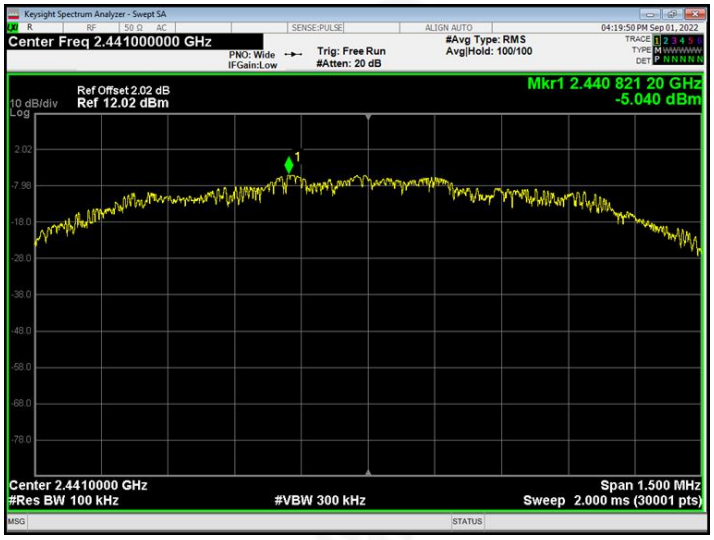
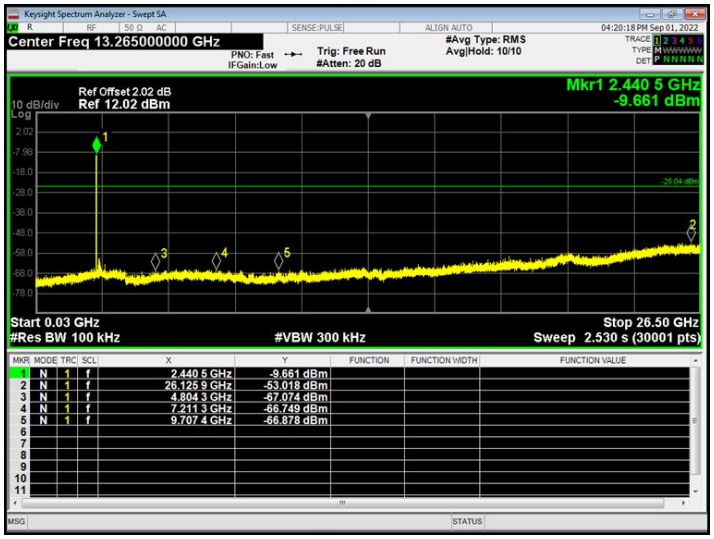
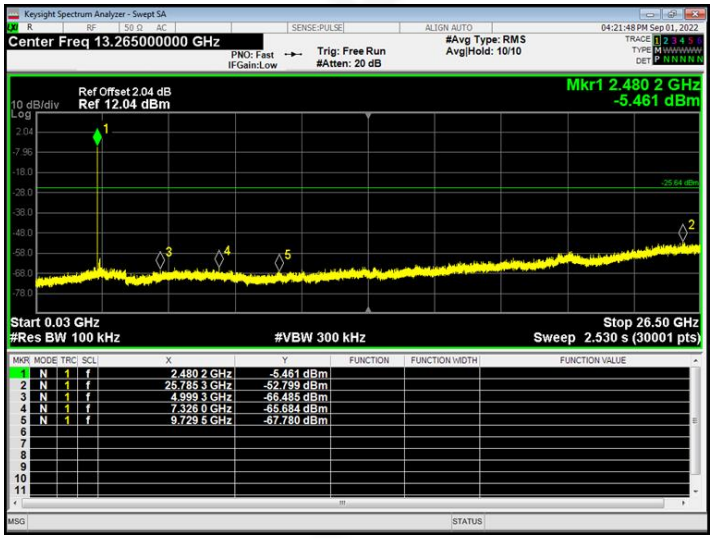
Test channel:	Middle channel





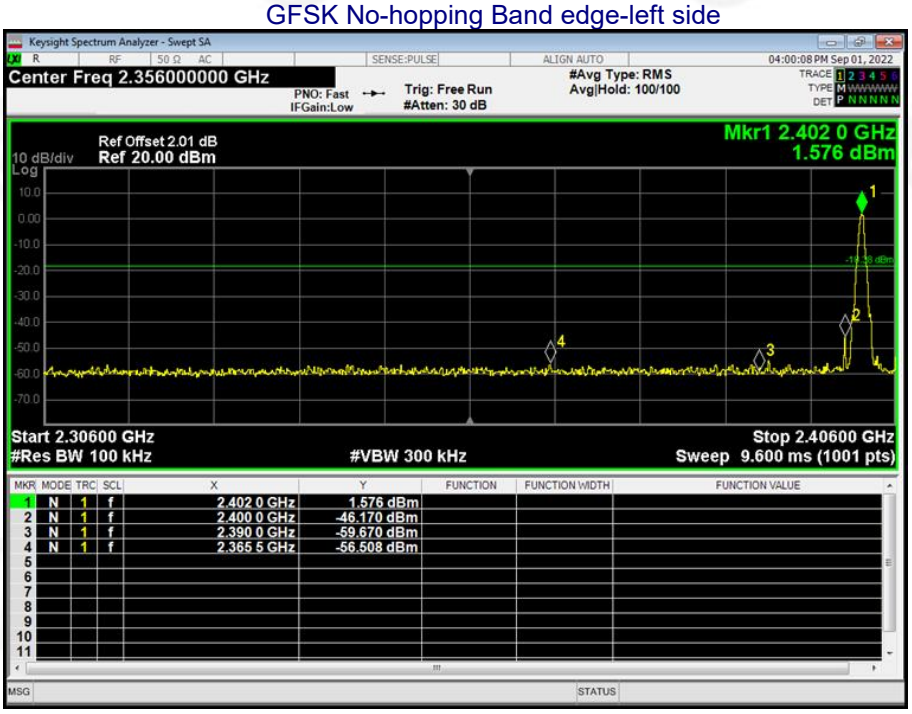
30MHz~26.5GHz

Test channel:	Highest channel

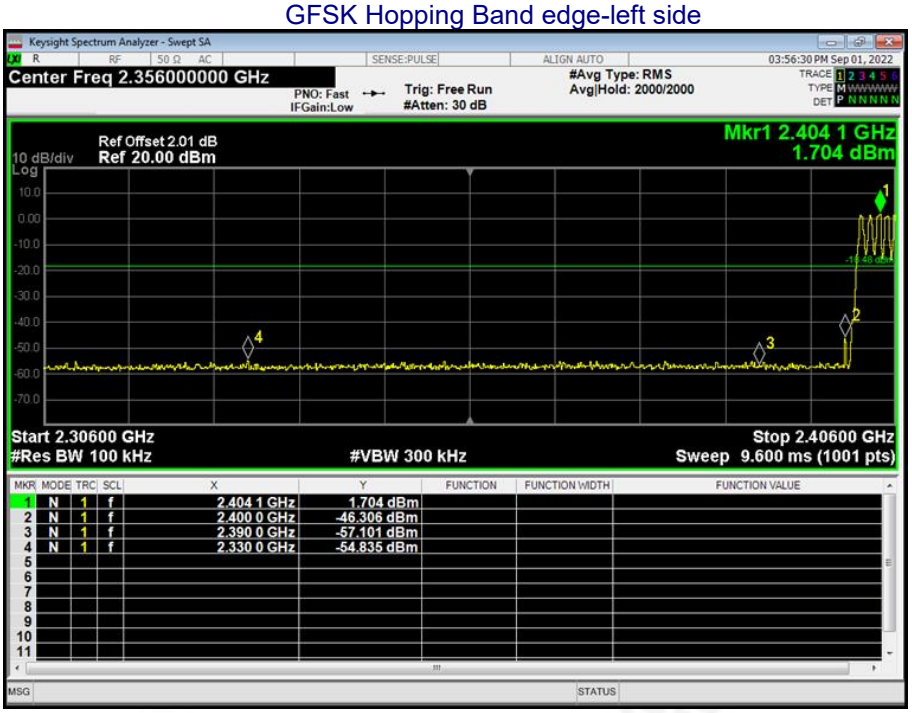


30MHz~26.5GHz

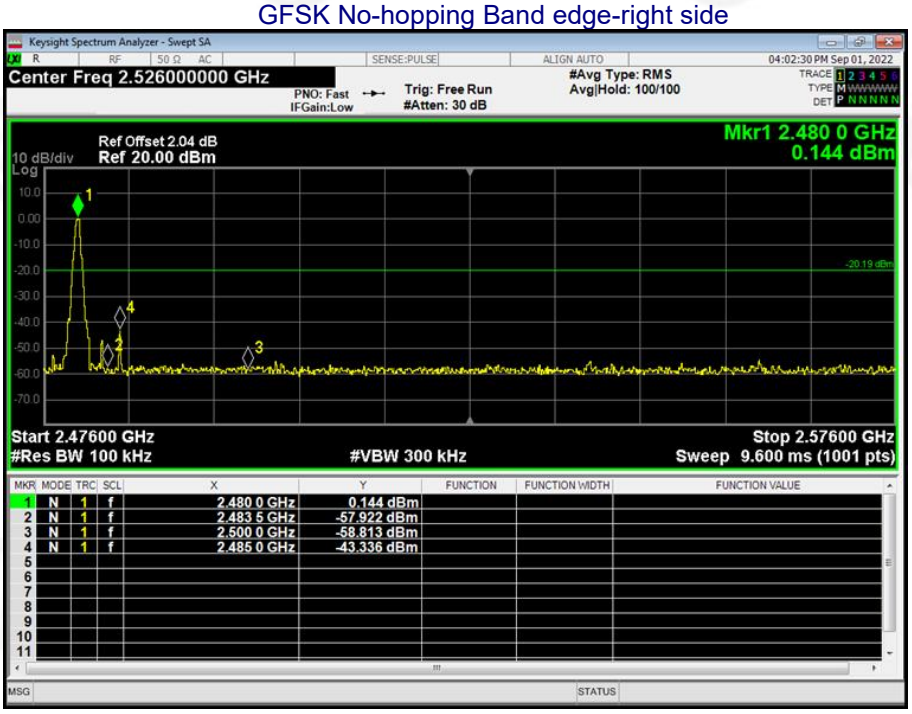
GFSK No-hopping Band edge-left side



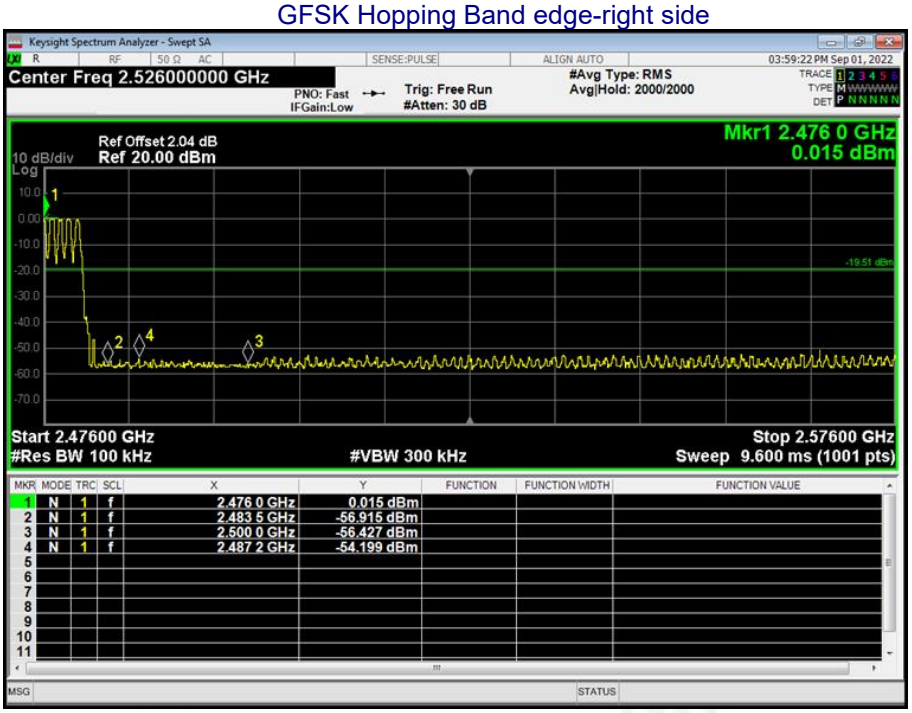
GFSK Hopping Band edge-left side



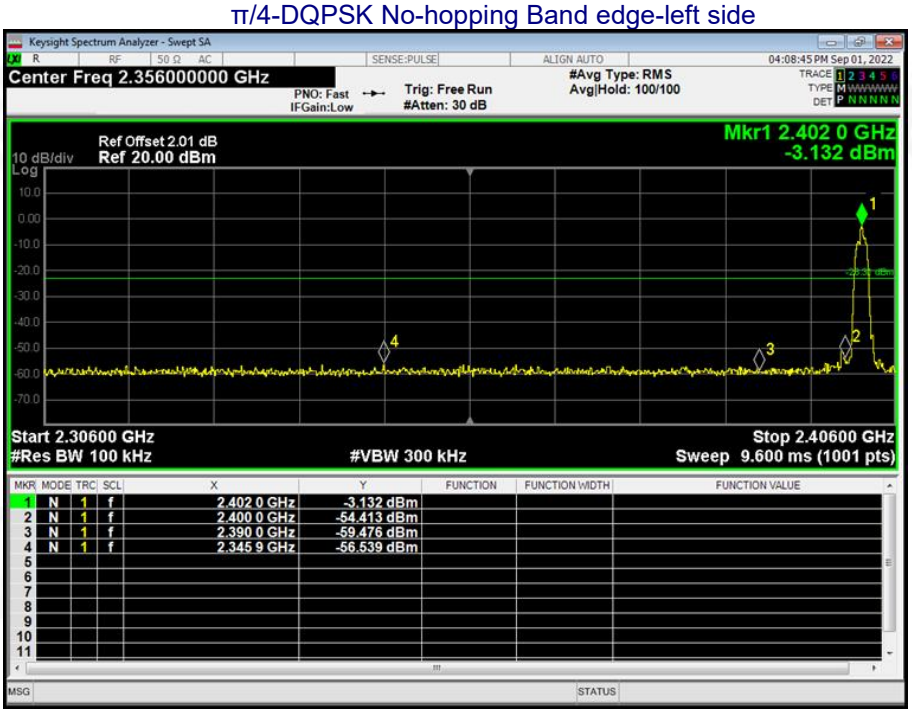
GFSK No-hopping Band edge-right side



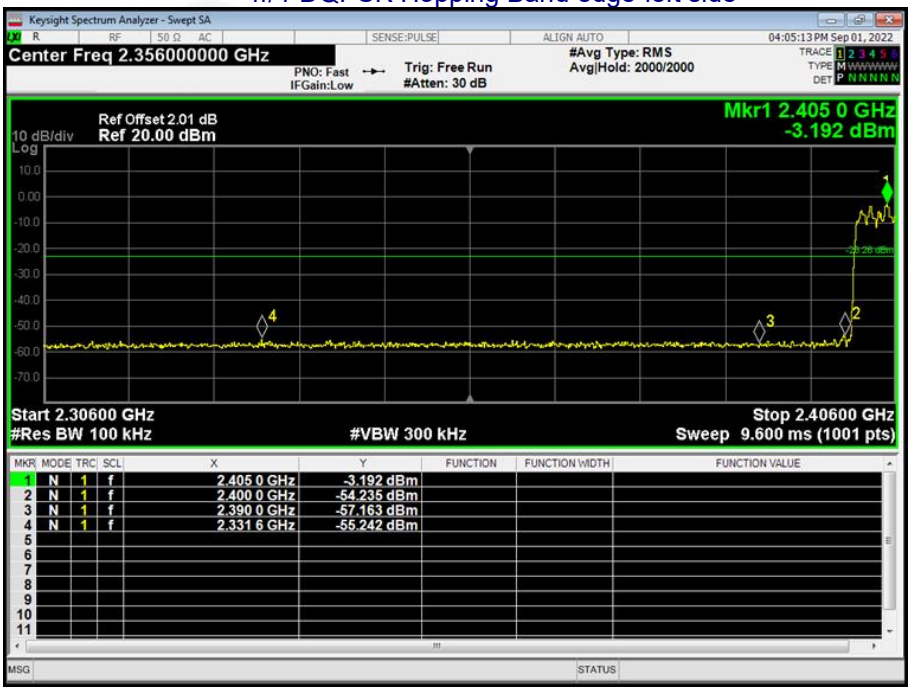
GFSK Hopping Band edge-right side



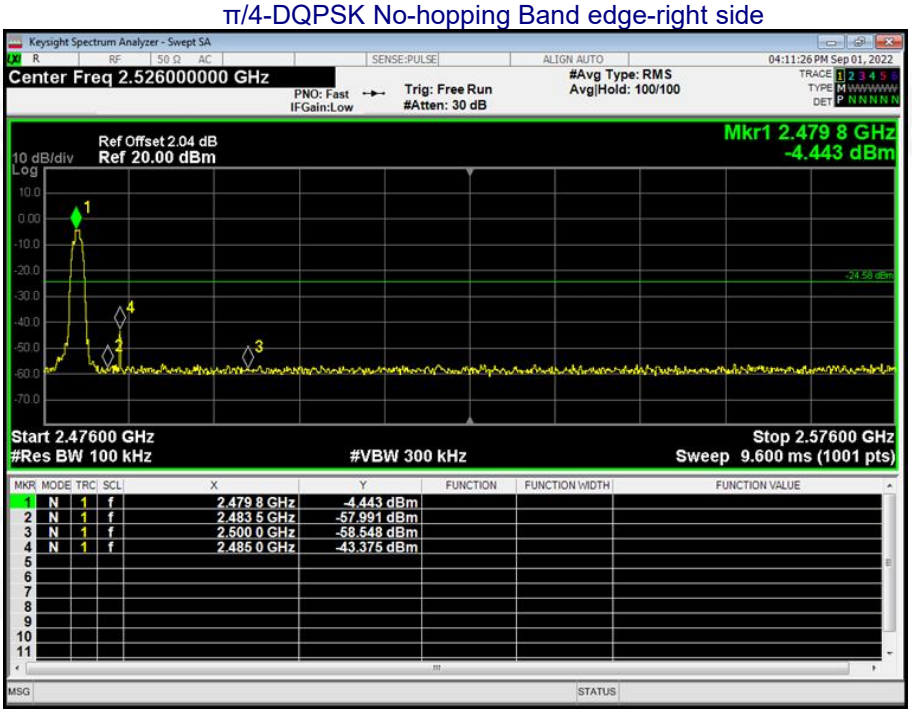
π/4-DQPSK No-hopping Band edge-left side



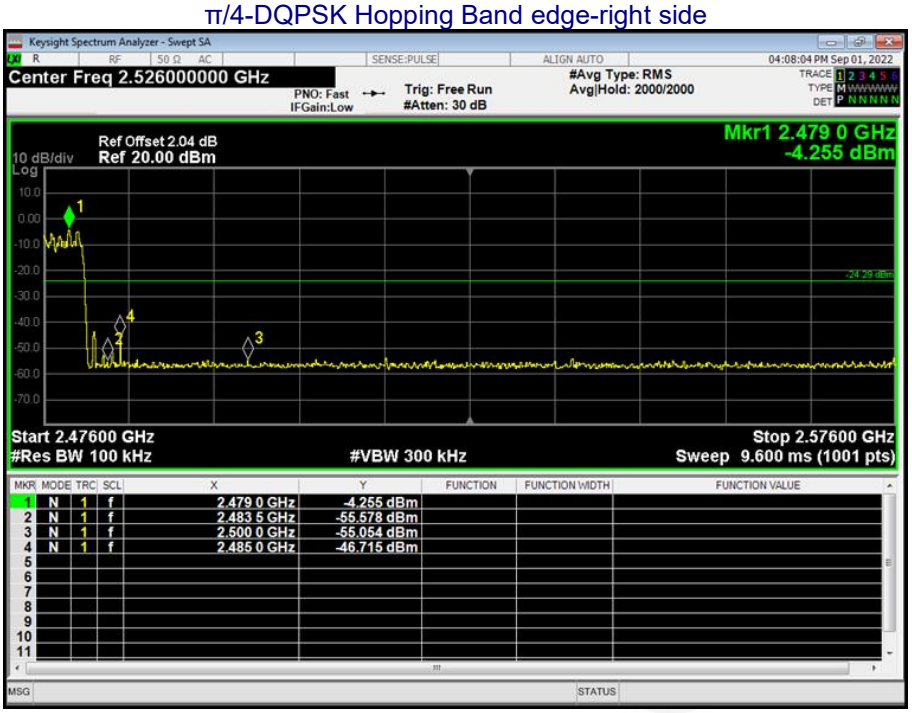
π/4-DQPSK Hopping Band edge-left side



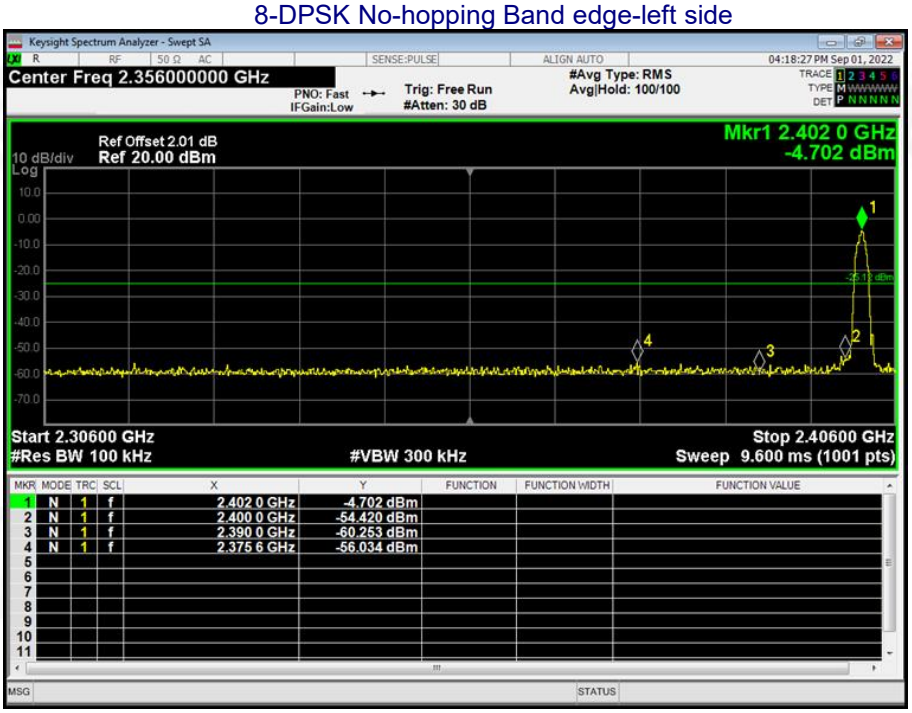
π/4-DQPSK No-hopping Band edge-right side



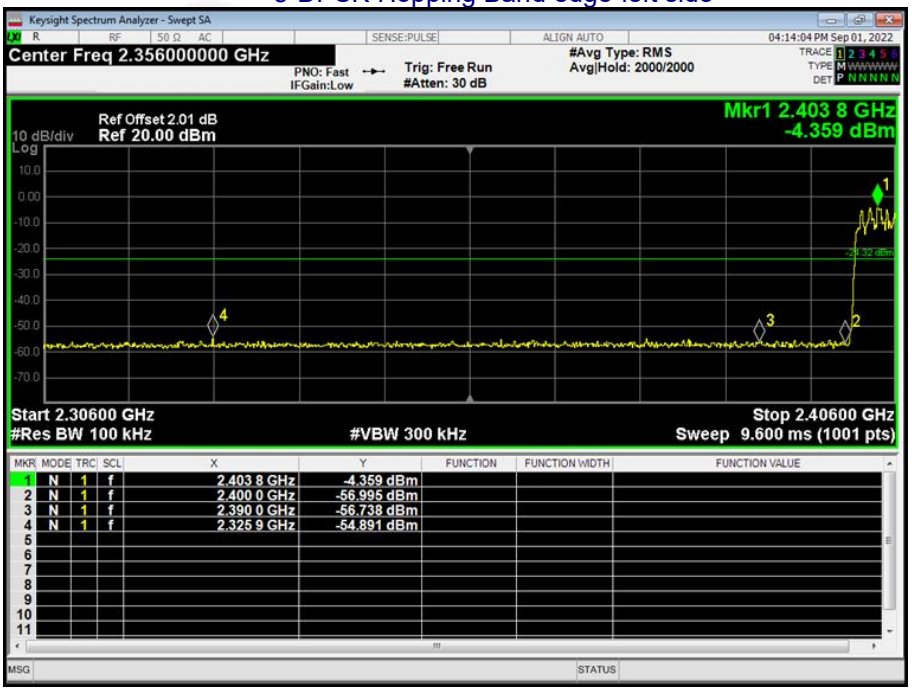
π/4-DQPSK Hopping Band edge-right side



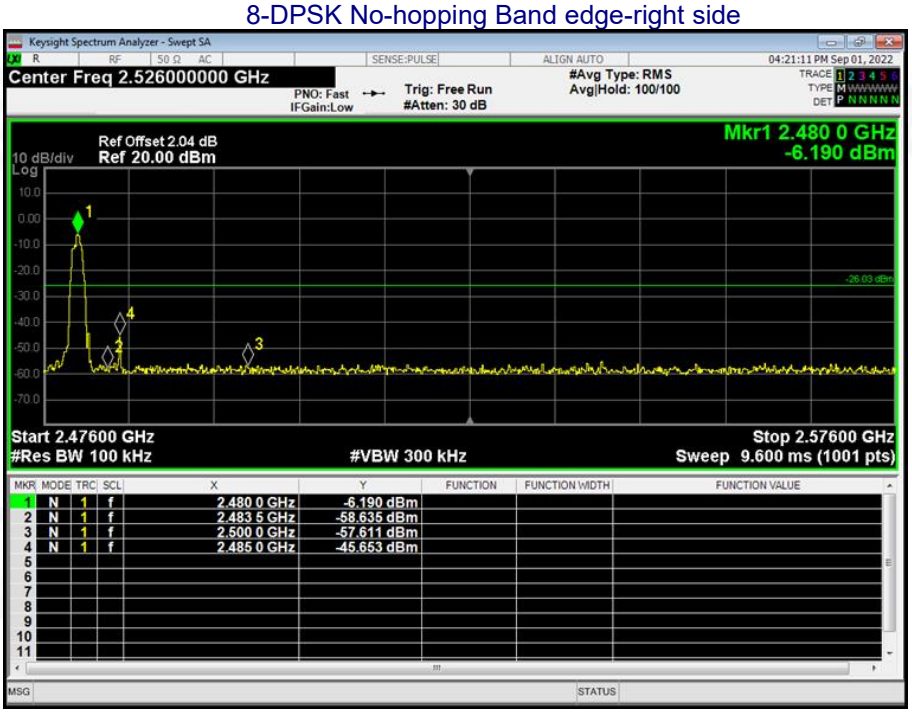
8-DPSK No-hopping Band edge-left side



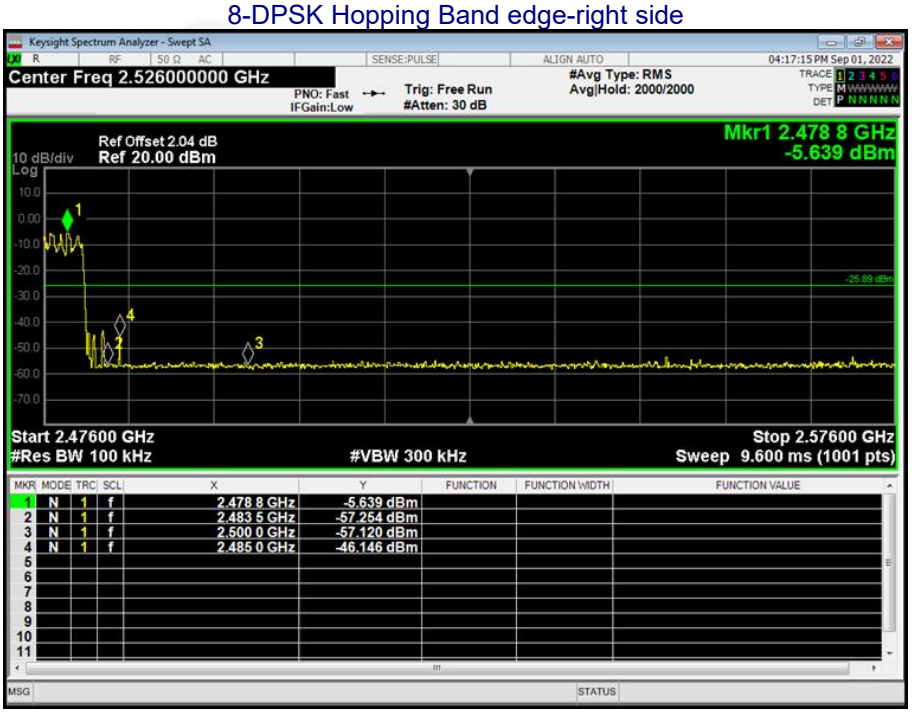
8-DPSK Hopping Band edge-left side



8-DPSK No-hopping Band edge-right side



8-DPSK Hopping Band edge-right side



7. 20DB&99% BANDWIDTH

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013

7.1 Test Setup

7.2 Limit

N/A

7.3 Test procedure

1. Set RBW = 30 kHz.

2. Set the video bandwidth (VBW) ≥ 3 x RBW.

3. Detector = Peak.

4. Trace mode = max hold.

5. Sweep = auto couple.

6. Allow the trace to stabilize.

7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.4 DEVIATION FROM STANDARD

No deviation.

7.5 Test Result

Mode	Test channel	20dB Emission Bandwidth (MHz)	99%Bandwidth (MHz)	Result
GFSK	Lowest	0.8568	0.8205	Pass
	Middle	0.8736	0.8373	
	Highest	0.8582	0.8292	
π/4-DQPSK	Lowest	1.4120	1.3361	Pass
	Middle	1.4220	1.3381	
	Highest	1.4140	1.3470	
8-DPSK	Lowest	1.4380	1.3395	Pass
	Middle	1.4640	1.3403	
	Highest	1.4250	1.3495	

Test plots

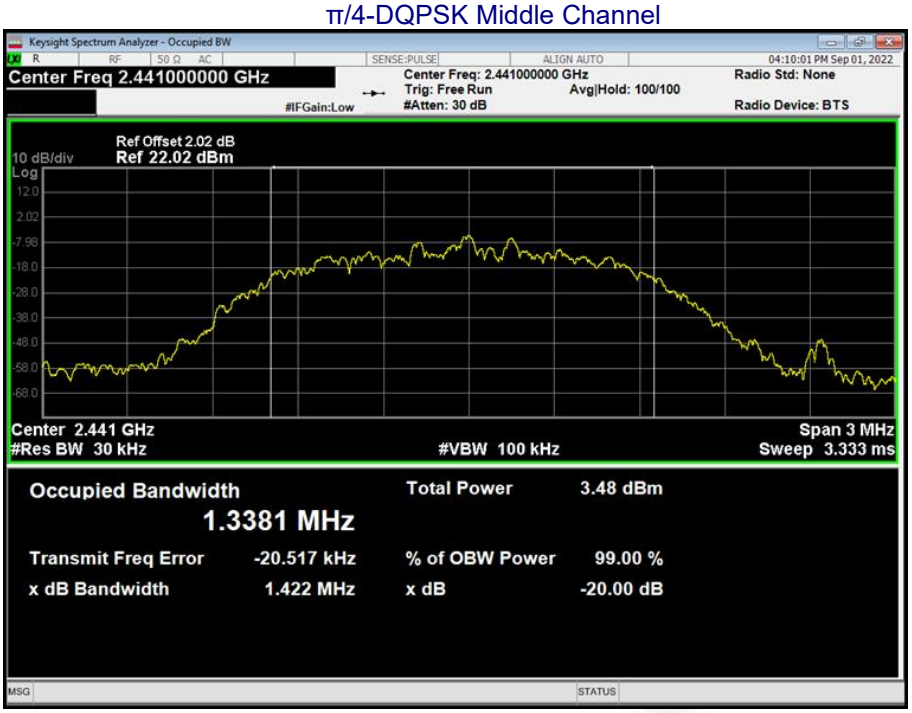
GFSK Low Channel

GFSK Middle Channel

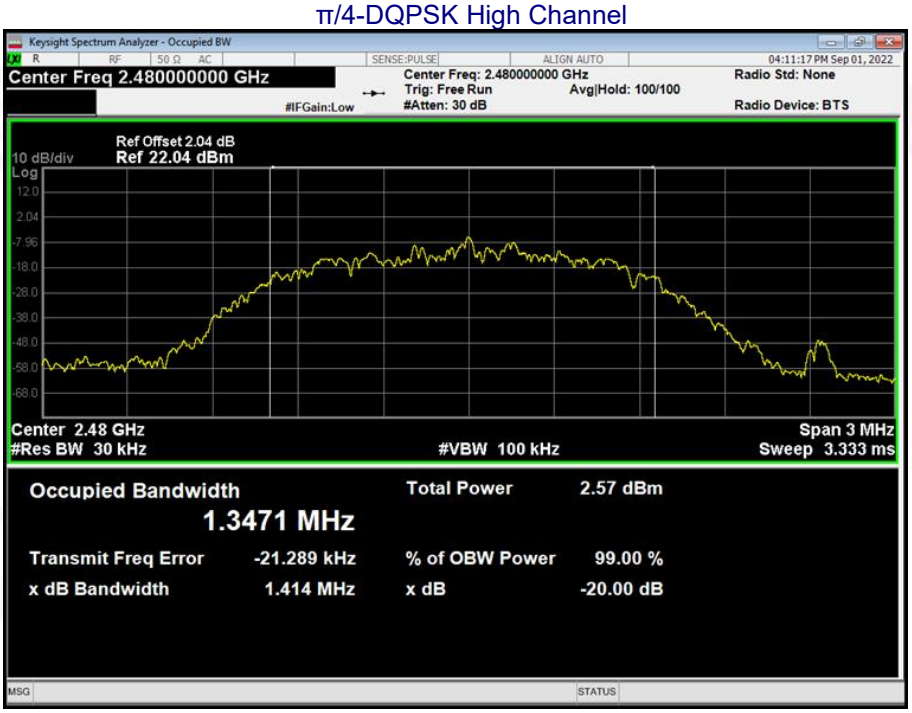
GFSK High Channel

π/4-DQPSK Low Channel

π/4-DQPSK Middle Channel

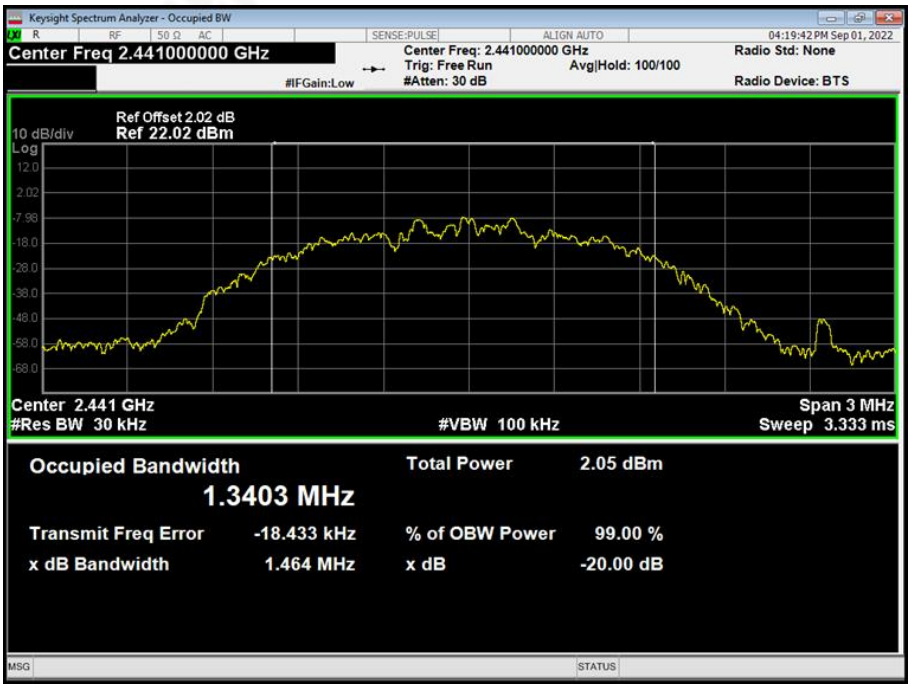


π/4-DQPSK High Channel



8-DPSK Low Channel

8-DPSK Middle Channel



8-DPSK High Channel

8. Maximum Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2013
Limit:	GFSK:30 dBm π/4-DQPSK & 8-DPSK:20.97 dBm

8.1 Block Diagram Of Test Setup

8.2 Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

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.

8.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set the spectrum analyzer: RBW = 2MHz. VBW =6MHz. Sweep = auto; Detector Function = Peak.

3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

8.4 DEVIATION FROM STANDARD

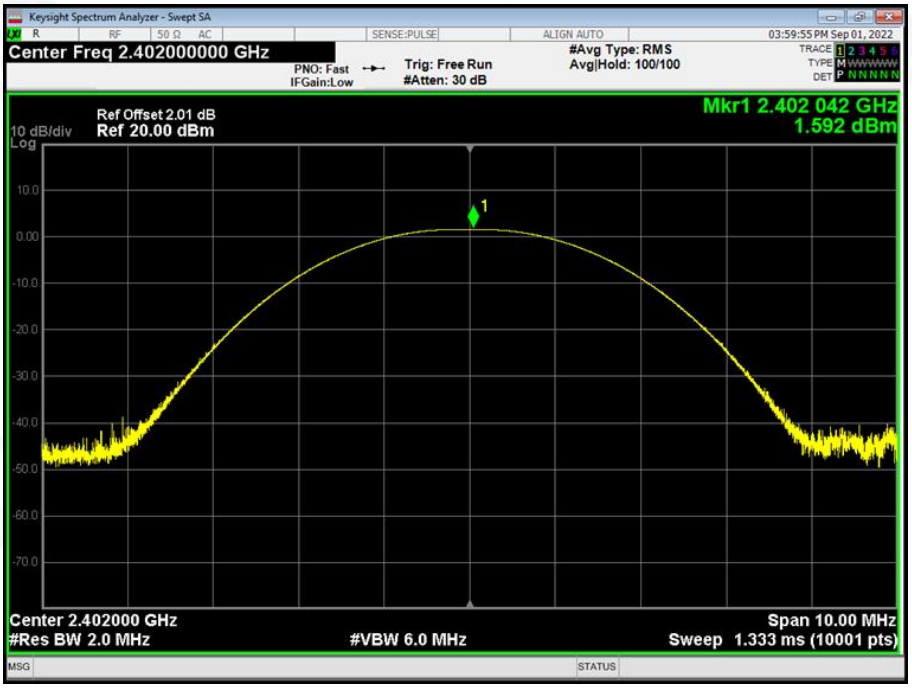
No deviation.

8.5 Test Result

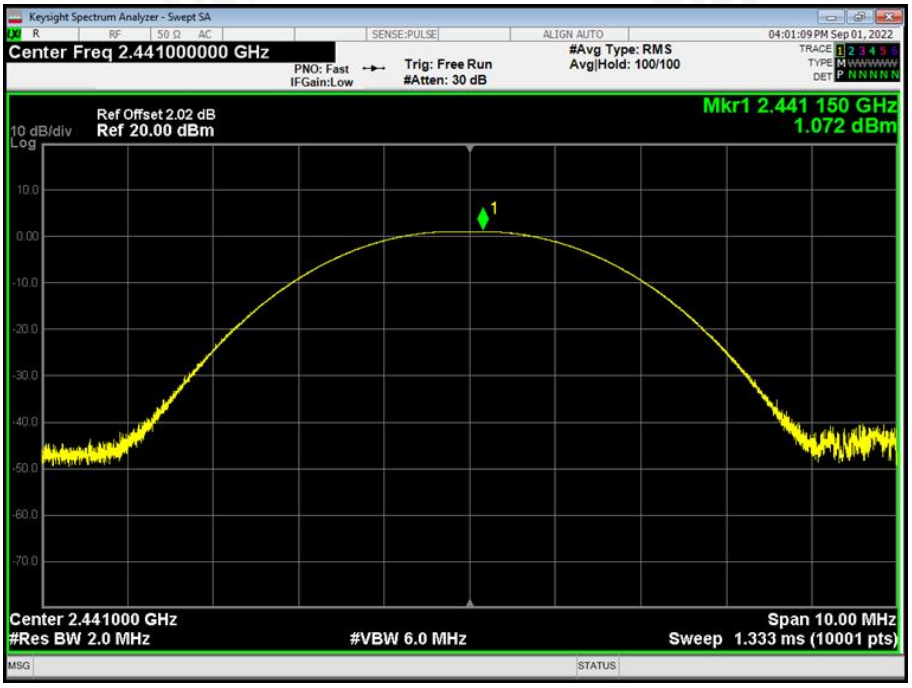
Mode	Test channel	Peak Output Power (dBm)	FCC Limit (dBm)	Result
GFSK	Lowest	1.592	30.00	Pass
	Middle	1.072		
	Highest	0.185		
π/4-DQPSK	Lowest	-1.195	21.00	Pass
	Middle	-1.742		
	Highest	-2.427		
8-DPSK	Lowest	-2.259	21.00	Pass
	Middle	-2.738		
	Highest	-3.525		

Test plots

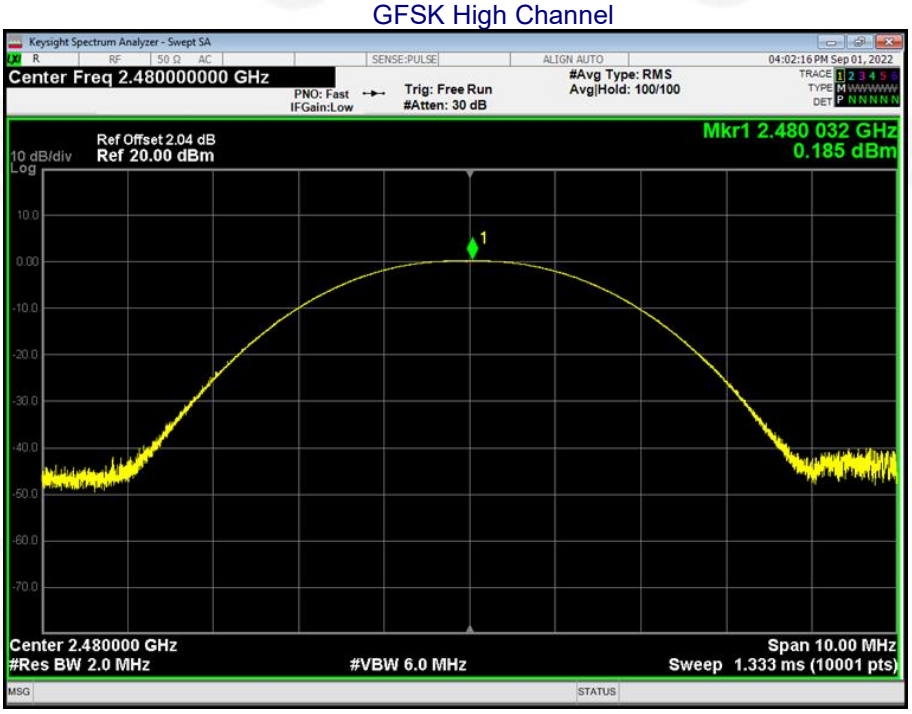
GFSK Low Channel



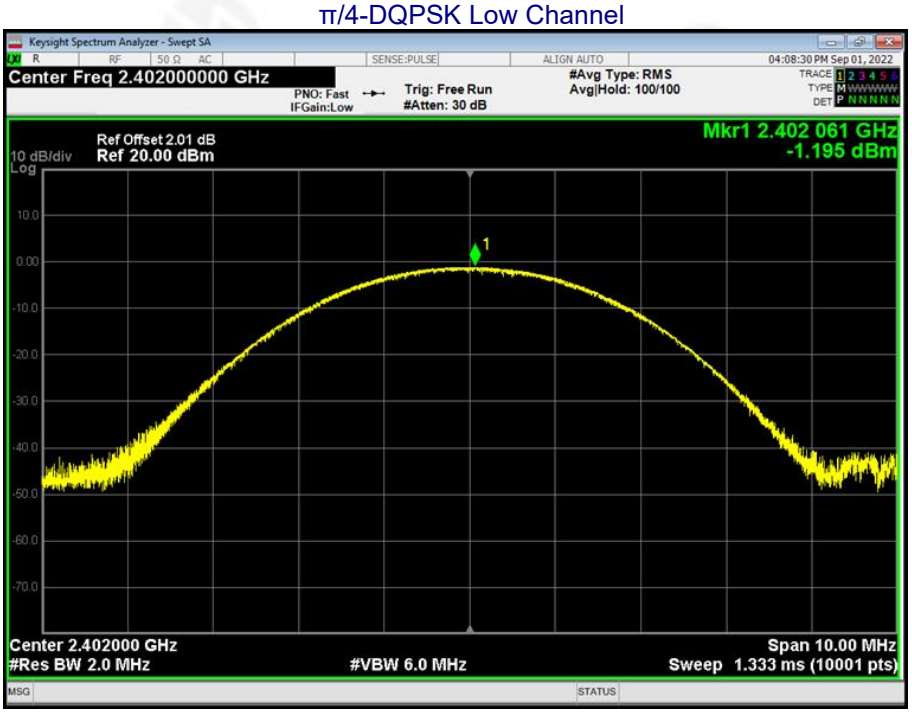
GFSK Middle Channel



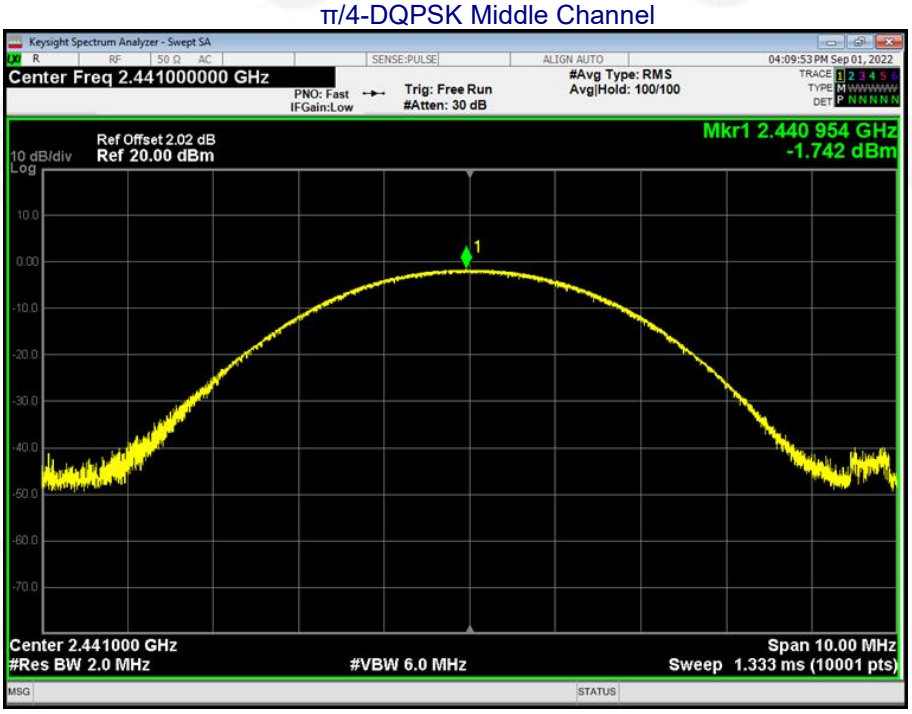
GFSK High Channel



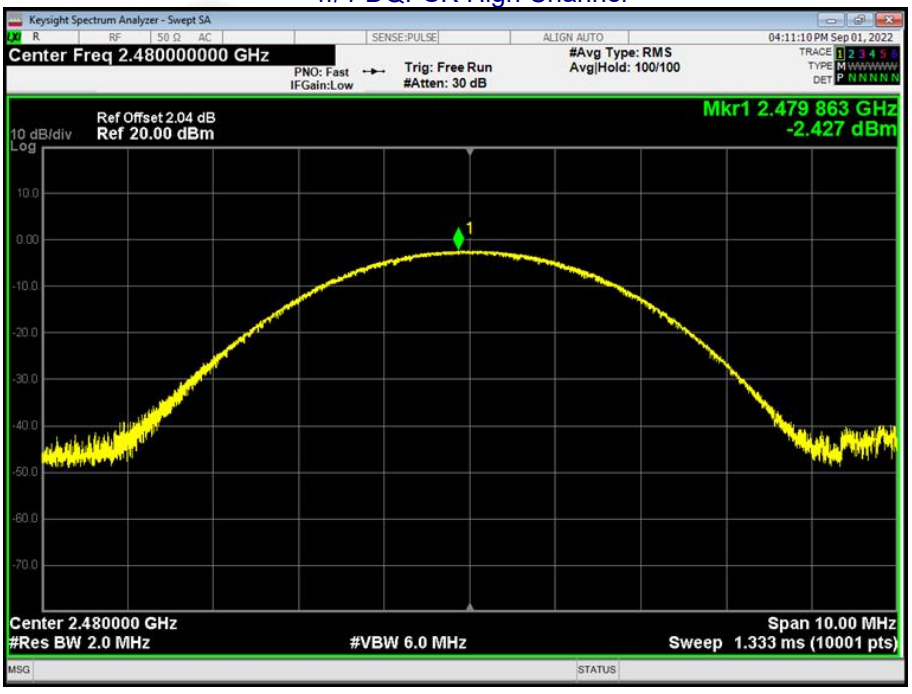
π/4-DQPSK Low Channel



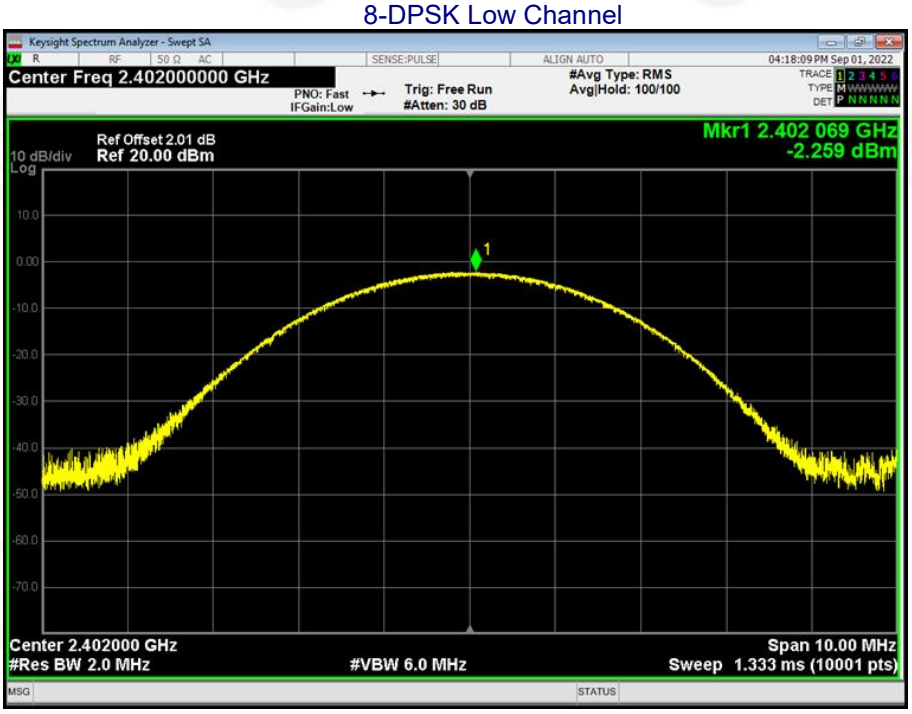
π/4-DQPSK Middle Channel



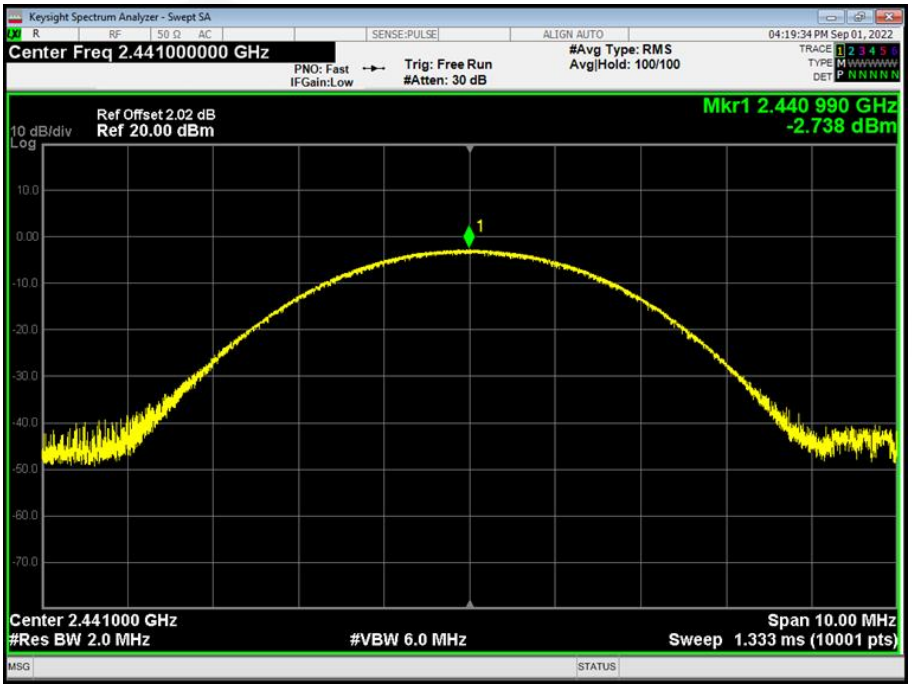
π/4-DQPSK High Channel



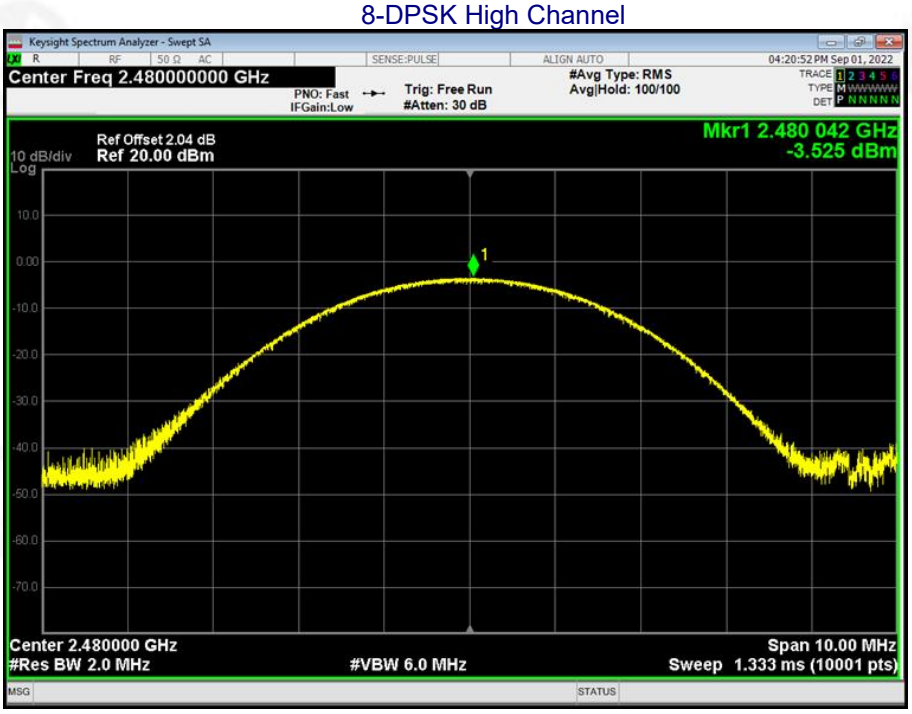
8-DPSK Low Channel



8-DPSK Middle Channel



8-DPSK High Channel



9. HOPPING CHANNEL SEPARATION

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=30KHz, VBW=100KHz, detector=Peak
Limit:	GFSK: 20dB bandwidth π/4-DQPSK & 8DSK: 0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)

9.1 Test Setup

9.2 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port

to the spectrum.

2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 2.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

9.3 DEVIATION FROM STANDARD

No deviation.

9.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.173	0.857	PASS
GFSK	Middle	1.026	0.871	PASS
GFSK	High	1.011	0.862	PASS
π/4-DQPSK	Low	1.146	0.919	PASS
π/4-DQPSK	Middle	1.164	0.955	PASS
π/4-DQPSK	High	1.158	0.951	PASS
8-DPSK	Low	1.002	0.957	PASS
8-DPSK	Middle	0.984	0.958	PASS
8-DPSK	High	0.975	0.971	PASS

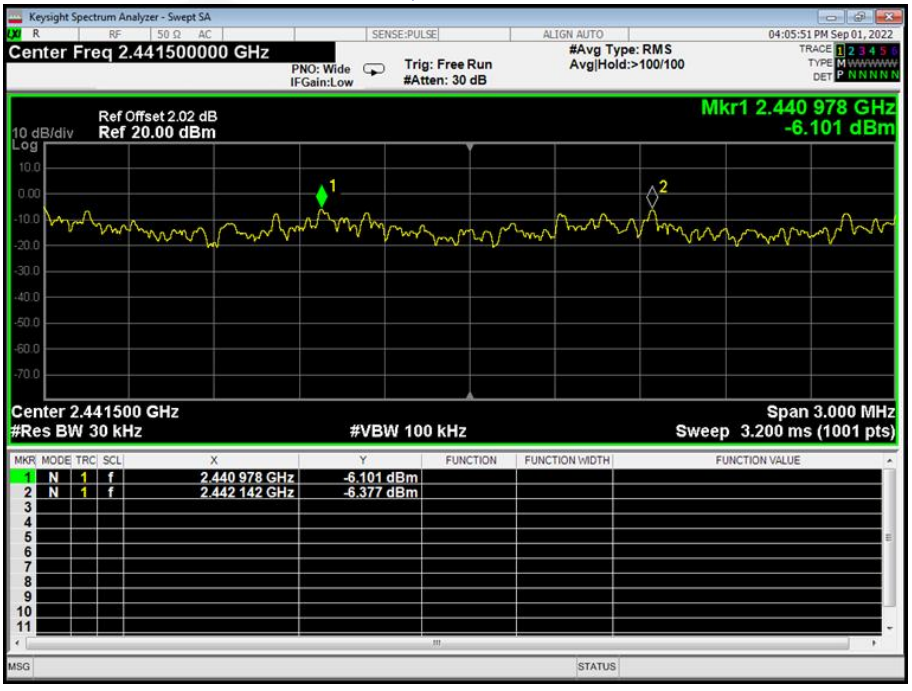
Test plots
GFSK Low Channel

GFSK Middle Channel

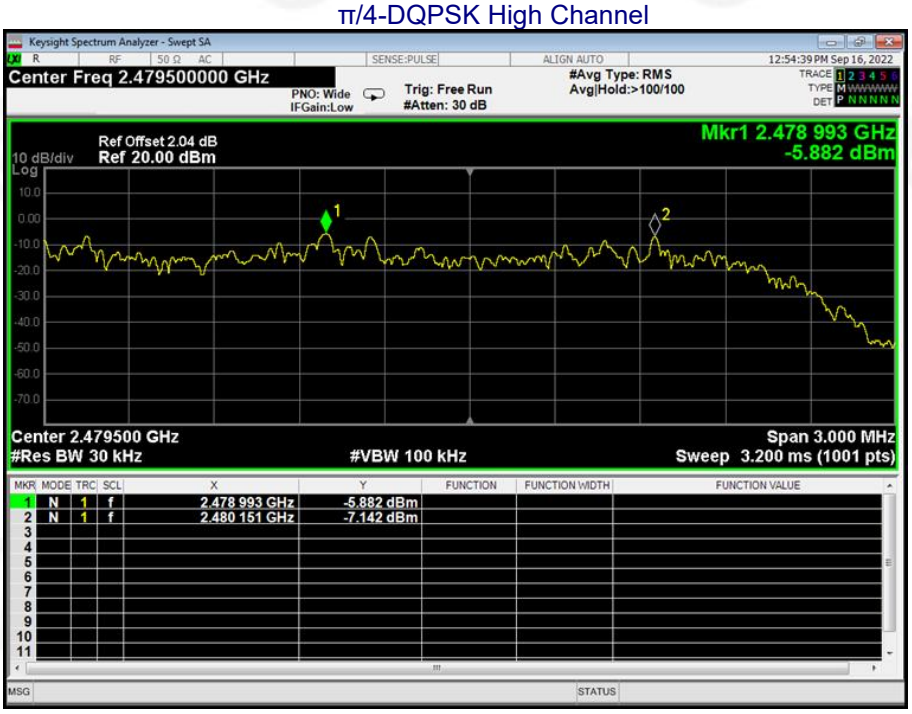
GFSK High Channel

π/4-DQPSK Low Channel

π/4-DQPSK Middle Channel

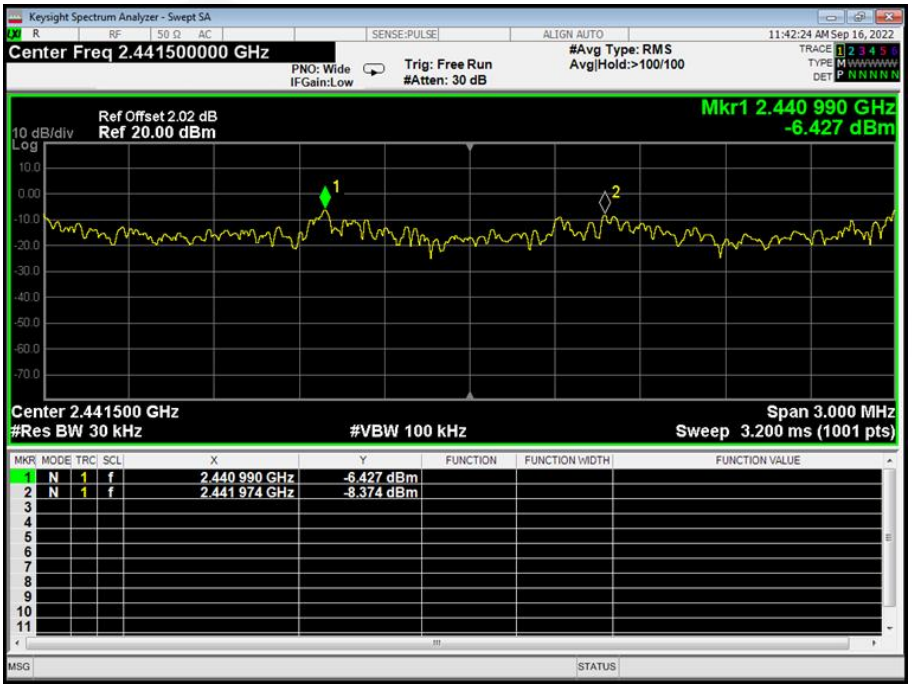


π/4-DQPSK High Channel

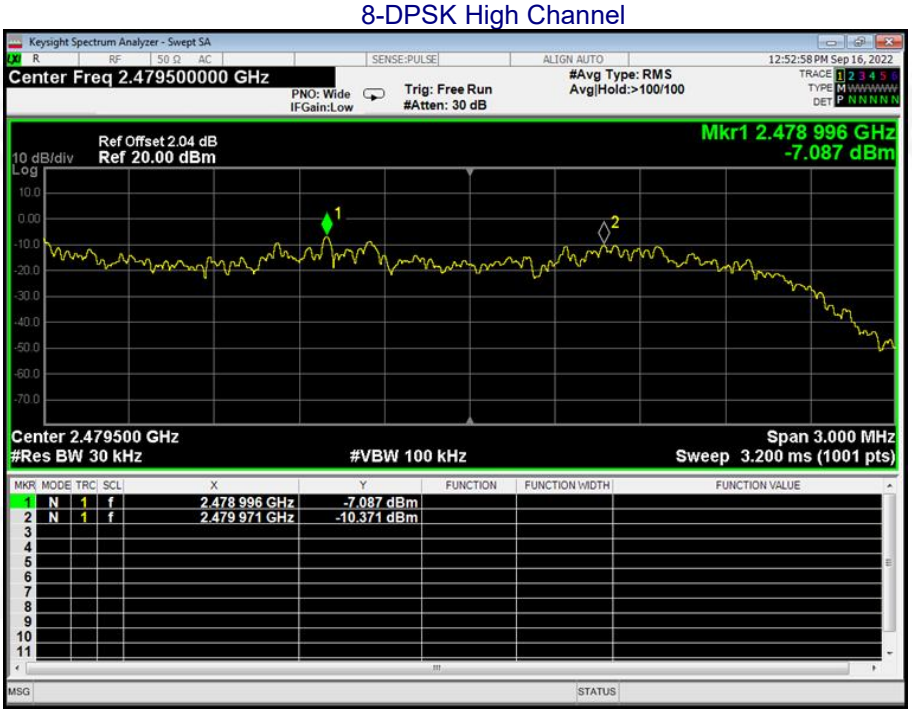


8-DPSK Low Channel

8-DPSK Middle Channel



8-DPSK High Channel



10.NUMBER OF HOPPING FREQUENCY

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels

10.1 Test Setup

10.2 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set the spectrum analyzer: RBW = 100kHz. VBW = 300kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.

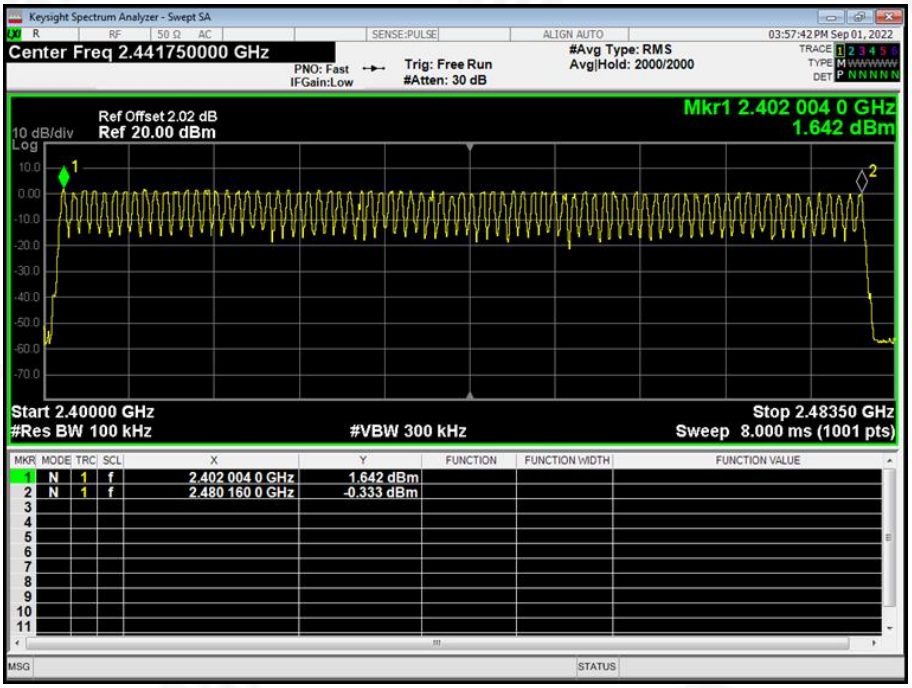
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

10.3 DEVIATION FROM STANDARD

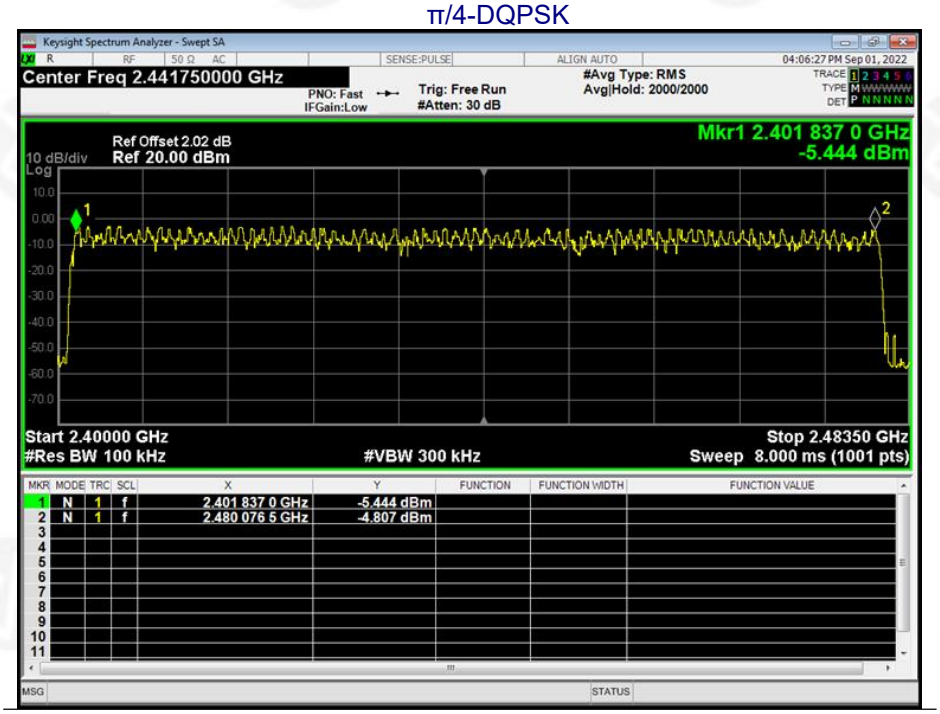
No deviation.

10.4 Test Result

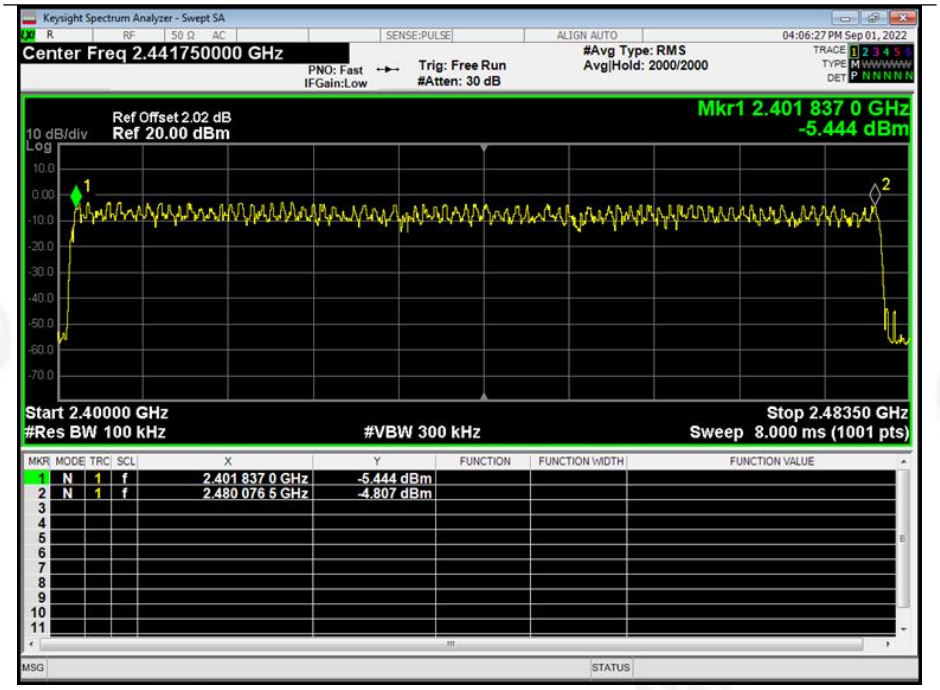
Test Plots:
79 Channels in total
GFSK



π/4-DQPSK



8-DPSK



11. DWELL TIME

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=3MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second

11.1 Test Setup

11.2 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set spectrum analyzer span = 0Hz;

3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.

4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

11.3 DEVIATION FROM STANDARD

No deviation.

11.4 Test Result

GFSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	DH1	121.600	400	Pass
2441MHz	DH3	261.760	400	Pass
2441MHz	DH5	307.627	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s
Test channel: as blow
CH:2441MHz time slot=0.380(ms)*(1600/ (2*79))*31.6=121.600ms
CH:2441MHz time slot=1.636(ms)*(1600/ (4*79))*31.6=261.760ms
CH:2441MHz time slot=2.884(ms)*(1600/ (6*79))*31.6=307.627ms

π/4-DQPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	2DH1	124.480	400	Pass
2441MHz	2DH3	262.560	400	Pass
2441MHz	2DH5	308.160	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s
Test channel: as blow
CH:2441MHz time slot=0.389(ms)*(1600/ (2*79))*31.6=124.480ms
CH:2441MHz time slot=1.641(ms)*(1600/ (4*79))*31.6=262.560ms
CH:2441MHz time slot=2.889(ms)*(1600/ (6*79))*31.6=308.160ms

8-DPSK mode:

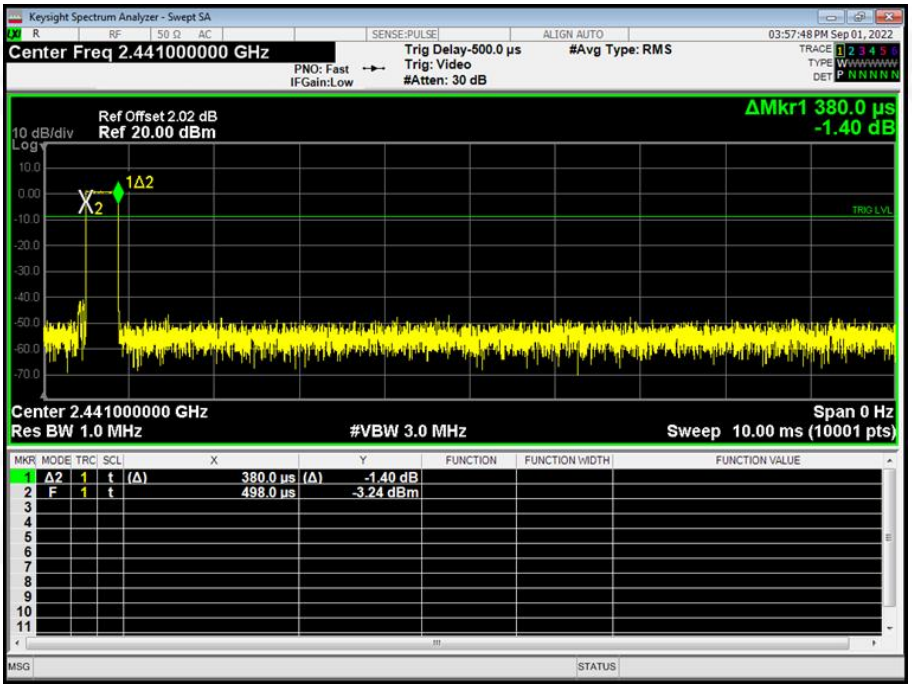
Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	3DH1	124.480	400	Pass
2441MHz	3DH3	262.400	400	Pass
2441MHz	3DH5	308.373	400	Pass

Remarks:

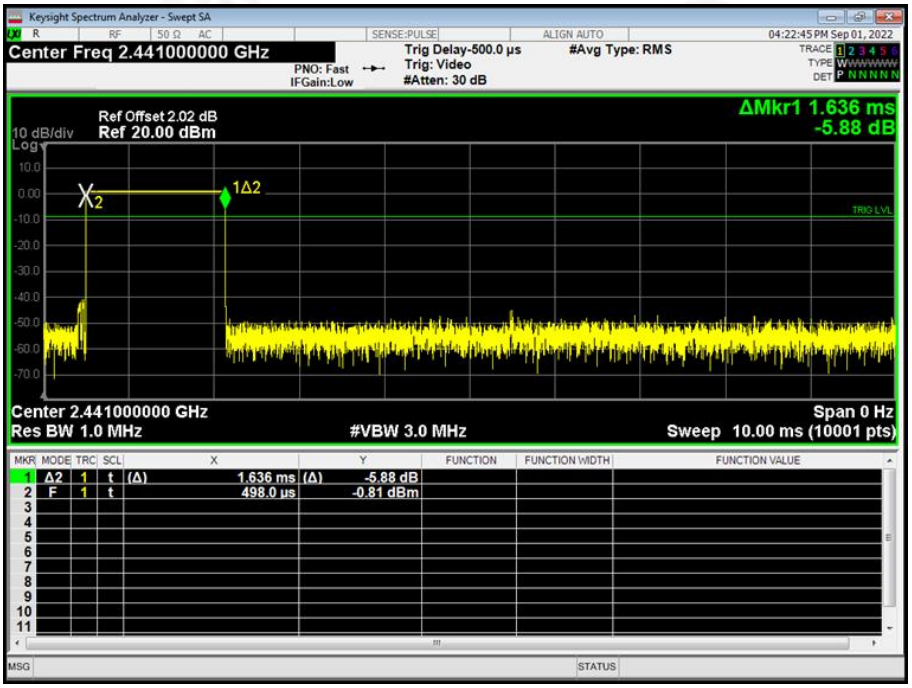
The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s
Test channel: as blow
CH:2441MHz time slot=0.389(ms)*(1600/ (2*79))*31.6=124.480ms
CH:2441MHz time slot=1.640(ms)*(1600/ (4*79))*31.6=262.400ms
CH:2441MHz time slot=2.891(ms)*(1600/ (6*79))*31.6=308.373ms

Test Plots

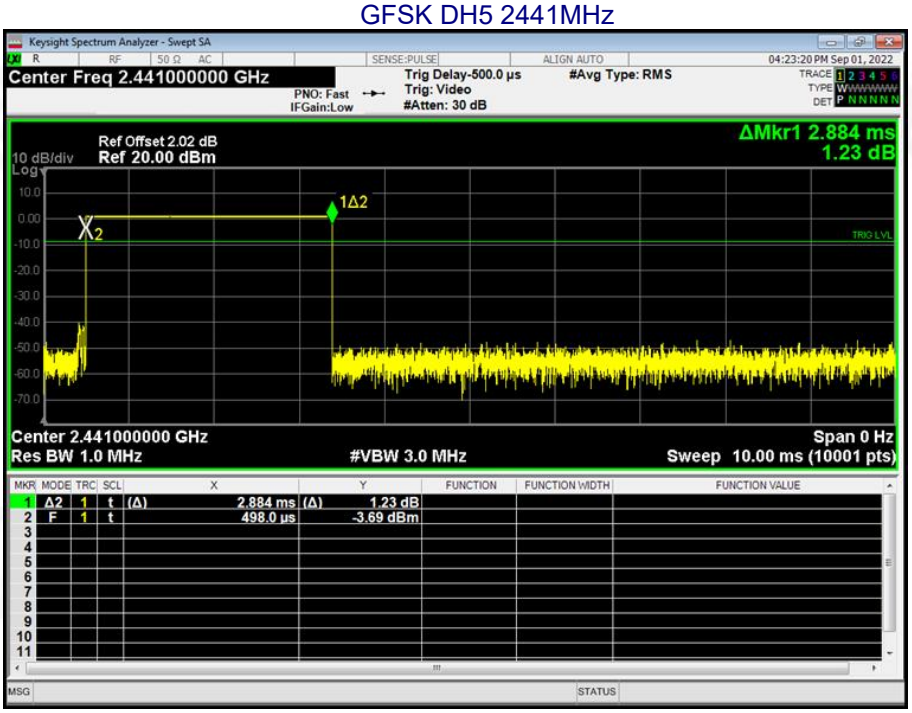
GFSK DH1 2441MHz



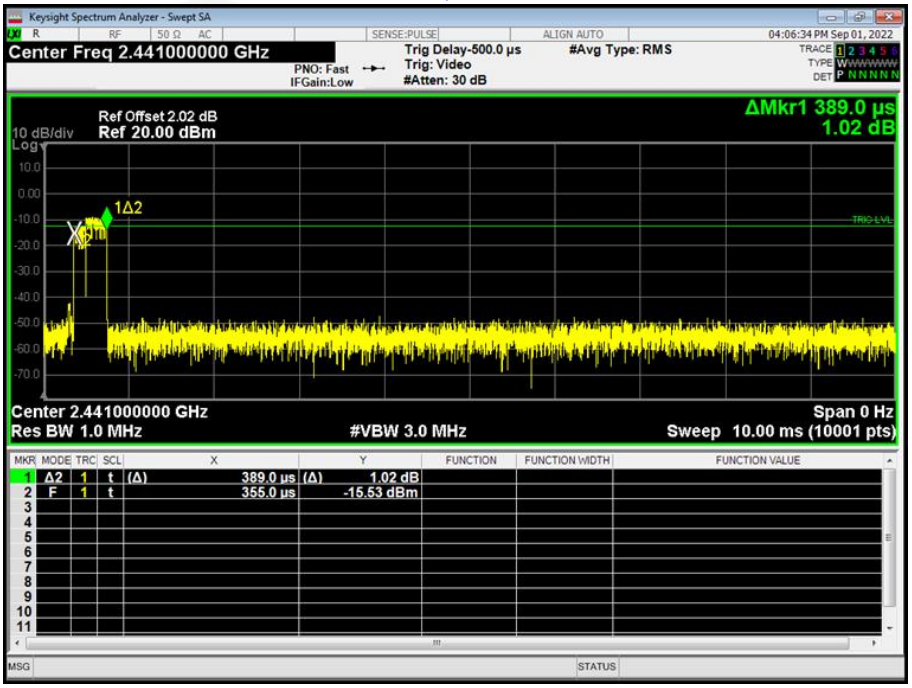
GFSK DH3 2441MHz



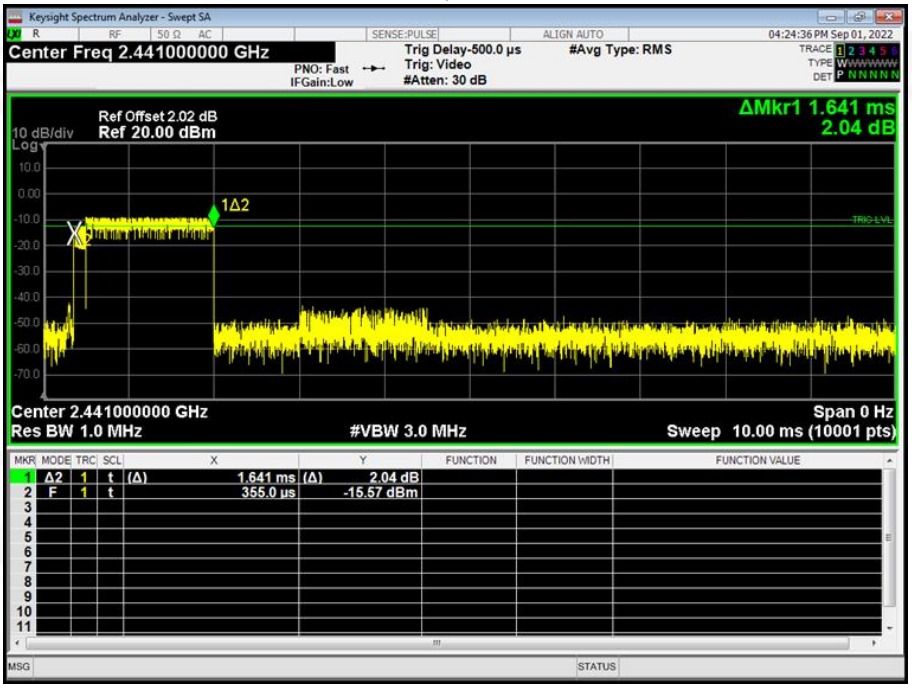
GFSK DH5 2441MHz



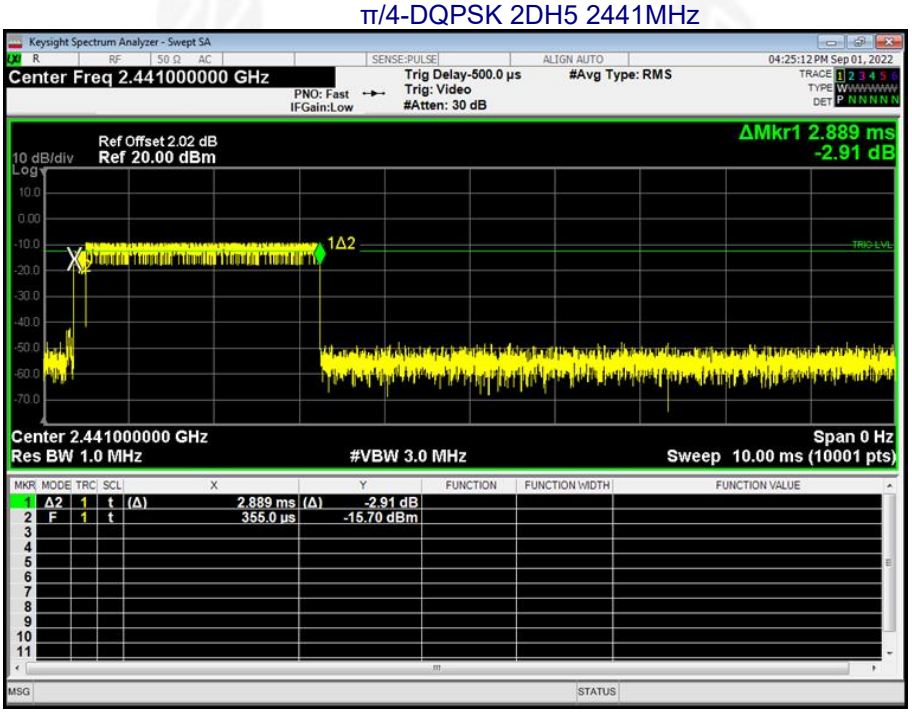
π/4-DQPSK 2DH1 2441MHz



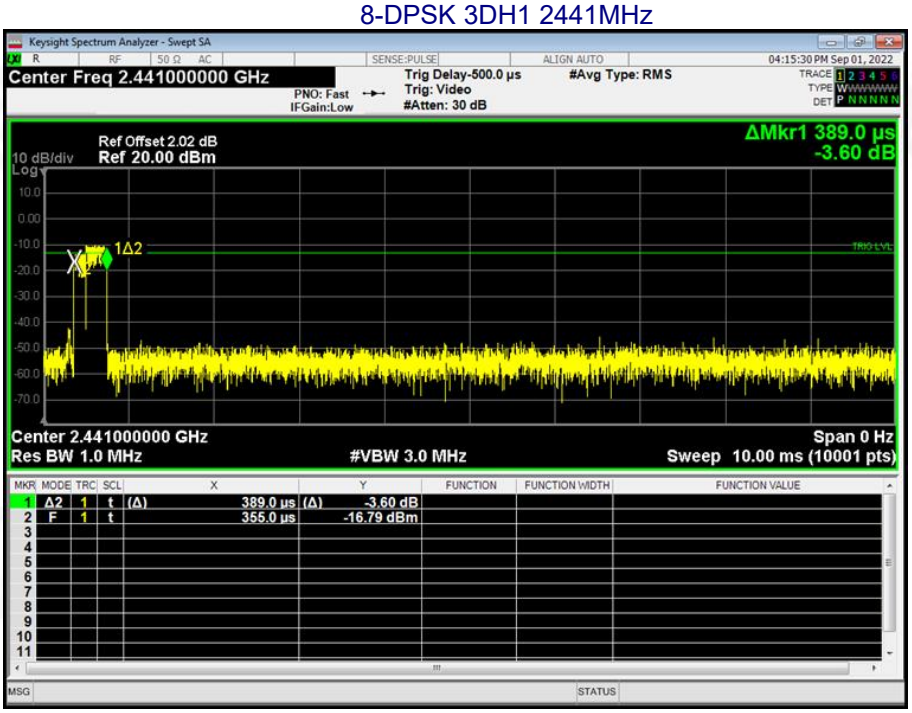
π/4-DQPSK 2DH3 2441MHz



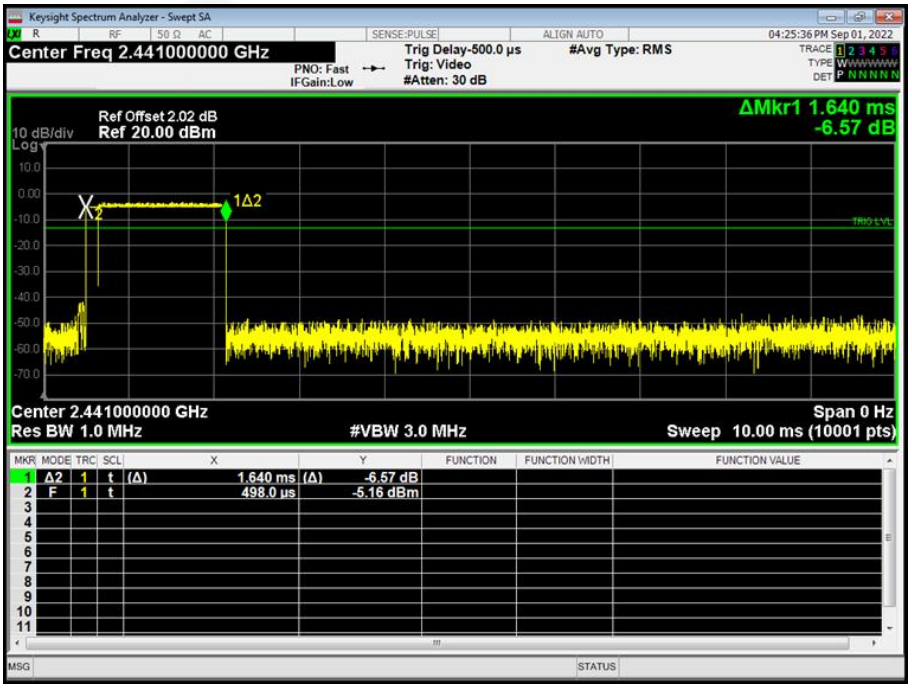
π/4-DQPSK 2DH5 2441MHz



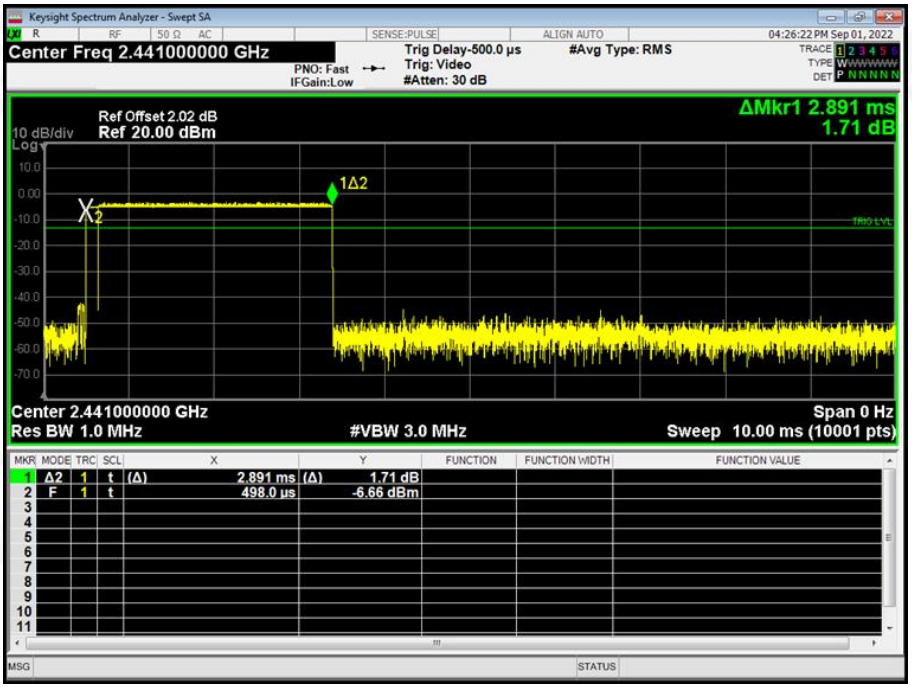
8-DPSK 3DH1 2441MHz



8-DPSK 3DH3 2441MHz



8-DPSK 3DH5 2441MHz



12. Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
15.203 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.	
EUT Antenna:	
The antenna is PCB antenna, the best case gain of the antennas is 3.49 dBi, reference to the appendix II for details	

13. Test Setup Photo

Reference to the appendix I for details.

14. EUT Constructional Details

Reference to the appendix II for details.

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