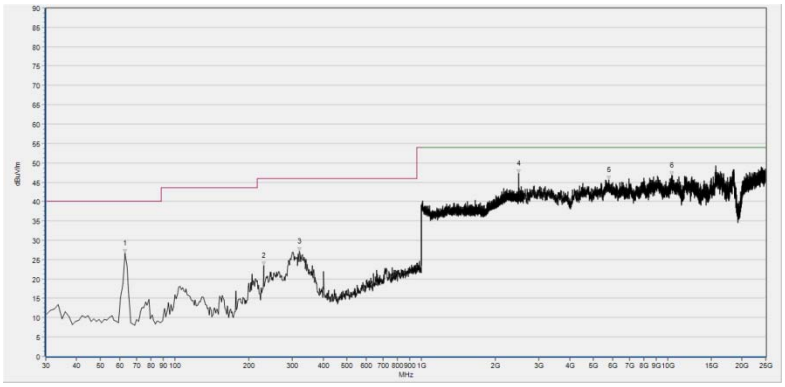
(30MHz to 25GHz, Antenna Horizontal @ GFSK, channel 39)



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
62.778	32.52	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
229.099	24.34	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
300.726	31.35	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1797.759	47.45	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
4172.359	44.31	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
9133.843	46.32	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

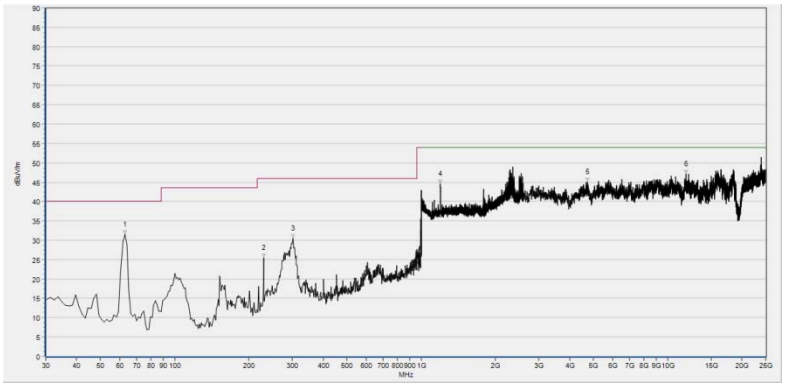
(30MHz to 25GHz, Antenna Vertical @ GFSK, channel 39)

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
62.778	26.62	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
229.099	23.48	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
321.364	27.23	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2479.632	47.28	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
5781.378	45.57	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
10364.030	46.77	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

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

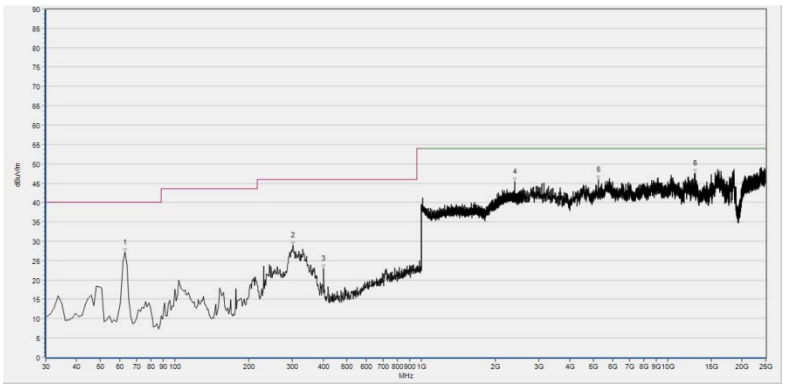


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
62.778	31.44	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
229.099	25.52	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
301.940	30.49	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1196.559	44.62	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
4730.424	45.15	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
11858.993	47.01	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

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

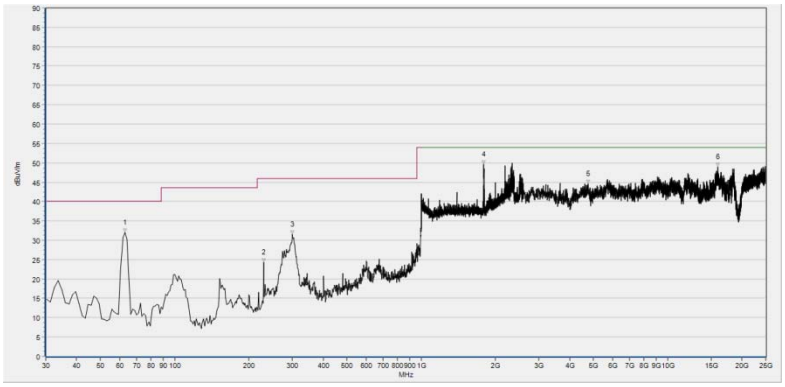
2.10.4.2 π/4-DQPSK Mode：

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
62.778	27.07	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
301.940	29.06	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
401.489	22.98	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2402.161	45.45	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
5223.313	45.95	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
12877.360	47.53	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

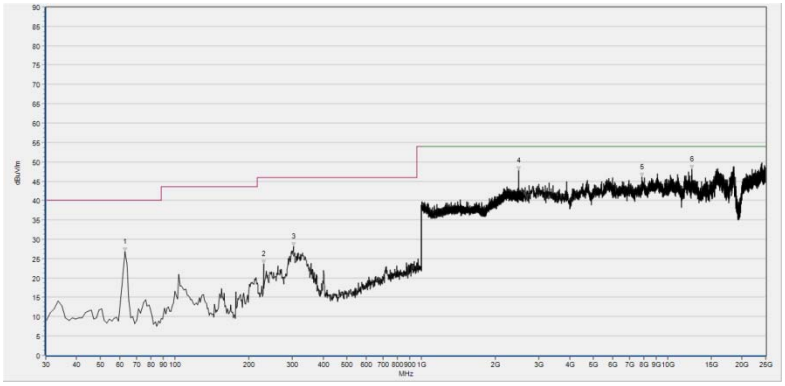
(30MHz to 25GHz, Antenna Horizontal @ π/4-DQPSK, channel 0)



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
62.778	32.02	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
229.099	24.35	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
300.726	31.49	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1795.838	49.63	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
4754.865	44.55	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
15997.636	48.88	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

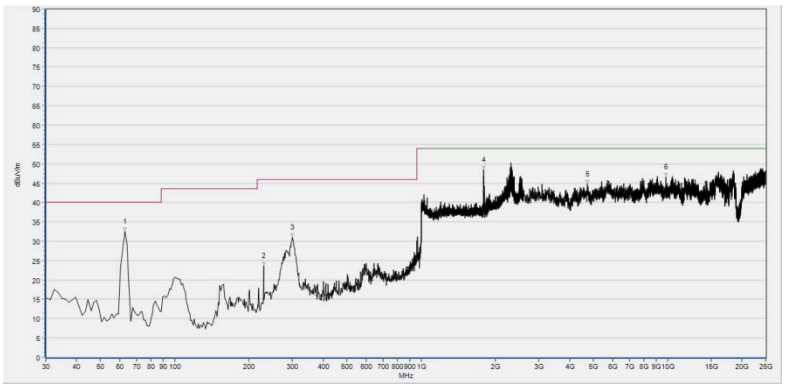
(30MHz to 25GHz, Antenna Vertical @ π/4-DQPSK, channel 0)

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
62.778	26.78	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
229.099	23.55	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
303.154	28.16	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2479.632	47.79	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
7875.141	46.03	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
12498.527	48.16	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

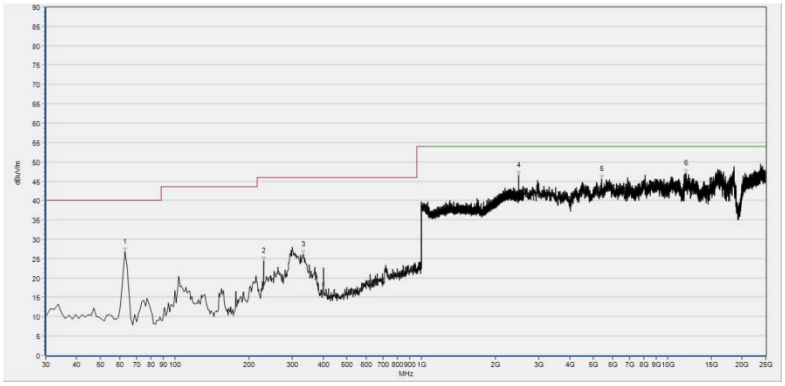
(30MHz to 25GHz, Antenna Horizontal @ π/4-DQPSK, channel 39)



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
62.778	32.45	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
229.099	23.67	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
300.726	31.03	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1795.198	48.43	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
4722.277	44.73	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
9822.259	46.67	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

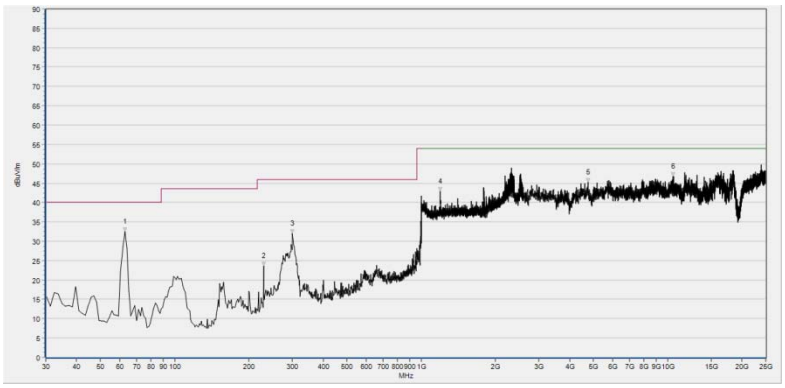
(30MHz to 25GHz, Antenna Vertical @ π/4-DQPSK, channel 39)

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
62.778	26.76	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
229.099	24.49	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
332.290	26.19	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2479.632	46.62	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
5382.179	45.55	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
11867.139	47.12	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

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

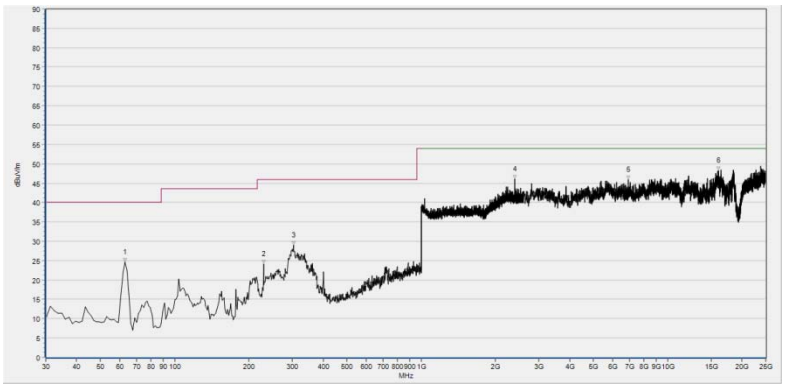


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
62.778	32.47	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
229.099	23.59	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
300.726	32.03	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1195.278	42.93	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
4746.718	45.18	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
10494.381	46.75	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

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

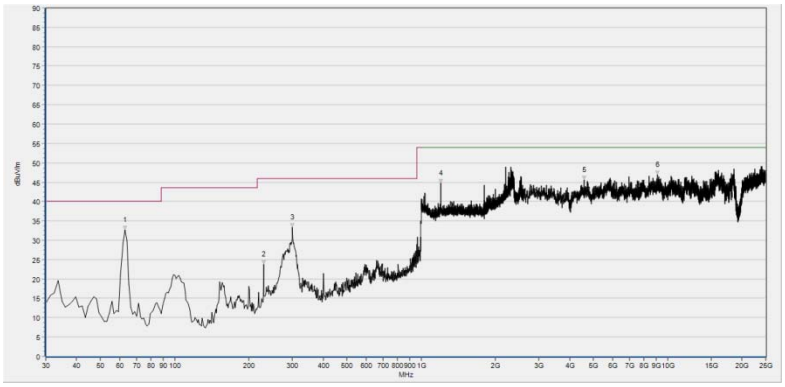
2.10.4.3 8-DPSK Mode:

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
62.778	24.63	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
229.099	24.10	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
303.154	29.08	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2401.521	46.16	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
6930.096	45.91	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
16087.252	48.32	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

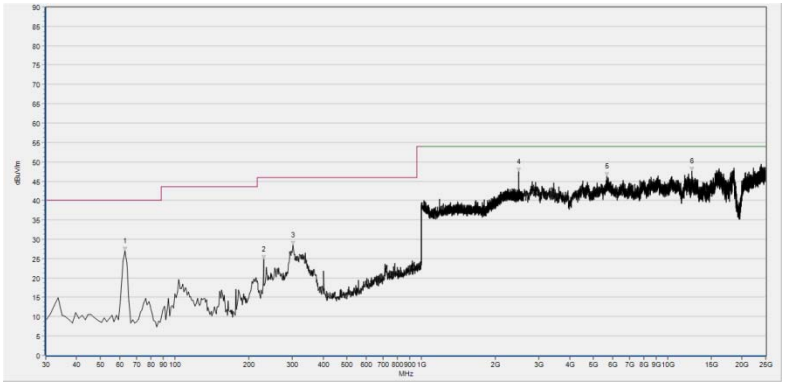
(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 0)



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
62.778	32.73	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
229.099	23.81	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
300.726	33.41	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1198.479	44.80	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
4571.558	45.66	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
9109.402	46.94	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

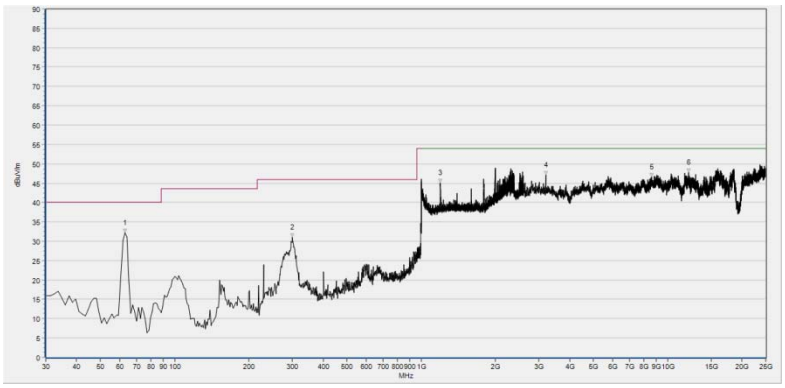
(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 0)

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
62.778	27.04	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
229.099	24.74	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
301.940	28.56	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2479.632	47.40	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
5671.395	46.22	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
12563.702	47.62	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS

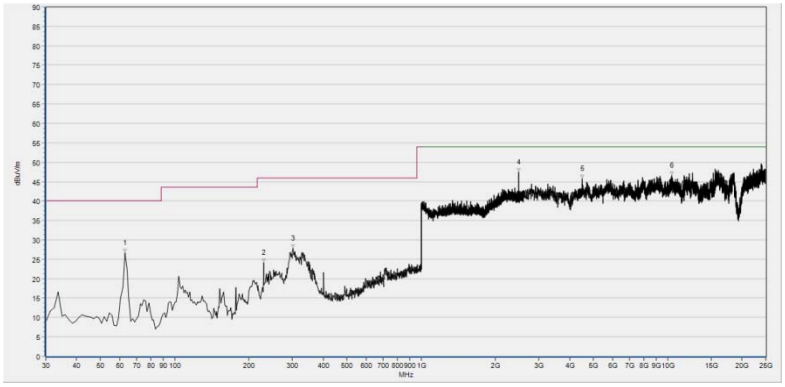
(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 39)



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
62.778	32.26	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
300.726	31.01	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1195.918	45.09	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
3198.800	47.08	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
8620.586	46.59	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
12152.282	47.70	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

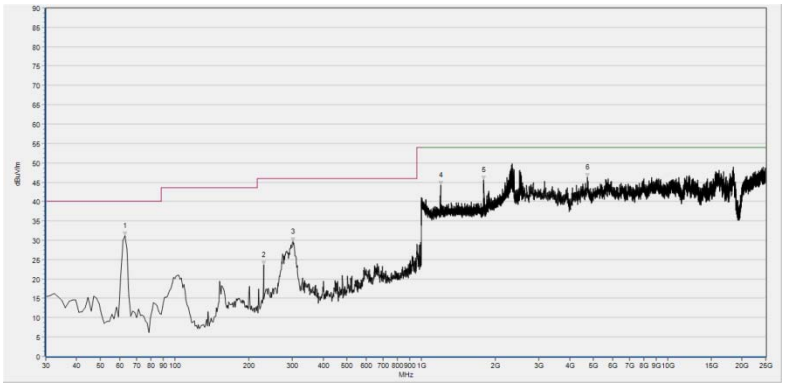
(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 39)

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
62.778	26.65	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
229.099	24.19	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
301.940	27.85	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2479.632	47.50	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
4498.236	45.69	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
10372.177	46.63	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
62.778	31.11	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
229.099	23.61	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
301.940	29.59	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1197.839	44.25	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
1794.558	45.51	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
4730.424	46.21	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

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

Annex A Test 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

Annex B Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Company Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Department:	Morlab Laboratory
Address:	FL.3, Building A , Fei Yang S cience P ark, N o.8 Lon gChang Road, B lock 6 7, B aoAn D istrict, S henZhen, GuangDong Province, P. R. China
Responsible Test Lab Manager:	Mr. Su Feng
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, B uilding A , Fei Yang S cience P ark, N o.8 LongChang Road, B lock 67, B aoAn D istrict, S henZhen, GuangDong Province, P. R. China

3. Facilities and Accreditations

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.

4. Test Equipments Utilized

4.1 Conducted Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Bluetooth Base Station	6K00006210	MT8852B	Anritsu	2017.05.24	2018.05.23
Power Splitter	NW521	1506A	Weinschel	2017.05.24	2018.05.23
Attenuator 1	(N/A.)	10dB	Resnet	2017.05.24	2018.05.23
Attenuator 2	(N/A.)	3dB	Resnet	2017.05.24	2018.05.23
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2017.12.03	2018.12.02
RF cable (30MHz-26GHz)	CB01	RF01	Morlab	N/A	N/A
Coaxial cable	CB02	RF02	Morlab	N/A	N/A
SMA connector	CN01	RF03	HUBER-SUHNER	N/A	N/A

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY56400093	N9038A	KEYSIGHT	2017.07.13	2018.07.12
LISN	812744	NSLK 8127	Schwarzbeck	2017.05.17	2018.05.16
Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2017.05.17	2018.05.16
Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A

4.3Auxiliary Test Equipment

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

4.4 Radiated Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY54130016	N9038A	Agilent	2017.05.17	2018.05.16
Test Antenna - Bi-Log	9163-519	VULB 9163	Schwarzbeck	2017.05.14	2018.05.13
Test Antenna - Horn	9170C-531	BBHA9170	Schwarzbeck	2017.09.13	2018.09.12
Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2017.03.07	2018.03.06
Test Antenna - Horn	01774	BBHA 9120D	Schwarzbeck	2017.09.13	2018.09.12
Coaxial cable (N male) (9KHz-30MHz)	CB04	EMC04	Morlab	N/A	N/A
Coaxial cable (N male) (30MHz-26GHz)	CB02	EMC02	Morlab	N/A	N/A
Coaxial cable (N male) (30MHz-26GHz)	CB03	EMC03	Morlab	N/A	N/A
1-18GHz pre-Amplifier	MA02	TS-PR18	Rohde& Schwarz	2017.05.17	2018.05.16
18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde& Schwarz	2017.05.17	2018.05.16
Anechoic Chamber	N/A	9m*6m*6m	CRT	2017.11.19	2020.11.18

END OF REPORT