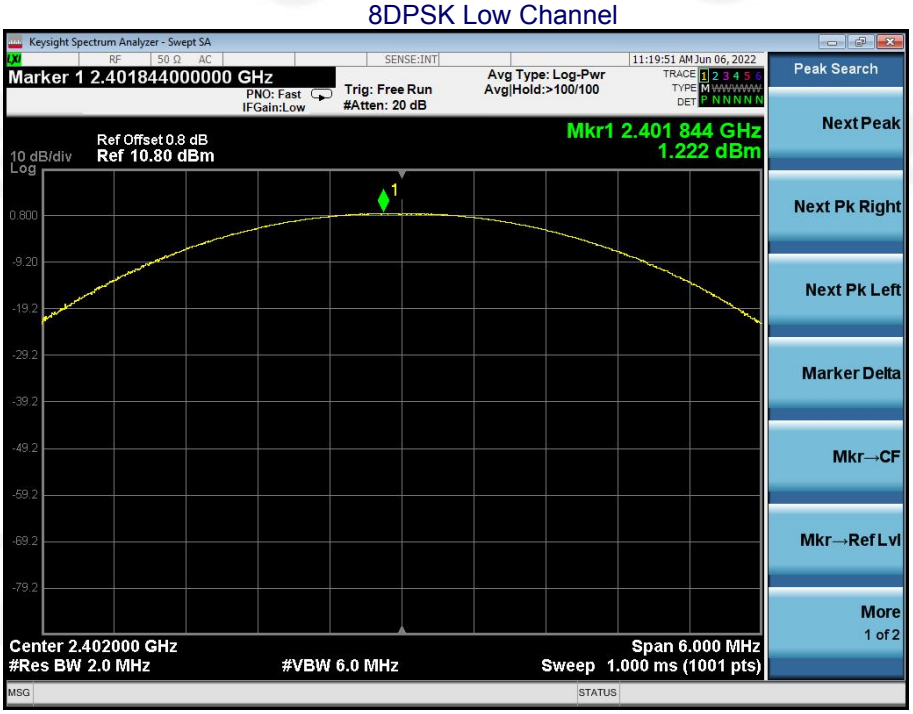
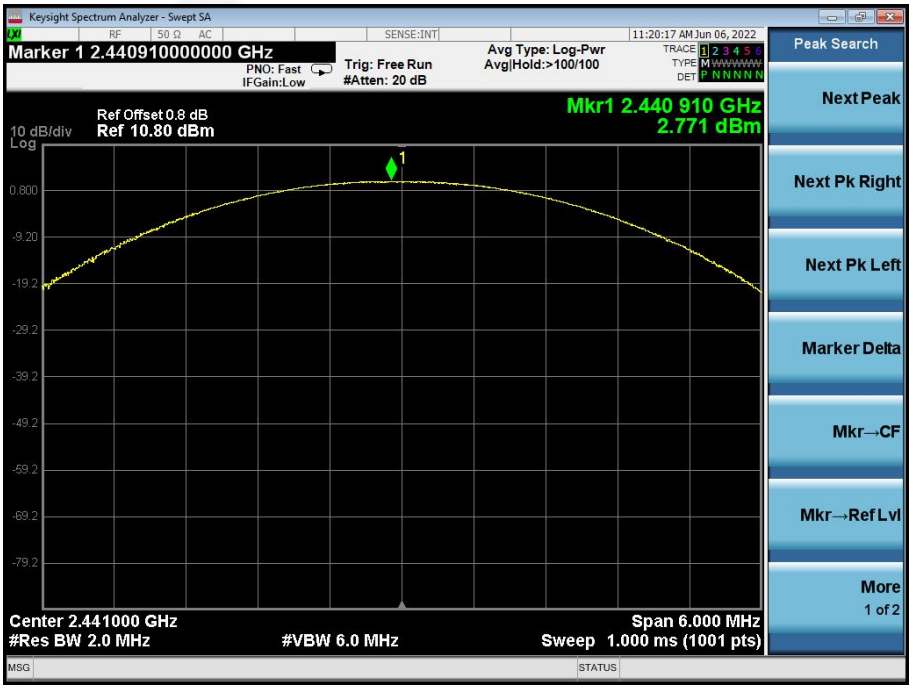
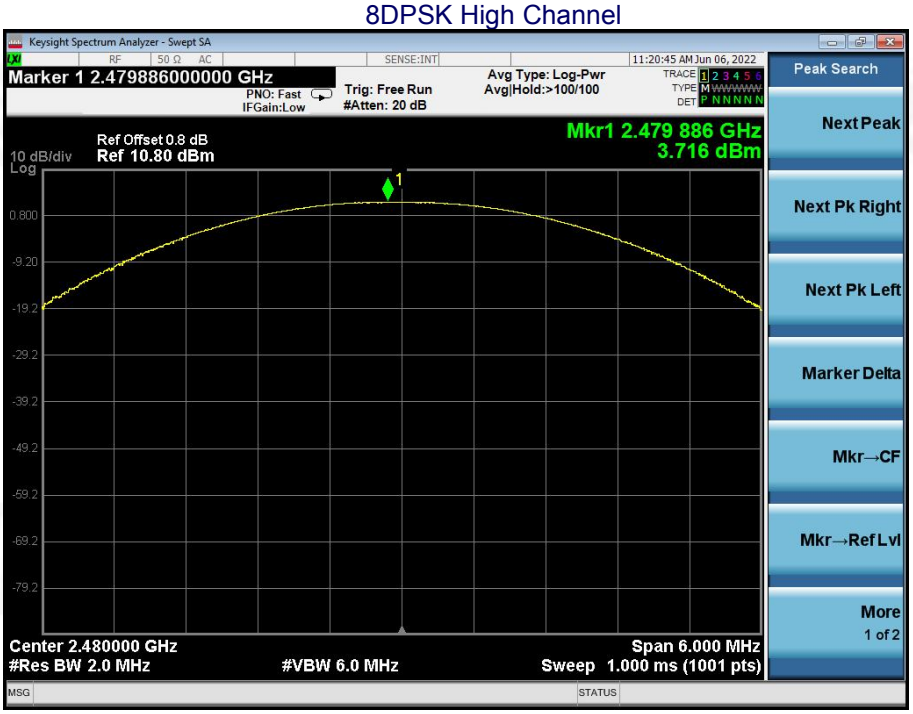
8DPSK Low Channel



8DPSK Middle Channel



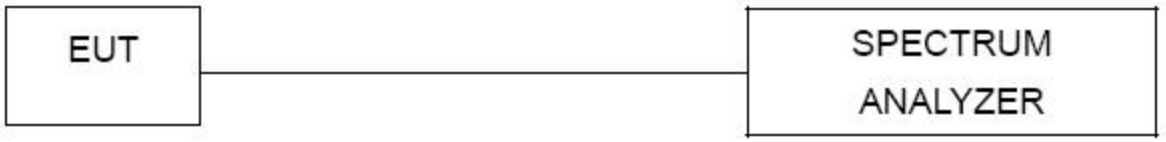
8DPSK High Channel



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 = 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.

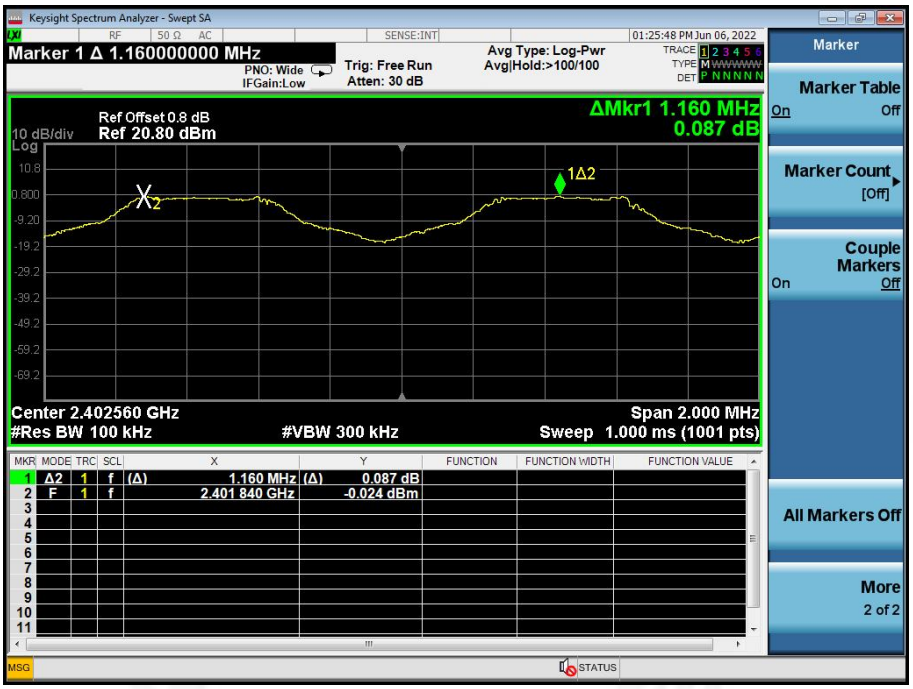
9.3 DEVIATION FROM STANDARD

No deviation.

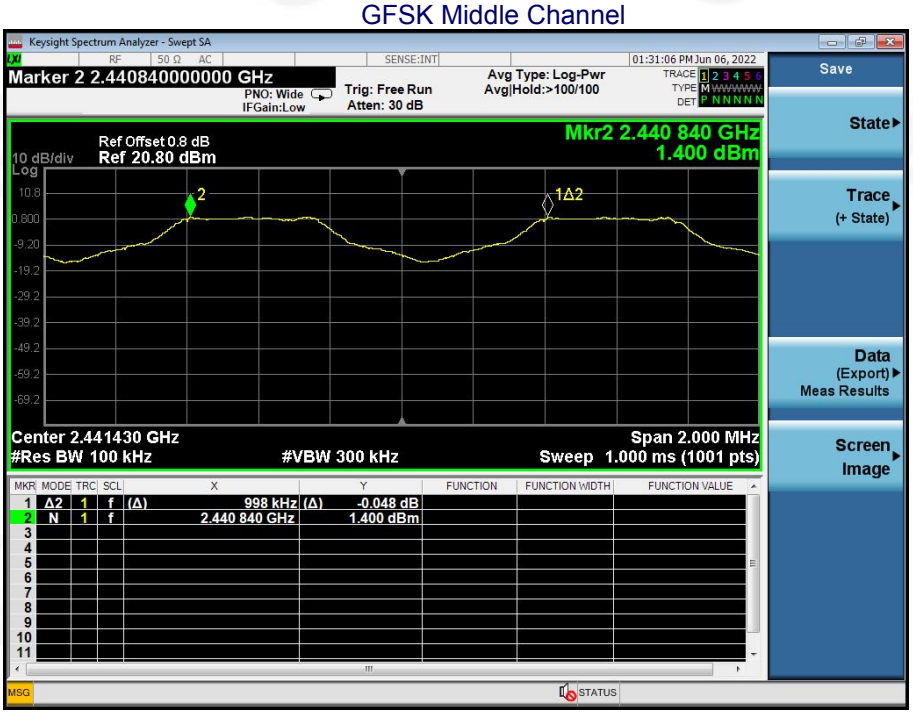
9.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.160	0.960	PASS
GFSK	Middle	0.998	0.879	PASS
GFSK	High	0.950	0.933	PASS
π/4DQPSK	Low	0.972	0.907	PASS
π/4DQPSK	Middle	1.096	0.910	PASS
π/4DQPSK	High	0.972	0.897	PASS
8DPSK	Low	1.024	0.872	PASS
8DPSK	Middle	1.036	0.899	PASS
8DPSK	High	0.996	0.853	PASS

Test plots
GFSK Low Channel

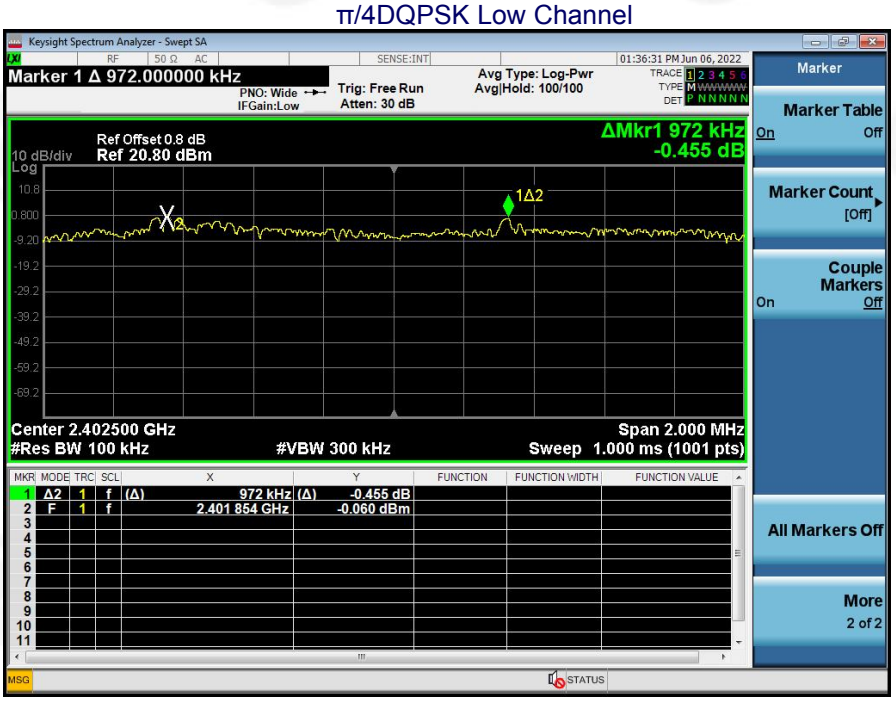


GFSK Middle Channel

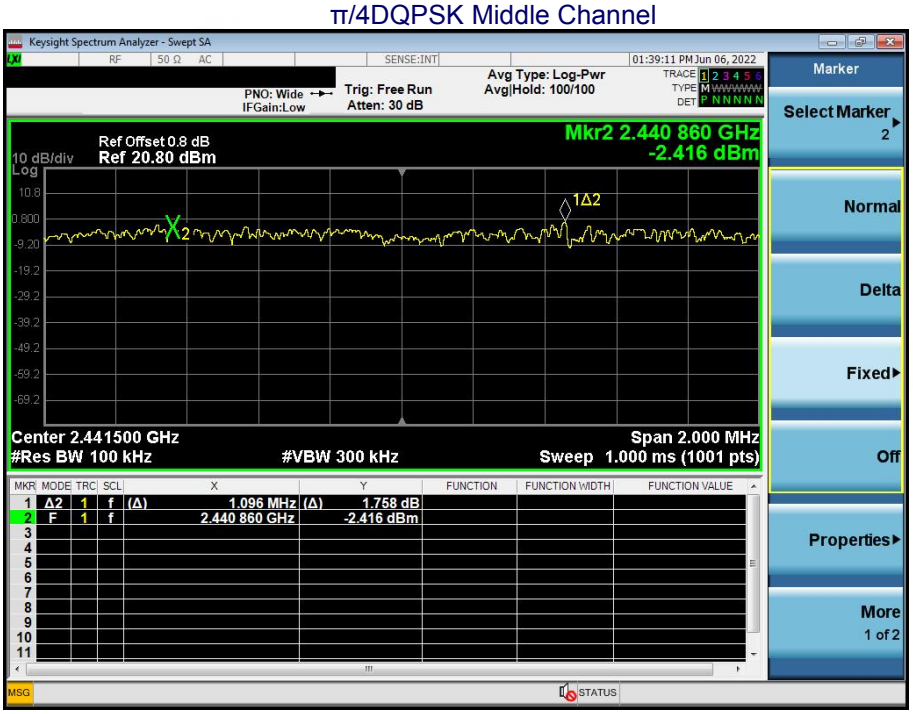


GFSK High Channel

π/4DQPSK Low Channel

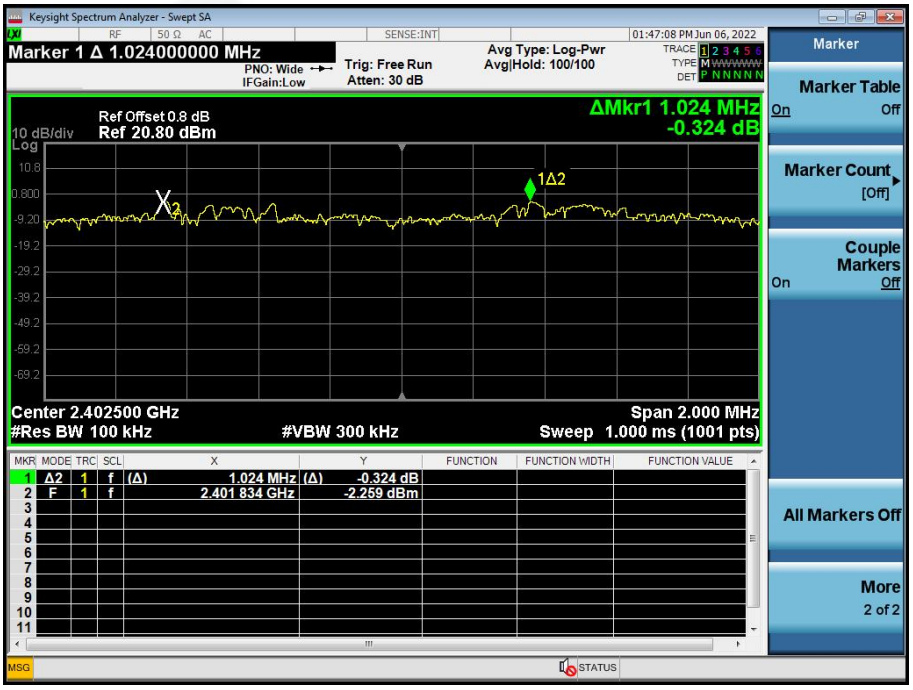


π/4DQPSK Middle Channel

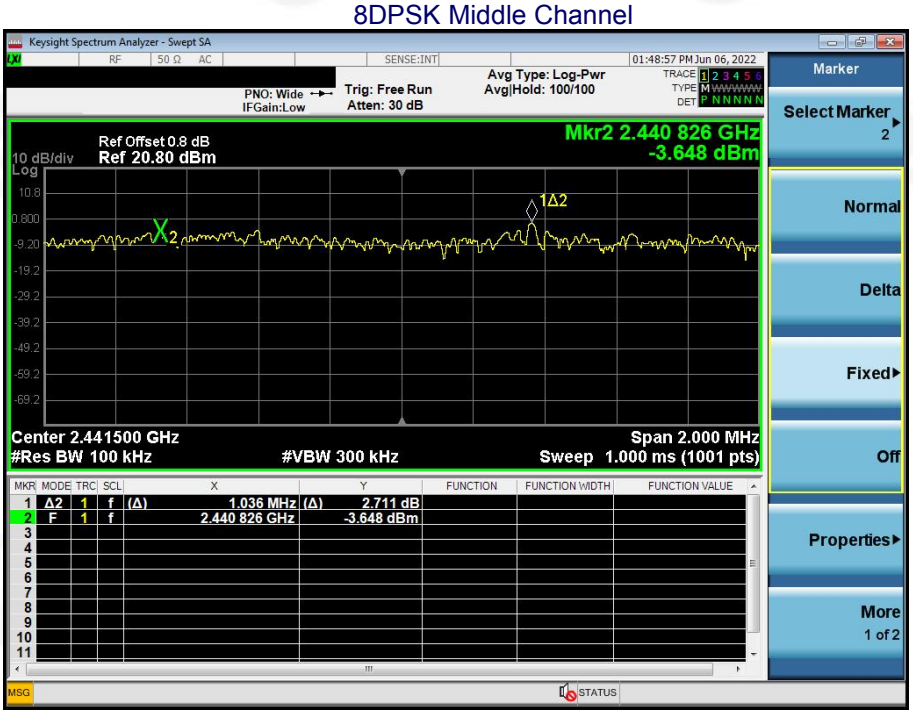


π/4DQPSK High Channel

8DPSK Low Channel



8DPSK Middle Channel



8DPSK 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.

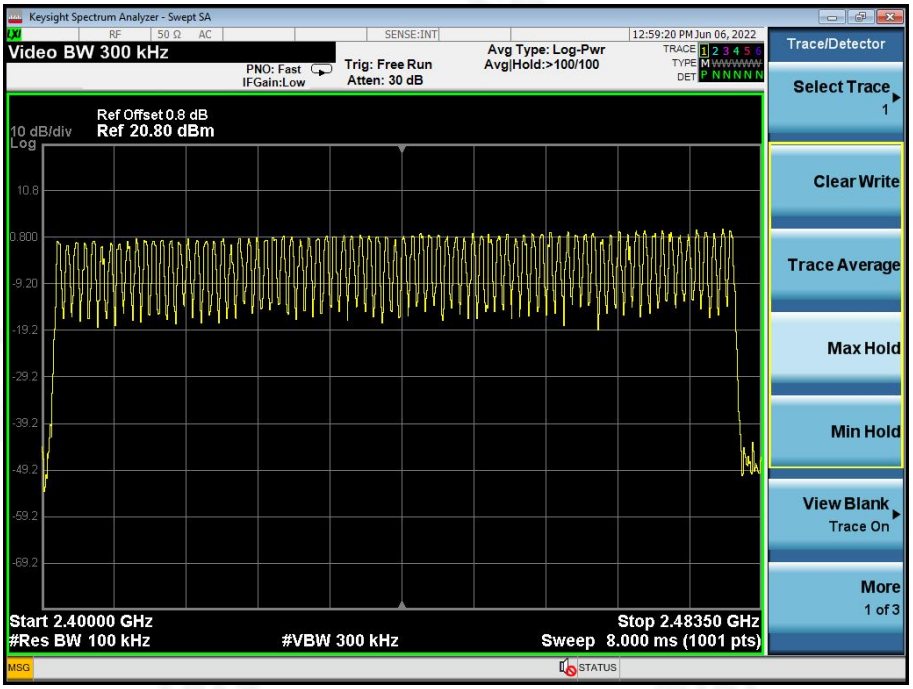
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

10.3 DEVIATION FROM STANDARD

No deviation.

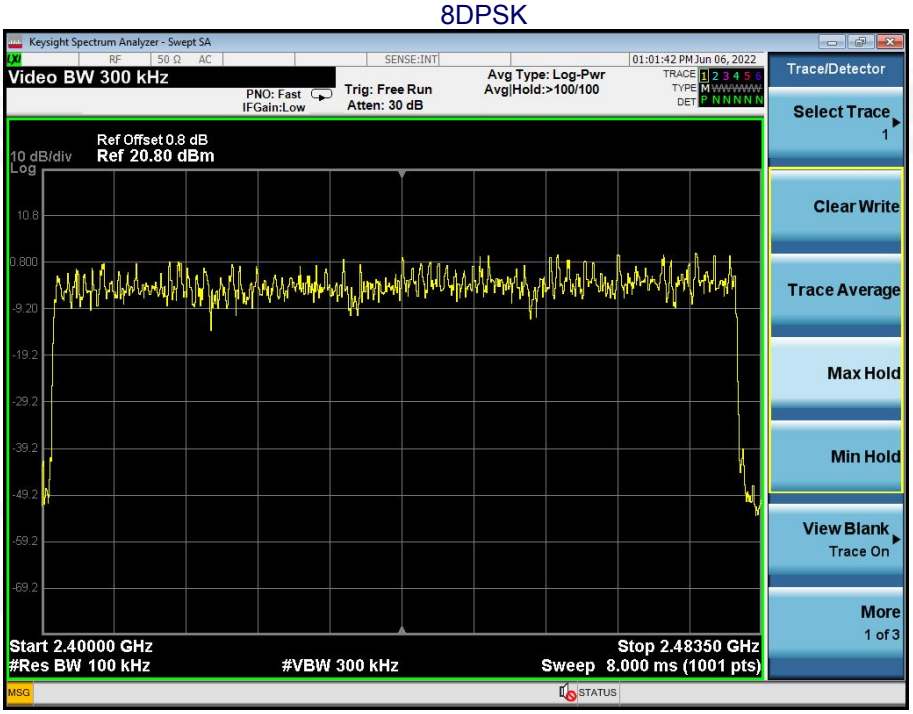
10.4 Test Result

Test Plots:
79 Channels in total
GFSK



π/4DQPSK

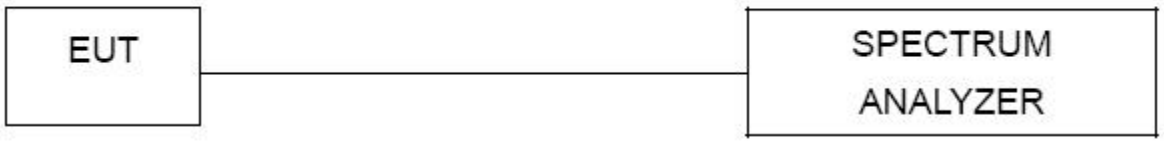
8DPSK


Keysight Spectrum Analyzer - Swept SA
RF
50 Ω
AC
SENSE:INT
01:01:42 PM Jun 06, 2022
Video BW 300 kHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Ref Offset 0.8 dB
10 dB/div
Log
Ref 20.80 dBm
10.8
0.800
-9.20
-19.2
-29.2
-39.2
-49.2
-59.2
-69.2
Start 2.40000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.48350 GHz
Sweep 8.000 ms (1001 pts)
MSG
STATUS
Trace/Detector
Select Trace
1
Clear Write
Trace Average
Max Hold
Min Hold
View Blank
Trace On
More
1 of 3

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	123.84	400	Pass
2441MHz	DH3	262.08	400	Pass
2441MHz	DH5	307.63	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=123.84ms
CH:2441MHz time slot=1.632(ms)*(1600/ (4*79))*31.6=262.08ms
CH:2441MHz time slot=2.860(ms)*(1600/ (6*79))*31.6=307.63ms

π/4-DQPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	2DH1	123.84	400	Pass
2441MHz	2DH3	262.08	400	Pass
2441MHz	2DH5	307.63	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=0.387(ms)*(1600/ (2*79))*31.6=123.84ms
CH:2441MHz time slot=1.638(ms)*(1600/ (4*79))*31.6=262.08ms
CH:2441MHz time slot=2.884(ms)*(1600/ (6*79))*31.6=307.63ms

8-DPSK mode:

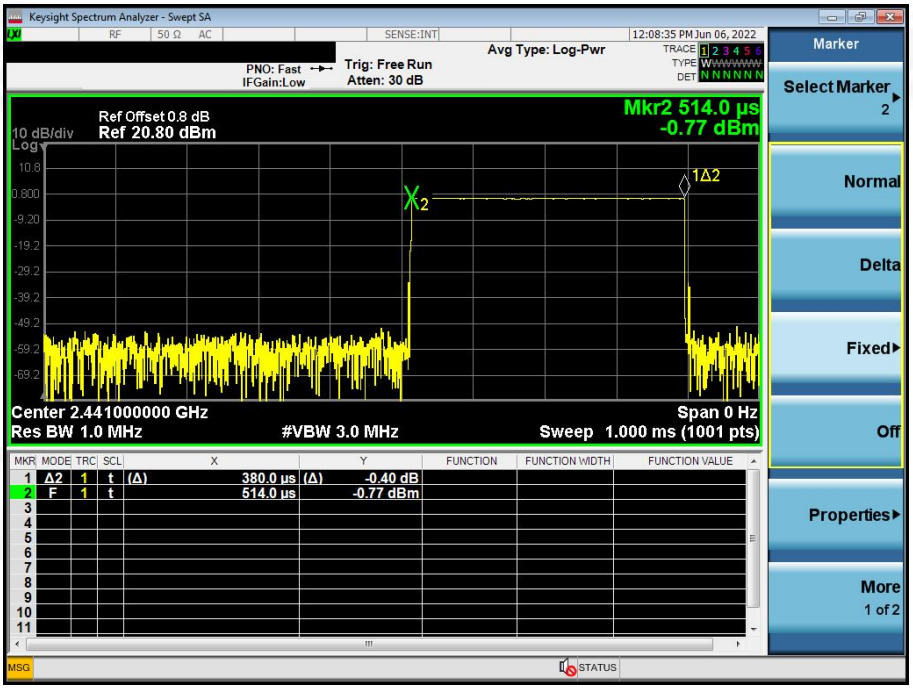
Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	3DH1	124.16	400	Pass
2441MHz	3DH3	261.76	400	Pass
2441MHz	3DH5	307.84	400	Pass

Remarks:

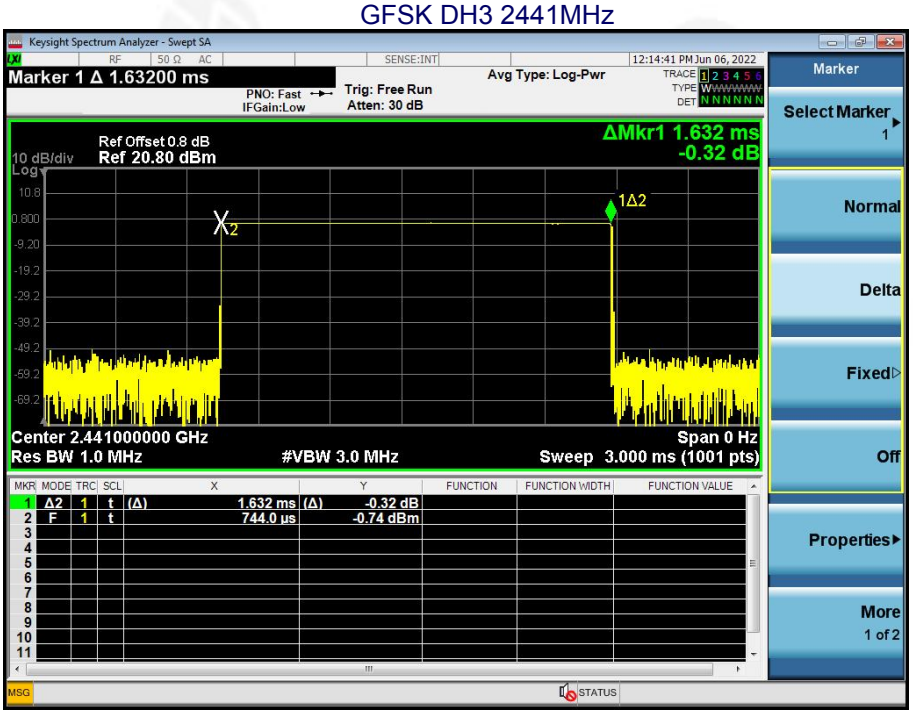
The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s
Test channel: as blow
CH:2441MHz time slot=0.388(ms)*(1600/ (2*79))*31.6=124.16ms
CH:2441MHz time slot=1.636(ms)*(1600/ (4*79))*31.6=261.76ms
CH:2441MHz time slot=2.886(ms)*(1600/ (6*79))*31.6=307.84ms

Test Plots

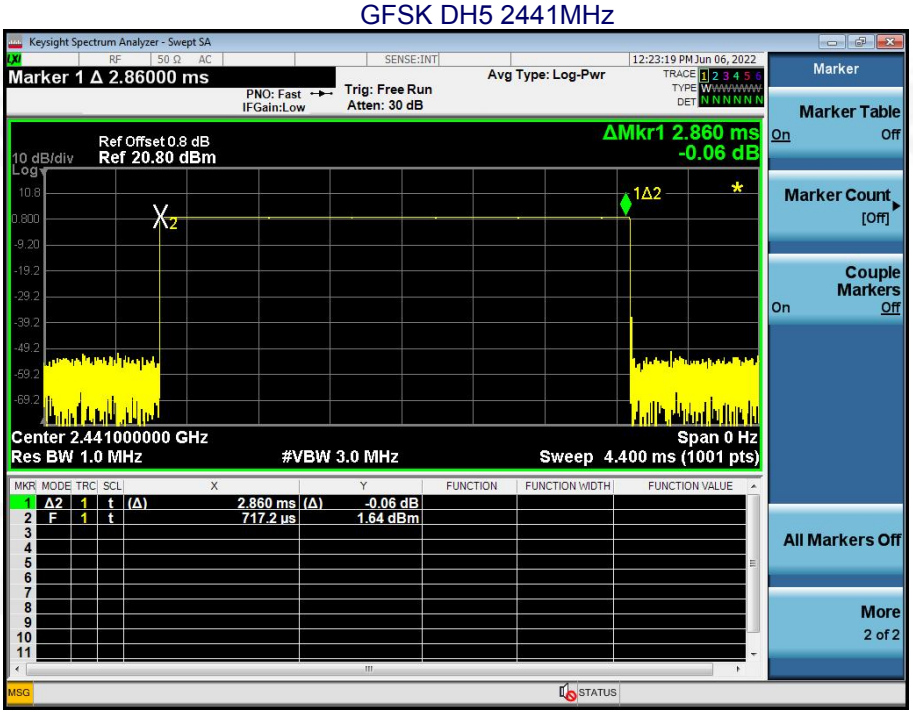
GFSK DH1 2441MHz



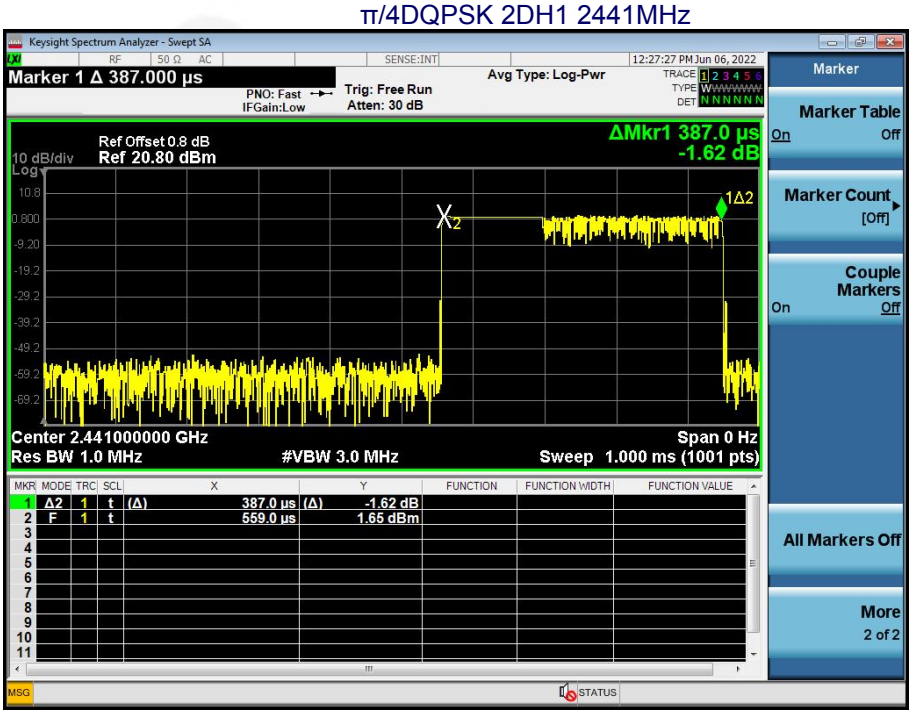
GFSK DH3 2441MHz



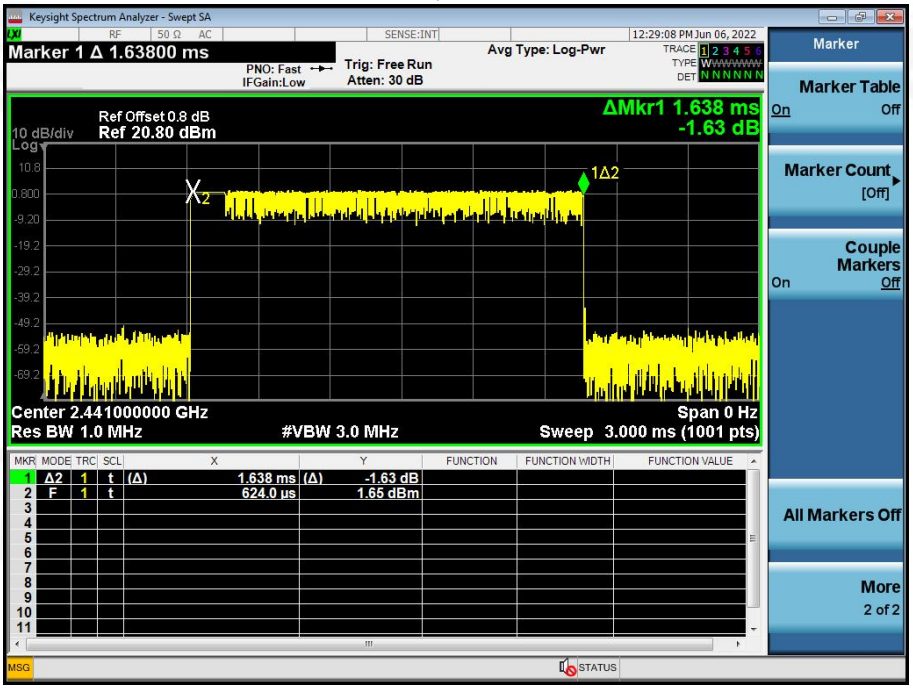
GFSK DH5 2441MHz



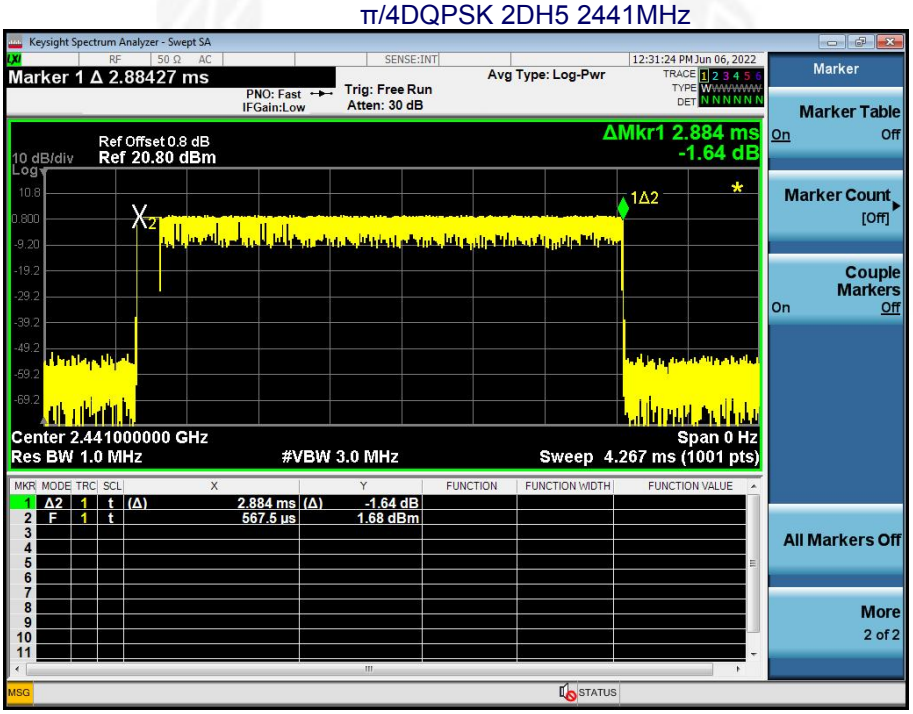
π/4DQPSK 2DH1 2441MHz



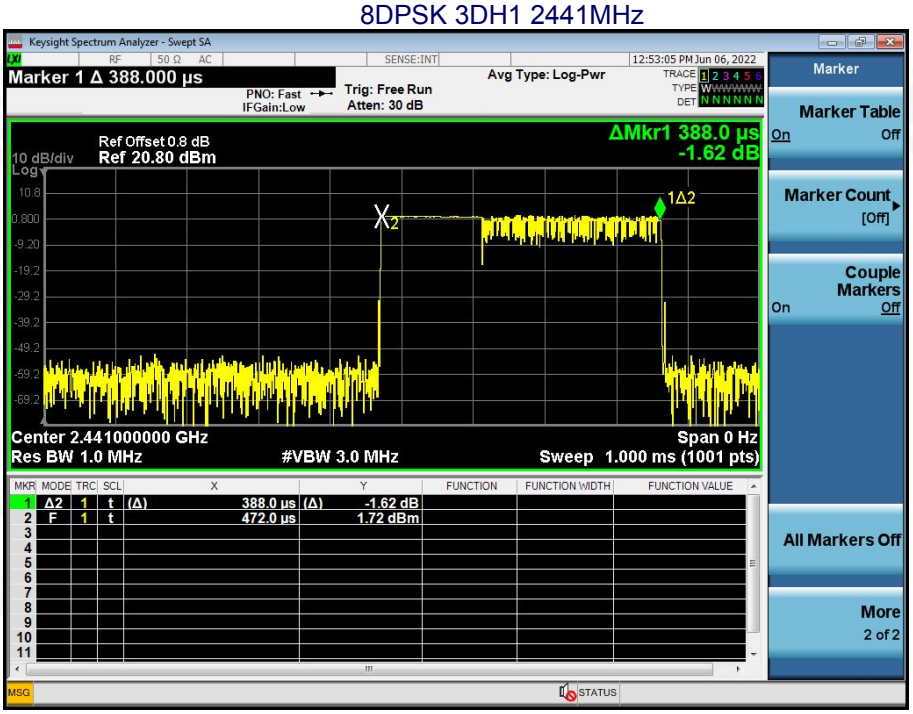
π/4DQPSK 2DH3 2441MHz



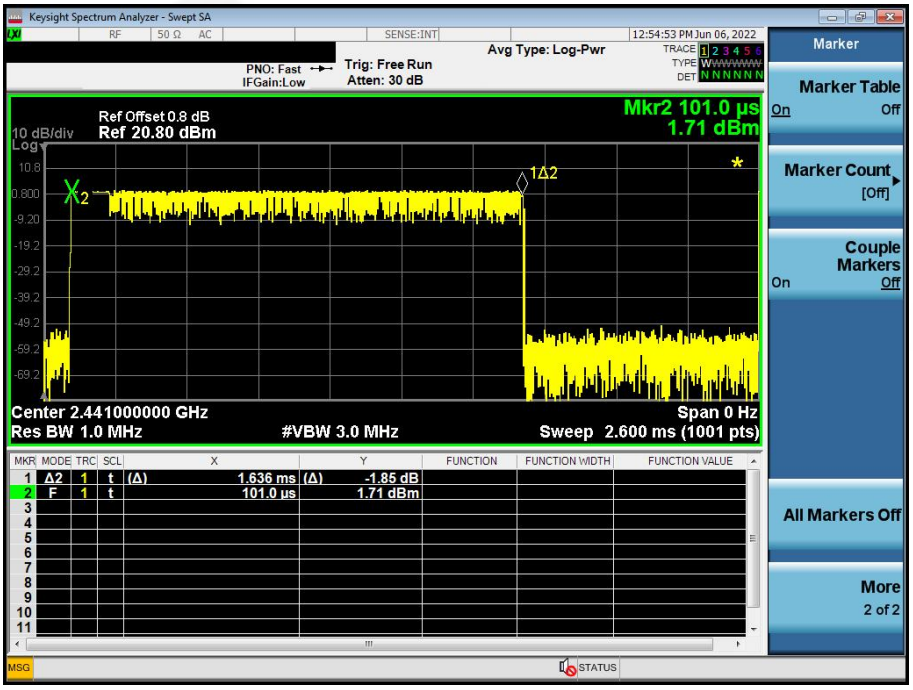
π/4DQPSK 2DH5 2441MHz



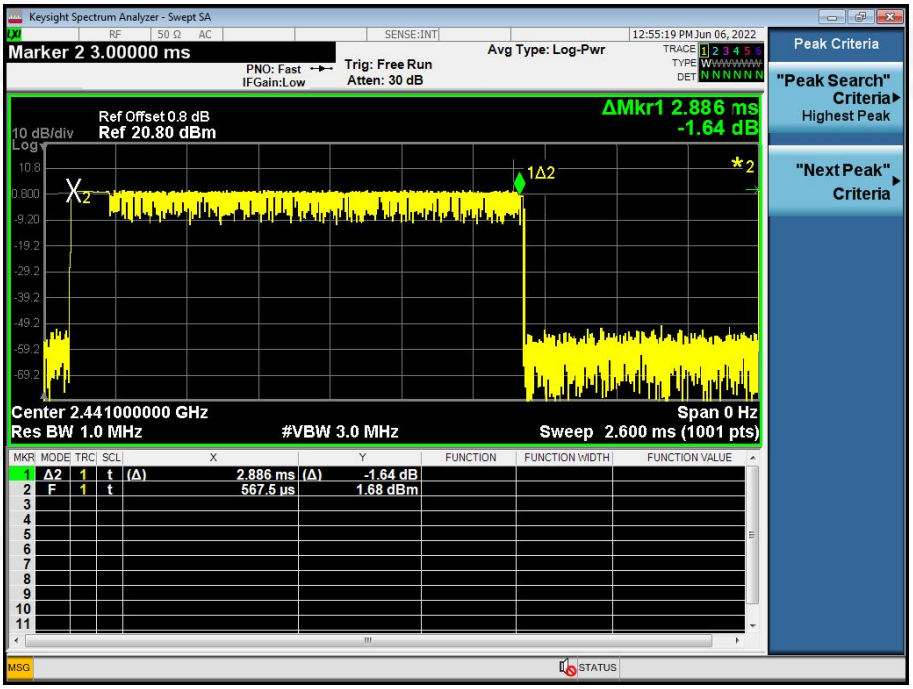
8DPSK 3DH1 2441MHz



8DPSK 3DH3 2441MHz



8DPSK 3DH5 2441MHz



12. Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(b)(4)
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(b) (4) requirement: (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
EUT Antenna:	
The antenna is SMT 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 ※※※※※