



# TEST REPORT



**DT&C Co., Ltd.**

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042  
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC1709-0170(1)
2. Customer
  - Name : POINTMOBILE CO.,LTD
  - Address : B-9F, Kabul Great Valley 32 Digital-ro 9-gil, Geumcheon-gu Seoul South Korea  
153-709
3. Use of Report : FCC & IC Original Grant
4. Product Name / Model Name : Mobile Computer / FCC: PM80, IC: PM80PW  
FCC ID: V2X-PM80W1 / IC: 10664A-PM80W1
5. Test Method Used : ANSI C63.10-2013  
Test Specification : FCC Part 15 Subpart C.247,  
RSS-247 Issue 2 (2017-02), RSS-GEN Issue 4 (2014-11)
6. Date of Test : 2017.03.20 ~ 2017.07.03
7. Testing Environment : See appended test report.
8. Test Result : Refer to the attached test result.

Affirmation	Tested by	Technical Manager
	Name : JaeHyeok Bang 	Name : HyunSu Son 

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

2017 . 09 . 13 .

**DT&C Co., Ltd.**

If this report is required to confirmation of authenticity, please contact to [report@dtnc.net](mailto:report@dtnc.net)

## Test Report Version

Test Report No.	Date	Description
DRTFCC1709-0170	Sep. 06, 2017	Initial issue
DRTFCC1709-0170(1)	Sep. 13, 2017	Update the Test specification

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## 1. General Information

### 1.1 Testing Laboratory

<b>DT&amp;C Co., Ltd.</b>	
The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The site is constructed in conformance with the requirements.	
- FCC MRA Accredited Test Firm No. : KR0034	
- IC Test site No. : 5740A-3	
<a href="http://www.dtn.net">www.dtn.net</a>	
Telephone	: + 82-31-321-2664
FAX	: + 82-31-321-1664

### 1.2 Testing Environment

Ambient Condition	
▪ Temperature	+21 °C ~ +25 °C
▪ Relative Humidity	42 % ~ 46 %

### 1.3 Measurement Uncertainty

Test items	Measurement uncertainty
Transmitter Output Power	0.7 dB (The confidence level is about 95 %, k = 2)
Conducted spurious emission	1.0 dB (The confidence level is about 95 %, k = 2)
AC conducted emission	2.4 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz Below)	5.1 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz ~ 18 GHz)	5.4 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (18 GHz Above)	5.3 dB (The confidence level is about 95 %, k = 2)

## 1.4 Details of Applicant

Applicant : POINT MOBILE CO.,LTD  
 Address : B-9F, Kabul Great Valley 32 Digital-ro 9-gil, Geumcheon-gu Seoul South Korea  
           : 153-709  
 Contact person : Wilson Park

## 1.5 Description of EUT

<b>EUT</b>	Mobile computer
<b>Model Name</b>	FCC: PM80 IC: PM80PW
<b>Add Model Name</b>	FCC: CHD8, XT2 IC: XT2PW
<b>Serial Number</b>	Identical prototype
<b>Hardware version</b>	MP
<b>Software version</b>	81.00
<b>Power Supply</b>	DC 3.8 V
<b>Frequency Range</b>	2402 MHz ~ 2480 MHz
<b>Modulation Technique</b>	GFSK, $\pi/4$ -DQPSK, 8DPSK
<b>Number of Channels</b>	79
<b>Antenna Type</b>	Internal Antenna
<b>Antenna Gain</b>	PK : -0.37 dBi

## 1.6 Declaration by the applicant / manufacturer

- NA

## 1.7 Information about the FHSS characteristics

- This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following :
  - A) The hopping sequence is pseudorandom
  - B) All channels are used equally on average
  - C) The receiver input bandwidth equals the transmit bandwidth
  - D) The receiver hops in sequence with the transmit signal
  
- 15.247(g) : In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.
  
- 15.247(h) : In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection / hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.
  
- 15.247(h) : The EUT employs Adaptive Frequency Hopping (AFH) which identifies sources of interference namely devices operating in 802.11 WLAN and excludes them from the list of available channels. The process of re-mapping reduces the number of test channels from 79 channels to a minimum number of 20 channels.

## 1.8 Test Equipment List

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	16/08/18 17/07/12	17/08/18 18/07/12	MY46471601
Spectrum Analyzer	Agilent Technologies	N9020A	16/10/11	17/10/11	MY46471251
Multimeter	FLUKE	17B	17/04/12	18/04/12	26030065WS
DC Power Supply	Agilent	66332A	17/01/11	18/01/11	US37473831
Signal Generator	Rohde Schwarz	SMBV100A	17/01/04	18/01/04	255571
Signal Generator	Rohde Schwarz	SMF100A	16/06/23 17/04/21	17/06/23 18/04/21	102341
Thermohygrometer	HCT	HCT-1	16/09/09	17/09/09	NONE
Power Splitter	Anritsu	K241B	17/01/11	18/01/11	1301183
Bluetooth Tester	TESCOM	TC-3000B	17/01/04	18/01/04	3000B770243
Loop Antenna	Schwarzbeck	FMZB1513	16/04/22	18/04/22	1513-128
BILOG ANTENNA	Schwarzbeck	VULB 9160	16/05/13	18/05/13	3358
Horn Antenna	ETS-LINDGREN	3117	16/05/03	18/05/03	00140394
Horn Antenna	A.H.Systems Inc.	SAS-574	15/09/03	17/09/03	155
PreAmplifier	Agilent	8449B	17/01/11	18/01/11	3008A00370
PreAmplifier	TSJ	MLA-010K01- B01-27	17/03/06	18/03/06	1844539
EMI Test Receiver	Rohde Schwarz	ESR7	17/02/16	18/02/16	101061
High-pass filter	Wainwright	WHKX12- 2580-3000- 18000-80SS	16/09/09	17/09/09	3
High-pass filter	Wainwright	WHNX6-6320- 8000-26500- 40CC	16/09/13	17/09/13	1
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2495A MA2490A	16/10/19	17/10/19	1308003 1249304
EMI TEST RECEIVER	R&S	ESCI	17/02/26	18/02/16	100364
PULSE LIMITER	Rohde Schwarz	ESH3-Z2	17/01/03	18/01/03	101334
SINGLE-PHASE MASTER	NF	4420	16/09/08	17/09/08	3049354420023
Artificial Mains Network	Narda S.T.S. / PMM	PMM L2-16B	17/06/07	18/06/07	000WX20305

Note: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2006.

## 1.9 Summary of Test Results

FCC Part RSS Std.	Parameter	Limit (Using in 2400~ 2483.5 MHz)	Test Condition	Status Note 1
15.247(a) RSS-247(5.1)	Carrier Frequency Separation	>= 25 kHz or >= Two thirds of the 20 dB BW, whichever is greater.	Conducted	C
	Number of Hopping Frequencies	>= 15 hops		C
	20 dB Bandwidth	N/A		C
	Dwell Time	=< 0.4 seconds		C
15.247(b) RSS-247(5.4)	Transmitter Output Power	<b>For FCC</b> =< 1 Watt , if CHs >= 75 Others =< 0.125 W <b>For IC</b> if CHs >= 75 =< 1 Watt For Conducted Power =< 4 Watt For e.i.r.p, Others =< 0.125 W For Conducted Power. =< 0.5 Watt For e.i.r.p		C
15.247(d) RSS-247(5.5)	Conducted Spurious Emissions	The radiated emission to any 100 kHz of out-band shall be at least 20 dB below the highest in-band spectral density.	C	
RSS Gen(6.6)	Occupied Bandwidth (99 %)	N/A	C	
15.247(d) 15.205 & 209 RSS-247(5.5) RSS-Gen (8.9 & 8.10)	Radiated Spurious Emissions	FCC 15.209 Limits RSS-Gen 8.9	Radiated	C <sup>Note2</sup>
15.207 RSS-Gen(8.8)	AC Conducted Emissions	FCC 15.207 Limits	AC Line Conducted	C
15.203 RSS-Gen(8.3)	Antenna Requirements	FCC 15.203	-	C
Note 1 : <b>C</b> = Comply <b>NC</b> = Not Comply <b>NT</b> = Not Tested <b>NA</b> = Not Applicable Note 2 : This test item was performed in each axis and the worst case data was reported. Note 3 : The sample was tested according to the following specifications : - ANSI C63.10-2013				



### 1.10 Conclusion of worst-case and operation mode

The EUT has three type of modulation (GFSK,  $\pi/4$ DQPSK and 8DPSK).

Therefore all applicable requirements were tested with all the modulations.

And packet type was tested at the worst case(DH5).

The field strength of spurious emission was measured in three orthogonal EUT positions (X-axis, Y-axis and Z-axis).

Tested frequency information,

- Hopping Function : Enable

	TX Frequency (MHz)	RX Frequency (MHz)
<b>Hopping Band</b>	2402 ~ 2480	2402 ~ 2480

- Hopping Function : Disable

	TX Frequency (MHz)	RX Frequency (MHz)
<b>Lowest Channel</b>	2402	2402
<b>Middle Channel</b>	2441	2441
<b>Highest Channel</b>	2480	2480

## 2. Maximum Peak Output Power Measurement

### 2.1 Test Setup

Refer to the APPENDIX I.

### 2.2 Limit

#### ■ FCC Requirements

The maximum peak output power of the intentional radiator shall not exceed the following :

1. §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.
2. §15.247(b)(1), For frequency hopping systems operating in the 2400 – 2483.5 MHz employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725 – 5805 MHz band : 1 Watt.

#### ■ IC Requirements

1. RSS-247(5.4), For FHSS operating in the band 2400 - 2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels the maximum peak conducted output power shall not exceed 0.125 W and the e.i.r.p. shall not exceed 0.5 W if the hopset uses less than 75 hopping channels

### 2.3 Test Procedure

1. The RF output power was measured with a spectrum analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency, A spectrum analyzer was used to record the shape of the transmit signal.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using ;  
Span = approximately 5 times of the 20 dB bandwidth, centered on a hopping channel  
RBW  $\geq$  20 dB BW  
VBW  $\geq$  RBW  
Sweep = auto  
Detector function = peak  
Trace = max hold

## 2.4 Test Results

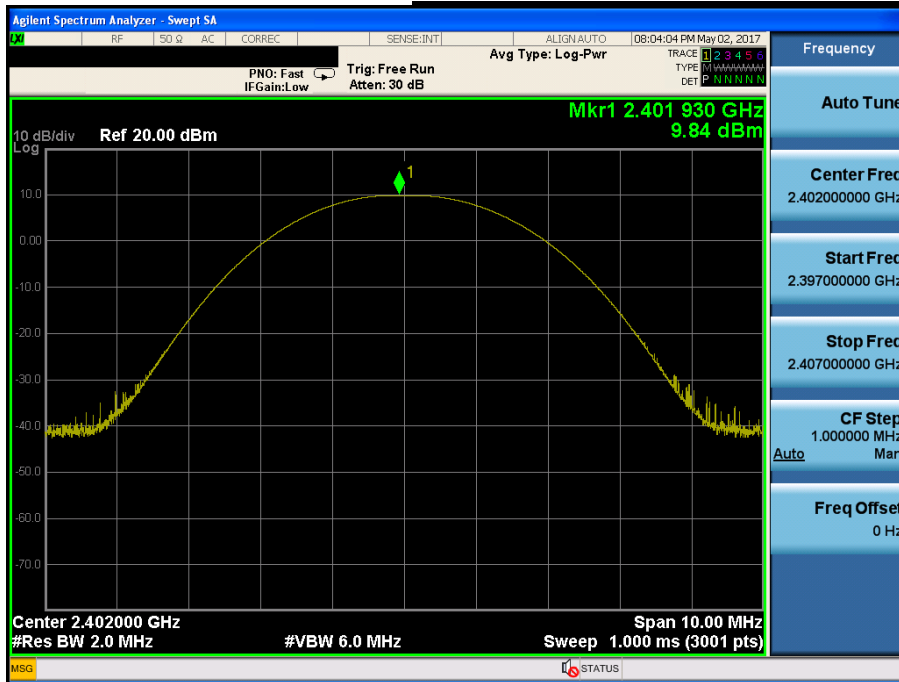
Modulation	Tested Channel	Frame Average Output Power		Peak Output Power	
		dBm	mW	dBm	mW
<b><u>GFSK</u></b>	<b>Lowest</b>	8.46	7.015	9.84	9.638
	<b>Middle</b>	8.17	6.561	9.53	8.974
	<b>Highest</b>	<b>8.69</b>	<b>7.396</b>	<b>9.97</b>	<b>9.931</b>
<b><u><math>\pi/4</math>DQPSK</u></b>	<b>Lowest</b>	6.31	4.276	9.85	9.661
	<b>Middle</b>	6.19	4.159	9.53	8.974
	<b>Highest</b>	<b>6.57</b>	<b>4.539</b>	<b>9.99</b>	<b>9.977</b>
<b><u>8DPSK</u></b>	<b>Lowest</b>	6.32	4.285	10.16	10.375
	<b>Middle</b>	6.22	4.188	9.80	9.550
	<b>Highest</b>	<b>6.58</b>	<b>4.550</b>	<b>10.29</b>	<b>10.691</b>

Note 1 : The frame average output power was tested using an average power meter for reference only.

Note 2 : See next pages for actual measured spectrum plots.

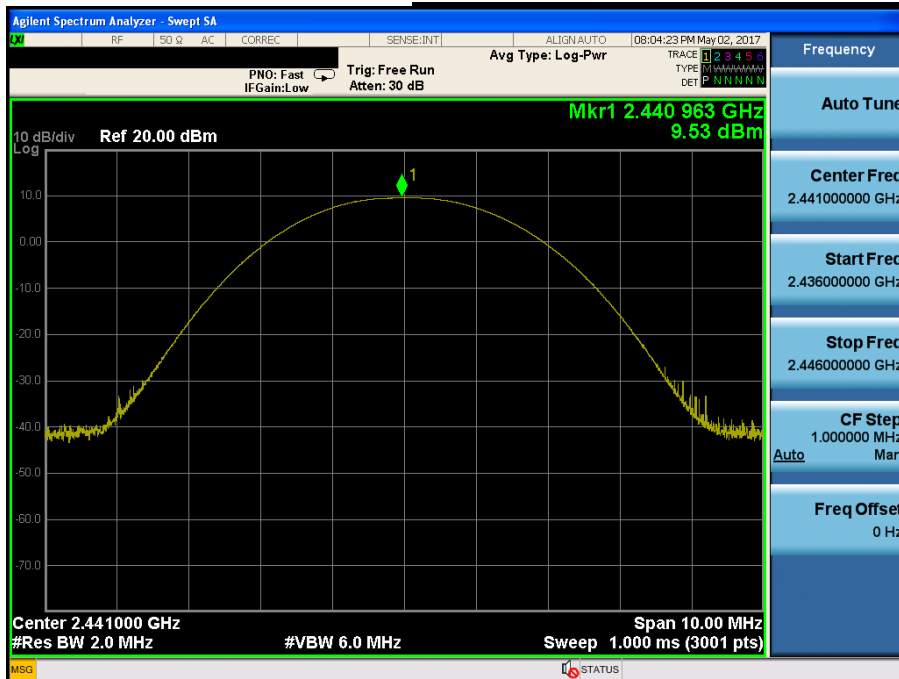
Peak Output Power

Lowest Channel & Modulation : GFSK



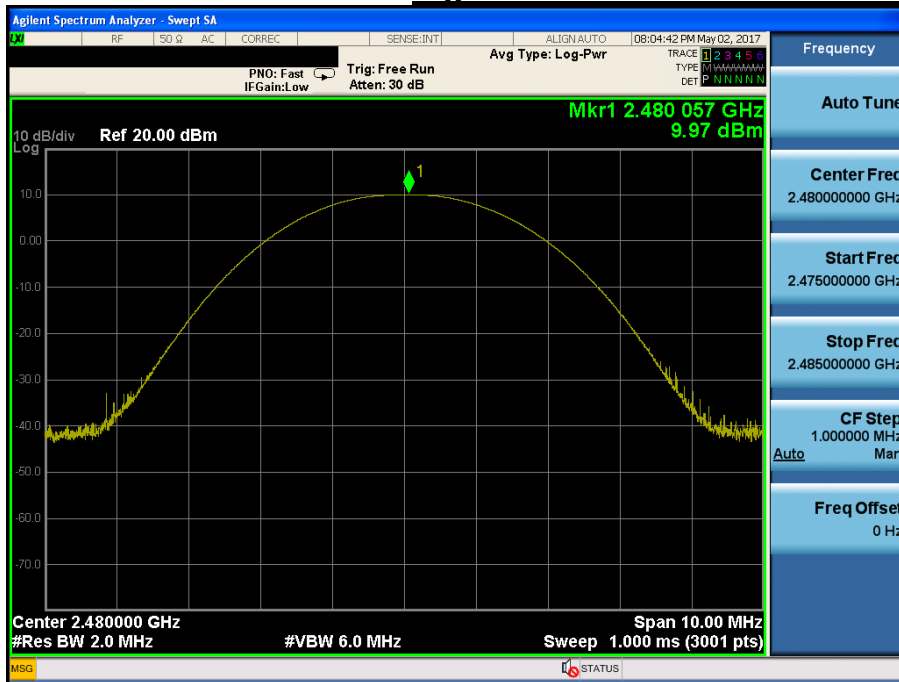
Peak Output Power

Middle Channel & Modulation : GFSK



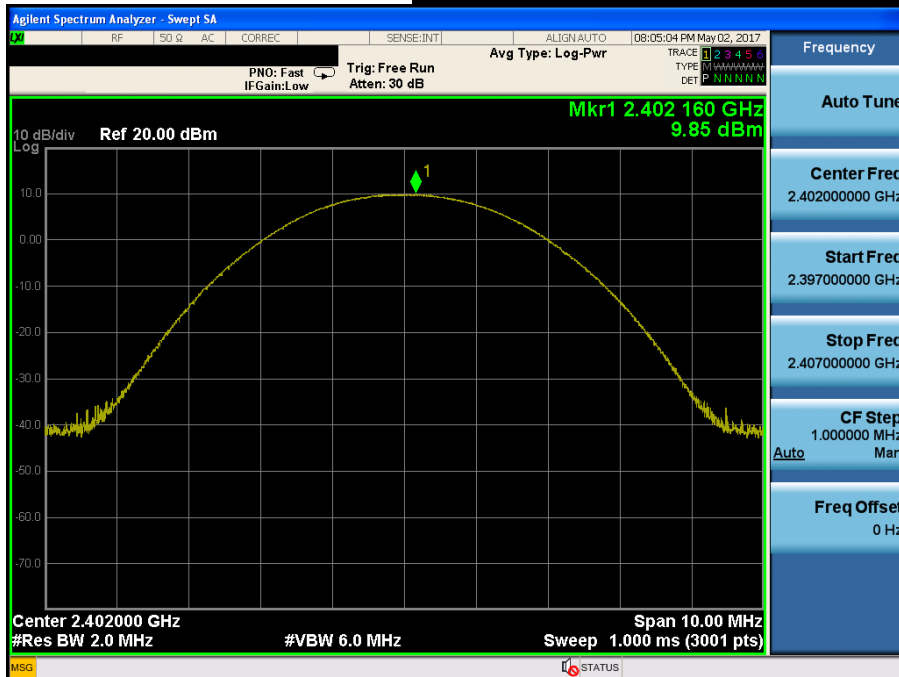
Peak Output Power

Highest Channel & Modulation : GFSK



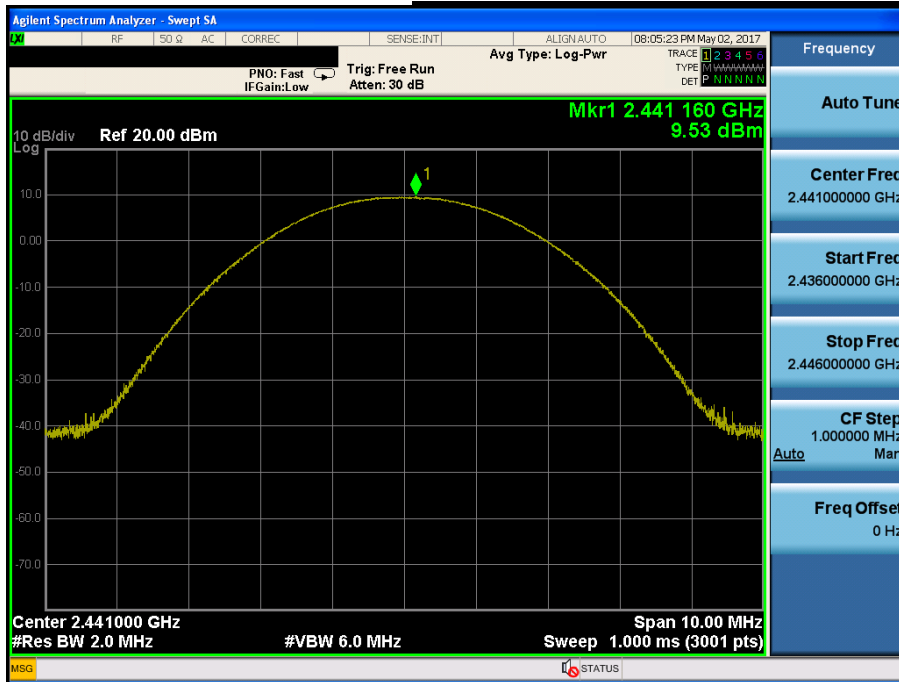
Peak Output Power

Lowest Channel & Modulation :  $\pi/4$ DQPSK



Peak Output Power

Middle Channel & Modulation :  $\pi/4$ DQPSK



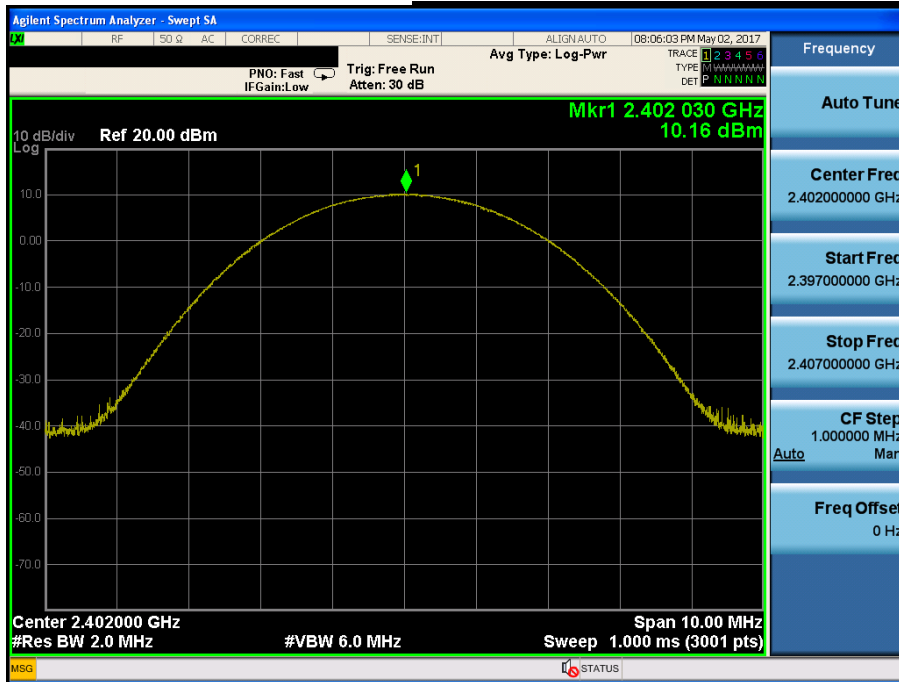
Peak Output Power

Highest Channel & Modulation :  $\pi/4$ DQPSK



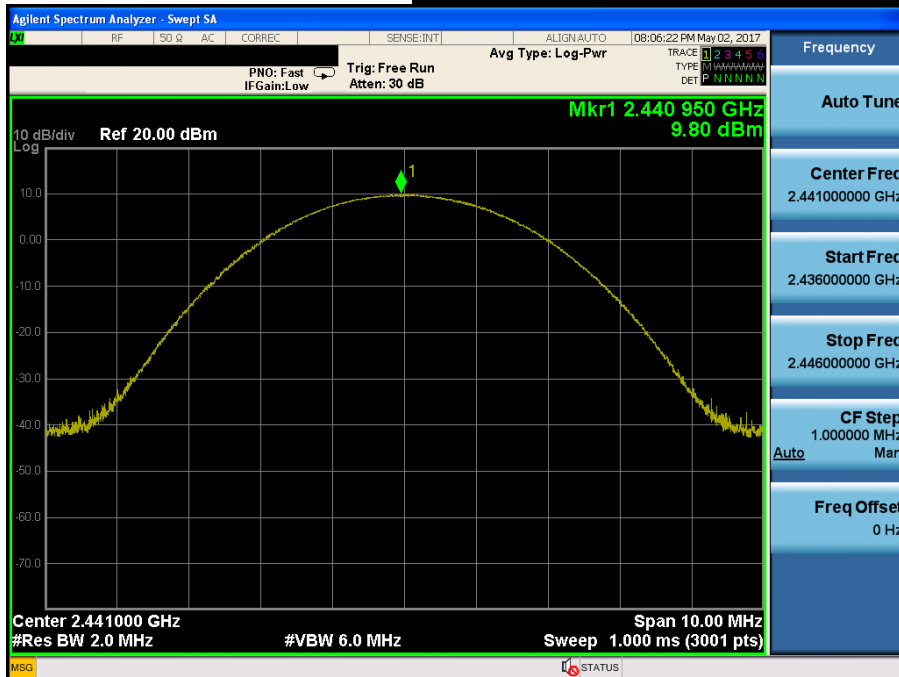
Peak Output Power

Lowest Channel & Modulation : 8DPSK



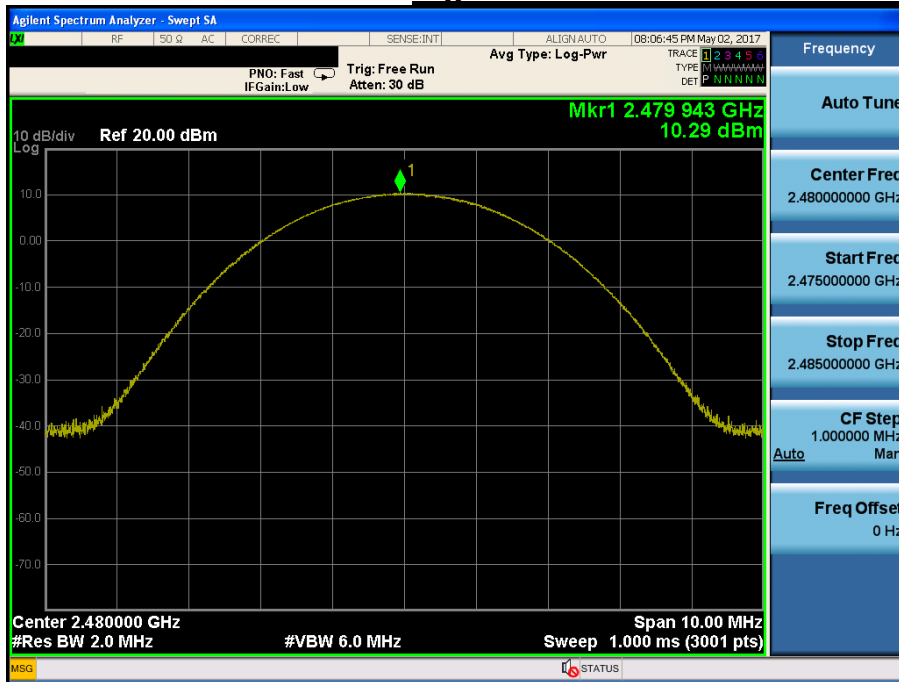
Peak Output Power

Middle Channel & Modulation : 8DPSK



Peak Output Power

***Highest Channel & Modulation : 8DPSK***





### 3. 20 dB BW

#### 3.1 Test Setup

Refer to the APPENDIX I.

#### 3.2 Limit

Limit : Not Applicable

#### 3.3 Test Procedure

1. The 20 dB bandwidth were measured with a spectrum analyzer connected to RF antenna Connector (conducted measurement) while EUT was operating in transmit mode. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using below setting: RBW shall be in the range of 1% to 5% of the 20 dB bandwidth and VBW  $\geq 3 \times$  RBW, Span = between two times and five times the 20 dB bandwidth.

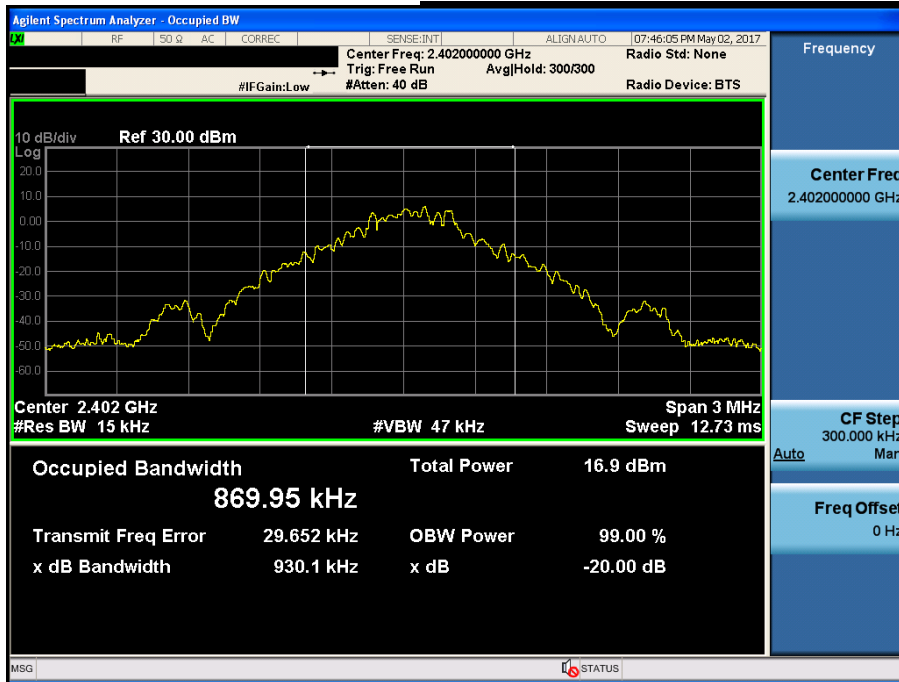
#### 3.4 Test Results

Modulation	Tested Channel	20 dB BW (MHz)
<b><u>GFSK</u></b>	<b>Lowest</b>	<b>0.930</b>
	<b>Middle</b>	0.930
	<b>Highest</b>	0.927
<b><u><math>\pi/4</math>DQPSK</u></b>	<b>Lowest</b>	1.316
	<b>Middle</b>	<b>1.331</b>
	<b>Highest</b>	1.319
<b><u>8DPSK</u></b>	<b>Lowest</b>	1.270
	<b>Middle</b>	<b>1.289</b>
	<b>Highest</b>	1.284

Note 1 : See next pages for actual measured spectrum plots.

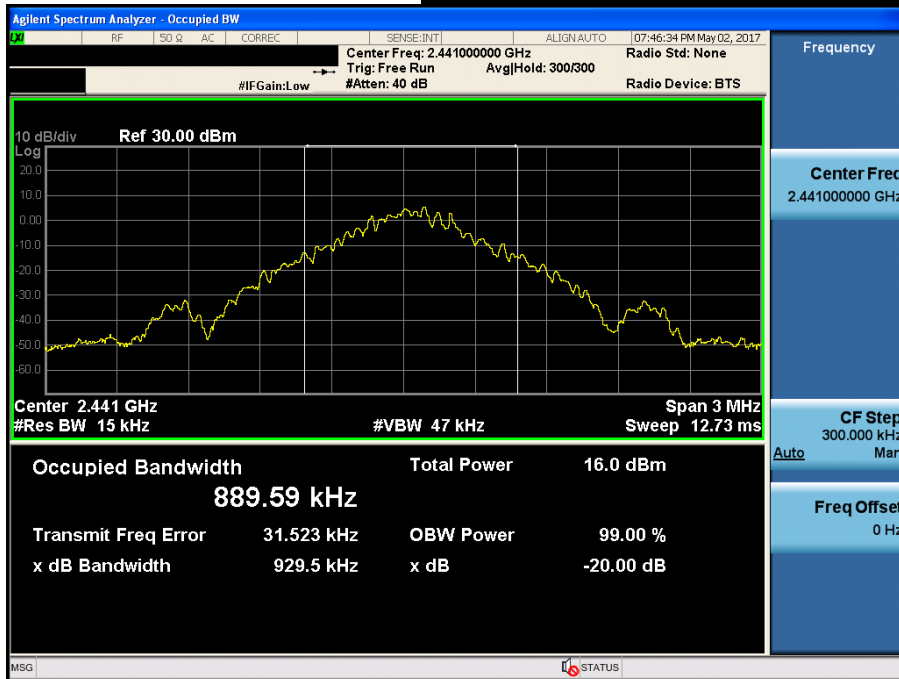
20 dB Bandwidth

***Lowest Channel & Modulation : GFSK***



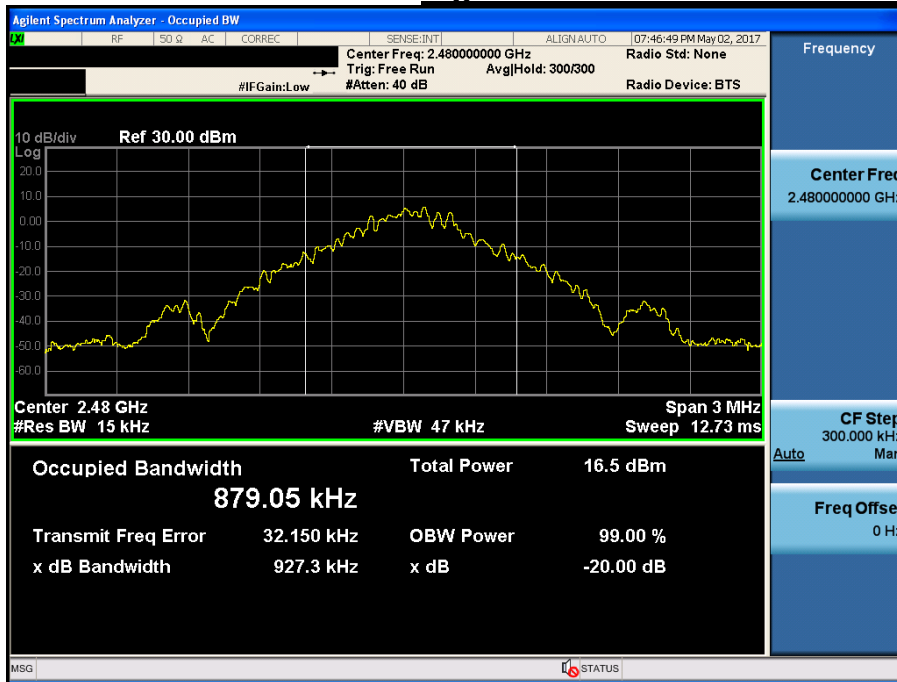
20 dB Bandwidth

***Middle Channel & Modulation : GFSK***



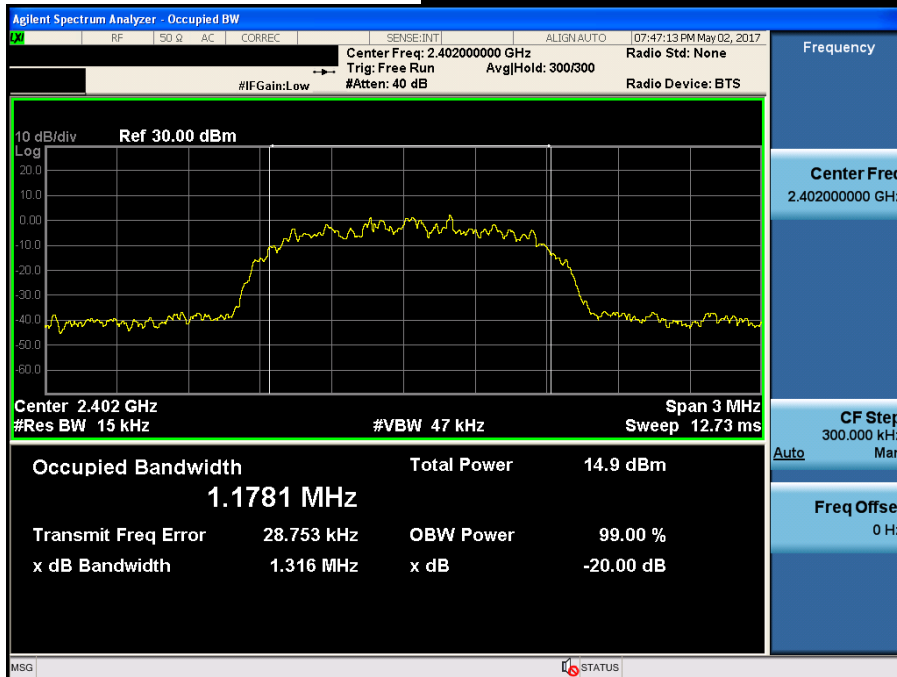
20 dB Bandwidth

**Highest Channel & Modulation : GFSK**



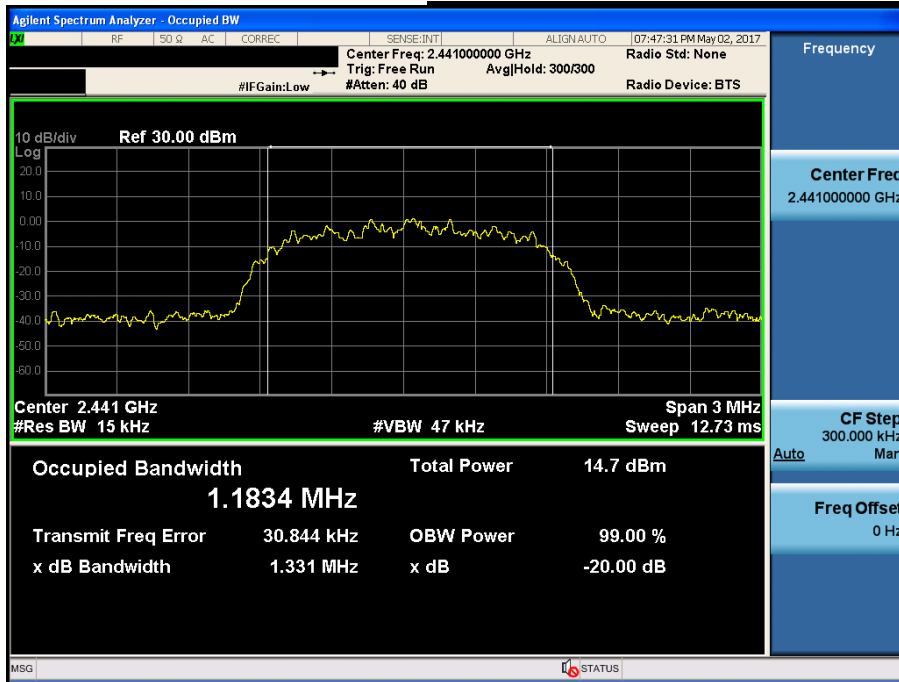
20 dB Bandwidth

**Lowest Channel & Modulation :  $\pi/4$ DQPSK**



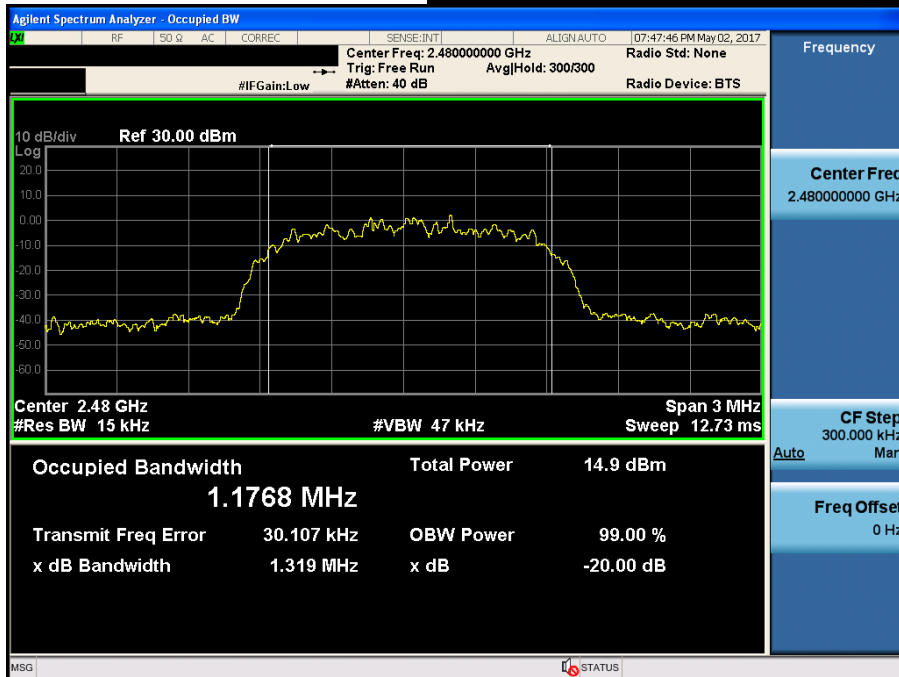
20 dB Bandwidth

***Middle Channel & Modulation :  $\pi/4$ DQPSK***



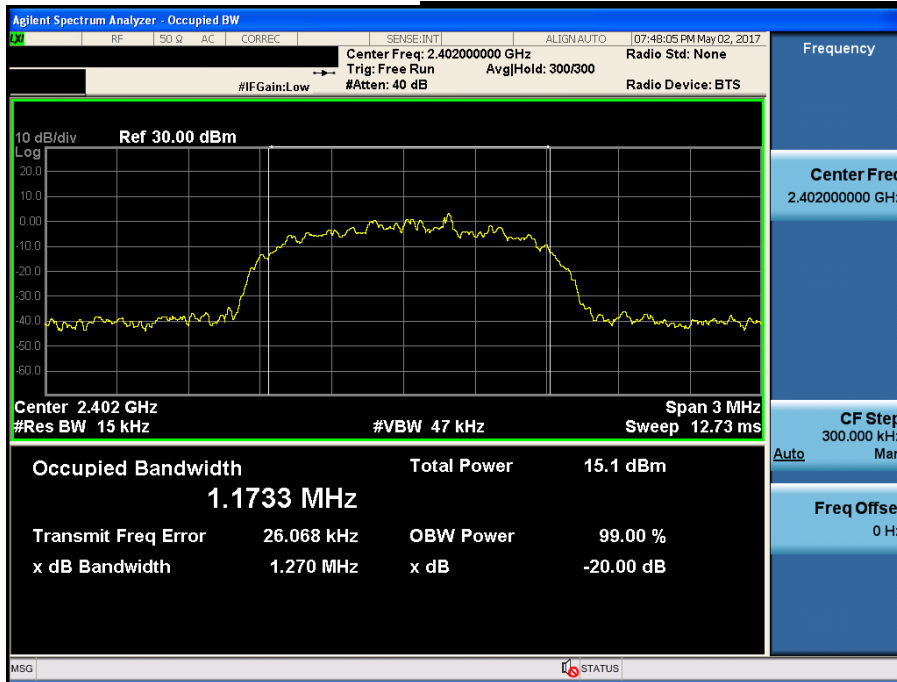
20 dB Bandwidth

***Highest Channel & Modulation :  $\pi/4$ DQPSK***



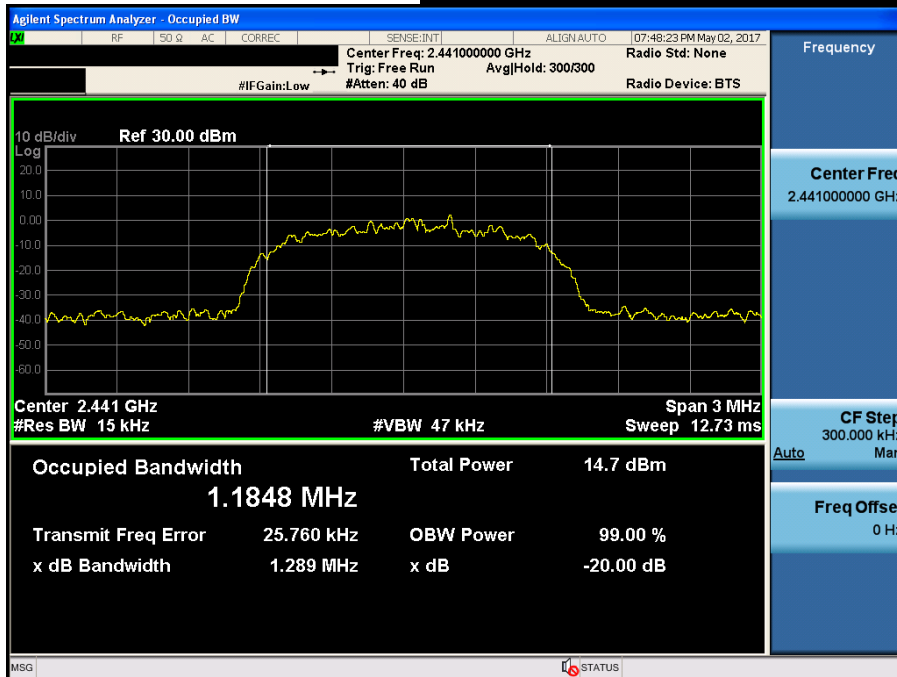
20 dB Bandwidth

***Lowest Channel & Modulation : 8DPSK***



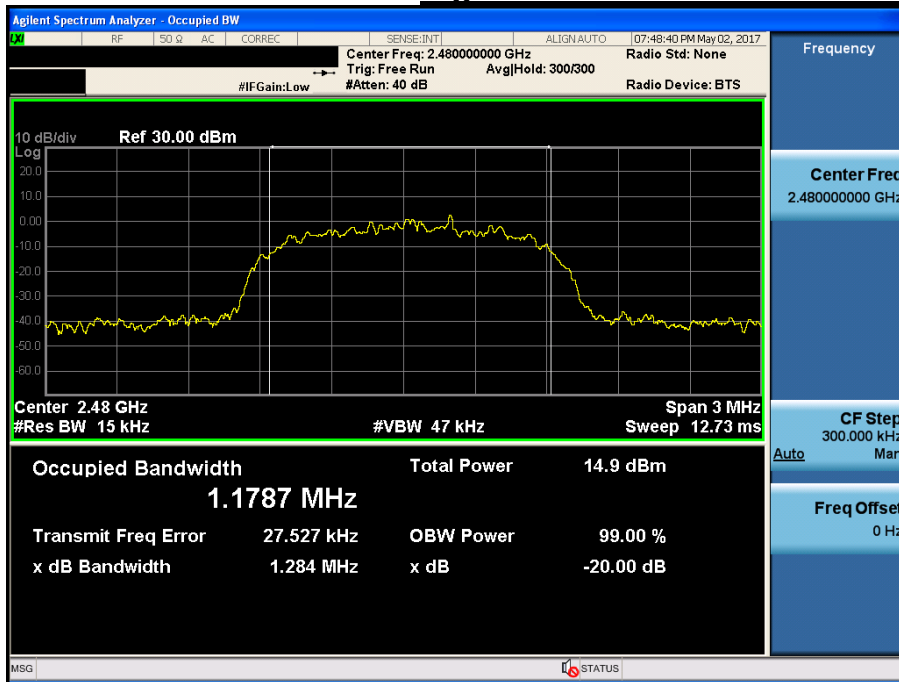
20 dB Bandwidth

***Middle Channel & Modulation : 8DPSK***



20 dB Bandwidth

***Highest Channel & Modulation : 8DPSK***



## 4. Carrier Frequency Separation

### 4.1 Test Setup

Refer to the APPENDIX I.

### 4.2 Limit

Limit :  $\geq 25$  kHz or  $\geq$  Two-Thirds of the 20 dB BW whichever is greater.

### 4.3 Procedure

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to :

Span = wide enough to capture the peaks of two adjacent channels

RBW = Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

### 4.4 Test Results

#### FH mode

Hopping Mode	Modulation	Peak of center channel (MHz)	Peak of adjacent Channel (MHz)	Test Result (MHz)
Enable	GFSK	2440.188	2441.188	1.000
	$\pi/4$ -DQPSK	2440.026	2441.026	1.000
	8DPSK	2440.024	2441.024	1.000

#### AFH mode

Hopping Mode	Modulation	Peak of center channel (MHz)	Peak of adjacent Channel (MHz)	Test Result (MHz)
Enable	GFSK	2439.922	2440.922	1.000
	$\pi/4$ -DQPSK	2440.028	2441.028	1.000
	8DPSK	2440.180	2441.180	1.000

Note 1 : See next pages for actual measured spectrum plots.

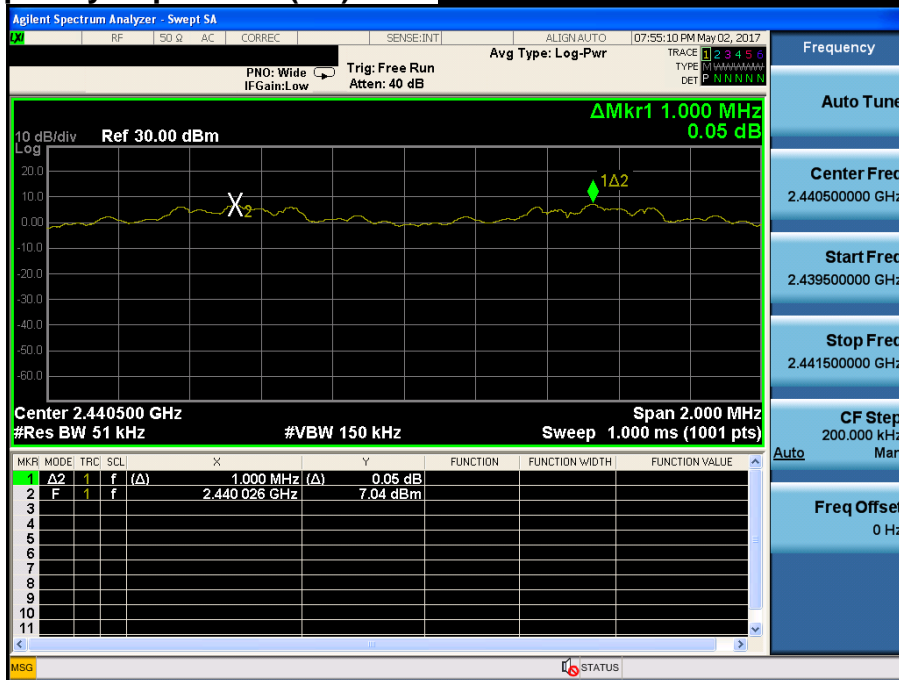
#### - Minimum Standard :

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400 - 2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW

**Carrier Frequency Separation (FH) *Hopping mode : Enable & GFSK***

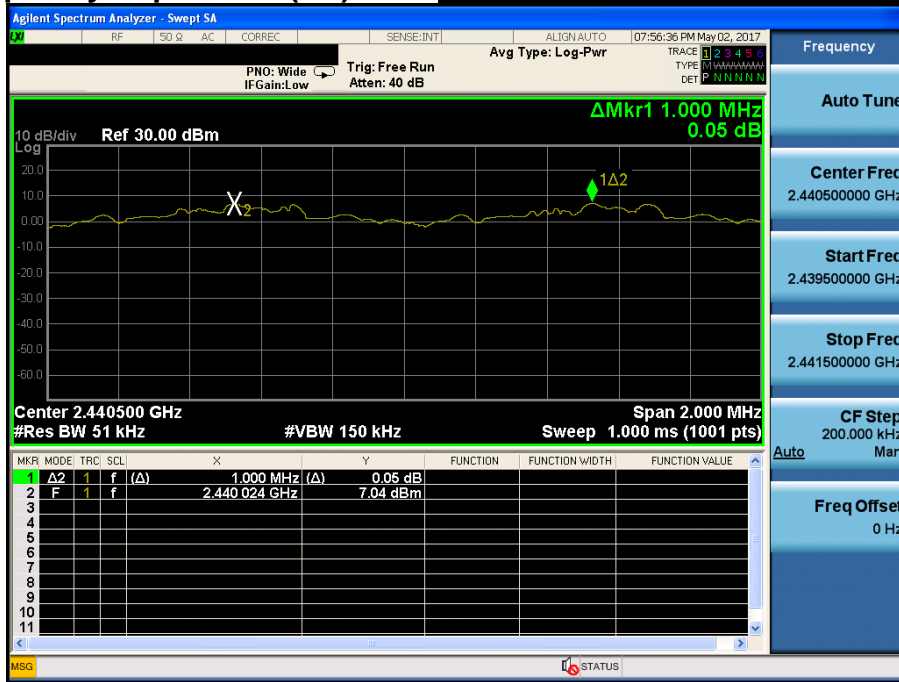


**Carrier Frequency Separation (FH) *Hopping mode : Enable & π/4-DQPSK***





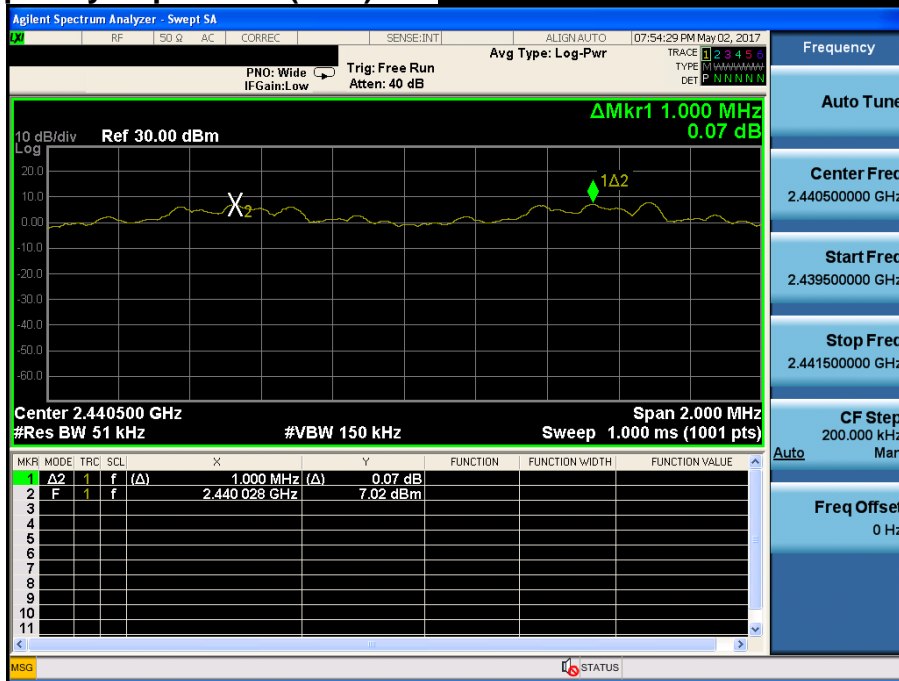
**Carrier Frequency Separation (FH) *Hopping mode : Enable & 8DPSK***



**Carrier Frequency Separation (AFH) *Hopping mode : Enable & GFSK***



**Carrier Frequency Separation (AFH) *Hopping mode : Enable & π/4-DQPSK***



**Carrier Frequency Separation (AFH) *Hopping mode : Enable & 8DPSK***



## 5. Number of Hopping Frequencies

### 5.1 Test Setup

Refer to the APPENDIX I.

### 5.2 Limit

Limit :  $\geq 15$  hops

### 5.3 Procedure

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

To get higher resolution, two frequency ranges for FH mode within the 2400 ~ 2483.5 MHz were examined.

The spectrum analyzer is set to :

Span for FH mode = 50 MHz      Start Frequency = 2391.5 MHz,      Stop Frequency = 2441.5 MHz

Start Frequency = 2441.5 MHz,      Stop Frequency = 2491.5 MHz

Span for AFH mode = 50 MHz      Start Frequency = 2416.0 MHz,      Stop Frequency = 2466.0 MHz

RBW = To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

### 5.4 Test Results

#### FH mode

Hopping mode	Modulation	Test Result (Total Hops)
Enable	GFSK	79
	$\pi/4$ -DQPSK	79
	8DPSK	79

#### AFH mode

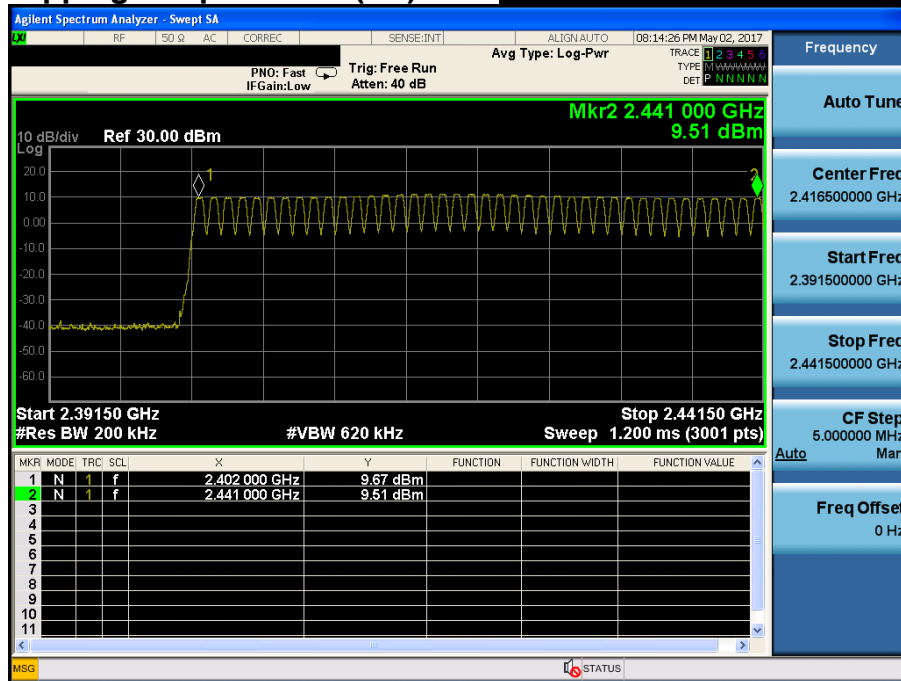
Hopping mode	Modulation	Test Result (Total Hops)
Enable	GFSK	20
	$\pi/4$ -DQPSK	20
	8DPSK	20

Note 1 : See next pages for actual measured spectrum plots.

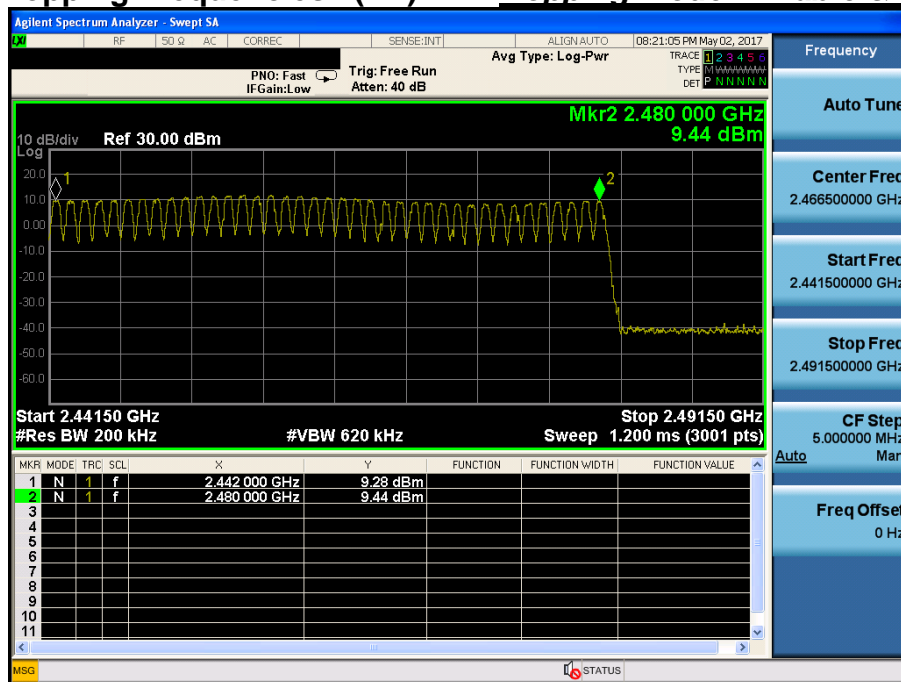
#### - Minimum Standard :

At least 15 hops
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**Number of Hopping Frequencies 1(FH) *Hopping mode : Enable & GFSK***

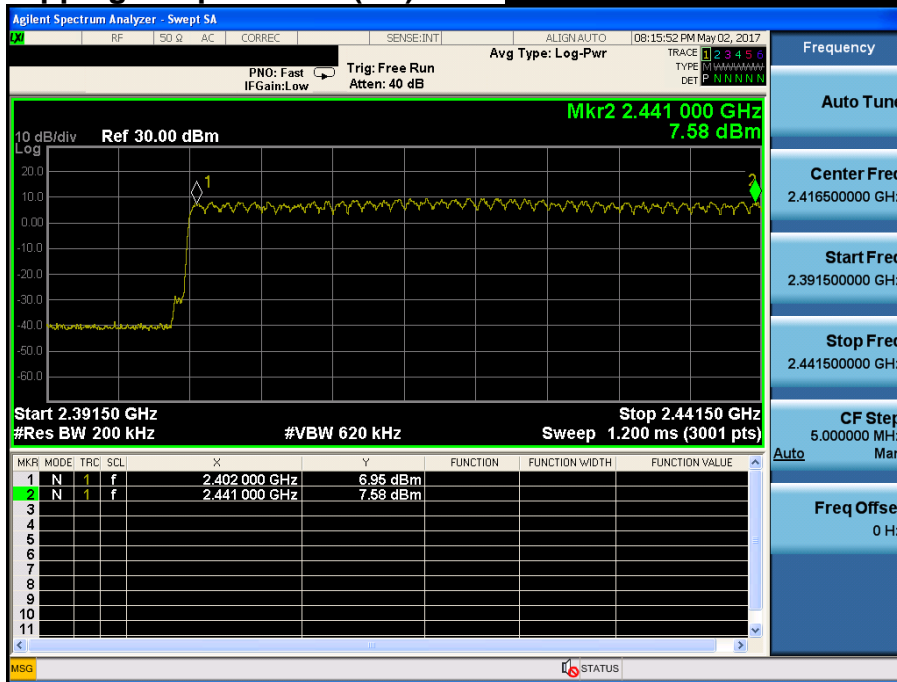


**Number of Hopping Frequencies 2(FH) *Hopping mode : Enable & GFSK***



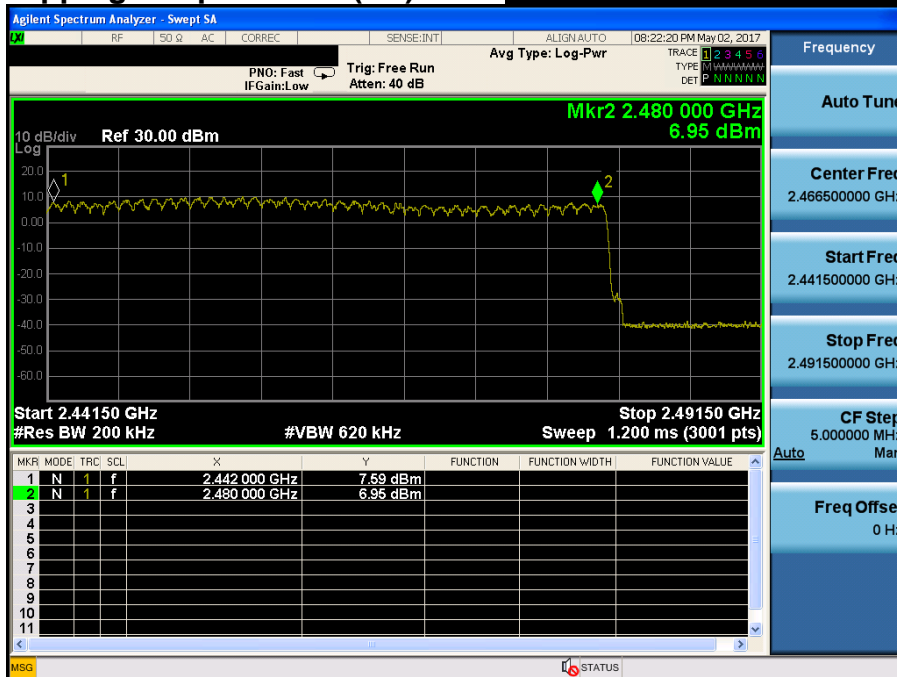
Number of Hopping Frequencies 1(FH)

Hopping mode : Enable &  $\pi/4$ -DQPSK

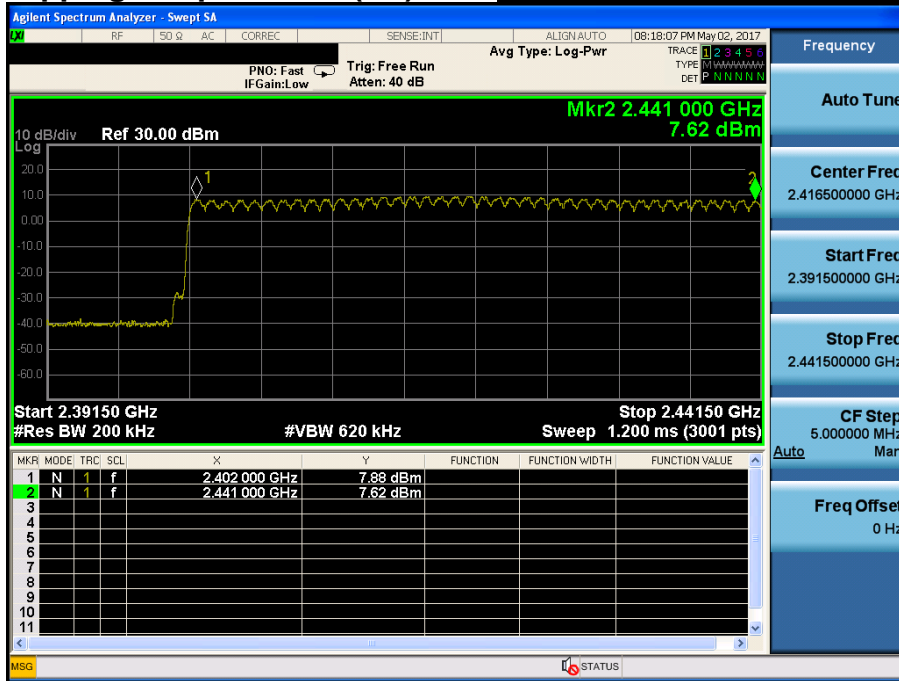


Number of Hopping Frequencies 2(FH)

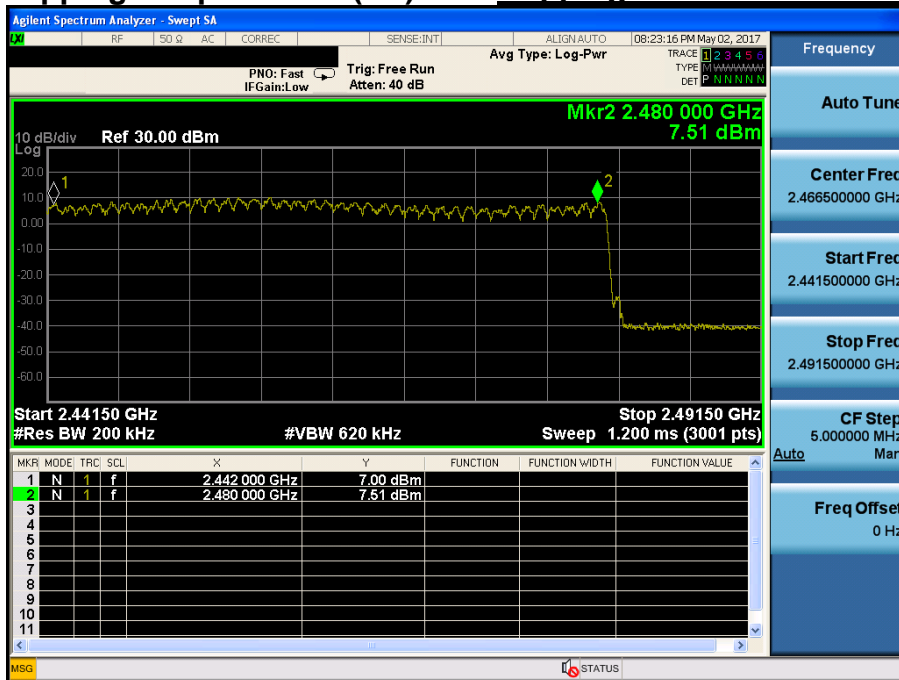
Hopping mode : Enable &  $\pi/4$ -DQPSK



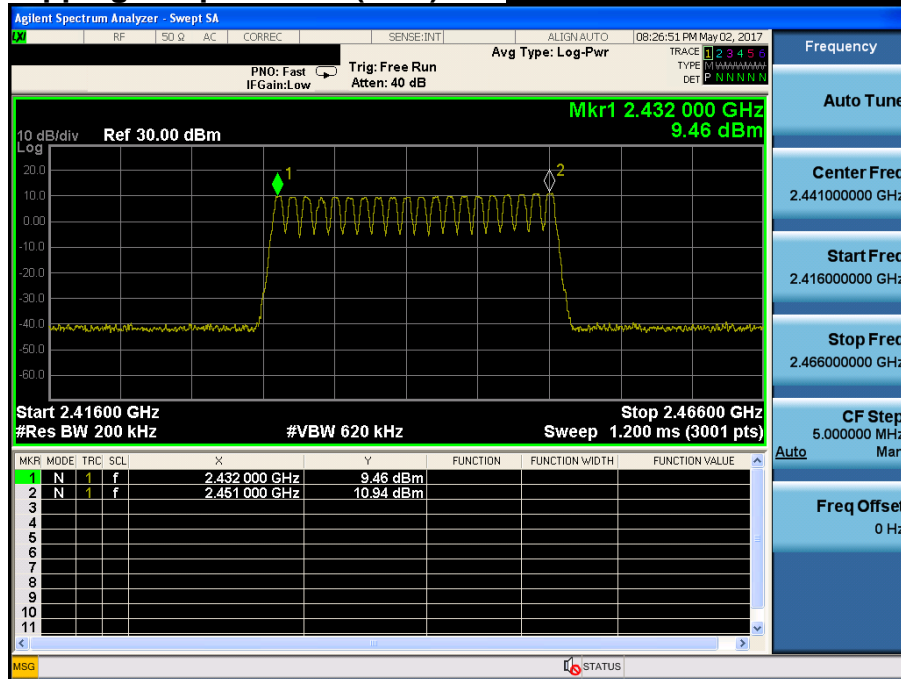
**Number of Hopping Frequencies 1(FH) *Hopping mode : Enable & 8DPSK***



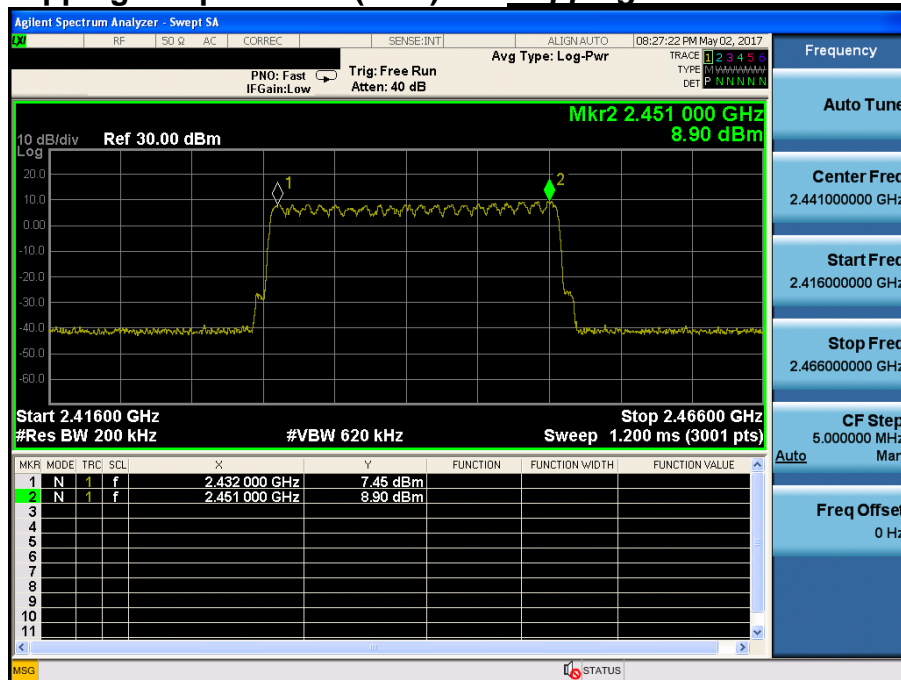
**Number of Hopping Frequencies 2(FH) *Hopping mode : Enable & 8DPSK***



**Number of Hopping Frequencies 1(AFH) *Hopping mode : Enable & GFSK***



**Number of Hopping Frequencies 1(AFH) *Hopping mode : Enable & π/4-DQPSK***





**Number of Hopping Frequencies 1(AFH) *Hopping mode : Enable & 8DPSK***

