

Appendix A

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

Product Name: Bluetooth Speaker

Trade Mark:  KOODUU

Test Model: Synergy 65 PRO

Environmental Conditions

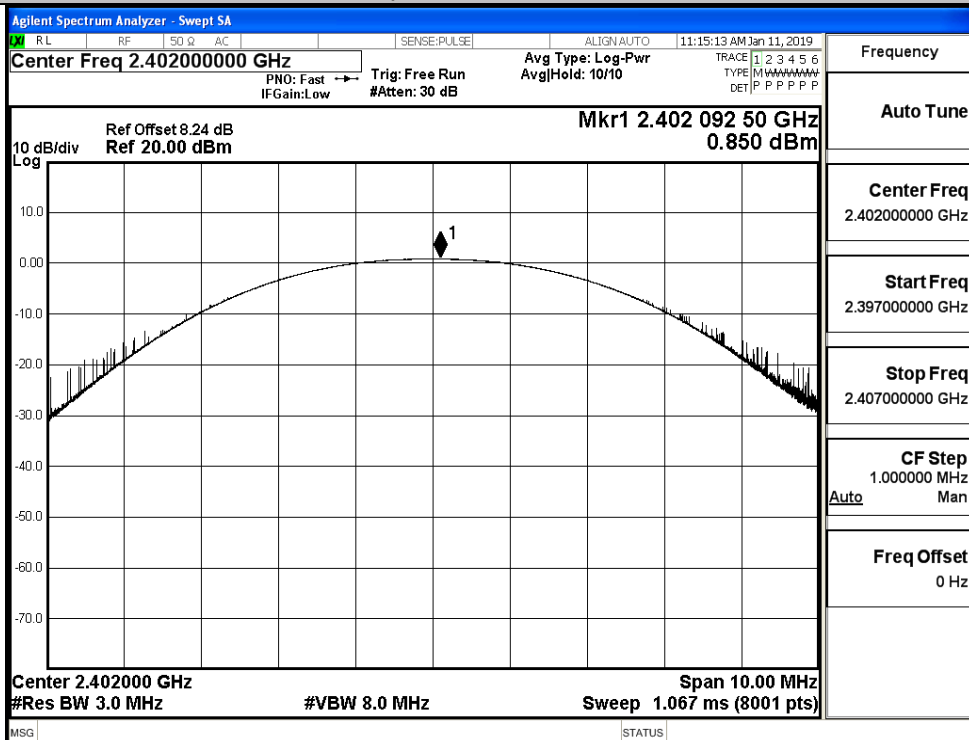
Temperature:	24.1 ° C
Relative Humidity:	52.1%
ATM Pressure:	100.0 kPa
Test Engineer:	David.Luo
Supervised by:	Jayden.Zhuo

A.1 Maximum Conducted Peak Output Power

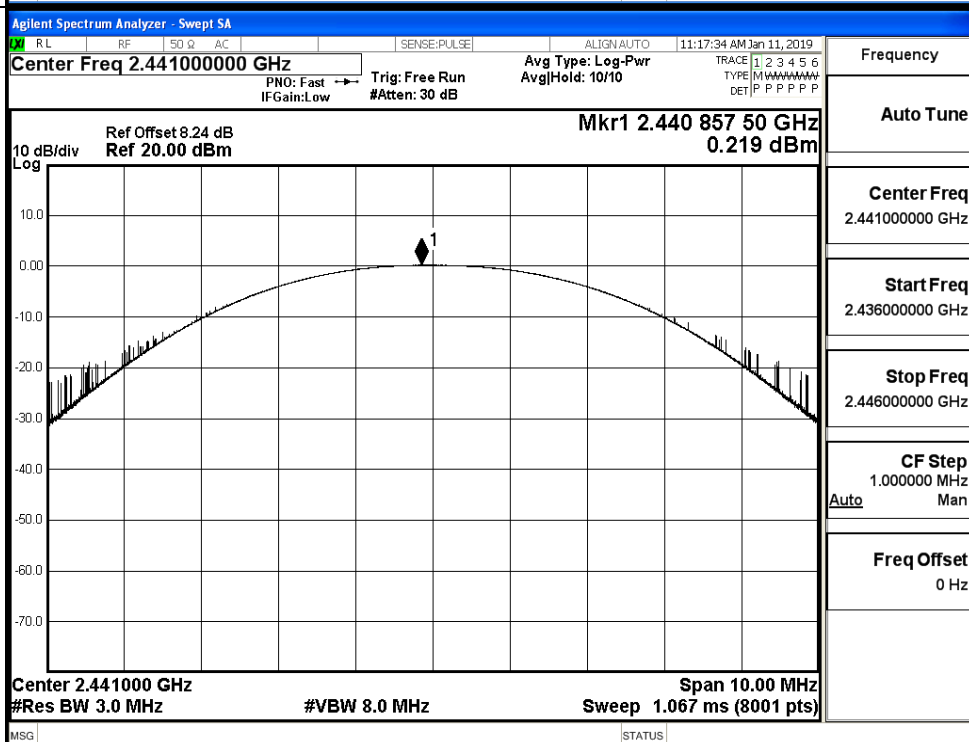
Mode	Channel.	Maximum Peak Output Power [dBm]	Limit [dBm]	Verdict
GFSK	LCH	0.850	30	PASS
	MCH	0.219	30	PASS
	HCH	0.691	30	PASS
$\pi/4$ DQPSK	LCH	3.098	21	PASS
	MCH	2.448	21	PASS
	HCH	2.986	21	PASS
8DPSK	LCH	3.587	21	PASS
	MCH	2.940	21	PASS
	HCH	3.398	21	PASS

Test Graphs

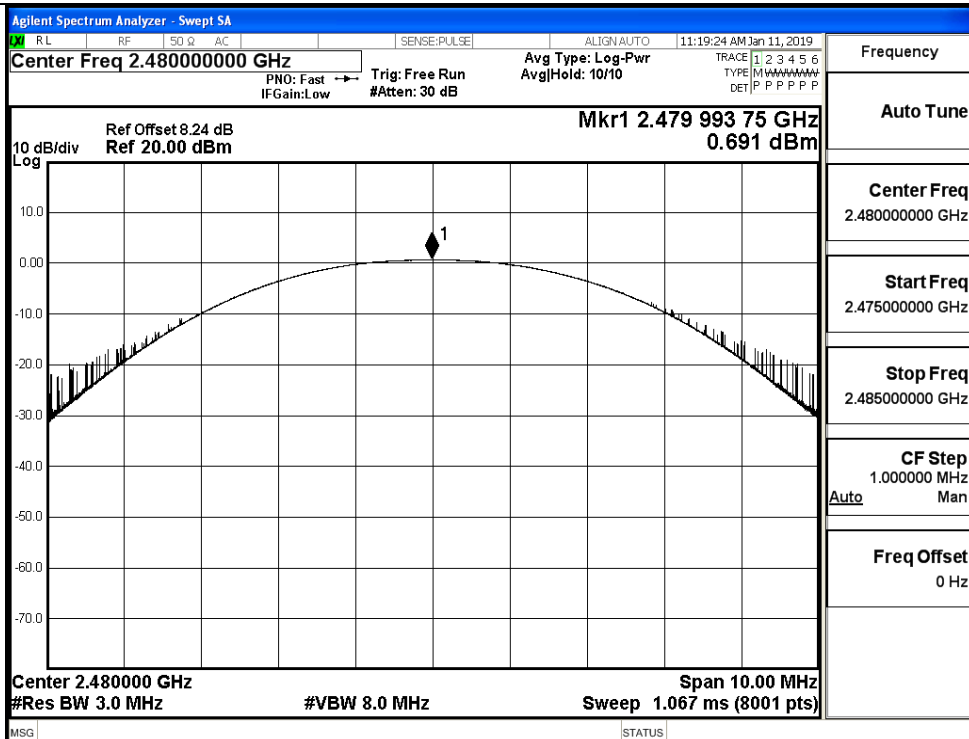
GFSK/LCH



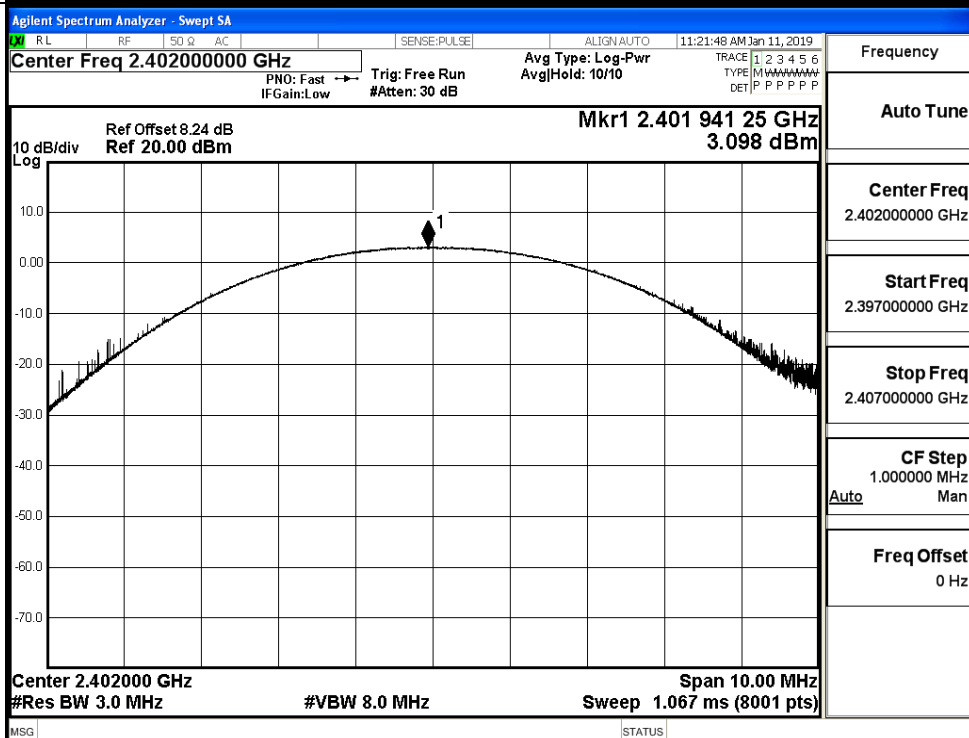
GFSK/MCH

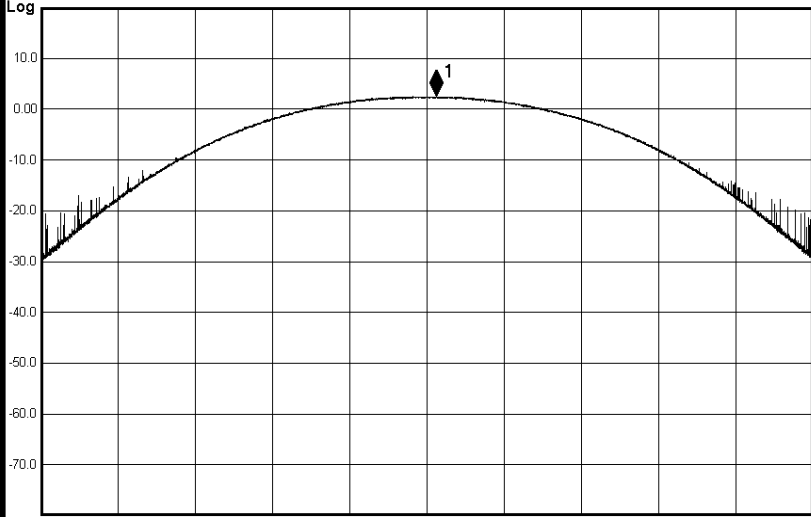
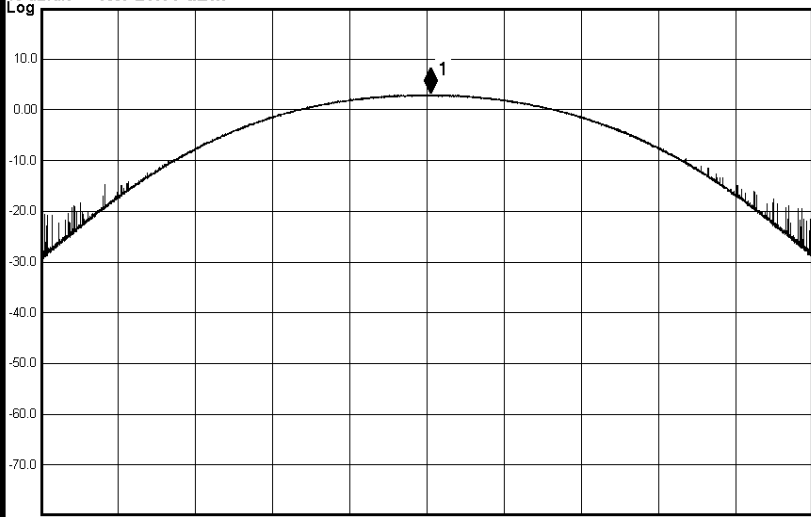


GFSK/HCH

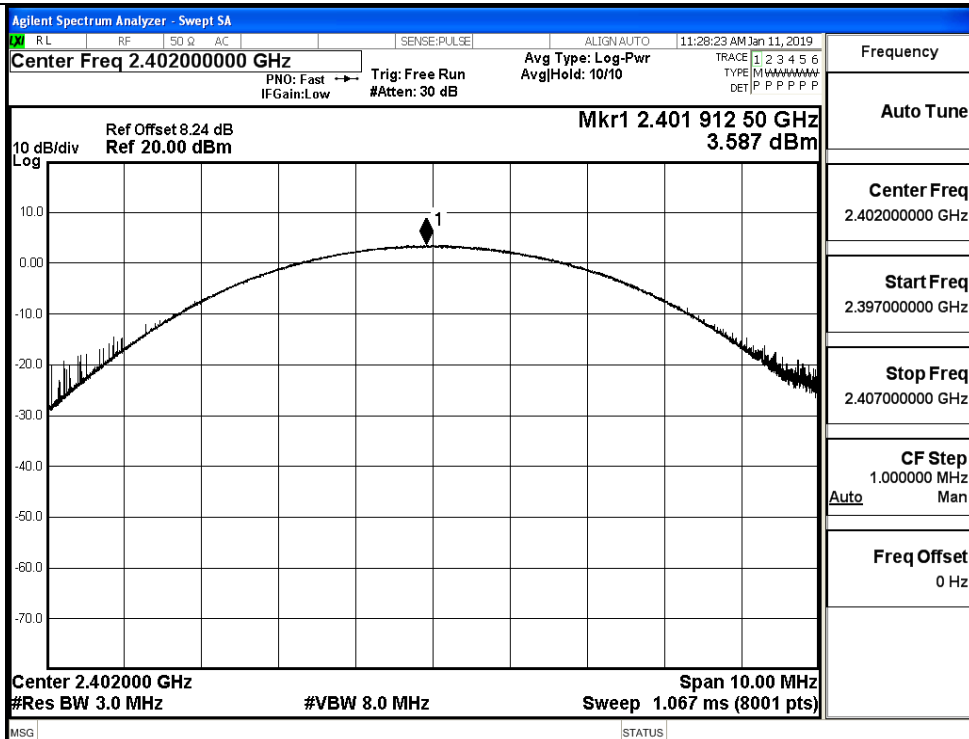


$\pi/4$ DQPSK/LCH

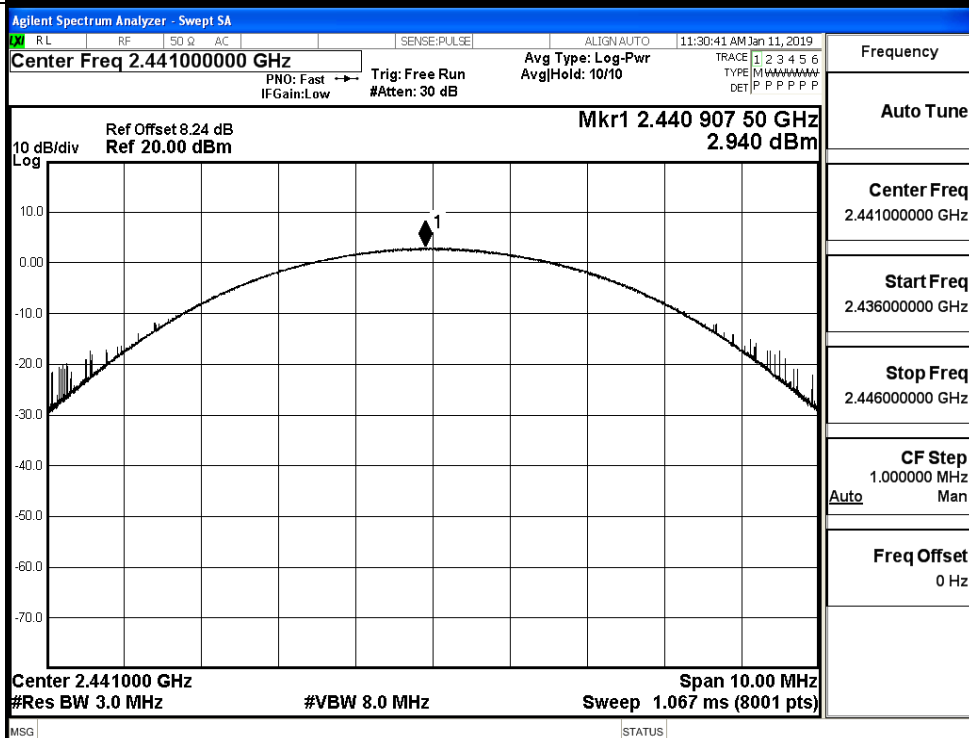


$\pi/4$DQPSK/MCH	Agilent Spectrum Analyzer - Swept SA ☒ R L ☐ RF ☐ 50 Ω ☐ AC ☐ SENSE:PULSE ☐ ALIGN:AUTO 11:24:12 AM Jan 11, 2019 Center Freq 2.441000000 GHz PNO: Fast ☐ Trg: Free Run Avg Type: Log-Pwr IF Gain: Low #Atten: 30 dB AvgHld: 10/10 TRACE 1 2 3 4 5 6 TYPE M W W W W W W W DET P P P P P P Ref Offset 8.24 dB Ref 20.00 dBm Mkr1 2.441 125 00 GHz 2.448 dBm  Center 2.441000 GHz #Res BW 3.0 MHz #VBW 8.0 MHz Span 10.00 MHz Sweep 1.067 ms (8001 pts) MSG ☐ STATUS ☐	Frequency 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
$\pi/4$DQPSK/HCH	Agilent Spectrum Analyzer - Swept SA ☒ R L ☐ RF ☐ 50 Ω ☐ AC ☐ SENSE:PULSE ☐ ALIGN:AUTO 11:25:51 AM Jan 11, 2019 Center Freq 2.480000000 GHz PNO: Fast ☐ Trg: Free Run Avg Type: Log-Pwr IF Gain: Low #Atten: 30 dB AvgHld: 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 Ref Offset 8.24 dB Ref 20.00 dBm Mkr1 2.480 053 75 GHz 2.986 dBm  Center 2.480000 GHz #Res BW 3.0 MHz #VBW 8.0 MHz Span 10.00 MHz Sweep 1.067 ms (8001 pts) MSG ☐ STATUS ☐	Frequency Auto Tune Center Freq 2.480000000 GHz Start Freq 2.475000000 GHz Stop Freq 2.485000000 GHz CF Step 1.000000 MHz Auto Man Freq Offset 0 Hz

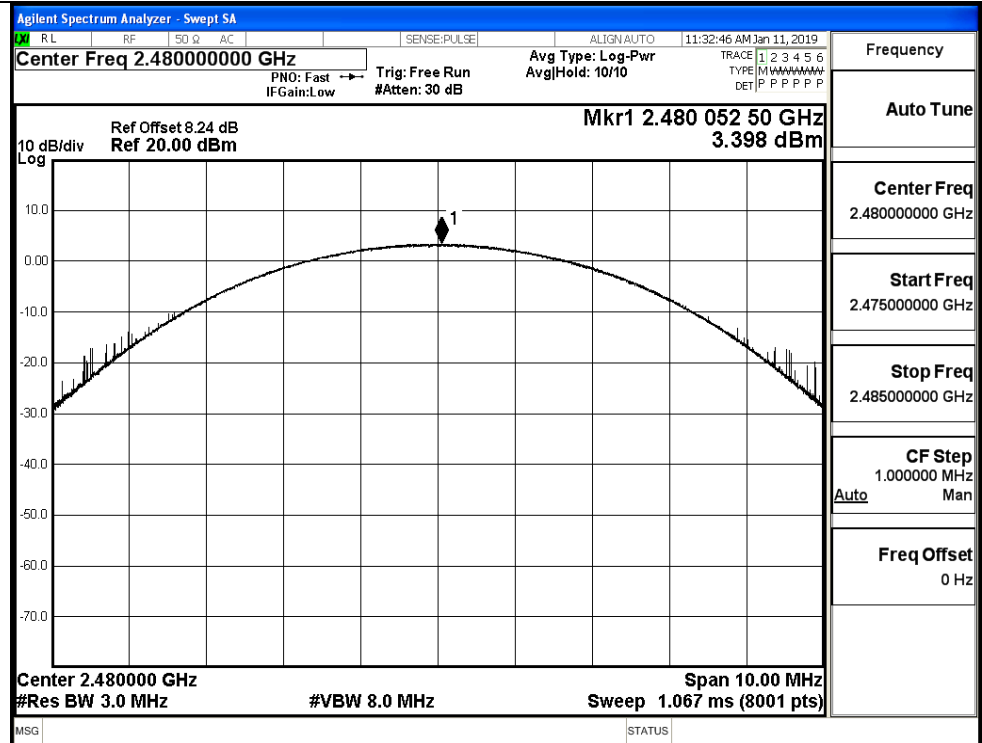
8DPSK/LCH



8DPSK/MCH



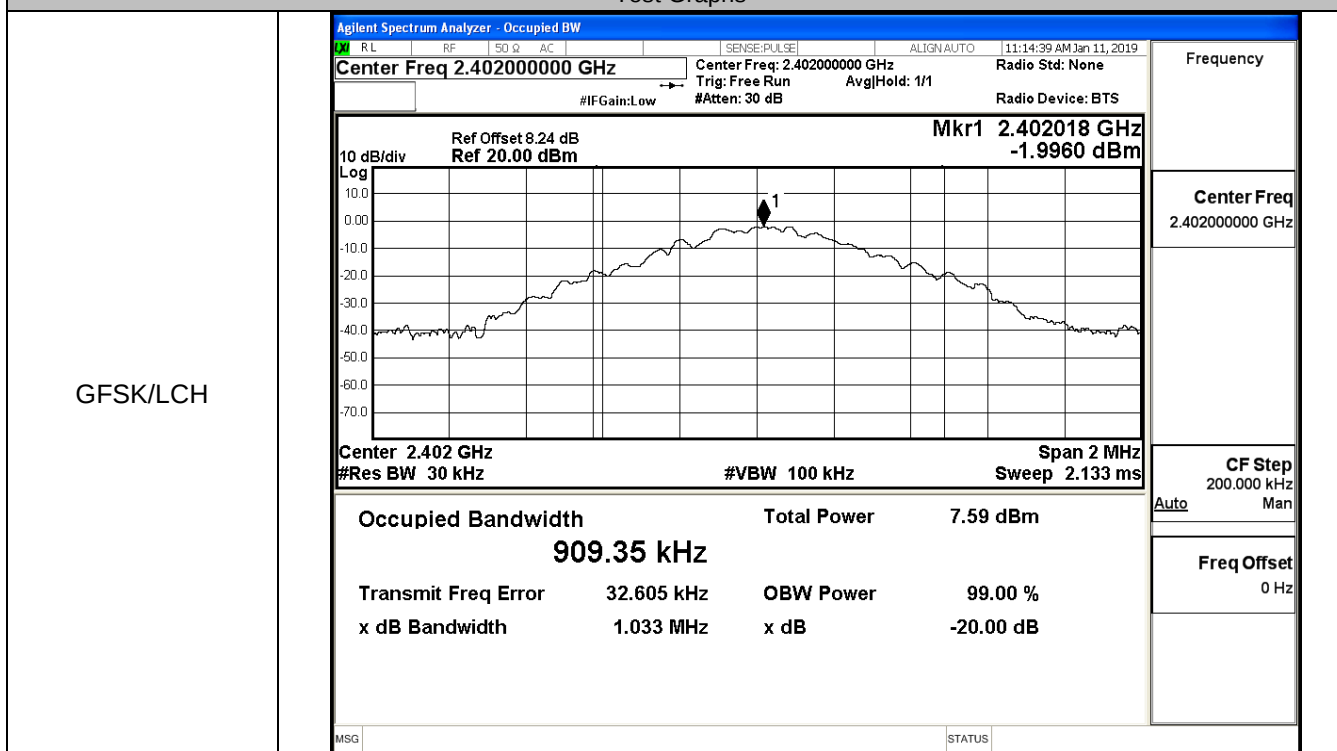
8DPSK/HCH



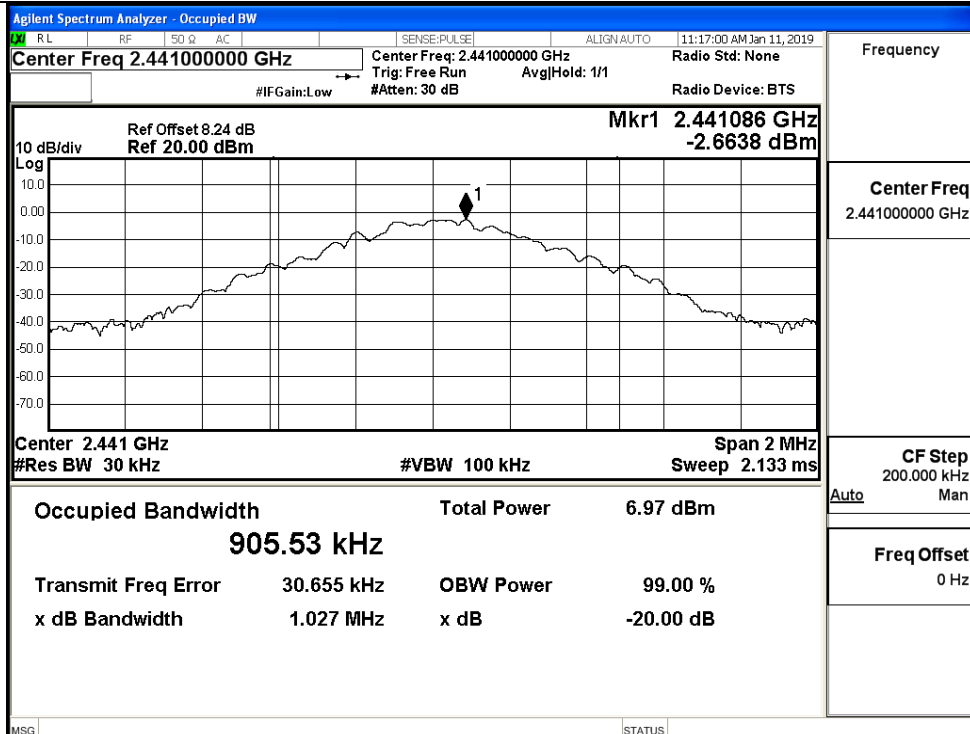
A.2 20dB Bandwidth

Mode	Channel.	20dB Bandwidth [MHz]	Limit [MHz]	Verdict
GFSK	LCH	1.033	Not Specified	PASS
	MCH	1.027	Not Specified	PASS
	HCH	0.9743	Not Specified	PASS
$\pi/4$ DQPSK	LCH	1.361	Not Specified	PASS
	MCH	1.361	Not Specified	PASS
	HCH	1.364	Not Specified	PASS
8DPSK	LCH	1.346	Not Specified	PASS
	MCH	1.347	Not Specified	PASS
	HCH	1.343	Not Specified	PASS

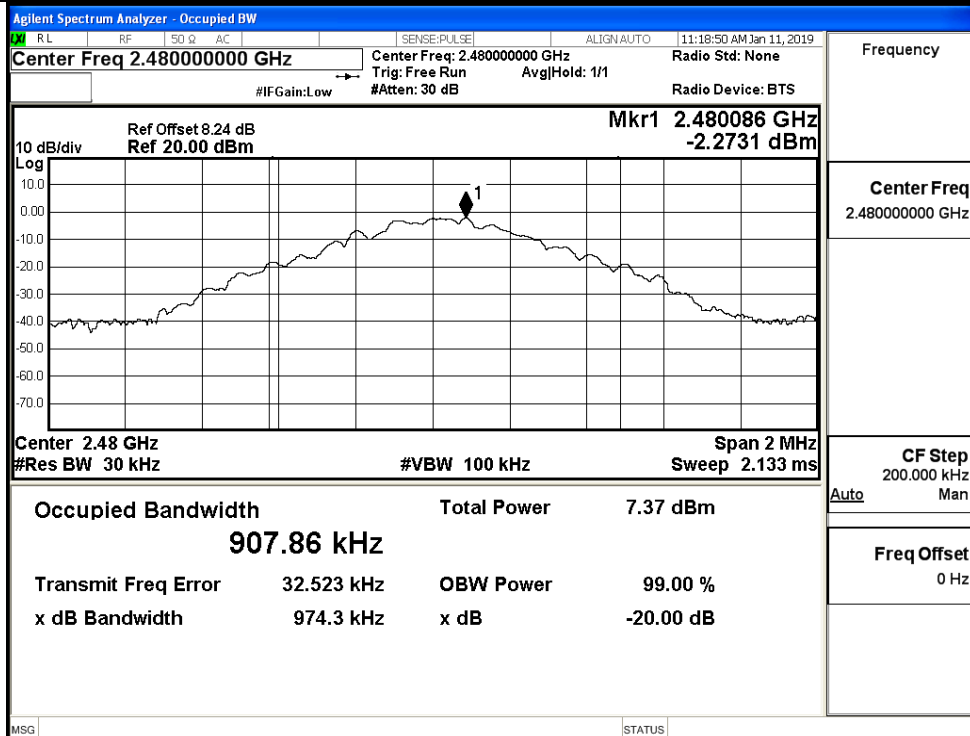
Test Graphs

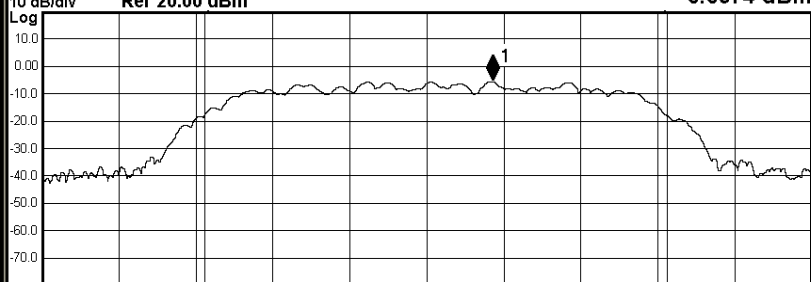
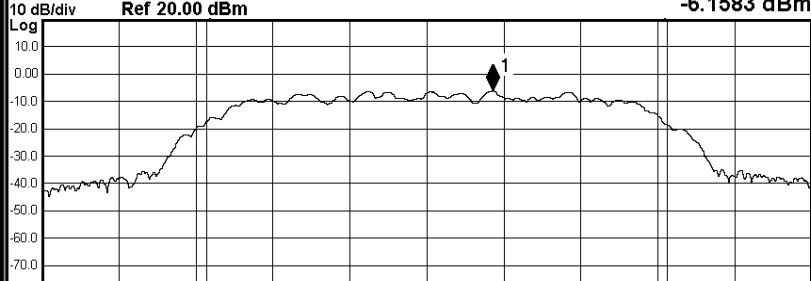


GFSK/MCH

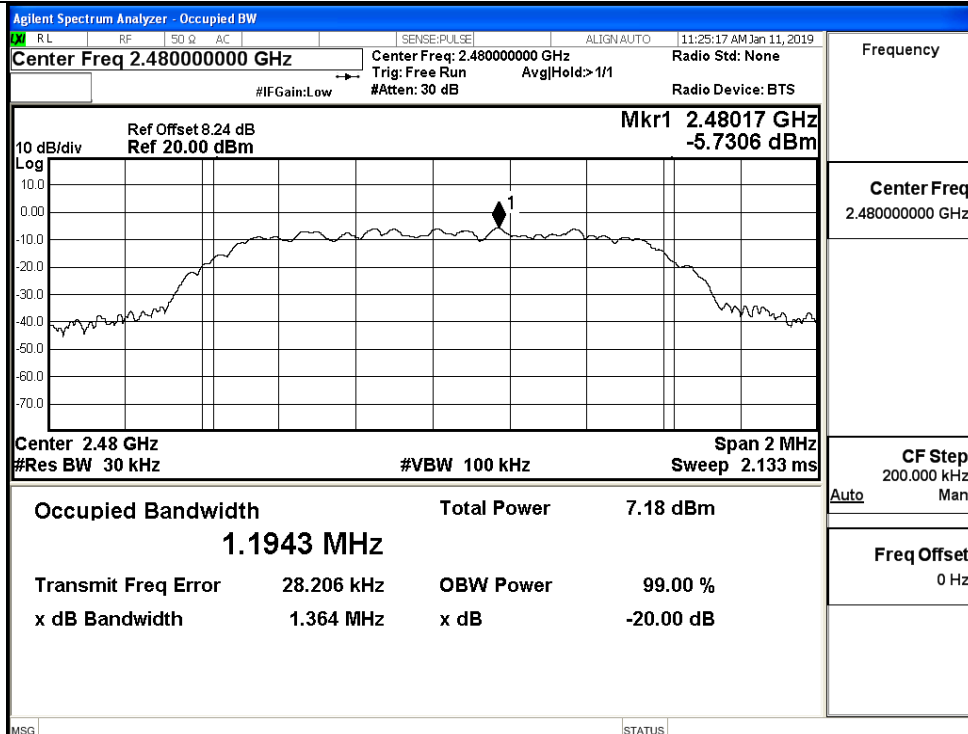


GFSK/HCH

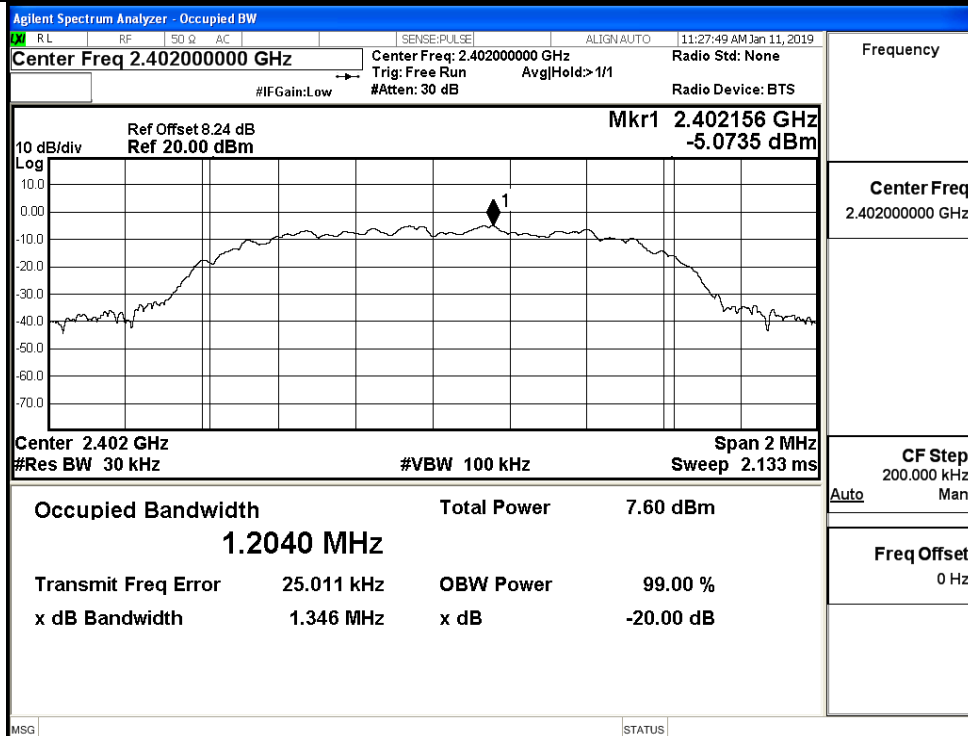


$\pi/4$DQPSK/LCH	Agilent Spectrum Analyzer - Occupied BW RL RF 50 Ω AC SENSE:PULSE ALIGN: AUTO 11:21:13 AM Jan 11, 2019 Center Freq 2.402000000 GHz Center Freq: 2.402000000 GHz Trig: Free Run Avg/Hold: 1/1 Radio Std: None #IFGain: Low #Atten: 30 dB Radio Device: BTS 10 dB/div Ref Offset 8.24 dB Ref 20.00 dBm Mkr1 2.40217 GHz -5.5974 dBm  Center 2.402 GHz #Res BW 30 kHz #VBW 100 kHz Span 2 MHz Sweep 2.133 ms Occupied Bandwidth 1.1936 MHz Total Power 7.42 dBm Transmit Freq Error 25.500 kHz OBW Power 99.00 % x dB Bandwidth 1.361 MHz x dB -20.00 dB MSG STATUS	Frequency Center Freq 2.402000000 GHz CF Step 200.000 kHz Auto Man Freq Offset 0 Hz
$\pi/4$DQPSK/MCH	Agilent Spectrum Analyzer - Occupied BW RL RF 50 Ω AC SENSE:PULSE ALIGN: AUTO 11:23:38 AM Jan 11, 2019 Center Freq 2.441000000 GHz Center Freq: 2.441000000 GHz Trig: Free Run Avg/Hold: 1/1 Radio Std: None #IFGain: Low #Atten: 30 dB Radio Device: BTS 10 dB/div Ref Offset 8.24 dB Ref 20.00 dBm Mkr1 2.44117 GHz -6.1583 dBm  Center 2.441 GHz #Res BW 30 kHz #VBW 100 kHz Span 2 MHz Sweep 2.133 ms Occupied Bandwidth 1.1937 MHz Total Power 6.75 dBm Transmit Freq Error 26.376 kHz OBW Power 99.00 % x dB Bandwidth 1.361 MHz x dB -20.00 dB MSG STATUS	Frequency Center Freq 2.441000000 GHz CF Step 200.000 kHz Auto Man Freq Offset 0 Hz

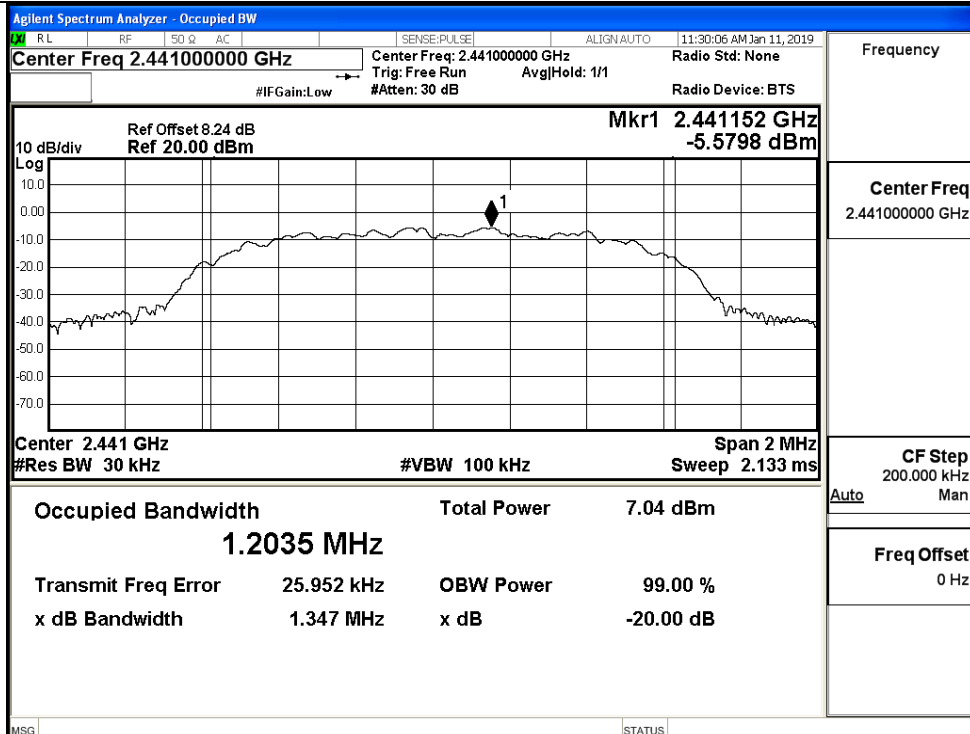
$\pi/4$ DQPSK/HCH



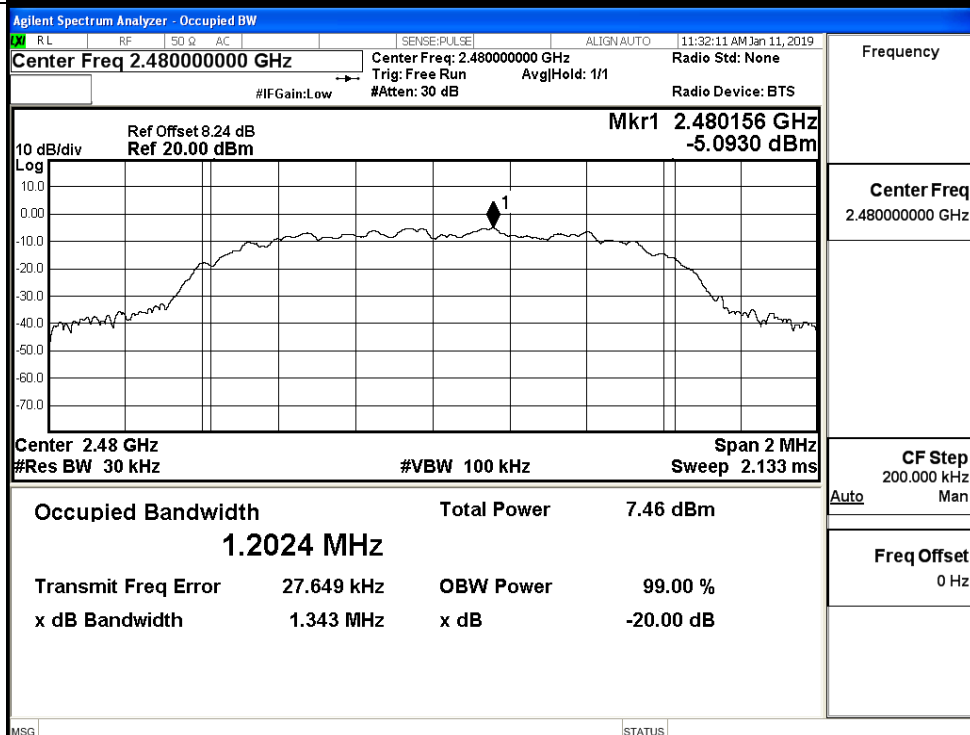
8DPSK/LCH



8DPSK/MCH



8DPSK/HCH

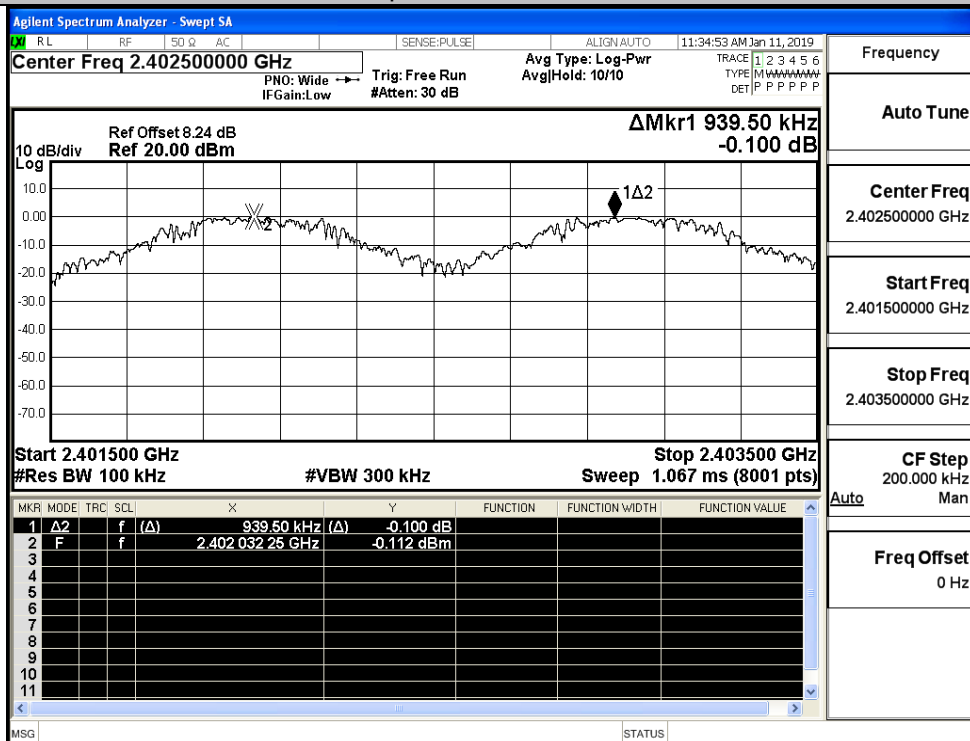


A.3 Carrier Frequency Separation

Mode	Channel.	Carrier Frequency Separation [MHz]	Limit [MHz]	Verdict
GFSK	LCH	0.939	0.689	PASS
	MCH	1.032	0.689	PASS
	HCH	1.064	0.689	PASS
$\pi/4$ DQPSK	LCH	0.980	0.909	PASS
	MCH	1.174	0.909	PASS
	HCH	0.988	0.909	PASS
8DPSK	LCH	1.120	0.898	PASS
	MCH	1.022	0.898	PASS
	HCH	1.136	0.898	PASS

Test Graphs

GFSK/LCH



Frequency

Auto Tune

Center Freq
2.402500000 GHz

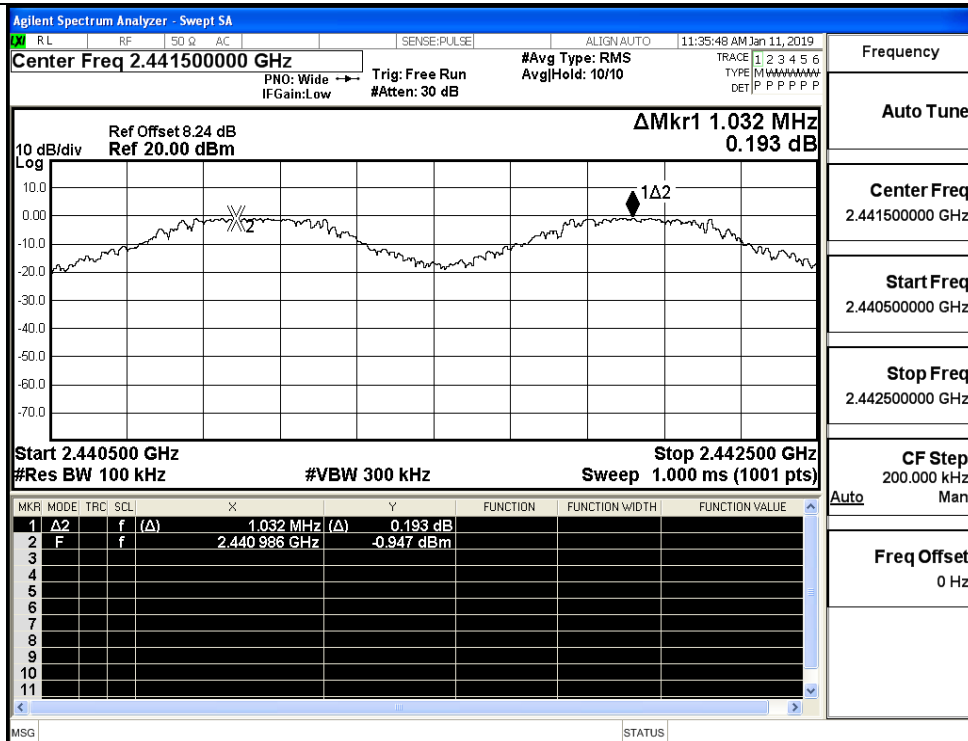
Start Freq
2.401500000 GHz

Stop Freq
2.403500000 GHz

CF Step
200.000 kHz
Man

Freq Offset
0 Hz

GFSK/MCH



Frequency

Auto Tune

Center Freq
2.441500000 GHz

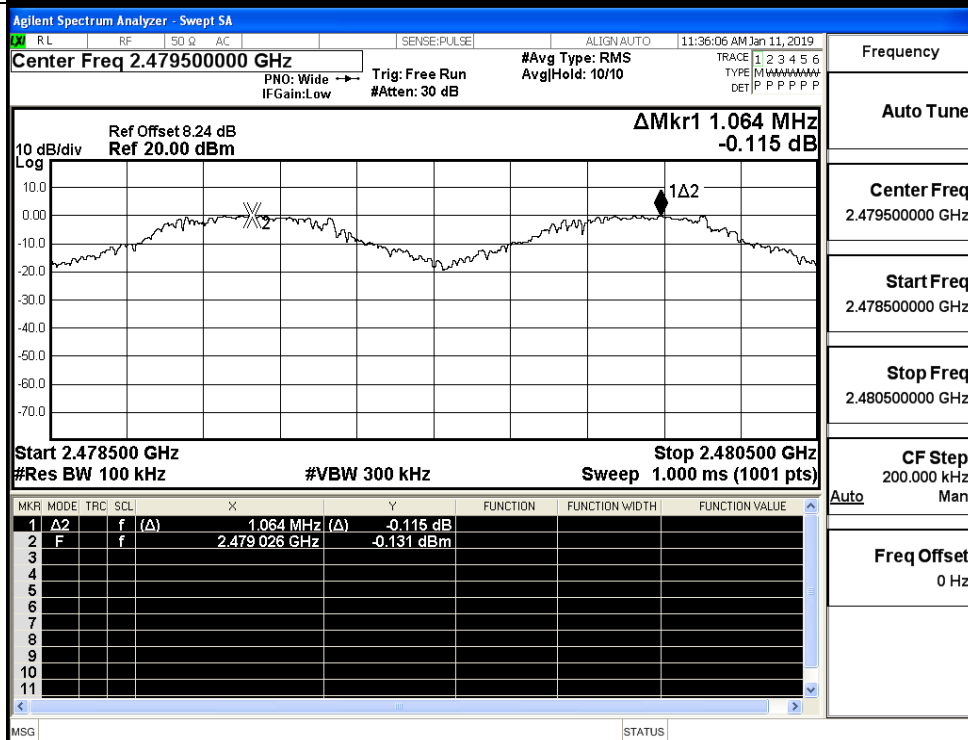
Start Freq
2.440500000 GHz

Stop Freq
2.442500000 GHz

CF Step
200.000 kHz
Man

Freq Offset
0 Hz

GFSK/HCH



Frequency

Auto Tune

Center Freq
2.479500000 GHz

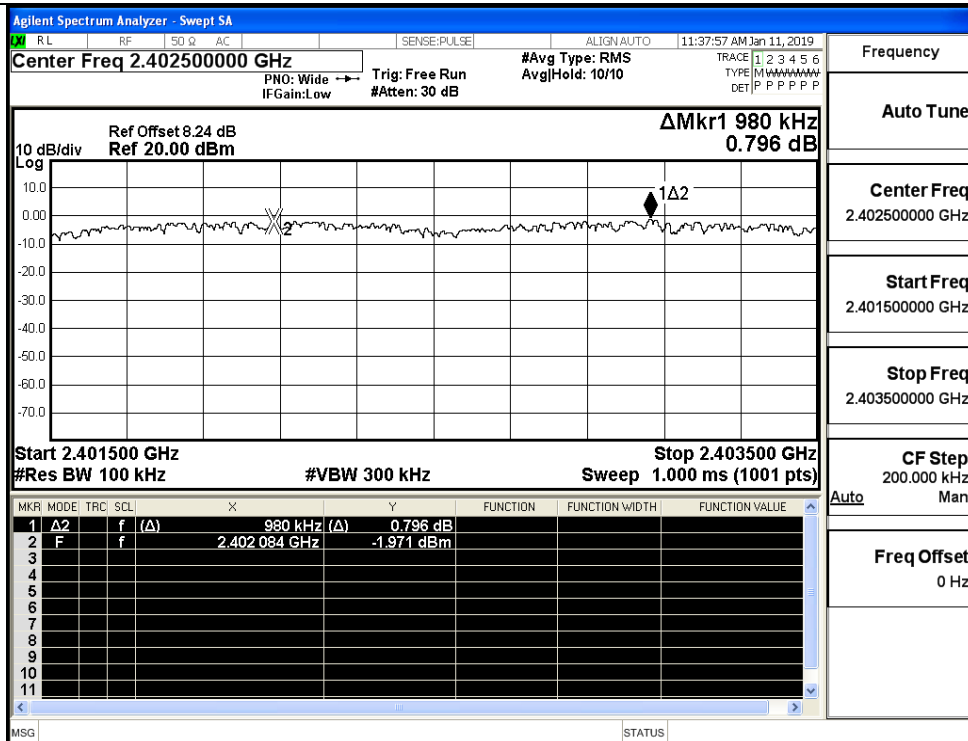
Start Freq
2.478500000 GHz

Stop Freq
2.480500000 GHz

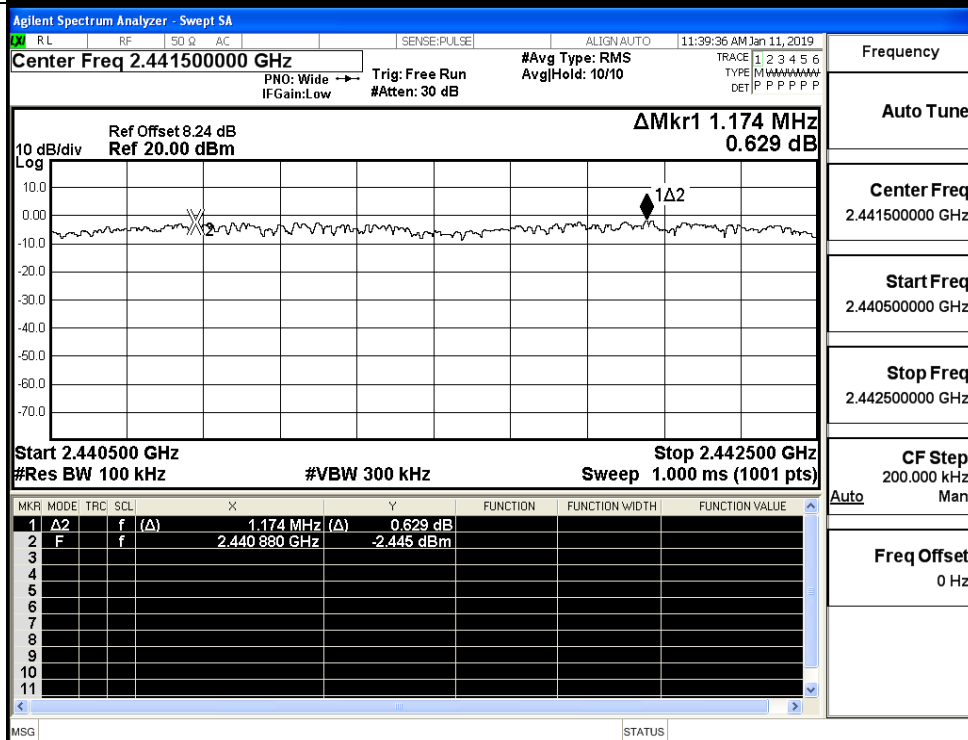
CF Step
200.000 kHz
Man

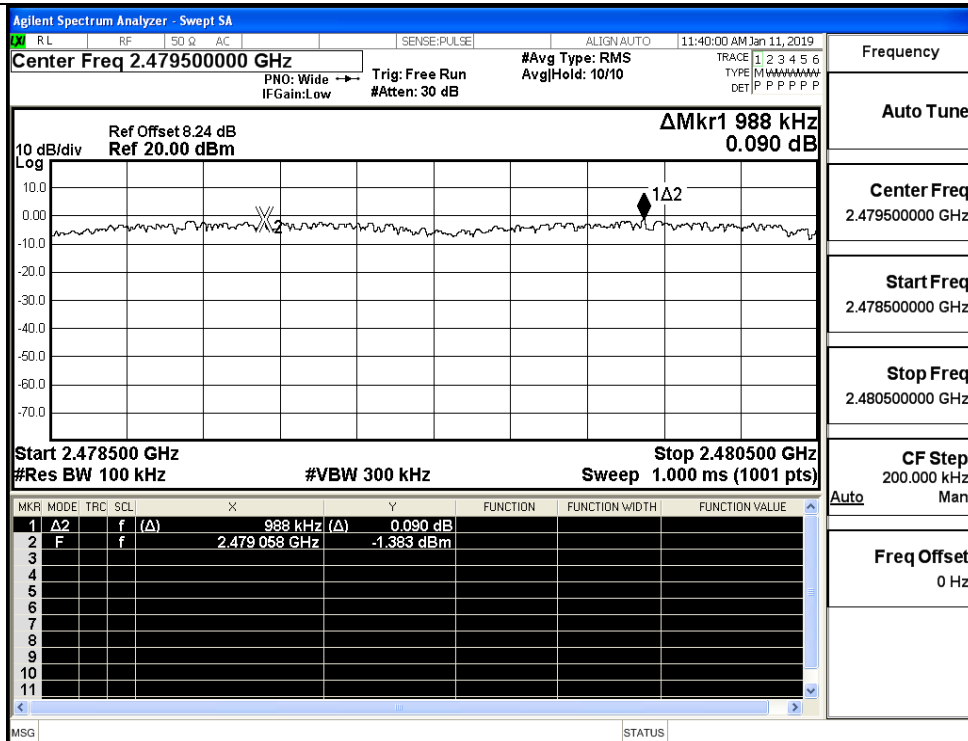
Freq Offset
0 Hz

$\pi/4$ DQPSK/LCH

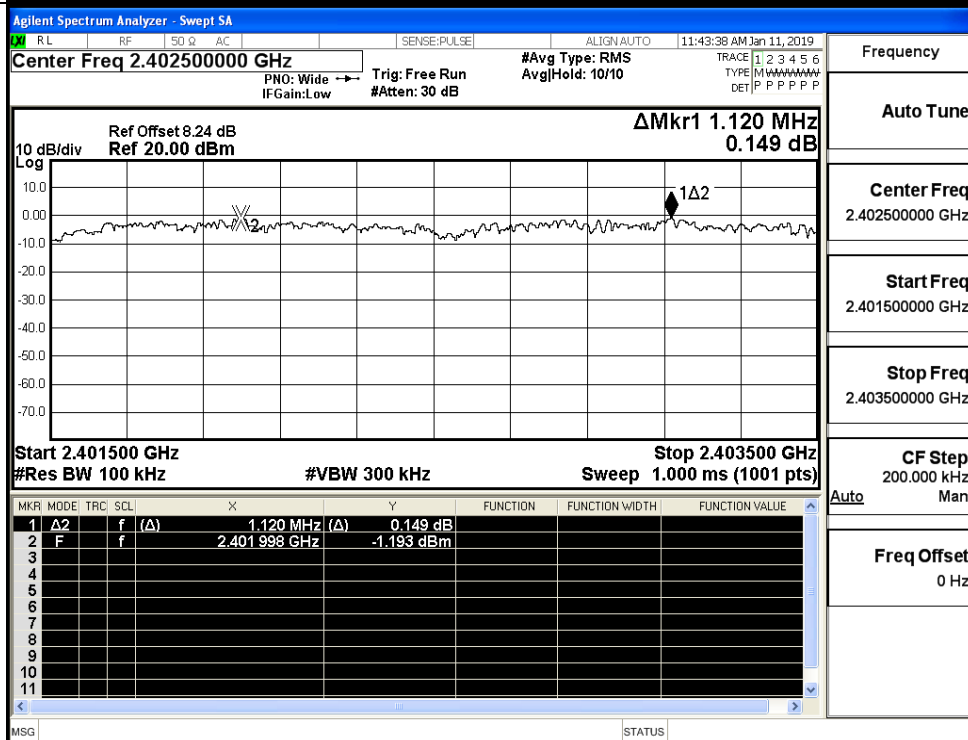


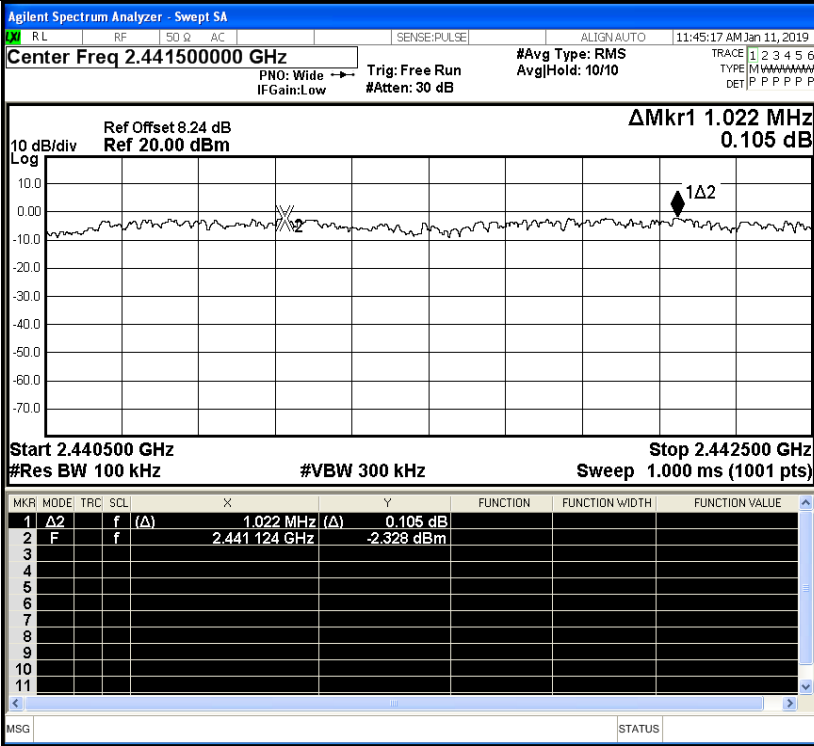
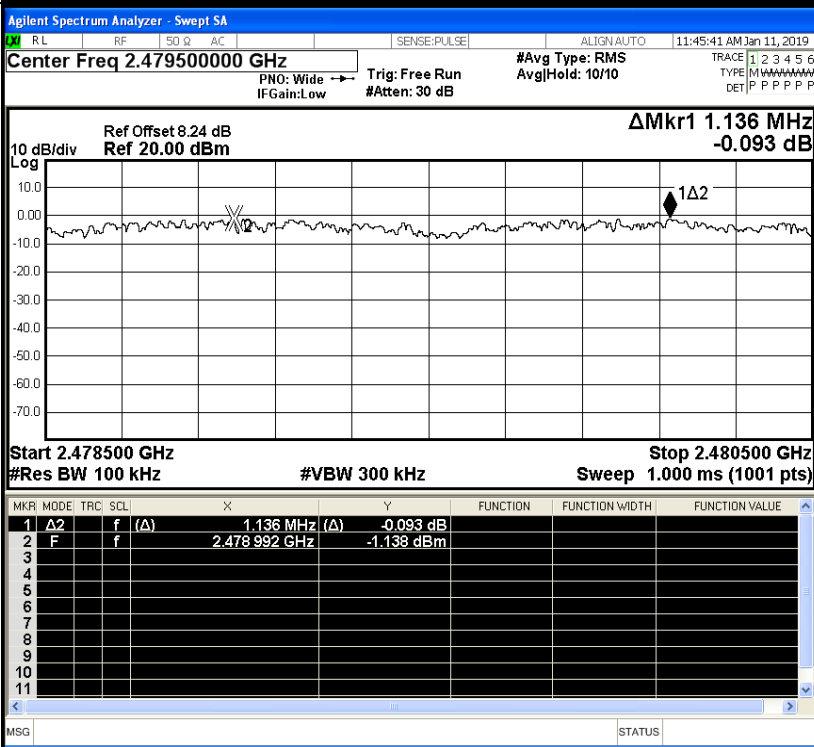
$\pi/4$ DQPSK/MCH



$\pi/4$ DQPSK/HCH

8DPSK/LCH



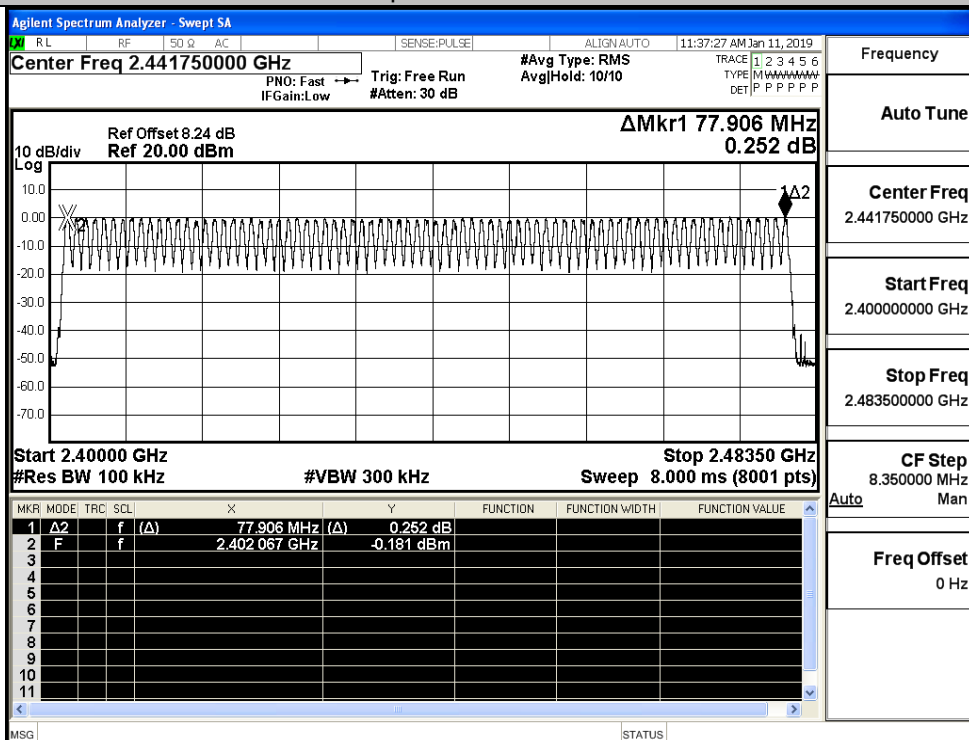
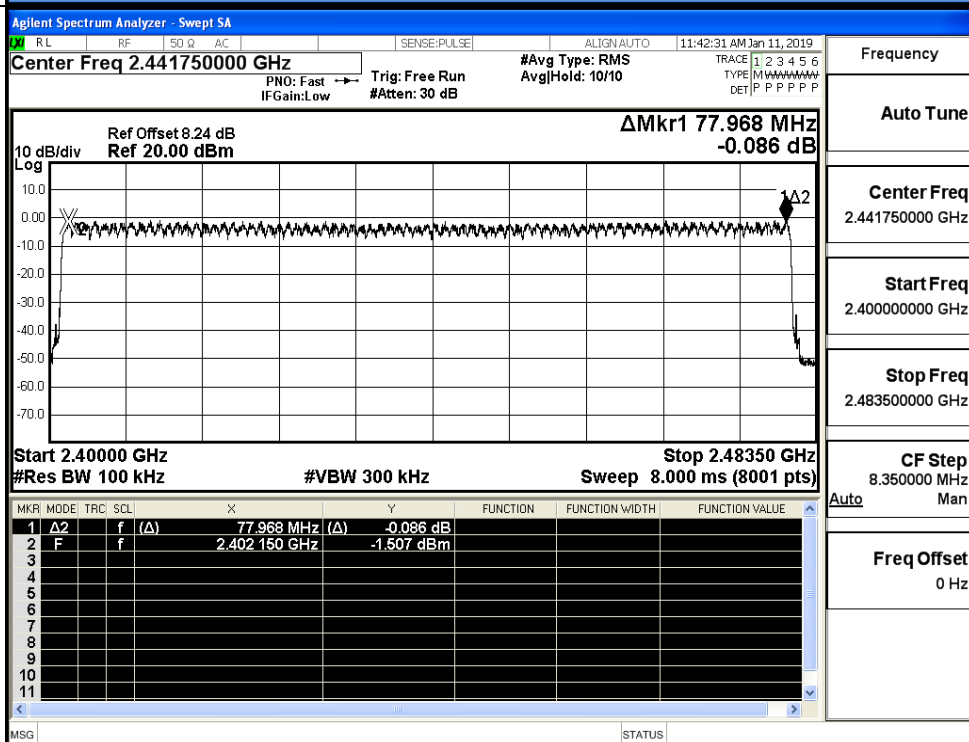
8DPSK/MCH	 Agilent Spectrum Analyzer - Swept SA Center Freq 2.441500000 GHz Ref Offset 8.24 dB Ref 20.00 dBm Start 2.440500 GHz Stop 2.442500 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 1.000 ms (1001 pts) Frequency Auto Tune Center Freq 2.441500000 GHz Start Freq 2.440500000 GHz Stop Freq 2.442500000 GHz CF Step 200.000 kHz Freq Offset 0 Hz
8DPSK/HCH	 Agilent Spectrum Analyzer - Swept SA Center Freq 2.479500000 GHz Ref Offset 8.24 dB Ref 20.00 dBm Start 2.478500 GHz Stop 2.480500 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 1.000 ms (1001 pts) Frequency Auto Tune Center Freq 2.479500000 GHz Start Freq 2.478500000 GHz Stop Freq 2.480500000 GHz CF Step 200.000 kHz Freq Offset 0 Hz

A.4 Hopping Channel Number

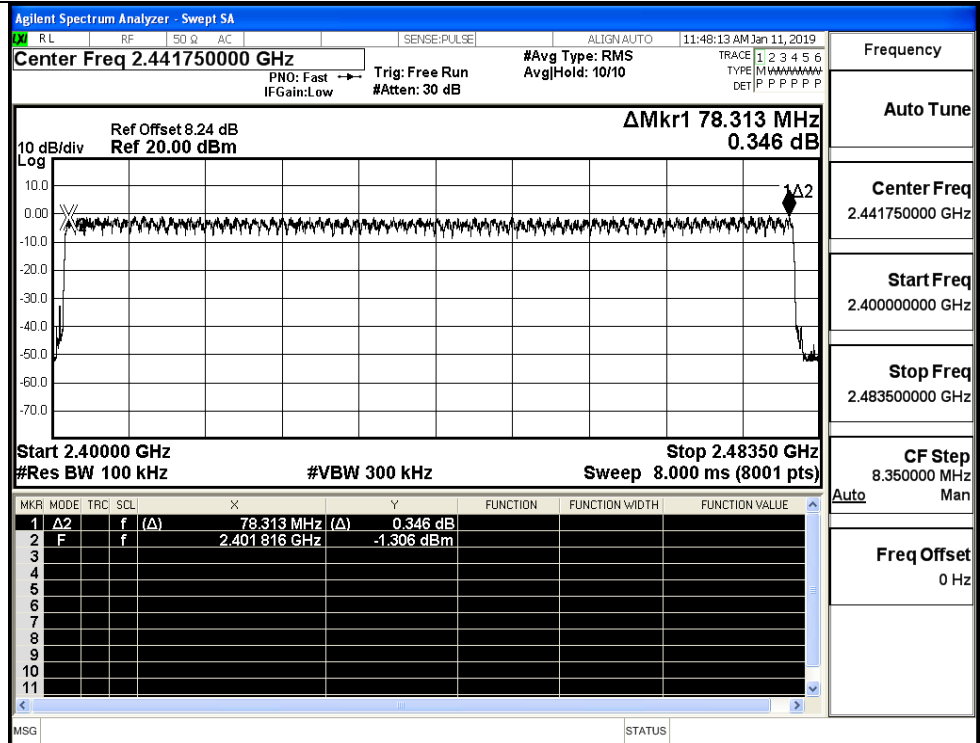
Mode	Channel.	Number of Hopping Channel [N]	Limit [N]	Verdict
GFSK	Hop	79	>=15	PASS
$\pi/4$ DQPSK	Hop	79	>=15	PASS
8DPSK	Hop	79	>=15	PASS

Test Graphs

GFSK/Hop

 $\pi/4$ DQPSK/Hop

8DPSK/Hop

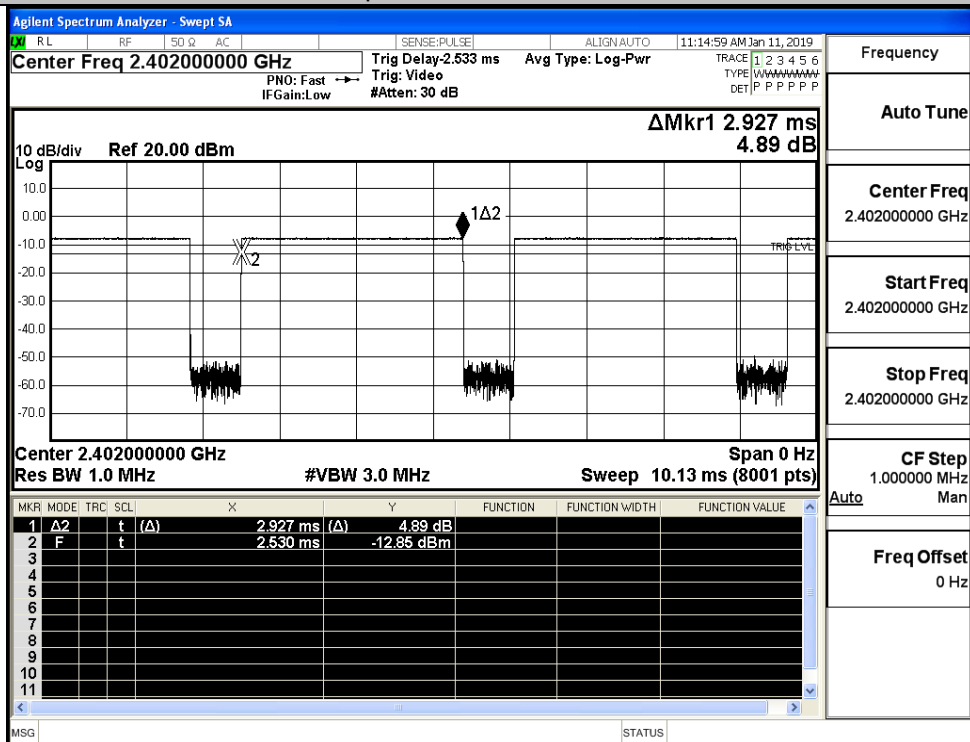


A.5 Dwell Time

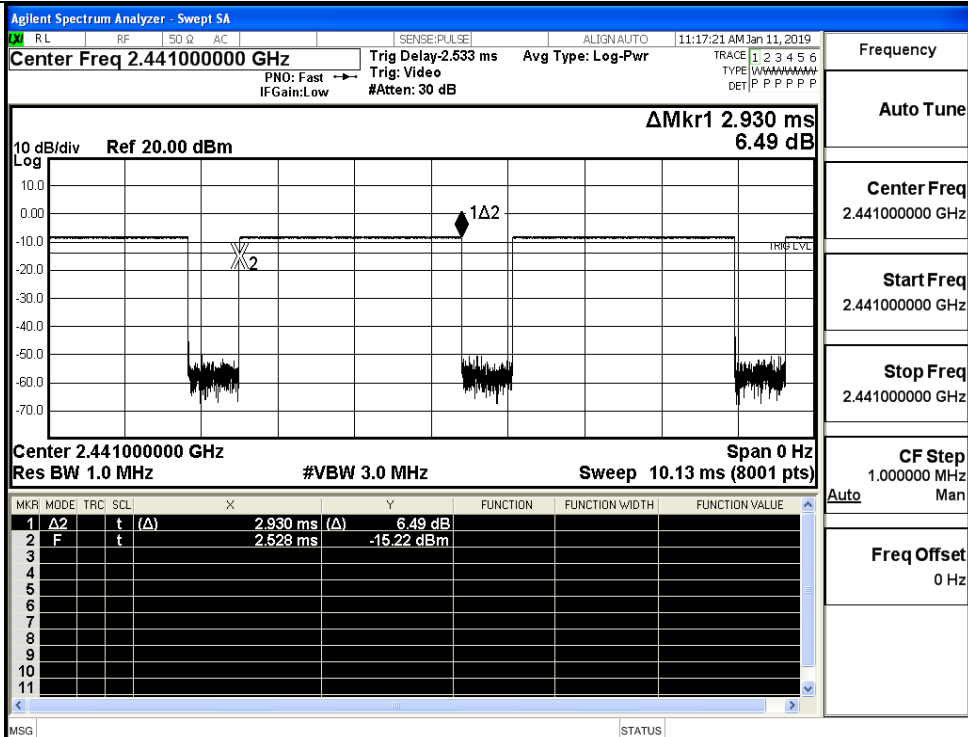
Mode	Packet	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Limit [s]	Verdict
GFSK	DH5	LCH	2.93	106.7	0.313	0.4	PASS
	DH5	MCH	2.93	106.7	0.313	0.4	PASS
	DH5	HCH	2.91	106.7	0.31	0.4	PASS
$\pi/4$ DQPSK	2DH5	LCH	2.93	106.7	0.313	0.4	PASS
	2DH5	MCH	2.93	106.7	0.313	0.4	PASS
	2DH5	HCH	2.91	106.7	0.313	0.4	PASS
8DPSK	3DH5	LCH	2.93	106.7	0.313	0.4	PASS
	3DH5	MCH	2.93	106.7	0.312	0.4	PASS
	3DH5	HCH	2.91	106.7	0.313	0.4	PASS

Test Graphs

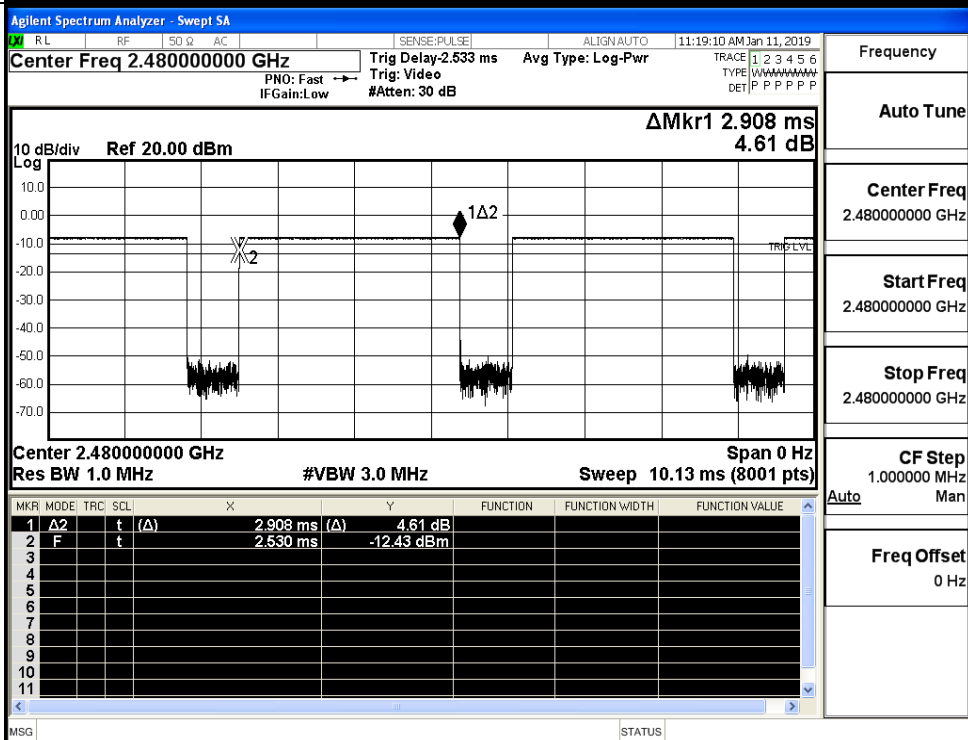
GFSK_DH5/LCH



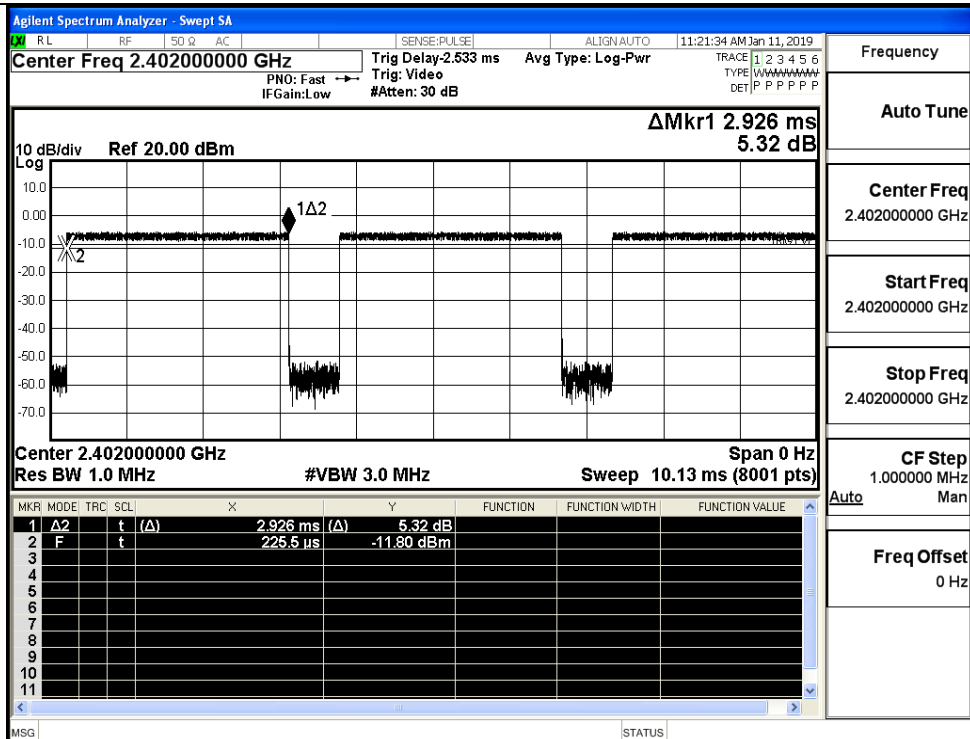
GFSK_DH5/MCH



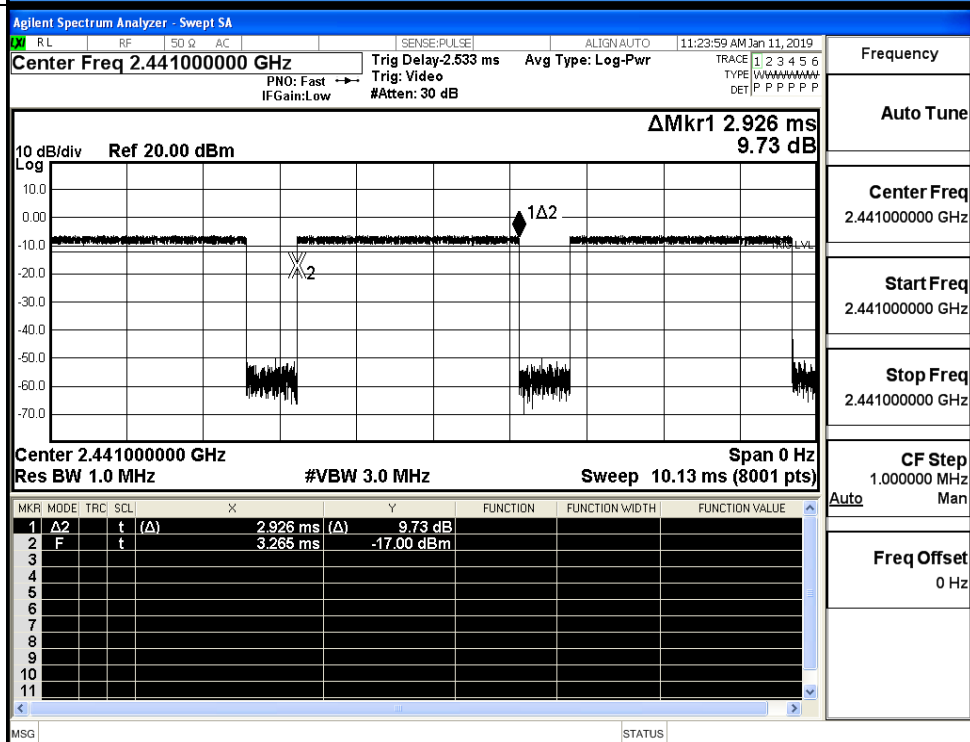
GFSK_DH5/HCH



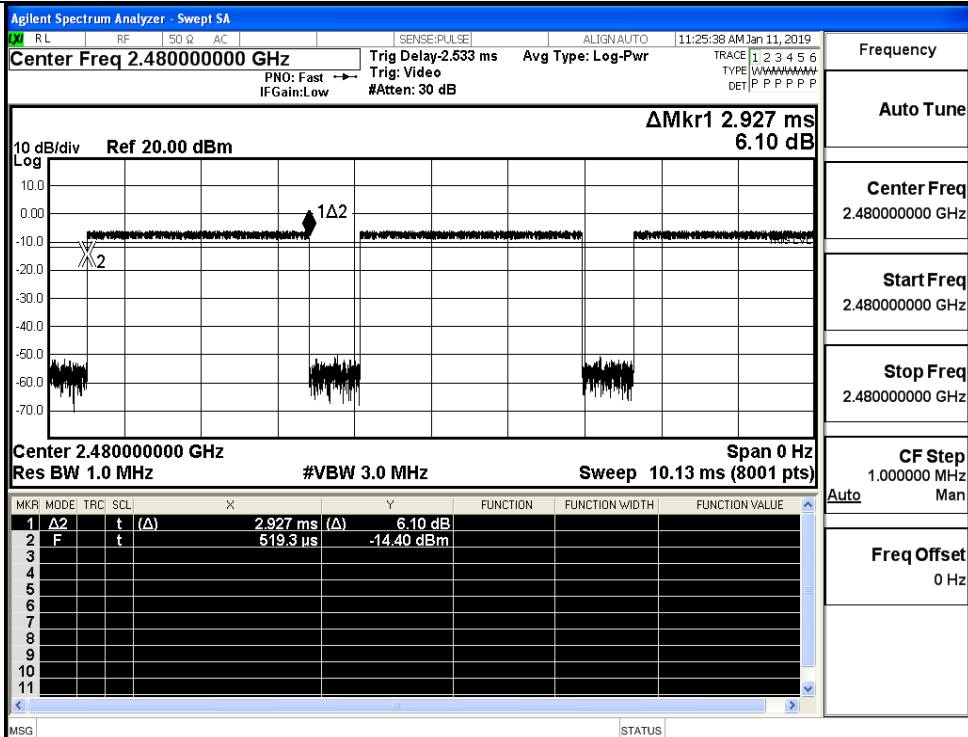
$\pi/4$ DQPSK
_2DH5/LCH



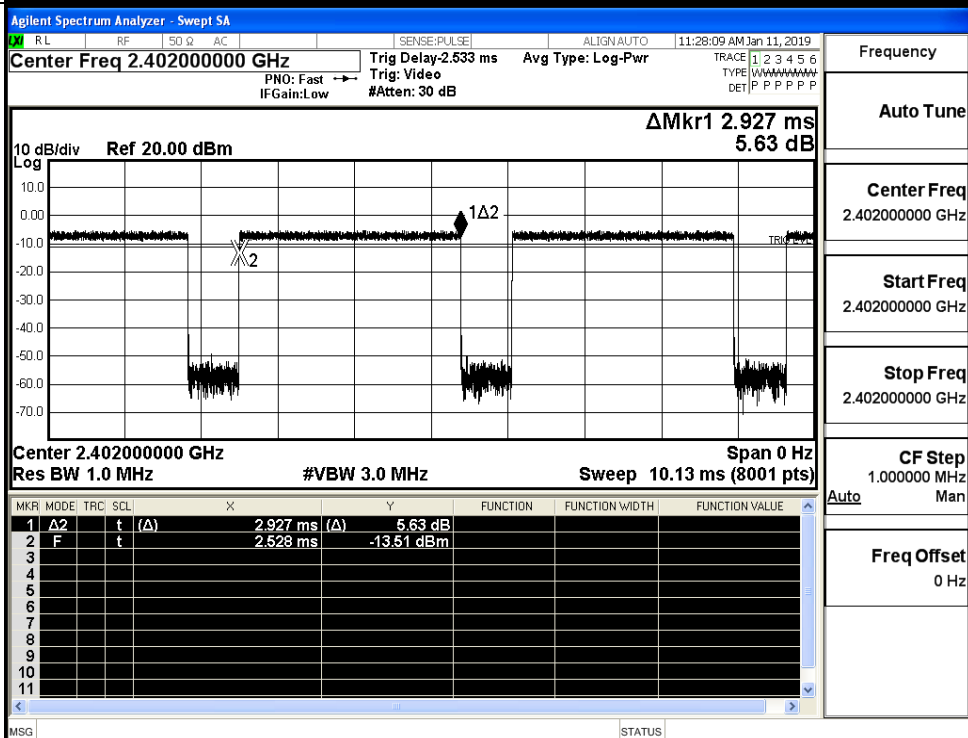
$\pi/4$ DQPSK
_2DH5/MCH



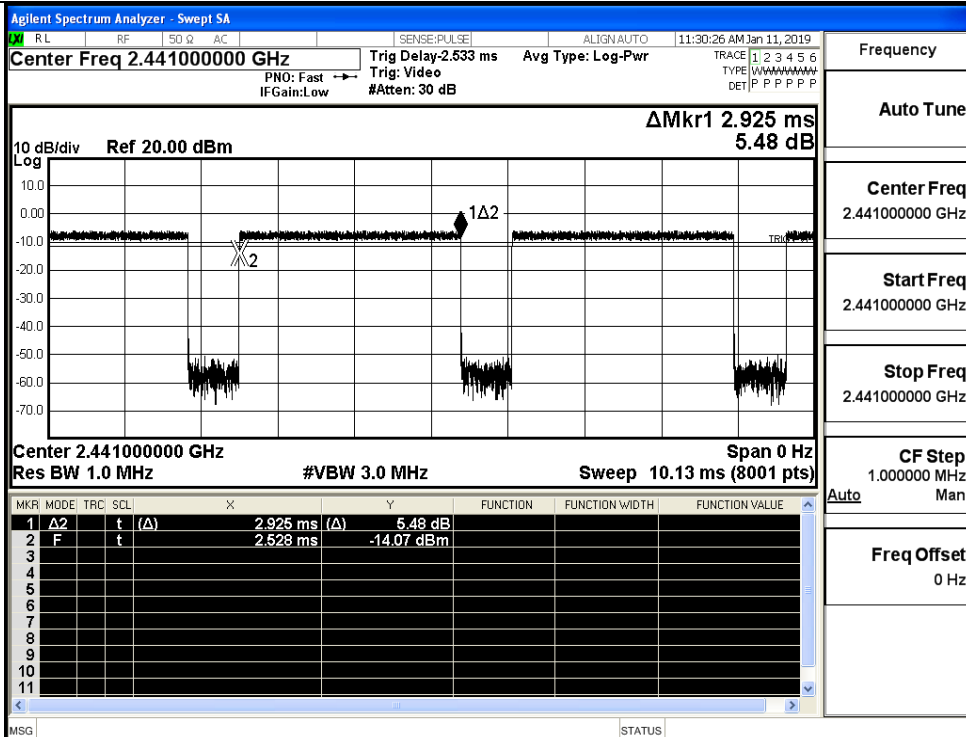
$\pi/4$ DQPSK
_2DH5/HCH



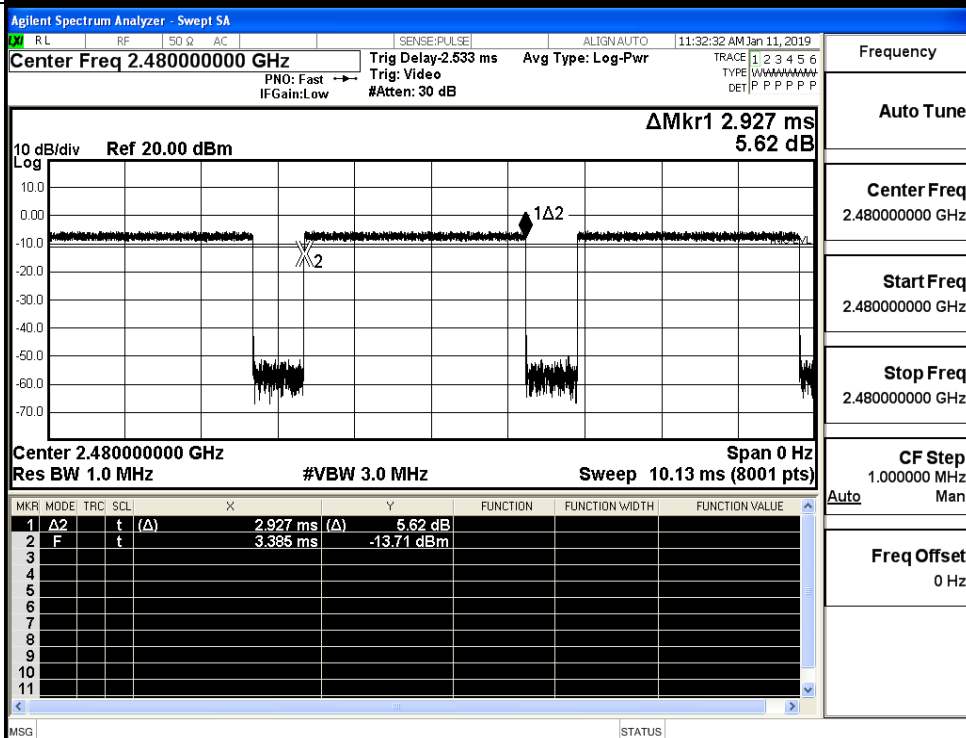
8DPSK _3DH5/LCH



8DPSK_3DH5/MCH



8DPSK_3DH5/HCH

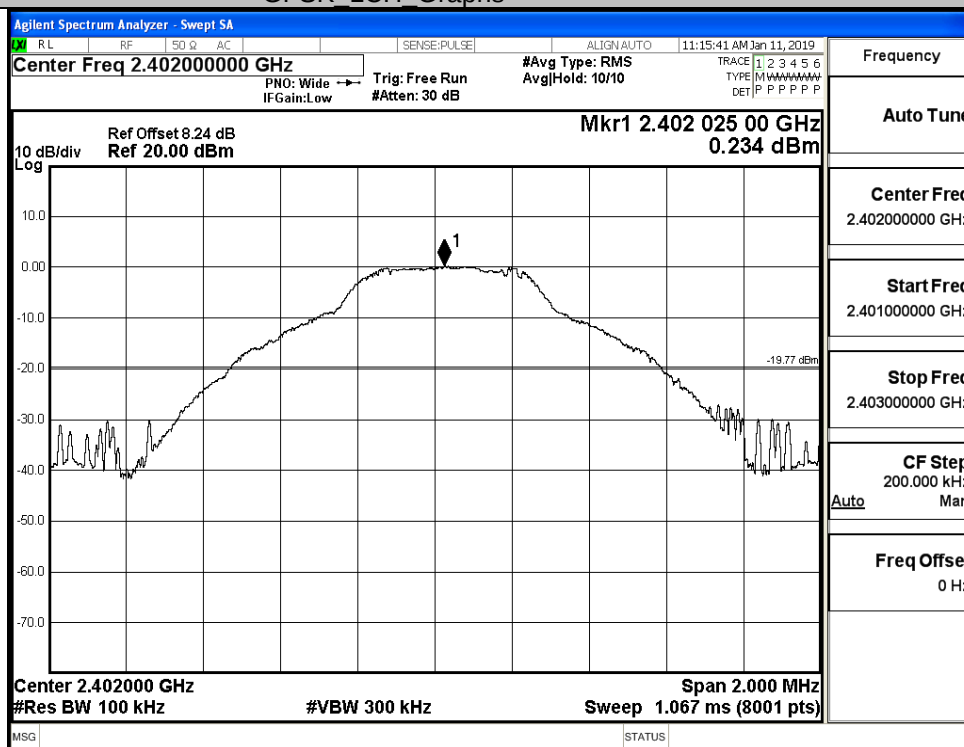


A.6 RF Conducted Spurious Emissions

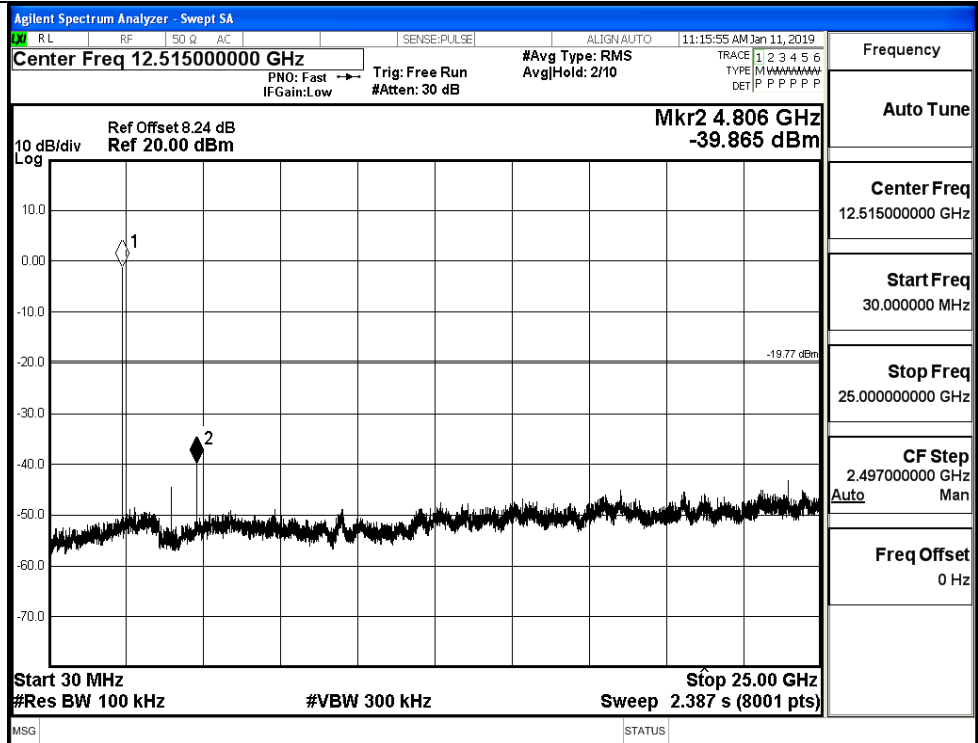
Mode	Channel	Pref [dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	0.234	-39.865	-19.766	PASS
	MCH	-0.351	-40.523	-20.351	PASS
	HCH	0.017	-42.848	-19.983	PASS
$\pi/4$ DQPSK	LCH	-1.045	-43.032	-21.045	PASS
	MCH	-1.582	-44.268	-21.582	PASS
	HCH	-1.161	-42.222	-21.161	PASS
8DPSK	LCH	-1.107	-43.570	-21.107	PASS
	MCH	-1.707	-44.105	-21.707	PASS
	HCH	-1.297	-43.305	-21.297	PASS

GFSK LCH Graphs

Pref

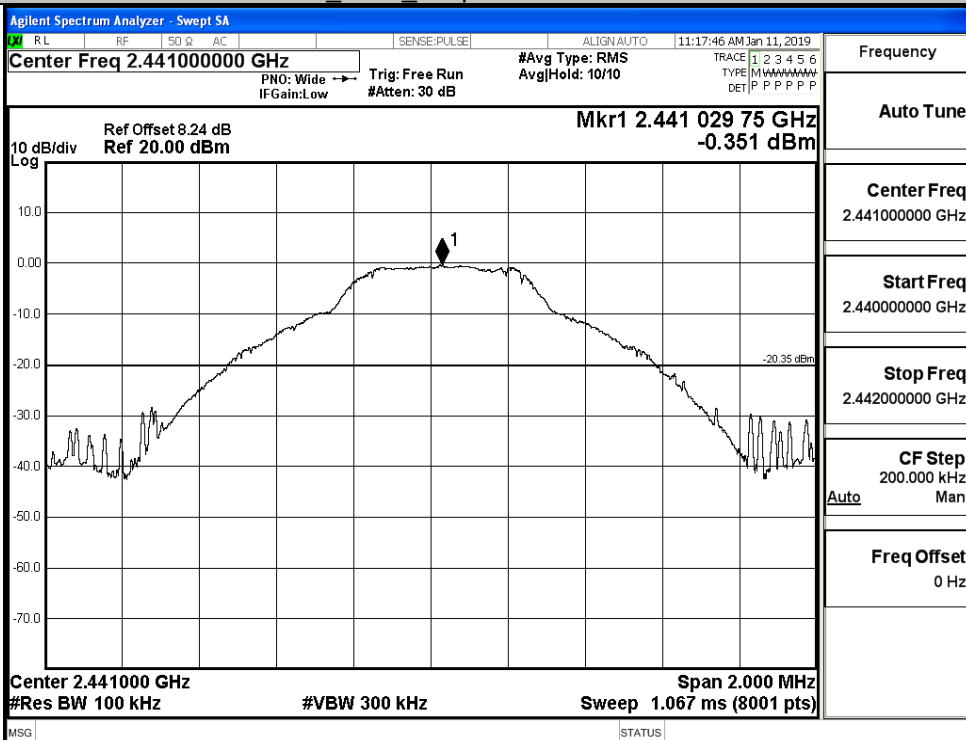


Puw

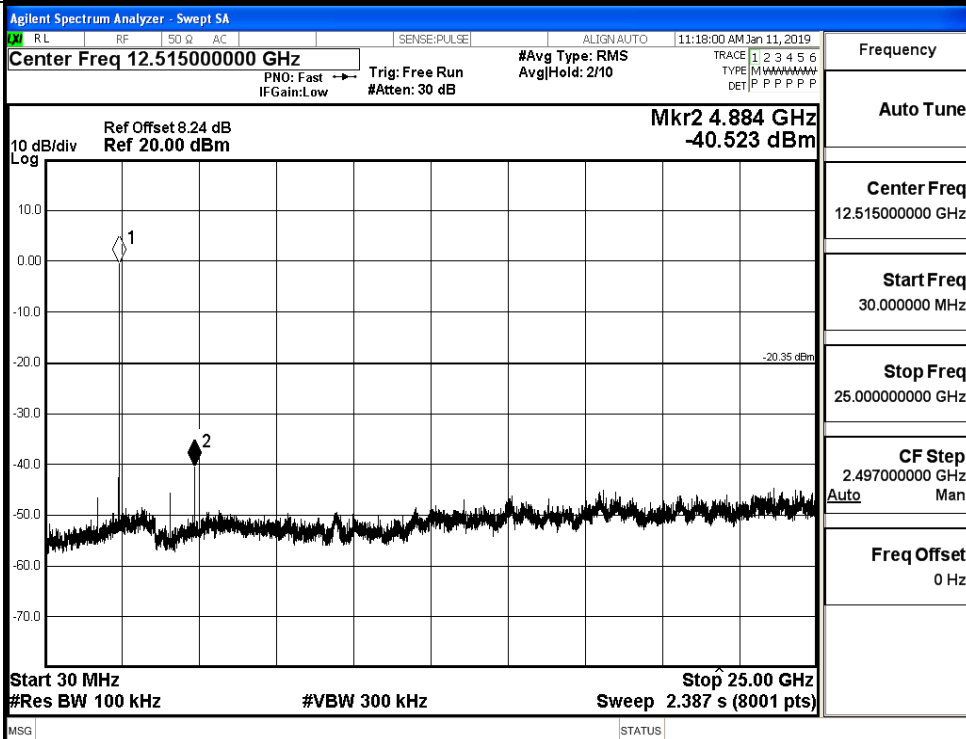


GFSK_MCH_Graphs

Pref

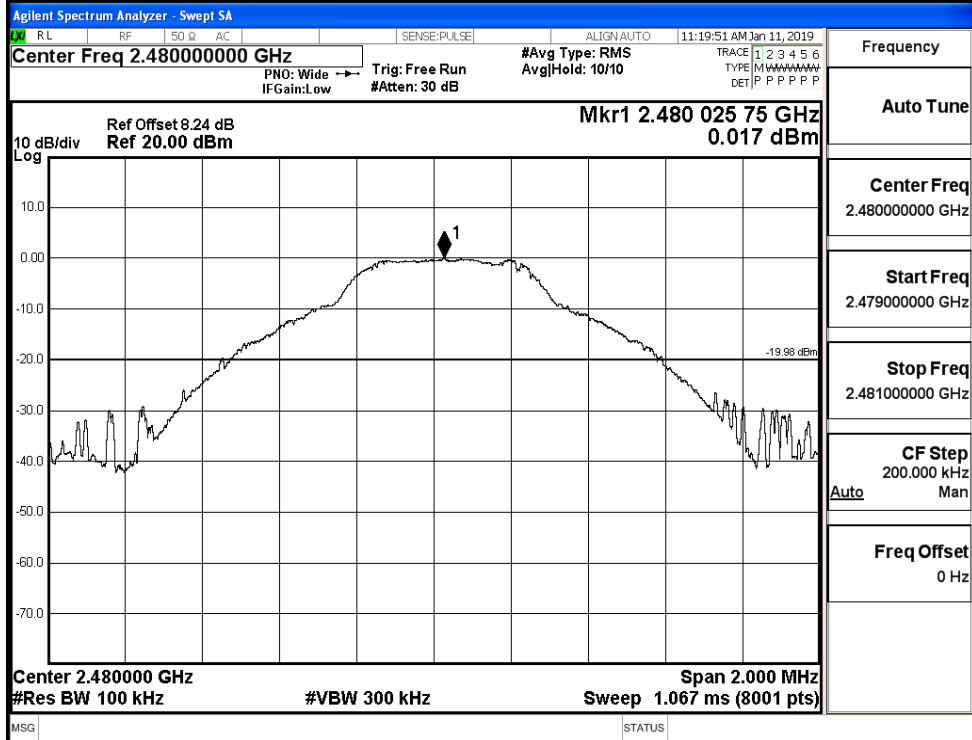


Puw

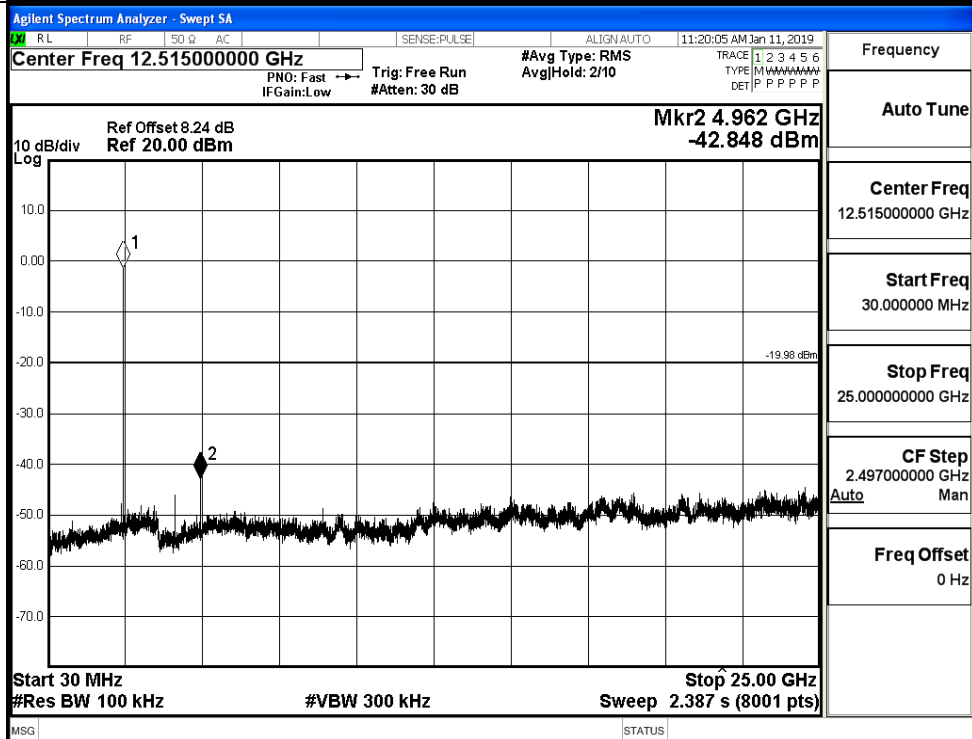


GFSK HCH_Graphs

Pref

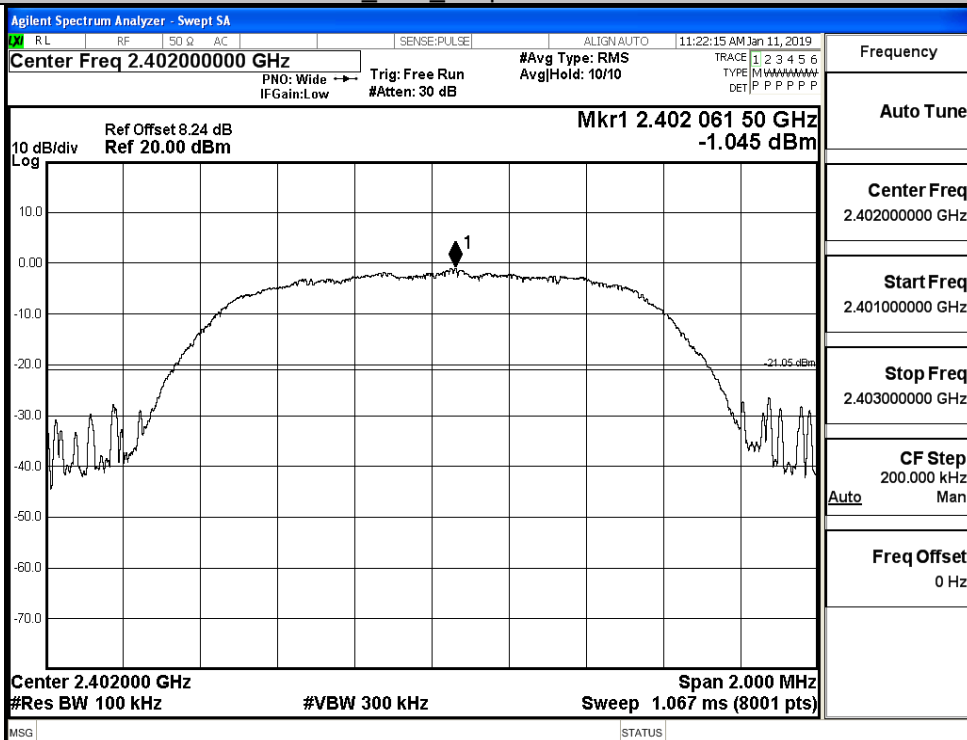


Puw

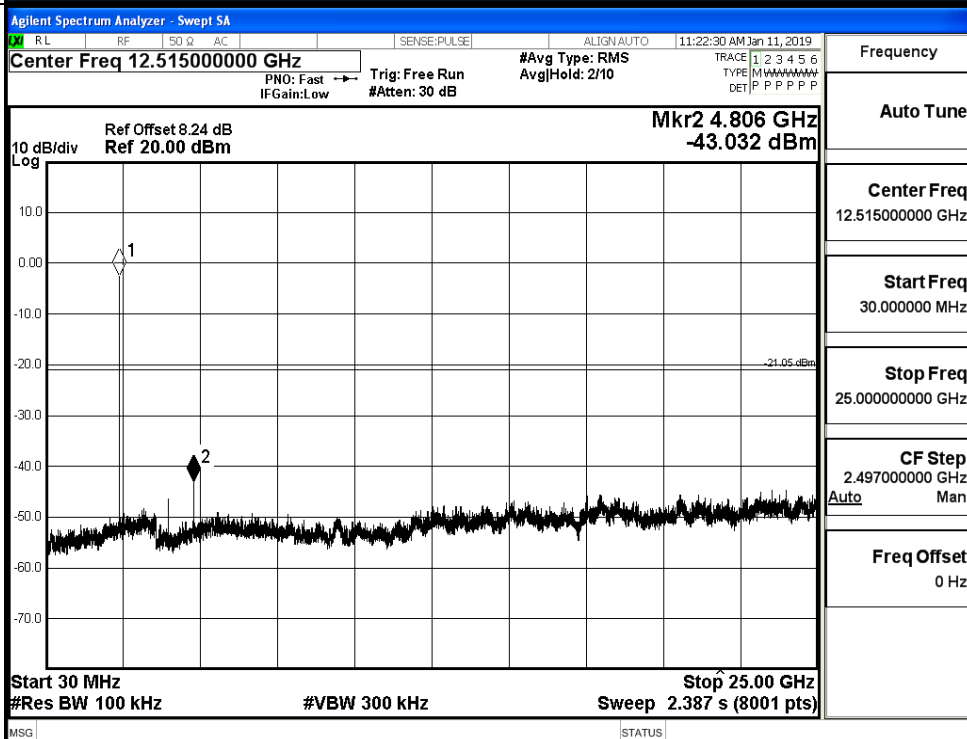


$\pi/4$ DQPSK_LCH_Graphs

Pref

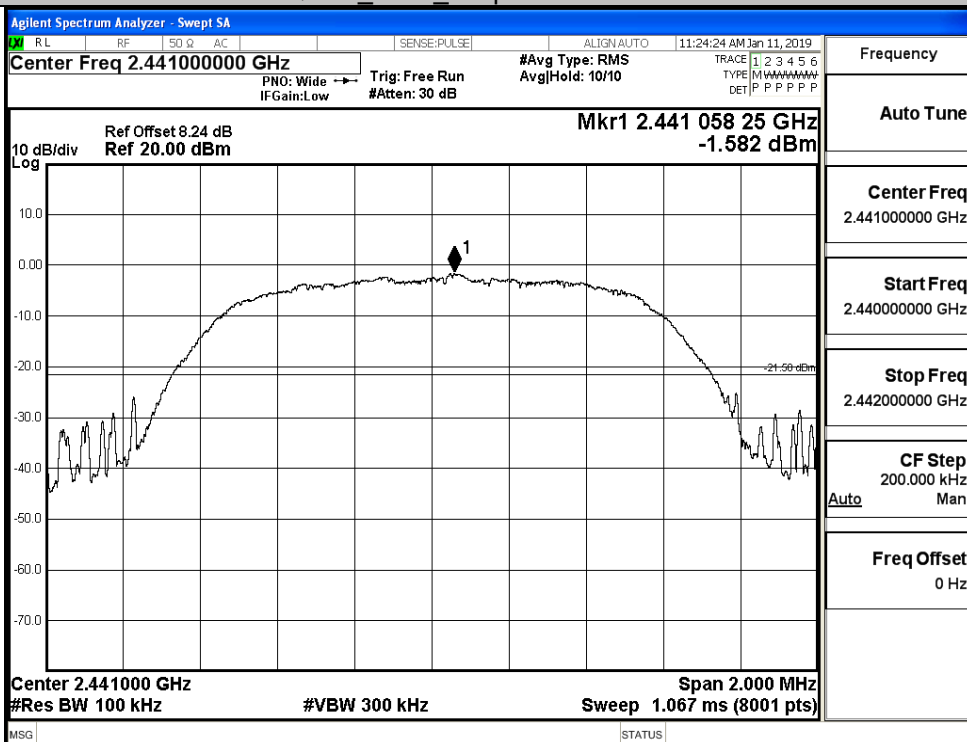


Puw

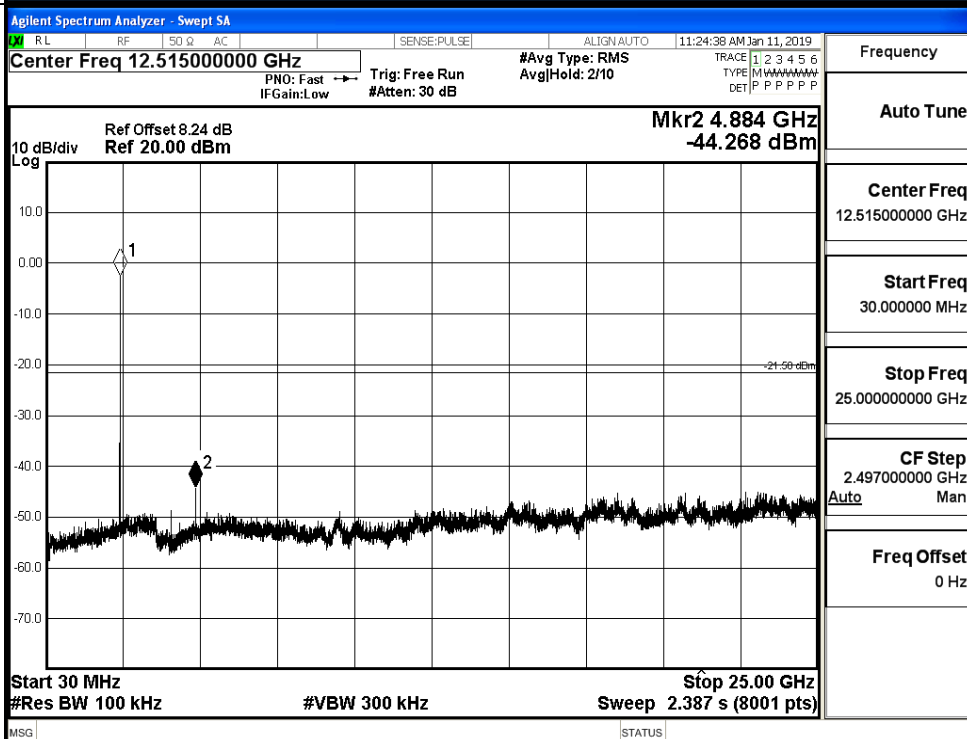


$\pi/4$ DQPSK_MCH_Graphs

Pref

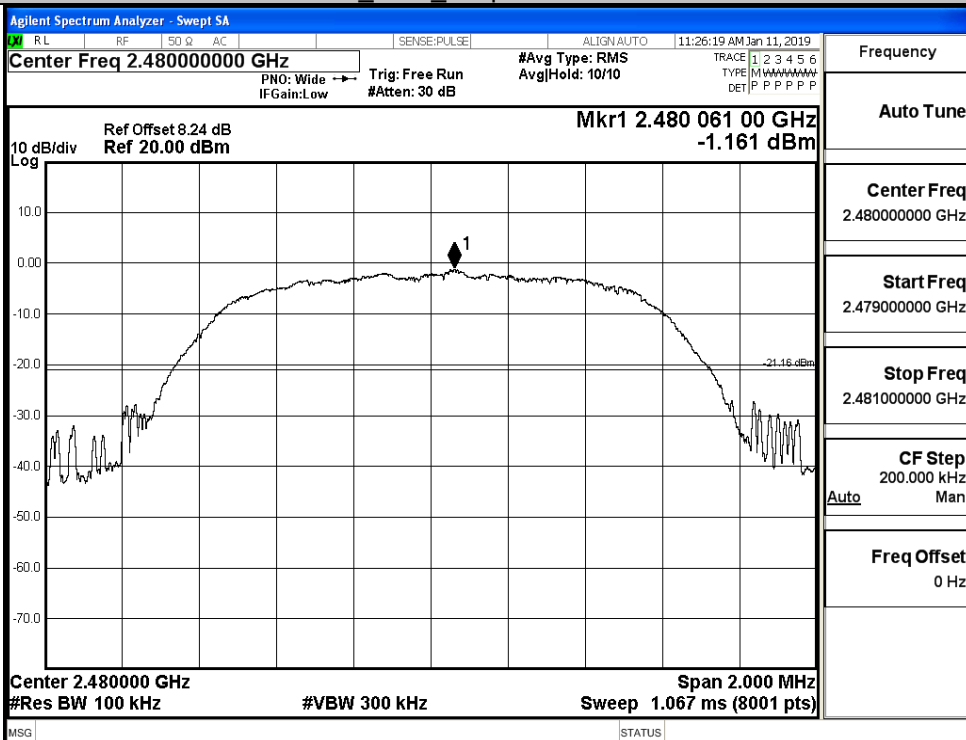


Puw

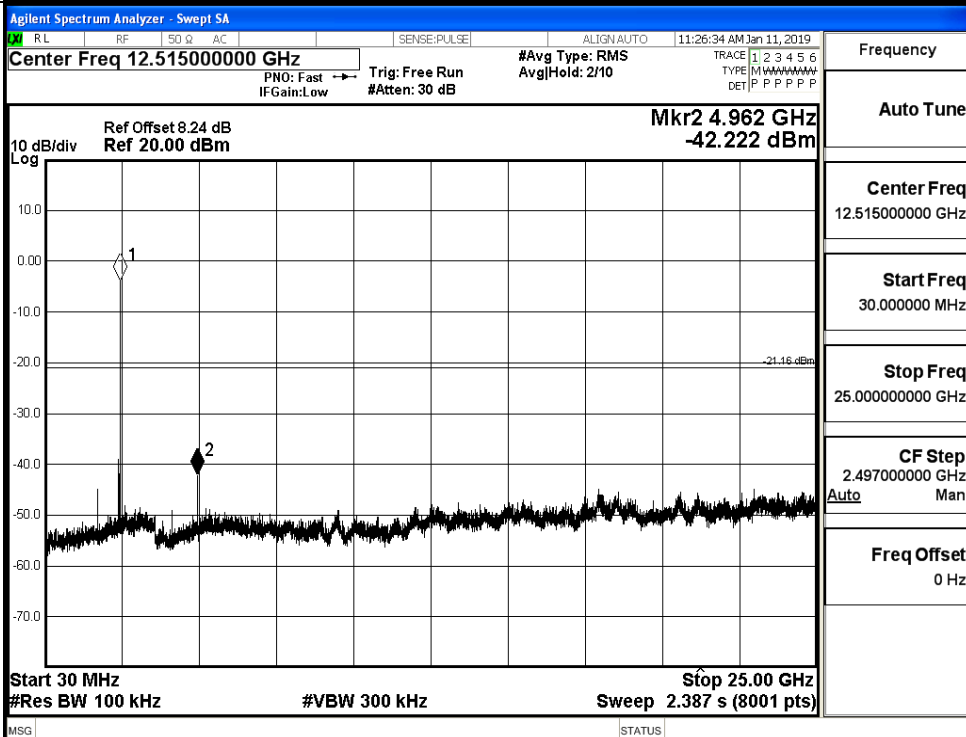


$\pi/4$ DQPSK_HCH_Graphs

Pref

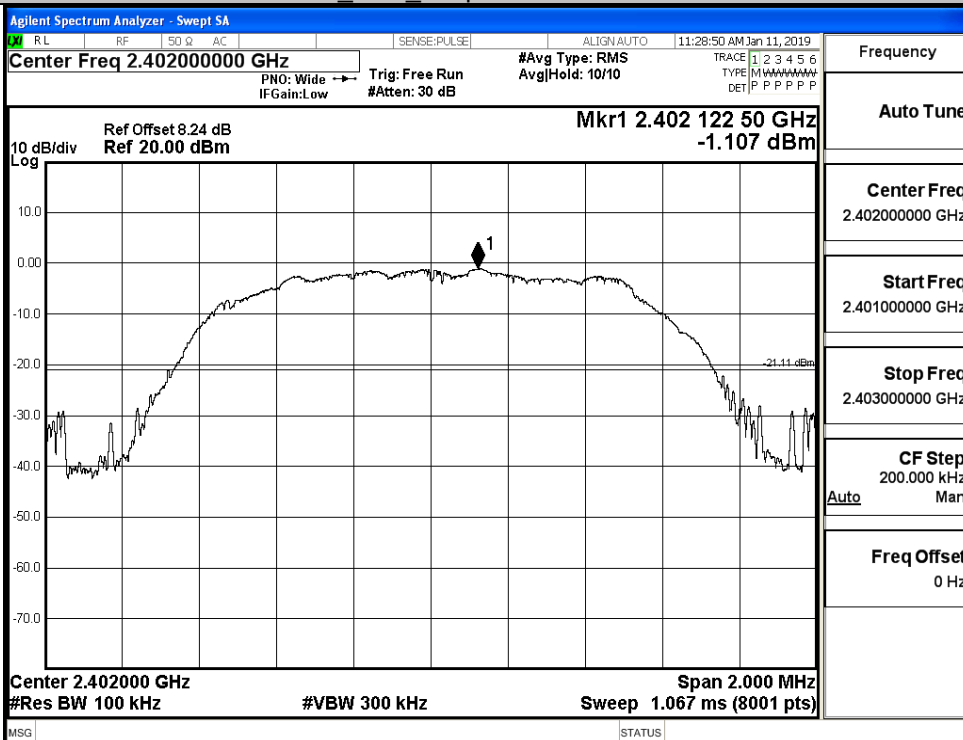


Puw

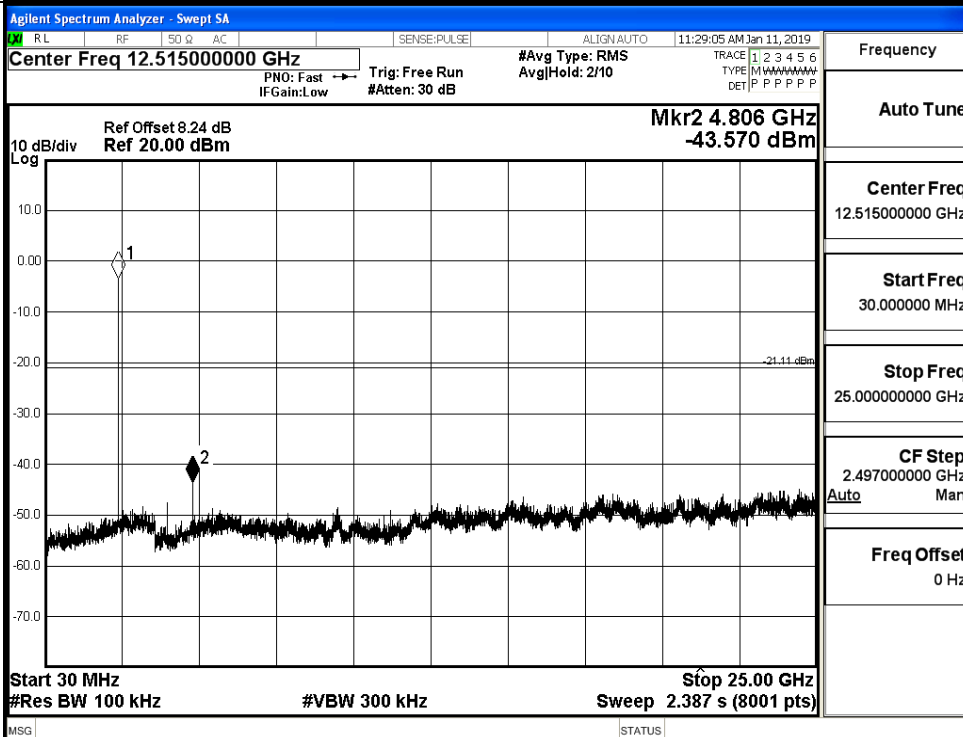


8DPSK_LCH_Graphs

Pref

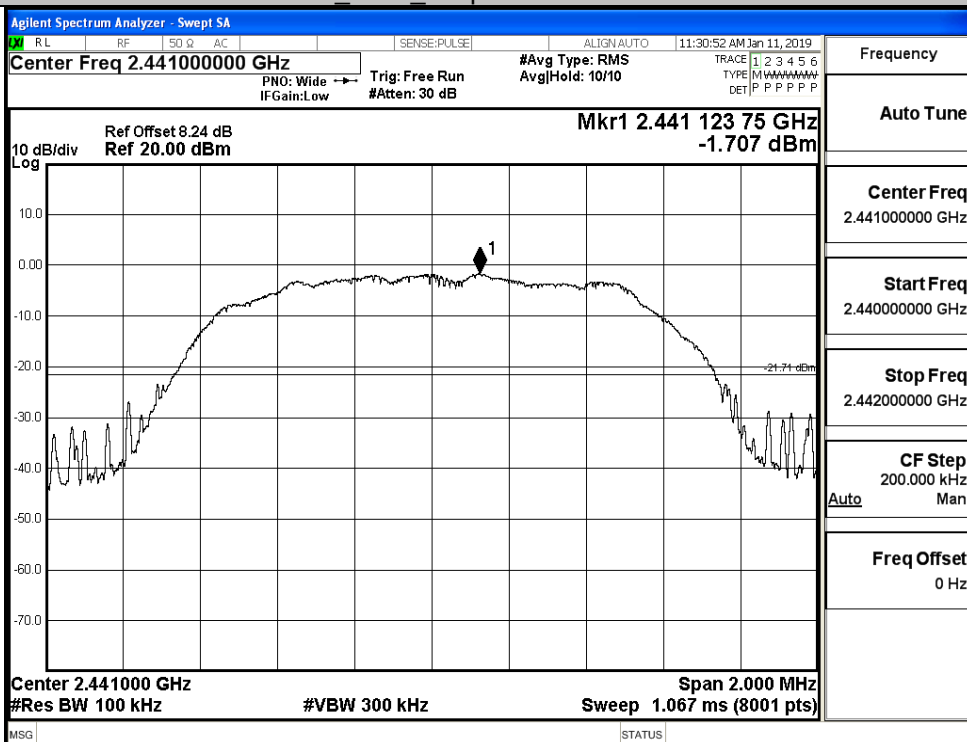


Puw

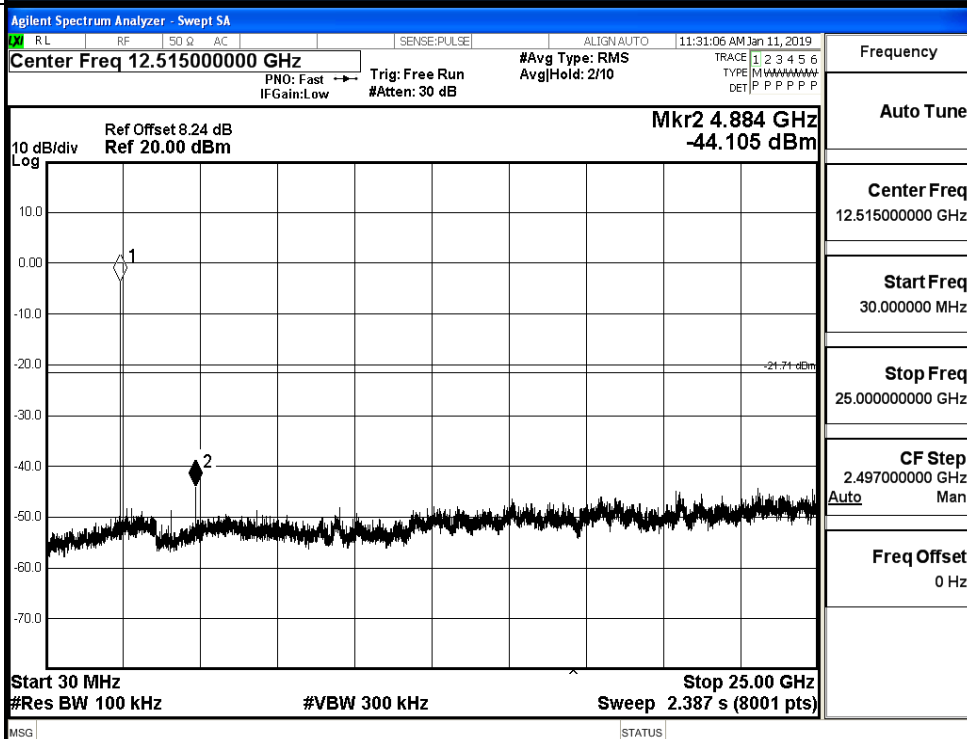


8DPSK_MCH_Graphs

Pref

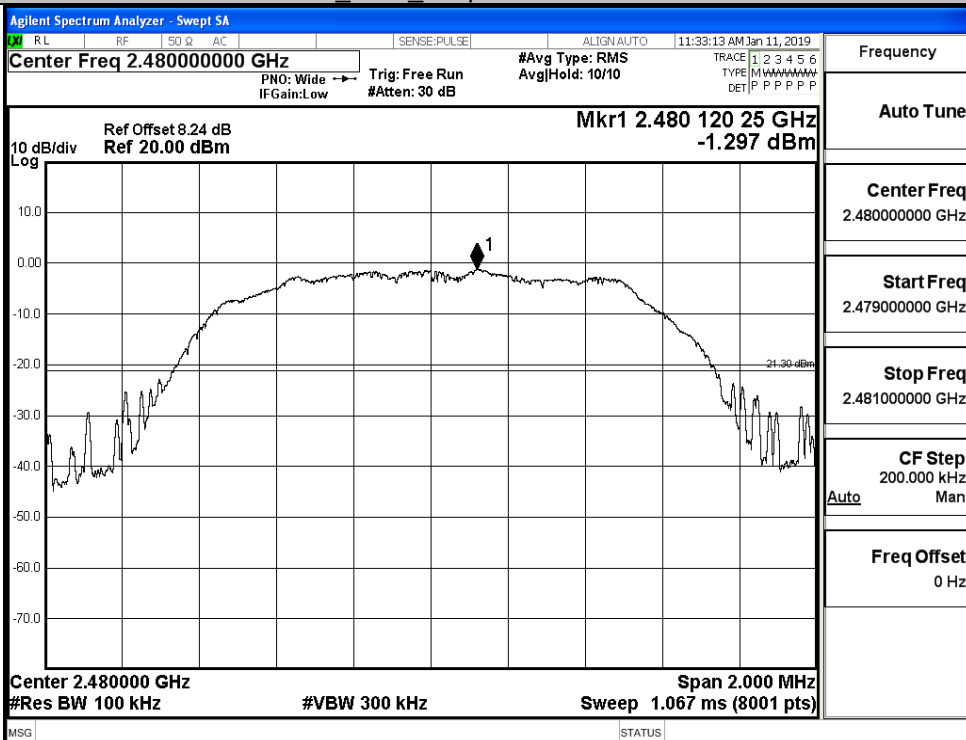


Puw

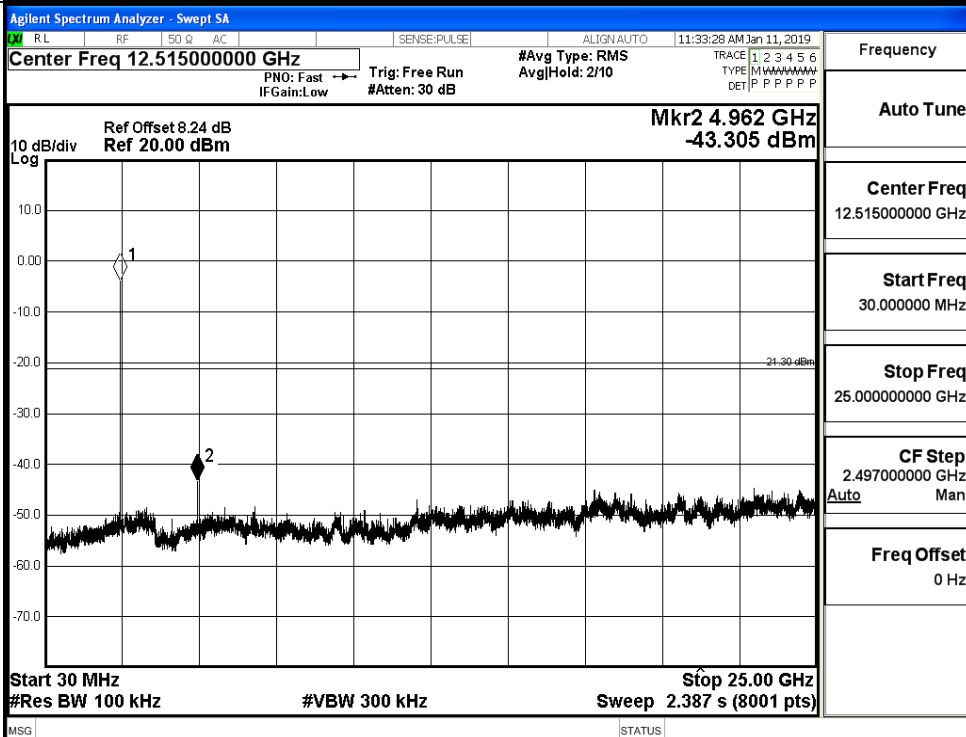


8DPSK_HCH_Graphs

Pref



Puw

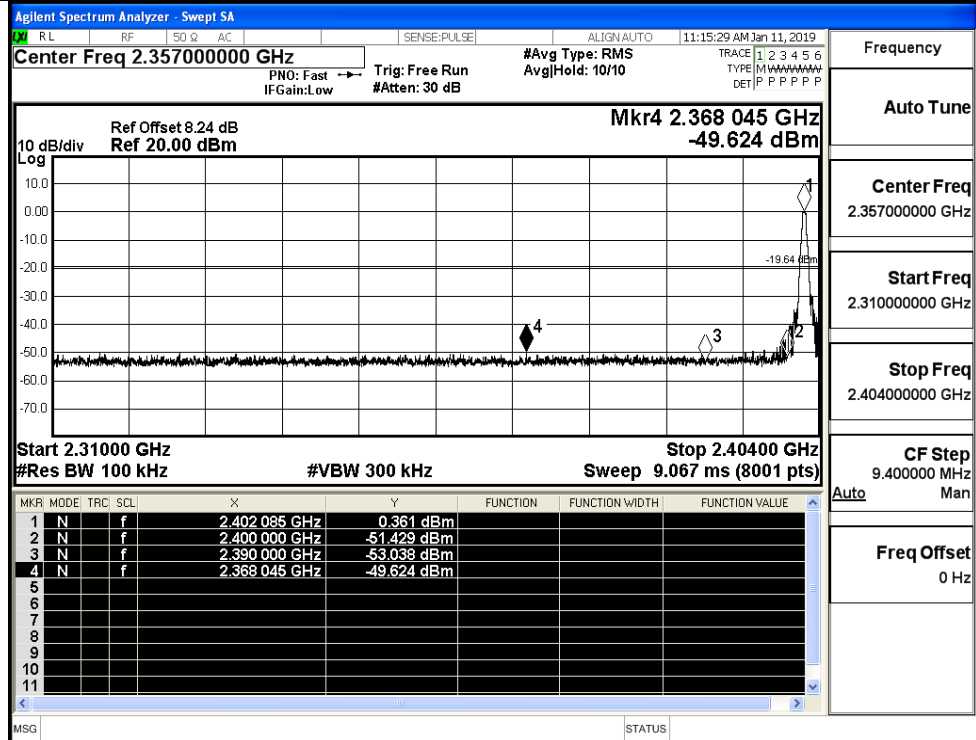


A.7 Band-edge for RF Conducted Emissions

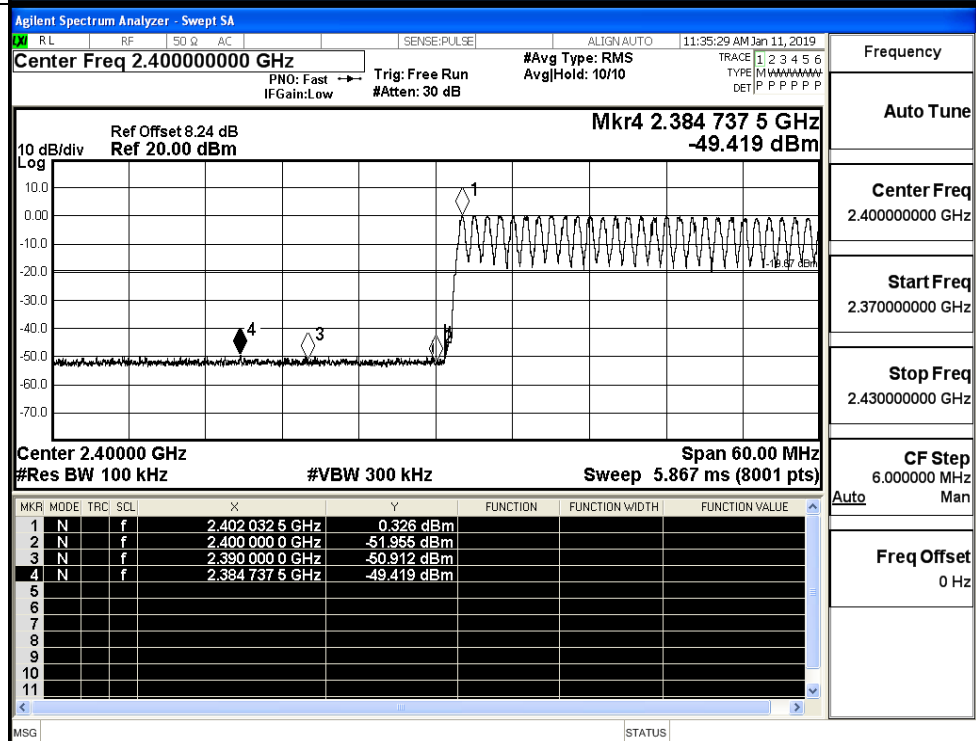
Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2402	0.361	Off	-49.624	-19.64	PASS
			0.326	On	-49.419	-19.67	PASS
	HCH	2480	0.364	Off	-47.433	-19.64	PASS
			0.386	On	-48.846	-19.61	PASS
$\pi/4$ DQPSK	LCH	2402	-0.712	Off	-48.678	-20.71	PASS
			-0.968	On	-49.133	-20.97	PASS
	HCH	2480	-1.024	Off	-48.461	-21.02	PASS
			-1.093	On	-48.647	-21.09	PASS
8DPSK	LCH	2402	-0.658	Off	-49.633	-20.66	PASS
			-0.812	On	-49.622	-20.81	PASS
	HCH	2480	-0.760	Off	-48.310	-20.76	PASS
			-0.529	On	-49.233	-20.53	PASS

Test Graphs

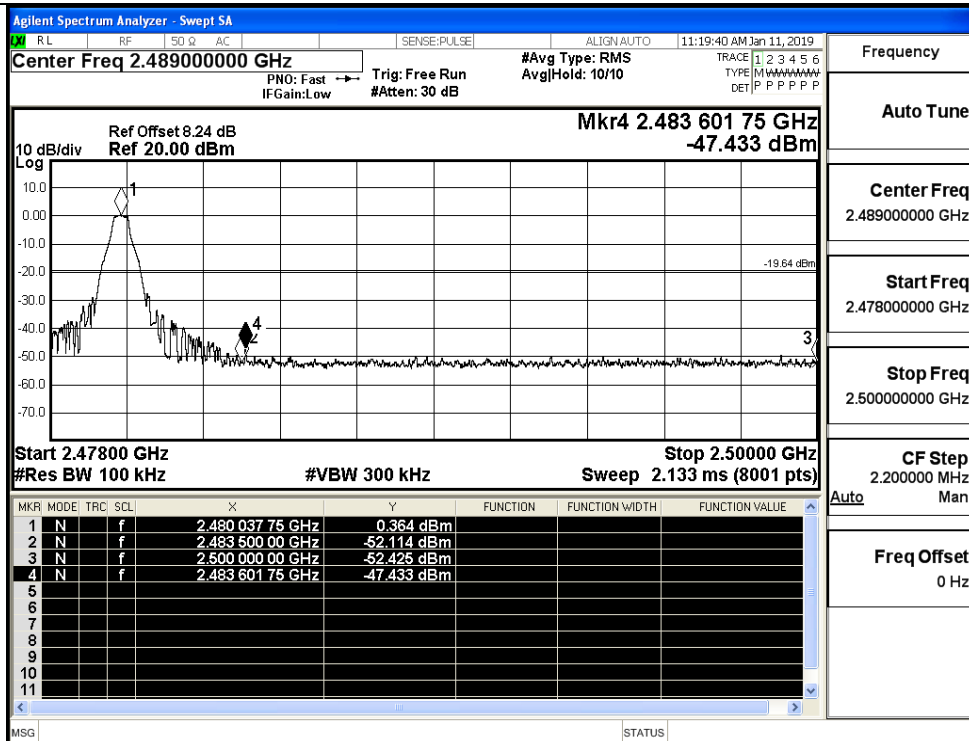
GFSK/LCH/No Hop



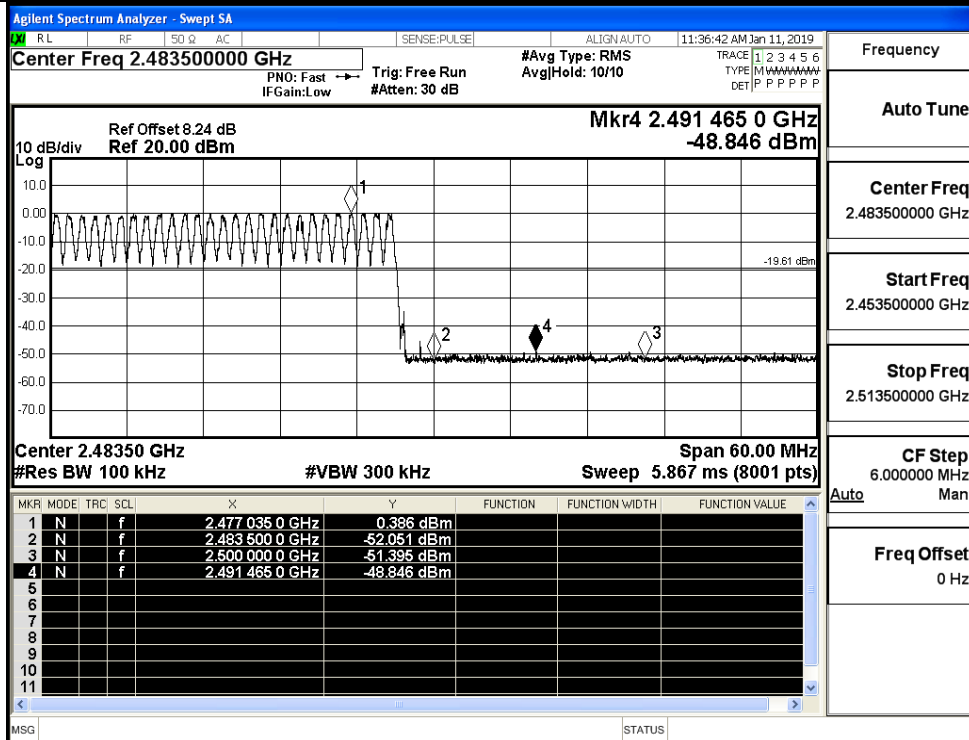
GFSK/LCH/Hop



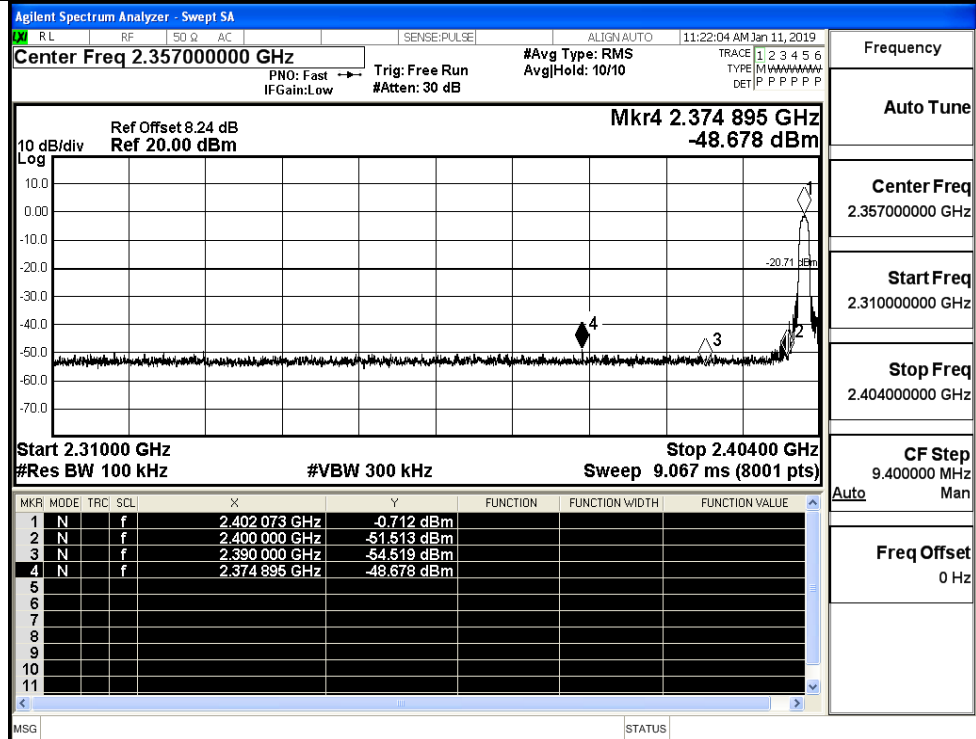
GFSK/HCH/No Hop



GFSK/HCH/Hop



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



Frequency

Auto Tune

Center Freq
2.357000000 GHz

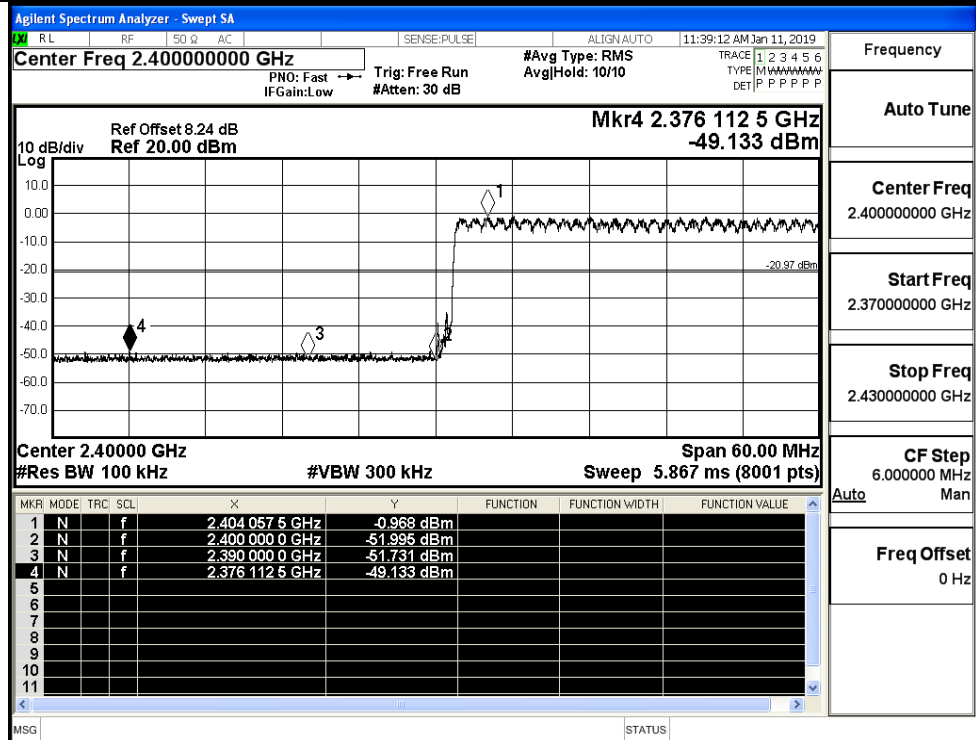
Start Freq
2.310000000 GHz

Stop Freq
2.404000000 GHz

CF Step
9.400000 MHz
Auto Man

Freq Offset
0 Hz

$\pi/4$ DQPSK/LCH/Hop



Frequency

Auto Tune

Center Freq
2.400000000 GHz

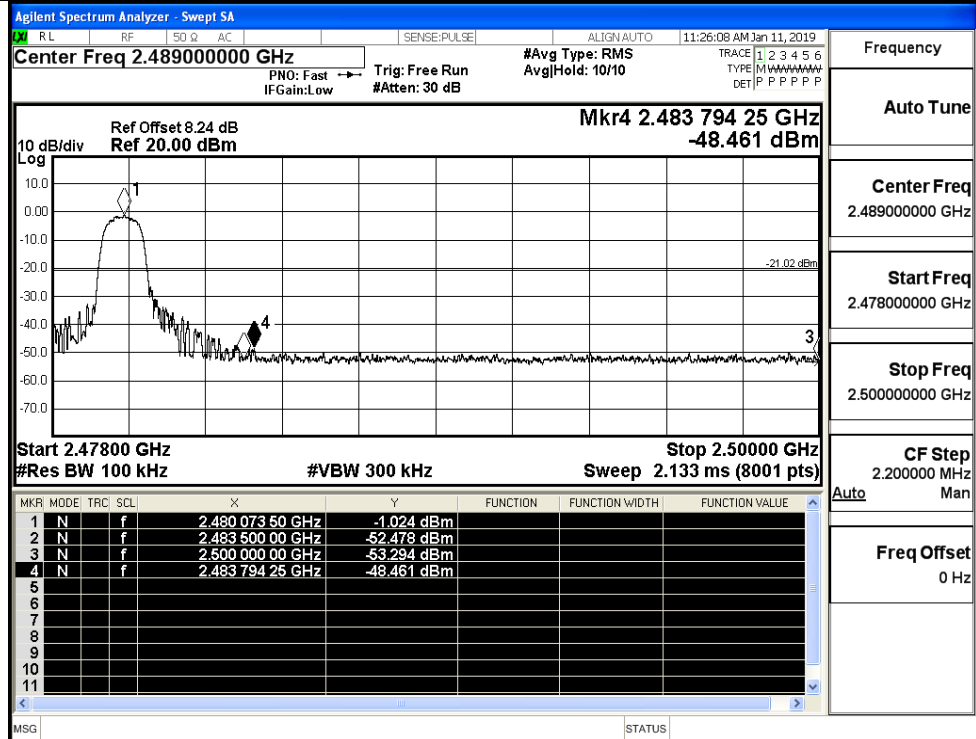
Start Freq
2.370000000 GHz

Stop Freq
2.430000000 GHz

CF Step
6.000000 MHz
Auto Man

Freq Offset
0 Hz

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



Frequency

Auto Tune

Center Freq
2.489000000 GHz

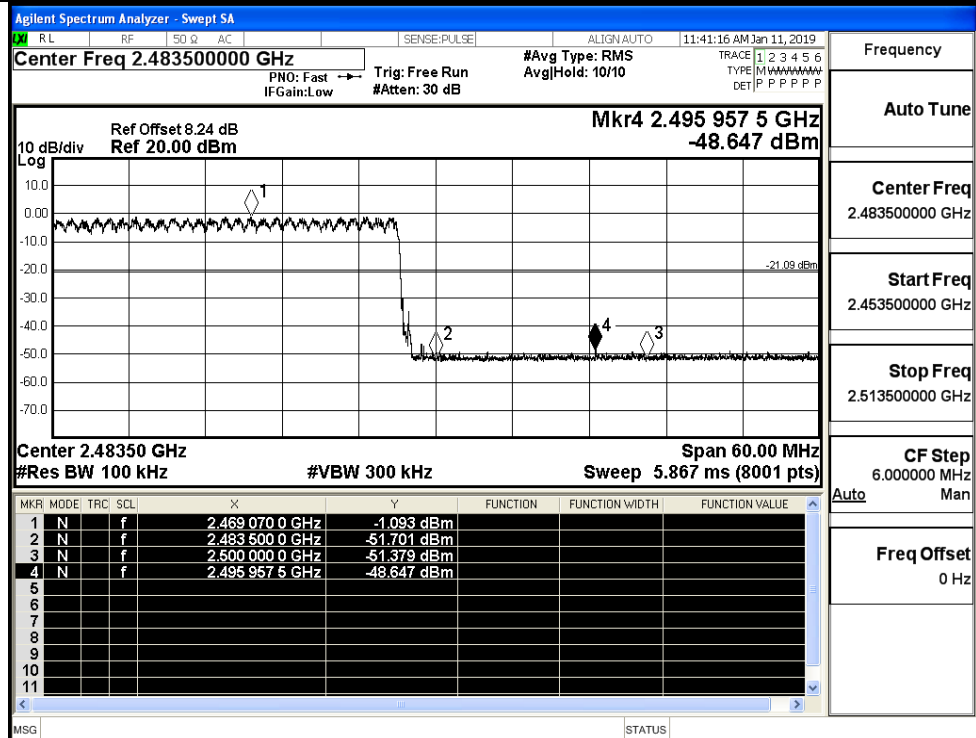
Start Freq
2.478000000 GHz

Stop Freq
2.500000000 GHz

CF Step
2.200000 MHz

Freq Offset
0 Hz

$\pi/4$ DQPSK/HCH/Hop



Frequency

Auto Tune

Center Freq
2.483500000 GHz

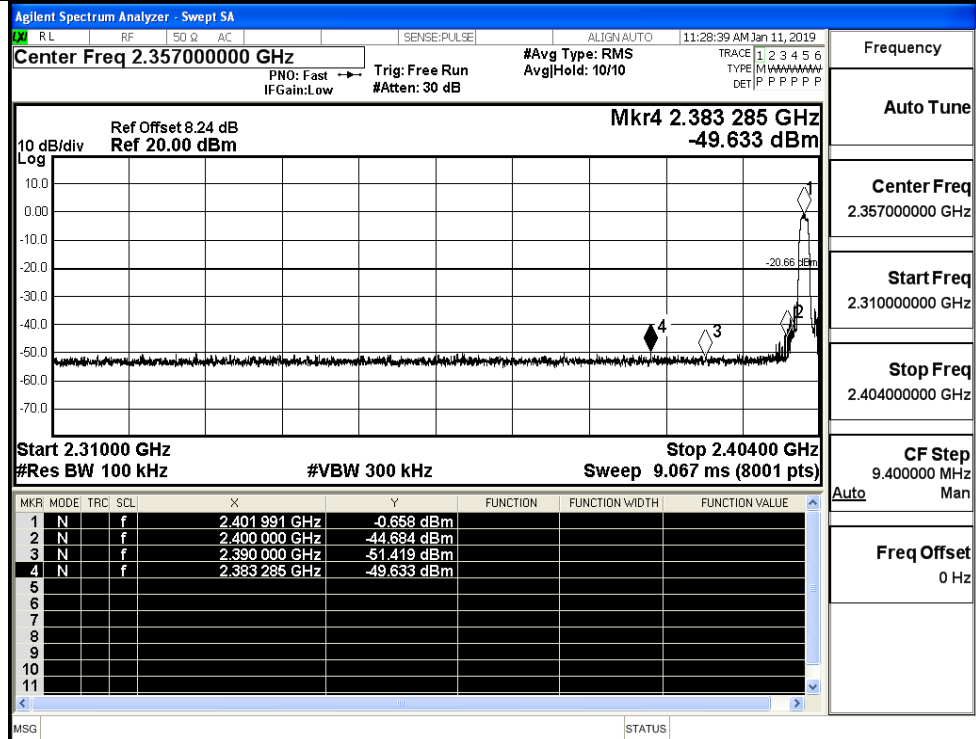
Start Freq
2.453500000 GHz

Stop Freq
2.513500000 GHz

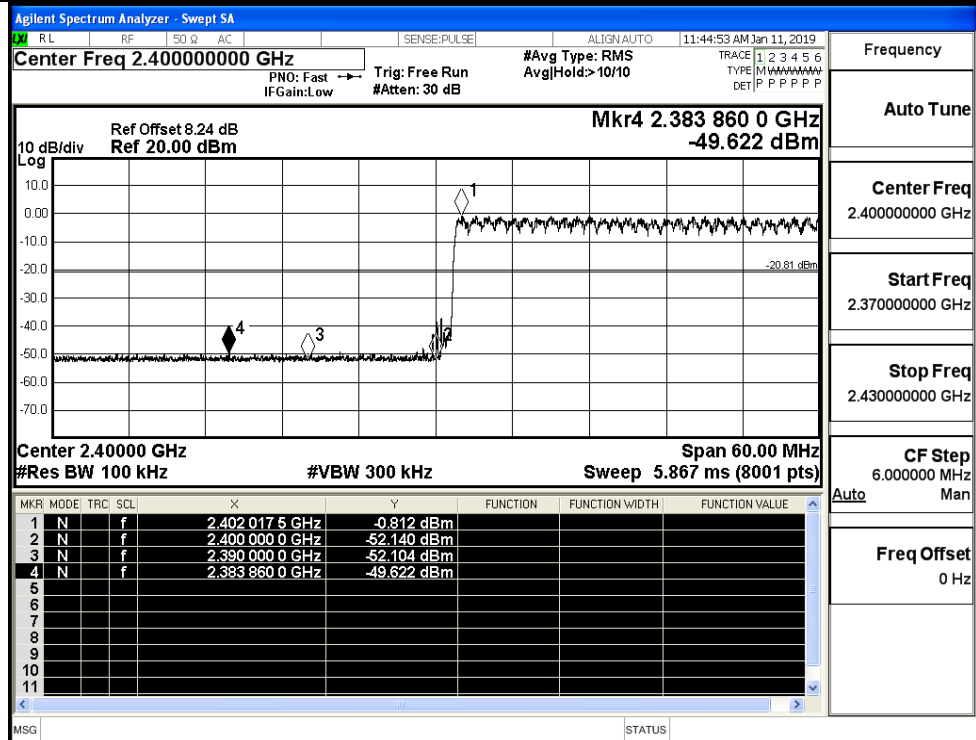
CF Step
6.000000 MHz

Freq Offset
0 Hz

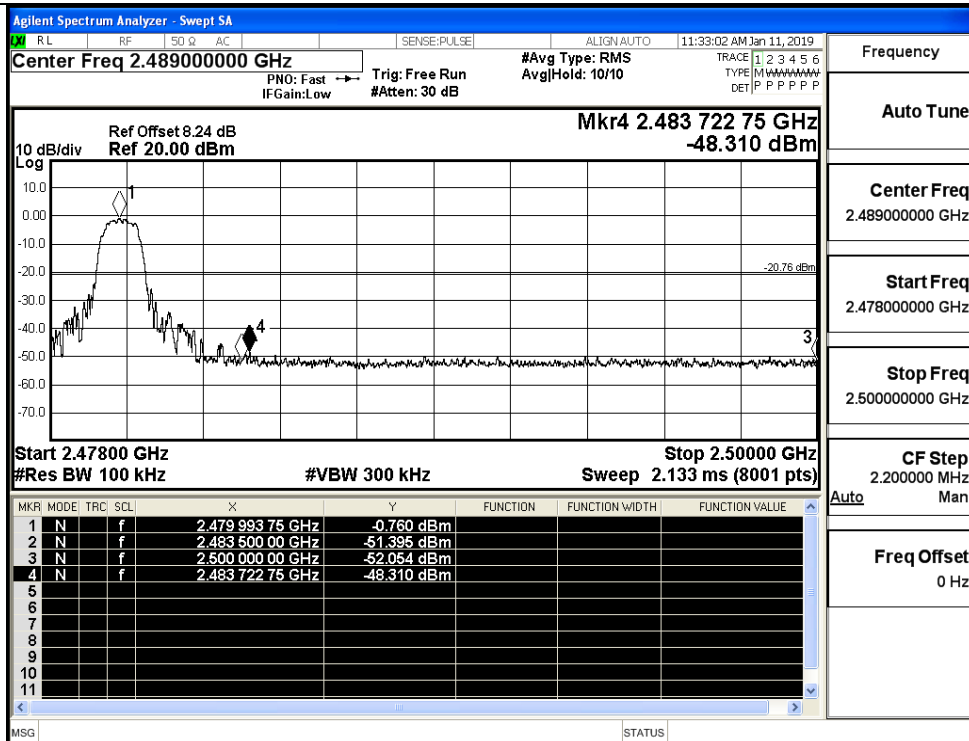
8DPSK/LCH/No Hop



8DPSK/LCH/Hop



8DPSK/HCH/No Hop



Frequency

Auto Tune

Center Freq
2.489000000 GHz

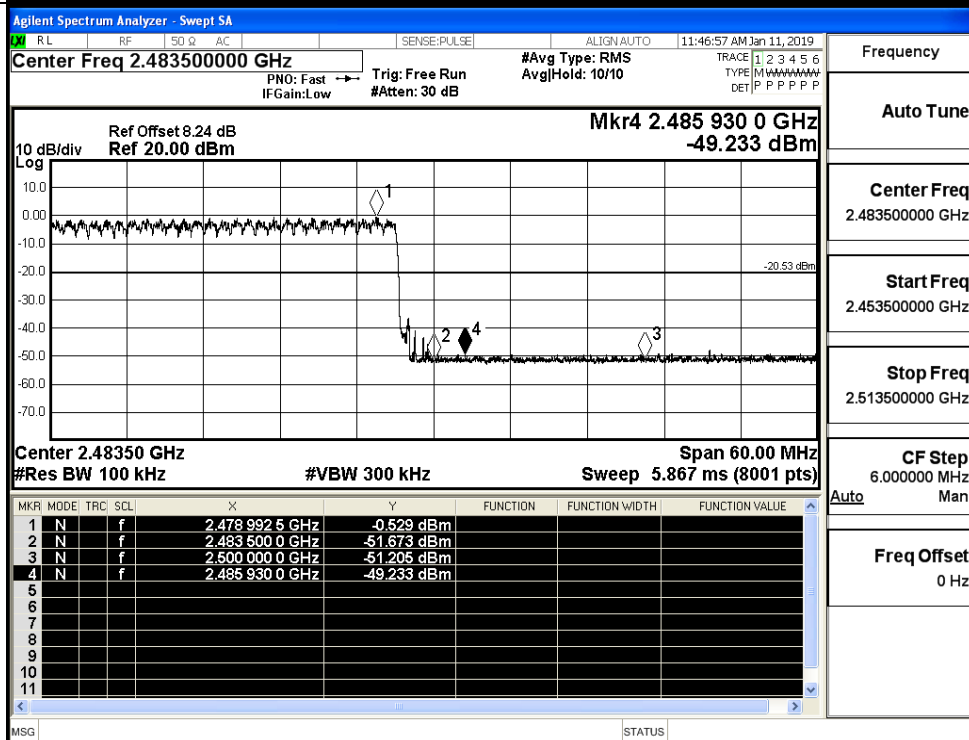
Start Freq
2.478000000 GHz

Stop Freq
2.500000000 GHz

CF Step
2.200000 MHz

Freq Offset
0 Hz

8DPSK/HCH/Hop



Frequency

Auto Tune

Center Freq
2.483500000 GHz

Start Freq
2.453500000 GHz

Stop Freq
2.513500000 GHz

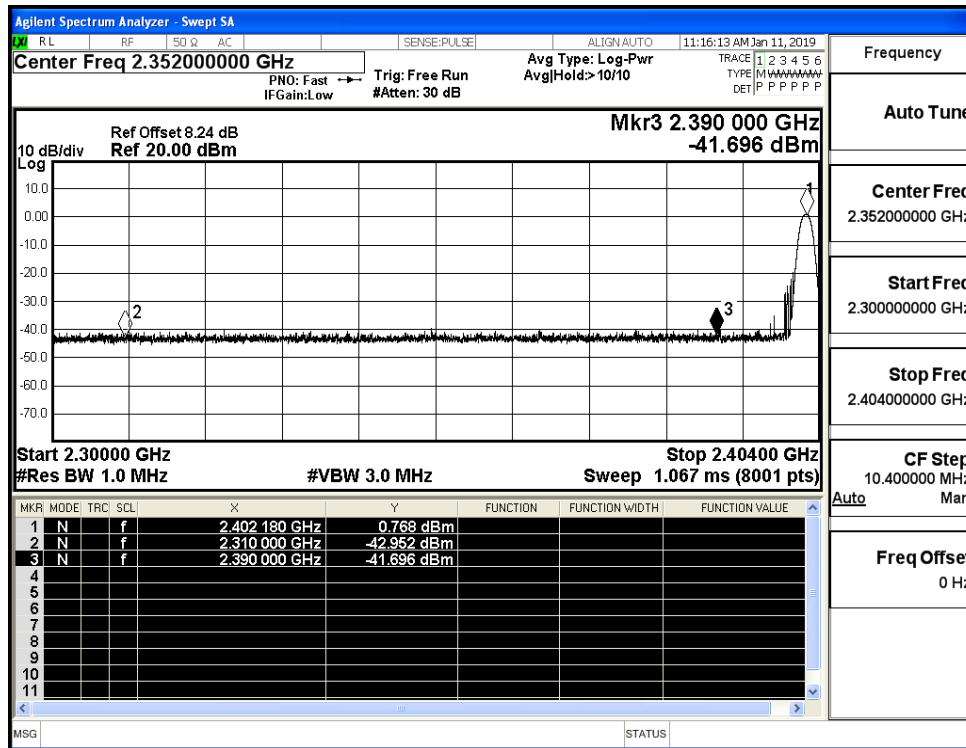
CF Step
6.000000 MHz

Freq Offset
0 Hz

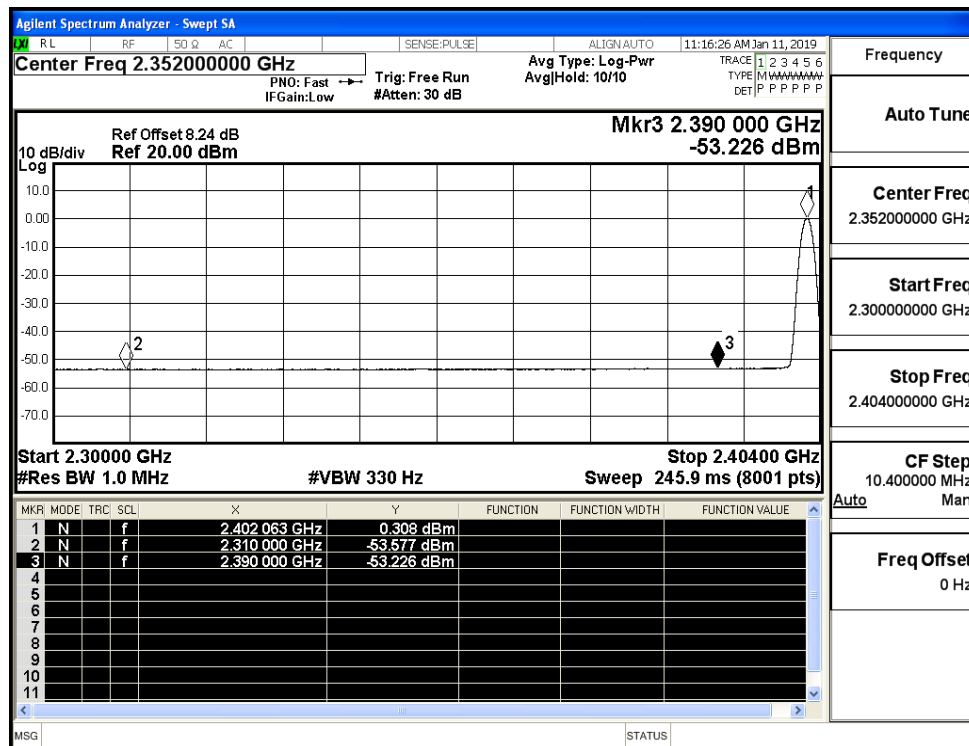
A.8 Restrict-band band-edge measurements

Test Mode	Hopping	Freq.	Power [dBm]	Gain	Ground Factor	E [dBuV/m]	Detector	Limit [dBuV/m]	Verdict
GFSK	Off	2310.0	-42.95	2.0	0	54.31	PEAK	74	PASS
	Off	2310.0	-53.58	2.0	0	43.68	AV	54	PASS
	Off	2390.0	-41.70	2.0	0	55.56	PEAK	74	PASS
	Off	2390.0	-53.23	2.0	0	44.03	AV	54	PASS
	Off	2483.5	-42.89	2.0	0	54.37	PEAK	74	PASS
	Off	2483.5	-52.62	2.0	0	44.64	AV	54	PASS
	Off	2500.0	-43.38	2.0	0	53.88	PEAK	74	PASS
	Off	2500.0	-52.89	2.0	0	44.37	AV	54	PASS
$\pi/4$ DQPSK	Off	2310.0	-44.13	2.0	0	53.13	PEAK	74	PASS
	Off	2310.0	-53.58	2.0	0	43.68	AV	54	PASS
	Off	2390.0	-44.09	2.0	0	53.17	PEAK	74	PASS
	Off	2390.0	-53.23	2.0	0	44.03	AV	54	PASS
	Off	2483.5	-42.21	2.0	0	55.05	PEAK	74	PASS
	Off	2483.5	-52.55	2.0	0	44.71	AV	54	PASS
	Off	2500.0	-42.12	2.0	0	55.14	PEAK	74	PASS
	Off	2500.0	-52.84	2.0	0	44.42	AV	54	PASS
8DPSK	Off	2310.0	-43.76	2.0	0	53.50	PEAK	74	PASS
	Off	2310.0	-53.47	2.0	0	43.79	AV	54	PASS
	Off	2390.0	-42.09	2.0	0	55.17	PEAK	74	PASS
	Off	2390.0	-53.28	2.0	0	43.98	AV	54	PASS
	Off	2483.5	-41.76	2.0	0	55.50	PEAK	74	PASS
	Off	2483.5	-52.63	2.0	0	44.63	AV	54	PASS
	Off	2500.0	-42.51	2.0	0	54.74	PEAK	74	PASS
	Off	2500.0	-52.85	2.0	0	44.41	AV	54	PASS

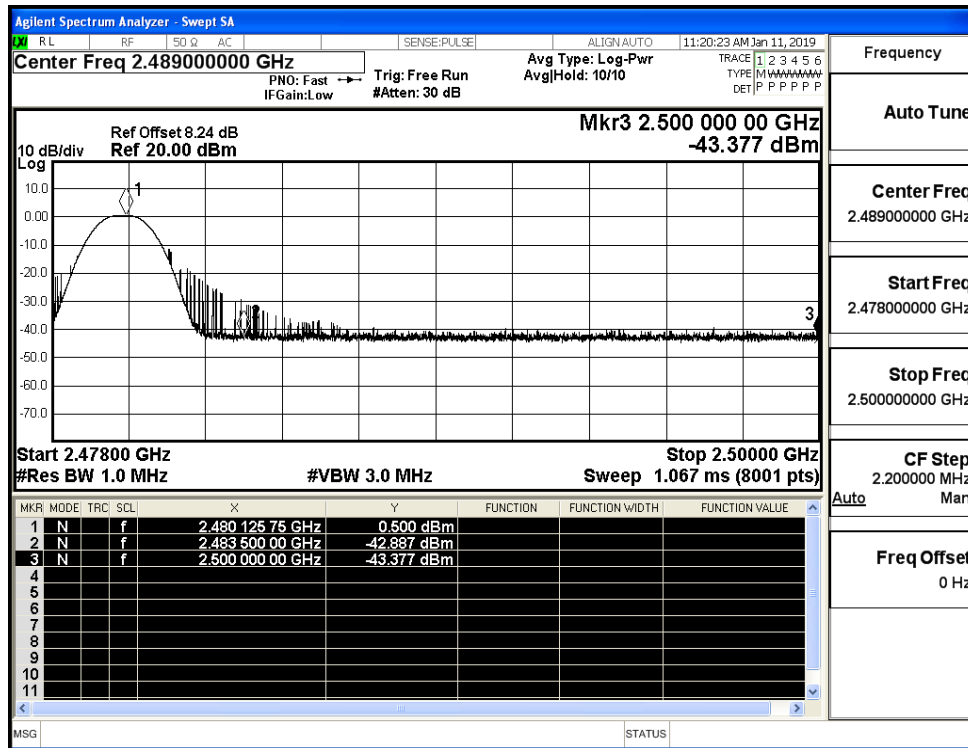
Restrict-band band-edge measurements_Hopping Off_GFSK_PEAK (Low Channel)



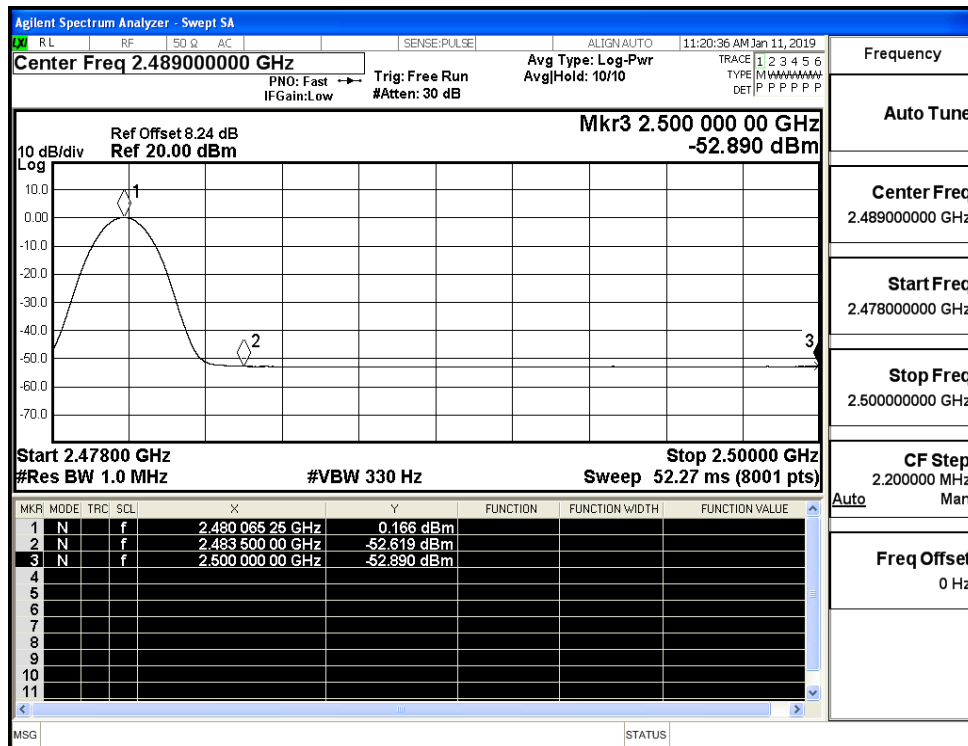
Restrict-band band-edge measurements_Hopping Off_GFSK_Average (Low Channel)



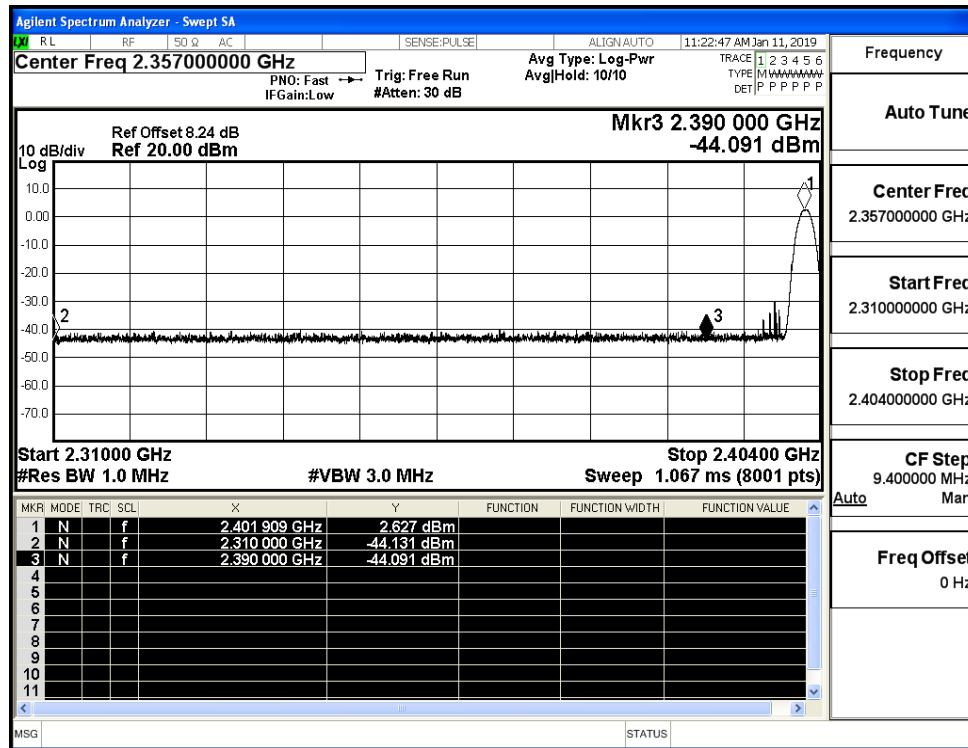
Restrict-band band-edge measurements_Hopping Off_GFSK_PEAK (High Channel)



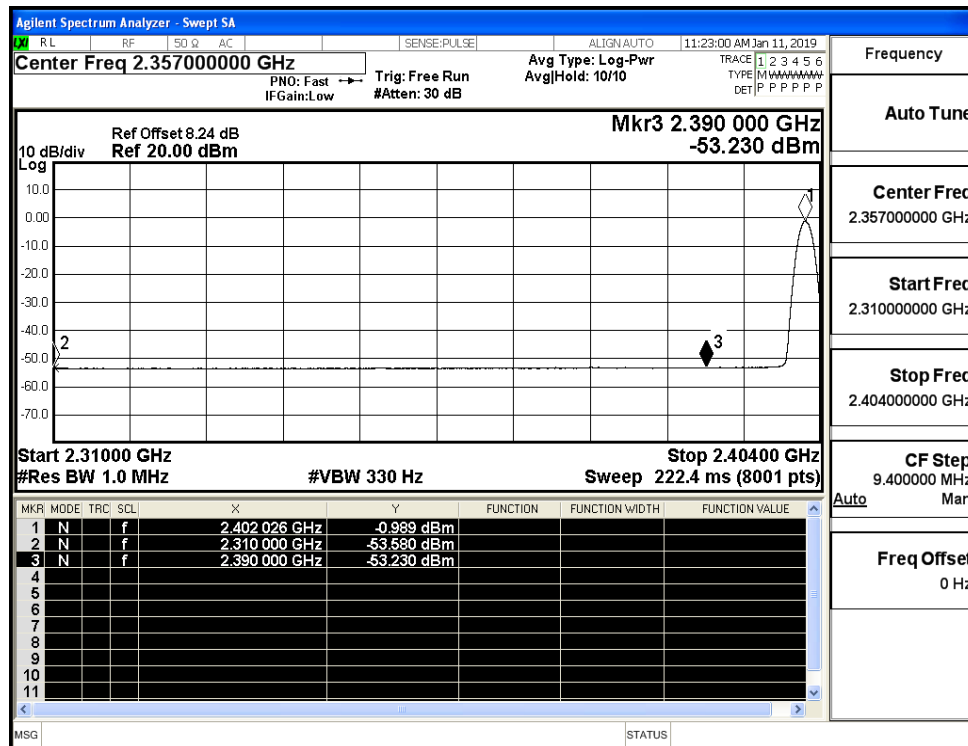
Restrict-band band-edge measurements_Hopping Off_GFSK_Average (High Channel)



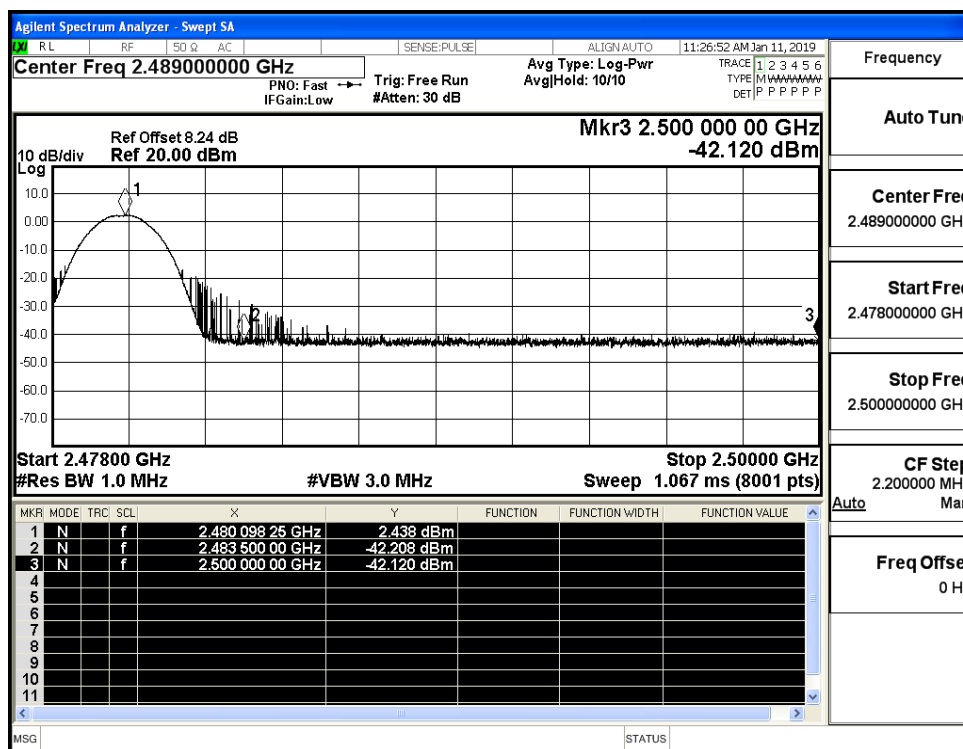
Restrict-band band-edge measurements_Hopping Off $\pi/4$ -DQPSK_PEAK (Low Channel)



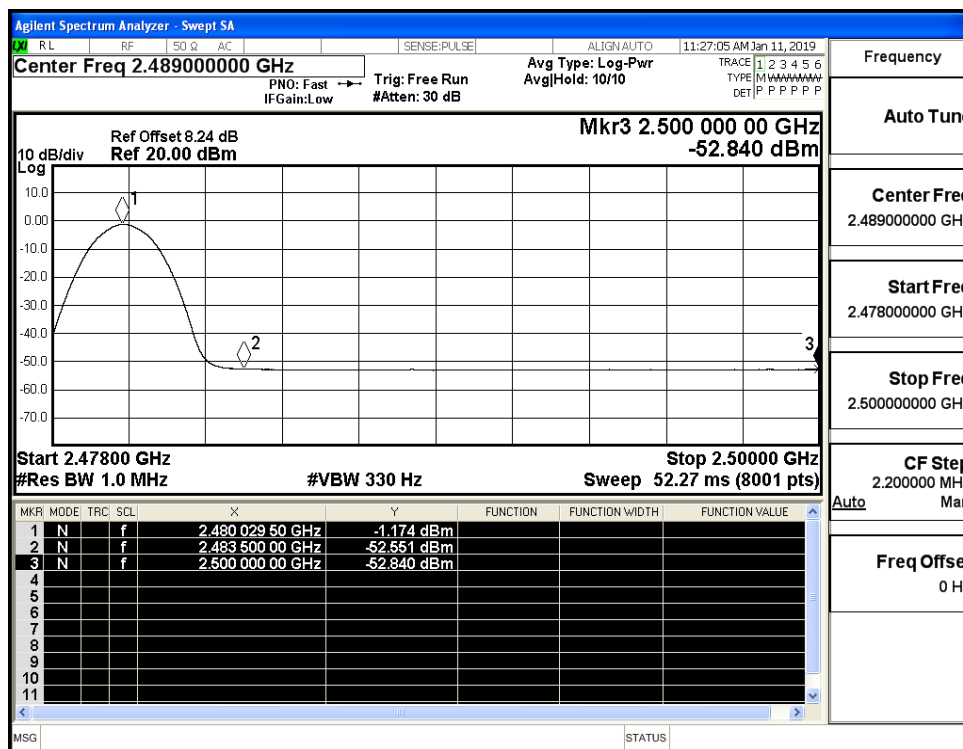
Restrict-band band-edge measurements_Hopping Off $\pi/4$ -DQPSK_Average (Low Channel)



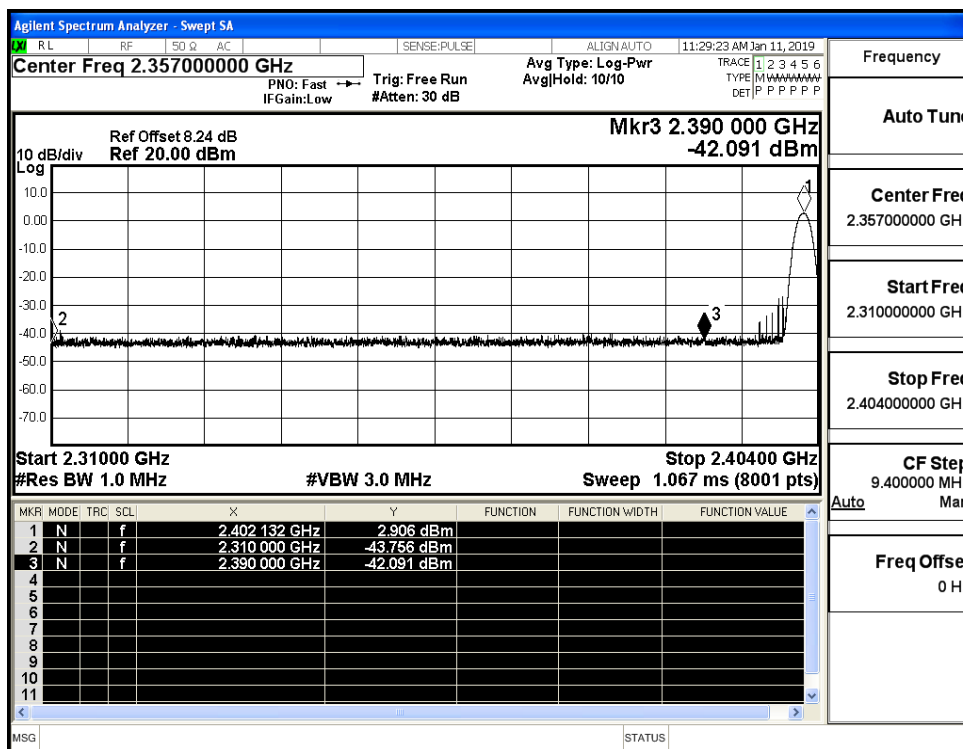
Restrict-band band-edge measurements_Hopping Off_π/4-DQPSK_PEAK (High Channel)



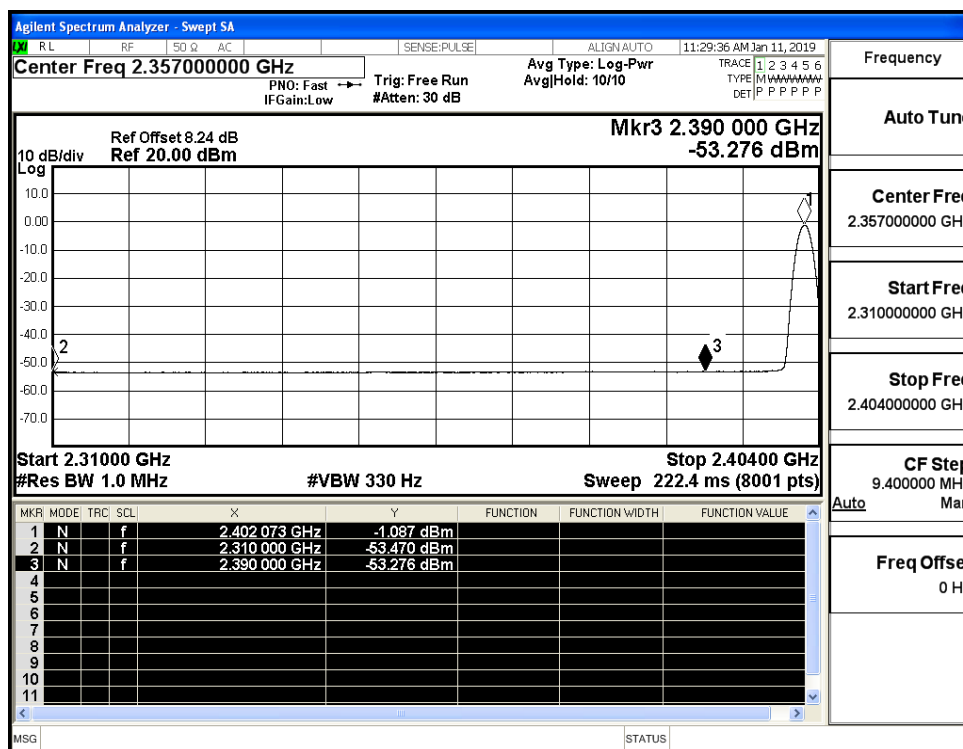
Restrict-band band-edge measurements_Hopping Off_π/4-DQPSK_Average (High Channel)



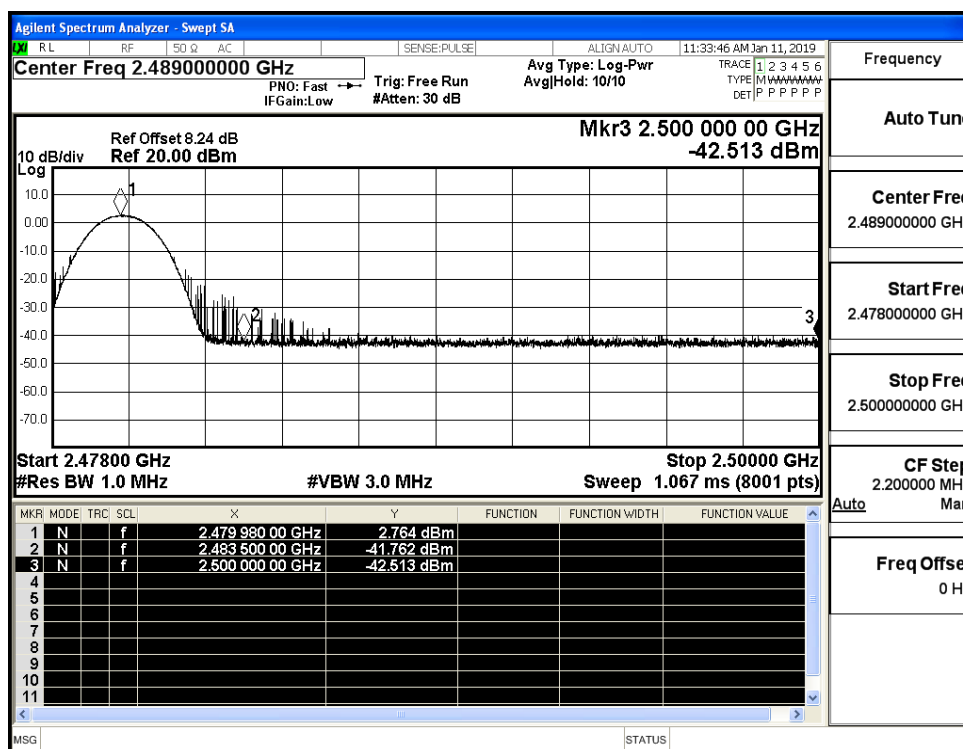
Restrict-band band-edge measurements_Hopping Off_8DPSK_PEAK (Low Channel)



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)

