TEST REPORT

DT&C Co., Ltd. 42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel : 031-321-2664, Fax : 031-321-1664	Report No : DRTFCC1602-0027 Pages:(1) / (88) page	Dt&C

1. Customer

   • Name : POINTMOBILE CO., LTD.

   • Address : B-9F, Kabul Great Valley 32 Digital-ro 9-gil, Geumcheon-gu, Seoul, Korea 153-709

2. Use of Report : FCC & IC Original Grant

3. Product Name (FCCID, IC) : Mobile Computer (V2X-PM80W, 10664A-PM80W)

4. Date of Test : 2015-10-12 ~ 2015-11-25

5. Test Method Used: FCC Part 15 Subpart C.247, RSS-247 issue 1, May 2015

6. Testing Environment : See appended test report

7. Test Result : ☒ Pass ☐ Fail

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by Name : Jaejin Lee (Signature)	Technical Manager Name : Bongjin Kim (Signature)

2016 . 02 . 03 .

DT&C Co., Ltd.

Test Report Version

Test Report No.	Date	Description
DRTFCC1602-0027	Feb. 03, 2016	Initial issue

Table of Contents

1. General Information

1.1 Testing Laboratory

DT&C Co., Ltd.			
Standard		**Site number**	**Address**
FCC	☒	**165783**	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	☐	**804488**	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	☐	**596748**	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	☐	**678747**	683-3, Yubang-dong, Cheoin-gu, Yongin-si, Kyeonggi-do, Korea, 449-080
IC	☒	**5740A-3**	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	☐	**5740A-2**	683-3, Yubang-dong, Cheoin-gu, Yongin-si, Kyeonggi-do, Korea, 449-080
www.dtnc.net			
Telephone	:	+ 82-31-321-2664	
FAX	:	+ 82-31-321-1664	

1.2 Details of Applicant

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

1.3 Description of EUT

EUT	Mobile Computer
Model Name	PM80-W
Add Model Name	NA
Serial Number	Identical prototype
Hardware version	Rev.5
Software version	80.02
Power Supply	DC 3.8 V
Battery type	Standard Battery: Lithium Ion Battery
Frequency Range	2402 MHz ~ 2480 MHz
Modulation Technique	GFSK, π/4-DQPSK, 8DPSK
Number of Channels	79
Antenna Type	Internal Antenna
Antenna Gain	PK : -0.84 dBi

1.4 Declaration by the applicant / manufacturer

- NA

1.5 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.

1.6 Test conditions

Ambient Condition	
▪ Temperature	+23 ℃ ~ +24 ℃
▪ Relative Humidity	43 % ~ 45 %

1.7 Test Equipment List

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
MXA Signal Analyzer	Agilent Technologies	N9020A	15/09/09	16/09/09	MY46471248
Multimeter	FLUKE	17B	15/04/27	16/04/27	26030065WS
DC Power Supply	HP	66332A	15/01/22	16/01/22	US37471368
Power Meter Power Sensor	Anritsu	ML2496A / MA2411B	15/06/25	16/06/25	1338004 1306053
Vector Signal Generator	Rohde Schwarz	SMBV100A	15/01/06	16/01/06	255571
Signal Generator	Rohde Schwarz	SMF100A	15/06/29	16/06/29	102341
Thermohygrometer	BODYCOM	BJ5478	15/02/26	16/02/26	1209
BlueTooth Tester	TESCOM	TC-3000B	15/01/06	16/01/06	3000B770243
Power Splitter	Anritsu	K241B	15/10/20	16/10/20	1701061
LOOP Antenna	Schwarzbeck	FMZB1513	14/04/29	16/04/29	1513-128
TRILOG Broadband Test-Antenna	Schwarzbeck	VULB 9160	14/04/30	16/04/30	3358
Double-Ridged Guide Antenna	ETS	3117	14/05/12	16/05/12	140394
Horn Antenna	A.H.Systems	SAS-574	15/04/30	17/04/30	154
Low Noise Pre Amplifier	tsj	MLA-010K01-B01-27	15/04/09	16/04/09	1844538
Amplifier (30dB)	Agilent	8449B	15/11/06	16/11/06	3008A02108
High-pass filter (3GHz)	Wainwright Instruments	WHKX3.0	15/01/06	16/01/06	12
EMI TEST RECEIVER	R&S	ESR7	15/10/19	16/10/19	101109
EMI TEST RECEIVER	R&S	ESCI	15/02/25	16/02/25	100364
SINGLE-PHASE MASTER	NF	4420	15/09/09	16/09/09	3049354420023
ARTIFICIAL MAINS NETWORK	Narda S.T.S. / PMM	PMM L2-16B	15/06/26	16/06/26	000WX20305

1.8 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	>= 20 dB BW or >= Two thirds of the 20 dB BW, whichever is greater.	Conducted	C
	Number of Hopping Frequencies	>= 15 hops		C
	20 dB Bandwidth	None		C
	Dwell Time	=< 0.4 seconds		C
15.247(b) RSS-247(5.4)	Transmitter Output Power	**For FCC** =< 1 Watt , if CHs >= 75 Others =< 0.125 W **For IC** 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 %)	RSS-Gen		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 Note2
15.207 RSS-Gen(8.8)	AC Conducted Emissions	FCC 15.207 Limits	AC Line Conducted	C
15.203	Antenna Requirements	FCC 15.203	-	C

Note 1 : **C** = Comply **NC** = Not Comply **NT** = Not Tested **NA** = 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

1.9 Conclusion of worst-case and operation mode

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

Therefore all applicable requirements were tested with all the modulations.

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)
Hopping Band	2402 ~ 2480	2402 ~ 2480

- Hopping Function : Disable

	TX Frequency (MHz)	RX Frequency (MHz)
Lowest Channel	2402	2402
Middle Channel	2441	2441
Highest Channel	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, 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 ≥ 20 dB BW
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold

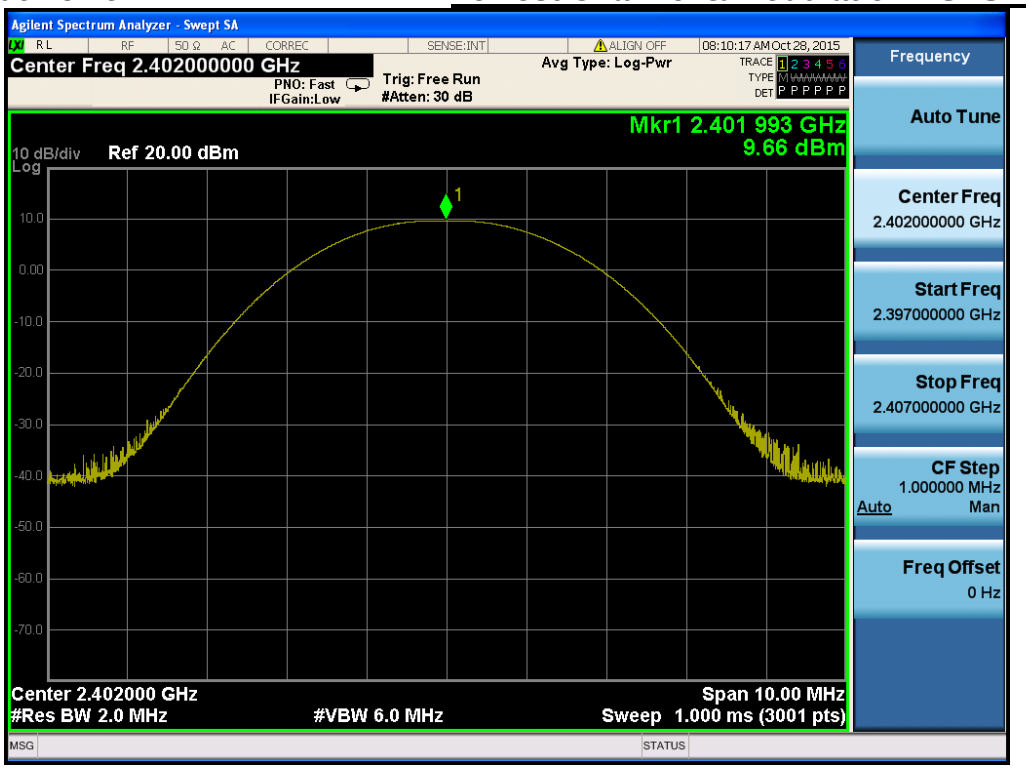
2.4 Test Results

Modulation	Tested Channel	Frame Average Output Power		Peak Output Power	
		dBm	mW	dBm	mW
GFSK	**Lowest**	8.07	6.412	9.66	9.247
	Middle	7.61	5.768	9.11	8.147
	Highest	8.17	6.561	**9.85**	**9.661**
π/4DQPSK	**Lowest**	5.74	3.750	9.64	9.204
	Middle	5.38	3.451	8.77	7.534
	Highest	5.78	3.784	**9.66**	**9.247**
8DPSK	**Lowest**	5.76	3.767	**9.59**	**9.103**
	Middle	5.41	3.475	8.95	7.847
	Highest	5.70	3.715	9.43	8.776

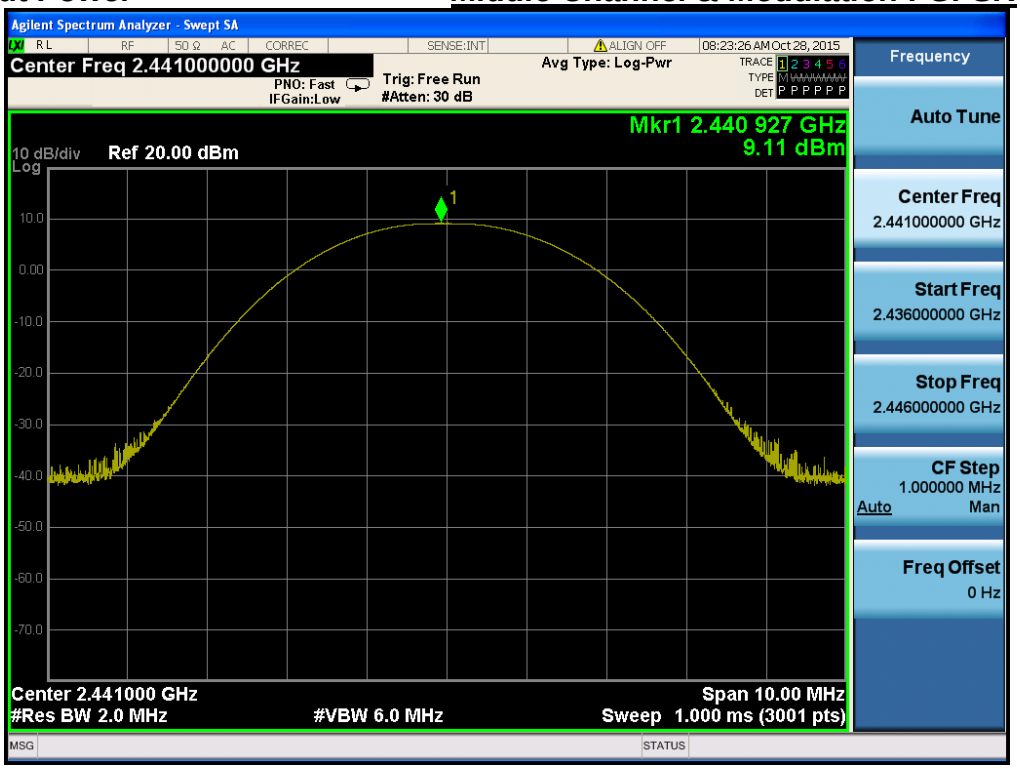
Note 1 : Average output power was using the average power meter for reference only.

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

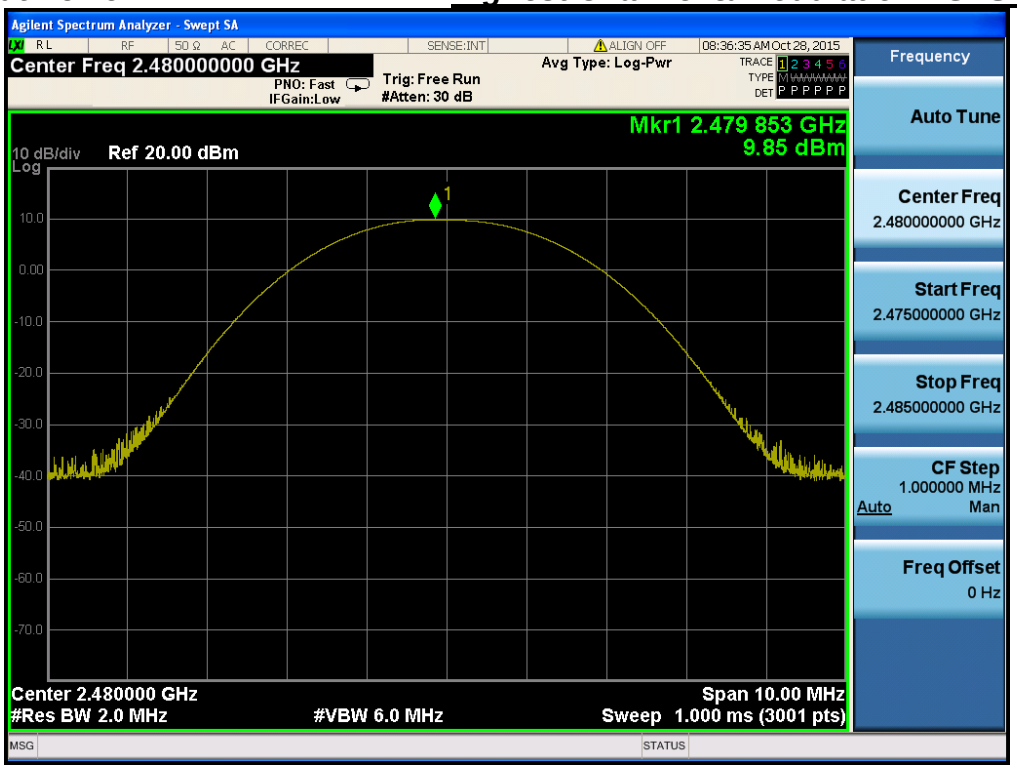
Peak Output Power *Lowest Channel & Modulation : GFSK*



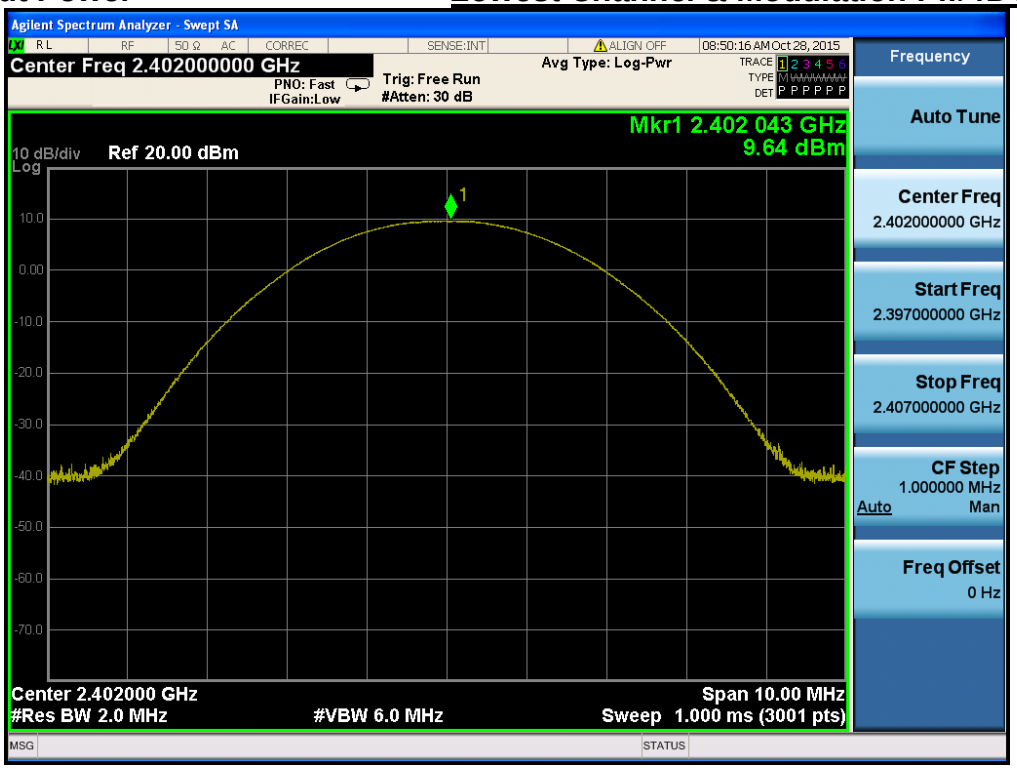
Peak Output Power *Middle Channel & Modulation : GFSK*



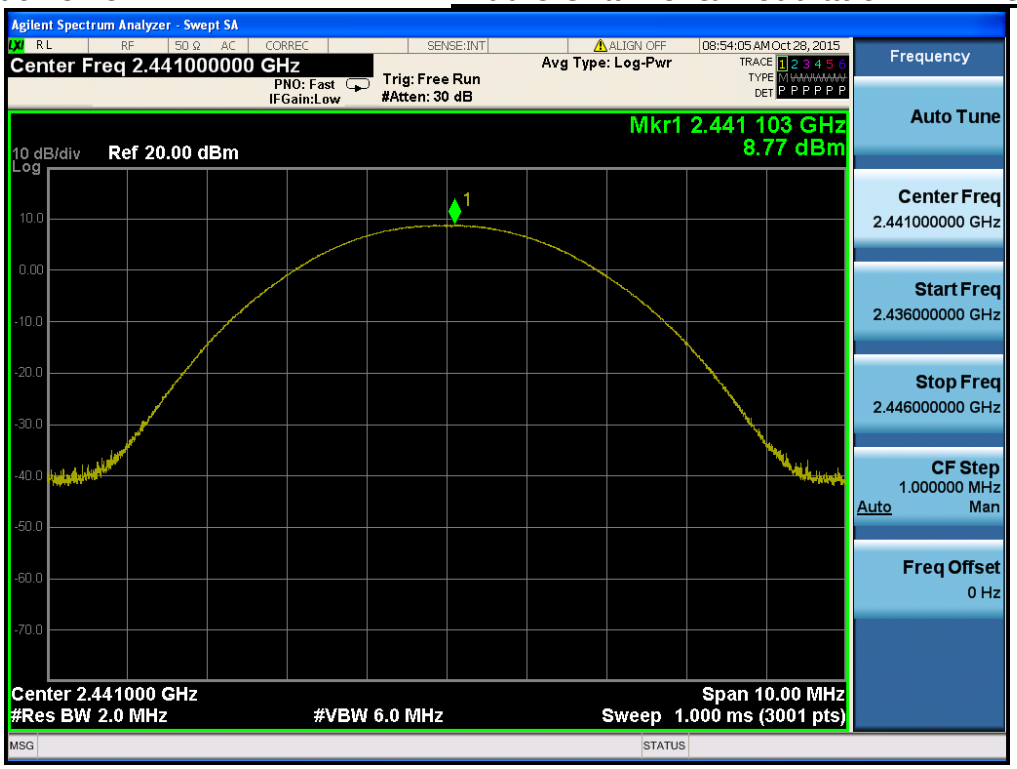
Peak Output Power *Highest Channel & Modulation : GFSK*



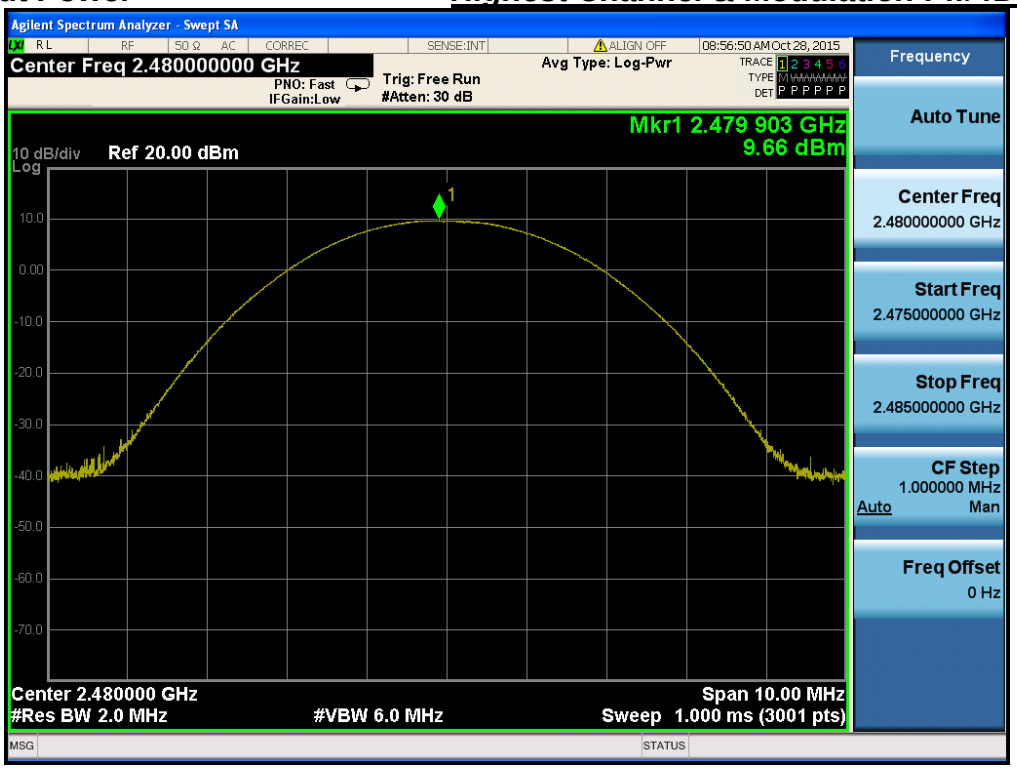
Peak Output Power *Lowest Channel & Modulation : π/4DQPSK*



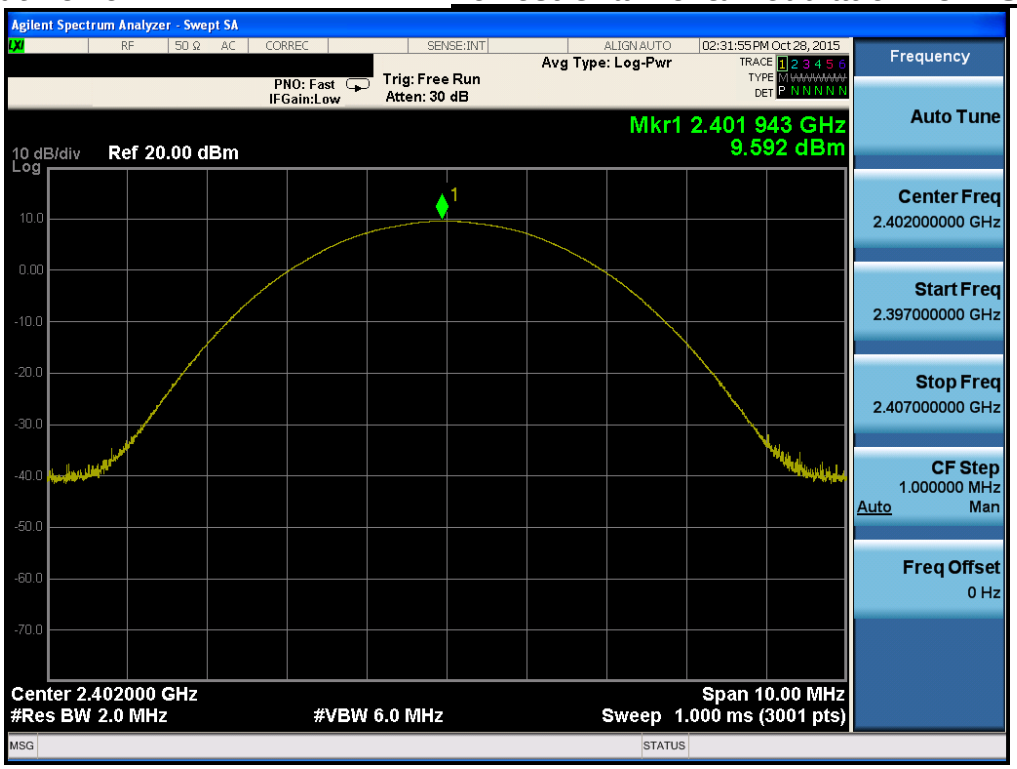
Peak Output Power *Middle Channel & Modulation : π/4DQPSK*



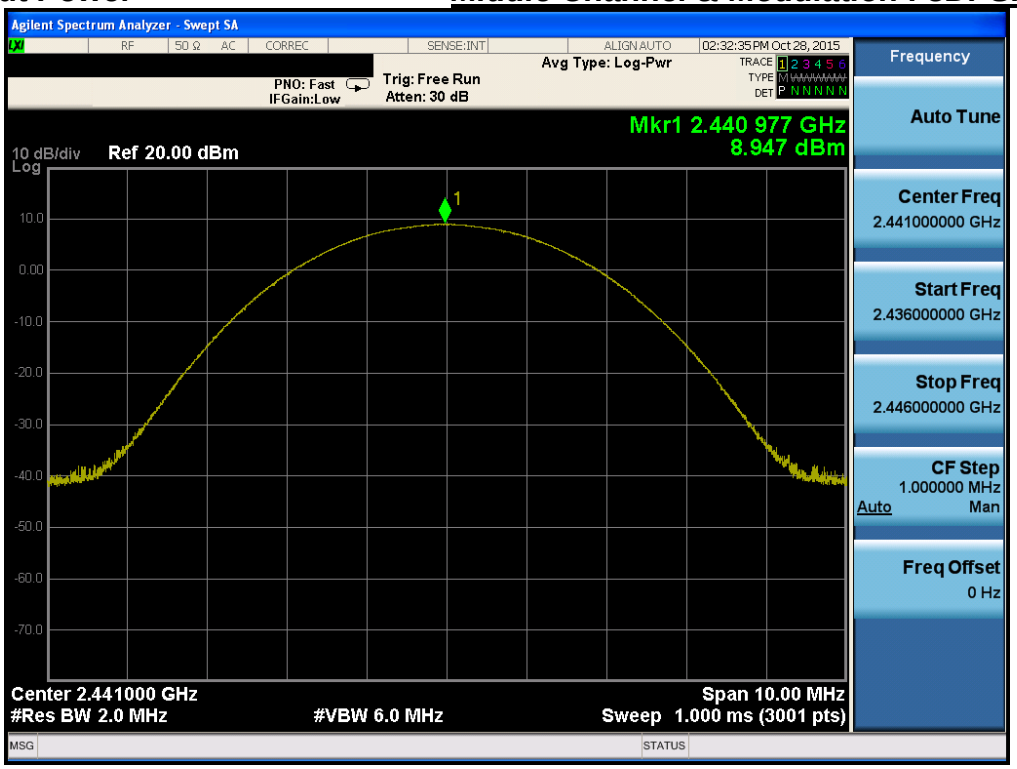
Peak Output Power *Highest Channel & Modulation : π/4DQPSK*



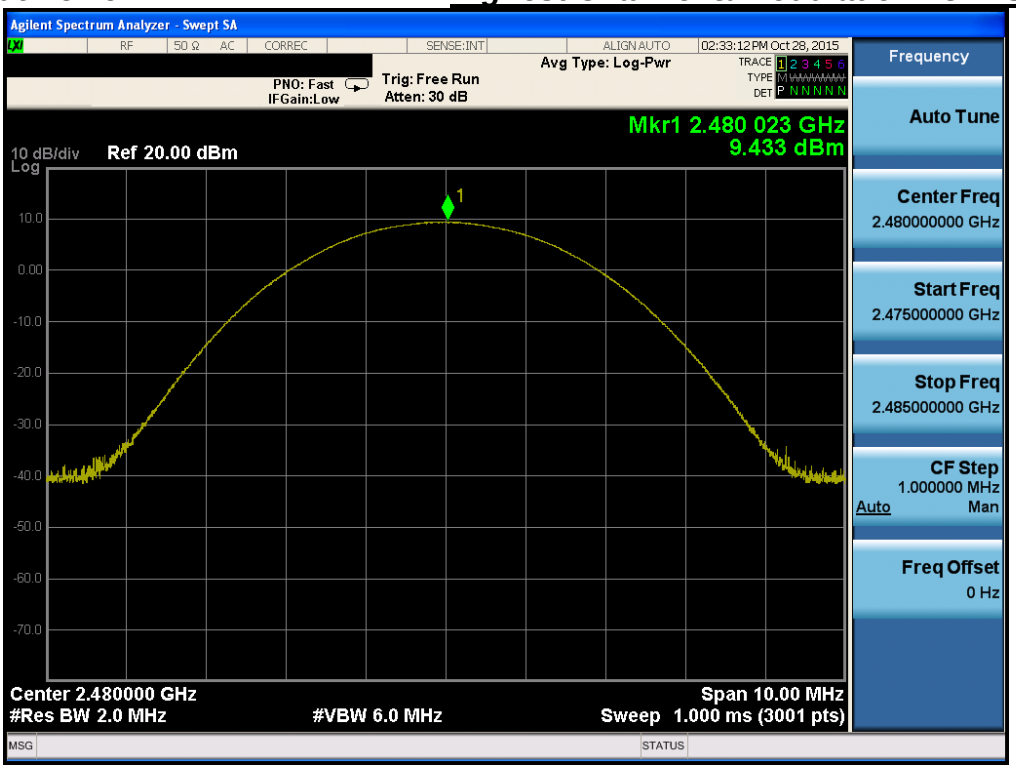
Peak Output Power *Lowest Channel & Modulation : 8DPSK*



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 RBW ≥ 1 % of the 20 dB bandwidth, VBW ≥ RBW, Span = 3 MHz.

3.4 Test Results

Modulation	Tested Channel	20 dB BW (MHz)
GFSK	**Lowest**	0.930
	Middle	0.930
	Highest	0.930
π/4DQPSK	**Lowest**	1.250
	Middle	1.320
	Highest	1.320
8DPSK	**Lowest**	1.280
	Middle	1.280
	Highest	1.280

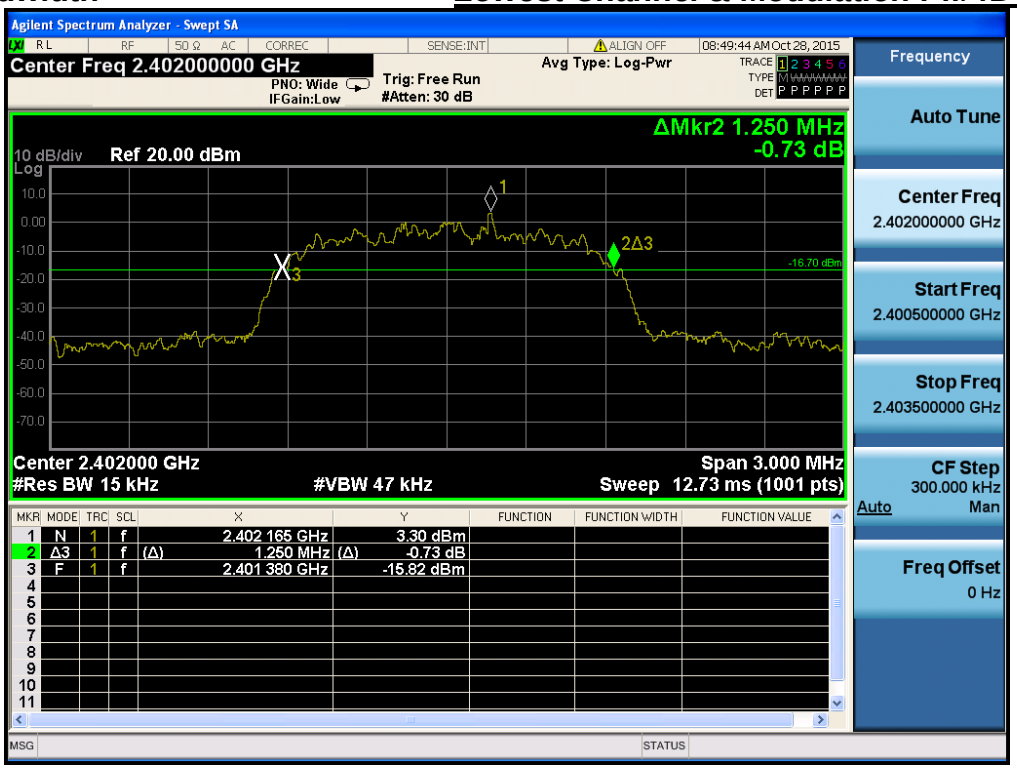
Note 1 : See next pages for actual measured spectrum plots.

20 dB Bandwidth *Lowest Channel & Modulation : GFSK*

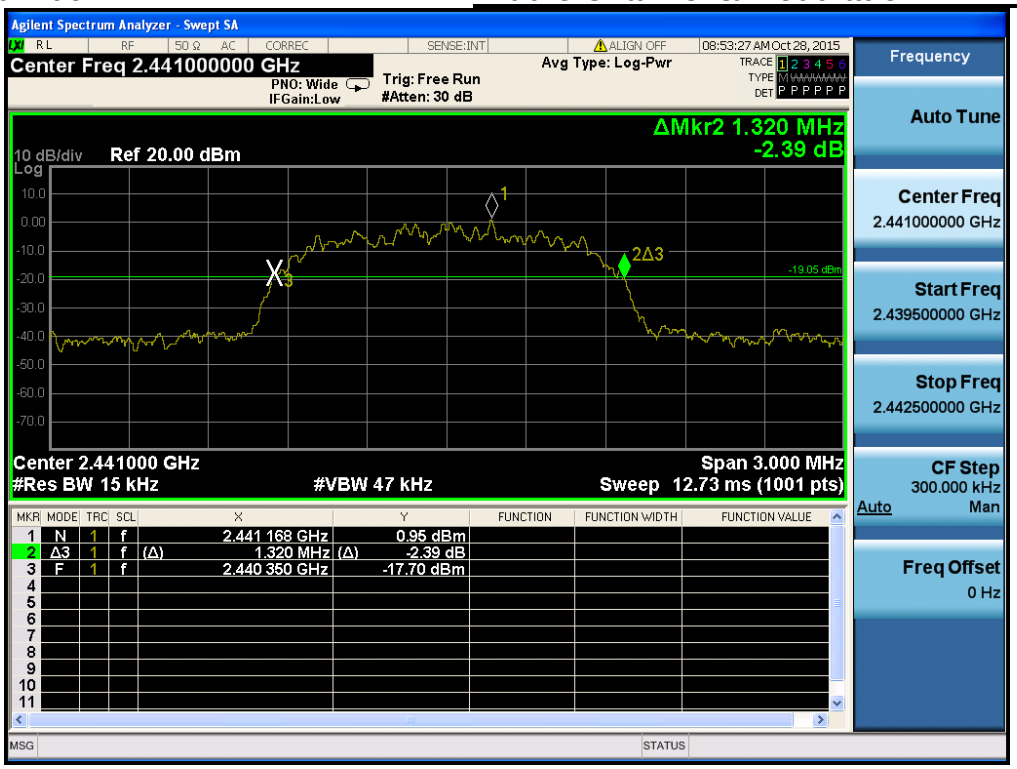
20 dB Bandwidth *Middle Channel & Modulation : GFSK*

20 dB Bandwidth ***Highest Channel & Modulation : GFSK***

20 dB Bandwidth ***Lowest Channel & Modulation : π/4DQPSK***

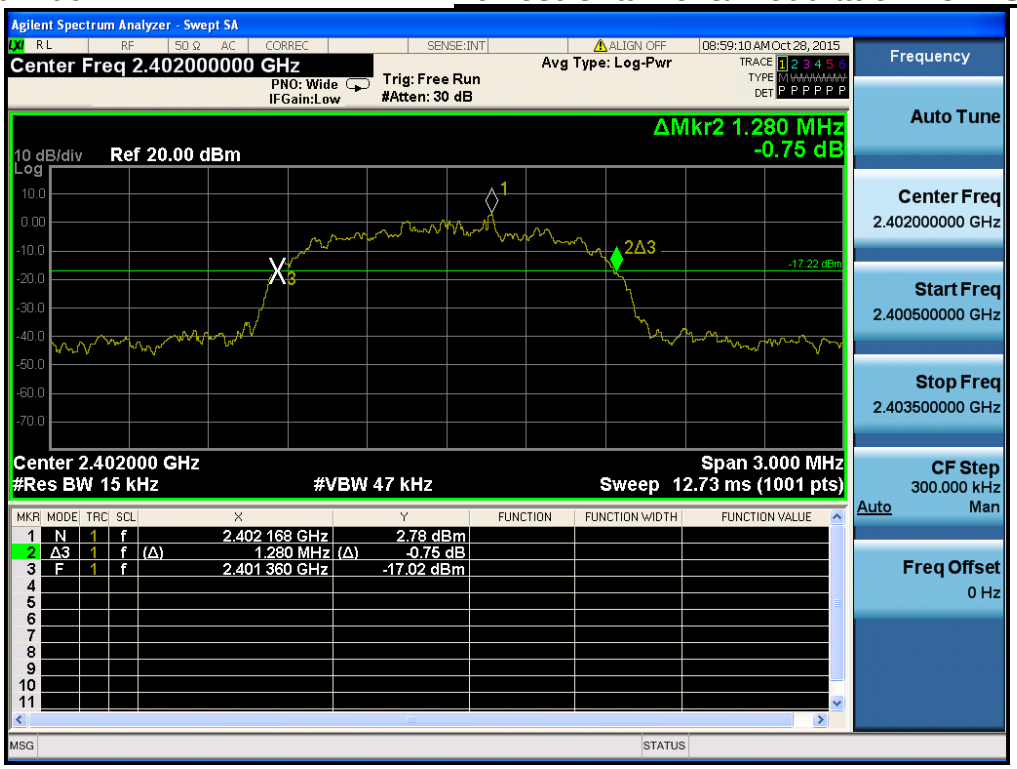


20 dB Bandwidth *Middle Channel & Modulation : π/4DQPSK*

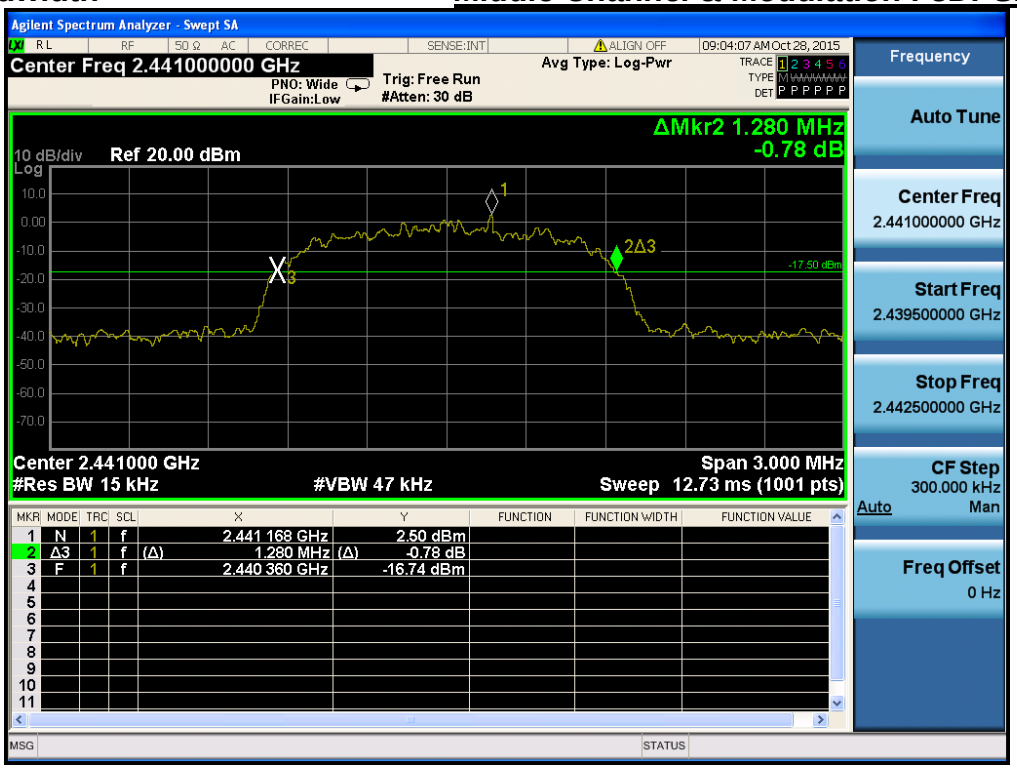


20 dB Bandwidth *Highest Channel & Modulation : π/4DQPSK*

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 : ≥ 20 dB BW or ≥ Two-Thirds of the 20 dB BW

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 ≥ RBW Sweep = auto
Detector function = peak Trace = max hold

4.4 Test Results

FH mode

Hopping Mode	Test Mode	Peak of center channel (MHz)	Peak of adjacent Channel (MHz)	Test Result (MHz)
Enable	GFSK	2441.021	2442.030	1.009
	π/4-DQPSK	2440.838	2441.838	1.000
	8DPSK	2441.168	2442.174	1.006

AFH mode

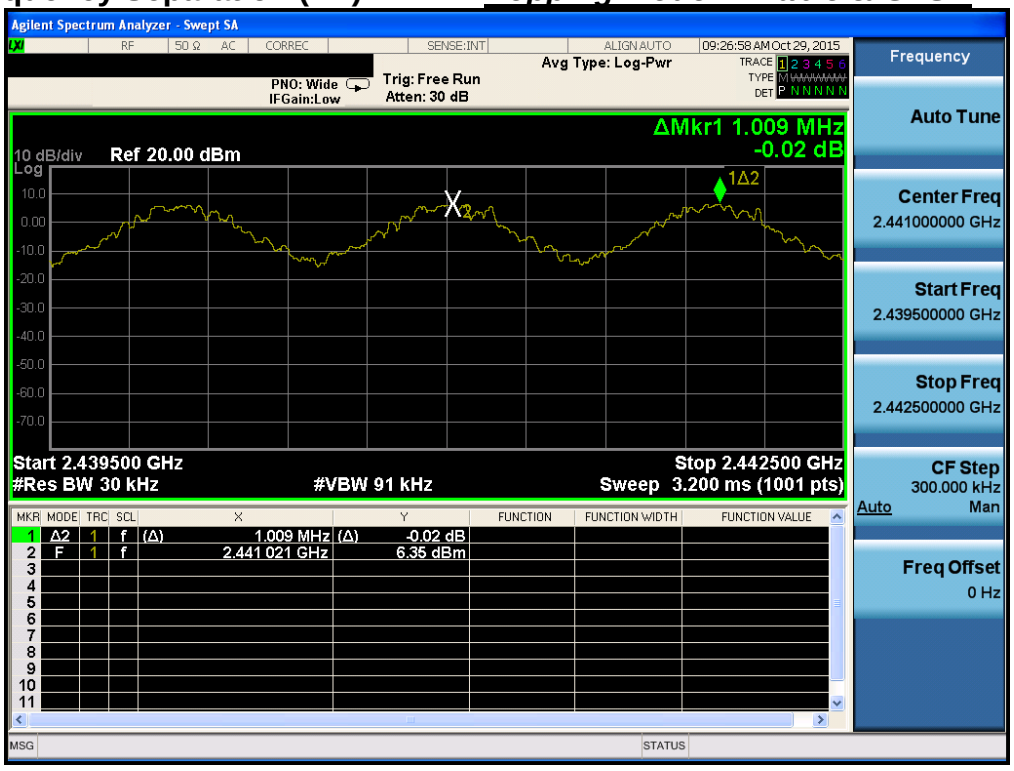
Hopping Mode	Test Mode	Peak of center channel (MHz)	Peak of adjacent Channel (MHz)	Test Result (MHz)
Enable	GFSK	2411.000	2412.003	1.003
	π/4-DQPSK	2411.165	2412.171	1.006
	8DPSK	2410.163	2411.169	1.006

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

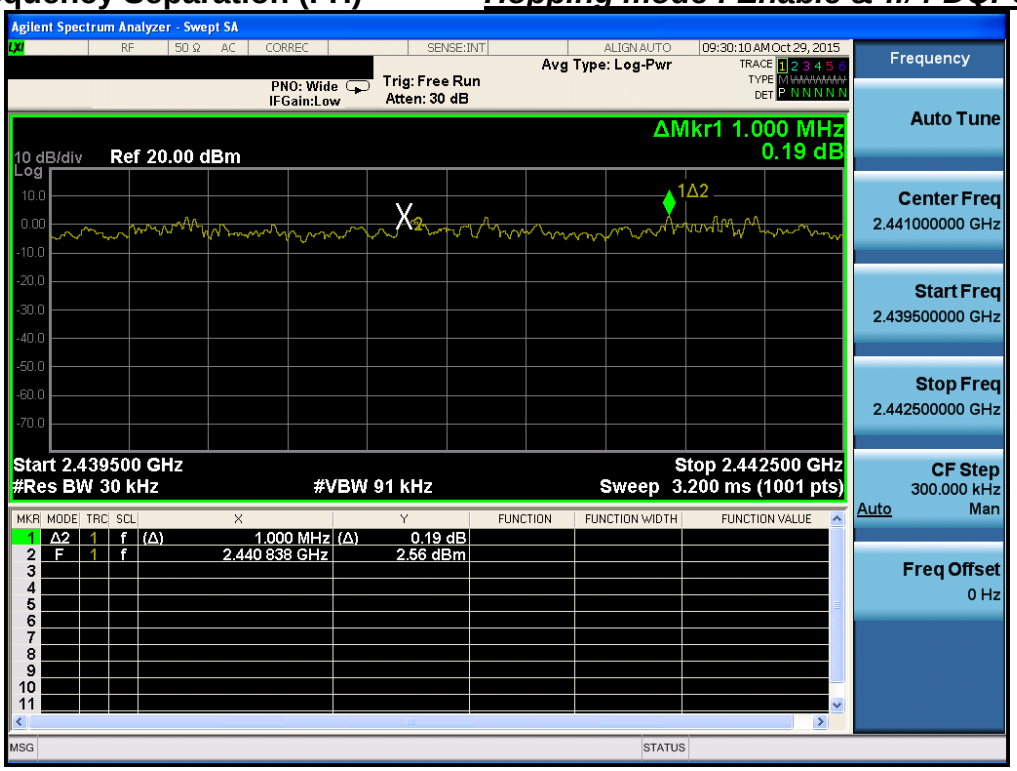
- **Minimum Standard :**

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

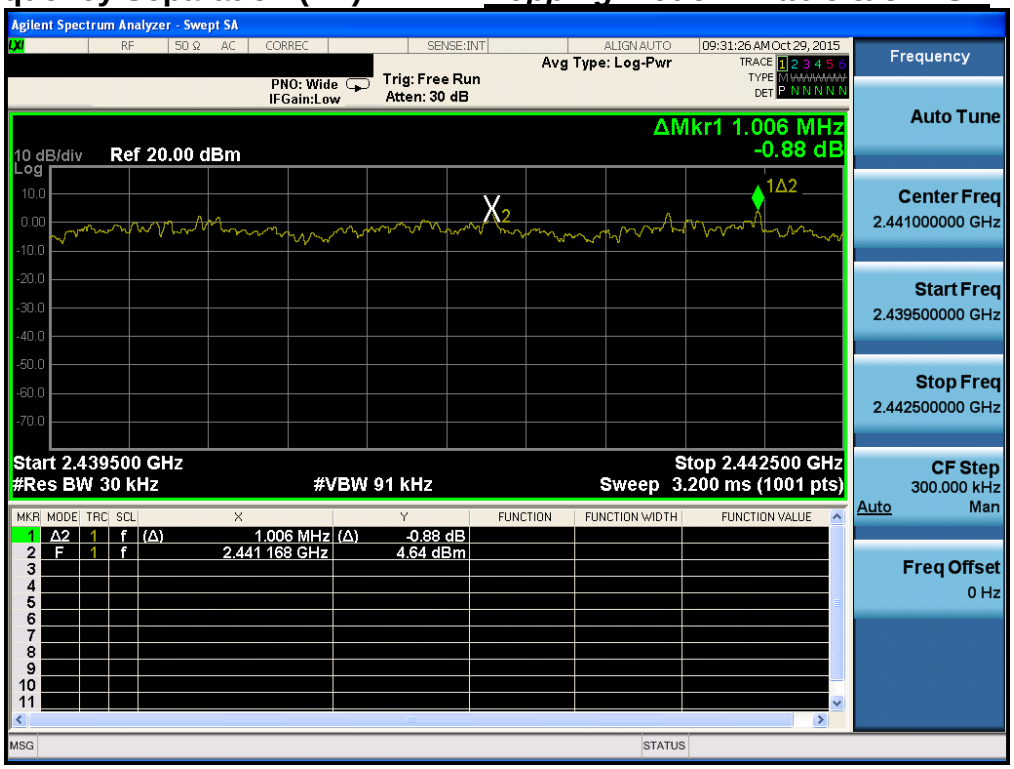
Carrier Frequency Separation (FH) ***Hopping mode : Enable & GFSK***



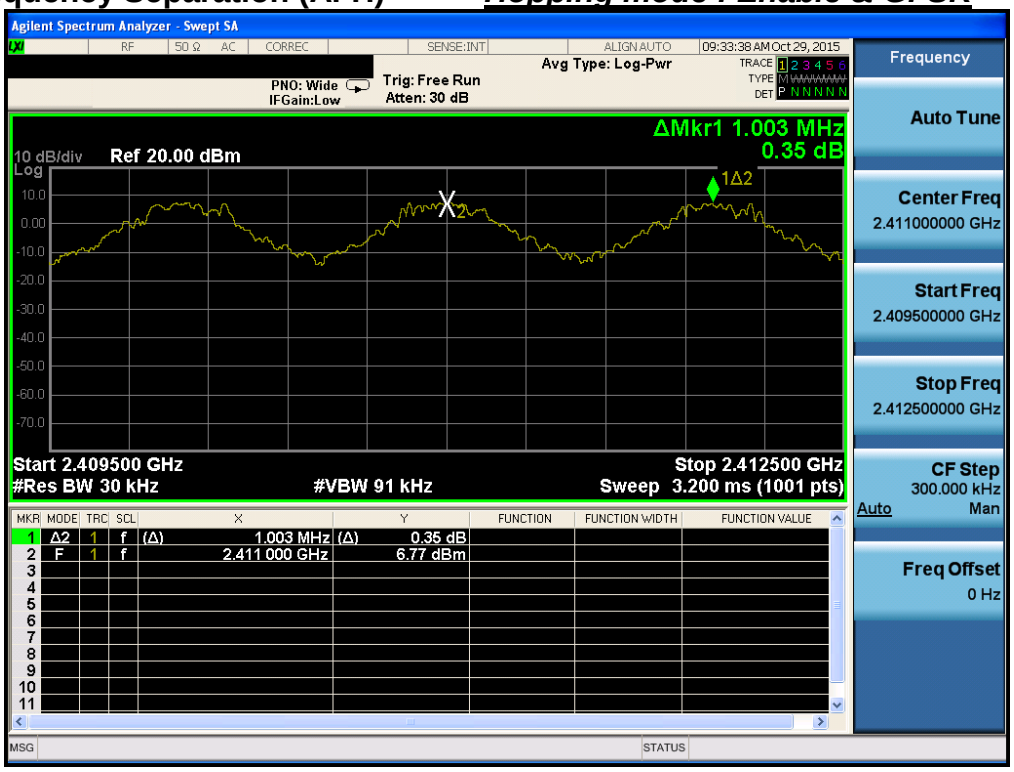
Carrier Frequency Separation (FH) ***Hopping mode : Enable & π/4-DQPSK***



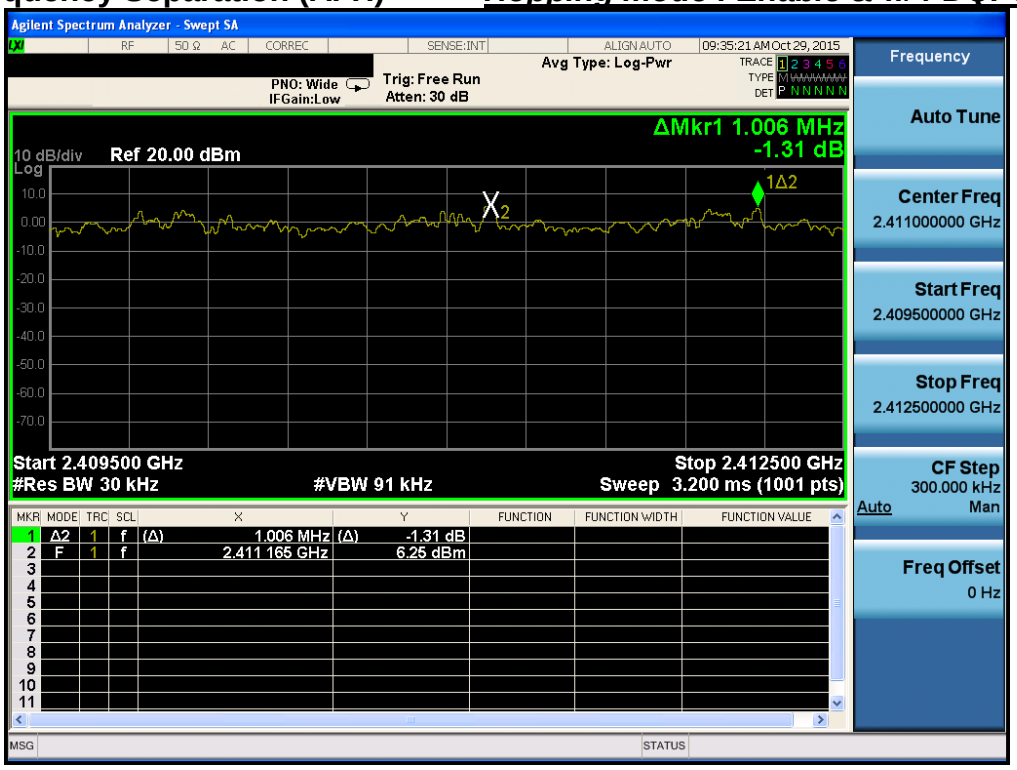
Carrier Frequency Separation (FH) ***Hopping mode : Enable & 8DPSK***



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***