

Bluetooth Conducted Measurements Test **Report**

FCC ID: 2AA9WV360

IC: 11665A-V360

FCC Rule Part: FCC Part 15 Subpart C

Manufacturer: VSN Technologies Inc.

Model: V360

**Test Facility: 12 Ang Mo Kio St 64 #03-01
UE BizHub Central (Blk A), 569088 Singapore.**

Test Begin Date: Oct 1, 2014

Test End Date: Nov 12, 2014

Report Issue Date: Nov 12, 2014

Test By:

Name: Christy Lim

Signature: *Christy*

Reviewed By:

Name: Yu Xue Dong

Signature: *Xue Dong*

1 List of Test Equipment

| Manufacturer | Model | Equipment Type | Serial No. | Last Calibration Date | Calibration Due Date |
|--------------|--------|-------------------|------------|-----------------------|----------------------|
| Agilent | E4404B | Spectrum Analyzer | MY44220422 | 06 Jan 14 | 06 Jan 16 |
| Advantest | R3273 | Spectrum Analyzer | 95090358 | 06 Oct 14 | 06 Oct 15 |
| Agilent | N1911A | Power Meter | MY50150005 | 24 Apr 13 | 24 Apr 15 |
| Agilent | N1921A | Power Sensor | MY50150006 | 16 Jun 13 | 16 Jun 15 |

2 Applicable Standard References

The following standards were used:

| FCC Rules | Description of Test | Result |
|--------------|--|--------|
| § 15.247 (a) | Frequency Separation & 20dB Bandwidth | Pass |
| § 15.247 (b) | Peak Output Power | Pass |
| § 15.247 (c) | Band-Edge Compliance of RF Conducted Emissions | Pass |
| § 15.247 (a) | Number of Hopping Frequencies | Pass |
| § 15.247 (a) | Time of Occupancy (Dwell Time) | Pass |
| § 15.209 | Spurious Emission | Pass |

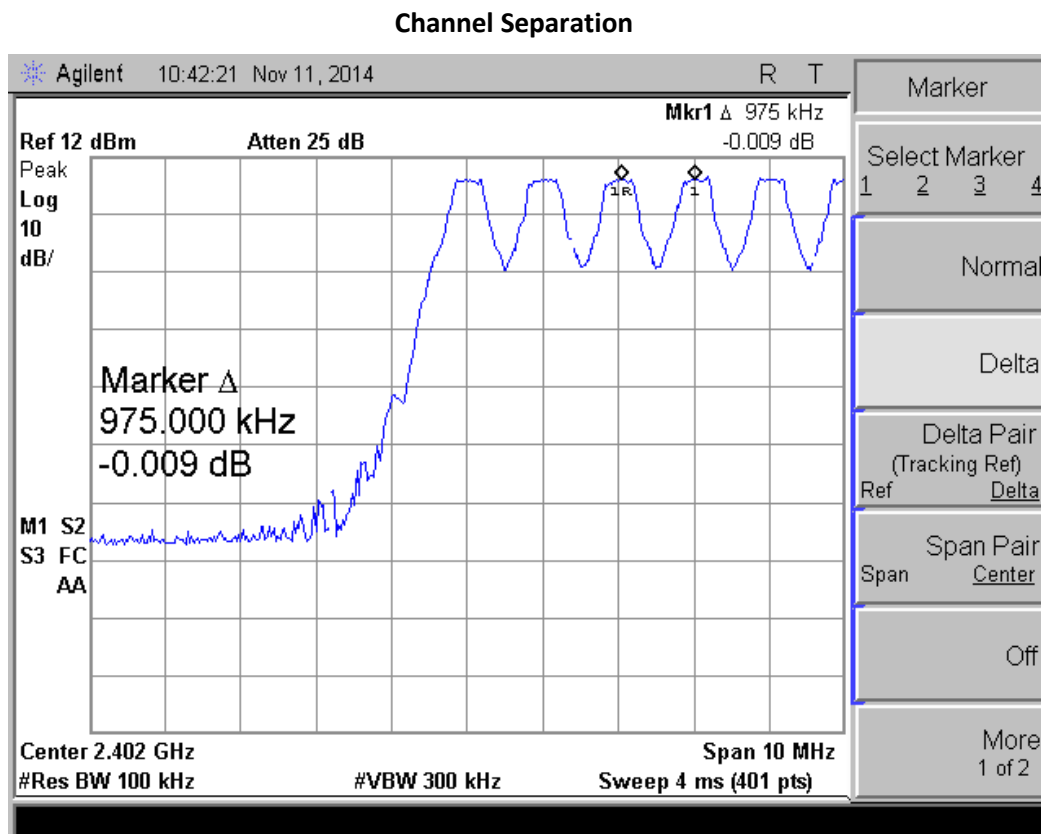
3 Summary of Tests

3.1 Frequency Separation & 20 dB Bandwidth – FCC Section 15.247 (a)(1)

3.1.1 Measurement Procedure

According to § 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The 20dB bandwidth was measured in accordance with the DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems: Carrier Frequency Separation & 20dB Bandwidth. The span was set to wide enough to capture the peaks of two adjacent channels. The RBW of the spectrum analyzer was set to greater than or equal to the 1% of the span. The VBW was set to a value greater than the RBW. The 20dB bandwidth is defined as the frequency range where the power is higher than the peak power minus 20dB.

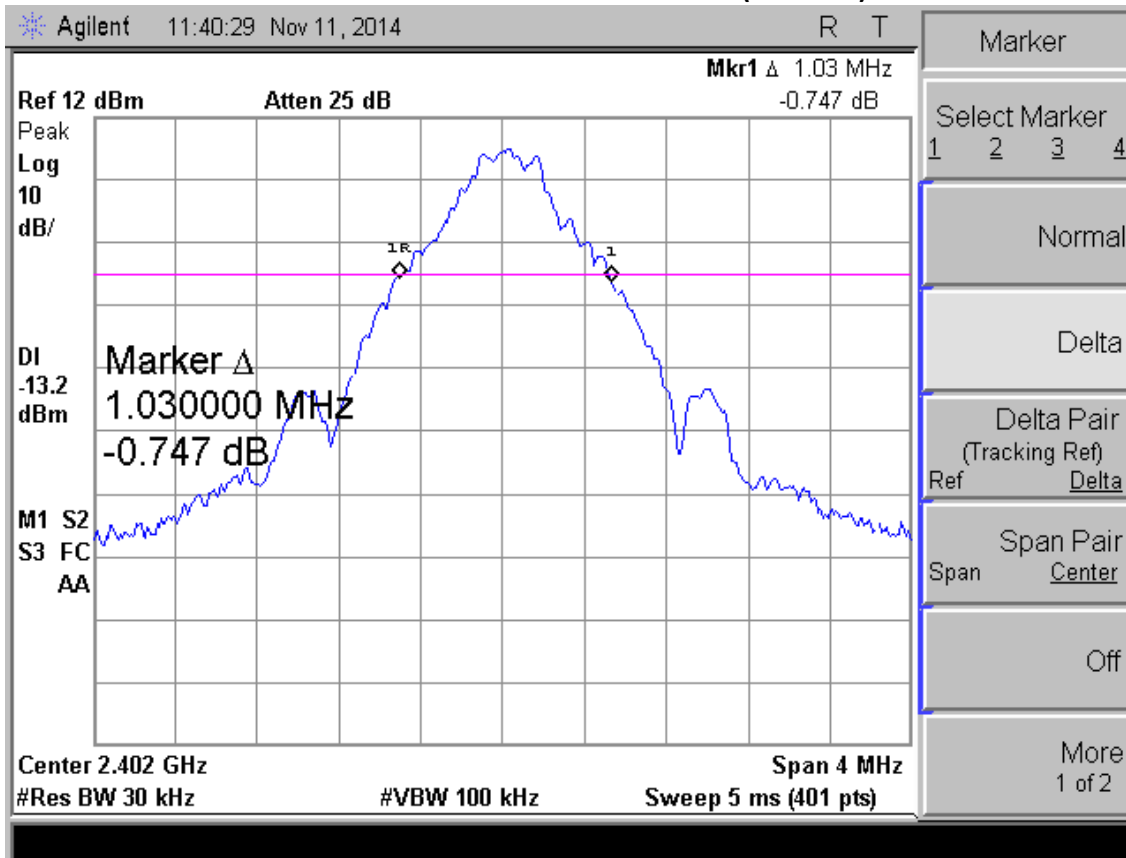
3.1.2 Measurement Result



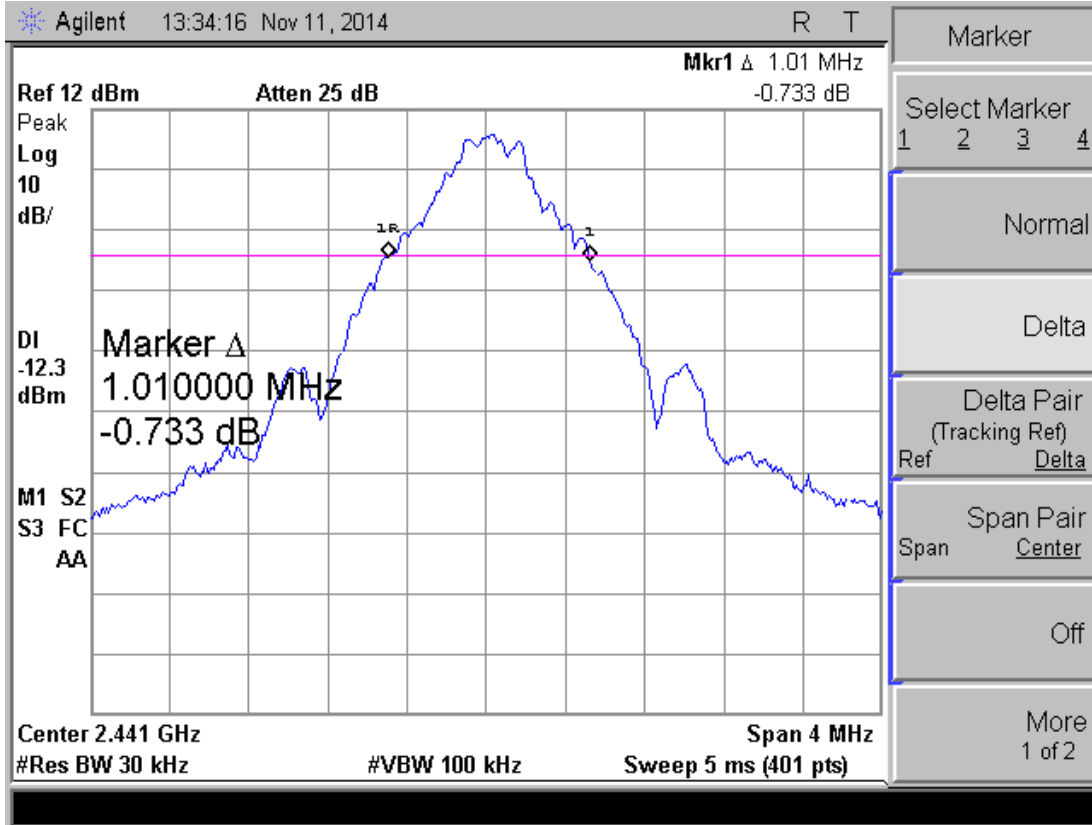
| Frequency (MHz) | For GFSK: 20dB Bandwidth (MHz) | For pi/4 DQPSK: 20dB Bandwidth (MHz) | For 8DPSK: 20dB Bandwidth (MHz) |
|-----------------|--------------------------------|--------------------------------------|---------------------------------|
| 2402 | 1.03 | 1.32 | 1.31 |
| 2441 | 1.01 | 1.29 | 1.31 |
| 2480 | 1.05 | 1.32 | 1.31 |

| Frequency (MHz) | For GFSK: 99% Bandwidth (MHz) | For pi/4 DQPSK: 99% Bandwidth (MHz) | For 8DPSK: 99% Bandwidth (MHz) |
|-----------------|-------------------------------|-------------------------------------|--------------------------------|
| 2402 | 0.975 | 1.2189 | 1.2319 |
| 2441 | 0.971 | 1.2260 | 1.2243 |
| 2480 | 0.976 | 1.2205 | 1.2347 |

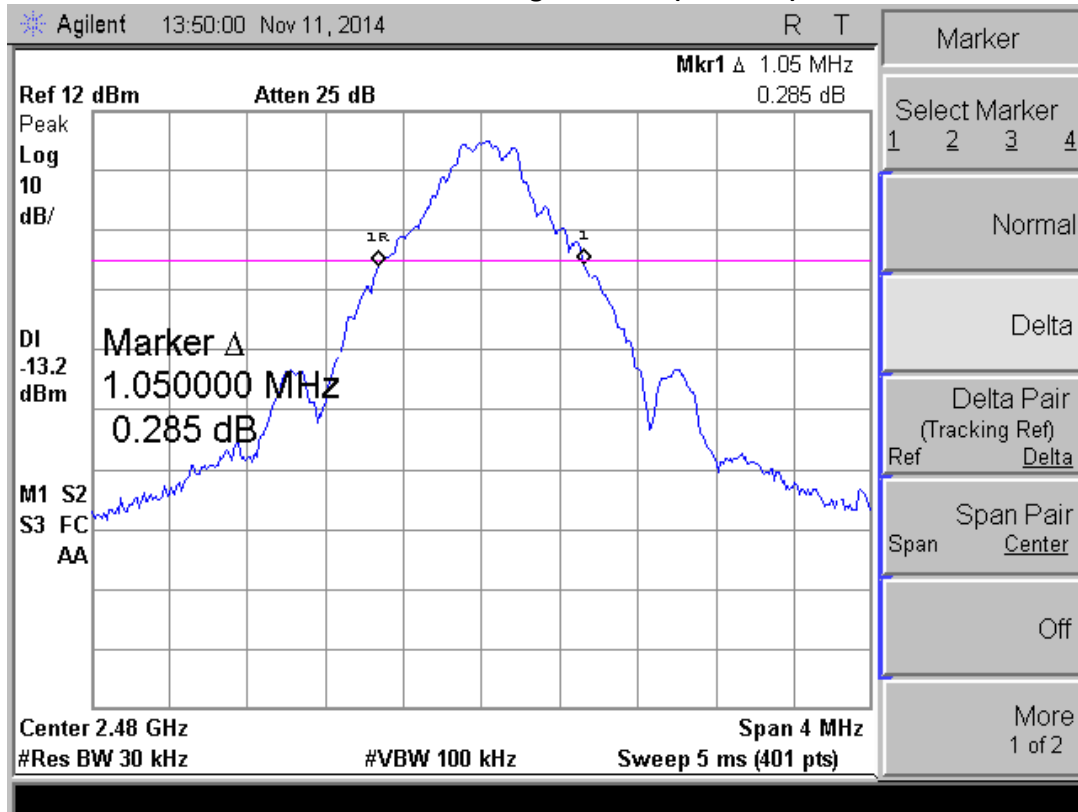
20dB Bandwidth-Low Channel (For GFSK)



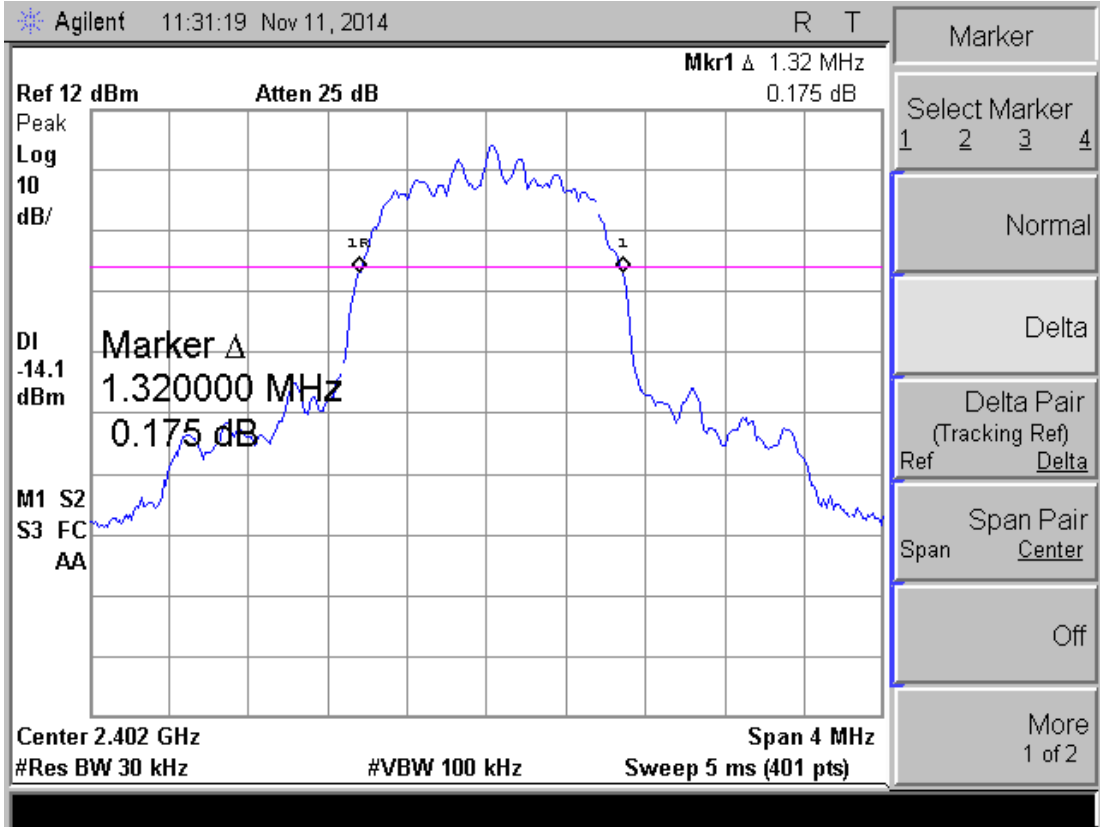
20dB Bandwidth-Middle Channel (For GFSK)



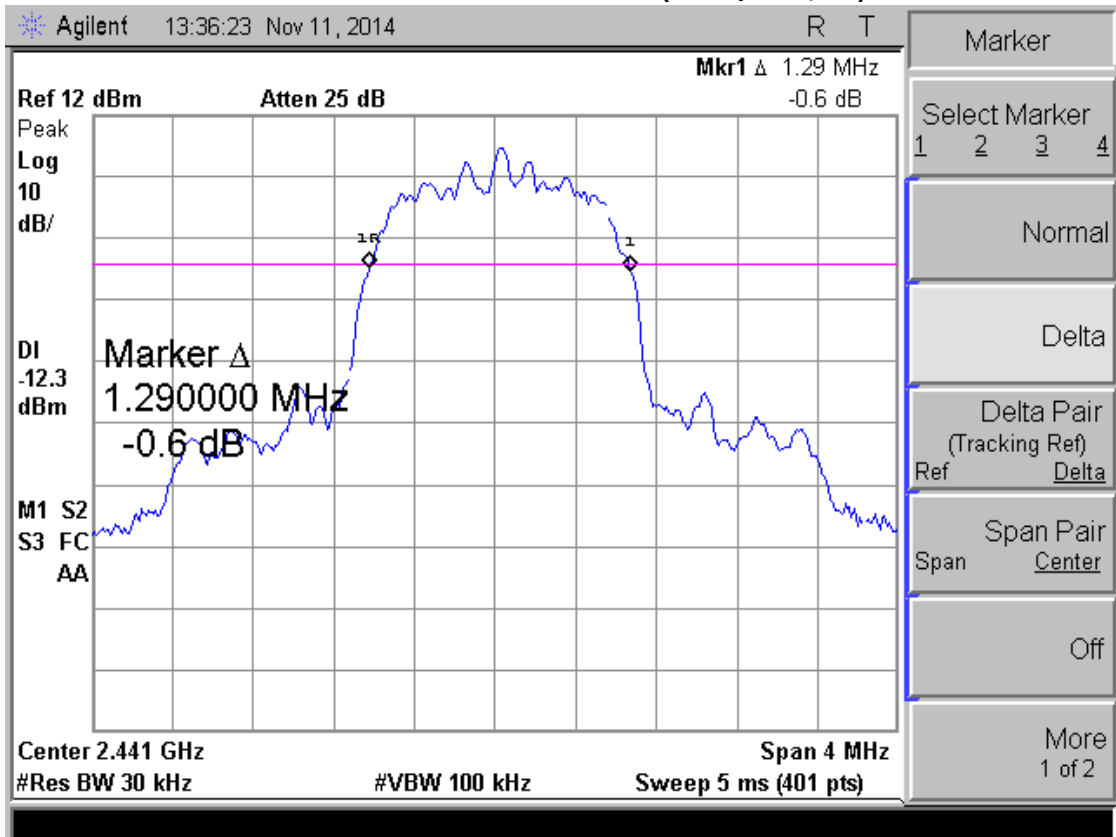
20dB Bandwidth-High Channel (For GFSK)



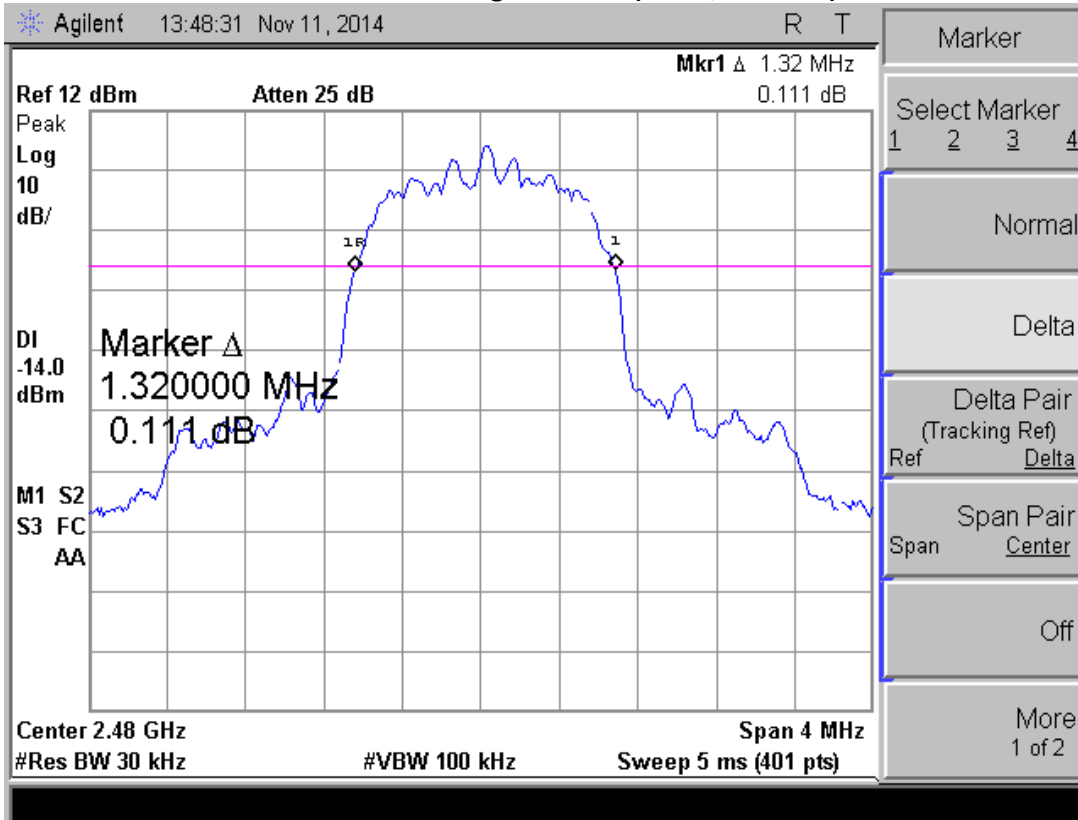
20dB Bandwidth-Low Channel (For Pi/4 DQPSK)



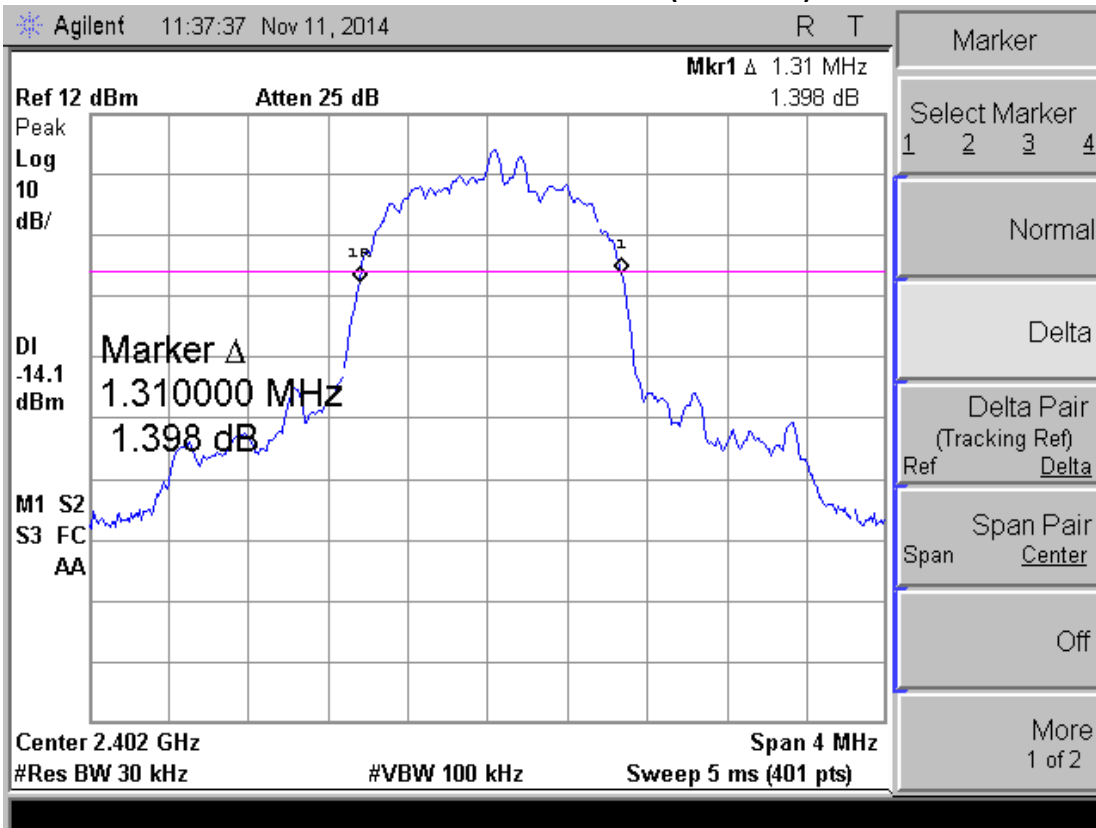
20dB Bandwidth-Middle Channel (For Pi/4 DQPSK)



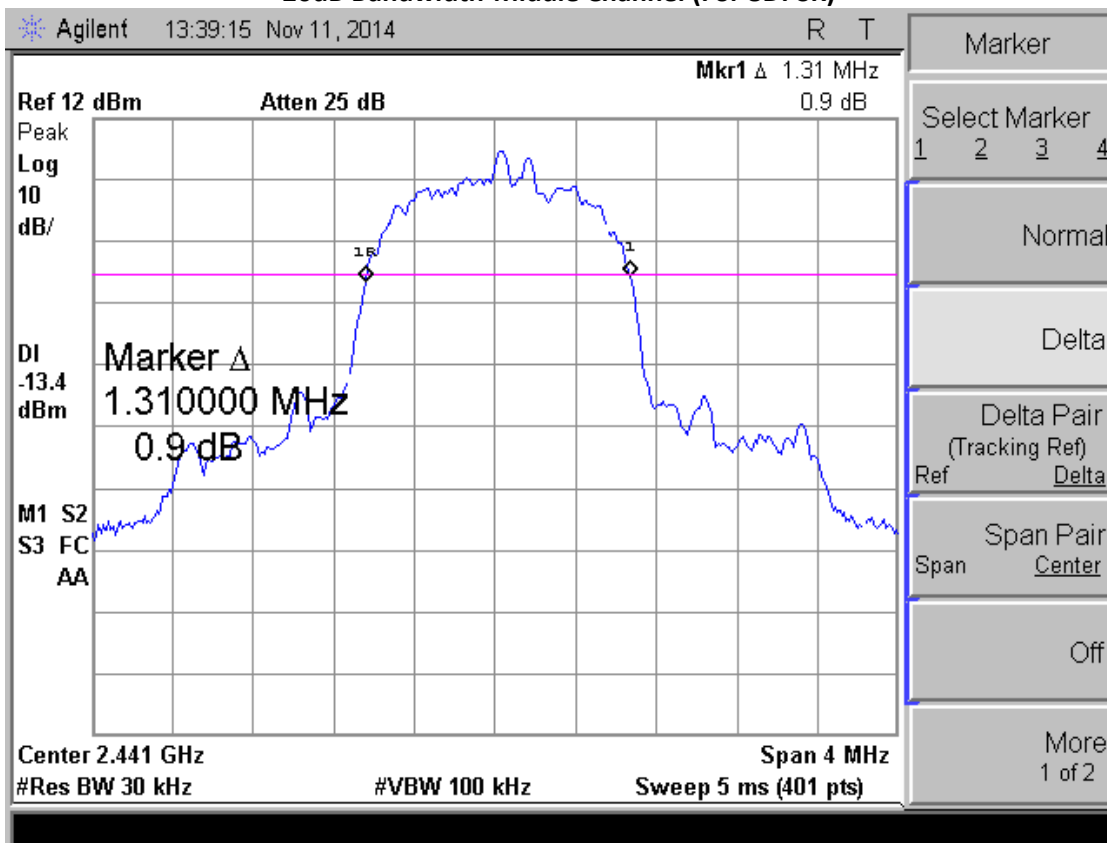
20dB Bandwidth-High Channel (For Pi/4 DQPSK)



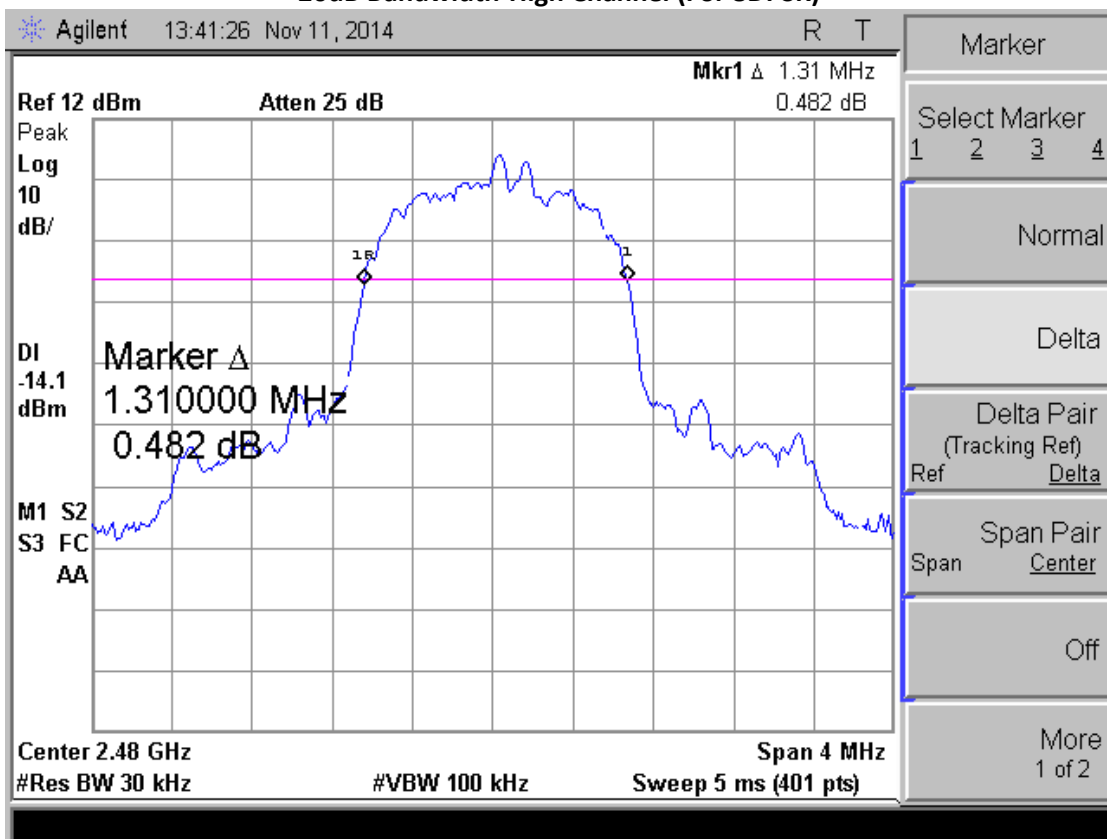
20dB Bandwidth-Low Channel (For 8DPSK)



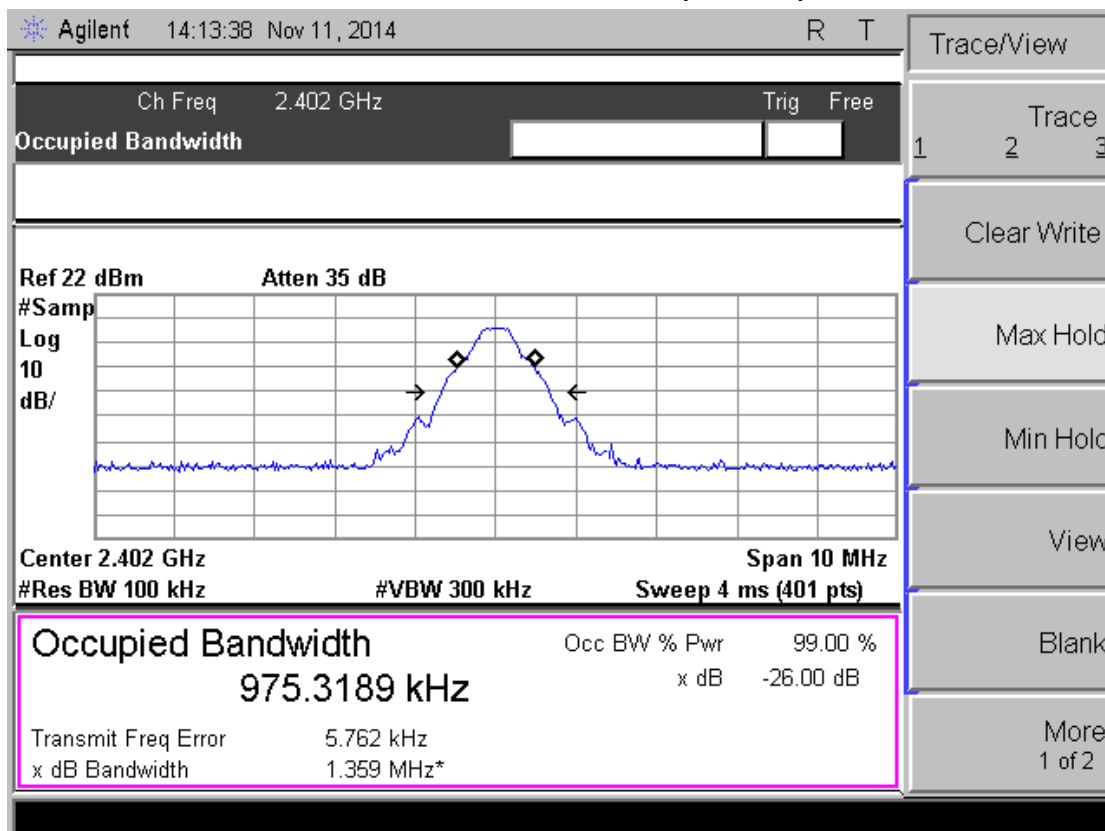
20dB Bandwidth-Middle Channel (For 8DPSK)



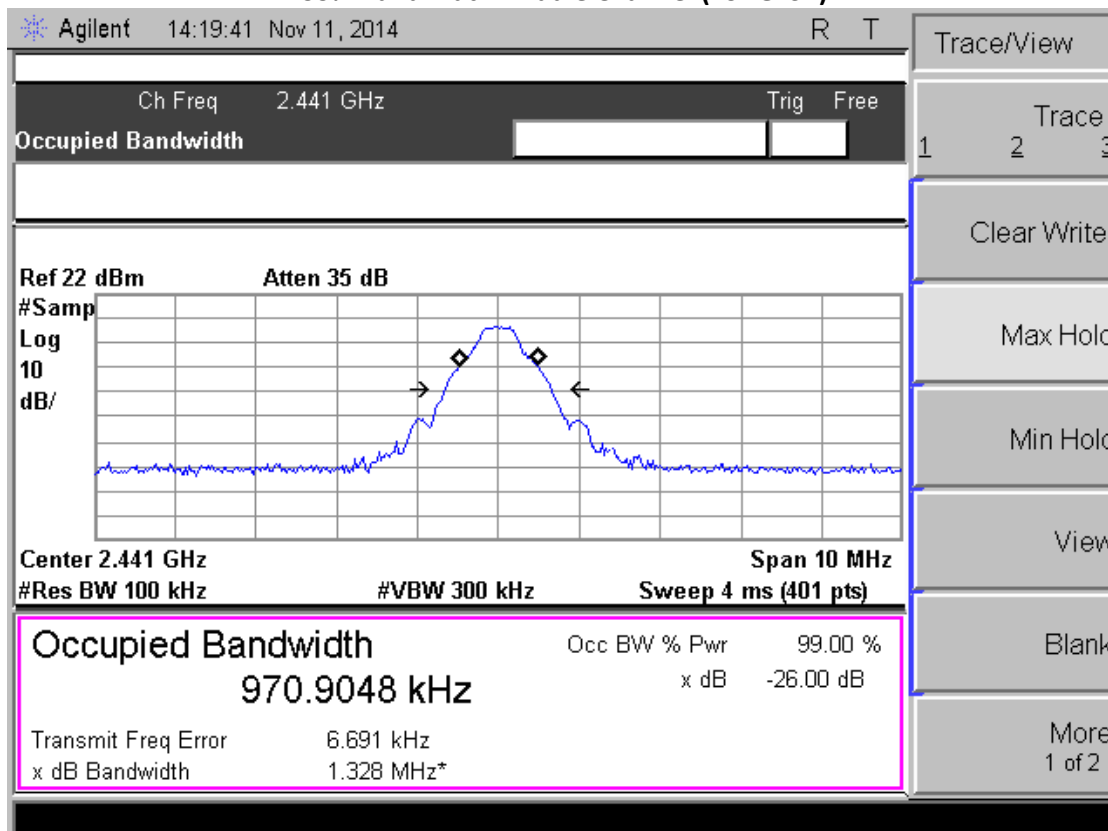
20dB Bandwidth-High Channel (For 8DPSK)



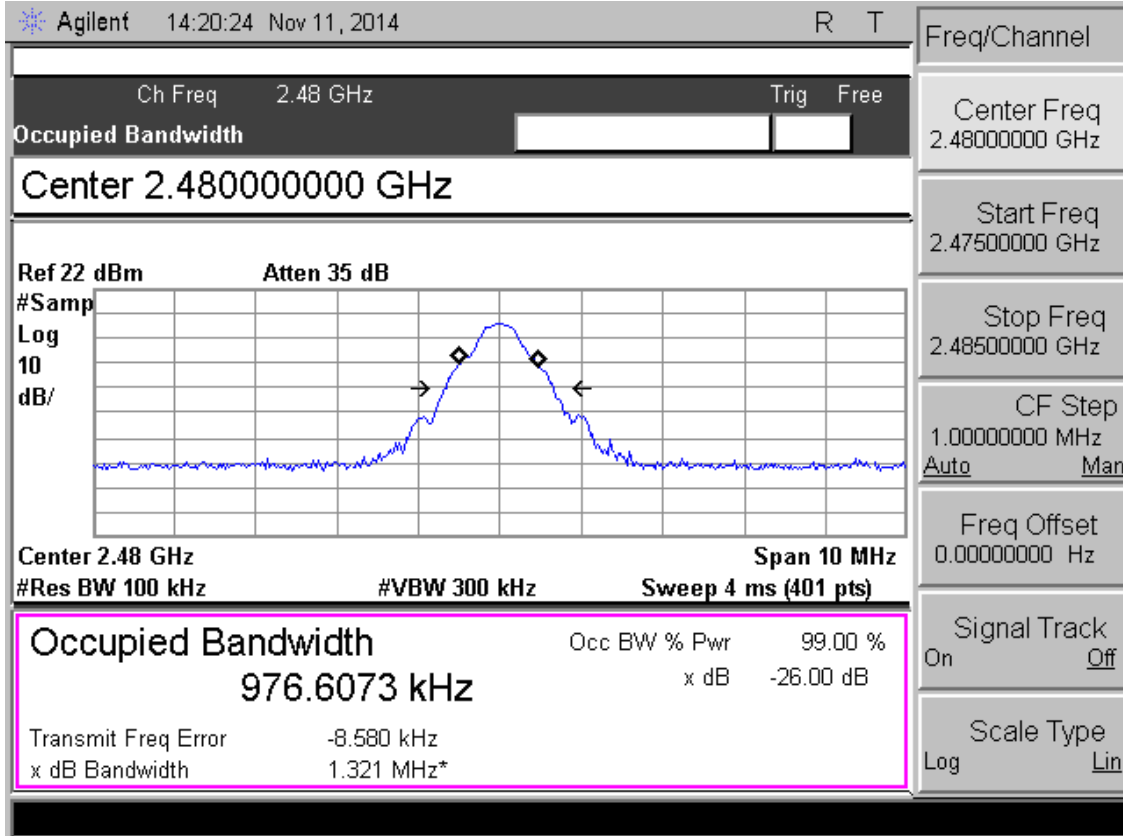
99% Bandwidth-Low Channel (For GFSK)



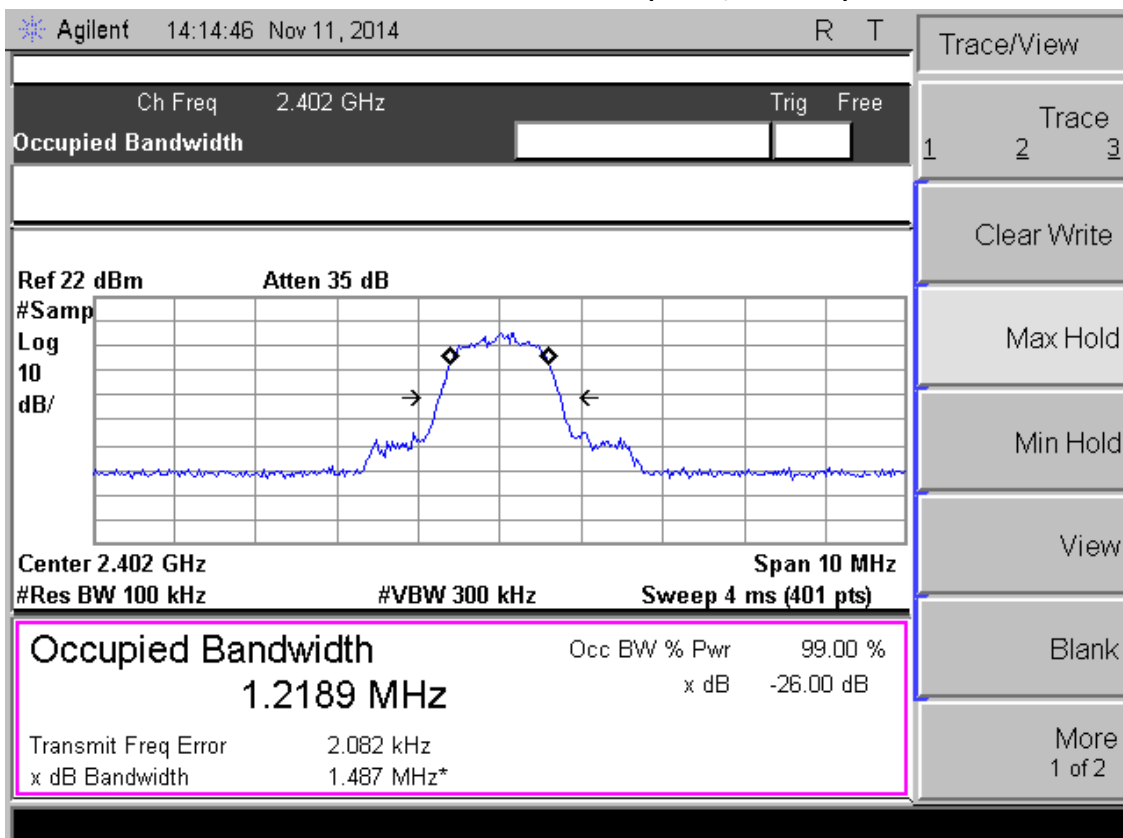
99% Bandwidth-Middle Channel (For GFSK)

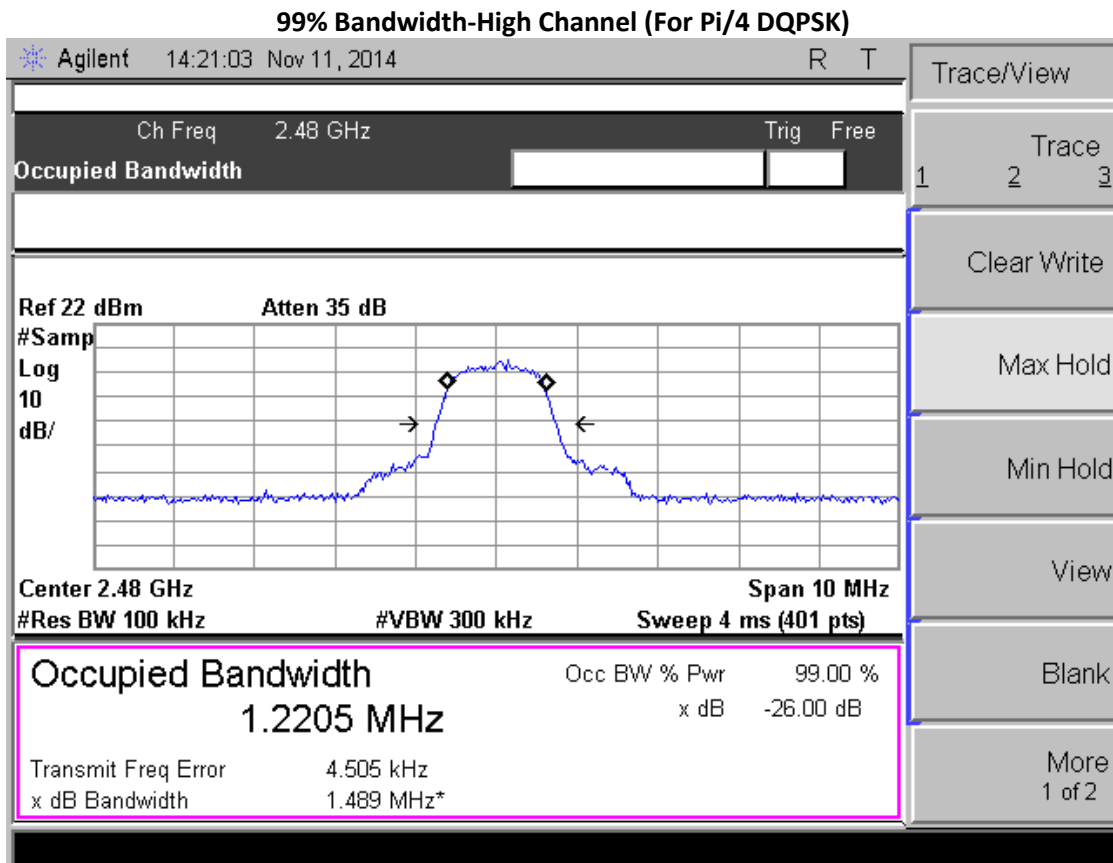
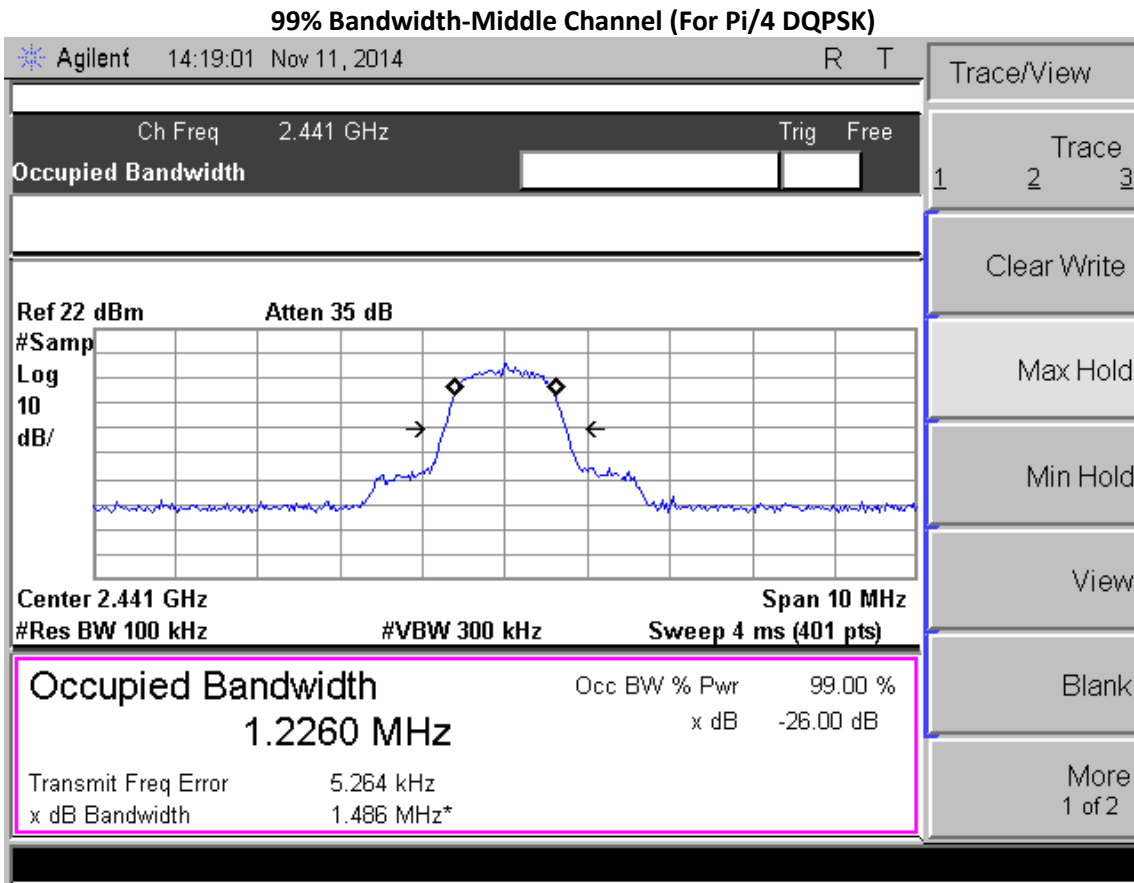


99% Bandwidth-High Channel (For GFSK)

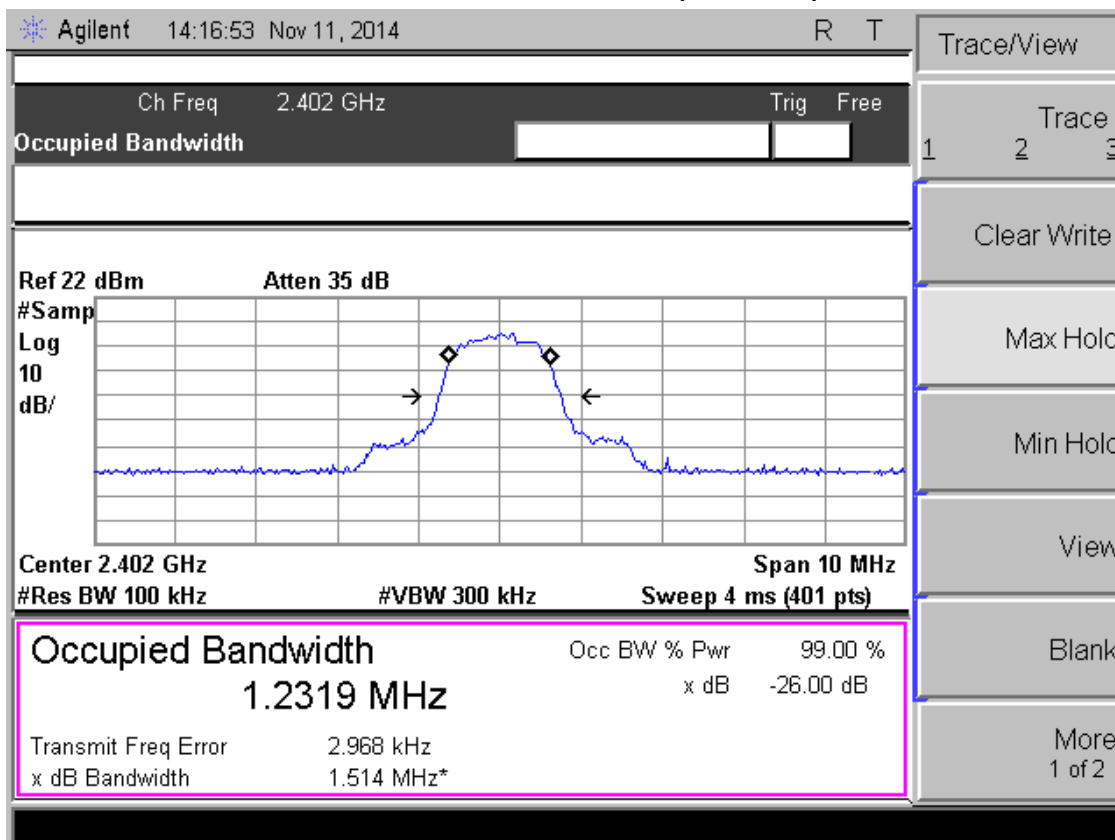


99% Bandwidth-Low Channel (For Pi/4 DQPSK)

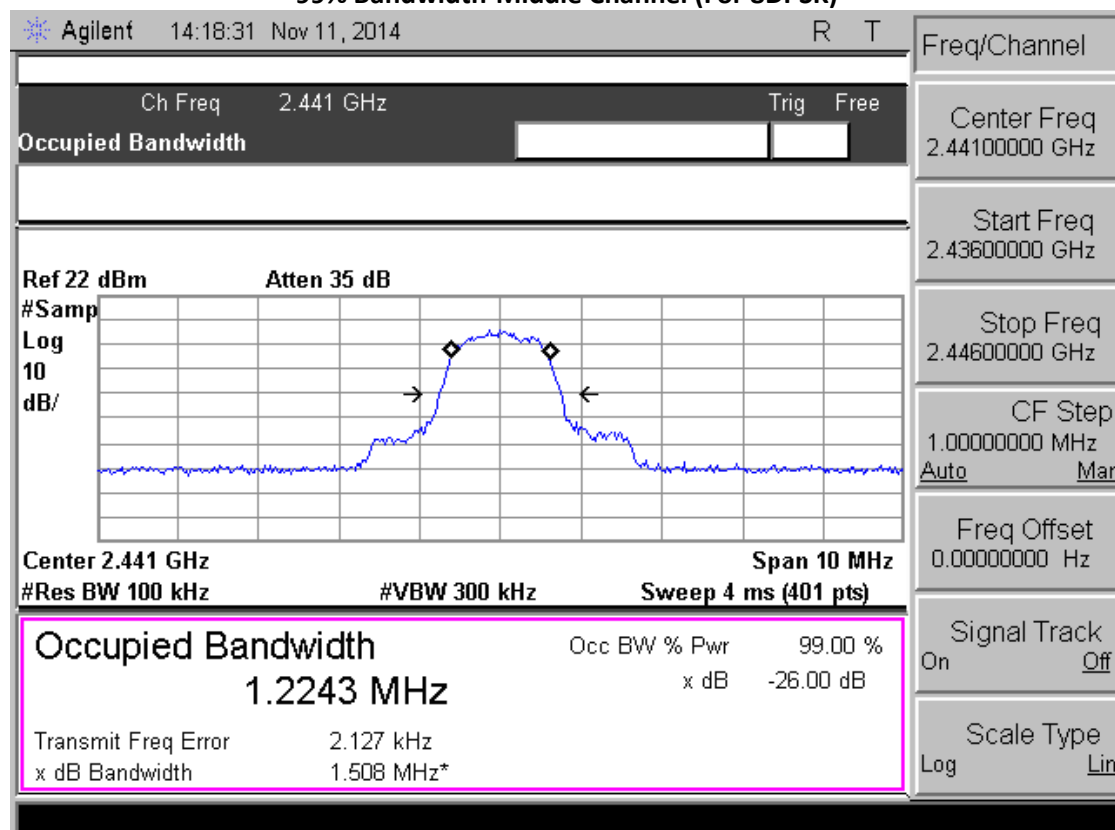


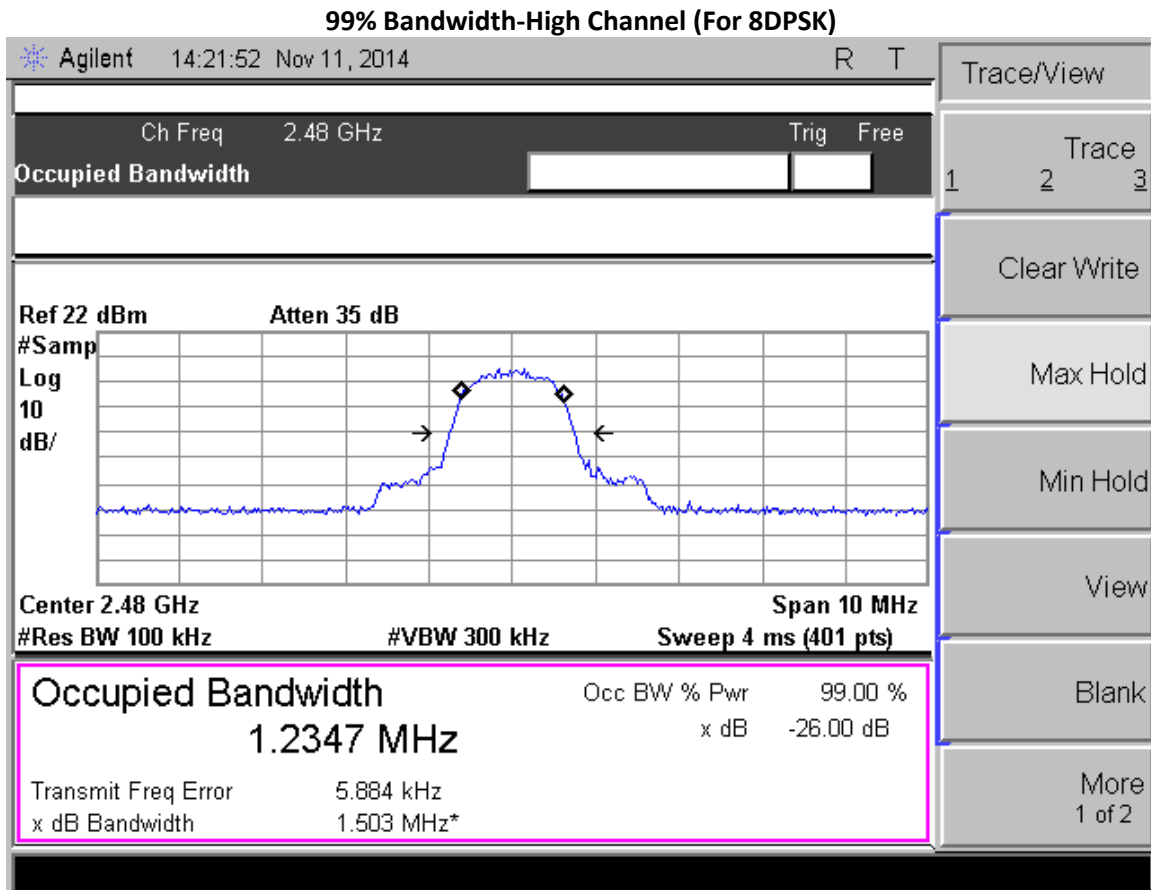


99% Bandwidth-Low Channel (For 8DPSK)



99% Bandwidth-Middle Channel (For 8DPSK)





3.2 Peak Output Power – FCC Section 15.247 (b)(1)

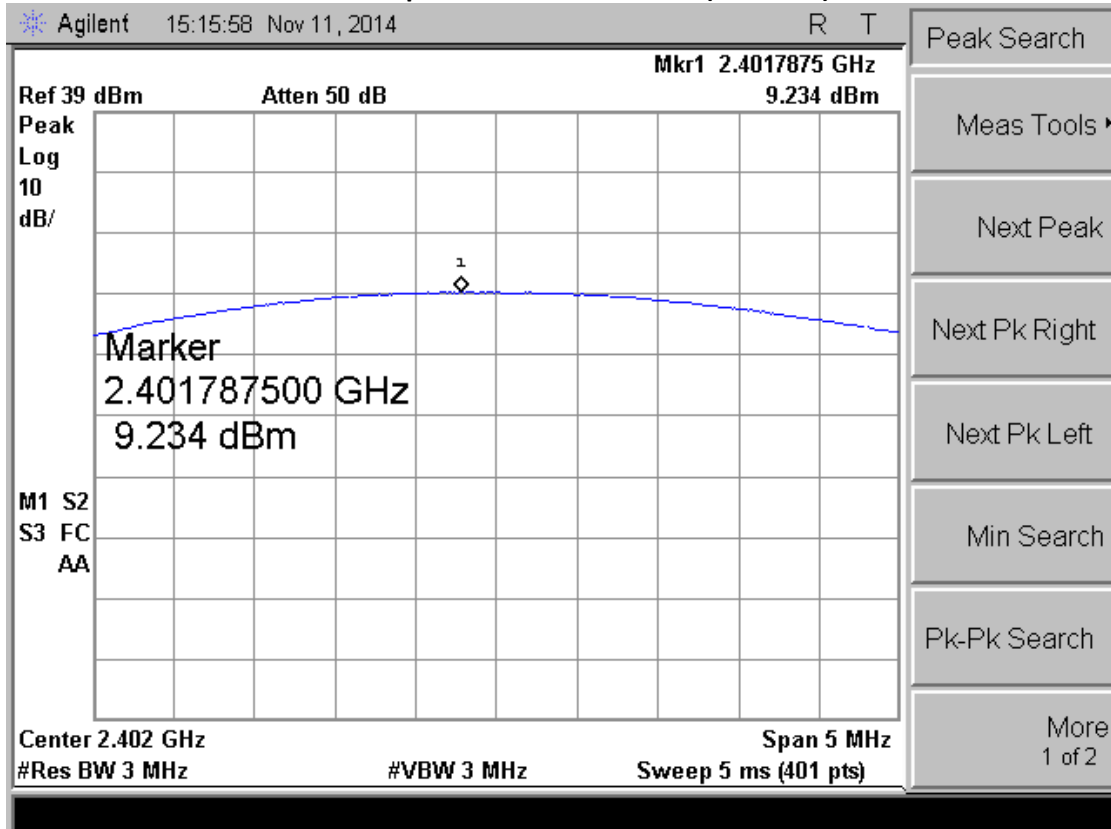
3.2.1 Measurement Procedure

According to § 15.247(b)(1), the maximum peak conducted output power of the intentional radiator shall not exceed 1 Watt for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels. The peak output power was measured in accordance with the DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems: Peak Output Power. The span was set to approximately 5 times the 20 dB bandwidth, centered on a hopping channel. The RBW was set to greater than the 20 dB bandwidth of the emission being measured whereas the $VBW \geq RBW$.

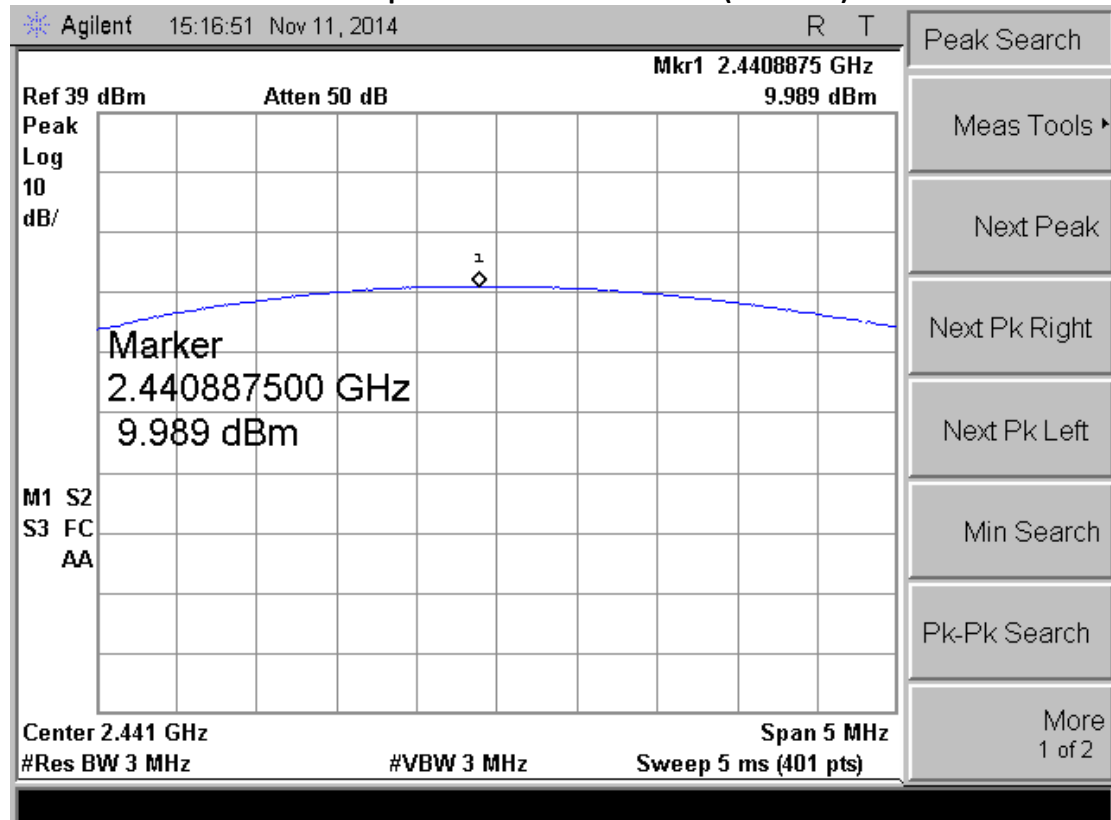
3.2.2 Measurement Result

| Frequency (MHz) | For GFSK: RF Output Power (dBm) | For pi/4 DQPSK: RF Output Power (dBm) | For 8DPSK: RF Output Power (dBm) |
|-----------------|---------------------------------|---------------------------------------|----------------------------------|
| 2402 | 9.234 | 9.925 | 10.18 |
| 2441 | 9.989 | 10.68 | 11.03 |
| 2480 | 9.328 | 10.05 | 10.4 |

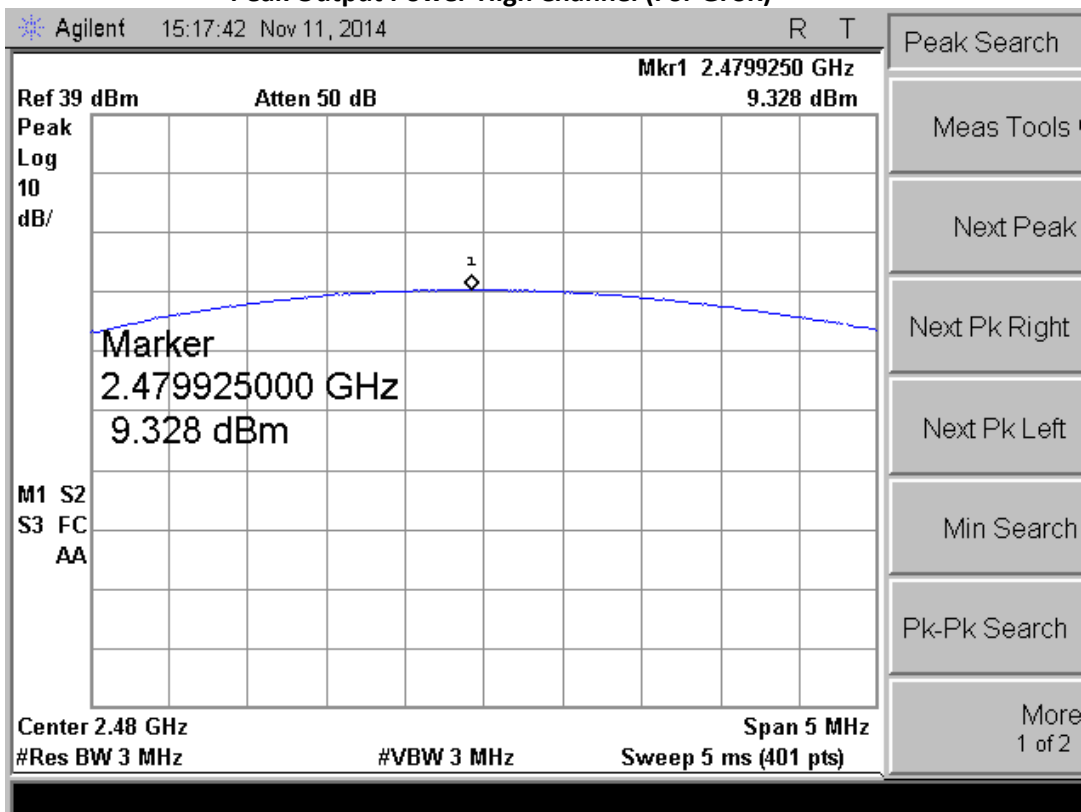
Peak Output Power-Low Channel (For GFSK)



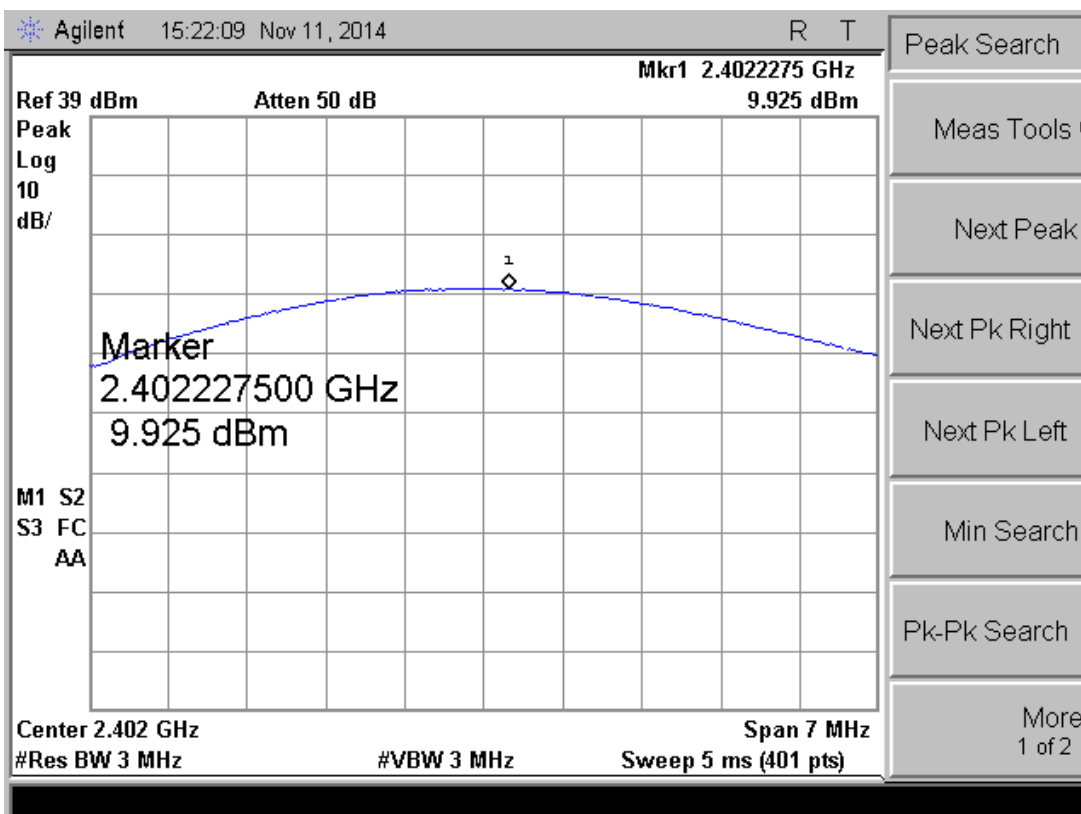
Peak Output Power-Middle Channel (For GFSK)



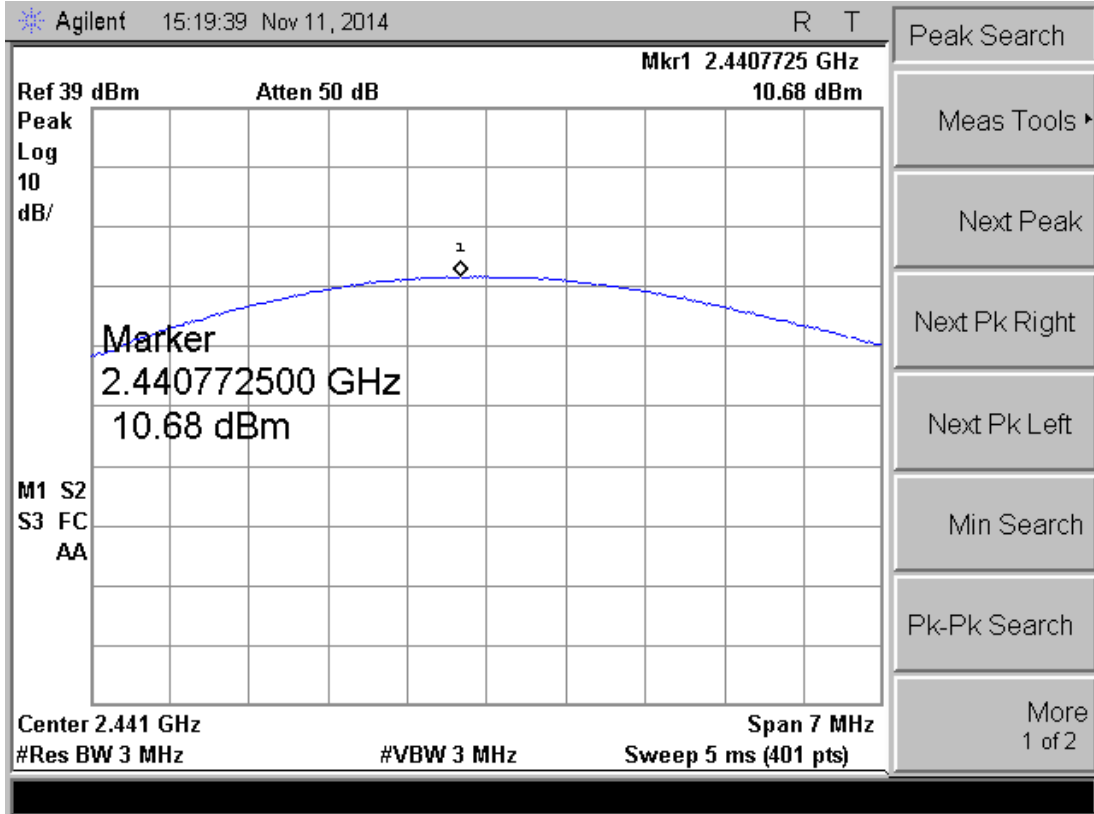
Peak Output Power-High Channel (For GFSK)



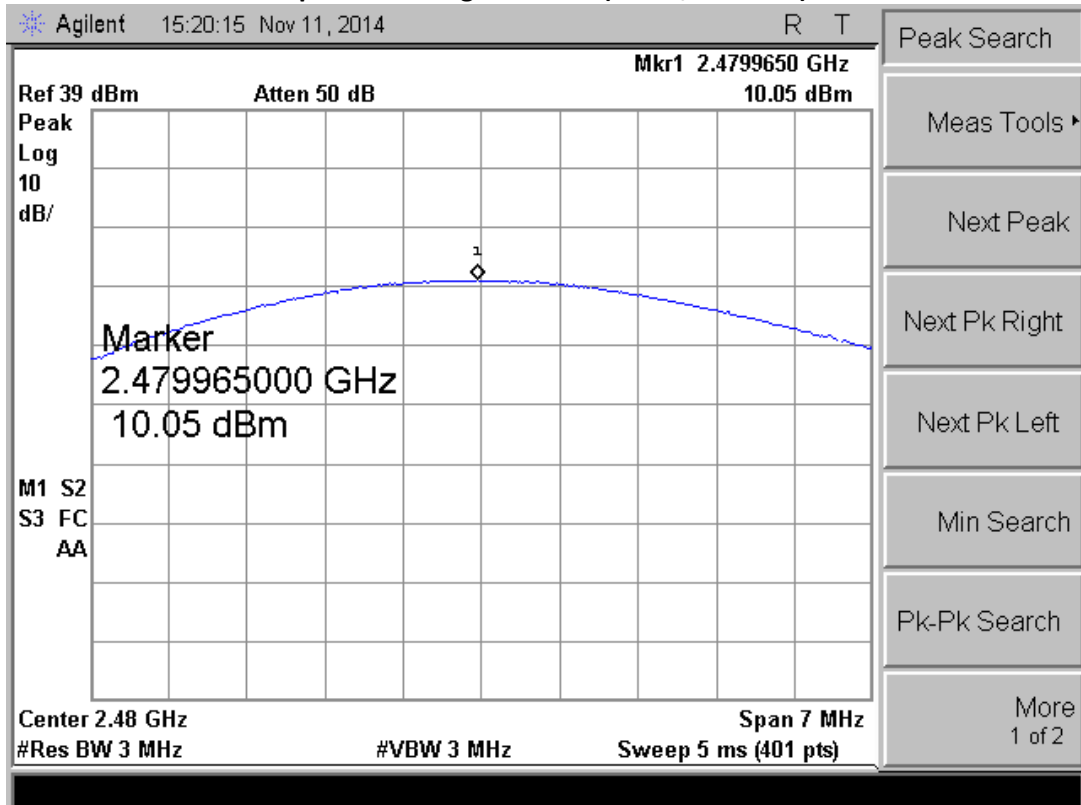
Peak Output Power-Low Channel (For PI/4 DQPSK)



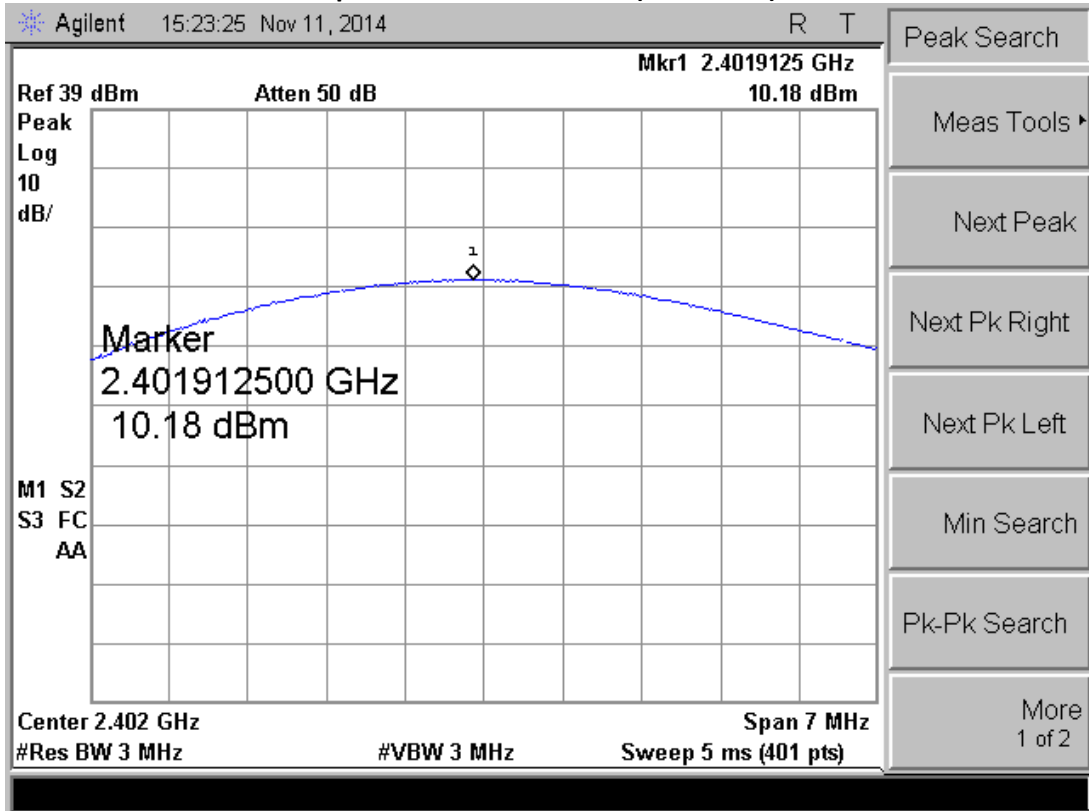
Peak Output Power-Middle Channel (For PI/4 DQPSK)



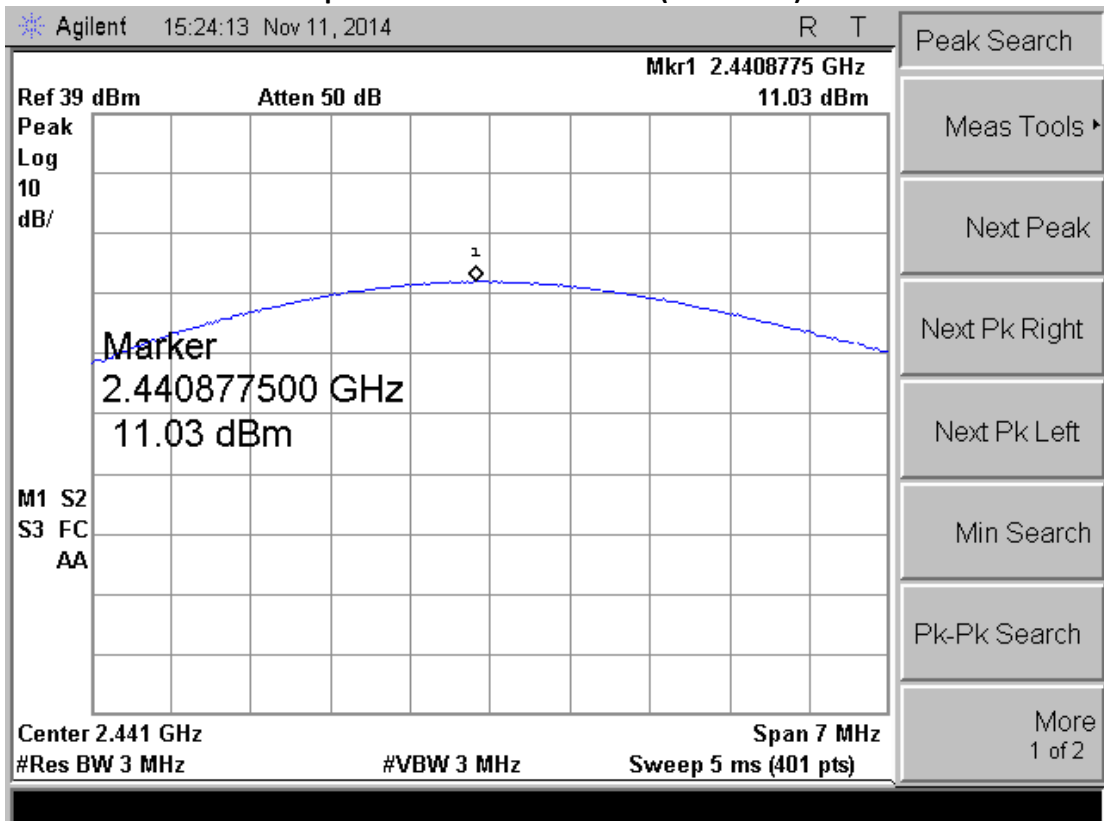
Peak Output Power-High Channel (For PI/4 DQPSK)

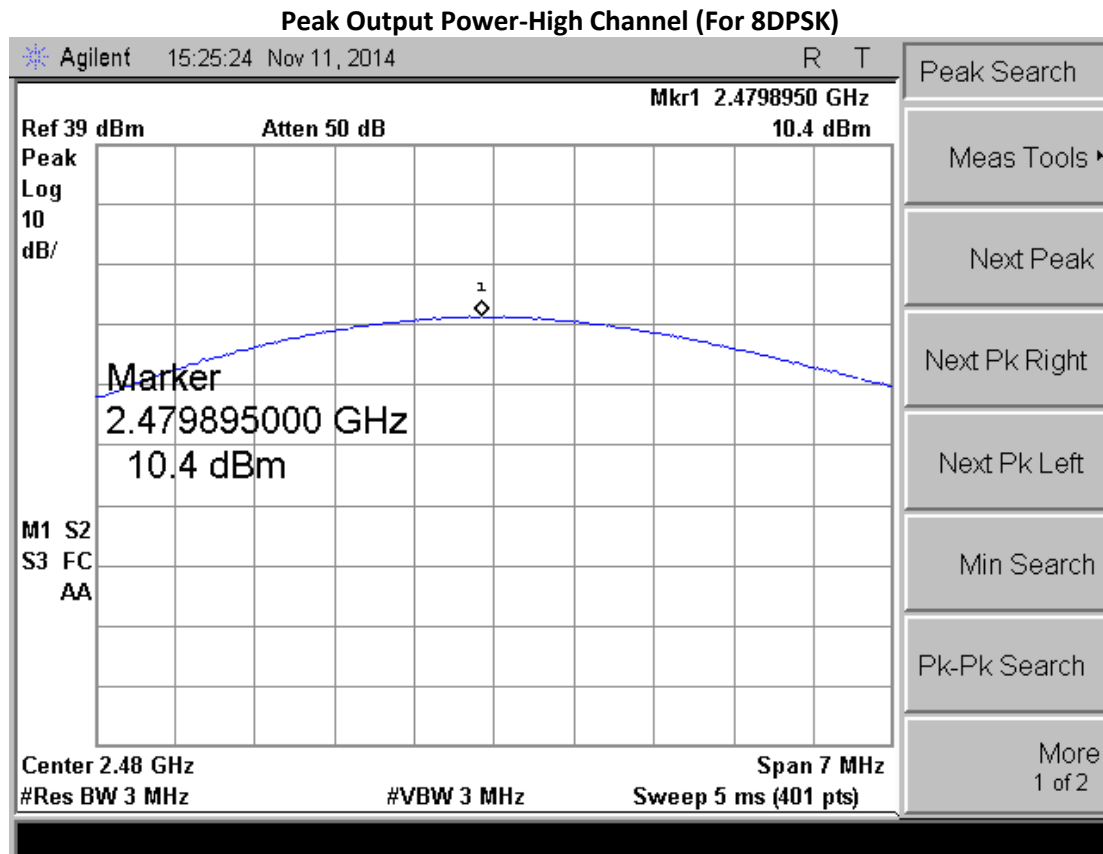


Peak Output Power-Low Channel (For 8DPSK)



Peak Output Power-Middle Channel (For 8DPSK)





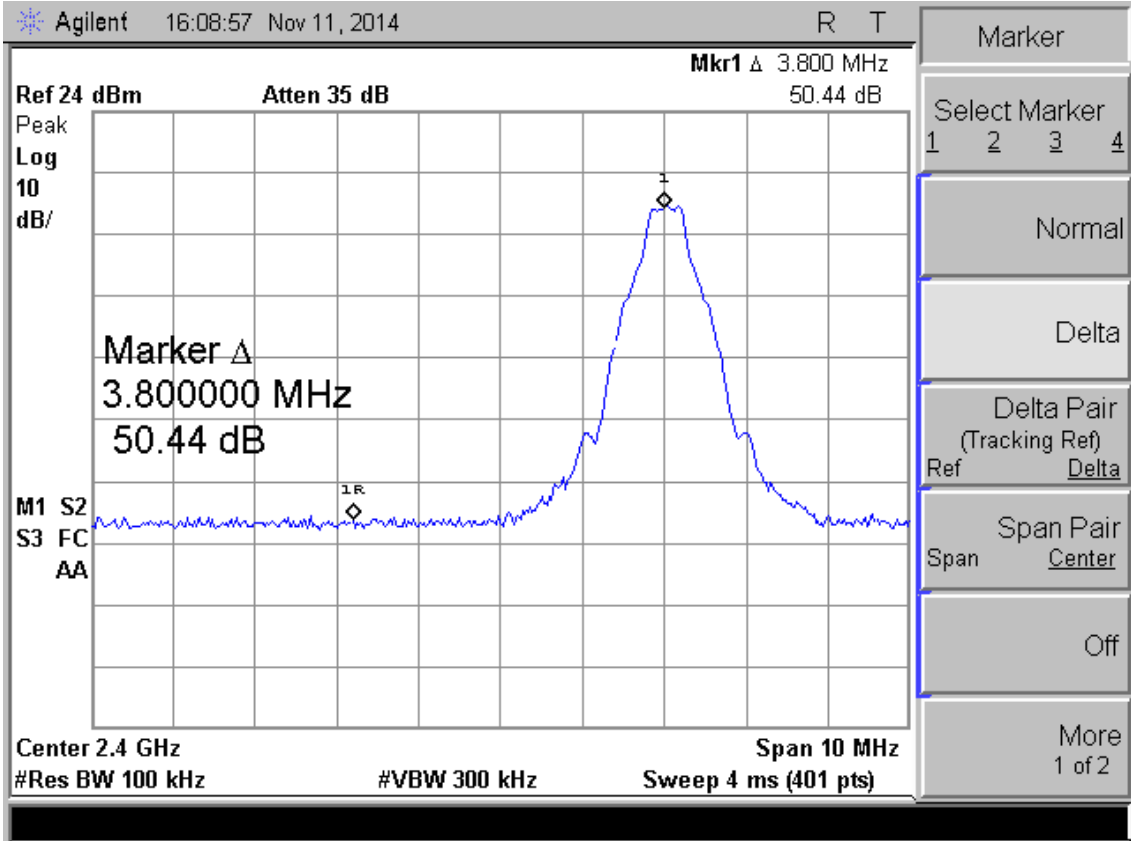
3.3 Band-Edge Compliance of RF Conducted Emissions – FCC Section 15.247(c)

3.3.1 Measurement Procedure

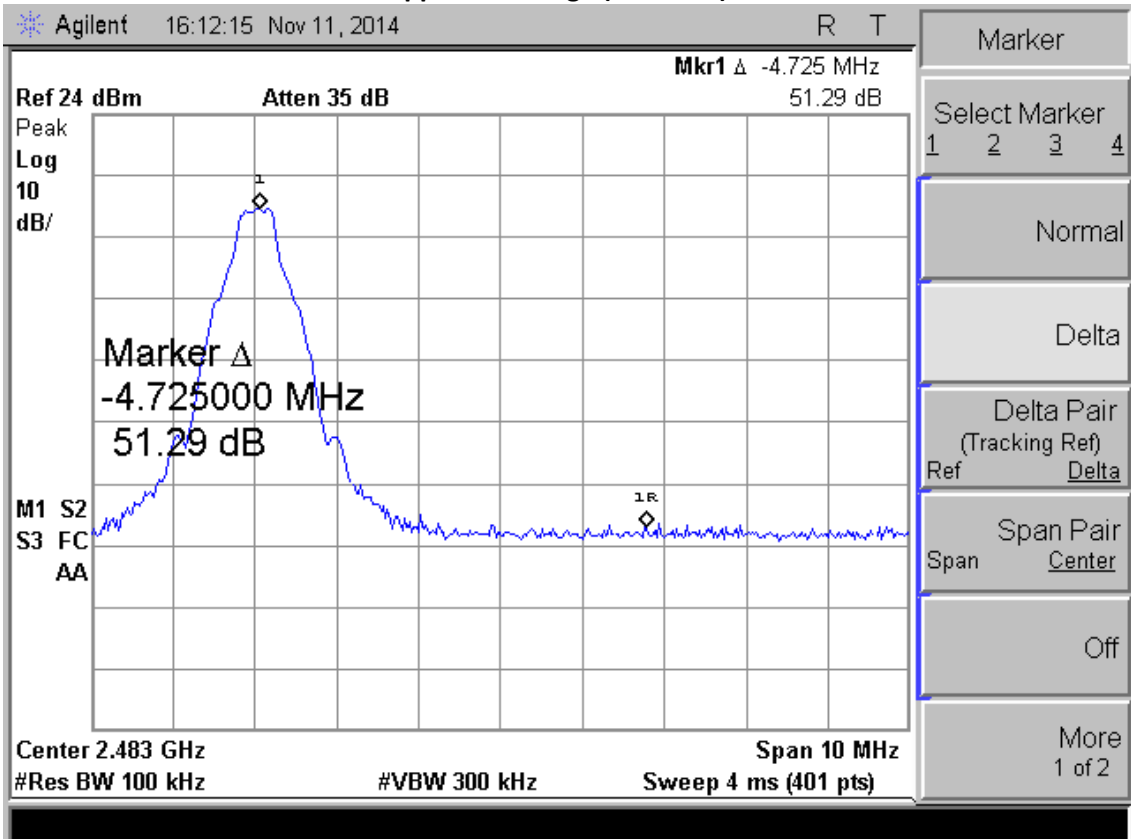
According to § 15.247(c), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. The band-edge compliance of RF conducted emissions was measured in accordance with the DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems: Band-edge compliance of RF conducted emissions. The span was set to wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. The RBW was set to $\geq 1\%$ of the span and $VBW \geq RBW$.

3.3.2 Measurement Result

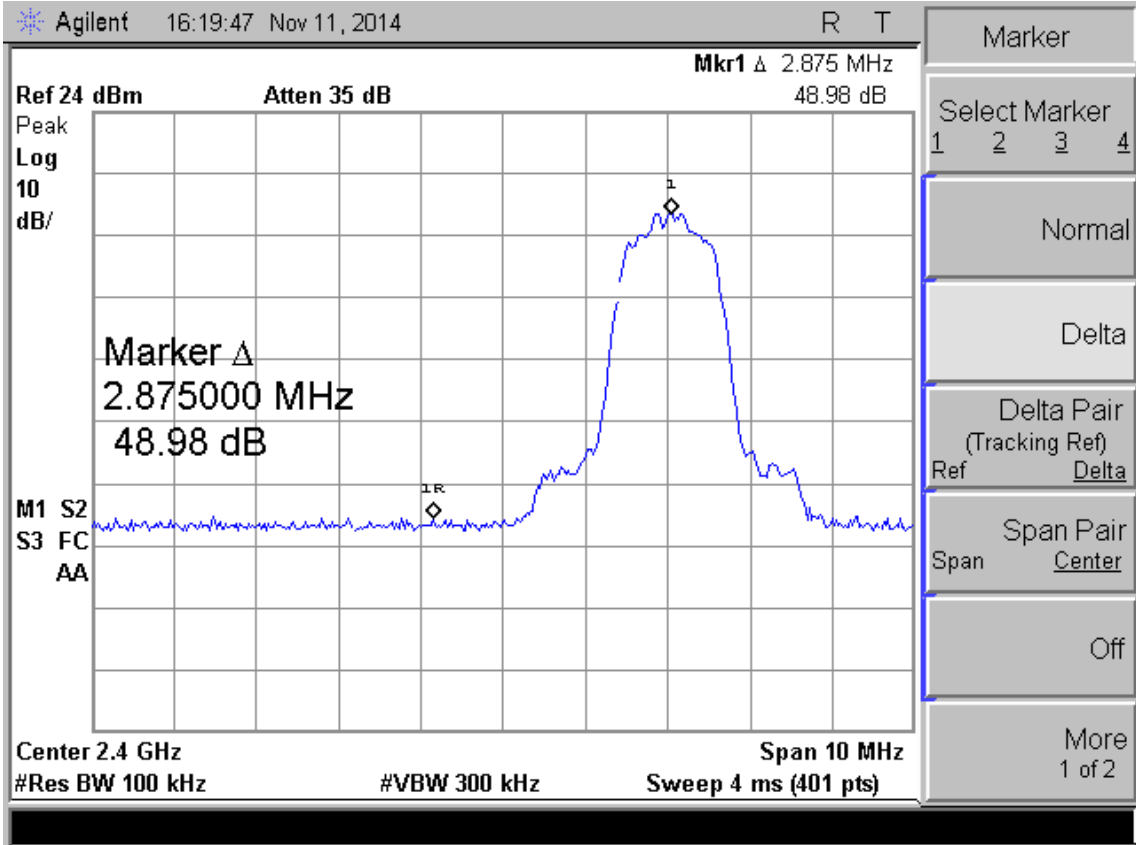
Lower Band Edge (For GFSK)



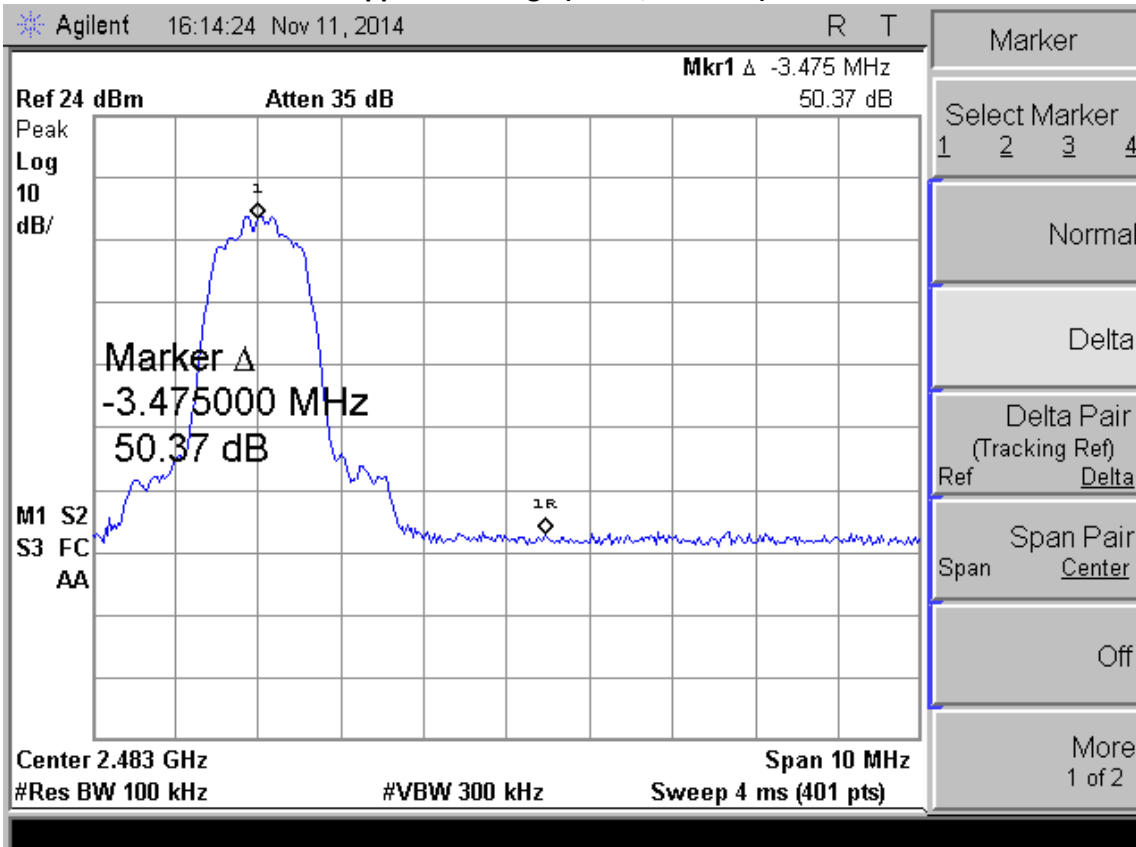
Upper Band Edge (For GFSK)



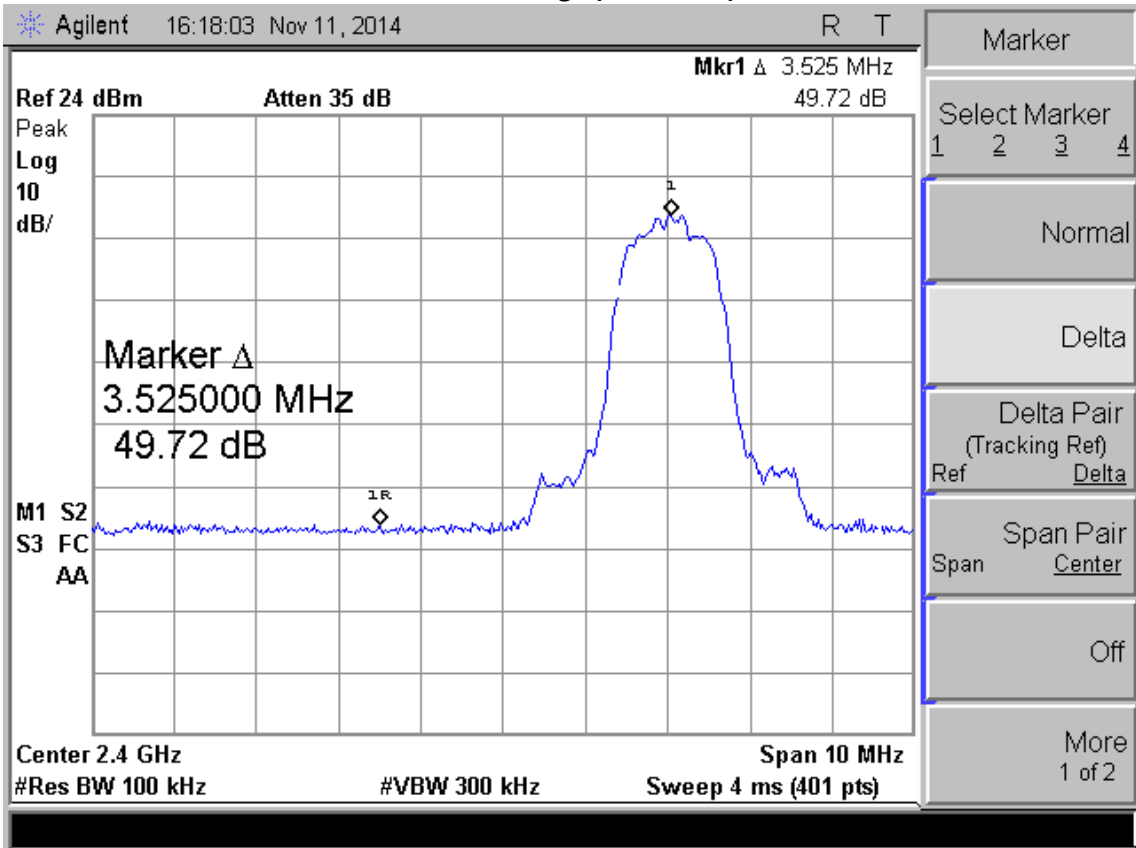
Lower Band Edge (For Pi/4 DQPSK)



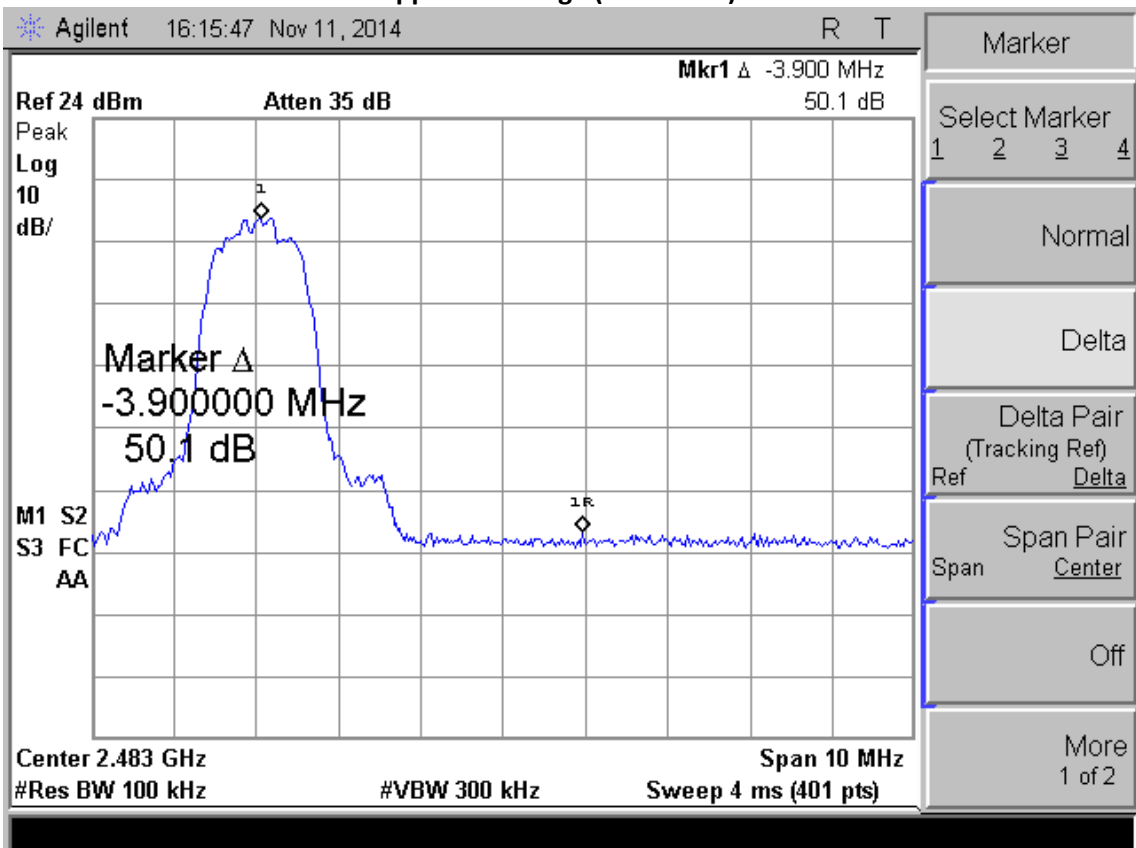
Upper Band Edge (For Pi/4 DQPSK)



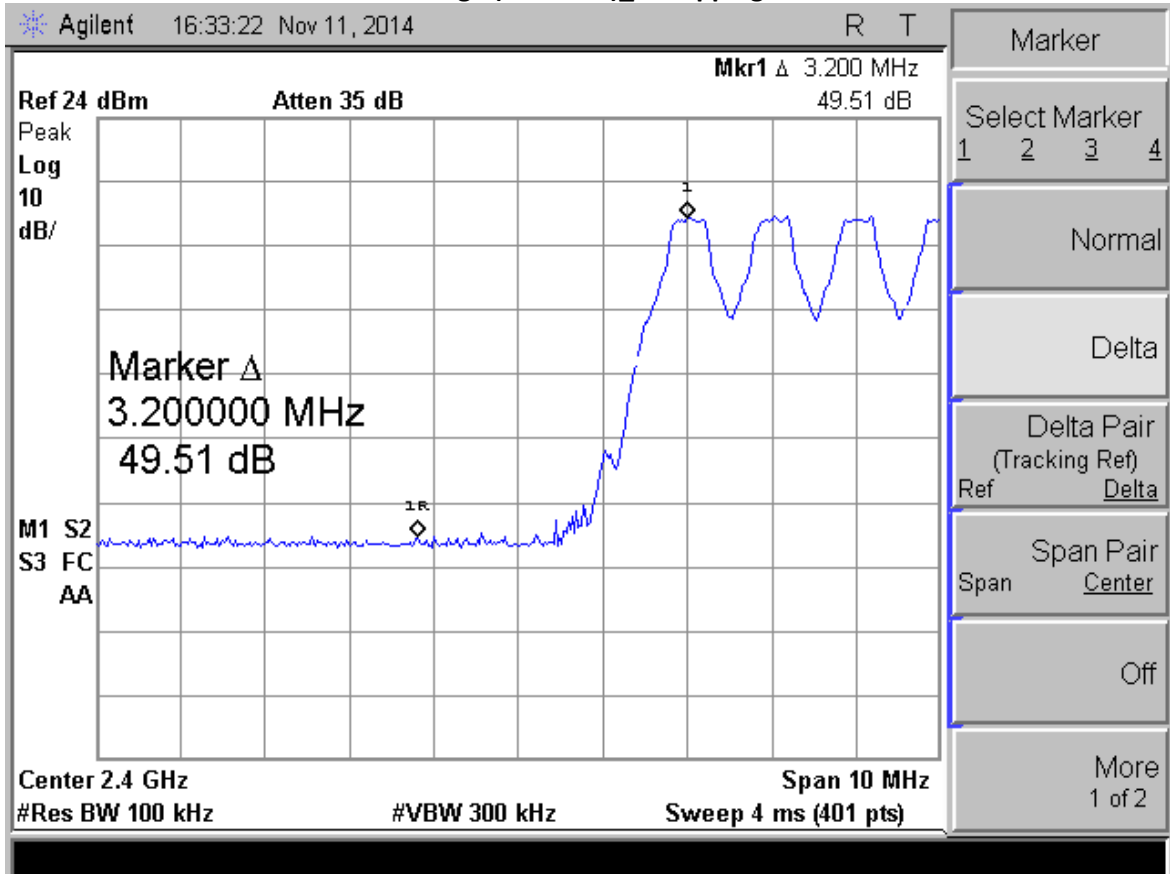
Lower Band Edge (For 8DPSK)



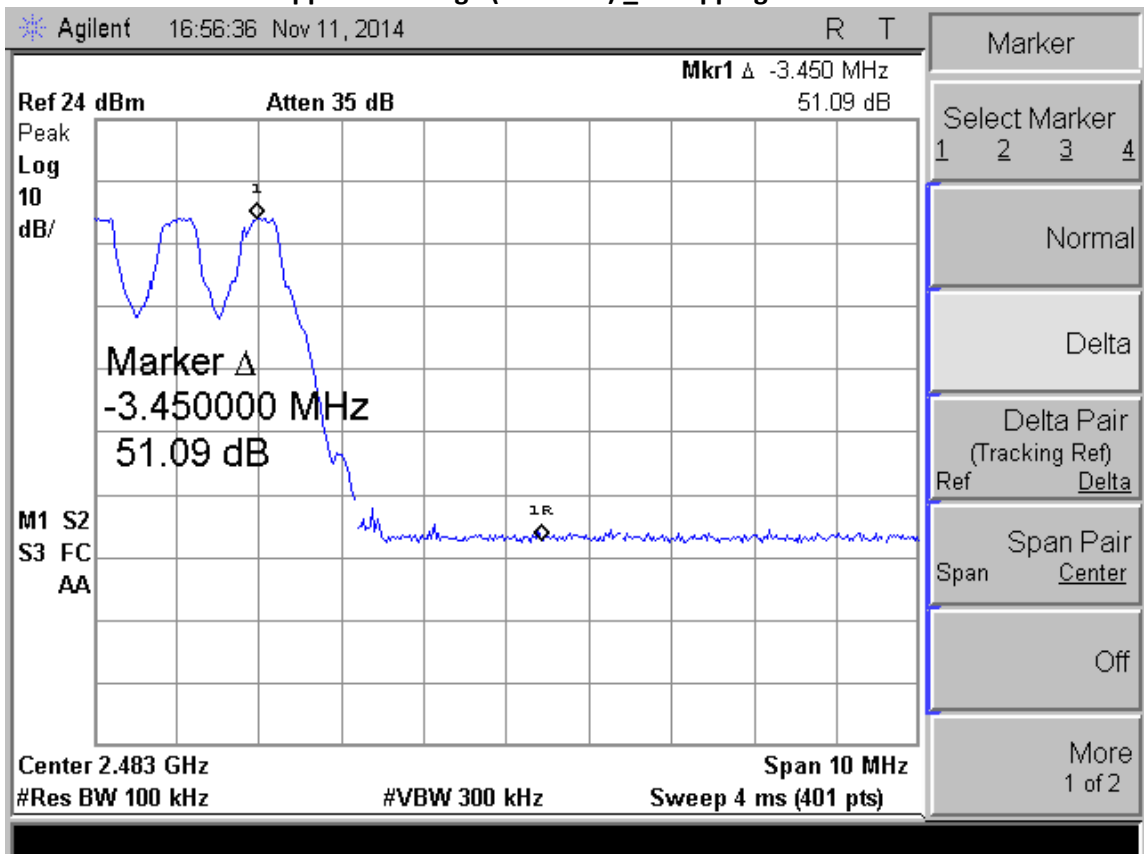
Upper Band Edge (For 8DPSK)



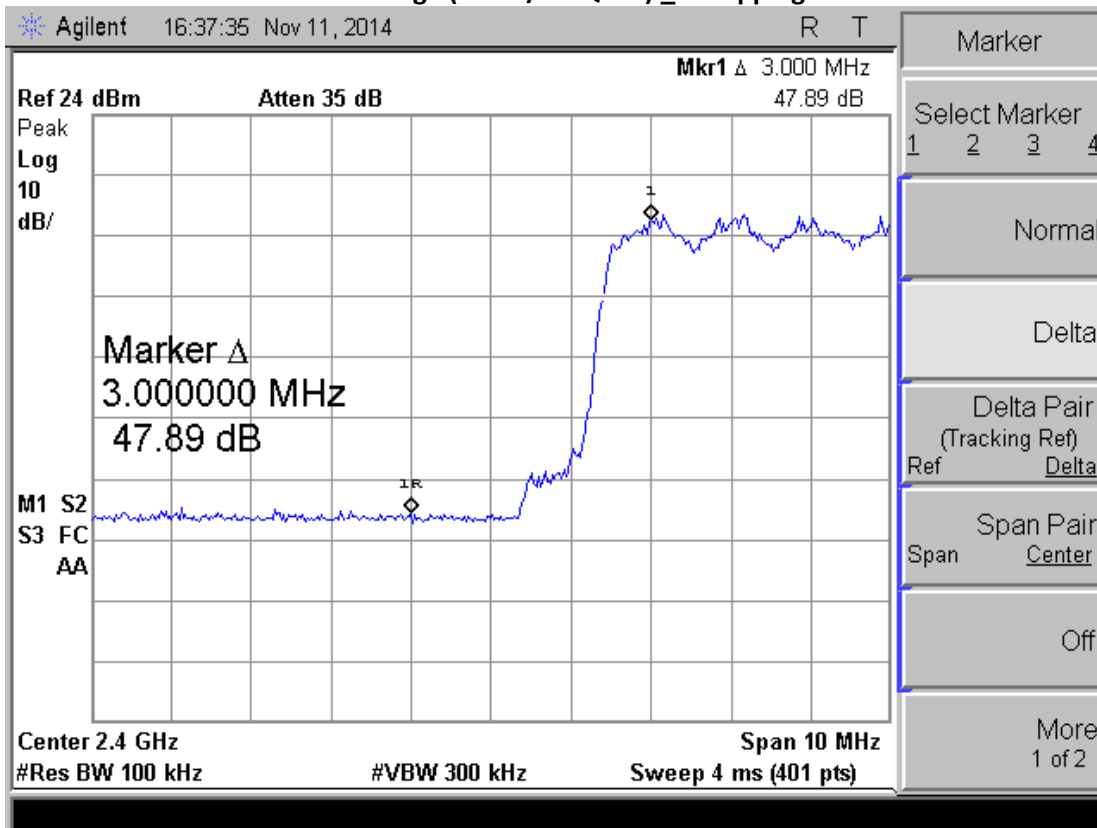
Lower Band Edge (For GFSK)_In hopping mode



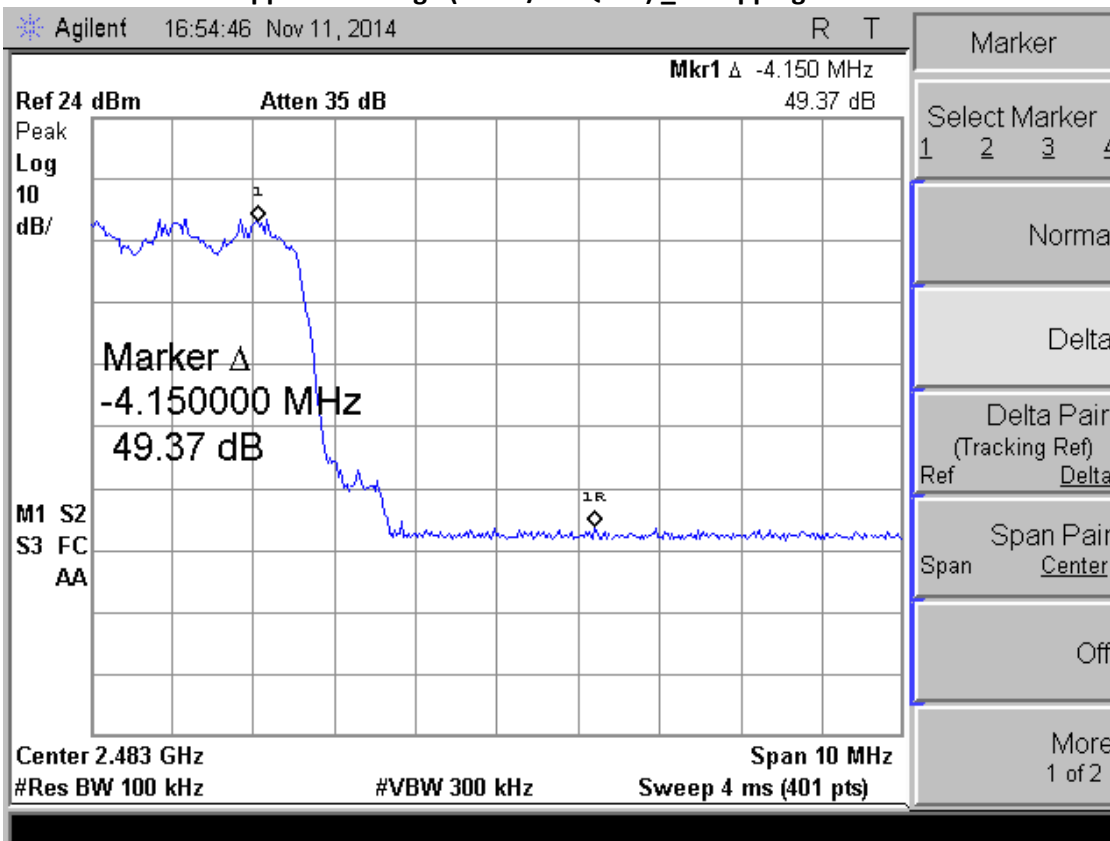
Upper Band Edge (For GFSK)_In hopping mode



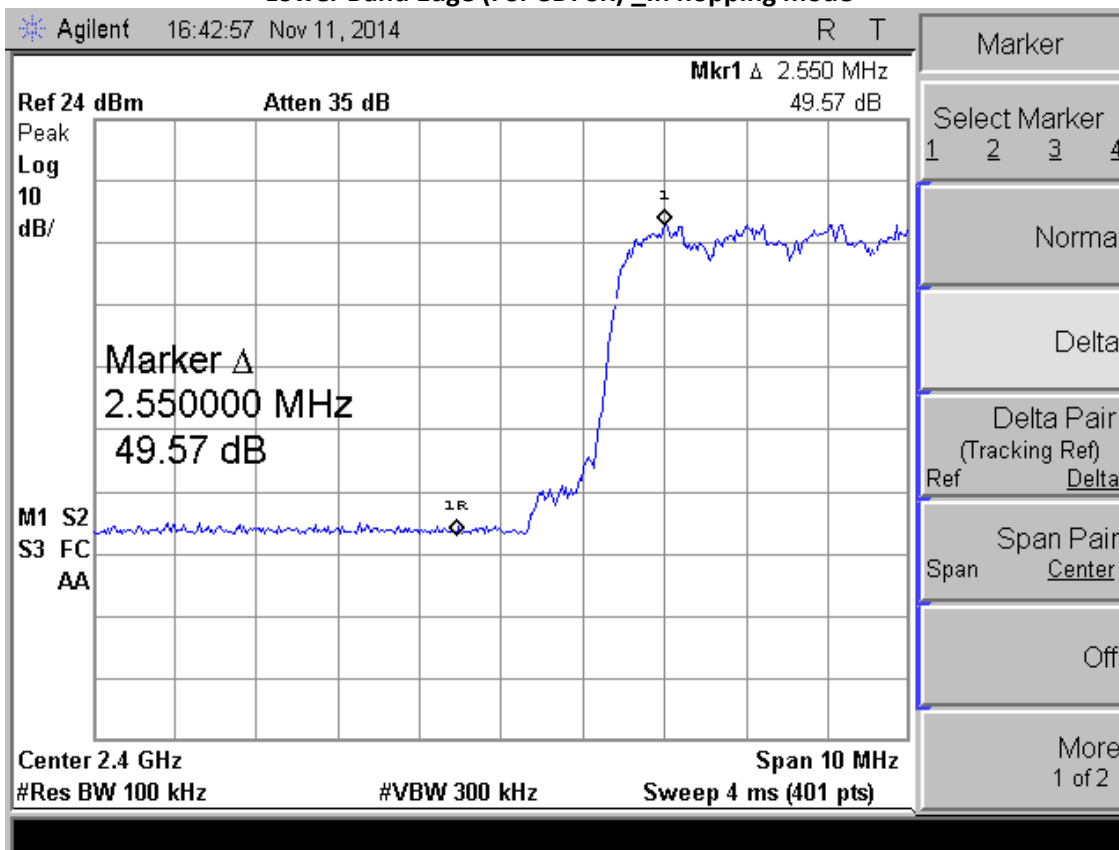
Lower Band Edge (For Pi/4 DQPSK) _In hopping mode



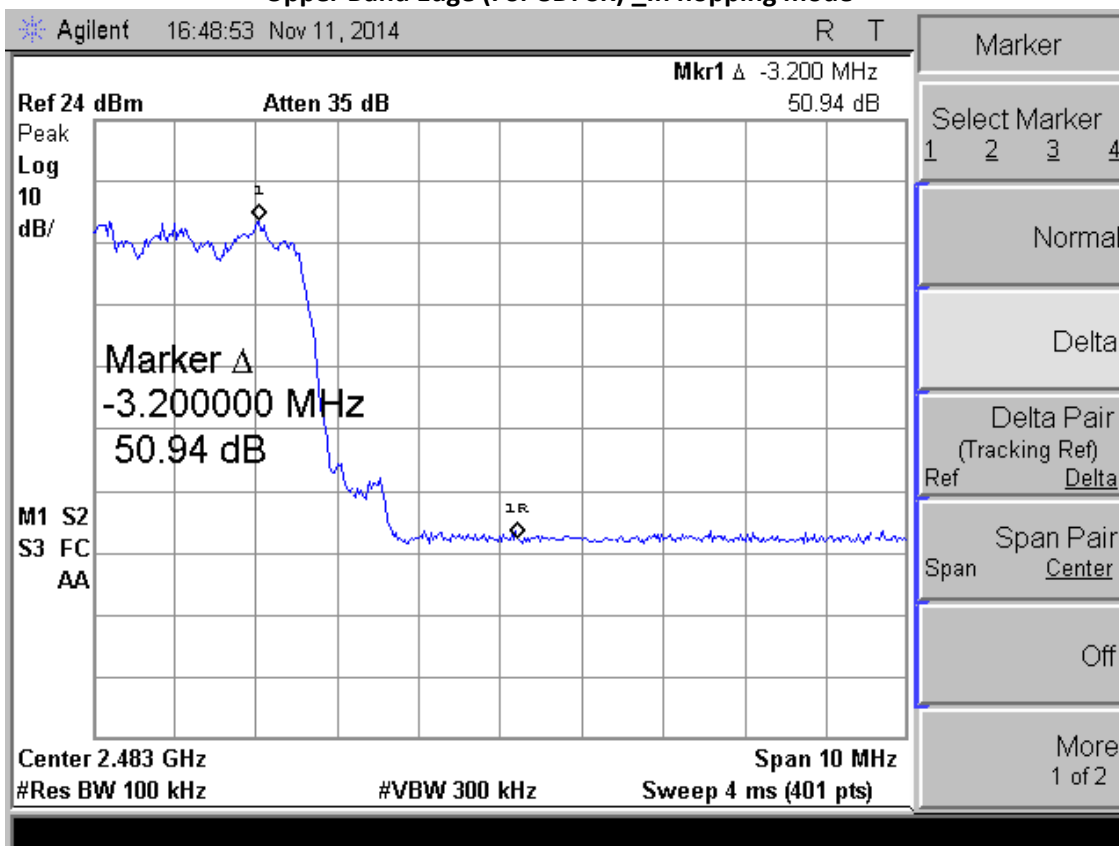
Upper Band Edge (For Pi/4 DQPSK) _In hopping mode



Lower Band Edge (For 8DPSK) _In hopping mode



Upper Band Edge (For 8DPSK) _In hopping mode

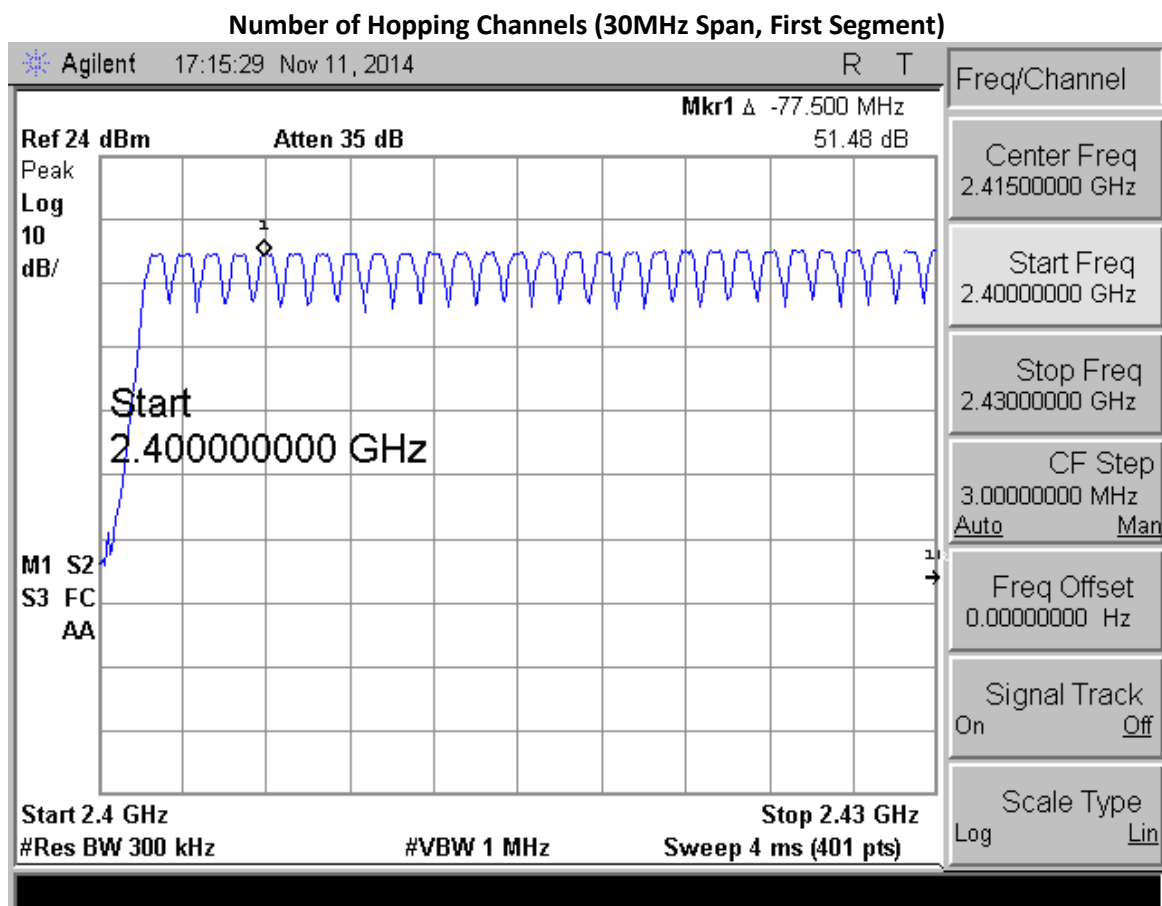


3.4 Number of Hopping Frequency – FCC Section 15.247(a)

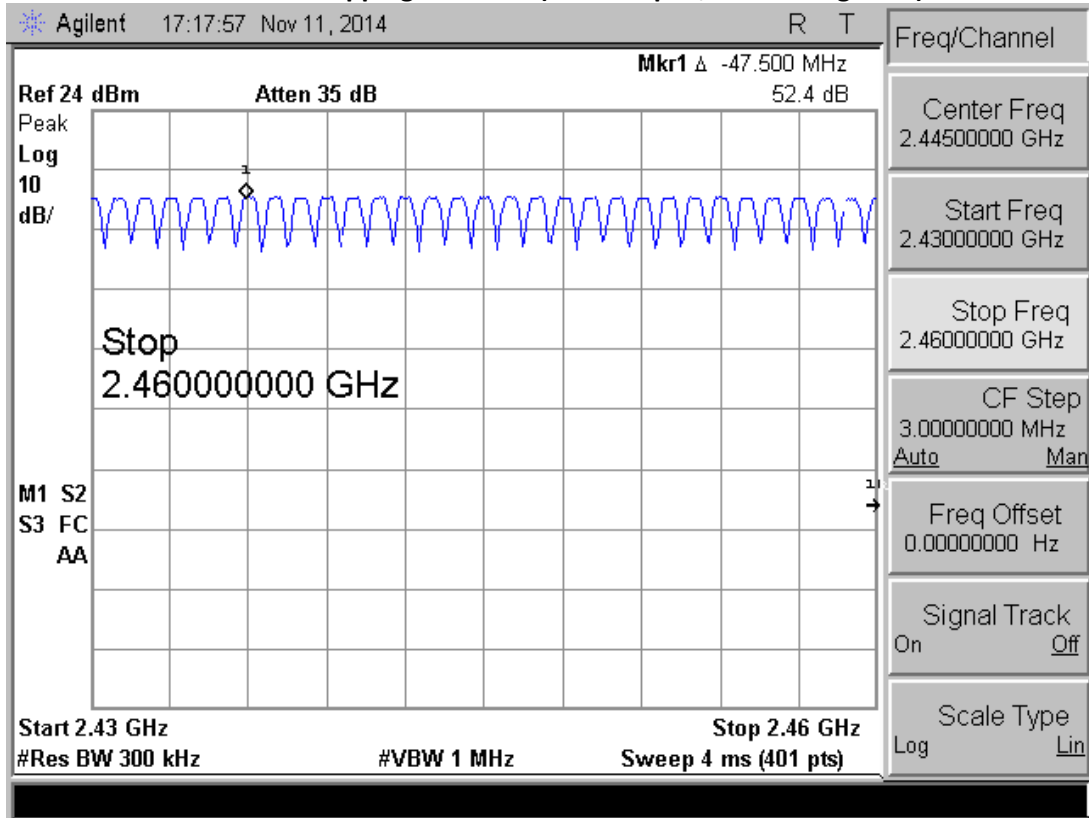
3.4.1 Measurement Procedure

According to FCC Section 15.247(a), frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. There are total 79 channels. The number of hopping frequencies was measured in accordance with the DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. The EUT was set to have its hopping function enabled. The span was set to the frequency band of operation. The RBW was set to $\geq 1\%$ of the span and VBW \geq RBW.

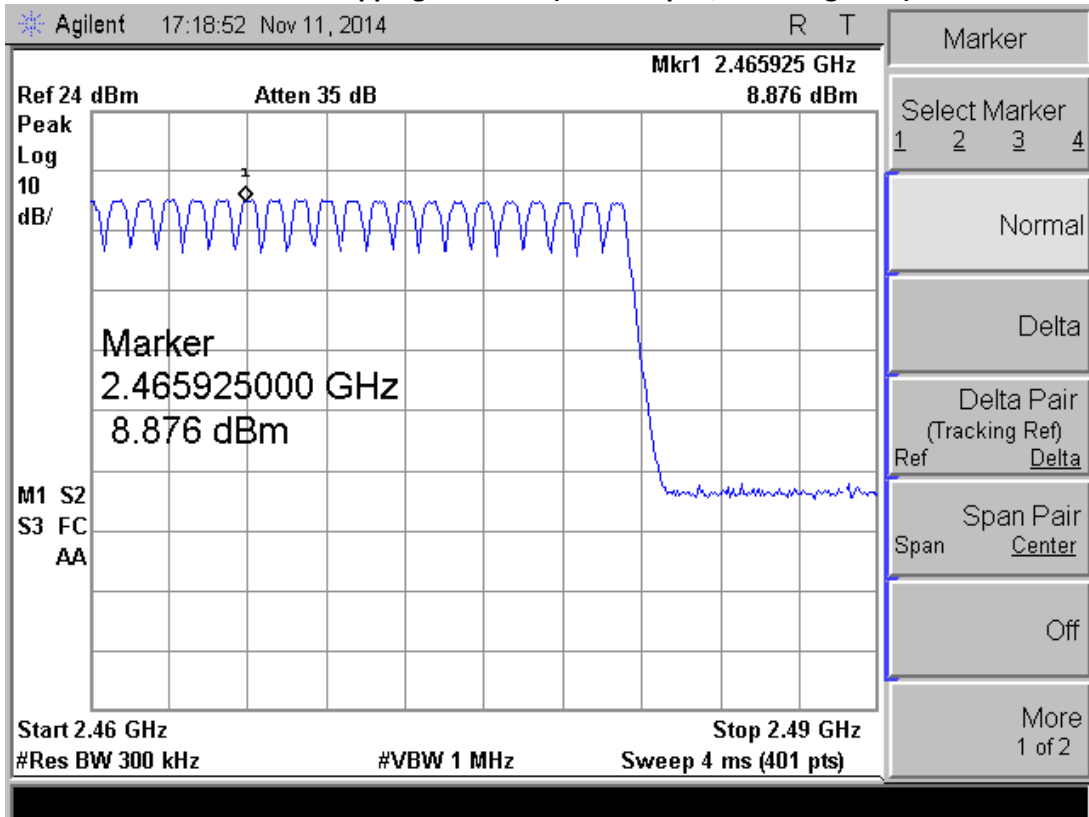
3.4.2 Measurement Result



Number of Hopping Channels (30MHz Span, Second Segment)



Number of Hopping Channels (30MHz Span, Third Segment)



3.5 Time of Occupancy (Dwell Time) – FCC Section 15.247(a)

3.5.1 Measurement Procedure

According to FCC Section 15.247(a), the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. The time of occupancy was measured in accordance with the DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. The EUT was set to have its hopping function enabled. The span was set to zero span, centered on a hopping channel. The RBW was set to 1MHz and $VBW \geq RBW$.

3.6.2 Measurement Result

Dwell time = time slot length * hop rate/number of hopping channels * 30s

A period time = 0.4 (ms) * 79 = 31.6 (s)

For GFSK: Middle Channel

DH1 Time Slot = $0.360(\text{ms}) * (1600/(2*79)) * 31.6 = 115.2 \text{ (ms)}$

DH3 Time Slot = $1.620(\text{ms}) * (1600/(4*79)) * 31.6 = 259.2 \text{ (ms)}$

DH5 Time Slot = $2.850(\text{ms}) * (1600/(6*79)) * 31.6 = 304 \text{ (ms)}$

For Pi/4 DQPSK: Middle Channel

DH1 Time Slot = $0.370(\text{ms}) * (1600/(2*79)) * 31.6 = 118.4 \text{ (ms)}$

DH3 Time Slot = $1.610(\text{ms}) * (1600/(4*79)) * 31.6 = 257.6 \text{ (ms)}$

DH5 Time Slot = $2.870(\text{ms}) * (1600/(6*79)) * 31.6 = 306.13 \text{ (ms)}$

For 8DPSK: Middle Channel

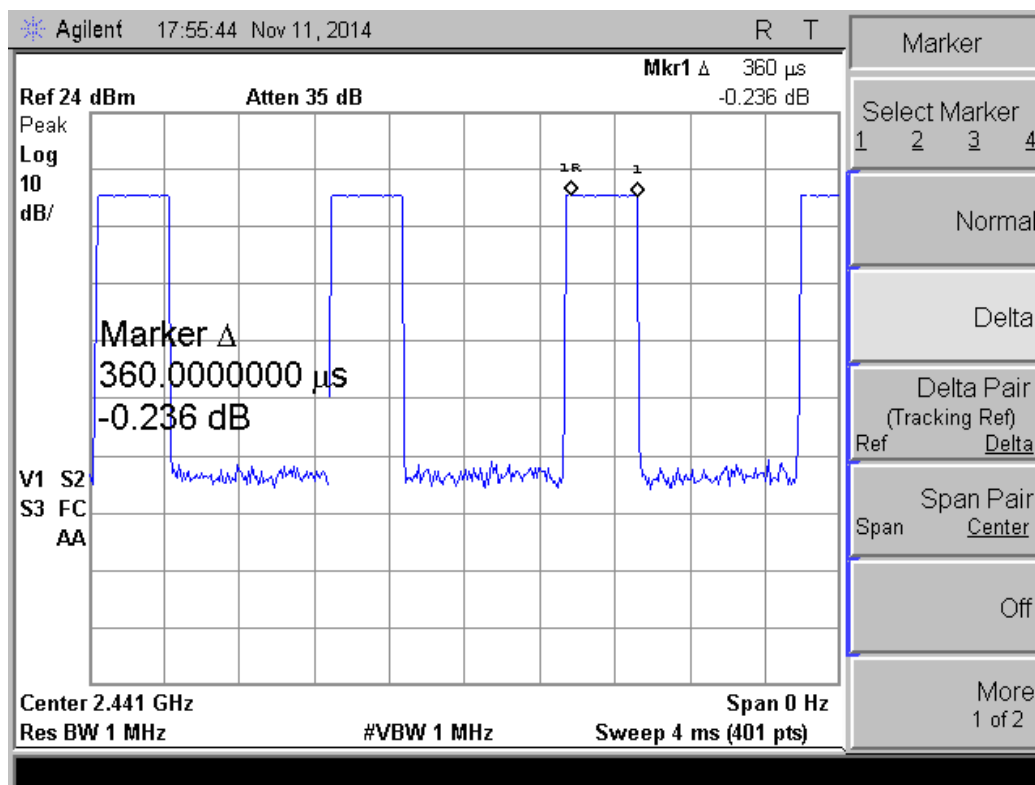
DH1 Time Slot = $0.370(\text{ms}) * (1600/(2*79)) * 31.6 = 118.4 \text{ (ms)}$

DH3 Time Slot = $1.620(\text{ms}) * (1600/(4*79)) * 31.6 = 259.2 \text{ (ms)}$

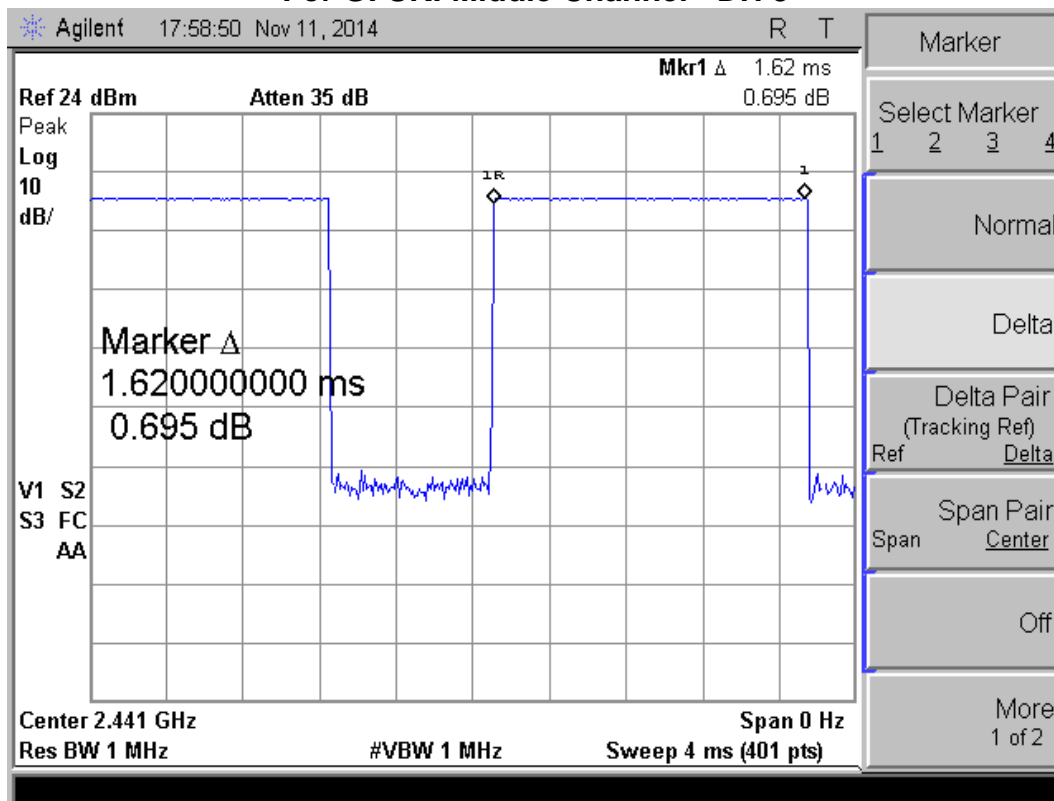
DH5 Time Slot = $2.850(\text{ms}) * (1600/(6*79)) * 31.6 = 304 \text{ (ms)}$

Dwell Time Test Data

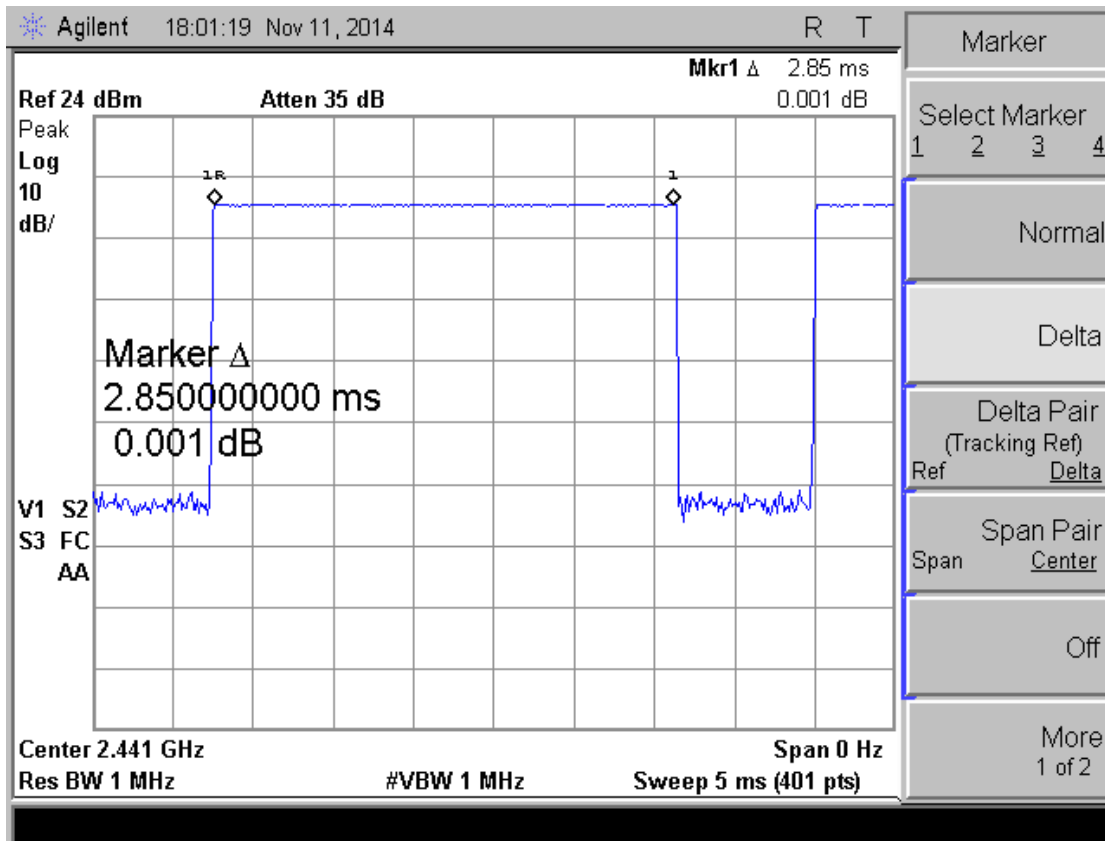
For GFSK: Middle Channel - DH 1



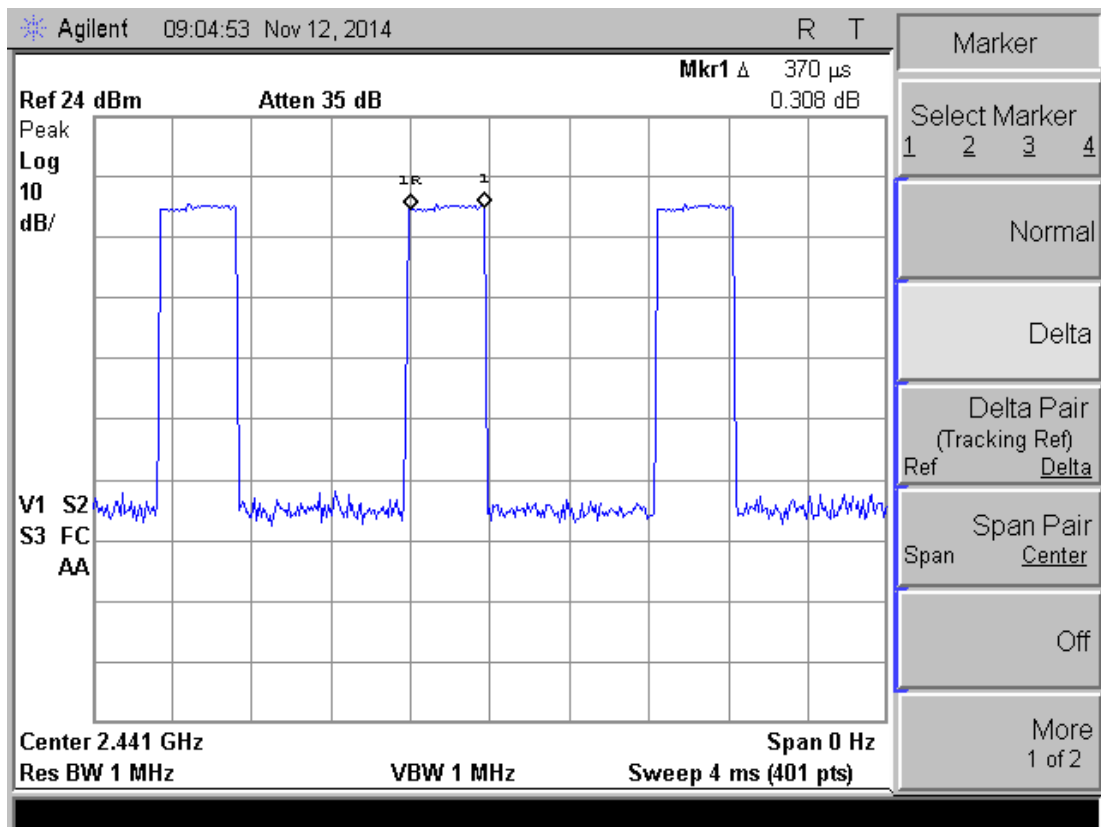
For GFSK: Middle Channel - DH 3



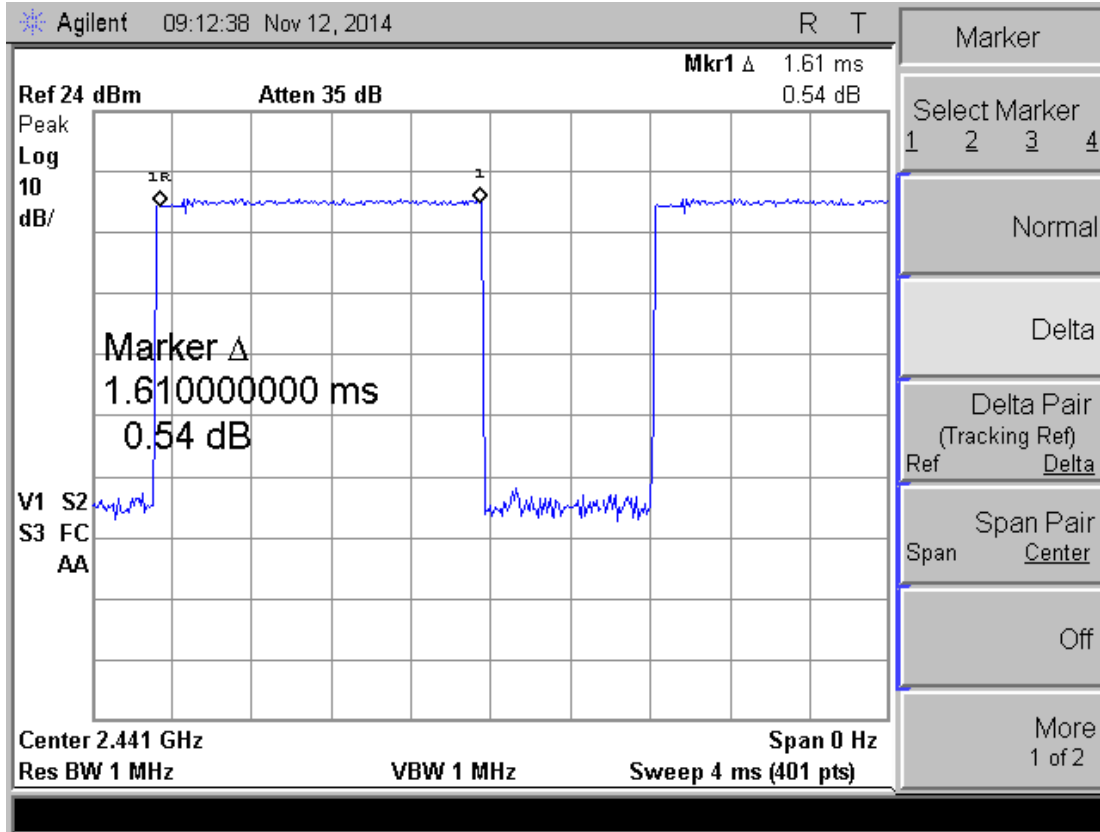
For GFSK: Middle Channel - DH 5



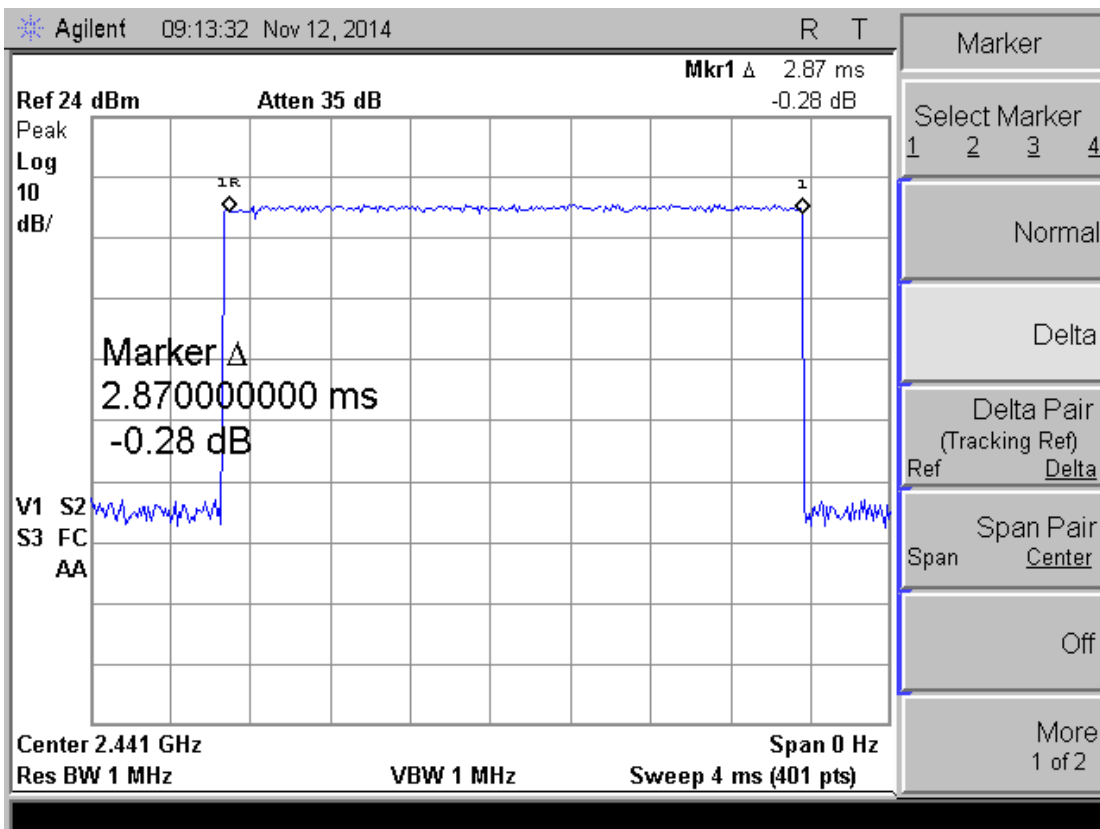
For PI/4 DQPSK: Middle Channel - DH 1



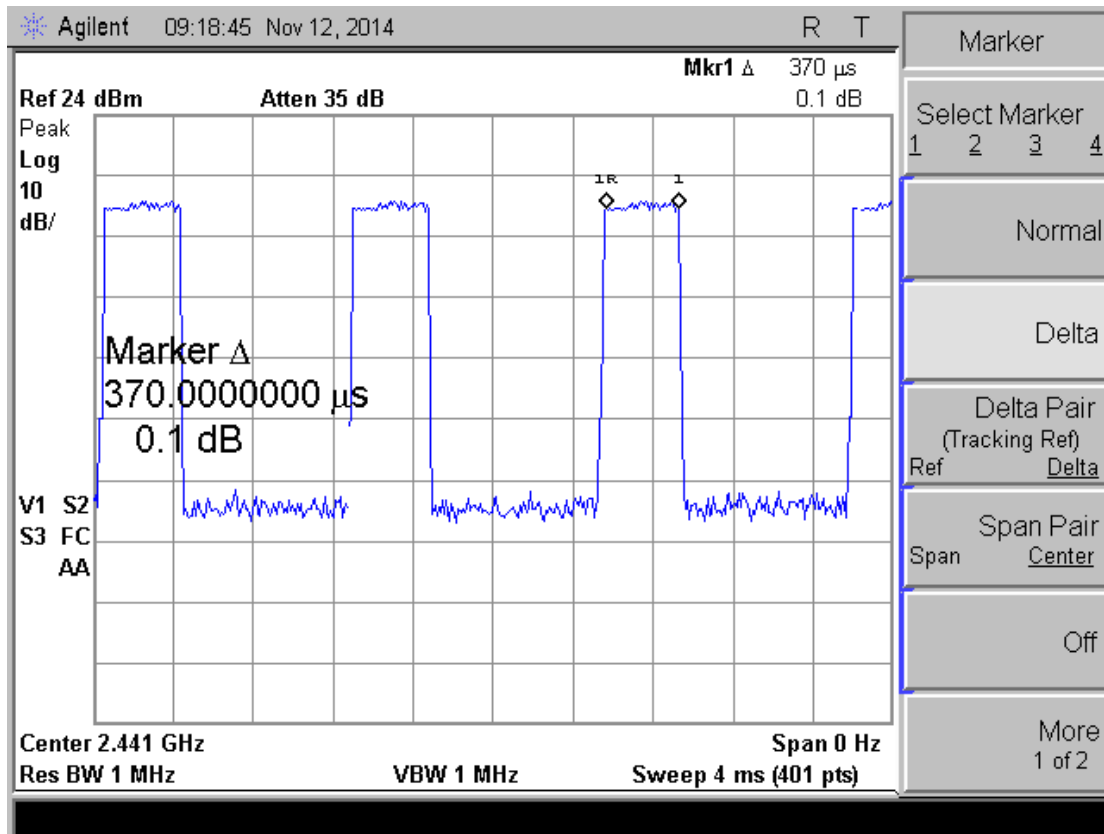
For PI/4 DQPSK: Middle Channel - DH 3



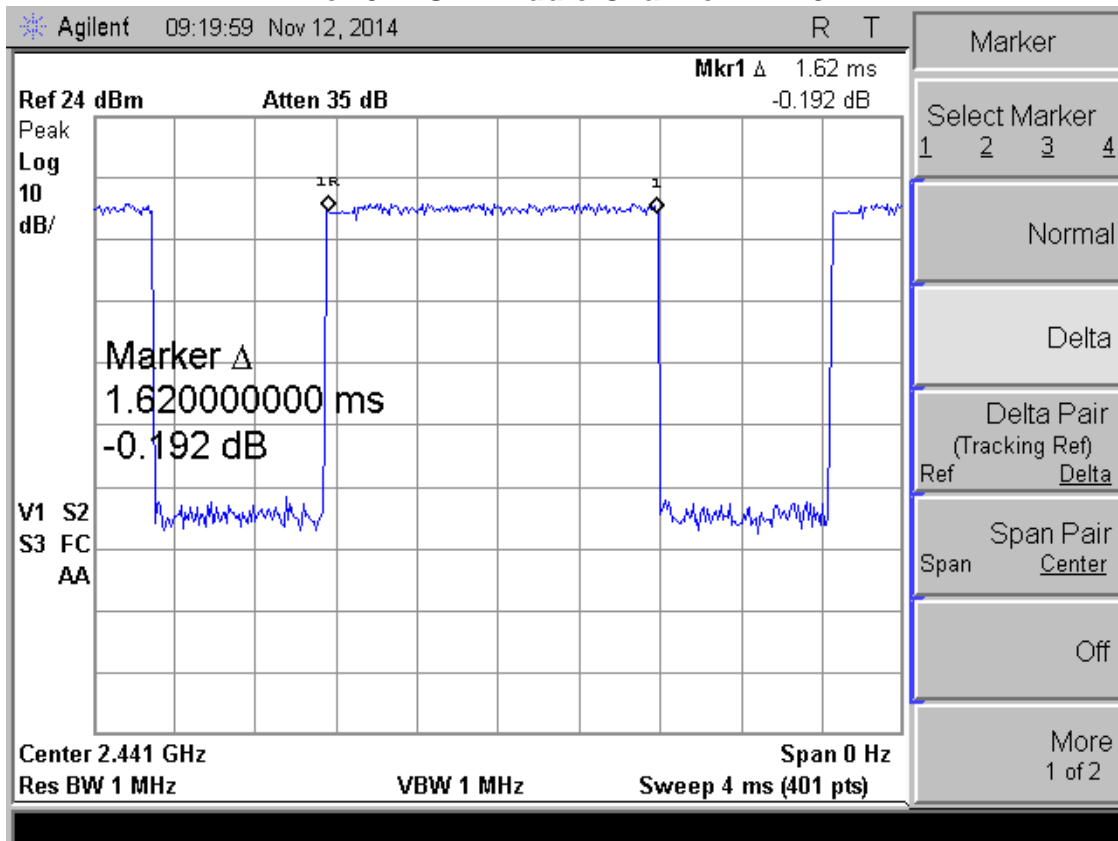
For PI/4 DQPSK: Middle Channel - DH 5



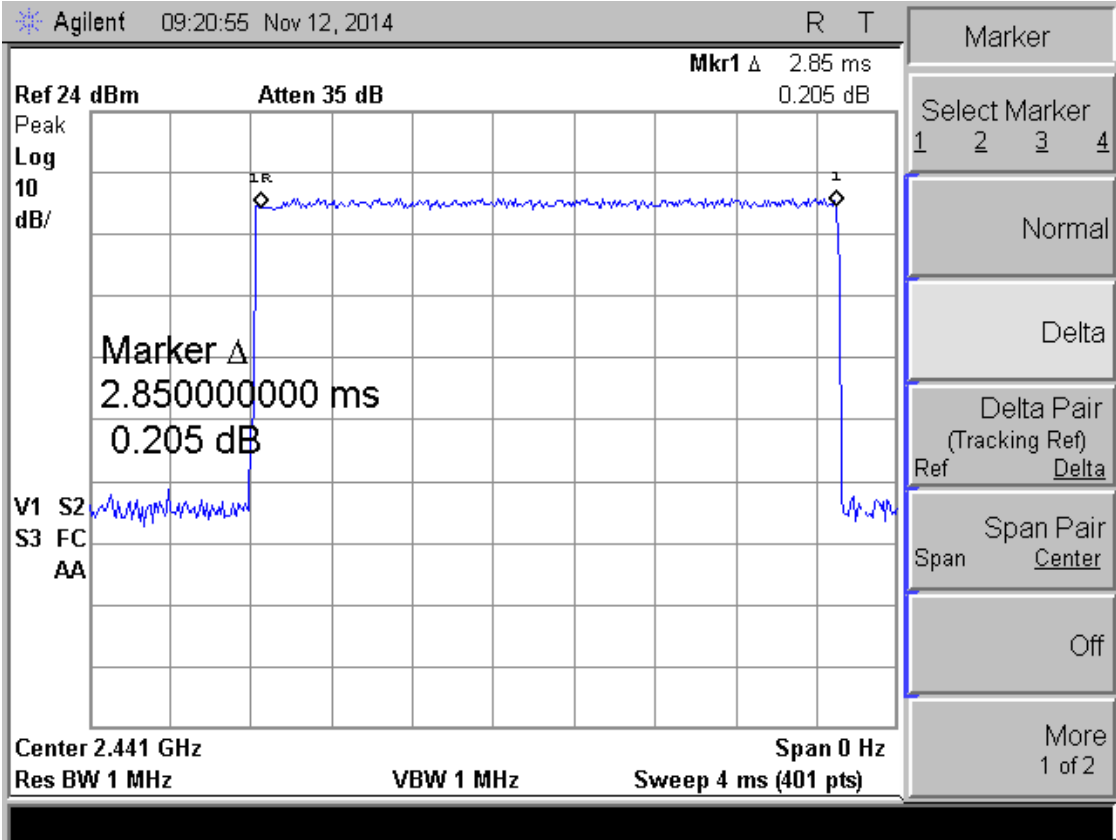
For 8DPSK: Middle Channel - DH 1



For 8DPSK: Middle Channel - DH 3



For 8DPSK: Middle Channel - DH 5

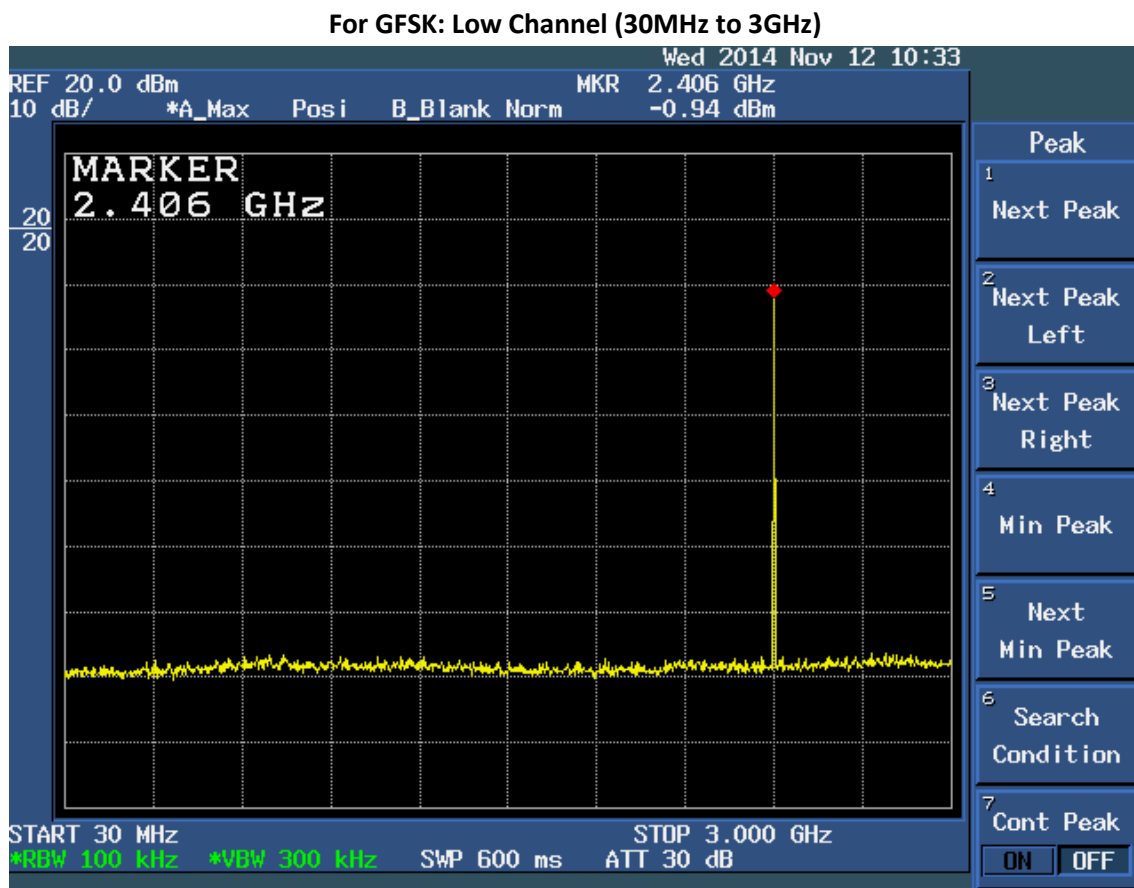


3.6 Conducted Spurious Emissions – FCC Section 15.247(d)

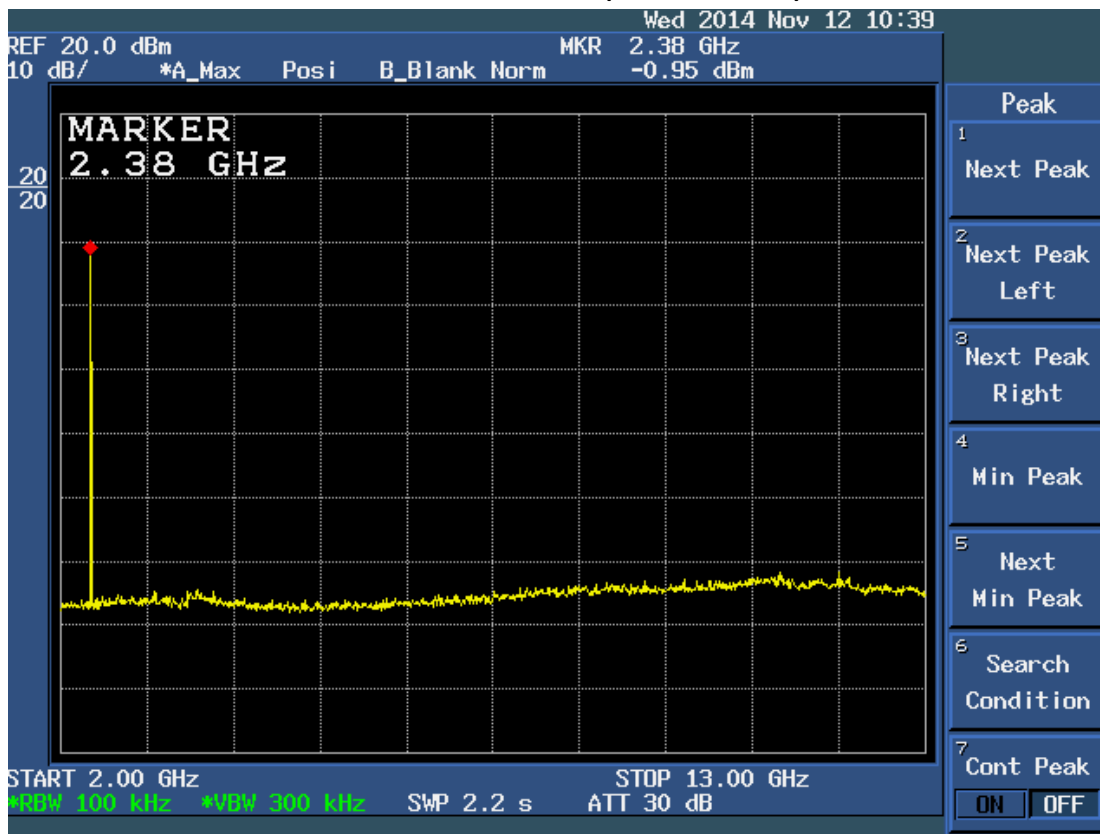
3.6.1 Measurement Procedure

The RF conducted spurious emissions were measured in accordance with the DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer. The EUT was investigated for conducted spurious emissions from 30MHz to 26GHz, 10 times the highest fundamental frequency. Measurements were made at the low, middle and high channels of the EUT. For each measurement, the RBW of the spectrum analyzer was set to 100 kHz and VBW 300 kHz.

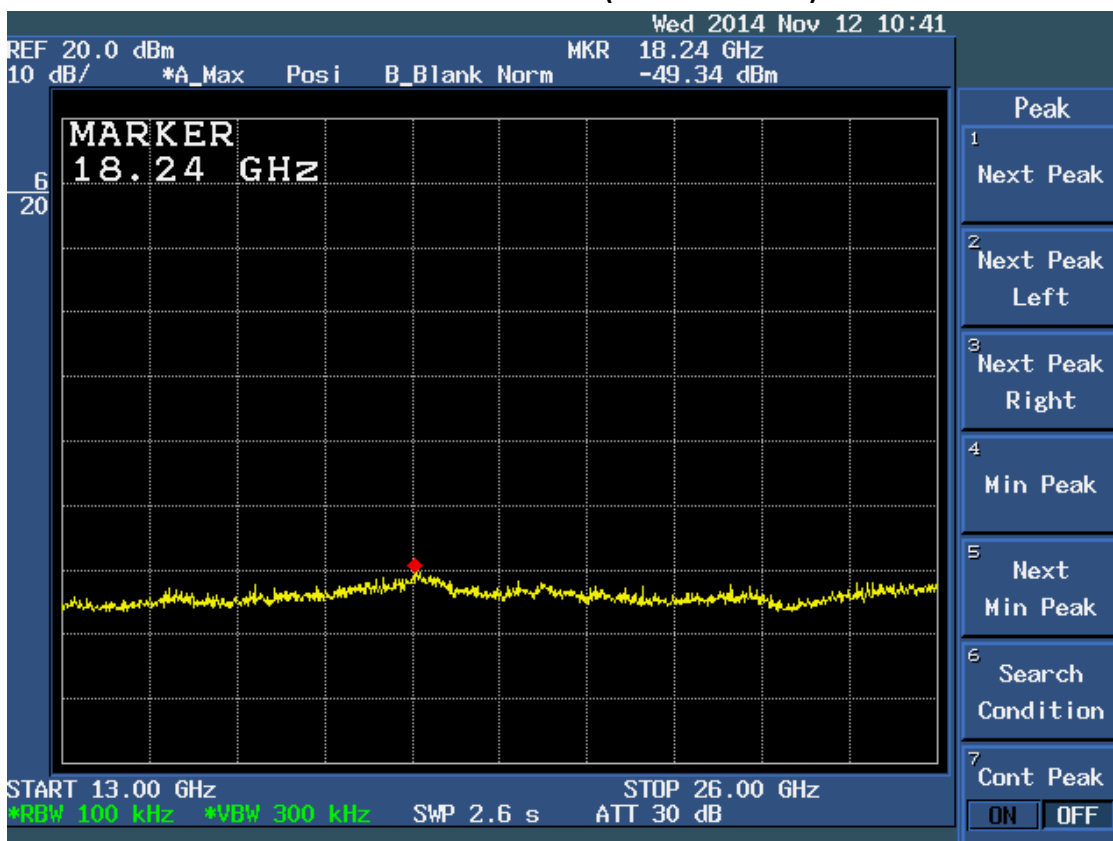
3.6.2 Measurement Result



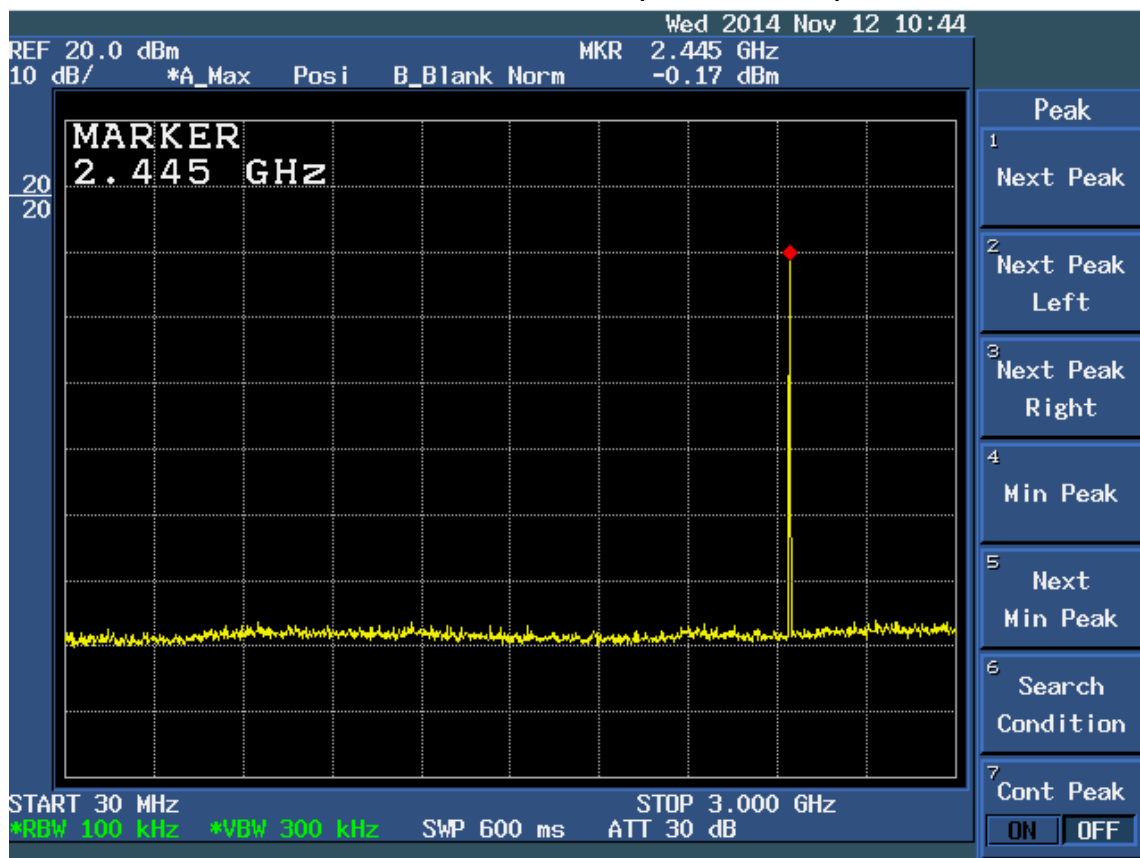
For GFSK: Low Channel (2GHz to 13GHz)



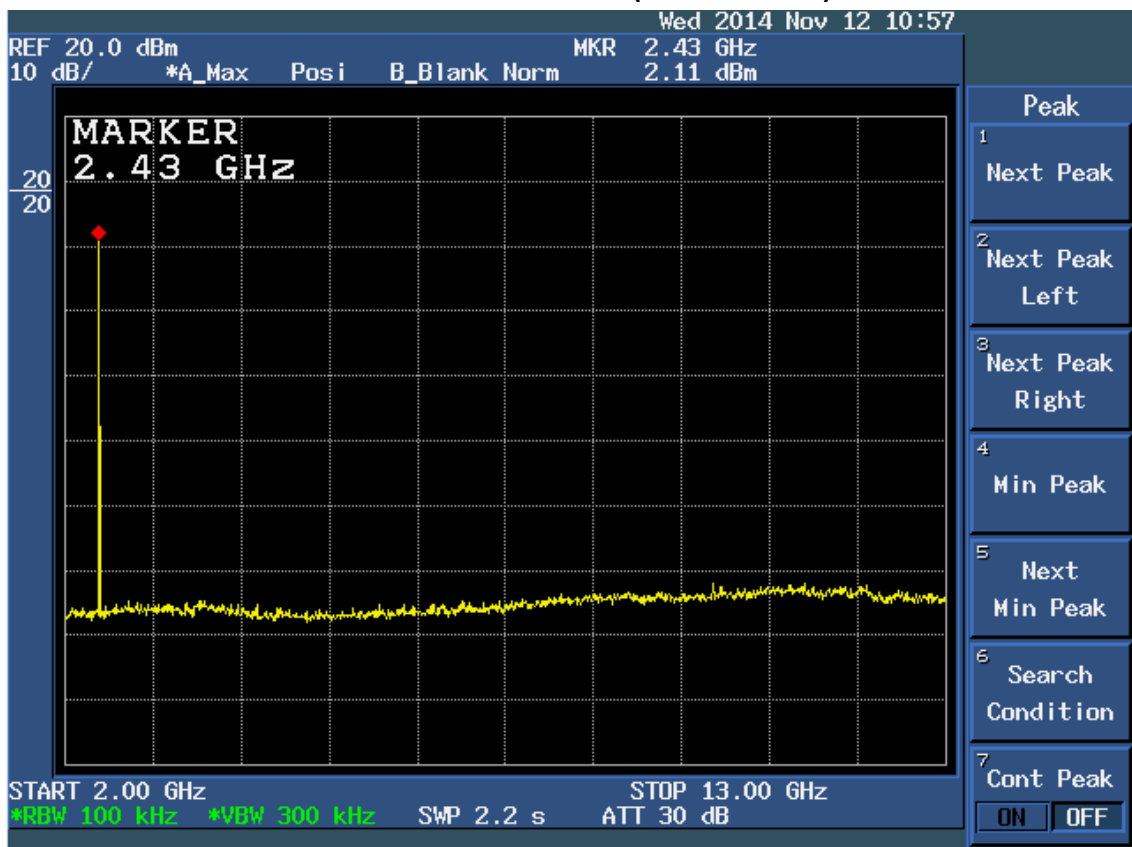
For GFSK: Low Channel (13GHz to 26GHz)



For GFSK: Middle Channel (30MHz to 3GHz)



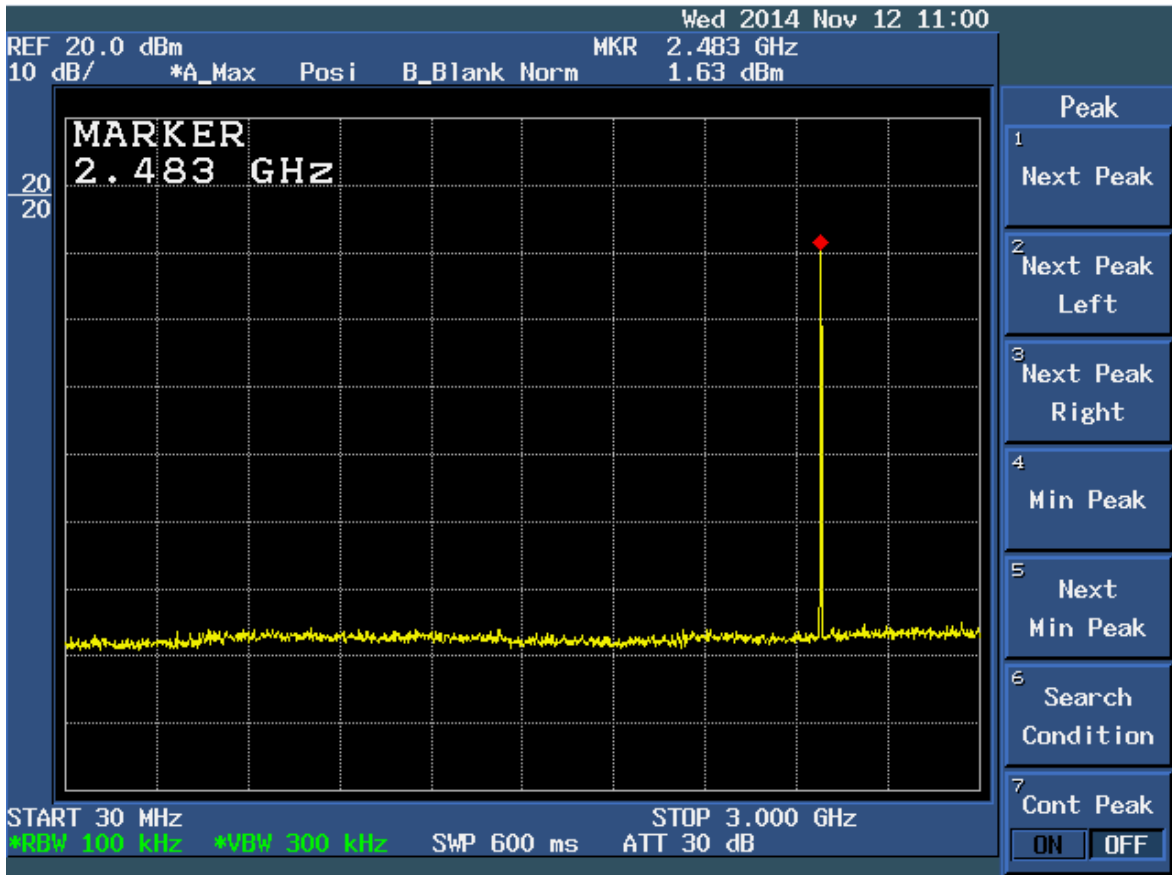
For GFSK: Middle Channel (2GHz to 13GHz)



For GFSK: Middle Channel (13GHz to 26GHz)



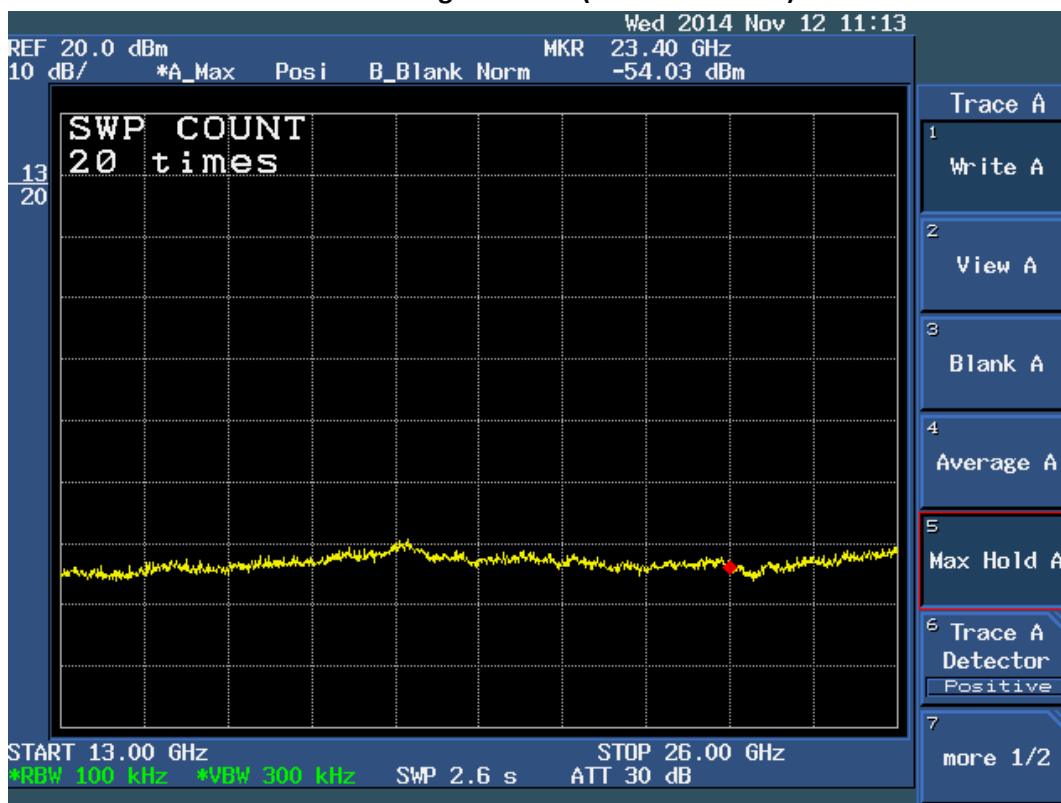
For GFSK: High Channel (30MHz to 3GHz)



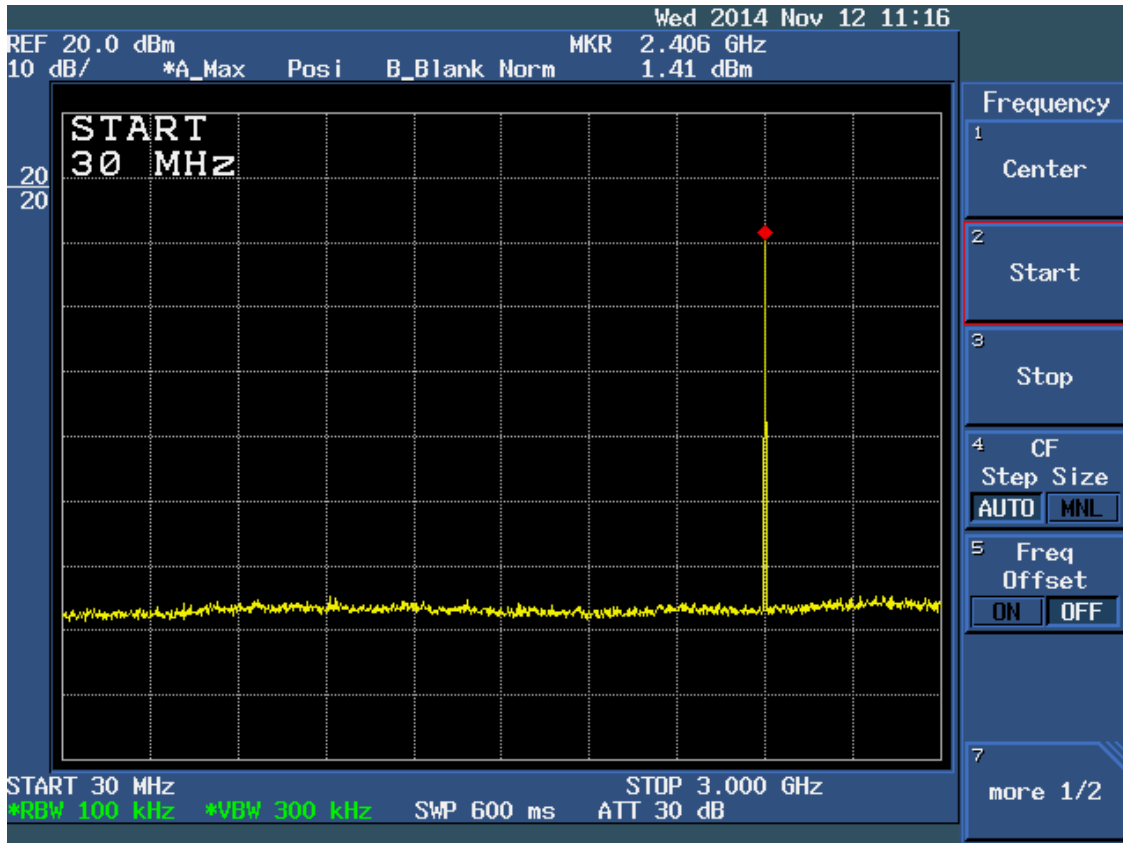
For GFSK: High Channel (2GHz to 13GHz)



For GFSK: High Channel (13GHz to 26GHz)



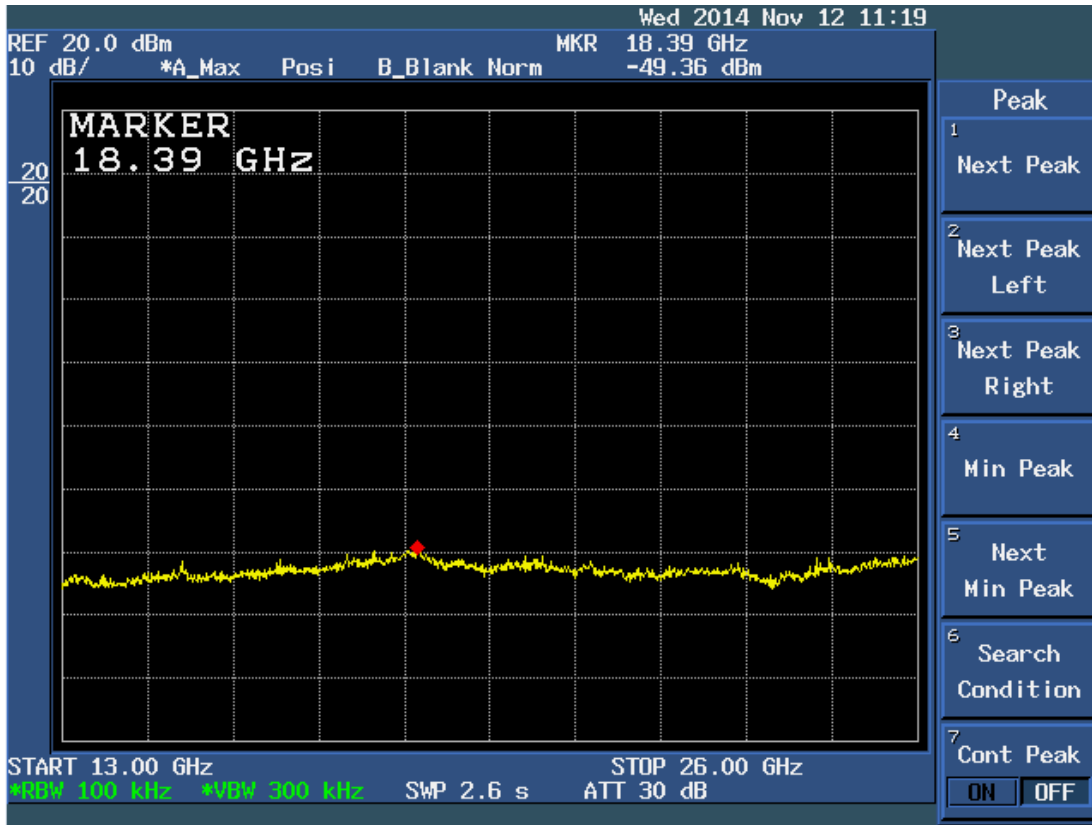
For PI/4 DQPSK: Low Channel (30MHz to 3GHz)



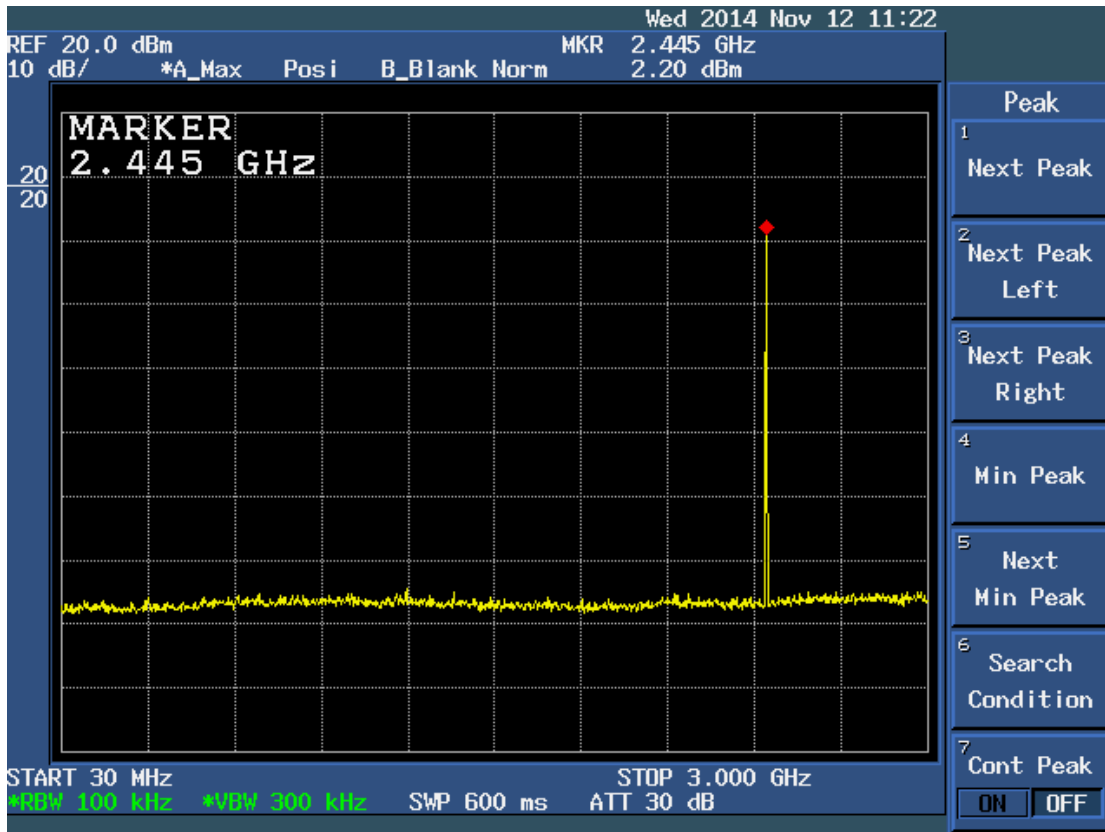
For PI/4 DQPSK: Low Channel (2GHz to 13GHz)



For PI/4 DQPSK: Low Channel (13GHz to 26GHz)



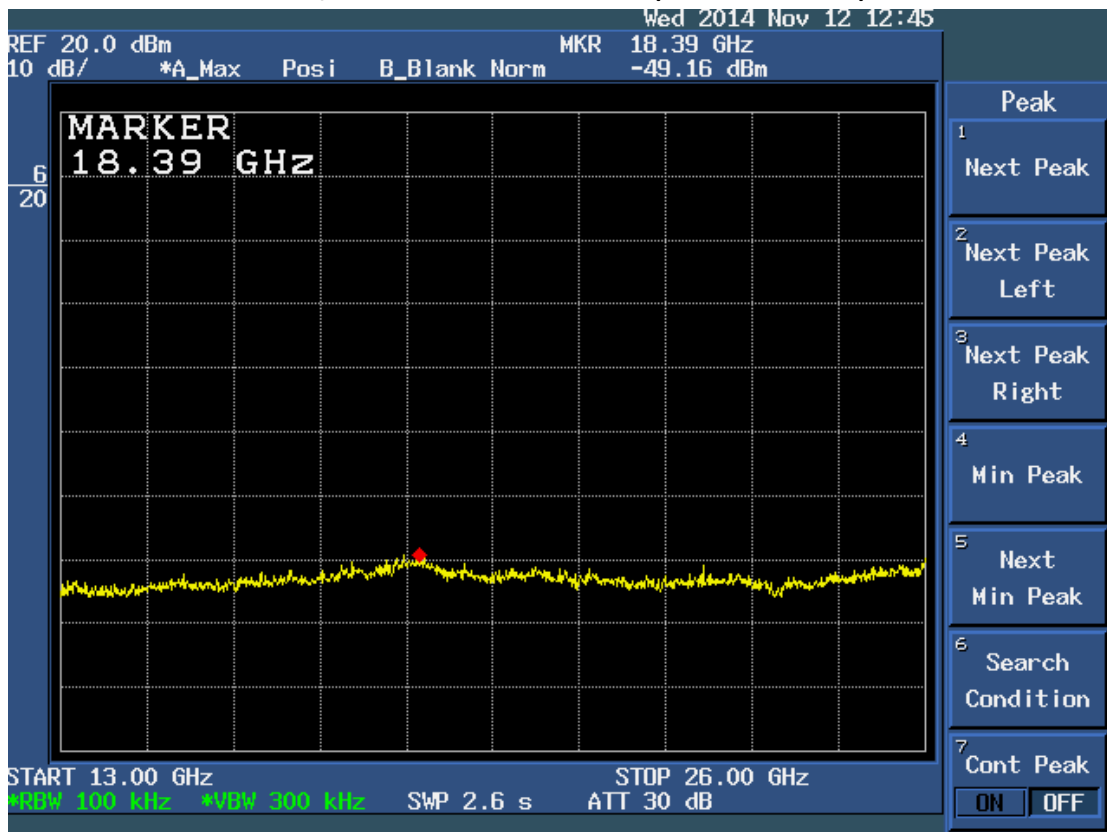
For PI/4 DQPSK: Middle Channel (30MHz to 3GHz)



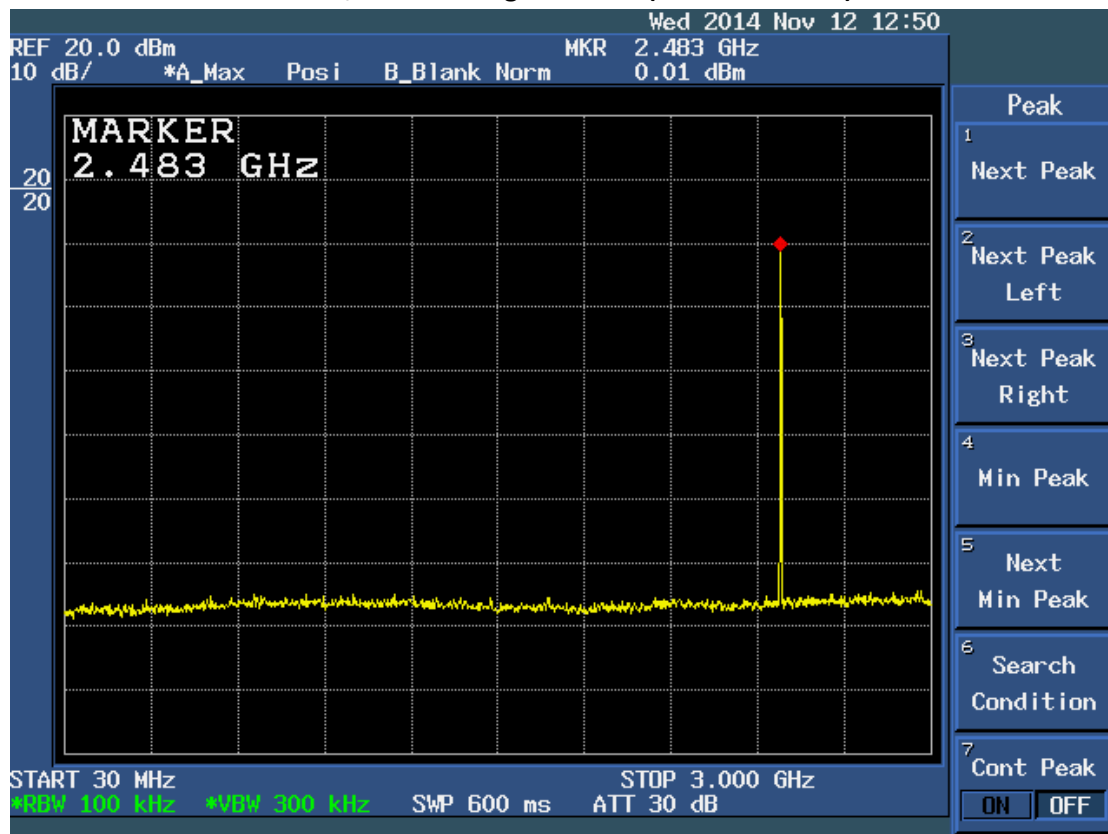
For PI/4 DQPSK: Middle Channel (2GHz to 13GHz)



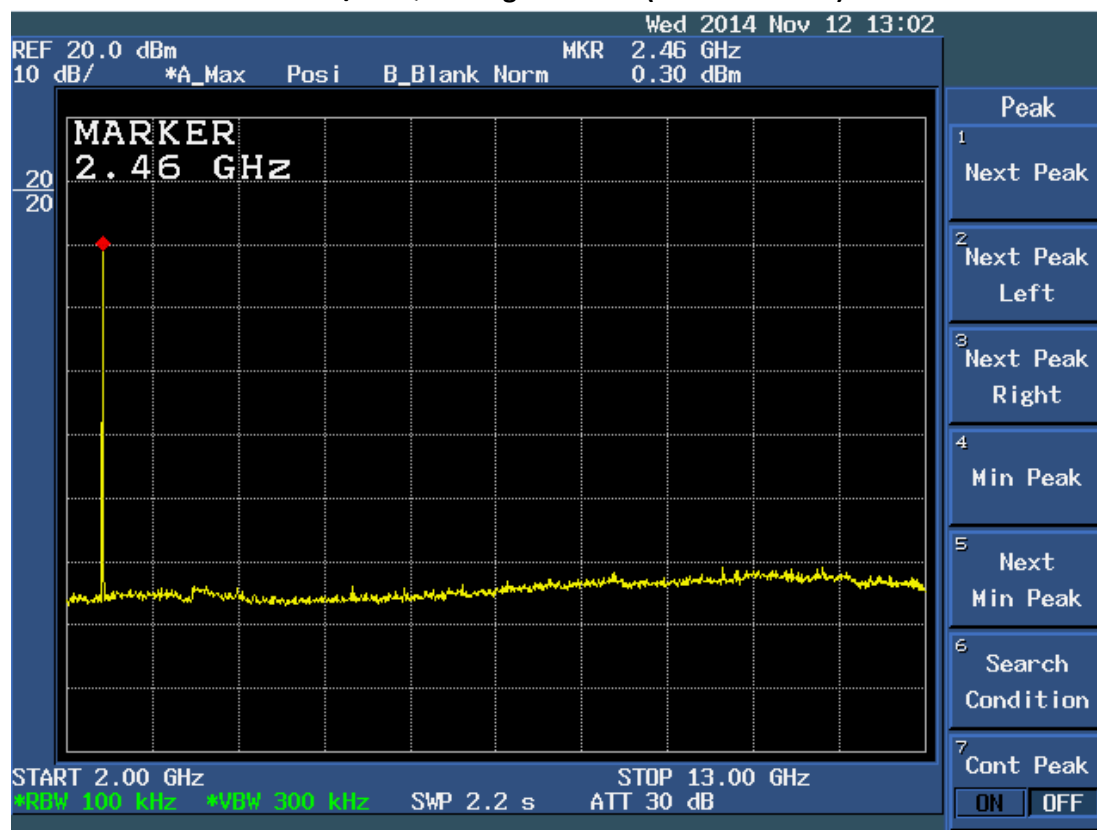
For PI/4 DQPSK: Middle Channel (13GHz to 26GHz)



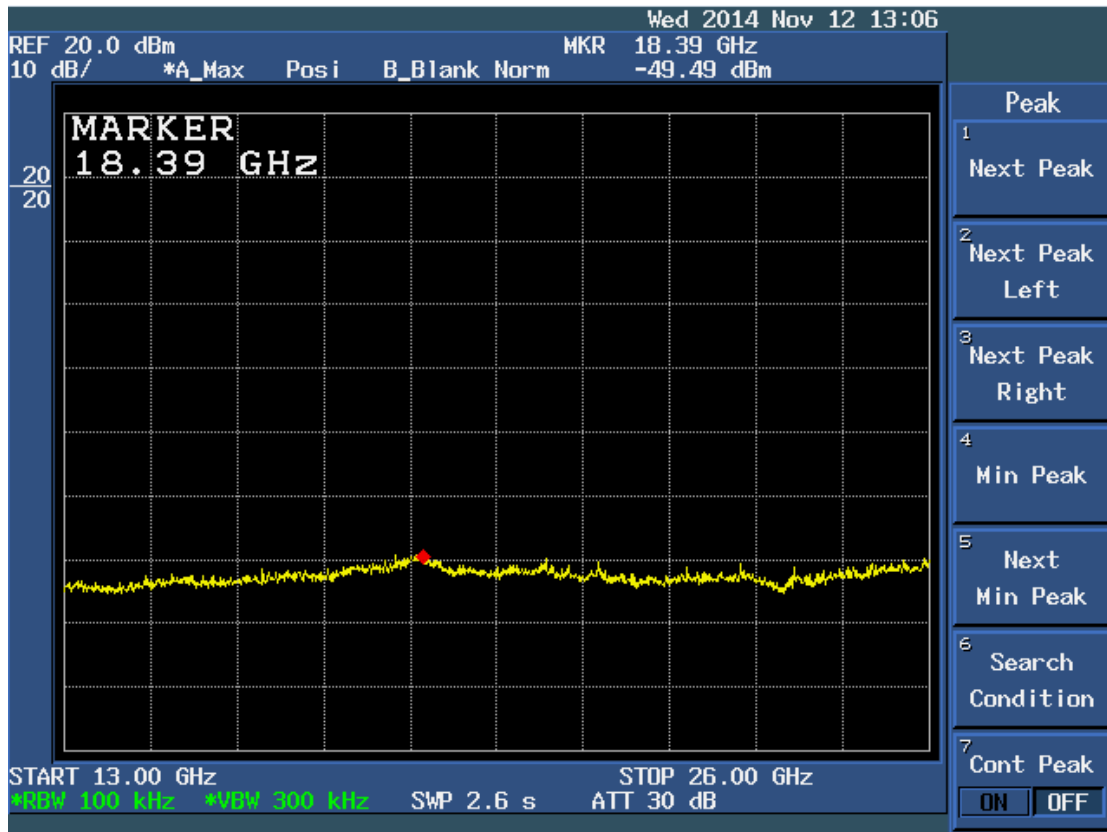
For PI/4 DQPSK: High Channel (30MHz to 3GHz)



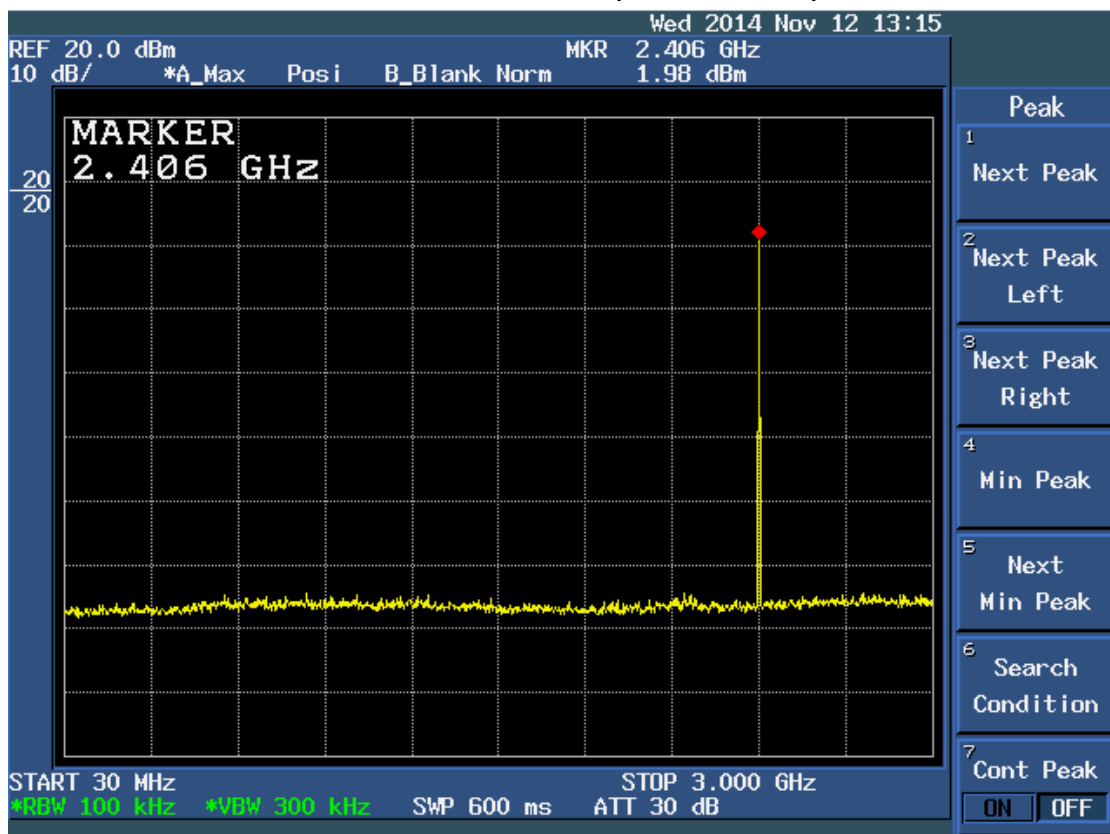
For PI/4 DQPSK: High Channel (2GHz to 13GHz)



For PI/4 DQPSK: High Channel (13GHz to 26GHz)



For 8DPSK: Low Channel (30MHz to 3GHz)



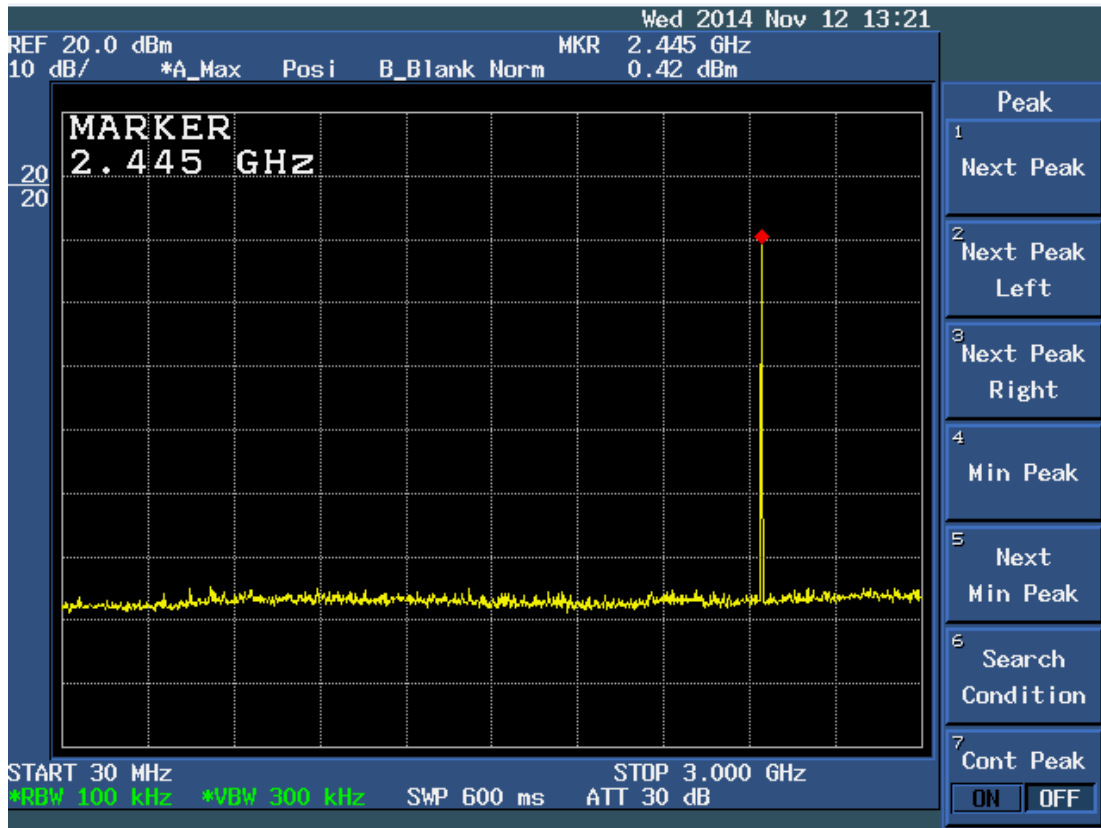
For 8DPSK: Low Channel (2GHz to 13GHz)



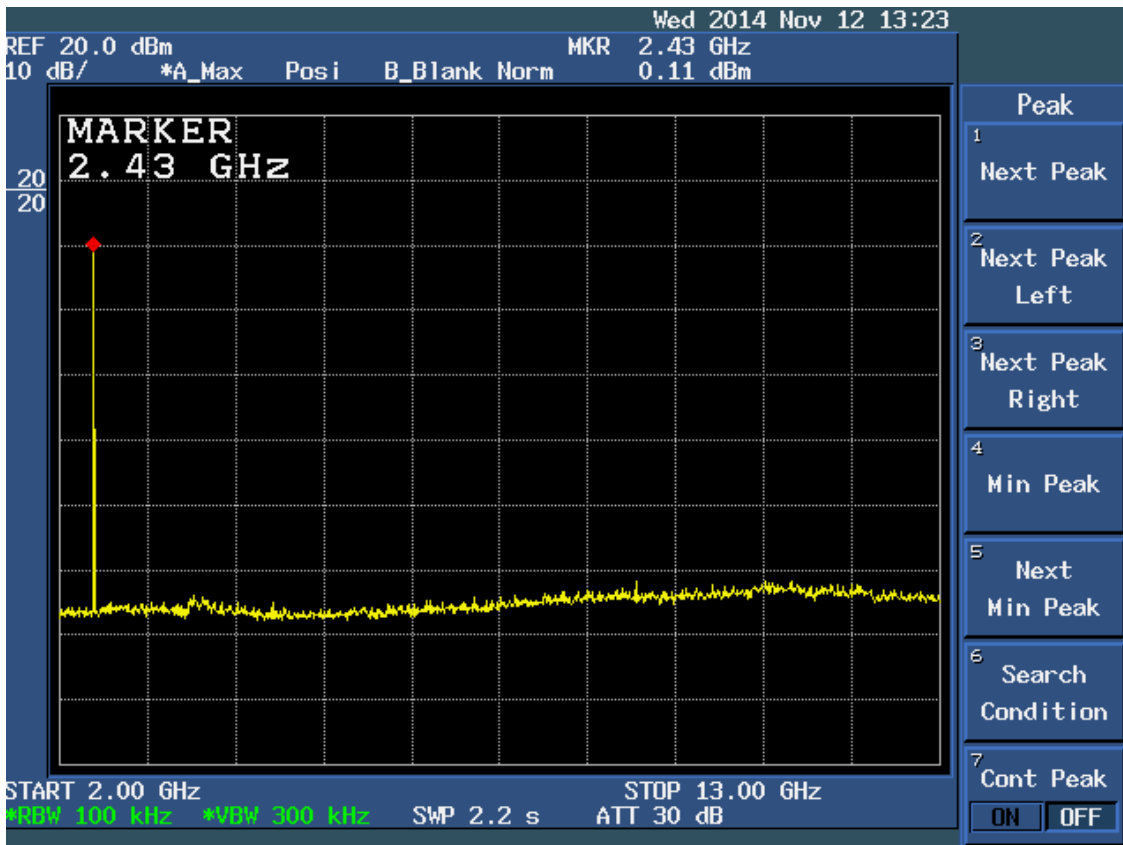
For 8DPSK: Low Channel (13GHz to 26GHz)



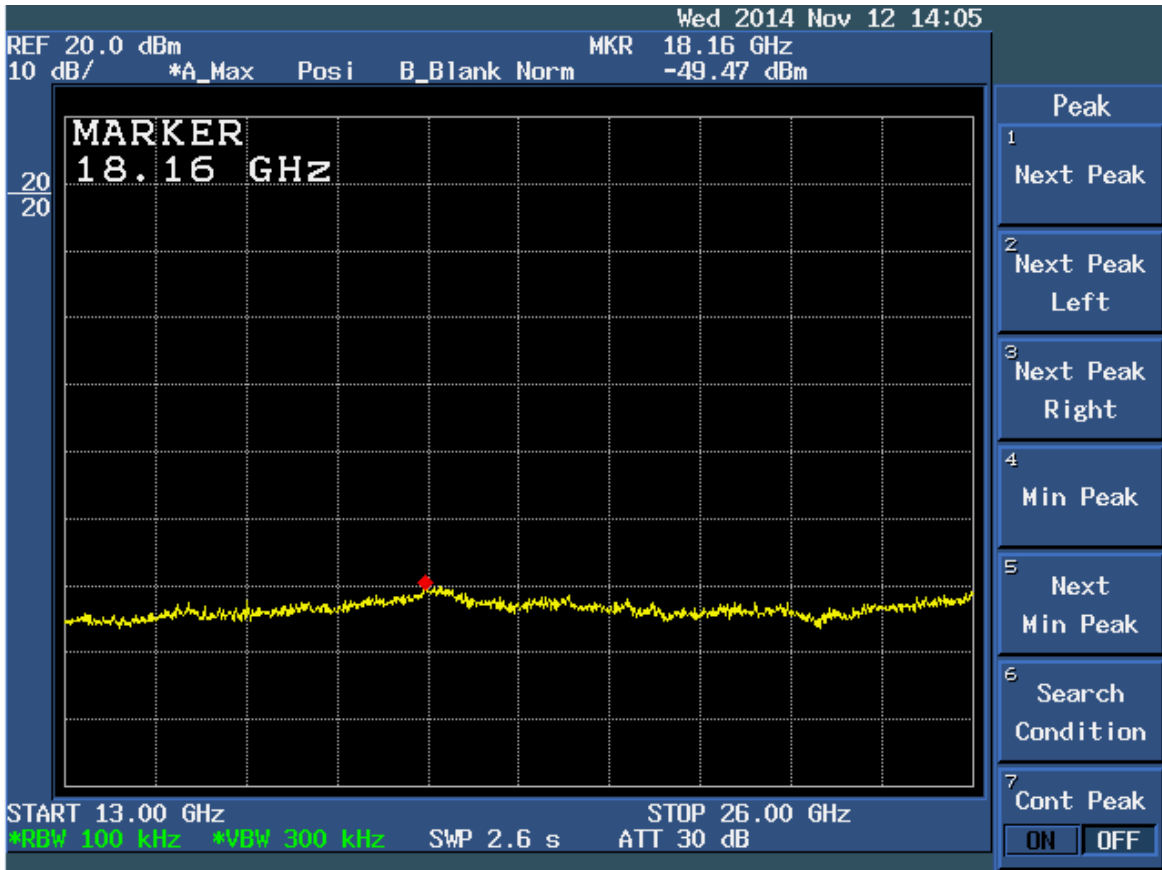
For 8DPSK: Middle Channel (30MHz to 3GHz)



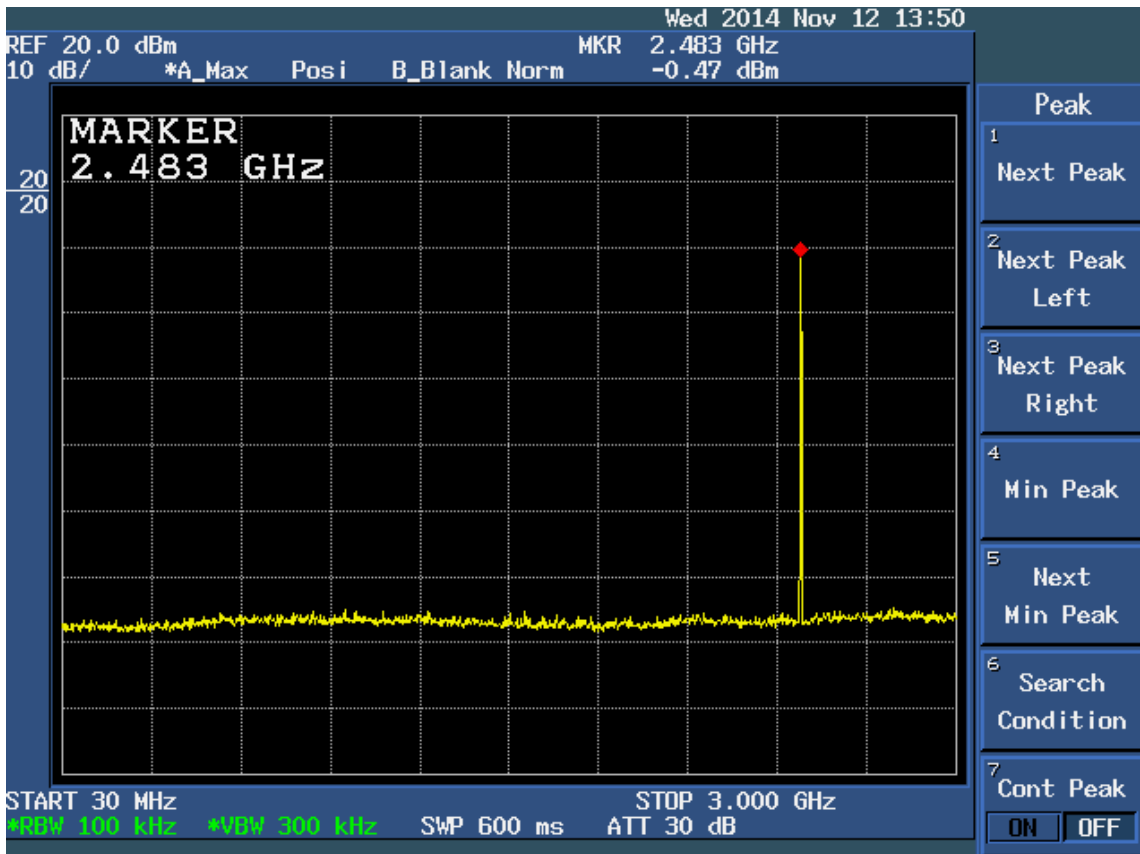
For 8DPSK: Middle Channel (2GHz to 13GHz)



For 8DPSK: Middle Channel (13GHz to 26GHz)



For 8DPSK: High Channel (30MHz to 3GHz)



For 8DPSK: High Channel (2GHz to 13GHz)



For 8DPSK: High Channel (13GHz to 26GHz)

