



### π/4-DQPSK - 2-DH1 Test plots

#### Low Channel



#### Middle Channel



#### High Channel





## 8-DPSK - 3-DH1 Test plots

## Low Channel



## Middle Channel



## High Channel

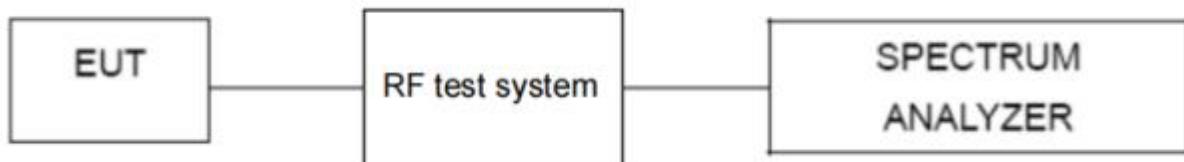




## 8. MAXIMUM PEAK OUTPUT POWER

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

### 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.



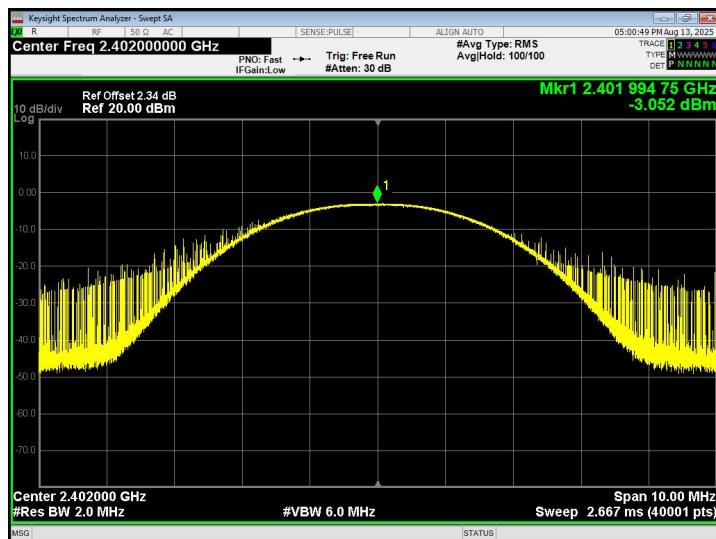
### 8.5 TEST RESULT

Modulation	Packet	Test channel	Peak output power (dBm)	Limit (dBm)	Result
GFSK	1-DH1	Lowest	-3.052	30.00	Pass
		Middle	-4.477		
		Highest	-4.897		
$\pi/4$ -DQPSK	2-DH1	Lowest	-4.418	21.00	Pass
		Middle	-4.042		
		Highest	-4.430		
8-DPSK	3-DH1	Lowest	-3.110	21.00	Pass
		Middle	-2.771		
		Highest	-3.159		

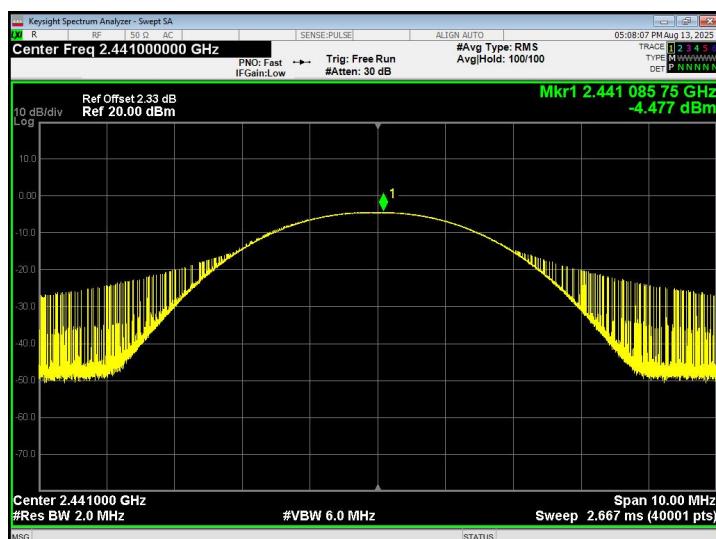


## GFSK - 1-DH1 Test plots

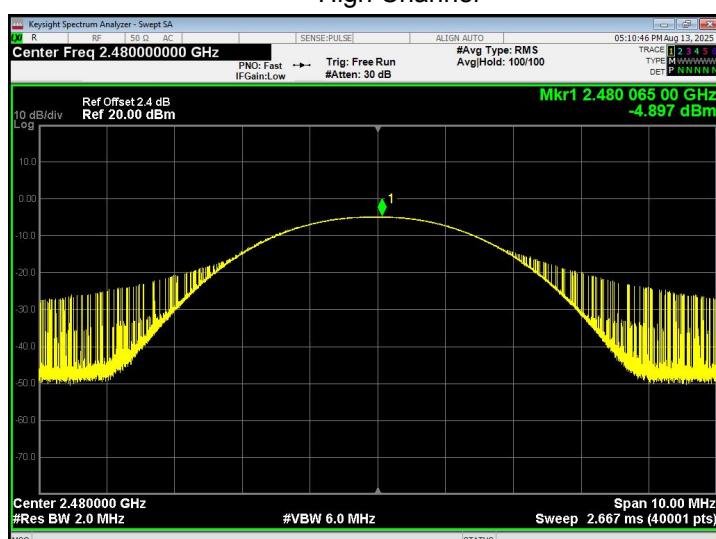
## Low Channel



## Middle Channel



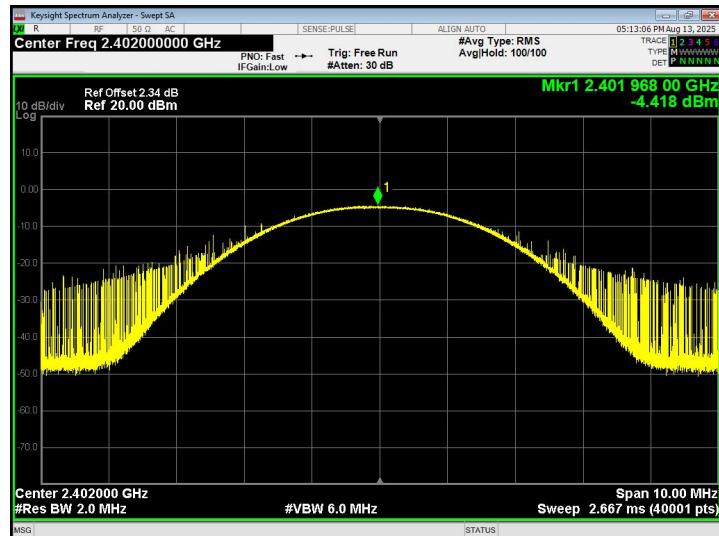
## High Channel



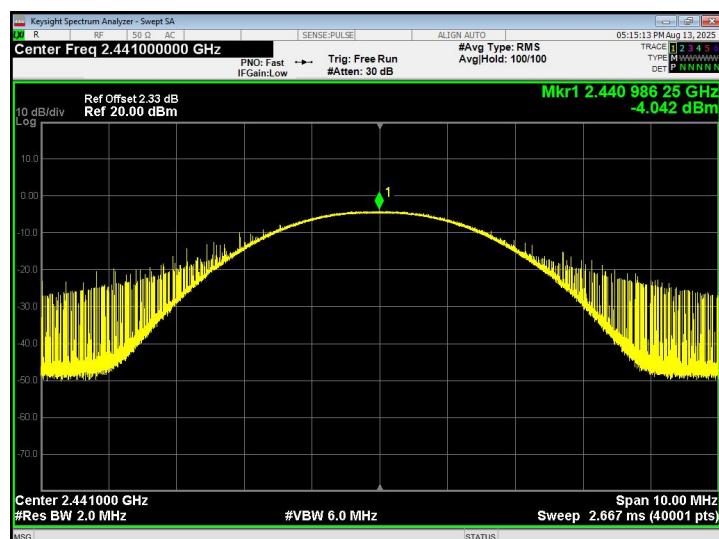


### π/4-DQPSK - 2-DH1 Test plots

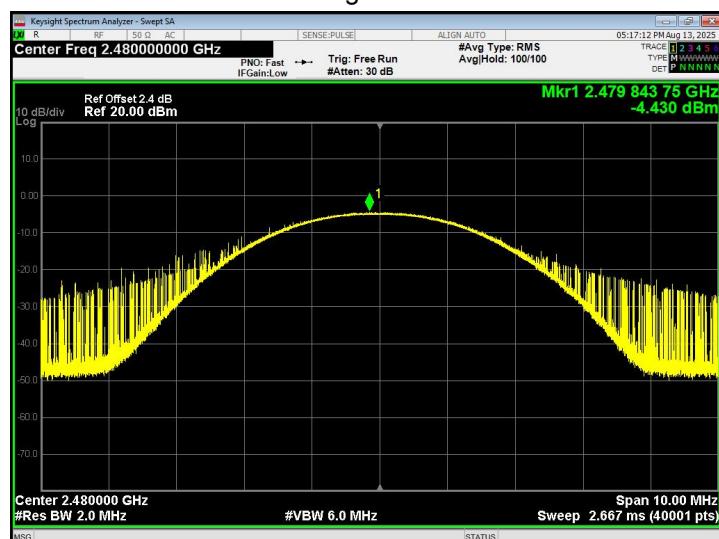
#### Low Channel



#### Middle Channel



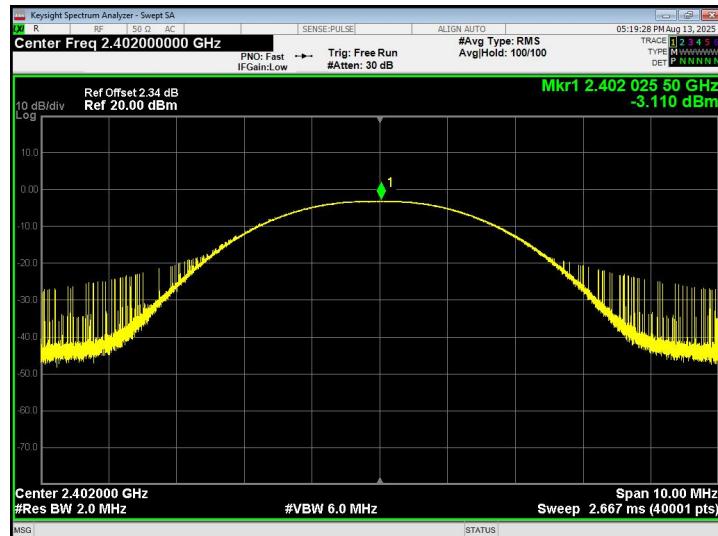
#### High Channel



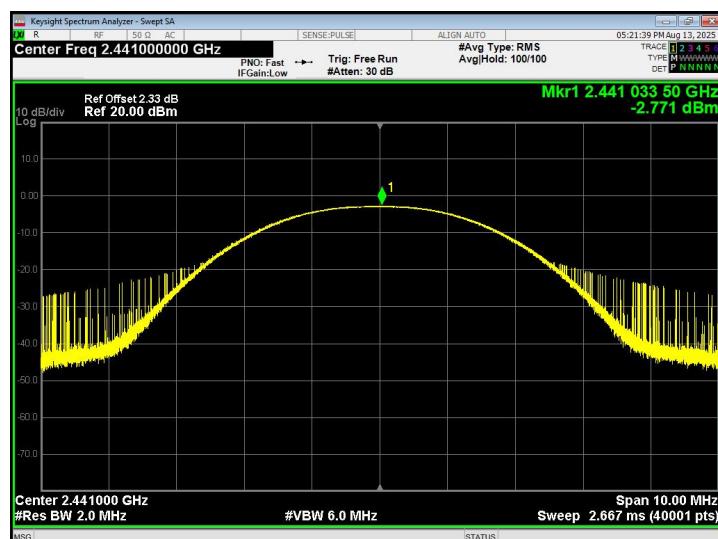


## 8-DPSK - 3-DH1 Test plots

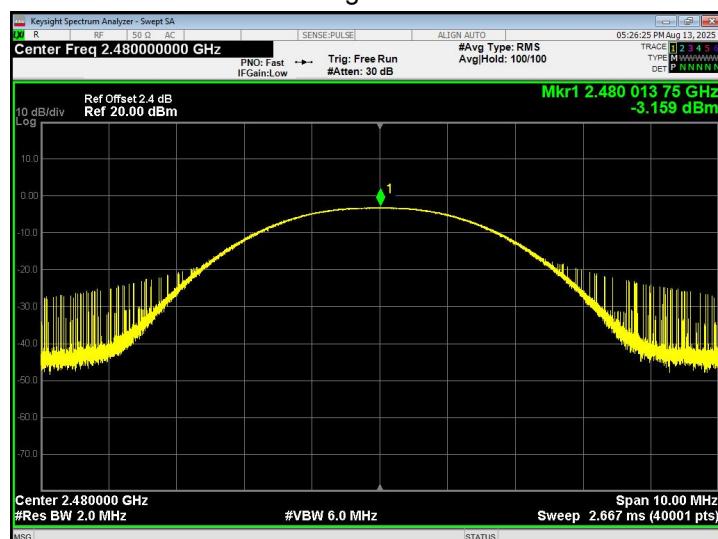
## Low Channel



## Middle Channel



## High Channel

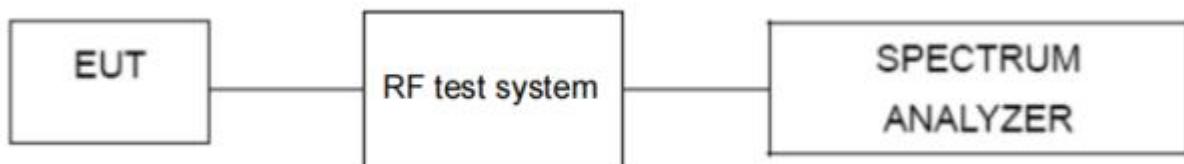




## 9. HOPPING CHANNEL SEPARATION

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 $\pi/4$ -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 = 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	Packet	Test Channel	Separation (MHz)	Limit (MHz)	Result
GFSK	1-DH1	Low	1.011	0.9528	PASS
		Middle	0.994	0.9487	PASS
		High	0.996	0.9958	PASS
$\pi/4$ -DQPSK	2-DH1	Low	1.041	0.8587	PASS
		Middle	0.999	0.8667	PASS
		High	1.089	0.8647	PASS
8-DPSK	3-DH1	Low	1.111	0.8907	PASS
		Middle	1.062	0.8160	PASS
		High	1.077	0.8180	PASS



## GFSK - 1-DH1 Test plots

## Low Channel



## Middle Channel



## High Channel



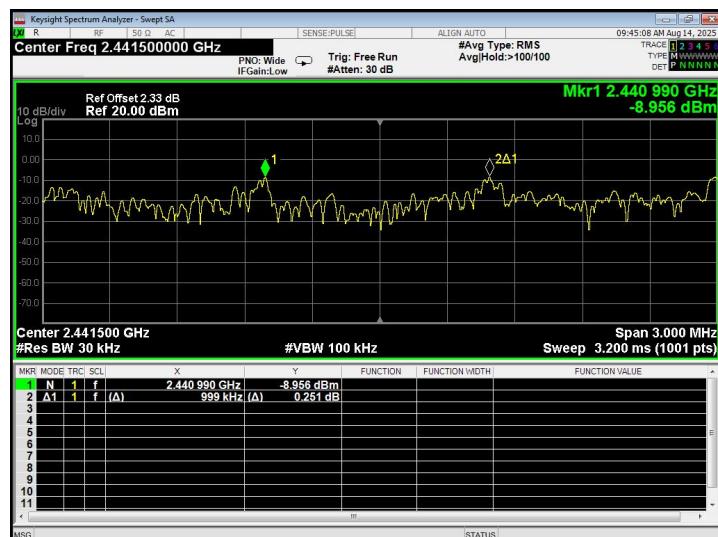


### π/4-DQPSK - 2-DH1 Test plots

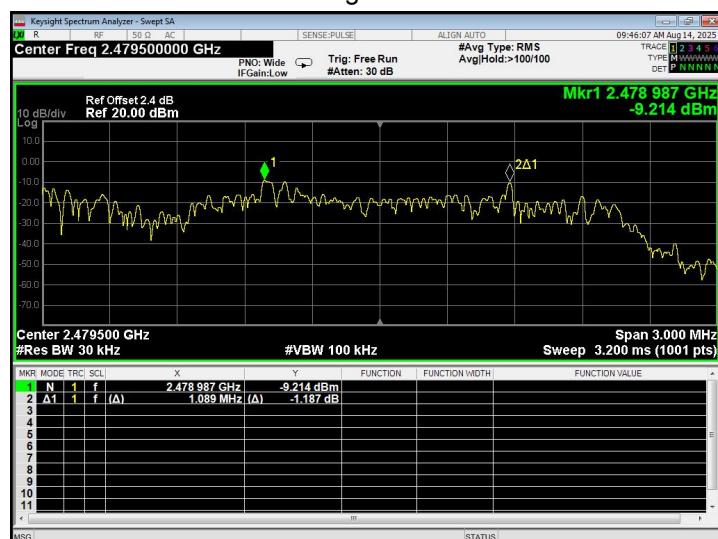
#### Low Channel



#### Middle Channel



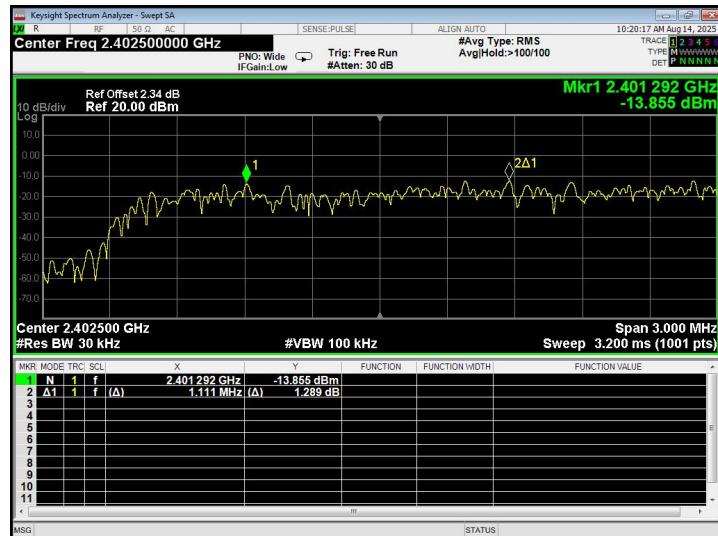
#### High Channel



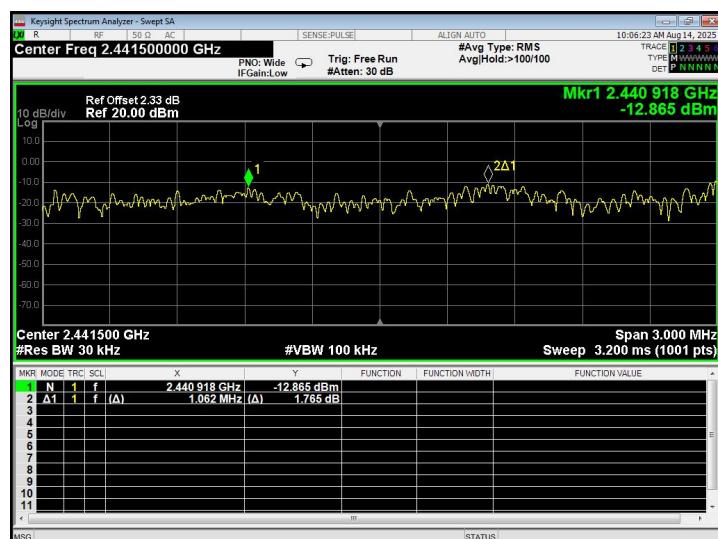


## 8-DPSK - 3-DH1 Test plots

## Low Channel



## Middle Channel



## High Channel

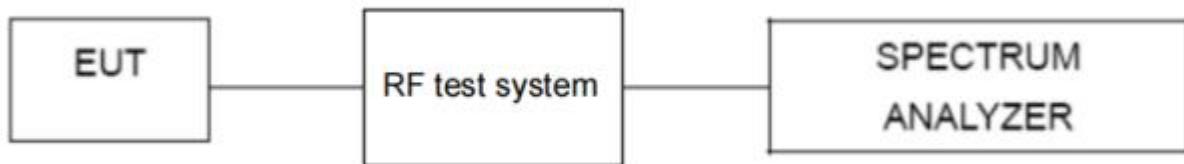




## 10. NUMBER OF HOPPING FREQUENCY

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW = 100 kHz, VBW = 300 kHz, Frequency Range = 2400MHz - 2483.5MHz, Detector = peak.
Limit:	$P_{\max\text{-pk}} \leq 1\text{W}$ , $N_{\text{ch}} \geq 75$ Channels $P_{\max\text{-pk}} \leq 0.125\text{W}$ , $N_{\text{ch}} \geq 15$ 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

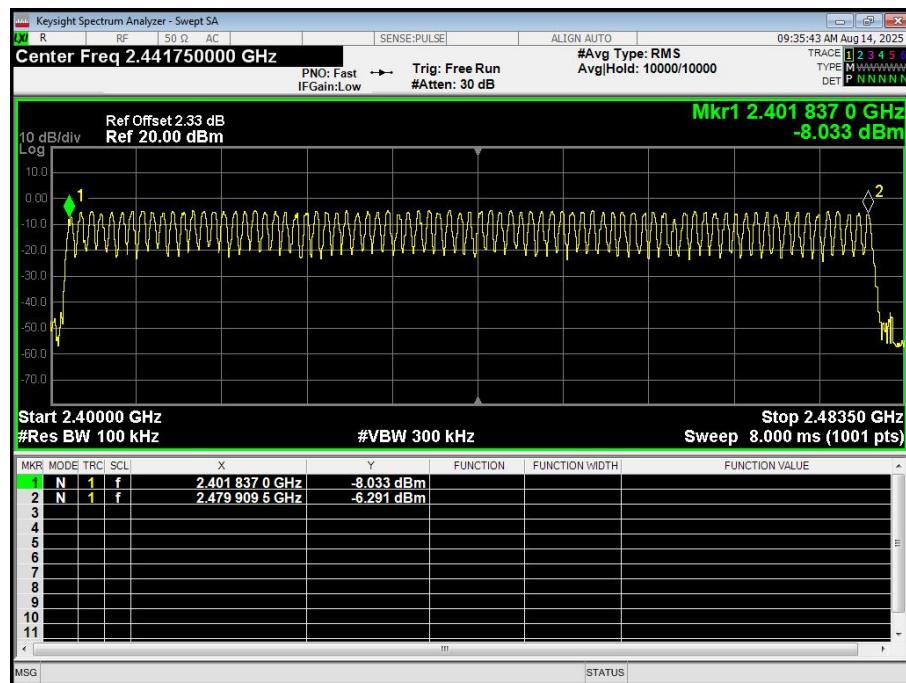
No deviation.



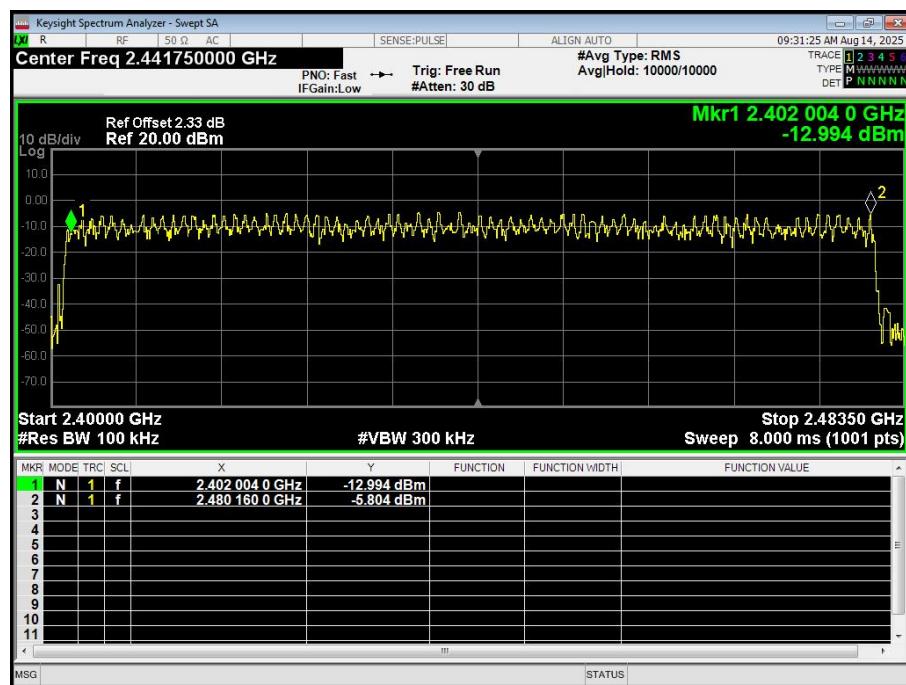
## 10.4 TEST RESULT

Modulation	Packet	Hopping Number	Limit	Result
GFSK	1-DH1	79	≥75	Pass
π/4-DQPSK	2-DH1	79	≥15	Pass
8-DPSK	3-DH1	79	≥15	Pass

## GFSK - 1-DH1 Test Plots

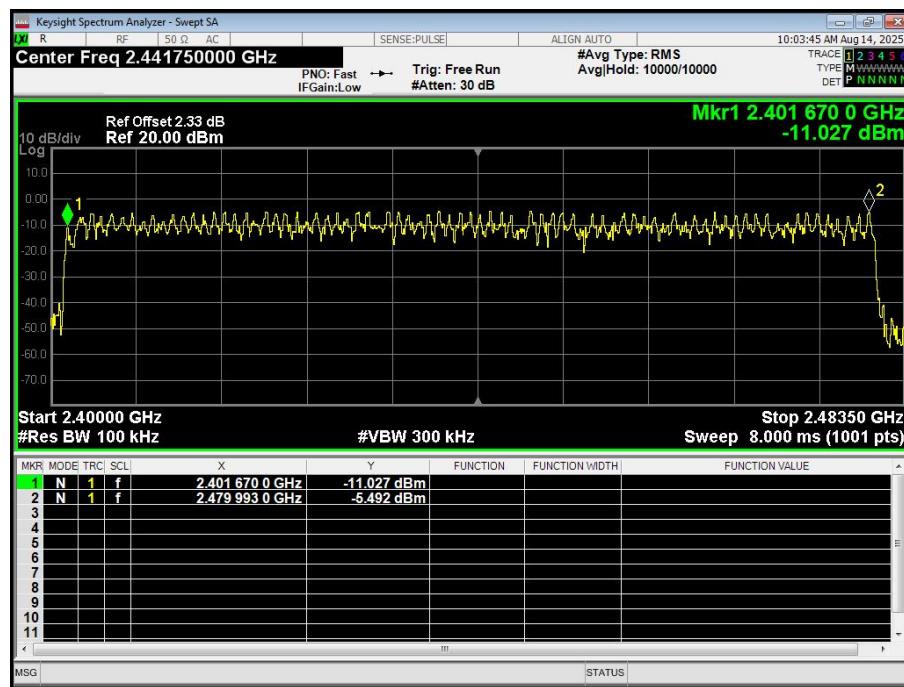


## π/4-DQPSK - 2-DH1 Test Plots





## 8-DPSK - 3-DH1 Test Plots





## 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 = 0 Hz;
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	Pulse Time (ms)	Total Dwell Time (ms)	Limit (ms)	Result
2441MHz	1-DH1	0.432	138.240	400	Pass
2441MHz	1-DH3	1.632	261.120	400	Pass
2441MHz	1-DH5	2.831	301.973	400	Pass

Remarks:

The test period:  $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

Test channel: as blow

CH:2441MHz time slot=0.432(ms)\*(1600/ (2\*79))\*31.6=138.240ms

CH:2441MHz time slot=1.632(ms)\*(1600/ (4\*79))\*31.6=261.120ms

CH:2441MHz time slot=2.831(ms)\*(1600/ (6\*79))\*31.6=301.973ms

$\pi/4$ -DQPSK mode:

Frequency	Packet	Pulse Time (ms)	Total Dwell Time (ms)	Limit (ms)	Result
2441MHz	2-DH1	0.490	156.800	400	Pass
2441MHz	2-DH3	1.691	270.560	400	Pass
2441MHz	2-DH5	2.889	308.160	400	Pass

Remarks:

The test period:  $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

Test channel: as blow

CH:2441MHz time slot=0.490(ms)\*(1600/ (2\*79))\*31.6=156.800ms

CH:2441MHz time slot=1.691(ms)\*(1600/ (4\*79))\*31.6=270.560ms

CH:2441MHz time slot=2.889(ms)\*(1600/ (6\*79))\*31.6=308.160ms

8-DPSK mode:

Frequency	Packet	Pulse Time (ms)	Total Dwell Time (ms)	Limit (ms)	Result
2441MHz	3-DH1	0.417	133.440	400	Pass
2441MHz	3-DH3	1.670	267.200	400	Pass
2441MHz	3-DH5	2.764	294.827	400	Pass

Remarks:

The test period:  $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

Test channel: as blow

CH:2441MHz time slot=0.417(ms)\*(1600/ (2\*79))\*31.6=133.440ms

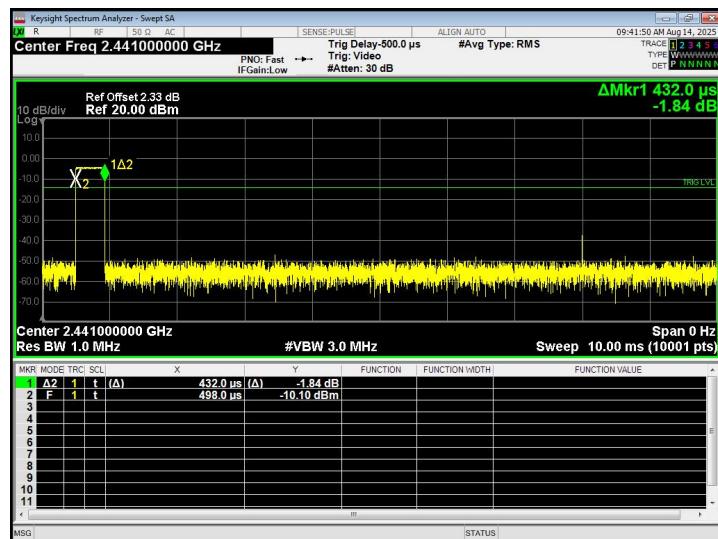
CH:2441MHz time slot=1.670(ms)\*(1600/ (4\*79))\*31.6=267.200ms

CH:2441MHz time slot=2.764(ms)\*(1600/ (6\*79))\*31.6=294.827ms

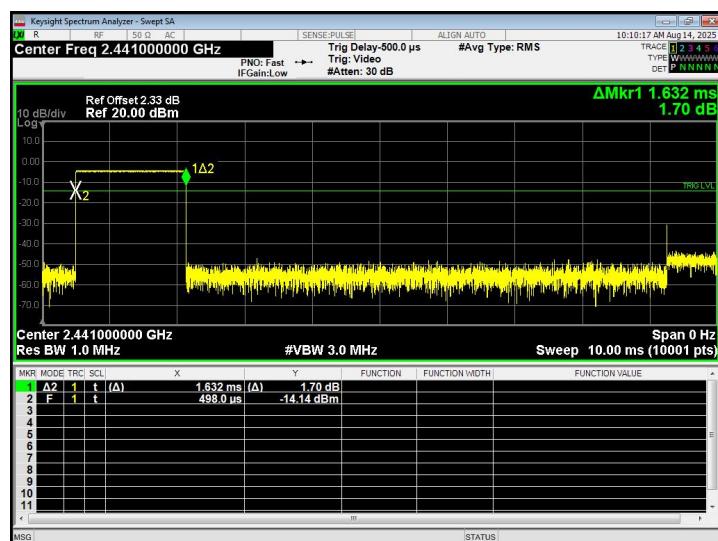


## GFSK Test Plots

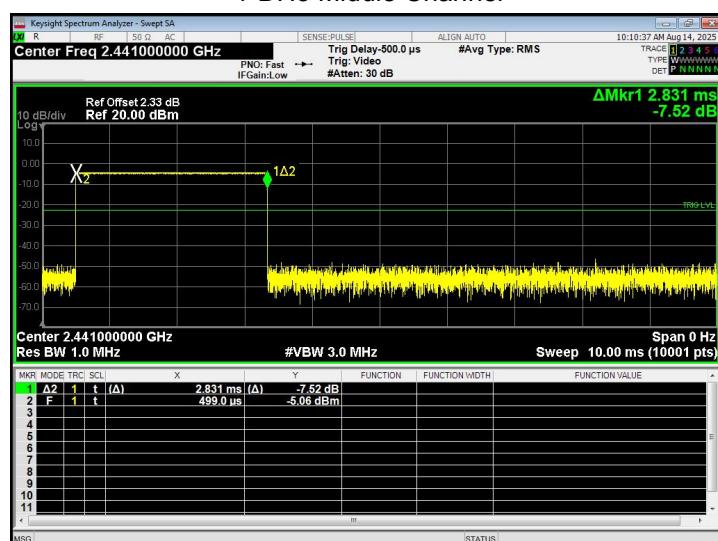
## 1-DH1 Middle Channel



## 1-DH3 Middle Channel



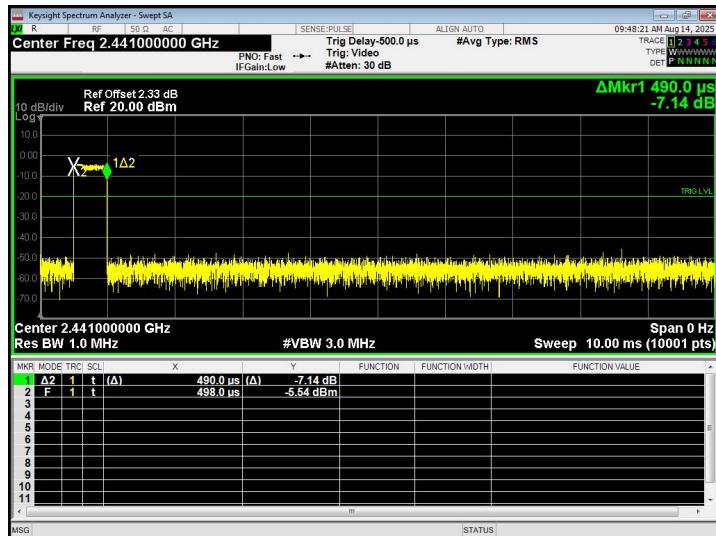
## 1-DH5 Middle Channel



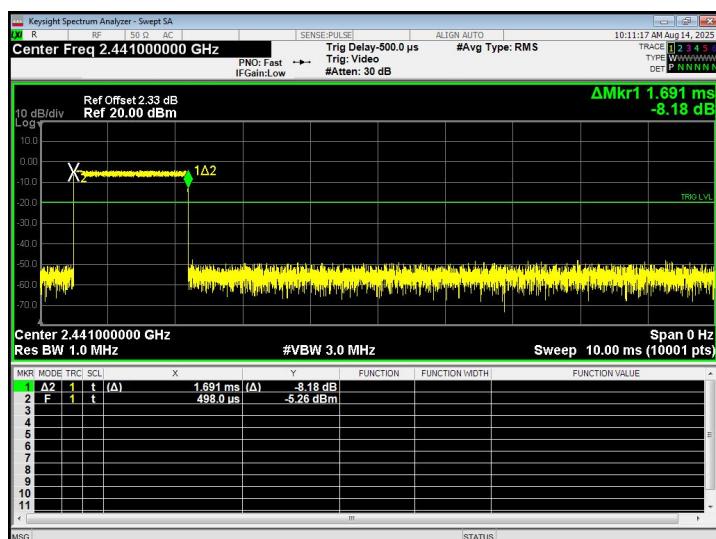


## π/4-DQPSK Test Plots

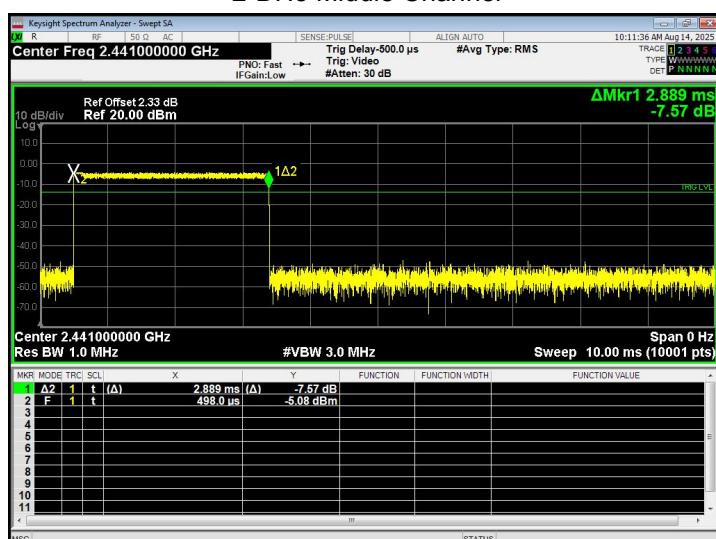
## 2-DH1 Middle Channel



## 2-DH3 Middle Channel



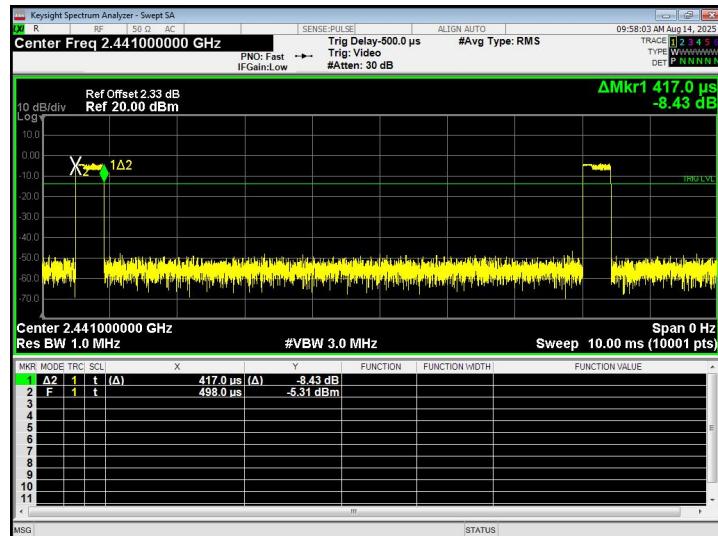
## 2-DH5 Middle Channel



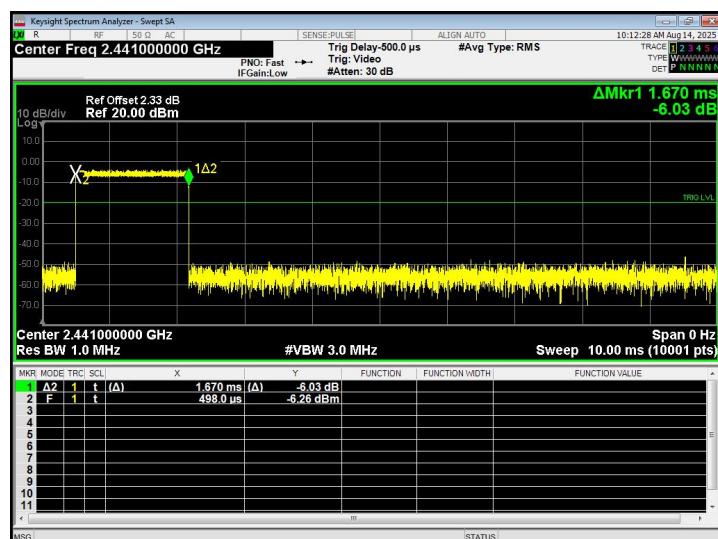


## 8-DPSK Test Plots

## 3-DH1 Middle Channel



## 3-DH3 Middle Channel



## 3-DH5 Middle Channel





## 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 2.0dBi, 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 \*\*\*\*\*