

# **Bluetooth Conducted Measurements Test** **Report**

**FCC ID: 2ADDK360FLY4K**

**IC: 12404A-360FLY4K**

**FCC Rule Part: CFR 47 Part 15 Subpart C**

**IC Radio Standards Specification: RSS-247**

**Manufacturer: 360fly Inc.**

**Model: 360FLY4K**

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

**Test Begin Date: March 8, 2016**

**Test End Date: April 19, 2016**

**Report Issue Date: April 19, 2016**

**Test By:**

**Name: PS Yeo**

**Signature: *PSYeo***

**Reviewed By:**

**Name: CC Pang**

**Signature: *CCPang***

# 1 List of Test Equipment

Manufacturer	Model	Equipment Type	Serial No.	Last Calibration Date	Calibration Due Date
Agilent	E4404B	Spectrum Analyzer	MY44220422	10 Feb 15	10 Feb 17
Advantest	R3273	Spectrum Analyzer	95090358	06 Oct 14	06 Oct 16
Agilent	N1911A	Power Meter	MY53150005	12 Jun 15	12 Jun 17
Agilent	N1921A	Power Sensor	MY53160021	23 Jun 15	23 Jun 16

# 2 Applicable Standard References

The following standards were used:

FCC Rules	IC Rules	Description of Test	Result
§ 15.247 (a)	RSS 247, 5.1.1, 5.1.2	Frequency Separation & 20dB Bandwidth	Pass
§ 15.247 (b)	RSS 247, 5.4.2	Peak Output Power	Pass
§ 15.247 (c)	RSS 247, 5.5	Band-Edge Compliance of RF Conducted Emissions	Pass
§ 15.247 (a)	RSS 247, 5.1.4	Number of Hopping Frequencies	Pass
§ 15.247 (a)	RSS 247, 5.1.4	Time of Occupancy (Dwell Time)	Pass
§ 15.209	RSS 247, 5.5	Spurious Emission	Pass

# 3 Summary of Tests

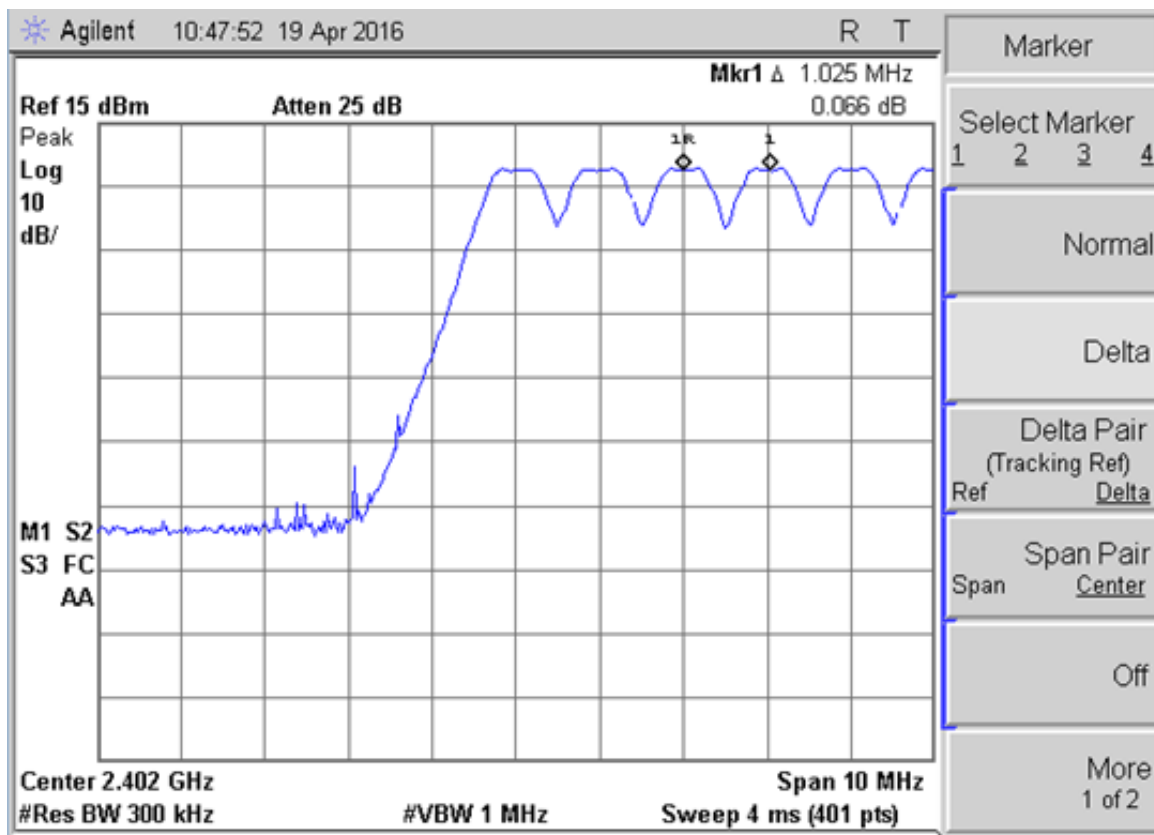
## 3.1 Frequency Separation & 20 dB Bandwidth – FCC Section 15.247 (a)(1) RSS 247, 5.1.1, 5.1.2

### 3.1.1 Measurement Procedure

According to § 15.247(a)(1), and **RSS 247, 5.1.1, 5.1.2** 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 ANSI C63.10 Section 6.9.2, 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% to 5% of the emission bandwidth. 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.

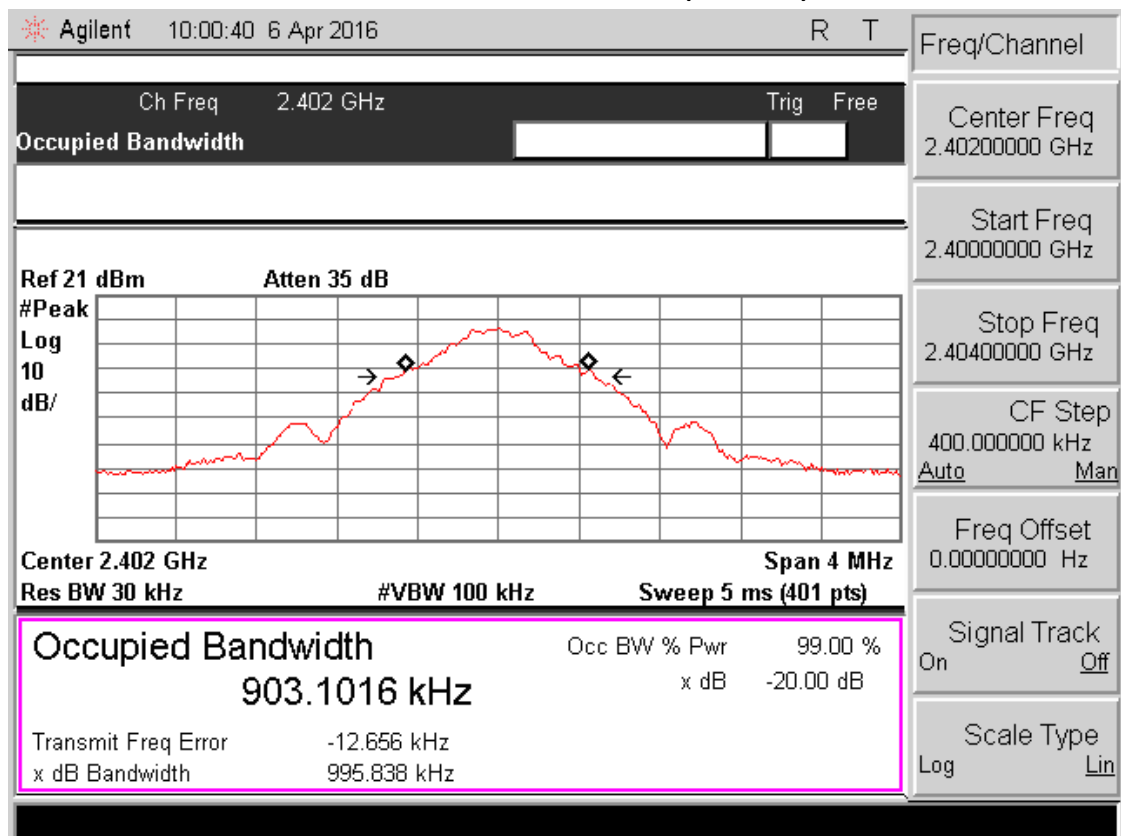
### 3.1.2 Measurement Result



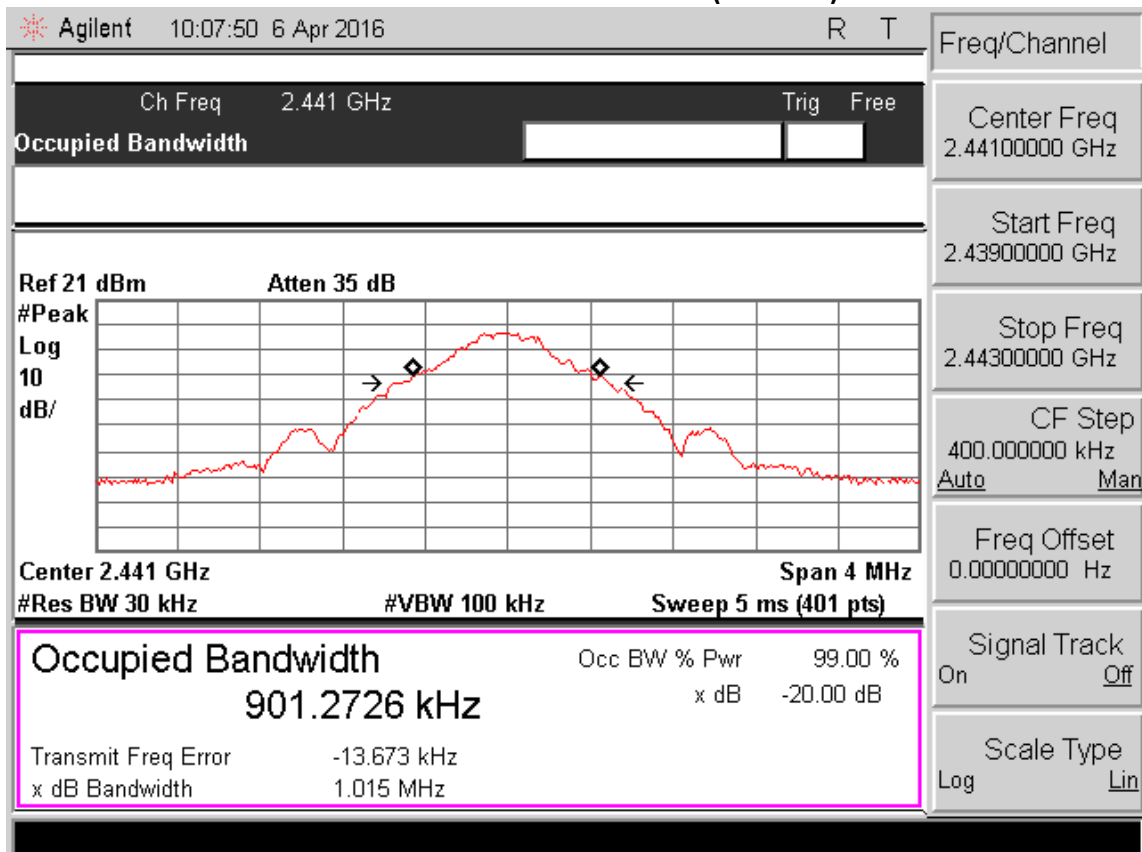
Frequency (MHz)	For GFSK: 20dB Bandwidth (MHz)	For pi/4 DQPSK: 20dB Bandwidth (MHz)	For 8DPSK: 20dB Bandwidth (MHz)
2402	0.996	1.289	1.301
2441	1.015	1.294	1.304
2480	1.012	1.302	1.312

Frequency (MHz)	For GFSK: 99% Bandwidth (MHz)	For pi/4 DQPSK: 99% Bandwidth (MHz)	For 8DPSK: 99% Bandwidth (MHz)
2402	0.903	1.172	1.178
2441	0.901	1.174	1.178
2480	0.904	1.175	1.189

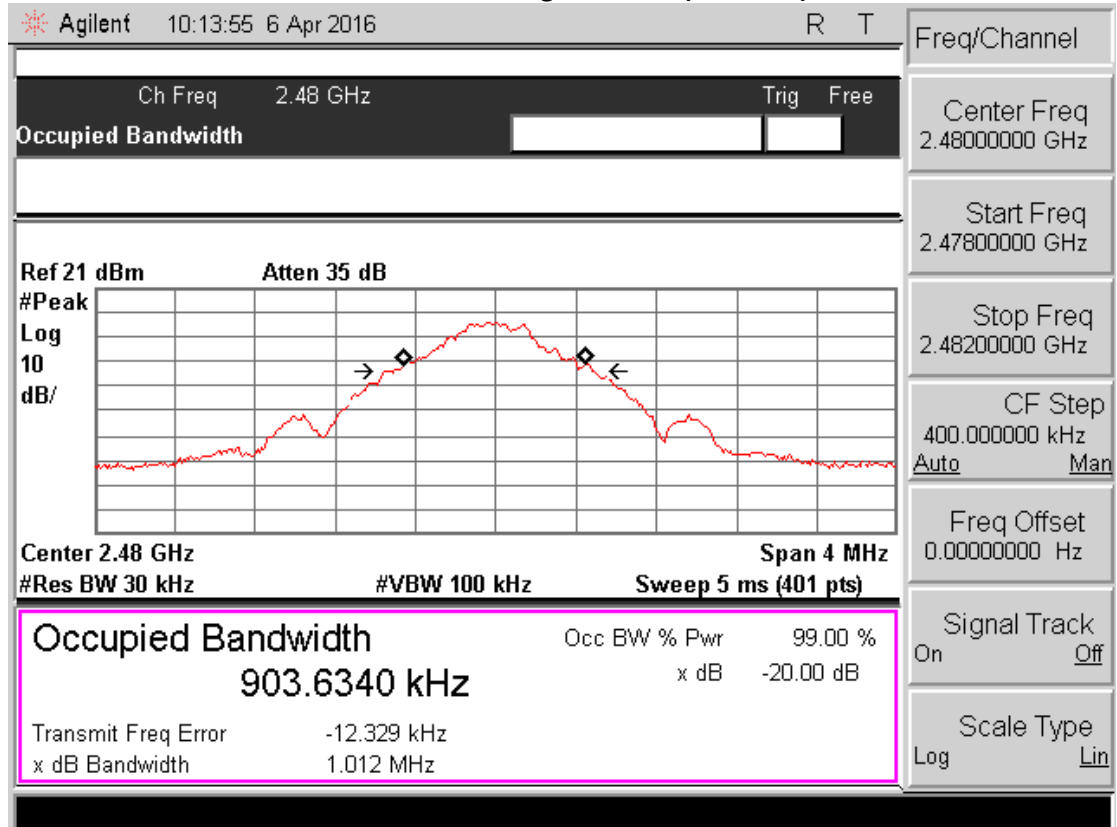
### 99% Bandwidth-Low Channel (For GFSK)



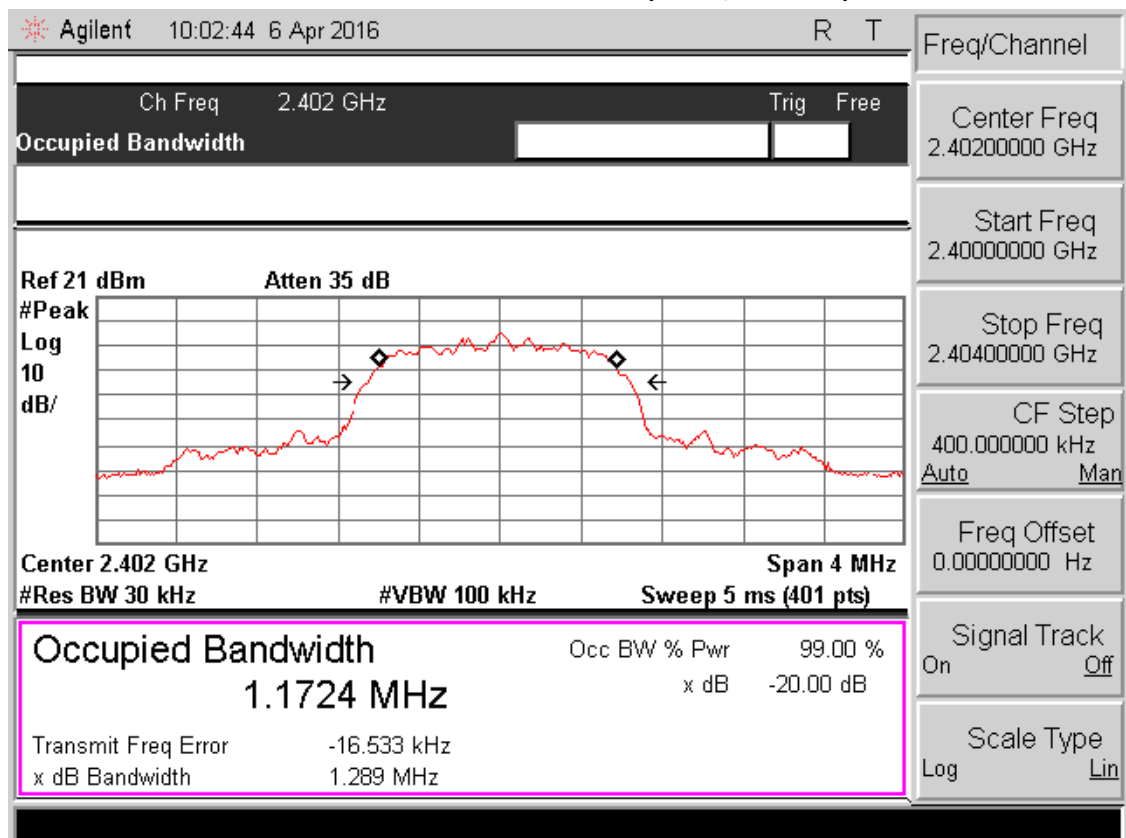
### 99% Bandwidth-Middle Channel (For GFSK)

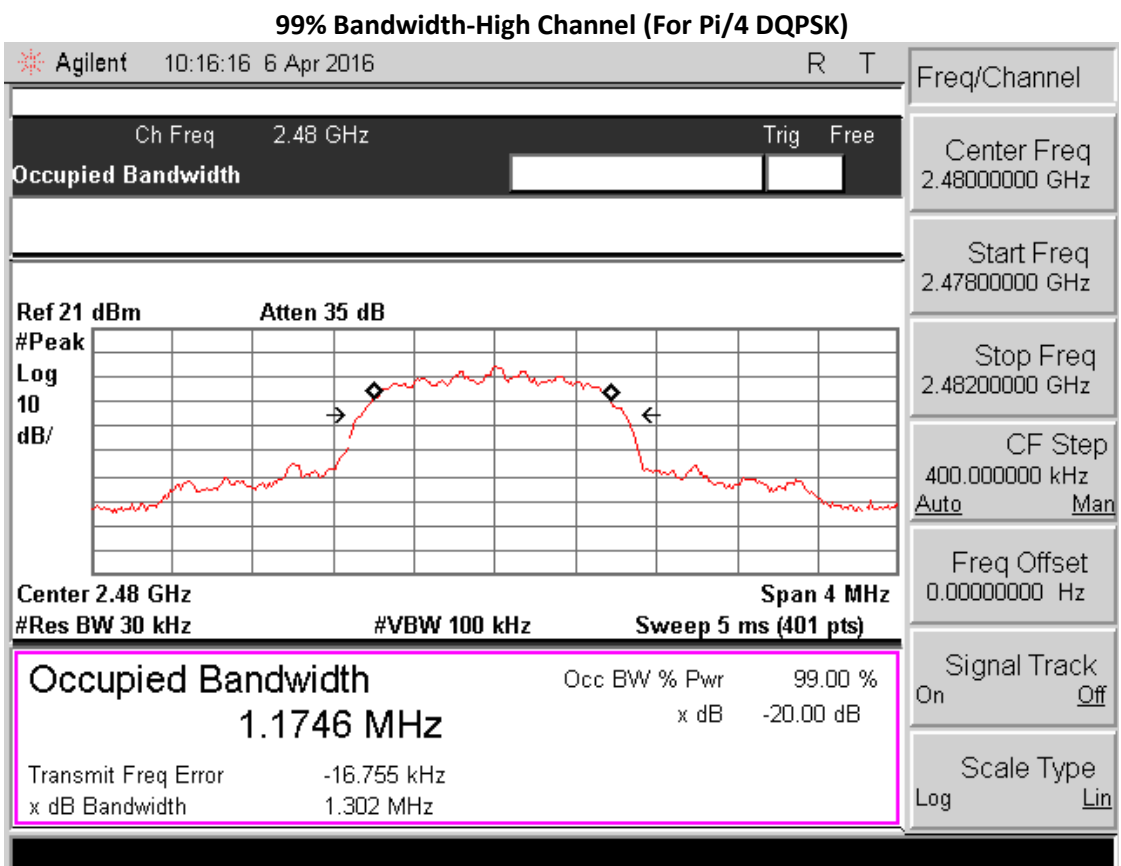
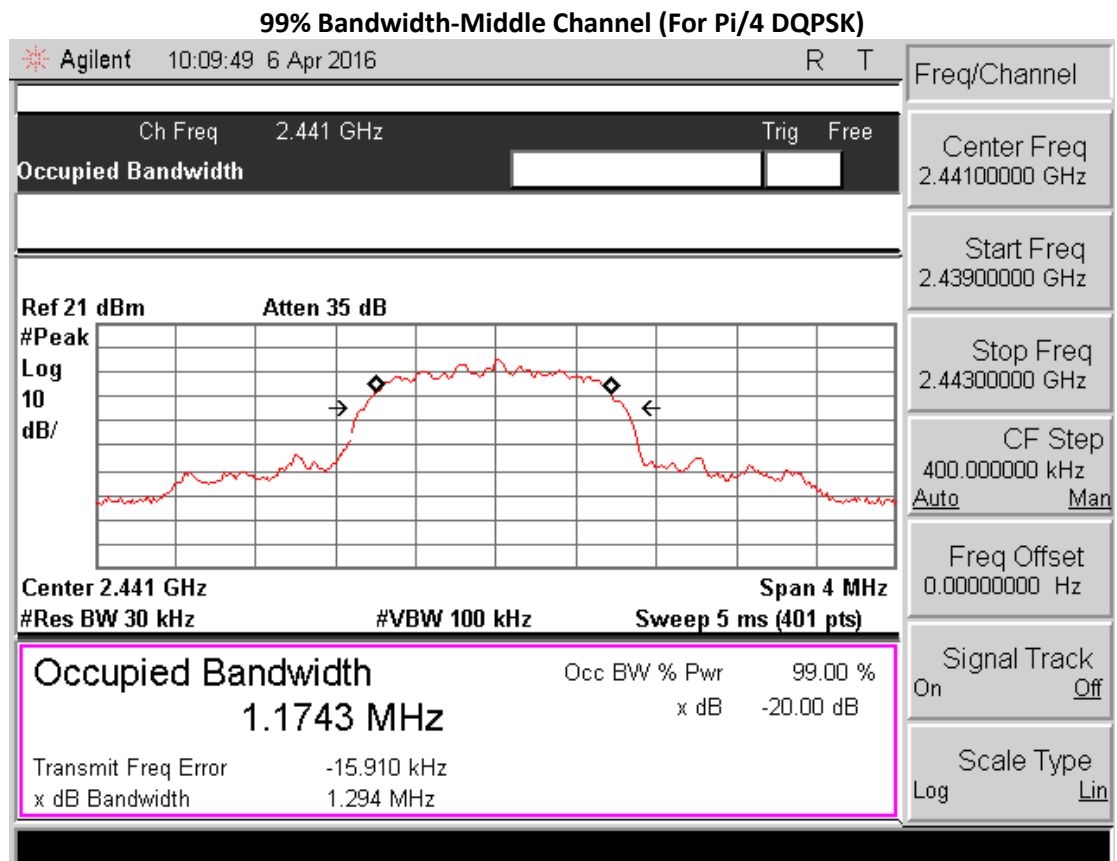


### 99% Bandwidth-High Channel (For GFSK)

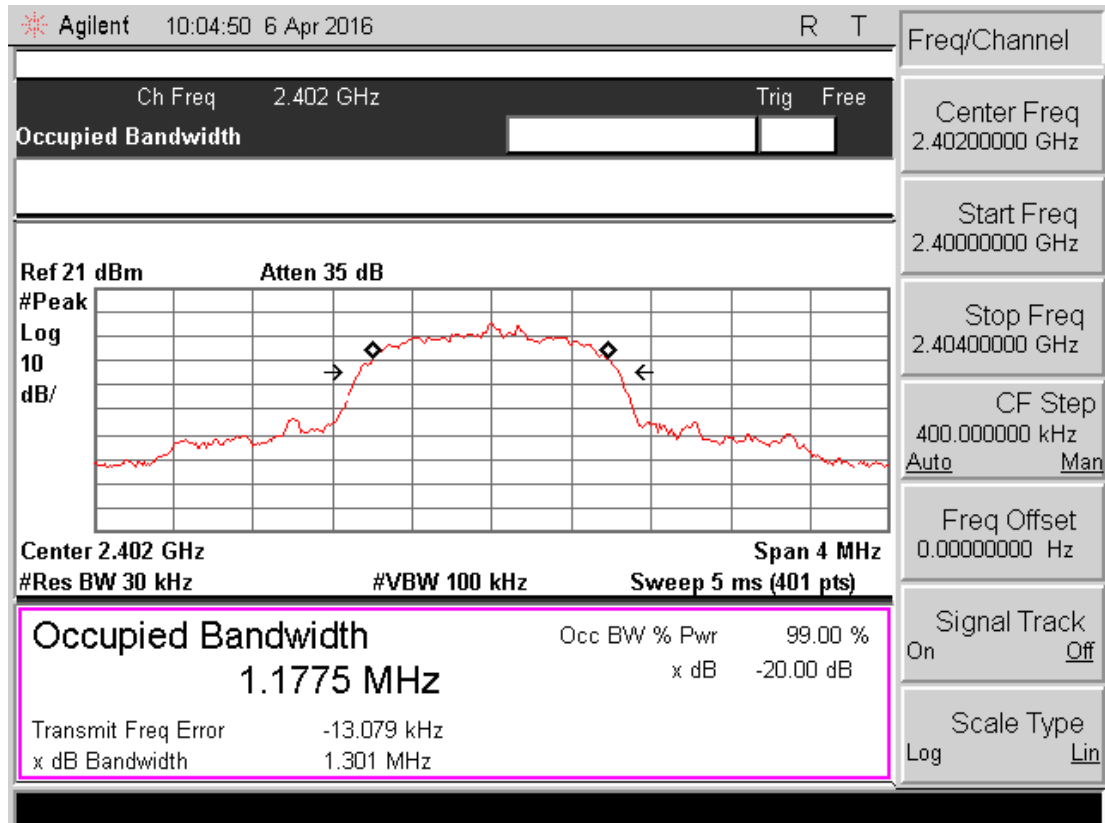


### 99% Bandwidth-Low Channel (For Pi/4 DQPSK)

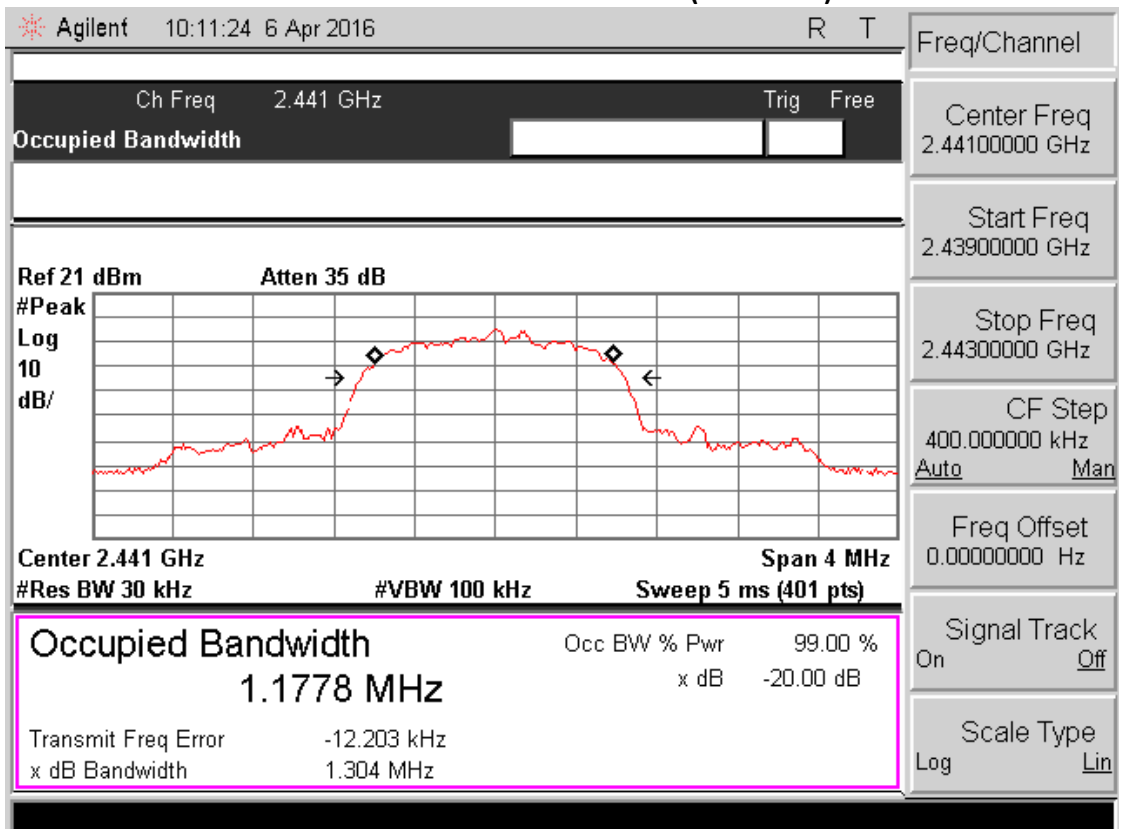




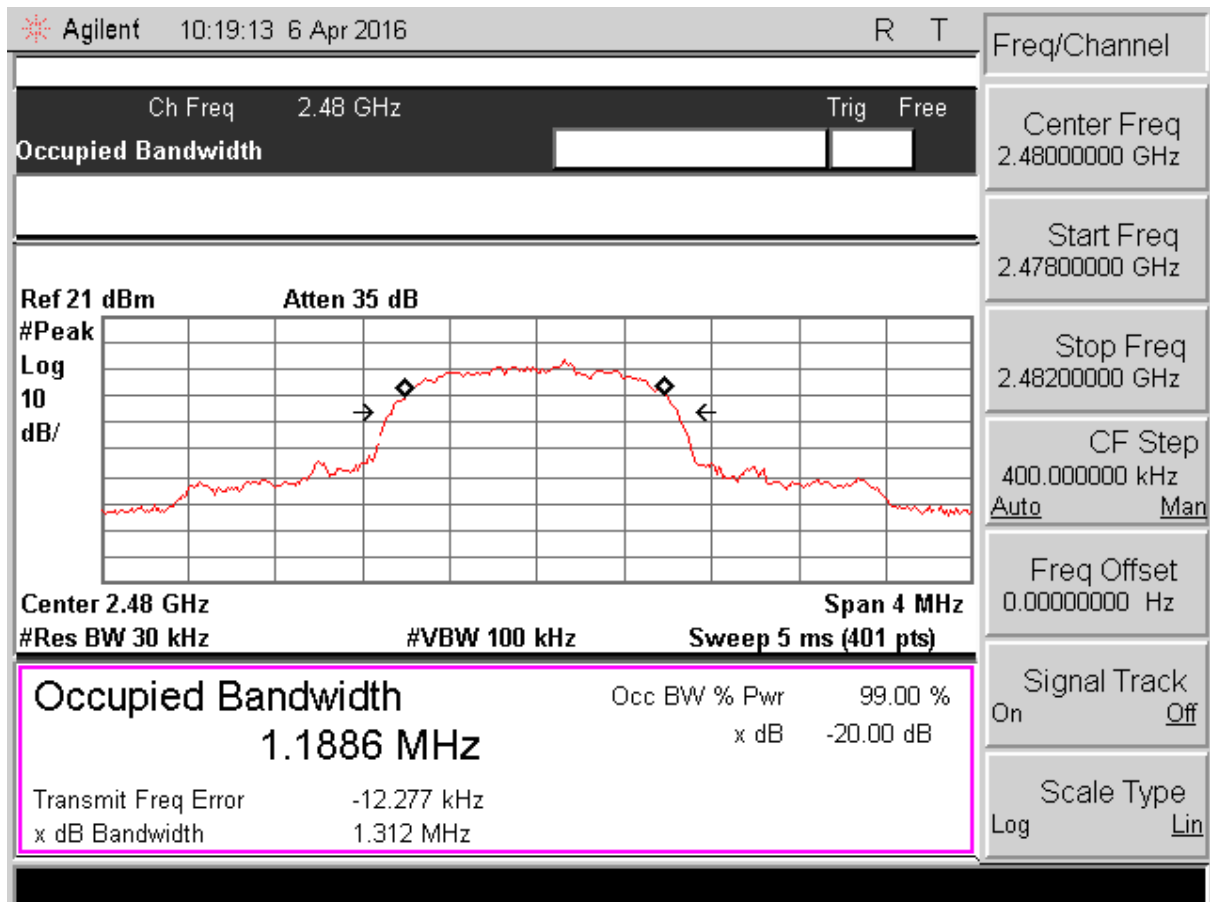
### 99% Bandwidth-Low Channel (For 8DPSK)



### 99% Bandwidth-Middle Channel (For 8DPSK)



### 99% Bandwidth-High Channel (For 8DPSK)



### 3.2 Peak Output Power – FCC Section 15.247 (b) RSS 247, 5.4.2

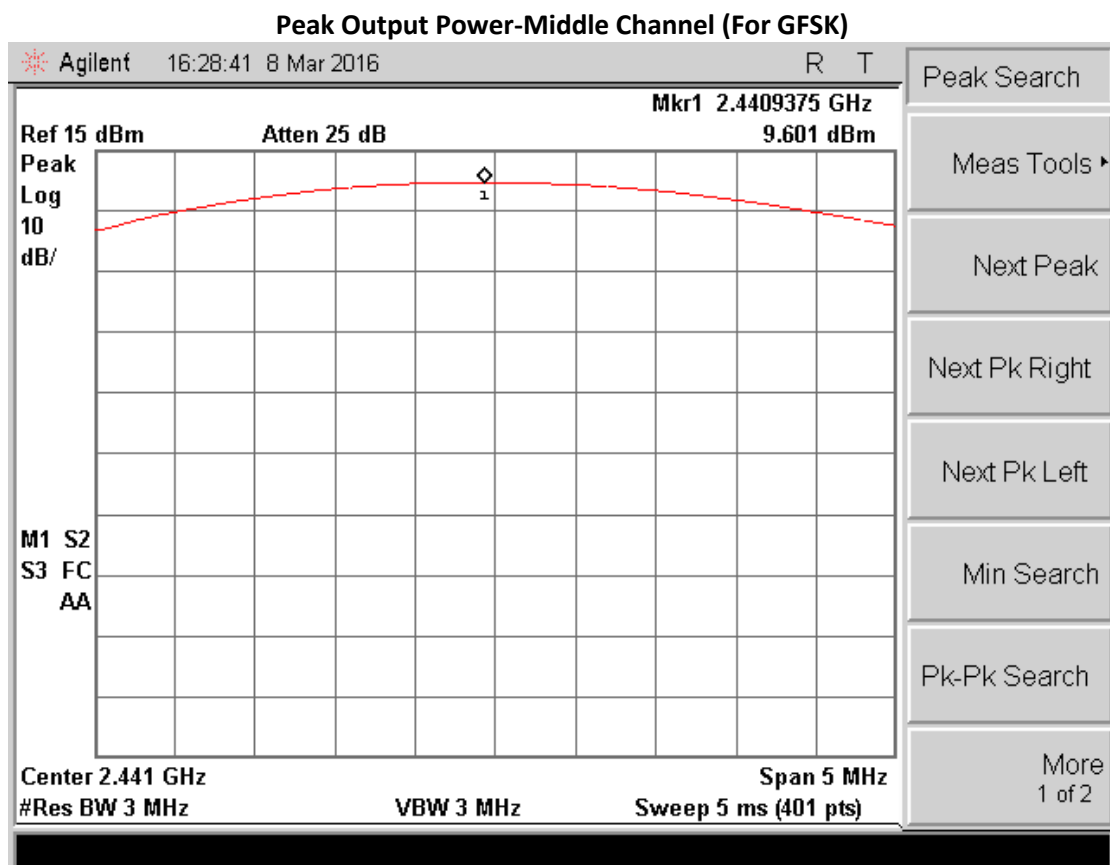
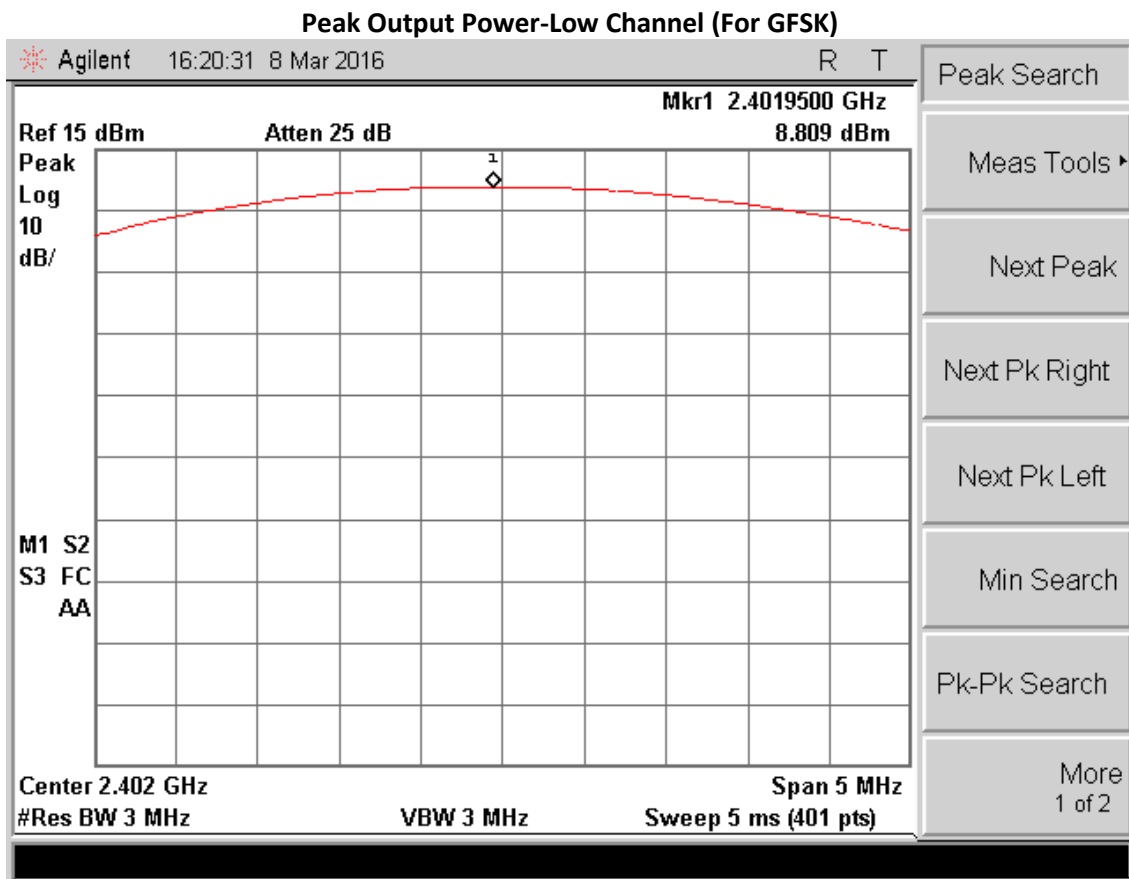
#### 3.2.1 Measurement Procedure

According to § 15.247(b)(1), and RSS 247 5.4.2 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 ANSI C63.10 Section 7.8.5. 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.

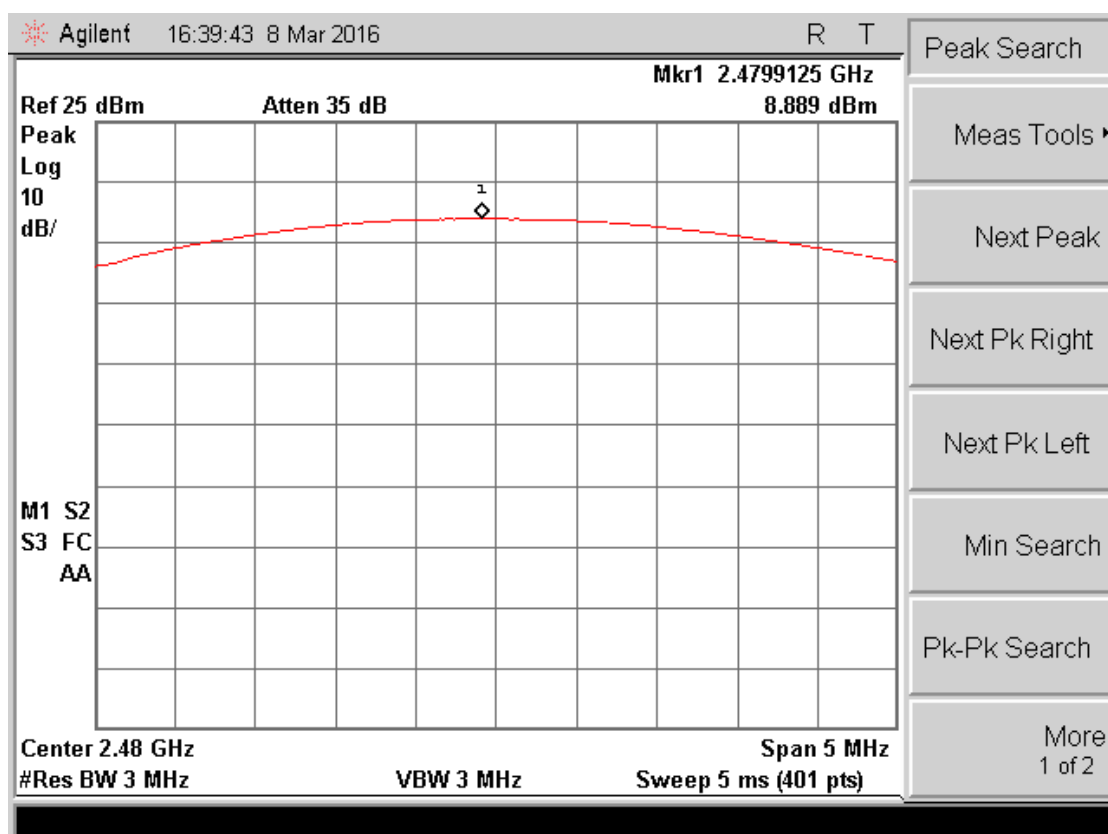
#### 3.2.2 Measurement Result

Frequency (MHz)	For GFSK: RF Output Power (dBm)	For Pi/4 DQPSK: RF Output Power (dBm)	For 8DPSK: RF Output Power (dBm)
2402	8.81	9.64	10.02
2441	9.60	10.50	10.80
2480	8.89	9.77	10.09

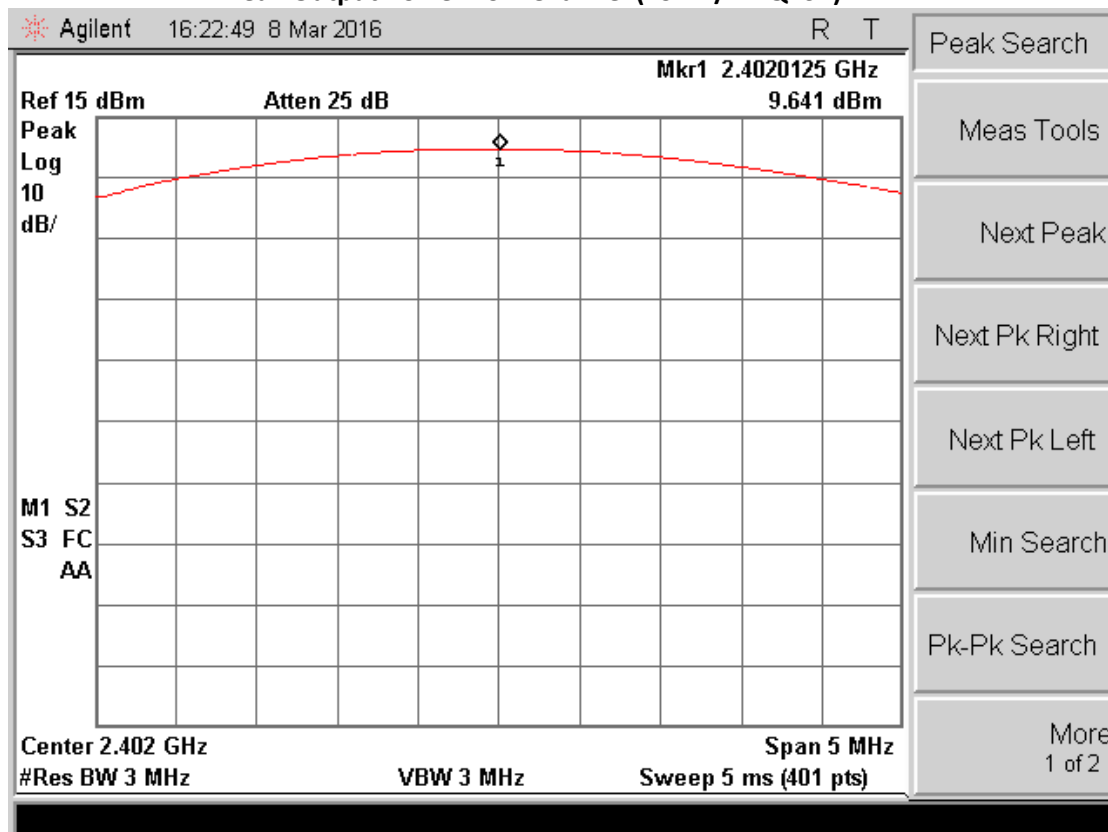




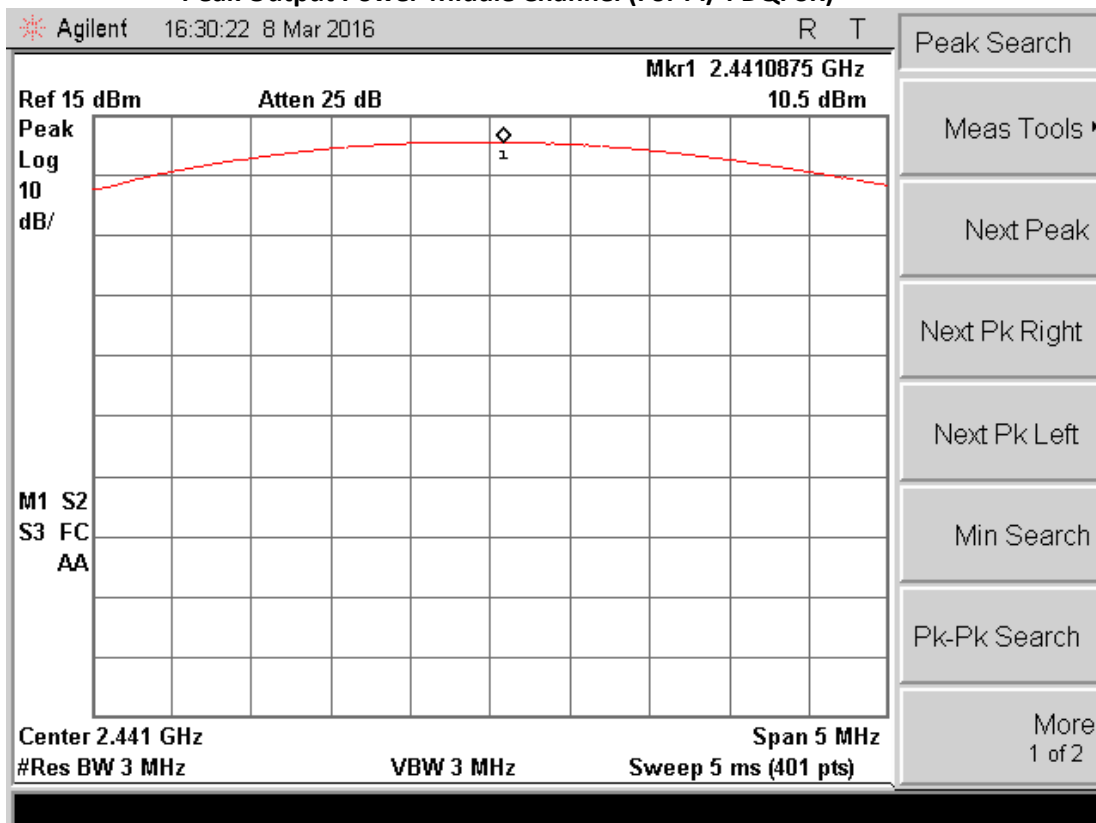
### Peak Output Power-High Channel (For GFSK)



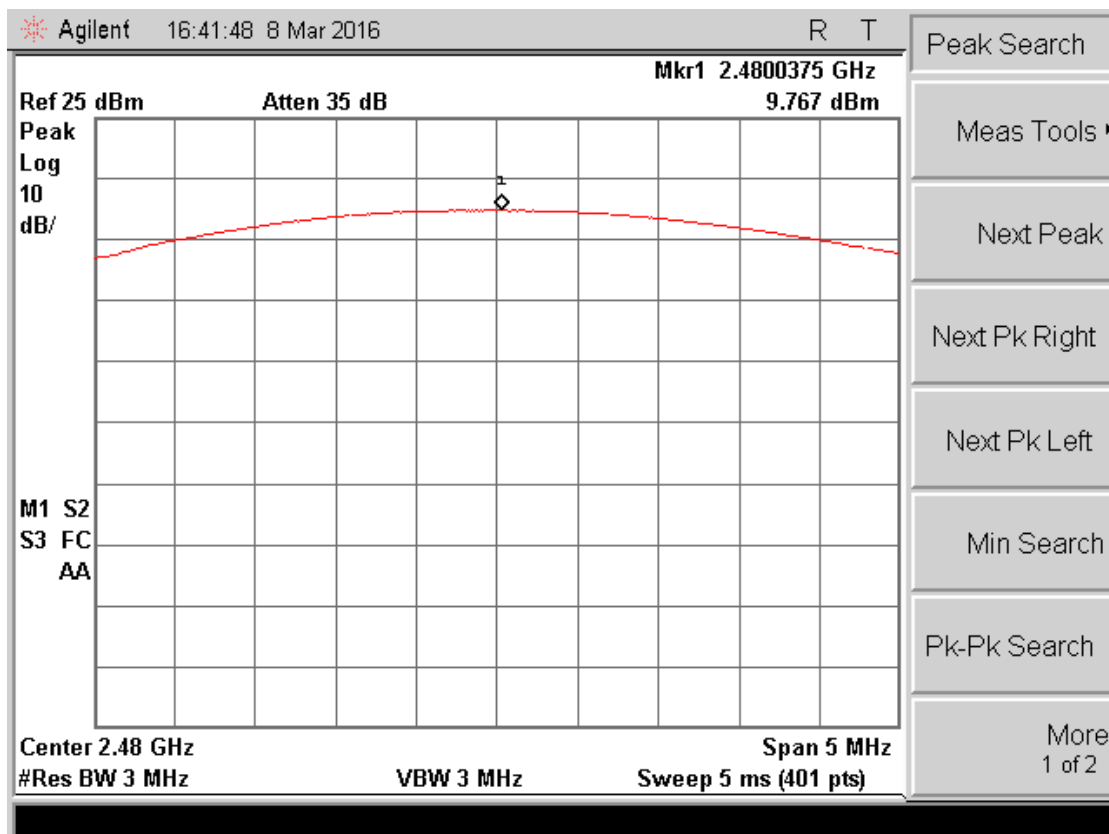
### Peak Output Power-Low Channel (For PI/4 DQPSK)

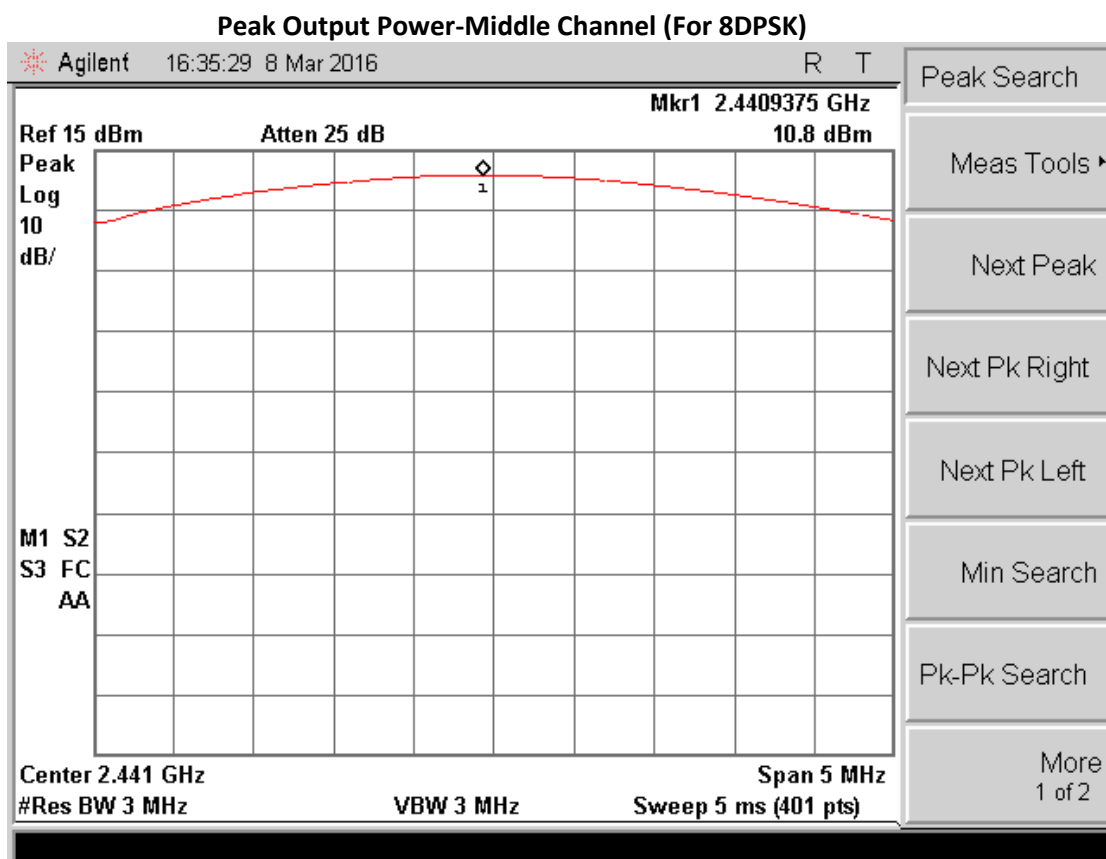
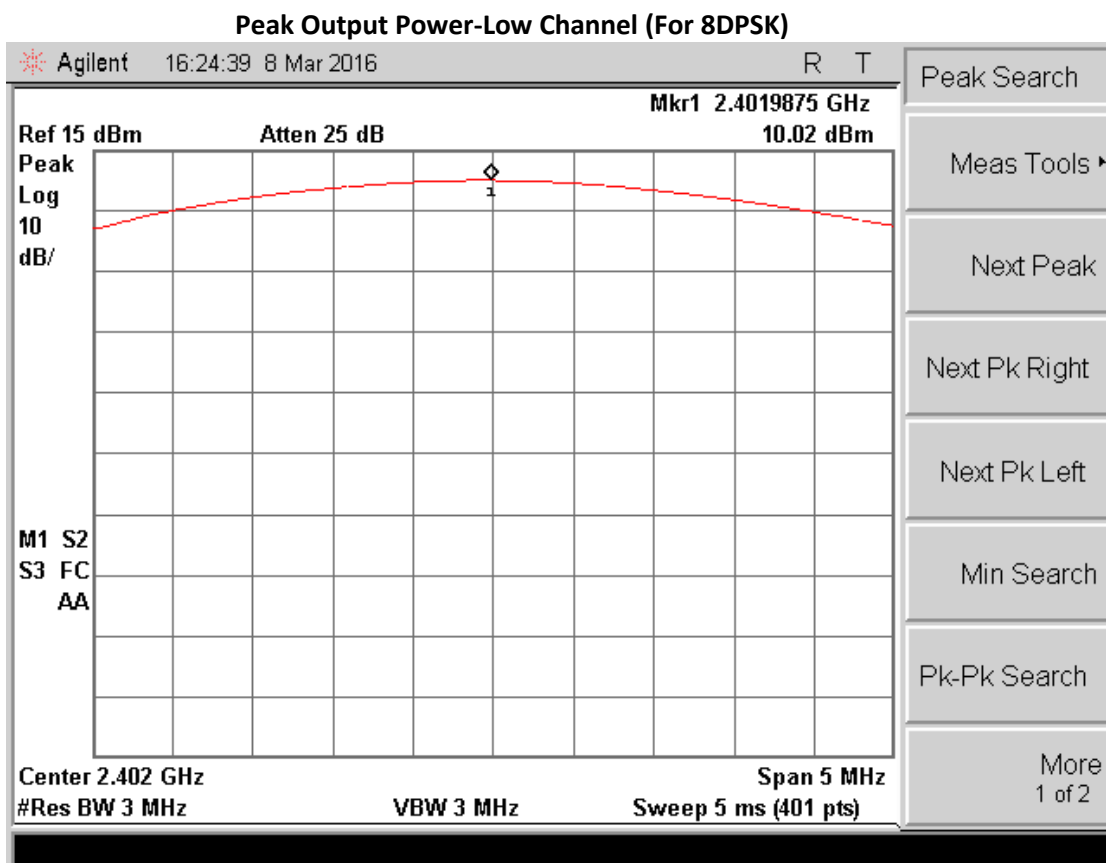


### Peak Output Power-Middle Channel (For PI/4 DQPSK)

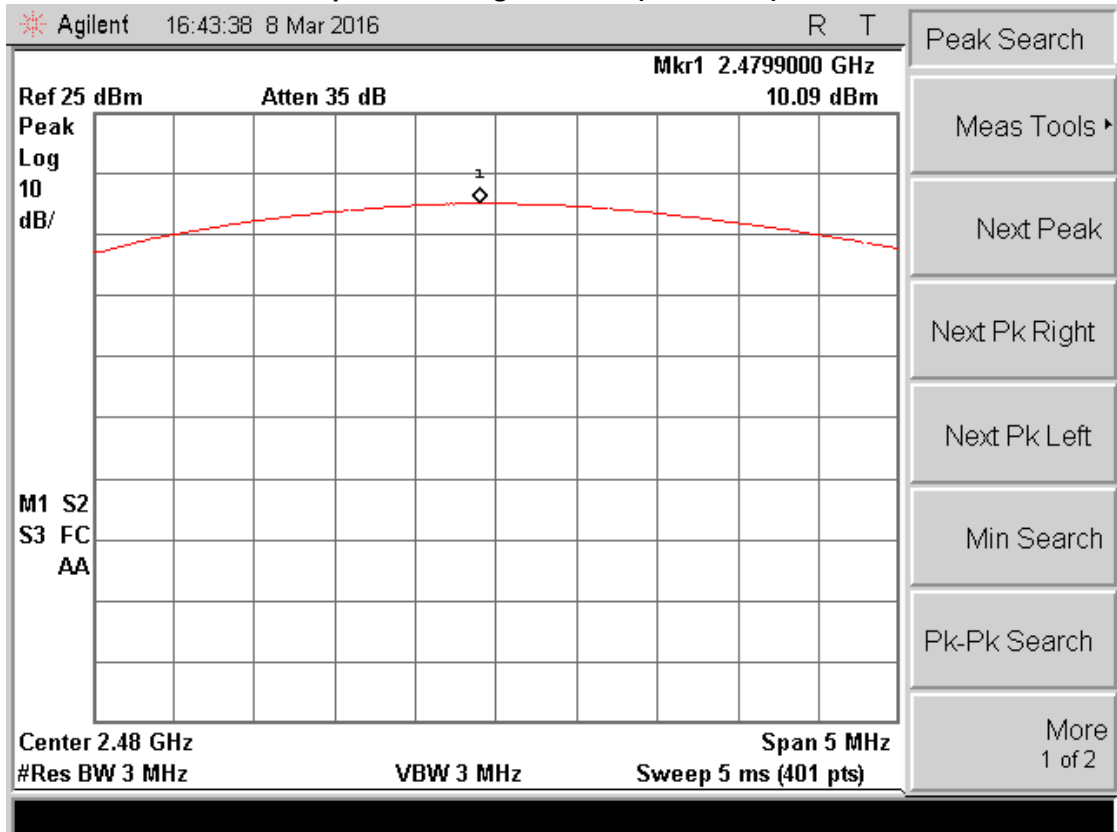


### Peak Output Power-High Channel (For PI/4 DQPSK)





# Peak Output Power-High Channel (For 8DPSK)



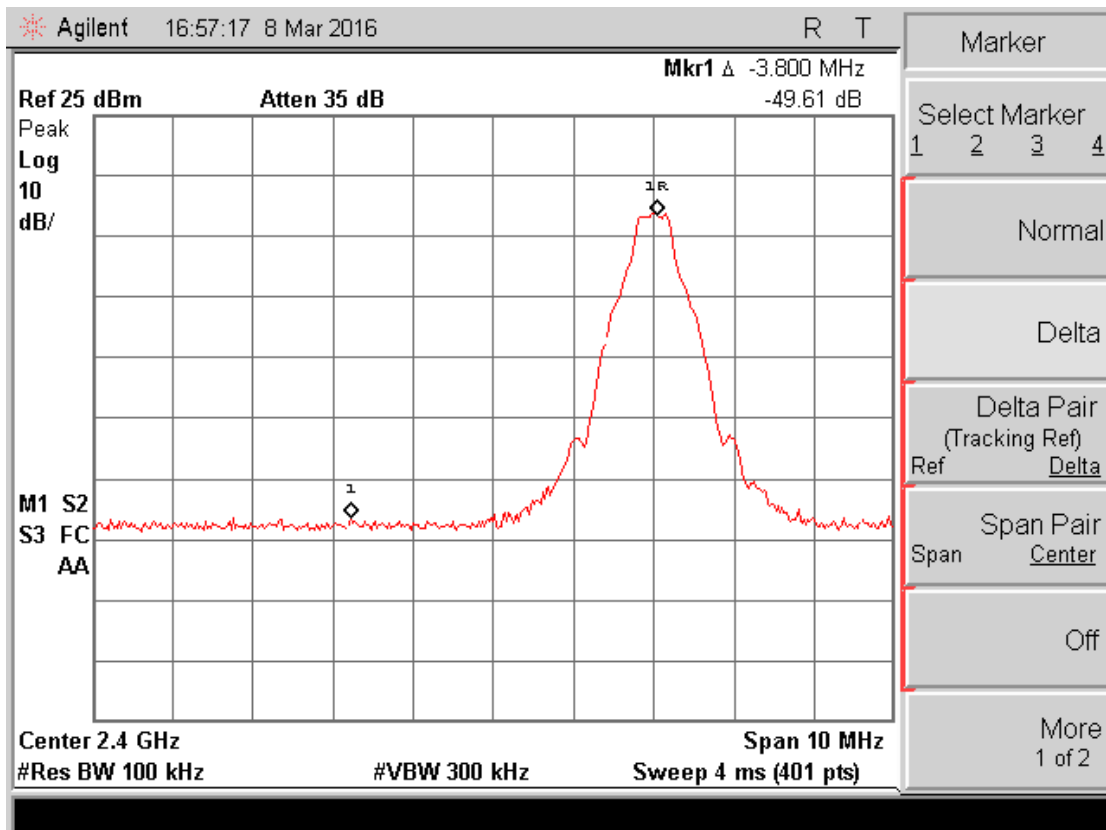
### **3.3 Band-Edge Compliance of RF Conducted Emissions – FCC Section 15.247(c) RSS-247 5.5**

#### **3.3.1 Measurement Procedure**

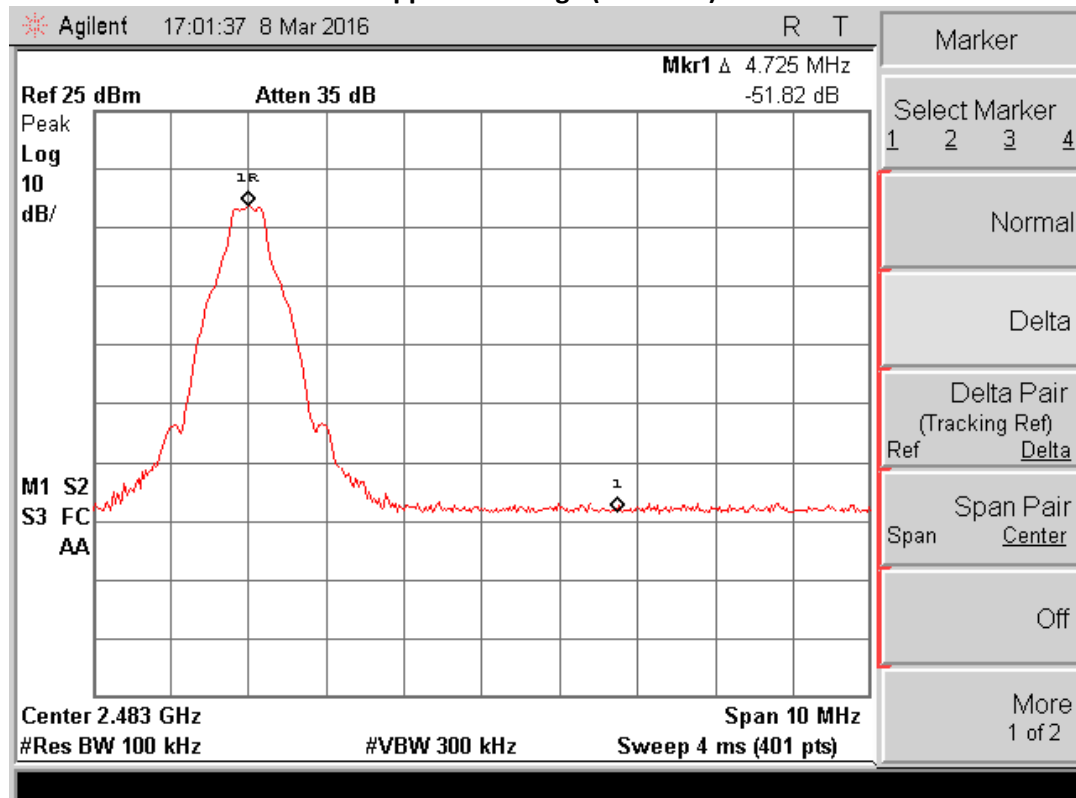
According to § 15.247(c), and RSS 247 5.5 any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth 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. 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 Results**

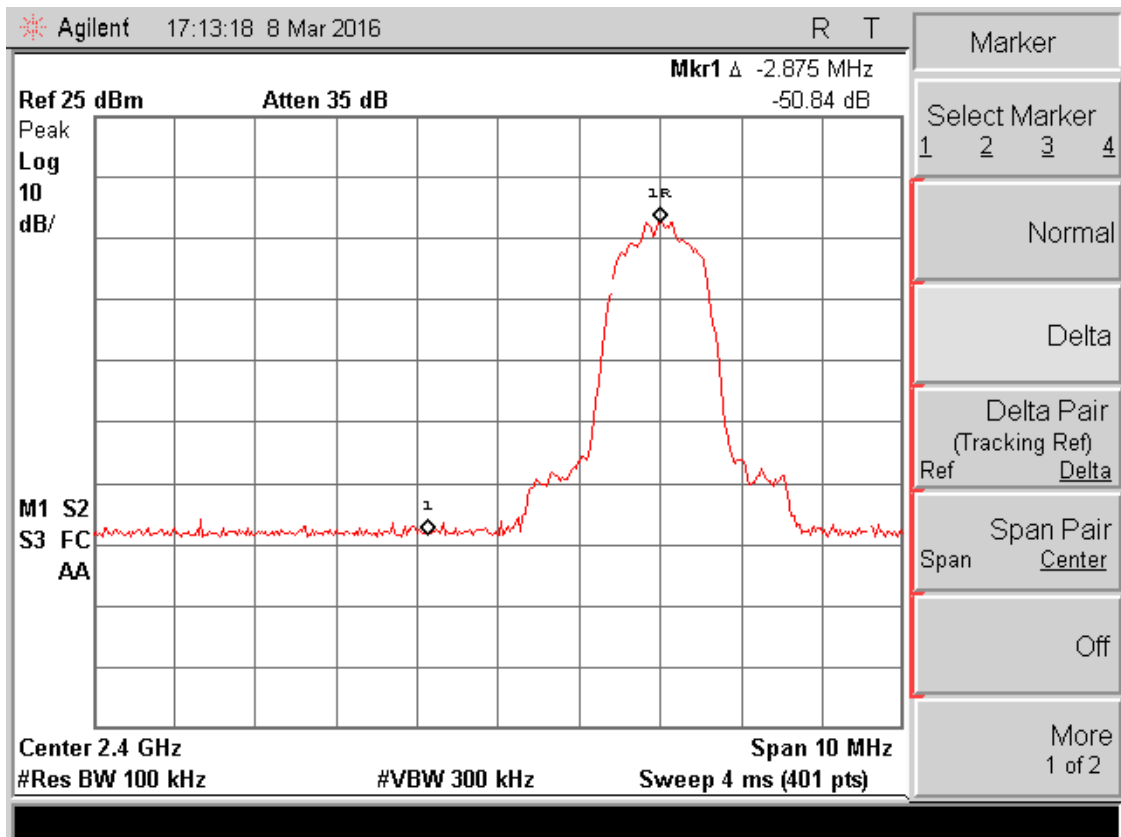
**Lower Band Edge (For GFSK)**



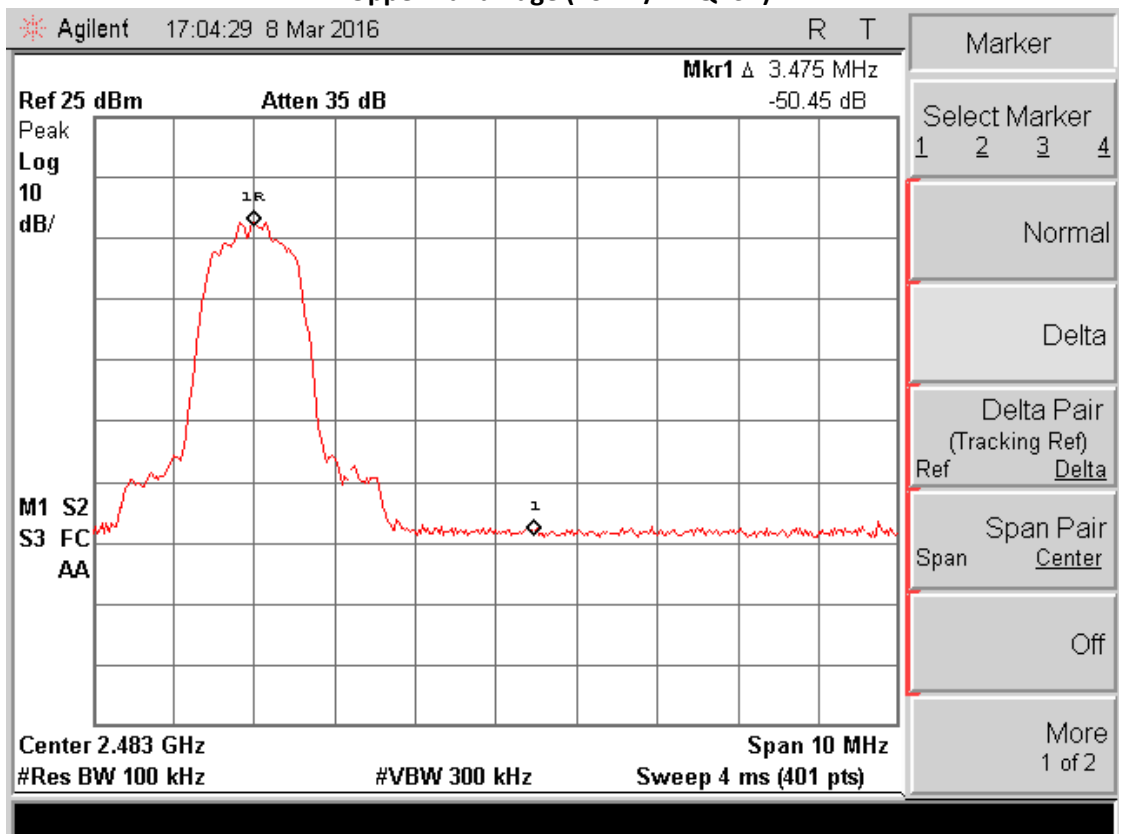
### Upper Band Edge (For GFSK)



### Lower Band Edge (For Pi/4 DQPSK)

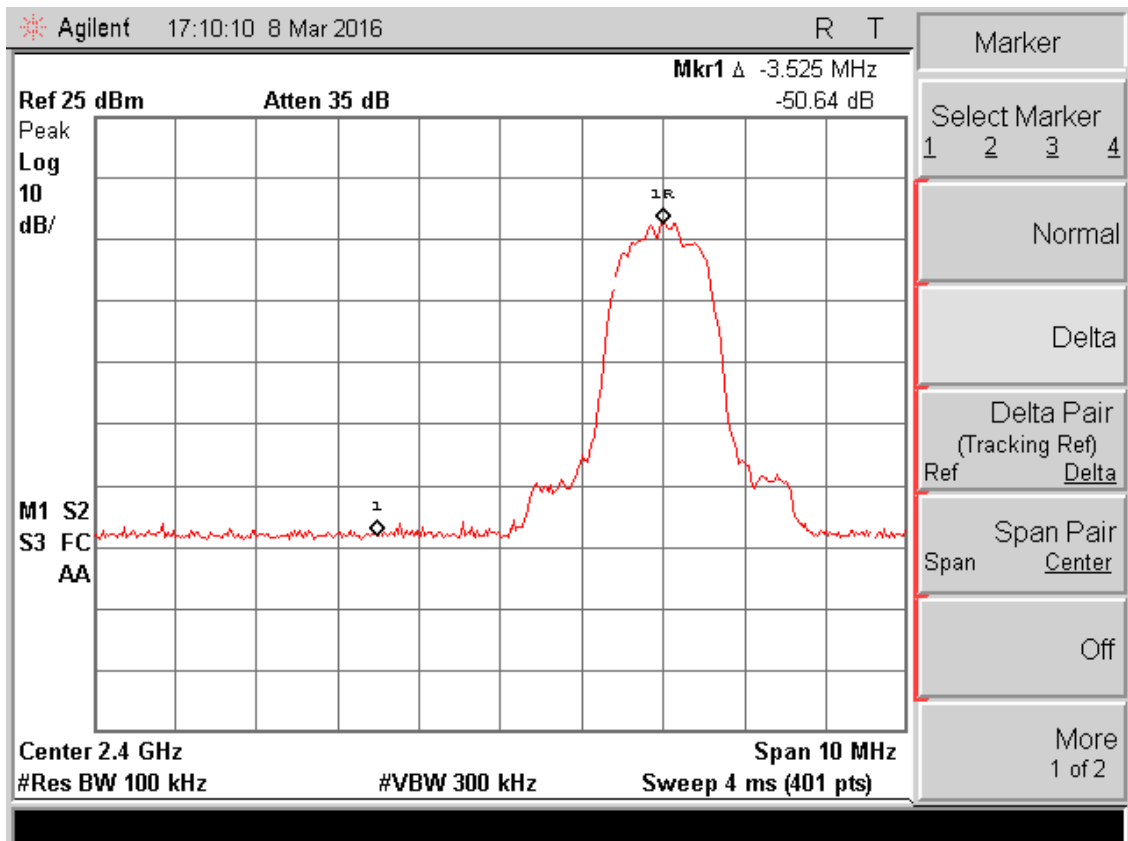


### Upper Band Edge (For Pi/4 DQPSK)

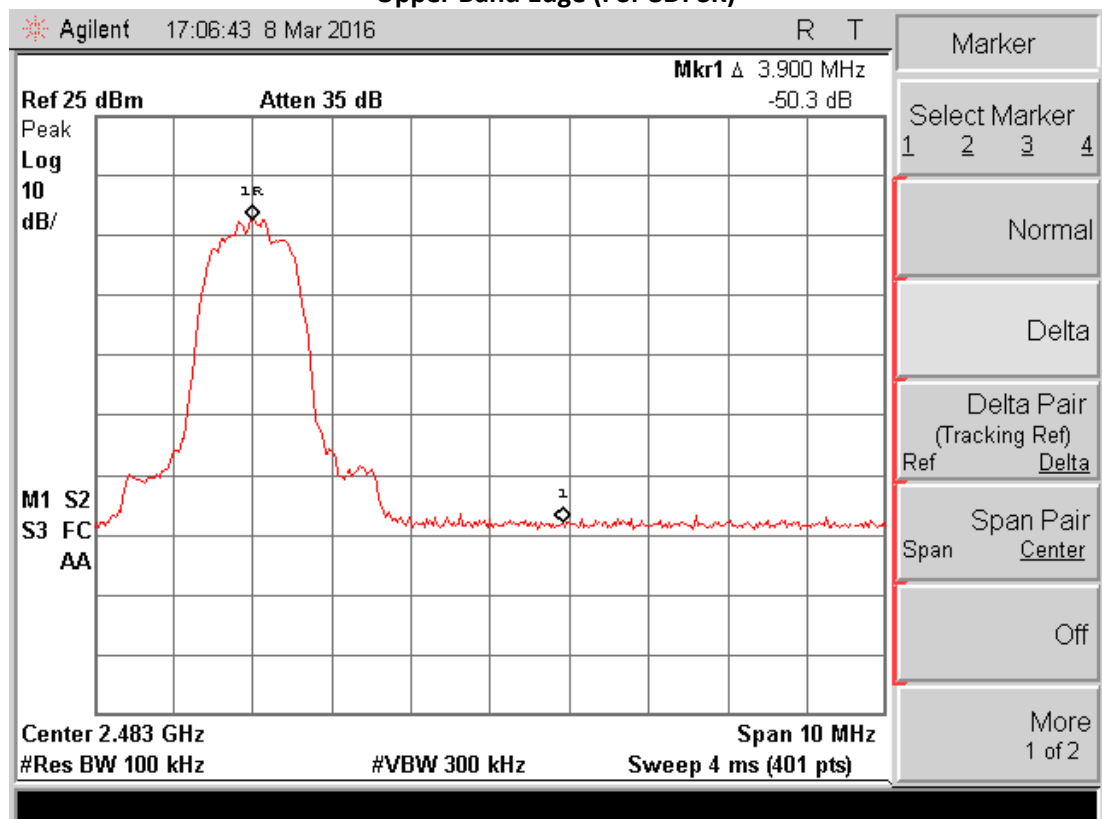


### Lower Band Edge (For 8DPSK)

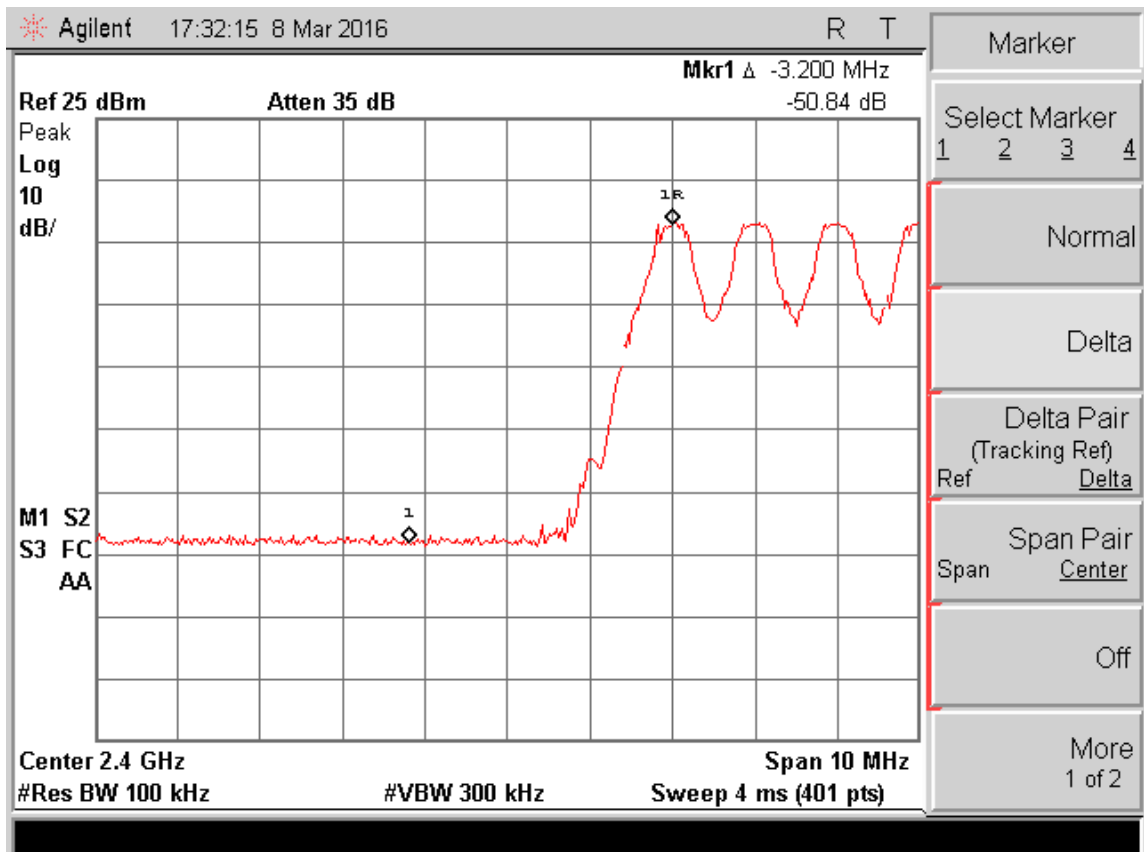




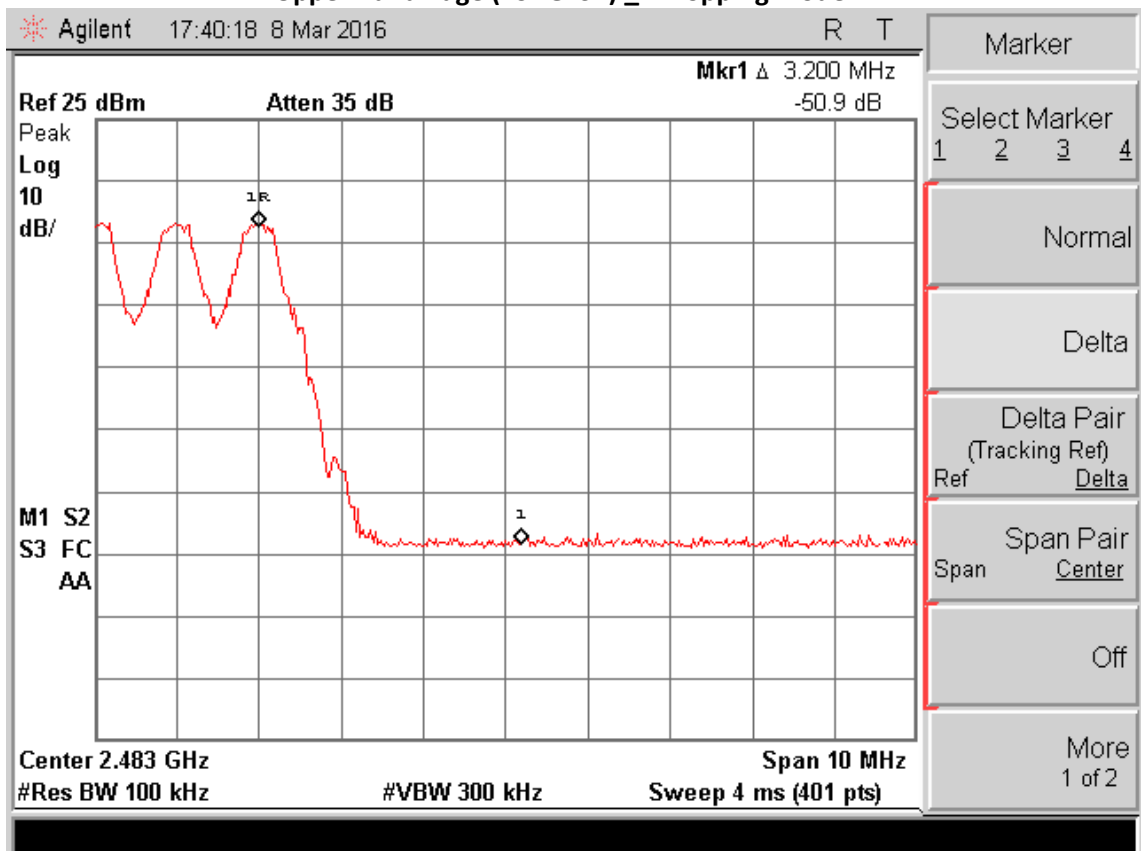
### Upper Band Edge (For 8DPSK)



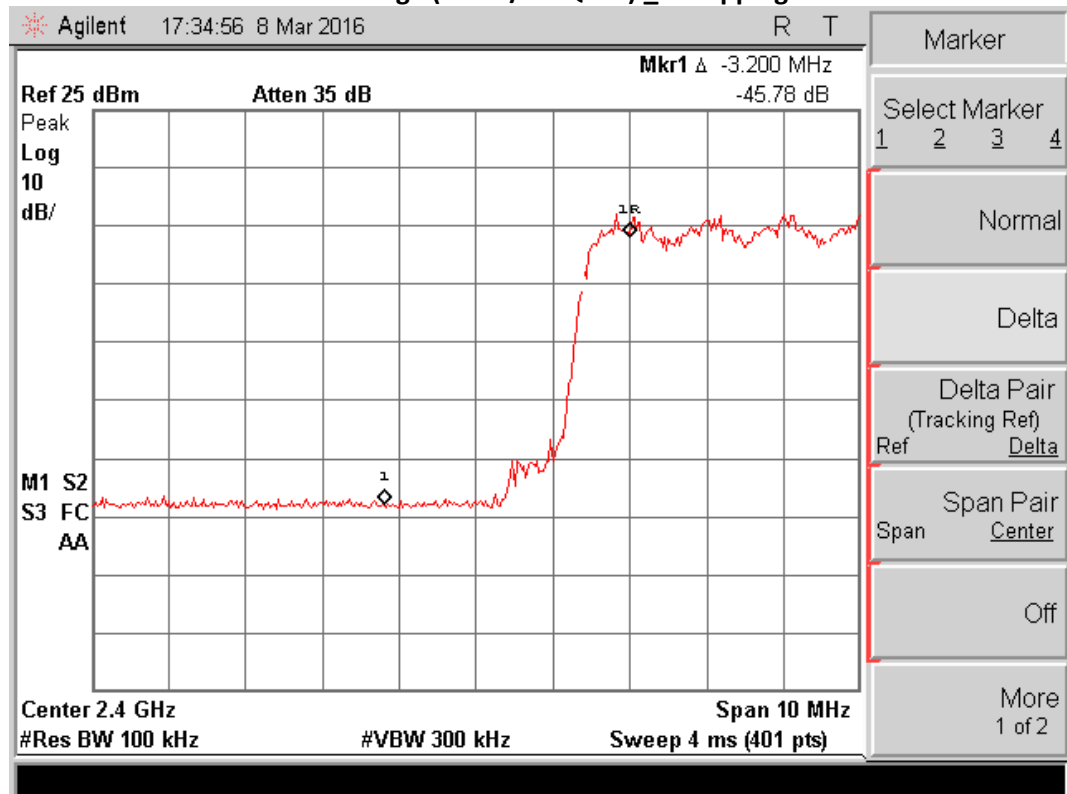
### Lower Band Edge (For GFSK)\_In hopping mode



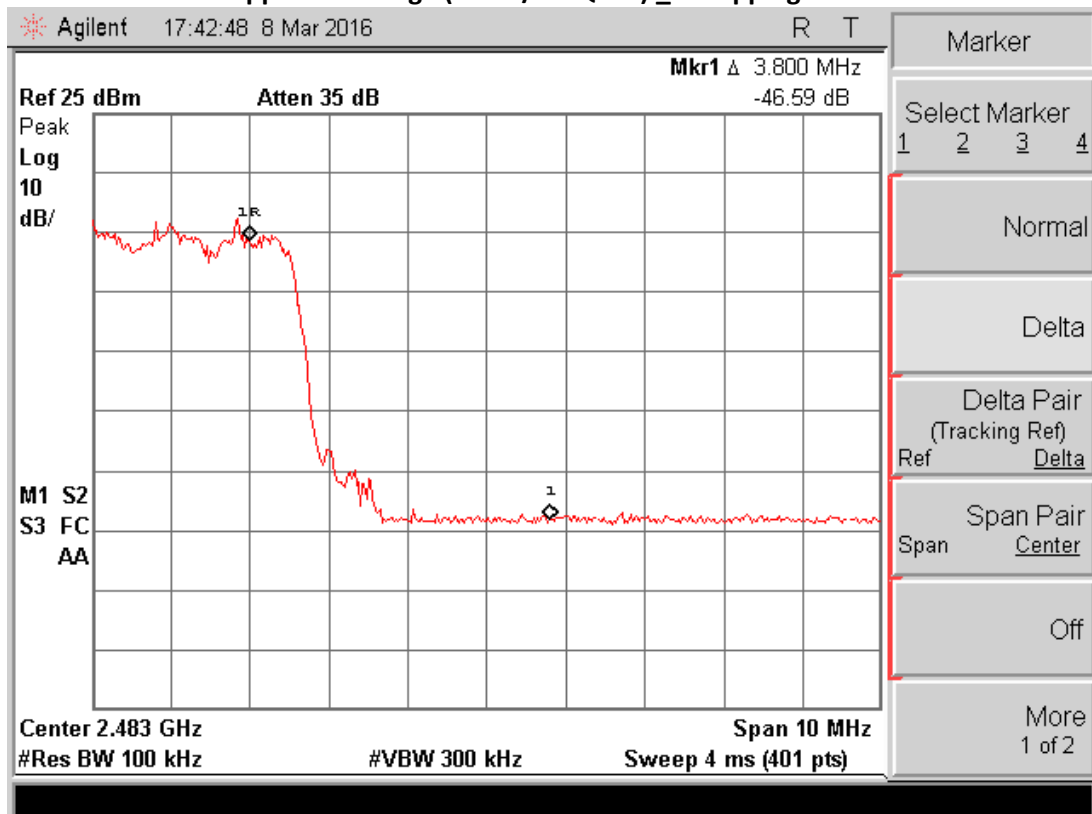
### Upper Band Edge (For GFSK) \_In hopping mode



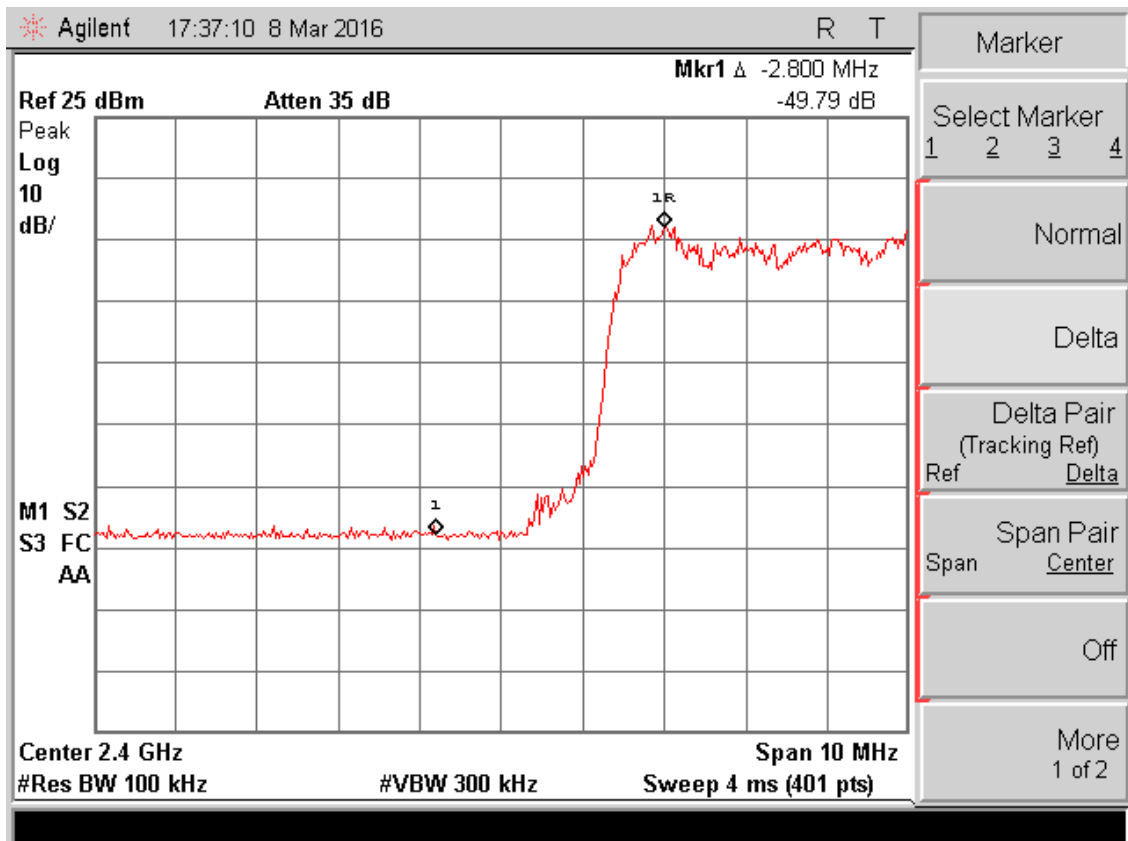
### Lower Band Edge (For Pi/4 DQPSK) \_In hopping mode



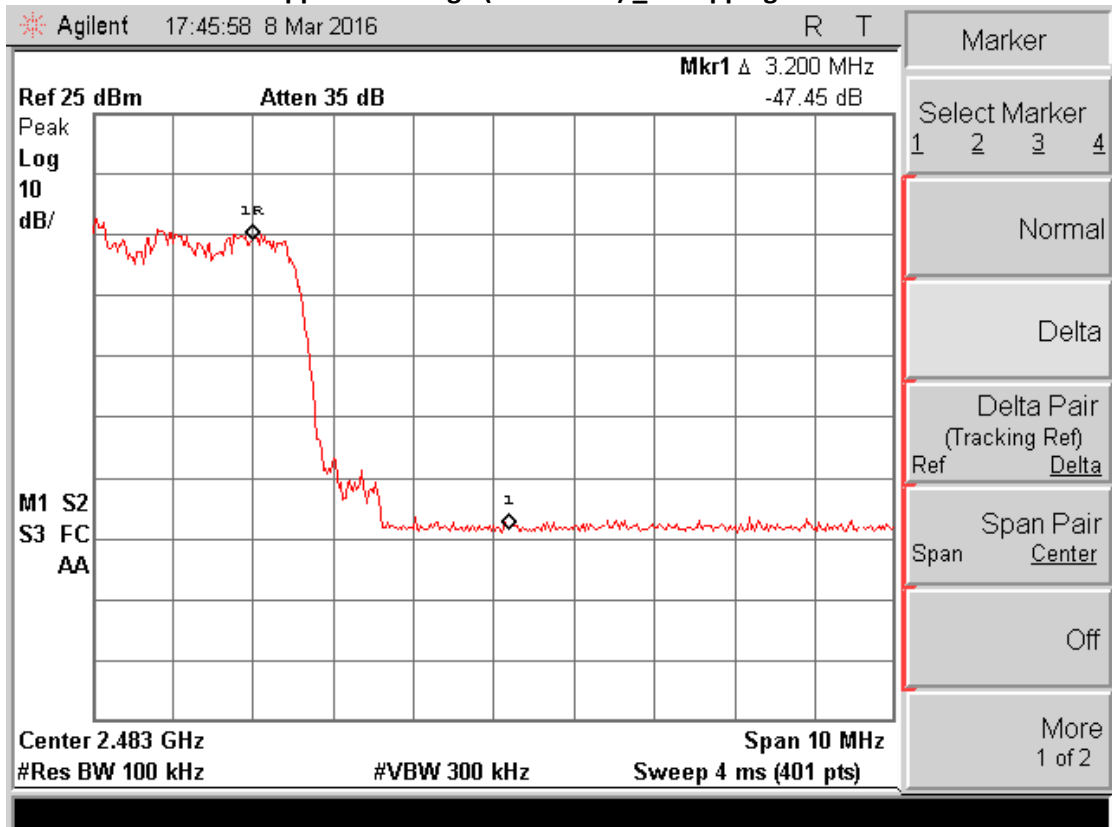
### Upper Band Edge (For Pi/4 DQPSK) \_In hopping mode



### Lower Band Edge (For 8DPSK) \_In hopping mode



### Upper Band Edge (For 8DPSK) \_In hopping mode

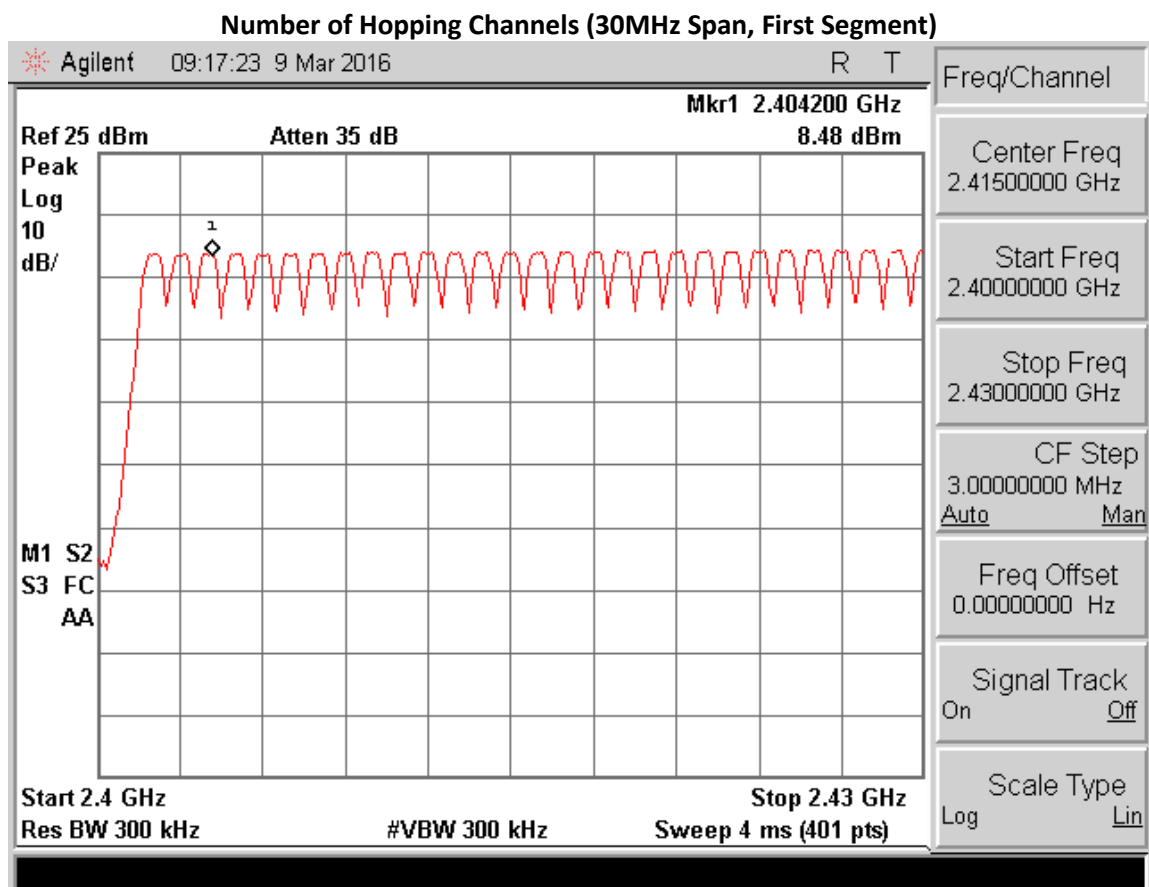


### 3.4 Number of Hopping Frequency – FCC Section 15.247(a) RSS 247, 5.1.4

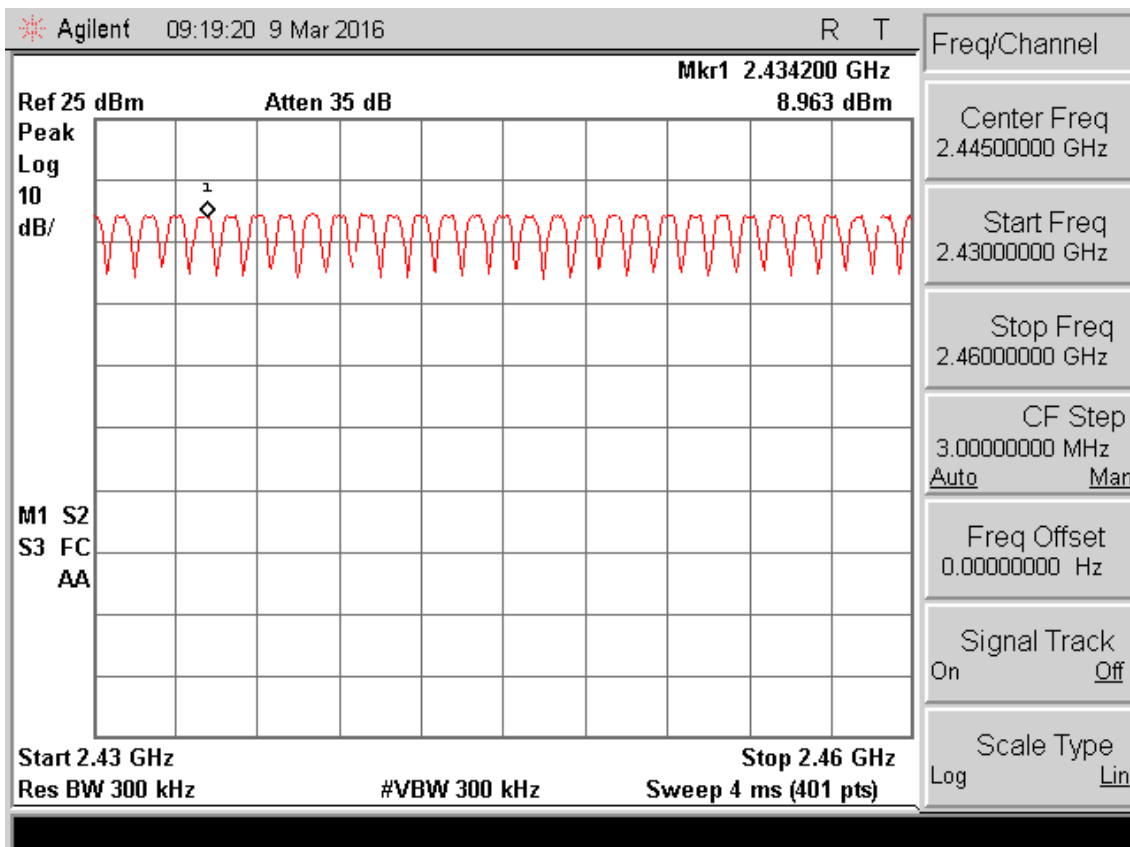
#### 3.4.1 Measurement Procedure

According to FCC Section 15.247(a), and **RSS 247, 5.1.4** 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 ANSI C63.10 section 7.8.3, 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.

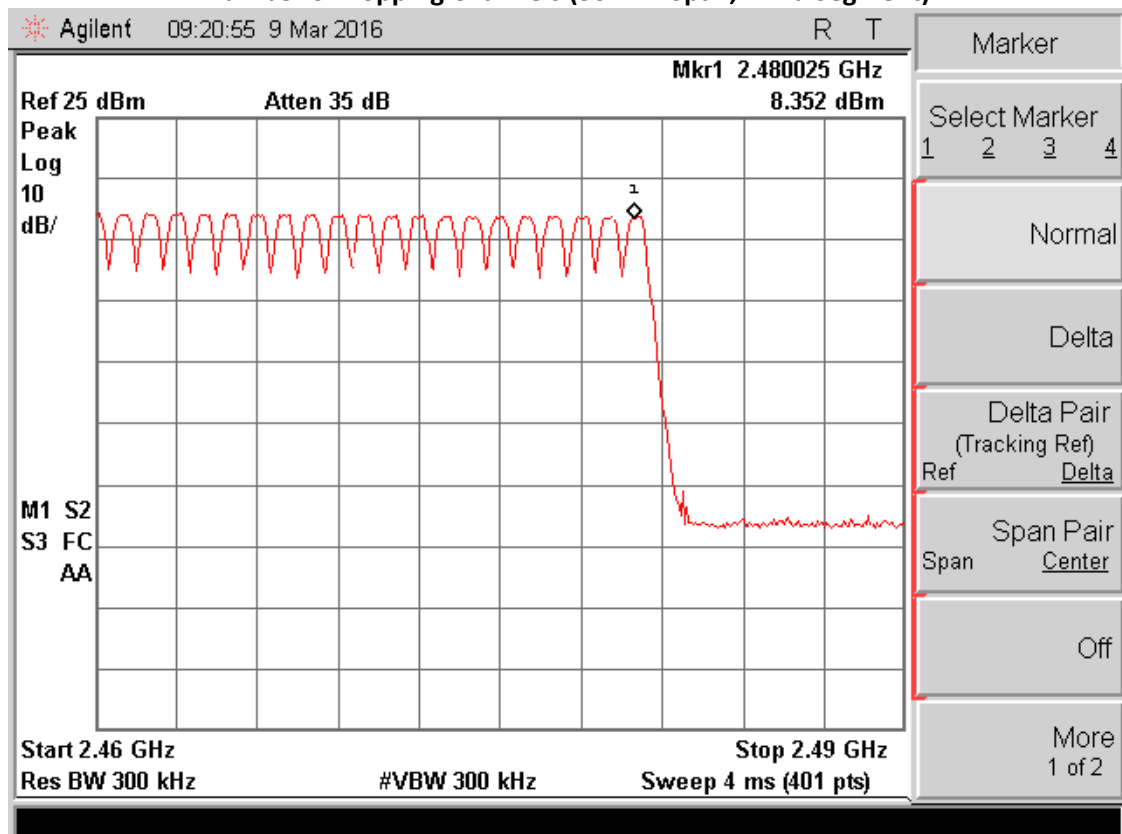
#### 3.4.2 Measurement Result



### 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) RSS 247, 5.1.4**

#### **3.5.1 Measurement Procedure**

According to FCC Section 15.247(a), and RSS 247, 5.1.4 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 ANSI C63.10 Section 7.8.4, 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

1600 = BT Hopping rate

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

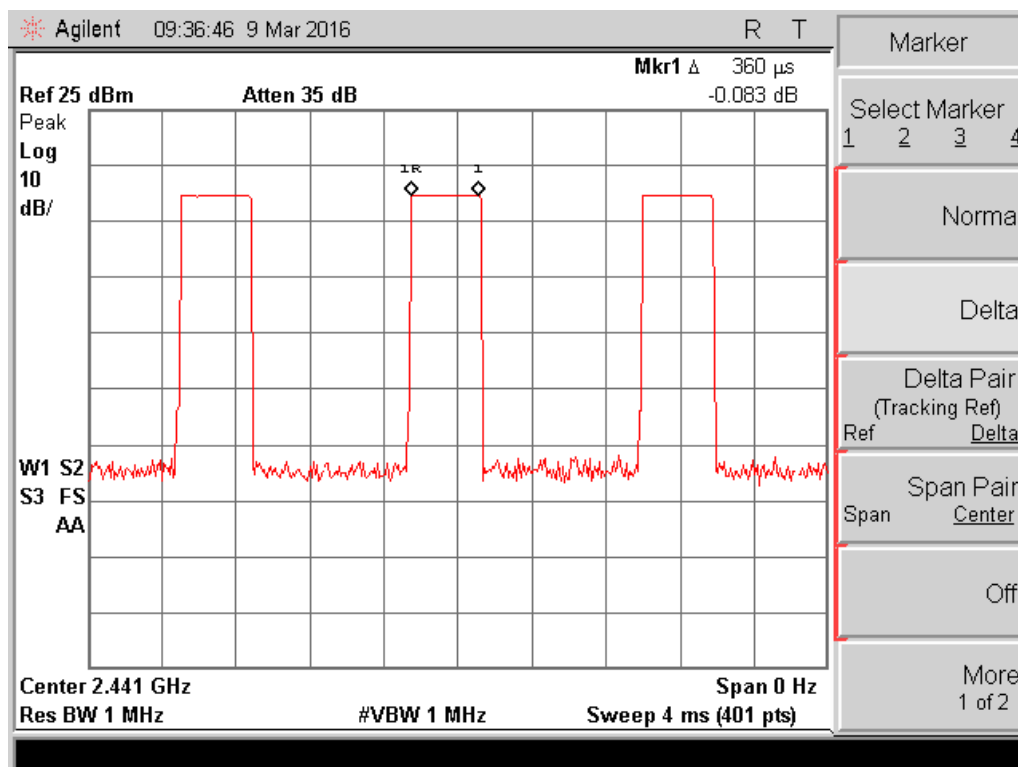
DH3 Time Slot =  $1.620(\text{ms}) * (1600/(4*79)) * 31.6 = 259.2 \text{ (ms)}$

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

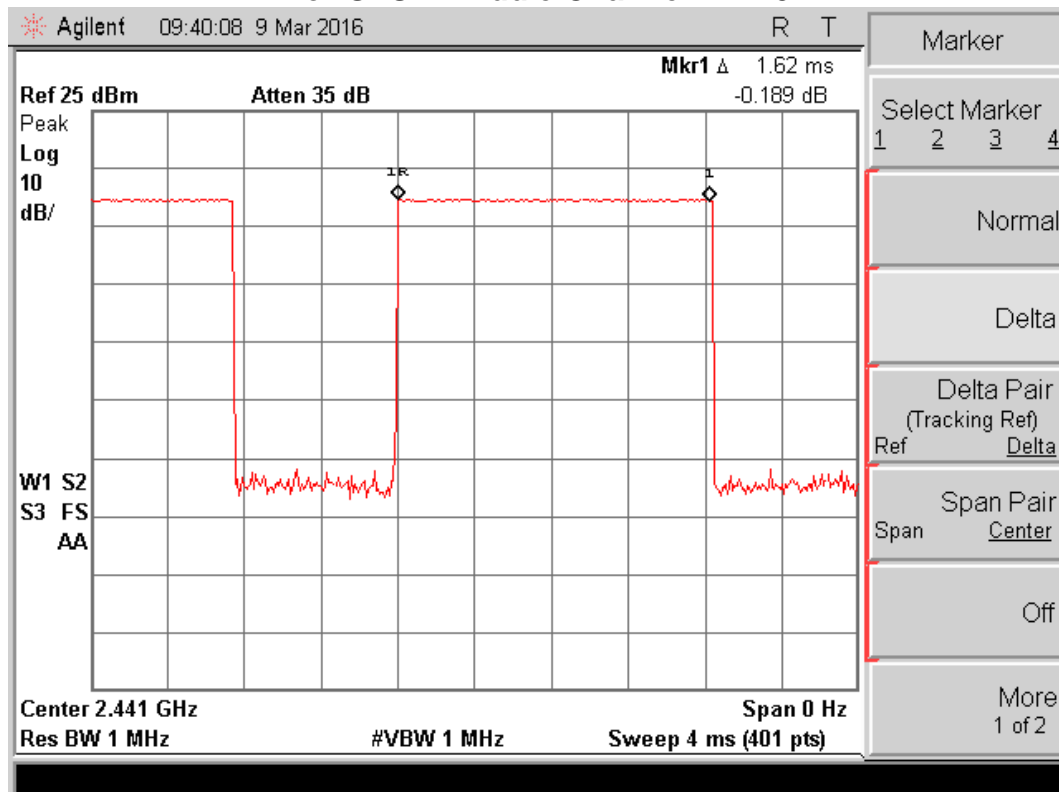


## Dwell Time Test Data

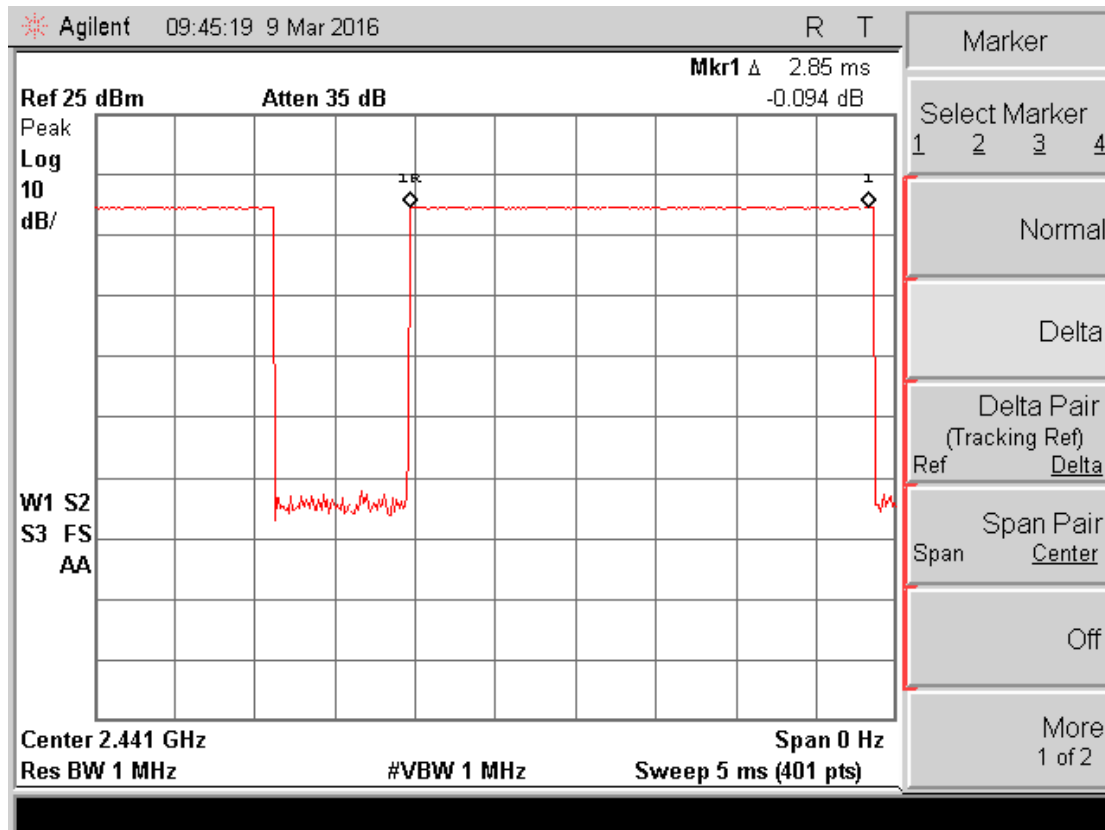
### For GFSK: Middle Channel - DH 1



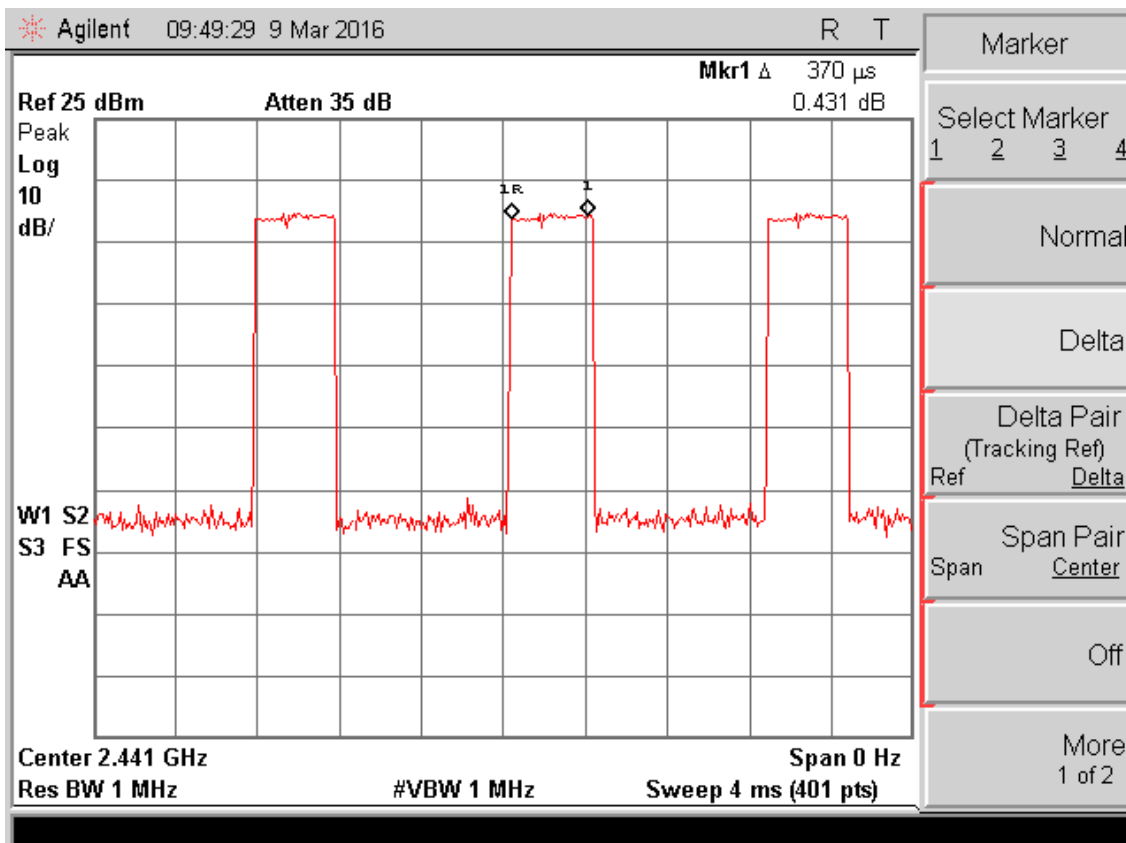
### For GFSK: Middle Channel - DH 3



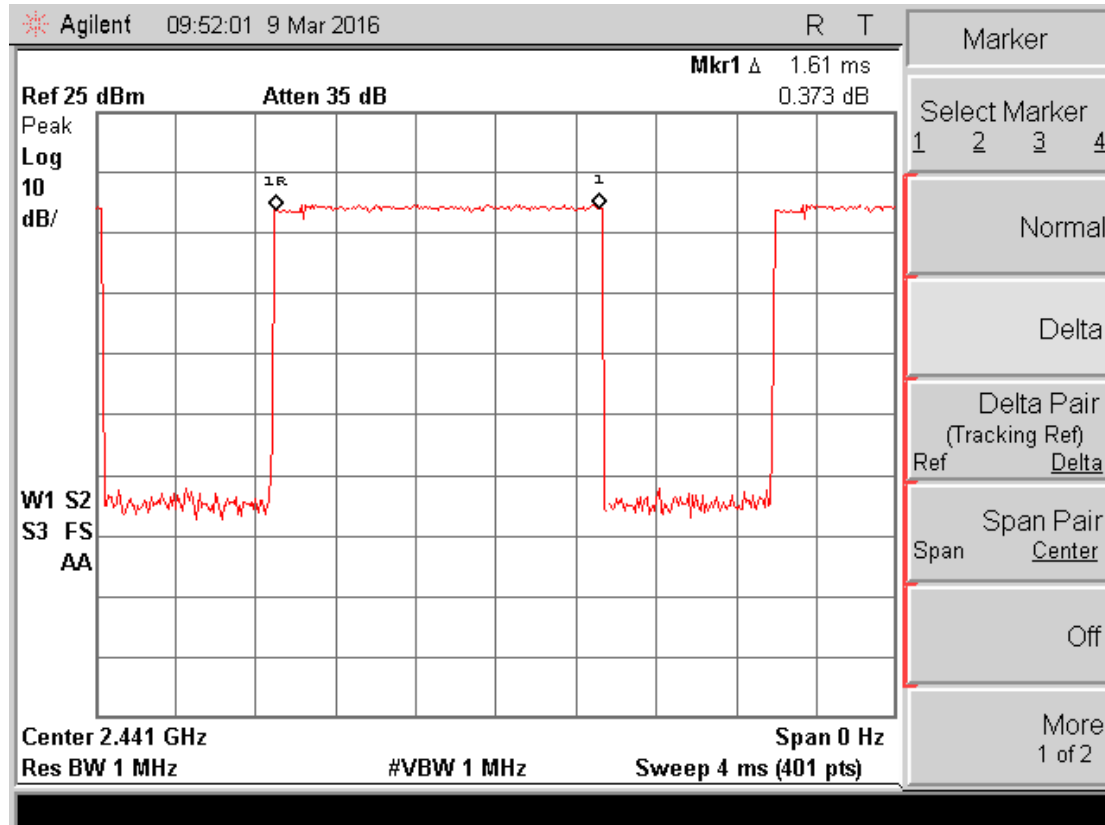
### For GFSK: Middle Channel - DH 5



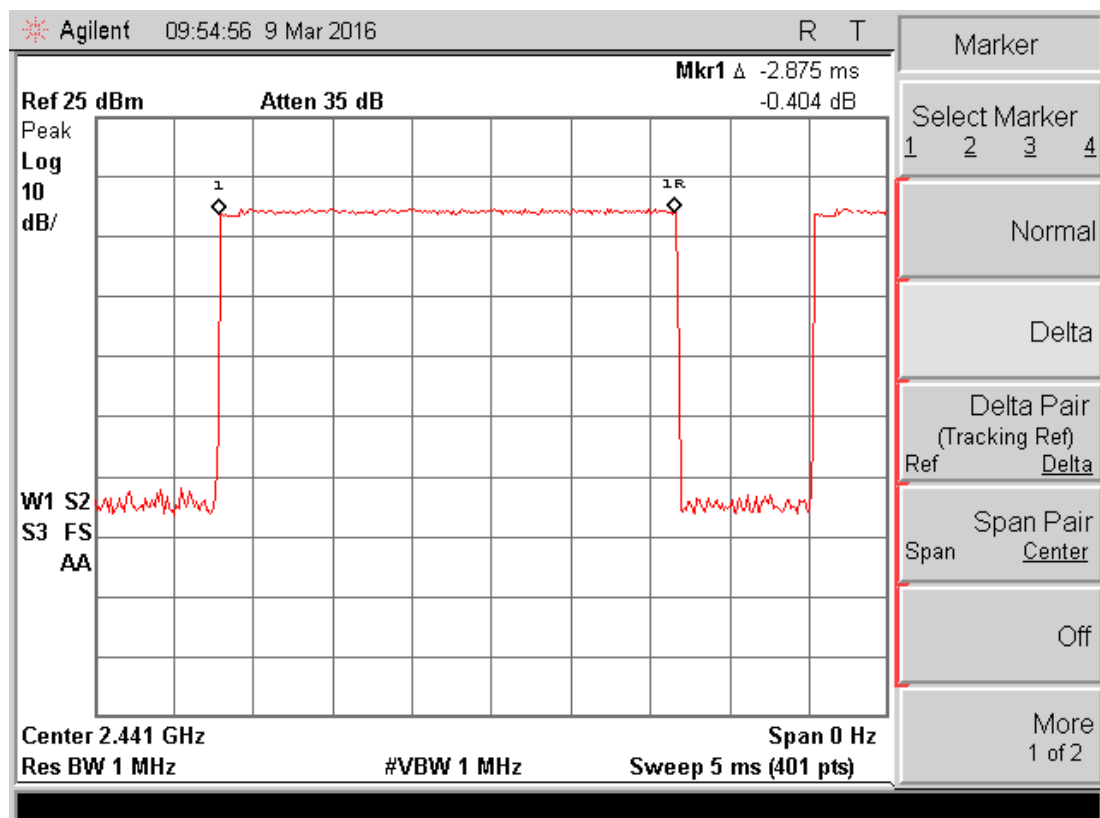
### For PI/4 DQPSK: Middle Channel - 2DH 1



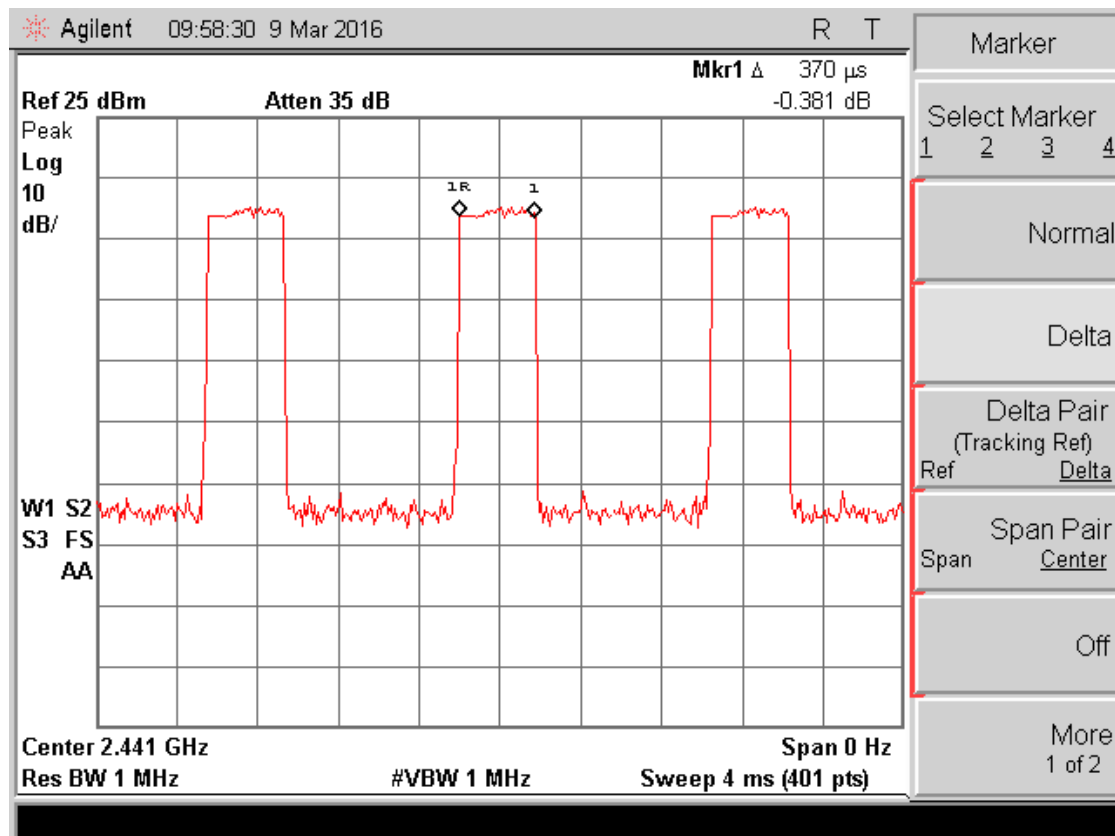
### For PI/4 DQPSK: Middle Channel - 2DH 3



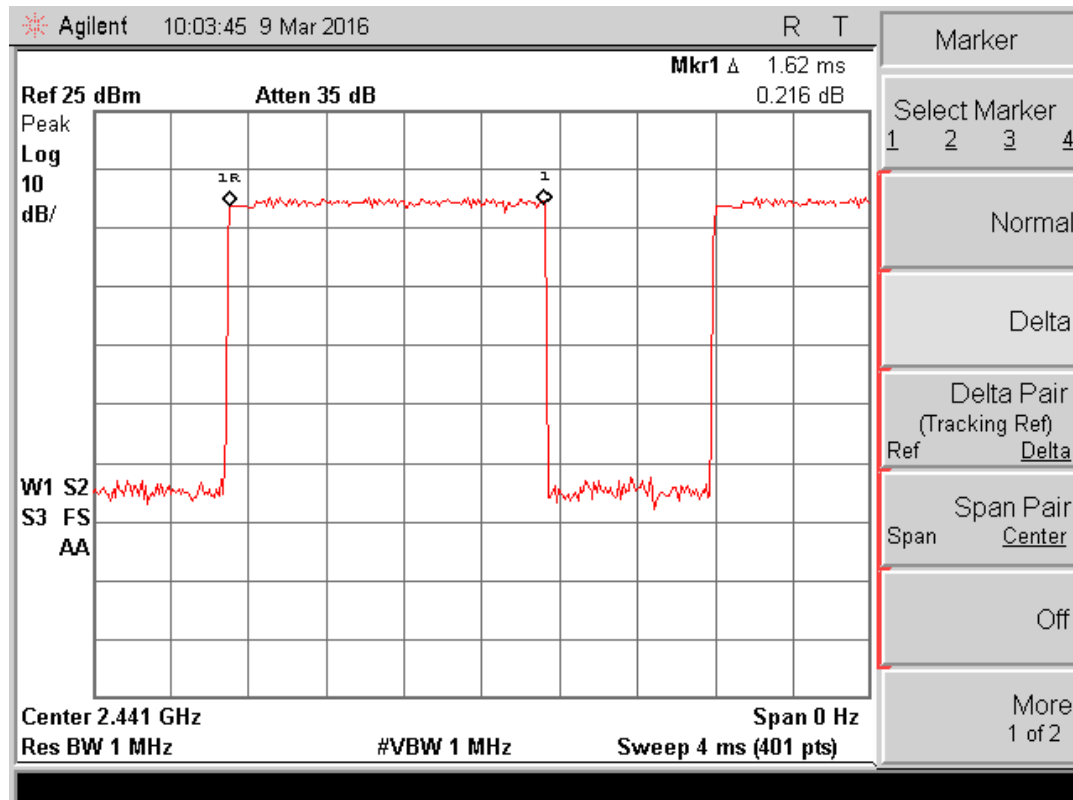
### For PI/4 DQPSK: Middle Channel - 2DH 5



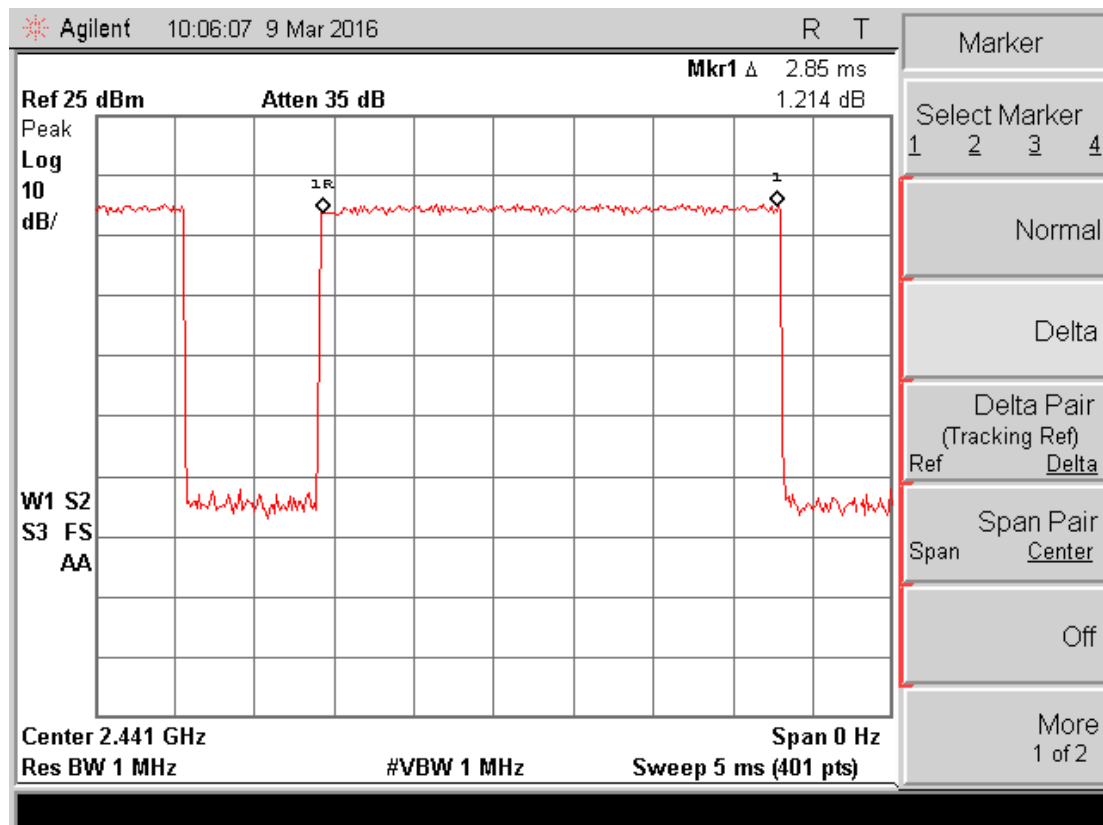
### For 8DPSK: Middle Channel - 3DH 1



### For 8DPSK: Middle Channel - 3DH 3



# For 8DPSK: Middle Channel - 3DH 5

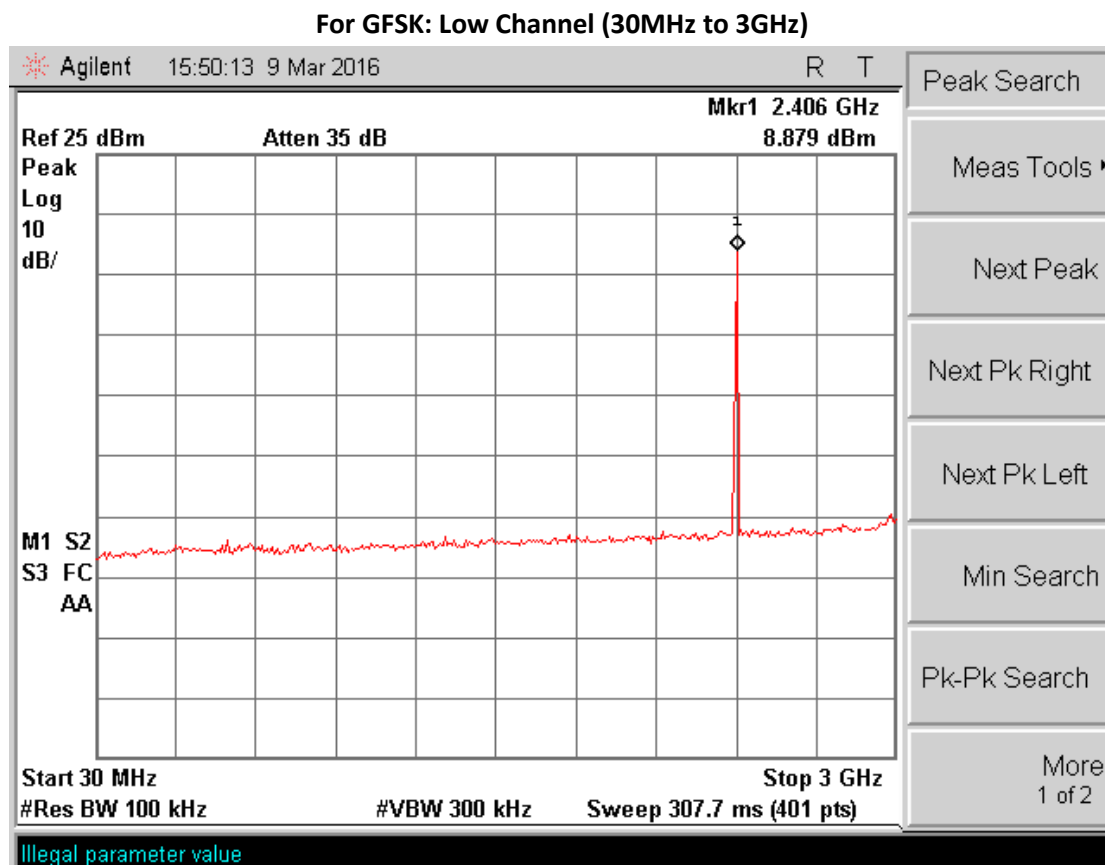


### 3.6 Conducted Spurious Emissions – FCC Section 15.247(d) RSS-247 5.5

#### 3.6.1 Measurement Procedure

The RF conducted spurious emissions were measured in accordance with the **RSS-247 5.5**, 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



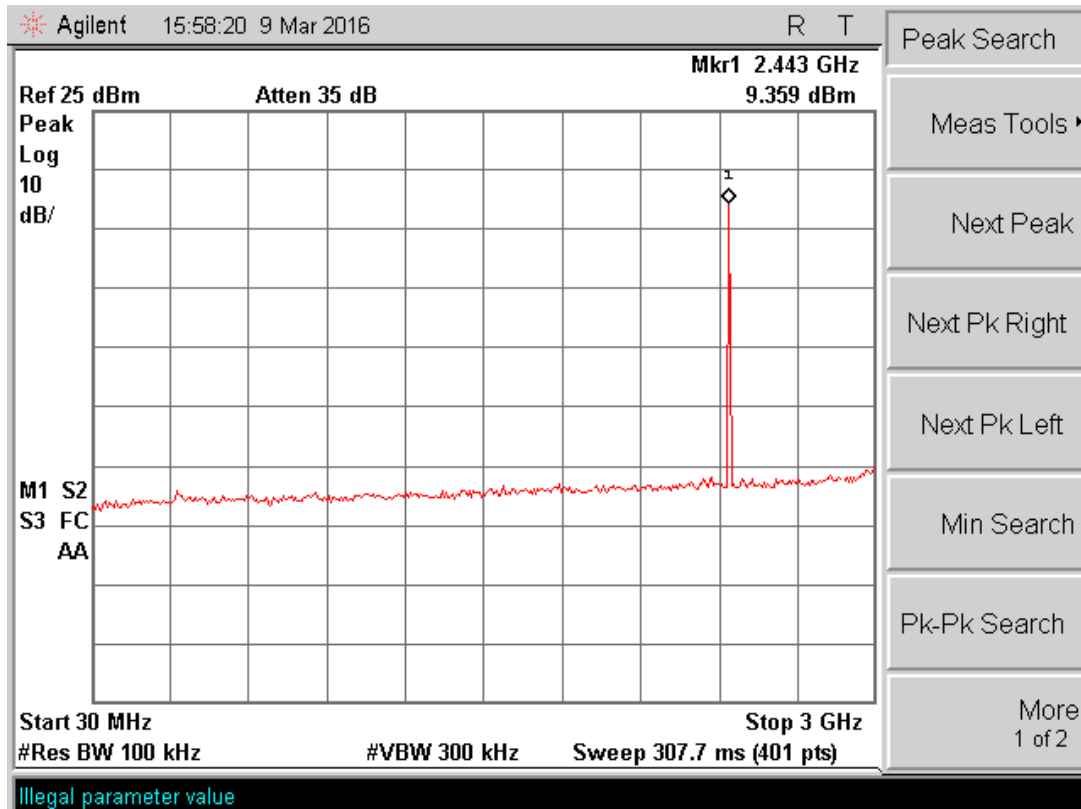
### For GFSK: Low Channel (2GHz to 13GHz)



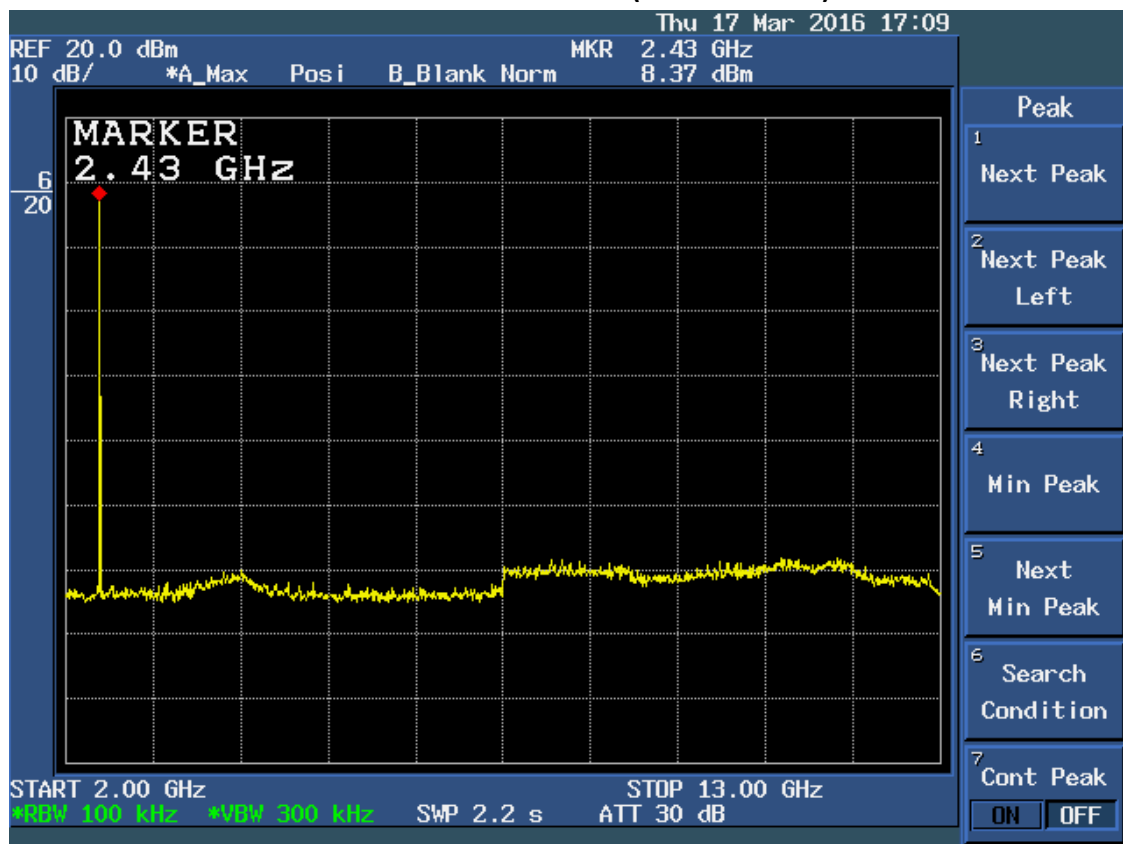
### For GFSK: Low Channel (13GHz to 26GHz)



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



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

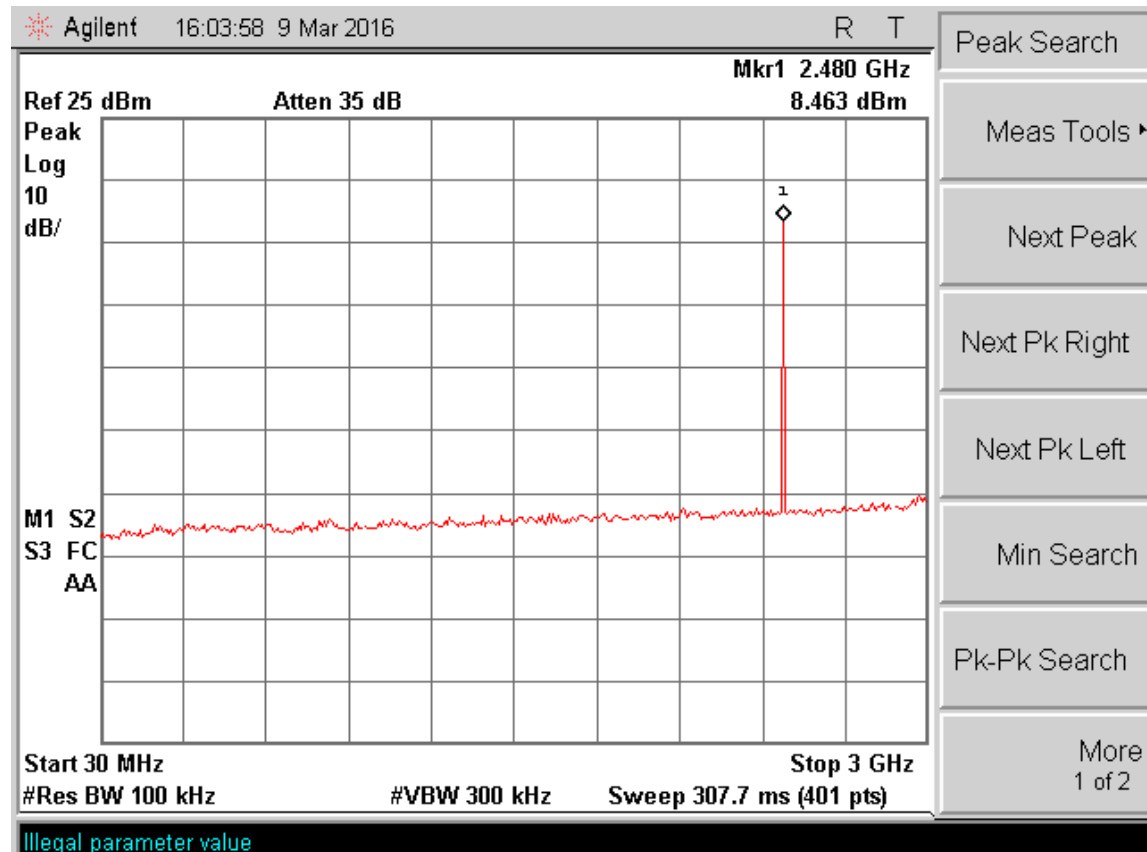




### For GFSK: Middle Channel (13GHz to 26GHz)



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



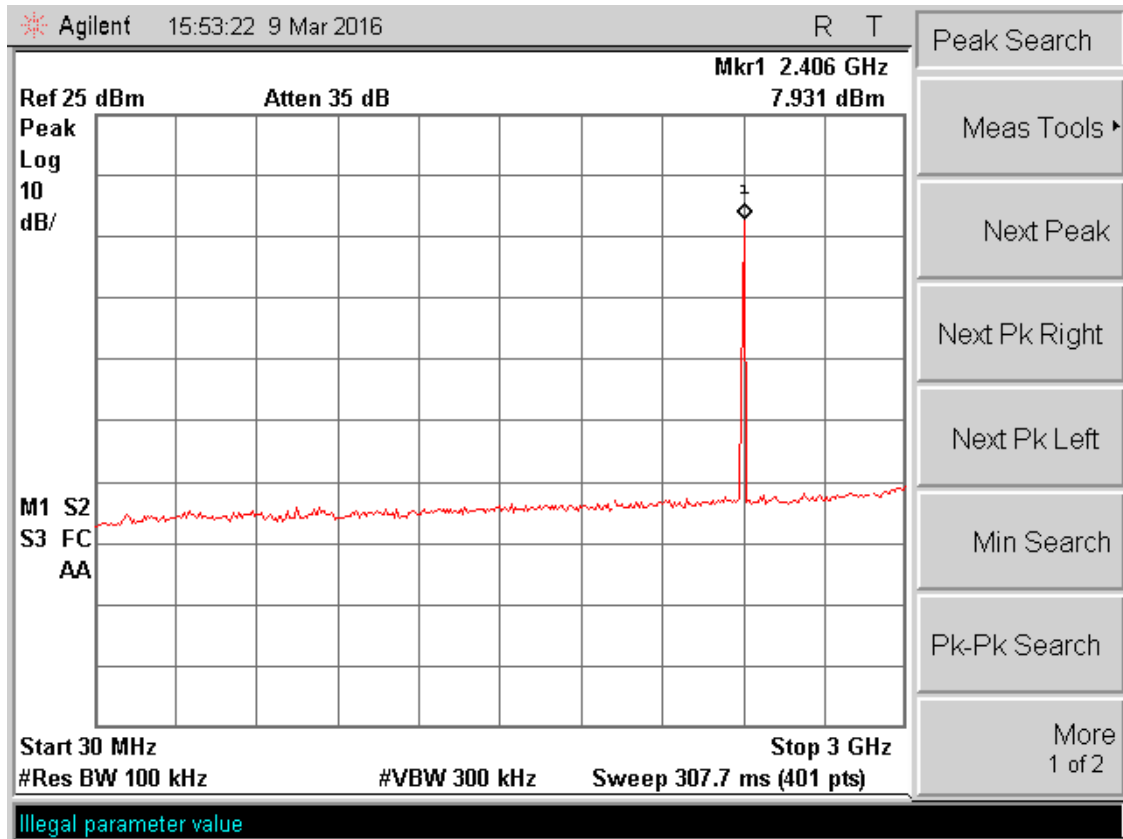
### For GFSK: High Channel (2GHz to 13GHz)



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



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



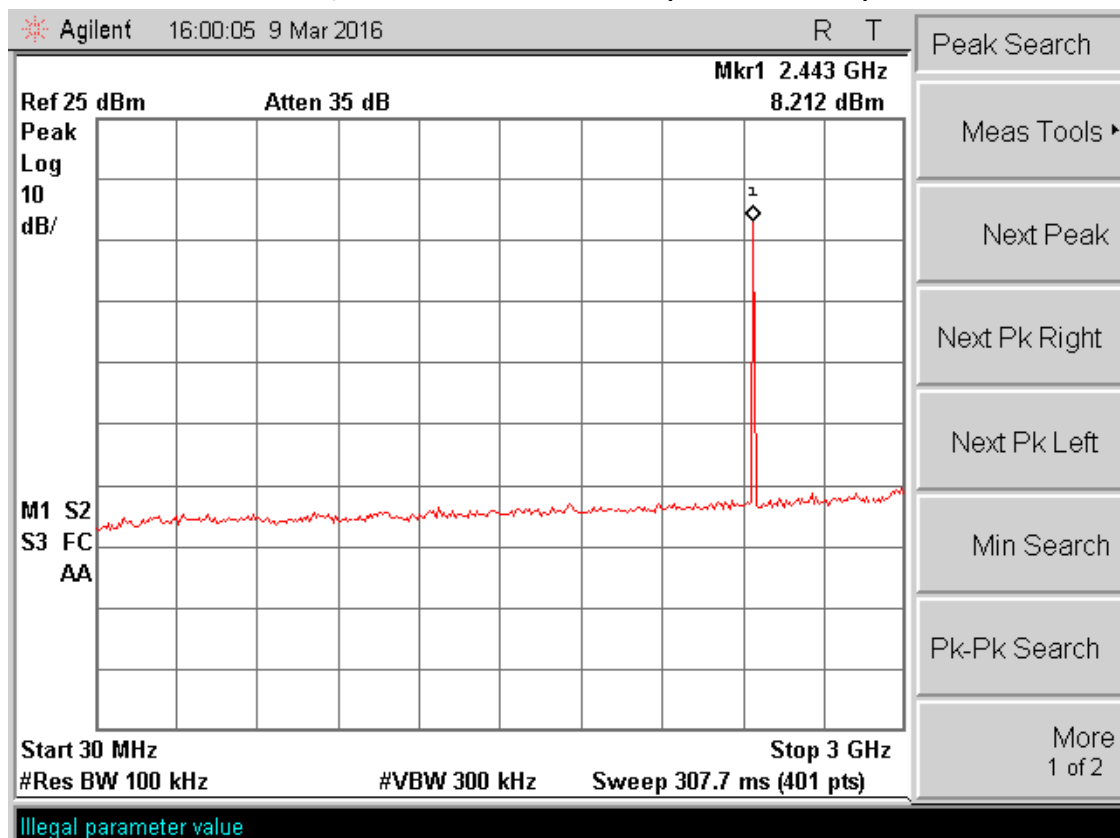
### For PI/4 DQPSK: Low Channel (2GHz to 13GHz)



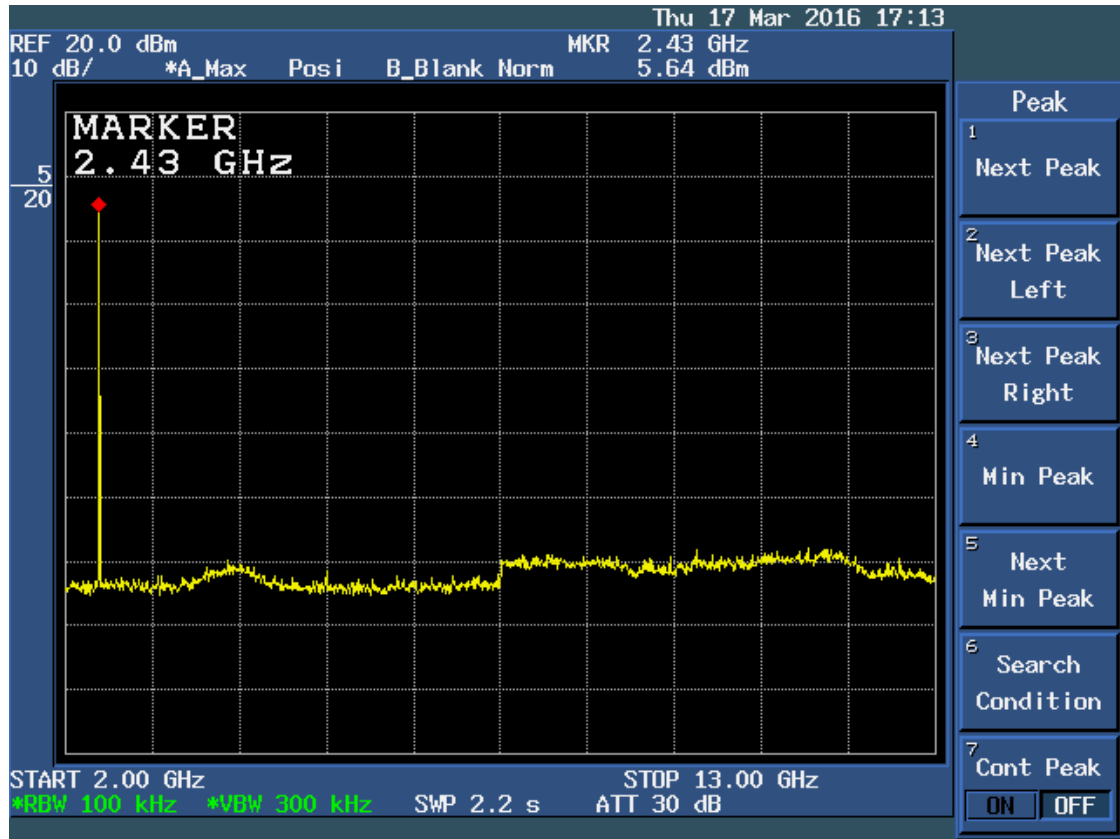
### For PI/4 DQPSK: Low Channel (13GHz to 26GHz)



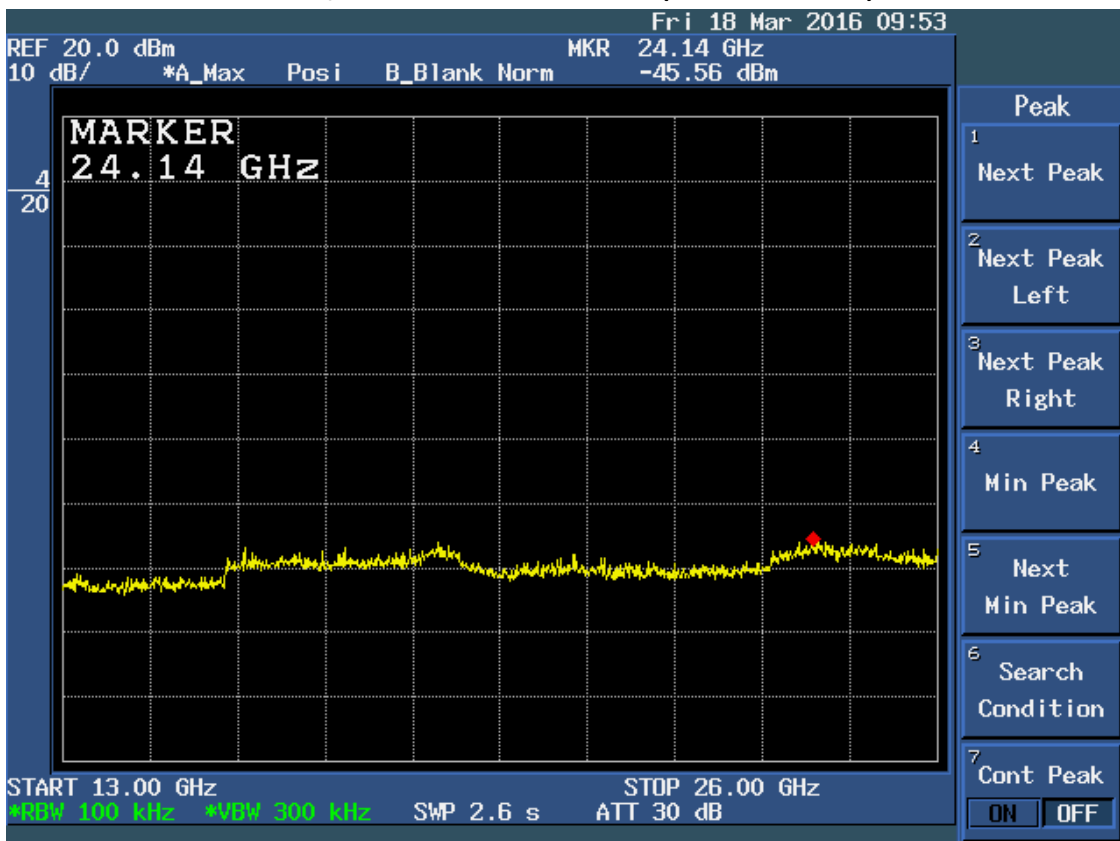
### For PI/4 DQPSK: Middle Channel (30MHz to 3GHz)



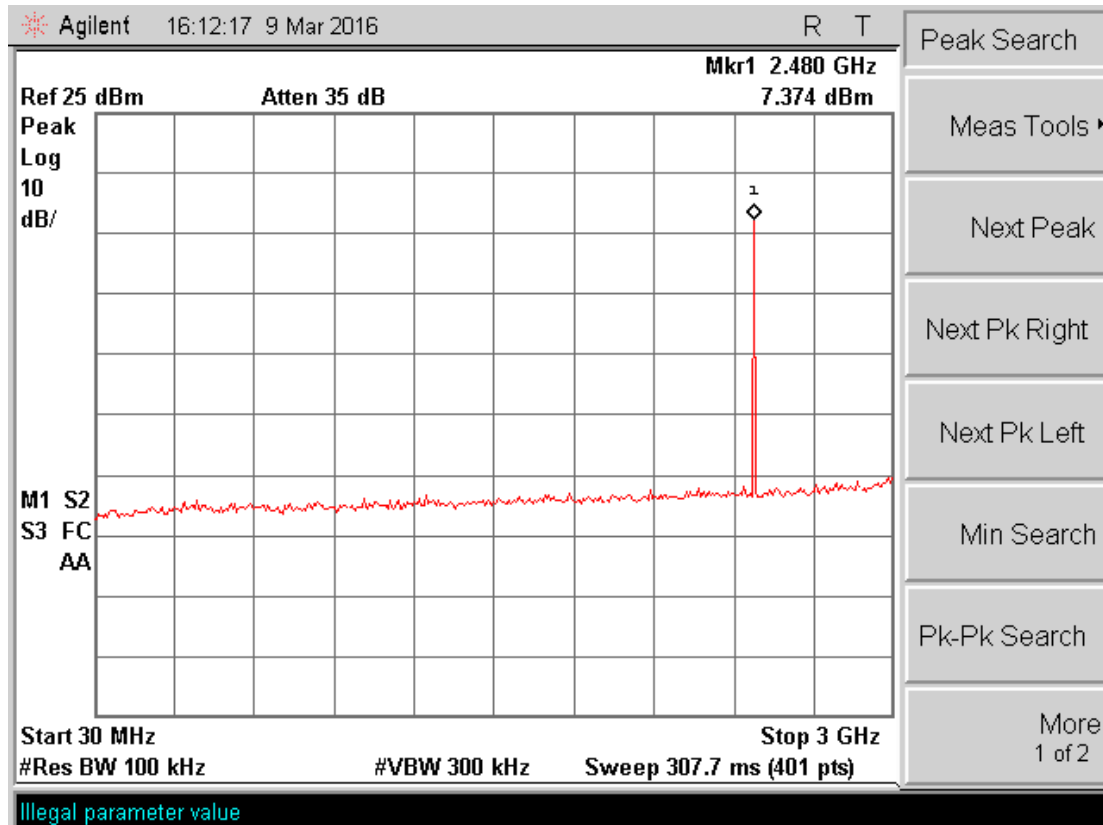
### For PI/4 DQPSK: Middle Channel (2GHz to 13GHz)



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



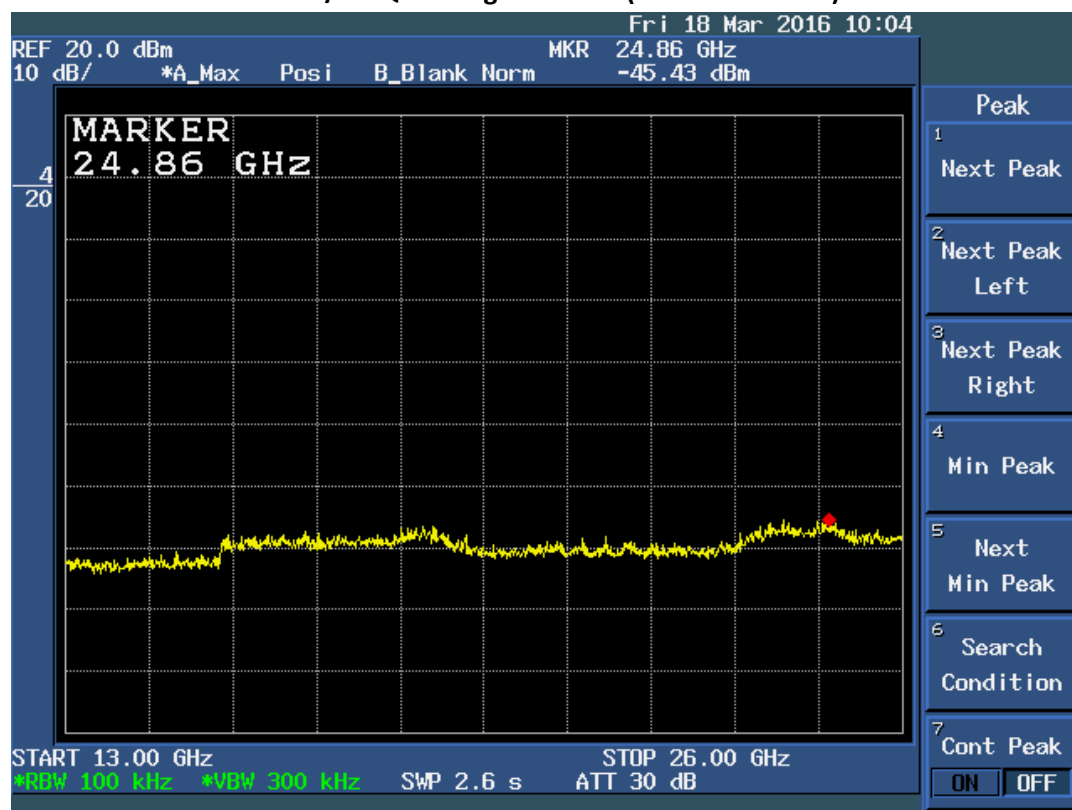
### For PI/4 DQPSK: High Channel (30MHz to 3GHz)



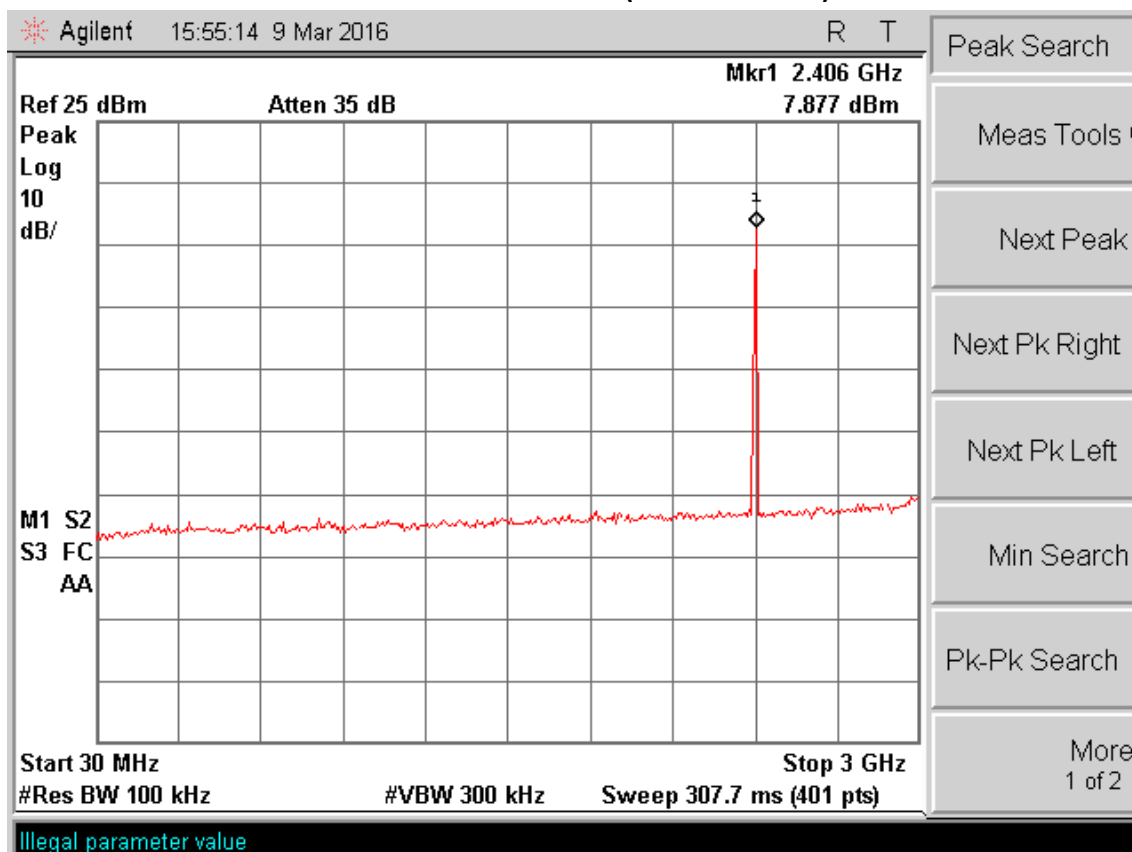
### For PI/4 DQPSK: High Channel (2GHz to 13GHz)



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



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



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

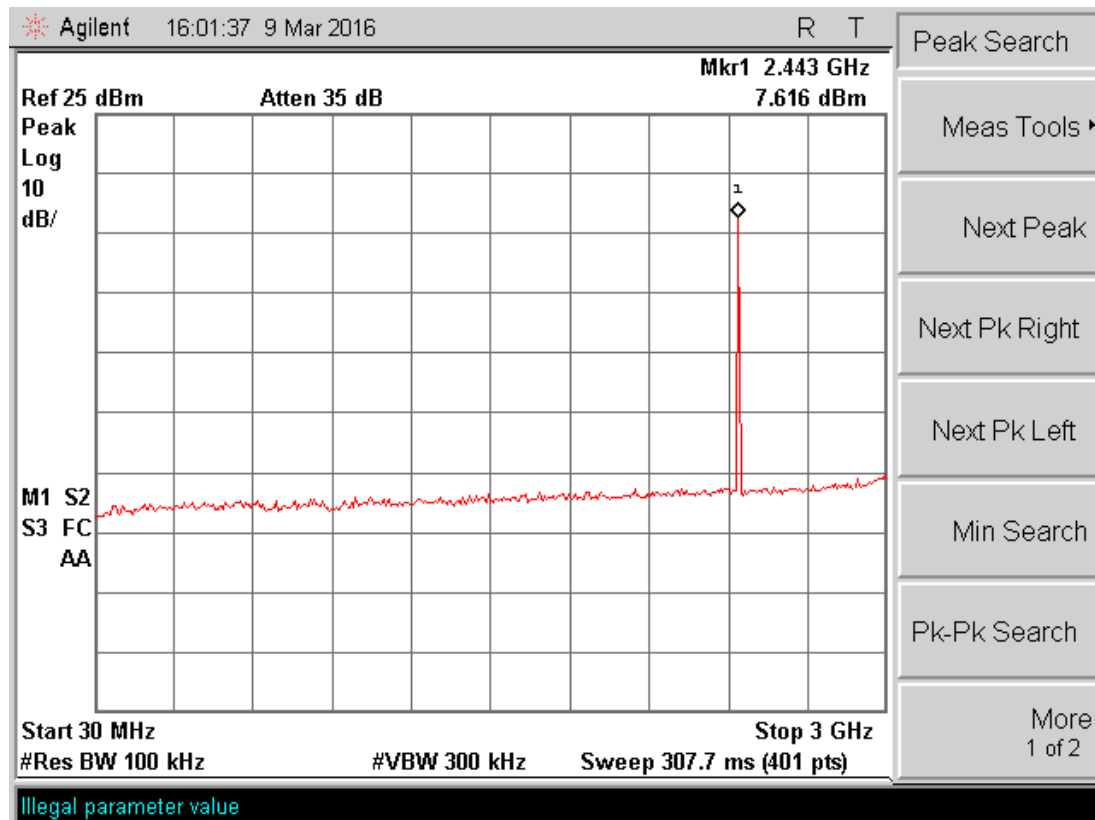


### For 8DPSK: Low Channel (13GHz to 26GHz)





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



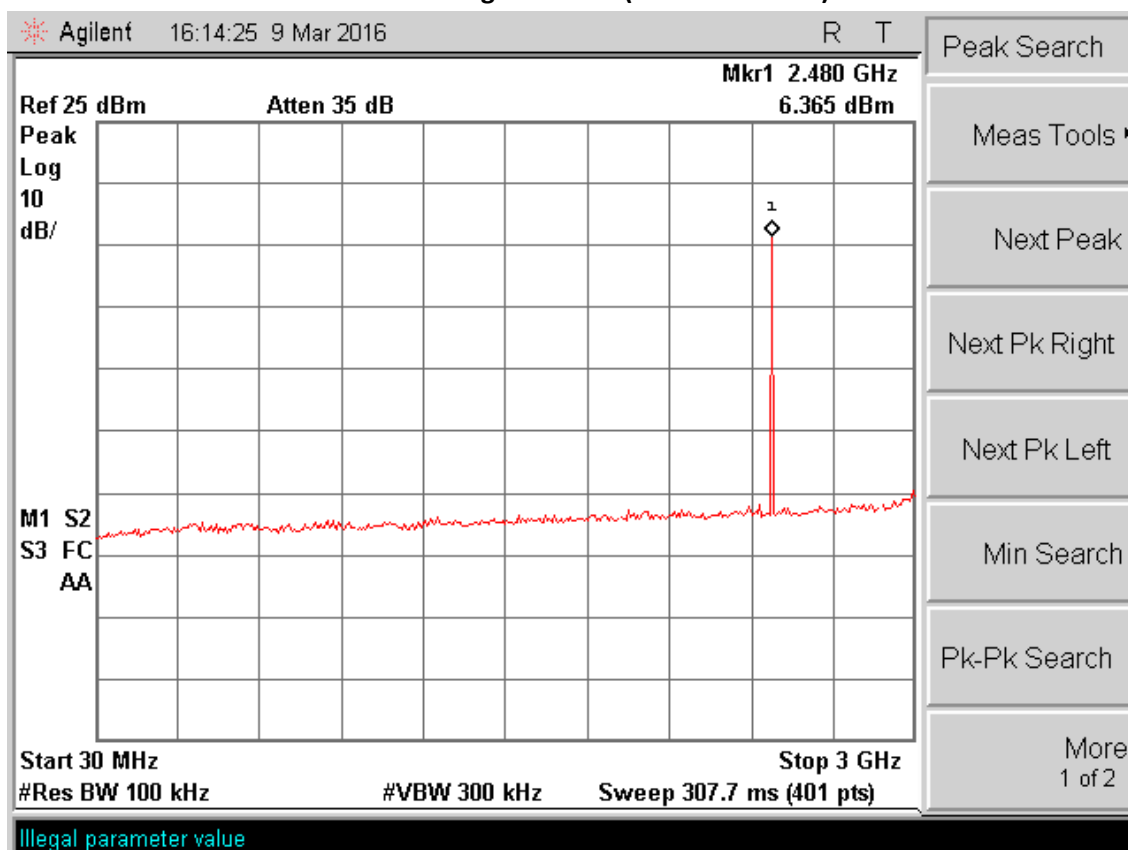
### For 8DPSK: Middle Channel (2GHz to 13GHz)



### 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)

