

Appendix A

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

Product Name: TWS Earbuds

Trade Mark: N/A

Test Model: TWS-20

Environmental Conditions

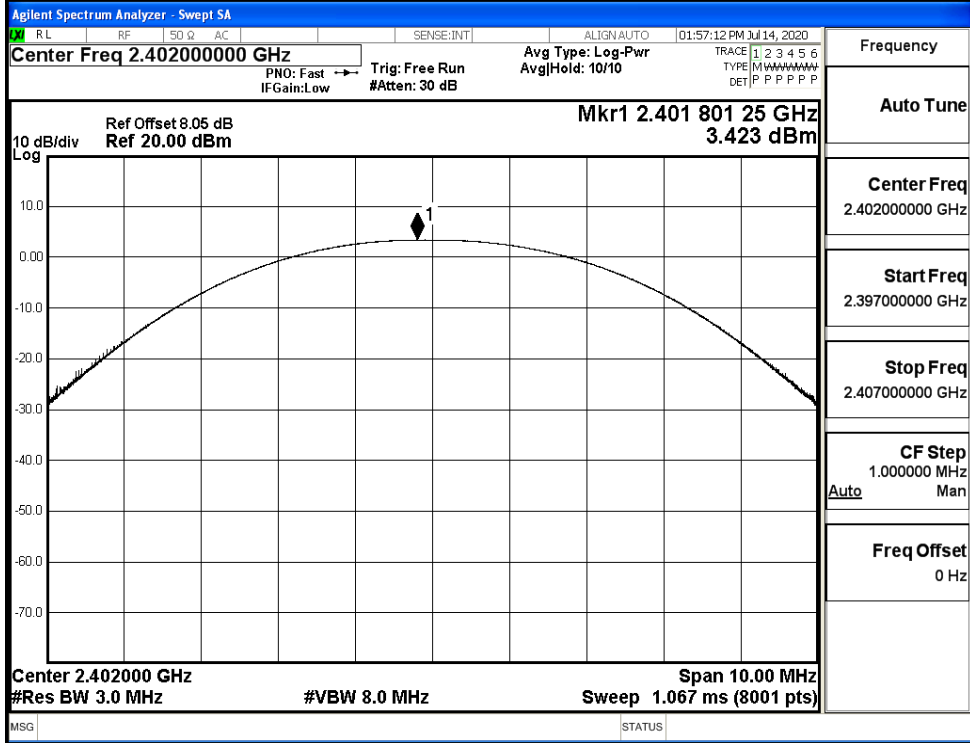
Temperature:	23.4 ° C
Relative Humidity:	54.5%
ATM Pressure:	100.0 kPa
Test Engineer:	Diamond Lu
Supervised by:	Li Huan

A.1 Maximum Conducted Peak Output Power

Mode	Channel.	Maximum Peak Output Power [dBm]	Limit [dBm]	Verdict
GFSK	LCH	3.423	21	PASS
	MCH	1.874	21	PASS
	HCH	0.250	21	PASS
$\pi/4$ DQPSK	LCH	5.680	21	PASS
	MCH	4.096	21	PASS
	HCH	2.432	21	PASS

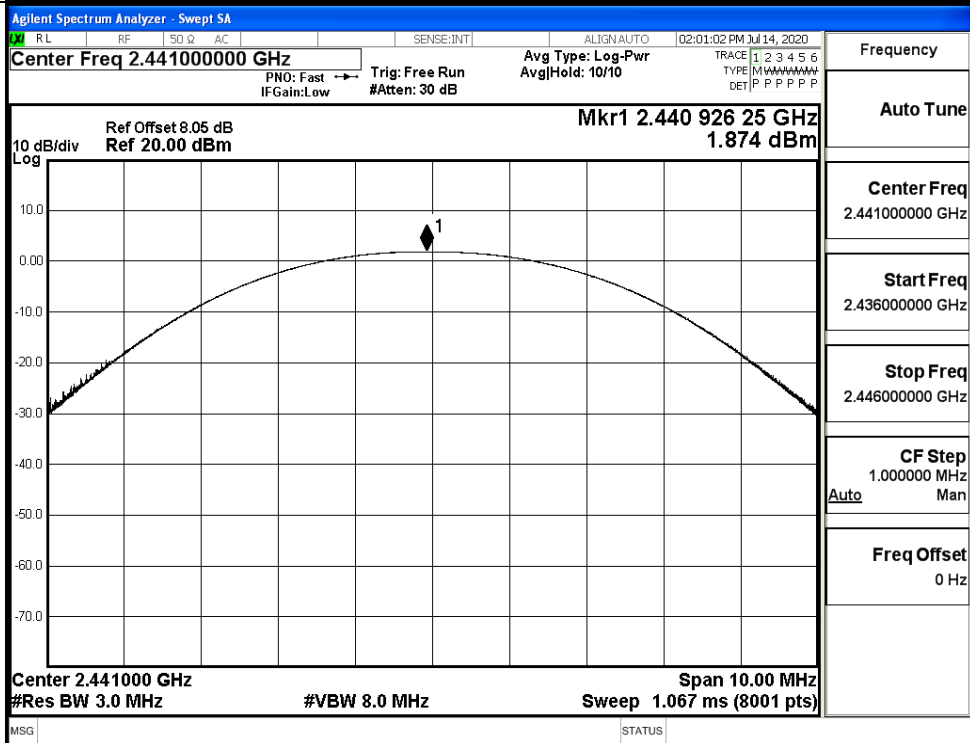
Test Graphs

GFSK/LCH



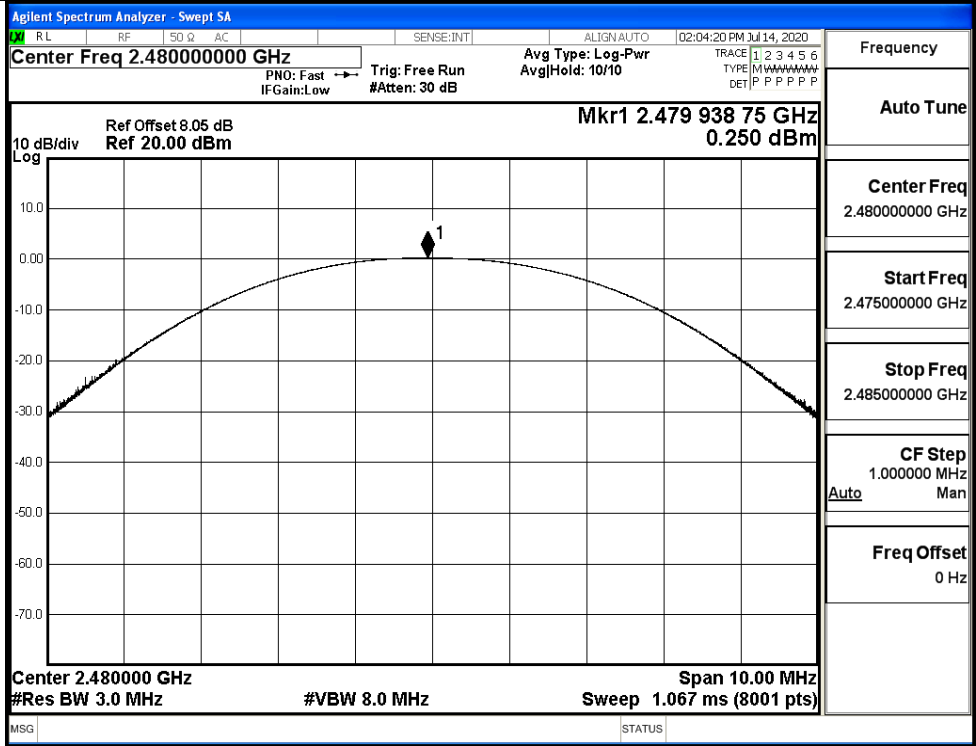
Frequency	2.402000000 GHz
Auto Tune	
Center Freq	2.402000000 GHz
Start Freq	2.397000000 GHz
Stop Freq	2.407000000 GHz
CF Step	1.000000 MHz
Auto	Man
Freq Offset	0 Hz

GFSK/MCH

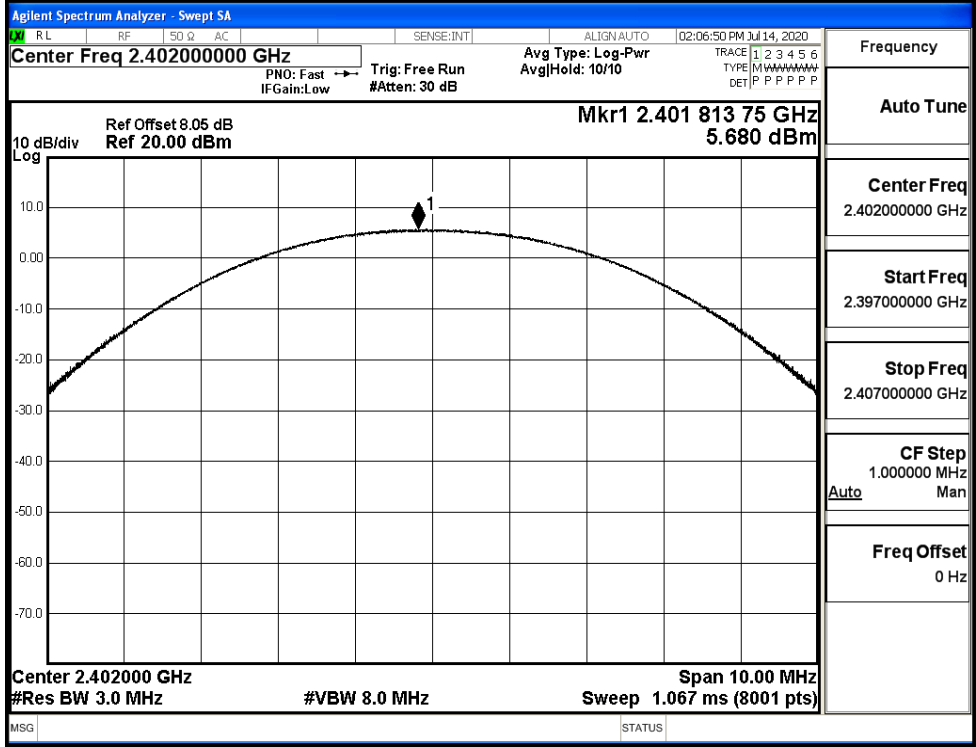


Frequency	2.441000000 GHz
Auto Tune	
Center Freq	2.441000000 GHz
Start Freq	2.436000000 GHz
Stop Freq	2.446000000 GHz
CF Step	1.000000 MHz
Auto	Man
Freq Offset	0 Hz

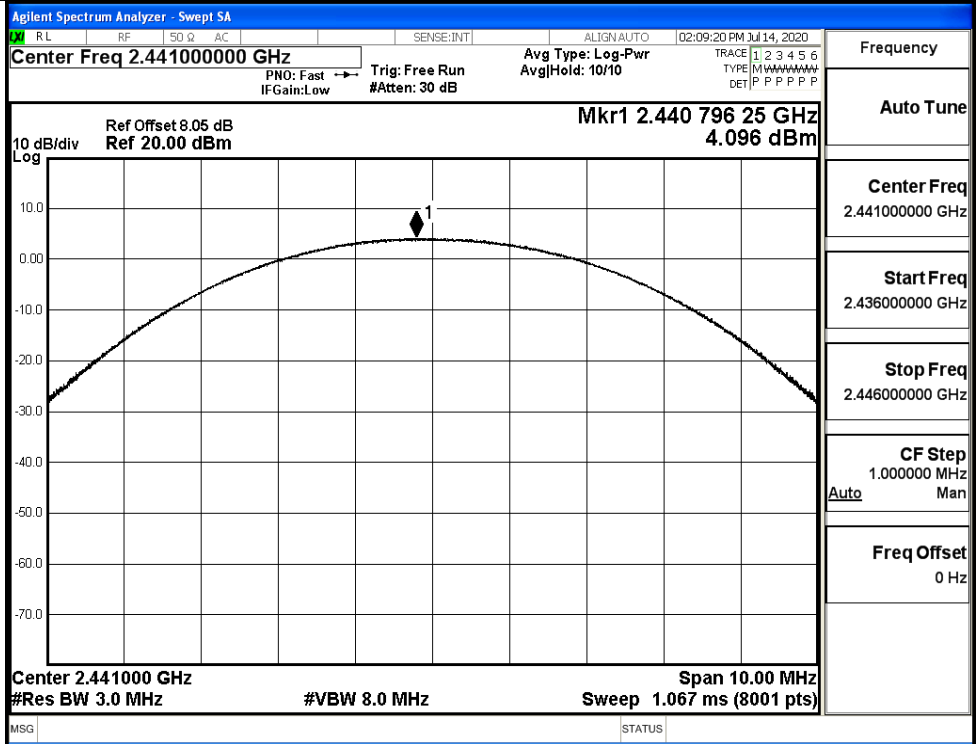
GFSK/HCH



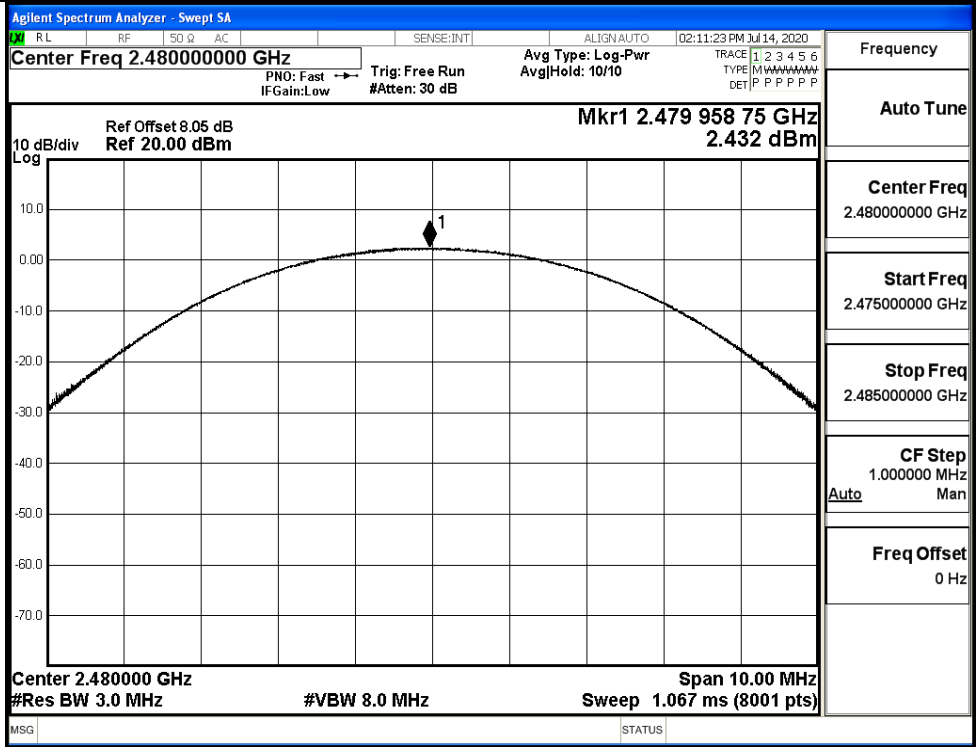
$\pi/4$ DQPSK/LCH



$\pi/4$ DQPSK/MCH



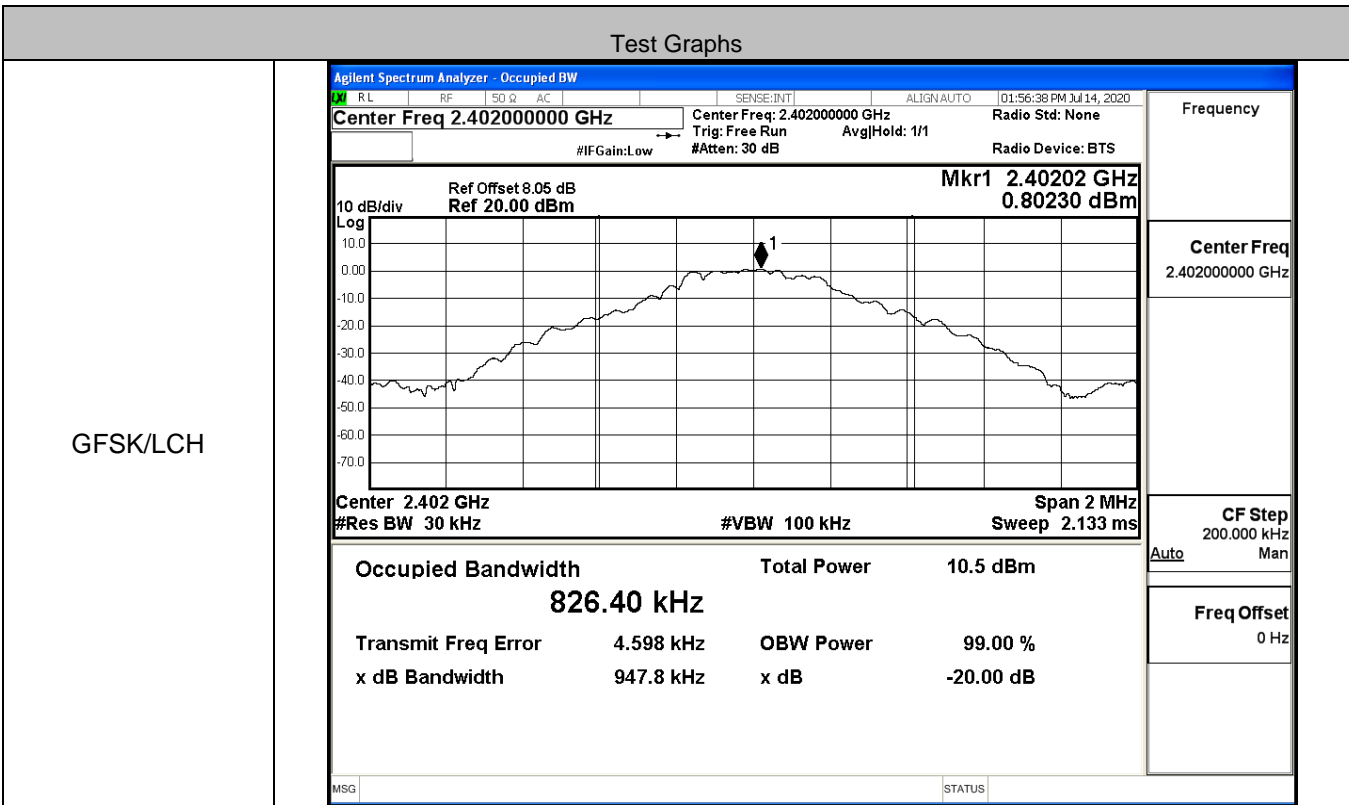
$\pi/4$ DQPSK/HCH



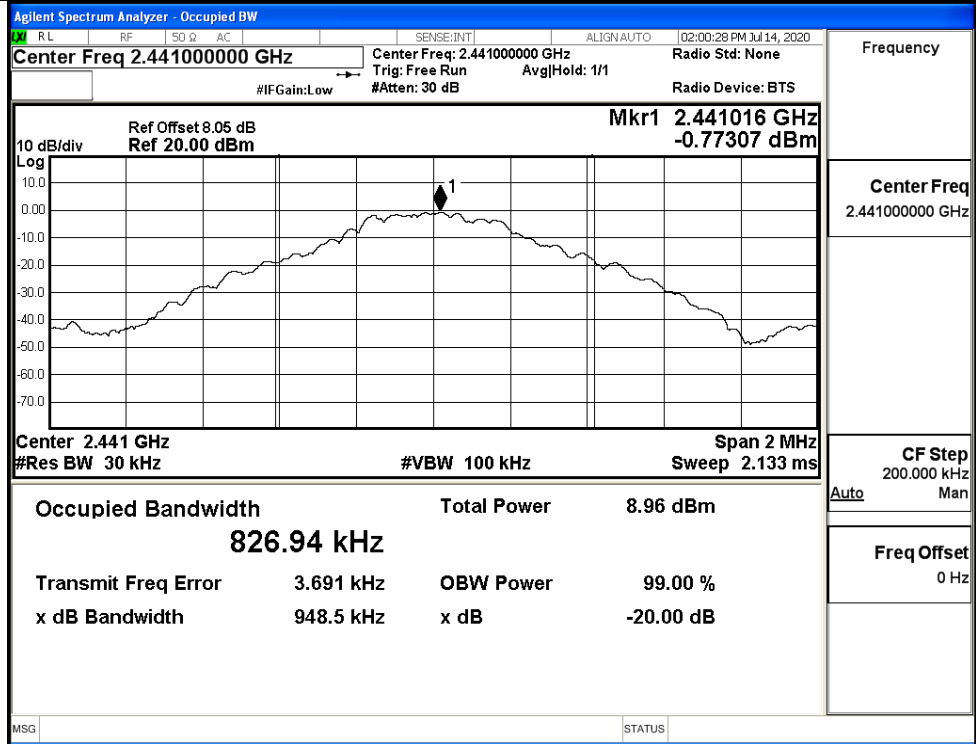
A.2 20dB Bandwidth

Mode	Channel.	20dB Bandwidth [MHz]	Limit [MHz]	Verdict
GFSK	LCH	0.9478	Not Specified	PASS
	MCH	0.9485	Not Specified	PASS
	HCH	0.9486	Not Specified	PASS
$\pi/4$ DQPSK	LCH	1.323	Not Specified	PASS
	MCH	1.325	Not Specified	PASS
	HCH	1.324	Not Specified	PASS

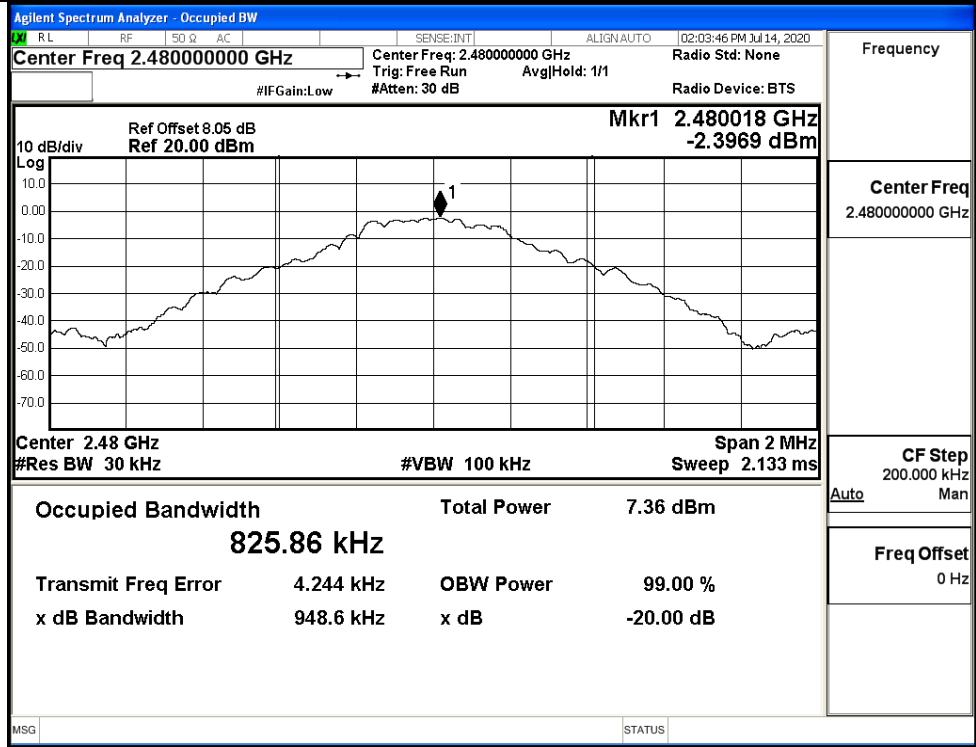
Test Graphs



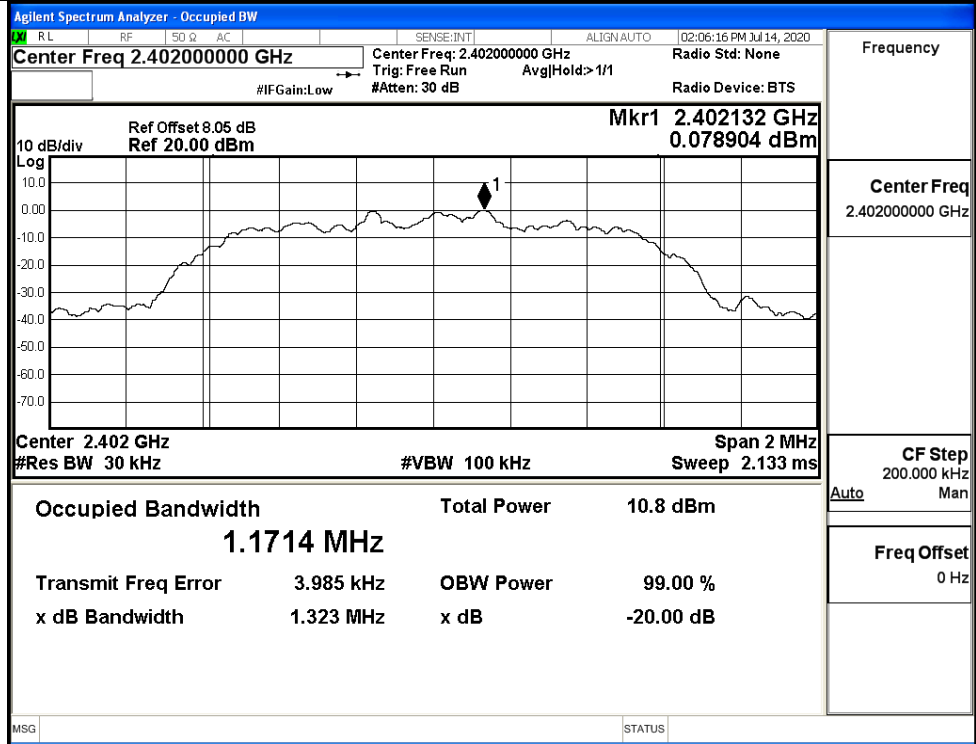
GFSK/MCH



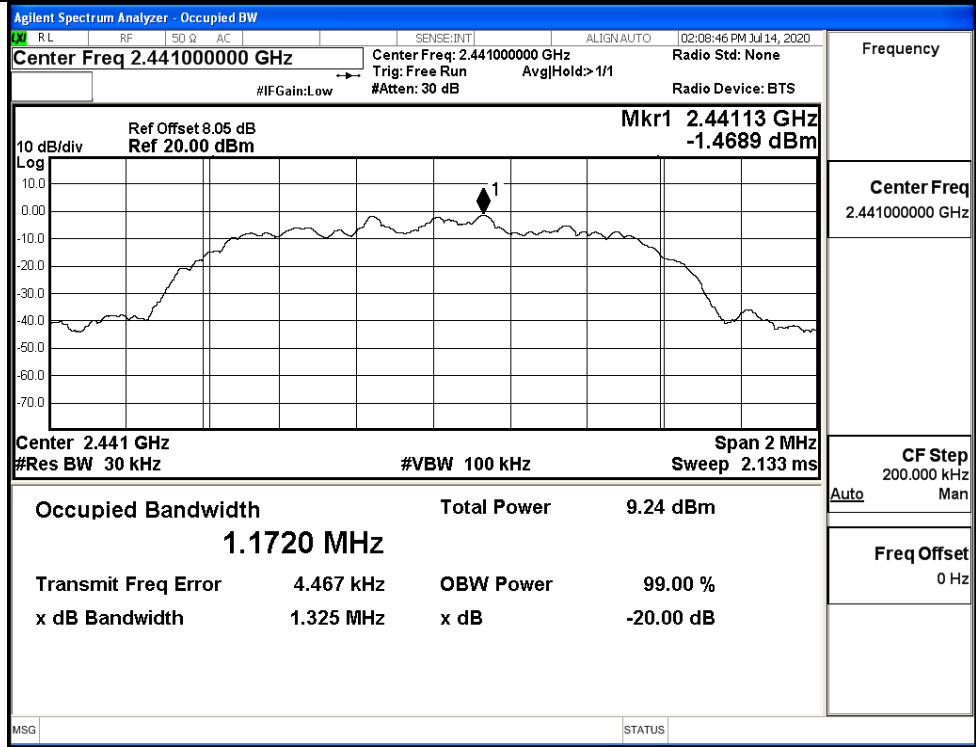
GFSK/HCH



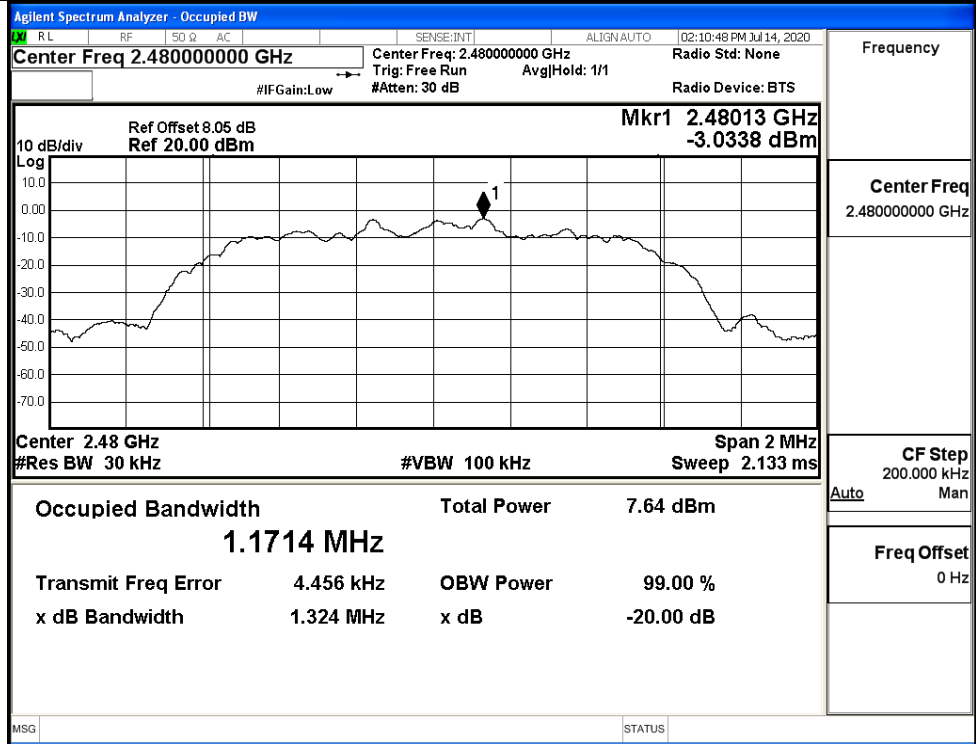
$\pi/4$ DQPSK/LCH



$\pi/4$ DQPSK/MCH

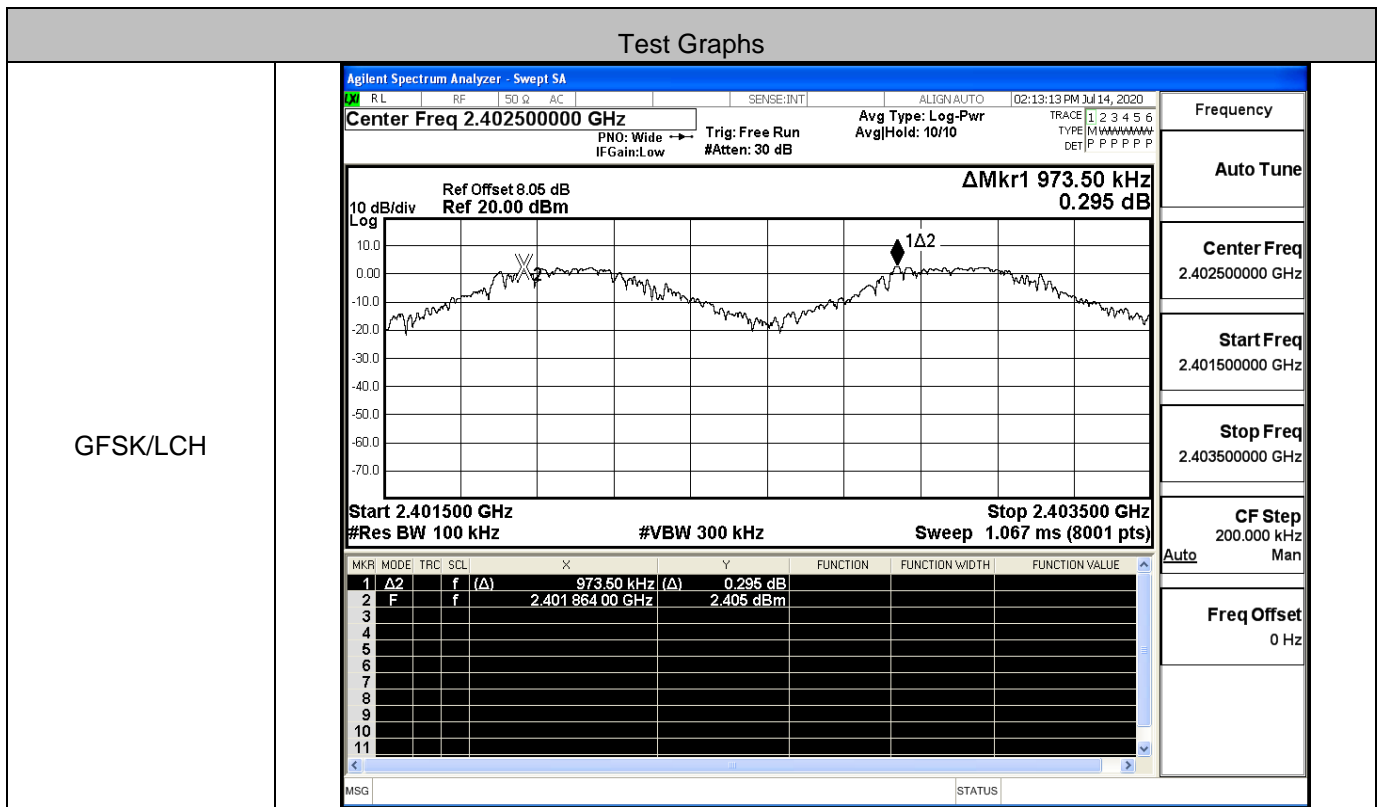


$\pi/4$ DQPSK/HCH

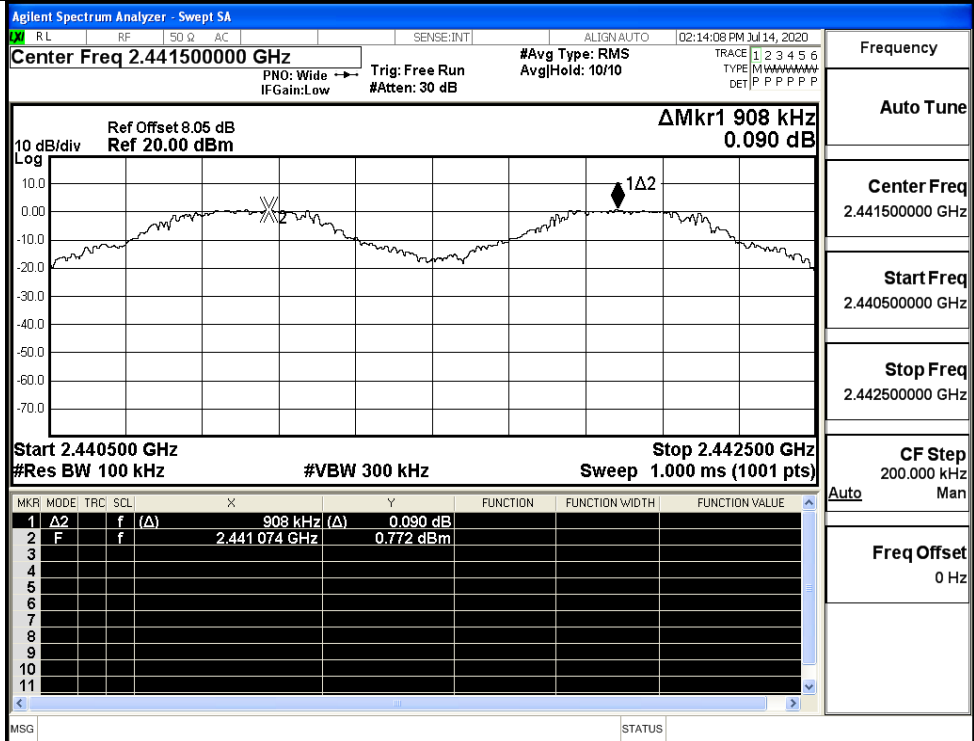


A.3 Carrier Frequency Separation

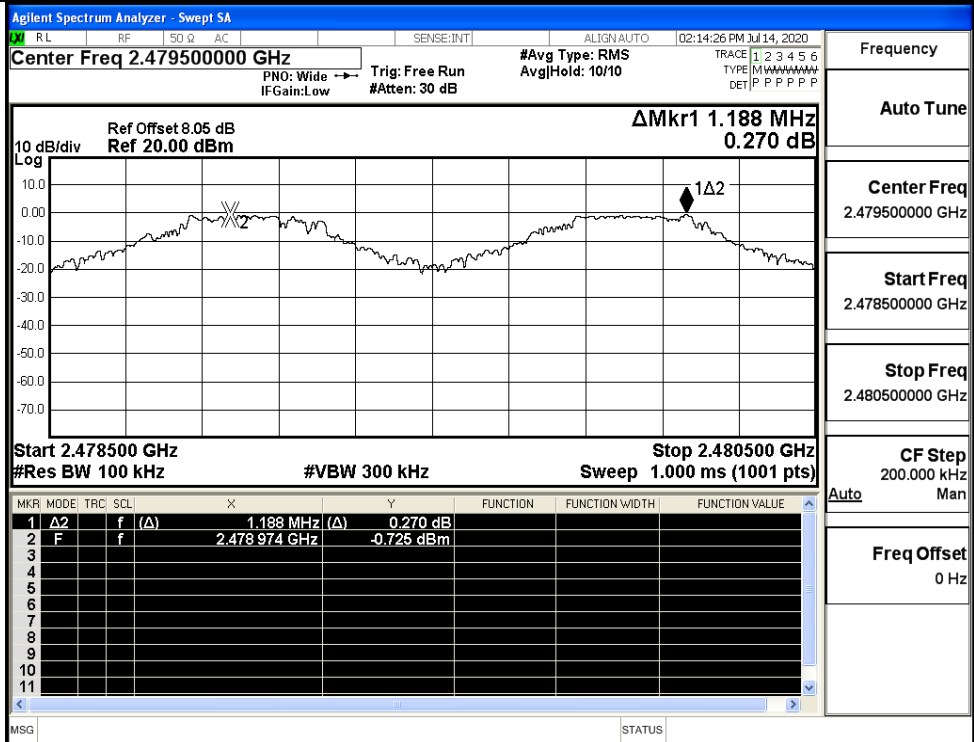
Mode	Channel	Carrier Frequency Separation [MHz]	Limit [MHz]	Verdict
GFSK	LCH	0.974	0.632	PASS
	MCH	0.908	0.632	PASS
	HCH	1.188	0.632	PASS
π/4DQPSK	LCH	1.118	0.882	PASS
	MCH	1.166	0.883	PASS
	HCH	0.918	0.883	PASS



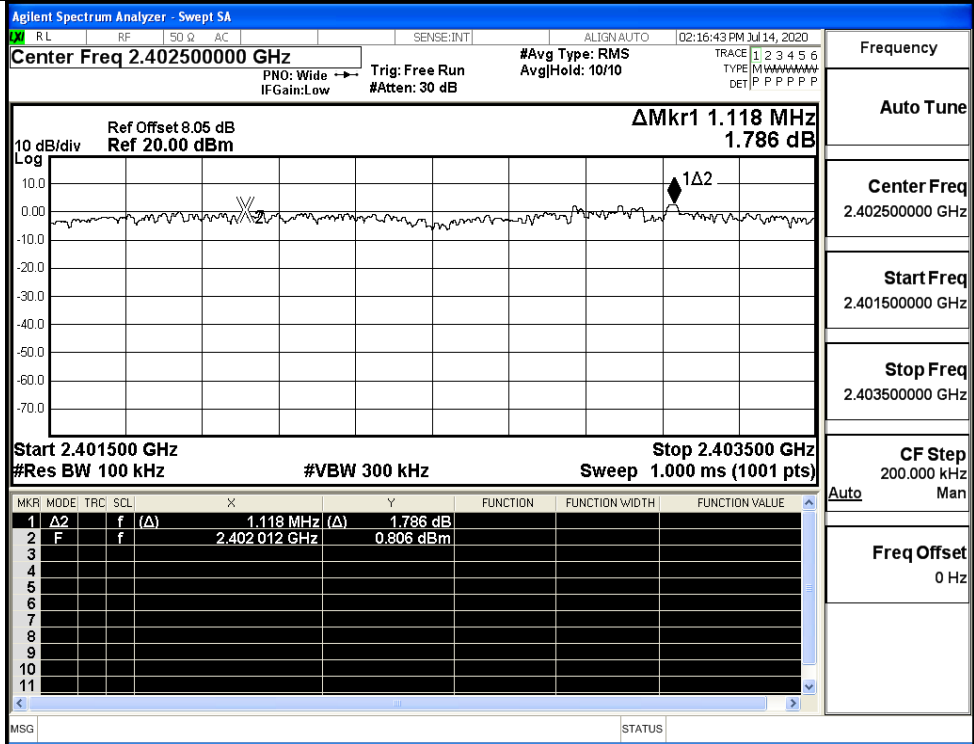
GFSK/MCH



GFSK/HCH

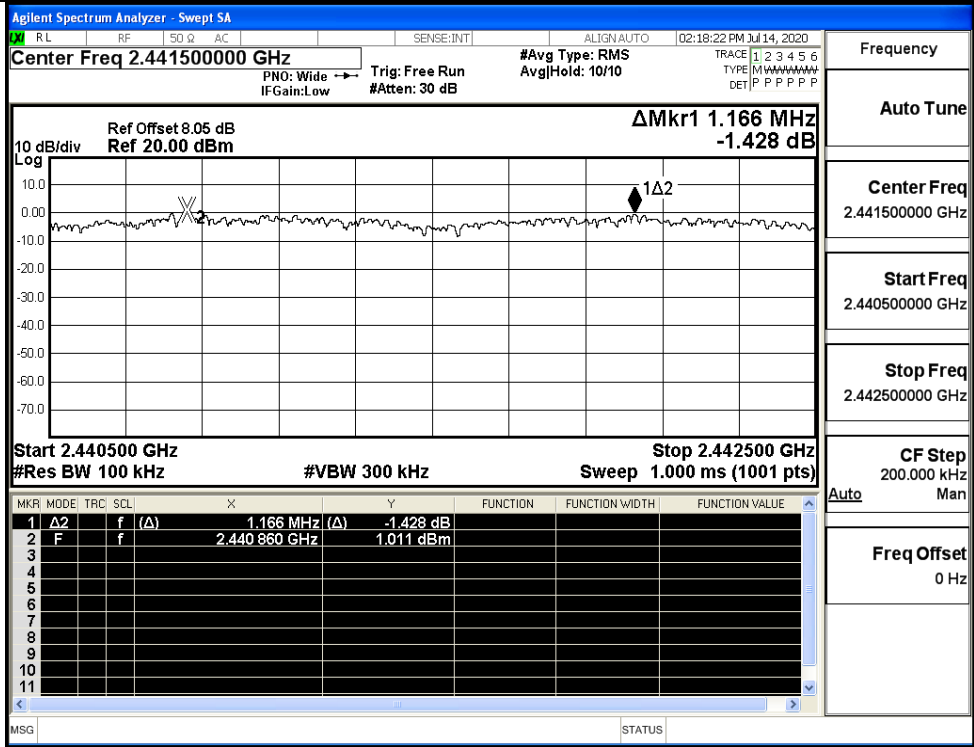


$\pi/4$ DQPSK/LCH



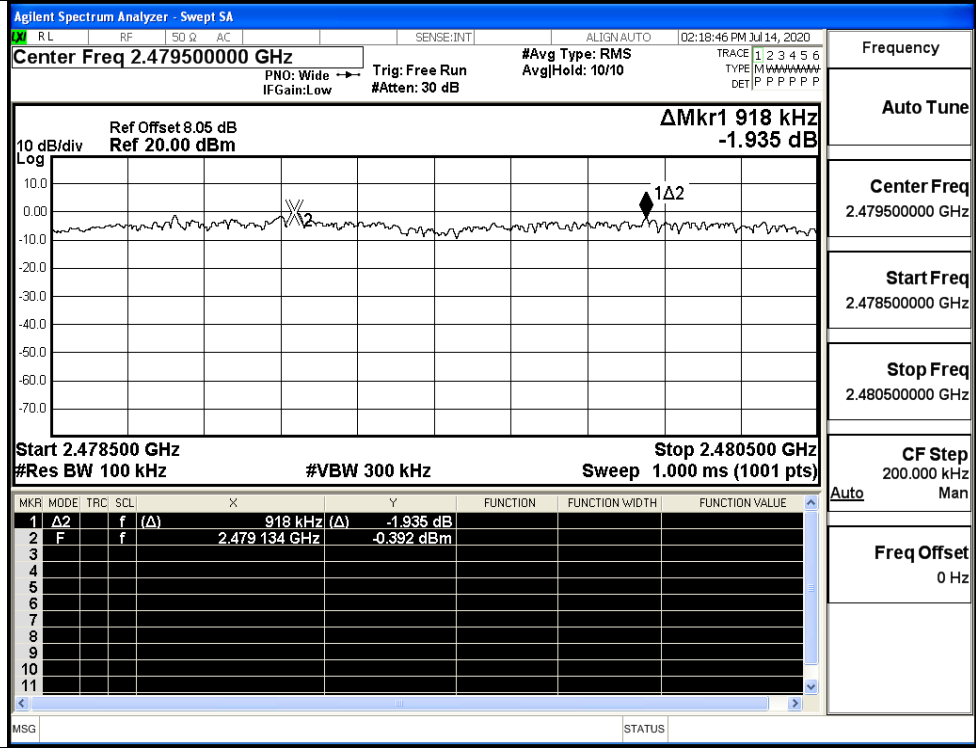
Frequency	2.402500000 GHz
Auto Tune	
Center Freq	2.402500000 GHz
Start Freq	2.401500000 GHz
Stop Freq	2.403500000 GHz
CF Step	200.000 kHz
Auto	Man
Freq Offset	0 Hz

$\pi/4$ DQPSK/MCH



Frequency	2.441500000 GHz
Auto Tune	
Center Freq	2.441500000 GHz
Start Freq	2.440500000 GHz
Stop Freq	2.442500000 GHz
CF Step	200.000 kHz
Auto	Man
Freq Offset	0 Hz

$\pi/4$ DQPSK/HCH



A.4 Hopping Channel Number

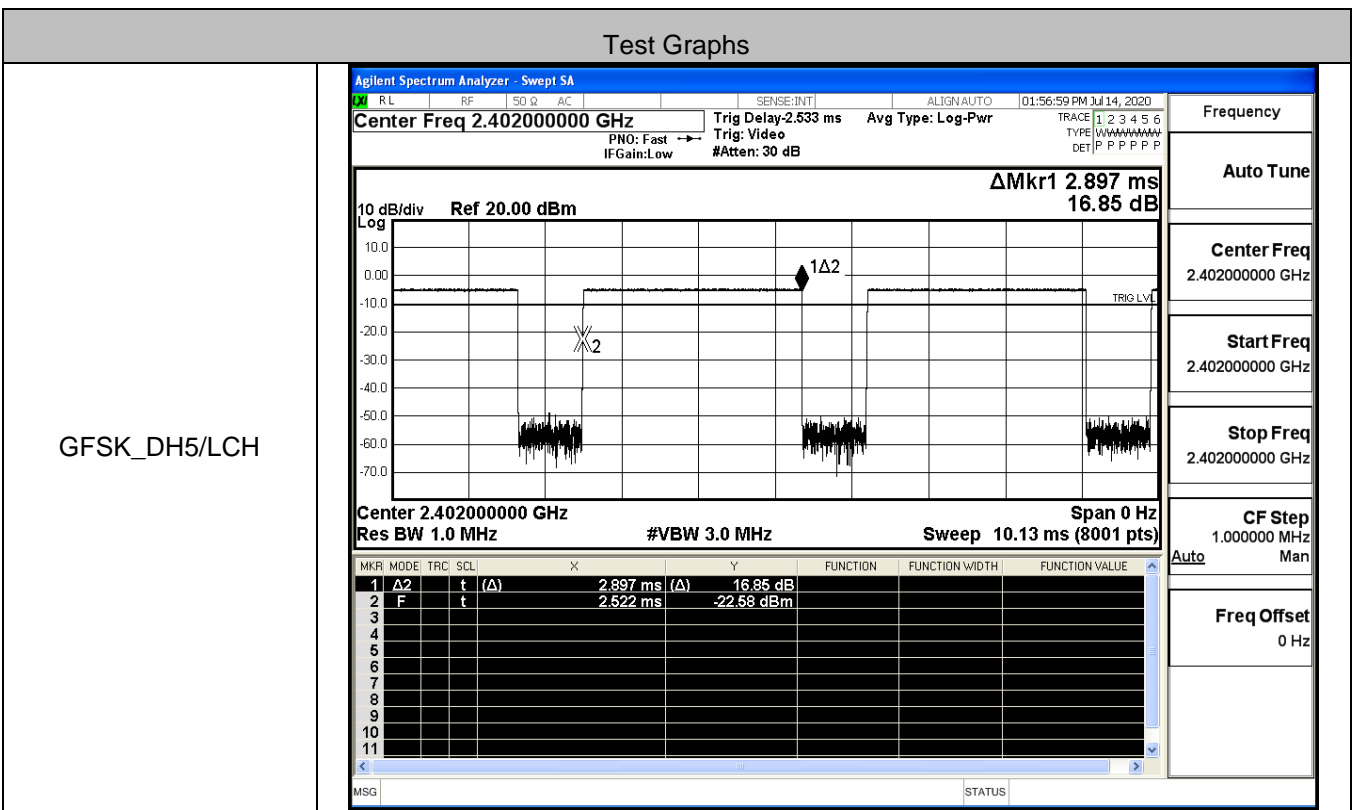
Mode	Channel.	Number of Hopping Channel [N]	Limit [N]	Verdict
GFSK	Hop	79	>=15	PASS
$\pi/4$ DQPSK	Hop	79	>=15	PASS

Test Graphs

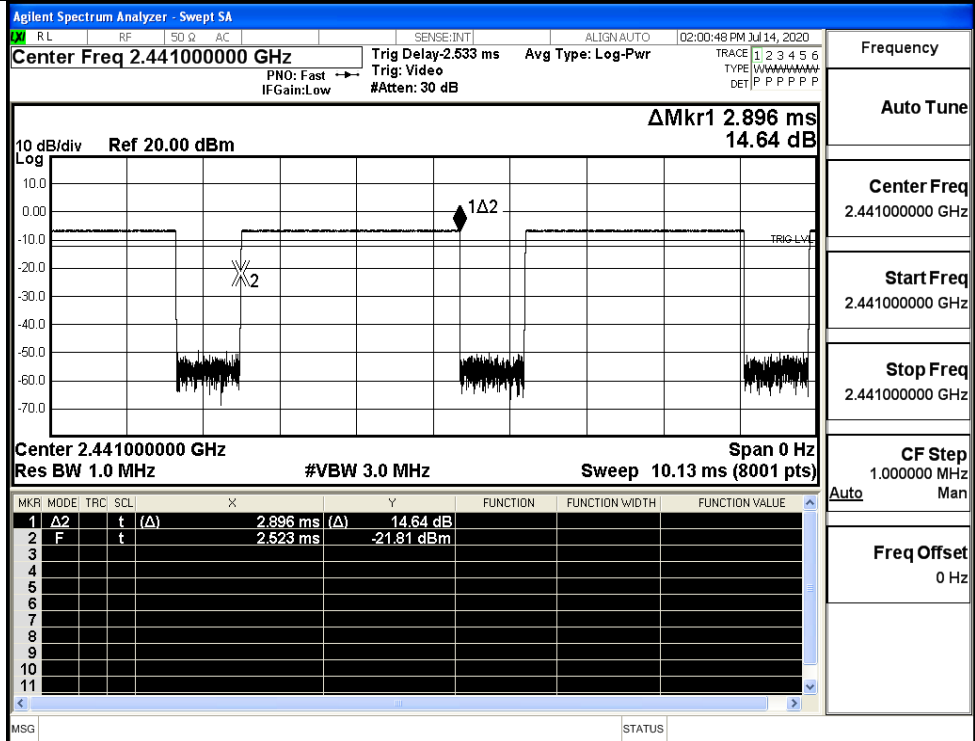
<p>GFSK/Hop</p>	<p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.441750000 GHz</p> <p>Ref Offset 8.05 dB Ref 20.00 dBm</p> <p>ΔMkr1 77.999 MHz -3.076 dB</p> <p>Start 2.40000 GHz #Res BW 100 kHz</p> <p>Stop 2.48350 GHz #VBW 300 kHz Sweep 8.000 ms (8001 pts)</p> <table border="1"> <thead> <tr> <th>MKR</th> <th>MODE</th> <th>TRC</th> <th>SCL</th> <th>X</th> <th>Y</th> <th>FUNCTION</th> <th>FUNCTION WIDTH</th> <th>FUNCTION VALUE</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Δ2</td> <td>f</td> <td>(Δ)</td> <td>77.999 MHz</td> <td>(Δ)</td> <td>-3.076 dB</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>F</td> <td>f</td> <td></td> <td>2.401847 GHz</td> <td></td> <td>2.864 dBm</td> <td></td> <td></td> </tr> </tbody> </table>	MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	Δ 2	f	(Δ)	77.999 MHz	(Δ)	-3.076 dB			2	F	f		2.401847 GHz		2.864 dBm			<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.441750000 GHz</p> <p>Start Freq 2.400000000 GHz</p> <p>Stop Freq 2.483500000 GHz</p> <p>CF Step 8.350000 MHz</p> <p>Freq Offset 0 Hz</p>
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																					
1	Δ 2	f	(Δ)	77.999 MHz	(Δ)	-3.076 dB																							
2	F	f		2.401847 GHz		2.864 dBm																							
<p>$\pi/4$DQPSK/Hop</p>	<p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.441750000 GHz</p> <p>Ref Offset 8.05 dB Ref 20.00 dBm</p> <p>ΔMkr1 78.135 MHz -4.015 dB</p> <p>Start 2.40000 GHz #Res BW 100 kHz</p> <p>Stop 2.48350 GHz #VBW 300 kHz Sweep 8.000 ms (8001 pts)</p> <table border="1"> <thead> <tr> <th>MKR</th> <th>MODE</th> <th>TRC</th> <th>SCL</th> <th>X</th> <th>Y</th> <th>FUNCTION</th> <th>FUNCTION WIDTH</th> <th>FUNCTION VALUE</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Δ2</td> <td>f</td> <td>(Δ)</td> <td>78.135 MHz</td> <td>(Δ)</td> <td>-4.015 dB</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>F</td> <td>f</td> <td></td> <td>2.401994 GHz</td> <td></td> <td>1.323 dBm</td> <td></td> <td></td> </tr> </tbody> </table>	MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	Δ 2	f	(Δ)	78.135 MHz	(Δ)	-4.015 dB			2	F	f		2.401994 GHz		1.323 dBm			<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.441750000 GHz</p> <p>Start Freq 2.400000000 GHz</p> <p>Stop Freq 2.483500000 GHz</p> <p>CF Step 8.350000 MHz</p> <p>Freq Offset 0 Hz</p>
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																					
1	Δ 2	f	(Δ)	78.135 MHz	(Δ)	-4.015 dB																							
2	F	f		2.401994 GHz		1.323 dBm																							

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	2.9	106.7	0.309	0.4	PASS
	DH5	MCH	2.9	106.7	0.309	0.4	PASS
	DH5	HCH	2.9	106.7	0.309	0.4	PASS
π/4DQPSK	2DH5	LCH	2.9	106.7	0.309	0.4	PASS
	2DH5	MCH	2.9	106.7	0.309	0.4	PASS
	2DH5	HCH	2.9	106.7	0.309	0.4	PASS

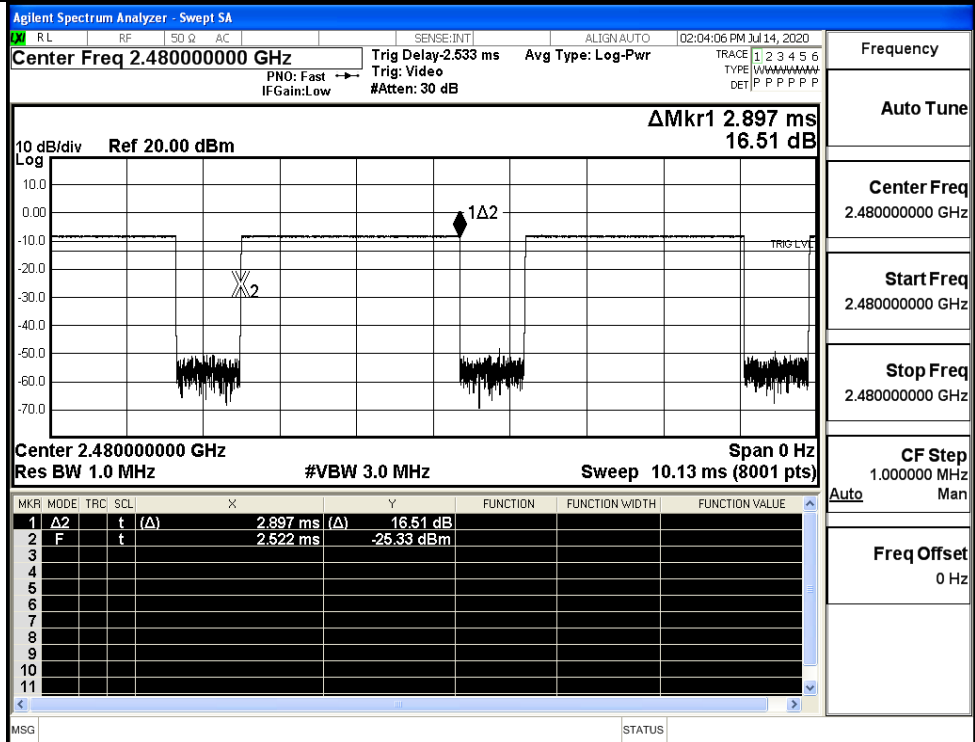


GFSK_DH5/MCH



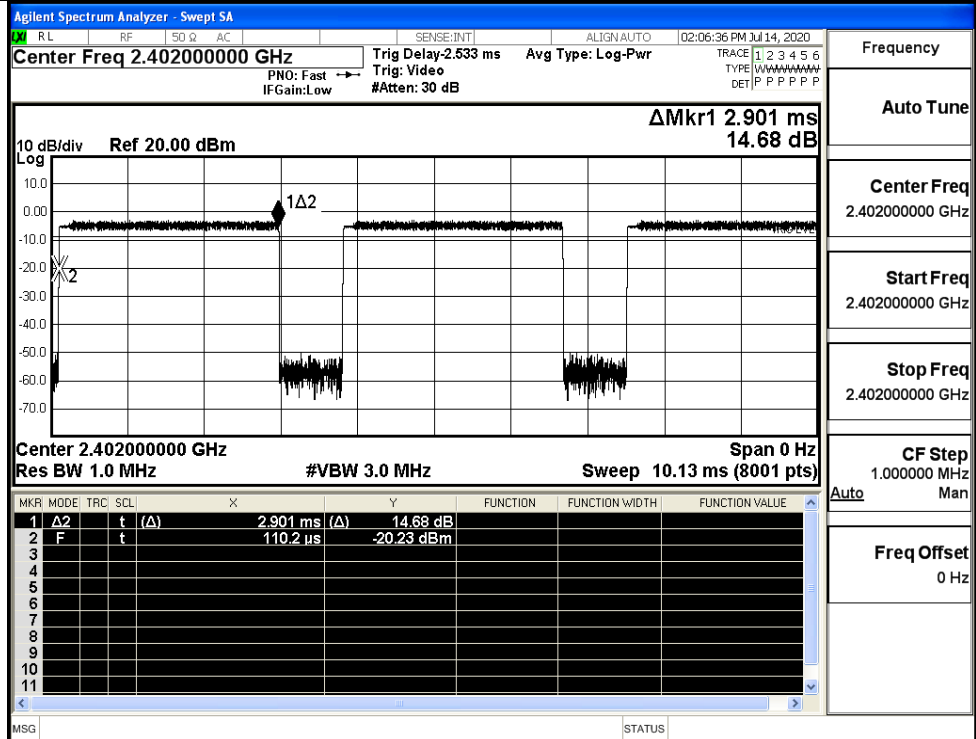
Frequency	
Auto Tune	
Center Freq	2.441000000 GHz
Start Freq	2.441000000 GHz
Stop Freq	2.441000000 GHz
CF Step	1.000000 MHz
Auto	Man
Freq Offset	0 Hz

GFSK_DH5/HCH



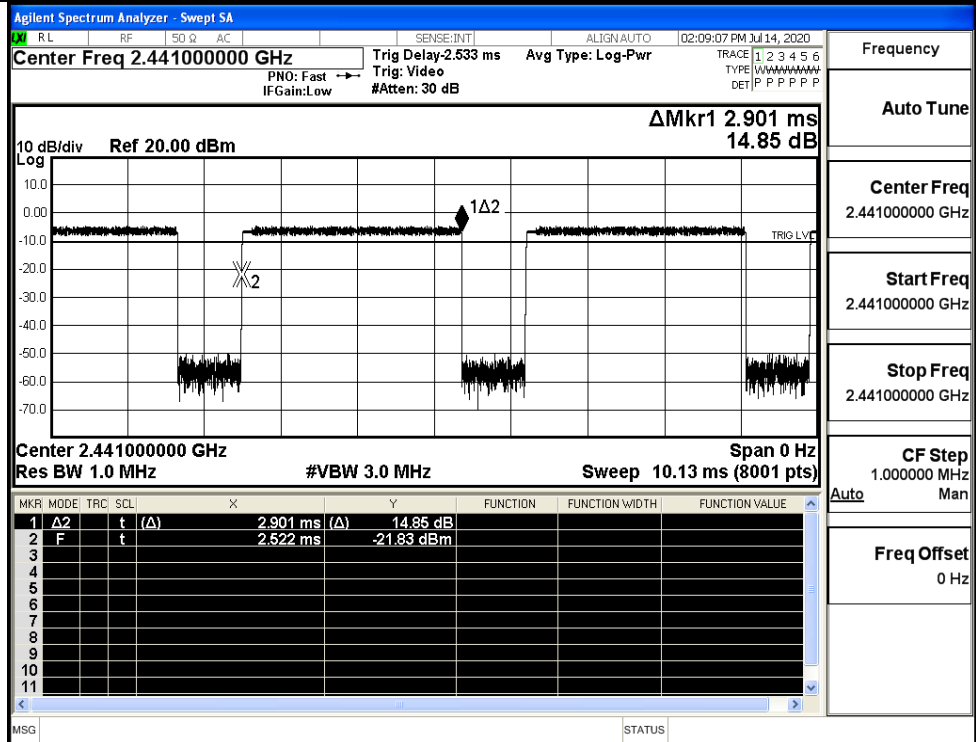
Frequency	
Auto Tune	
Center Freq	2.480000000 GHz
Start Freq	2.480000000 GHz
Stop Freq	2.480000000 GHz
CF Step	1.000000 MHz
Auto	Man
Freq Offset	0 Hz

$\pi/4$ DQPSK
_2DH5/LCH



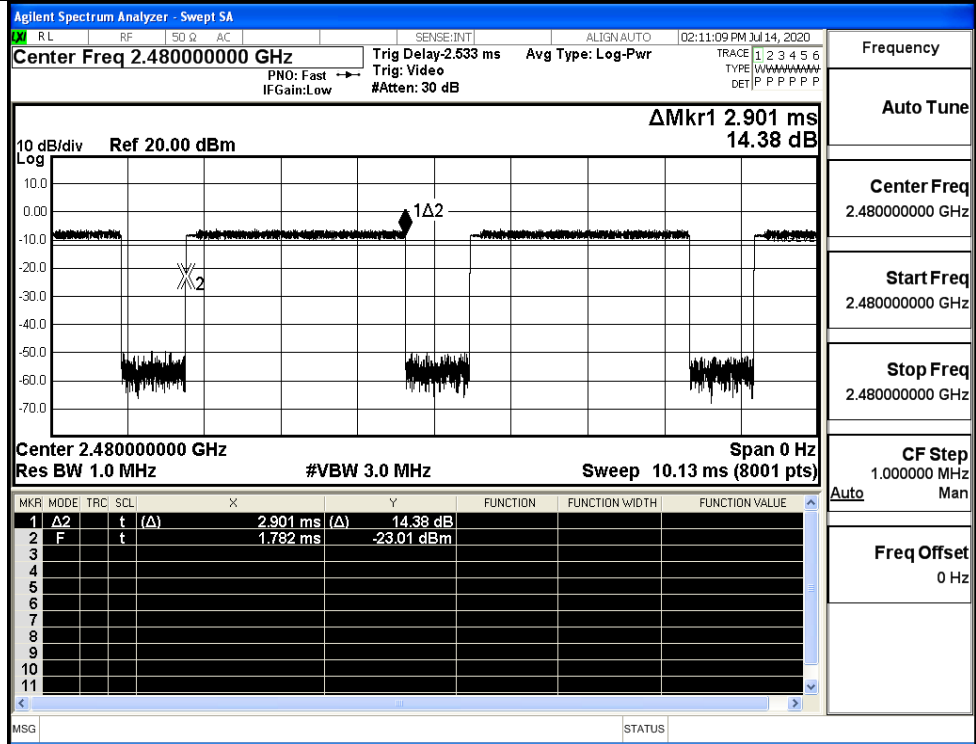
Frequency	2.40200000 GHz
Auto Tune	
Center Freq	2.40200000 GHz
Start Freq	2.40200000 GHz
Stop Freq	2.40200000 GHz
CF Step	1.000000 MHz
Auto	Man
Freq Offset	0 Hz

$\pi/4$ DQPSK
_2DH5/MCH



Frequency	2.44100000 GHz
Auto Tune	
Center Freq	2.44100000 GHz
Start Freq	2.44100000 GHz
Stop Freq	2.44100000 GHz
CF Step	1.000000 MHz
Auto	Man
Freq Offset	0 Hz

$\pi/4$ DQPSK
_2DH5/HCH

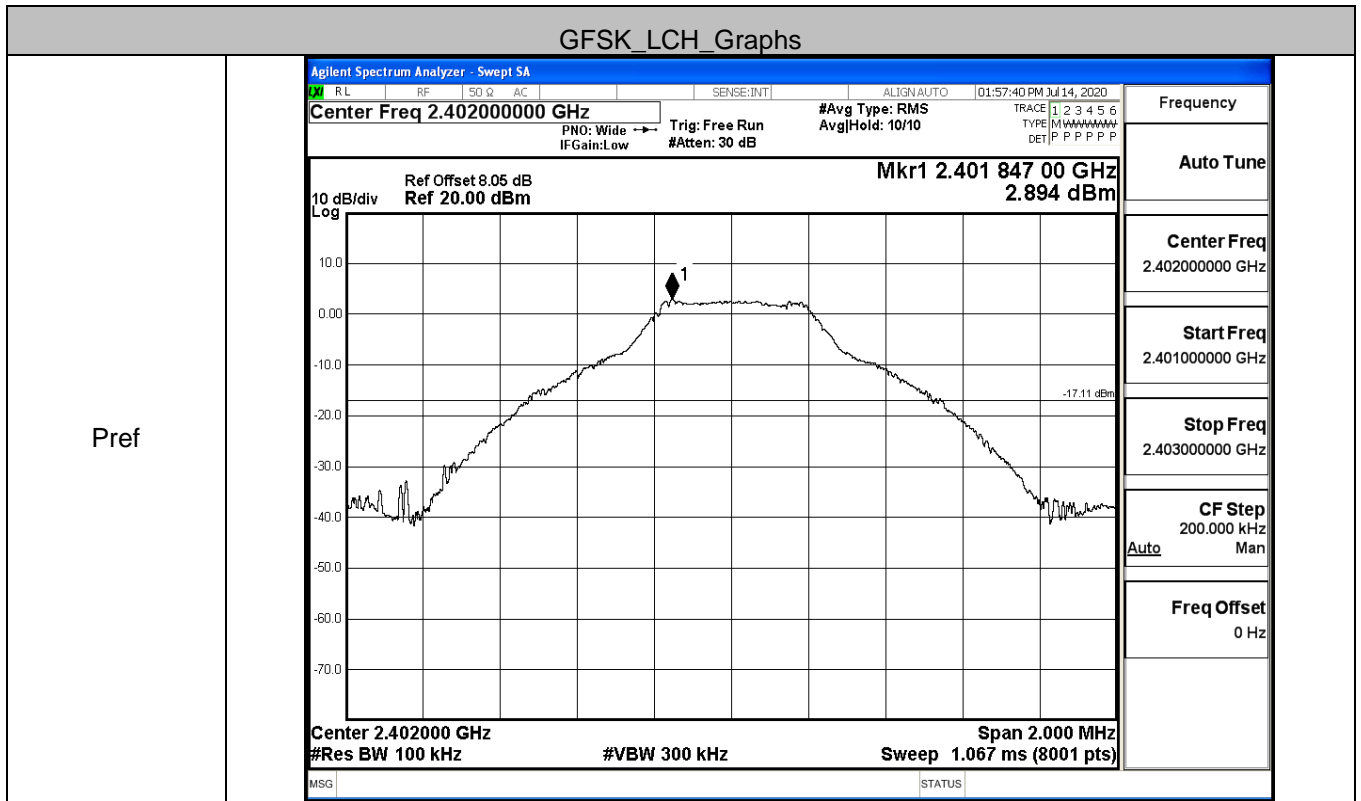


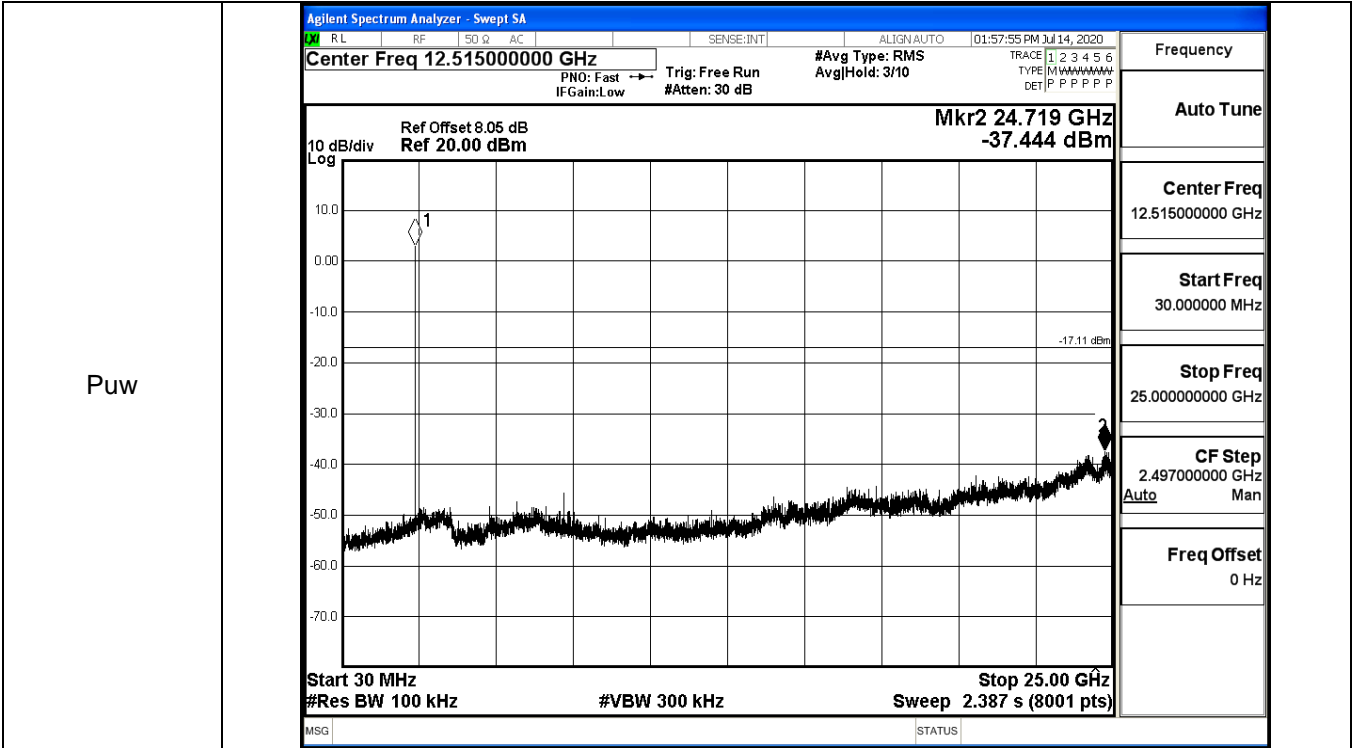
Frequency	
Auto Tune	
Center Freq	2.480000000 GHz
Start Freq	2.480000000 GHz
Stop Freq	2.480000000 GHz
CF Step	1.000000 MHz
Auto	Man
Freq Offset	0 Hz

A.6 RF Conducted Spurious Emissions

Mode	Channel	Pref [dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2.894	-37.444	-17.106	PASS
	MCH	1.363	-37.774	-18.637	PASS
	HCH	-0.236	-37.288	-20.236	PASS
π /4DQPSK	LCH	2.677	-37.760	-17.323	PASS
	MCH	1.122	-37.943	-18.878	PASS
	HCH	-0.437	-37.562	-20.437	PASS

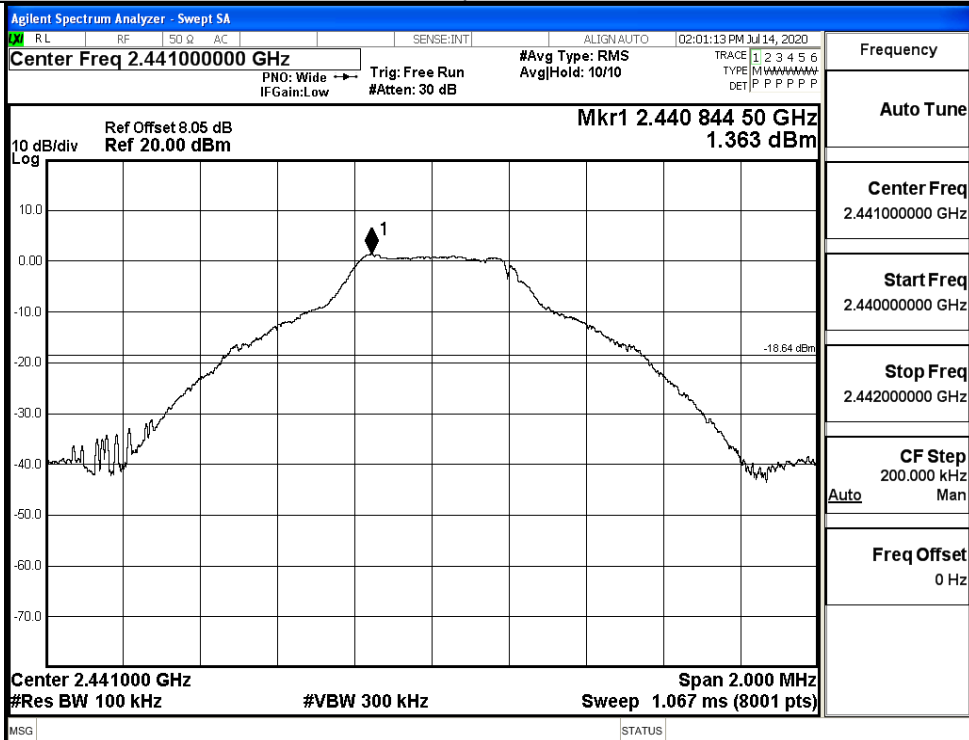
GFSK_LCH_Graphs



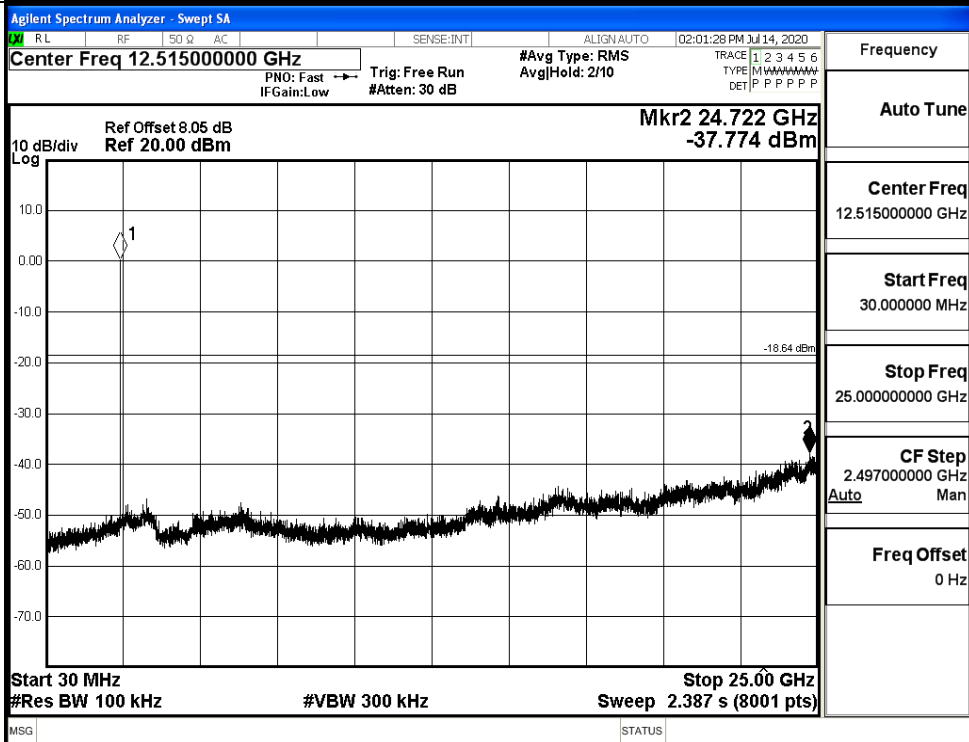


GFSK_MCH_Graphs

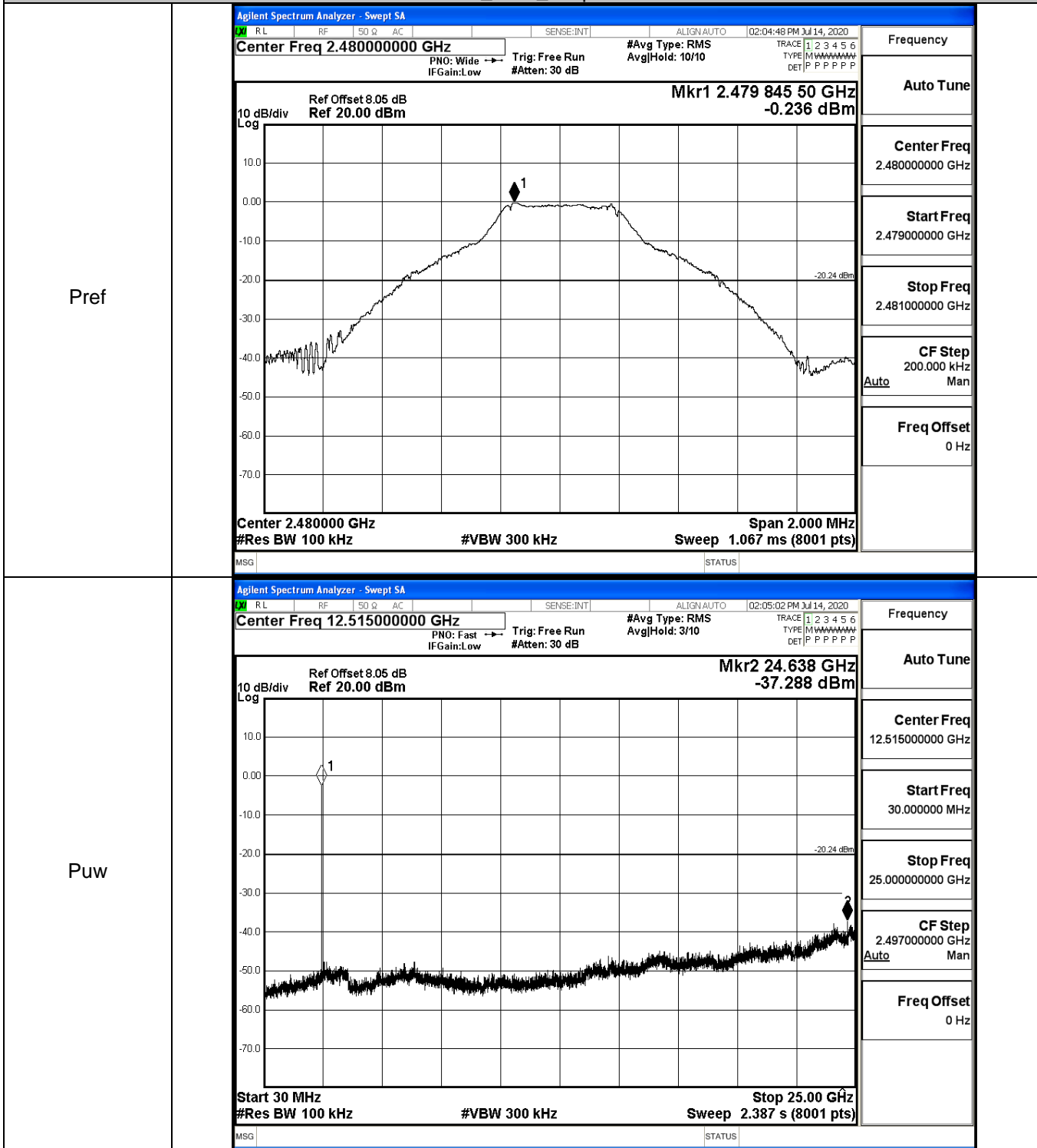
Pref



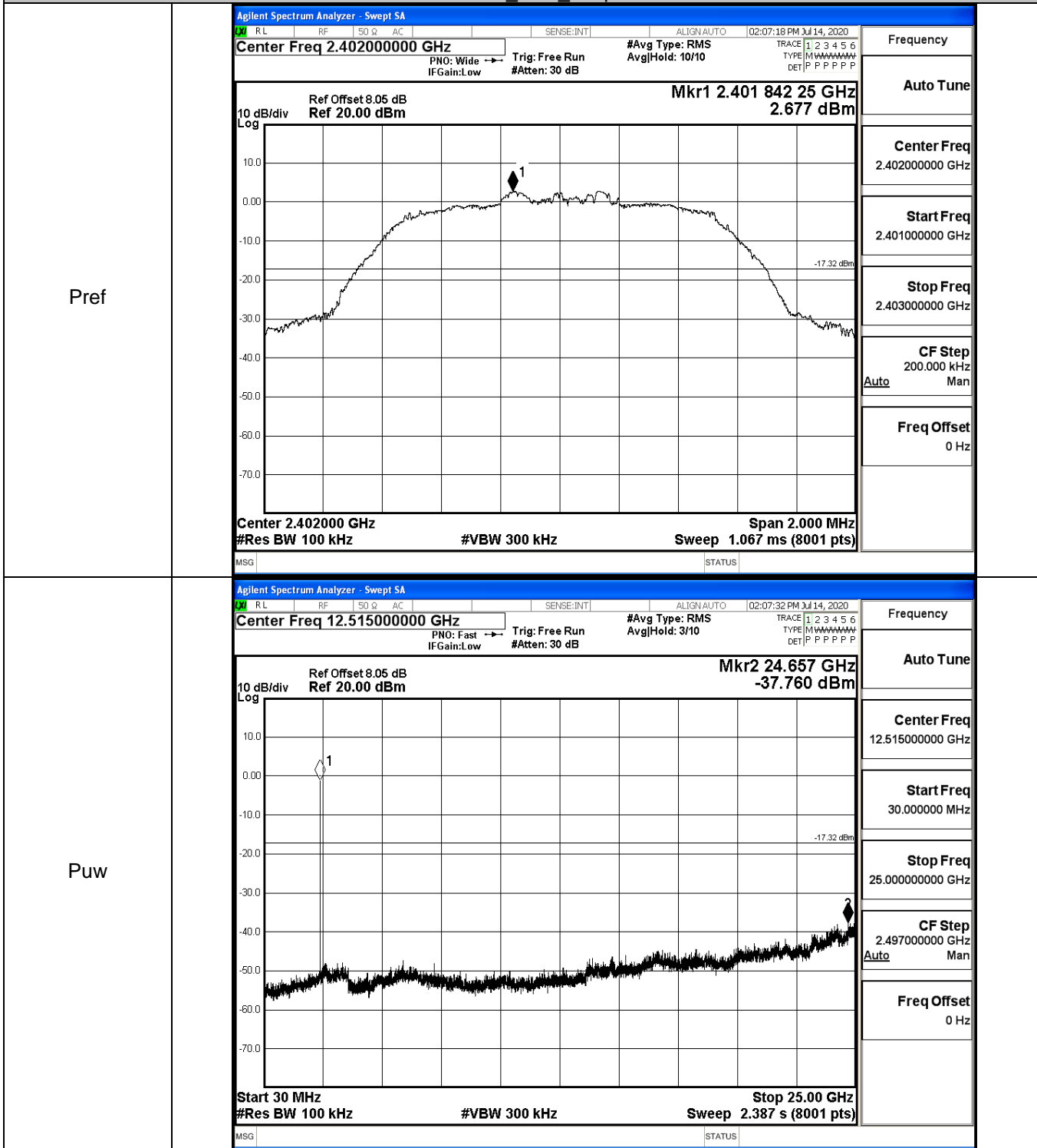
Puw



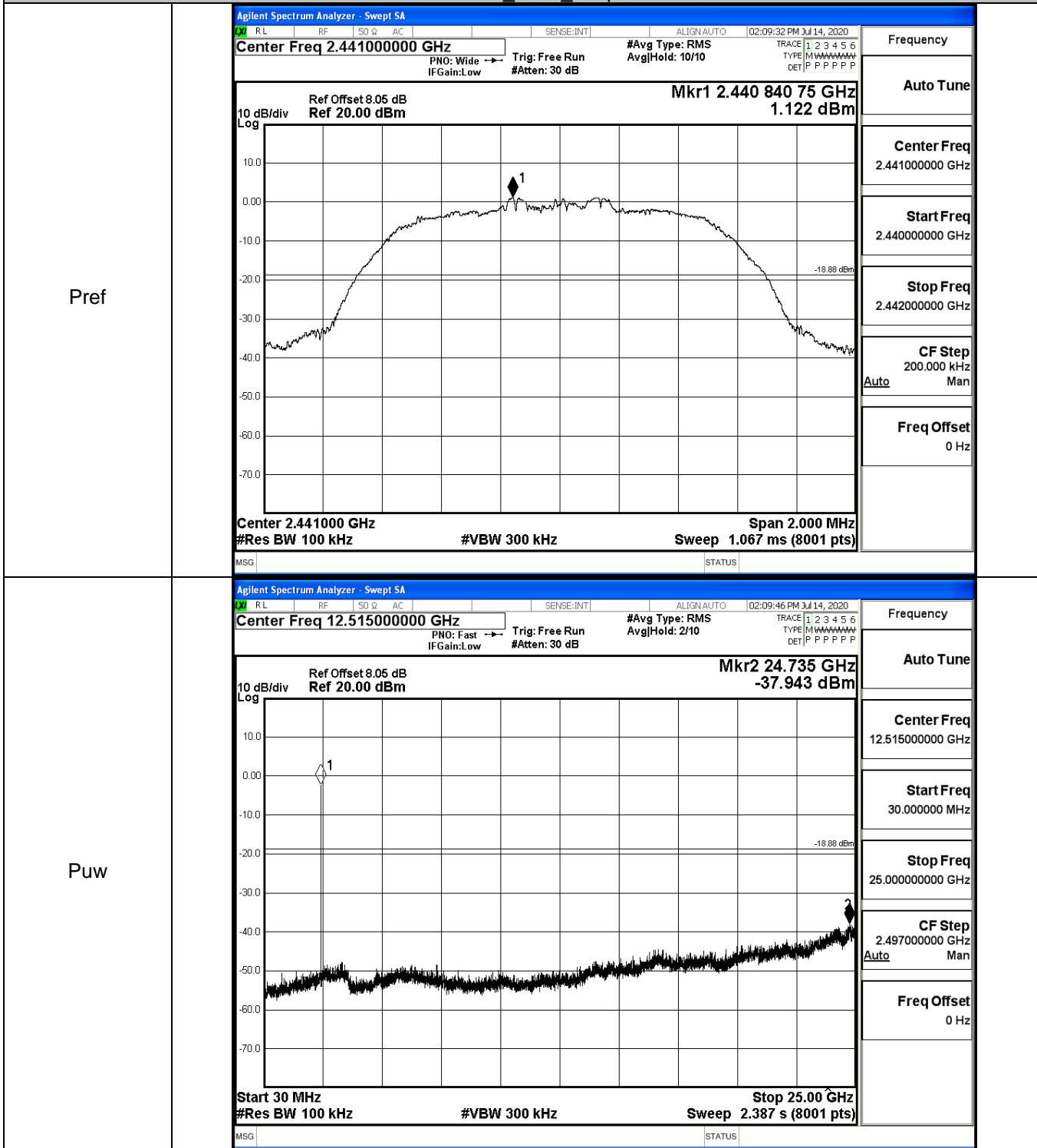
GFSK_HCH_Graphs



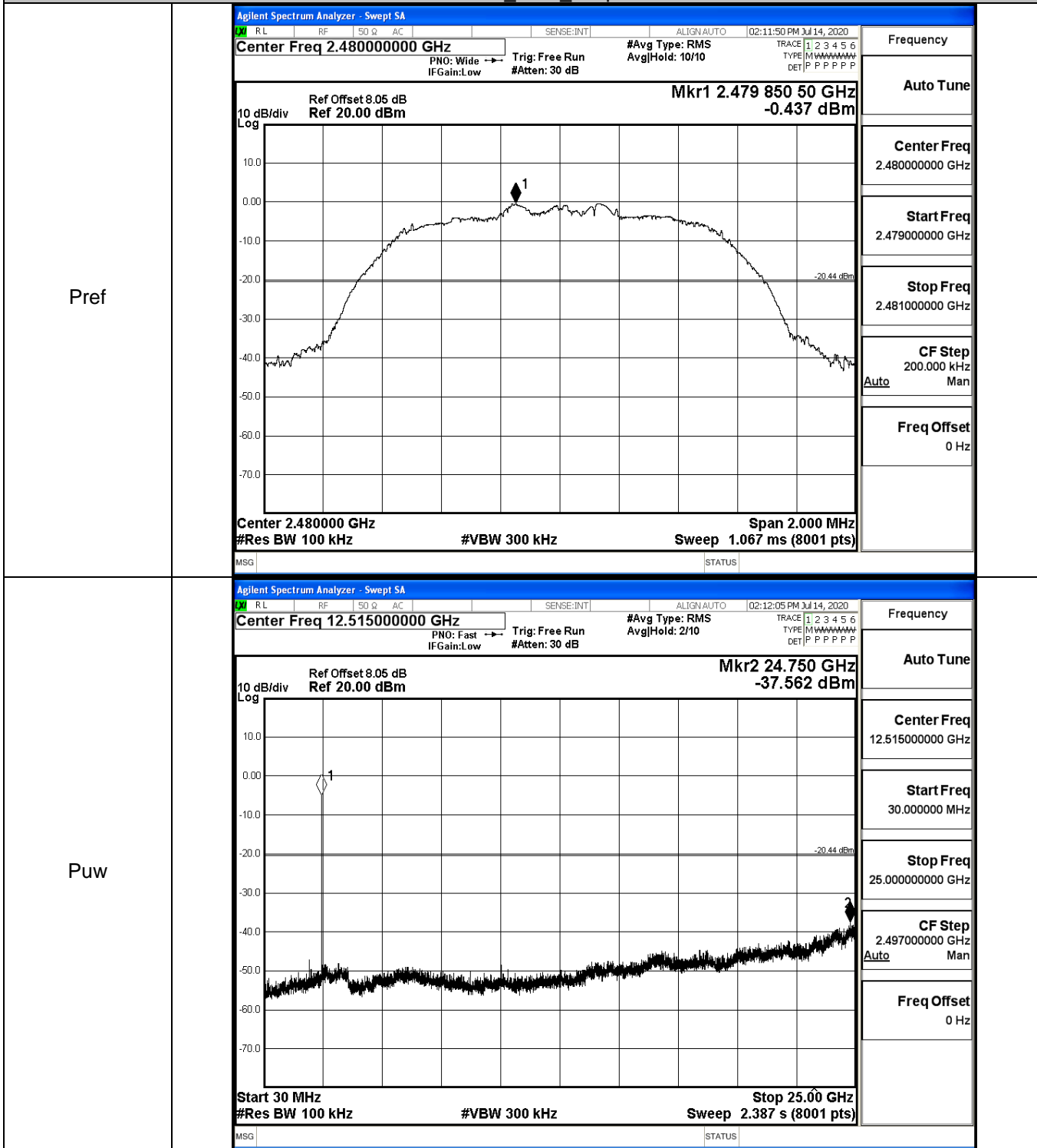
$\pi/4$ DQPSK_LCH_Graphs



$\pi/4$ DQPSK_MCH_Graphs



$\pi/4$ DQPSK_HCH_Graphs

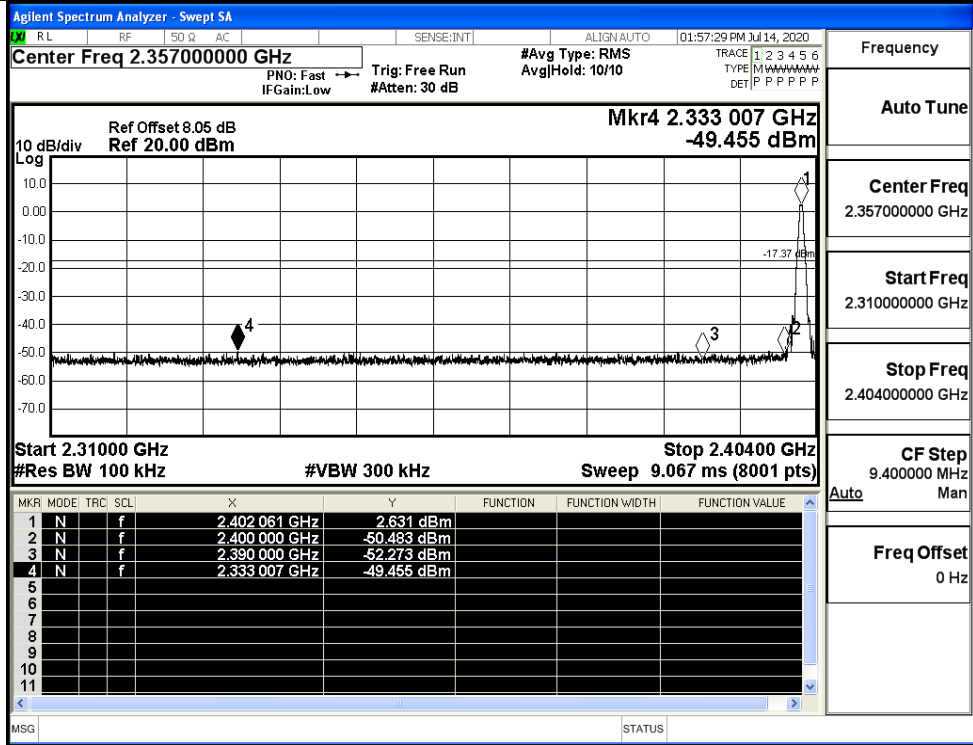


A.7 Band-edge for RF Conducted Emissions

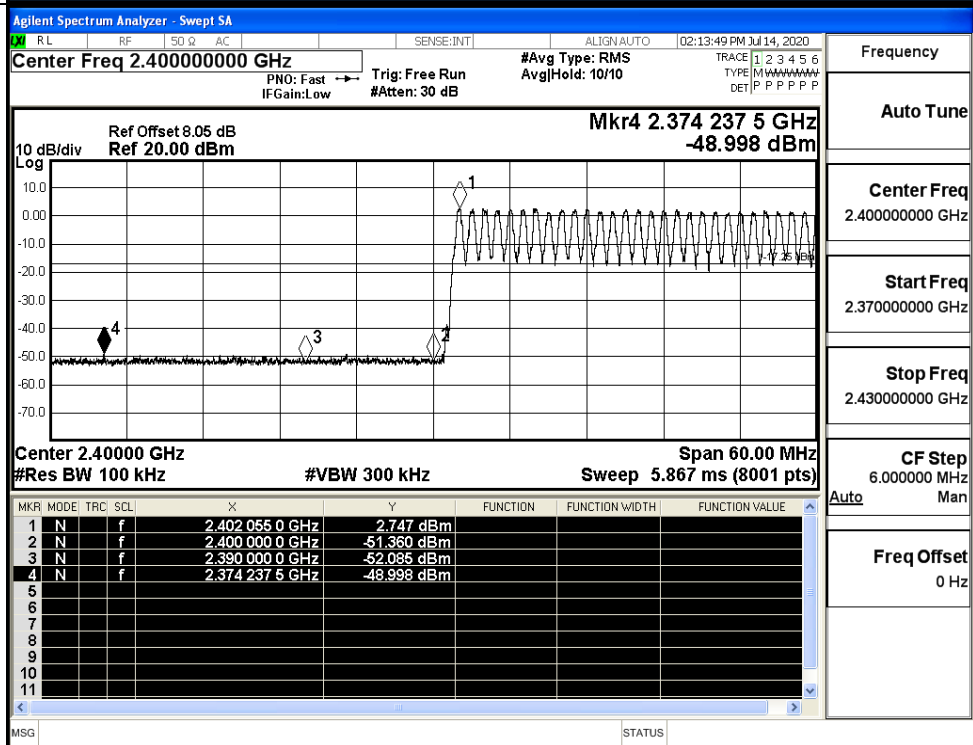
Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2402	2.631	Off	-49.455	-17.37	PASS
			2.747	On	-48.998	-17.25	PASS
	HCH	2480	-0.063	Off	-48.739	-20.06	PASS
			0.397	On	-48.725	-19.6	PASS
$\pi/4$ DQPSK	LCH	2402	2.875	Off	-48.999	-17.13	PASS
			2.907	On	-48.841	-17.09	PASS
	HCH	2480	-0.449	Off	-48.617	-20.45	PASS
			0.414	On	-48.479	-19.59	PASS

Test Graphs

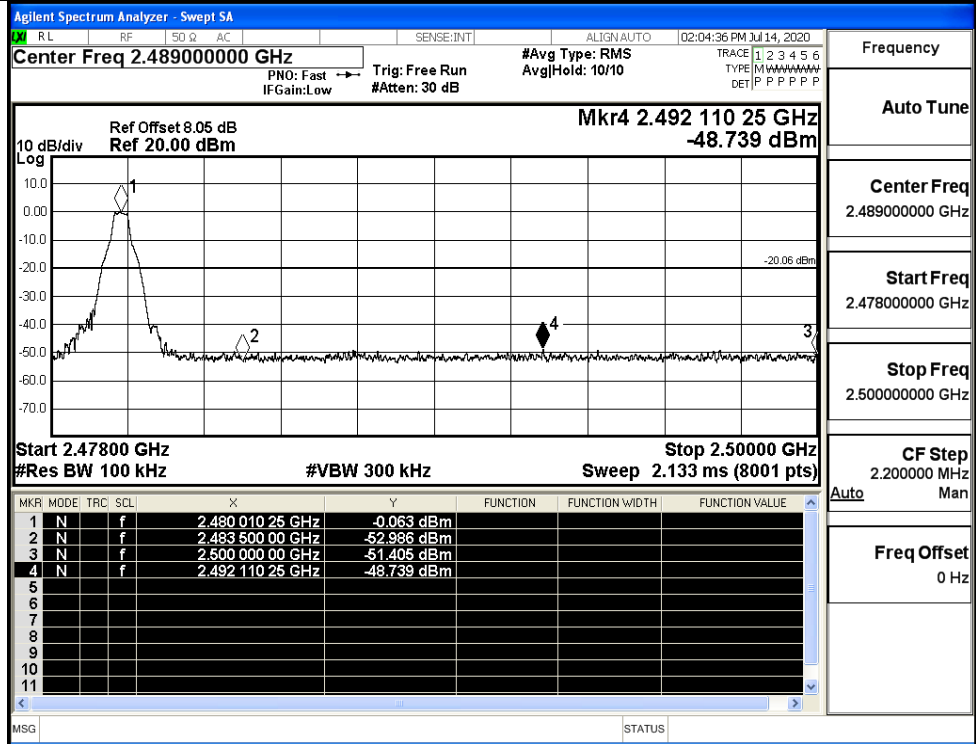
GFSK/LCH/No Hop



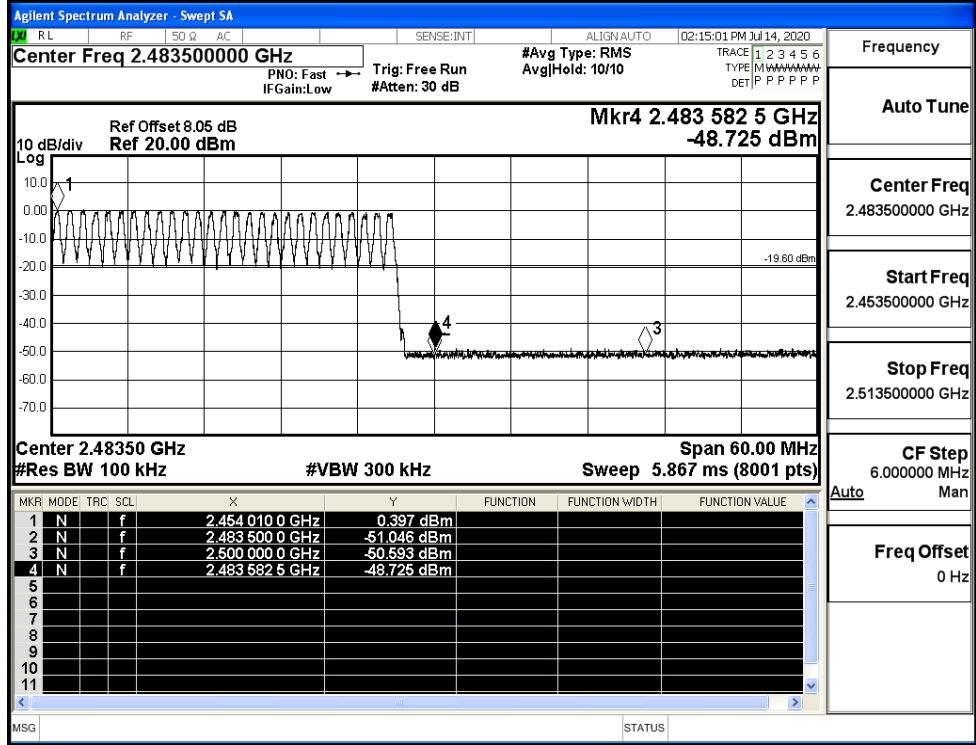
GFSK/LCH/Hop



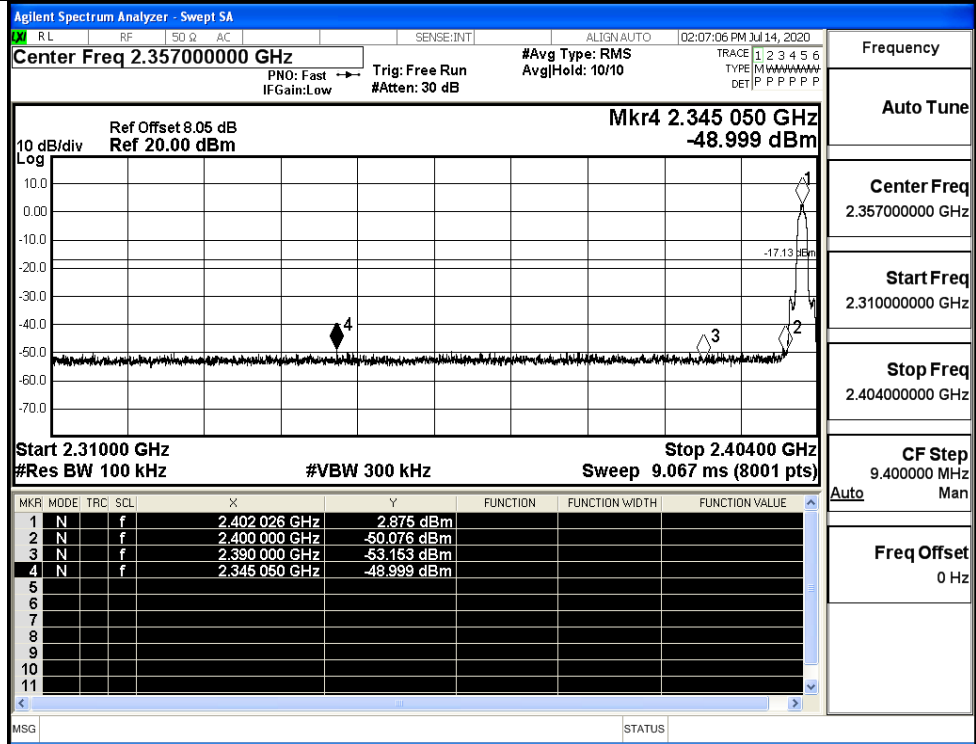
GFSK/HCH/No Hop



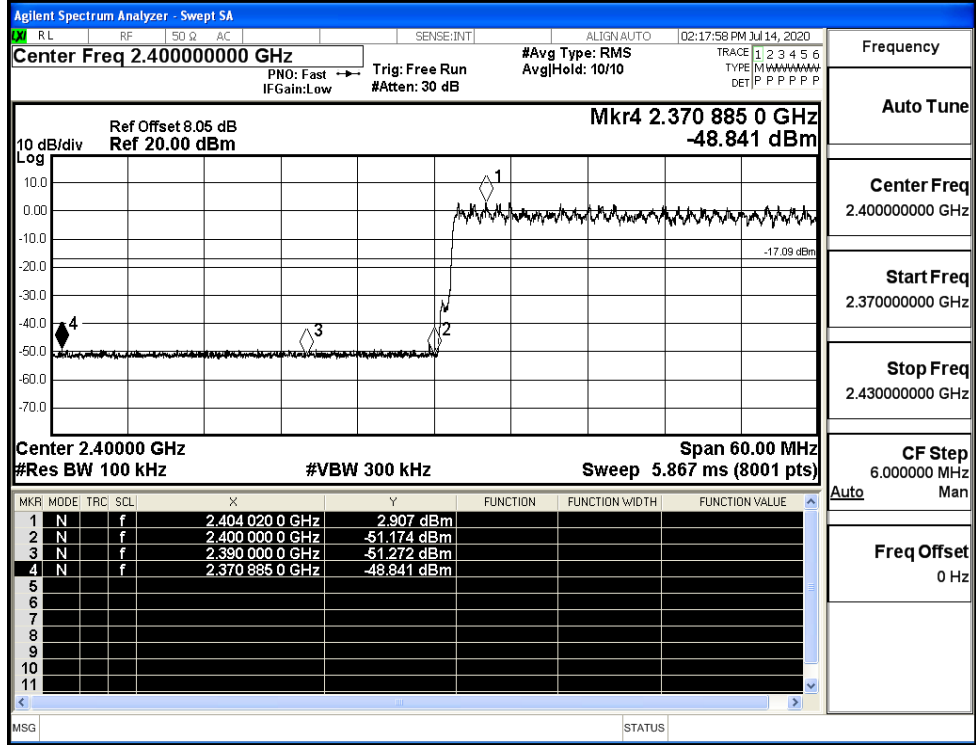
GFSK/HCH/Hop



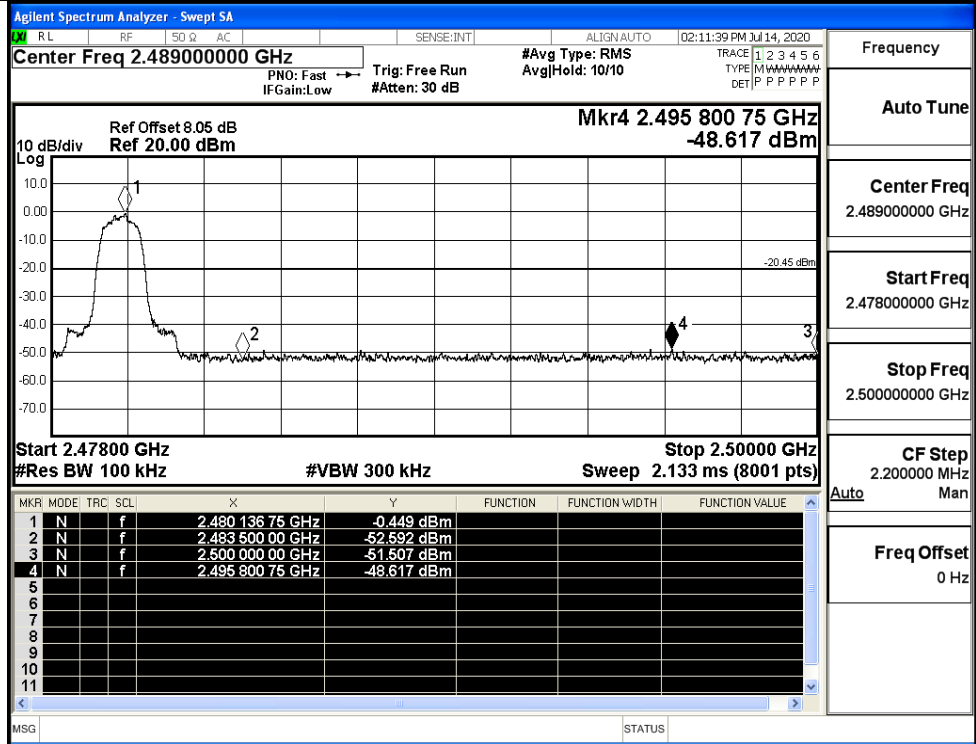
$\pi/4$ DQPSK/LCH/No
Hop



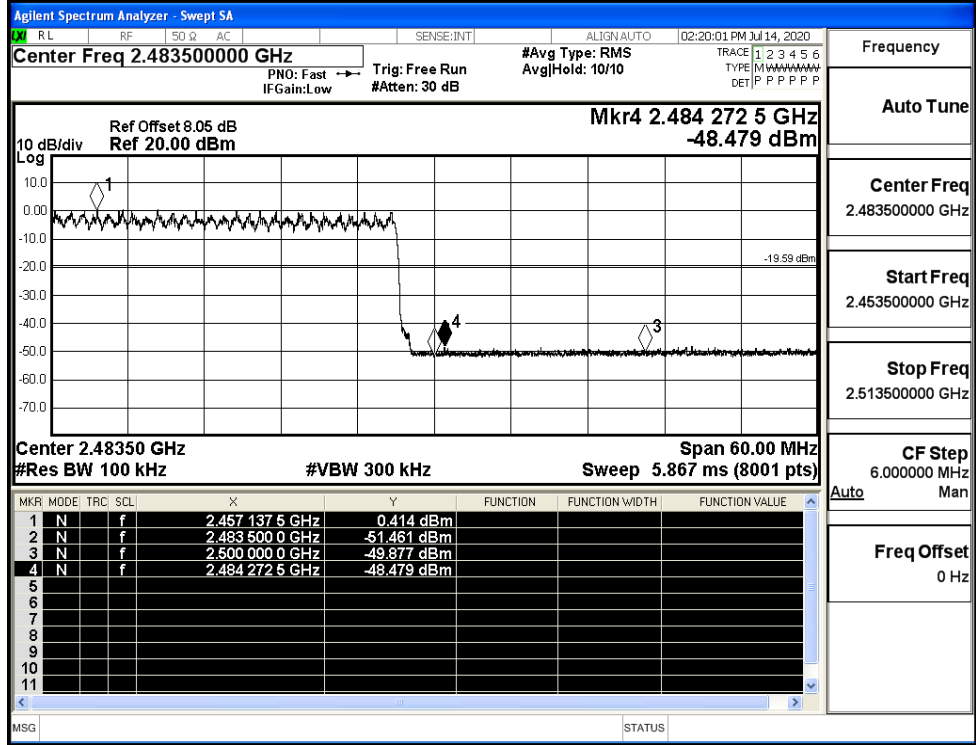
$\pi/4$ DQPSK/LCH/Hop



π /4DQPSK/HCH/No
Hop



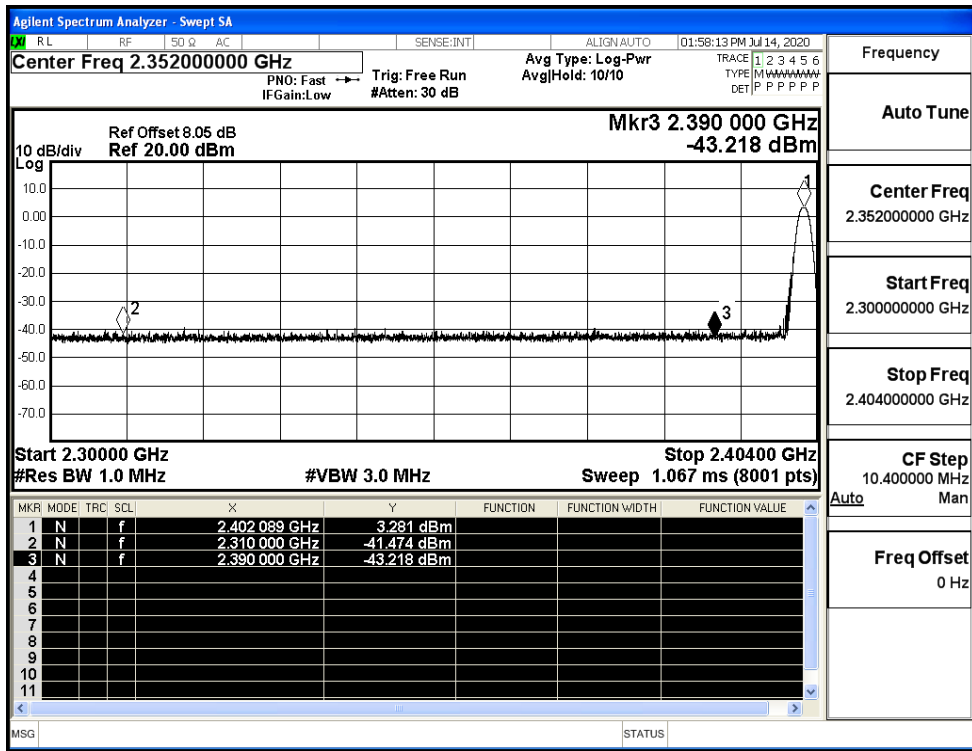
π /4DQPSK/HCH/Hop



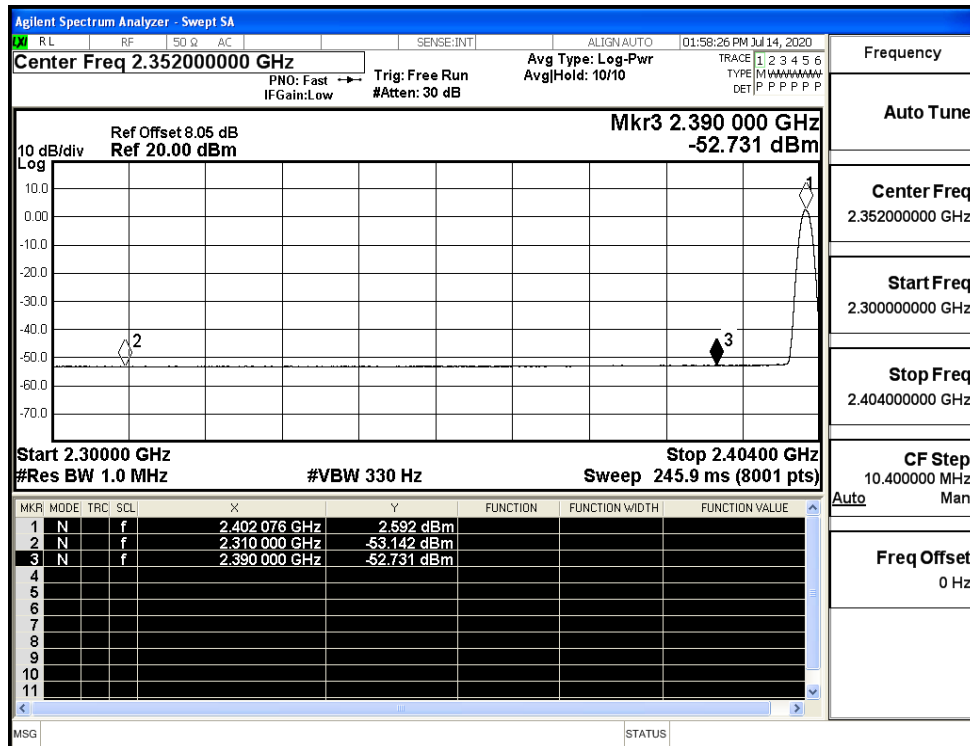
A.8 Restrict-band band-edge measurements

Test Mode	Hopping	Freq.	Power [dBm]	Gain	Ground Factor	E [dBuV/m]	Detector	Limit [dBuV/m]	Verdict
GFSK	Off	2310.0	-41.47	2.0	0	55.79	PEAK	74	PASS
	Off	2310.0	-53.14	2.0	0	44.12	AV	54	PASS
	Off	2390.0	-43.22	2.0	0	54.04	PEAK	74	PASS
	Off	2390.0	-52.73	2.0	0	44.53	AV	54	PASS
	Off	2483.5	-42.46	2.0	0	54.80	PEAK	74	PASS
	Off	2483.5	-52.22	2.0	0	45.04	AV	54	PASS
	Off	2500.0	-41.64	2.0	0	55.62	PEAK	74	PASS
	Off	2500.0	-52.16	2.0	0	45.10	AV	54	PASS
$\pi/4$ DQPSK	Off	2310.0	-42.61	2.0	0	54.65	PEAK	74	PASS
	Off	2310.0	-53.25	2.0	0	44.01	AV	54	PASS
	Off	2390.0	-42.91	2.0	0	54.35	PEAK	74	PASS
	Off	2390.0	-52.81	2.0	0	44.45	AV	54	PASS
	Off	2483.5	-41.92	2.0	0	55.34	PEAK	74	PASS
	Off	2483.5	-52.14	2.0	0	45.12	AV	54	PASS
	Off	2500.0	-42.18	2.0	0	55.08	PEAK	74	PASS
	Off	2500.0	-52.26	2.0	0	45.00	AV	54	PASS

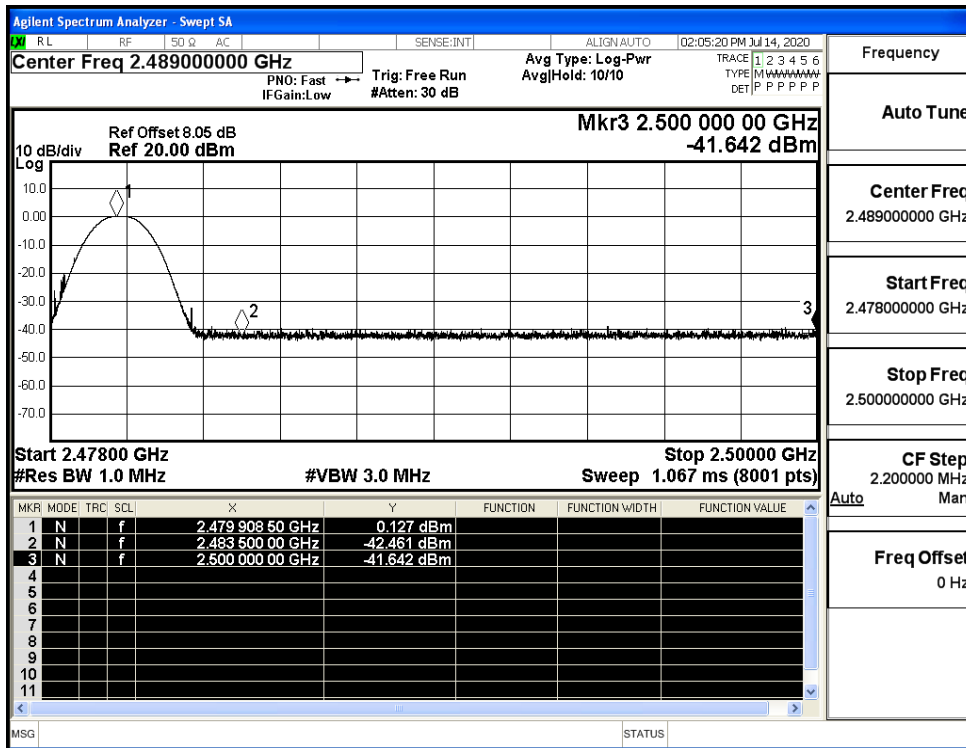
Restrict-band band-edge measurements_Hopping Off_GFSK_PEAK (Low Channel)



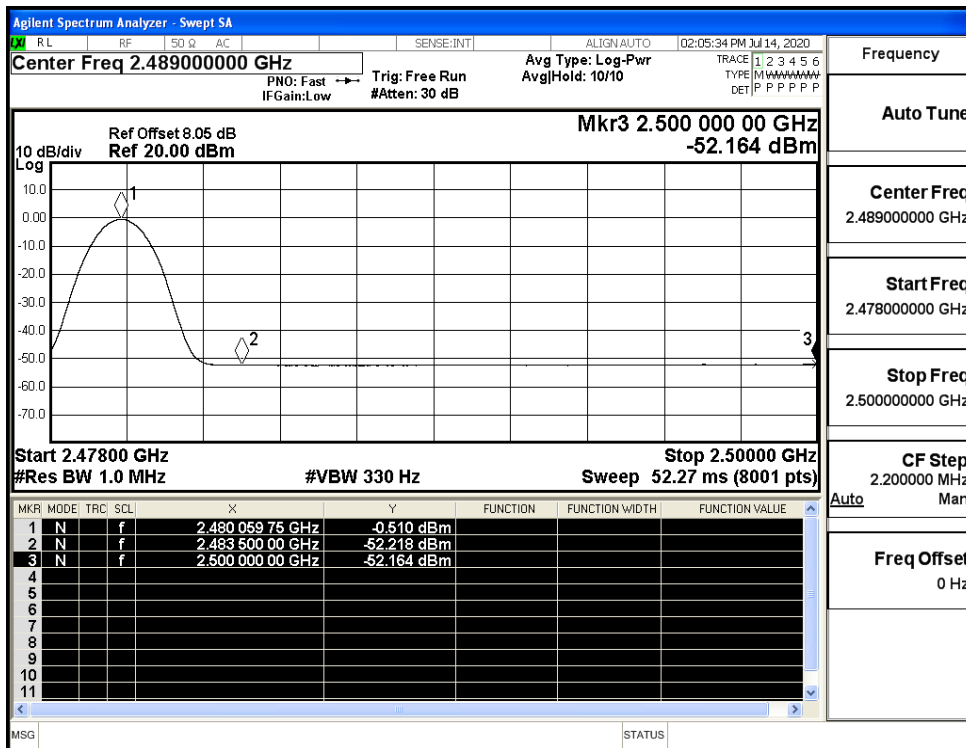
Restrict-band band-edge measurements_Hopping Off_GFSK_Average (Low Channel)



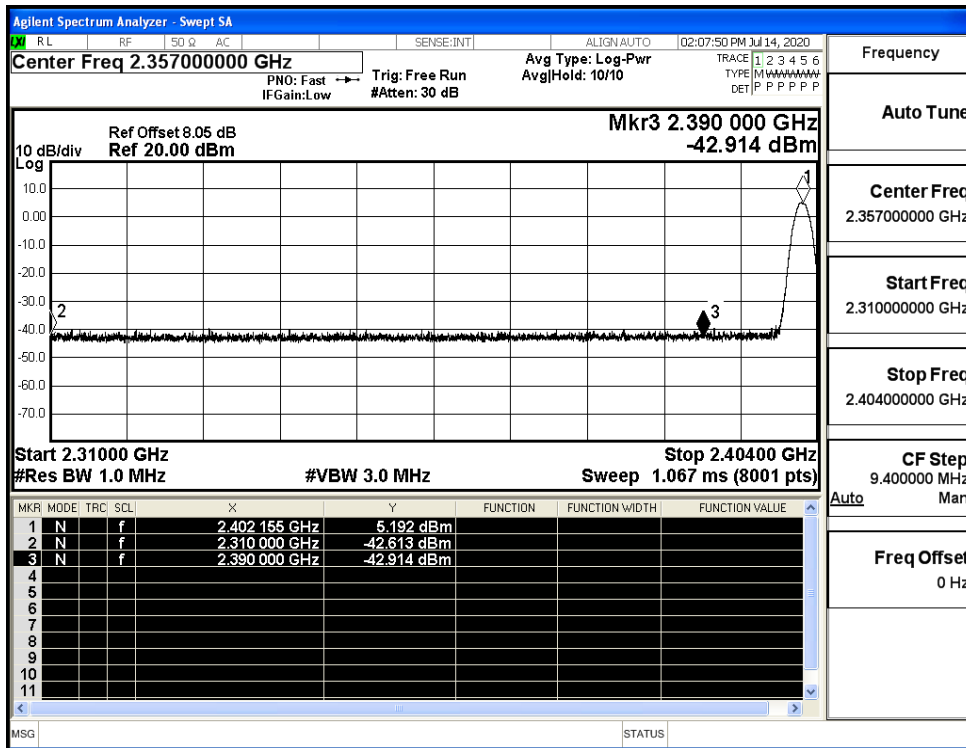
Restrict-band band-edge measurements_Hopping Off_ GFSK_PEAK (High Channel)



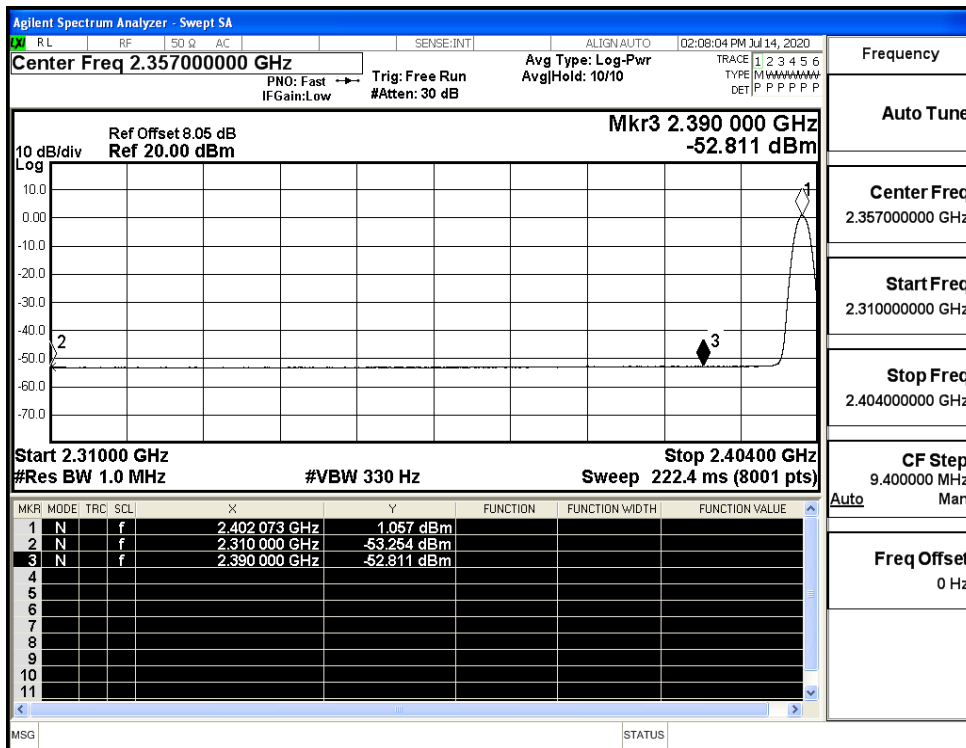
Restrict-band band-edge measurements_Hopping Off_ GFSK_Average (High Channel)



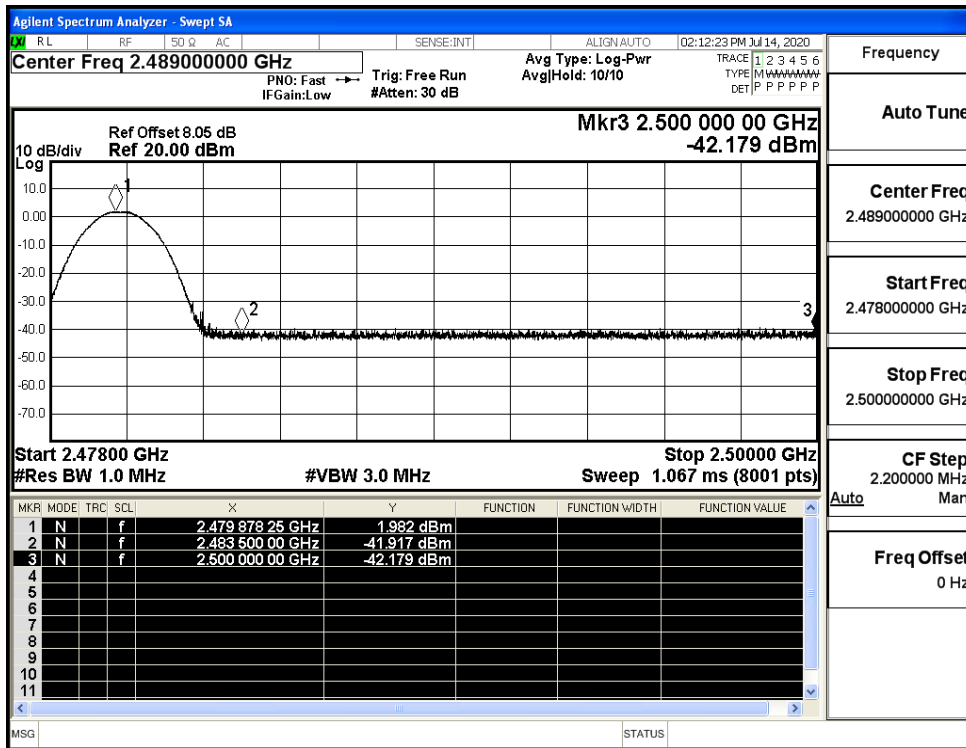
Restrict-band band-edge measurements_Hopping Off $\pi/4$ -DQPSK_PEAK (Low Channel)



Restrict-band band-edge measurements_Hopping Off $\pi/4$ -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)

