

## Appendix A

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

Product Name: TWS Wireless Earbuds

Trade Mark: Poweradd

Test Model: S10

#### Environmental Conditions

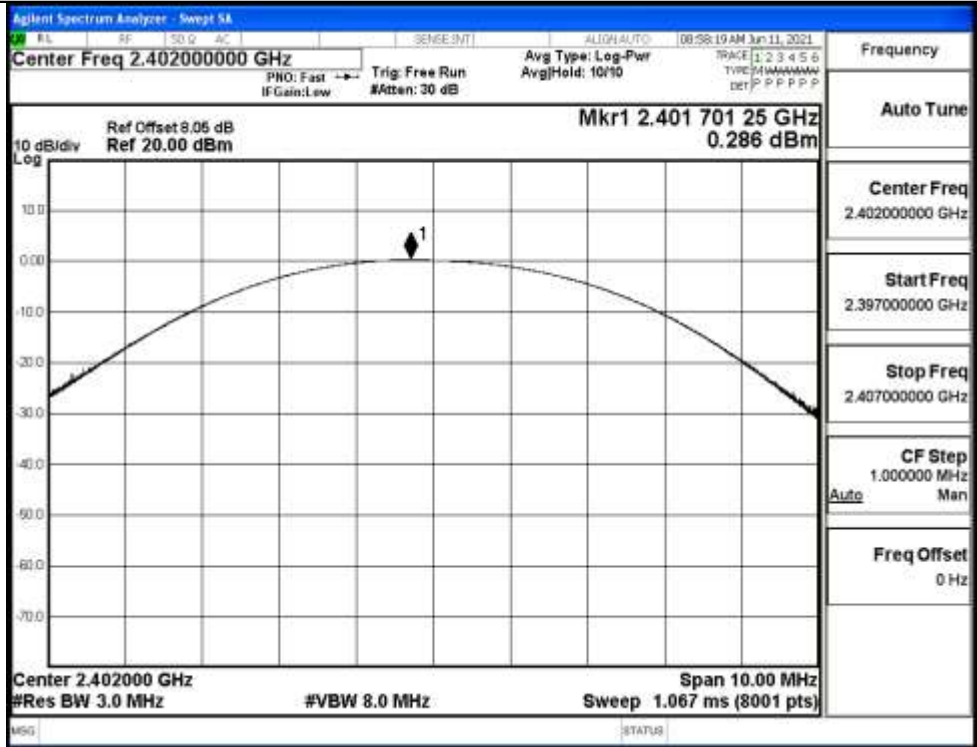
Temperature:	25 ° C
Relative Humidity:	50%
ATM Pressure:	100.0 kPa
Test Engineer:	Kay Hu
Supervised by:	Li Huan

#### A.1 Maximum Conducted Peak Output Power

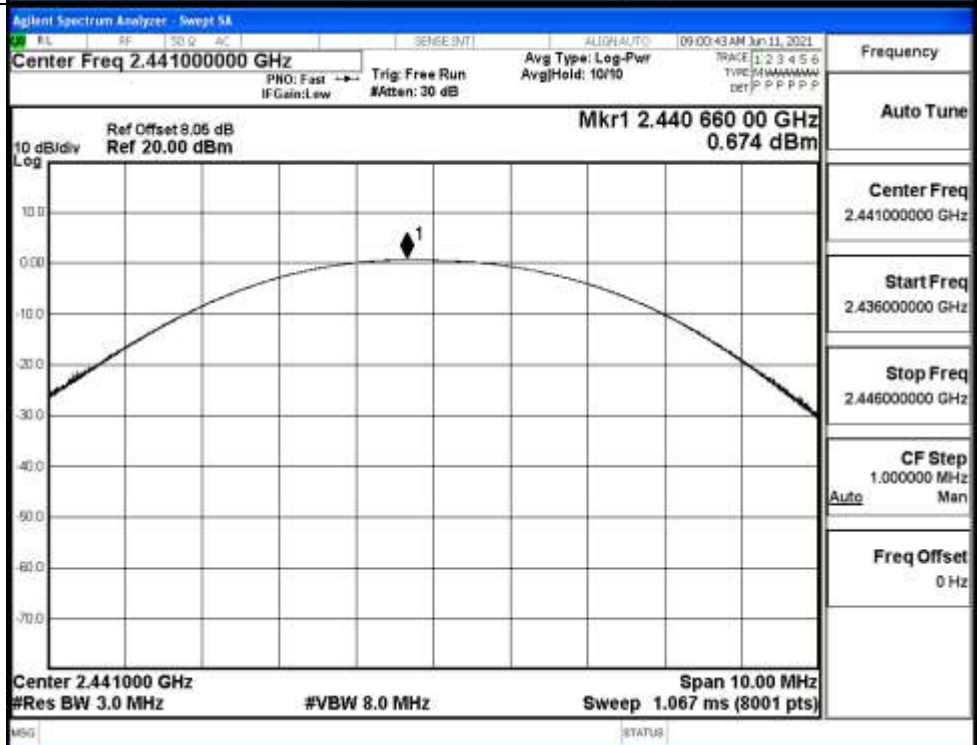
Mode	Channel.	Maximum Peak Output Power [dBm]	Limit [dBm]	Verdict
GFSK	LCH	0.286	21	PASS
	MCH	0.674	21	PASS
	HCH	0.397	21	PASS
$\pi/4$ DQPSK	LCH	1.074	21	PASS
	MCH	1.334	21	PASS
	HCH	1.061	21	PASS
8DPSK	LCH	1.040	21	PASS
	MCH	1.348	21	PASS
	HCH	1.084	21	PASS

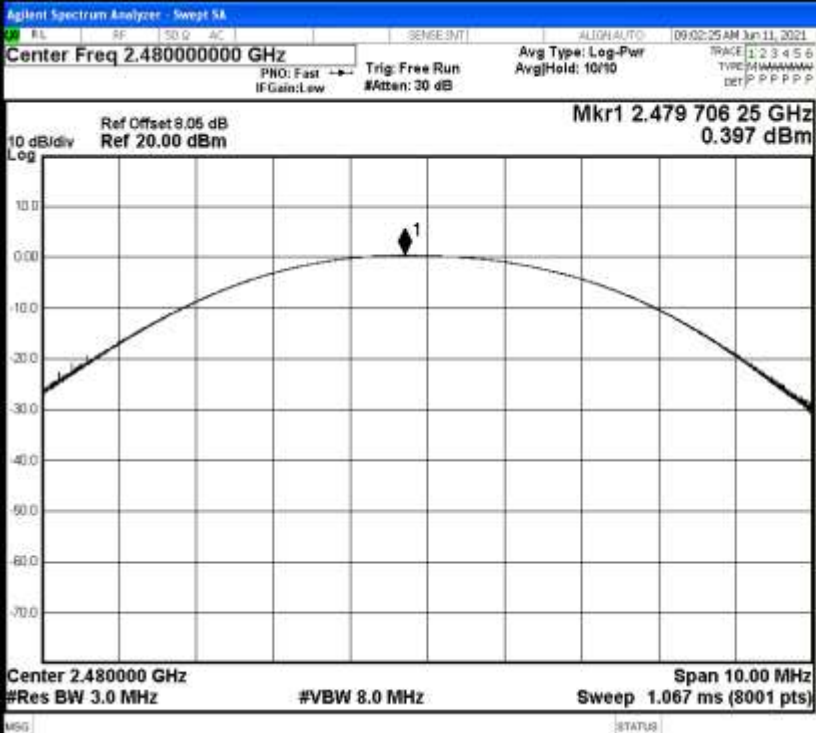
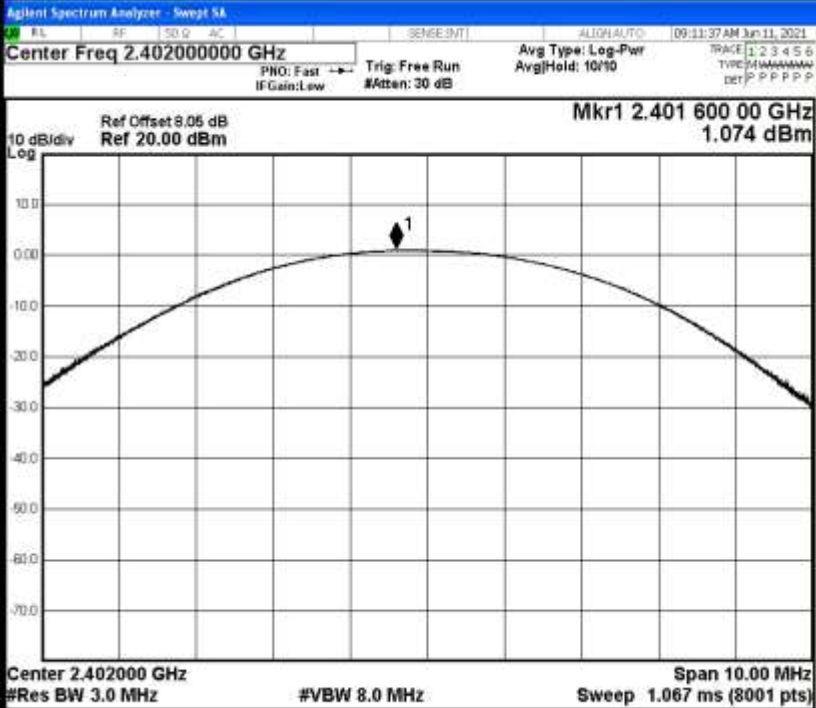
Test Graphs

GFSK/LCH

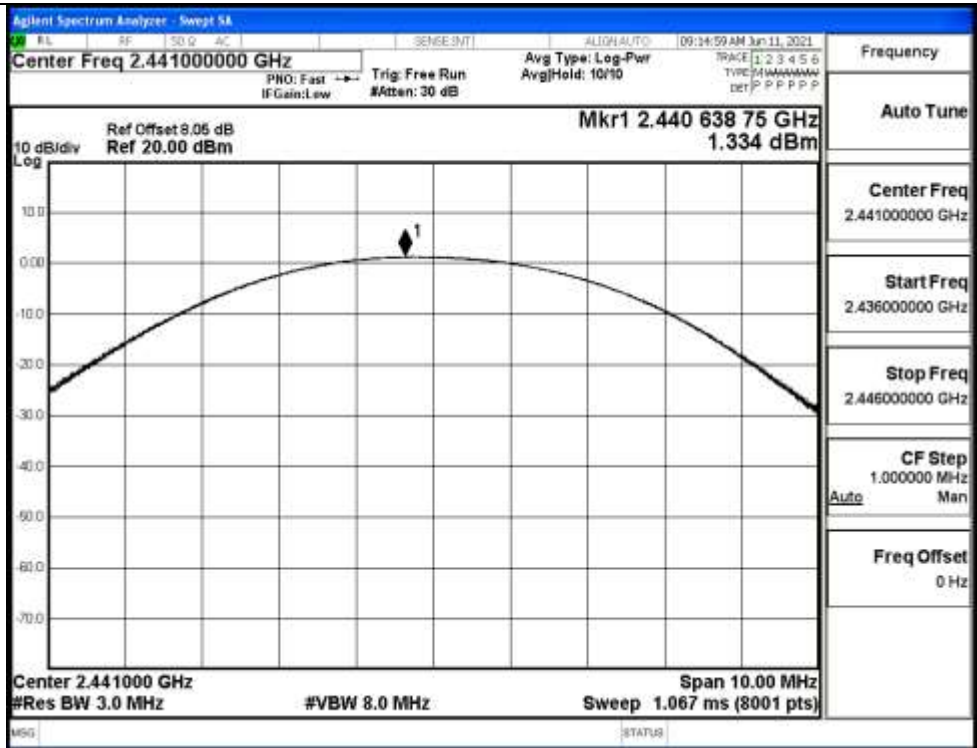


GFSK/MCH

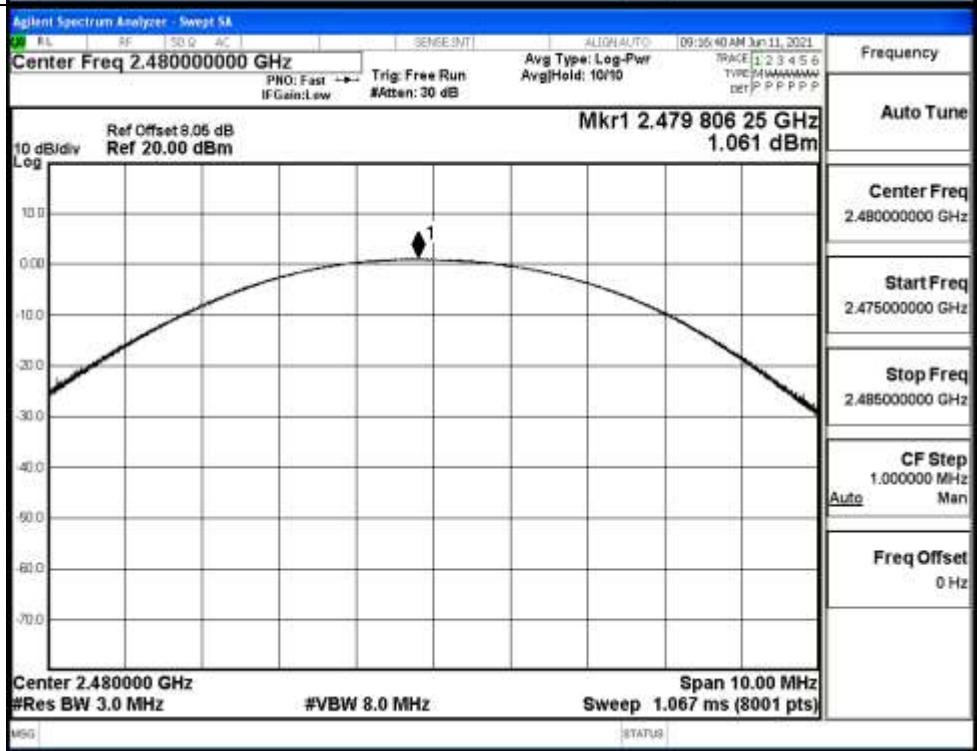


<p>GFSK/HCH</p>	 <p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.48000000 GHz</p> <p>Mkr1 2.479 706 25 GHz 0.397 dBm</p> <p>Ref Offset 3.05 dB Ref 20.00 dBm</p> <p>Center 2.480000 GHz #Res BW 3.0 MHz #VBW 8.0 MHz Span 10.00 MHz Sweep 1.067 ms (8001 pts)</p>
<p><math>\pi/4</math>DQPSK/LCH</p>	 <p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.40200000 GHz</p> <p>Mkr1 2.401 600 00 GHz 1.074 dBm</p> <p>Ref Offset 3.05 dB Ref 20.00 dBm</p> <p>Center 2.402000 GHz #Res BW 3.0 MHz #VBW 8.0 MHz Span 10.00 MHz Sweep 1.067 ms (8001 pts)</p>

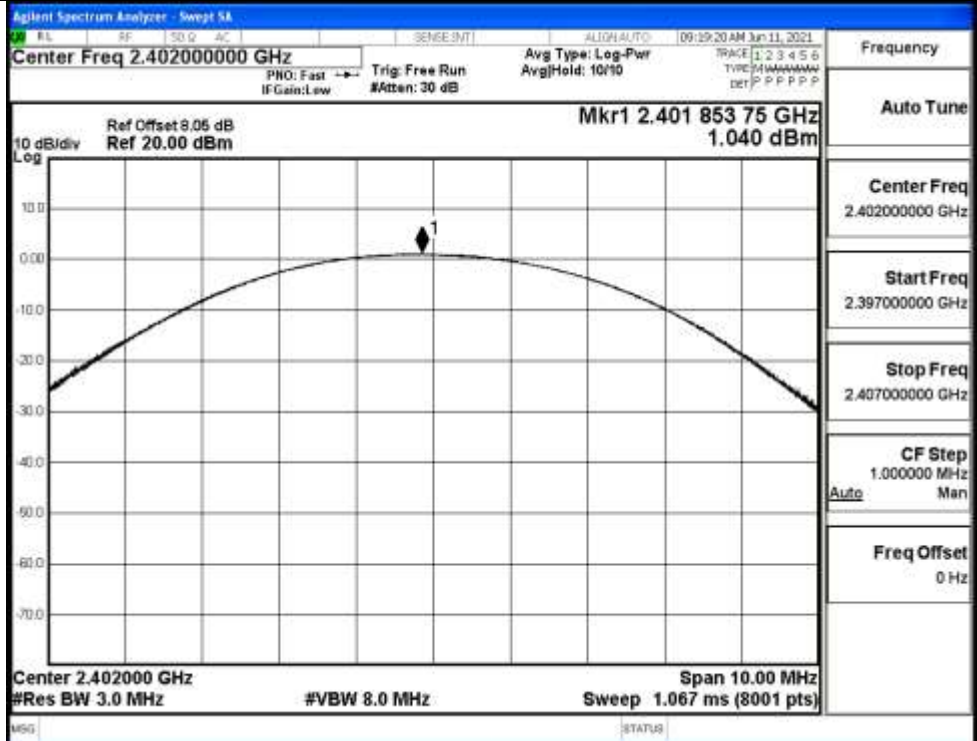
$\pi/4$ DQPSK/MCH



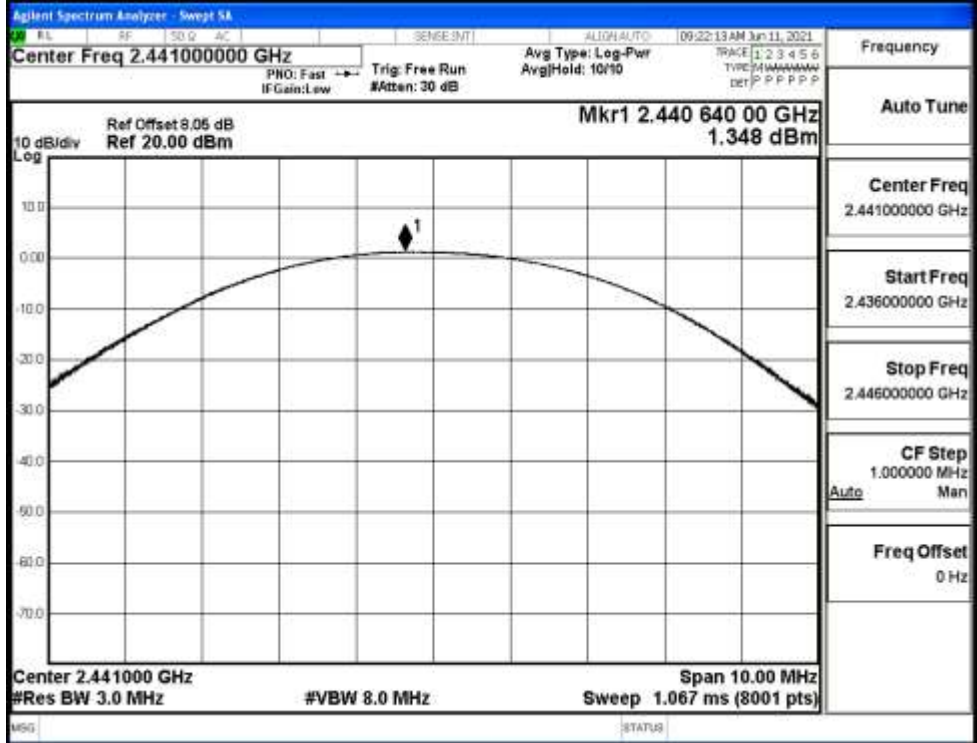
$\pi/4$ DQPSK/HCH



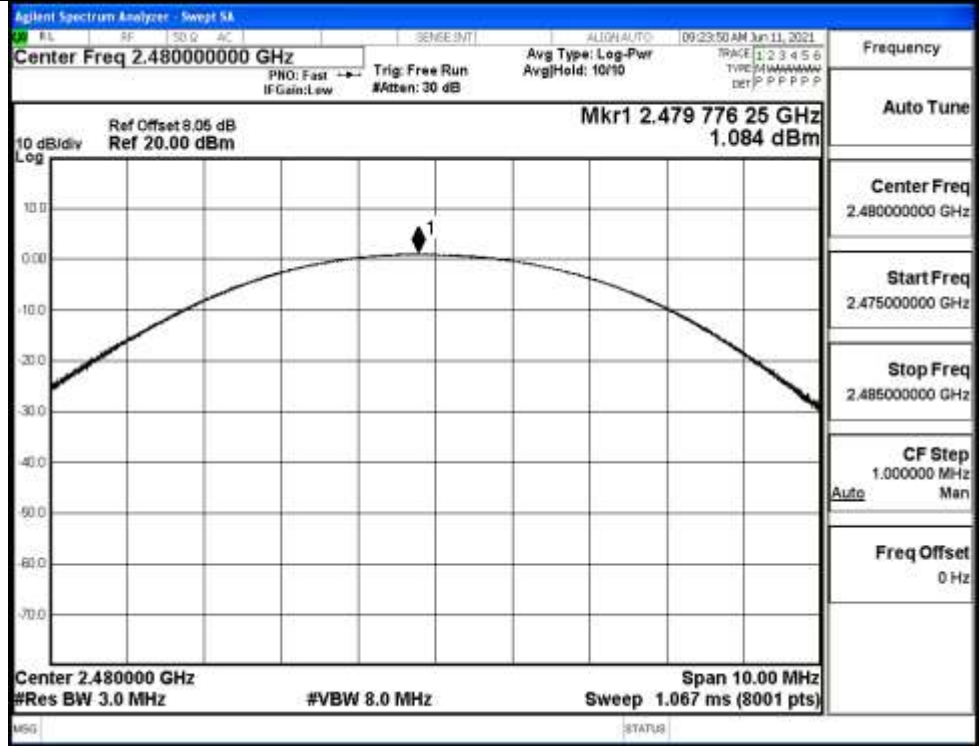
8DPSK/LCH



8DPSK/MCH



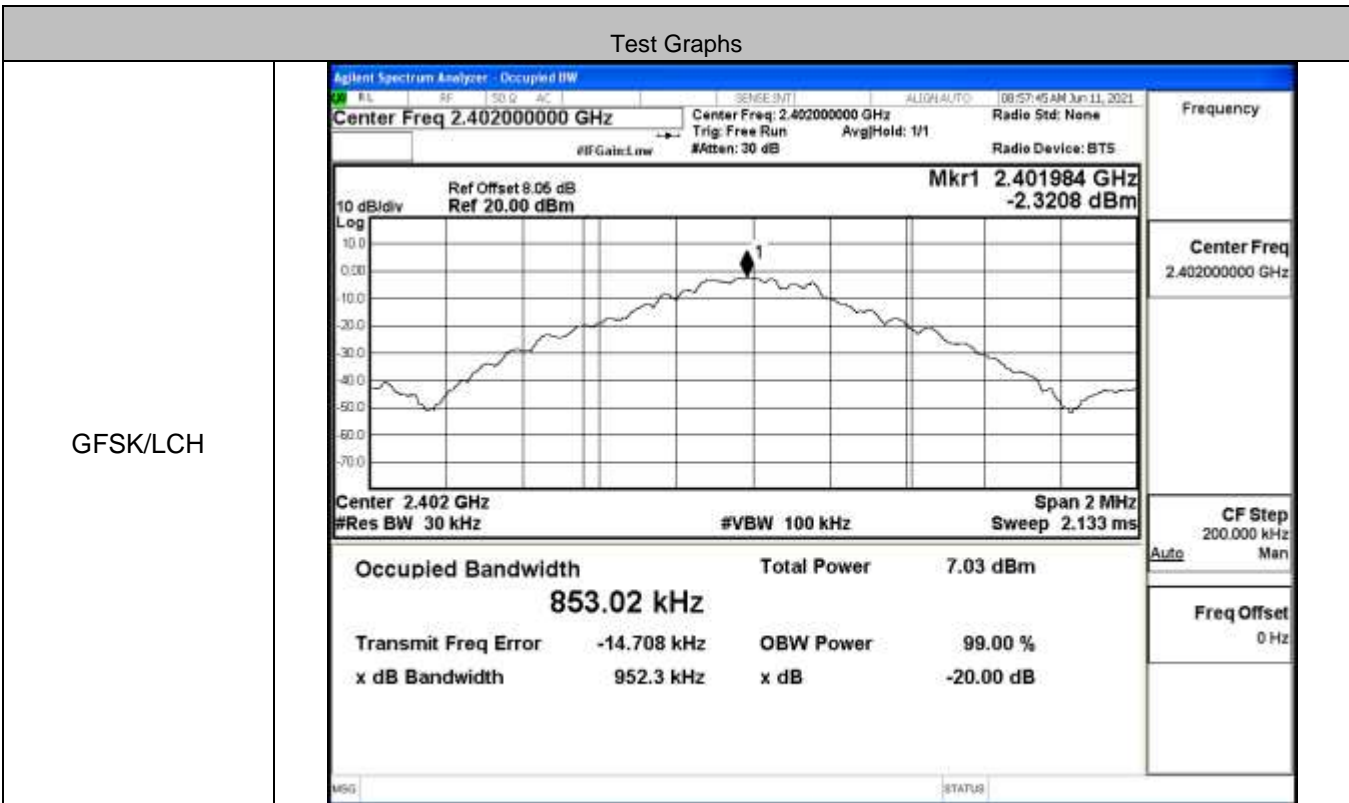
8DPSK/HCH

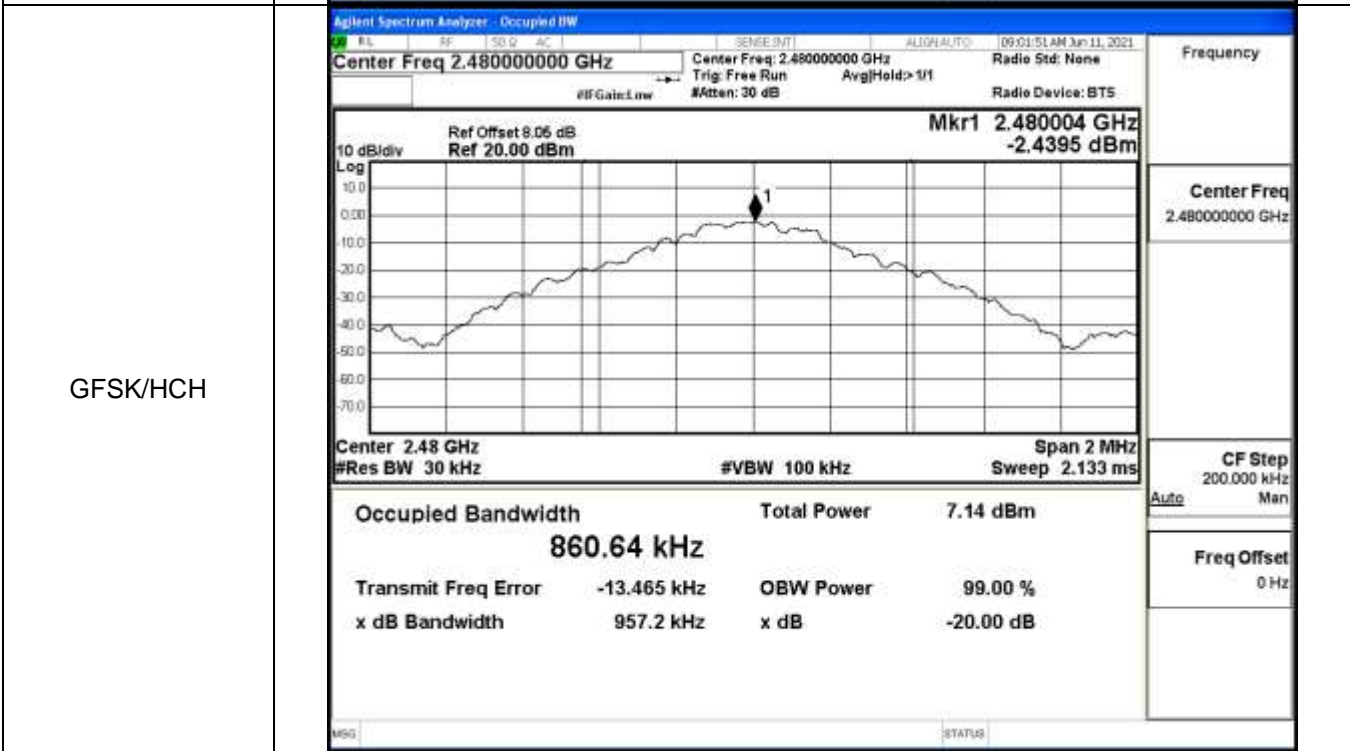
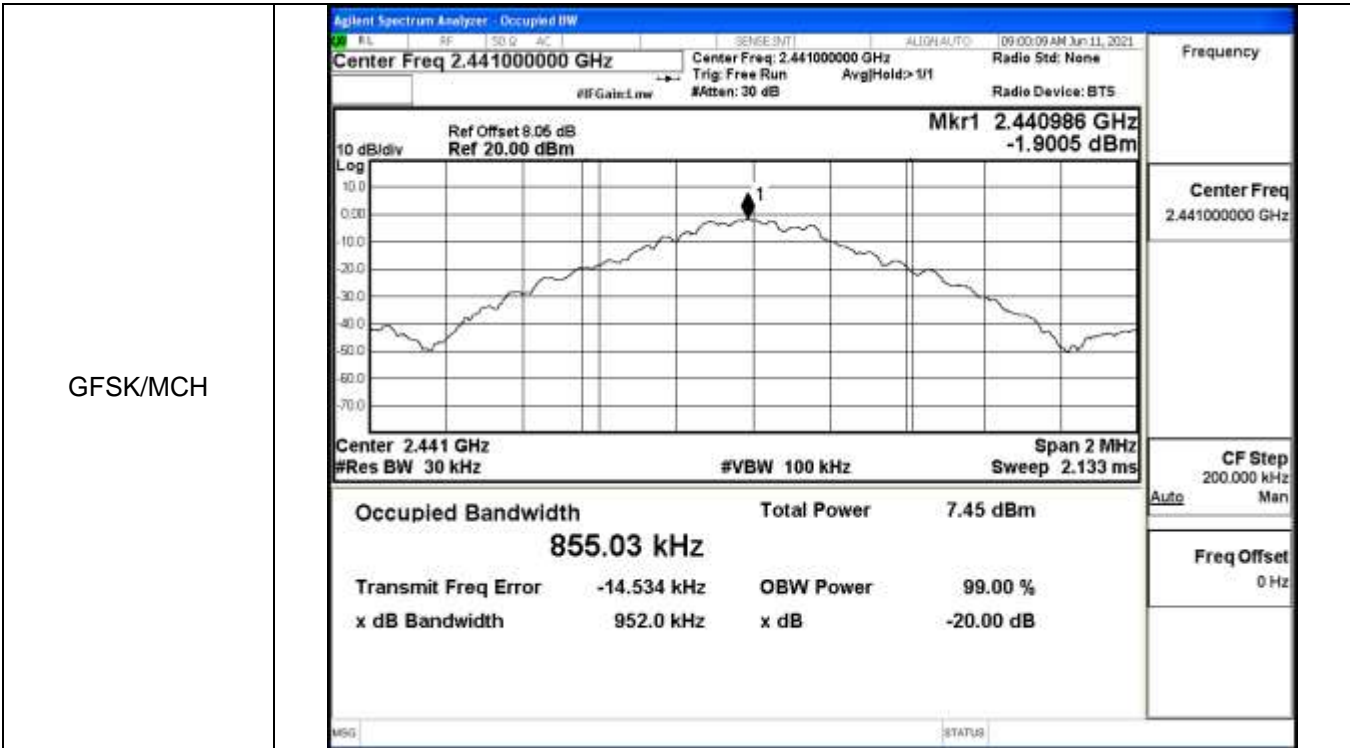


**A.2 20dB Bandwidth**

Mode	Channel.	20dB Bandwidth [MHz]	Limit [MHz]	Verdict
GFSK	LCH	0.9523	Not Specified	PASS
	MCH	0.9520	Not Specified	PASS
	HCH	0.9572	Not Specified	PASS
$\pi/4$ DQPSK	LCH	1.312	Not Specified	PASS
	MCH	1.313	Not Specified	PASS
	HCH	1.312	Not Specified	PASS
8DPSK	LCH	1.311	Not Specified	PASS
	MCH	1.313	Not Specified	PASS
	HCH	1.312	Not Specified	PASS

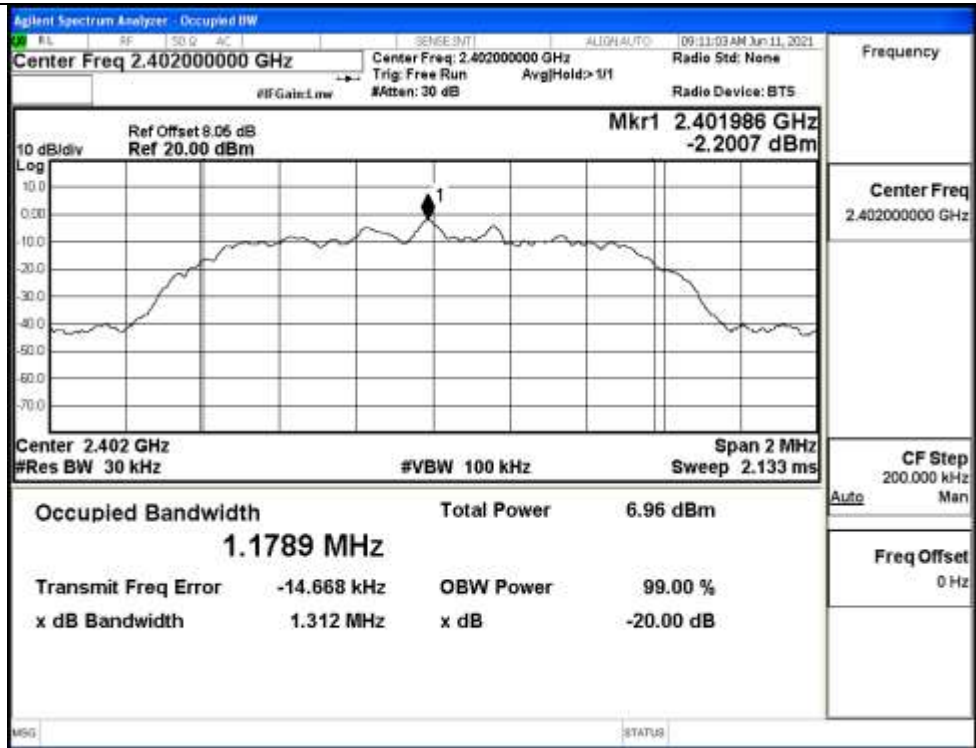
Test Graphs



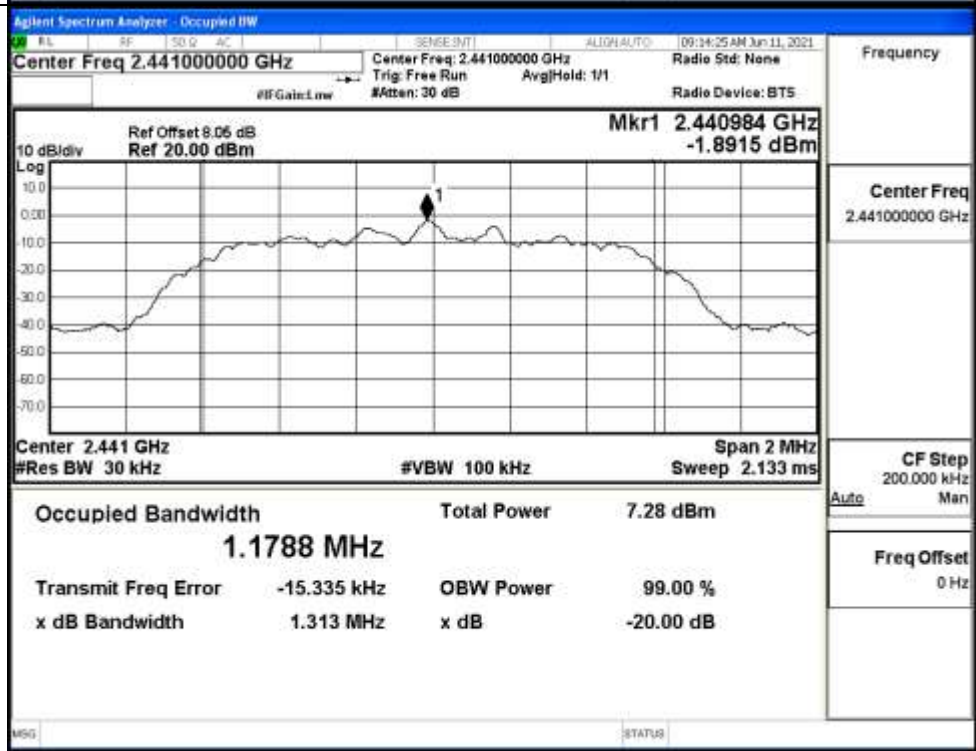


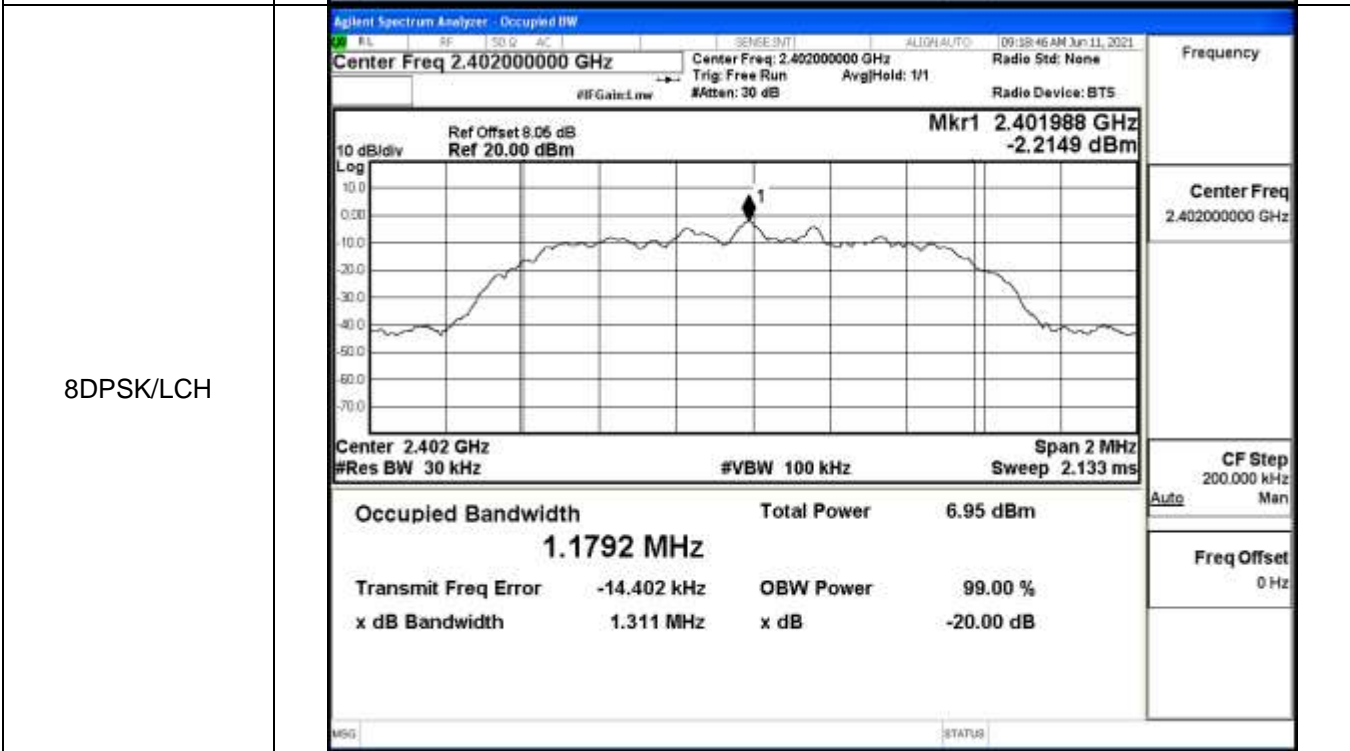
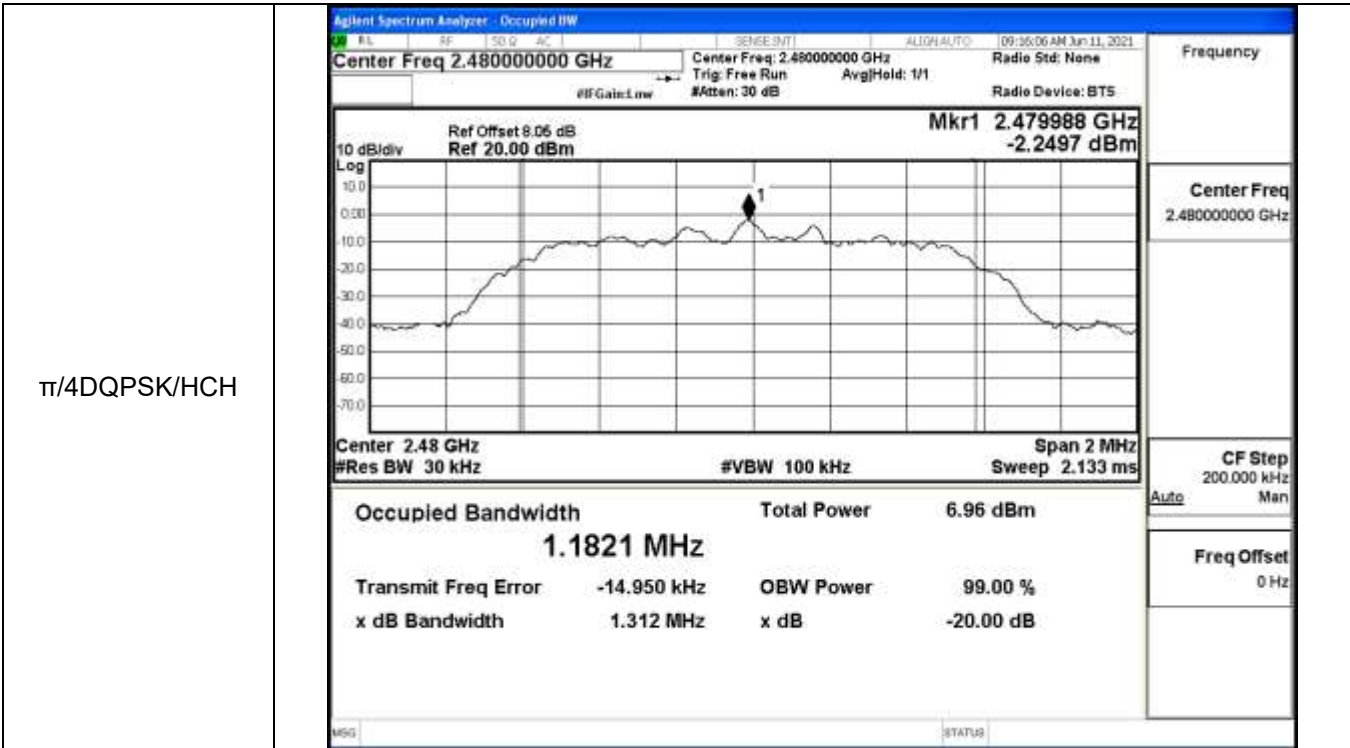


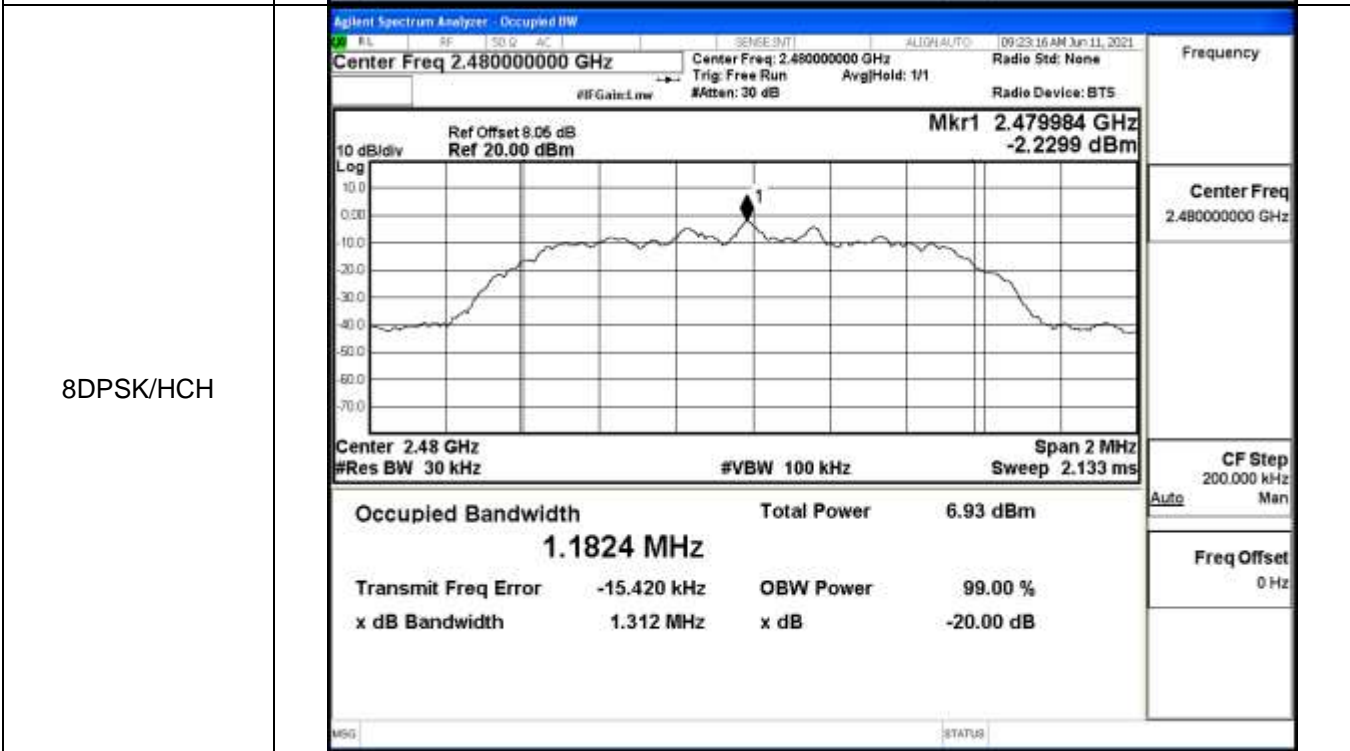
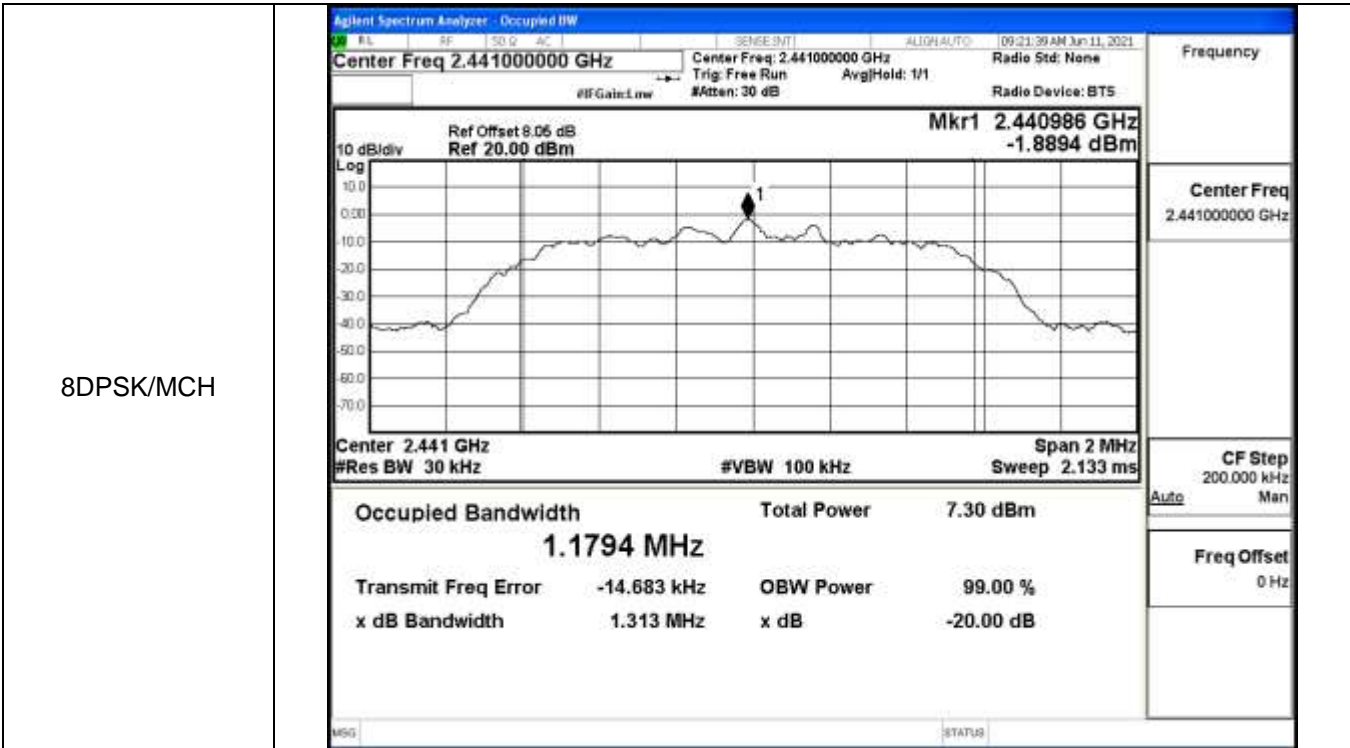
$\pi/4$ DQPSK/LCH



$\pi/4$ DQPSK/MCH



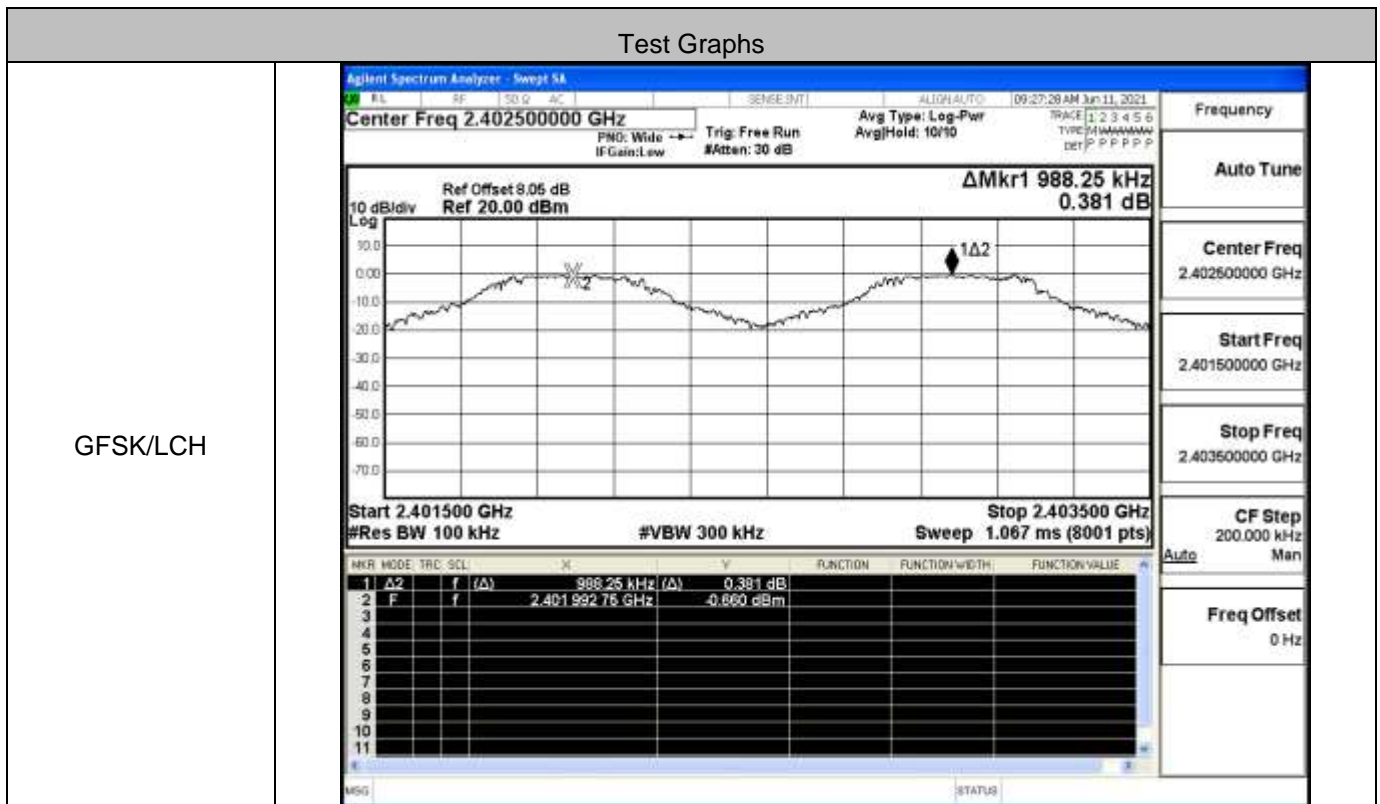




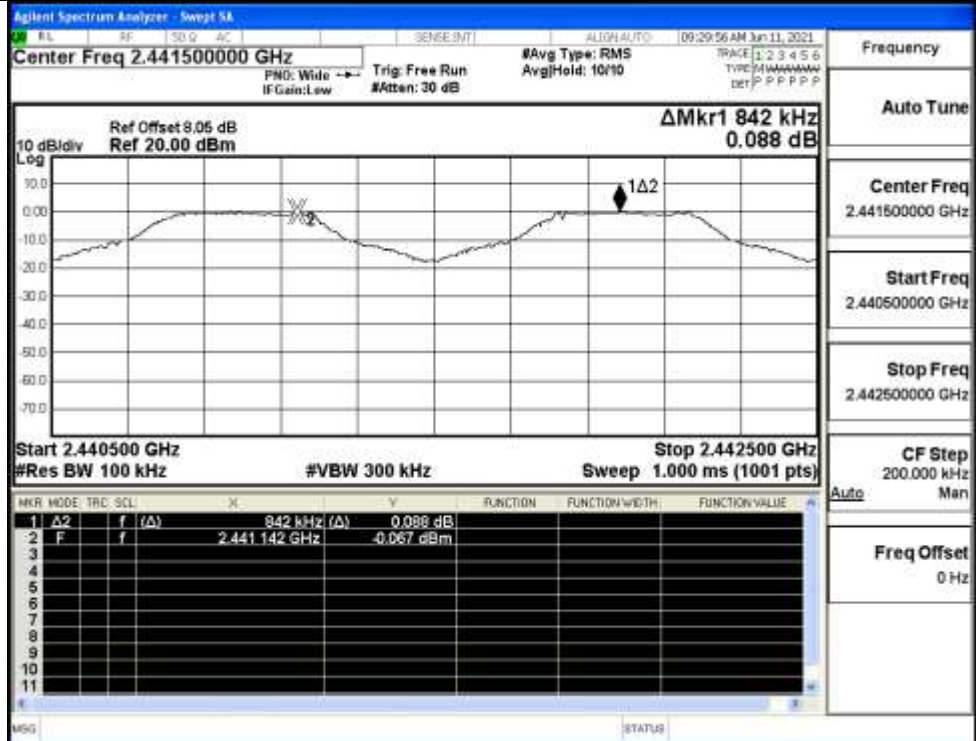
### A.3 Carrier Frequency Separation

Mode	Channel	Carrier Frequency Separation [MHz]	Limit [MHz]	Verdict
GFSK	LCH	0.988	0.638	PASS
	MCH	0.842	0.638	PASS
	HCH	1.108	0.638	PASS
π/4DQPSK	LCH	0.992	0.875	PASS
	MCH	1.018	0.875	PASS
	HCH	1.002	0.875	PASS
8DPSK	LCH	1.014	0.875	PASS
	MCH	0.968	0.875	PASS
	HCH	1.124	0.875	PASS

#### Test Graphs

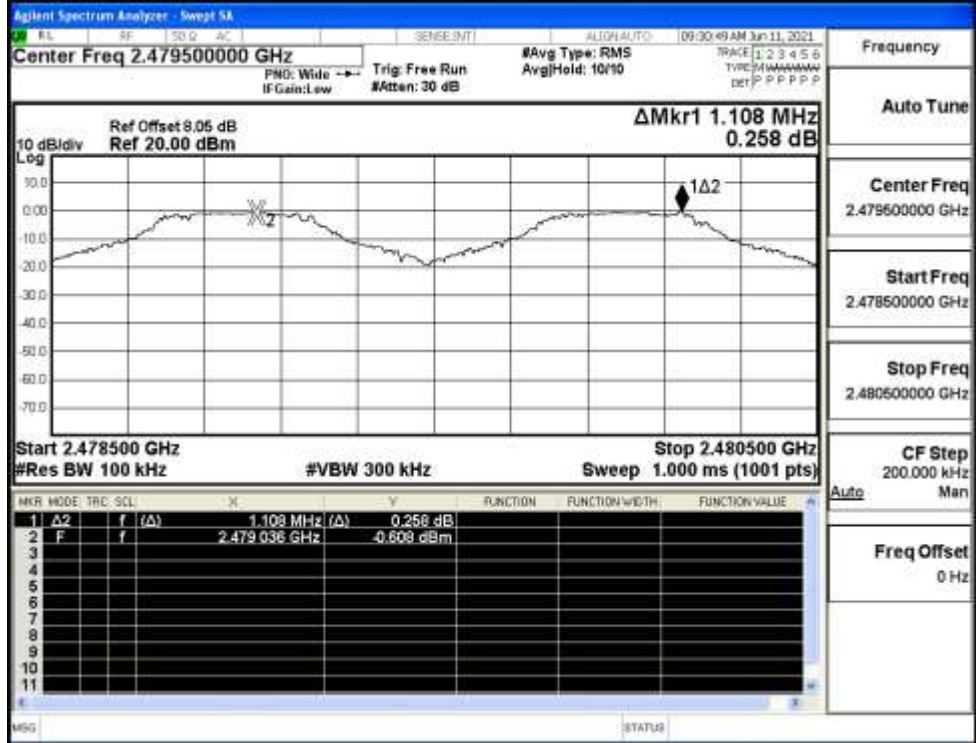


GFSK/MCH



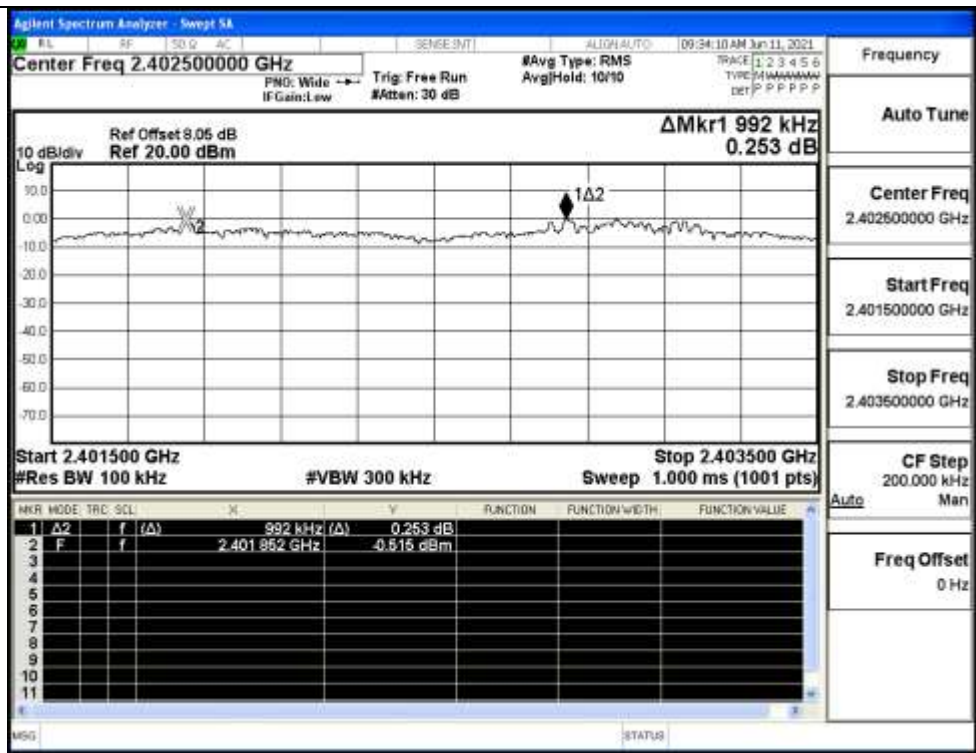
Frequency  
Auto Tune  
Center Freq  
2.441500000 GHz  
Start Freq  
2.440500000 GHz  
Stop Freq  
2.442500000 GHz  
CF Step  
200.000 kHz  
Auto Man  
Freq Offset  
0 Hz

GFSK/HCH

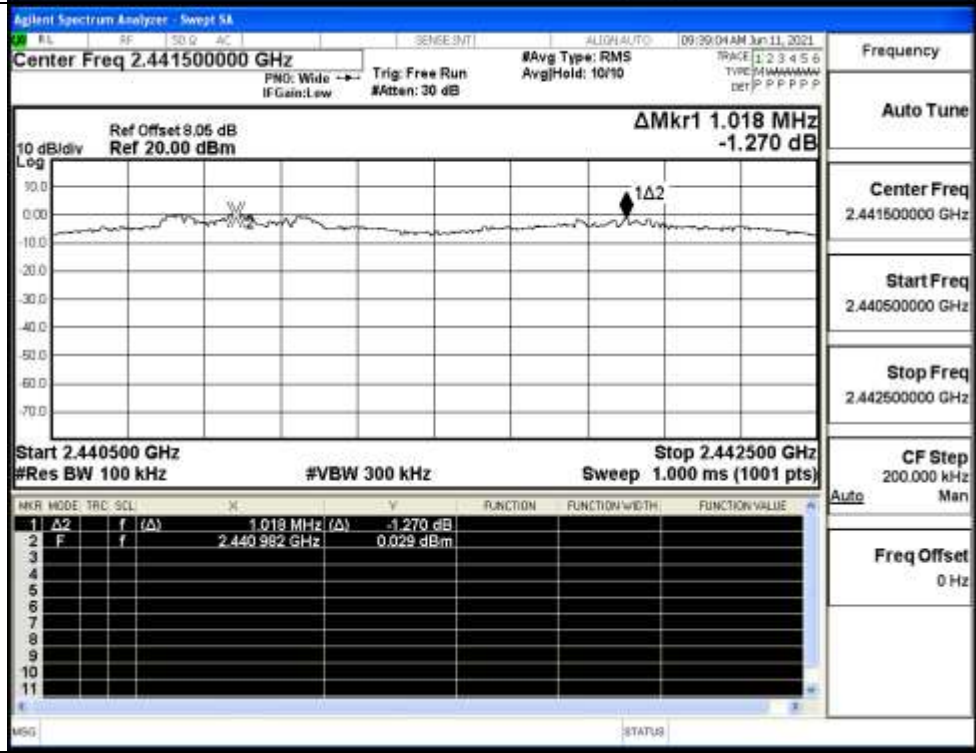


Frequency  
Auto Tune  
Center Freq  
2.479500000 GHz  
Start Freq  
2.478500000 GHz  
Stop Freq  
2.480500000 GHz  
CF Step  
200.000 kHz  
Auto Man  
Freq Offset  
0 Hz

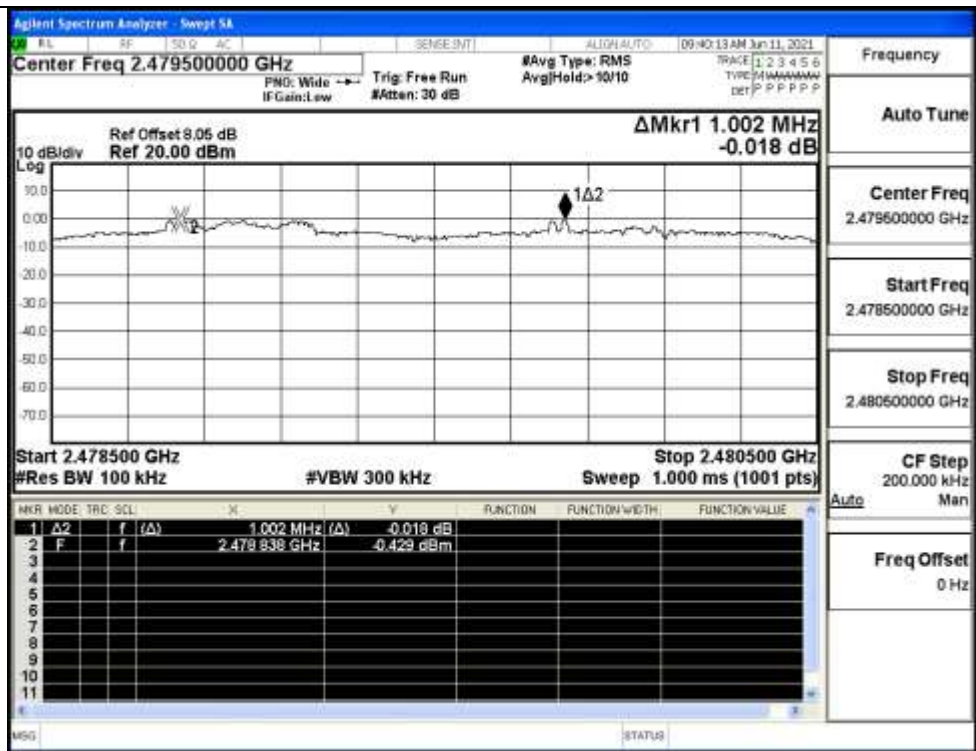
$\pi/4$ DQPSK/LCH



$\pi/4$ DQPSK/MCH

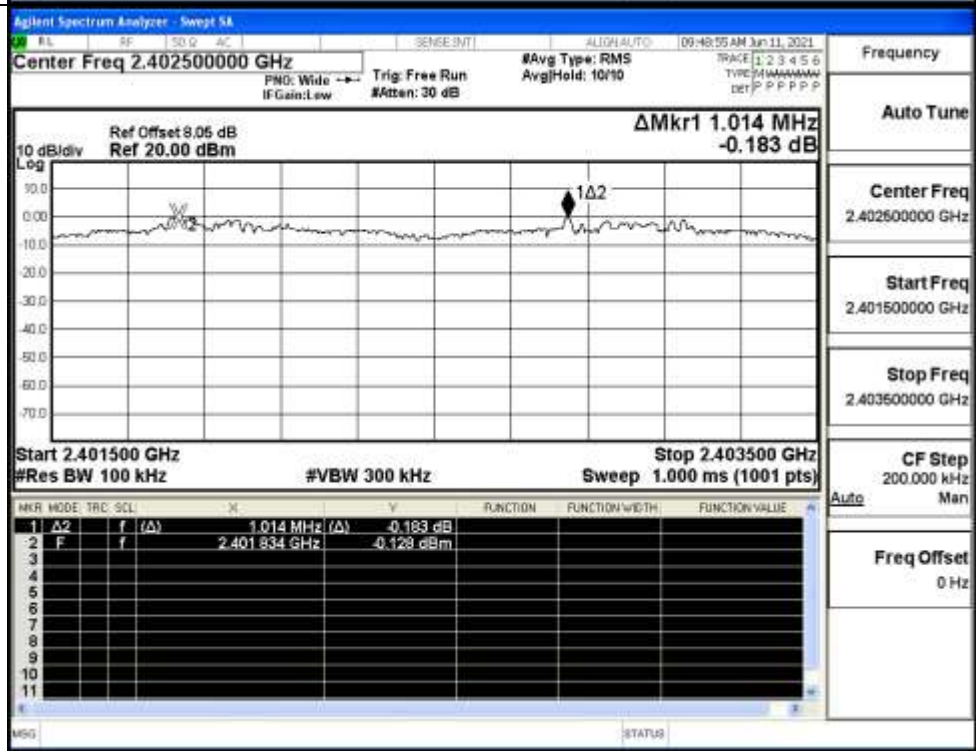


π/4DQPSK/HCH



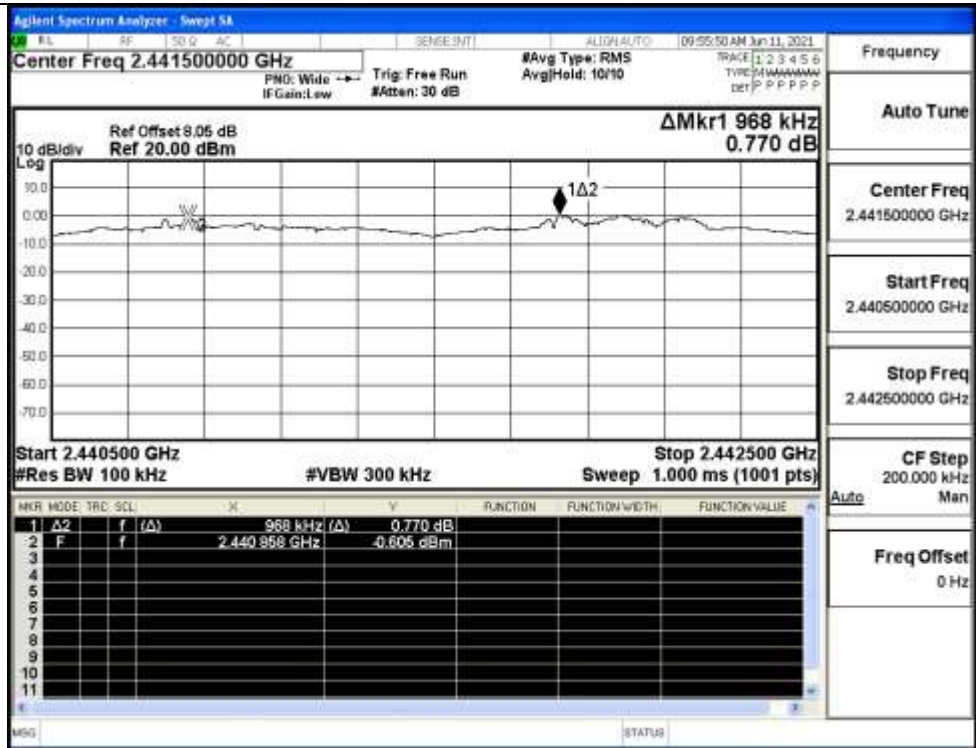
Frequency	2.479500000 GHz
Auto Tune	
Center Freq	2.479500000 GHz
Start Freq	2.478500000 GHz
Stop Freq	2.480500000 GHz
CF Step	200.000 kHz
Auto	Man
Freq Offset	0 Hz

8DPSK/LCH

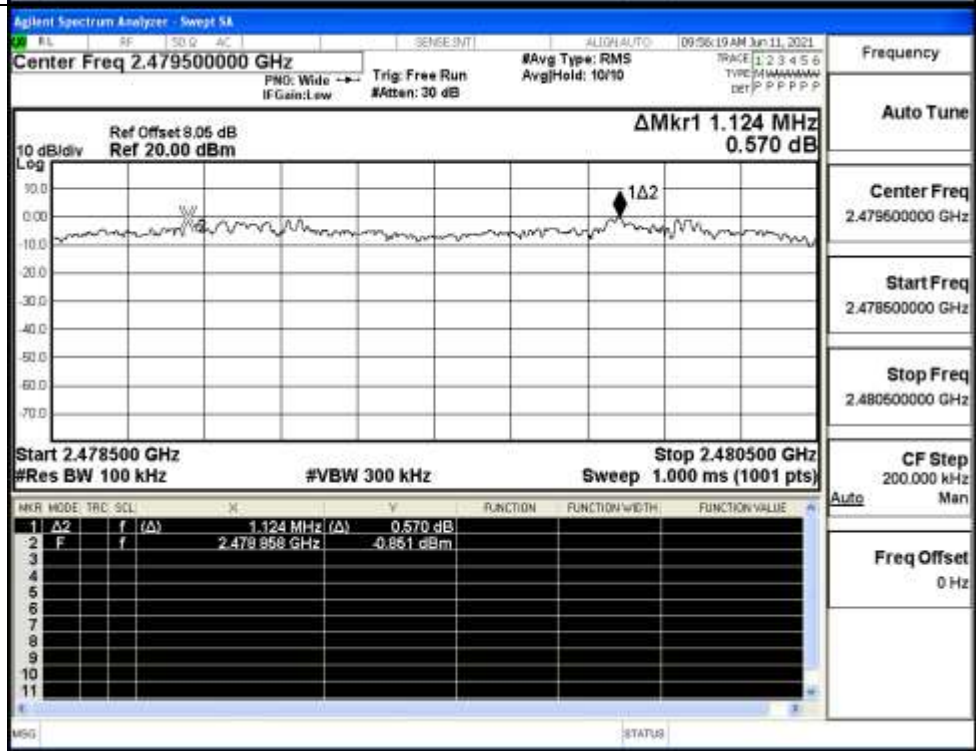


Frequency	2.402500000 GHz
Auto Tune	
Center Freq	2.402500000 GHz
Start Freq	2.401500000 GHz
Stop Freq	2.403500000 GHz
CF Step	200.000 kHz
Auto	Man
Freq Offset	0 Hz

8DPSK/MCH



8DPSK/HCH



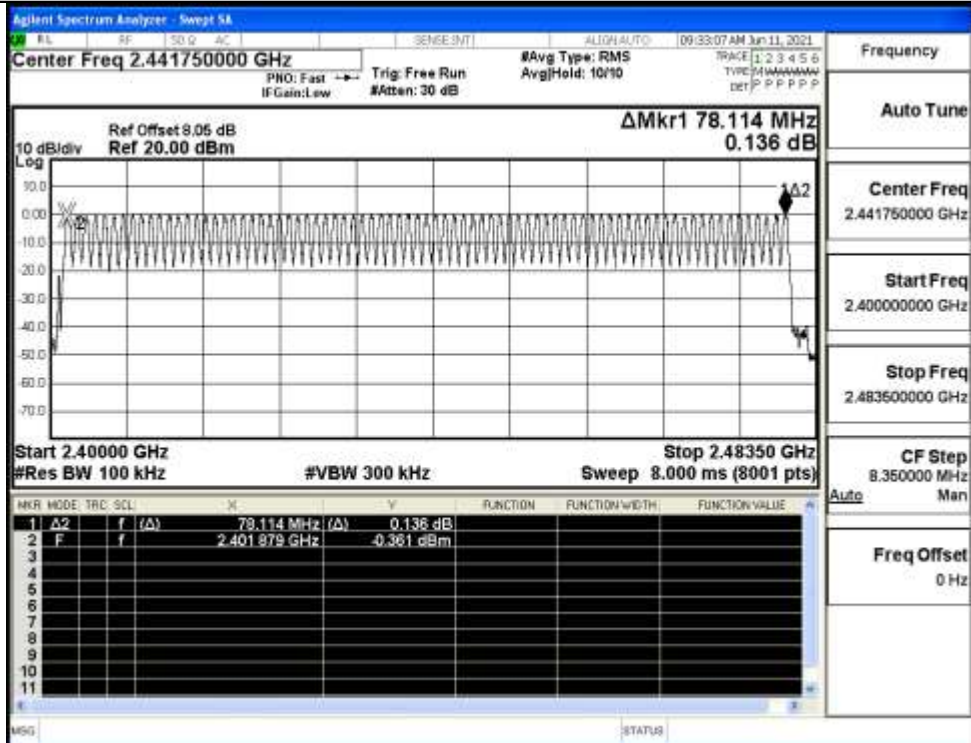


### A.4 Hopping Channel Number

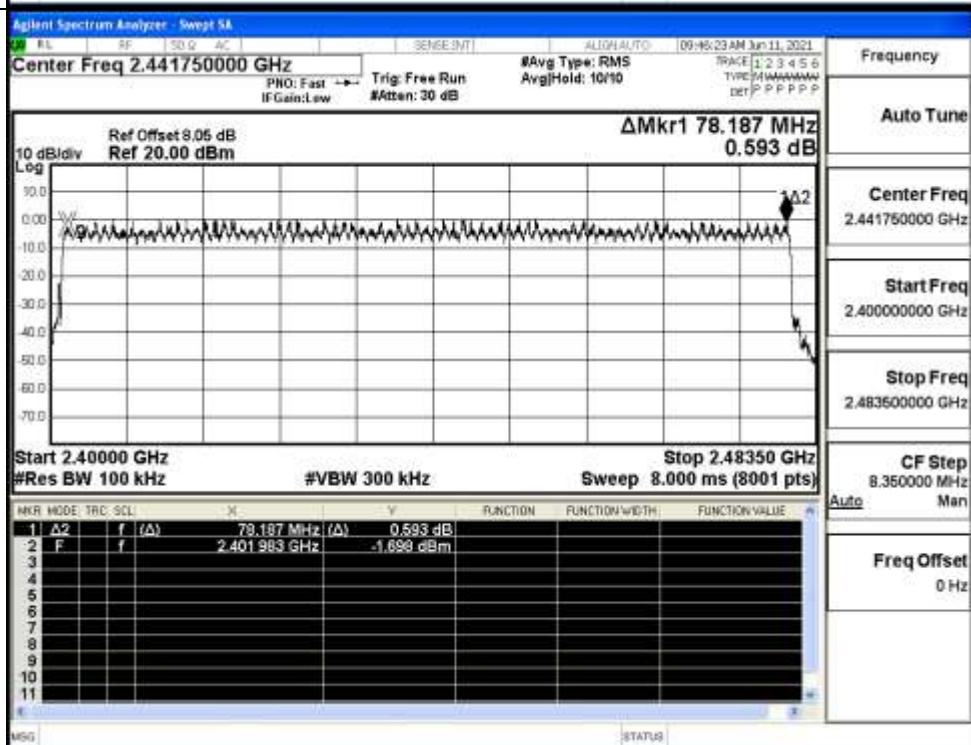
Mode	Channel.	Number of Hopping Channel [N]	Limit [N]	Verdict
GFSK	Hop	79	>=15	PASS
$\pi/4$ DQPSK	Hop	79	>=15	PASS
8DPSK	Hop	79	>=15	PASS

#### Test Graphs

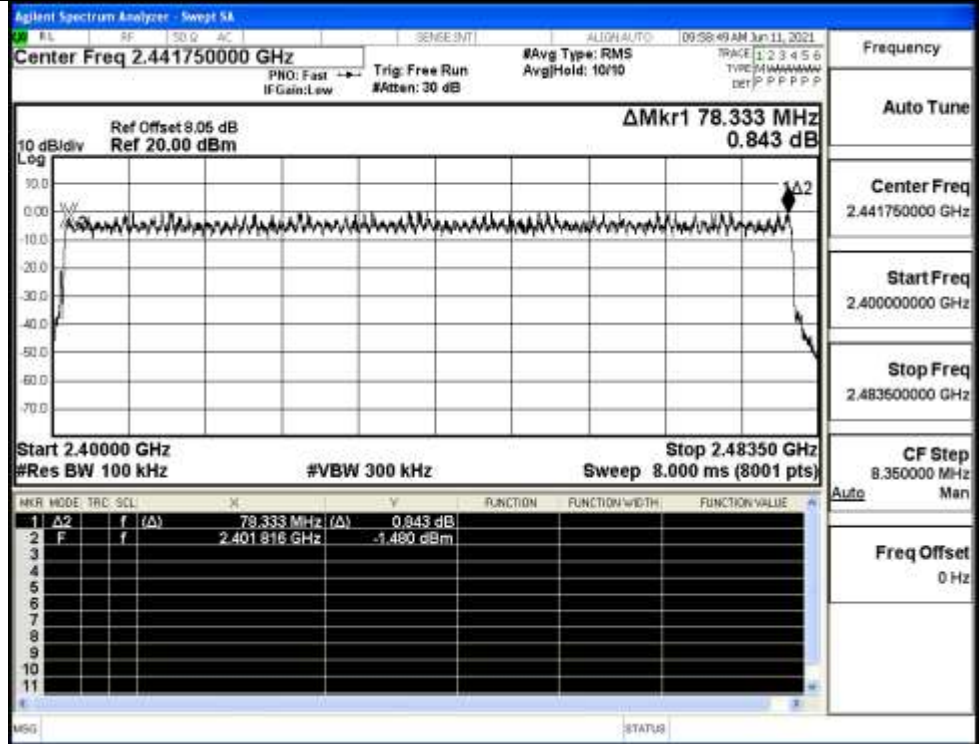
GFSK/Hop



$\pi/4$ DQPSK/Hop



8DPSK/Hop

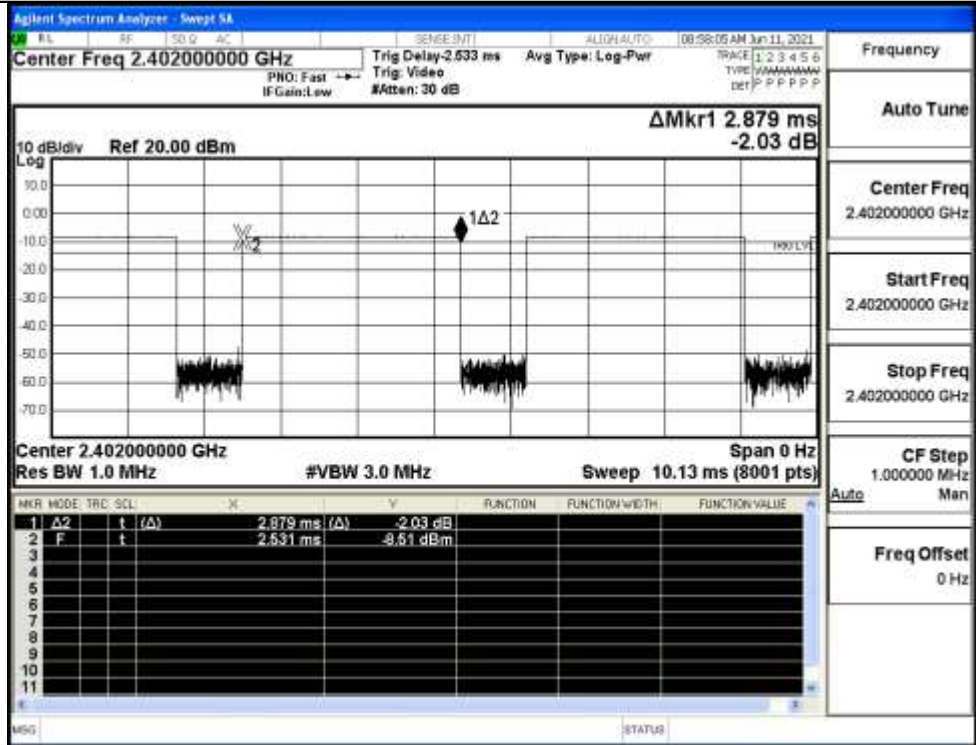


**A.5 Dwell Time**

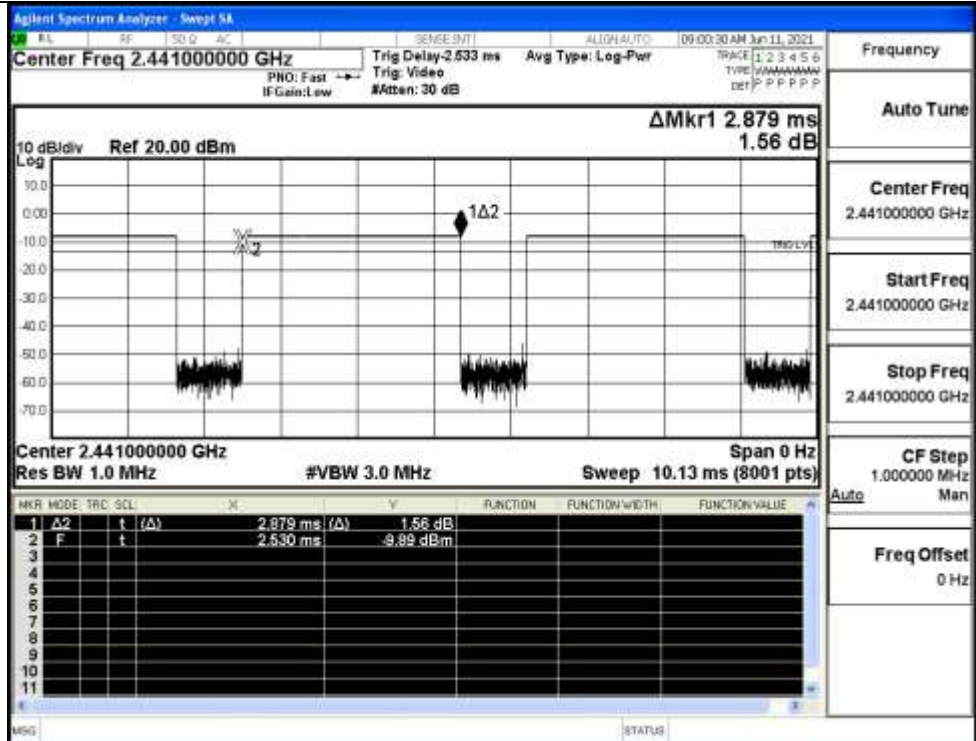
Mode	Packet	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Limit [s]	Verdict
GFSK	DH5	LCH	2.88	106.7	0.307	0.4	PASS
	DH5	MCH	2.88	106.7	0.307	0.4	PASS
	DH5	HCH	2.88	106.7	0.307	0.4	PASS
$\pi/4$ DQPSK	2DH5	LCH	2.88	106.7	0.307	0.4	PASS
	2DH5	MCH	2.88	106.7	0.308	0.4	PASS
	2DH5	HCH	2.88	106.7	0.307	0.4	PASS
8DPSK	3DH5	LCH	2.88	106.7	0.307	0.4	PASS
	3DH5	MCH	2.88	106.7	0.307	0.4	PASS
	3DH5	HCH	2.88	106.7	0.307	0.4	PASS

**Test Graphs**

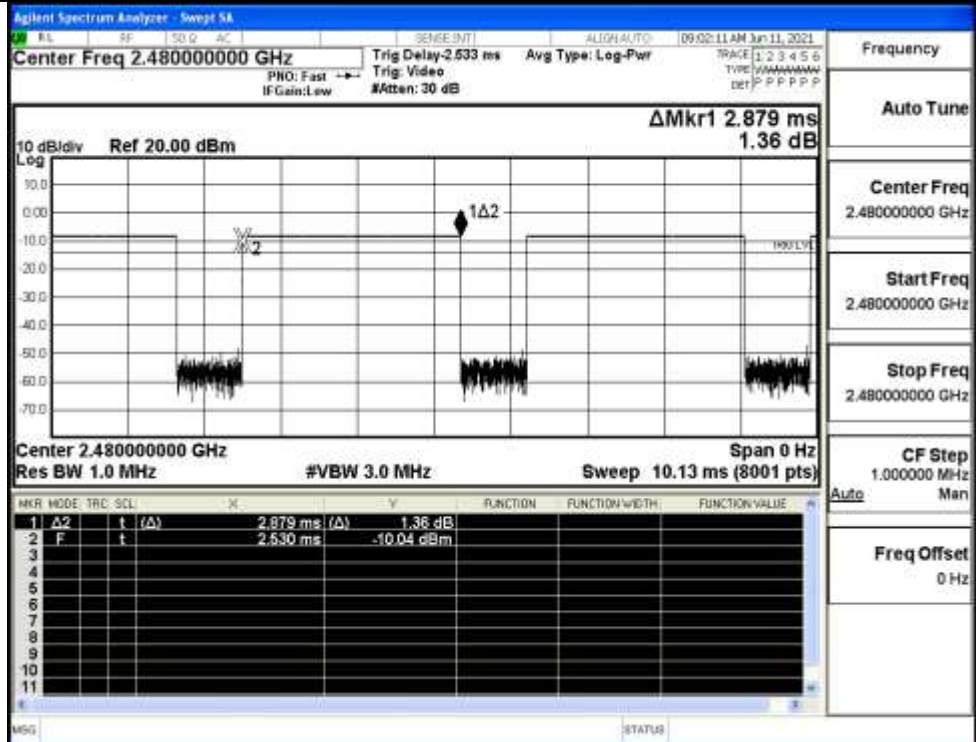
GFSK\_DH5/LCH



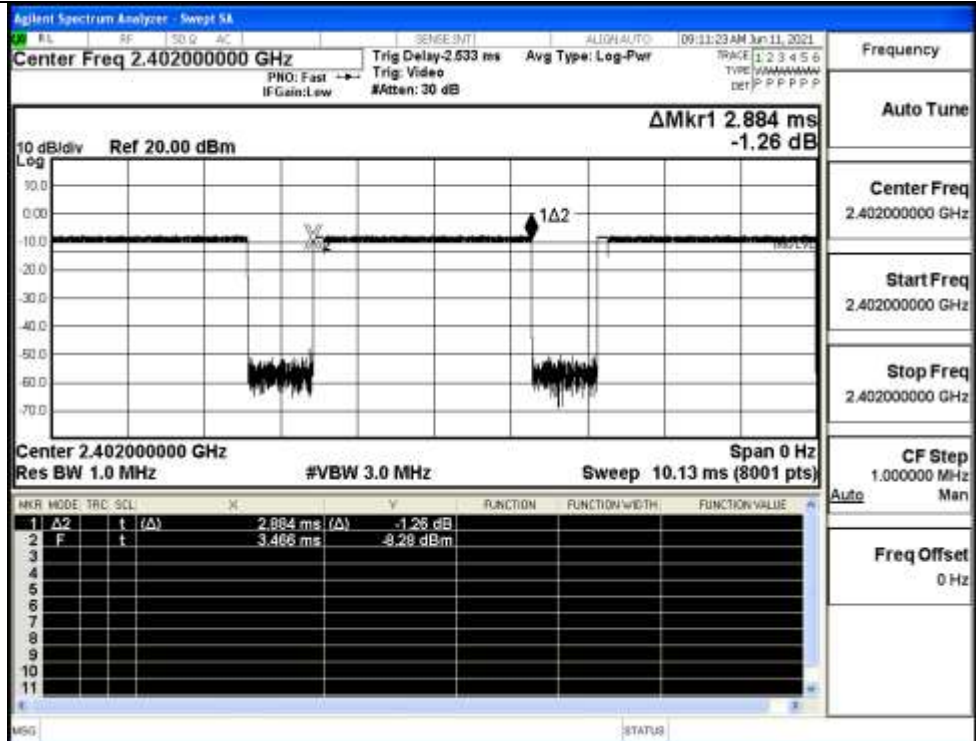
GFSK\_DH5/MCH



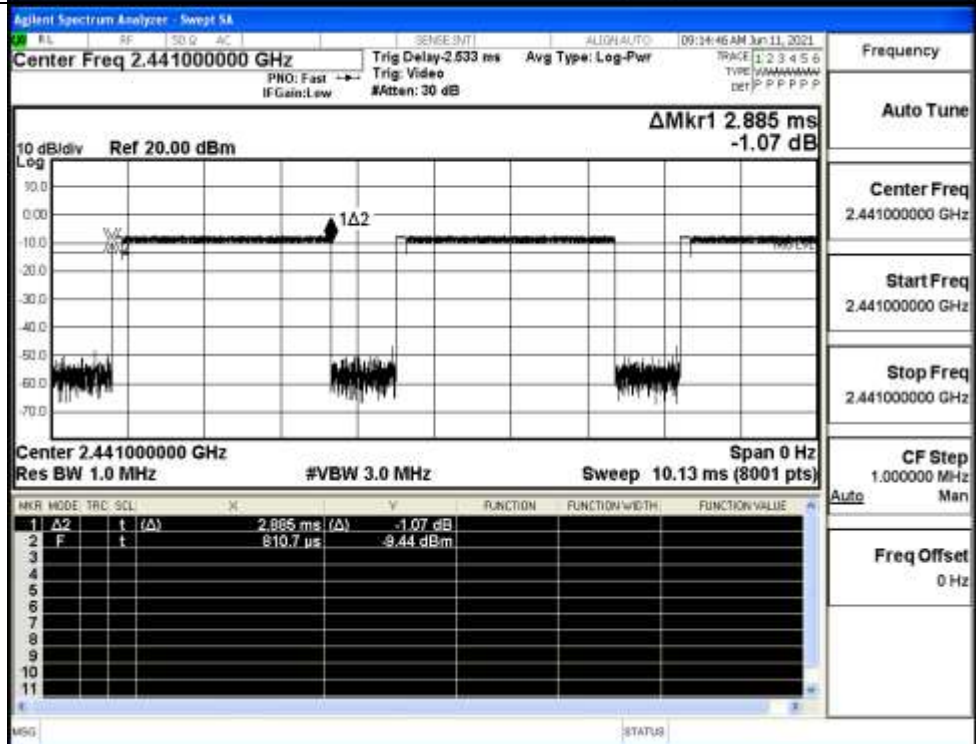
GFSK\_DH5/HCH



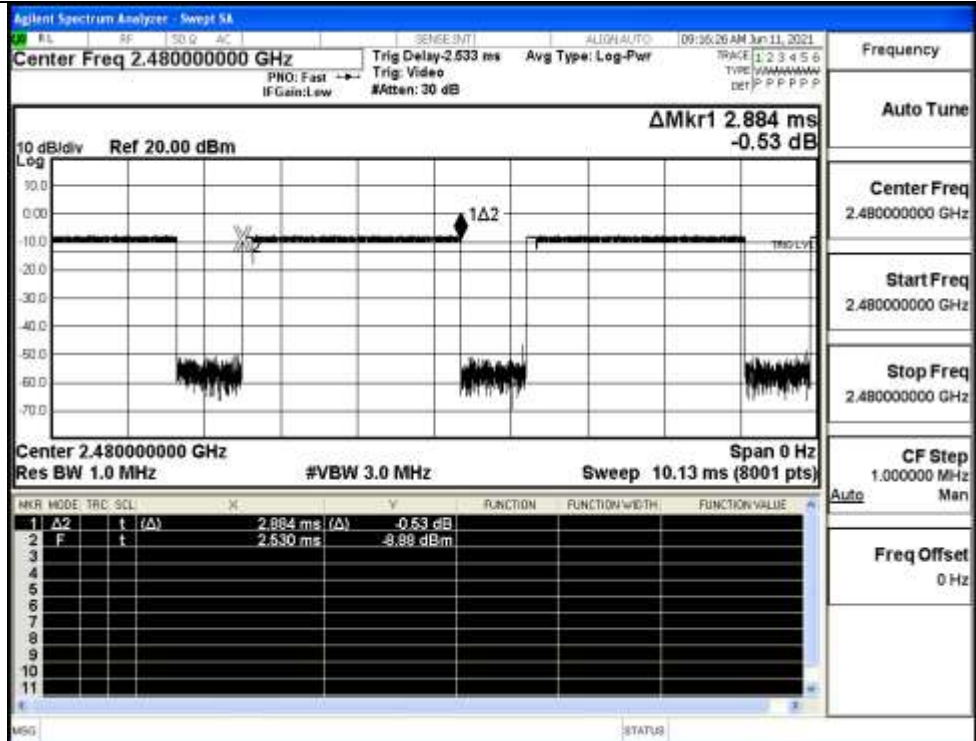
$\pi/4$ DQPSK  
\_2DH5/LCH



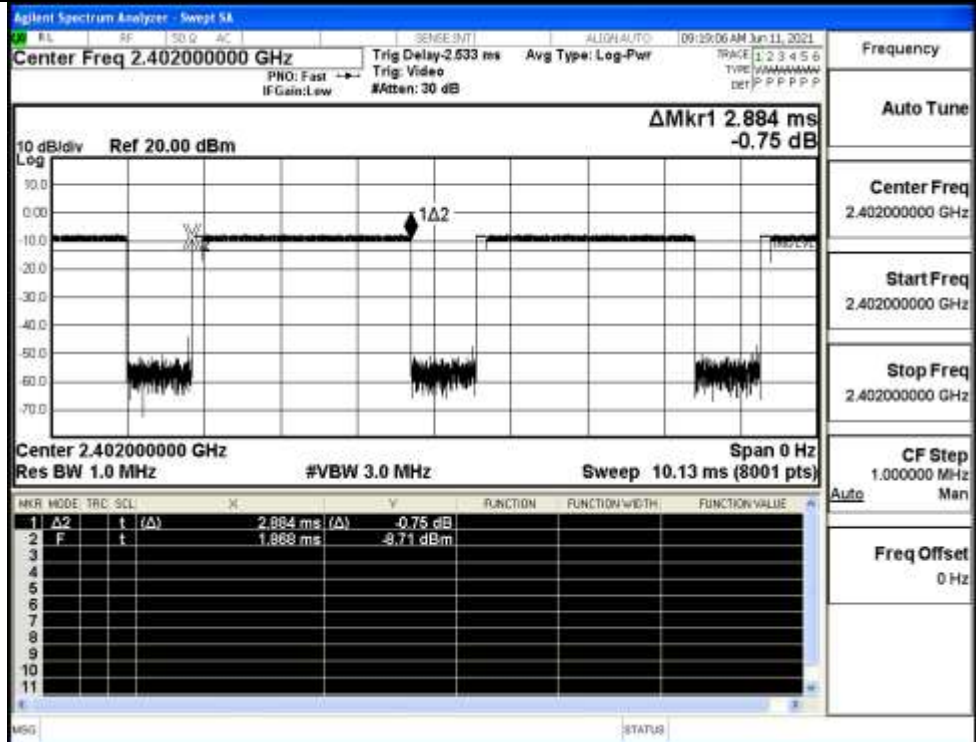
$\pi/4$ DQPSK  
\_2DH5/MCH



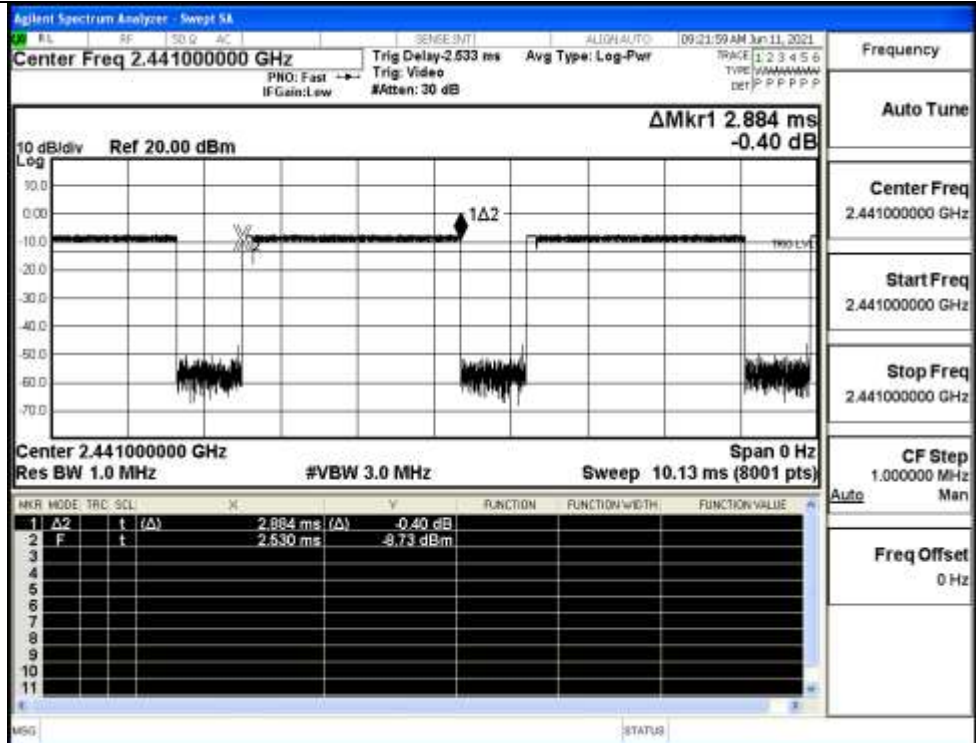
$\pi/4$ DQPSK  
\_2DH5/HCH



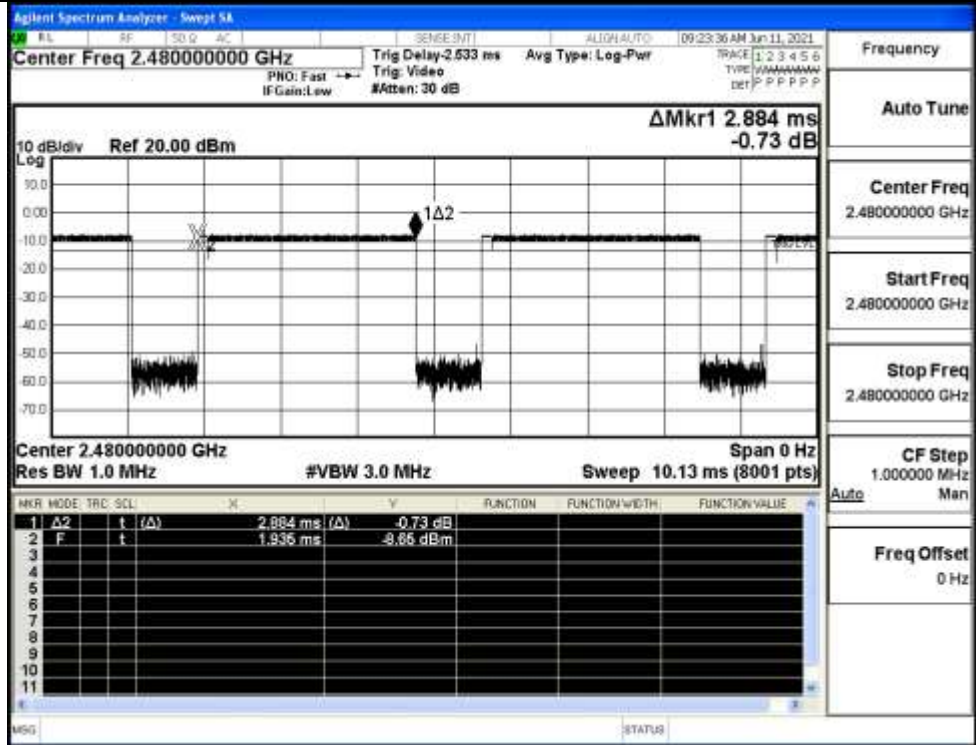
8DPSK\_3DH5/LCH



8DPSK\_3DH5/MCH



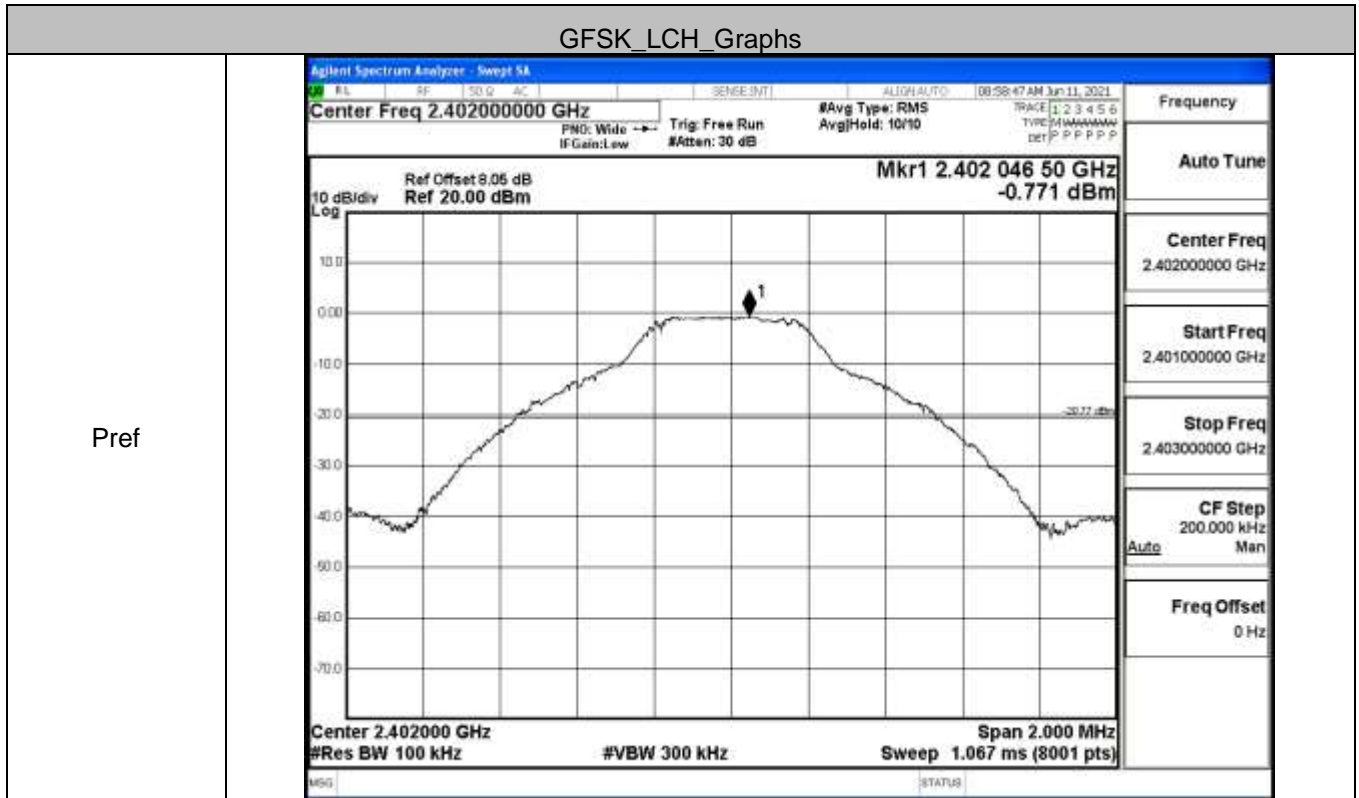
8DPSK\_3DH5/HCH



**A.6 RF Conducted Spurious Emissions**

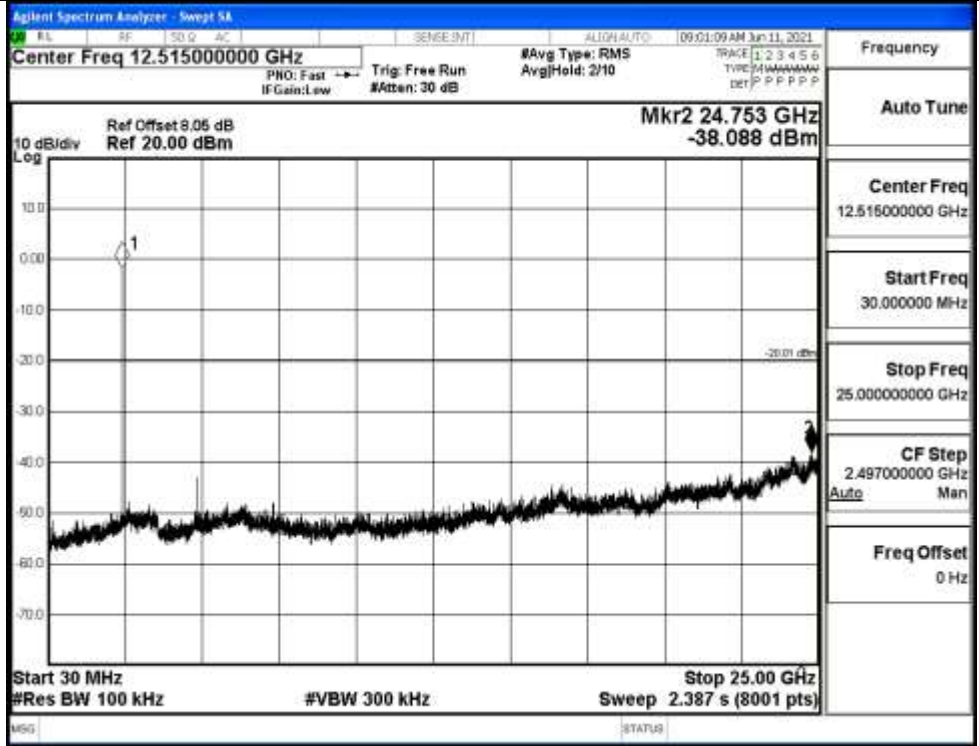
Mode	Channel	Pref [dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	-0.771	-38.088	-20.013	PASS
	MCH	-0.013	-38.088	-20.013	PASS
	HCH	-0.57	-38.099	-20.570	PASS
$\pi/4$ DQPSK	LCH	-0.318	-38.232	-20.318	PASS
	MCH	0.129	-38.682	-19.871	PASS
	HCH	-0.122	-37.507	-20.122	PASS
8DPSK	LCH	-0.095	-37.536	-20.095	PASS
	MCH	0.174	-37.517	-19.826	PASS
	HCH	-0.108	-38.025	-20.108	PASS

GFSK\_LCH\_Graphs



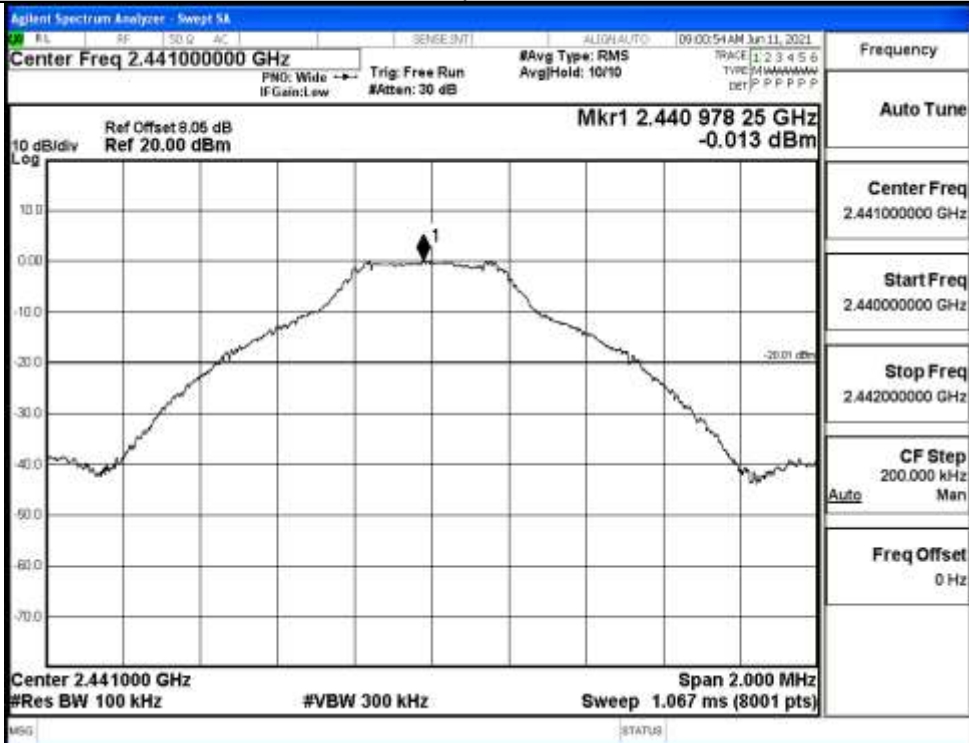


P<sub>uw</sub>

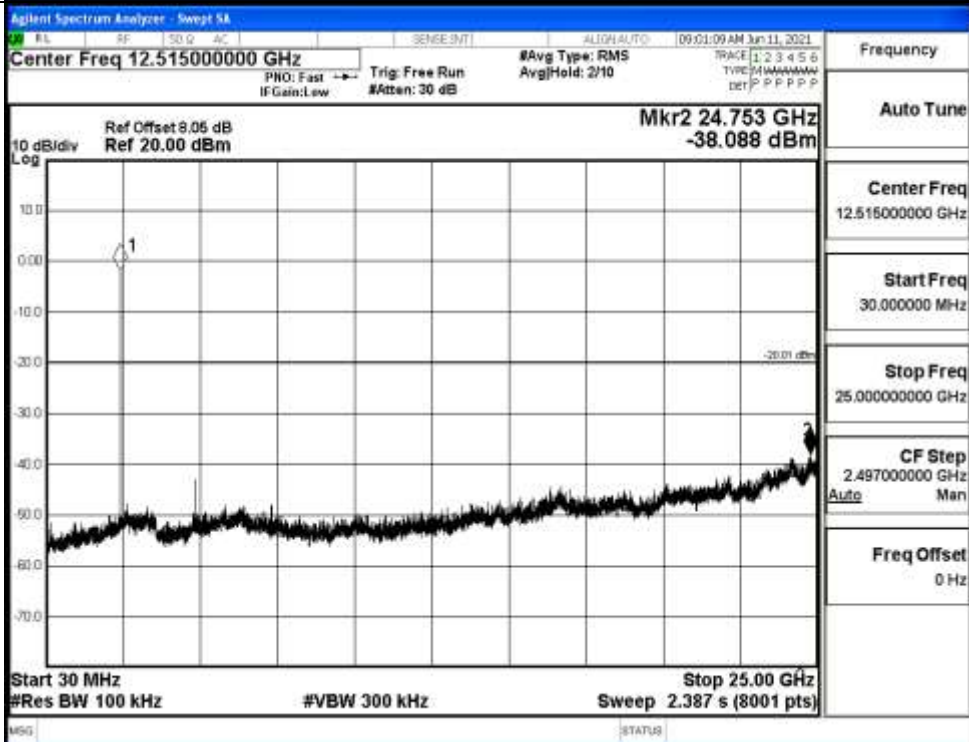


GFSK\_MCH\_Graphs

Pref

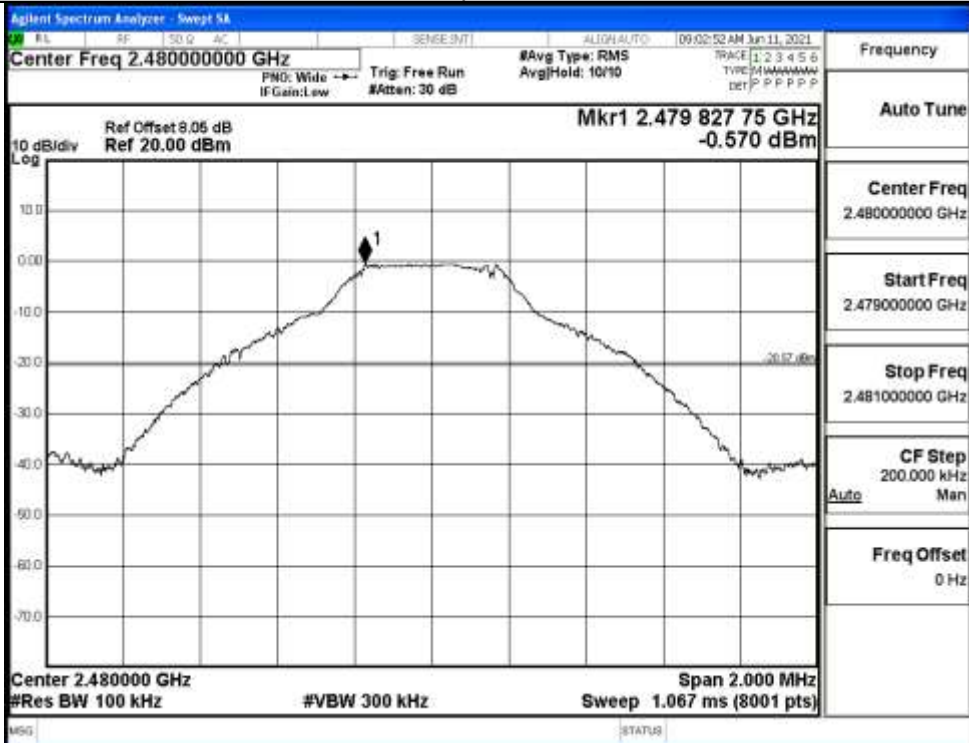


Puw

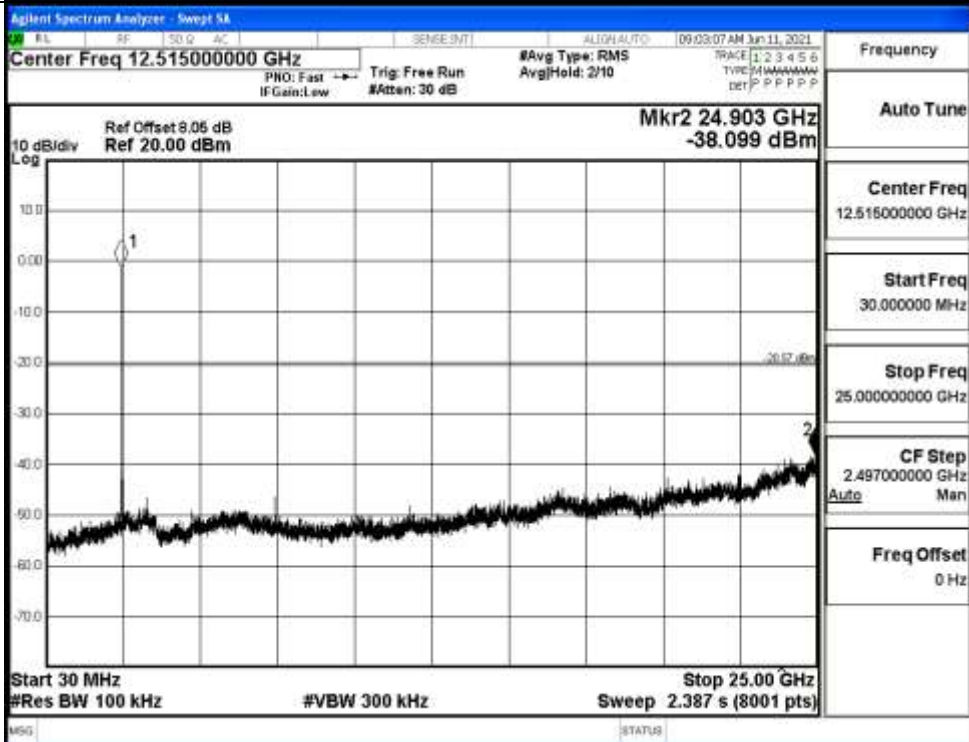


GFSK\_HCH\_Graphs

Pref

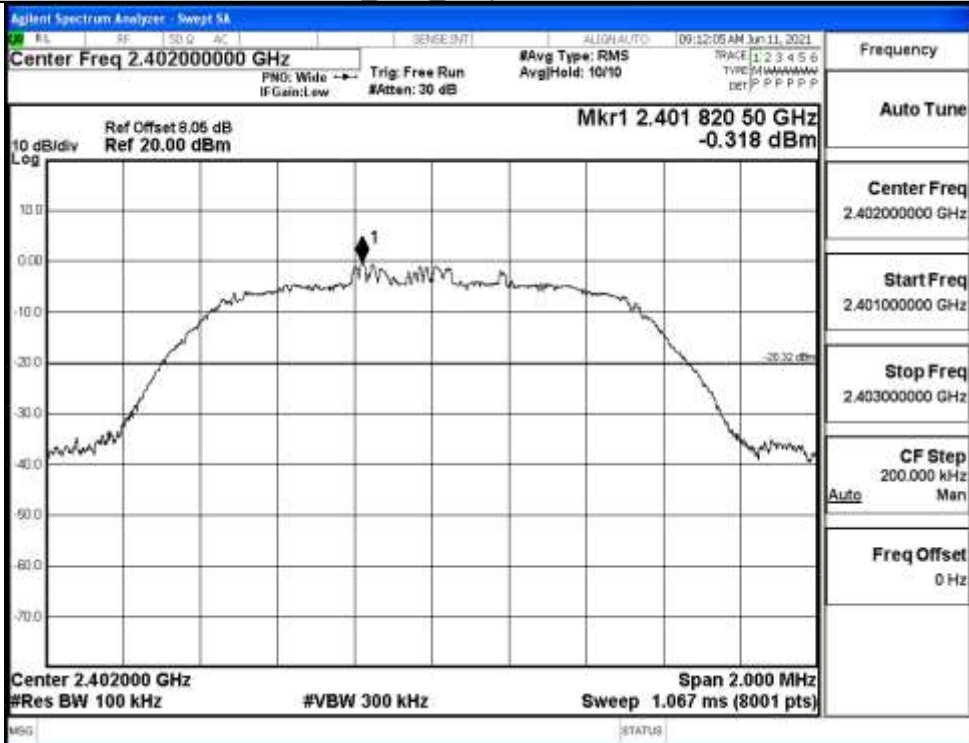


Puw

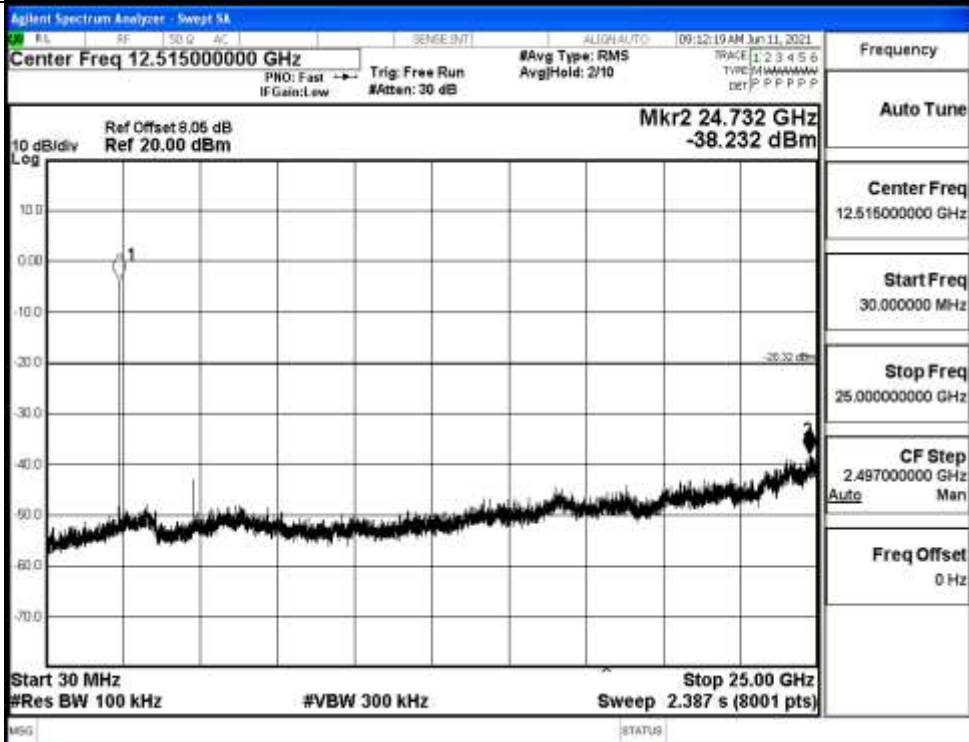


$\pi/4$ DQPSK\_LCH\_Graphs

Pref

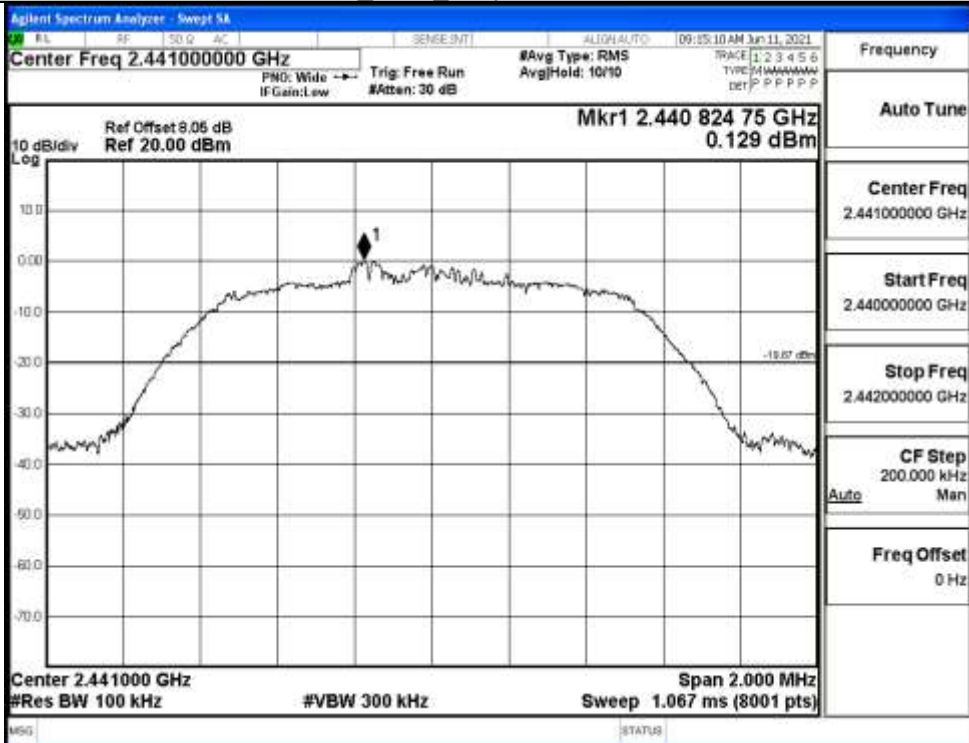


Puw

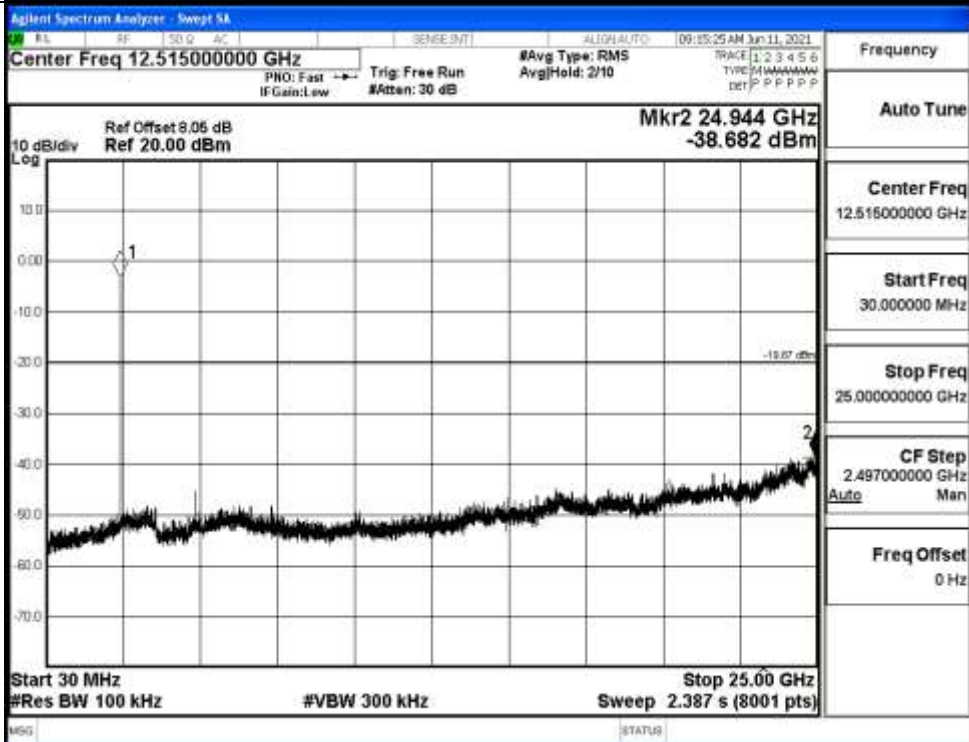


$\pi/4$ DQPSK\_MCH\_Graphs

Pref

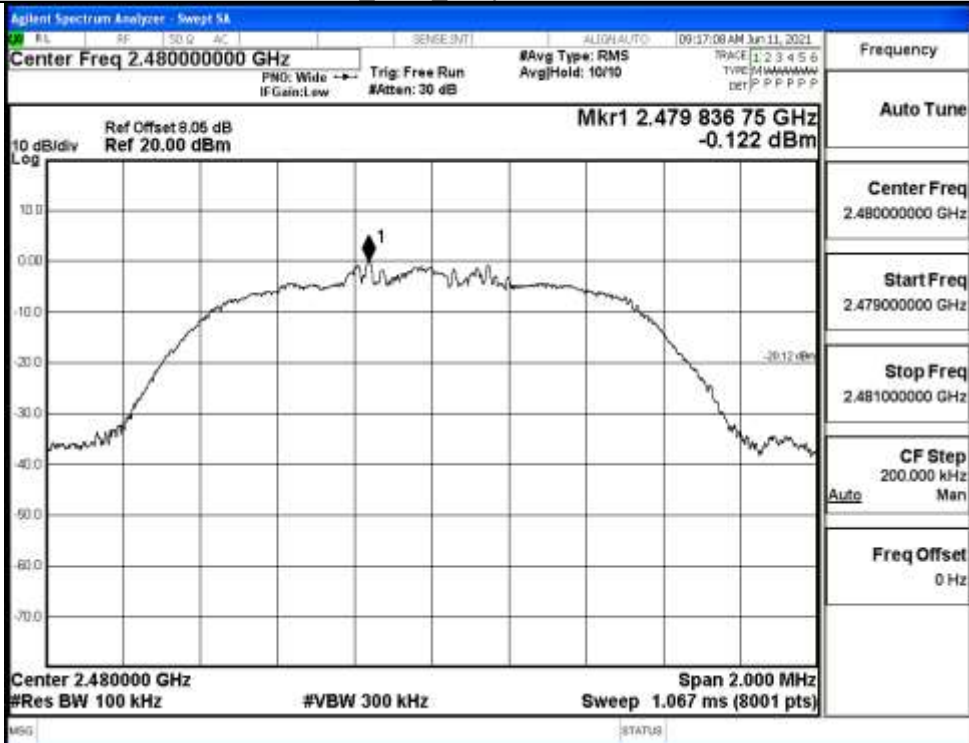


Puw

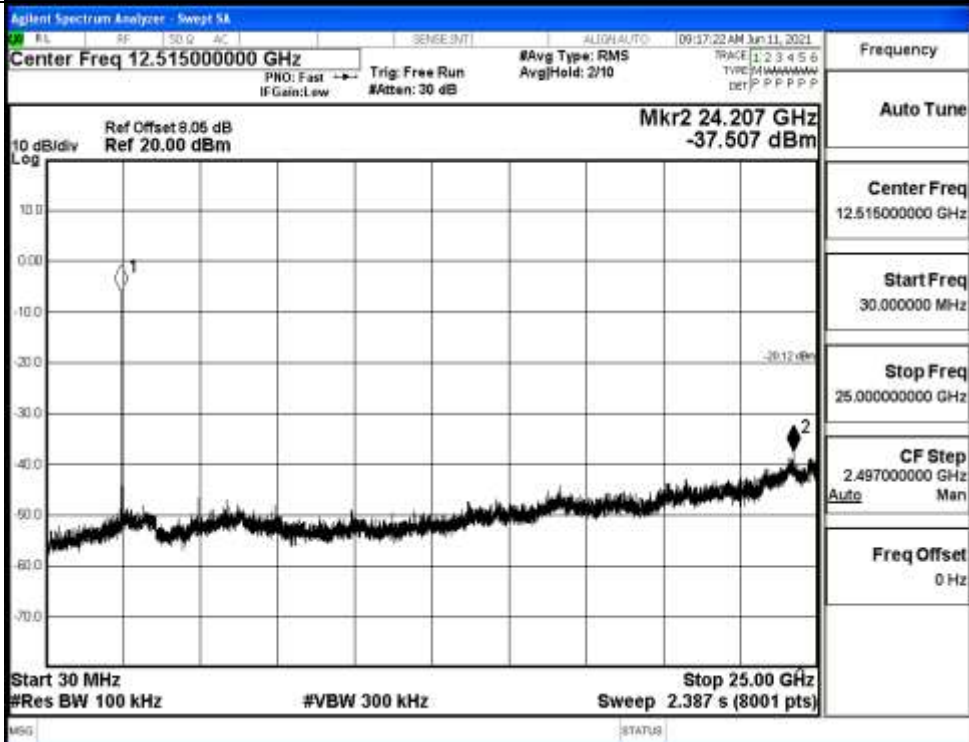


$\pi/4$ DQPSK\_HCH\_Graphs

Pref

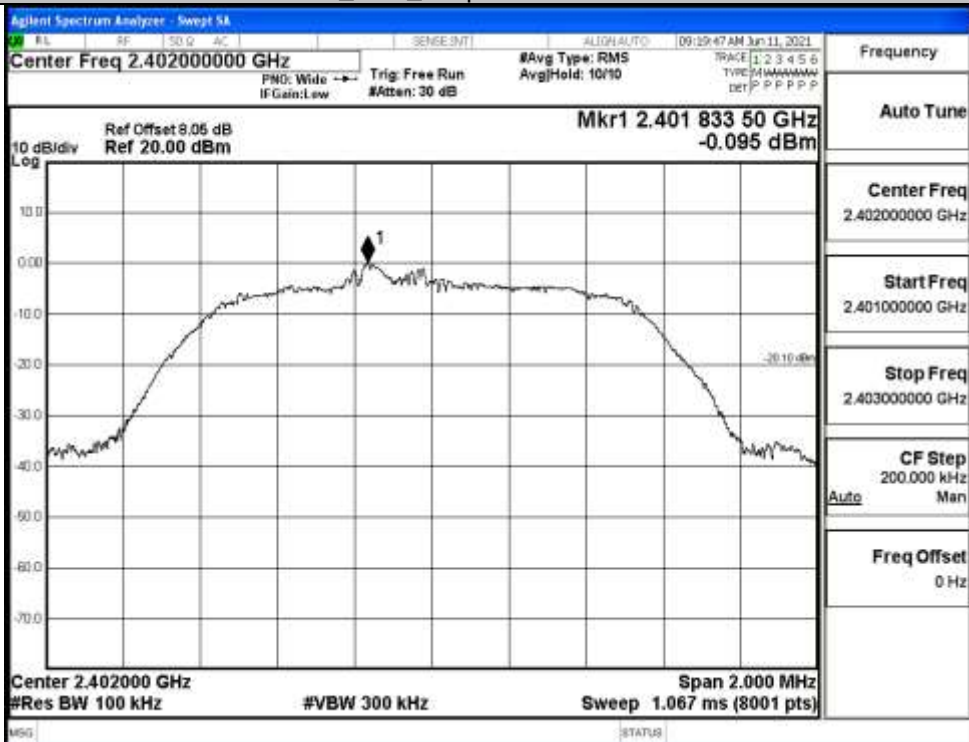


Puw

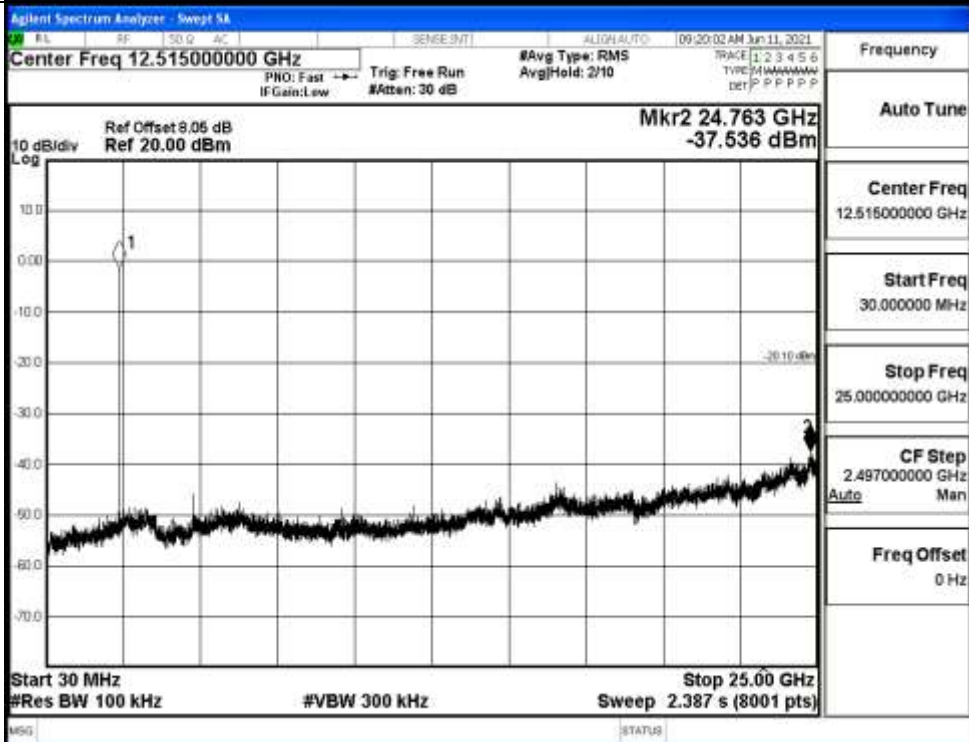


8DPSK\_LCH\_Graphs

Pref

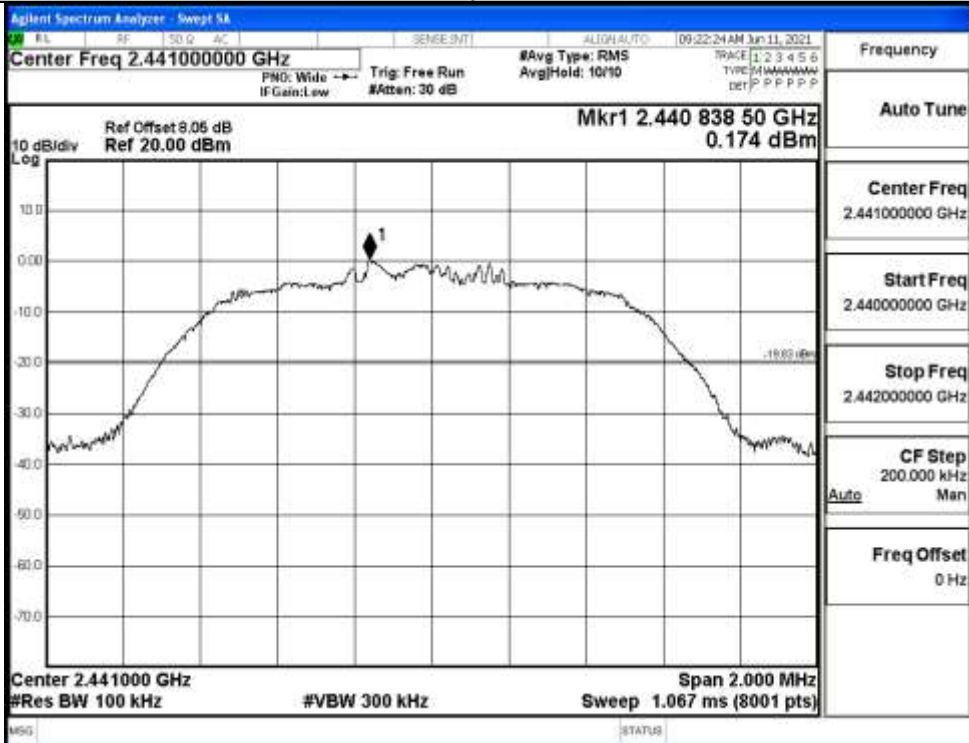


Puw

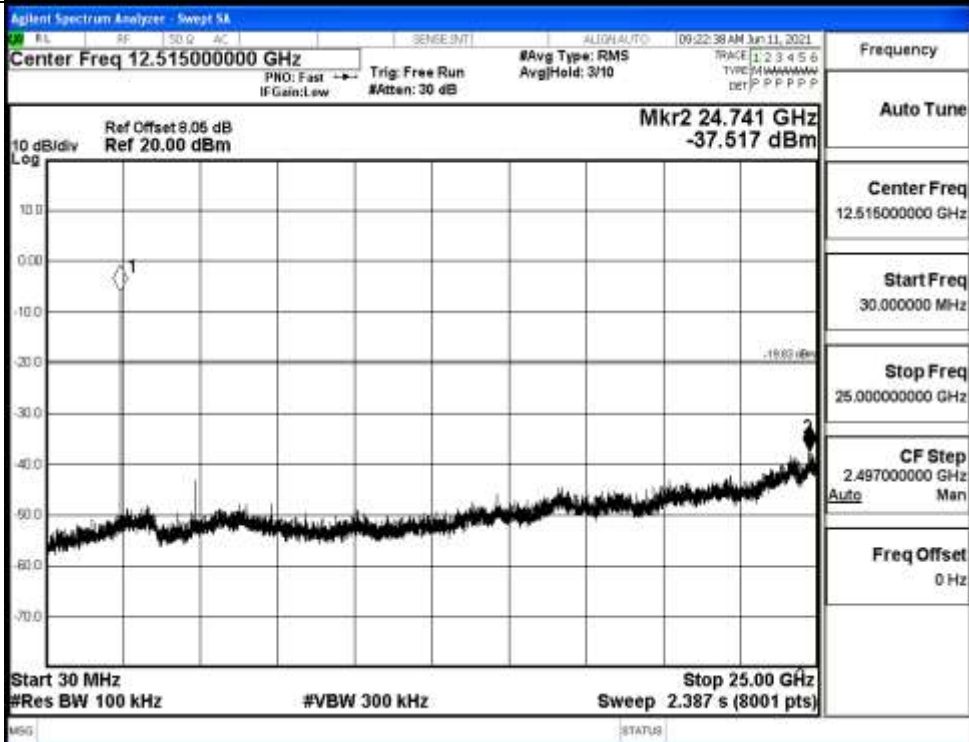


8DPSK\_MCH\_Graphs

Pref



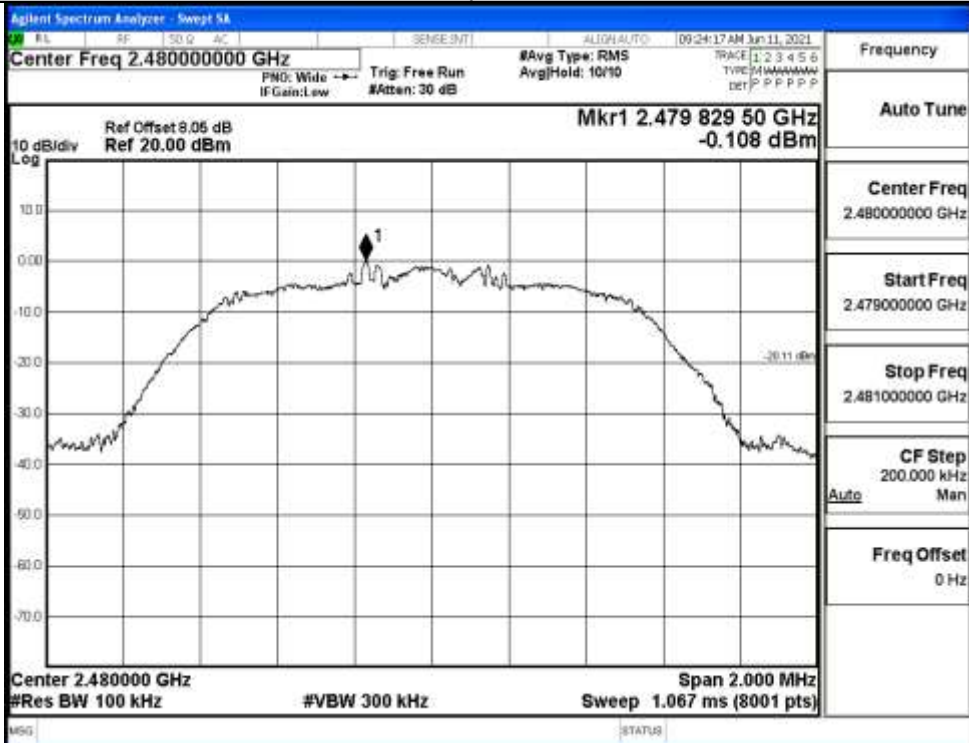
Puw



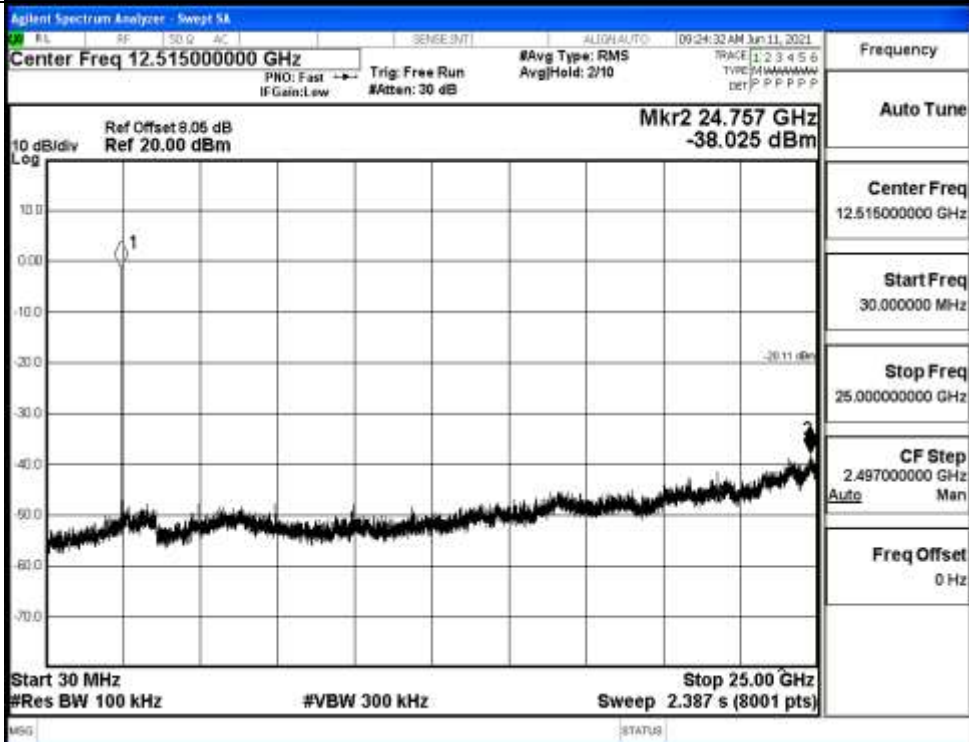


8DPSK\_HCH\_Graphs

Pref



Puw

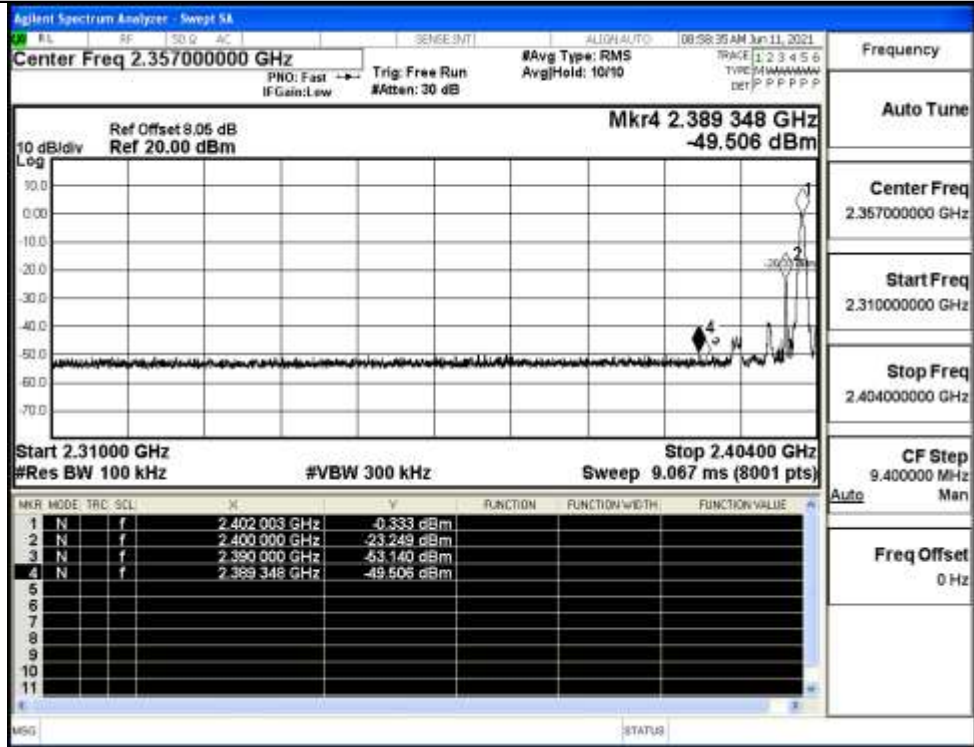


## A.7 Band-edge for RF Conducted Emissions

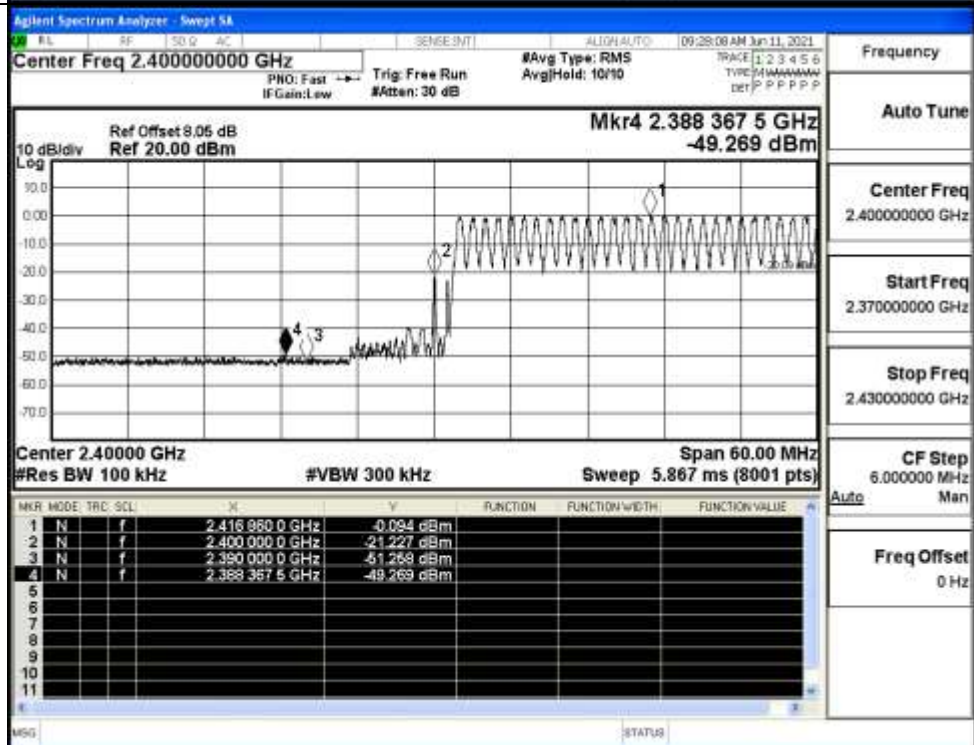
Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2402	-0.333	Off	-49.506	-20.33	PASS
			-0.094	On	-49.269	-20.09	PASS
	HCH	2480	-0.221	Off	-48.324	-20.22	PASS
			0.062	On	-48.999	-19.94	PASS
$\pi/4$ DQPSK	LCH	2402	-0.113	Off	-50.025	-20.11	PASS
			0.208	On	-48.756	-19.79	PASS
	HCH	2480	-0.650	Off	-47.589	-20.65	PASS
			0.289	On	-48.419	-19.71	PASS
8DPSK	LCH	2402	-0.294	Off	-49.320	-20.29	PASS
			0.123	On	-48.942	-19.88	PASS
	HCH	2480	-0.099	Off	-48.659	-20.1	PASS
			0.146	On	-48.780	-19.85	PASS

Test Graphs

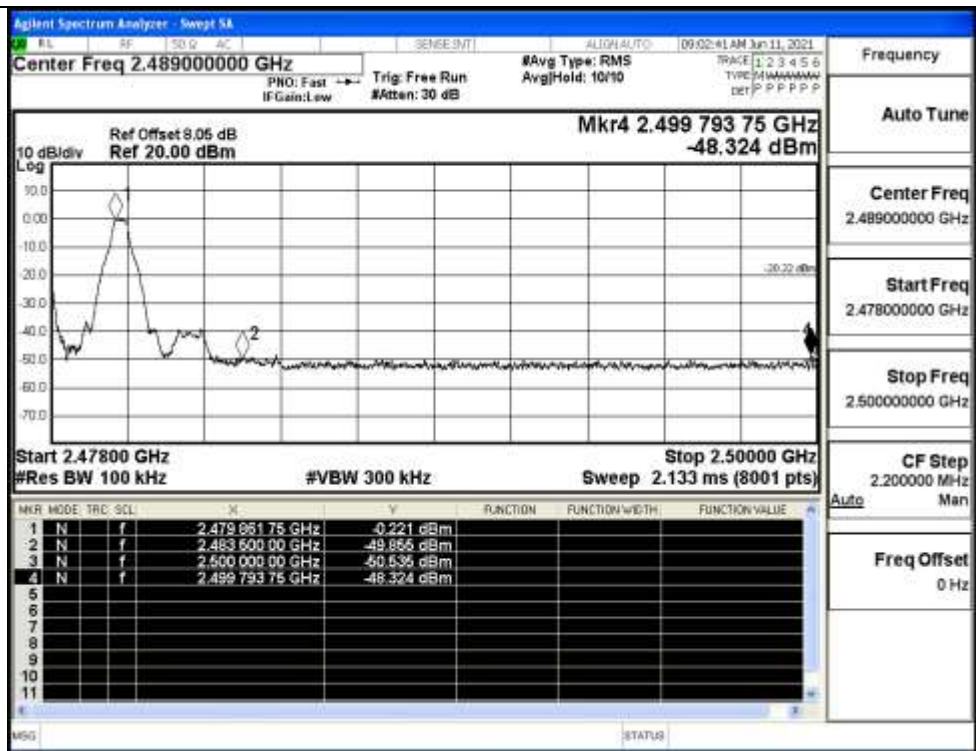
GFSK/LCH/No Hop



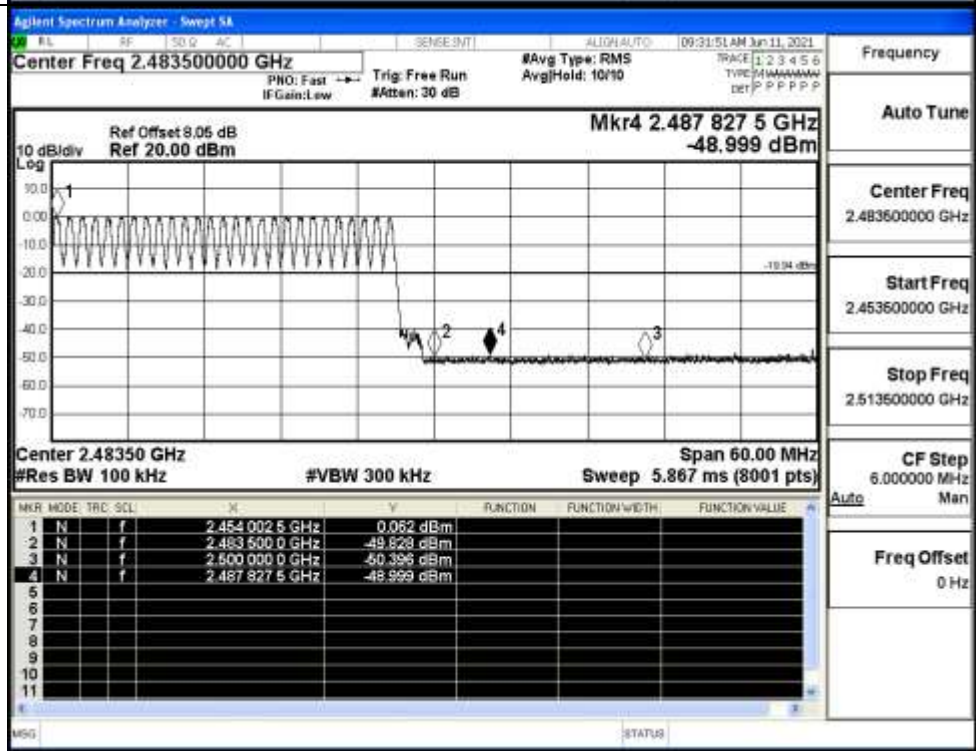
GFSK/LCH/Hop



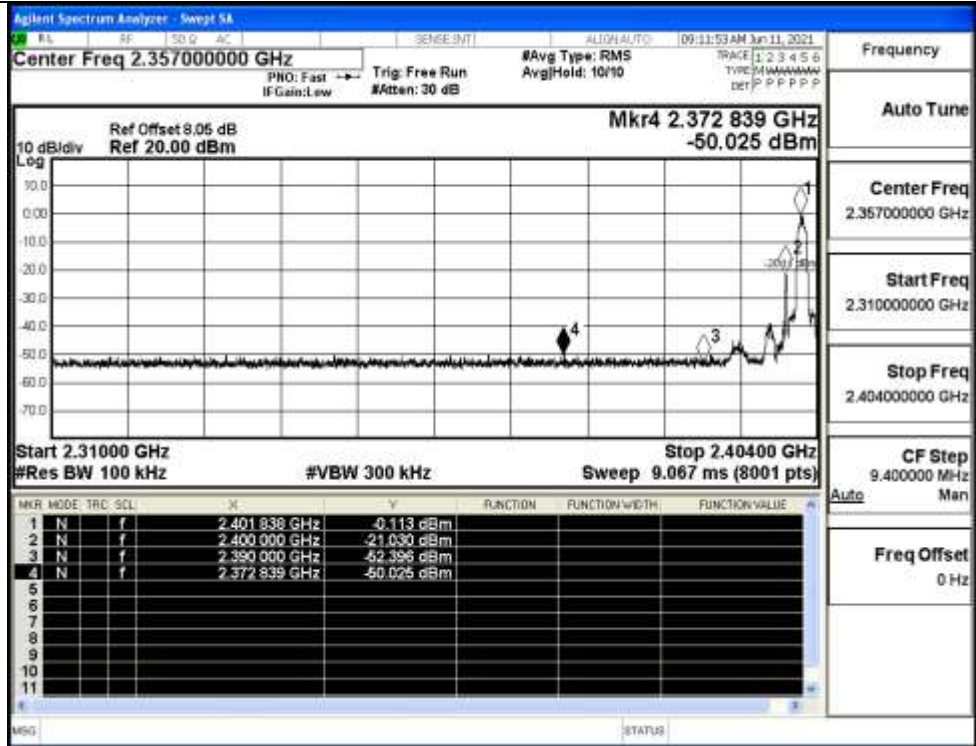
GFSK/HCH/No Hop



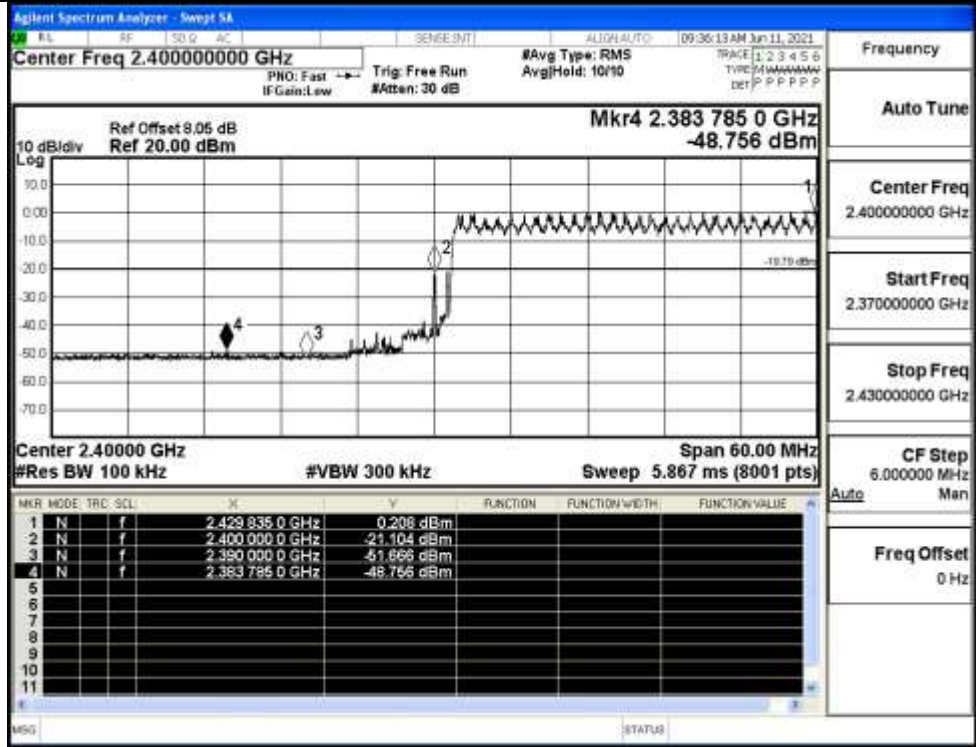
GFSK/HCH/Hop



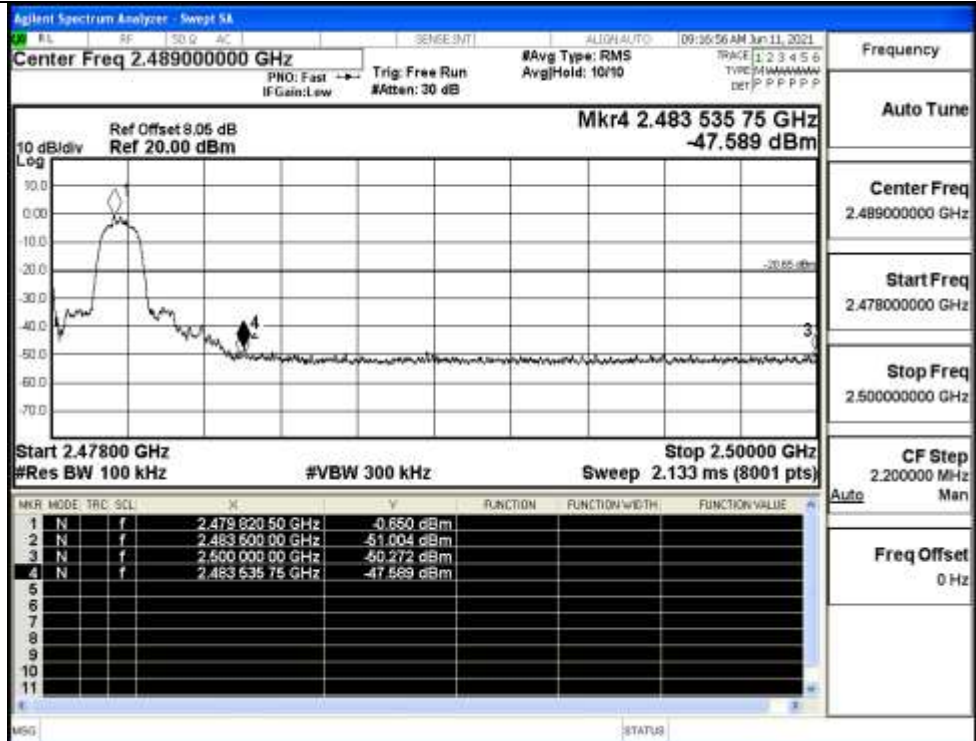
$\pi/4$ DQPSK/LCH/No Hop



$\pi/4$ DQPSK/LCH/Hop



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



Frequency

Auto Tune

Center Freq  
2.489000000 GHz

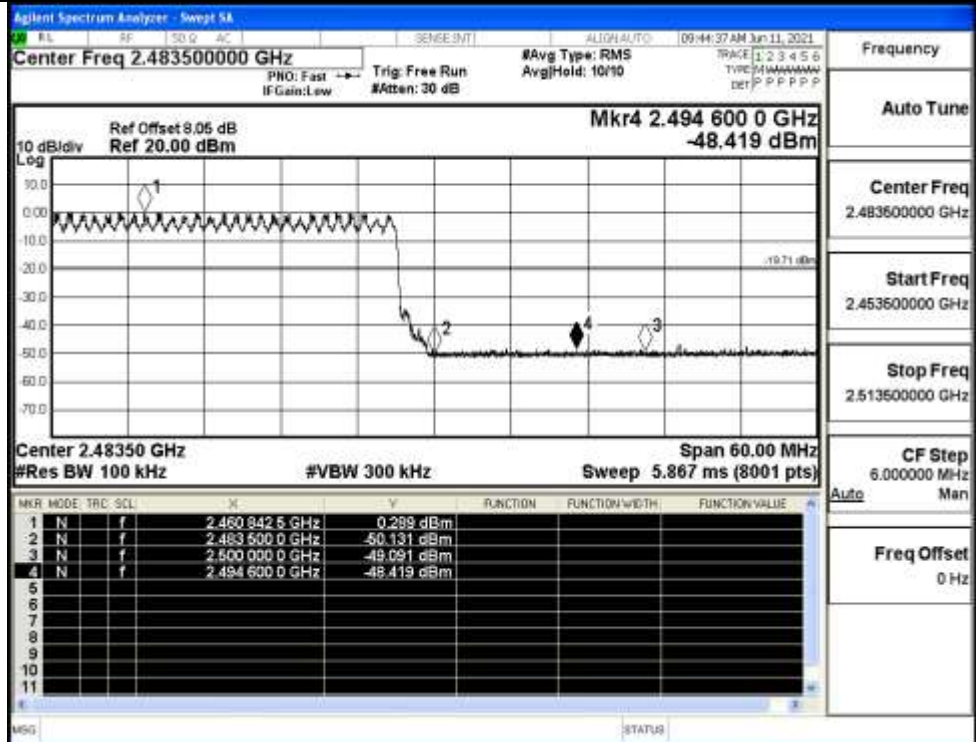
Start Freq  
2.478000000 GHz

Stop Freq  
2.500000000 GHz

CF Step  
2.200000 MHz

Freq Offset  
0 Hz

$\pi$ /4DQPSK/HCH/Hop



Frequency

Auto Tune

Center Freq  
2.483500000 GHz

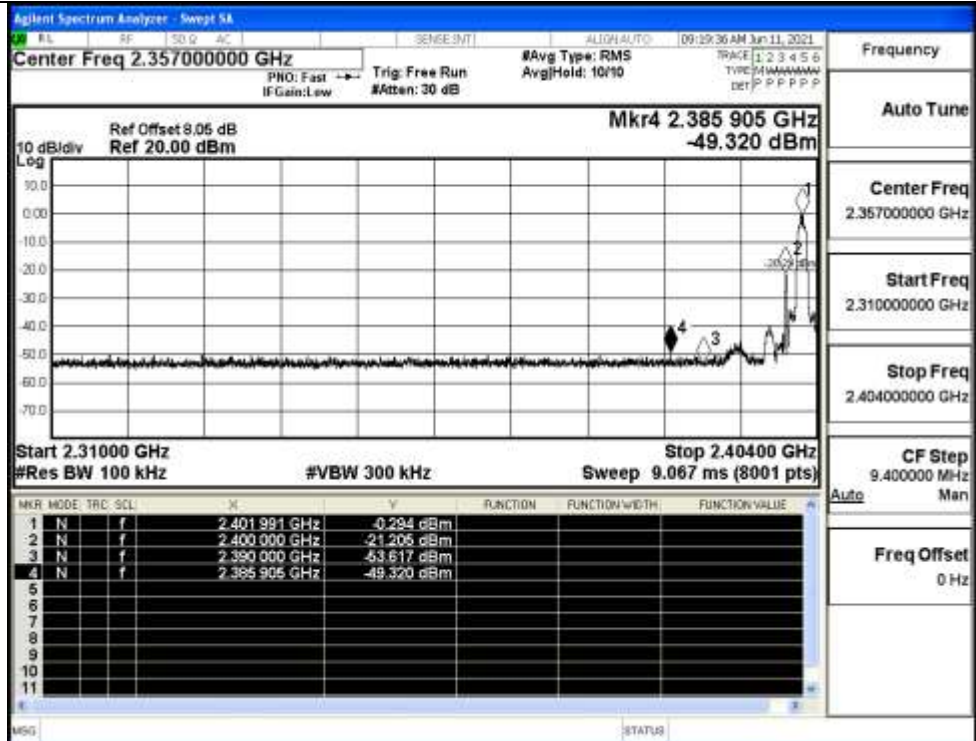
Start Freq  
2.453500000 GHz

Stop Freq  
2.513500000 GHz

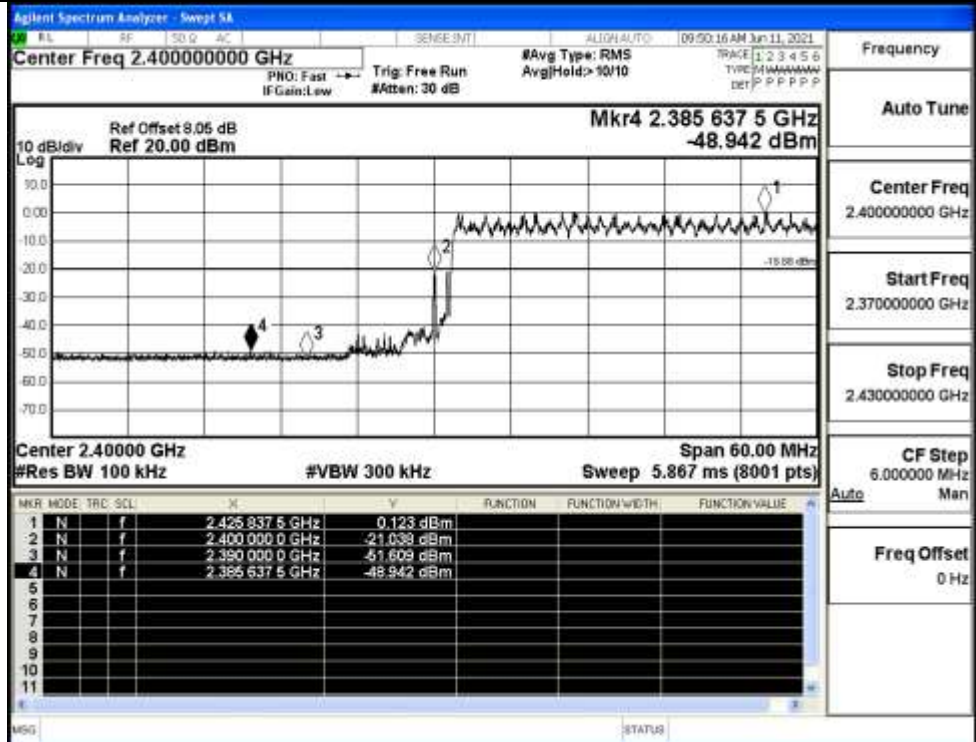
CF Step  
6.000000 MHz

Freq Offset  
0 Hz

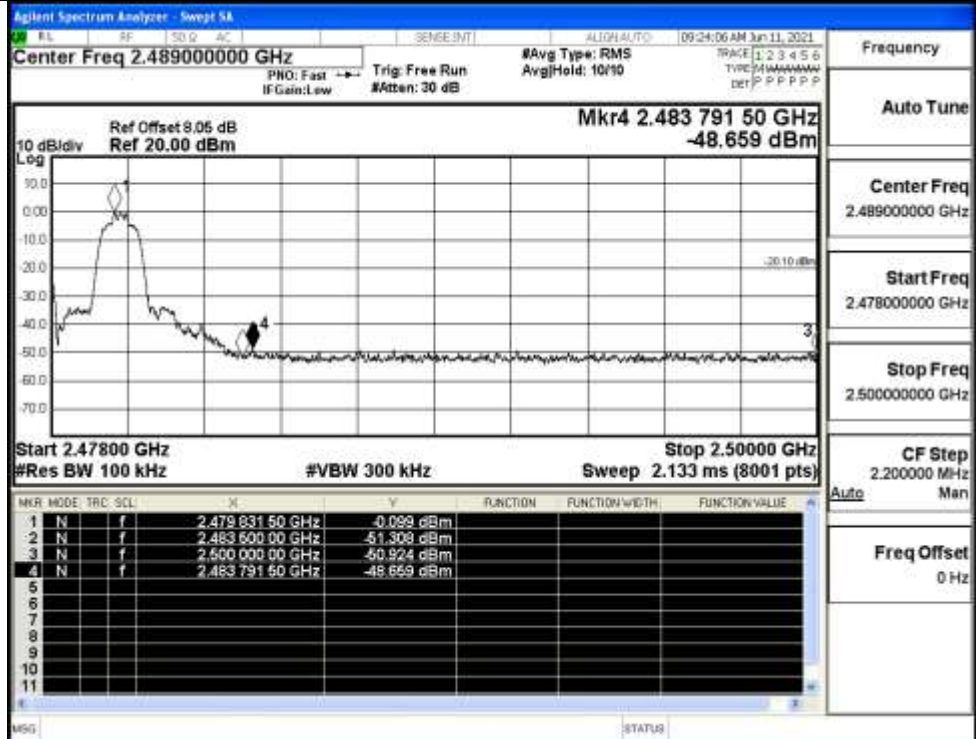
8DPSK/LCH/No Hop



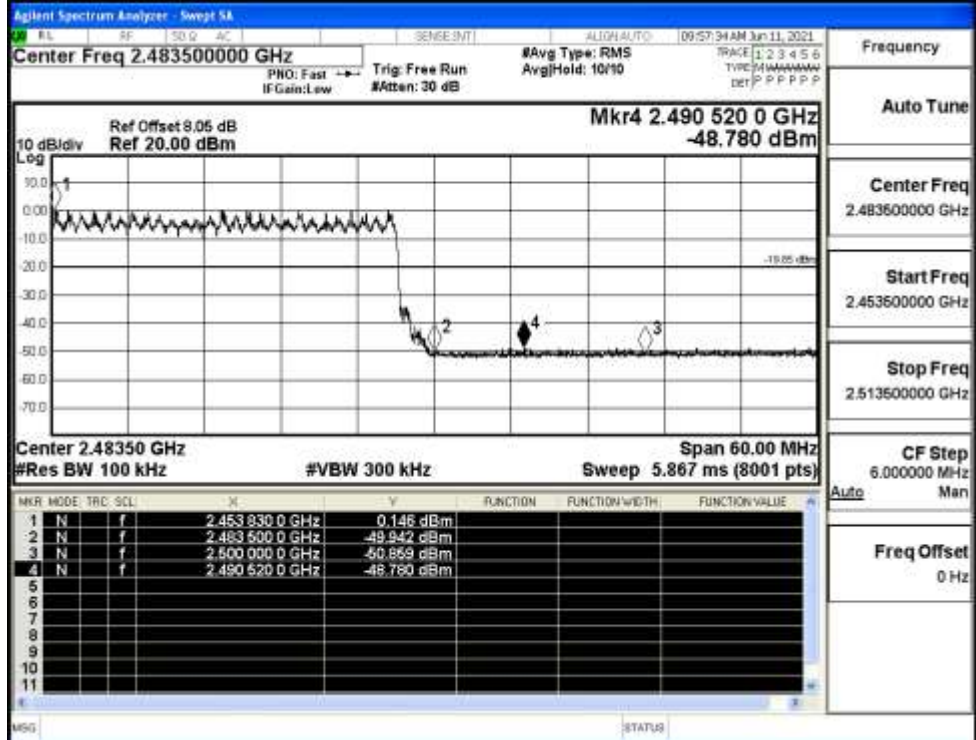
8DPSK/LCH/Hop



8DPSK/HCH/No Hop



8DPSK/HCH/Hop

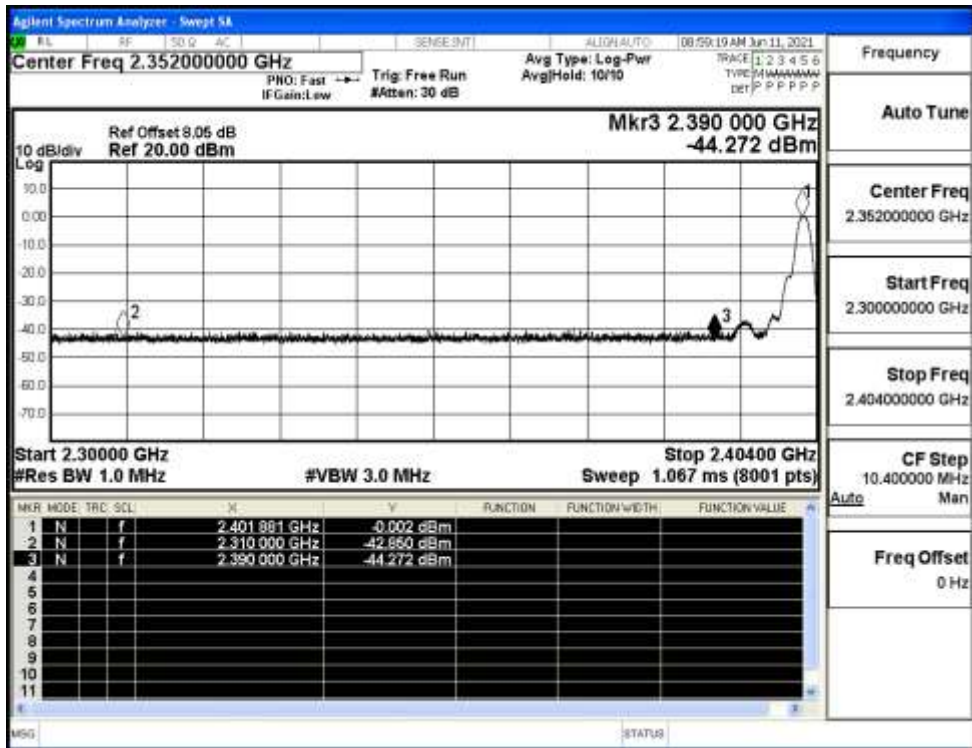




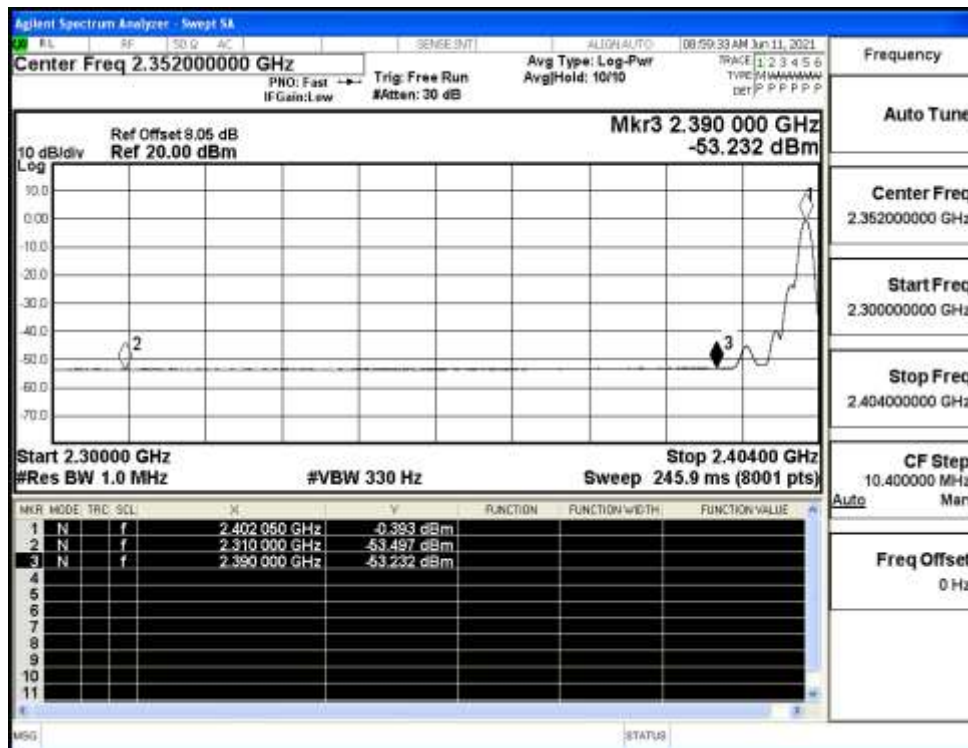
## A.8 Restrict-band band-edge measurements

Test Mode	Hopping	Freq.	Power [dBm]	Gain	Ground Factor	E [dBuV/m]	Detector	Limit [dBuV/m]	Verdict
GFSK	Off	2310.0	-42.85	3	0	55.38	PEAK	74	PASS
	Off	2310.0	-53.50	3	0	44.73	AV	54	PASS
	Off	2390.0	-44.27	3	0	53.96	PEAK	74	PASS
	Off	2390.0	-53.23	3	0	45.00	AV	54	PASS
	Off	2483.5	-41.08	3	0	57.15	PEAK	74	PASS
	Off	2483.5	-50.40	3	0	47.83	AV	54	PASS
	Off	2500.0	-42.70	3	0	55.53	PEAK	74	PASS
	Off	2500.0	-52.51	3	0	45.72	AV	54	PASS
$\pi/4$ DQPSK	Off	2310.0	-44.16	3	0	54.07	PEAK	74	PASS
	Off	2310.0	-53.47	3	0	44.76	AV	54	PASS
	Off	2390.0	-42.93	3	0	55.30	PEAK	74	PASS
	Off	2390.0	-53.08	3	0	45.15	AV	54	PASS
	Off	2483.5	-41.14	3	0	57.09	PEAK	74	PASS
	Off	2483.5	-50.33	3	0	47.90	AV	54	PASS
	Off	2500.0	-42.68	3	0	55.55	PEAK	74	PASS
	Off	2500.0	-52.42	3	0	45.81	AV	54	PASS
8DPSK	Off	2310.0	-43.98	3	0	54.25	PEAK	74	PASS
	Off	2310.0	-53.53	3	0	44.70	AV	54	PASS
	Off	2390.0	-42.67	3	0	55.56	PEAK	74	PASS
	Off	2390.0	-53.12	3	0	45.11	AV	54	PASS
	Off	2483.5	-40.61	3	0	57.62	PEAK	74	PASS
	Off	2483.5	-50.39	3	0	47.84	AV	54	PASS
	Off	2500.0	-41.85	3	0	56.38	PEAK	74	PASS
	Off	2500.0	-52.48	3	0	45.75	AV	54	PASS

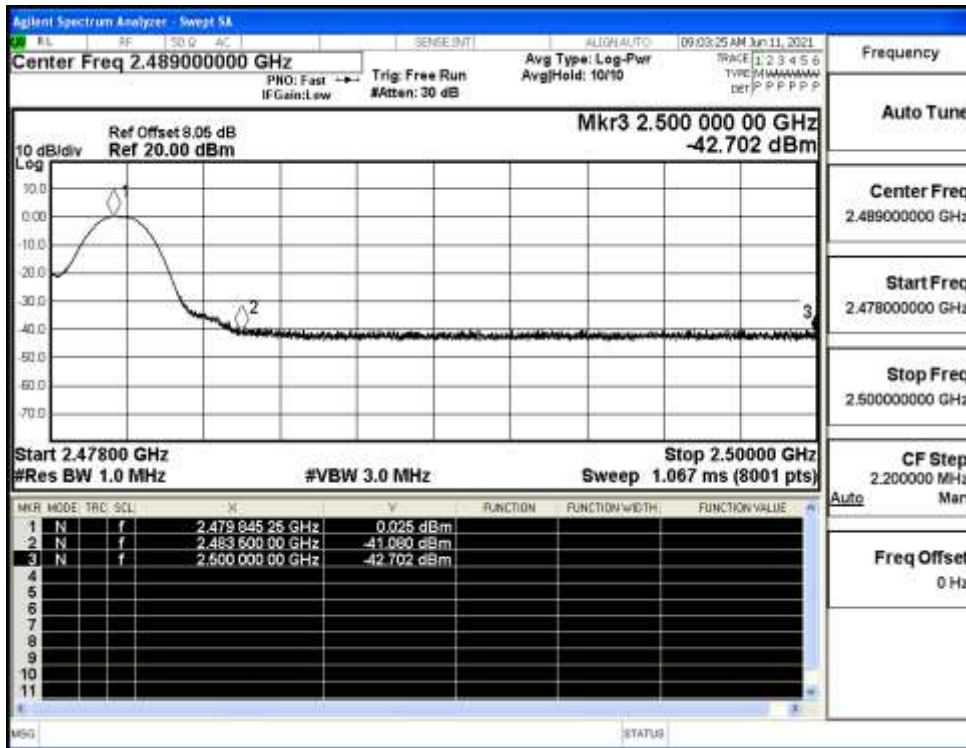
Restrict-band band-edge measurements\_Hopping Off\_GFSK\_PEAK (Low Channel)



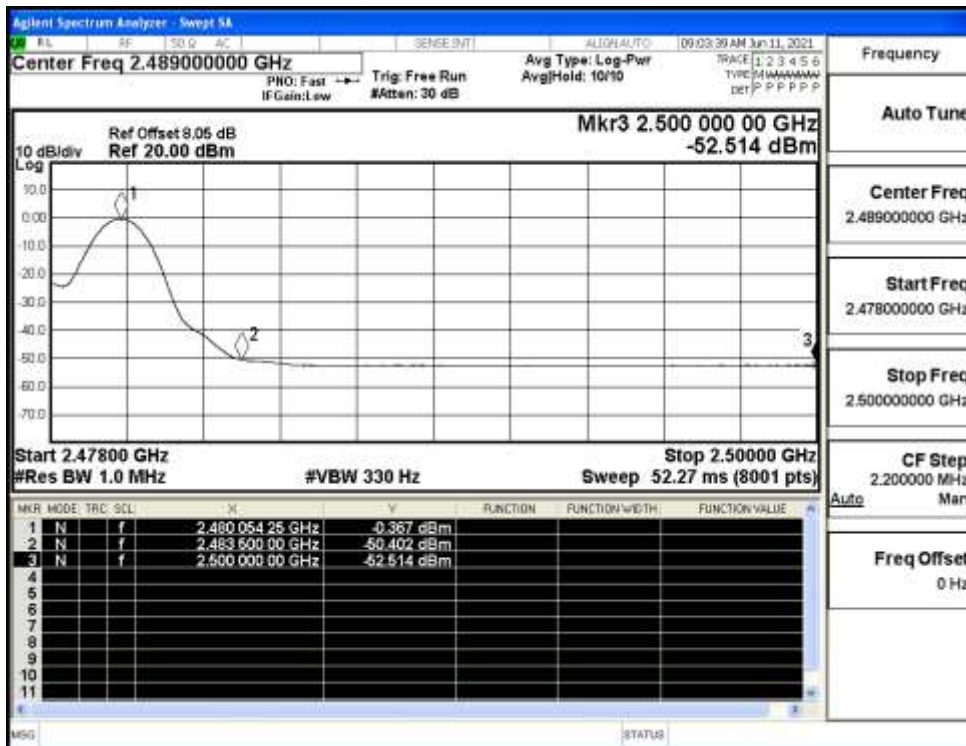
Restrict-band band-edge measurements\_Hopping Off\_GFSK\_Average (Low Channel)



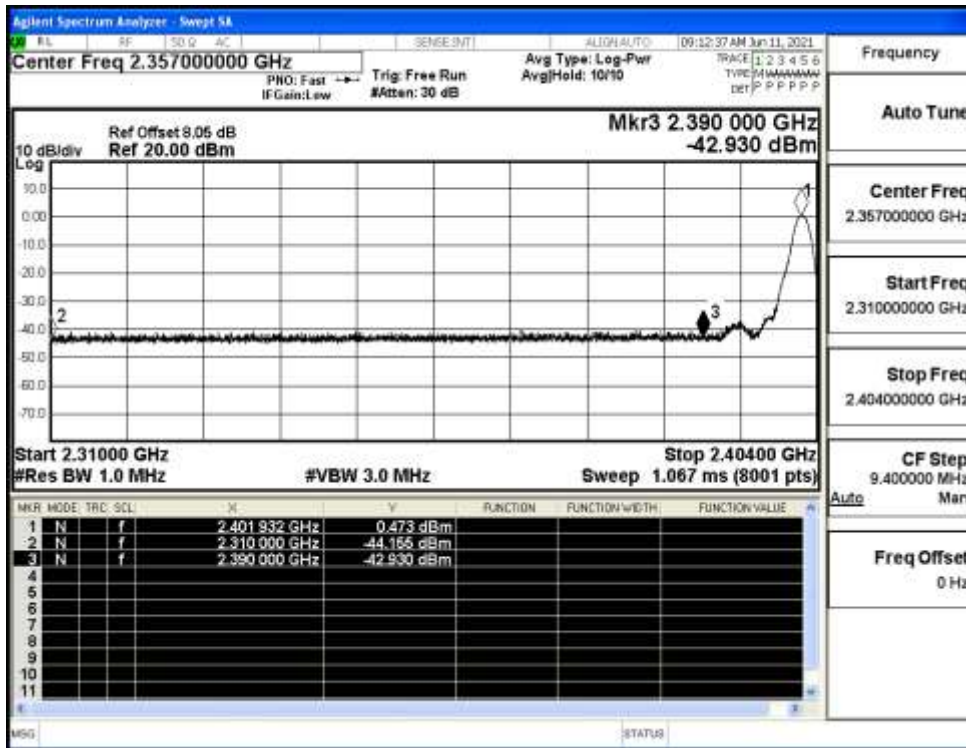
Restrict-band band-edge measurements\_Hopping Off\_ GFSK\_PEAK (High Channel)



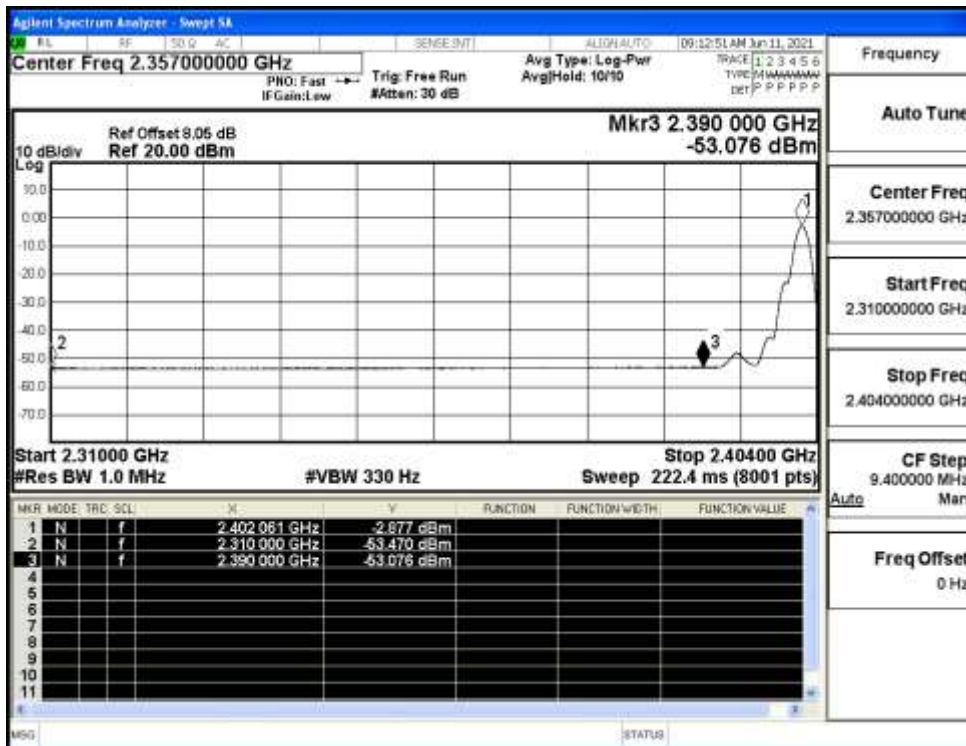
Restrict-band band-edge measurements\_Hopping Off\_ GFSK\_Average (High Channel)



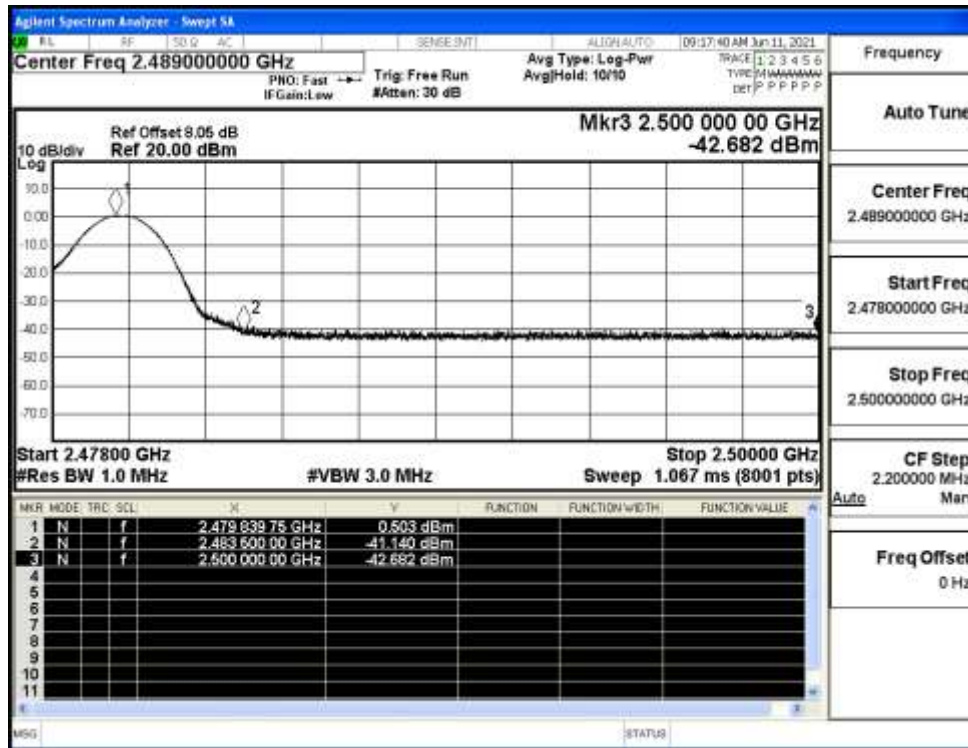
Restrict-band band-edge measurements\_Hopping Off  $\pi/4$ -DQPSK\_PEAK (Low Channel)



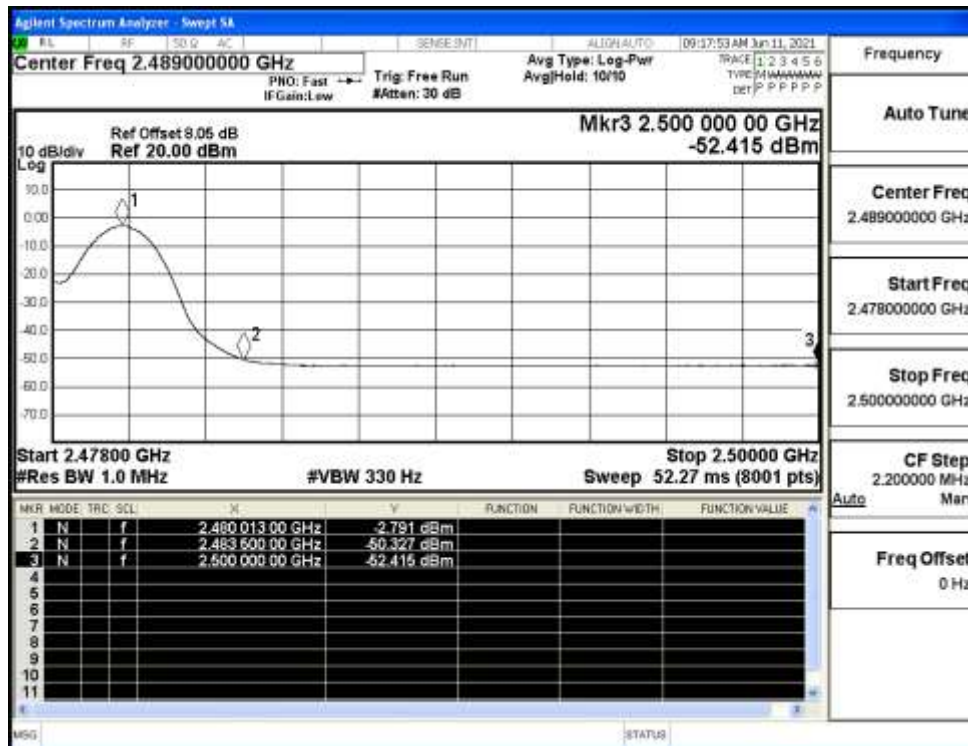
Restrict-band band-edge measurements\_Hopping Off  $\pi/4$ -DQPSK\_Average (Low Channel)



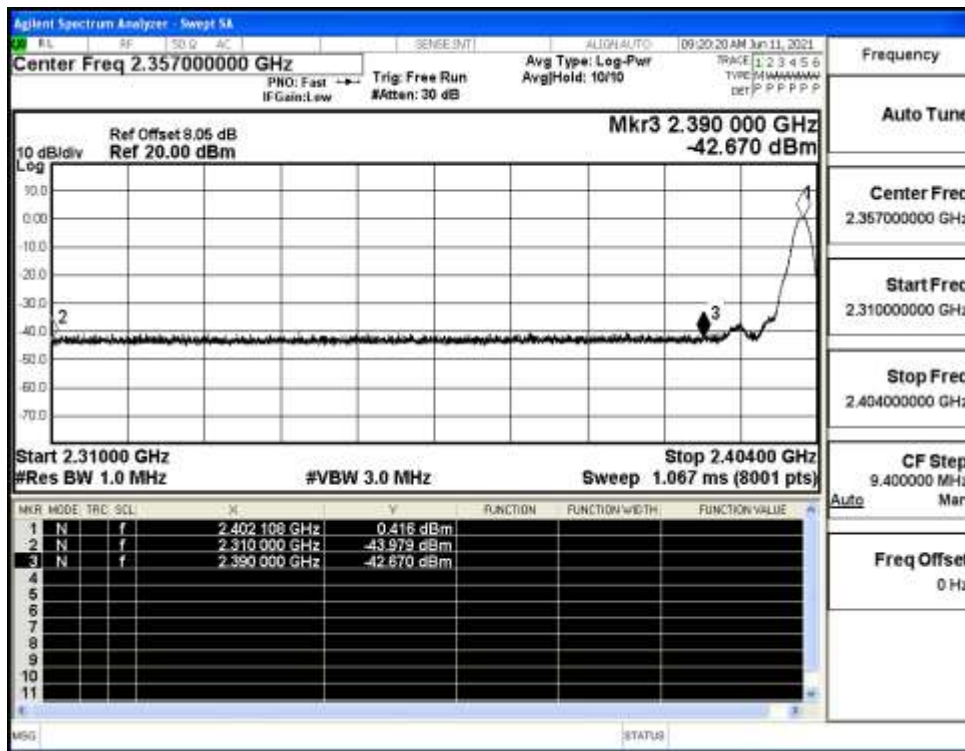
Restrict-band band-edge measurements\_Hopping Off  $\pi/4$ -DQPSK\_PEAK (High Channel)



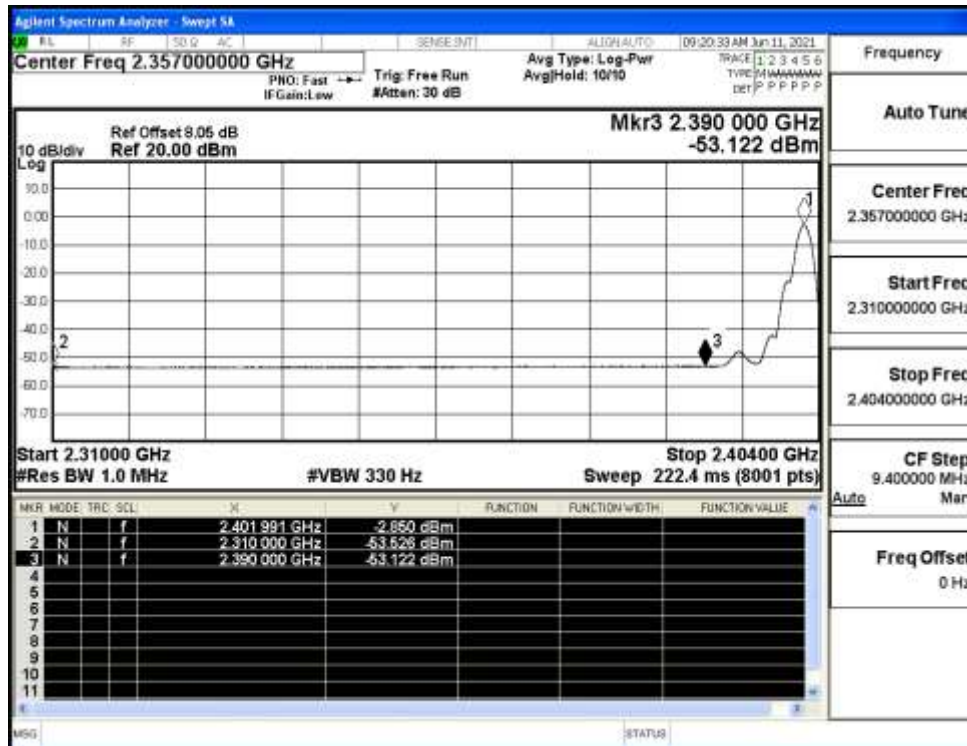
Restrict-band band-edge measurements\_Hopping Off  $\pi/4$ -DQPSK\_Average (High Channel)



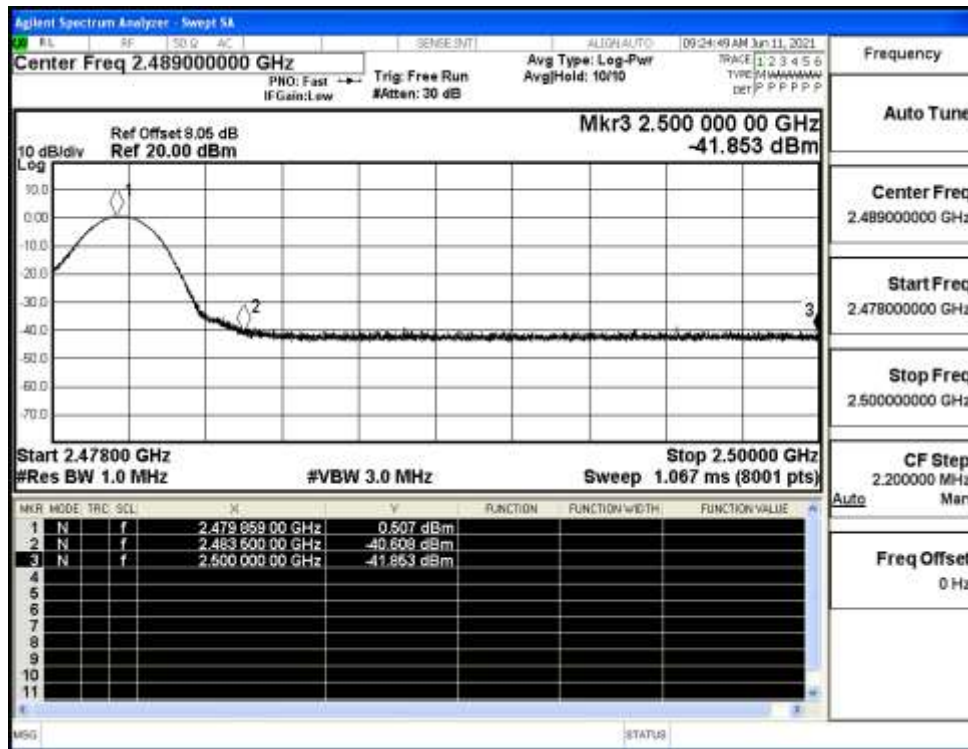
Restrict-band band-edge measurements\_Hopping Off\_8DPSK\_PEAK (Low Channel)



Restrict-band band-edge measurements\_Hopping Off\_8DPSK\_Average (Low Channel)



Restrict-band band-edge measurements\_Hopping Off\_8DPSK\_PEAK (High Channel)



Restrict-band band-edge measurements\_Hopping Off\_8DPSK\_Average (High Channel)

