

## Appendix A

### RF Test Data for BT 4.2(BDR/EDR) (Conducted Measurement)

Product Name: HEADSET

Trade Mark: microlab

Test Model: Necklace 200

#### Environmental Conditions

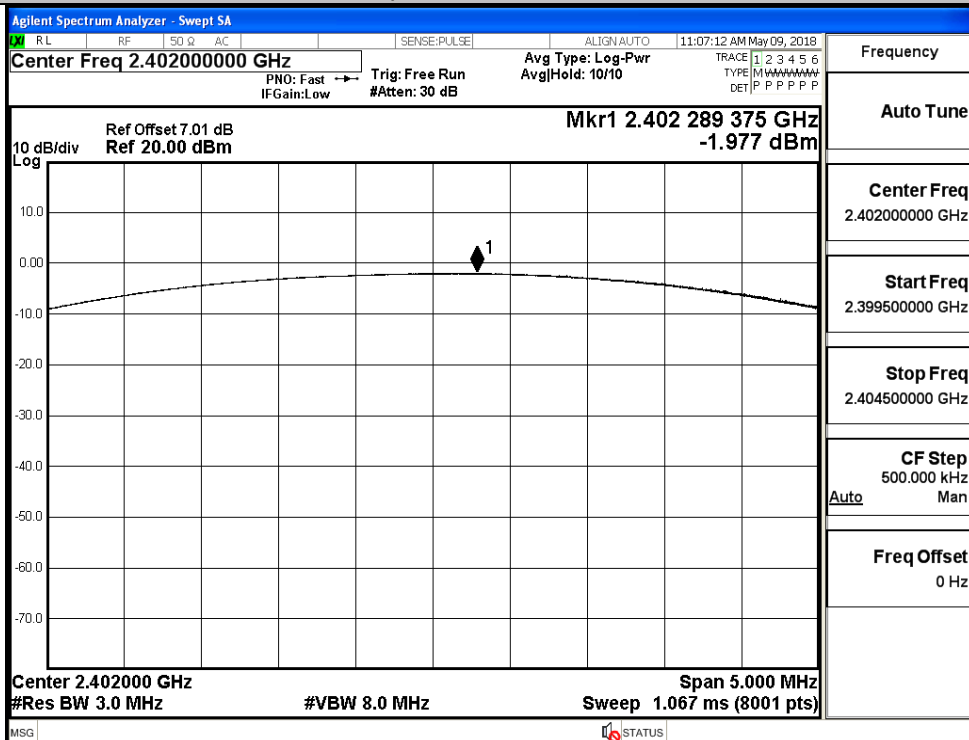
|                    |             |
|--------------------|-------------|
| Temperature:       | 21.6 ° C    |
| Relative Humidity: | 52.6%       |
| ATM Pressure:      | 100.0 kPa   |
| Test Engineer:     | Mina.xu     |
| Supervised by:     | Jayden.Zhuo |

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

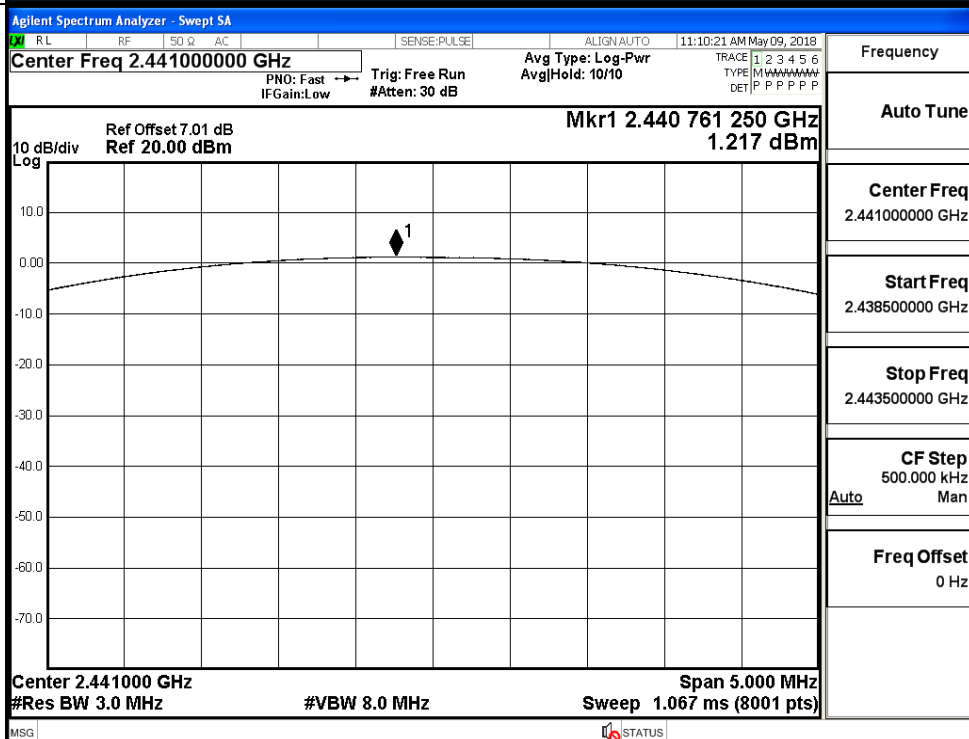
| Mode          | Channel. | Maximum Peak Output Power [dBm] | Limit [dBm] | Verdict |
|---------------|----------|---------------------------------|-------------|---------|
| GFSK          | LCH      | -1.977                          | 30          | PASS    |
|               | MCH      | 1.217                           | 30          | PASS    |
|               | HCH      | 2.638                           | 30          | PASS    |
| $\pi/4$ DQPSK | LCH      | -1.029                          | 21          | PASS    |
|               | MCH      | -0.212                          | 21          | PASS    |
|               | HCH      | 1.500                           | 21          | PASS    |
| 8DPSK         | LCH      | -0.913                          | 21          | PASS    |
|               | MCH      | 0.085                           | 21          | PASS    |
|               | HCH      | 1.743                           | 21          | PASS    |

## Test Graphs

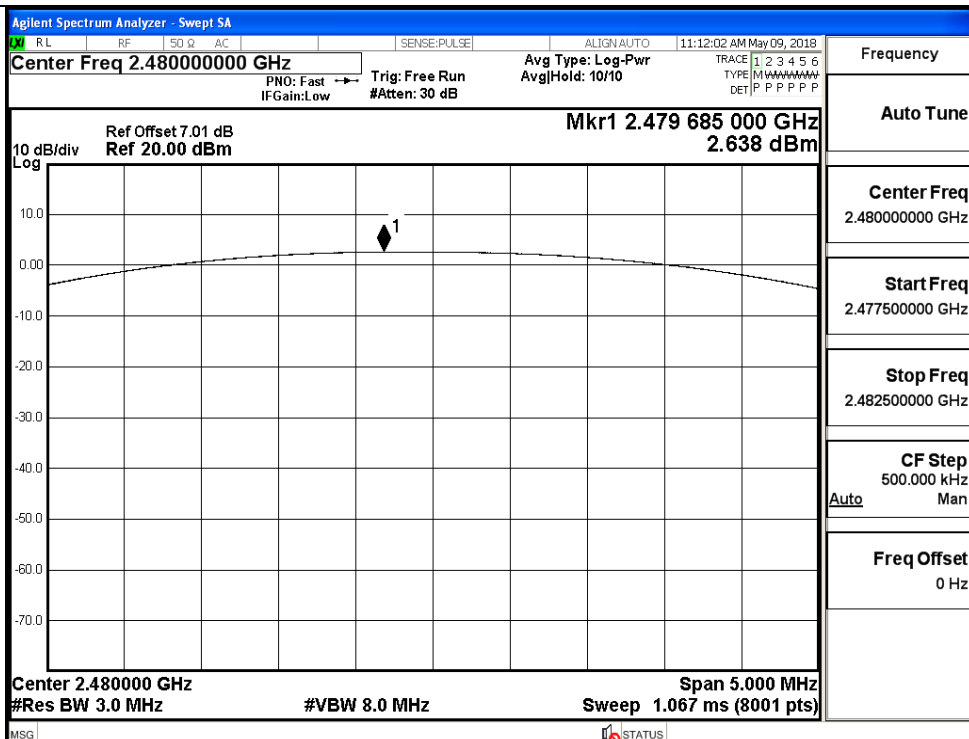
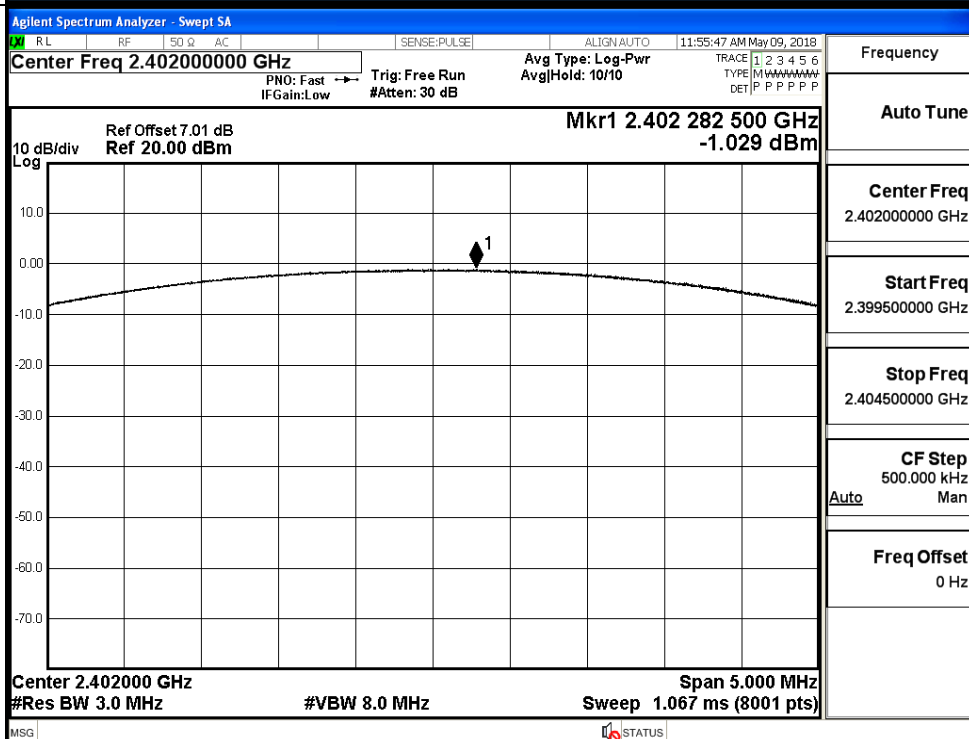
GFSK/LCH

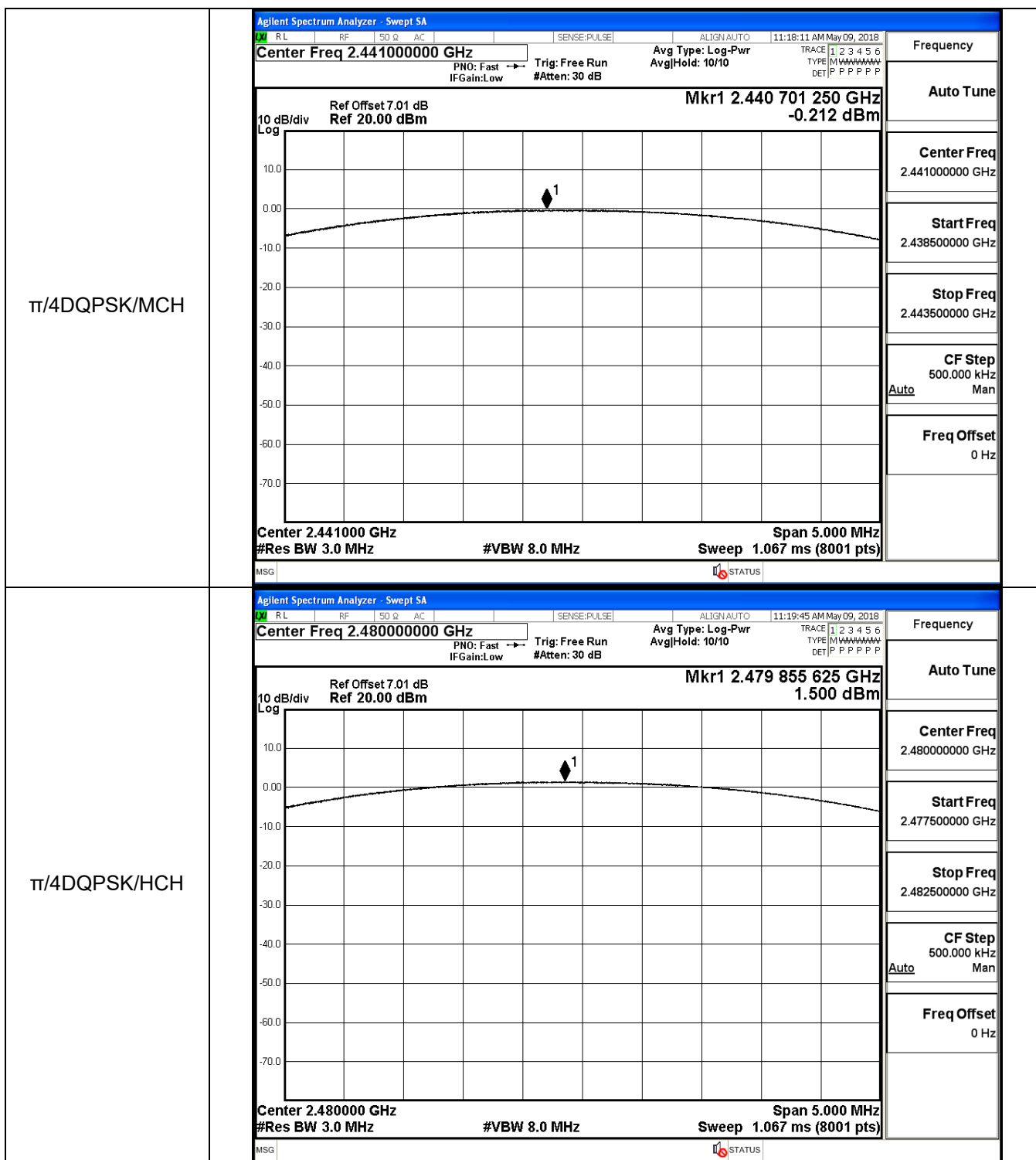


GFSK/MCH

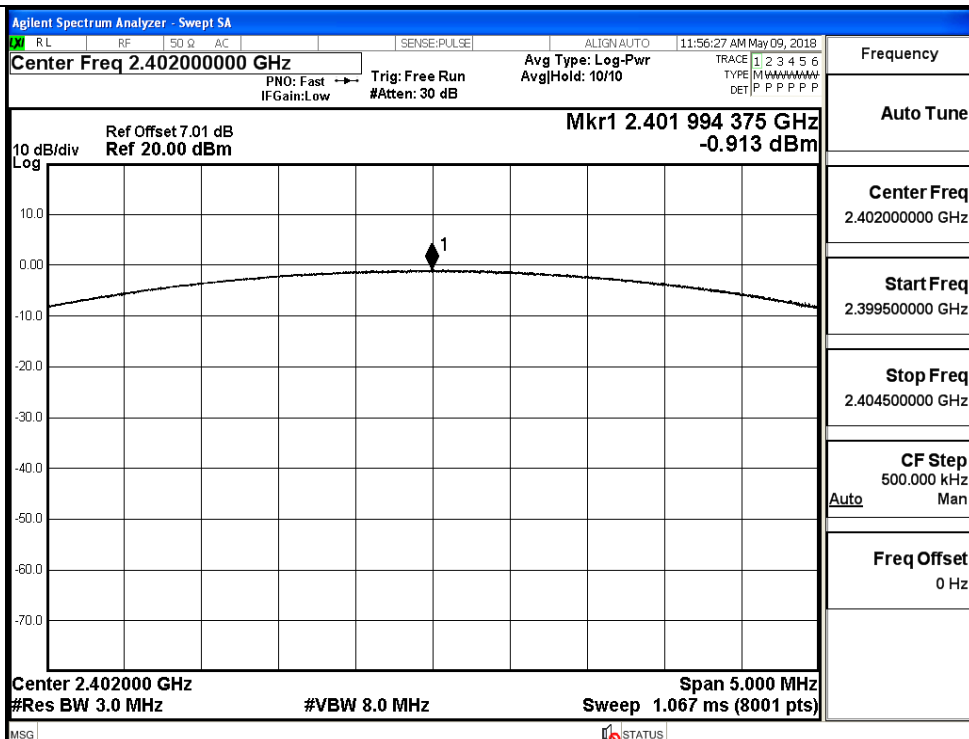


GFSK/HCH

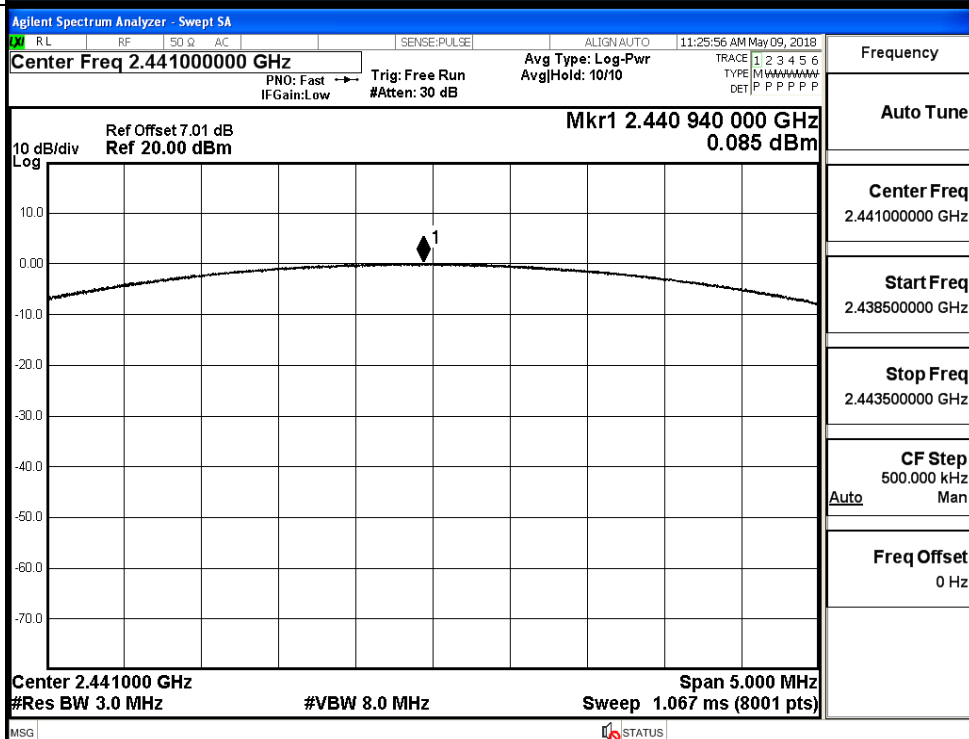
 $\pi$ /4DQPSK/LCH



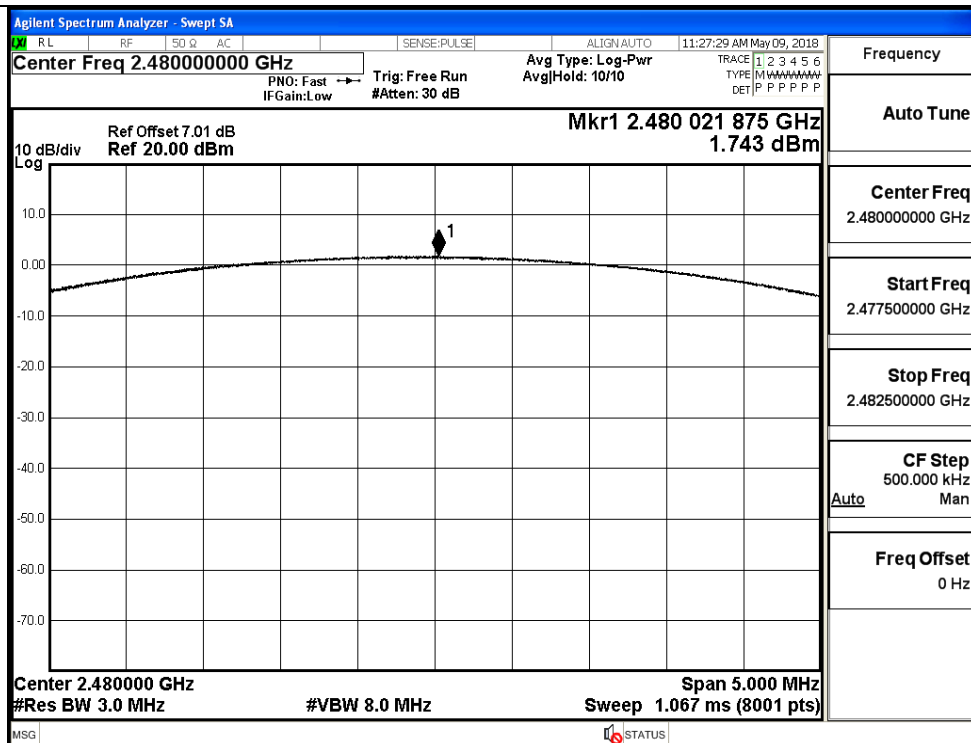
8DPSK/LCH



8DPSK/MCH



8DPSK/HCH

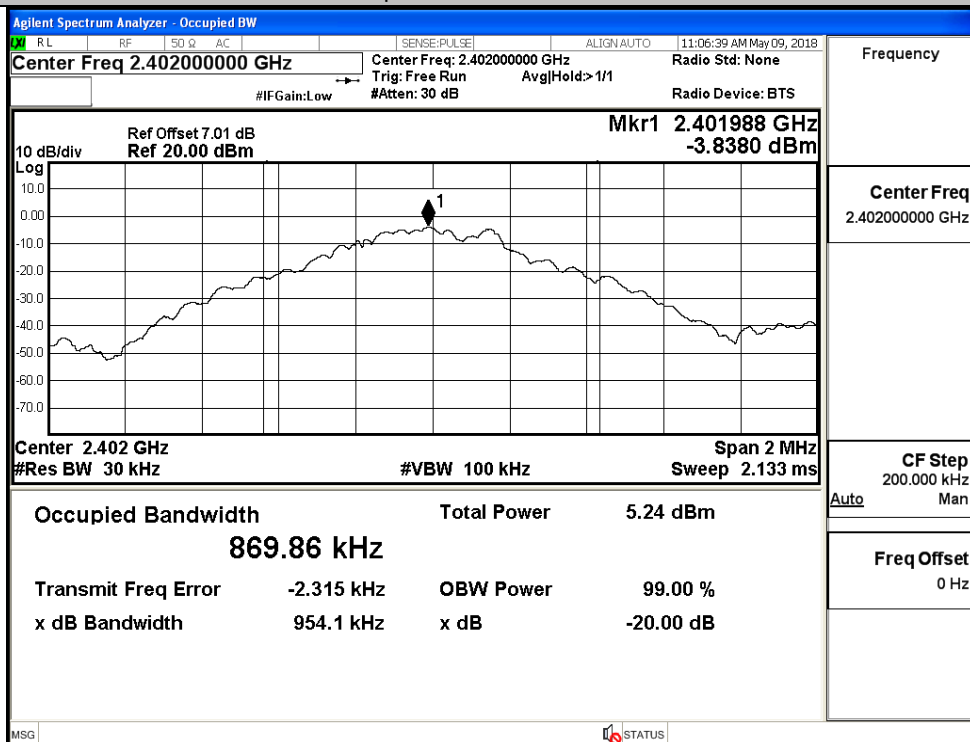


## A.2 20dB Bandwidth

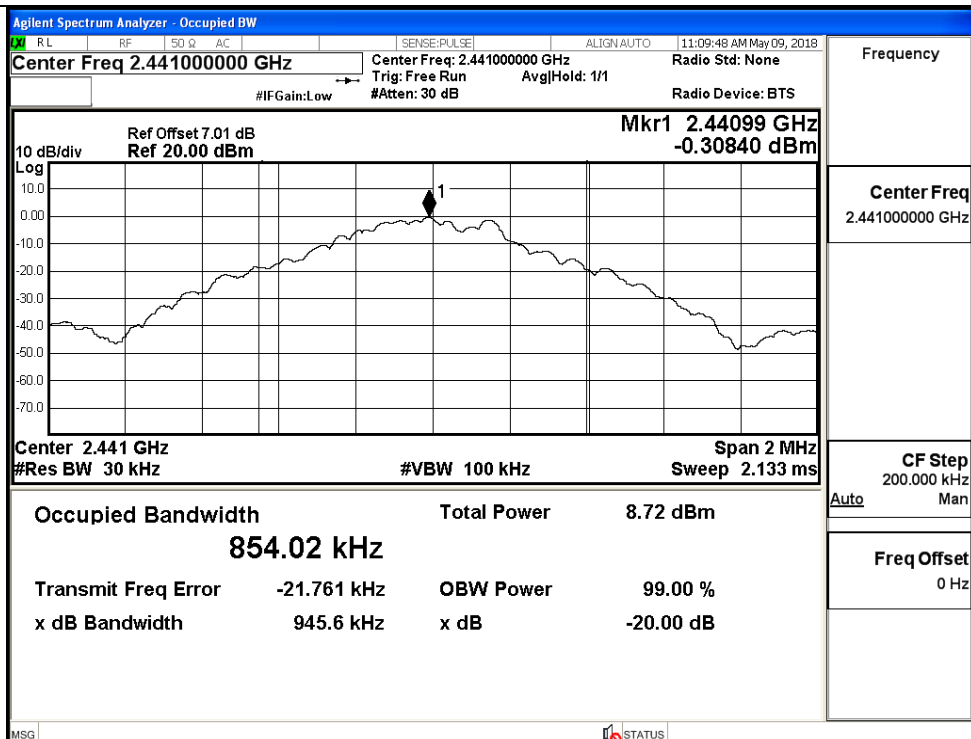
| Mode          | Channel. | 20dB Bandwidth [MHz] | Limit [MHz]   | Verdict |
|---------------|----------|----------------------|---------------|---------|
| GFSK          | LCH      | 0.9541               | Not Specified | PASS    |
|               | MCH      | 0.9456               | Not Specified | PASS    |
|               | HCH      | 0.9446               | Not Specified | PASS    |
| $\pi/4$ DQPSK | LCH      | 1.265                | Not Specified | PASS    |
|               | MCH      | 1.231                | Not Specified | PASS    |
|               | HCH      | 1.232                | Not Specified | PASS    |
| 8DPSK         | LCH      | 1.282                | Not Specified | PASS    |
|               | MCH      | 1.267                | Not Specified | PASS    |
|               | HCH      | 1.261                | Not Specified | PASS    |

## Test Graphs

GFSK/LCH



GFSK/MCH



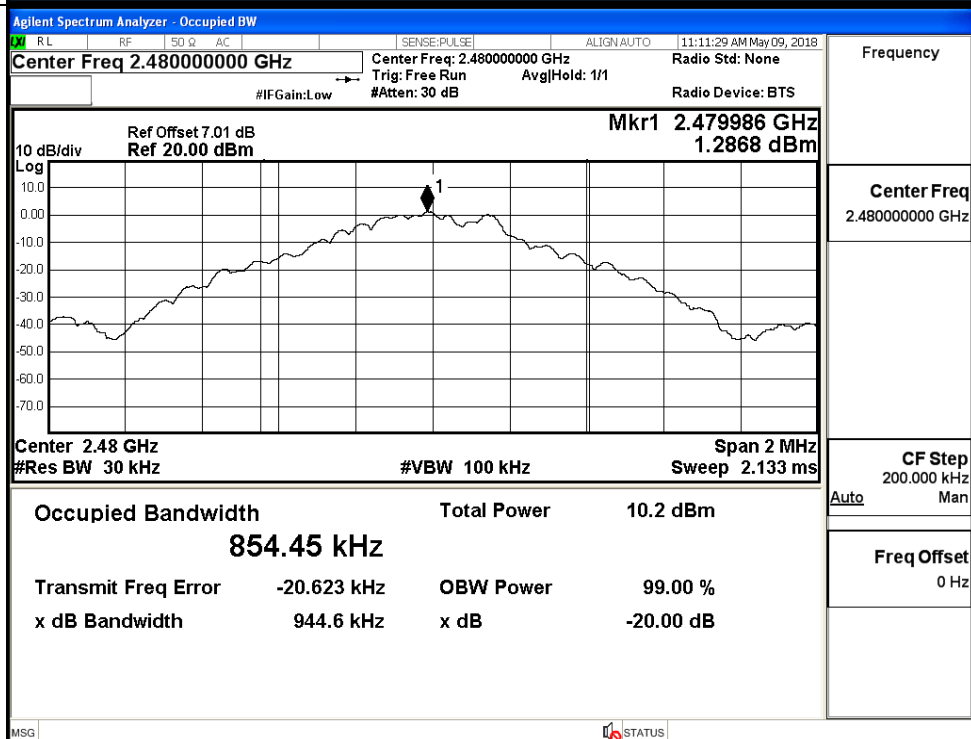
Frequency

Center Freq  
2.441000000 GHzCF Step  
200.000 kHz  
Man

Auto

Freq Offset  
0 Hz

GFSK/HCH



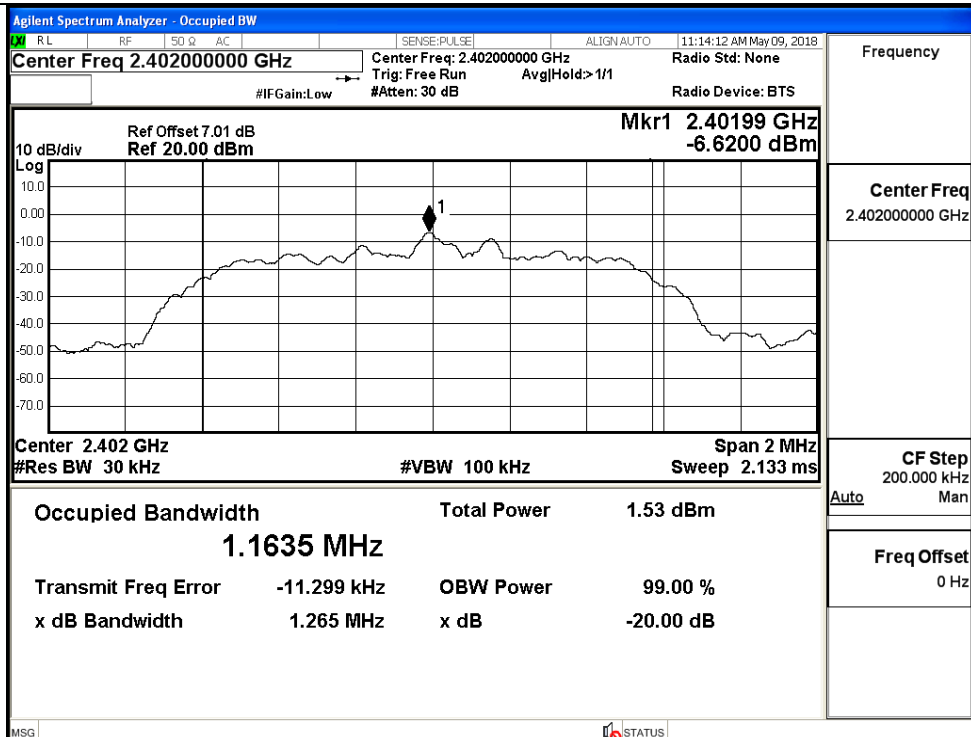
Frequency

Center Freq  
2.480000000 GHzCF Step  
200.000 kHz  
Man

Auto

Freq Offset  
0 Hz

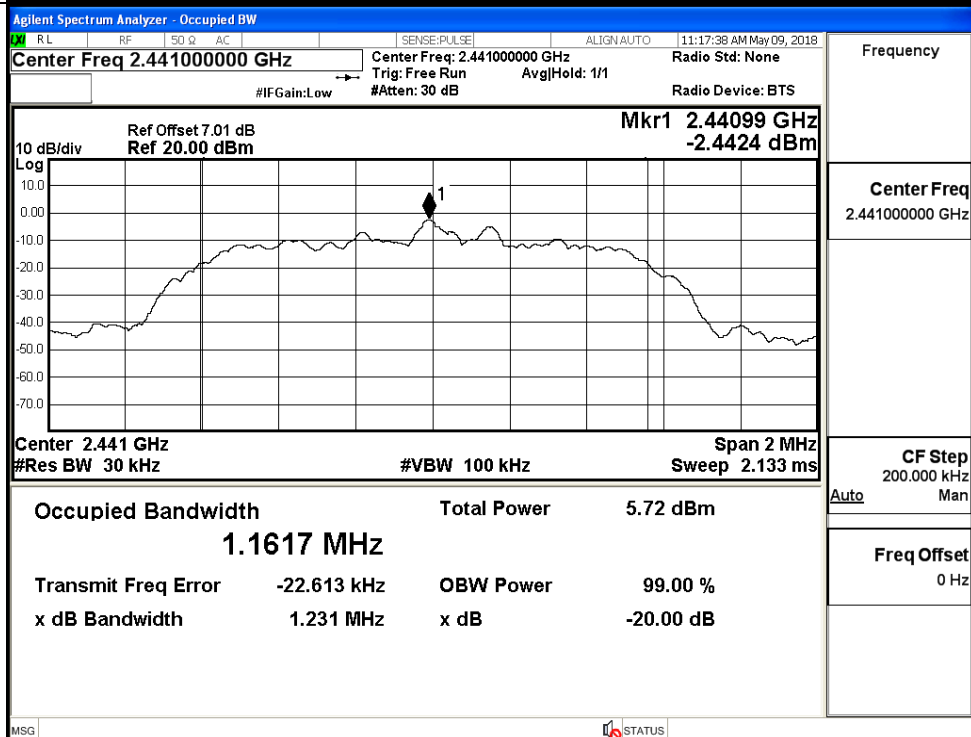


$\pi/4$ DQPSK/LCH

Frequency

Center Freq  
2.402000000 GHzCF Step  
200.000 kHz  
Man

Auto

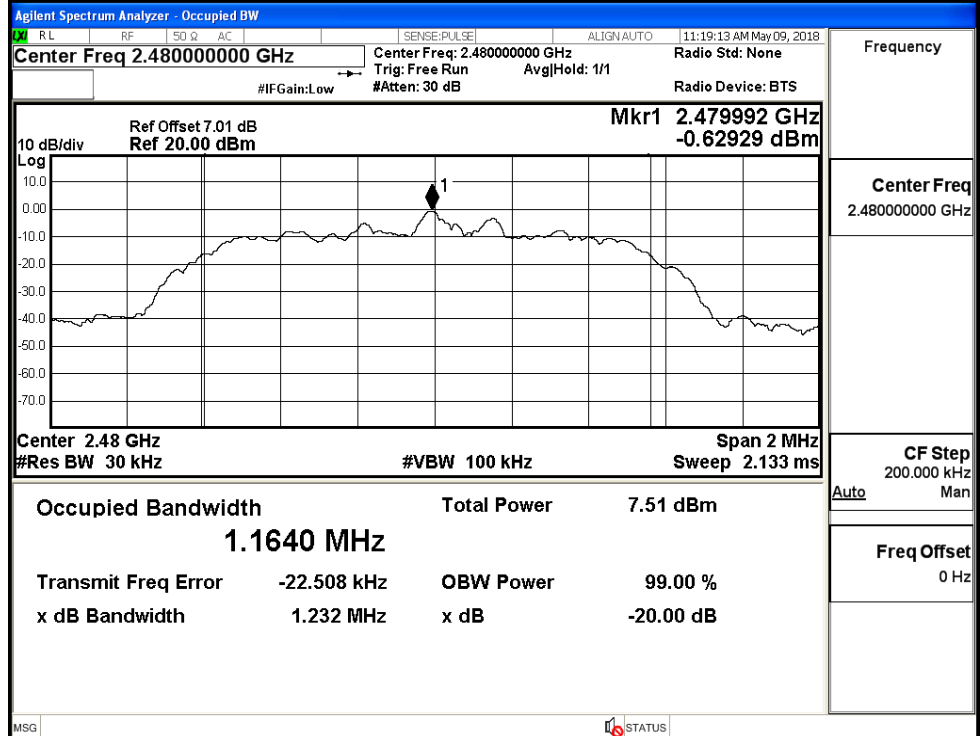
Freq Offset  
0 Hz $\pi/4$ DQPSK/MCH

Frequency

Center Freq  
2.441000000 GHzCF Step  
200.000 kHz  
Man

Auto

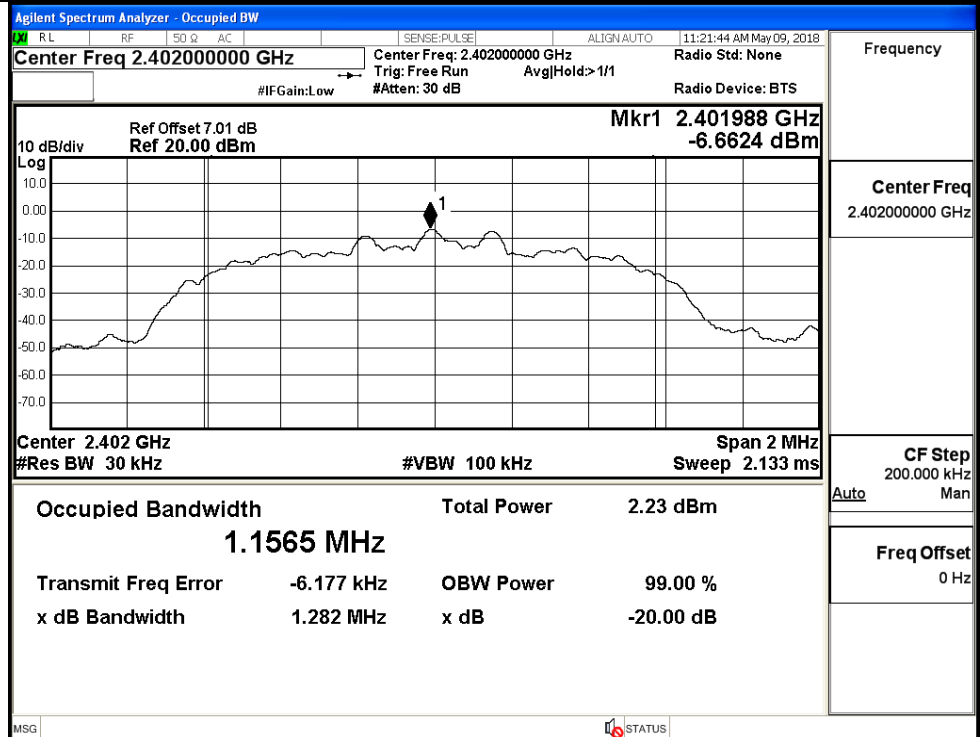
Freq Offset  
0 Hz

$\pi/4$ DQPSK/HCH

Frequency

Center Freq  
2.480000000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

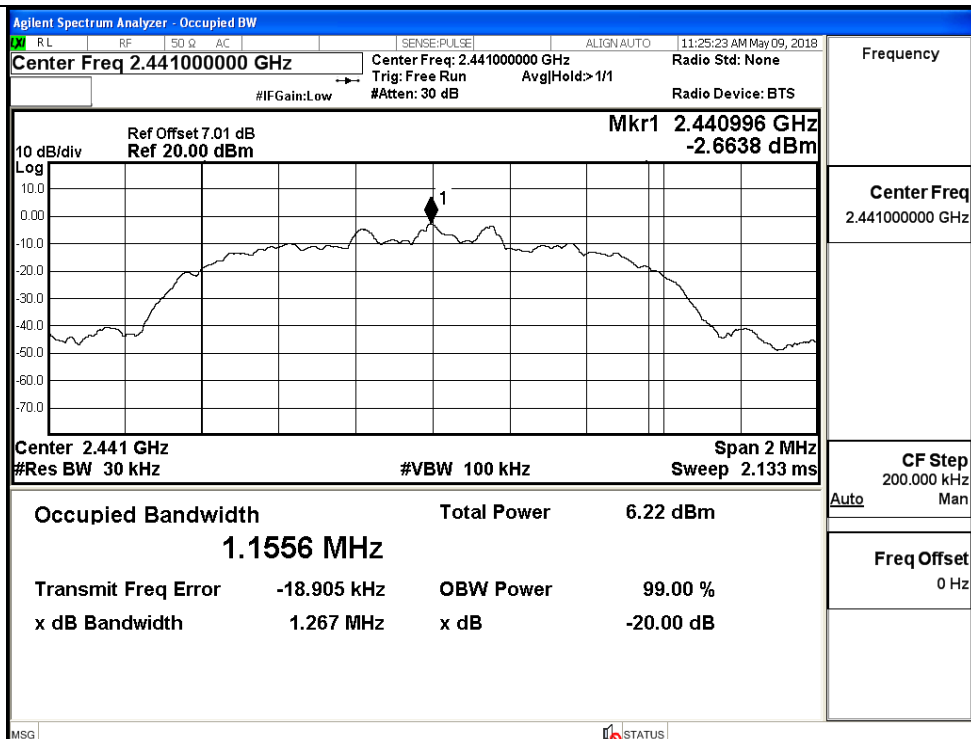
8DPSK/LCH



Frequency

Center Freq  
2.402000000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

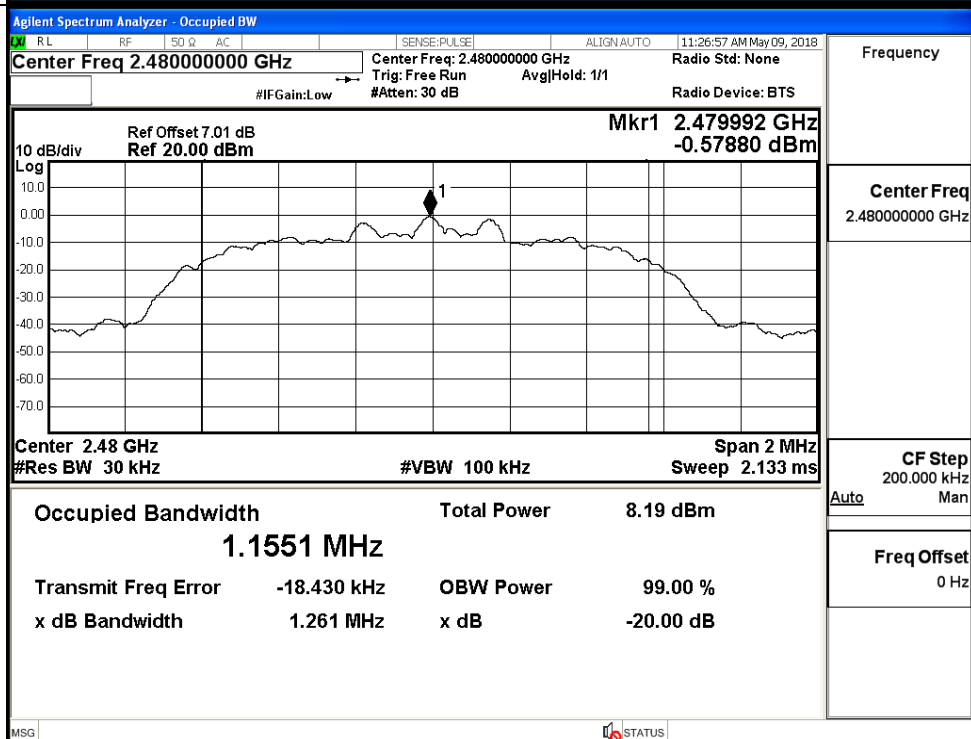
8DPSK/MCH



Frequency

Center Freq  
2.441000000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

8DPSK/HCH



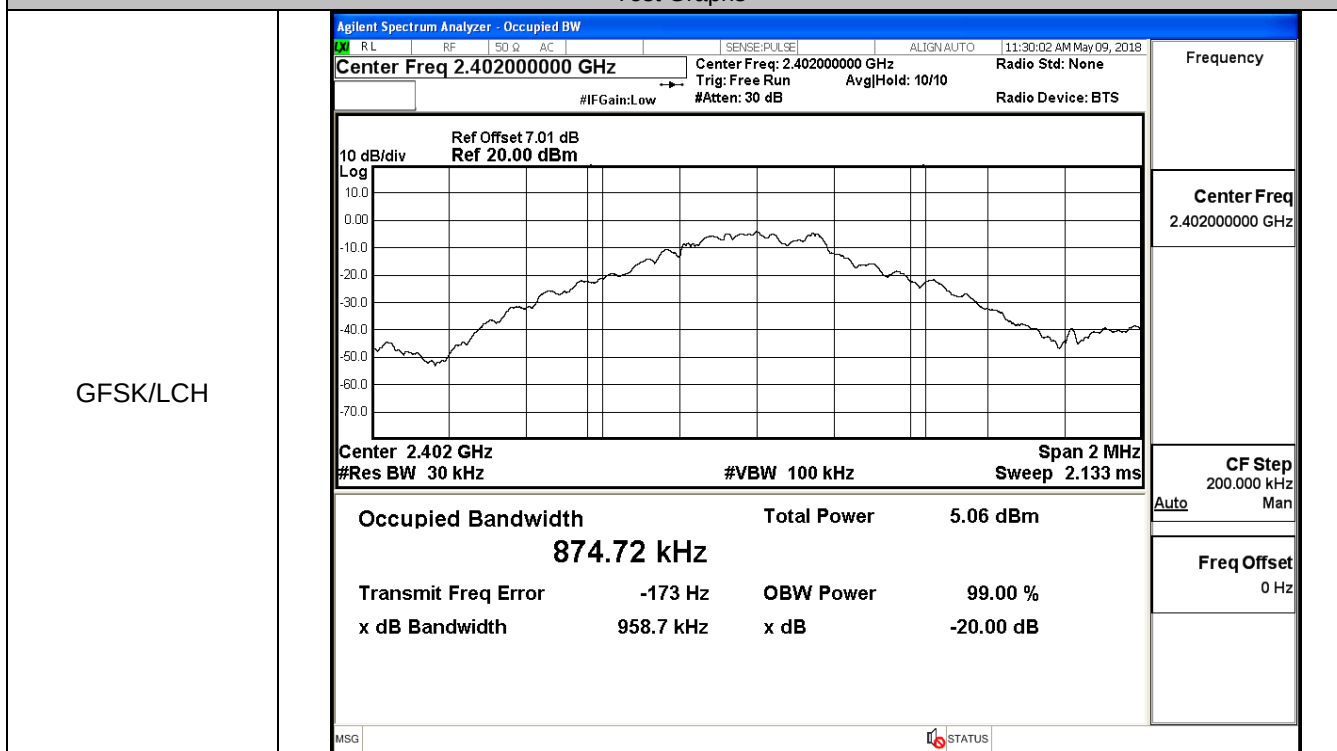
Frequency

Center Freq  
2.480000000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

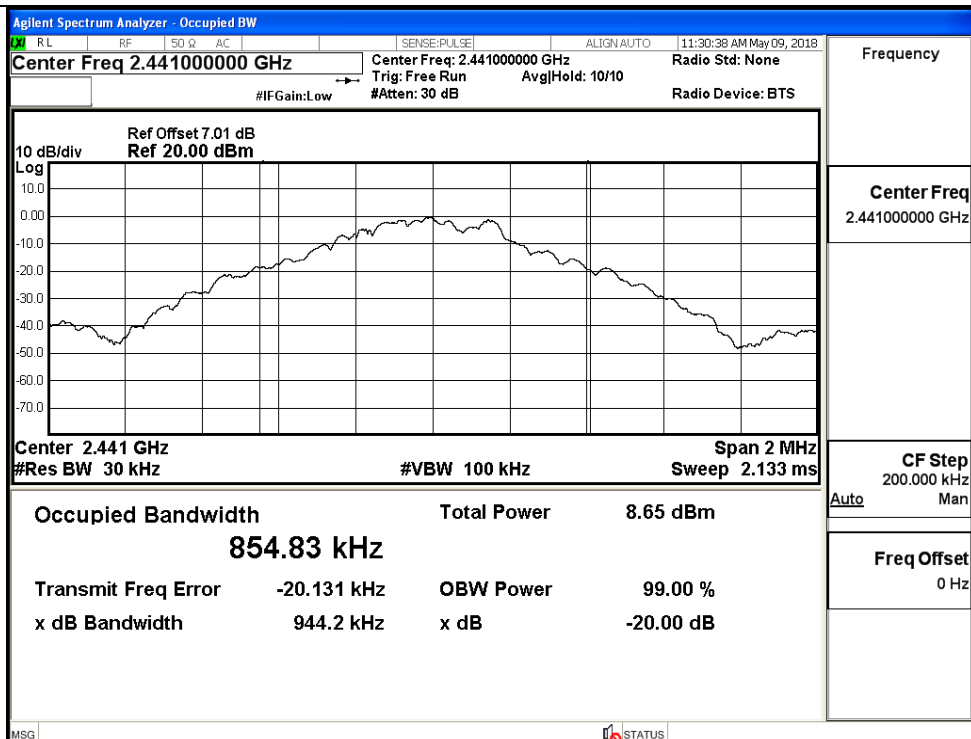
### A.3 Occupied Bandwidth

| Mode          | Channel. | Occupied Bandwidth [MHz] | Limit [MHz]   | Verdict |
|---------------|----------|--------------------------|---------------|---------|
| GFSK          | LCH      | 0.87472                  | Not Specified | PASS    |
|               | MCH      | 0.85483                  | Not Specified | PASS    |
|               | HCH      | 0.85411                  | Not Specified | PASS    |
| $\pi/4$ DQPSK | LCH      | 1.1666                   | Not Specified | PASS    |
|               | MCH      | 1.1620                   | Not Specified | PASS    |
|               | HCH      | 1.1628                   | Not Specified | PASS    |
| 8DPSK         | LCH      | 1.1574                   | Not Specified | PASS    |
|               | MCH      | 1.1558                   | Not Specified | PASS    |
|               | HCH      | 1.1572                   | Not Specified | PASS    |

Test Graphs



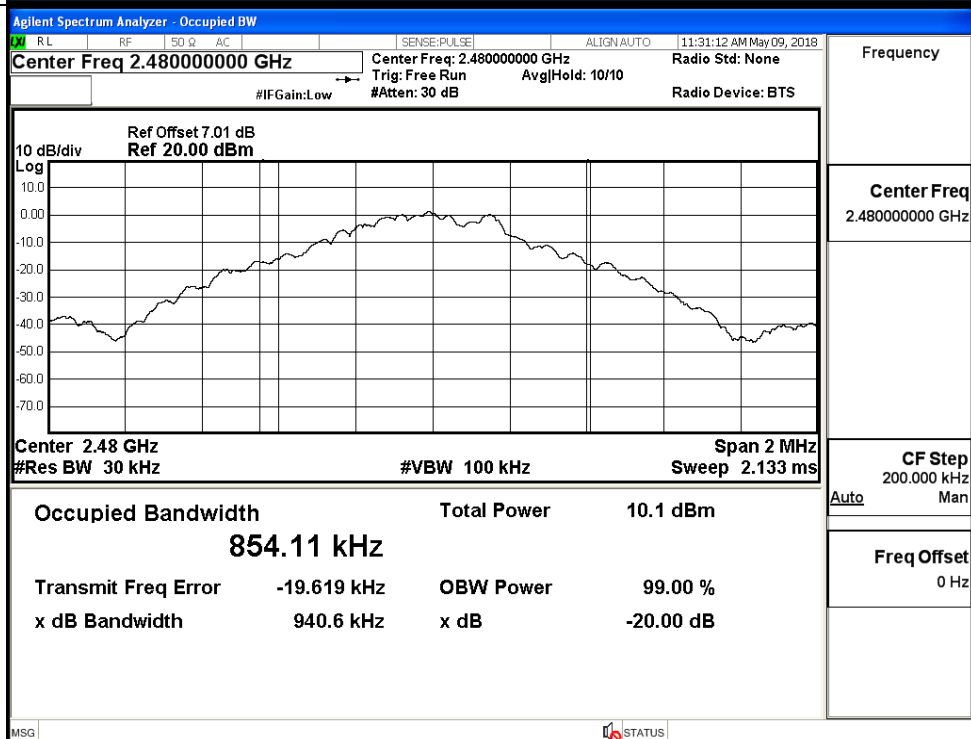
GFSK/MCH



Frequency

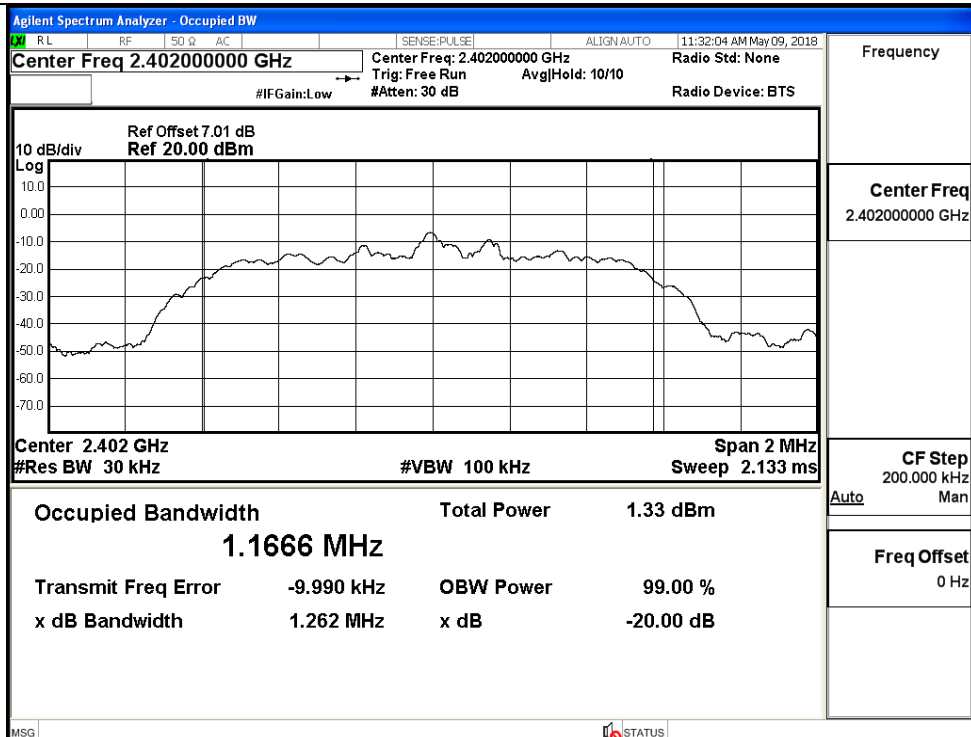
Center Freq  
2.441000000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

GFSK/HCH

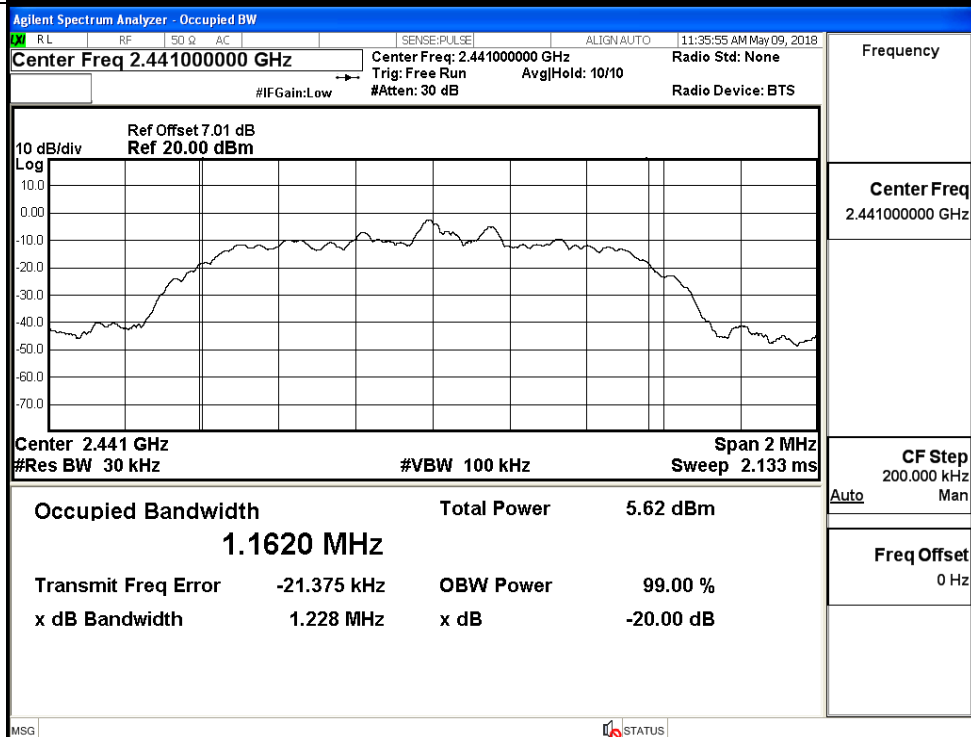


Frequency

Center Freq  
2.480000000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

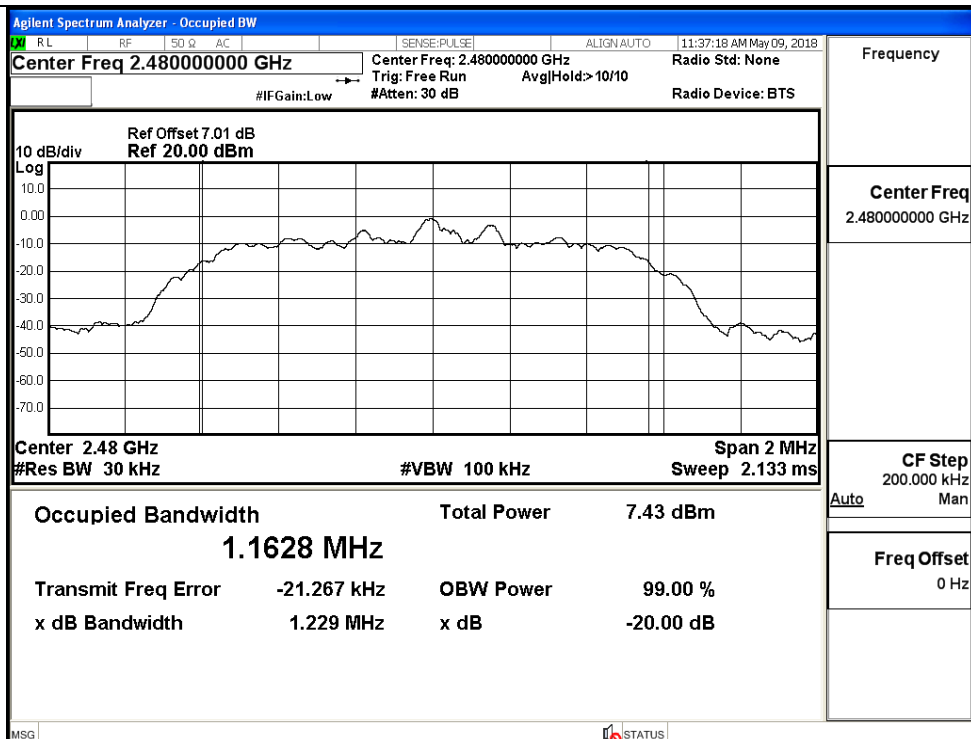
$\pi/4$ DQPSK/LCH

Frequency

Center Freq  
2.402000000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz $\pi/4$ DQPSK/MCH

Frequency

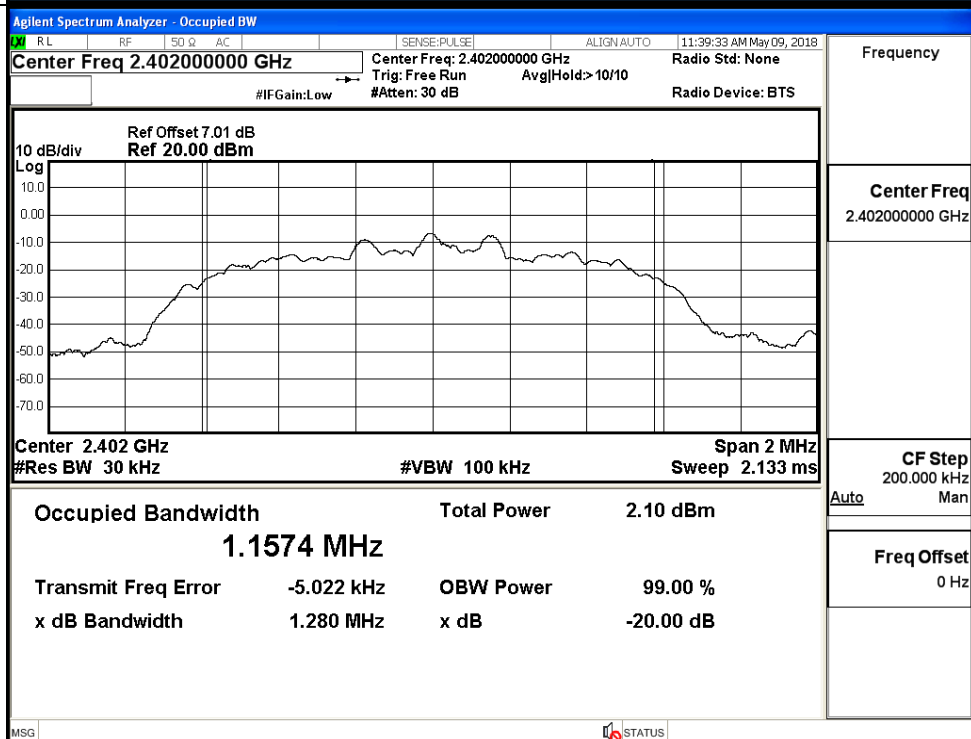
Center Freq  
2.441000000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

$\pi/4$ DQPSK/HCH

Frequency

Center Freq  
2.480000000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

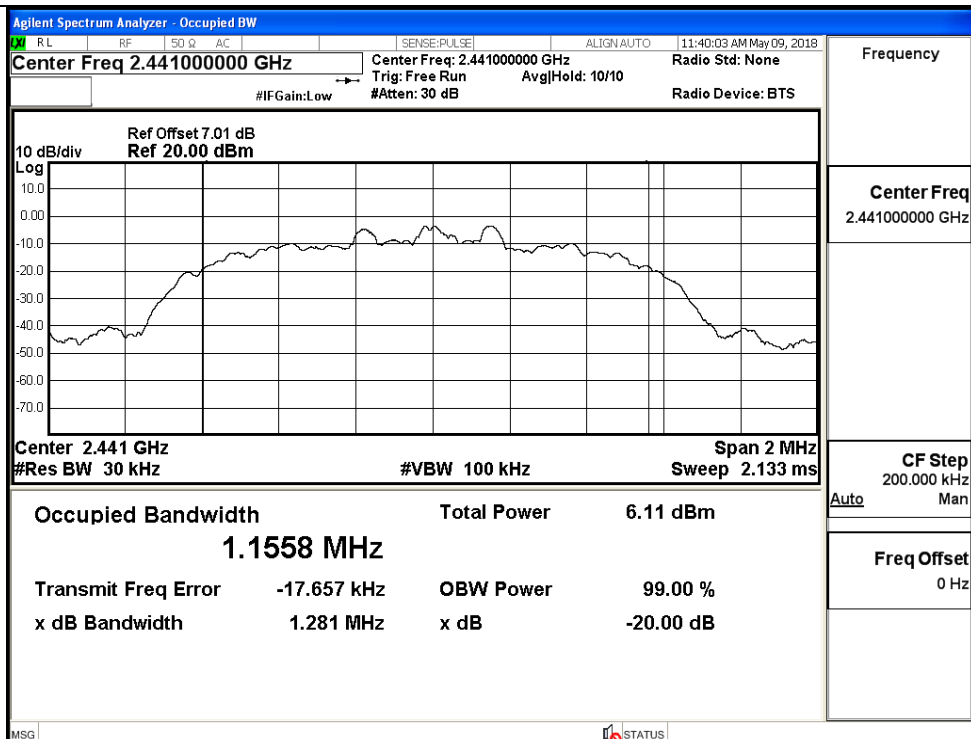
8DPSK/LCH



Frequency

Center Freq  
2.402000000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

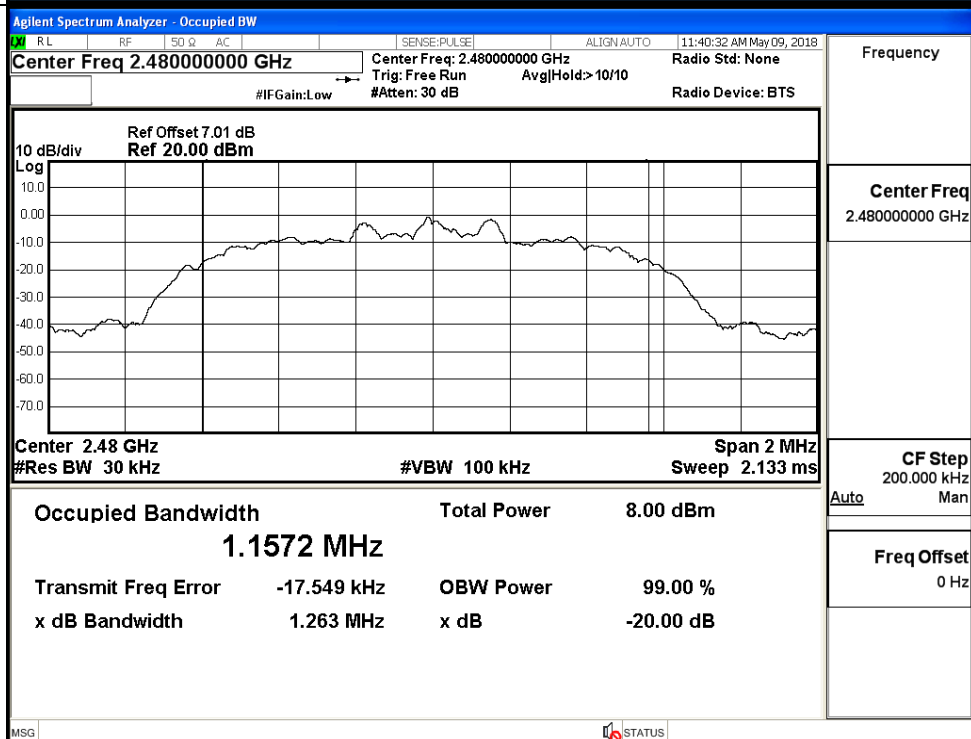
8DPSK/MCH



Frequency

Center Freq  
2.441000000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

8DPSK/HCH



Frequency

Center Freq  
2.480000000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

## A.4 Carrier Frequency Separation

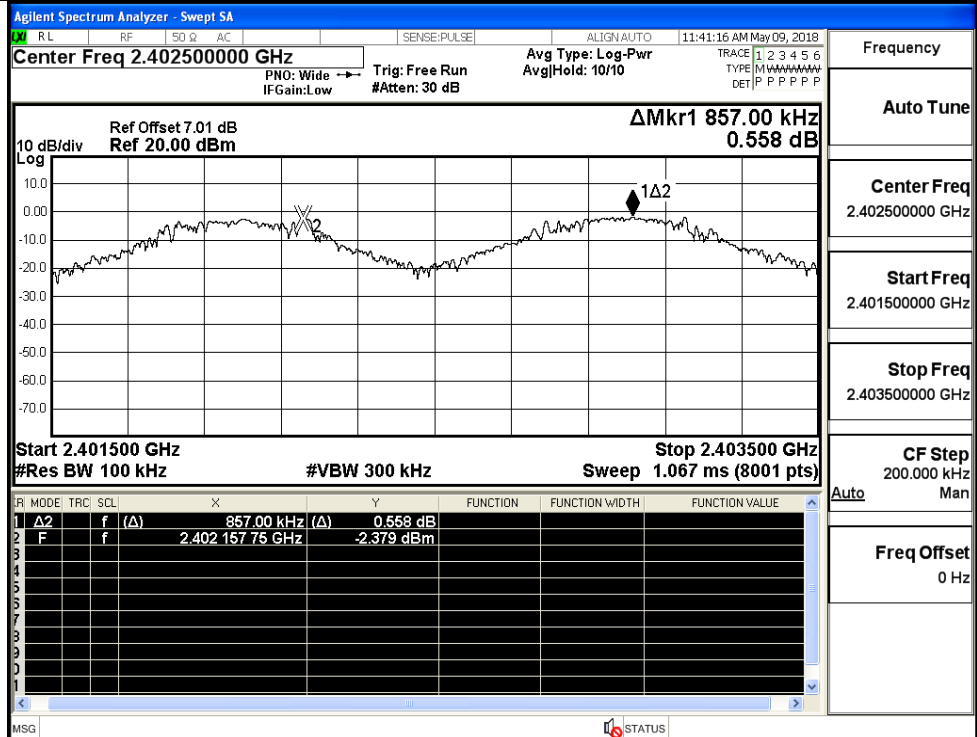
| Mode          | Channel. | Carrier Frequency Separation [MHz] | Limit [MHz] | Verdict |
|---------------|----------|------------------------------------|-------------|---------|
| GFSK          | LCH      | 0.857                              | 0.636       | PASS    |
|               | MCH      | 1.216                              | 0.636       | PASS    |
|               | HCH      | 1.108                              | 0.636       | PASS    |
| $\pi/4$ DQPSK | LCH      | 1.172                              | 0.843       | PASS    |



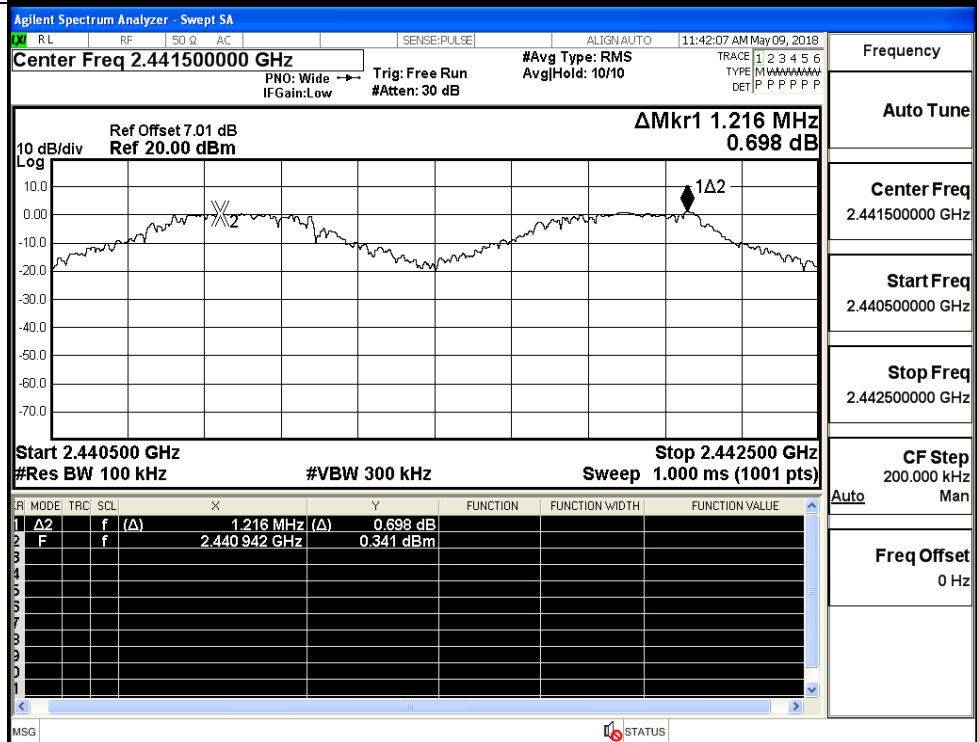
|       |     |       |       |      |
|-------|-----|-------|-------|------|
| 8DPSK | MCH | 1.004 | 0.843 | PASS |
|       | HCH | 0.904 | 0.843 | PASS |
|       | LCH | 1.168 | 0.855 | PASS |
|       | MCH | 1.012 | 0.855 | PASS |
|       | HCH | 1.132 | 0.855 | PASS |

## Test Graphs

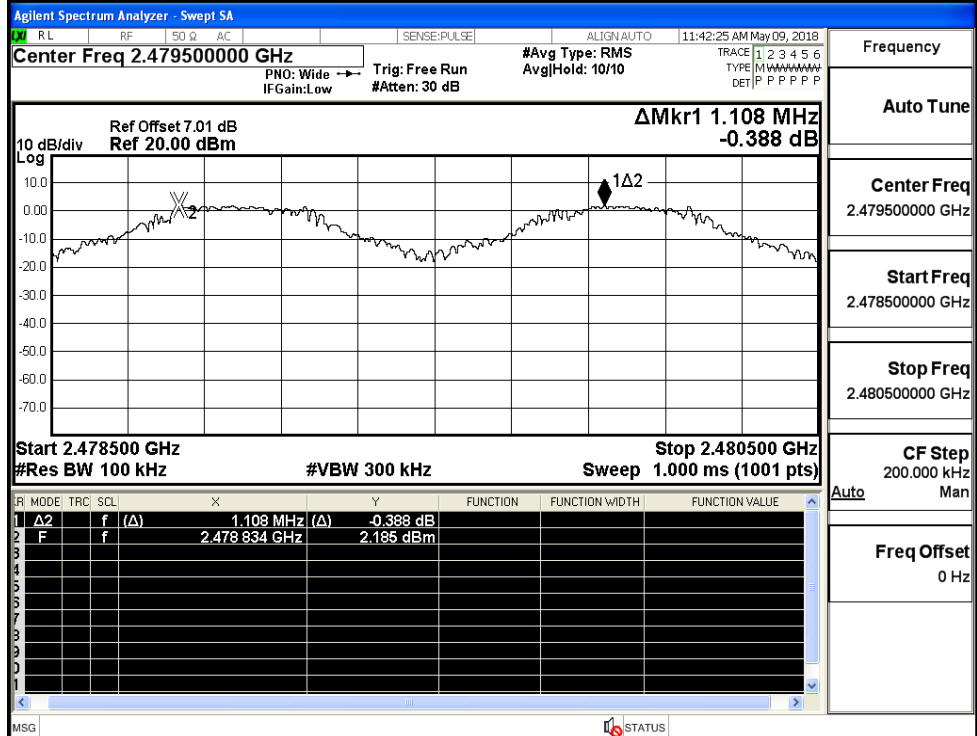
GFSK/LCH



GFSK/MCH



GFSK/HCH

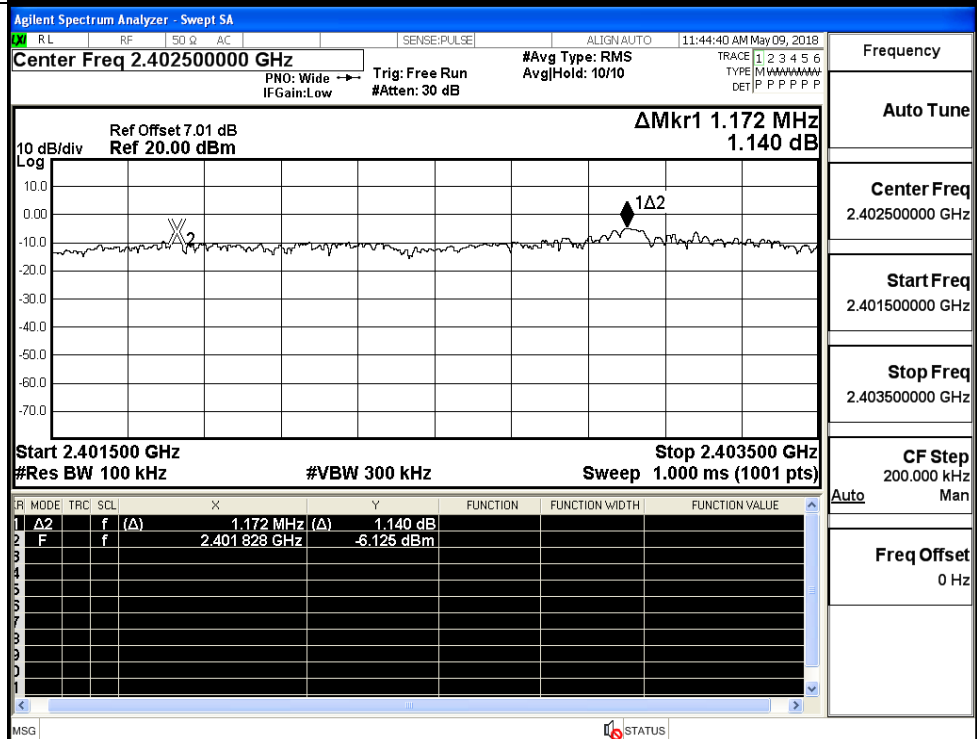


Frequency

Auto Tune

Center Freq  
2.479500000 GHzStart Freq  
2.478500000 GHzStop Freq  
2.480500000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

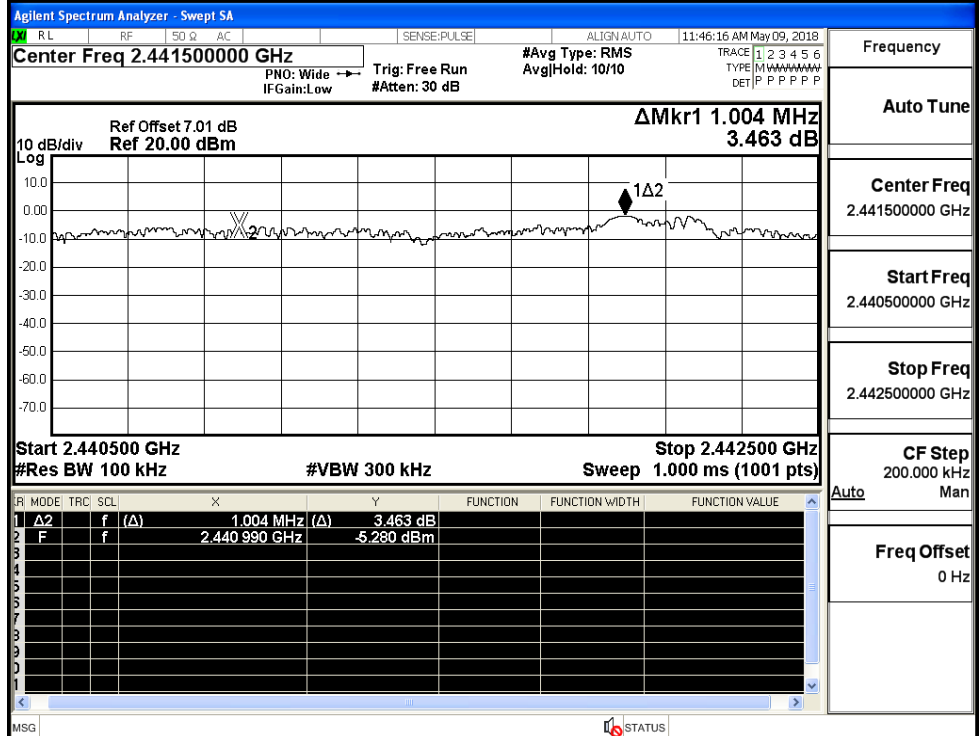
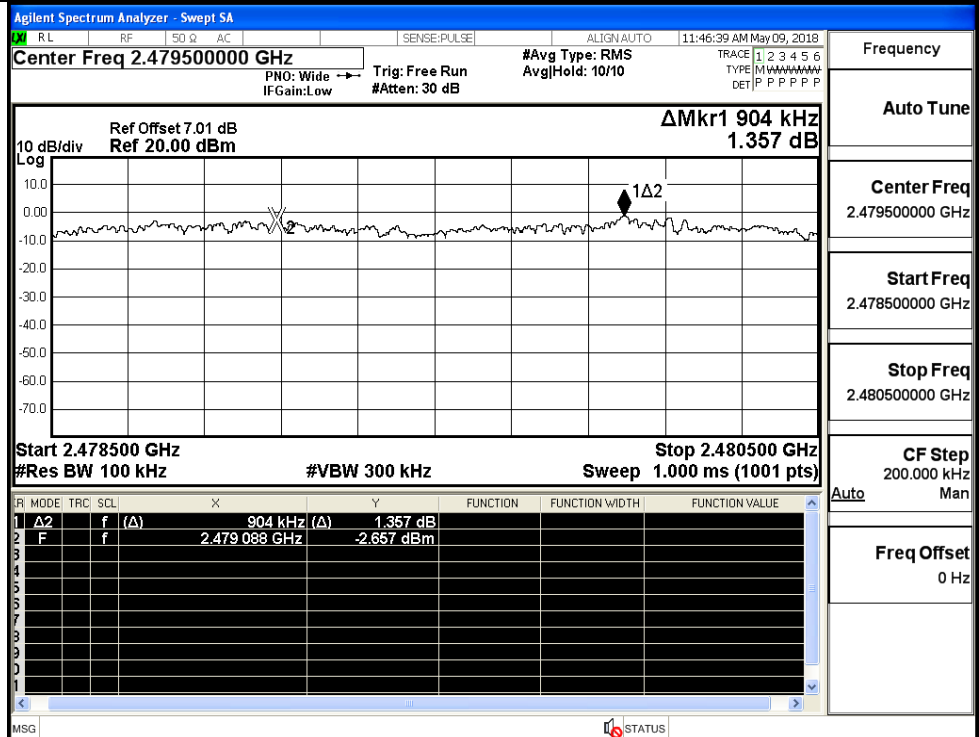
π/4DQPSK/LCH



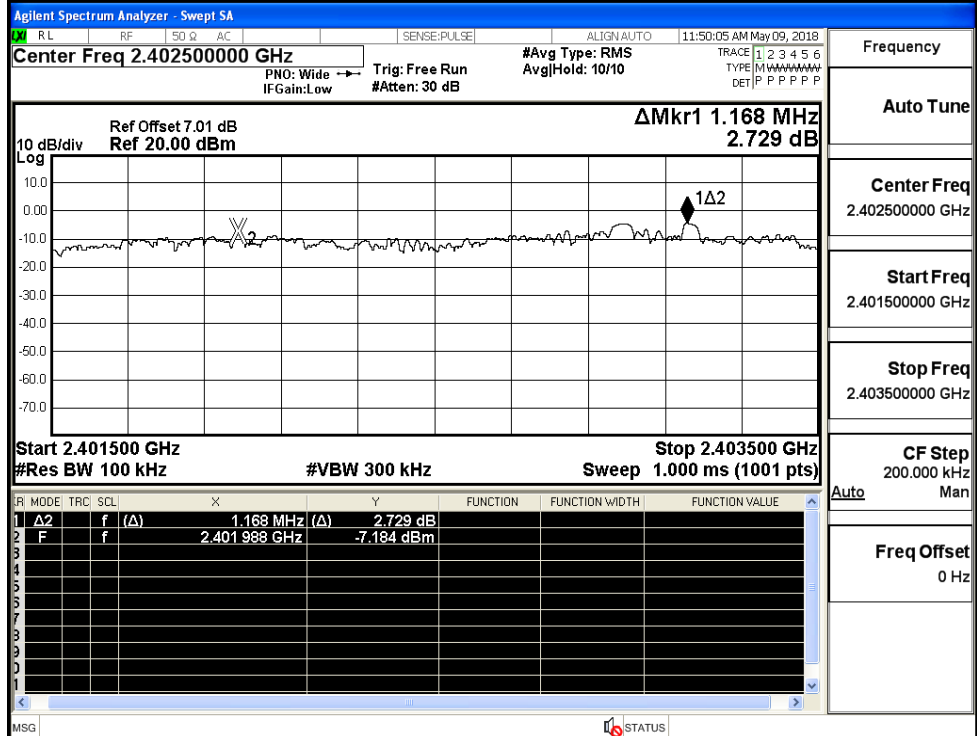
Frequency

Auto Tune

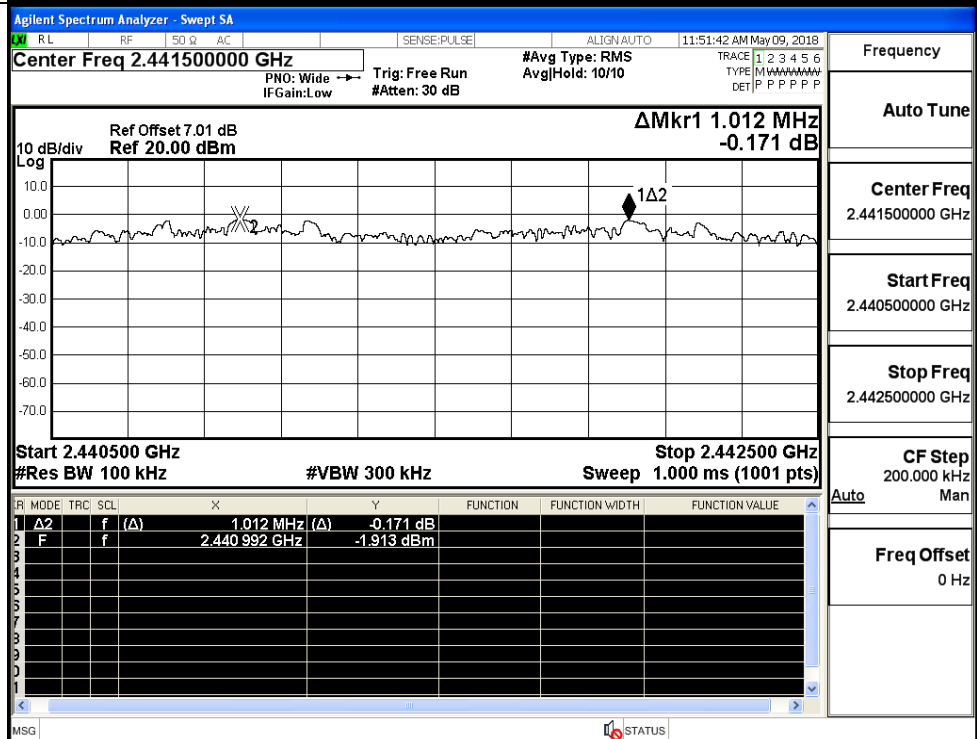
Center Freq  
2.402500000 GHzStart Freq  
2.401500000 GHzStop Freq  
2.403500000 GHzCF Step  
200.000 kHz  
ManFreq Offset  
0 Hz

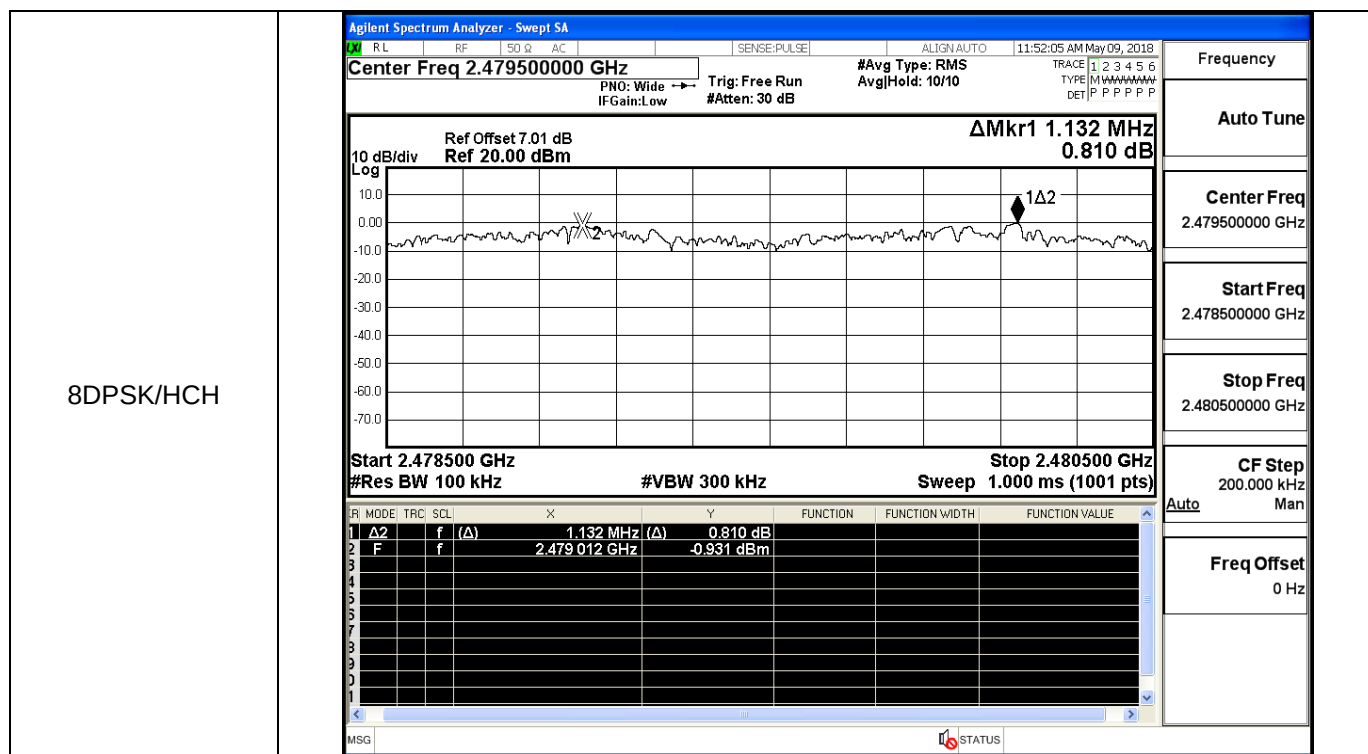
$\pi/4$ DQPSK/MCH $\pi/4$ DQPSK/HCH

8DPSK/LCH



8DPSK/MCH



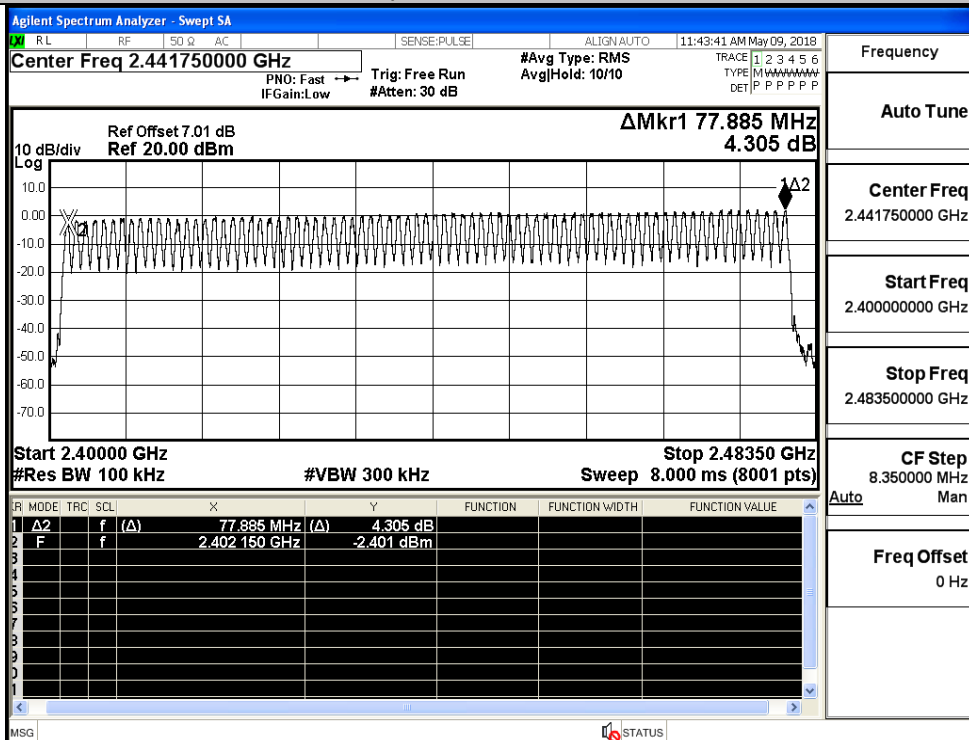


### A.5 Hopping Channel Number

| 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

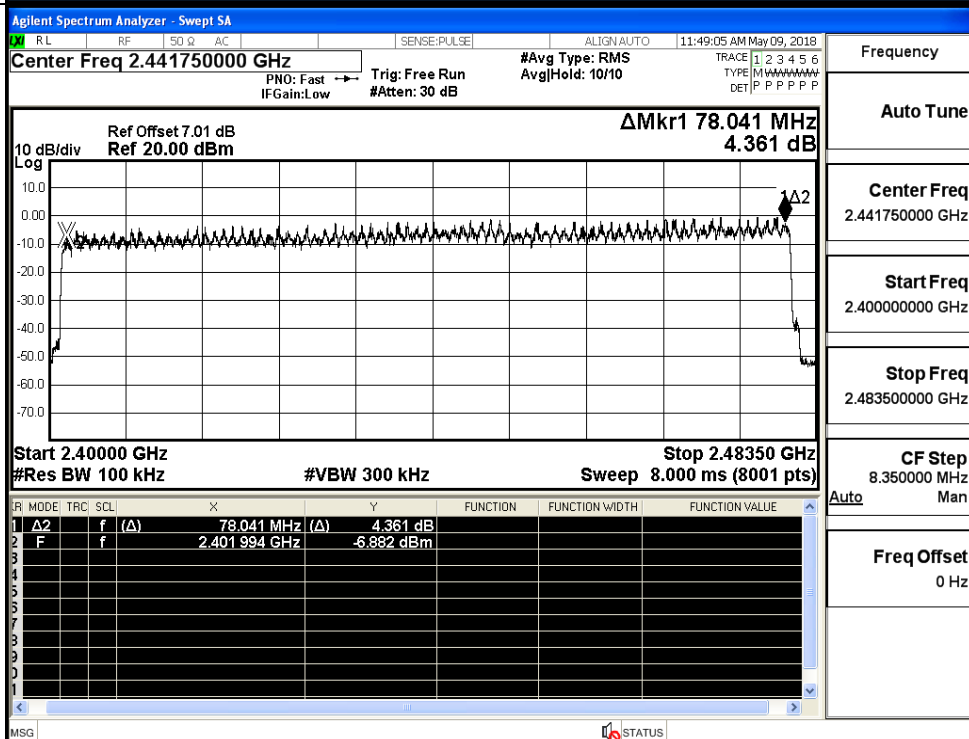


Frequency

Auto Tune

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

π/4DQPSK/Hop

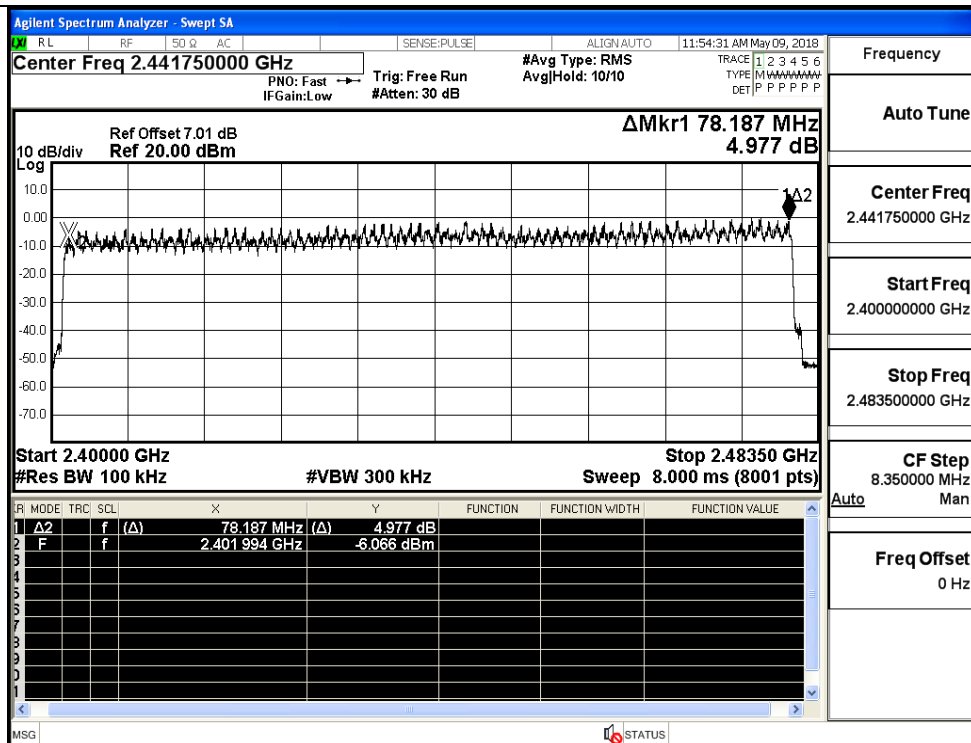


Frequency

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

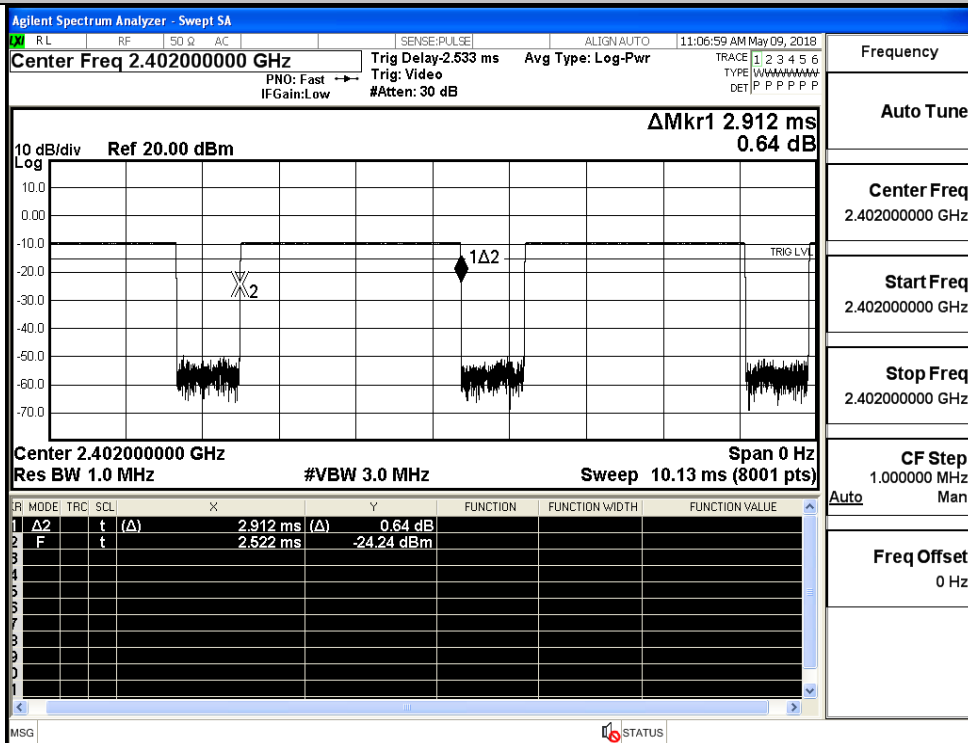


## A.6 Dwell Time

| Mode          | Packet | Channel | Burst Width<br>[ms/hop/ch] | Total<br>Hops[hop*ch] | Dwell Time[s] | Limit [s] | Verdict |
|---------------|--------|---------|----------------------------|-----------------------|---------------|-----------|---------|
| GFSK          | DH5    | LCH     | 2.91                       | 106.7                 | 0.31          | 0.4       | PASS    |
|               | DH5    | MCH     | 2.91                       | 106.7                 | 0.31          | 0.4       | PASS    |
|               | DH5    | HCH     | 2.91                       | 106.7                 | 0.31          | 0.4       | PASS    |
| $\pi/4$ DQPSK | 2DH5   | LCH     | 2.91                       | 106.7                 | 0.312         | 0.4       | PASS    |
|               | 2DH5   | MCH     | 2.91                       | 106.7                 | 0.312         | 0.4       | PASS    |
|               | 2DH5   | HCH     | 2.91                       | 106.7                 | 0.312         | 0.4       | PASS    |
| 8DPSK         | 3DH5   | LCH     | 2.91                       | 106.7                 | 0.312         | 0.4       | PASS    |
|               | 3DH5   | MCH     | 2.91                       | 106.7                 | 0.312         | 0.4       | PASS    |
|               | 3DH5   | HCH     | 2.91                       | 106.7                 | 0.312         | 0.4       | PASS    |

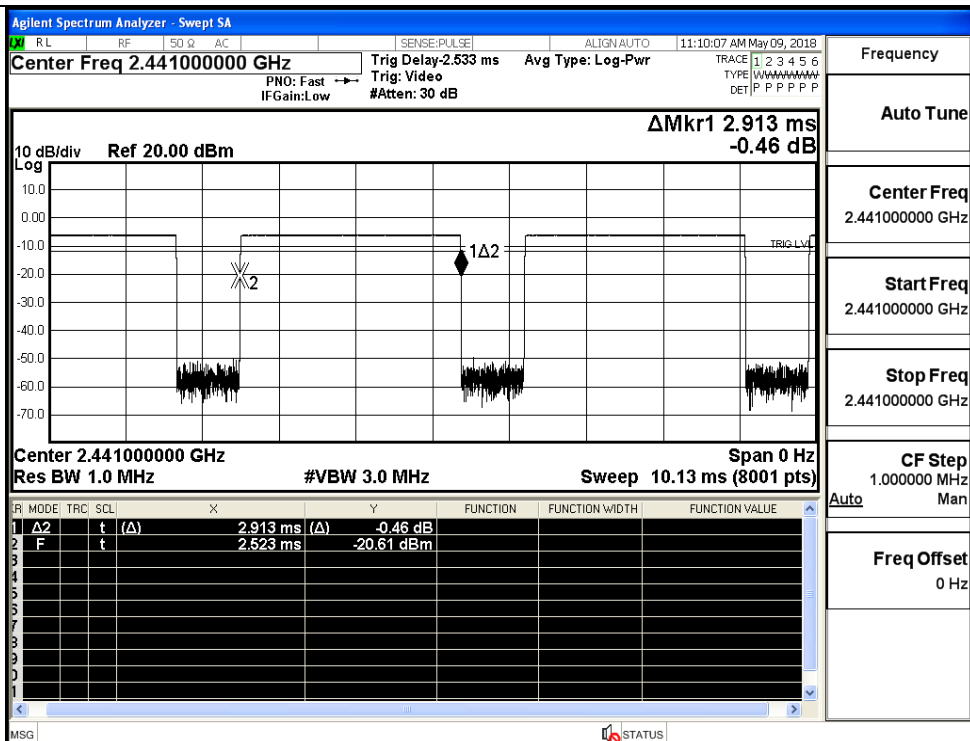
## Test Graphs

GFSK\_DH5/LCH

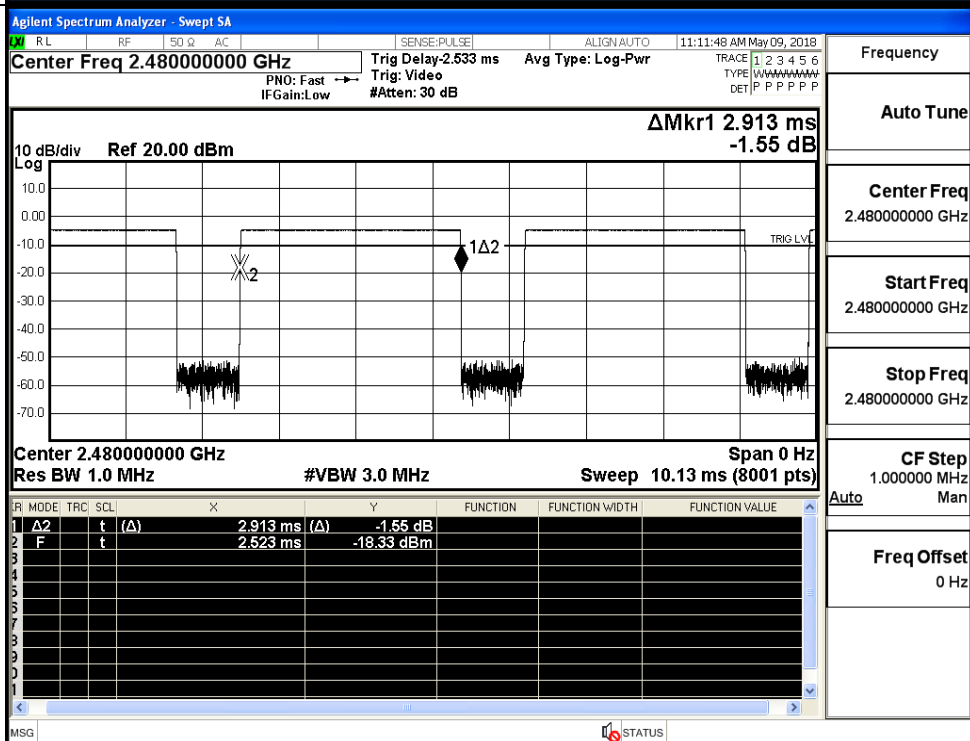




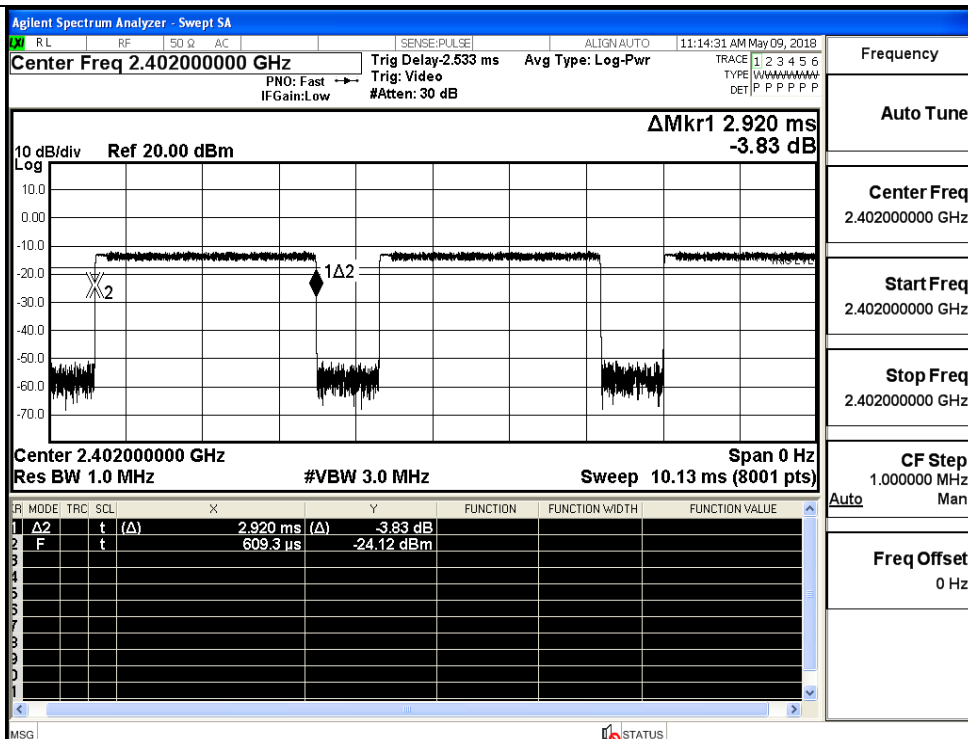
GFSK\_DH5/MCH



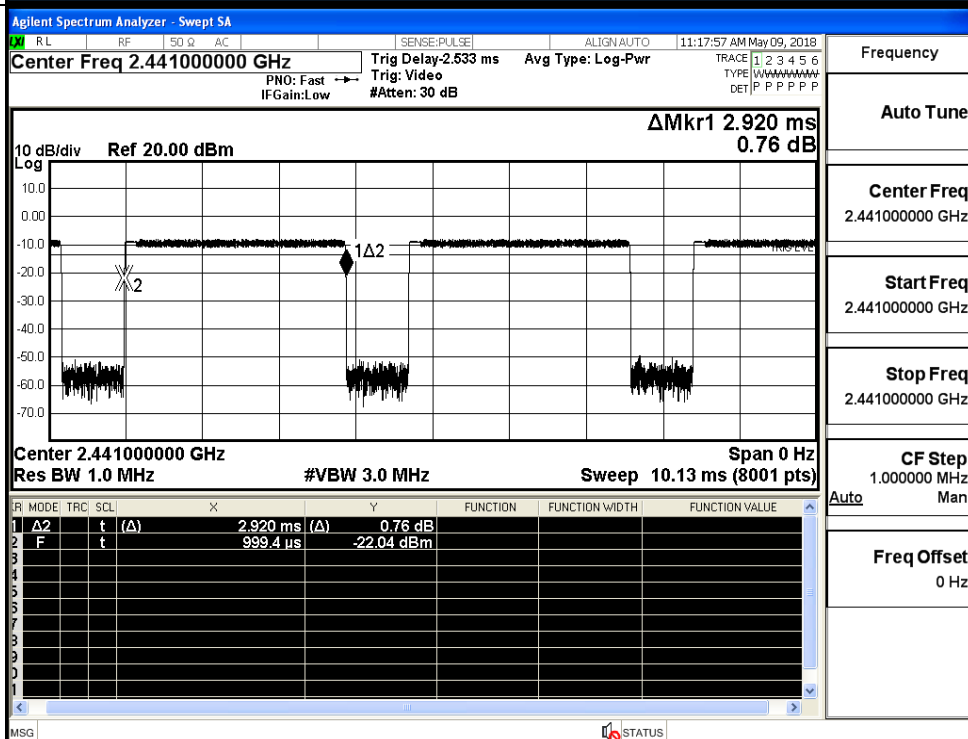
GFSK\_DH5/HCH



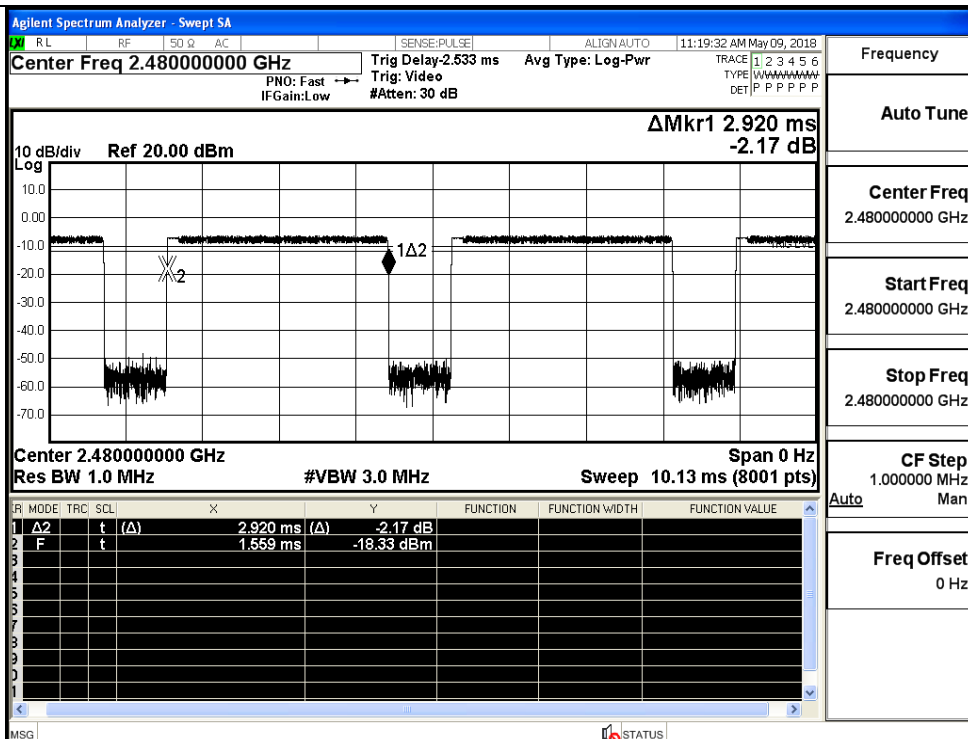
$\pi/4$ DQPSK  
\_2DH5/LCH



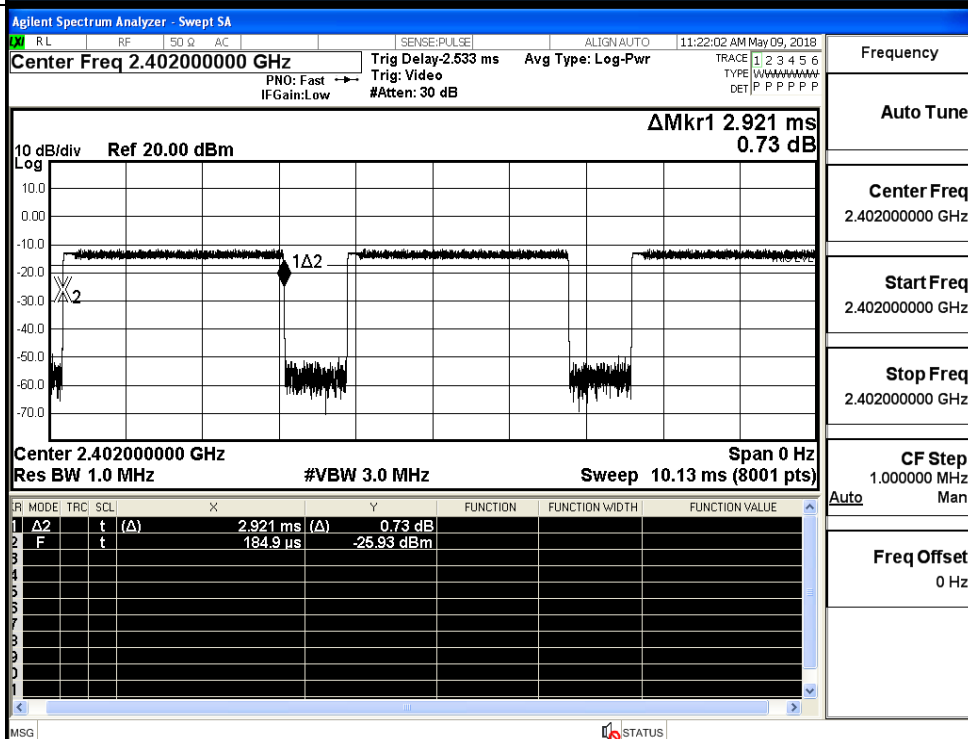
$\pi/4$ DQPSK  
\_2DH5/MCH



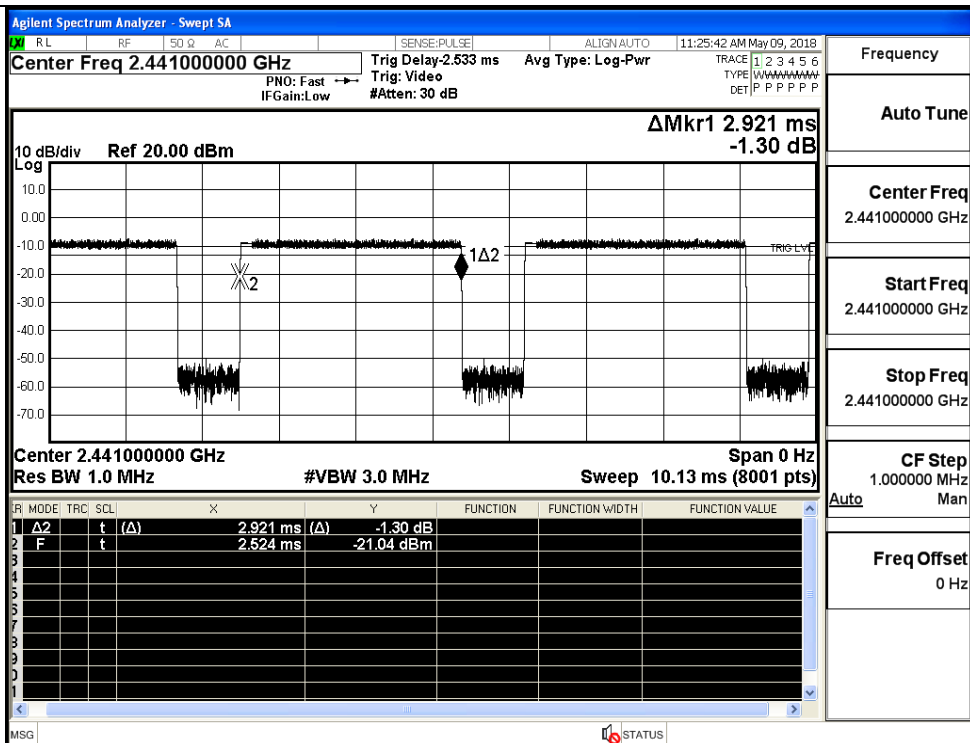
$\pi/4$ DQPSK  
\_2DH5/HCH



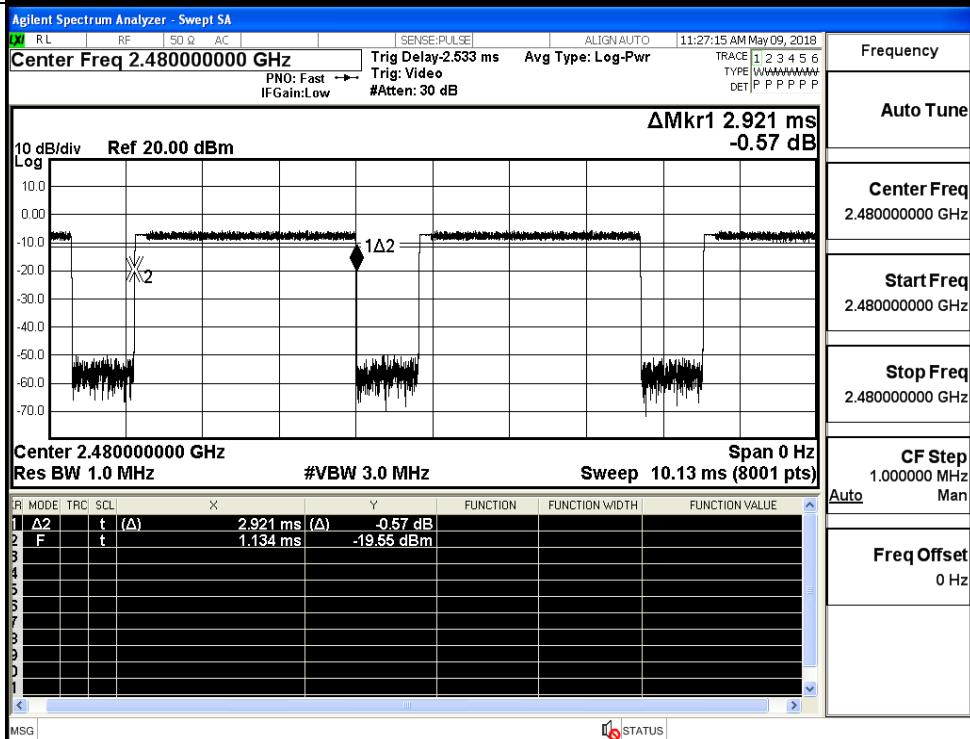
8DPSK\_3DH5/LCH



8DPSK\_3DH5/MCH



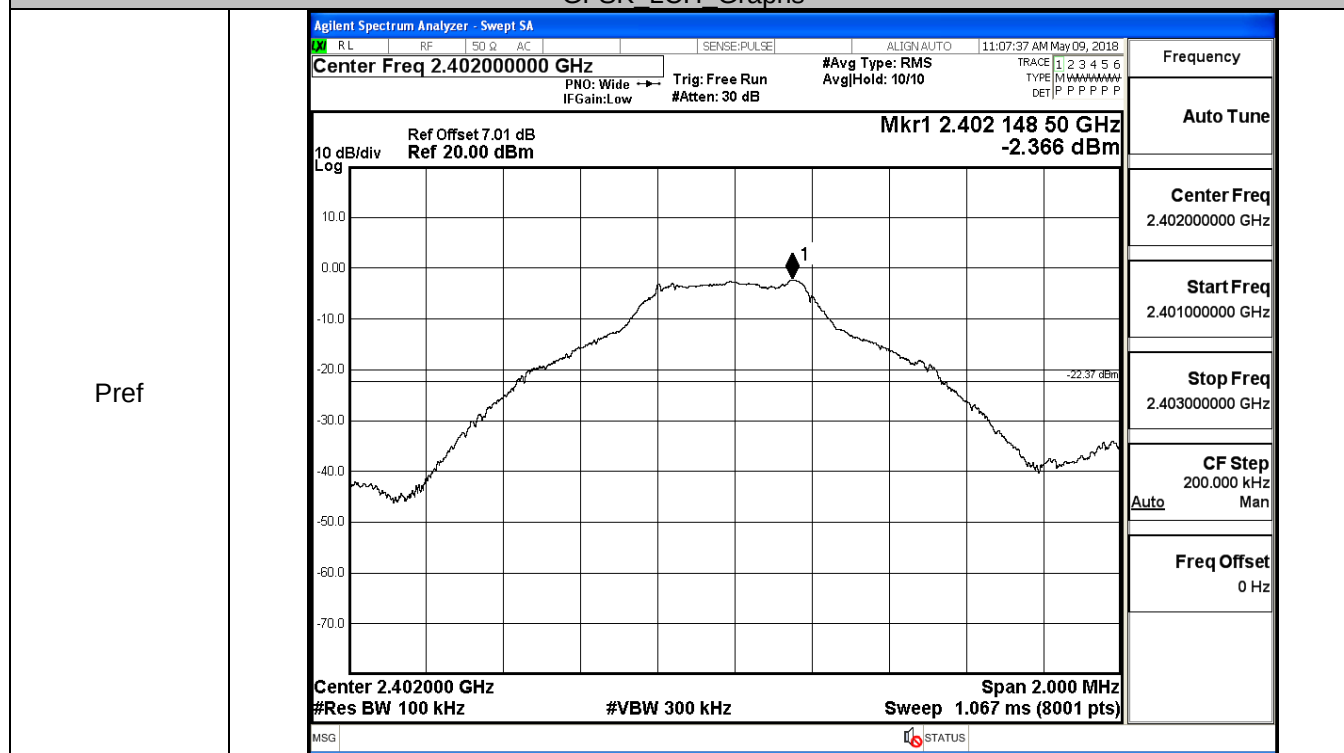
8DPSK\_3DH5/HCH



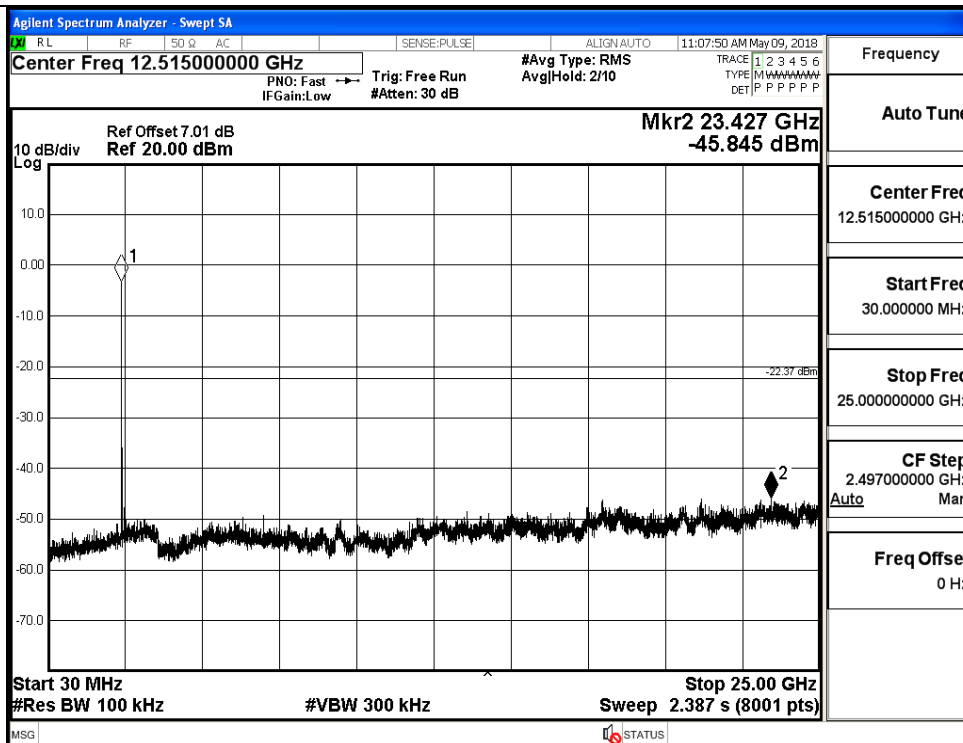
## A.7 RF Conducted Spurious Emissions

| Mode          | Channel | Pref [dBm] | Max. Level [dBm] | Limit [dBm] | Verdict |
|---------------|---------|------------|------------------|-------------|---------|
| GFSK          | LCH     | -2.366     | -45.845          | -22.366     | PASS    |
|               | MCH     | 0.759      | -45.808          | -19.241     | PASS    |
|               | HCH     | 2.296      | -44.686          | -17.704     | PASS    |
| $\pi/4$ DQPSK | LCH     | -6.213     | -45.223          | -26.213     | PASS    |
|               | MCH     | -2.096     | -46.208          | -22.096     | PASS    |
|               | HCH     | -0.158     | -45.806          | -20.158     | PASS    |
| 8DPSK         | LCH     | -5.882     | -45.534          | -25.882     | PASS    |
|               | MCH     | -1.791     | -45.311          | -21.791     | PASS    |
|               | HCH     | -0.055     | -45.867          | -20.055     | PASS    |

GFSK LCH Graphs

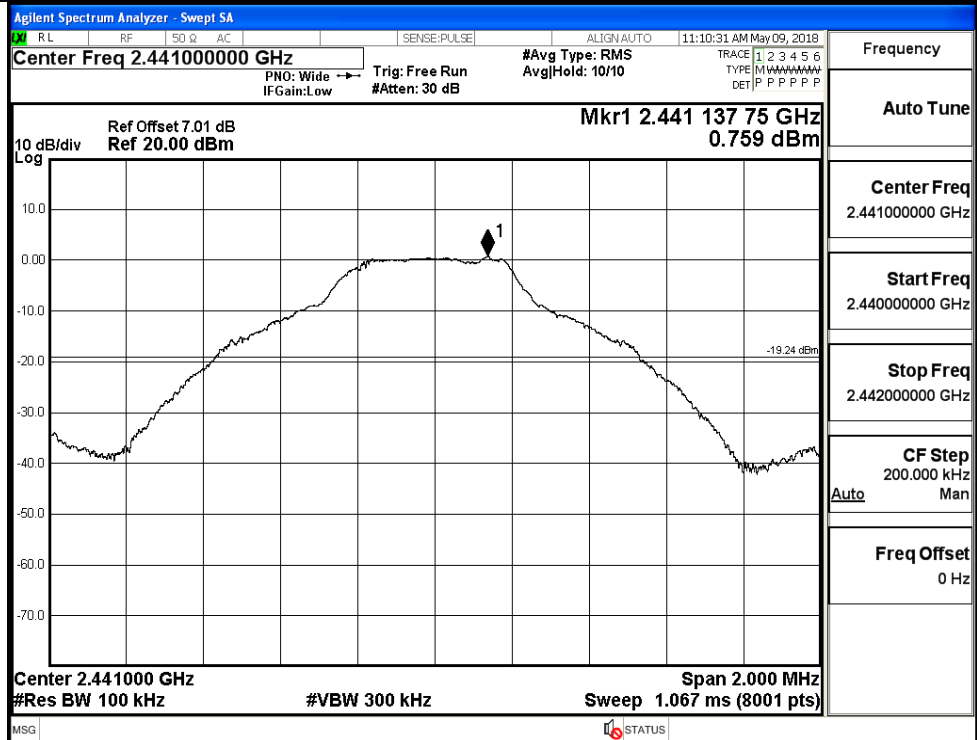


Puw

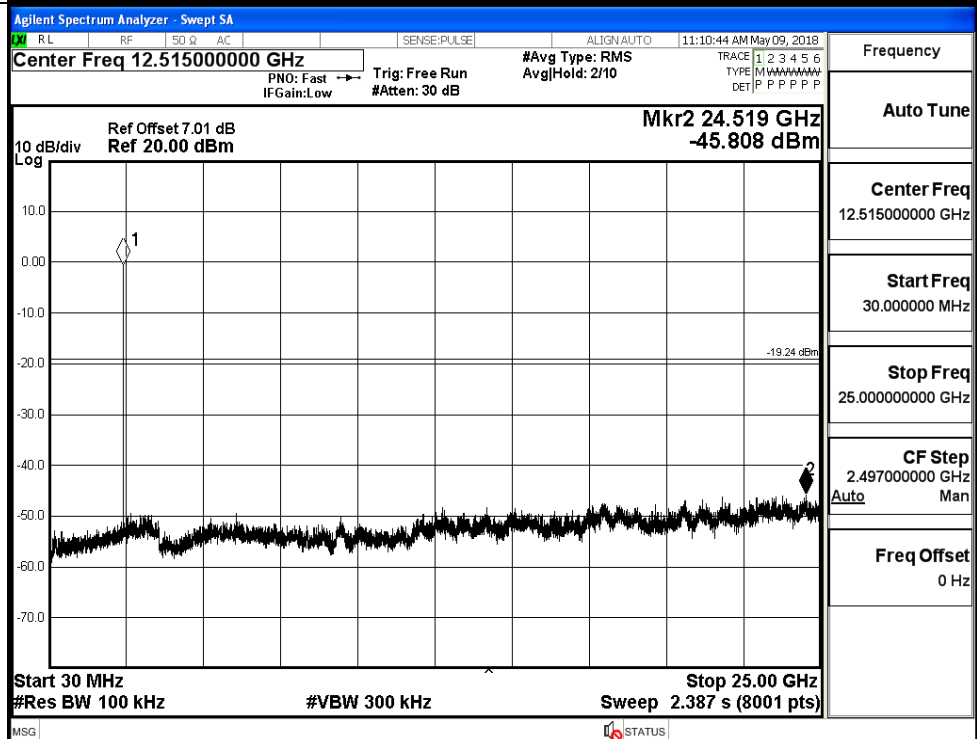


## GFSK MCH\_Graphs

Pref

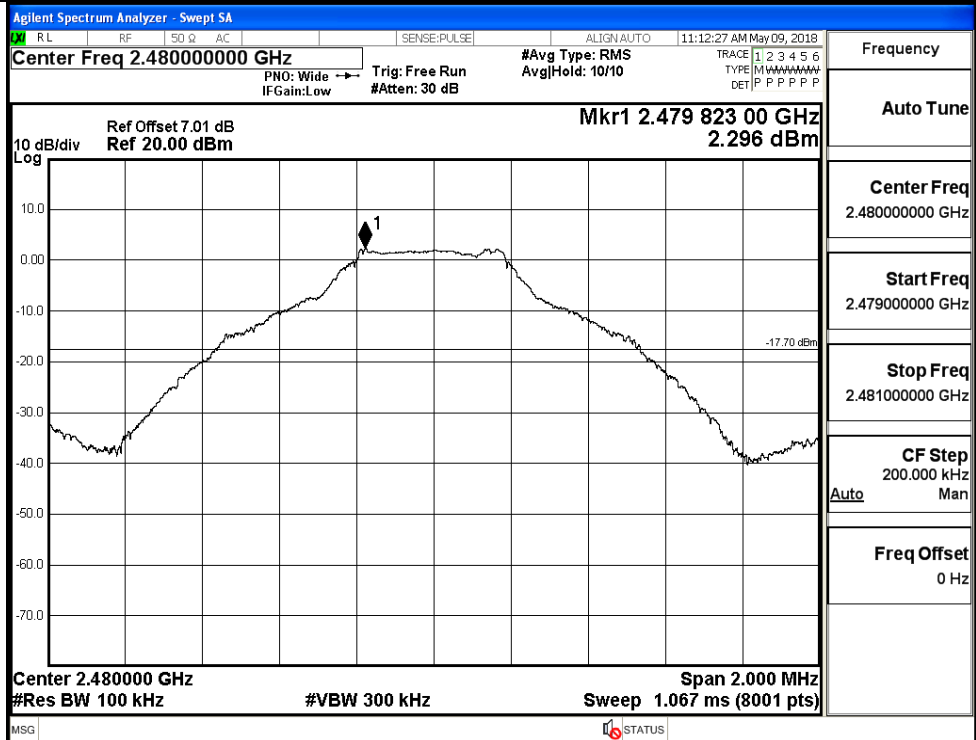


Puw

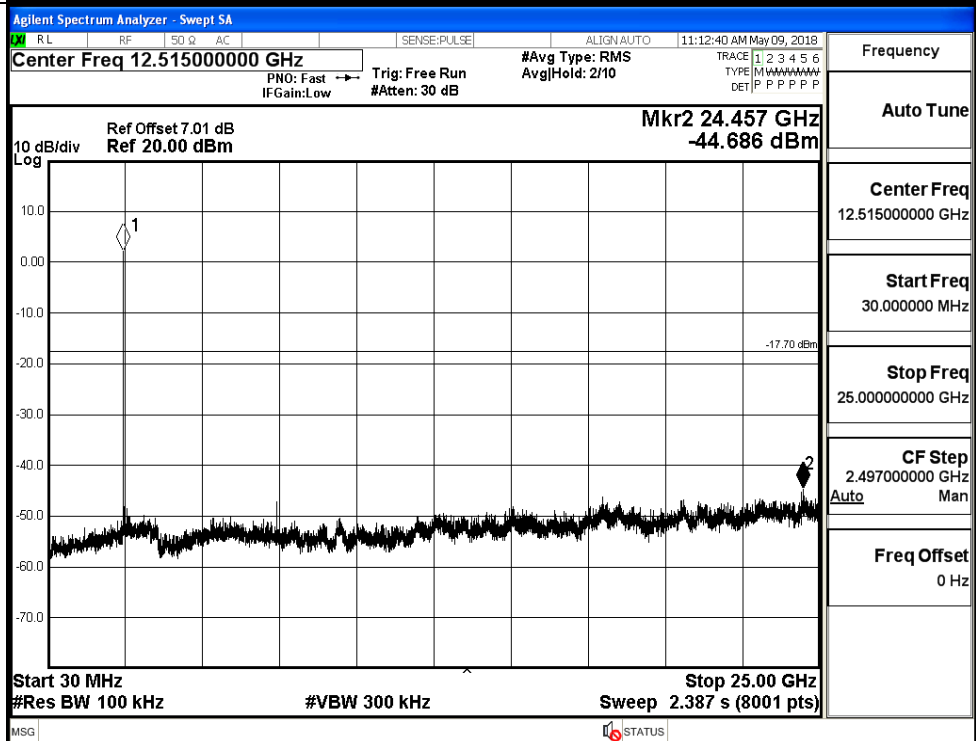


## GFSK HCH Graphs

Pref



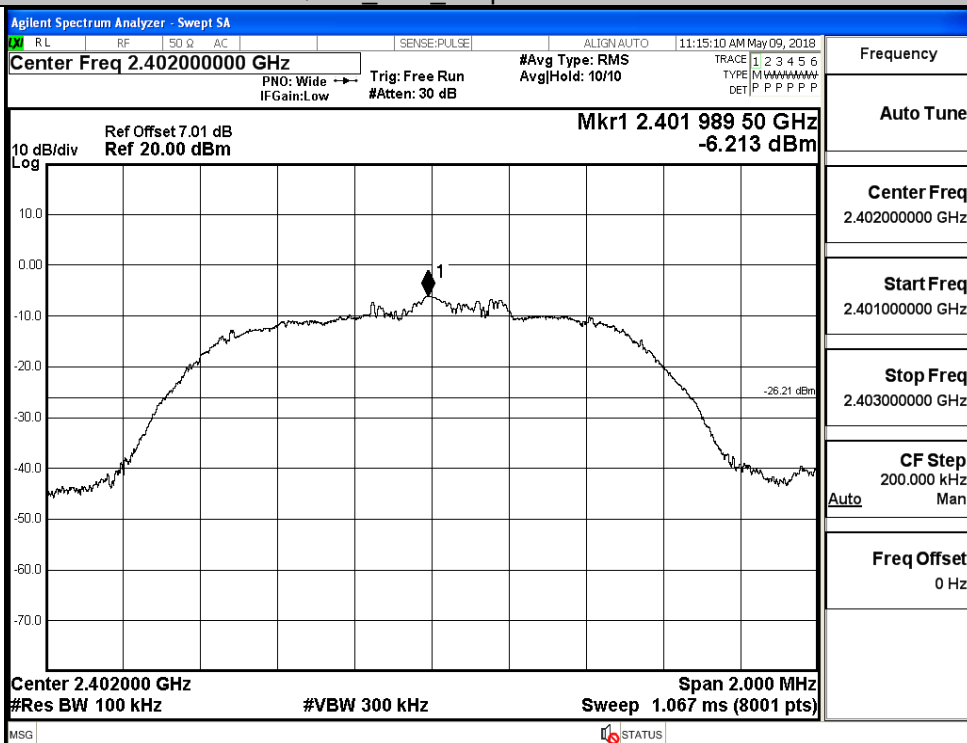
Puw



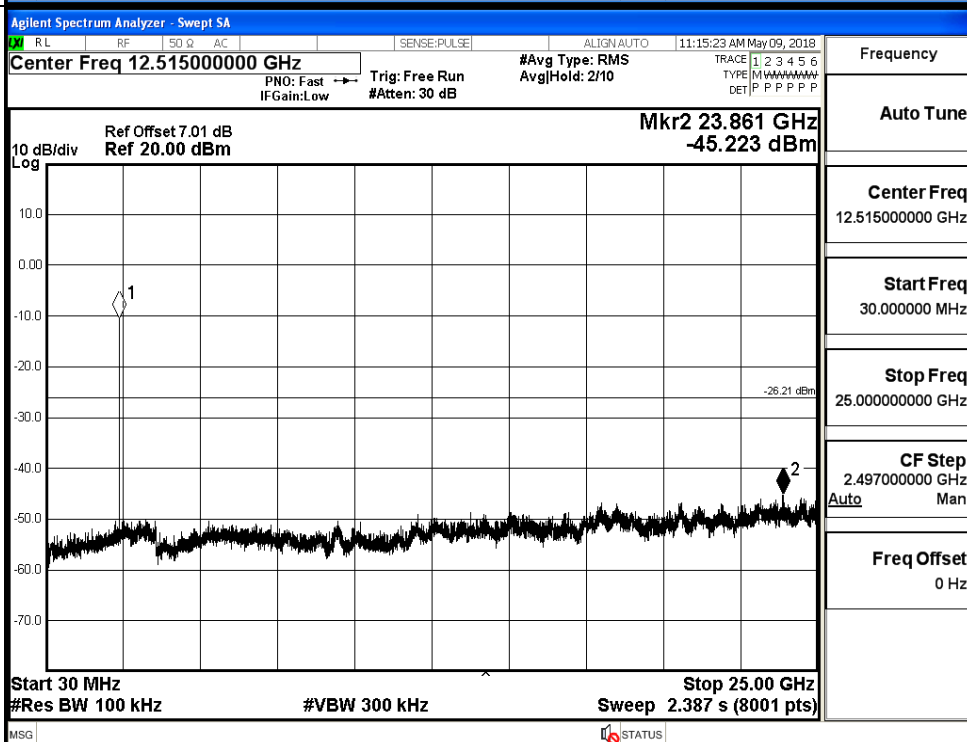


$\pi/4$ DQPSK LCH Graphs

Pref

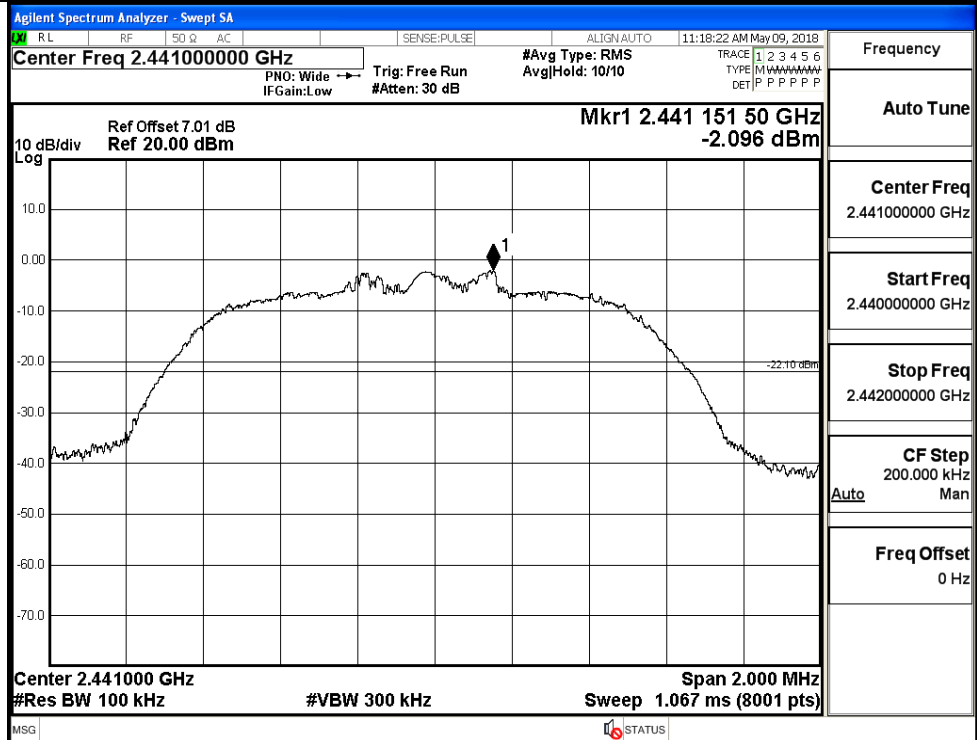


Puw

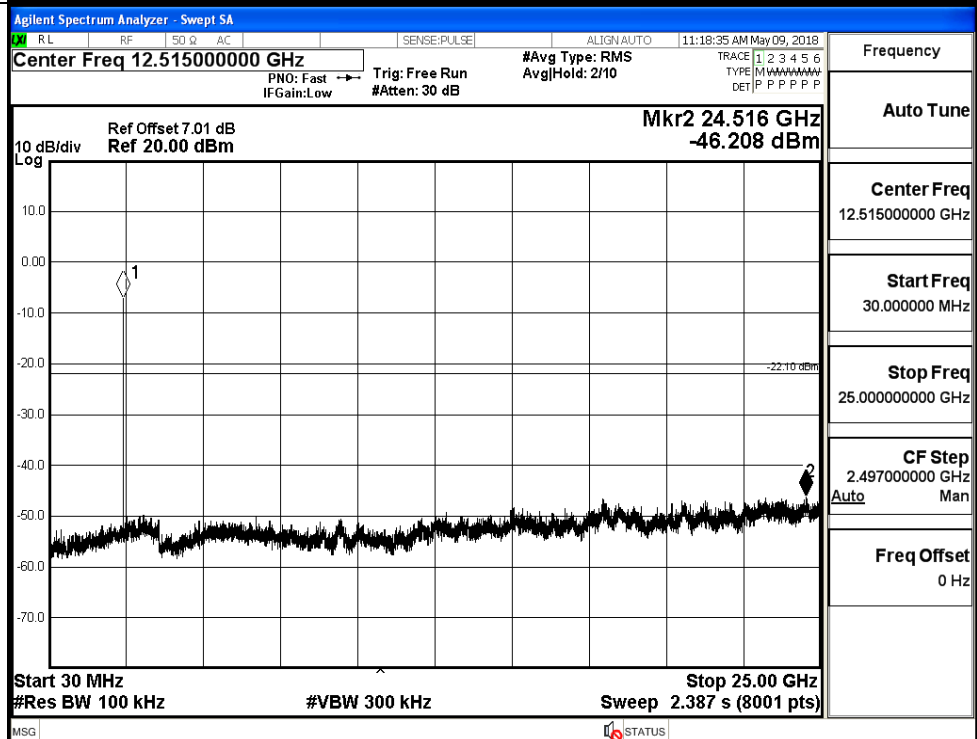


$\pi/4$ DQPSK MCH\_Graphs

Pref

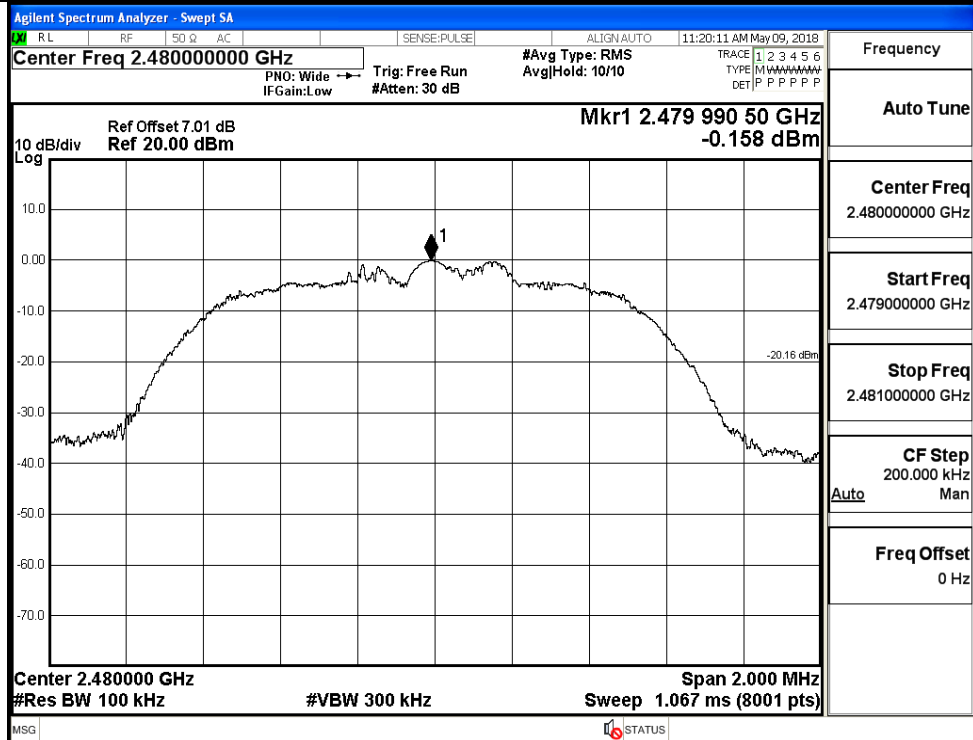


Puw

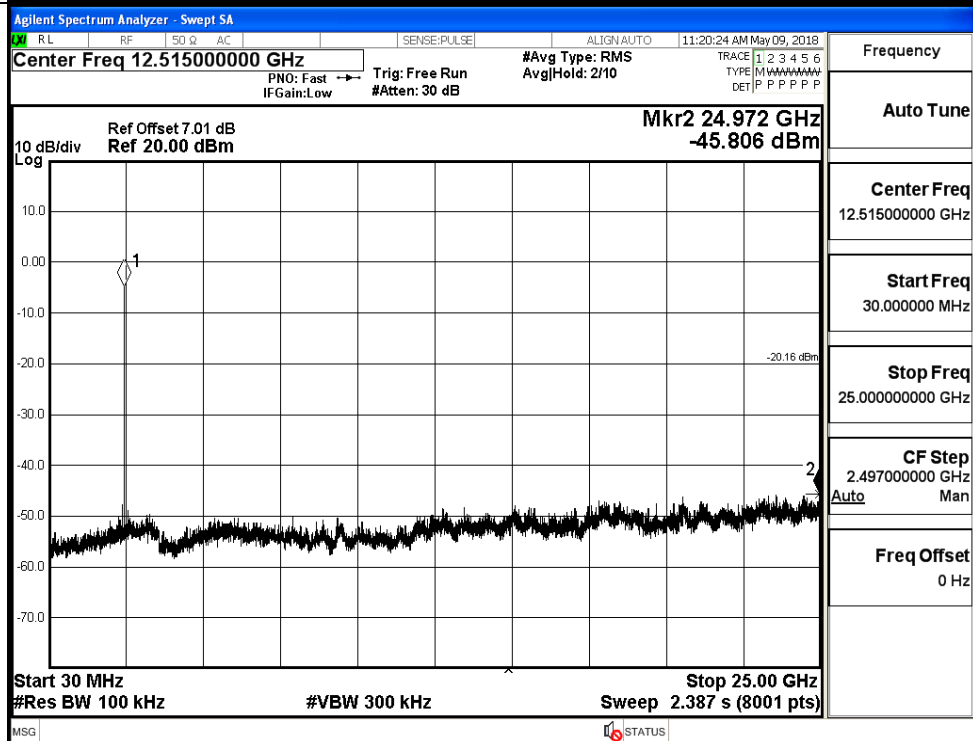


$\pi/4$ DQPSK HCH Graphs

Pref

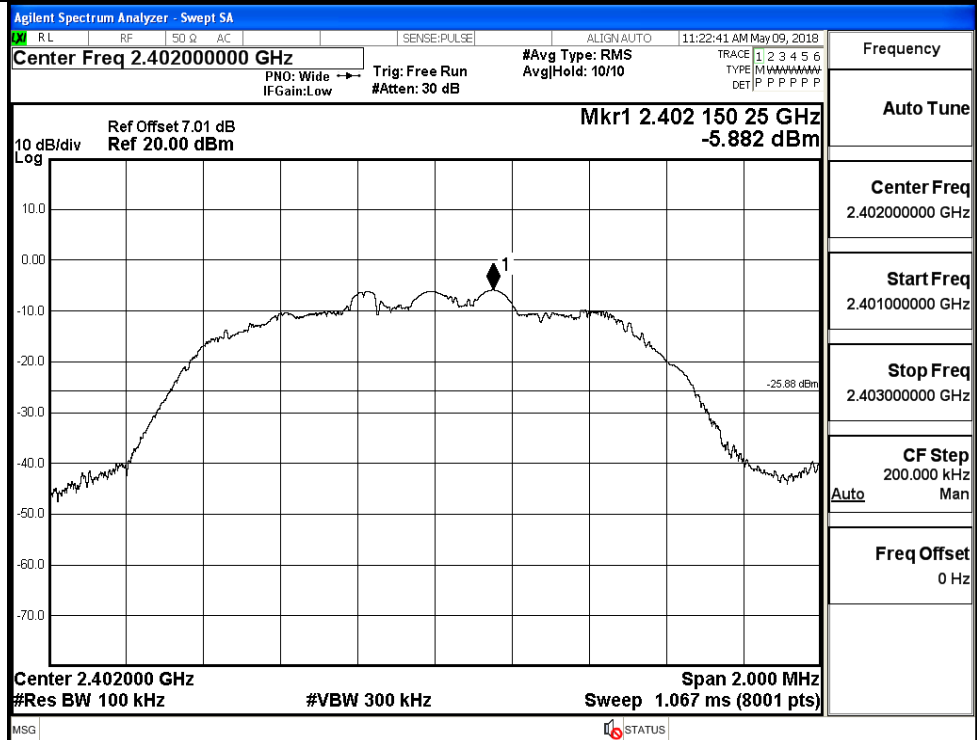


Puw

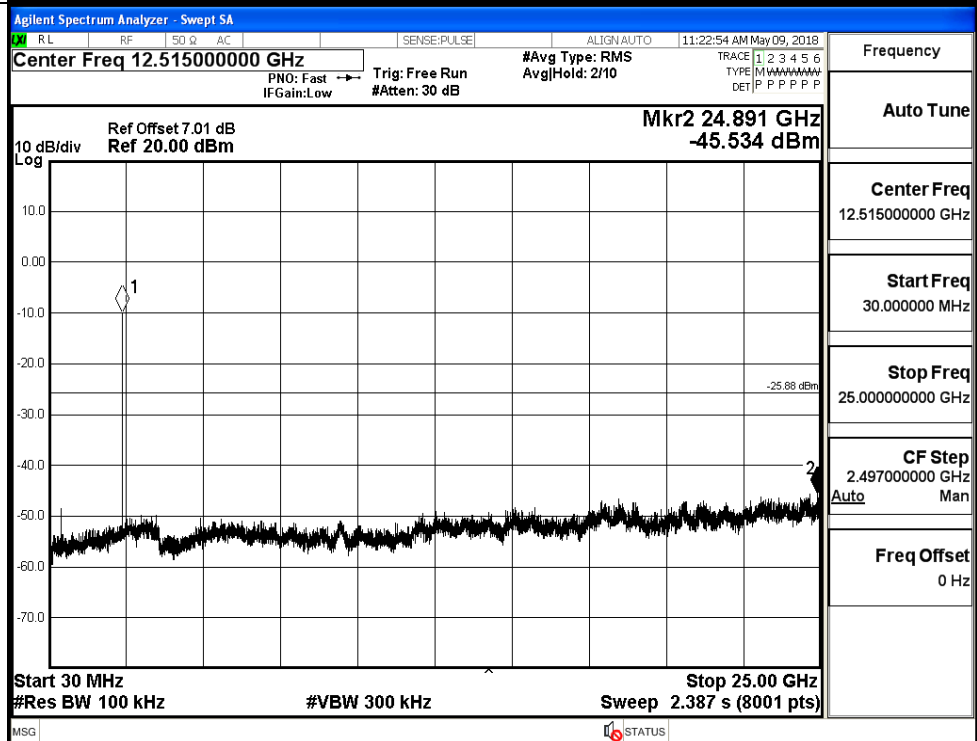


## 8DPSK\_LCH Graphs

Pref

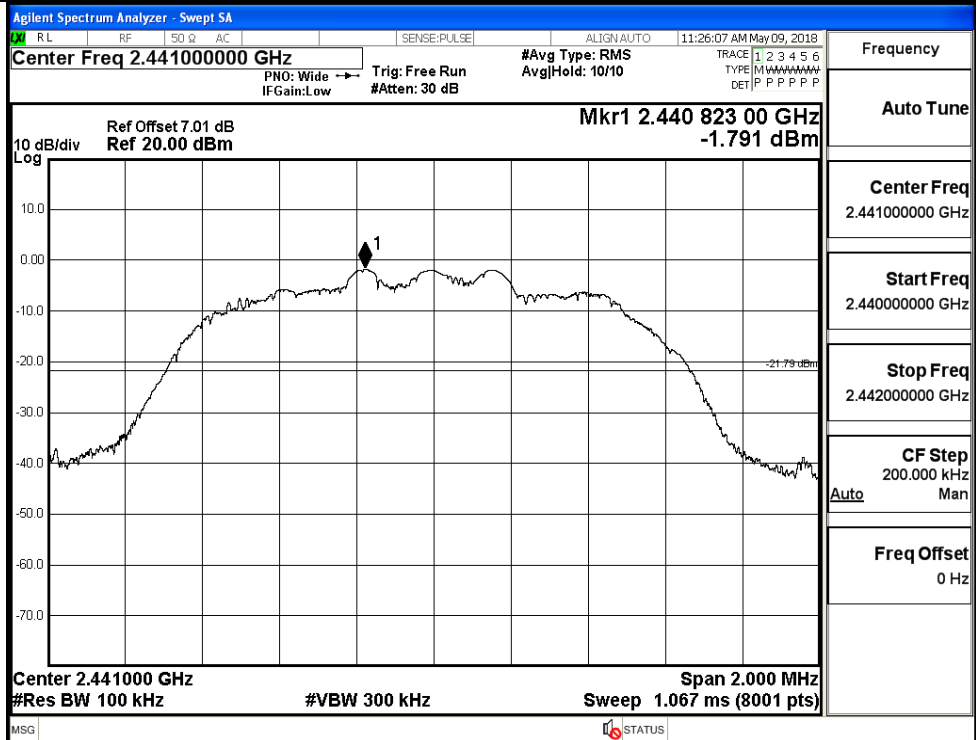


Puw

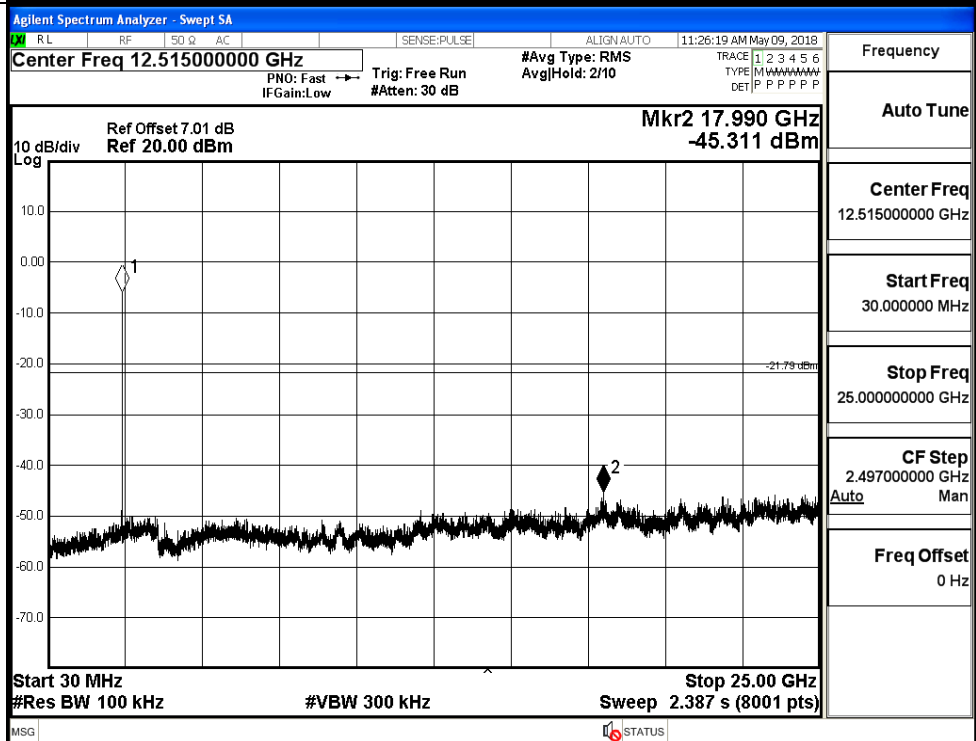


## 8DPSK MCH\_Graphs

Pref

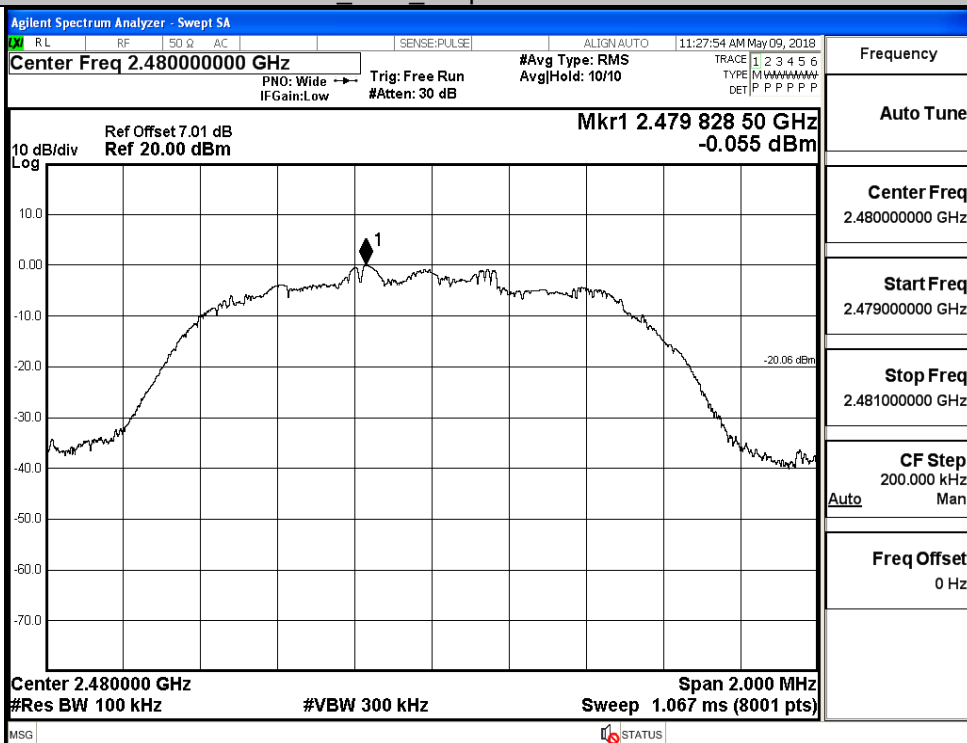


Puw

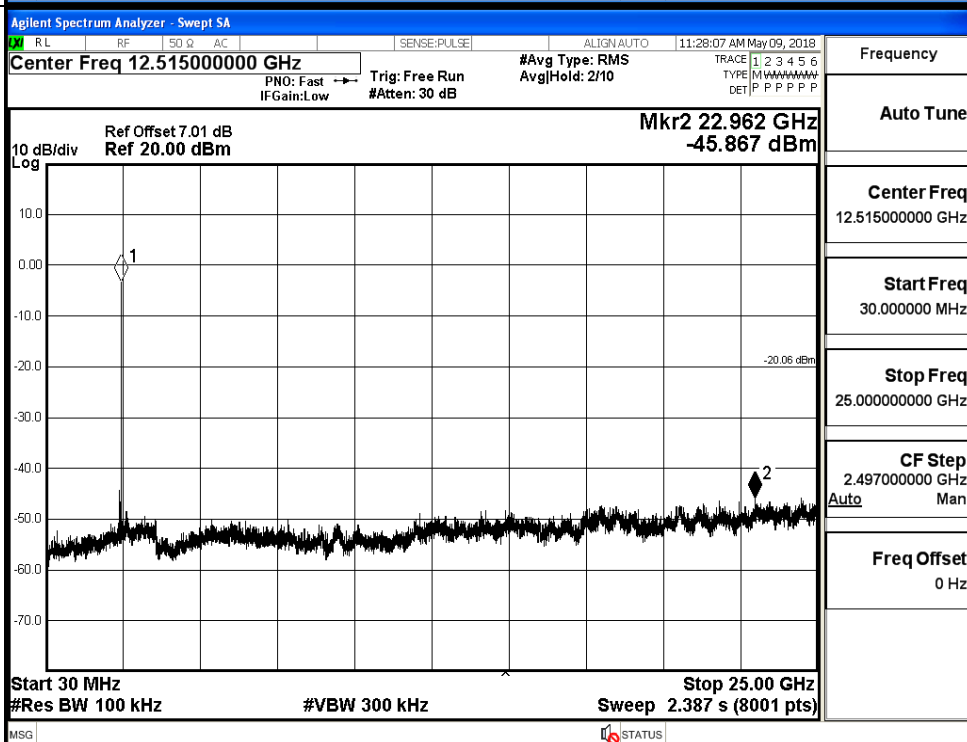


## 8DPSK\_HCH\_Graphs

Pref



Puw

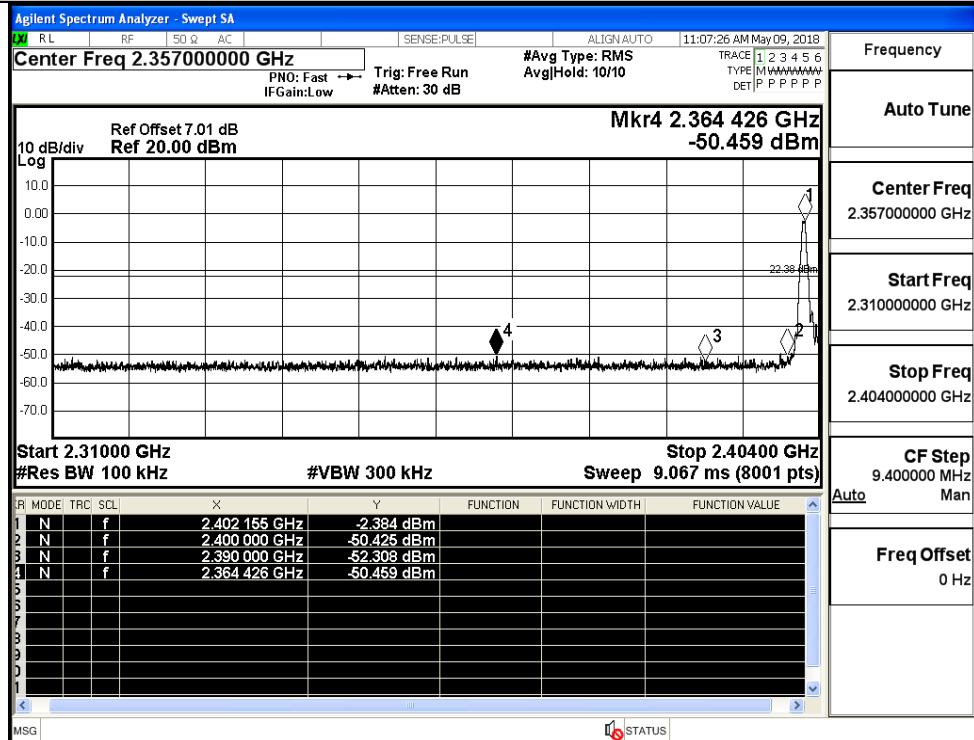


## A.8 Band-edge for RF Conducted Emissions

| Mode          | Channel | Carrier Frequency [MHz] | Carrier Power [dBm] | Frequency Hopping | Max Spurious Level [dBm] | Limit [dBm] | Verdict |
|---------------|---------|-------------------------|---------------------|-------------------|--------------------------|-------------|---------|
| GFSK          | LCH     | 2402                    | -2.384              | Off               | -50.459                  | -22.38      | PASS    |
|               |         |                         | -0.342              | On                | -50.852                  | -20.34      | PASS    |
|               | HCH     | 2480                    | 2.473               | Off               | -50.237                  | -17.53      | PASS    |
|               |         |                         | 2.316               | On                | -49.746                  | -17.68      | PASS    |
| $\pi$ /4DQPSK | LCH     | 2402                    | -6.184              | Off               | -51.057                  | -26.18      | PASS    |
|               |         |                         | -3.301              | On                | -50.676                  | -23.3       | PASS    |
|               | HCH     | 2480                    | -0.113              | Off               | -50.126                  | -20.11      | PASS    |
|               |         |                         | -0.077              | On                | -49.407                  | -20.08      | PASS    |
| 8DPSK         | LCH     | 2402                    | -5.760              | Off               | -50.609                  | -25.76      | PASS    |
|               |         |                         | -2.807              | On                | -50.380                  | -22.81      | PASS    |
|               | HCH     | 2480                    | 0.145               | Off               | -50.218                  | -19.86      | PASS    |
|               |         |                         | 0.059               | On                | -49.580                  | -19.94      | PASS    |

## Test Graphs

GFSK/LCH/No Hop

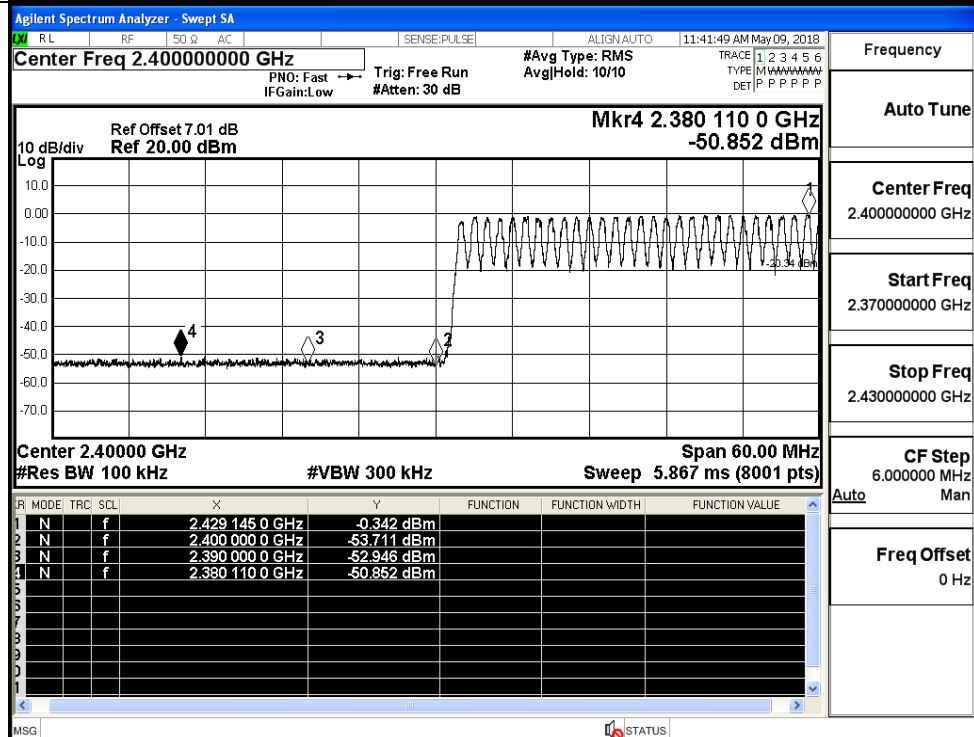


Frequency

Auto Tune

Center Freq  
2.357000000 GHzStart Freq  
2.310000000 GHzStop Freq  
2.404000000 GHzCF Step  
9.400000 MHz  
ManFreq Offset  
0 Hz

GFSK/LCH/Hop



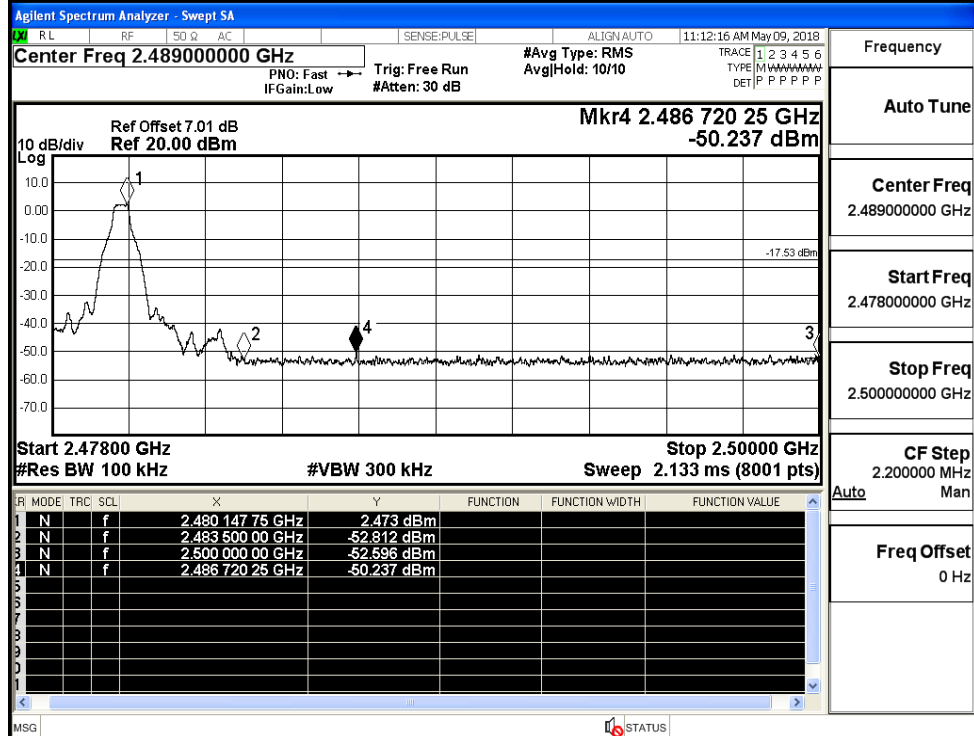
Frequency

Auto Tune

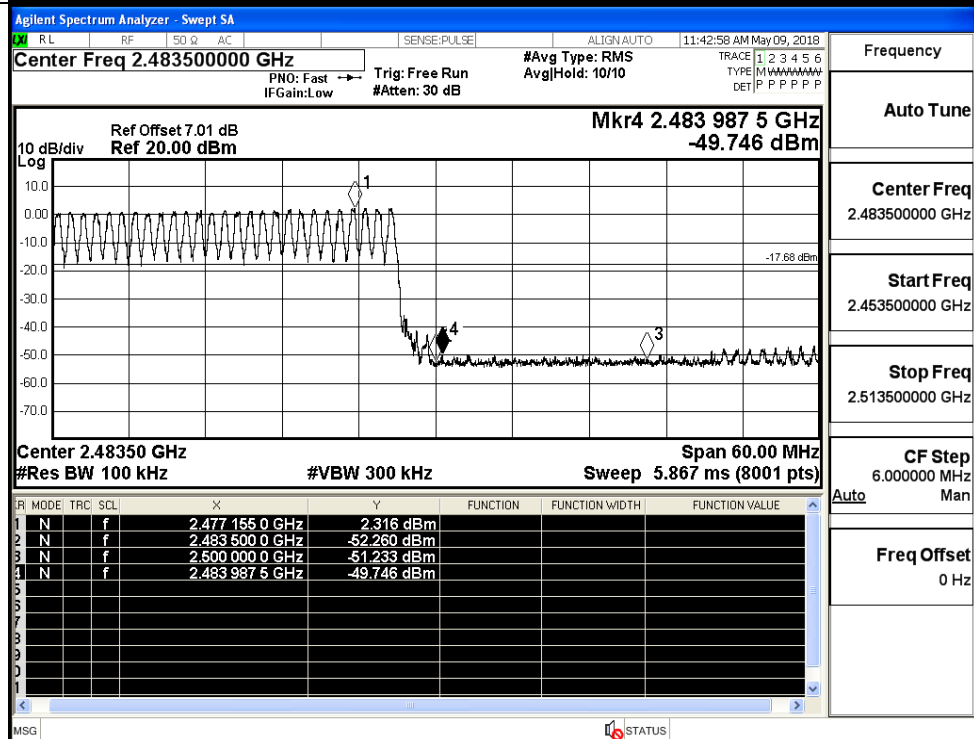
Center Freq  
2.400000000 GHzStart Freq  
2.370000000 GHzStop Freq  
2.430000000 GHzCF Step  
6.000000 MHz  
ManFreq Offset  
0 Hz



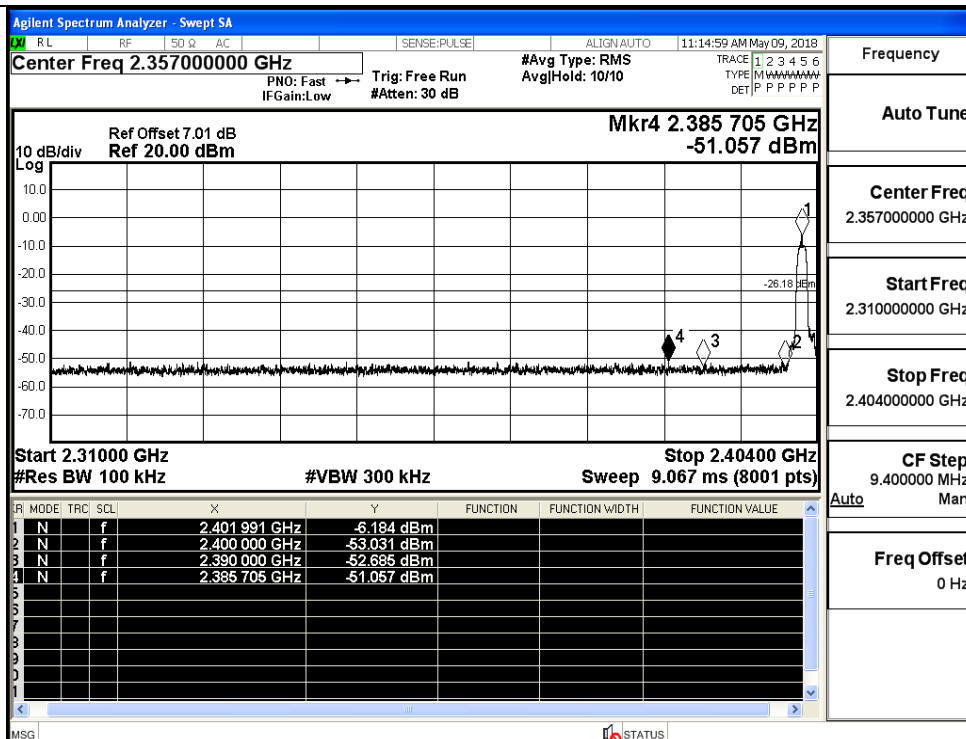
GFSK/HCH/No Hop



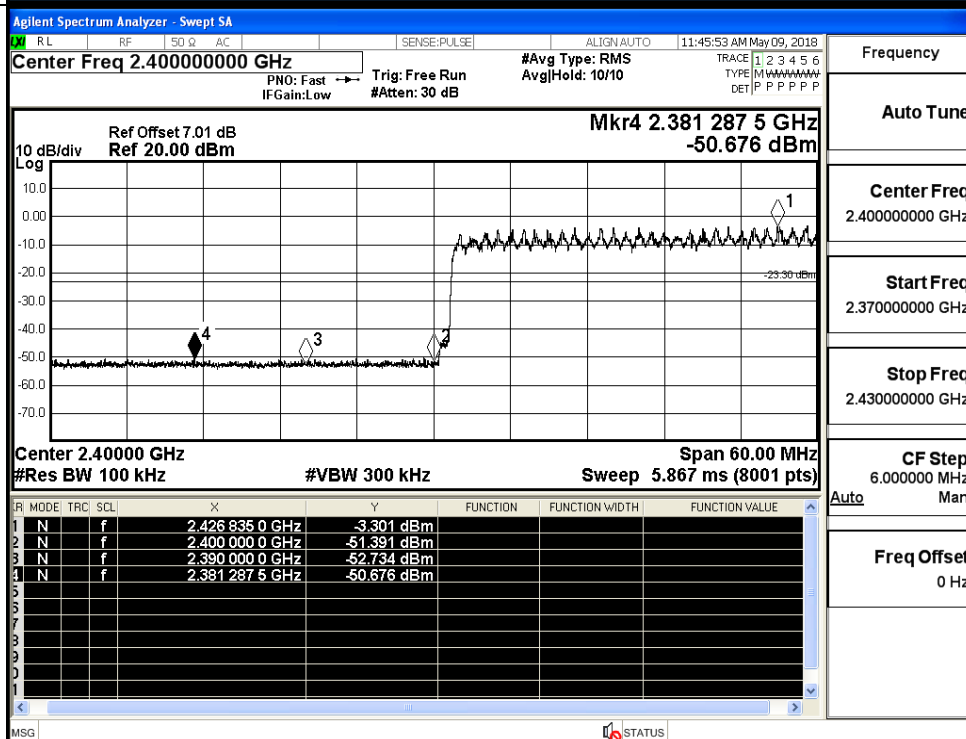
GFSK/HCH/Hop



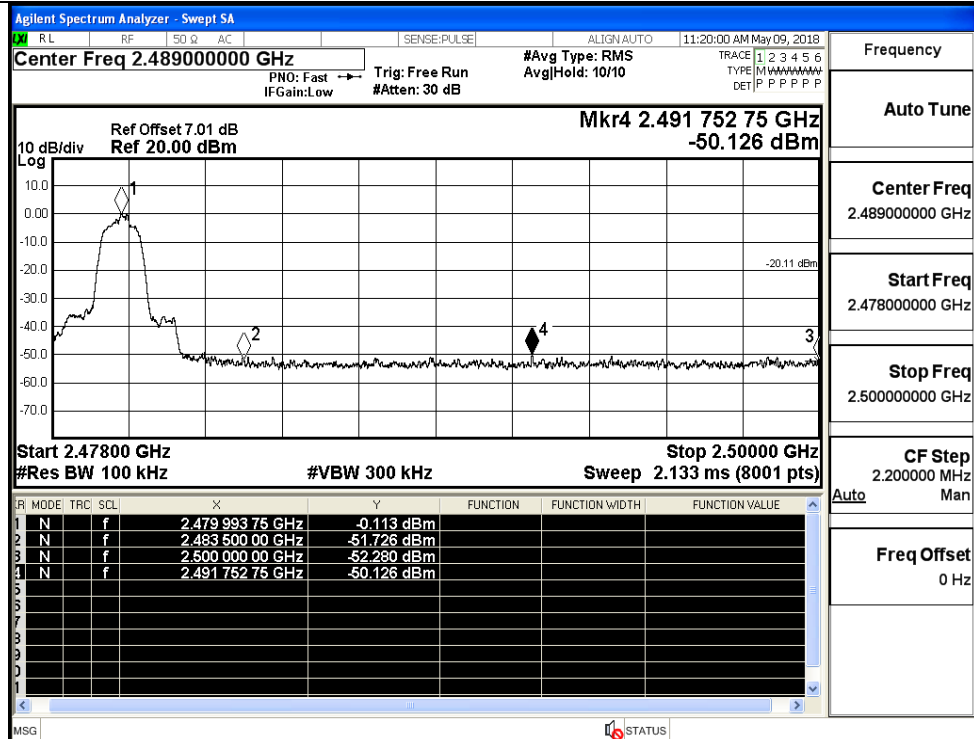
$\pi/4$ DQPSK/LCH/No  
Hop



$\pi/4$ DQPSK/LCH/Hop



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



Frequency

Auto Tune

Center Freq  
2.489000000 GHz

Start Freq  
2.478000000 GHz

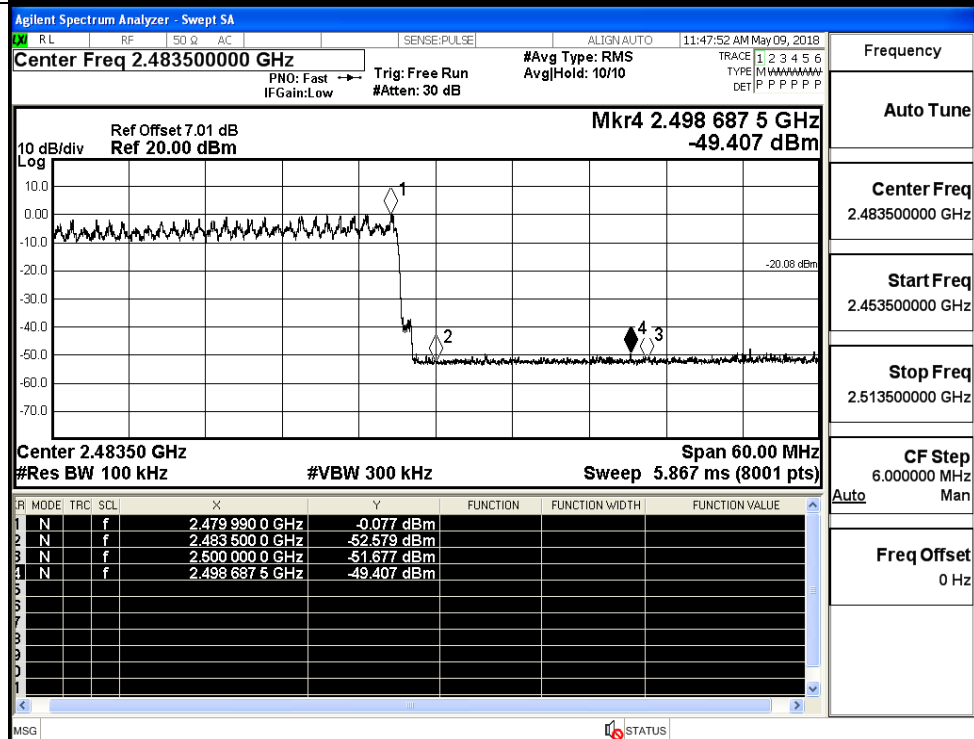
Stop Freq  
2.500000000 GHz

CF Step  
2.200000 MHz

Auto Man

Freq Offset  
0 Hz

$\pi/4$ DQPSK/HCH/Hop



Frequency

Auto Tune

Center Freq  
2.483500000 GHz

Start Freq  
2.453500000 GHz

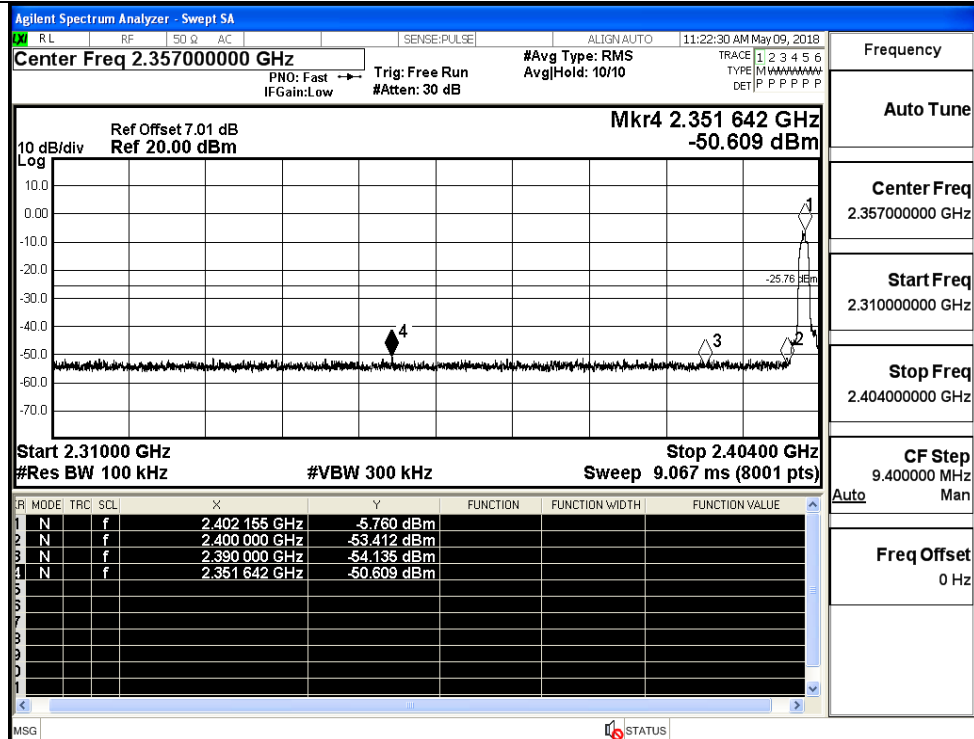
Stop Freq  
2.513500000 GHz

CF Step  
6.000000 MHz

Auto Man

Freq Offset  
0 Hz

8DPSK/LCH/No Hop



Frequency

Auto Tune

Center Freq  
2.357000000 GHz

Start Freq  
2.310000000 GHz

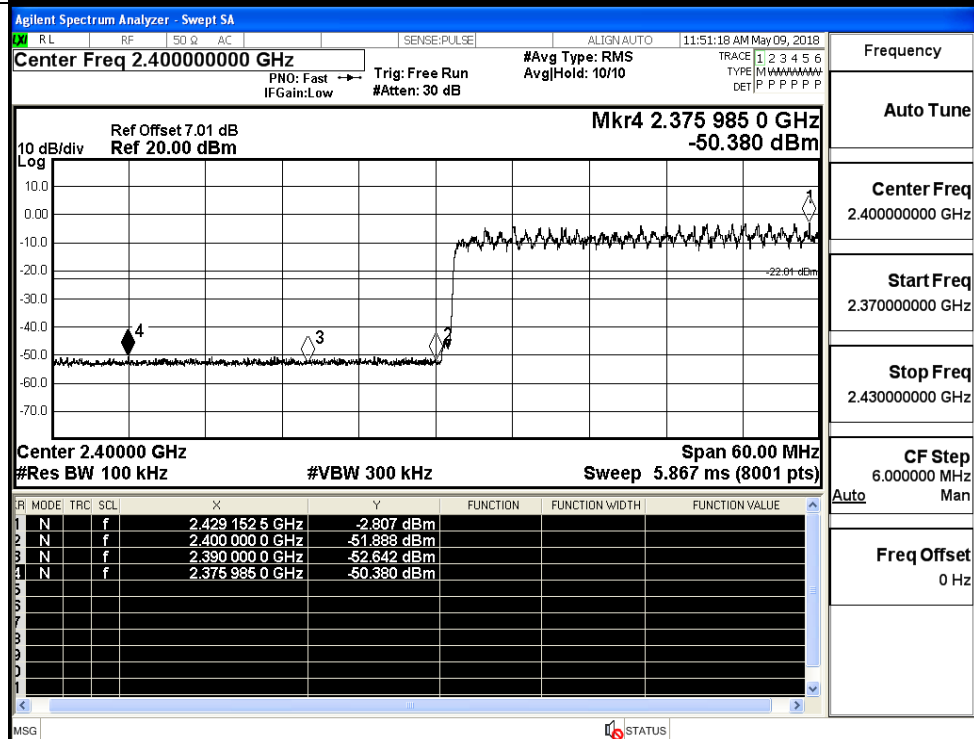
Stop Freq  
2.404000000 GHz

CF Step  
9.400000 MHz

Auto Man

Freq Offset  
0 Hz

8DPSK/LCH/Hop



Frequency

Auto Tune

Center Freq  
2.400000000 GHz

Start Freq  
2.370000000 GHz

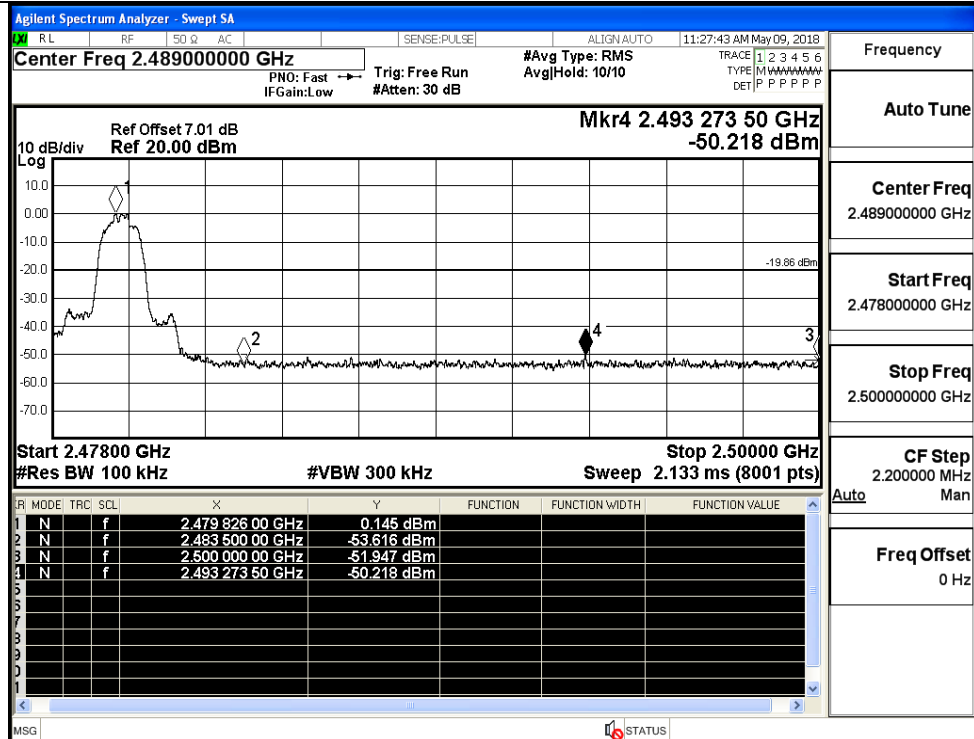
Stop Freq  
2.430000000 GHz

CF Step  
6.000000 MHz

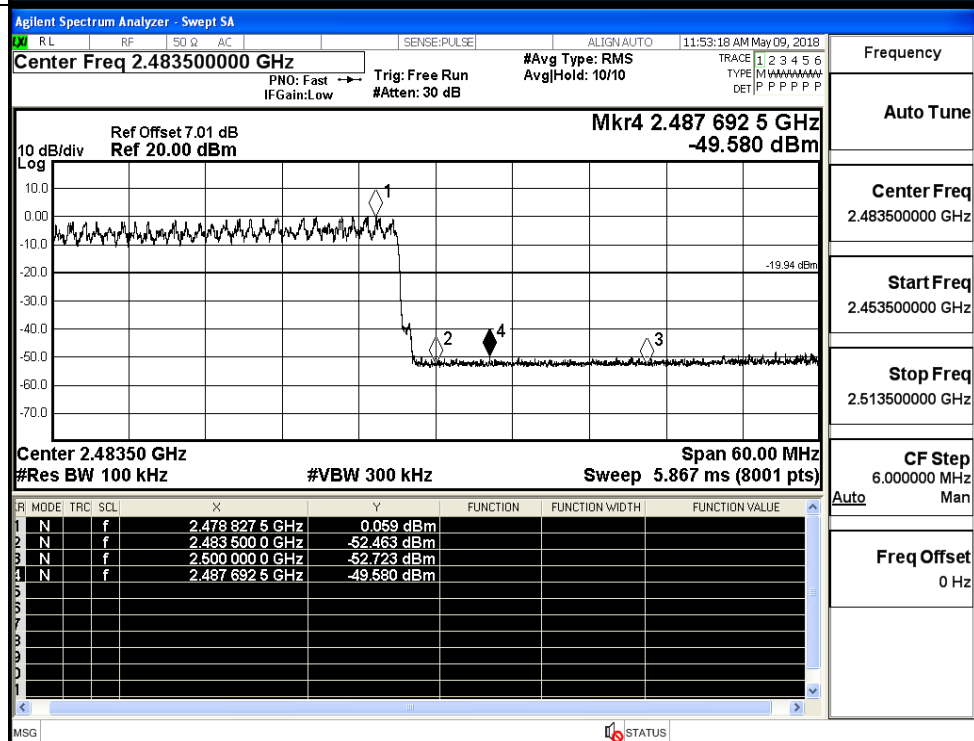
Auto Man

Freq Offset  
0 Hz

8DPSK/HCH/No Hop



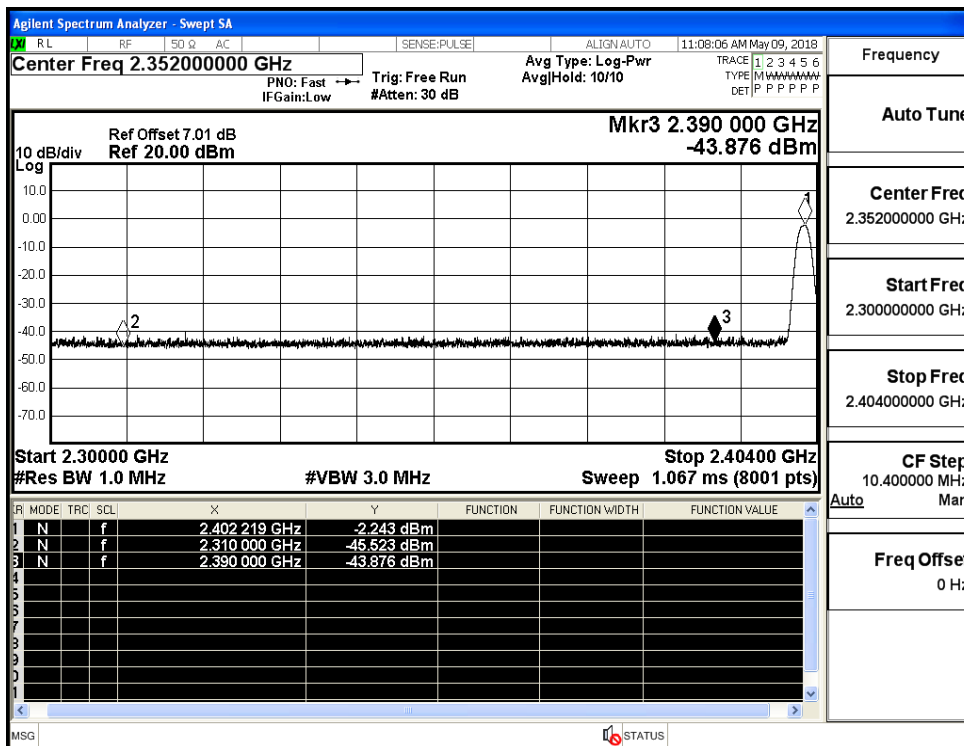
8DPSK/HCH/Hop



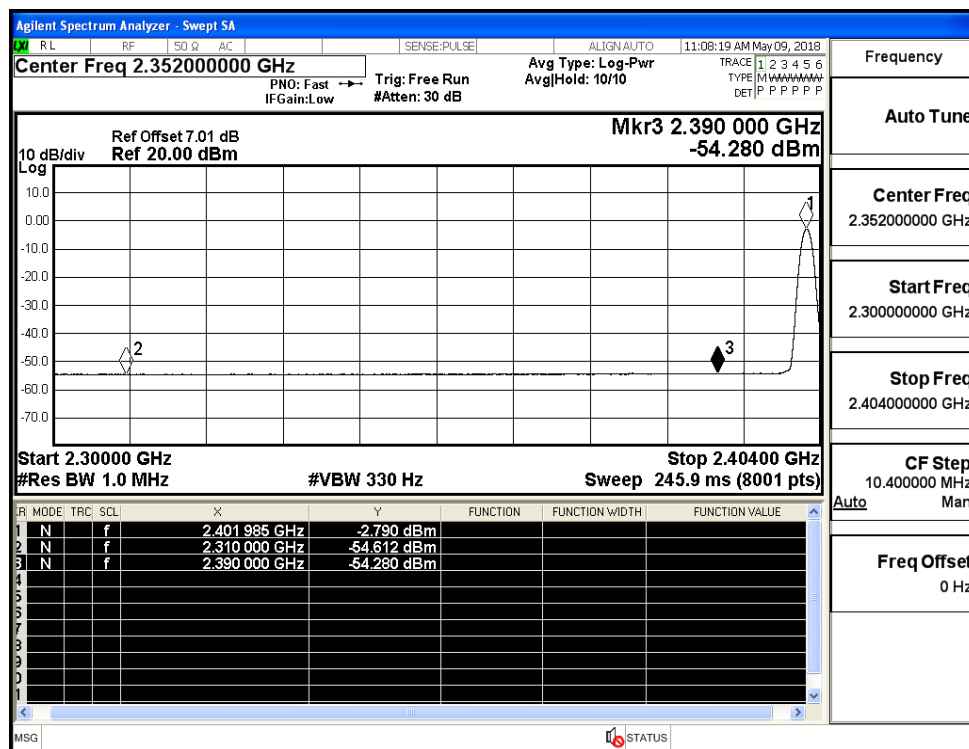
## A.8 Restrict-band band-edge measurements

| Test Mode     | Hopping | Freq.  | Power [dBm] | Gain | Ground Factor | E [dBuV/m] | Detector | Limit [dBuV/m] | Verdict |
|---------------|---------|--------|-------------|------|---------------|------------|----------|----------------|---------|
| GFSK          | Off     | 2310.0 | -45.52      | 2.5  | 0             | 52.23      | PEAK     | 74             | PASS    |
|               | Off     | 2310.0 | -54.61      | 2.5  | 0             | 43.15      | AV       | 54             | PASS    |
|               | Off     | 2390.0 | -43.88      | 2.5  | 0             | 53.88      | PEAK     | 74             | PASS    |
|               | Off     | 2390.0 | -54.28      | 2.5  | 0             | 43.48      | AV       | 54             | PASS    |
|               | Off     | 2483.5 | -41.54      | 2.5  | 0             | 56.21      | PEAK     | 74             | PASS    |
|               | Off     | 2483.5 | -51.36      | 2.5  | 0             | 46.40      | AV       | 54             | PASS    |
|               | Off     | 2500.0 | -42.51      | 2.5  | 0             | 55.25      | PEAK     | 74             | PASS    |
|               | Off     | 2500.0 | -53.81      | 2.5  | 0             | 43.95      | AV       | 54             | PASS    |
| $\pi/4$ DQPSK | Off     | 2310.0 | -44.17      | 2.5  | 0             | 53.59      | PEAK     | 74             | PASS    |
|               | Off     | 2310.0 | -54.56      | 2.5  | 0             | 43.19      | AV       | 54             | PASS    |
|               | Off     | 2390.0 | -43.92      | 2.5  | 0             | 53.83      | PEAK     | 74             | PASS    |
|               | Off     | 2390.0 | -54.37      | 2.5  | 0             | 43.38      | AV       | 54             | PASS    |
|               | Off     | 2483.5 | -44.08      | 2.5  | 0             | 53.68      | PEAK     | 74             | PASS    |
|               | Off     | 2483.5 | -53.62      | 2.5  | 0             | 44.14      | AV       | 54             | PASS    |
|               | Off     | 2500.0 | -42.63      | 2.5  | 0             | 55.12      | PEAK     | 74             | PASS    |
|               | Off     | 2500.0 | -53.90      | 2.5  | 0             | 43.86      | AV       | 54             | PASS    |
| 8DPSK         | Off     | 2310.0 | -43.90      | 2.5  | 0             | 53.86      | PEAK     | 74             | PASS    |
|               | Off     | 2310.0 | -54.56      | 2.5  | 0             | 43.20      | AV       | 54             | PASS    |
|               | Off     | 2390.0 | -44.01      | 2.5  | 0             | 53.75      | PEAK     | 74             | PASS    |
|               | Off     | 2390.0 | -54.33      | 2.5  | 0             | 43.43      | AV       | 54             | PASS    |
|               | Off     | 2483.5 | -42.17      | 2.5  | 0             | 55.59      | PEAK     | 74             | PASS    |
|               | Off     | 2483.5 | -53.65      | 2.5  | 0             | 44.11      | AV       | 54             | PASS    |
|               | Off     | 2500.0 | -44.44      | 2.5  | 0             | 53.32      | PEAK     | 74             | PASS    |
|               | Off     | 2500.0 | -53.93      | 2.5  | 0             | 43.83      | AV       | 54             | PASS    |

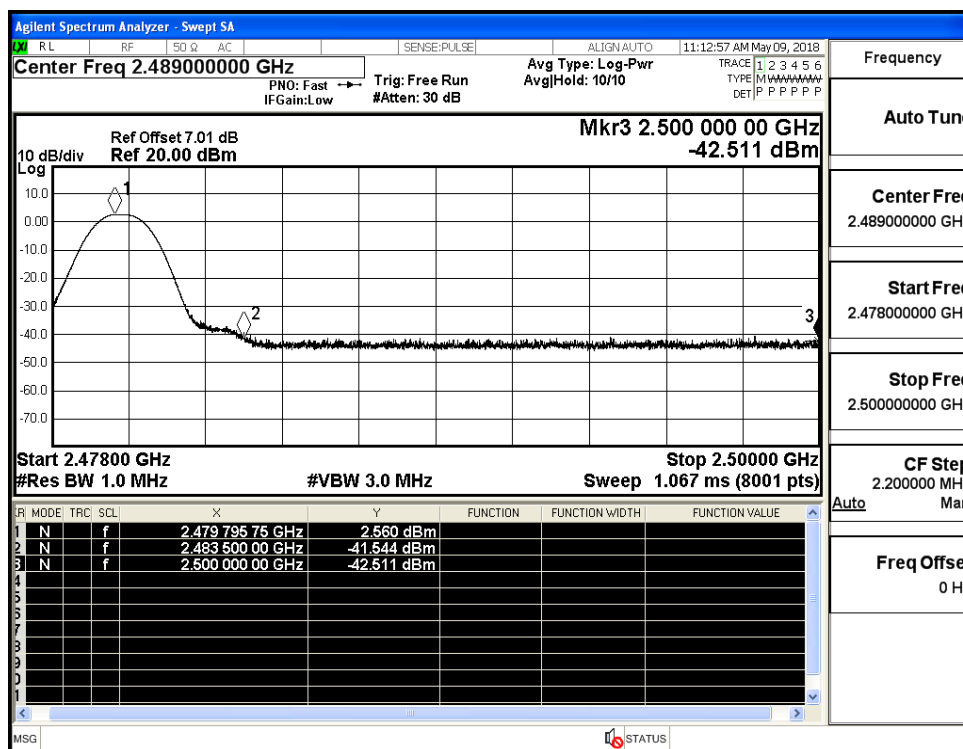
## Restrict-band band-edge measurements\_Hopping Off\_ GFSK\_PEAK (Low Channel)



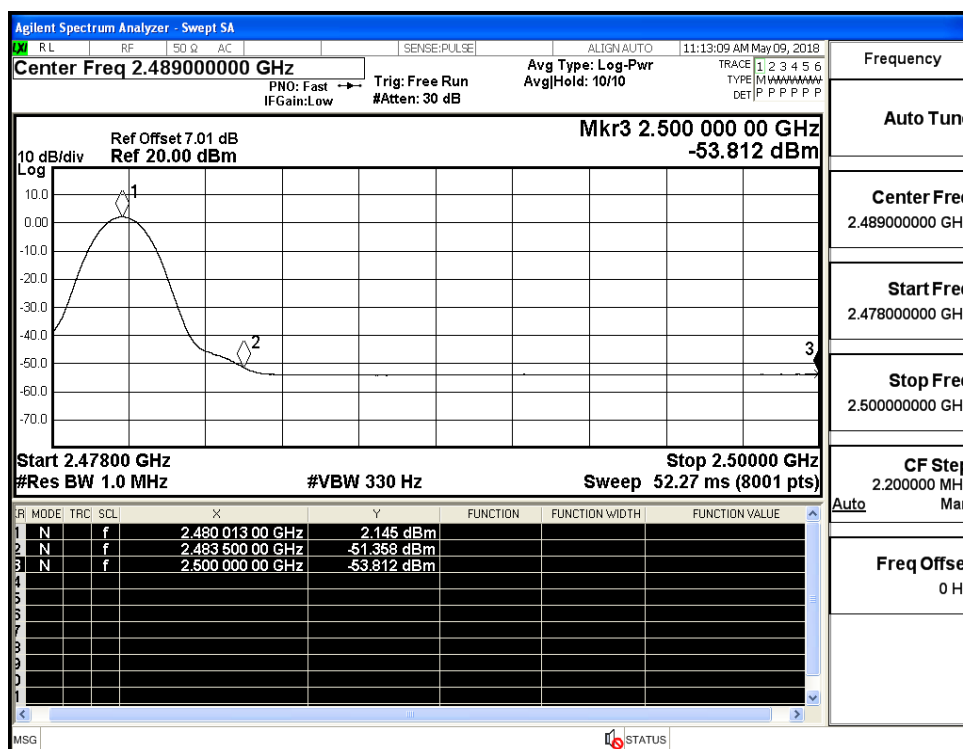
## Restrict-band band-edge measurements\_Hopping Off\_ GFSK\_Average (Low Channel)



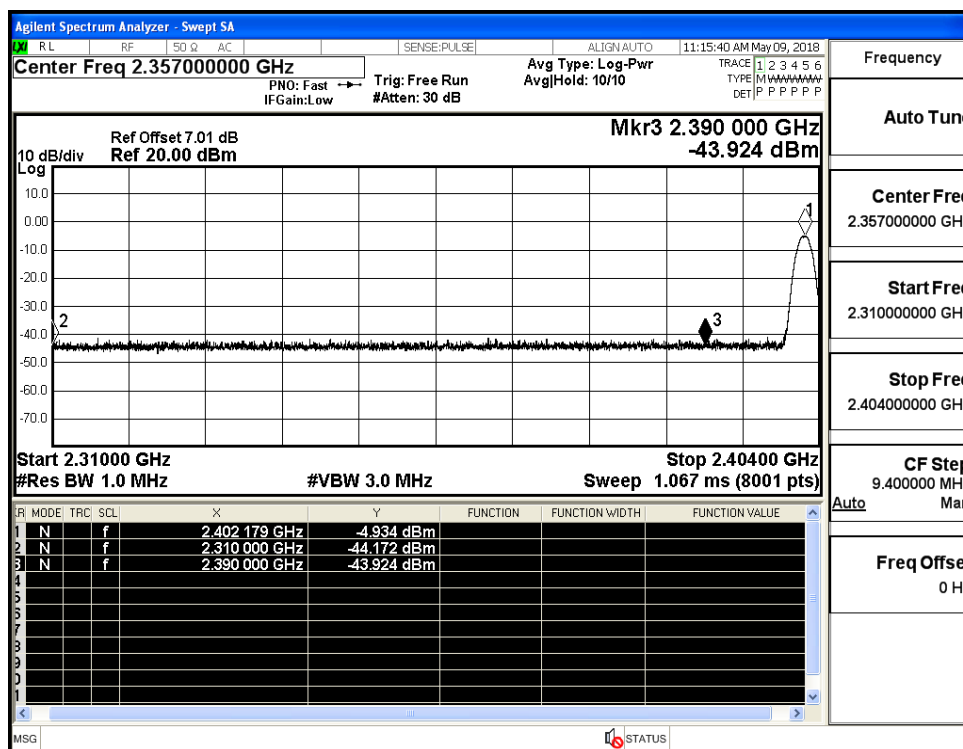
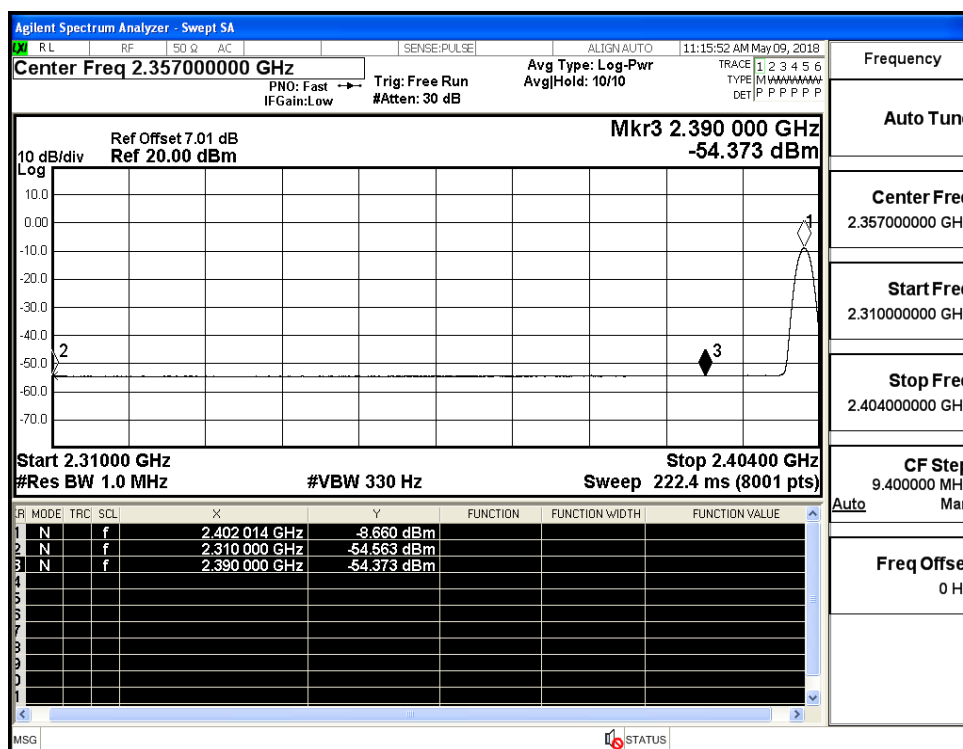
## Restrict-band band-edge measurements\_Hopping Off\_GFSK\_PEAK (High Channel)



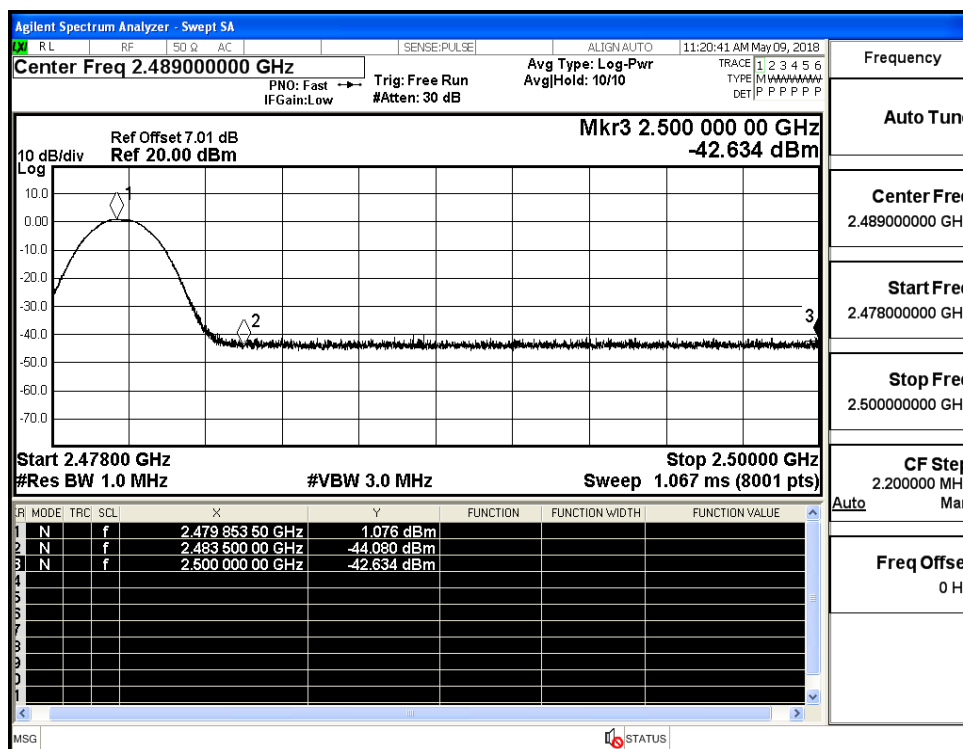
## Restrict-band band-edge measurements\_Hopping Off\_GFSK\_Average (High Channel)



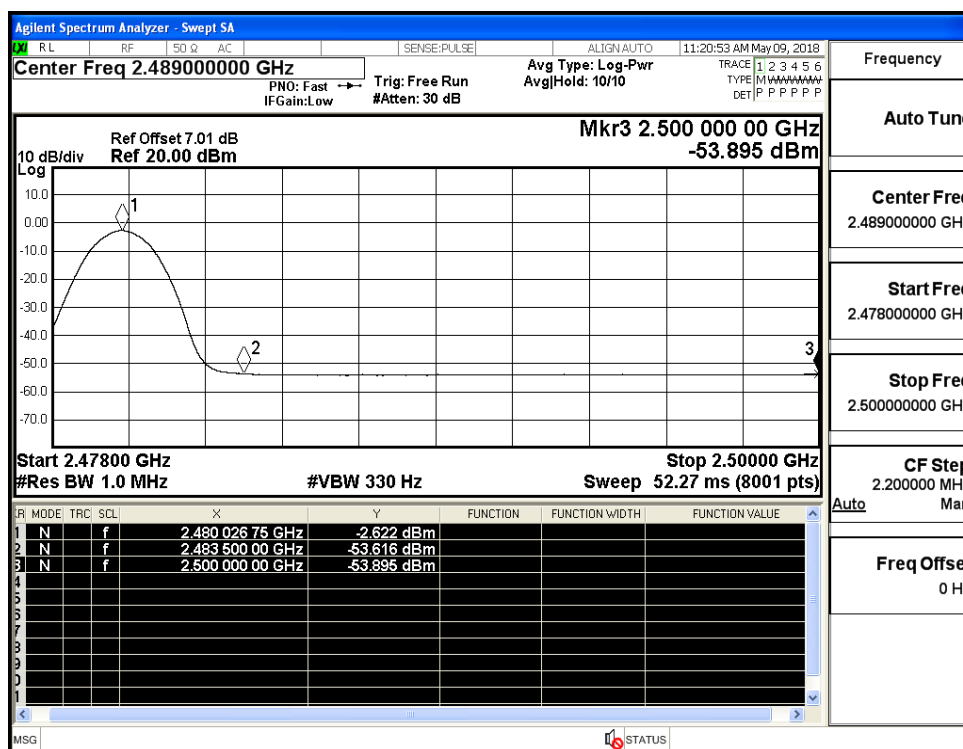


Restrict-band band-edge measurements\_Hopping Off  $\pi/4$ -DQPSK\_PEAK (Low Channel)Restrict-band band-edge measurements\_Hopping Off  $\pi/4$ -DQPSK\_Average (Low Channel)

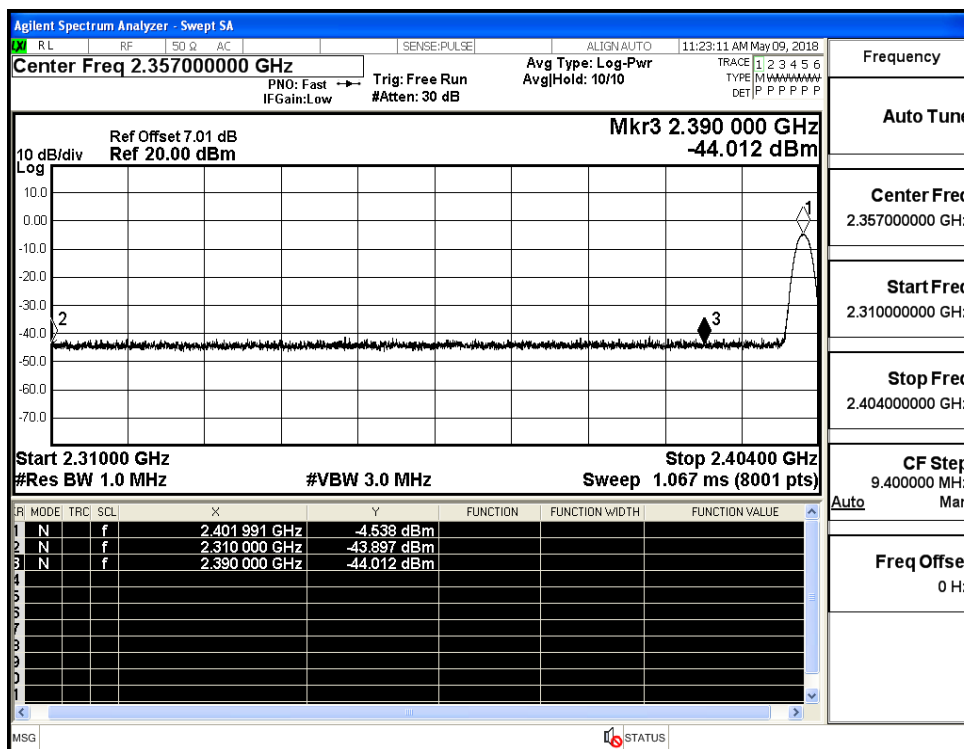
## Restrict-band band-edge measurements\_Hopping Off\_π/4-DQPSK\_PEAK (High Channel)



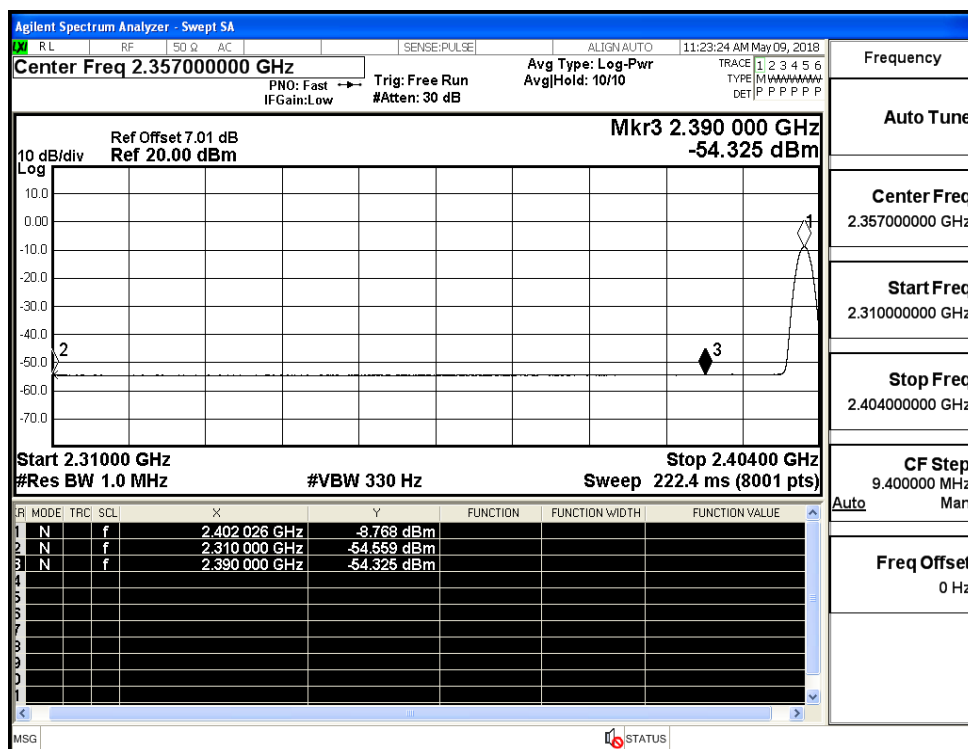
## Restrict-band band-edge measurements\_Hopping Off\_π/4-DQPSK\_Average (High Channel)



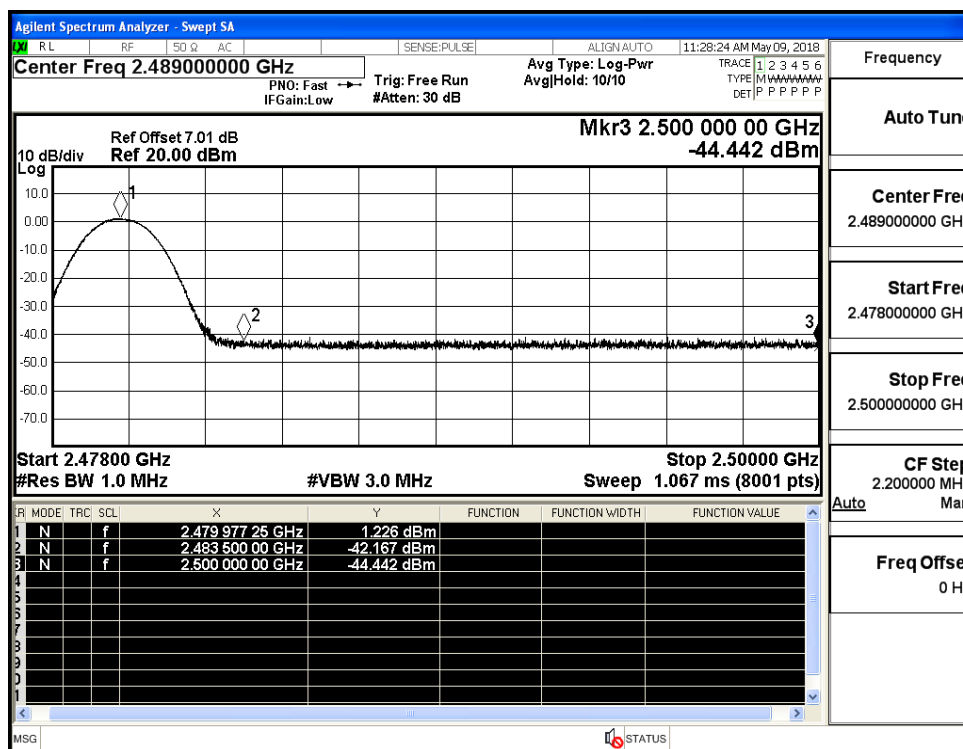
## Restrict-band band-edge measurements\_Hopping Off\_8DPSK\_PEAK (Low Channel)



## 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)

