

## GFSK Modulation



## CH00



## CH39



## CH78

$\pi/4$ DQPSK Modulation

## CH00



## CH39



## CH78

## 8DPSK Modulation



## CH00



## CH39



## CH78

## 4.5 Frequency Separation

### LIMIT

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the  $2/3 \times 20\text{dB}$  bandwidth of the hopping channel, whichever is greater.

### TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 KHz RBW and 300 KHz VBW.

### TEST CONFIGURATION



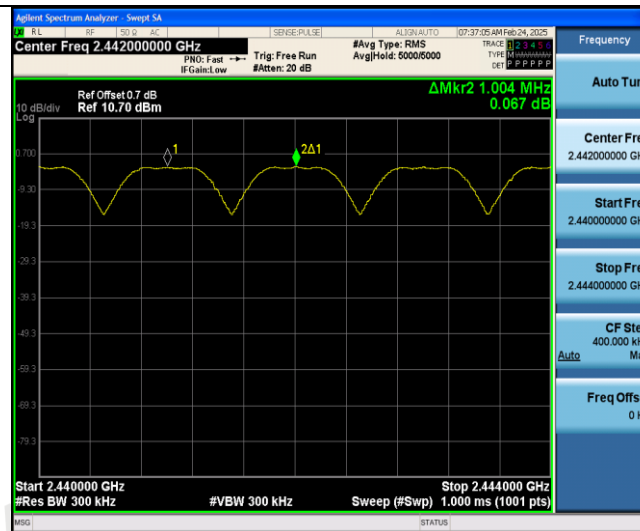
### TEST RESULTS

Modulation	Channel	Channel Separation (MHz)	Limit(MHz)	Result
GFSK	CH38	1.004	25KHz or $2/3 \times 20\text{dB}$ bandwidth	Pass
	CH39			
$\pi/4$ DQPSK	CH38	1.004	25KHz or $2/3 \times 20\text{dB}$ bandwidth	Pass
	CH39			
8DPSK	CH38	1.180	25KHz or $2/3 \times 20\text{dB}$ bandwidth	Pass
	CH39			

Note:

We have tested all mode at high, middle and low channel, and recorded worst case at middle

Test plot as follows:



GFSK

 $\pi/4$ DQPSK

8DPSK

#### 4.6 Number of hopping frequency

##### Limit

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

##### Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set spectrum analyzer start 2400MHz to 2483.5MHz with 100 KHz RBW and 300 KHz VBW.

##### Test Configuration

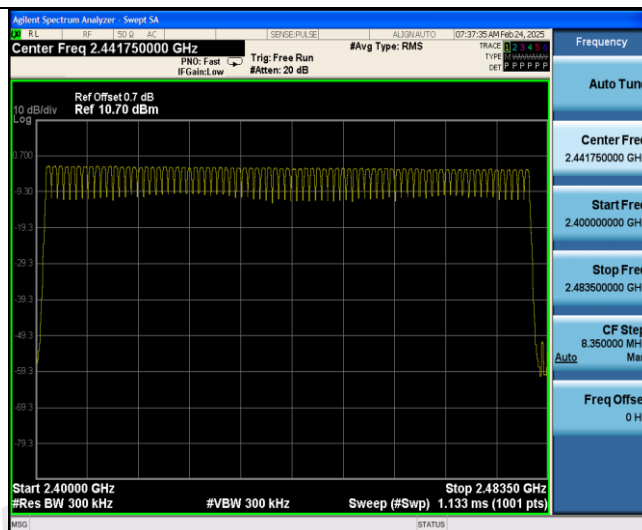


##### Test Results

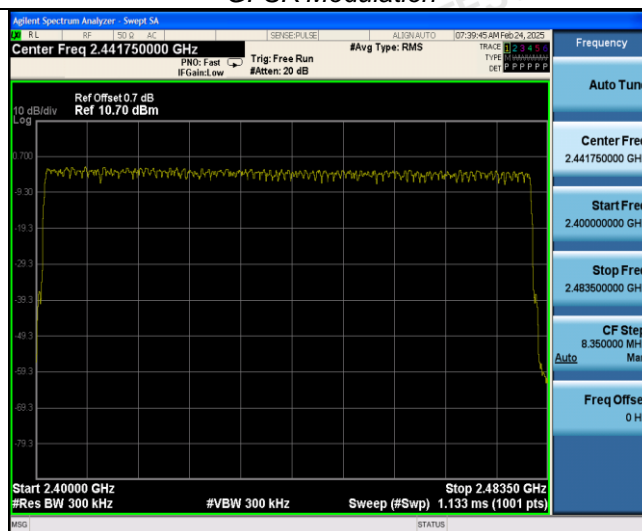
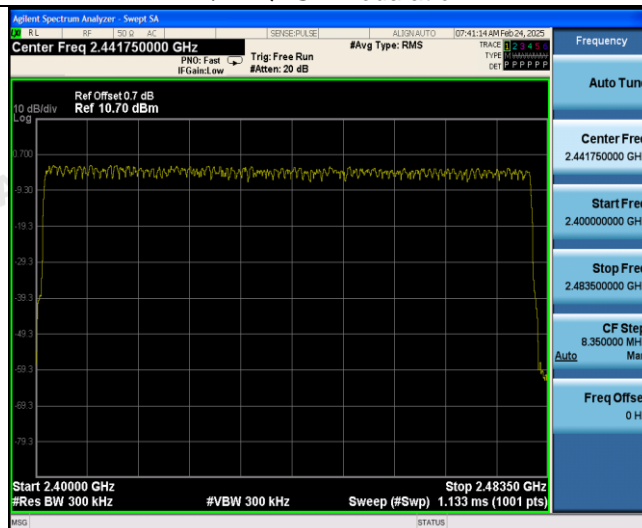
Modulation	Number of Hopping Channel	Limit	Result
GFSK	79	≥15	Pass
$\pi/4$ DQPSK	79		
8DPSK	79		

##### Test plot as follows:





GFSK Modulation

 $\pi/4$ DQPSK Modulation

8DPSK Modulation

#### 4.7 Time of Occupancy (Dwell Time)

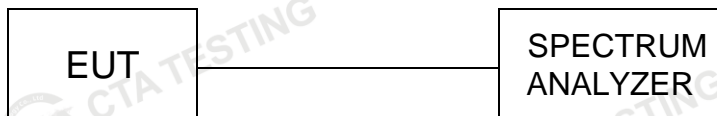
##### Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

##### Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with 1MHz RBW and 1MHz VBW, Span 0Hz.

##### Test Configuration



##### Test Results

Modulation	Packet	Burst time (ms)	Dwell time (s)	Limit (s)	Result
GFSK	DH1	0.390	0.125	0.40	Pass
	DH3	1.640	0.262		
	DH5	2.900	0.309		
π/4DQPSK	2-DH1	0.390	0.125	0.40	Pass
	2-DH3	1.650	0.264		
	2-DH5	2.900	0.309		
8DPSK	3-DH1	0.380	0.122	0.40	Pass
	3-DH3	1.650	0.264		
	3-DH5	2.900	0.309		

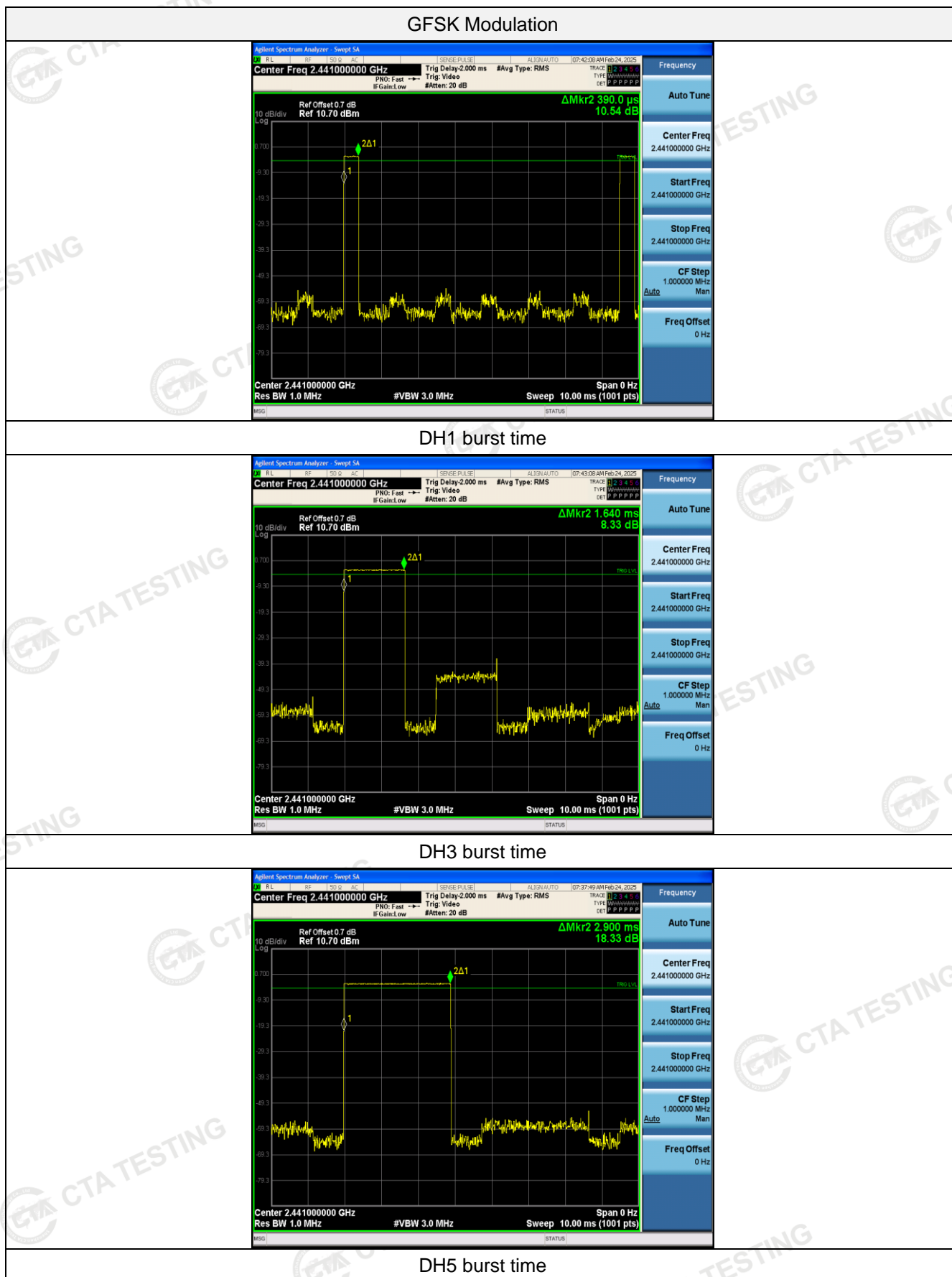
Note: We have tested all mode at high, middle and low channel, and recorded worst case at middle channel.

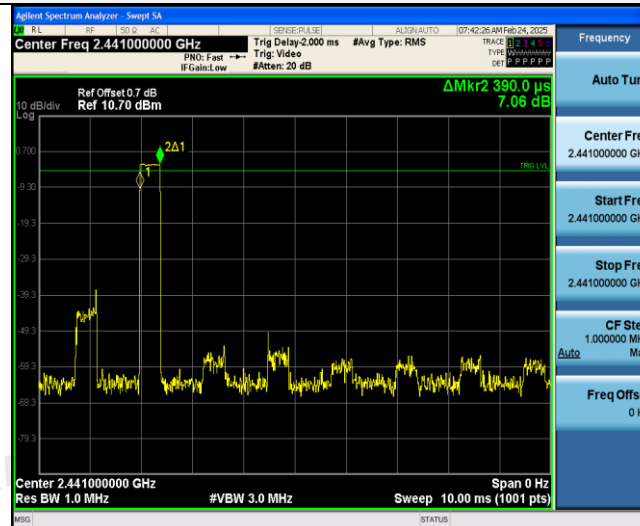
Dwell time = Pulse time (ms) × (1600 ÷ 2 ÷ 79) × 31.6 Second for DH1, 2-DH1, 3-DH1

Dwell time = Pulse time (ms) × (1600 ÷ 4 ÷ 79) × 31.6 Second for DH3, 2-DH3, 3-DH3

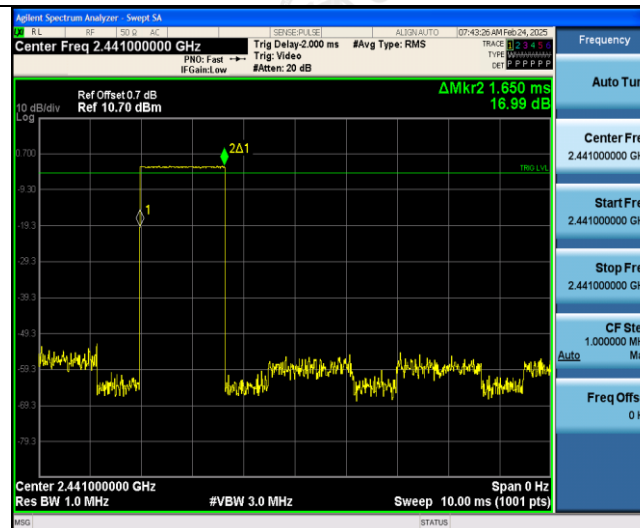
Dwell time = Pulse time (ms) × (1600 ÷ 6 ÷ 79) × 31.6 Second for DH5, 2-DH5, 3-DH5



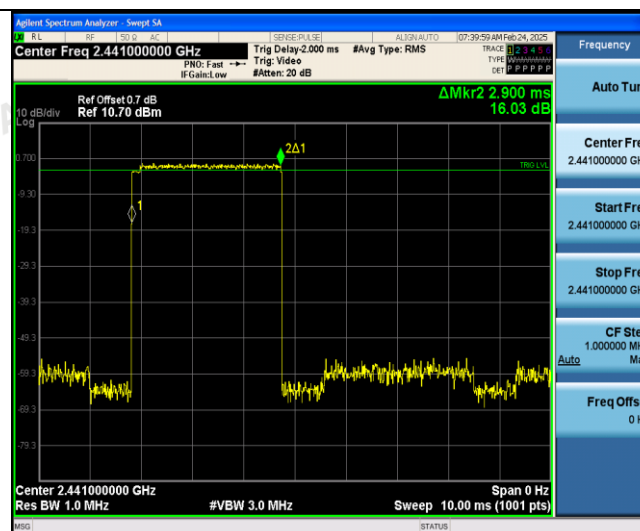
**Test plot as follows:**

$\pi/4$ DQPSK Modulation

2-DH1 burst time

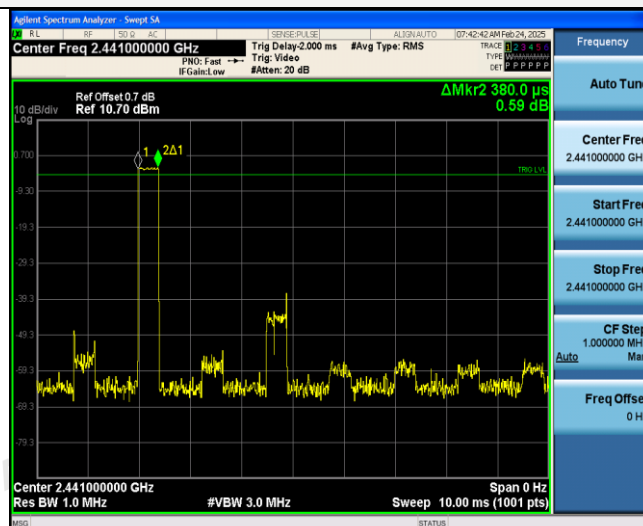


2-DH3 burst time



2-DH5 burst time

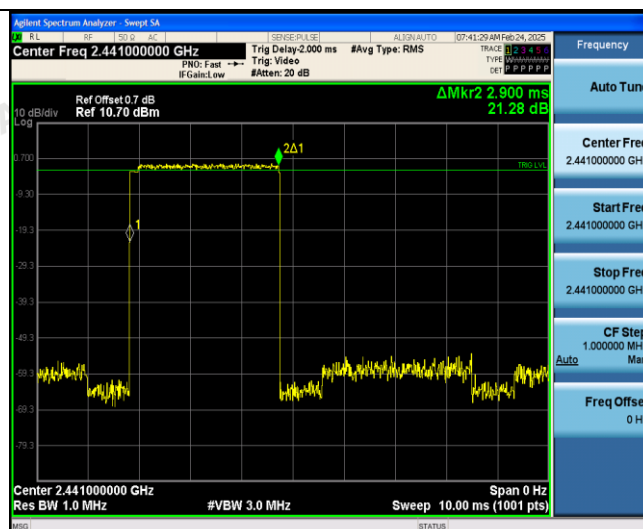
## 8DPSK Modulation



## 3-DH1 burst time



## 3-DH3 burst time



## 3-DH5 burst time

## 4.8 Out-of-band Emissions

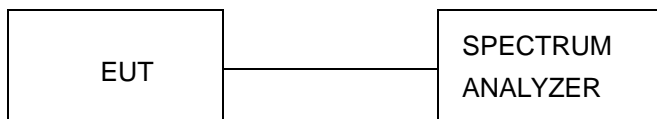
### Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

### Test Procedure

Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, band edge and out-of-band emissions.

### Test Configuration



### Test Results

Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and band edge measurement data.

We measured all conditions (DH1, DH3, DH5) and recorded worst case at DH5

Test plot as follows:

