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 : DRTFCC2007-0190
2. Customer
   - Name : Pittasoft Co., Ltd.
   - Address : A 4th floor, ABN Tower, 331, Pangyo-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea 13488
3. Use of Report : FCC Original Grant
4. Product Name / Model Name : Car dashcam / DR750X-2CH
   FCC ID : YCK-DR750X-2CH
5. Test Method Used : KDB558074 D01v05r02, ANSI C63.10-2013
   Test Specification : FCC Part 15.247
6. Date of Test : 2020.04.20 ~ 2020.06.21
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.

Affirmation	Tested by Name : JungWoo Kim (Signature)	Reviewed by Name : JaeJin Lee (Signature)

2020 . 07 . 03 .

DT&C Co., Ltd.

Not abided by KS Q ISO / IEC 17025 and KOLAS accreditation.

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
DRTFCC2007-0190	Jul. 03, 2020	Initial issue	JungWoo Kim	JaeJin Lee

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1. General Information

1.1 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 § 2.948 according to ANSI C63.4-2014. **- FCC MRA Designation No. : KR0034**		
www.dtnc.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

1.2 Testing Environment

Ambient Condition	
▪ Temperature	+20 ℃ ~ +25 ℃
▪ Relative Humidity	35 % ~ 45 %

1.3 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.

Test items	Measurement uncertainty
Transmitter Output Power	0.9 dB (The confidence level is about 95 %, k = 2)
Conducted spurious emission	0.9 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz Below)	4.9 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz ~ 18 GHz)	5.1 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	:	Pittasoft Co., Ltd.
Address	:	A 4th floor, ABN Tower, 331, Pangyo-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, 13488, South Korea
Contact person	:	Kwangjo Kim

1.5 Description of EUT

EUT	Car dashcam
Model Name	DR750X-2CH
Add Model Name	DR750X-1CH, DR750X-1CH Plus, DR750G-1CH Pro, DR750X-2CH IR, DR750X-2CH Plus, DR750X-2CH Truck, DR750G-2CH Pro, DR750G-2CH IR Pro, DR750XJ-2CH, DR750X-3CH, DR750X-3CH Truck
Serial Number	Identical prototype
Power Supply	DC 12, 24 V
Frequency Range	2 402 MHz ~ 2 480 MHz
Modulation Technique (Data rate)	GFSK(1Mbps), π/4DQPSK(2Mbps), 8DPSK(3Mbps)
Number of Channels	79
Antenna Type	WIFI Dual Chip Antenna
Antenna Gain	PK : 1.88 dBi

- Auxiliary equipment for testing

Equipment	Model Name	Serial NO.	Manufacturer	Note
Notebook PC	6235ANHMW	JGL491UD801408V	Samsung	FCC ID: A3L6235ANH

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

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 transmit ted signals.

B) All channels are used equally on average

C) The receiver input bandwidth equals the transmit bandwidth

D) The receiver hops in sequenc e 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	20/02/26	21/02/26	MY46471251
Spectrum Analyzer	Agilent Technologies	N9020A	19/12/16	20/12/16	MY48011700
Spectrum Analyzer	Agilent Technologies	N9020A	19/06/26	20/06/26	US47360812
DC Power Supply	Agilent Technologies	6654A	19/06/27	20/06/27	MY40002935
DC Power Supply	SM techno	SDP30-5D	19/06/24	20/06/24	305DMG305
Multimeter	FLUKE	17B	19/12/16	20/12/16	26030065WS
Signal Generator	Rohde Schwarz	SMBV100A	19/12/16	20/12/16	255571
Signal Generator	ANRITSU	MG3695C	19/12/16	20/12/16	173501
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-1
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-2
Thermohygrometer	BODYCOM	BJ5478	19/06/25	20/06/25	N/A
Loop Antenna	Schwarzbeck	FMZB1513	20/02/19	22/02/19	1513-128
BILOG ANTENNA	Schwarzbeck	VULB 9160	19/04/23	21/04/23	9160-3362
Horn Antenna	ETS-Lindgren	3115	20/01/30	22/01/30	6419
Horn Antenna	A.H.Systems Inc.	SAS-574	19/07/03	21/07/03	155
PreAmplifier	tsj	MLA-0118-B01-40	19/12/16	20/12/16	1852267
PreAmplifier	tsj	MLA-1840-J02-45	19/06/27	20/06/27	16966-10728
PreAmplifier	H.P	8447D	19/12/16	20/12/16	2944A07774
High Pass Filter	Wainwright Instruments	WHKX12-935-1000-15000-40SS	19/06/26	20/06/26	8
High Pass Filter	Wainwright Instruments	WHKX10-2838-3300-18000-60SS	19/06/26	20/06/26	1
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5-6SS	19/06/27	20/06/27	3
Attenuator	Hefei Shunze	SS5T2.92-10-40	19/06/27	20/06/27	16012202
Attenuator	SRTechnology	F01-B0606-01	19/06/27	20/06/27	13092403
Attenuator	Aeroflex/Weinschel	20515	19/06/27	20/06/27	Y2370
Attenuator	SMAJK	SMAJK-2-3	19/06/27	20/06/27	2
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2495A MA2490A	19/06/24	20/06/24	1306007 1249001
EMI Receiver	ROHDE&SCHWARZ	ESW44	19/07/30	20/07/30	101645
Cable	Junkosha	MWX241	20/01/13	21/01/13	G-04
Cable	Junkosha	MWX241	20/01/13	21/01/13	G-07
Cable	DT&C	Cable	20/01/13	21/01/13	G-13
Cable	DT&C	Cable	20/01/13	21/01/13	G-14
Cable	HUBER+SUHNER	SUCOFLEX 104	20/01/13	21/01/13	G-15
Cable	Radiall	TESTPRO3	20/01/16	21/01/16	M-01
Cable	Junkosha	MWX315	20/01/16	21/01/16	M-05
Cable	Junkosha	MWX221	20/01/16	21/01/16	M-06
Cable	Radiall	TESTPRO3	20/01/16	21/01/16	RF-92

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.

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	**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(6.7)	Occupied Bandwidth (99 %)	N/A		NA
15.247(d) 15.205 & 209 RSS-247(5.5) RSS-Gen (8.9 & 8.10)	Radiated Spurious Emissions	FCC 15.209 Limits	Radiated	C
15.207 RSS-Gen(8.8)	AC Conducted Emissions	FCC 15.207 Limits	AC Line Conducted	NA Note3
15.203	Antenna Requirements	FCC 15.203	-	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 device is installed in a car. Therefore the power source is only a battery of car.

1.10 Conclusion of worst-case and operation mode

The EUT has three types of modulation (GFSK, π/4DQPSK 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 two orthogonal EUT positions (X, Y-axis).

Tested frequency information,

- Hopping Function : Enable

	TX Frequency (MHz)	RX Frequency (MHz)
Hopping Band	2 402 ~ 2 480	2 402 ~ 2 480

- Hopping Function : Disable

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

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. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

▣ IC Requirements

1. RSS-247(5.4) (b), For FHSS operating in the band 2400 - 2483.5 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)

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 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 ≥ 20 dB BW
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold

2.4 Test Results

- 12 V

Modulation	Tested Channel	Frame Average Output Power		Peak Output Power	
		dBm	mW	dBm	mW
GFSK	**Lowest**	**3.12**	**2.05**	**5.26**	**3.36**
	Middle	2.69	1.86	5.14	3.27
	Highest	2.48	1.77	5.13	3.26
π/4DQPSK	**Lowest**	**3.01**	**2.00**	**7.29**	**5.36**
	Middle	2.56	1.80	7.19	5.24
	Highest	2.37	1.73	7.25	5.31
8DPSK	**Lowest**	**3.00**	**2.00**	**7.75**	**5.96**
	Middle	2.50	1.78	7.56	5.70
	Highest	2.35	1.72	7.48	5.60

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.

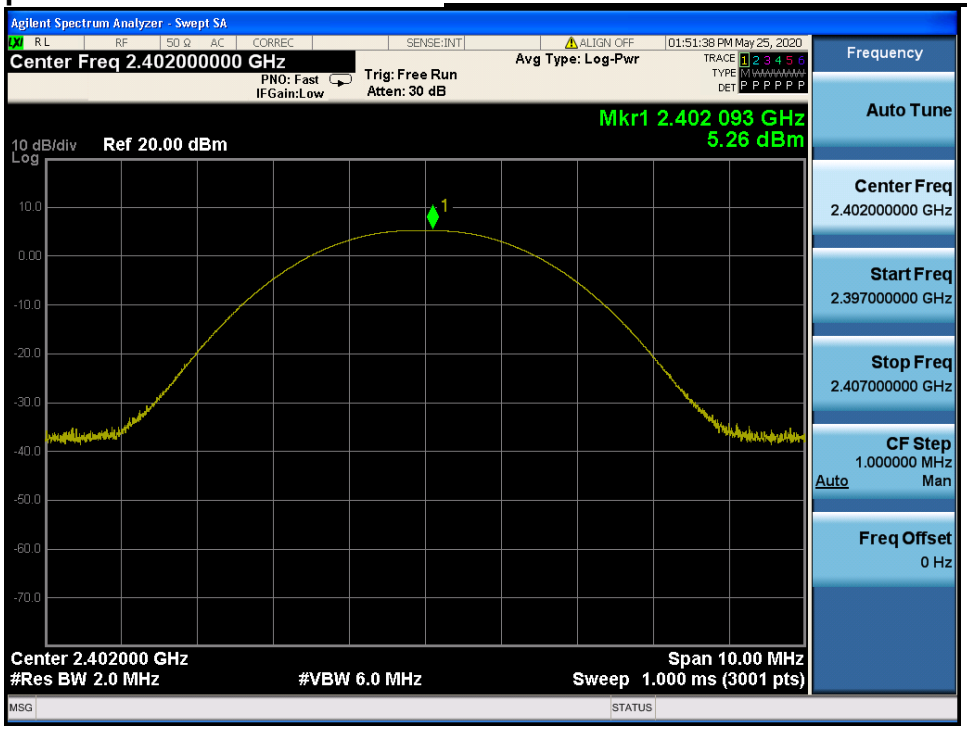
- 24 V

Modulation	Tested Channel	Frame Average Output Power		Peak Output Power	
		dBm	mW	dBm	mW
GFSK	**Lowest**	**2.98**	**1.99**	**5.24**	**3.34**
	Middle	2.54	1.79	5.04	3.19
	Highest	2.44	1.75	5.13	3.26
π/4DQPSK	**Lowest**	**2.95**	**1.97**	**7.30**	**5.37**
	Middle	2.55	1.80	7.23	5.28
	Highest	2.34	1.71	7.28	5.35
8DPSK	**Lowest**	**2.91**	**1.95**	**7.79**	**6.01**
	Middle	2.52	1.79	7.64	5.81
	Highest	2.33	1.71	7.66	5.83

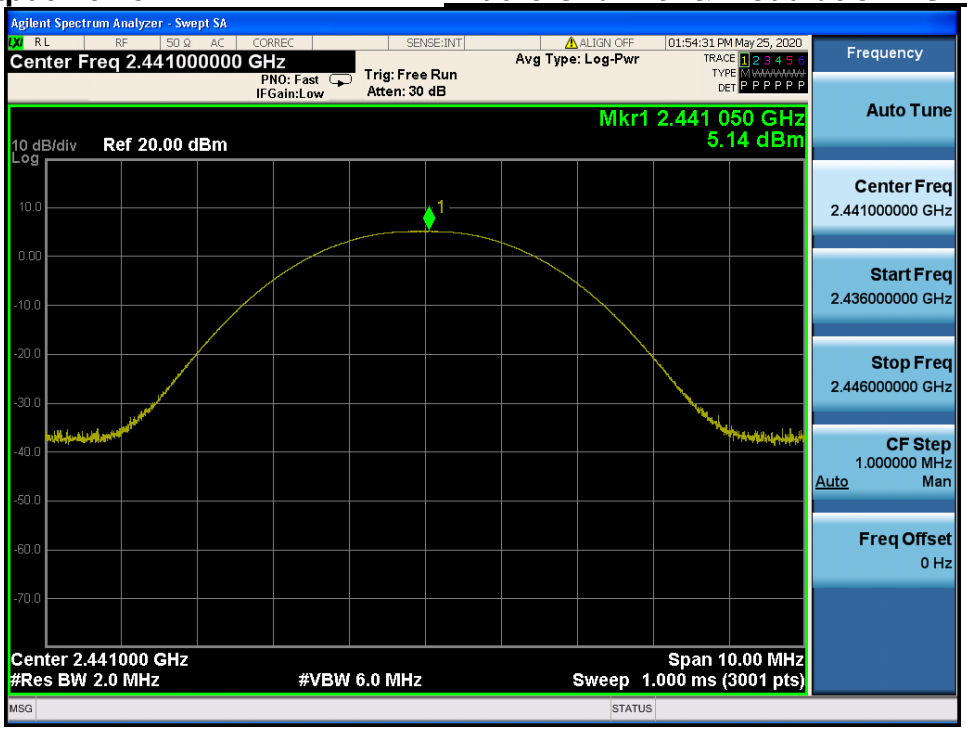
Note 1: The Frame average output power was tested using an average power meter for reference only.
Note 2: See next pages for actual measured spectrum plots.

- Tested Power Supply: 12 V

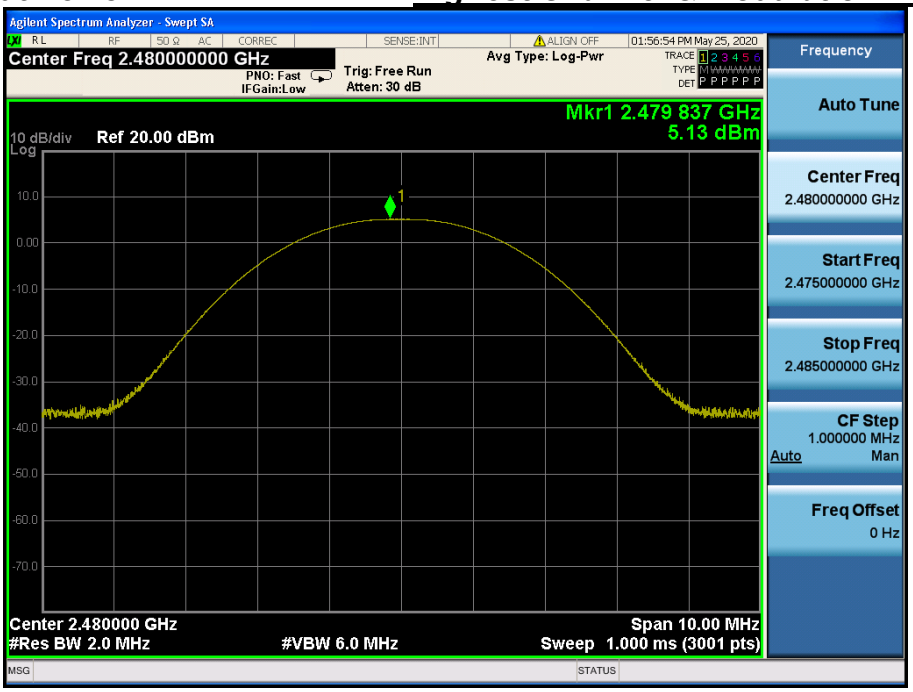
Peak Output Power *Lowest Channel & Modulation : GFSK*



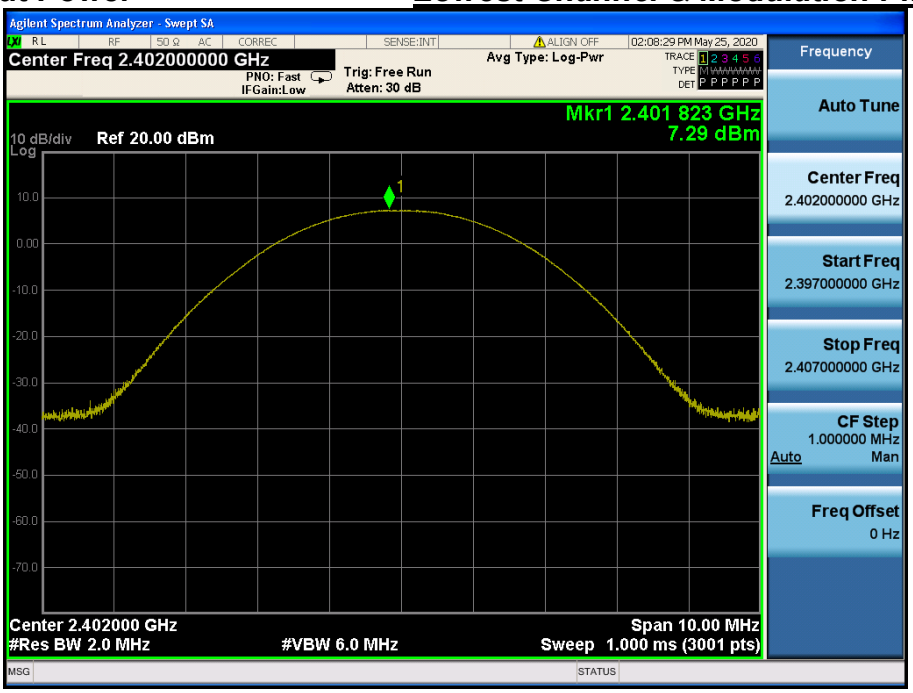
Peak Output Power *Middle Channel & Modulation : GFSK*



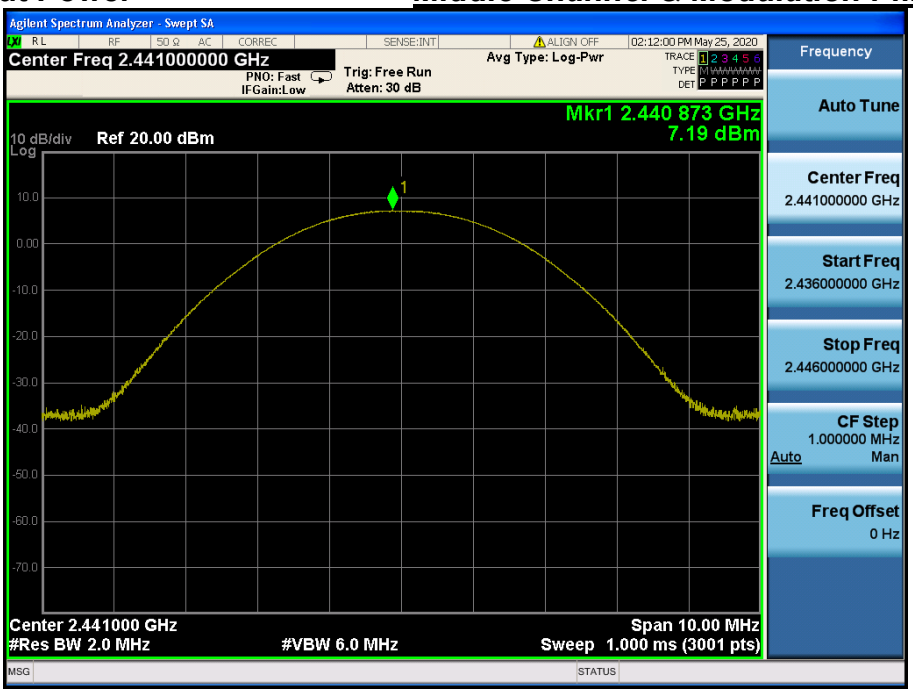
Peak Output Power *Highest Channel & Modulation : GFSK*



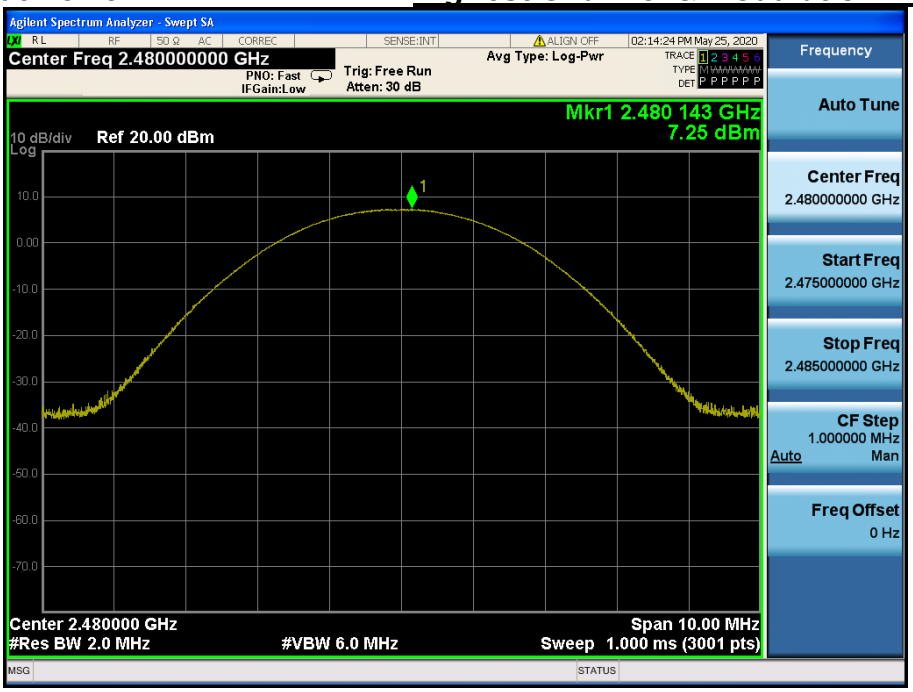
Peak Output Power *Lowest Channel & Modulation : π/4DQPSK*



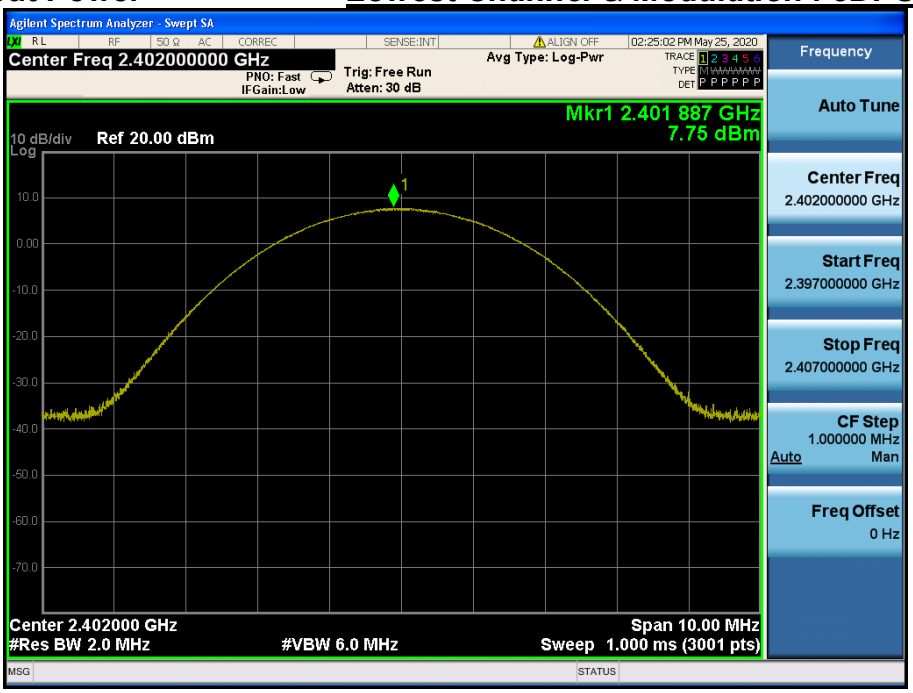
Peak Output Power *Middle Channel & Modulation : π/4DQPSK*



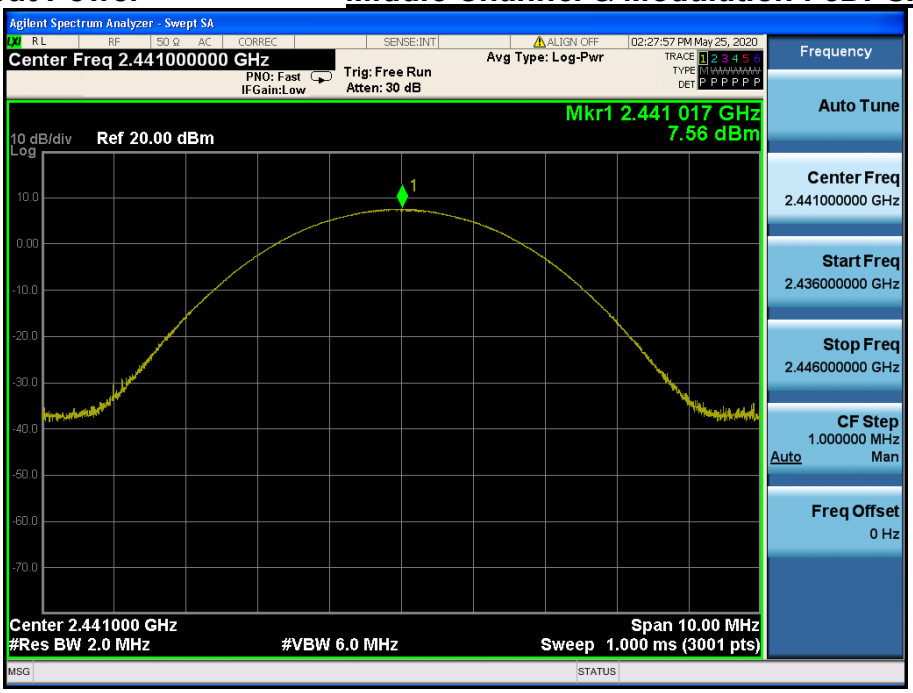
Peak Output Power *Highest Channel & Modulation : π/4DQPSK*



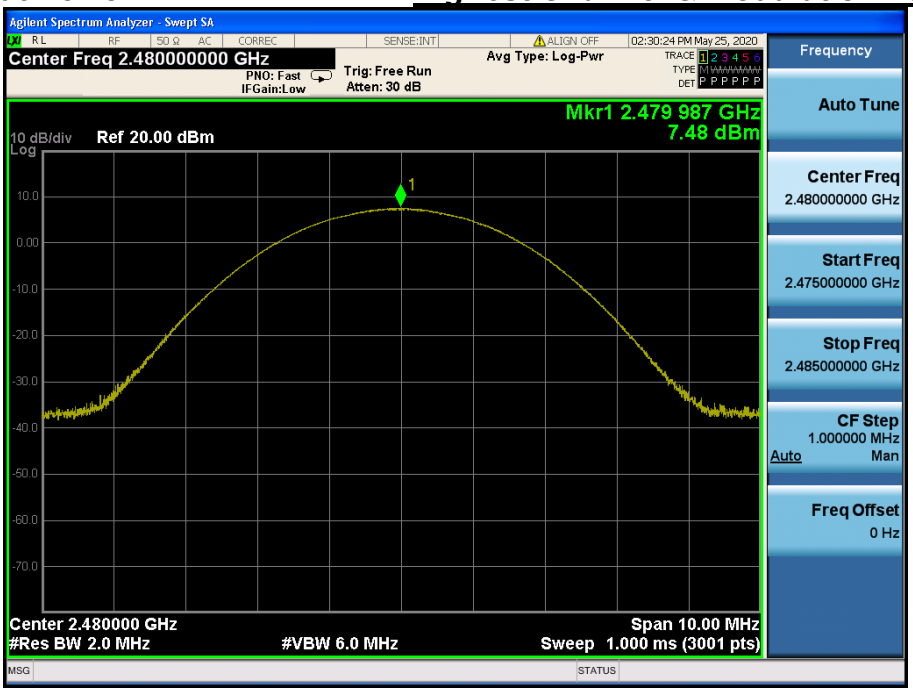
Peak Output Power *Lowest Channel & Modulation : 8DPSK*



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

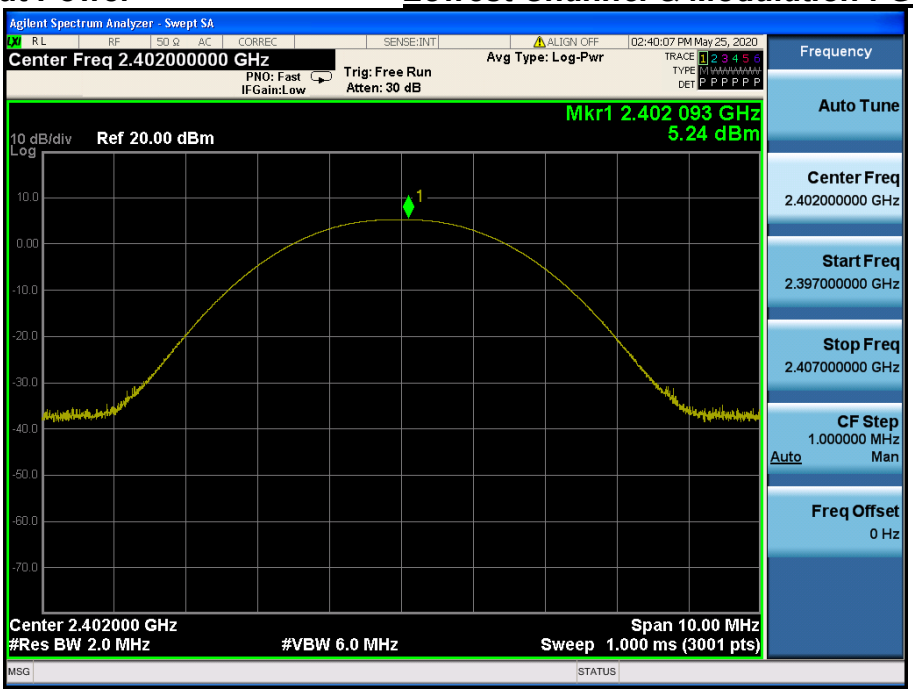


Peak Output Power ***Highest Channel & Modulation : 8DPSK***

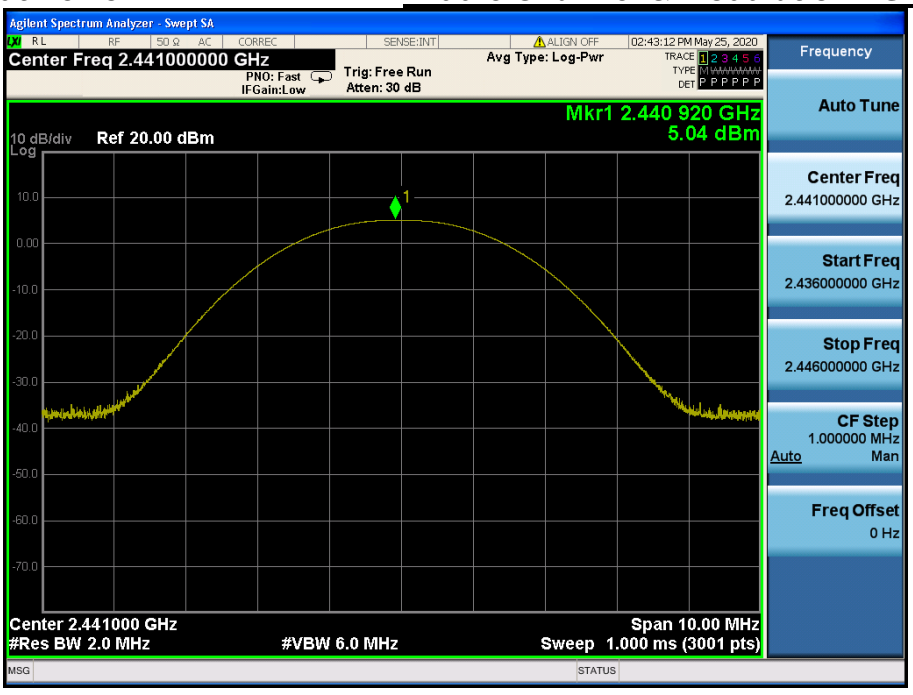


- Tested Power Supply: 24 V

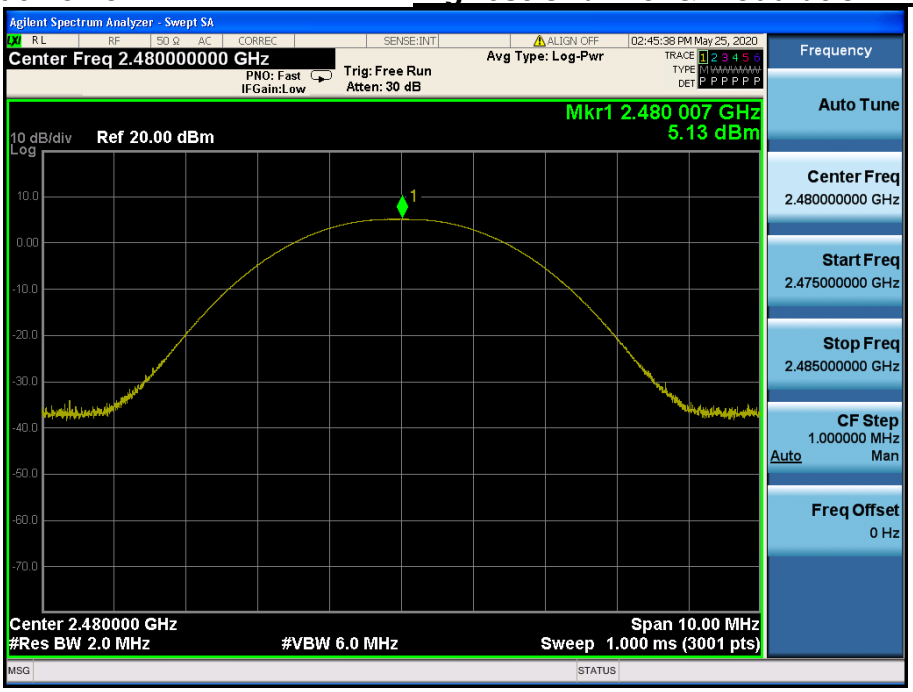
Peak Output Power ***Lowest Channel & Modulation : GFSK***



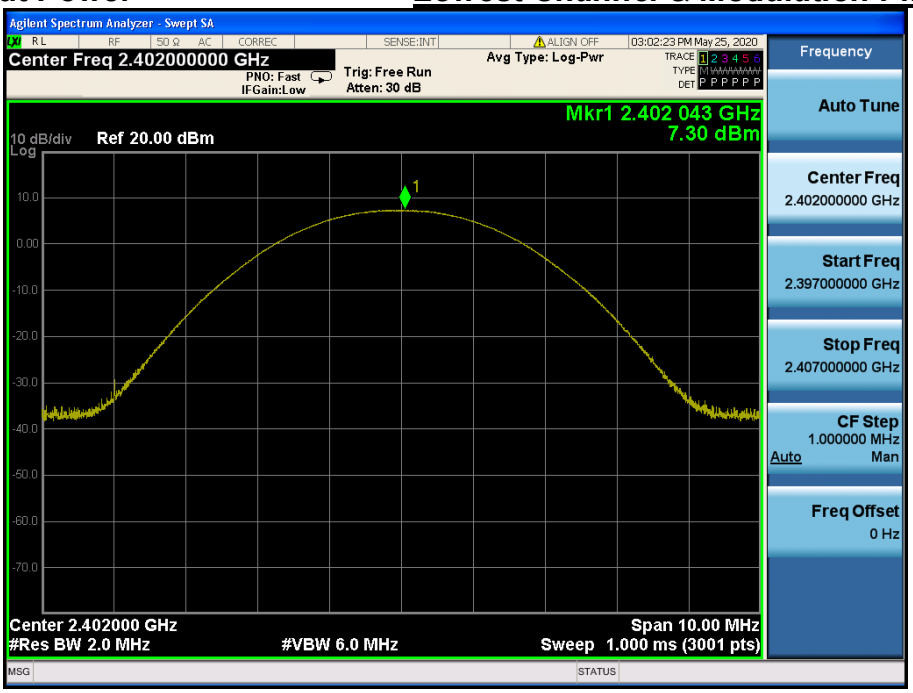
Peak Output Power ***Middle Channel & Modulation : GFSK***



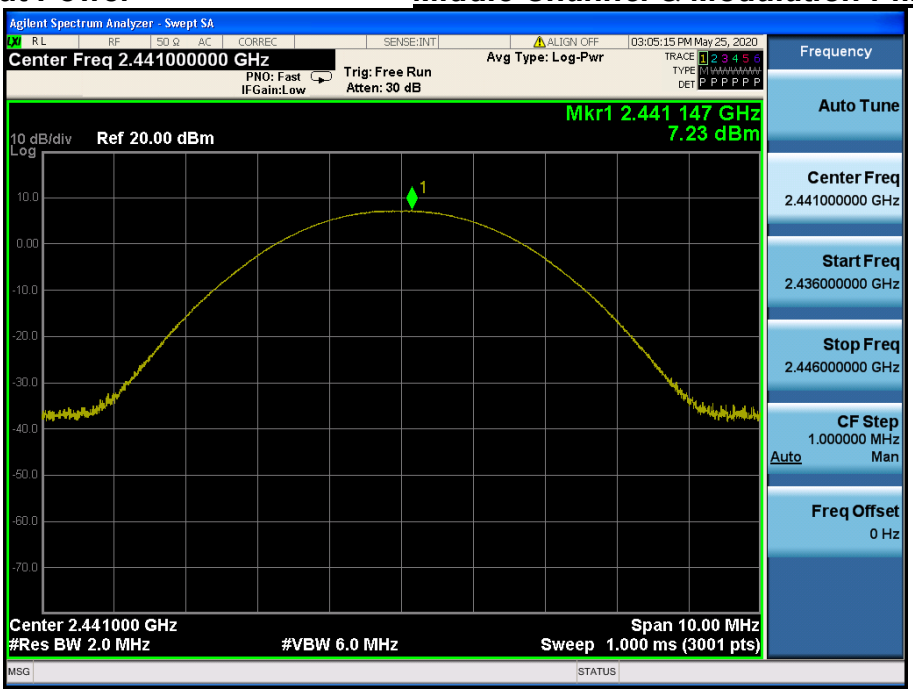
Peak Output Power *Highest Channel & Modulation : GFSK*



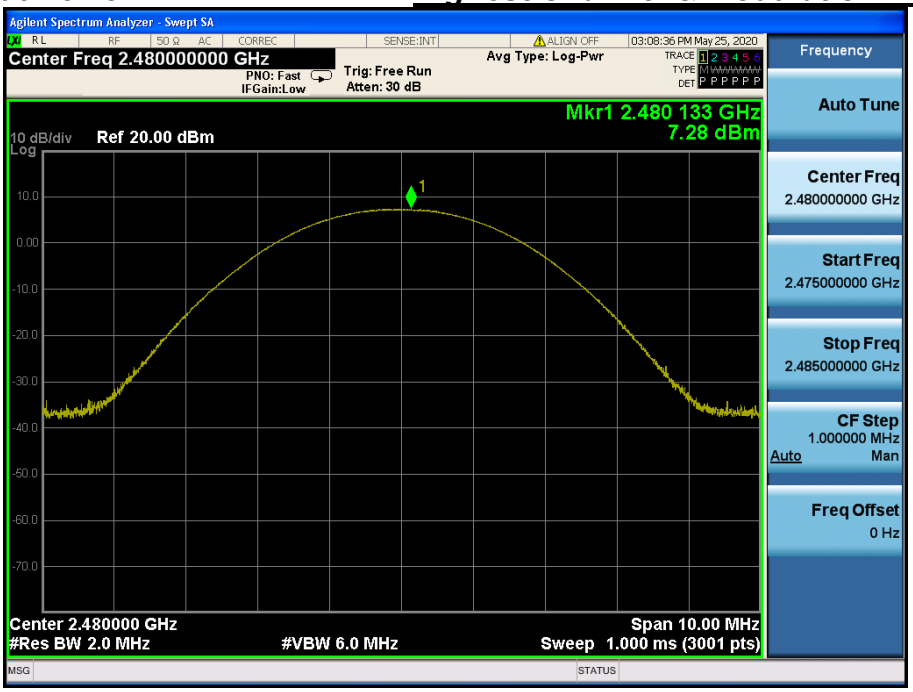
Peak Output Power *Lowest Channel & Modulation : π/4DQPSK*



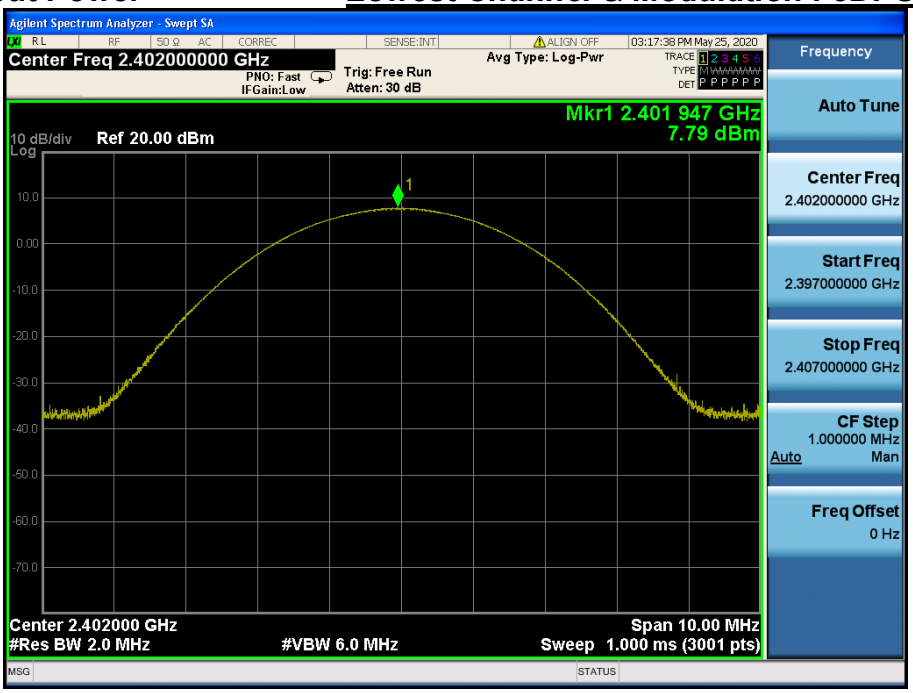
Peak Output Power ***Middle Channel & Modulation : π/4DQPSK***



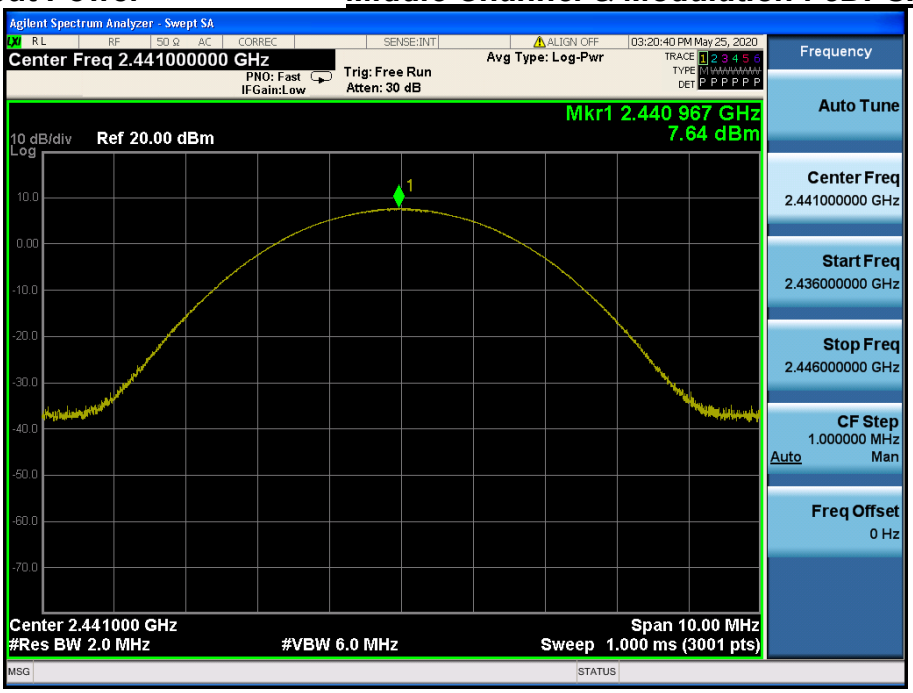
Peak Output Power ***Highest Channel & Modulation : π/4DQPSK***



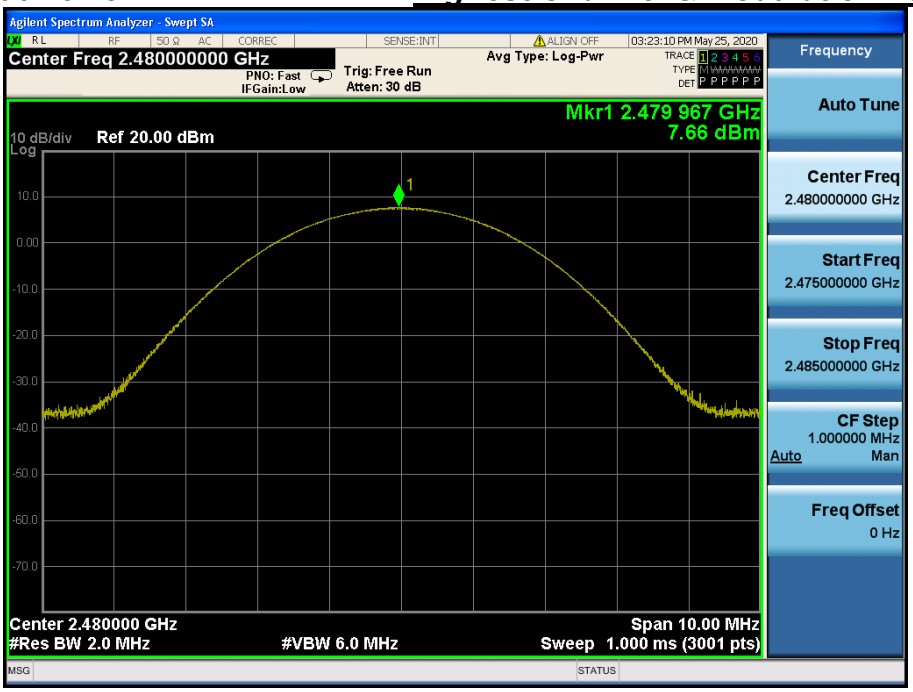
Peak Output Power *Lowest Channel & Modulation : 8DPSK*



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

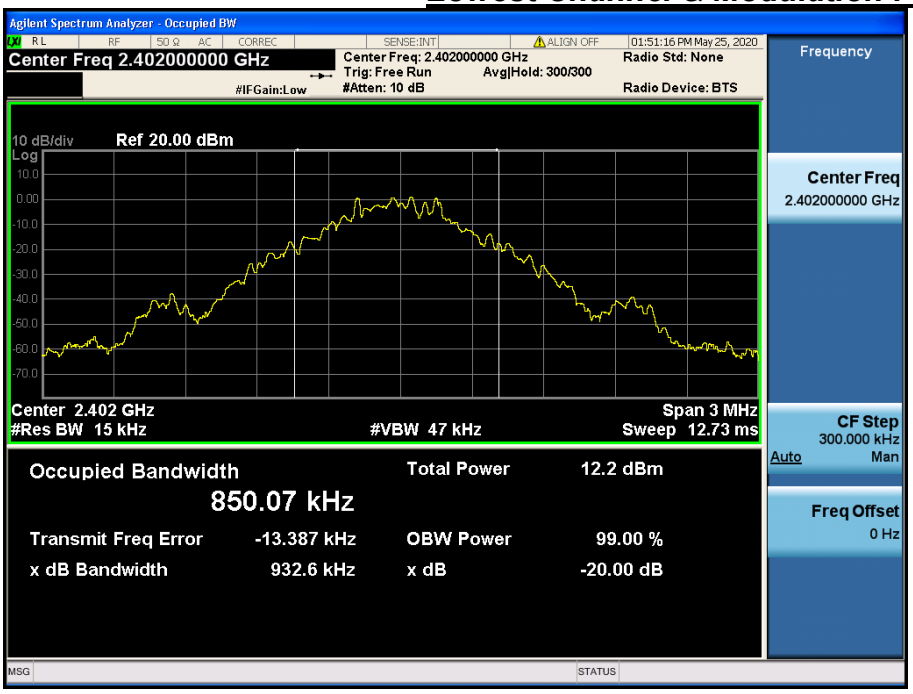
1. The 20 dB bandwidth & Occupied bandwidth were measured with a spectrum analyzer connected to RF antenna Connector(conducted measurement) while EUT was operating in transmit mode. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using below setting:
   RBW = 1% to 5% of the 20 dB BW & Occupied BW
   VBW ≥ 3 × RBW
   Span = between two times and five times the 20 dB bandwidth & Occupied BW
   Sweep = auto
   Detector function = peak
   Trace = max hold

3.4 Test Results

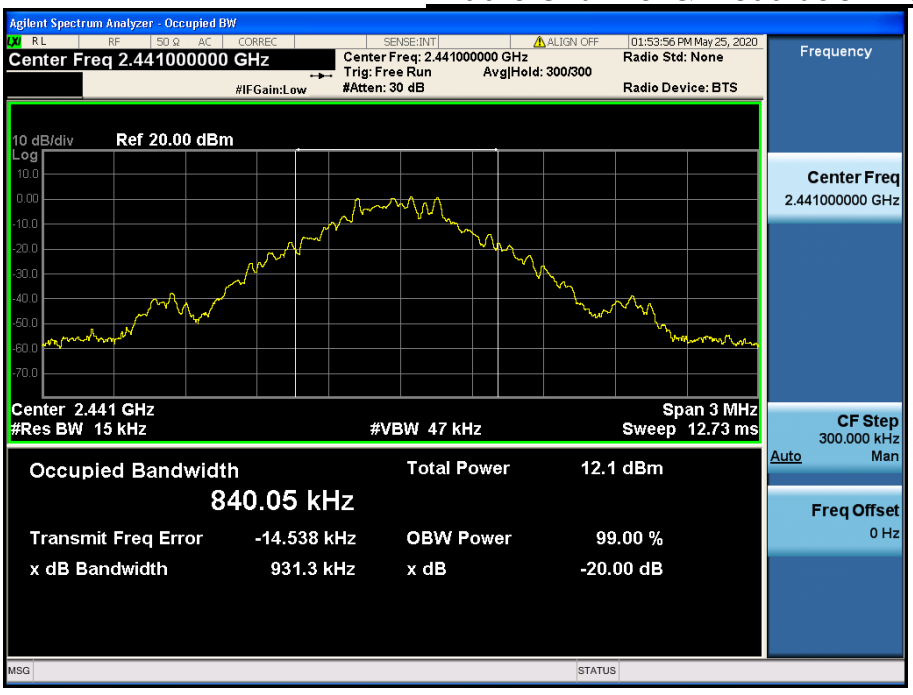
Modulation	Tested Channel	20 dB BW (MHz) (12 V)	20 dB BW (MHz) (24 V)
GFSK	**Lowest**	**0.933**	0.932
	Middle	0.931	**0.932**
	Highest	0.928	0.931
π/4DQPSK	**Lowest**	**1.314**	1.314
	Middle	1.313	1.313
	Highest	1.313	**1.315**
8DPSK	**Lowest**	**1.266**	**1.268**
	Middle	**1.266**	1.262
	Highest	1.264	1.263

- Tested Power Supply: 12 V

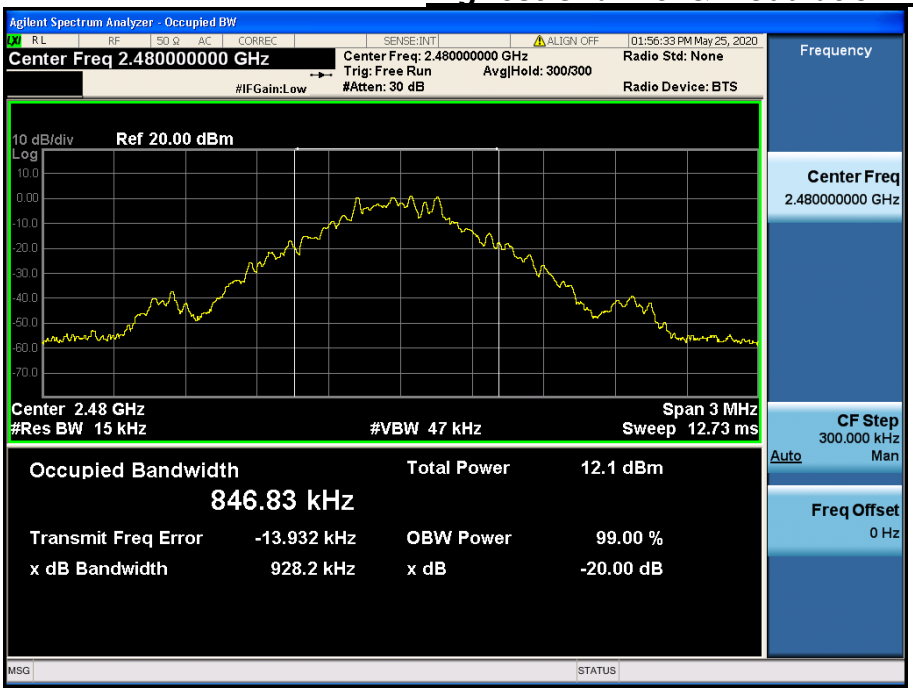
20 dB BW ***Lowest Channel & Modulation : GFSK***



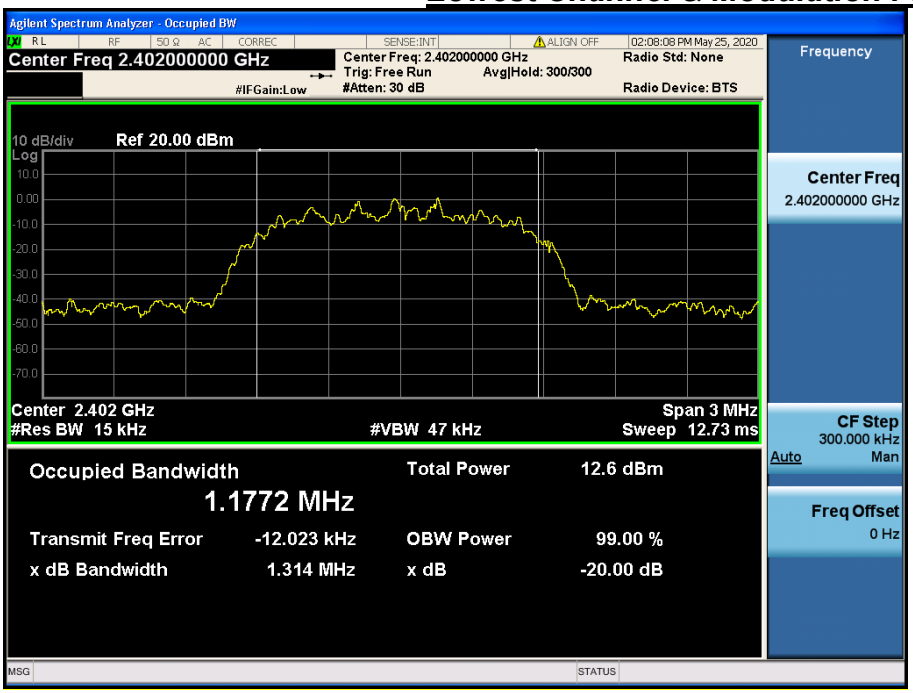
20 dB BW ***Middle Channel & Modulation : GFSK***



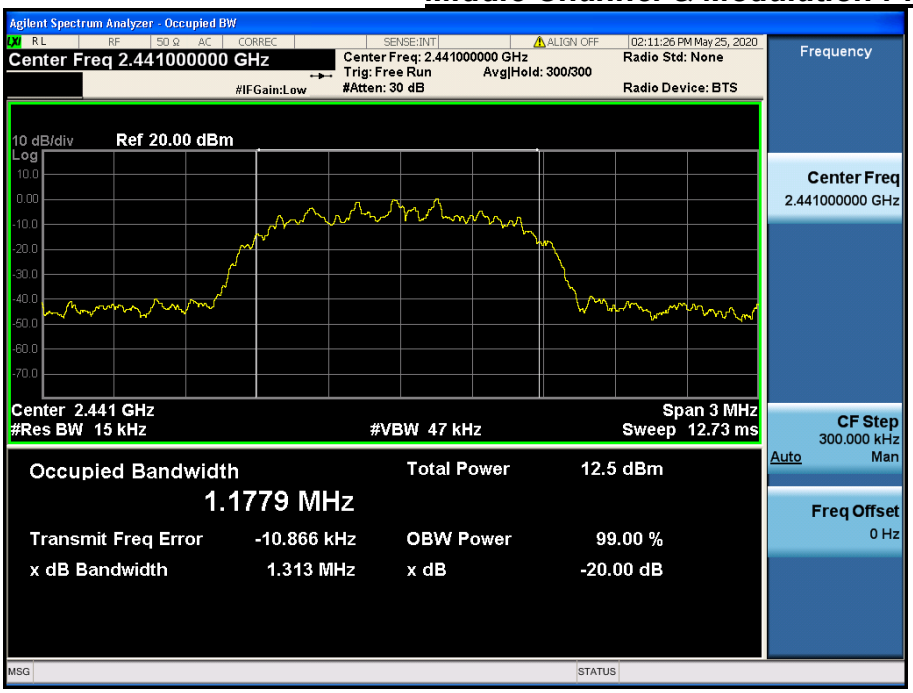
20 dB BW ***Highest Channel & Modulation : GFSK***



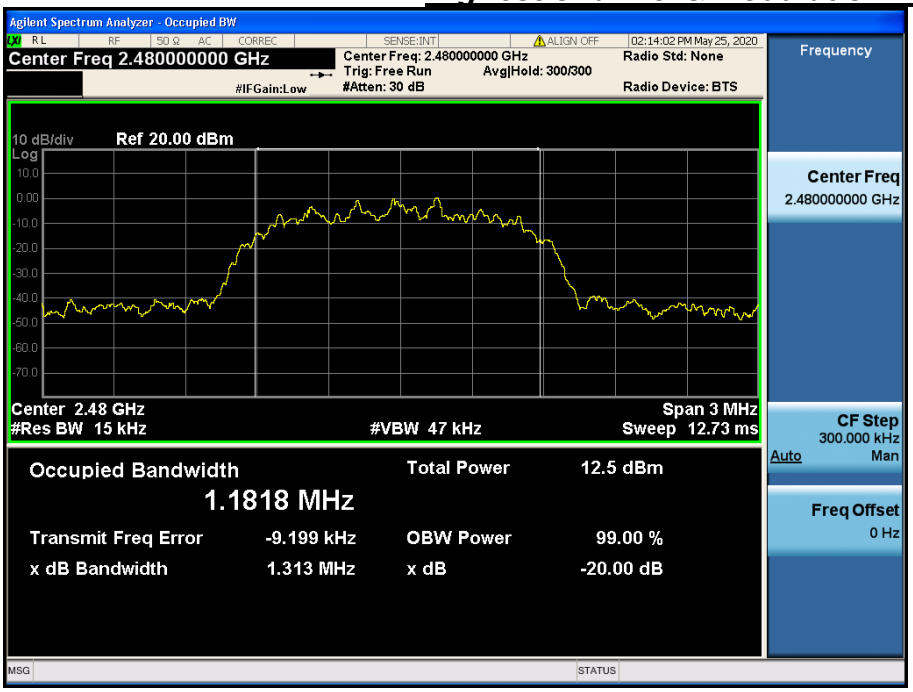
20 dB BW ***Lowest Channel & Modulation : π/4DQPSK***



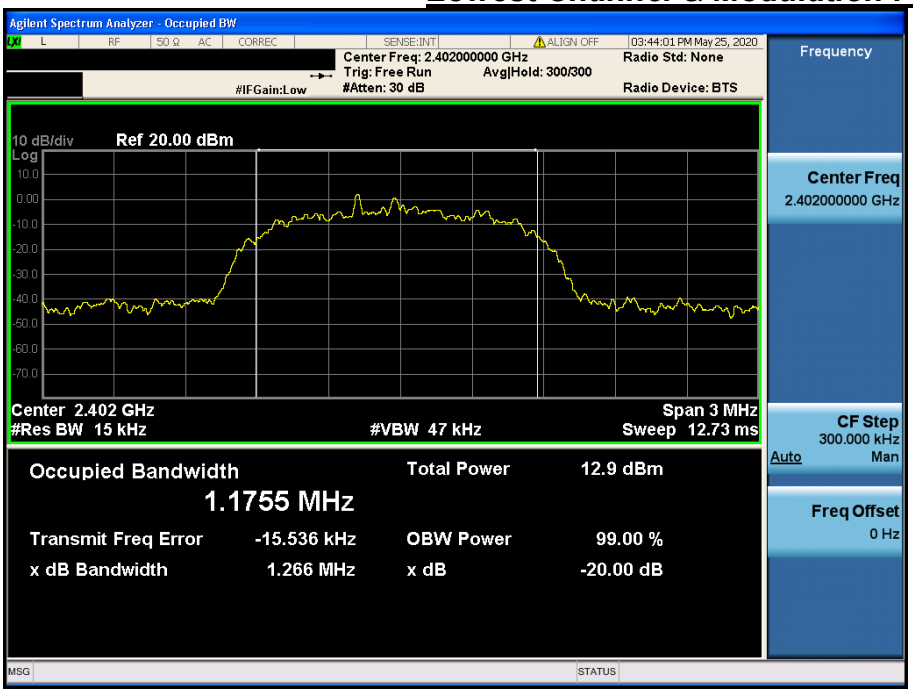
20 dB BW ***Middle Channel & Modulation : π/4DQPSK***



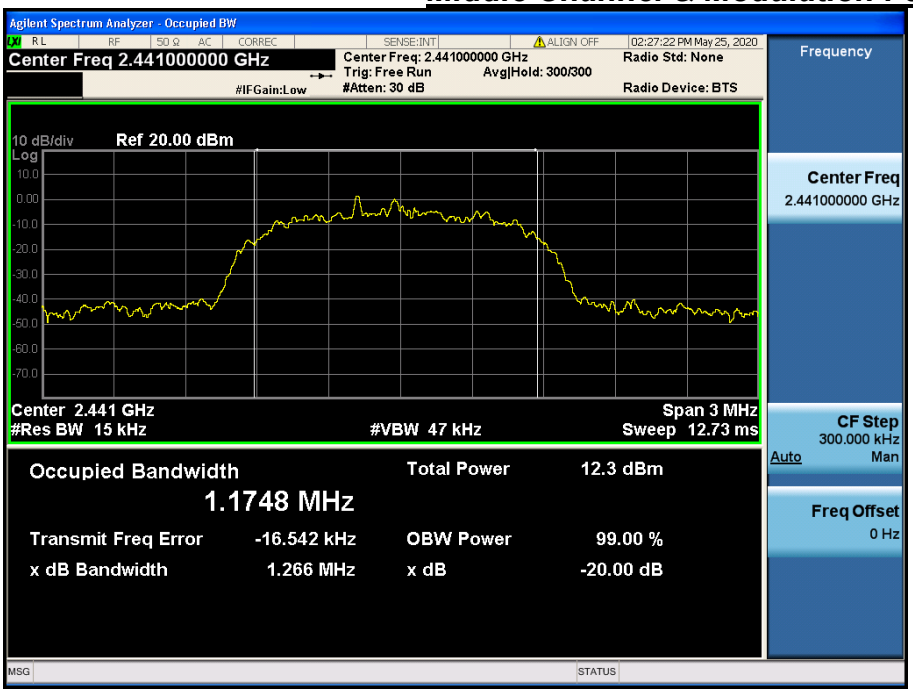
20 dB BW ***Highest Channel & Modulation : π/4DQPSK***



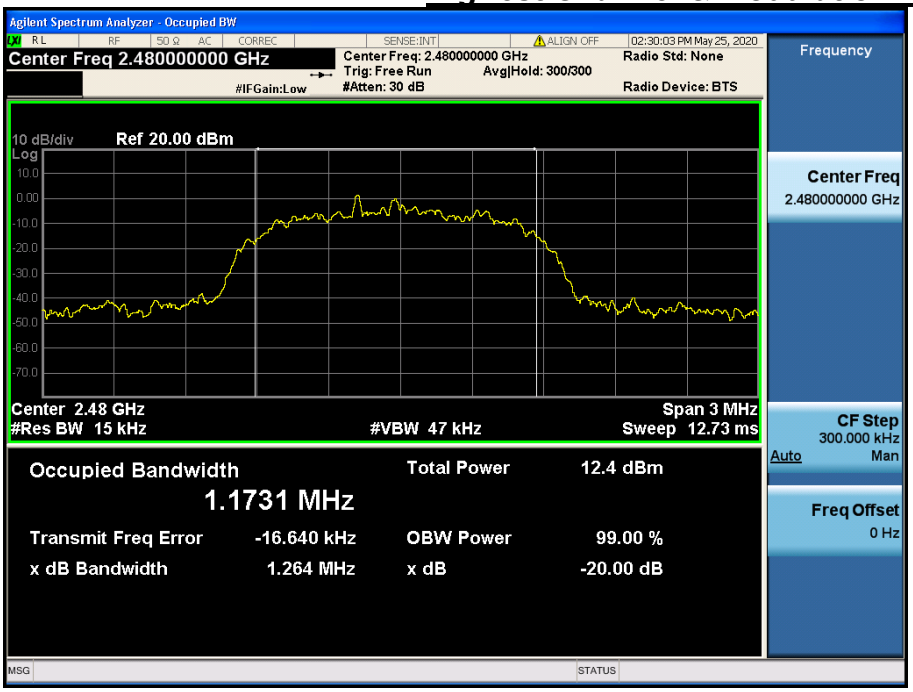
20 dB BW ***Lowest Channel & Modulation : 8DPSK***



20 dB BW ***Middle Channel & Modulation : 8DPSK***

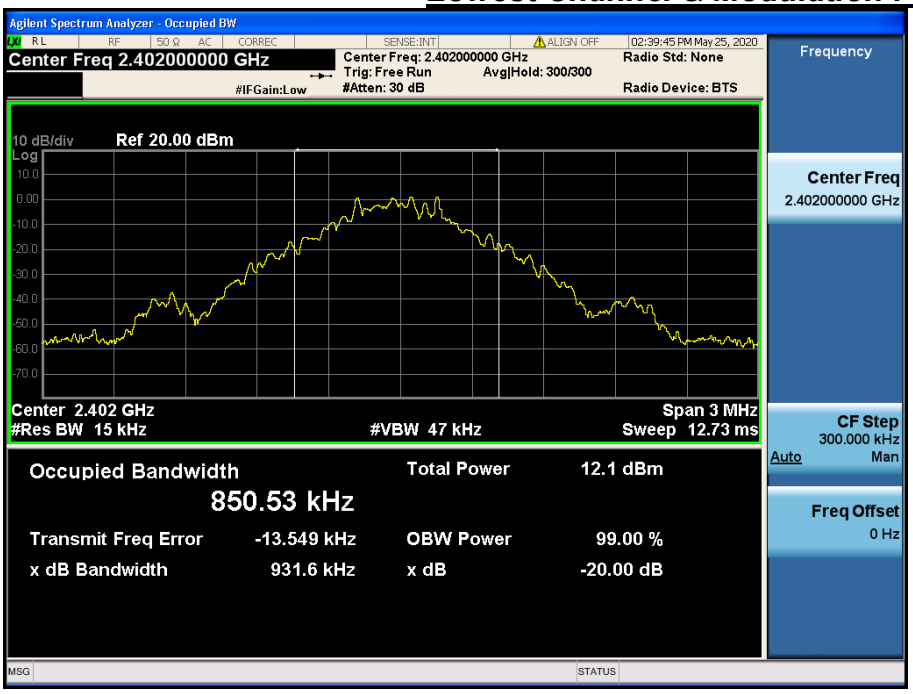


20 dB BW ***Highest Channel & Modulation : 8DPSK***

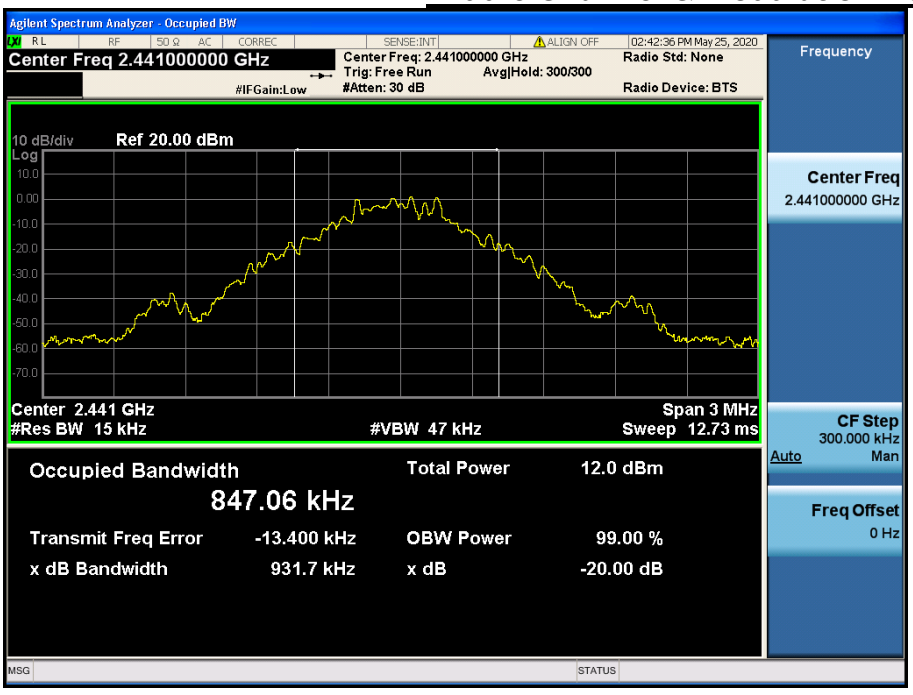


- Tested Power Supply: 24 V

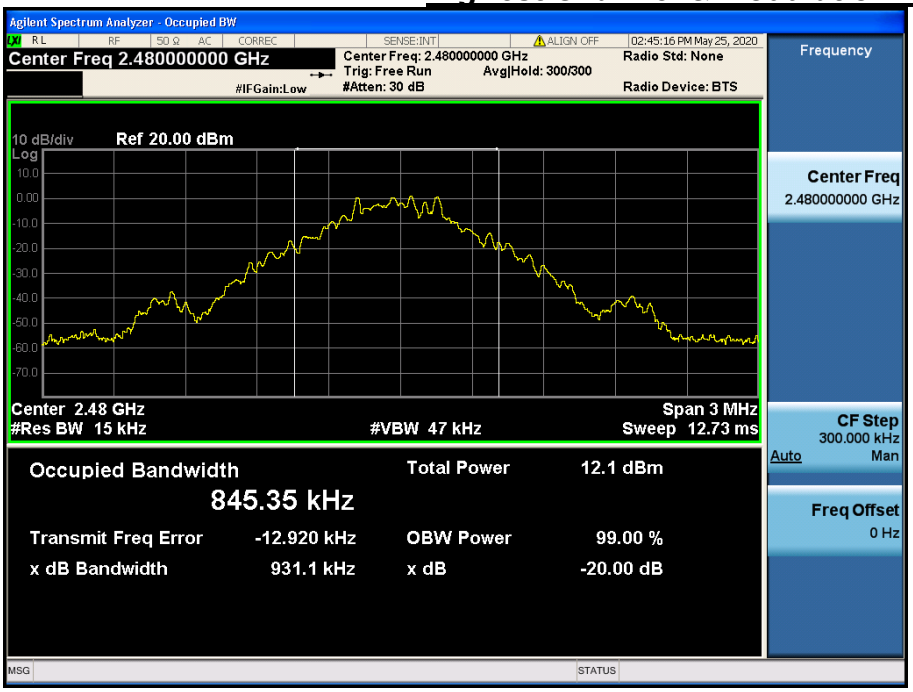
20 dB BW ***Lowest Channel & Modulation : GFSK***



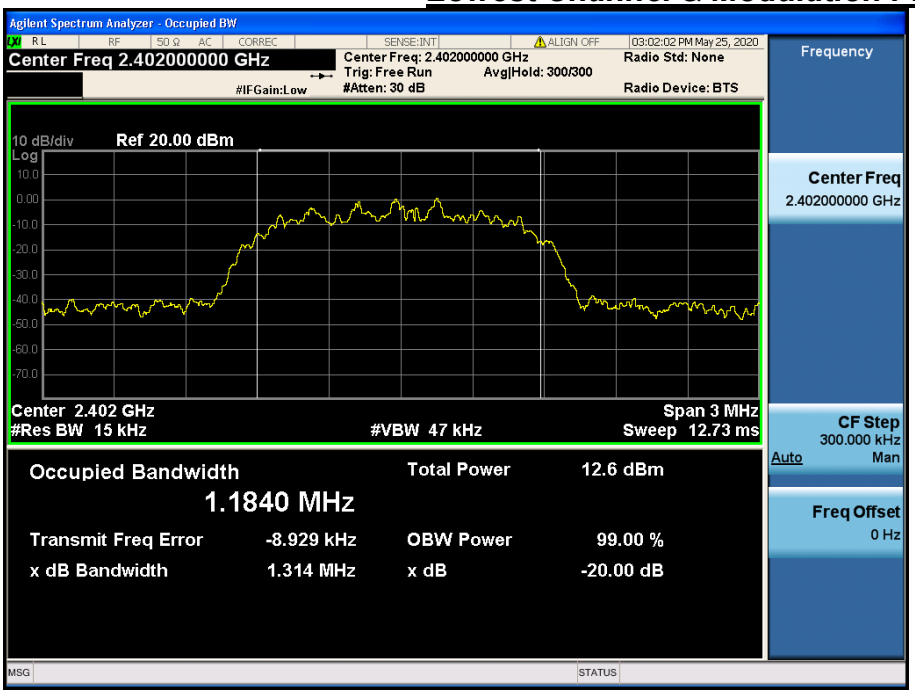
20 dB BW ***Middle Channel & Modulation : GFSK***



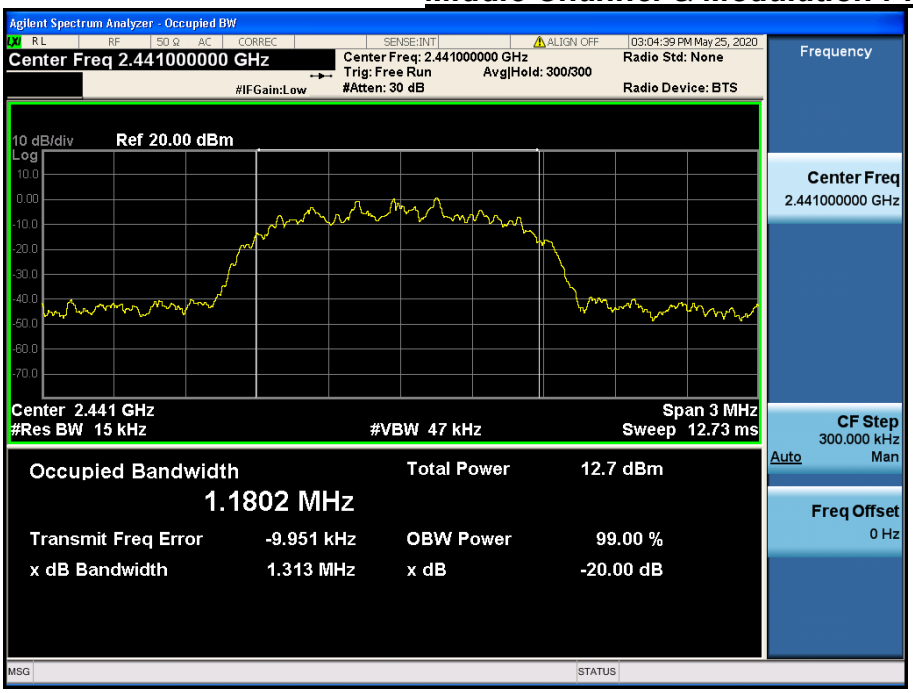
20 dB BW ***Highest Channel & Modulation : GFSK***



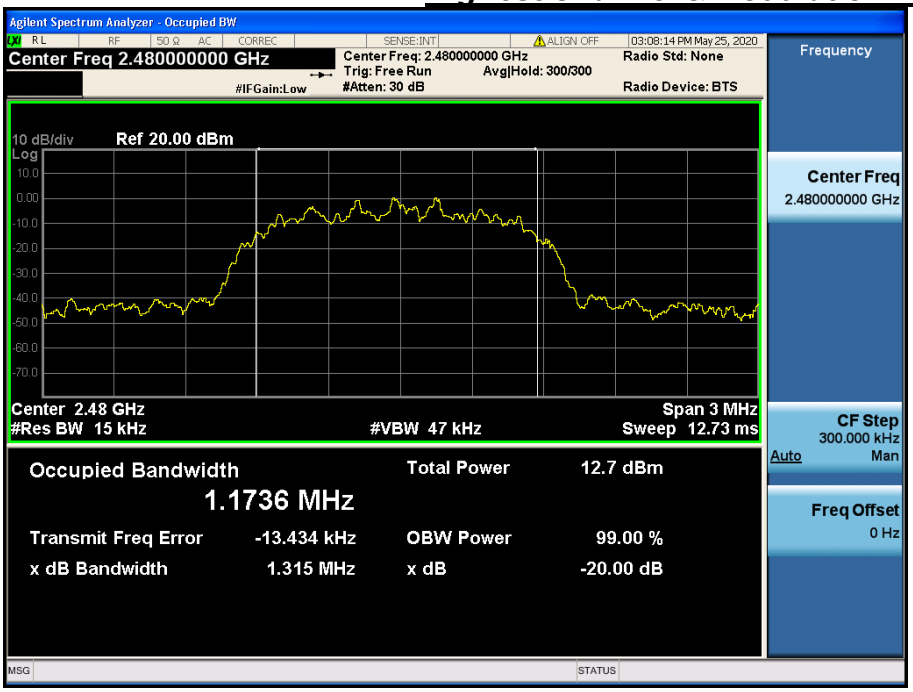
20 dB BW ***Lowest Channel & Modulation : π/4DQPSK***



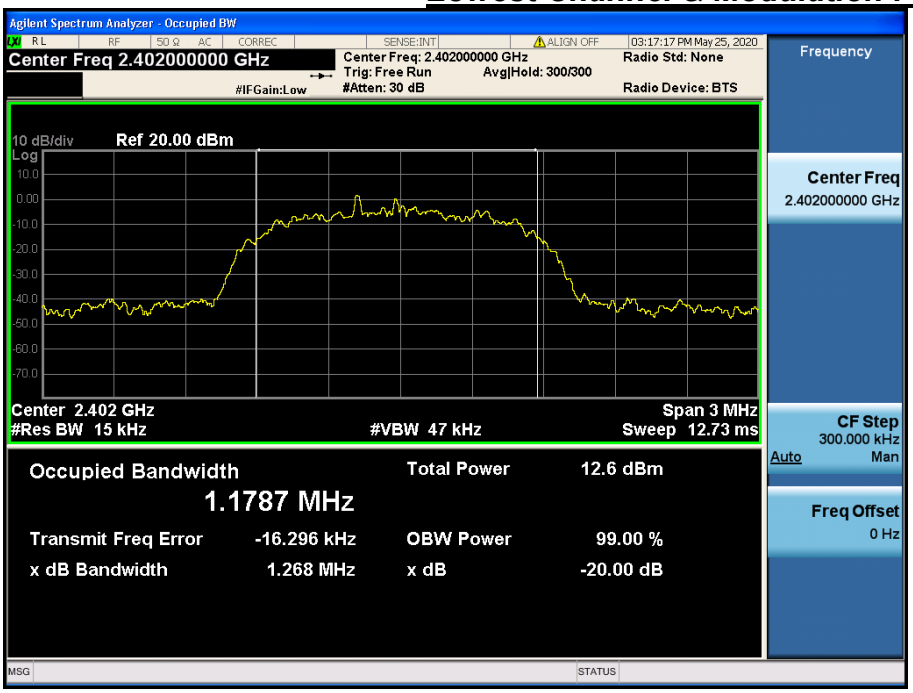
20 dB BW ***Middle Channel & Modulation : π/4DQPSK***



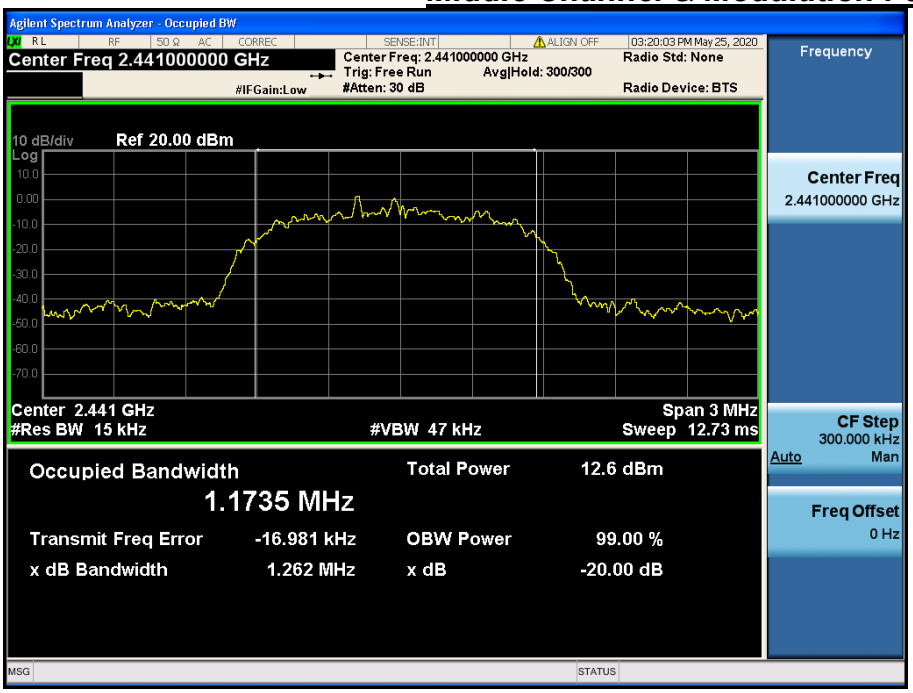
20 dB BW ***Highest Channel & Modulation : π/4DQPSK***



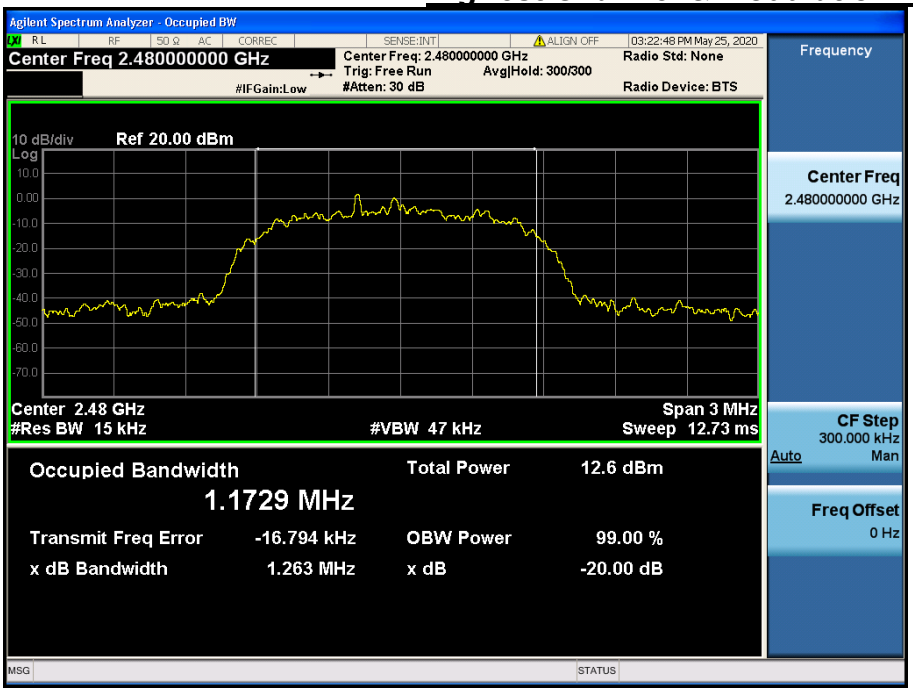
20 dB BW ***Lowest Channel & Modulation : 8DPSK***



20 dB BW ***Middle Channel & Modulation : 8DPSK***



20 dB BW ***Highest Channel & Modulation : 8DPSK***



4. Carrier Frequency Separation

4.1 Test Setup

Refer to the APPENDIX I.

4.2 Limit

Limit : ≥ 25 kHz or ≥ 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 ≥ RBW Sweep = auto
Detector function = peak Trace = max hold

4.4 Test Results

- Tested Power Supply: 12 V

FH mode

Hopping Mode	Modulation	Peak of reference Channel (MHz)	Peak of adjacent Channel (MHz)	Test Result (MHz)
Enable	GFSK	2 441.152	2442.156	1.004
	π/4DQPSK	2 441.159	2442.154	0.995
	8DPSK	2440.827	2 441.818	0.991

AFH mode

Hopping Mode	Modulation	Peak of reference Channel (MHz)	Peak of adjacent Channel (MHz)	Test Result (MHz)
Enable	GFSK	2 441.153	2442.155	1.002
	π/4DQPSK	2 441.159	2442.155	0.996
	8DPSK	2440.825	2 441.829	1.004

Note 1 : See next pages for actual measured spectrum

- Tested Power Supply: 24 V

FH mode

Hopping Mode	Modulation	Peak of reference Channel (MHz)	Peak of adjacent Channel (MHz)	Test Result (MHz)
Enable	GFSK	2 441.152	2442.153	1.001
	π/4DQPSK	2 441.160	2442.155	0.995
	8DPSK	2439.822	2440.821	0.999

AFH mode

Hopping Mode	Modulation	Peak of reference Channel (MHz)	Peak of adjacent Channel (MHz)	Test Result (MHz)
Enable	GFSK	2 441.156	2442.150	0.994
	π/4DQPSK	2 441.152	2442.155	1.003
	8DPSK	2440.815	2 441.823	1.008

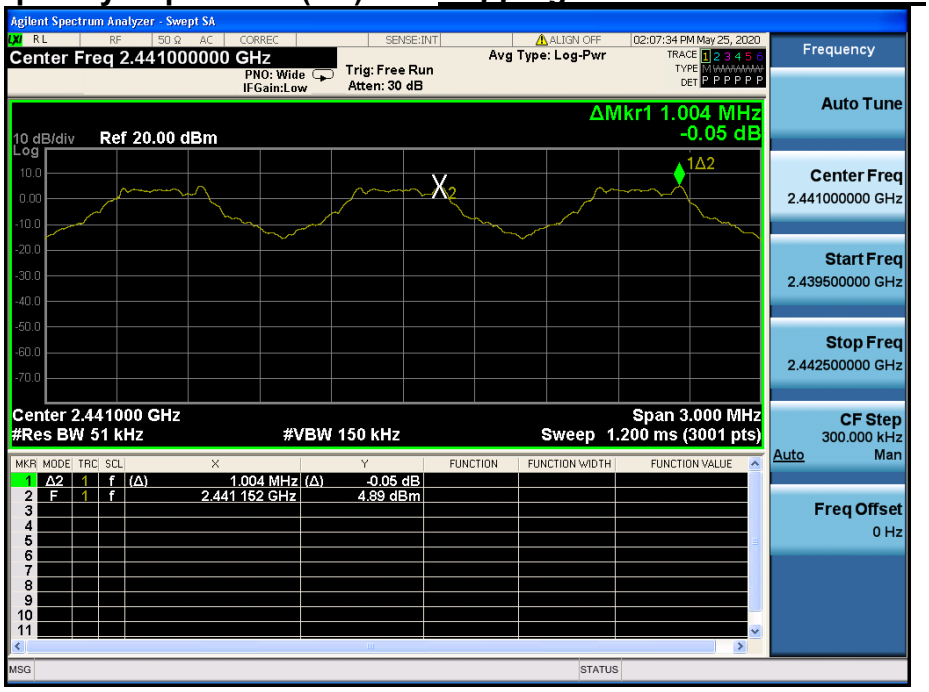
Note 1 : See next pages for actual measured spectrum

- Minimum Standard :

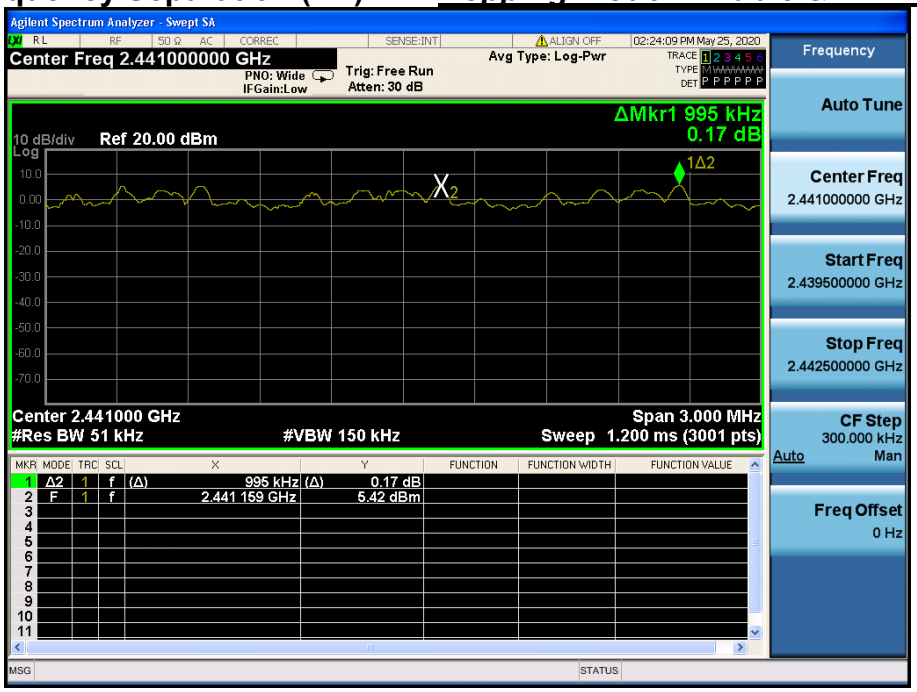
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.
Alternatively, frequency hopping systems operating in the 2400 - 2483.5 MHz band may have hopping channel carrier frequencies 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

- Tested Power Supply: 12 V

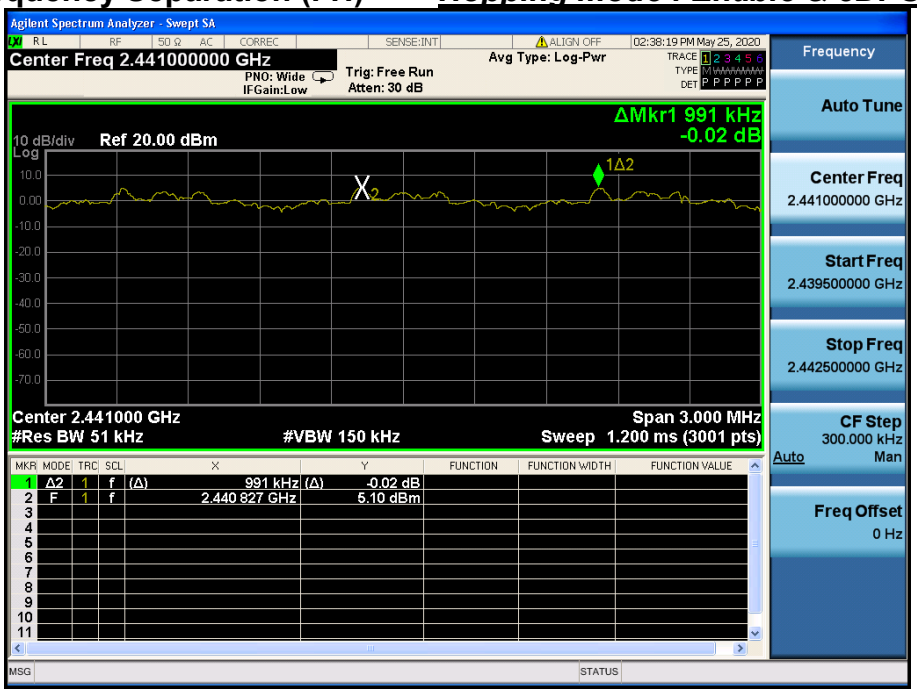
Carrier Frequency Separation (FH) ***Hopping mode : Enable & GFSK***



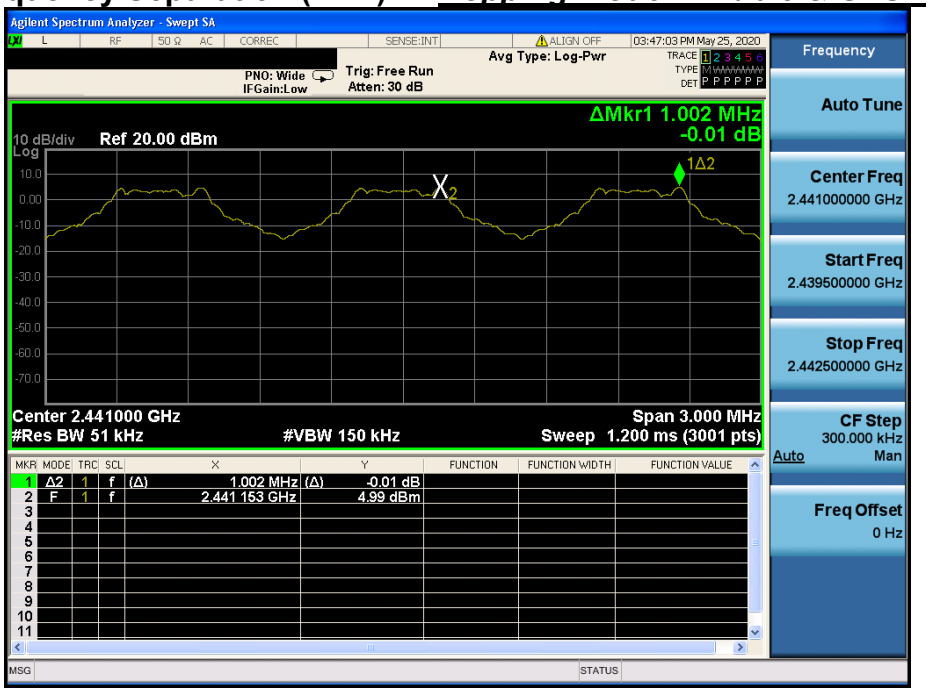
Carrier Frequency Separation (FH) ***Hopping mode : Enable & π/4DQPSK***



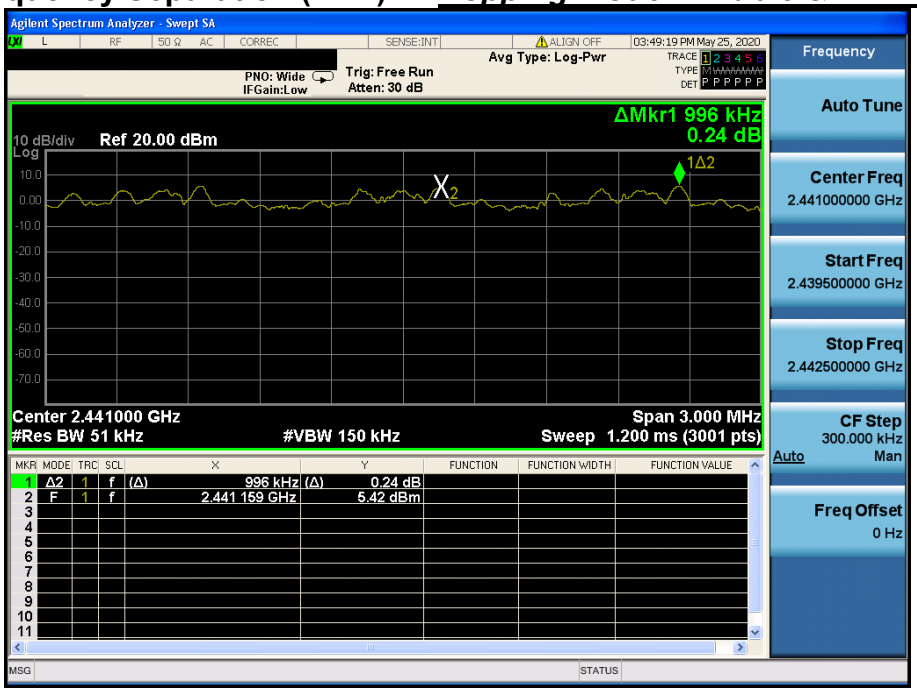
Carrier Frequency Separation (FH) ***Hopping mode : Enable & 8DPSK***



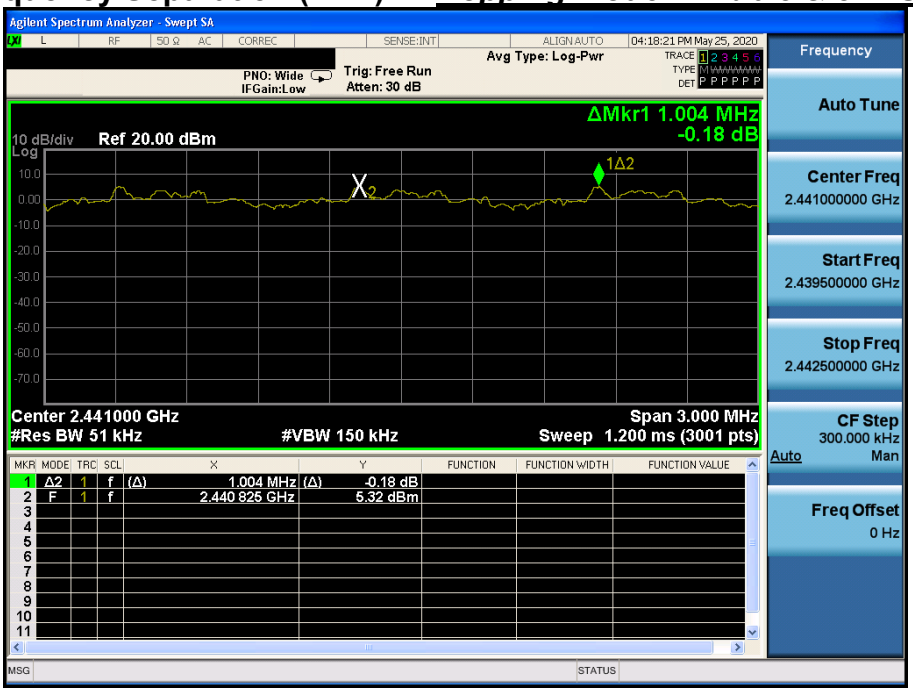
Carrier Frequency Separation (AFH) ***Hopping mode : Enable & GFSK***



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

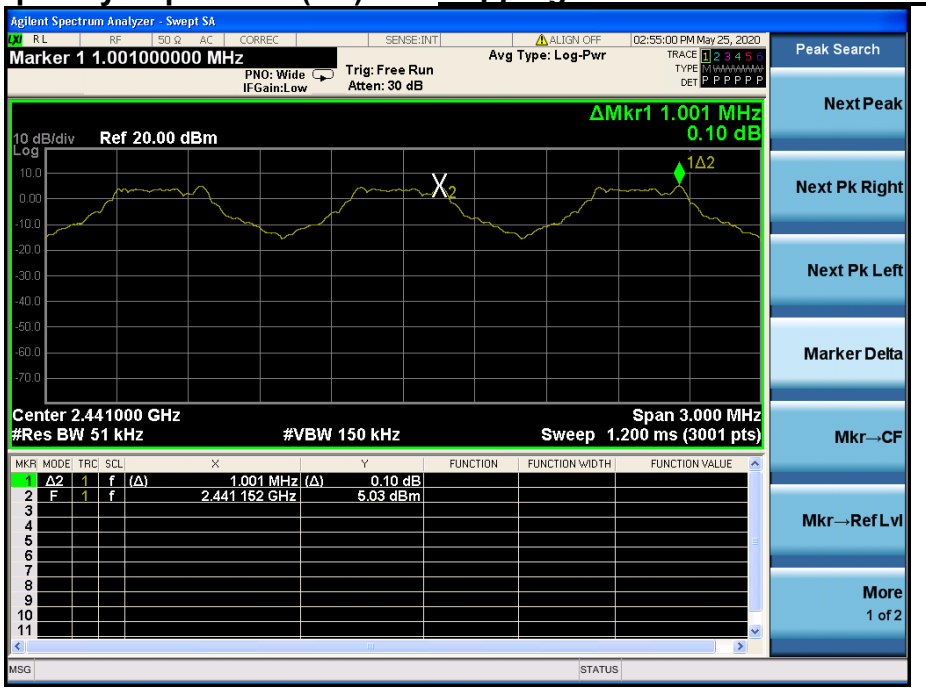


Carrier Frequency Separation (AFH) ***Hopping mode : Enable & 8DPSK***

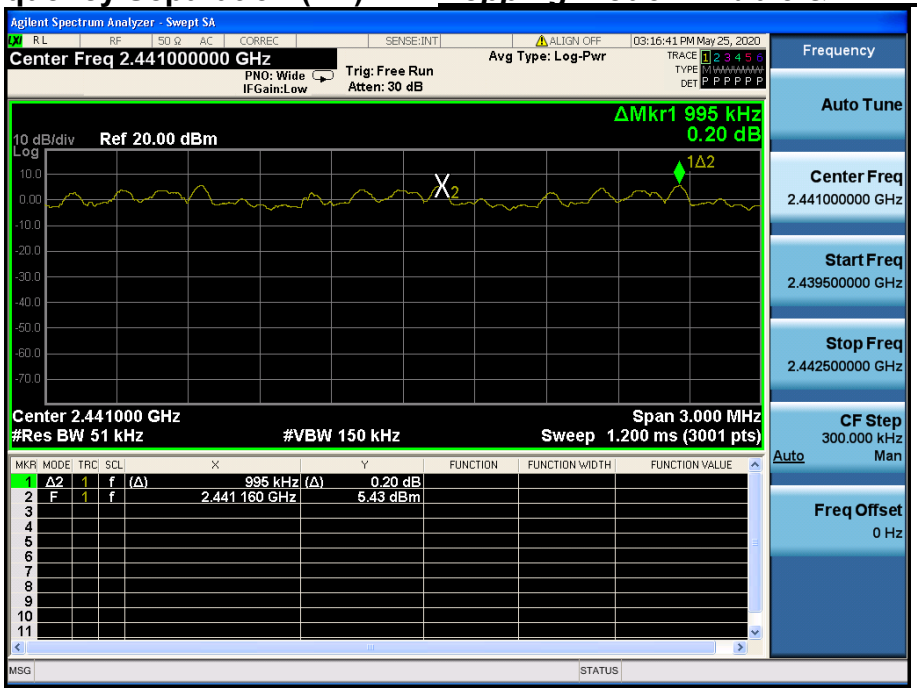


- Tested Power Supply: 24 V

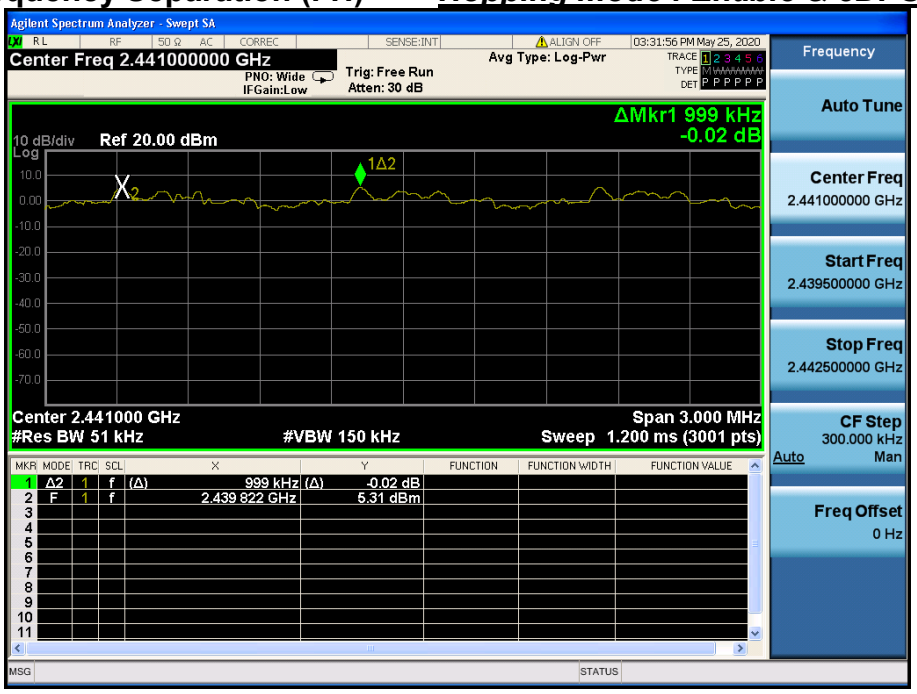
Carrier Frequency Separation (FH) ***Hopping mode : Enable & GFSK***



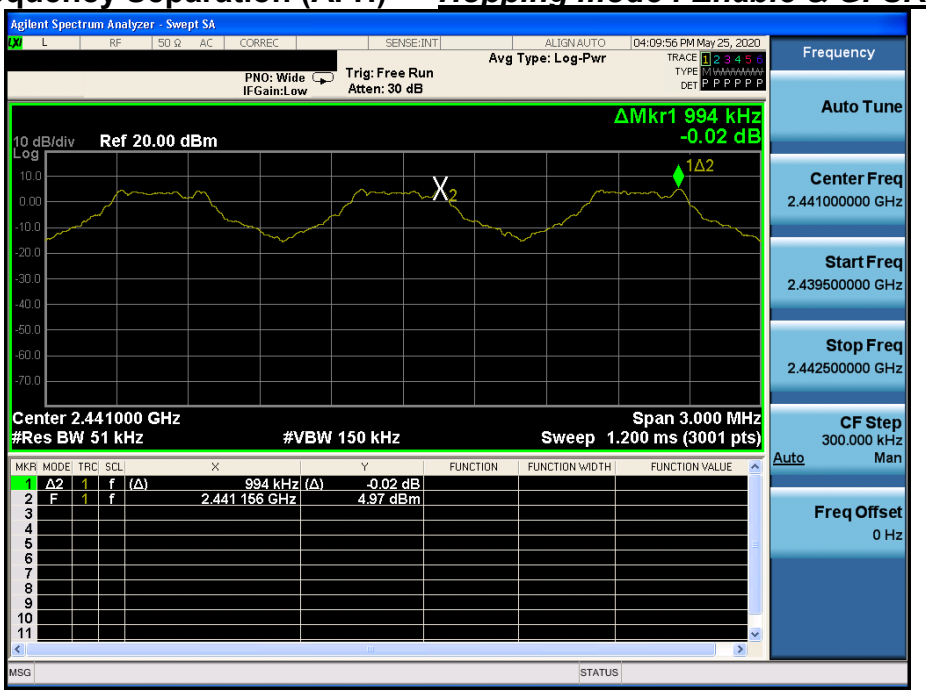
Carrier Frequency Separation (FH) ***Hopping mode : Enable & π/4DQPSK***



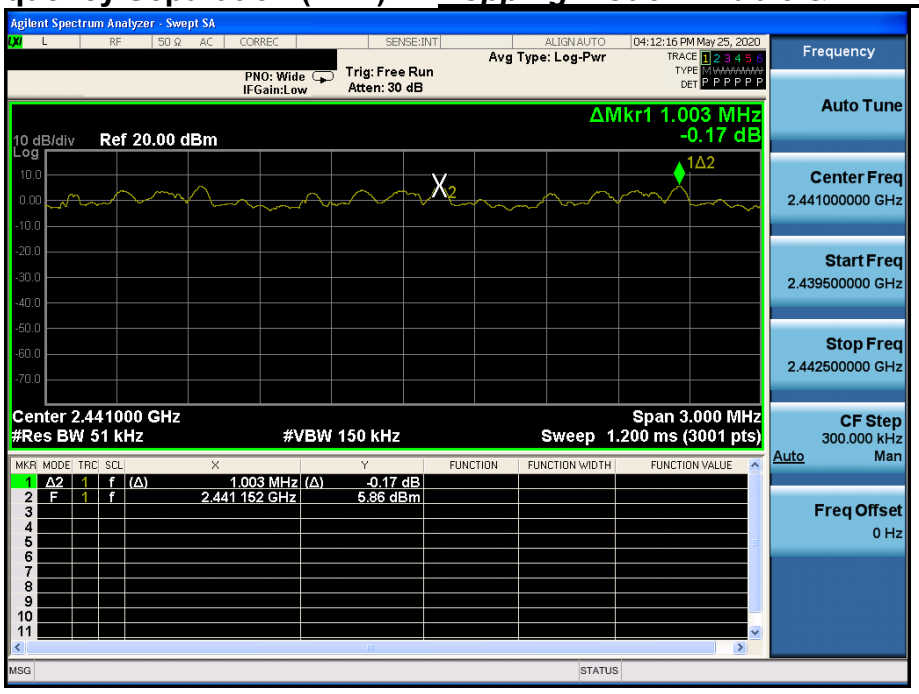
Carrier Frequency Separation (FH) ***Hopping mode : Enable & 8DPSK***



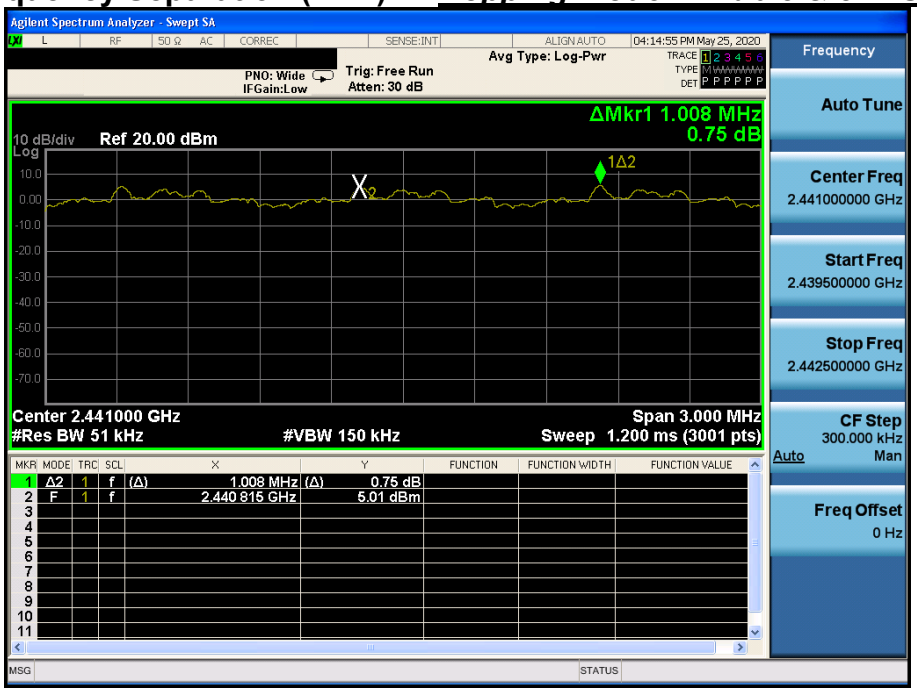
Carrier Frequency Separation (AFH) ***Hopping mode : Enable & GFSK***



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



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



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 = 2 441.5 MHz
Start Frequency = 2 441.5 MHz, Stop Frequency = 2491.5 MHz

Span for AFH mode = 30 MHz Start Frequency = 2426.0 MHz, Stop Frequency = 2456.0 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 ≥ RBW Sweep = auto

Detector function = peak Trace = max hold

5.4 Test Results

- Tested Power Supply: 12 V

FH mode

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

AFH mode

Hopping mode	Modulation	Test Result (Total Hops)
Enable	GFSK	20
	π/4DQPSK	20
	8DPSK	20

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

- Tested Power Supply: 24 V

FH mode

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

AFH mode

Hopping mode	Modulation	Test Result (Total Hops)
Enable	GFSK	20
	π/4DQPSK	20
	8DPSK	20

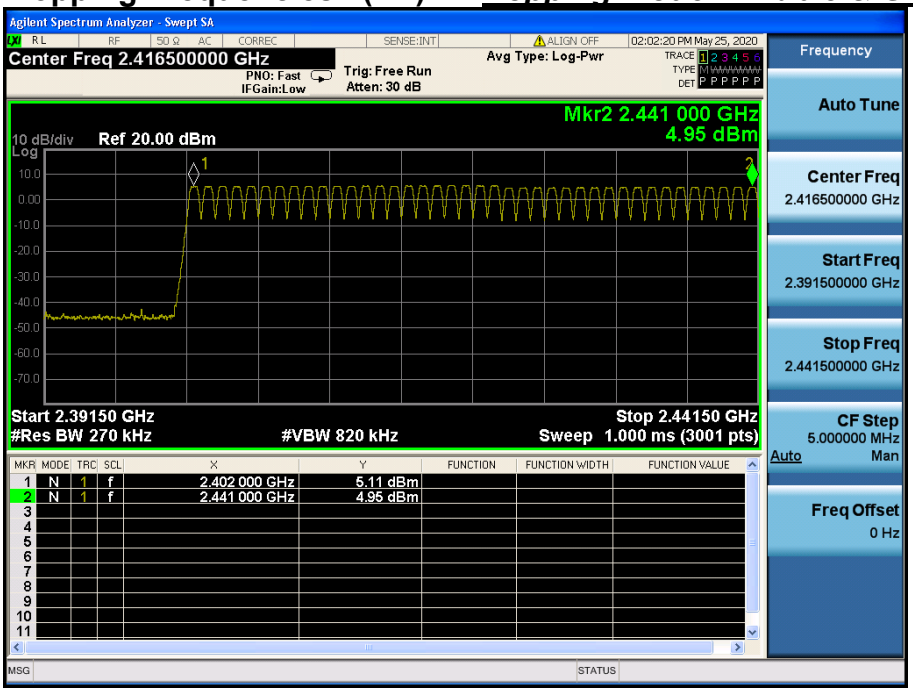
Note 1 : See next pages for actual measured spectrum plots.

- Minimum Standard :

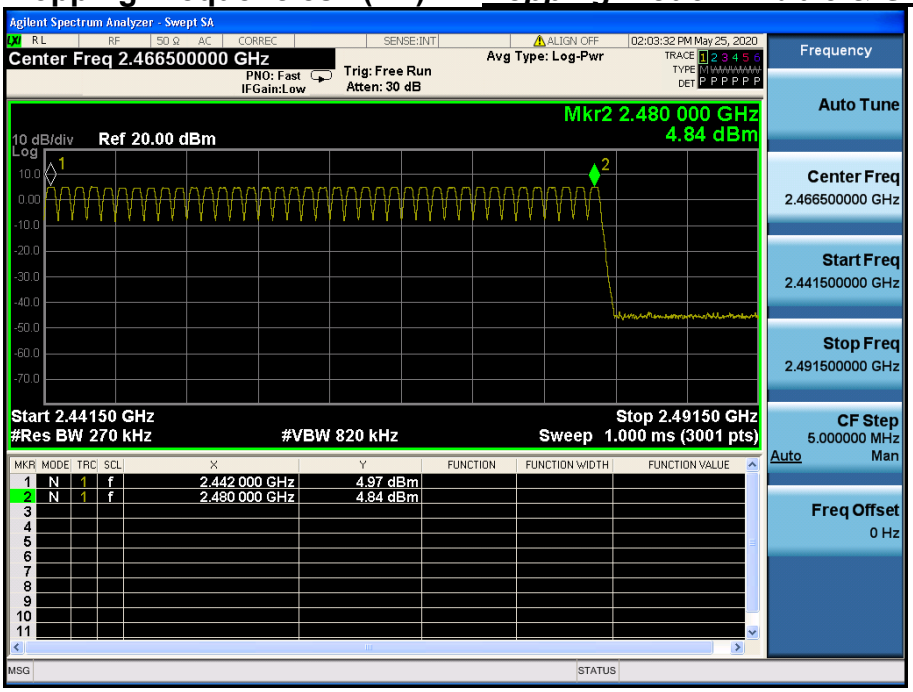
At least 15 hopes

- Tested Power Supply: 12 V

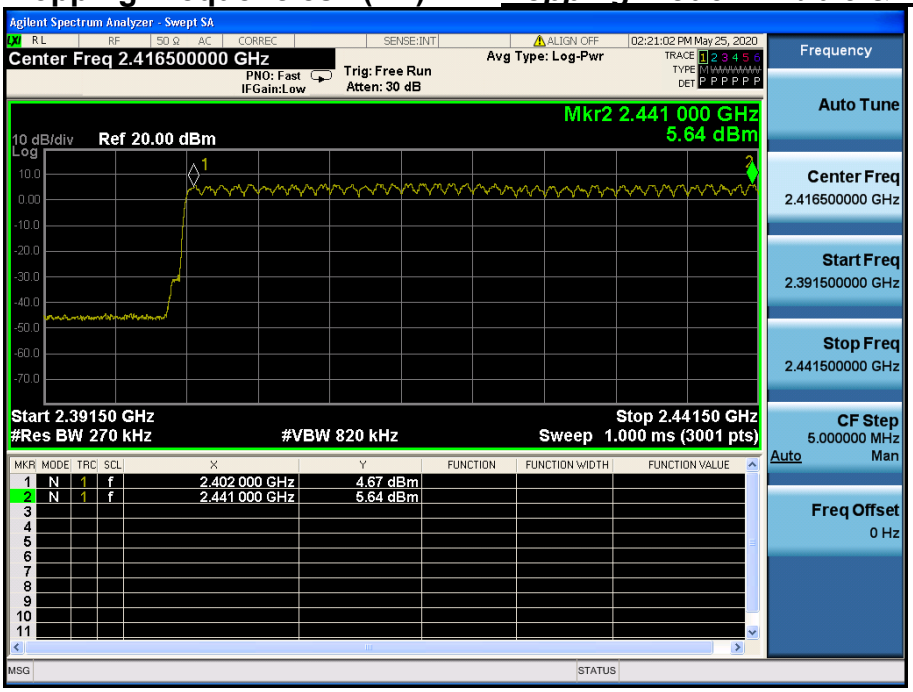
Number of Hopping Frequencies 1(FH) ***Hopping mode : Enable & GFSK***



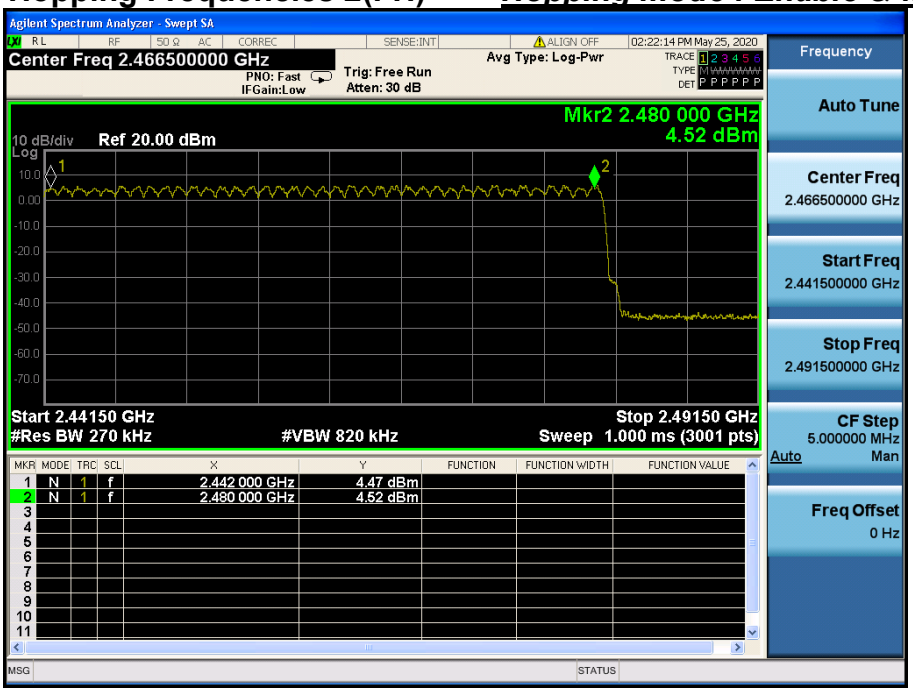
Number of Hopping Frequencies 2(FH) ***Hopping mode : Enable & GFSK***



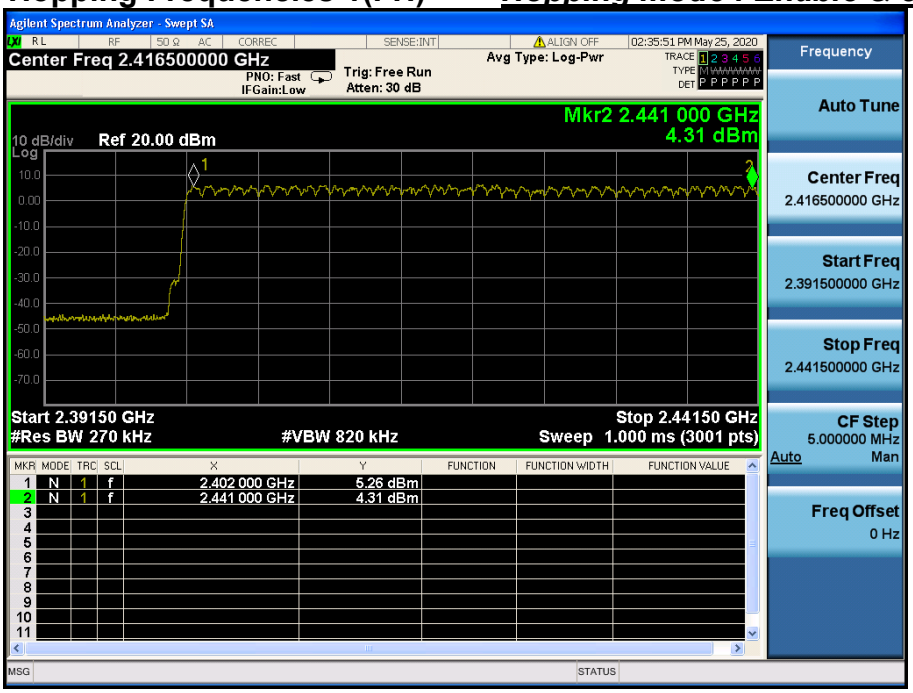
Number of Hopping Frequencies 1(FH) ***Hopping mode : Enable & π/4DQPSK***



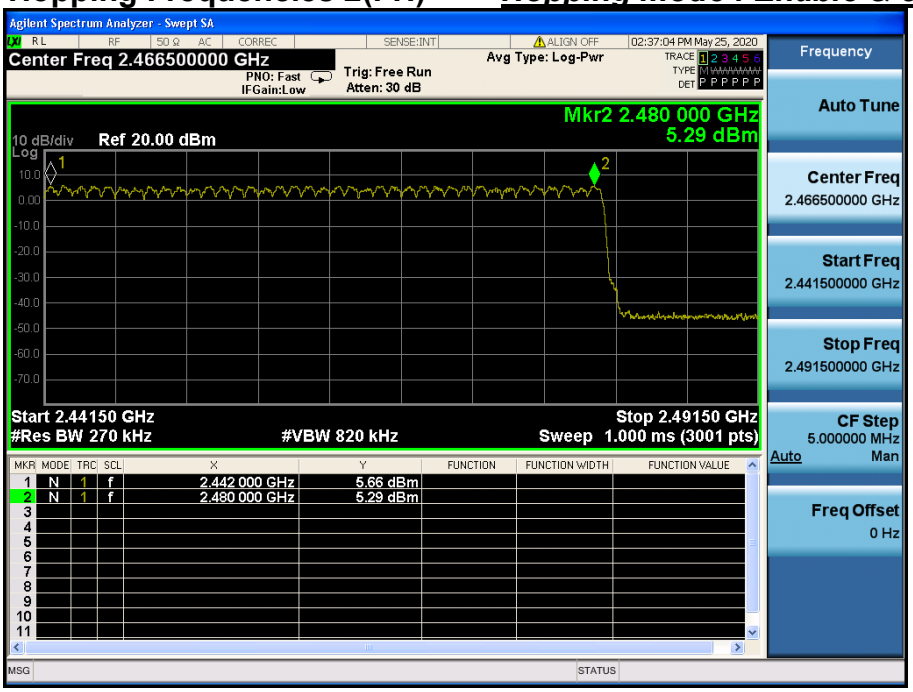
Number of Hopping Frequencies 2(FH) ***Hopping mode : Enable & π/4DQPSK***



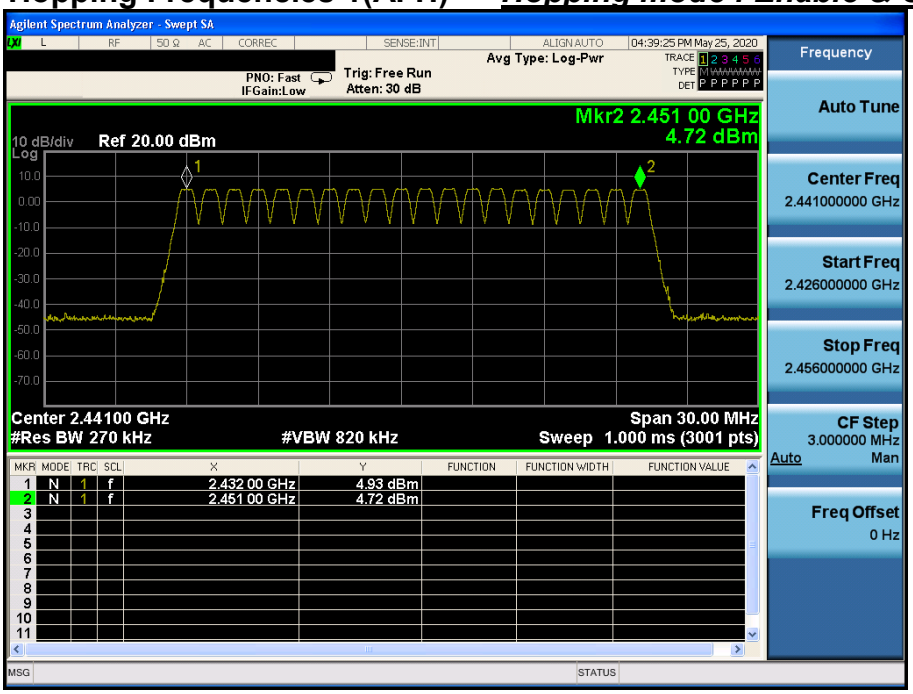
Number of Hopping Frequencies 1(FH) *Hopping mode : Enable & 8DPSK*



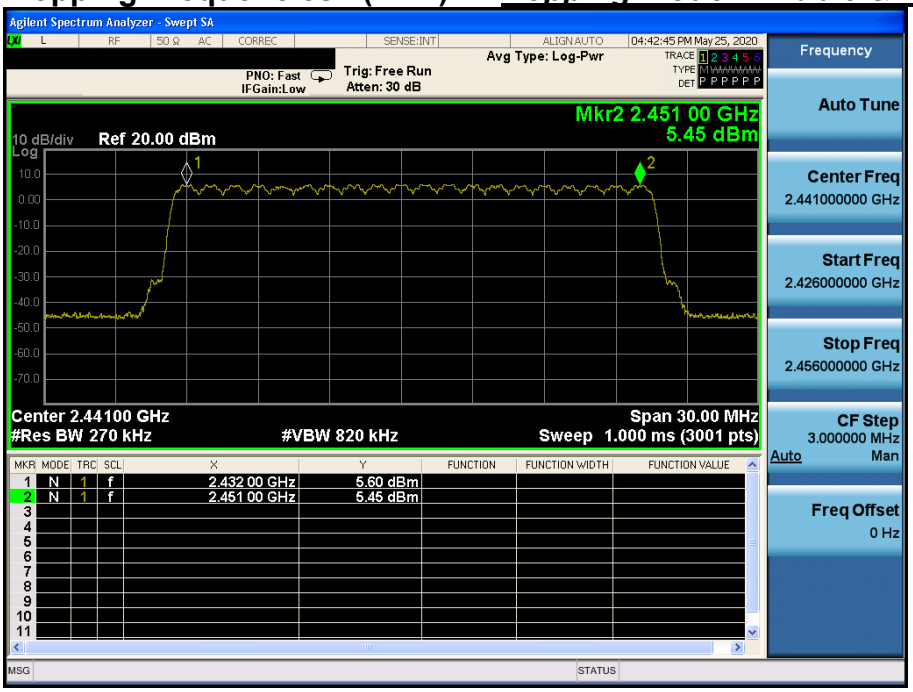
Number of Hopping Frequencies 2(FH) *Hopping mode : Enable & 8DPSK*



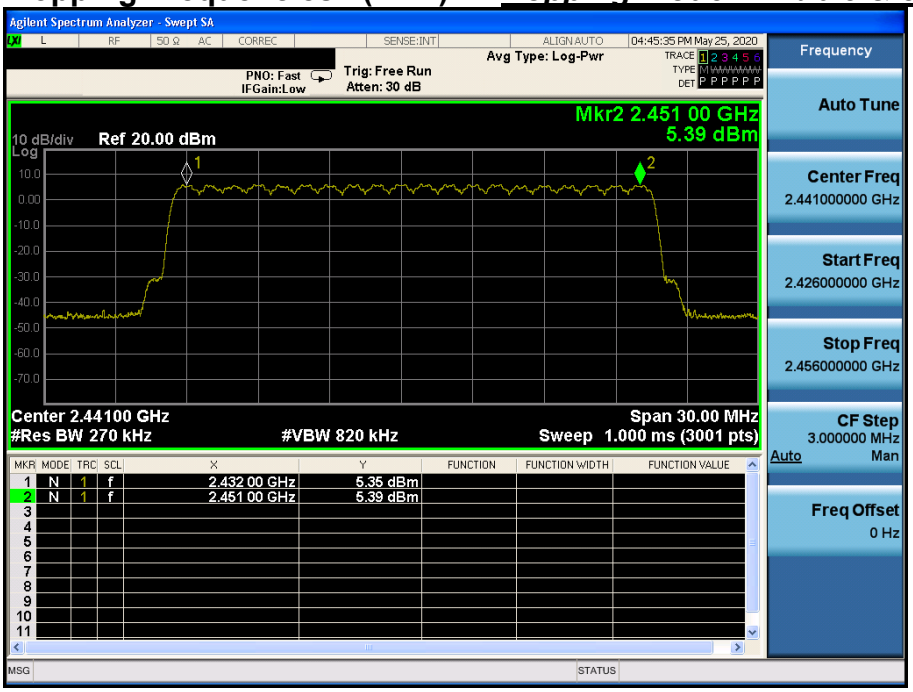
Number of Hopping Frequencies 1(AFH) ***Hopping mode : Enable & GFSK***



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

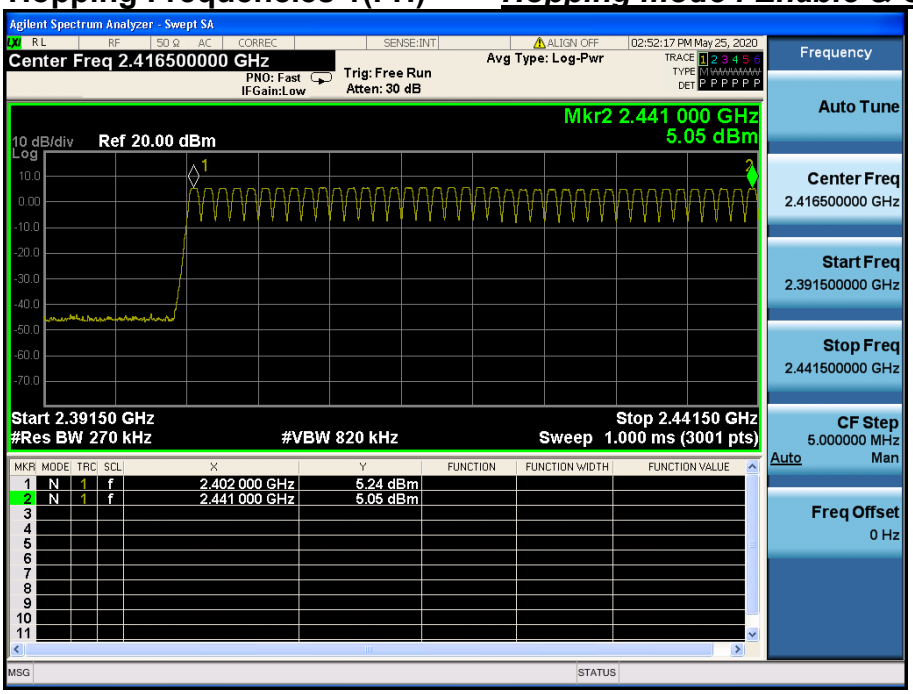


Number of Hopping Frequencies 1(AFH) ***Hopping mode : Enable & 8DPSK***

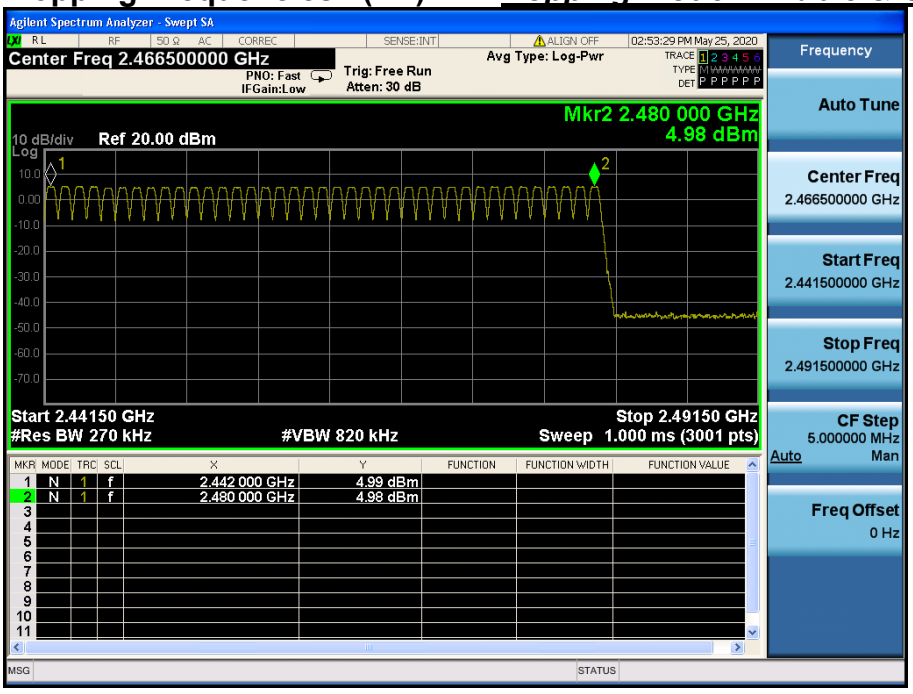


- Tested Power Supply: 24 V

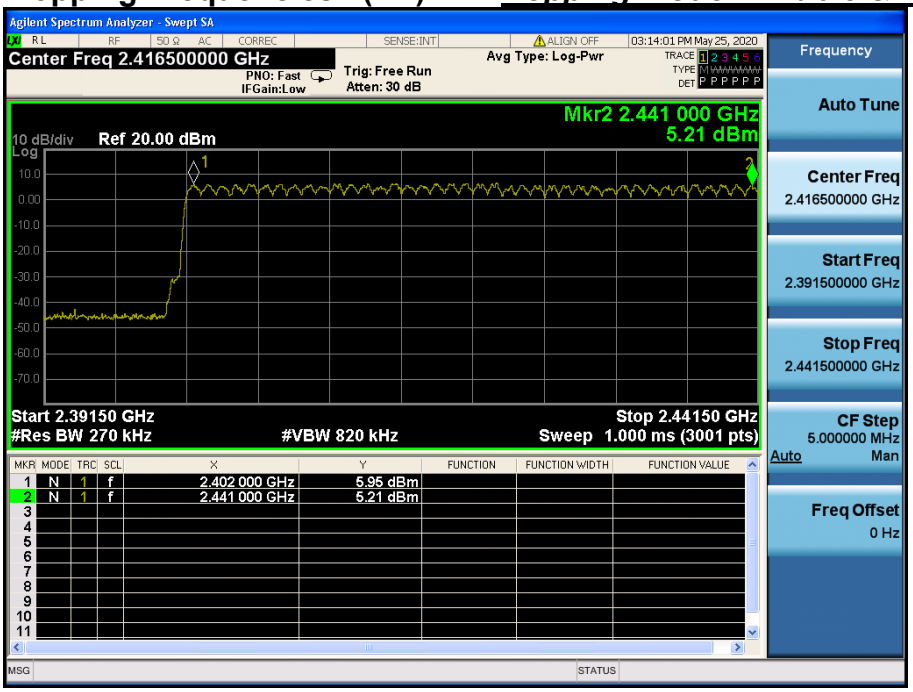
Number of Hopping Frequencies 1(FH) ***Hopping mode : Enable & GFSK***



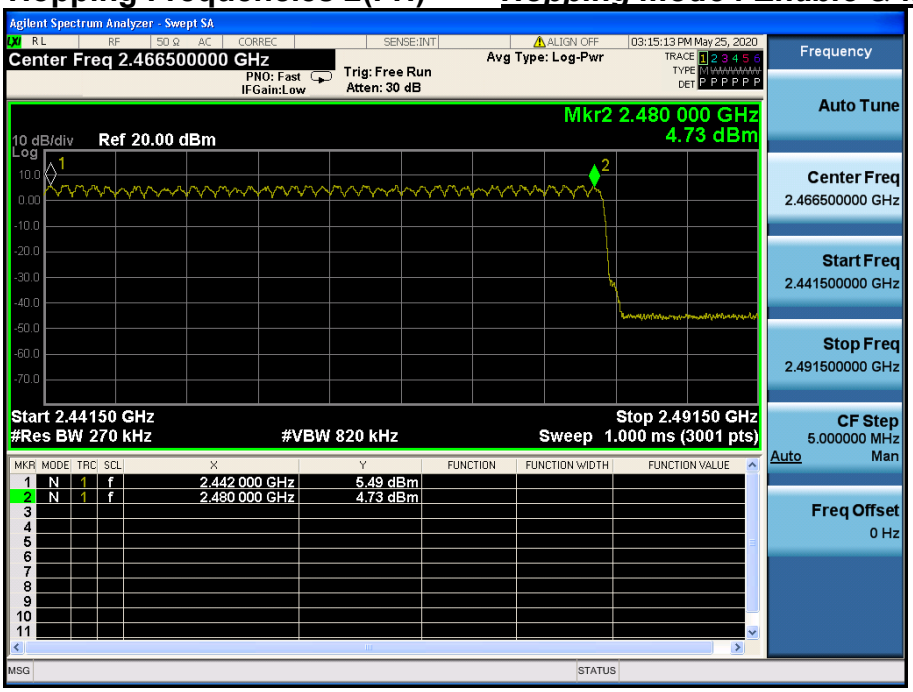
Number of Hopping Frequencies 2(FH) ***Hopping mode : Enable & GFSK***



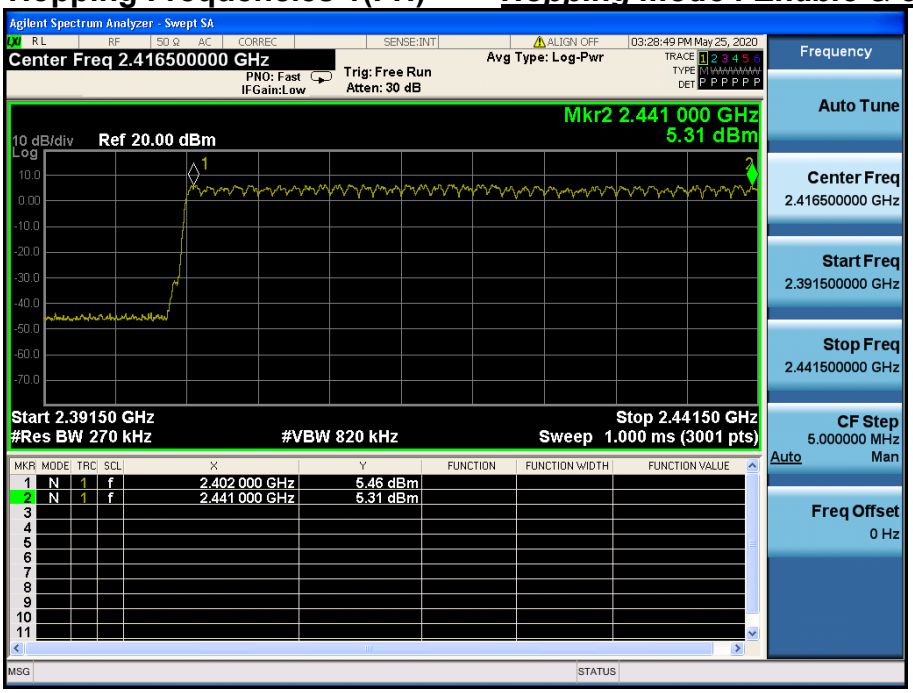
Number of Hopping Frequencies 1(FH) ***Hopping mode : Enable & π/4DQPSK***



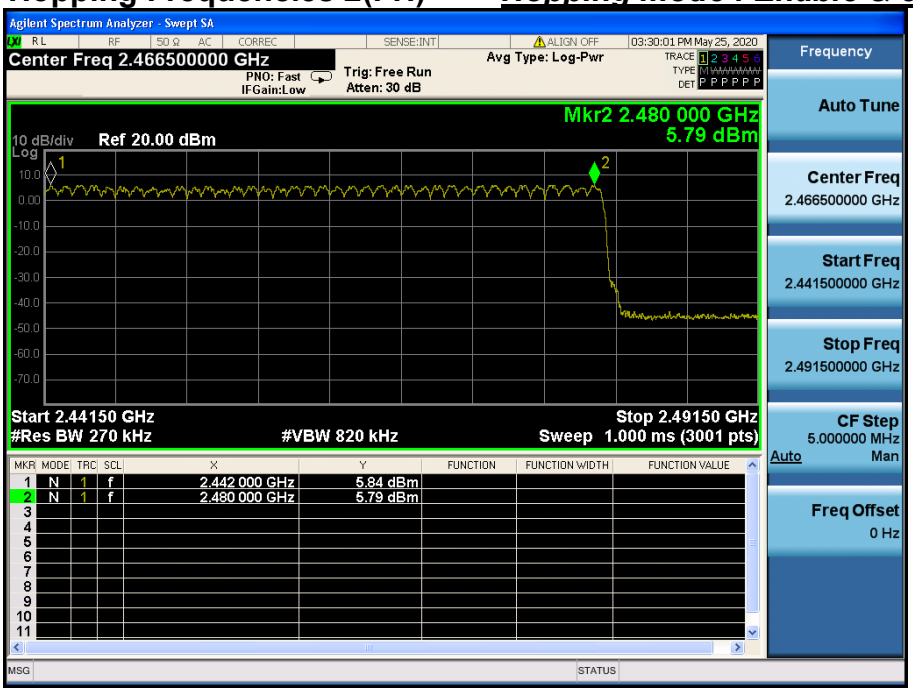
Number of Hopping Frequencies 2(FH) ***Hopping mode : Enable & π/4DQPSK***



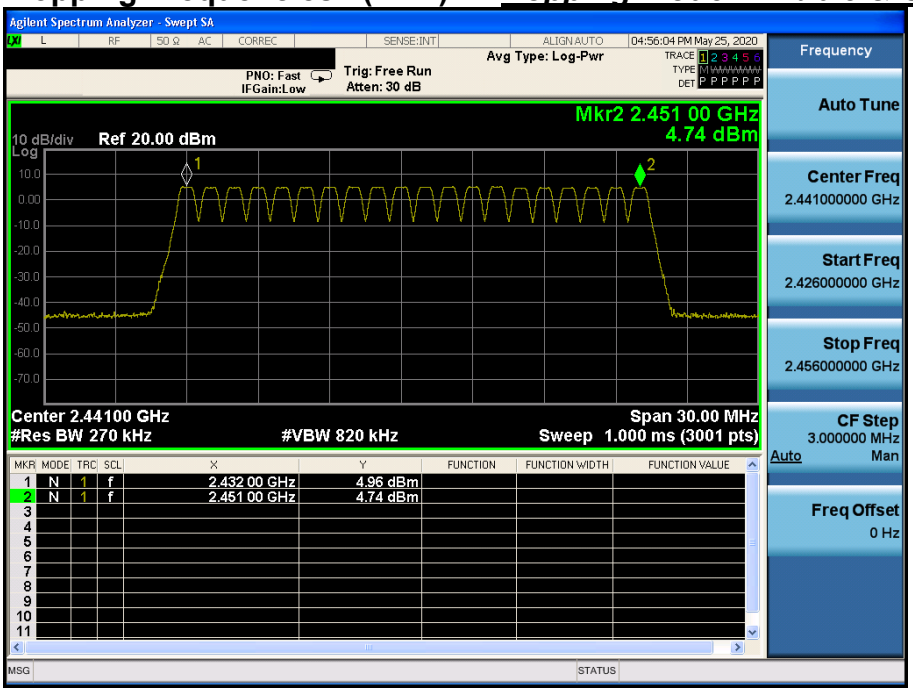
Number of Hopping Frequencies 1(FH) ***Hopping mode : Enable & 8DPSK***



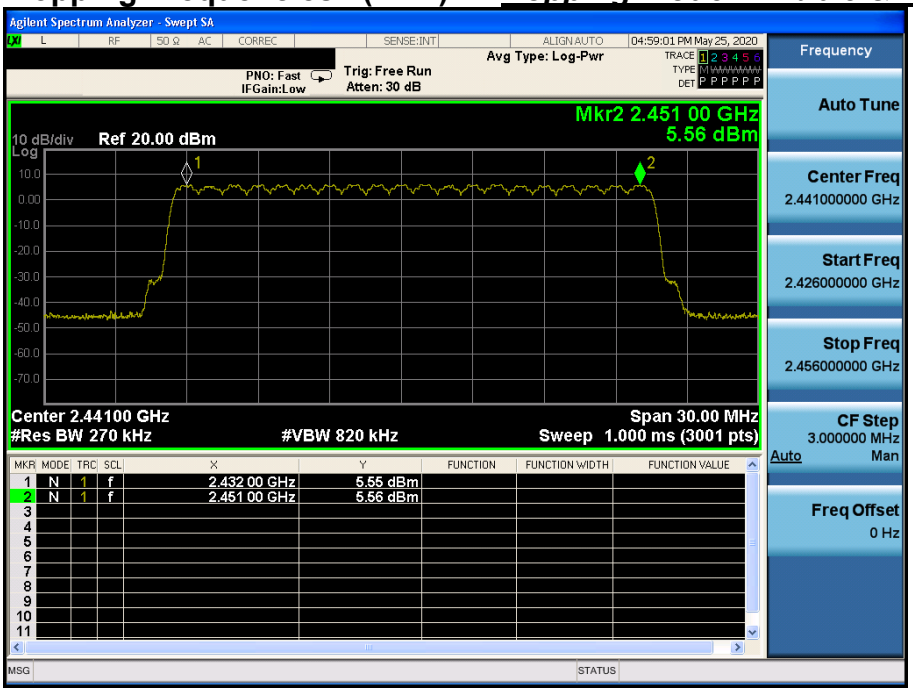
Number of Hopping Frequencies 2(FH) ***Hopping mode : Enable & 8DPSK***



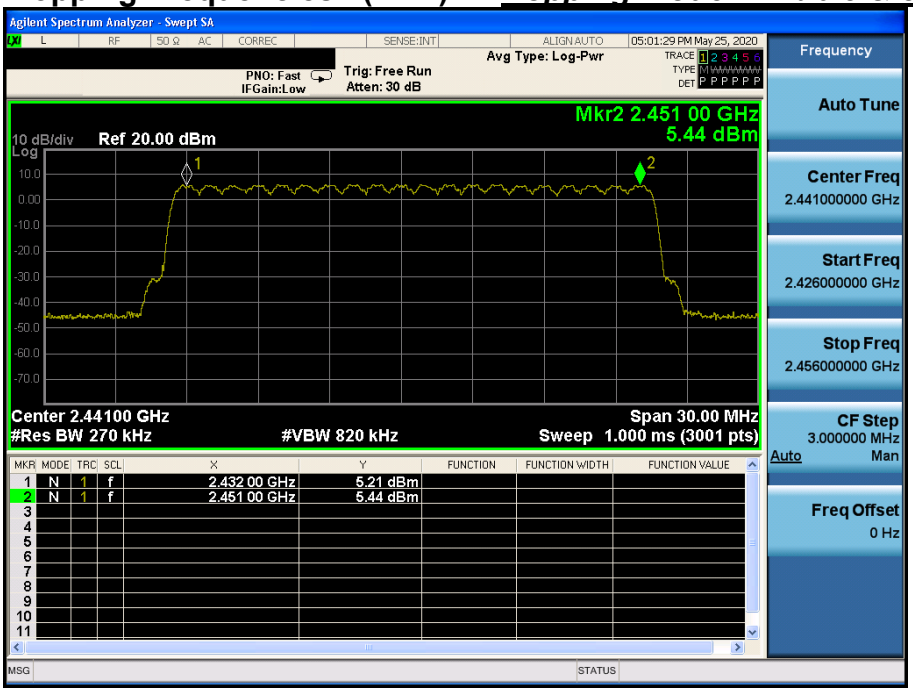
Number of Hopping Frequencies 1(AFH) ***Hopping mode : Enable & GFSK***



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



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



6. Time of Occupancy (Dwell Time)

6.1 Test Setup

Refer to the APPENDIX I.

6.2 Limit

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

6.3 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 ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel)

VBW ≥ RBW Detector function = peak

Trace = max hold

6.4 Test Results

- Tested 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	3.780	0.306
	2 DH 5	79	2.865	3.780	0.306
	3 DH 5	79	2.865	3.780	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	3.780	0.153
	2 DH 5	20	2.865	3.780	0.153
	3 DH 5	20	2.865	3.780	0.153

- Tested 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	3.780	0.306
	2 DH 5	79	2.865	3.780	0.306
	3 DH 5	79	2.865	3.780	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	3.780	0.153
	2 DH 5	20	2.865	3.780	0.153
	3 DH 5	20	2.865	3.780	0.153

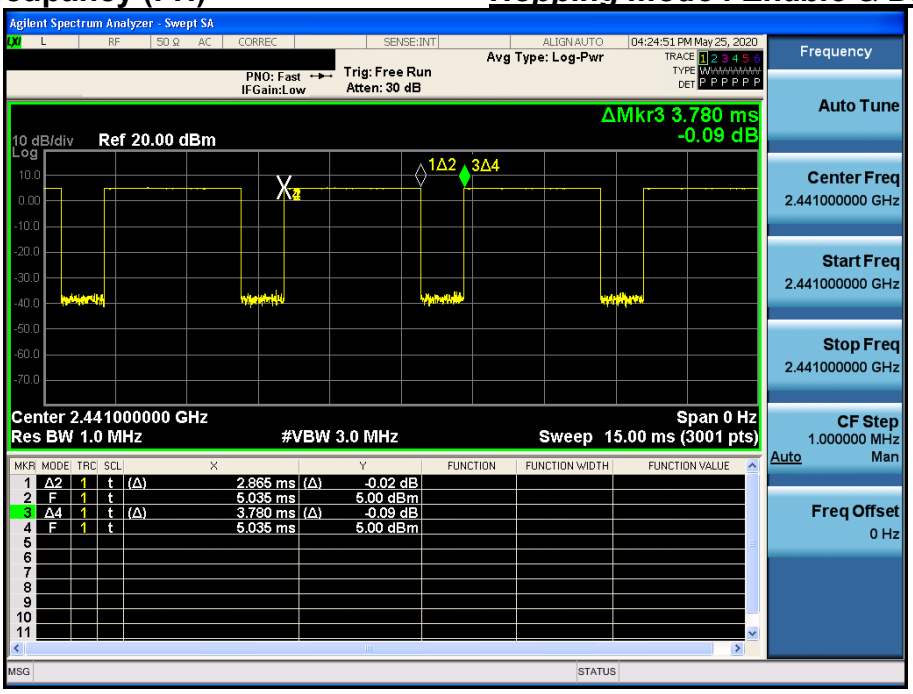
Note 1 : Dwell Time = 0.4 × Hopping channel × Burst ON time ×
((Hopping rate ÷ Time slots) ÷ Hopping channel)

- Time slots for DH5 = 6 slots (TX = 5 slot / RX = 1 slot)
- Hopping Rate = 1600 for FH mode & 800 for AFH mode

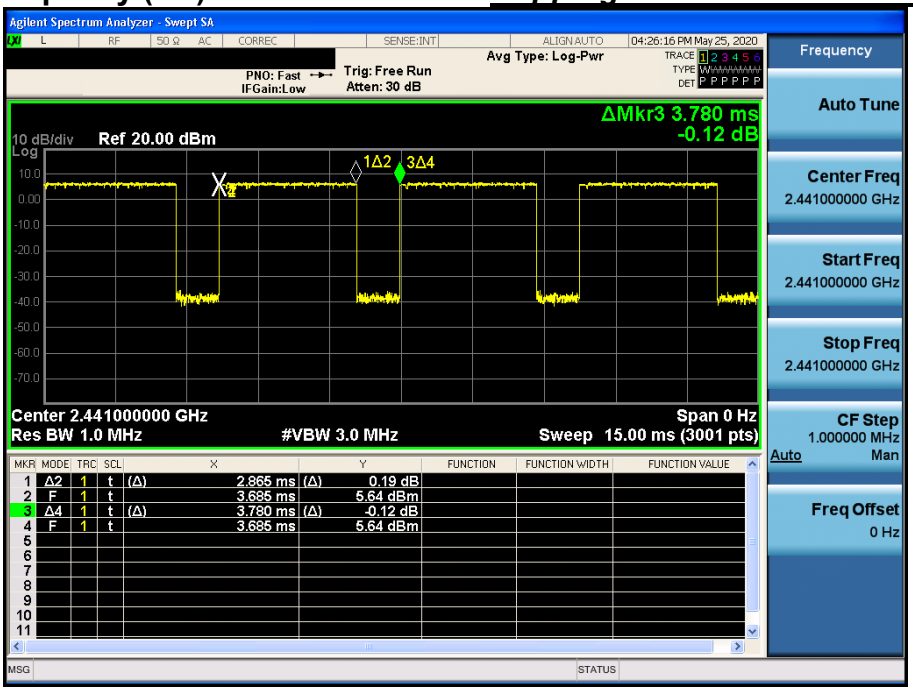
Note 2 : See next pages for actual measured spectrum plots.

- Tested Power Supply: 12 V

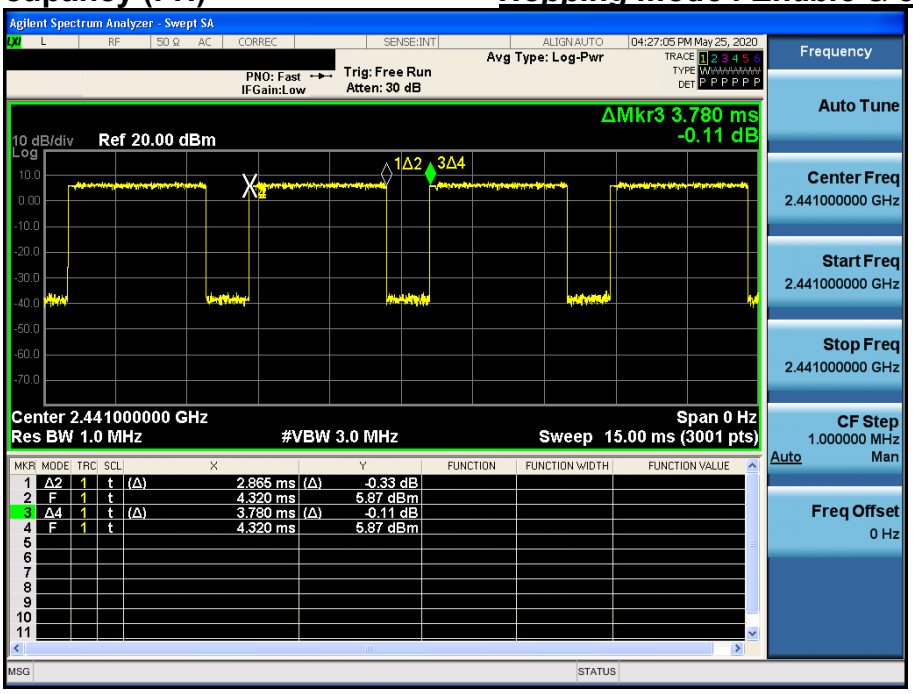
Time of Occupancy (FH) ***Hopping mode : Enable & DH5***



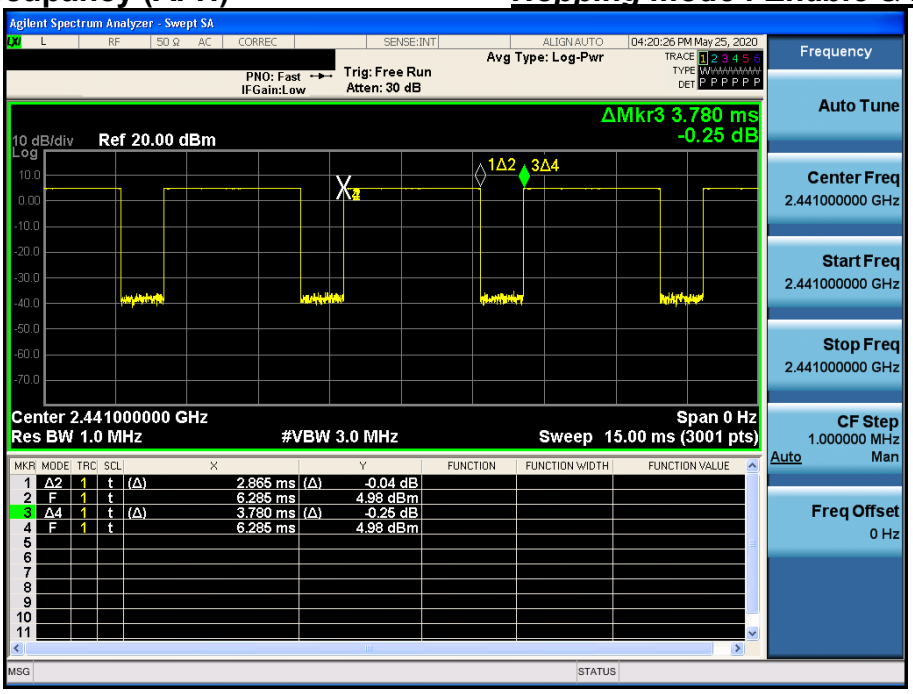
Time of Occupancy (FH) ***Hopping mode : Enable & 2-DH5***



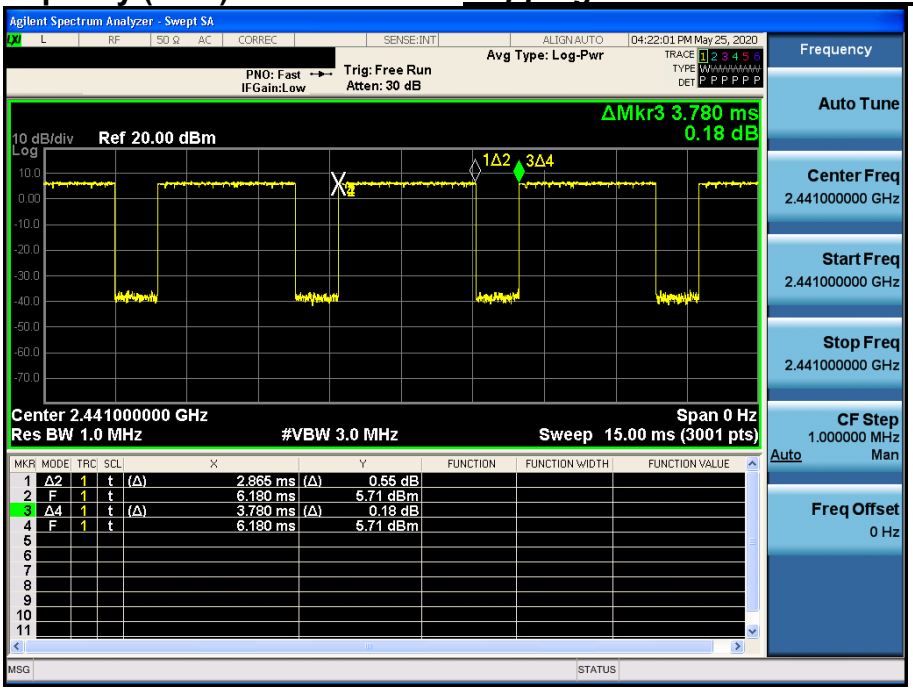
Time of Occupancy (FH) ***Hopping mode : Enable & 3-DH5***



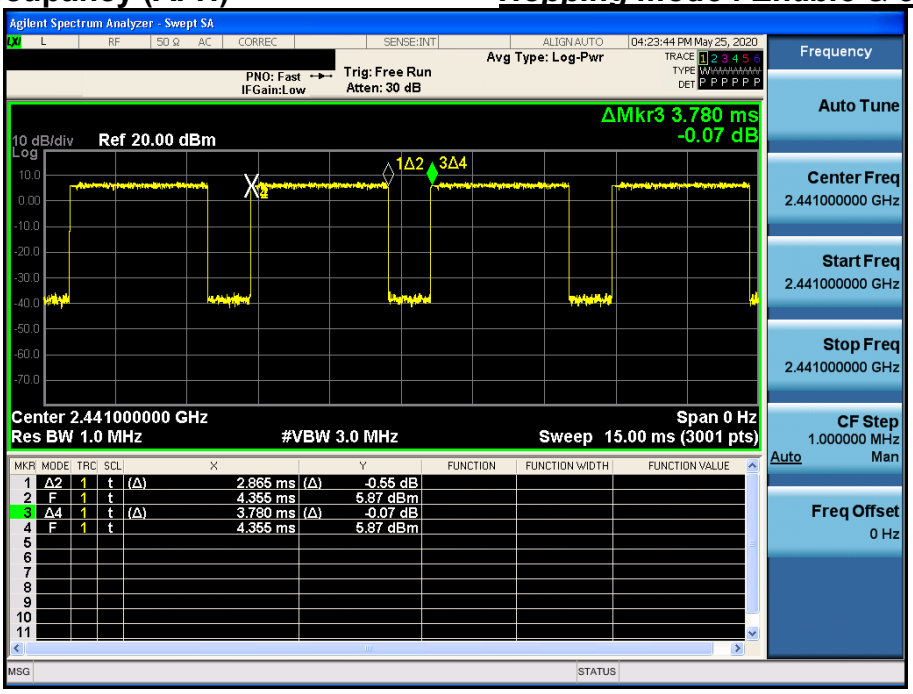
Time of Occupancy (AFH) ***Hopping mode : Enable & DH5***



Time of Occupancy (AFH) ***Hopping mode : Enable & 2-DH5***

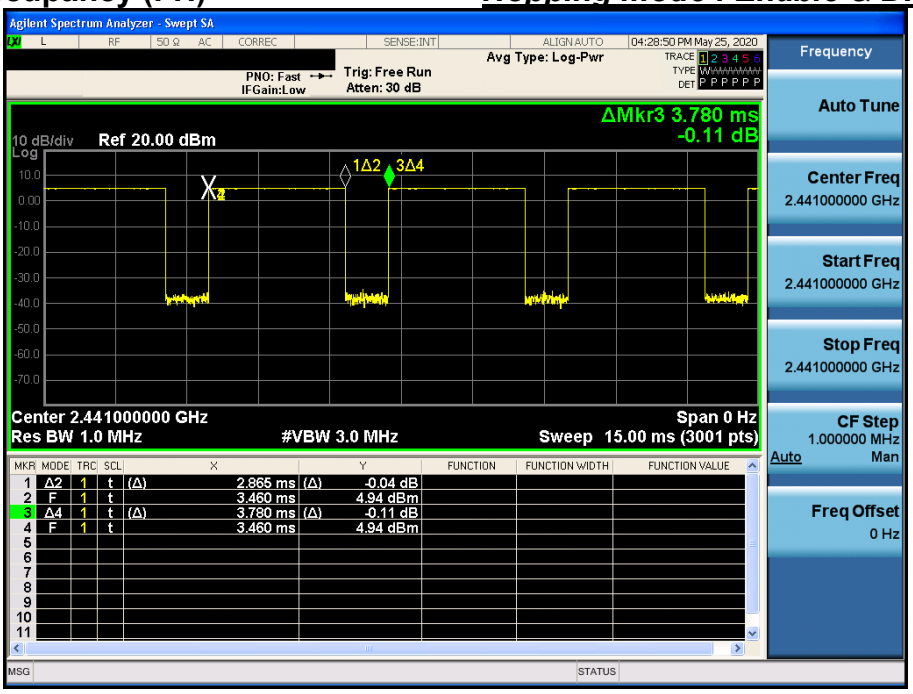


Time of Occupancy (AFH) ***Hopping mode : Enable & 3-DH5***

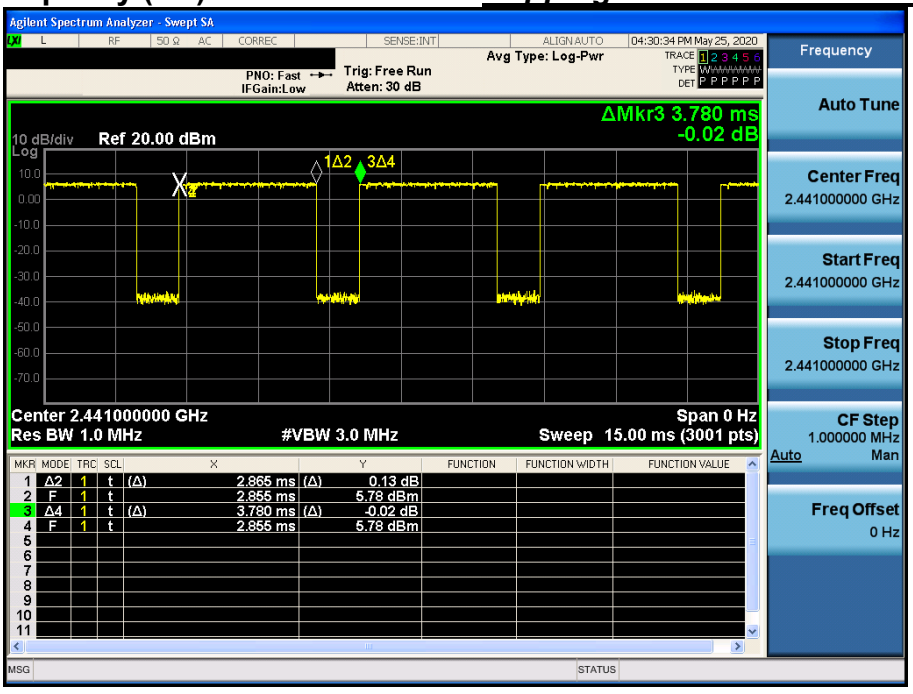


- Tested Power Supply: 24 V

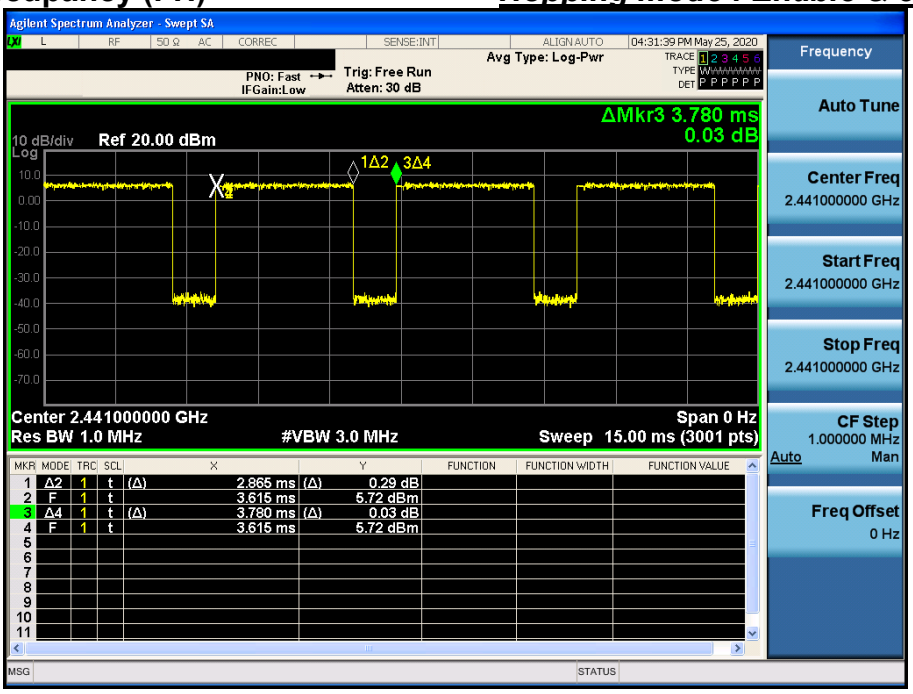
Time of Occupancy (FH) ***Hopping mode : Enable & DH5***



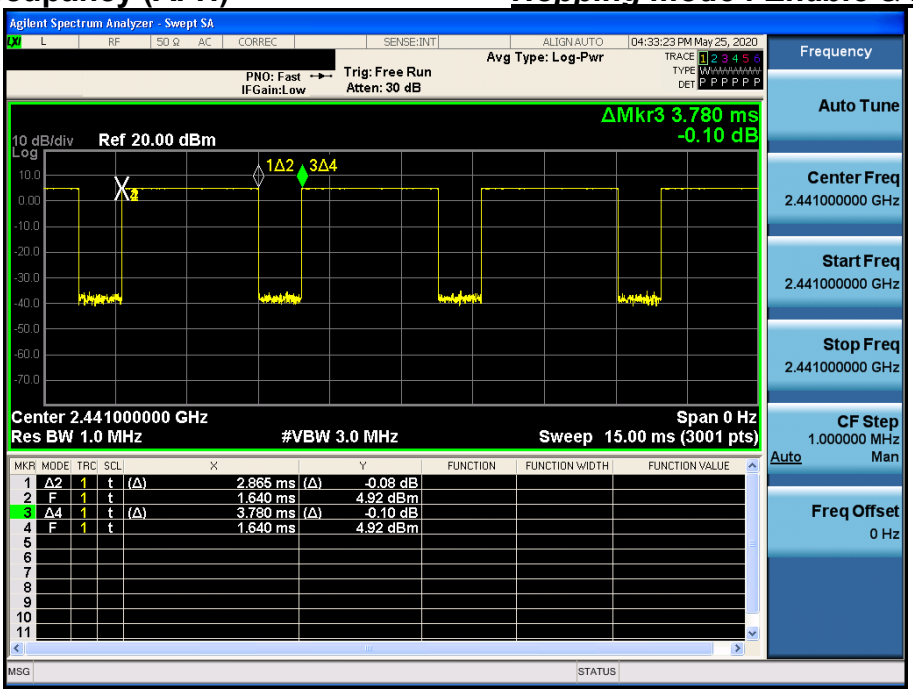
Time of Occupancy (FH) ***Hopping mode : Enable & 2-DH5***



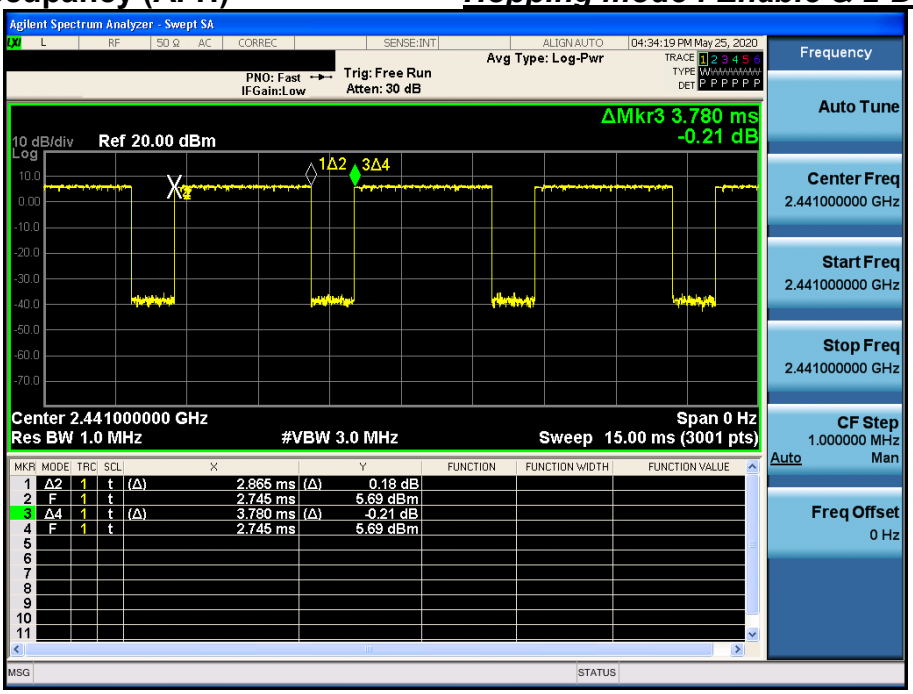
Time of Occupancy (FH) ***Hopping mode : Enable & 3-DH5***



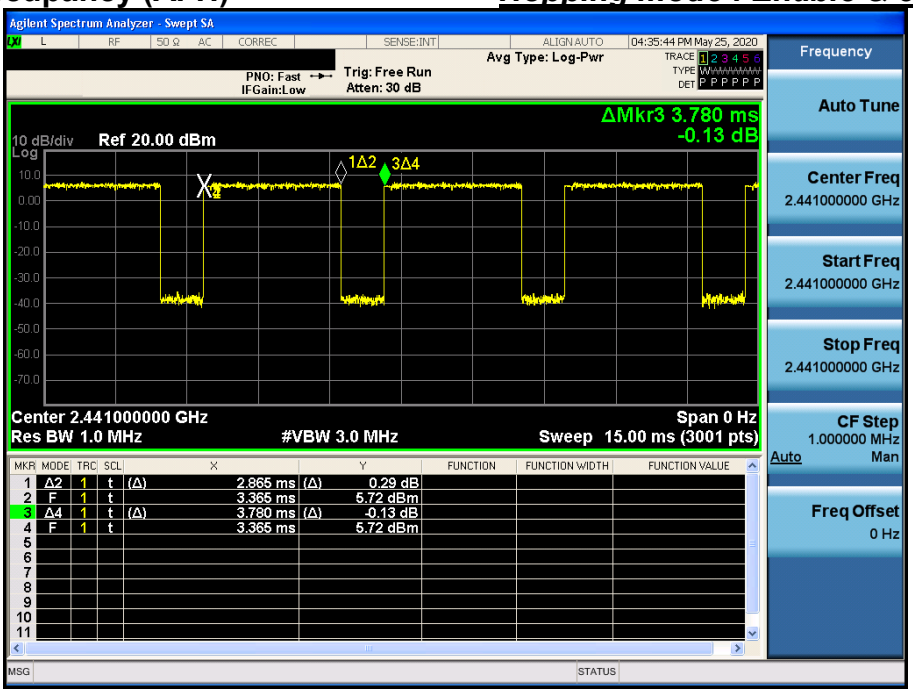
Time of Occupancy (AFH) ***Hopping mode : Enable & DH5***



Time of Occupancy (AFH) ***Hopping mode : Enable & 2-DH5***



Time of Occupancy (AFH) ***Hopping mode : Enable & 3-DH5***



7. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

7.1 Test Setup

Refer to the APPENDIX I.

7.2 Limit

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval , as permitted under paragraph(b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

According to § 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1705	24000/F (kHz)	30
1705 ~ 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 - 72 MHz, 76 - 88 MHz, 174 - 216 MHz or 470 - 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

According to § 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below :

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~ 156.52525	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.7 ~ 156.9	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	162.0125 ~ 167.17	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	167.72 ~ 173.2	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	240 ~ 285	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	322 ~ 335.4	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	960 ~ 1240	3345.8 ~ 3358		
			3600 ~ 4400		

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

7.3. Test Procedures

7.3.1. Test Procedures for Radiated Spurious Emissions

1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
   The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 1 or 3 meter away from the interference-receiving antenna.
3. For measurements above 1GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.
4. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
5. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.

Measurement Instrument Setting

1. Frequency Range Below 1 GHz

RBW = As specified in table, VBW ≥ 3 x RBW, Sweep = Auto, Detector = Peak or Quasi Peak,

Trace mode = Max Hold until the trace stabilize

Frequency	RBW
9 kHz	200 - 300 Hz
0.15 - 30 MHz	9 -10 kHz
30 - 1000 MHz	100 - 120 kHz

2. Frequency Range > 1 GHz

Peak Measurement

RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Sweep time = Auto, Trace mode = Max Hold until the trace stabilizes

Average Measurement

The result of Average measurement is calculated using PK result and duty correction factor.

7.3.2. Test Procedures for Conducted Spurious Emissions

1. The transmitter output was connected to the spectrum analyzer.
2. The **reference level** of the fundamental frequency was measured with the spectrum analyzer using RBW = 100 kHz, VBW = 300 kHz.
3. The conducted spurious emission was tested each ranges were set as below.

Frequency range : 9 kHz ~ 30 MHz
RBW = 100 kHz, VBW = 300 kHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

Frequency range : 30 MHz ~ 10 GHz, 10 GHz ~ 25 GHz
RBW = 1 MHz, VBW = 3 MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

LIMIT LINE = 20 dB below of the reference level of above measurement procedure Step 2. (RBW = 100 kHz, VBW = 300 kHz)

If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 kHz, VBW = 300 kHz, SPAN = 100 MHz and BINS = 2001 to get accurate emission level within 100 kHz BW.

Also the path loss for conducted measurement setup was used as described on the Appendix I of this test report.

7.4. Test Results

7.4.1. Radiated Emissions

- Tested Power Supply: 12 V

9 kHz ~ 1 GHz Data

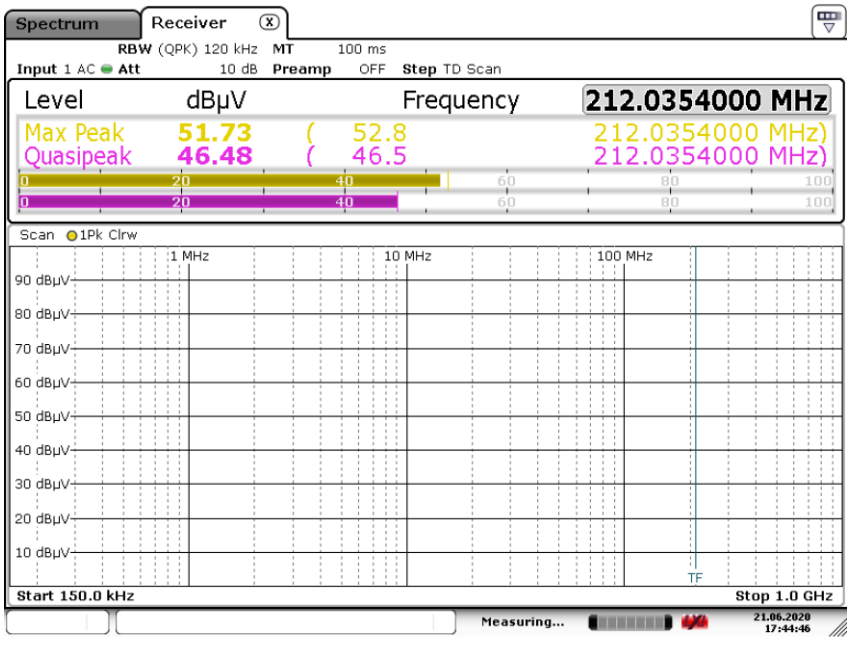
▪ GFSK & Lowest Channel (Worst Case)

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
44.55	V	X	PK	36.30	-8.30	N/A	N/A	28.00	40.00	12.00
212.04	H	X	QP	46.50	-10.00	N/A	N/A	36.50	43.50	7.00
399.57	H	X	PK	39.90	-3.30	N/A	N/A	36.60	46.00	9.40
424.79	H	X	PK	38.90	-2.60	N/A	N/A	36.30	46.00	9.70
480.08	H	X	PK	41.60	-1.80	N/A	N/A	39.80	46.00	6.20
818.60	V	X	PK	29.00	5.60	N/A	N/A	34.60	46.00	11.40
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ **Note.**

1. No other spurious and harmonic emissions were found above listed frequencies.
2. Information of Distance Factor
   For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.
   In this case, the distance factor is applied to the result.
   - Calculation of distance factor
   At frequencies below 30 MHz = 40 log(tested distance / specified distance)
   At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)
   When distance factor is “N/A”, the measurements were performed at the specified distance and distance factor is not applied.
3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)
   - Time to cycle through all channels = Δt = T [ms] X 20 minimum hopping channels , where T = pulse width = **2.865 ms**
   - 100 ms / Δt [ms] = H -> Round up to next highest integer, to account for worst case, H' = **100 / (2.865 X 20)** = **1.75** ≒ **2**
   - The Worst Case Dwell Time = T [ms] x H' = **2.865 ms X 2** = **5.73 ms**
   - D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = **20 log(5.73 / 100)** = **-24.84 dB**
4. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F + D.C.F + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.

2 402MHz & X axis & Hor **Detector Mode : QP**



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1 GHz ~ 25 GHz Data (Modulation : ***GFSK***)

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 388.15	H	X	PK	50.82	4.79	N/A	N/A	55.61	74.00	18.39
2 388.15	H	X	AV	50.82	4.79	-24.84	N/A	30.77	54.00	23.23
4 803.94	V	X	PK	49.62	0.78	N/A	N/A	50.40	74.00	23.60
4 803.94	V	X	AV	49.62	0.78	-24.84	N/A	25.56	54.00	28.44

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4 881.72	V	X	PK	49.98	1.36	N/A	N/A	51.34	74.00	22.66
4 881.72	V	X	AV	49.98	1.36	-24.84	N/A	26.50	54.00	27.50

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 483.89	H	X	PK	49.92	5.26	N/A	N/A	55.18	74.00	18.82
2 483.89	H	X	AV	49.92	5.26	-24.84	N/A	30.34	54.00	23.66
4 960.28	V	X	PK	50.32	1.61	N/A	N/A	51.93	74.00	22.07
4 960.28	V	X	AV	50.32	1.61	-24.84	N/A	27.09	54.00	26.91

▪ **Note.**

1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.
2. Information of Distance Factor
   For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.
   In this case, the distance factor is applied to the result.
   - Calculation of distance factor
   At frequencies below 30 MHz = 40 log(tested distance / specified distance)
   At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)
   When distance factor is "N/A", the measurements were performed at the specified distance and distance factor is not applied.
3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)
   - Time to cycle through all channels = Δt = T [ms] X 20 minimum hopping channels , where T = pulse width = **2.865 ms**
   - 100 ms / Δt [ms] = H -> Round up to next highest integer, to account for worst case, H' = **100 / (2.865 X 20)** = **1.75** ≒ **2**
   - The Worst Case Dwell Time = T [ms] x H' = **2.865 ms X 2** = **5.73 ms**
   - D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = **20 log(5.73 / 100)** = **-24.84 dB**
4. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F + D.C.F + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.

1 GHz ~ 25 GHz Data (Modulation : π/4DQPSK)

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 386.02	H	X	PK	49.87	4.79	N/A	N/A	54.66	74.00	19.34
2 386.02	H	X	AV	49.87	4.79	-24.84	N/A	29.82	54.00	24.18
4 803.93	V	X	PK	49.97	0.78	N/A	N/A	50.75	74.00	23.25
4 803.93	V	X	AV	49.97	0.78	-24.84	N/A	25.91	54.00	28.09

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4 881.62	V	X	PK	50.46	1.35	N/A	N/A	51.81	74.00	22.19
4 881.62	V	X	AV	50.46	1.35	-24.84	N/A	26.97	54.00	27.03

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 484.68	H	X	PK	49.04	5.27	N/A	N/A	54.31	74.00	19.69
2 484.68	H	X	AV	49.04	5.27	-24.84	N/A	29.47	54.00	24.53
4 959.65	V	X	PK	50.13	1.61	N/A	N/A	51.74	74.00	22.26
4 959.65	V	X	AV	50.13	1.61	-24.84	N/A	26.90	54.00	27.10

▪ **Note.**

1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.
2. Information of Distance Factor
   For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.
   In this case, the distance factor is applied to the result.
   - Calculation of distance factor
   At frequencies below 30 MHz = 40 log(tested distance / specified distance)
   At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)
   When distance factor is “N/A”, the measurements were performed at the specified distance and distance factor is not applied.
3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)
   - Time to cycle through all channels = Δt = T [ms] X 20 minimum hopping channels , where T = pulse width = **2.865 ms**
   - 100 ms / Δt [ms] = H -> Round up to next highest integer, to account for worst case, H' = **100 / (2.865 X 20)** = **1.75** ≒ **2**
   - The Worst Case Dwell Time = T [ms] x H' = **2.865 ms X 2** = **5.73 ms**
   - D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = **20 log(5.73 / 100)** = **-24.84 dB**
4. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F + D.C.F + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.

.

1 GHz ~ 25 GHz Data (Modulation : *8DPSK*)

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 388.52	H	X	PK	49.52	4.80	N/A	N/A	54.32	74.00	19.68
2 388.52	H	X	AV	49.52	4.80	-24.84	N/A	29.48	54.00	24.52
4 804.17	V	X	PK	50.12	0.78	N/A	N/A	50.90	74.00	23.10
4 804.17	V	X	AV	50.12	0.78	-24.84	N/A	26.06	54.00	27.94

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4 882.22	V	X	PK	50.15	1.36	N/A	N/A	51.51	74.00	22.49
4 882.22	V	X	AV	50.15	1.36	-24.84	N/A	26.67	54.00	27.33

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 484.92	H	X	PK	50.93	5.27	N/A	N/A	56.20	74.00	17.80
2 484.92	H	X	AV	50.93	5.27	-24.84	N/A	31.36	54.00	22.64
4 959.95	V	X	PK	49.28	1.61	N/A	N/A	50.89	74.00	23.11
4 959.95	V	X	AV	49.28	1.61	-24.84	N/A	26.05	54.00	27.95

▪ **Note.**

1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.
2. Information of Distance Factor
   For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.
   In this case, the distance factor is applied to the result.
   - Calculation of distance factor
   At frequencies below 30 MHz = 40 log(tested distance / specified distance)
   At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)
   When distance factor is “N/A”, the measurements were performed at the specified distance and distance factor is not applied.
3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)
   - Time to cycle through all channels = Δt = T [ms] X 20 minimum hopping channels , where T = pulse width = **2.865 ms**
   - 100 ms / Δt [ms] = H -> Round up to next highest integer, to account for worst case, H' = **100 / (2.865 X 20)** = **1.75** ≒ **2**
   - The Worst Case Dwell Time = T [ms] x H' = **2.865 ms X 2** = **5.73 ms**
   - D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = **20 log(5.73 / 100)** = **-24.84 dB**
4. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F + D.C.F + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.

- Tested Power Supply: 24 V

9 kHz ~ 1 GHz Data

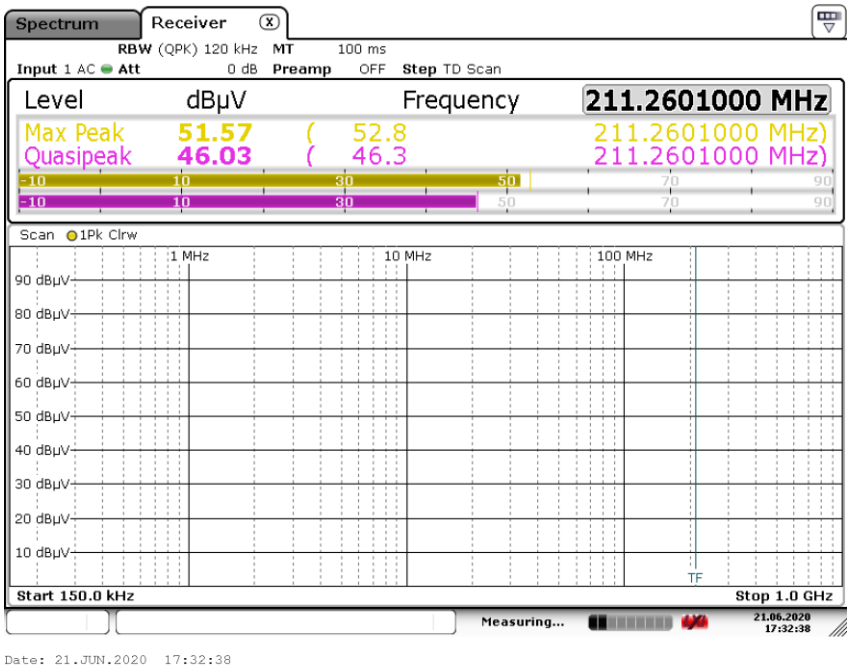
▪ GFSK & Lowest Channel (Worst Case)

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
211.26	H	X	QP	46.30	-10.00	N/A	N/A	36.30	43.50	7.20
399.57	H	X	PK	39.40	-3.30	N/A	N/A	36.10	46.00	9.90
424.79	H	X	PK	39.50	-2.60	N/A	N/A	36.90	46.00	9.10
480.08	V	X	PK	36.90	-1.80	N/A	N/A	35.10	46.00	10.90
704.15	H	X	PK	31.50	2.40	N/A	N/A	33.90	46.00	12.10
988.35	V	X	PK	26.80	7.50	N/A	N/A	34.30	54.00	19.70
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

▪ **Note.**

1. No other spurious and harmonic emissions were found above listed frequencies.
2. Information of Distance Factor
   For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.
   In this case, the distance factor is applied to the result.
   - Calculation of distance factor
   At frequencies below 30 MHz = 40 log(tested distance / specified distance)
   At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)
   When distance factor is “N/A”, the measurements were performed at the specified distance and distance factor is not applied.
3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)
   - Time to cycle through all channels = Δt = T [ms] X 20 minimum hopping channels , where T = pulse width = **2.865 ms**
   - 100 ms / Δt [ms] = H -> Round up to next highest integer, to account for worst case, H' = **100 / (2.865 X 20)** = **1.75** ≒ **2**
   - The Worst Case Dwell Time = T [ms] x H' = **2.865 ms X 2** = **5.73 ms**
   - D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = **20 log(5.73 / 100)** = **-24.84 dB**
4. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F + D.C.F + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.

2 402MHz & X axis & Hor **Detector Mode : QP**



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1 GHz ~ 25 GHz Data (Modulation : *GFSK*)

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 388.81	H	X	PK	50.49	4.80	N/A	N/A	55.29	74.00	18.71
2 388.81	H	X	AV	50.49	4.80	-24.84	N/A	30.45	54.00	23.55
4 803.99	V	X	PK	50.25	0.78	N/A	N/A	51.03	74.00	22.97
4 803.99	V	X	AV	50.25	0.78	-24.84	N/A	26.19	54.00	27.81

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4 882.08	V	X	PK	49.58	1.36	N/A	N/A	50.94	74.00	23.06
4 882.08	V	X	AV	49.58	1.36	-24.84	N/A	26.10	54.00	27.90

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 484.06	H	X	PK	49.60	5.26	N/A	N/A	54.86	74.00	19.14
2 484.06	H	X	AV	49.60	5.26	-24.84	N/A	30.02	54.00	23.98
4 960.44	V	X	PK	49.24	1.61	N/A	N/A	50.85	74.00	23.15
4 960.44	V	X	AV	49.24	1.61	-24.84	N/A	26.01	54.00	27.99

▪ **Note.**

1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.
2. Information of Distance Factor
   For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.
   In this case, the distance factor is applied to the result.
   - Calculation of distance factor
   At frequencies below 30 MHz = 40 log(tested distance / specified distance)
   At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)
   When distance factor is “N/A”, the measurements were performed at the specified distance and distance factor is not applied.
3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)
   - Time to cycle through all channels = Δt = T [ms] X 20 minimum hopping channels , where T = pulse width = **2.865 ms**
   - 100 ms / Δt [ms] = H -> Round up to next highest integer, to account for worst case, H' = **100 / (2.865 X 20)** = **1.75** ≒ **2**
   - The Worst Case Dwell Time = T [ms] x H' = **2.865 ms X 2** = **5.73 ms**
   - D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = **20 log(5.73 / 100)** = **-24.84 dB**
4. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F + D.C.F + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.

1 GHz ~ 25 GHz Data (Modulation : π/4DQPSK)

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 388.58	H	X	PK	50.12	4.80	N/A	N/A	54.92	74.00	19.08
2 388.58	H	X	AV	50.12	4.80	-24.84	N/A	30.08	54.00	23.92
4 803.96	V	X	PK	49.83	0.78	N/A	N/A	50.61	74.00	23.39
4 803.96	V	X	AV	49.83	0.78	-24.84	N/A	25.77	54.00	28.23

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4 881.98	V	X	PK	50.13	1.36	N/A	N/A	51.49	74.00	22.51
4 881.98	V	X	AV	50.13	1.36	-24.84	N/A	26.65	54.00	27.35

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 484.56	H	X	PK	50.00	5.27	N/A	N/A	55.27	74.00	18.73
2 484.56	H	X	AV	50.00	5.27	-24.84	N/A	30.43	54.00	23.57
4 959.60	V	X	PK	49.25	1.61	N/A	N/A	50.86	74.00	23.14
4 959.60	V	X	AV	49.25	1.61	-24.84	N/A	26.02	54.00	27.98

▪ **Note.**

1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.
2. Information of Distance Factor
   For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.
   In this case, the distance factor is applied to the result.
   - Calculation of distance factor
   At frequencies below 30 MHz = 40 log(tested distance / specified distance)
   At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)
   When distance factor is “N/A”, the measurements were performed at the specified distance and distance factor is not applied.
3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)
   - Time to cycle through all channels = Δt = T [ms] X 20 minimum hopping channels , where T = pulse width = **2.865 ms**
   - 100 ms / Δt [ms] = H -> Round up to next highest integer, to account for worst case, H' = **100 / (2.865 X 20)** = **1.75** ≒ **2**
   - The Worst Case Dwell Time = T [ms] x H' = **2.865 ms X 2** = **5.73 ms**
   - D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = **20 log(5.73 / 100)** = **-24.84 dB**
4. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F + D.C.F + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.

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1 GHz ~ 25 GHz Data (Modulation : *8DPSK*)

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 389.30	H	X	PK	49.19	4.80	N/A	N/A	53.99	74.00	20.01
2 389.30	H	X	AV	49.19	4.80	-24.84	N/A	29.15	54.00	24.85
4 803.66	V	X	PK	49.73	0.78	N/A	N/A	50.51	74.00	23.49
4 803.66	V	X	AV	49.73	0.78	-24.84	N/A	25.67	54.00	28.33

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4 881.92	V	X	PK	50.85	1.36	N/A	N/A	52.21	74.00	21.79
4 881.92	V	X	AV	50.85	1.36	-24.84	N/A	27.37	54.00	26.63

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 483.79	H	X	PK	48.93	5.26	N/A	N/A	54.19	74.00	19.81
2 483.79	H	X	AV	48.93	5.26	-24.84	N/A	29.35	54.00	24.65
4 959.97	V	X	PK	50.43	1.61	N/A	N/A	52.04	74.00	21.96
4 959.97	V	X	AV	50.43	1.61	-24.84	N/A	27.20	54.00	26.80

▪ **Note.**

1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.
2. Information of Distance Factor
   For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.
   In this case, the distance factor is applied to the result.
   - Calculation of distance factor
   At frequencies below 30 MHz = 40 log(tested distance / specified distance)
   At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)
   When distance factor is “N/A”, the measurements were performed at the specified distance and distance factor is not applied.
3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)
   - Time to cycle through all channels = Δt = T [ms] X 20 minimum hopping channels , where T = pulse width = **2.865 ms**
   - 100 ms / Δt [ms] = H -> Round up to next highest integer, to account for worst case, H' = **100 / (2.865 X 20)** = **1.75** ≒ **2**
   - The Worst Case Dwell Time = T [ms] x H' = **2.865 ms X 2** = **5.73 ms**
   - D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = **20 log(5.73 / 100)** = **-24.84 dB**
4. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F + D.C.F + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.