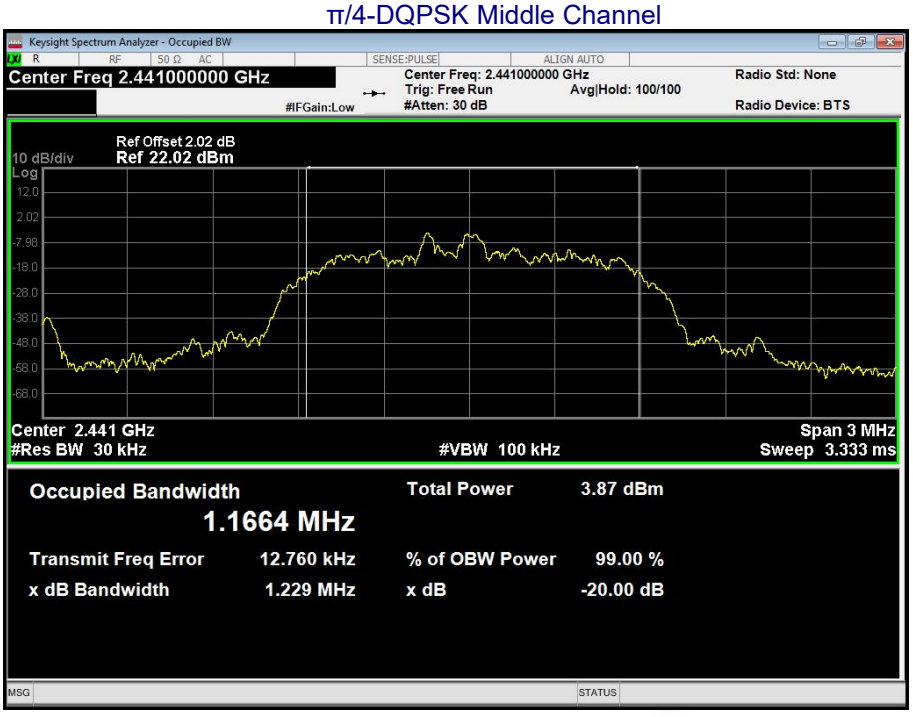
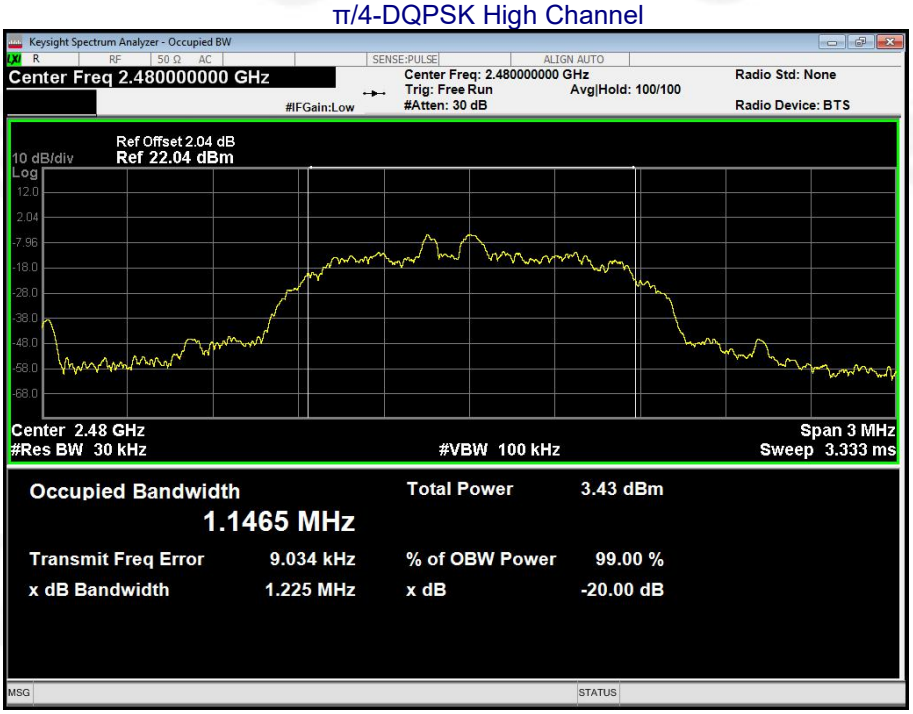
π/4-DQPSK Low Channel

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) RSS-247.5.4(4)
Test Method:	ANSI C63.10:2013
Limit:	FCC:20.97 dBm IC:30dBm

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

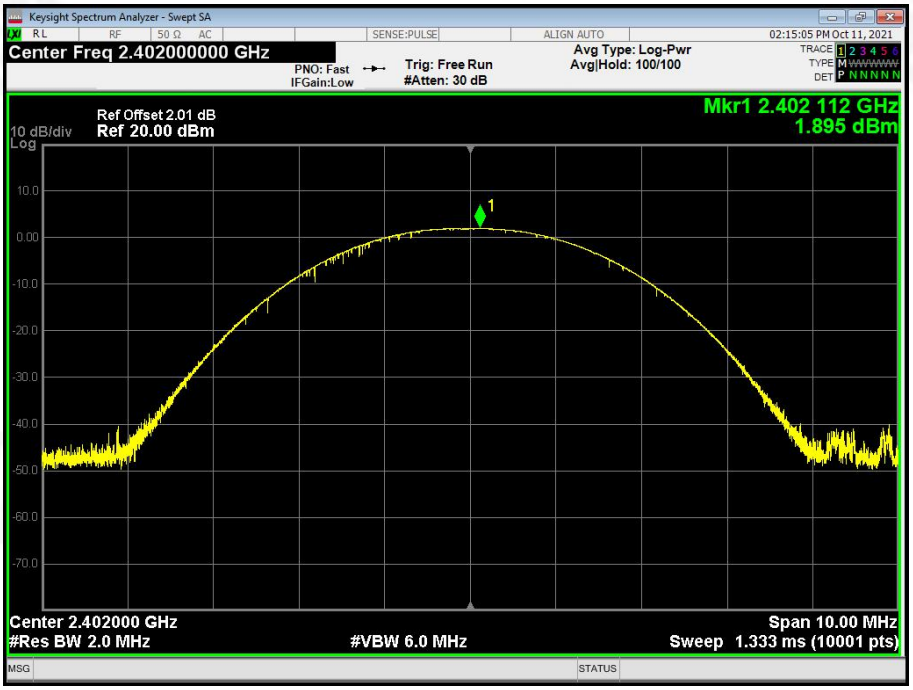
No deviation.

8.5 Test Result

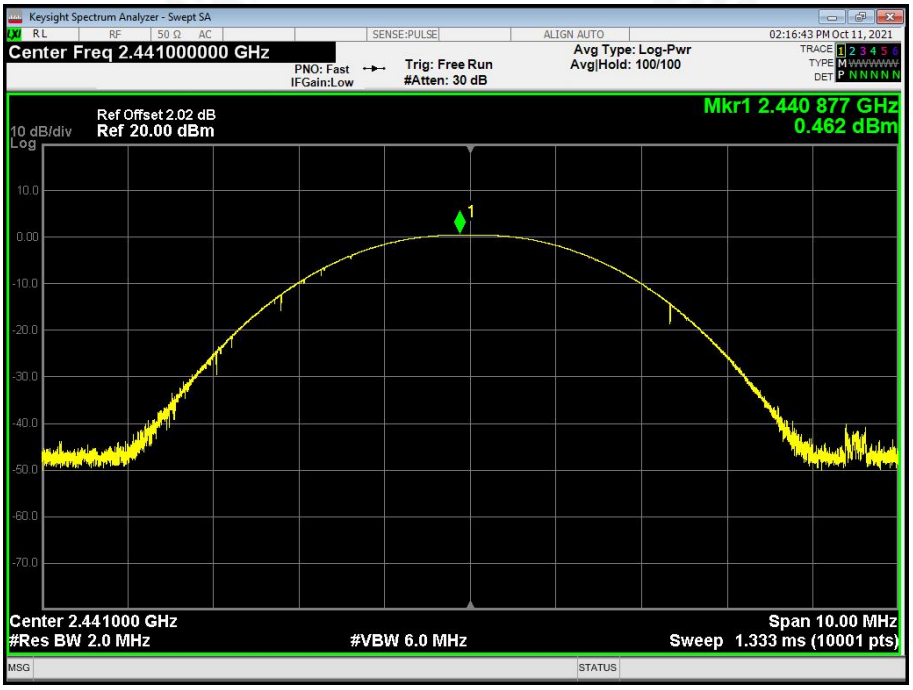
Mode	Test channel	Peak Output Power (dBm)	FCC Limit (dBm)	Result
GFSK	Lowest	1.895	30.00	Pass
	Middle	0.462		
	Highest	-0.602		
π/4-DQPSK	Lowest	-0.427	21.00	Pass
	Middle	-1.957		
	Highest	-3.314		
8-DPSK	Lowest	-1.446	21.00	Pass
	Middle	-2.963		
	Highest	-4.433		

Test plots

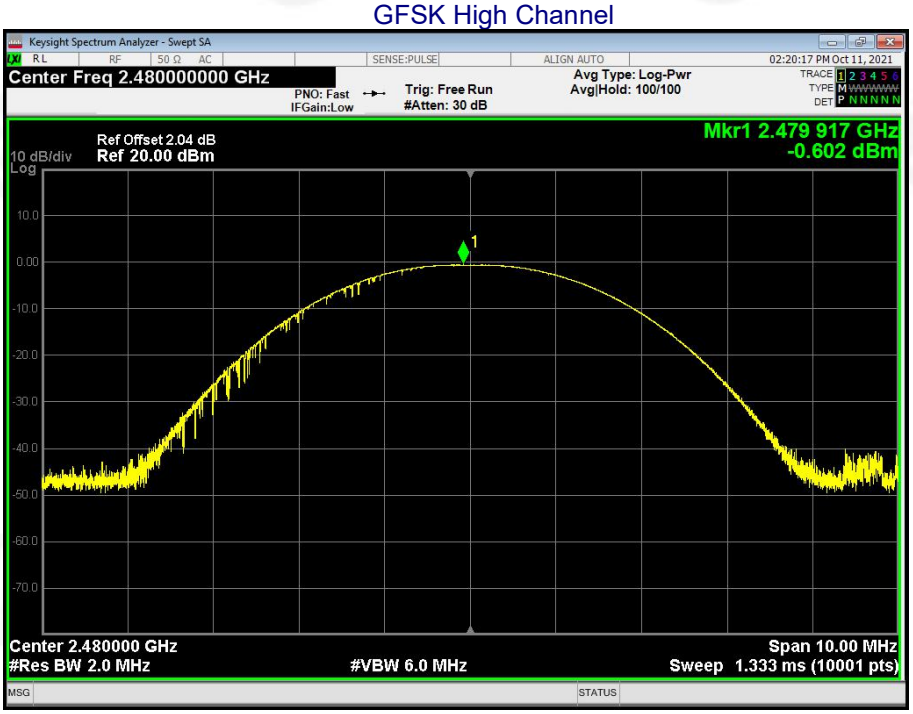
GFSK Low Channel



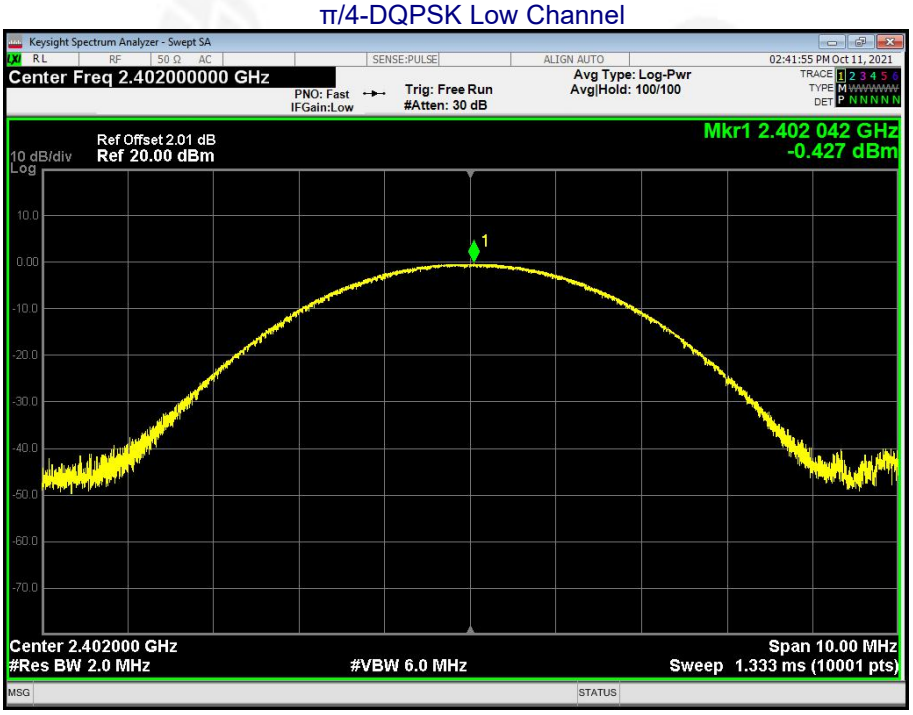
GFSK Middle Channel



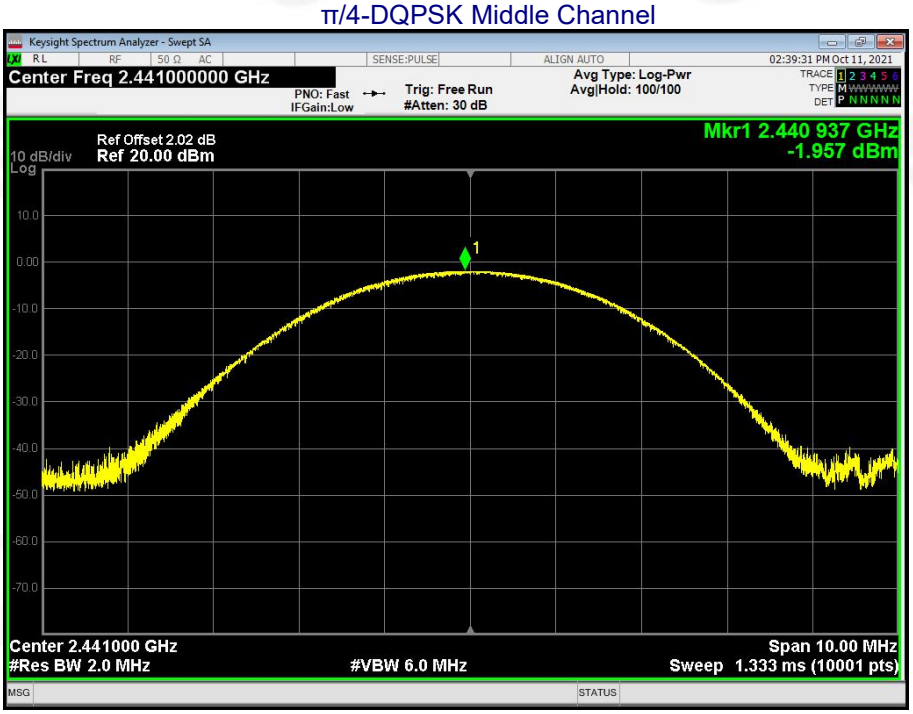
GFSK High Channel



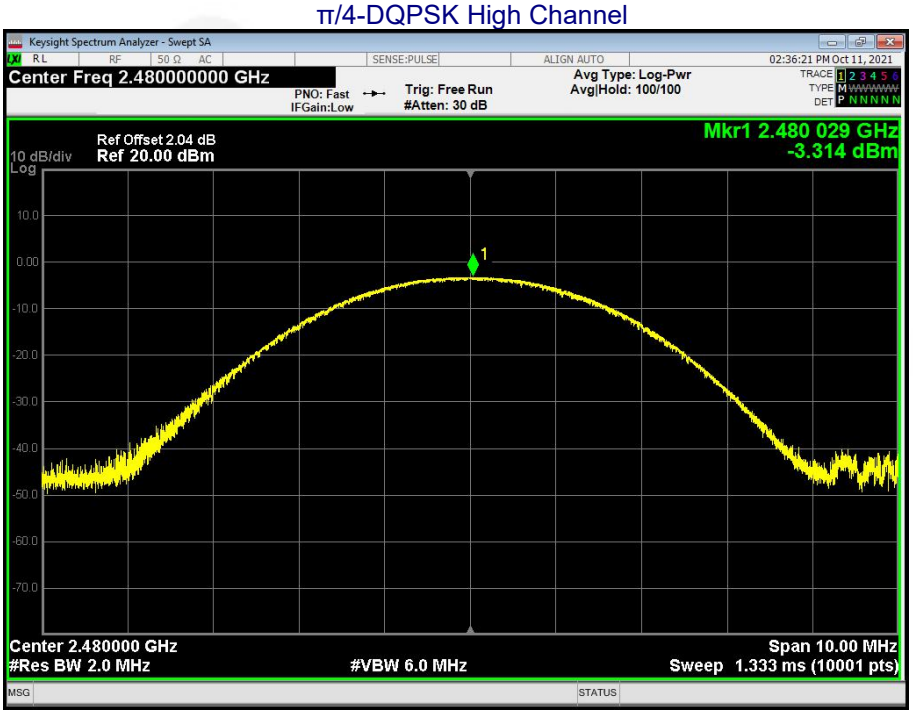
π/4-DQPSK Low Channel



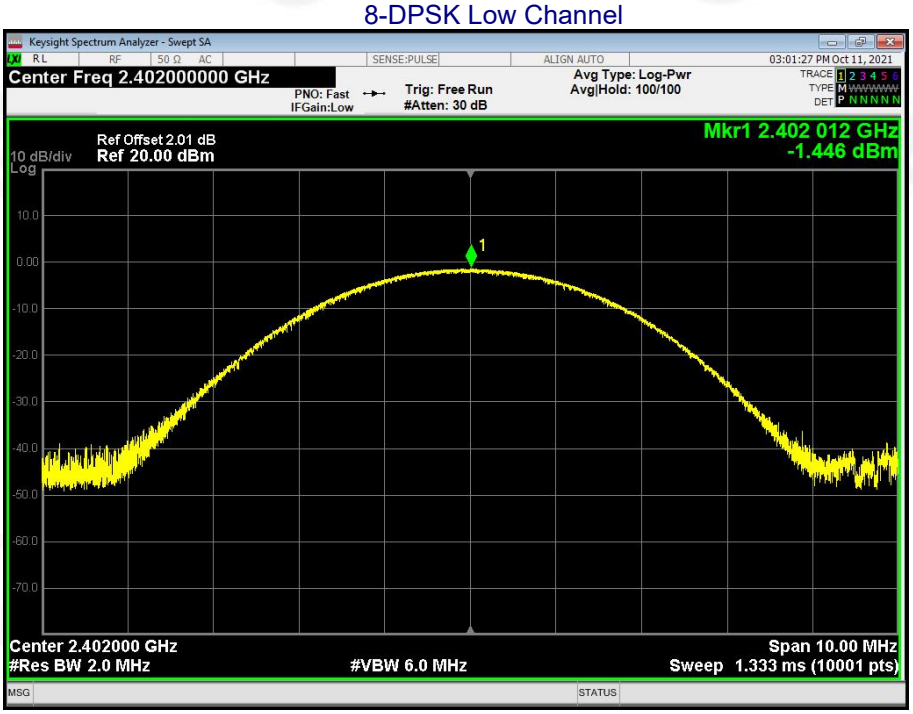
π/4-DQPSK Middle Channel



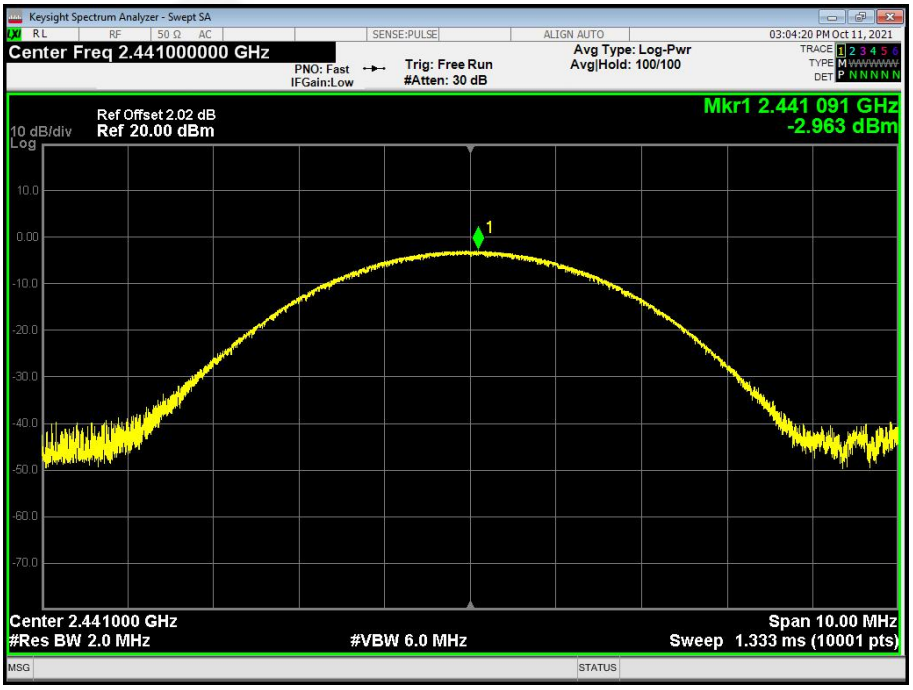
π/4-DQPSK High Channel



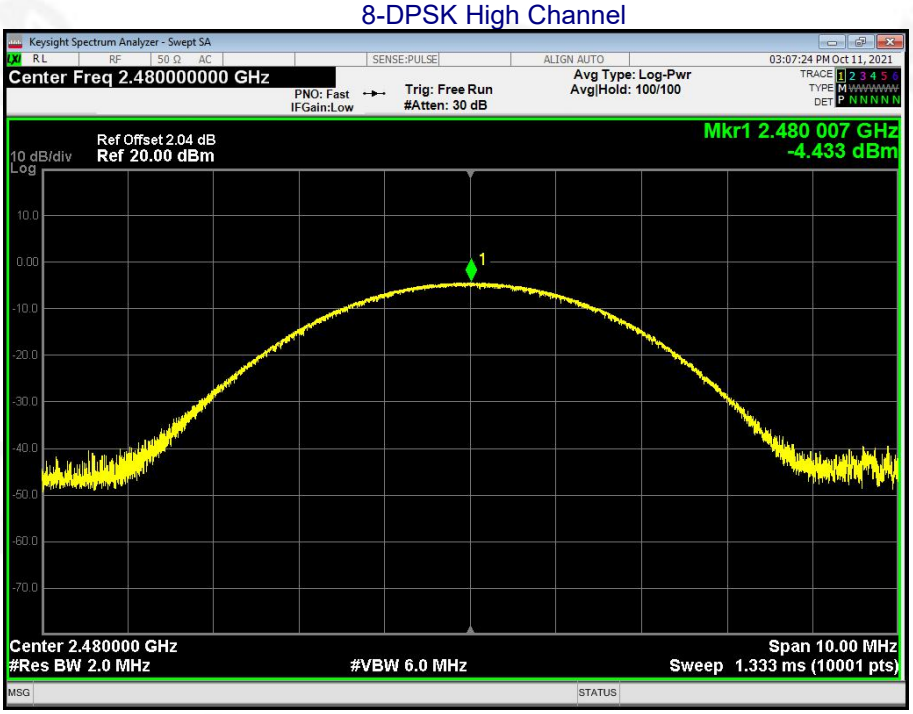
8-DPSK Low Channel



8-DPSK Middle Channel



8-DPSK High Channel



9. HOPPING CHANNEL SEPARATION

Test Requirement:	FCC Part15 C Section 15.247 (a)(1) RSS-247.5.1(4)
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 = 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.

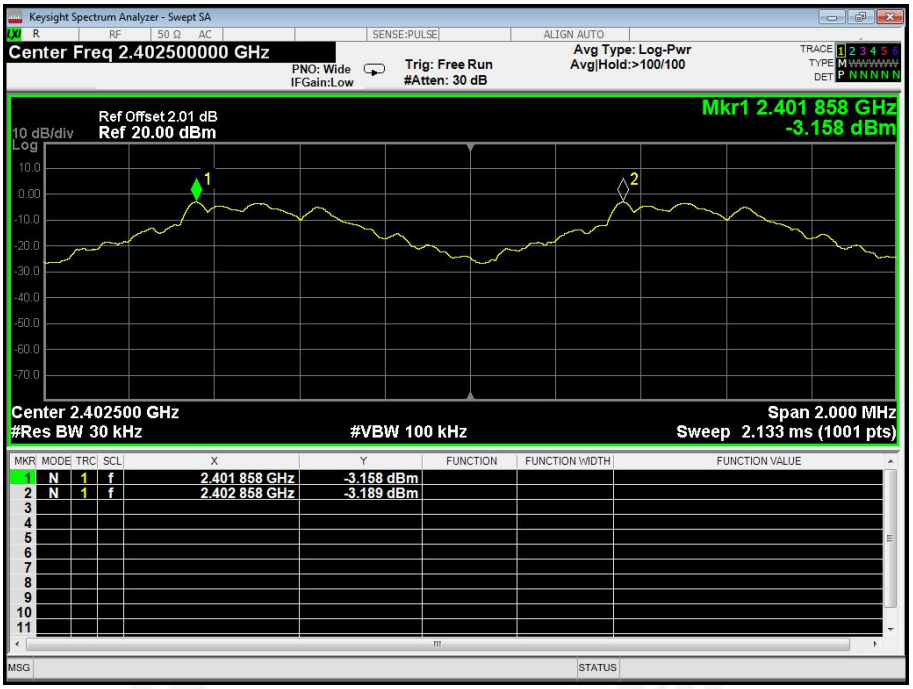
9.3 DEVIATION FROM STANDARD

No deviation.

9.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.000	0.869	PASS
GFSK	Middle	0.998	0.873	PASS
GFSK	High	1.000	0.853	PASS
π/4-DQPSK	Low	0.998	0.833	PASS
π/4-DQPSK	Middle	0.998	0.819	PASS
π/4-DQPSK	High	1.000	0.817	PASS
8-DPSK	Low	1.000	0.824	PASS
8-DPSK	Middle	0.998	0.838	PASS
8-DPSK	High	1.000	0.813	PASS

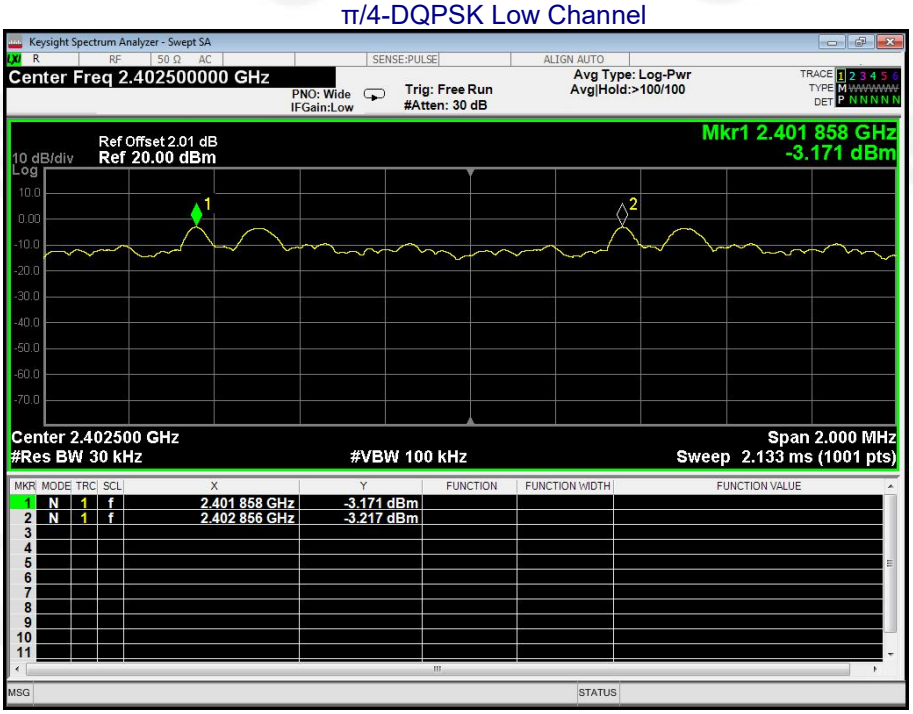
Test plots
GFSK Low Channel



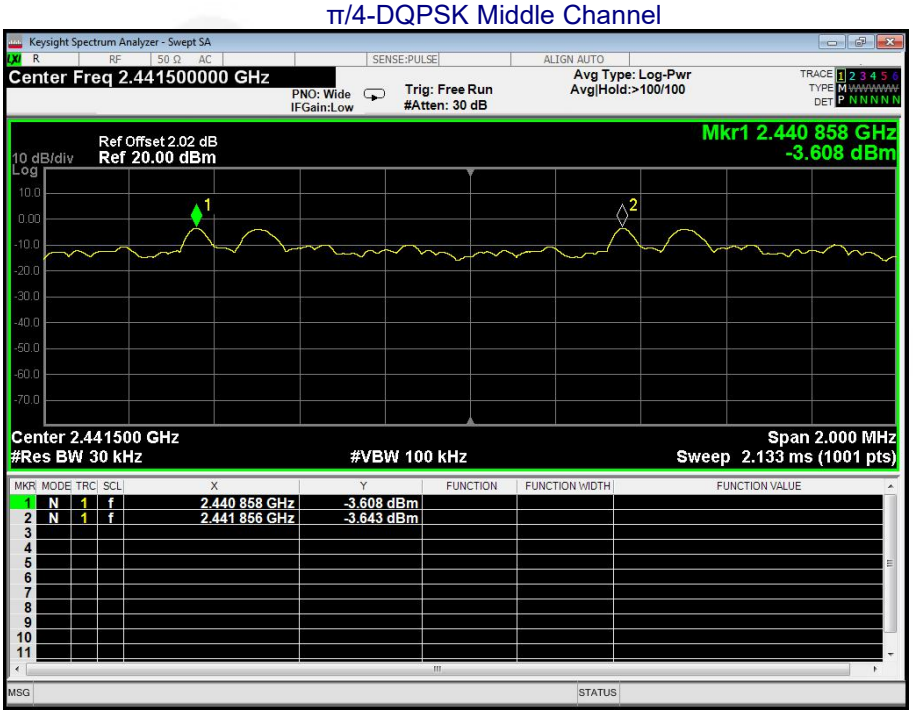
GFSK Middle Channel

GFSK High Channel

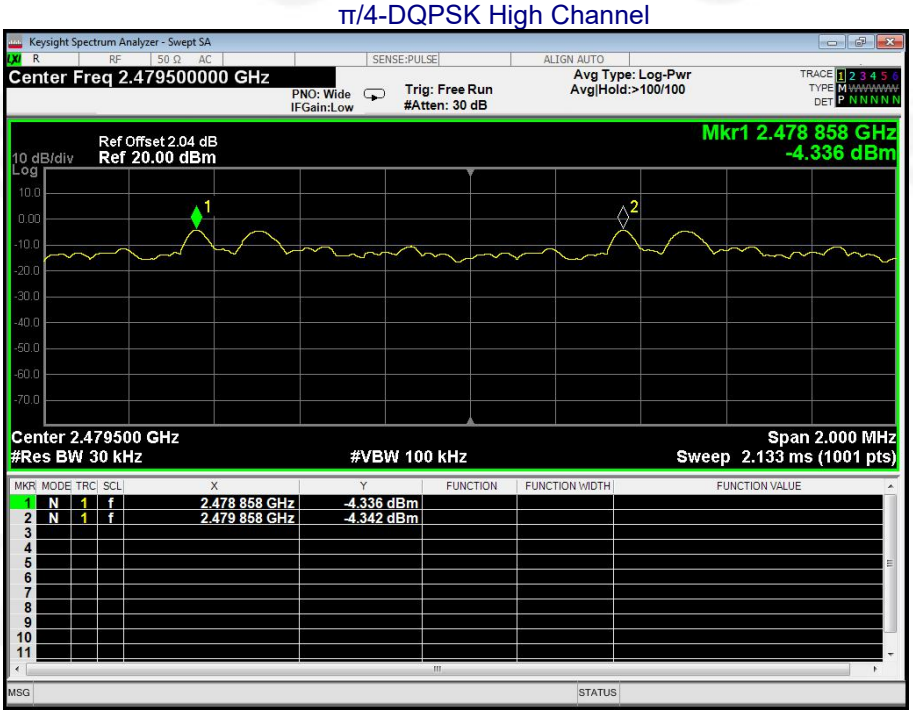
π/4-DQPSK Low Channel



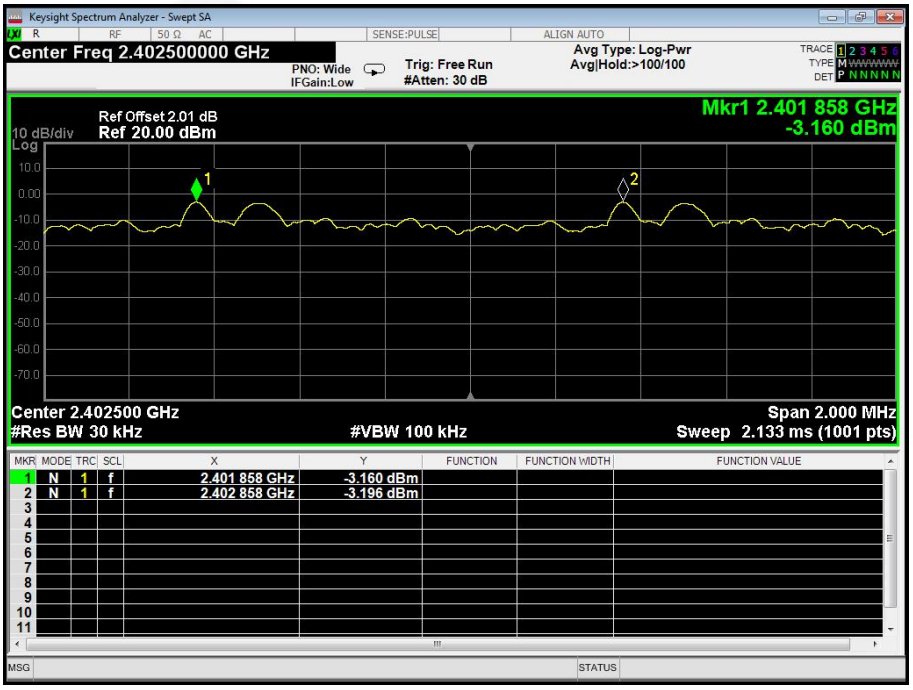
π/4-DQPSK Middle Channel



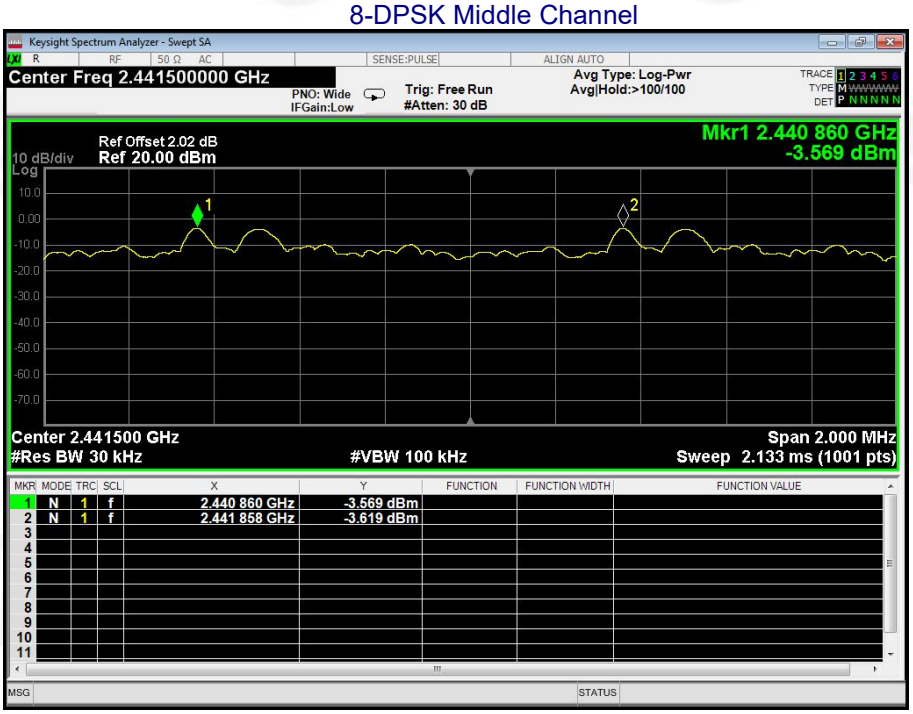
π/4-DQPSK High Channel



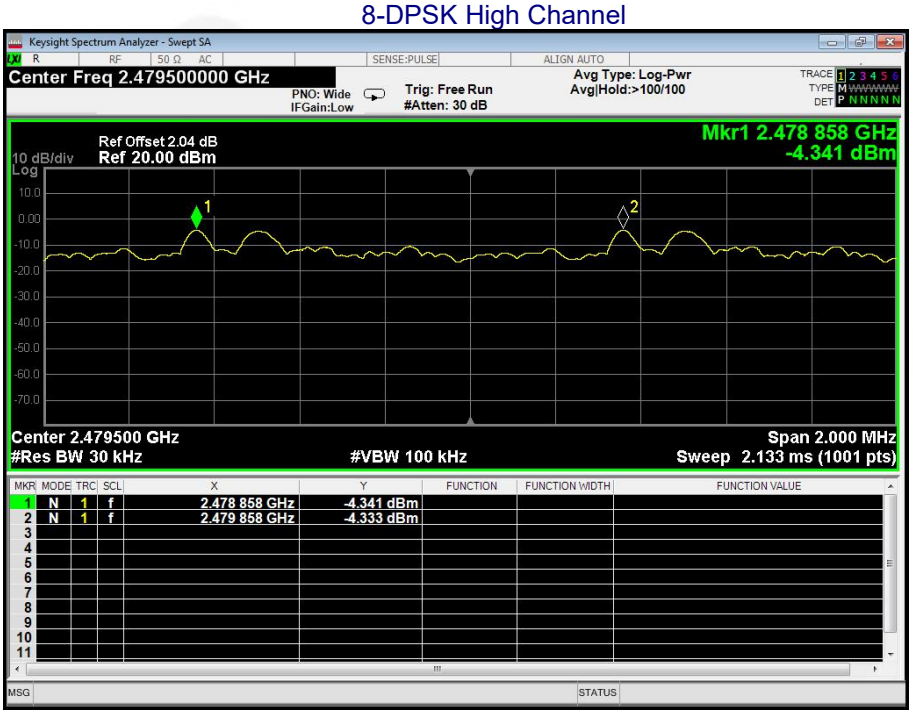
8-DPSK Low Channel



8-DPSK Middle Channel



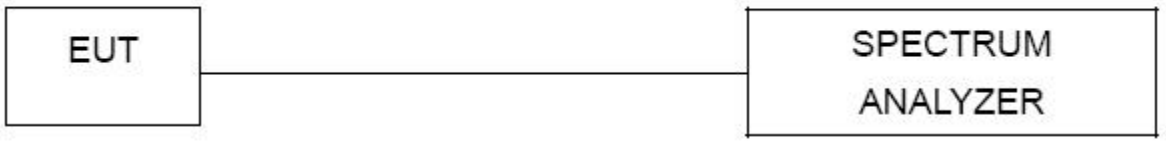
8-DPSK High Channel



10.NUMBER OF HOPPING FREQUENCY

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii) RSS-247.5.1(4)
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.

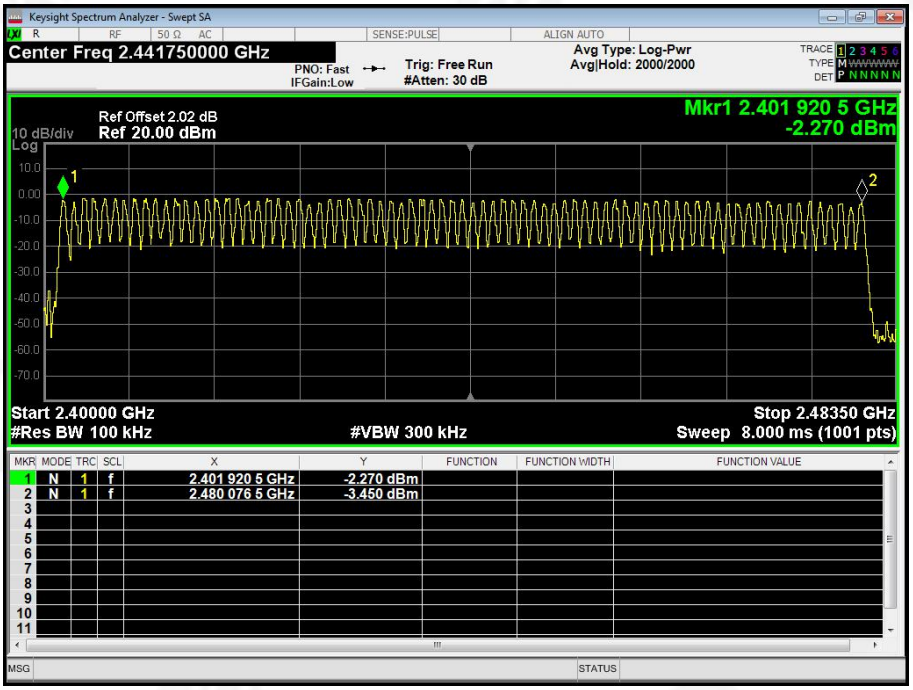
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

10.3 DEVIATION FROM STANDARD

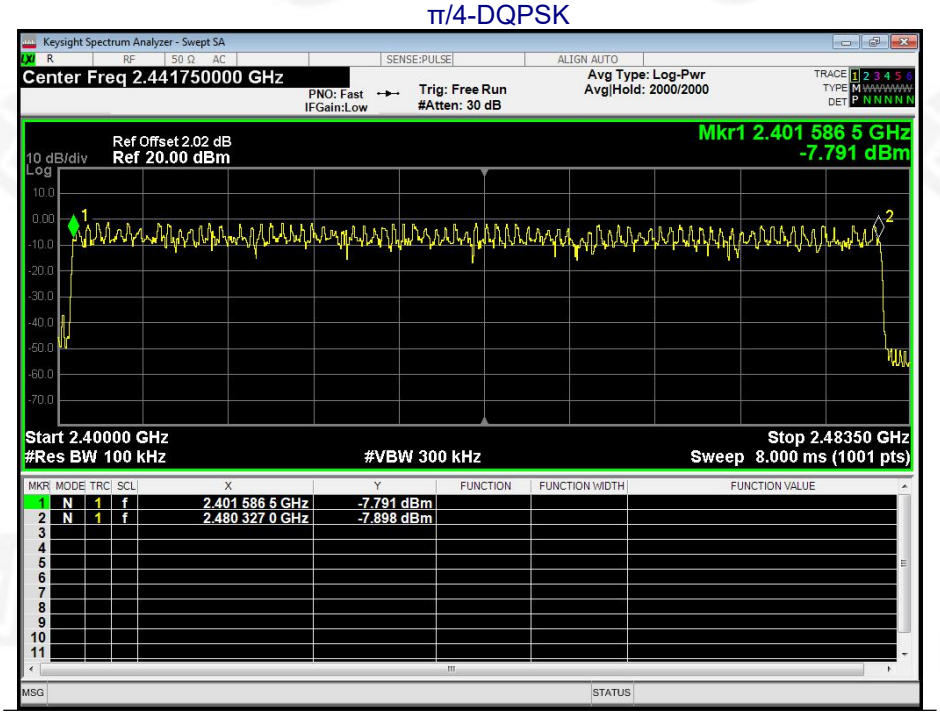
No deviation.

10.4 Test Result

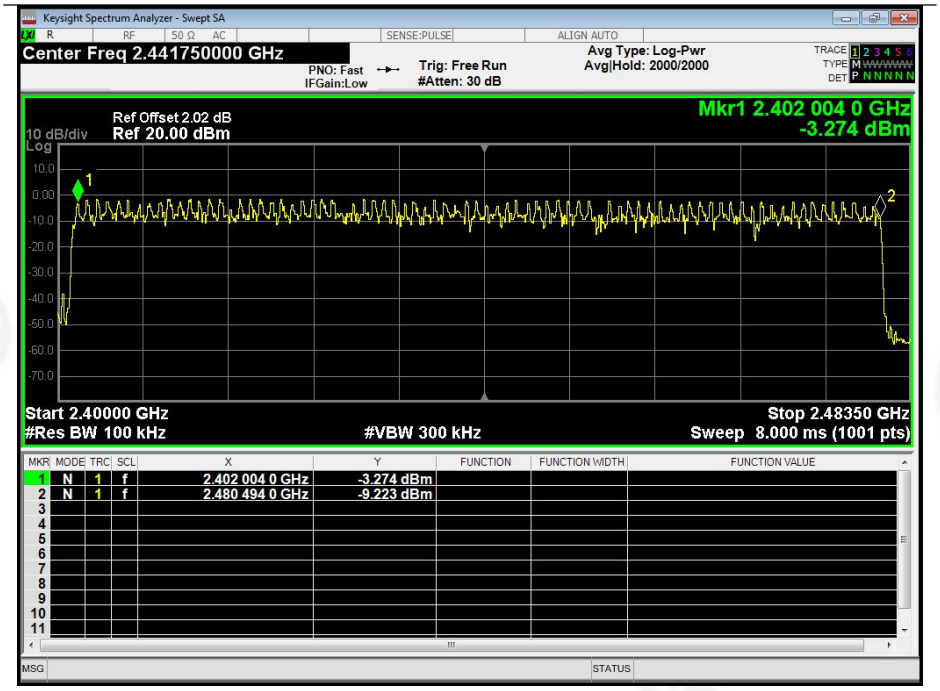
Test Plots:
79 Channels in total
GFSK



π/4-DQPSK



8-DPSK



11. DWELL TIME

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii) RSS-247.5.1(5)
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: as blow
CH:2441MHz time slot=0.392(ms)*(1600/ (2*79))*31.6=125.44ms
CH:2441MHz time slot=1.649(ms)*(1600/ (4*79))*31.6=263.84ms
CH:2441MHz 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: as blow
CH:2441MHz time slot=0.397(ms)*(1600/ (2*79))*31.6=127.04ms
CH:2441MHz time slot=1.654(ms)*(1600/ (4*79))*31.6=264.64ms
CH:2441MHz time slot=2.906(ms)*(1600/ (6*79))*31.6=309.97ms

8-DPSK mode:

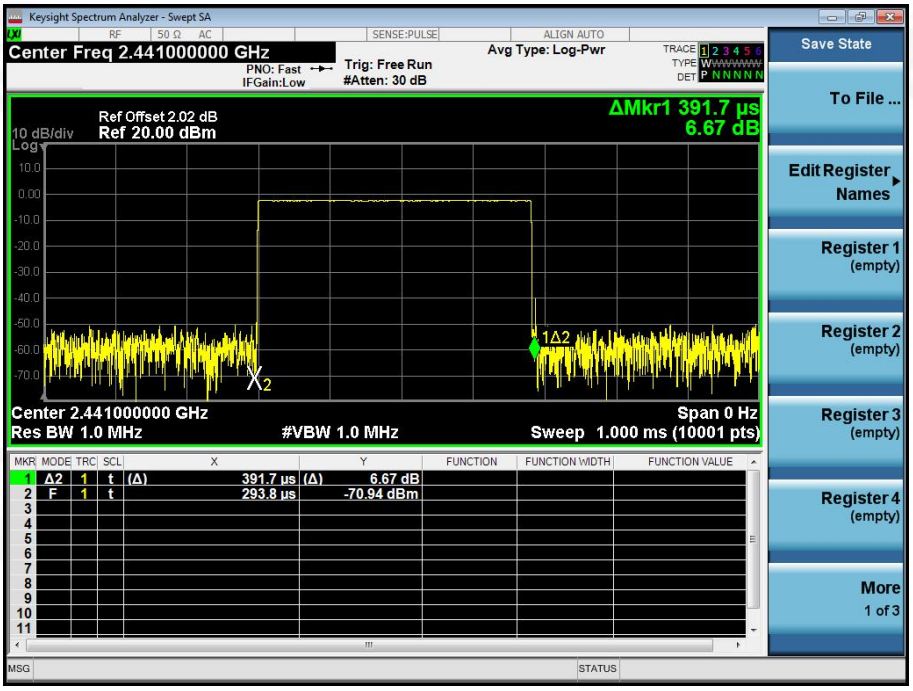
Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	3DH1	127.68	400	Pass
2441MHz	3DH3	264.48	400	Pass
2441MHz	3DH5	309.76	400	Pass

Remarks:

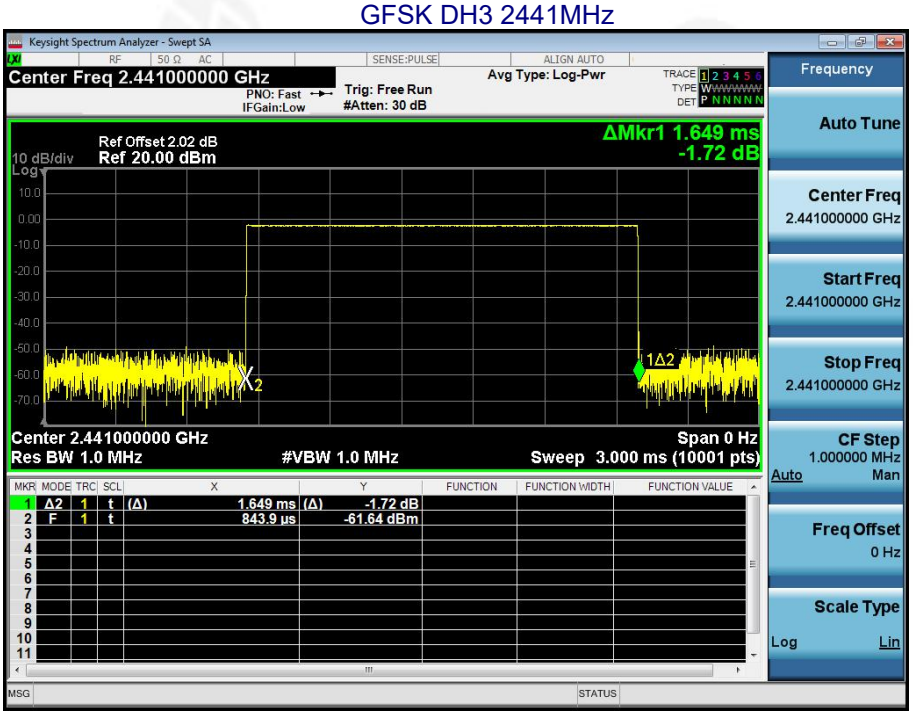
The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s
Test channel: as blow
CH:2441MHz time slot=0.399(ms)*(1600/ (2*79))*31.6=127.68ms
CH:2441MHz time slot=1.653(ms)*(1600/ (4*79))*31.6=264.48ms
CH:2441MHz time slot=2.904(ms)*(1600/ (6*79))*31.6=309.76ms

Test Plots

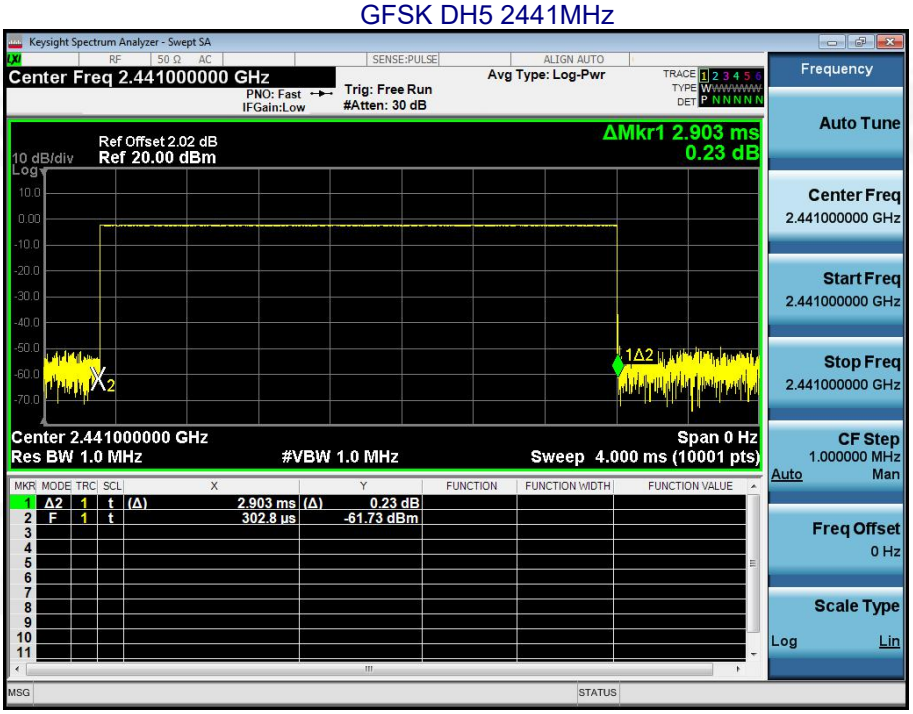
GFSK DH1 2441MHz



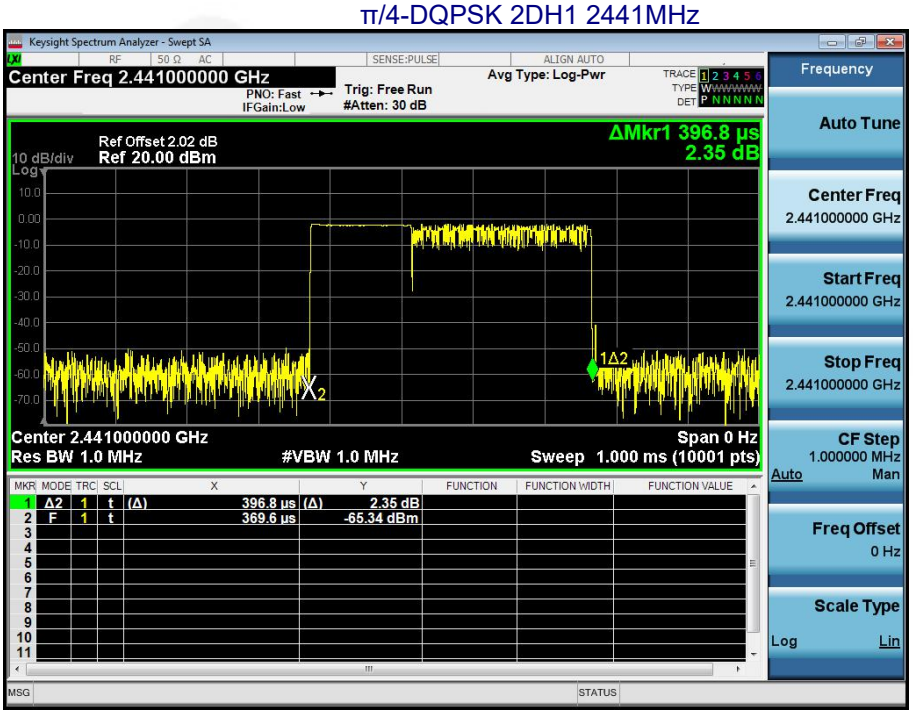
GFSK DH3 2441MHz



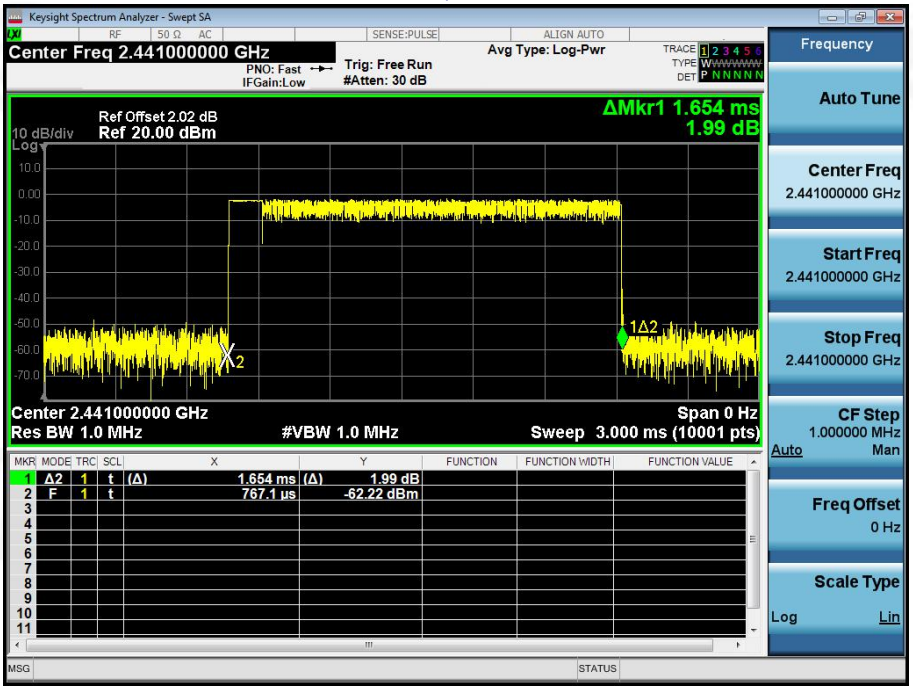
GFSK DH5 2441MHz



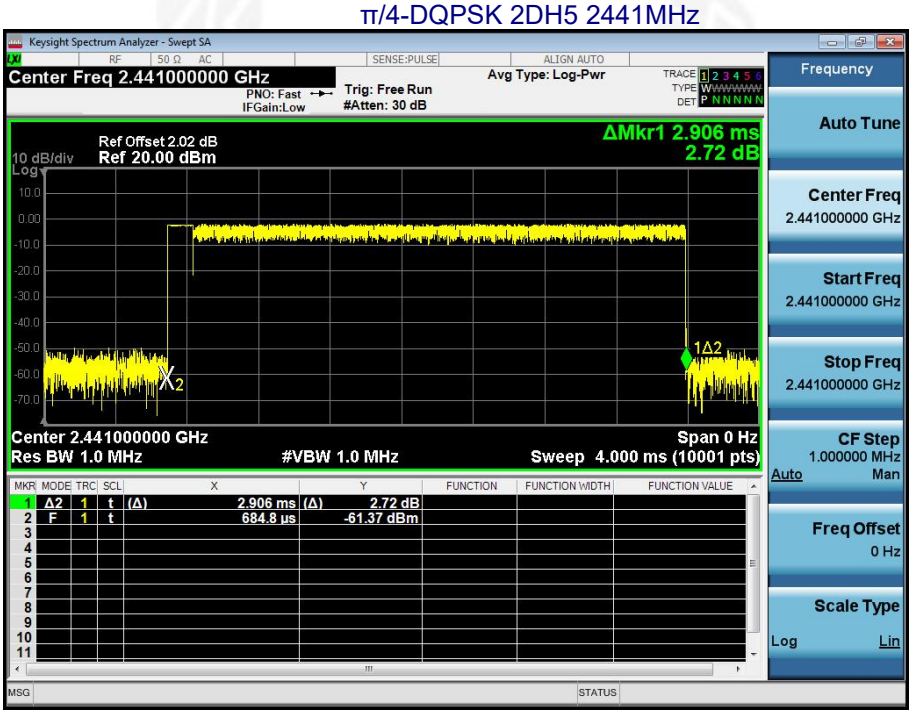
π/4-DQPSK 2DH1 2441MHz



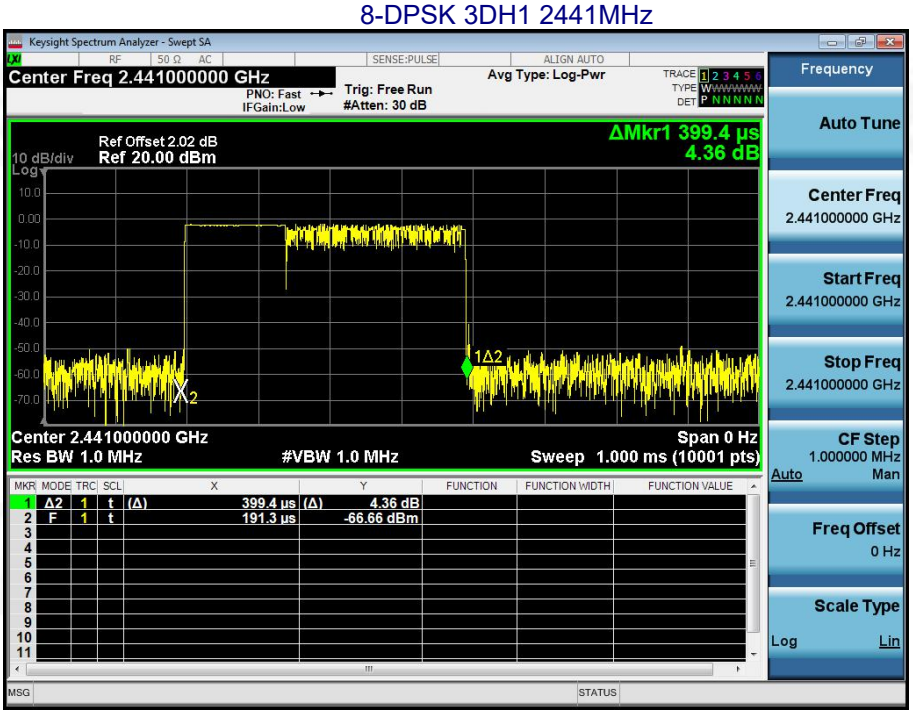
π/4-DQPSK 2DH3 2441MHz



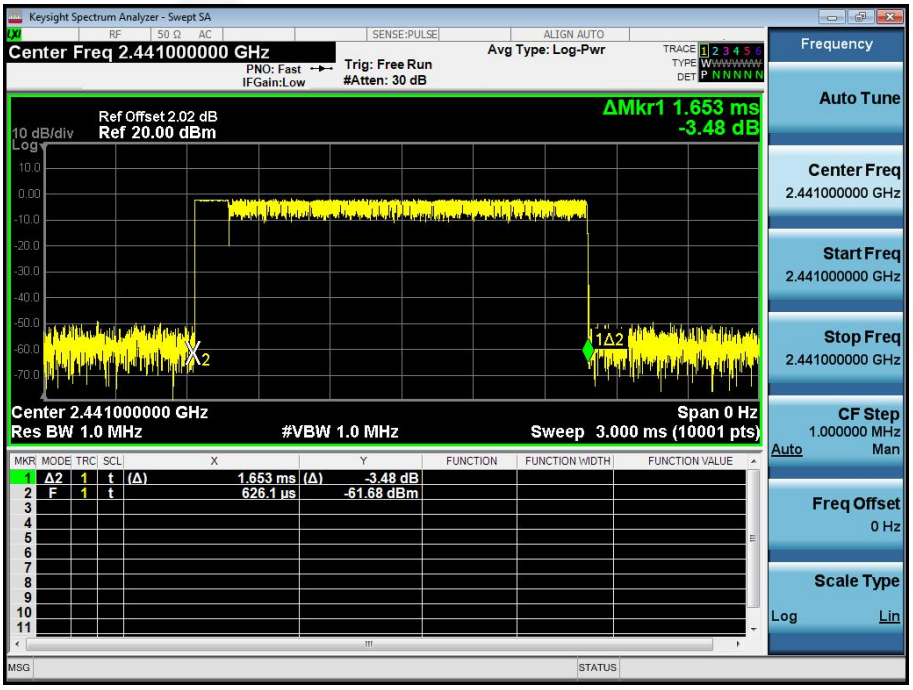
π/4-DQPSK 2DH5 2441MHz



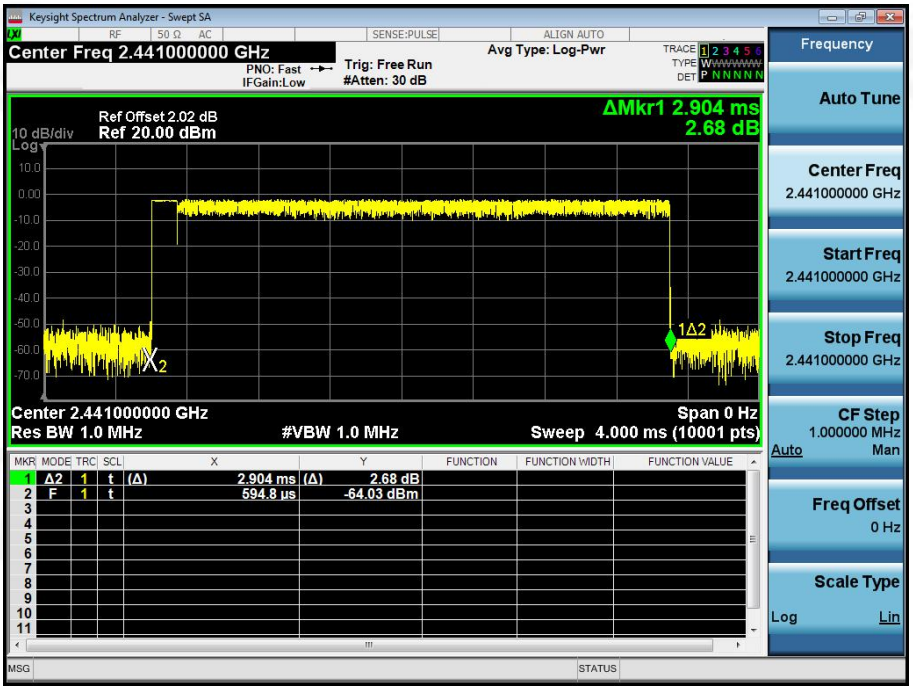
8-DPSK 3DH1 2441MHz



8-DPSK 3DH3 2441MHz



8-DPSK 3DH5 2441MHz



12. Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c) RSS-Gen 6.8

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.

A transmitter can only be sold or operated with antennas with which it was approved.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. For transmitters of RF output power of 10 milliwatts or less, only the portion of the antenna gain that is in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power to demonstrate compliance with the radiated power limits specified in the applicable standard. For transmitters of output power greater than 10 milliwatts, the total antenna gain shall be added to the measured RF output power to demonstrate compliance to the specified radiated power

EUT Antenna:

The antenna is PCB permanent antenna, the best case gain of the antennas is 1 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.

※※※※※ END OF REPORT ※※※※※