

## Appendix A

### RF Test Data for BT V5.0(BDR/EDR) (Conducted Measurement)

Product Name: VIM3

Trade Mark: Khadas

Test Model: VIM3 Pro

#### Environmental Conditions

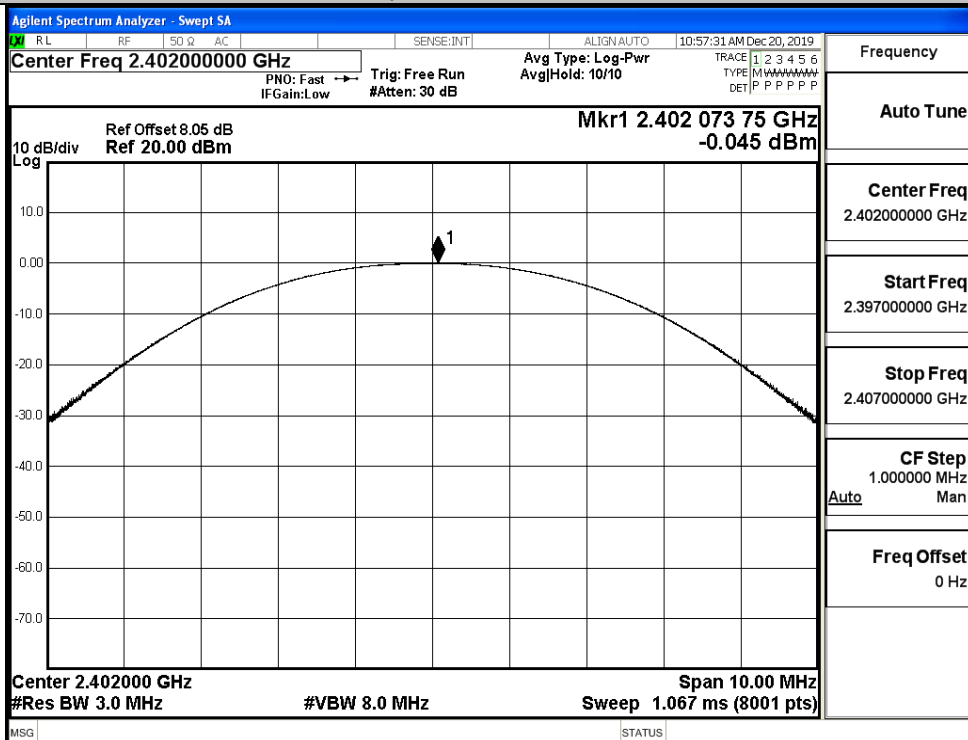
|                    |             |
|--------------------|-------------|
| Temperature:       | 23.8 °C     |
| Relative Humidity: | 53.1%       |
| ATM Pressure:      | 100.0 kPa   |
| Test Engineer:     | Qu Xin      |
| Supervised by:     | Wang Chuang |

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

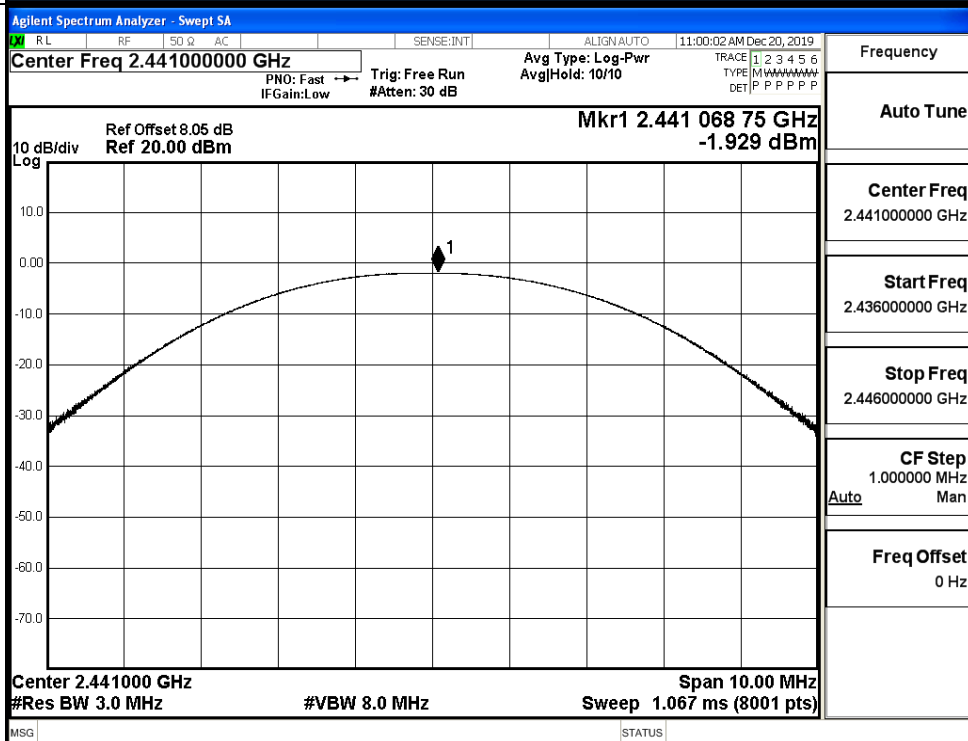
| Mode          | Channel. | Maximum Peak Output Power [dBm] | Limit [dBm] | Verdict |
|---------------|----------|---------------------------------|-------------|---------|
| GFSK          | LCH      | -0.045                          | 21          | PASS    |
|               | MCH      | -1.929                          | 21          | PASS    |
|               | HCH      | -0.682                          | 21          | PASS    |
| $\pi/4$ DQPSK | LCH      | -0.770                          | 21          | PASS    |
|               | MCH      | -2.578                          | 21          | PASS    |
|               | HCH      | -1.437                          | 21          | PASS    |
| 8DPSK         | LCH      | -0.571                          | 21          | PASS    |
|               | MCH      | -2.407                          | 21          | PASS    |
|               | HCH      | -1.271                          | 21          | PASS    |

## Test Graphs

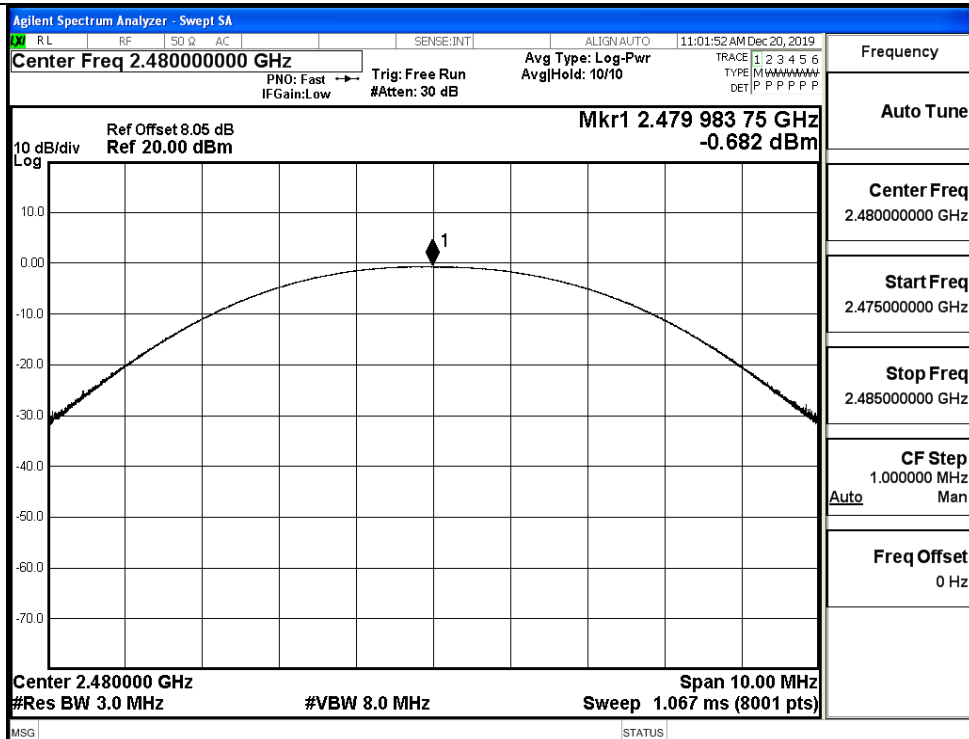
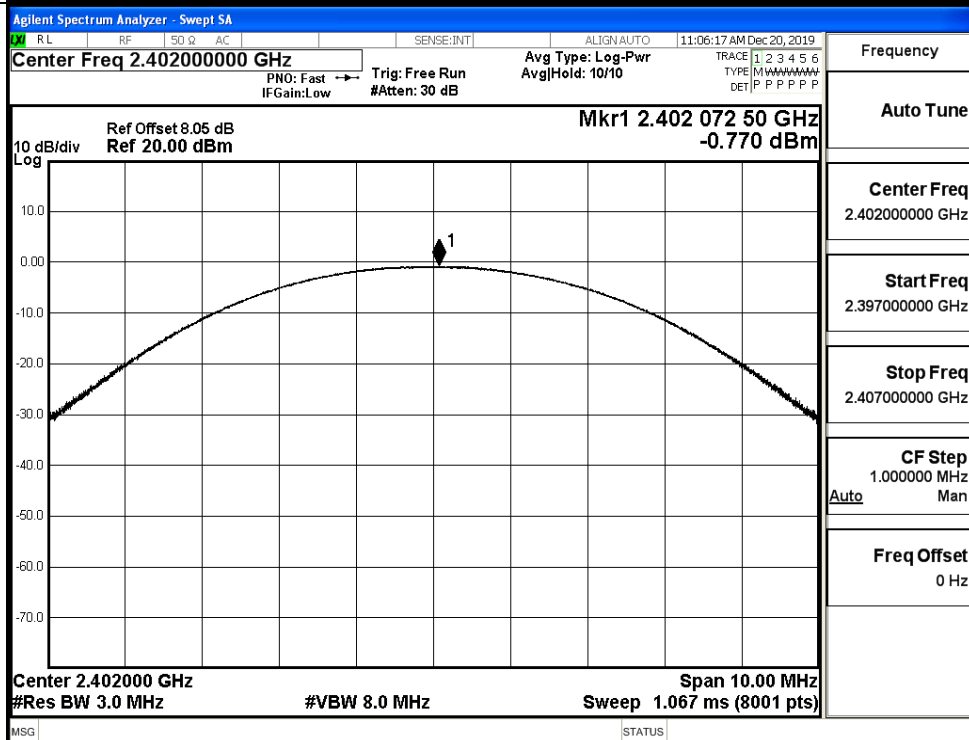
GFSK/LCH

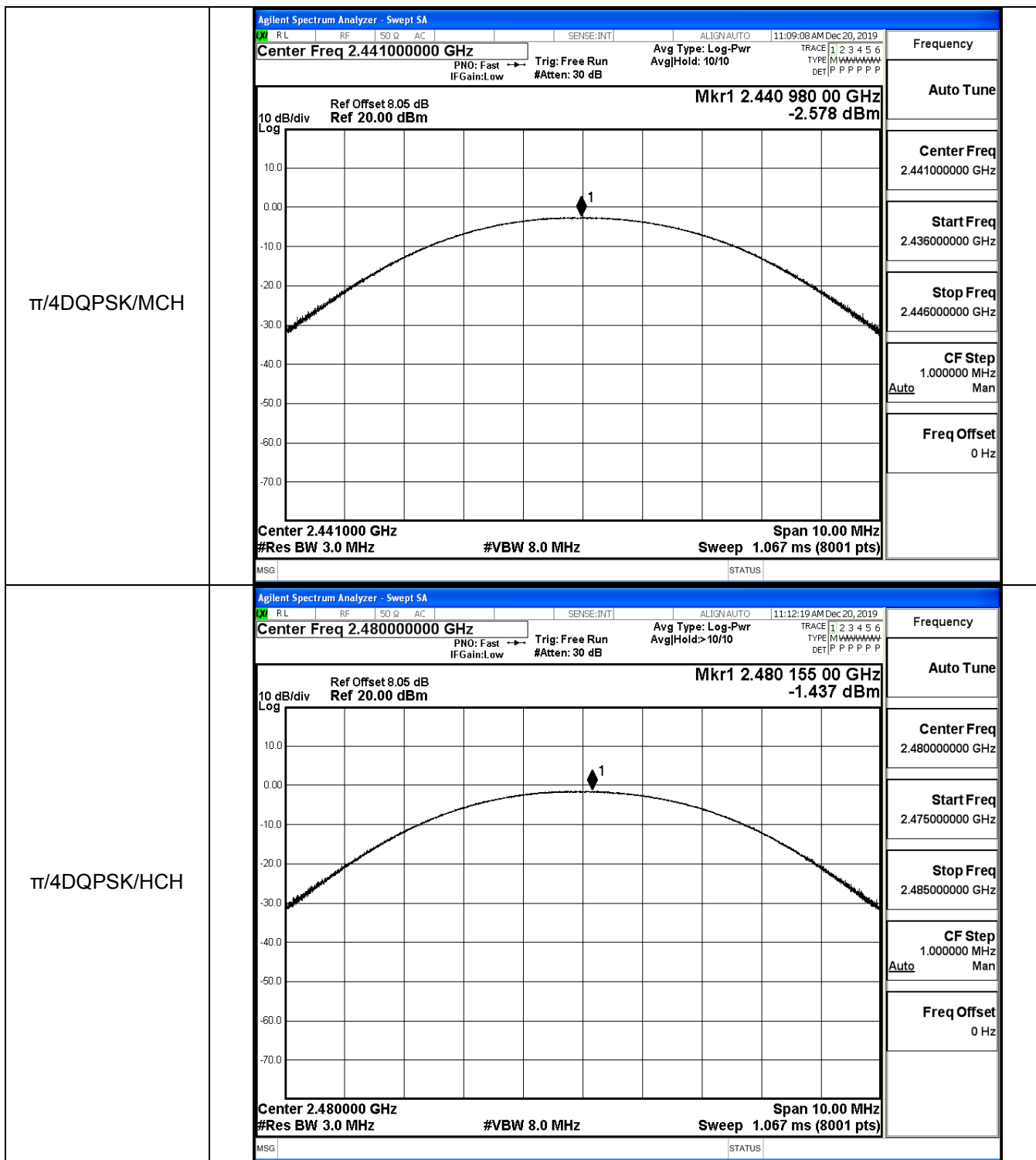


GFSK/MCH

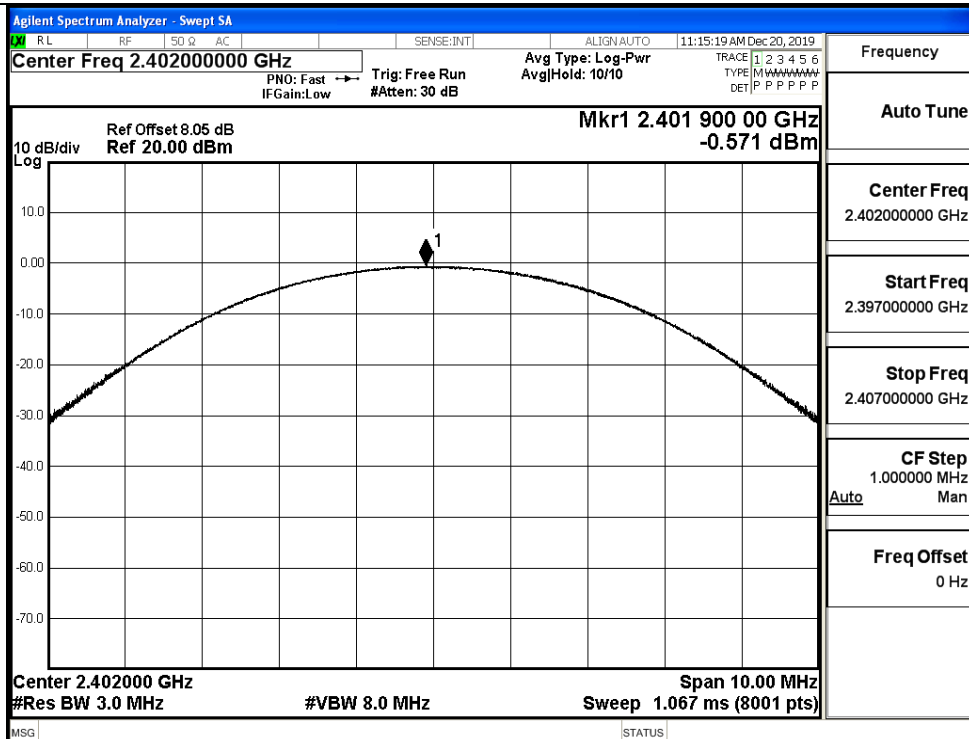


GFSK/HCH

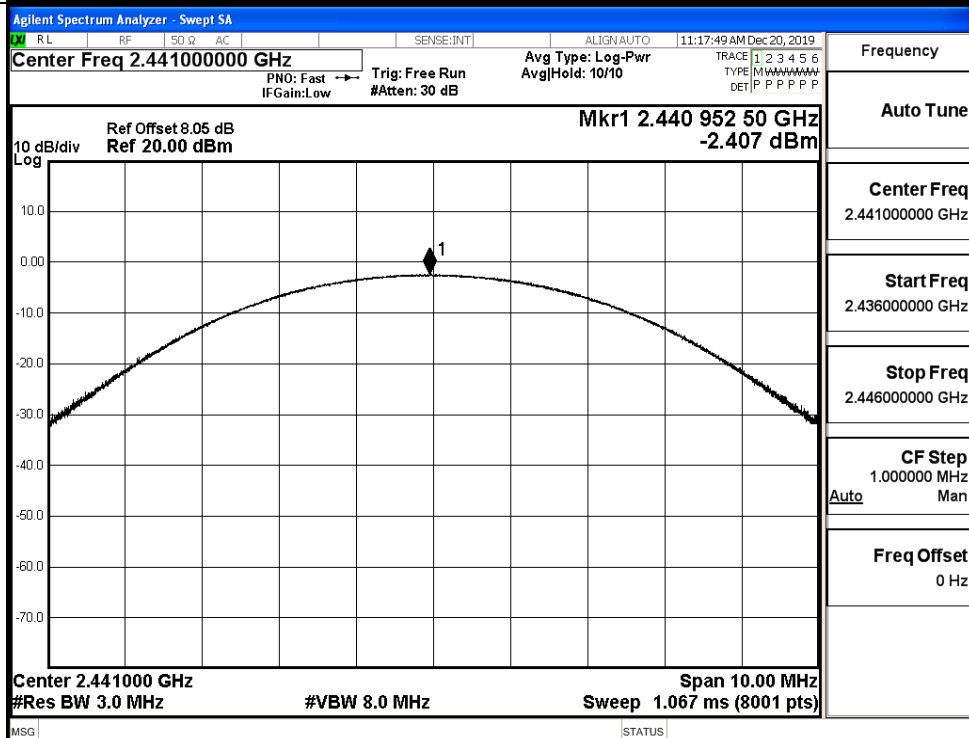
 $\pi/4$ DQPSK/LCH



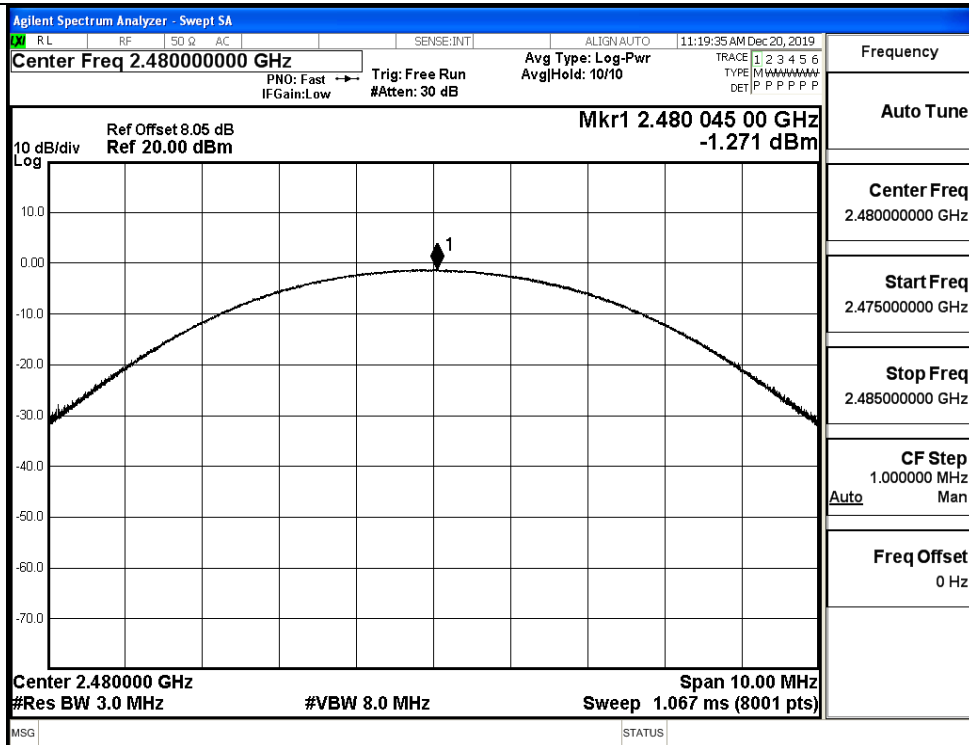
8DPSK/LCH



8DPSK/MCH



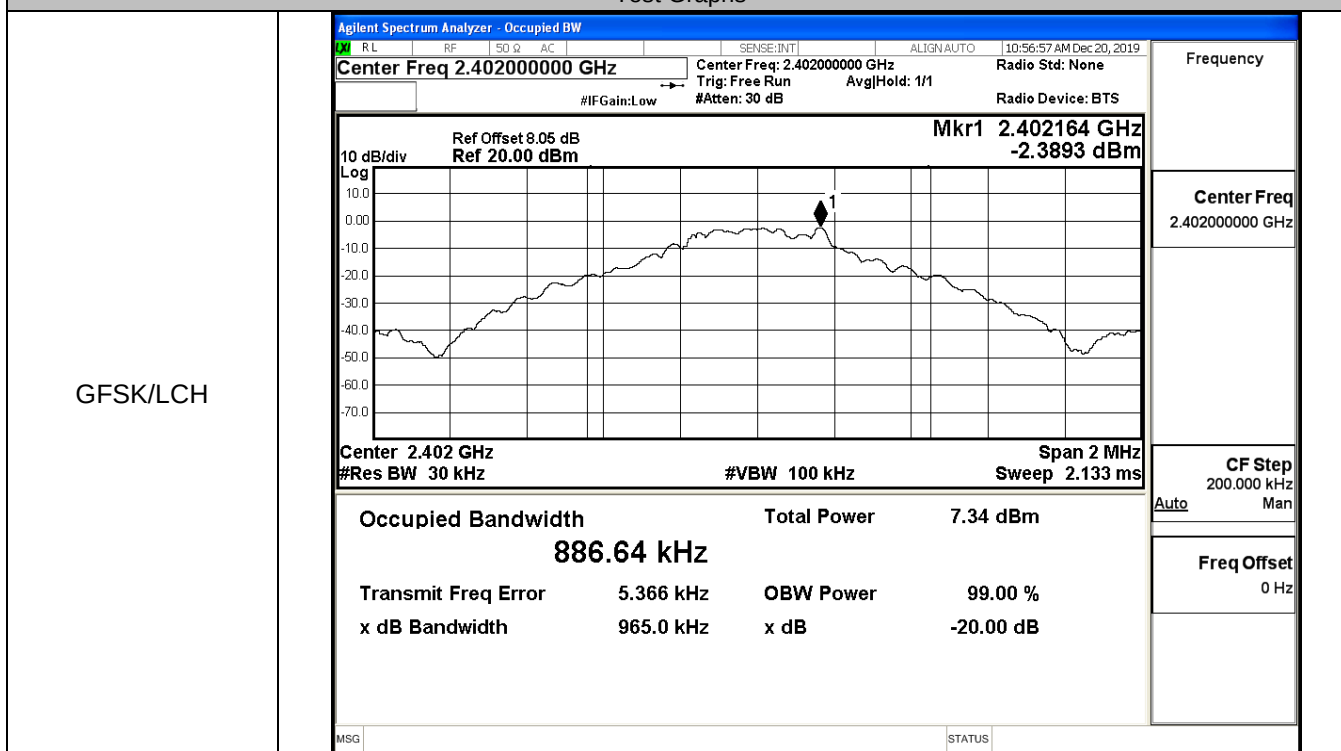
8DPSK/HCH



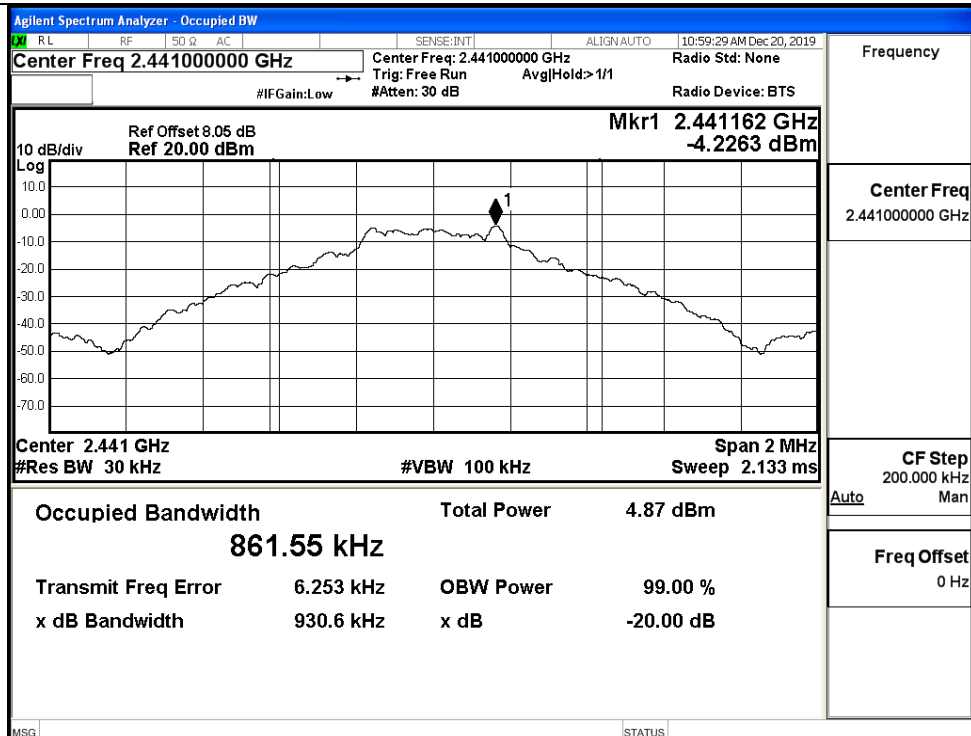
## A.2 20dB Bandwidth

| Mode          | Channel. | 20dB Bandwidth [MHz] | Limit [MHz]   | Verdict |
|---------------|----------|----------------------|---------------|---------|
| GFSK          | LCH      | 0.9650               | Not Specified | PASS    |
|               | MCH      | 0.9306               | Not Specified | PASS    |
|               | HCH      | 1.034                | Not Specified | PASS    |
| $\pi/4$ DQPSK | LCH      | 1.289                | Not Specified | PASS    |
|               | MCH      | 1.310                | Not Specified | PASS    |
|               | HCH      | 1.290                | Not Specified | PASS    |
| 8DPSK         | LCH      | 1.292                | Not Specified | PASS    |
|               | MCH      | 1.300                | Not Specified | PASS    |
|               | HCH      | 1.294                | Not Specified | PASS    |

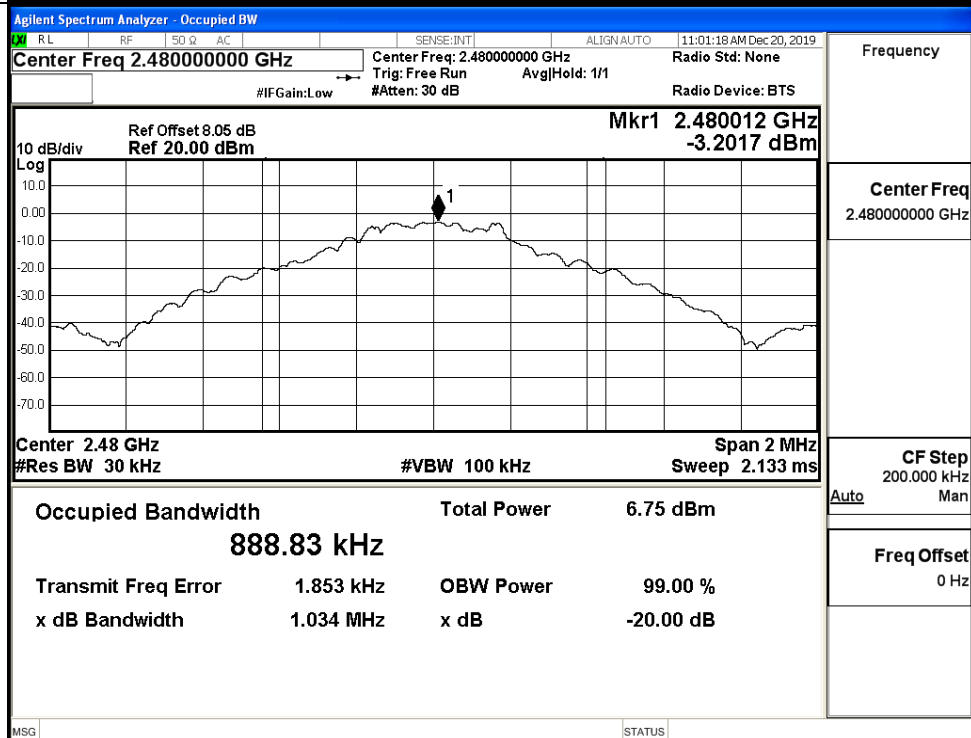
Test Graphs

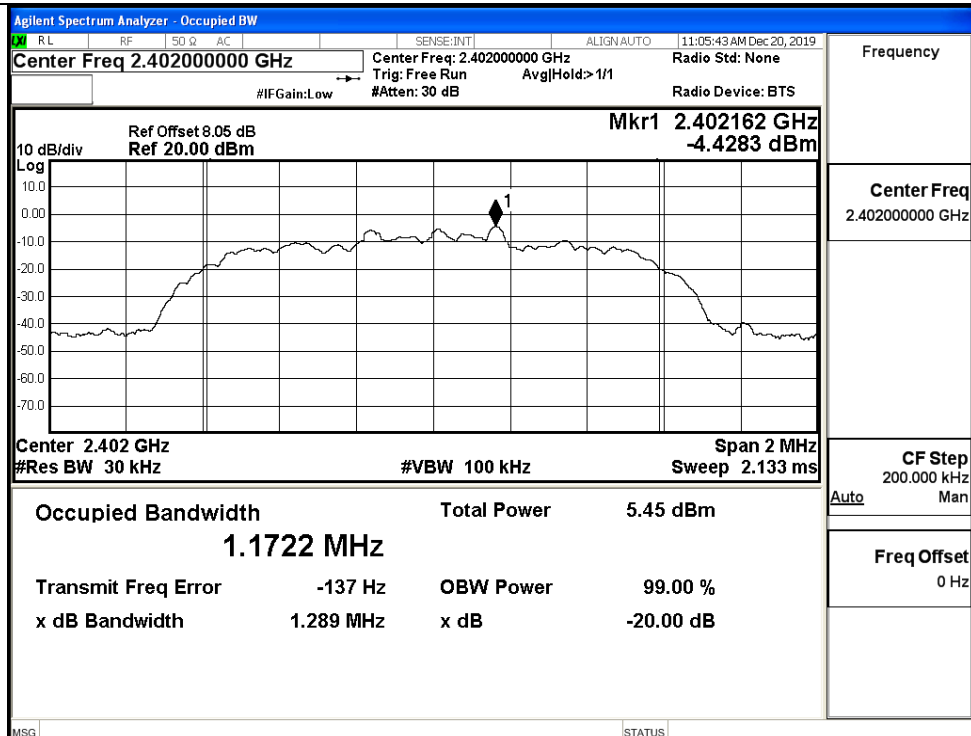


GFSK/MCH



GFSK/HCH

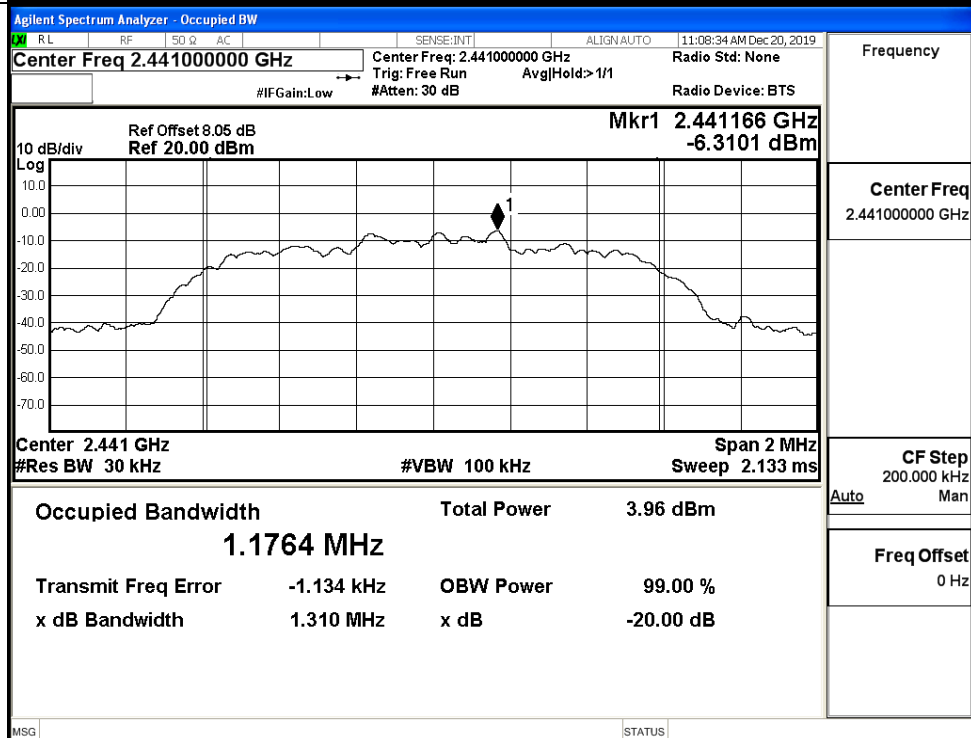


$\pi/4$ DQPSK/LCH

Frequency

Center Freq  
2.40200000 GHzCF Step  
200.000 kHz

Auto

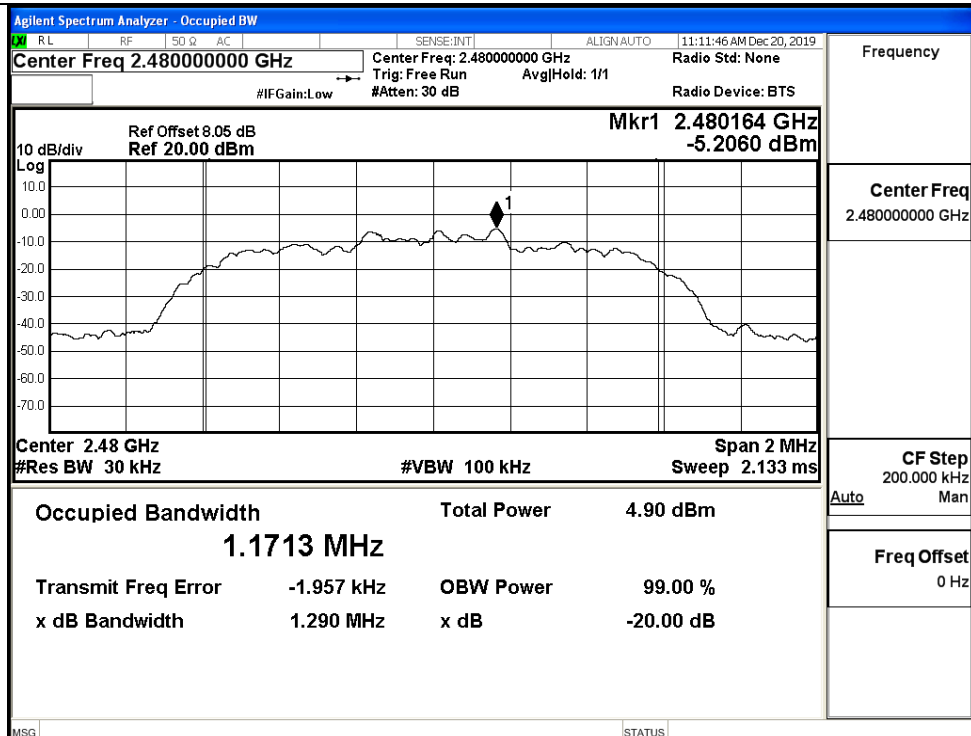
Freq Offset  
0 Hz $\pi/4$ DQPSK/MCH

Frequency

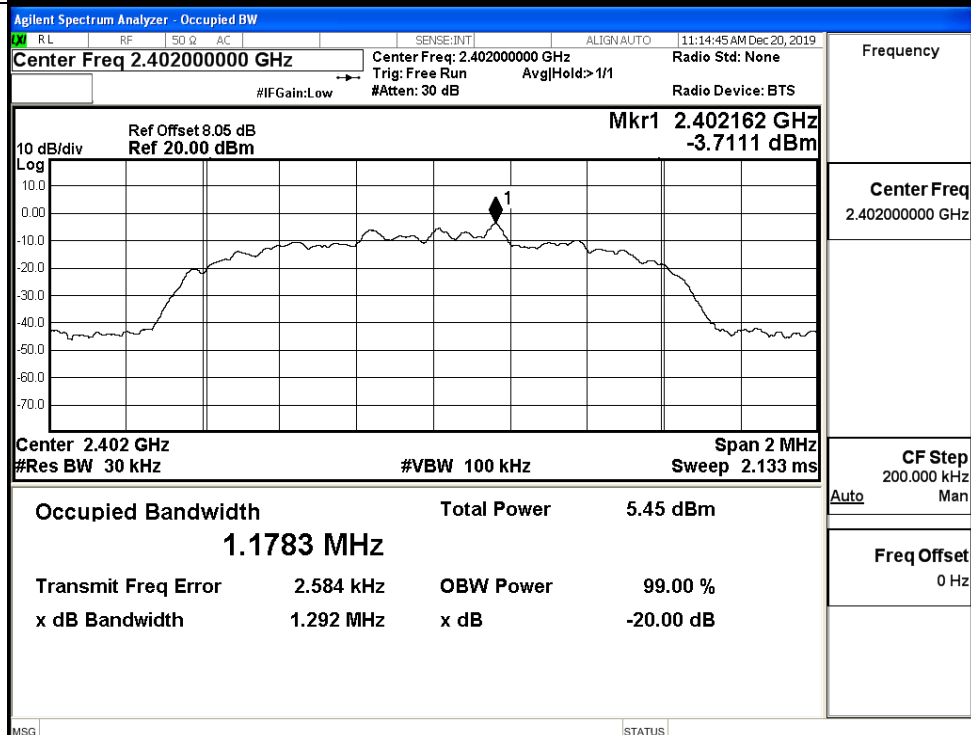
Center Freq  
2.44100000 GHzCF Step  
200.000 kHz

Auto

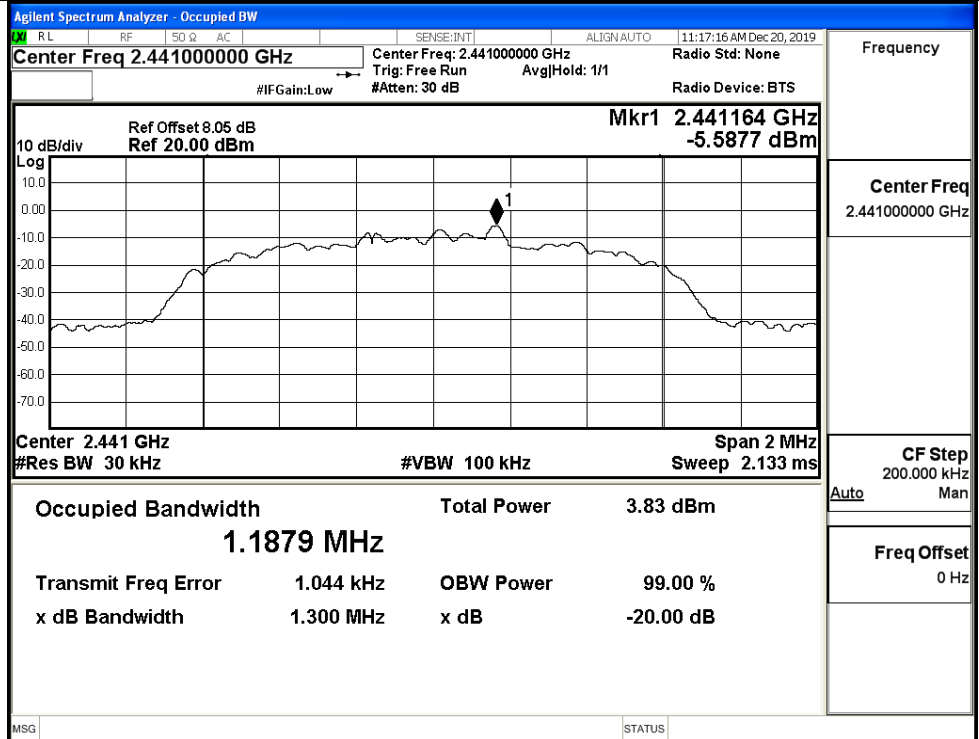
Freq Offset  
0 Hz

$\pi/4$ DQPSK/HCH

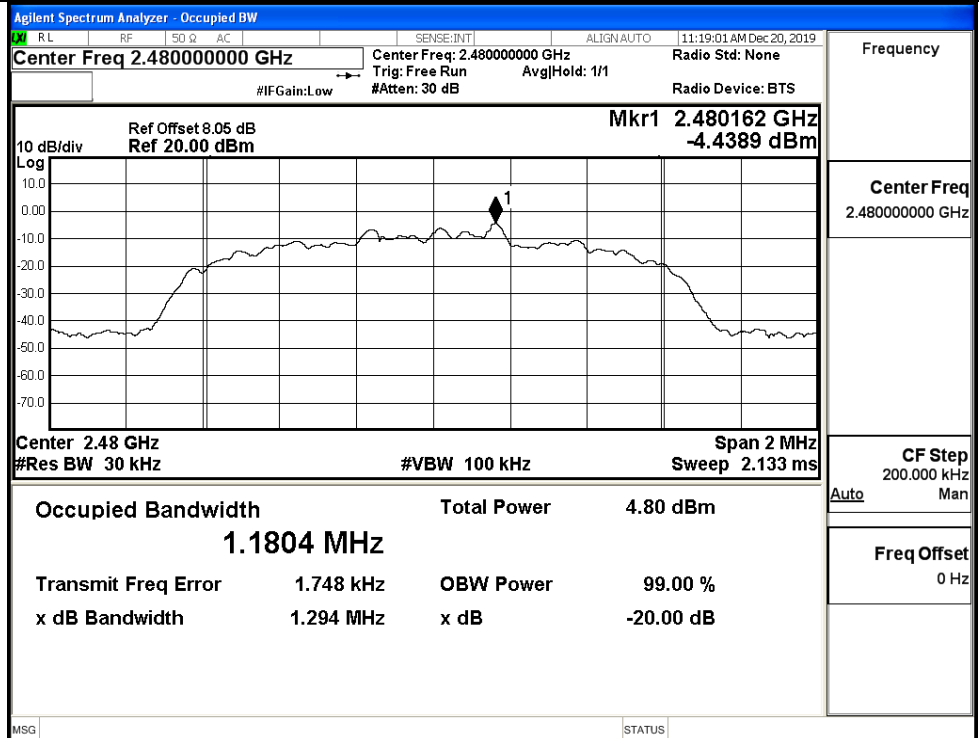
8DPSK/LCH



8DPSK/MCH



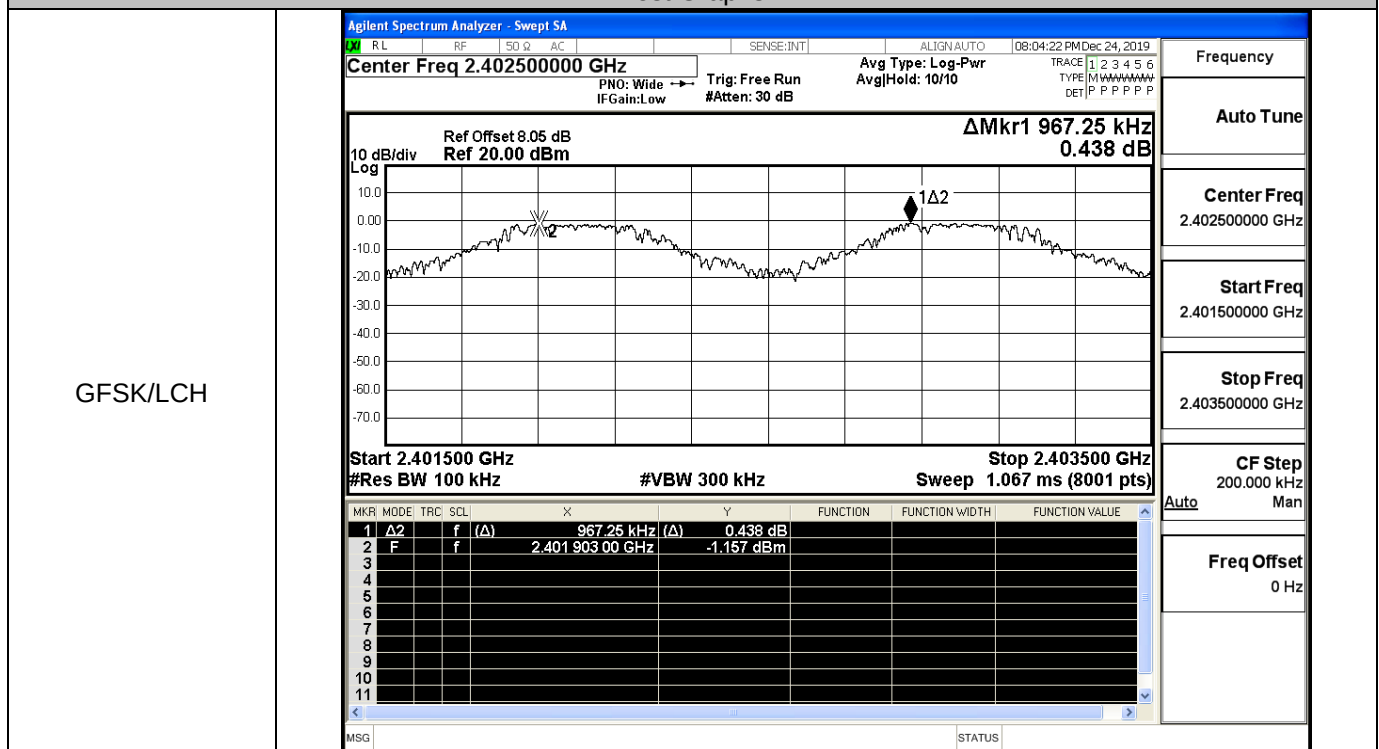
8DPSK/HCH



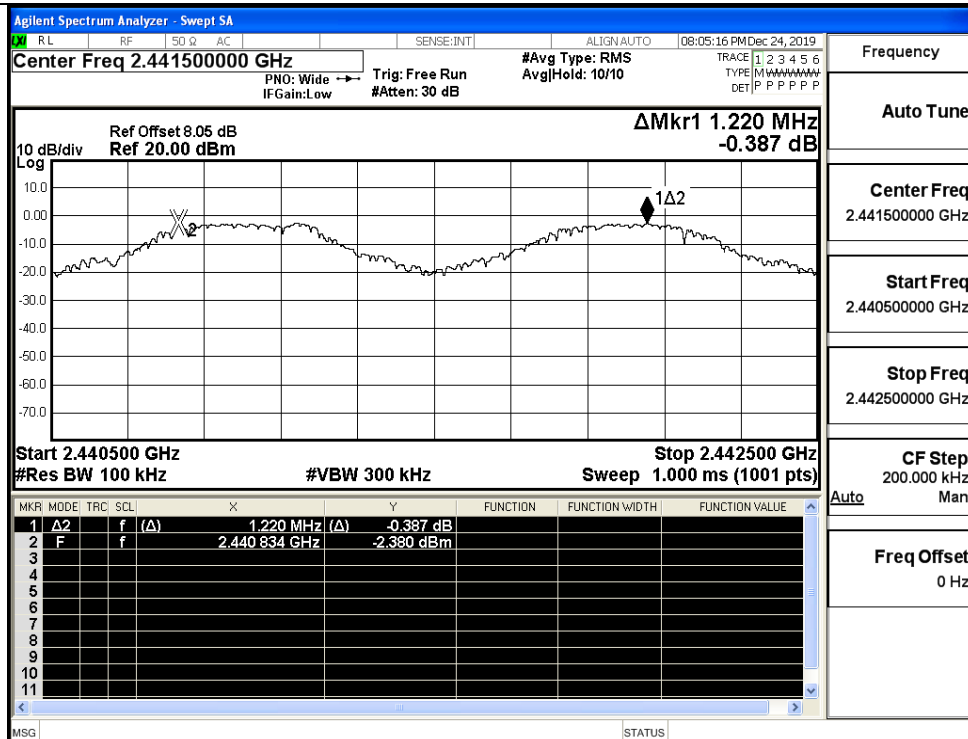
### A.3 Carrier Frequency Separation

| Mode          | Channel | Carrier Frequency Separation [MHz] | Limit [MHz] | Verdict |
|---------------|---------|------------------------------------|-------------|---------|
| GFSK          | LCH     | 0.967                              | 0.689       | PASS    |
|               | MCH     | 1.220                              | 0.689       | PASS    |
|               | HCH     | 1.024                              | 0.689       | PASS    |
| $\pi/4$ DQPSK | LCH     | 0.928                              | 0.873       | PASS    |
|               | MCH     | 1.628                              | 0.873       | PASS    |
|               | HCH     | 1.318                              | 0.873       | PASS    |
| 8DPSK         | LCH     | 1.016                              | 0.867       | PASS    |
|               | MCH     | 0.946                              | 0.867       | PASS    |
|               | HCH     | 1.076                              | 0.867       | PASS    |

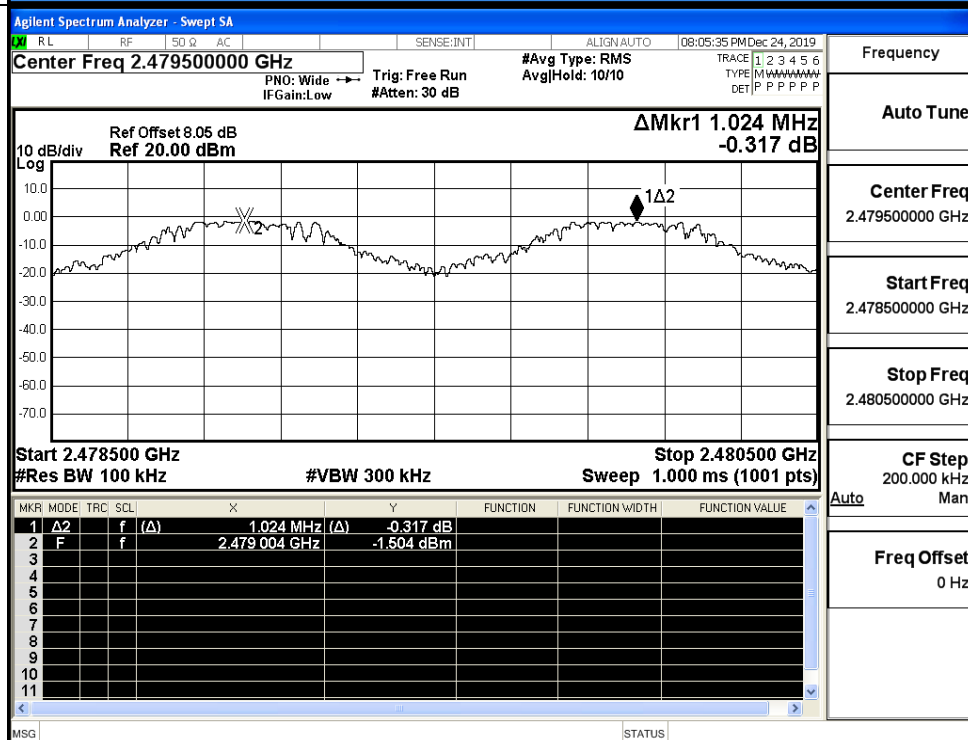
#### Test Graphs

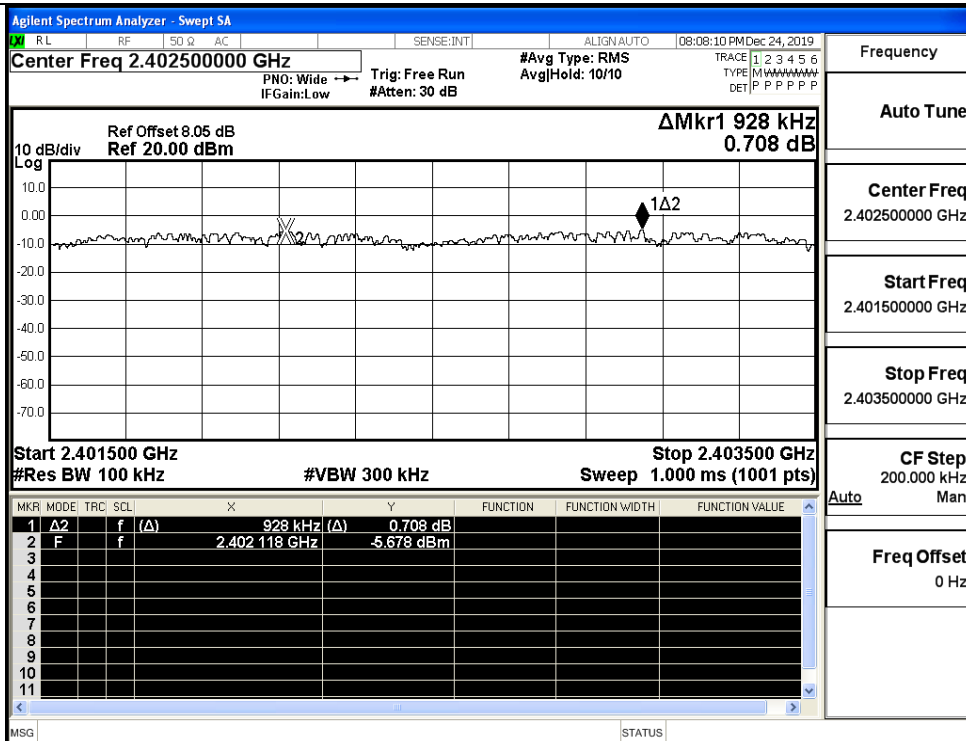
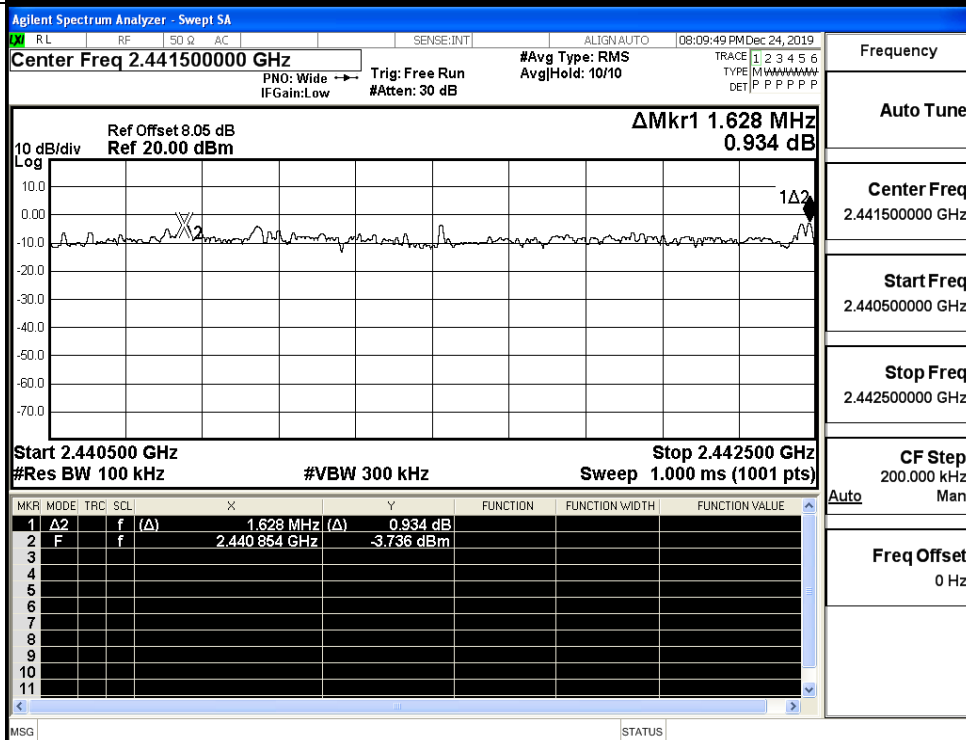


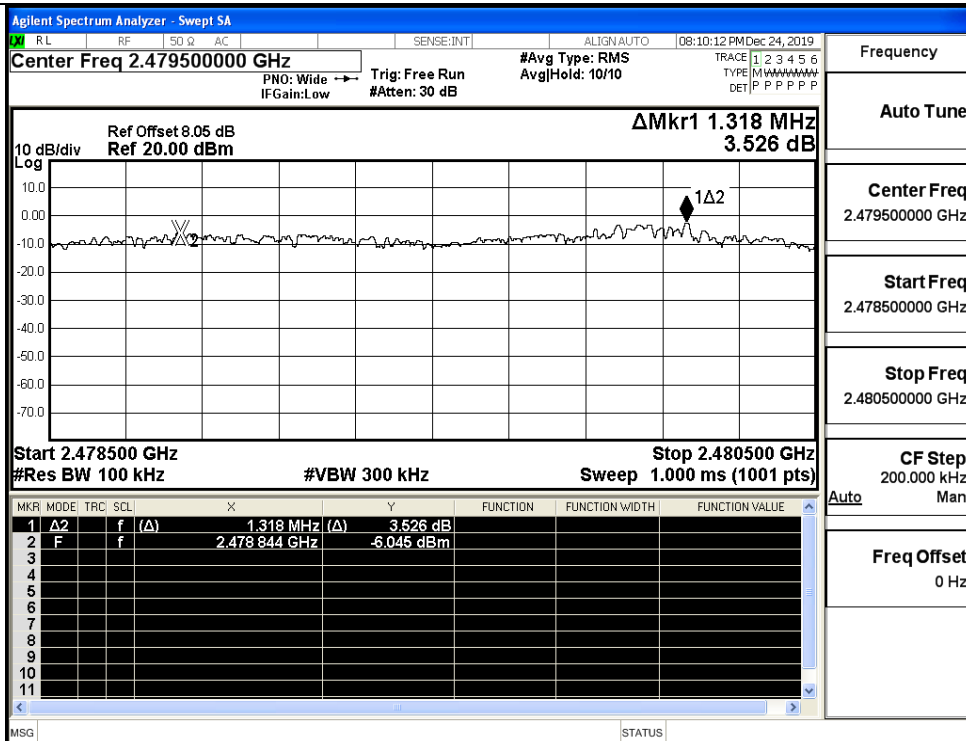
GFSK/MCH



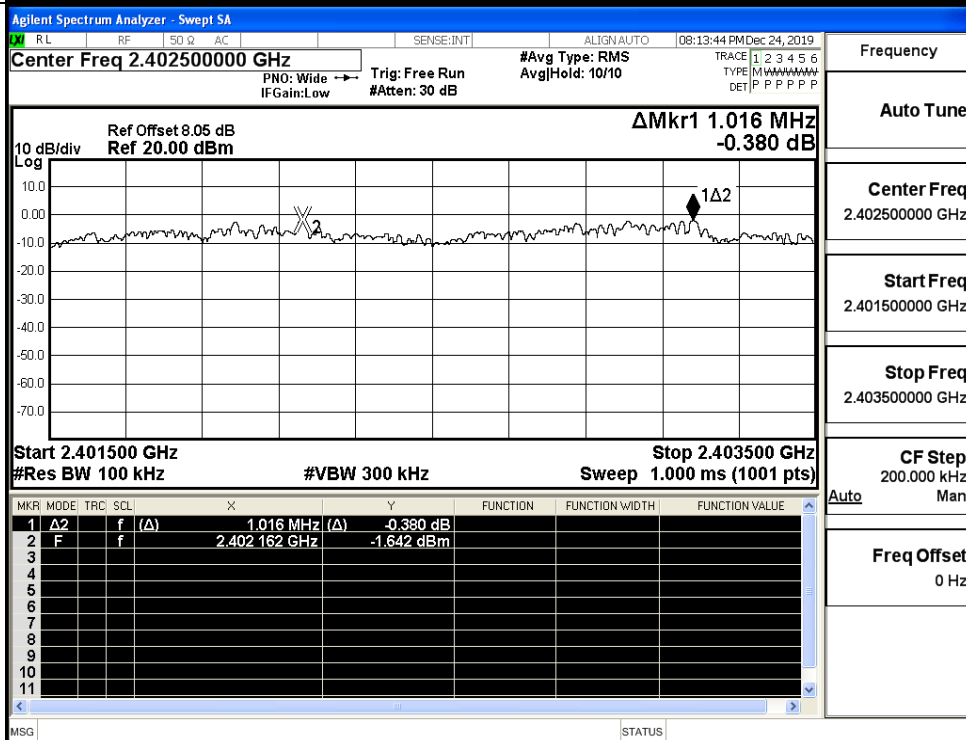
GFSK/HCH



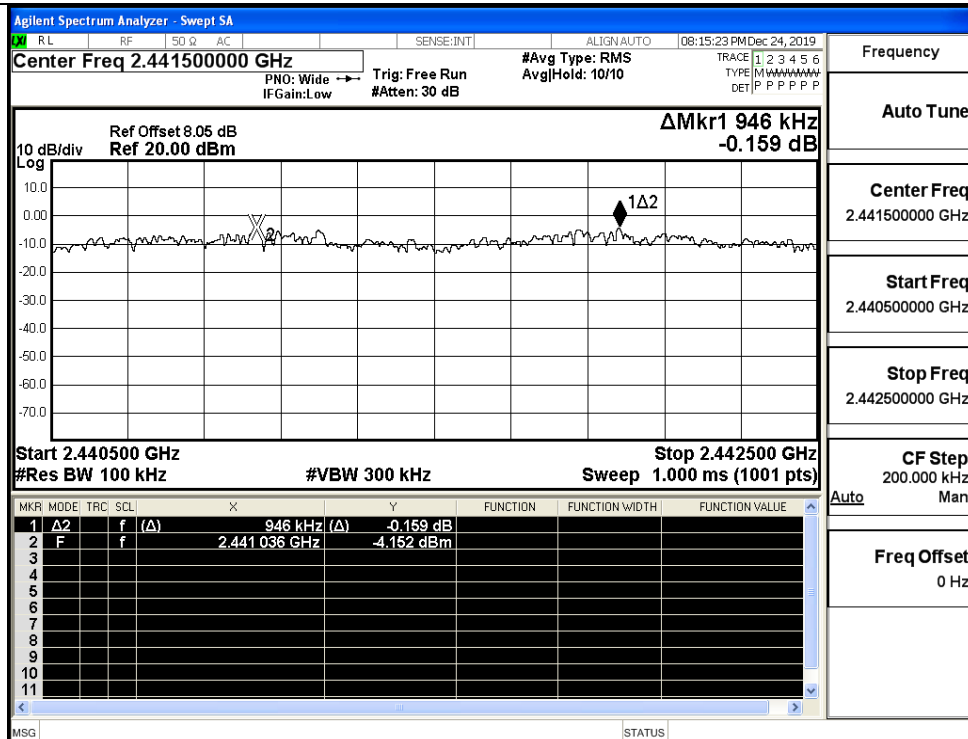
$\pi/4$ DQPSK/LCH $\pi/4$ DQPSK/MCH

$\pi/4$ DQPSK/HCH

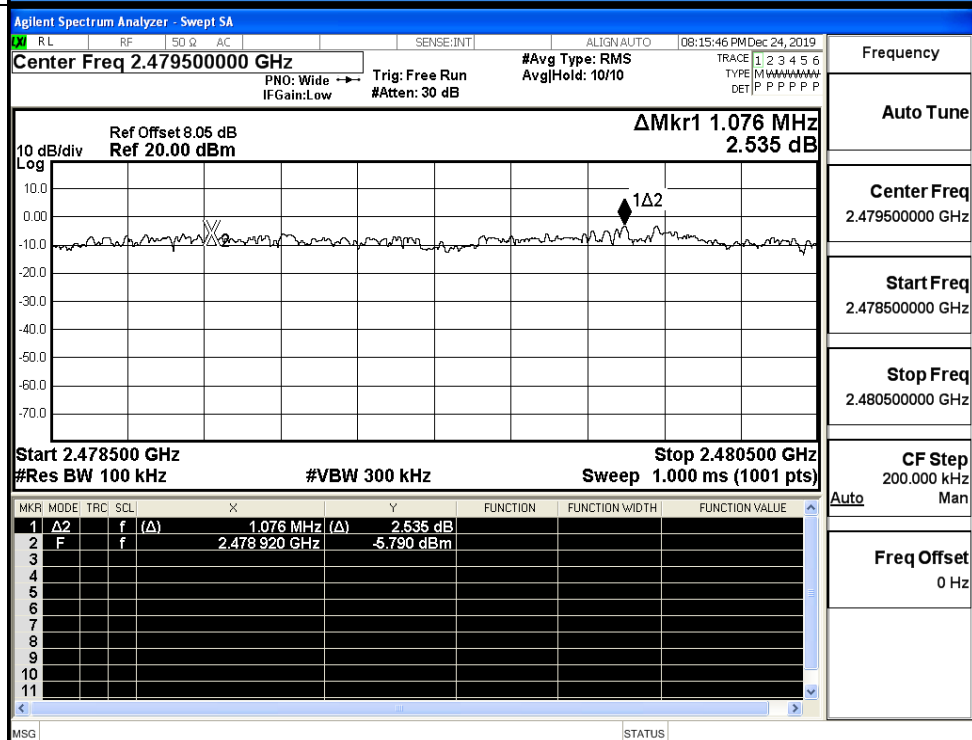
8DPSK/LCH



8DPSK/MCH



8DPSK/HCH

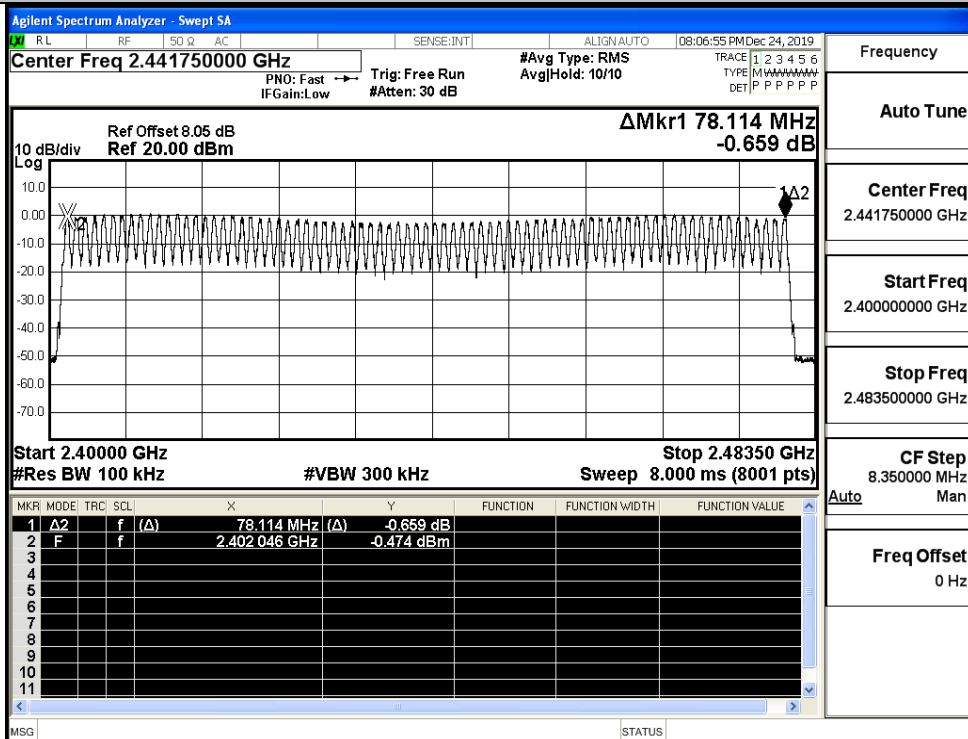
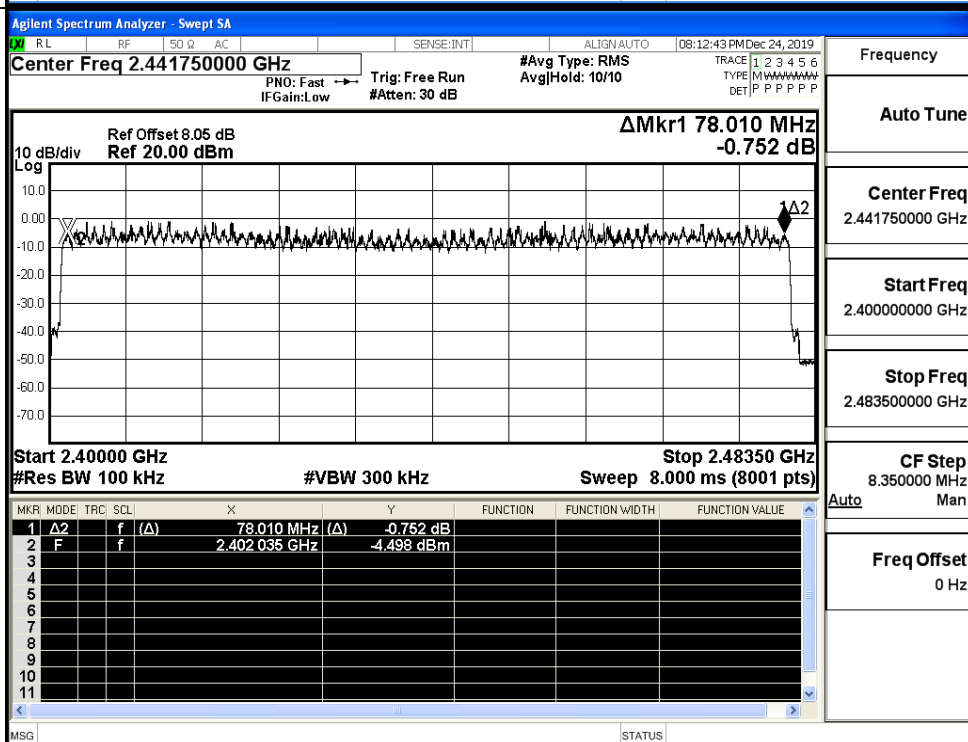


## A.4 Hopping Channel Number

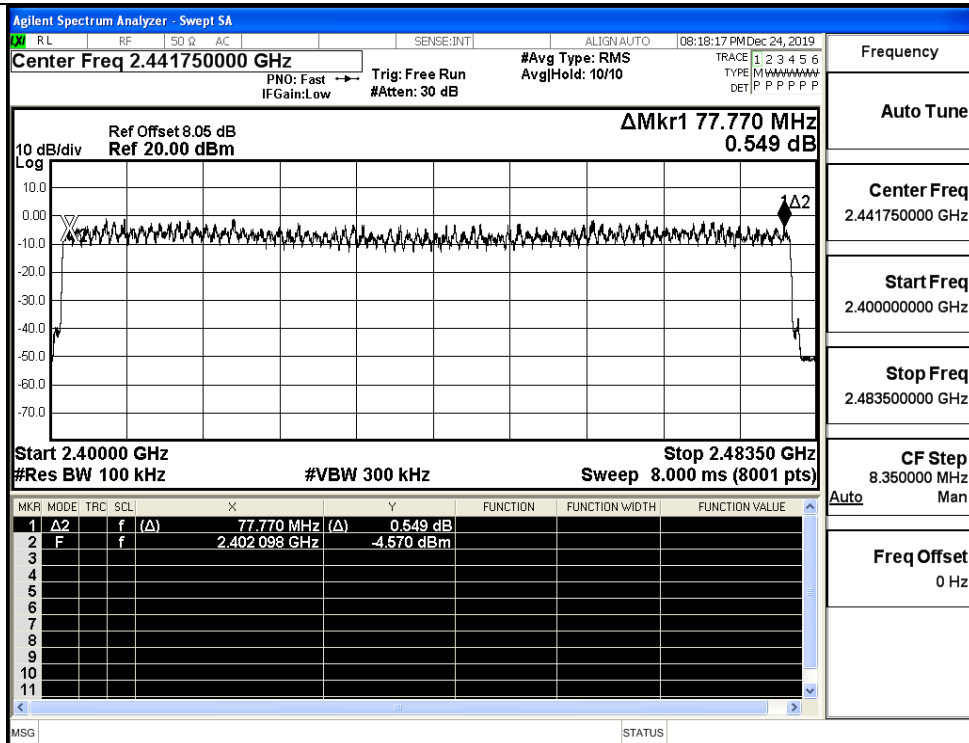
| Mode          | Channel. | Number of Hopping Channel [N] | Limit [N] | Verdict |
|---------------|----------|-------------------------------|-----------|---------|
| GFSK          | Hop      | 79                            | $\geq 15$ | PASS    |
| $\pi/4$ DQPSK | Hop      | 79                    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

### Test Graphs

GFSK/Hop

 $\pi/4$ DQPSK/Hop

8DPSK/Hop

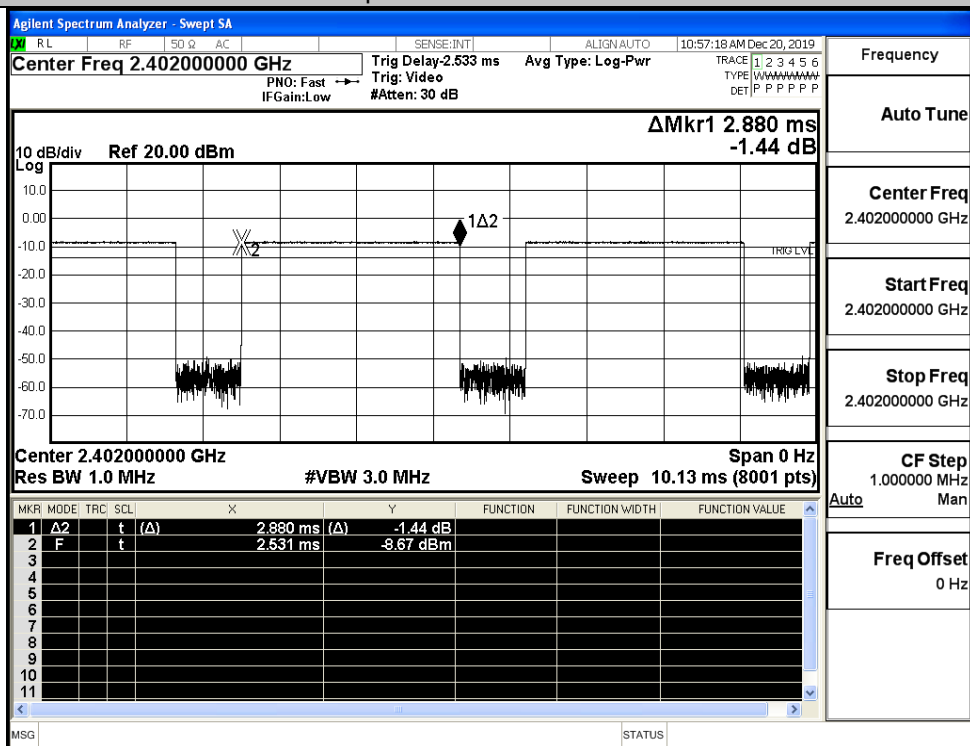


## A.5 Dwell Time

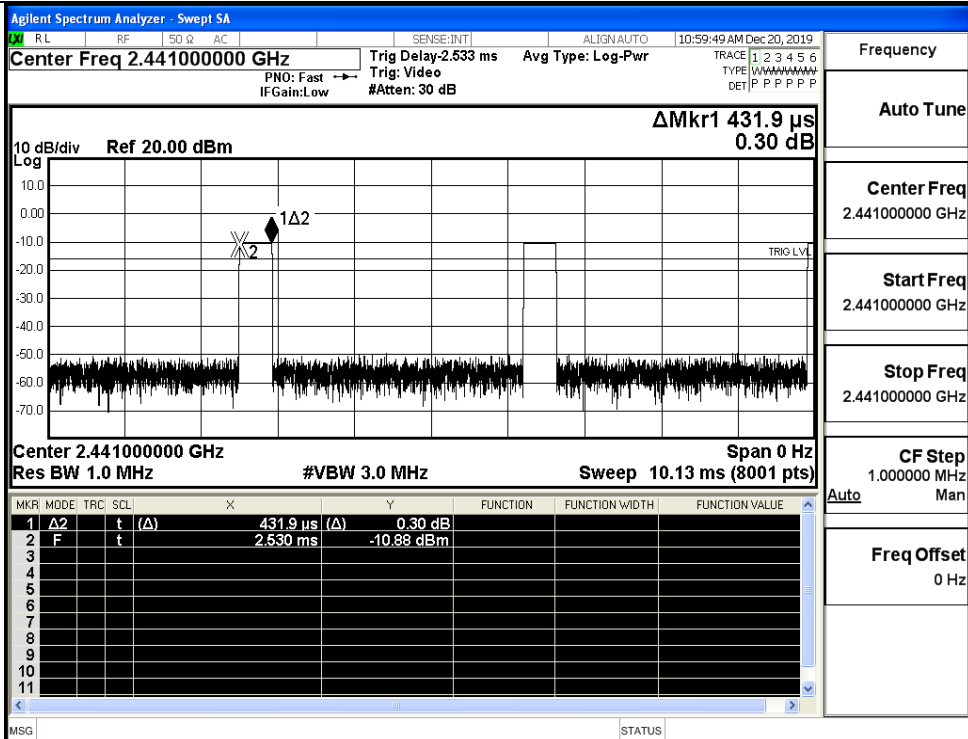
| Mode          | Packet | Channel | Burst Width<br>[ms/hop/ch] | Total<br>Hops[hop*ch] | Dwell Time[s] | Limit [s] | Verdict |
|---------------|--------|---------|----------------------------|-----------------------|---------------|-----------|---------|
| GFSK          | DH5    | LCH     | 2.88                       | 106.7                 | 0.307         | 0.4       | PASS    |
|               | DH5    | MCH     | 0.43                       | 106.7                 | 0.046         | 0.4       | PASS    |
|               | DH5    | HCH     | 2.88                       | 106.7                 | 0.307         | 0.4       | PASS    |
| $\pi/4$ DQPSK | 2DH5   | LCH     | 2.88                       | 106.7                 | 0.307         | 0.4       | PASS    |
|               | 2DH5   | MCH     | 0.43                       | 106.7                 | 0.307         | 0.4       | PASS    |
|               | 2DH5   | HCH     | 2.88                       | 106.7                 | 0.307         | 0.4       | PASS    |
| 8DPSK         | 3DH5   | LCH     | 2.88                       | 106.7                 | 0.308         | 0.4       | PASS    |
|               | 3DH5   | MCH     | 0.43                       | 106.7                 | 0.308         | 0.4       | PASS    |
|               | 3DH5   | HCH     | 2.88                       | 106.7                 | 0.308         | 0.4       | PASS    |

Test Graphs

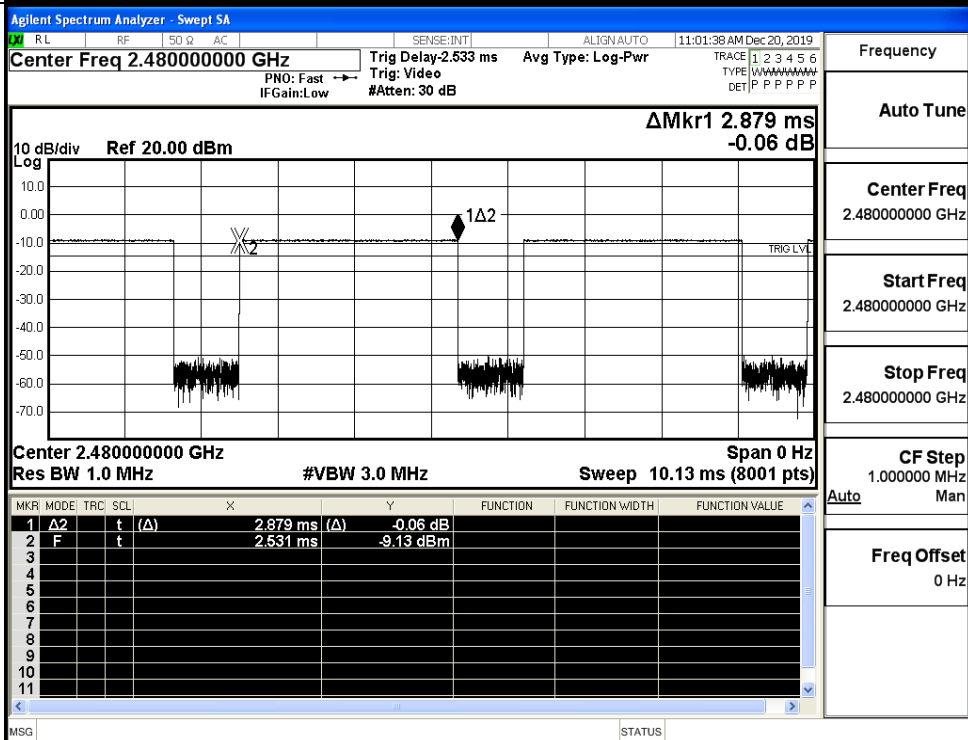
GFSK\_DH5/LCH



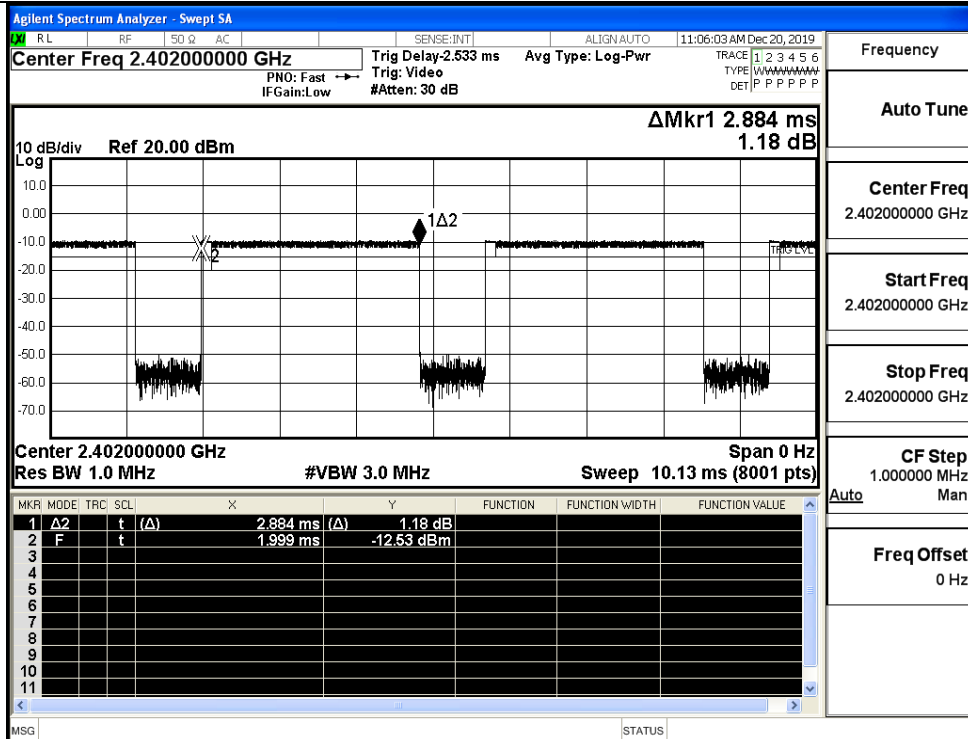
GFSK\_DH5/MCH



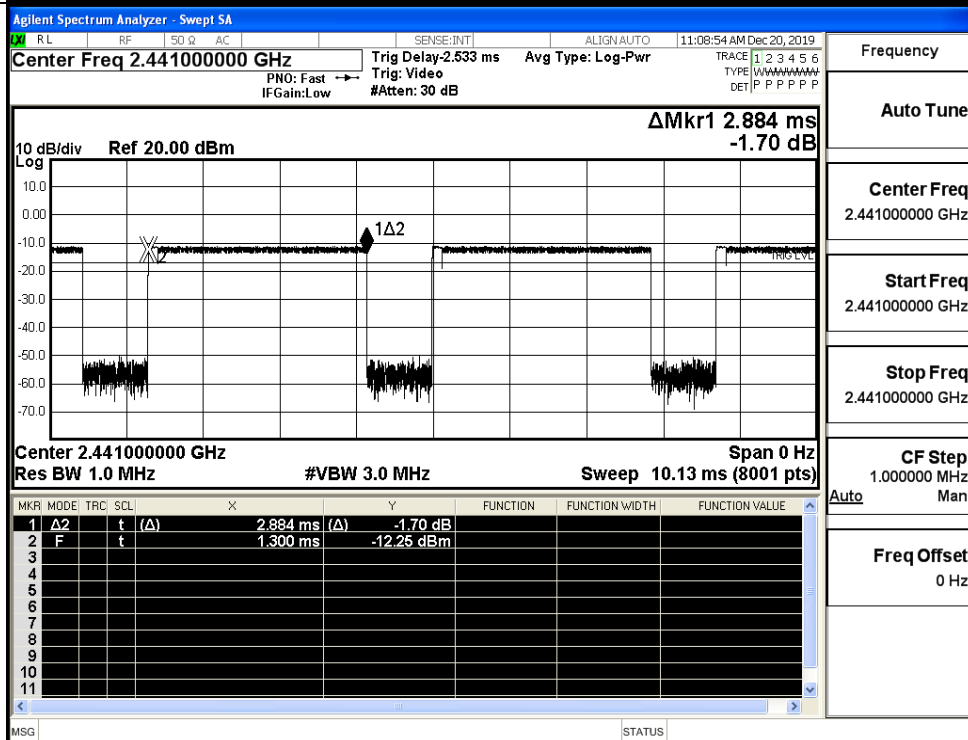
GFSK\_DH5/HCH



$\pi/4$ DQPSK  
\_2DH5/LCH



$\pi/4$ DQPSK  
\_2DH5/MCH



**Agilent Spectrum Analyzer - Swept SA**

RL RF 50 Ω AC SENSE:INT ALIGN:AUTO 11:12:06 AM Dec 20, 2019  
Center Freq 2.48000000 GHz Trig Delay-2.533 ms Avg Type: Log-Pwr PNO: Fast IF Gain: Low #Atten: 30 dB TYPE: DET:P P P P P P

**ΔMkr1 2.883 ms  
-1.34 dB**

| MKR MODE TRC SCAL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE |
|--------------------------------------------------------------|
| 1 Δf2 t (Δ) 2.883 ms (-1.34 dB)                              |
| 2 F t 1.249 ms (-10.57 dBm)                                  |
| 3                                                            |
| 4                                                            |
| 5                                                            |
| 6                                                            |
| 7                                                            |
| 8                                                            |
| 9                                                            |
| 10                                                           |
| 11                                                           |

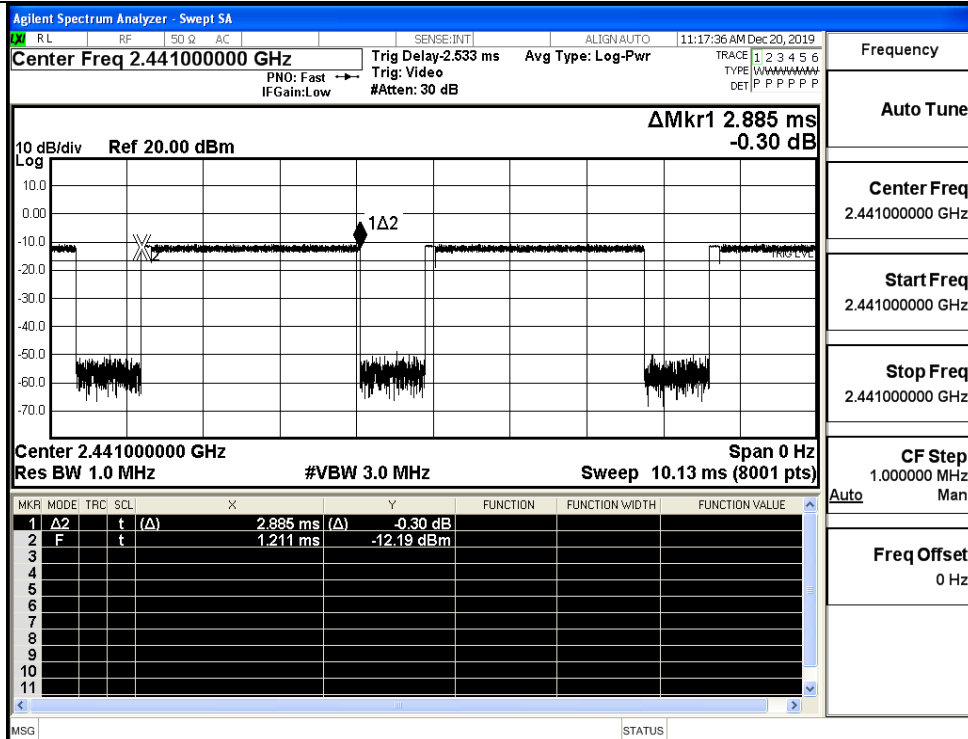
Center 2.48000000 GHz Span 0 Hz  
Res BW 1.0 MHz #VBW 3.0 MHz Sweep 10.13 ms (8001 pts)

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

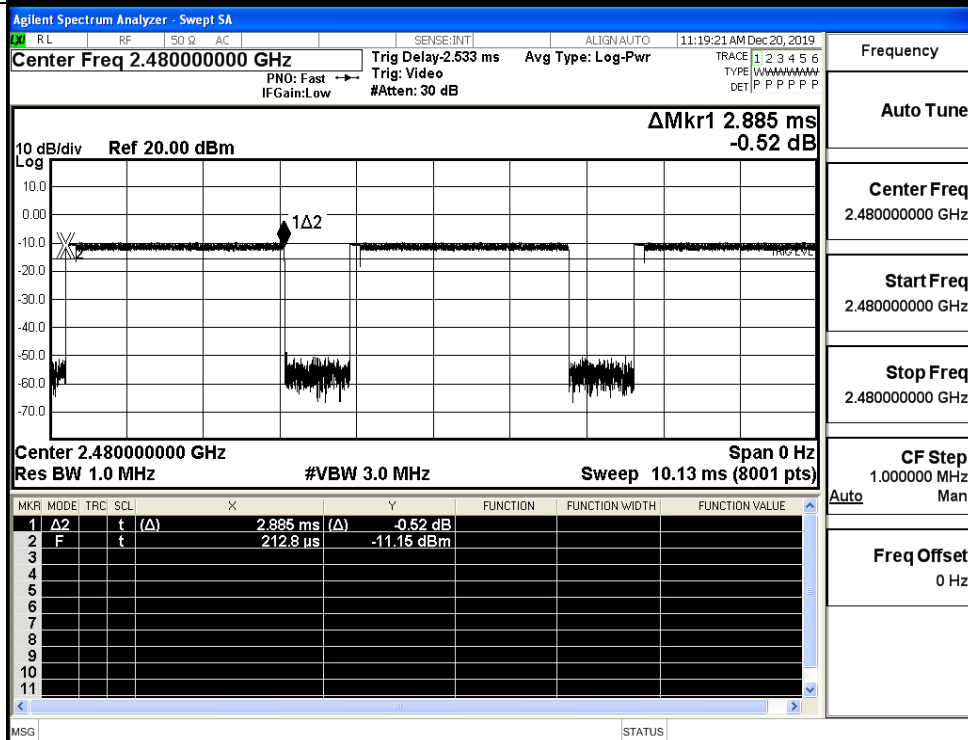
[illegible]

|                                |
|--------------------------------|
| Frequency                      |
| Auto Tune                      |
| Center Freq<br>2.402000000 GHz |
| Start Freq<br>2.402000000 GHz  |
| Stop Freq<br>2.402000000 GHz   |
| CF Step<br>1.000000 MHz        |
| Auto Man                       |
| Freq Offset<br>0 Hz            |
|                                |

8DPSK\_3DH5/MCH



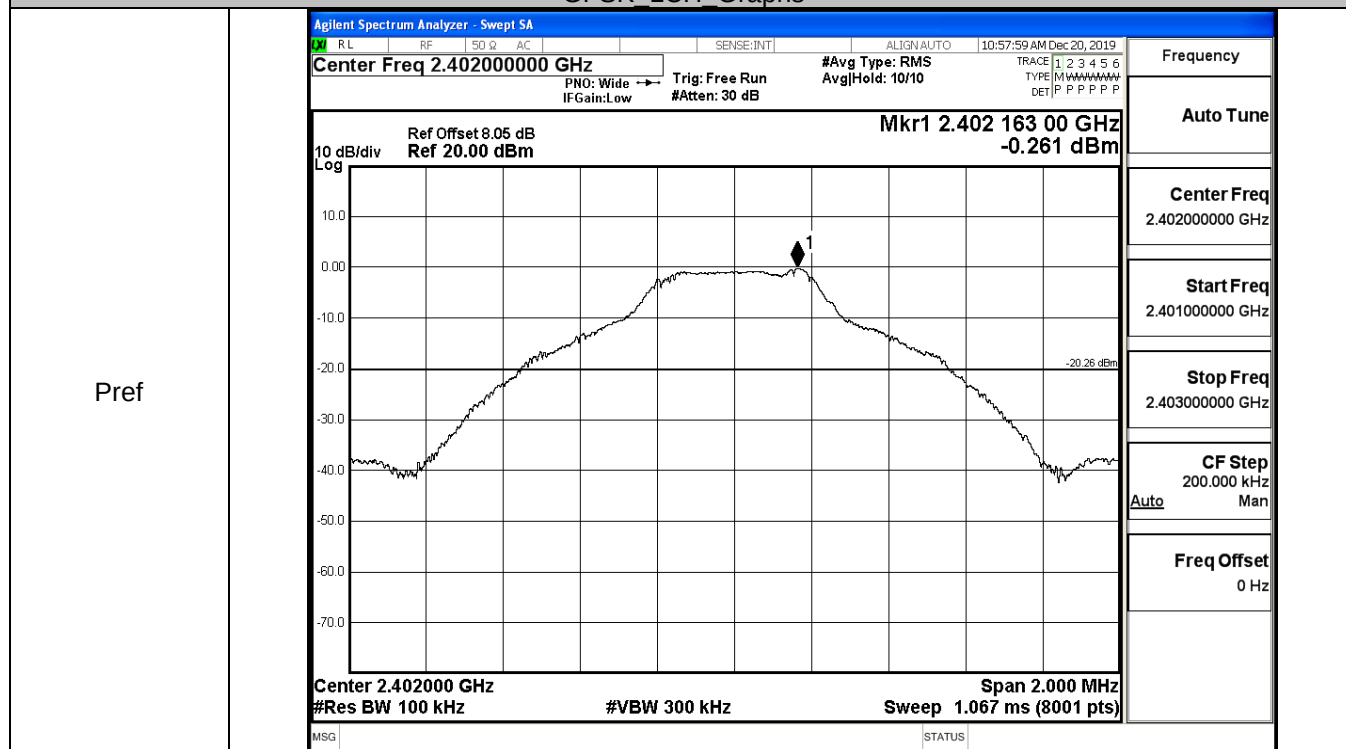
8DPSK\_3DH5/HCH



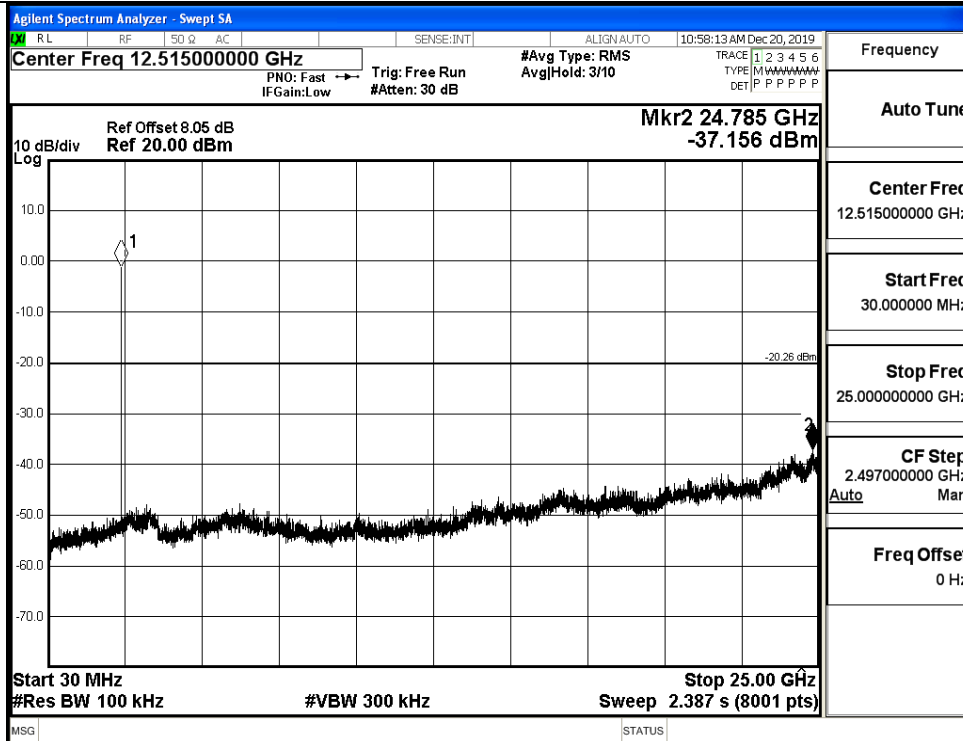
## A.6 RF Conducted Spurious Emissions

| Mode          | Channel | Pref [dBm] | Max. Level [dBm] | Limit [dBm] | Verdict |
|---------------|---------|------------|------------------|-------------|---------|
| GFSK          | LCH     | -0.261     | -37.156          | -20.261     | PASS    |
|               | MCH     | -2.163     | -37.278          | -22.163     | PASS    |
|               | HCH     | -1.003     | -37.549          | -21.003     | PASS    |
| $\pi/4$ DQPSK | LCH     | -1.694     | -37.727          | -21.694     | PASS    |
|               | MCH     | -3.365     | -37.672          | -23.365     | PASS    |
|               | HCH     | -2.573     | -37.583          | -22.573     | PASS    |
| 8DPSK         | LCH     | -1.833     | -37.872          | -21.833     | PASS    |
|               | MCH     | -3.416     | -37.183          | -23.416     | PASS    |
|               | HCH     | -2.498     | -37.561          | -22.498     | PASS    |

GFSK LCH Graphs

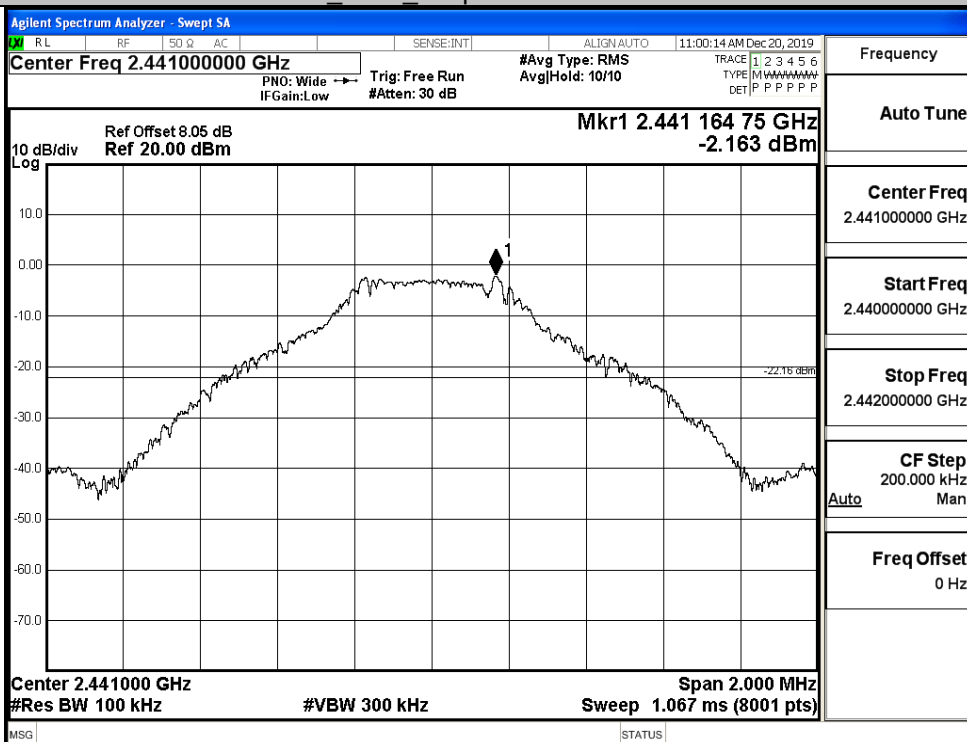


Puw

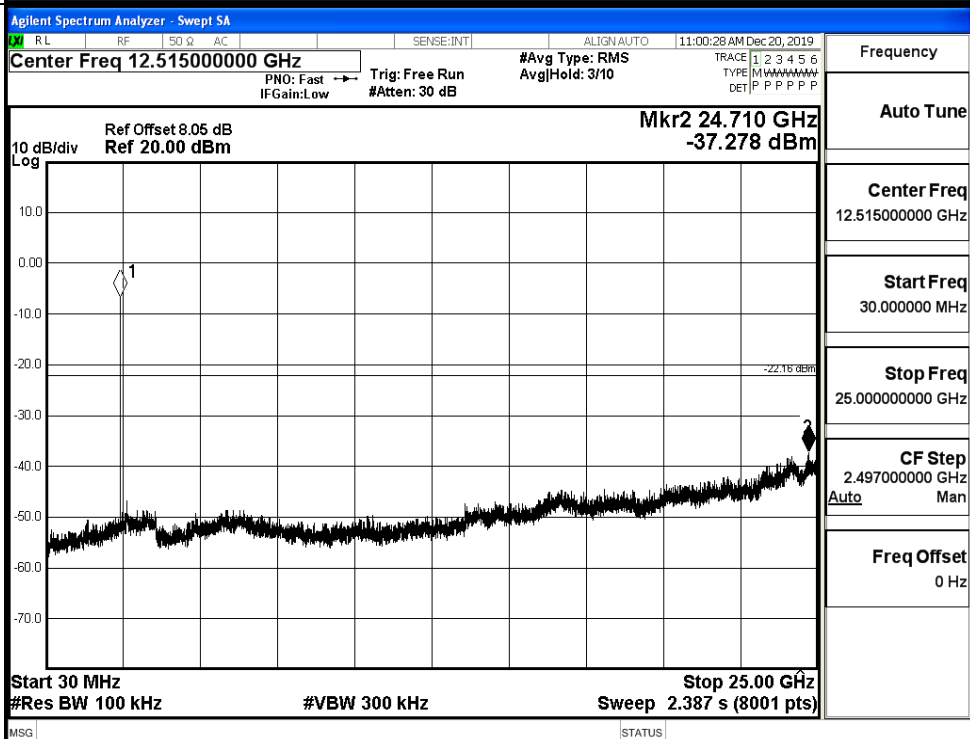


## GFSK\_MCH\_Graphs

Pref

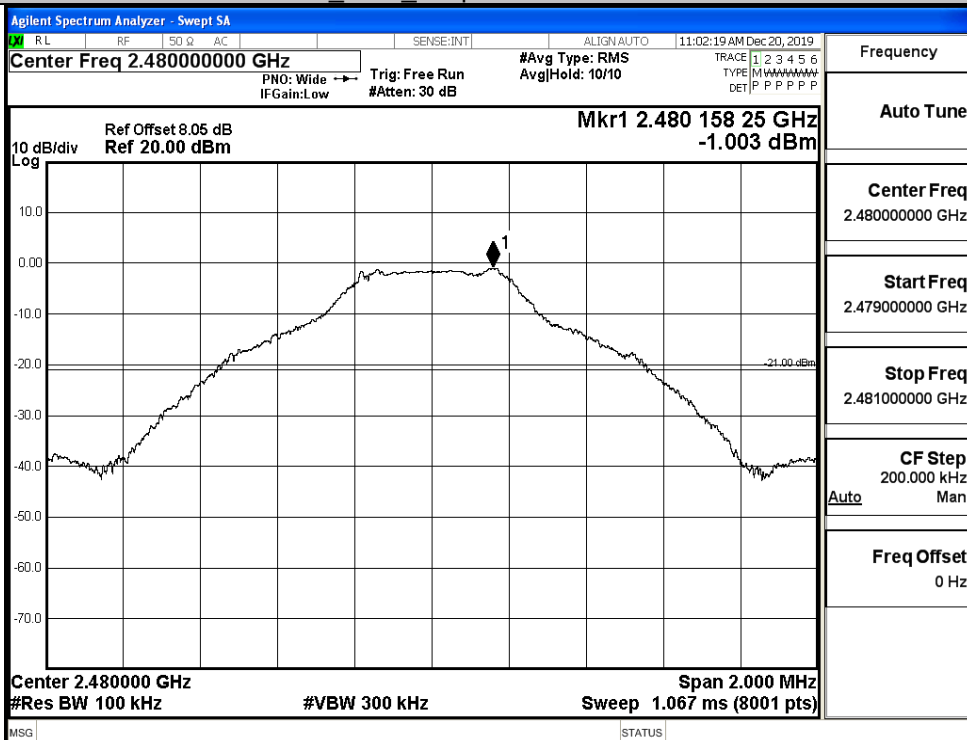


Puw

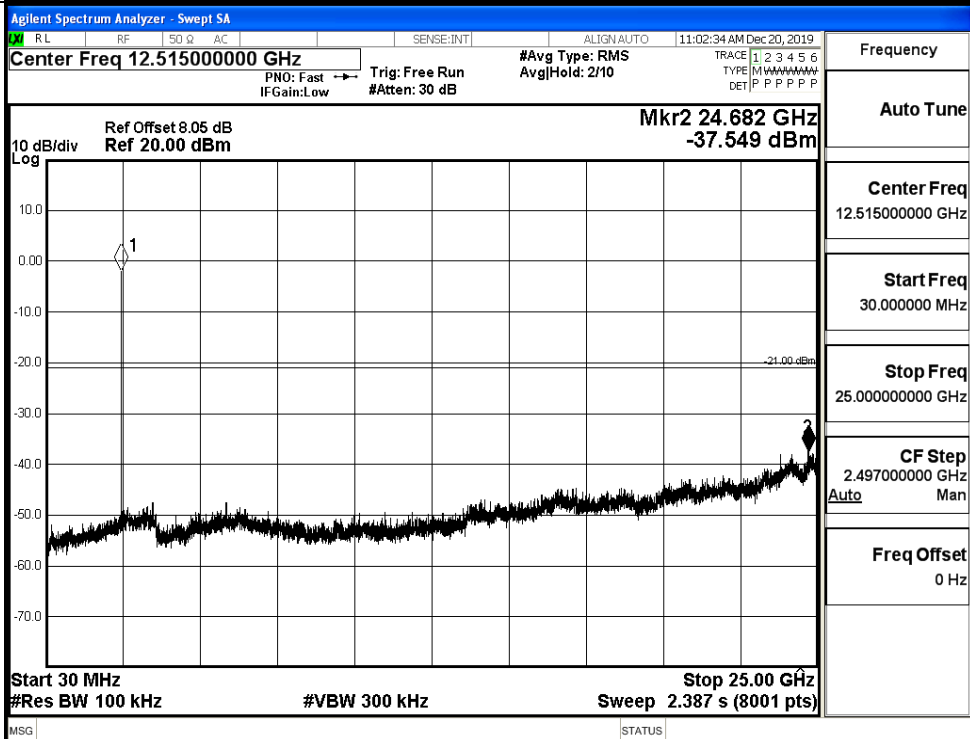


## GFSK HCH Graphs

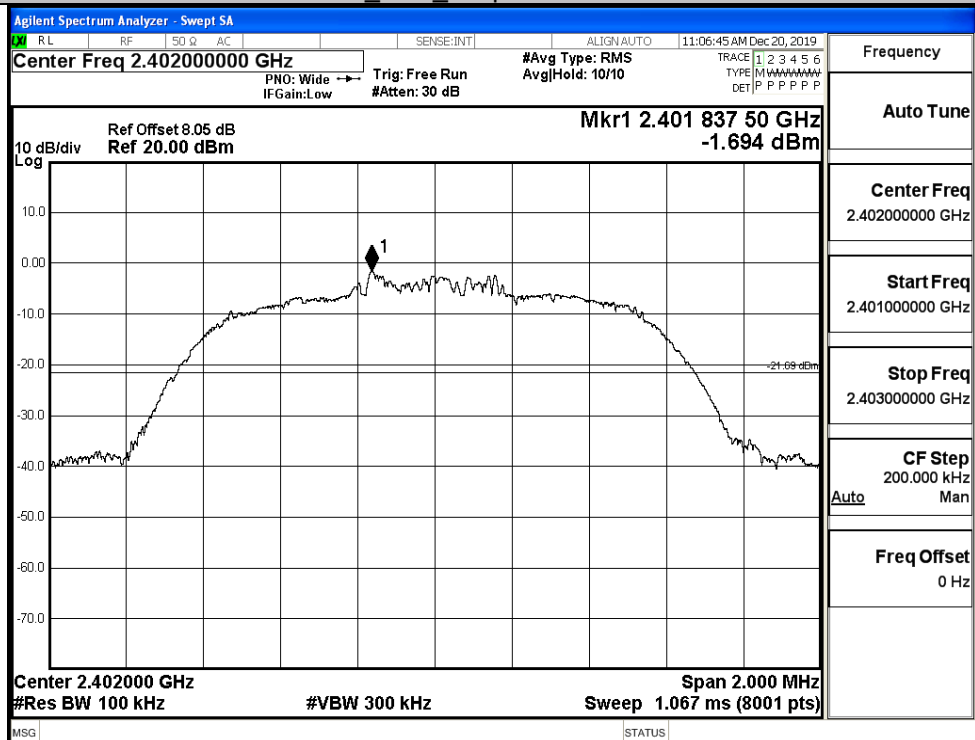
Pref



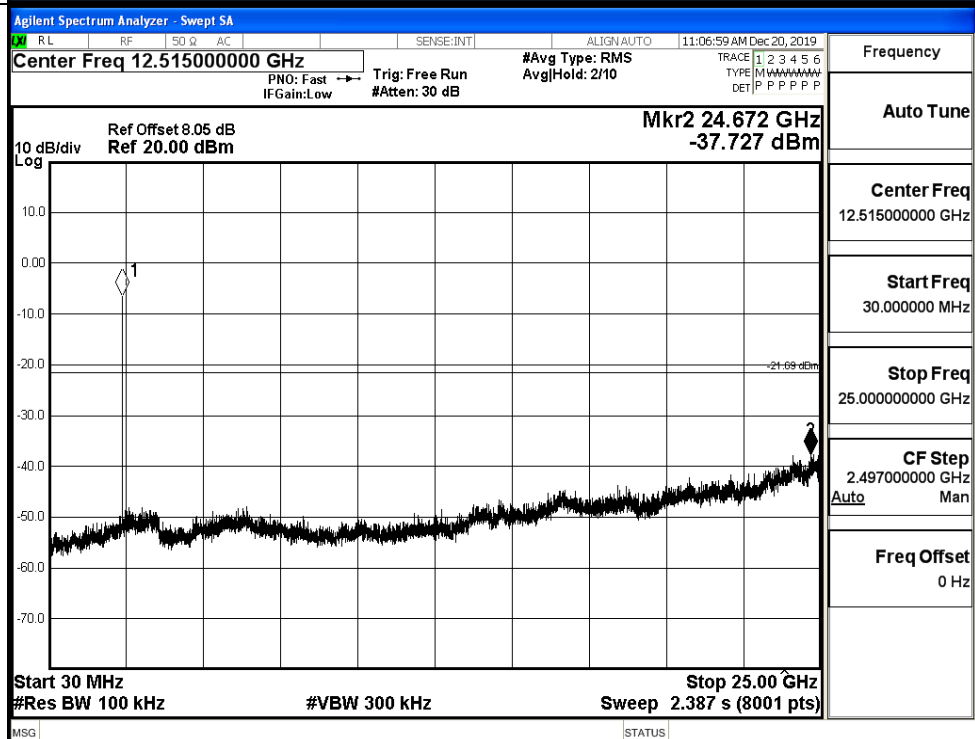
Puw



Pref

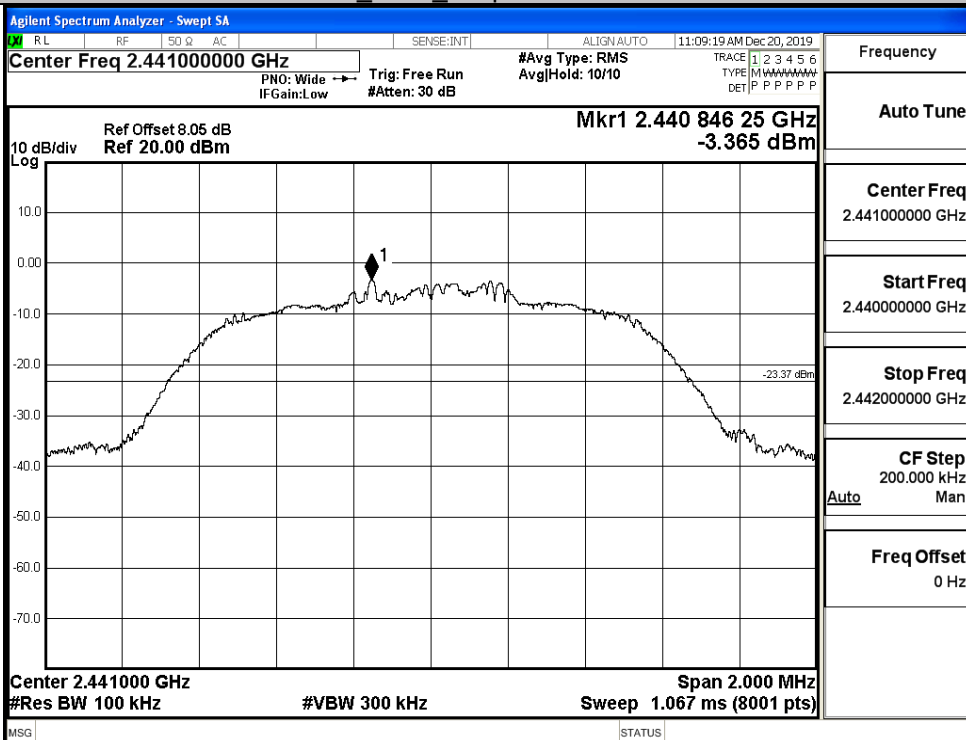


PuW

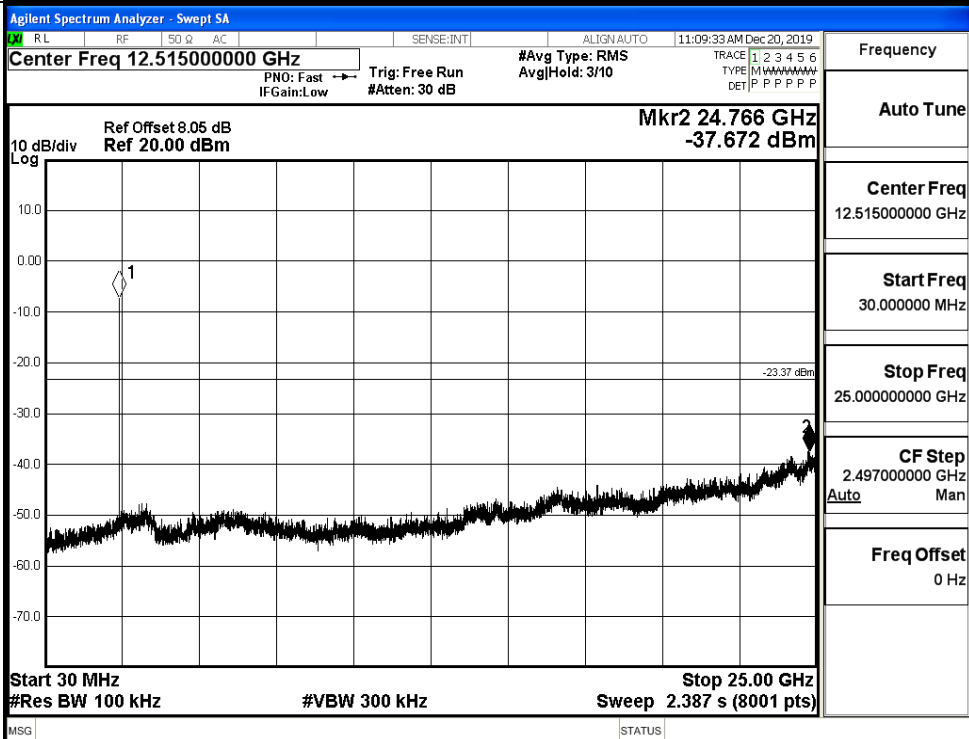


$\pi$ /4DQPSK\_MCH\_Graphs

Pref

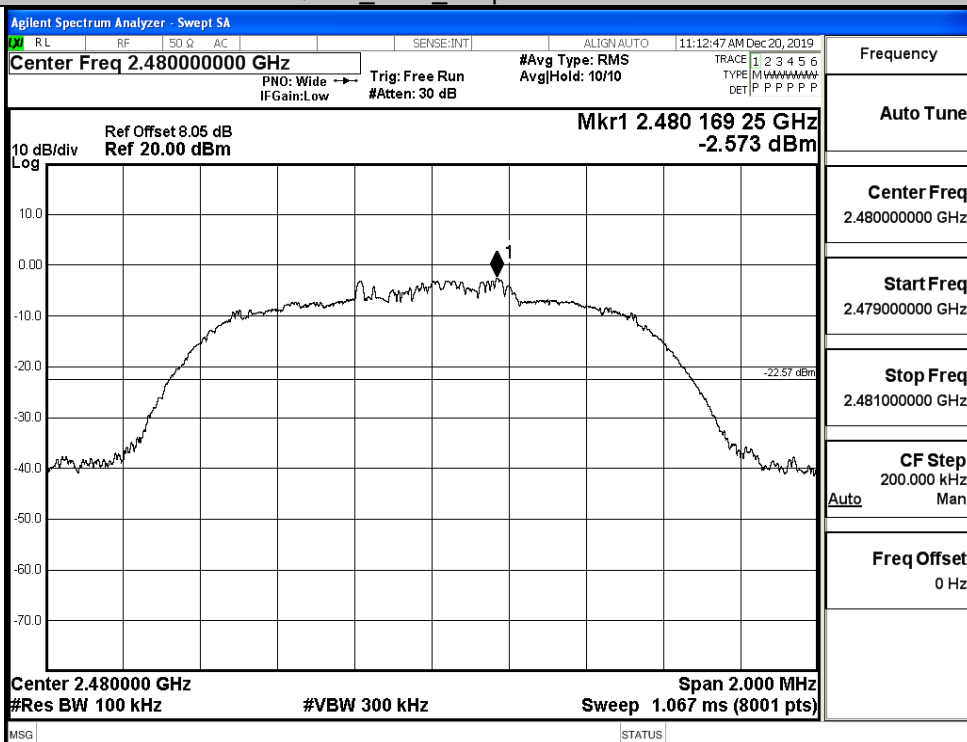


Puw

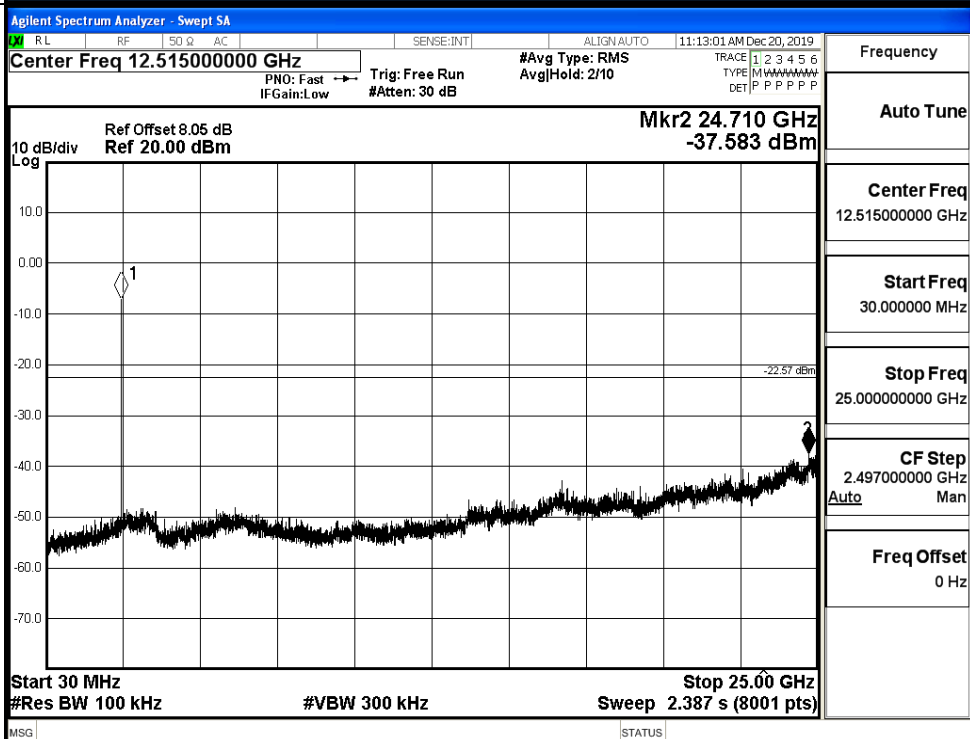


$\pi$ /4DQPSK\_HCH\_Graphs

Pref

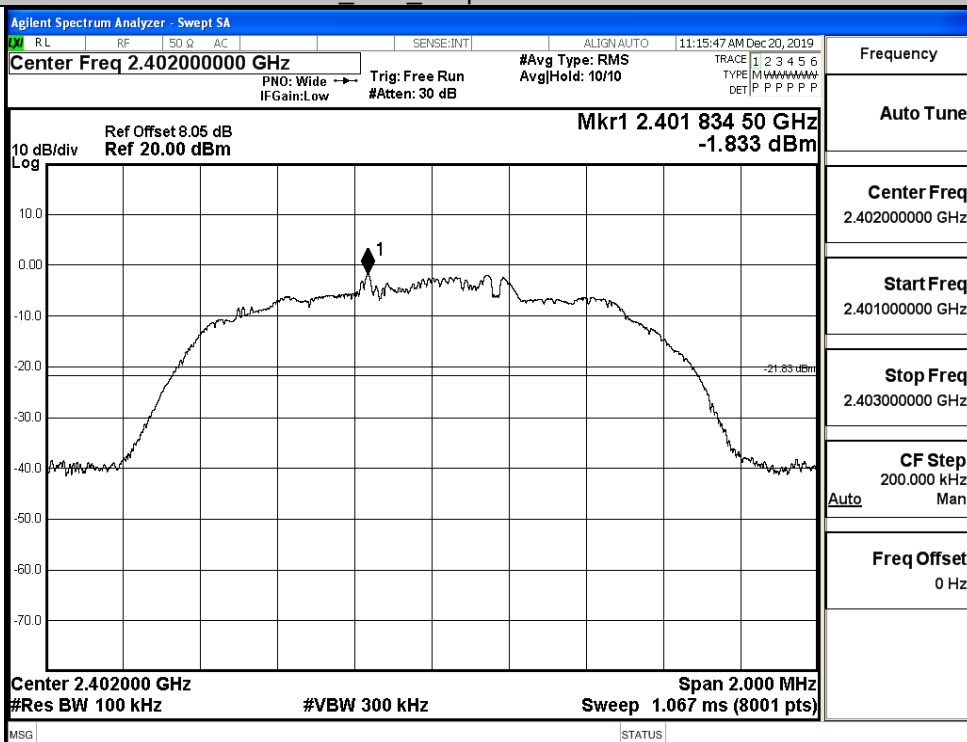


Puw

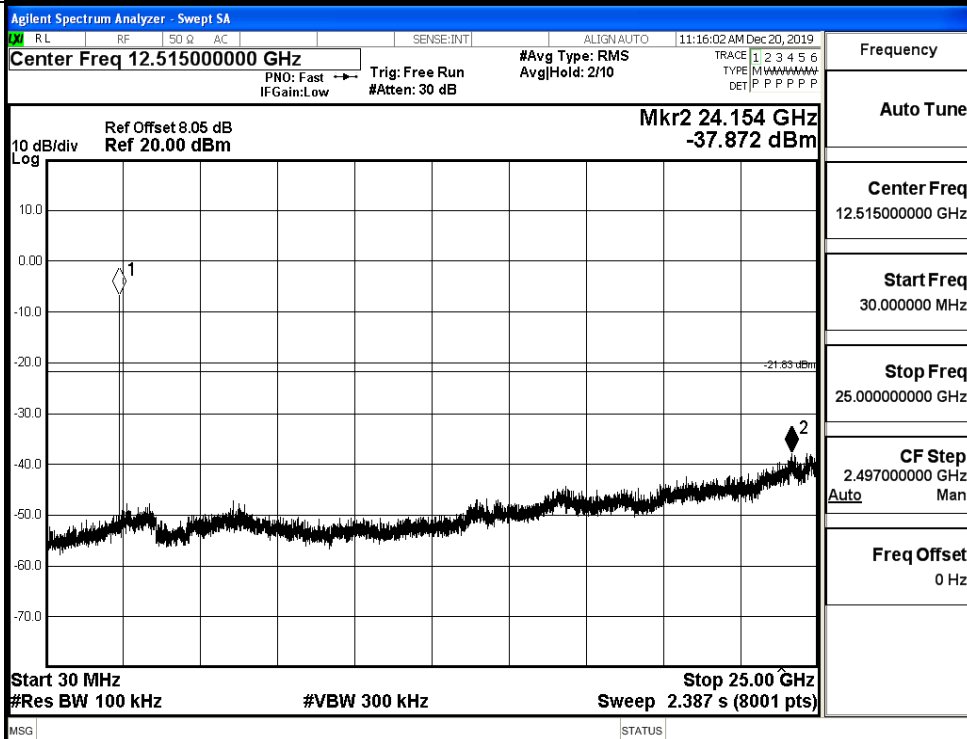


## 8DPSK\_LCH\_Graphs

Pref

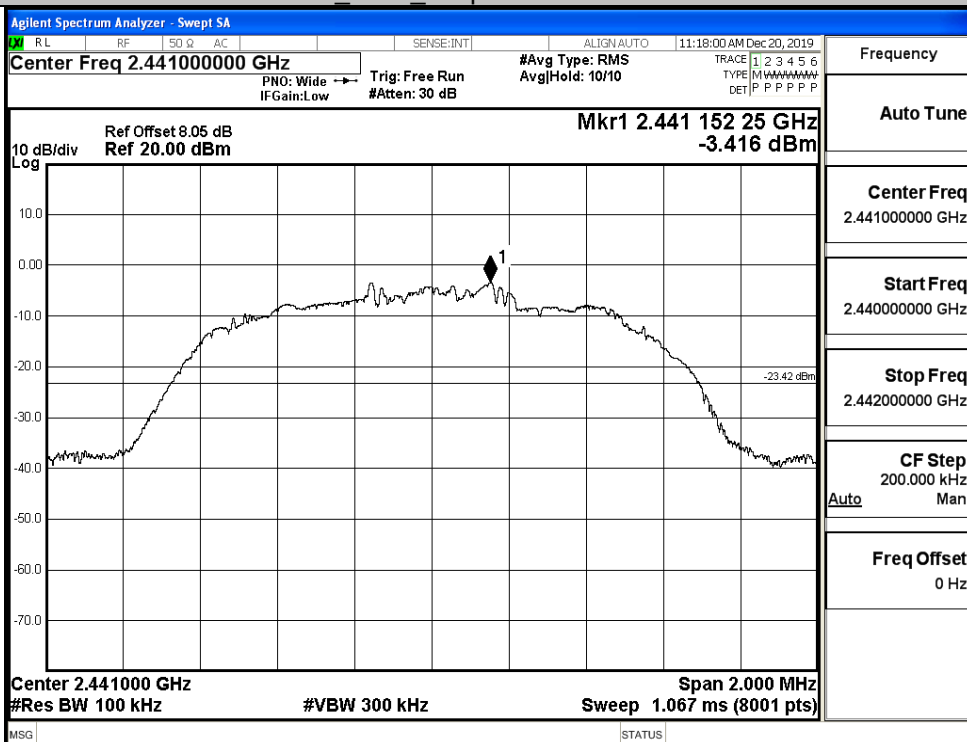


Puw

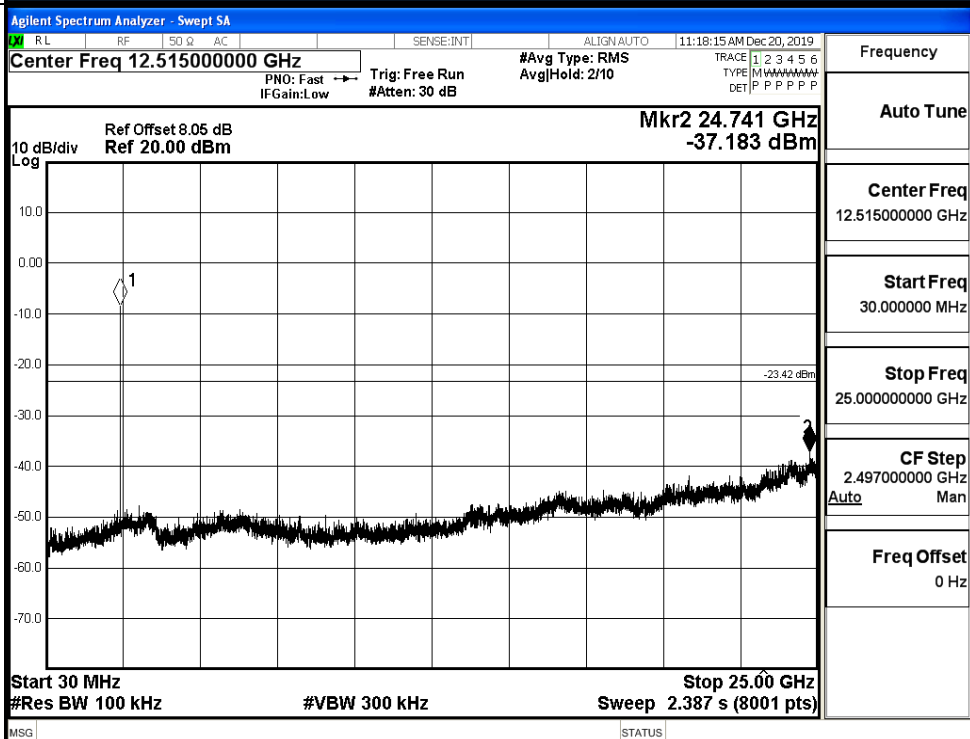


## 8DPSK\_MCH\_Graphs

Pref

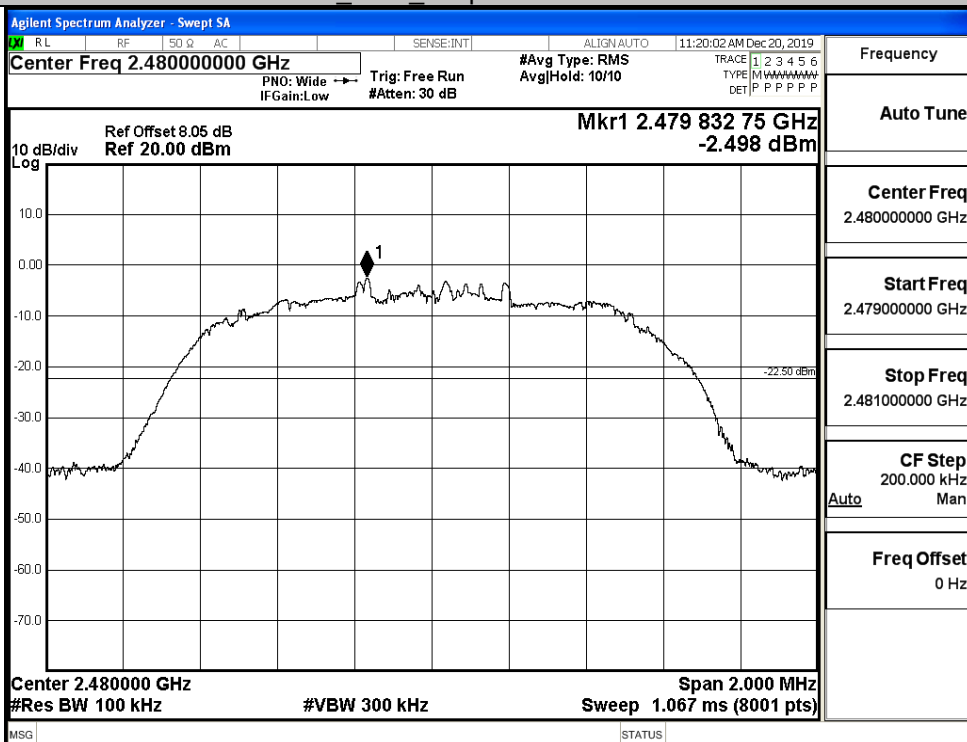


Puw

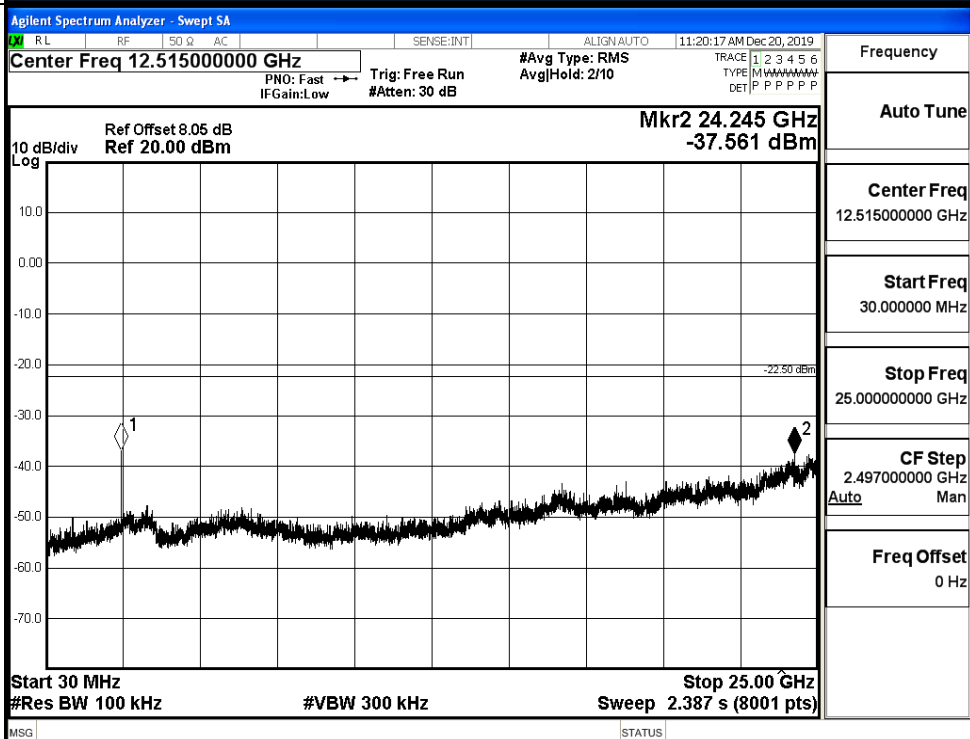


## 8DPSK\_HCH\_Graphs

Pref



Puw

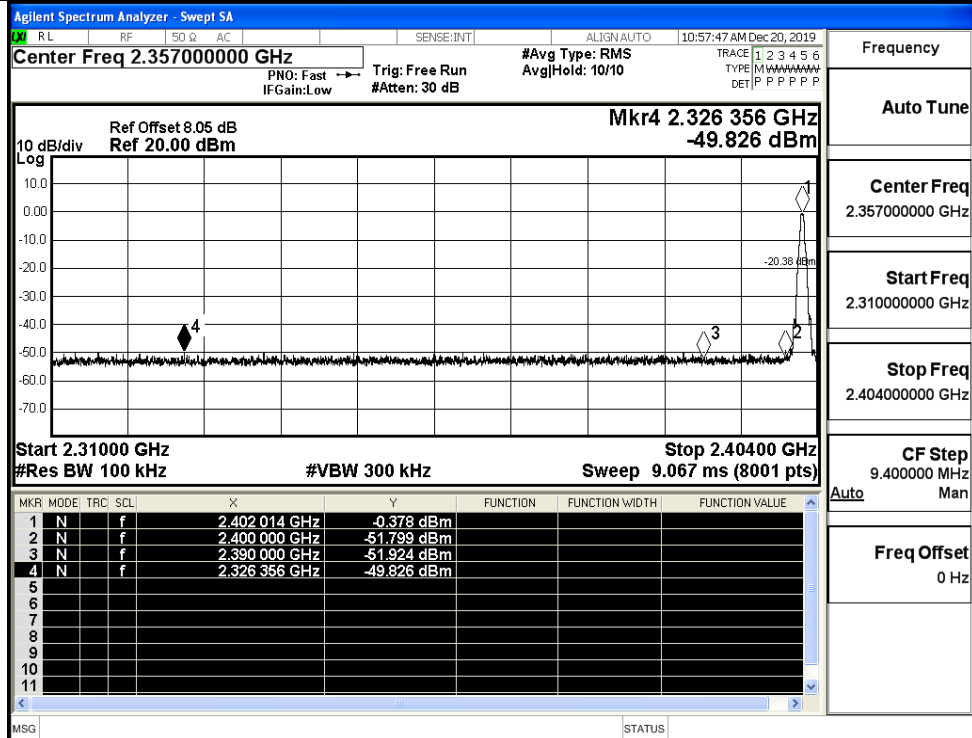


## A.7 Band-edge for RF Conducted Emissions

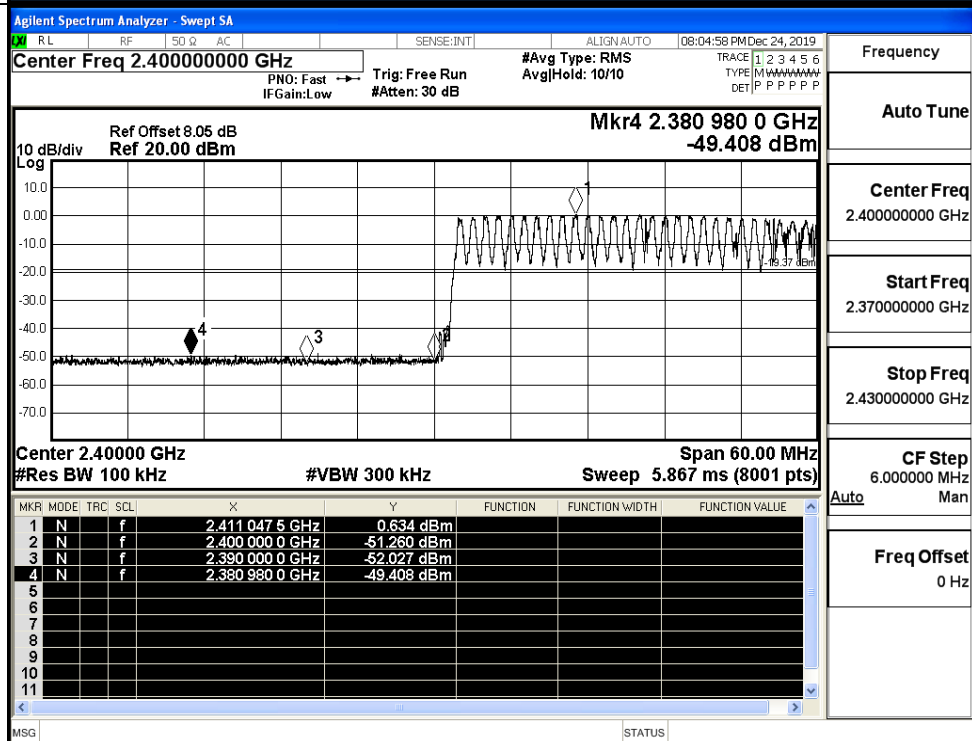
| Mode          | Channel | Carrier Frequency [MHz] | Carrier Power [dBm] | Frequency Hopping | Max Spurious Level [dBm] | Limit [dBm] | Verdict |
|---------------|---------|-------------------------|---------------------|-------------------|--------------------------|-------------|---------|
| GFSK          | LCH     | 2402                    | -0.378              | Off               | -49.826                  | -20.38      | PASS    |
|               |         |                         | 0.634               | On                | -49.408                  | -19.37      | PASS    |
|               | HCH     | 2480                    | -1.039              | Off               | -49.235                  | -21.04      | PASS    |
|               |         |                         | 0.840               | On                | -48.717                  | -19.16      | PASS    |
| $\pi/4$ DQPSK | LCH     | 2402                    | -2.945              | Off               | -49.841                  | -22.95      | PASS    |
|               |         |                         | -0.643              | On                | -47.986                  | -20.64      | PASS    |
|               | HCH     | 2480                    | -2.227              | Off               | -49.318                  | -22.23      | PASS    |
|               |         |                         | 1.929               | On                | -34.863                  | -18.07      | PASS    |
| 8DPSK         | LCH     | 2402                    | -2.046              | Off               | -49.188                  | -22.05      | PASS    |
|               |         |                         | -0.960              | On                | -48.498                  | -20.96      | PASS    |
|               | HCH     | 2480                    | -2.355              | Off               | -48.068                  | -22.36      | PASS    |
|               |         |                         | -1.345              | On                | -48.003                  | -21.35      | PASS    |

## Test Graphs

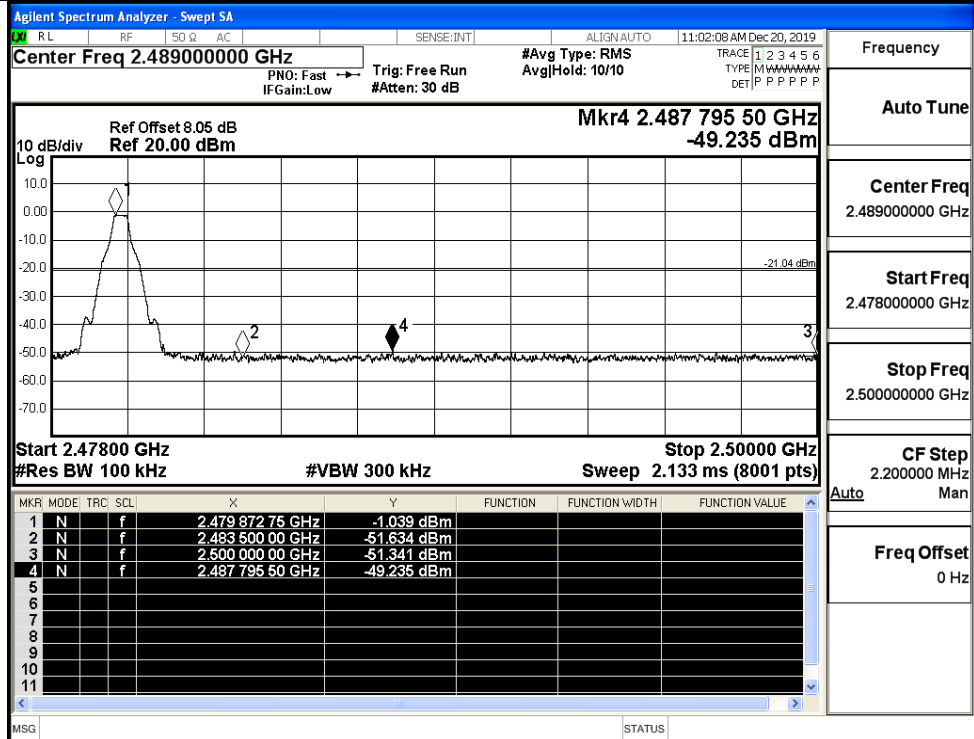
GFSK/LCH/No Hop



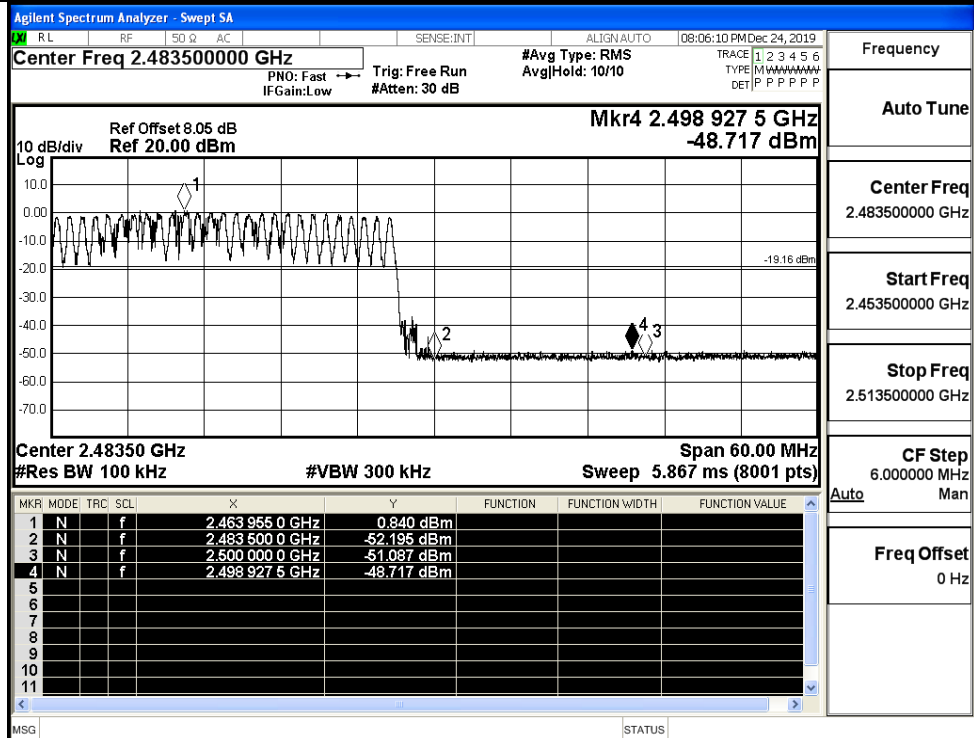
GFSK/LCH/Hop



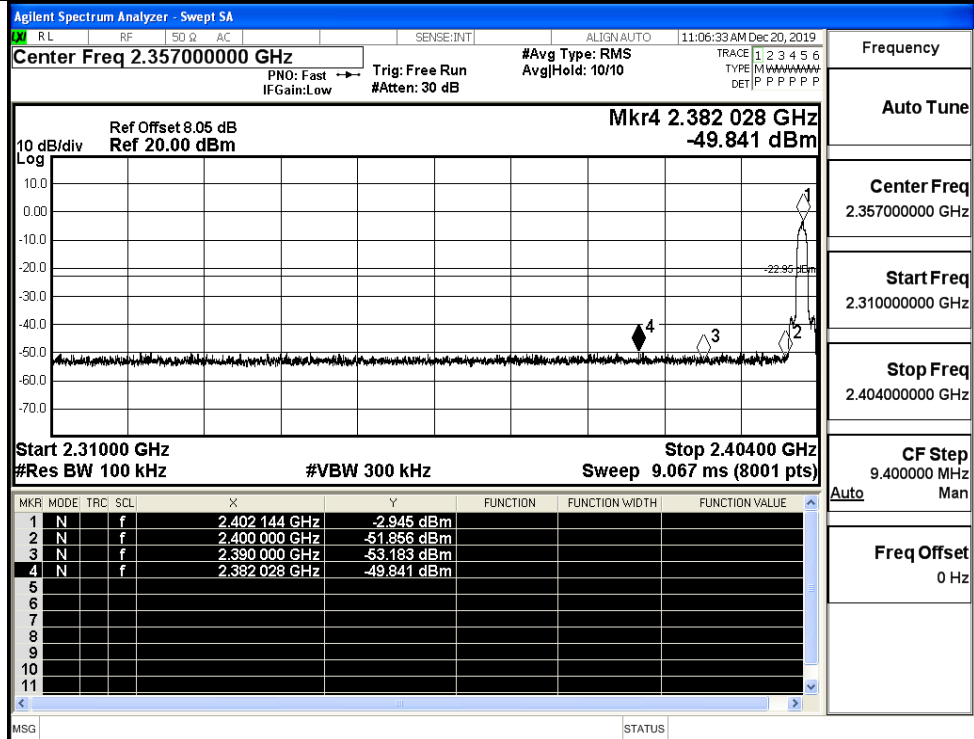
GFSK/HCH/No Hop



GFSK/HCH/Hop



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



Frequency

Auto Tune

Center Freq  
2.357000000 GHz

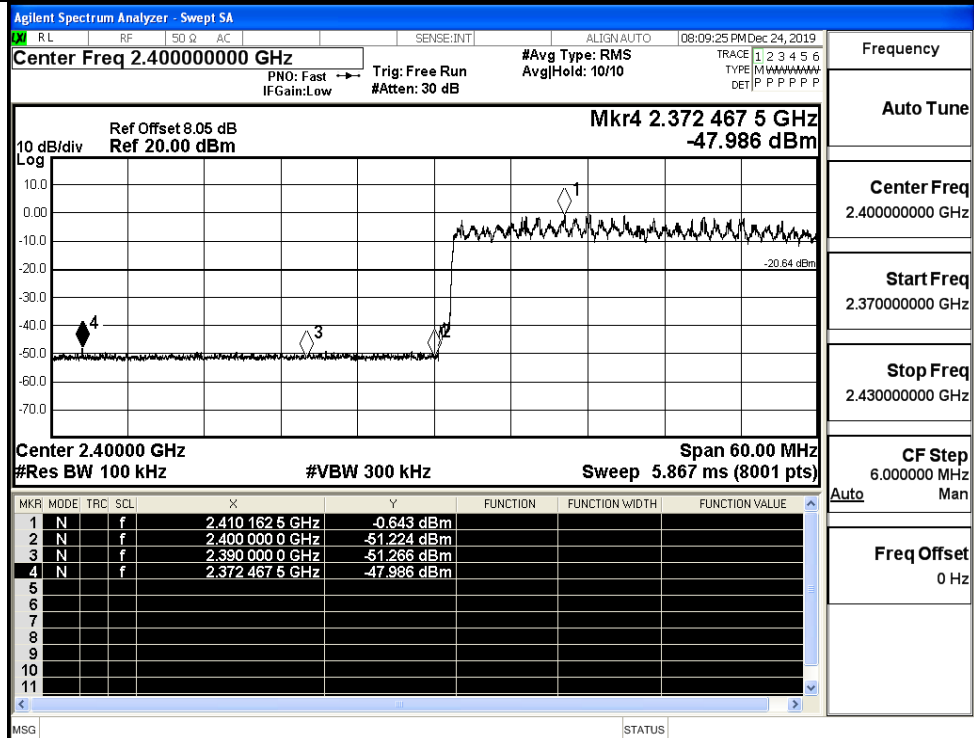
Start Freq  
2.310000000 GHz

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

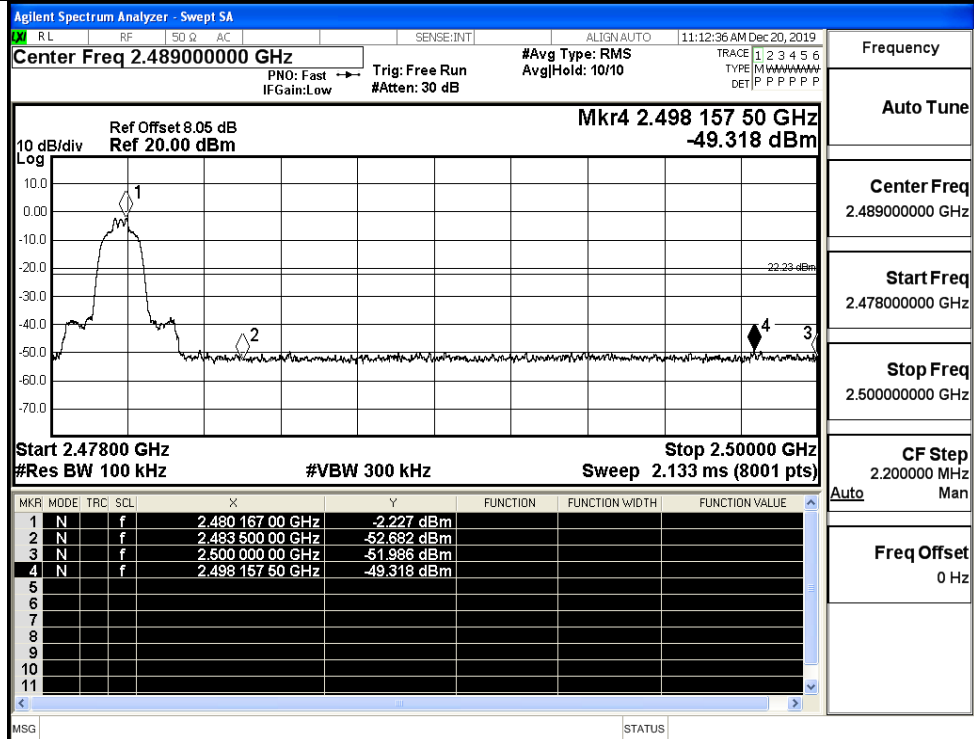
Start Freq  
2.370000000 GHz

Stop Freq  
2.430000000 GHz

CF Step  
6.000000 MHz  
Auto Man

Freq Offset  
0 Hz

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

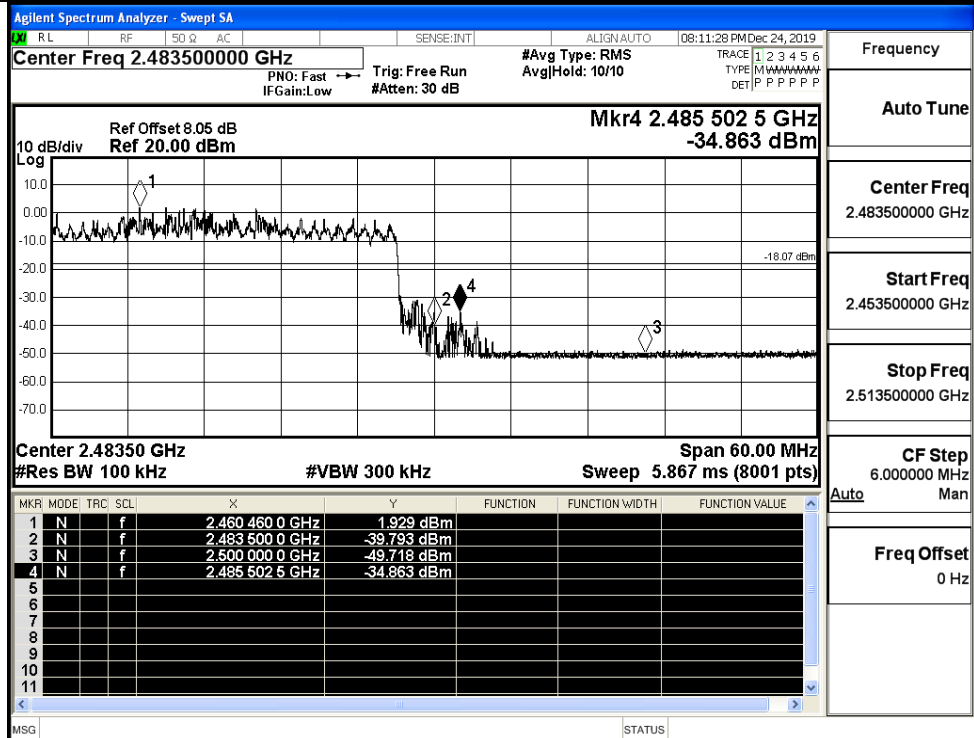


Frequency

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

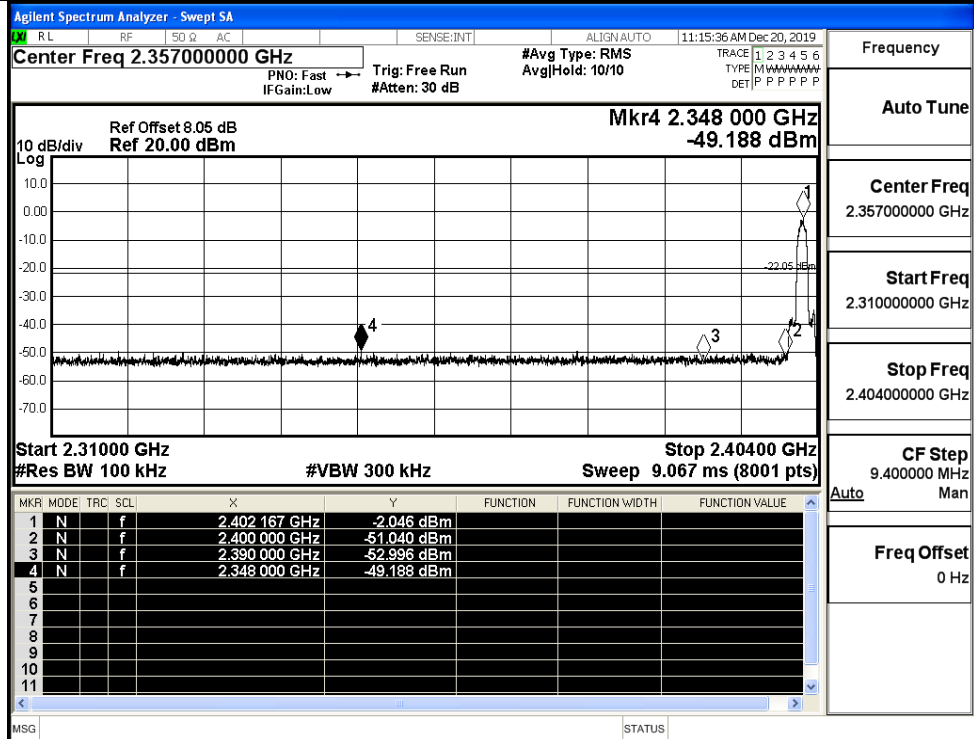


Frequency

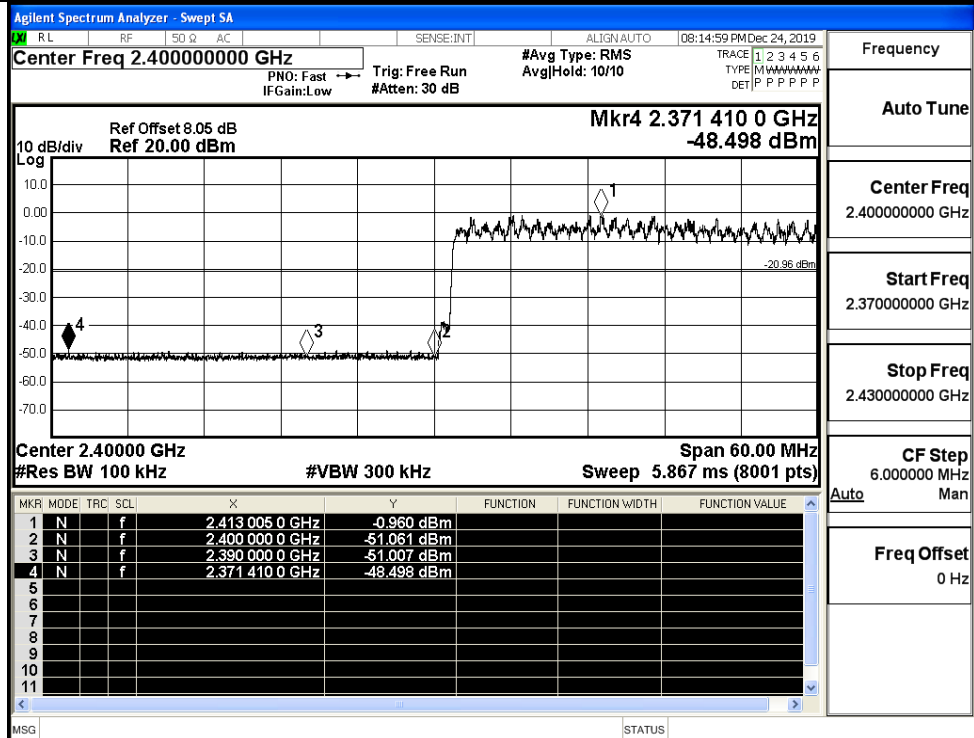
Auto Tune

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

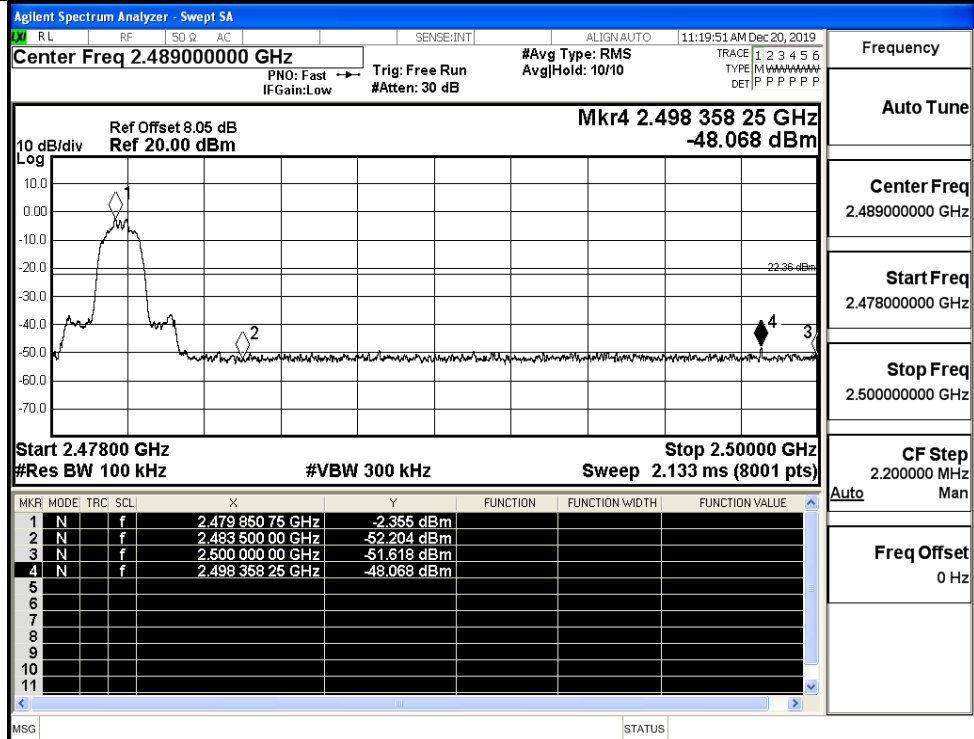
8DPSK/LCH/No Hop



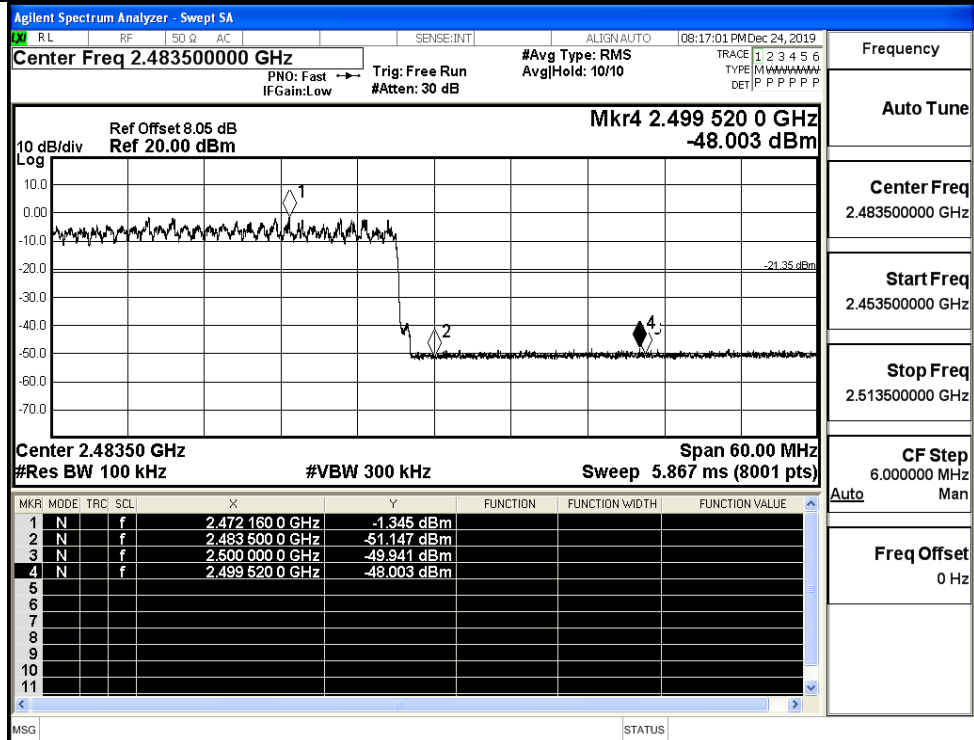
8DPSK/LCH/Hop



8DPSK/HCH/No Hop



8DPSK/HCH/Hop



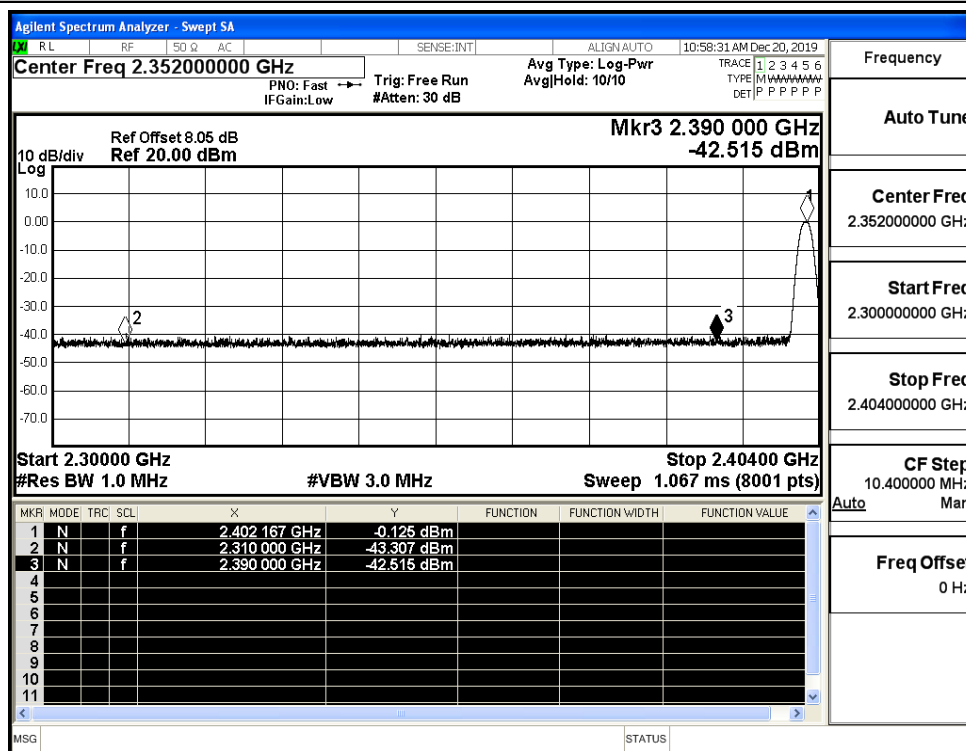
## A.8 Restrict-band band-edge measurements

| Test Mode     | Hopping | Freq.  | Power [dBm] | Gain | Ground Factor | E [dBuV/m] | Detector | Limit [dBuV/m] | Verdict |
|---------------|---------|--------|-------------|------|---------------|------------|----------|----------------|---------|
| GFSK          | Off     | 2310.0 | -43.31      | -3.7 | 0             | 53.95      | PEAK     | 74             | PASS    |
|               | Off     | 2310.0 | -53.39      | -3.7 | 0             | 43.87      | AV       | 54             | PASS    |
|               | Off     | 2390.0 | -42.52      | -3.7 | 0             | 54.74      | PEAK     | 74             | PASS    |
|               | Off     | 2390.0 | -52.97      | -3.7 | 0             | 44.29      | AV       | 54             | PASS    |
|               | Off     | 2483.5 | -42.60      | -3.7 | 0             | 54.66      | PEAK     | 74             | PASS    |
|               | Off     | 2483.5 | -52.60      | -3.7 | 0             | 44.66      | AV       | 54             | PASS    |
|               | Off     | 2500.0 | -42.57      | -3.7 | 0             | 54.69      | PEAK     | 74             | PASS    |
|               | Off     | 2500.0 | -52.35      | -3.7 | 0             | 44.91      | AV       | 54             | PASS    |
| $\pi/4$ DQPSK | Off     | 2310.0 | -43.45      | -3.7 | 0             | 53.81      | PEAK     | 74             | PASS    |
|               | Off     | 2310.0 | -53.42      | -3.7 | 0             | 43.84      | AV       | 54             | PASS    |
|               | Off     | 2390.0 | -43.51      | -3.7 | 0             | 53.75      | PEAK     | 74             | PASS    |
|               | Off     | 2390.0 | -53.11      | -3.7 | 0             | 44.15      | AV       | 54             | PASS    |
|               | Off     | 2483.5 | -42.77      | -3.7 | 0             | 54.49      | PEAK     | 74             | PASS    |
|               | Off     | 2483.5 | -52.60      | -3.7 | 0             | 44.66      | AV       | 54             | PASS    |
|               | Off     | 2500.0 | -42.80      | -3.7 | 0             | 54.46      | PEAK     | 74             | PASS    |
|               | Off     | 2500.0 | -52.42      | -3.7 | 0             | 44.84      | AV       | 54             | PASS    |
| 8DPSK         | Off     | 2310.0 | -43.19      | -3.7 | 0             | 54.07      | PEAK     | 74             | PASS    |
|               | Off     | 2310.0 | -53.45      | -3.7 | 0             | 43.81      | AV       | 54             | PASS    |
|               | Off     | 2390.0 | -43.47      | -3.7 | 0             | 53.79      | PEAK     | 74             | PASS    |
|               | Off     | 2390.0 | -53.06      | -3.7 | 0             | 44.20      | AV       | 54             | PASS    |
|               | Off     | 2483.5 | -41.56      | -3.7 | 0             | 55.70      | PEAK     | 74             | PASS    |
|               | Off     | 2483.5 | -52.54      | -3.7 | 0             | 44.72      | AV       | 54             | PASS    |
|               | Off     | 2500.0 | -42.31      | -3.7 | 0             | 54.95      | PEAK     | 74             | PASS    |
|               | Off     | 2500.0 | -52.43      | -3.7 | 0             | 44.83      | AV       | 54             | PASS    |

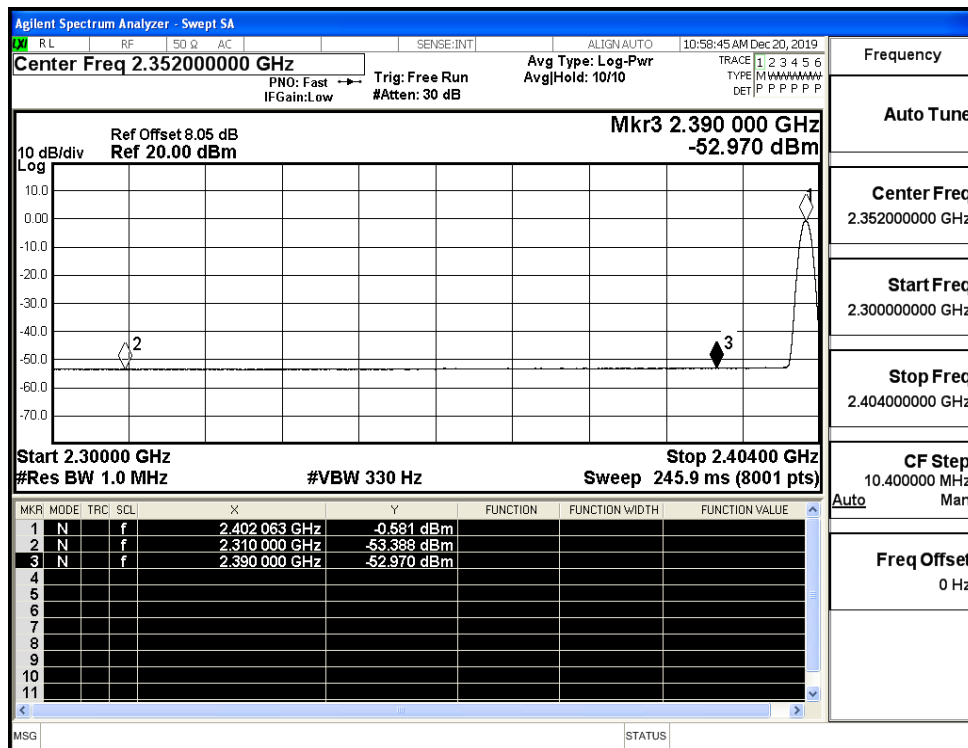
$E$  [dBuV/m] = Power [dBm] + Gain + Ground Factor + 95.26

The upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands or 2 dBi, whichever is greater

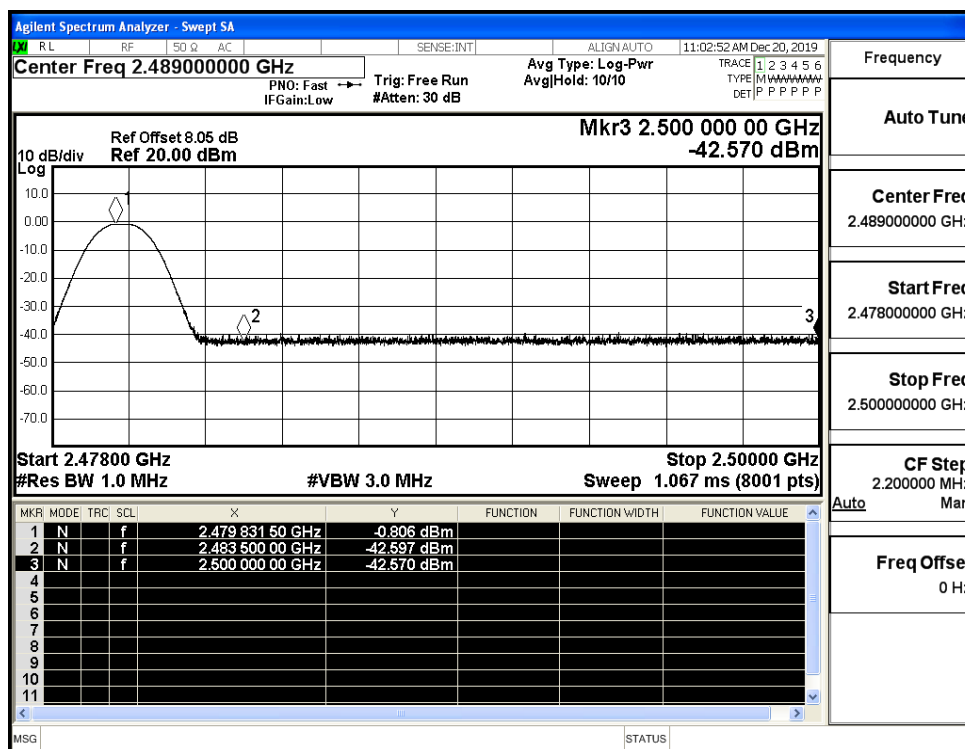
## Restrict-band band-edge measurements\_Hopping Off\_GFSK\_PEAK (Low Channel)



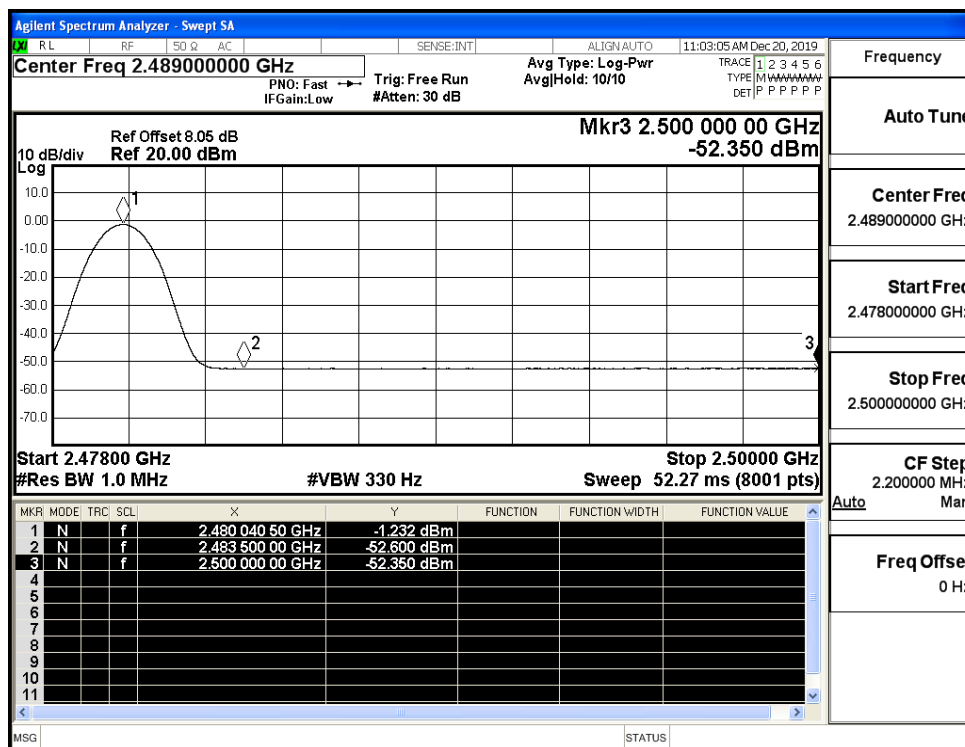
## Restrict-band band-edge measurements\_Hopping Off\_GFSK\_Average (Low Channel)

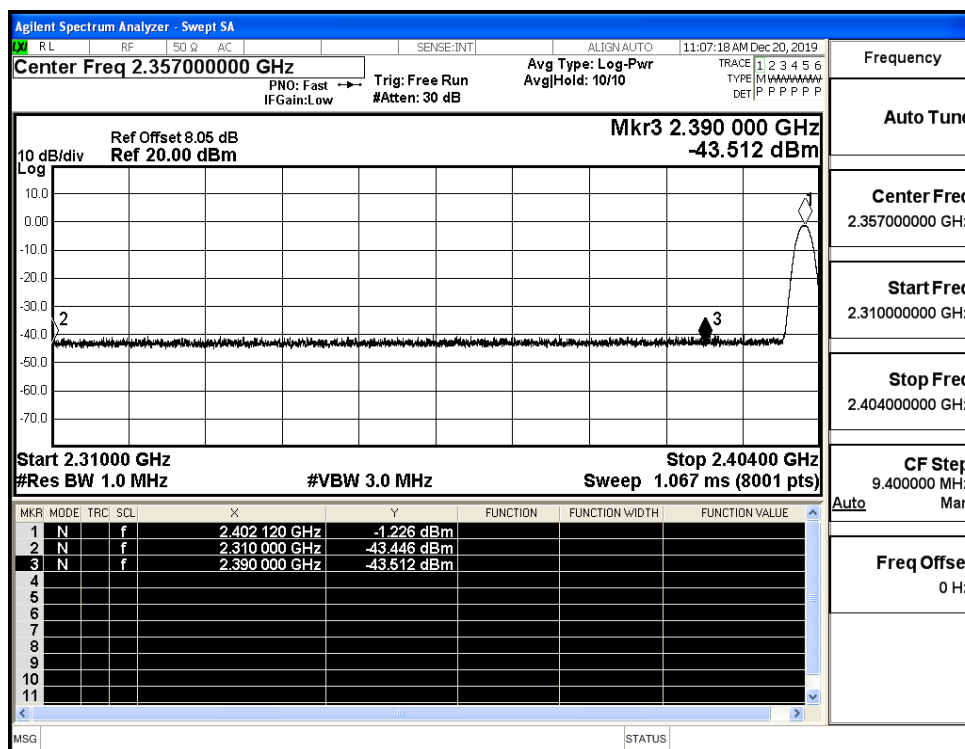
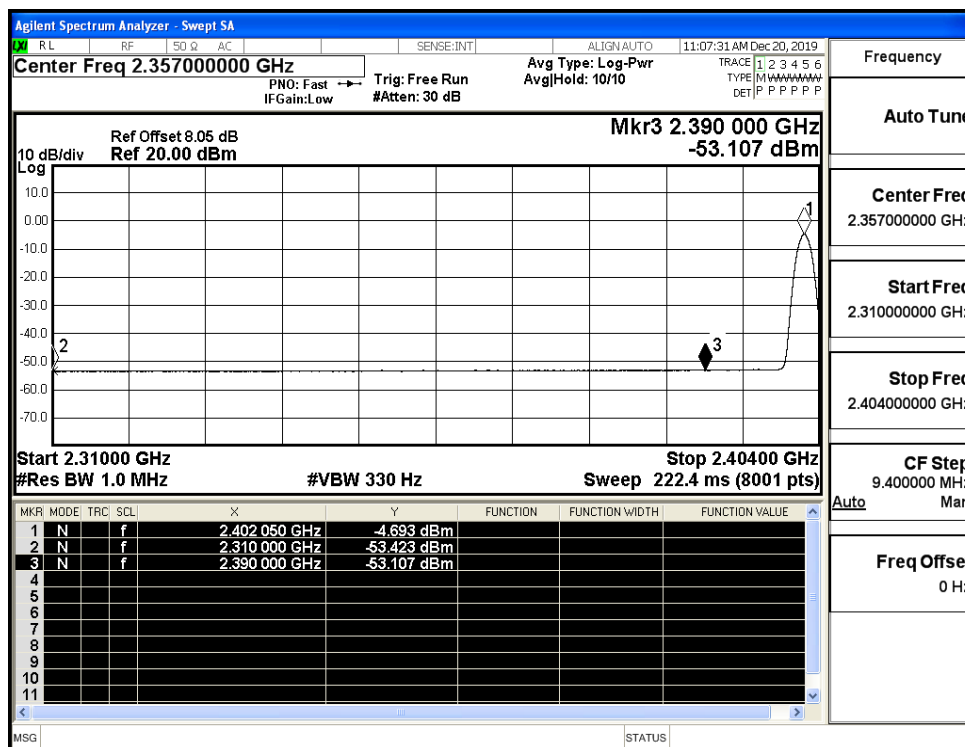


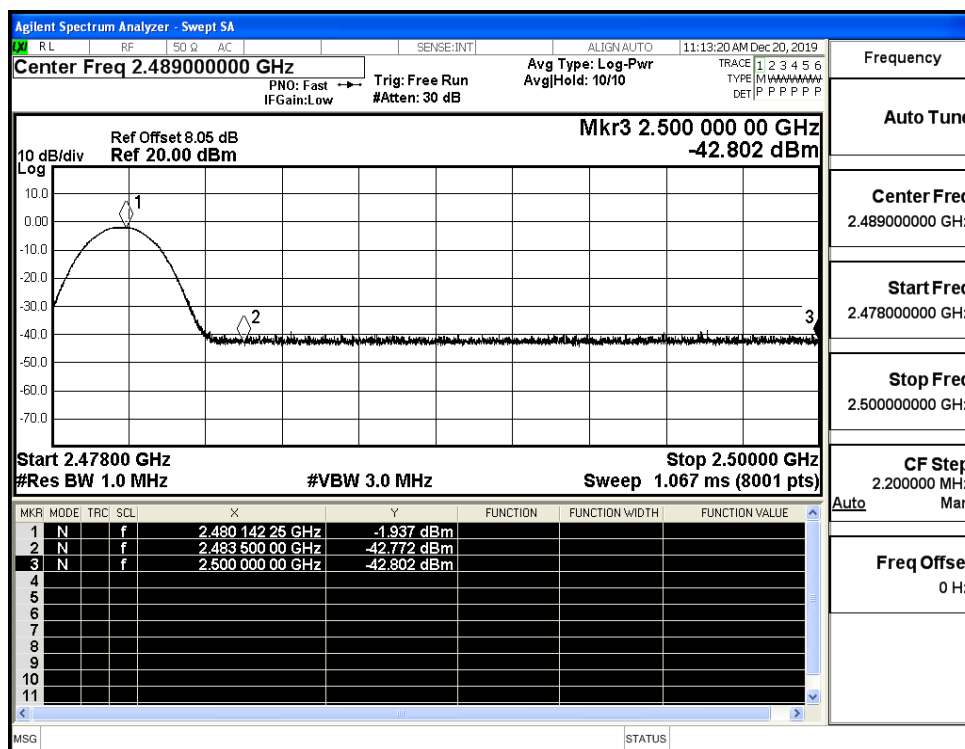
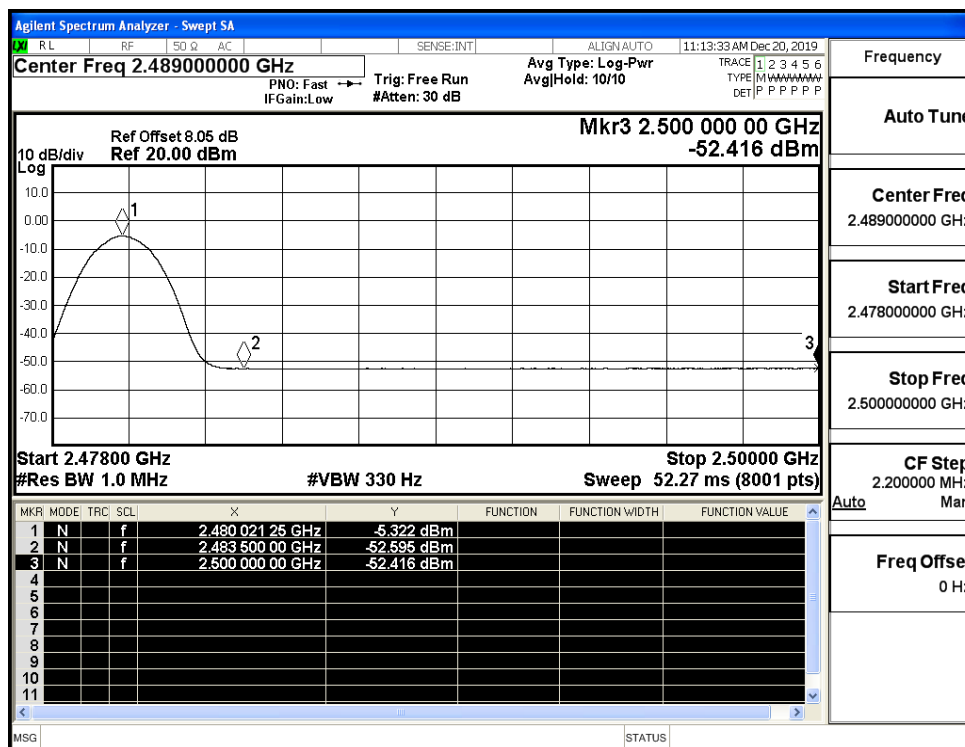
## Restrict-band band-edge measurements\_Hopping Off\_GFSK\_PEAK (High Channel)



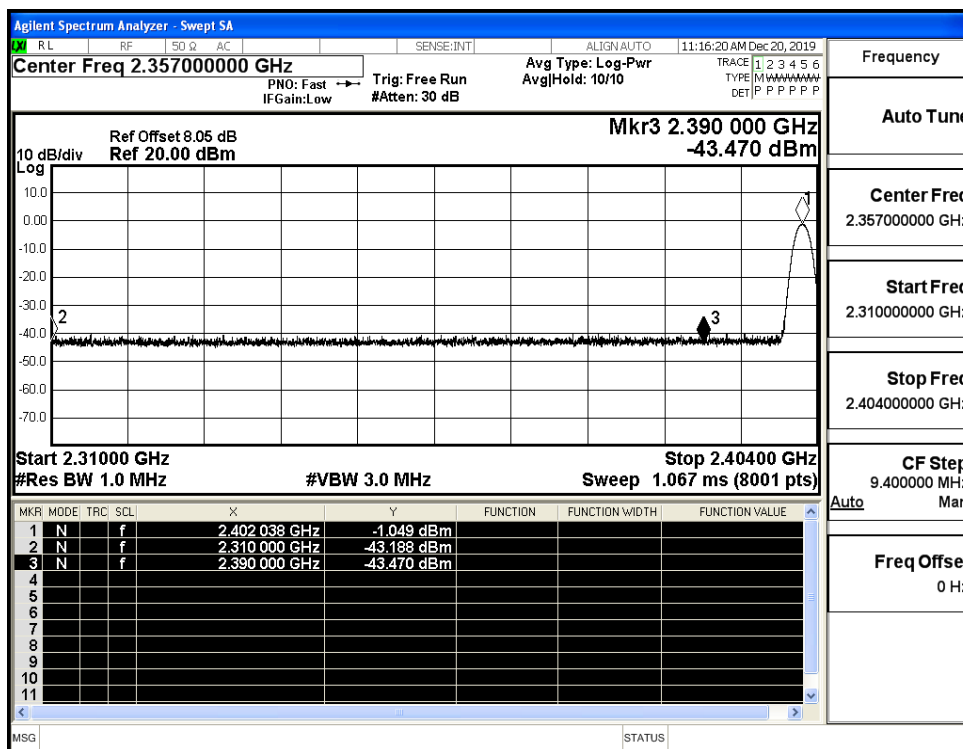
## Restrict-band band-edge measurements\_Hopping Off\_GFSK\_Average (High Channel)



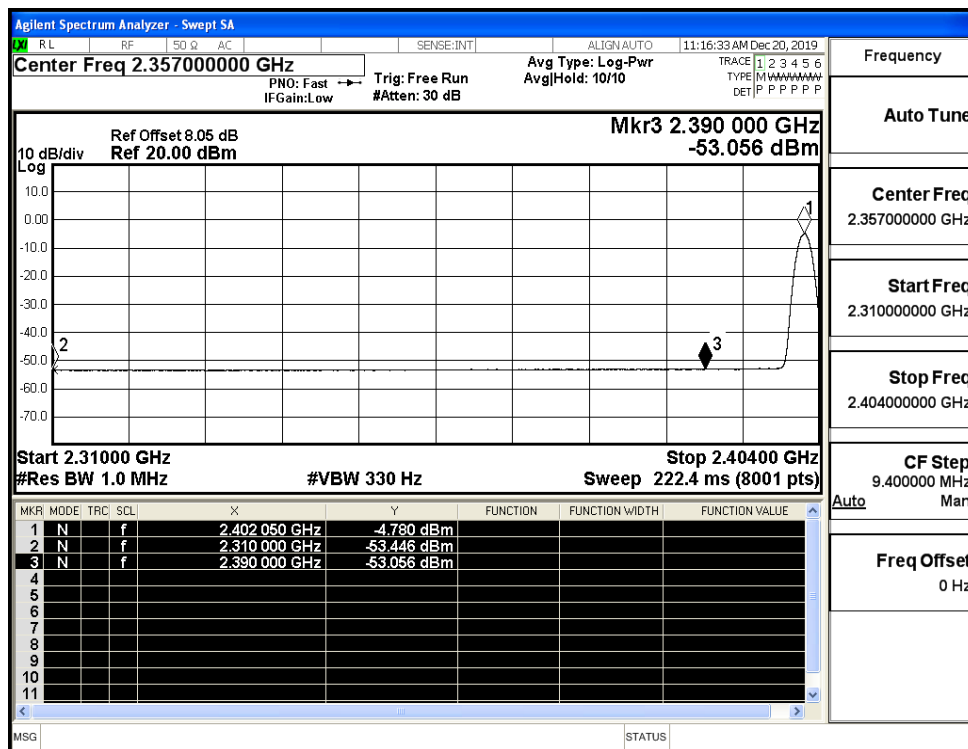
Restrict-band band-edge measurements\_Hopping Off  $\pi/4$ -DQPSK\_PEAK (Low Channel)Restrict-band band-edge measurements\_Hopping Off  $\pi/4$ -DQPSK\_Average (Low Channel)

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

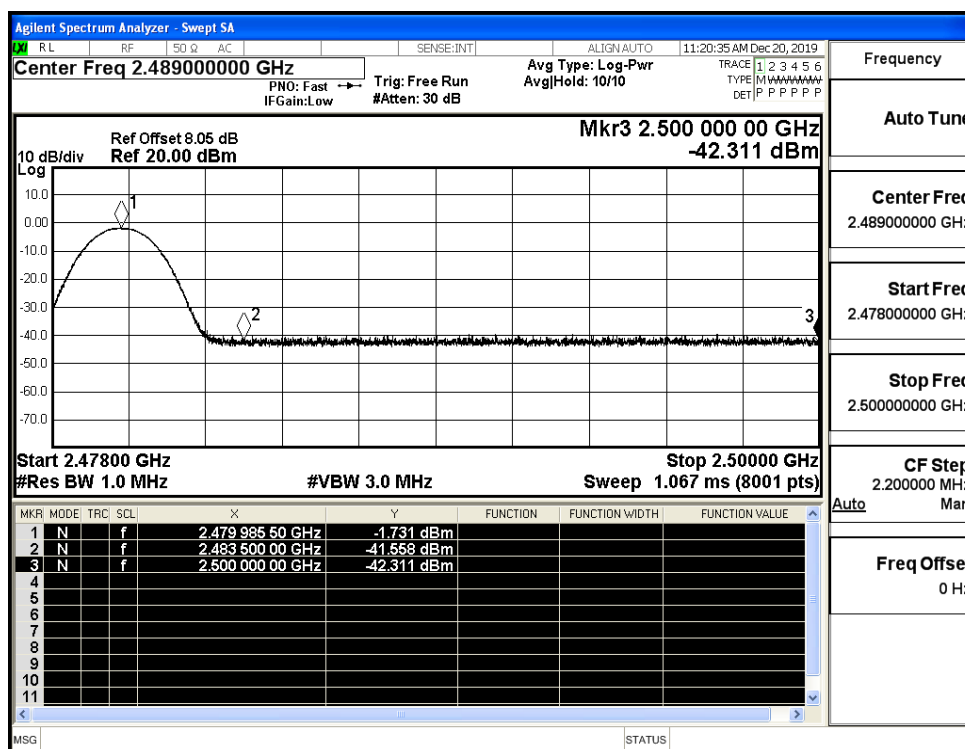
## Restrict-band band-edge measurements\_Hopping Off\_8DPSK\_PEAK (Low Channel)



## 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)

