

TEST REPORT



DT&C Co., Ltd.

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Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC1706-0113

2. Customer

• Name : POINT MOBILE 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: PM80P

FCC ID / IC : V2X-PM80G1 / 10664A-PM80G1

5. Test Method Used : ANSI C63.10-2013

Test Specification : FCC Part 15 Subpart C.247,

RSS-247 Issue 1 (2015-05), RSS-GEN Issue 4 (2014-11)

6. Date of Test : 2017.03.20 ~ 2017.05.02

7. Testing Environment : See appended test report.

8. Test Result : Refer to the attached test result.

Affirmation	Tested by	Technical Manager
	Name : SunGeun Lee (Signature)	Name : GeunKi Son (Signature)

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2017 . 06 . 27 .

DT&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRTFCC1706-0113	Jun. 27, 2017	Initial issue

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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
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FAX	:	+ 82-31-321-1664

1.2 Testing Environment

Ambient Condition	
▪ Temperature	+23 °C ~ +25 °C
▪ Relative Humidity	43 % ~ 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

EUT	Mobile computer
Model Name	FCC: PM80 IC: PM80P
Add Model Name	FCC: CHD8, XT2 IC: XT2P
Serial Number	Identical prototype
Hardware version	MP
Software version	81.00
Power Supply	DC 3.8 V
Frequency Range	2402 MHz ~ 2480 MHz
Modulation Technique	GFSK, $\pi/4$ -DQPSK, 8DPSK
Number of Channels	79
Antenna Type	Internal Antenna
Antenna Gain	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	17/08/18	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	17/06/23	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	16/06/22	17/06/22	000WX20305

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 $\geq$ 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	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.	Radiated	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 Note2
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 : 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

1.10 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)
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. 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

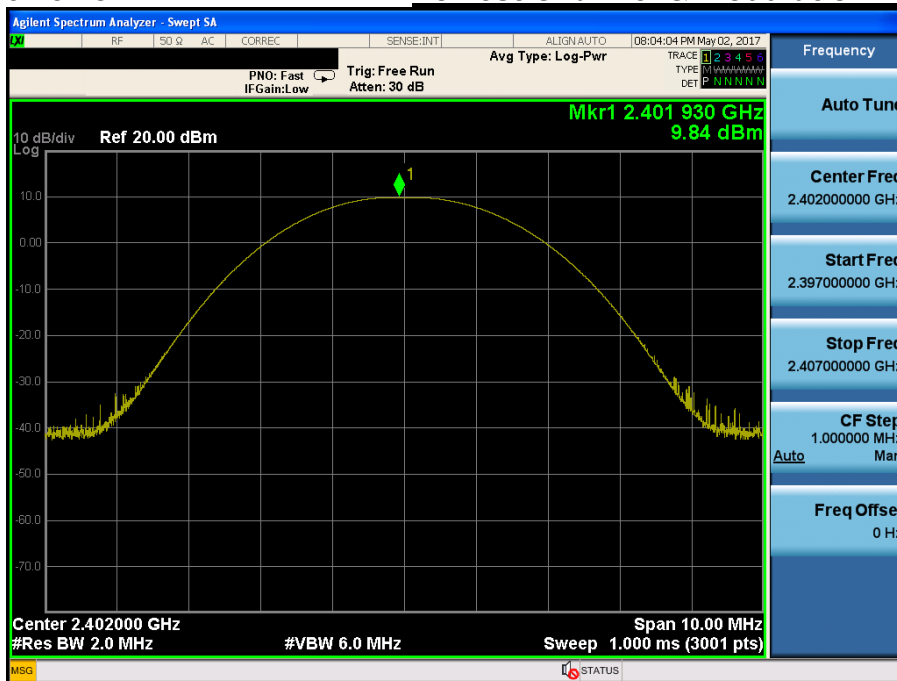
Modulation	Tested Channel	Frame Average Output Power		Peak Output Power	
		dBm	mW	dBm	mW
<u>GFSK</u>	Lowest	8.46	7.015	9.84	9.638
	Middle	8.17	6.561	9.53	8.974
	Highest	8.69	7.396	9.97	9.931
<u>$\pi/4$DQPSK</u>	Lowest	6.31	4.276	9.85	9.661
	Middle	6.19	4.159	9.53	8.974
	Highest	6.57	4.539	9.99	9.977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

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.

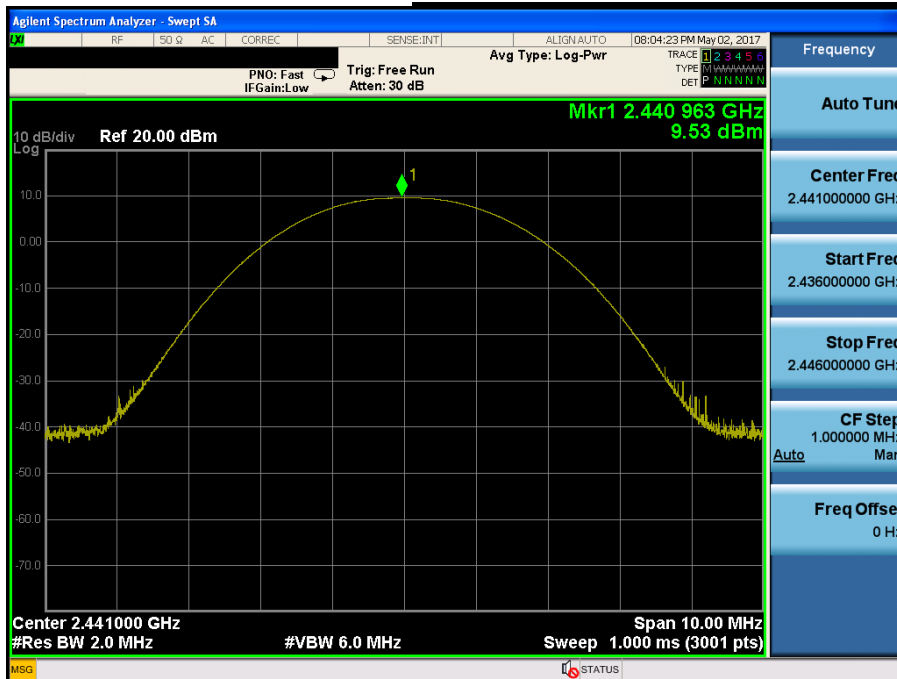
Peak Output Power

Lowest Channel & Modulation : GFSK



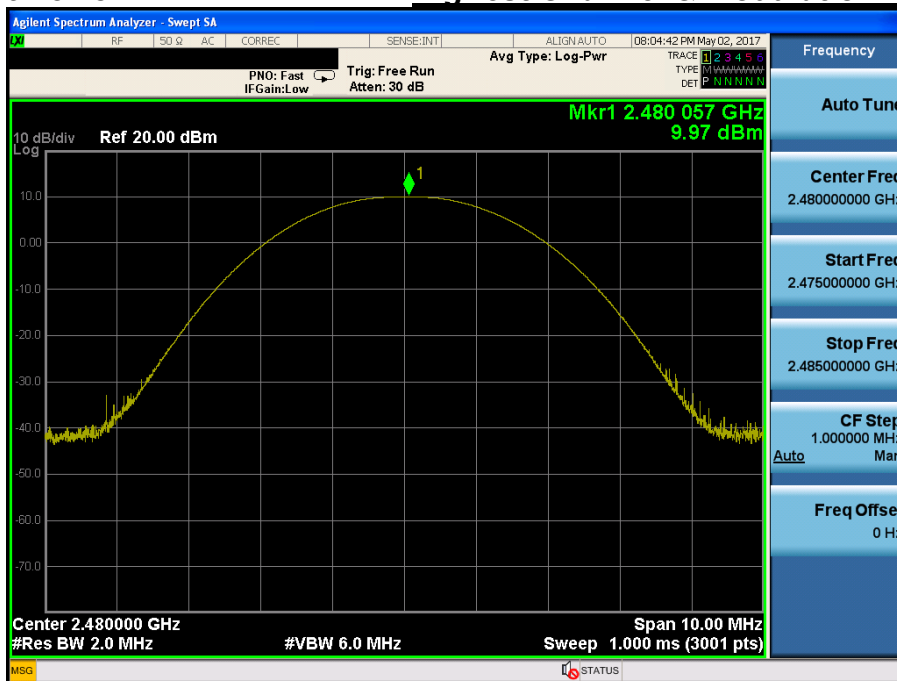
Peak Output Power

Middle Channel & Modulation : GFSK



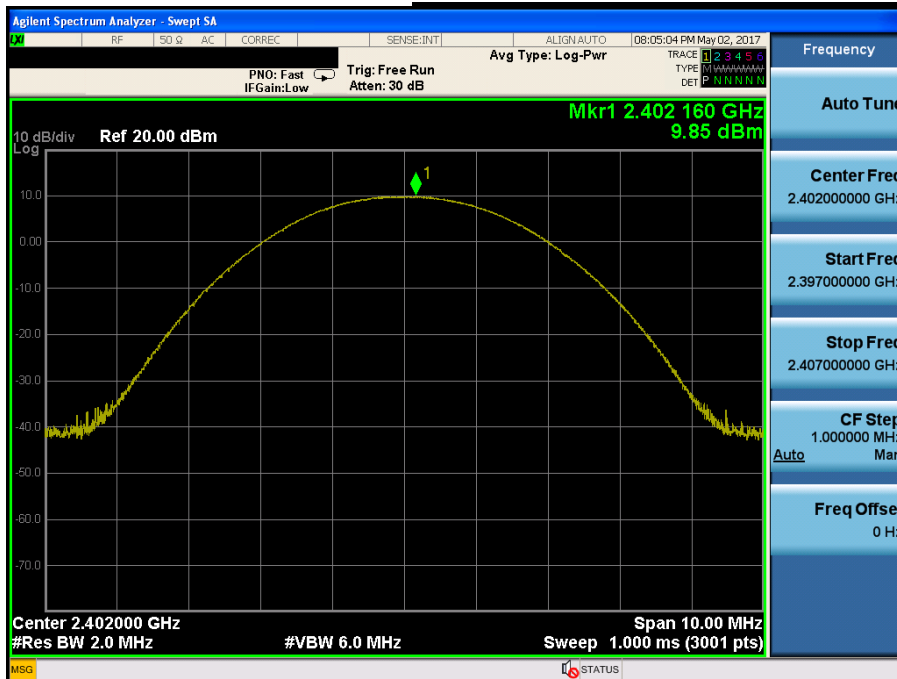
Peak Output Power

Highest Channel & Modulation : GFSK

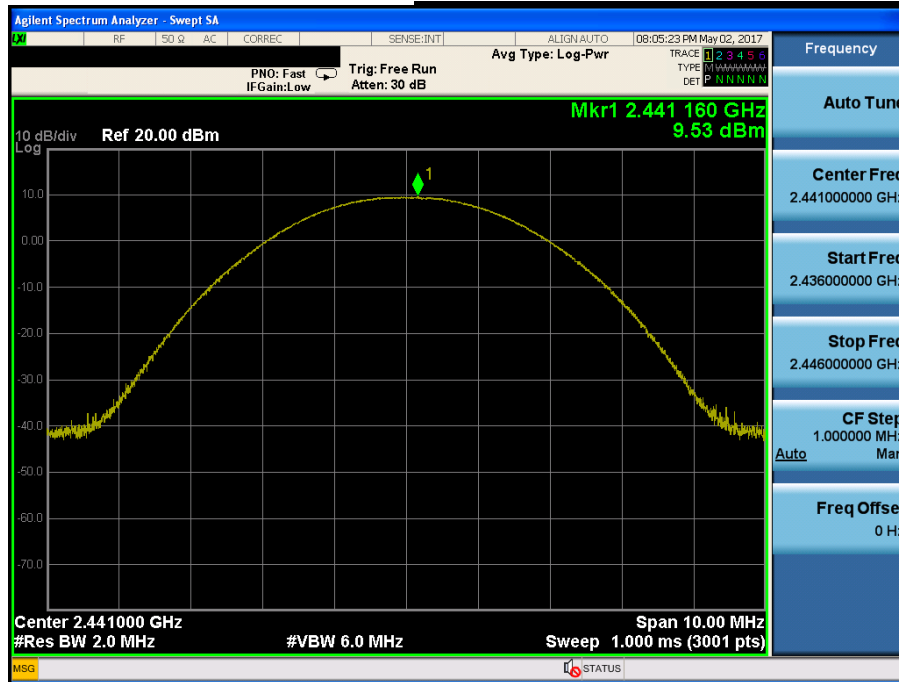


Peak Output Power

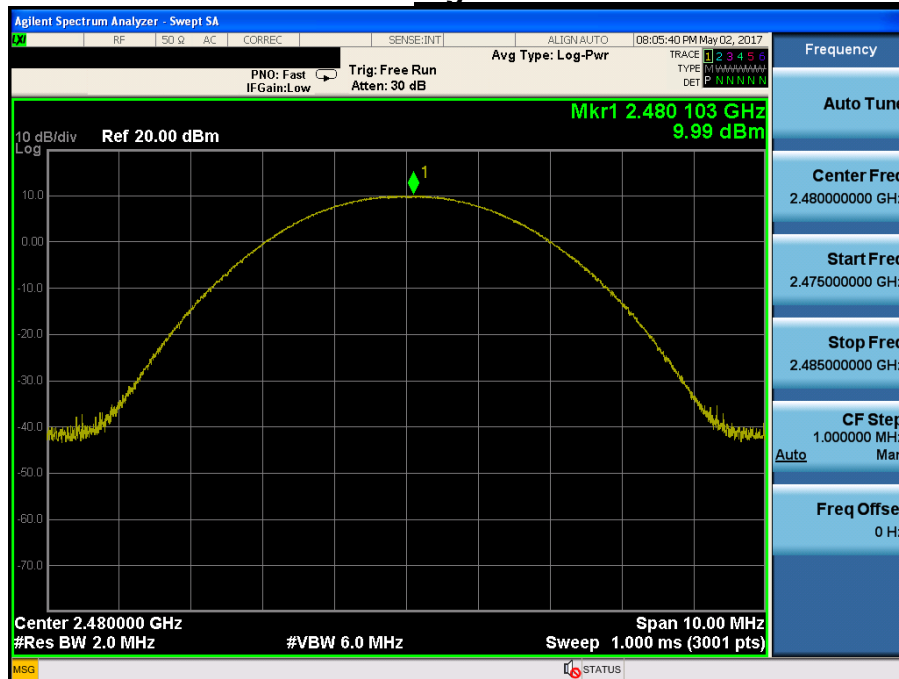
Lowest Channel & Modulation : $\pi/4$ DQPSK



Peak Output Power

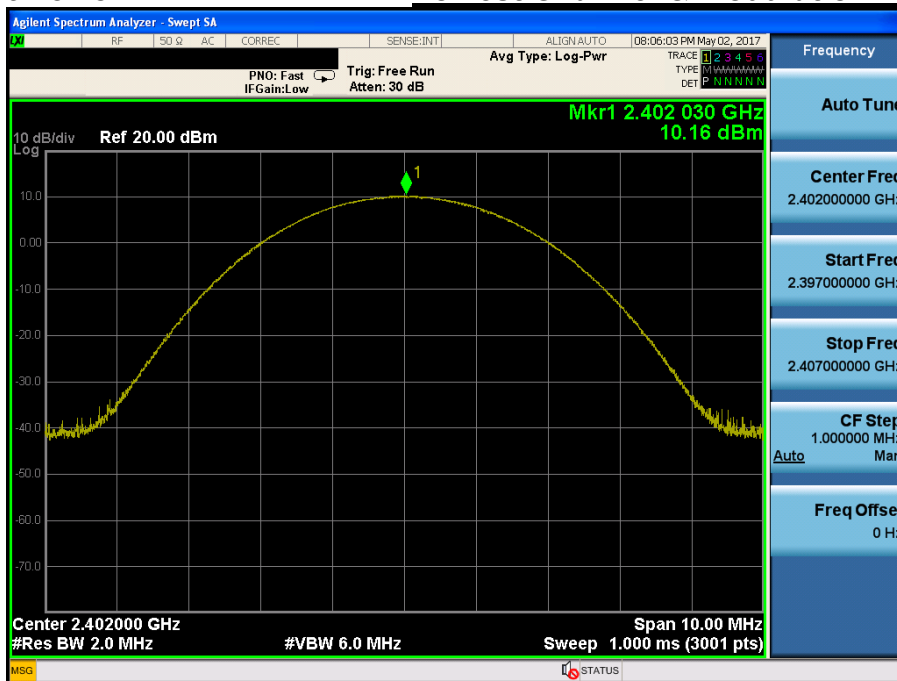
Middle Channel & Modulation : $\pi/4$ DQPSK

Peak Output Power

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

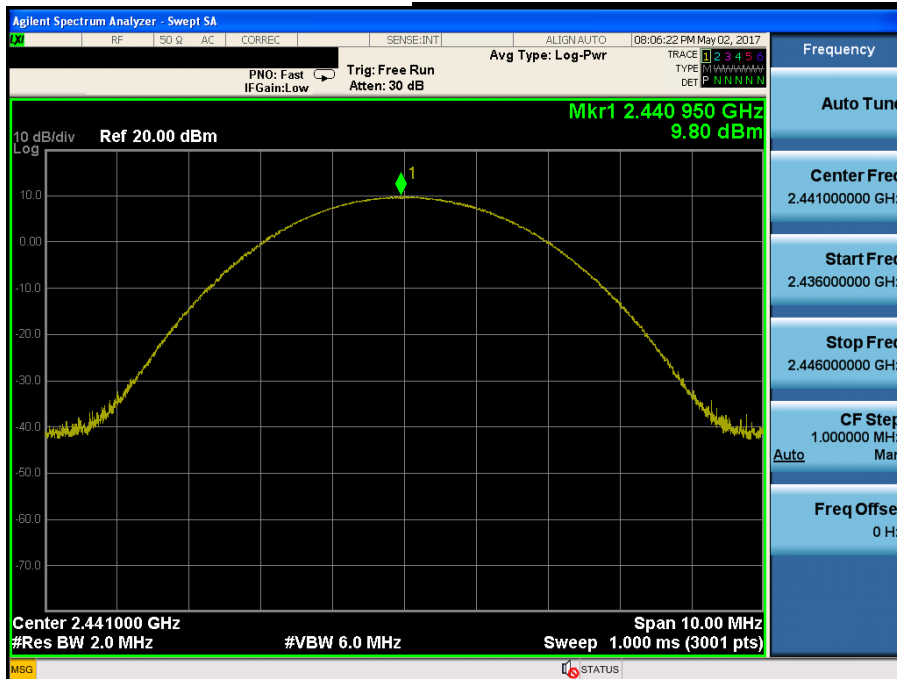
Peak Output Power

Lowest Channel & Modulation : 8DPSK



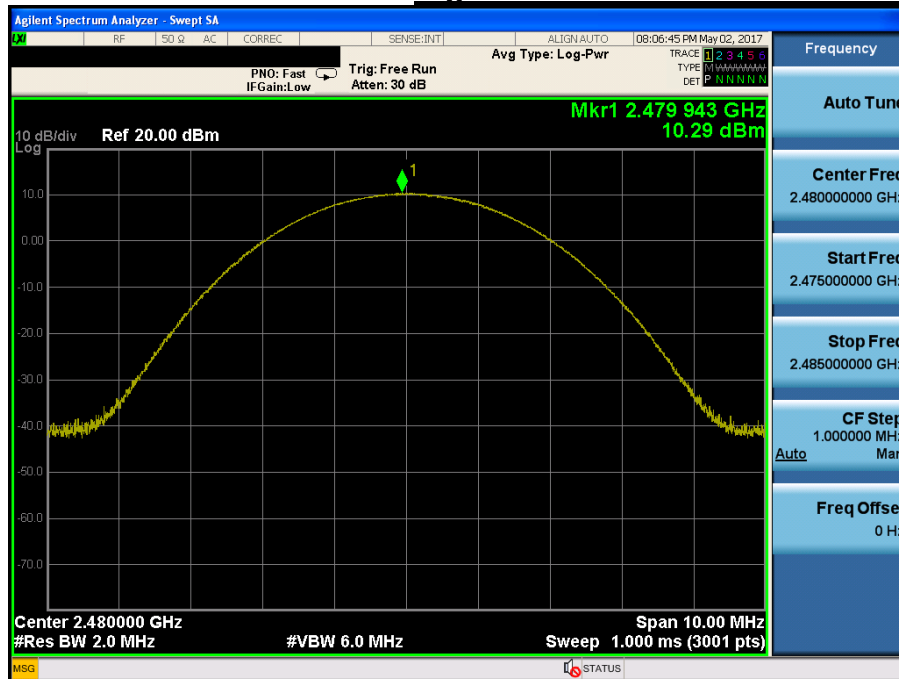
Peak Output Power

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)
<u>GFSK</u>	Lowest	0.930
	Middle	0.930
	Highest	0.927
<u>$\pi/4$DQPSK</u>	Lowest	1.316
	Middle	1.331
	Highest	1.319
<u>8DPSK</u>	Lowest	1.270
	Middle	1.289
	Highest	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



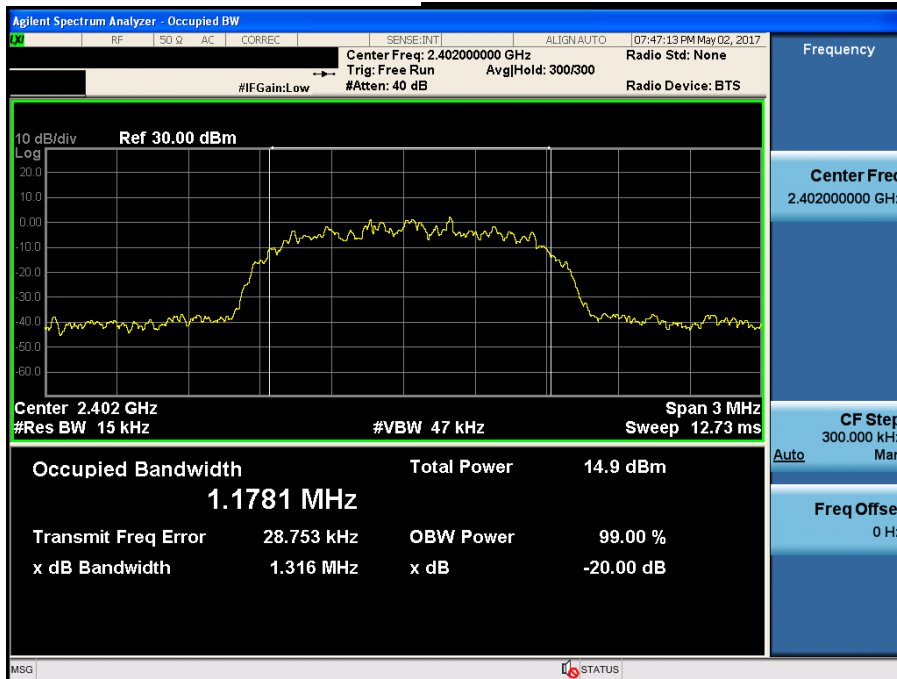
20 dB Bandwidth

Highest Channel & Modulation : GFSK



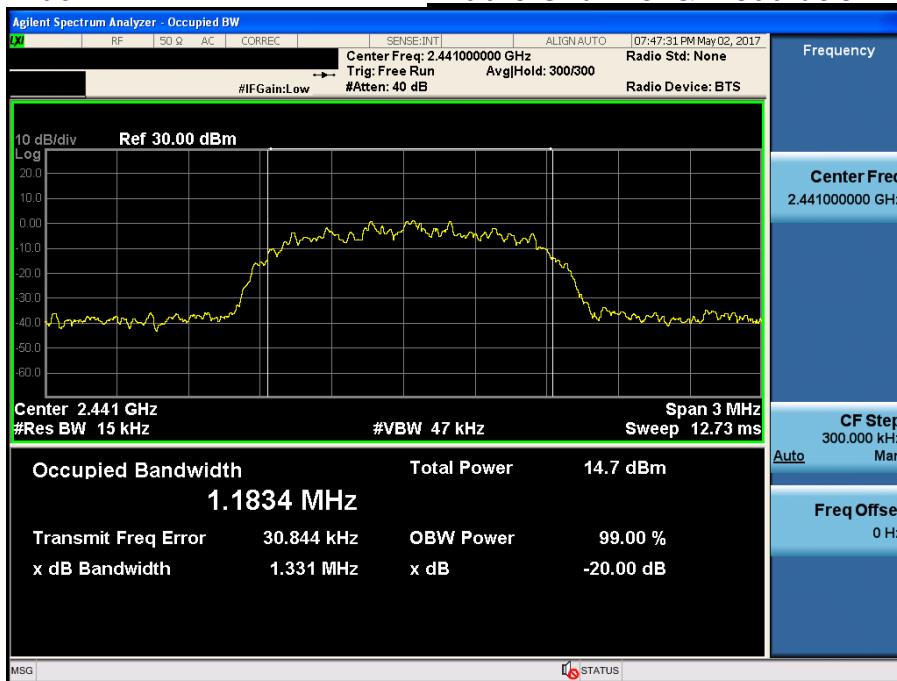
20 dB Bandwidth

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



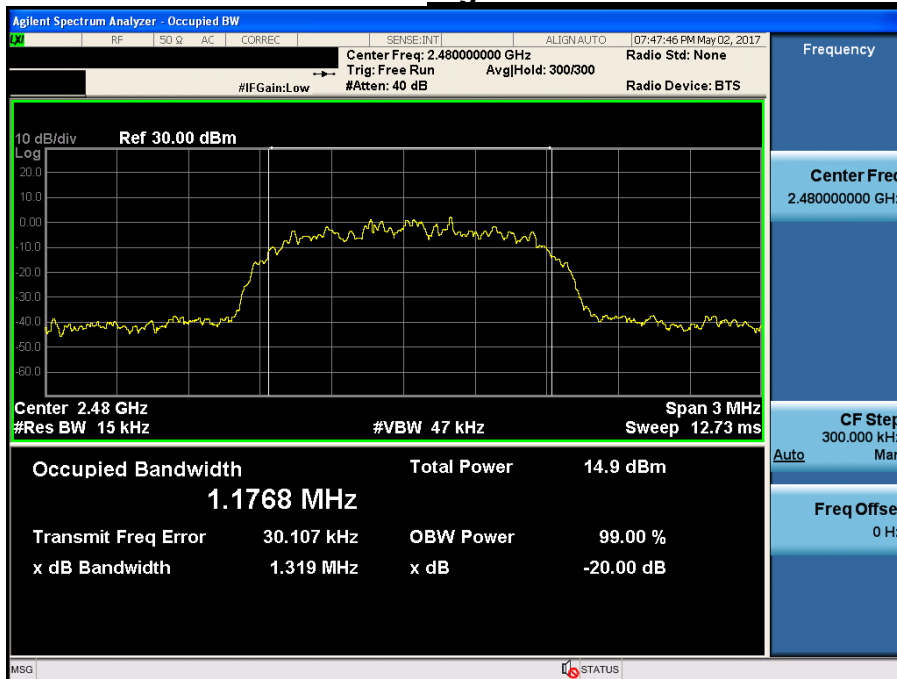
20 dB Bandwidth

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



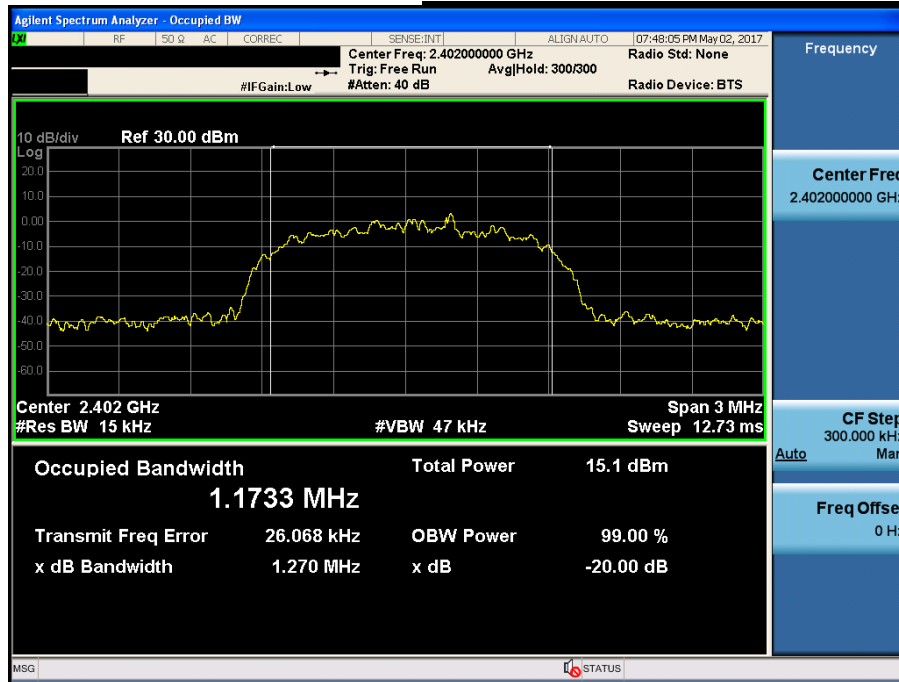
20 dB Bandwidth

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



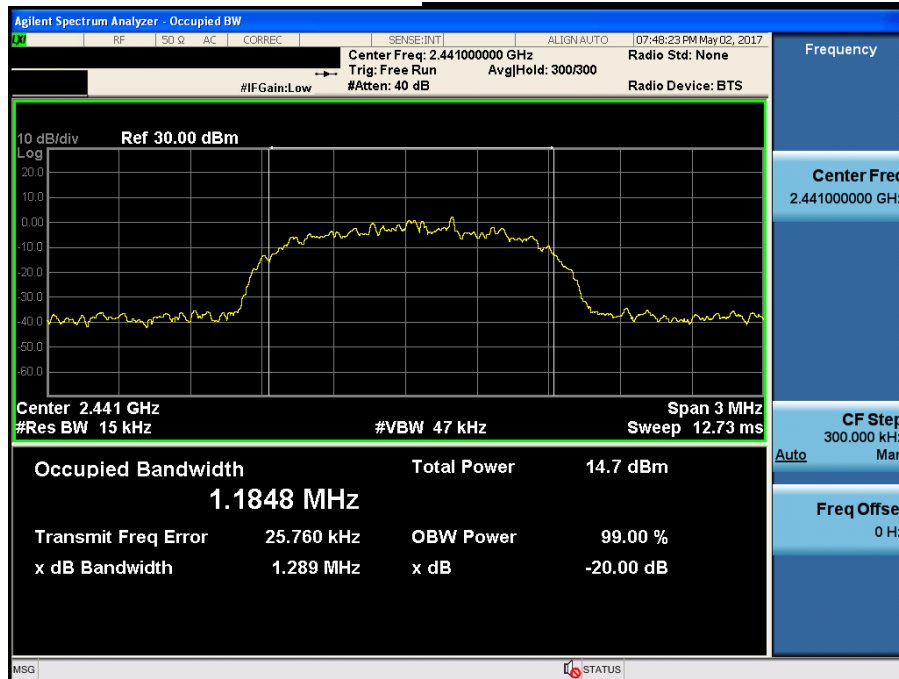
20 dB Bandwidth

Lowest Channel & Modulation : 8DPSK



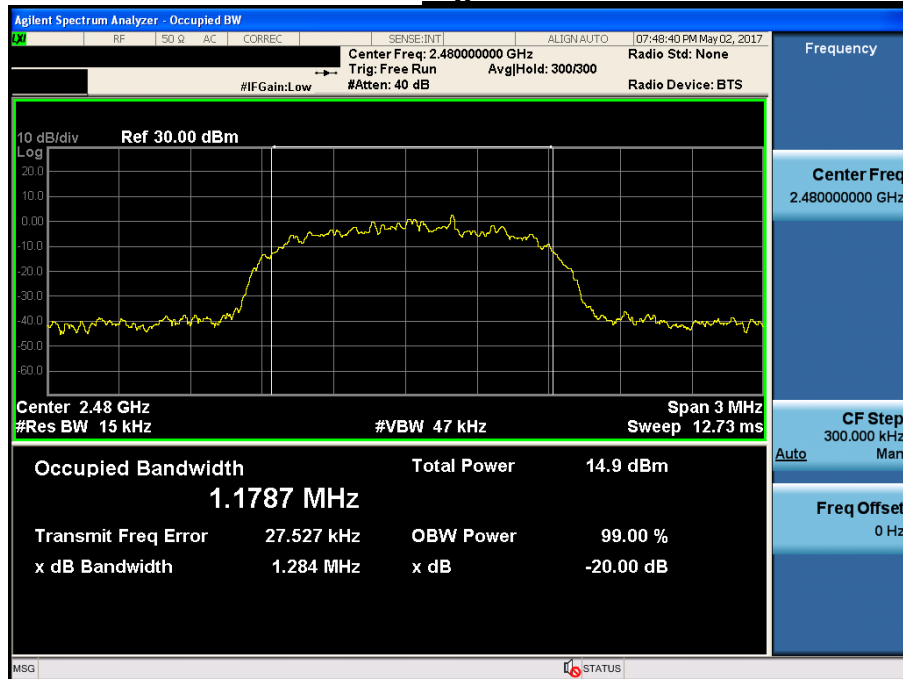
20 dB Bandwidth

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 : ≥ 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

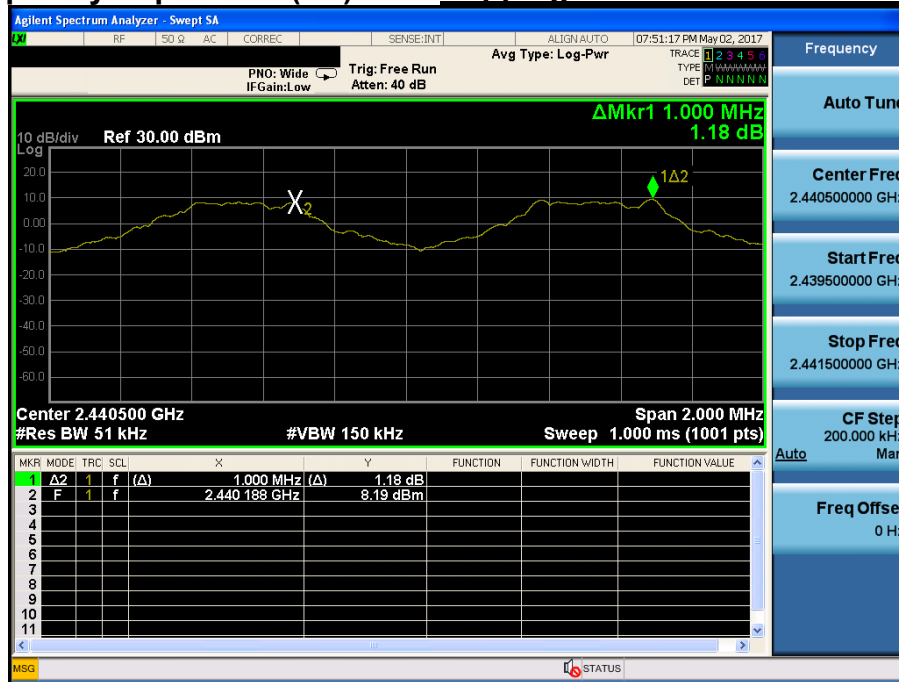
Hopping Mode	Modulation	Peak of center channel (MHz)	Peak of adjacent Channel (MHz)	Test Result (MHz)
Enable	GFSK	2439.922	2440.922	1.000
	$\pi/4$ -DQPSK	2440.028	2441.028	1.000
	8DPSK	2440.180	2441.180	1.000

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

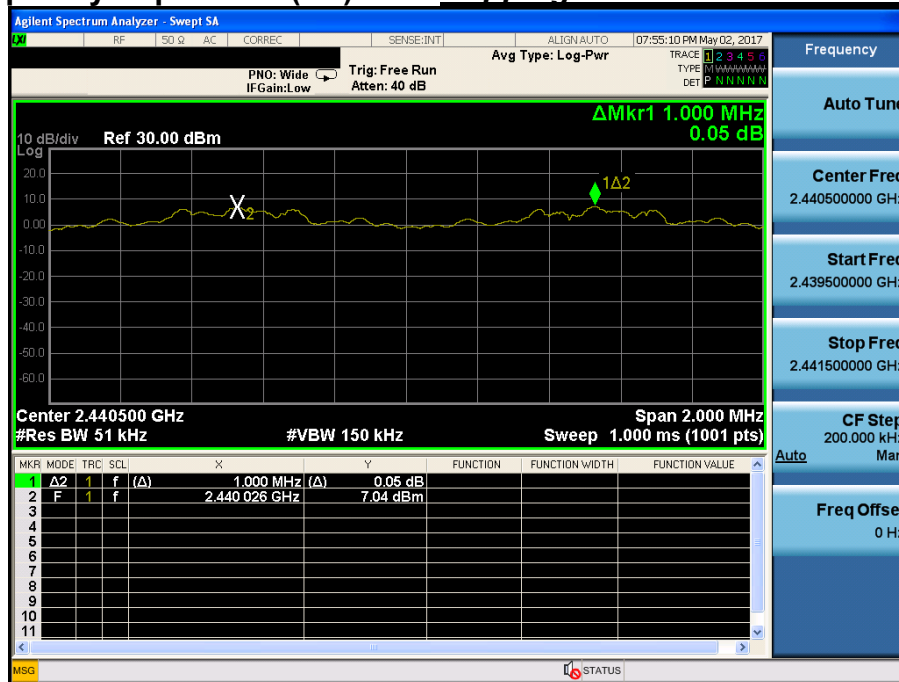
- Minimum Standard :

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)

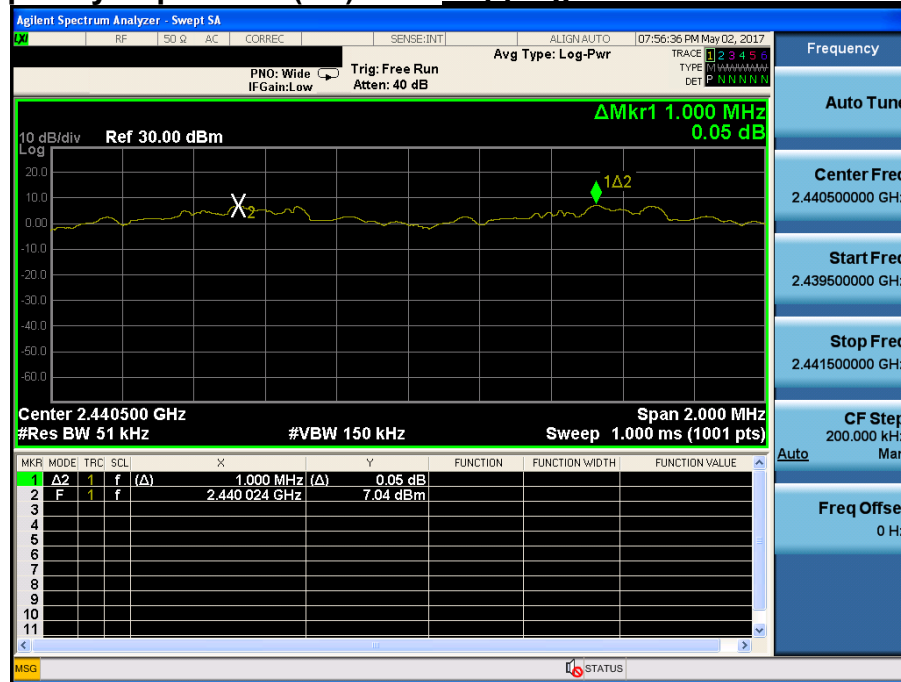
Hopping mode : Enable & GFSK

Carrier Frequency Separation (FH)

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

Carrier Frequency Separation (FH)

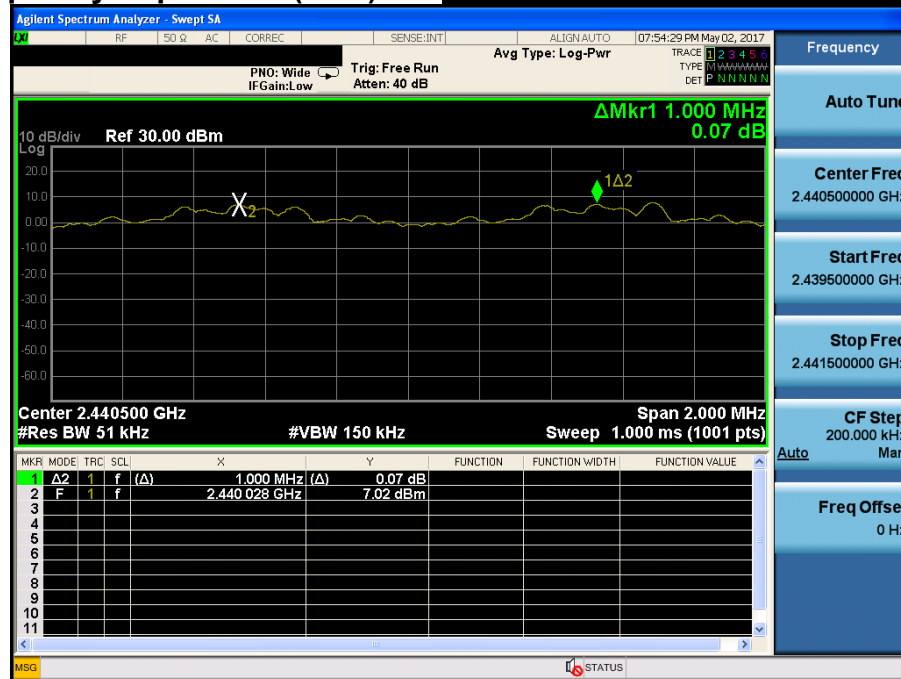
Hopping mode : Enable & 8DPSK



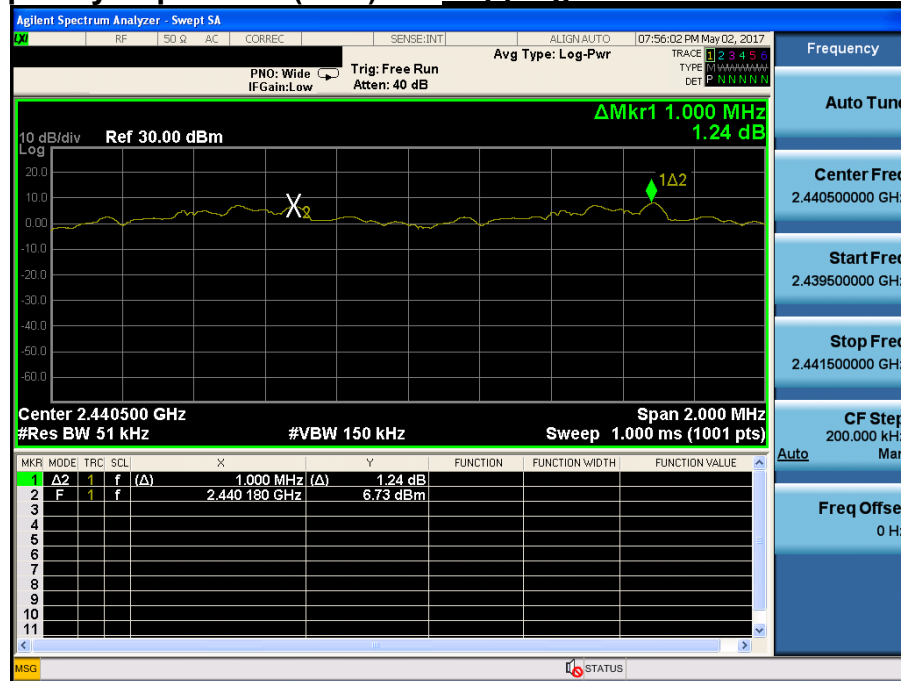
Carrier Frequency Separation (AFH) *Hopping mode : Enable & GFSK*



Carrier Frequency Separation (AFH) *Hopping mode : Enable & $\pi/4$ -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 : ≥ 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

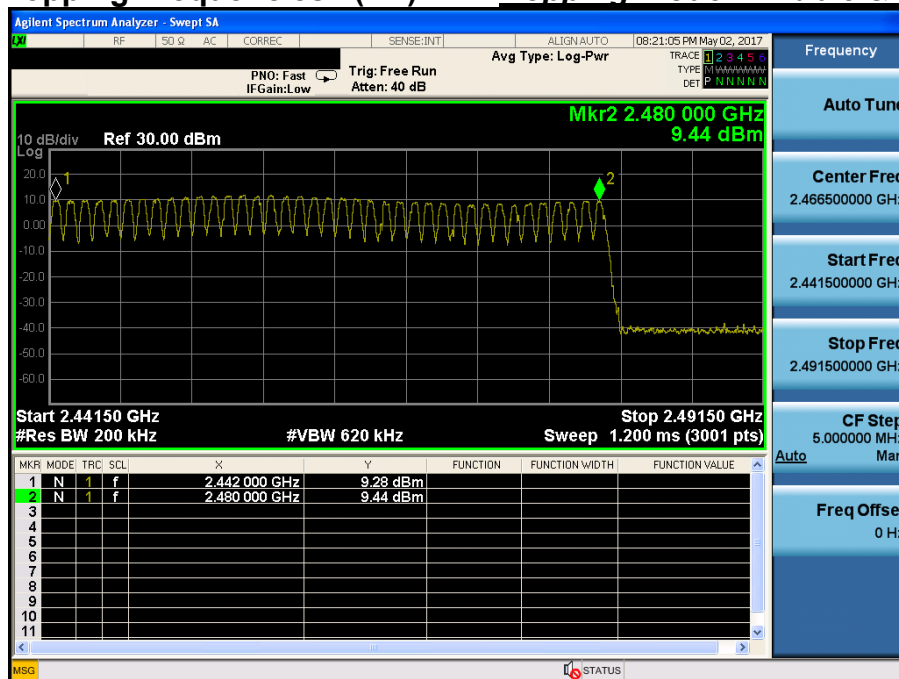
Number of Hopping Frequencies 1(FH)

Hopping mode : Enable & GFSK



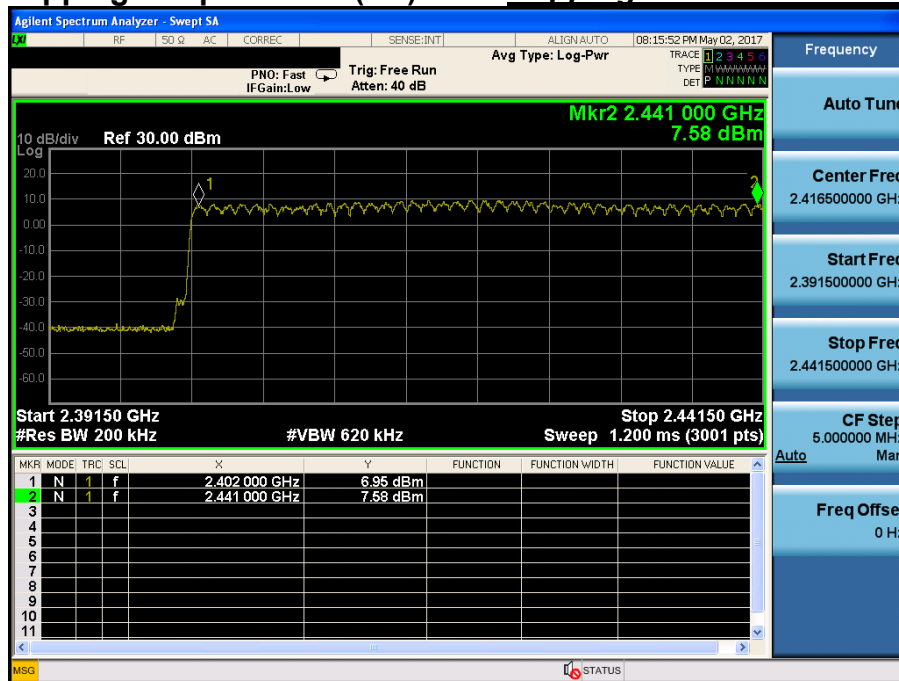
Number of Hopping Frequencies 2(FH)

Hopping mode : Enable & GFSK



Number of Hopping Frequencies 1(FH)

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



Number of Hopping Frequencies 2(FH)

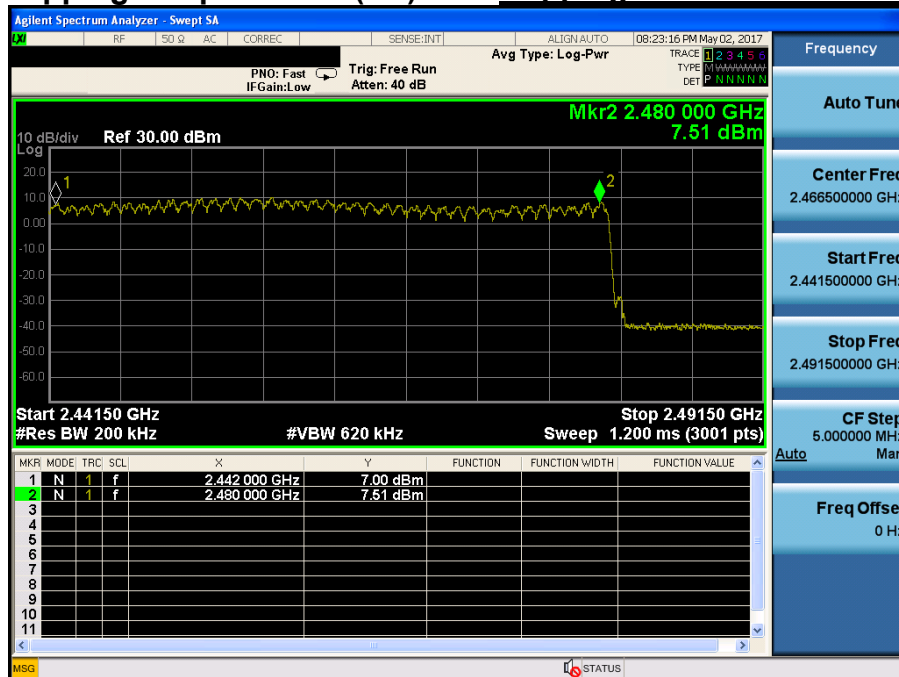
Hopping mode : Enable & $\pi/4$ -DQPSK



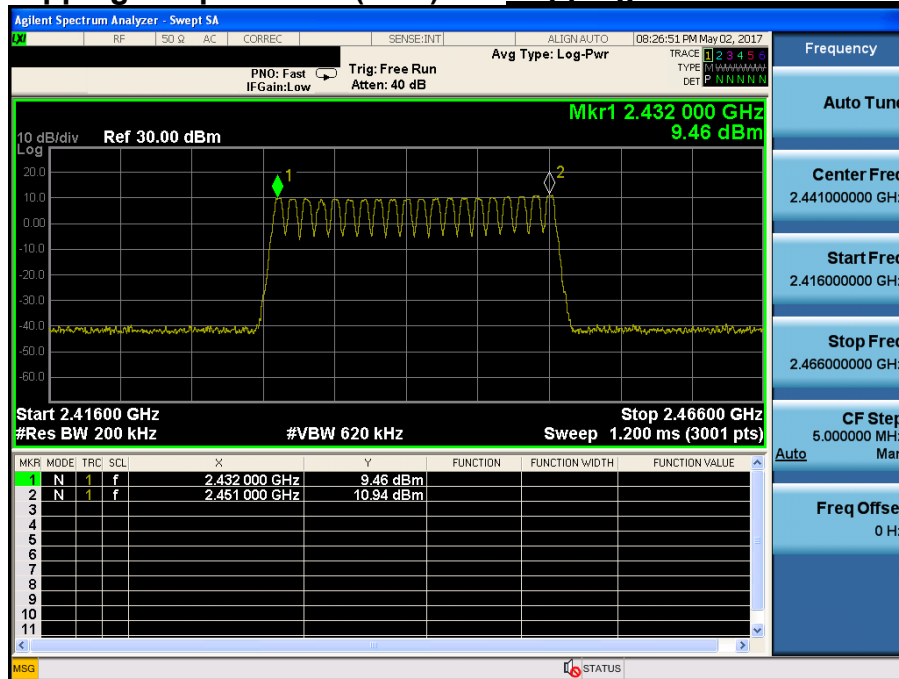
Number of Hopping Frequencies 1(FH)

Hopping mode : Enable & 8DPSK

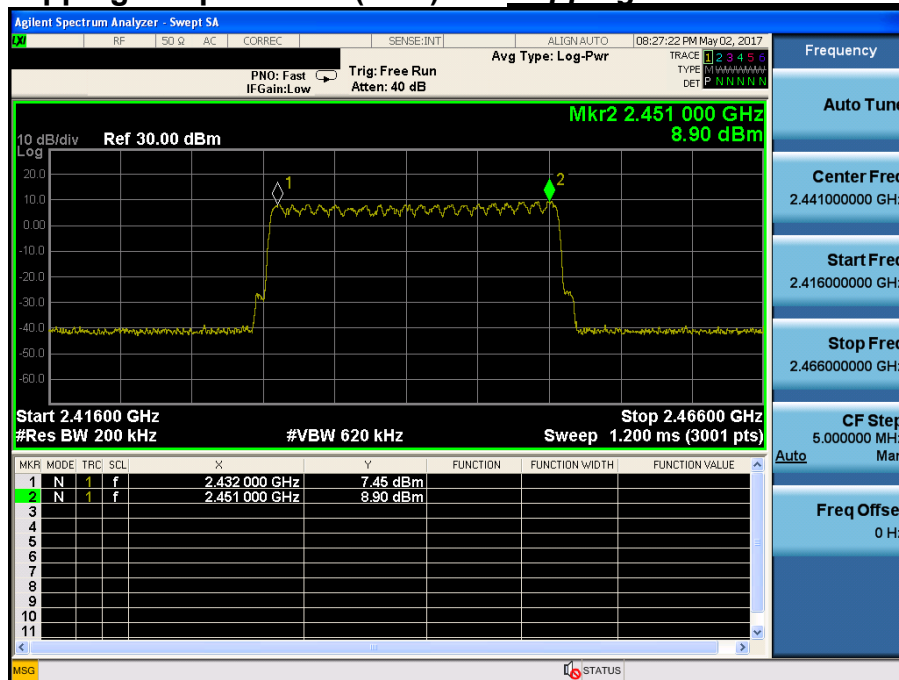
Number of Hopping Frequencies 2(FH)

Hopping mode : Enable & 8DPSK

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



Number of Hopping Frequencies 1(AFH) Hopping mode : Enable & $\pi/4$ -DQPSK



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

