Appendix A

RF Test Data for BT V4.2(BDR/EDR) (Conducted Measurement)

Product Name: atomi Shower Speaker

Trade Mark: atomi

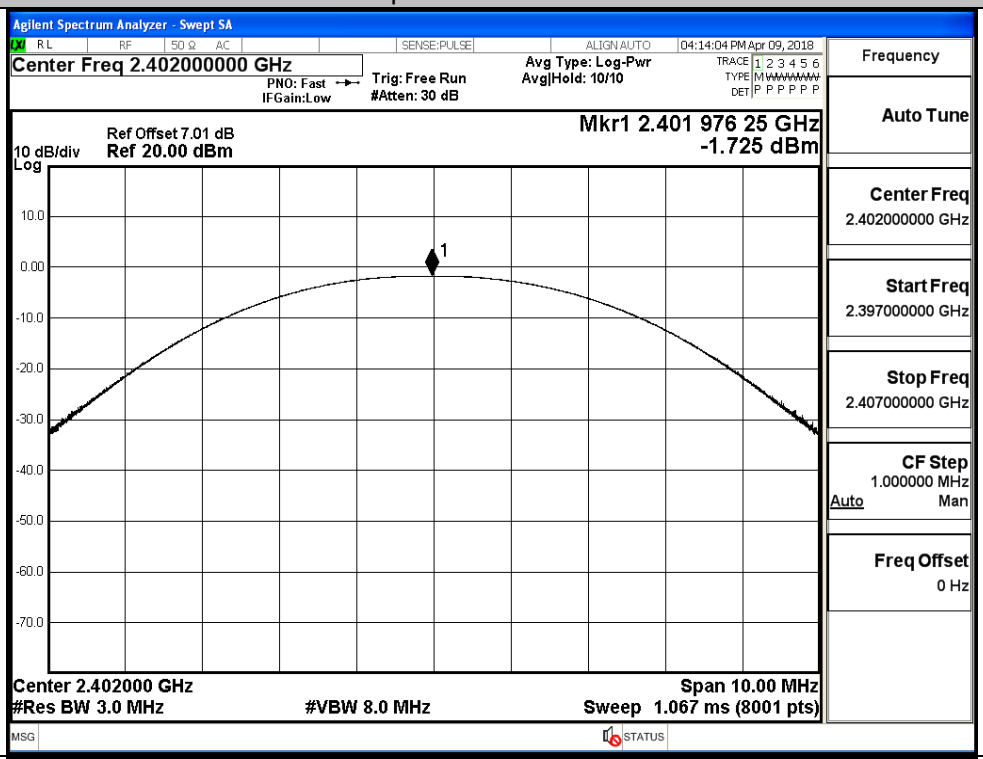
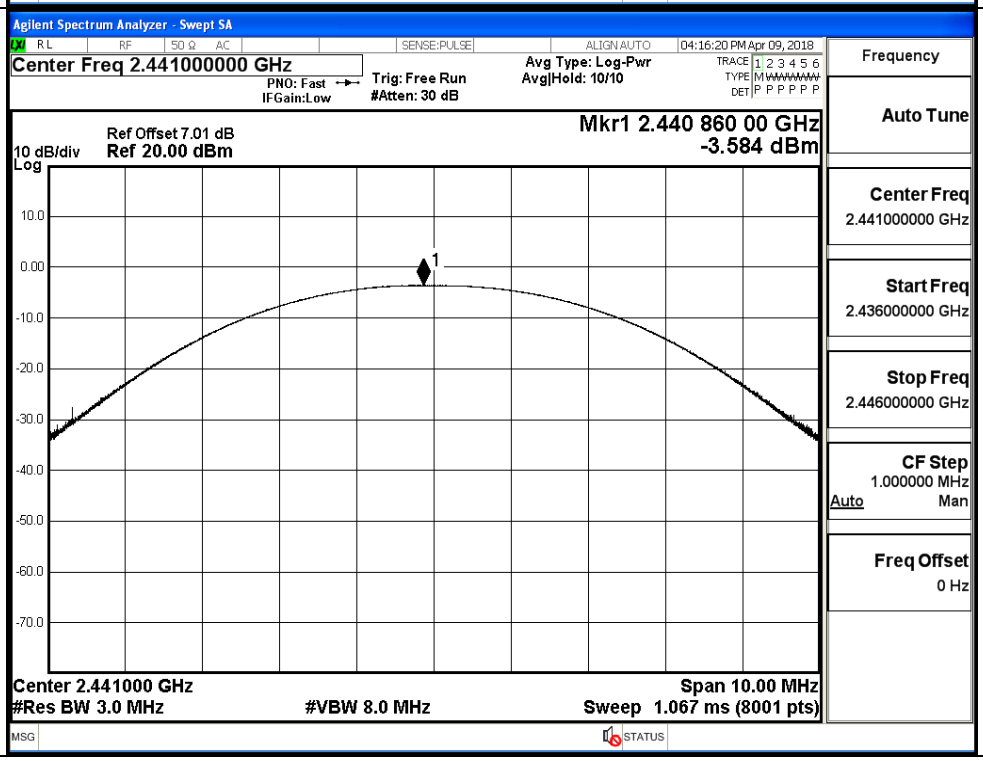
Test Model: AT1219

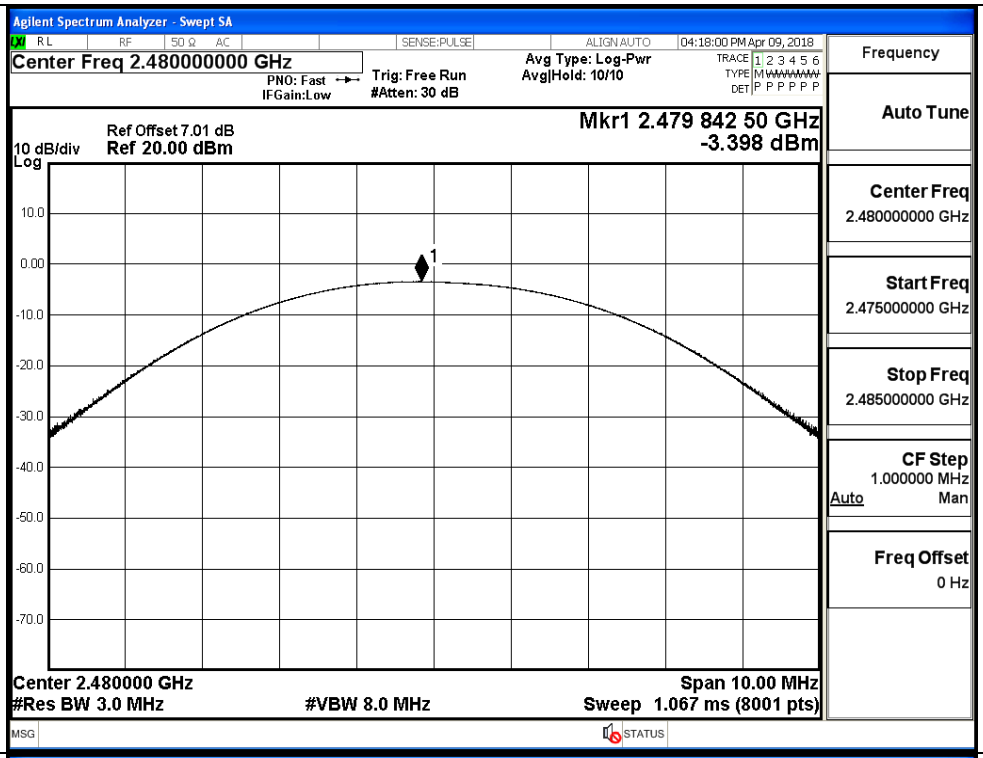
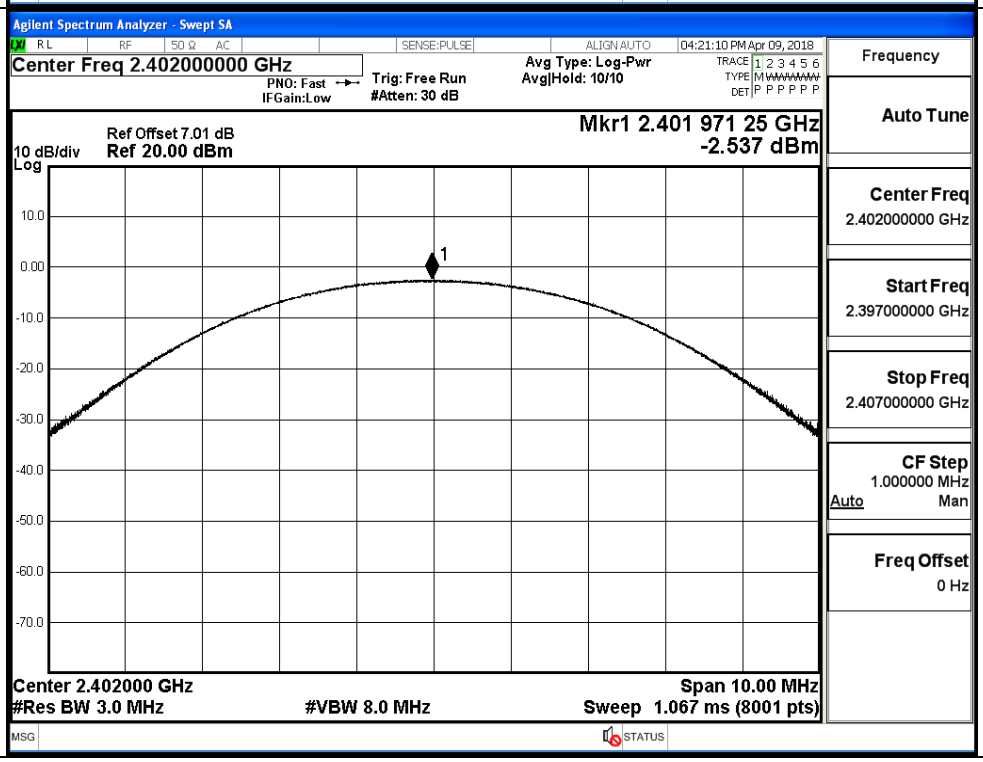
Environmental Conditions

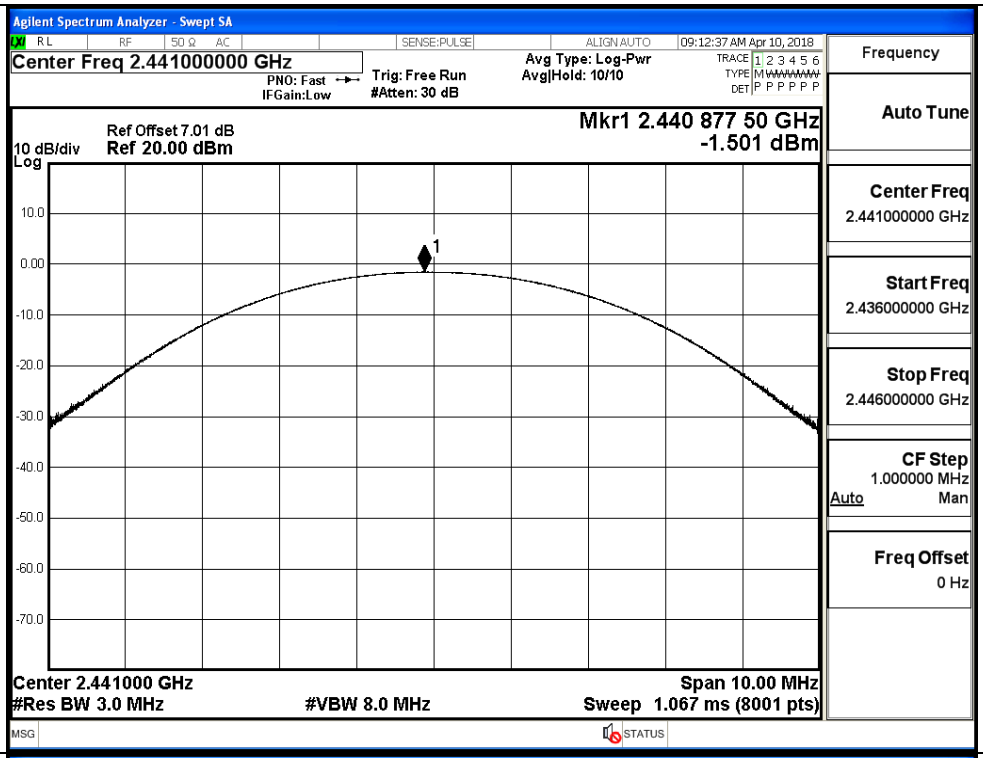
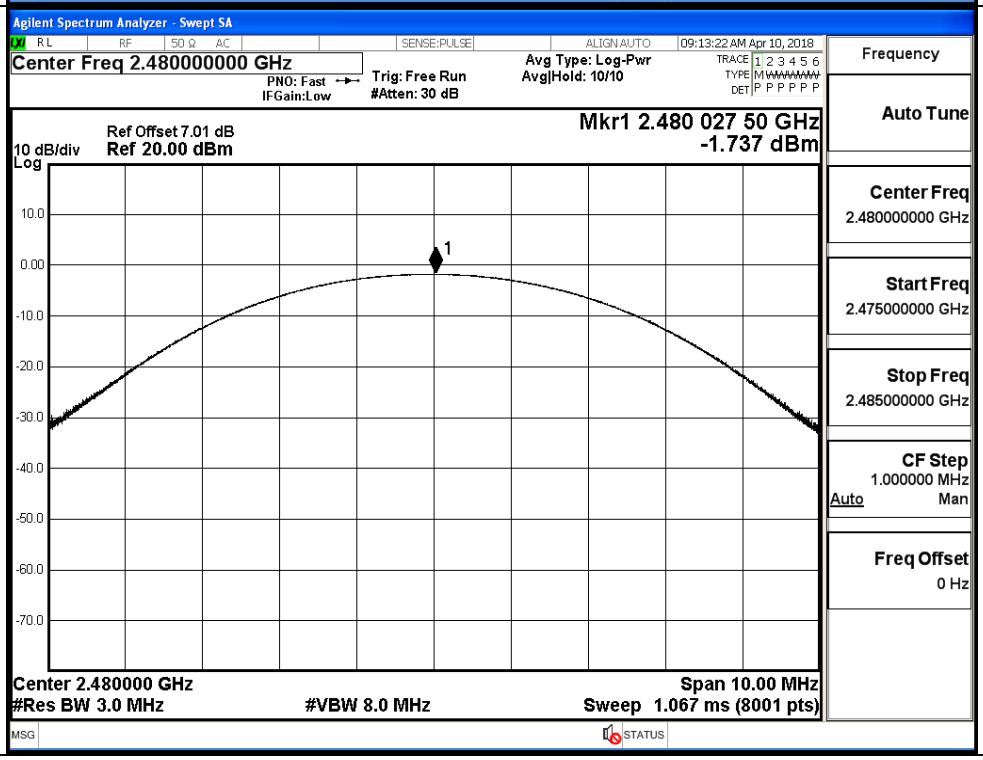
Temperature:	23.2 ° C
Relative Humidity:	52.3%
ATM Pressure:	100.0 kPa
Test Engineer:	Wangchuang
Supervised by:	Jayden Zhuo

A.1 Maxmum Conducted Peak Output Power

Mode	Channel.	Maximum Peak Output Power [dBm]	Limit [dBm]	Verdict
GFSK	LCH	-1.725	21	PASS
	MCH	-3.584	21	PASS
	HCH	-3.398	21	PASS
π/4DQPSK	LCH	-2.537	21	PASS
	MCH	-1.501	21	PASS
	HCH	-1.737	21	PASS

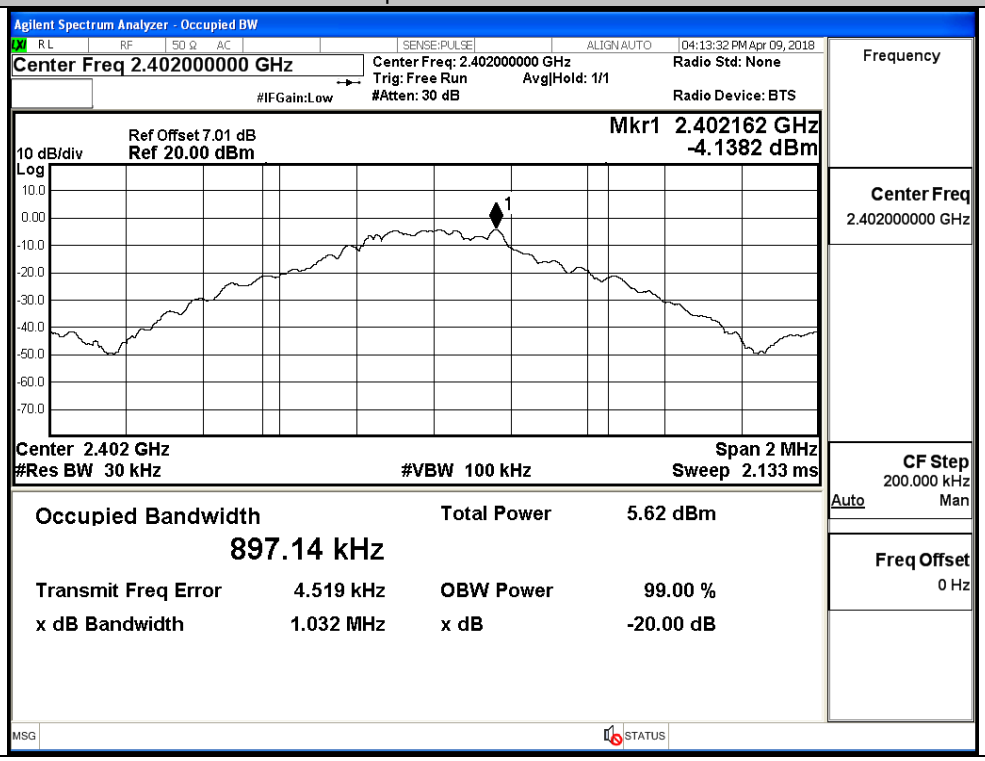
Test Graphs		
GFSK/LCH		
GFSK/MCH		

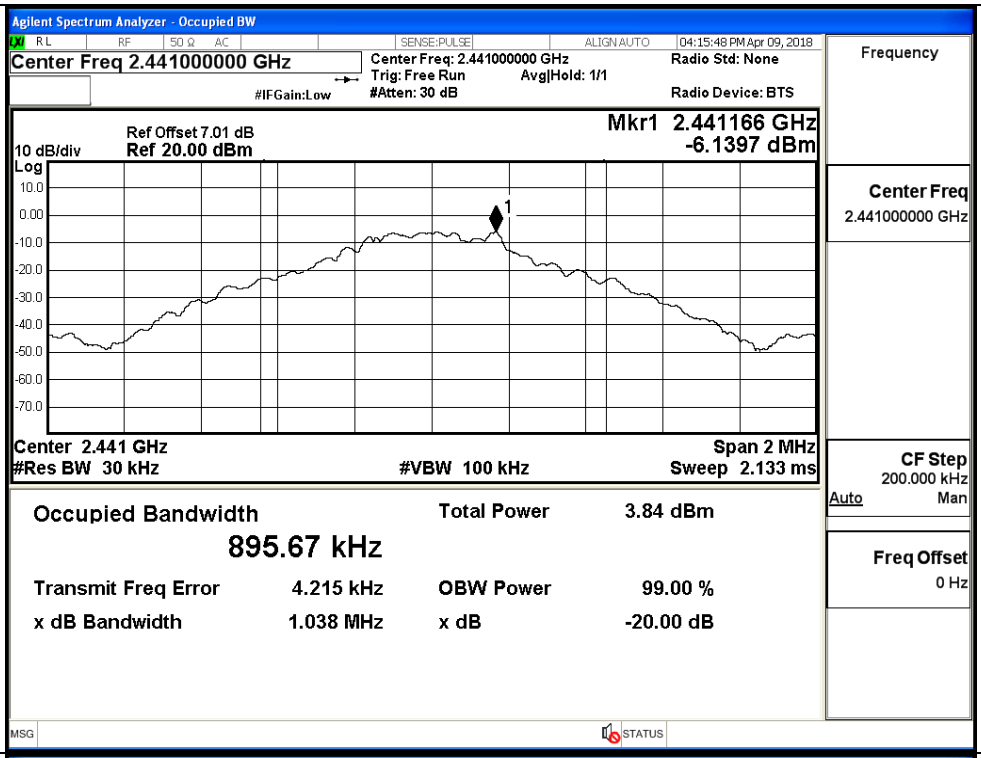
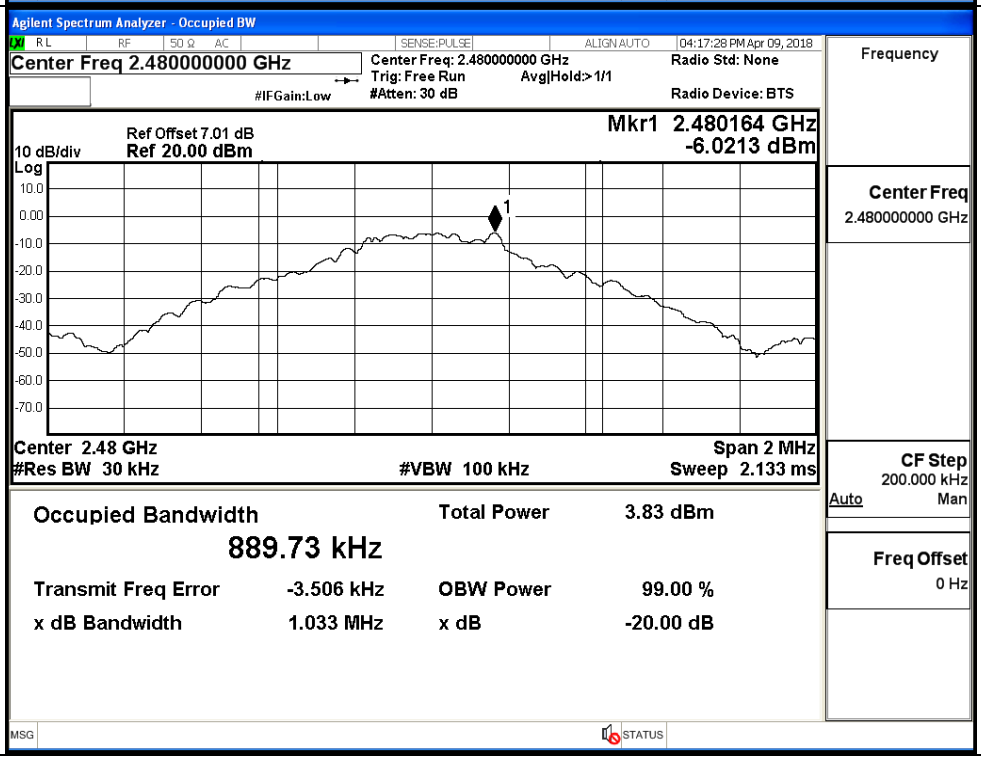
GFSK/HCH	
π/4DQPSK/LCH	

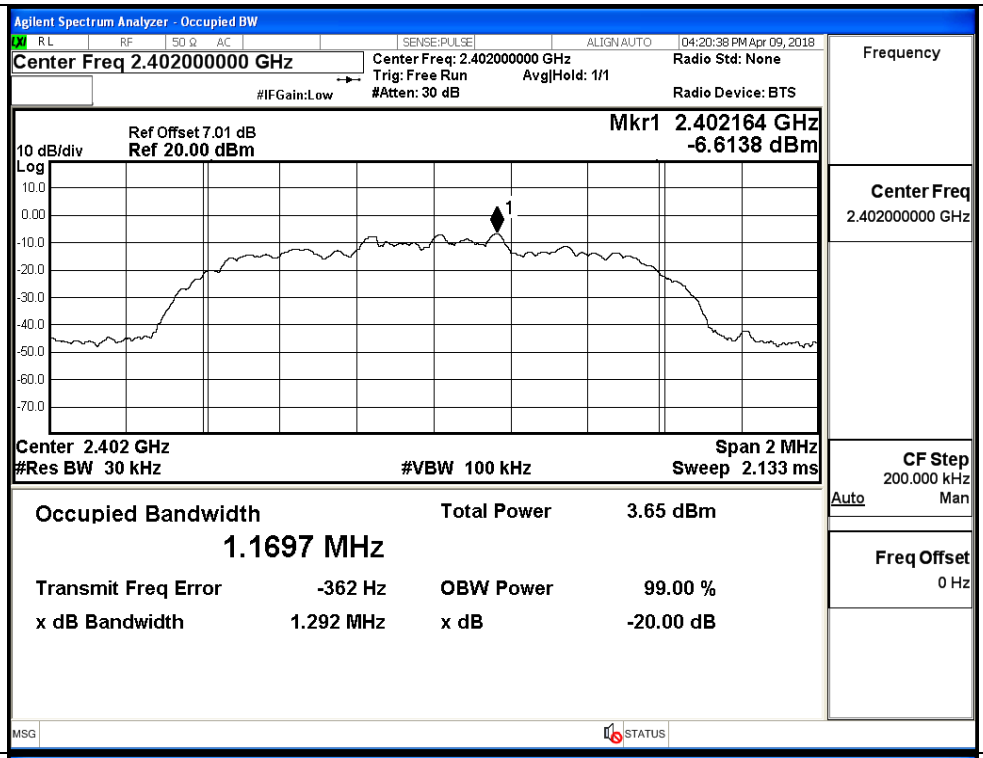
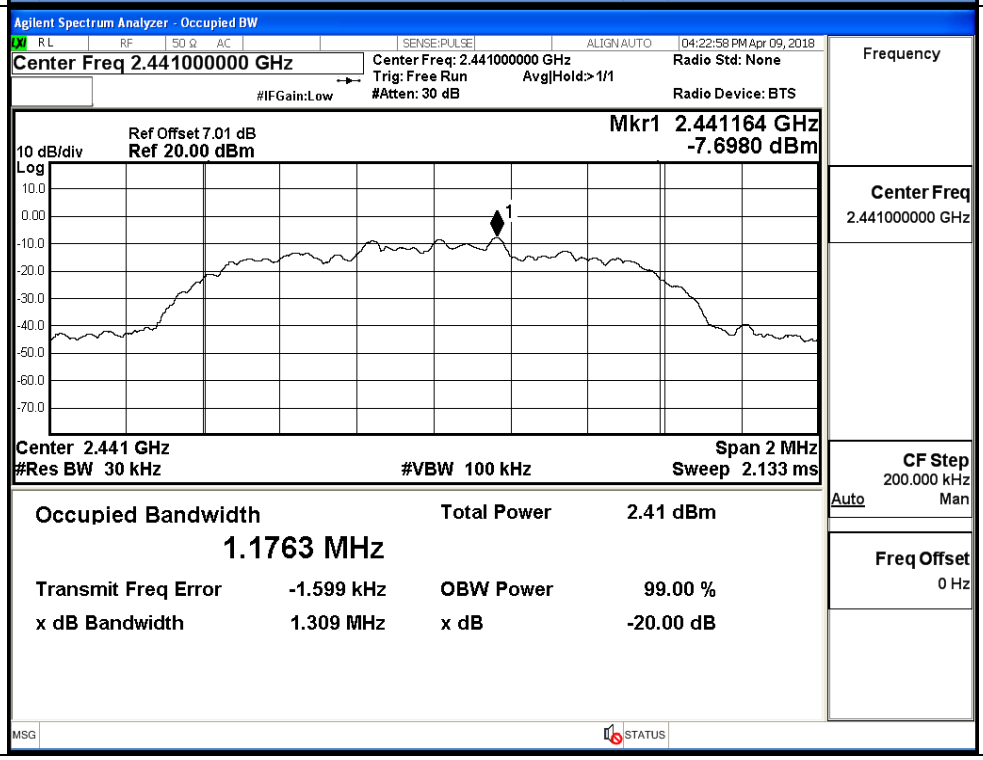
π/4DQPSK/MCH	
π/4DQPSK/HCH	

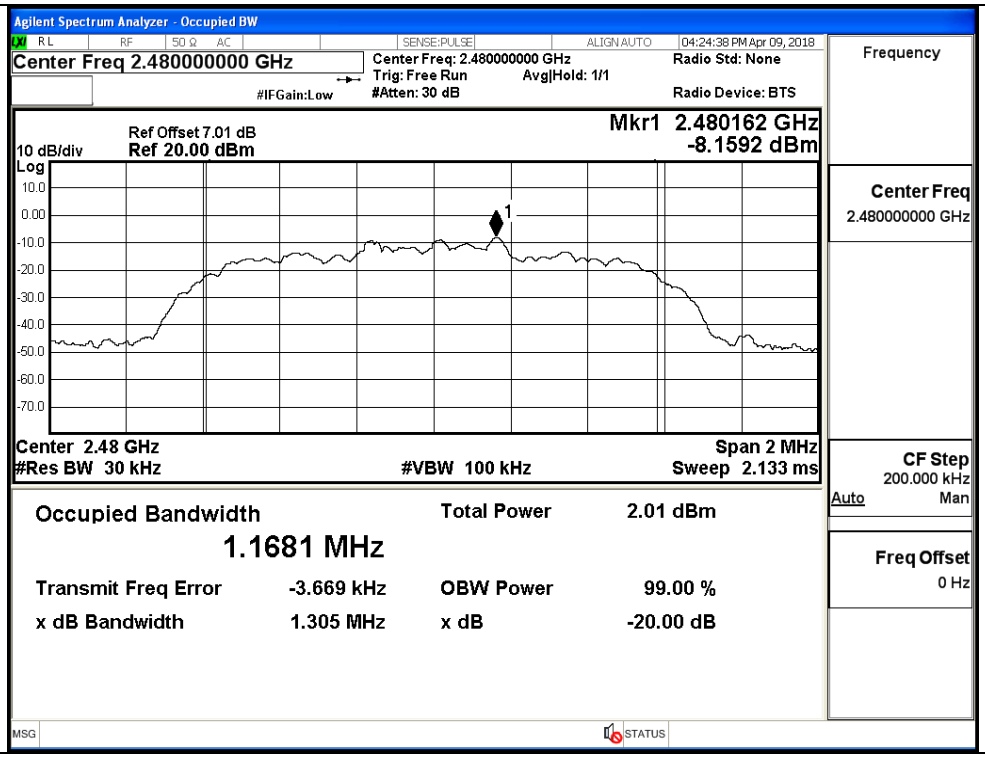
A.2 20dB Bandwidth

Mode	Channel.	20dB Bandwidth [MHz]	Limit [MHz]	Verdict
GFSK	LCH	1.032	Not Specified	PASS
	MCH	1.038	Not Specified	PASS
	HCH	1.033	Not Specified	PASS
π/4DQPSK	LCH	1.292	Not Specified	PASS
	MCH	1.309	Not Specified	PASS
	HCH	1.305	Not Specified	PASS

Test Graphs	
GFSK/LCH	

GFSK/MCH	
GFSK/HCH	

π/4DQPSK/LCH	
π/4DQPSK/MCH	

π/4DQPSK/HCH	

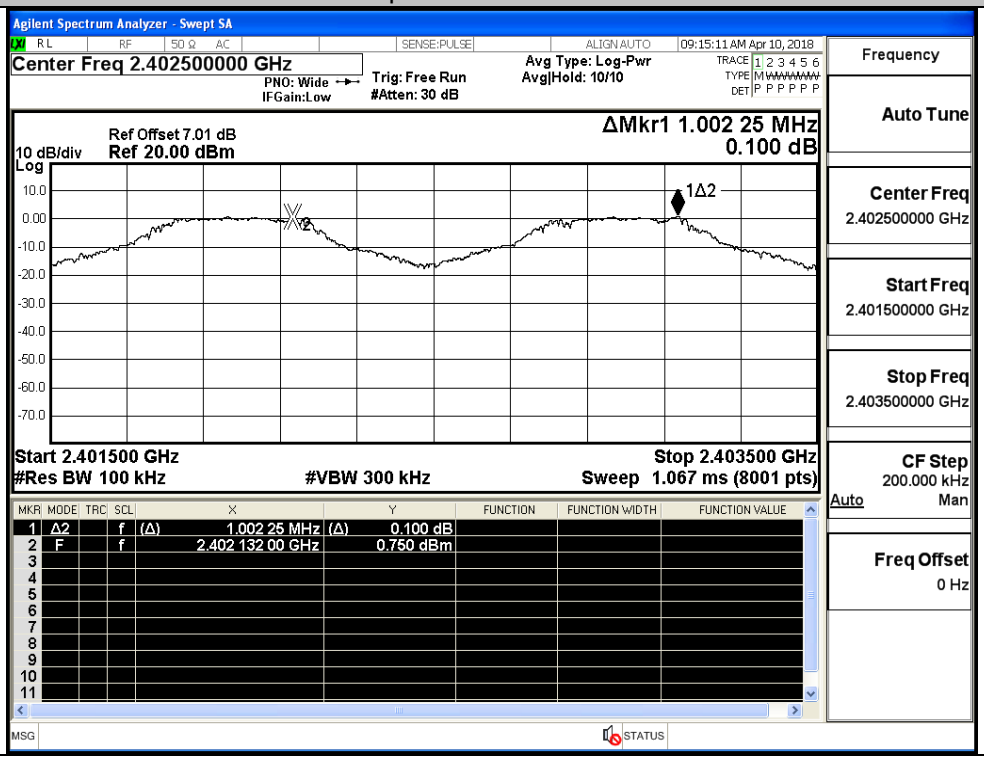
Agilent Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:PULSE
ALIGN AUTO
04:24:38 PM Apr 09, 2018
Center Freq 2.480000000 GHz
#IFGain:Low
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 1/1
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 7.01 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 2.480162 GHz
-8.1592 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
1
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2 MHz
Sweep 2.133 ms
Occupied Bandwidth
1.1681 MHz
Total Power
2.01 dBm
Transmit Freq Error
-3.669 kHz
OBW Power
99.00 %
x dB Bandwidth
1.305 MHz
x dB
-20.00 dB
Center Freq
2.480000000 GHz
CF Step
200.000 kHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS

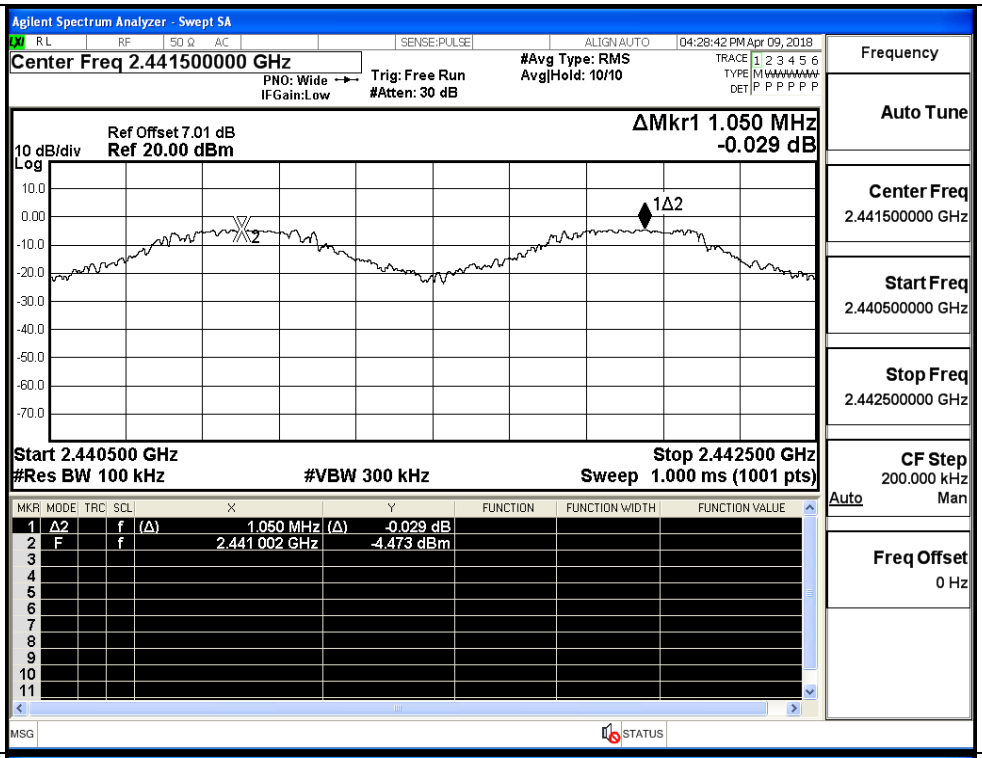
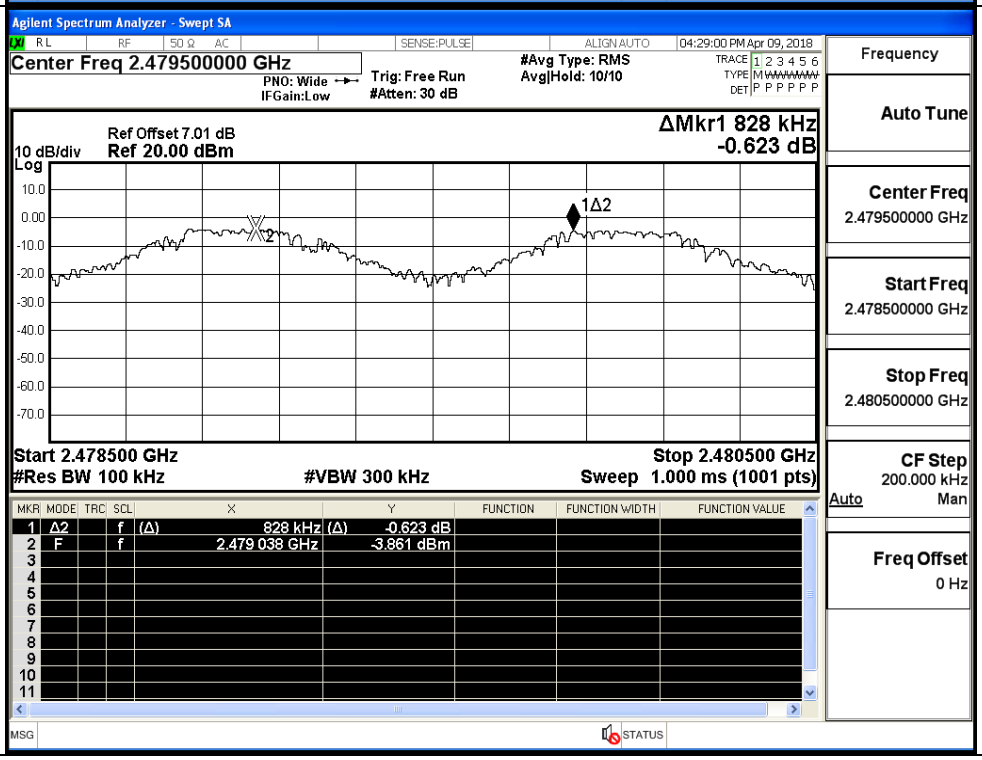
A.3 Carrier Frequency Separation

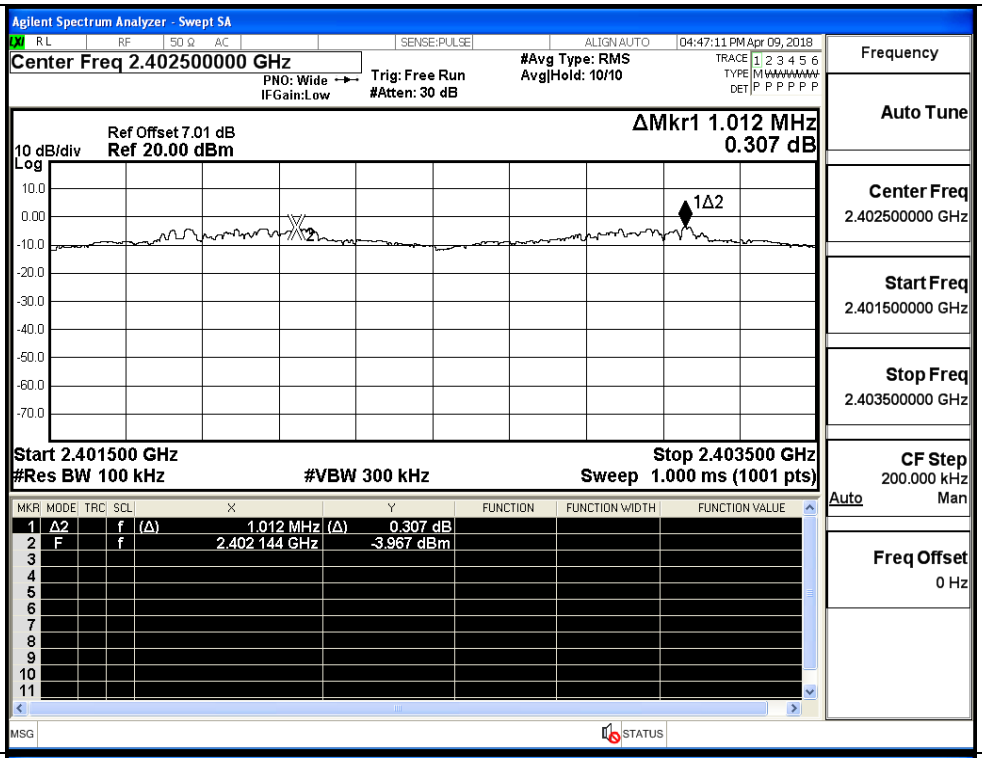
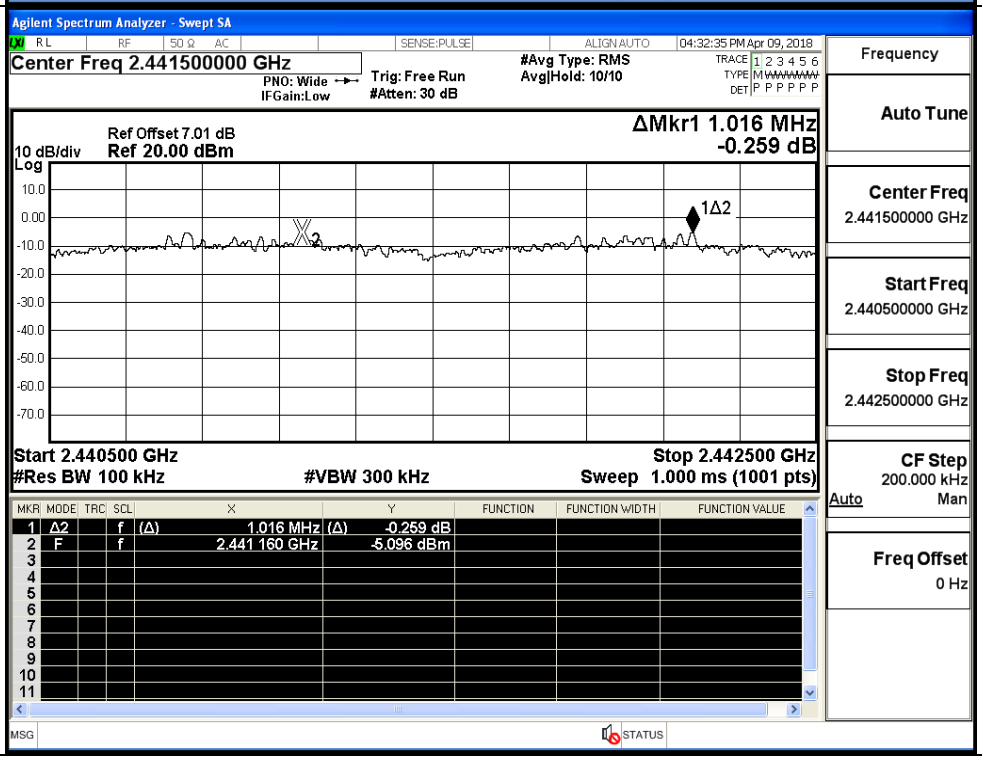
Mode	Channel.	Carrier Frequency Separation [MHz]	Limit [MHz]	Verdict
GFSK	LCH	1.002	0.688	PASS
	MCH	1.050	0.692	PASS
	HCH	0.828	0.689	PASS
π/4DQPSK	LCH	1.012	0.861	PASS
	MCH	1.016	0.873	PASS
	HCH	0.980	0.870	PASS

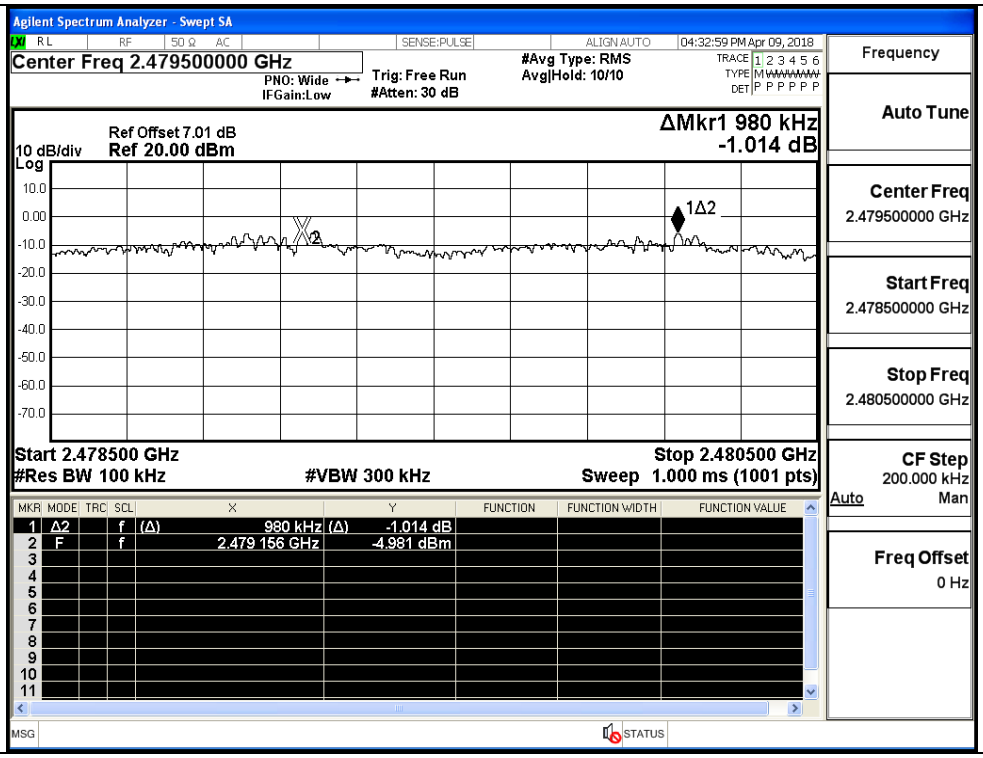
Test Graphs

GFSK/LCH



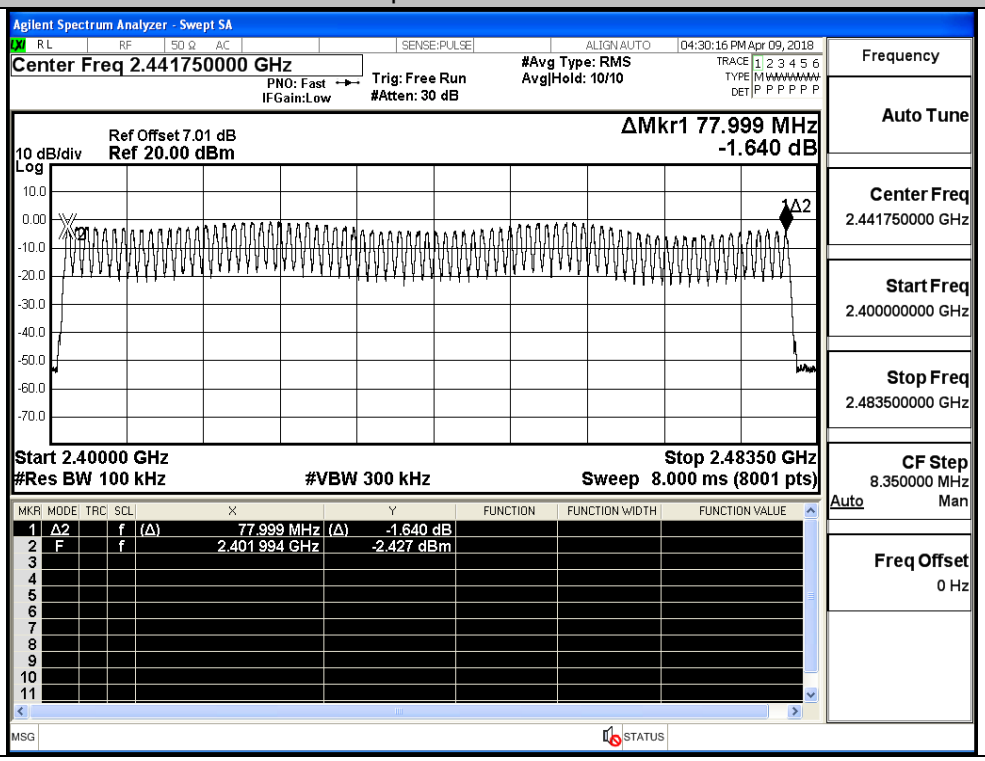
GFSK/MCH	
GFSK/HCH	

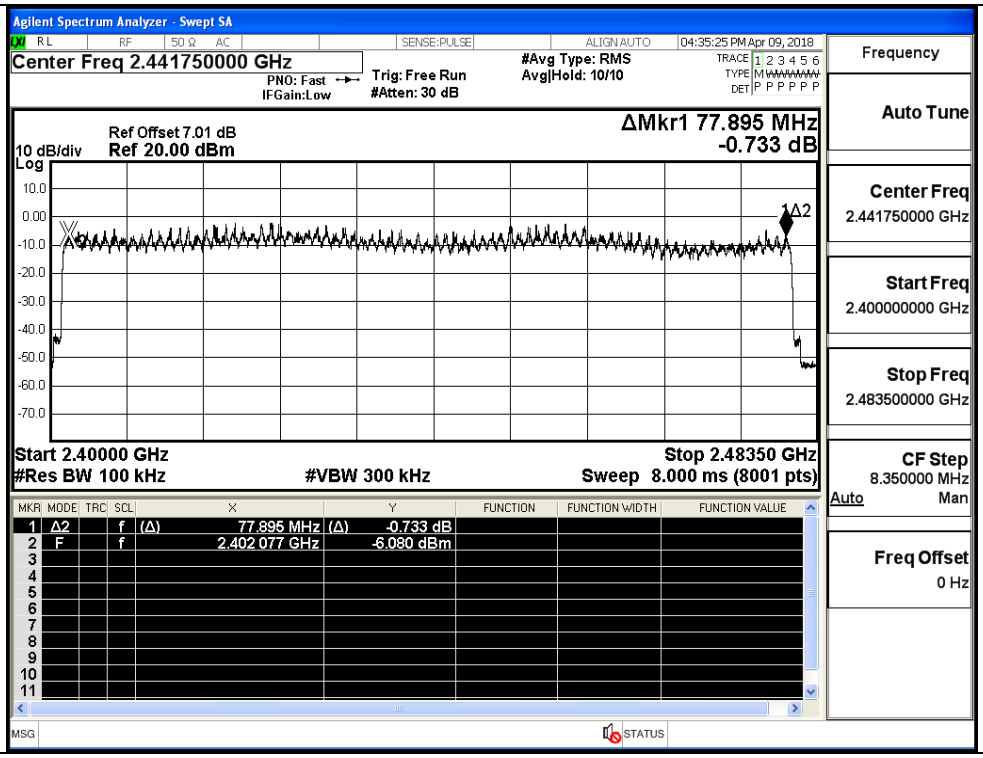
π/4DQPSK/LCH	
π/4DQPSK/MCH	

π/4DQPSK/HCH	

A.4 Hopping Channel Number

Mode	Channel.	Number of Hopping Channel [N]	Limit [N]	Verdict
GFSK	Hop	79	>=15	PASS
π/4DQPSK	Hop	79	>=15	PASS

Test Graphs	
GFSK/Hop	

π/4DQPSK/Hop	

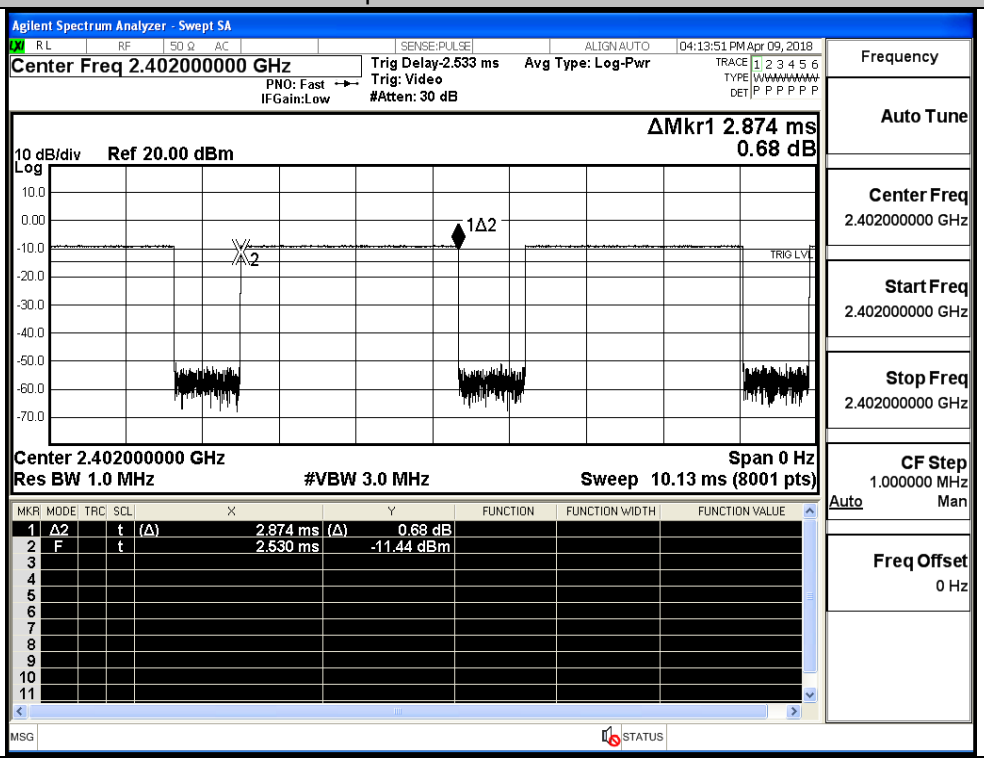
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441750000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 10/10
04:35:25 PM Apr 09, 2018
Ref Offset 7.01 dB
10 dB/div
Log
Ref 20.00 dBm
ΔMkr1 77.895 MHz
-0.733 dB
Start 2.40000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.48350 GHz
Sweep 8.000 ms (8001 pts)
1 Δ2 f (Δ) 77.895 MHz (Δ) -0.733 dB
2 F f 2.402 077 GHz -6.080 dBm
Frequency
Auto Tune
Center Freq
2.441750000 GHz
Start Freq
2.400000000 GHz
Stop Freq
2.483500000 GHz
CF Step
8.350000 MHz
Auto
Man
Freq Offset
0 Hz

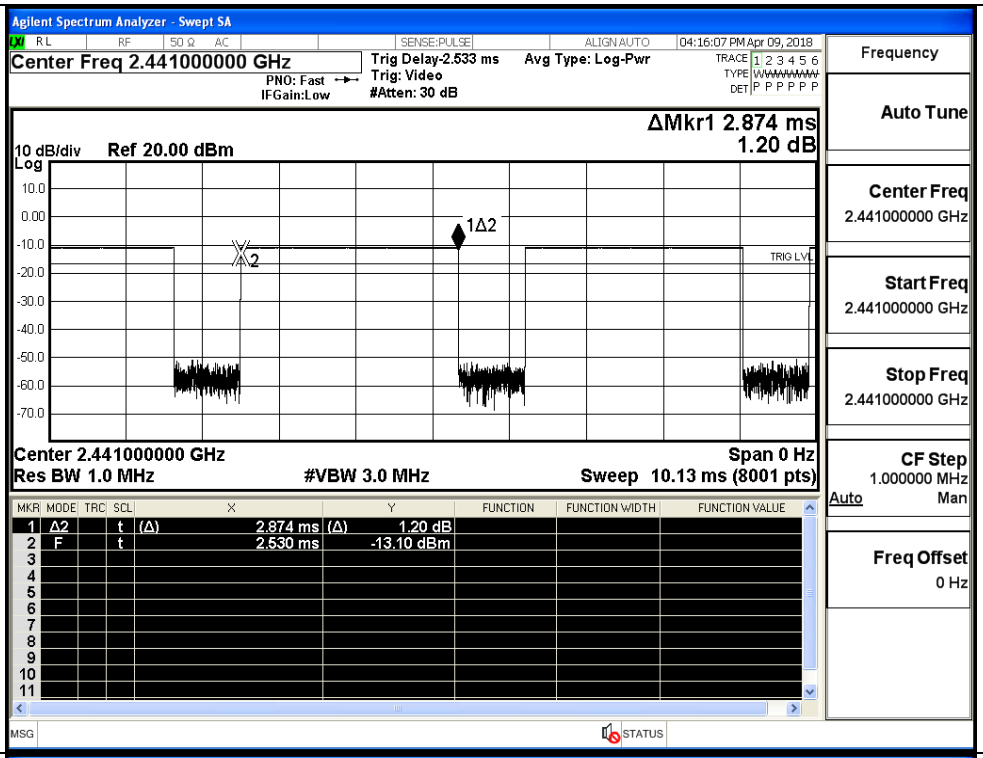
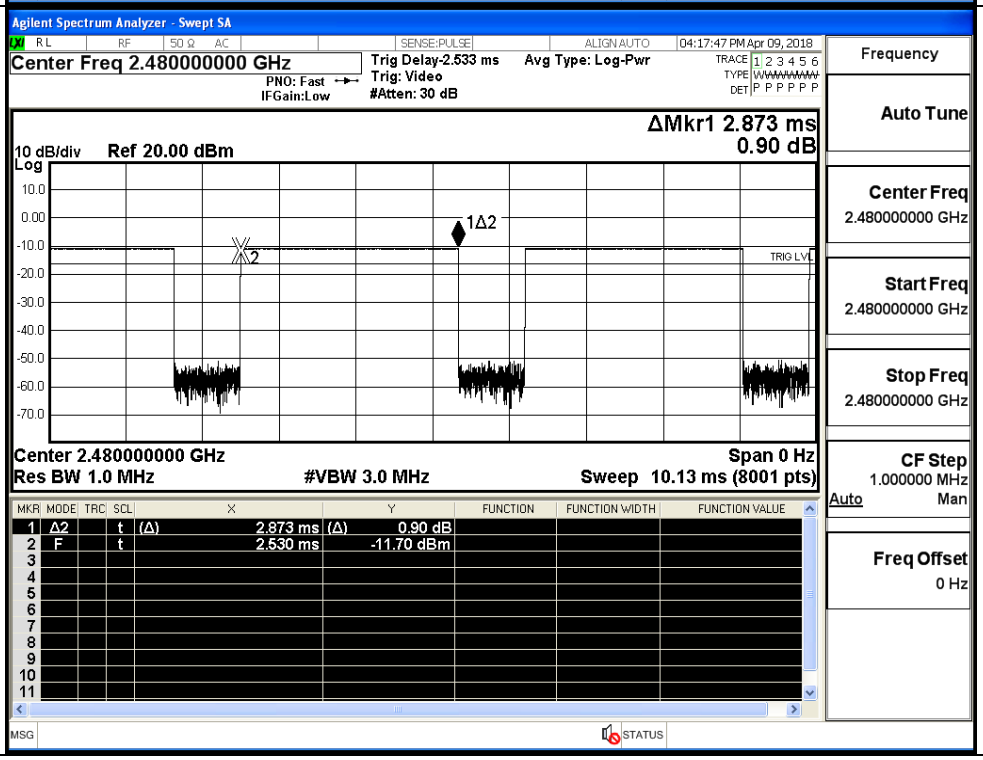
A.5 Dwell Time

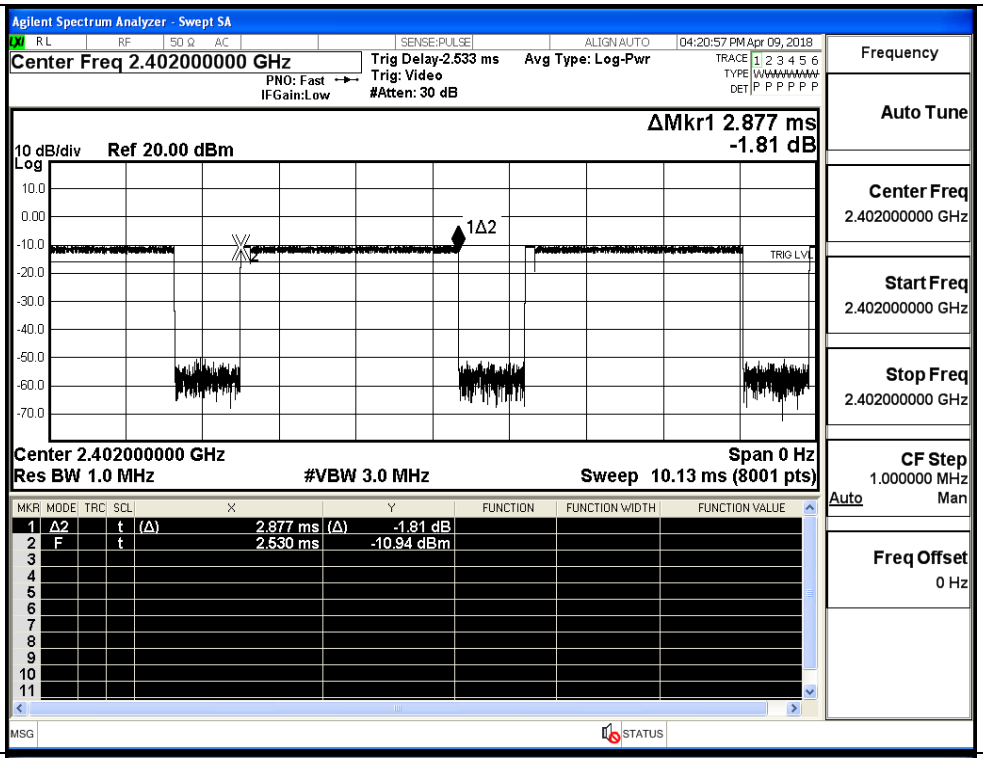
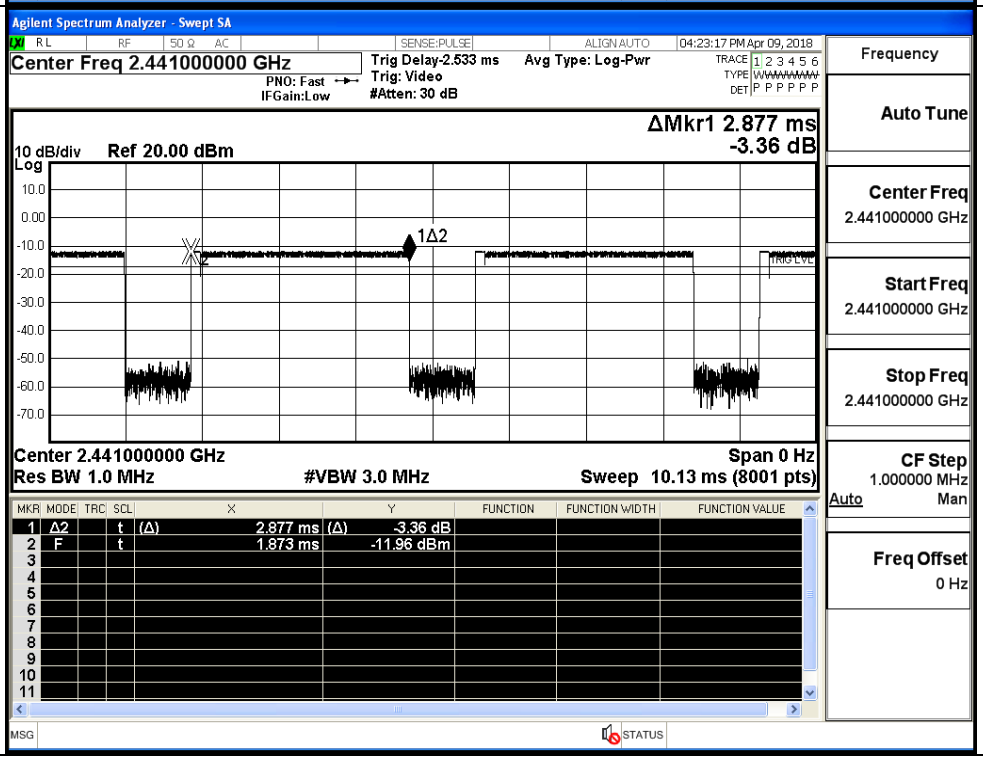
Mode	Packet	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Limit [s]	Verdict
GFSK	DH5	LCH	2.87	106.7	0.306	0.4	PASS
	DH5	MCH	2.87	106.7	0.306	0.4	PASS
	DH5	HCH	2.87	106.7	0.306	0.4	PASS
π/4DQPSK	2DH5	LCH	2.87	106.7	0.307	0.4	PASS
	2DH5	MCH	2.87	106.7	0.307	0.4	PASS
	2DH5	HCH	2.87	106.7	0.307	0.4	PASS

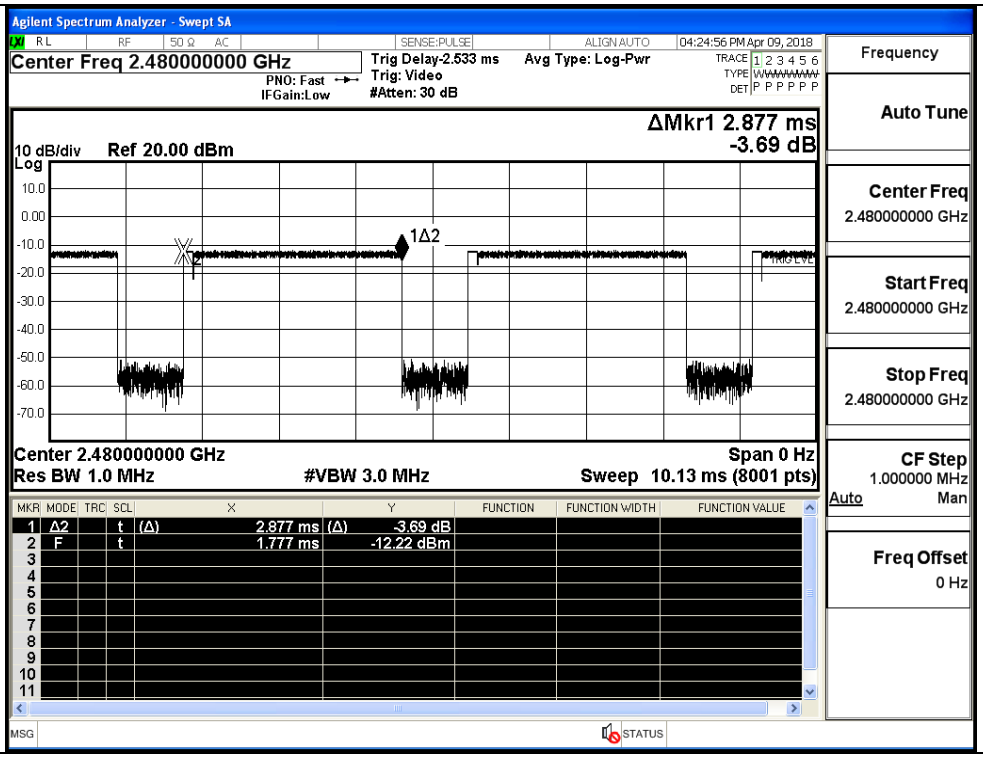
Test Graphs

GFSK_DH5/LCH



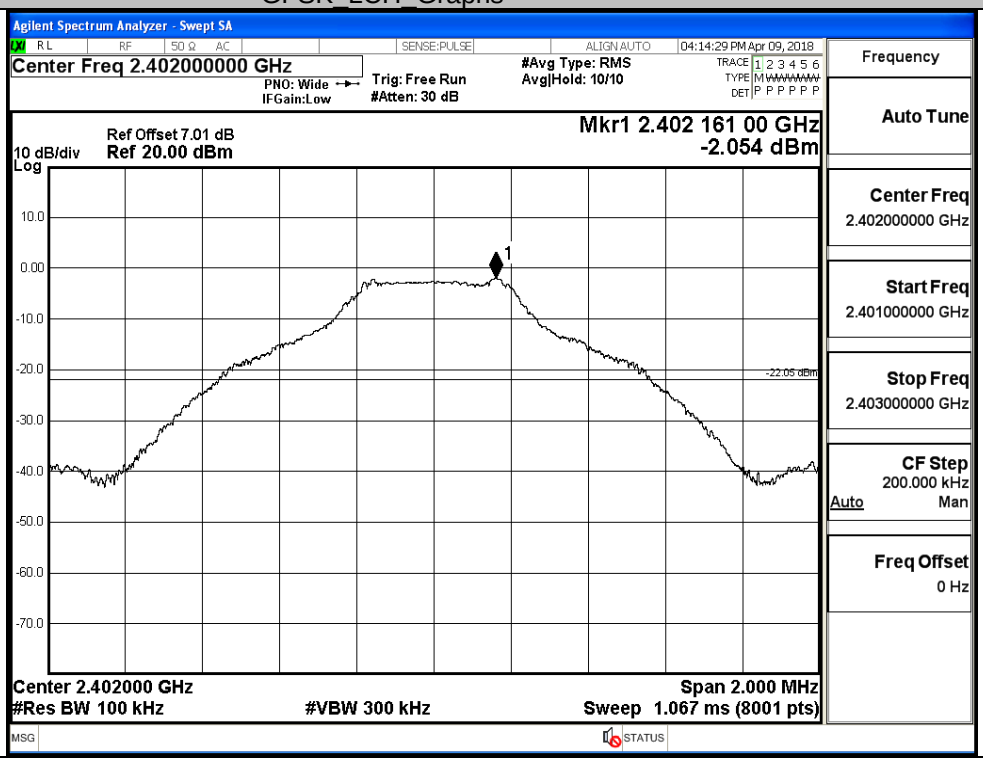
GFSK_DH5/MCH	
GFSK_DH5/HCH	

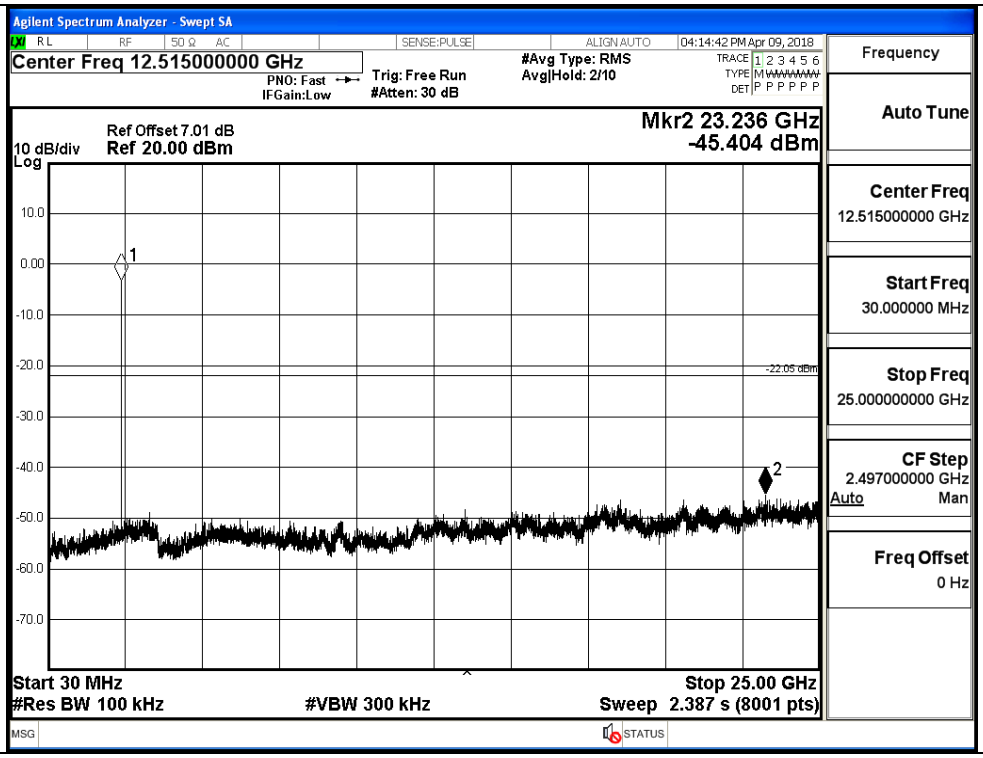
π/4DQPSK _2DH5/LCH	
π/4DQPSK _2DH5/MCH	

π/4DQPSK _2DH5/HCH	

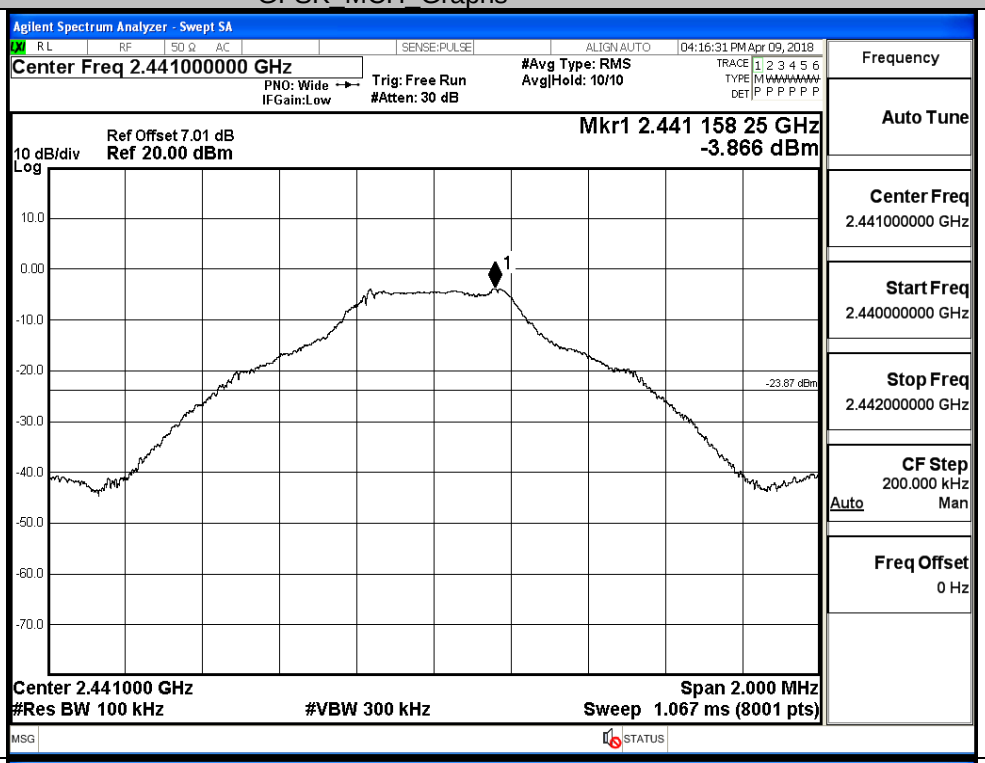
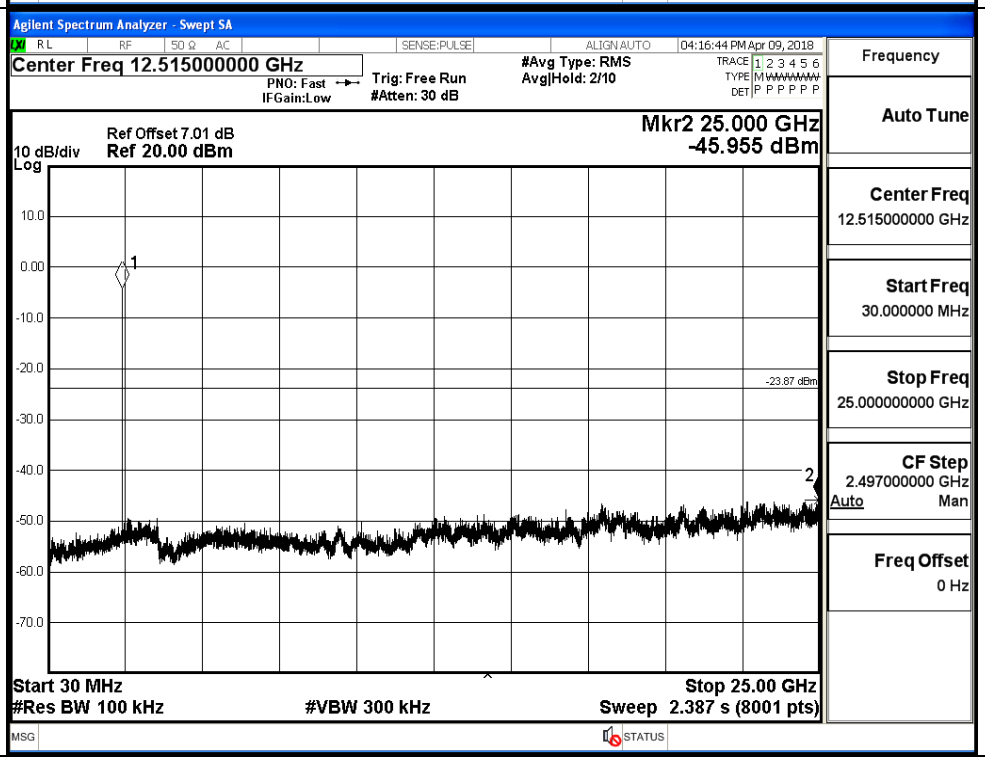
A.6 RF Conducted Spurious Emissions

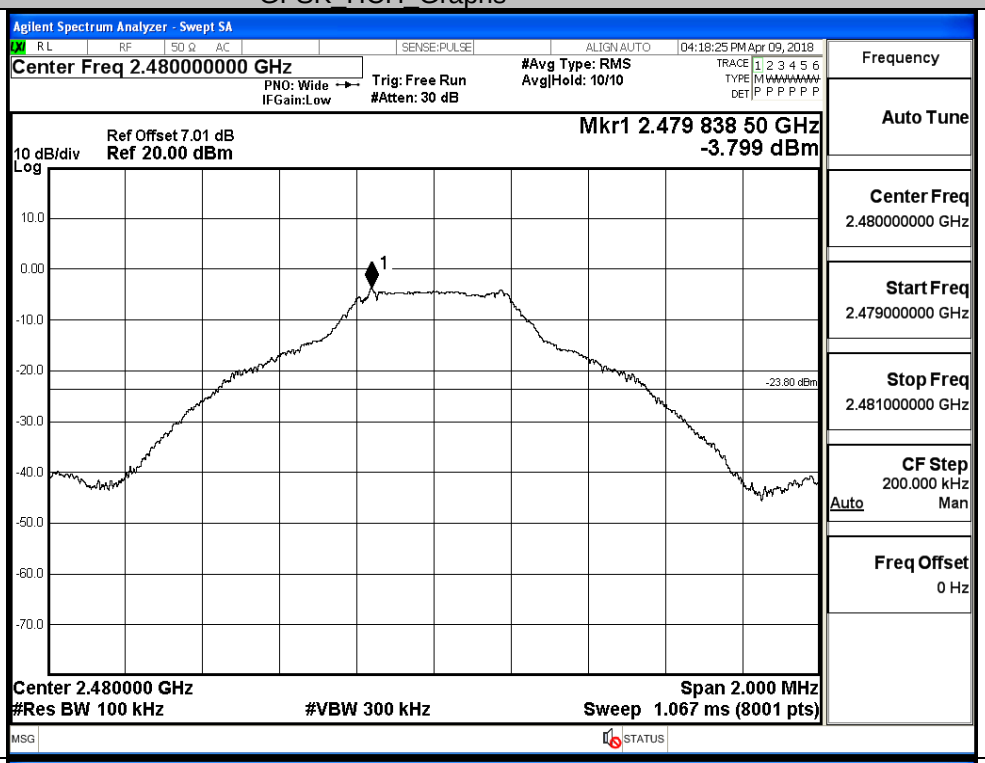
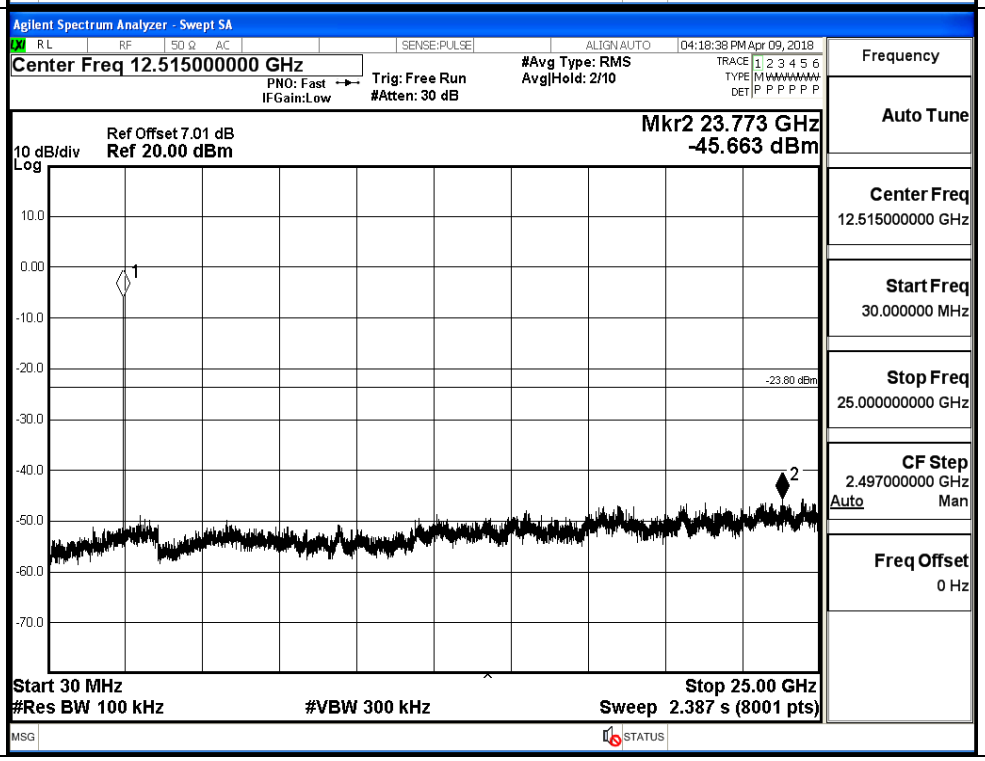
Mode	Channel	Pref [dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	-2.054	-45.404	-22.054	PASS
	MCH	-3.866	-45.955	-23.866	PASS
	HCH	-3.799	-45.663	-23.799	PASS
π/4DQPSK	LCH	-3.667	-44.896	-23.667	PASS
	MCH	-4.92	-45.618	-24.920	PASS
	HCH	-5.843	-45.642	-25.843	PASS

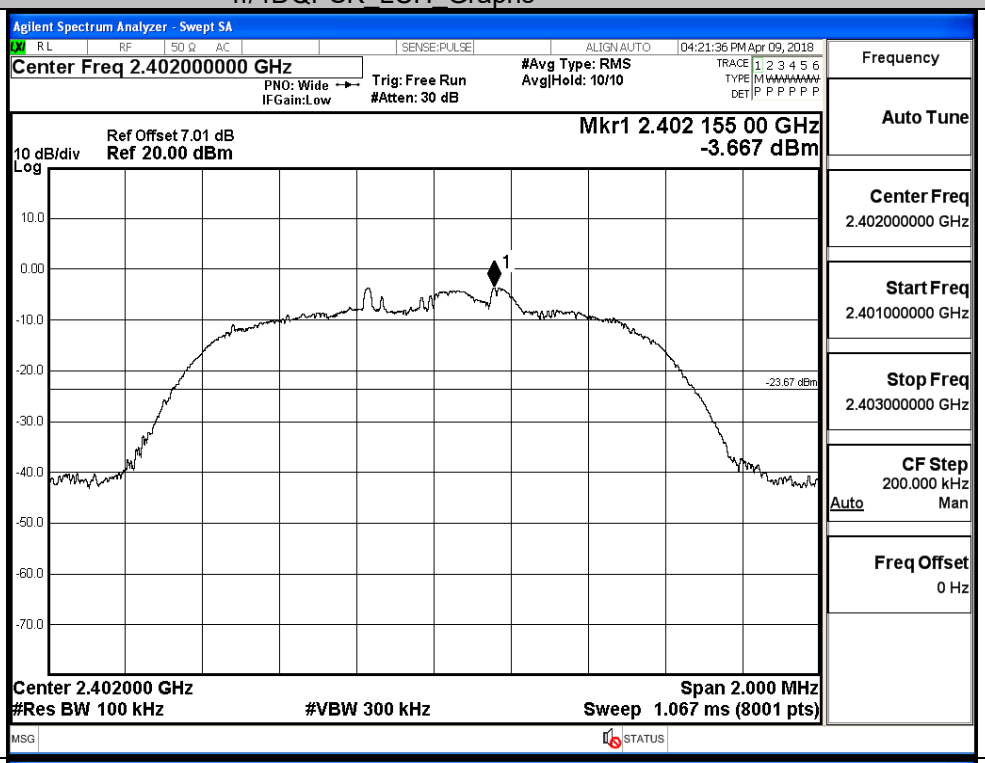
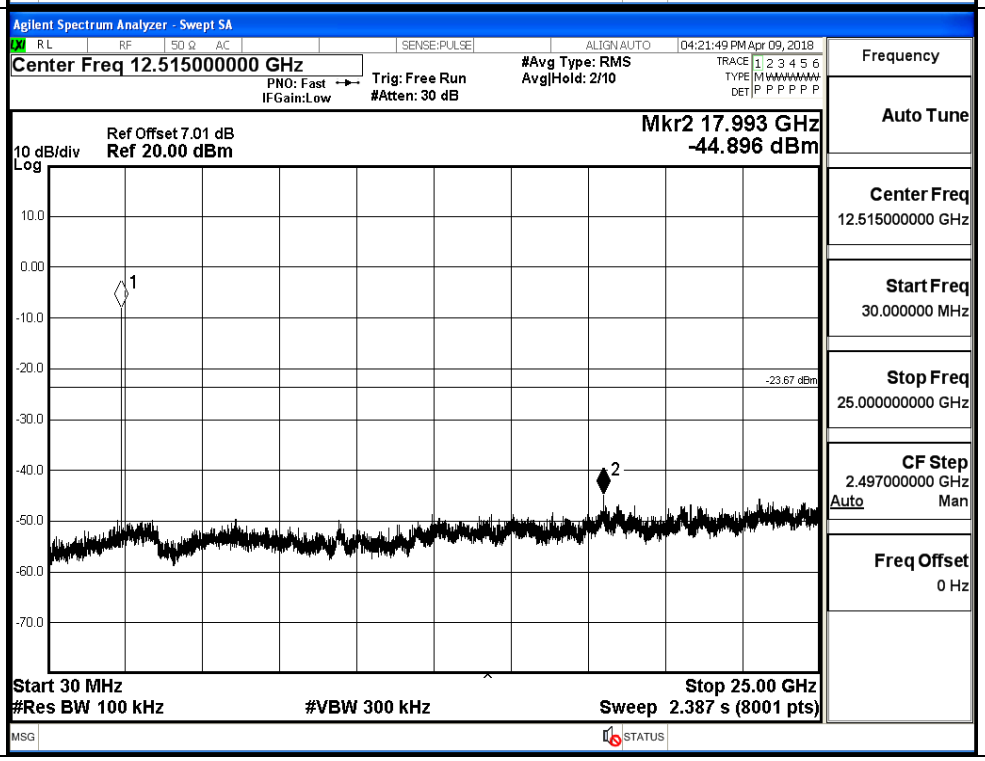
GFSK_LCH_Graphs	
Pref	

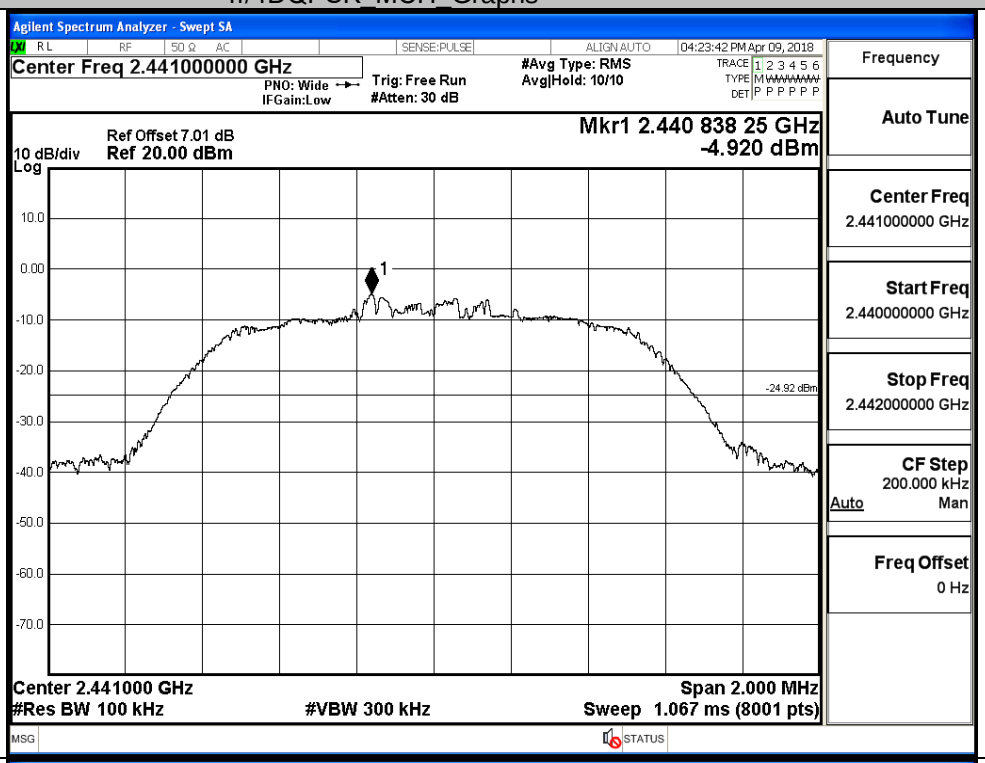
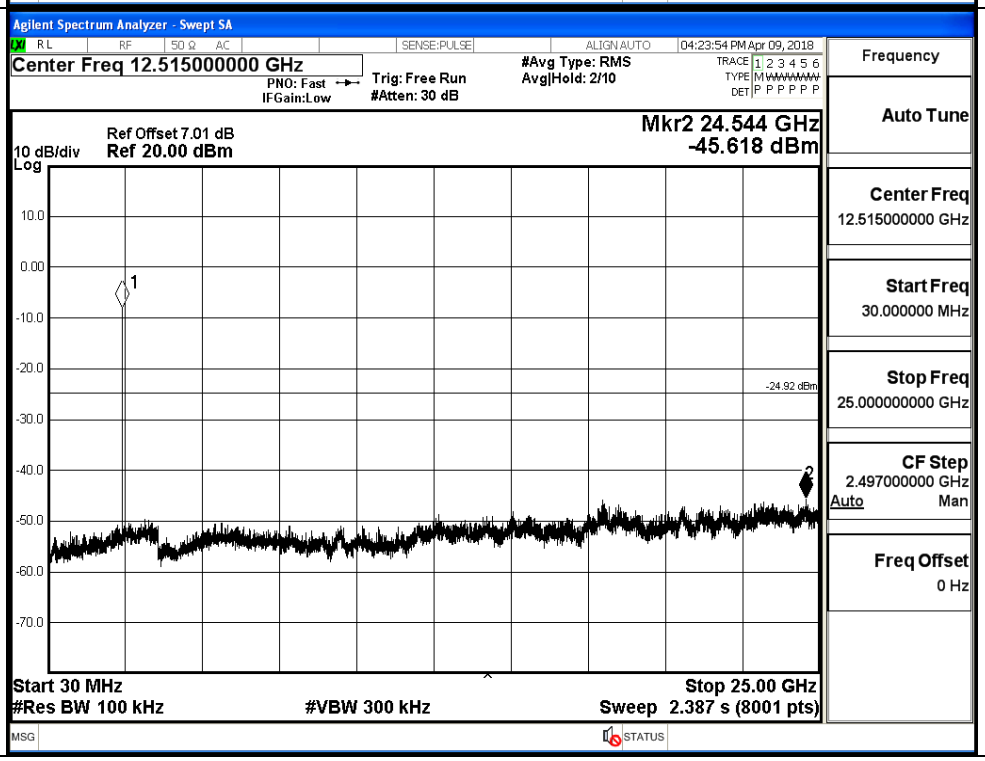
Puw		

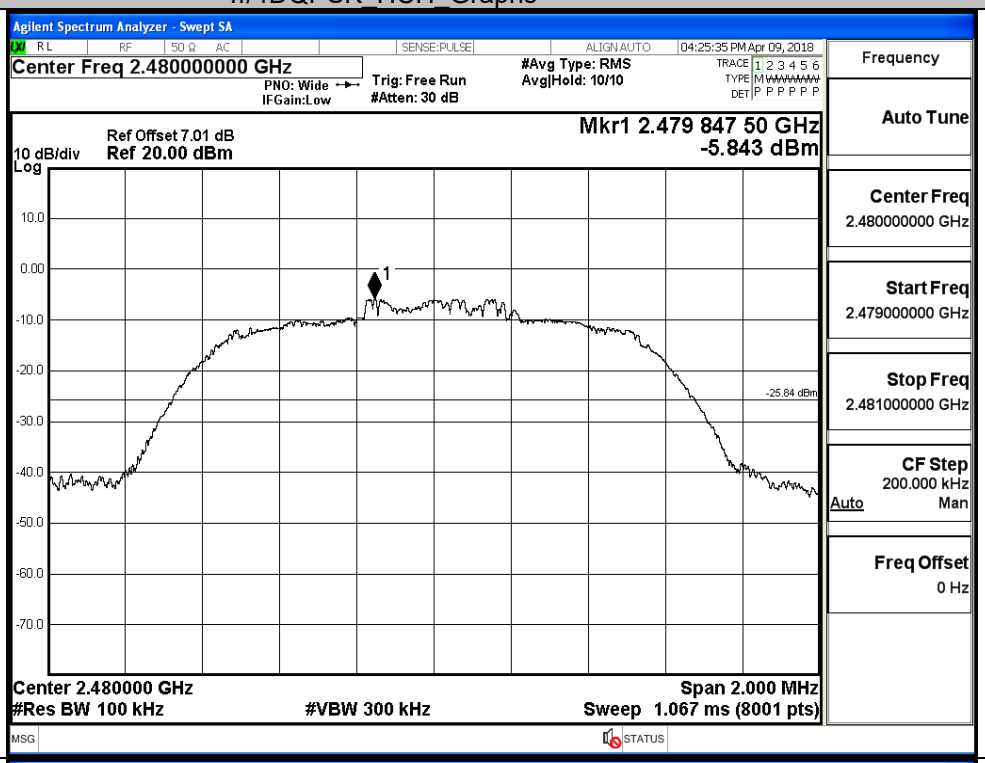
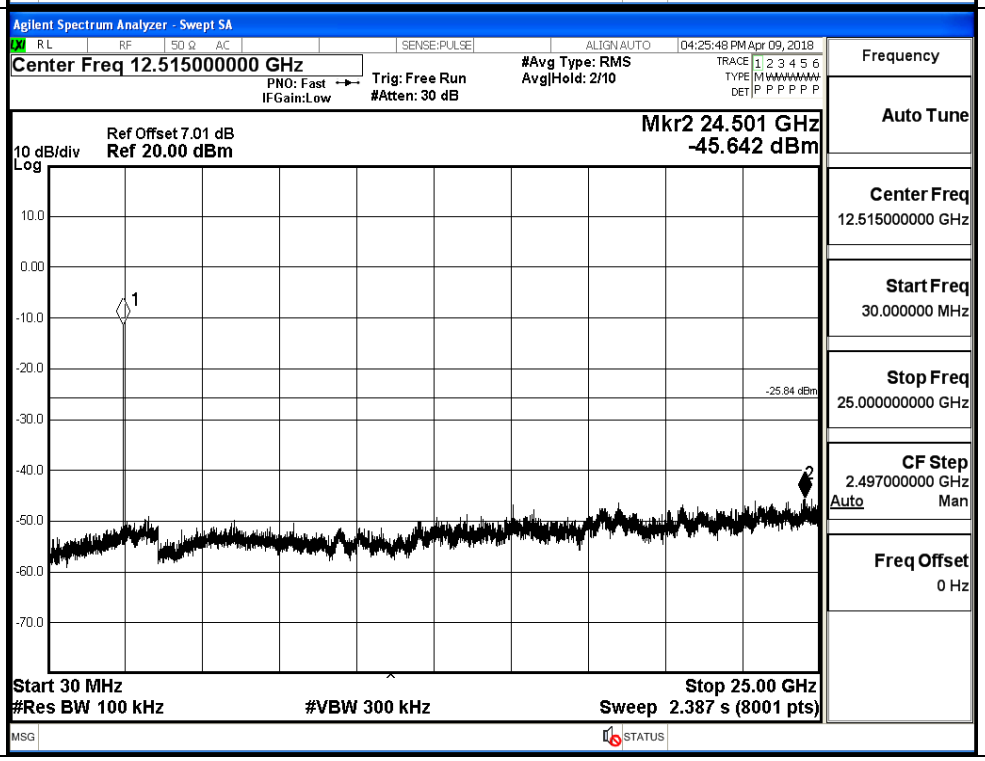
Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:PULSE
ALIGN AUTO
04:14:42 PM Apr 09, 2018
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 2/10
TRACE 1 2 3 4 5 6
TYPE M
DET P P P P P
Ref Offset 7.01 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr2 23.236 GHz
-45.404 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-22.05 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (8001 pts)
MSG
STATUS
Frequency
Auto Tune
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz

GFSK_MCH_Graphs			
Pref			
Puw			

GFSK_HCH_Graphs			
Pref			
Puw			

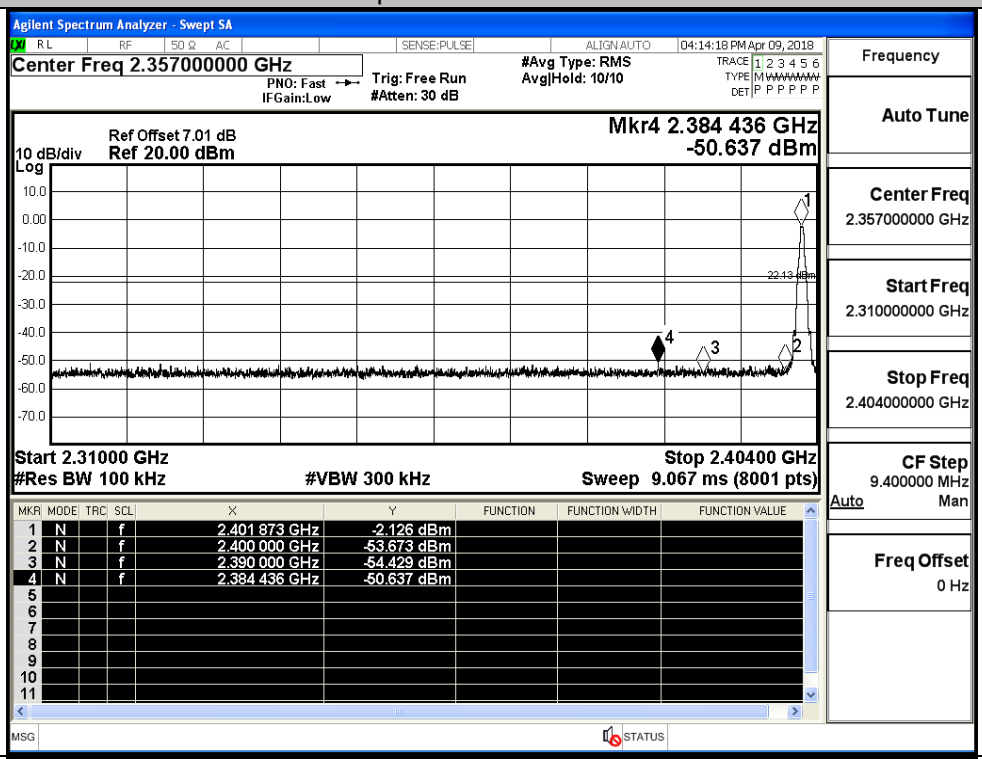
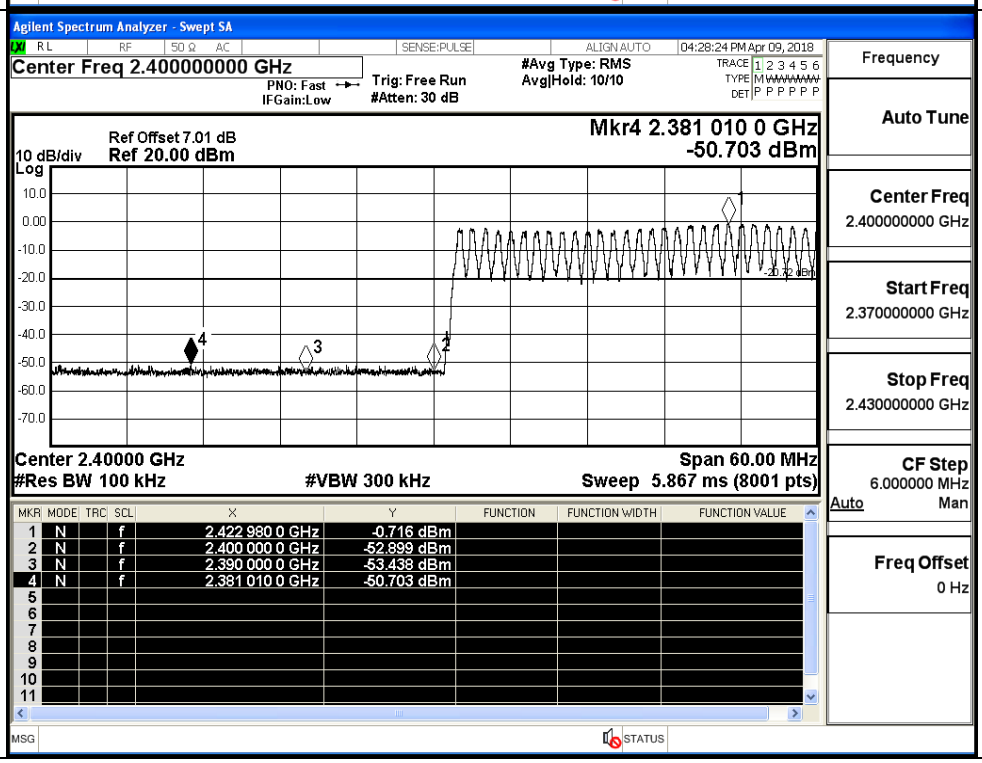
π/4DQPSK_LCH_Graphs			
Pref			
Puw			

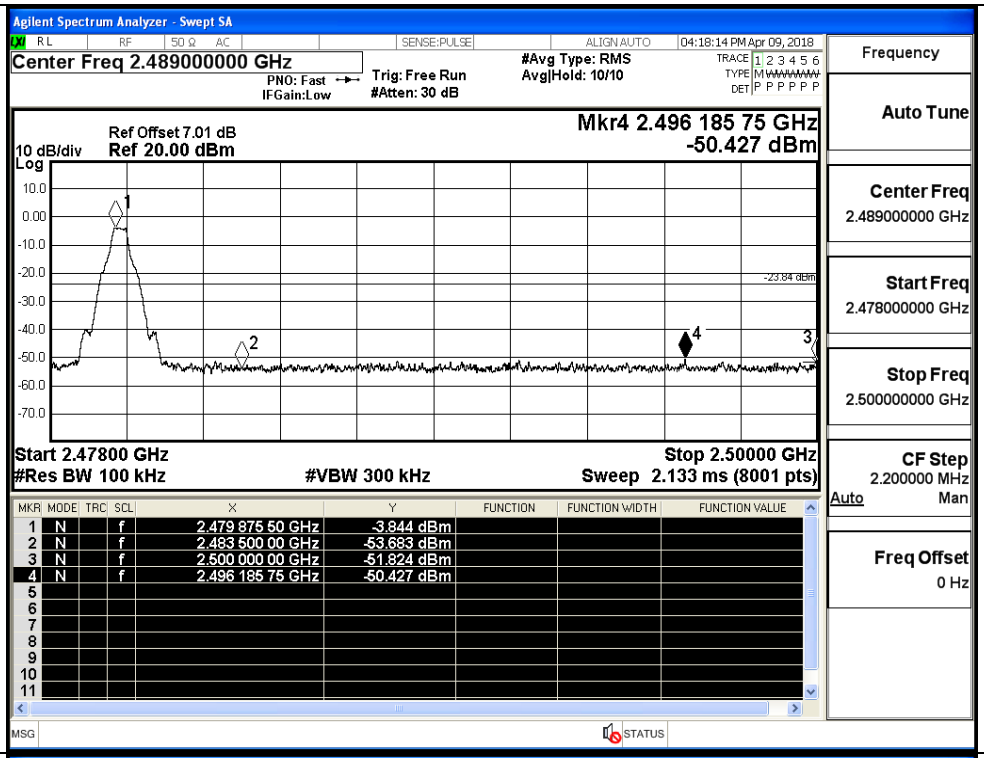
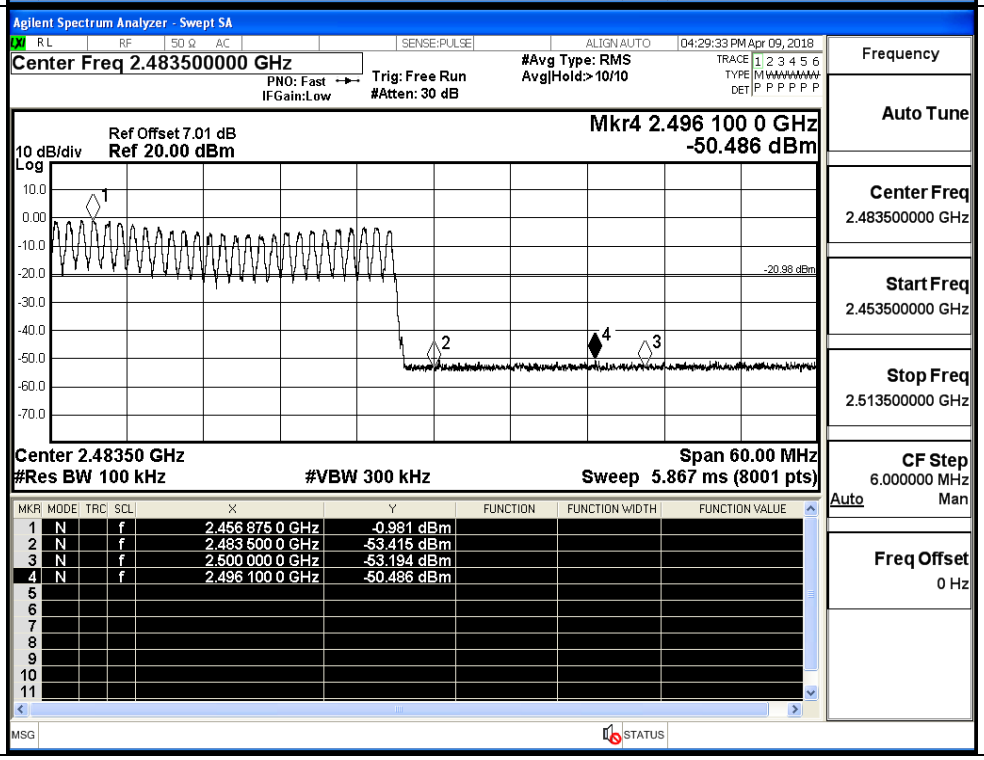
π/4DQPSK_MCH_Graphs		
Pref		
Puw		

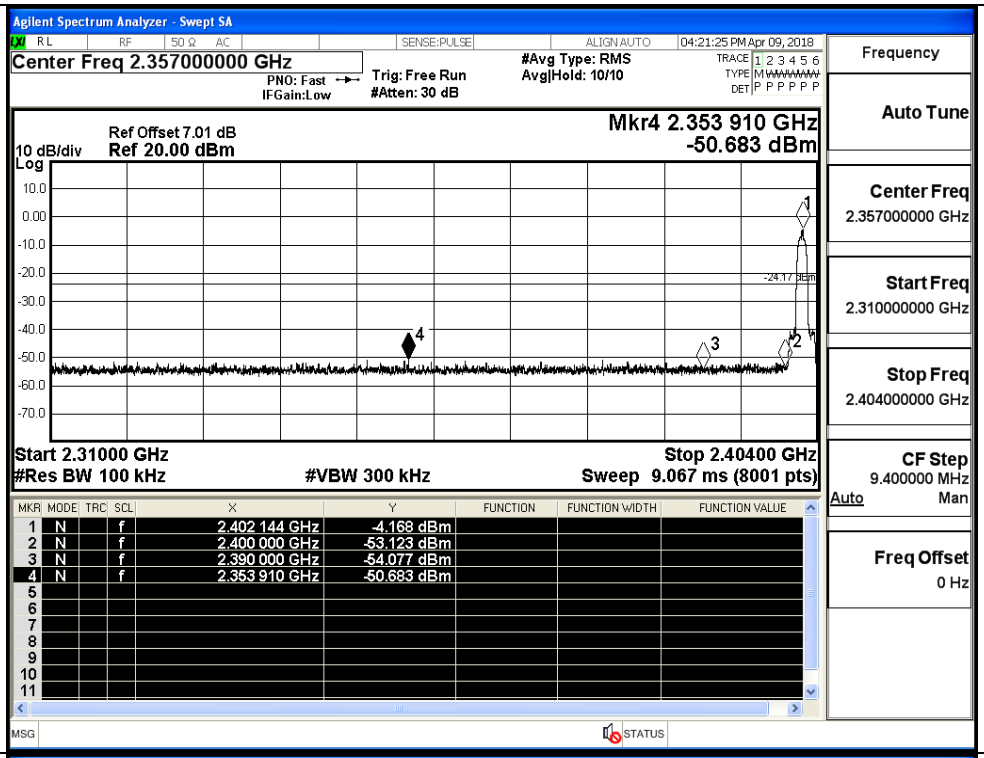
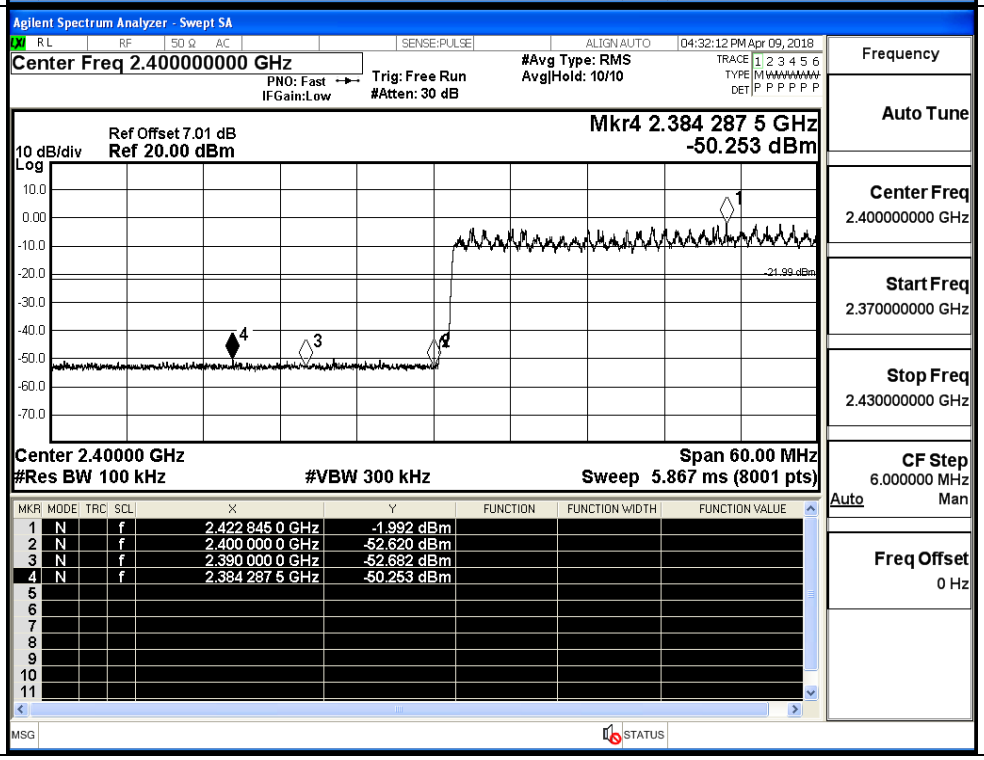
π/4DQPSK_HCH_Graphs		
Pref		
Puw		

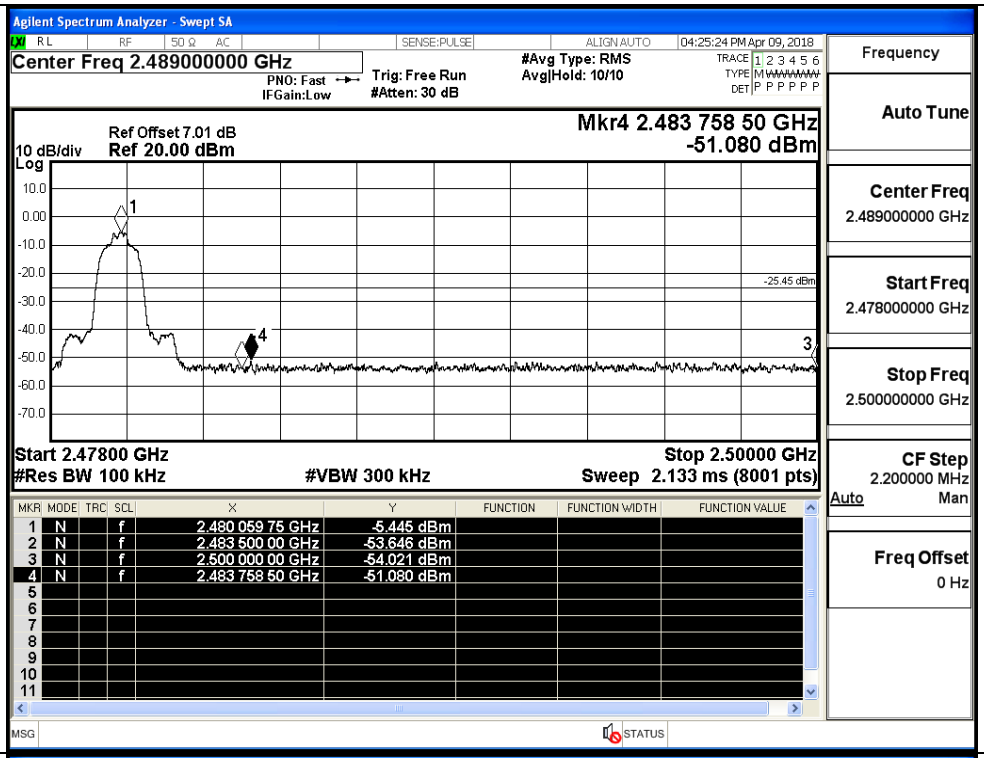
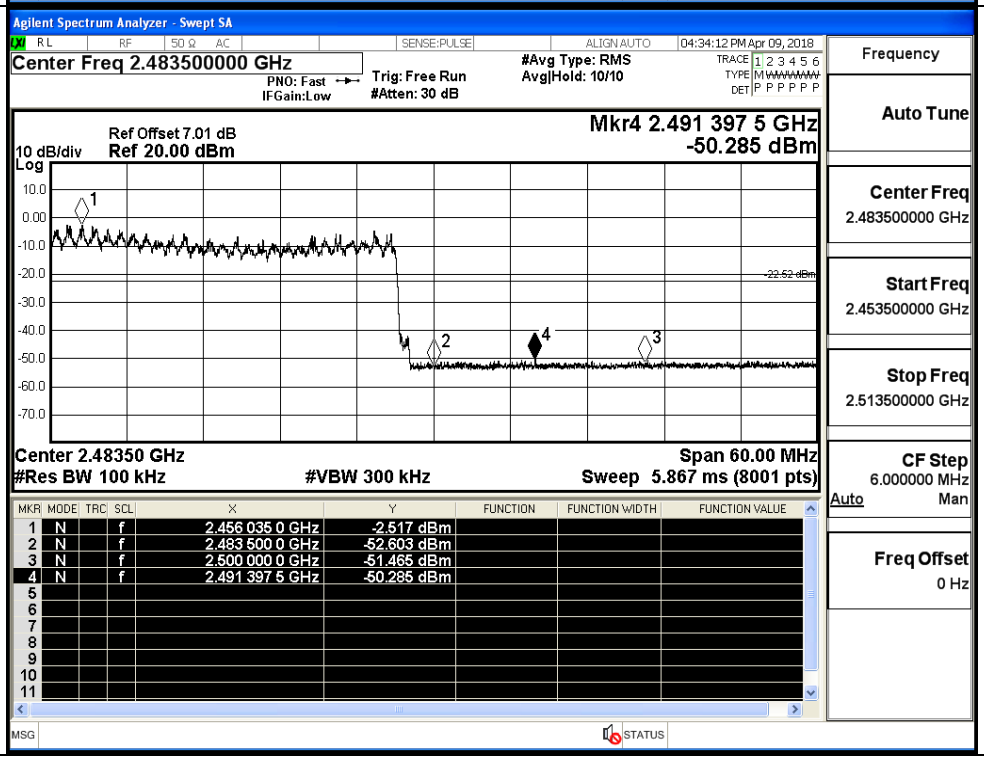
A.7 Band-edge for RF Conducted Emissions

Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2402	-2.126	Off	-50.637	-22.13	PASS
			-0.716	On	-50.703	-20.72	PASS
	HCH	2480	-3.844	Off	-50.427	-23.84	PASS
			-0.981	On	-50.486	-20.98	PASS
π/4DQPSK	LCH	2402	-4.168	Off	-50.683	-24.17	PASS
			-1.992	On	-50.253	-21.99	PASS
	HCH	2480	-5.445	Off	-51.080	-25.45	PASS
			-2.517	On	-50.285	-22.52	PASS

Test Graphs	
GFSK/LCH/No Hop	
GFSK/LCH/Hop	

GFSK/HCH/No Hop	
GFSK/HCH/Hop	

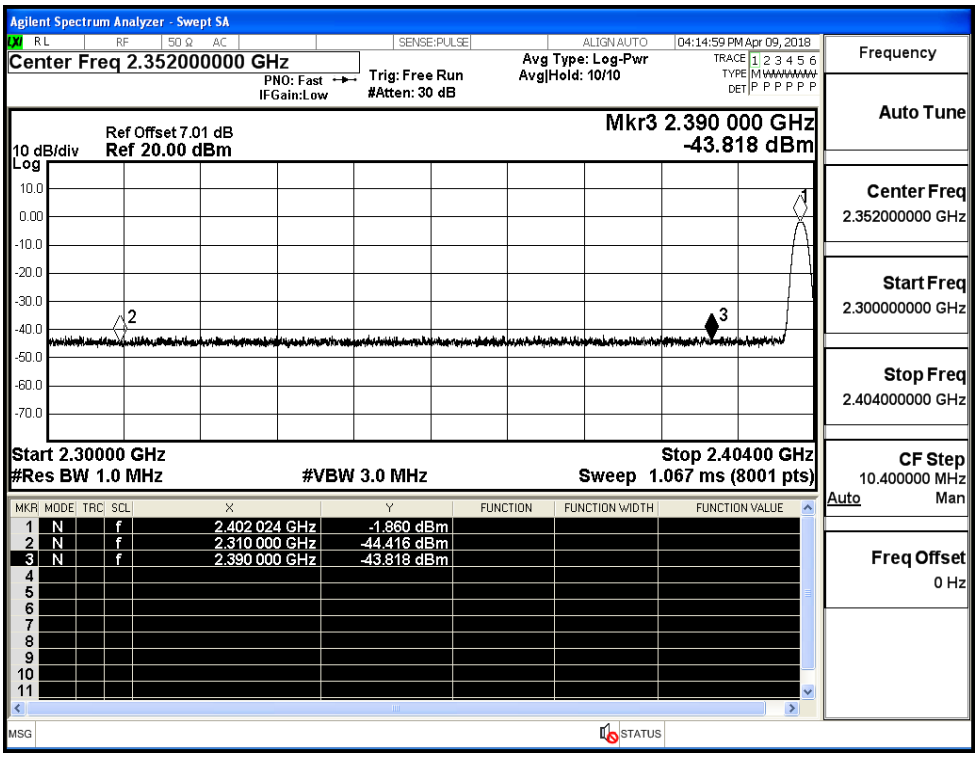
π/4DQPSK/LCH/No Hop	
π/4DQPSK/LCH/Hop	

π/4DQPSK/HCH/No Hop	
π/4DQPSK/HCH/Hop	

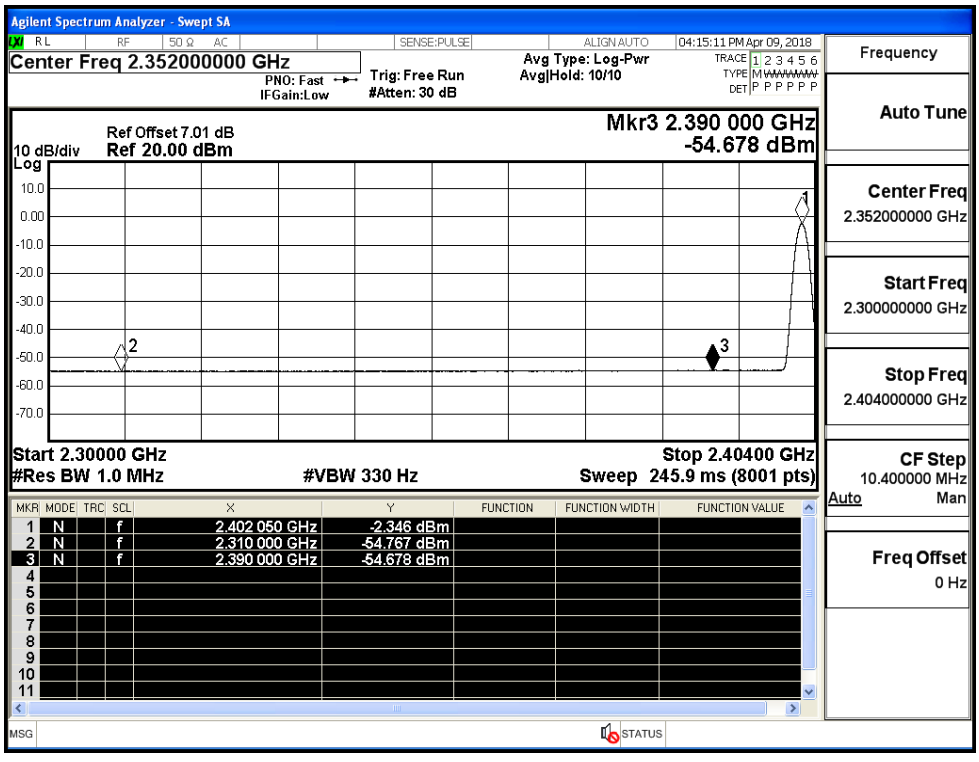
A.8 Restrict-band band-edge measurements

Test Mode	Hopping	Freq.	Power [dBm]	Gain	Ground Factor	E [dBuV/m]	Detector	Limit [dBuV/m]	Verdict
GFSK	Off	2310.0	-44.42	2.0	0	50.84	PEAK	74	PASS
	Off	2310.0	-54.77	2.0	0	40.49	AV	54	PASS
	Off	2390.0	-43.82	2.0	0	51.44	PEAK	74	PASS
	Off	2390.0	-54.68	2.0	0	40.58	AV	54	PASS
	Off	2483.5	-44.00	2.0	0	51.26	PEAK	74	PASS
	Off	2483.5	-54.24	2.0	0	41.02	AV	54	PASS
	Off	2500.0	-44.90	2.0	0	50.35	PEAK	74	PASS
	Off	2500.0	-54.24	2.0	0	41.02	AV	54	PASS
π/4DQPSK	Off	2310.0	-43.31	2.0	0	51.95	PEAK	74	PASS
	Off	2310.0	-54.84	2.0	0	40.42	AV	54	PASS
	Off	2390.0	-43.35	2.0	0	51.91	PEAK	74	PASS
	Off	2390.0	-54.62	2.0	0	40.64	AV	54	PASS
	Off	2483.5	-44.90	2.0	0	50.36	PEAK	74	PASS
	Off	2483.5	-54.34	2.0	0	40.92	AV	54	PASS
	Off	2500.0	-44.35	2.0	0	50.91	PEAK	74	PASS
	Off	2500.0	-54.14	2.0	0	41.12	AV	54	PASS

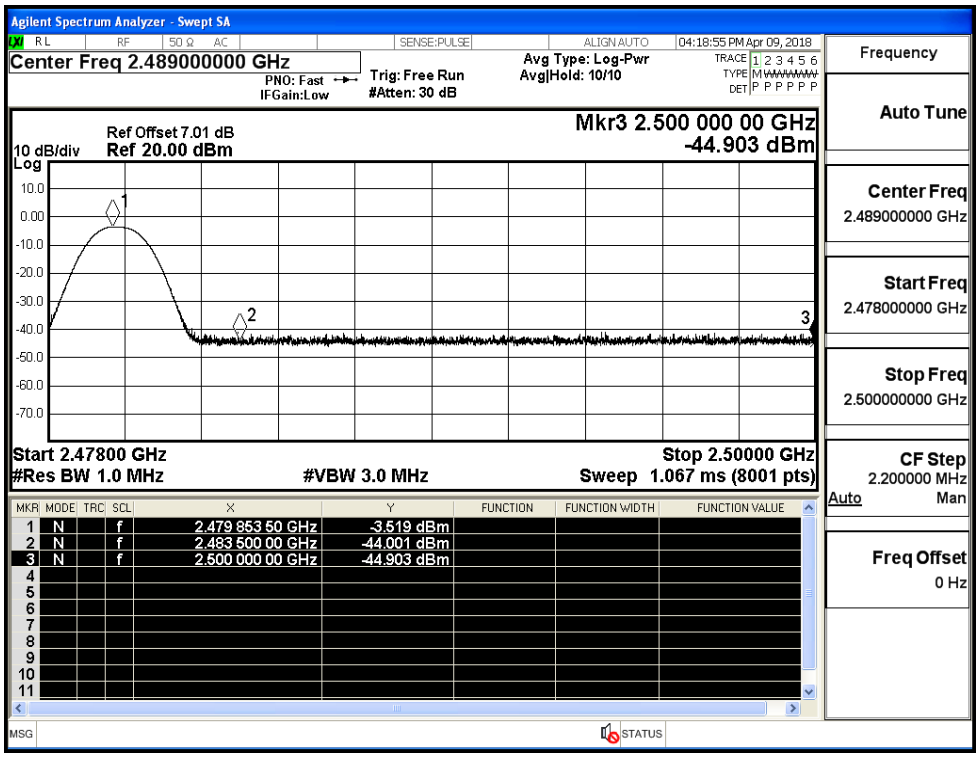
Restrict-band band-edge measurements_Hopping Off_ GFSK_PEAK (Low Channel)



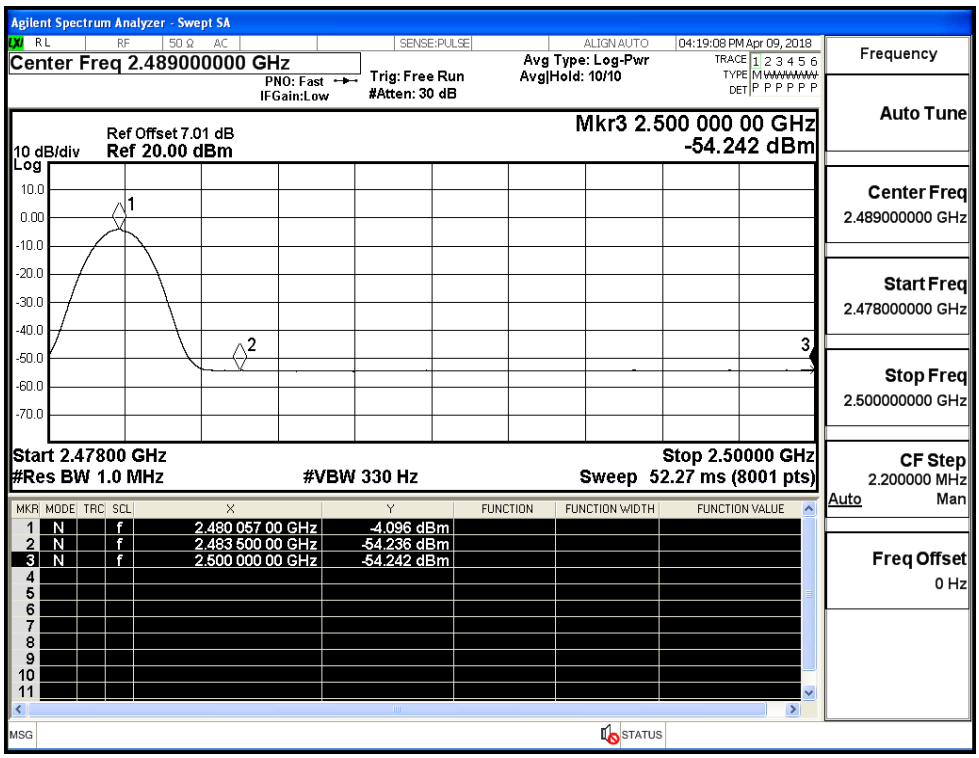
Restrict-band band-edge measurements_Hopping Off_ GFSK_Average (Low Channel)



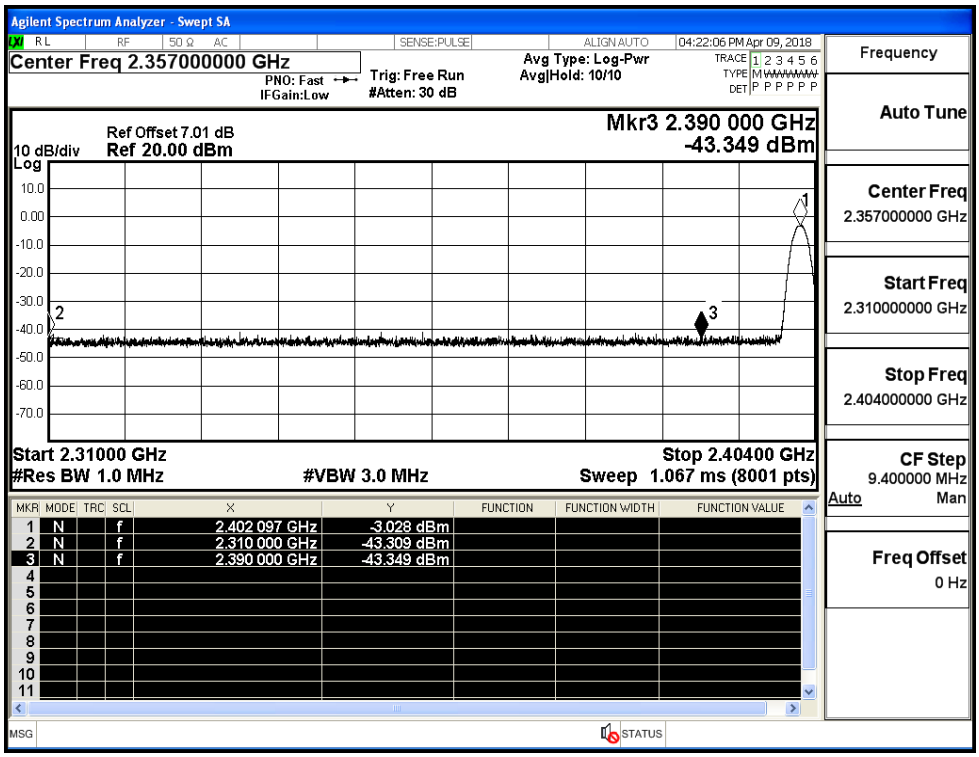
Restrict-band band-edge measurements_Hopping Off_ GFSK_PEAK (High Channel)



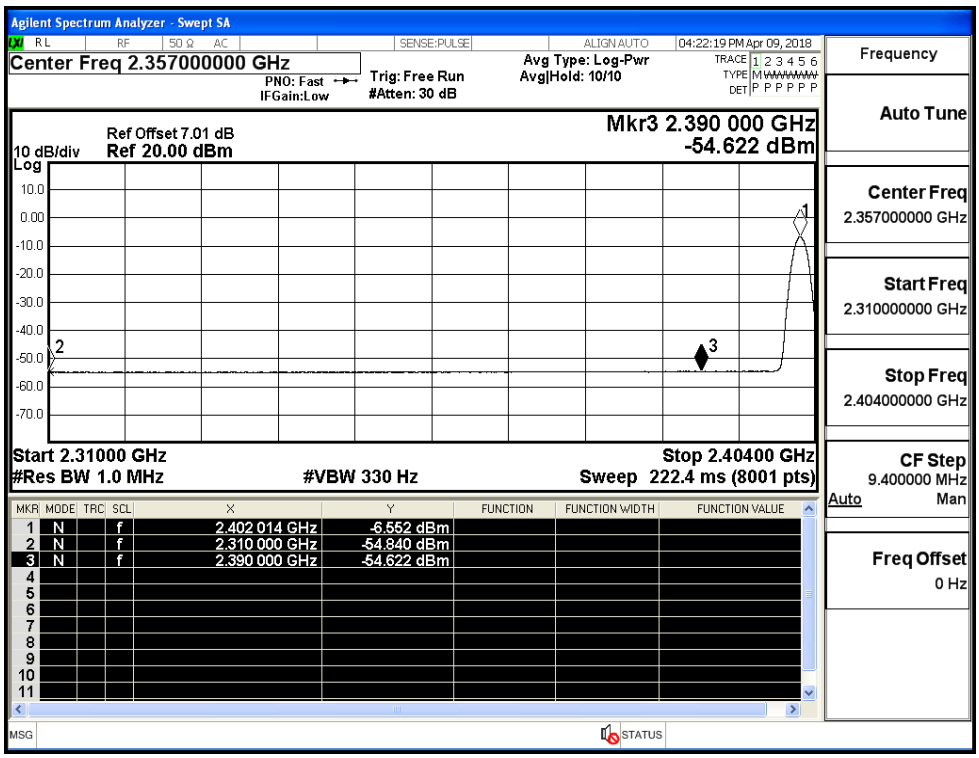
Restrict-band band-edge measurements_Hopping Off_ GFSK_Average (High Channel)



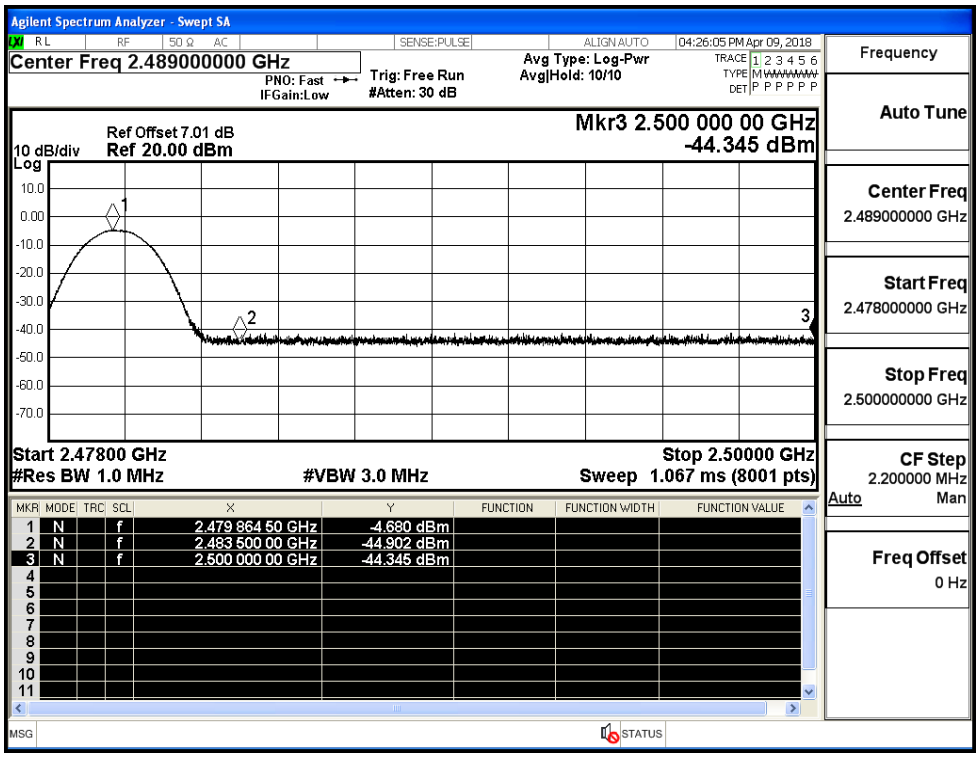
Restrict-band band-edge measurements_Hopping Off_π/4-DQPSK_PEAK (Low Channel)



Restrict-band band-edge measurements_Hopping Off_π/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)