

TEST REPORT



DT&C Co., Ltd.

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

1. Report No : DRTFCC2109-0100

2. Customer

• Name (FCC) : Pittasoft Co., Ltd. / Name (IC) : PITTASOFT CO., LTD.

• Address (FCC) : A 4th floor, ABN Tower, 331, Pangyo-ro, Bundang-gu Seongnam-si, Gyeonggi-do
South Korea 13488

Address (IC) : A 4th floor, ABN Tower, 331, Pangyo-ro, Bundang-gu, Seongnam-si Gyeonggi-do
08506 Korea (Republic Of)

3. Use of Report : FCC & IC Certificaion

4. Product Name / Model Name : Car dashcam / DR750X LTE Plus

FCC ID : YCK-DR750XLTEP

IC : 23402-DR750XLTEP

5. FCC Regulation(s): Part 15.247

IC Standard(s): RSS-247 Issue 2

Test Method used: KDB558074 D01v05r02, ANSI C63.10-2013

6. Date of Test : 2021.07.07 ~ 2021.09.06

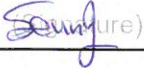
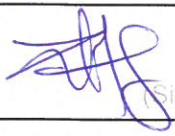
7. Location of Test : Permanent Testing Lab On Site Testing

8. Testing Environment : See appended test report.

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

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

This test report is not related to KOLAS accreditation.

Affirmation	Tested by	Reviewed by
	Name : SeungMin Gil 	Name : JaeJin Lee 

2021. 09. 08.

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	Revised by	Reviewed by
DRTFCC2109-0100	Sep. 08, 2021	Initial issue	SeungMin Gil	JaeJin Lee

Table of Contents

1. General Information	4
1.1. Description of EUT	4
1.2. Declaration by the applicant / manufacturer	4
1.3. Testing Laboratory	5
1.4. Testing Environment	5
1.5. Measurement Uncertainty	5
1.6. Information about the FHSS characteristics	6
1.7. Conclusion of worst-case and operation mode	7
1.8. Test Equipment List	8
2. Antenna Requirement	9
3. Summary of Test Results	10
4. Maximum Peak Conducted Output Power	11
4.1. Test Setup	11
4.2. Limit	11
4.3. Test Procedure	11
4.4. Test Results	12
5. 20 dB BW & Occupied BW	23
5.1. Test Setup	23
5.2. Limit	23
5.3. Test Procedure	23
5.4. Test Results	23
6. Carrier Frequency Separation	35
6.1. Test Setup	35
6.2. Limit	35
6.3. Test Procedure	35
6.4. Test Results	35
7. Number of Hopping Channels	45
7.1. Test Setup	45
7.2. Limit	45
7.3. Test Procedure	45
7.4. Test Results	45
8. Time of Occupancy	57
8.1. Test Setup	57
8.2. Limit	57
8.3. Test Procedure	57
8.4. Test Results	57
9. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission	67
9.1. Test Setup	67
9.2. Limit	67
9.3. Test Procedures	69
9.3.1. Test Procedures for Radiated Spurious Emissions	69
9.3.2. Test Procedures for Conducted Spurious Emissions	70
9.4. Test Results	71
9.4.1. Radiated Emissions	71
9.4.2. Conducted Spurious Emissions	74
10. AC Power-Line Conducted Emissions	122
10.1. Test Setup	122
10.2. Limit	122
10.3. Test Procedure	122
10.4 Test Results	122
APPENDIX I	123
APPENDIX II	124

1. General Information

1.1. Description of EUT

Equipment Class	Part 15 Spread Spectrum Transmitter (DSS)
Product Name	Car dashcam
Model Name	DR750X LTE Plus
Add Model Name	DR750X-2CH LTE Plus, DR750X-1CH LTE Plus, DR750X-2CH IR LTE Plus, DR750X-2CH Truck LTE Plus, DR750X-2CH DMS LTE Plus
Firmware Version Identification Number	V1.000
EUT Serial Number	Radiated: 75LPNAAK400014, Conducted: 75LPNAAK400009
Power Supply	DC 12 V, DC 24 V
Frequency Range	2 402 MHz ~ 2 480 MHz
Max. RF Output Power	9.94 dBm (0.010 W)
Modulation Technique (Data rate)	GFSK(1 Mbps), $\pi/4$ DQPSK(2 Mbps), 8DPSK(3 Mbps)
Number of Channels	79
Antenna Specification	Antenna Type: CHIP Antenna Gain: 1.99 dBi (PK)

1.2. Declaration by the applicant / manufacturer

- NA

1.3. Testing Laboratory

DT&C Co., Ltd.		
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 test site complies with the requirements of Part 2.948 according to ANSI C63.4-2014.		
- FCC & IC MRA Designation No. : KR0034		
- ISED#: 5740A		
www.dtnet.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

1.4. Testing Environment

Ambient Condition	
▪ Temperature	+22 °C ~ +26 °C
▪ Relative Humidity	40 % ~ 45 %

1.5. Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.4-2014 and ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence.

Parameter	Measurement uncertainty
Antenna-port conducted emission	1.0 dB (The confidence level is about 95 %, $k = 2$)
AC power-line conducted emission	3.4 dB (The confidence level is about 95 %, $k = 2$)
Radiated emission (1 GHz Below)	4.9 dB (The confidence level is about 95 %, $k = 2$)
Radiated emission (1 GHz ~ 18 GHz)	5.0 dB (The confidence level is about 95 %, $k = 2$)
Radiated emission (18 GHz Above)	5.3 dB (The confidence level is about 95 %, $k = 2$)

1.6. 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

Note 1 : Pseudorandom Frequency Hopping Sequence Table as below:

Channel: 08, 24, 40, 56, 42, 54, 72, 09, 01, 11, 33, 41, 34, 42, 65, 73, 53, 69, 06, 22, 04, 20,
36, 52, 38, 46, 70, 78, 68, 76, 21, 29, 10, 26, 41, 58, 44, 60, 76, 13, 03, 11, 35, 43,
37, 45, 69, 77, 52, 71, 08, 24, 06, 24, 48, 56, 45, 46, 70, 01, 72, 06, 25, 33, 12, 28,
49, 60, 45, 58, 74, 13, 05, 18, 37, 49 etc

The System receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchroniztation with the transmitted signals.

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.

1.7. Conclusion of worst-case and operation mode

The EUT has three types 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).

EUT Operation test setup

- Test Software: RTLBTAPP_08.16.2018,2
- Power setting: BDR: 31, EDR: 32

Tested frequency information

- Hopping Function : Enable

	Tested Frequency (MHz)
Hopping Band	2 402 ~ 2 480

- Hopping Function : Disable

	Tested Frequency (MHz)
Lowest Channel	2 402
Middle Channel	2 441
Highest Channel	2 480

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	21/03/22	22/03/22	MY52091063
Spectrum Analyzer	Agilent Technologies	N9020A	20/12/16	21/12/16	MY48011700
Spectrum Analyzer	Agilent Technologies	N9020A	21/06/24	22/06/24	US47360812
DC Power Supply	SM techno	SDP30-5D	21/06/24	22/06/24	305DNF079
DC Power Supply	H.P	6633A	20/12/16	21/12/16	3524A06634
Multimeter	FLUKE	17B+	20/12/16	21/12/16	36390701WS
Signal Generator	Rohde Schwarz	SMBV100A	20/12/16	21/12/16	255571
Signal Generator	ANRITSU	MG3695C	20/12/16	21/12/16	173501
Thermohygrometer	BODYCOM	BJ5478	20/12/16	21/12/16	120612-1
Thermohygrometer	BODYCOM	BJ5478	20/12/16	21/12/16	120612-2
Thermohygrometer	BODYCOM	BJ5478	21/06/24	22/06/24	N/A
Loop Antenna	ETS-Lindgren	6502	21/01/28	23/01/28	00226186
BILOG ANTENNA	Schwarzbeck	VULB 9160	20/12/16	21/12/16	3362
Horn Antenna	ETS-Lindgren	3115	20/12/16	21/12/16	6419
Horn Antenna	A.H.Systems Inc.	SAS-574	21/06/24	22/06/24	155
PreAmplifier	tsj	MLA-0118-B01-40	20/12/16	21/12/16	1852267
PreAmplifier	tsj	MLA-1840-J02-45	21/06/24	22/06/24	16966-10728
PreAmplifier	H.P	8447D	20/12/16	21/12/16	2944A07774
High Pass Filter	Wainwright Instruments	WHKX12-935-1000-15000-40SS	21/06/24	22/06/24	8
High Pass Filter	Wainwright Instruments	WHKX10-2838-3300-18000-60SS	21/06/24	22/06/24	1
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5-6SS	21/06/24	22/06/24	3
Attenuator	Hefei Shunze	SS5T2.92-10-40	21/06/24	22/06/24	16012202
Attenuator	SRTechnology	F01-B0606-01	21/06/24	22/06/24	13092403
Attenuator	SMAJK	SMAJK-2-3	21/06/24	22/06/24	3
Attenuator	SMAJK	SMAJK-2-3	21/06/24	22/06/24	2
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2495A MA2490A	21/06/24	22/06/24	1306007 1249001
Cable	DT&C	Cable	21/01/08	22/01/08	G-1
Cable	DT&C	Cable	21/01/08	22/01/08	G-2
Cable	HUBER+SUHNER	SUCOFLEX 100	21/01/08	22/01/08	G-3
Cable	DT&C	Cable	21/01/08	22/01/08	G-4
Cable	Junkosha	MWX241	21/01/08	22/01/08	mmW-1
Cable	Junkosha	MWX241	21/01/08	22/01/08	mmW-4
Cable	HUBER+SUHNER	SUCOFLEX100	21/01/08	22/01/08	M-01
Cable	HUBER+SUHNER	SUCOFLEX100	21/01/08	22/01/08	M-02
Cable	JUNFLON	MWX241	21/01/08	22/01/08	M-03
Cable	JUNFLON	J12J101757-00	21/01/08	22/01/08	M-07
Cable	HUBER+SUHNER	SUCOFLEX106	21/01/08	22/01/08	M-09
Test Software	tsj	Radiated Emission Measurement	NA	NA	Version 2.00.0177

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.

Note2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.

2. Antenna Requirement

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.

Conclusion: Comply

The antenna is permanently attached on the device.

Therefore this E.U.T complies with the requirement of Part 15.203

3. Summary of Test Results

FCC part section(s)	RSS section(s)	Test Description	Limit (Using in 2400~ 2483.5 MHz)	Test Condition	Status Note 1
15.247(b)	RSS-247[5.4]	Maximum Peak Conducted 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. =< 4 Watt For e.i.r.p	Conducted	C
15.247(a)	RSS-247[5.2]	20 dB Bandwidth	NA		C
		Carrier Frequency Separation	>= 25 kHz or >= Two thirds of the 20 dB BW, whichever is greater.		C
		Number of Hopping Channels	>= 15 hops		C
		Time of Occupancy	=< 0.4 seconds		C
-	RSS-Gen[6.7]	Occupied Bandwidth (99 %)	NA		C
15.247(d)	RSS-247[5.5]	Unwanted 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	
15.247(d) 15.205 15.209	RSS-247[5.5] RSS-Gen[8.9] RSS-Gen[8.10]	Unwanted Emissions	Part 15.209 Limits (Refer to section 9)	Radiated	C Note3, 4
15.207	RSS-Gen[8.8]	AC Power-Line Conducted Emissions	Part 15.207 Limits (Refer to section 10)	AC Line Conducted	NA Note5
15.203	-	Antenna Requirement	Part 15.203 (Refer to section 2)	-	C
Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable Note 2: For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated with OATS. Note 3: This test item was performed in three orthogonal EUT positions and the worst case data was reported. Note 4: The Radiated test items were performed at DC 12V and DC 24V. And the worst case date are repored. Note 5: This device is installed a car. Therefore the power scurce is a battery of car.					

4. Maximum Peak Conducted Output Power

4.1. Test Setup

Refer to the APPENDIX I.

4.2. 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 2 400 MHz - 2 483.5 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 2 400 – 2 483.5 MHz employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725 MHz – 5 805 MHz band : 1 Watt. For all other frequency hopping systems in the 2 400 MHz – 2 483.5 MHz band: 0.125 watts.

■ IC Requirements

1. RSS-247(5.4) (b), For FHSS operating in the band 2 400 MHz – 2 483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels, the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p shall not exceed 4 W, except as provided in section 5.4(e)

4.3. 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 peak output power 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

4.4. Test Results

- Power Supply: 24 V

Modulation	Tested Channel	Frame Average Output Power		Peak Output Power	
		dBm	mW	dBm	mW
<u>GFSK</u>	Lowest	5.95	3.94	7.45	5.56
	Middle	5.87	3.86	7.31	5.38
	Highest	5.85	3.85	7.48	5.60
<u>$\pi/4$DQPSK</u>	Lowest	5.85	3.85	9.51	8.93
	Middle	5.66	3.68	9.40	8.71
	Highest	5.65	3.67	9.48	8.87
<u>8DPSK</u>	Lowest	5.79	3.79	9.83	9.62
	Middle	5.55	3.59	9.76	9.46
	Highest	5.54	3.58	9.89	9.75

- Power Supply: 12 V

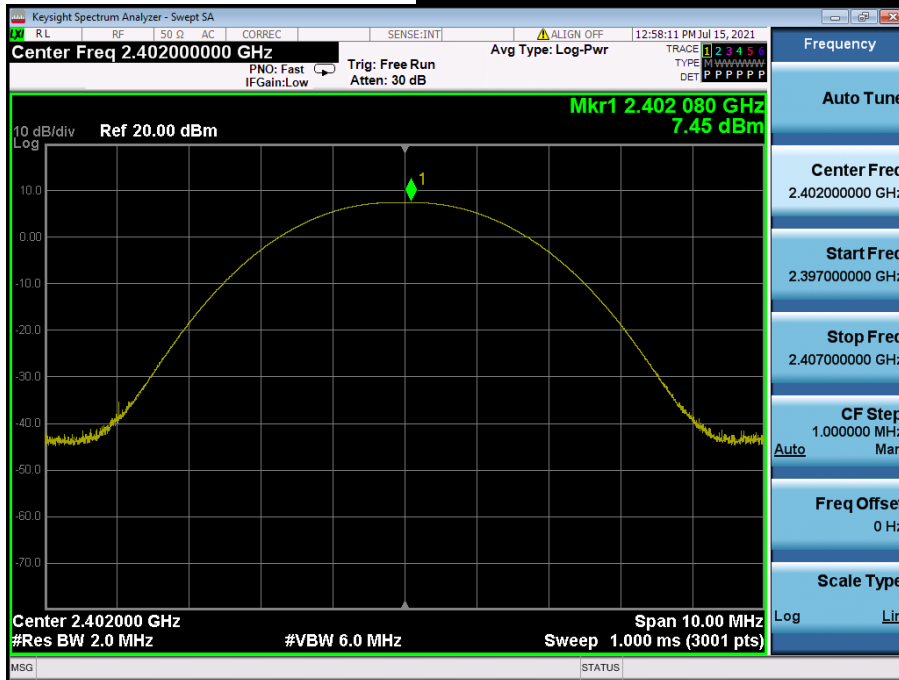
Modulation	Tested Channel	Frame Average Output Power		Peak Output Power	
		dBm	mW	dBm	mW
<u>GFSK</u>	Lowest	5.66	3.68	7.53	5.66
	Middle	5.53	3.57	7.13	5.16
	Highest	5.49	3.54	7.07	5.09
<u>$\pi/4$DQPSK</u>	Lowest	5.62	3.65	9.54	8.99
	Middle	5.42	3.48	9.13	8.18
	Highest	5.39	3.46	9.09	8.11
<u>8DPSK</u>	Lowest	5.58	3.61	9.94	9.86
	Middle	5.41	3.48	9.55	9.02
	Highest	5.38	3.45	9.52	8.95

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

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

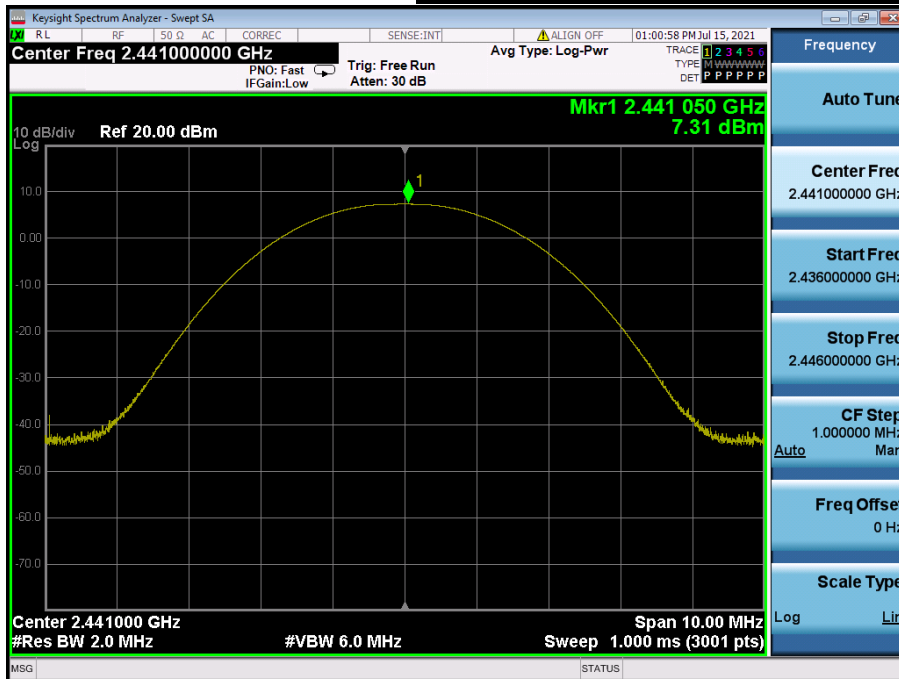
**- Power Supply: 24 V
Peak Output Power**

Lowest Channel & Modulation : GFSK



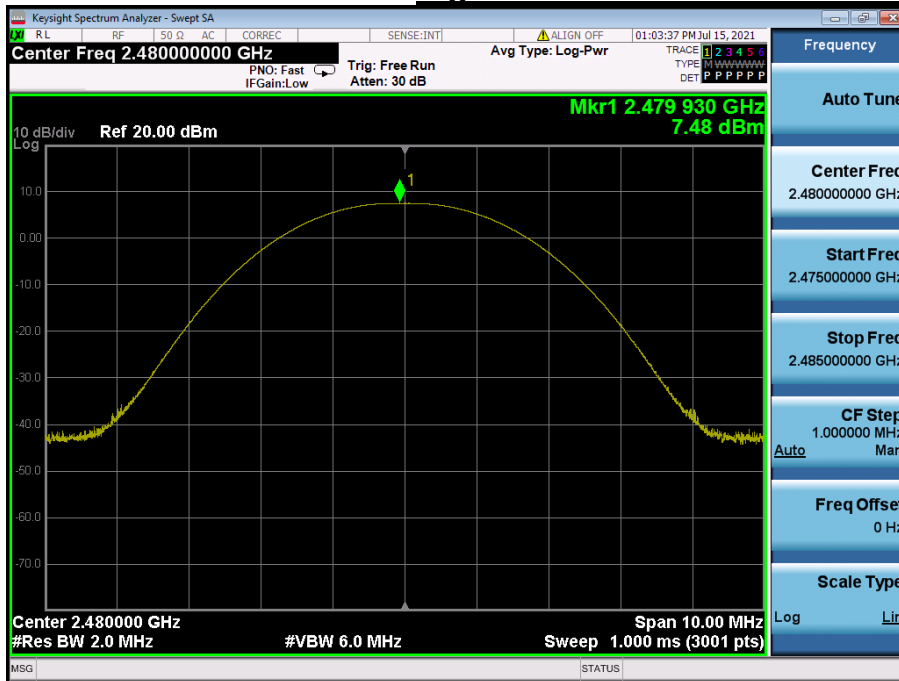
Peak Output Power

Middle Channel & Modulation : GFSK



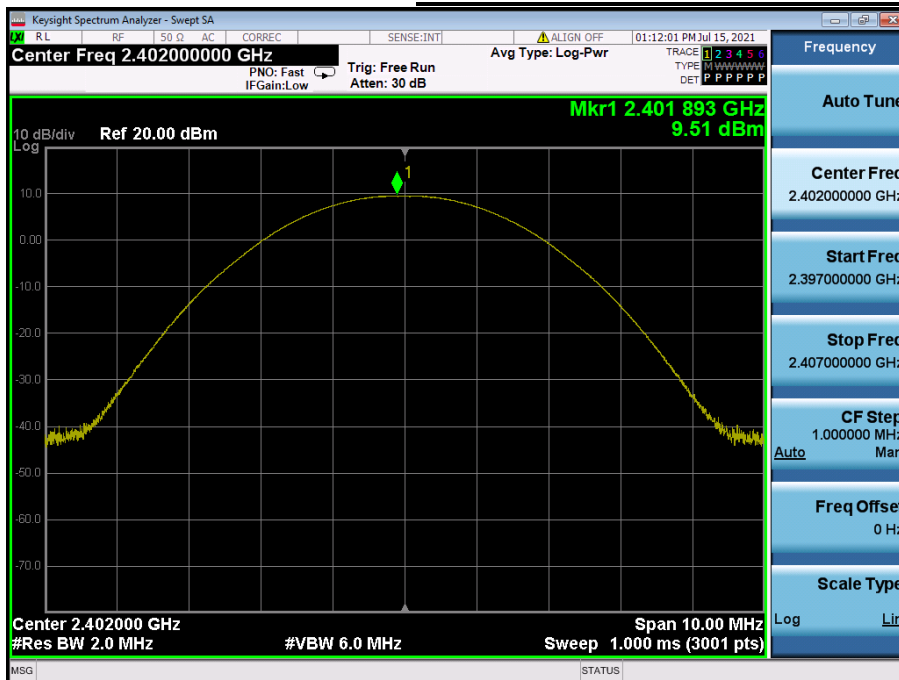
Peak Output Power

Highest Channel & Modulation : GFSK



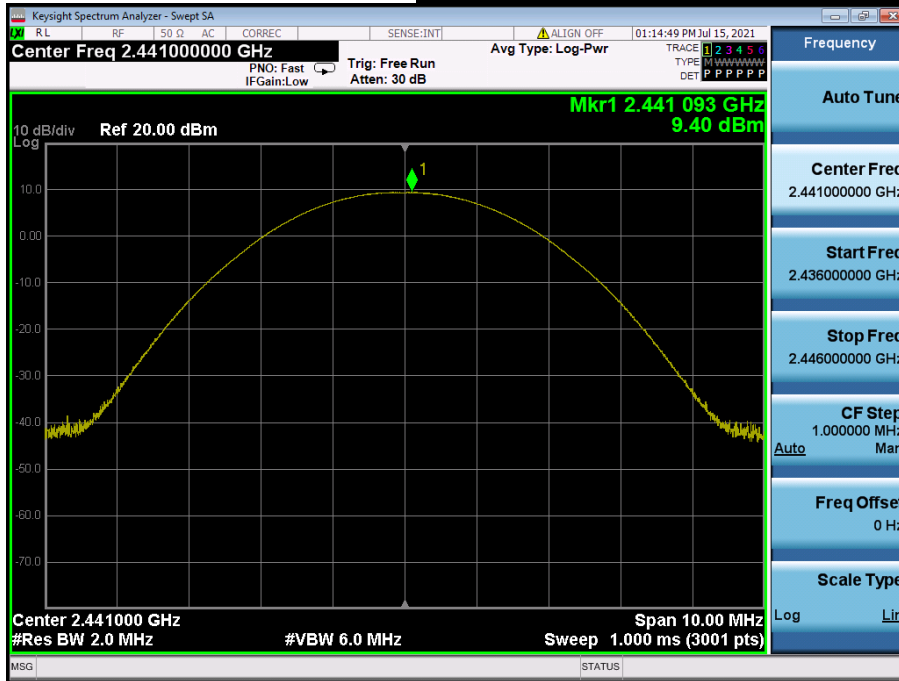
Peak Output Power

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



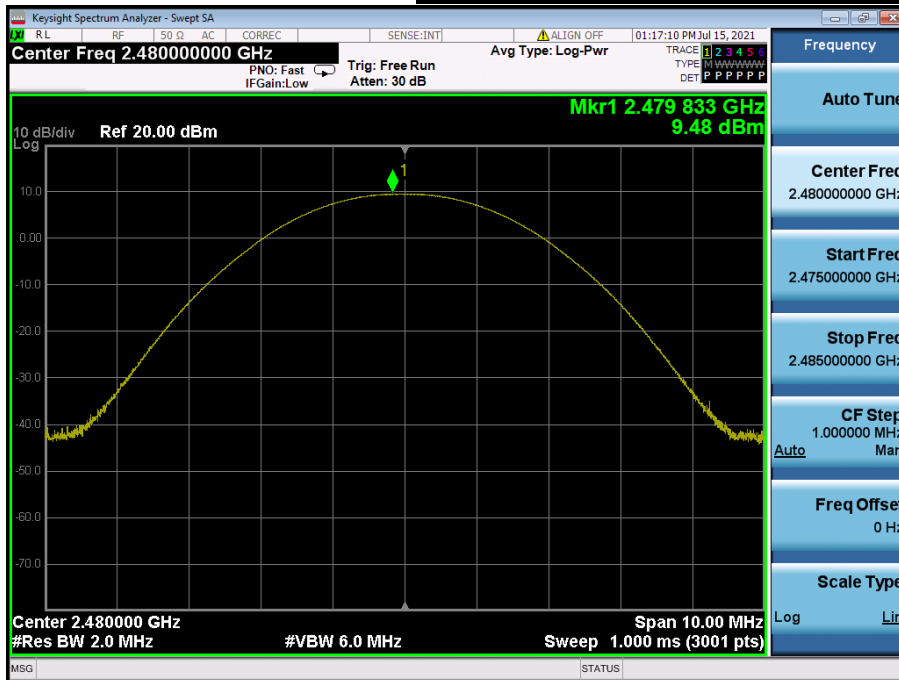
Peak Output Power

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



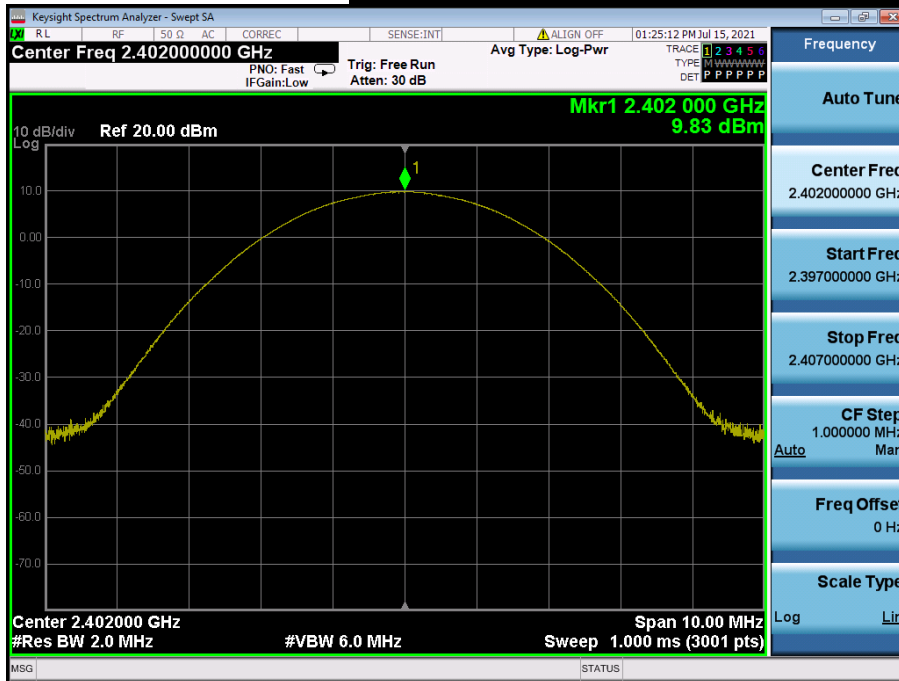
Peak Output Power

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



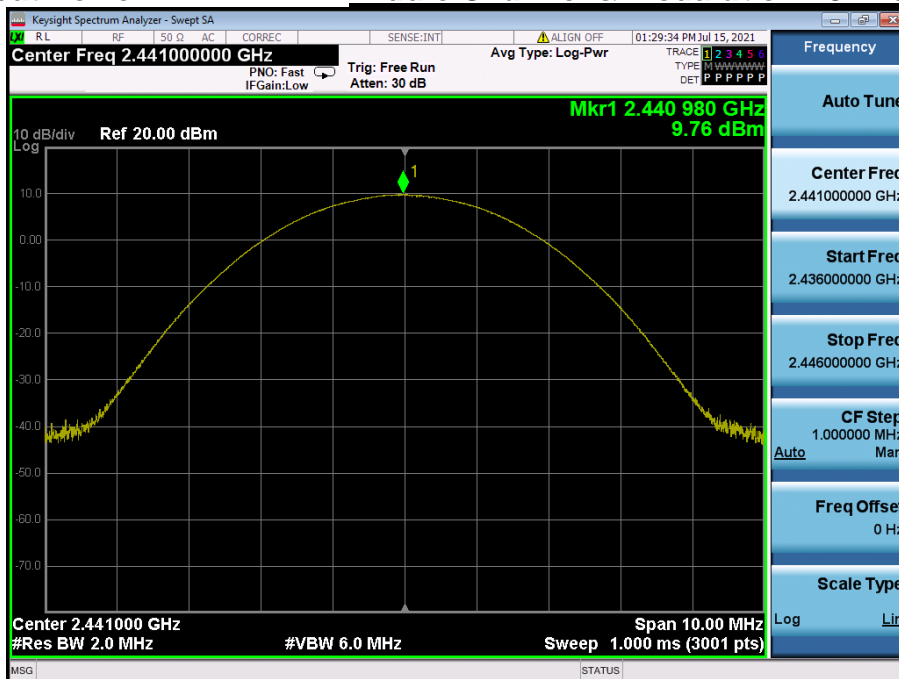
Peak Output Power

Lowest Channel & Modulation : 8DPSK



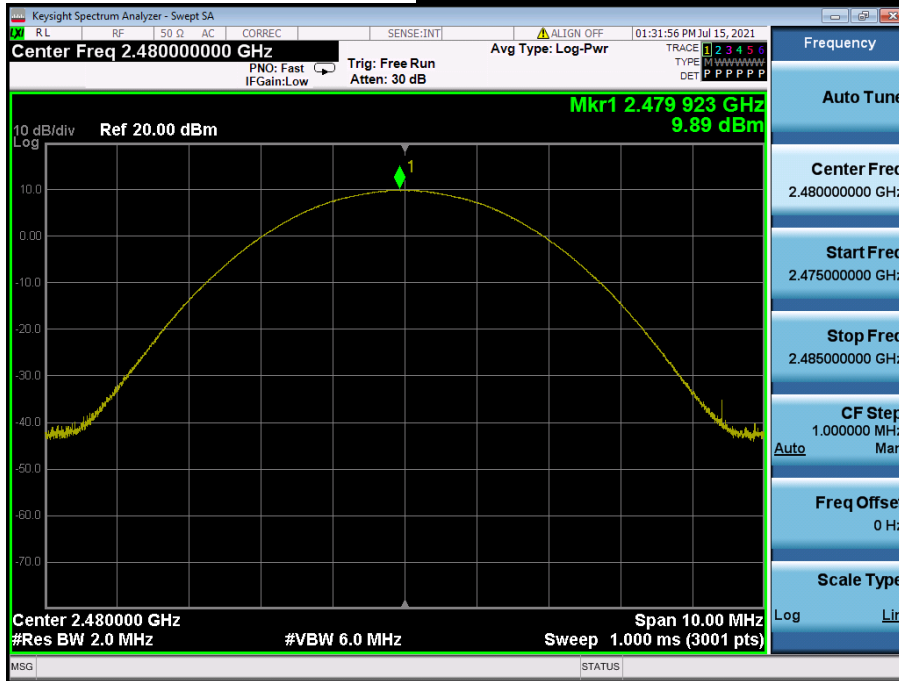
Peak Output Power

Middle Channel & Modulation : 8DPSK



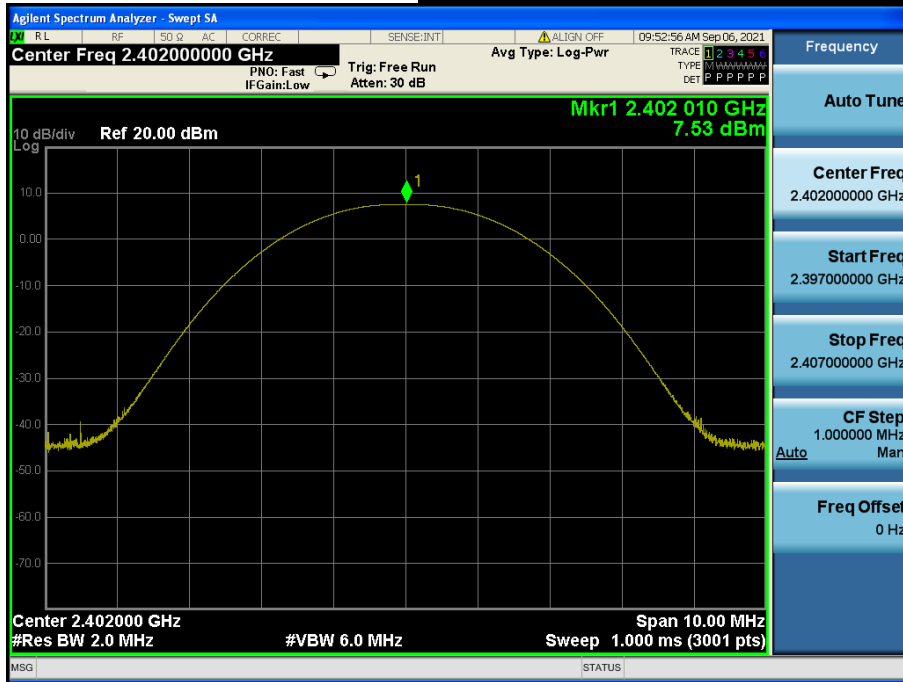
Peak Output Power

Highest Channel & Modulation : 8DPSK



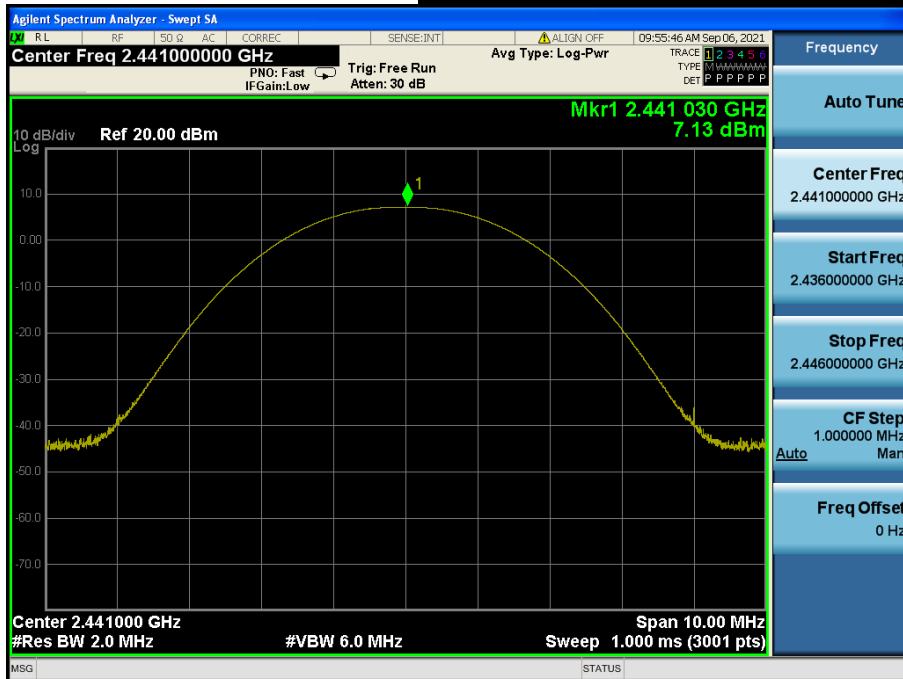
- Power Supply: 12 V
Peak Output Power

Lowest Channel & Modulation : GFSK



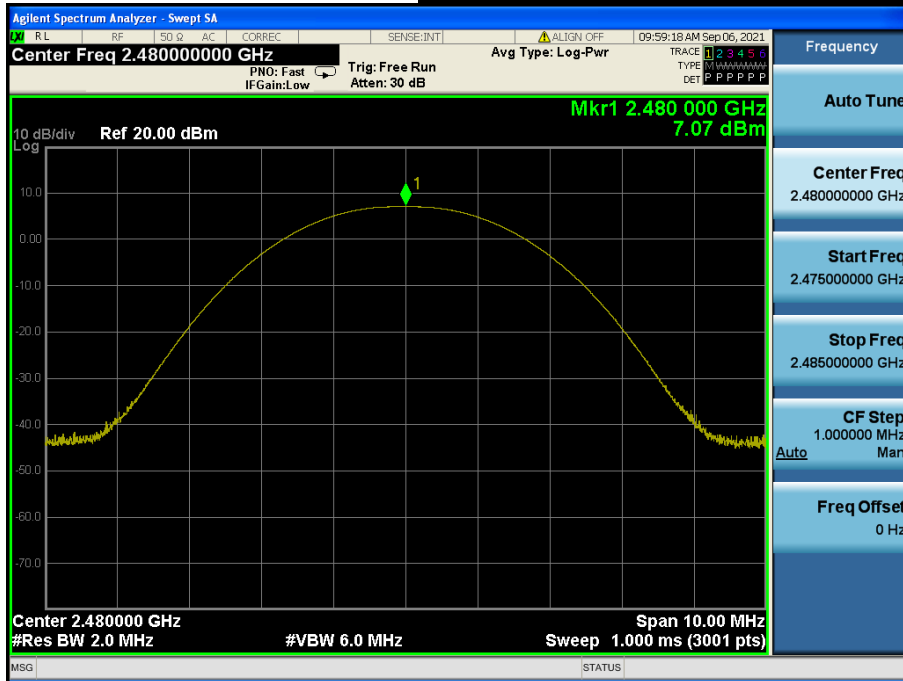
Peak Output Power

Middle Channel & Modulation : GFSK



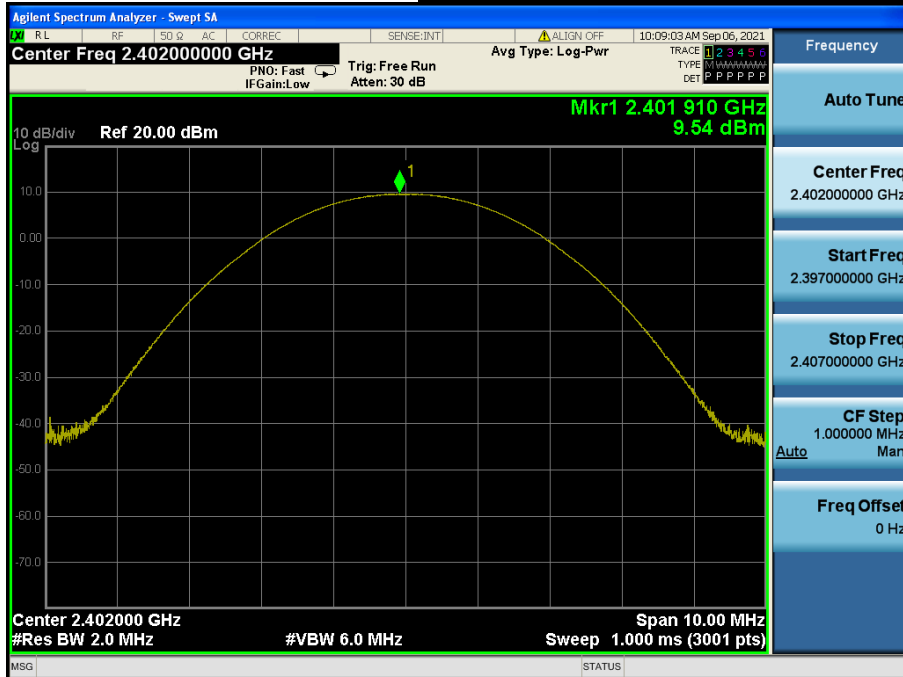
Peak Output Power

Highest Channel & Modulation : GFSK



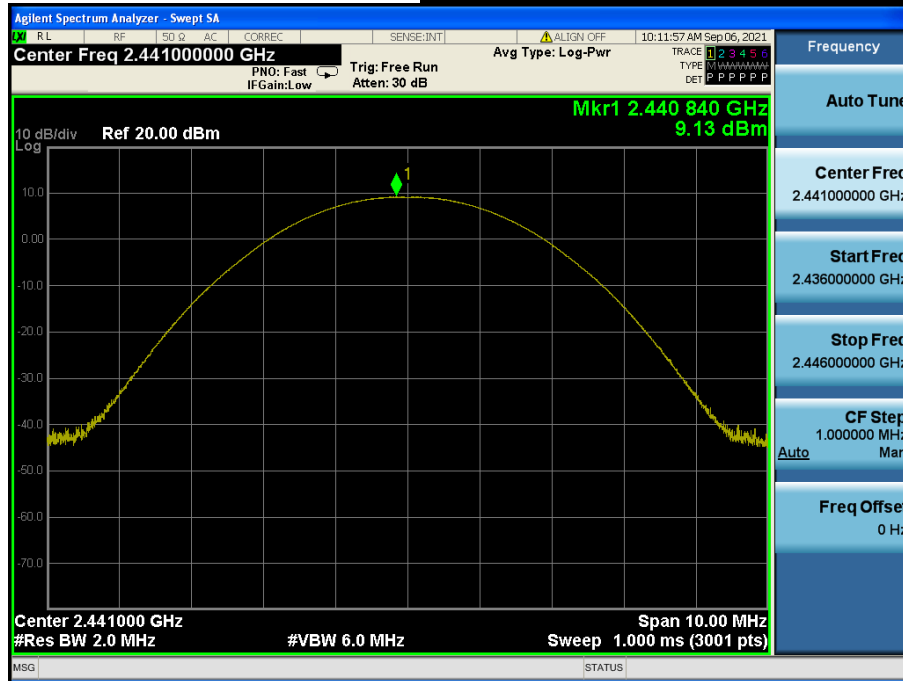
Peak Output Power

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



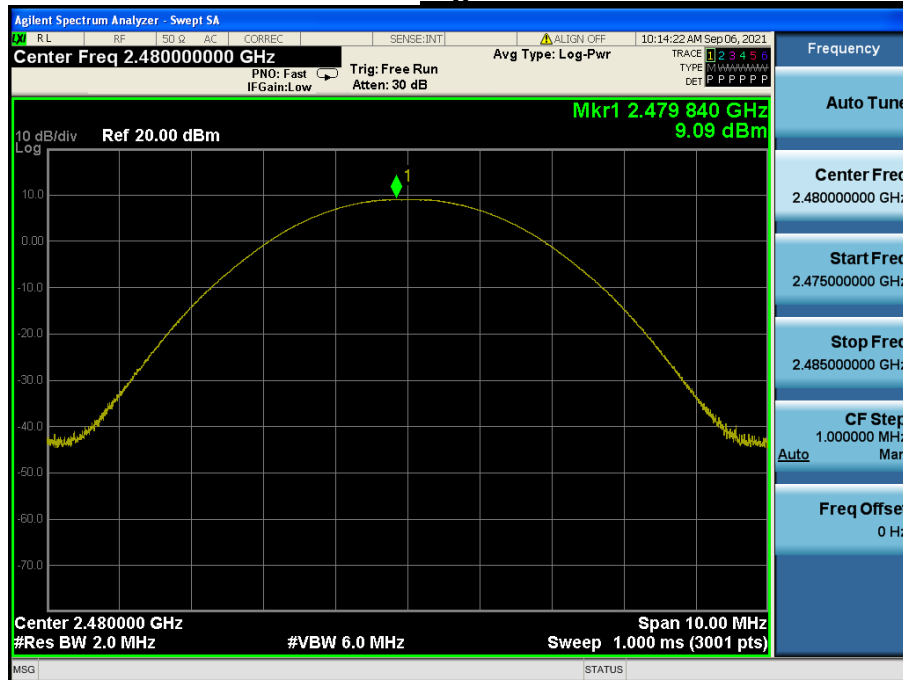
Peak Output Power

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



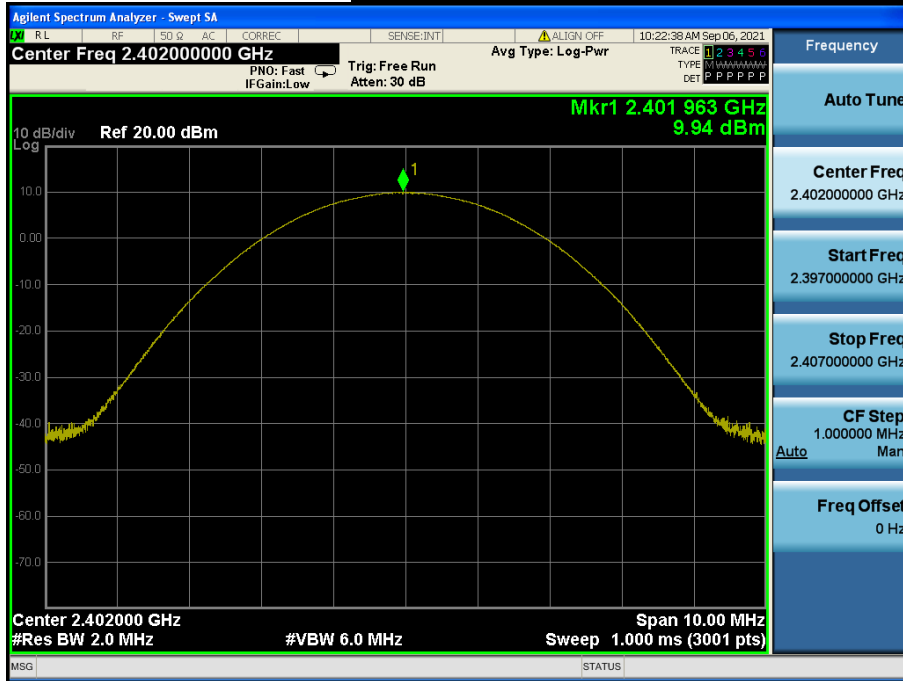
Peak Output Power

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



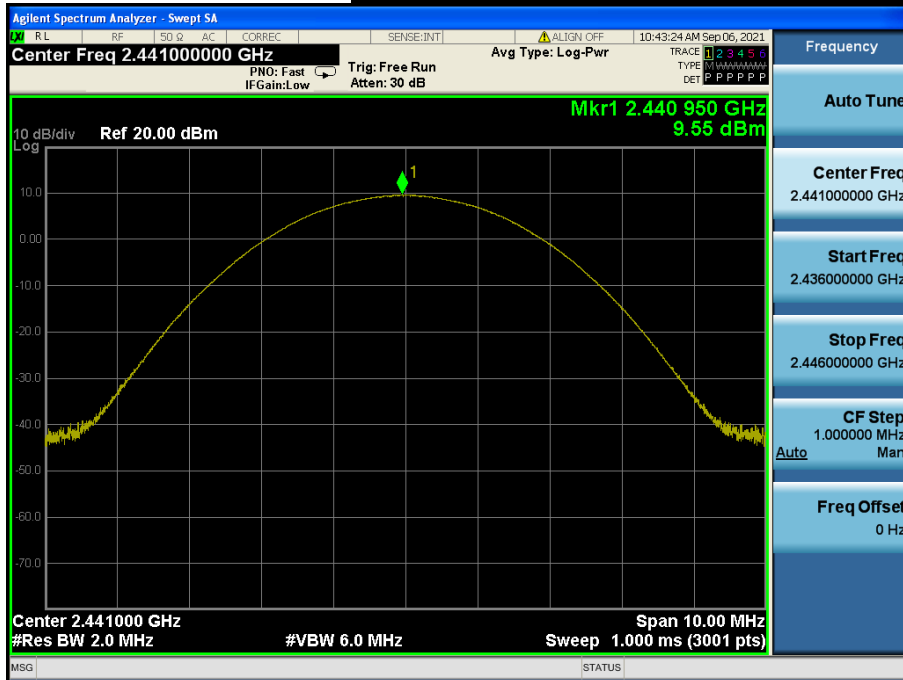
Peak Output Power

Lowest Channel & Modulation : 8DPSK



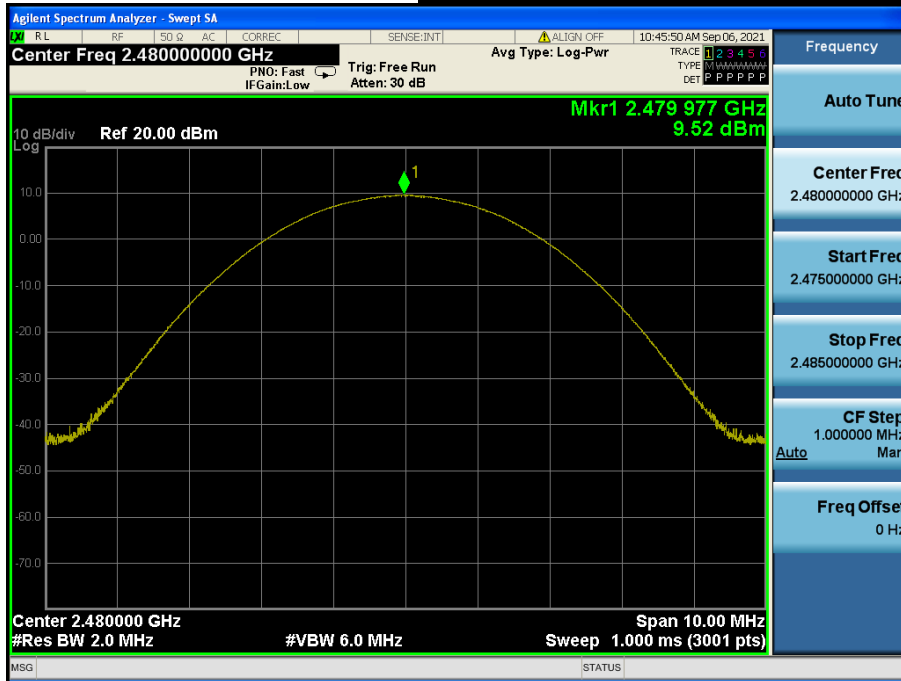
Peak Output Power

Middle Channel & Modulation : 8DPSK



Peak Output Power

Highest Channel & Modulation : 8DPSK



5. 20 dB BW & Occupied BW

5.1. Test Setup

Refer to the APPENDIX I.

5.2. Limit

Limit : Not Applicable

5.3. Test Procedure

- The 20 dB bandwidth was 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.
- The bandwidth of the fundamental frequency was measured with the spectrum analyzer using below setting:
 RBW = 1 % to 5 % of the 20 dB BW & Occupied BW
 VBW $\geq 3 \times$ RBW
 Span = between two times and five times the 20 dB bandwidth & Occupied BW
 Sweep = auto
 Detector function = peak
 Trace = max hold

5.4. Test Results

- Power Supply: 24 V

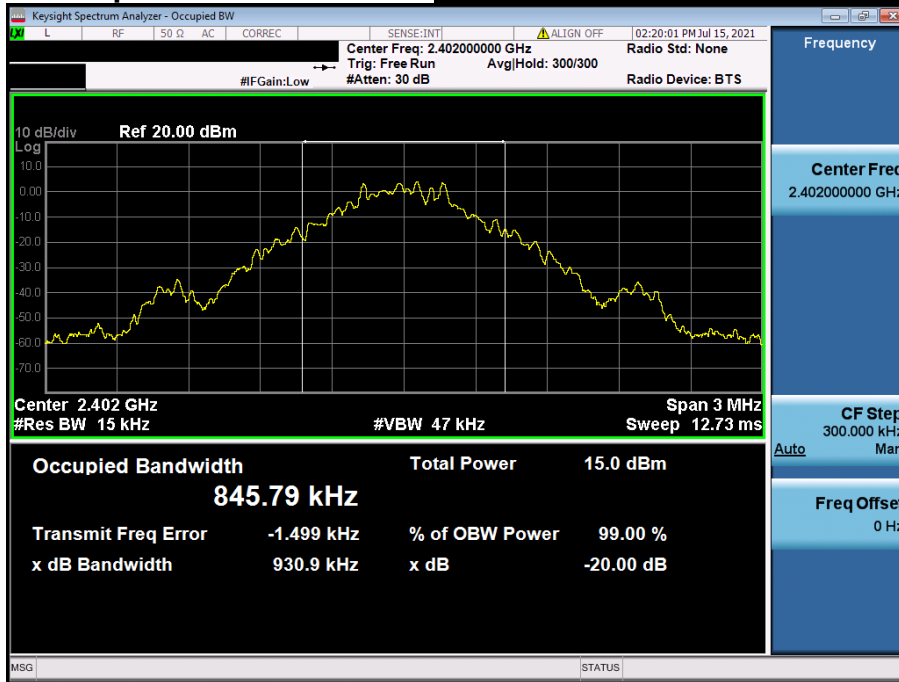
Modulation	Tested Channel	20 dB BW (MHz)	Occupied BW (MHz)
<u>GFSK</u>	Lowest	0.931	0.846
	Middle	0.928	0.847
	Highest	0.931	0.847
<u>$\pi/4$DQPSK</u>	Lowest	1.314	1.181
	Middle	1.314	1.181
	Highest	1.313	1.183
<u>8DPSK</u>	Lowest	1.267	1.177
	Middle	1.267	1.176
	Highest	1.266	1.174

- Power Supply: 12 V

Modulation	Tested Channel	20 dB BW (MHz)	Occupied BW (MHz)
<u>GFSK</u>	Lowest	0.932	0.847
	Middle	0.931	0.856
	Highest	0.932	0.854
<u>$\pi/4$DQPSK</u>	Lowest	1.314	1.183
	Middle	1.314	1.183
	Highest	1.313	1.181
<u>8DPSK</u>	Lowest	1.266	1.178
	Middle	1.267	1.175
	Highest	1.266	1.176

- Power Supply: 24 V
20 dB BW & Occupied BW

Lowest Channel & Modulation : GFSK



20 dB BW & Occupied BW

Middle Channel & Modulation : GFSK



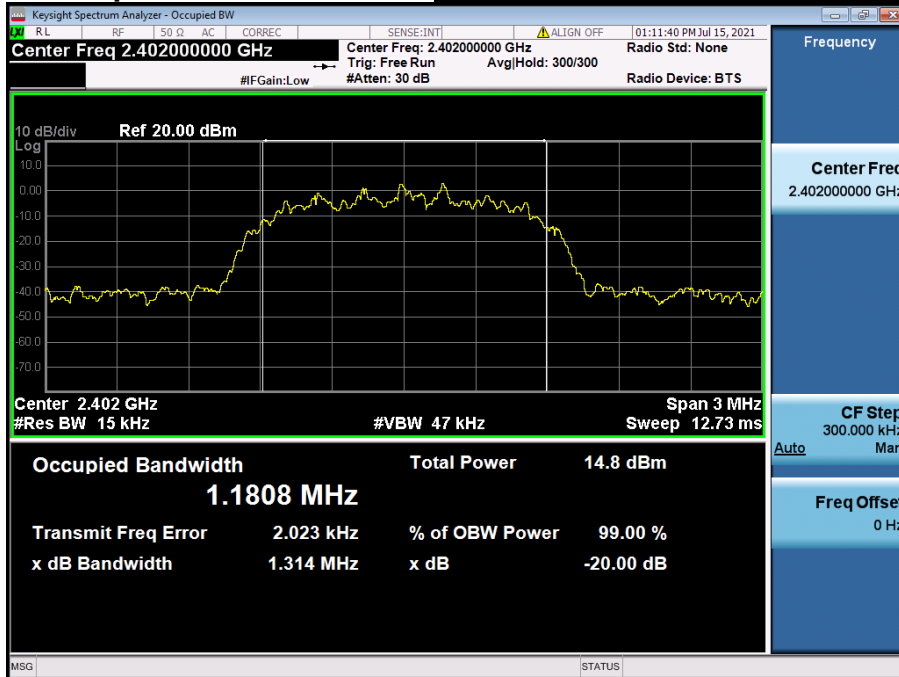
20 dB BW & Occupied BW

Highest Channel & Modulation : GFSK



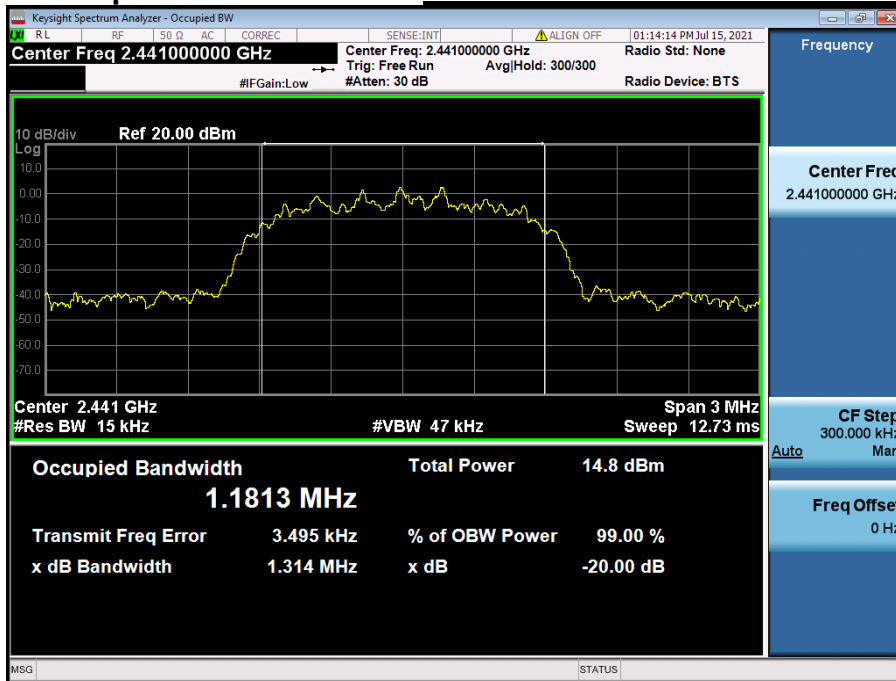
20 dB BW & Occupied BW

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



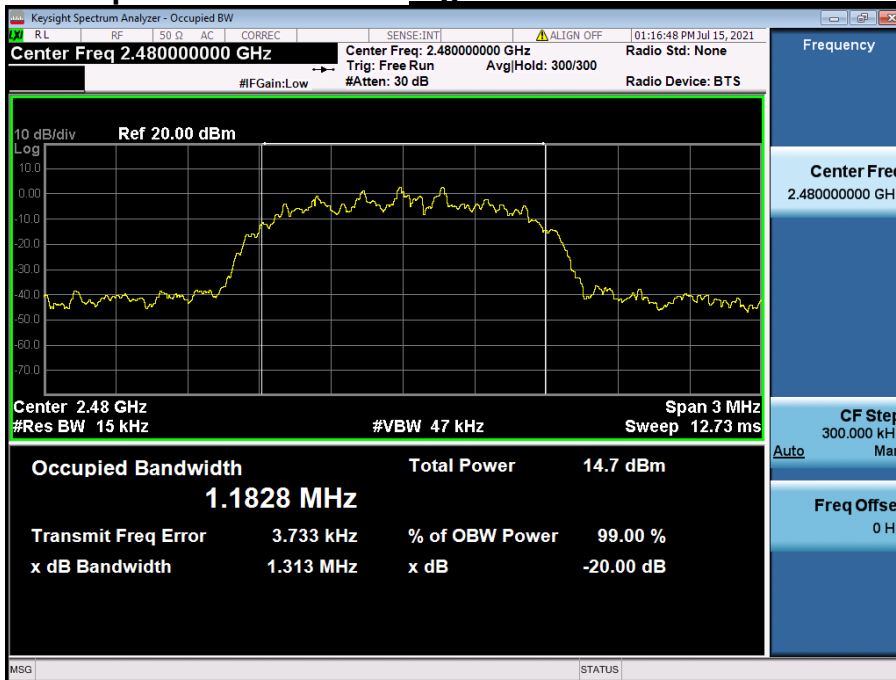
20 dB BW & Occupied BW

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



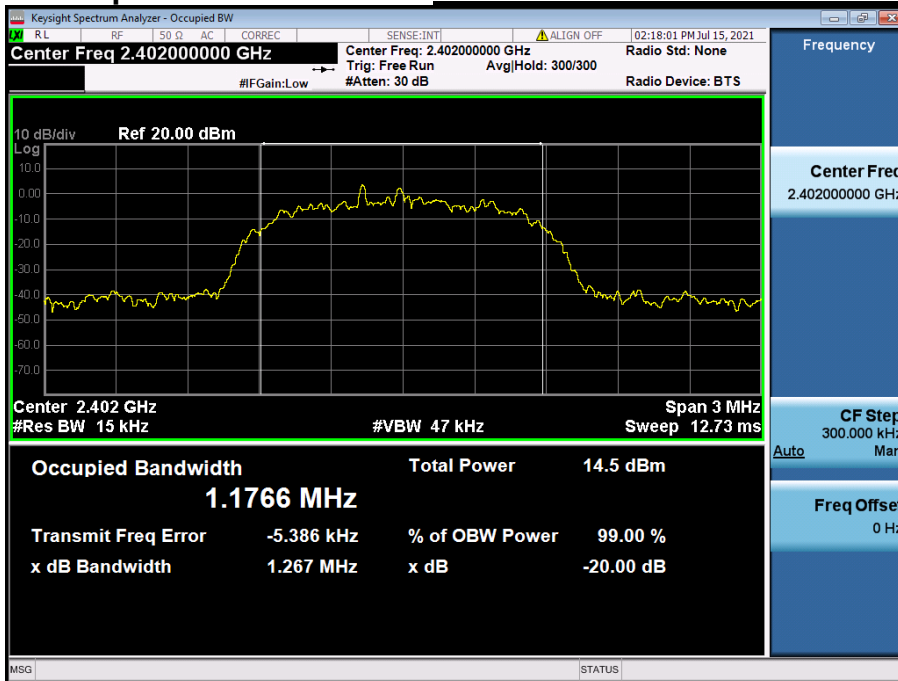
20 dB BW & Occupied BW

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



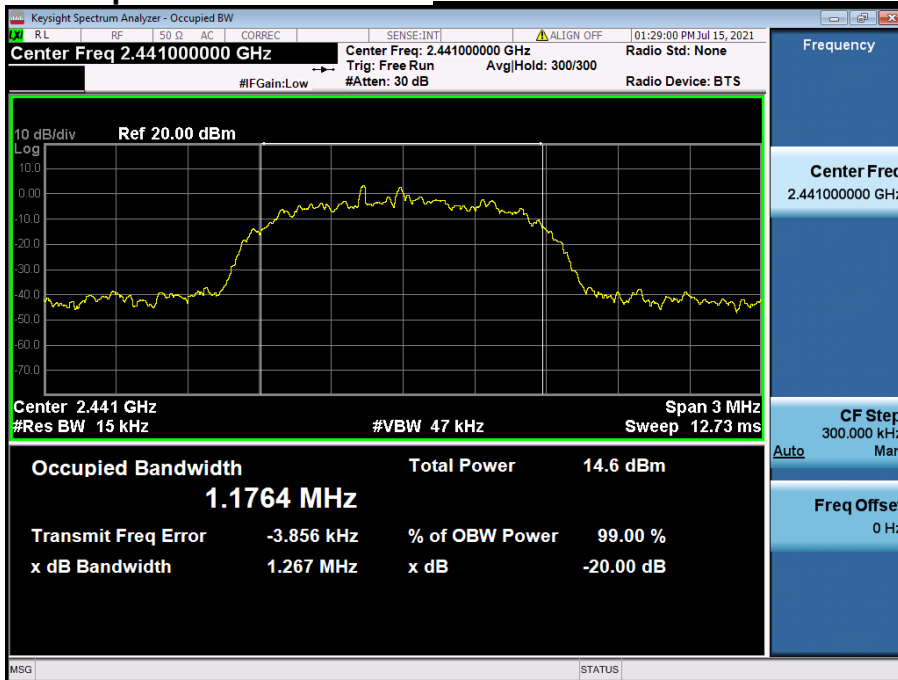
20 dB BW & Occupied BW

Lowest Channel & Modulation : 8DPSK



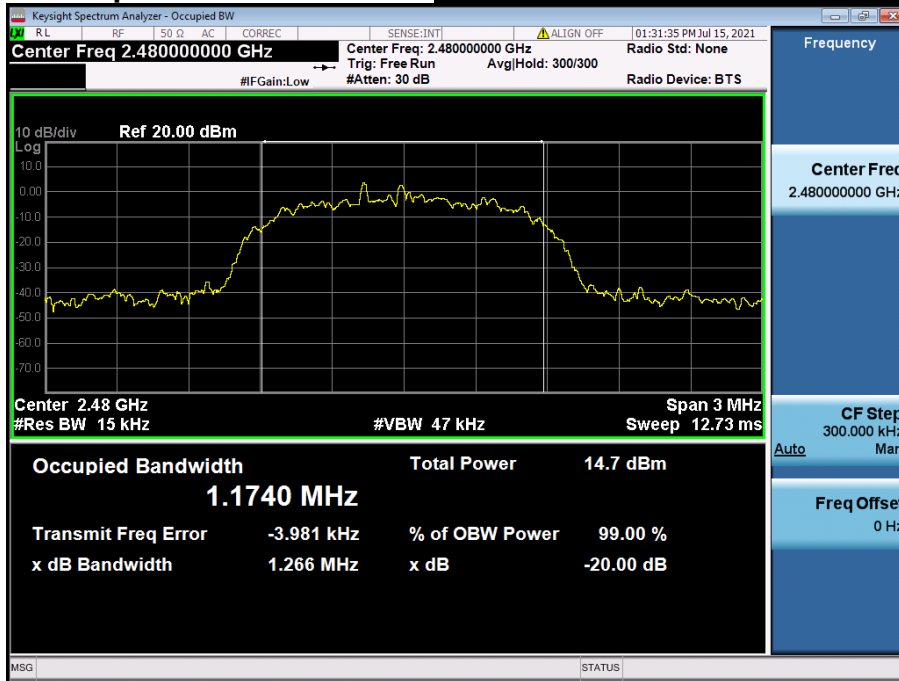
20 dB BW & Occupied BW

Middle Channel & Modulation : 8DPSK



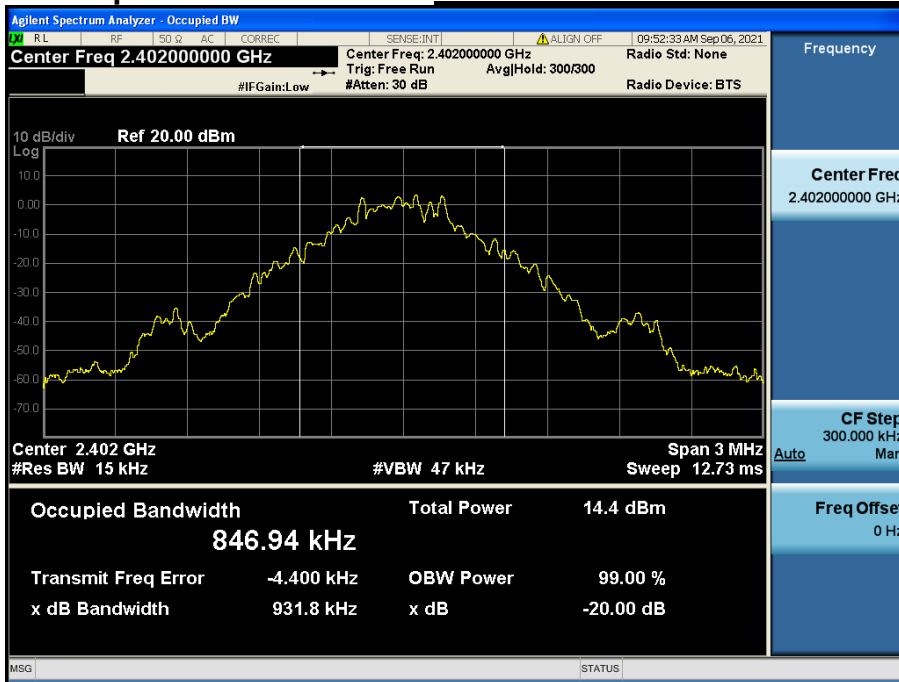
20 dB BW & Occupied BW

Highest Channel & Modulation : 8DPSK



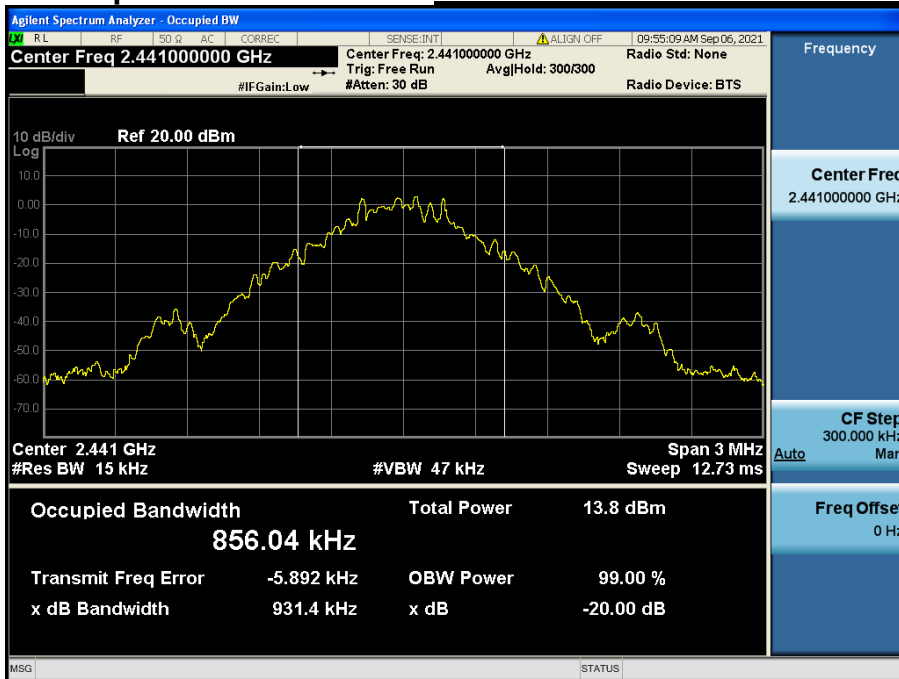
**- Power Supply: 12 V
20 dB BW & Occupied BW**

Lowest Channel & Modulation : GFSK



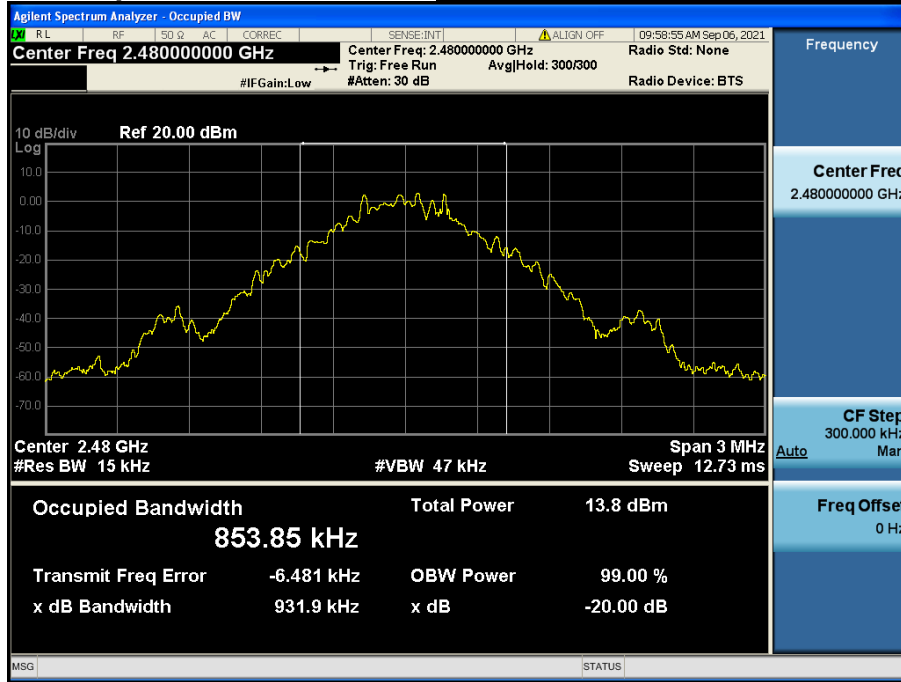
20 dB BW & Occupied BW

Middle Channel & Modulation : GFSK



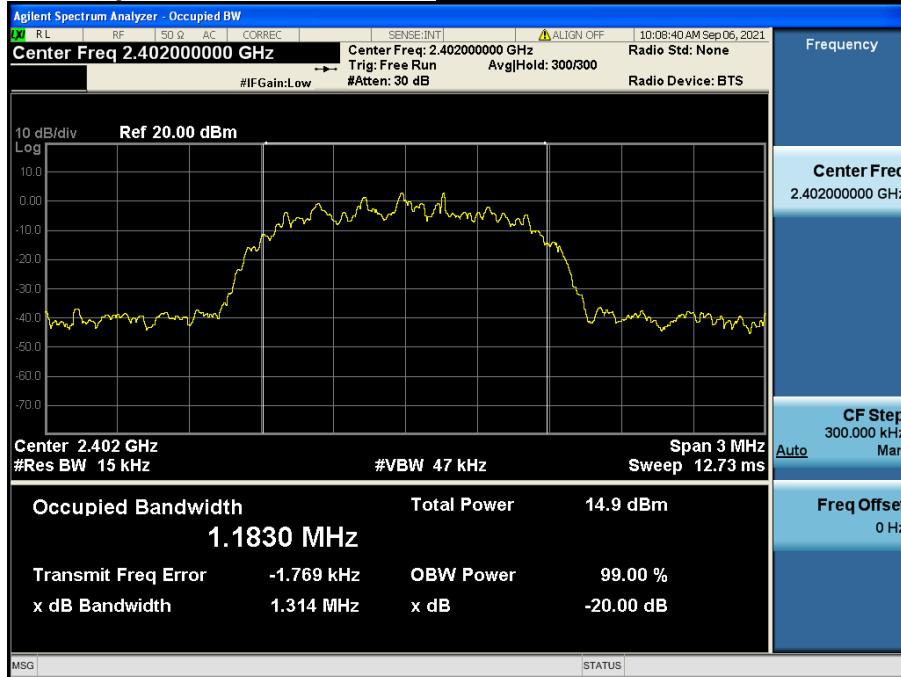
20 dB BW & Occupied BW

Highest Channel & Modulation : GFSK



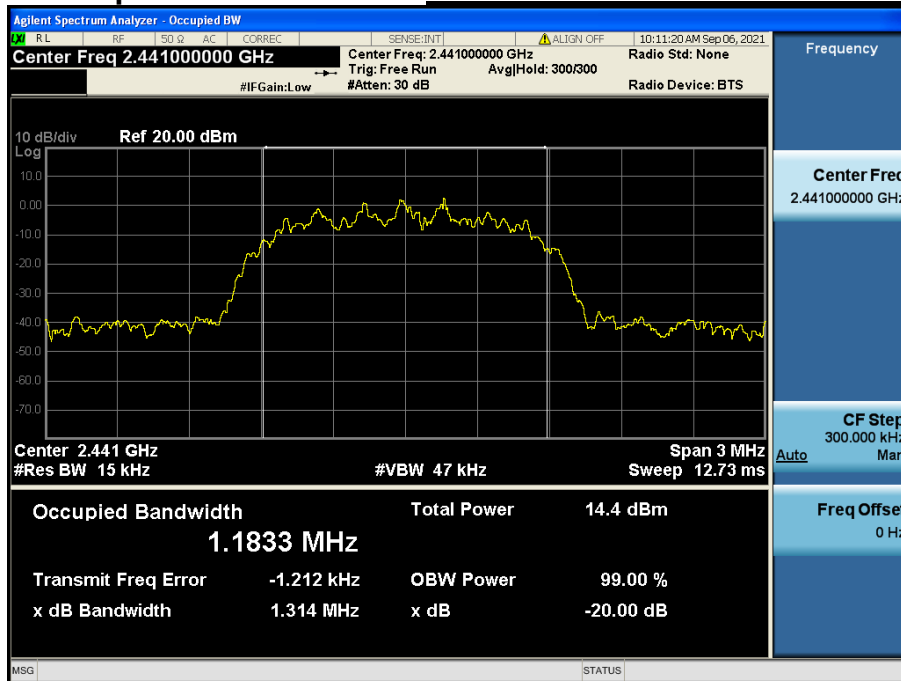
20 dB BW & Occupied BW

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



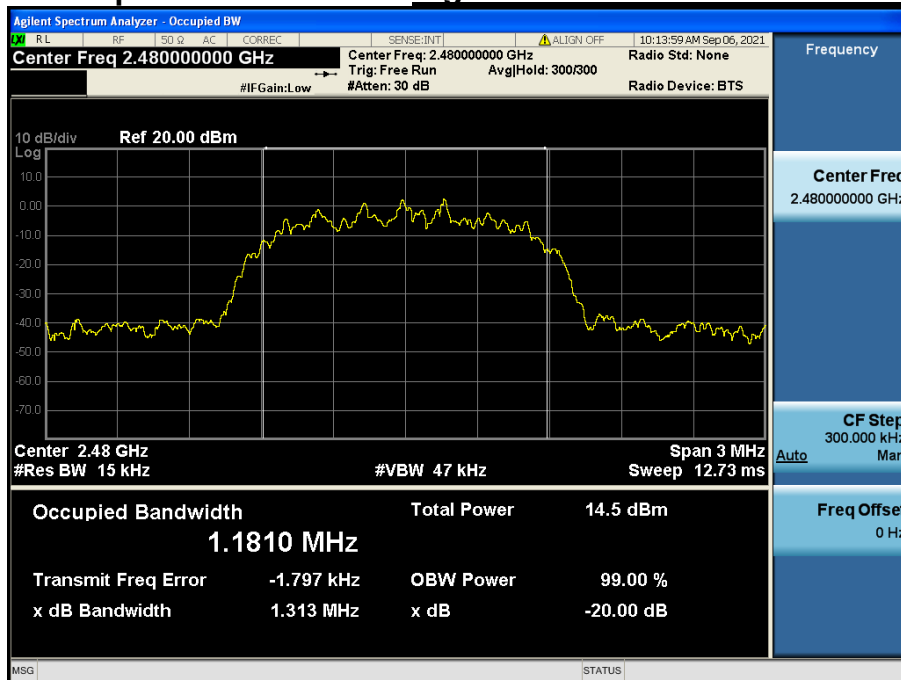
20 dB BW & Occupied BW

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



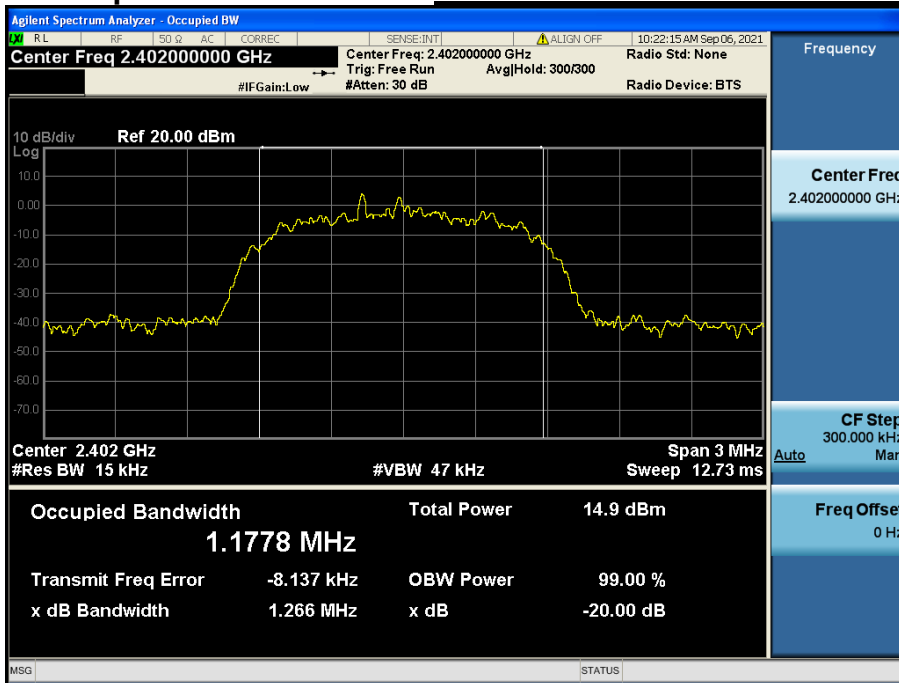
20 dB BW & Occupied BW

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



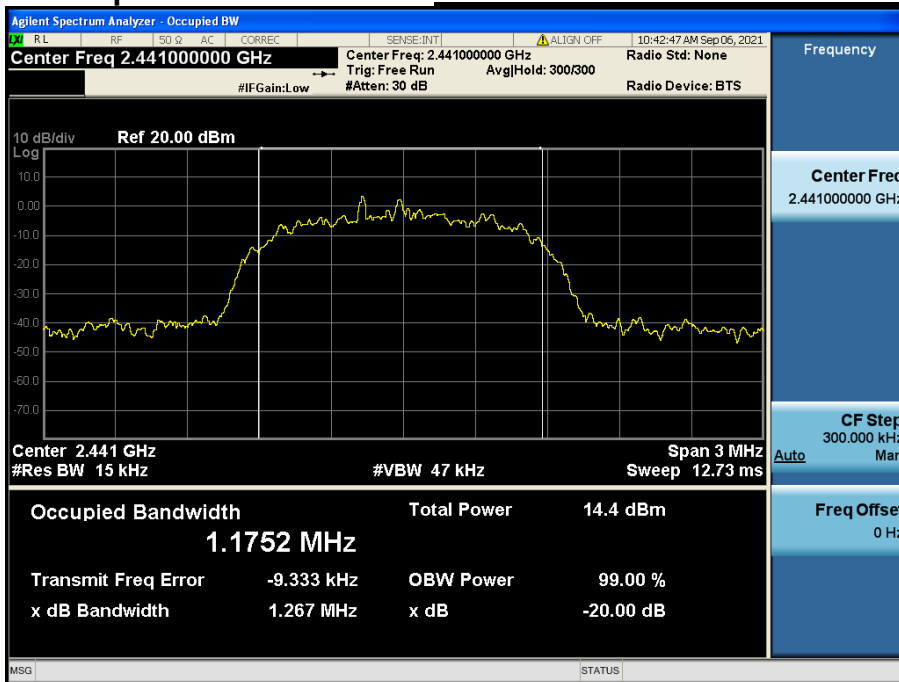
20 dB BW & Occupied BW

Lowest Channel & Modulation : 8DPSK



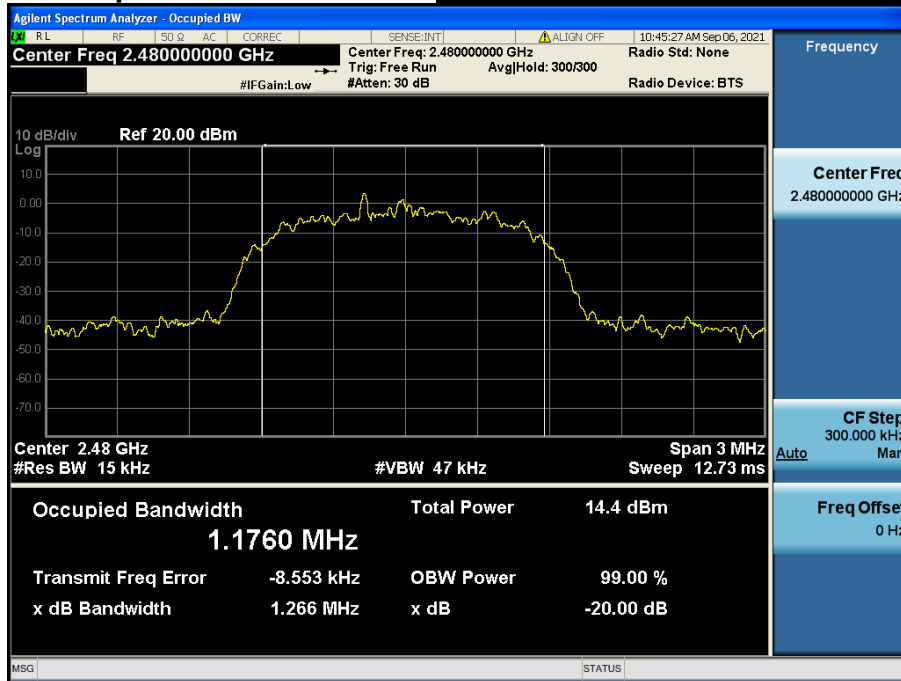
20 dB BW & Occupied BW

Middle Channel & Modulation : 8DPSK



20 dB BW & Occupied BW

Highest Channel & Modulation : 8DPSK



6. Carrier Frequency Separation

6.1. Test Setup

Refer to the APPENDIX I.

6.2. Limit

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

6.3. Test 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

6.4. Test Results

- Power Supply: 24 V

FH mode

Hopping Mode	Modulation	Peak of reference channel(MHz)	Peak of adjacent Channel(MHz)	Test Result (MHz)
Enable	GFSK	2 441.161	2 442.167	1.006
	$\pi/4$ DQPSK	2 441.167	2 442.164	0.997
	8DPSK	2 440.836	2 441.834	0.998

AFH mode

Hopping Mode	Modulation	Peak of reference channel(MHz)	Peak of adjacent Channel(MHz)	Test Result (MHz)
Enable	GFSK	2 441.167	2 442.165	0.998
	$\pi/4$ DQPSK	2 441.165	2 442.164	0.999
	8DPSK	2 440.831	2 441.834	1.003

- Power Supply: 12 V
FH mode

Hopping Mode	Modulation	Peak of reference channel(MHz)	Peak of adjacent Channel(MHz)	Test Result (MHz)
Enable	GFSK	2 441.162	2 442.164	1.002
	$\pi/4$ DQPSK	2 441.161	2 442.167	1.006
	8DPSK	2 440.829	2 441.827	0.998

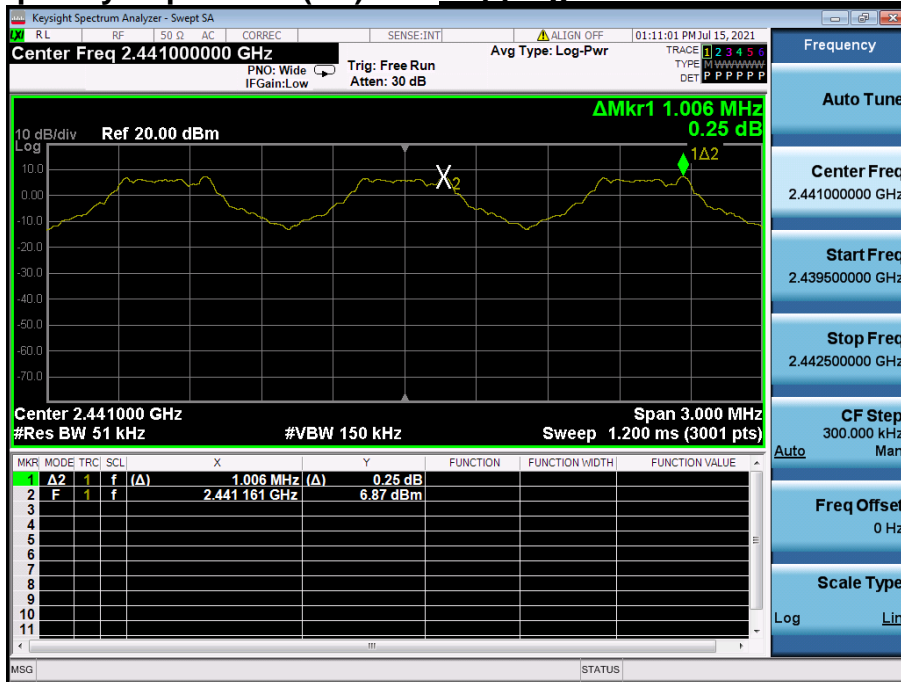
AFH mode

Hopping Mode	Modulation	Peak of reference channel(MHz)	Peak of adjacent Channel(MHz)	Test Result (MHz)
Enable	GFSK	2 441.158	2 442.159	1.001
	$\pi/4$ DQPSK	2 441.163	2 442.166	1.003
	8DPSK	2 440.834	2 441.829	0.995

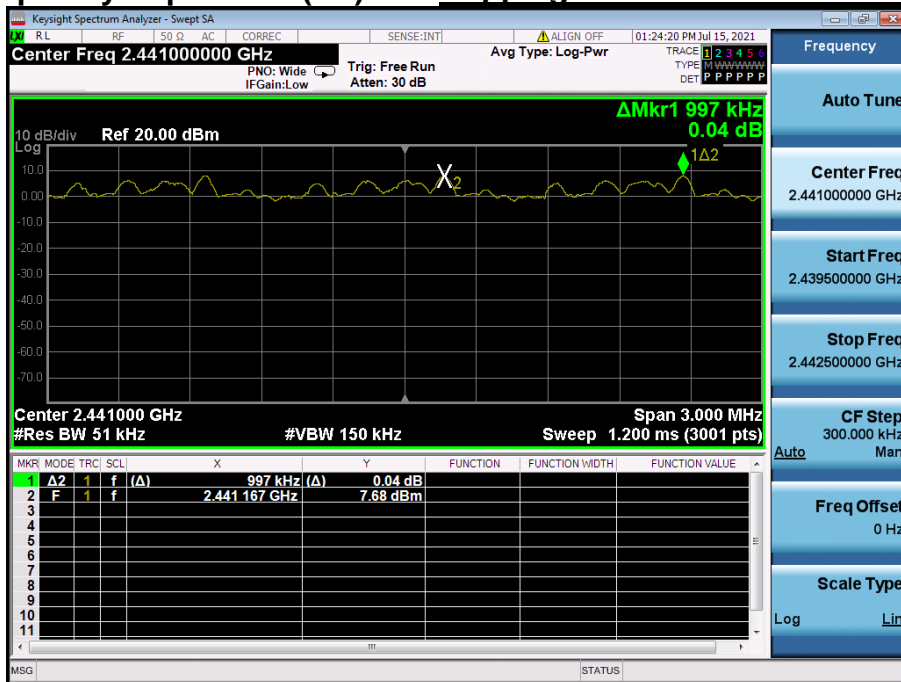
Note 1 : See next pages for actual measured spectrum

- TPower Supply: 24 V

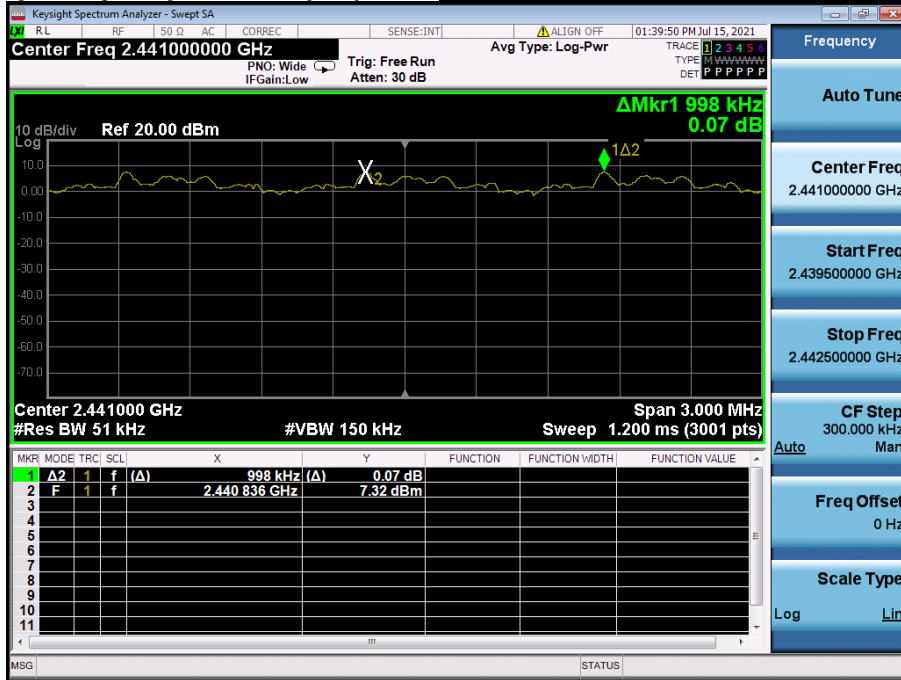
Carrier Frequency Separation (FH) *Hopping mode : Enable&GFSK*



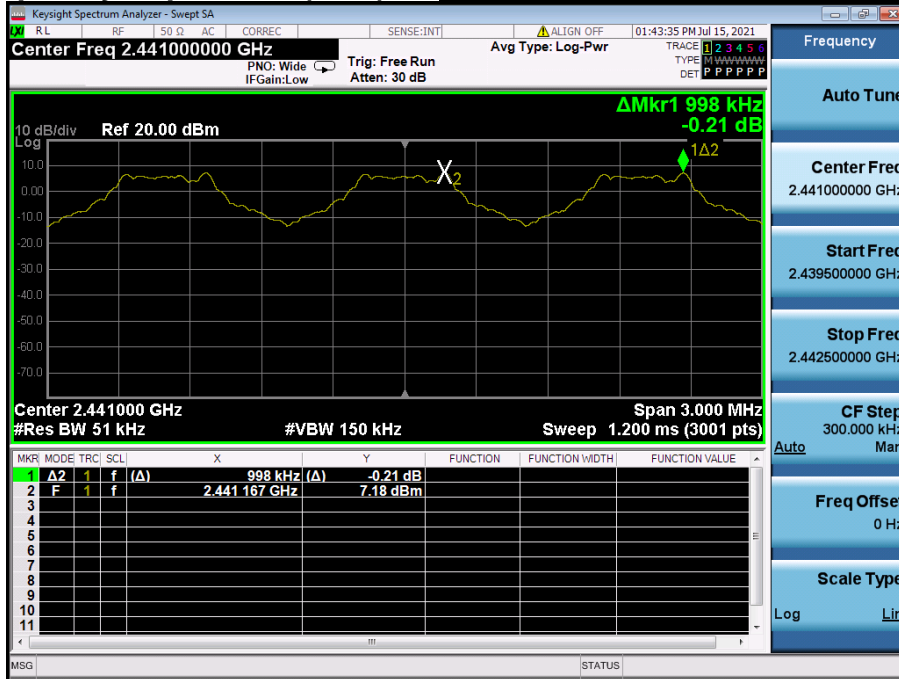
Carrier Frequency Separation (FH) *Hopping mode : Enable&π/4DQPSK*



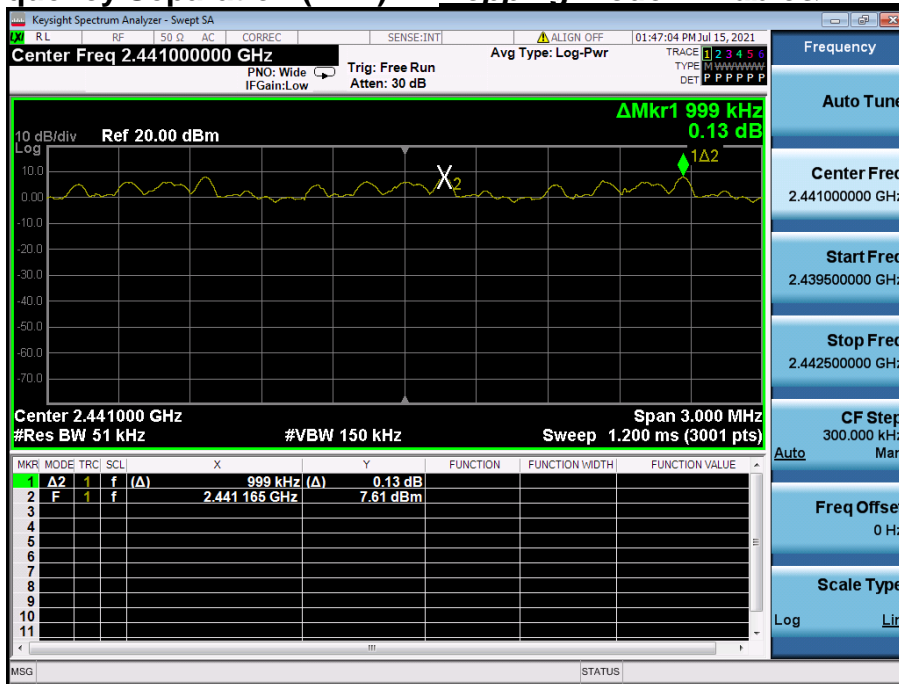
Carrier Frequency Separation (FH) *Hopping mode : Enable&8DPSK*



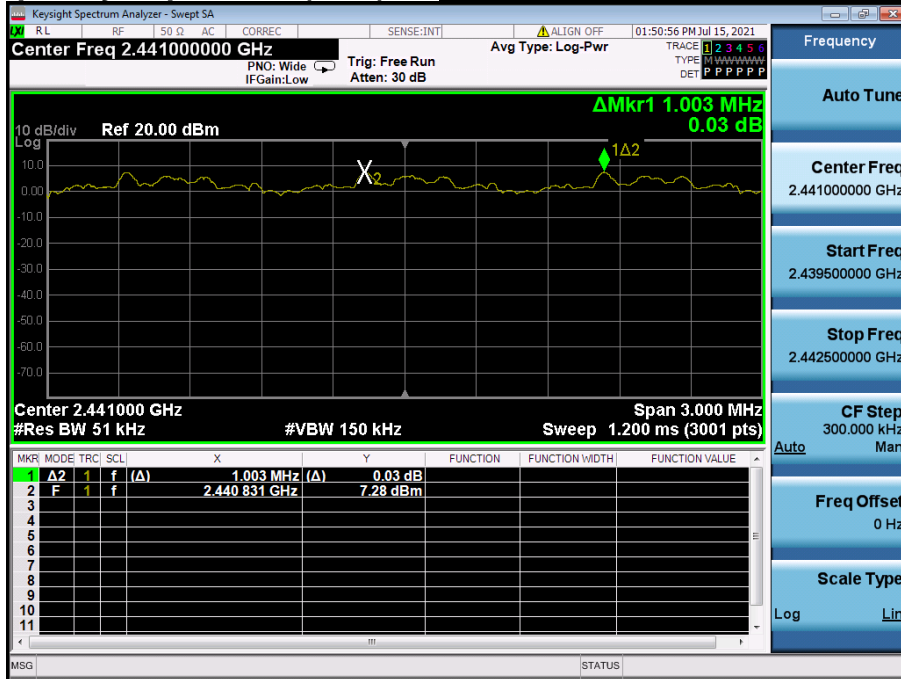
Carrier Frequency Separation (AFH) *Hopping mode : Enable&GFSK*



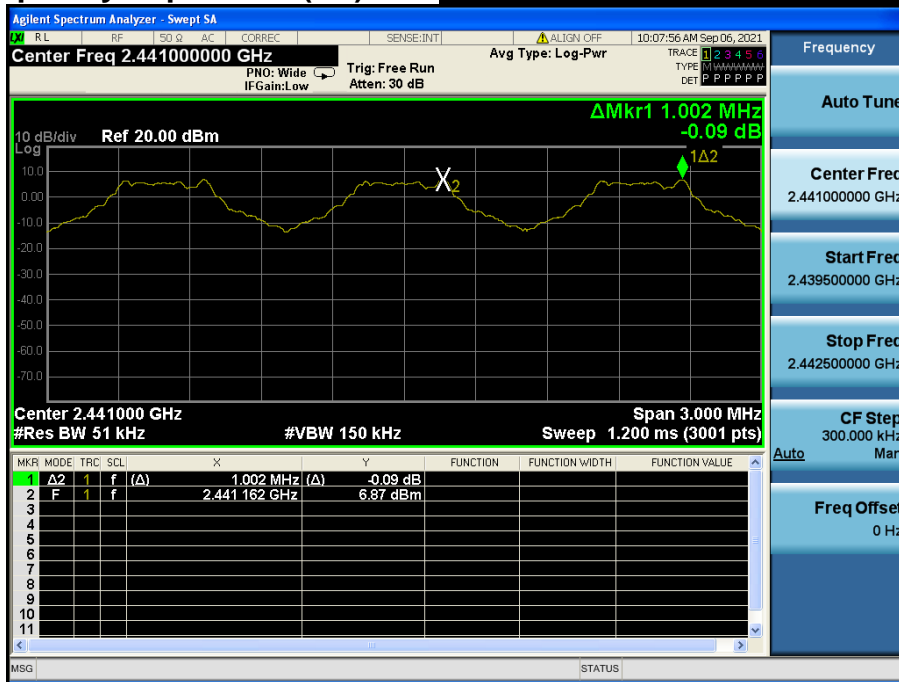
Carrier Frequency Separation (AFH) *Hopping mode : Enable& π /4DQPSK*



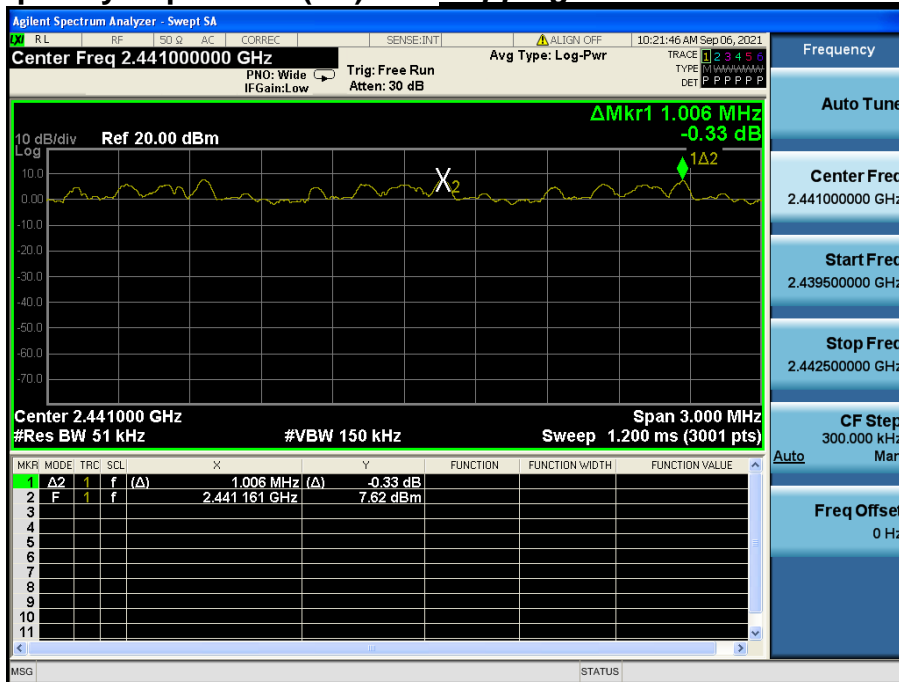
Carrier Frequency Separation (AFH) *Hopping mode : Enable&8DPSK*



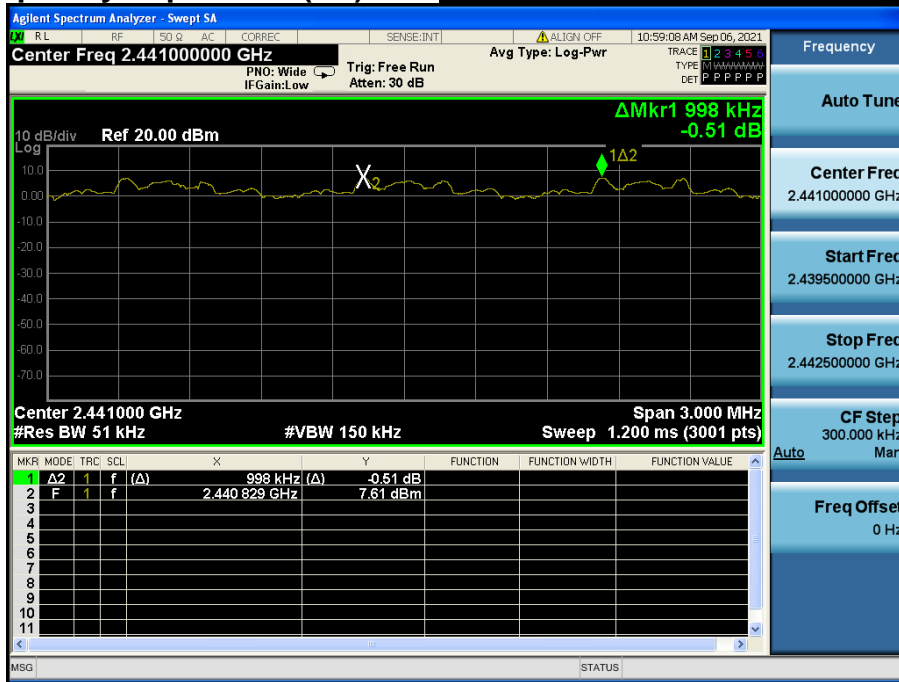
- Power Supply: 12 V
Carrier Frequency Separation (FH) Hopping mode : Enable&GFSK



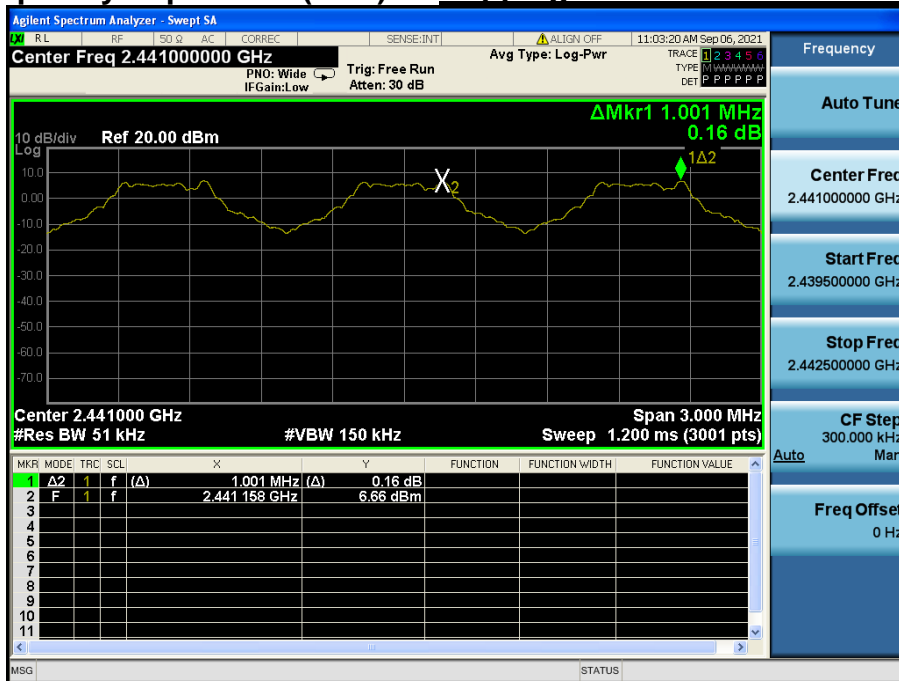
Carrier Frequency Separation (FH) Hopping mode : Enable& π /4DQPSK



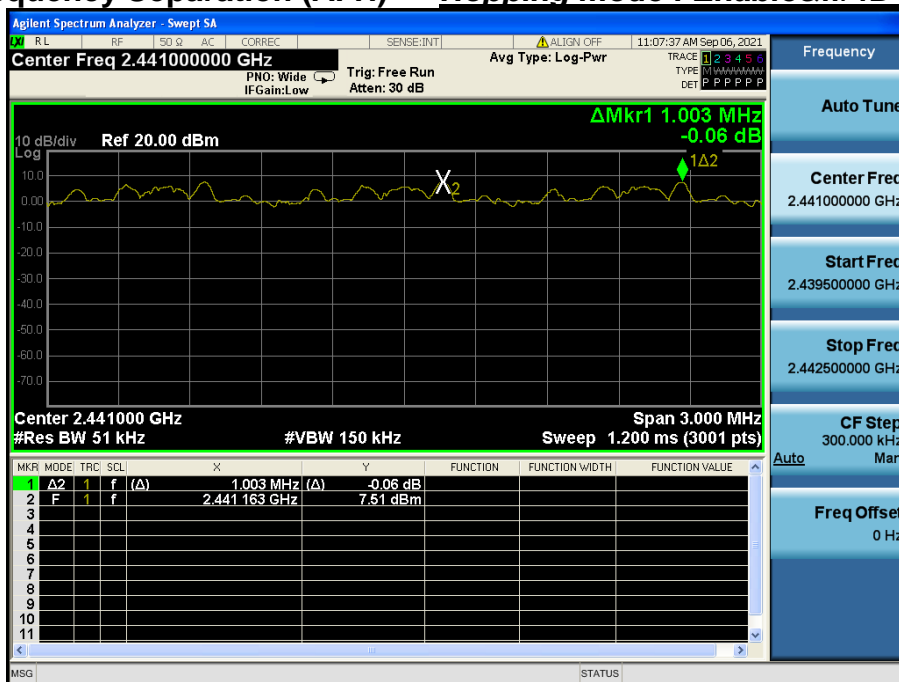
Carrier Frequency Separation (FH) *Hopping mode : Enable&8DPSK*



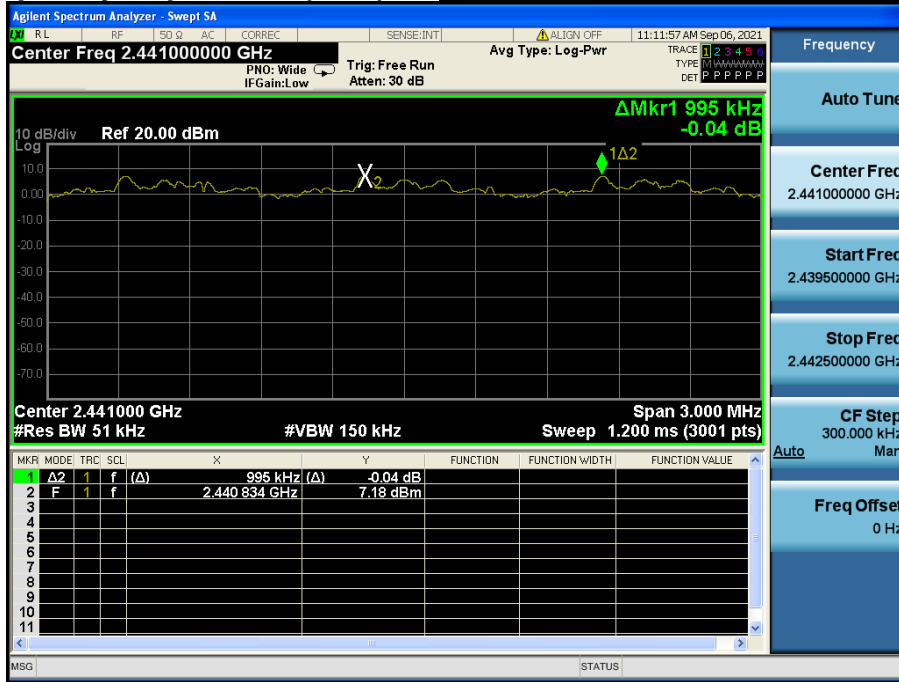
Carrier Frequency Separation (AFH) *Hopping mode : Enable&GFSK*



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



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



7. Number of Hopping Channels

7.1. Test Setup

Refer to the APPENDIX I.

7.2. Limit

Limit : ≥ 15 hops

7.3. Test 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 2 400 MHz ~ 2 483.5 MHz were examined.

The spectrum analyzer is set to :

Span for FH mode = 50 MHz Start Frequency = 2 391.5 MHz, Stop Frequency = 2 441.5 MHz

Start Frequency = 2 441.5 MHz, Stop Frequency = 2 491.5 MHz

Span for AFH mode = 30 MHz Start Frequency = 2 426.0 MHz, Stop Frequency = 2 456.0 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

7.4. Test Results

- Power Supply: 24 V

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

- Power Supply: 12 V
FH mode

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

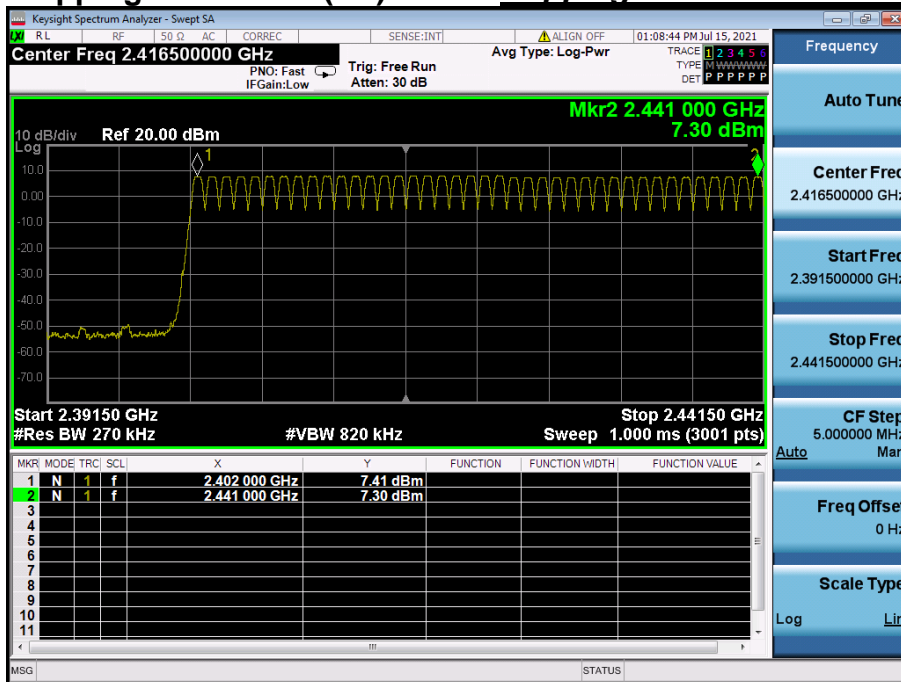
AFH mode

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.

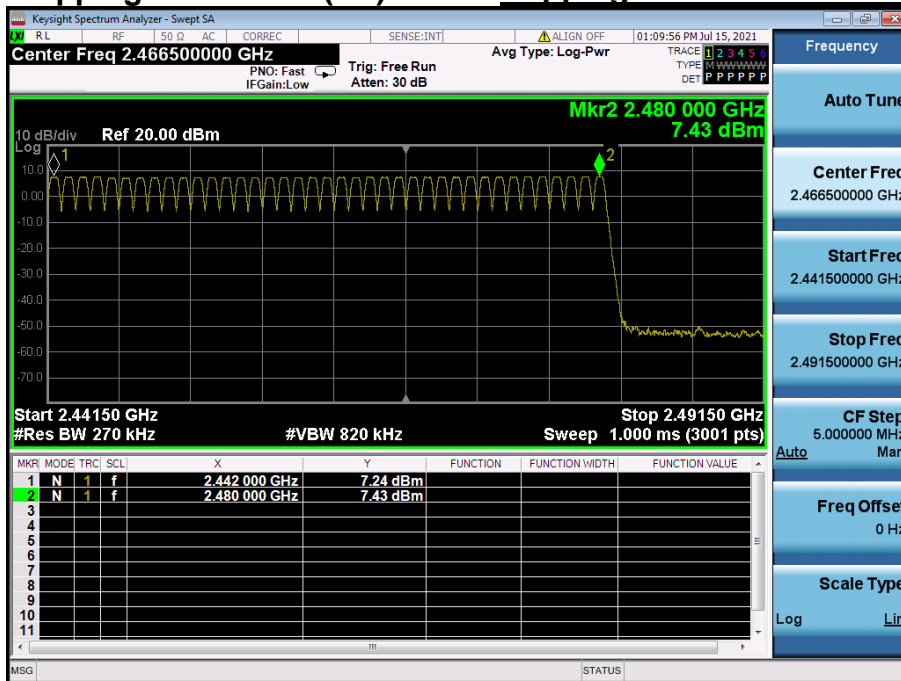
- Power Supply: 24 V
Number of Hopping Channels 1(FH)

Hopping mode : Enable & GFSK



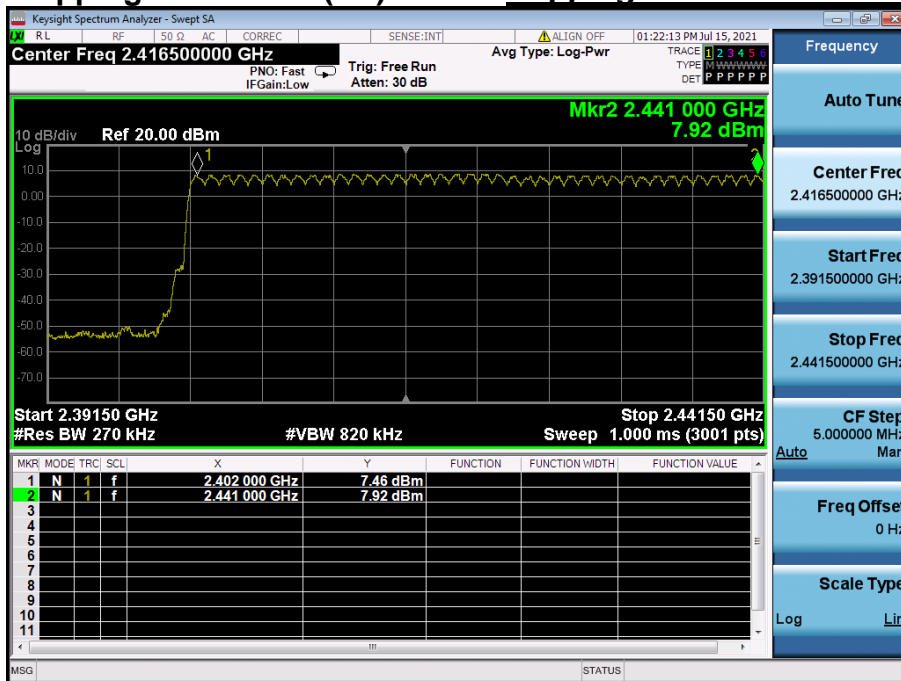
Number of Hopping Channels 2(FH)

Hopping mode : Enable & GFSK



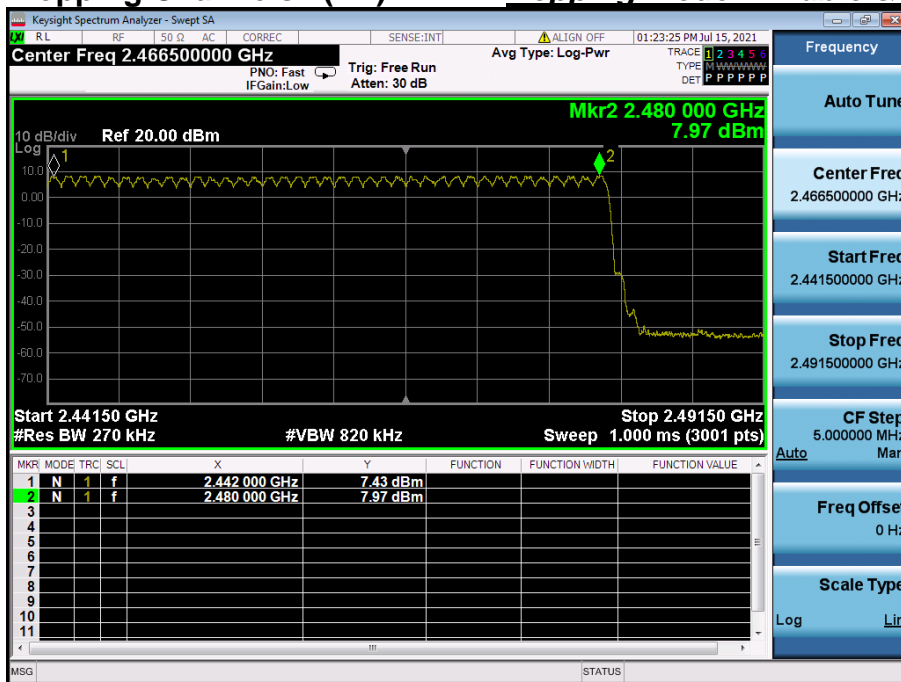
Number of Hopping Channels 1(FH)

Hopping mode : Enable & $\pi/4$ QPSK

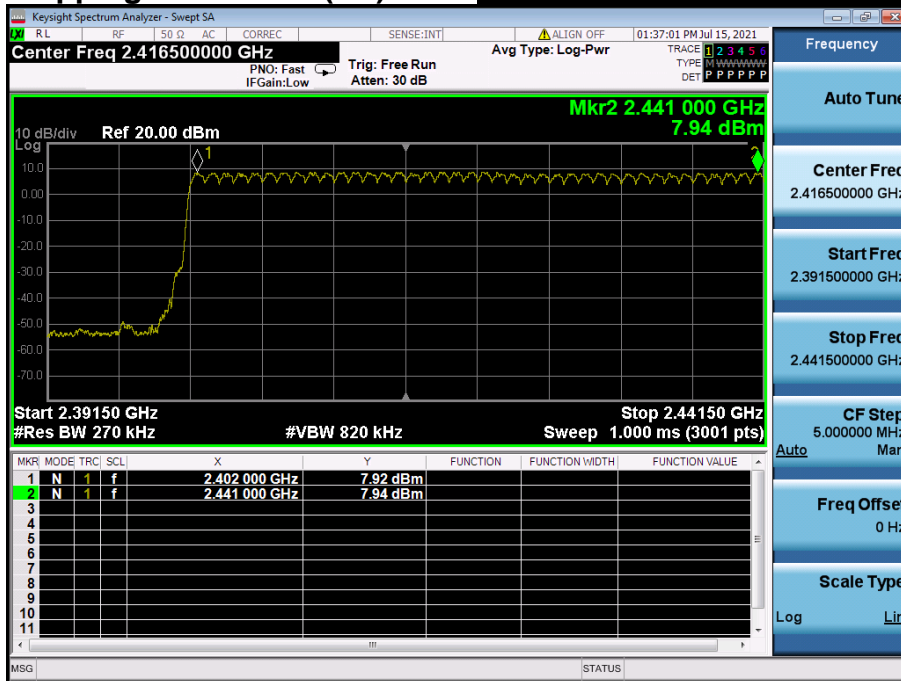


Number of Hopping Channels 2(FH)

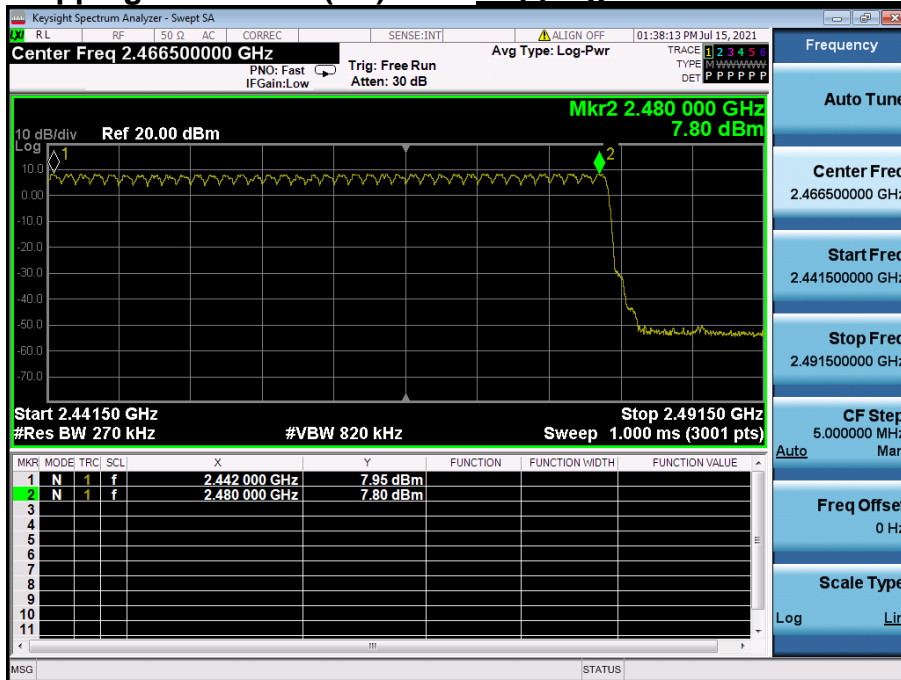
Hopping mode : Enable & $\pi/4$ QPSK



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

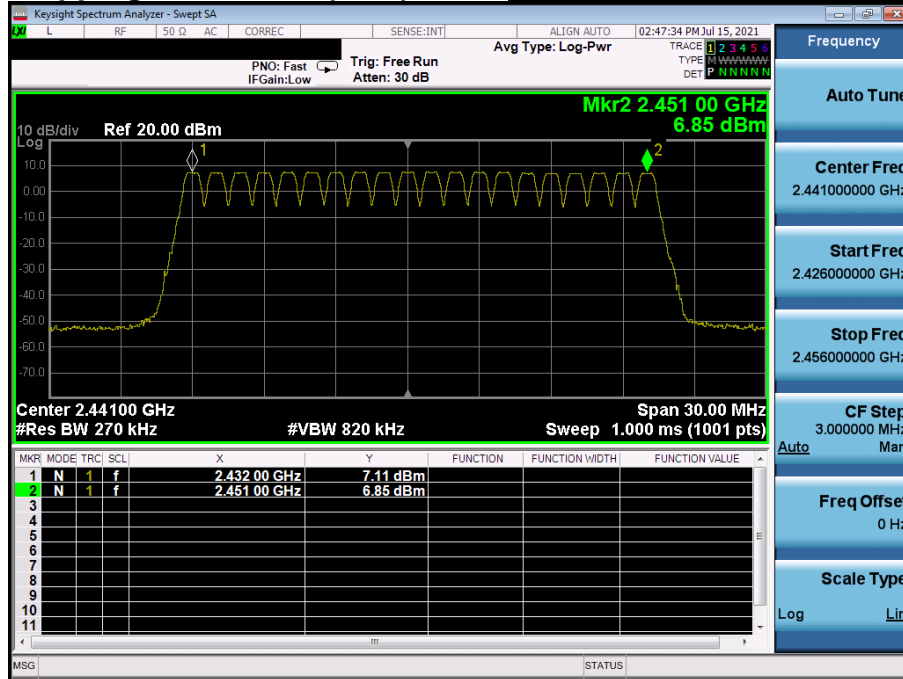


Number of Hopping Channels 2(FH) *Hopping mode : Enable & 8DPSK*



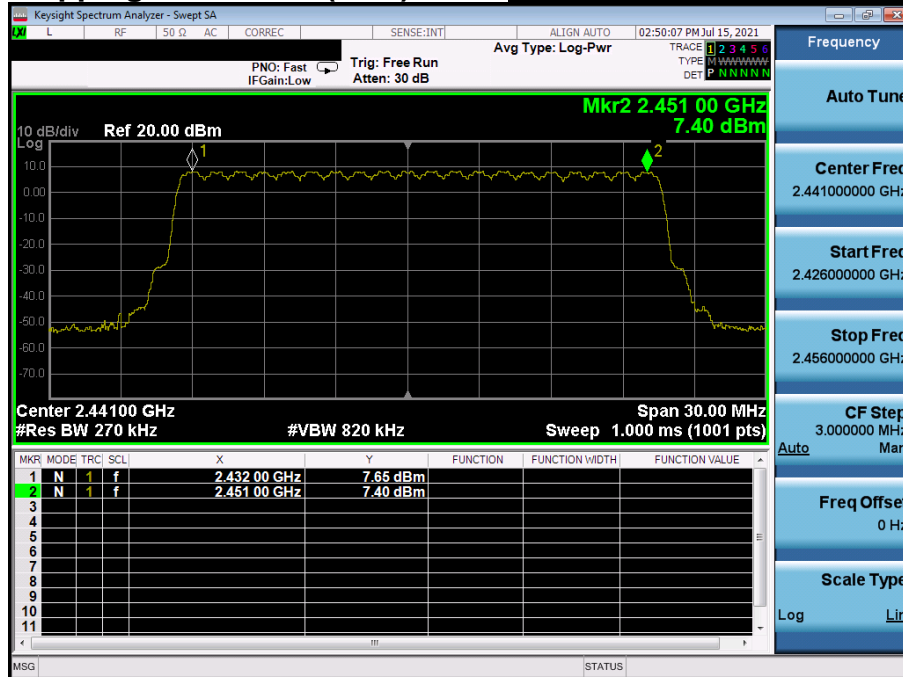
Number of Hopping Channels 1(AFH)

Hopping mode : Enable & GFSK

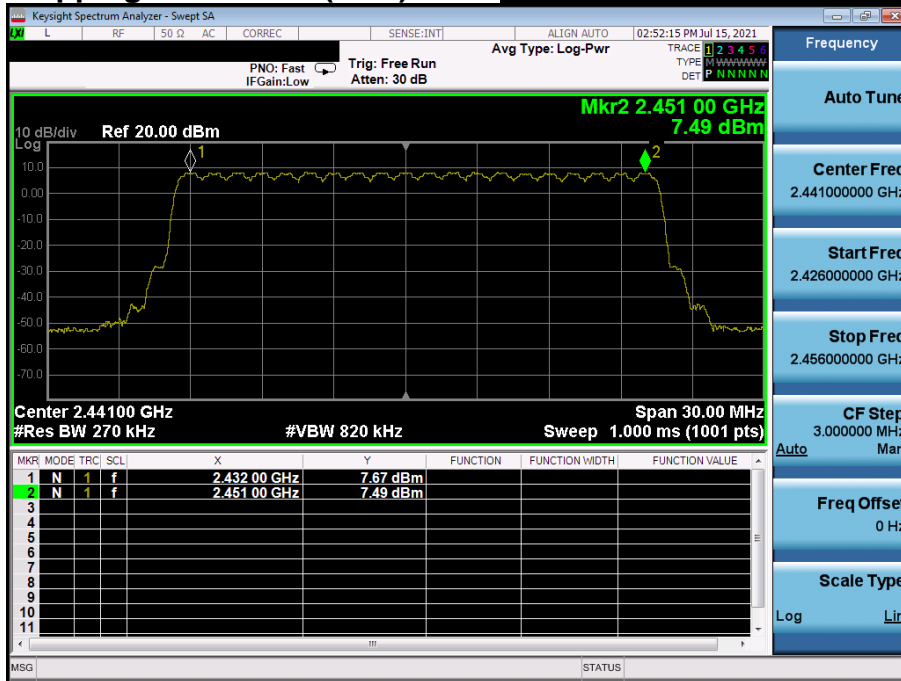


Number of Hopping Channels 1(AFH)

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



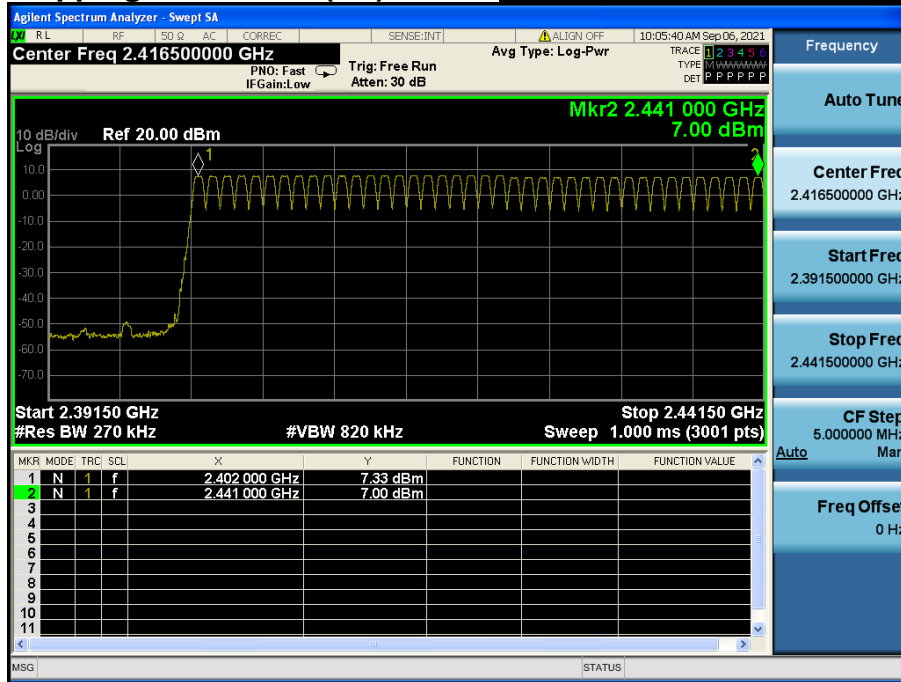
Number of Hopping Channels 1(AFH) *Hopping mode : Enable & 8DPSK*



- Power Supply: 12 V

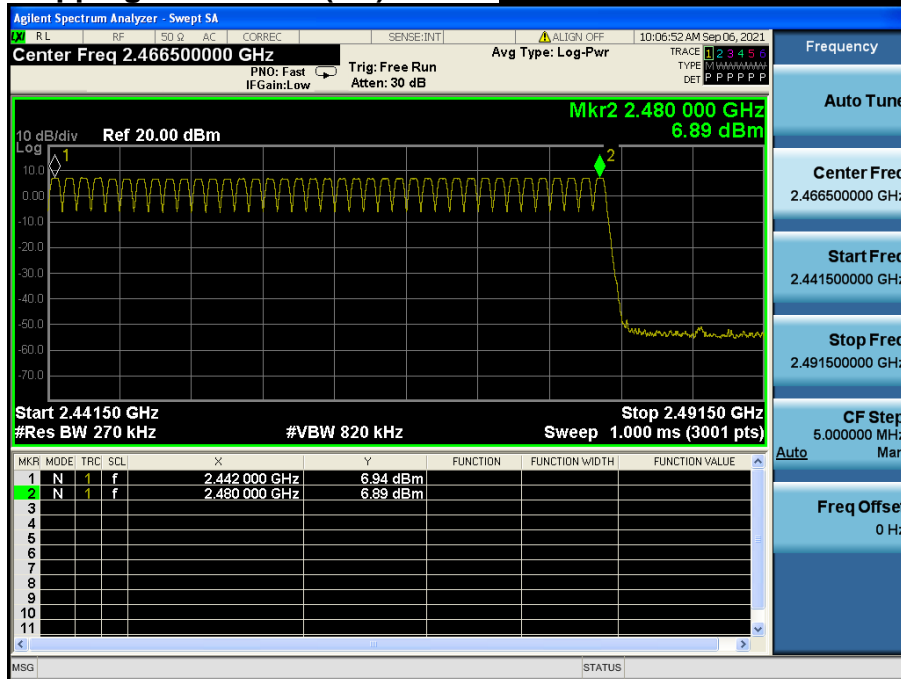
Number of Hopping Channels 1(FH)

Hopping mode : Enable & GFSK



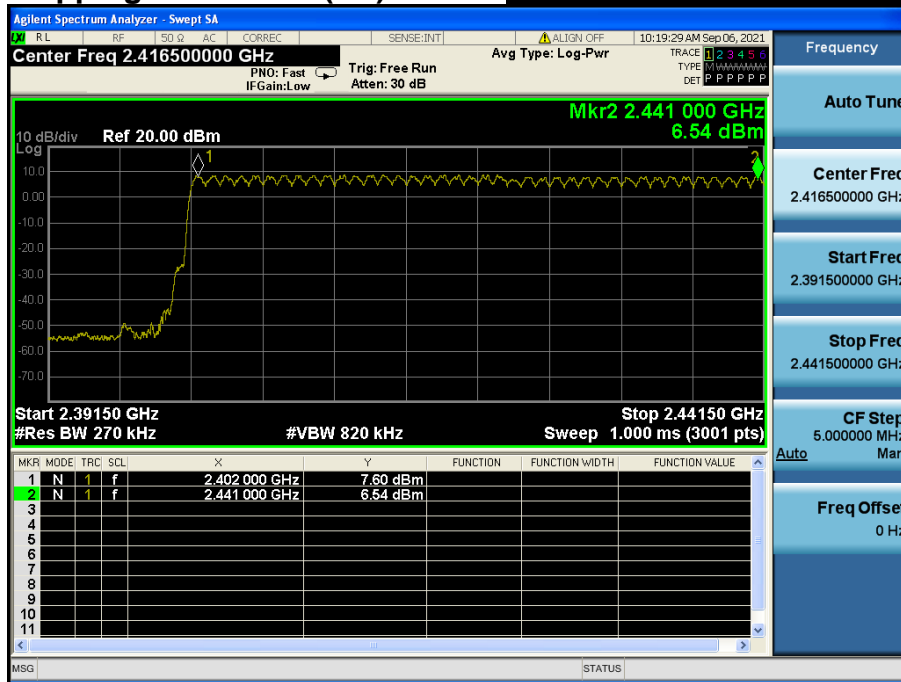
Number of Hopping Channels 2(FH)

Hopping mode : Enable & GFSK



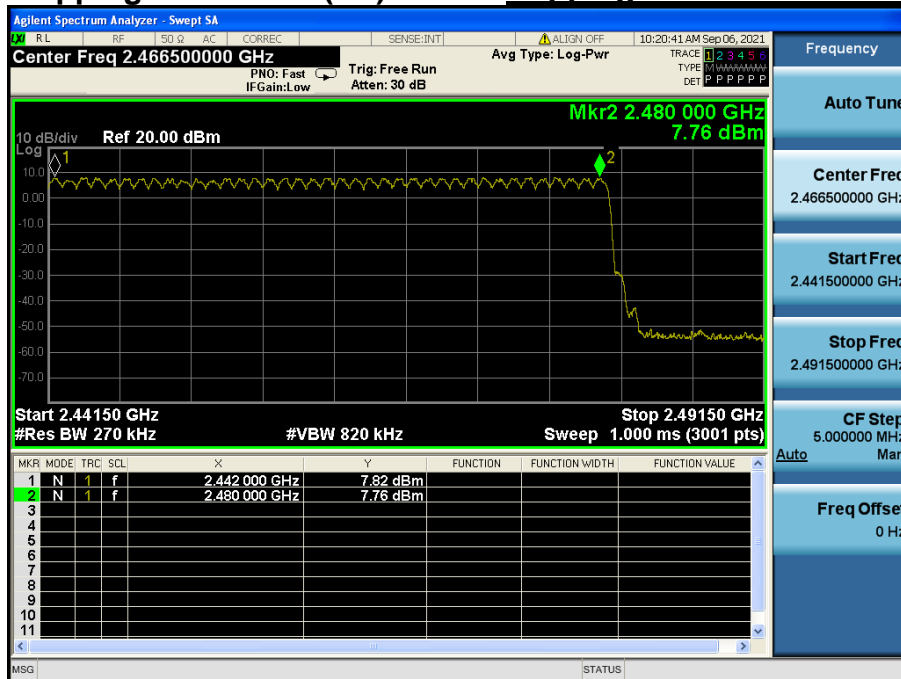
Number of Hopping Channels 1(FH)

Hopping mode : Enable & $\pi/4$ QPSK

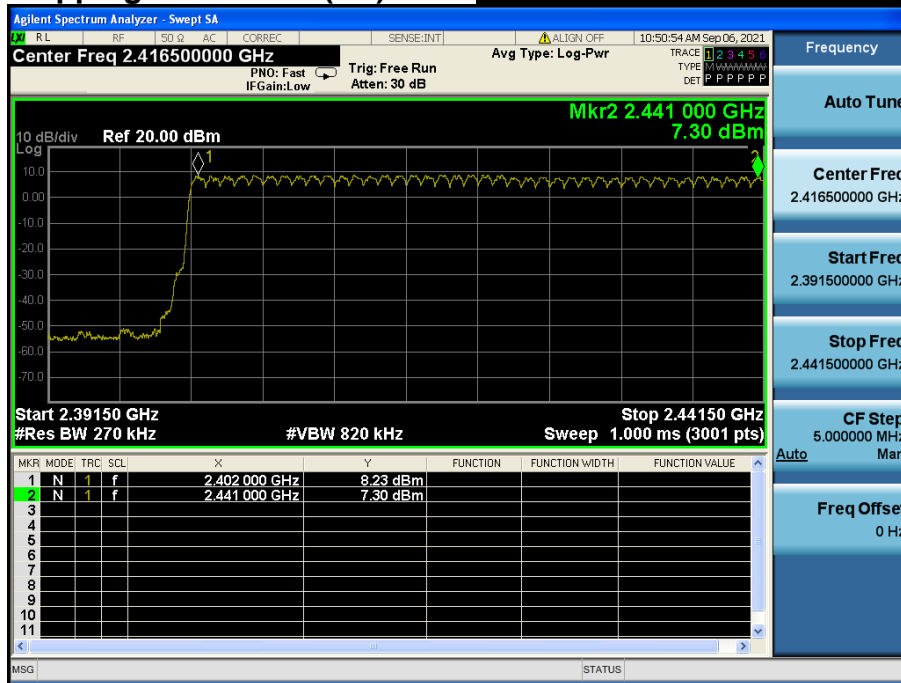


Number of Hopping Channels 2(FH)

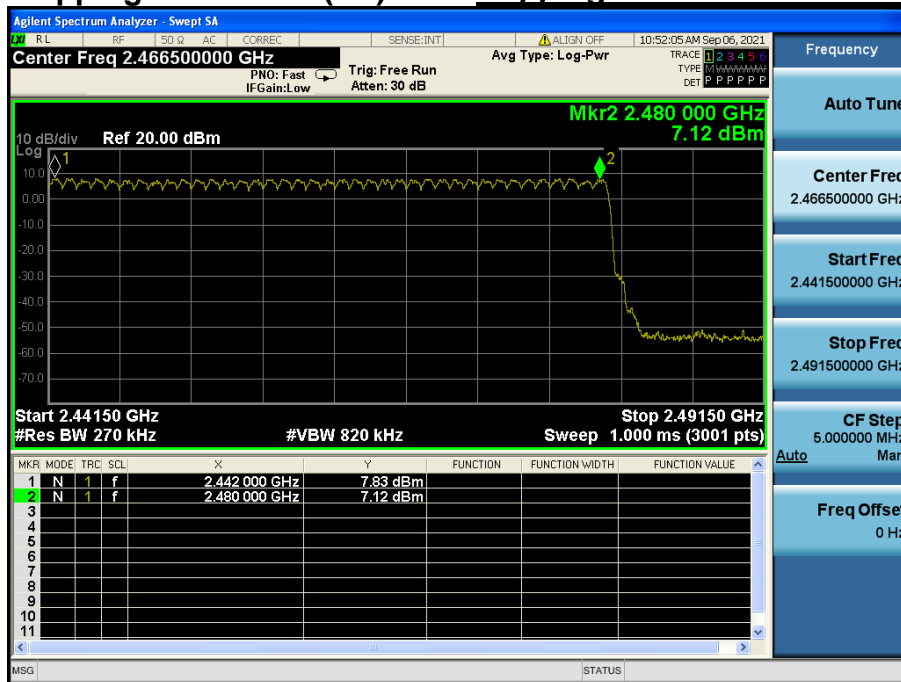
Hopping mode : Enable & $\pi/4$ QPSK



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

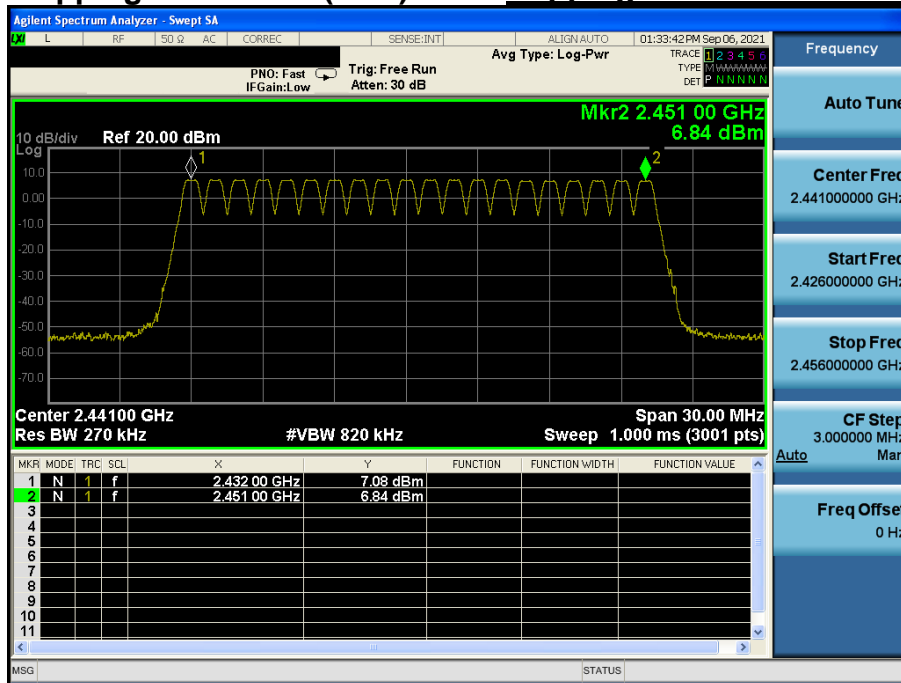


Number of Hopping Channels 2(FH) *Hopping mode : Enable & 8DPSK*



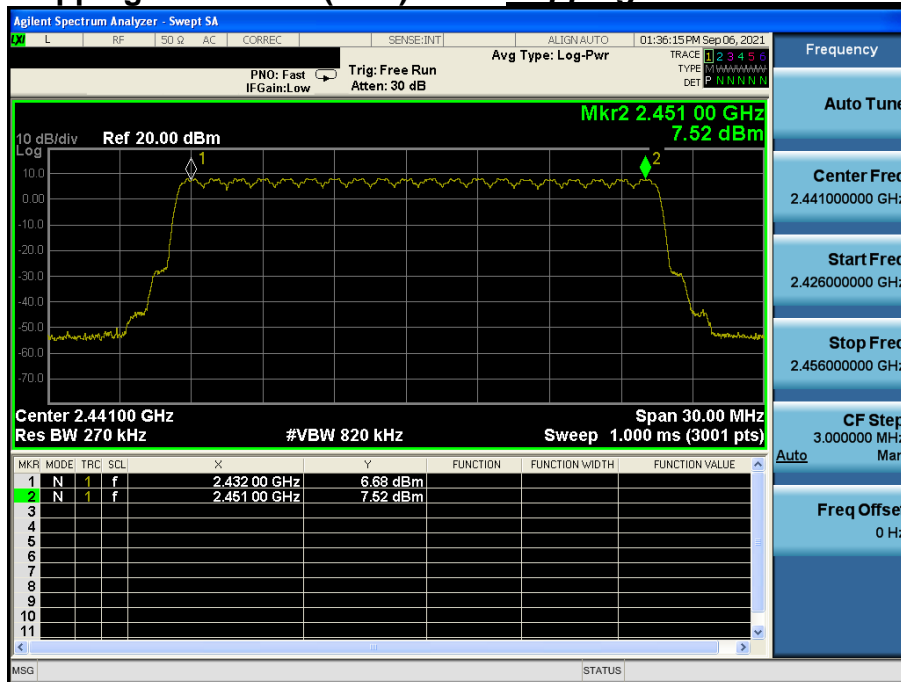
Number of Hopping Channels 1(AFH)

Hopping mode : Enable &GFSK

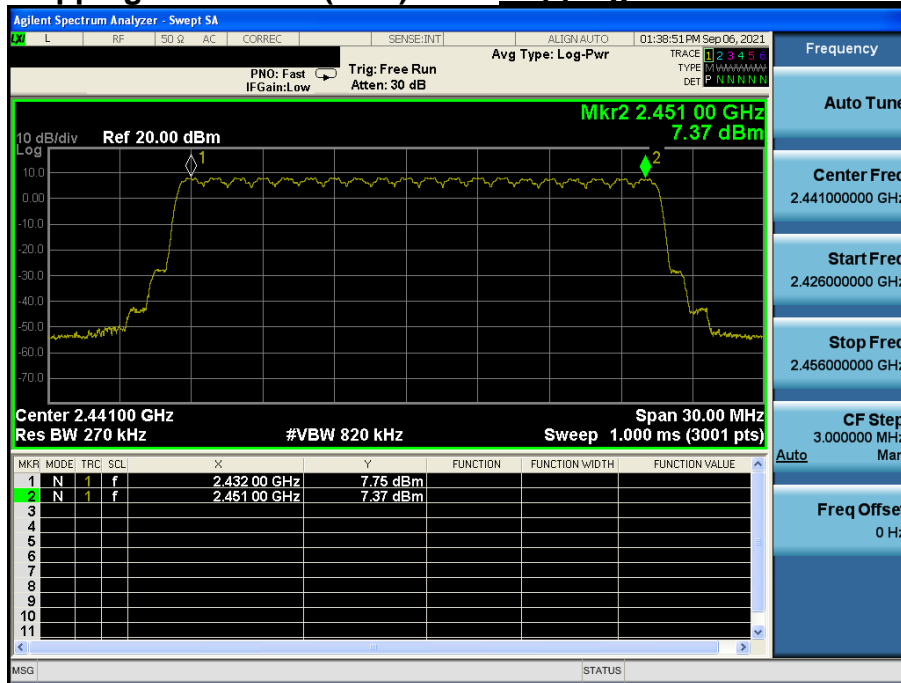


Number of Hopping Channels 1(AFH)

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



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



8. Time of Occupancy

8.1. Test Setup

Refer to the APPENDIX I.

8.2. Limit

The maximum permissible time of occupancy is 400 ms within a period of 400 ms multiplied by the number of hopping channels employed.

8.3. Test Procedure

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

The spectrum analyzer is set to :

Center frequency = 2 441 MHz

Span = zero

RBW = 1 MHz (RBW shall be \leq channel spacing and where possible RBW should be set $\gg 1 / T$, where T is the expected dwell time per channel)

VBW \geq RBW

Detector function = peak

Trace = max hold

8.4. Test Results

- Power Supply: 24 V

FH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)
Enable	DH 5	79	2.865	3.765	0.306
	2 DH 5	79	2.865	3.765	0.306
	3 DH 5	79	2.865	3.765	0.306

AFH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)
Enable	DH 5	20	2.865	3.765	0.153
	2 DH 5	20	2.865	3.765	0.153
	3 DH 5	20	2.865	3.765	0.153

Note 1 : Dwell Time = $0.4 \times \text{Hopping channel} \times \text{Burst ON time} \times$

$((\text{Hopping rate} \div \text{Time slots}) \div \text{Hopping channel})$

- Time slots for DH5 = 6 slots (TX = 5 slots / RX = 1 slot)

- Hopping Rate = 1 600 for FH mode & 800 for AFH mode

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

- Power Supply: 12 V
FH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)
Enable	DH 5	79	2.865	3.765	0.306
	2 DH 5	79	2.865	3.765	0.306
	3 DH 5	79	2.865	3.765	0.306

AFH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)
Enable	DH 5	20	2.865	3.765	0.153
	2 DH 5	20	2.865	3.765	0.153
	3 DH 5	20	2.865	3.765	0.153

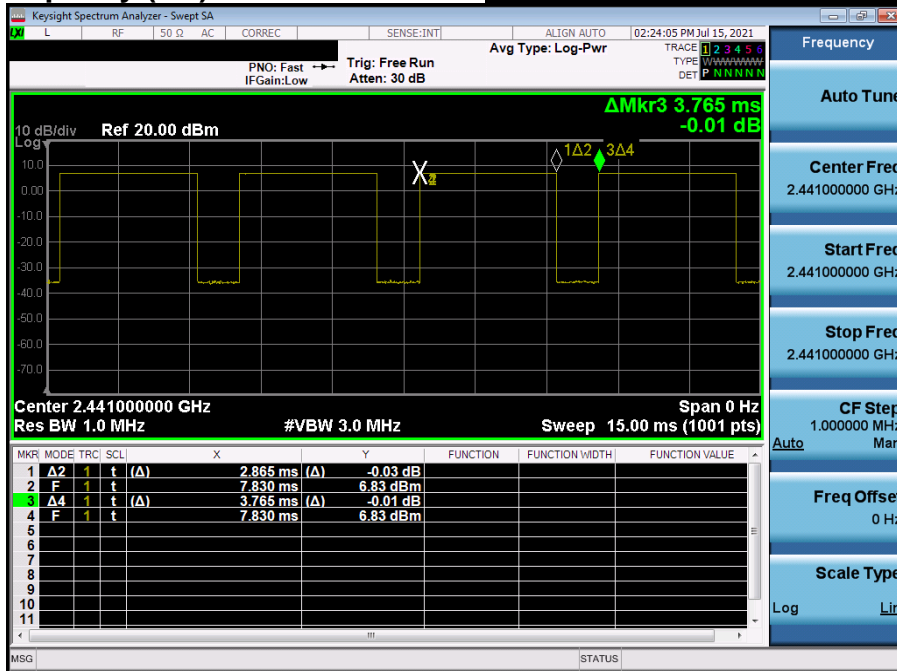
Note 1 : Dwell Time = $0.4 \times \text{Hopping channel} \times \text{Burst ON time} \times ((\text{Hopping rate} \div \text{Time slots}) \div \text{Hopping channel})$

- Time slots for DH5 = 6 slots (TX = 5 slots / RX = 1 slot)
- Hopping Rate = 1 600 for FH mode & 800 for AFH mode

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

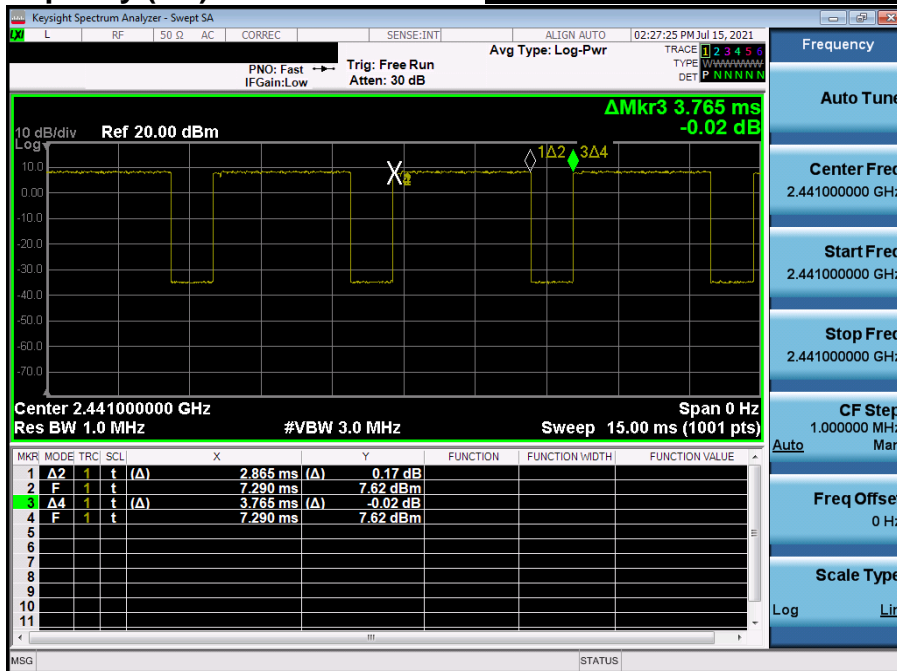
- Power Supply: 24 V
Time of Occupancy (FH)

Hopping mode : Enable&DH5



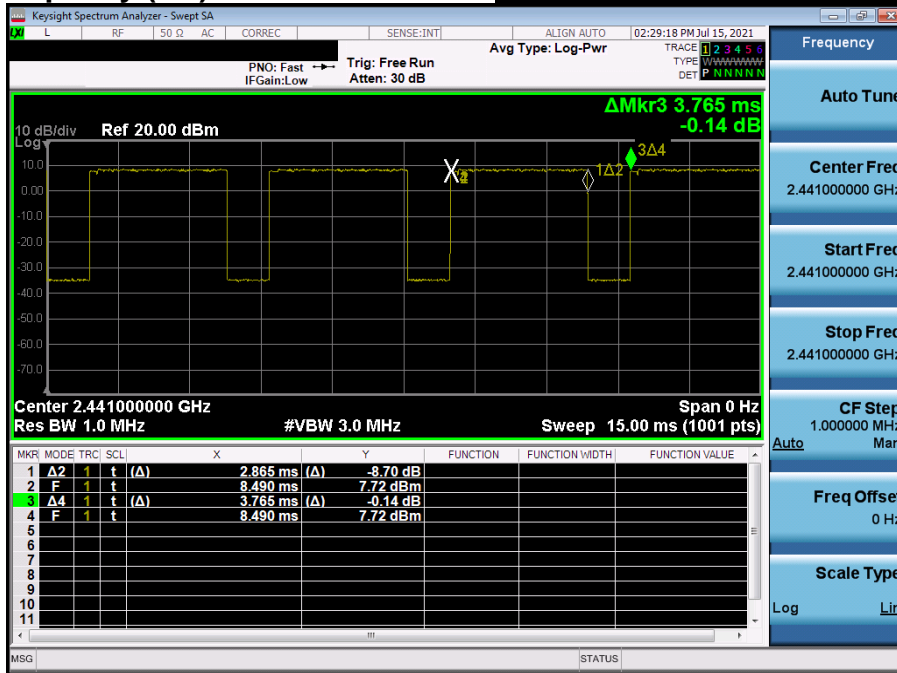
Time of Occupancy (FH)

Hopping mode : Enable&2-DH5



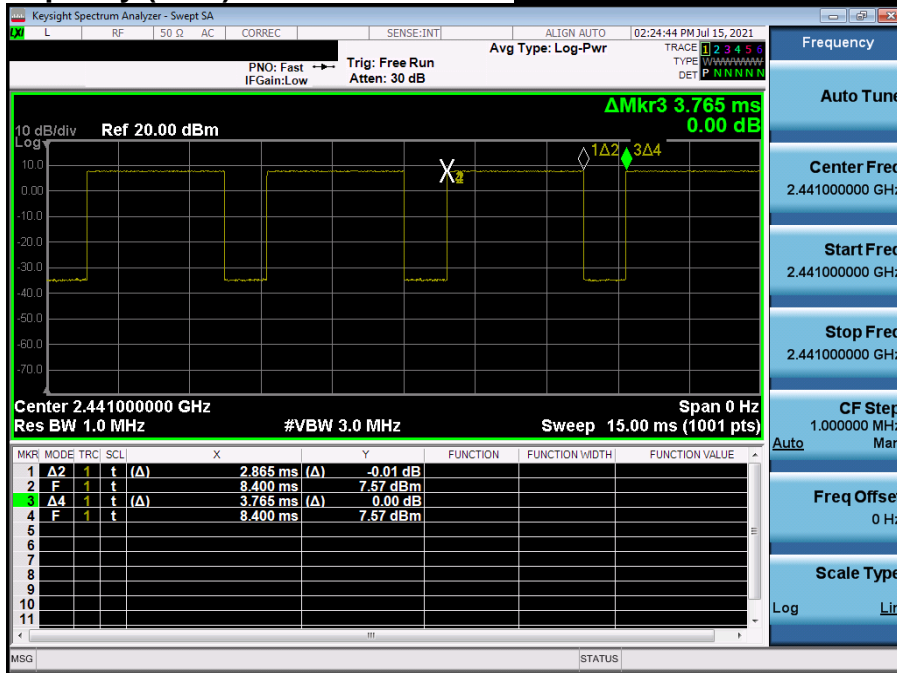
Time of Occupancy (FH)

Hopping mode : Enable&3-DH5



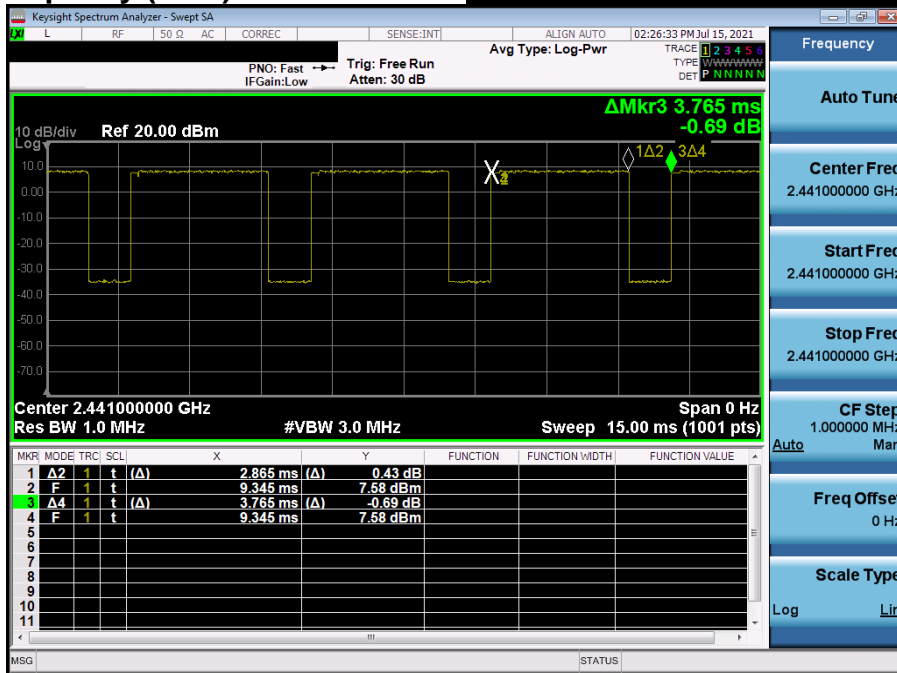
Time of Occupancy (AFH)

Hopping mode : Enable&DH5



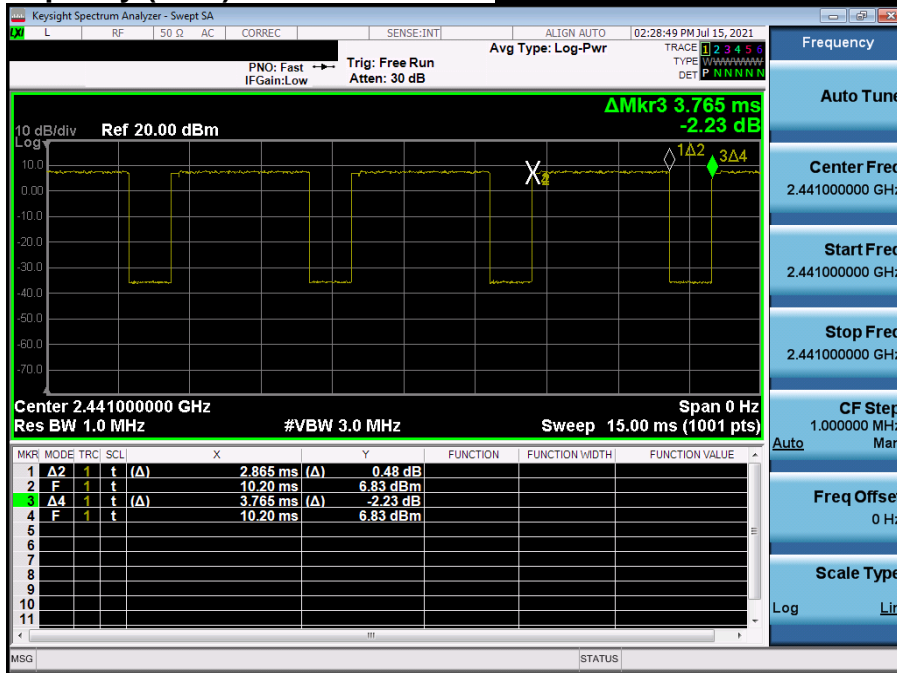
Time of Occupancy (AFH)

Hopping mode : Enable&2-DH5



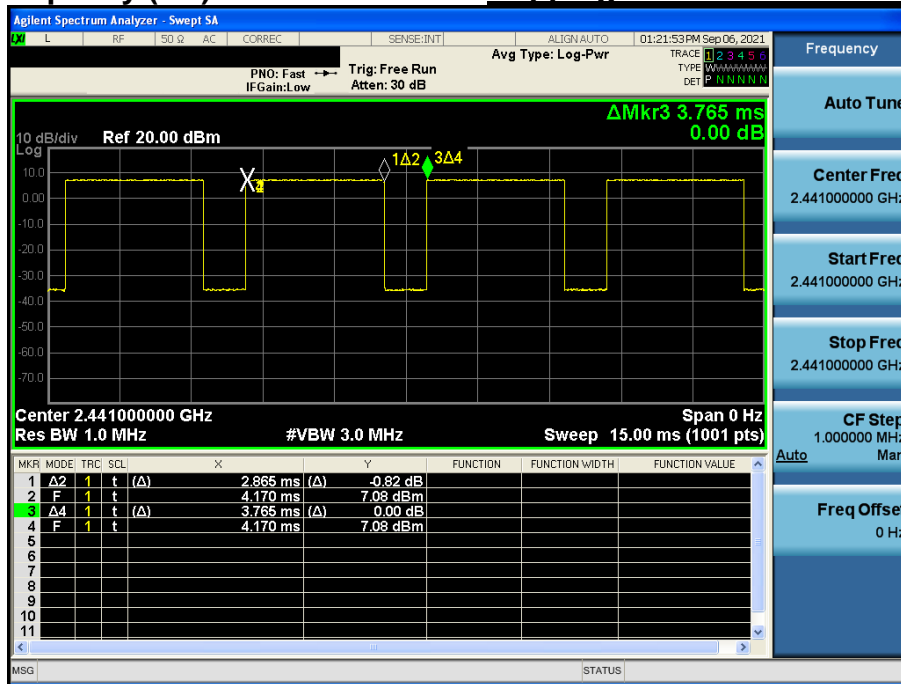
Time of Occupancy (AFH)

Hopping mode : Enable&3-DH5



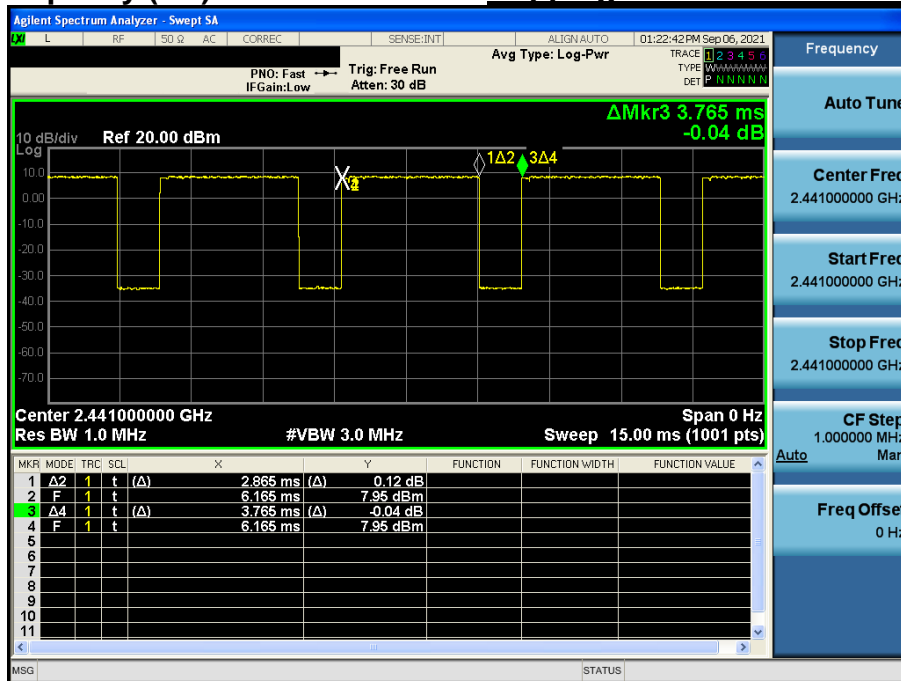
- Power Supply: 12 V
Time of Occupancy (FH)

Hopping mode : Enable&DH5



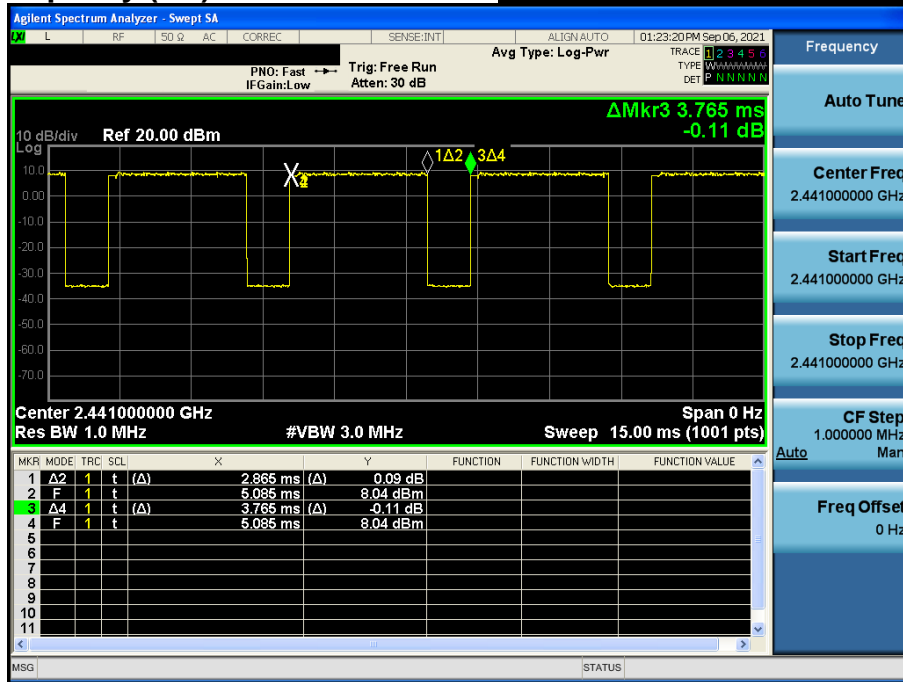
Time of Occupancy (FH)

Hopping mode : Enable&2-DH5



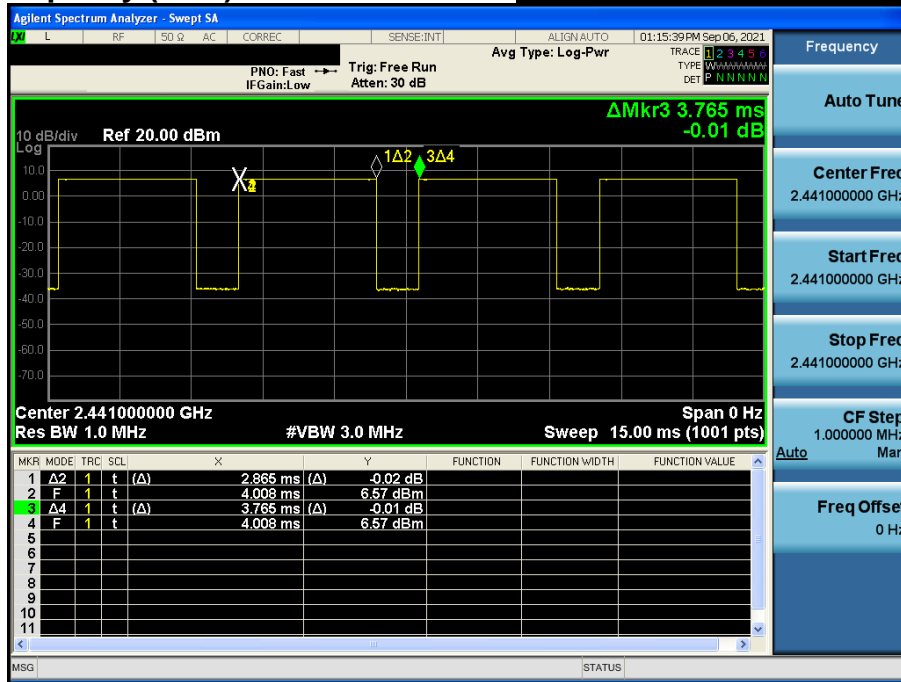
Time of Occupancy (FH)

Hopping mode : Enable&3-DH5



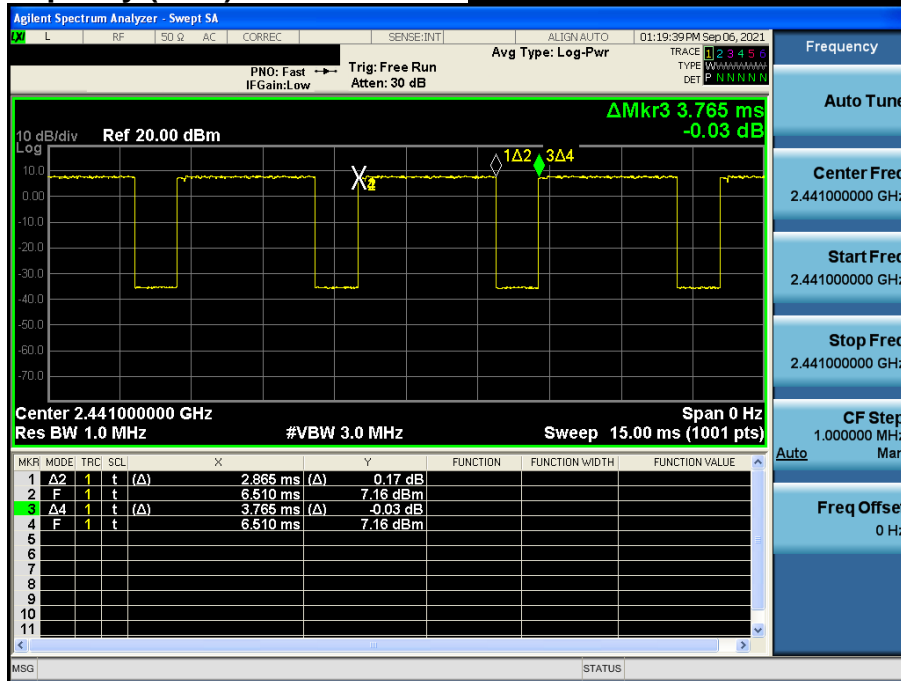
Time of Occupancy (AFH)

Hopping mode : Enable&DH5



Time of Occupancy (AFH)

Hopping mode : Enable&2-DH5



Time of Occupancy (AFH)

Hopping mode : Enable&3-DH5

