REPORT No. : SZ18010222W02

TEST REPORT

APPLICANT	:	Cleer Limited
PRODUCT NAME	:	Portable Bluetooth Speaker with Alexa Voice Service
MODEL NAME	:	STAGE
BRAND NAME	:	Cleer
FCC ID	:	2AETW-1251
STANDARD(S)	:	47 CFR Part 15 Subpart C
TEST DATE	:	2018-01-29 to 2018-01-30
ISSUE DATE	:	2018-01-31

Tested by: Su Hang

Su Hang (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	2018-01-31	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Cleer Limited
Applicant Address:	Unit518, Lakeside 1, Science Park West Ave. HK Science Park, Hong Kong
Manufacturer:	Cleer Limited
Manufacturer Address:	Unit518, Lakeside 1, Science Park West Ave. HK Science Park, Hong Kong

1.2. Equipment Under Test (EUT) Description

Product Name:	Portable Bluetooth Speaker with Alexa Voice Service
Serial No:	(N/A, marked #1 by test site)
Hardware Version:	V2
Software Version:	2.04.1
Modulation Type:	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:	PIFA Antenna
Antenna Gain:	2.0 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: 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 3: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C (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 29, 2018	Su Hang	PASS
3	15.247(b)	Peak Output Power	Jan 29, 2018	Su Hang	PASS
4	15.247(a)	20dB Bandwidth	Jan 29, 2018	Su Hang	PASS
5	15.247(a)	Carrier Frequency Separation	Jan 29, 2018	Su Hang	PASS
6	15.247(a)	Time of Occupancy (Dwell time)	Jan 29, 2018	Su Hang	PASS
7	15.247(d)	Conducted Spurious Emission	Jan 29, 2018	Su Hang	PASS
8	15.247(d)	Restricted Frequency Bands	Jan 30, 2018	Wen Zhichao	PASS
9	15.209, 15.247(d)	Radiated Emission	Jan 29, 2018	Wen Zhichao	PASS
10	15.207	Conducted Emission	Jan 30, 2018	Wen Zhichao	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.

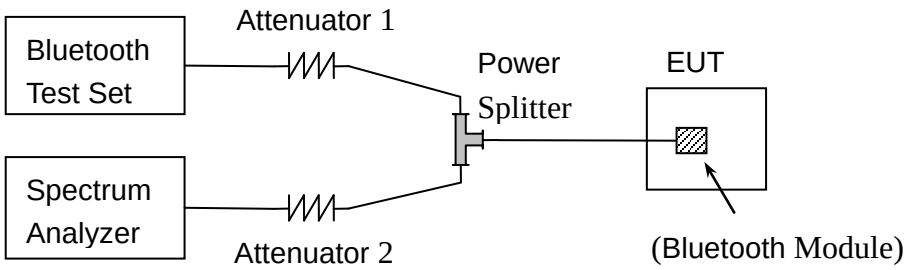
2.2. Number of Hopping Frequency

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

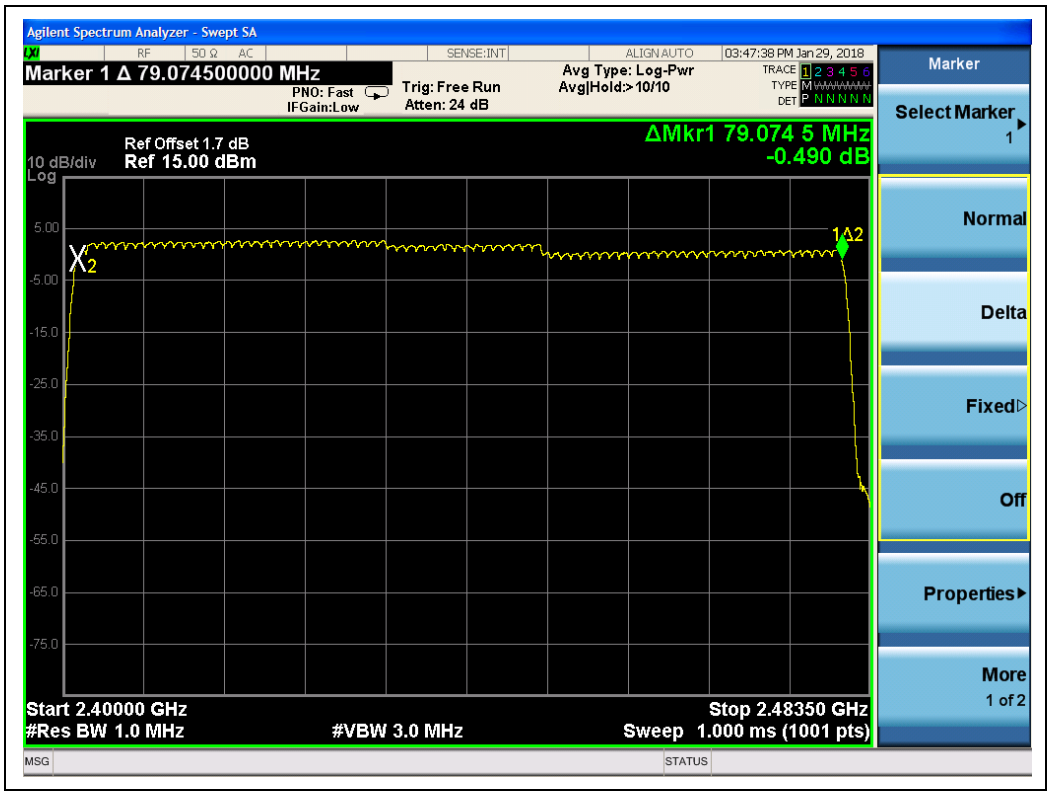
2.2.4. Test Result

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.

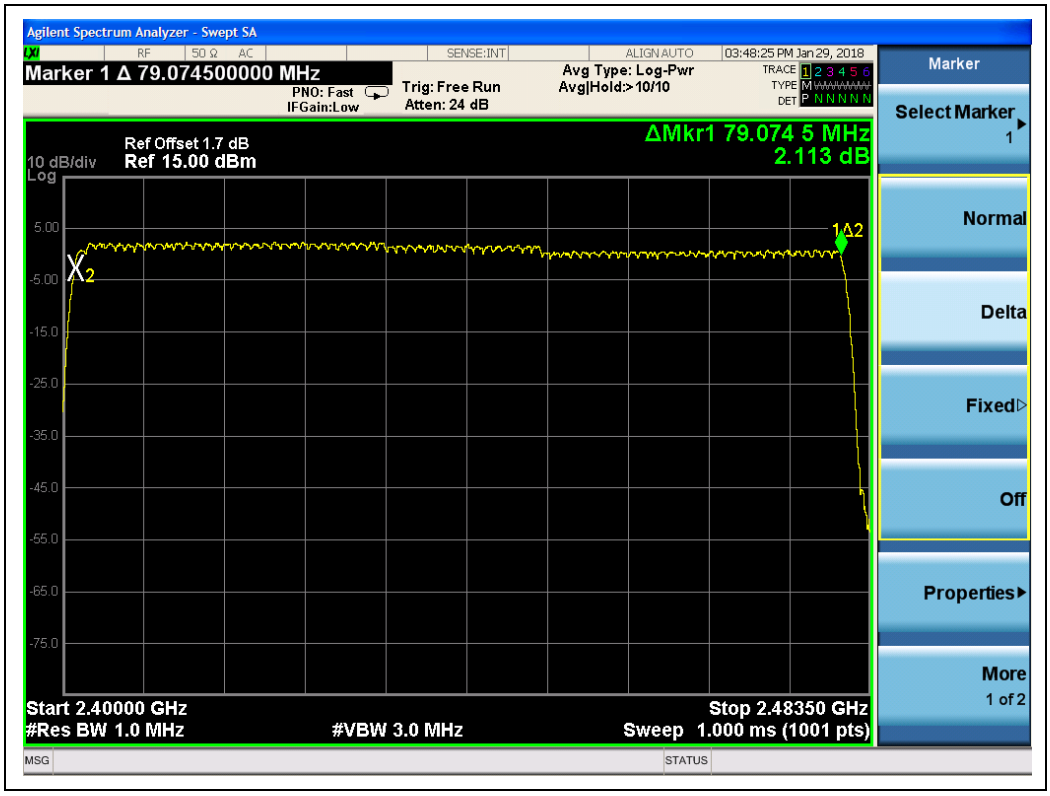
A. Test Verdict:

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

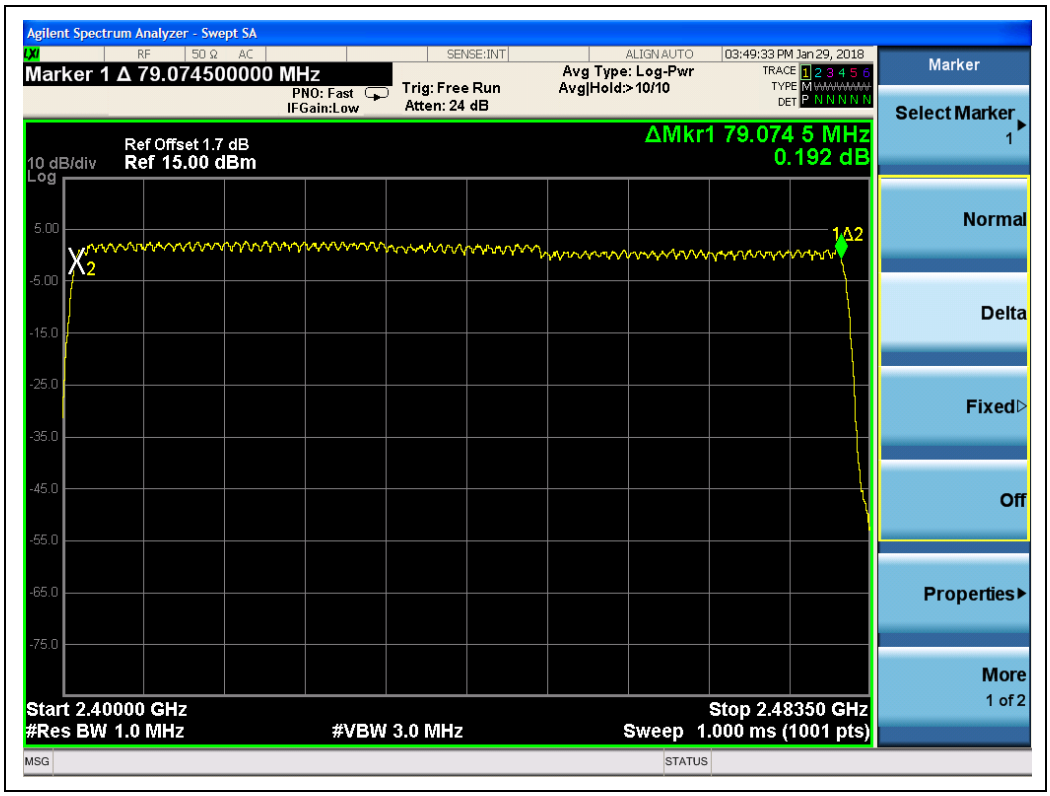
B. Test Plots:



(GFSK)



(π/4-DQPSK)



(8- DPSK)

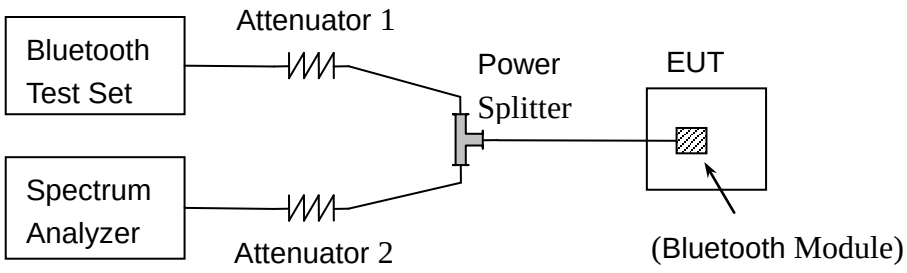
2.3. Peak Output Power

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

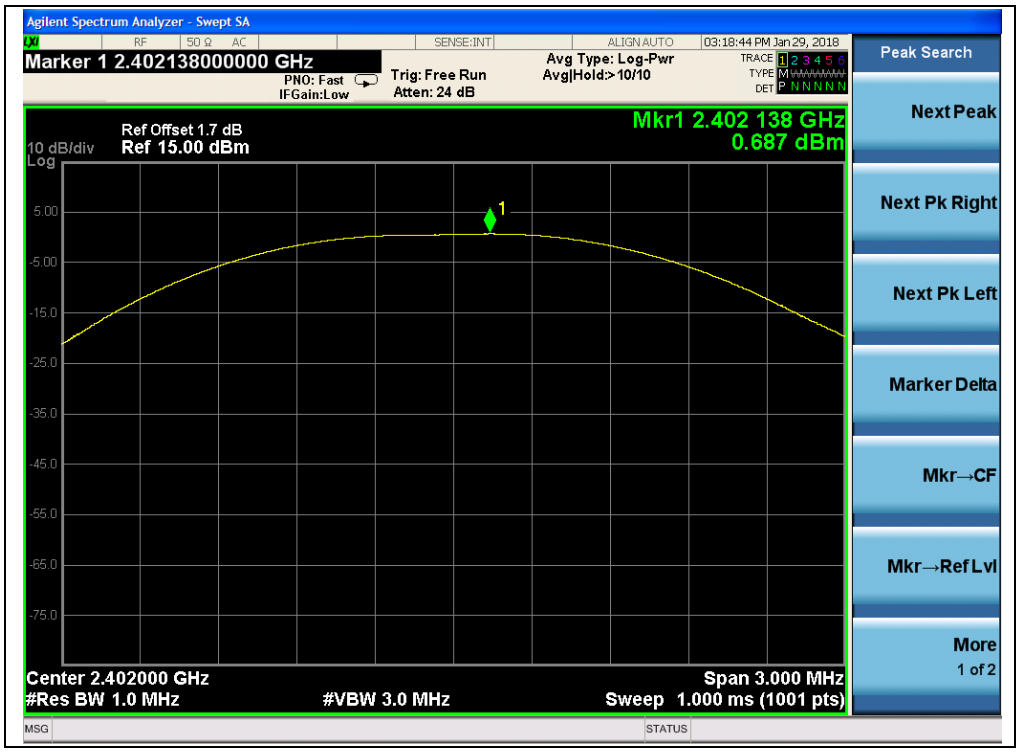
The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the module. The lowest, middle and highest channel were tested by USB Wideband Power Sensor.

2.3.3.1 GFSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	0.69	0.00117	30	1	PASS
39	2441	1.79	0.00151			PASS
78	2480	0.68	0.00117			PASS

B. Test Plots:



(GFSK, Channel 0, 2402MHz)

(GFSK, Channel 19, 2440MHz)

(GFSK, Channel 39, 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	1.27	0.00134	30	1	PASS
39	2441	2.01	0.00159			PASS
78	2480	1.05	0.00127			PASS

B. Test Plots:

(π/4-DQPSK, Channel 0, 2402MHz)

(π/4-DQPSK, Channel 19, 2440MHz)

(π/4-DQPSK, Channel 39, 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	1.71	0.00148	30	1	PASS
39	2441	2.45	0.00176			PASS
78	2480	1.44	0.00139			PASS

B. Test Plots:

(8-DPSK, Channel 0, 2402MHz)

(8-DPSK, Channel 19, 2440MHz)

(8-DPSK, Channel 39, 2480MHz)

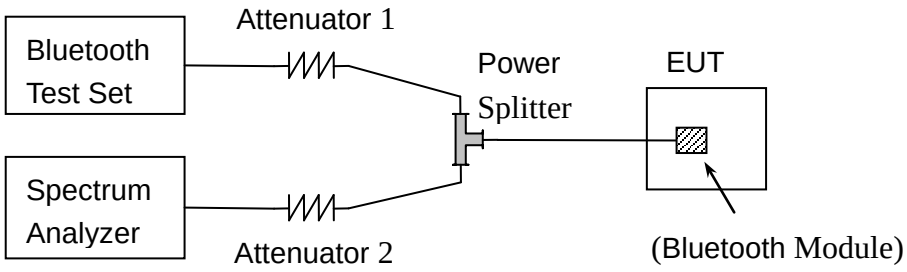
2.4. 20dB Bandwidth

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:



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

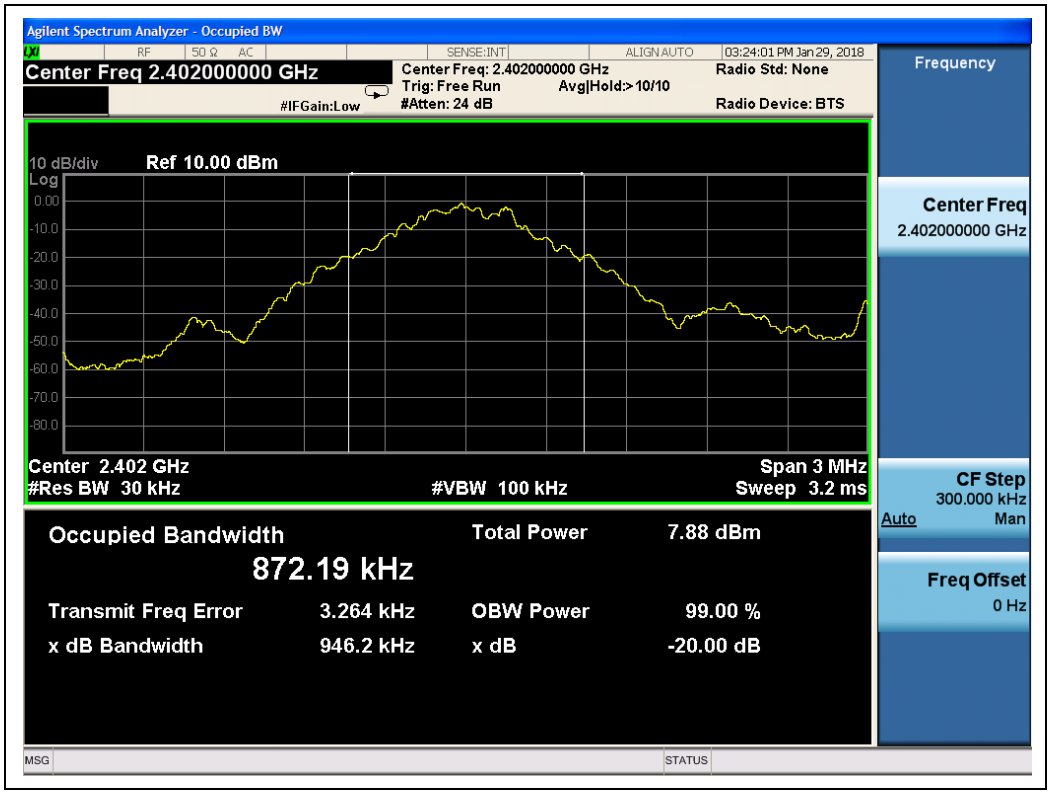
The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to record the 20dB bandwidth of the Module.

2.4.4.1 GFSK Mode

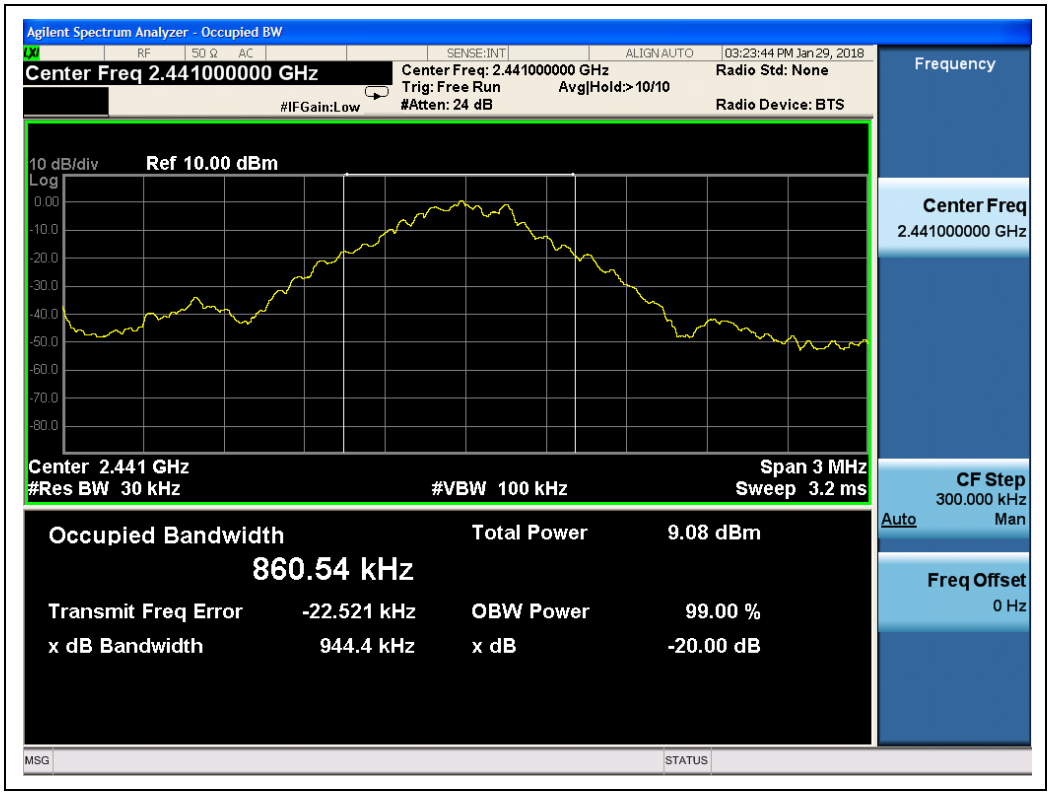
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	0.9462	PASS
39	2441	0.9444	PASS
78	2480	0.9469	PASS

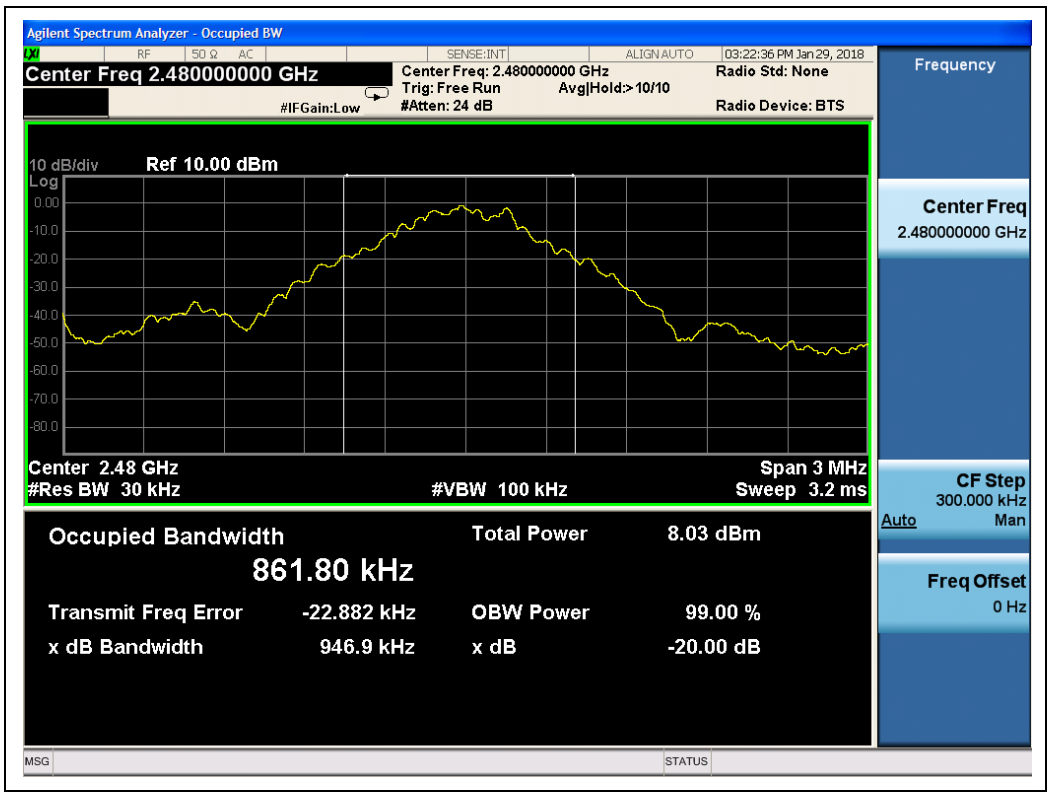
B. Test Plots:



(GFSK, Channel 0, 2402MHz)



(GFSK, Channel 19, 2440MHz)



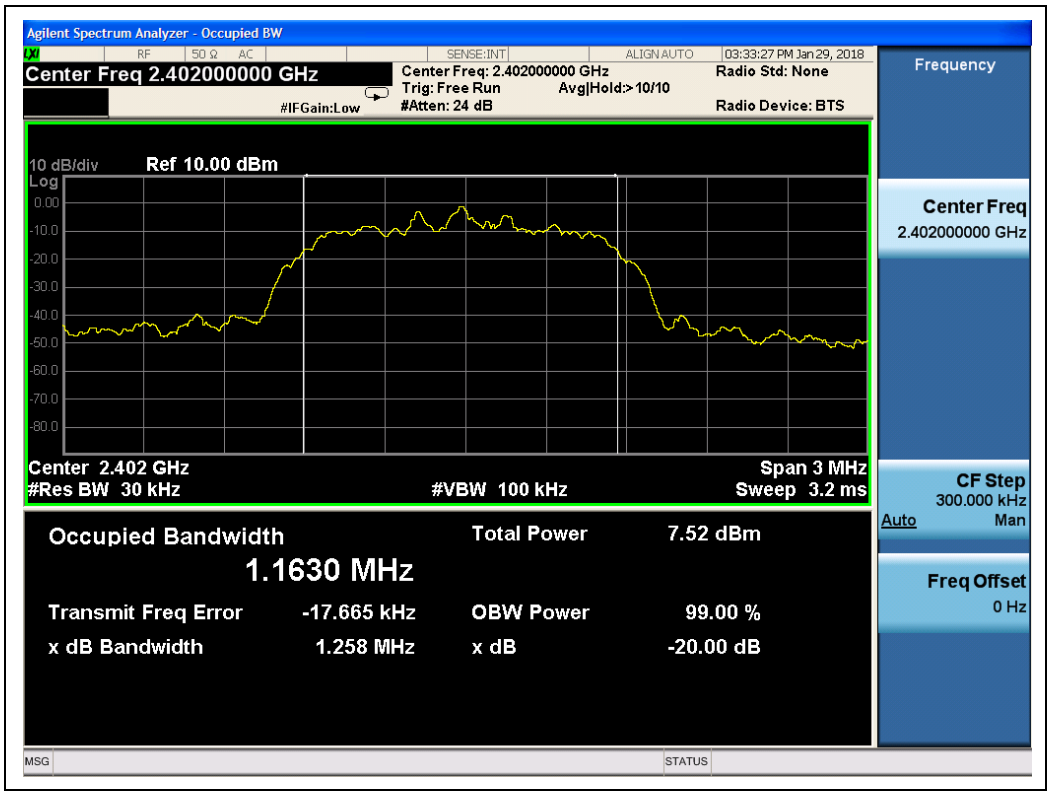
(GFSK, Channel 39, 2480MHz)

2.4.4.2 π/4-DQPSK Mode

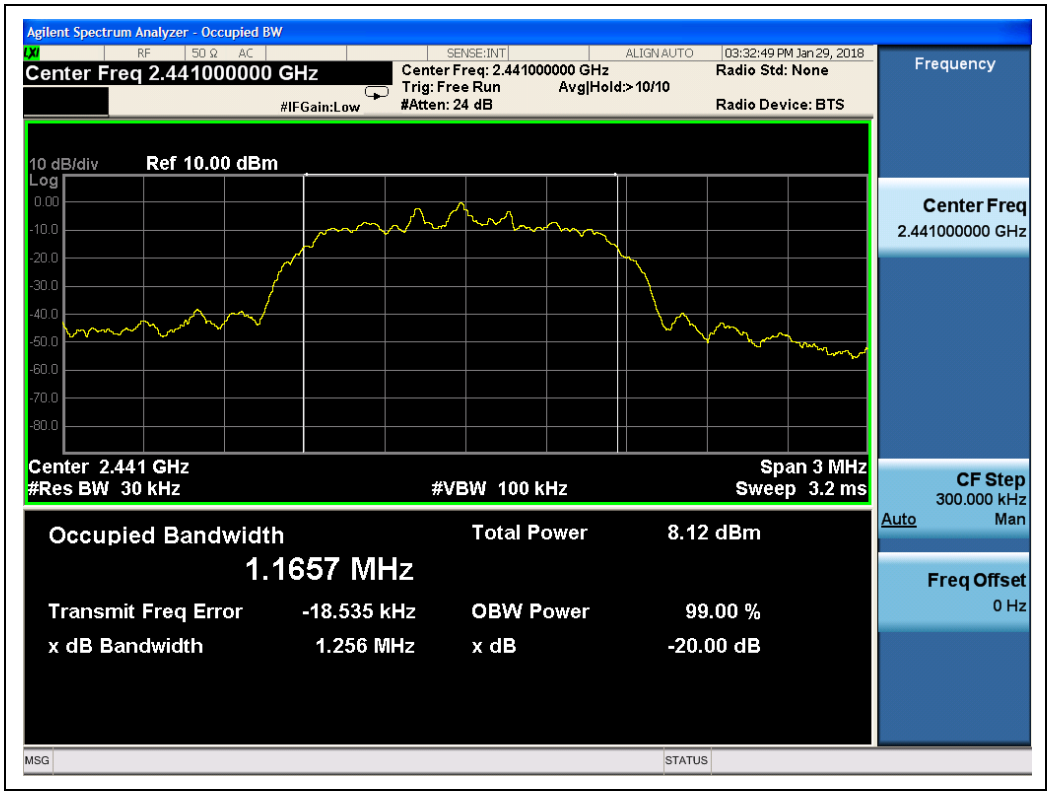
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.258	PASS
39	2441	1.256	PASS
78	2480	1.250	PASS

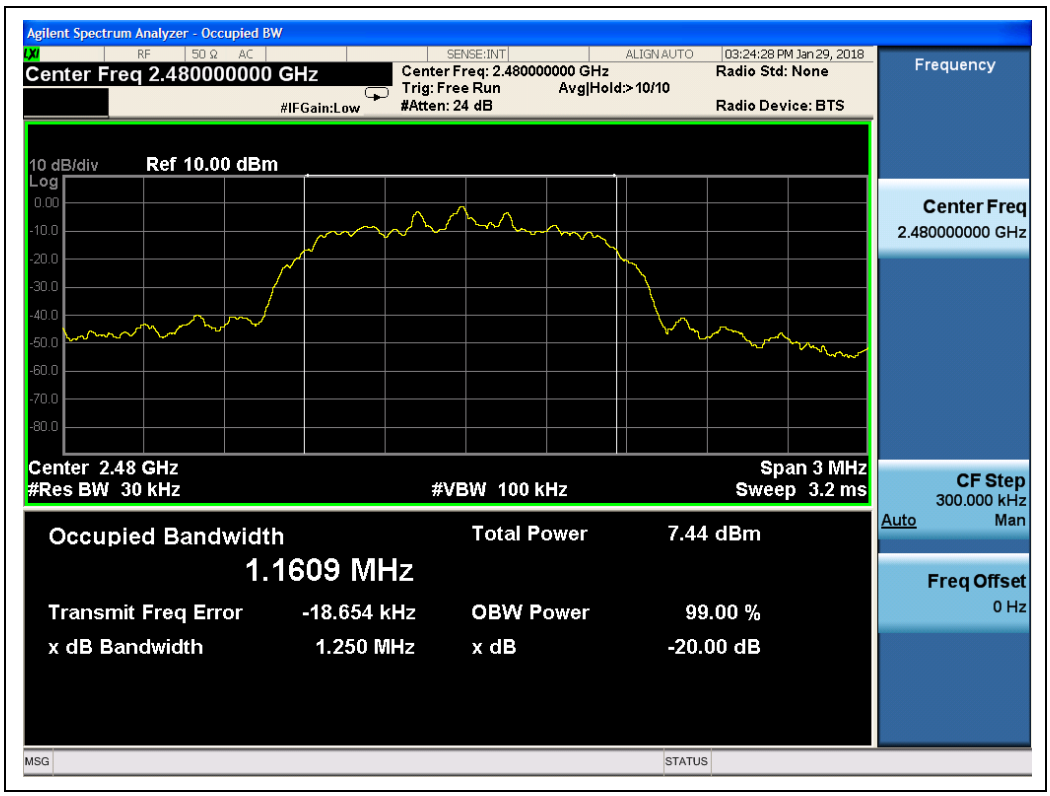
B. Test Plots:



(π/4-DQPSK, Channel 0, 2402MHz)



(π/4-DQPSK, Channel 19, 2440MHz)



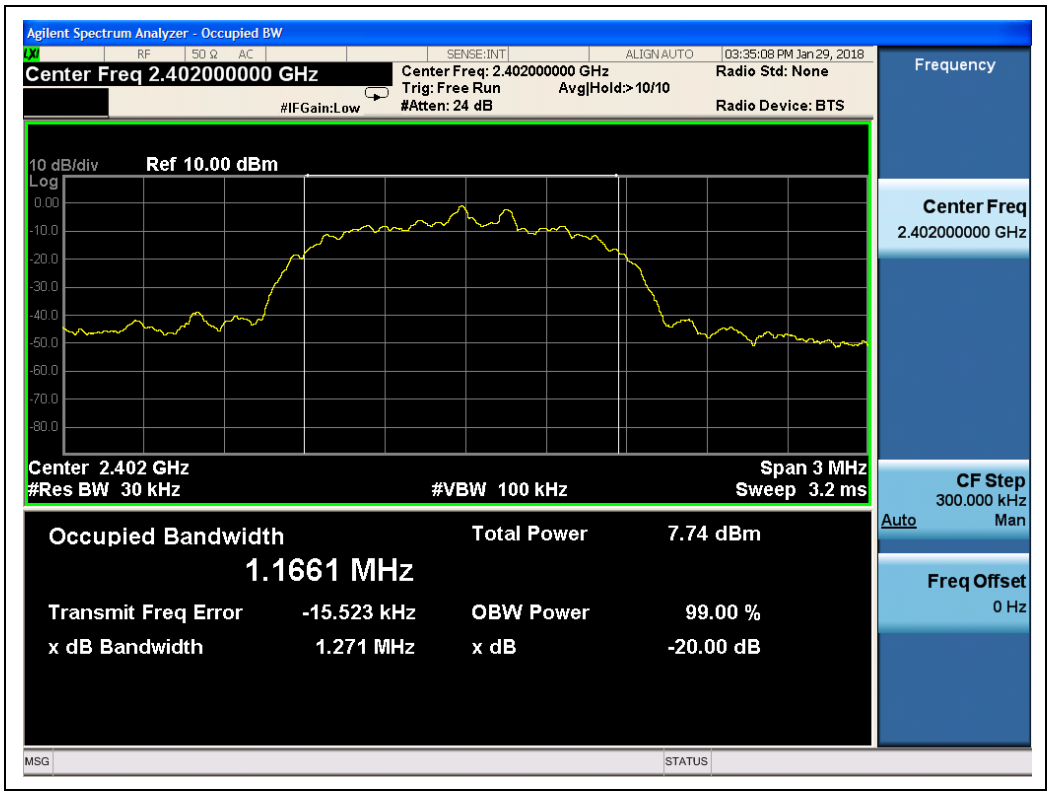
(π/4-DQPSK, Channel 39, 2480MHz)

2.4.4.3 8-DPSK Mode

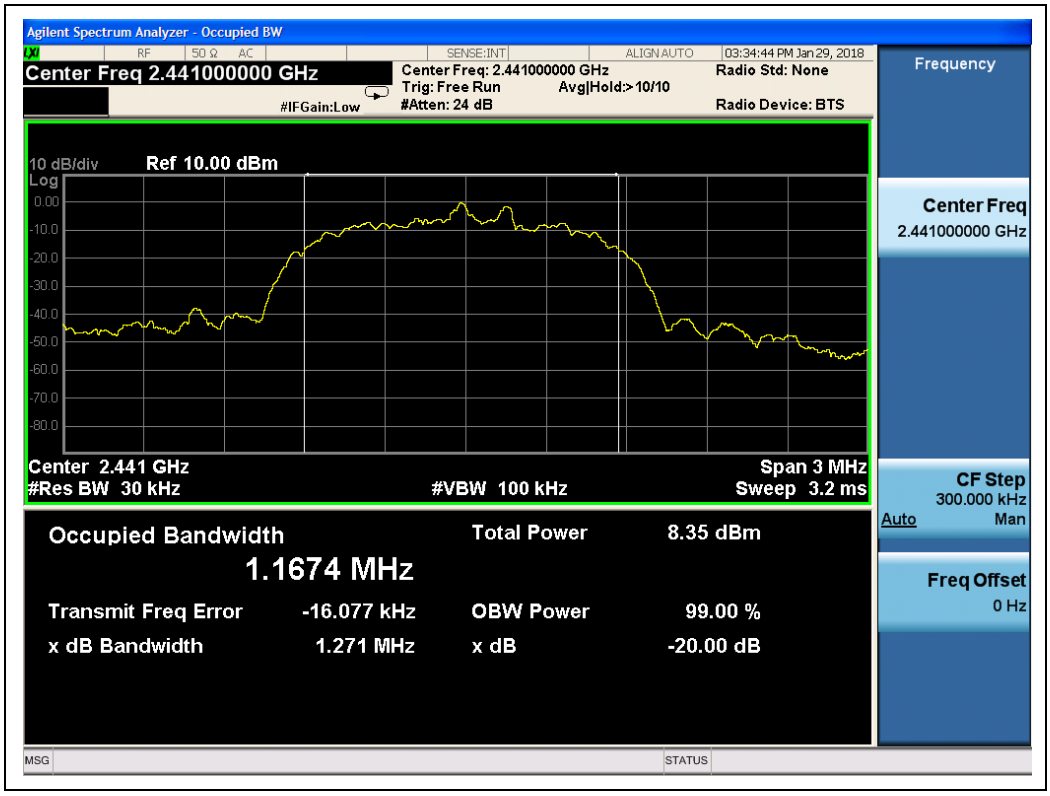
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.271	PASS
39	2441	1.271	PASS
78	2480	1.273	PASS

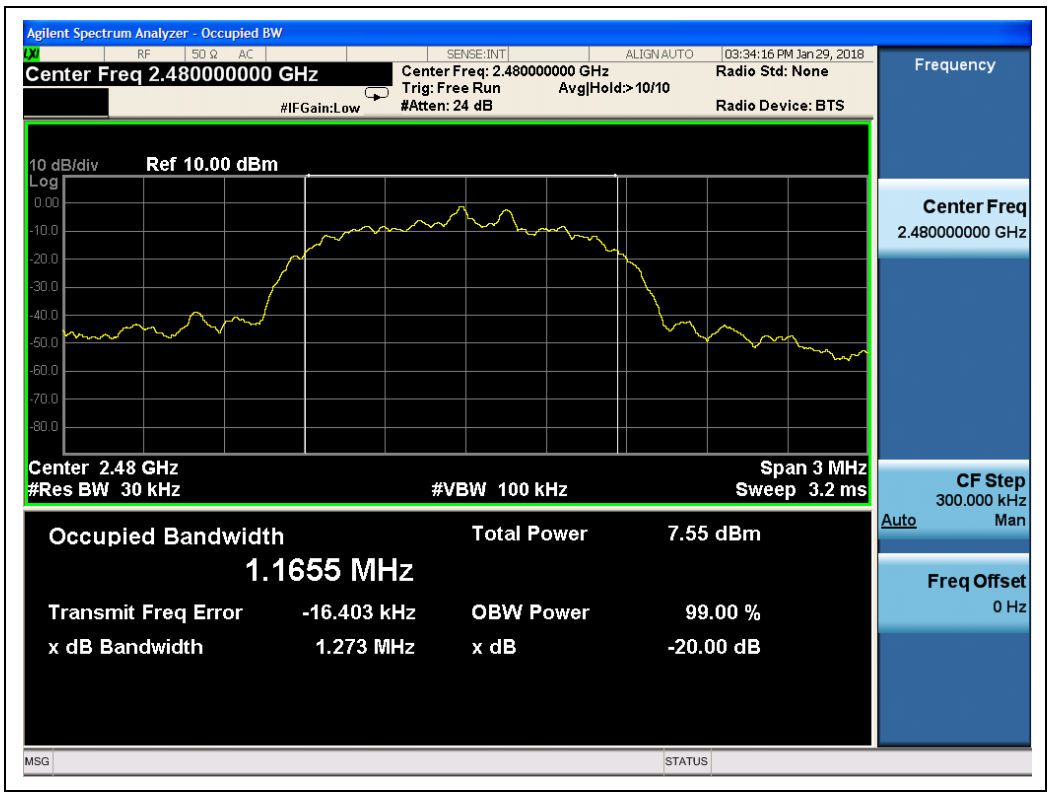
B. Test Plots:



(8-DPSK, Channel 0, 2402MHz)



(8-DPSK, Channel 19, 2440MHz)



(8-DPSK, Channel 39, 2480MHz)

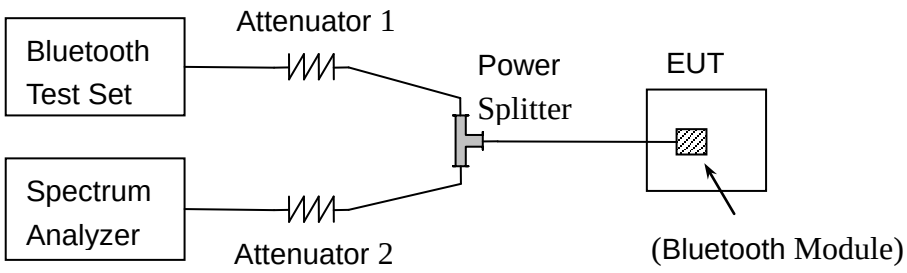
2.5. Carried Frequency Separation

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:



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B. Equipments List:

Please reference ANNEX A(1.5).

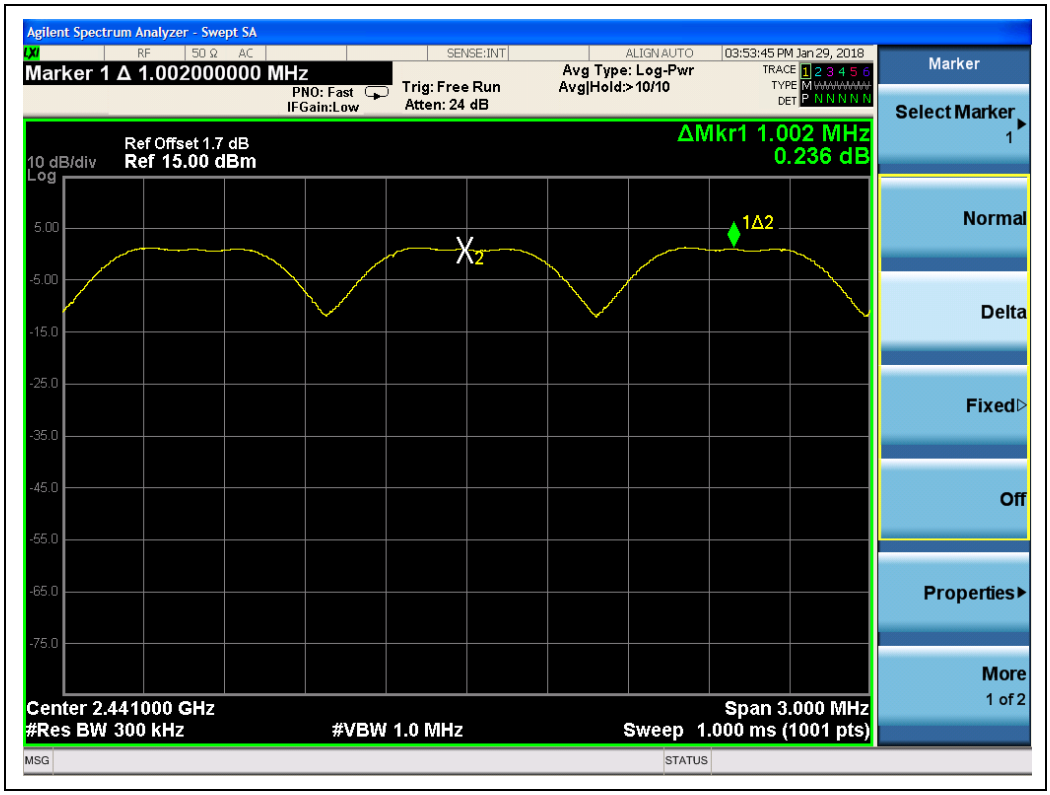
2.5.3. Test Procedure

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

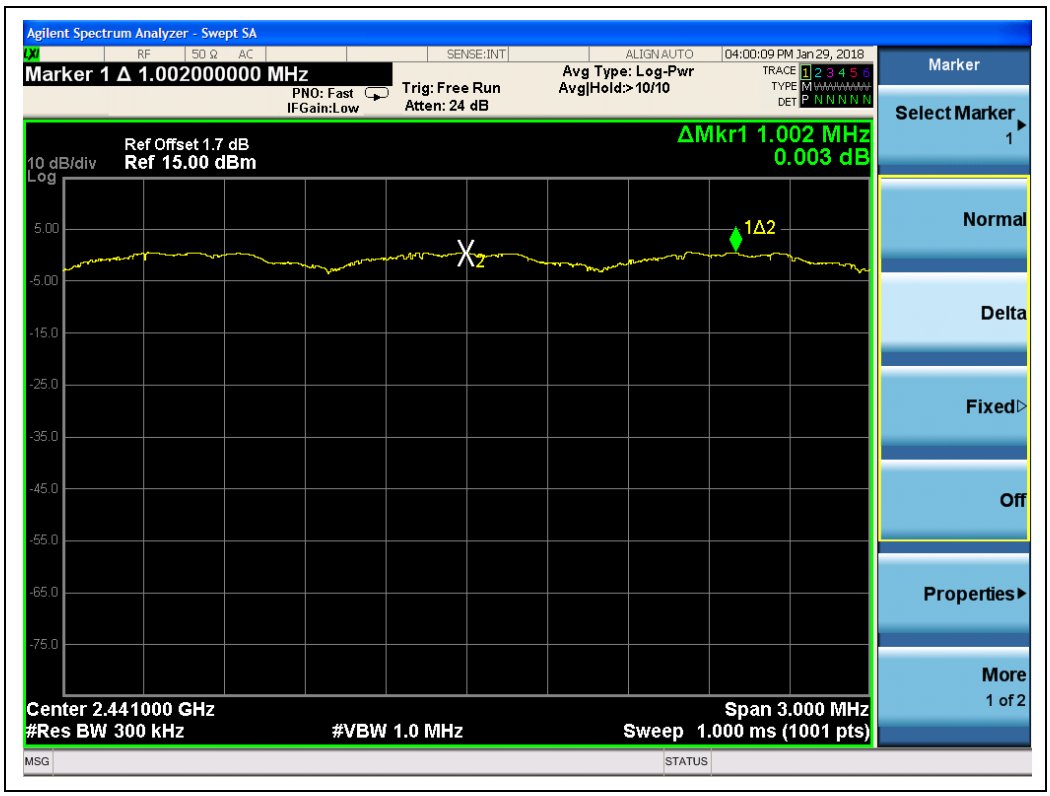
The Bluetooth Module operates at hopping-on test mode. For any adjacent channels (e.g. the channel 39 and 40 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (refer to section 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	0.9444	two-thirds of the 20dB bandwidth	PASS
π/4-DQPSK	39 and 40	1.002	1.250		PASS
8-DPSK	39 and 40	1.002	1.271		PASS



(GFSK)

(π/4-DQPSK)



(8-DPSK)

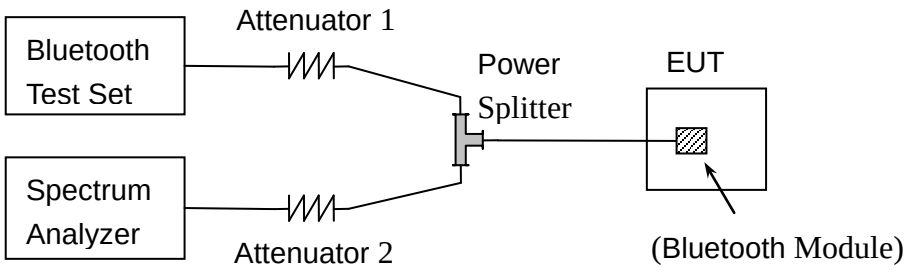
2.6. Time of Occupancy (Dwell time)

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:



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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.

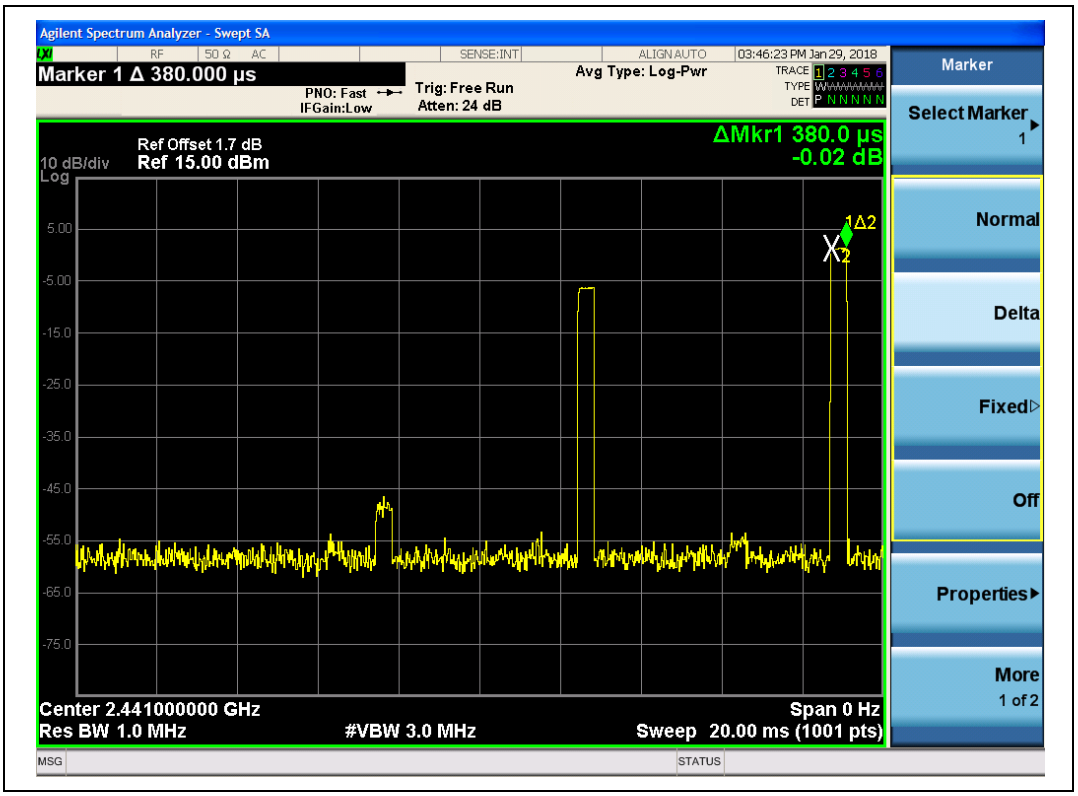
2.6.4. Test Result

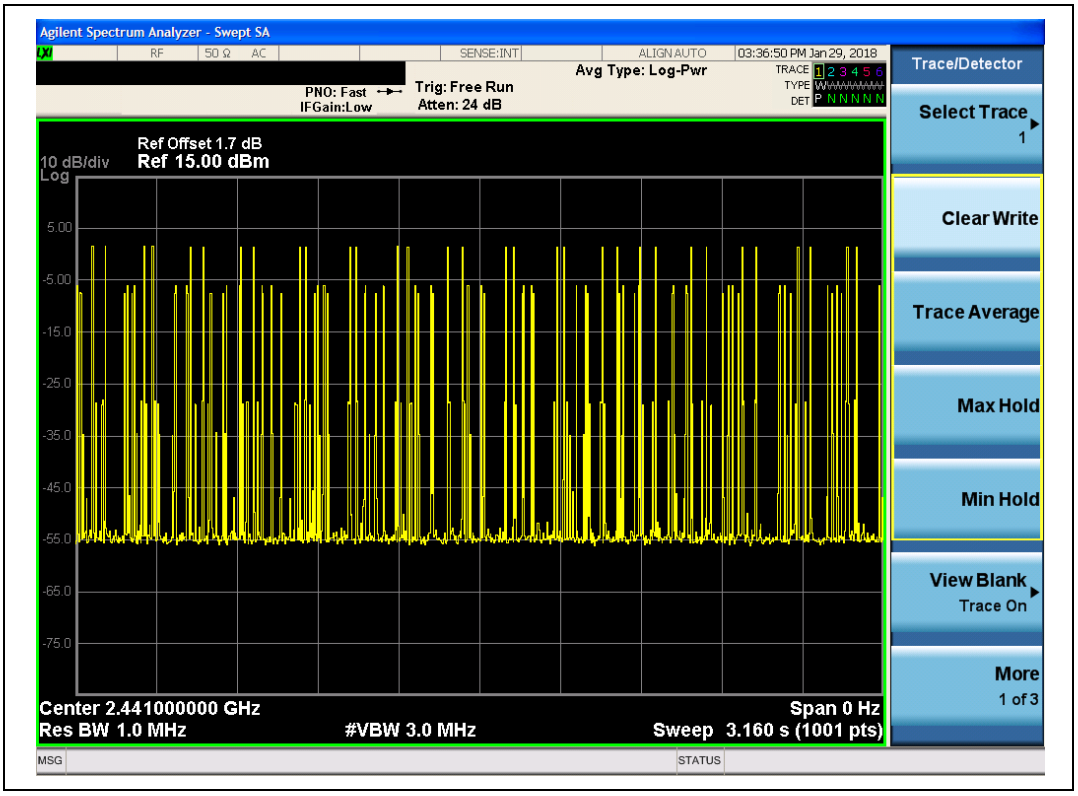
2.6.4.1 GFSK Mode

A. Test Verdict:

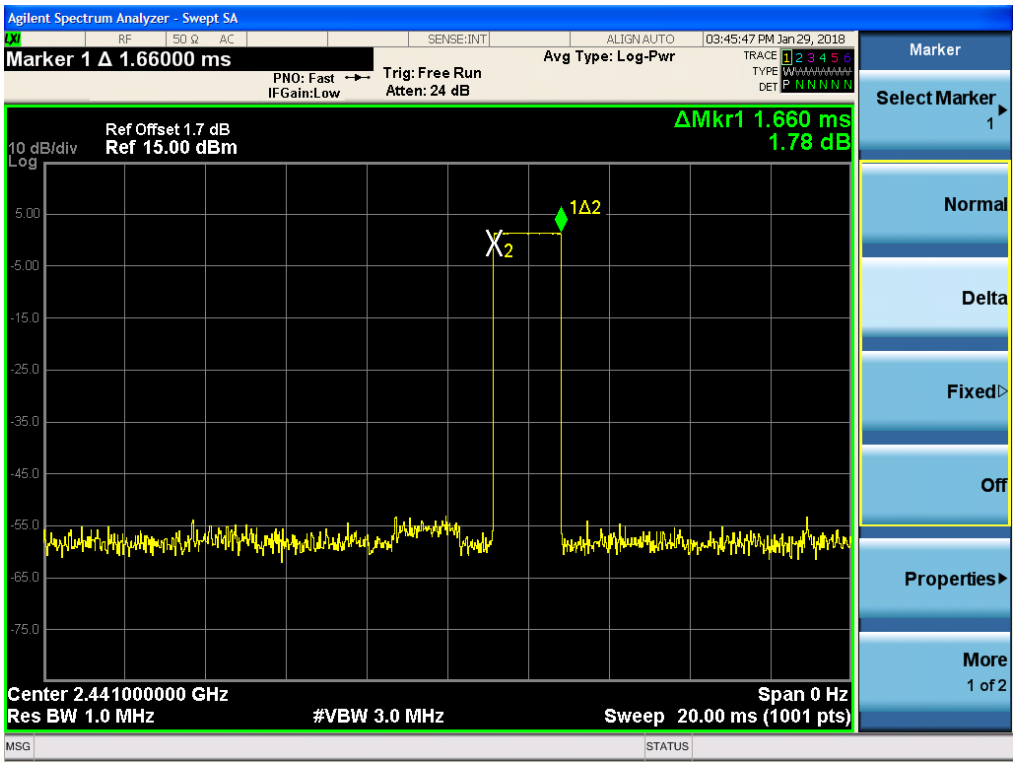
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.38	32	0.01216	0.1216	0.4	PASS
DH3	1.66	17	0.02822	0.2822		PASS
DH5	2.88	10	0.02880	0.2880		PASS

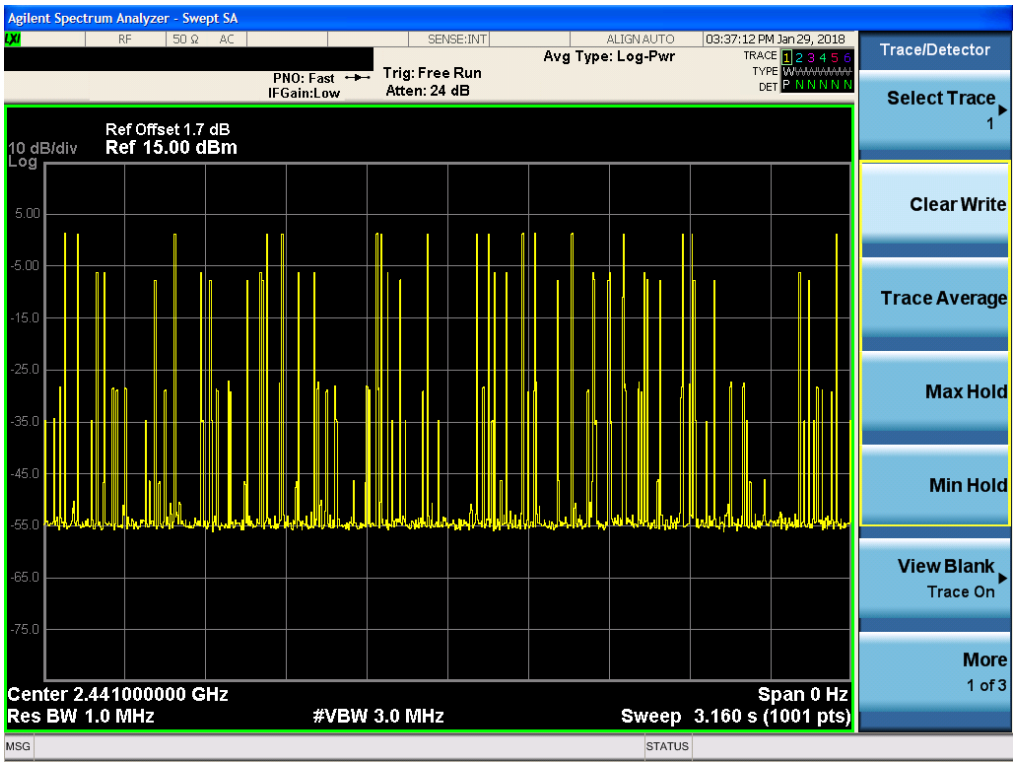
B. Test Plots:



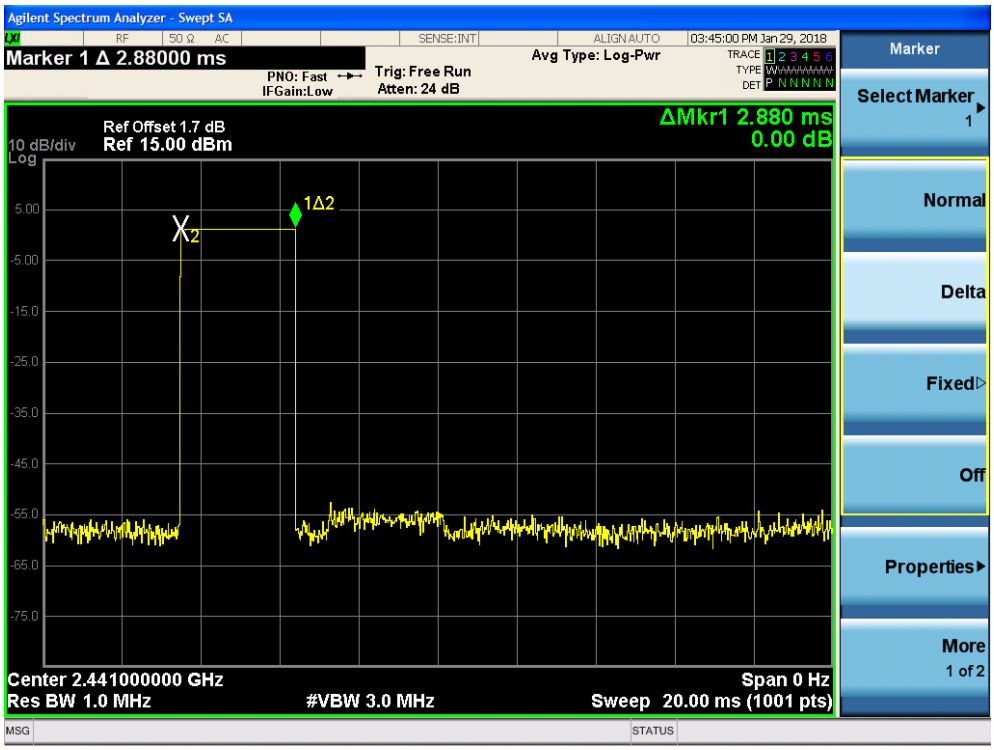

Agilent Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
03:36:50 PM Jan 29, 2018
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W
DET P N N N N N
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 24 dB
Ref Offset 1.7 dB
10 dB/div
Log
Ref 15.00 dBm
5.00
-5.00
-15.0
-25.0
-35.0
-45.0
-55.0
-65.0
-75.0
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

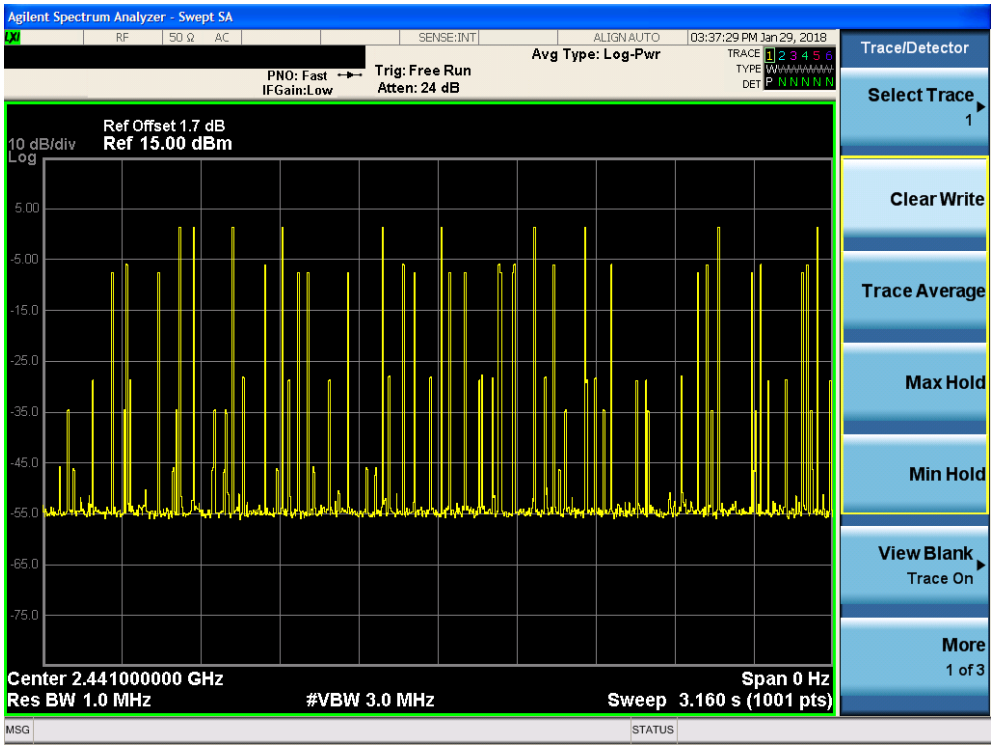
(DH1, GFSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 1.66000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 24 dB
Avg Type: Log-Pwr
03:45:47 PM Jan 29, 2018
Ref Offset 1.7 dB
10 dB/div
Log
Ref 15.00 dBm
ΔMkr1 1.660 ms
1.78 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
Normal
Delta
Fixed
Off
Properties
More
1 of 2


Agilent Spectrum Analyzer - Swept SA
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 24 dB
Avg Type: Log-Pwr
03:37:12 PM Jan 29, 2018
Ref Offset 1.7 dB
10 dB/div
Log
Ref 15.00 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: 24 dB
Avg Type: Log-Pwr
03:45:00 PM Jan 29, 2018
Ref Offset 1.7 dB
10 dB/div
Ref 15.00 dBm
ΔMkr1 2.880 ms
0.00 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
Normal
Delta
Fixed
Off
Properties
More
1 of 2


Agilent Spectrum Analyzer - Swept SA
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 24 dB
Avg Type: Log-Pwr
03:37:29 PM Jan 29, 2018
Ref Offset 1.7 dB
10 dB/div
Ref 15.00 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

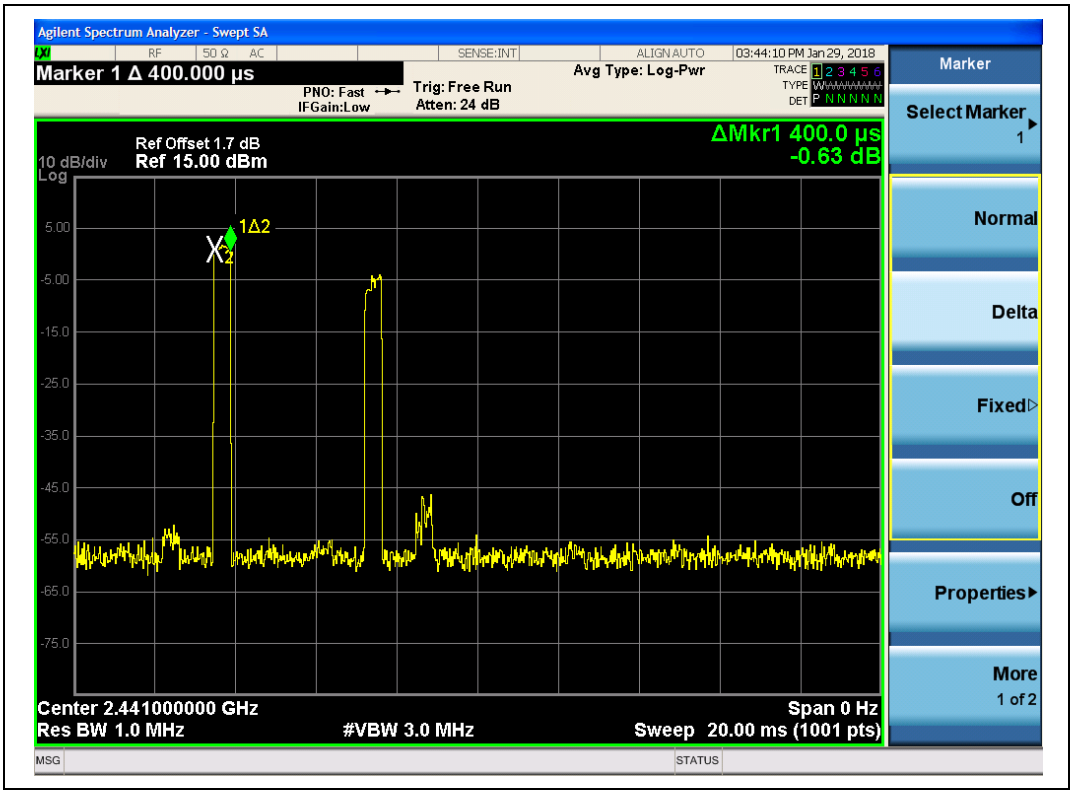
(DH5, GFSK)

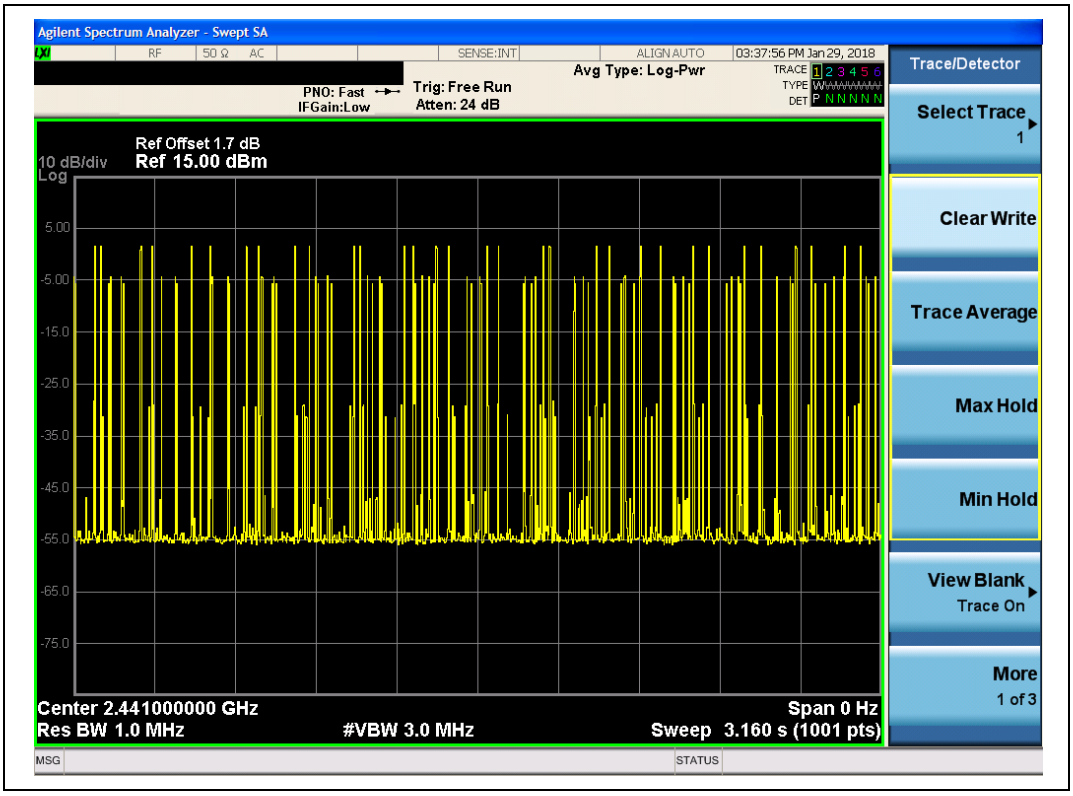
2.6.4.2 π/4-DQPSK Mode

A. Test Verdict:

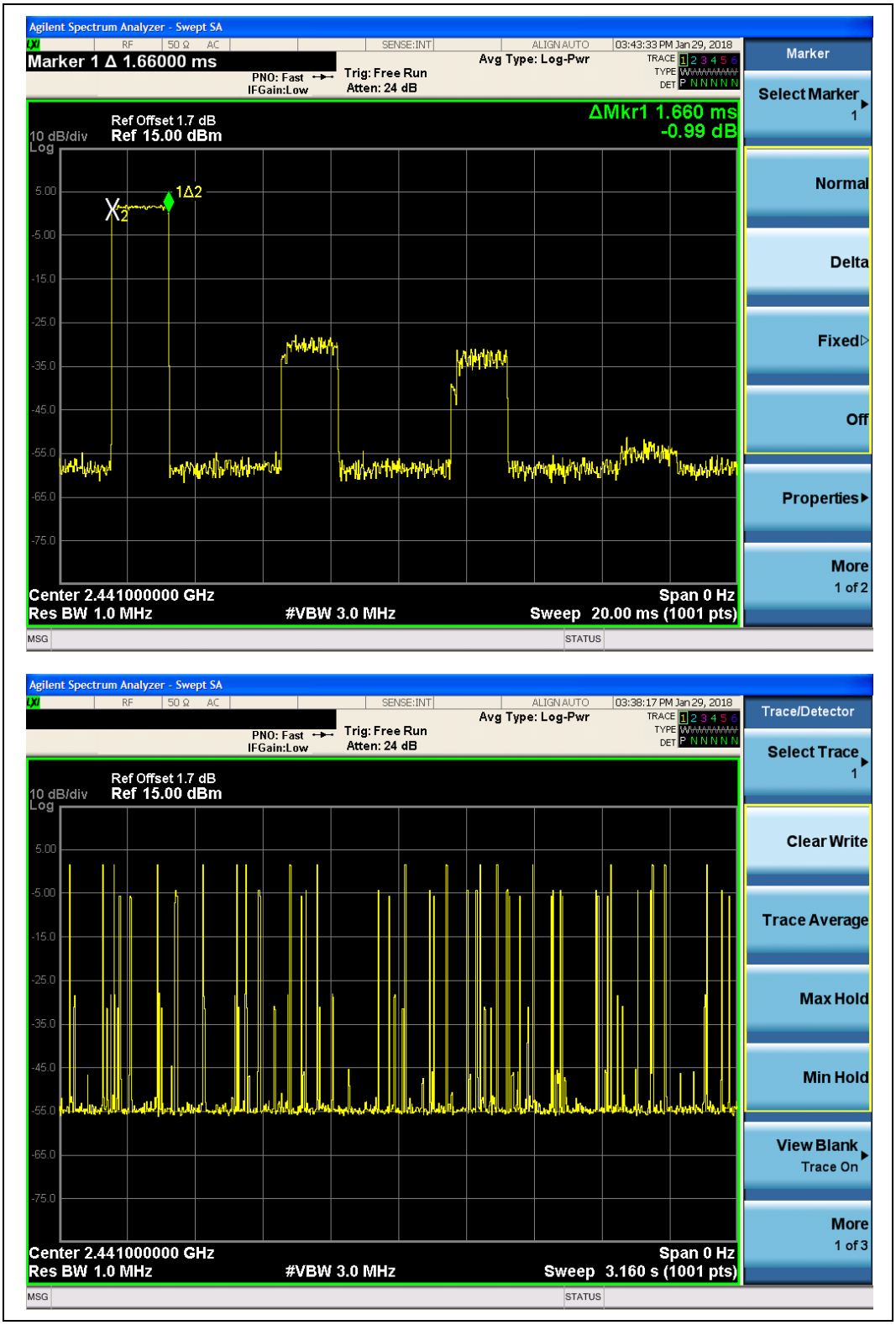
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.40	32	0.01280	0.1280	0.4	PASS
DH3	1.66	18	0.02988	0.2988		PASS
DH5	2.90	10	0.02900	0.2900		PASS

B. Test Plots:

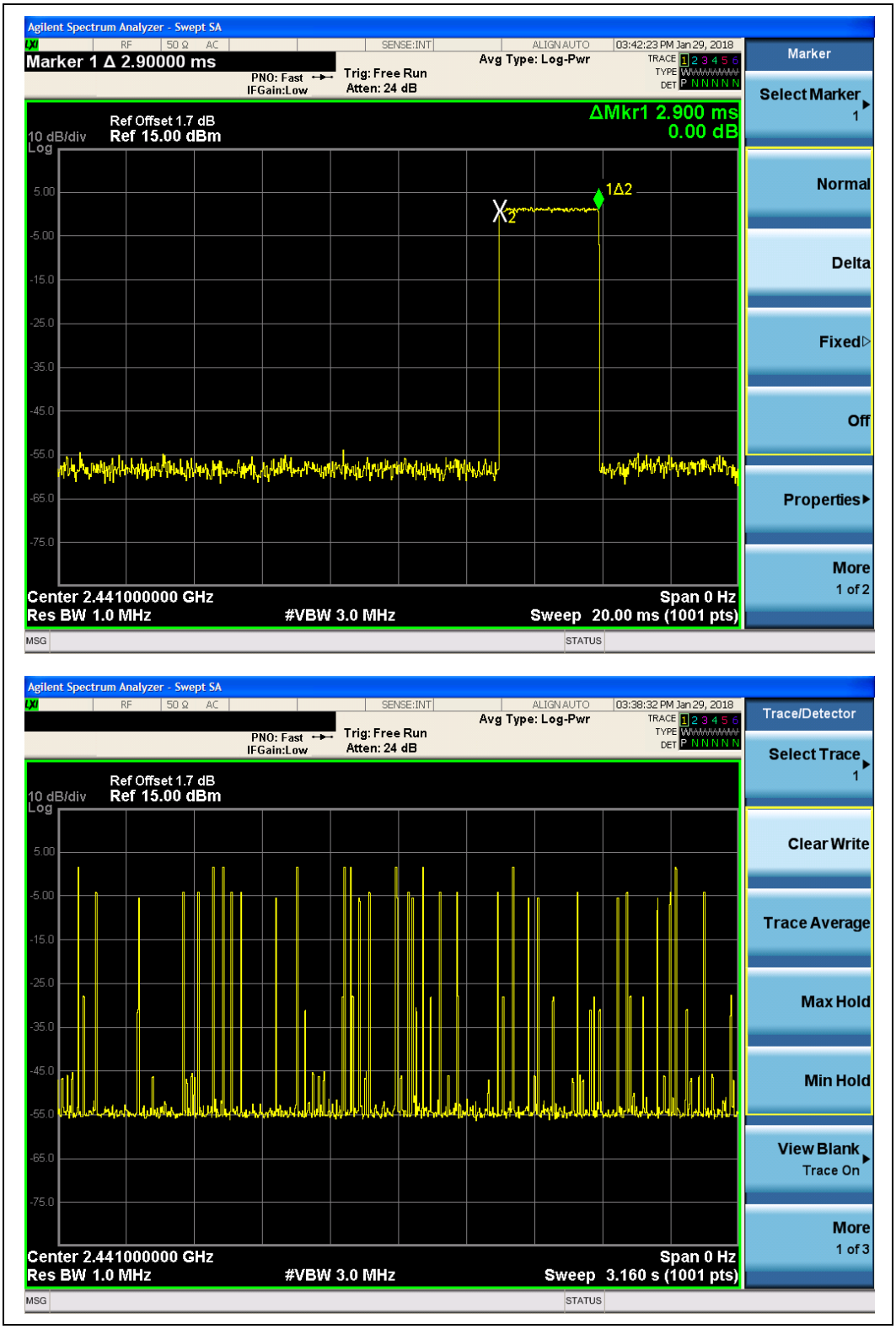



Agilent Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
03:37:56 PM Jan 29, 2018
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W
DET P N N N N N
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 24 dB
Ref Offset 1.7 dB
10 dB/div
Log
Ref 15.00 dBm
5.00
-5.00
-15.0
-25.0
-35.0
-45.0
-55.0
-65.0
-75.0
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, π/4-DQPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 1.66000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 24 dB
Avg Type: Log-Pwr
03:43:33 PM Jan 29, 2018
Ref Offset 1.7 dB
10 dB/div
Ref 15.00 dBm
ΔMkr1 1.660 ms
-0.99 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
03:38:17 PM Jan 29, 2018
Trace/Detector
Select Trace
Clear Write
Trace Average
Max Hold
Min Hold
View Blank
Trace On
More
1 of 3
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)

(DH3, π/4-DQPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 2.90000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 24 dB
Avg Type: Log-Pwr
03:42:23 PM Jan 29, 2018
Ref Offset 1.7 dB
10 dB/div
Ref 15.00 dBm
ΔMkr1 2.900 ms
0.00 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
Normal
Delta
Fixed
Off
Properties
More
1 of 2
Agilent Spectrum Analyzer - Swept SA
03:38:32 PM Jan 29, 2018
Trace/Detector
Select Trace
Clear Write
Trace Average
Max Hold
Min Hold
View Blank
Trace On
More
1 of 3
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)

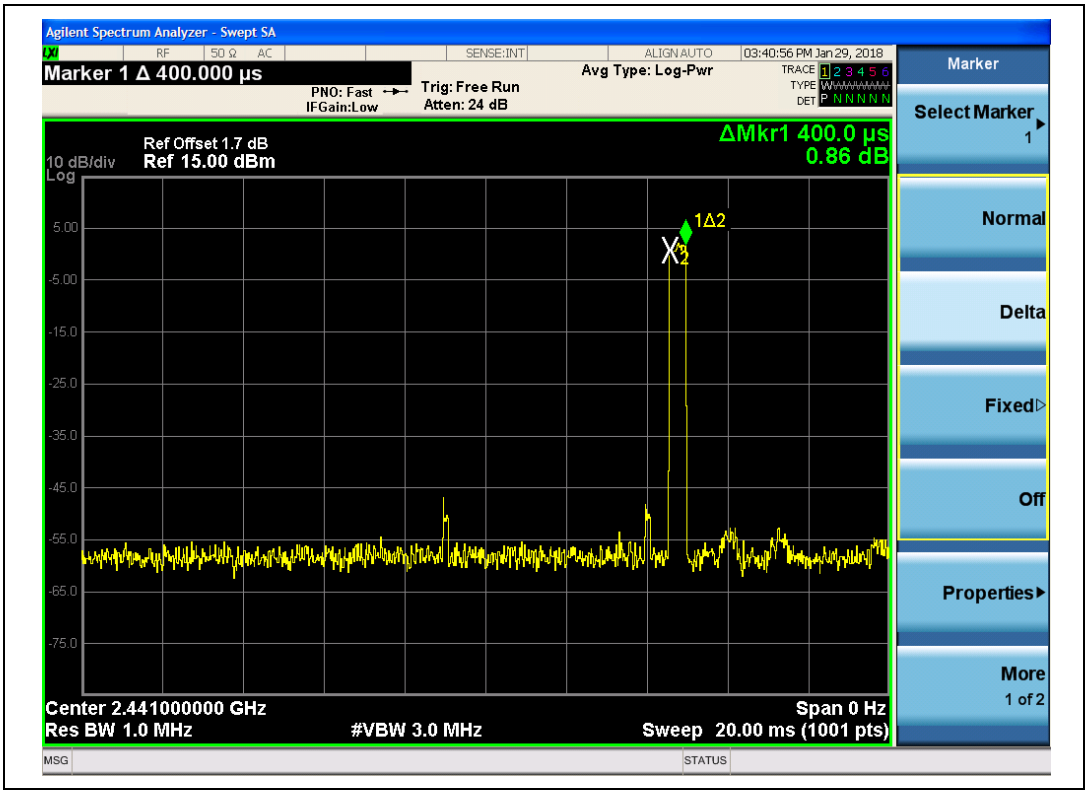
(DH5, π/4-DQPSK)

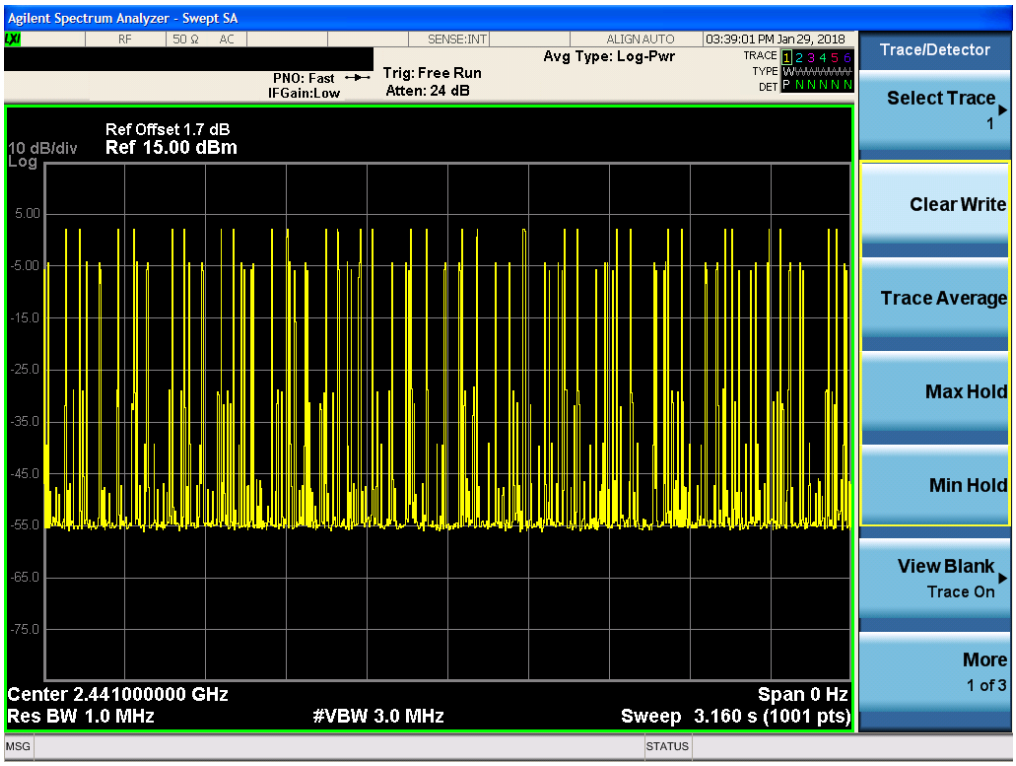
2.6.4.3 8-DPSK mode

A. Test Verdict:

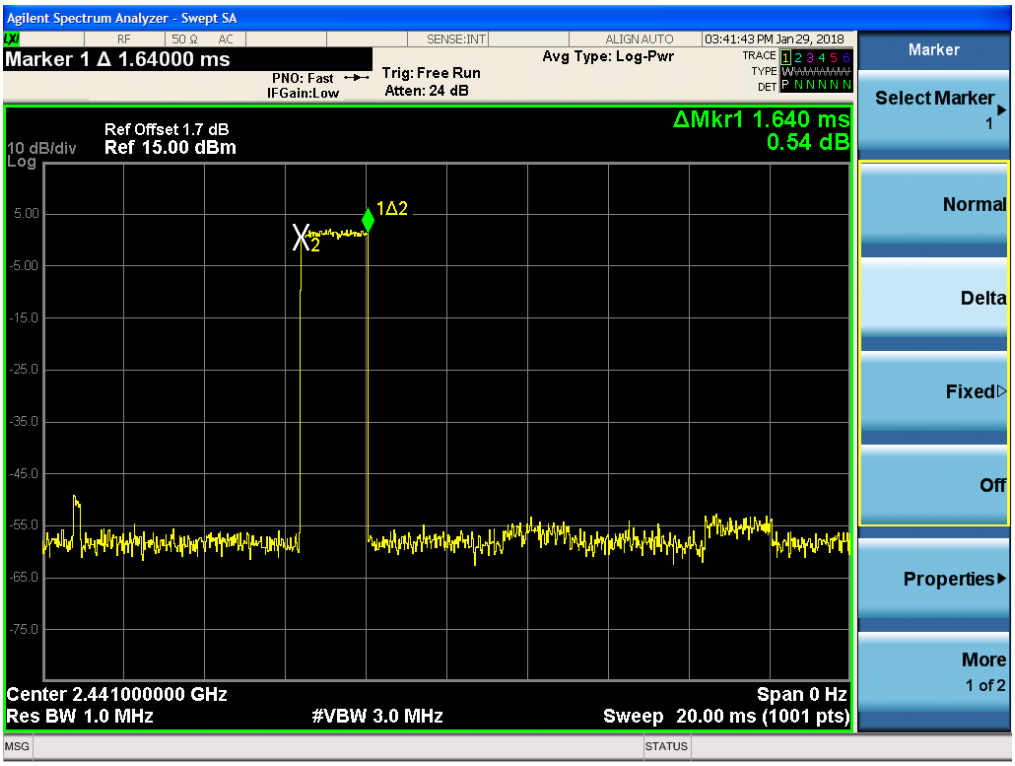
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.40	31	0.01240	0.1240	0.4	PASS
DH3	1.64	14	0.02296	0.2296		PASS
DH5	2.90	13	0.03770	0.3770		PASS

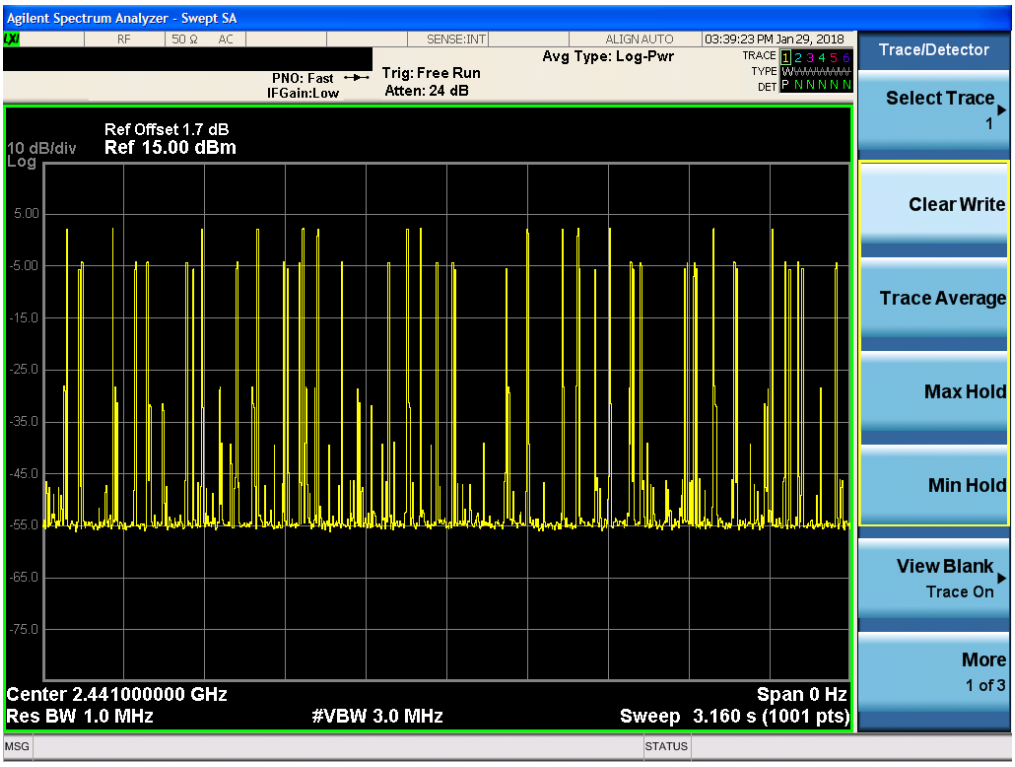
B. Test Plots:



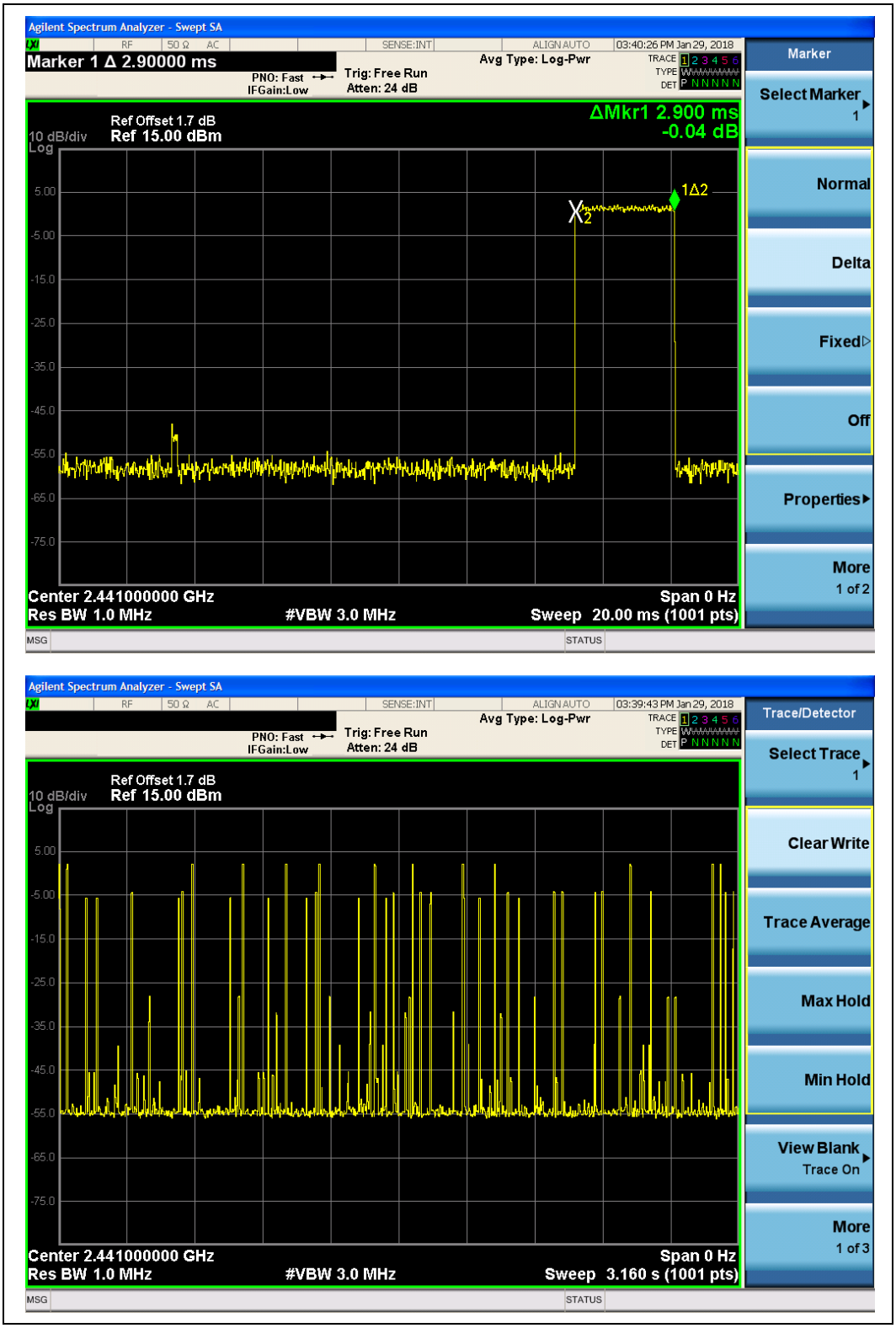

Agilent Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
03:39:01 PM Jan 29, 2018
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W
DET P N N N N N
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 24 dB
Ref Offset 1.7 dB
10 dB/div
Log
Ref 15.00 dBm
5.00
-5.00
-15.0
-25.0
-35.0
-45.0
-55.0
-65.0
-75.0
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, 8-DPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 1.64000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 24 dB
Avg Type: Log-Pwr
03:41:43 PM Jan 29, 2018
Ref Offset 1.7 dB
10 dB/div
Ref 15.00 dBm
ΔMkr1 1.640 ms
0.54 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
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 24 dB
Avg Type: Log-Pwr
03:39:23 PM Jan 29, 2018
Ref Offset 1.7 dB
10 dB/div
Ref 15.00 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
1
Clear Write
Trace Average
Max Hold
Min Hold
View Blank
Trace On
More
1 of 3
MSG
STATUS

(DH3, 8-DPSK)


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 2.90000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 24 dB
Avg Type: Log-Pwr
03:40:26 PM Jan 29, 2018
Ref Offset 1.7 dB
10 dB/div
Ref 15.00 dBm
ΔMkr1 2.900 ms
-0.04 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
Normal
Delta
Fixed
Off
Properties
More
1 of 2
Agilent Spectrum Analyzer - Swept SA
03:39:43 PM Jan 29, 2018
Trace/Detector
Select Trace
Clear Write
Trace Average
Max Hold
Min Hold
View Blank
Trace On
More
1 of 3
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.160 s (1001 pts)

(DH5, 8-DPSK)

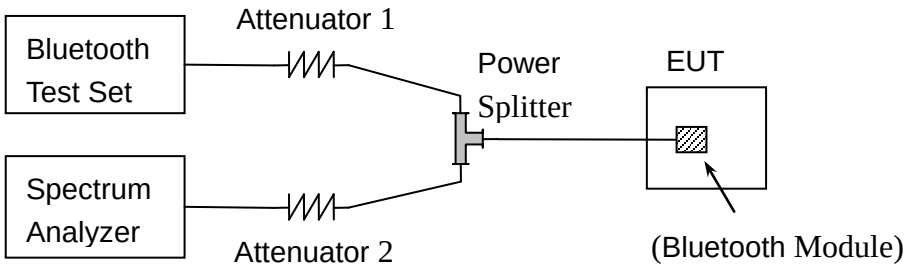
2.7. Conducted Spurious Emissions

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.

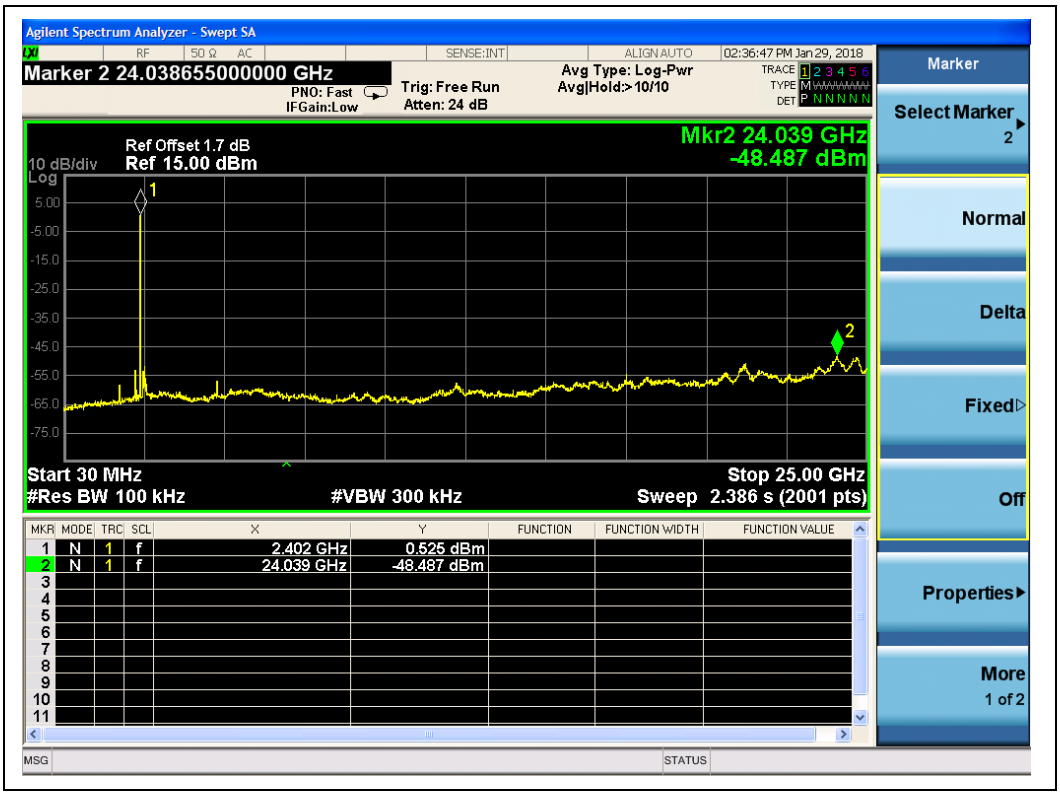
2.7.4.1 GFSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-48.49	0.53	-19.47	PASS
39	2441	-48.07	1.34	-18.66	PASS
78	2480	-48.40	-0.04	-20.04	PASS

B. Test Plots:

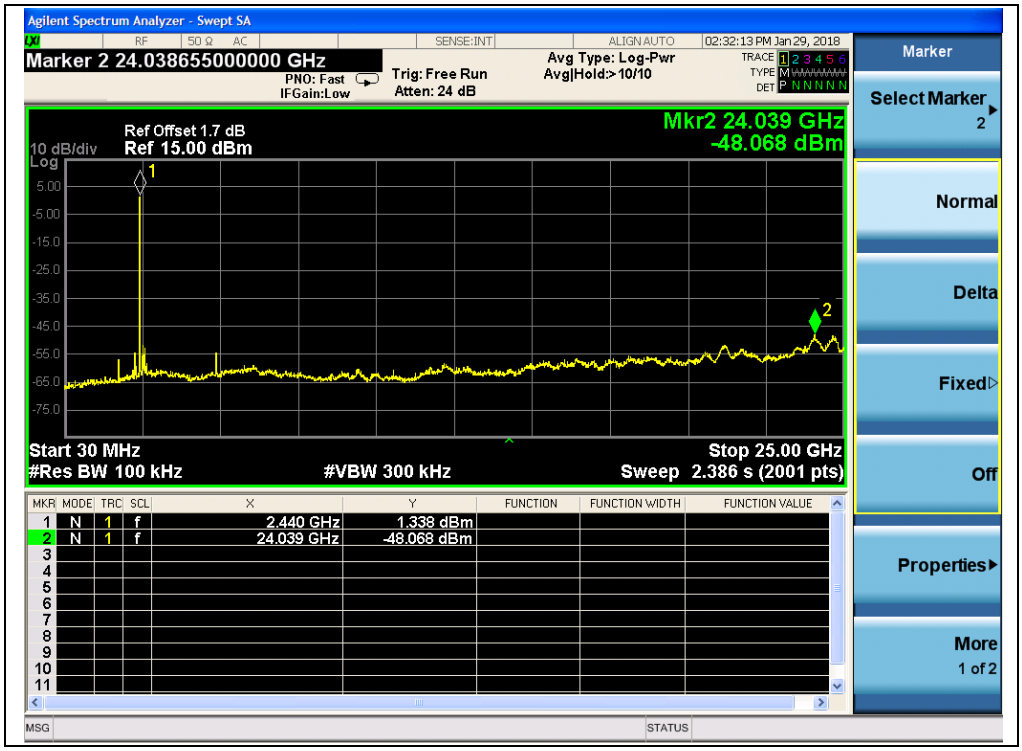
Note: the power of the Module transmitting frequency should be ignored.



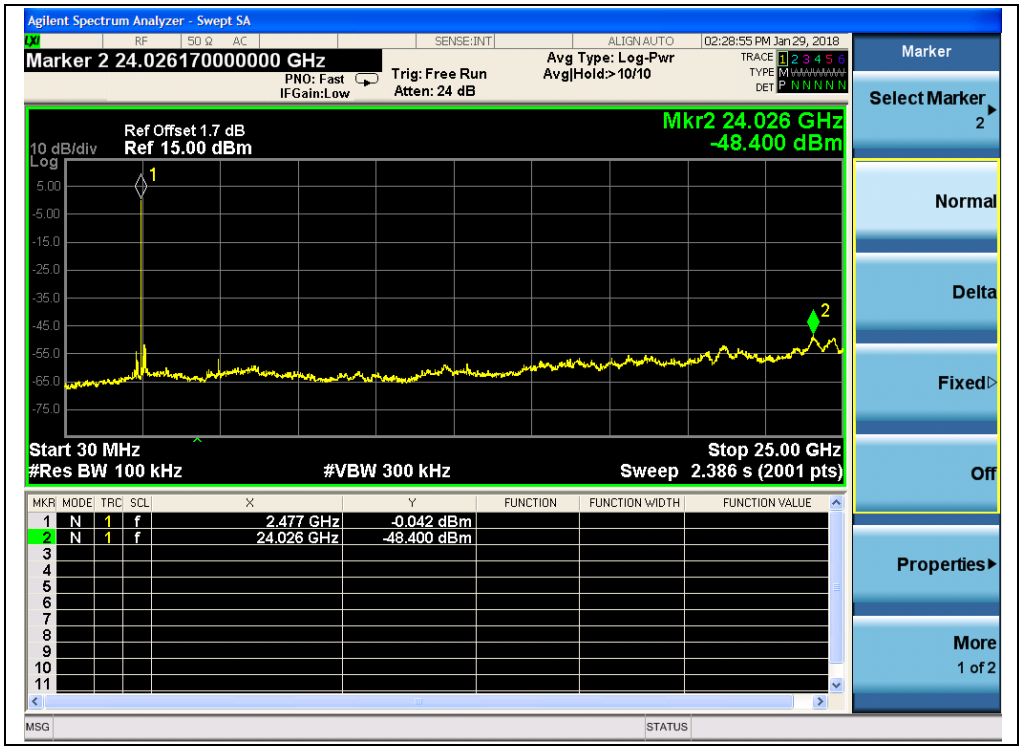
(Channel = 0, 30MHz to 25GHz, GFSK Mode)

(Channel = 0, Band edge,GFSK Mode)

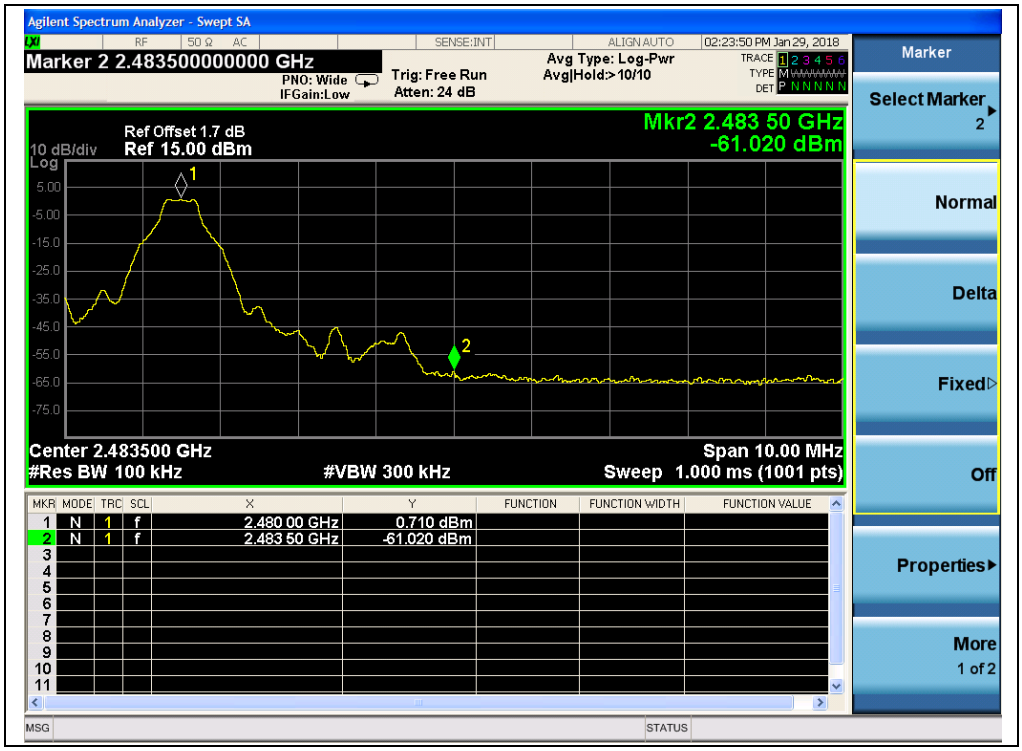
(Channel = 0, Band edge with hopping on, GFSK Mode)



(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)

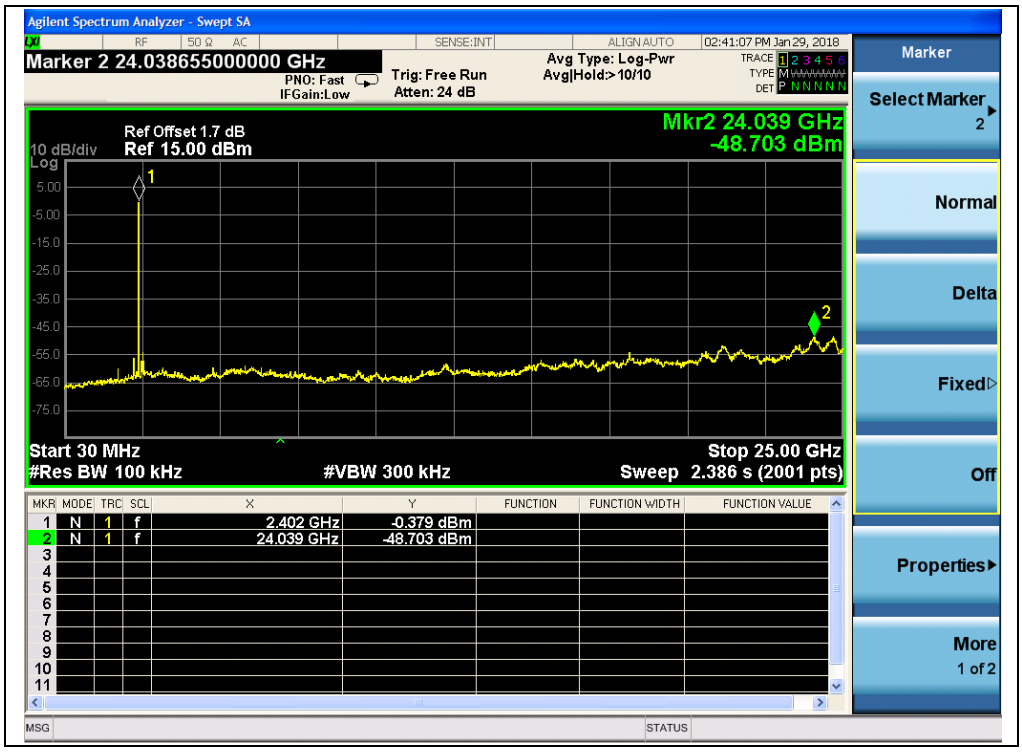
2.7.4.2 π/4-DQPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-48.70	-0.38	-20.38	PASS
39	2441	-47.81	0.42	-19.58	PASS
78	2480	-48.61	-3.30	-23.30	PASS

B. Test Plots:

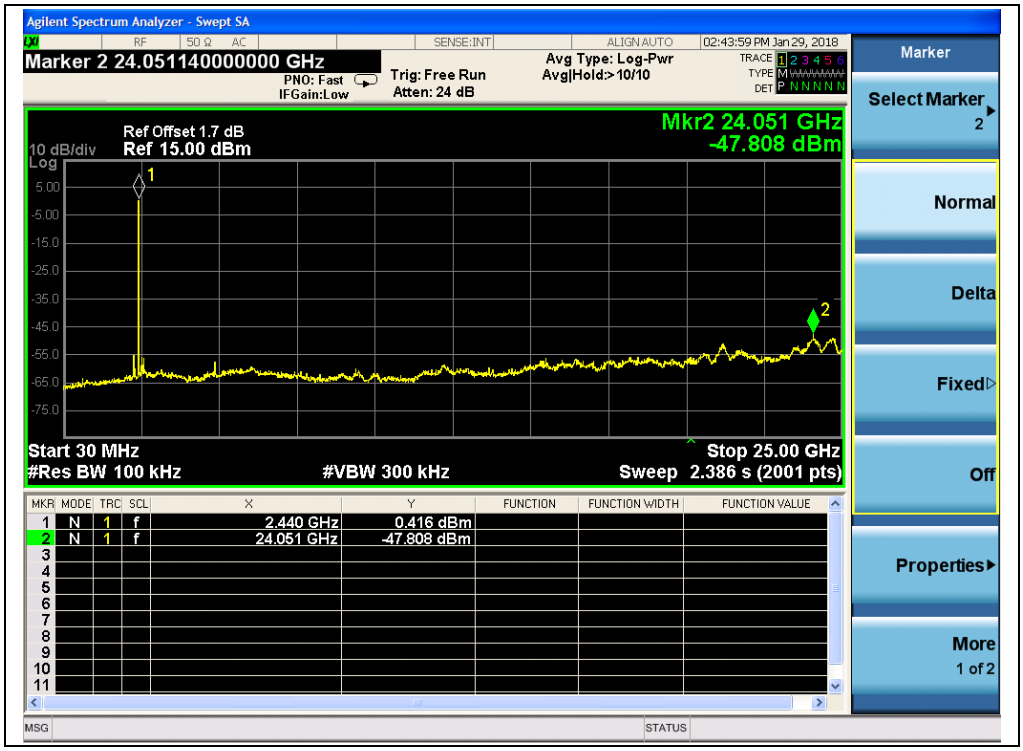
Note: the power of the Module transmitting frequency should be ignored.



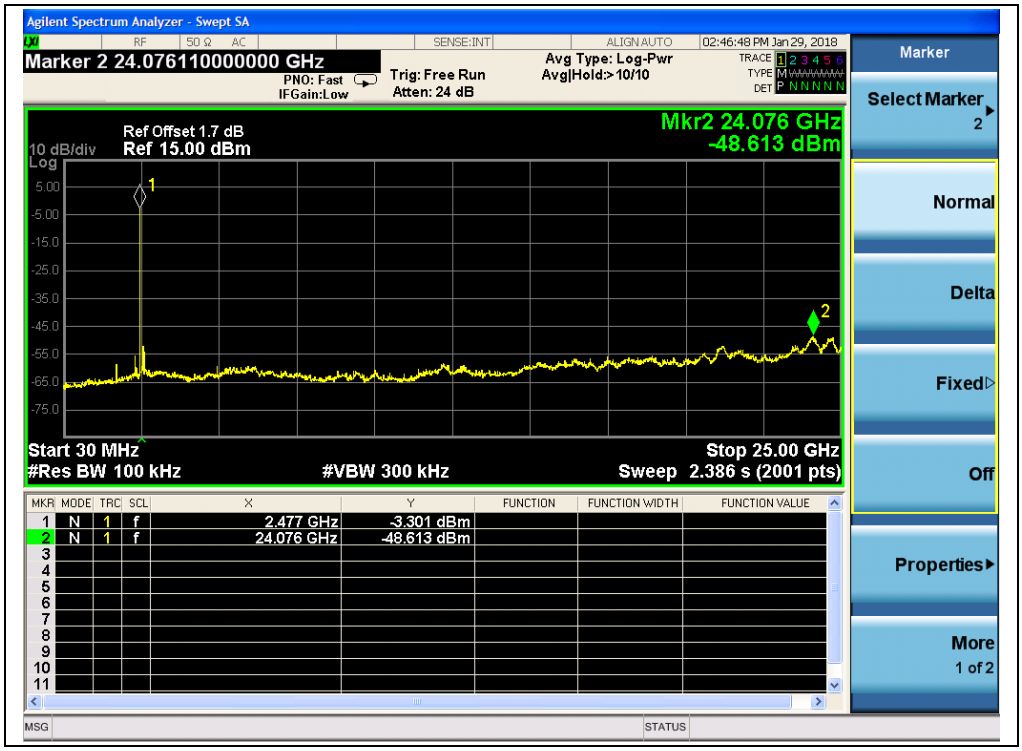
(Channel = 0, 30MHz to 25GHz, π/4-DQPSK)

(Channel = 0, Band edge, π/4-DQPSK)

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

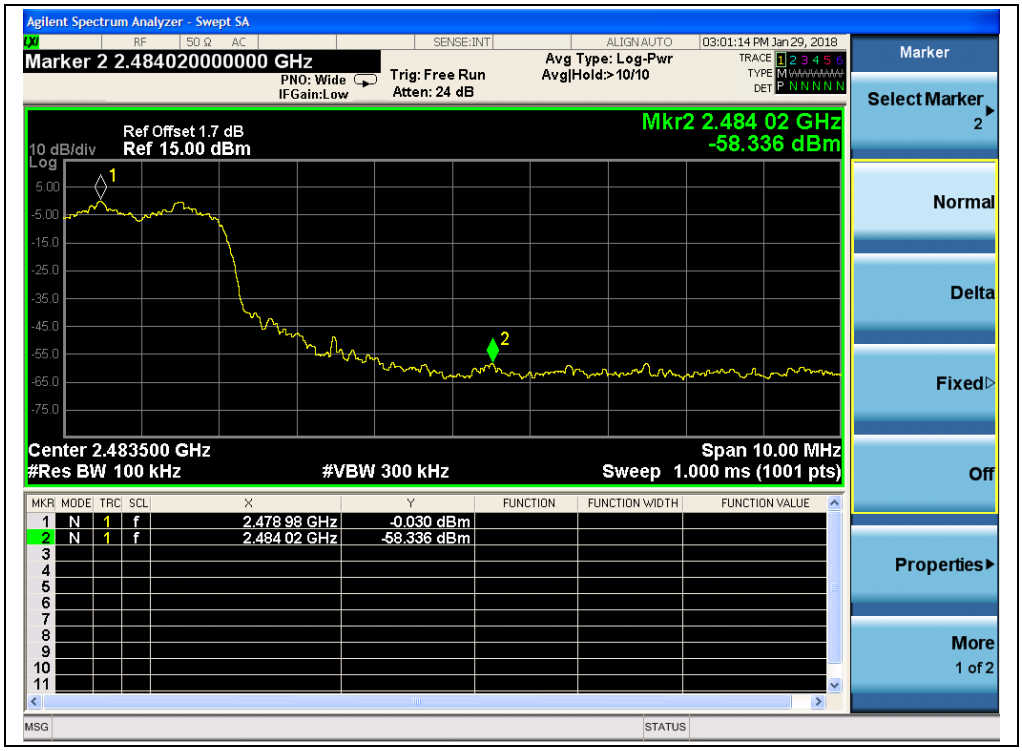


(Channel = 39, 30MHz to 25GHz, π/4-DQPSK)



(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)

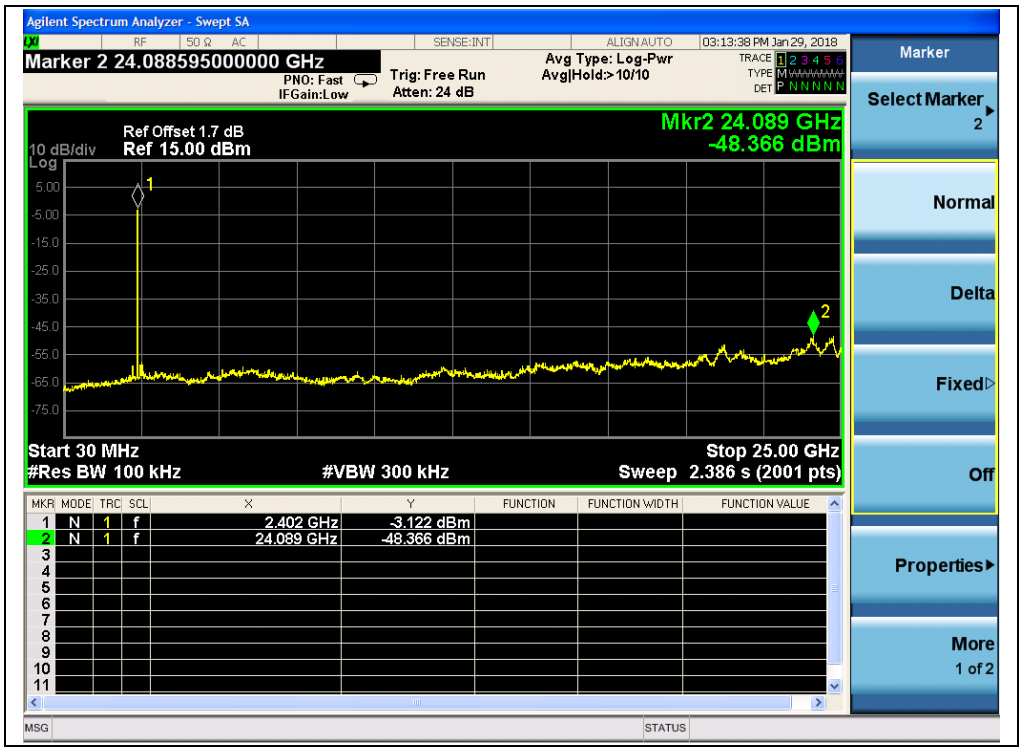
2.7.4.3 8-DPSK Mode

A. Test Verdict:

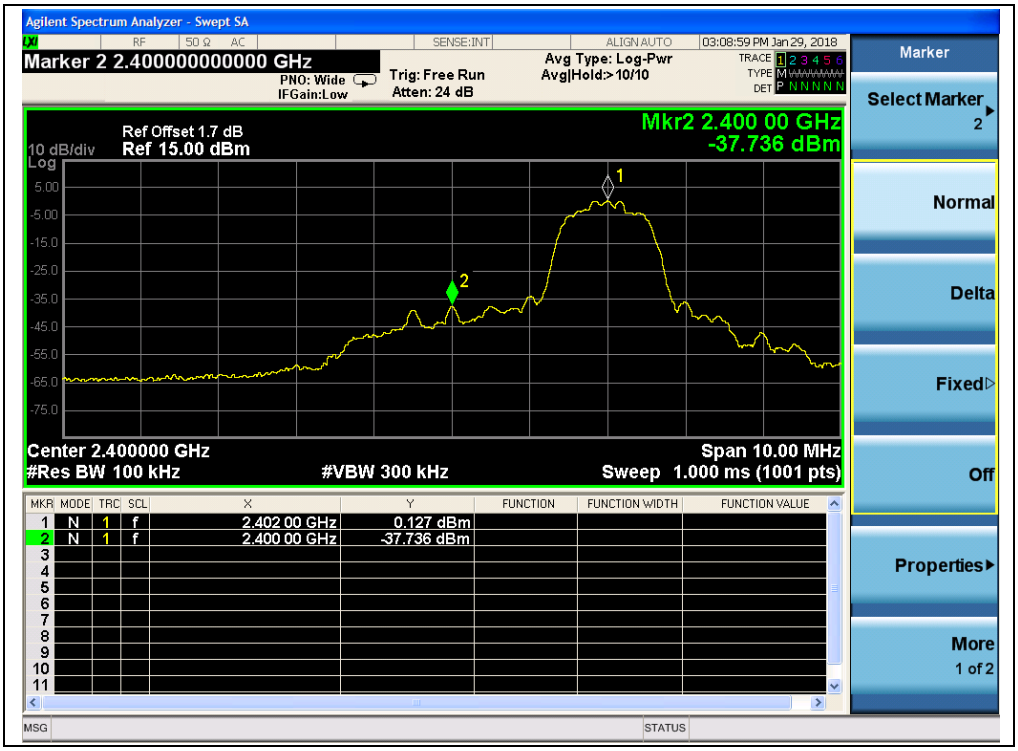
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-48.37	-3.12	-23.12	PASS
39	2441	-49.53	-2.32	-22.32	PASS
78	2480	-49.29	-1.83	-21.83	PASS

B. Test Plots:

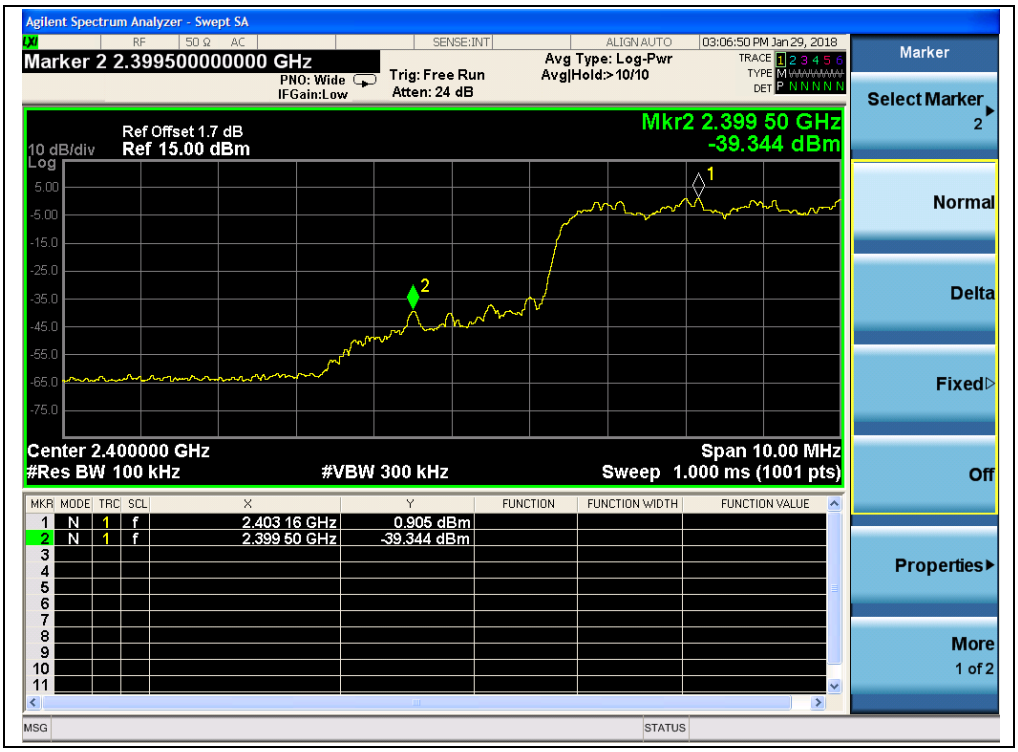
Note: the power of the Module transmitting frequency should be ignored.



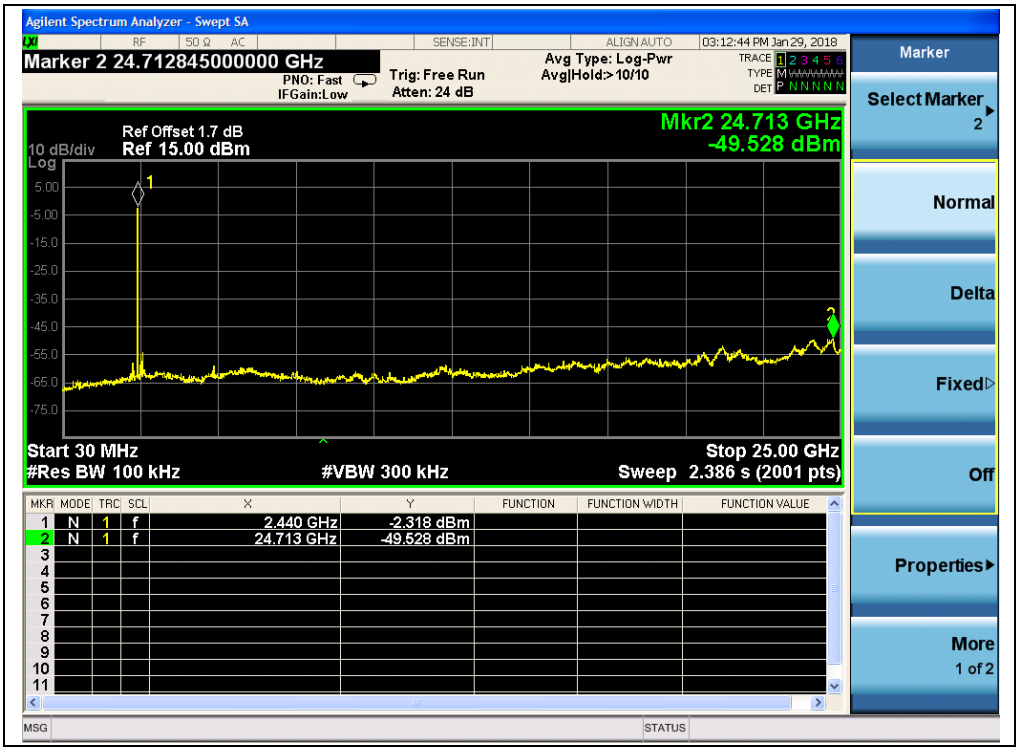
(Channel = 0, 30MHz to 25GH, 8-DPSK)



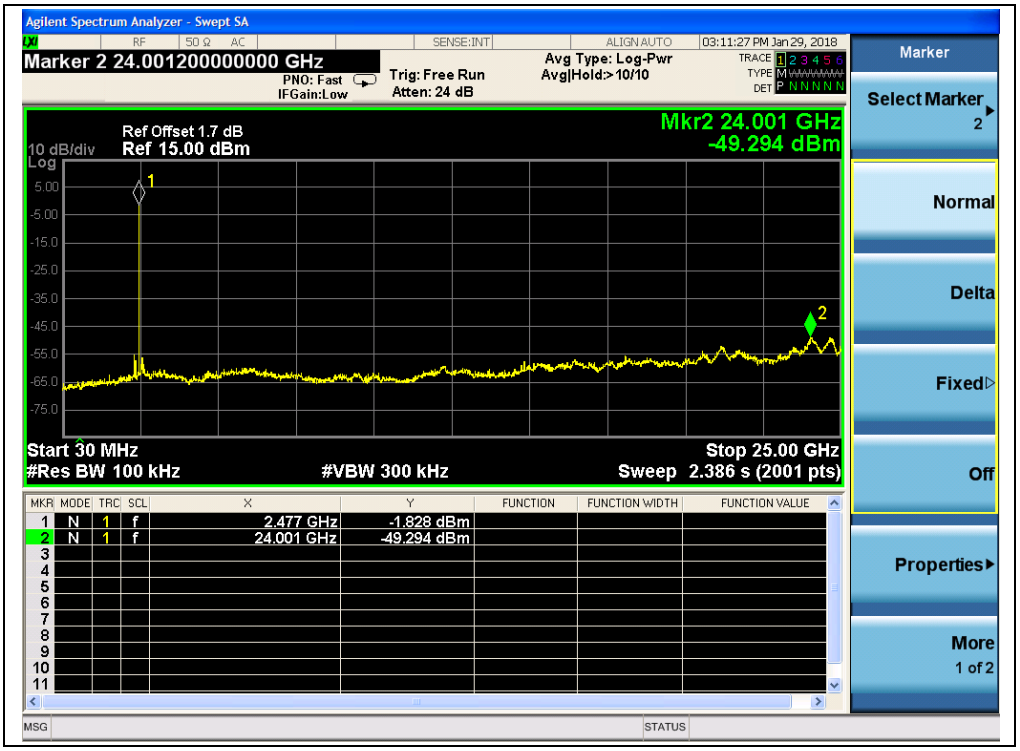
(Channel = 0, Band edge, 8-DPSK)



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

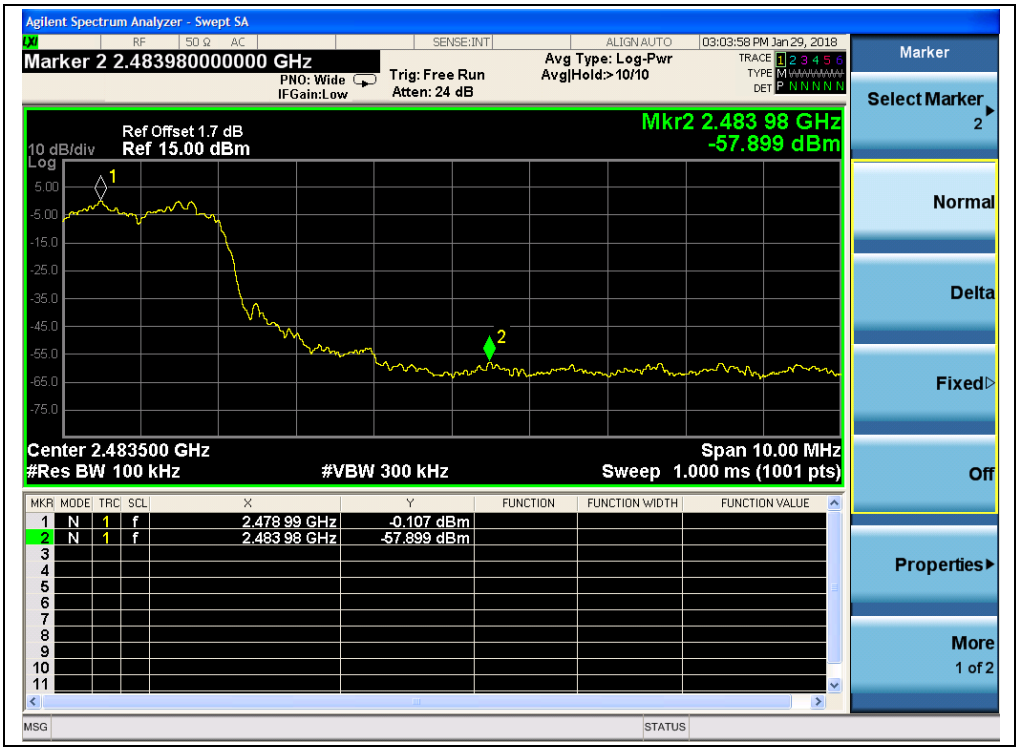


(Channel = 39, 30MHz to 25GHz, 8-DPSK)



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

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



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

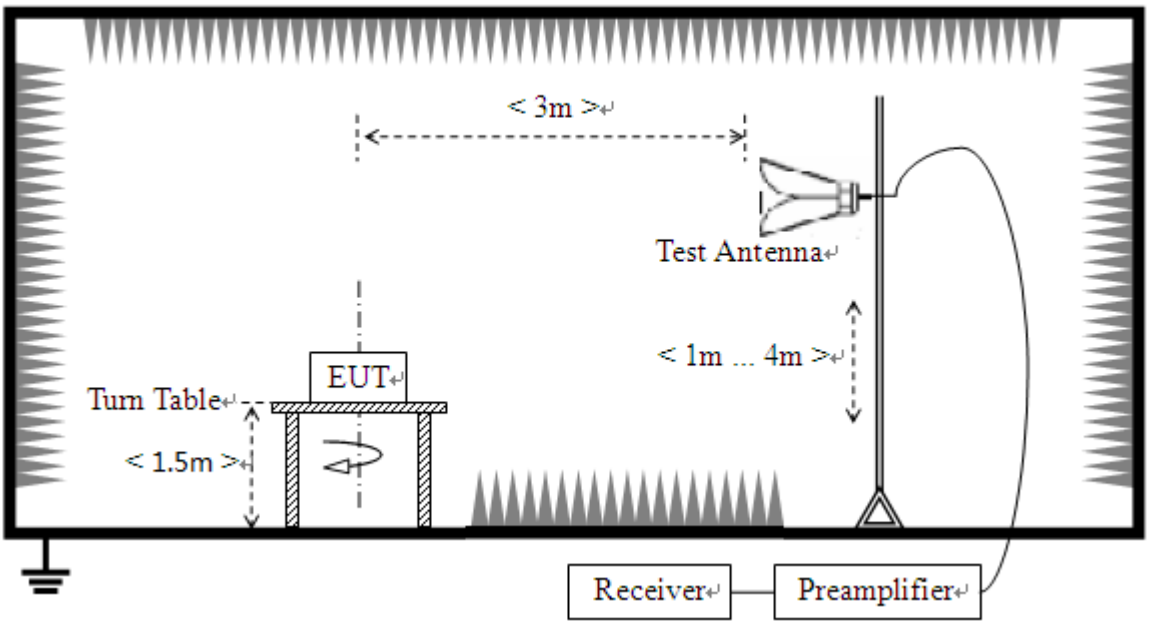
2.8. Restricted Frequency Bands

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

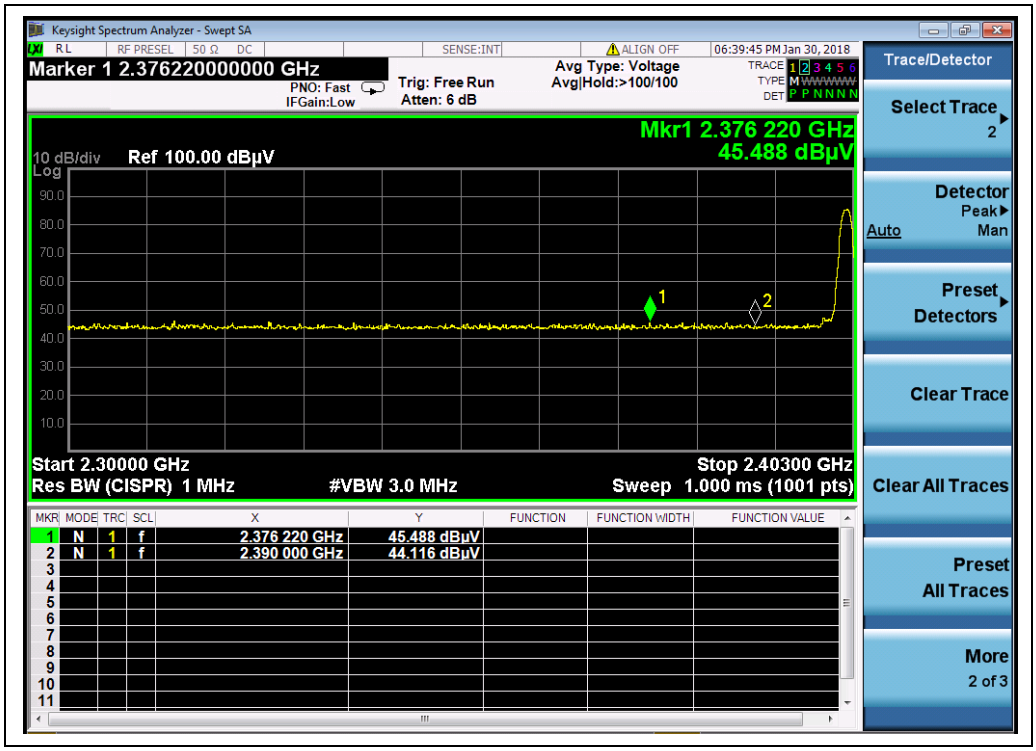
The lowest and highest channels are tested to verify Restricted Frequency Bands.
The measurement results are obtained as below:
E [dBμV/m] =U_R + A_T + A_{Factor} [dB]; AT =$L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
AT: Total correction Factor except Antenna
UR: Receiver Reading
Gpreamp: Preamplifier Gain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

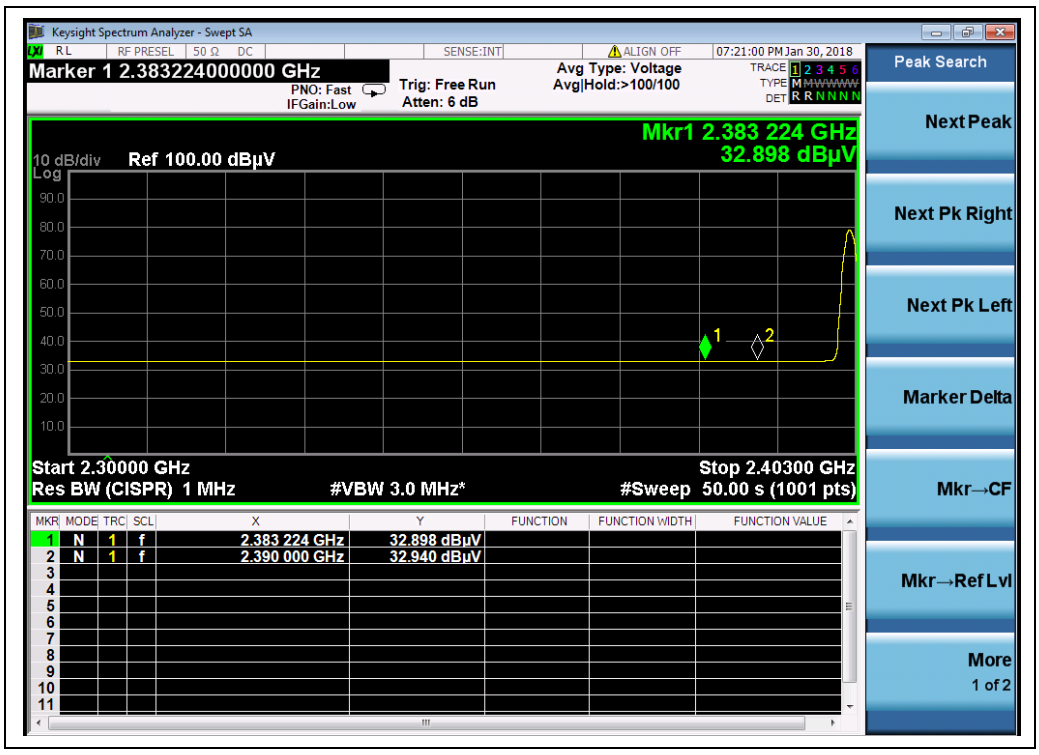
A. Test Verdict:

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	2376.22	PK	45.49	-33.63	32.56	44.42	74	Pass
0	2383.22	AV	32.90	-33.63	32.56	31.83	54	Pass
78	2484.63	PK	44.33	-33.18	32.5	43.65	74	Pass
78	2484.86	AV	32.80	-33.18	32.5	32.12	54	Pass

B. Test Plots:

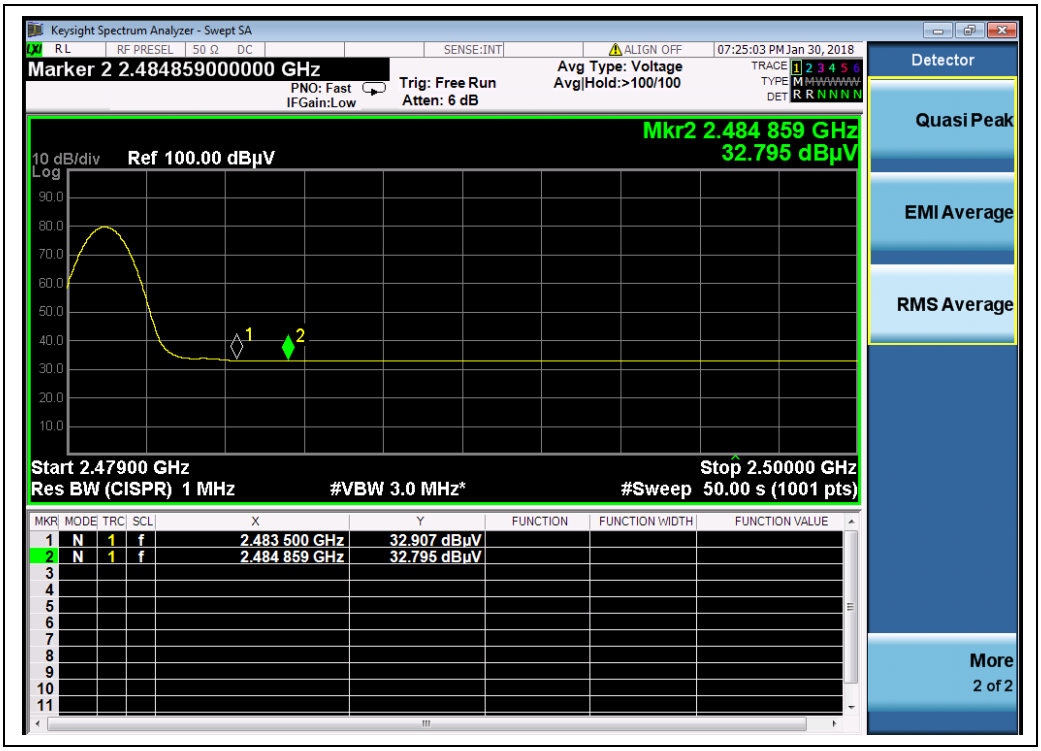


(Channel = 0, PEAK, GFSK)



(Channel = 0, AVERAGE, GFSK)

(Channel = 78, PEAK , GFSK)



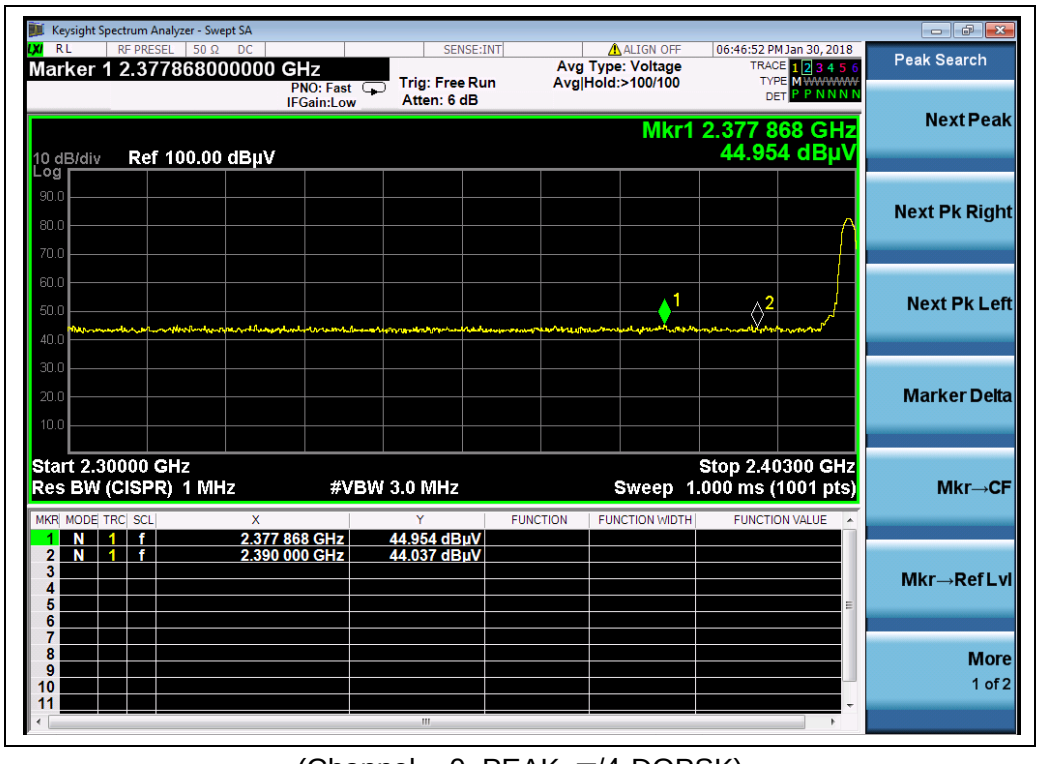
(Channel = 78, AVERAGE, GFSK)

2.8.4.2 π/4-DQPSK Mode

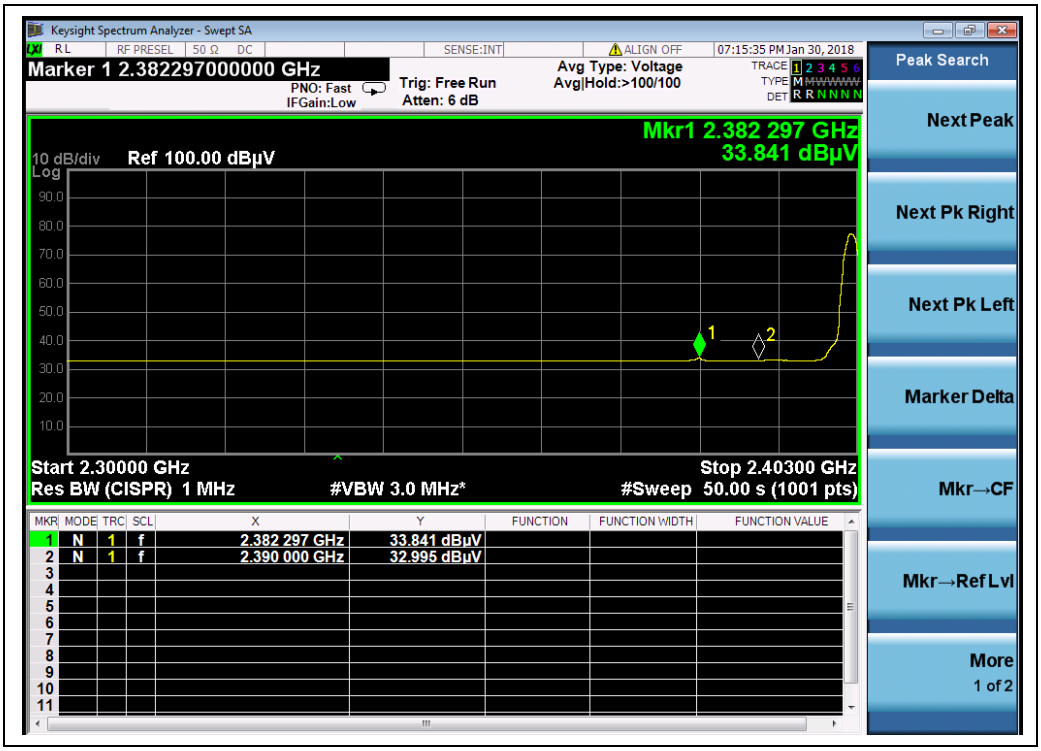
A. Test Verdict:

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	2377.87	PK	44.95	-33.63	32.56	43.88	74	Pass
0	2382.30	AV	33.84	-33.63	32.56	32.77	54	Pass
78	2483.94	PK	44.83	-33.18	32.5	44.15	74	Pass
78	2485.66	AV	32.79	-33.18	32.5	32.11	54	Pass

B. Test Plots:

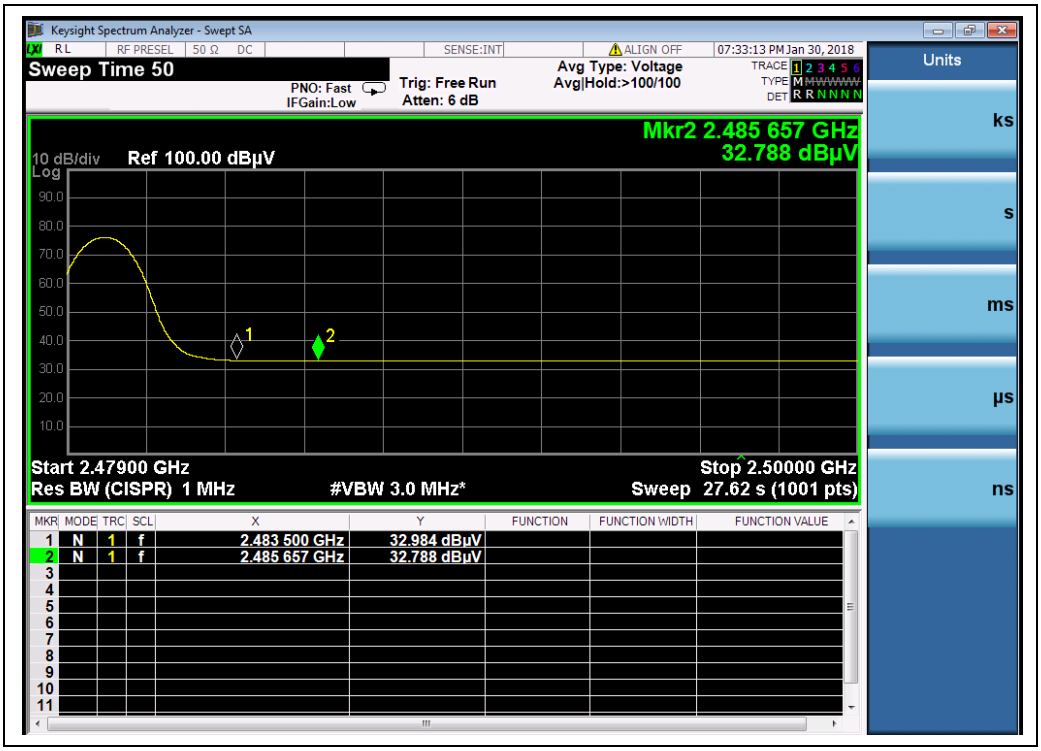


(Channel = 0, PEAK, π/4-DQPSK)



(Channel = 0, AVERAGE, π/4-DQPSK)

(Channel = 78, PEAK, π/4-DQPSK)



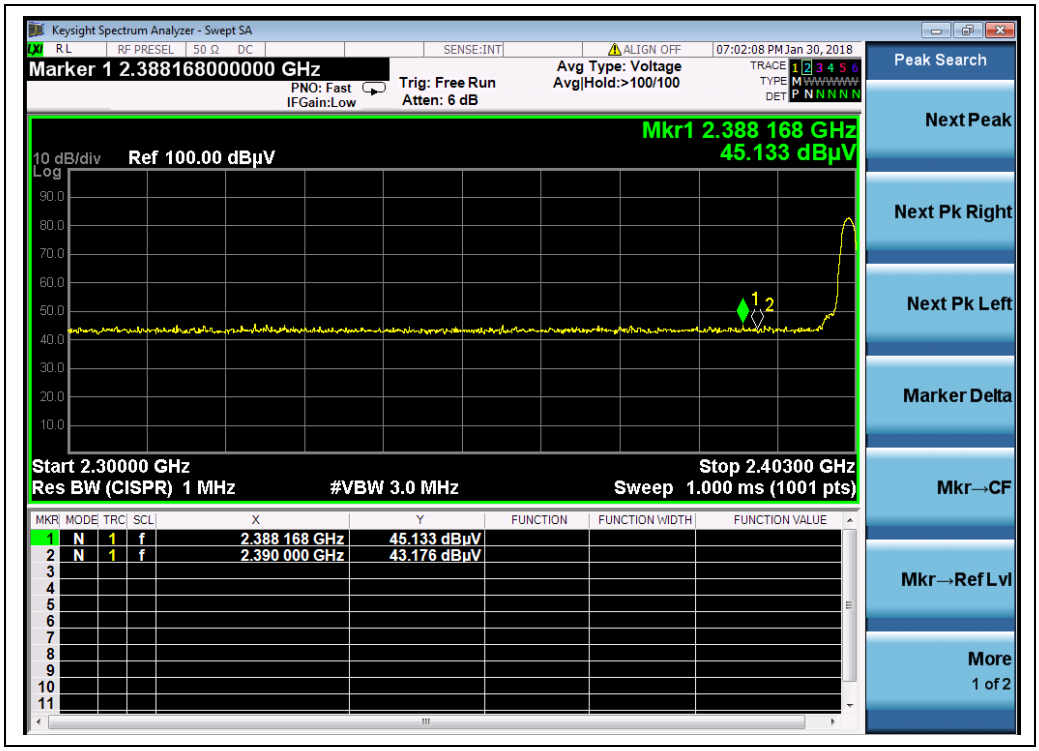
(Channel = 78, AVERAGE, π/4-DQPSK)

2.8.4.3 8-DPSK Mode

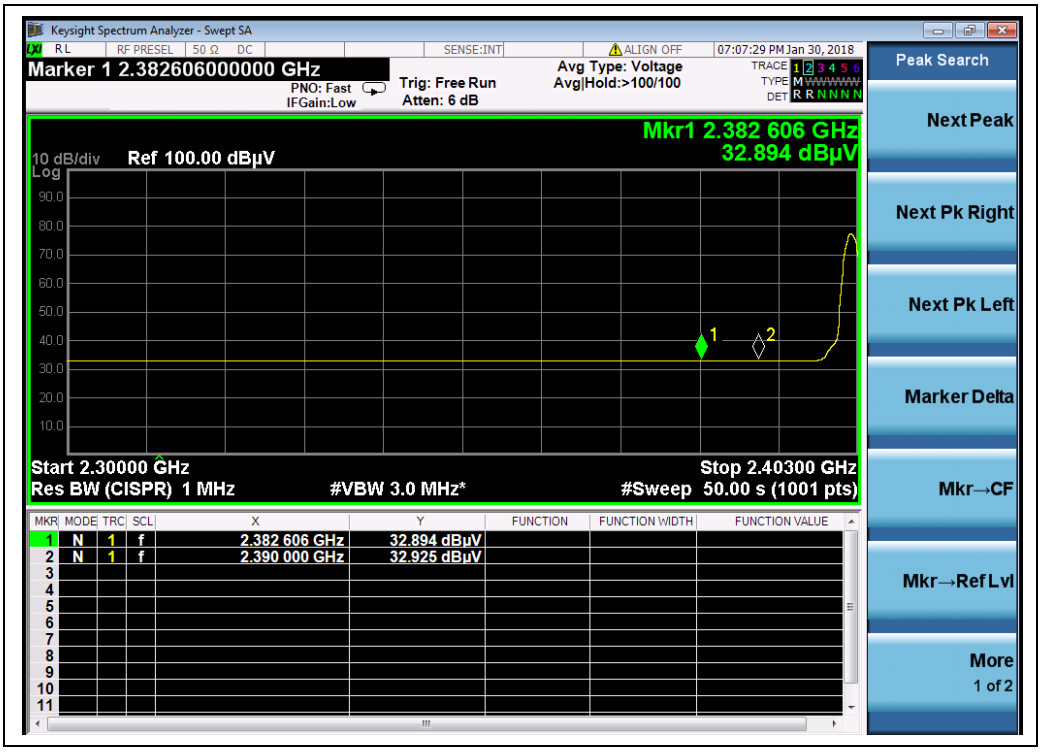
A. Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBµV/m)	Limit (dBµV/m)	Verdict
		PK/ AV						
0	2388.17	PK	45.13	-33.63	32.56	44.06	74	Pass
0	2382.61	AV	32.89	-33.63	32.56	31.82	54	Pass
78	2485.87	PK	44.62	-33.18	32.5	43.94	74	Pass
78	2484.19	AV	32.88	-33.18	32.5	32.20	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

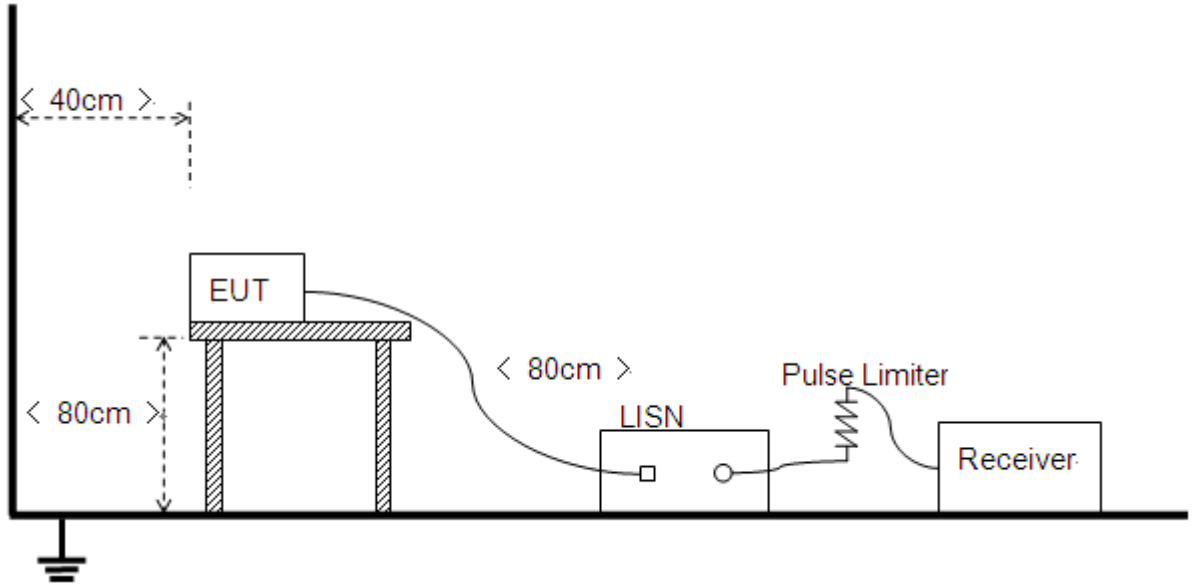
NOTE:

(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

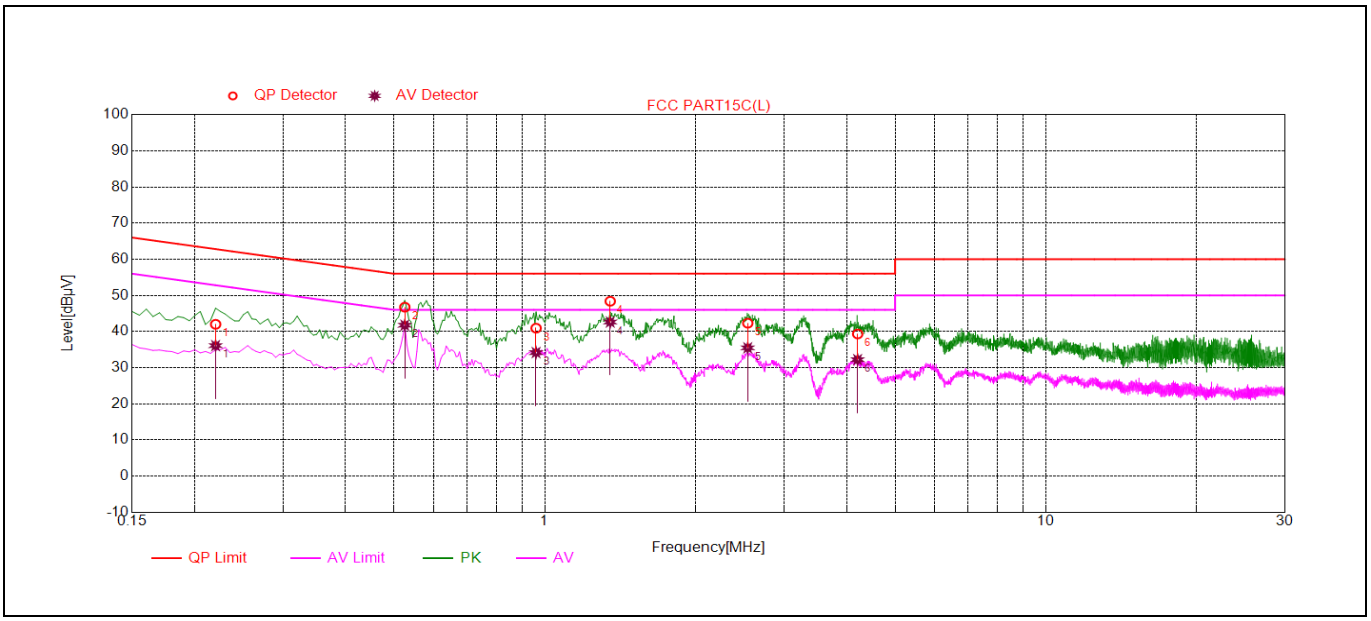
The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT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

A. Test setup:

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

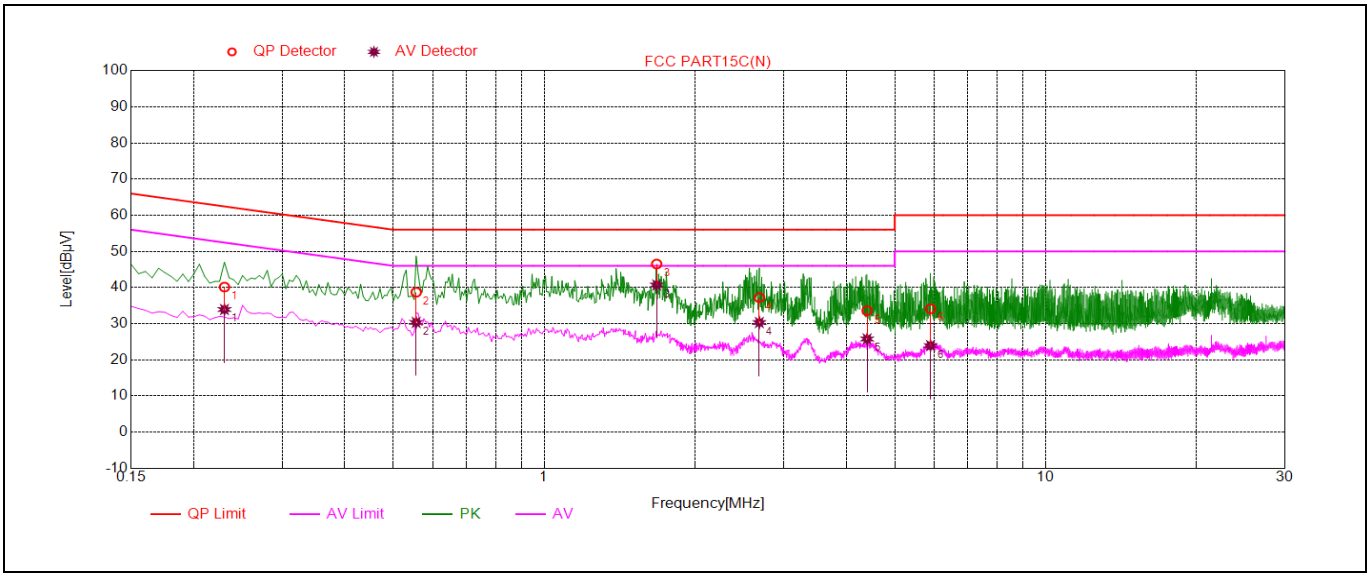
Note: The test voltage is AC 120V/60Hz.

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	0.20	42.01	36.10	62.82	52.82	Line	PASS
2	0.52	46.74	41.75	56.00	46.00		PASS
3	0.96	40.93	34.17	56.00	46.00		PASS
4	1.34	48.39	42.63	56.00	46.00		PASS
5	2.55	42.32	35.48	56.00	46.00		PASS
6	4.20	39.34	32.21	56.00	46.00		PASS



(Plot B: N Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.20	40.13	33.91	62.45	52.45	Neutral	PASS
2	0.50	38.70	30.34	56.00	46.00		PASS
3	1.68	46.51	40.71	56.00	46.00		PASS
4	2.68	37.20	30.31	56.00	46.00		PASS
5	4.00	33.59	25.75	56.00	46.00		PASS
6	5.89	34.11	23.93	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:

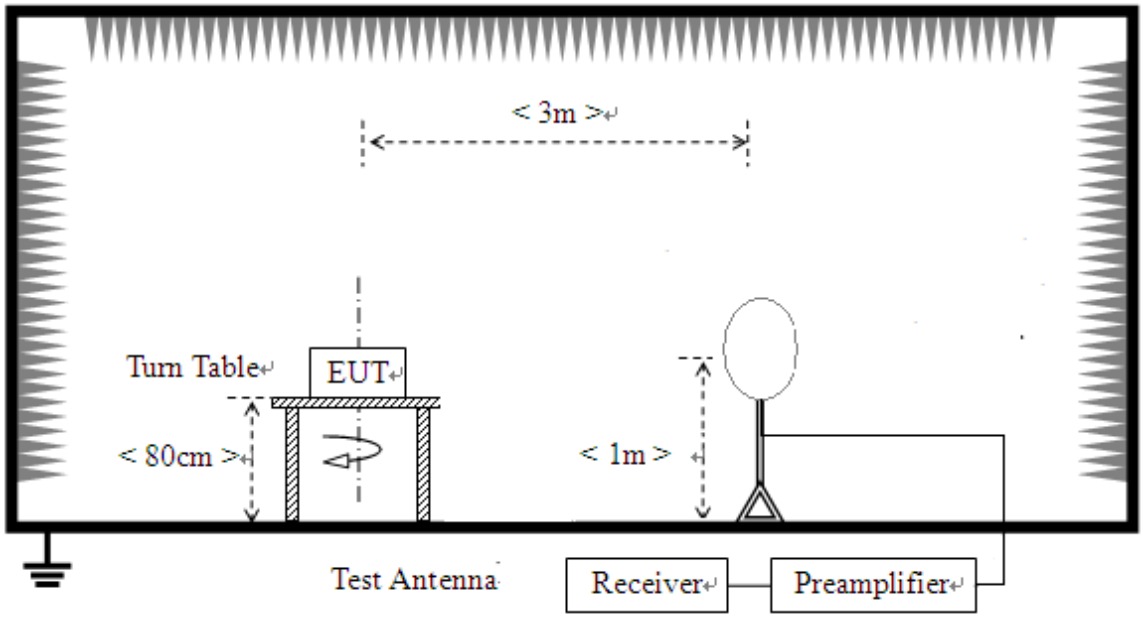
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength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

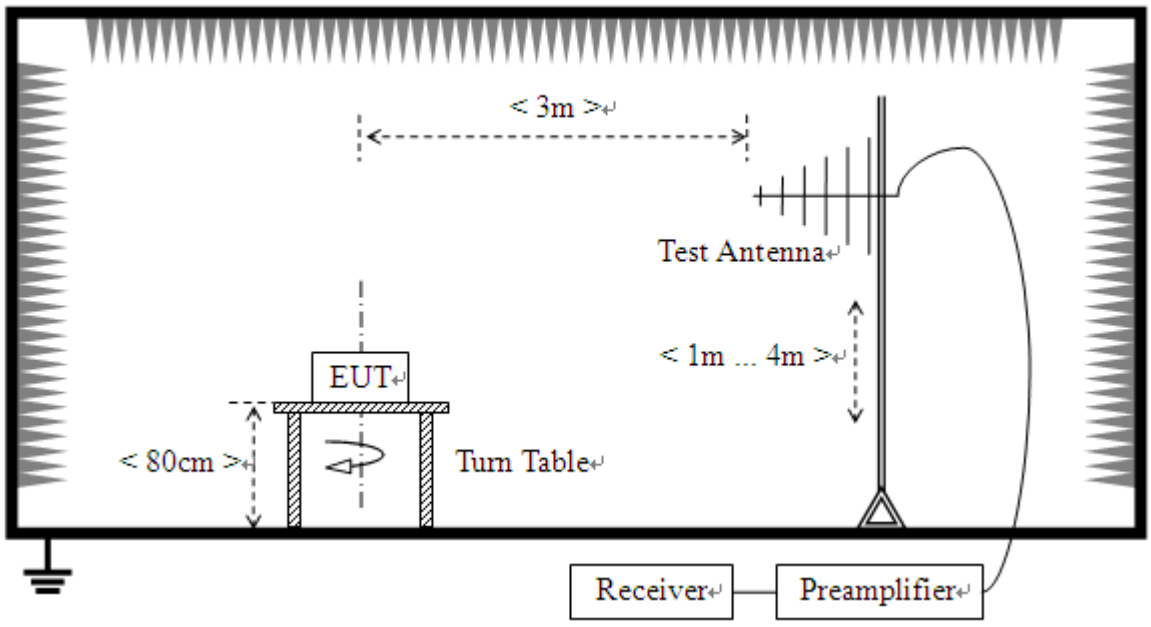
2.10.2. Test Description

A. Test Setup:

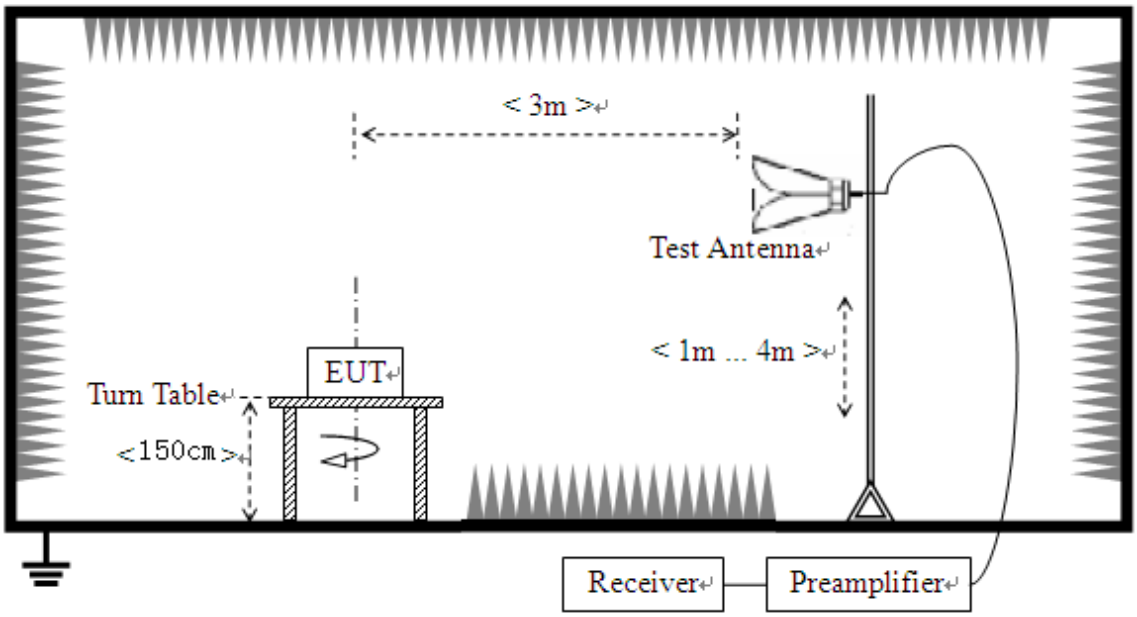
1) For radiated emissions from 9kHz to 30MHz



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:

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

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.

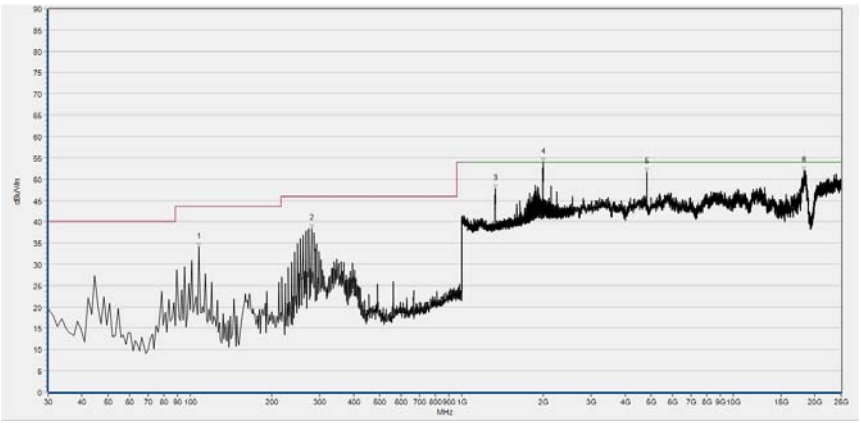
The low frequency, which started from 9KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

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
48.210	36.34	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
107.697	39.33	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
304.368	40.17	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2557.743	47.01	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
4804.200	56.70	N/A	40.45	74.0	N/A	54.00	Horizontal	PASS
18384.688	52.28	N/A	39.44	74.0	N/A	54.00	Horizontal	PASS

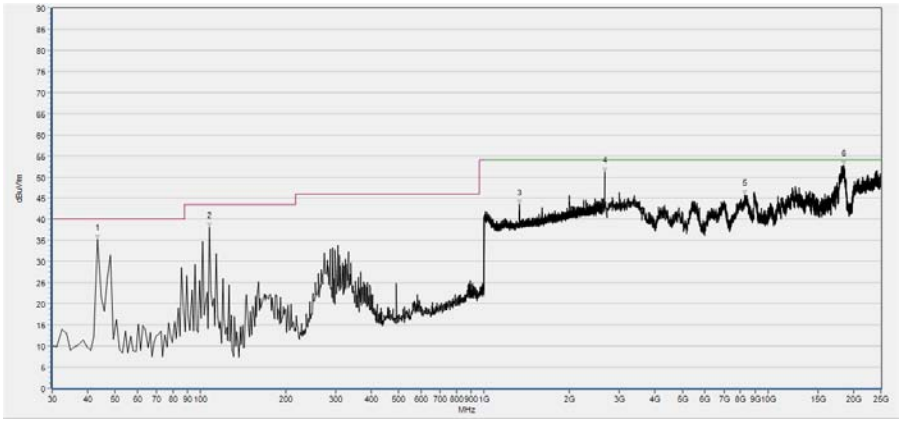
(30MHz to 25GHz, Antenna Horizontal, GFSK, channel 0)



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
107.697	34.06	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
280.088	38.35	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1330.372	47.79	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
1996.500	55.08	N/A	31.20	74.0	N/A	54.00	Vertical	PASS
4804.400	52.61	N/A	38.52	74.0	N/A	54.00	Vertical	PASS
18274.704	51.95	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

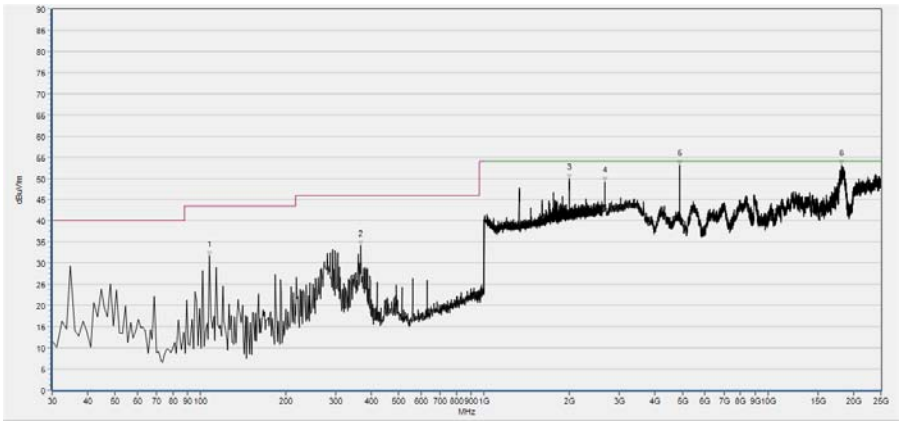
(30MHz to 25GHz, Antenna Vertical, GFSK, channel 0)

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
43.354	35.24	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
107.697	38.05	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1330.372	43.48	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
2657.029	51.26	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
8286.561	45.84	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
18555.774	52.86	N/A	42.34	74.0	N/A	54.00	Horizontal	PASS

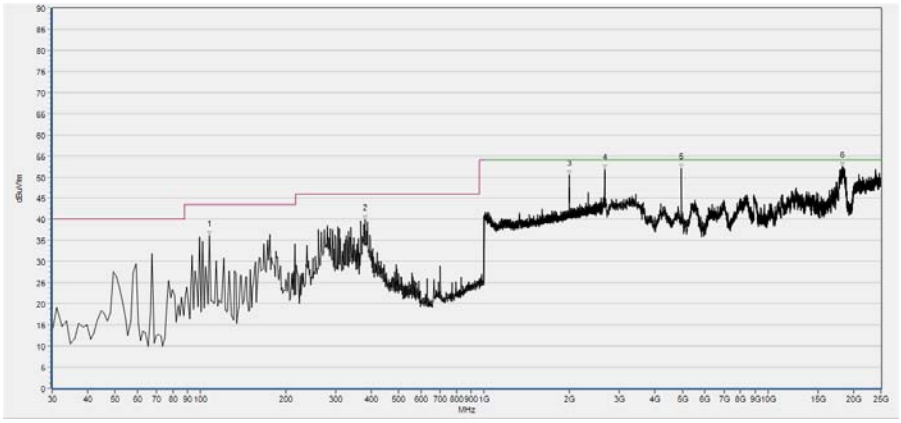
(30MHz to 25GHz, Antenna Horizontal, GFSK, channel 39)



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
107.697	31.72	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
367.497	34.18	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1995.598	49.93	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
2665.175	49.29	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
4881.142	53.21	N/A	40.23	74.0	N/A	54.00	Vertical	PASS
18225.823	53.19	N/A	41.34	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
107.697	36.16	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
379.637	39.91	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1993.037	50.51	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2655.300	52.55	N/A	32.16	74.0	N/A	54.00	Horizontal	PASS
4960.400	52.05	N/A	46.04	74.0	N/A	54.00	Horizontal	PASS
18267.001	51.90	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

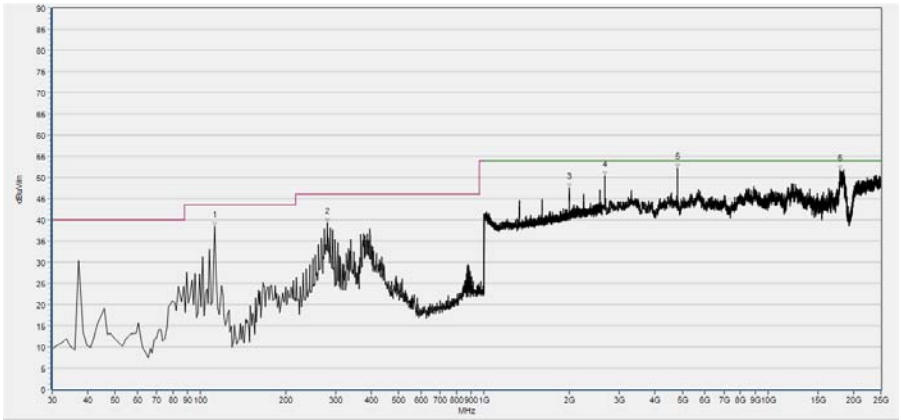
(30MHz to 25GHz, Antenna Horizontal, GFSK, channel 78)

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
107.697	30.59	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
348.073	37.16	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1329.732	50.19	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
1992.397	50.31	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
4958.538	52.13	N/A	40.23	74.0	N/A	54.00	Vertical	PASS
18478.378	52.79	N/A	41.87	74.0	N/A	54.00	Vertical	PASS

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

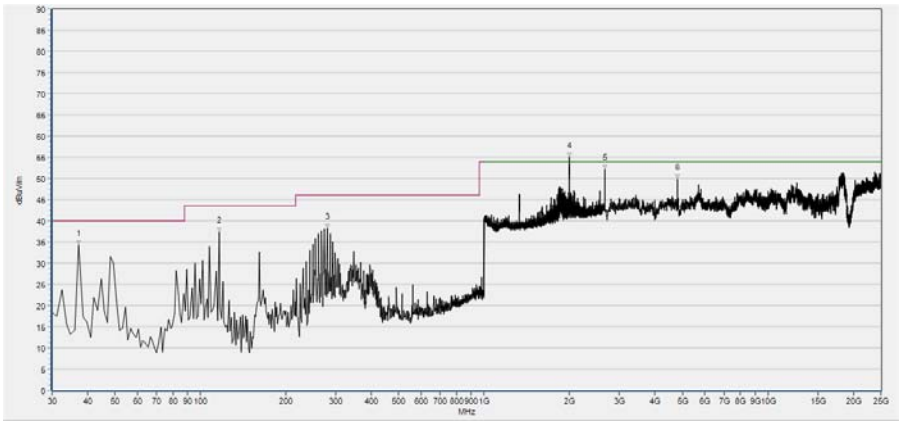
2.10.4.2 π/4-DQPSK Mode：

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
112.553	38.42	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
280.088	39.36	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1995.598	47.42	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
2661.102	50.43	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
4803.500	53.06	N/A	42.74	74.0	N/A	54.00	Horizontal	PASS
17985.488	51.78	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

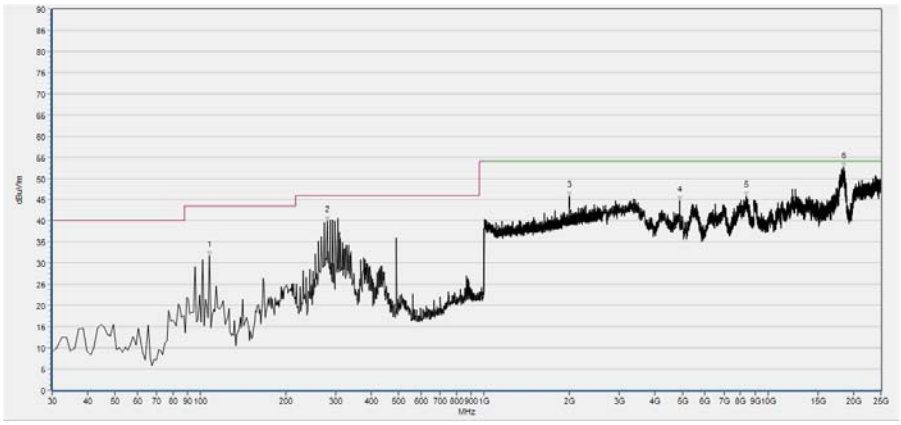
(30MHz to 25GHz, Antenna Horizontal @ π/4-DQPSK, channel 0)



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
37.284	34.22	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
116.195	37.40	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
280.088	38.29	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1996.700	55.91	N/A	30.97	74.0	N/A	54.00	Vertical	PASS
2662.400	54.74	N/A	32.22	74.0	N/A	54.00	Vertical	PASS
4803.746	49.80	N/A	N/A	74.0	N/A	54.00	Vertical	PASS

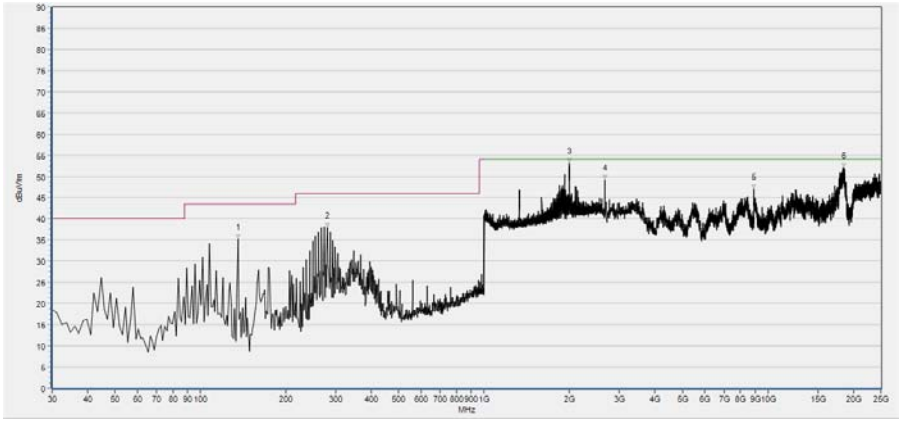
(30MHz to 25GHz, Antenna Vertical @ π/4-DQPSK, channel 0)

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
107.697	31.59	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
280.088	39.86	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1993.037	45.75	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
4881.142	44.71	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
8368.031	45.81	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
18547.627	52.66	N/A	41.16	74.0	N/A	54.00	Horizontal	PASS

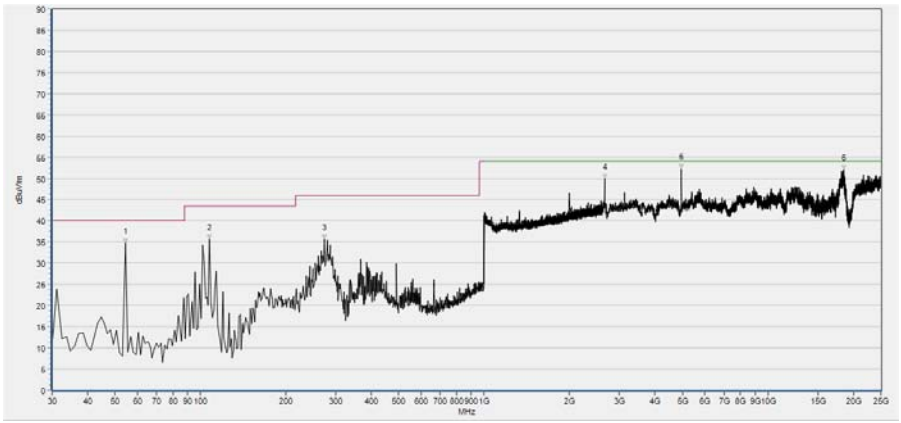
(30MHz to 25GHz, Antenna Horizontal @ π/4-DQPSK, channel 39)



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
135.620	35.23	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
280.088	37.96	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1999.440	53.23	N/A	35.71	74.0	N/A	54.00	Vertical	PASS
2661.102	49.23	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
8930.169	47.04	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
18560.000	52.57	N/A	40.22	74.0	N/A	54.00	Vertical	PASS

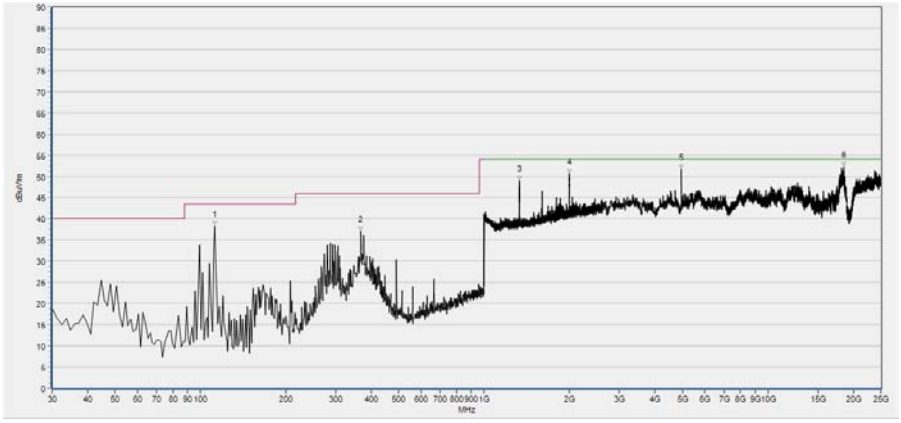
(30MHz to 25GHz, Antenna Vertical @ π/4-DQPSK, channel 39)

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
54.280	34.67	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
107.697	35.60	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
274.018	35.56	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2657.029	49.88	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
4958.538	52.16	N/A	46.35	74.0	N/A	54.00	Horizontal	PASS
18515.039	52.11	N/A	40.21	74.0	N/A	54.00	Horizontal	PASS

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

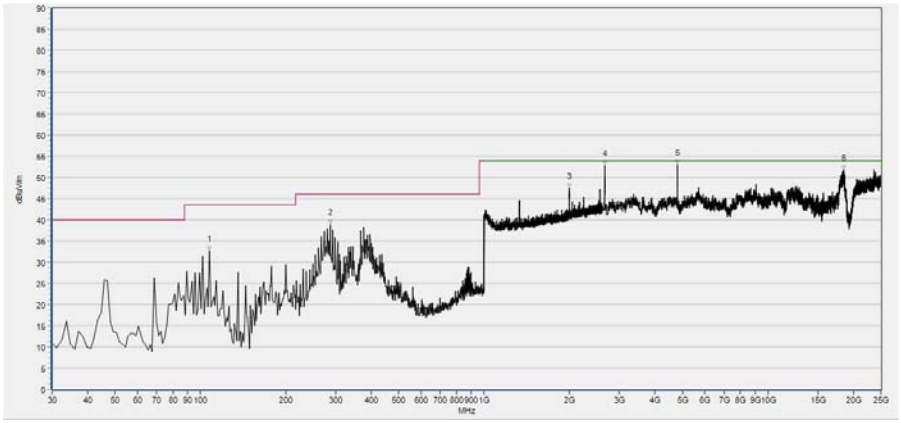


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
112.553	38.38	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
367.497	37.05	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1328.451	49.08	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
1998.800	50.61	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
4958.538	51.64	N/A	N/A	74.0	N/A	54.00	Vertical	PASS
18458.011	52.23	N/A	39.88	74.0	N/A	54.00	Vertical	PASS

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

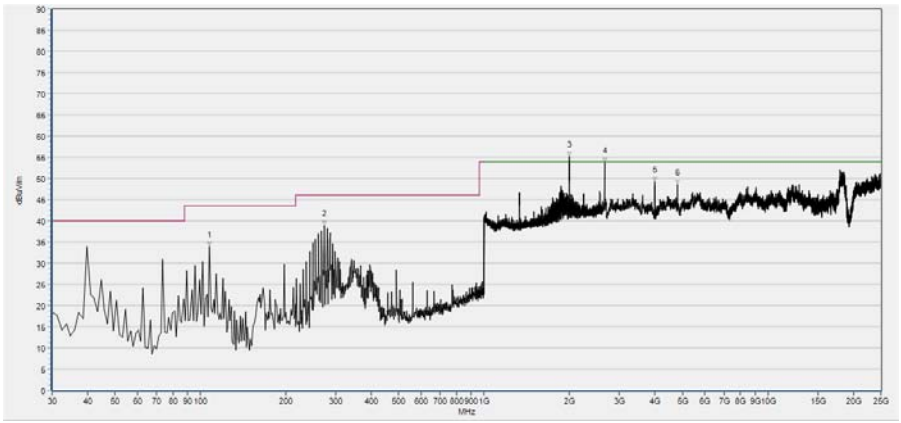
2.10.4.3 8-DPSK Mode:

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
107.697	32.72	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
286.158	38.94	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1998.800	47.53	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
2665.600	52.30	N/A	35.34	74.0	N/A	54.00	Horizontal	PASS
4803.700	53.22	N/A	43.31	74.0	N/A	54.00	Horizontal	PASS
18466.157	51.78	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

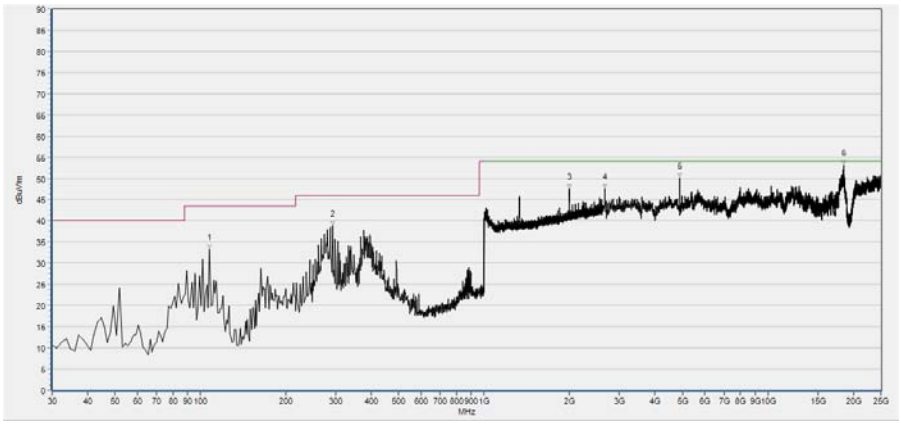
(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 0)



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
107.697	34.00	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
274.018	38.86	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1997.519	55.24	N/A	36.41	74.0	N/A	54.00	Horizontal	PASS
2656.200	53.17	N/A	32.15	74.0	N/A	54.00	Horizontal	PASS
3997.199	49.21	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
4803.746	48.62	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

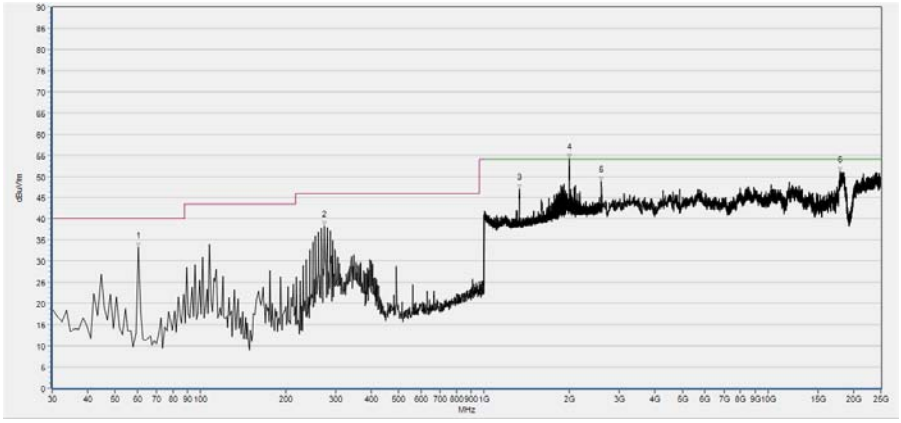
(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 0)

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
107.697	33.25	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
292.228	38.75	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1999.440	47.52	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
2661.102	47.61	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
4881.142	50.09	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
18492.000	53.45	N/A	40.06	74.0	N/A	54.0	Horizontal	PASS

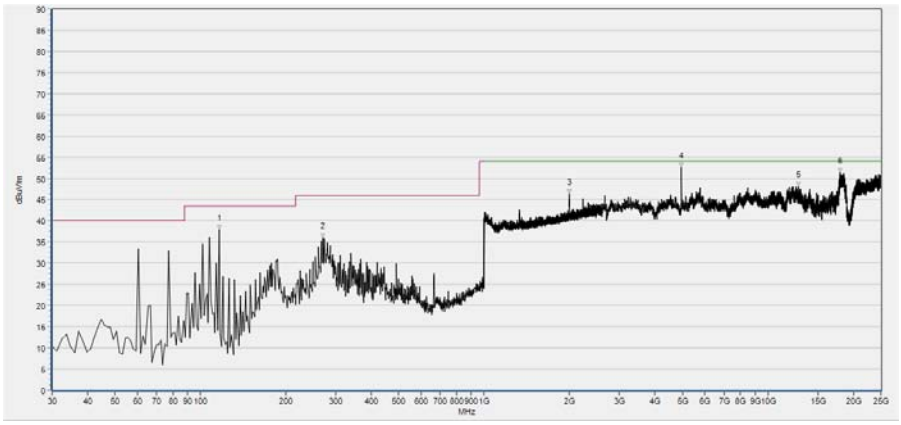
(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 39)



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
60.350	33.33	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
272.804	38.27	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1329.092	47.06	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
1999.440	54.18	N/A	32.78	74.0	N/A	54.0	Vertical	PASS
2589.116	48.81	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
18001.782	51.26	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

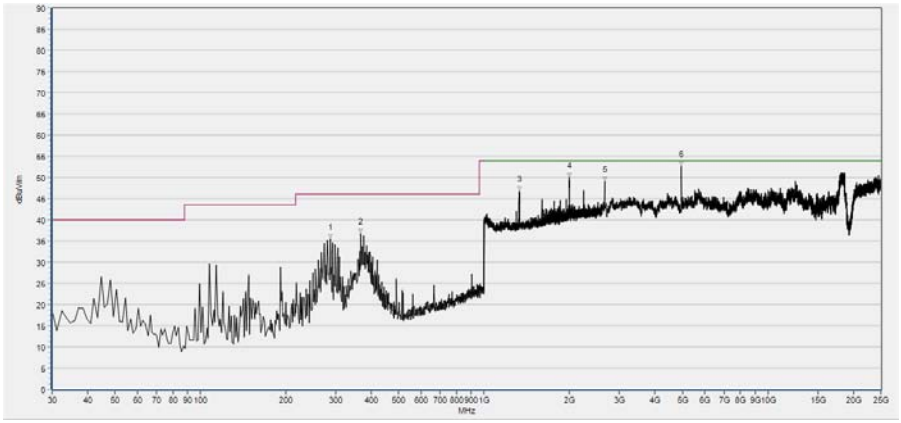
(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 39)

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
116.195	37.95	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
270.375	35.90	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1995.598	46.36	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
4958.538	52.61	N/A	45.78	74.0	N/A	54.00	Horizontal	PASS
12783.670	48.05	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
17993.635	51.43	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
286.158	35.47	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
367.497	36.71	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1327.171	46.82	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
1998.159	50.09	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
2657.029	49.15	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
4960.300	52.71	N/A	41.96	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