

Appendix A

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

Product Name: Exos Bluetooth® Headphones

Trade Mark: Gemline

Test Model: 100245-001B

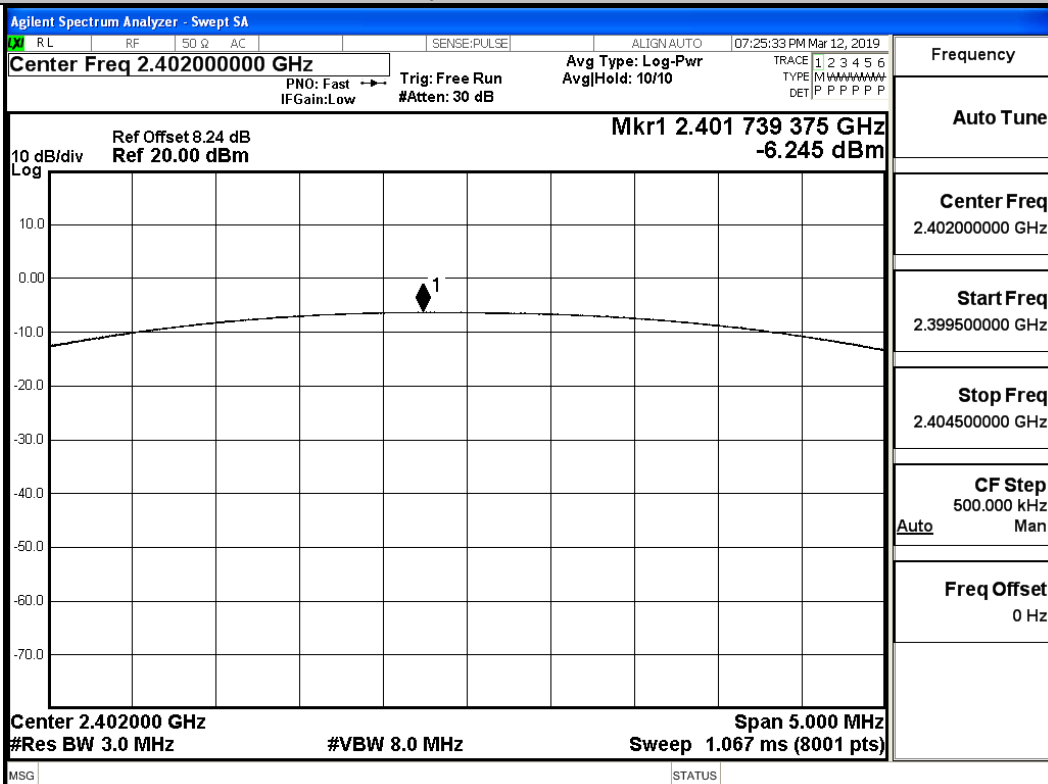
Environmental Conditions

Temperature:	24.5 ° C
Relative Humidity:	51.9%
ATM Pressure:	100.0 kPa
Test Engineer:	David.Luo
Supervised by:	Wang Chuang

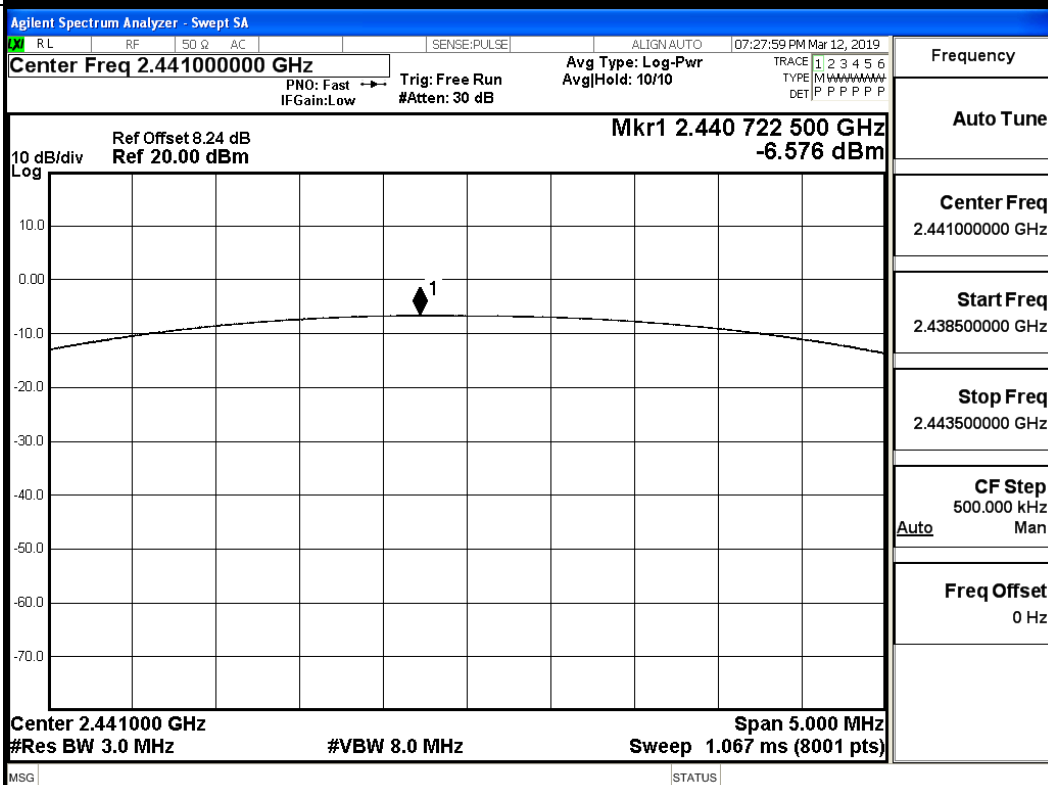
A.1 Maximum Conducted Peak Output Power

Mode	Channel.	Maximum Peak Output Power [dBm]	Limit [dBm]	Verdict
GFSK	LCH	-6.245	21	PASS
	MCH	-6.576	21	PASS
	HCH	-6.794	21	PASS
$\pi/4$ DQPSK	LCH	-6.125	21	PASS
	MCH	-6.384	21	PASS
	HCH	-6.251	21	PASS

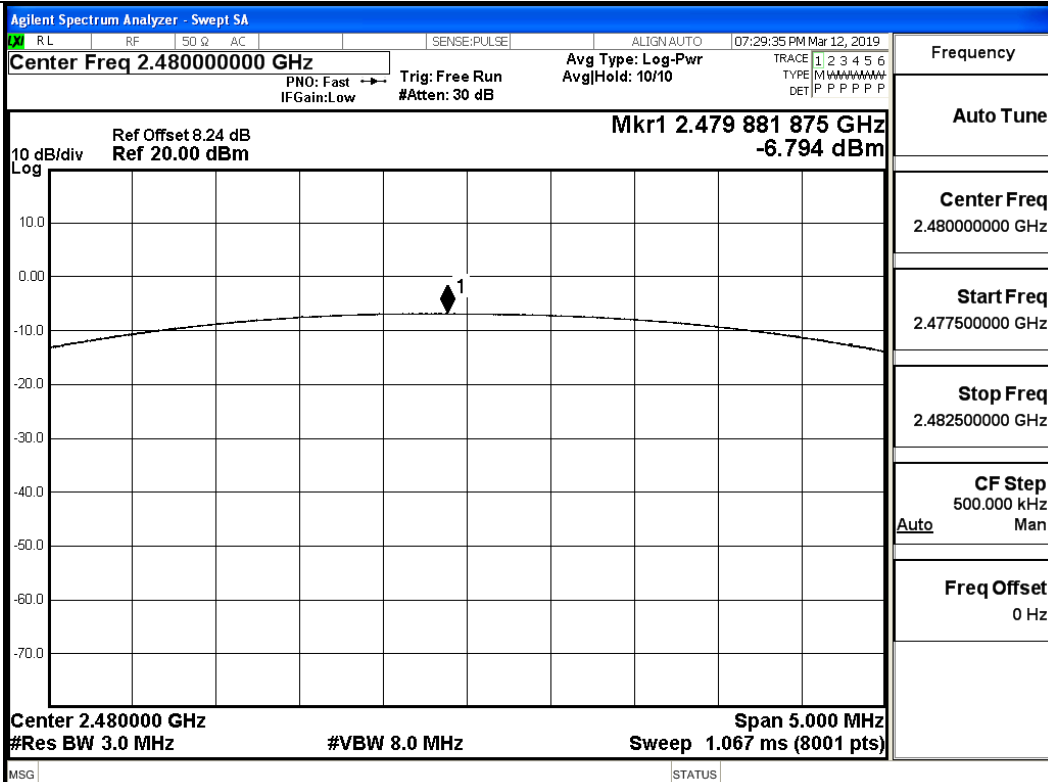
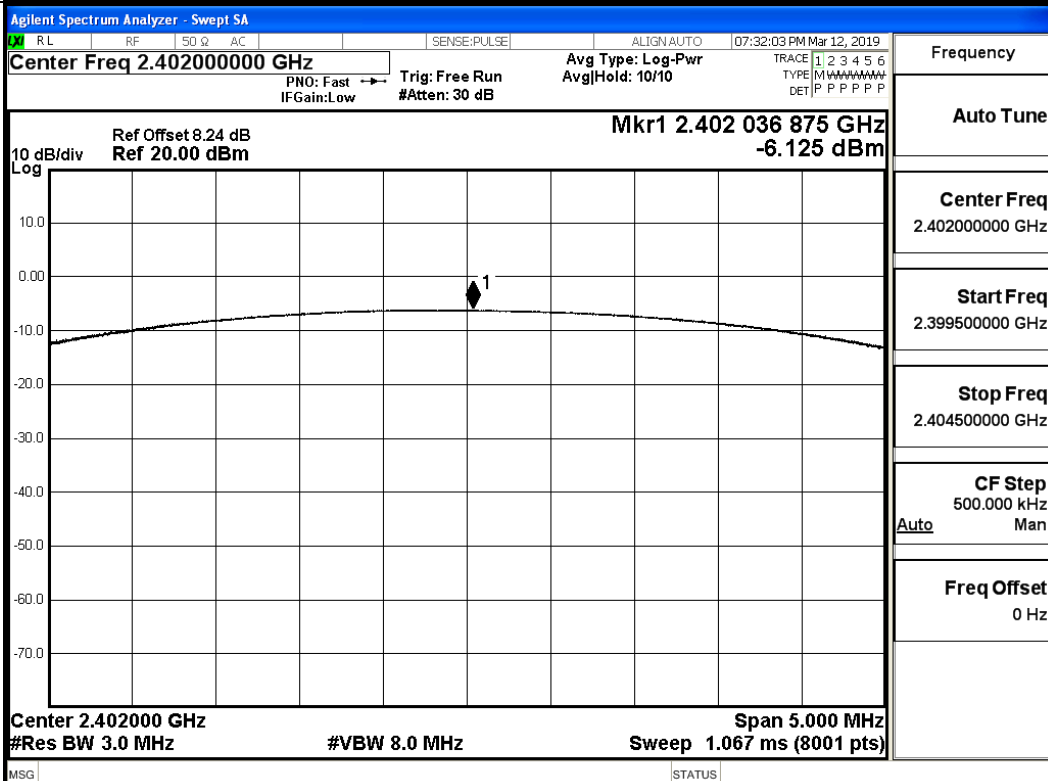
GFSK/LCH

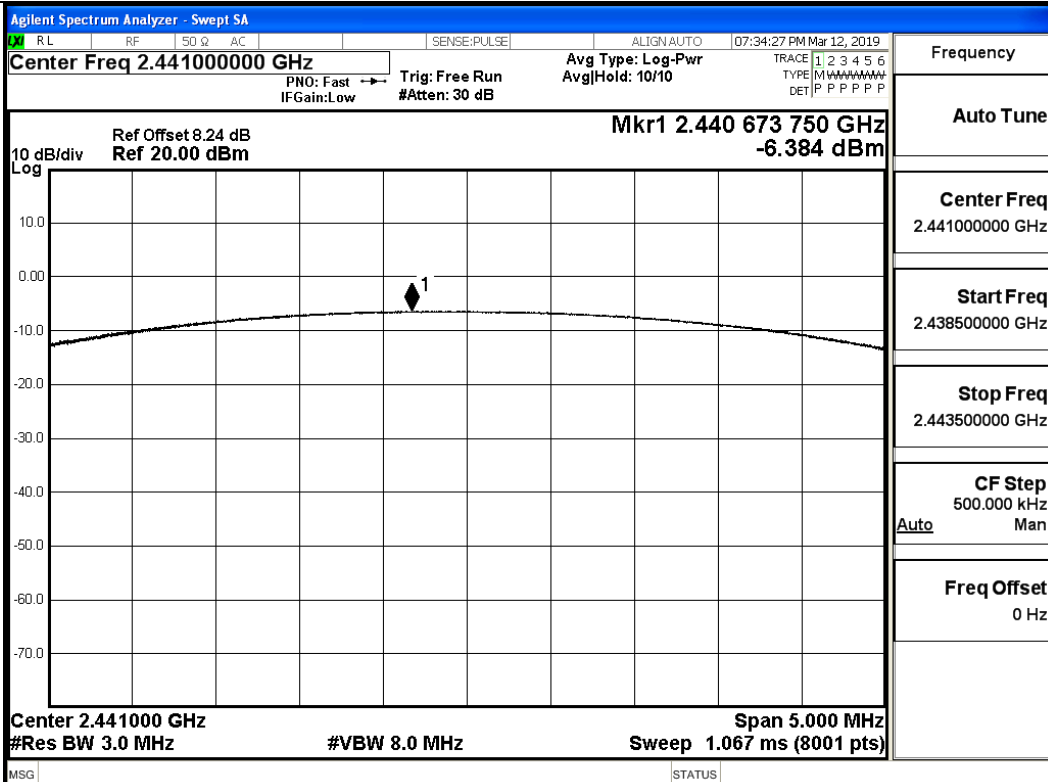
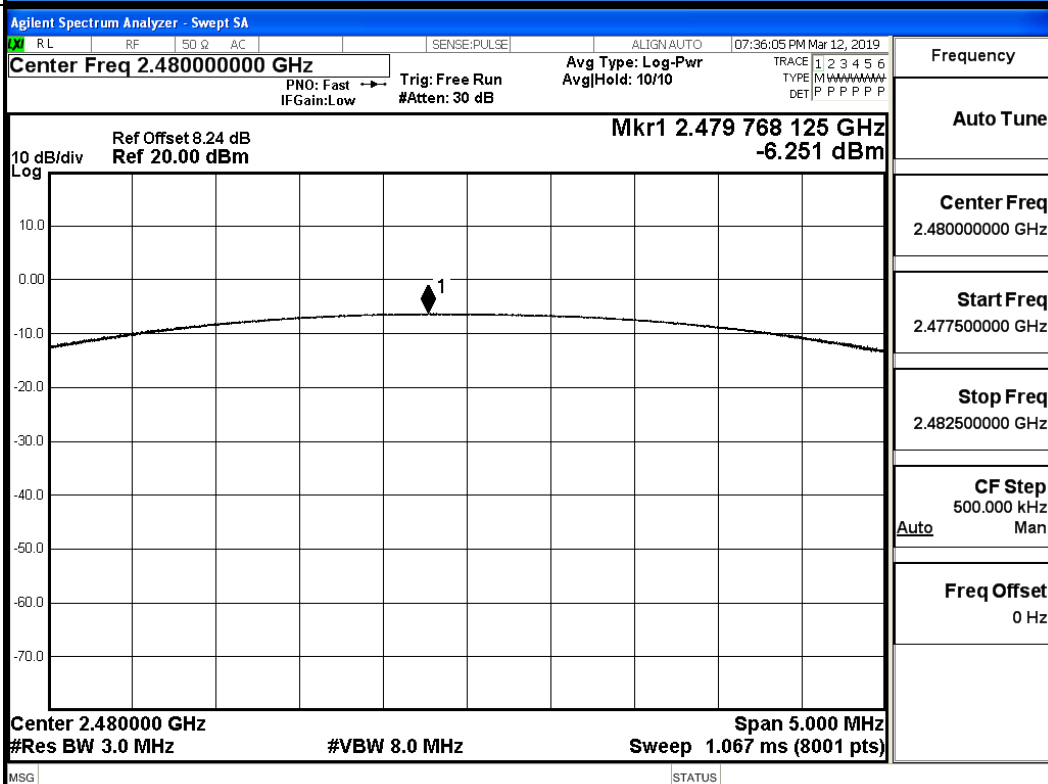


GFSK/MCH



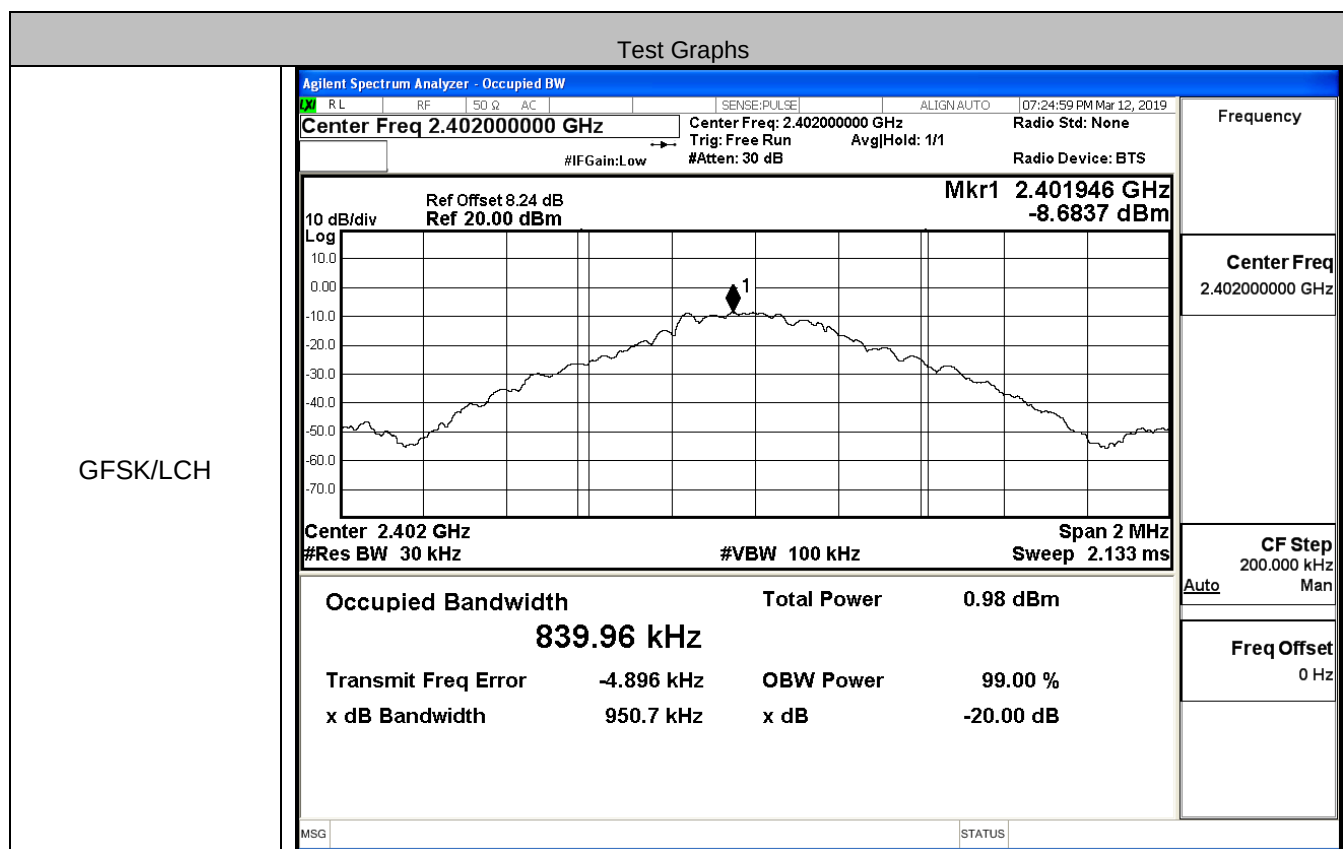
GFSK/HCH

 π /4DQPSK/LCH

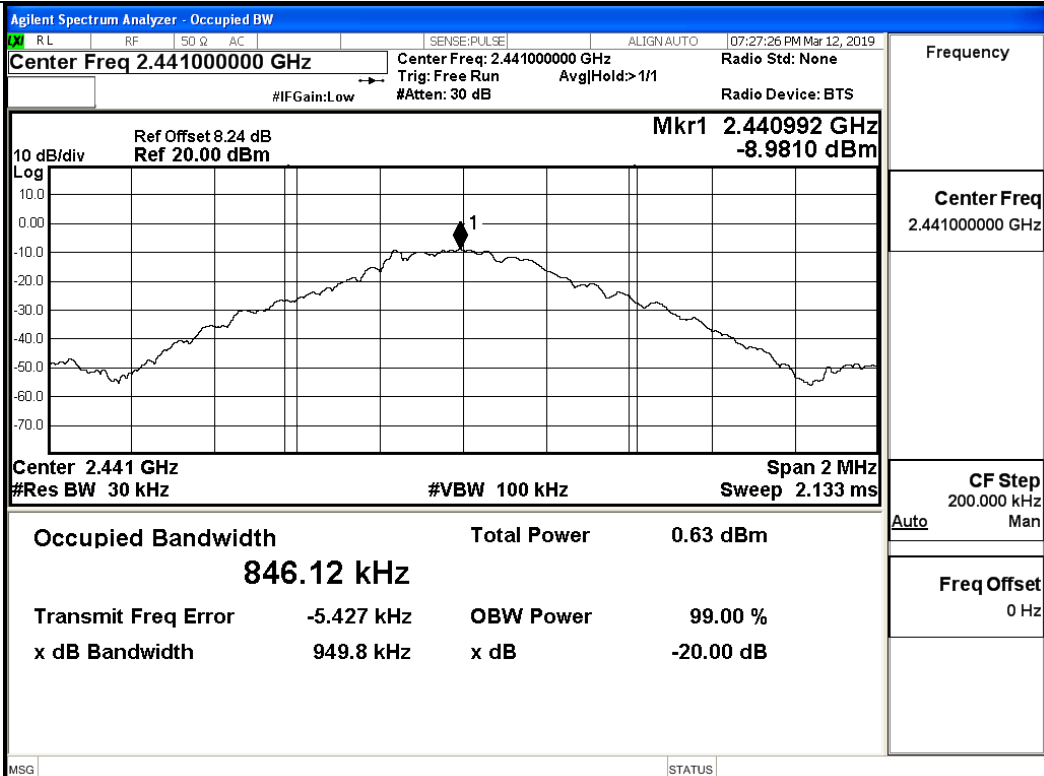
π /4DQPSK/MCH π /4DQPSK/HCH

A.2 99% and 20dB Bandwidth

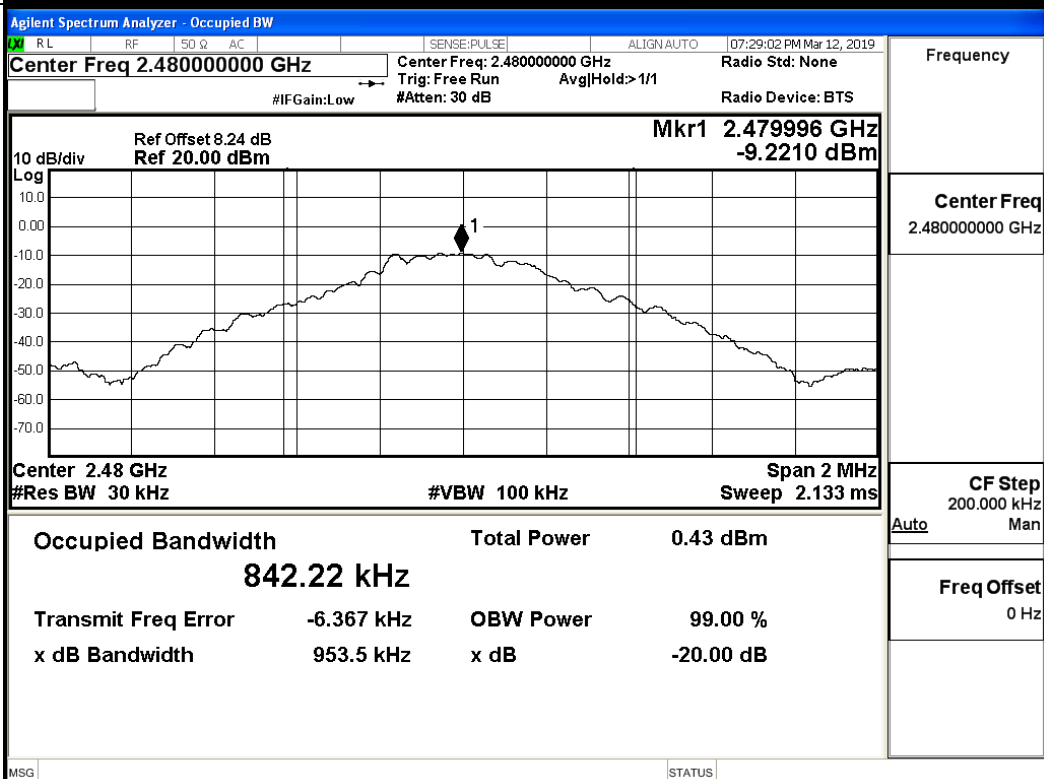
Mode	Channel.	99% Bandwidth [MHz]	20dB Bandwidth [MHz]	Limit [MHz]	Verdict
GFSK	LCH	0.83996	0.9507	Not Specified	PASS
	MCH	0.84612	0.9498	Not Specified	PASS
	HCH	0.84222	0.9535	Not Specified	PASS
π /4DQPSK	LCH	1.1876	1.318	Not Specified	PASS
	MCH	1.1926	1.322	Not Specified	PASS
	HCH	1.1883	1.320	Not Specified	PASS

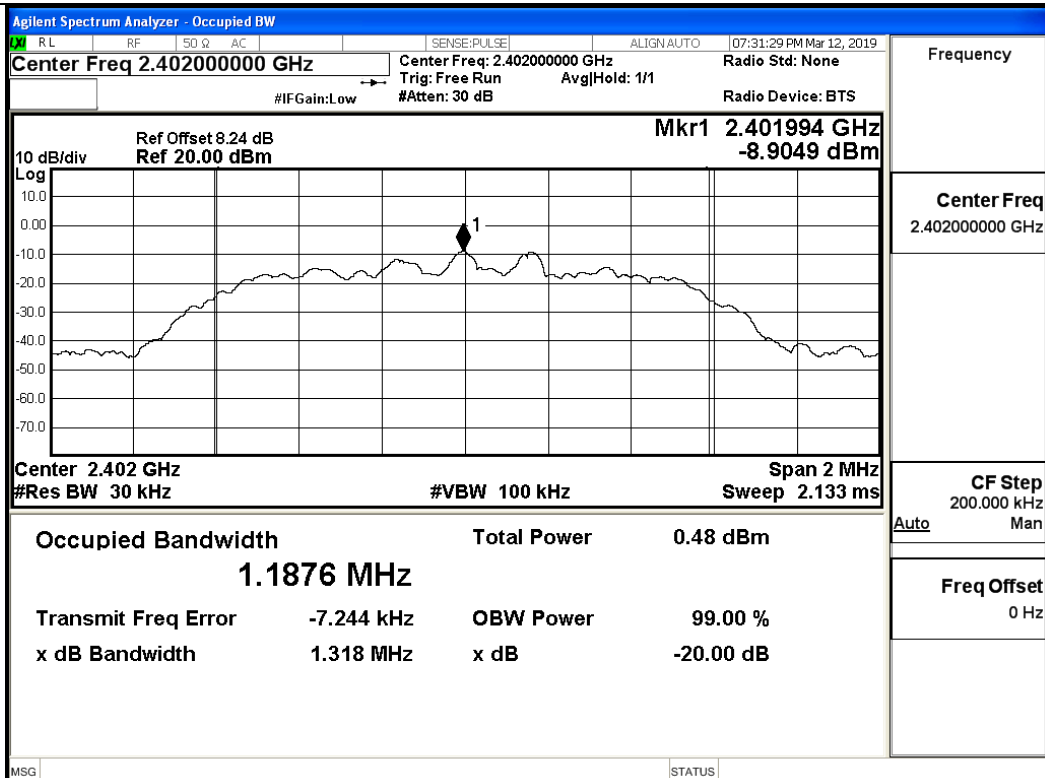
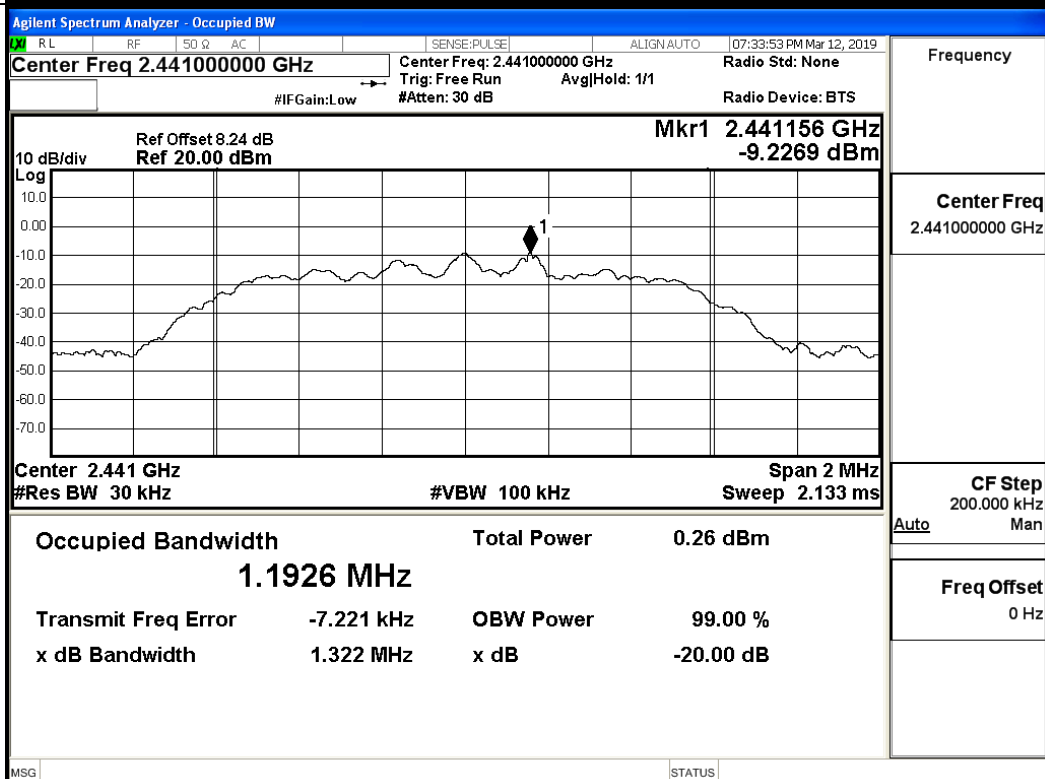


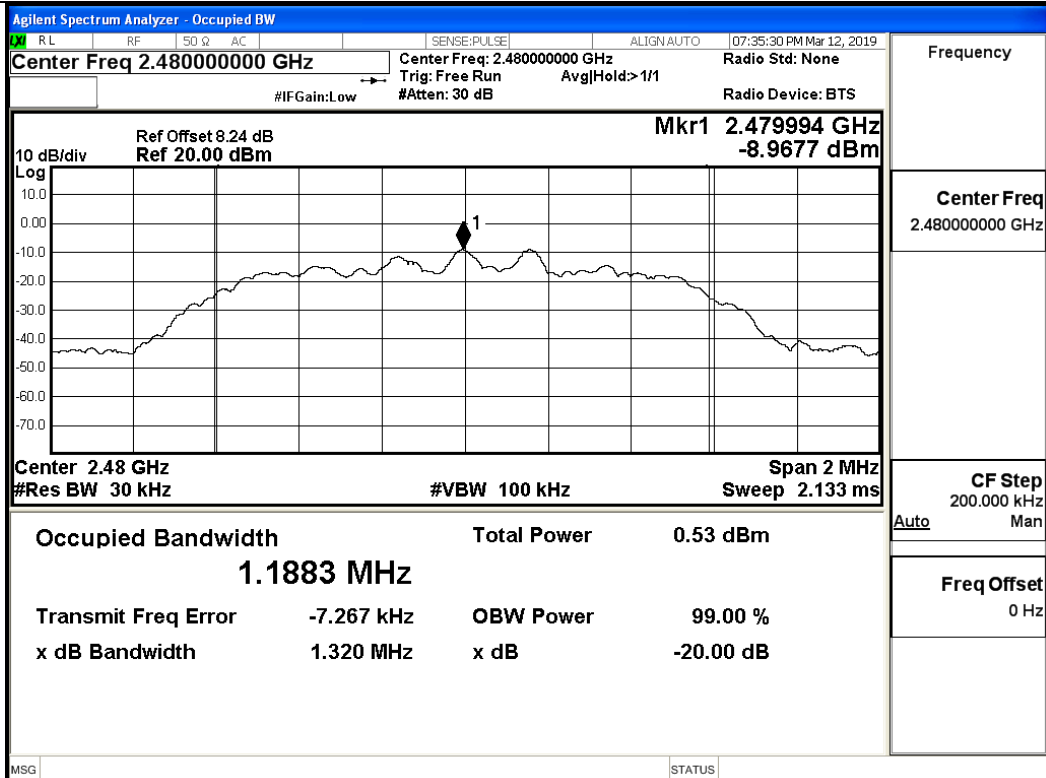
GFSK/MCH



GFSK/HCH



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

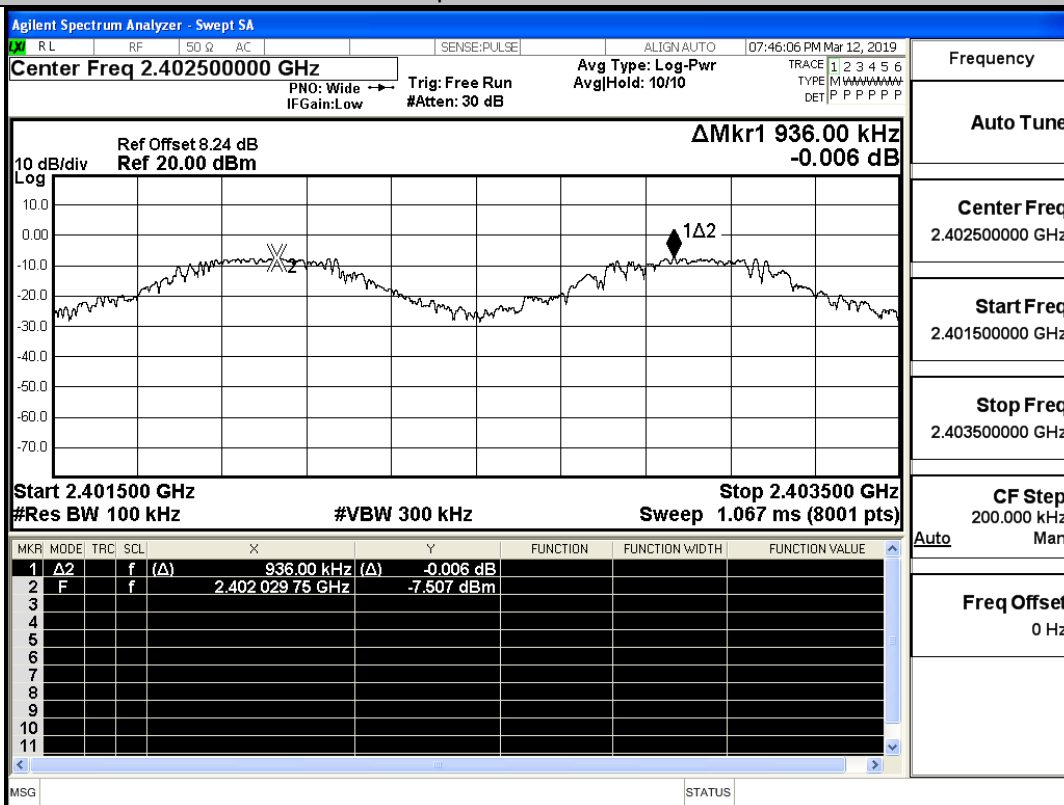
$\pi/4$ DQPSK/HCH

A.3 Carrier Frequency Separation

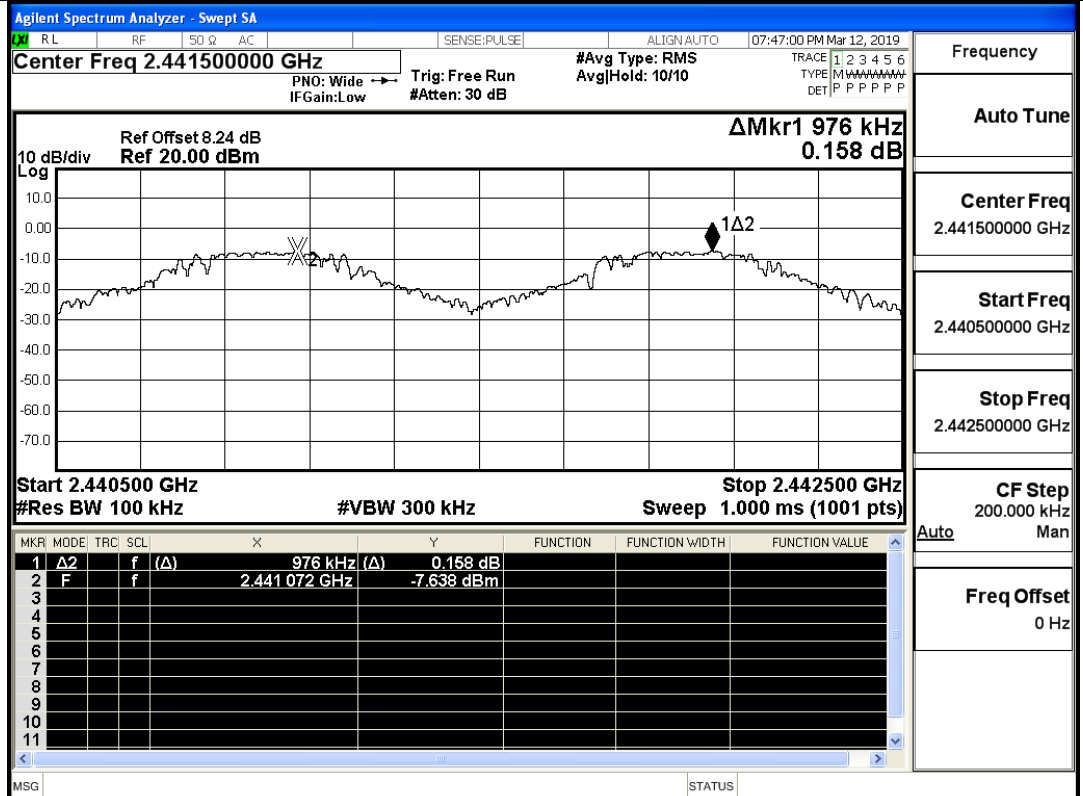
Mode	Channel.	Carrier Frequency Separation [MHz]	Limit [MHz]	Verdict
GFSK	LCH	0.936	0.636	PASS
	MCH	0.976	0.636	PASS
	HCH	1.170	0.636	PASS
π /4DQPSK	LCH	1.198	0.881	PASS
	MCH	1.116	0.881	PASS
	HCH	0.992	0.881	PASS

Test Graphs

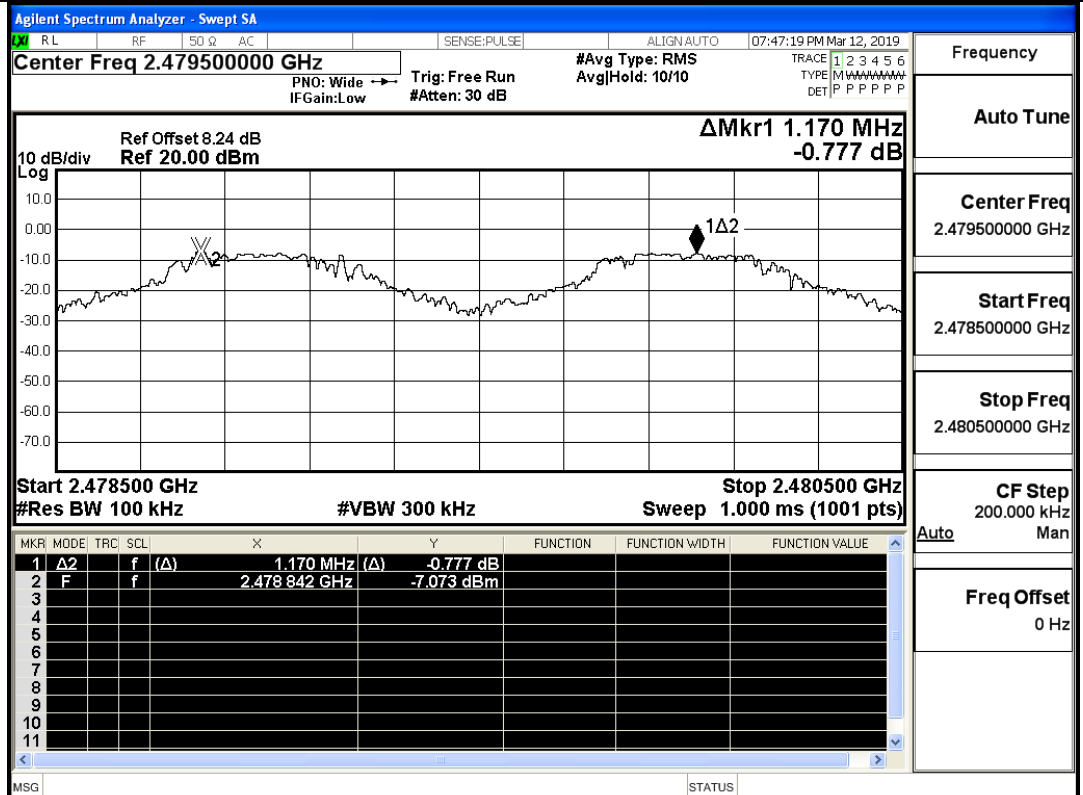
GFSK/LCH

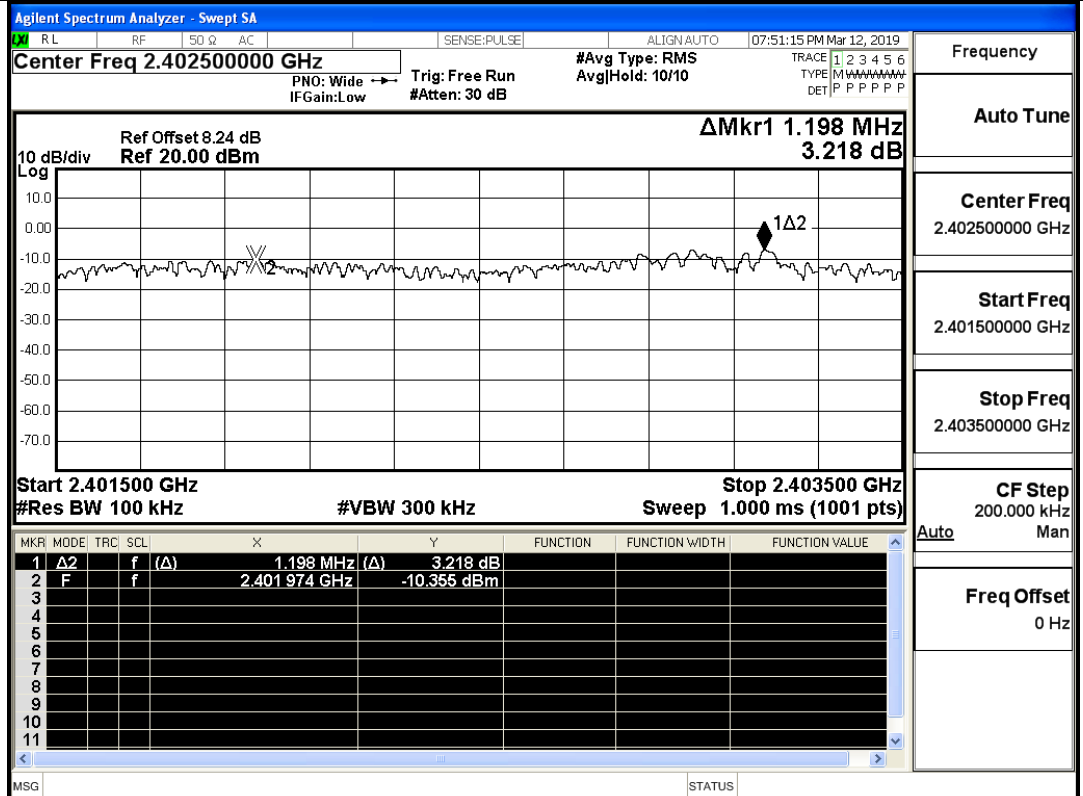
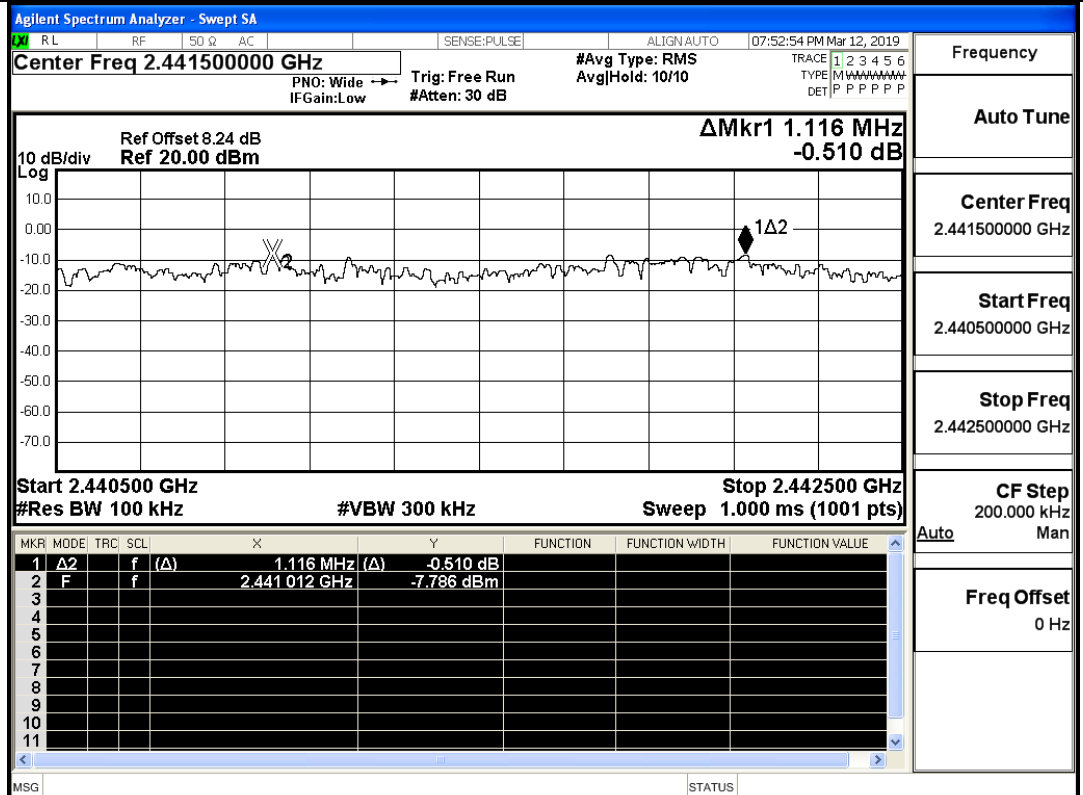


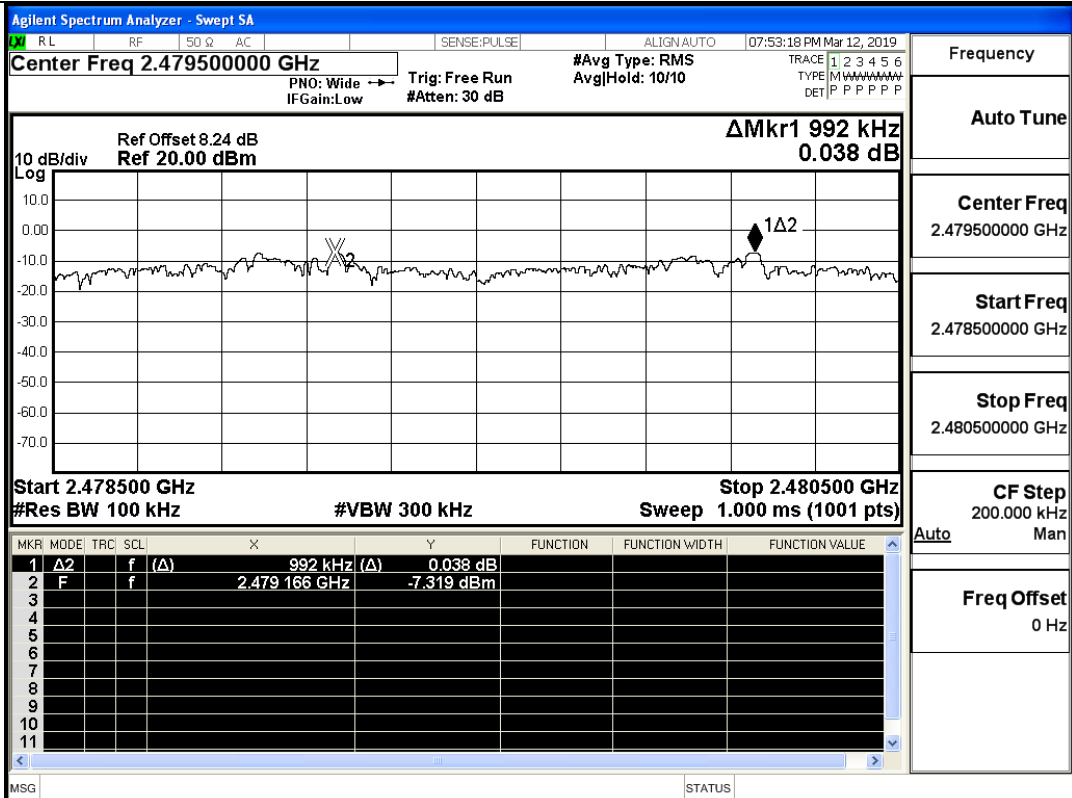
GFSK/MCH



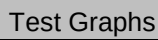
GFSK/HCH

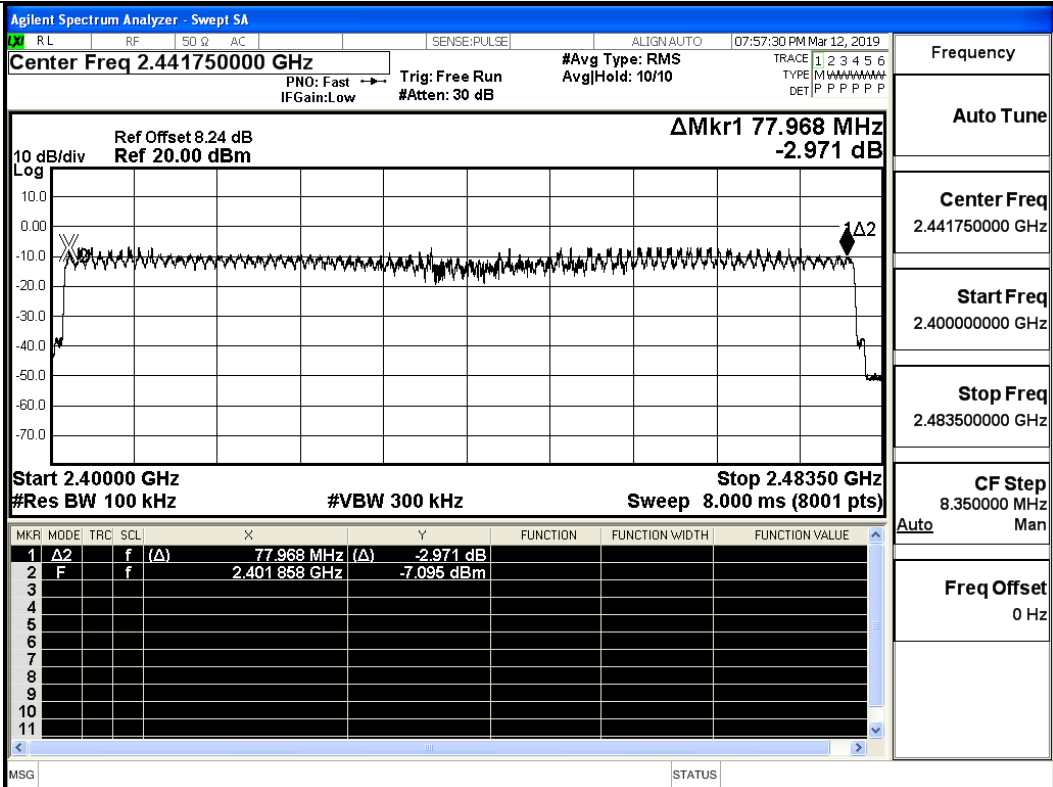


$\pi/4$ DQPSK/LCH $\pi/4$ DQPSK/MCH

$\pi/4$ DQPSK/HCH

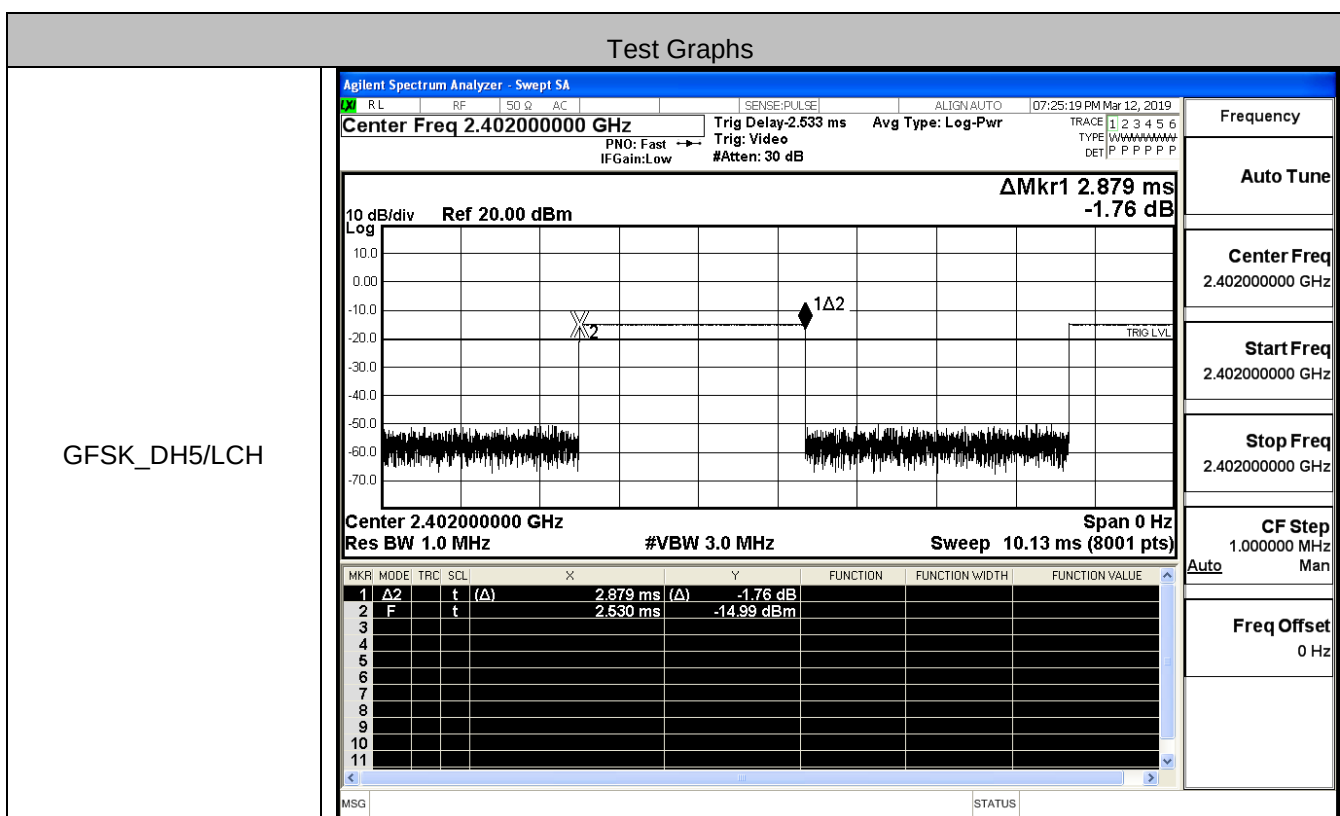
Mode	Channel.	Number of Hopping Channel [N]	Limit [N]	Verdict
GFSK	Hop	79	≥ 15	PASS
$\pi/4$ DQPSK	Hop	79	≥ 15	PASS



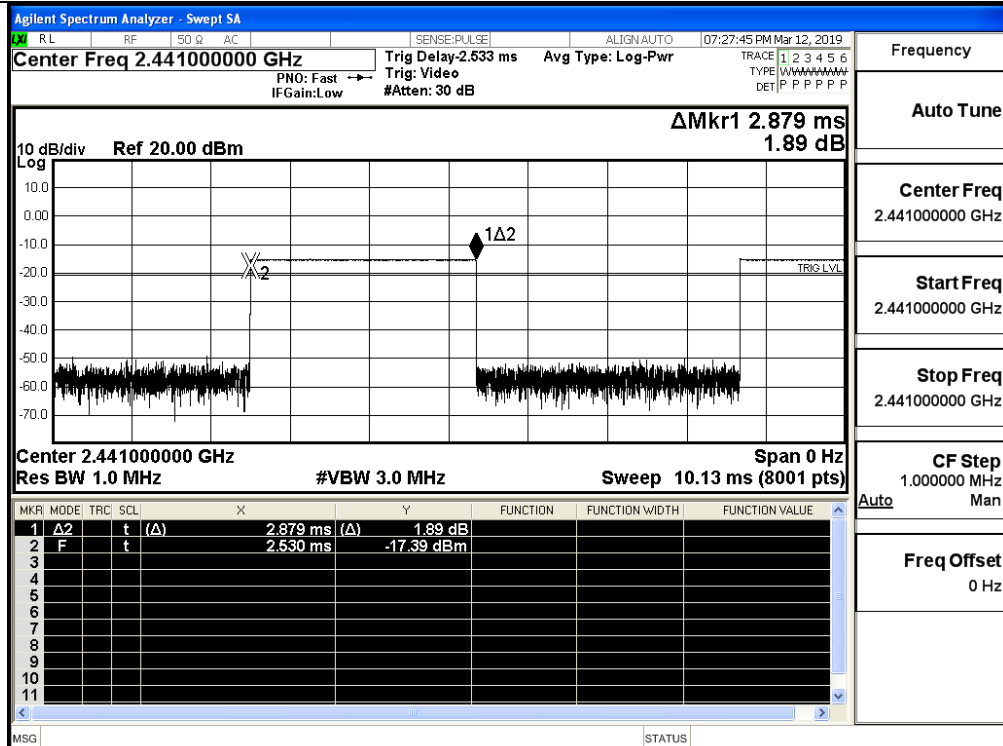
$\pi/4$ DQPSK/Hop

A.5 Dwell Time

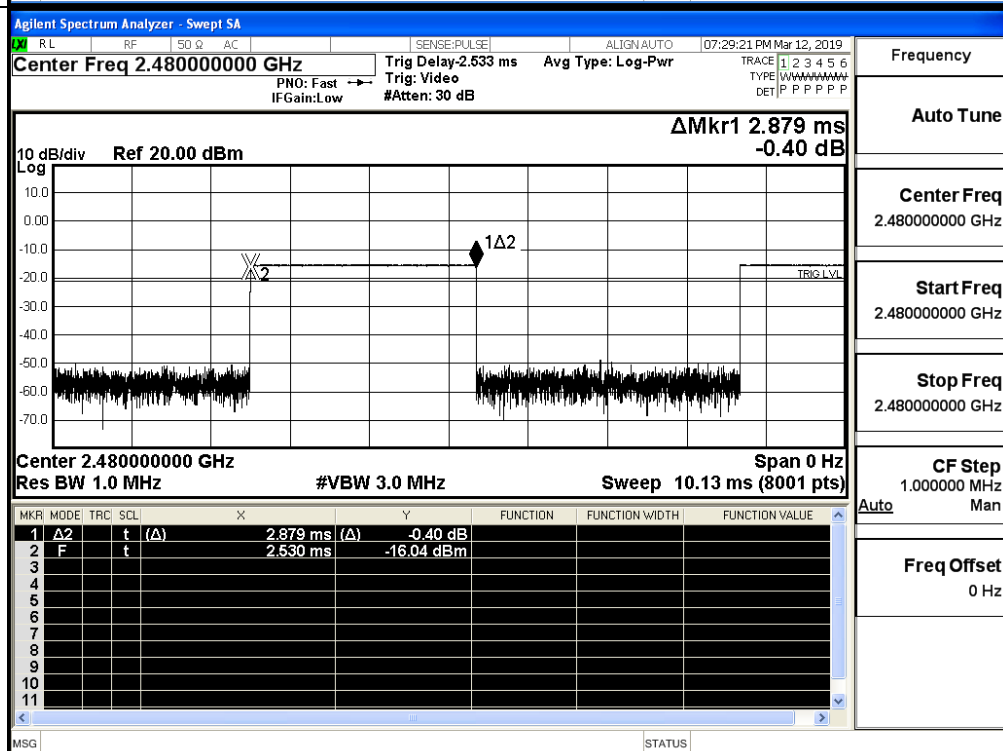
Mode	Packet	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Limit [s]	Verdict
GFSK	DH5	LCH	2.88	106.7	0.307	0.4	PASS
	DH5	MCH	2.88	106.7	0.307	0.4	PASS
	DH5	HCH	2.88	106.7	0.307	0.4	PASS
$\pi/4$ DQPSK	2DH5	LCH	2.88	106.7	0.307	0.4	PASS
	2DH5	MCH	2.88	106.7	0.307	0.4	PASS
	2DH5	HCH	2.89	106.7	0.308	0.4	PASS



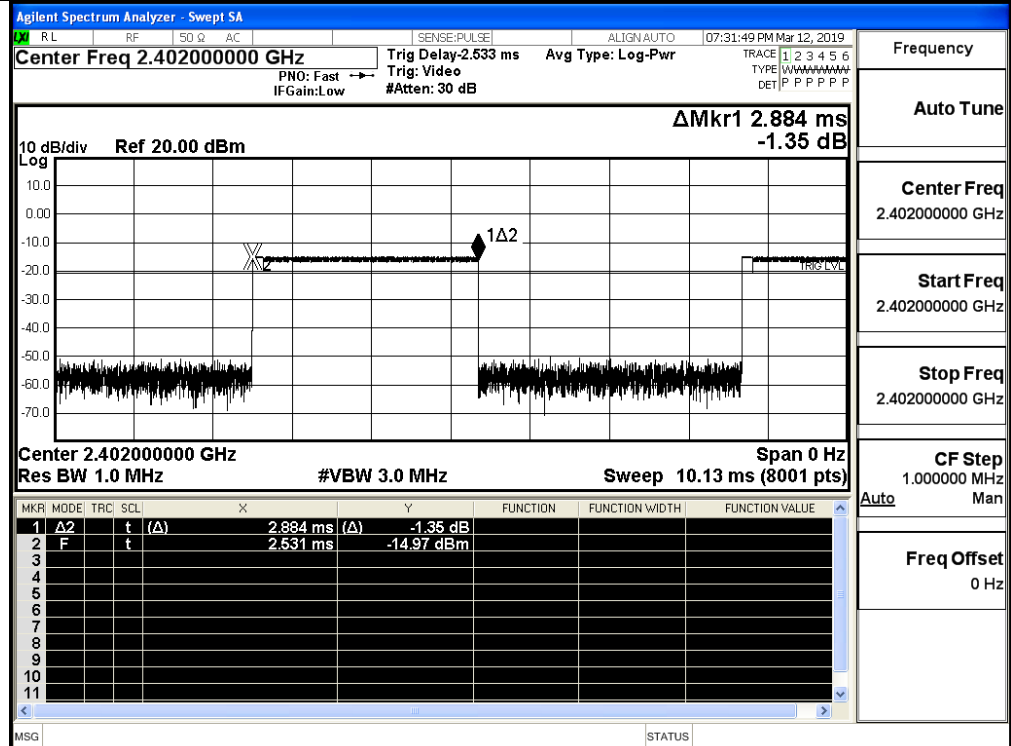
GFSK_DH5/MCH



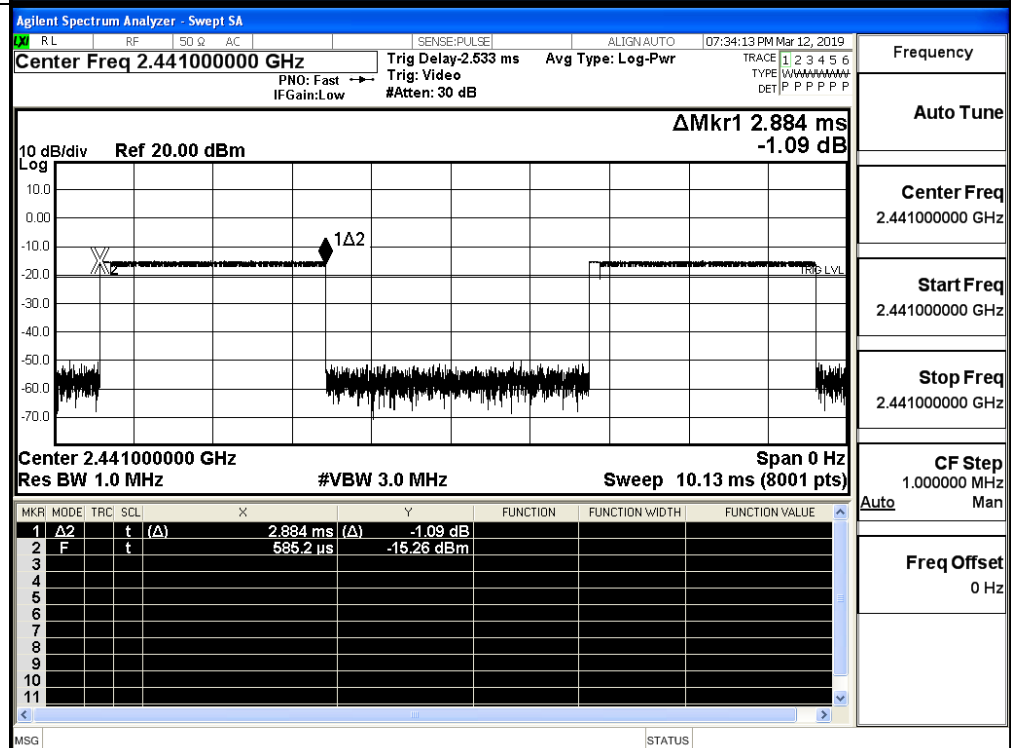
GFSK_DH5/HCH



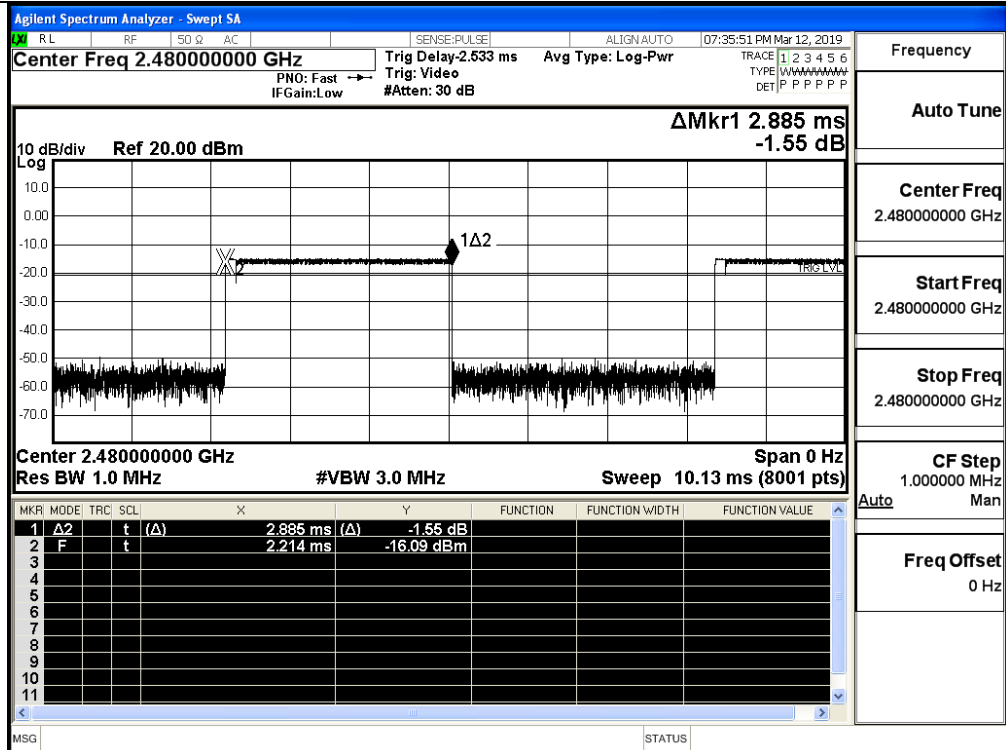
$\pi/4$ DQPSK
_2DH5/LCH



$\pi/4$ DQPSK
_2DH5/MCH



$\pi/4$ DQPSK
_2DH5/HCH

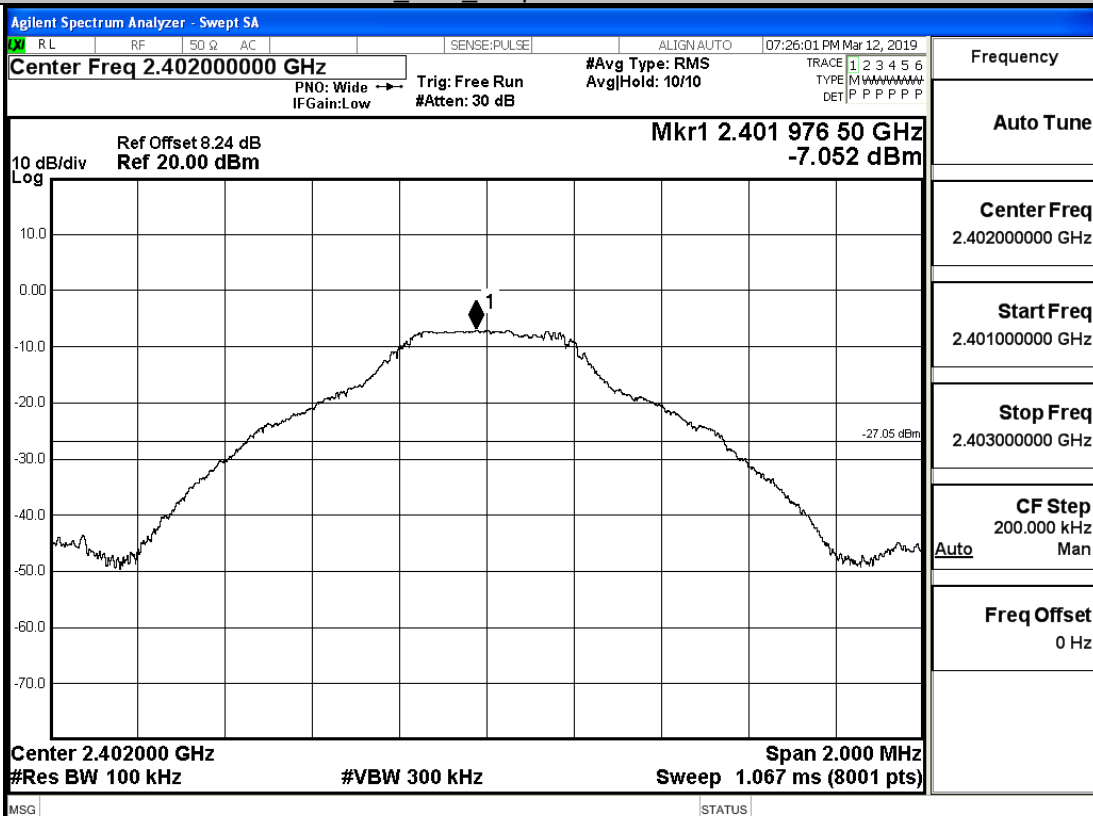


A.6 RF Conducted Spurious Emissions

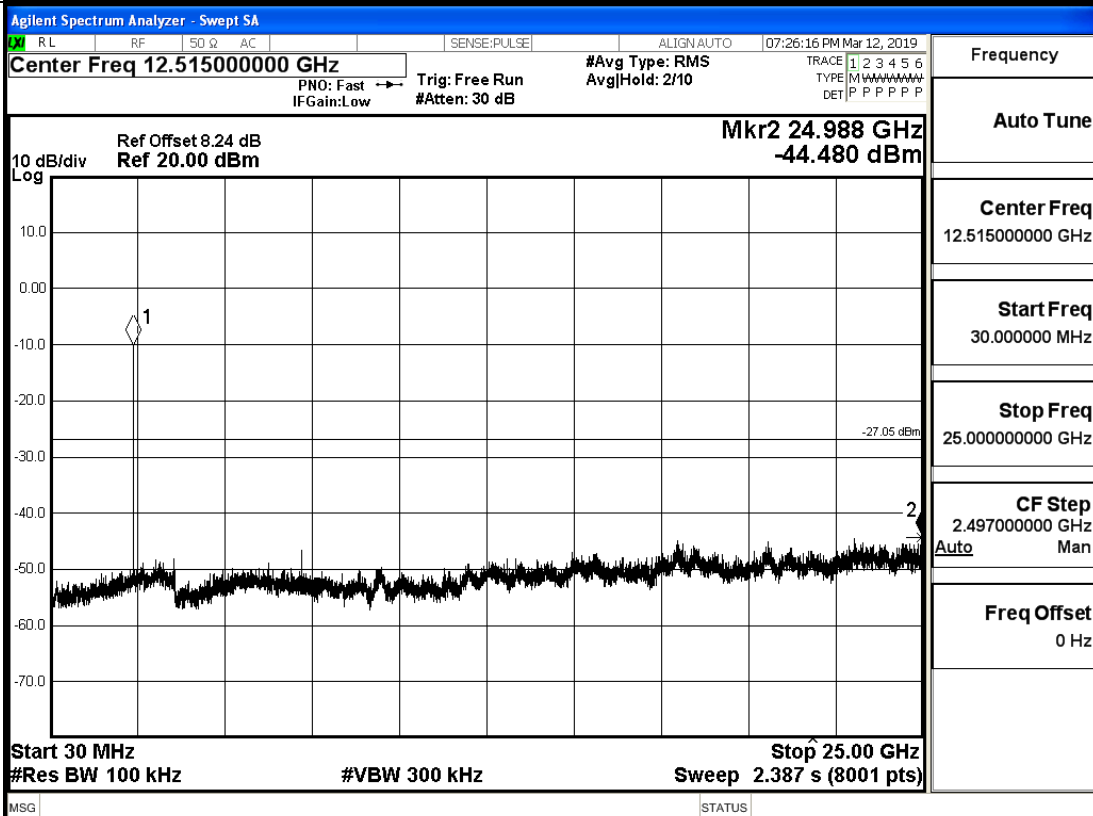
Mode	Channel	Pref [dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	-7.052	-44.480	-27.052	PASS
	MCH	-7.475	-44.191	-27.475	PASS
	HCH	-7.087	-45.060	-27.087	PASS
$\pi/4$ DQPSK	LCH	-6.791	-44.186	-26.791	PASS
	MCH	-6.623	-44.692	-26.623	PASS
	HCH	-7.237	-44.559	-27.237	PASS

GFSK_LCH_Graphs

Pref



Puw



GFSK_MCH_Graphs

Pref

Agilent Spectrum Analyzer - Swept SA

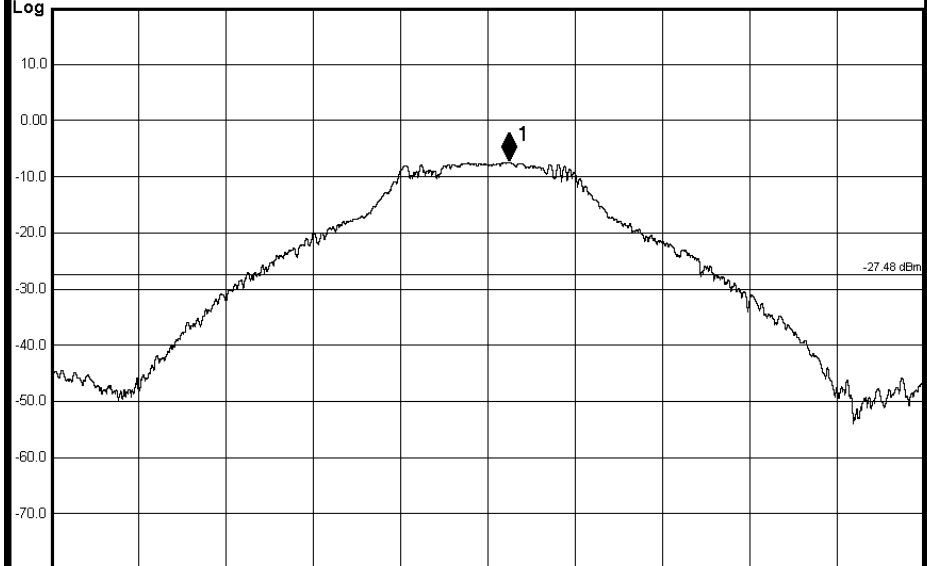
Center Freq 2.441000000 GHz
PNO: Wide → Trig: Free Run #Ave Type: RMS
IFGain:Low #Atten: 30 dB AvgHold: 10/10

ALIGN AUTO 07:28:11 PM Mar 12, 2019

TRACE 1 2 3 4 5 6
TYPE M W W W W W W W
DET P P P P P P P

Frequency

Auto Tune

Ref Offset 8.24 dB
Ref 20.00 dBmMkr1 2.441 049 75 GHz
-7.475 dBmCenter Freq
2.441000000 GHzStart Freq
2.440000000 GHzStop Freq
2.442000000 GHzCF Step
200.000 kHz
Auto ManFreq Offset
0 Hz

Puw

Agilent Spectrum Analyzer - Swept SA

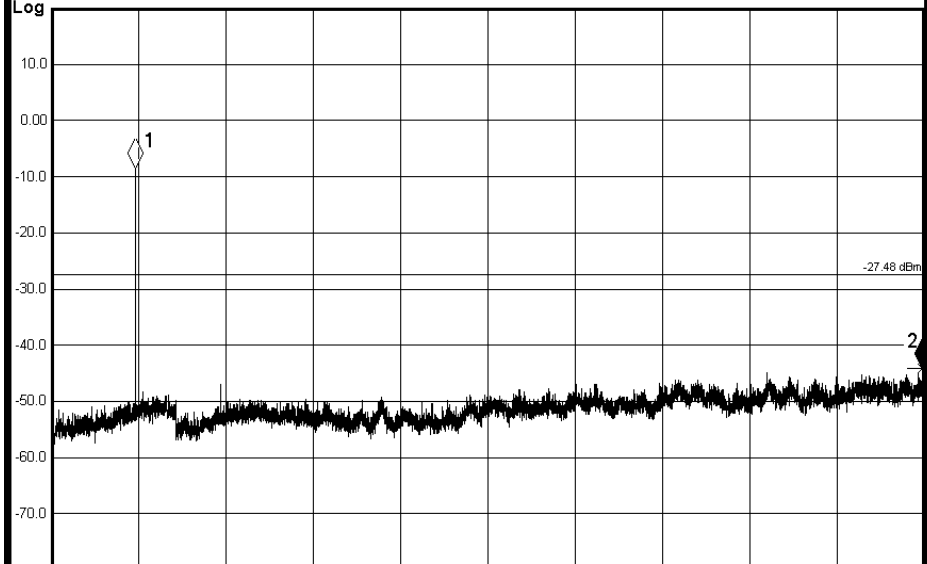
Center Freq 12.515000000 GHz
PNO: Fast → Trig: Free Run #Ave Type: RMS
IFGain:Low #Atten: 30 dB AvgHold: 2/10

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TRACE 1 2 3 4 5 6
TYPE M W W W W W W W
DET P P P P P P P

Frequency

Auto Tune

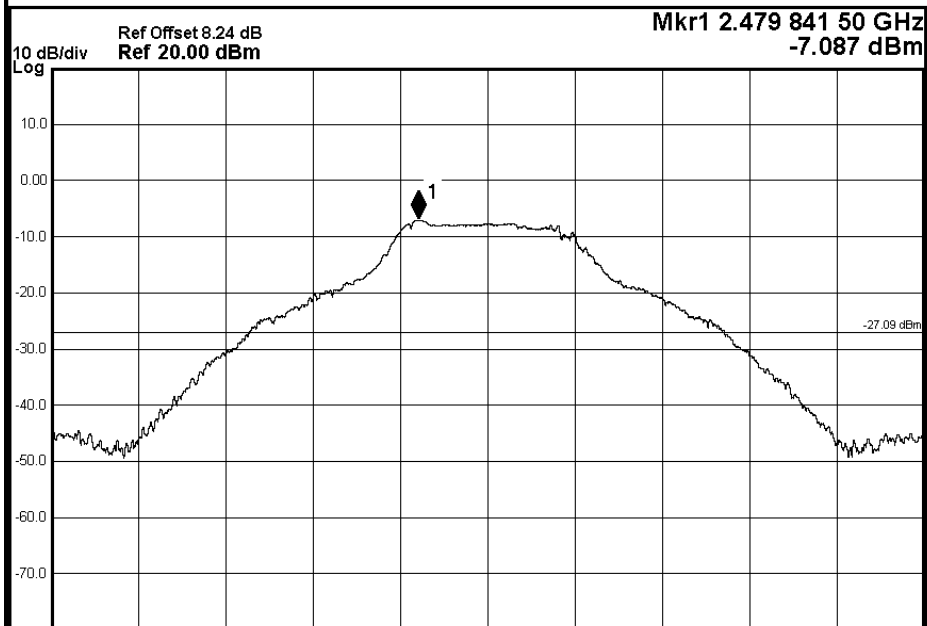
Ref Offset 8.24 dB
Ref 20.00 dBmMkr2 24.931 GHz
-44.191 dBmCenter Freq
12.515000000 GHzStart Freq
30.000000 MHzStop Freq
25.000000000 GHzCF Step
2.497000000 GHz
Auto ManFreq Offset
0 Hz

GFSK HCH_Graphs

Pref

Agilent Spectrum Analyzer - Swept SA

Center Freq 2.48000000 GHz
PNO: Wide → Trig: Free Run
IFGain:Low #Atten: 30 dB
#Avg Type: RMS
AvgHold: 10/10
TRACE 1 2 3 4 5 6
TYPE M W W W W W W W
DET P P P P P P P



MSG

STATUS

Frequency

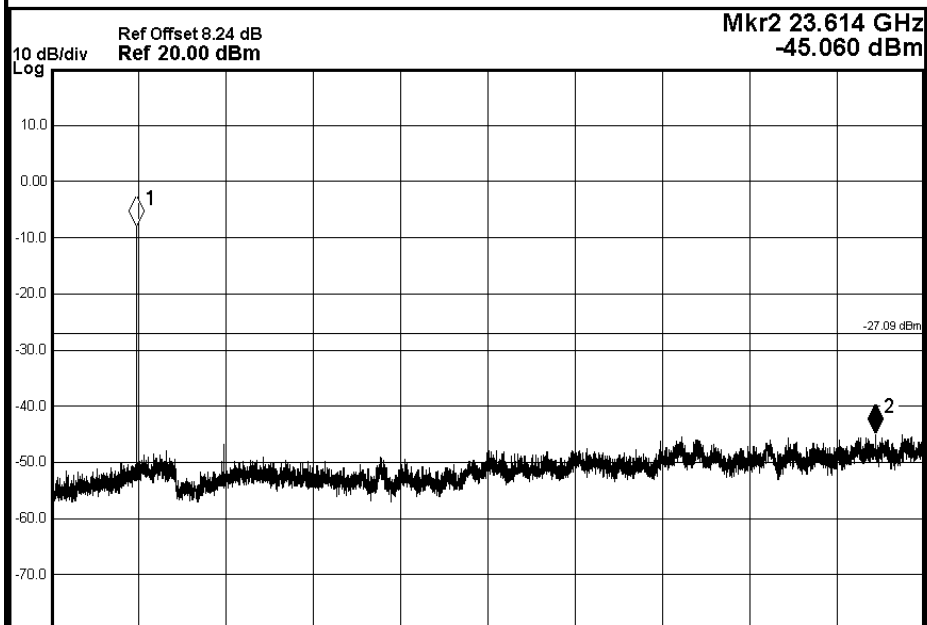
Auto Tune

Center Freq
2.480000000 GHzStart Freq
2.479000000 GHzStop Freq
2.481000000 GHzCF Step
200.000 kHz
Auto ManFreq Offset
0 Hz

Puw

Agilent Spectrum Analyzer - Swept SA

Center Freq 12.51500000 GHz
PNO: Fast → Trig: Free Run
IFGain:Low #Atten: 30 dB
#Avg Type: RMS
AvgHold: 2/10
TRACE 1 2 3 4 5 6
TYPE M W W W W W W W
DET P P P P P P P



MSG

STATUS

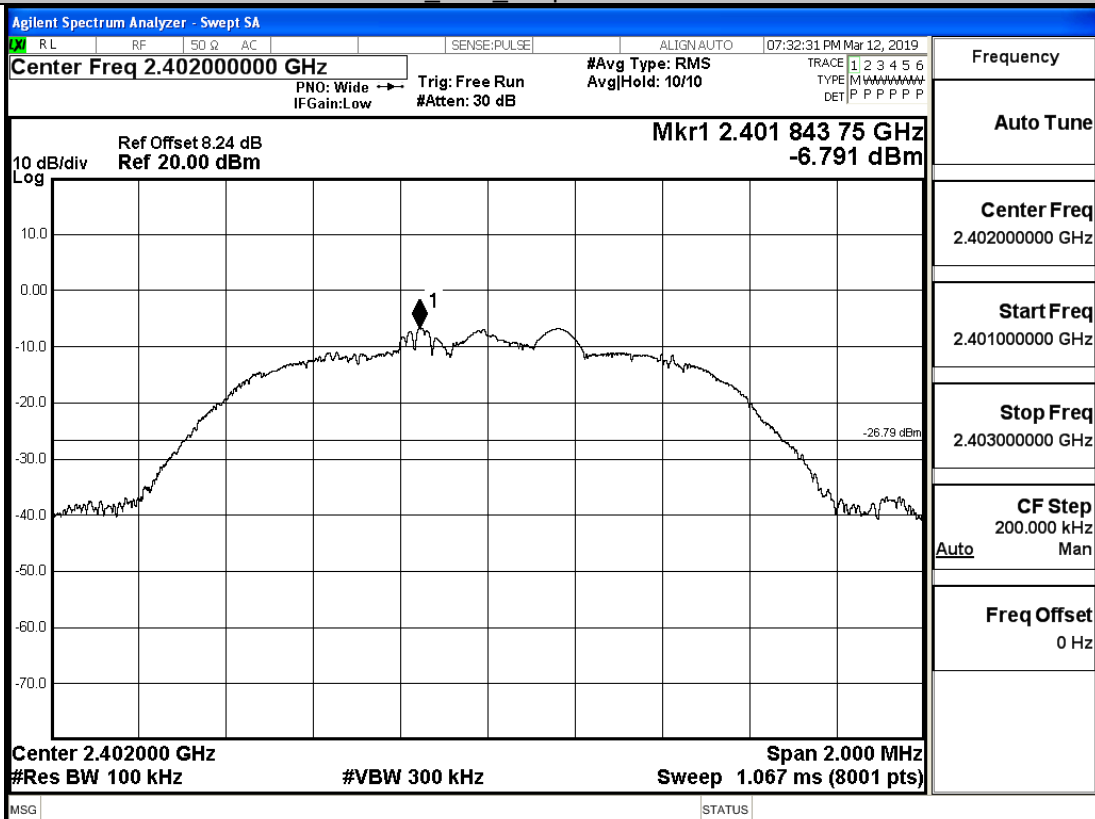
Frequency

Auto Tune

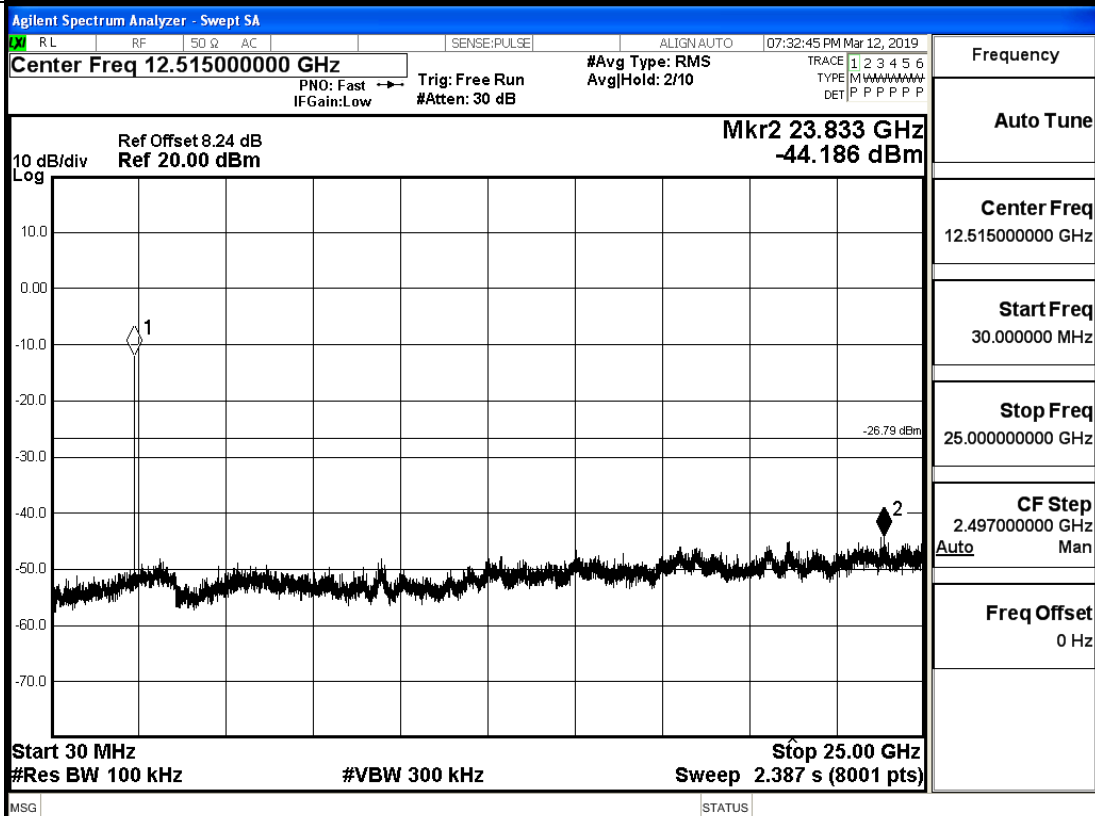
Center Freq
12.515000000 GHzStart Freq
30.000000 MHzStop Freq
25.000000000 GHzCF Step
2.497000000 GHz
Auto ManFreq Offset
0 Hz

$\pi/4$ DQPSK LCH_Graphs

Pref



Puw



$\pi/4$ DQPSK_MCH_Graphs

Pref

Agilent Spectrum Analyzer - Swept SA

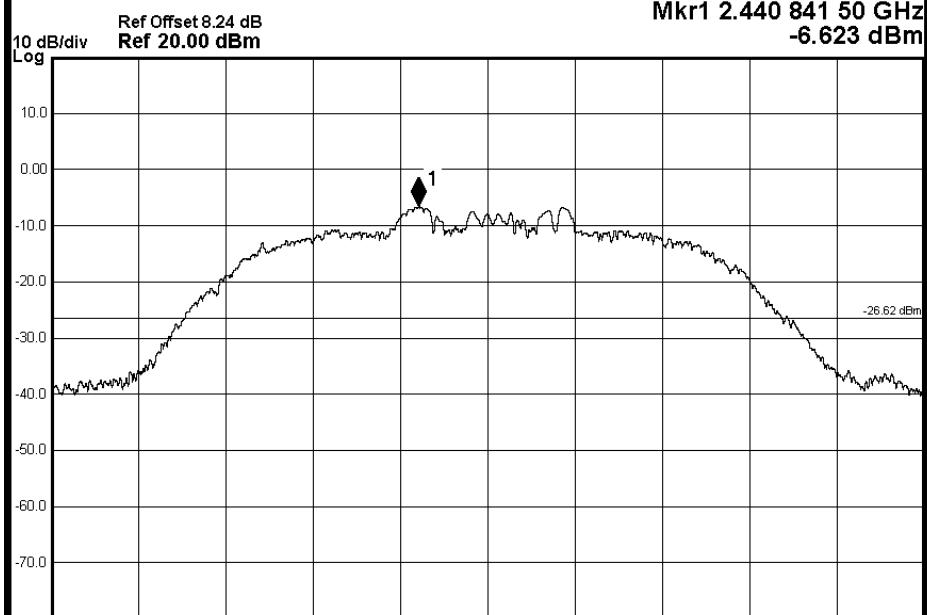
Center Freq 2.441000000 GHz
PNO: Wide → Trig: Free Run #Ave Type: RMS
IFGain:Low #Atten: 30 dB AvgHold: 10/10

ALIGN AUTO 07:34:39 PM Mar 12, 2019

TRACE 1 2 3 4 5 6
TYPE M W W W W W W W
DET P P P P P P P

Frequency

Auto Tune



Center 2.441000 GHz Span 2.000 MHz
#Res BW 100 kHz #VBW 300 kHz Sweep 1.067 ms (8001 pts)

MSG

STATUS

Center Freq
2.441000000 GHzStart Freq
2.440000000 GHzStop Freq
2.442000000 GHzCF Step
200.000 kHz
Auto ManFreq Offset
0 Hz

Puw

Agilent Spectrum Analyzer - Swept SA

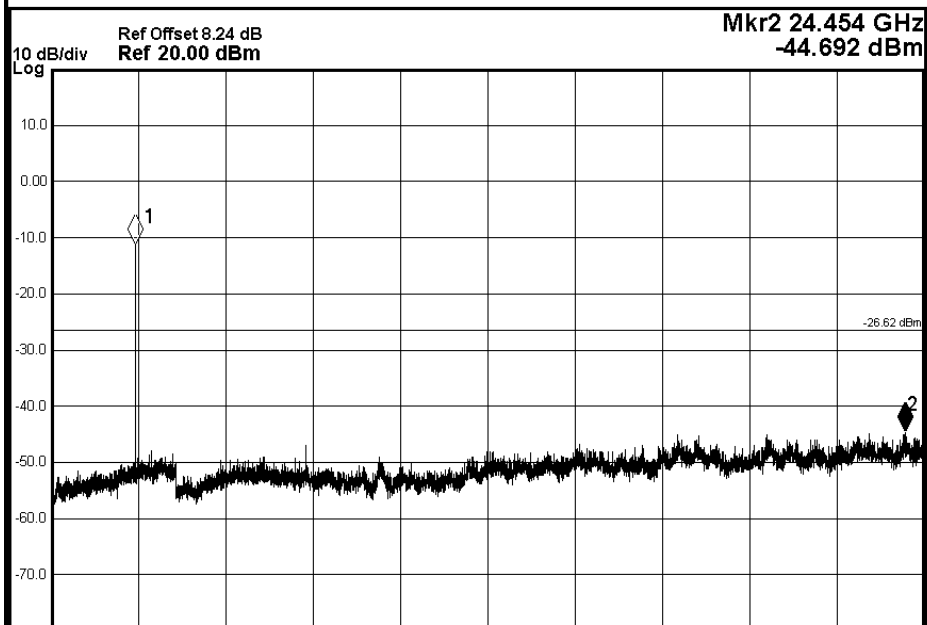
Center Freq 12.515000000 GHz
PNO: Fast → Trig: Free Run #Ave Type: RMS
IFGain:Low #Atten: 30 dB AvgHold: 2/10

ALIGN AUTO 07:34:53 PM Mar 12, 2019

TRACE 1 2 3 4 5 6
TYPE M W W W W W W W
DET P P P P P P P

Frequency

Auto Tune



Start 30 MHz Stop 25.00 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 2.387 s (8001 pts)

MSG

STATUS

Center Freq
12.515000000 GHzStart Freq
30.000000 MHzStop Freq
25.000000000 GHzCF Step
2.497000000 GHz
Auto ManFreq Offset
0 Hz

$\pi/4$ DQPSK_HCH_Graphs

Pref

Agilent Spectrum Analyzer - Swept SA

Center Freq 2.48000000 GHz
PNO: Wide → Trig: Free Run #Avg Type: RMS
IFGain:Low #Atten: 30 dB AvgHold: 10/10

ALIGN AUTO 07:36:33 PM Mar 12, 2019

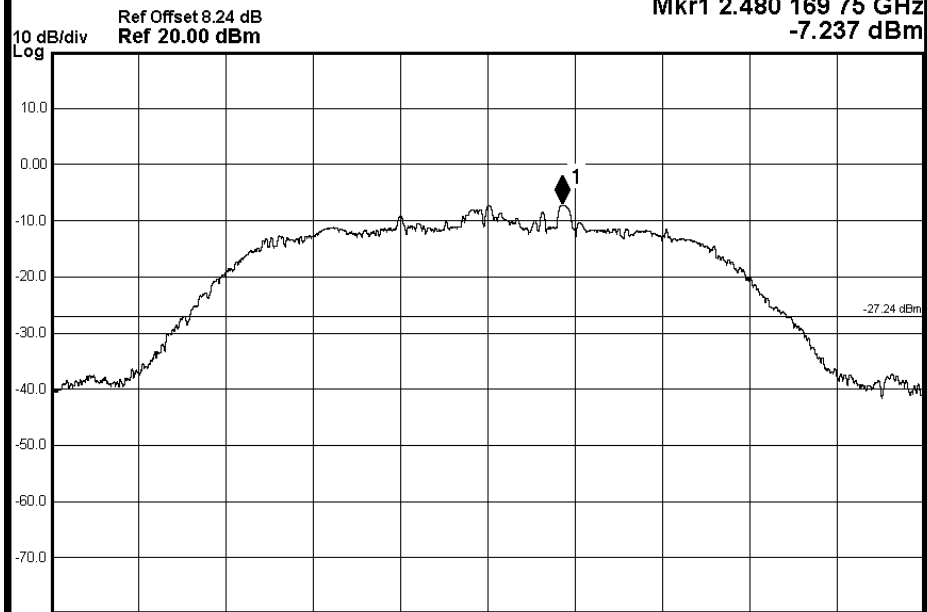
TRACE 1 2 3 4 5 6

TYPE M W W W W W W W

DET P P P P P P

Frequency

Auto Tune

Center Freq
2.480000000 GHzStart Freq
2.479000000 GHzStop Freq
2.481000000 GHzCF Step
200.000 kHz
Auto ManFreq Offset
0 Hz

Center 2.480000 GHz Span 2.000 MHz
#Res BW 100 kHz #VBW 300 kHz Sweep 1.067 ms (8001 pts)

MSG

STATUS

Puw

Agilent Spectrum Analyzer - Swept SA

Center Freq 12.51500000 GHz
PNO: Fast → Trig: Free Run #Avg Type: RMS
IFGain:Low #Atten: 30 dB AvgHold: 2/10

ALIGN AUTO 07:36:47 PM Mar 12, 2019

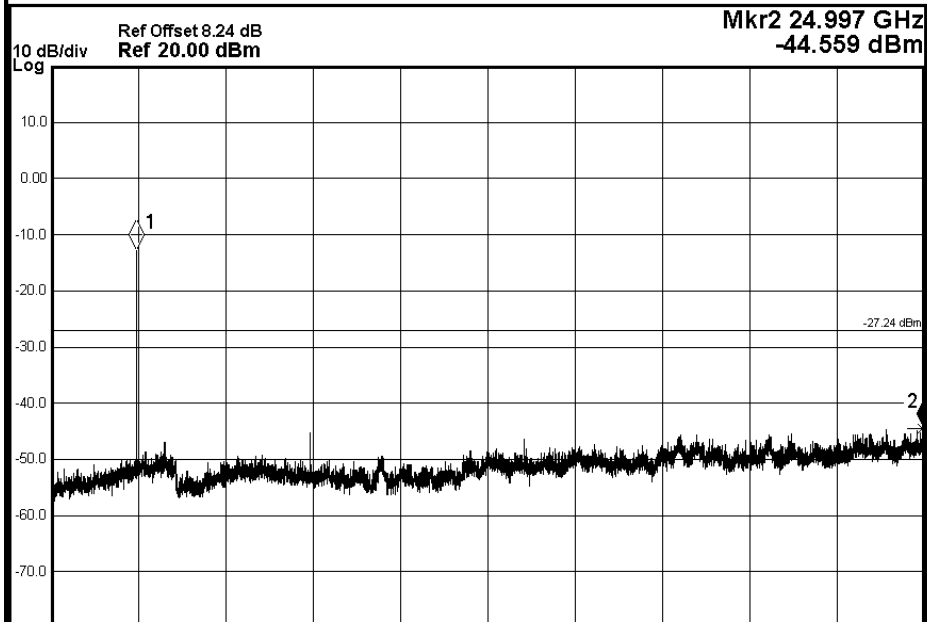
TRACE 1 2 3 4 5 6

TYPE M W W W W W W W

DET P P P P P P

Frequency

Auto Tune

Center Freq
12.515000000 GHzStart Freq
30.000000 MHzStop Freq
25.000000000 GHzCF Step
2.497000000 GHz
Auto ManFreq Offset
0 Hz

Start 30 MHz Stop 25.00 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 2.387 s (8001 pts)

MSG

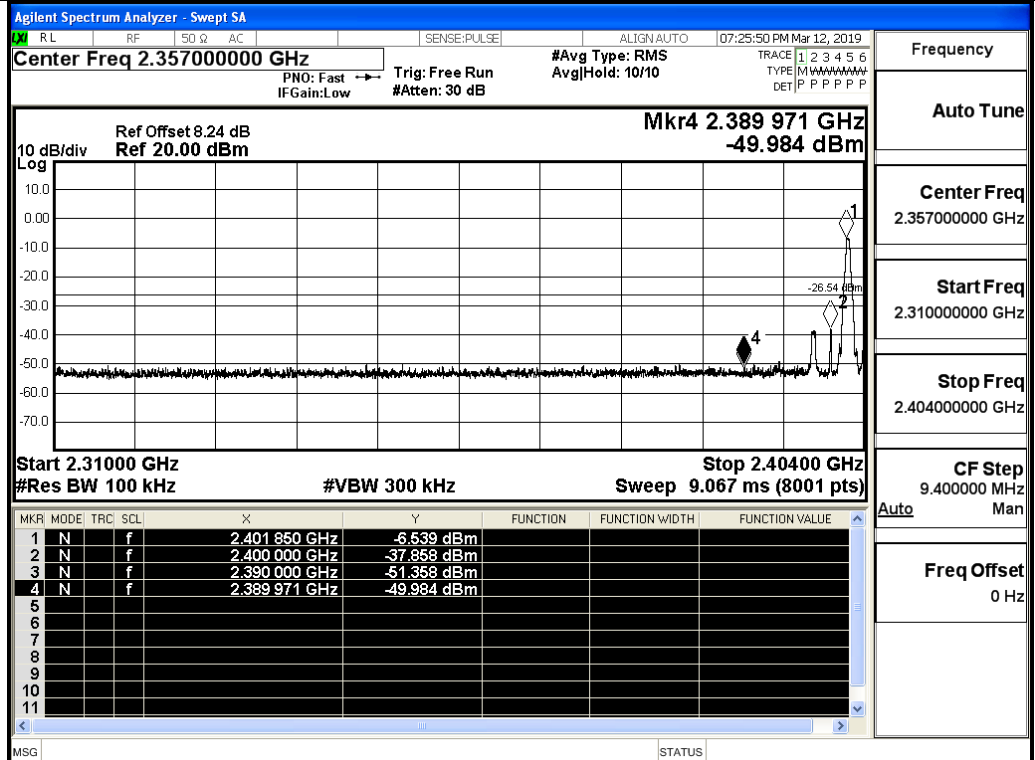
STATUS

A.7 Band-edge for RF Conducted Emissions

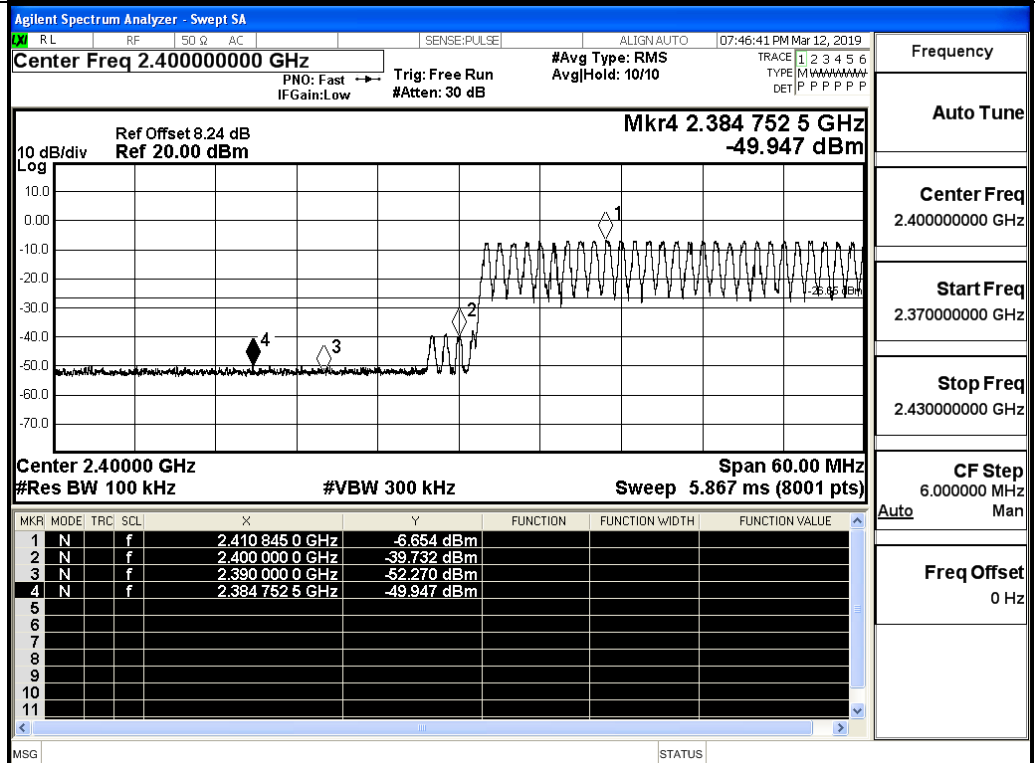
Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2402	-6.539	Off	-49.984	-26.54	PASS
			-6.654	On	-49.947	-26.65	PASS
	HCH	2480	-7.276	Off	-45.965	-27.28	PASS
			-6.959	On	-46.157	-26.96	PASS
π /4DQPSK	LCH	2402	-8.121	Off	-49.794	-28.12	PASS
			-6.743	On	-49.781	-26.74	PASS
	HCH	2480	-7.001	Off	-45.184	-27.00	PASS
			-7.069	On	-48.575	-27.07	PASS

Test Graphs

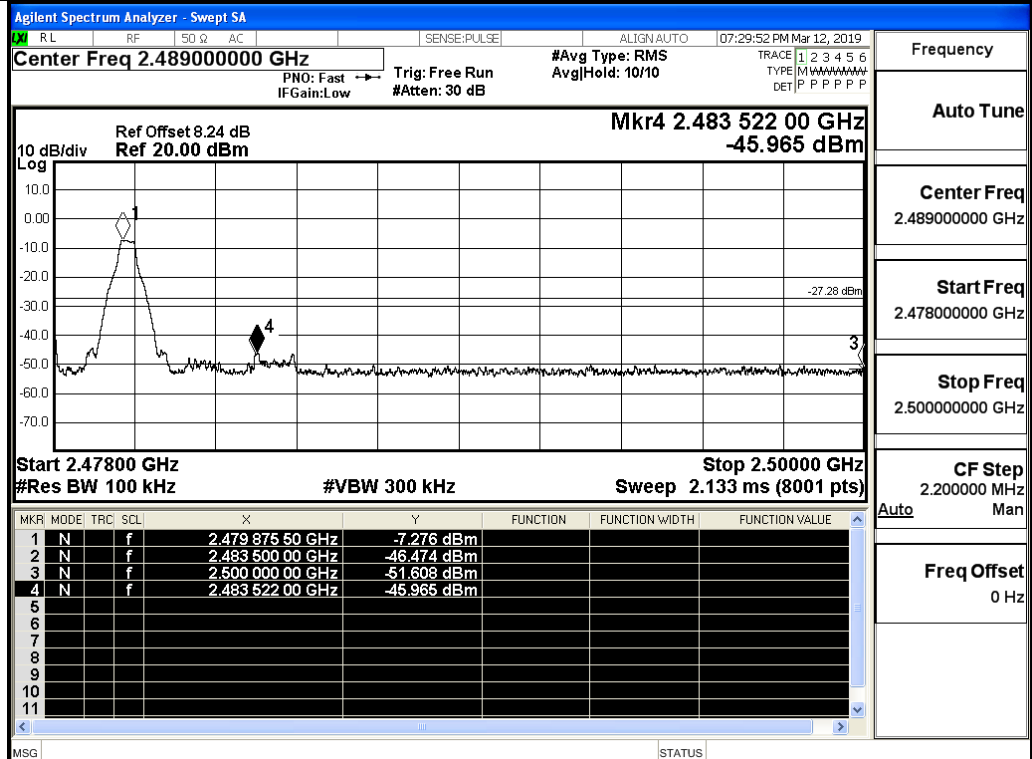
GFSK/LCH/No Hop



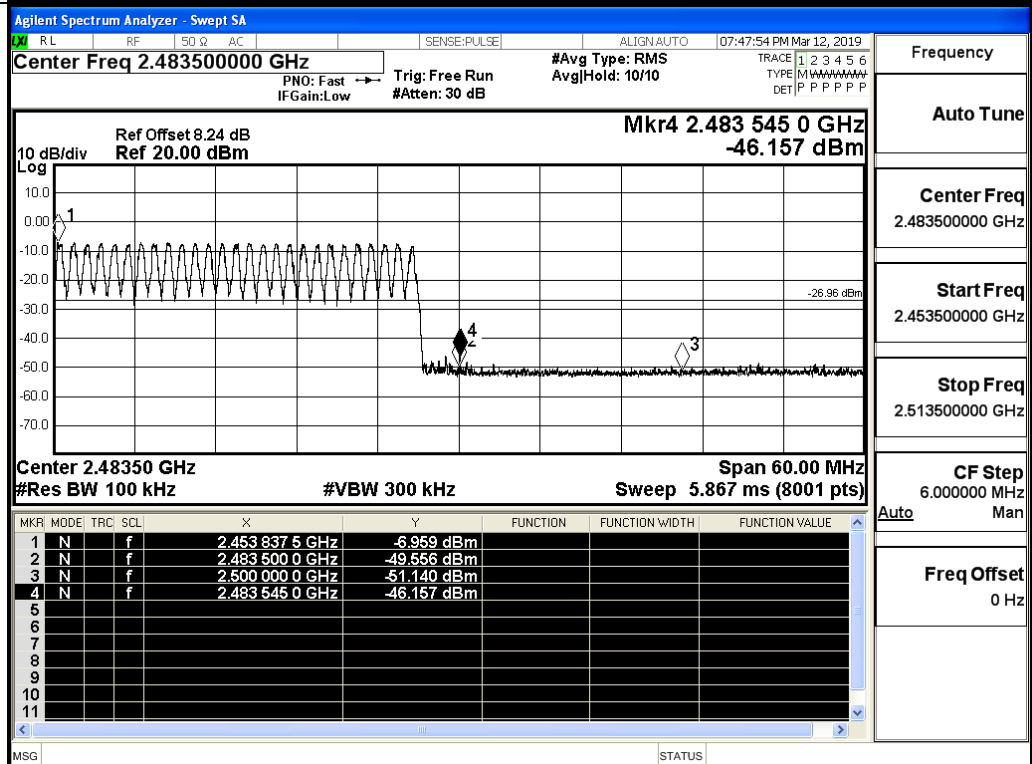
GFSK/LCH/Hop



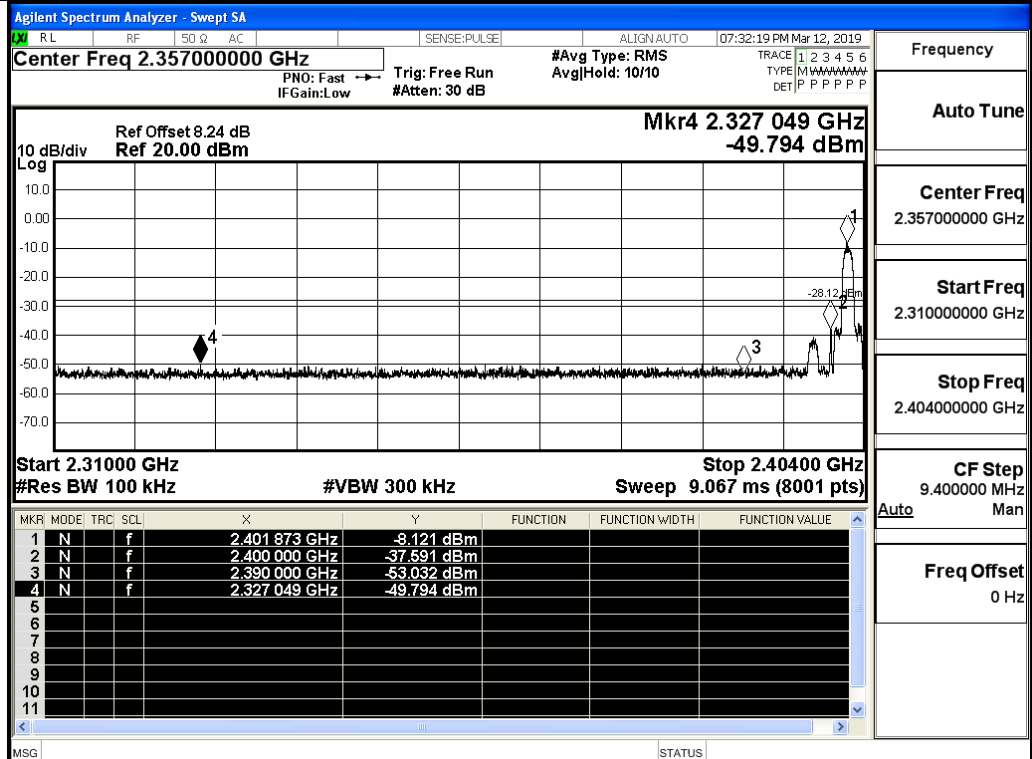
GFSK/HCH/No Hop



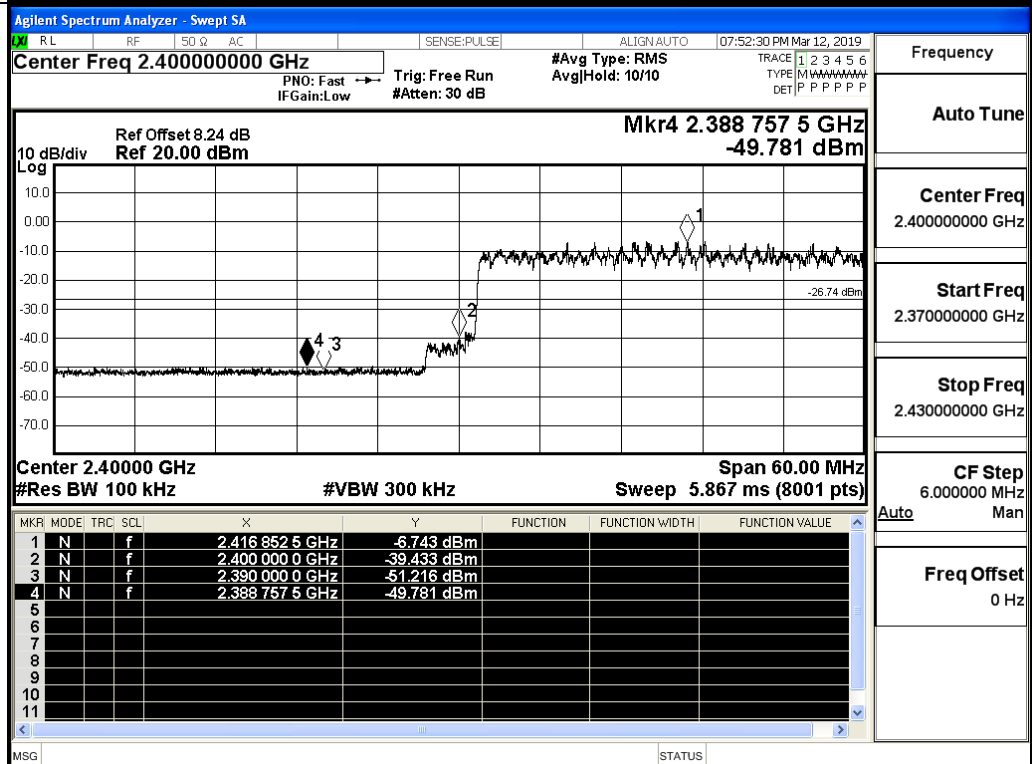
GFSK/HCH/Hop



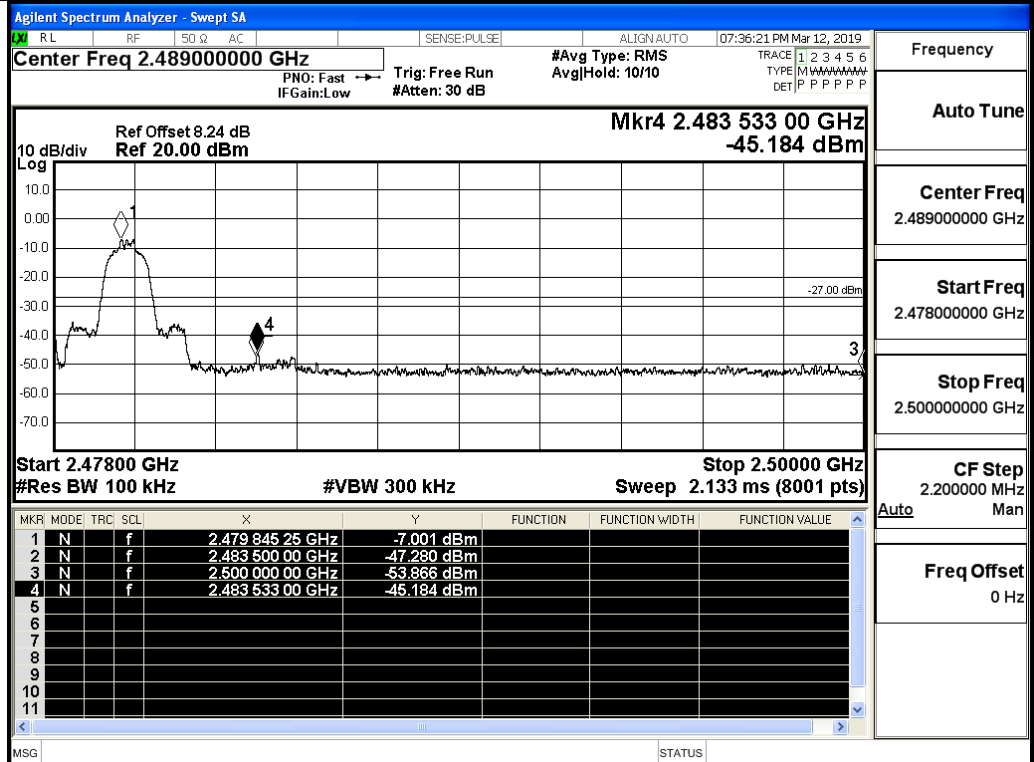
$\pi/4$ DQPSK/LCH/No
Hop



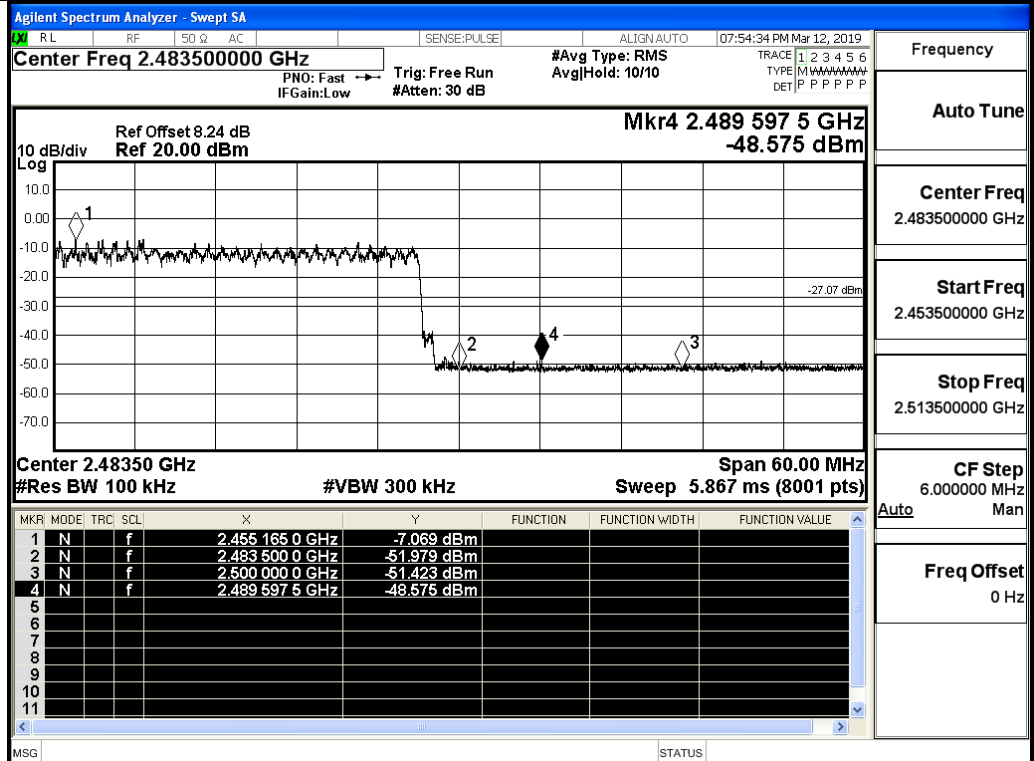
$\pi/4$ DQPSK/LCH/Hop



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



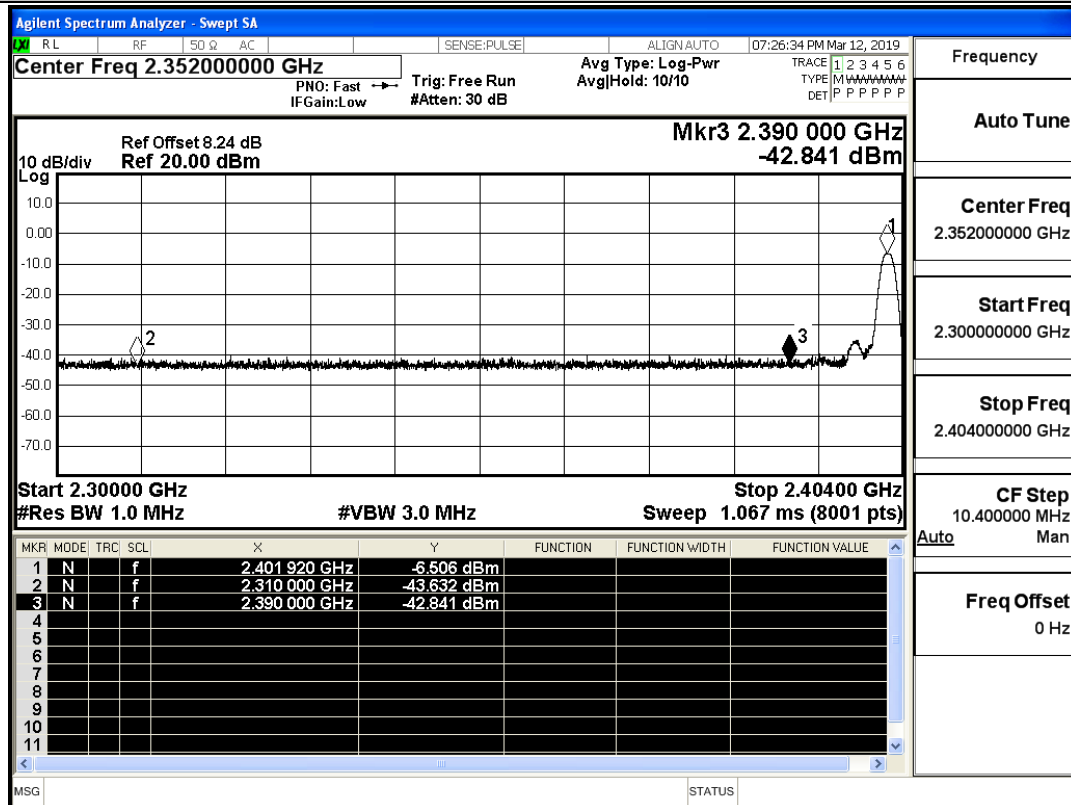
$\pi/4$ DQPSK/HCH/Hop



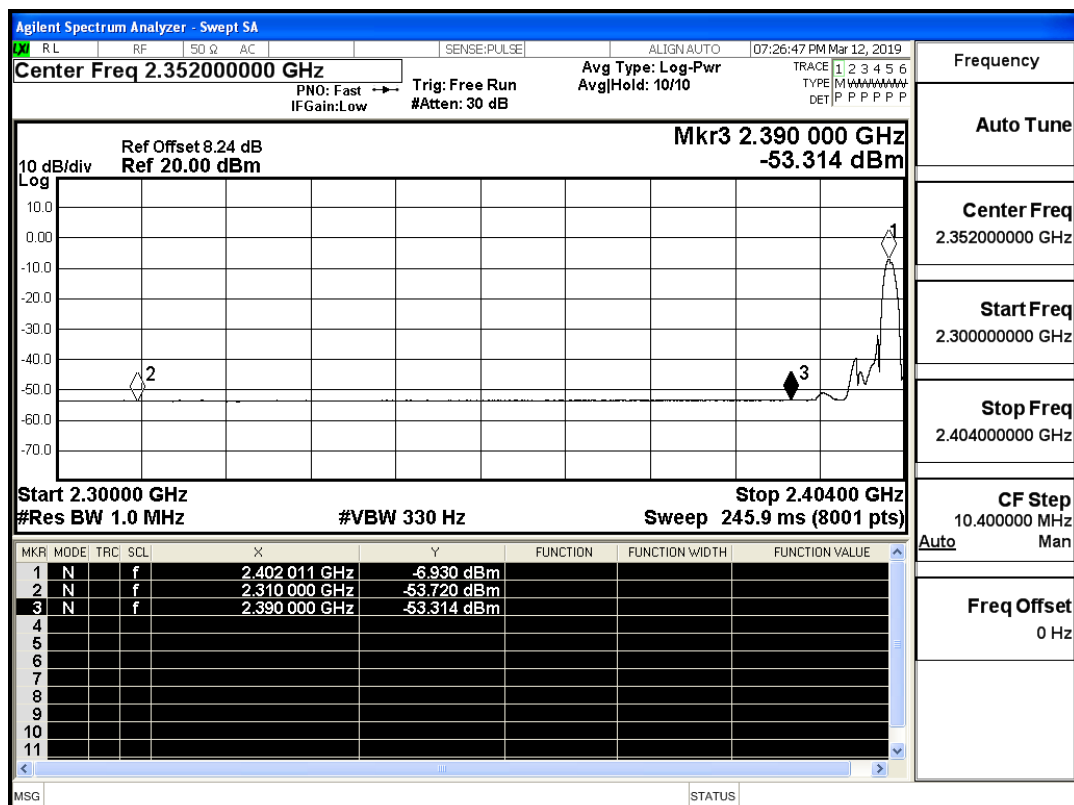
A.8 Restrict-band band-edge measurements

Test Mode	Hopping	Freq.	Power [dBm]	Gain	Ground Factor	E [dBuV/m]	Detector	Limit [dBuV/m]	Verdict
GFSK	Off	2310.0	-43.63	2.0	0	53.63	PEAK	74	PASS
	Off	2310.0	-53.72	2.0	0	43.54	AV	54	PASS
	Off	2390.0	-42.84	2.0	0	54.42	PEAK	74	PASS
	Off	2390.0	-53.31	2.0	0	43.94	AV	54	PASS
	Off	2483.5	-40.77	2.0	0	56.49	PEAK	74	PASS
	Off	2483.5	-49.22	2.0	0	48.04	AV	54	PASS
	Off	2500.0	-42.11	2.0	0	55.15	PEAK	74	PASS
	Off	2500.0	-53.03	2.0	0	44.23	AV	54	PASS
$\pi/4$ DQPSK	Off	2310.0	-43.46	2.0	0	53.79	PEAK	74	PASS
	Off	2310.0	-53.67	2.0	0	43.58	AV	54	PASS
	Off	2390.0	-43.32	2.0	0	53.93	PEAK	74	PASS
	Off	2390.0	-53.22	2.0	0	44.04	AV	54	PASS
	Off	2483.5	-41.00	2.0	0	56.26	PEAK	74	PASS
	Off	2483.5	-50.85	2.0	0	46.40	AV	54	PASS
	Off	2500.0	-42.39	2.0	0	54.87	PEAK	74	PASS
	Off	2500.0	-52.90	2.0	0	44.35	AV	54	PASS

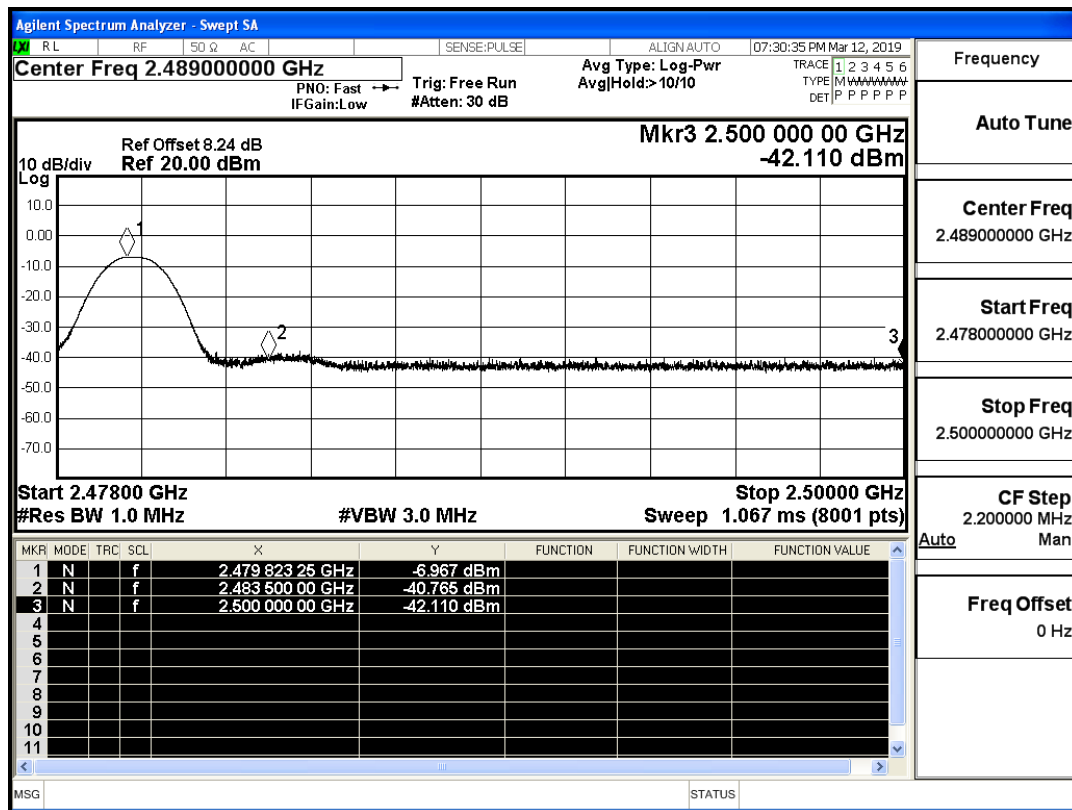
Restrict-band band-edge measurements_Hopping Off_GFSK_PEAK (Low Channel)



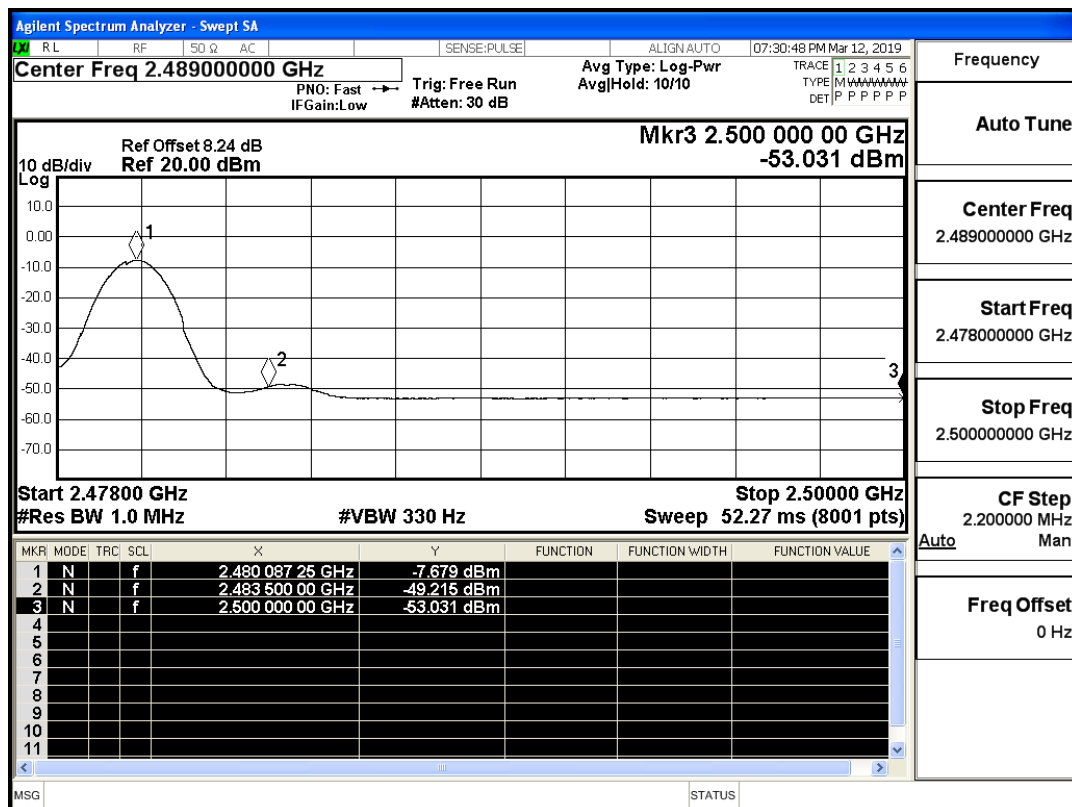
Restrict-band band-edge measurements_Hopping Off_GFSK_Average (Low Channel)

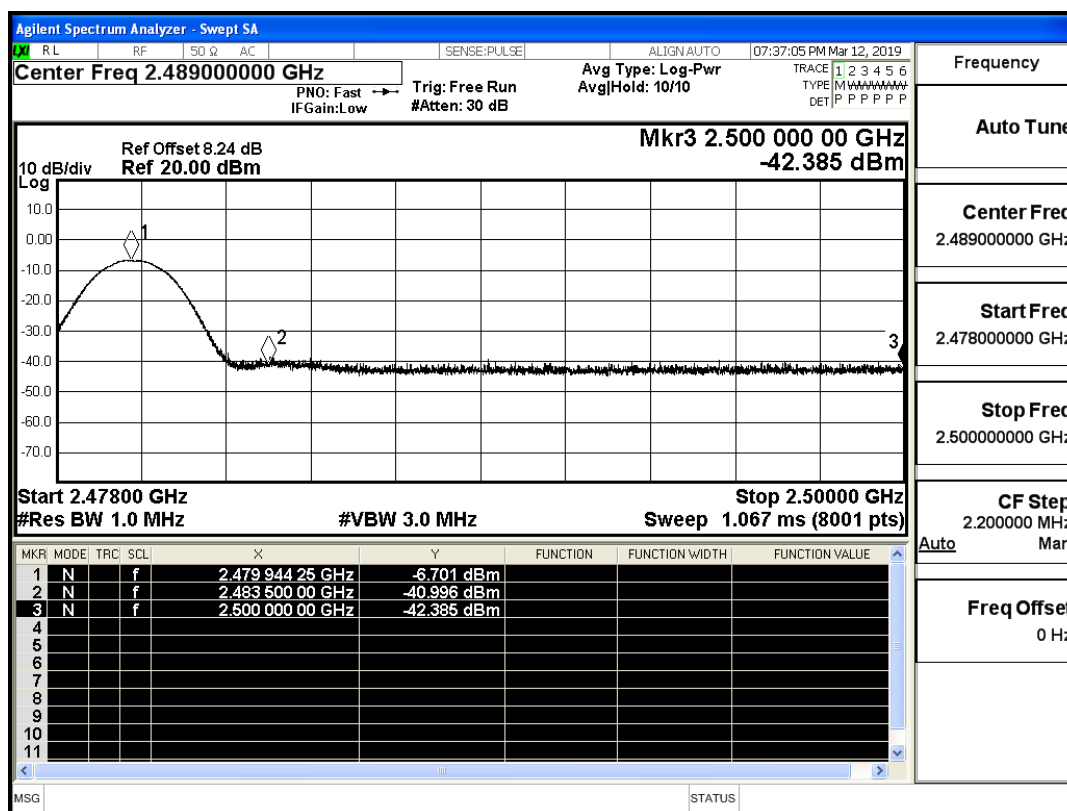


Restrict-band band-edge measurements_Hopping Off_GFSK_PEAK (High Channel)



Restrict-band band-edge measurements_Hopping Off_GFSK_Average (High Channel)



Restrict-band band-edge measurements_Hopping Off $\pi/4$ -DQPSK_PEAK (High Channel)Restrict-band band-edge measurements_Hopping Off $\pi/4$ -DQPSK_Average (High Channel)