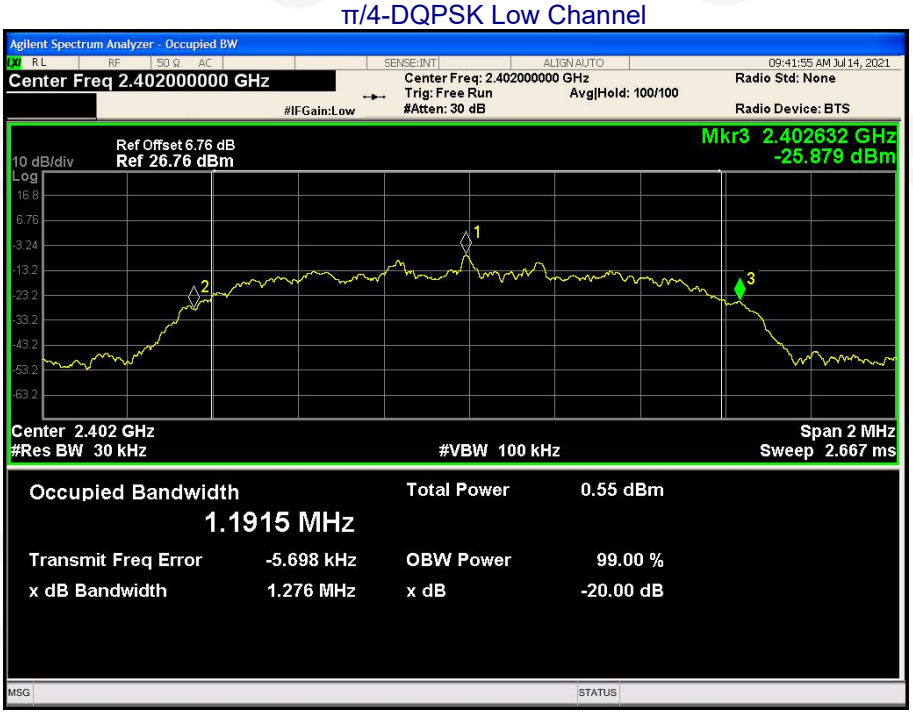
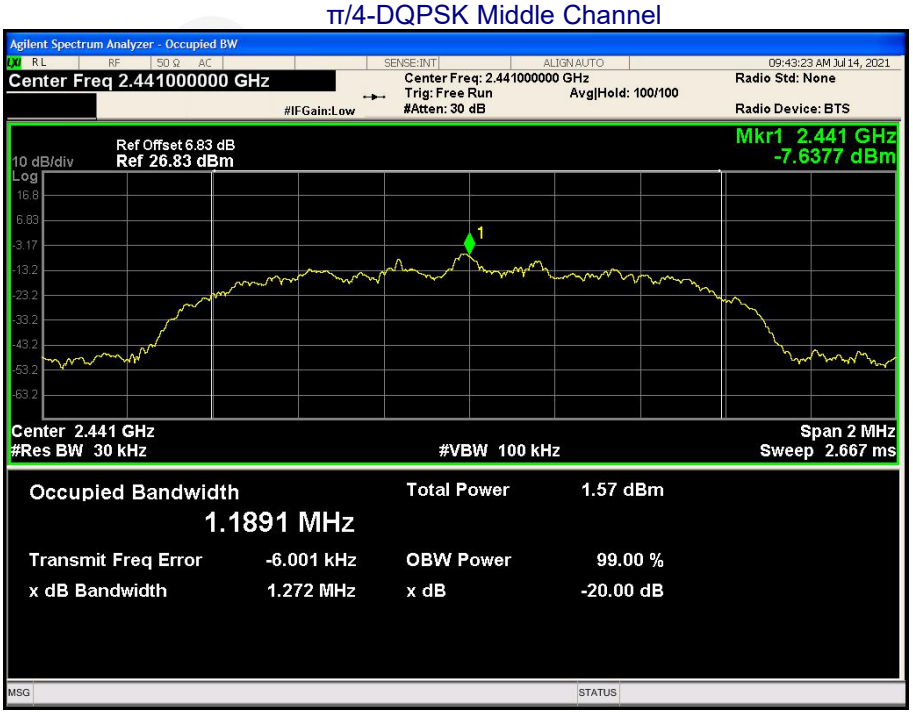
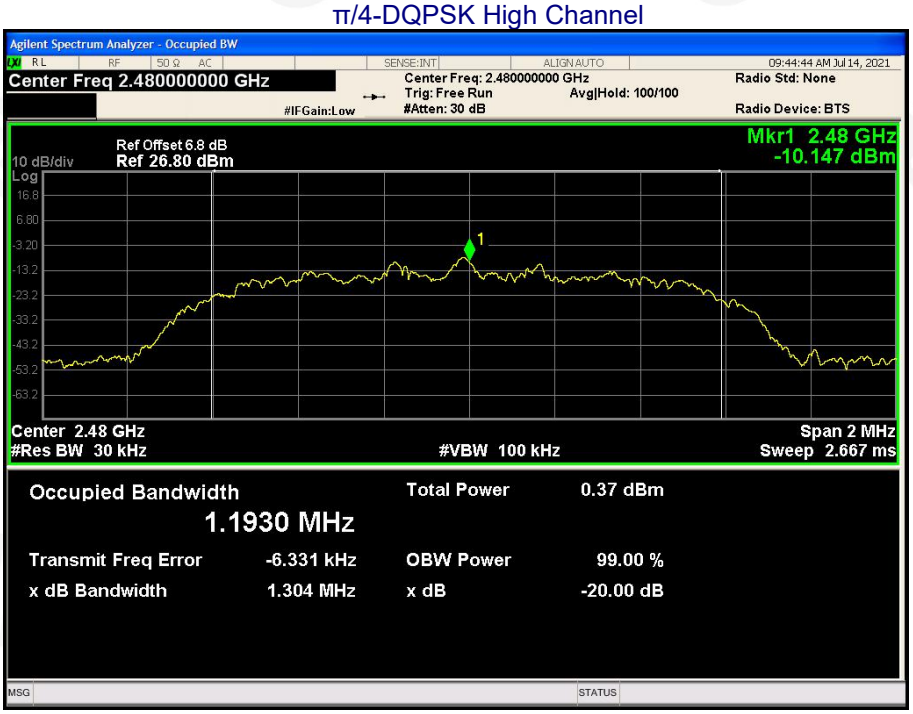
π/4-DQPSK Low Channel



π/4-DQPSK Middle Channel



π/4-DQPSK High Channel



8. Maximum Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2013
Limit:	30dBm(for GFSK), 20.97dBm(for EDR)

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.

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.

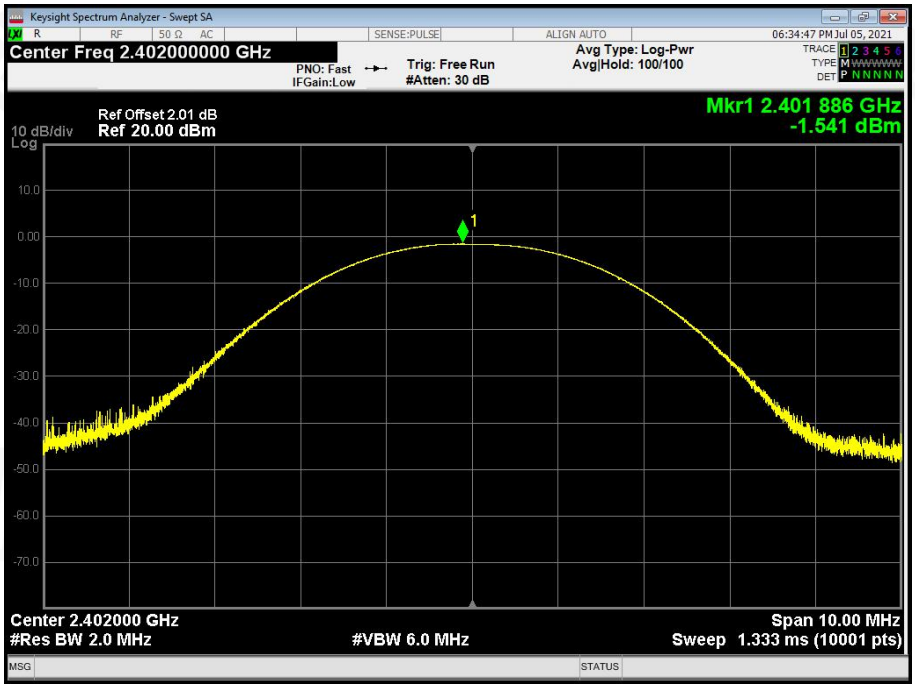
8.4 DEVIATION FROM STANDARD

No deviation.

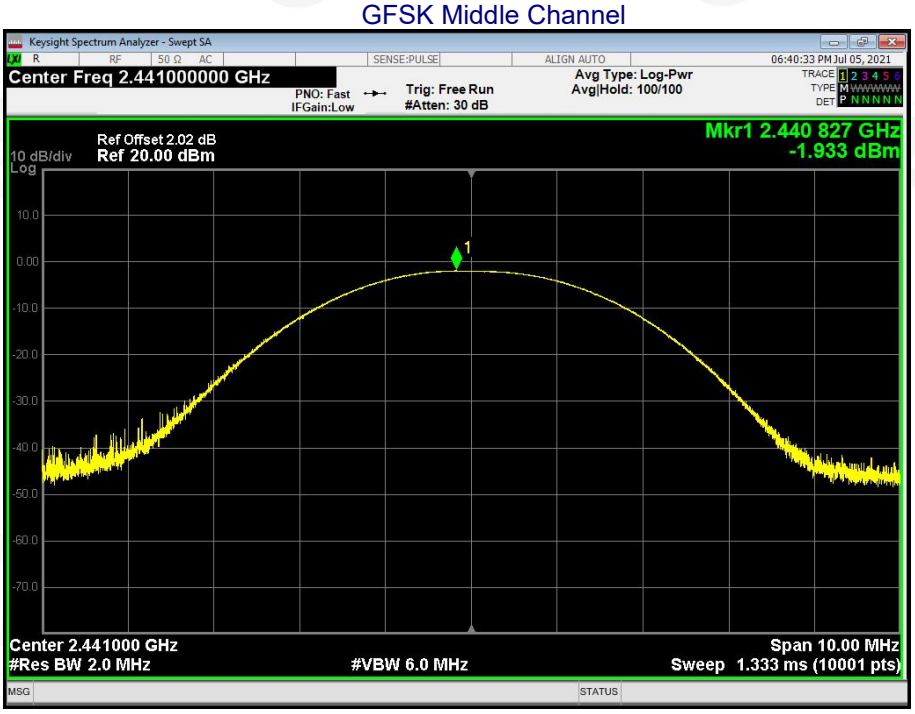
8.5 Test Result

Mode	Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
GFSK	Lowest	-1.541	30.00	Pass
	Middle	-1.933		
	Highest	-2.661		
π/4-DQPSK	Lowest	-0.634	20.97	Pass
	Middle	-1.074		
	Highest	-1.775		

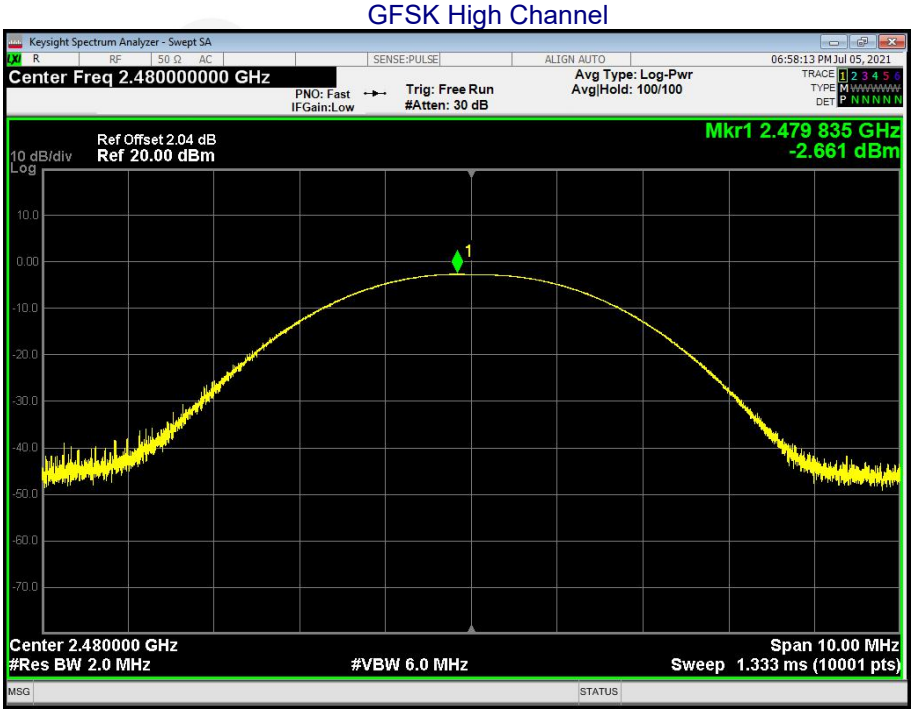
Test plots
GFSK Low Channel



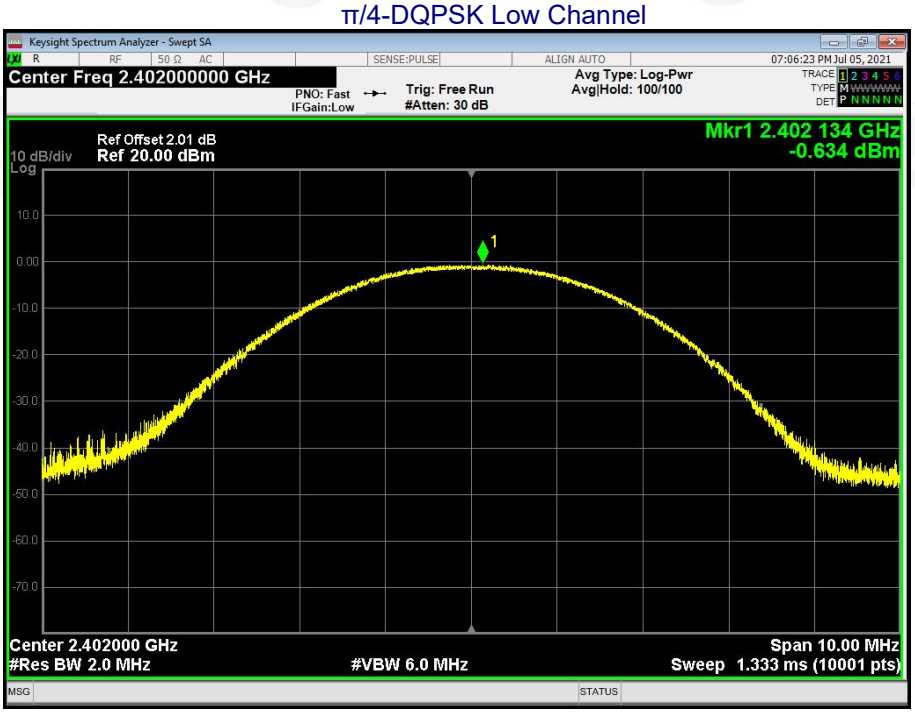
GFSK Middle Channel



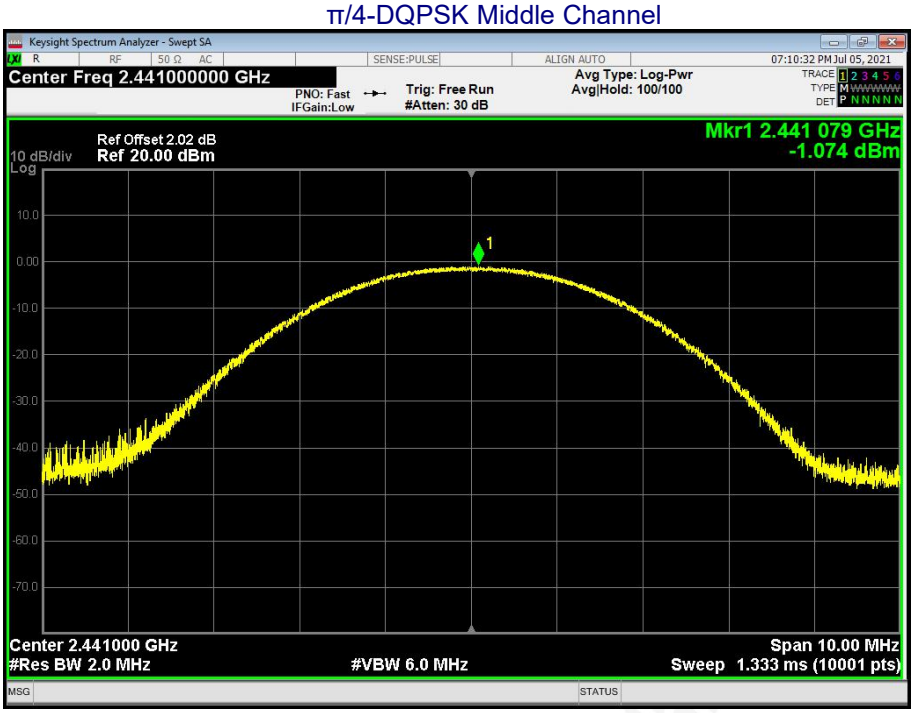
GFSK High Channel



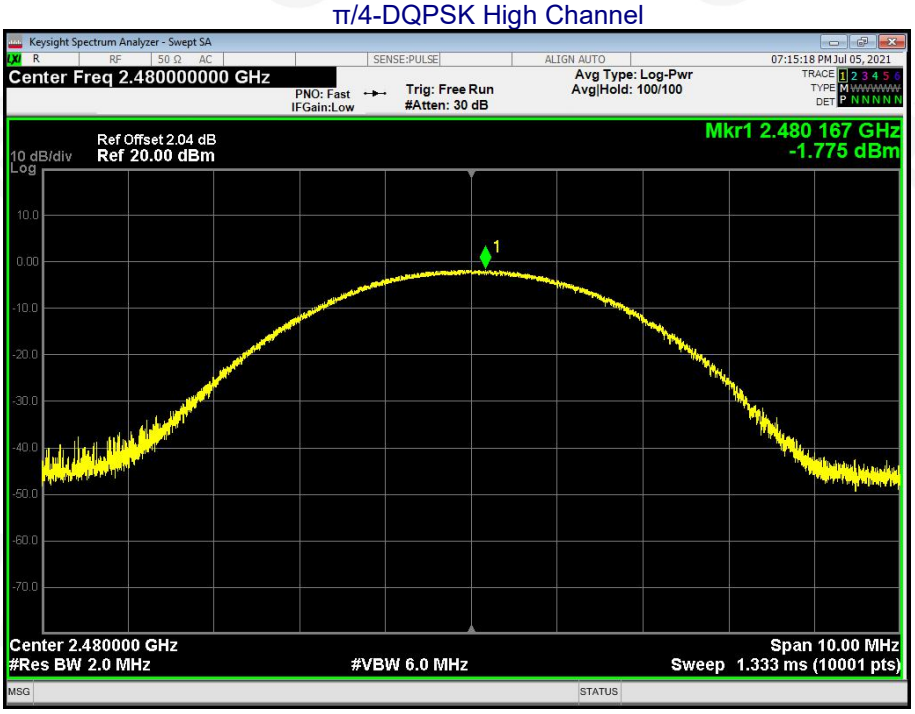
π/4-DQPSK Low Channel



π/4-DQPSK Middle Channel



π/4-DQPSK High Channel



9. HOPPING CHANNEL SEPARATION

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100KHz, VBW=300KHz, 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 = 100kHz. VBW = 300kHz , Span = 3.0MHz. 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.

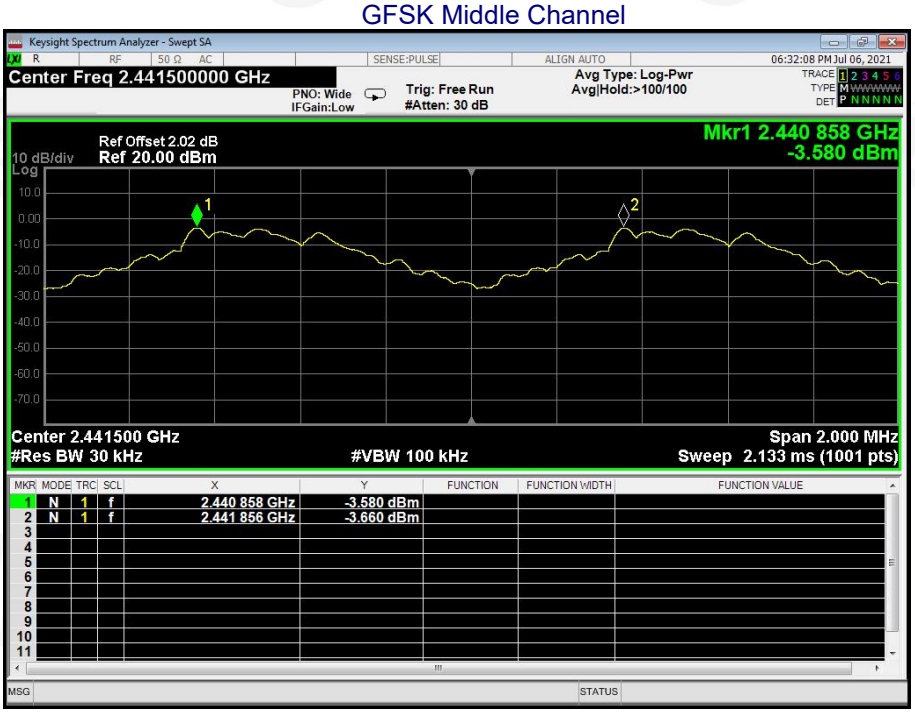
9.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.000	0.878	PASS
GFSK	Middle	0.998	0.868	PASS
GFSK	High	1.000	0.866	PASS
π/4-DQPSK	Low	0.998	0.851	PASS
π/4-DQPSK	Middle	0.998	0.848	PASS
π/4-DQPSK	High	1.000	0.869	PASS

Test plots

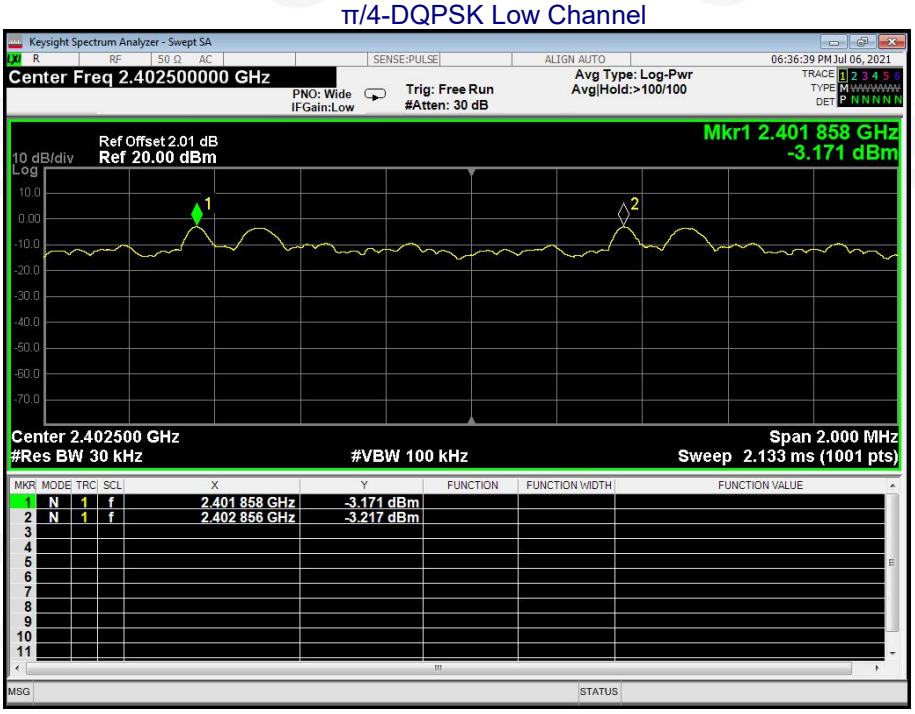
GFSK Low Channel

GFSK Middle Channel

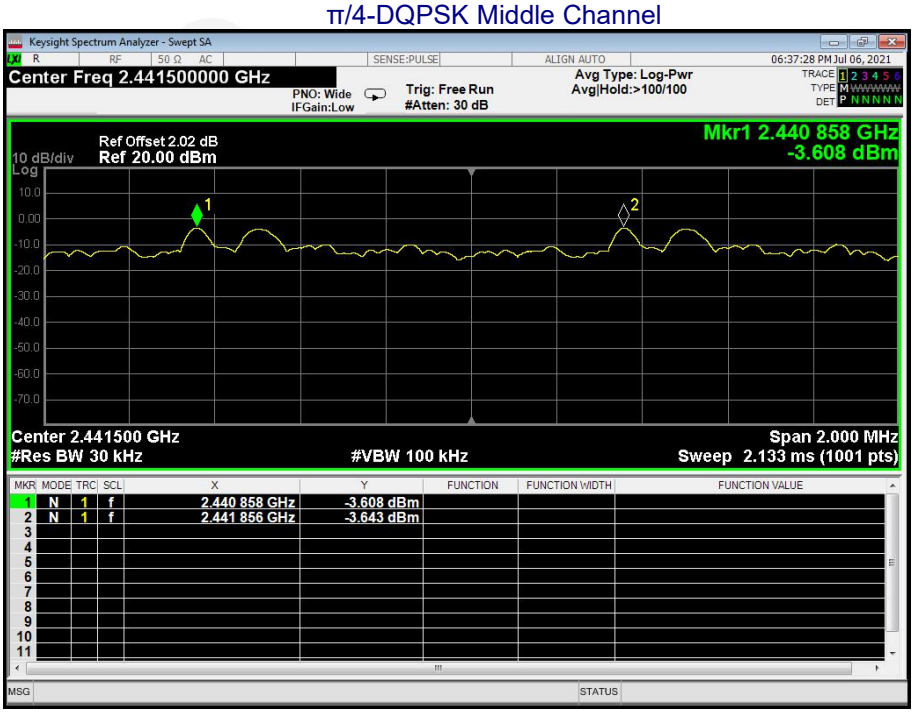


GFSK High Channel

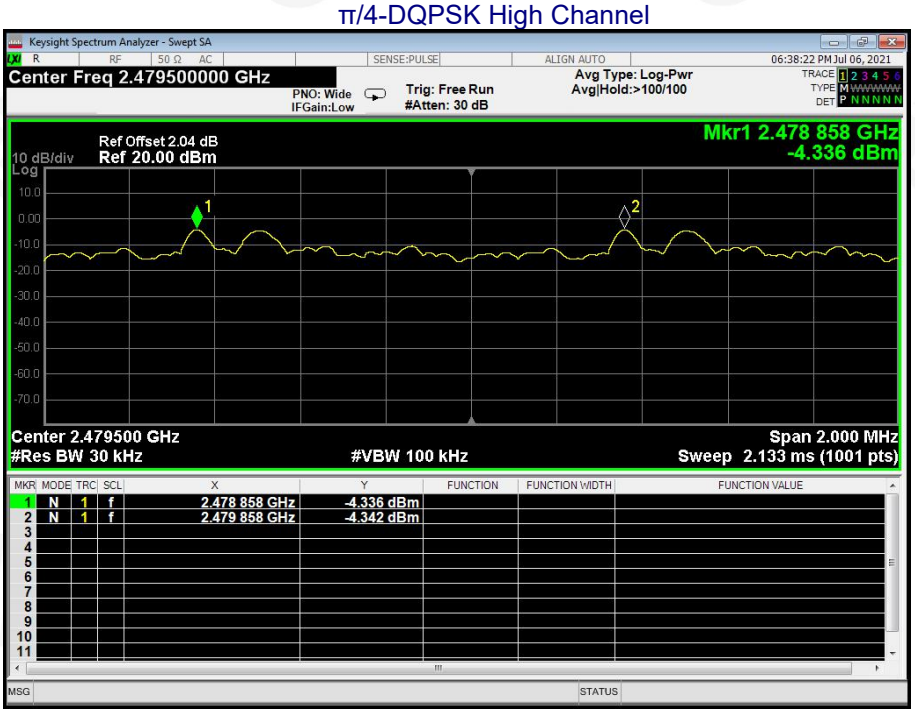
π/4-DQPSK Low Channel



π/4-DQPSK Middle Channel



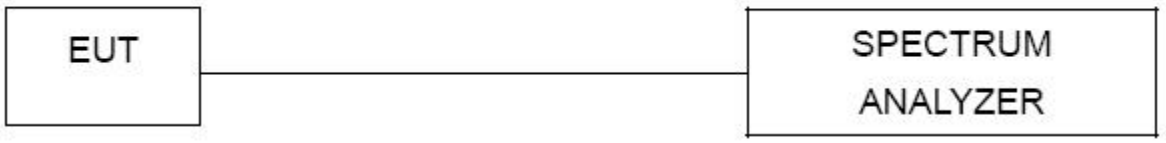
π/4-DQPSK High Channel



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.

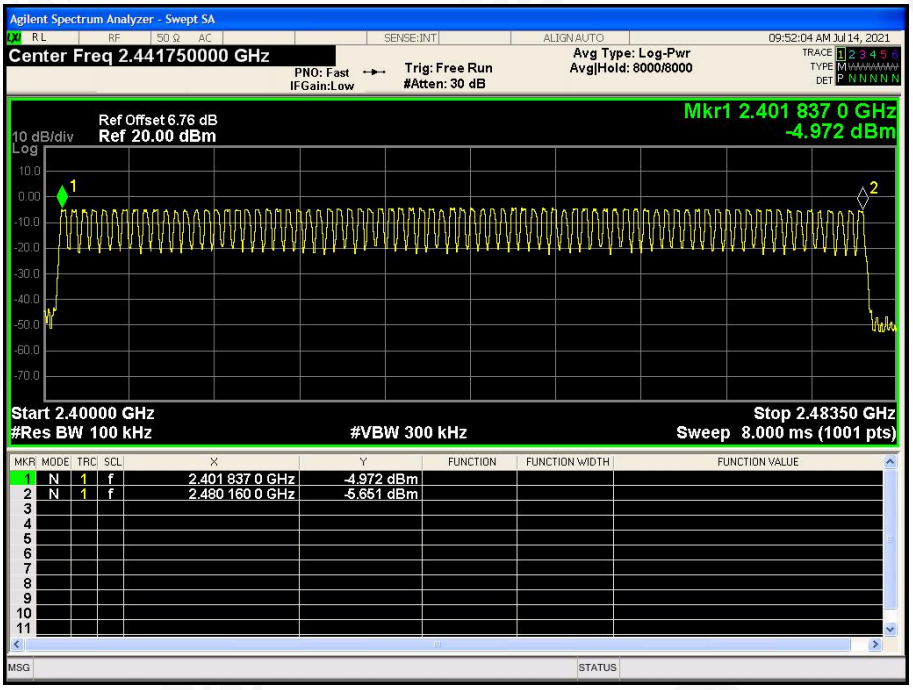
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

10.3 DEVIATION FROM STANDARD

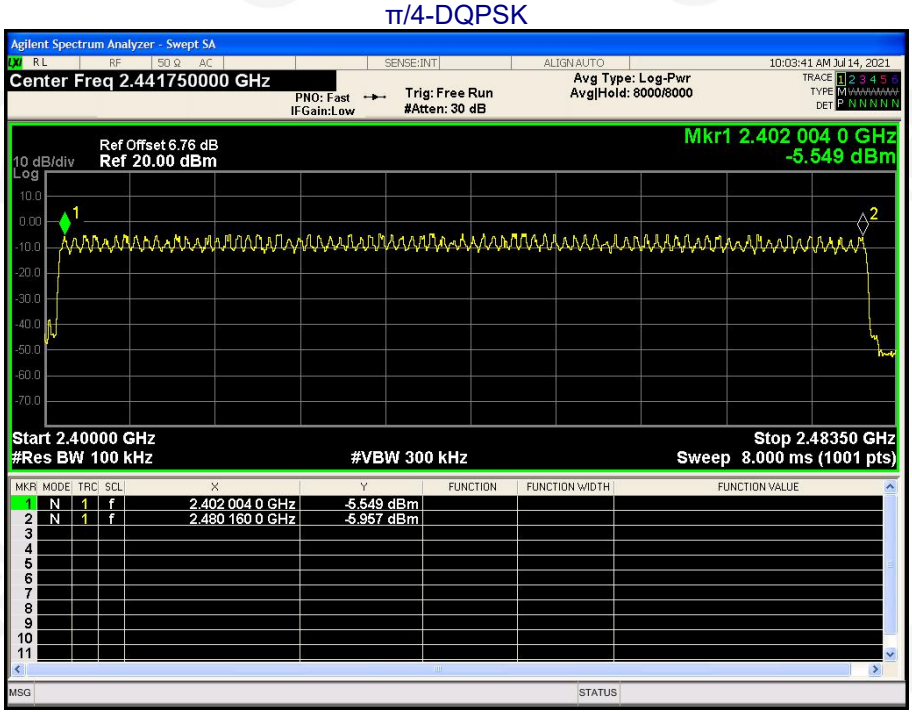
No deviation.

10.4 Test Result

Test Plots:
79 Channels in total
GFSK



π/4-DQPSK


Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:03:41 AM Jul 14, 2021
Center Freq 2.441750000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 8000/8000
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Ref Offset 6.76 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 2.402 004 0 GHz
-5.549 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
1
2
Start 2.40000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.48350 GHz
Sweep 8.000 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.402 004 0 GHz -5.549 dBm
2 N 1 f 2.480 160 0 GHz -5.957 dBm
3
4
5
6
7
8
9
10
11
MSG
STATUS

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	125.44	400	Pass
2441MHz	DH3	263.84	400	Pass
2441MHz	DH5	309.65	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s
Test channel: 2441MHz as blow
DH1 time slot=0.392(ms)*(1600/ (2*79))*31.6=125.44ms
DH3 time slot=1.649(ms)*(1600/ (4*79))*31.6=263.84ms
DH5 time slot=2.903(ms)*(1600/ (6*79))*31.6=309.65ms

π/4-DQPSK mode:

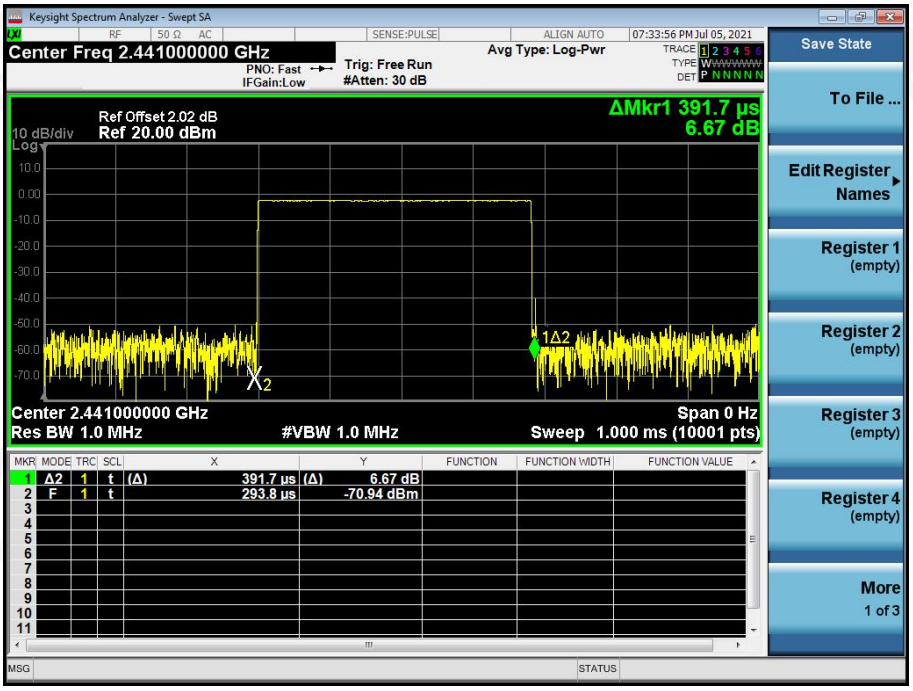
Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	2DH1	127.04	400	Pass
2441MHz	2DH3	264.64	400	Pass
2441MHz	2DH5	309.97	400	Pass

Remarks:

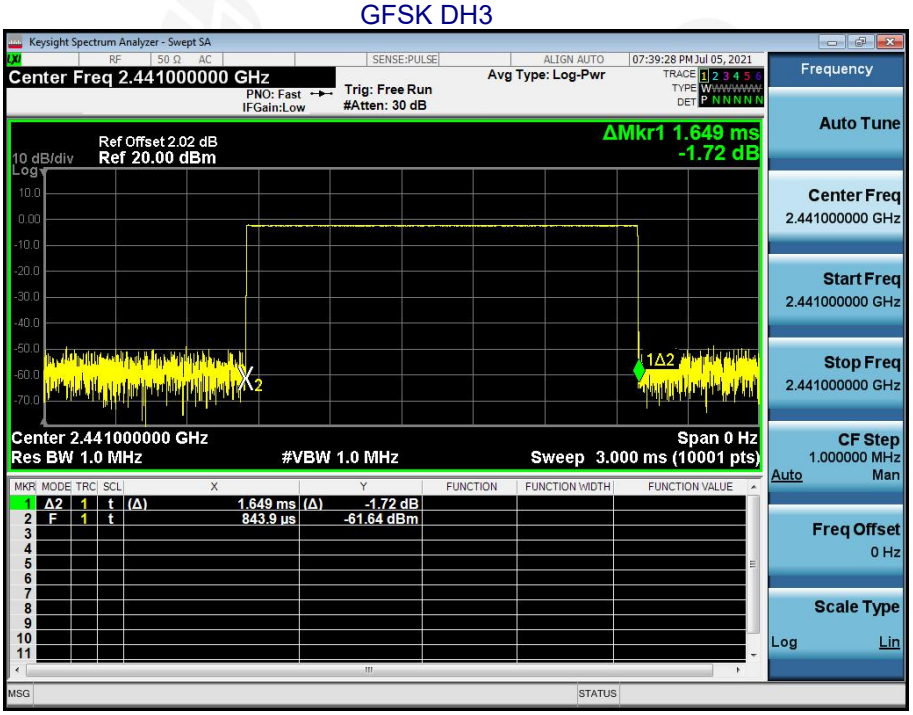
The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s
Test channel: 2441MHz as blow
DH1 time slot=0.397(ms)*(1600/ (2*79))*31.6=127.04ms
DH3 time slot=1.654(ms)*(1600/ (4*79))*31.6=264.64ms
DH5 time slot=2.906(ms)*(1600/ (6*79))*31.6=309.97ms

Test Plots

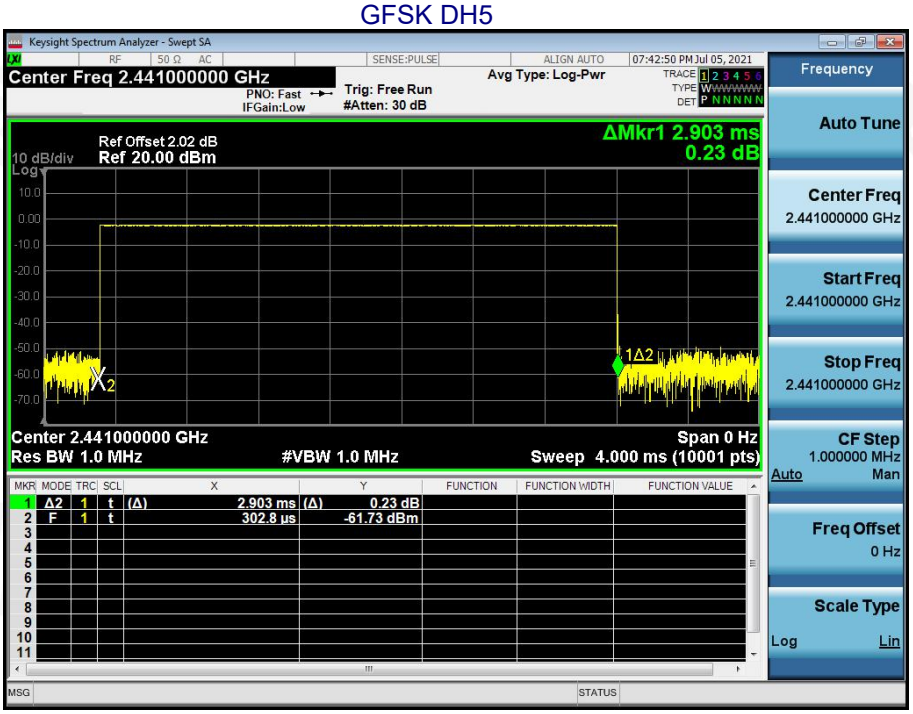
GFSK DH1



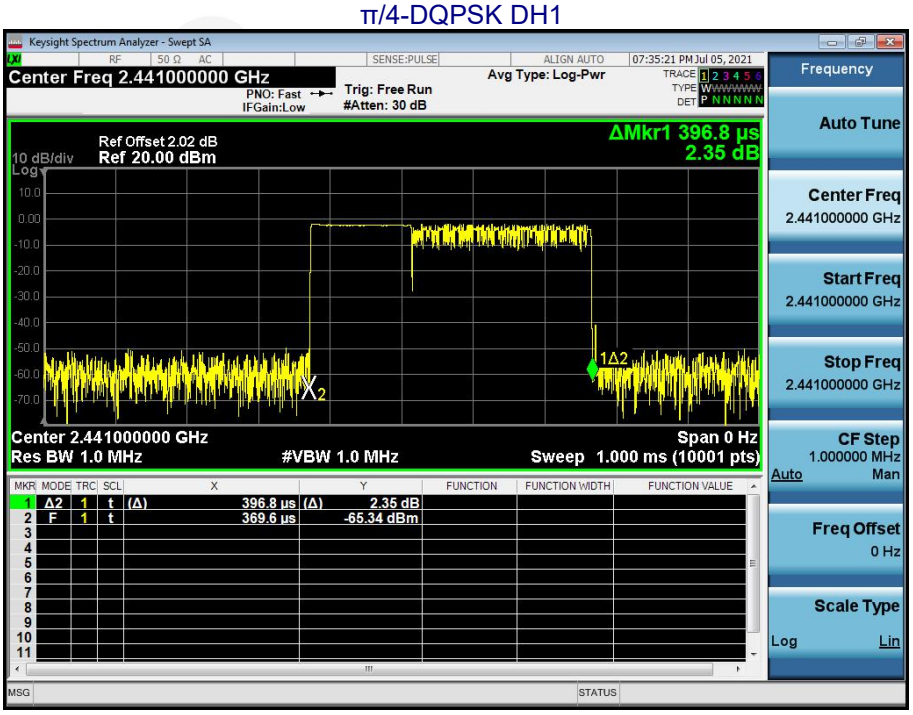
GFSK DH3



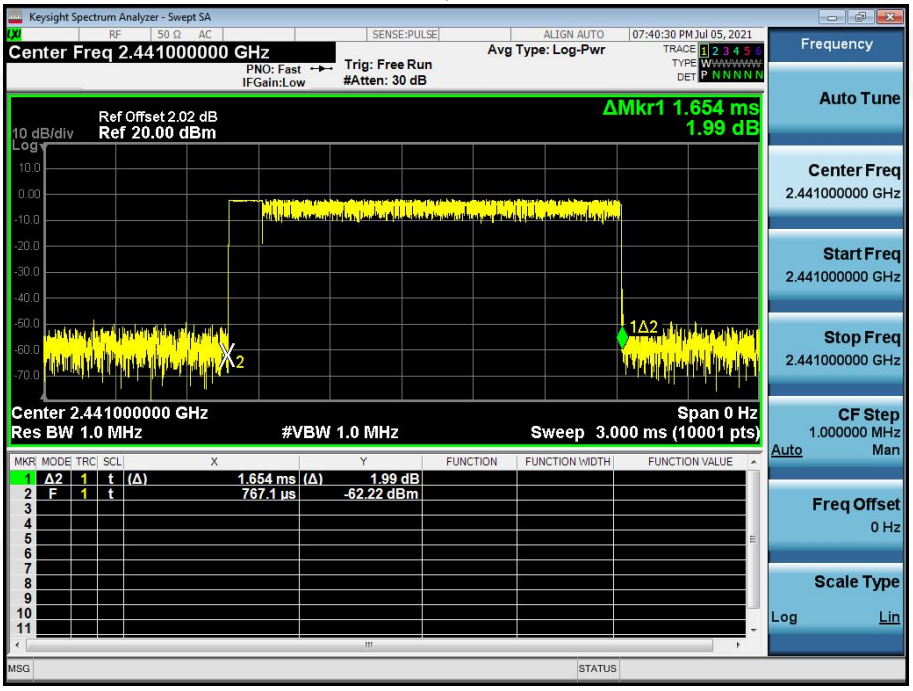
GFSK DH5



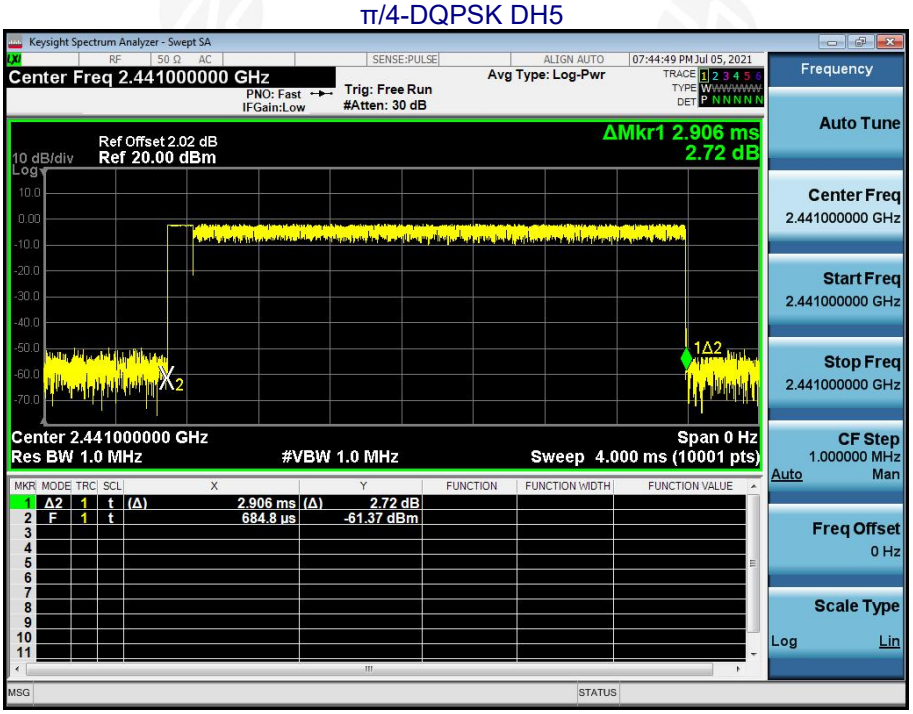
π/4-DQPSK DH1



π/4-DQPSK DH3



π/4-DQPSK DH5



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 Chip antenna, the best case gain of the antennas is 0dBi, 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.

※※※※※ END OF REPORT ※※※※※