REPORT No. : SZ17120091W01

TEST REPORT

APPLICANT	:	ShenZhen Earfone Technology Co. Ltd
PRODUCT NAME	:	Bluetooth headset
MODEL NAME	:	SD-V1,SD-V2,V11,V13,V18,V19
BRAND NAME	:	SAUDIO EARFONE
FCC ID	:	2ALGKSDV1SDV2V11V13
STANDARD(S)	:	47 CFR Part 15 Subpart C
TEST DATE	:	2018-01-03 to 2018-01-05
ISSUE DATE	:	2018-01-10

Tested by: Su Hang

Su Hang (Test Engineer)

Approved by: Andy Yeh

Andy Yeh (Technical Director)

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MORLAB

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DIRECTORY

1. Technical Information ····· 4
1.1. Manufacturer and Factory Information ····· 4
1.2. Equipment Under Test (EUT) Description ····· 4
1.3. Test Standards and Results ····· 5
1.4. Environmental Conditions ····· 5
2. 47 CFR Part 15C Requirements ····· 6
2.1. Antenna requirement ····· 6
2.2. Number of Hopping Frequency ····· 6
2.3. Peak Output Power ····· 10
2.4. 20dB Bandwidth ····· 17
2.5. Carried Frequency Separation ····· 24
2.6. Time of Occupancy (Dwell time) ····· 27
2.7. Conducted Spurious Emissions ····· 40
2.8. Restricted Frequency Bands ····· 53
2.9. Conducted Emission ····· 62
2.10. Radiated Emission ····· 66
Annex A Test Uncertainty ····· 79
Annex B Testing Laboratory Information ····· 80

Change History		
Issue	**Date**	**Reason for change**
1.0	2018-01-09	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	ShenZhen Earfone Technology Co. Ltd
Applicant Address:	4D 5block NanYou TianAn Industrial Zone,DengLiang Road, Nanshan District,Shenzhen City, Guangdong province,China
Manufacturer:	Dongguan City Dongcheng Earfone Electronics Factory
Manufacturer Address:	earfone Industrial Zone Lian Tang Road, Dong Cheng District,Dong Guan City, China

1.2. Equipment Under Test (EUT) Description

Product Name:	Bluetooth headset
Serial No:	(N/A, marked #1 by test site)
Hardware Version:	HV2.1.2
Software Version:	SV1.1.6
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:	Chip Antenna
Antenna Gain:	4.9 dBi

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: According to the certificate holder, they declared that the models: SD-V1, SD-V2, V11, V13, V18 and V19 only the model numbers are different, everything else is the same. The main measuring model is SD-V1, only the results for SD-V1 were recorded in this report.

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.

Note 4: 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	Jan 03, 2018	Su Hang	PASS
3	15.247(b)	Peak Output Power	Jan 03, 2018	Su Hang	PASS
4	15.247(a)	20dB Bandwidth	Jan 03, 2018	Su Hang	PASS
5	15.247(a)	Carrier Frequency Separation	Jan 03, 2018	Su Hang	PASS
6	15.247(a)	Time of Occupancy (Dwell time)	Jan 03, 2018	Su Hang	PASS
7	15.247(d)	Conducted Spurious Emission	Jan 03, 2018	Su Hang	PASS
8	15.247(d)	Restricted Frequency Bands	Jan 04, 2018	Peng Shiqing	PASS
9	15.209, 15.247(d)	Radiated Emission	Jan 04, 2018	Peng Shiqing	PASS
10	15.207	Conducted Emission	Jan 05, 2018	Peng Shiqing	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.

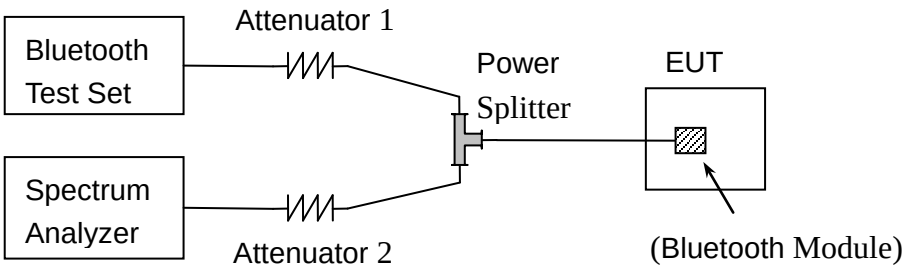
2.2. Number of Hopping Frequency

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

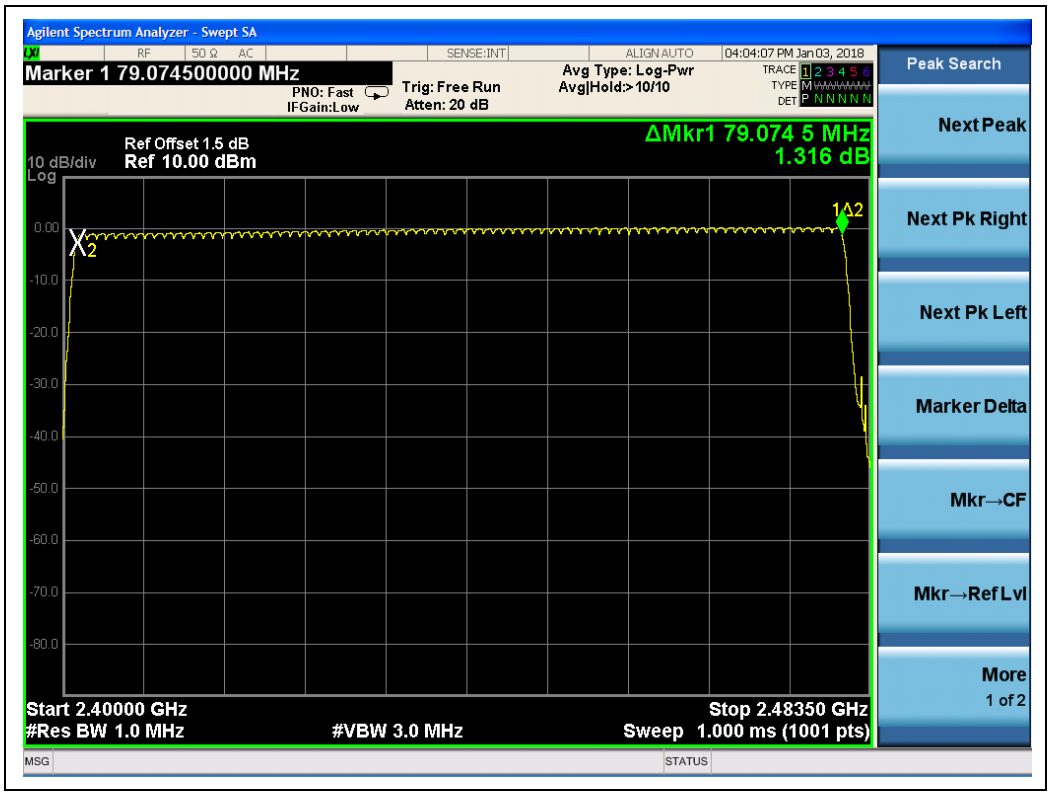
2.2.4. Test Result

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.

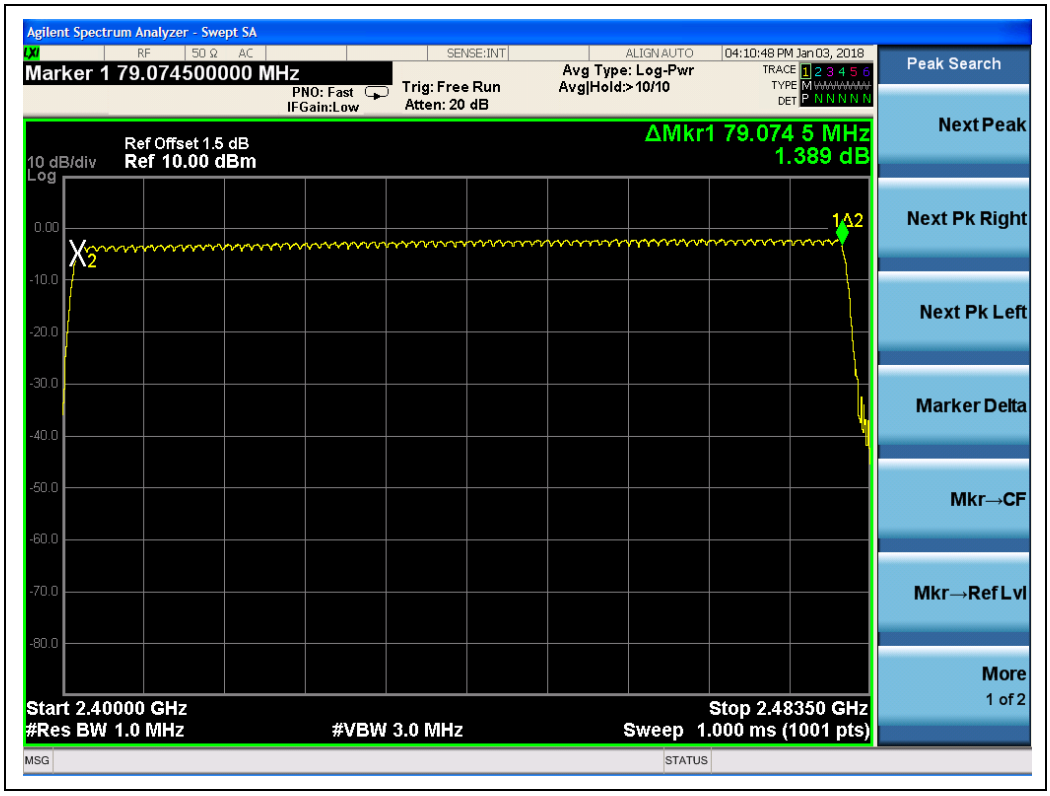
A. Test Verdict:

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

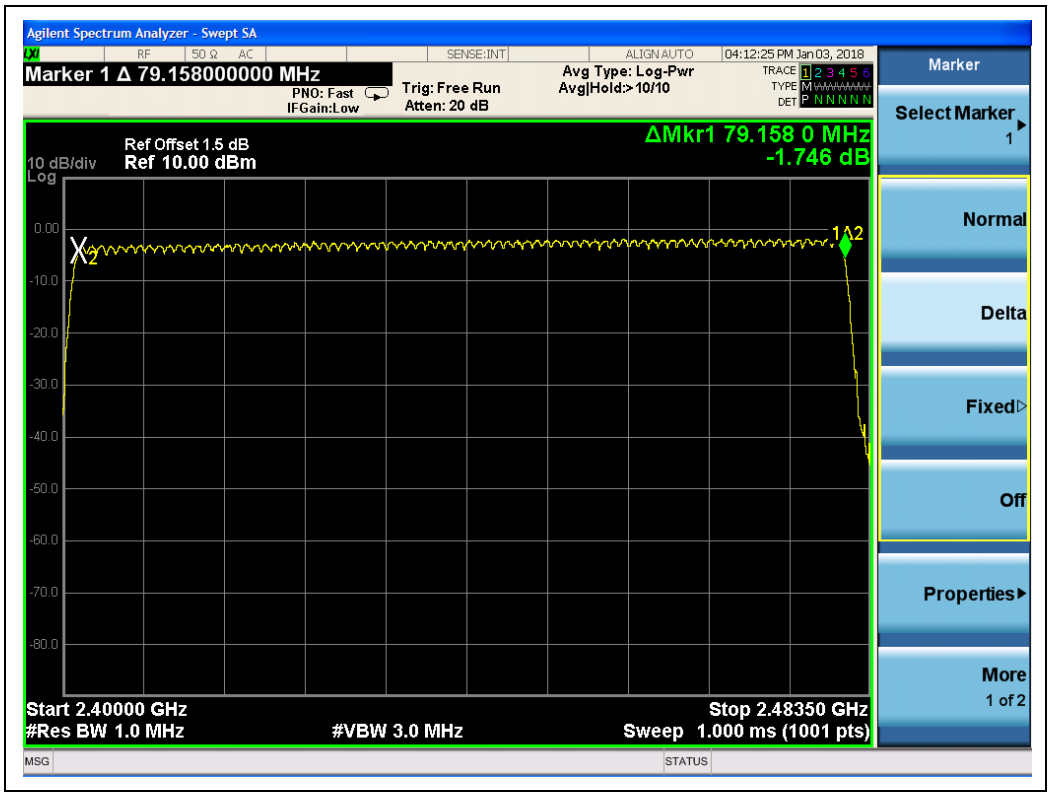
B. Test Plots:



(GFSK)



(π/4-DQPSK)



(8- DPSK)

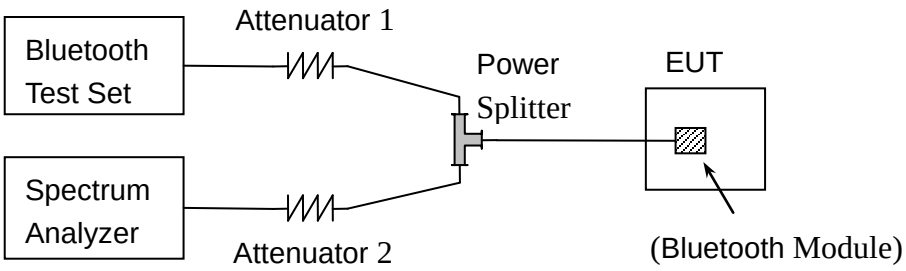
2.3. Peak Output Power

2.3.1. Requirement

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

2.3.2. Test Description

A. Test Setup:



The 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

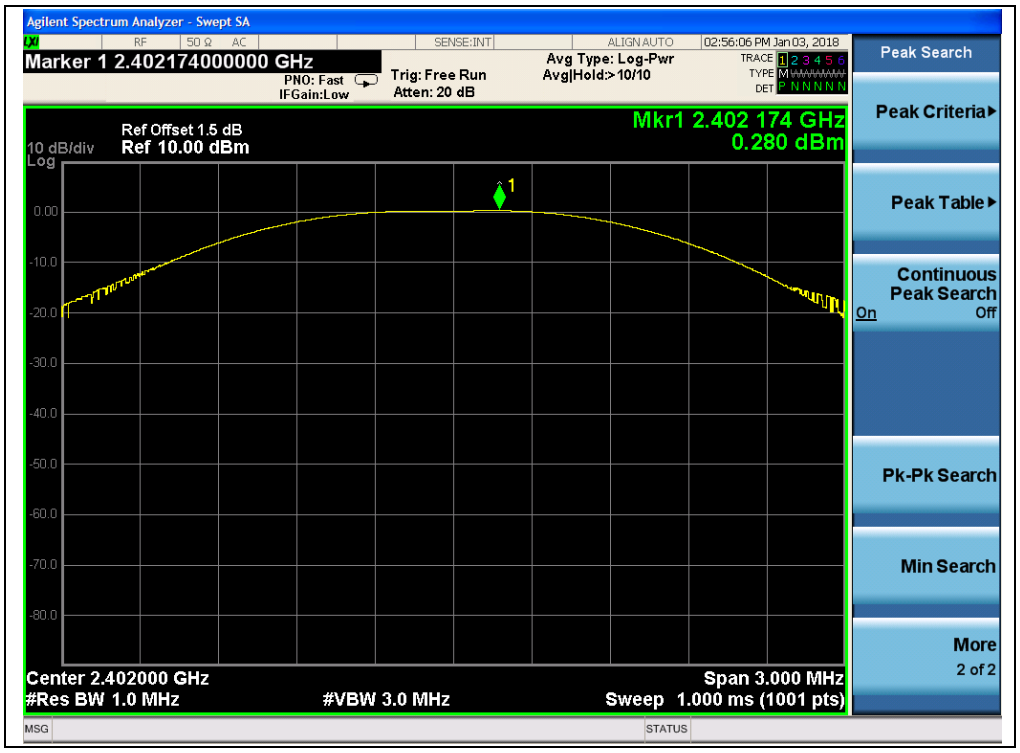
The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the module. The lowest, middle and highest channel were tested by USB Wideband Power Sensor.

2.3.3.1 GFSK Mode

A. Test Verdict:

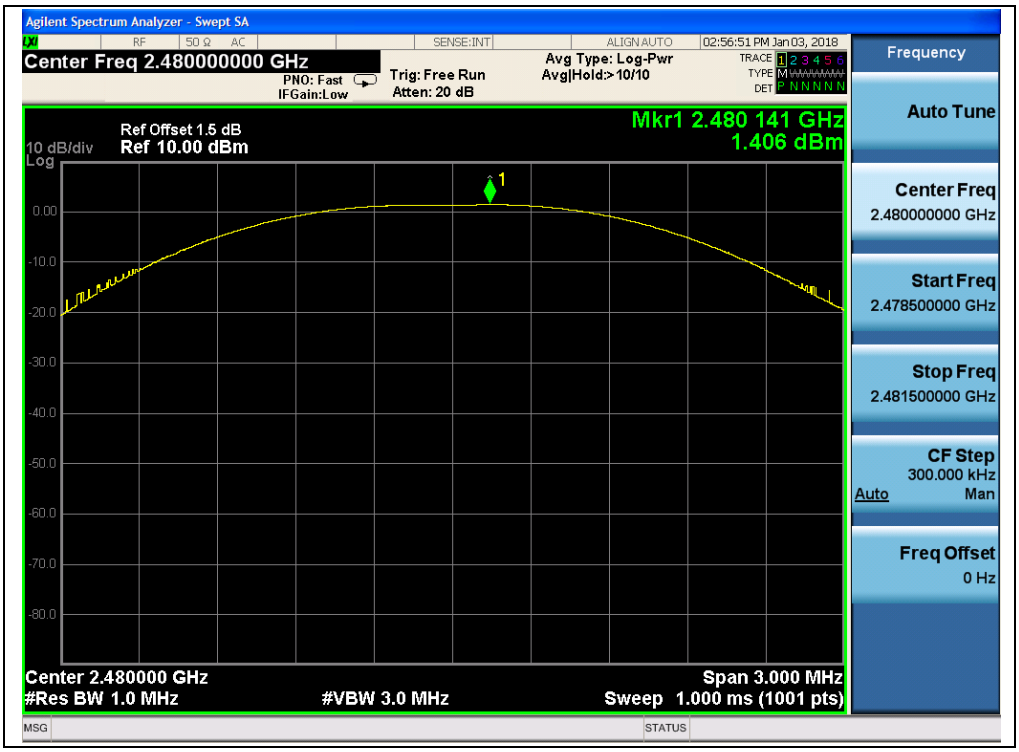
Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	0.28	0.00107	30	1	PASS
39	2441	1.15	0.00130			PASS
78	2480	1.41	0.00138			PASS

B. Test Plots:



(GFSK, Channel 0, 2402MHz)

(GFSK, Channel 39, 2441MHz)



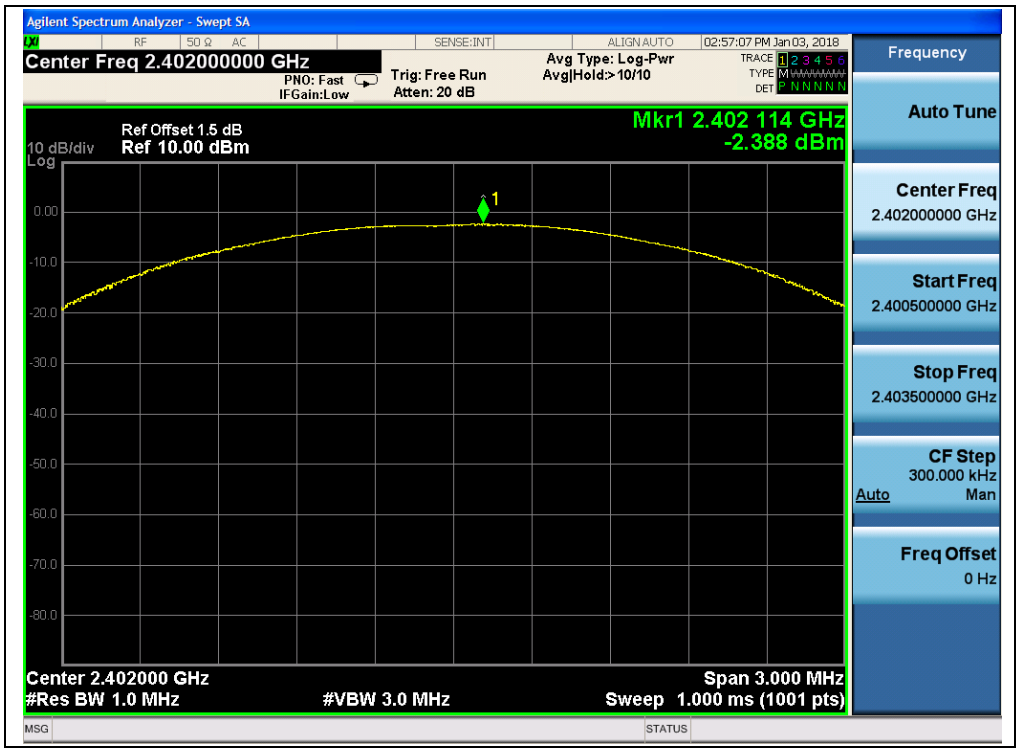
(GFSK, Channel 78, 2480MHz)

2.3.3.2 π/4-DQPSK Mode

A. Test Verdict:

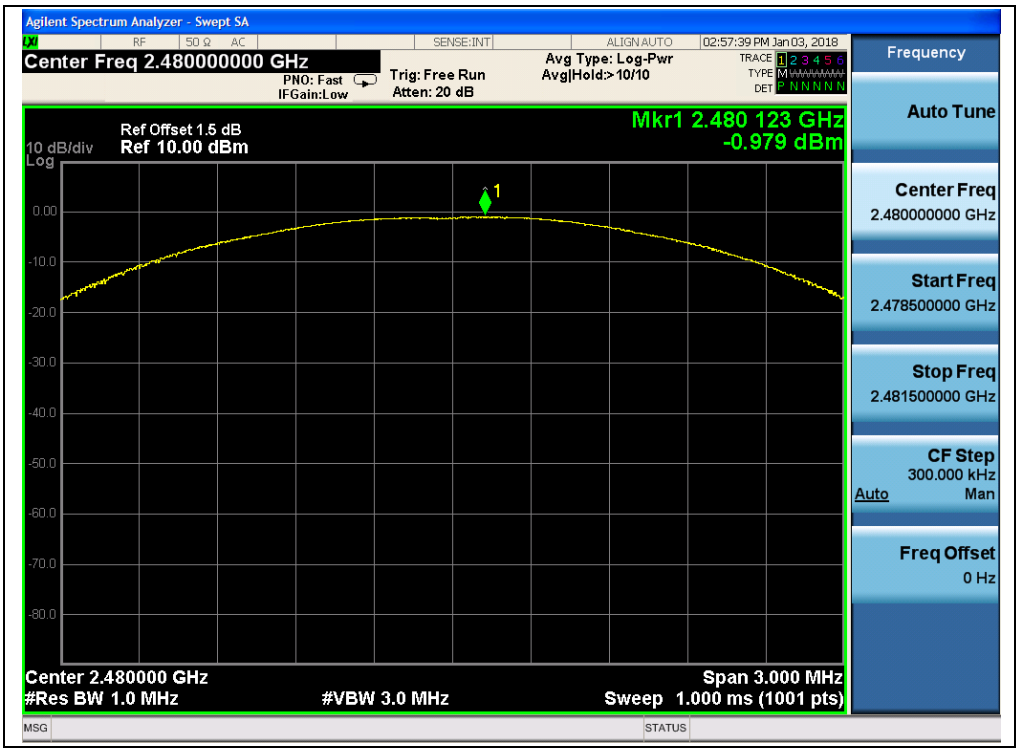
Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	-2.39	0.00058	30	1	PASS
39	2441	-1.36	0.00073			PASS
78	2480	-0.98	0.00080			PASS

B. Test Plots:



(π/4-DQPSK, Channel 0, 2402MHz)

(π/4-DQPSK, Channel 39, 2441MHz)



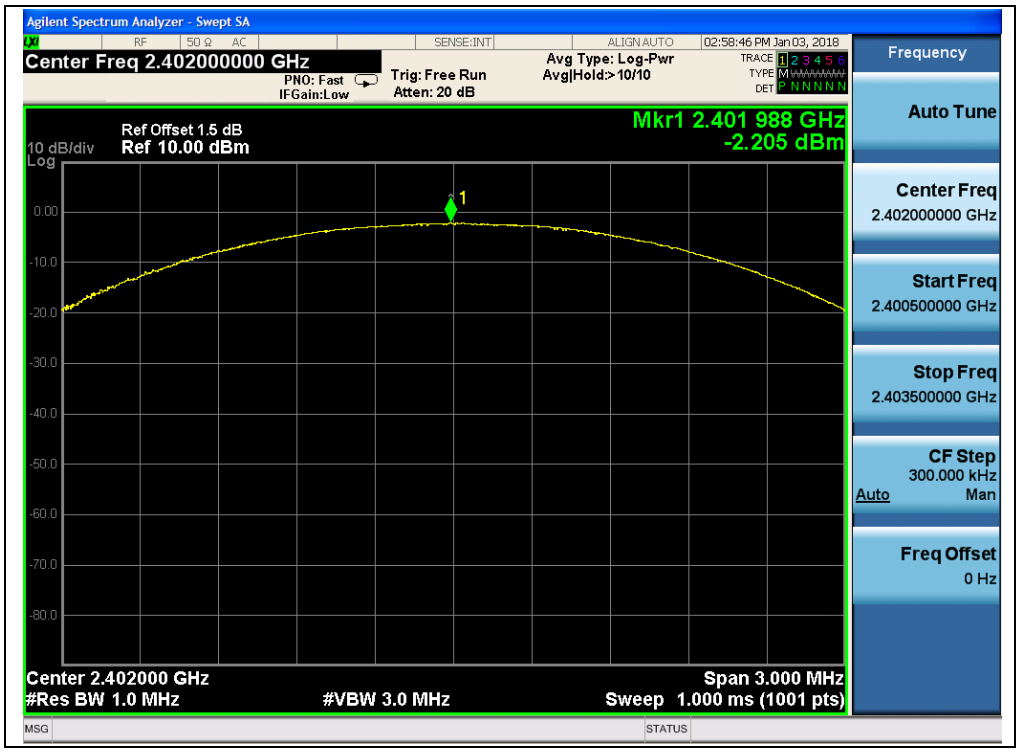
(π/4-DQPSK, Channel 78, 2480MHz)

2.3.3.3 8-DPSK Mode

A. Test Verdict:

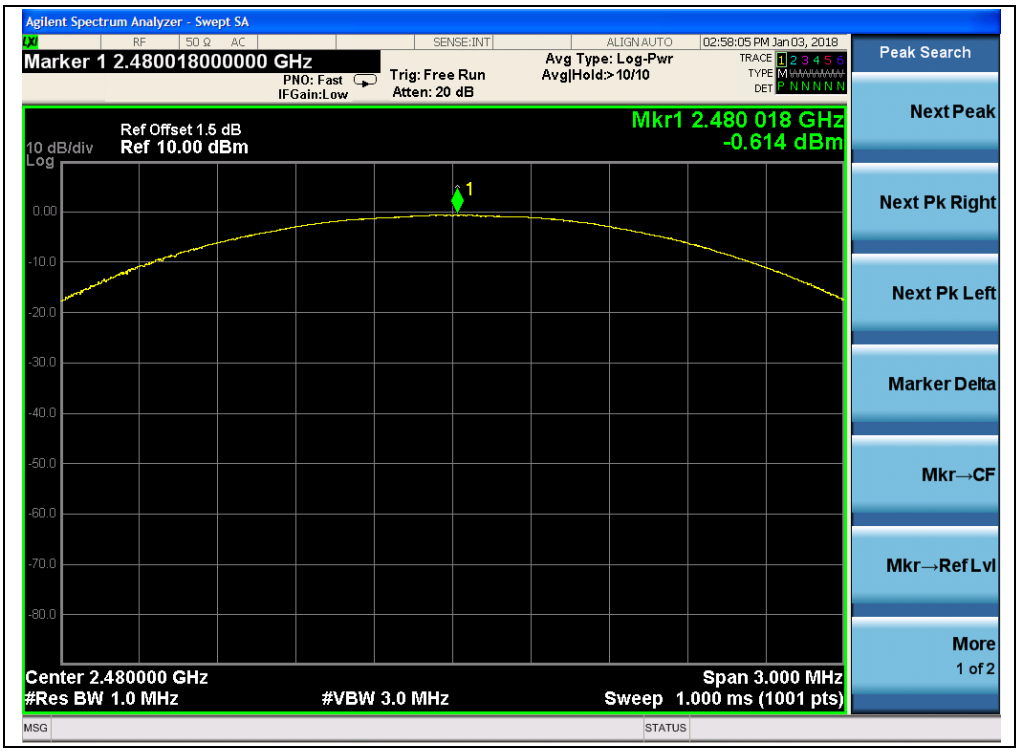
Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	-2.21	0.00060	30	1	PASS
39	2441	-1.19	0.00076			PASS
78	2480	-0.61	0.00087			PASS

B. Test Plots:



(8-DPSK, Channel 0, 2402MHz)

(8-DPSK, Channel 39, 2441MHz)



(8-DPSK, Channel 78, 2480MHz)

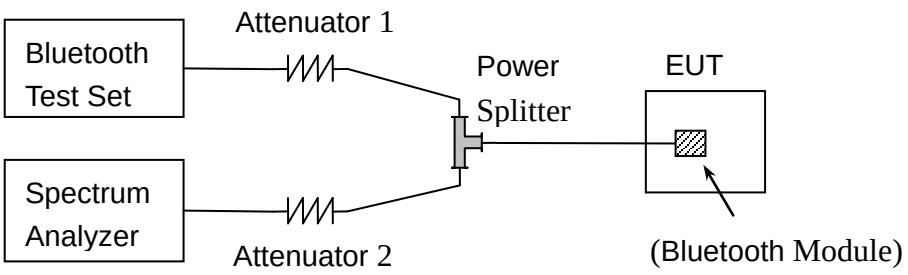
2.4. 20dB Bandwidth

2.4.1. Definition

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth (10*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

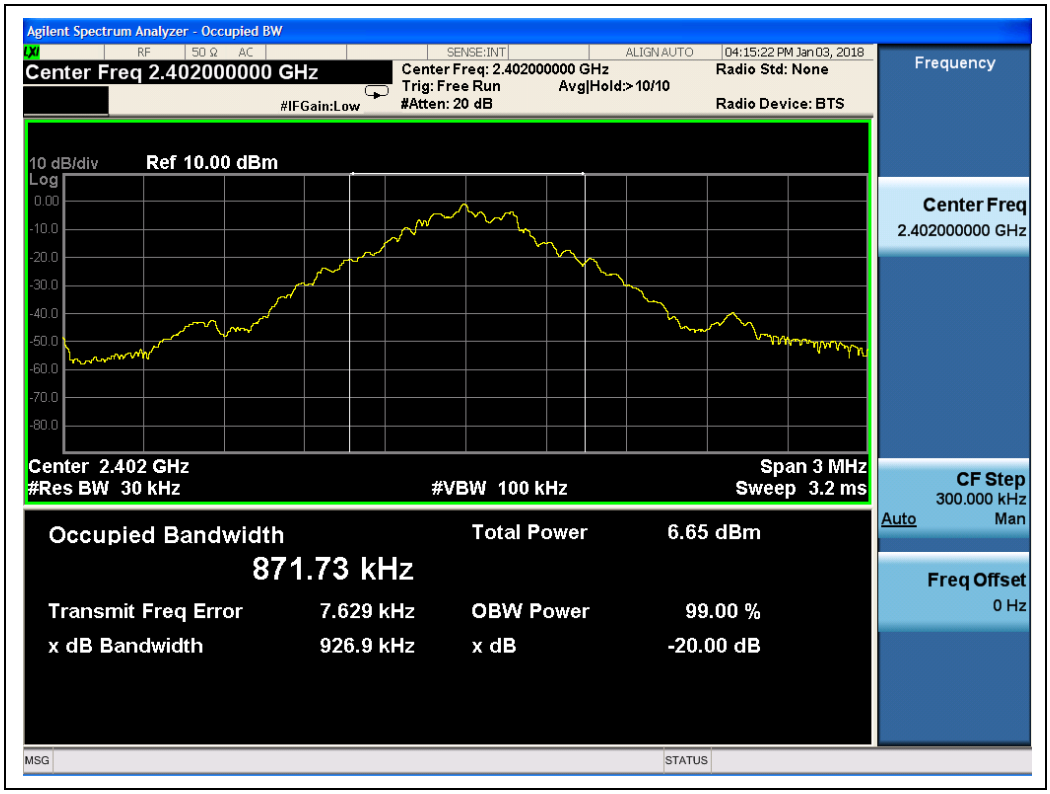
The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to record the 20dB bandwidth of the Module.

2.4.4.1 GFSK Mode

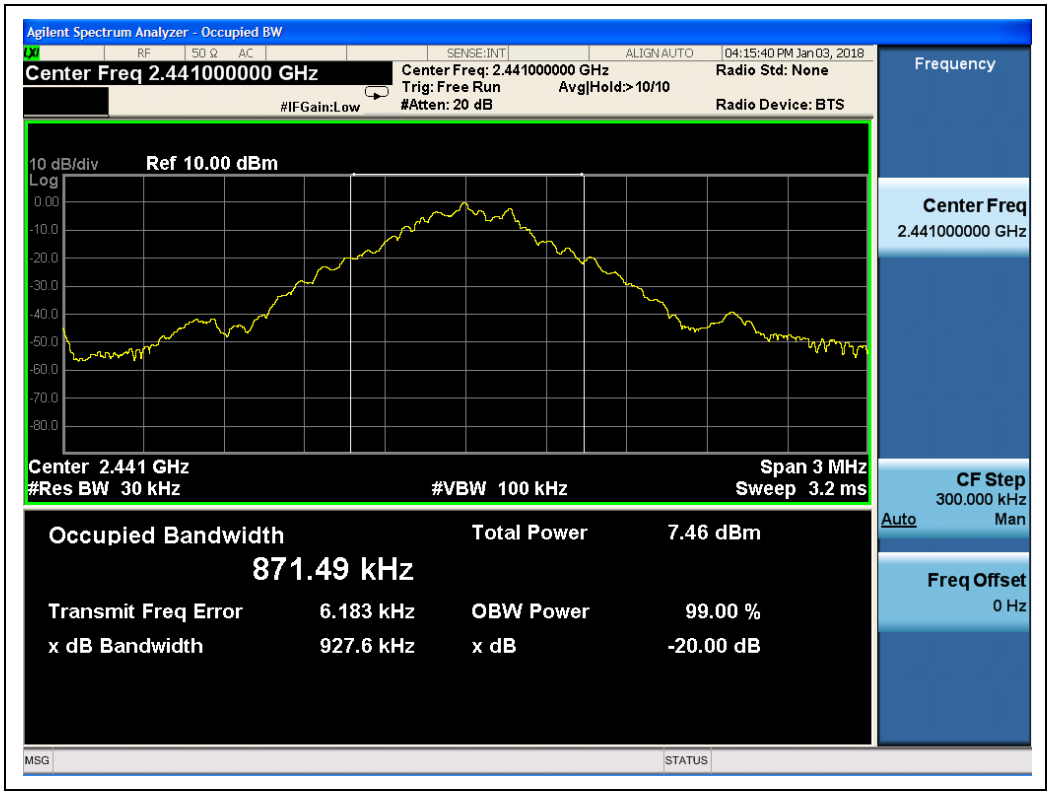
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	0.9269	PASS
39	2441	0.9276	PASS
78	2480	0.9271	PASS

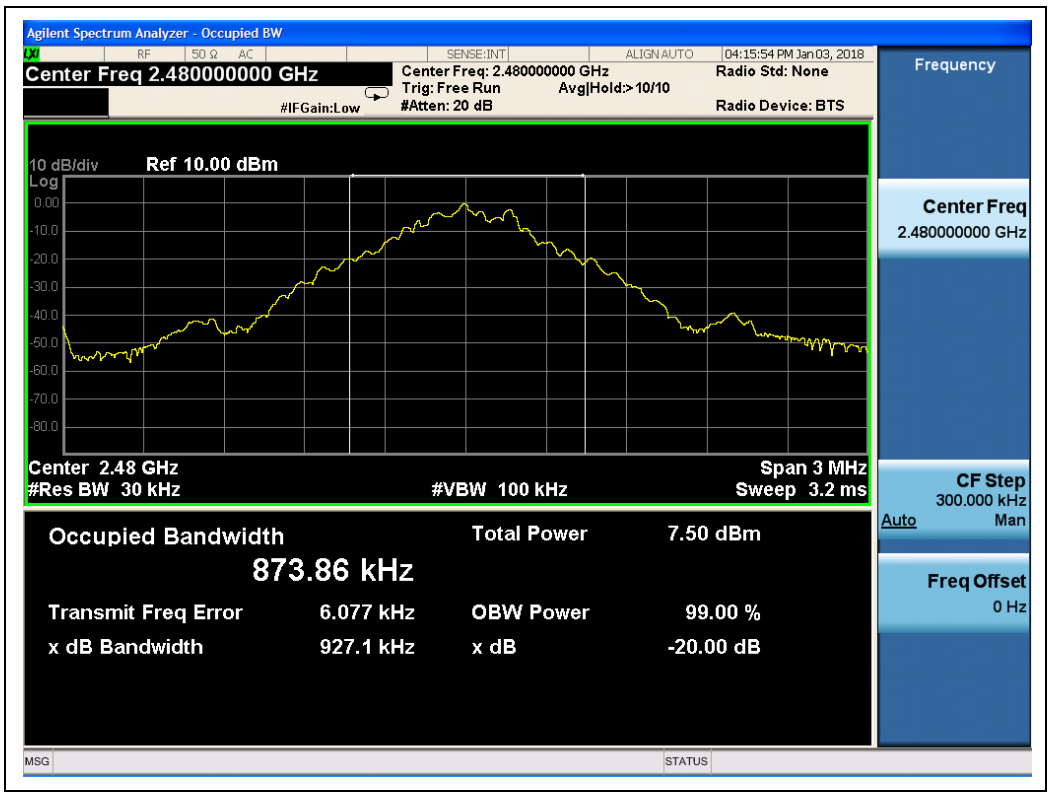
B. Test Plots:



(GFSK, Channel 0, 2402MHz)



(GFSK, Channel 39, 2441MHz)



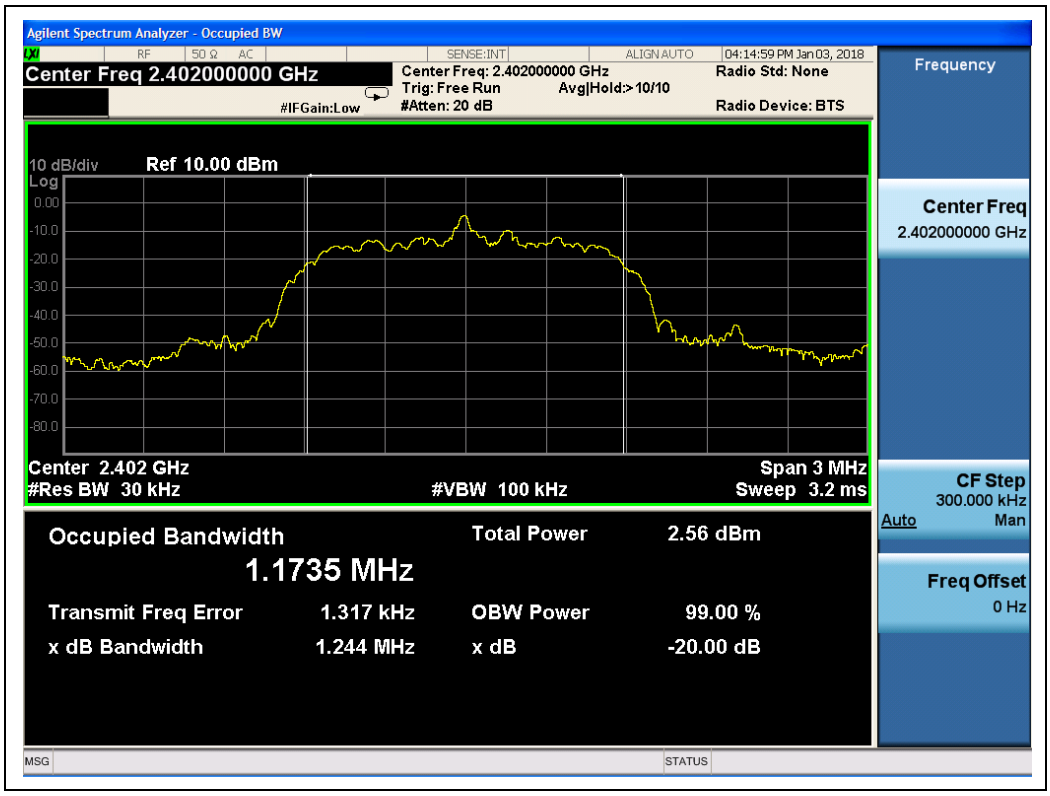
(GFSK, Channel 78, 2480MHz)

2.4.4.2 π/4-DQPSK Mode

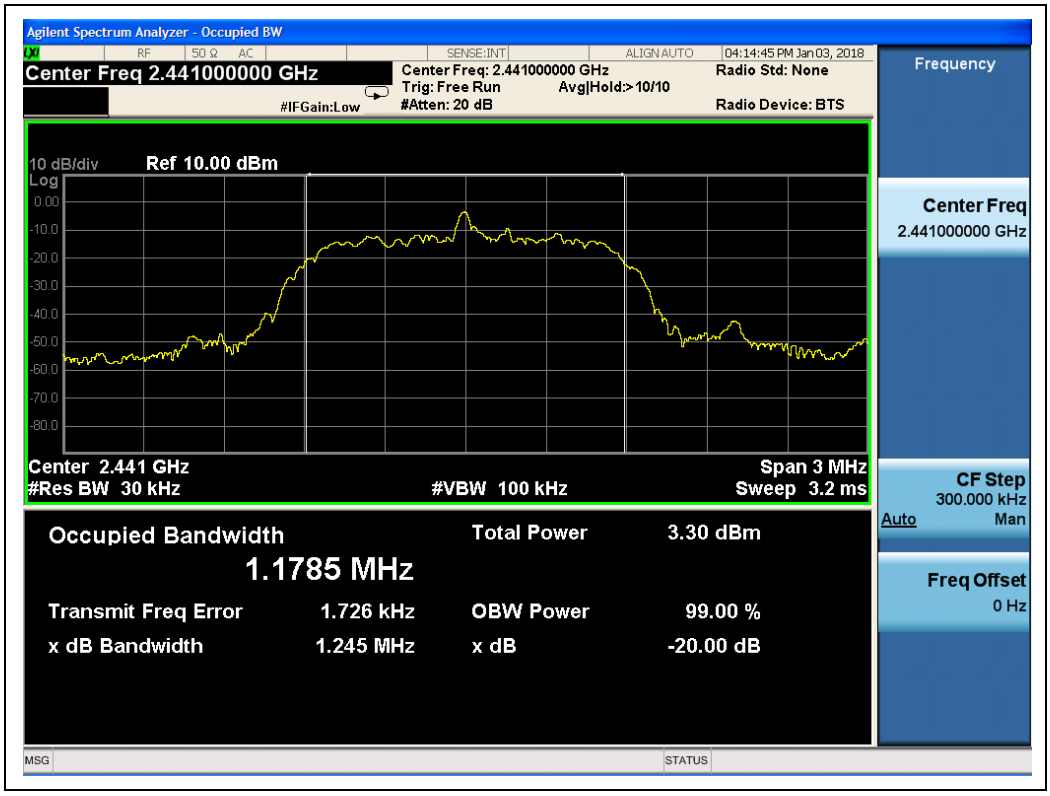
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.244	PASS
39	2441	1.245	PASS
78	2480	1.240	PASS

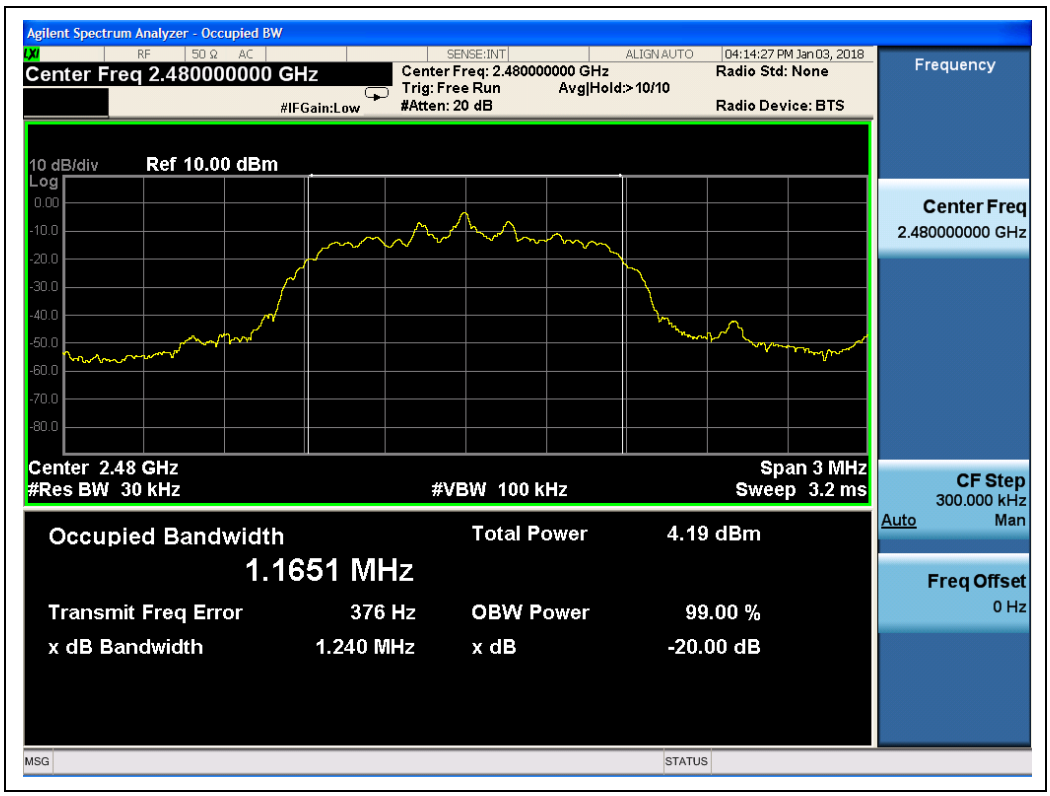
B. Test Plots:



(π/4-DQPSK, Channel 0, 2402MHz)



(π/4-DQPSK, Channel 39, 2441MHz)



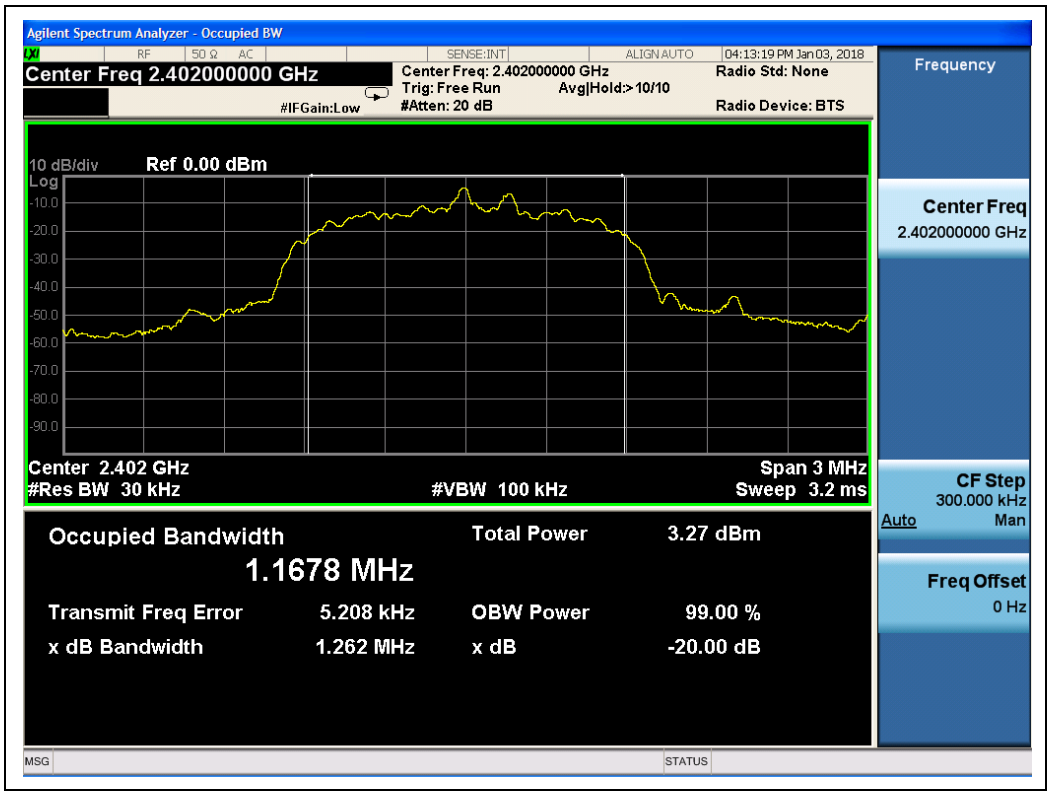
(π/4-DQPSK, Channel 78, 2480MHz)

2.4.4.3 8-DPSK Mode

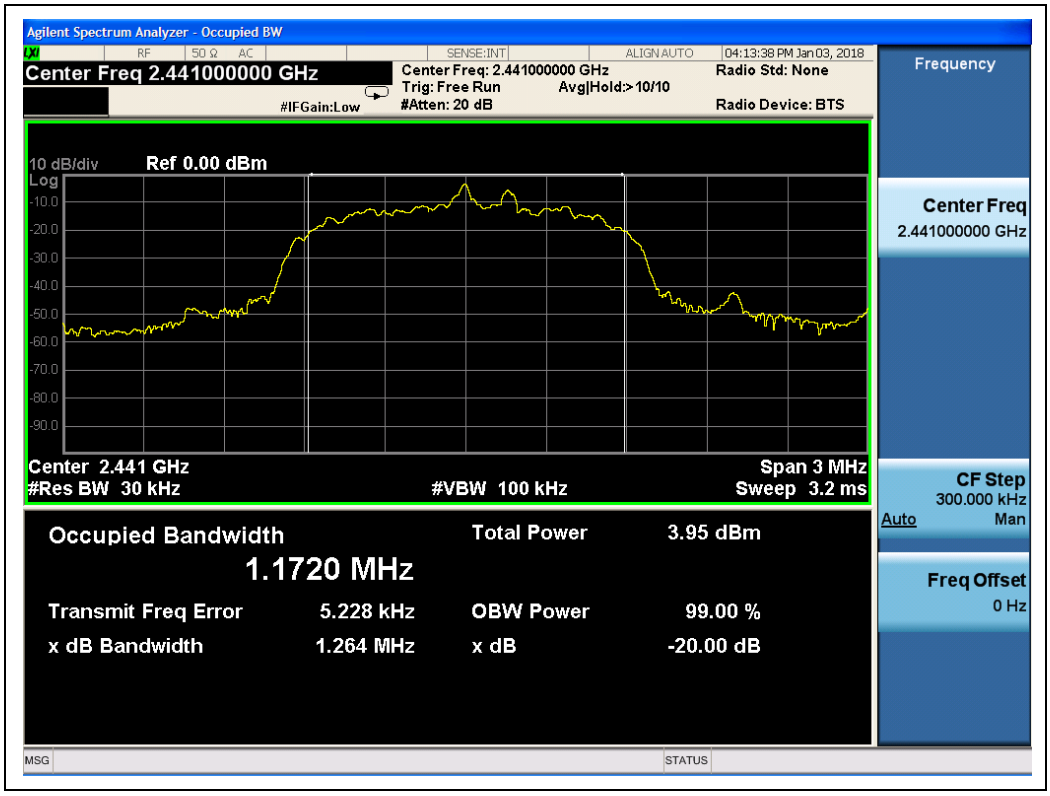
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.262	PASS
39	2441	1.264	PASS
78	2480	1.261	PASS

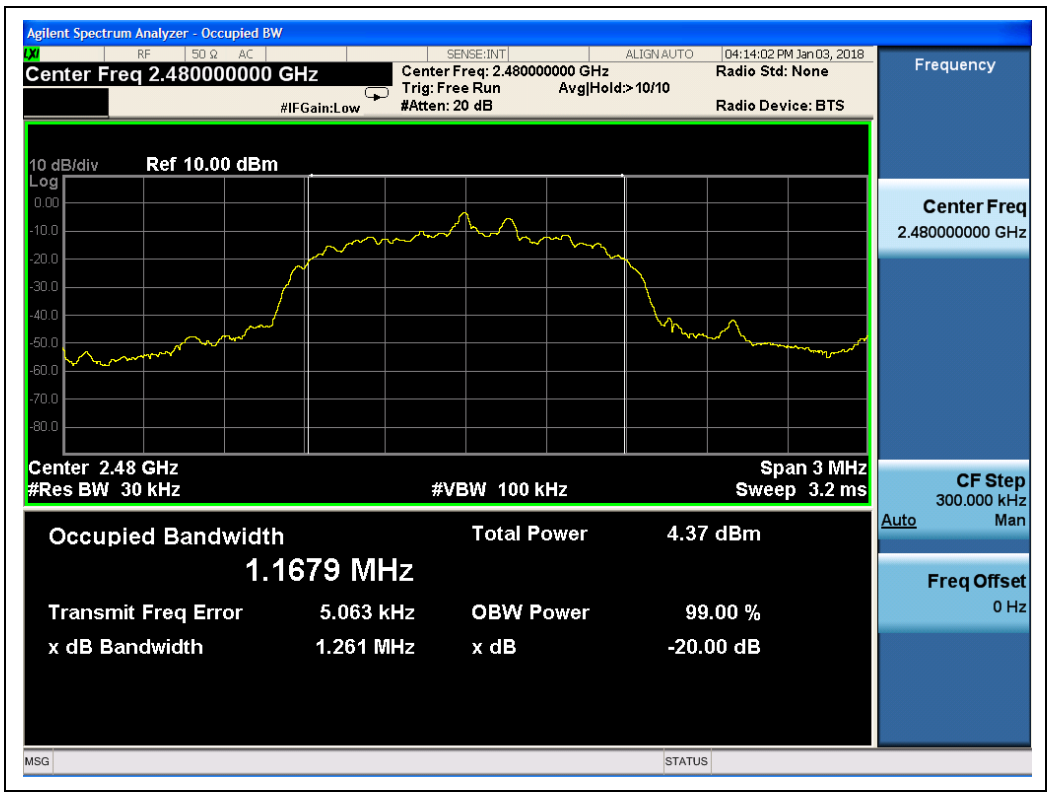
B. Test Plots:



(8-DPSK, Channel 0, 2402MHz)



(8-DPSK, Channel 39, 2441MHz)



(8-DPSK, Channel 78, 2480MHz)

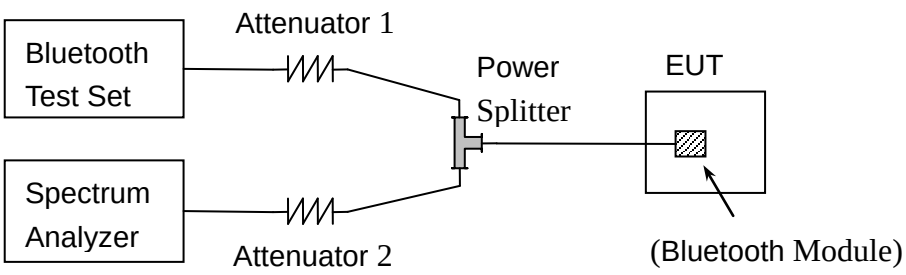
2.5. Carried Frequency Separation

2.5.1. Definition

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

2.5.2. Test Description

A. Test Setup:



The 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).

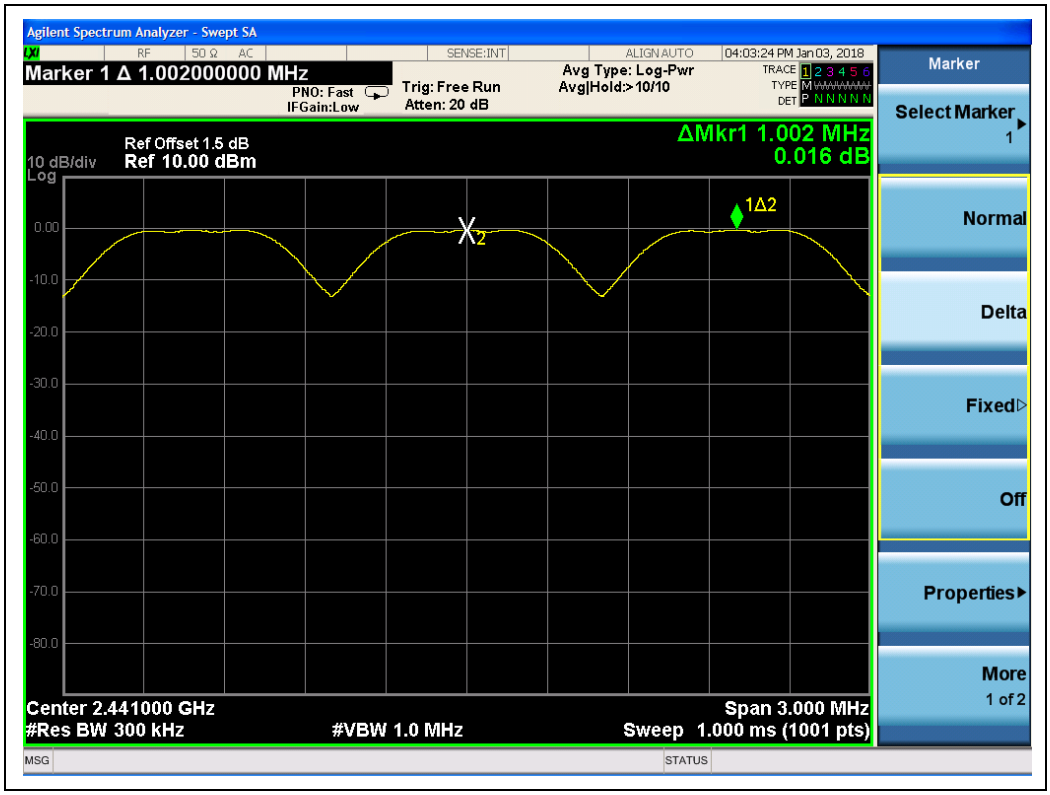
2.5.3. Test Procedure

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	20dB bandwidth (MHz)	Min. Limit	Verdict
GFSK	39 and 40	1.002	0.9269	two-thirds of the 20dB bandwidth	PASS
π/4-DQPSK	39 and 40	1.014	1.240		PASS
8-DPSK	39 and 40	1.011	1.261		PASS



(GFSK)

(π/4-DQPSK)

(8-DPSK)

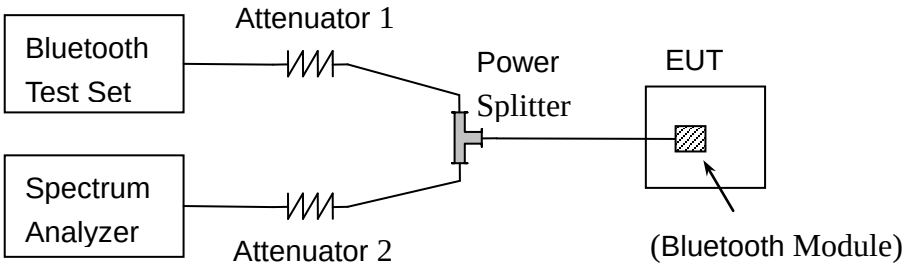
2.6. Time of Occupancy (Dwell time)

2.6.1. Requirement

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

2.6.2. Test Description

A. Test Setup:



The 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.

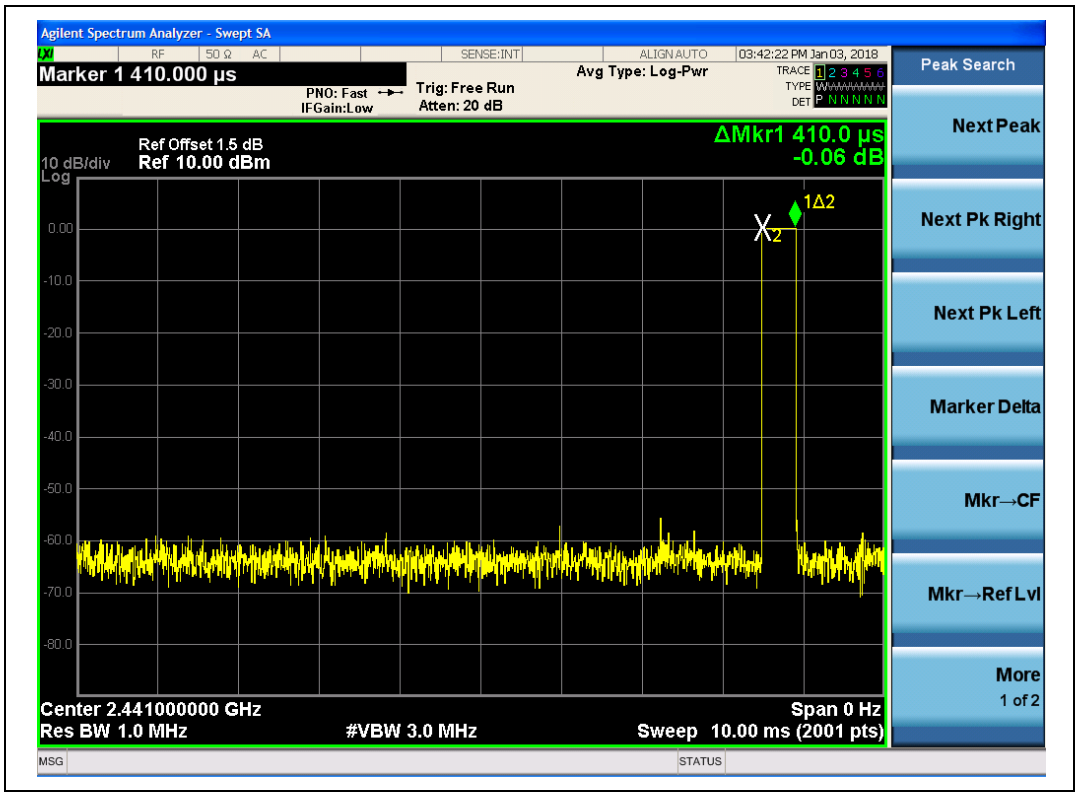
2.6.4. Test Result

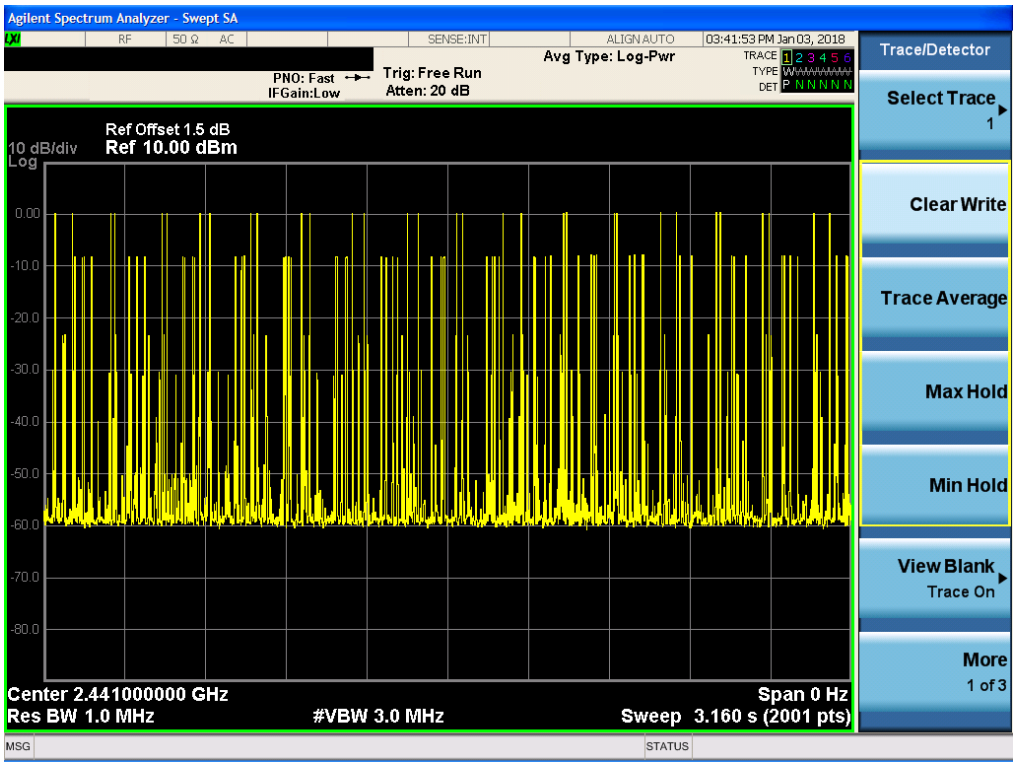
2.6.4.1 GFSK Mode

A. Test Verdict:

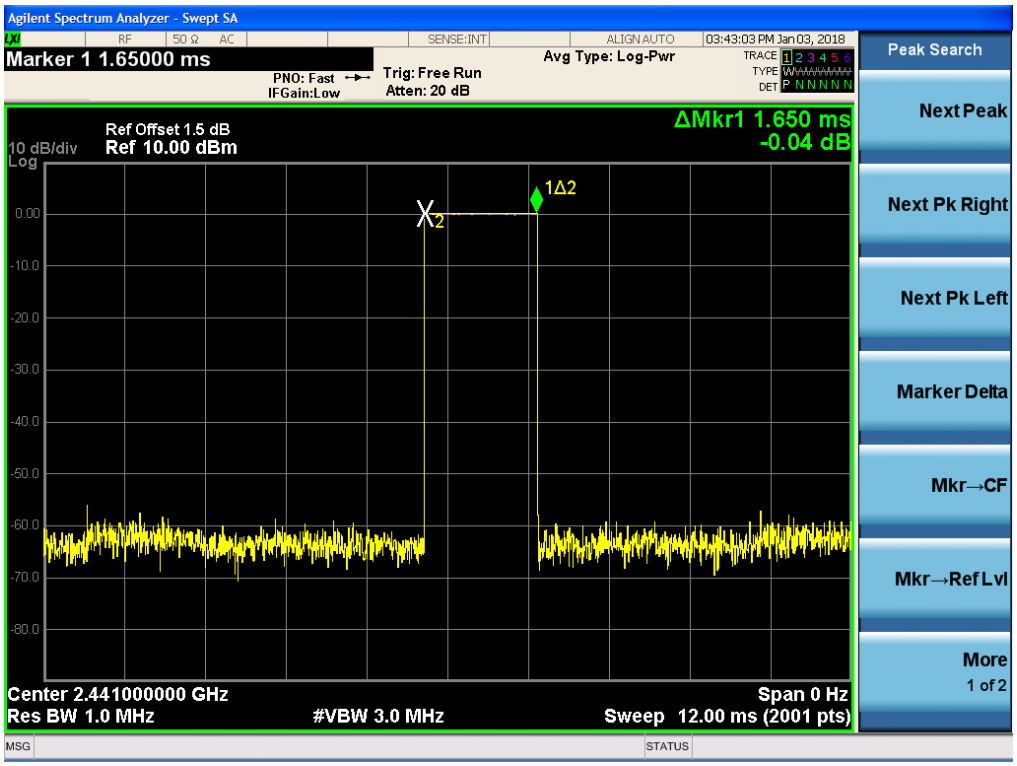
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.41	32	0.01312	0.1312	0.4	PASS
DH3	1.65	13	0.02145	0.2145		PASS
DH5	2.88	7	0.02016	0.2016		PASS

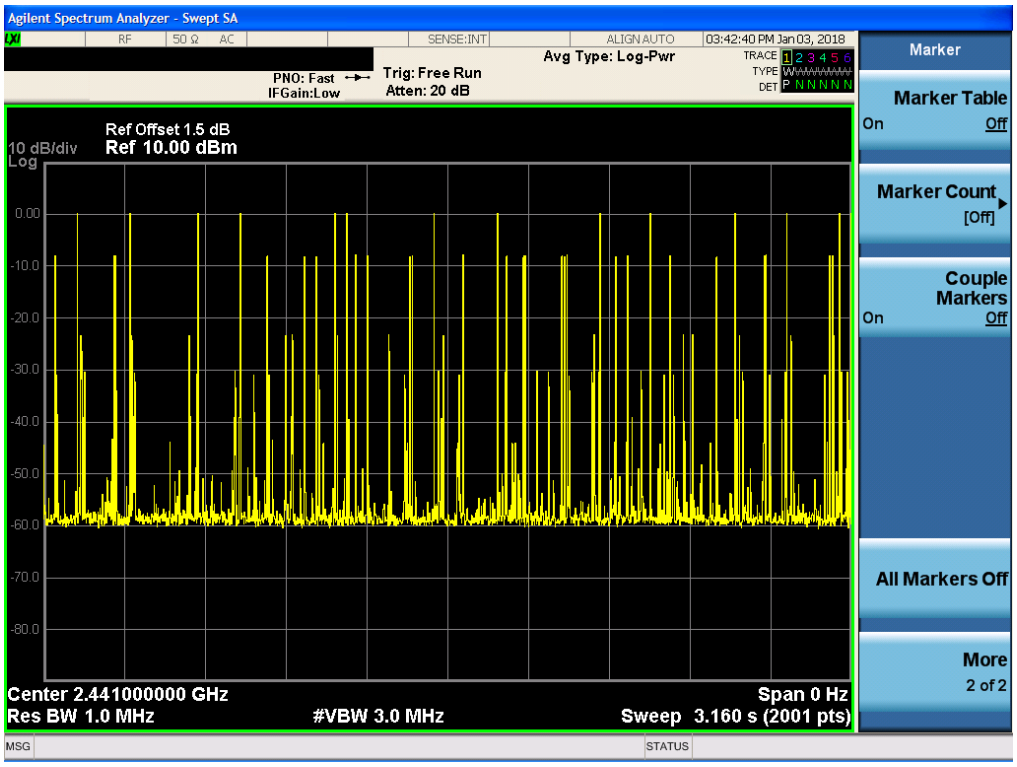
B. Test Plots:



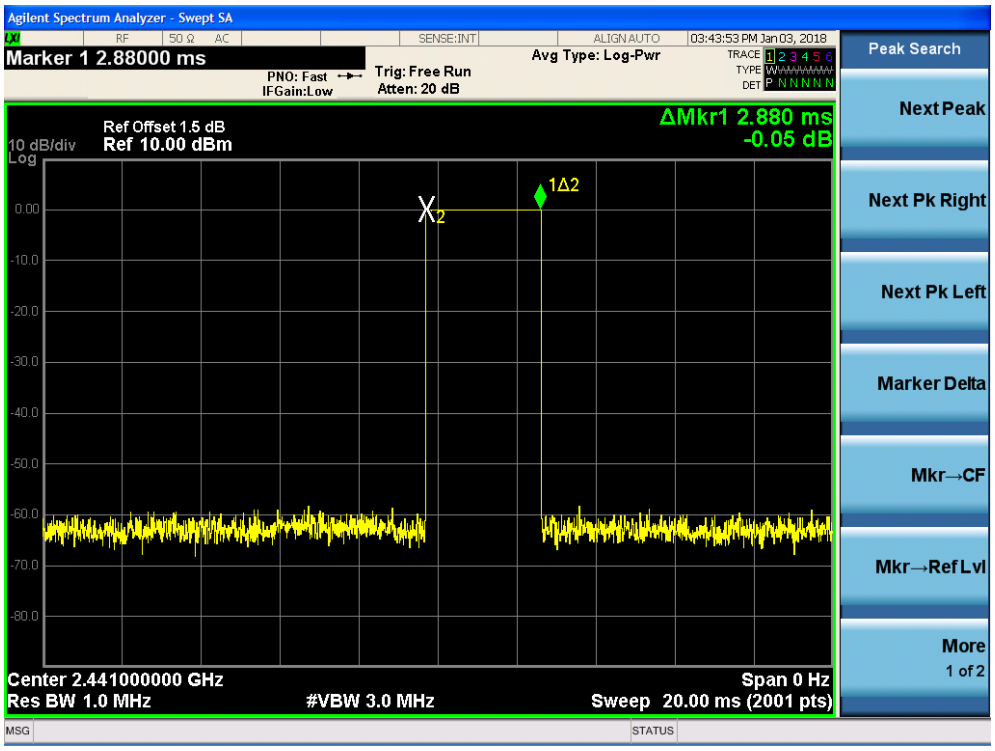

Agilent Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
03:41:53 PM Jan 03, 2018
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W
DET P N N N N N
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Log
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.441000000 GHz
Span 0 Hz
Res BW 1.0 MHz
#VBW 3.0 MHz
Sweep 3.160 s (2001 pts)
Trace/Detector
Select Trace
1
Clear Write
Trace Average
Max Hold
Min Hold
View Blank
Trace On
More
1 of 3
MSG
STATUS

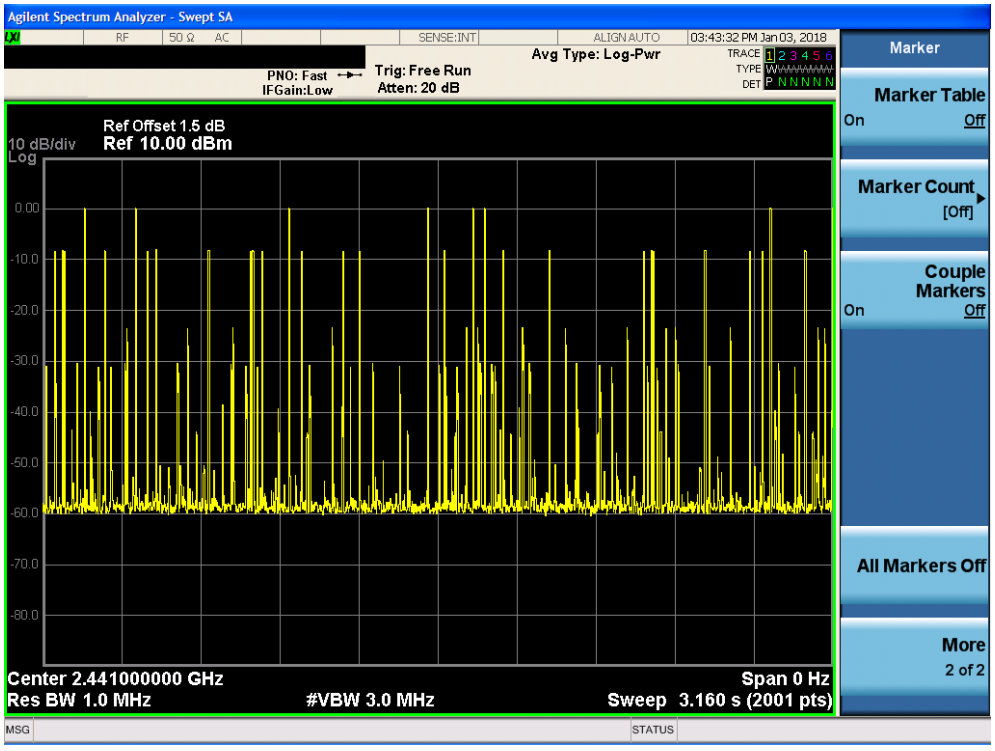
(DH1, GFSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 1.65000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
03:43:03 PM Jan 03, 2018
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 1.650 ms
-0.04 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 12.00 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
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
03:42:40 PM Jan 03, 2018
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (2001 pts)
Marker
Marker Table
On Off
Marker Count
[Off]
Couple Markers
On Off
All Markers Off
More
2 of 2

(DH3, GFSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.88000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
03:43:53 PM Jan 03, 2018
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 2.880 ms
-0.05 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 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
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
03:43:32 PM Jan 03, 2018
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (2001 pts)
Marker
Marker Table
On Off
Marker Count
[Off]
Couple Markers
On Off
All Markers Off
More
2 of 2

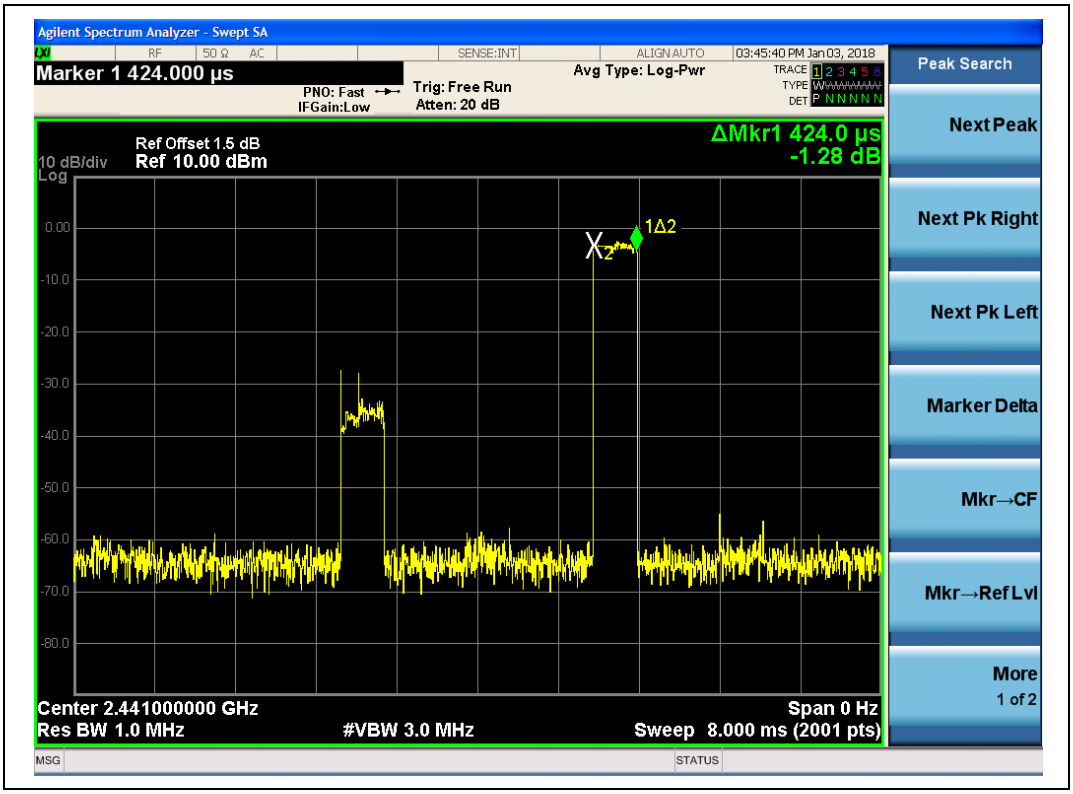
(DH5, GFSK)

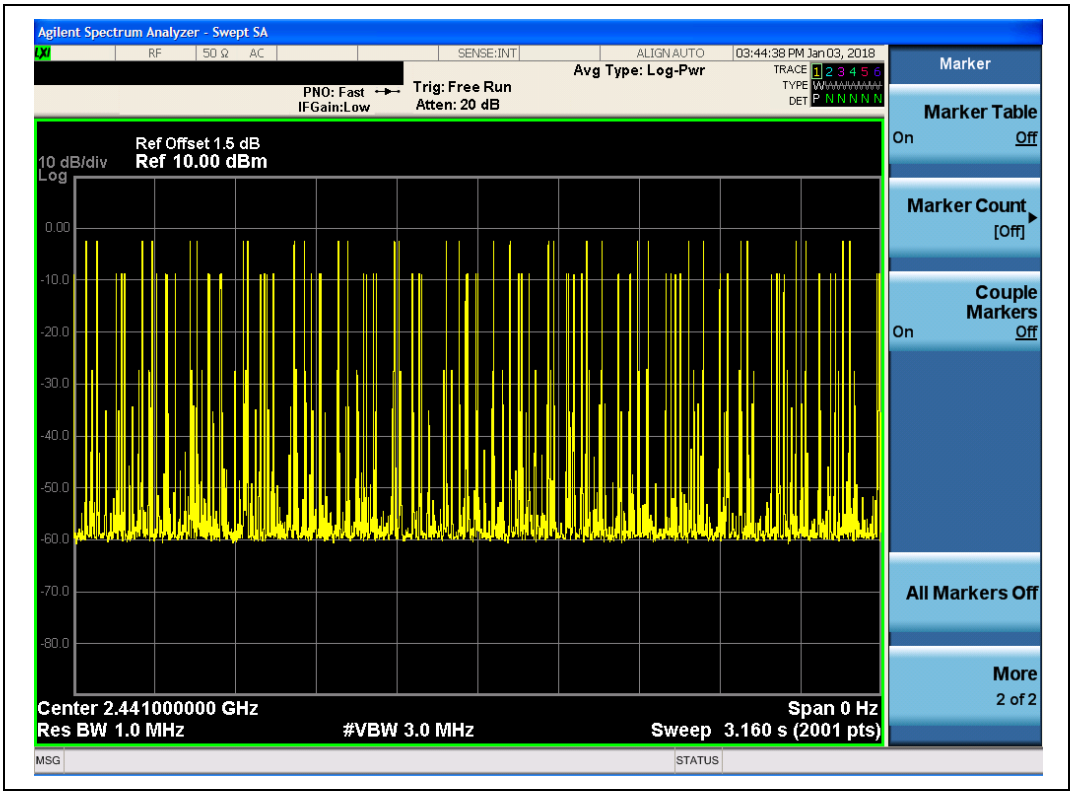
2.6.4.2 π/4-DQPSK Mode

A. Test Verdict:

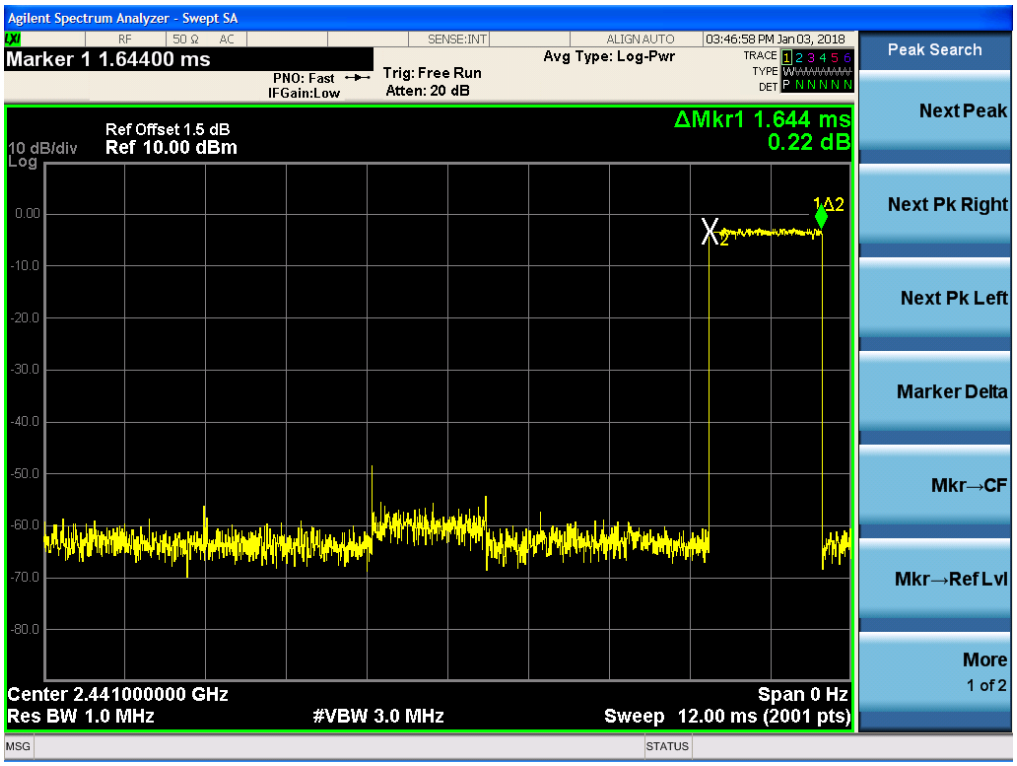
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.42	32	0.01344	0.1344	0.4	PASS
DH3	1.64	19	0.03116	0.3116		PASS
DH5	2.92	8	0.02336	0.2336		PASS

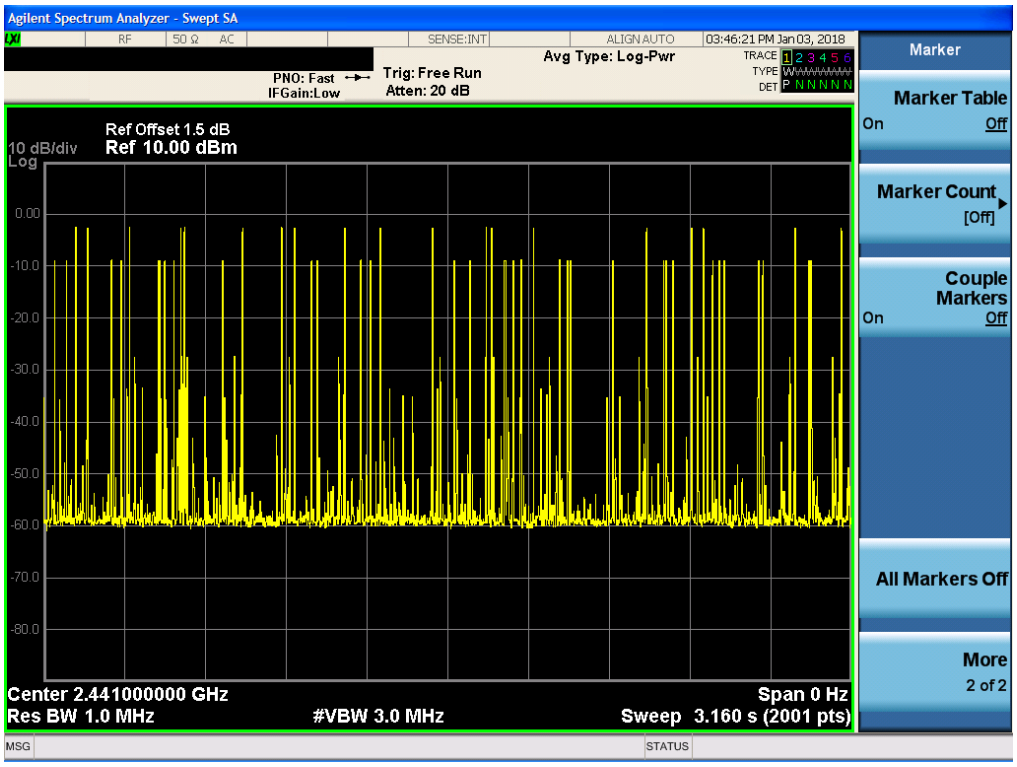
B. Test Plots:



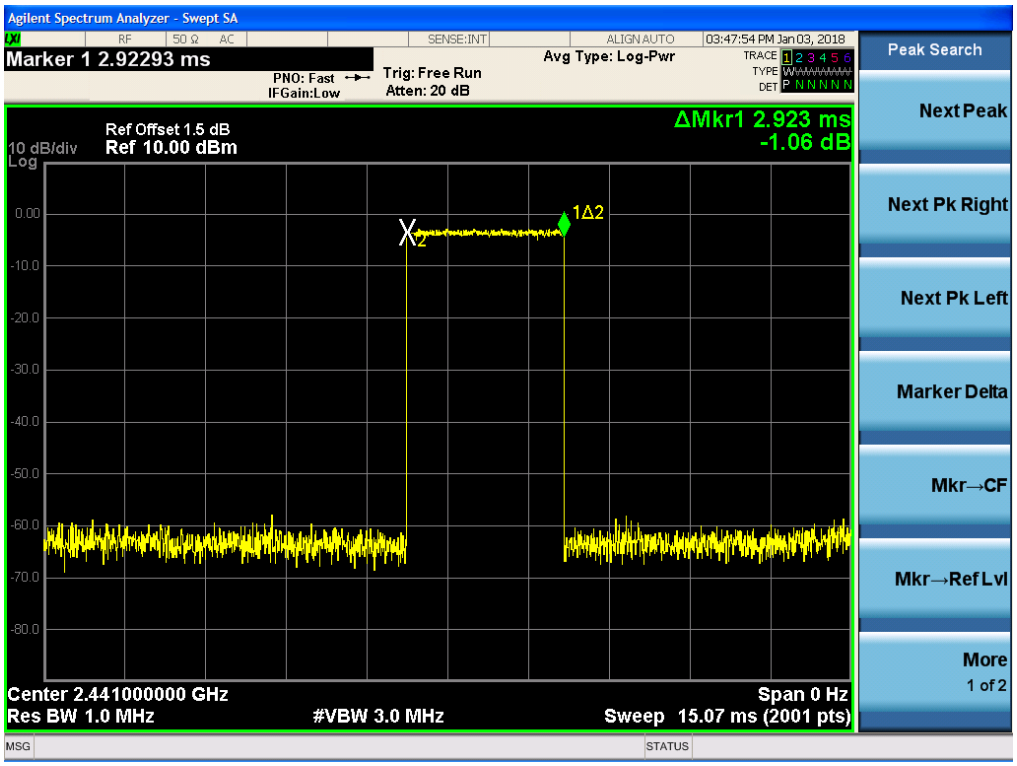

Agilent Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
03:44:38 PM Jan 03, 2018
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W
DET P N N N N N
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Log
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (2001 pts)
Marker
Marker Table
On Off
Marker Count
[Off]
Couple Markers
On Off
All Markers Off
More
2 of 2
MSG
STATUS

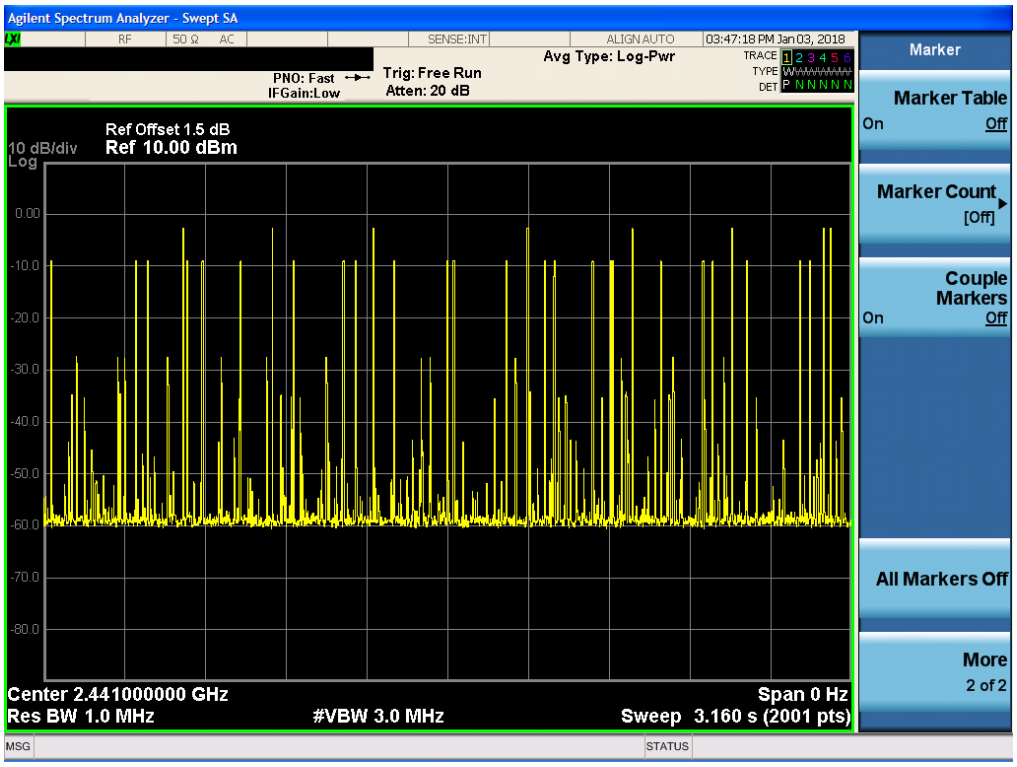
(DH1, π/4-DQPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 1.64400 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
03:46:58 PM Jan 03, 2018
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 1.644 ms
0.22 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 12.00 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
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
03:46:21 PM Jan 03, 2018
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (2001 pts)
Marker
Marker Table
On Off
Marker Count
[Off]
Couple Markers
On Off
All Markers Off
More
2 of 2

(DH3, π/4-DQPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.92293 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
03:47:54 PM Jan 03, 2018
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Log
ΔMkr1 2.923 ms
-1.06 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 15.07 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
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
03:47:18 PM Jan 03, 2018
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Log
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (2001 pts)
Marker
Marker Table
On Off
Marker Count
[Off]
Couple Markers
On Off
All Markers Off
More
2 of 2

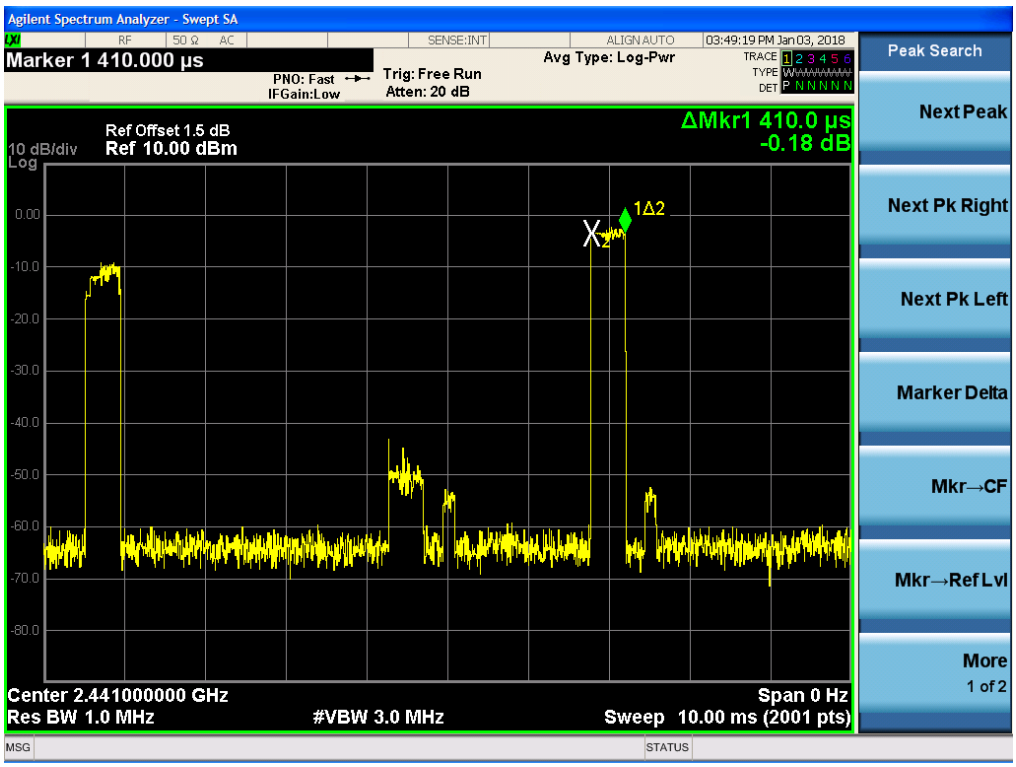
(DH5, π/4-DQPSK)

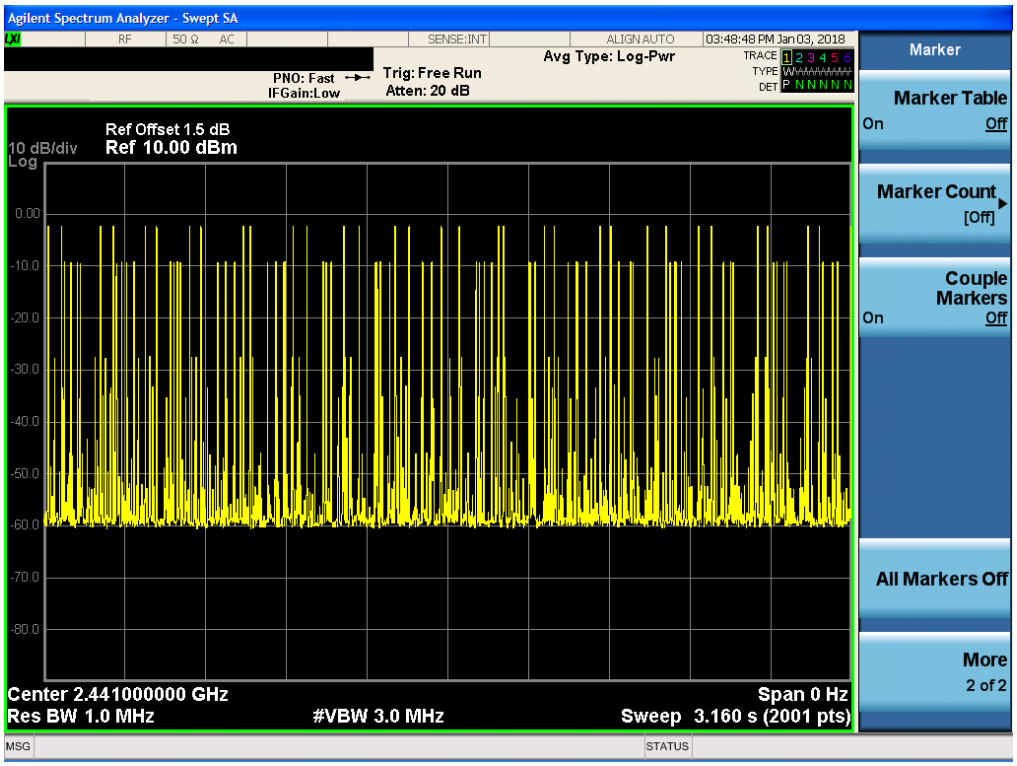
2.6.4.3 8-DPSK mode

A. Test Verdict:

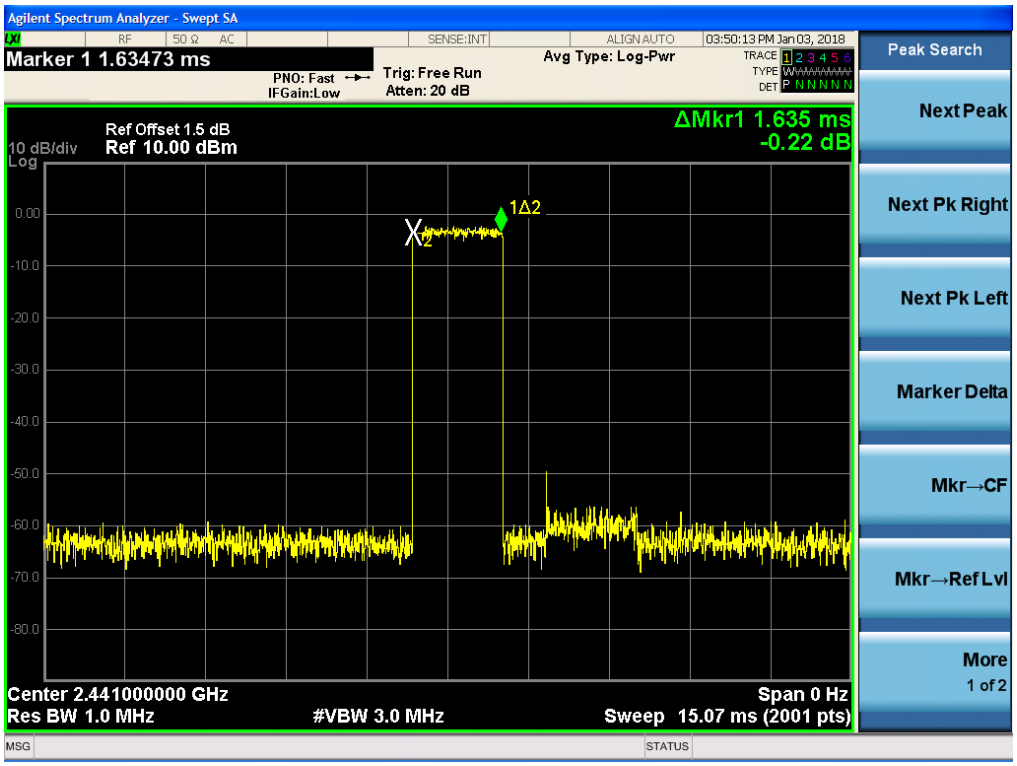
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.41	32	0.01312	0.1312	0.4	PASS
DH3	1.64	17	0.02788	0.2788		PASS
DH5	2.90	9	0.02610	0.2610		PASS

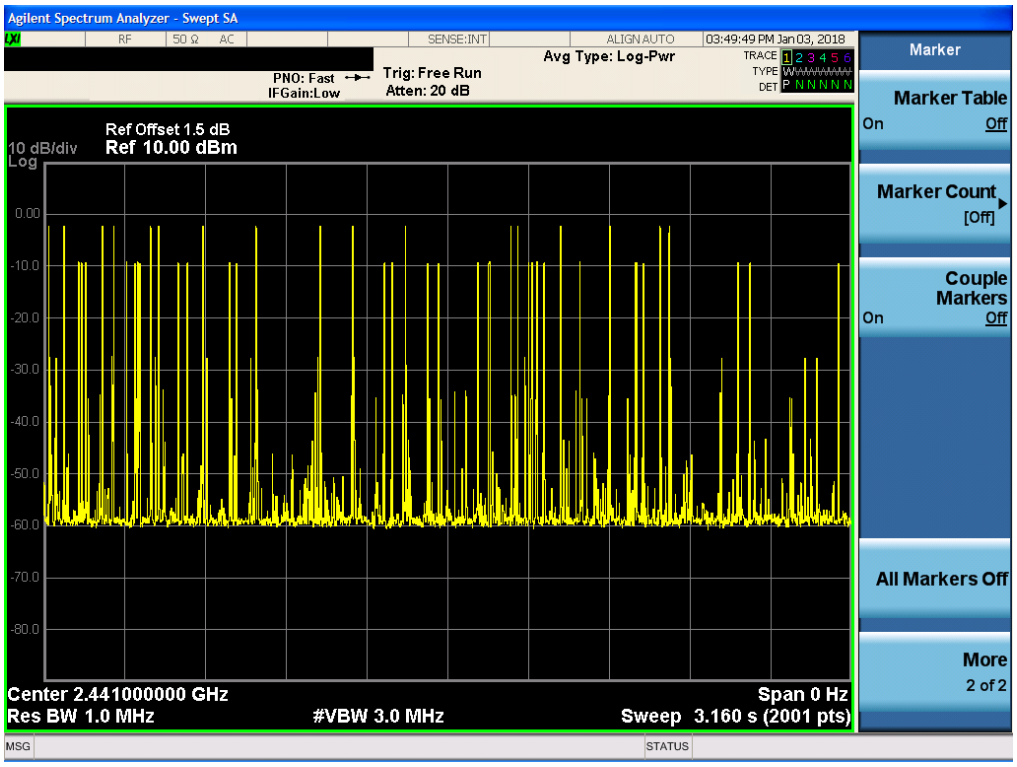
B. Test Plots:



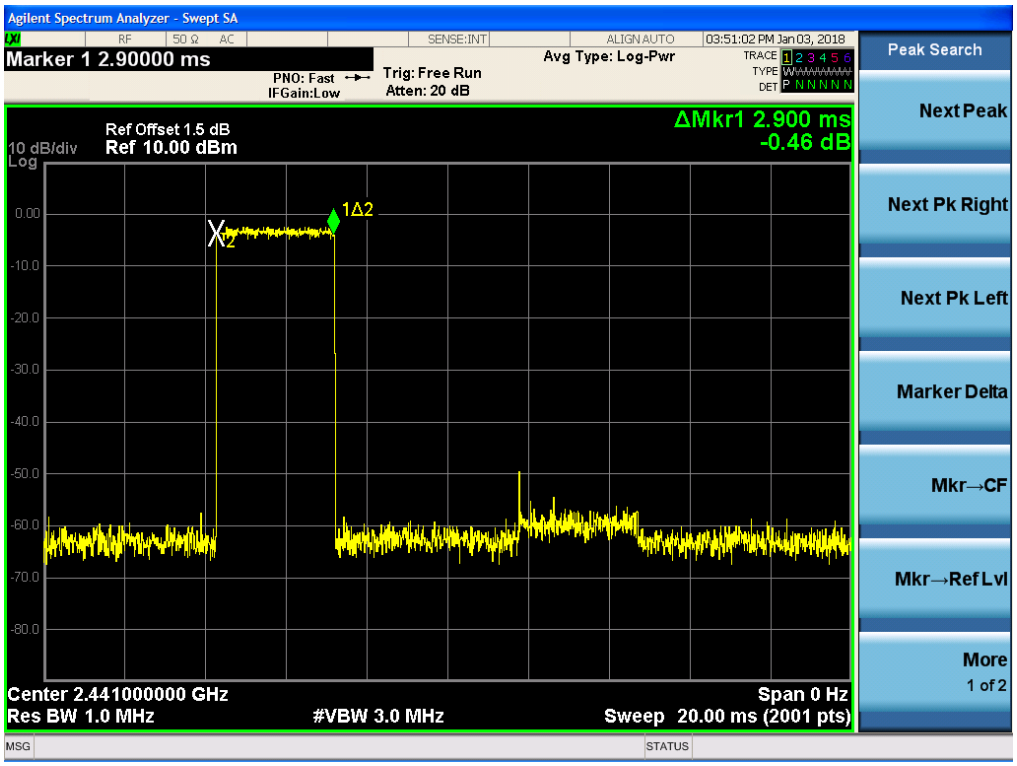

Agilent Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
03:48:48 PM Jan 03, 2018
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W
DET P N N N N N
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Log
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.441000000 GHz
Span 0 Hz
Res BW 1.0 MHz
#VBW 3.0 MHz
Sweep 3.160 s (2001 pts)
Marker
Marker Table
On Off
Marker Count
[Off]
Couple Markers
On Off
All Markers Off
More
2 of 2
MSG
STATUS

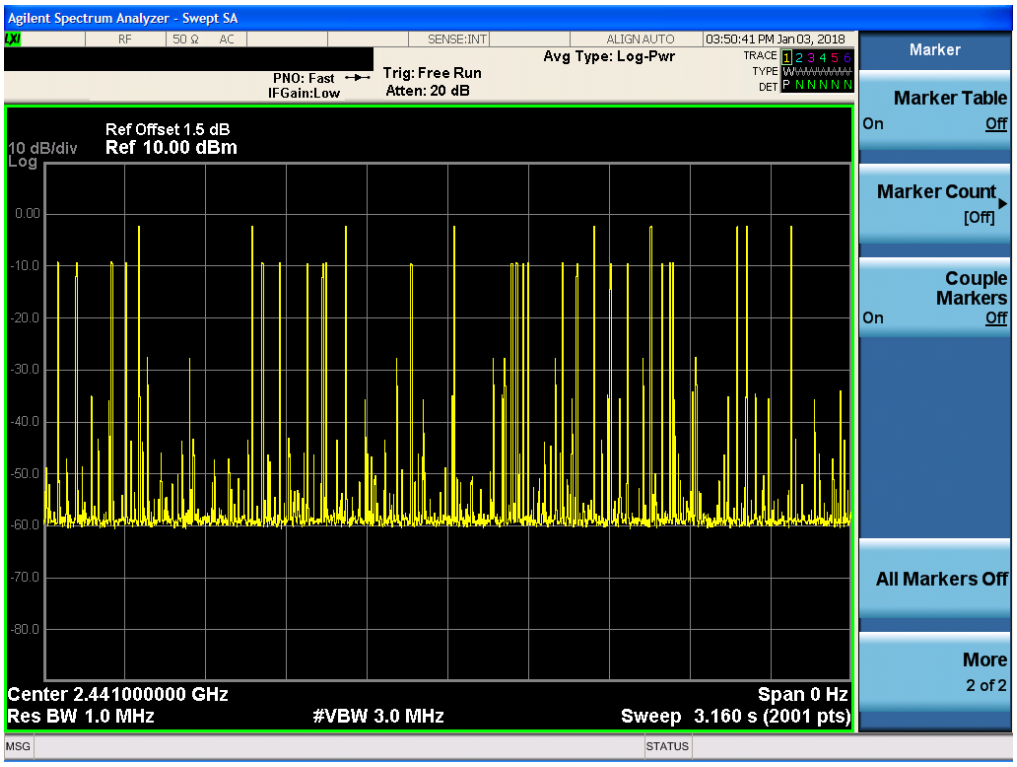
(DH1, 8-DPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 1.63473 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
03:50:13 PM Jan 03, 2018
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 1.635 ms
-0.22 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 15.07 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
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
03:49:49 PM Jan 03, 2018
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (2001 pts)
Marker
Marker Table
On Off
Marker Count
[Off]
Couple Markers
On Off
All Markers Off
More
2 of 2

(DH3, 8-DPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.90000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
03:51:02 PM Jan 03, 2018
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 2.900 ms
-0.46 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 20.00 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
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
03:50:41 PM Jan 03, 2018
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (2001 pts)
Marker
Marker Table
On Off
Marker Count
[Off]
Couple Markers
On Off
All Markers Off
More
2 of 2

(DH5, 8-DPSK)

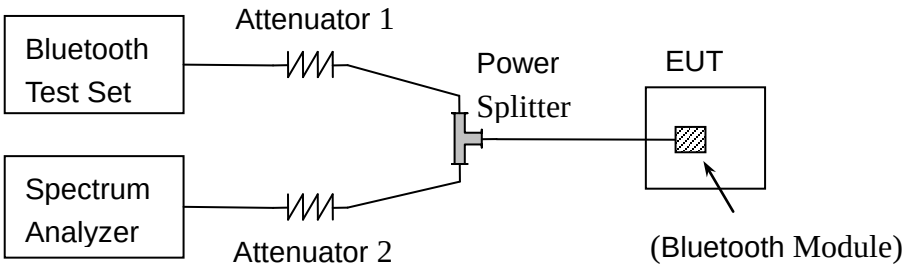
2.7. Conducted Spurious Emissions

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.

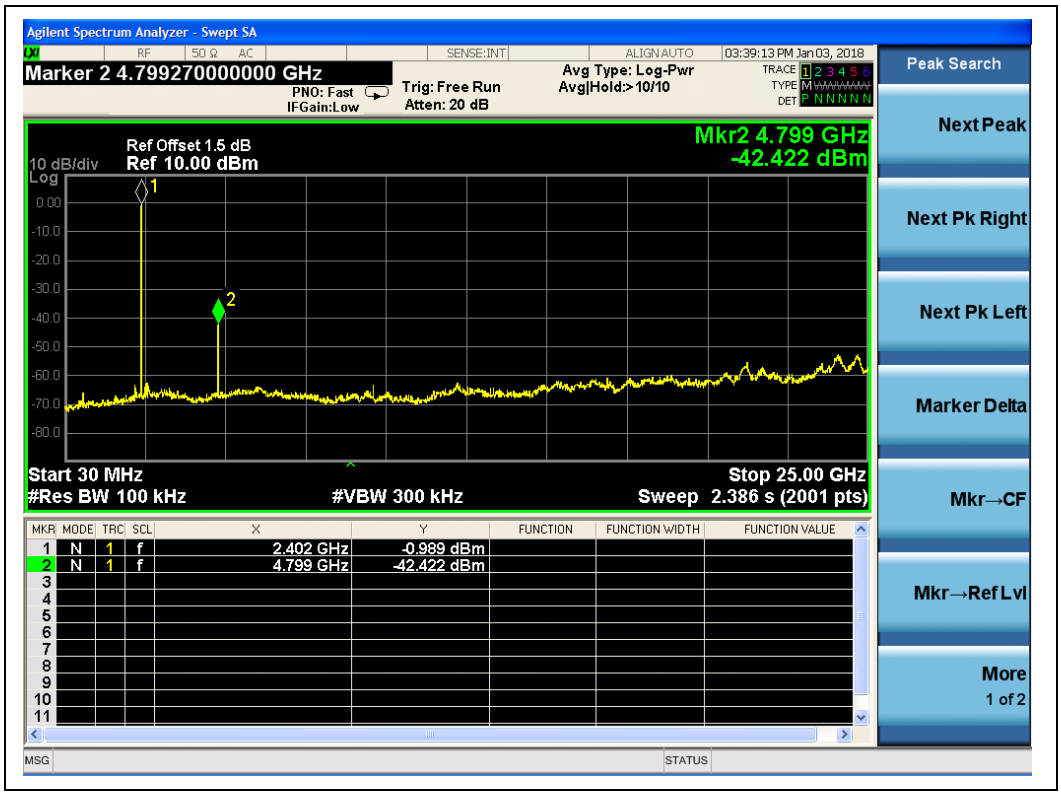
2.7.4.1 GFSK Mode

A. Test Verdict:

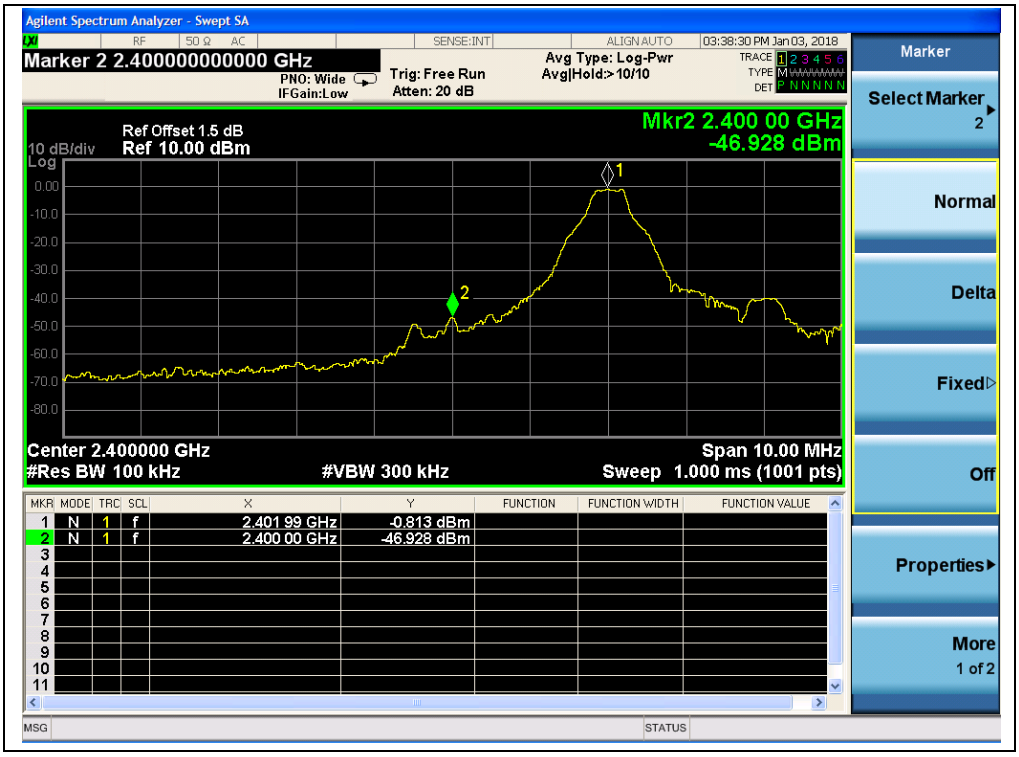
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-42.42	-0.99	-20.99	PASS
39	2441	-38.97	-0.84	-20.84	PASS
78	2480	-37.87	-0.84	-20.84	PASS

B. Test Plots:

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

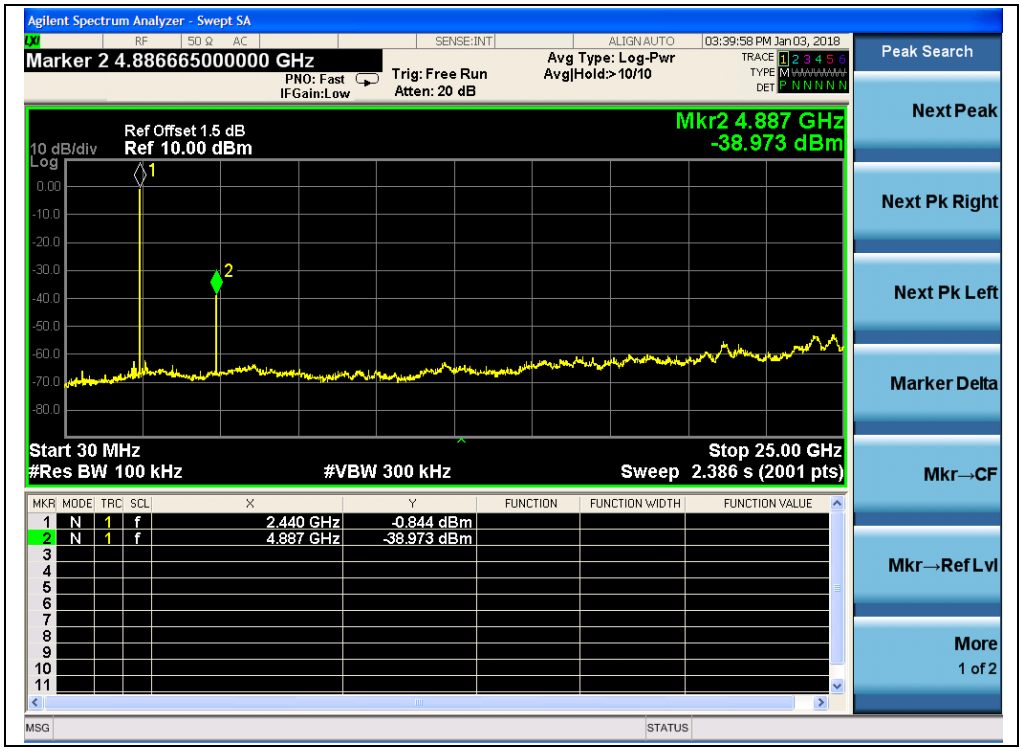


(Channel = 0, 30MHz to 25GHz, GFSK Mode)

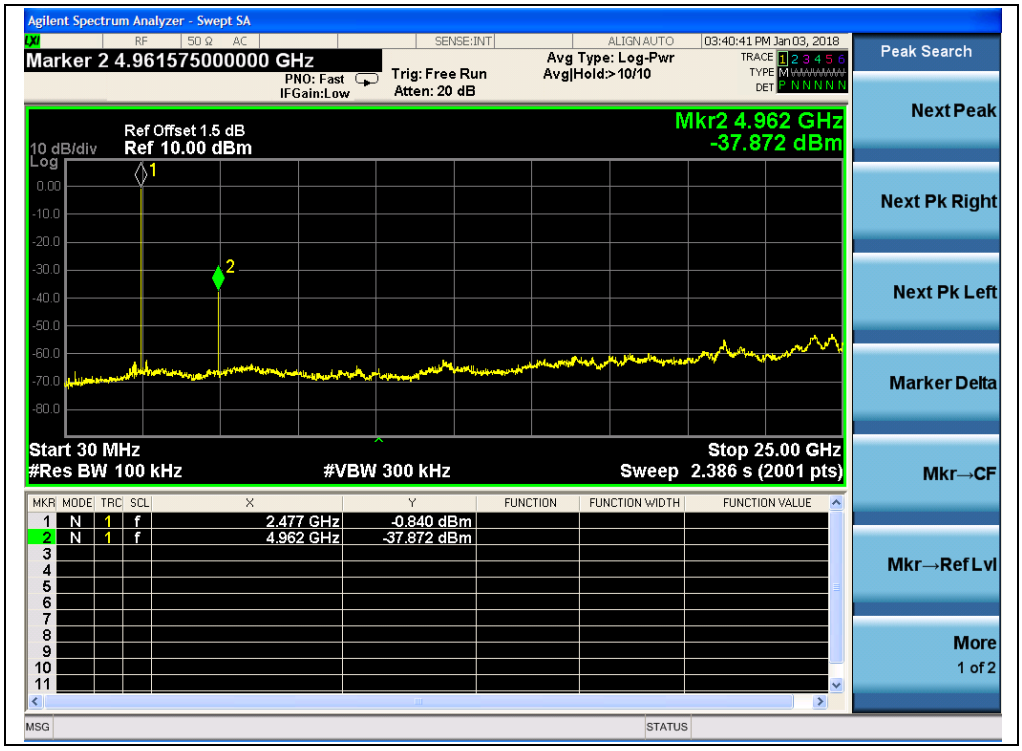


(Channel = 0, Band edge,GFSK Mode)

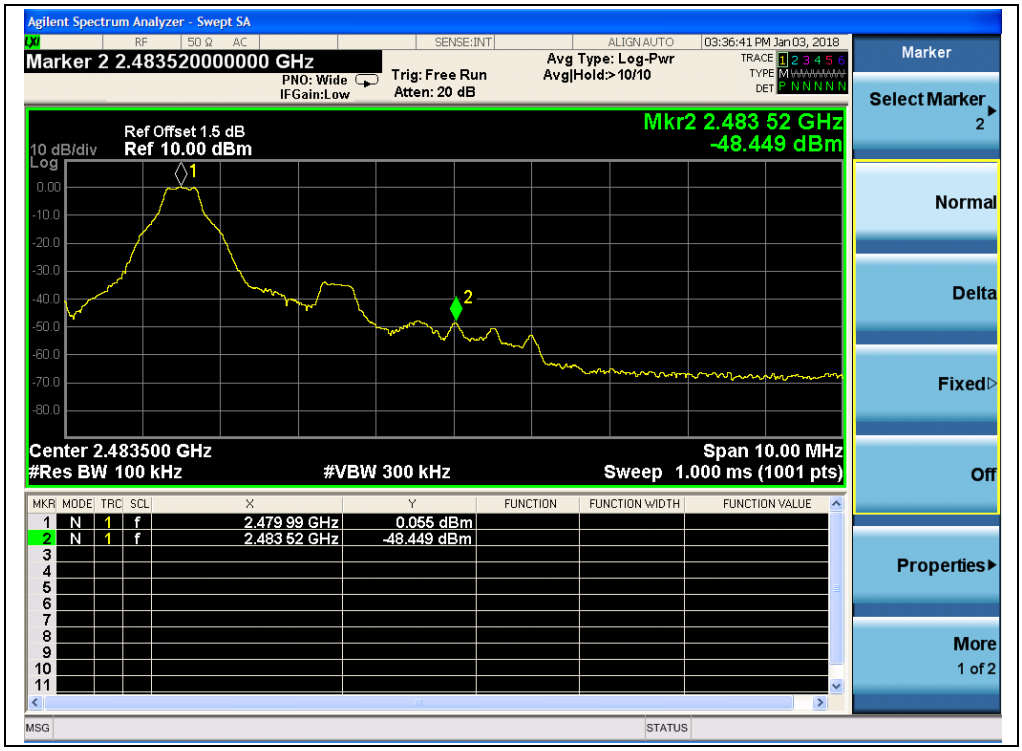
(Channel = 0, Band edge with hopping on, GFSK Mode)



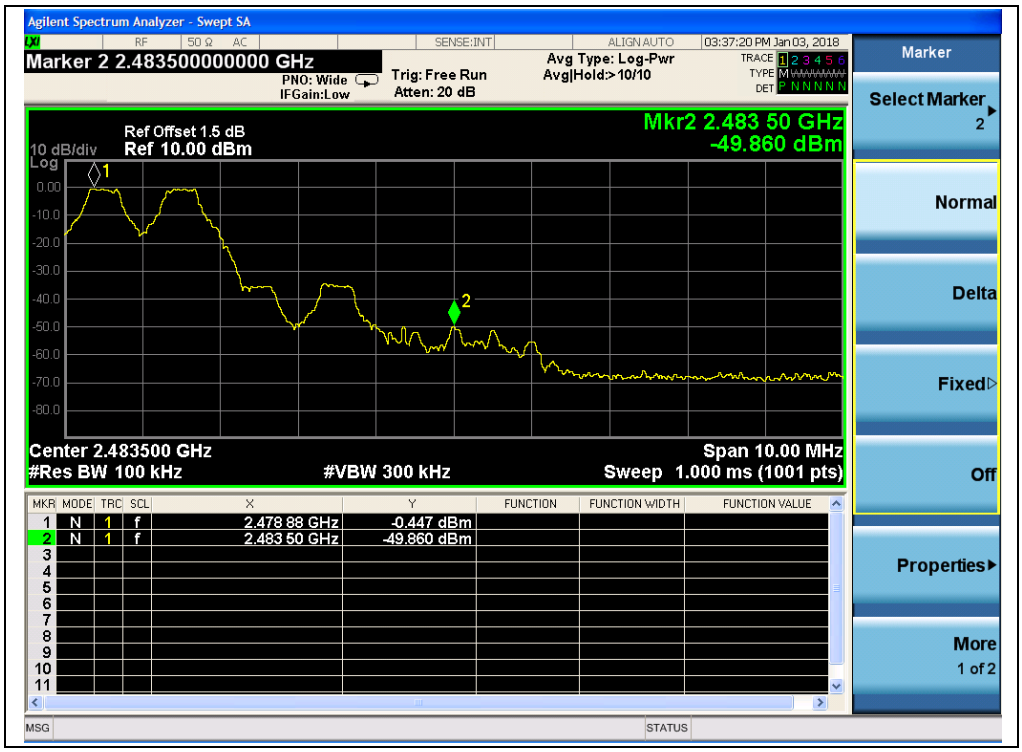
(Channel = 39, 30MHz to 25GHz, GFSK Mode)



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



(Channel = 78, Band edge,GFSK Mode)



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

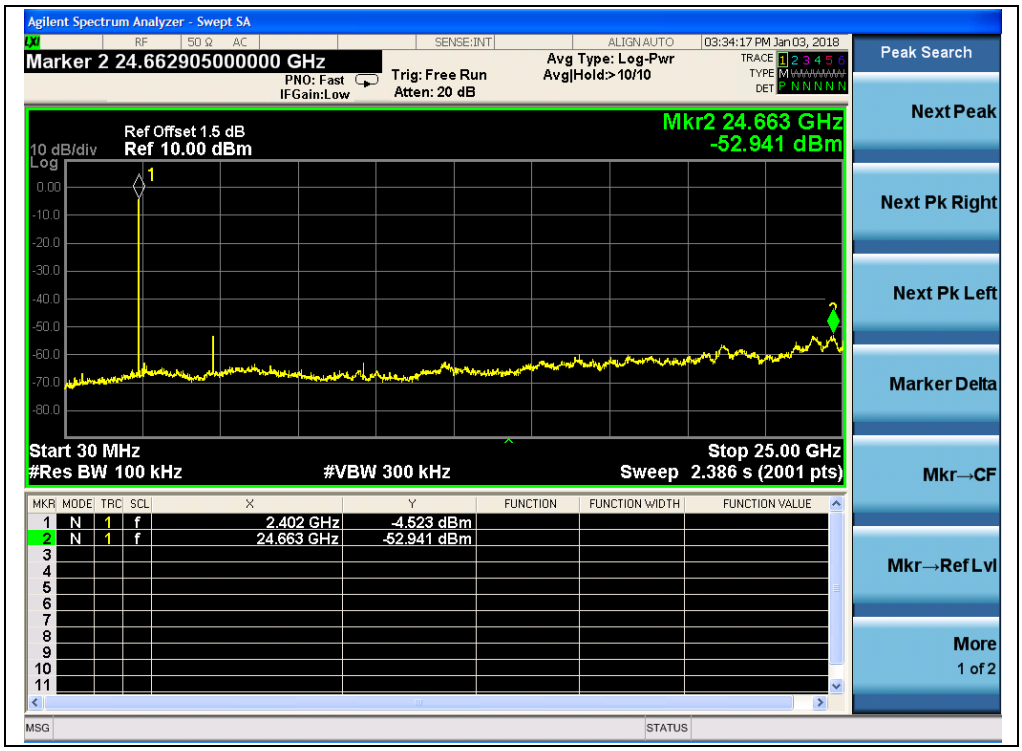
2.7.4.2 π/4-DQPSK Mode

A. Test Verdict:

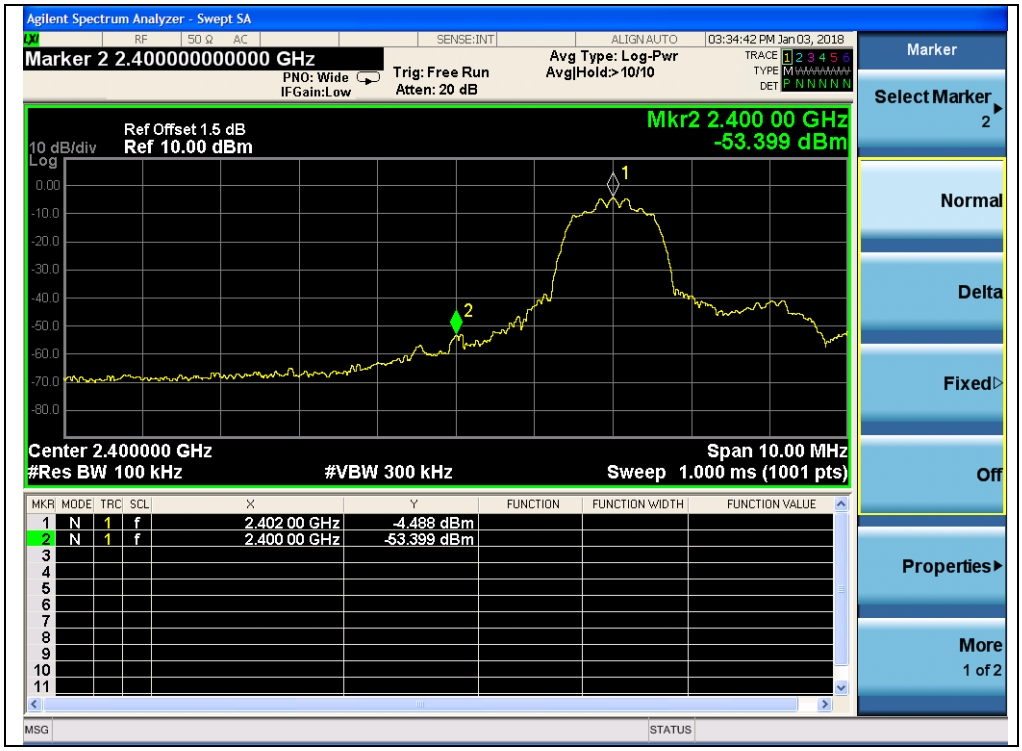
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-52.94	-4.52	-24.52	PASS
39	2441	-47.11	-3.55	-23.55	PASS
78	2480	-47.96	-7.77	-27.77	PASS

B. Test Plots:

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

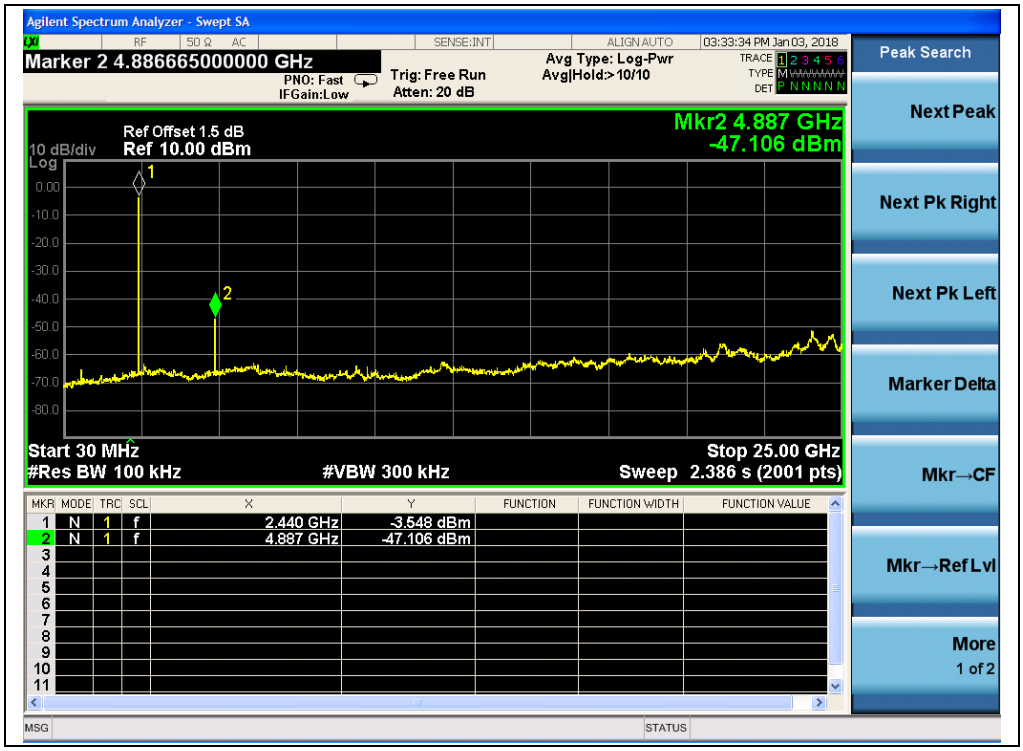


(Channel = 0, 30MHz to 25GHz, π/4-DQPSK)

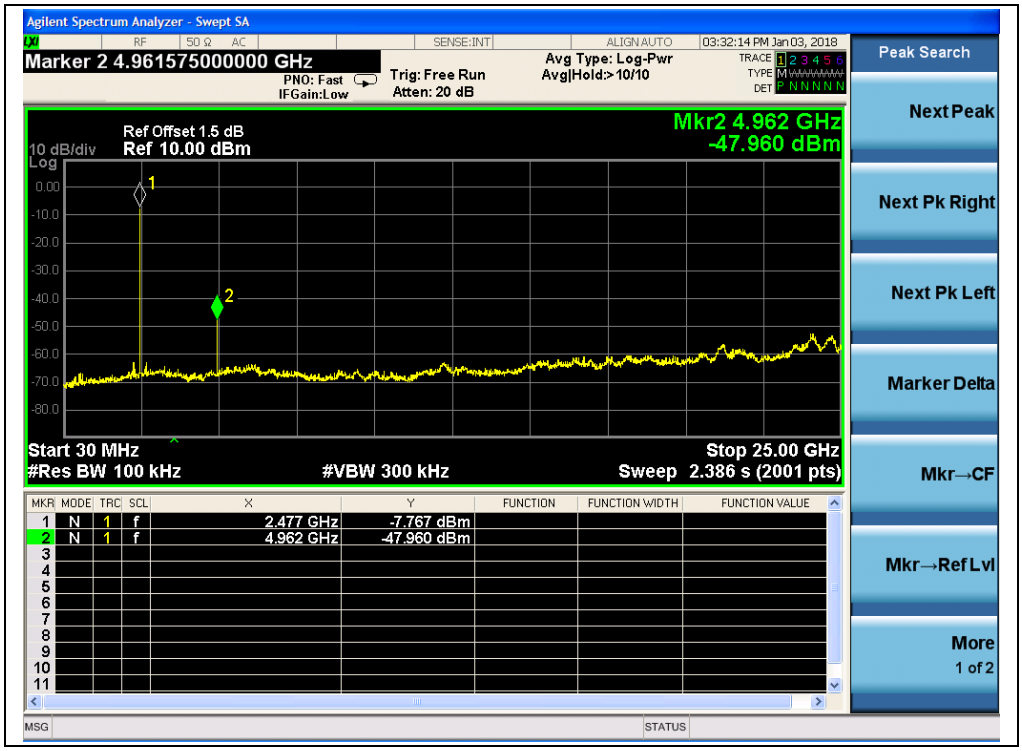


(Channel = 0, Band edge, π/4-DQPSK)

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



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



(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)

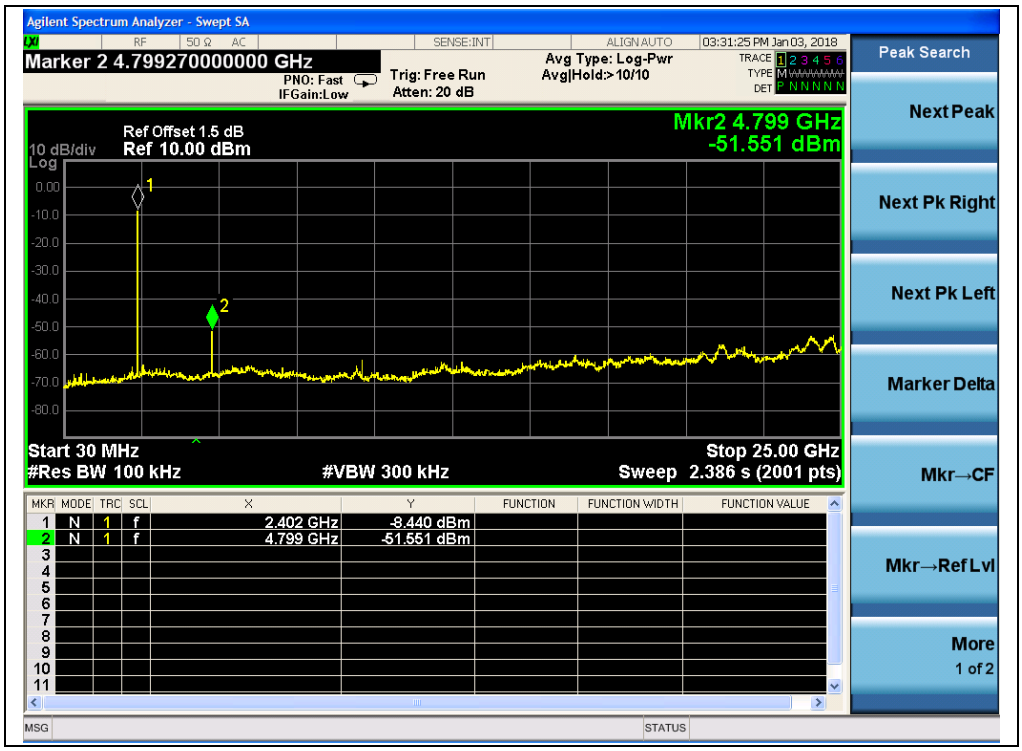
2.7.4.3 8-DPSK Mode

A. Test Verdict:

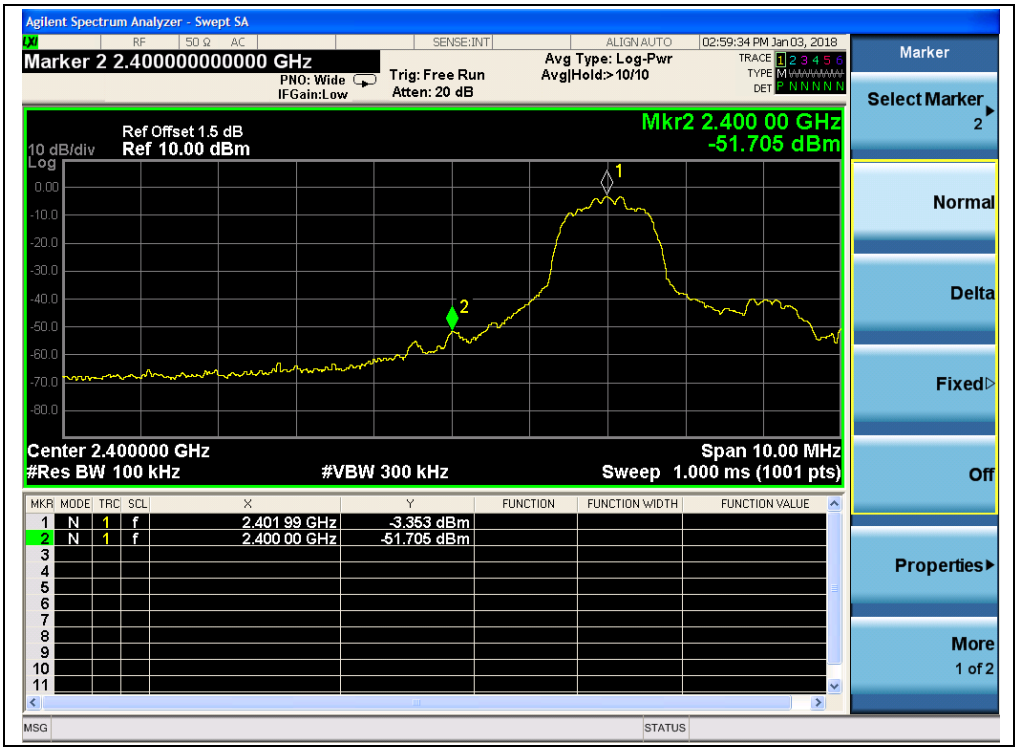
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-51.56	-8.44	-28.44	PASS
39	2441	-50.79	-3.39	-23.39	PASS
78	2480	-47.64	-6.02	-26.02	PASS

B. Test Plots:

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

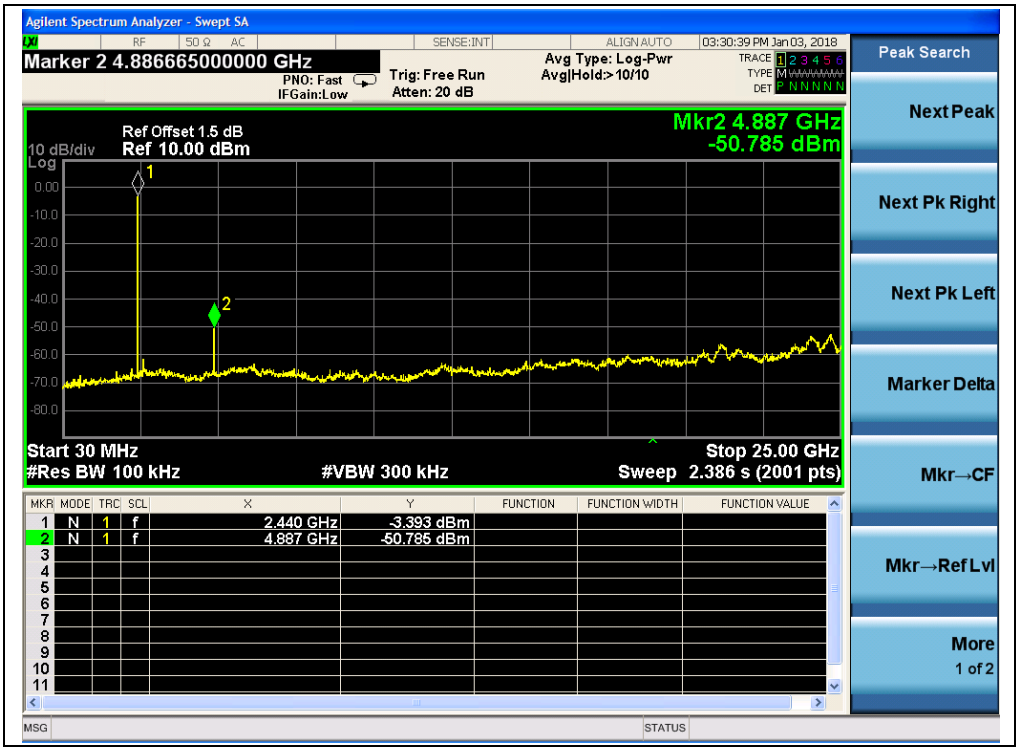


(Channel = 0, 30MHz to 25GH, 8-DPSK)

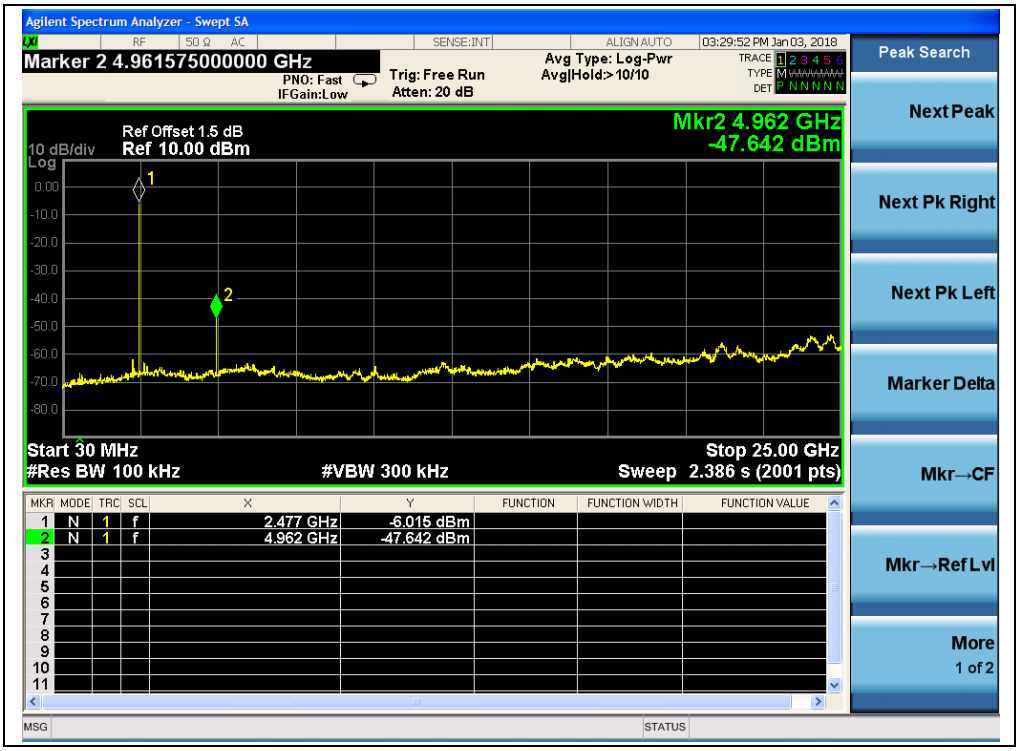


(Channel = 0, Band edge, 8-DPSK)

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



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



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

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

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

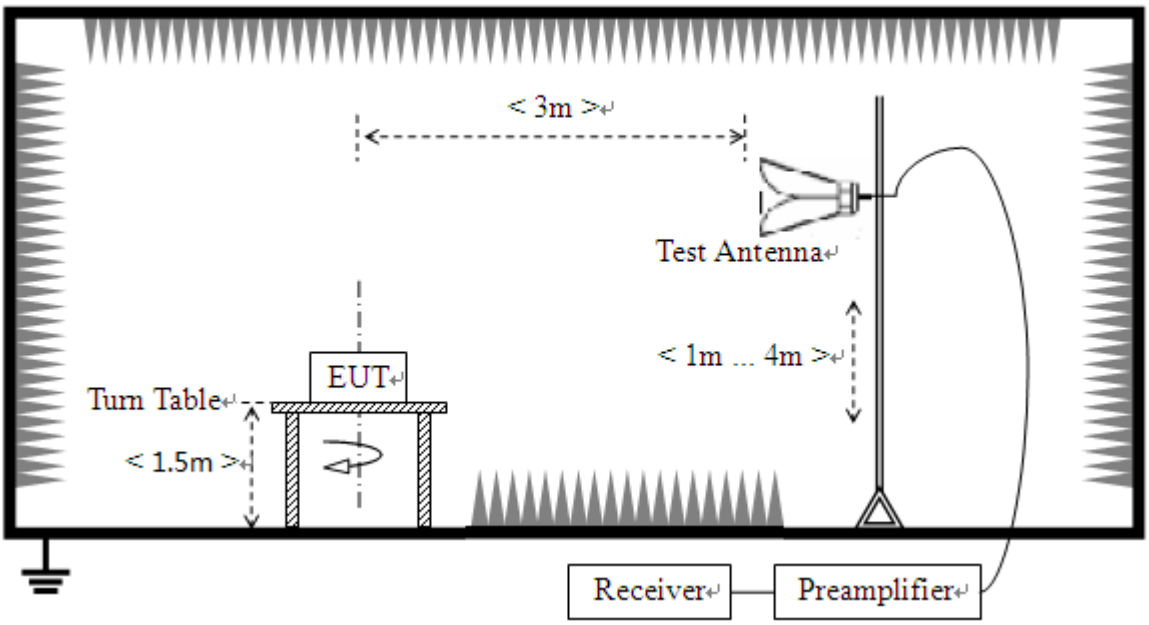
2.8. Restricted Frequency Bands

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

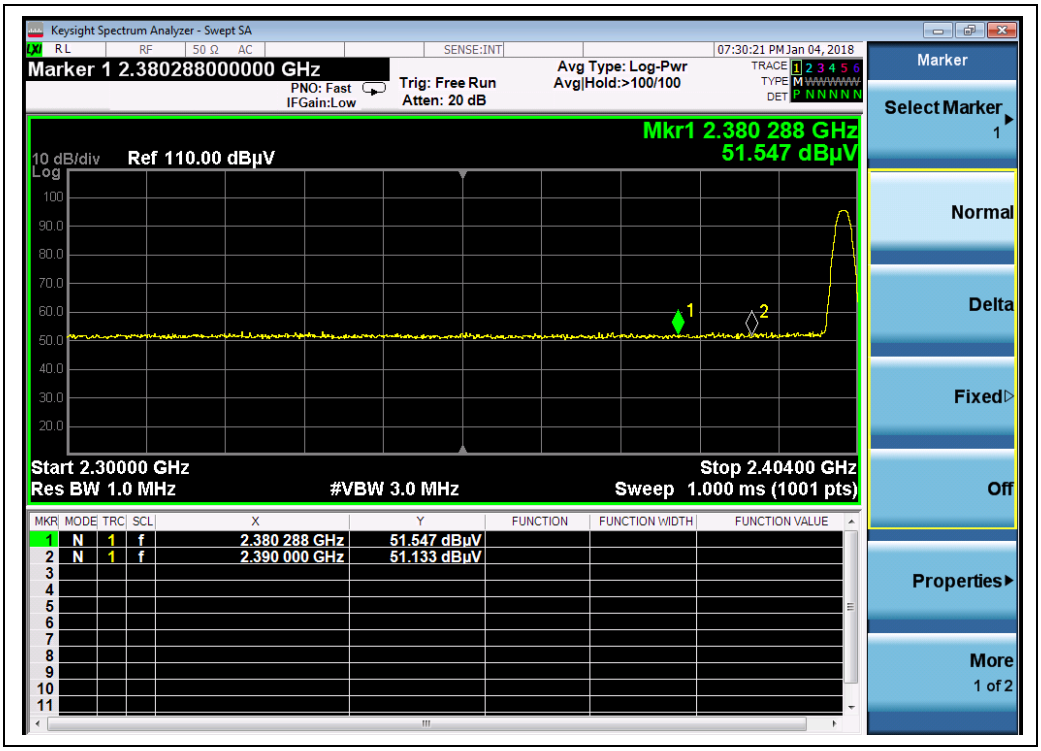
The lowest and highest channels are tested to verify Restricted Frequency Bands.
The measurement results are obtained as below:
E [dBμV/m] $=U_R + A_T + A_{Factor}$ [dB]; AT $=L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
AT: Total correction Factor except Antenna
UR: Receiver Reading
Gpreamp: Preamplifier Gain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

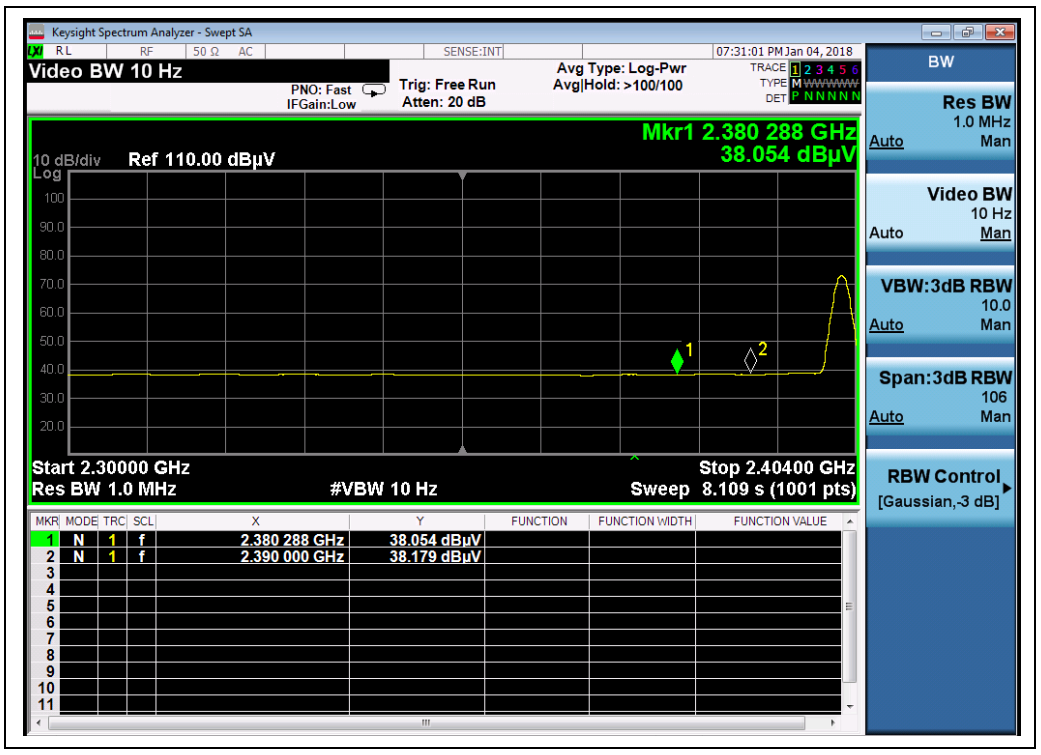
A. Test Verdict:

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	2380.29	PK	51.55	-32.81	40.30	59.04	74	Pass
0	2380.29	AV	38.05	-32.81	40.30	45.54	54	Pass
78	2488.67	PK	51.67	-32.81	40.30	59.16	74	Pass
78	2488.67	AV	37.94	-32.81	40.30	45.43	54	Pass

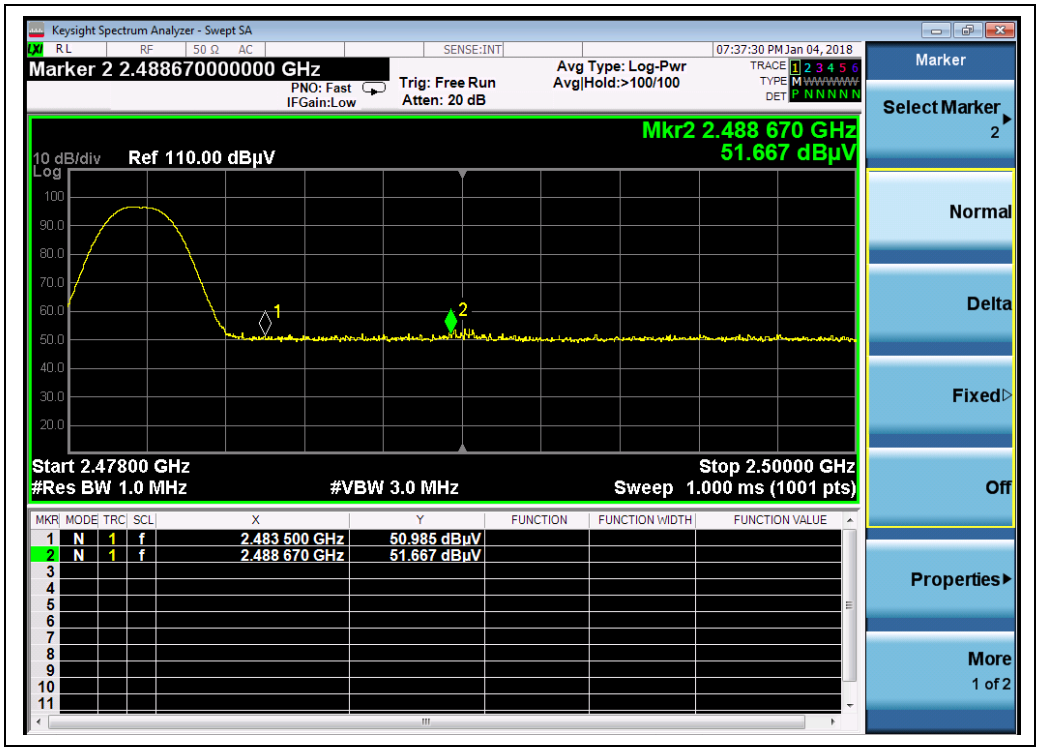
B. Test Plots:



(Channel = 0, PEAK, GFSK)



(Channel = 0, AVERAGE, GFSK)



(Channel = 78, PEAK, GFSK)

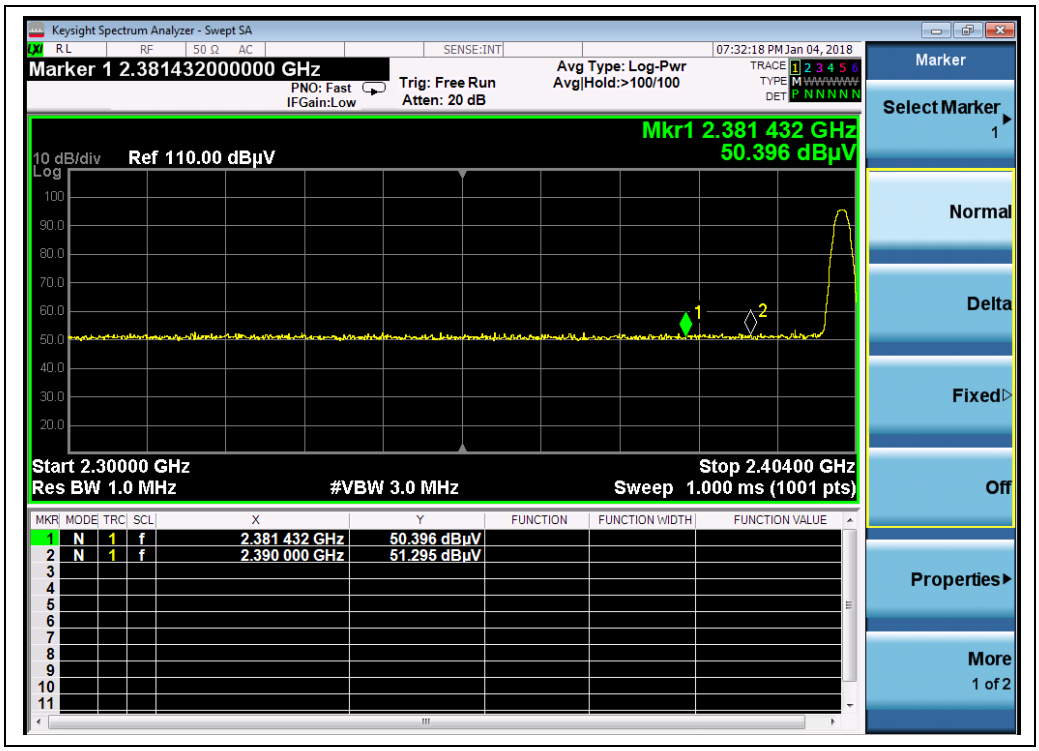
(Channel = 78, AVERAGE, GFSK)

2.8.4.2 π/4-DQPSK Mode

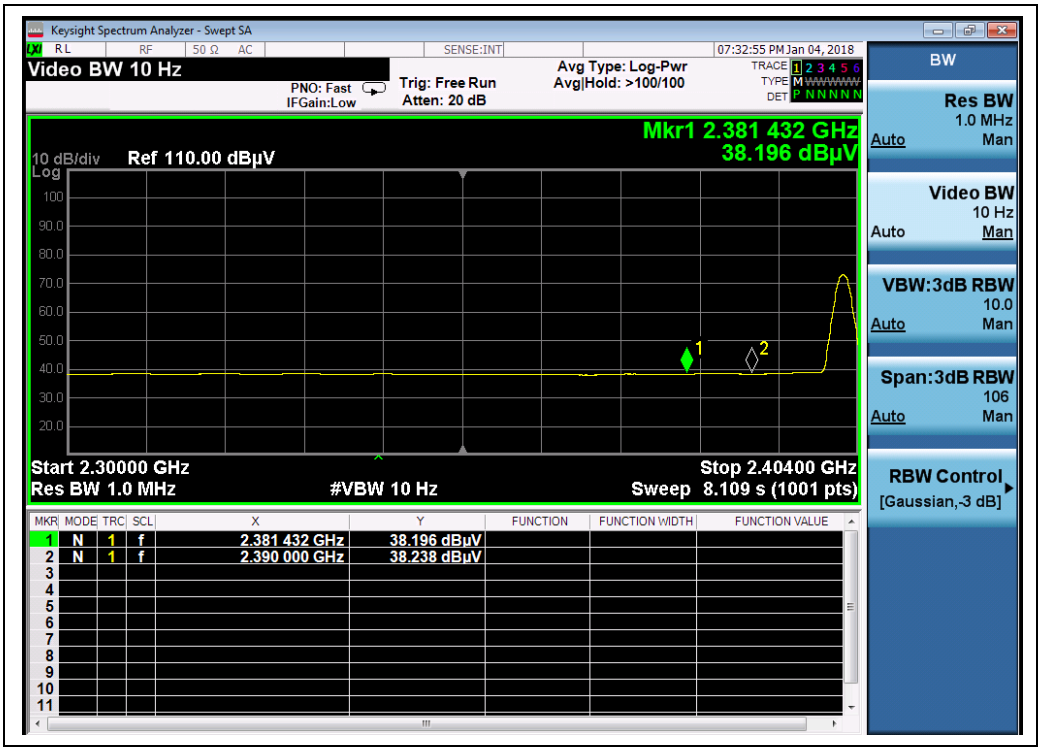
A. Test Verdict:

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	2381.43	PK	50.40	-32.81	40.30	57.89	74	Pass
0	2381.43	AV	38.20	-32.81	40.30	45.69	54	Pass
78	2487.48	PK	50.16	-32.81	40.30	57.65	74	Pass
78	2487.48	AV	38.01	-32.81	40.30	45.50	54	Pass

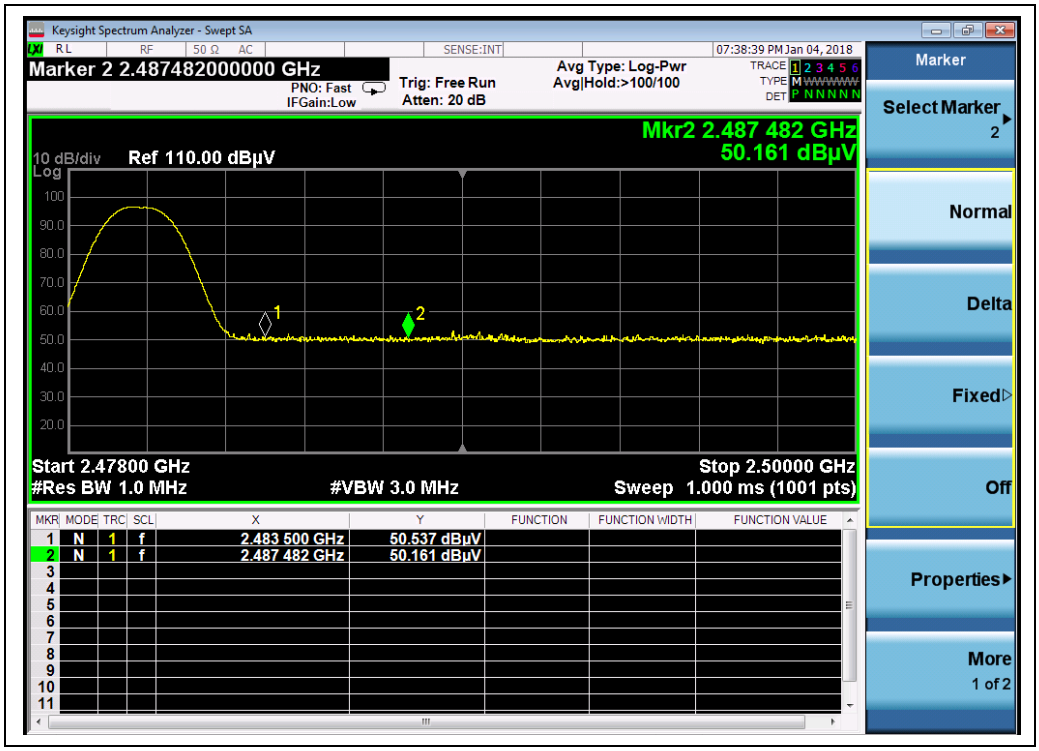
B. Test Plots:



(Channel = 0, PEAK, π/4-DQPSK)



(Channel = 0, AVERAGE, π/4-DQPSK)



(Channel = 78, PEAK, π/4-DQPSK)

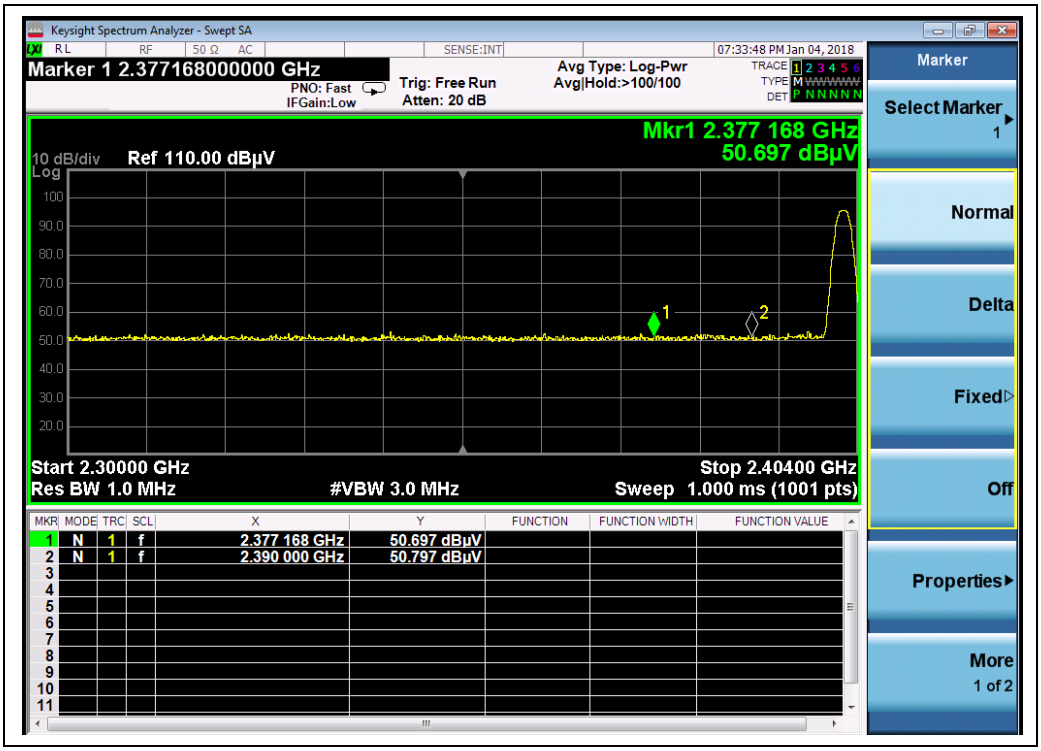
(Channel = 78, AVERAGE, π/4-DQPSK)

2.8.4.3 8-DPSK Mode

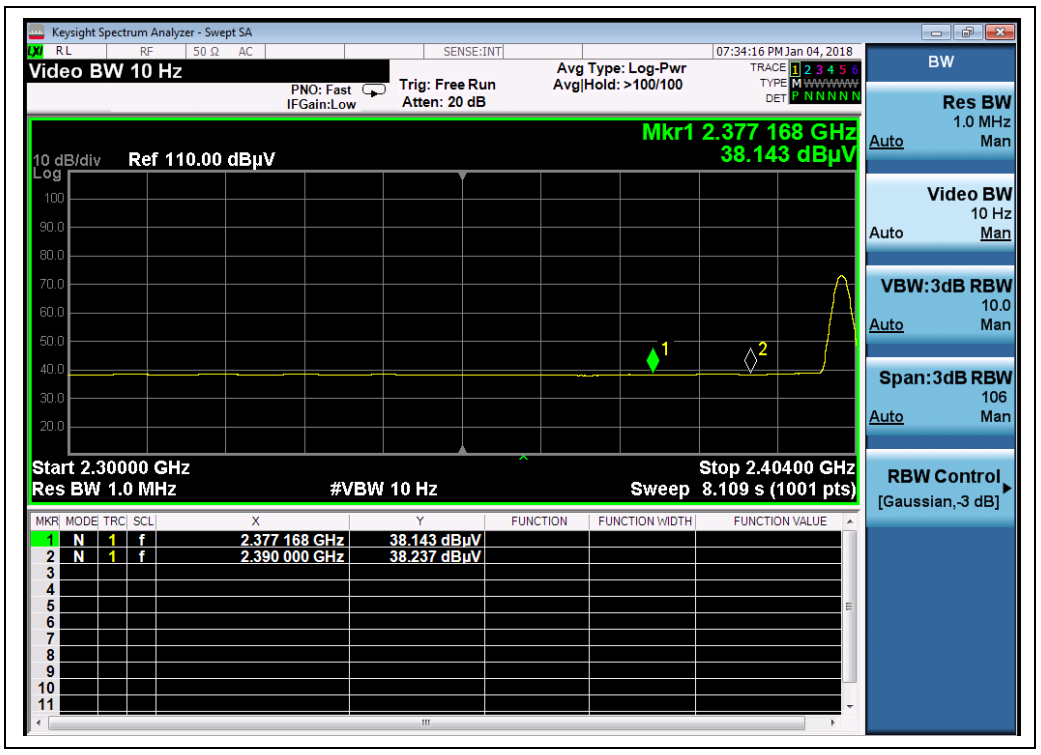
A. Test Verdict:

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	2377.17	PK	50.70	-32.81	40.30	58.19	74	Pass
0	2377.17	AV	38.14	-32.81	40.30	45.63	54	Pass
78	2488.71	PK	51.29	-32.81	40.30	58.78	74	Pass
78	2488.71	AV	37.94	-32.81	40.30	45.43	54	Pass

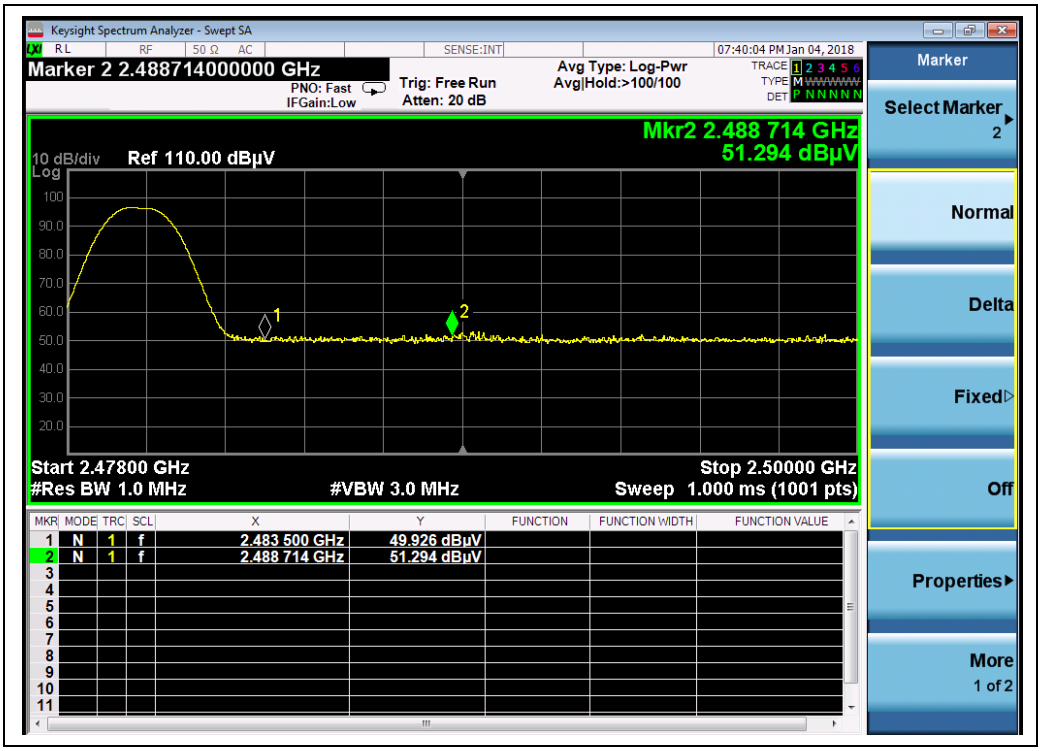
B. Test Plots:



(Channel = 0, PEAK, 8-DPSK)



(Channel = 0, AVERAGE, 8-DPSK)



(Channel = 78, PEAK, 8-DPSK)

(Channel = 78, AVERAGE, 8-DPSK)

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 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

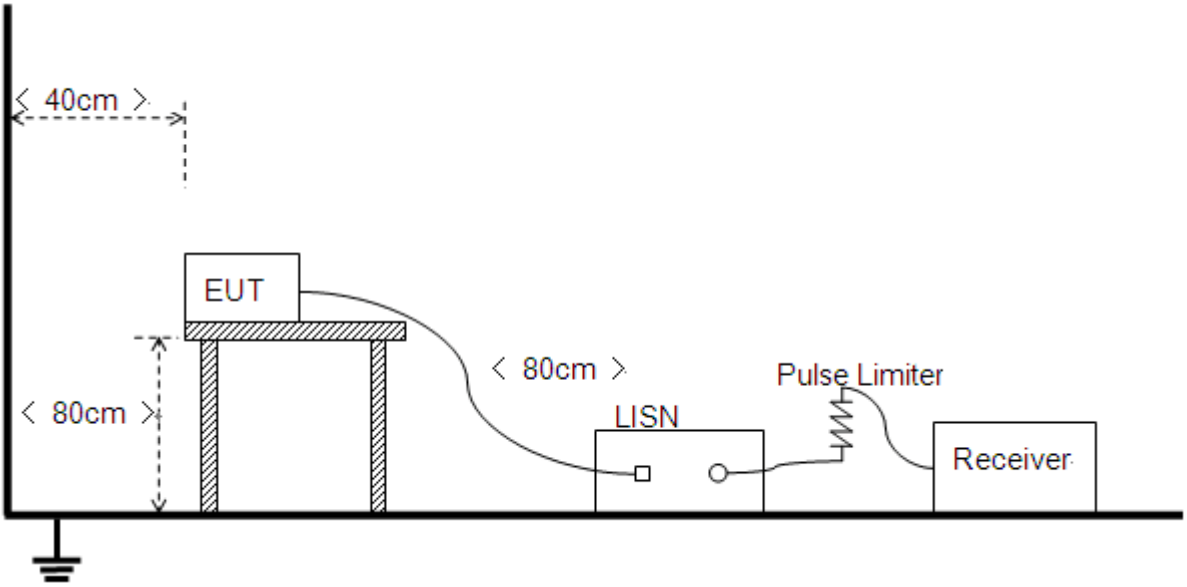
NOTE:

(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

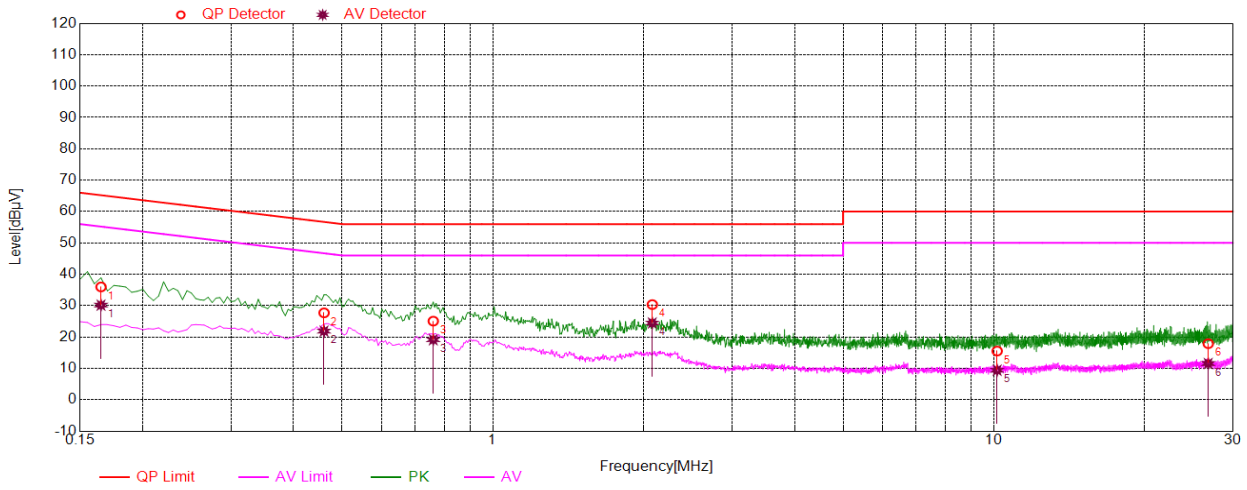
The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT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

A. Test setup:

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

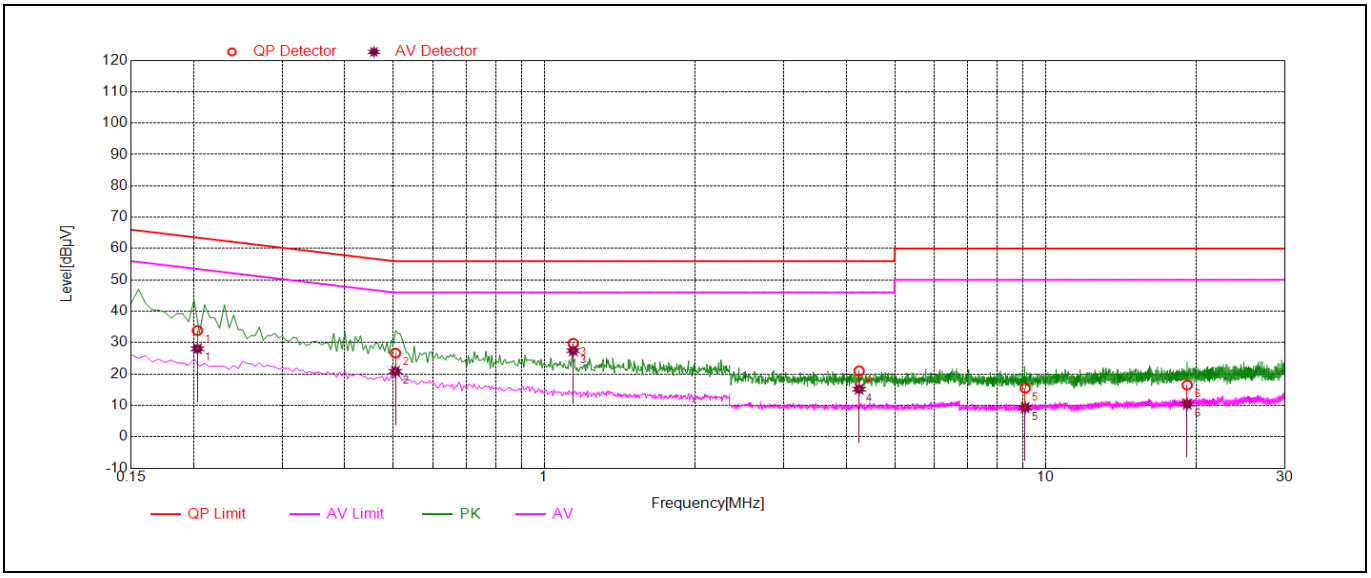
Note: The test voltage is AC 120V/60Hz.

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	0.16	35.97	30.16	65.21	55.21	Line	PASS
2	0.46	27.71	21.88	56.69	46.69		PASS
3	0.76	25.08	19.14	56.00	46.00		PASS
4	2.08	30.35	24.47	56.00	46.00		PASS
5	10.15	15.53	9.41	60.00	50.00		PASS
6	26.79	17.88	11.55	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	0.20	33.89	28.05	63.48	53.48	Neutral	PASS
2	0.50	26.67	20.84	56.00	46.00		PASS
3	1.14	29.80	27.44	56.00	46.00		PASS
4	4.25	21.00	15.17	56.00	46.00		PASS
5	9.10	15.49	9.27	60.00	50.00		PASS
6	19.17	16.47	10.41	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:

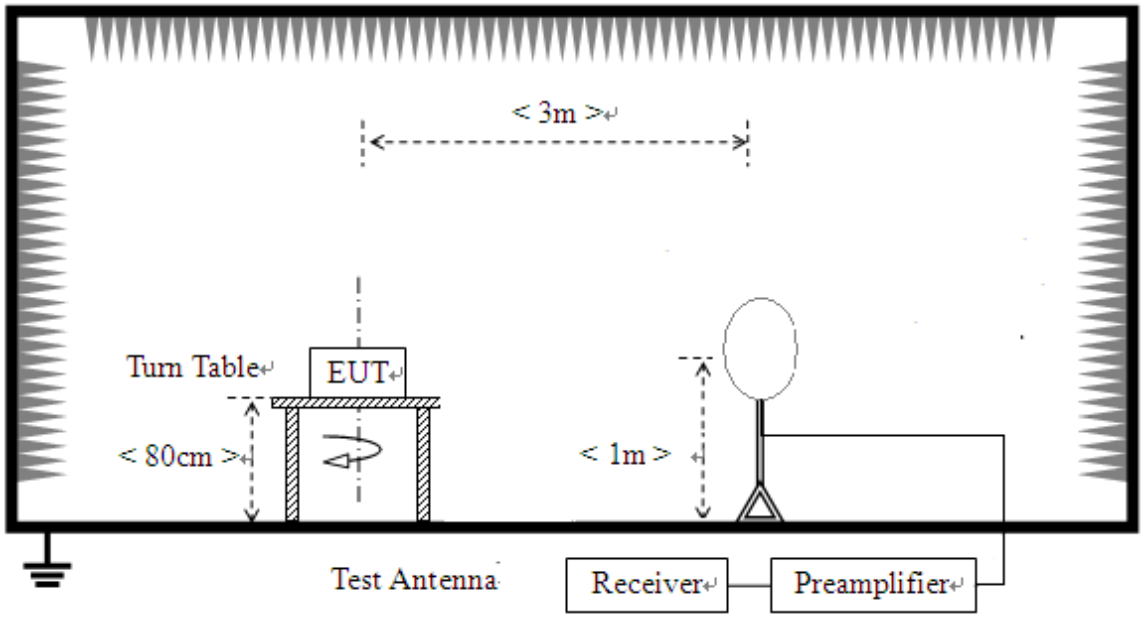
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength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

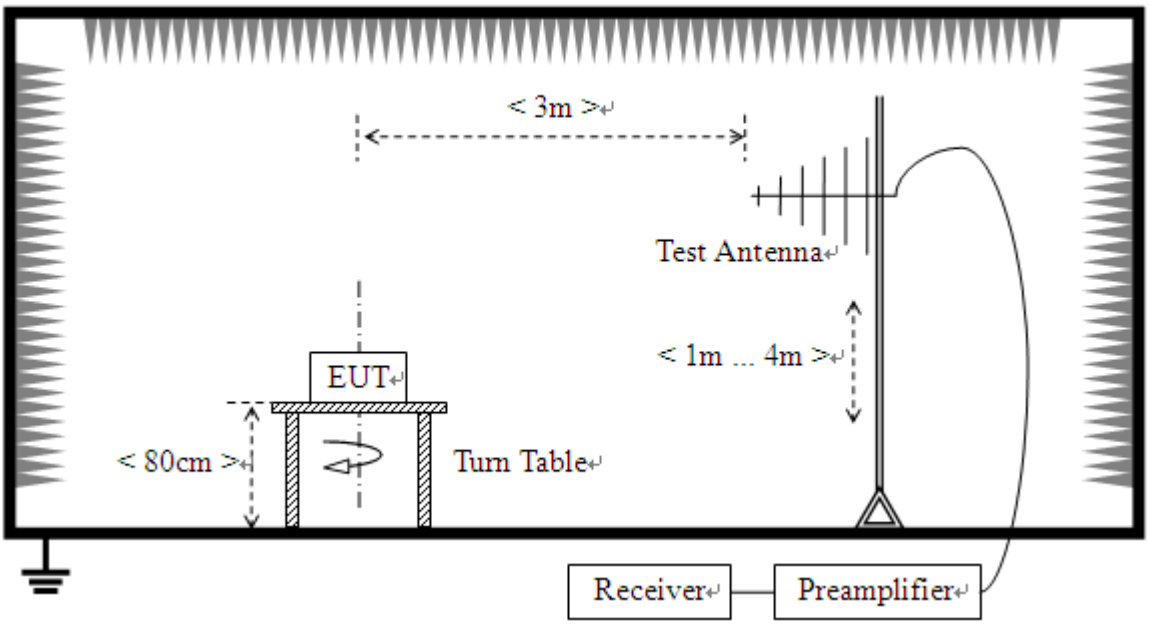
2.10.2. Test Description

A. Test Setup:

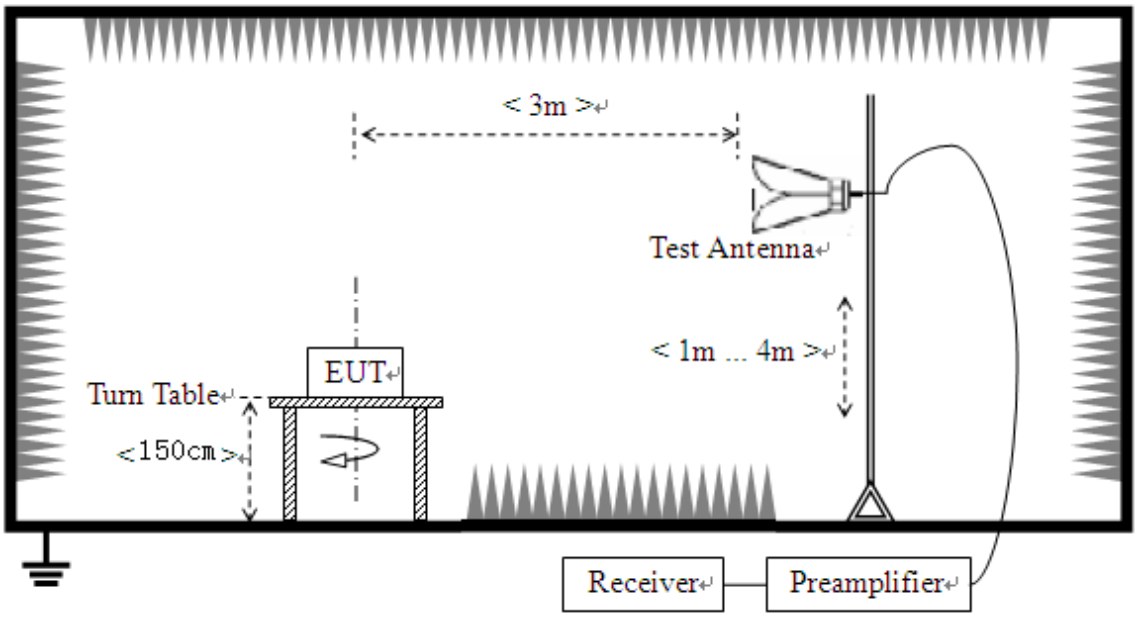
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The 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.

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

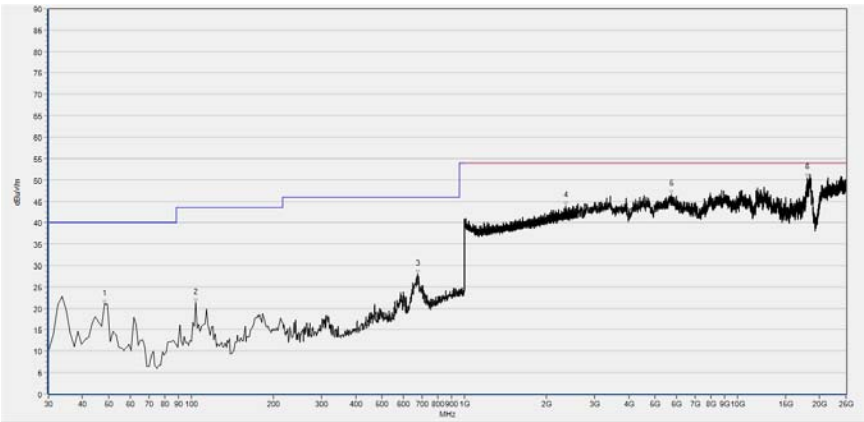
During the test, the total correction Factor AT and A_{Factor} were built in test software.

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.

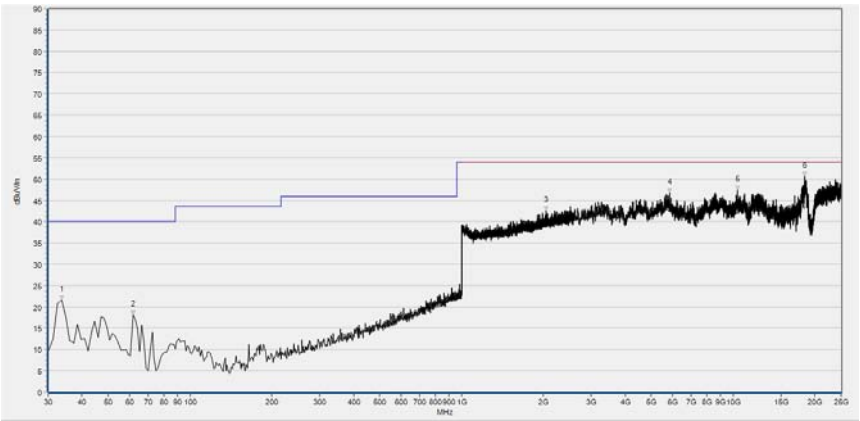
2.10.4.1 GFSK Mode:

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
48.210	20.99	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
104.055	21.27	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
674.643	28.03	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2359.264	43.97	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
5736.570	46.66	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
17997.709	50.46	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

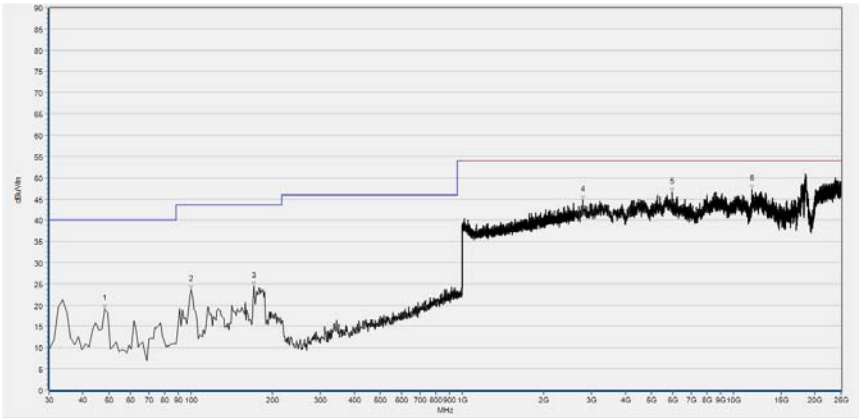
(30MHz to 25GHz, Antenna Horizontal, GFSK, channel 0)



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
33.642	21.62	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
61.564	18.06	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
2047.459	42.50	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
5838.407	46.79	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
10355.883	47.45	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
18396.909	50.60	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

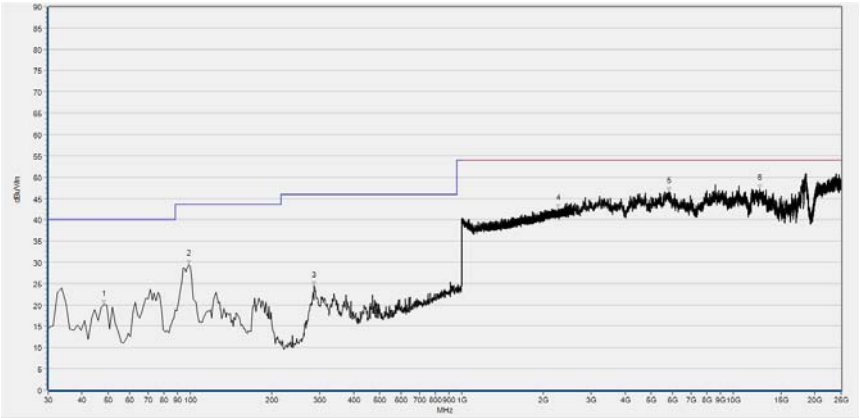
(30MHz to 25GHz, Antenna Vertical, GFSK, channel 0)

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
48.210	19.13	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
100.413	23.60	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
170.826	24.50	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2791.453	44.77	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
5964.684	46.54	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
11724.568	47.33	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

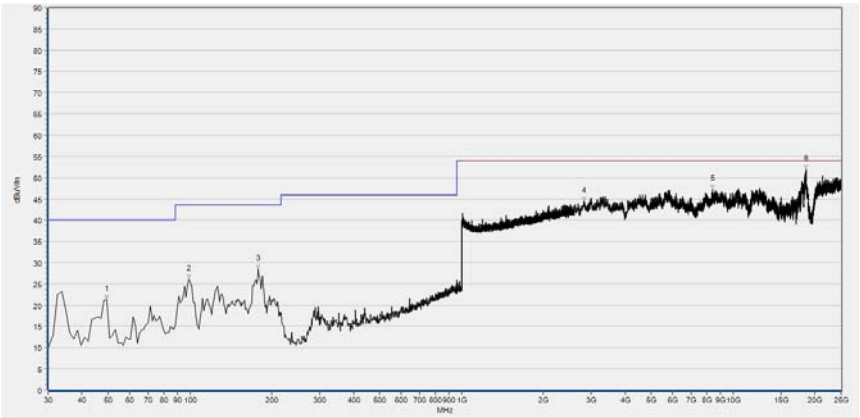
(30MHz to 25GHz, Antenna Horizontal, GFSK, channel 39)



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
48.210	20.17	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
99.199	29.56	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
286.158	24.39	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2272.189	42.51	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
5801.746	46.66	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
12531.115	47.34	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

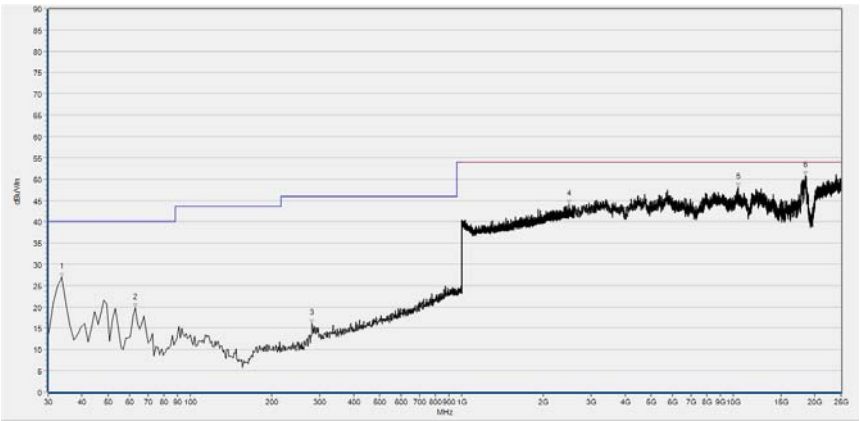
(30MHz to 25GHz, Antenna Vertical, GFSK, channel 39)

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
49.424	21.33	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
99.199	26.16	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
178.110	28.41	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2819.967	44.49	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
8412.839	47.25	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
18559.847	51.97	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

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

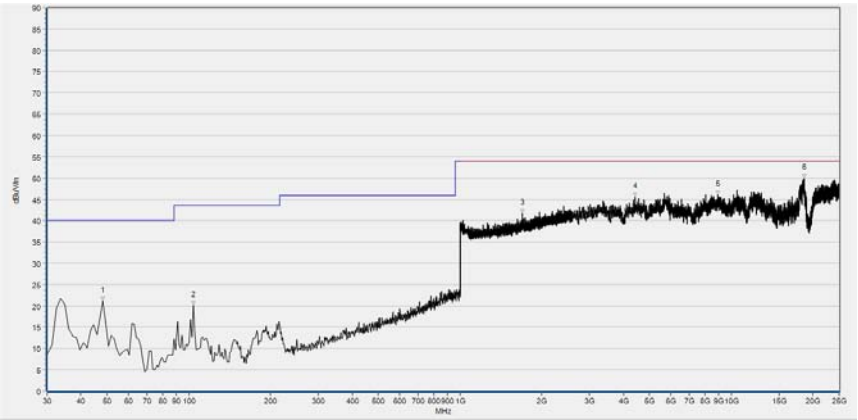


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
33.642	26.97	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
62.778	19.83	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
281.302	16.05	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2479.632	44.00	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
10433.279	48.07	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
18486.525	50.74	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

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

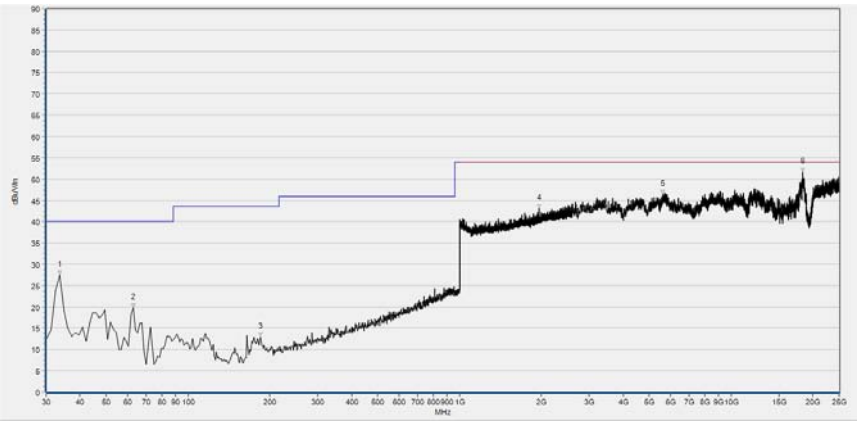
2.10.4.2 π/4-DQPSK Mode:

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
48.210	21.03	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
104.055	20.04	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1695.318	41.69	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
4424.914	45.59	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
8938.316	46.12	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
18523.186	49.99	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

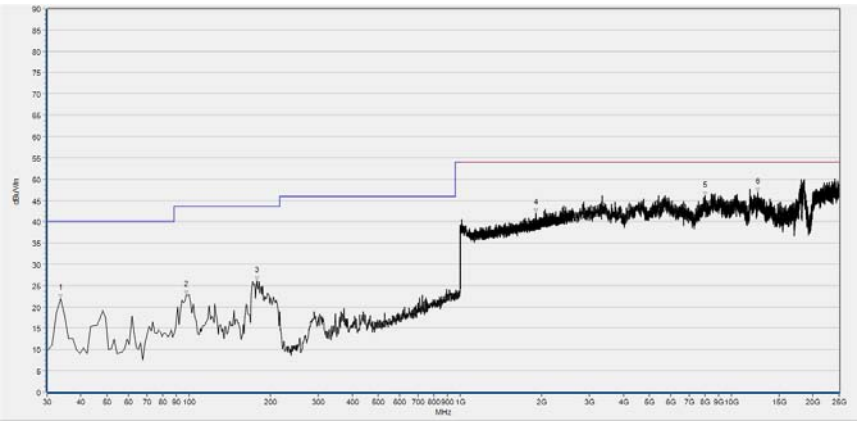
(30MHz to 25GHz, Antenna Horizontal @ π/4-DQPSK, channel 0)



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
33.642	27.54	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
62.778	19.78	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
184.180	12.91	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1957.183	43.00	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
5598.072	46.49	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
18400.982	51.70	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

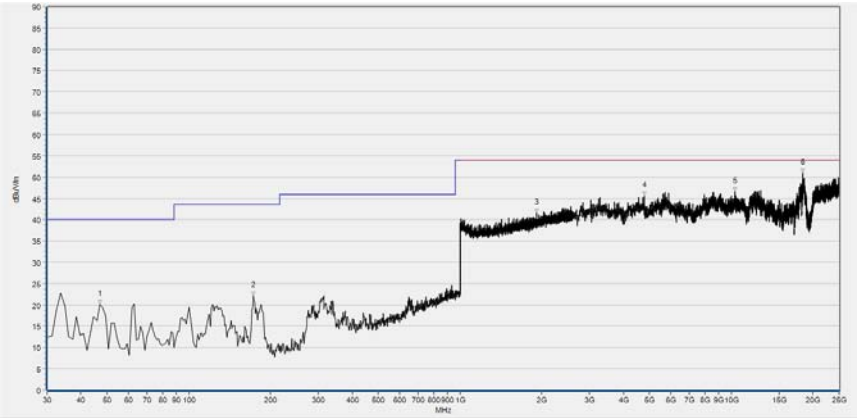
(30MHz to 25GHz, Antenna Vertical @ π/4-DQPSK, channel 0)

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
33.642	22.01	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
97.985	22.73	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
178.110	26.19	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1904.682	42.01	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
7981.051	46.08	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
12506.674	47.00	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

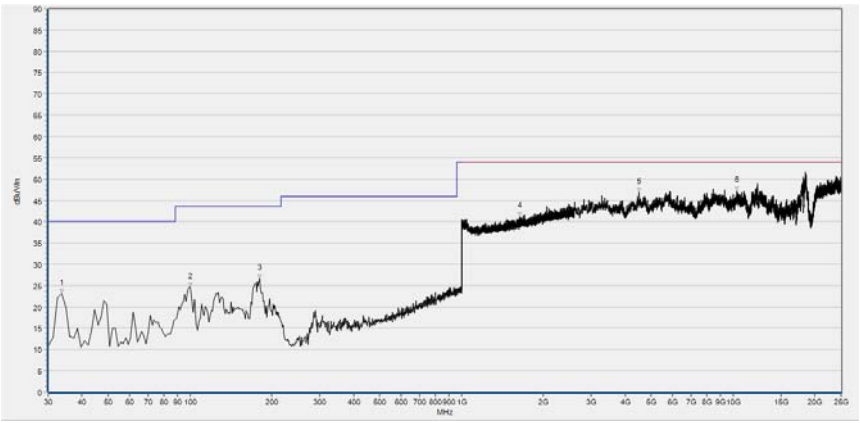
(30MHz to 25GHz, Antenna Horizontal @ π/4-DQPSK, channel 39)



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
46.996	20.04	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
173.254	22.17	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1914.926	41.61	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
4787.452	45.59	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
10319.222	46.63	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
18360.247	50.91	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

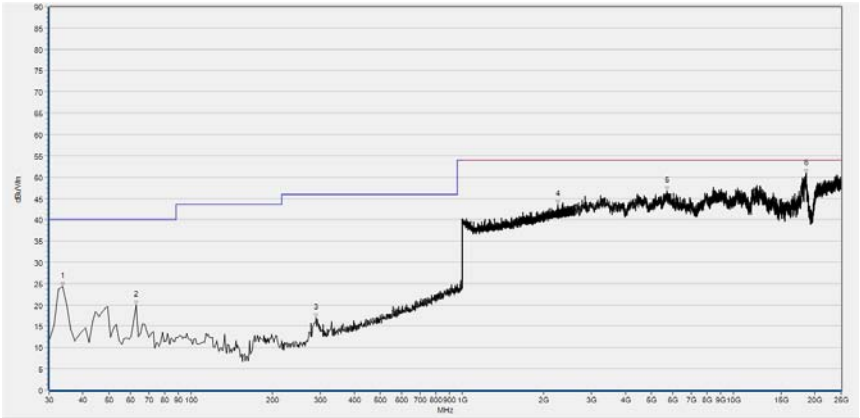
(30MHz to 25GHz, Antenna Vertical @ π/4-DQPSK, channel 39)

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
33.642	23.08	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
100.413	24.59	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
180.538	26.62	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1631.293	41.17	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
4510.456	46.94	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
10351.809	47.27	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

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

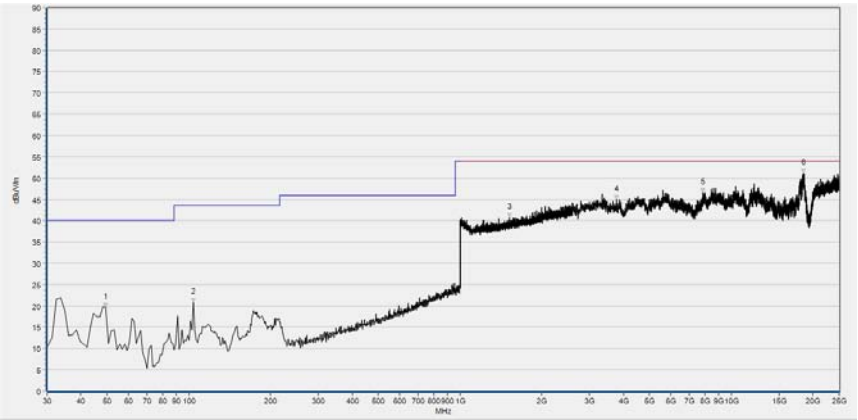


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
33.642	24.37	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
62.778	19.92	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
289.800	16.89	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2260.024	43.57	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
5699.909	46.78	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
18539.480	50.80	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

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

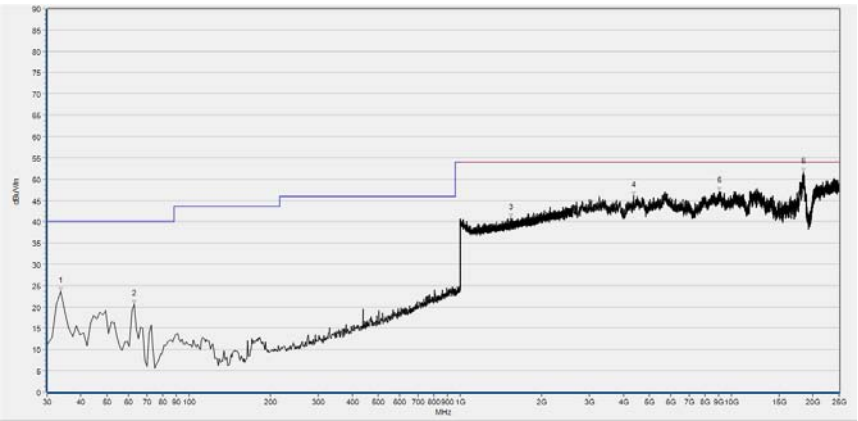
2.10.4.3 8-DPSK Mode:

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
49.424	19.58	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
104.055	20.70	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1521.168	40.73	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
3777.232	44.93	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
7875.141	46.57	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
18429.496	51.05	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

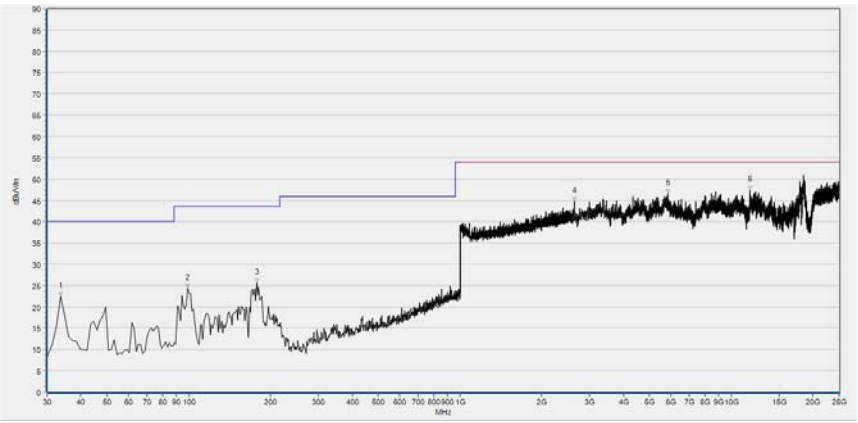
(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 0)



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
33.642	23.69	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
62.778	20.54	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
1541.016	40.86	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
4367.885	46.02	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
9032.006	47.09	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
18519.113	51.61	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

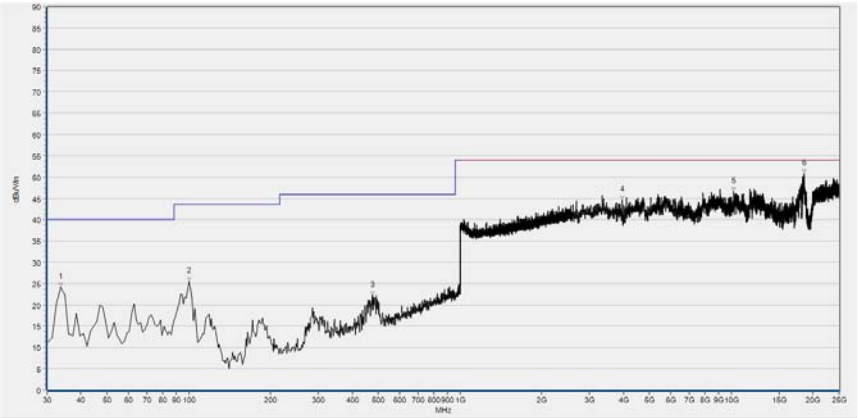
(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 0)

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
33.642	22.44	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
99.199	24.24	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
178.110	25.67	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2640.735	44.69	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
5842.480	46.57	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
11732.715	47.35	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS

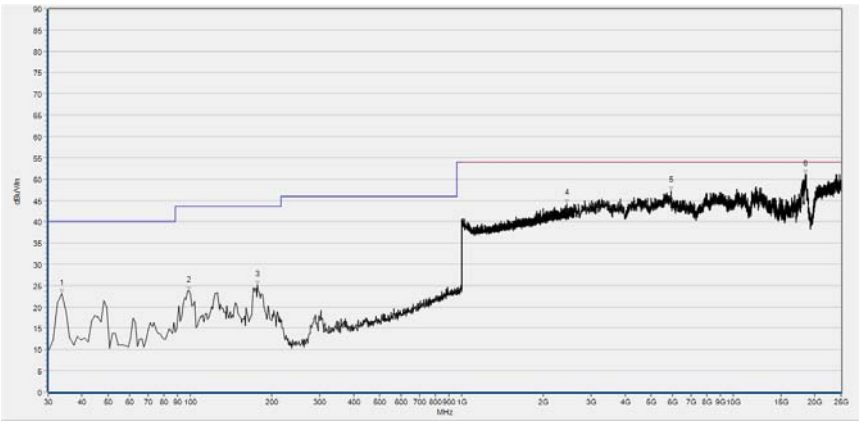
(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 39)



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
33.642	24.07	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
100.413	25.56	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
474.330	22.08	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
3956.465	44.52	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
10225.532	46.51	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
18551.700	50.80	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

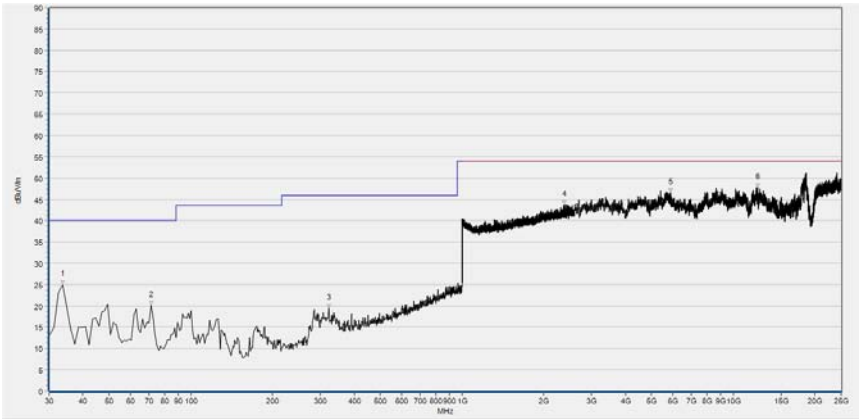
(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 39)

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
33.642	23.05	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
99.199	23.79	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
176.896	25.14	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2446.339	44.24	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
5899.509	47.33	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
18433.570	51.09	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
33.642	24.91	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
71.277	20.07	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
322.578	19.48	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2375.270	43.81	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
5875.068	46.63	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
12274.486	47.85	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, 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

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

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