

## Appendix A

### RF Test Data for BT V5.0(DSS) (Conducted Measurement)

Product Name: Wireless Sport Earbuds

Trade Mark: N/A

Test Model: X181

#### Environmental Conditions

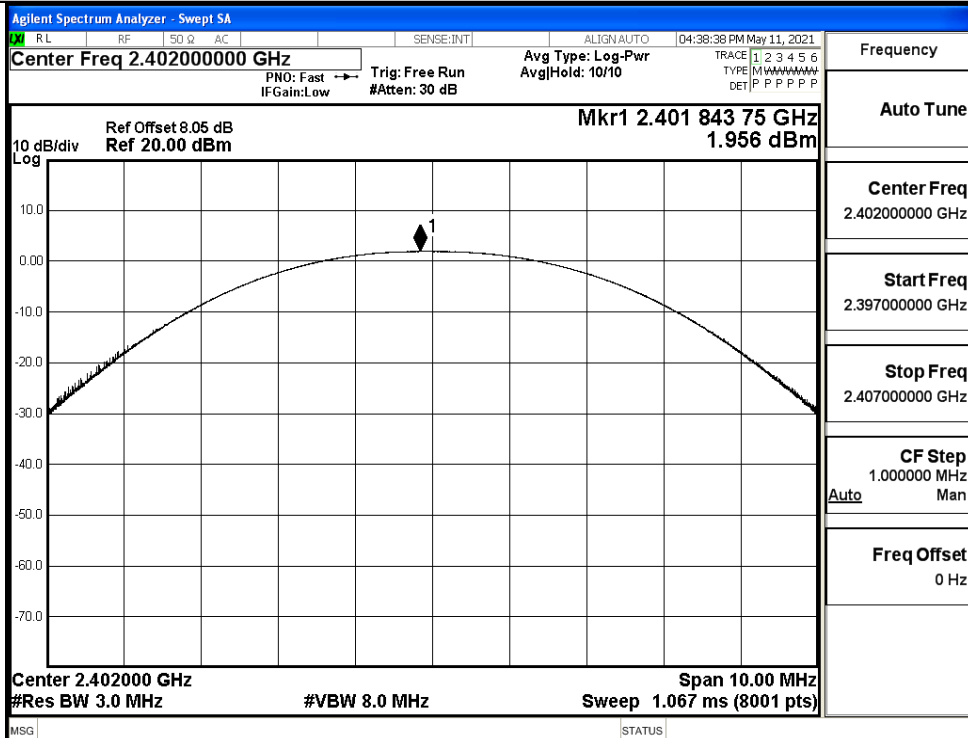
|                    |           |
|--------------------|-----------|
| Temperature:       | 24.6 ° C  |
| Relative Humidity: | 54.1%     |
| ATM Pressure:      | 100.0 kPa |
| Test Engineer:     | Jay Li    |
| Supervised by:     | Li Huan   |

#### A.1 Maximum Conducted Peak Output Power

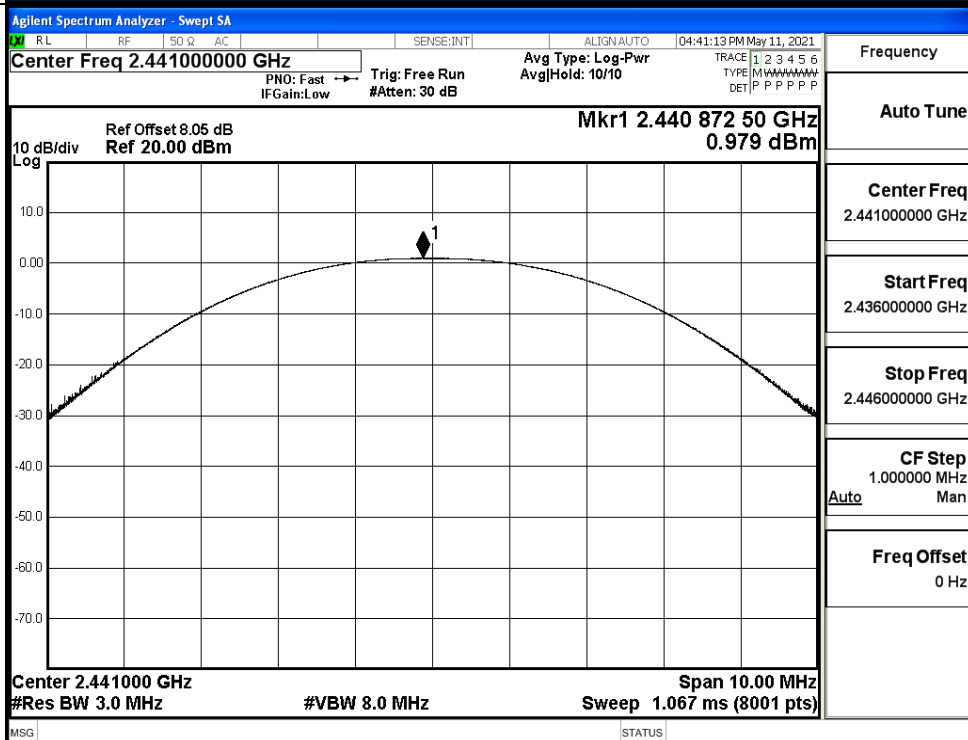
| Mode          | Channel. | Maximum Peak Output Power [dBm] | Limit [dBm] | Verdict |
|---------------|----------|---------------------------------|-------------|---------|
| GFSK          | LCH      | 1.956                           | 21          | PASS    |
|               | MCH      | 0.979                           | 21          | PASS    |
|               | HCH      | -0.218                          | 21          | PASS    |
| $\pi/4$ DQPSK | LCH      | 4.156                           | 21          | PASS    |
|               | MCH      | 3.296                           | 21          | PASS    |
|               | HCH      | 2.051                           | 21          | PASS    |
| 8DPSK         | LCH      | 4.690                           | 21          | PASS    |
|               | MCH      | 3.834                           | 21          | PASS    |
|               | HCH      | 2.589                           | 21          | PASS    |

## Test Graphs

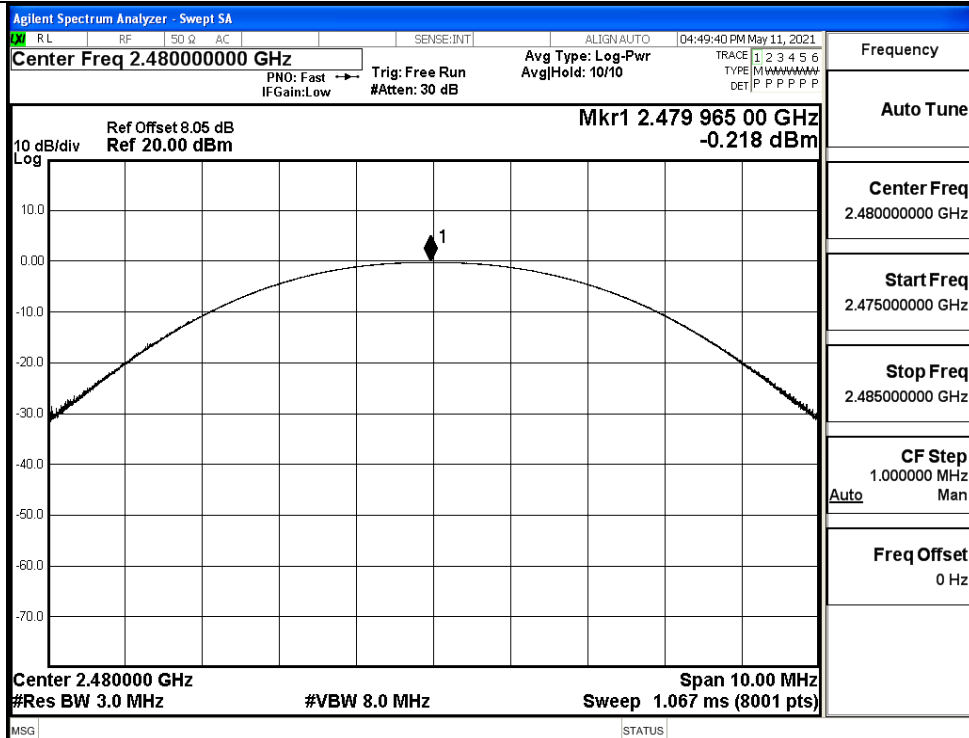
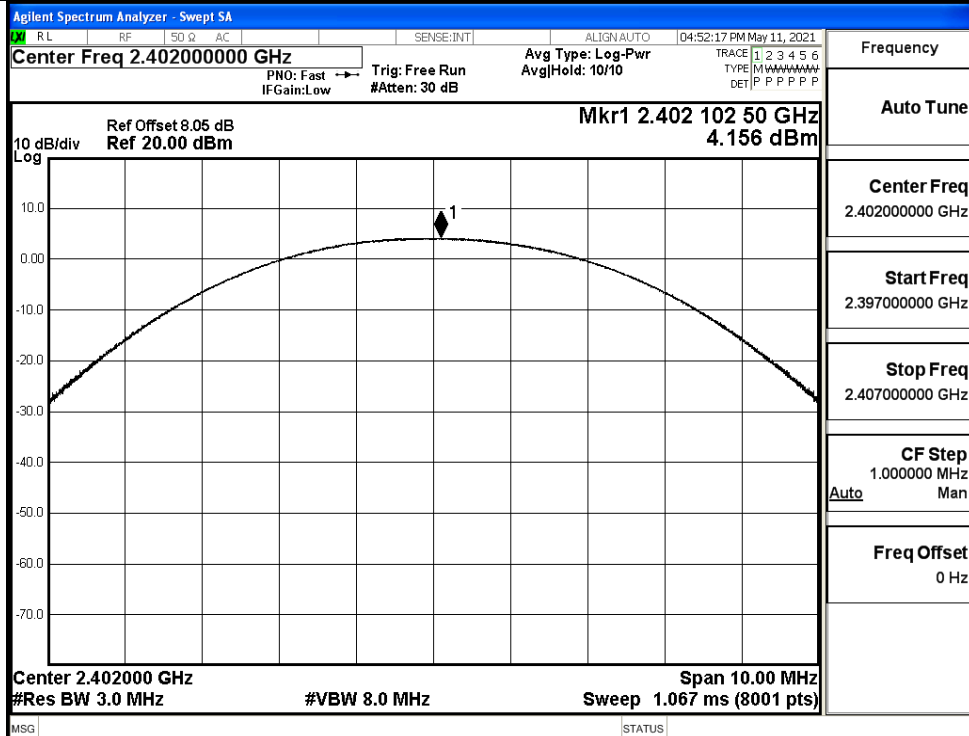
GFSK/LCH

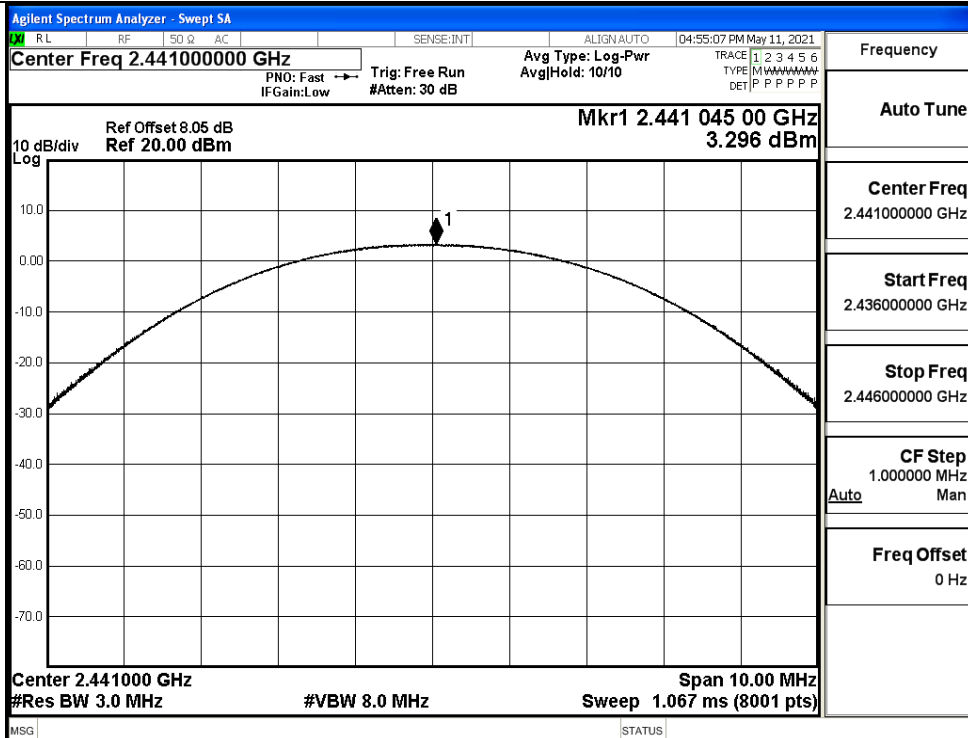
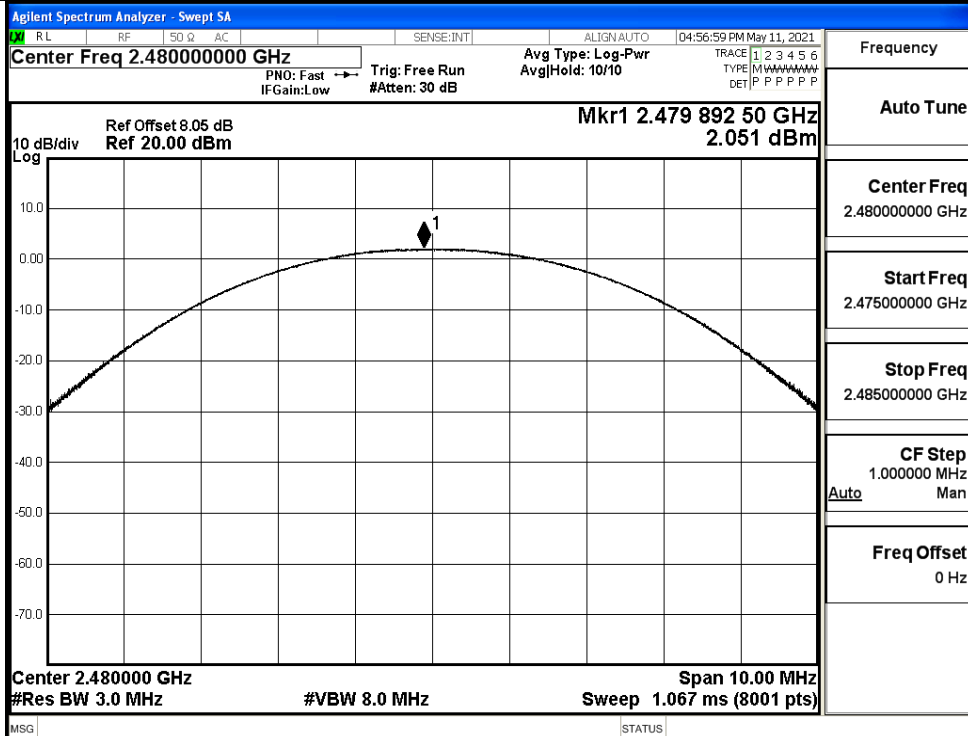


GFSK/MCH

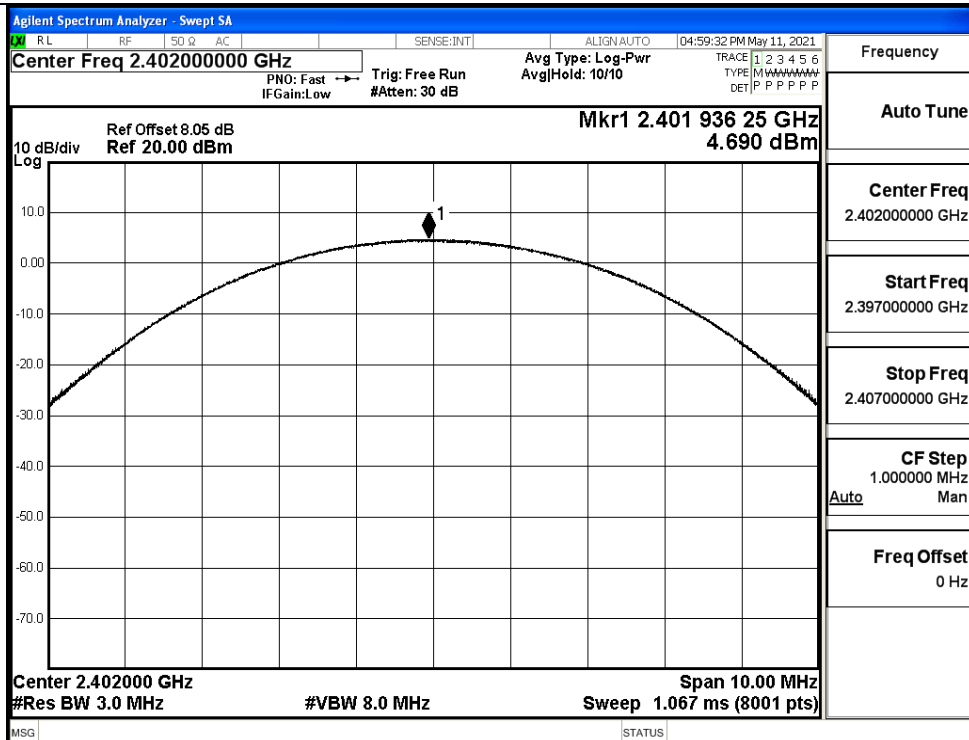


GFSK/HCH

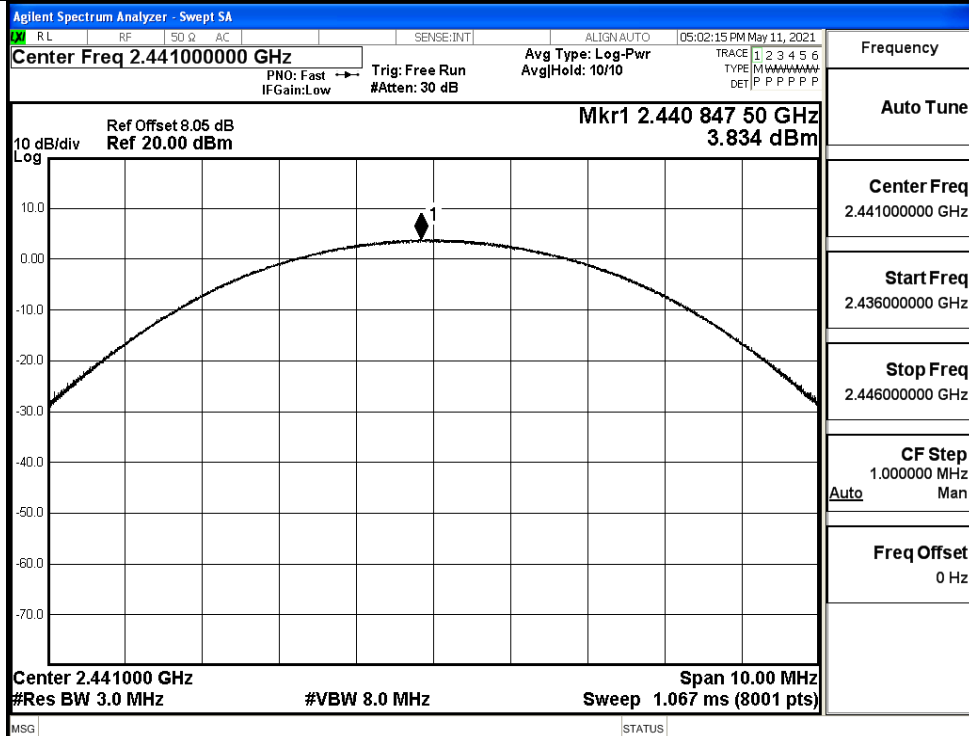
 $\pi/4$ DQPSK/LCH

$\pi$ /4DQPSK/MCH $\pi$ /4DQPSK/HCH

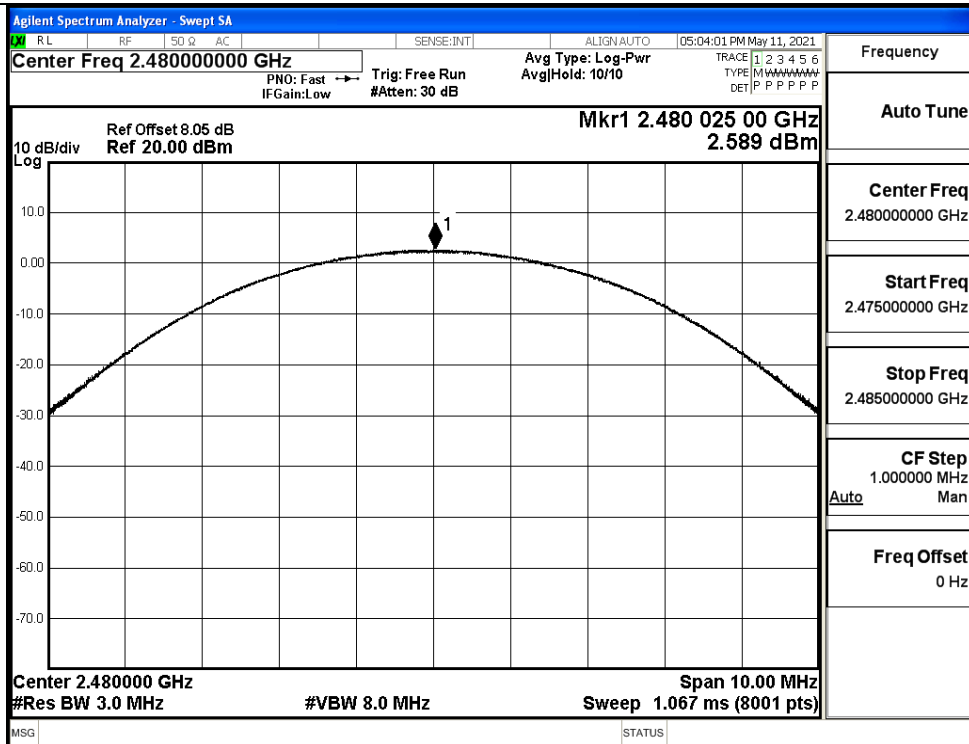
8DPSK/LCH



8DPSK/MCH



8DPSK/HCH

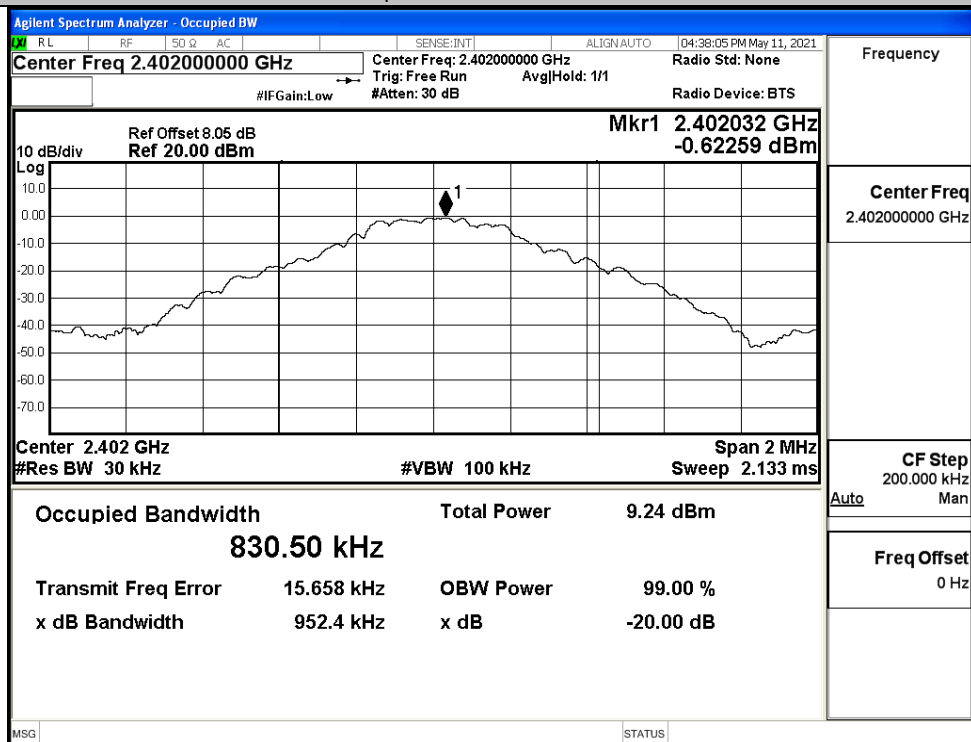


## A.2 20dB Bandwidth

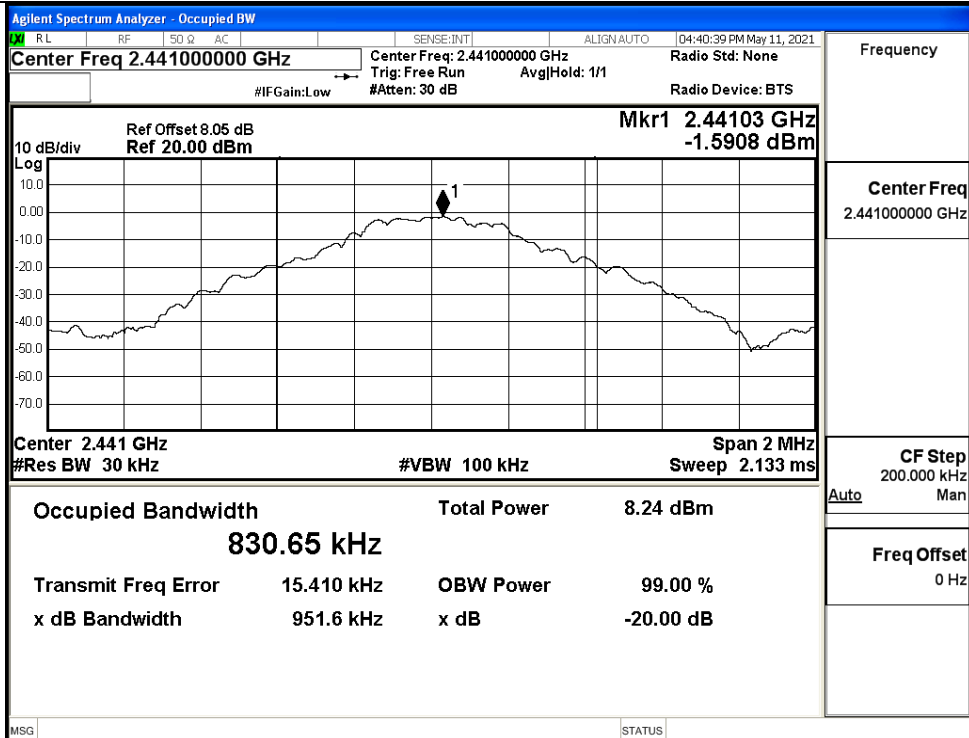
| Mode          | Channel. | 20dB Bandwidth [MHz] | Limit [MHz]   | Verdict |
|---------------|----------|----------------------|---------------|---------|
| GFSK          | LCH      | 0.9524               | Not Specified | PASS    |
|               | MCH      | 0.9516               | Not Specified | PASS    |
|               | HCH      | 0.9505               | Not Specified | PASS    |
| $\pi/4$ DQPSK | LCH      | 1.332                | Not Specified | PASS    |
|               | MCH      | 1.332                | Not Specified | PASS    |
|               | HCH      | 1.334                | Not Specified | PASS    |
| 8DPSK         | LCH      | 1.309                | Not Specified | PASS    |
|               | MCH      | 1.308                | Not Specified | PASS    |
|               | HCH      | 1.308                | Not Specified | PASS    |

## Test Graphs

GFSK/LCH



GFSK/MCH



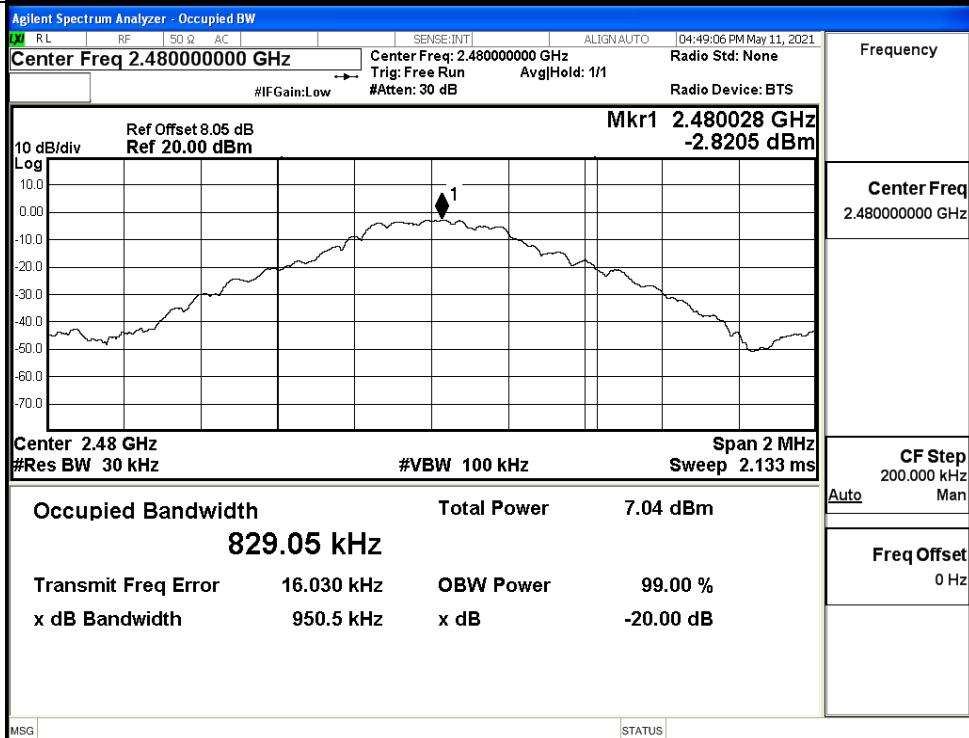
Frequency

Center Freq  
2.441000000 GHzCF Step  
200.000 kHz  
Man

Auto

Freq Offset  
0 Hz

GFSK/HCH



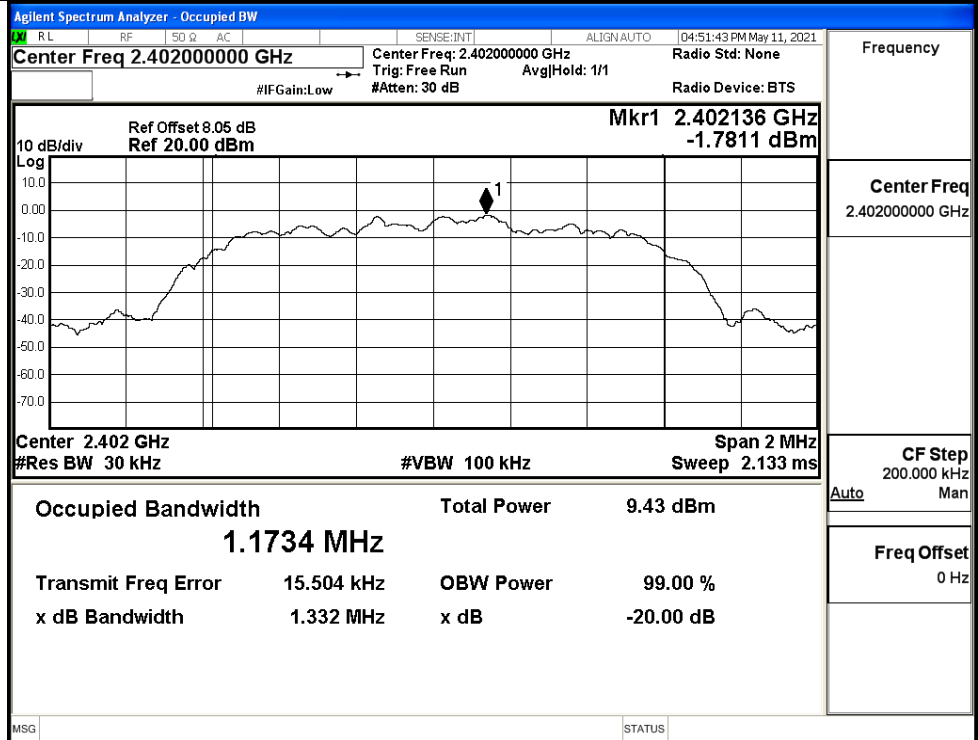
Frequency

Center Freq  
2.480000000 GHzCF Step  
200.000 kHz  
Man

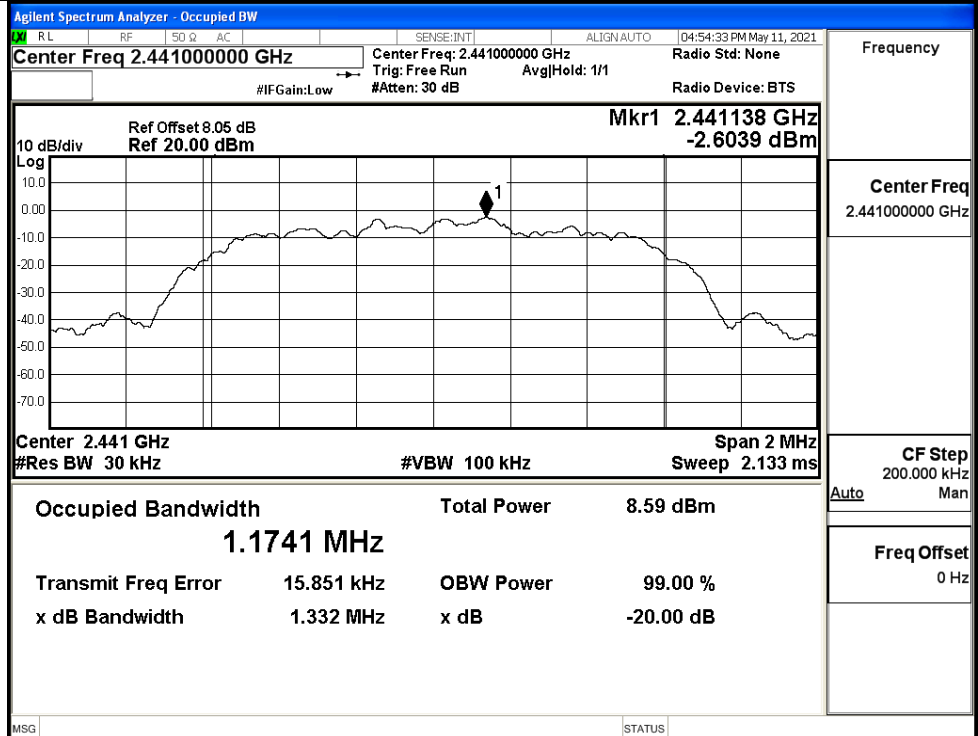
Auto

Freq Offset  
0 Hz



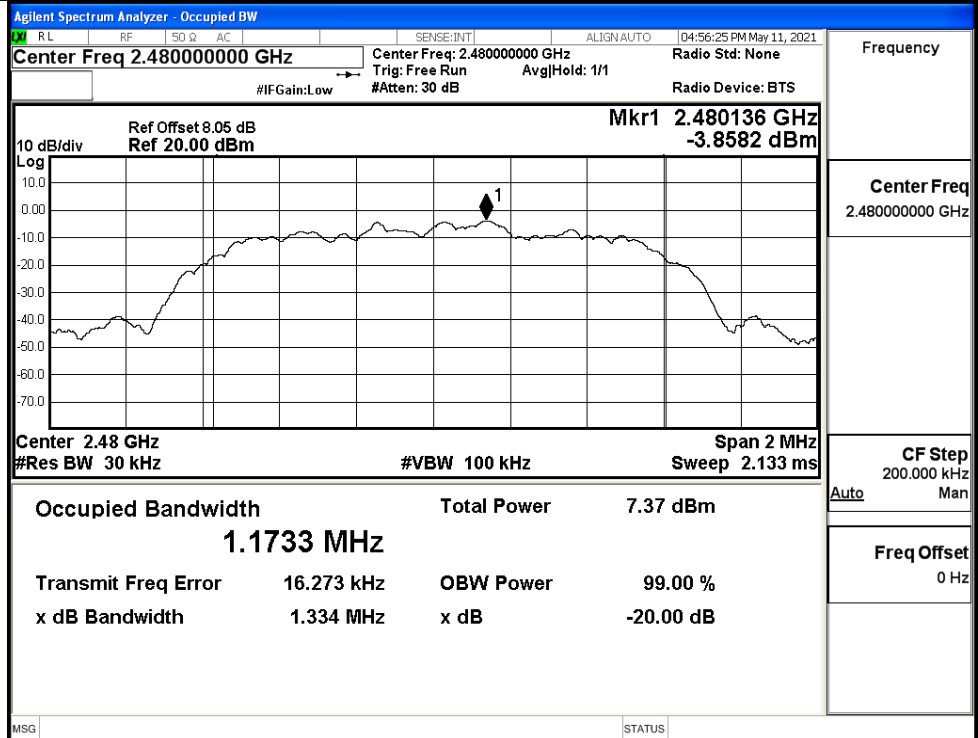
$\pi/4$ DQPSK/LCH

Frequency

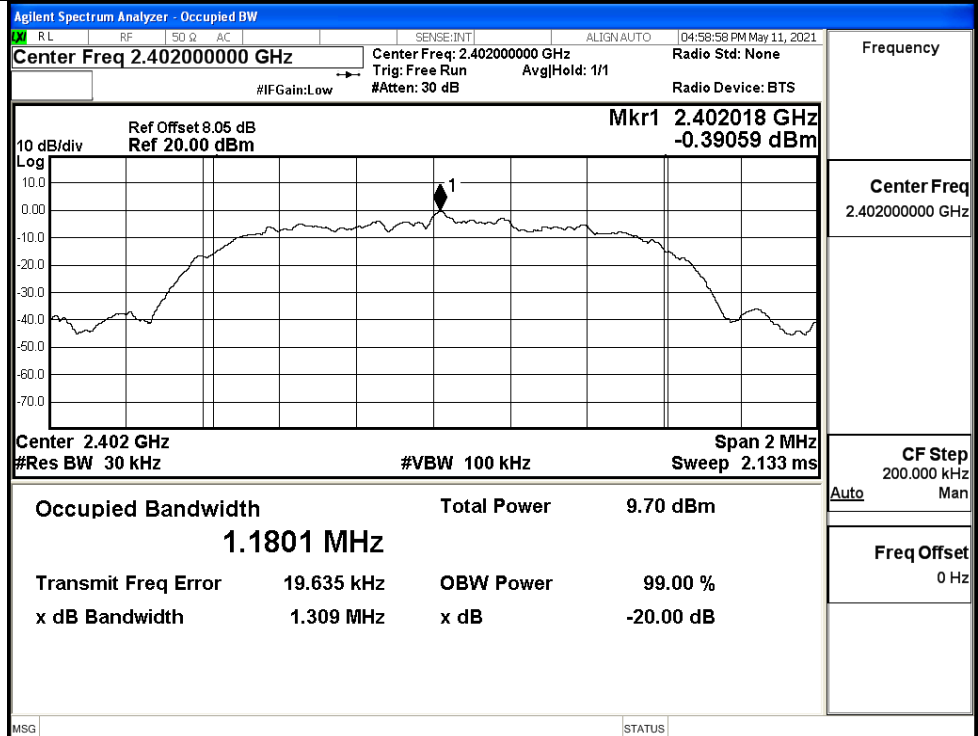
Center Freq  
2.40200000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz $\pi/4$ DQPSK/MCH

Frequency

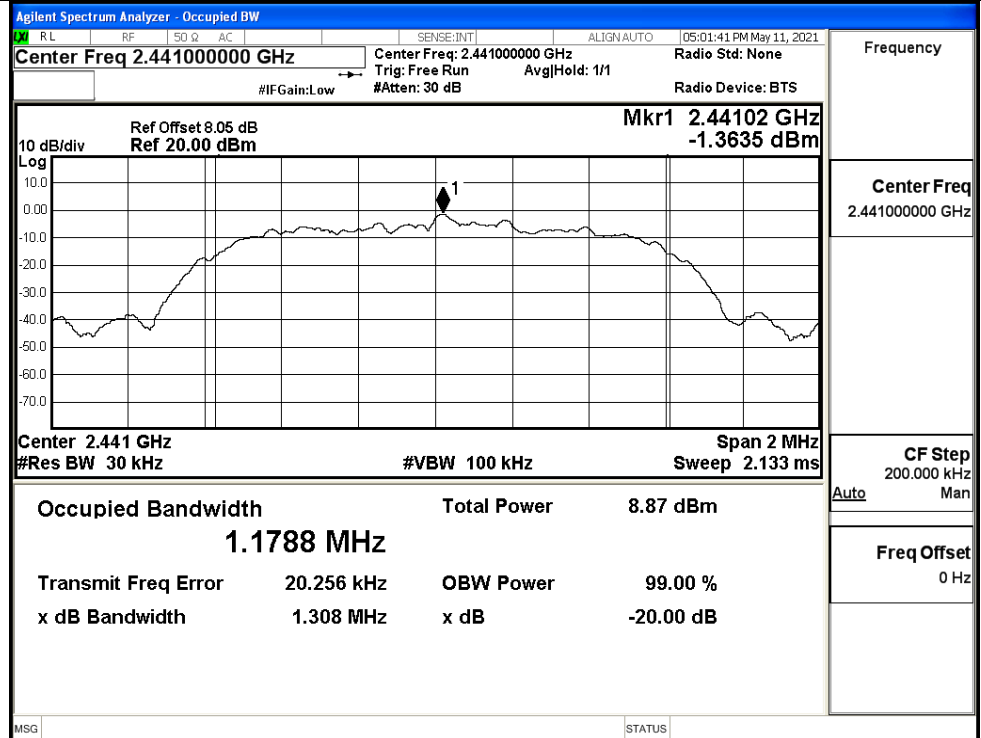
Center Freq  
2.44100000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

$\pi/4$ DQPSK/HCH

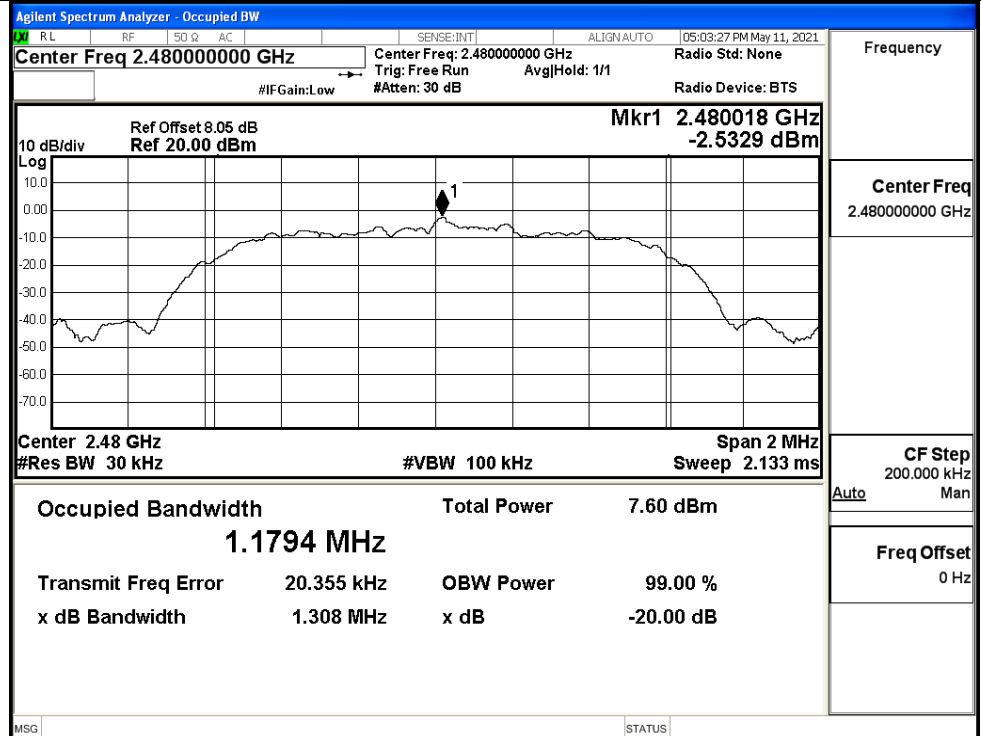
8DPSK/LCH



8DPSK/MCH



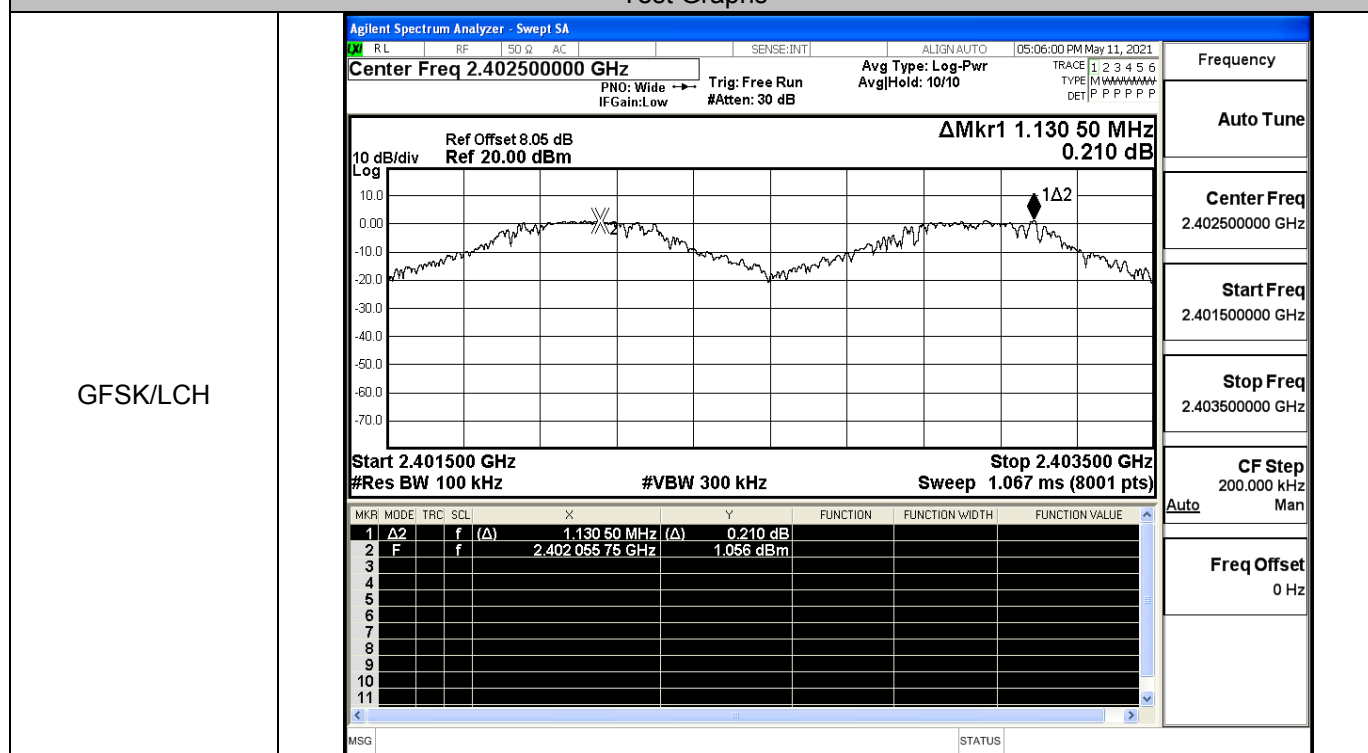
8DPSK/HCH



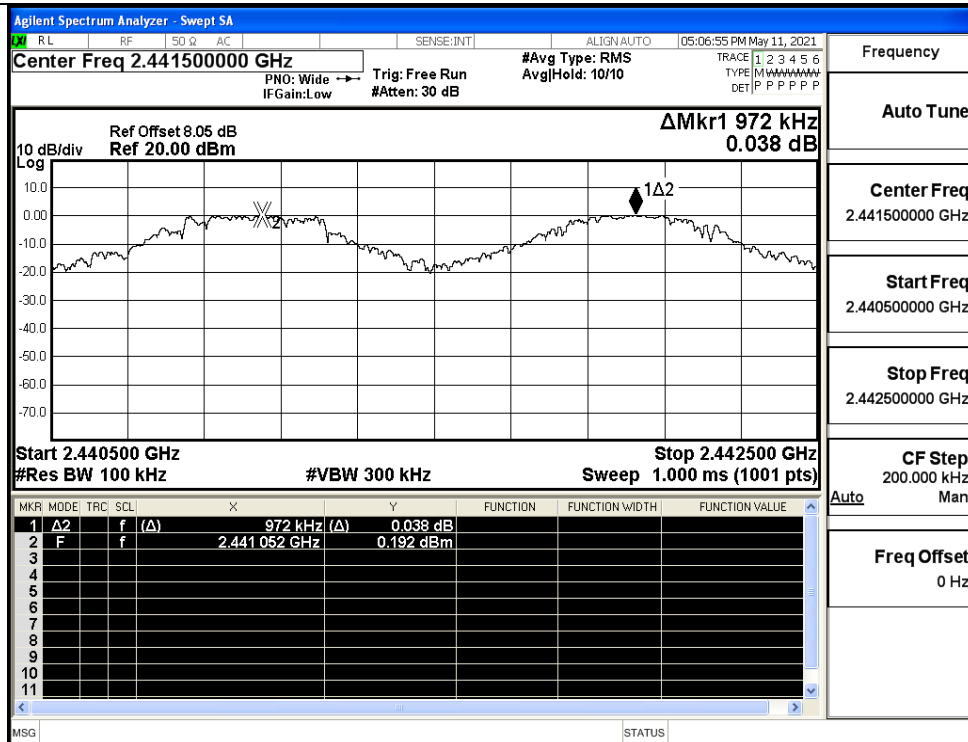
### A.3 Carrier Frequency Separation

| Mode          | Channel. | Carrier Frequency Separation [MHz] | Limit [MHz] | Verdict |
|---------------|----------|------------------------------------|-------------|---------|
| GFSK          | LCH      | 1.131                              | 0.635       | PASS    |
|               | MCH      | 0.972                              | 0.635       | PASS    |
|               | HCH      | 0.672                              | 0.635       | PASS    |
| $\pi/4$ DQPSK | LCH      | 1.096                              | 0.889       | PASS    |
|               | MCH      | 1.294                              | 0.889       | PASS    |
|               | HCH      | 1.106                              | 0.889       | PASS    |
| 8DPSK         | LCH      | 1.082                              | 0.873       | PASS    |
|               | MCH      | 0.910                              | 0.873       | PASS    |
|               | HCH      | 1.008                              | 0.873       | PASS    |

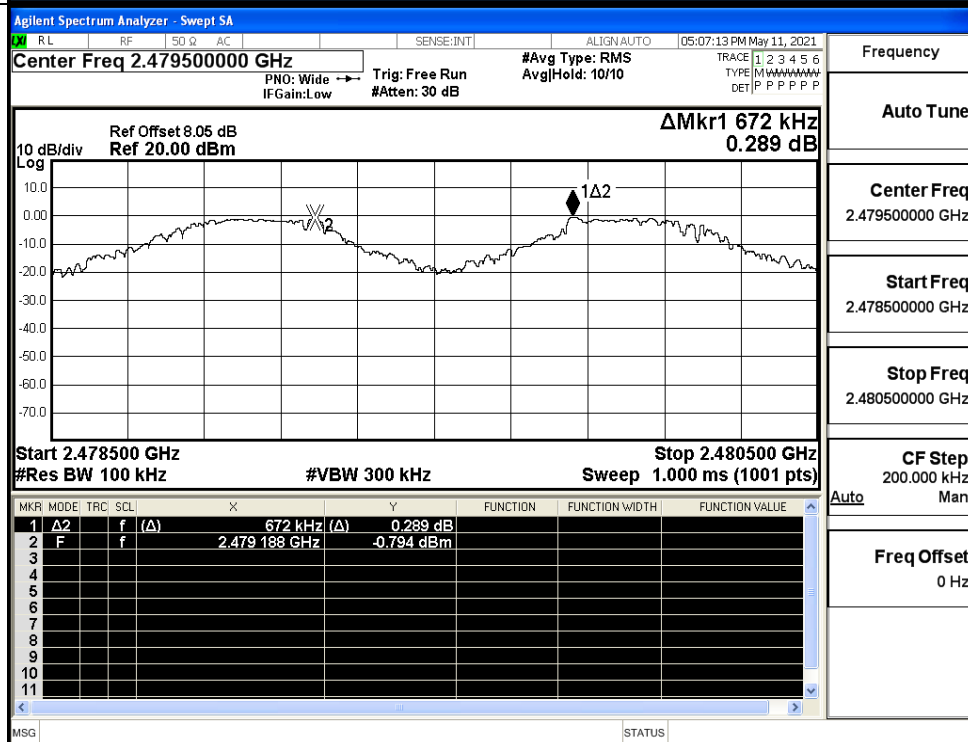
#### Test Graphs

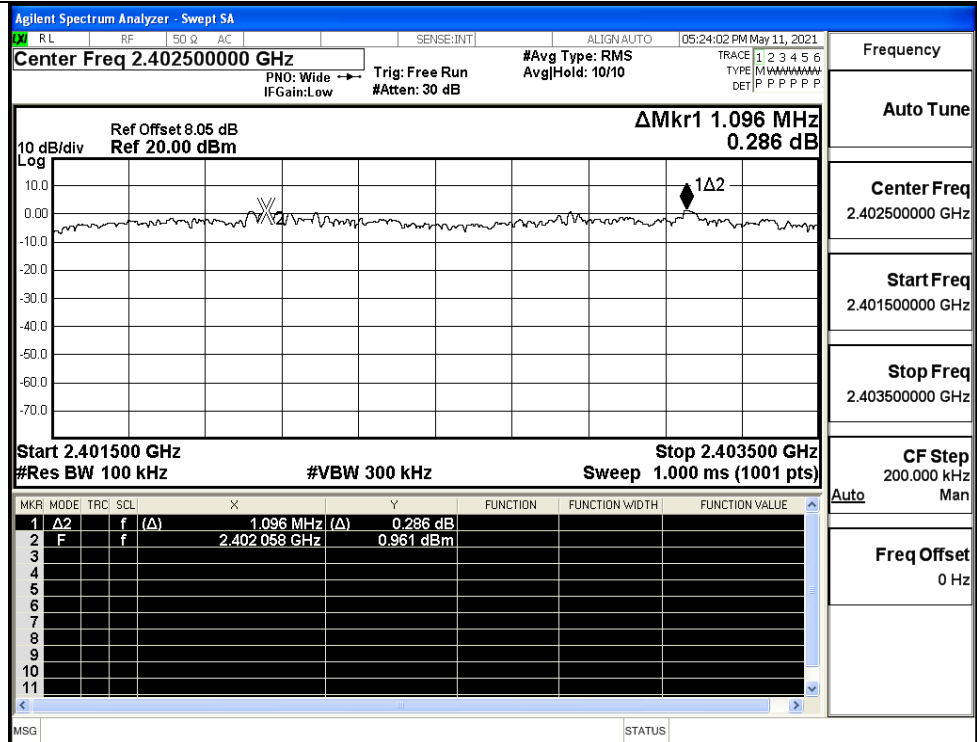
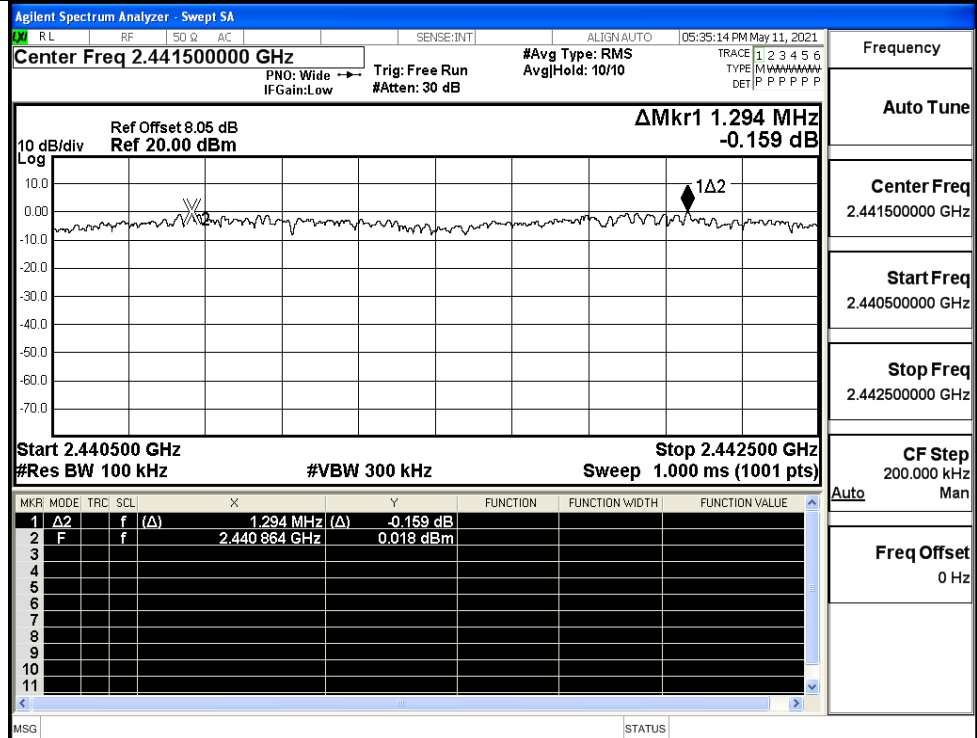


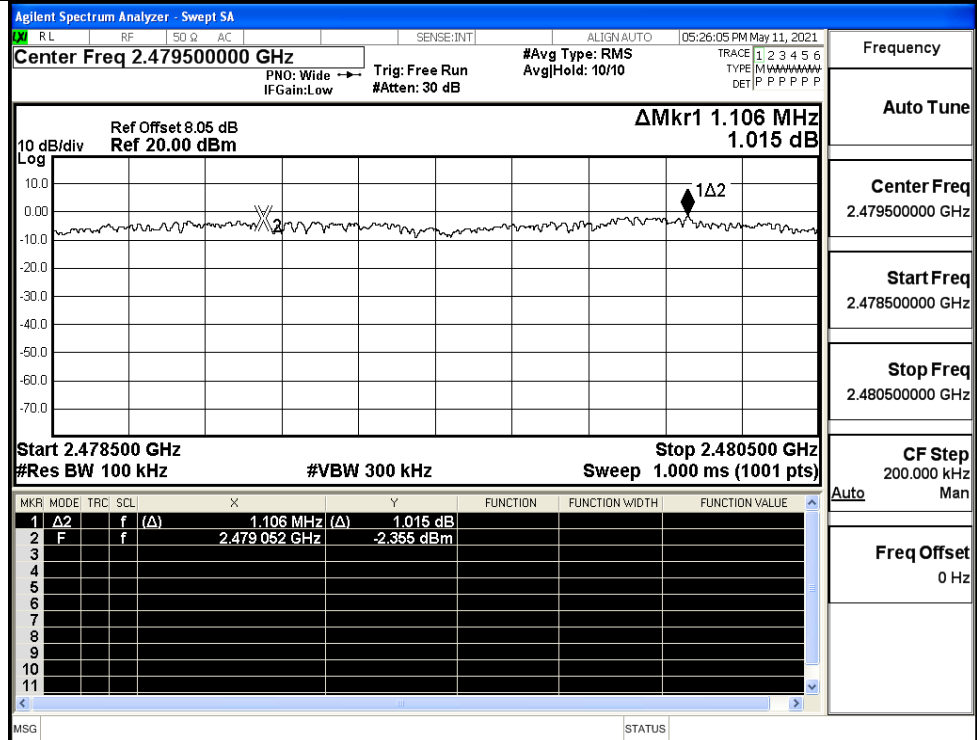
GFSK/MCH



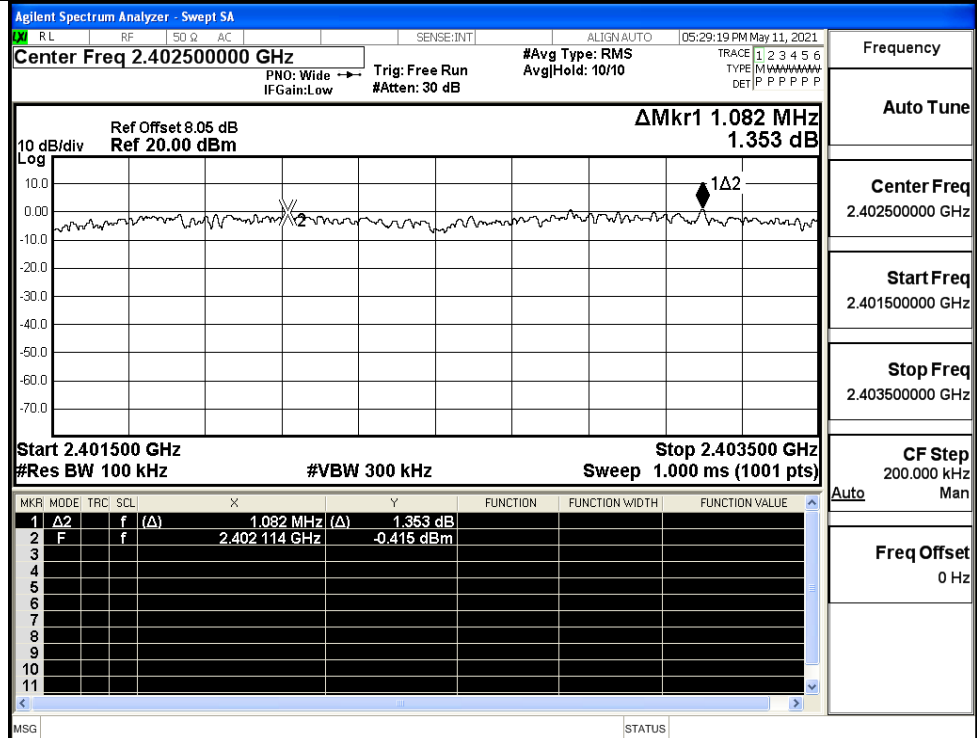
GFSK/HCH



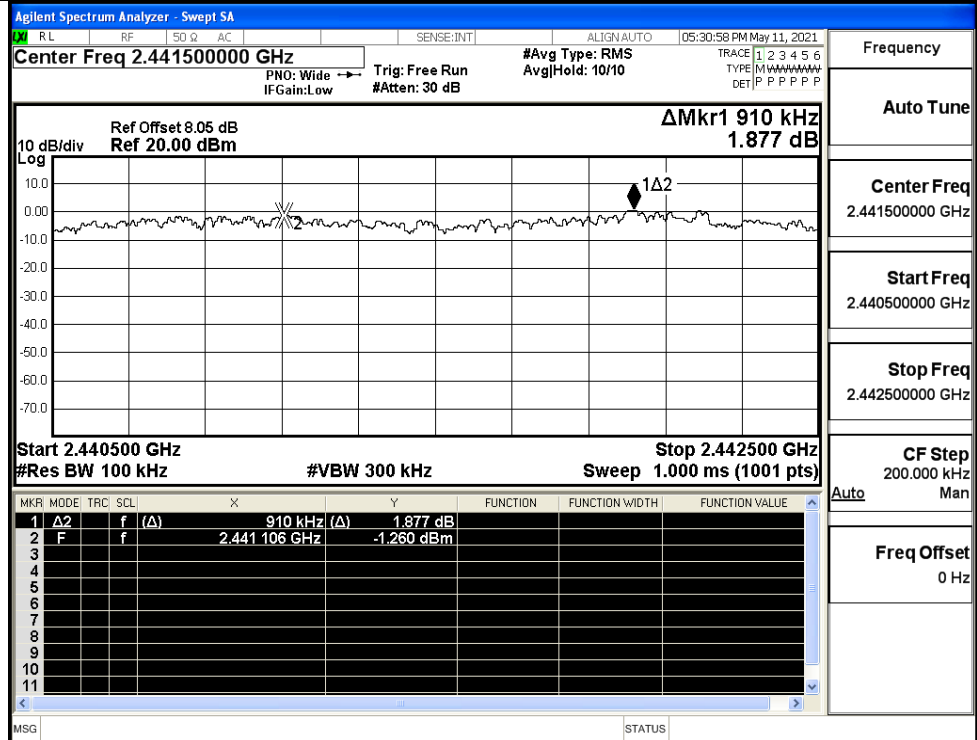
$\pi$ /4DQPSK/LCH $\pi$ /4DQPSK/MCH

$\pi/4$ DQPSK/HCH

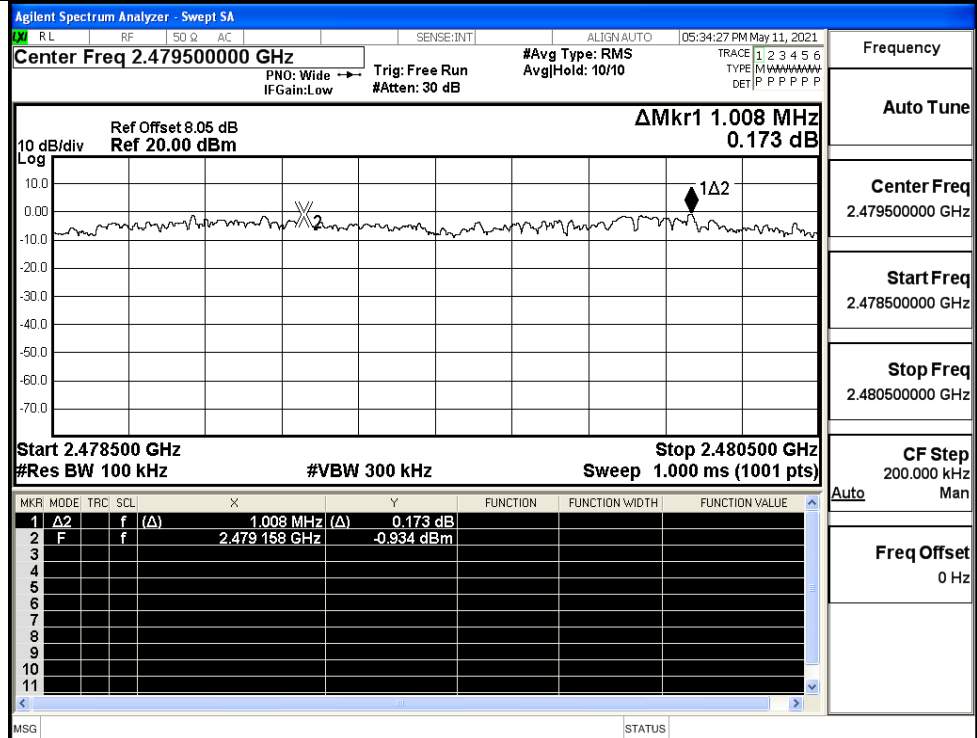
8DPSK/LCH



8DPSK/MCH



8DPSK/HCH



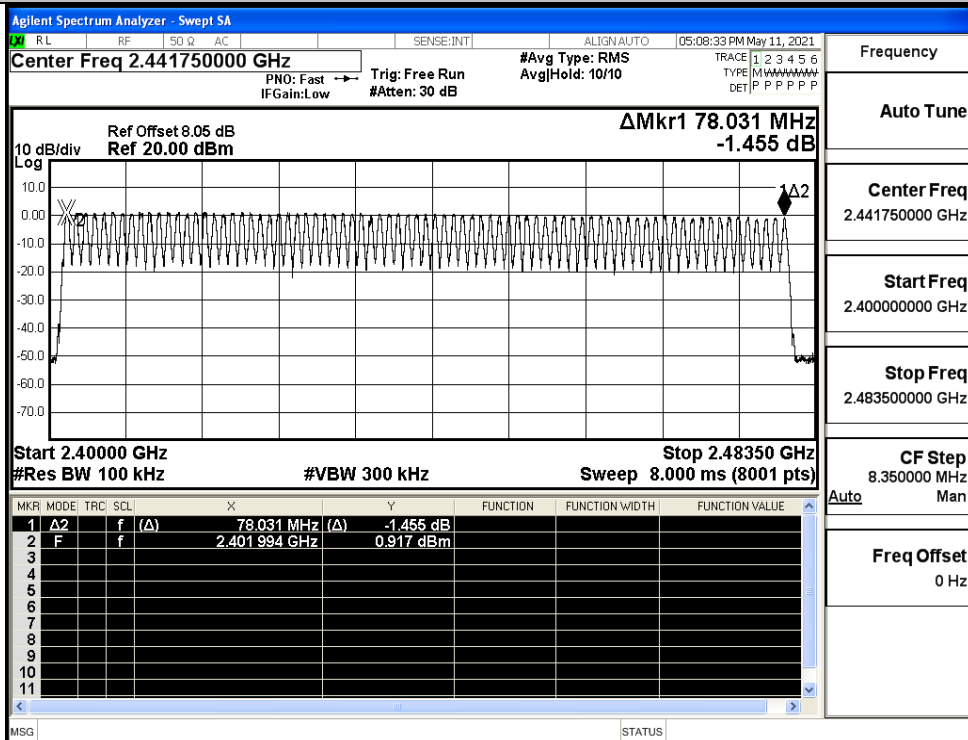


## A.4 Hopping Channel Number

| Mode          | Channel. | Number of Hopping Channel [N] | Limit [N] | Verdict |
|---------------|----------|-------------------------------|-----------|---------|
| GFSK          | Hop      | 79                            | >=15      | PASS    |
| $\pi/4$ DQPSK | Hop      | 79                            | >=15      | PASS    |
| 8DPSK         | Hop      | 79                            | >=15      | PASS    |

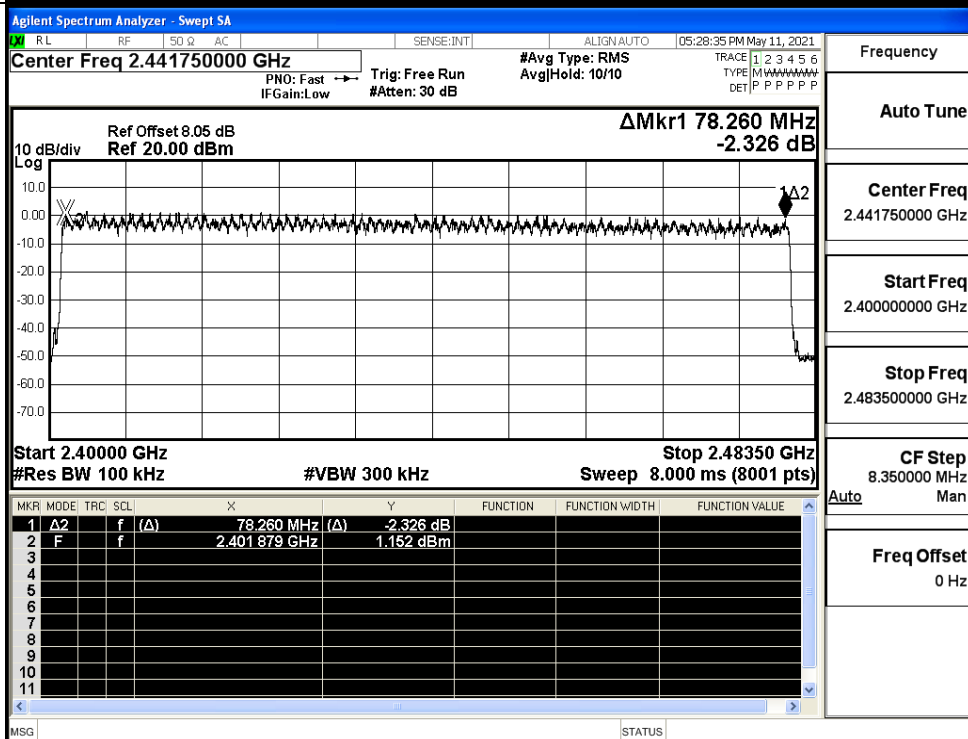
## Test Graphs

GFSK/Hop



Frequency

Auto Tune

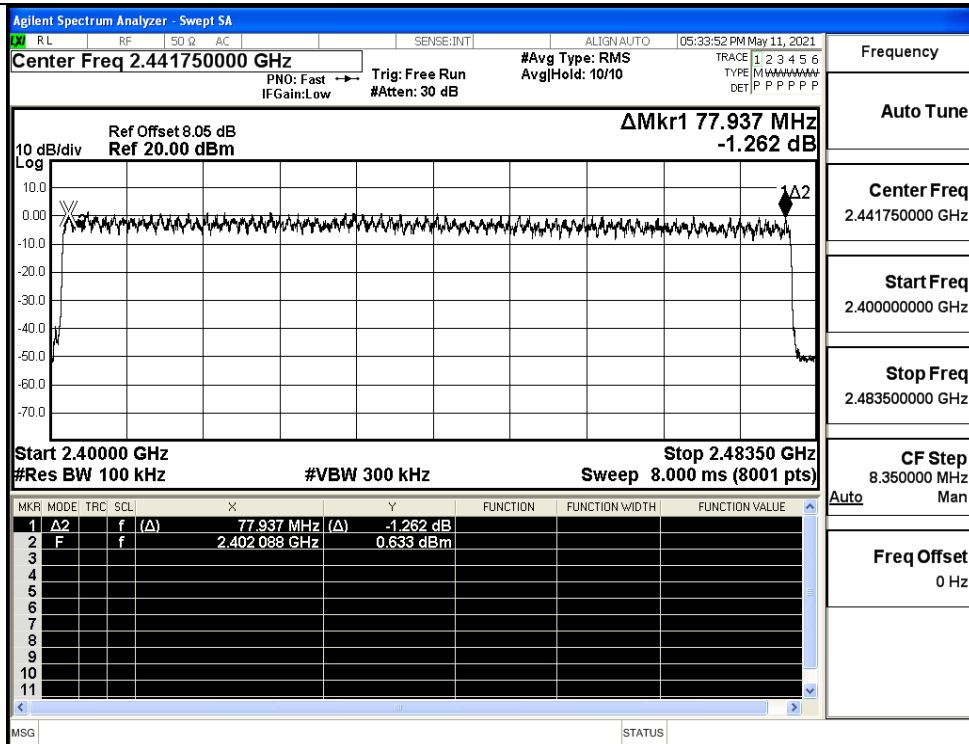
Center Freq  
2.441750000 GHzStart Freq  
2.400000000 GHzStop Freq  
2.483500000 GHzCF Step  
8.350000 MHz  
ManFreq Offset  
0 Hz $\pi/4$ DQPSK/Hop

Frequency

Auto Tune

Center Freq  
2.441750000 GHzStart Freq  
2.400000000 GHzStop Freq  
2.483500000 GHzCF Step  
8.350000 MHz  
ManFreq Offset  
0 Hz

8DPSK/Hop

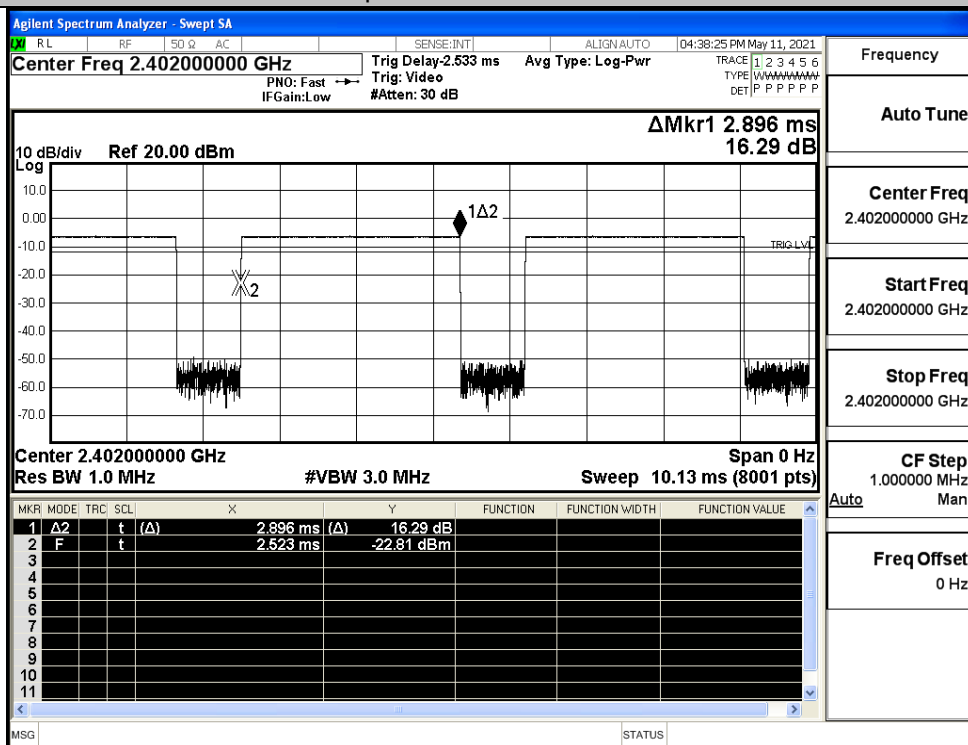


## A.5 Dwell Time

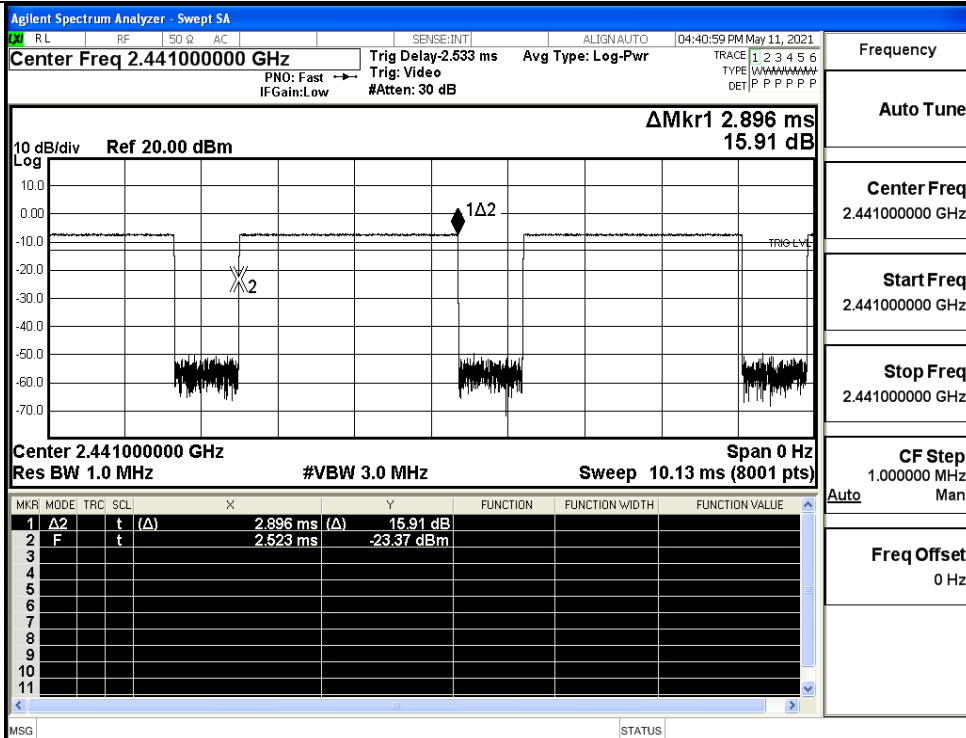
| Mode          | Packet | Channel | Burst Width<br>[ms/hop/ch] | Total<br>Hops[hop*ch] | Dwell Time[s] | Limit [s] | Verdict |
|---------------|--------|---------|----------------------------|-----------------------|---------------|-----------|---------|
| GFSK          | DH5    | LCH     | 2.9                        | 106.7                 | 0.309         | 0.4       | PASS    |
|               | DH5    | MCH     | 2.9                        | 106.7                 | 0.309         | 0.4       | PASS    |
|               | DH5    | HCH     | 2.9                        | 106.7                 | 0.309         | 0.4       | PASS    |
| $\pi/4$ DQPSK | 2DH5   | LCH     | 2.9                        | 106.7                 | 0.309         | 0.4       | PASS    |
|               | 2DH5   | MCH     | 2.9                        | 106.7                 | 0.309         | 0.4       | PASS    |
|               | 2DH5   | HCH     | 2.9                        | 106.7                 | 0.309         | 0.4       | PASS    |
| 8DPSK         | 3DH5   | LCH     | 2.9                        | 106.7                 | 0.309         | 0.4       | PASS    |
|               | 3DH5   | MCH     | 2.9                        | 106.7                 | 0.309         | 0.4       | PASS    |
|               | 3DH5   | HCH     | 2.9                        | 106.7                 | 0.309         | 0.4       | PASS    |

## Test Graphs

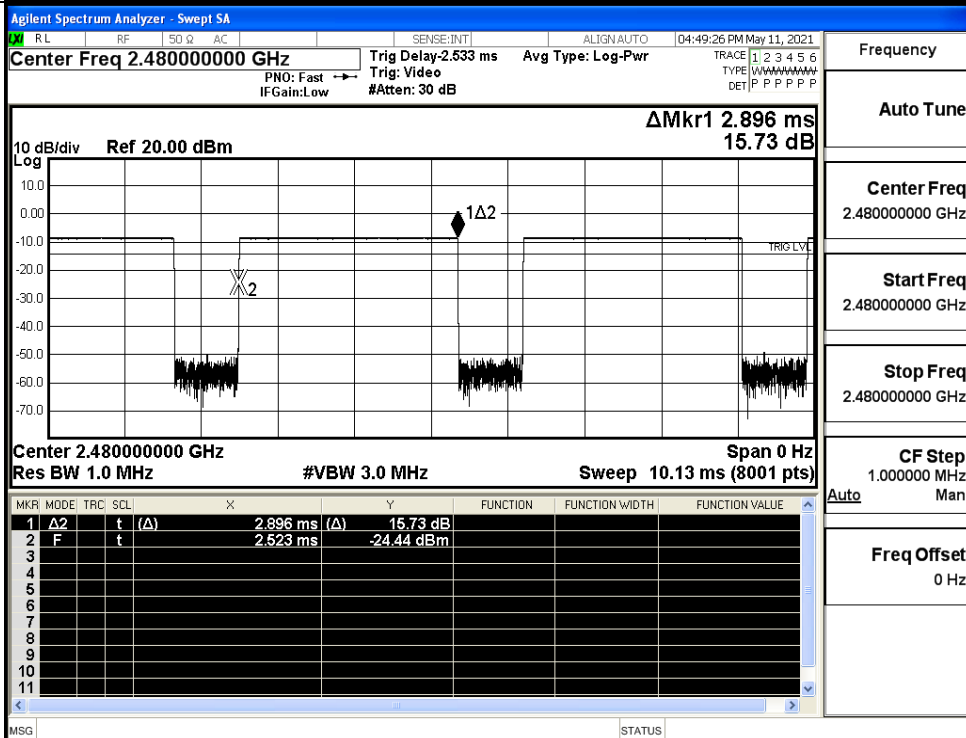
GFSK\_DH5/LCH



GFSK\_DH5/MCH



GFSK\_DH5/HCH



Agilent Spectrum Analyzer - Swept SA

RL RF 50 Q AC SENSE:INT ALIGN:AUTO 04:52:04 PM May 11, 2012

Center Freq 2.402000000 GHz Trig Delay: 2.533 ms Avg Type: Log-Pwr  
 PNO: Fast IF Gain: Low Trig: Video #Atten: 30 dB  
 TRACE 1 2 3 4 5 6  
 TYPE W W W W W W W W  
 DET P P P P P P P P

10 dB/div Ref 20.00 dBm  $\Delta$ Mkr1 2.901 ms 13.66 dB

Center 2.402000000 GHz Span 0 Hz  
 Res BW 1.0 MHz #VBW 3.0 MHz Sweep 10.13 ms (8001 pts)

| MKR | MODE       | TRC | SCL          | X        | Y                     | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |
|-----|------------|-----|--------------|----------|-----------------------|----------|----------------|----------------|
| 1   | $\Delta$ 2 | t   | ( $\Delta$ ) | 2.901 ms | ( $\Delta$ ) 13.66 dB |          |                |                |
| 2   | F          | t   |              | 1.759 ms | -20.49 dBm            |          |                |                |
| 3   |            |     |              |          |                       |          |                |                |
| 4   |            |     |              |          |                       |          |                |                |
| 5   |            |     |              |          |                       |          |                |                |
| 6   |            |     |              |          |                       |          |                |                |
| 7   |            |     |              |          |                       |          |                |                |
| 8   |            |     |              |          |                       |          |                |                |
| 9   |            |     |              |          |                       |          |                |                |
| 10  |            |     |              |          |                       |          |                |                |
| 11  |            |     |              |          |                       |          |                |                |

MSG STATUS

Frequency Auto Tune Center Freq 2.402000000 GHz Start Freq 2.402000000 GHz Stop Freq 2.402000000 GHz CF Step 1.000000 MHz Man Freq Offset 0 Hz

**Agilent Spectrum Analyzer - Swept SA**

RL RF 50 Q AC SENSE:INT ALIGN AUTO 04:54:54 PM May 11, 2021

**Center Freq 2.441000000 GHz** Trig Delay-2.533 ms Avg Type: Log-Pwr  
 PNO: Fast → Trg: Video TYPE: W W W W W W W W  
 IF Gain: Low #Atten: 30 dB DET: P P P P P P

**Frequency**  
Auto Tune

**ΔMkr1 2.902 ms**  
**15.18 dB**

10 dB/div Ref 20.00 dBm

**Center 2.441000000 GHz** Span 0 Hz  
**Res BW 1.0 MHz** #VBW 3.0 MHz Sweep 10.13 ms (8001 pts)

| MKR | MODE | TRC | SCL | X        | Y            | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |
|-----|------|-----|-----|----------|--------------|----------|----------------|----------------|
| 1   | Δ2   | t   | (Δ) | 2.902 ms | (Δ) 15.18 dB |          |                |                |
| 2   | F    | t   |     | 3.493 ms | -22.90 dBm   |          |                |                |
| 3   |      |     |     |          |              |          |                |                |
| 4   |      |     |     |          |              |          |                |                |
| 5   |      |     |     |          |              |          |                |                |
| 6   |      |     |     |          |              |          |                |                |
| 7   |      |     |     |          |              |          |                |                |
| 8   |      |     |     |          |              |          |                |                |
| 9   |      |     |     |          |              |          |                |                |
| 10  |      |     |     |          |              |          |                |                |
| 11  |      |     |     |          |              |          |                |                |

**Freq Offset**  
0 Hz

[illegible]

|             |                 |
|-------------|-----------------|
| Frequency   |                 |
| Auto Tune   |                 |
| Center Freq | 2.480000000 GHz |
| Start Freq  | 2.480000000 GHz |
| Stop Freq   | 2.480000000 GHz |
| CF Step     | 1.000000 MHz    |
| Auto        | Man             |
| Freq Offset | 0 Hz            |

Agilent Spectrum Analyzer - Swept SA

RL RF 50 Ω AC SENSE:INT ALIGN:AUTO 04:59:18 PM May 11, 2021

**Center Freq 2.40200000 GHz** Trig Delay: 2.533 ms Avg Type: Log-Pwr  
 PNO: Fast → IF Gain: Low Trig: Video #Atten: 30 dB TRACE 1 2 3 4 5 6 TYPE WWWWWW DET PPPPP

10 dB/div Ref 20.00 dBm  $\Delta Mkr1$  2.904 ms 14.39 dB

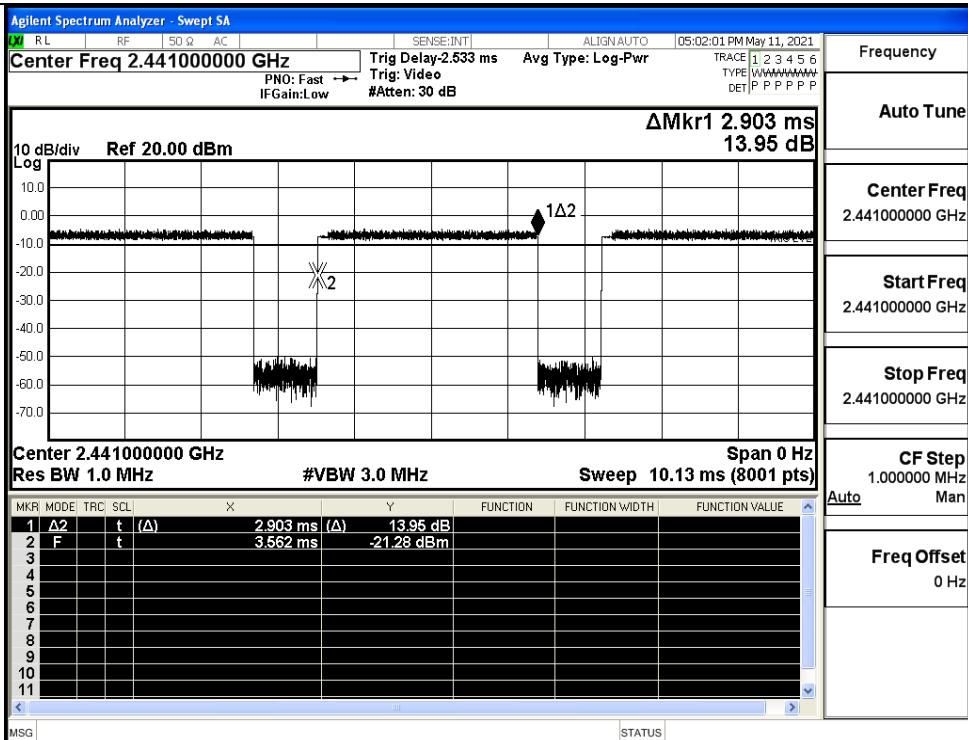
Log

Center 2.40200000 GHz Span 0 Hz  
 Res BW 1.0 MHz #VBW 3.0 MHz Sweep 10.13 ms (8001 pts)

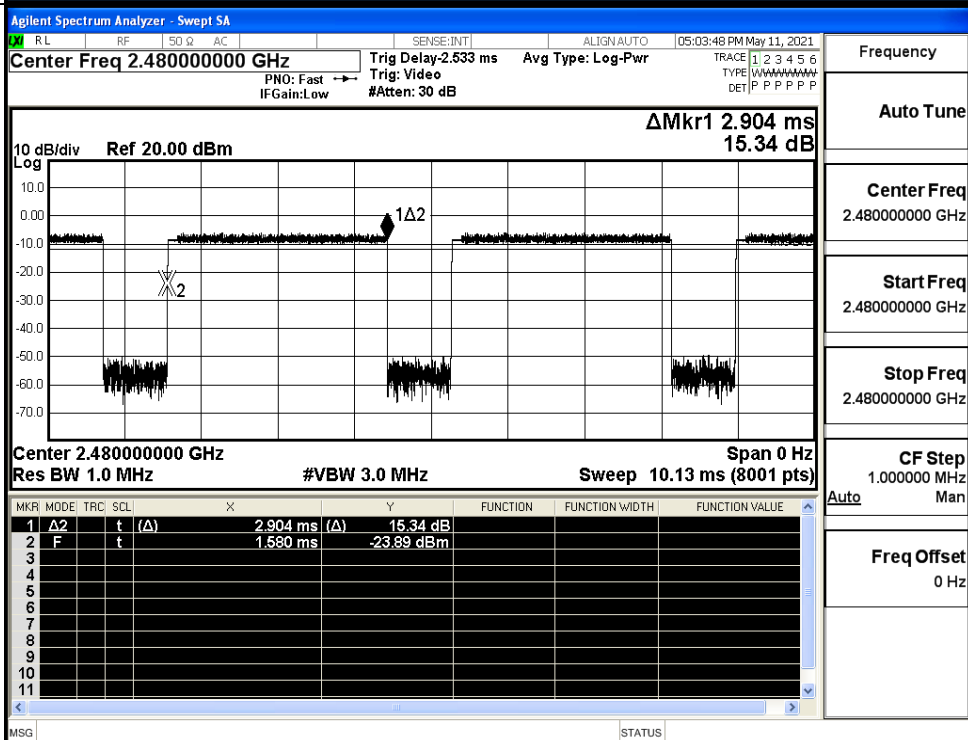
| MKR MODE: | TRC:     | SCL: | X                     | Y                     | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |
|-----------|----------|------|-----------------------|-----------------------|----------|----------------|----------------|
| 1         | $\Delta$ | t    | ( $\Delta$ ) 2.904 ms | ( $\Delta$ ) 14.39 dB |          |                |                |
| 2         | F        | t    | 1.566 ms              | -20.95 dBm            |          |                |                |
| 3         |          |      |                       |                       |          |                |                |
| 4         |          |      |                       |                       |          |                |                |
| 5         |          |      |                       |                       |          |                |                |
| 6         |          |      |                       |                       |          |                |                |
| 7         |          |      |                       |                       |          |                |                |
| 8         |          |      |                       |                       |          |                |                |
| 9         |          |      |                       |                       |          |                |                |
| 10        |          |      |                       |                       |          |                |                |
| 11        |          |      |                       |                       |          |                |                |

|             |                 |
|-------------|-----------------|
| Frequency   |                 |
| Auto Tune   |                 |
| Center Freq | 2.402000000 GHz |
| Start Freq  | 2.402000000 GHz |
| Stop Freq   | 2.402000000 GHz |
| CF Step     | 1.0000000 MHz   |
| Auto        | Man             |
| Freq Offset | 0 Hz            |

8DPSK\_3DH5/MCH



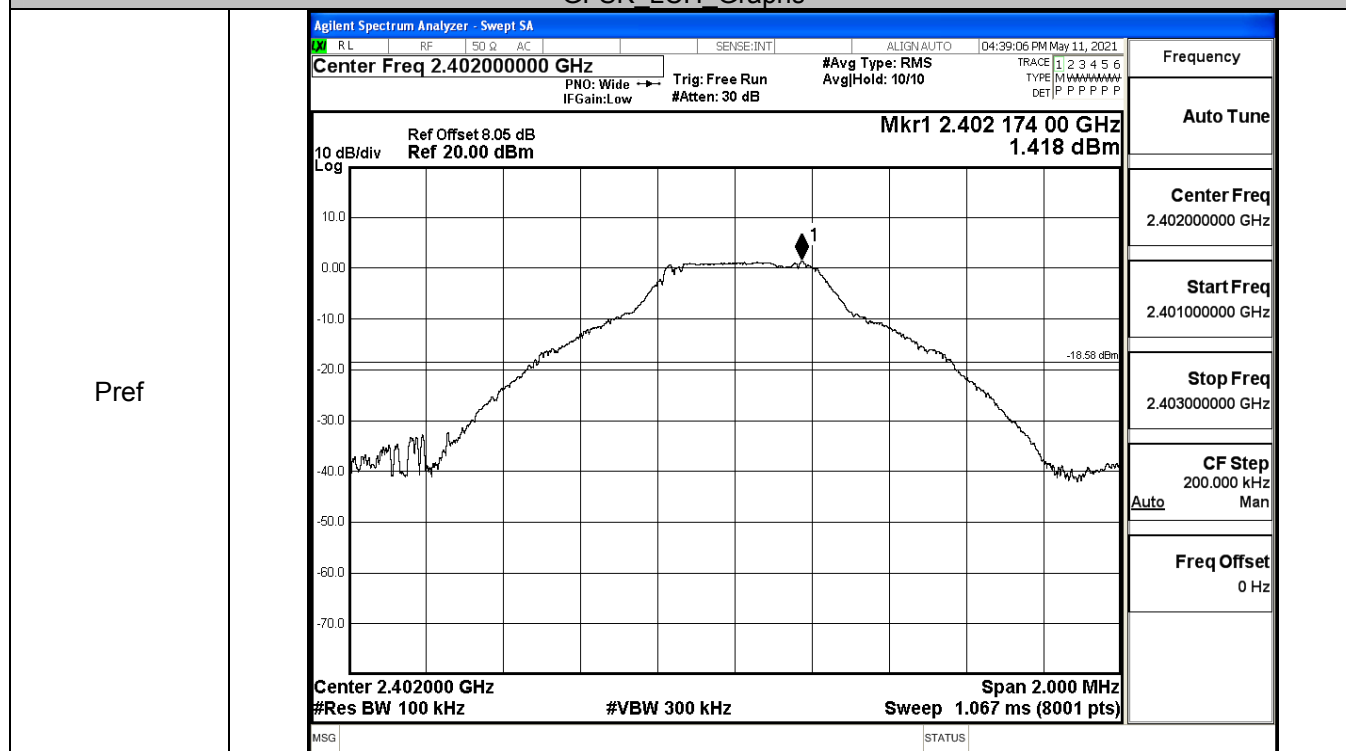
8DPSK\_3DH5/HCH



## A.6 RF Conducted Spurious Emissions

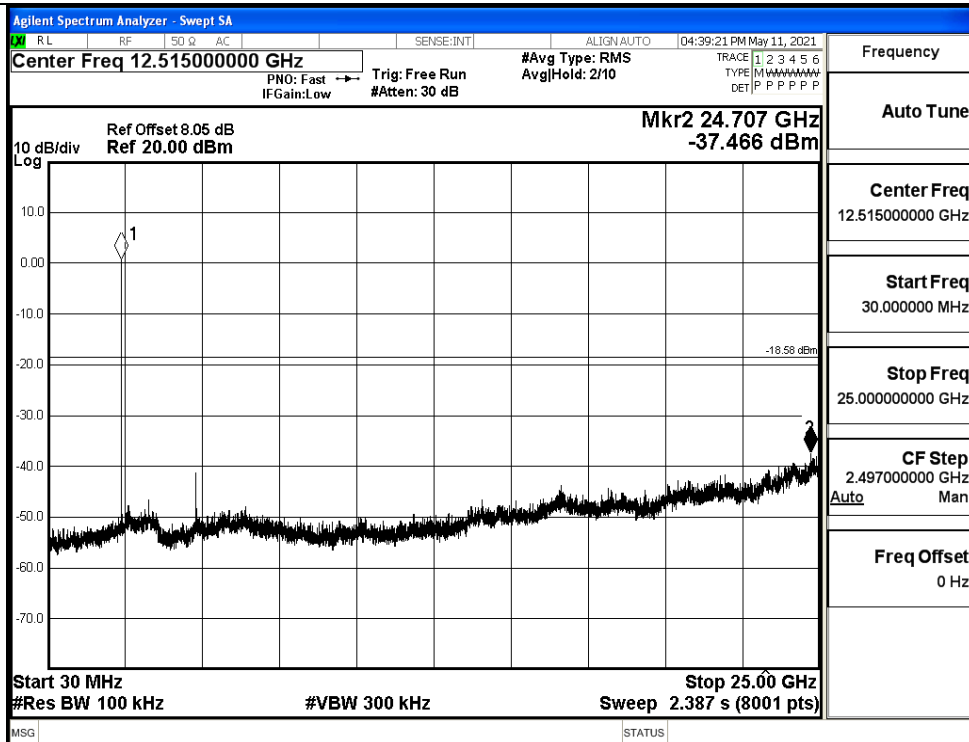
| Mode          | Channel | Pref [dBm] | Max. Level [dBm] | Limit [dBm] | Verdict |
|---------------|---------|------------|------------------|-------------|---------|
| GFSK          | LCH     | 1.418      | -37.466          | -18.582     | PASS    |
|               | MCH     | 0.727      | -37.964          | -19.273     | PASS    |
|               | HCH     | -0.57      | -38.242          | -20.570     | PASS    |
| $\pi/4$ DQPSK | LCH     | 0.864      | -36.348          | -19.136     | PASS    |
|               | MCH     | 0.001      | -37.772          | -19.999     | PASS    |
|               | HCH     | -0.661     | -38.199          | -20.661     | PASS    |
| 8DPSK         | LCH     | 1.45       | -37.175          | -18.550     | PASS    |
|               | MCH     | 0.663      | -30.495          | -19.337     | PASS    |
|               | HCH     | -0.561     | -38.187          | -20.561     | PASS    |

GFSK LCH Graphs



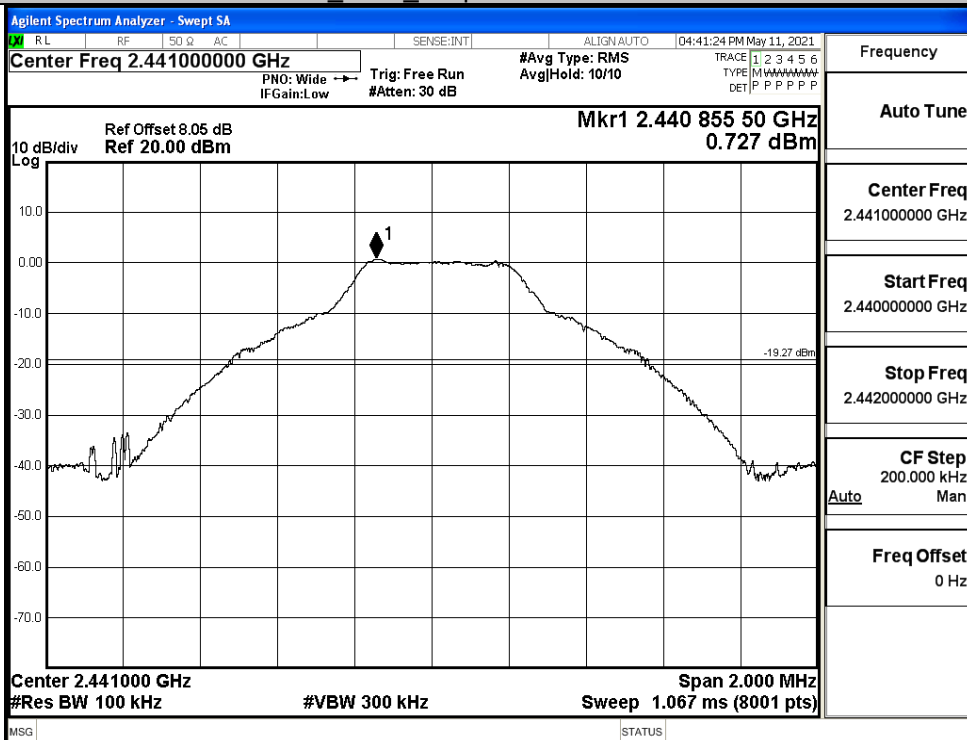


Puw

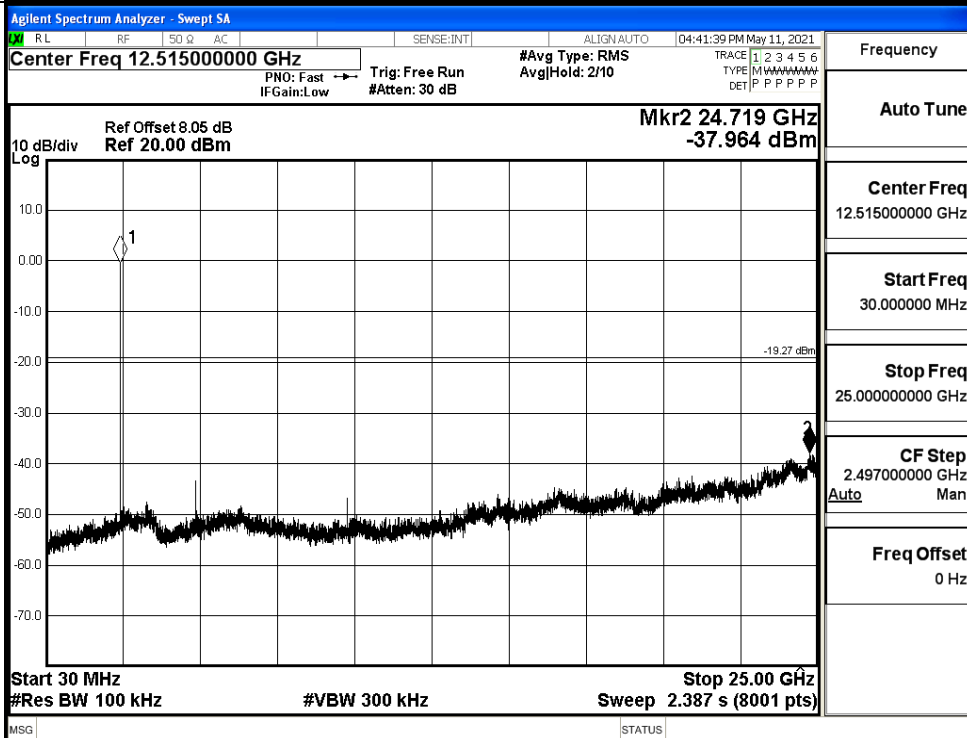


## GFSK\_MCH\_Graphs

Pref

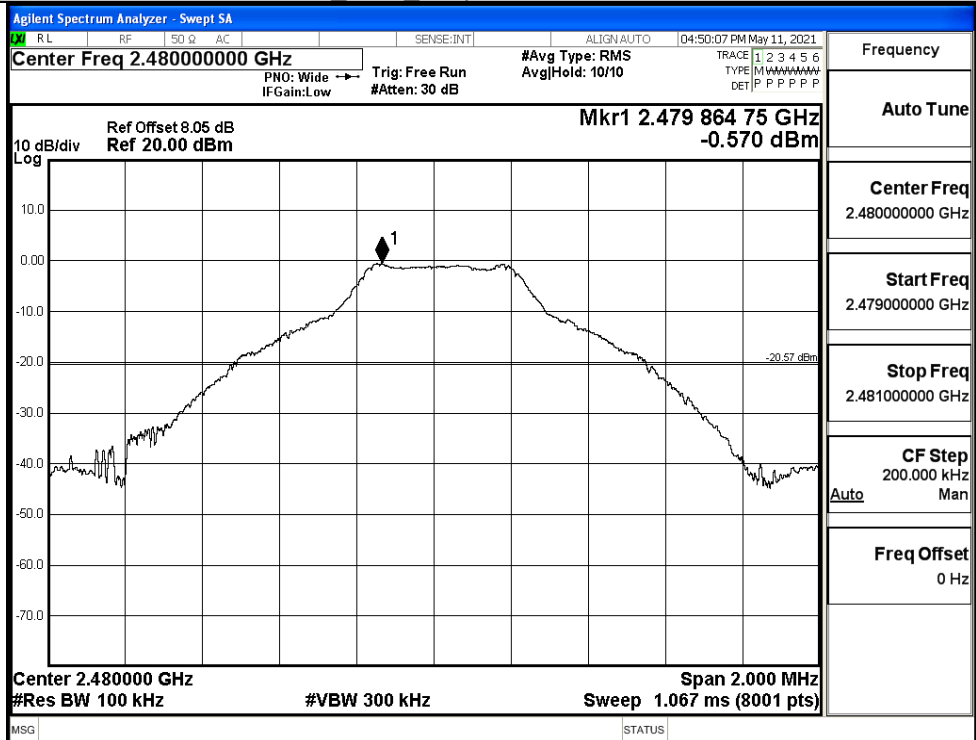


Puw

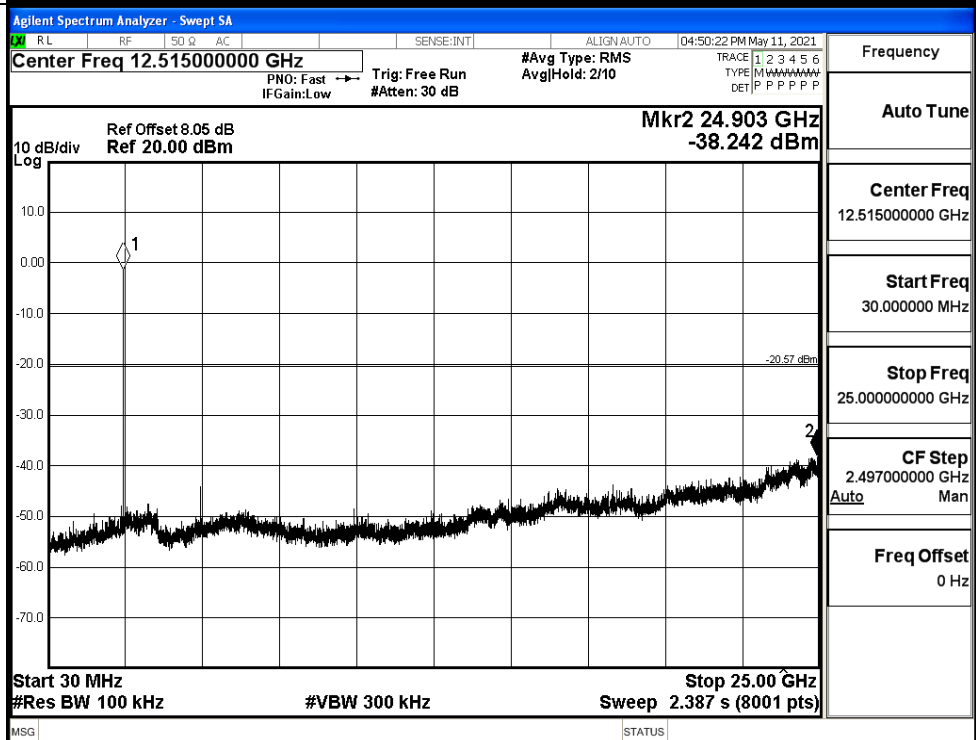


## GFSK\_HCH\_Graphs

Pref

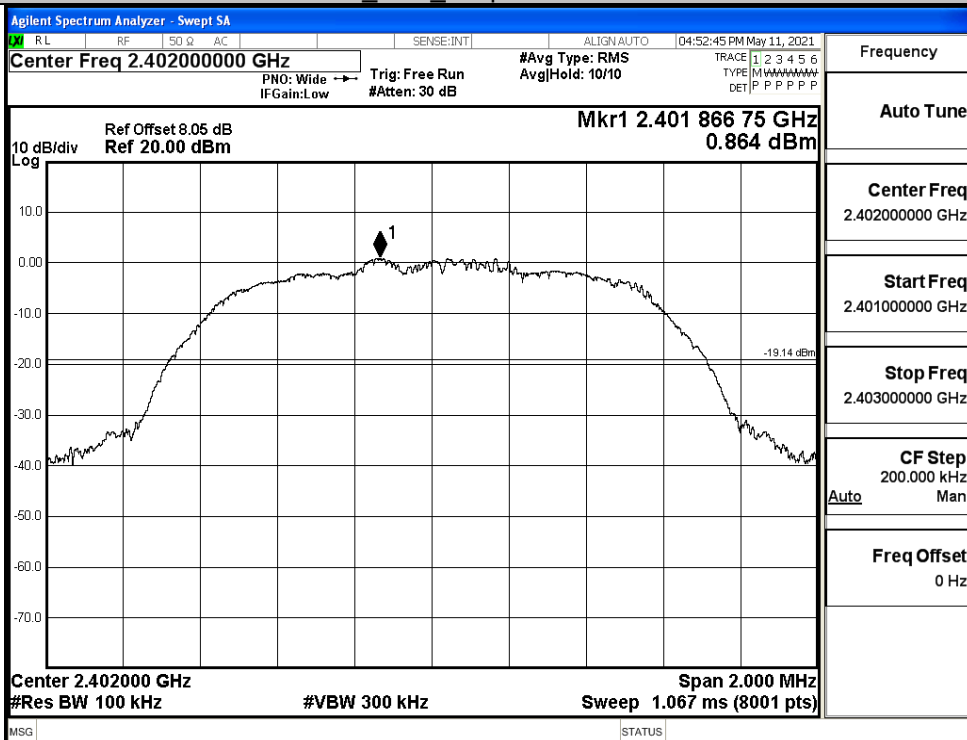


Puw

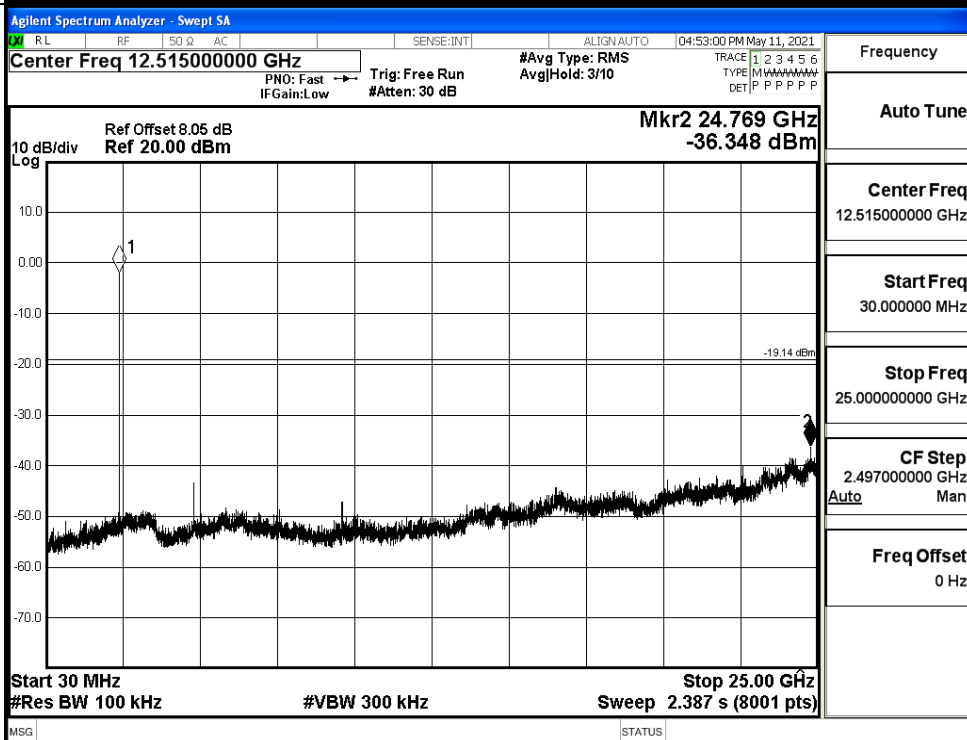


$\pi/4$ DQPSK\_LCH\_Graphs

Pref

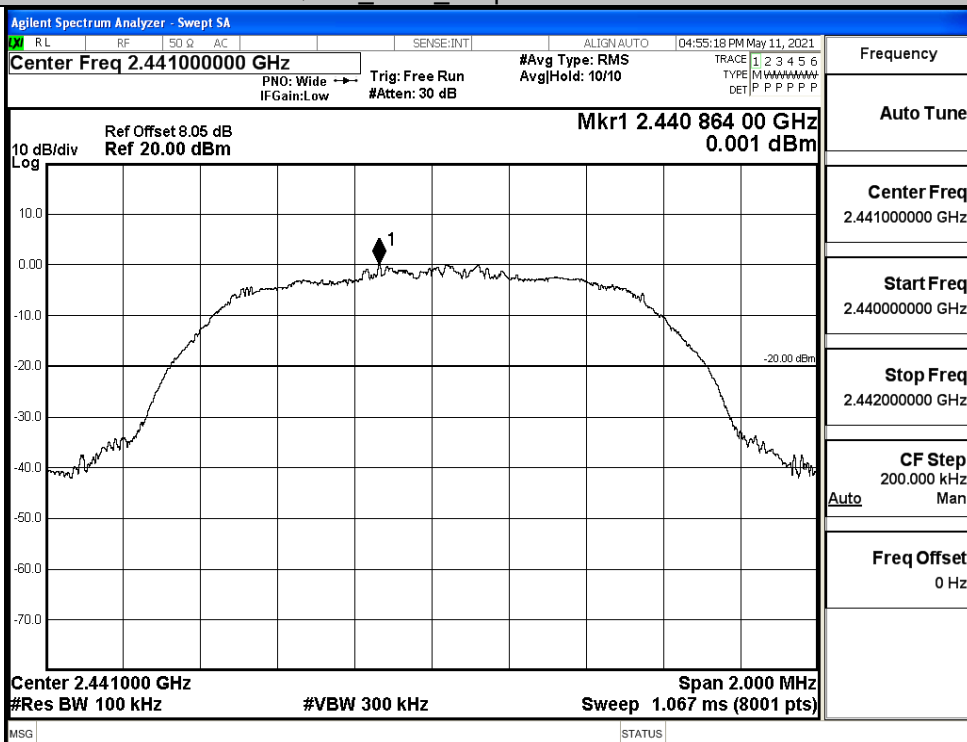


Puw

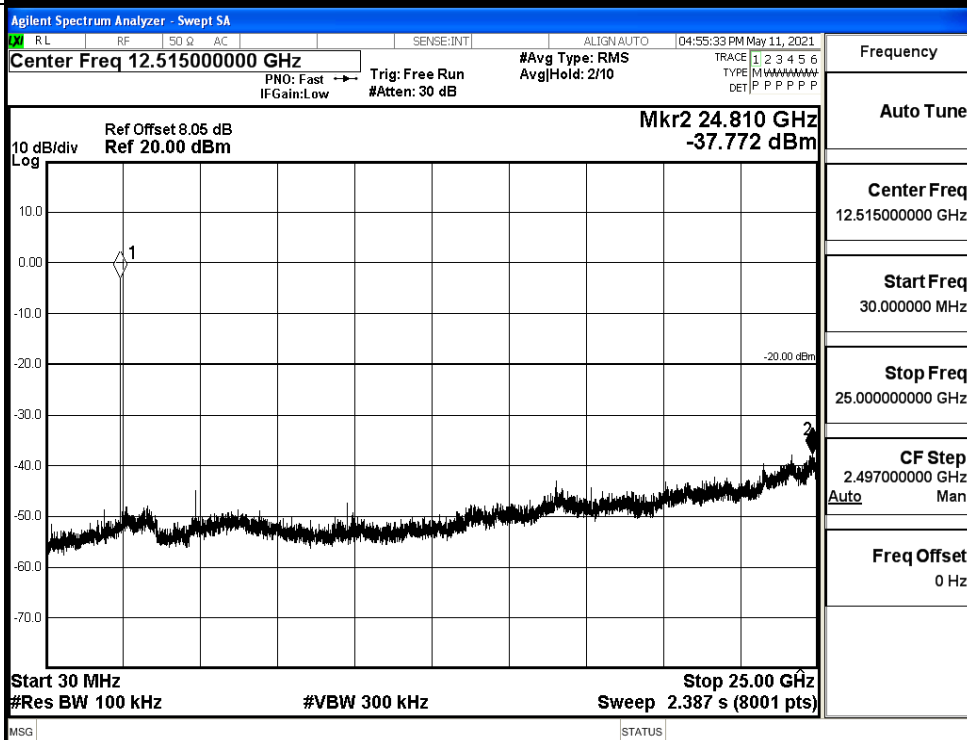


$\pi/4$ DQPSK\_MCH\_Graphs

Pref

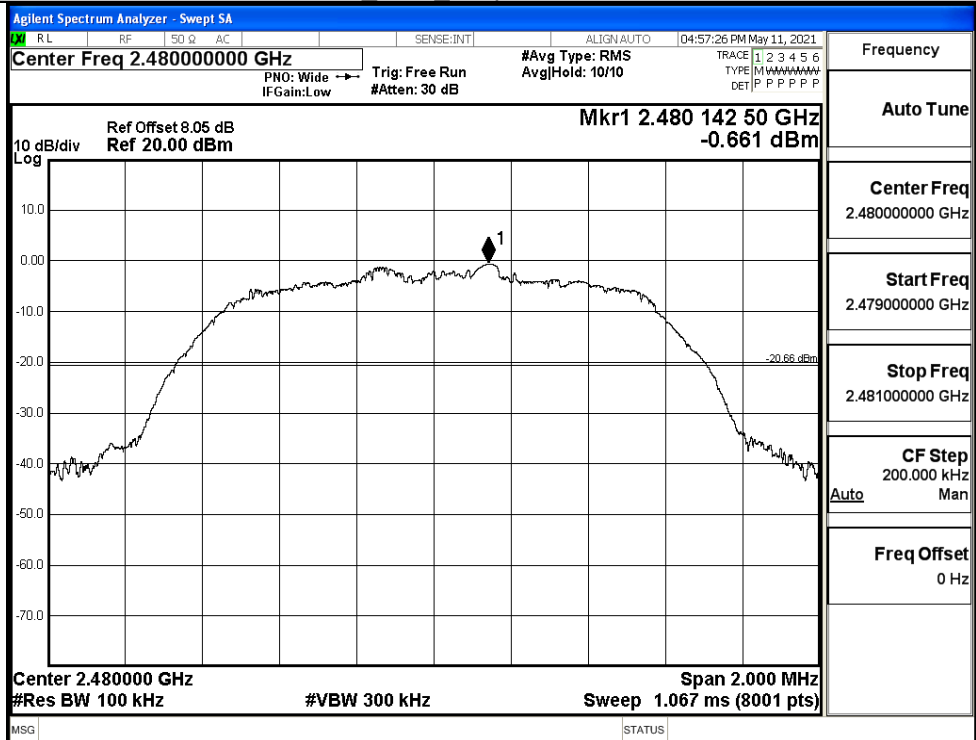


Puw

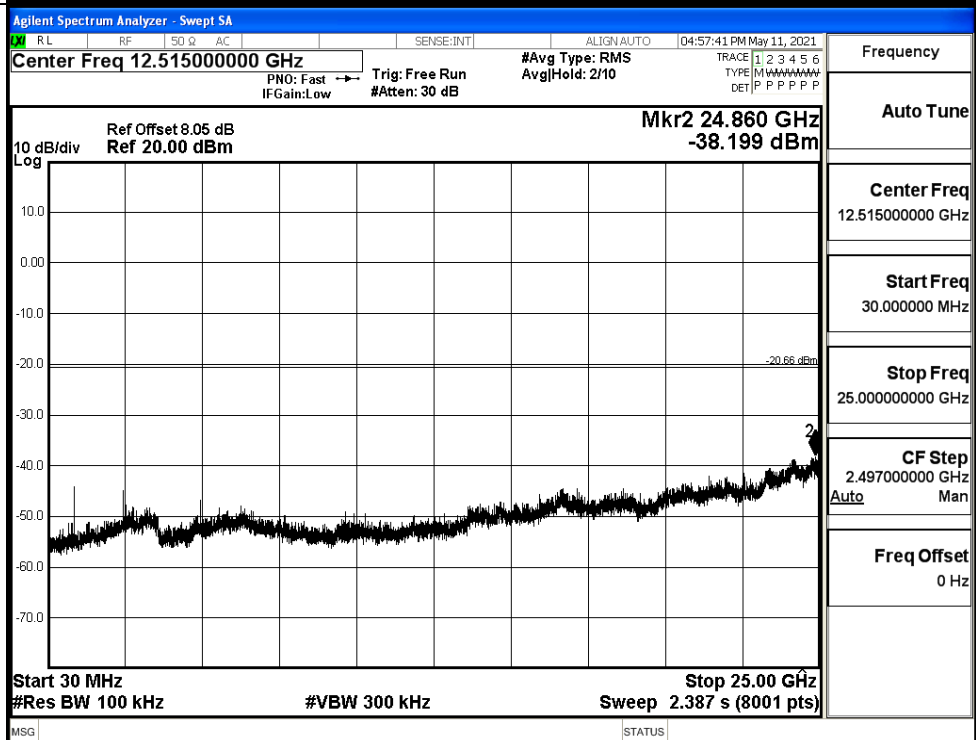


$\pi/4$ DQPSK\_HCH\_Graphs

Pref

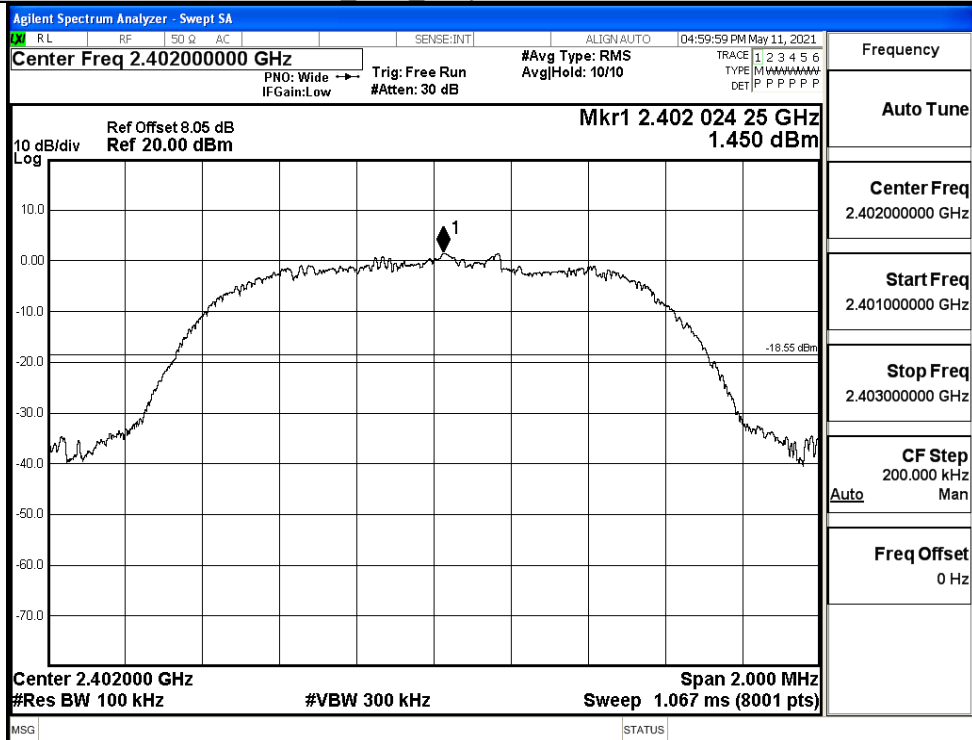


Puw

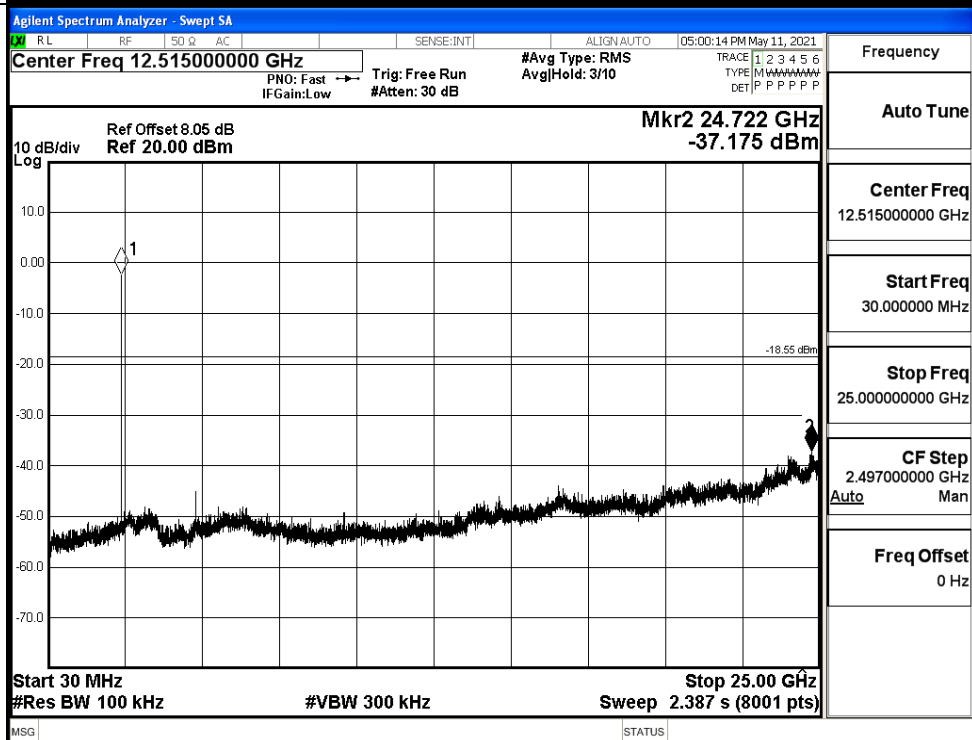


## 8DPSK\_LCH\_Graphs

Pref

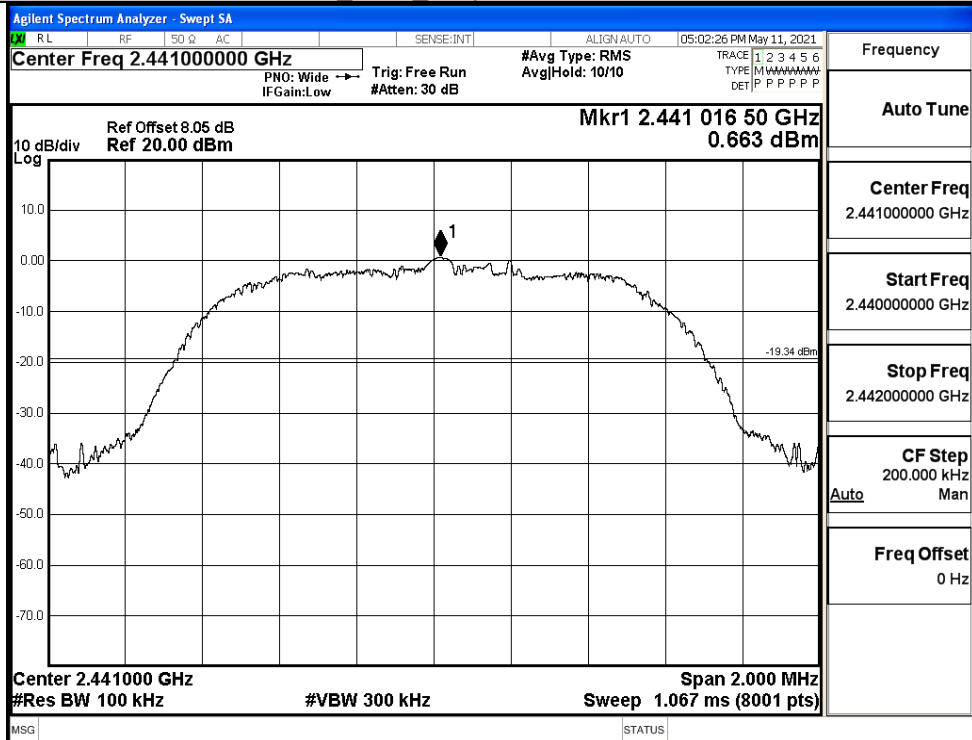


Puw

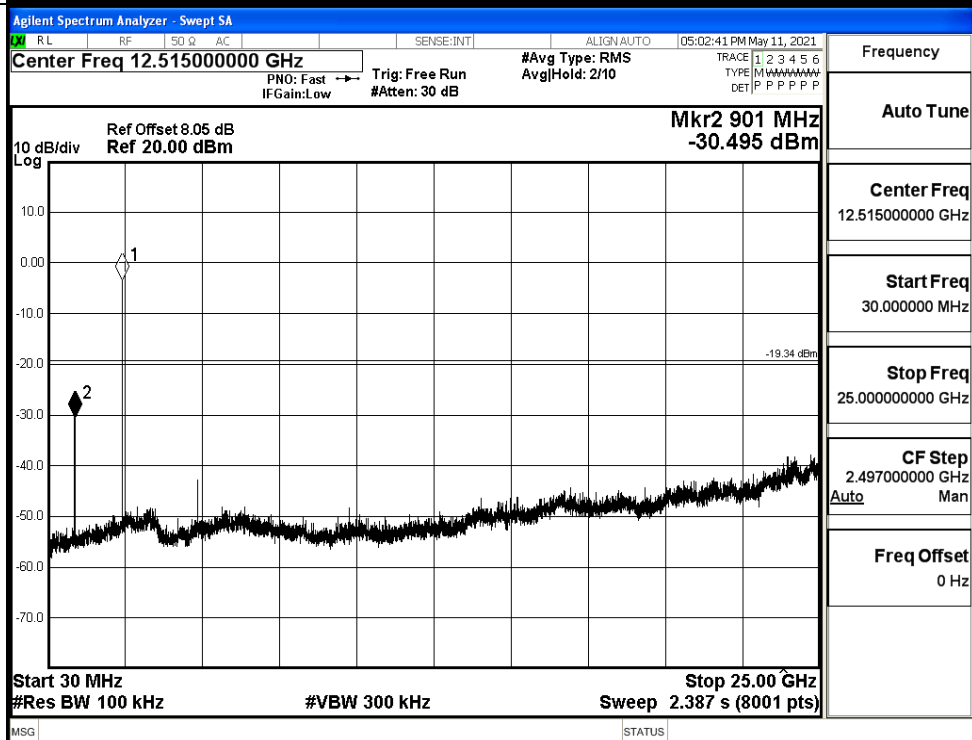


## 8DPSK\_MCH\_Graphs

Pref



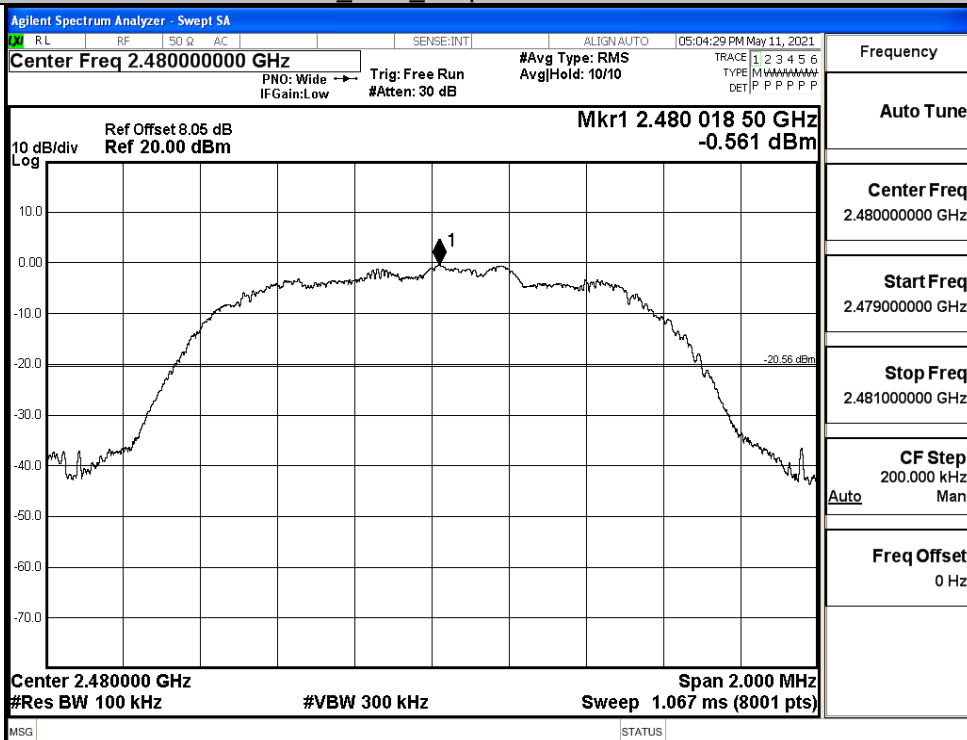
Puw



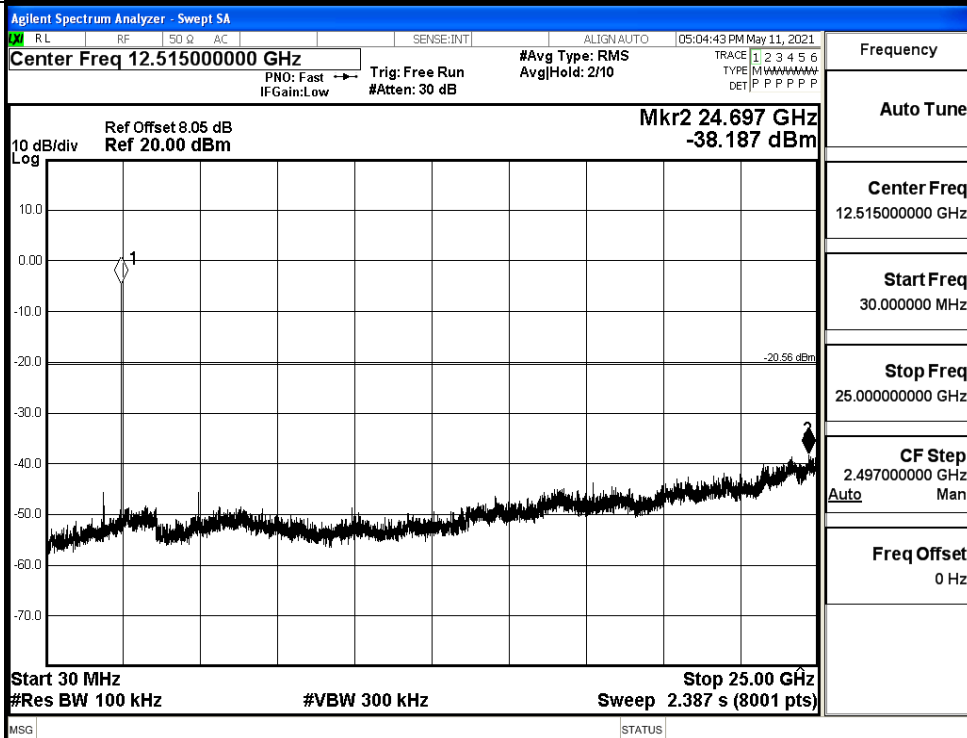


## 8DPSK\_HCH\_Graphs

Pref



Puw

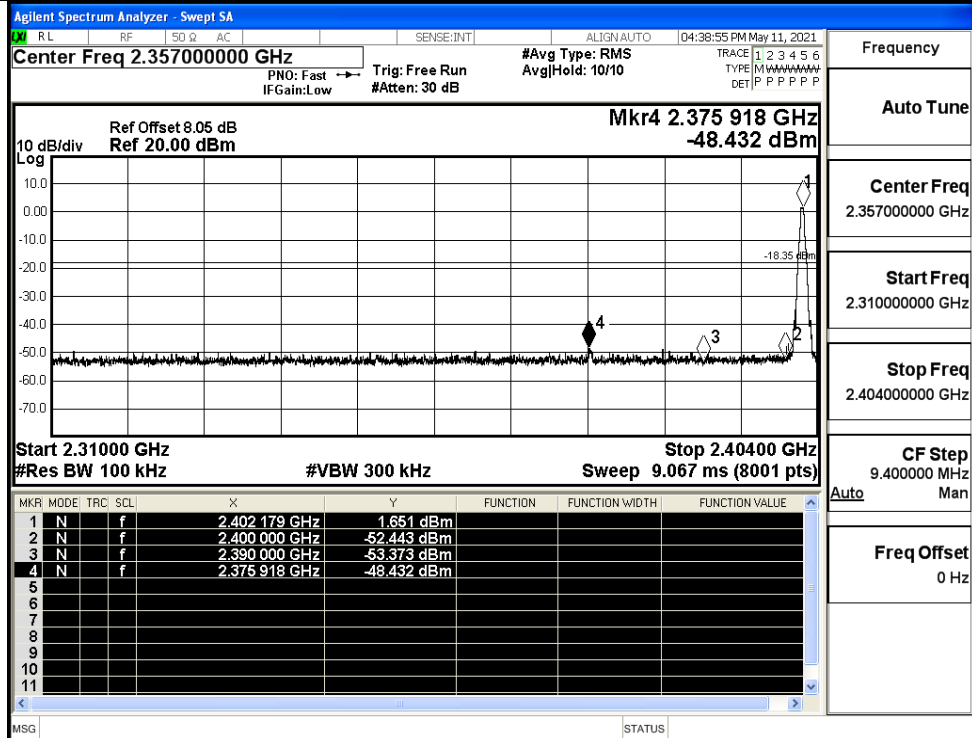


## A.7 Band-edge for RF Conducted Emissions

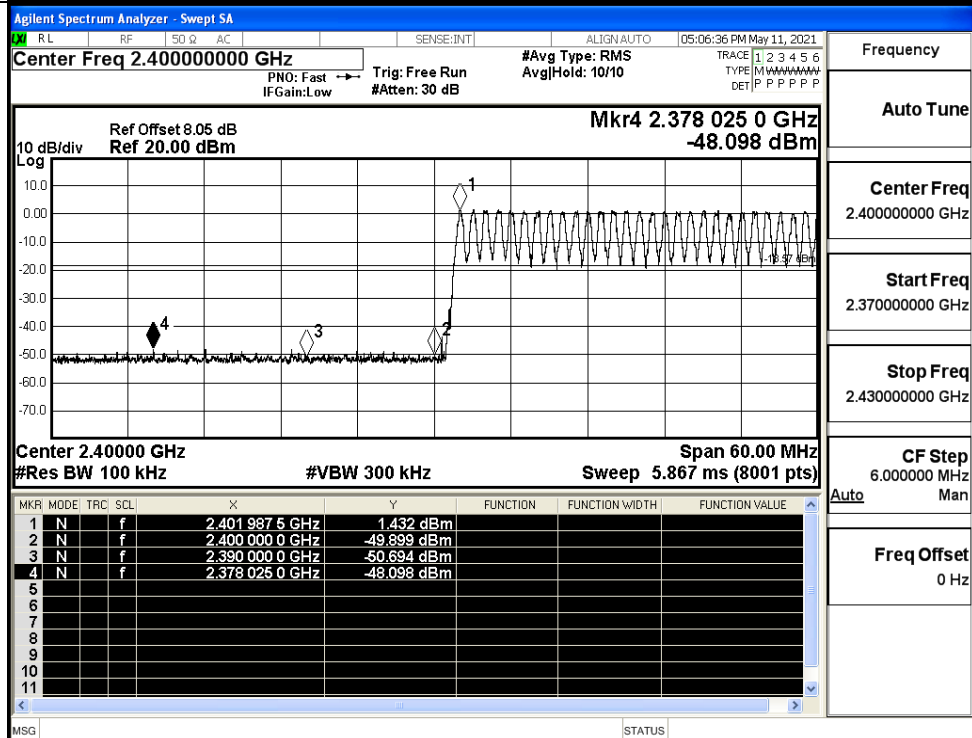
| Mode          | Channel | Carrier Frequency [MHz] | Carrier Power [dBm] | Frequency Hopping | Max Spurious Level [dBm] | Limit [dBm] | Verdict |
|---------------|---------|-------------------------|---------------------|-------------------|--------------------------|-------------|---------|
| GFSK          | LCH     | 2402                    | 1.651               | Off               | -48.432                  | -18.35      | PASS    |
|               |         |                         | 1.432               | On                | -48.098                  | -18.57      | PASS    |
|               | HCH     | 2480                    | -0.487              | Off               | -49.202                  | -20.49      | PASS    |
|               |         |                         | 0.104               | On                | -48.192                  | -19.9       | PASS    |
| $\pi/4$ DQPSK | LCH     | 2402                    | 1.166               | Off               | -48.812                  | -18.83      | PASS    |
|               |         |                         | 1.117               | On                | -48.795                  | -18.88      | PASS    |
|               | HCH     | 2480                    | -0.639              | Off               | -49.174                  | -20.64      | PASS    |
|               |         |                         | 0.090               | On                | -48.572                  | -19.91      | PASS    |
| 8DPSK         | LCH     | 2402                    | 1.553               | Off               | -45.546                  | -18.45      | PASS    |
|               |         |                         | 1.469               | On                | -48.567                  | -18.53      | PASS    |
|               | HCH     | 2480                    | -0.585              | Off               | -49.243                  | -20.59      | PASS    |
|               |         |                         | 0.207               | On                | -48.448                  | -19.79      | PASS    |

## Test Graphs

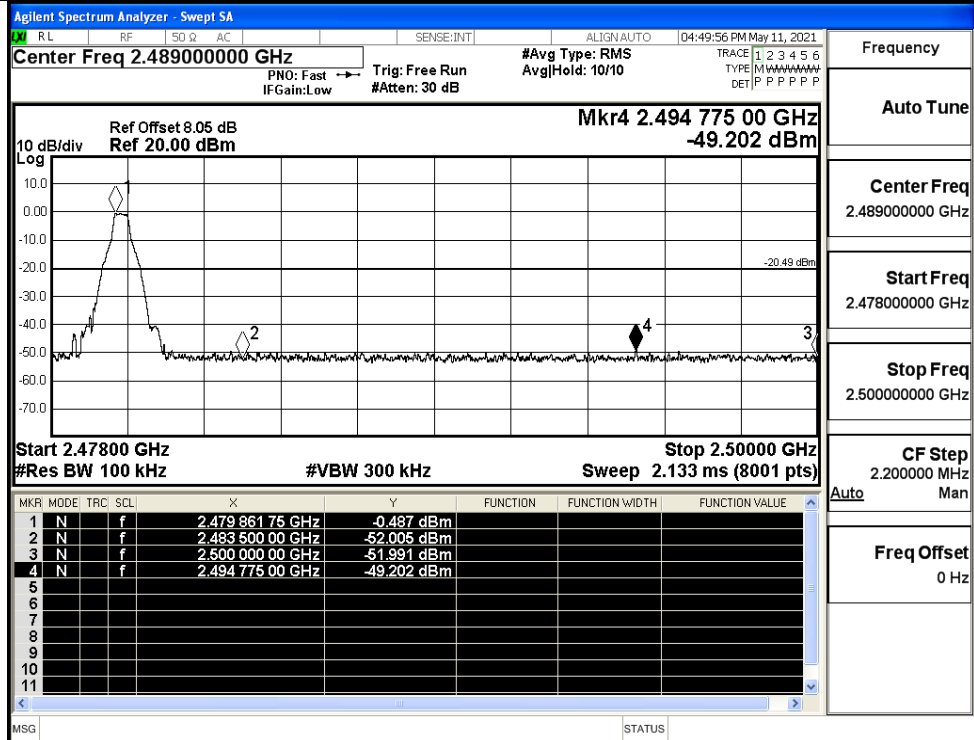
GFSK/LCH/No Hop



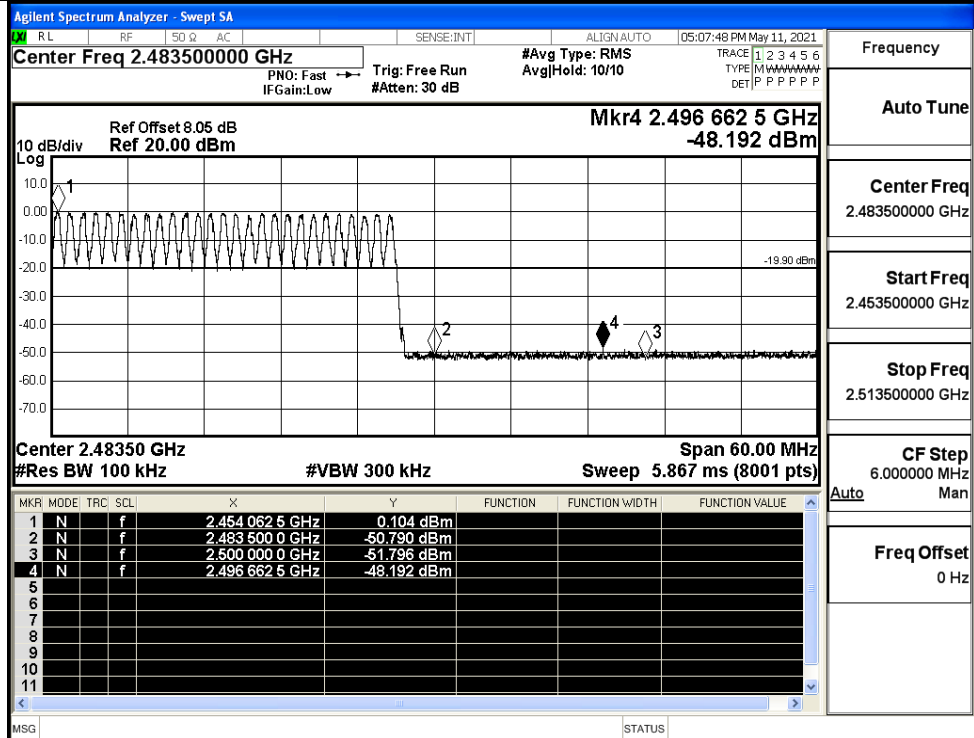
GFSK/LCH/Hop



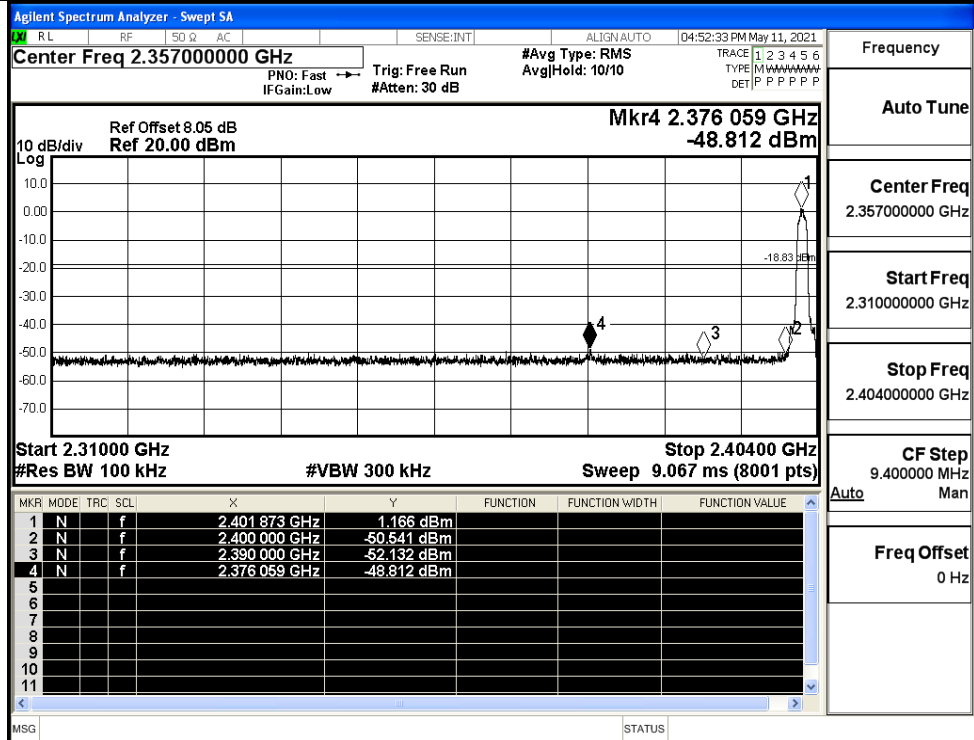
GFSK/HCH/No Hop



GFSK/HCH/Hop



$\pi/4$ DQPSK/LCH/No  
Hop



Frequency

Auto Tune

Center Freq  
2.357000000 GHz

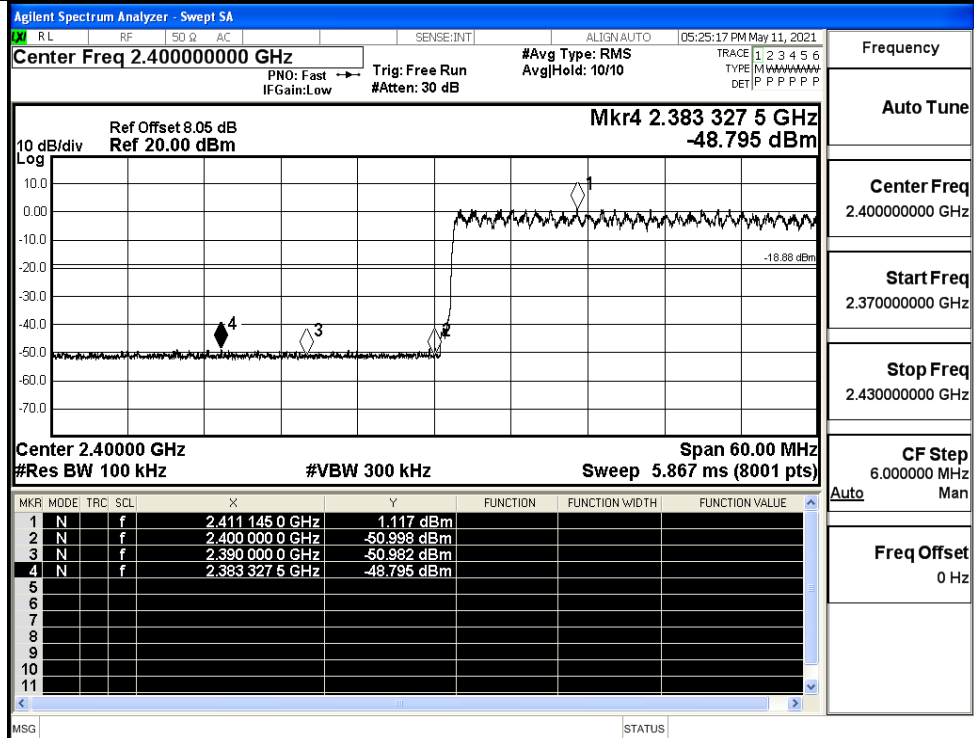
Start Freq  
2.310000000 GHz

Stop Freq  
2.404000000 GHz

CF Step  
9.400000 MHz  
Auto Man

Freq Offset  
0 Hz

$\pi/4$ DQPSK/LCH/Hop



Frequency

Auto Tune

Center Freq  
2.400000000 GHz

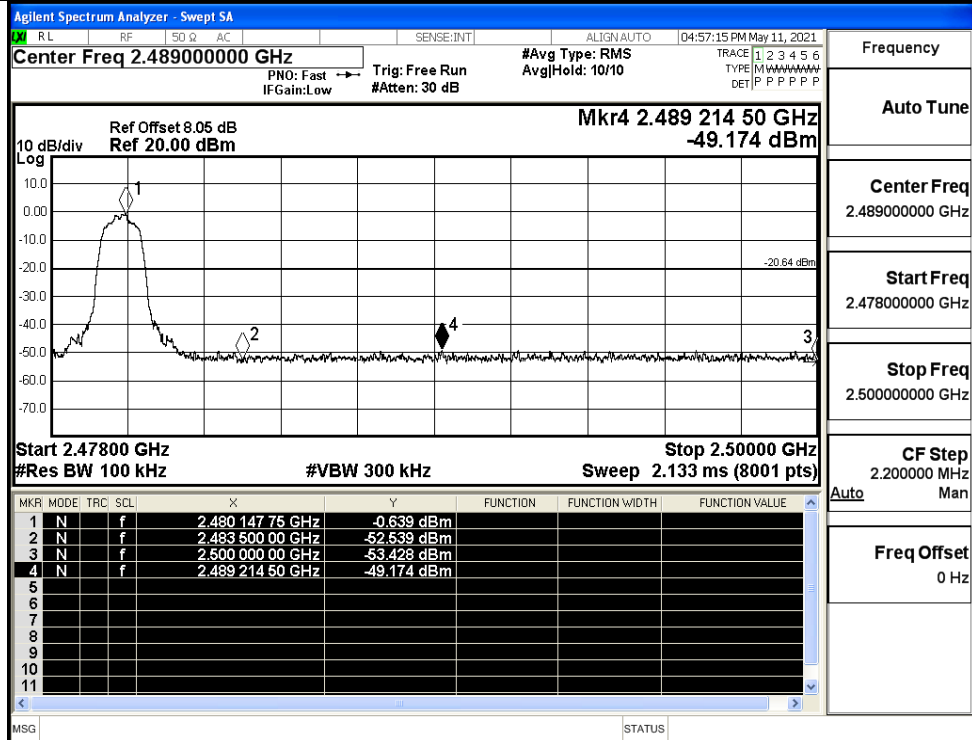
Start Freq  
2.370000000 GHz

Stop Freq  
2.430000000 GHz

CF Step  
6.000000 MHz  
Auto Man

Freq Offset  
0 Hz

$\pi/4$ DQPSK/HCH/No  
Hop

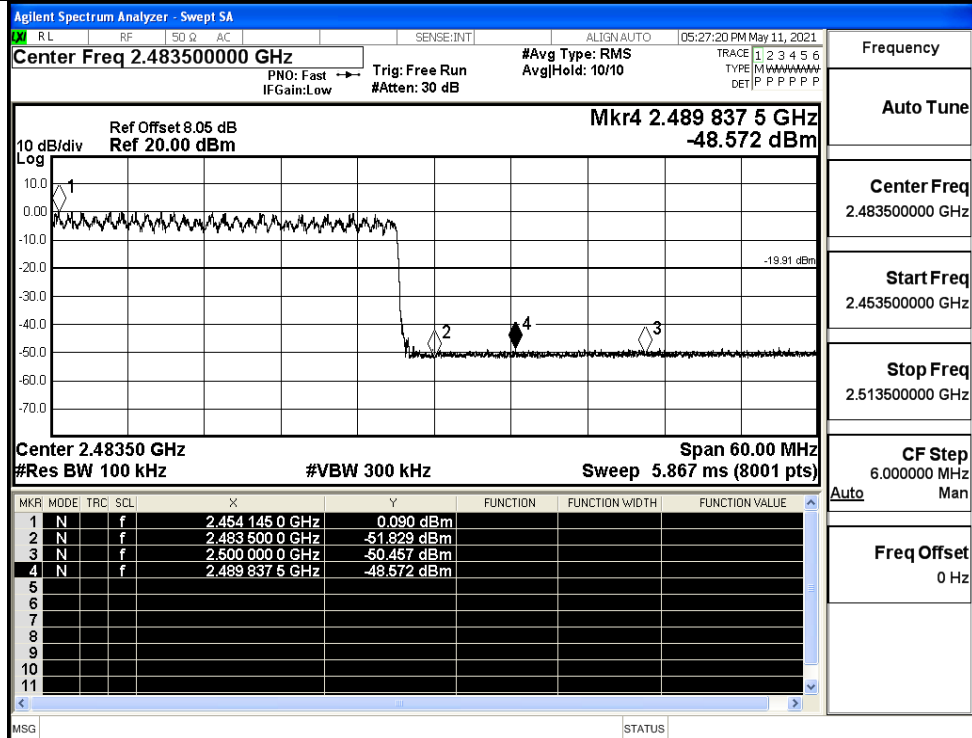


Frequency

Auto Tune

Center Freq  
2.489000000 GHzStart Freq  
2.478000000 GHzStop Freq  
2.500000000 GHzCF Step  
2.200000 MHz  
Auto ManFreq Offset  
0 Hz

$\pi/4$ DQPSK/HCH/Hop

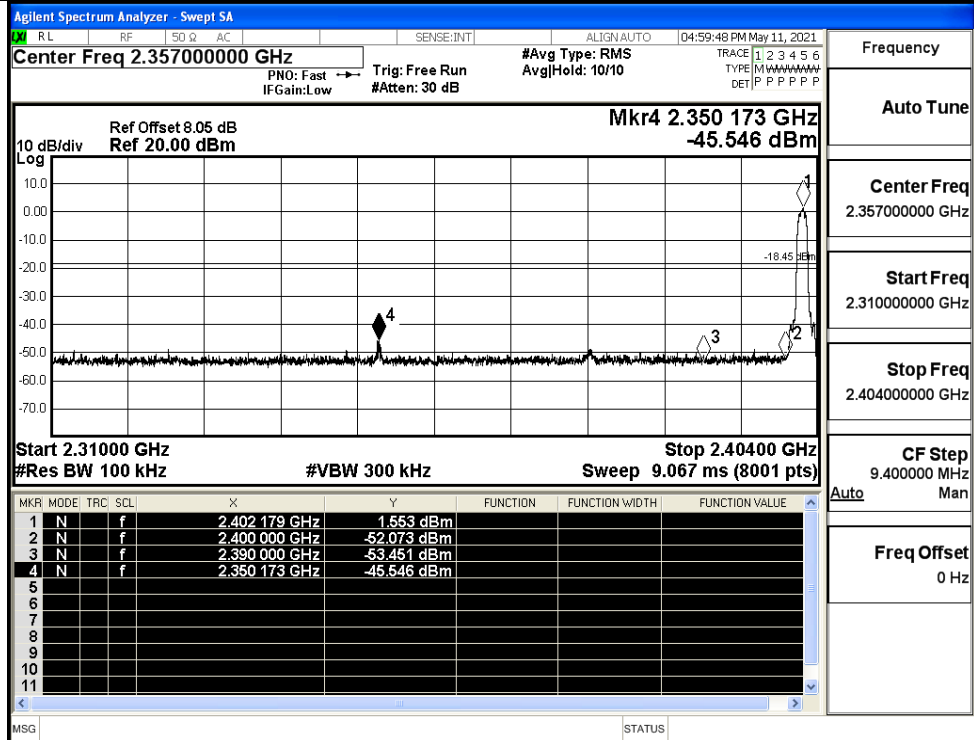


Frequency

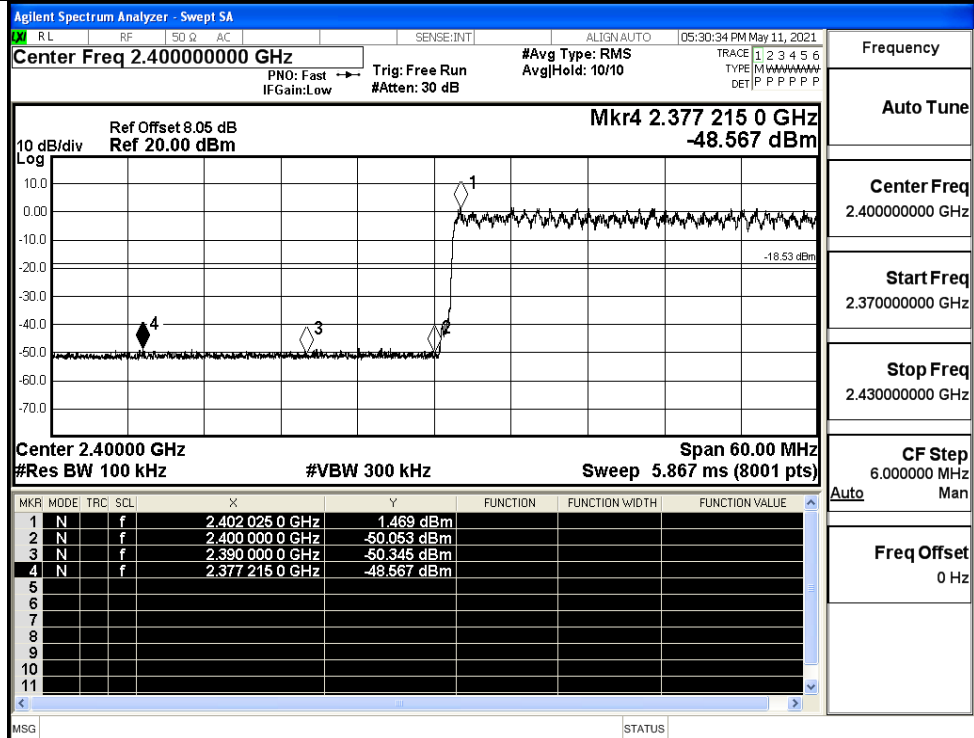
Auto Tune

Center Freq  
2.483500000 GHzStart Freq  
2.453500000 GHzStop Freq  
2.513500000 GHzCF Step  
6.000000 MHz  
Auto ManFreq Offset  
0 Hz

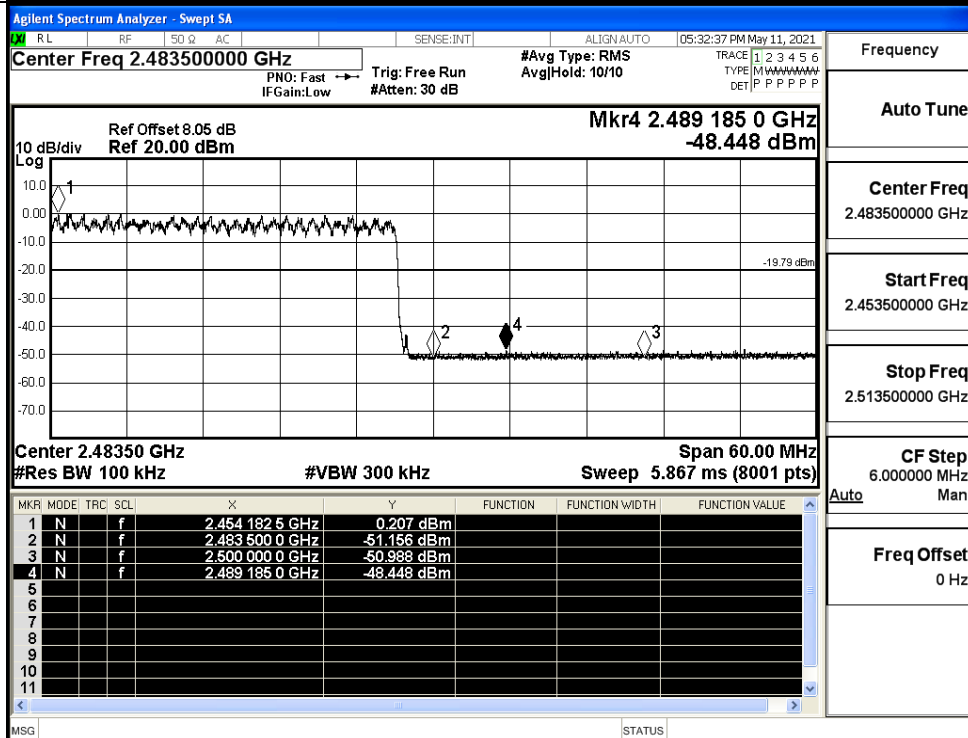
8DPSK/LCH/No Hop



8DPSK/LCH/Hop



8DPSK/HCH/Hop

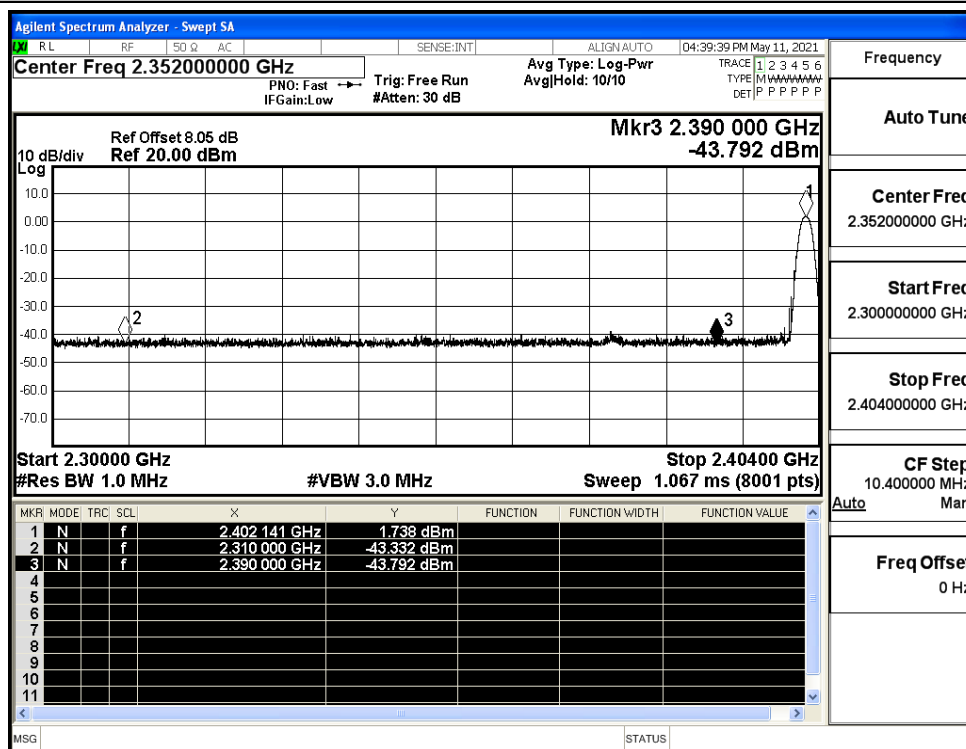




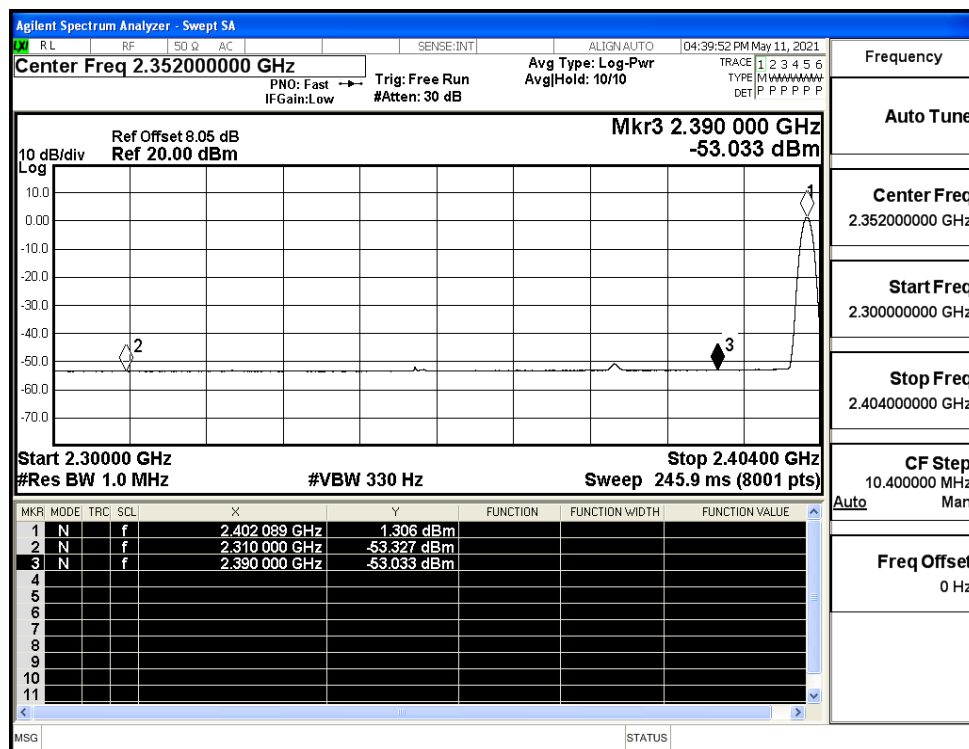
## A.8 Restrict-band band-edge measurements

| Test Mode     | Hopping | Freq.  | Power [dBm] | Gain | Ground Factor | E [dBuV/m] | Detector | Limit [dBuV/m] | Verdict |
|---------------|---------|--------|-------------|------|---------------|------------|----------|----------------|---------|
| GFSK          | Off     | 2310.0 | -43.33      | 2.0  | 0             | 51.93      | PEAK     | 74             | PASS    |
|               | Off     | 2310.0 | -53.33      | 2.0  | 0             | 41.93      | AV       | 54             | PASS    |
|               | Off     | 2390.0 | -43.79      | 2.0  | 0             | 51.47      | PEAK     | 74             | PASS    |
|               | Off     | 2390.0 | -53.03      | 2.0  | 0             | 42.22      | AV       | 54             | PASS    |
|               | Off     | 2483.5 | -42.99      | 2.0  | 0             | 52.27      | PEAK     | 74             | PASS    |
|               | Off     | 2483.5 | -52.48      | 2.0  | 0             | 42.77      | AV       | 54             | PASS    |
|               | Off     | 2500.0 | -42.08      | 2.0  | 0             | 53.18      | PEAK     | 74             | PASS    |
|               | Off     | 2500.0 | -52.35      | 2.0  | 0             | 42.91      | AV       | 54             | PASS    |
| $\pi/4$ DQPSK | Off     | 2310.0 | -43.16      | 2.0  | 0             | 52.10      | PEAK     | 74             | PASS    |
|               | Off     | 2310.0 | -53.32      | 2.0  | 0             | 41.94      | AV       | 54             | PASS    |
|               | Off     | 2390.0 | -42.09      | 2.0  | 0             | 53.17      | PEAK     | 74             | PASS    |
|               | Off     | 2390.0 | -53.03      | 2.0  | 0             | 42.23      | AV       | 54             | PASS    |
|               | Off     | 2483.5 | -41.22      | 2.0  | 0             | 54.03      | PEAK     | 74             | PASS    |
|               | Off     | 2483.5 | -52.39      | 2.0  | 0             | 42.87      | AV       | 54             | PASS    |
|               | Off     | 2500.0 | -42.00      | 2.0  | 0             | 53.26      | PEAK     | 74             | PASS    |
|               | Off     | 2500.0 | -52.33      | 2.0  | 0             | 42.93      | AV       | 54             | PASS    |
| 8DPSK         | Off     | 2310.0 | -42.92      | 2.0  | 0             | 52.34      | PEAK     | 74             | PASS    |
|               | Off     | 2310.0 | -53.36      | 2.0  | 0             | 41.90      | AV       | 54             | PASS    |
|               | Off     | 2390.0 | -43.24      | 2.0  | 0             | 52.02      | PEAK     | 74             | PASS    |
|               | Off     | 2390.0 | -52.99      | 2.0  | 0             | 42.26      | AV       | 54             | PASS    |
|               | Off     | 2483.5 | -42.42      | 2.0  | 0             | 52.83      | PEAK     | 74             | PASS    |
|               | Off     | 2483.5 | -52.44      | 2.0  | 0             | 42.82      | AV       | 54             | PASS    |
|               | Off     | 2500.0 | -42.41      | 2.0  | 0             | 52.85      | PEAK     | 74             | PASS    |
|               | Off     | 2500.0 | -52.41      | 2.0  | 0             | 42.85      | AV       | 54             | PASS    |

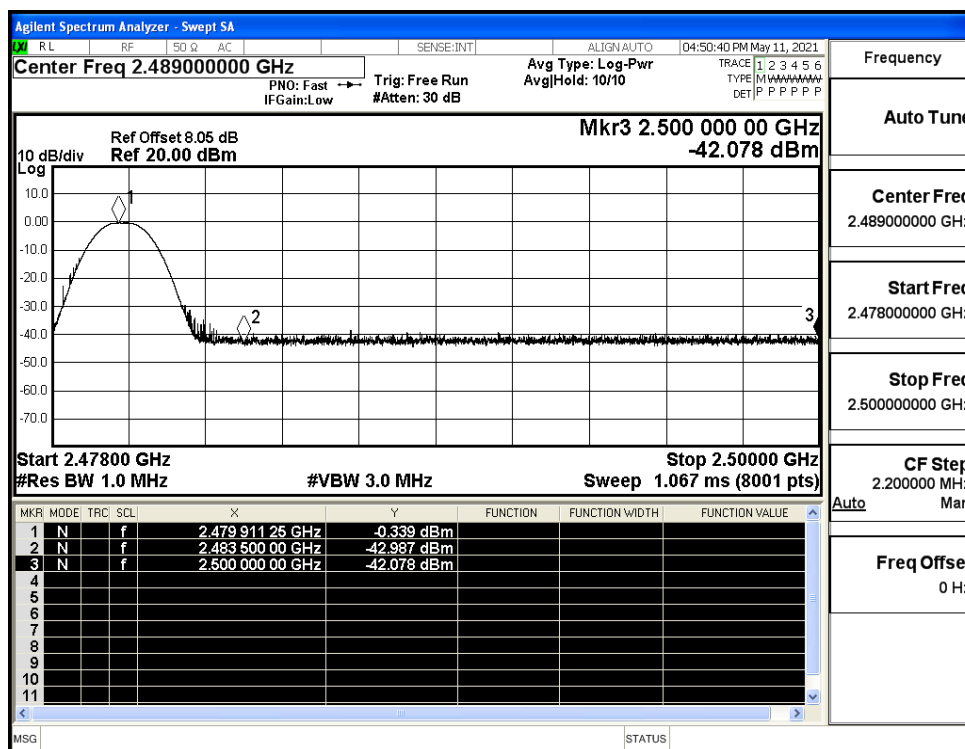
## Restrict-band band-edge measurements\_Hopping Off\_GFSK\_PEAK (Low Channel)



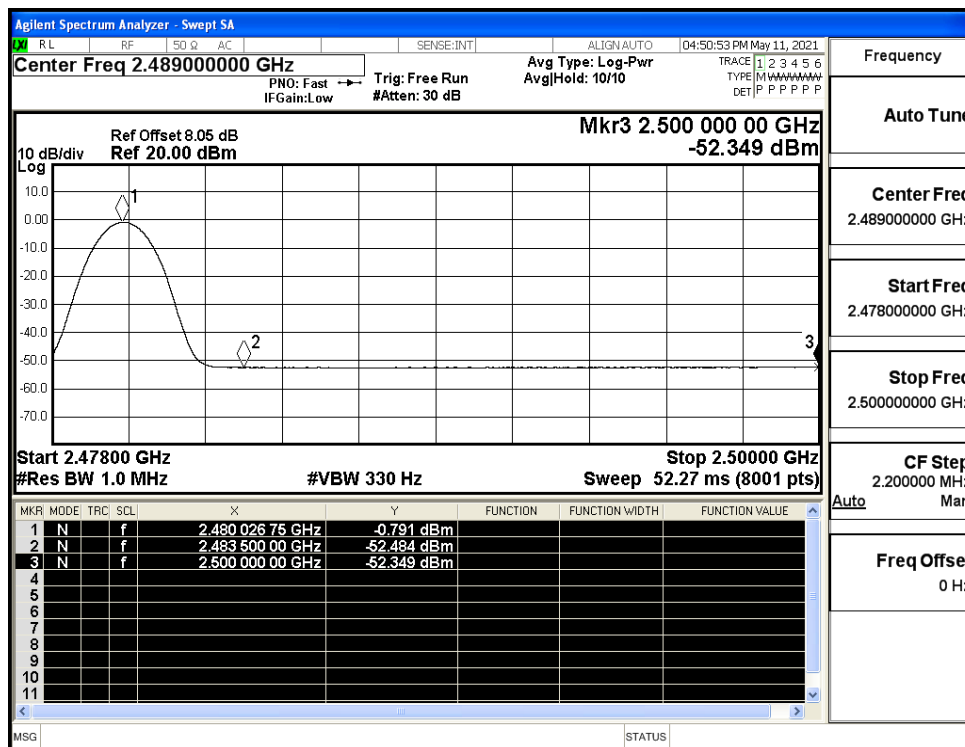
## Restrict-band band-edge measurements\_Hopping Off\_GFSK\_Average (Low Channel)

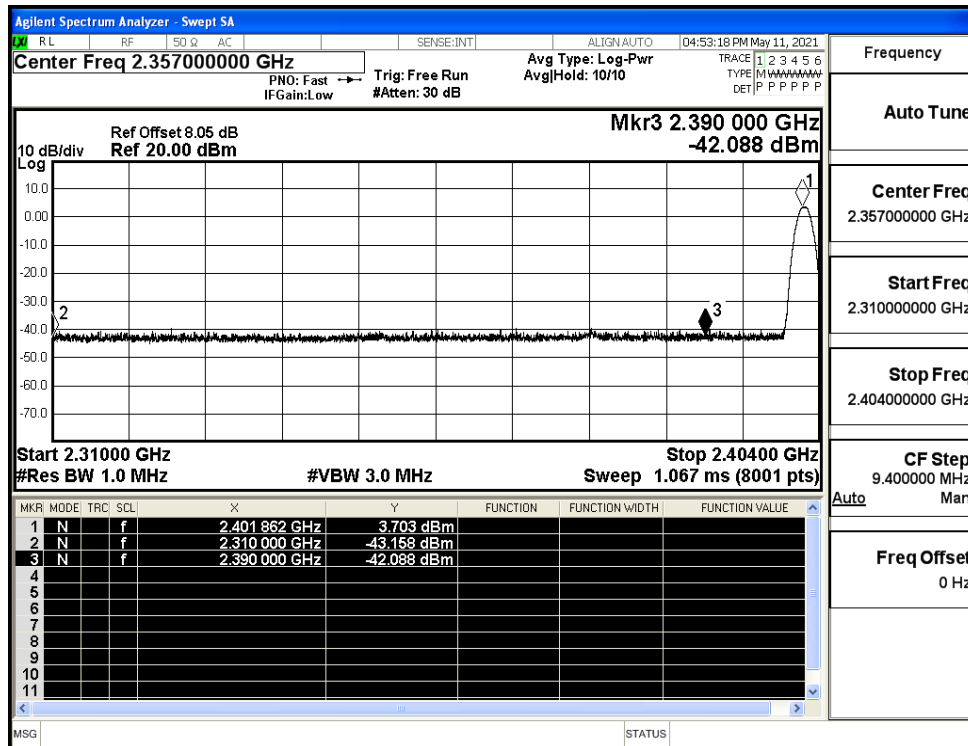
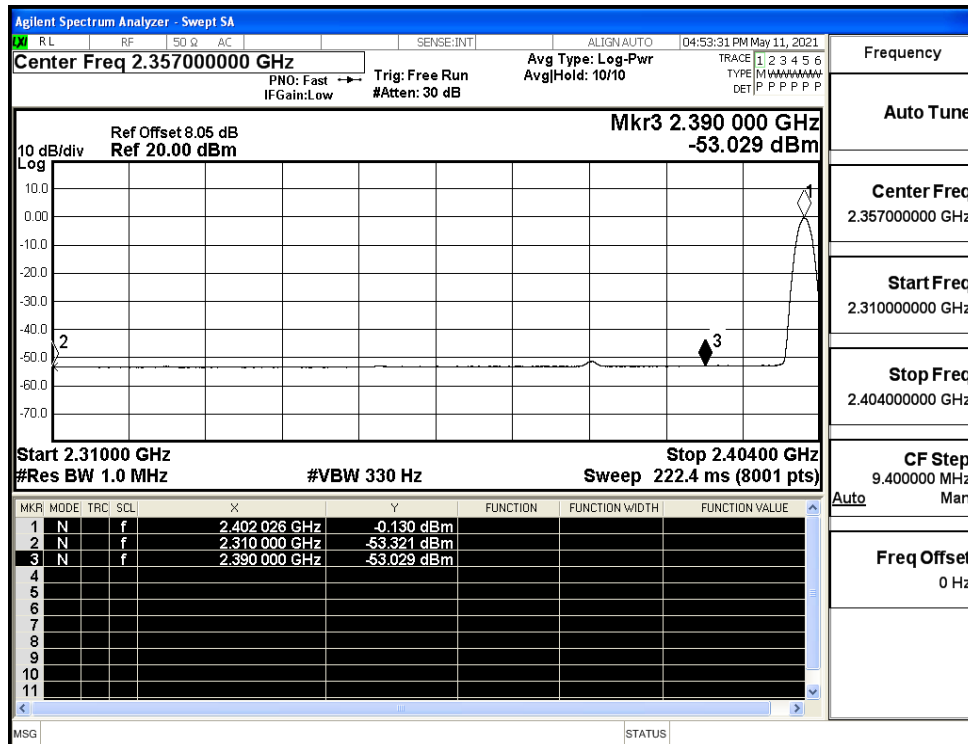


## Restrict-band band-edge measurements\_Hopping Off\_ GFSK\_PEAK (High Channel)

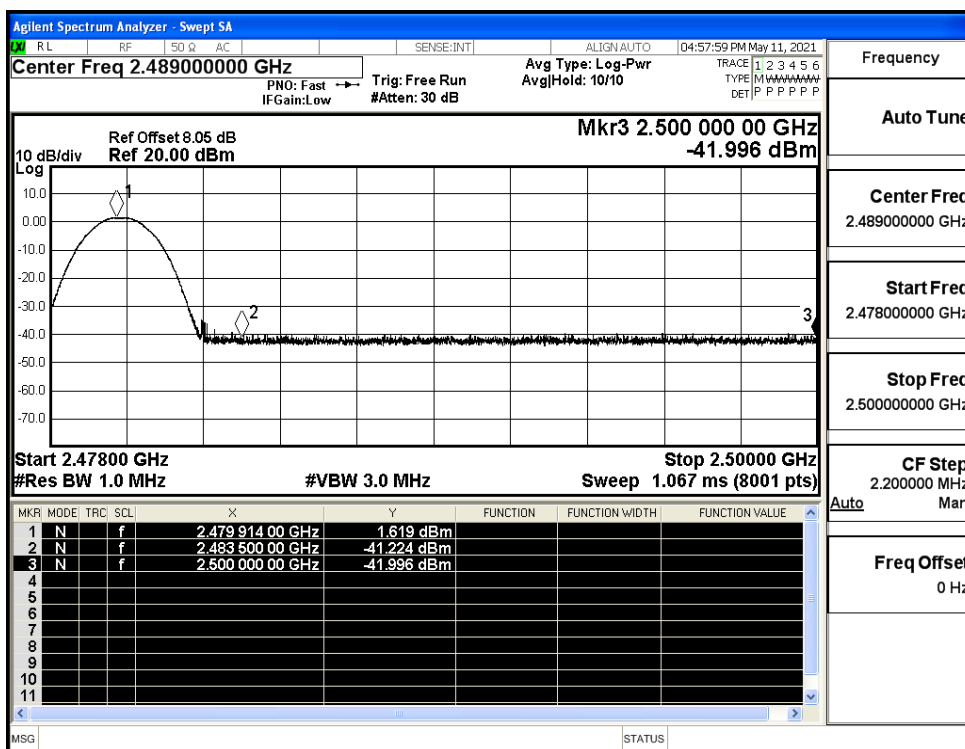


## Restrict-band band-edge measurements\_Hopping Off\_ GFSK\_Average (High Channel)

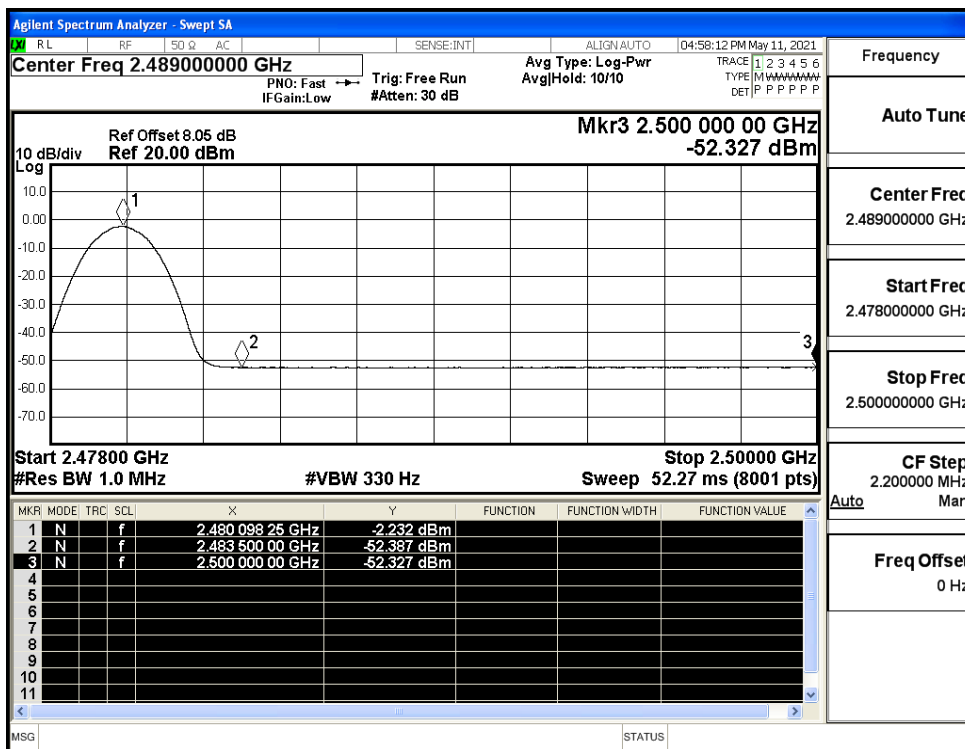


Restrict-band band-edge measurements\_Hopping Off  $\pi/4$ -DQPSK\_PEAK (Low Channel)Restrict-band band-edge measurements\_Hopping Off  $\pi/4$ -DQPSK\_Average (Low Channel)

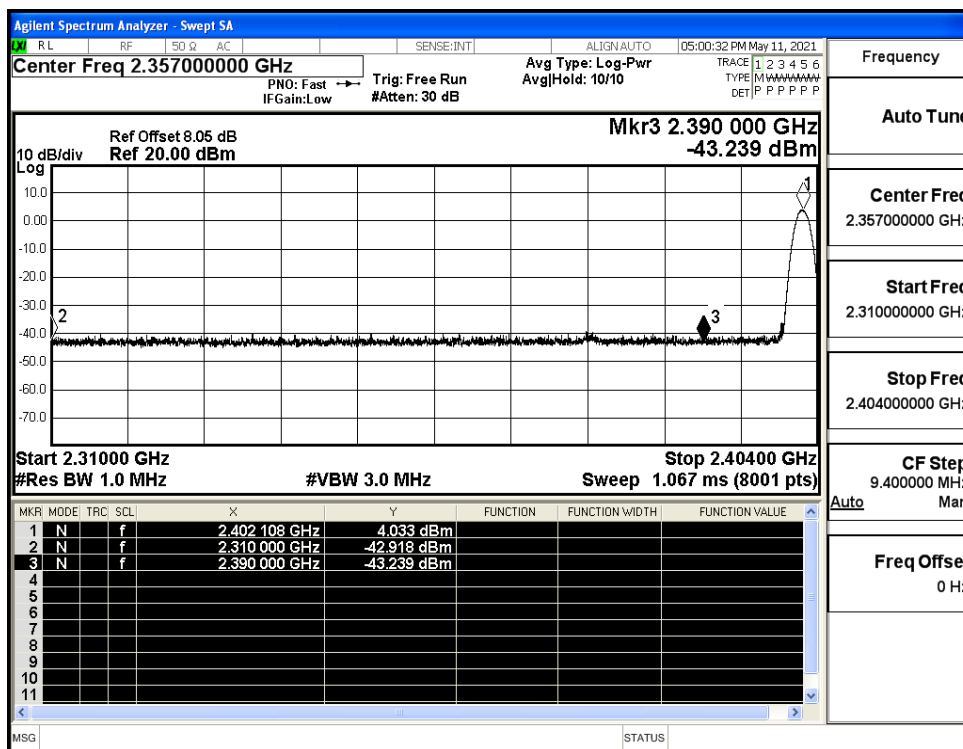
## Restrict-band band-edge measurements\_Hopping Off\_π/4-DQPSK\_PEAK (High Channel)



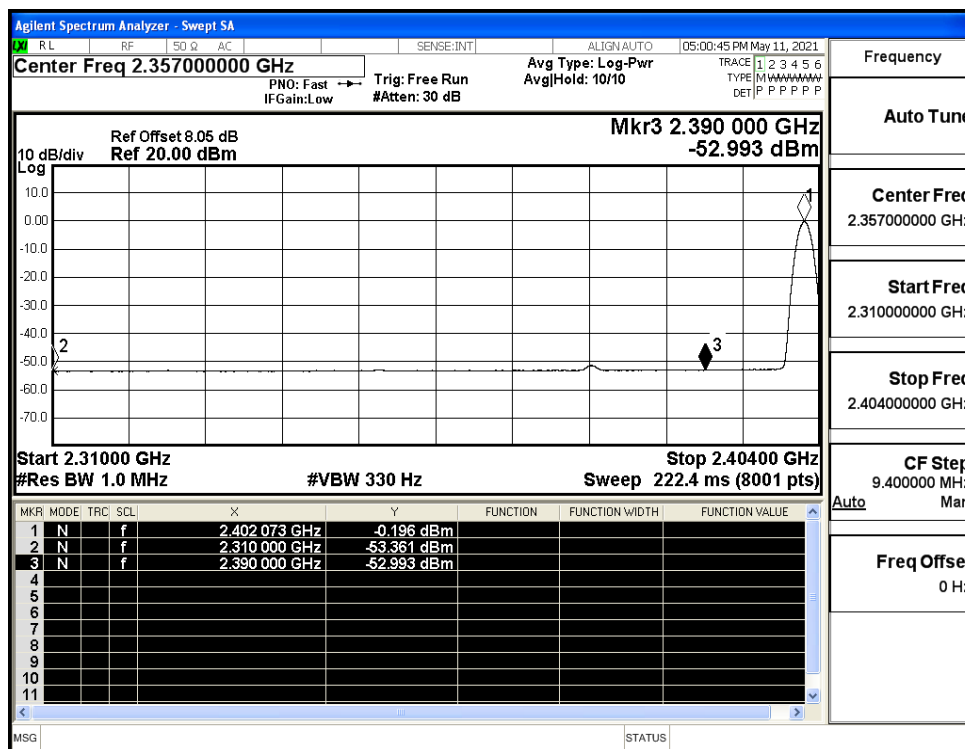
## Restrict-band band-edge measurements\_Hopping Off\_π/4-DQPSK\_Average (High Channel)



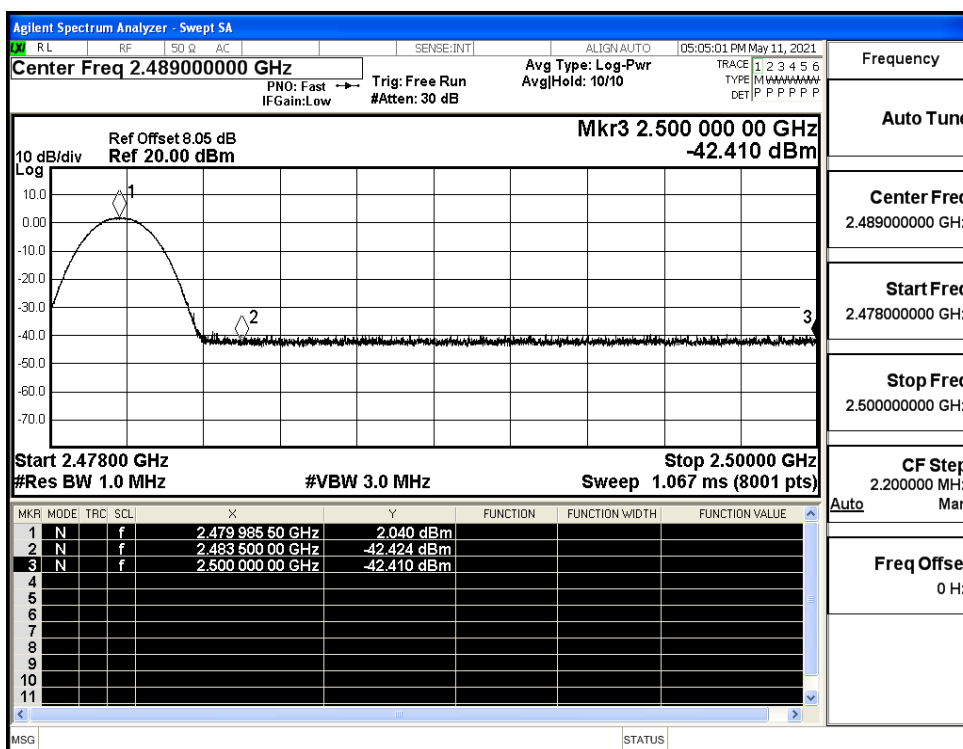
## Restrict-band band-edge measurements\_Hopping Off\_8DPSK\_PEAK (Low Channel)



## Restrict-band band-edge measurements\_Hopping Off\_8DPSK\_Average (Low Channel)



## Restrict-band band-edge measurements\_Hopping Off\_8DPSK\_PEAK (High Channel)



## Restrict-band band-edge measurements\_Hopping Off\_8DPSK\_Average (High Channel)

