



REPORT No. : SZ14100069W04

# FCC RF TEST REPORT

**APPLICANT** : ZTE Corporation  
**PRODUCT NAME** : WCDMA Digital Mobile Phone Handset  
**MODEL NAME** : NX406E  
**TRADE NAME** : ZTE  
**BRAND NAME** : ZTE  
**FCC ID** : SRQ-NX406E  
**STANDARD(S)** : 47 CFR Part 15 Subpart C  
**ISSUE DATE** : 2014-11-05



**SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd.**

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Change History		
Issue	Date	Reason for change
1.0	2014-11-05	First edition



### Test Report Declaration

Applicant	ZTE Corporation
Applicant Address	ZTE Plaza, Keji Road South, Hi-Tech, Industrial Park, Nanshan District, Shenzhen, Guangdong, P.R. China
Manufacturer	ZTE Corporation
Manufacturer Address	ZTE Plaza, Keji Road South, Hi-Tech, Industrial Park, Nanshan District, Shenzhen, Guangdong, P.R. China
Product Name	WCDMA Digital Mobile Phone Handset
Model Name	NX406E
Brand Name	ZTE
HW Version	NX406J
SW Version	NX406J_VE_V1.01
Test Standards	47 CFR Part 15 Subpart C
Test Date	2014-10-16 to 2014-10-30
Test Result	PASS

Tested by : Wu Jianwu  
Wu Jianwu

Reviewed by : Qiu Xiaojun  
Qiu Xiaojun

Approved by : Zeng Dexin  
Zeng Dexin



# 1. Technical Information

Note: Provide by applicant.

## 1.1. Applicant Information

Company:	ZTE Corporation
Address:	ZTE Plaza, Keji Road South, Hi-Tech, Industrial Park, Nanshan District, Shenzhen, Guangdong, P.R. China

## 1.2. Equipment under Test (EUT) Description

Brand Name:	ZTE
Trade Name:	ZTE
Model Name:	NX406E
Frequency Range:	The frequency range used is 2402MHz – 2480MHz (79 channels, at intervals of 1MHz); The frequency block is 2400MHz to 2483.5MHz.
Modulation Type:	Bluetooth: FHSS (GFSK(1Mbps), $\pi/4$ -DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps))
Bluetooth Version:	2.1+EDR
Antenna Type:	PIFA Antenna
Antenna Gain:	1.5dBi

### NOTE:

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

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

### 1.2.1. Identification of all used EUTs

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



EUT Identity	Hardware Version	Software Version
A01	NX406J	NX406J_VE_V1.01

### 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 (10-1-13 Edition)	Radio Frequency Devices

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

No.	Section in CFR 47	Description	Result
1	15.203	Antenna Requirement	<b><u>PASS</u></b>
2	15.247(a)	Number of Hopping Frequency	<b><u>PASS</u></b>
3	15.247(b)	Peak Output Power	<b><u>PASS</u></b>
4	15.247(a)	20dB Bandwidth	<b><u>PASS</u></b>
5	15.247(a)	Carrier Frequency Separation	<b><u>PASS</u></b>
6	15.247(a)	Time of Occupancy (Dwell time)	<b><u>PASS</u></b>
7	15.247(d)	Conducted Spurious Emission	<b><u>PASS</u></b>
8	15.247(d)	Restricted Frequency Bands	<b><u>PASS</u></b>
9	15.207	Conducted Emission	<b><u>PASS</u></b>
10	15.209 15.247(d)	Radiated Emission	<b><u>PASS</u></b>
11	15.247(i),1.1307& 2.1093	RF exposure evaluation	<b><u>PASS</u></b>

**NOTE:** The tests were performed according to the method of measurements prescribed in DA-00-705, ANSI C63.4-2003 and ANSI C63.10-2009.

#### 1.3.1. Test Environment Conditions

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

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



## 2. 47 CFR PART 15C REQUIREMENTS

### 2.1. Antenna requirement

#### 2.1.1. Applicable Standard

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

#### 2.1.2. Result: Compliant

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

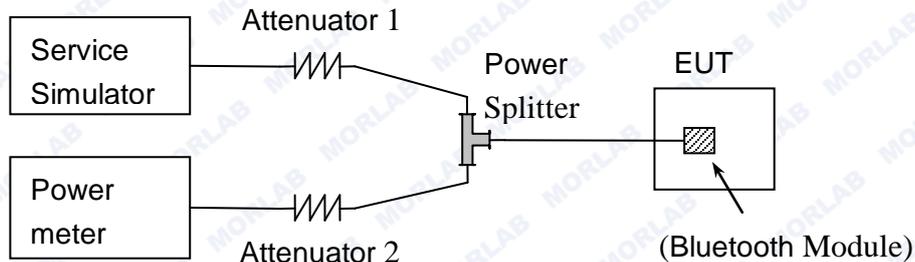
### 2.2. Number of Hopping Frequency

#### 2.2.1. Requirement

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

#### 2.2.2. Test Description

##### A. Test Setup:



The Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Service Simulator (SS) 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(1.4).

### 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  $\geq$  1% of the span

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

### 2.2.4. Test Result

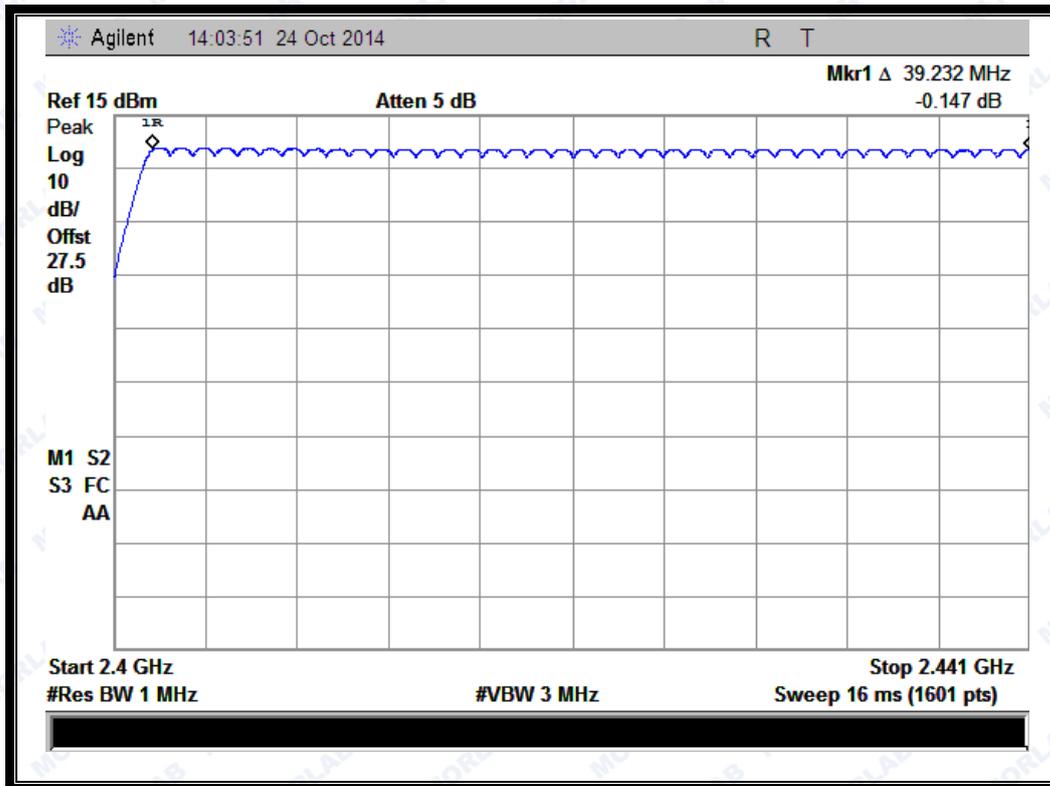
The Bluetooth Module operates at hopping-on test mode; the frequencies number employed is counted to verify the Module's using the number of hopping frequency.

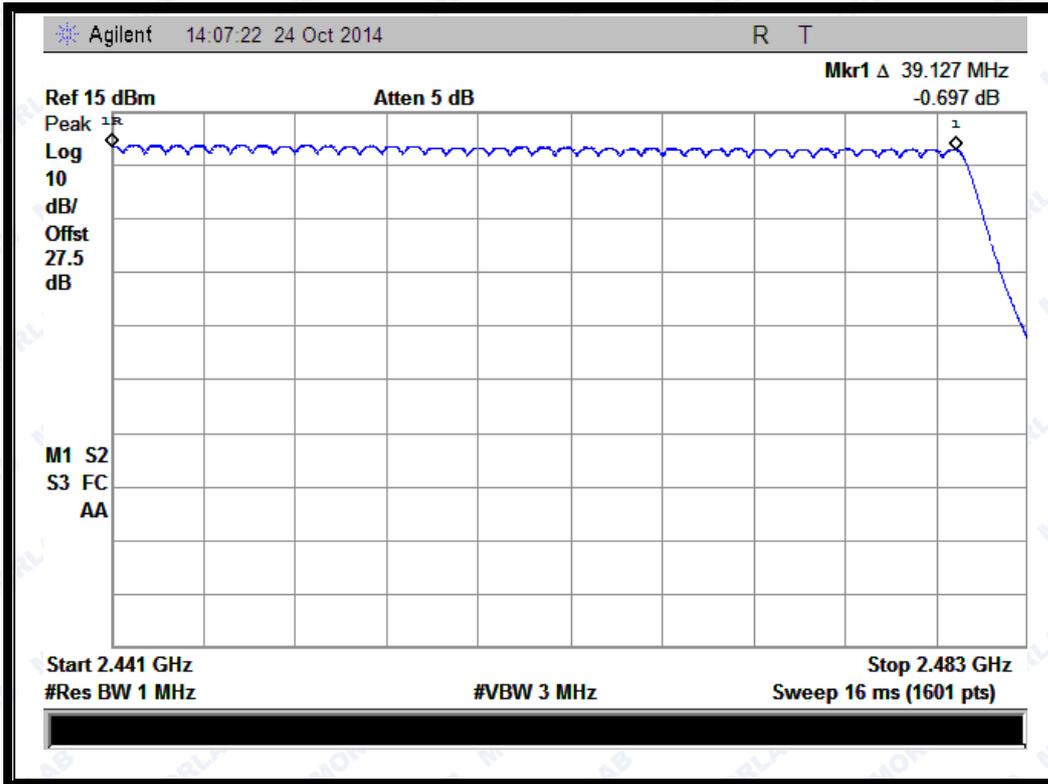
#### A. Test Verdict:



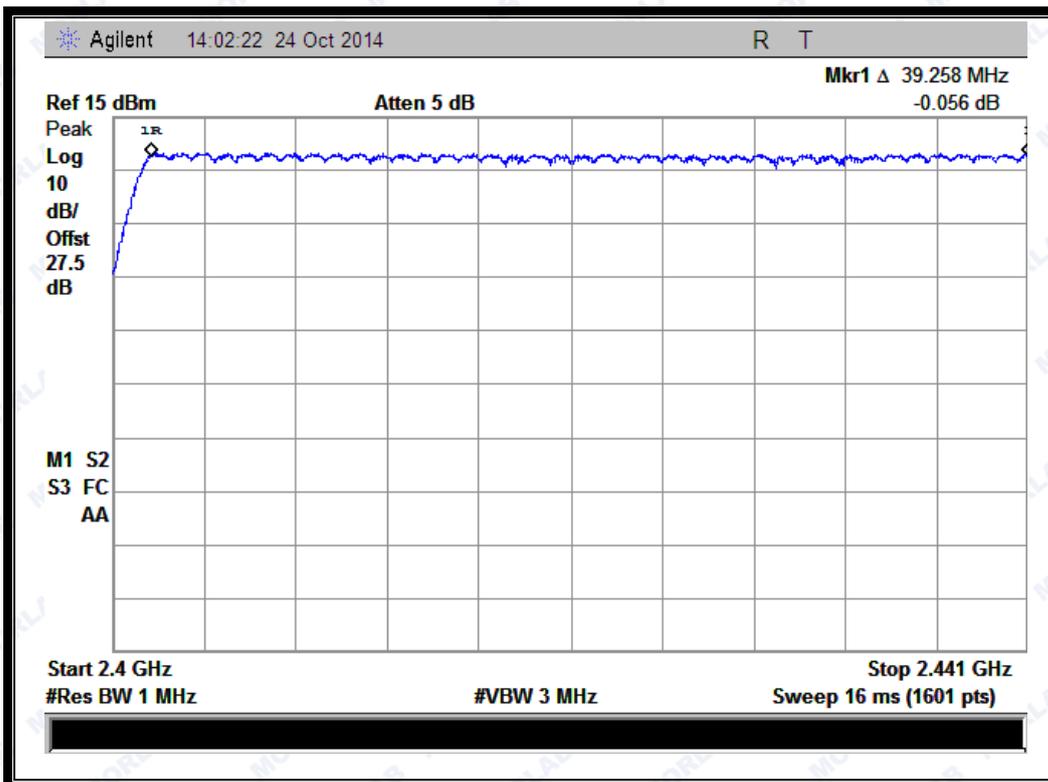
Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Refer to Plot	Verdict
GFSK	2400 - 2483.5	79	15	Plot A	PASS
π/4-DQPSK K	2400 - 2483.5	79	15	Plot B	PASS
8-DPSK	2400 - 2483.5	79	15	Plot C	PASS

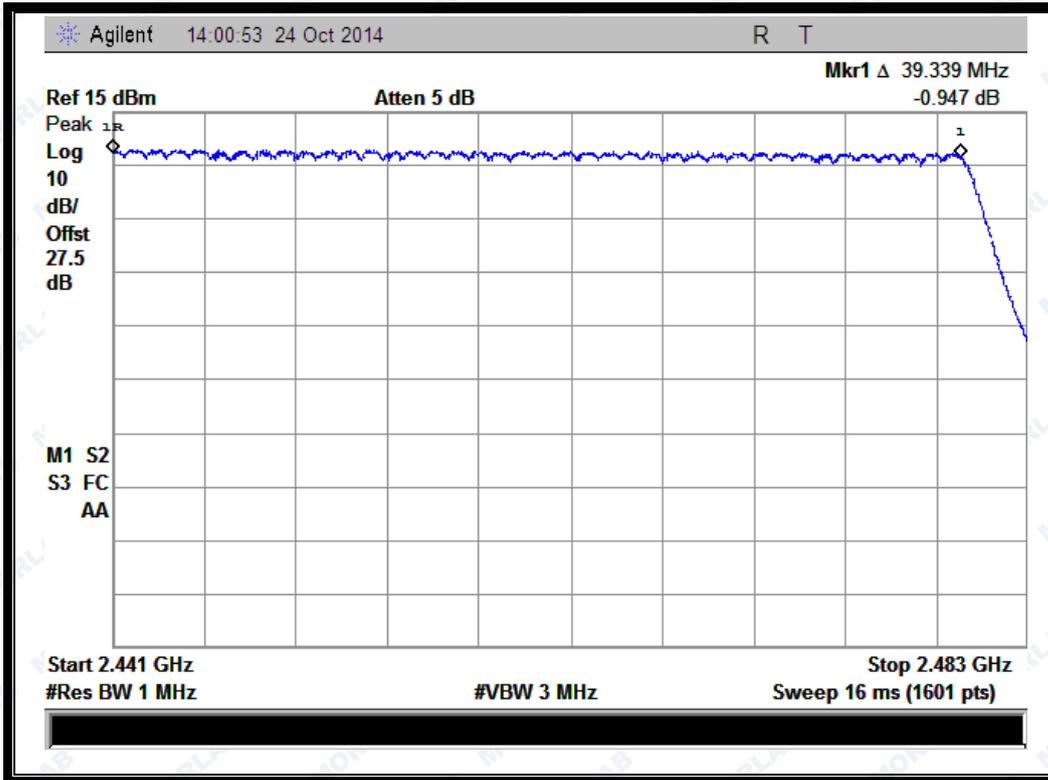
**B. Test Plots:**



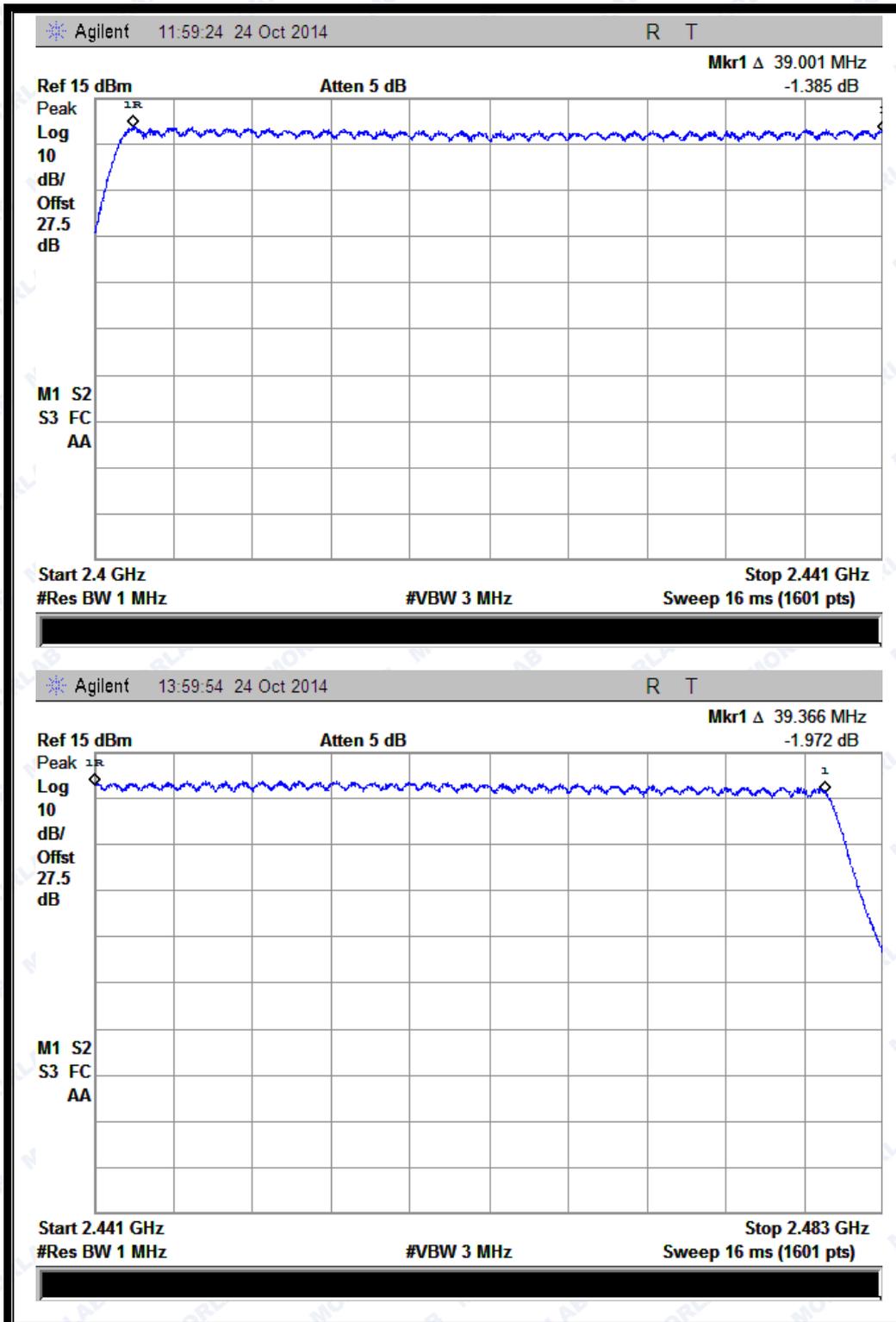


(Plot A: GFSK)





(Plot B:  $\pi/4$ -DQPSK)



(Plot C: 8- DPSK)

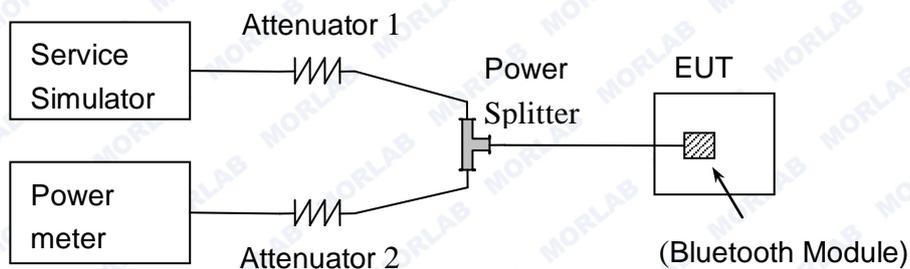
## 2.3. Peak Output Power

### 2.3.1. Requirement

According to FCC §15.247(b)(1), for frequency hopping systems that operates in the 2400MHz to 2483.5MHz band employing at least 75 hopping channels, the maximum peak output power of the intentional 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 Power meter and the Bluetooth Service Simulator (SS) 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(1.4).

### 2.3.3. Test Result

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



### 2.3.3.1. GFSK Mode

#### A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	8.730	0.007464	20.97	0.125	PASS
39	2441	8.393	0.006907			PASS
78	2480	7.375	0.005460			PASS

### 2.3.3.2. □/4-DQPSK Mode

#### A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	8.042	0.006371	20.97	0.125	PASS
39	2441	7.737	0.005939			PASS
78	2480	6.643	0.004620			PASS

### 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	8.290	0.006745	20.97	0.125	PASS
39	2441	7.955	0.006245			PASS
78	2480	6.913	0.004910			PASS

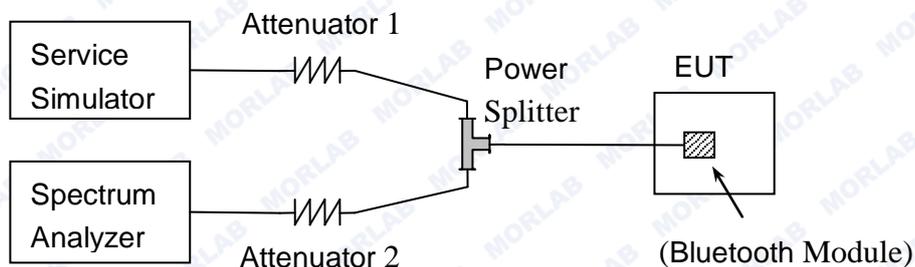
## 2.4. 20dB Bandwidth

### 2.4.1. Definition

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth ( $10 \cdot \log 1\% = 20\text{dB}$ ) 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 Service Simulator (SS) 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(1.4).

### 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  $\geq$  1% of the 20 dB bandwidth



VBW  $\geq$  RBW  
Sweep = auto  
Detector function = peak  
Trace = max hold

## 2.4.4. Test Result

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

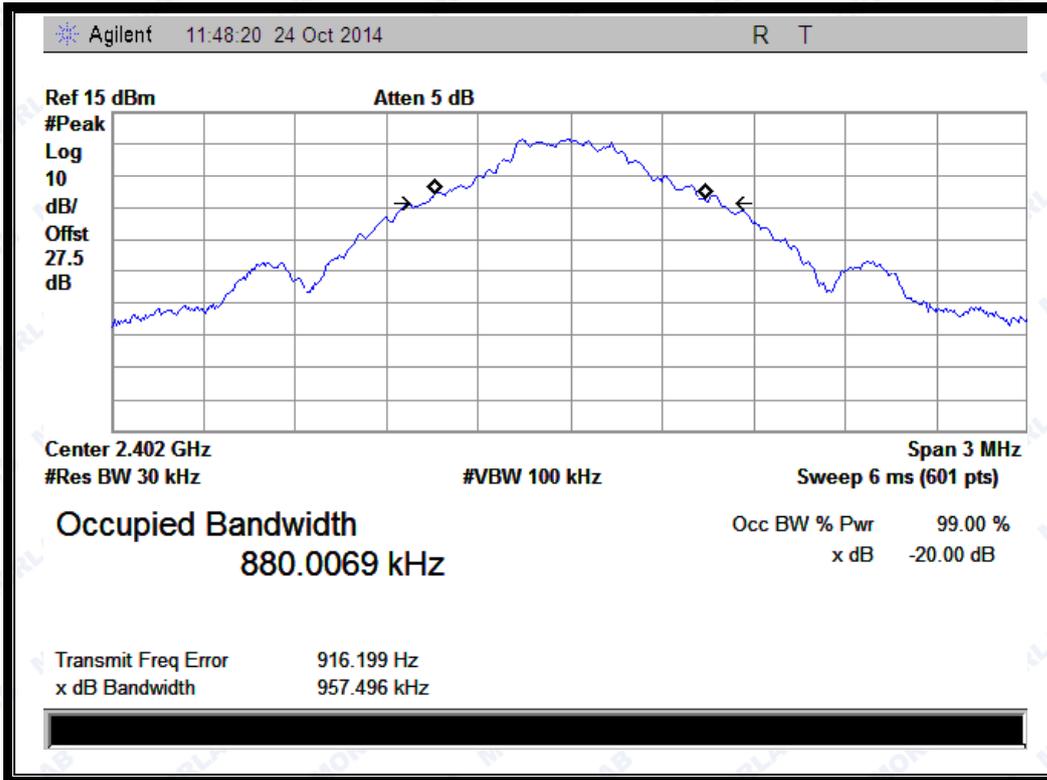
### 2.4.4.1. GFSK Mode

#### A. Test Verdict:

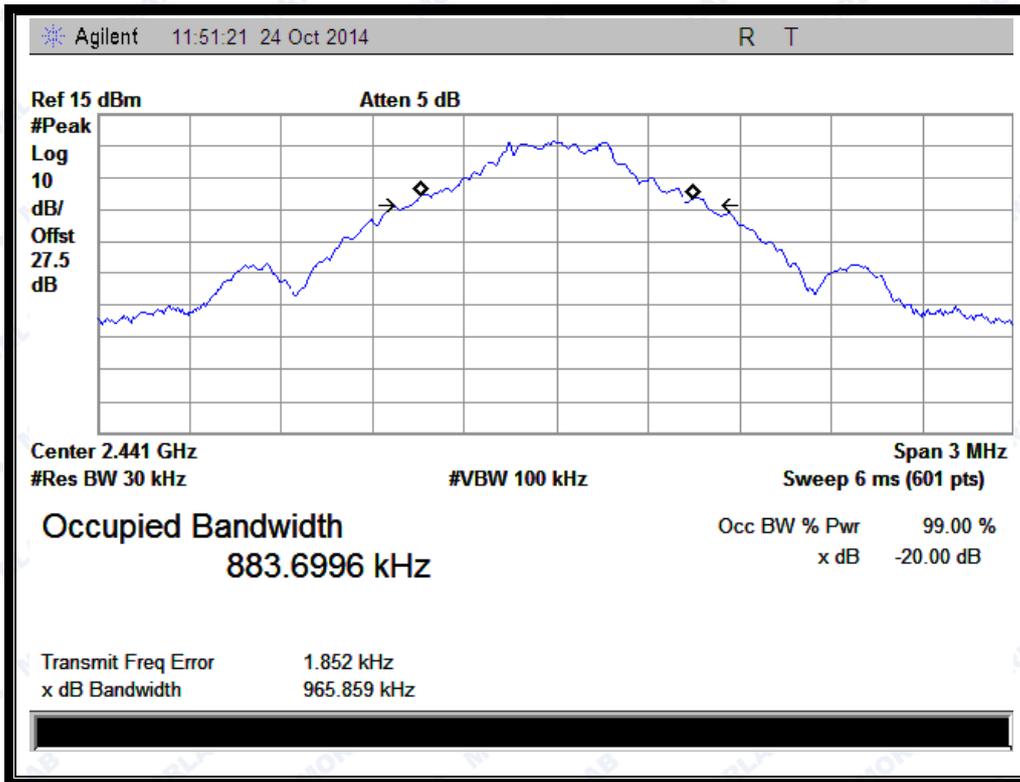
The maximum 20dB bandwidth measured is 1.015MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	0.957	Plot A
39	2441	0.966	Plot B
78	2480	0.967	Plot C

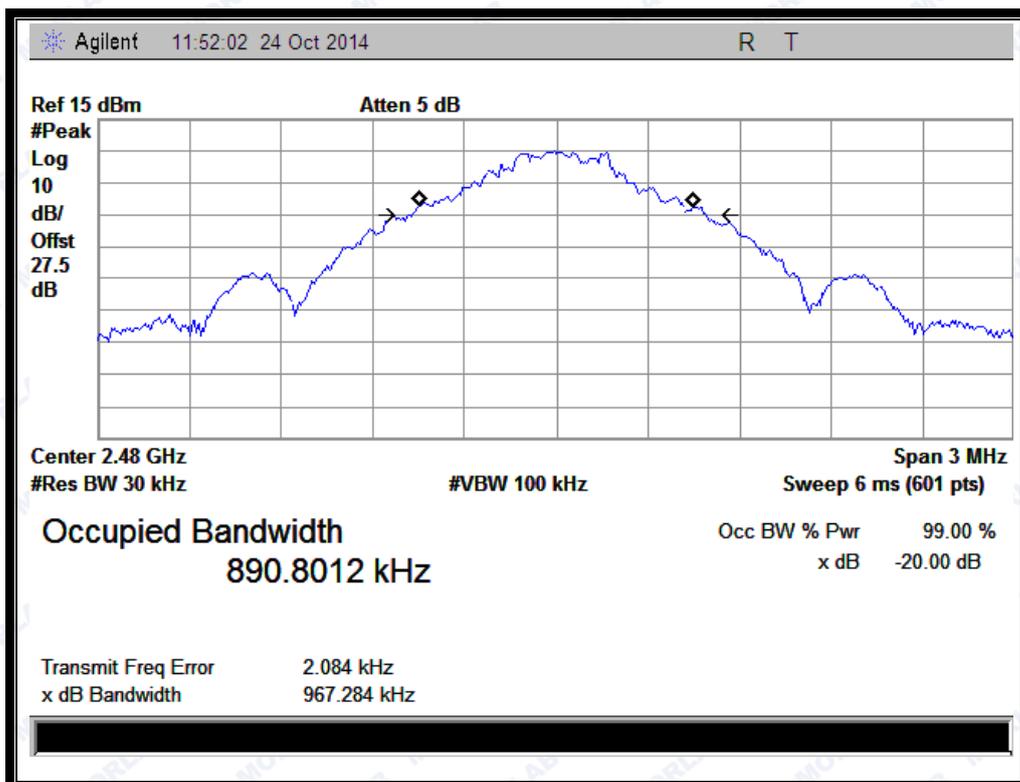
#### B. Test Plots:



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)



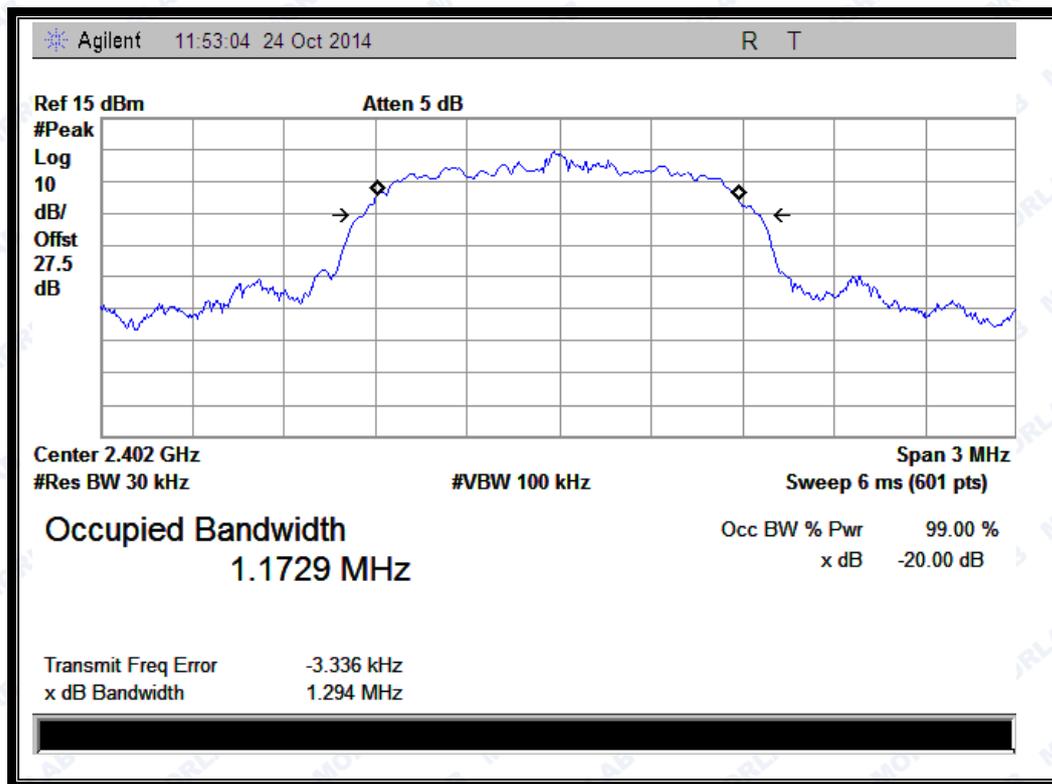
2.4.4.2.  $\pi/4$ -DQPSK Mode

A. Test Verdict:

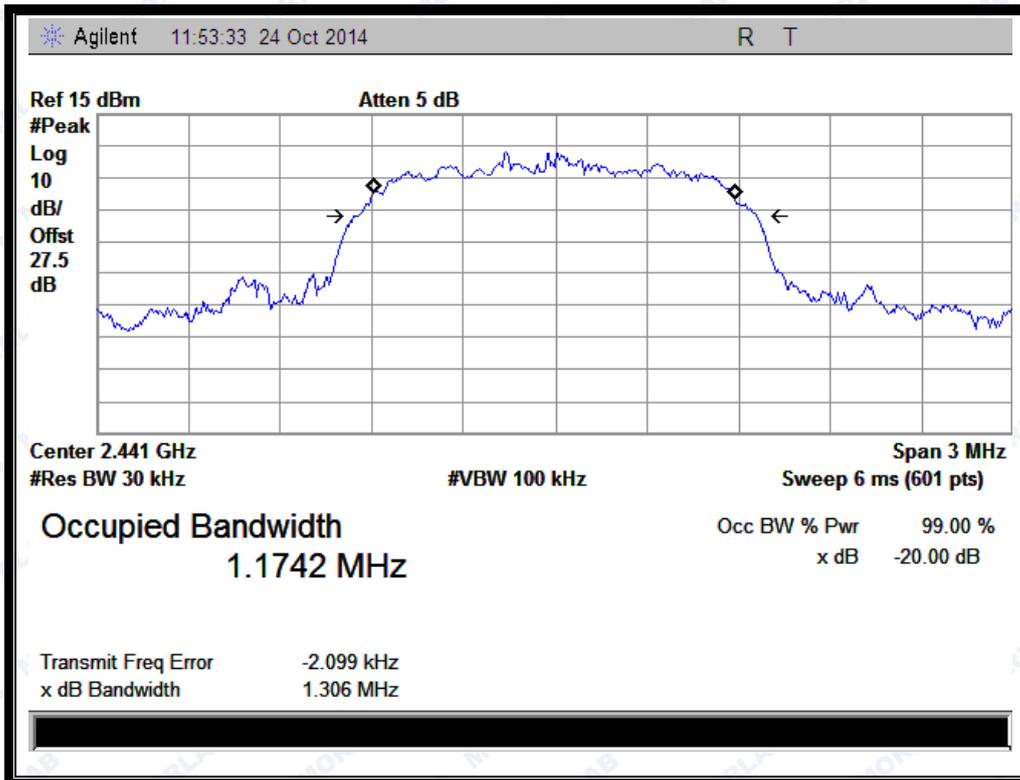
The maximum 20dB bandwidth measured is 1.348MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.294	Plot D
39	2441	1.306	Plot E
78	2480	1.289	Plot F

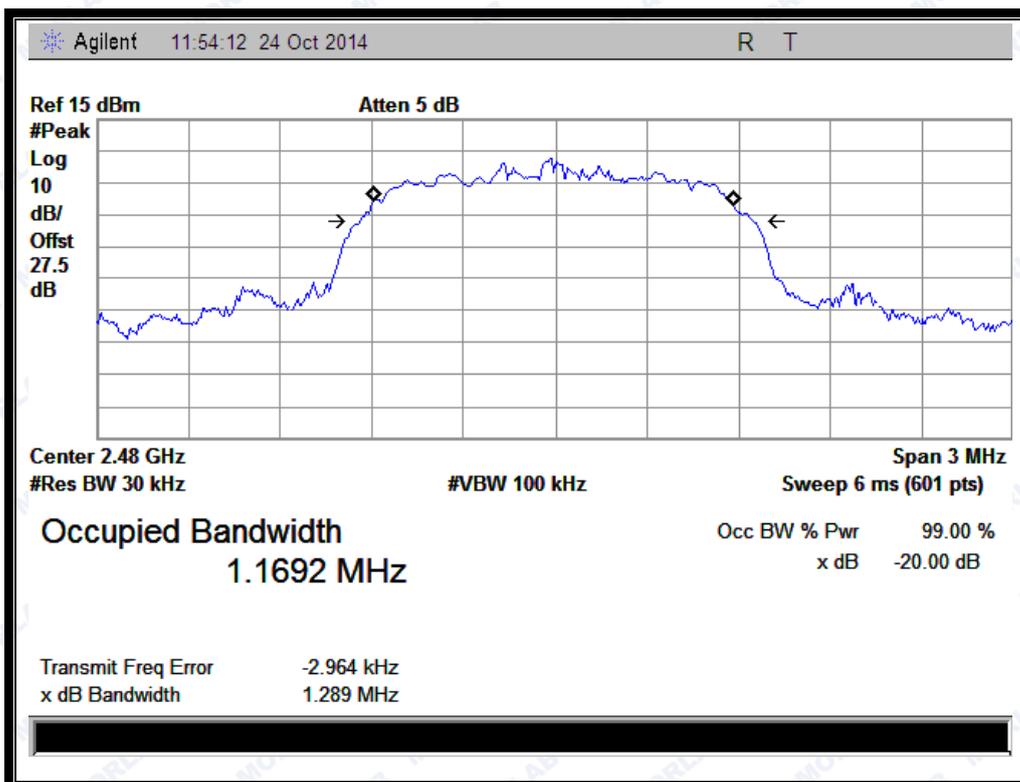
B. Test Plots:



(Plot D: Channel = 2402 @  $\pi/4$ -DQPSK)



(Plot E: Channel = 2441 @  $\pi/4$ -DQPSK)



(Plot F: Channel = 2480 @  $\pi/4$ -DQPSK)



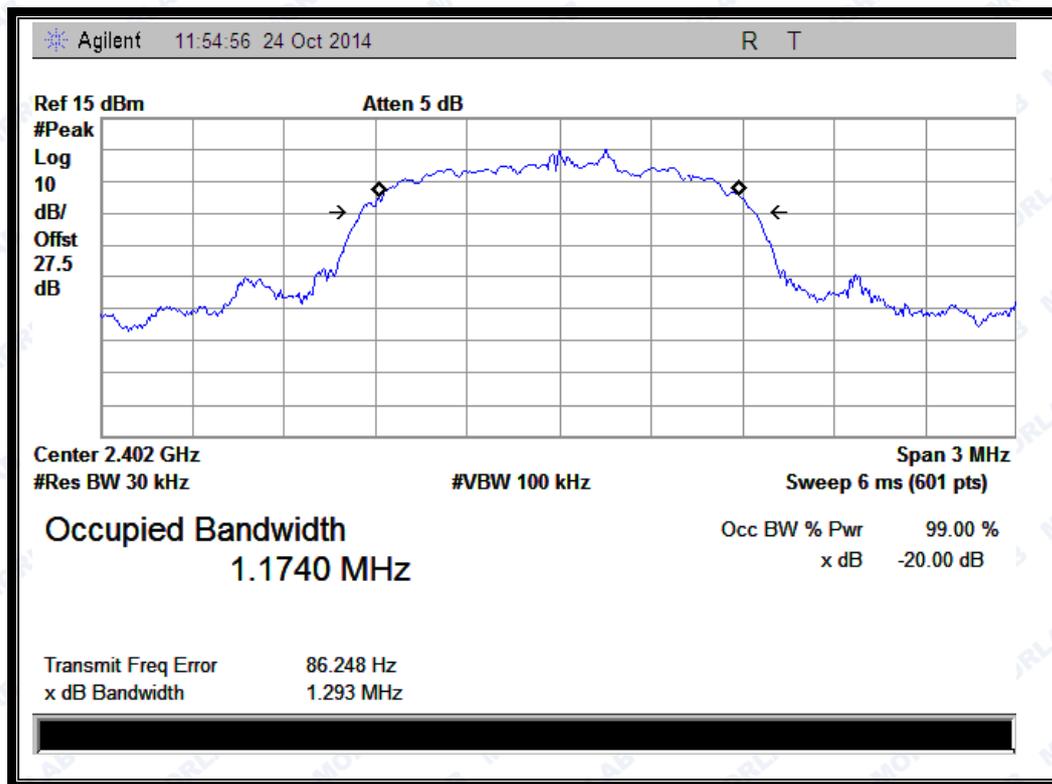
**2.4.4.3. 8-DPSK Mode**

**A. Test Verdict:**

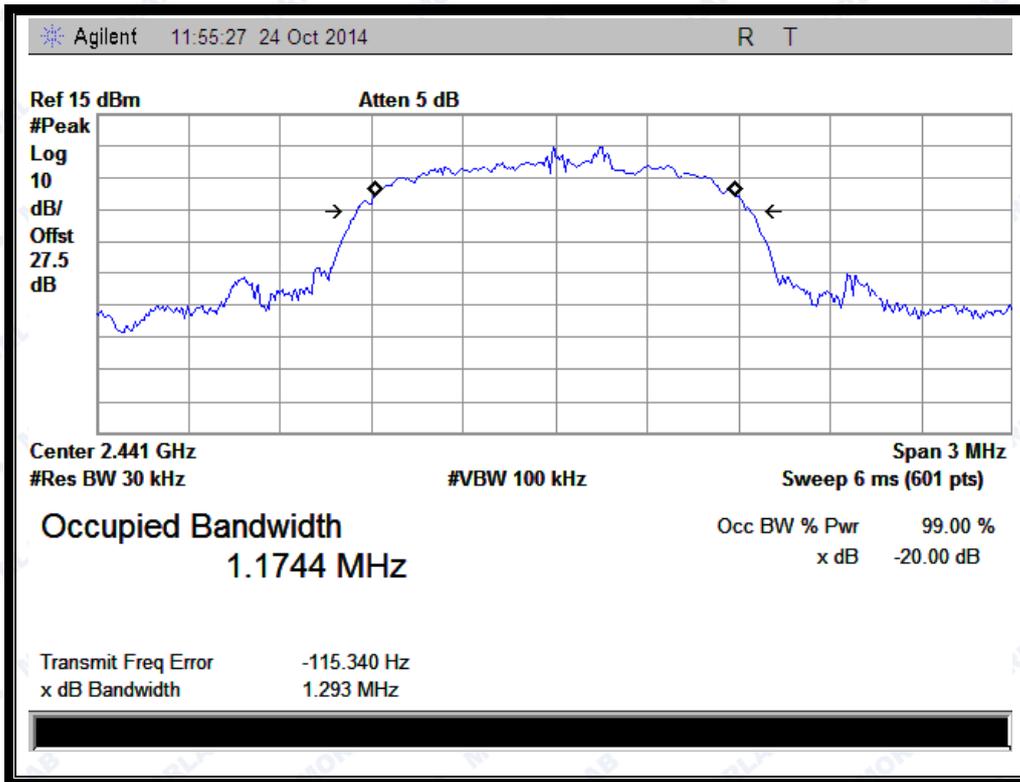
The maximum 20dB bandwidth measured is 1.357MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.293	Plot G
39	2441	1.293	Plot H
78	2480	1.293	Plot I

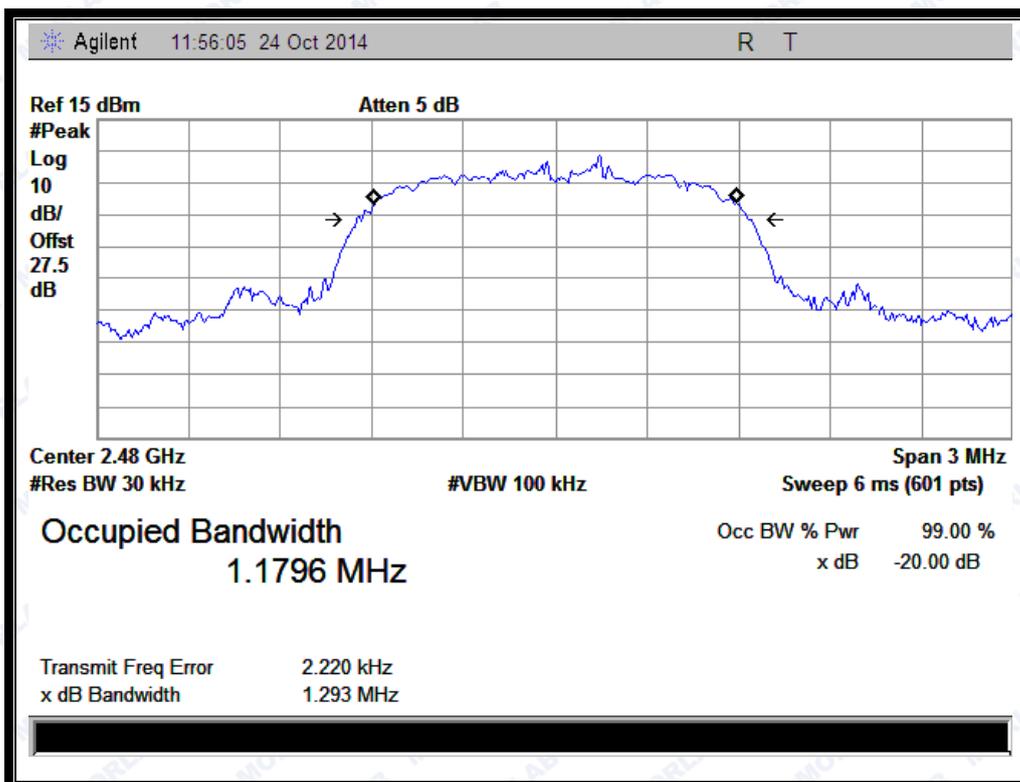
**B. Test Plots:**



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



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



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

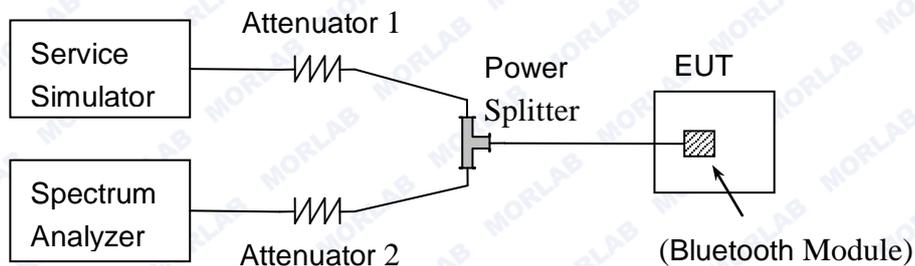
## 2.5. Carried Frequency Separation

### 2.5.1. Definition

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

### 2.5.2. Test Description

#### A. Test Setup:



The Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Service Simulator (SS) 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(1.4).

### 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)  $\geq$  1% of the span

Video (or Average) Bandwidth (VBW)  $\geq$  RBW



Sweep = auto

Detector function = peak

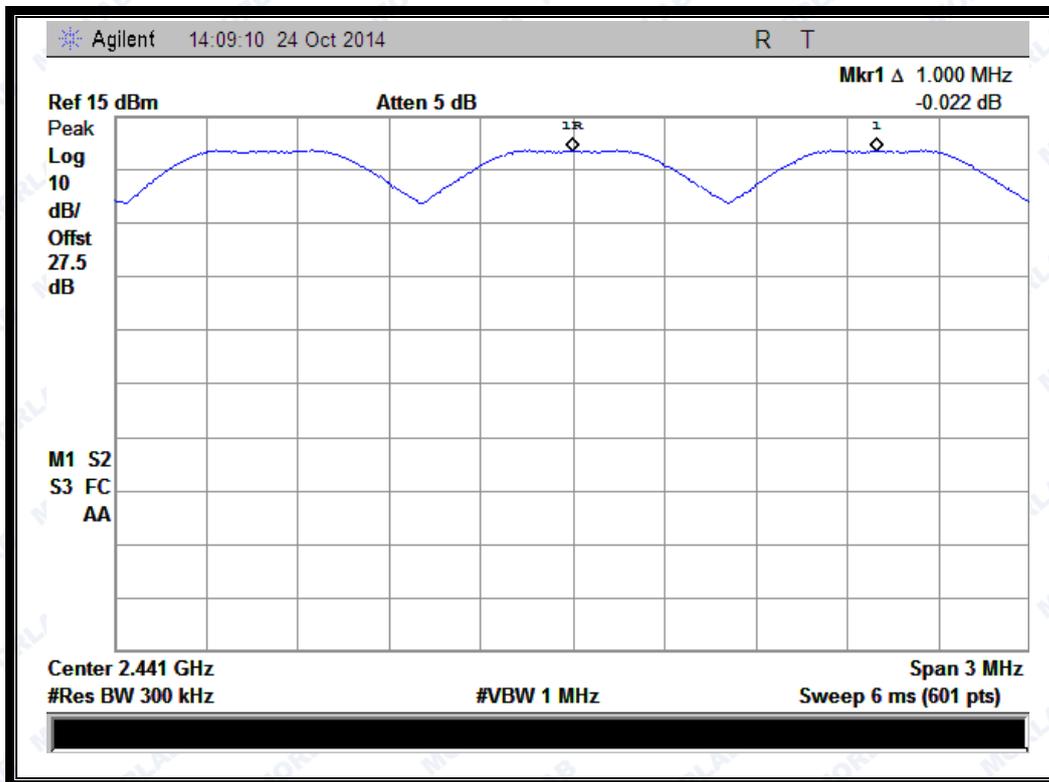
Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

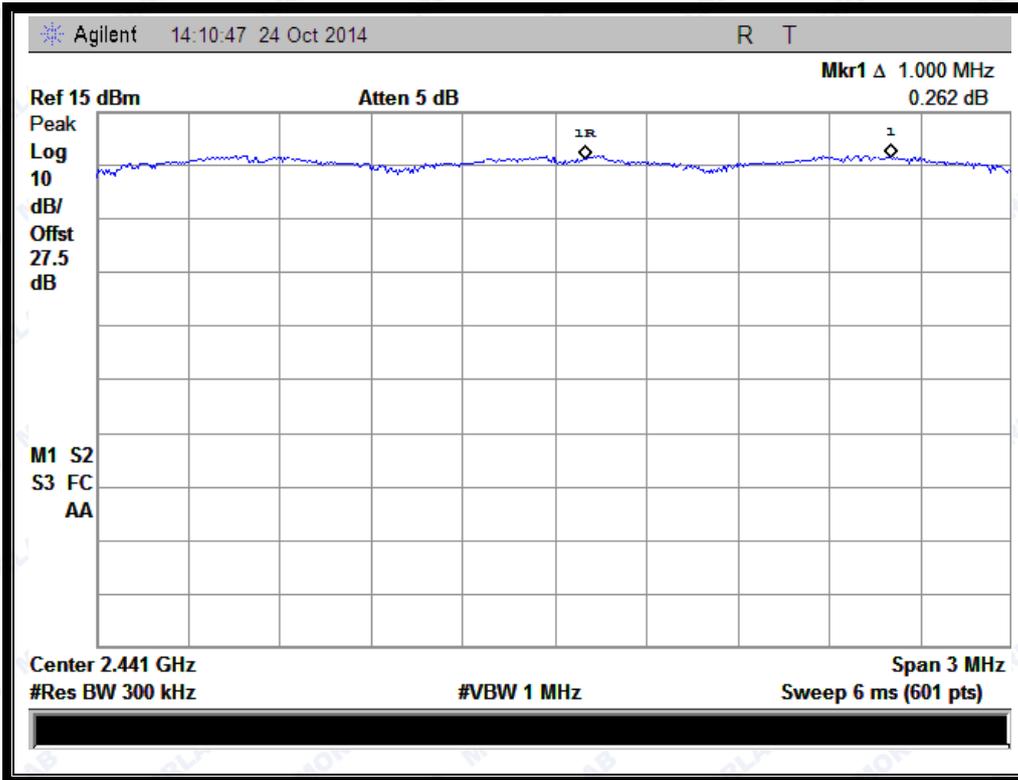
### 2.5.4. Test Result

The Bluetooth Module operates at hopping-on test mode.

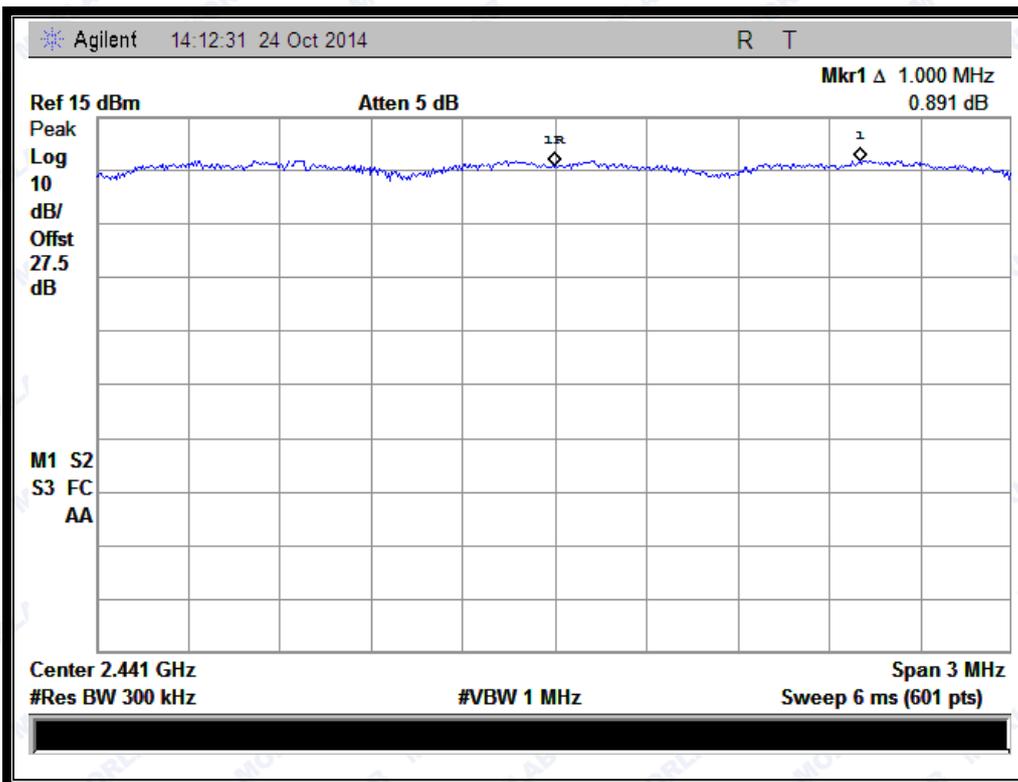
For any adjacent channels (e.g. the channel 39 and 40 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (refer to section 0), whichever is greater. So, the verdict is PASSING



(Plot A: GFSK)



(Plot B: 1/4-DQPSK)



(Plot C: 8-DPSK)

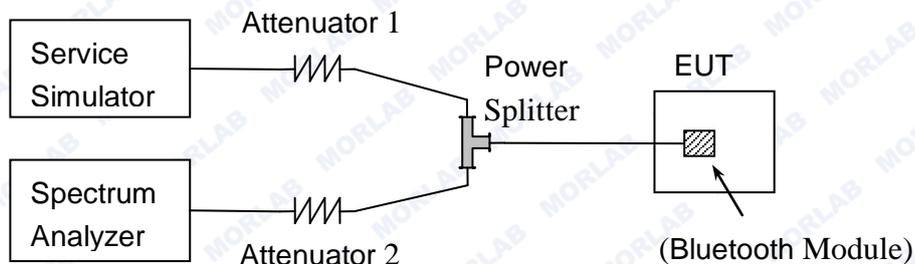
## 2.6. Time of Occupancy (Dwell time)

### 2.6.1. Requirement

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

### 2.6.2. Test Description

#### A. Test Setup:



The Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Service Simulator (SS) 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(1.4).

### 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.

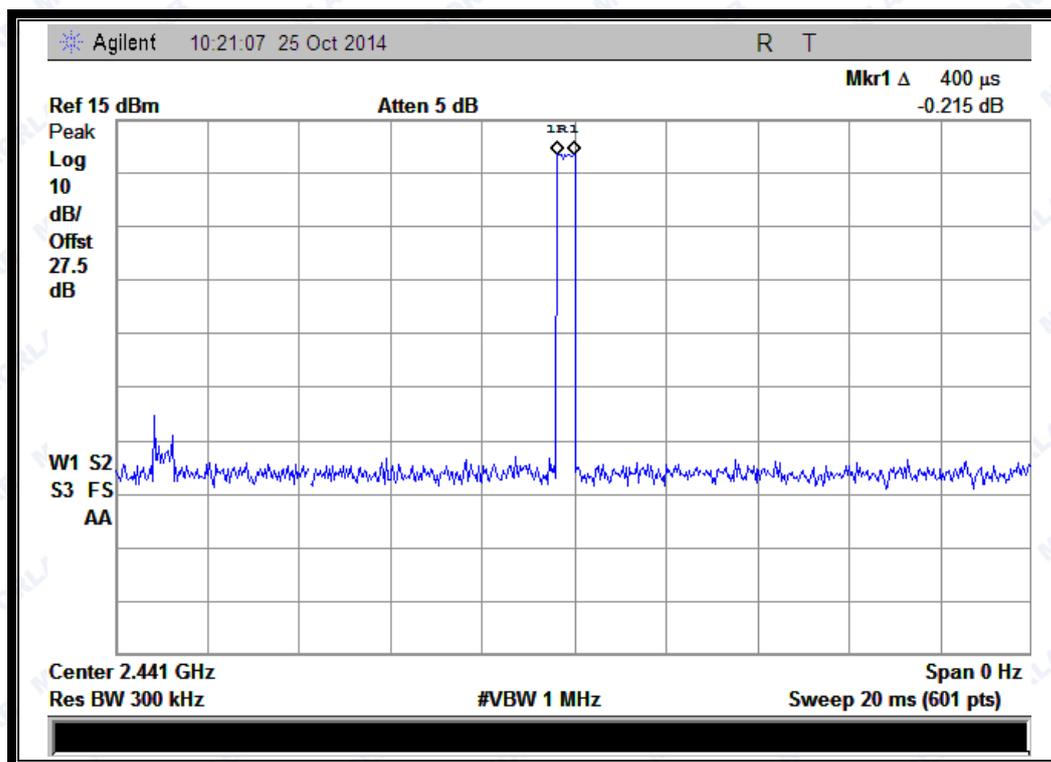
## 2.6.4. Test Result

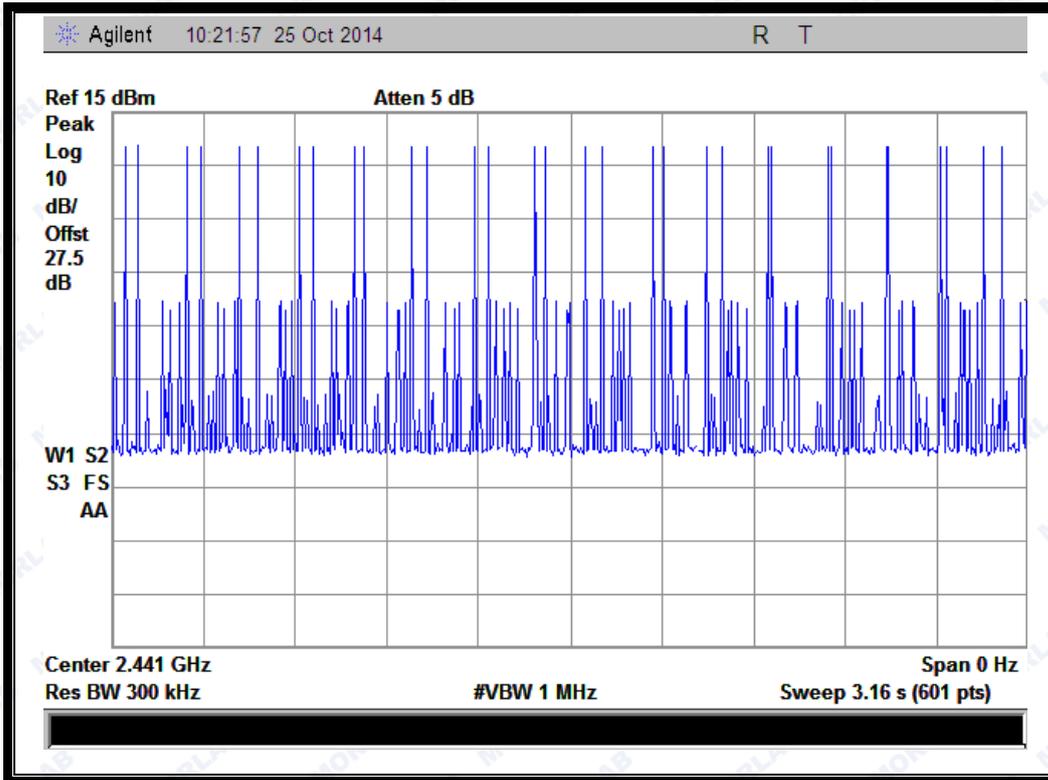
### 2.6.4.1. GFSK Mode

#### A. Test Verdict:

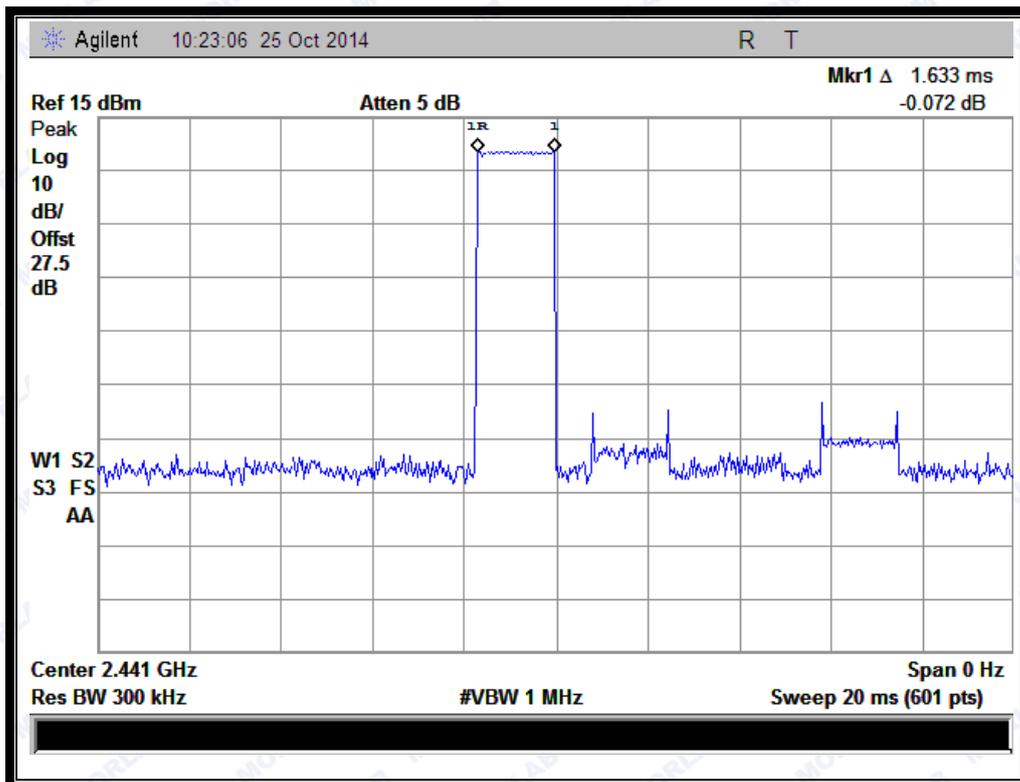
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Refer to Plot	Average Time of Occupancy (sec)	Limit (sec)	Verdict
DH1	0.400	32	Plot A	0.128	0.4	PASS
DH3	1.633	15	Plot B	0.245		PASS
DH5	2.833	15	Plot C	0.425		PASS

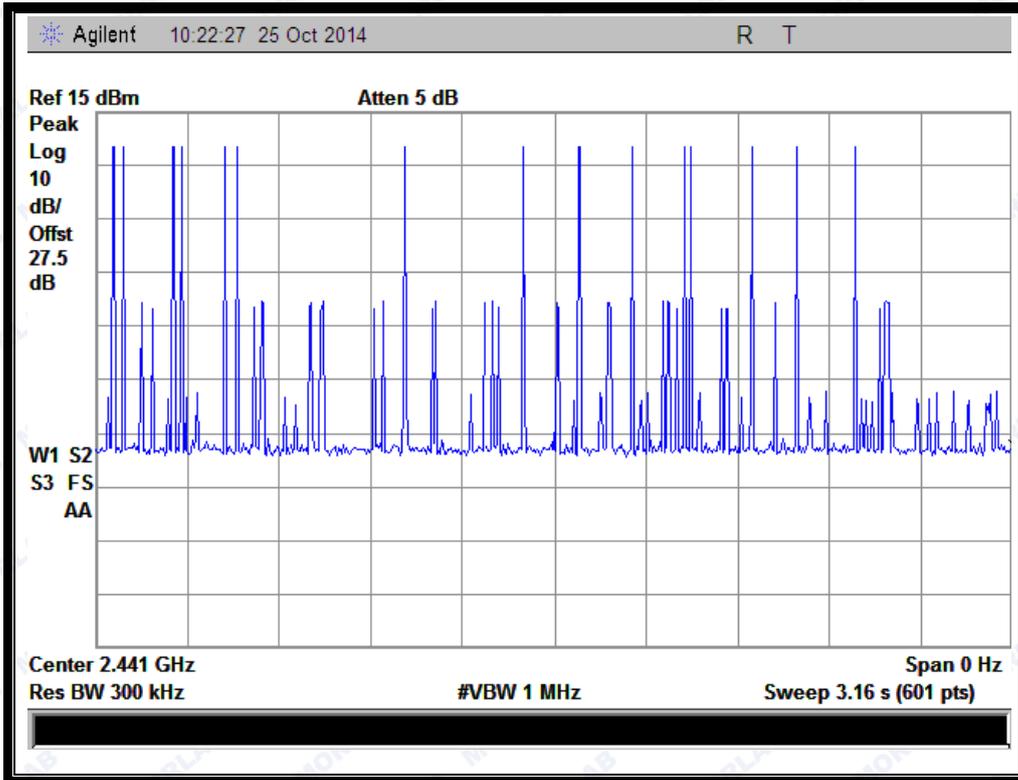
#### B. Test Plots:



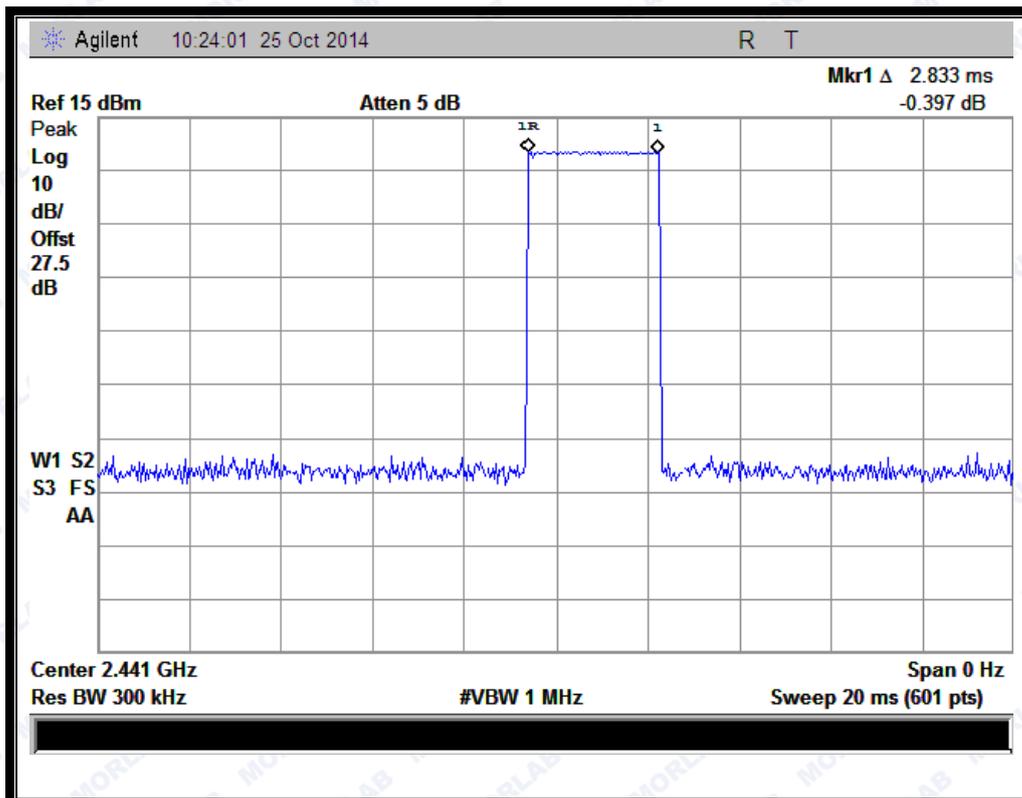


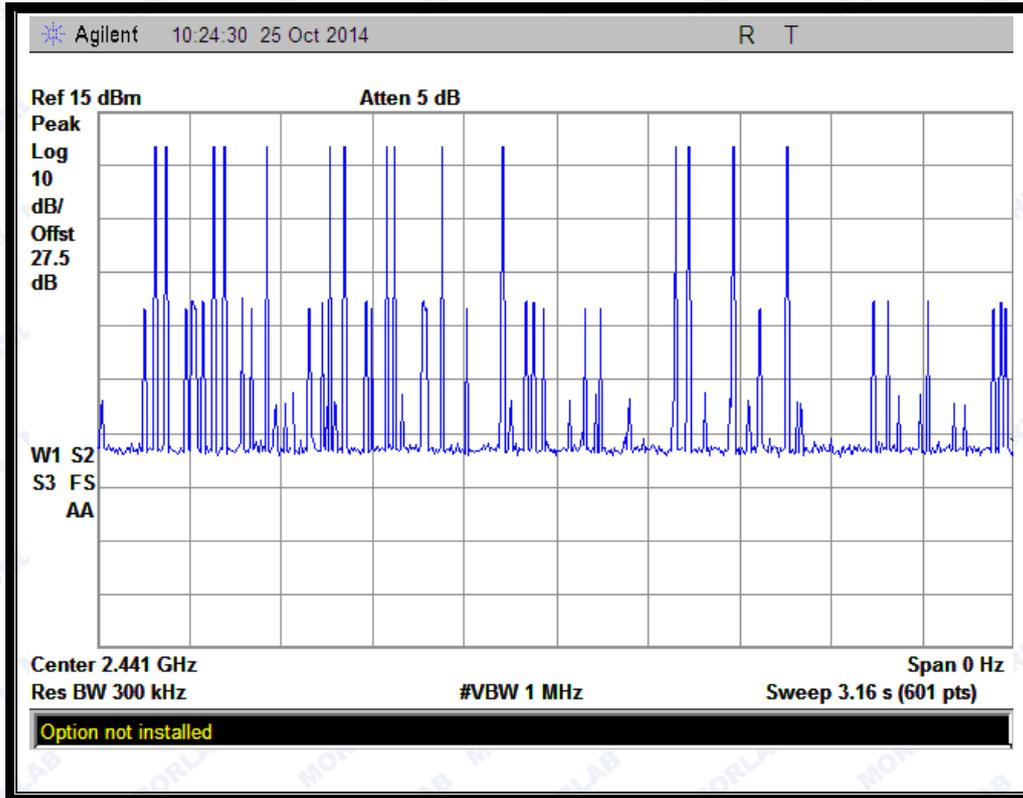
(Plot A: DH1 @ GFSK)





(Plot B: DH3 @ GFSK)





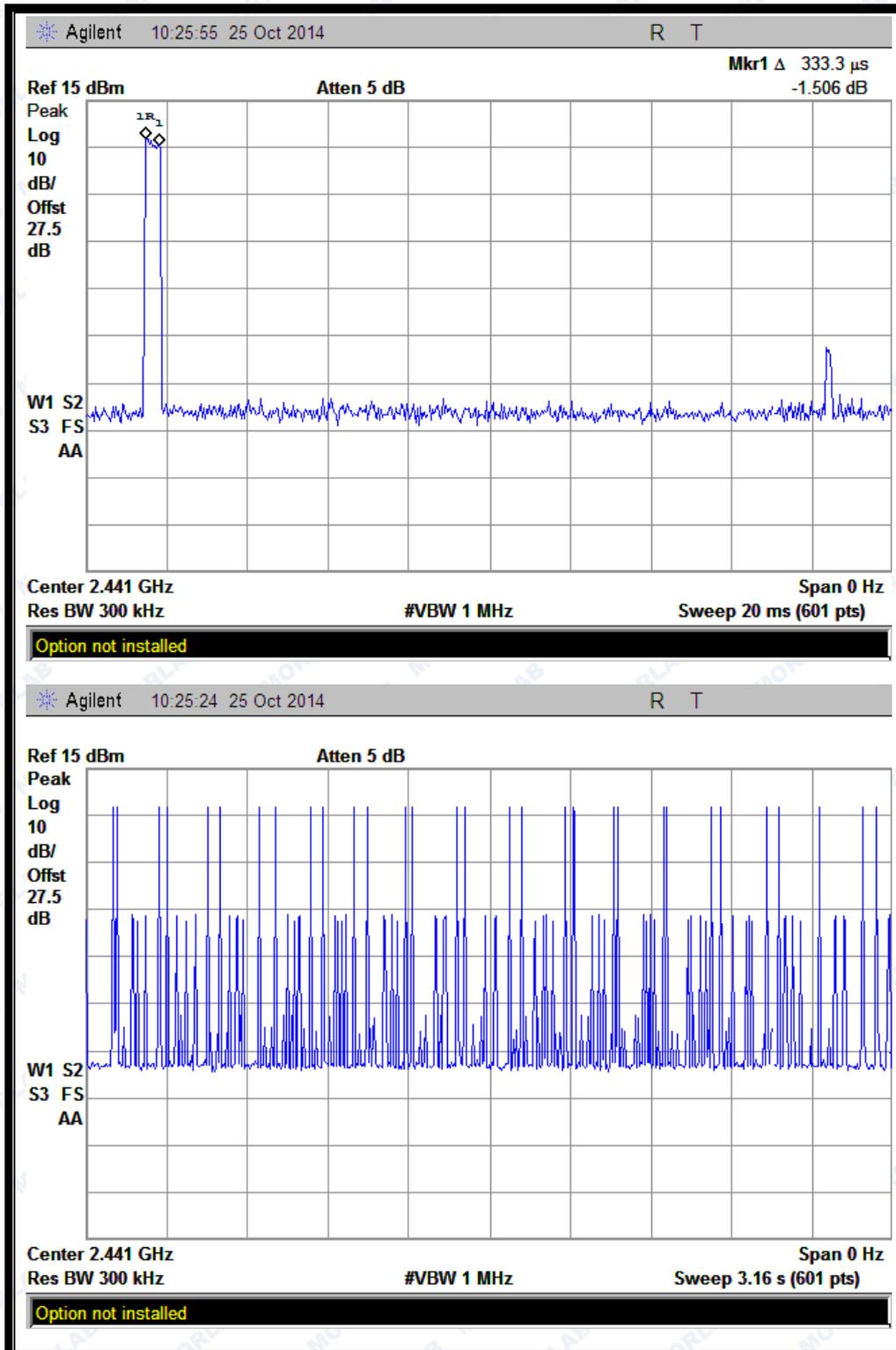
(Plot C: DH5 @ GFSK)

### 2.6.4.2. □/4-DQPSK Mode

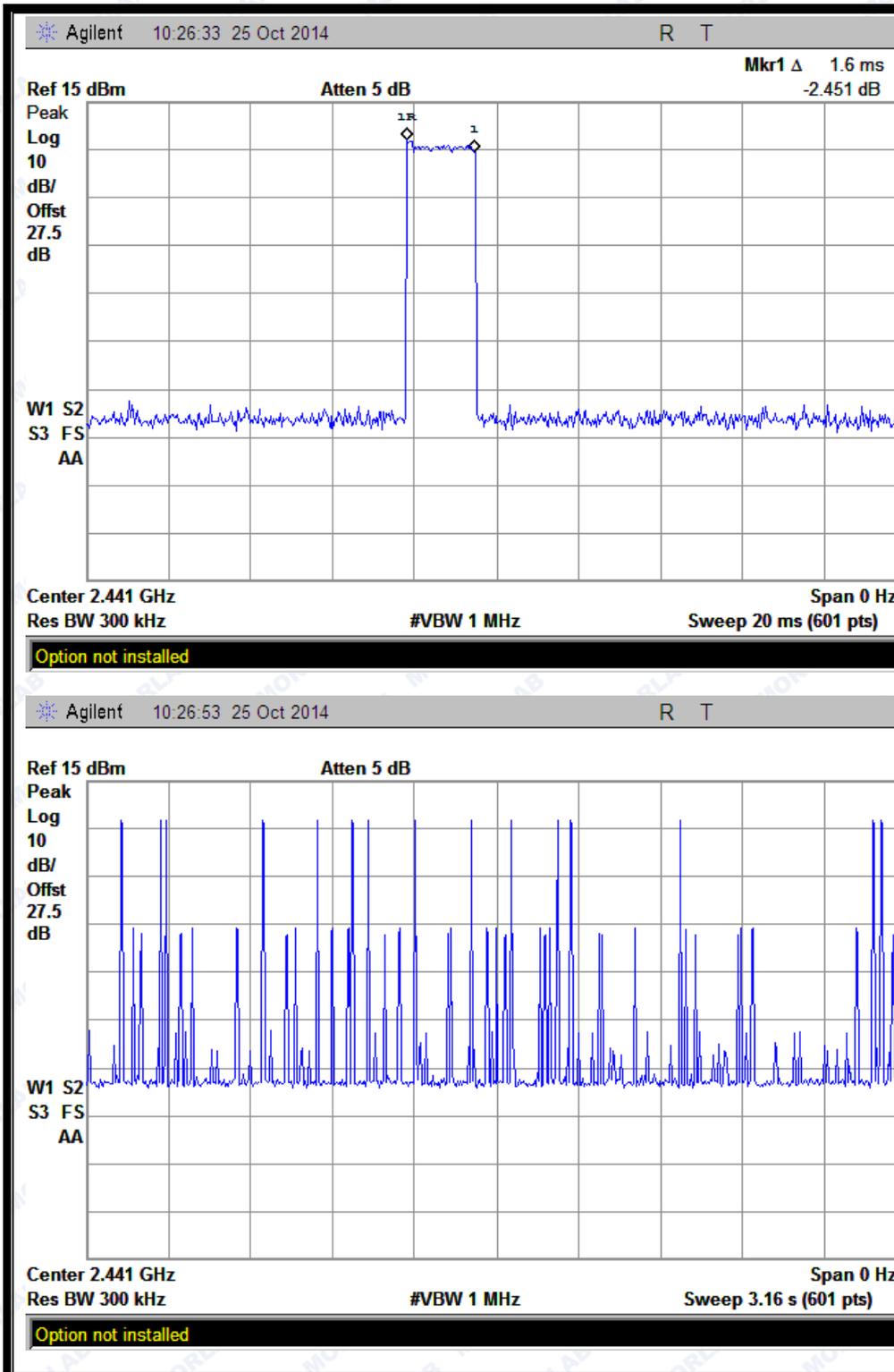
#### A. Test Verdict:

DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Refer to Plot	Average Time of Occupancy (sec)	Limit (sec)	Verdict
DH1	0.333	32	Plot A	0.107	0.4	PASS
DH3	1.600	15	Plot B	0.240		PASS
DH5	2.900	14	Plot C	0.406		PASS

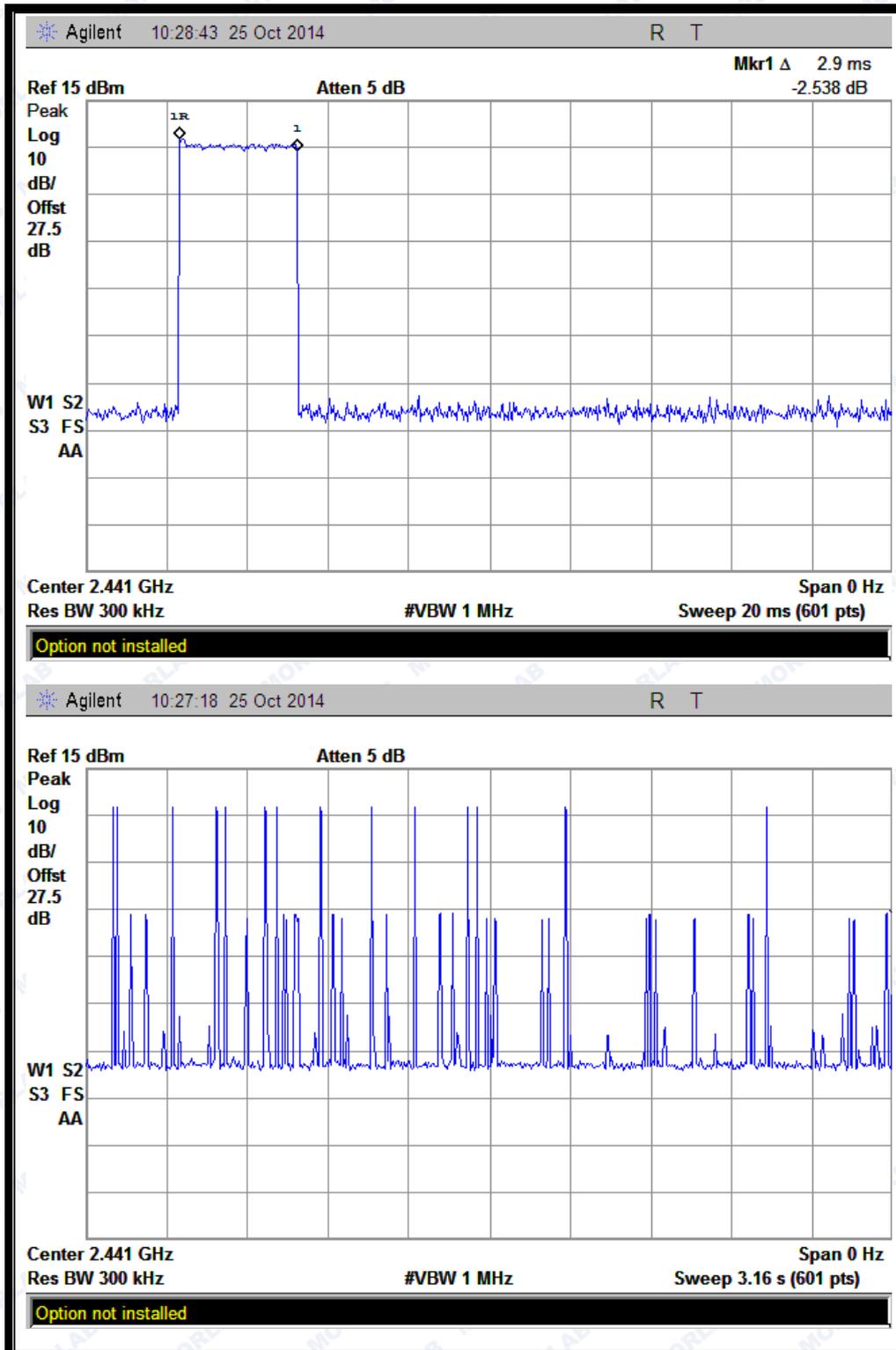
#### B. Test Plots:



(Plot D: DH1 @ π/4-DQPSK)



(Plot E: DH3 @  $\pi/4$ -DQPSK)



(Plot F: DH5 @  $\pi/4$ -DQPSK)

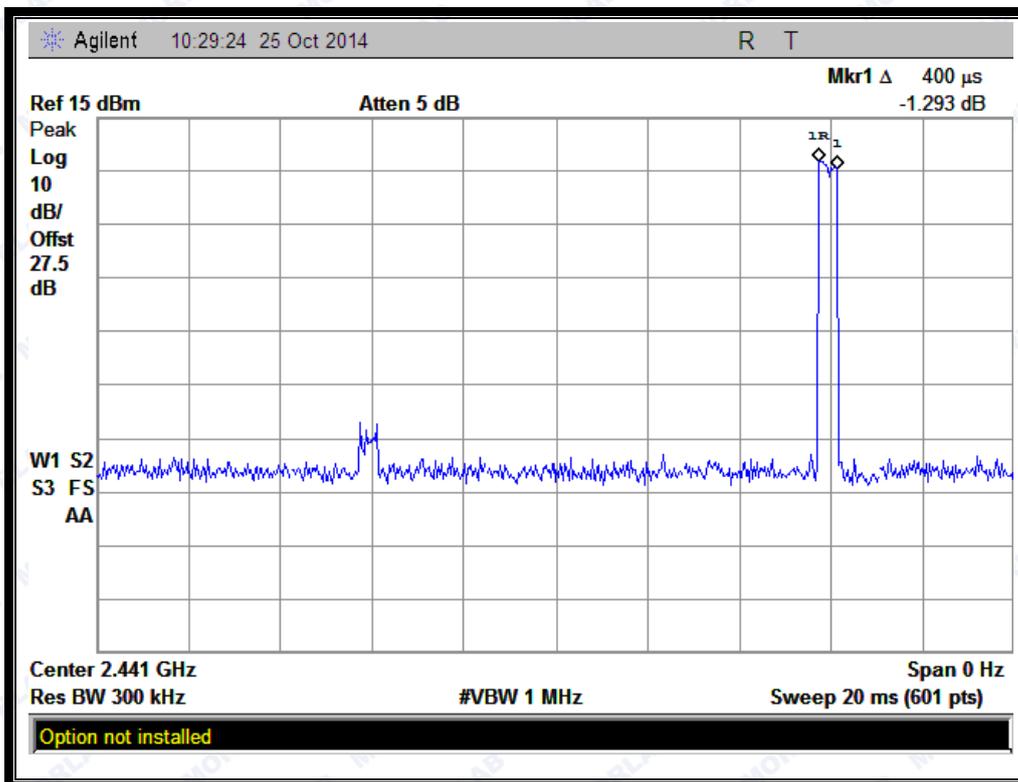


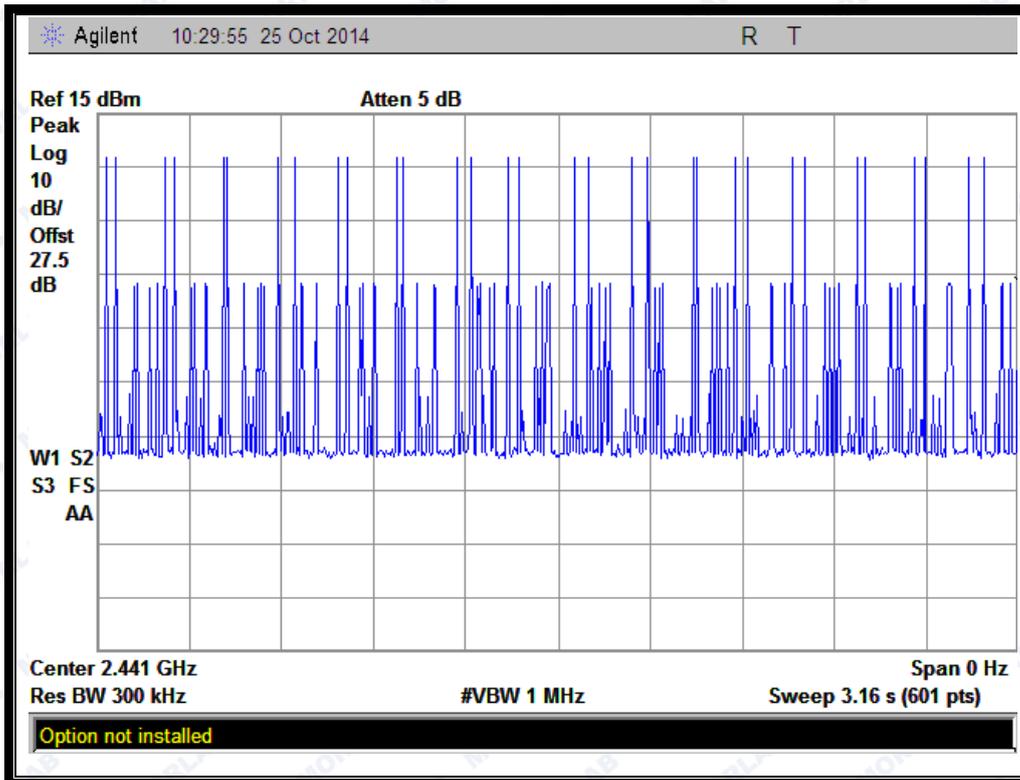
2.6.4.3. 8-DPSK mode

A. Test Verdict:

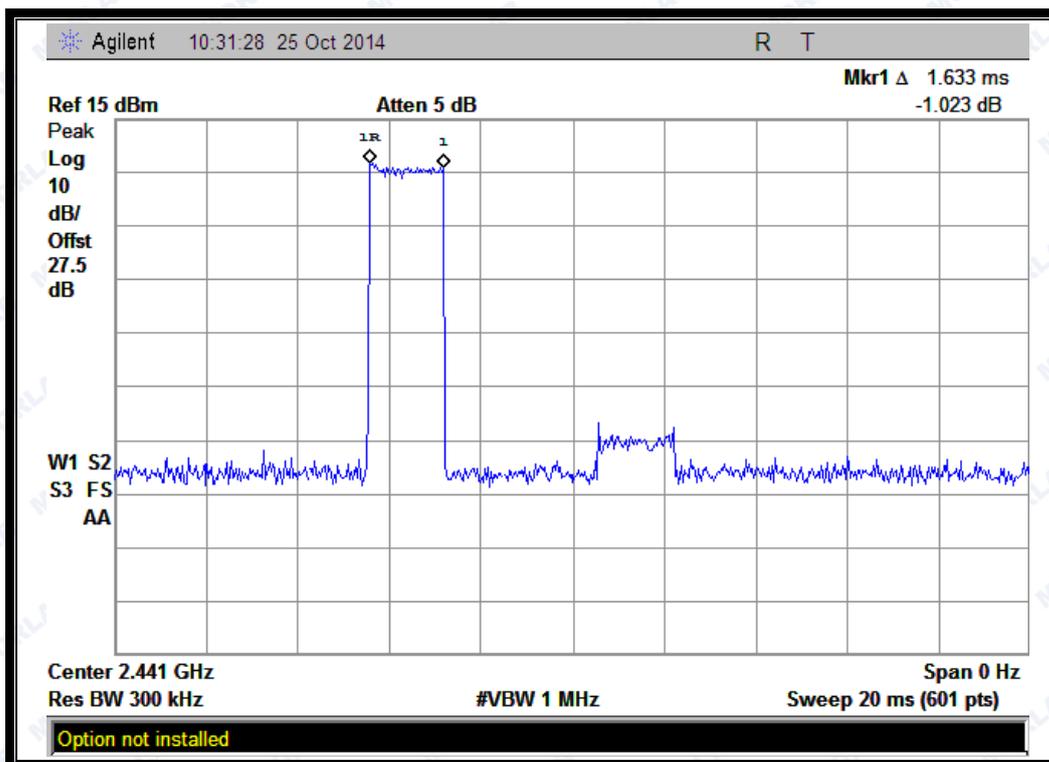
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Refer to Plot	Average Time of Occupancy (sec)	Limit (sec)	Verdict
DH1	0.400	32	Plot A	0.128	0.4	PASS
DH3	1.633	17	Plot B	0.278		PASS
DH5	2.900	13	Plot C	0.377		PASS

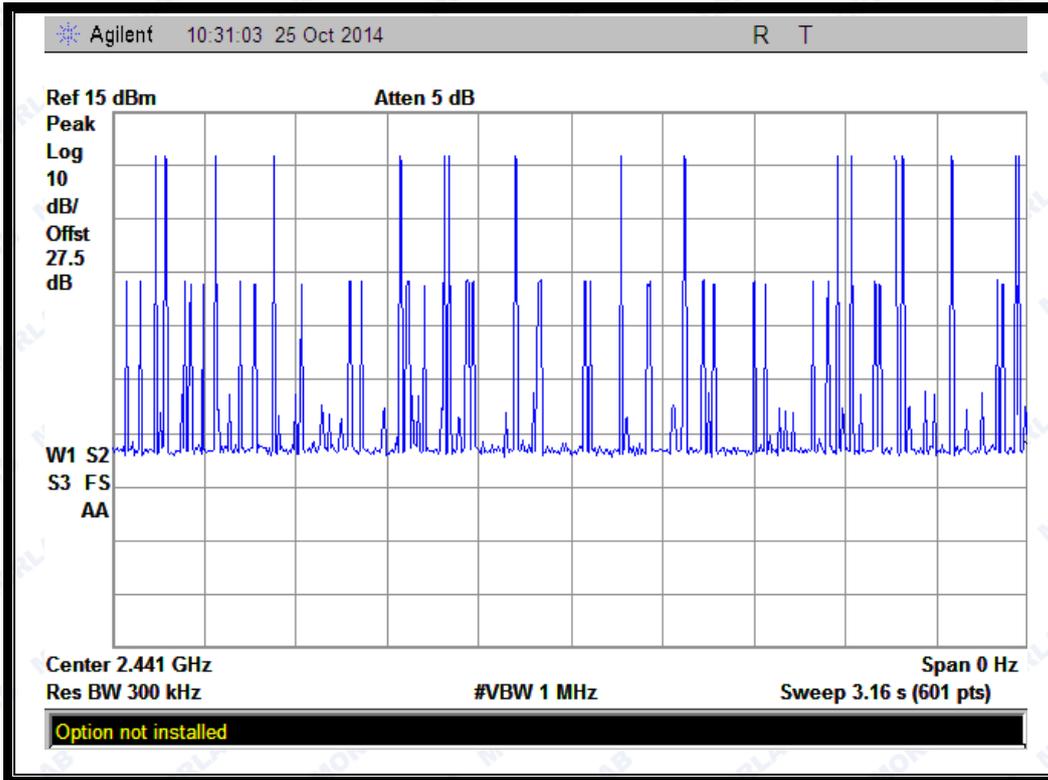
B. Test Plots:



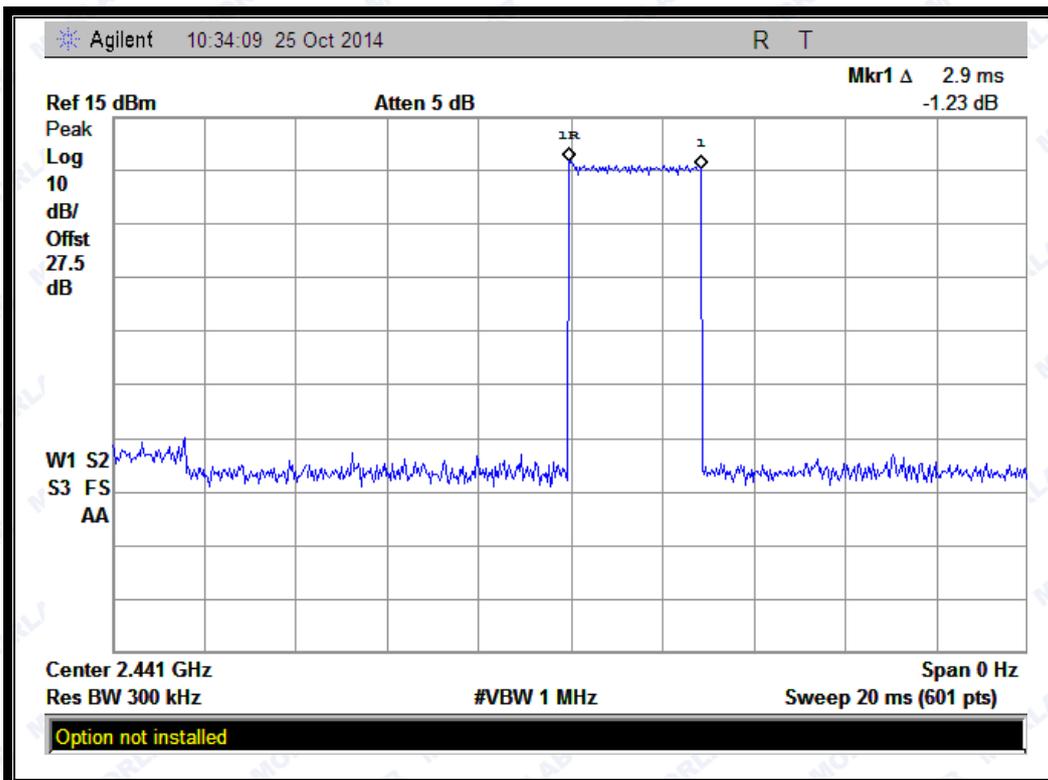


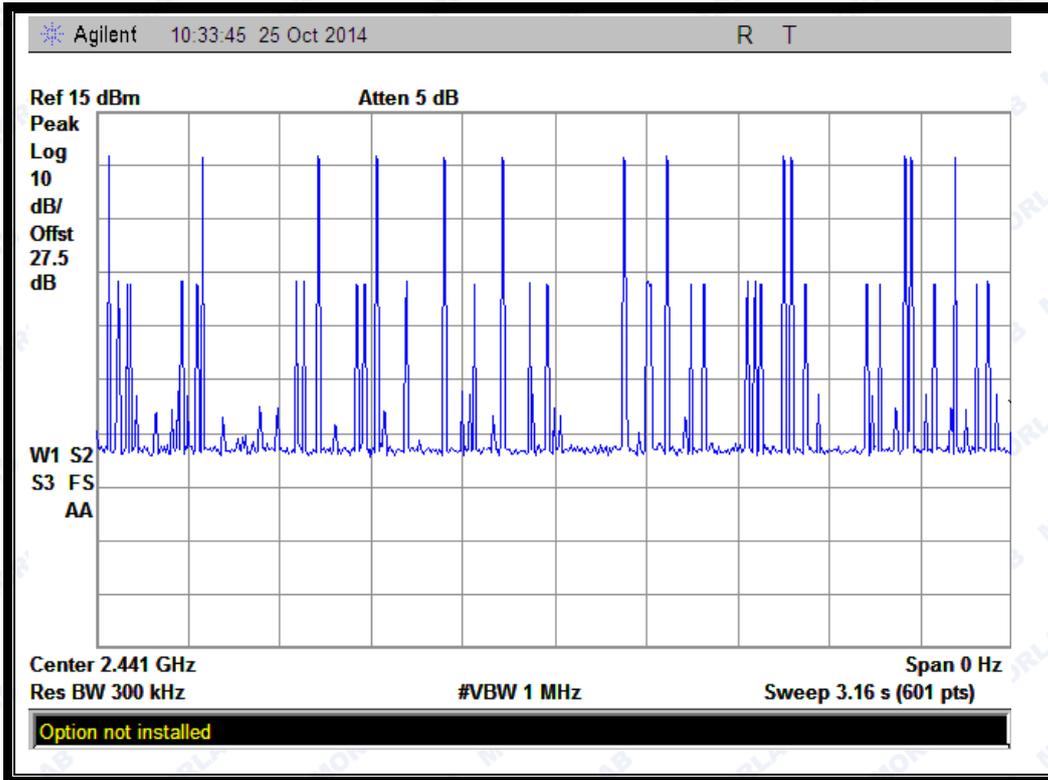
(Plot G: DH1 @ 8-DPSK)





(Plot H: DH3 @ 8-DPSK)





(Plot I: DH5 @ 8-DPSK)

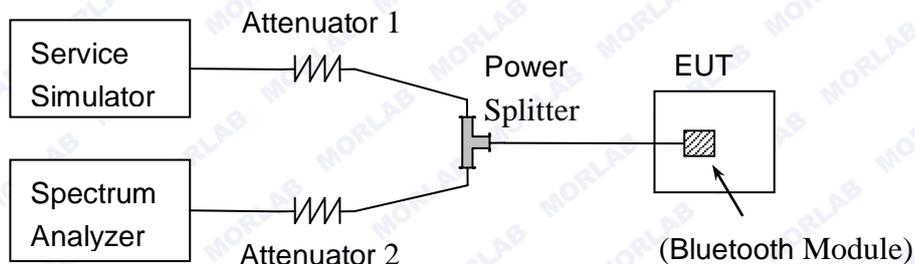
## 2.7. Conducted Spurious Emissions

### 2.7.1. Requirement

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

### 2.7.2. Test Description

#### A. Test Setup:



The Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Service Simulator (SS) 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(1.4).

### 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  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

## 2.7.4. Test Result

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

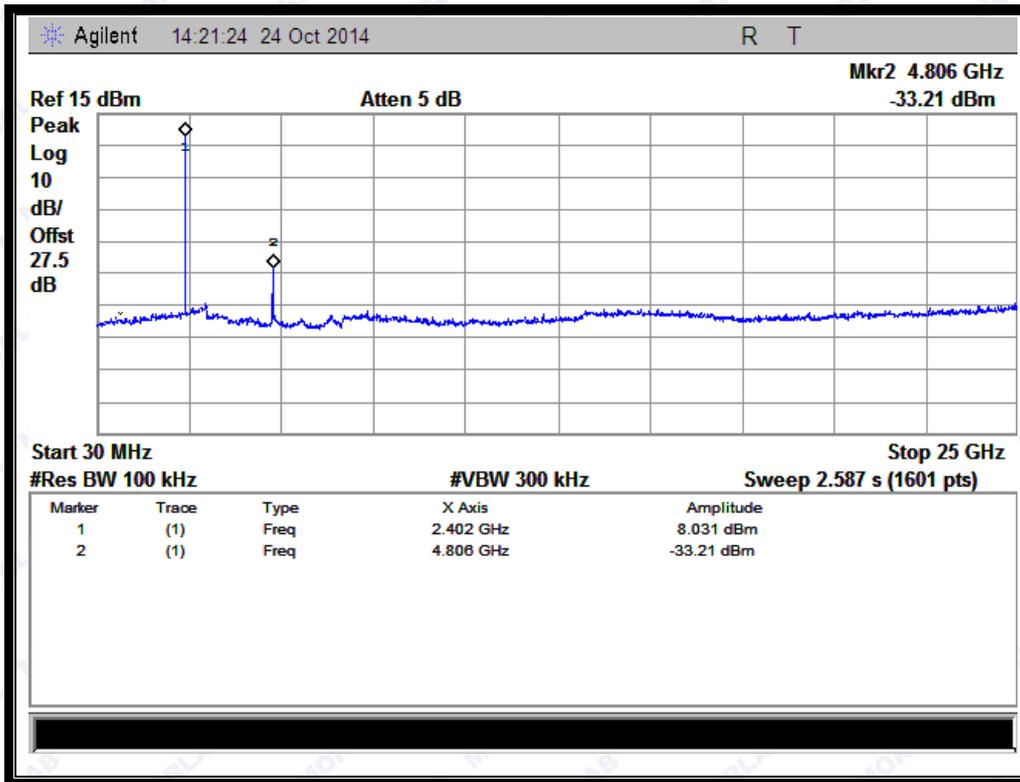
### 2.7.4.1. GFSK Mode

#### A. Test Verdict:

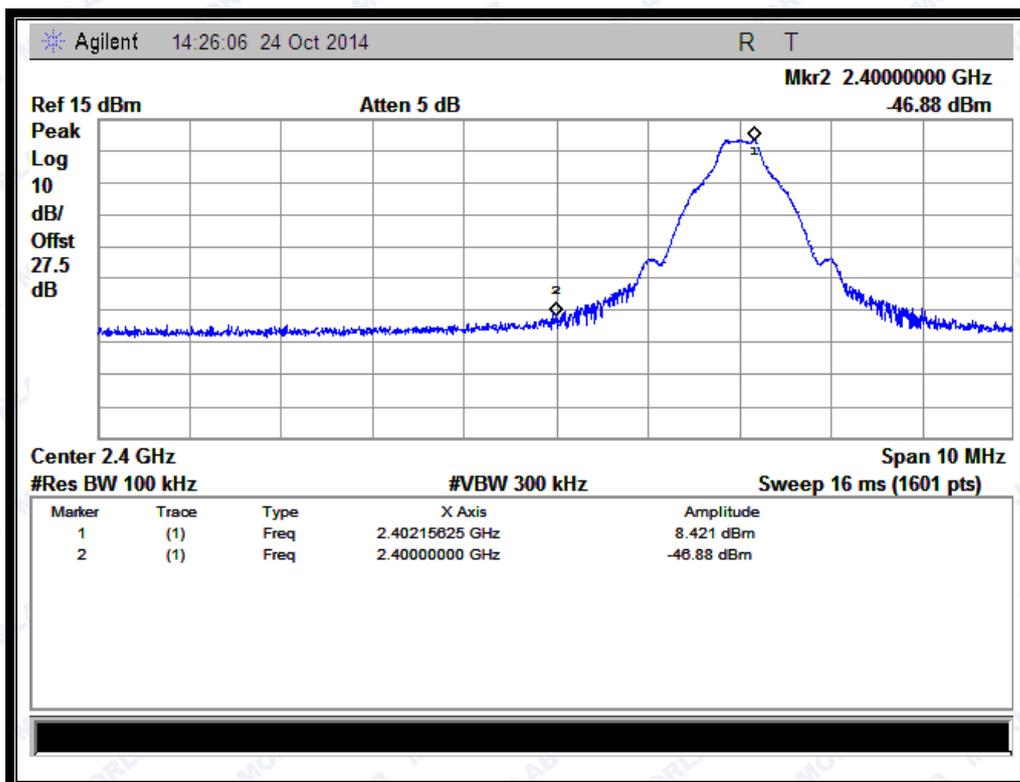
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-33.210	Plot A.1	8.031	-12.0	PASS
39	2441	-37.840	Plot B.1	7.168	-12.8	PASS
78	2480	-40.950	Plot C.1	6.688	-13.3	PASS

#### B. Test Plots:

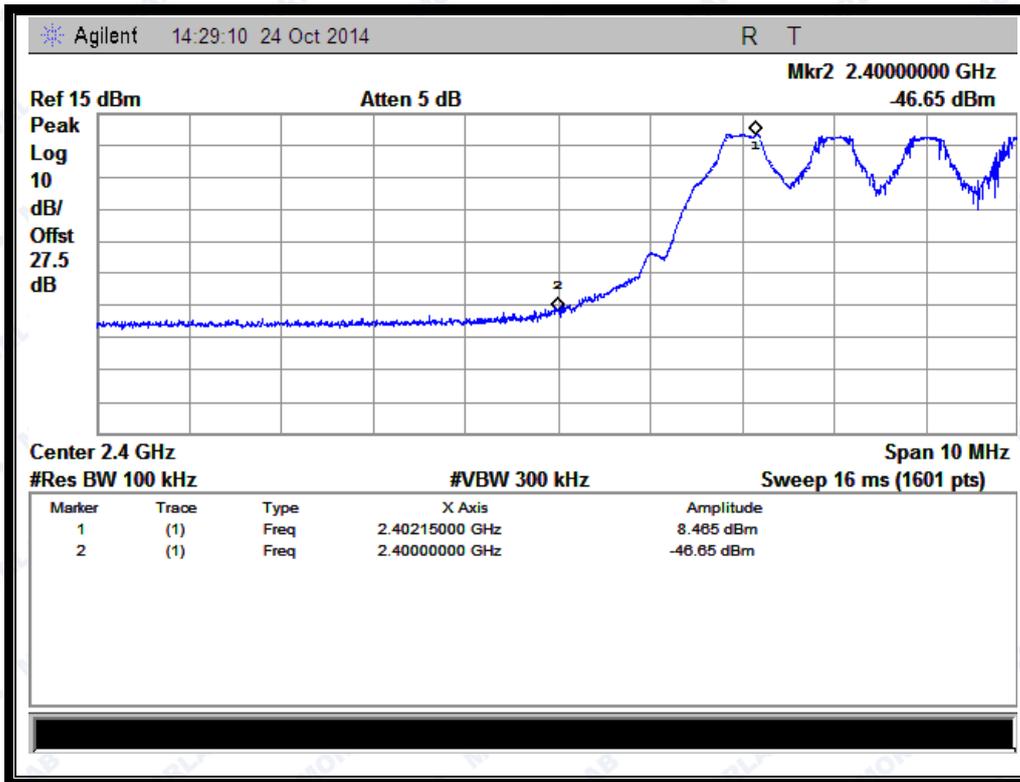
**Note:** the power of the Module transmitting frequency should be ignored.



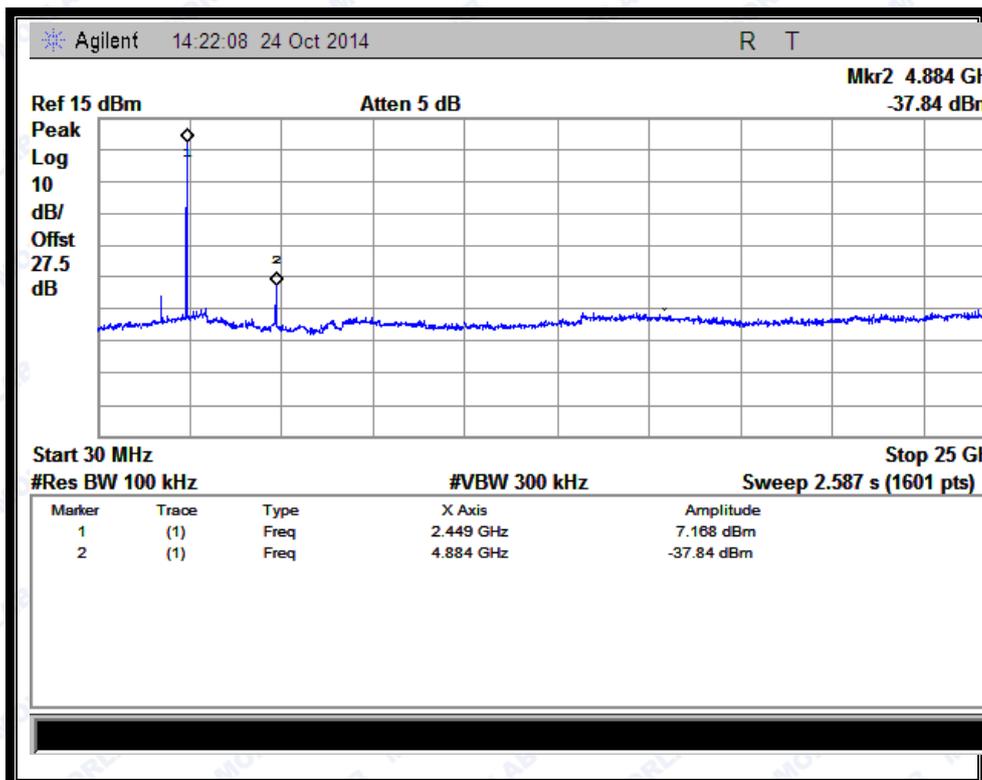
(Plot A.1: Channel = 0, 30MHz to 25GHz @ GFSK Mode)



(Channel = 0, Band edge @ GFSK Mode)

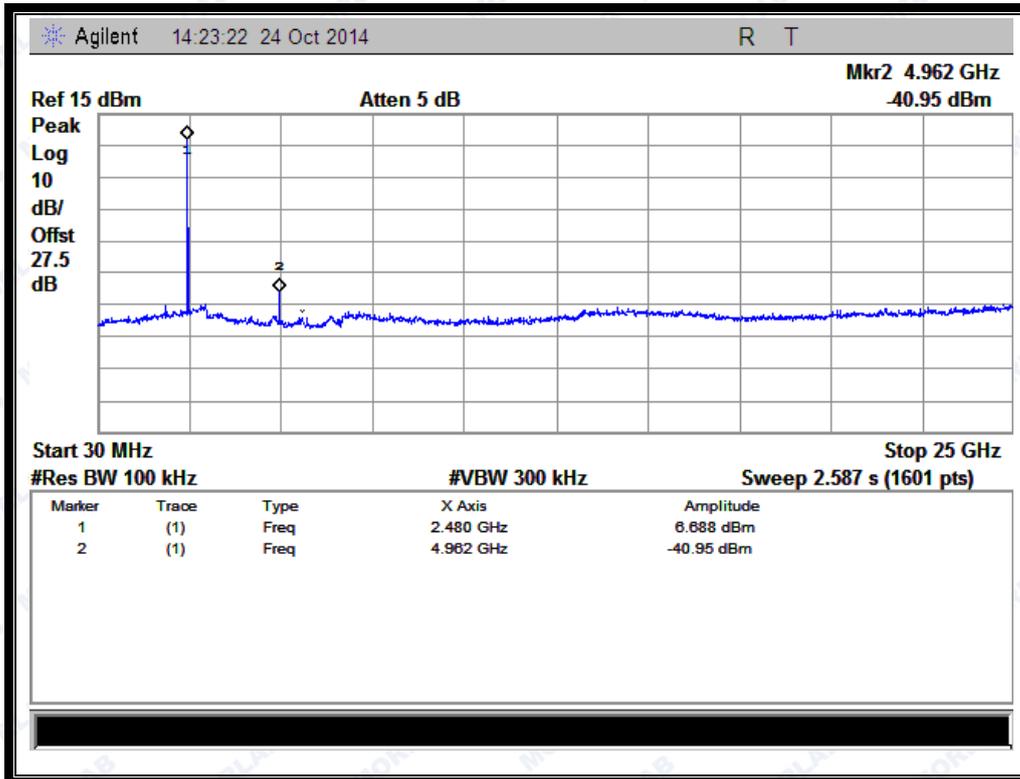


(Channel = 0, Band edge with hopping on @ GFSK Mode)

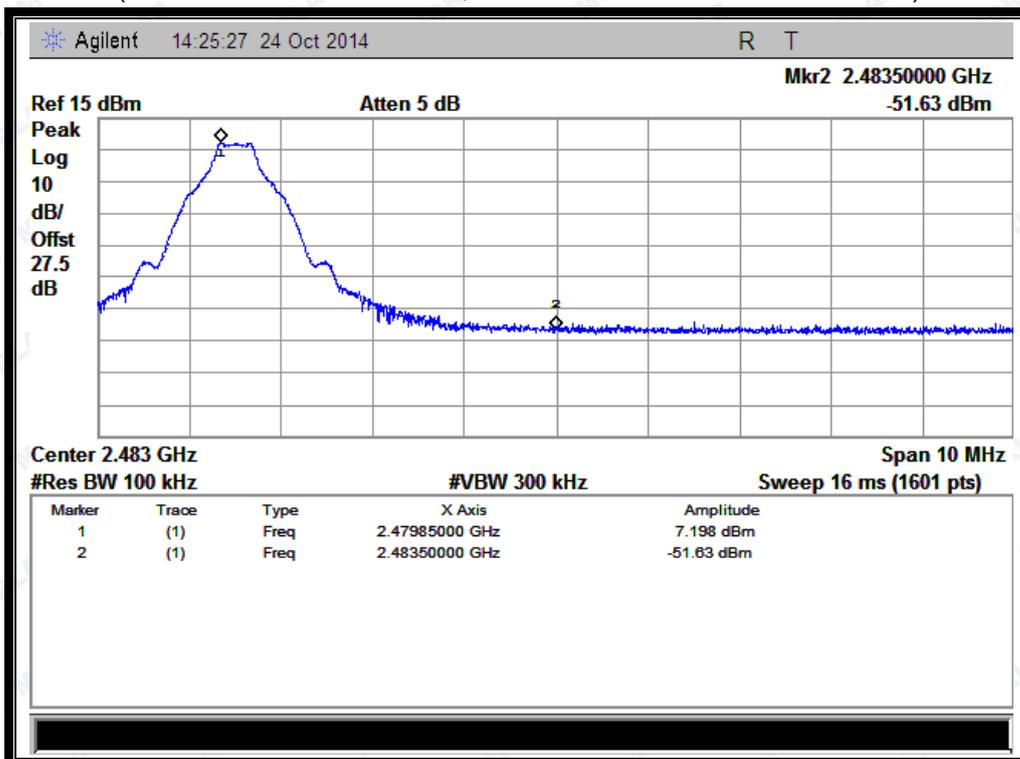




(Plot B.1: Channel = 39, 30MHz to 25GHz @ GFSK Mode)

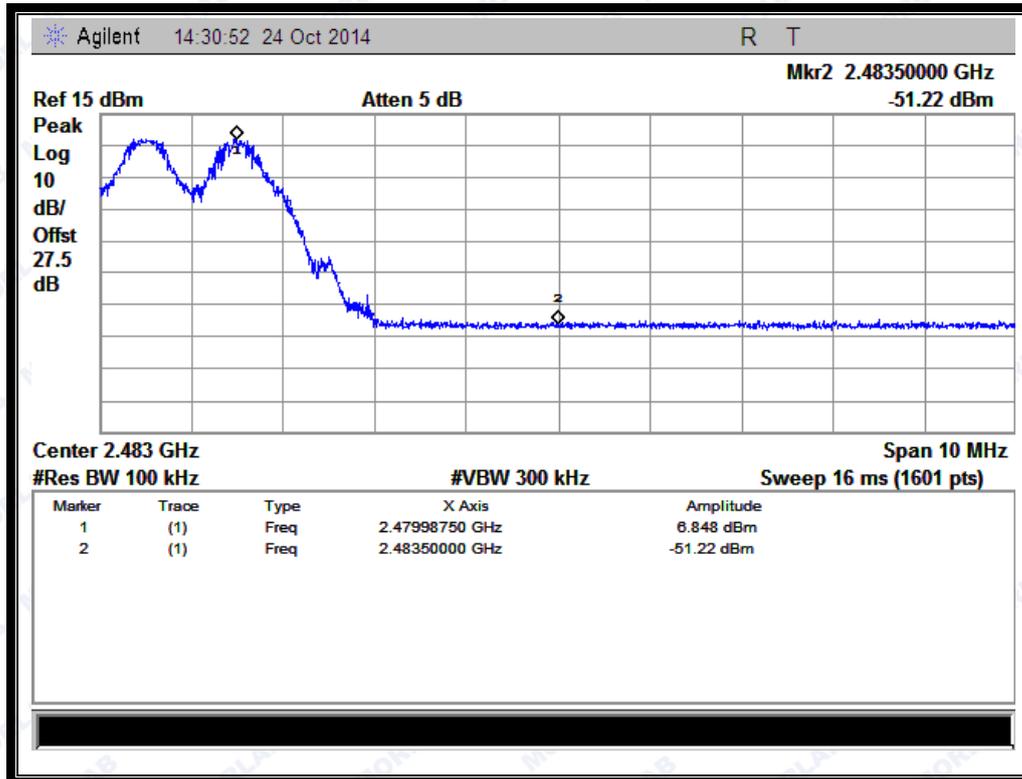


(Plot C.1: Channel = 78, 30MHz to 25GHz @ GFSK Mode)





(Channel = 78, Band edge @ GFSK Mode)



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

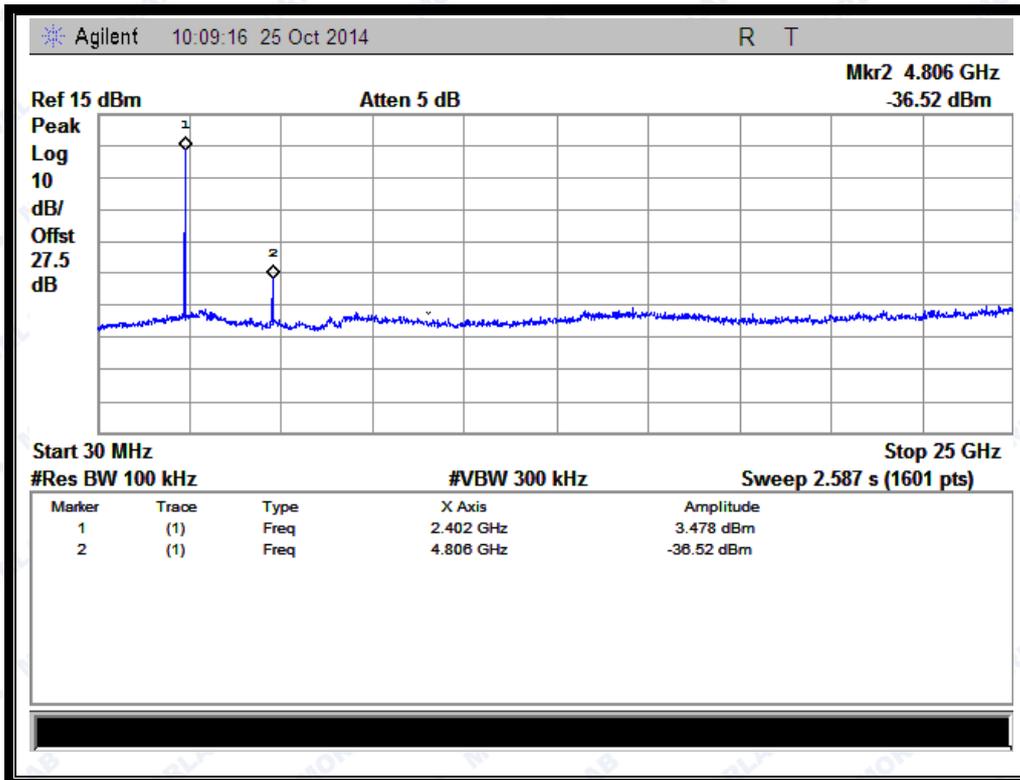
### 2.7.4.2. $\pi/4$ -DQPSK Mode

#### A. Test Verdict:

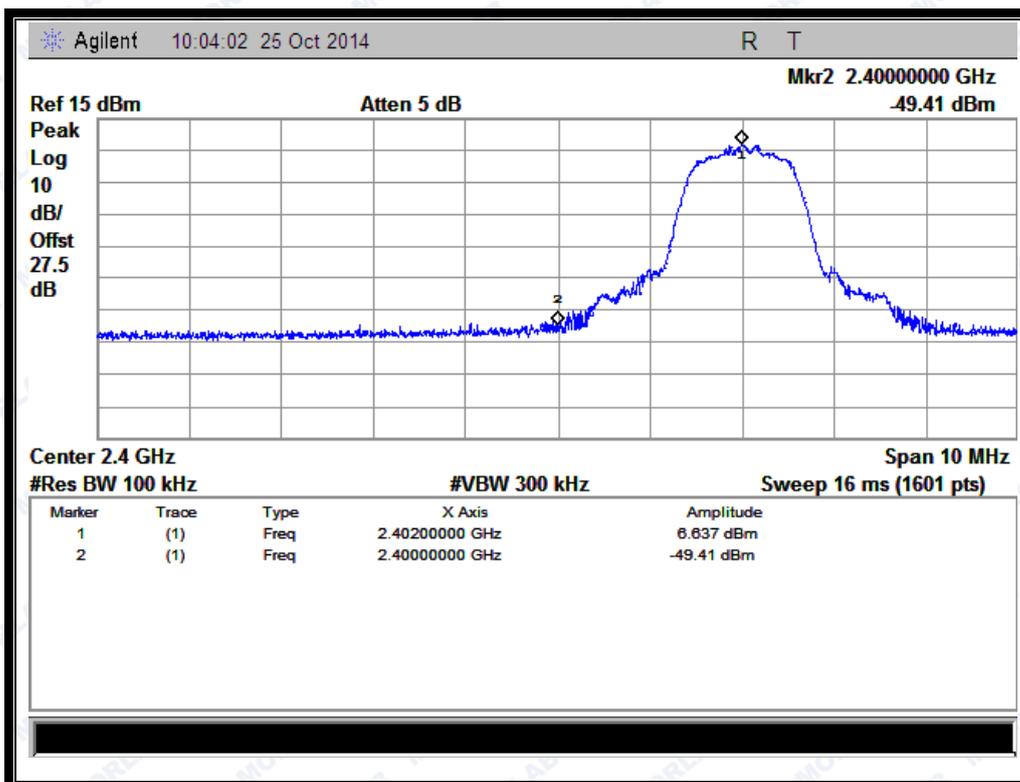
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-36.520	Plot D.1	3.478	-16.5	PASS
39	2441	-44.240	Plot E.1	4.501	-15.5	PASS
78	2480	-45.930	Plot F.1	1.224	-18.8	PASS

#### B. Test Plots:

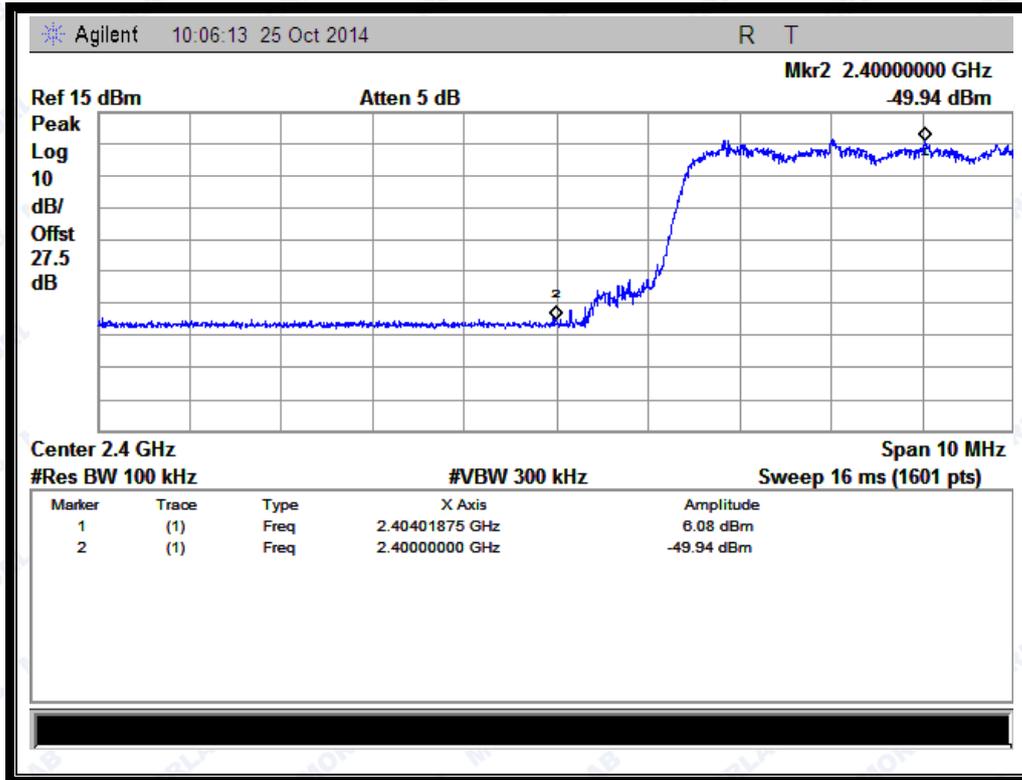
**Note:** the power of the Module transmitting frequency should be ignored.



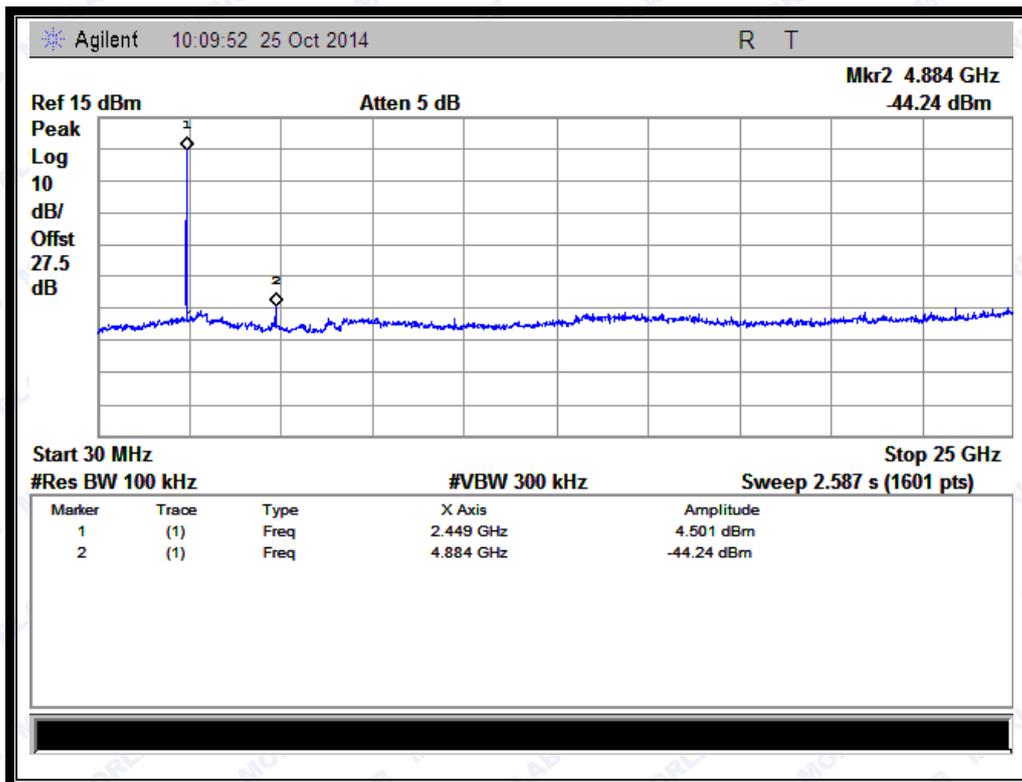
(Plot D.1: Channel = 0, 30MHz to 25GHz @  $\pi/4$ -DQPSK)



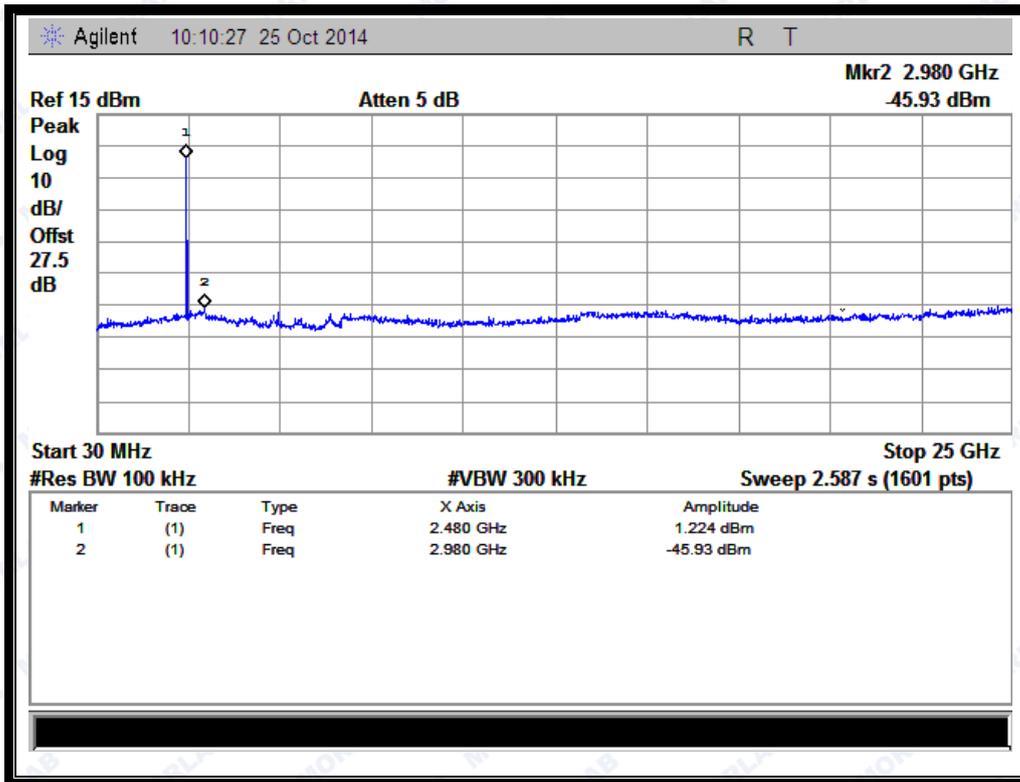
(Channel = 0, Band edge @  $\pi/4$ -DQPSK)



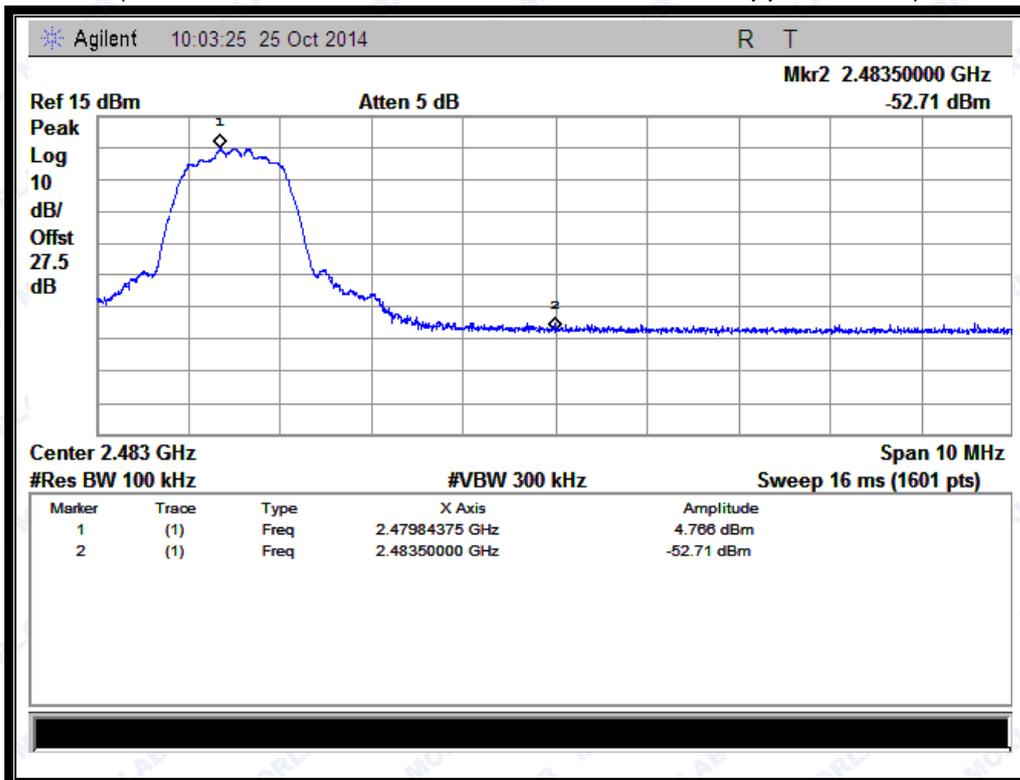
(Channel = 0, Band edge with hopping on @  $\pi/4$ -DQPSK)



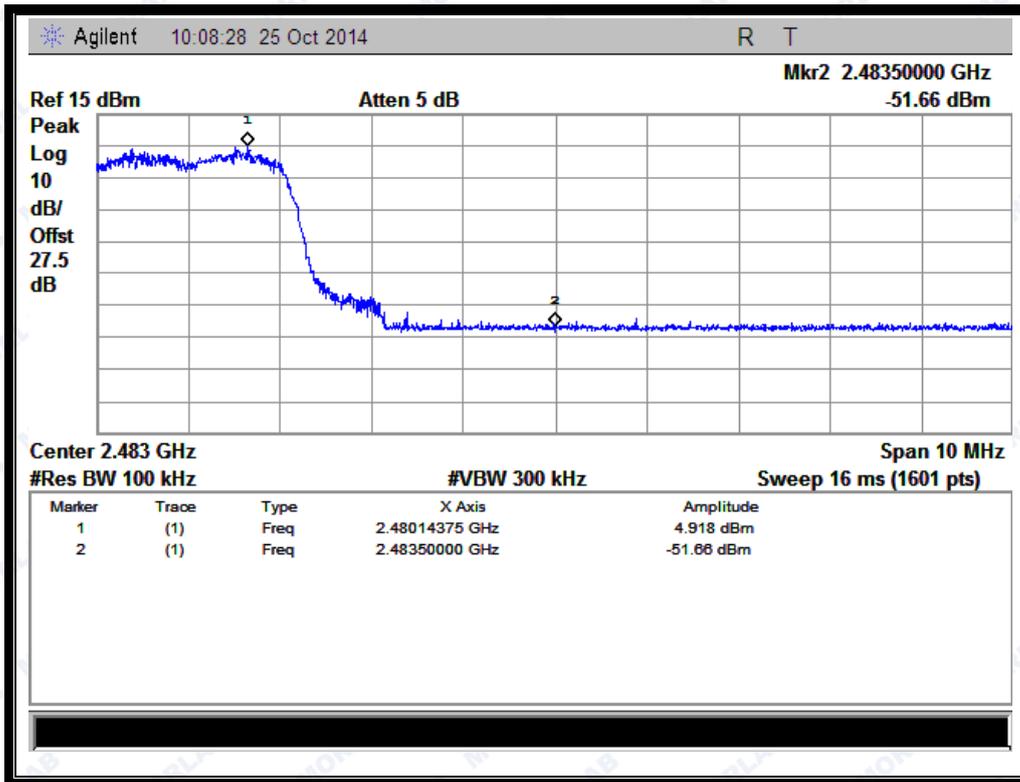
(Plot E.1: Channel = 39, 30MHz to 25GHz @  $\pi/4$ -DQPSK)



(Plot F.1: Channel = 78, 30MHz to 25GHz @  $\pi/4$ -DQPSK)



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



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

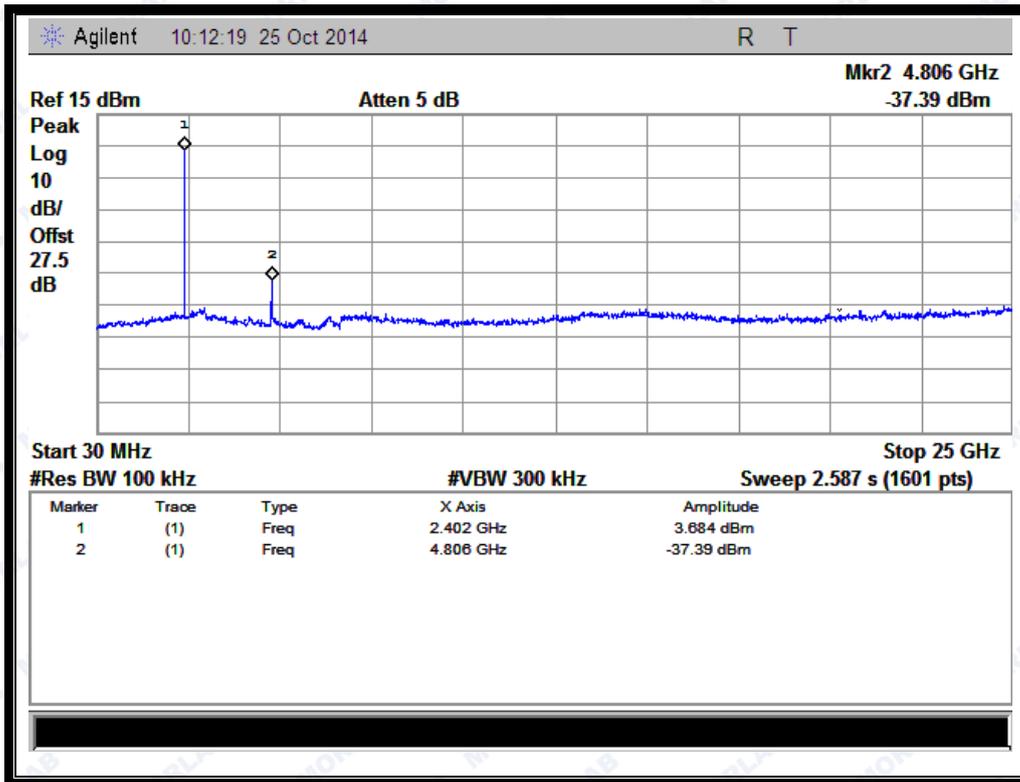
### 2.7.4.3. 8-DPSK Mode

#### A. Test Verdict:

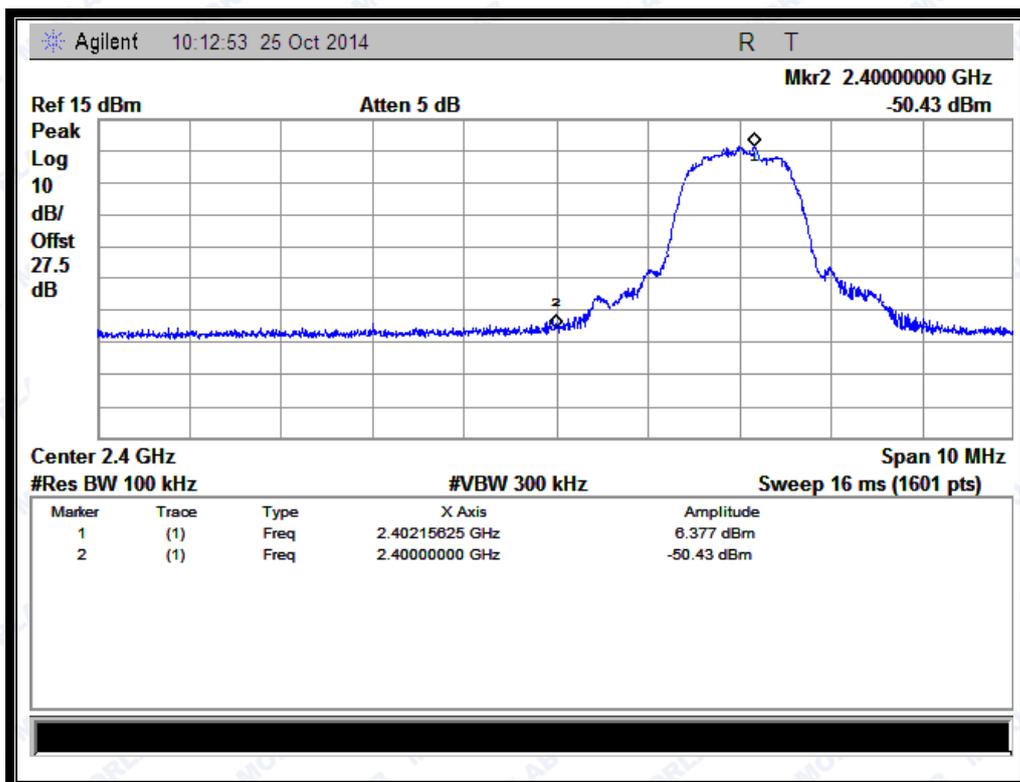
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-37.390	Plot G.1	3.684	-20.4	PASS
39	2441	-44.600	Plot H.1	2.768	-18.2	PASS
78	2480	-46.160	Plot I.1	0.839	-22.2	PASS

#### B. Test Plots:

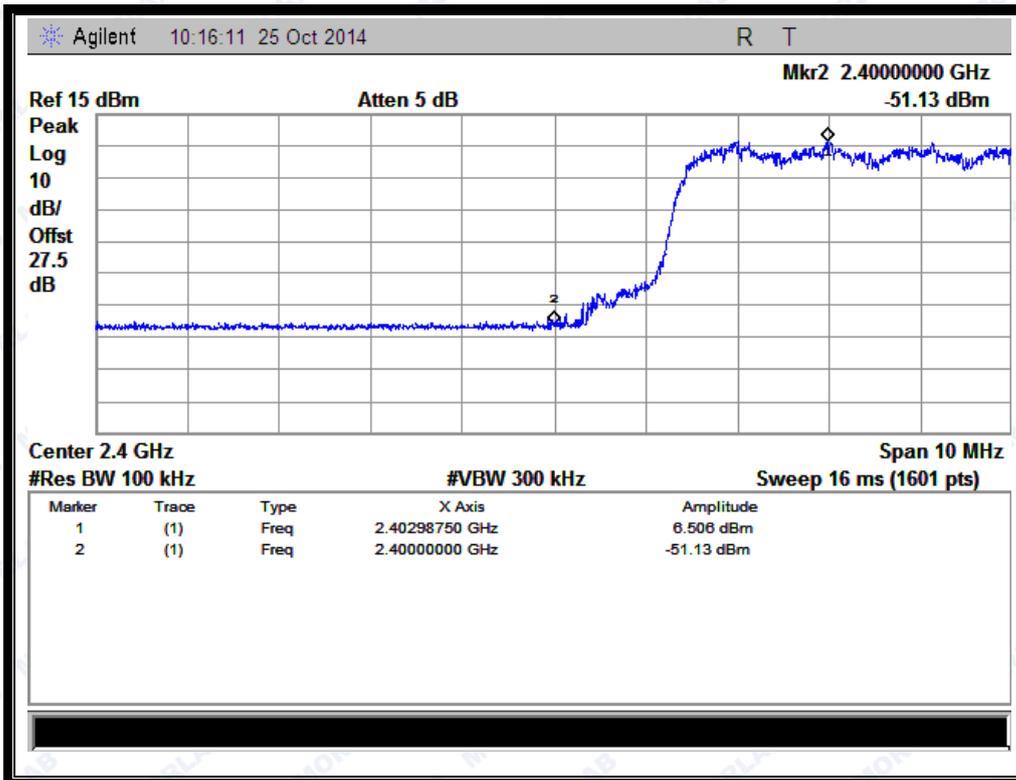
**Note:** the power of the Module transmitting frequency should be ignored.



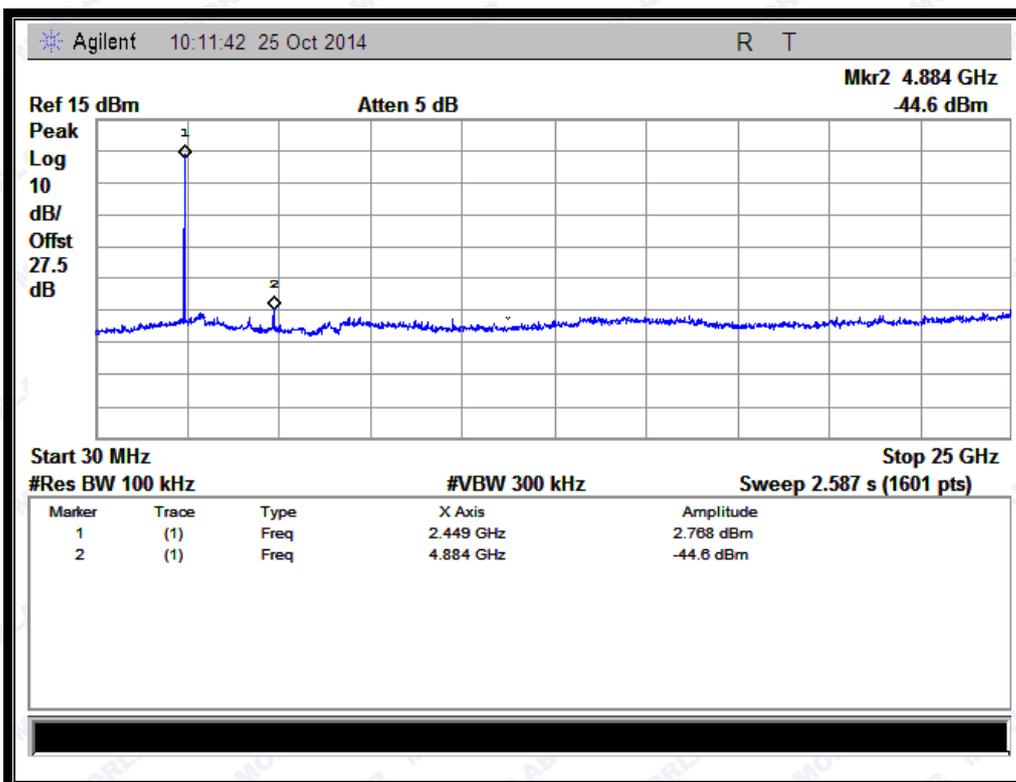
(Plot G.1: Channel = 0, 30MHz to 25GHz @ 8-DPSK)



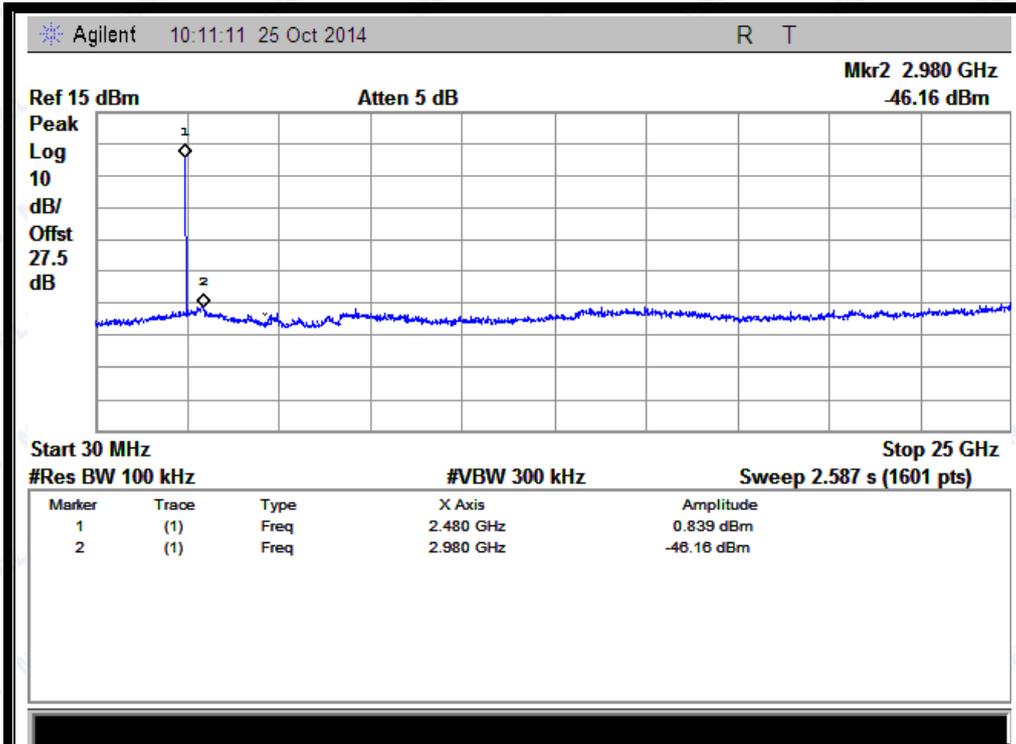
(Channel = 0, Band edge @ 8-DPSK)



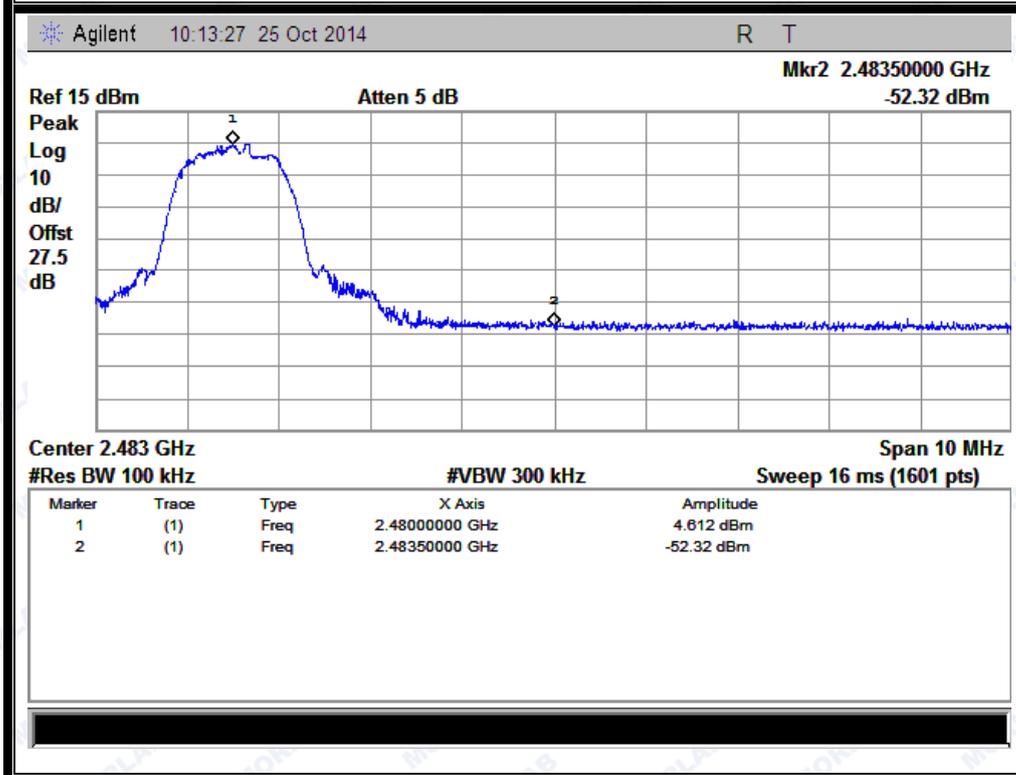
(Channel = 0, Band edge with hopping on @ 8-DPSK)



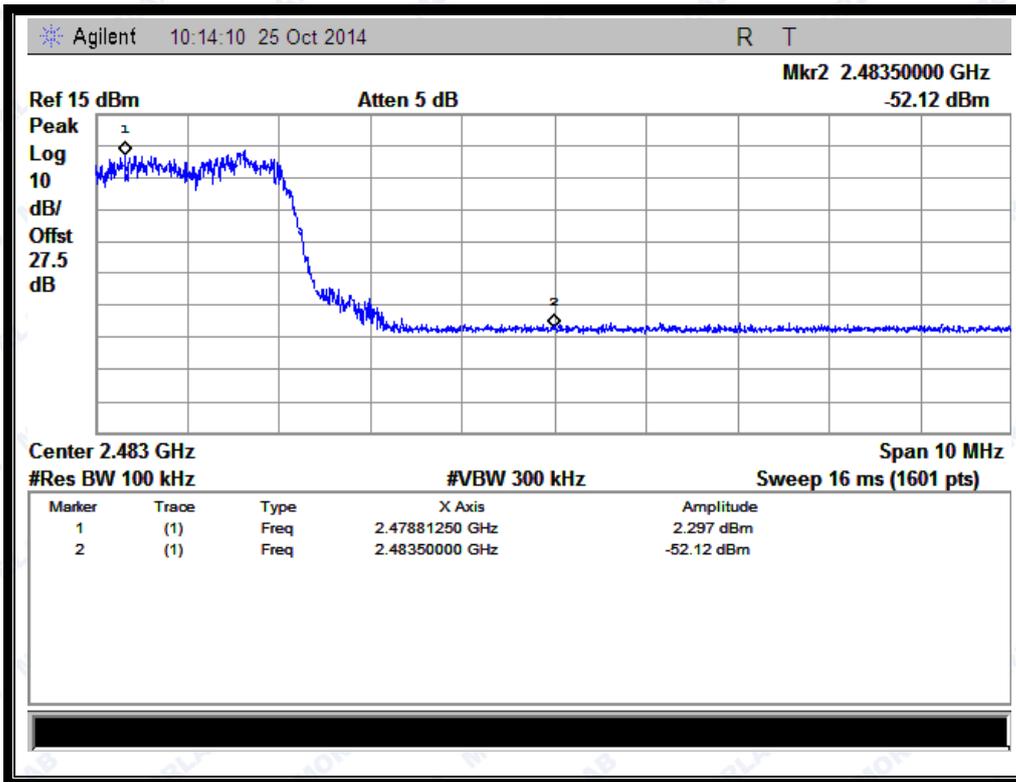
(Plot H.1: Channel = 39, 30MHz to 25GHz @ 8-DPSK)



(Plot I.1: Channel = 78, 30MHz to 25GHz @ 8-DPSK)



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



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

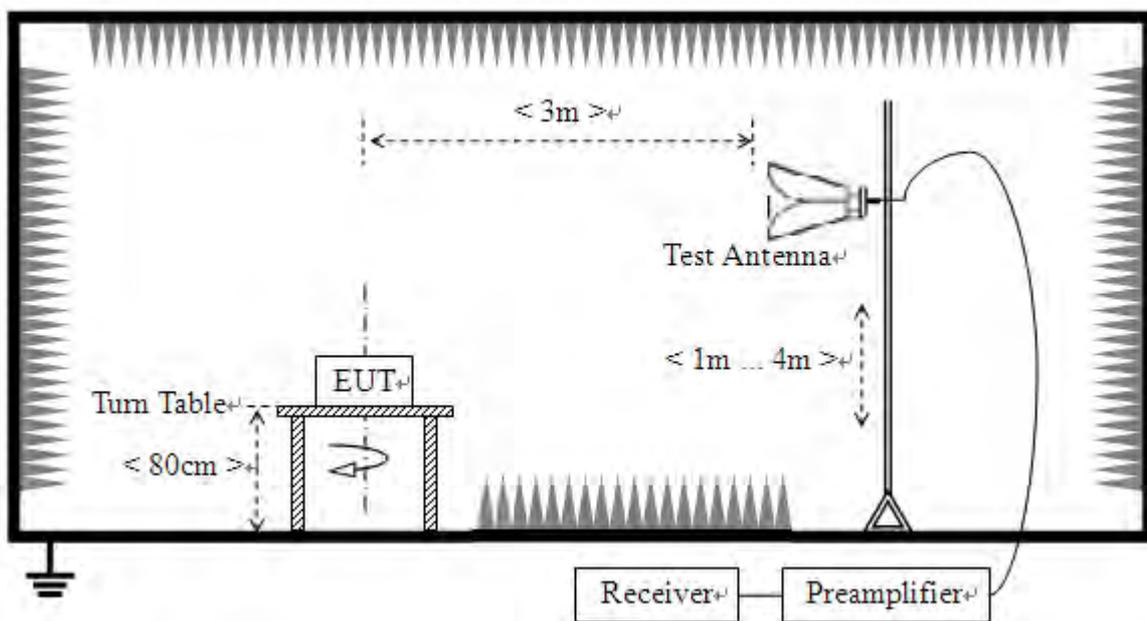
## 2.8. Restricted Frequency Bands

### 2.8.1. Requirement

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

### 2.8.2. Test Description

#### A. Test Setup:



The Module 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 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.



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(1.4).

## 2.8.3. Test Procedure

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1\text{GHz}$ , 100 KHz for  $f < 1\text{GHz}$

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:

$E \text{ [dB}\mu\text{V/m]} = \text{UR} + \text{AT} + \text{AFactor [dB]}; \text{AT} = \text{LCable loss [dB]} - \text{Gpreamp [dB]}$

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.

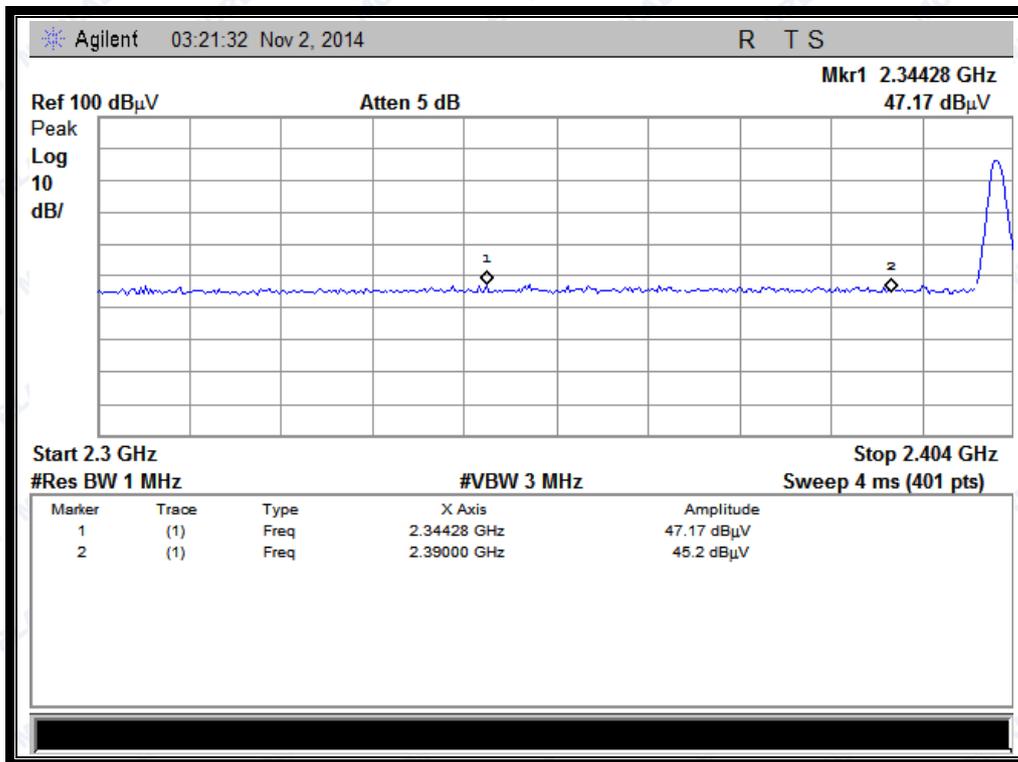
### 2.8.4.1. GFSK Mode

### A. Test Verdict:

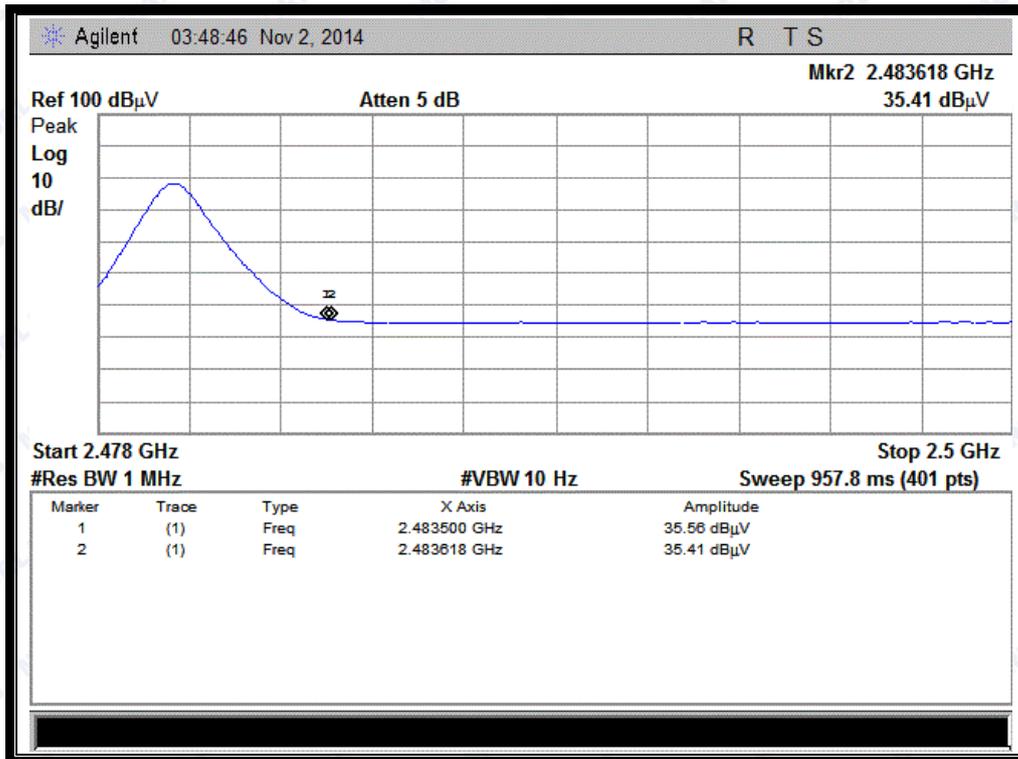


Channel	Frequency (MHz)	Detector	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBuV/m)	Limit (dBuV/m)	Verdict
		PK/ AV						
0	2344.28	PK	41.17	-33.63	32.56	47.44	74	Pass
0	2483.36	AV	34.75	-33.63	32.56	35.93	54	Pass
78	2487.80	PK	50.05	-33.18	32.50	49.46	74	Pass
78	2483.78	AV	35.56	-33.18	32.50	38.09	54	Pass

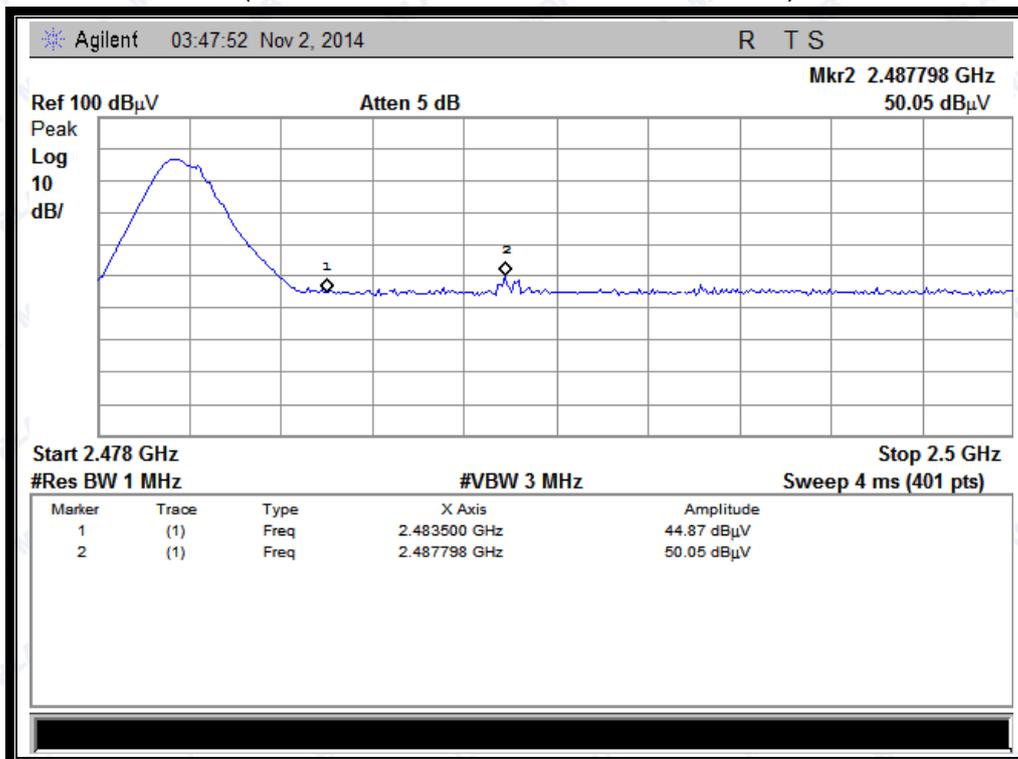
**B. Test Plots:**



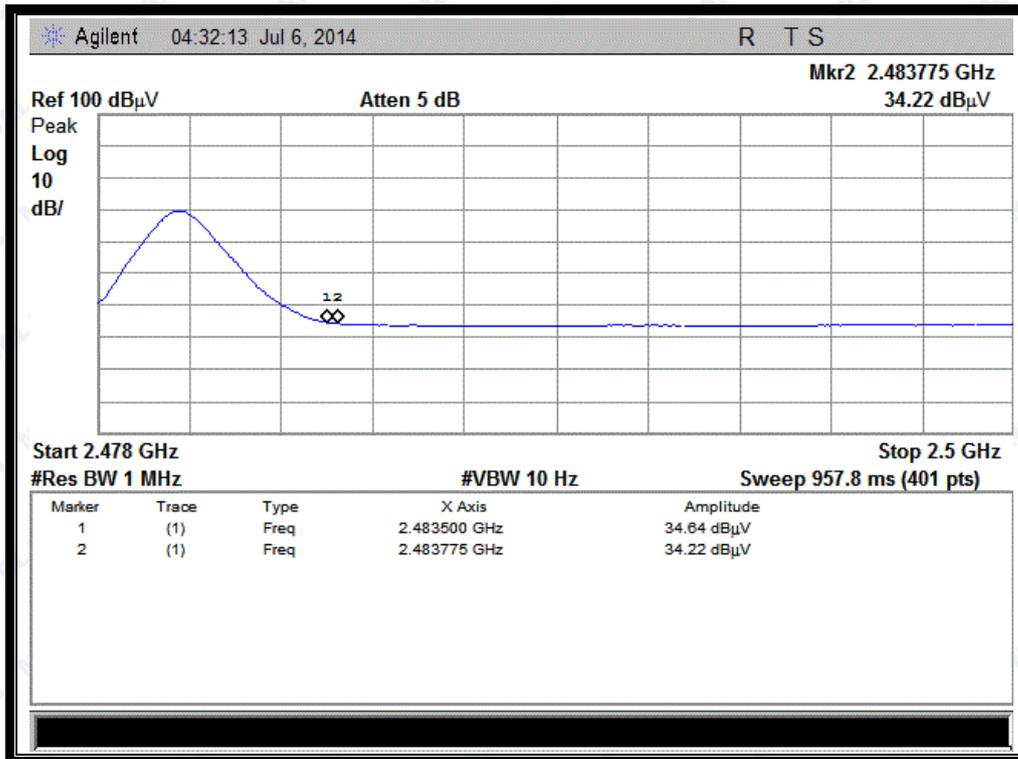
(Plot A1:Channel = 0 PEAK @ GFSK)



(Plot A2:Channel = 0 AVERAGE @ GFSK)



(Plot B1:Channel = 78 PEAK @ GFSK)



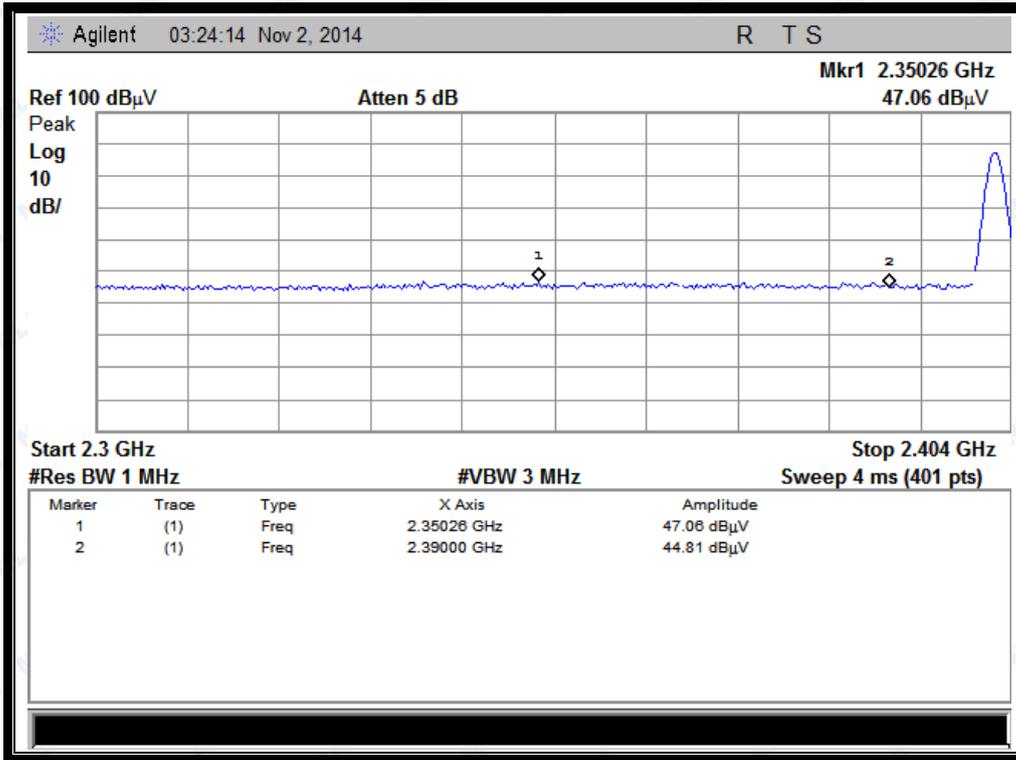
(Plot B2: Channel = 78 AVERAGE @ GFSK)

### 2.8.4.2. □/4-DQPSK Mode

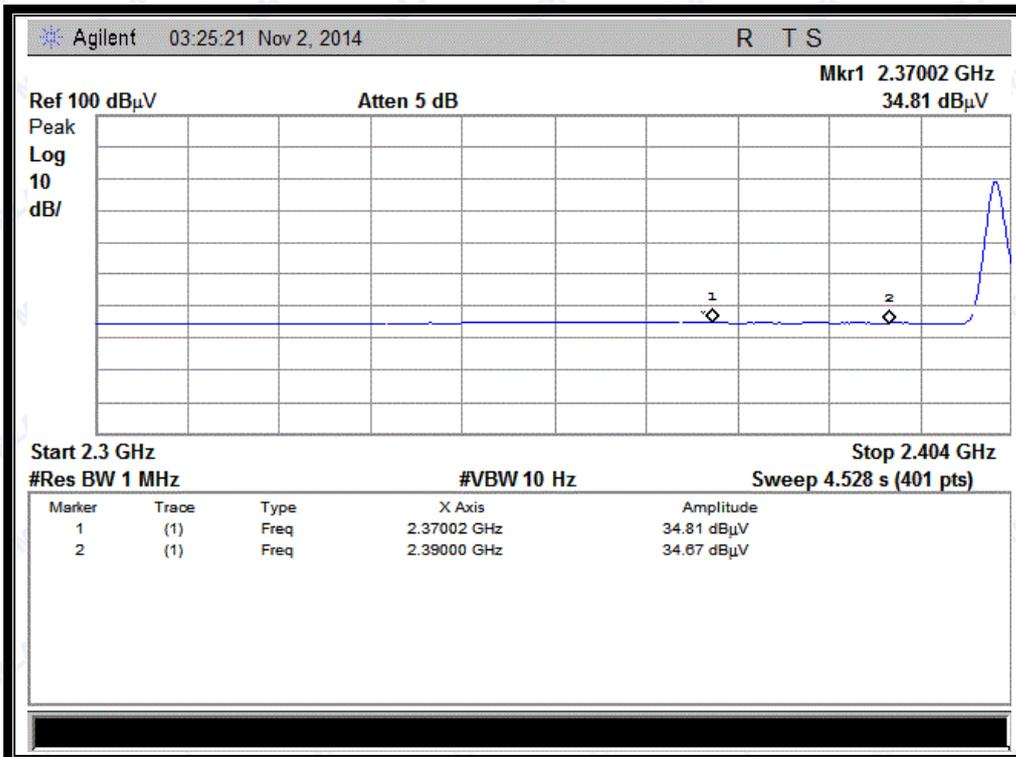
#### A. Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBµV/m)	Limit (dBµV/m)	Verdict
		PK/ AV						
0	2350.26	PK	47.06	-33.63	32.56	47.41	74	Pass
0	2370.02	AV	34.81	-33.63	32.56	35.91	54	Pass
78	2448.24	PK	49.51	-33.18	32.50	49.48	74	Pass
78	2483.67	AV	35.61	-33.18	32.50	37.69	54	Pass

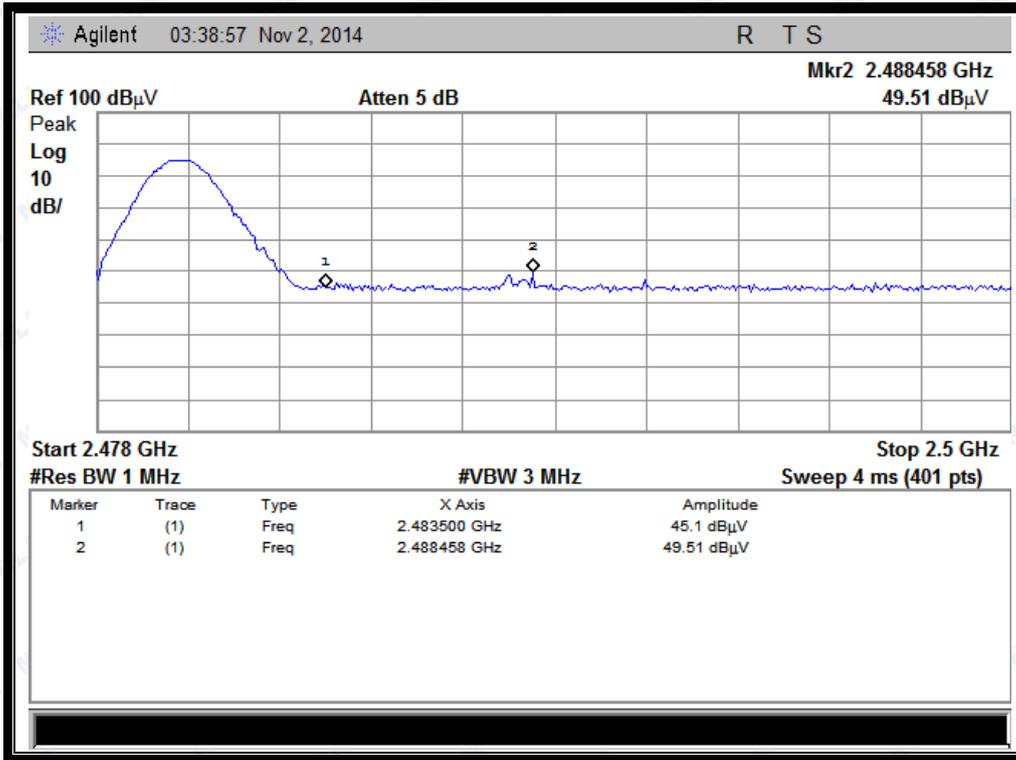
#### B. Test Plots:



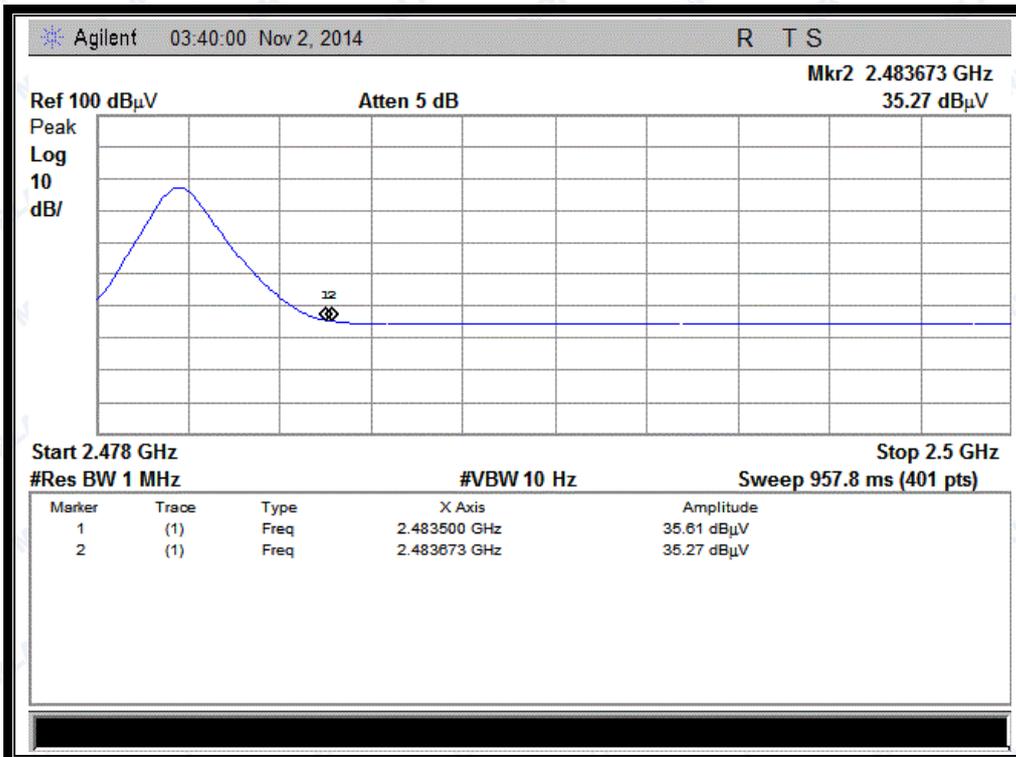
(Plot C1: Channel = 0 PEAK @  $\pi/4$ -DQPSK)



(Plot C2: Channel = 0 AVERAGE @  $\pi/4$ -DQPSK)



(Plot D1: Channel = 78 PEAK @  $\pi/4$ -DQPSK)



(Plot D2: Channel = 78 AVERAGE @  $\pi/4$ -DQPSK)

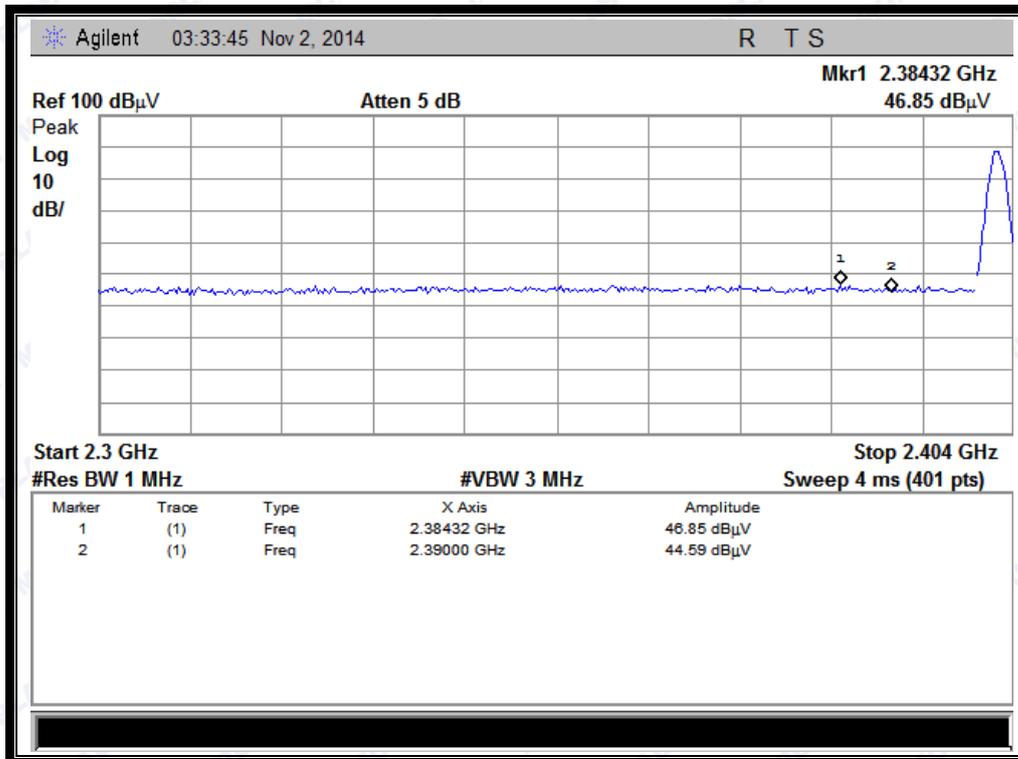


2.8.4.3. 8-DPSK Mode

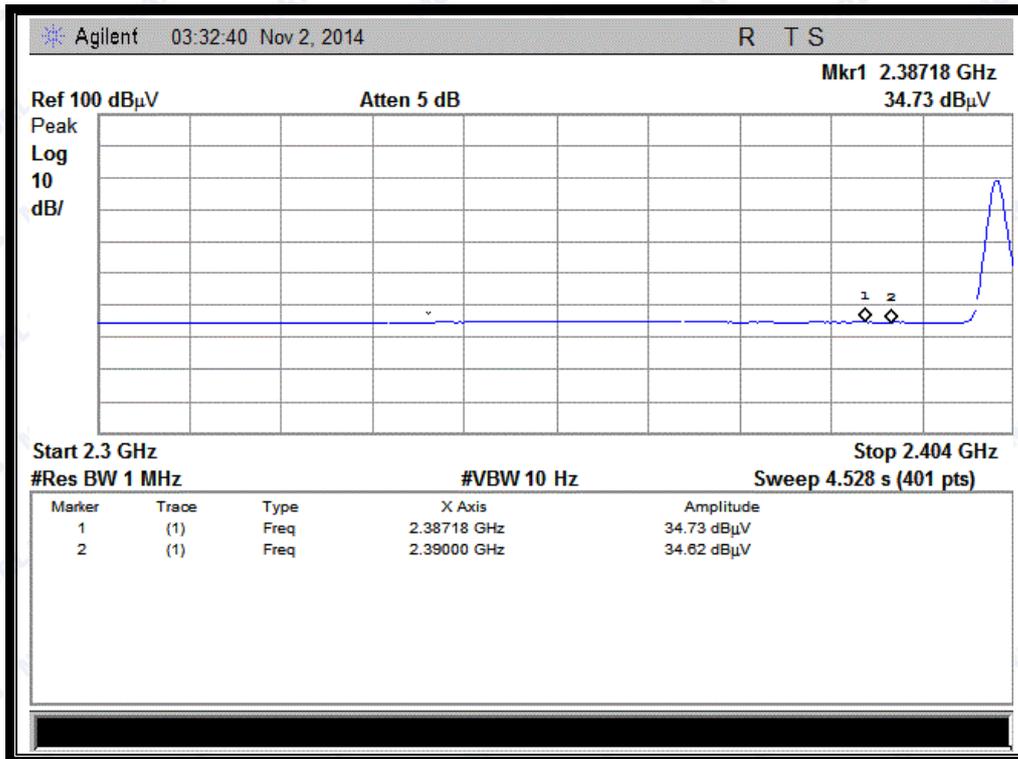
A. Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
0	2384.32	PK	46.85	-33.63	32.56	47.22	74	Pass
0	2387.18	AV	34.73	-33.63	32.56	35.94	54	Pass
78	2480.18	PK	48.21	-33.18	32.50	48.93	74	Pass
78	2483.50	AV	35.66	-33.18	32.50	38.09	54	Pass

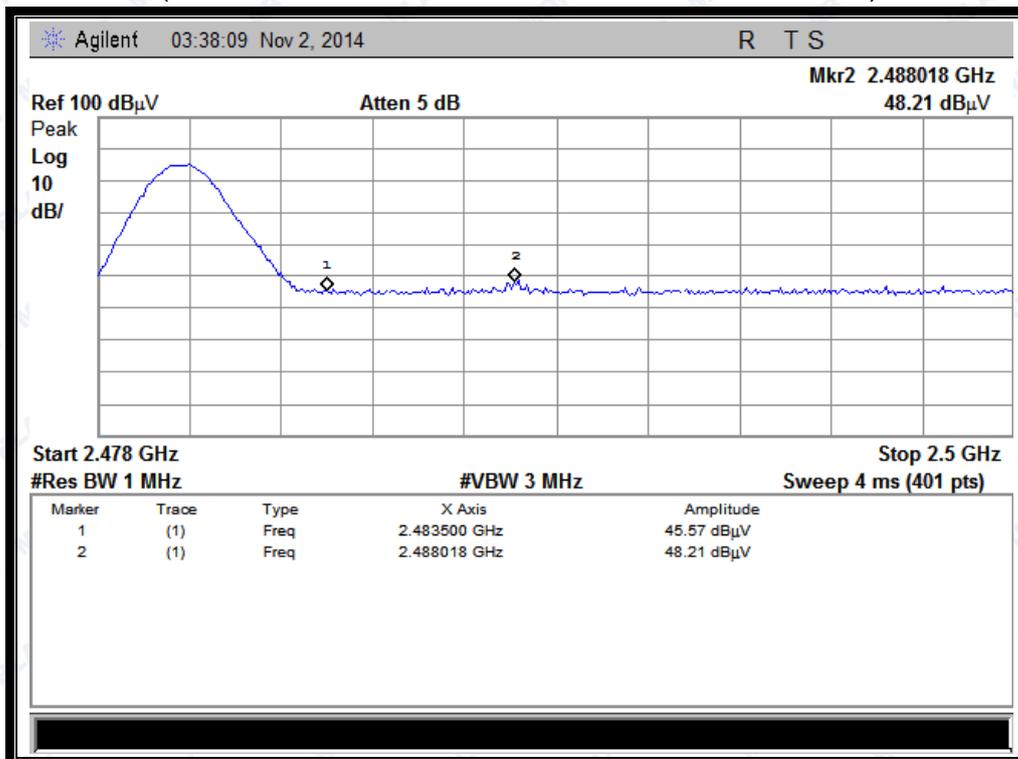
B. Test Plots:



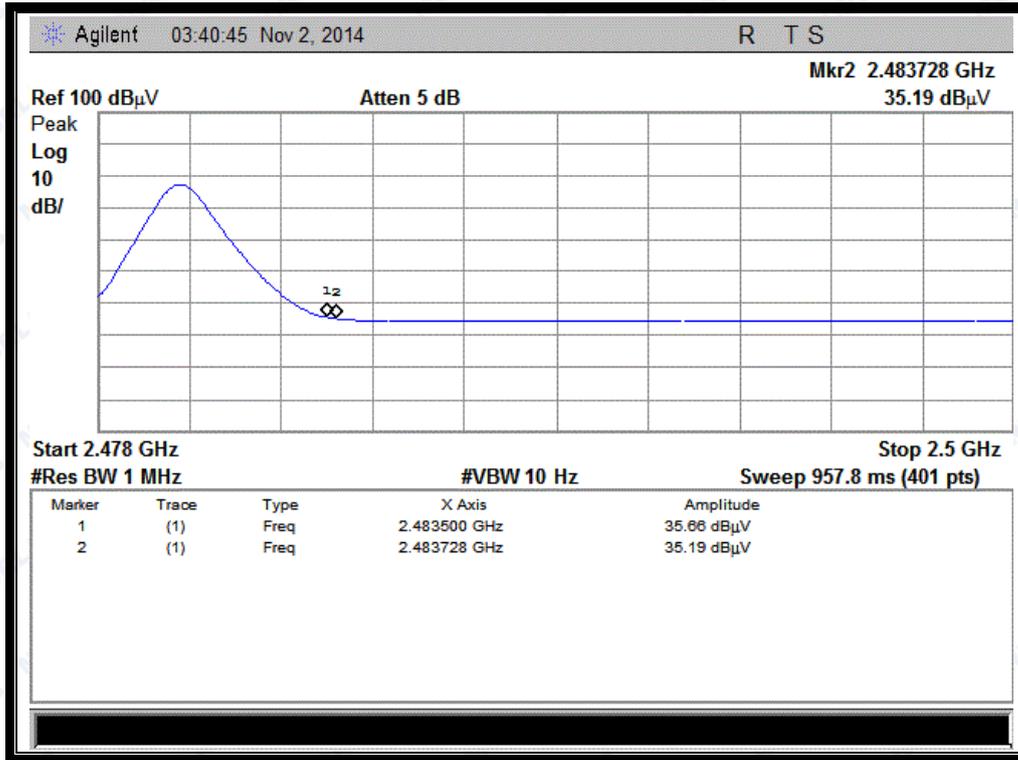
(Plot E1: Channel = 0 PEAK @ 8-DPSK Mode)



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



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



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

## 2.9. Conducted Emission

### 2.9.1. Requirement

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

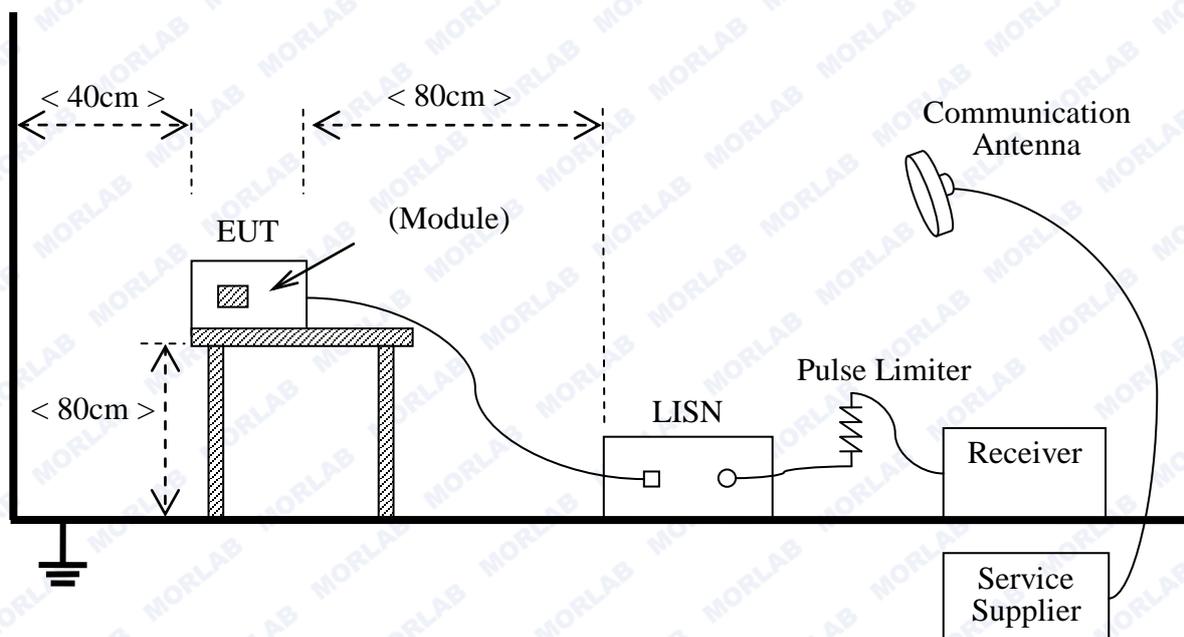
Frequency range (MHz)	Conducted Limit (dB $\mu\text{V}$ )	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5- 30	60	50

**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 C63.4:2009

The factors of the site are calibrated to correct the reading. During the measurement, the Bluetooth Module 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(1.4).

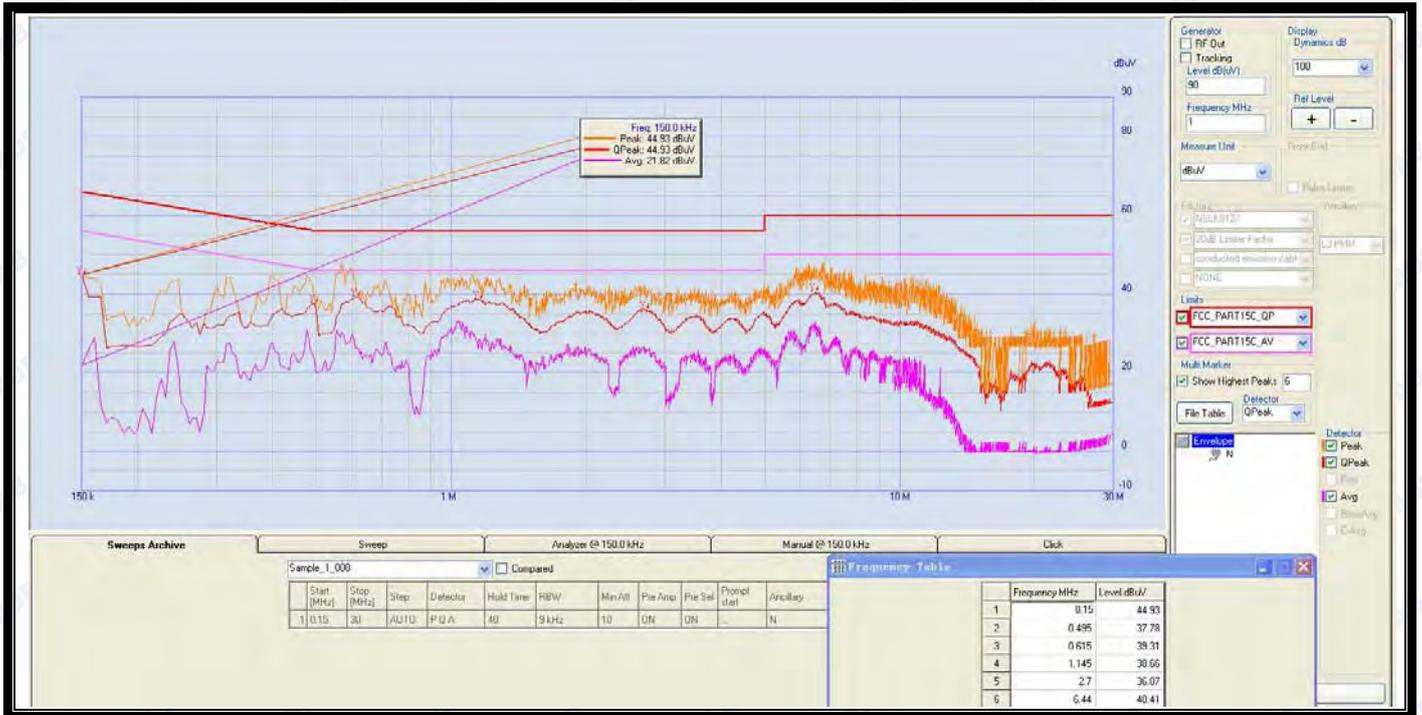
### **2.9.3. Test Result**

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.

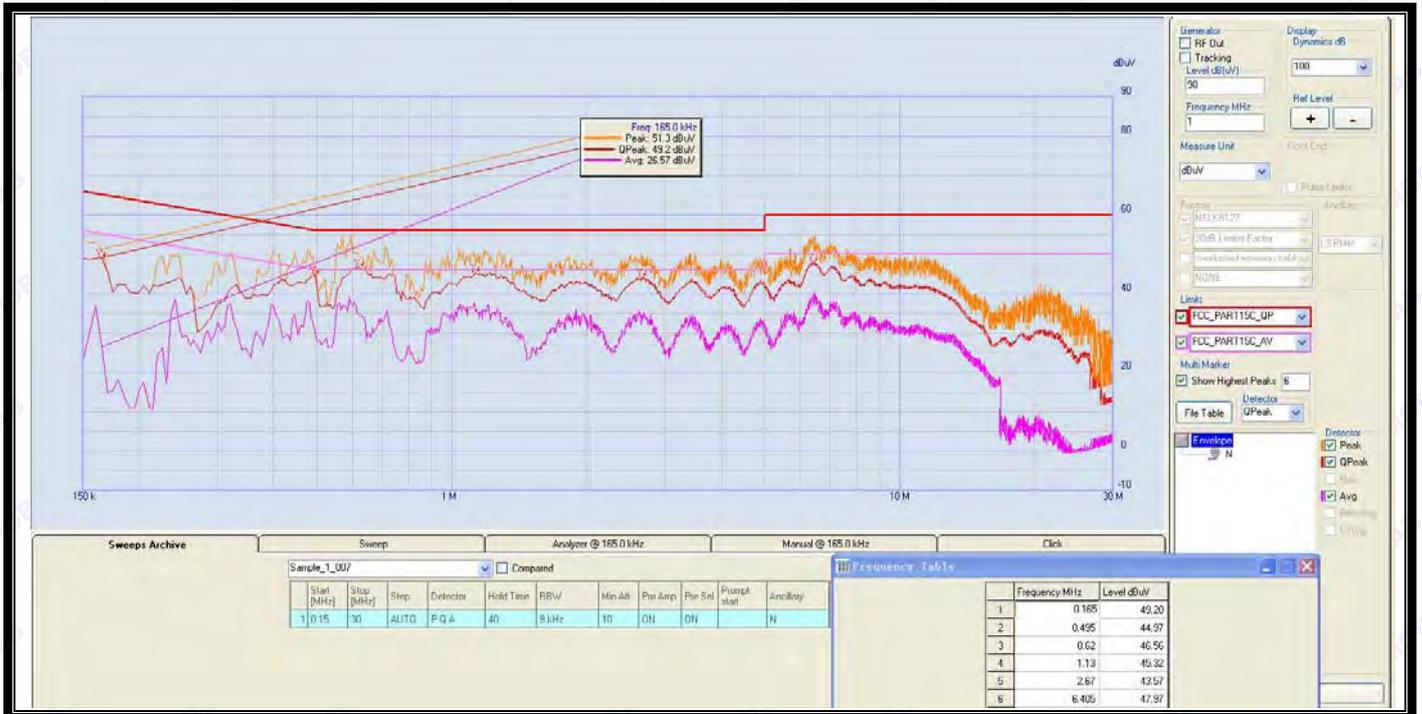
#### **A. Test setup:**

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

#### **B. Test Plots:**



(Plot A: L Phase)



(Plot B: N Phase)



## 2.10. Radiated Emission

### 2.10.1. Requirement

According to FCC section 15.247(d) and RSS-A8.5, 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 ( $\mu\text{V}/\text{m}$ )	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:**

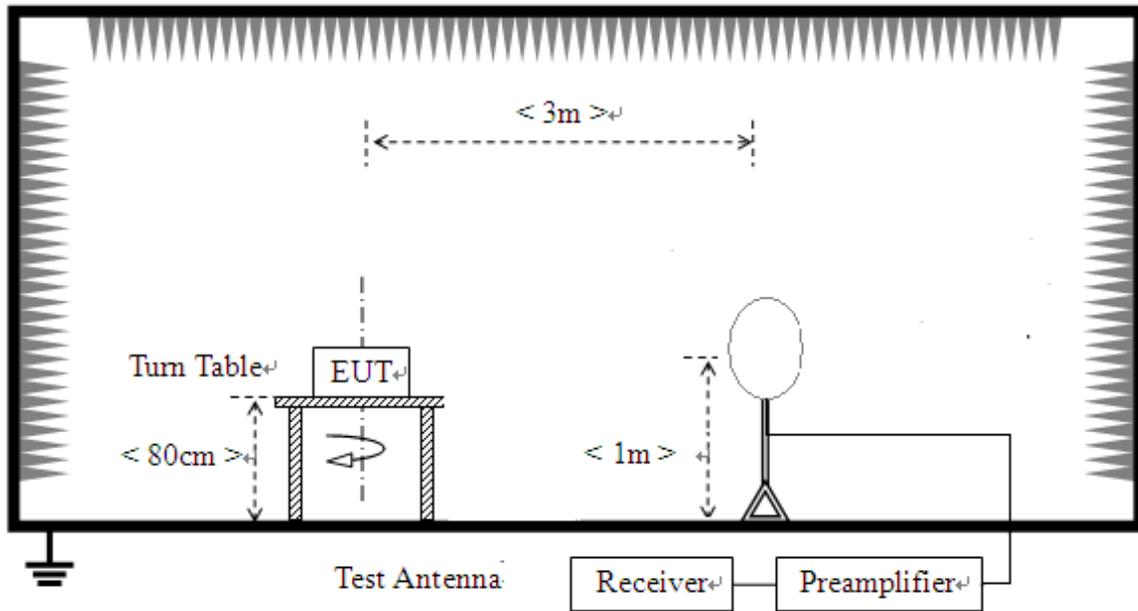
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength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

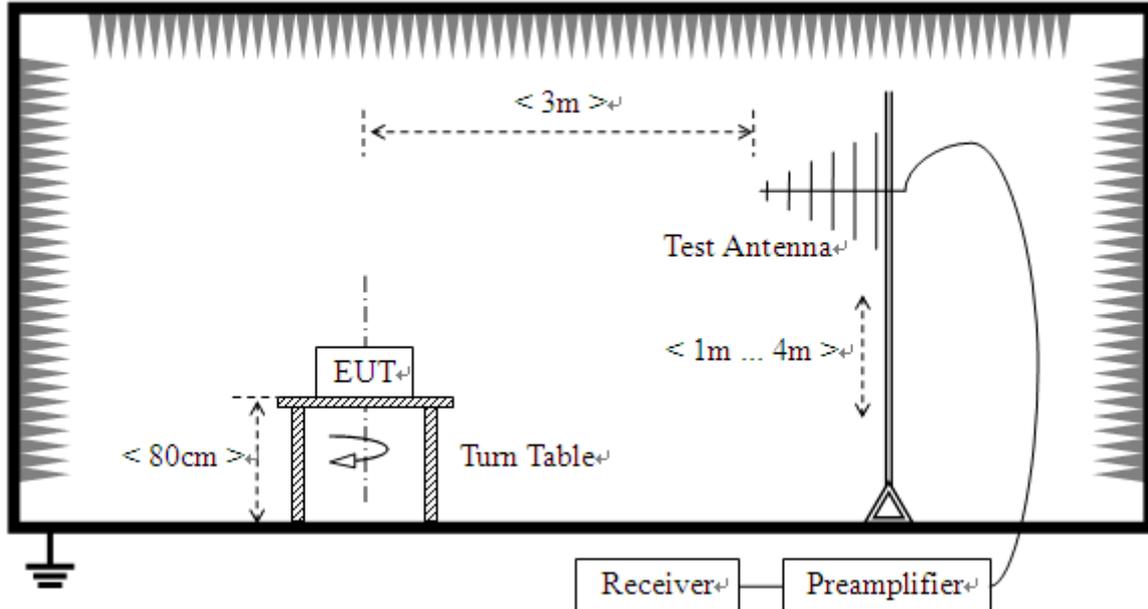
### 2.10.2. Test Description

#### A. Test Setup:

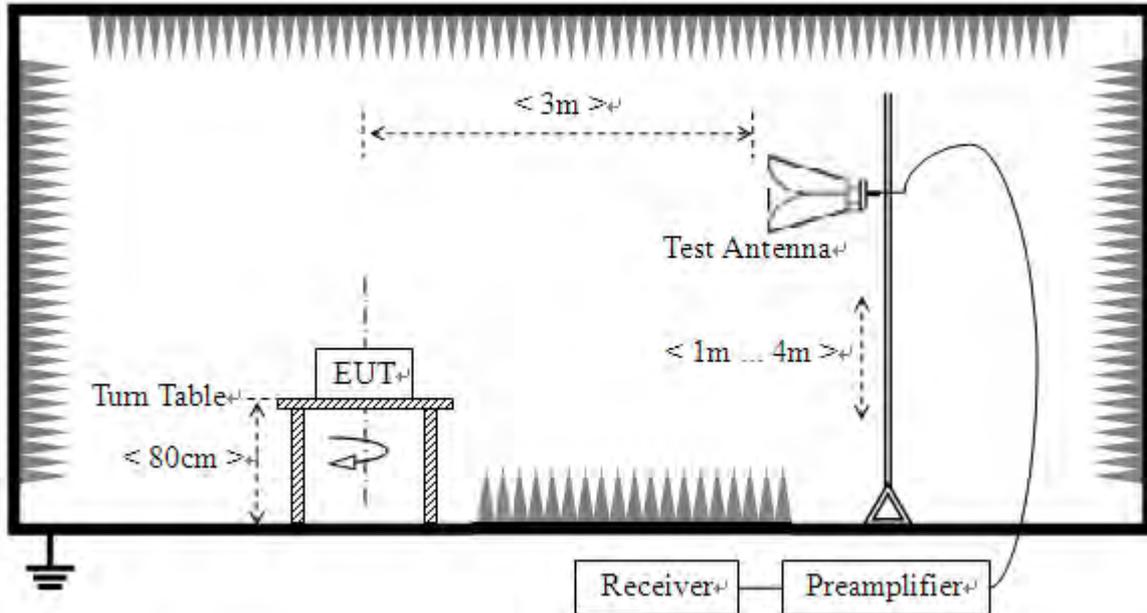
- 1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to 1GHz



## 3) For radiated emissions above 1GHz



The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.4 (2009). The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.4.

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 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.

For the Test Antenna:

- 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.
- In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. 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. The emission levels at both horizontal and vertical polarizations should be tested.



## B. Equipments List:

Please reference ANNEX A(1.4).

### 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  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

### 2.10.4. Test Result

According to ANSI C63.4 selection 4.2.2, 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:

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

$A_T$ : Total correction Factor except Antenna

$U_R$ : Receiver Reading

$G_{\text{preamp}}$ : Preamplifier Gain

$A_{\text{Factor}}$ : Antenna Factor at 3m

During the test, the total correction Factor  $A_T$  and  $A_{\text{Factor}}$  were built in test software.

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

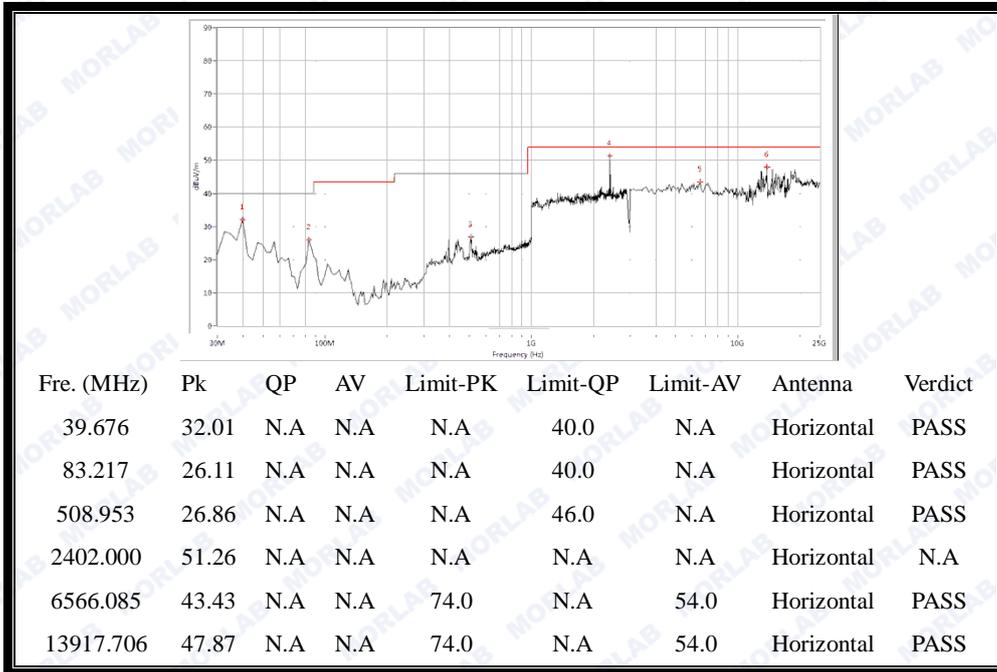
The low frequency, which started from 9KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.



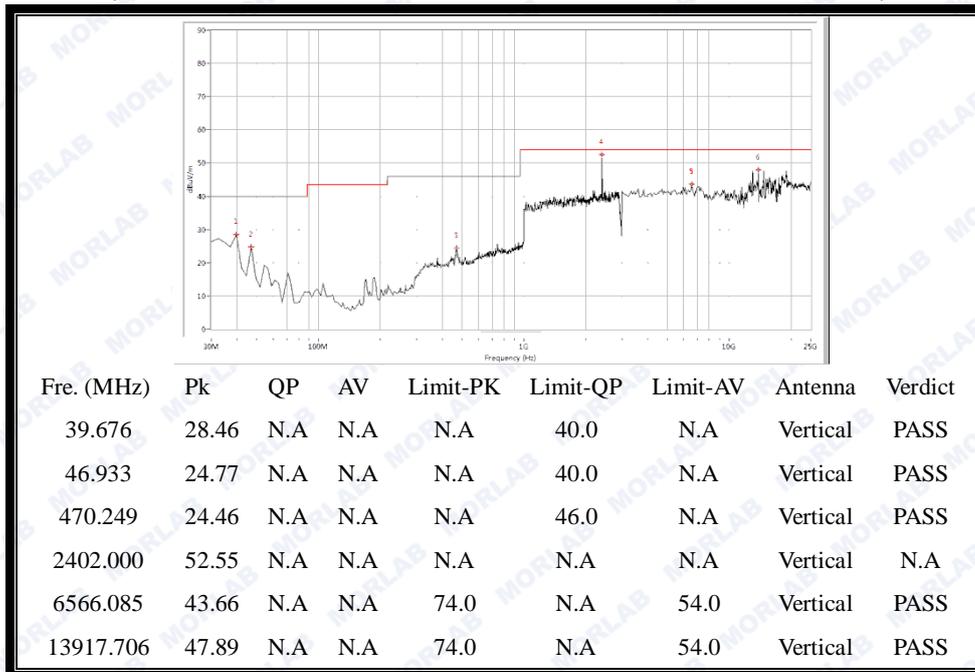
**2.10.4.1. GFSK Mode:**

**A. Test Plots for the Whole Measurement Frequency Range:**

Plots for Channel = 0

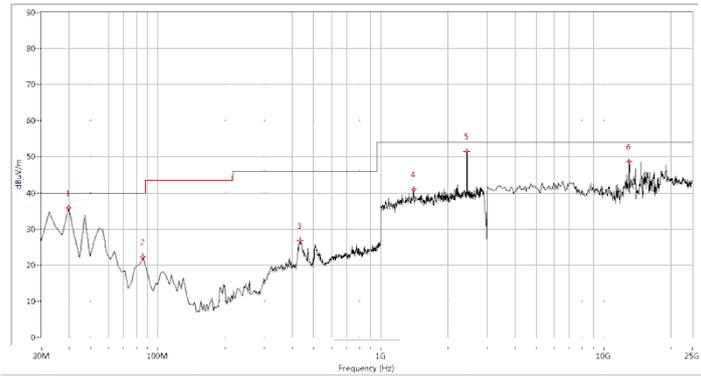


(30MHz to 25GHz, Antenna Horizontal @ GFSK, channel 0)



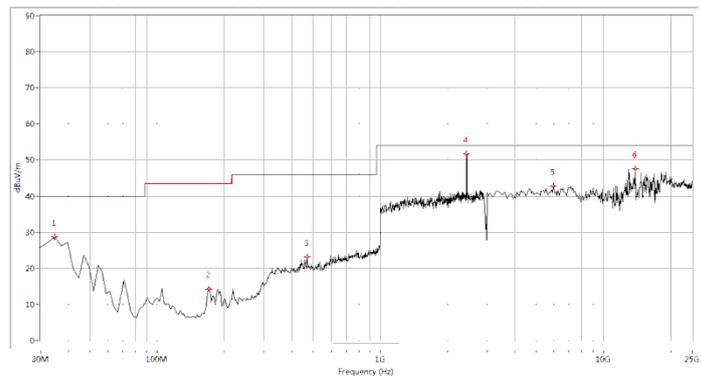
(30MHz to 25GHz, Antenna Vertical @ GFSK, channel 0)

Plot for Channel = 39



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
39.676	35.80	N.A	N.A	N.A	40.0	N.A	Horizontal	PASS
85.636	22.35	N.A	N.A	N.A	40.0	N.A	Horizontal	PASS
433.965	26.72	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
1403.990	40.98	N.A	N.A	54.0	N.A	54.0	Horizontal	PASS
2441.000	51.54	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
12985.037	48.68	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

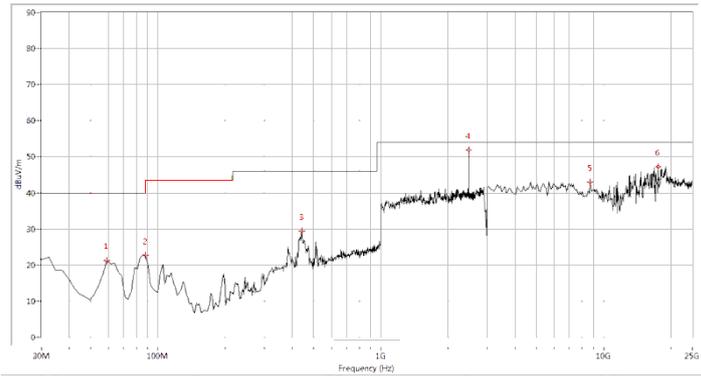
(30MHz to 25GHz, Antenna Horizontal @ GFSK, channel 39)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
34.838	28.67	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
170.299	14.19	N.A	N.A	N.A	43.5	N.A	Vertical	PASS
470.249	23.11	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
2441.000	51.60	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
5962.594	42.70	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
13917.706	47.59	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

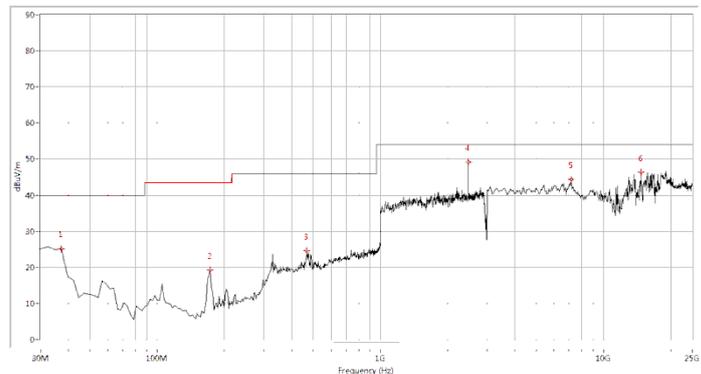
(30MHz to 25GHz, Antenna Vertical @ GFSK, channel 39)

Plot for Channel = 78



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
59.027	21.25	N.A	N.A	N.A	40.0	N.A	Horizontal	PASS
88.055	22.68	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
441.222	29.48	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
2480.000	51.93	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
8705.736	42.94	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
17593.516	47.28	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

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



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
37.257	25.06	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
172.718	19.28	N.A	N.A	N.A	43.5	N.A	Vertical	PASS
467.830	24.67	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
2480.000	49.17	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7169.576	44.37	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
14795.511	46.32	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

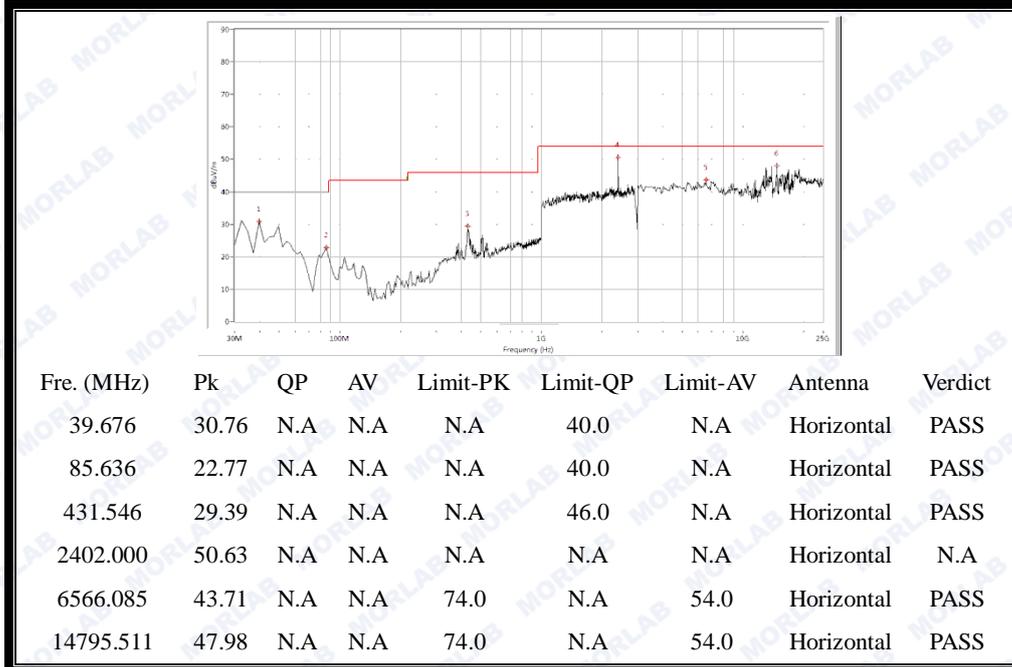
(30MHz to 25GHz, Antenna Vertical @ GFSK, channel 78)



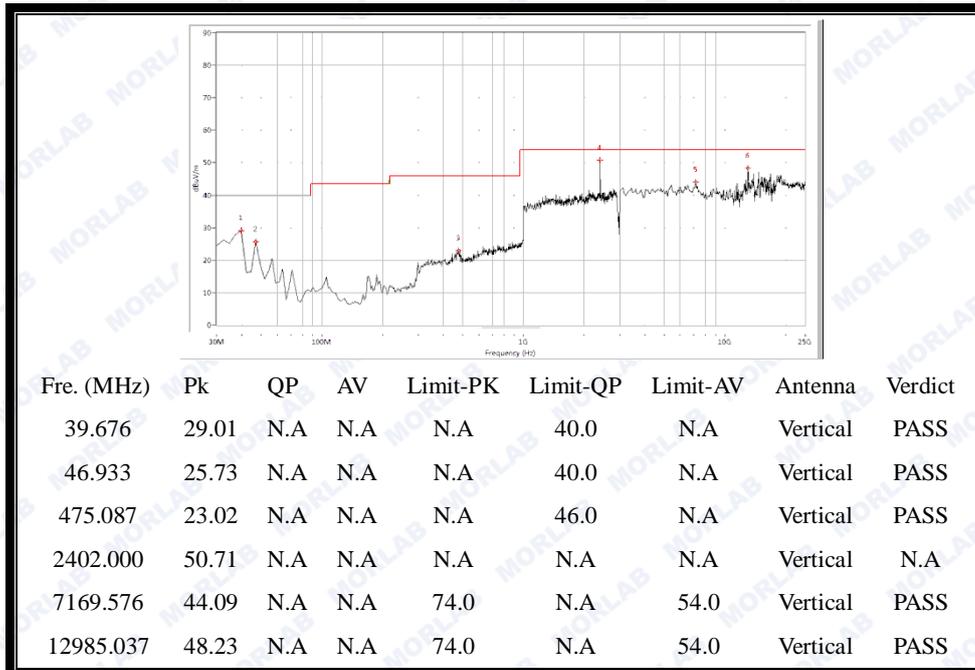
2.10.4.2.  $\pi/4$ -DQPSK Mode:

A. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 0



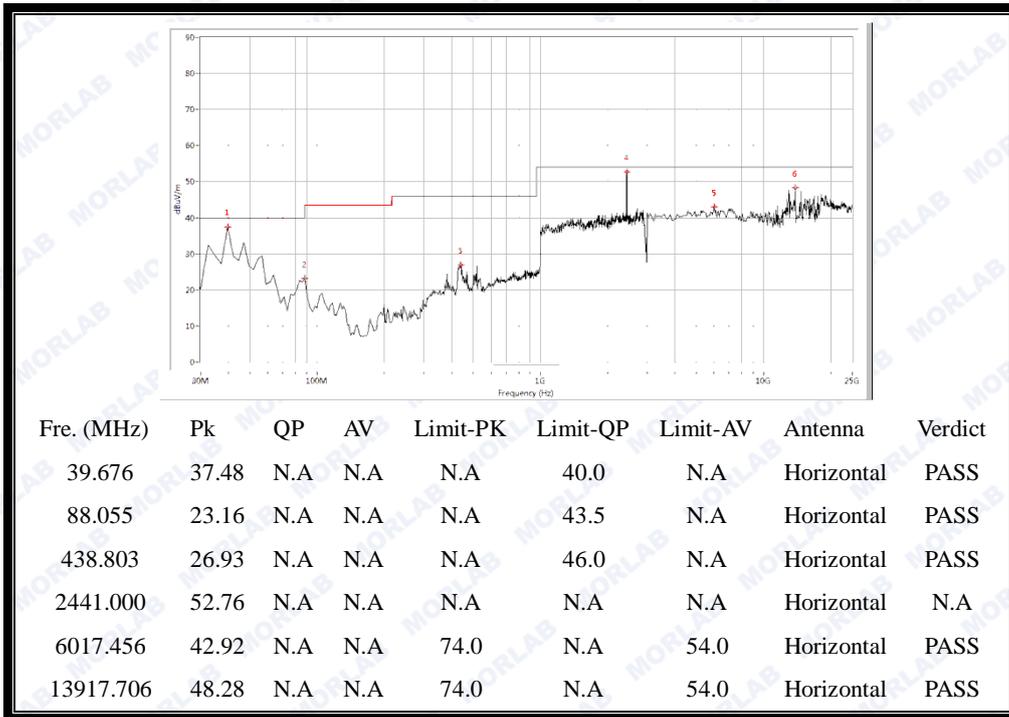
(30MHz to 25GHz, Antenna Horizontal @  $\pi/4$ -DQPSK, channel 0)



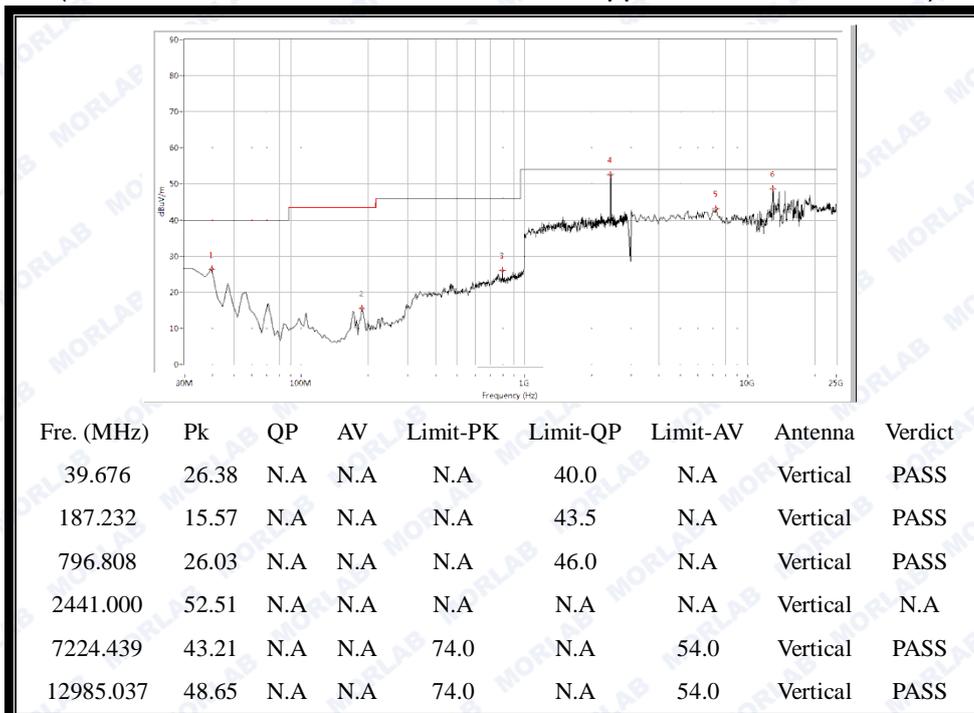
(30MHz to 25GHz, Antenna Vertical @  $\pi/4$ -DQPSK, channel 0)



Plot for Channel = 39



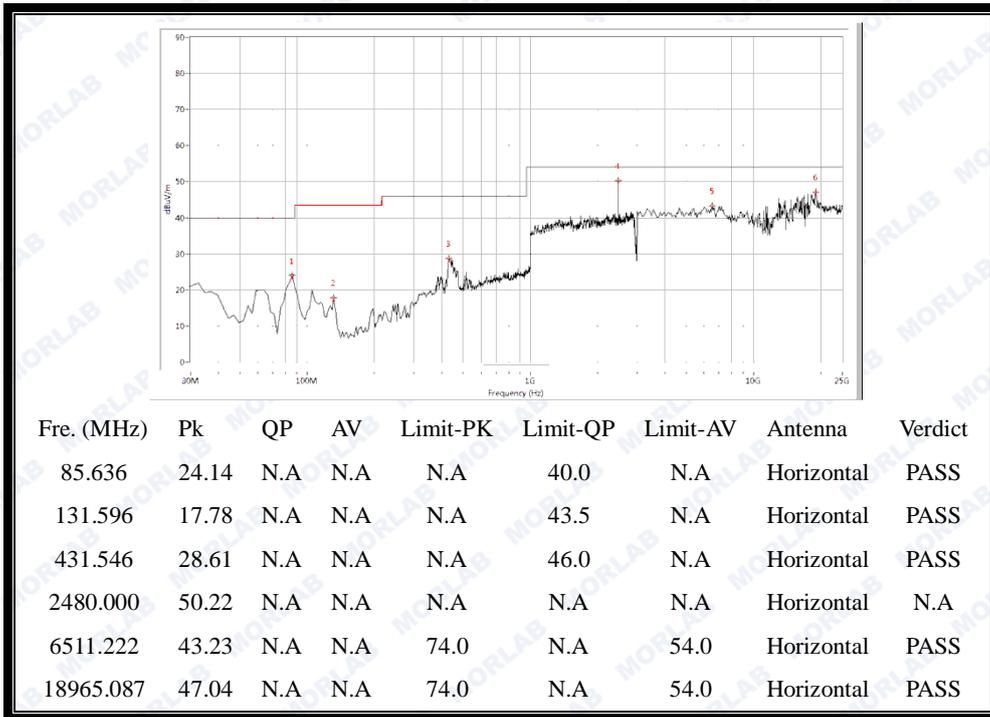
(30MHz to 25GHz, Antenna Horizontal @  $\pi/4$ -DQPSK, channel 39)



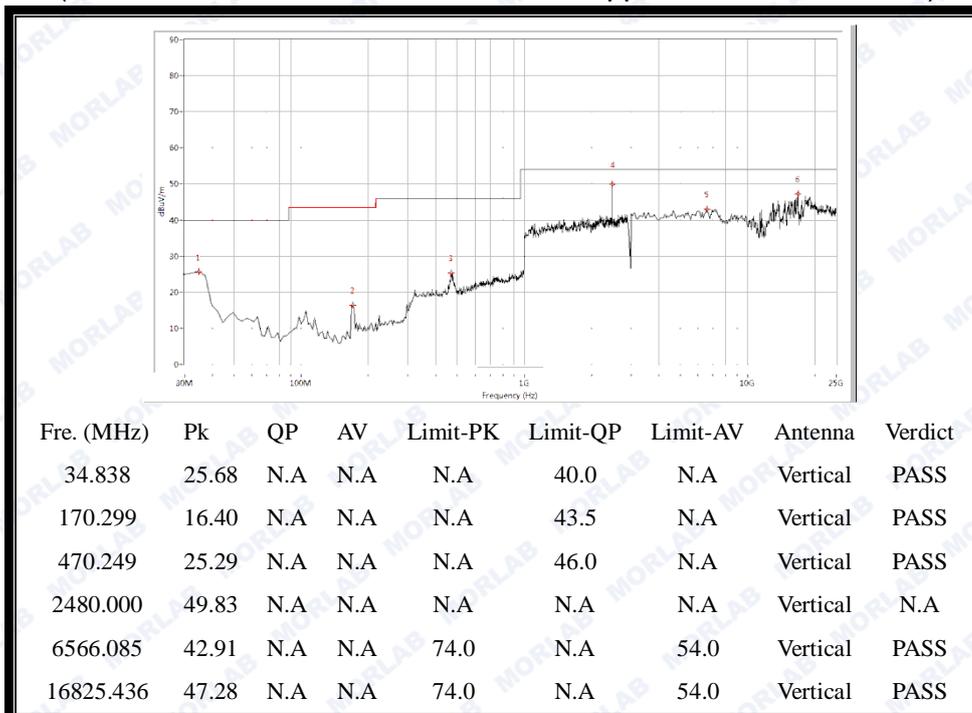
(30MHz to 25GHz, Antenna Vertical @  $\pi/4$ -DQPSK, channel 39)



Plot for Channel = 78



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



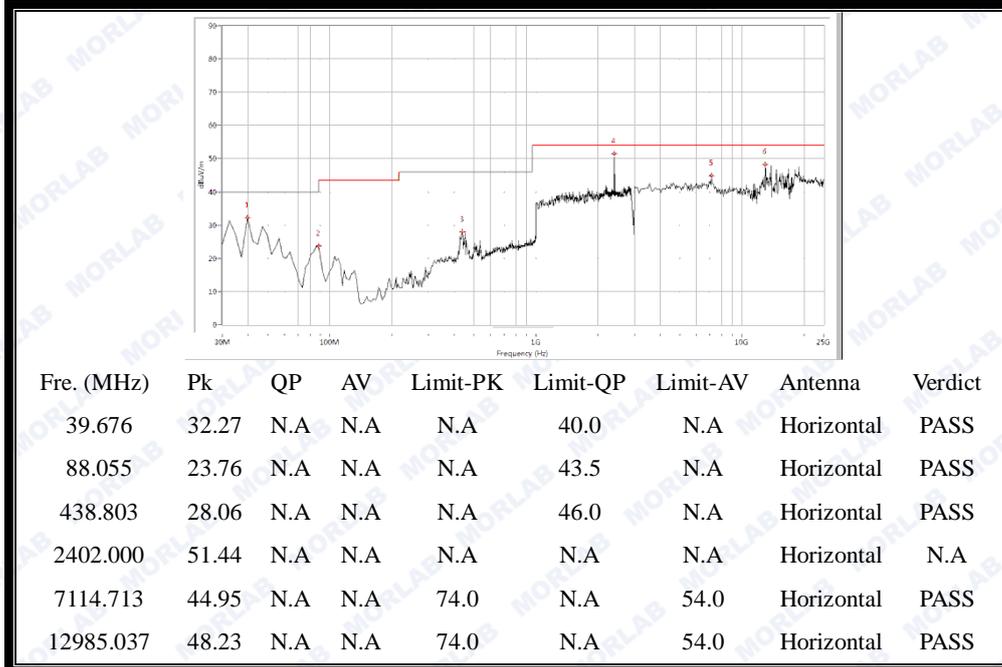
(30MHz to 25GHz, Antenna Vertical @  $\pi/4$ -DQPSK, channel 78)



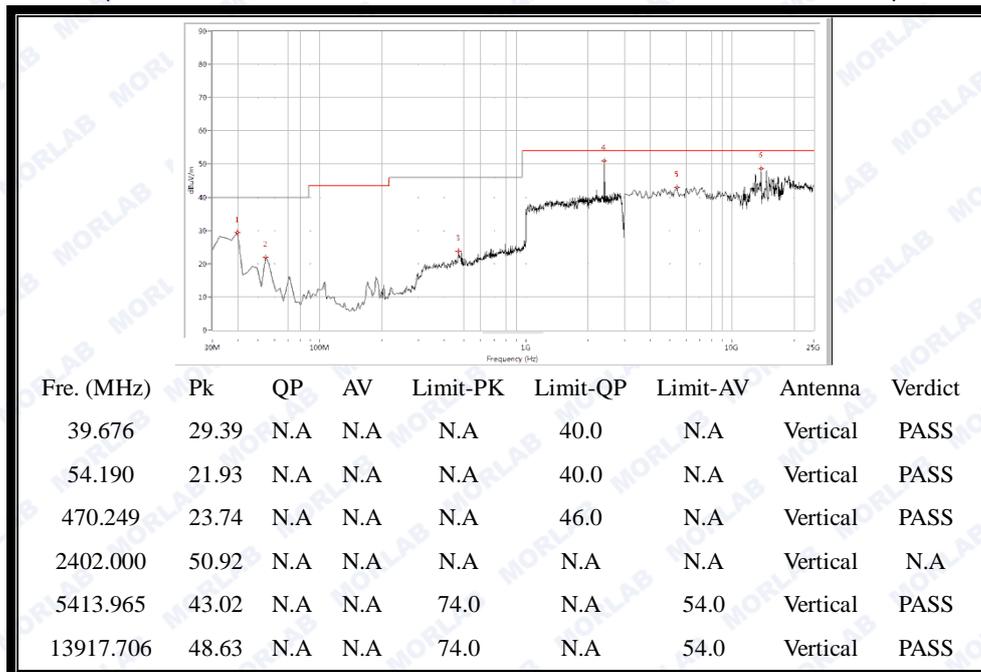
**2.10.4.3. 8-DPSK Mode:**

**A. Test Plots for the Whole Measurement Frequency Range:**

Plots for Channel = 0



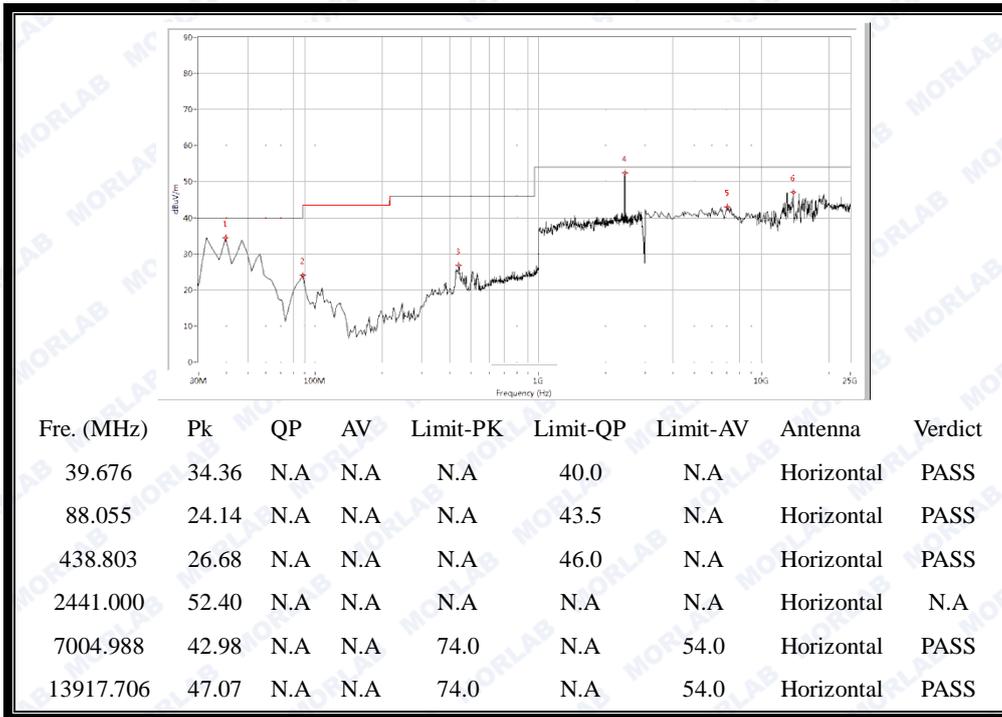
(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 0)



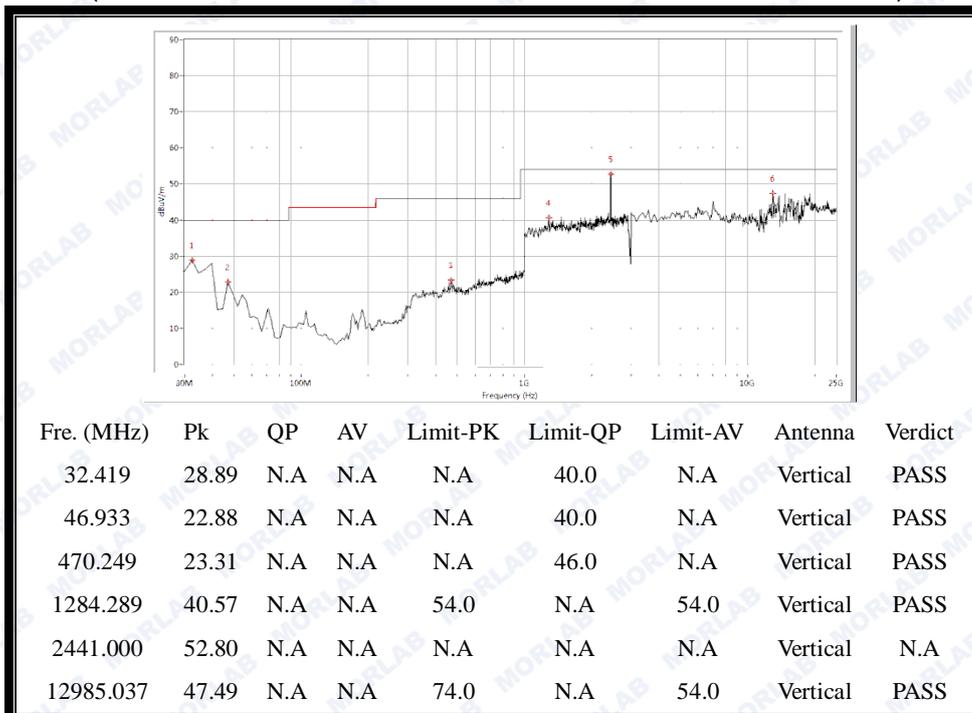
(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 0)



Plot for Channel = 39



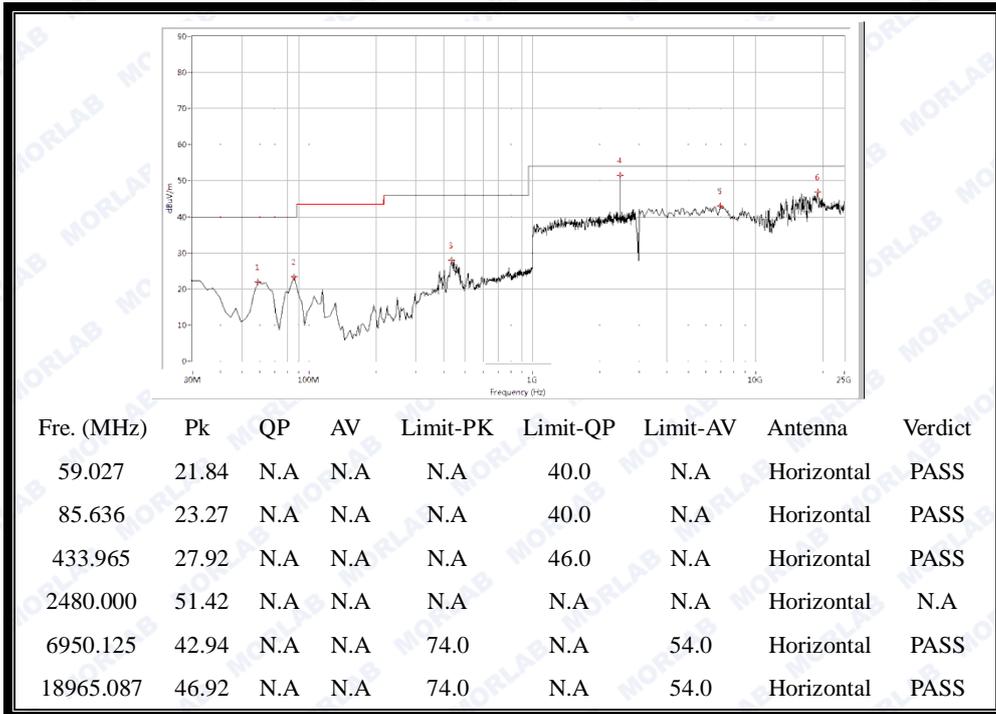
(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 39)



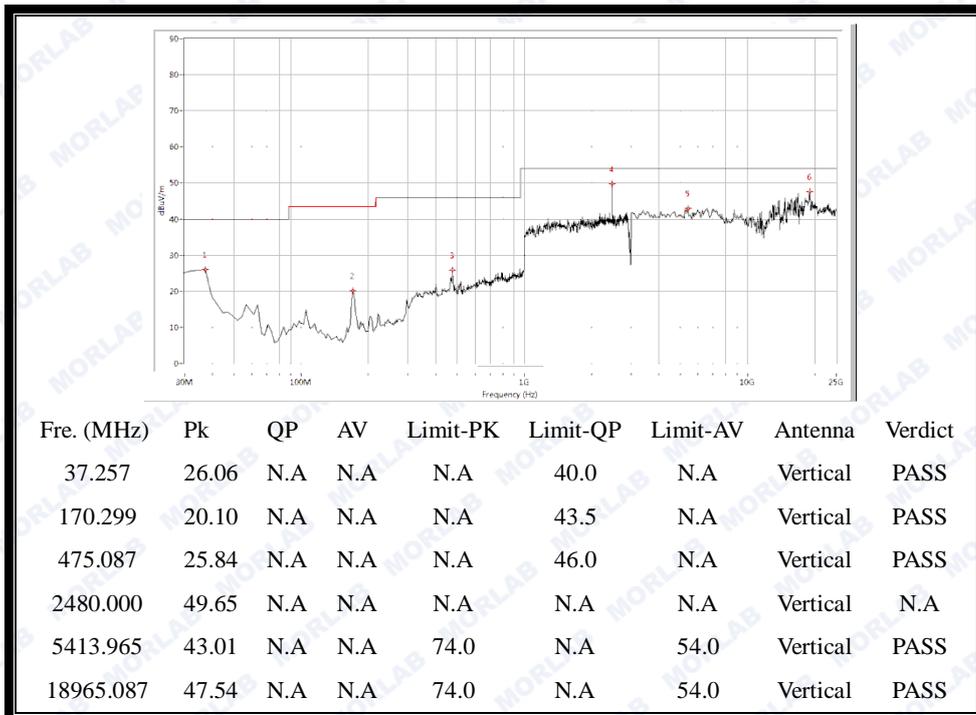
(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 39)



Plot for Channel = 78



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



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



## 2.11. RF exposure evaluation

### 2.11.1. Requirement

According to § 1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of Commission's guideline.

### 2.11.2. Result

Please refer to SAR report.



## Annex A General Information

### 1.1 Identification of the Responsible Testing Laboratory

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

### 1.2 Identification of the Responsible Testing Location

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

### 1.3 Facilities and Accreditations

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

All measurement facilities used to collect the measurement data are located at FL.1, 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 2009, ANSI C63.4 2009 and CISPR Publication 22; the FCC registration number is 695796.

The IC registration number is 7183A-2.



## 1.4 Test Equipments Utilized

### 1.4.1 Conducted Test Equipments

No.	Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
1	System Simulator	6K00006210	MT8852B	Anritsu	2014.02.26	2015.02.25
2	Spectrum Analyzer	MY45101810	E4407B	Agilent	2014.02.26	2015.02.25
3	Power Splitter	NW521	1506A	Weinschel	2014.02.26	2015.02.25
4	Attenuator 1	(n.a.)	10dB	Resnet	2014.02.26	2015.02.25
5	Attenuator 2	(n.a.)	3dB	Resnet	2014.02.26	2015.02.25
6	EXA Signal Analyzer	MY51440152	N9010A	Agilent	2014.02.26	2015.02.25
7	RF cable	CB01	RF01	Morlab	N/A	N/A
8	Coaxial cable	CB02	RF02	Morlab	N/A	N/A
9	SMA connector	CN01	RF03	HUBER-SUHNER	N/A	N/A

### 1.4.2 Conducted Emission Test Equipments

No.	Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
1	Receiver	US44210471	E7405A	Agilent	2014.02.26	2015.02.25
2	LISN	812744	NSLK 8127	Schwarzbeck	2014.02.26	2015.02.25
3	Service Supplier	100448	CMU200	R&S	2014.02.26	2015.02.25
4	Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2014.02.26	2015.02.25
5	Coaxial cable(BNC)	CB01	EMC01	Morlab	N/A	N/A



### 1.4.3 Radiated Test Equipments

No.	Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal.Due Date
1	System Simulator	100448	CMU200	R&S	2014.02.26	2015.02.25
2	Receiver	US44210471	E7405A	Agilent	2014.02.26	2015.02.25
3	Test Antenna - Bi-Log	9163-274	9m*6m*6m	Albatross	2014.02.26	2015.02.25
4	Test Antenna - Horn	9120D-963	VULB 9163	Schwarzbeck	2014.02.26	2015.02.25
5	Test Antenna - Horn	71688	BBHA 9120D	Schwarzbeck	2014.02.26	2015.02.25
6	Test Antenna - Loop	1519-022	HL050S7	R&S	2014.02.26	2015.02.25
7	Reject Filter	(n.a.)	BRM50702	Micro-Tronics	2014.02.26	2015.02.25
8	Coaxial cable (N male)	CB02	EMC02	Morlab	N/A	N/A
9	Coaxial cable (N male)	CB03	EMC03	Morlab	N/A	N/A

### 1.4.4 Climate Chamber

No.	Equipment Name	Serial No.	Type	Manufacturer	Cal.Date	Cal.Due Date
1	Climate Chamber	2004012	HL4003T	Yinhe	2014.02.26	2015.02.25

### 1.4.5 Vibration Table

No.	Equipment Name	Serial No.	Type	Manufacturer	Cal.Date	Cal.Due Date
1	Vibration Table	N/A	ACT2000-S015L	CMI-COM	2014.02.26	2015.02.25

### 1.4.6 Anechoic Chamber

No.	Equipment Name	Serial No.	Type	Manufacturer	Cal.Date	Cal.Due Date
1	Anechoic Chamber	N/A	9m*6m*6m	Albatross	2014.02.26	2015.02.25

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