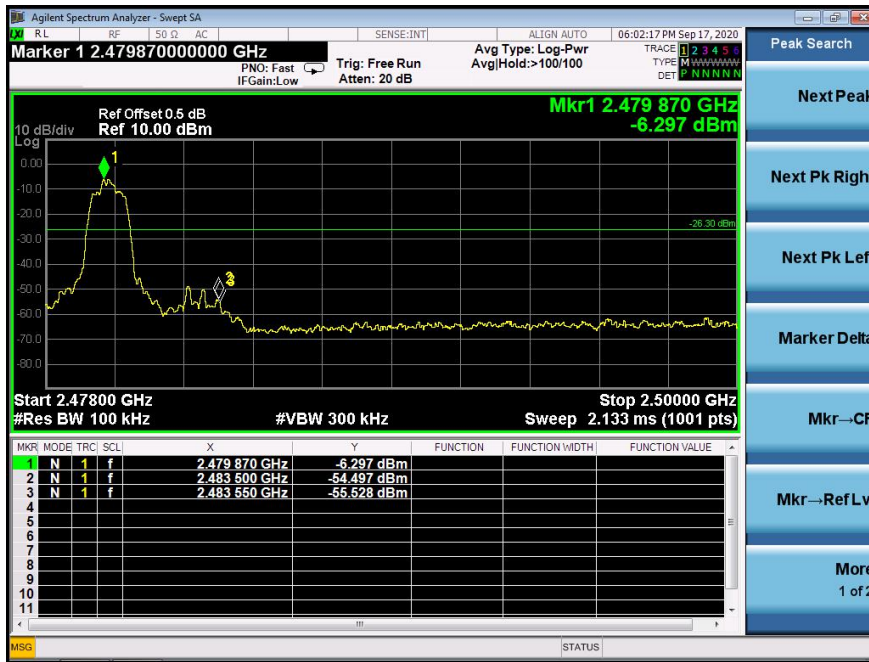
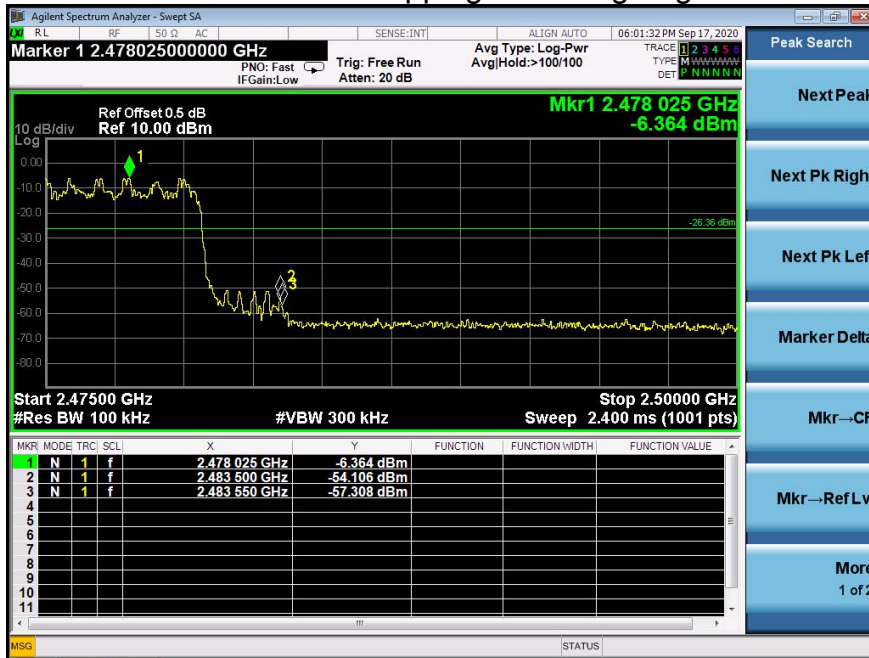


Pi/4 DQPSK Transmitting Band edge-right side



Pi/4 DQPSK Hopping Band edge-right side



## 10. 20 DB BANDWIDTH

### 10.1 Block Diagram Of Test Setup



### 10.2 Limit

N/A

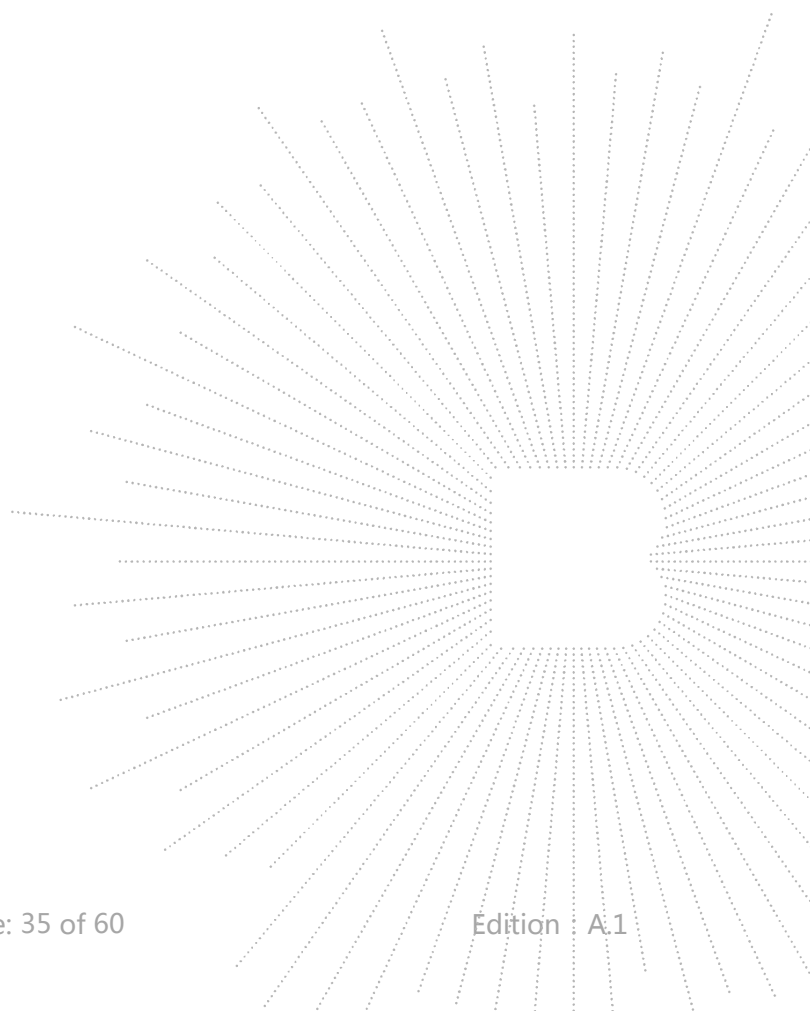
### 10.3 Test procedure

1. Set RBW = 30kHz.
2. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

**10.4 Test Result**

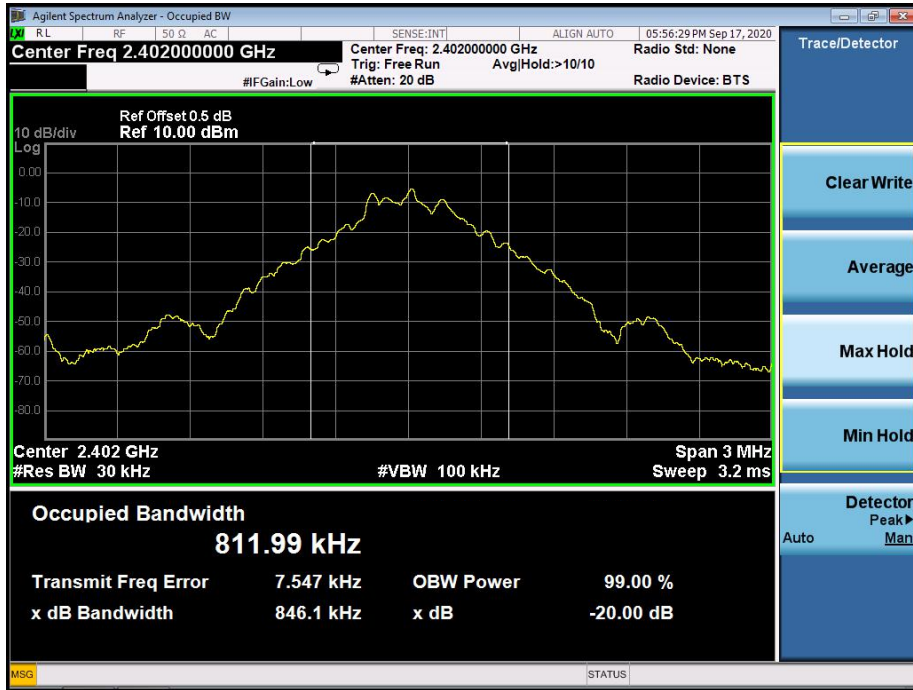
Temperature :	26°C	Relative Humidity :	54%
Test Voltage :	DC 3.7V	Remark	N/A

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	0.846
GFSK	Middle	0.844
GFSK	High	0.847
Pi/4 DQPSK	Low	1.215
Pi/4 DQPSK	Middle	1.215
Pi/4 DQPSK	High	1.215

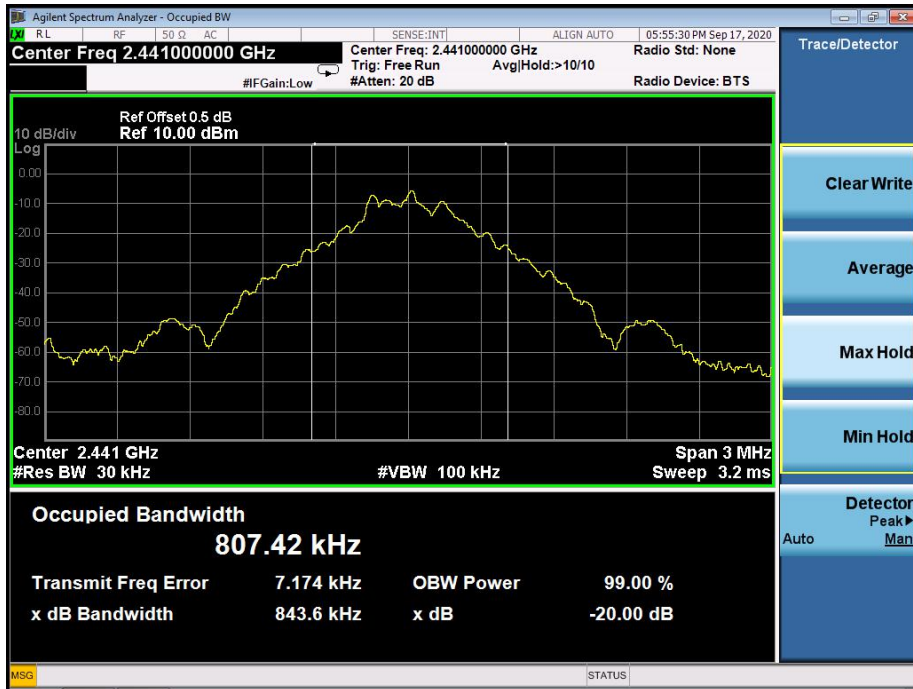




## Test plots GFSK Low Channel

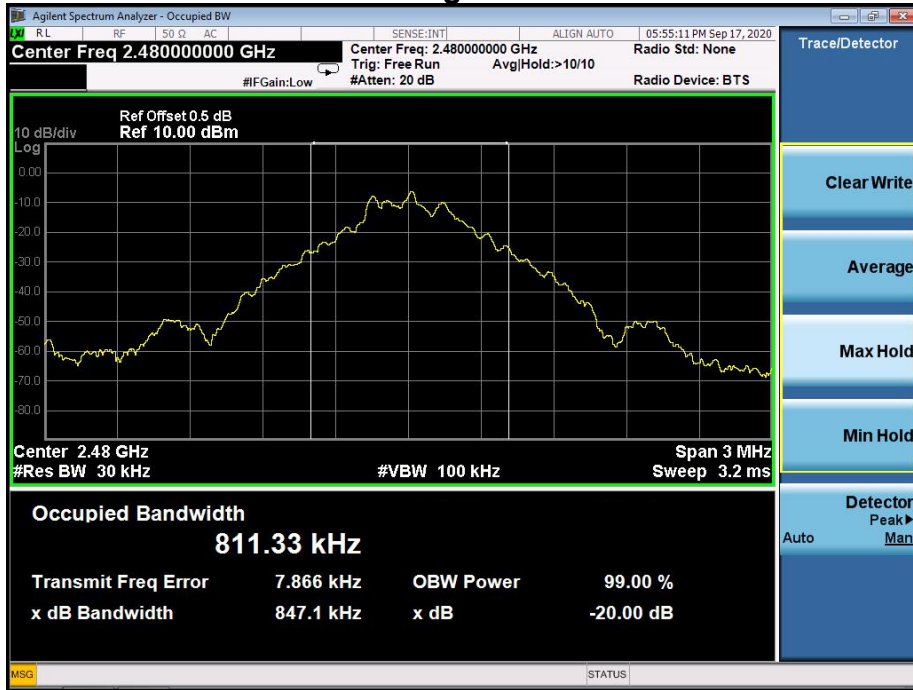


## GFSK Middle Channel

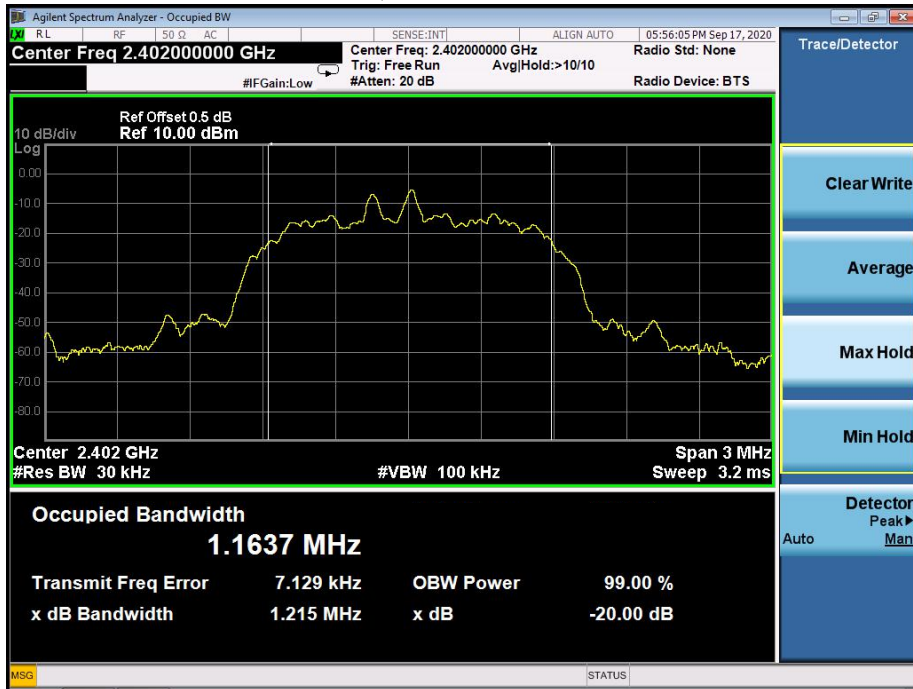




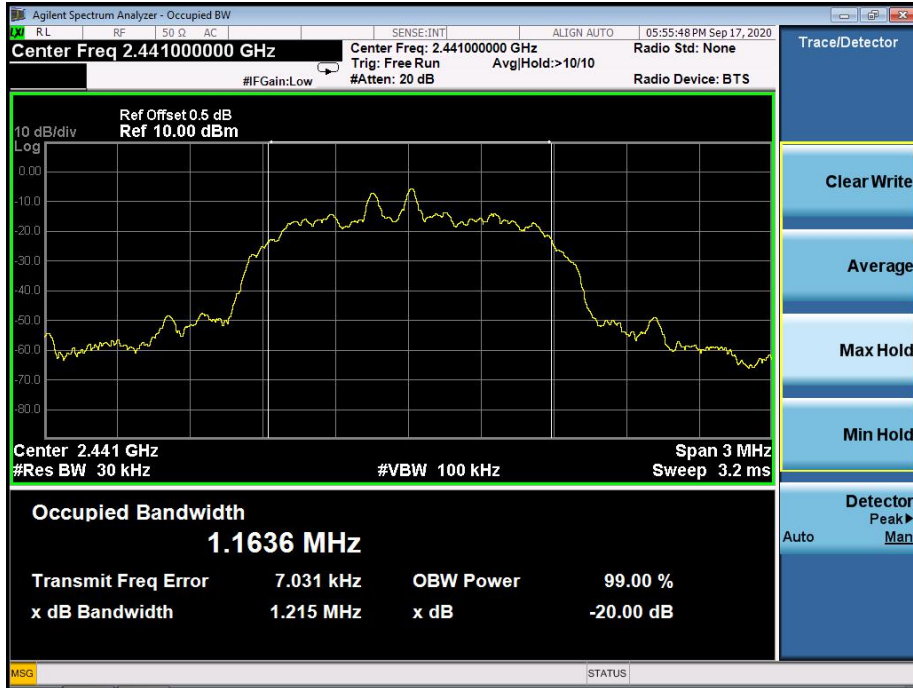
## GFSK High Channel



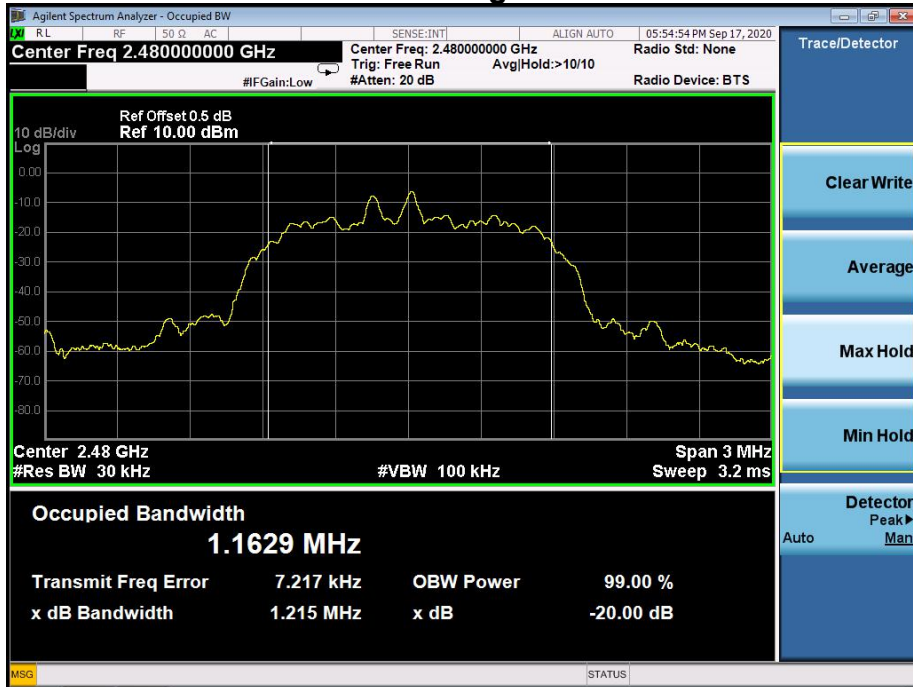
## Pi/4 DQPSK Low Channel



**Pi/4 DQPSK Middle Channel**



**Pi/4 DQPSK High Channel**



## 11. MAXIMUM PEAK OUTPUT POWER

### 11.1 Block Diagram Of Test Setup

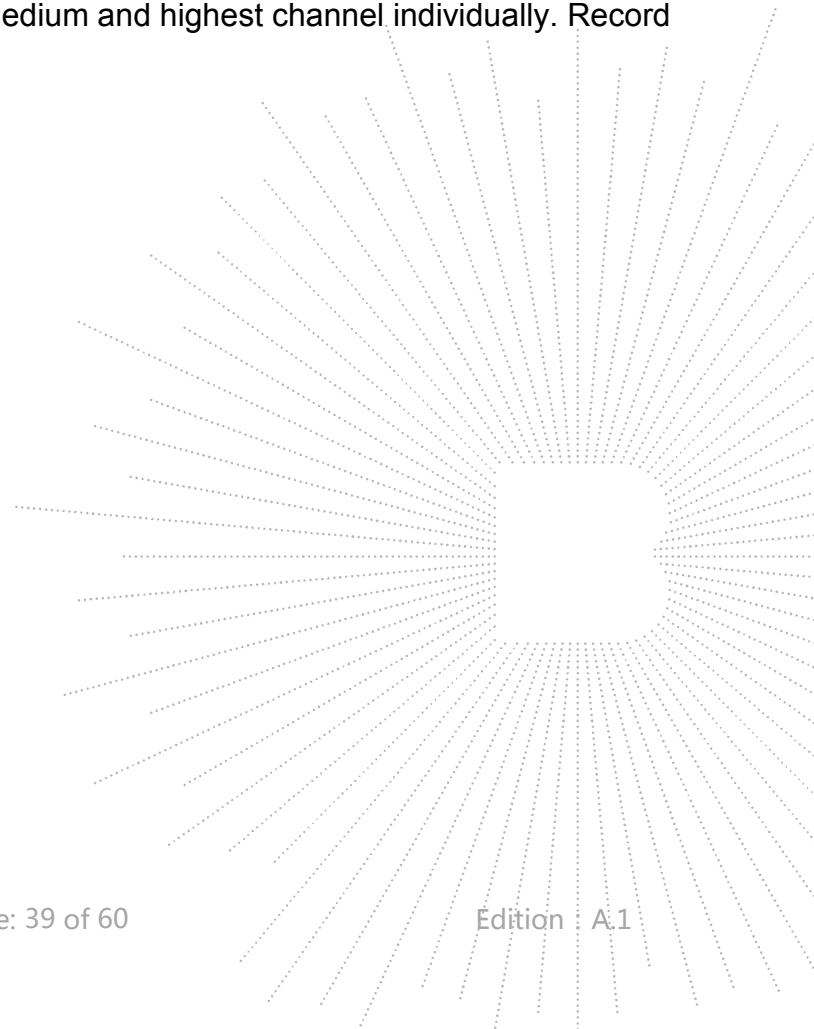


### 11.2 Limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(1)	Peak Output Power	0.125 watt or 21dBm	2400-2483.5	PASS

### 11.3 Test procedure

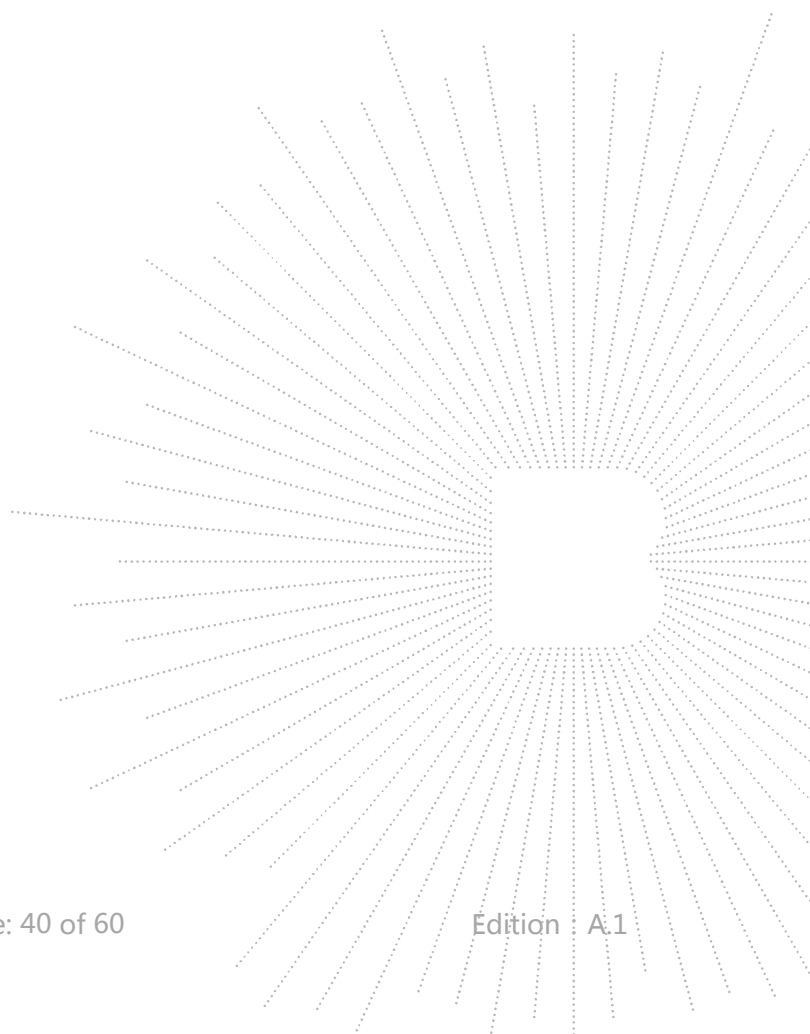
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.



### 11.4 Test Result

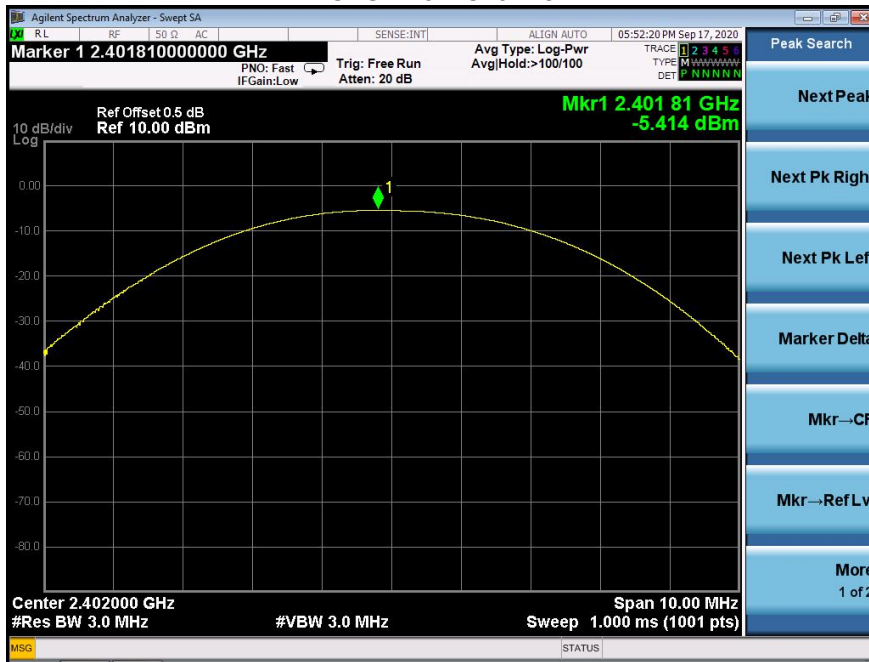
Temperature :	26°C	Relative Humidity :	54%
Test Voltage :	DC 3.7V	Remark:	N/A

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	-5.414	21
GFSK	Middle	-5.681	21
GFSK	High	-6.302	21
Pi/4 DQPSK	Low	-4.571	21
Pi/4 DQPSK	Middle	-4.813	21
Pi/4 DQPSK	High	-5.435	21

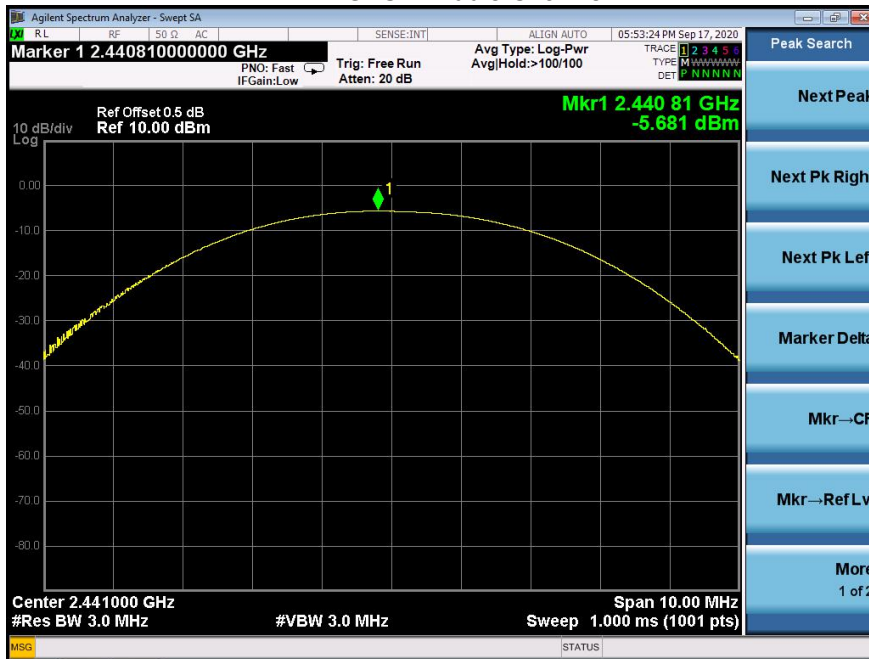




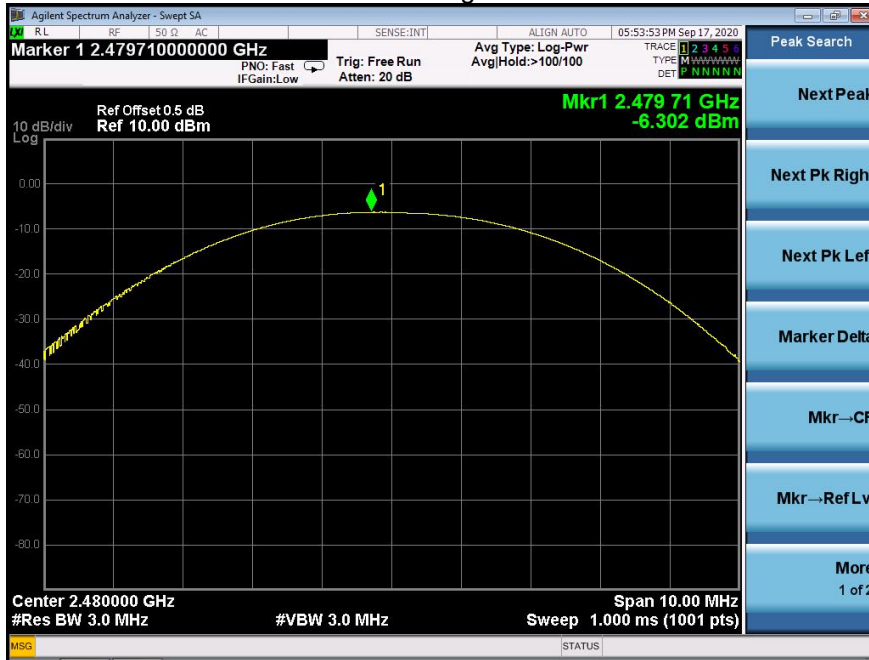
Test plots  
GFSK Low Channel



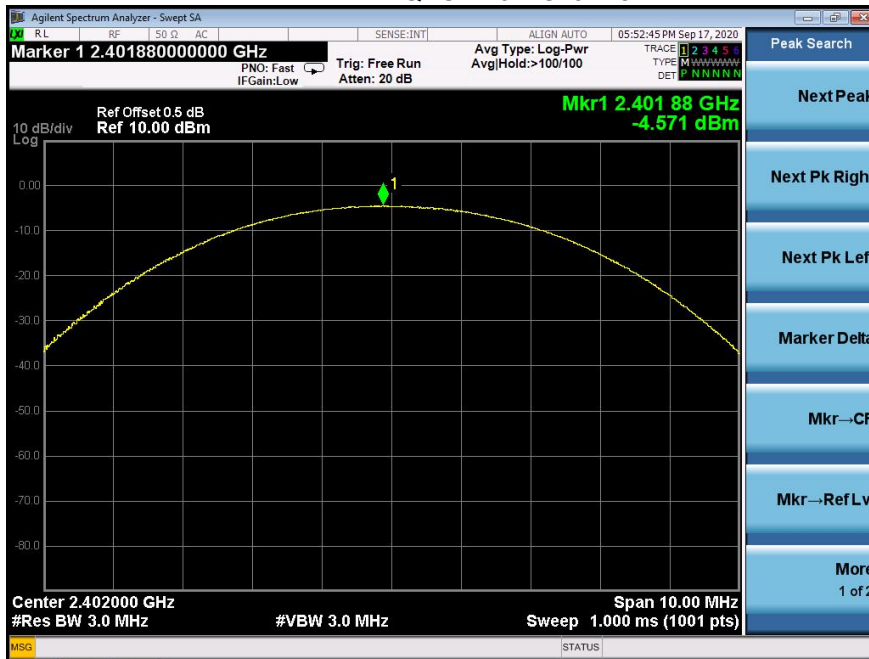
GFSK Middle Channel



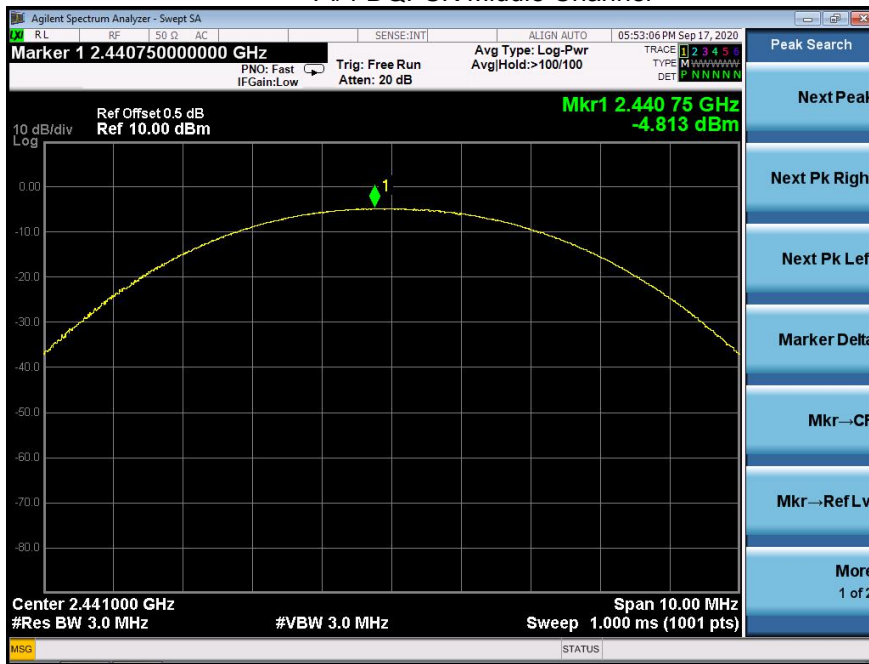
GFSK High Channel



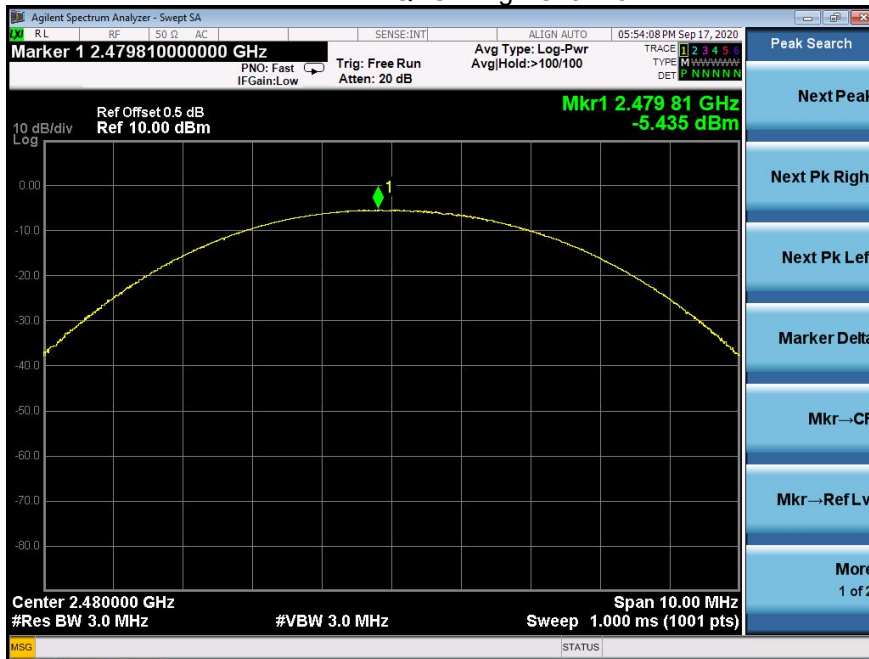
Pi/4 DQPSK Low Channel



Pi/4 DQPSK Middle Channel



Pi/4 DQPSK High Channel



## 12. HOPPING CHANNEL SEPARATION

### 12.1 Block Diagram Of Test Setup



### 12.2 Limit

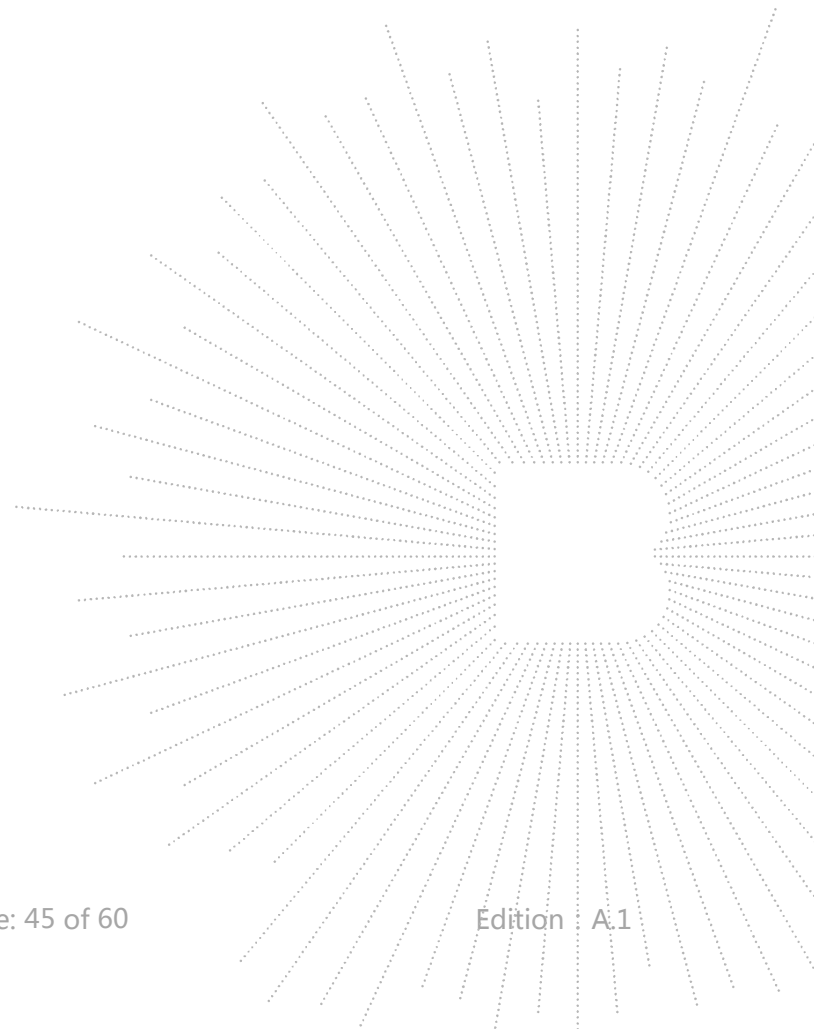
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125W.

### 12.3 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 = 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.

## 12.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	0.998	0.564	PASS
GFSK	Middle	1.000	0.563	PASS
GFSK	High	1.000	0.565	PASS
Pi/4 DQPSK	Low	1.000	0.810	PASS
Pi/4 DQPSK	Middle	0.998	0.810	PASS
Pi/4 DQPSK	High	0.990	0.810	PASS



### Test plots GFSK Low Channel



### GFSK Middle Channel



GFSK High Channel

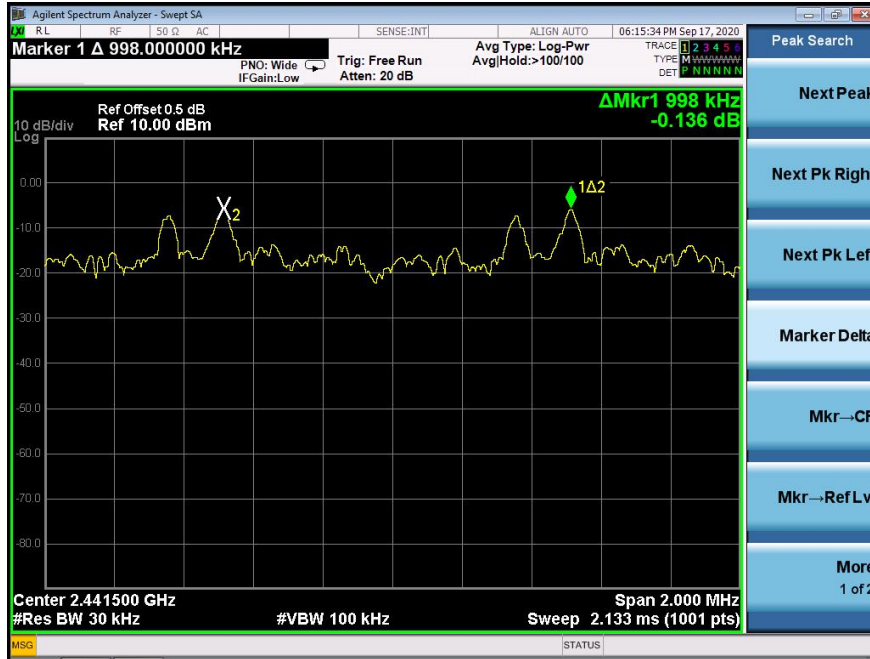


Pi/4 DQPSK Low Channel





## Pi/4 DQPSK Middle Channel



## Pi/4 DQPSK High Channel





### 13. NUMBER OF HOPPING FREQUENCY

#### 13.1 Block Diagram Of Test Setup

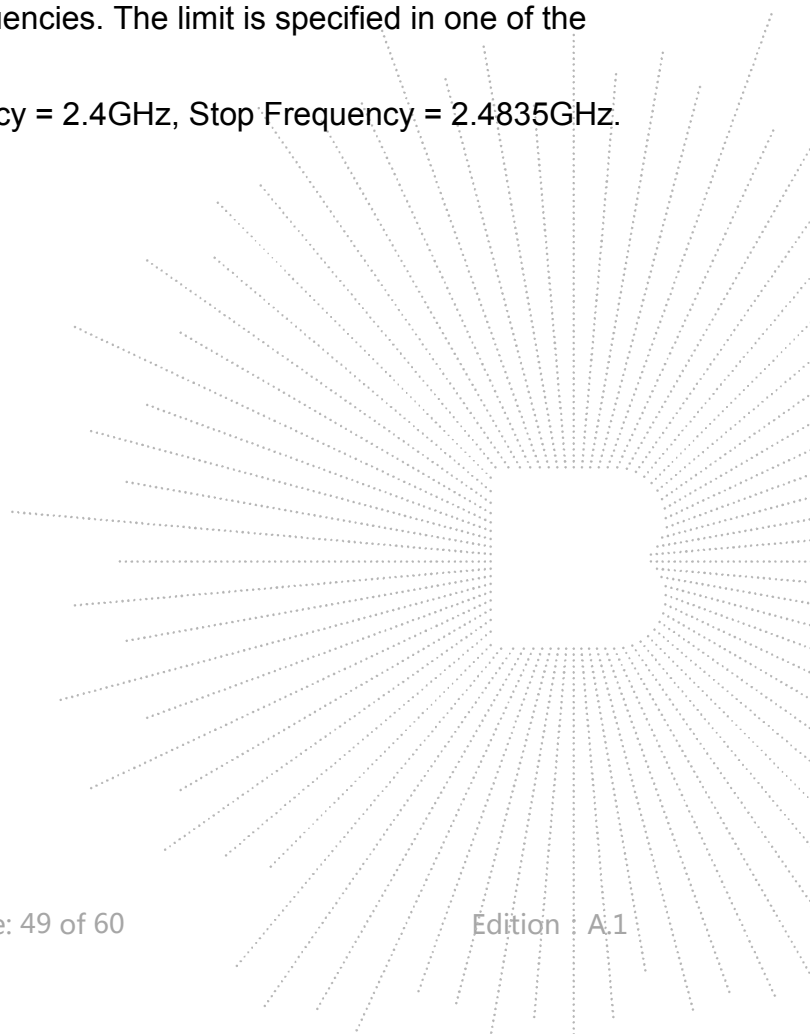


#### 13.2 Limit

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

#### 13.3 Test procedure

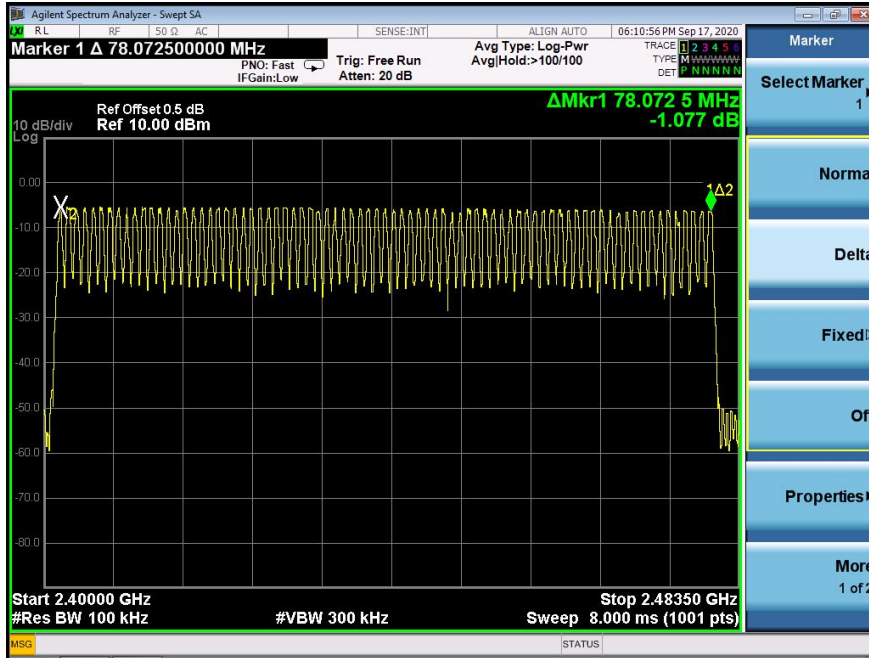
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100kHz. VBW = 300kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to 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;



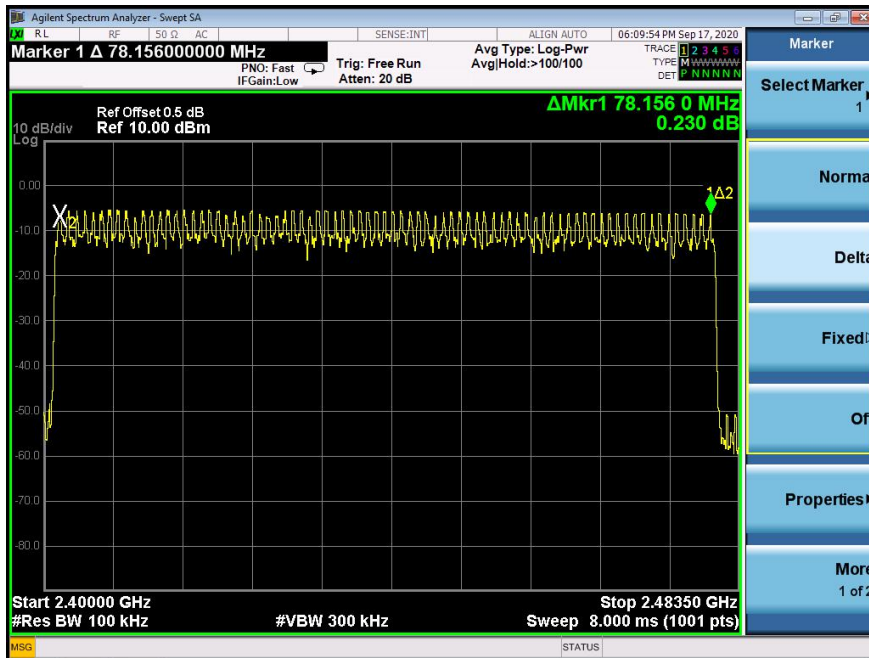
13.4 Test Result

**Test Plots:**

79 Channels in total  
GFSK



Pi/4 DQPSK



## 14. DWELL TIME

### 14.1 Block Diagram Of Test Setup



### 14.2 Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### 14.3 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 spectrum analyzer span = 0. Centred on a hopping channel;
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).

## 14.4 Test Result

DH5 Packet permit maximum 1600 / 79 / 6 hops per second in each channel (5 time slots RX, 1 time slot TX).

DH3 Packet permit maximum 1600 / 79 / 4 hops per second in each channel (3 time slots RX, 1 time slot TX).

DH1 Packet permit maximum 1600 / 79 / 2 hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

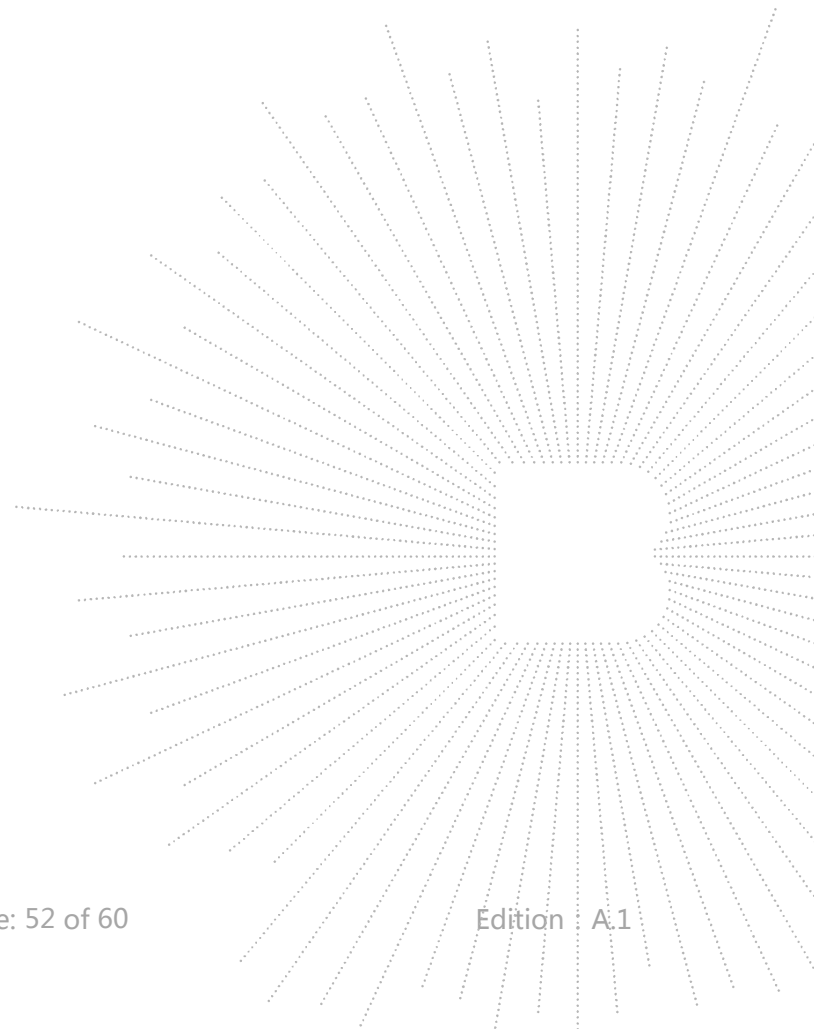
DH5:  $1600/79/6 \times 0.4 \times 79 \times (\text{MkrDelta}) / 1000$

DH3:  $1600/79/4 \times 0.4 \times 79 \times (\text{MkrDelta}) / 1000$

DH1:  $1600/79/2 \times 0.4 \times 79 \times (\text{MkrDelta}) / 1000$

Remark: Mkr Delta is once pulse time.

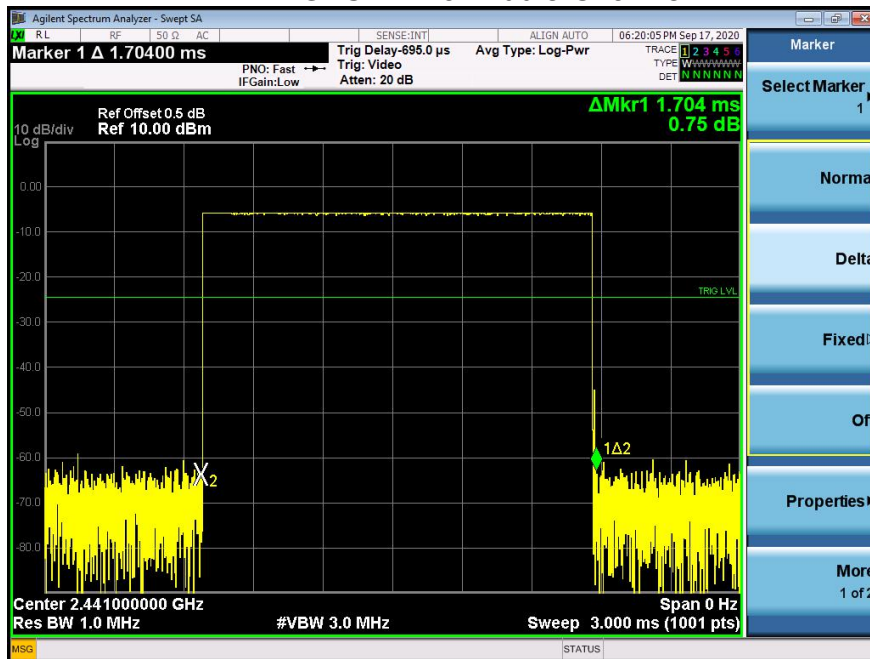
Modulation	Channel Data	Packet	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	Middle	DH1	0.438	0.140	0.4
		DH3	1.704	0.273	0.4
		DH5	2.970	0.317	0.4
Pi/4DQPSK	Middle	2DH1	0.444	0.142	0.4
		2DH3	1.704	0.273	0.4
		2DH5	2.970	0.317	0.4



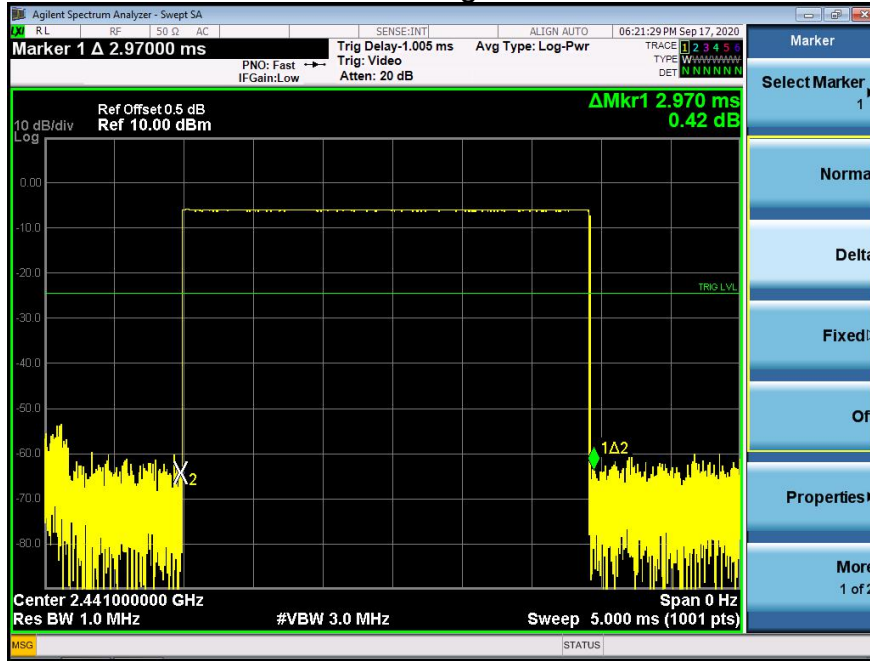
**Test Plots**  
GFSK DH1 Middle Channel



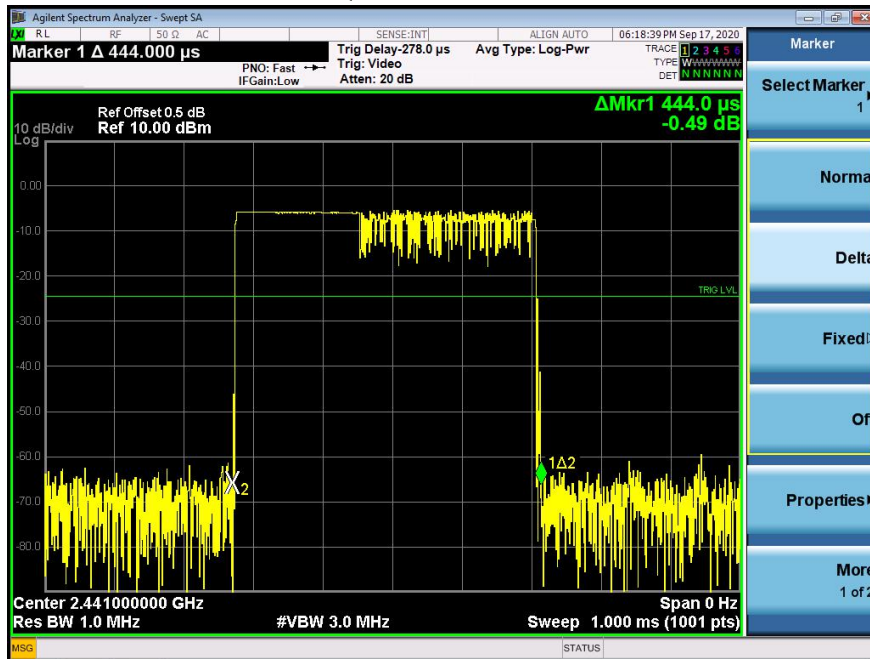
GFSK DH3 Middle Channel



GFSK DH5 High Middle Channel

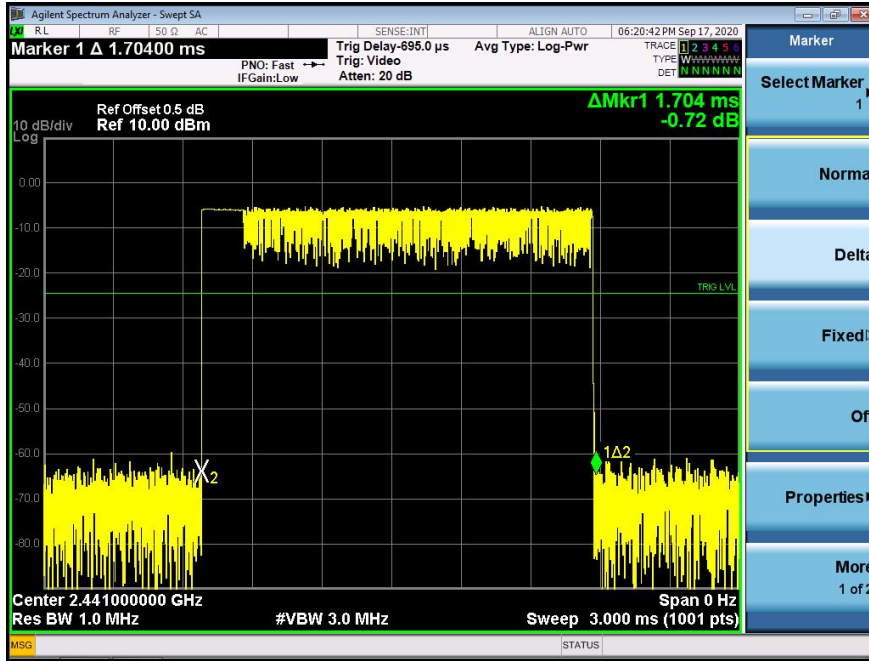


Pi/4DQPSK DH1 Middle Channel

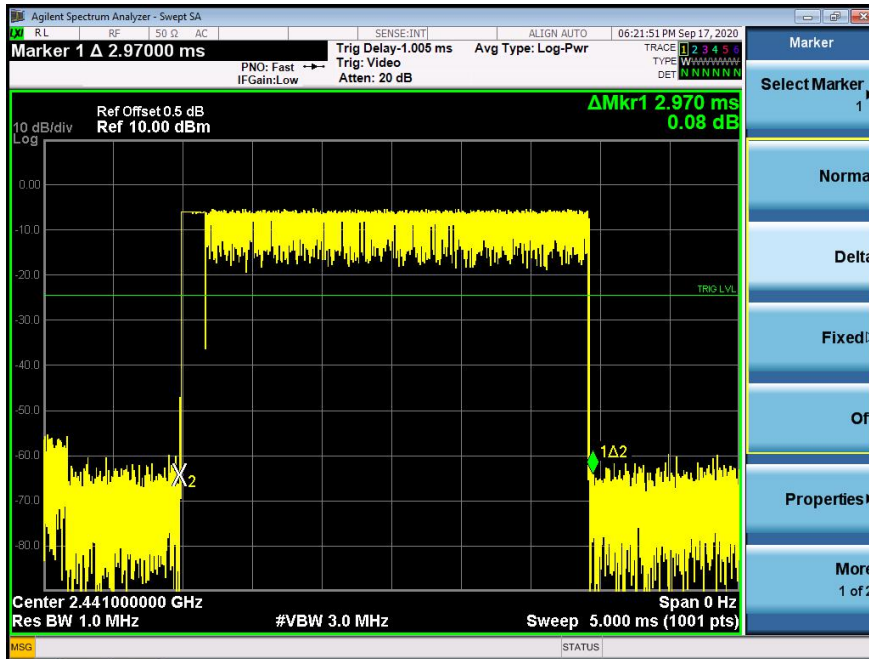




## Pi/4DQPSK DH3 Middle Channel



## Pi/4DQPSK DH5 Middle Channel



## 15. ANTENNA REQUIREMENT

### 15.1 Limit

15.203 requirement: For intentional device, according to 15.203: 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.

### 15.2 Test Result

The EUT antenna is Chip antenna, fulfill the requirement of this section.

