

Appendix A

RF Test Data for 2.4G WIFI (Conducted Measurement)

Product Name: Butler

Trade Mark: 

Test Model: VN-BTLR-01

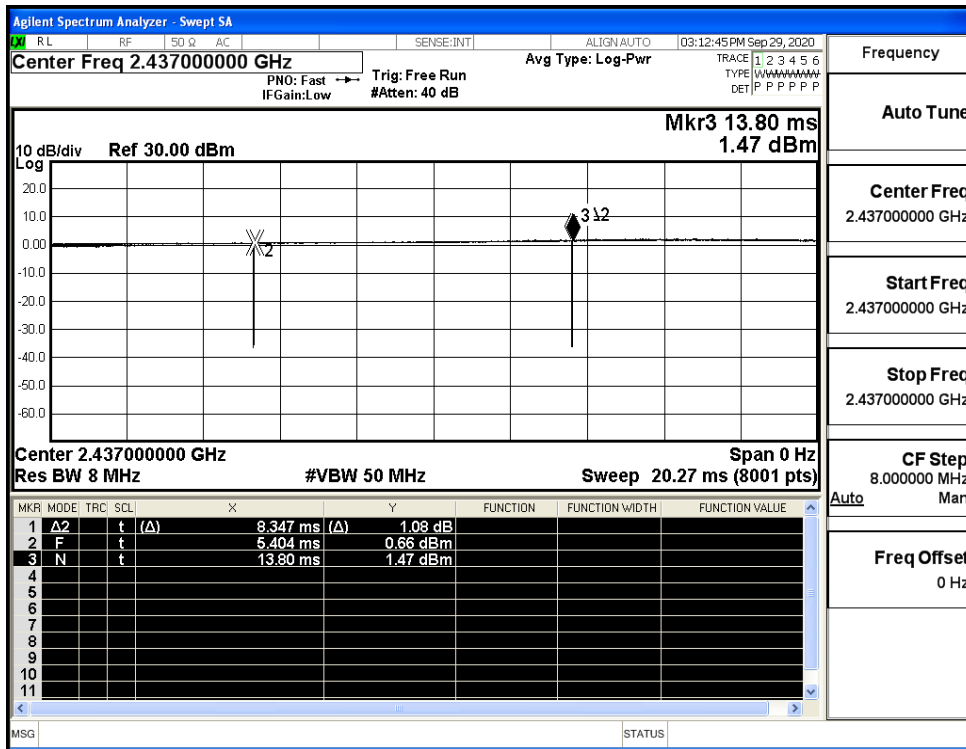
Environmental Conditions

Temperature:	23.7 ° C
Relative Humidity:	53.5%
ATM Pressure:	100.0 kPa
Test Engineer:	Jam Zheng
Supervised by:	Li Huan

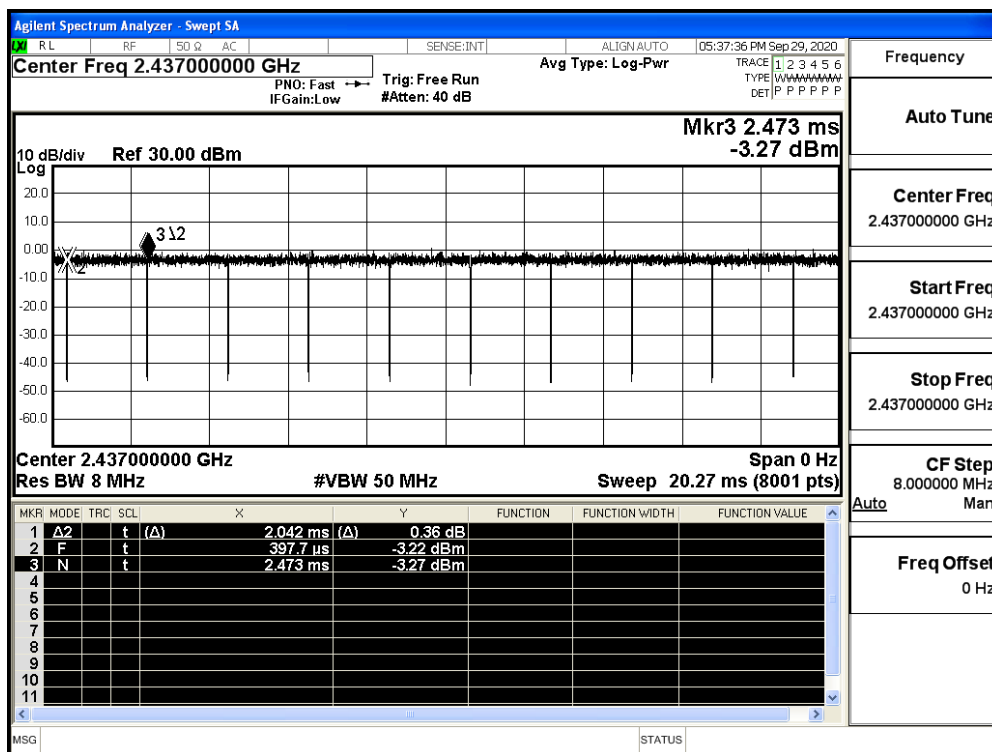
A.1 Duty Cycle

Test Mode	Test Channel	Ant	Duty Cycle[%]	Verdict
11B	2437	Ant1	99.4	PASS
11G	2437	Ant1	98.4	PASS
11N20SISO	2437	Ant1	98.67	PASS
11N40SISO	2437	Ant1	98.74	PASS

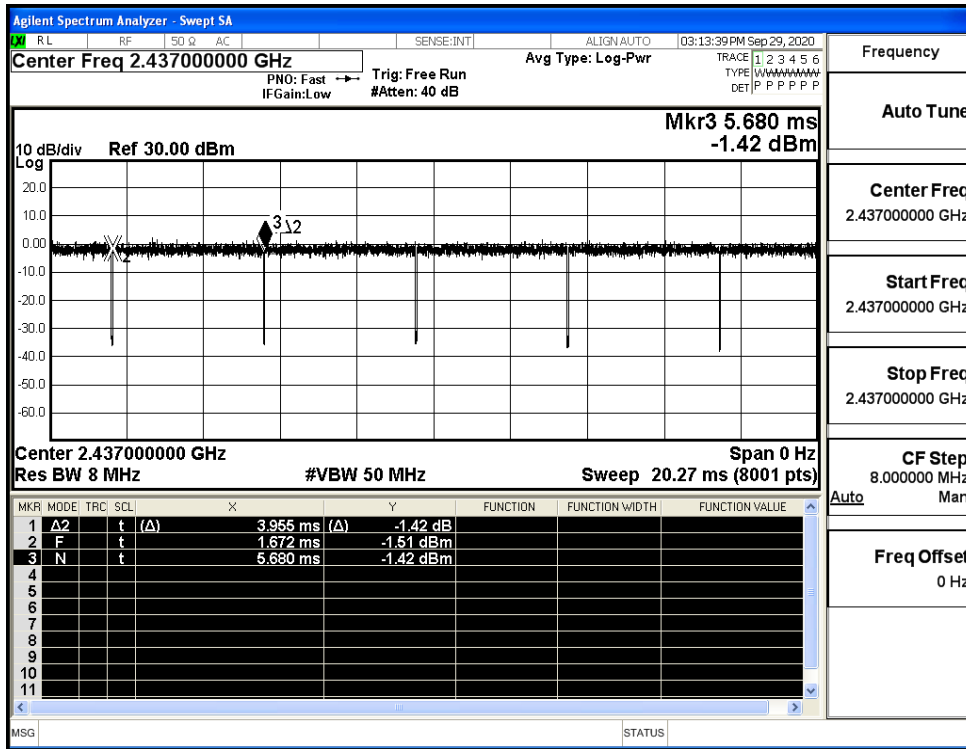
Duty Cycle_11B_2437_Ant1



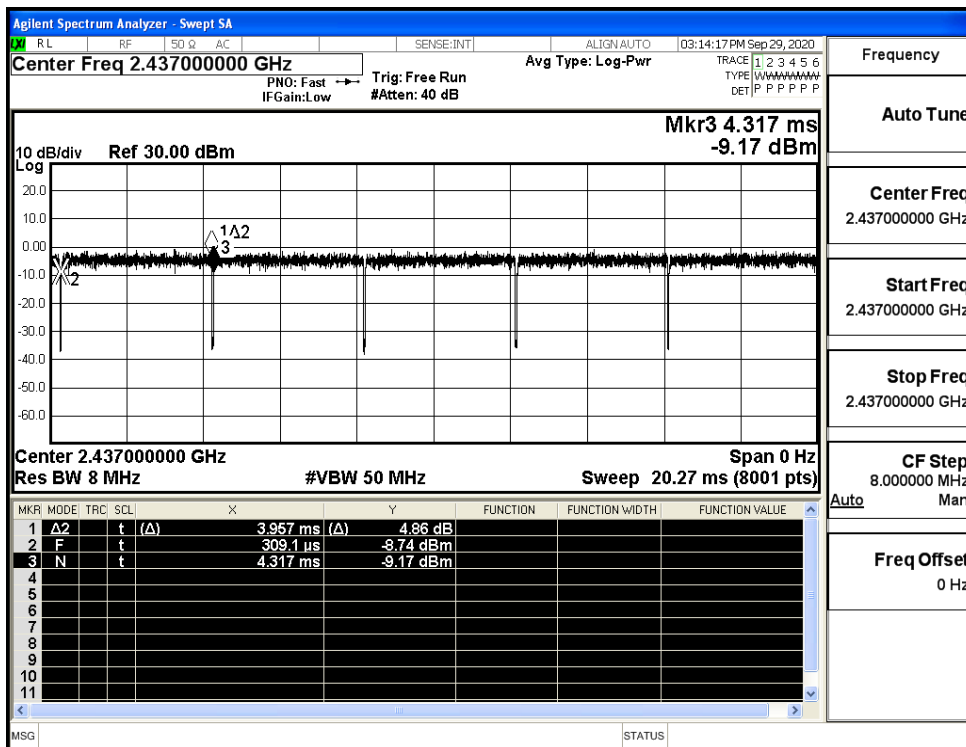
Duty Cycle_11G_2437_Ant1



Duty Cycle_11N20SISO_2437_Ant1



Duty Cycle_11N40SISO_2437_Ant1

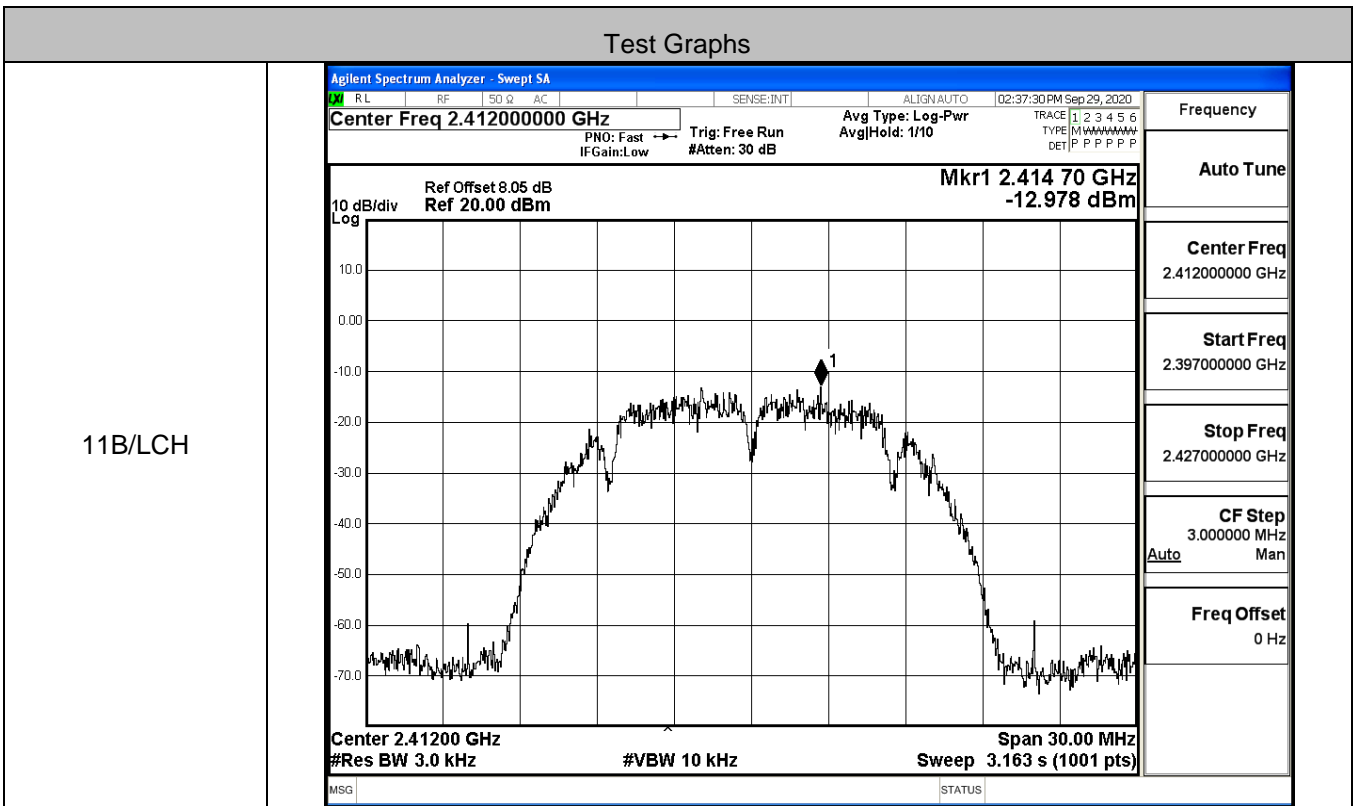


A.2 Maximum Conducted Output Power

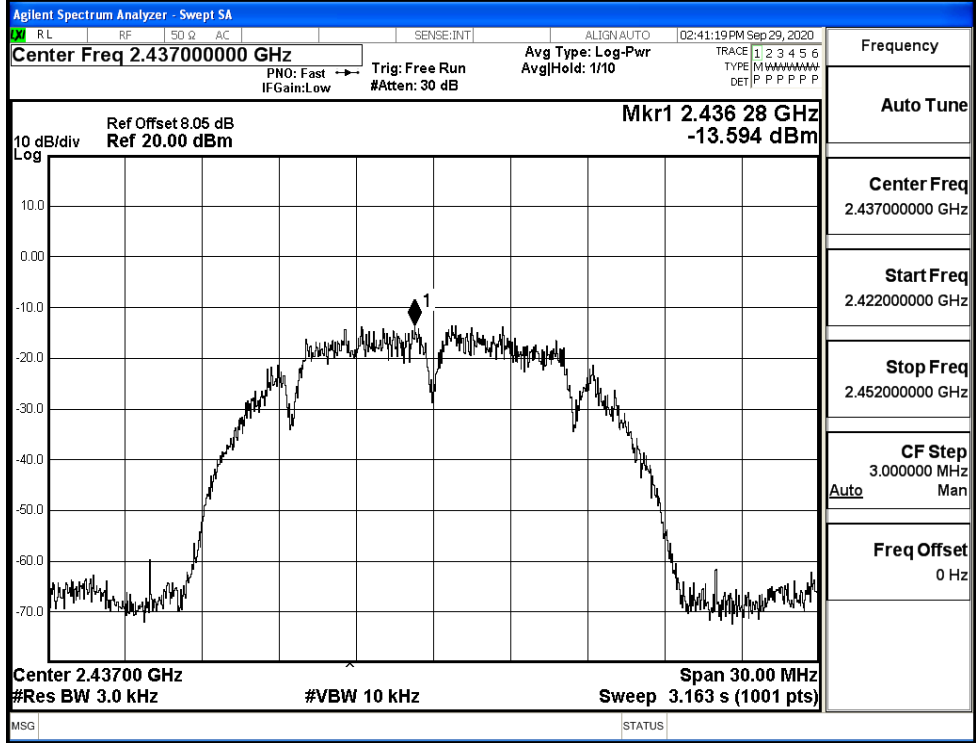
Mode	Channel	Meas.Level [dBm]	Limit [dBm]	Verdict
11B	LCH	13.98	30	PASS
	MCH	14.03	30	PASS
	HCH	14.38	30	PASS
11G	LCH	13.95	30	PASS
	MCH	14.11	30	PASS
	HCH	14.33	30	PASS
11N20SISO	LCH	14.19	30	PASS
	MCH	14	30	PASS
	HCH	14.38	30	PASS
11N40SISO	LCH	14.16	30	PASS
	MCH	14.46	30	PASS
	HCH	14.2	30	PASS

A.3 Maximum Power Spectral Density

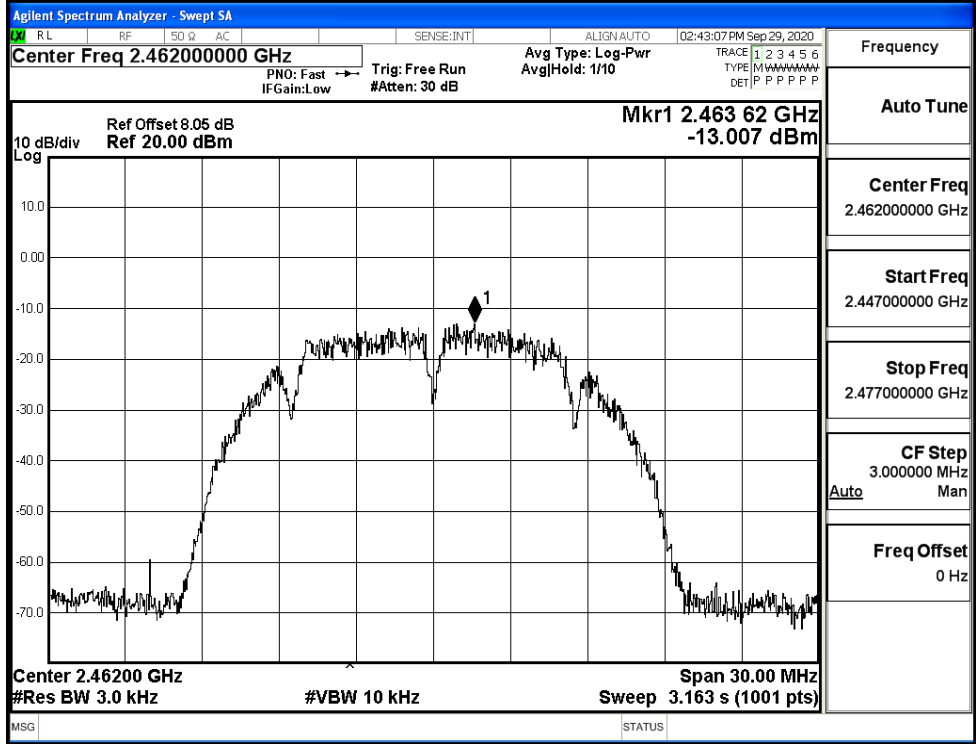
Mode	Channel	Meas.Level [dBm/3KHz]	Limit [dBm/3KHz]	Verdict
11B	LCH	-12.978	8	PASS
	MCH	-13.594	8	PASS
	HCH	-13.007	8	PASS
11G	LCH	-20.188	8	PASS
	MCH	-19.794	8	PASS
	HCH	-20.428	8	PASS
11N20SISO	LCH	-20.856	8	PASS
	MCH	-21.607	8	PASS
	HCH	-22.433	8	PASS
11N40SISO	LCH	-24.169	8	PASS
	MCH	-25.154	8	PASS
	HCH	-24.980	8	PASS



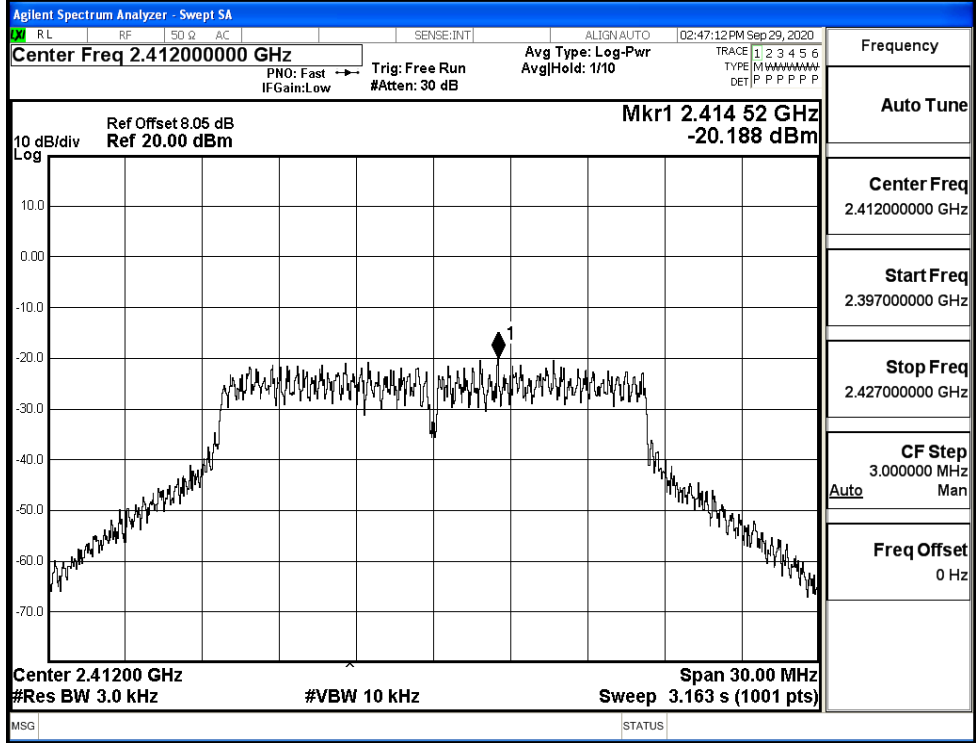
11B/MCH



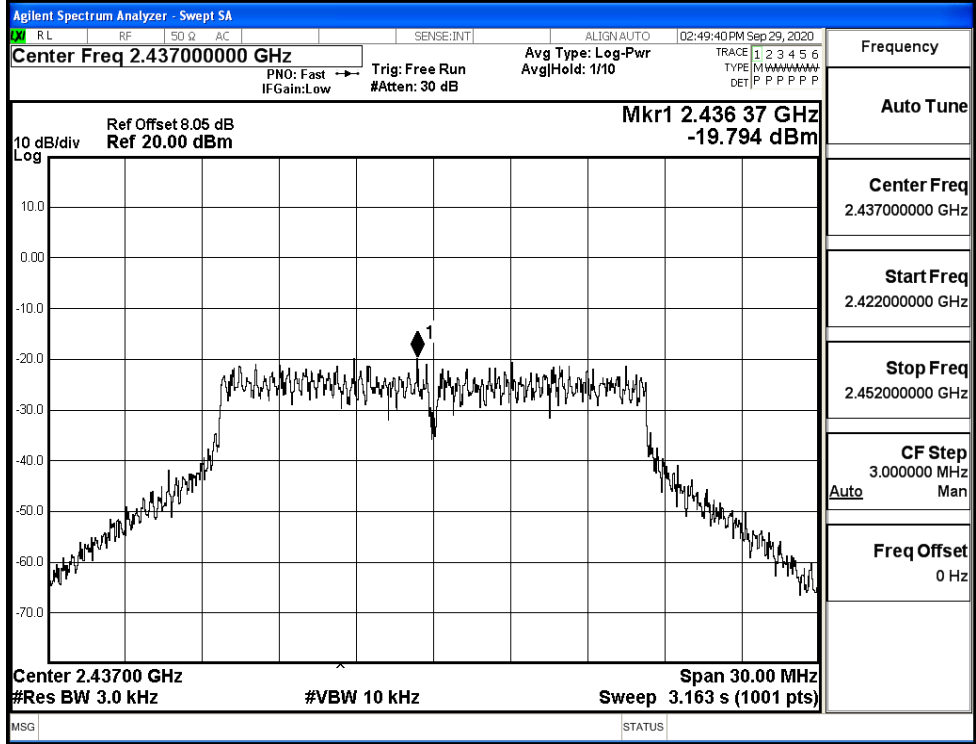
11B/HCH



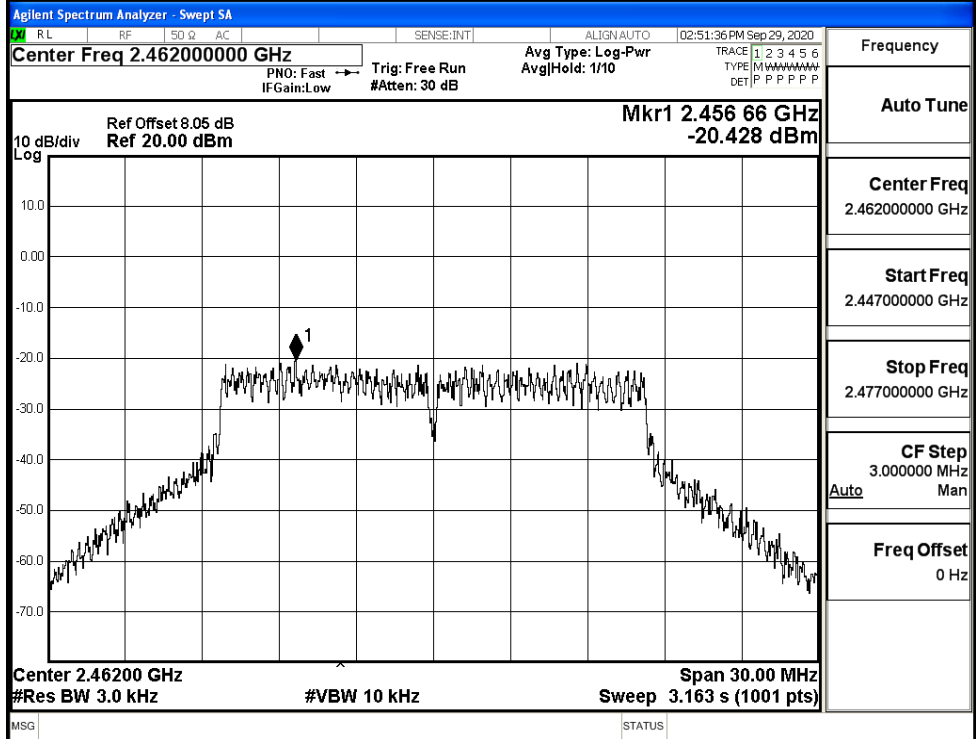
11G/LCH



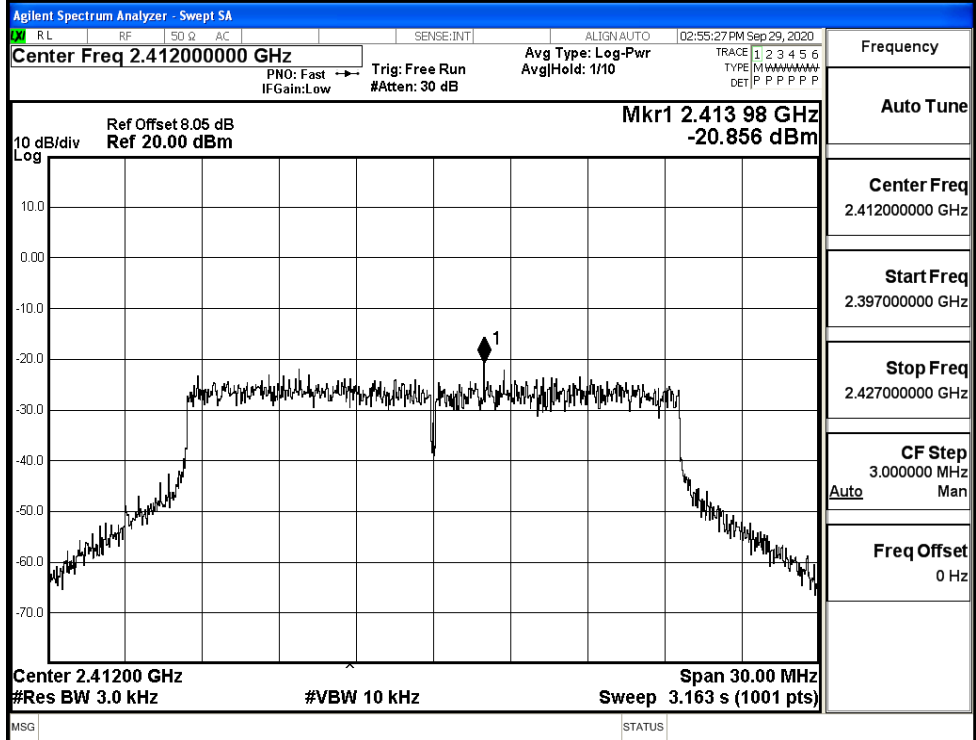
11G/MCH



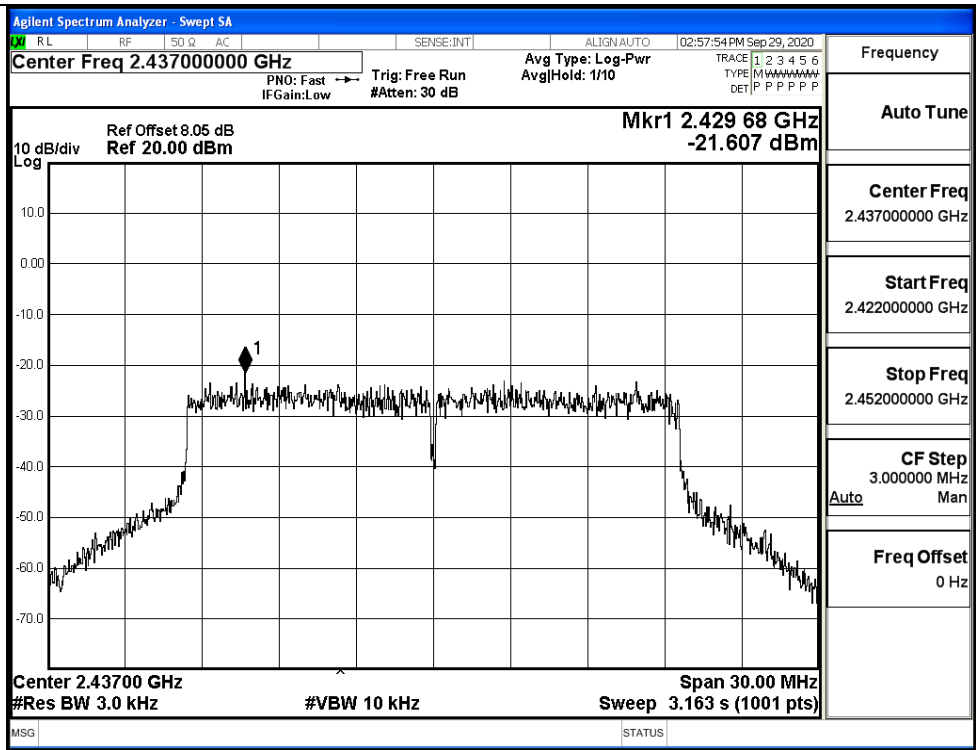
11G/HCH



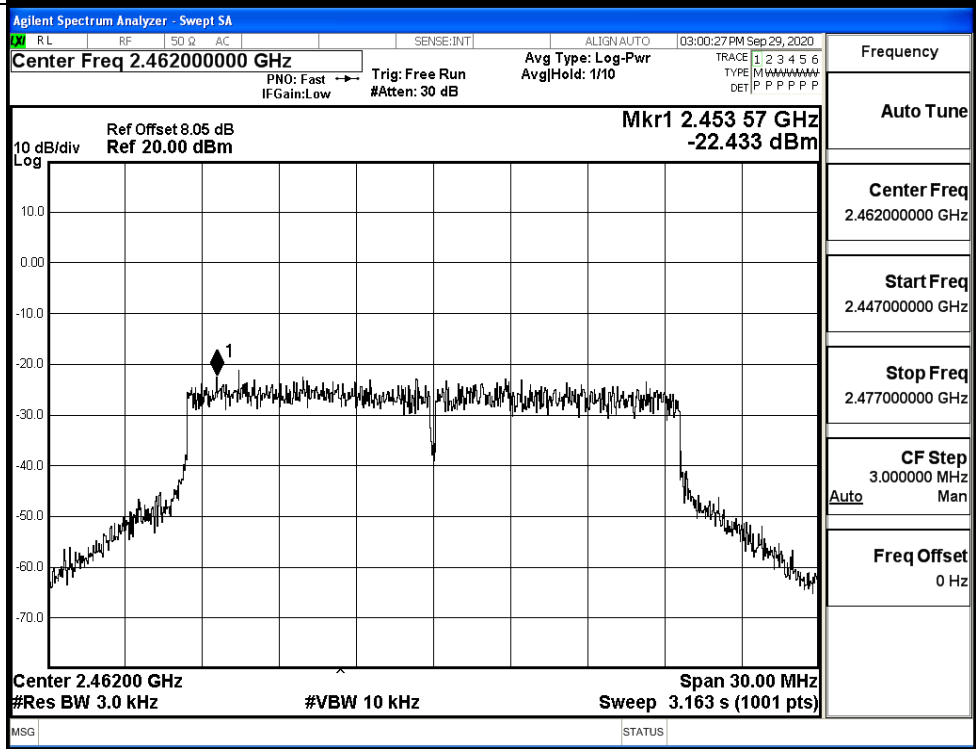
11N20SISO/LCH



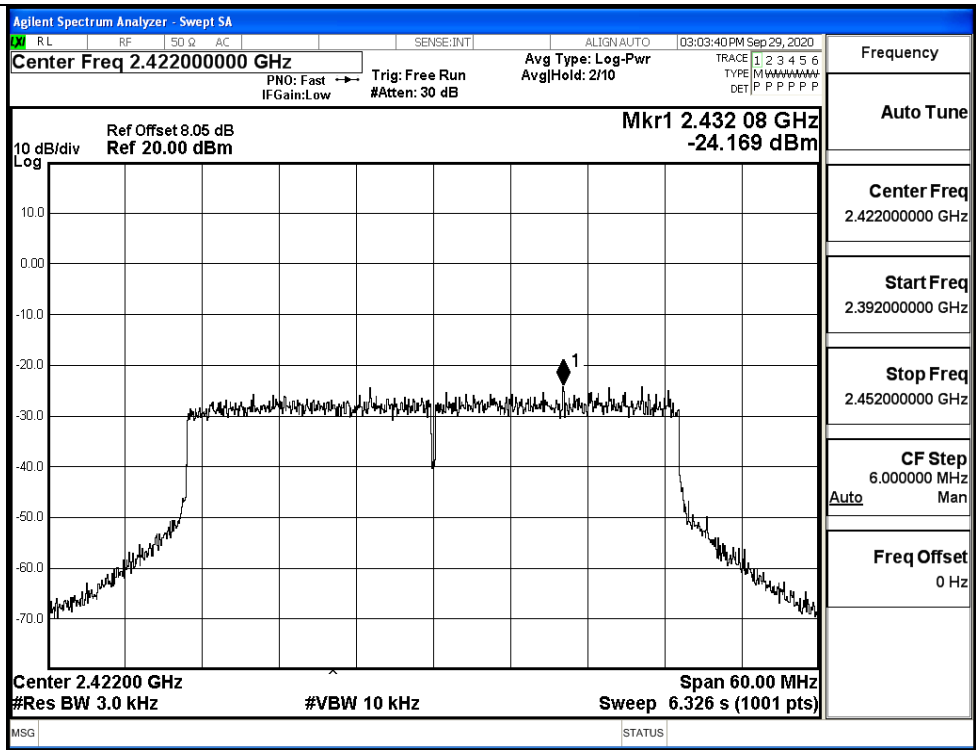
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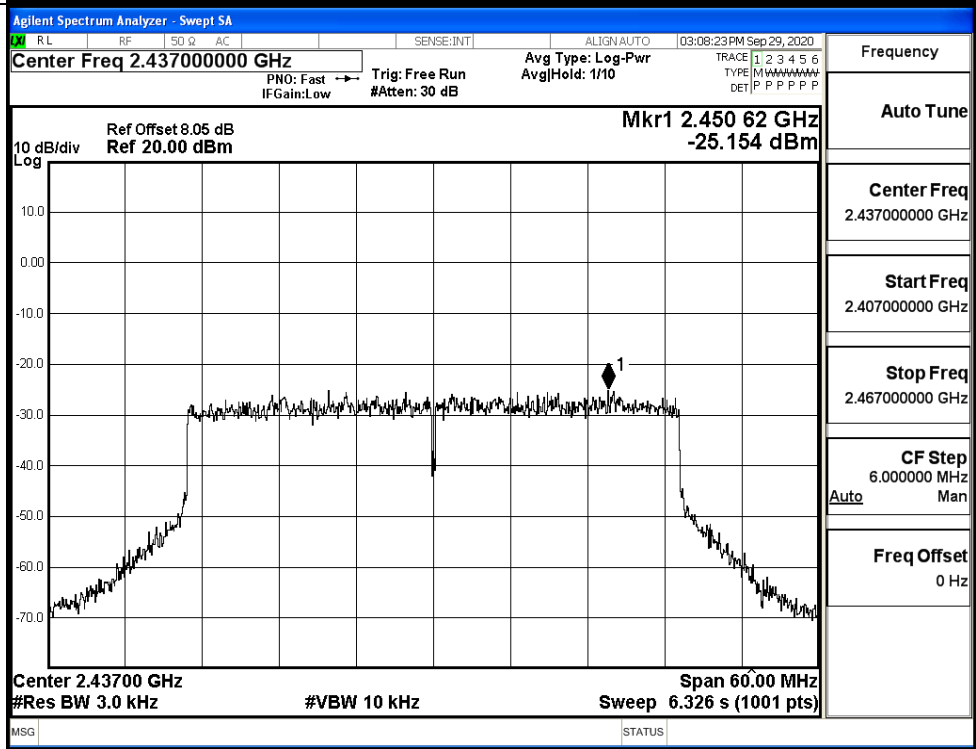
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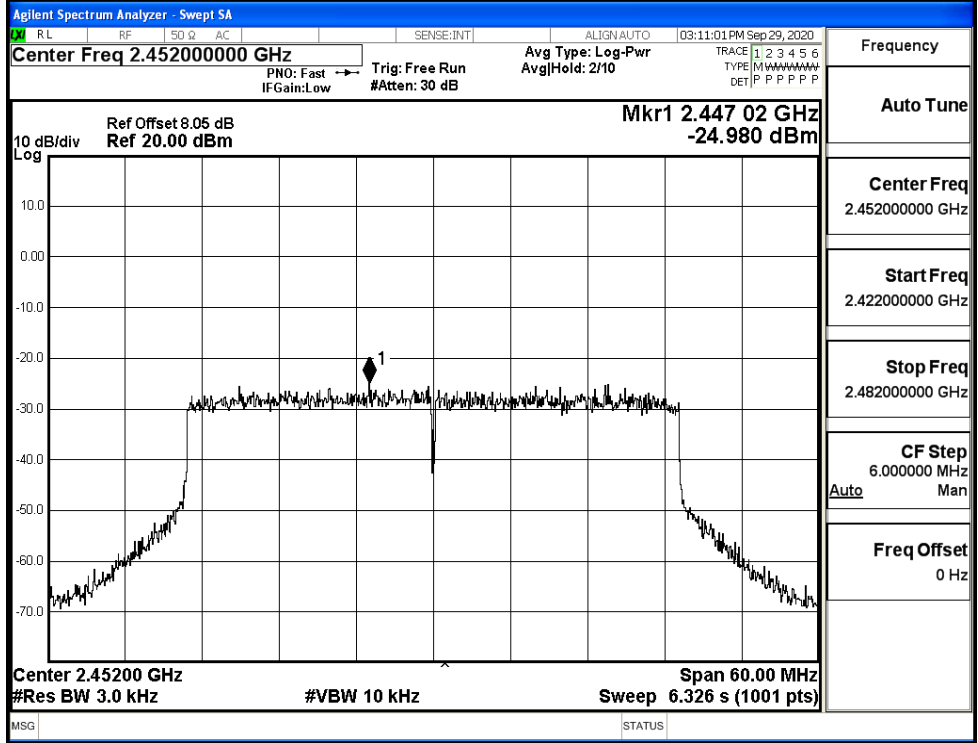
11N40SISO/LCH



11N40SISO/MCH

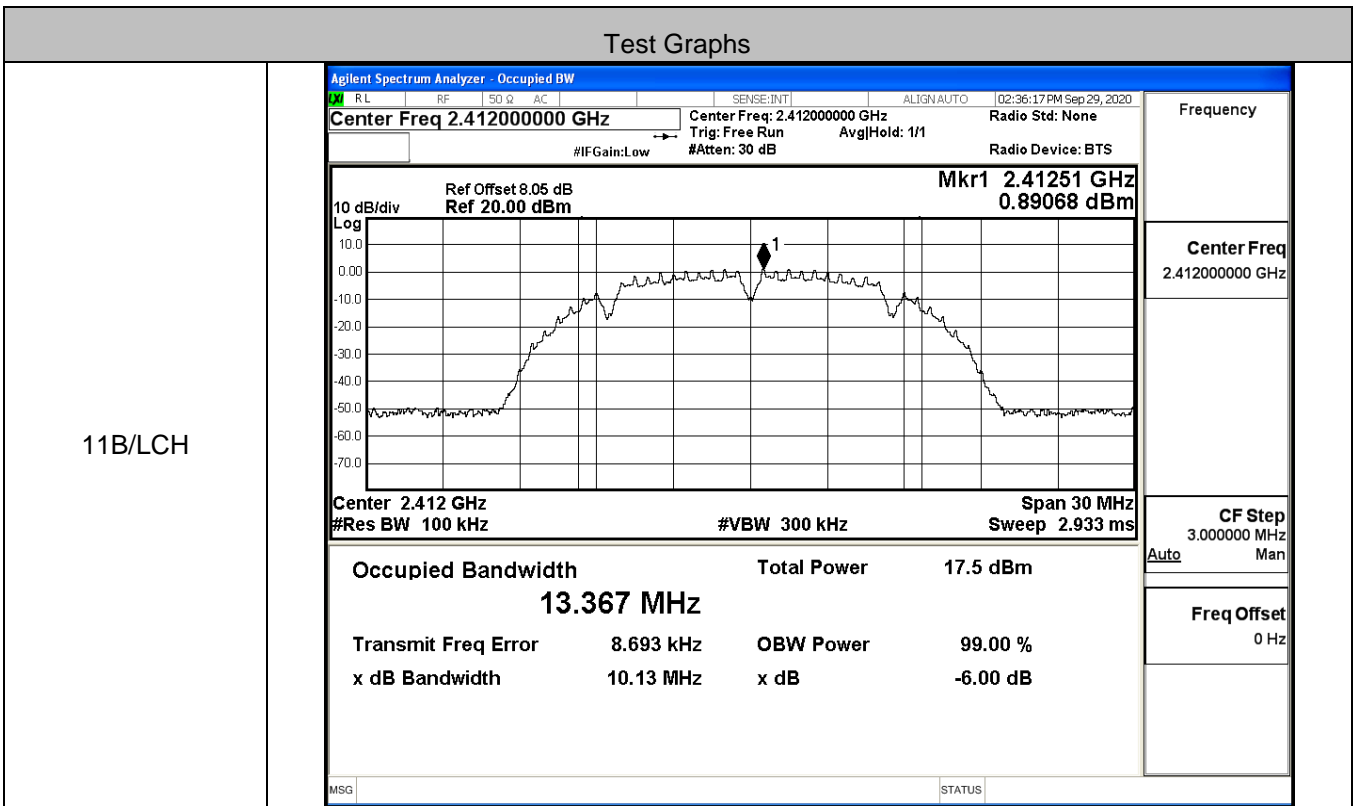


11N40SISO/HCH

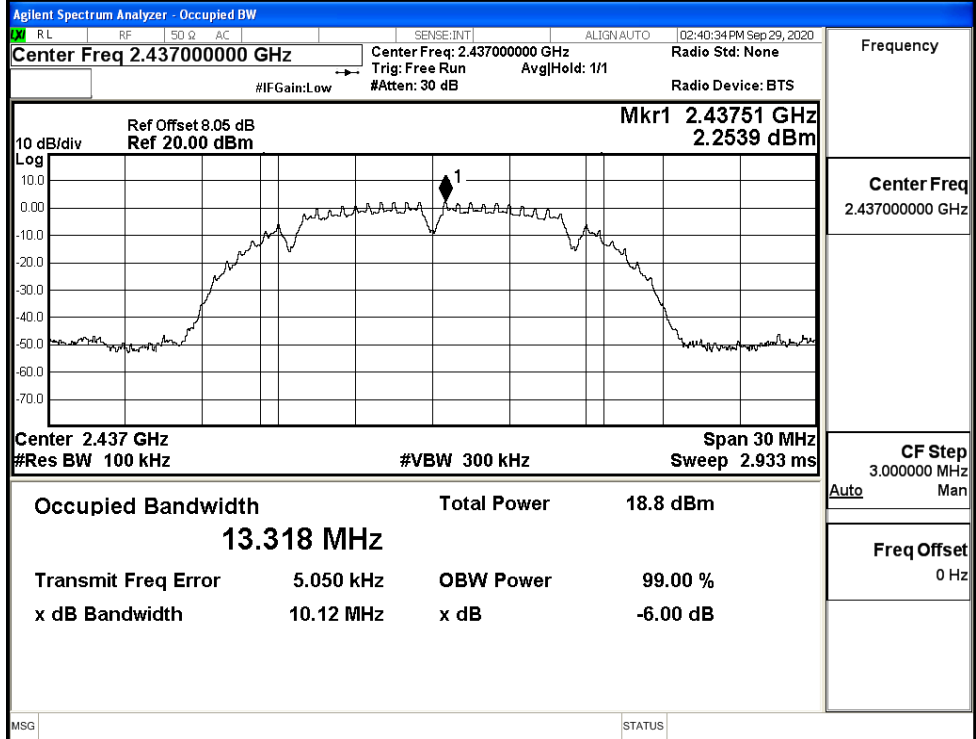


A.4 6dB Bandwidth

Mode	Channel	6dB Bandwidth [MHz]	Limit [MHz]	Verdict
11B	LCH	10.13	≥0.5	PASS
	MCH	10.12	≥0.5	PASS
	HCH	10.12	≥0.5	PASS
11G	LCH	16.38	≥0.5	PASS
	MCH	16.38	≥0.5	PASS
	HCH	16.37	≥0.5	PASS
11N20SISO	LCH	18.89	≥0.5	PASS
	MCH	18.81	≥0.5	PASS
	HCH	18.89	≥0.5	PASS
11N40SISO	LCH	37.77	≥0.5	PASS
	MCH	37.80	≥0.5	PASS
	HCH	37.74	≥0.5	PASS



11B/MCH



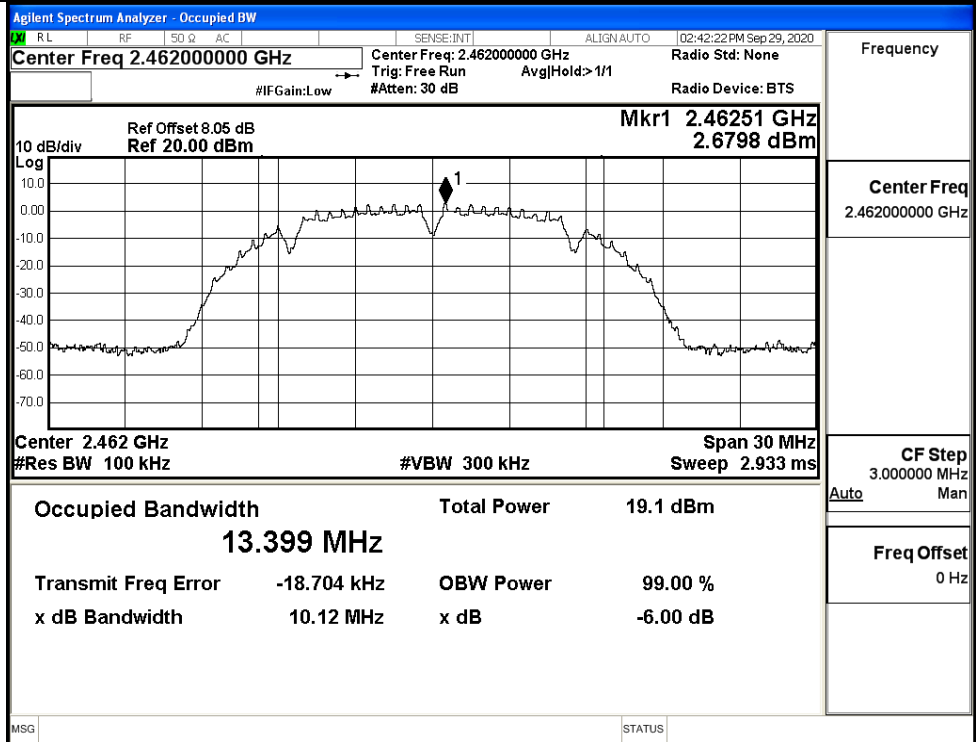
Frequency

Center Freq
2.43700000 GHz

CF Step
3.000000 MHz
Auto Man

Freq Offset
0 Hz

11B/HCH



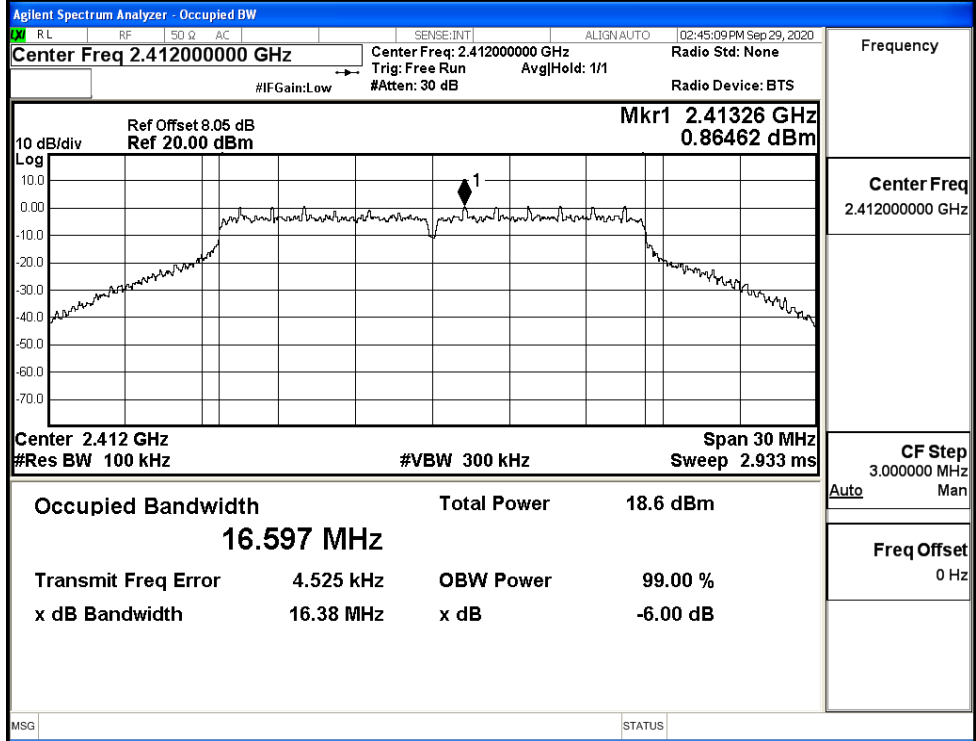
Frequency

Center Freq
2.46200000 GHz

CF Step
3.000000 MHz
Auto Man

Freq Offset
0 Hz

11G/LCH



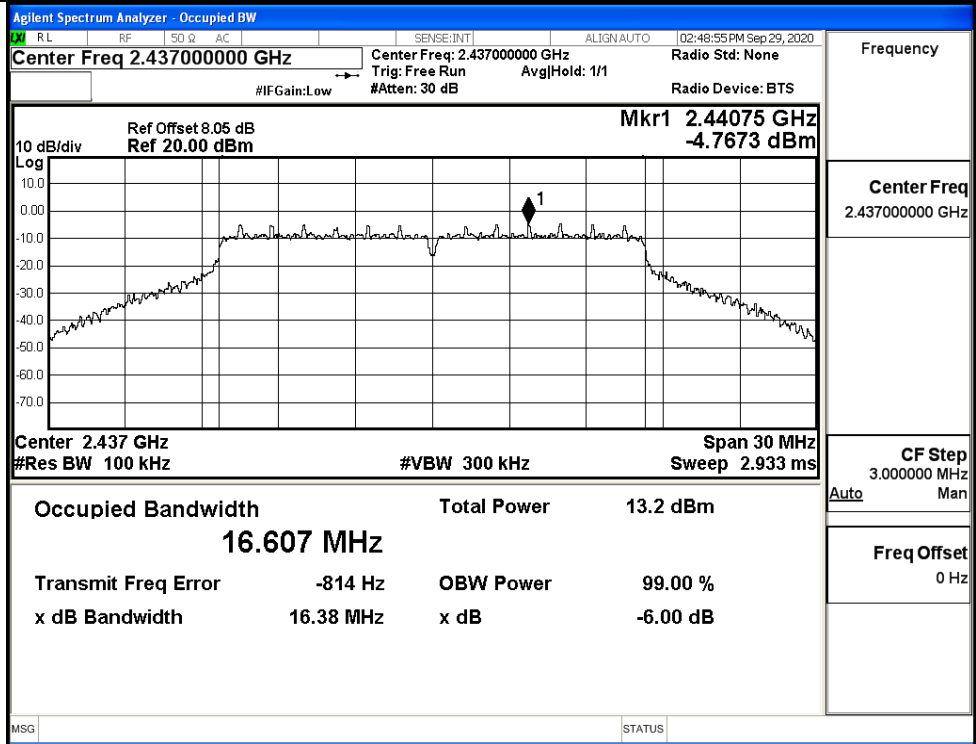
Frequency

Center Freq
2.41200000 GHz

CF Step
3.000000 MHz
Auto Man

Freq Offset
0 Hz

11G/MCH



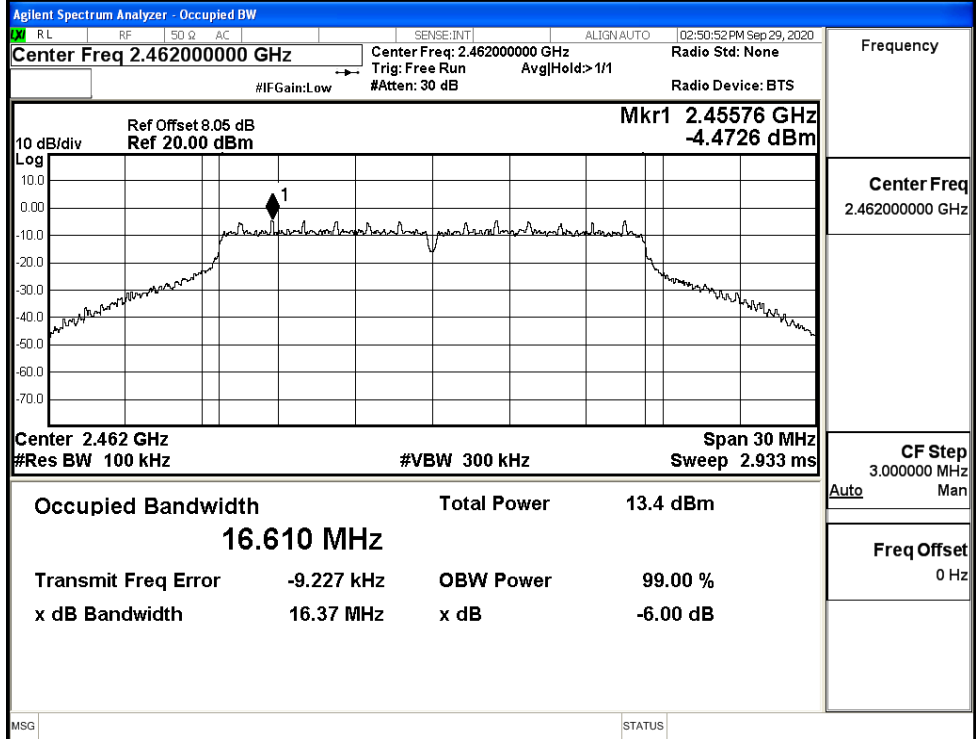
Frequency

Center Freq
2.43700000 GHz

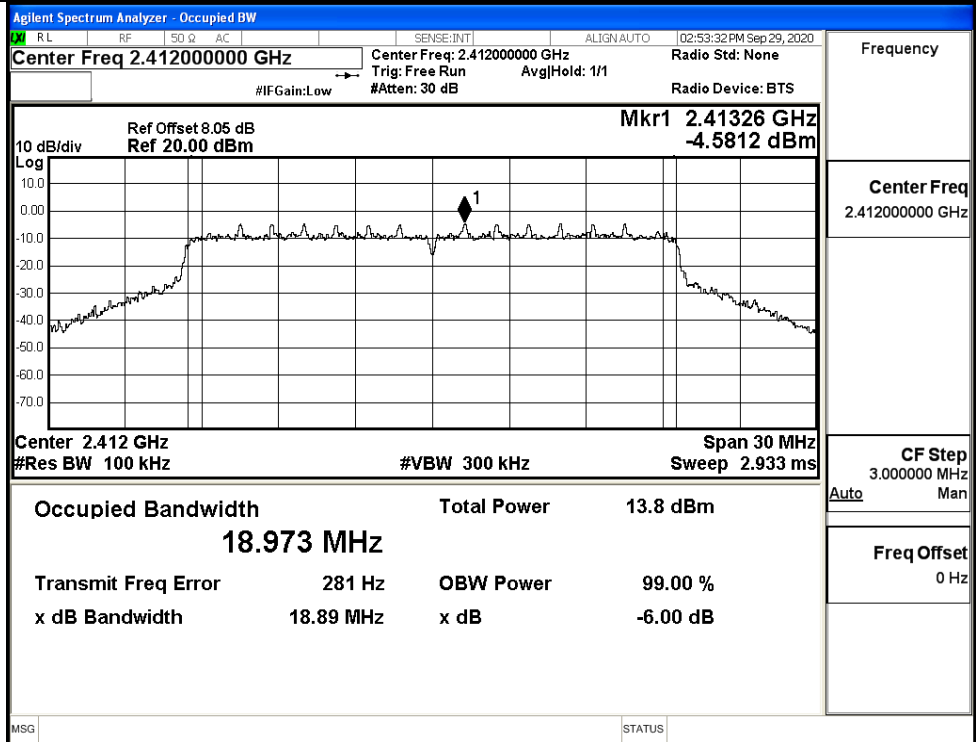
CF Step
3.000000 MHz
Auto Man

Freq Offset
0 Hz

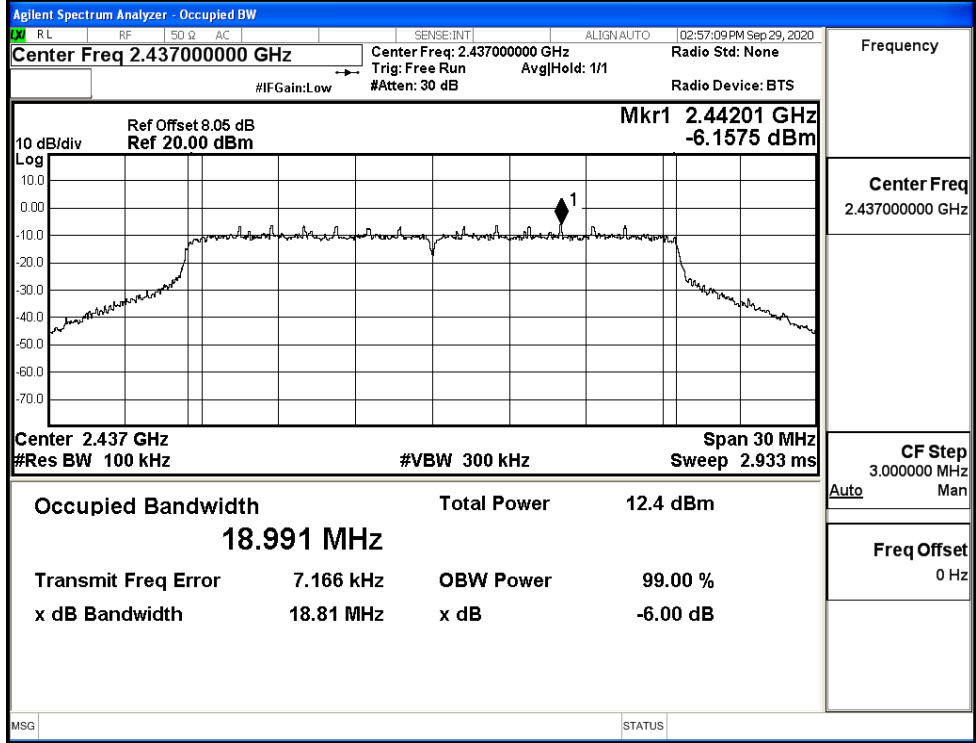
11G/HCH



11N20SISO/LCH

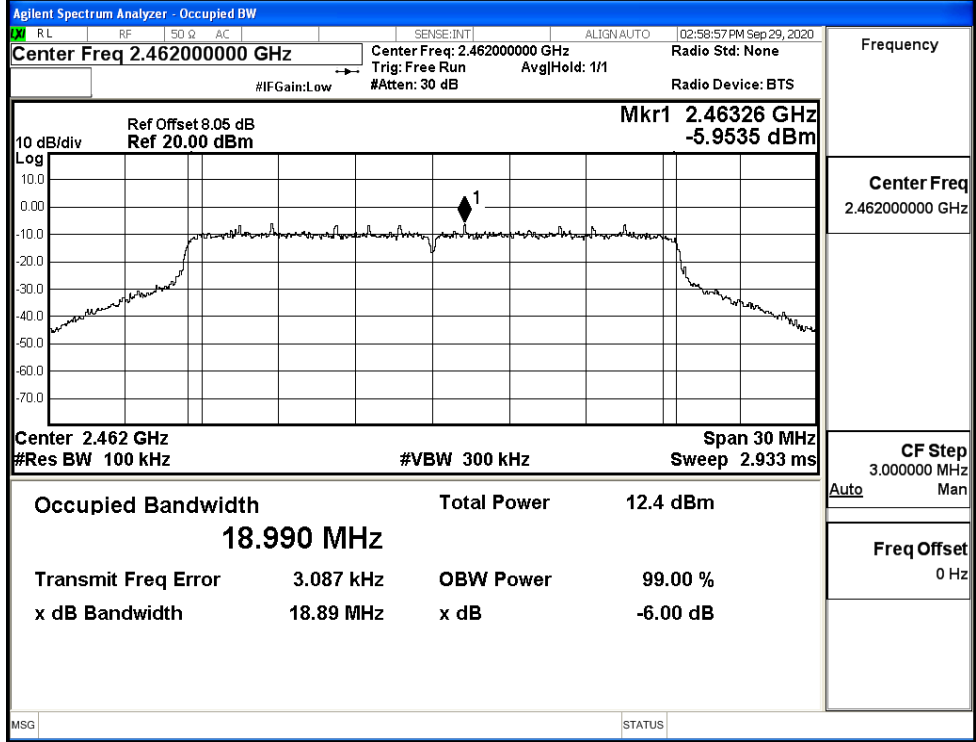


11N20SISO/MCH

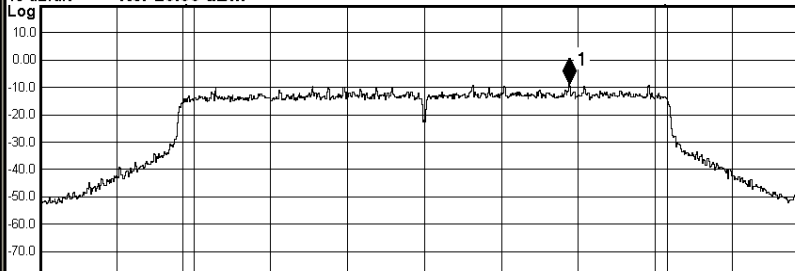
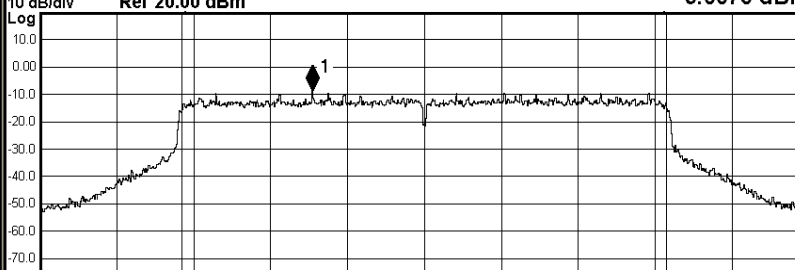


Frequency	2.43700000 GHz
Center Freq	2.43700000 GHz
CF Step	3.000000 MHz
Auto	Man
Freq Offset	0 Hz

11N20SISO/HCH



Frequency	2.46200000 GHz
Center Freq	2.46200000 GHz
CF Step	3.000000 MHz
Auto	Man
Freq Offset	0 Hz

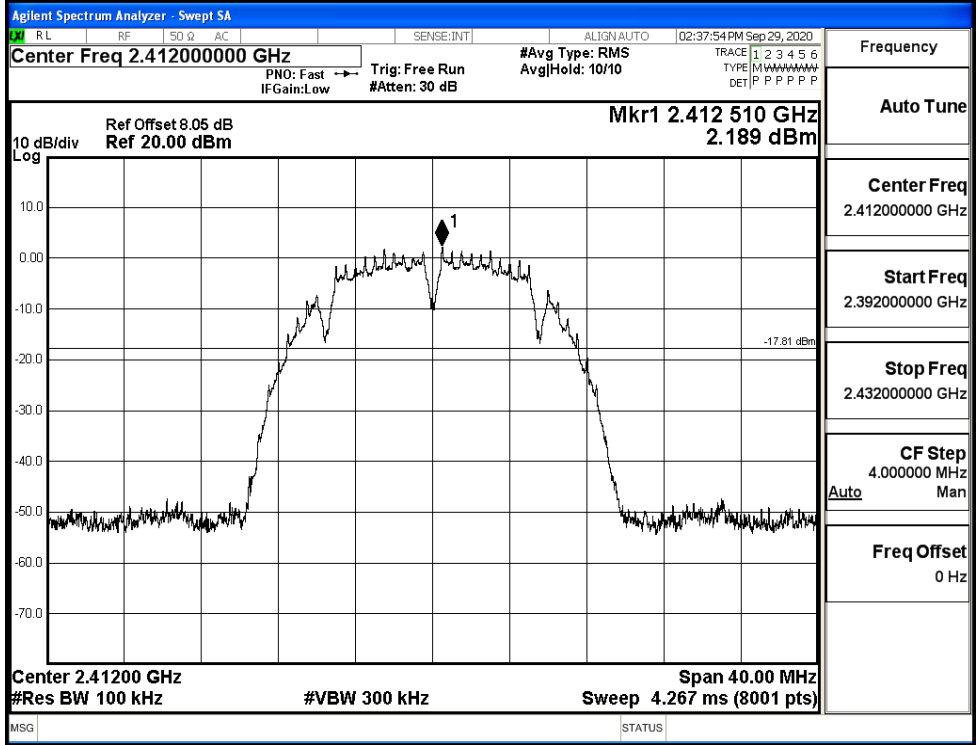
<p>11N40SISO/LCH</p>	<p>Agilent Spectrum Analyzer - Occupied BW</p> <p>RL RF SQ AC SENSE:INT ALIGN AUTO 03:02:09 PM Sep 29, 2020</p> <p>Center Freq 2.42200000 GHz Center Freq: 2.42200000 GHz Radio Std: None Trig: Free Run Avg Hold: 1/1 #IFGain:Low #Atten: 30 dB Radio Device: BTS</p> <p>10 dB/div Ref Offset 8.05 dB Mkr1 2.43328 GHz Ref 20.00 dBm -9.0087 dBm</p>  <p>Center 2.422 GHz Span 60 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 5.8 ms</p> <p>Occupied Bandwidth 37.744 MHz Total Power 12.6 dBm</p> <p>Transmit Freq Error 57.943 kHz OBW Power 99.00 % x dB Bandwidth 37.77 MHz x dB -6.00 dB</p> <p>MSG STATUS</p>	<p>Frequency</p> <p>Center Freq 2.42200000 GHz</p> <p>CF Step 6.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
	<p>11N40SISO/MCH</p>	<p>Agilent Spectrum Analyzer - Occupied BW</p> <p>RL RF SQ AC SENSE:INT ALIGN AUTO 03:05:49 PM Sep 29, 2020</p> <p>Center Freq 2.43700000 GHz Center Freq: 2.43700000 GHz Radio Std: None Trig: Free Run Avg Hold: 1/1 #IFGain:Low #Atten: 30 dB Radio Device: BTS</p> <p>10 dB/div Ref Offset 8.05 dB Mkr1 2.42824 GHz Ref 20.00 dBm -9.0075 dBm</p>  <p>Center 2.437 GHz Span 60 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 5.8 ms</p> <p>Occupied Bandwidth 37.694 MHz Total Power 12.7 dBm</p> <p>Transmit Freq Error 22.262 kHz OBW Power 99.00 % x dB Bandwidth 37.80 MHz x dB -6.00 dB</p> <p>MSG STATUS</p>

A.5 RF Conducted Spurious Emissions

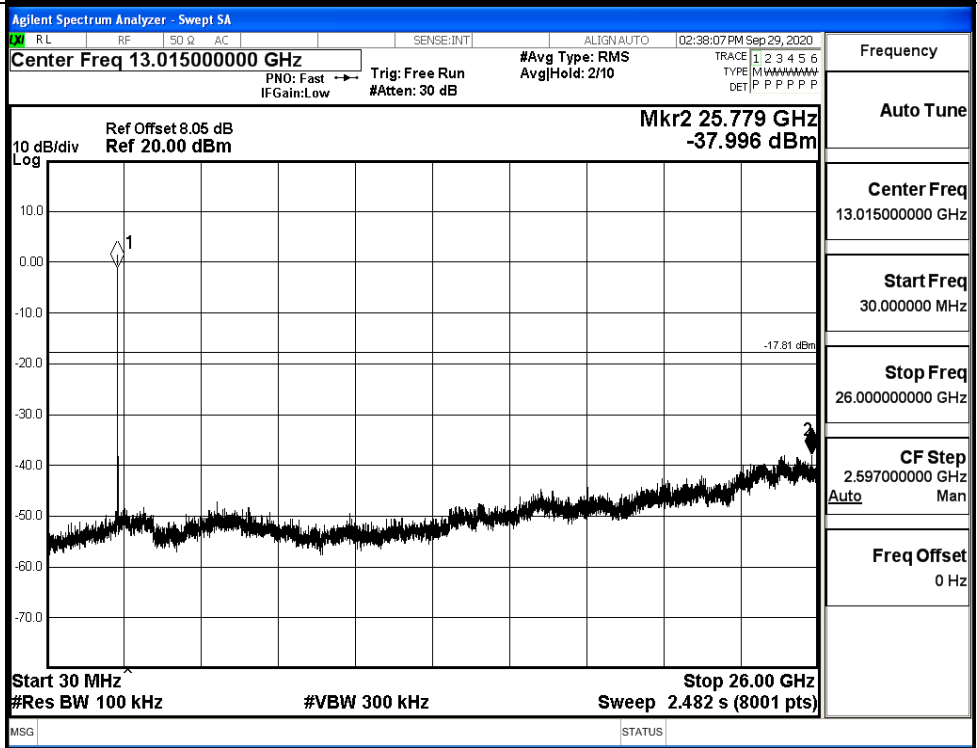
Mode	Channel	Pref [dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
11B	LCH	2.189	-37.996	-17.811	PASS
	MCH	1.978	-38.598	-18.022	PASS
	HCH	2.43	-38.330	-17.570	PASS
11G	LCH	-4.832	-38.531	-24.832	PASS
	MCH	-4.882	-37.602	-24.882	PASS
	HCH	-4.509	-37.617	-24.509	PASS
11N20 SISO	LCH	-6.168	-37.951	-26.168	PASS
	MCH	-6.588	-37.869	-26.588	PASS
	HCH	-5.875	-37.434	-25.875	PASS
11N40 SISO	LCH	-9.479	-38.799	-29.479	PASS
	MCH	-9.422	-38.611	-29.422	PASS
	HCH	-9.651	-38.525	-29.651	PASS

11B_LCH_Graphs

Pref/11B/LCH



Puw/11B/LCH

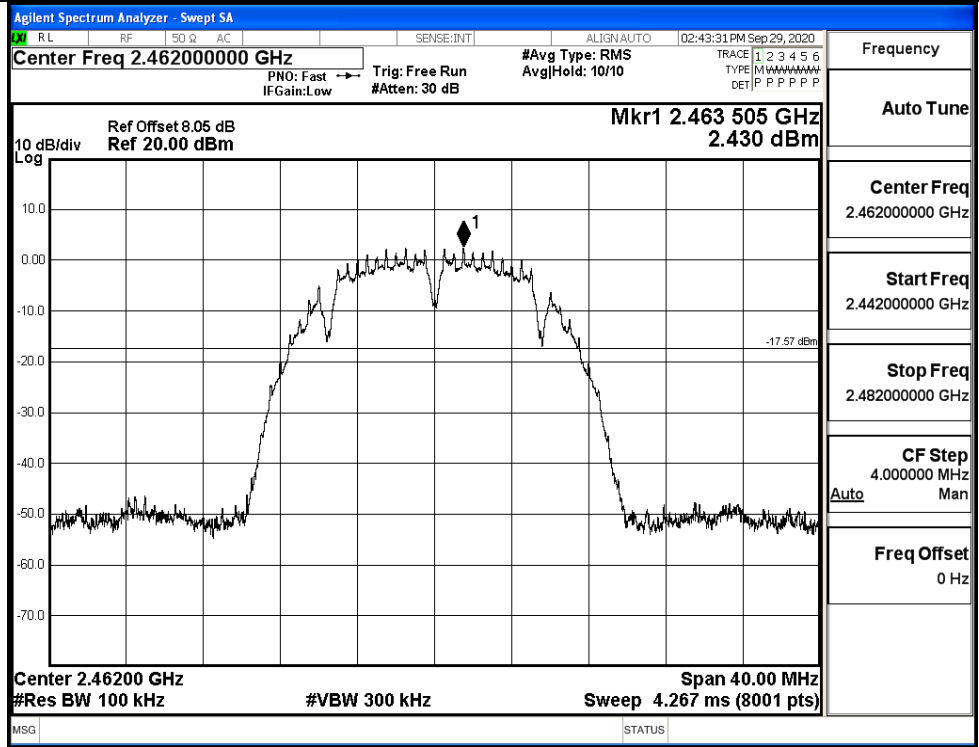


11B_MCH_Graphs

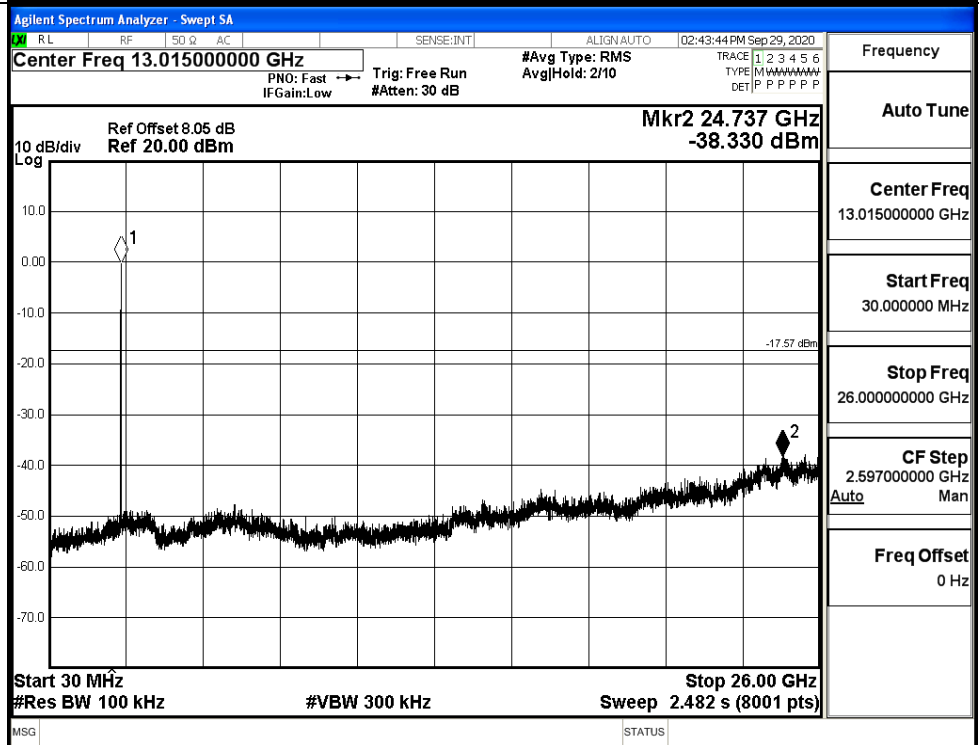
<p>Pref/11B/MCH</p>	<p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.43700000 GHz</p> <p>Mkr1 2.435 505 GHz 1.978 dBm</p> <p>10 dB/div Log</p> <p>Ref Offset 8.05 dB Ref 20.00 dBm</p> <p>Center 2.43700 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 4.267 ms (8001 pts)</p>	<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.437000000 GHz</p> <p>Start Freq 2.417000000 GHz</p> <p>Stop Freq 2.457000000 GHz</p> <p>CF Step 4.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
	<p>Puw/11B/MCH</p>	<p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 13.01500000 GHz</p> <p>Mkr2 24.760 GHz -38.598 dBm</p> <p>10 dB/div Log</p> <p>Ref Offset 8.05 dB Ref 20.00 dBm</p> <p>Start 30 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.482 s (8001 pts)</p>

11B_HCH_Graphs

Pref/11B/HCH

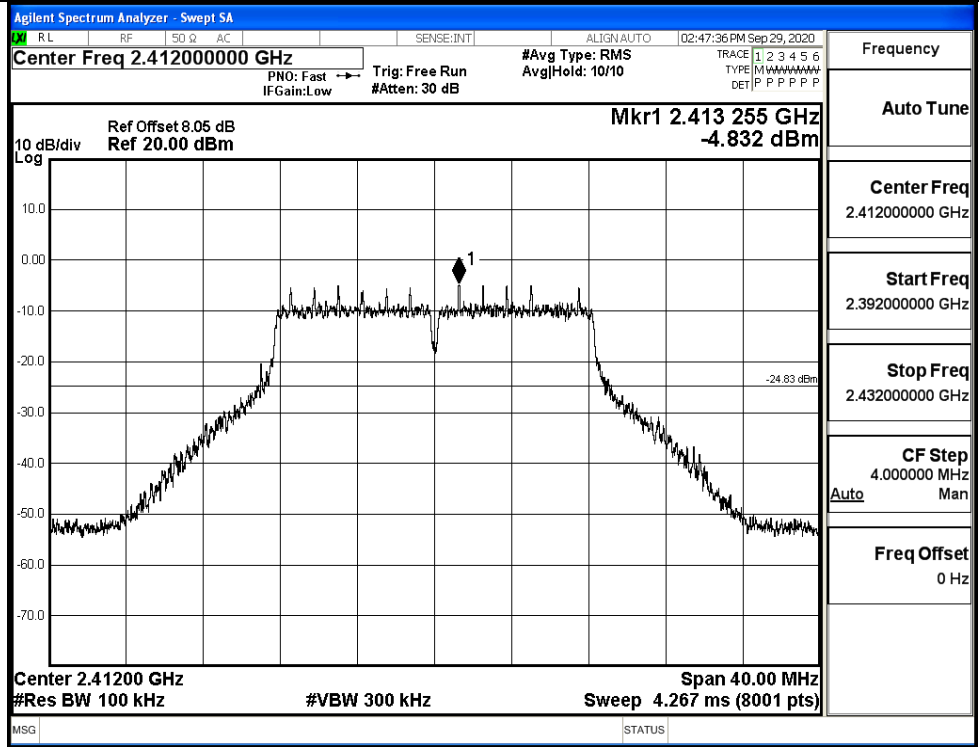


Puw/11B/HCH

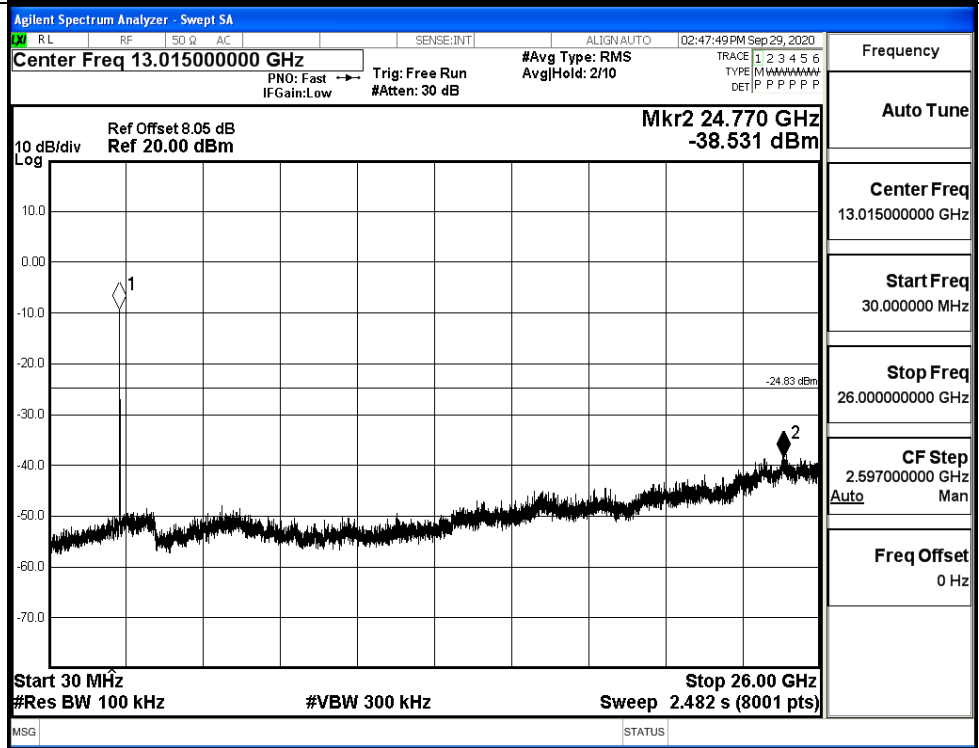


11G_LCH_Graphs

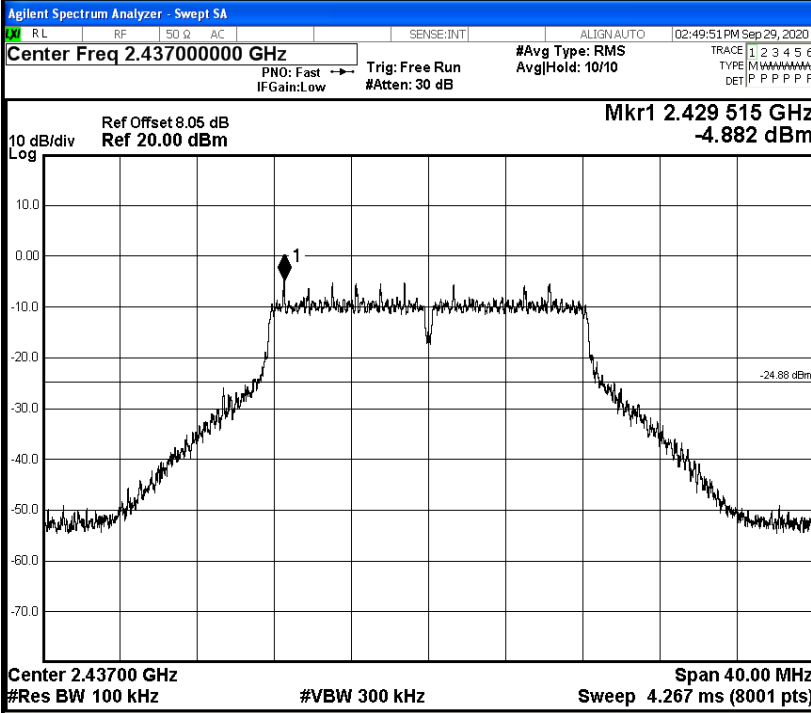
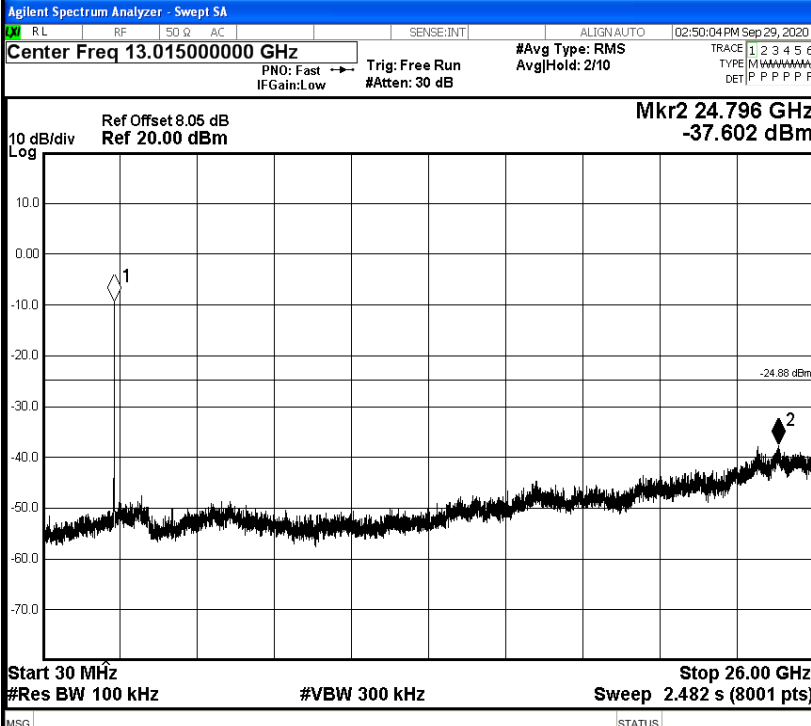
Pref/11G/LCH



Puw/11G/LCH



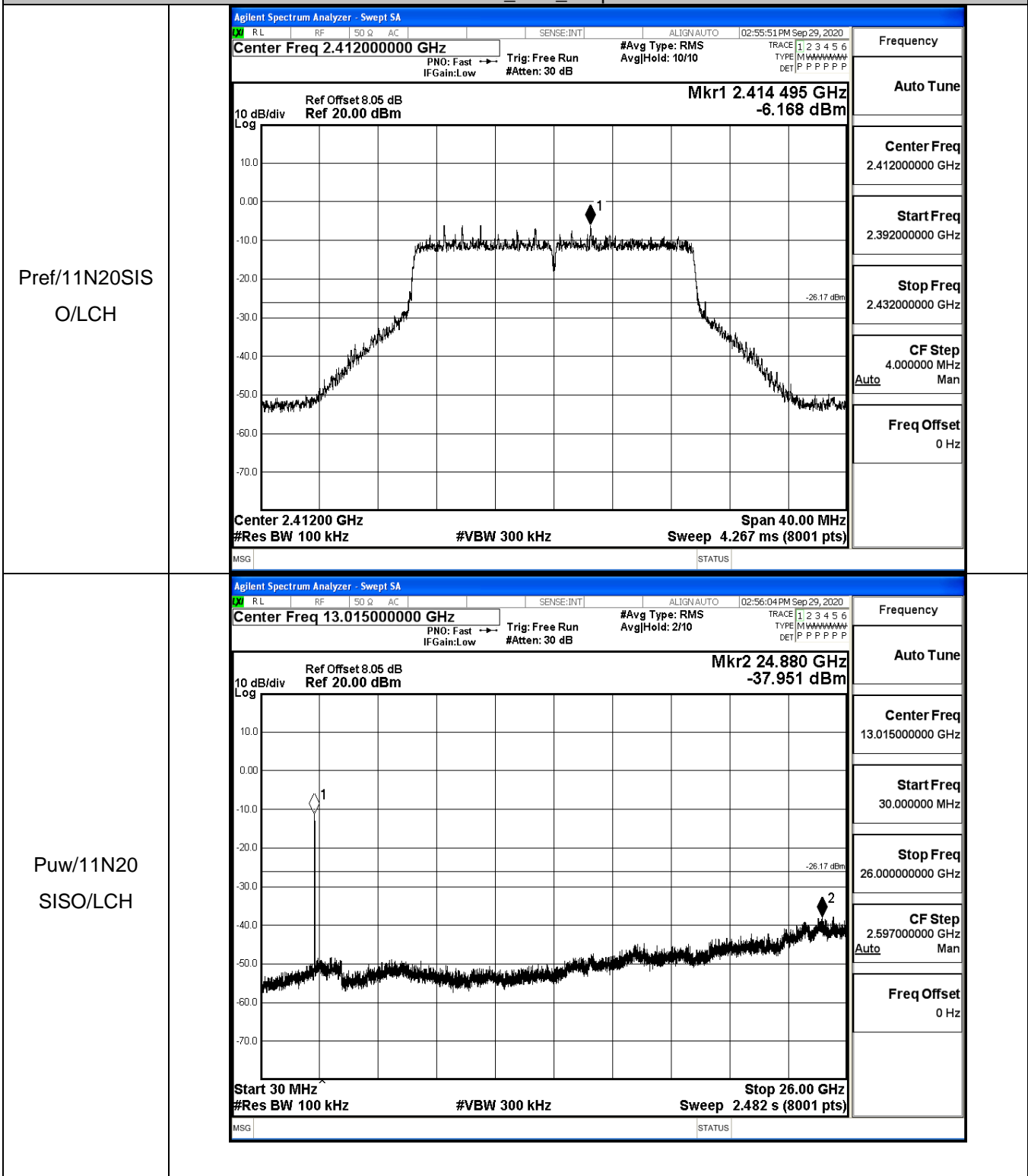
11G_MCH_Graphs

<p>Pref/11G/MCH</p>	 <p>Agilent Spectrum Analyzer - Swept SA Center Freq 2.43700000 GHz Mkr1 2.429 515 GHz -4.882 dBm 10 dB/div Log Ref Offset 8.05 dB Ref 20.00 dBm Center 2.43700 GHz #Res BW 100 kHz #VBW 300 kHz Span 40.00 MHz Sweep 4.267 ms (8001 pts)</p>	<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.437000000 GHz</p> <p>Start Freq 2.417000000 GHz</p> <p>Stop Freq 2.457000000 GHz</p> <p>CF Step 4.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>Puw/11G/MCH</p>	 <p>Agilent Spectrum Analyzer - Swept SA Center Freq 13.01500000 GHz Mkr2 24.796 GHz -37.602 dBm 10 dB/div Log Ref Offset 8.05 dB Ref 20.00 dBm Start 30 MHz #Res BW 100 kHz #VBW 300 kHz Stop 26.00 GHz Sweep 2.482 s (8001 pts)</p>	<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 13.015000000 GHz</p> <p>Start Freq 30.000000 MHz</p> <p>Stop Freq 26.000000000 GHz</p> <p>CF Step 2.597000000 GHz Auto Man</p> <p>Freq Offset 0 Hz</p>

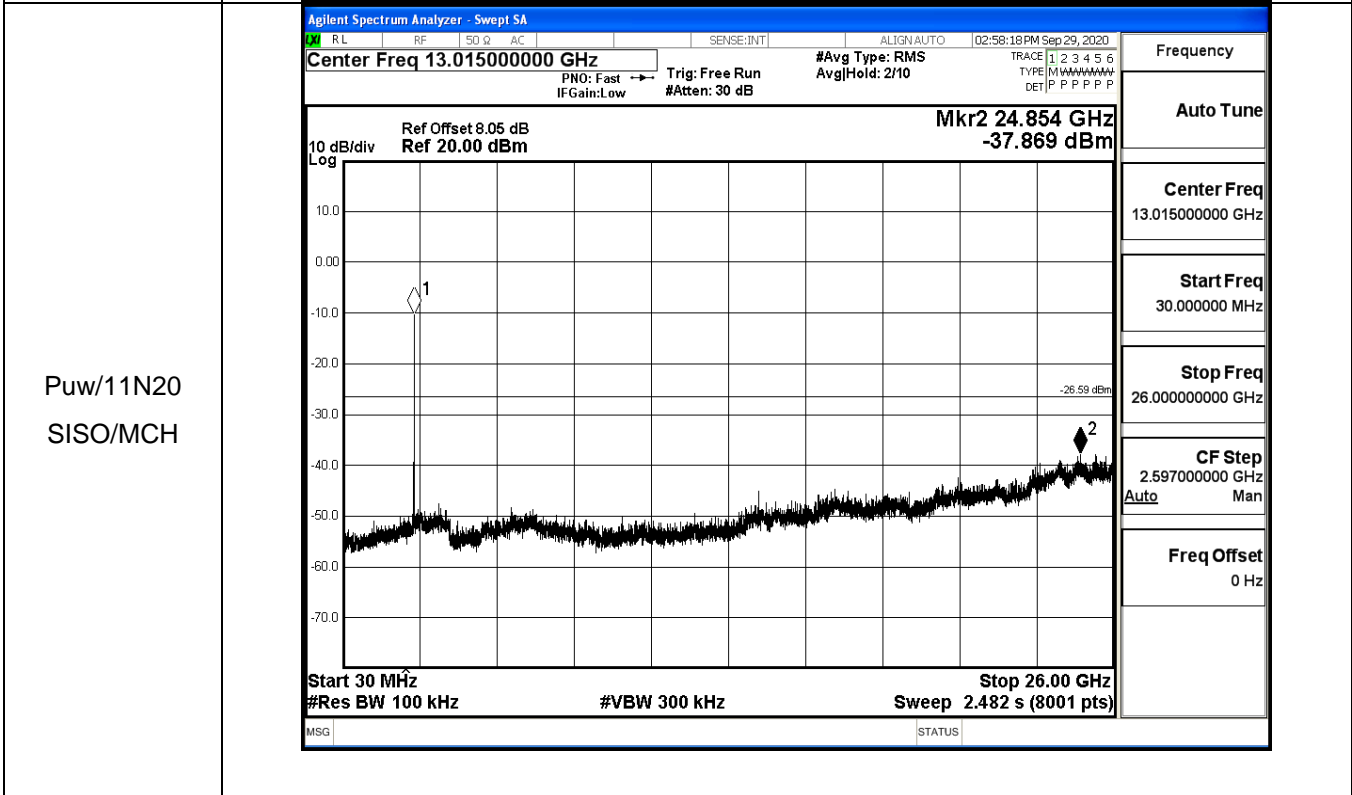
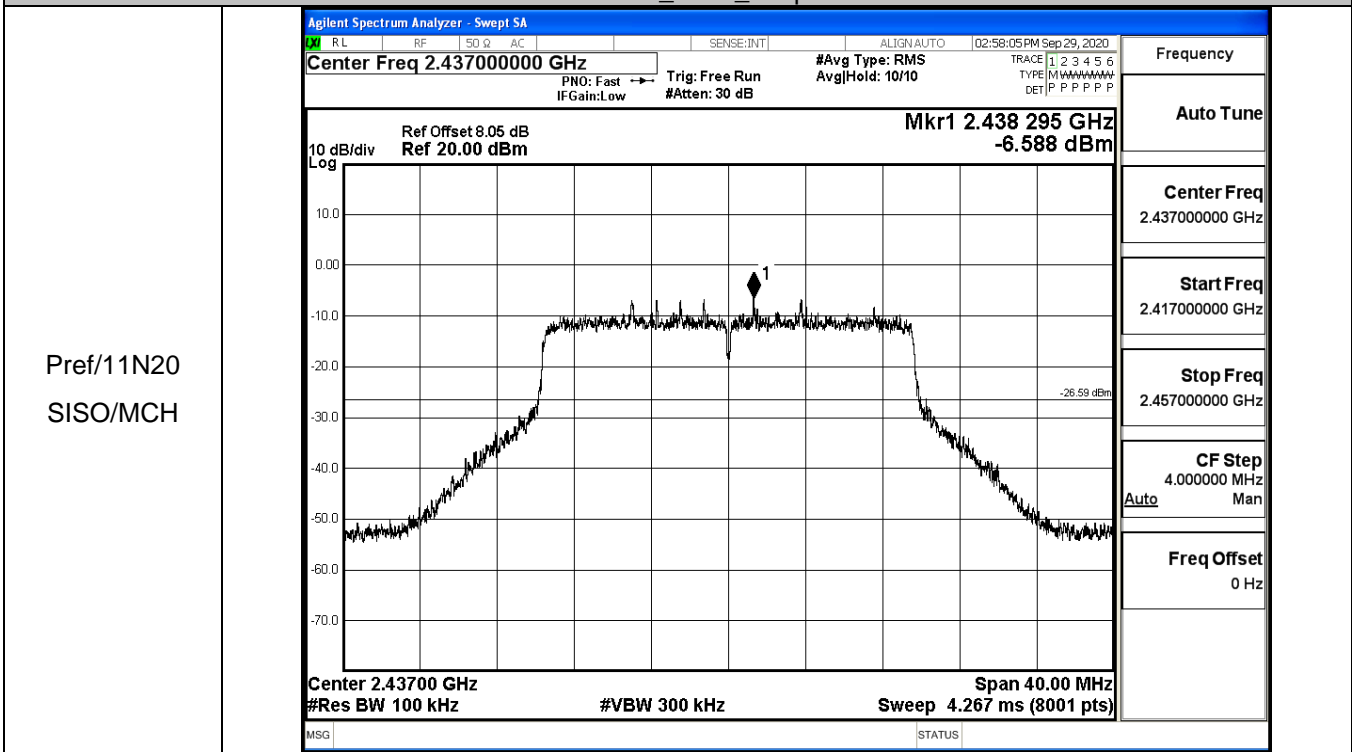
11G_HCH_Graphs

<p>Pref/11G/HCH</p>		<p>Agilent Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.46200000 GHz</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.46200000 GHz</p> <p>Start Freq 2.442000000 GHz</p> <p>Stop Freq 2.482000000 GHz</p> <p>CF Step 4.000000 MHz</p> <p>Freq Offset 0 Hz</p>
	<p>Puw/11G/HCH</p>	

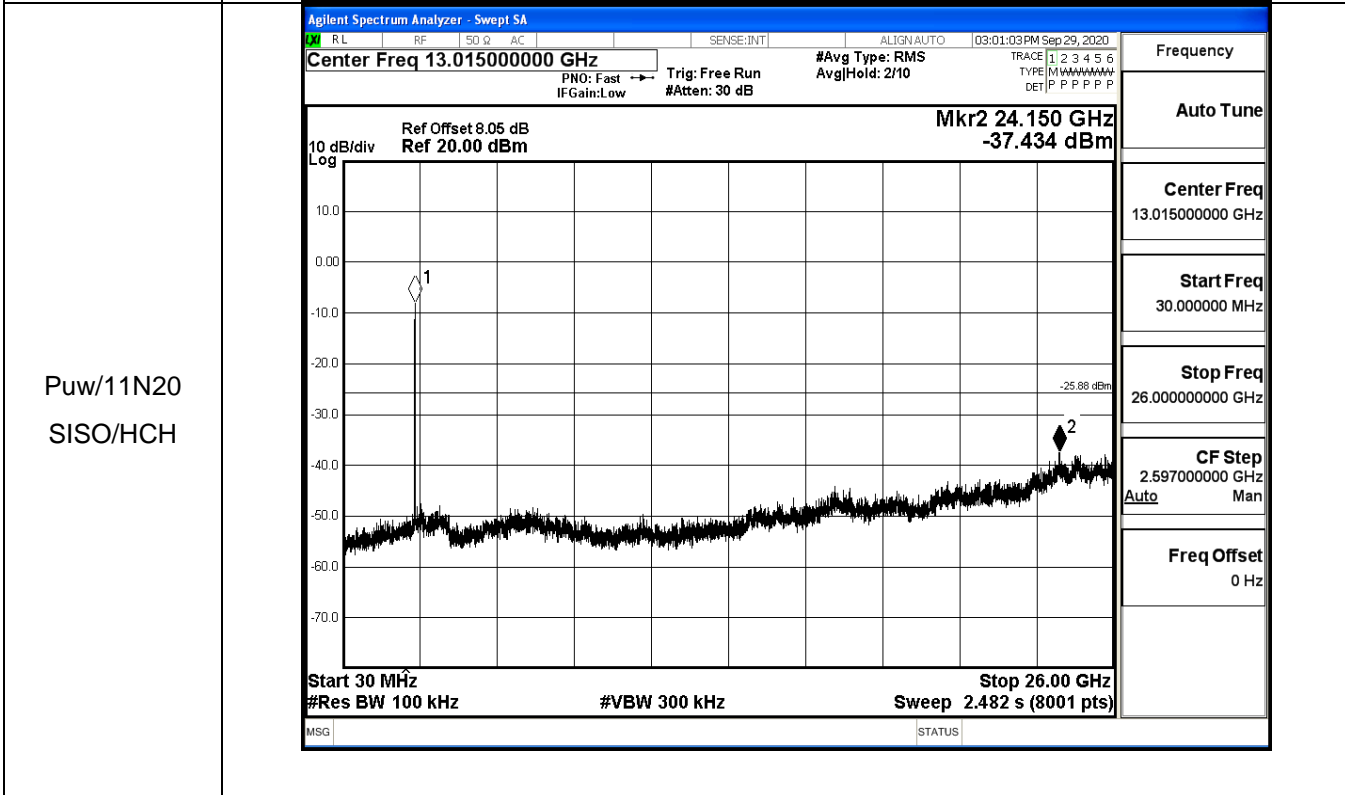
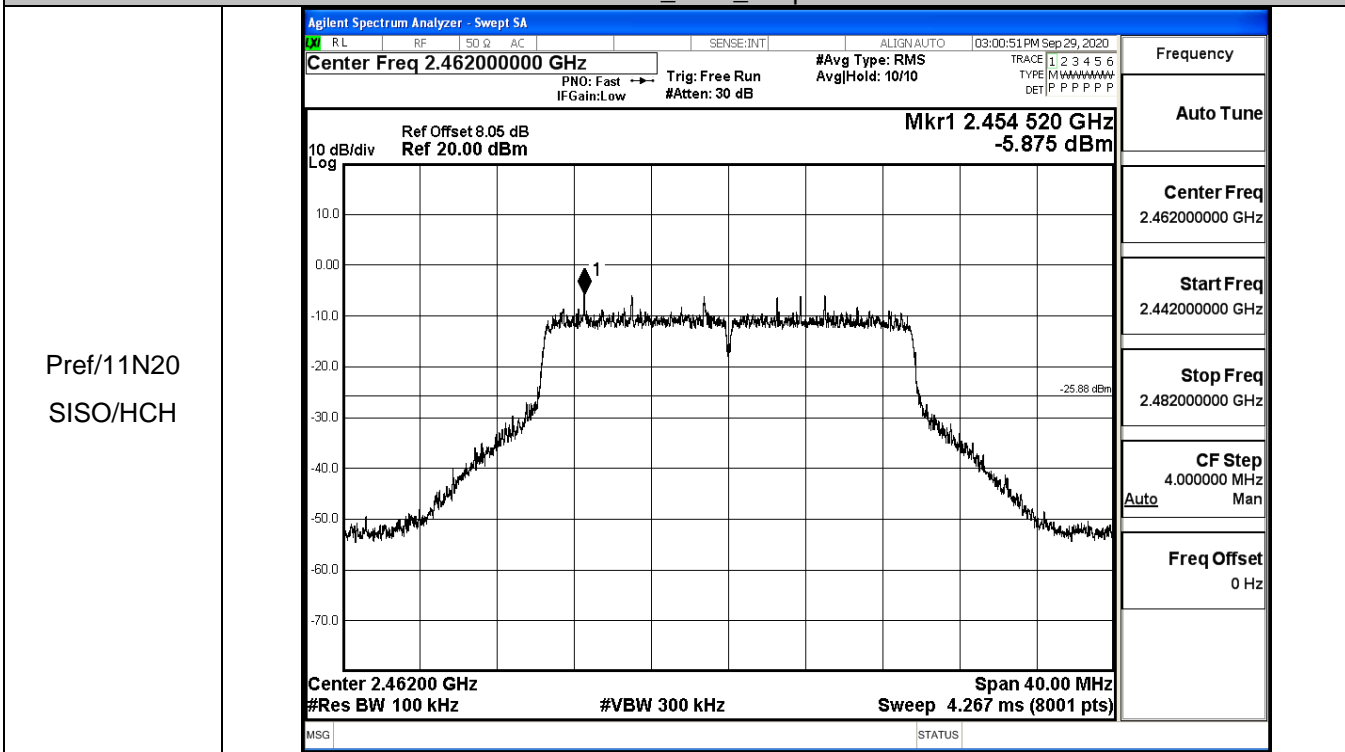
11N20SISO_LCH_Graphs



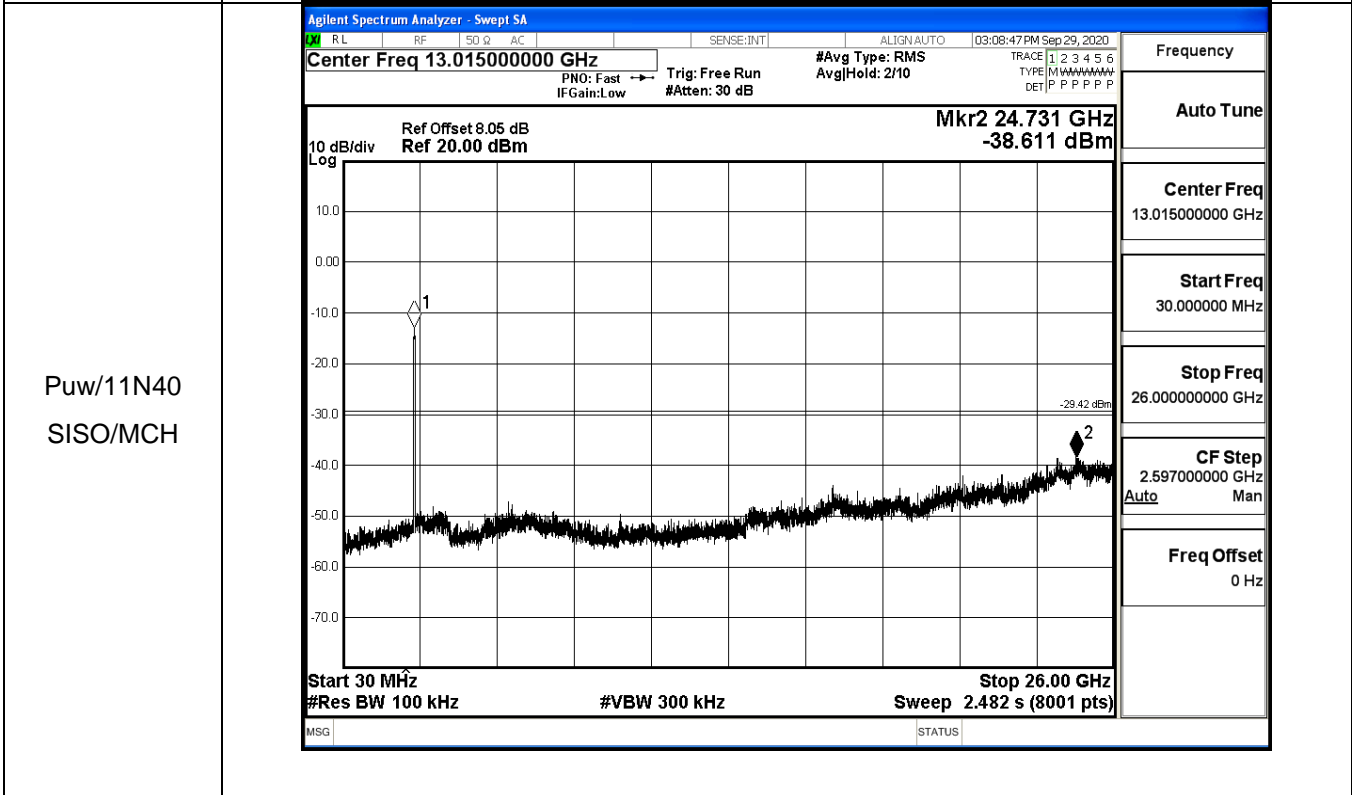
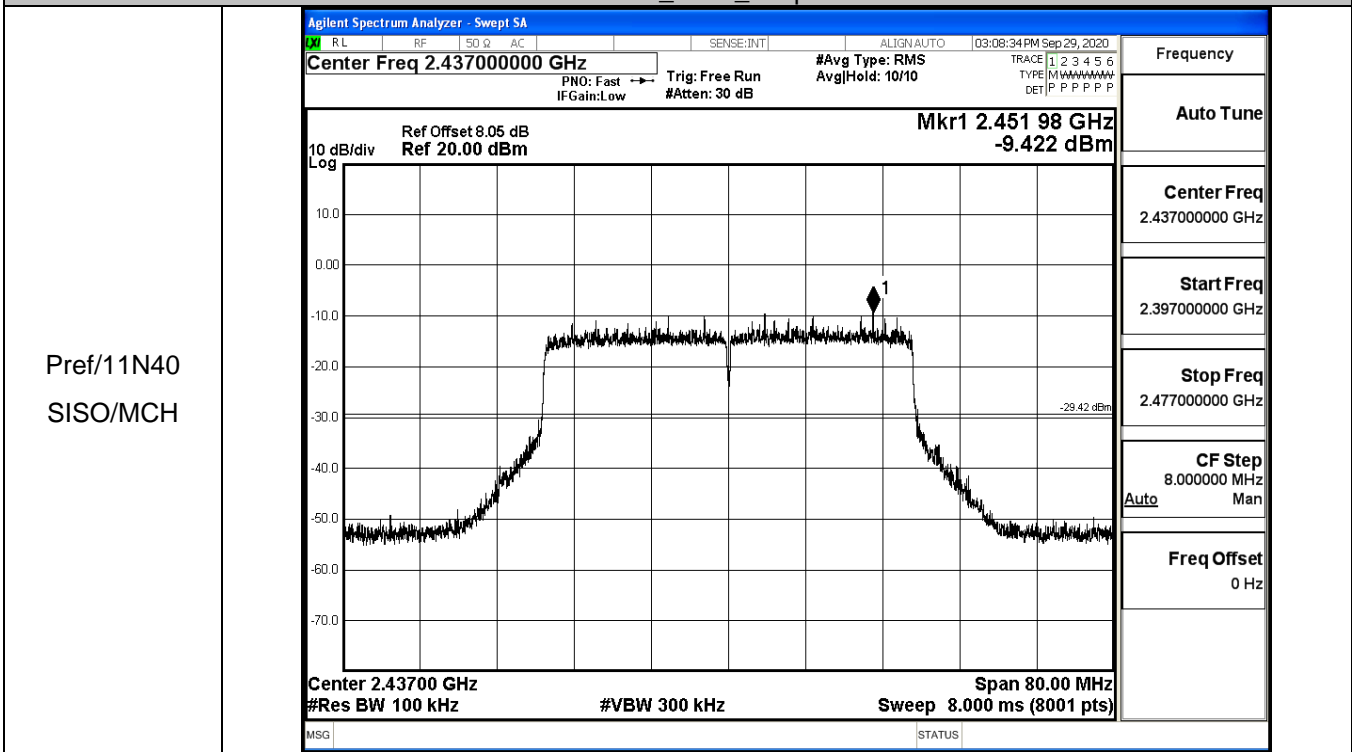
11N20SISO_MCH_Graphs



11N20SISO_HCH_Graphs

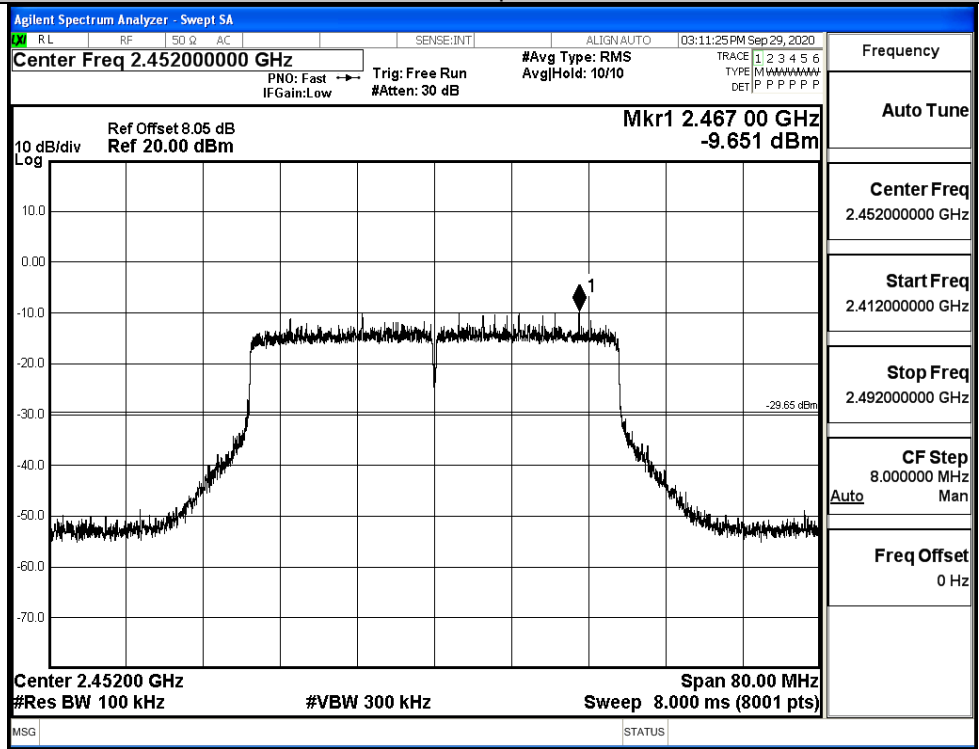


11N40SISO_MCH_Graphs

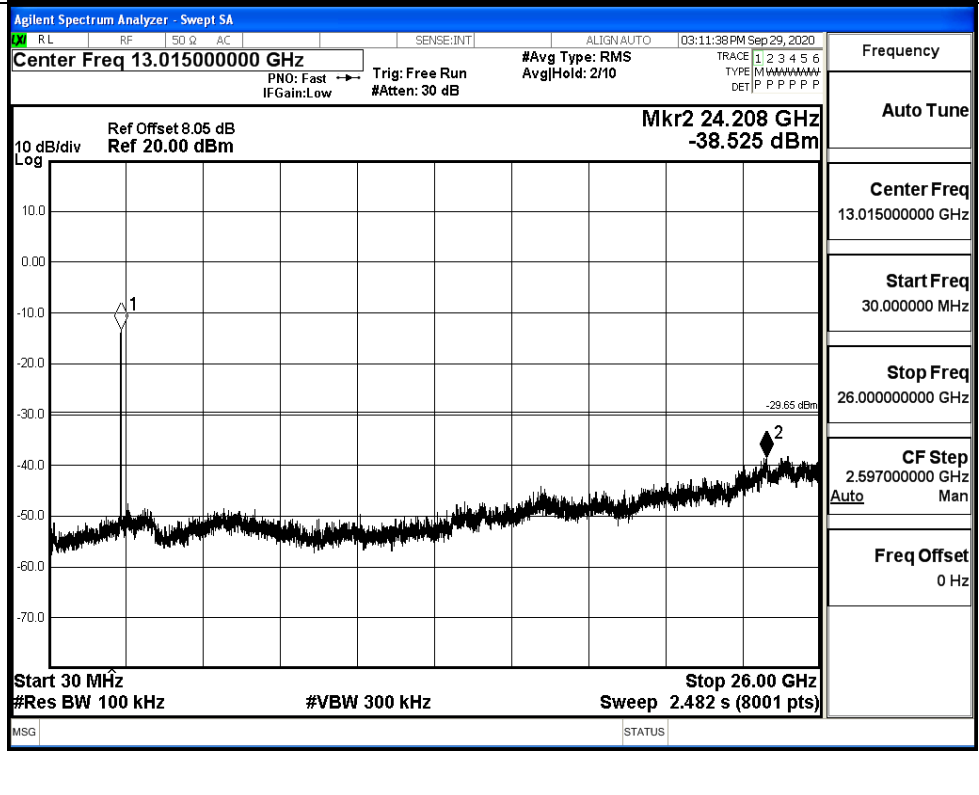


11N40SISO_HCH_Graphs

Pref/11N40
SISO/HCH

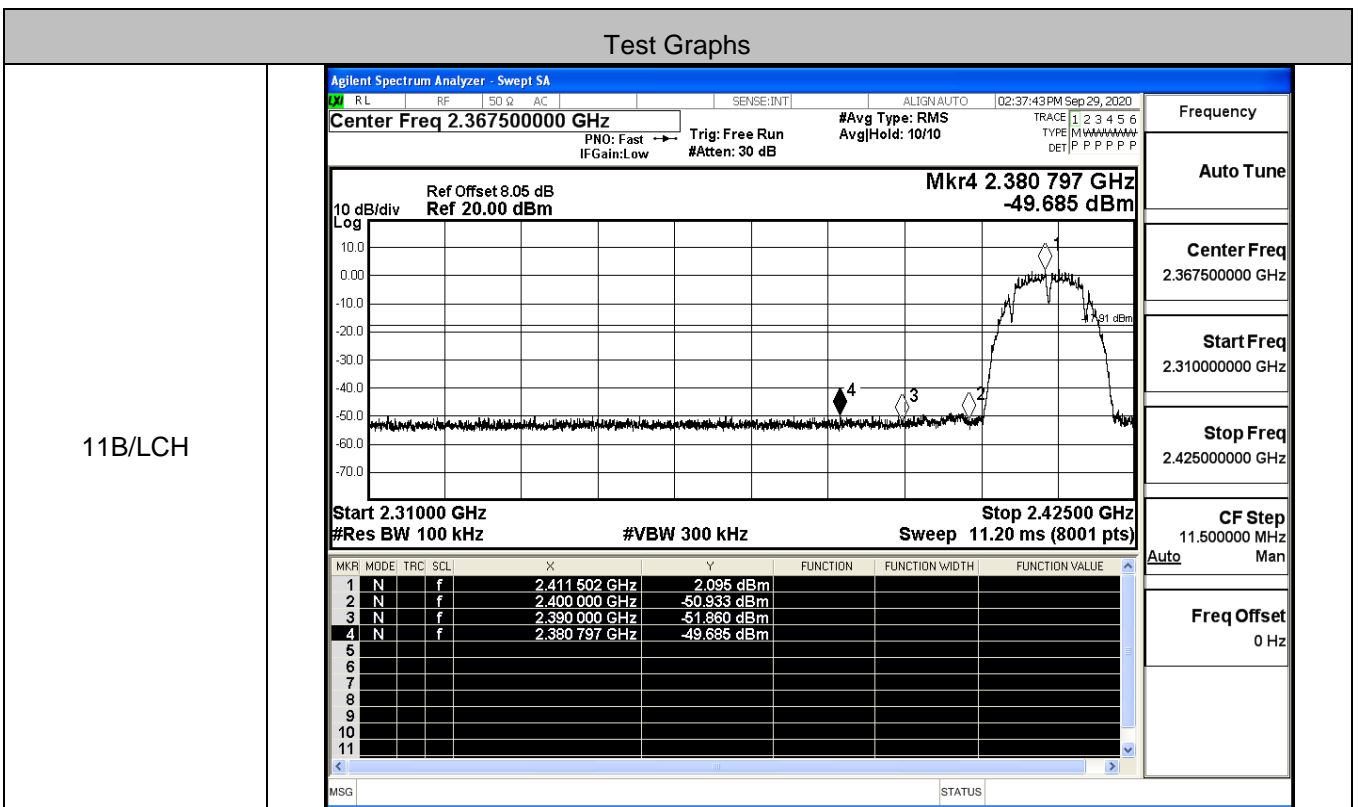


Puw/11N40
SISO/HCH

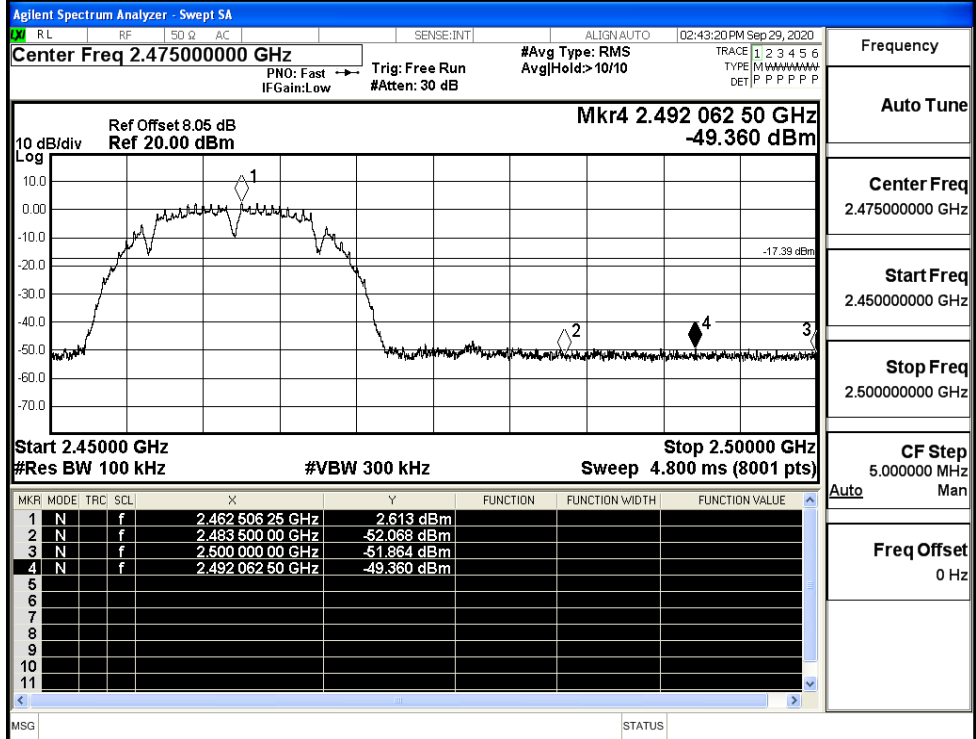


A.6 Band-edge for RF Conducted Emissions

Mode	Channel	Carrier Power[dBm]	Max.Spurious Level [dBm]	Limit [dBm]	Verdict
11B	LCH	2.095	-49.685	-17.91	PASS
	HCH	2.613	-49.360	-17.39	PASS
11G	LCH	-4.858	-49.416	-24.86	PASS
	HCH	-4.752	-48.907	-24.75	PASS
11N20SISO	LCH	-5.821	-49.736	-25.82	PASS
	HCH	-6.017	-49.599	-26.02	PASS
11N40SISO	LCH	-9.331	-49.724	-29.33	PASS
	HCH	-9.298	-49.605	-29.3	PASS

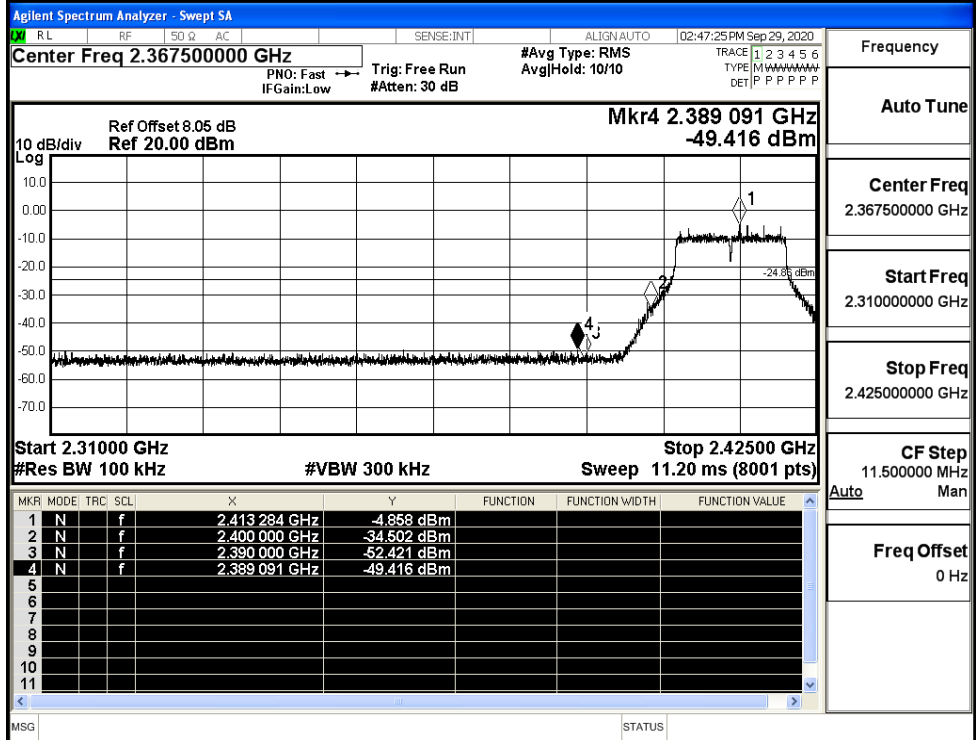


11B/HCH



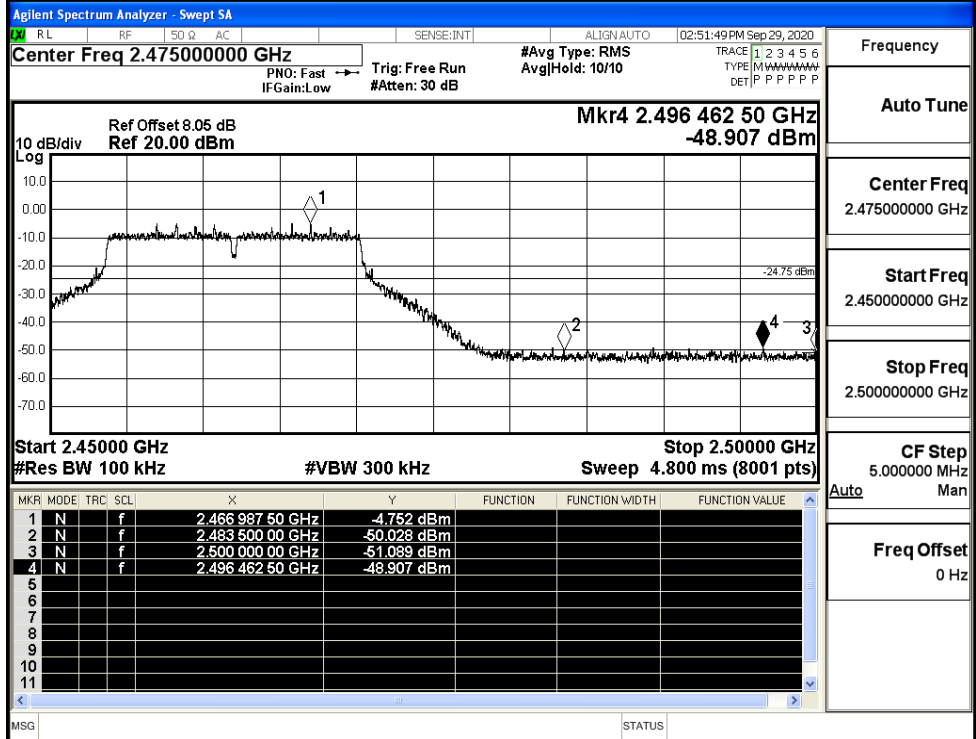
Frequency	2.47500000 GHz
Auto Tune	
Center Freq	2.47500000 GHz
Start Freq	2.45000000 GHz
Stop Freq	2.50000000 GHz
CF Step	5.000000 MHz
Freq Offset	0 Hz

11G/LCH



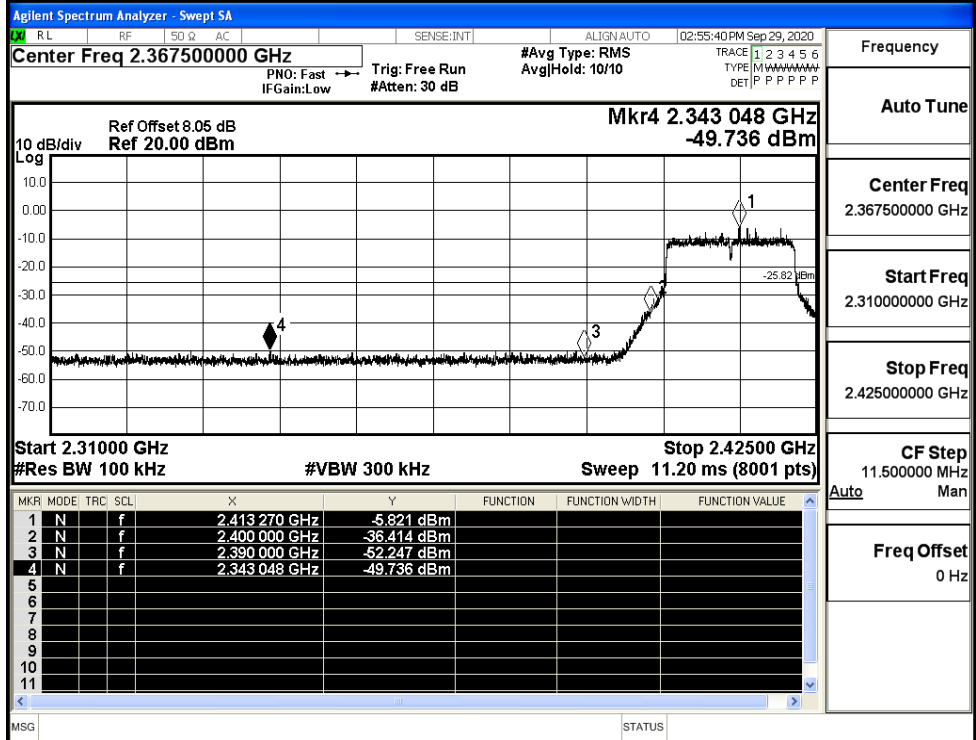
Frequency	2.36750000 GHz
Auto Tune	
Center Freq	2.36750000 GHz
Start Freq	2.31000000 GHz
Stop Freq	2.42500000 GHz
CF Step	11.500000 MHz
Freq Offset	0 Hz

11G/HCH



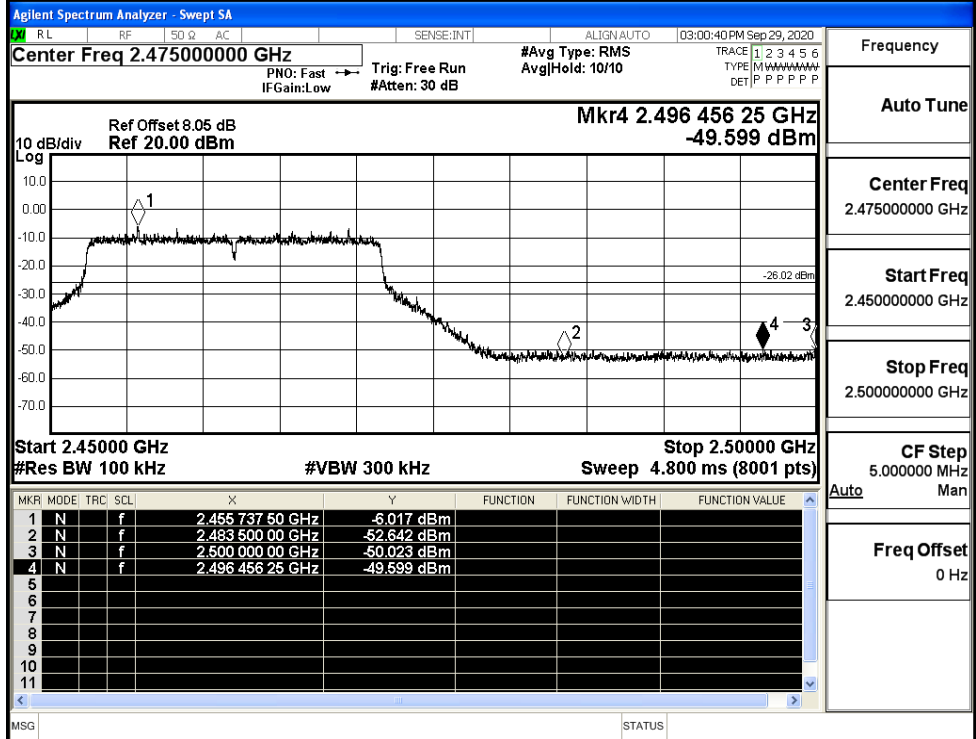
Frequency	2.475000000 GHz
Auto Tune	
Center Freq	2.475000000 GHz
Start Freq	2.450000000 GHz
Stop Freq	2.500000000 GHz
CF Step	5.000000 MHz
Freq Offset	0 Hz

11N20SISO/LCH



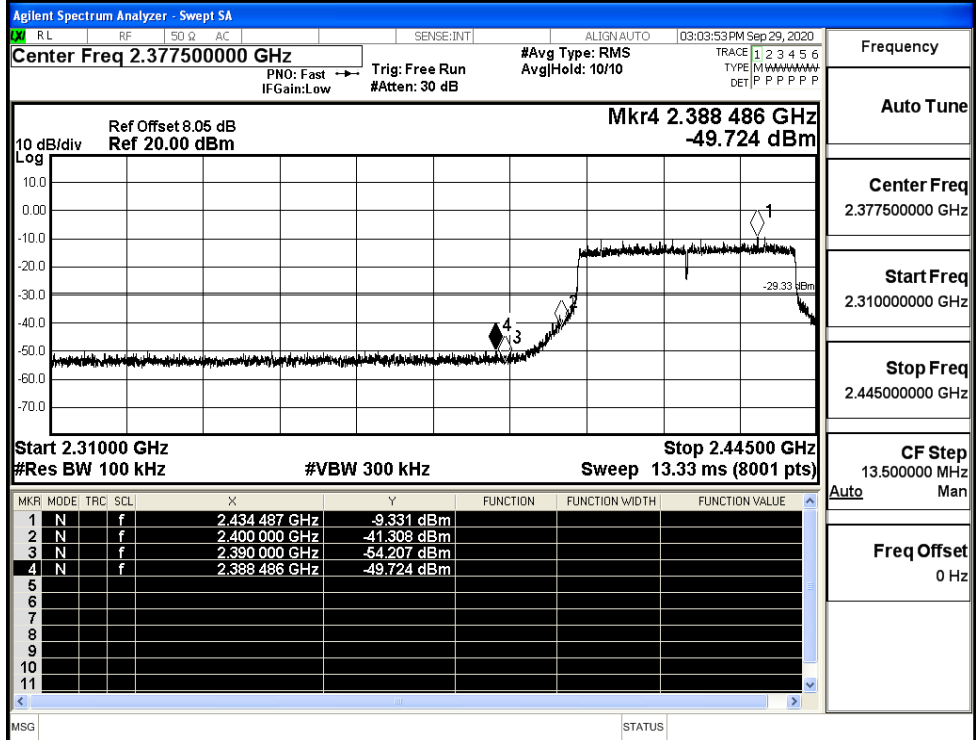
Frequency	2.367500000 GHz
Auto Tune	
Center Freq	2.367500000 GHz
Start Freq	2.310000000 GHz
Stop Freq	2.425000000 GHz
CF Step	11.500000 MHz
Freq Offset	0 Hz

11N20SISO/HCH



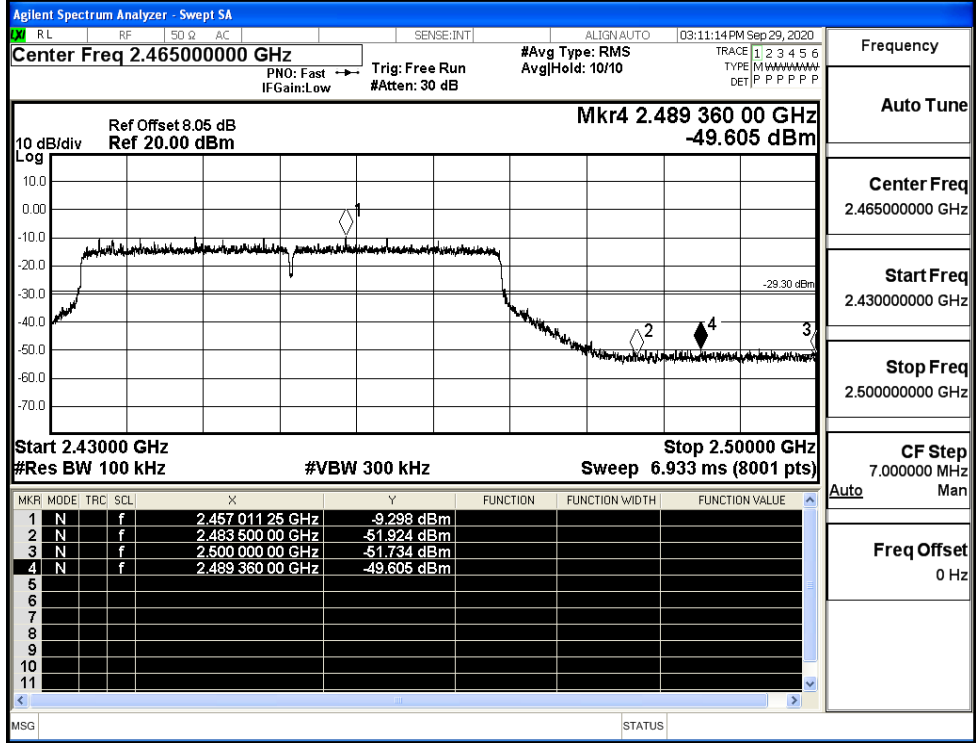
Frequency	Auto Tune
Center Freq	2.475000000 GHz
Start Freq	2.450000000 GHz
Stop Freq	2.500000000 GHz
CF Step	5.000000 MHz
Freq Offset	0 Hz

11N40SISO/LCH



Frequency	Auto Tune
Center Freq	2.377500000 GHz
Start Freq	2.310000000 GHz
Stop Freq	2.445000000 GHz
CF Step	13.500000 MHz
Freq Offset	0 Hz

11N40SISO/HCH

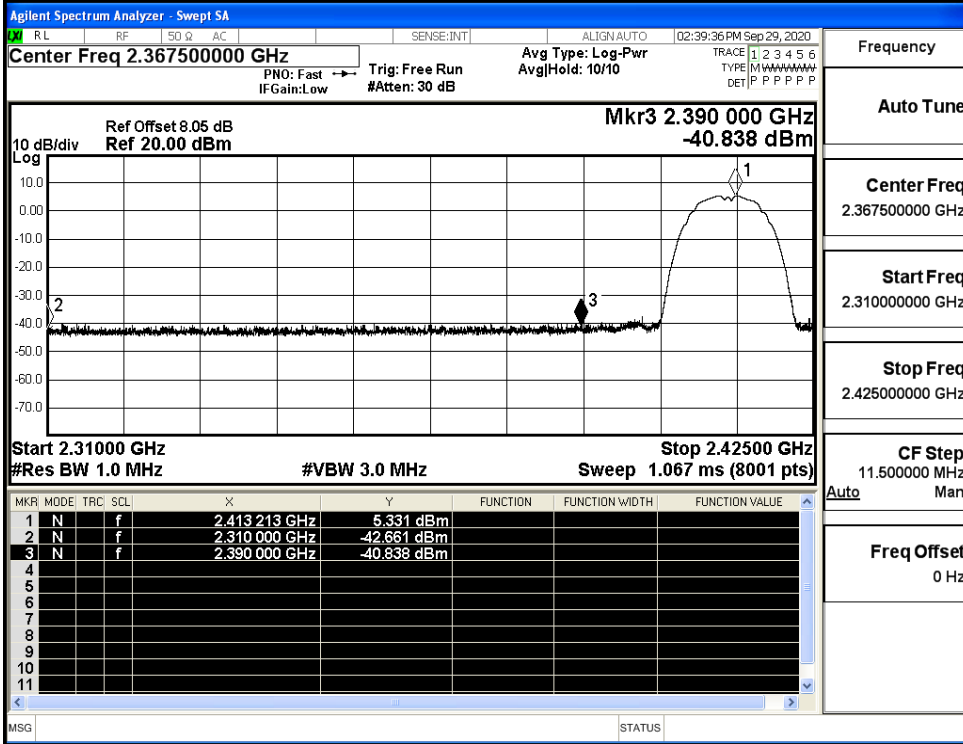


A.7 Restrict-band band-edge measurements

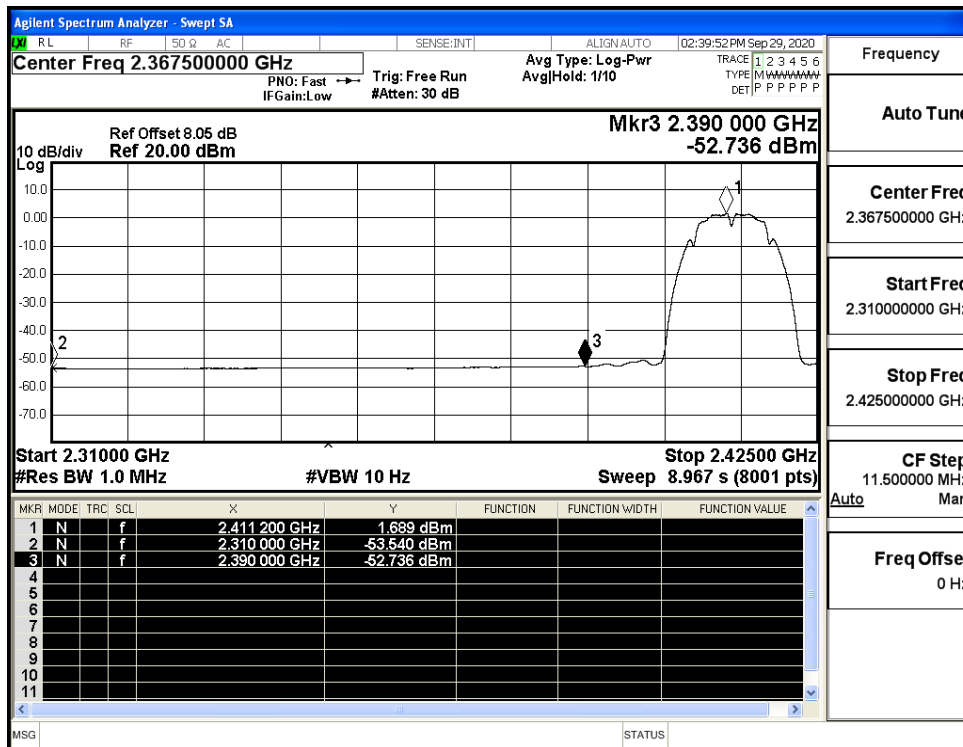
Test Mode	Test Channel	Ant	Freq.	Power [dBm]	Gain	Ground Factor	E [dBuV/m]	Detector	Limit [dBu V/m]	Verdict
11B	2412	Ant1	2310.0	-42.66	3.0	0	55.6	PEAK	74	PASS
	2412	Ant1	2310.0	-53.54	3.0	0	44.72	AV	54	PASS
	2412	Ant1	2390.0	-40.84	3.0	0	57.42	PEAK	74	PASS
	2412	Ant1	2390.0	-52.74	3.0	0	45.52	AV	54	PASS
	2462	Ant1	2483.5	-42.20	3.0	0	56.06	PEAK	74	PASS
	2462	Ant1	2483.5	-52.25	3.0	0	46.01	AV	54	PASS
	2462	Ant1	2500.0	-42.42	3.0	0	55.84	PEAK	74	PASS
	2462	Ant1	2500.0	-52.47	3.0	0	45.79	AV	54	PASS
11G	2412	Ant1	2310.0	-43.29	3.0	0	54.97	PEAK	74	PASS
	2412	Ant1	2310.0	-53.58	3.0	0	44.68	AV	54	PASS
	2412	Ant1	2390.0	-42.44	3.0	0	55.82	PEAK	74	PASS
	2412	Ant1	2390.0	-53.15	3.0	0	45.11	AV	54	PASS
	2462	Ant1	2483.5	-43.43	3.0	0	54.83	PEAK	74	PASS
	2462	Ant1	2483.5	-52.73	3.0	0	45.53	AV	54	PASS
	2462	Ant1	2500.0	-42.67	3.0	0	55.59	PEAK	74	PASS
	2462	Ant1	2500.0	-52.57	3.0	0	45.69	AV	54	PASS
11N20 SISO	2412	Ant1	2310.0	-42.28	3.0	0	55.98	PEAK	74	PASS
	2412	Ant1	2310.0	-53.57	3.0	0	44.69	AV	54	PASS
	2412	Ant1	2390.0	-41.51	3.0	0	56.75	PEAK	74	PASS
	2412	Ant1	2390.0	-53.20	3.0	0	45.06	AV	54	PASS
	2462	Ant1	2483.5	-40.64	3.0	0	57.62	PEAK	74	PASS
	2462	Ant1	2483.5	-52.72	3.0	0	45.54	AV	54	PASS
	2462	Ant1	2500.0	-42.25	3.0	0	56.01	PEAK	74	PASS
	2462	Ant1	2500.0	-52.58	3.0	0	45.68	AV	54	PASS
11N40 SISO	2422	Ant1	2310.0	-42.82	3.0	0	55.44	PEAK	74	PASS
	2422	Ant1	2310.0	-53.55	3.0	0	44.71	AV	54	PASS

	2422	Ant1	2390.0	-43.39	3.0	0	54.87	PEAK	74	PASS
	2422	Ant1	2390.0	-52.98	3.0	0	45.28	AV	54	PASS
	2452	Ant1	2483.5	-42.40	3.0	0	55.86	PEAK	74	PASS
	2452	Ant1	2483.5	-52.64	3.0	0	45.62	AV	54	PASS
	2452	Ant1	2500.0	-42.26	3.0	0	56.00	PEAK	74	PASS
	2452	Ant1	2500.0	-52.56	3.0	0	45.70	AV	54	PASS

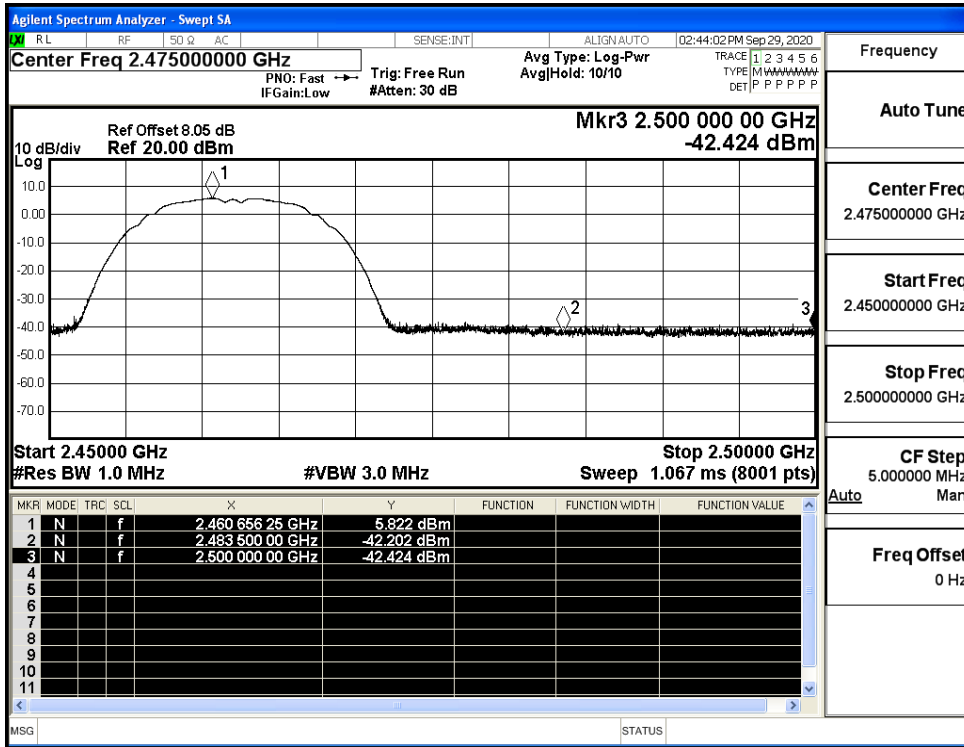
Restrict-band band-edge measurements_11B_2412_Ant1_PEAK



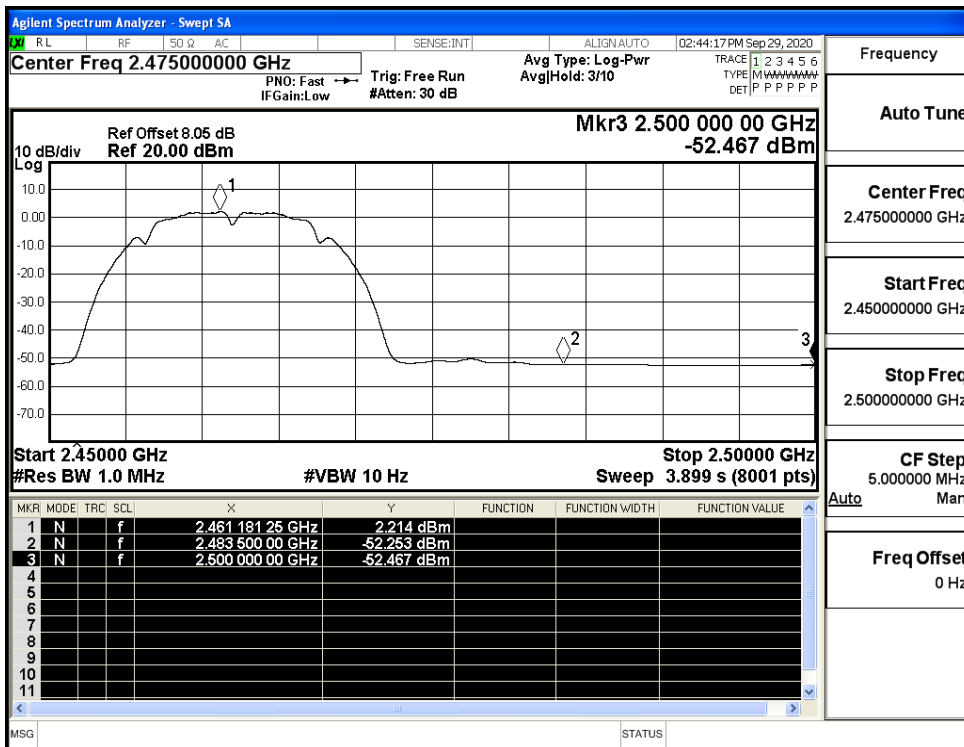
Restrict-band band-edge measurements_11B_2412_Ant1_AV



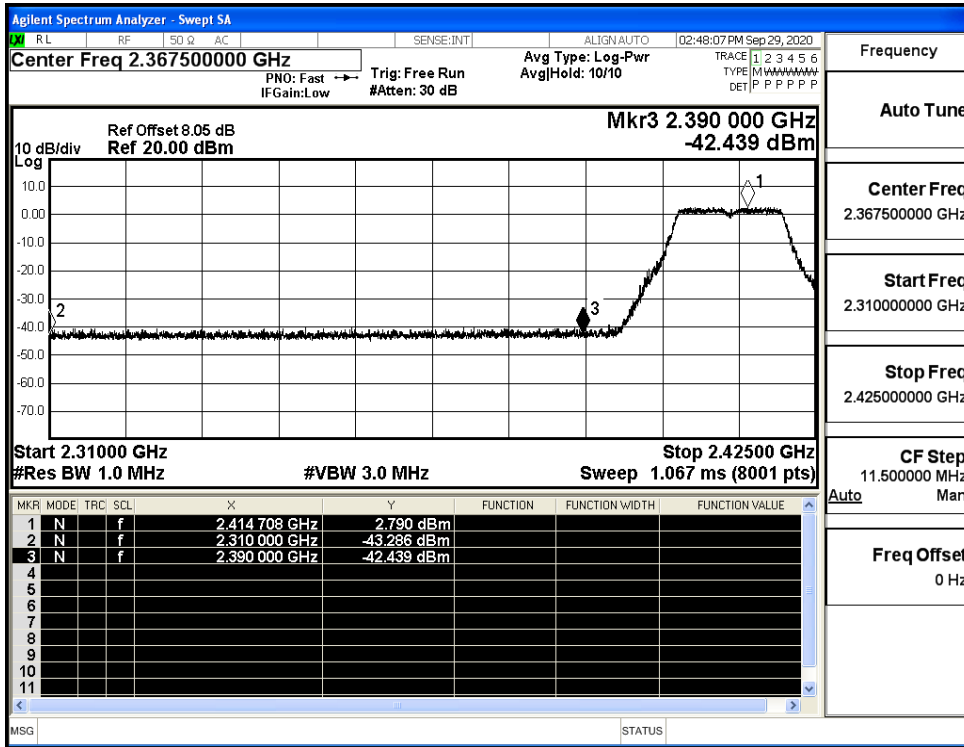
Restrict-band band-edge measurements_11B_2462_Ant1_PEAK



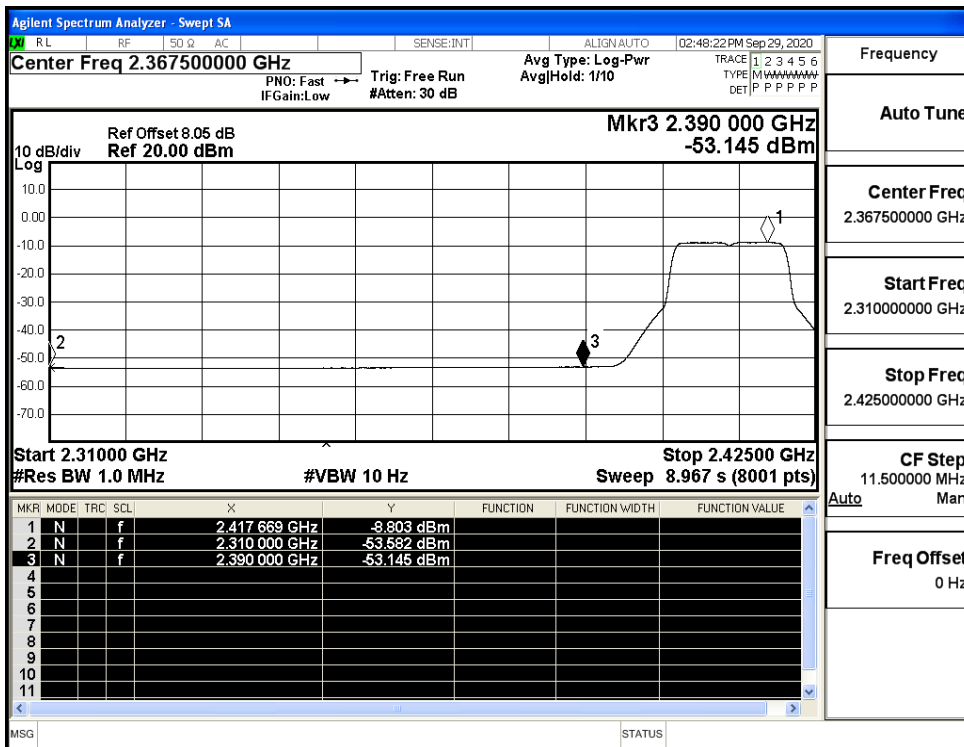
Restrict-band band-edge measurements_11B_2462_Ant1_AV



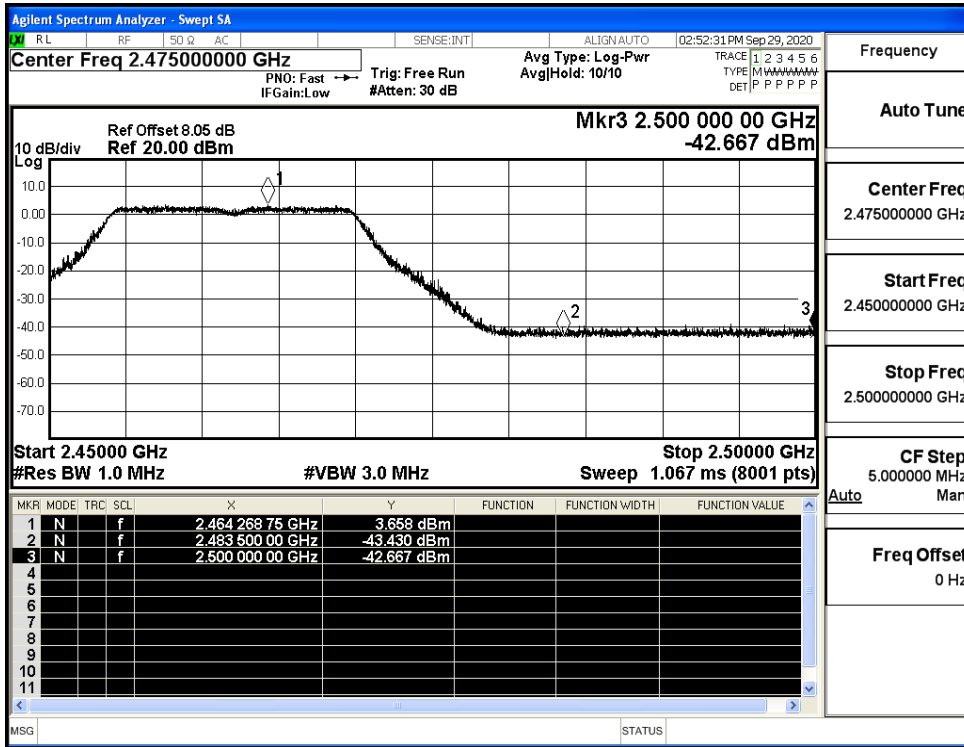
Restrict-band band-edge measurements_11G_2412_Ant1_PEAK



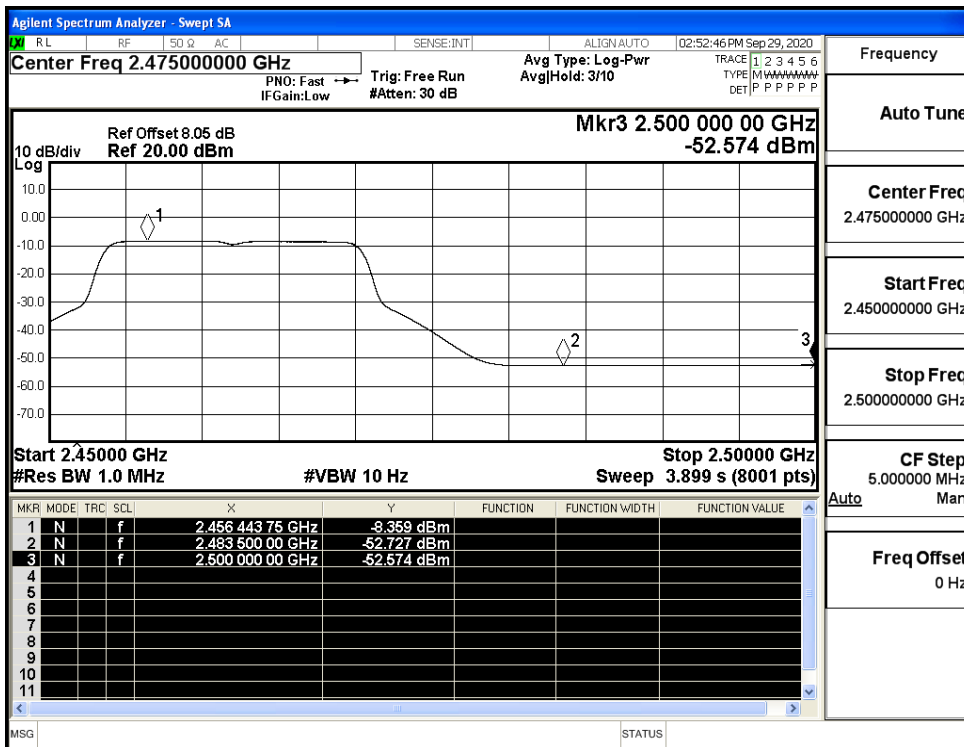
Restrict-band band-edge measurements_11G_2412_Ant1_AV



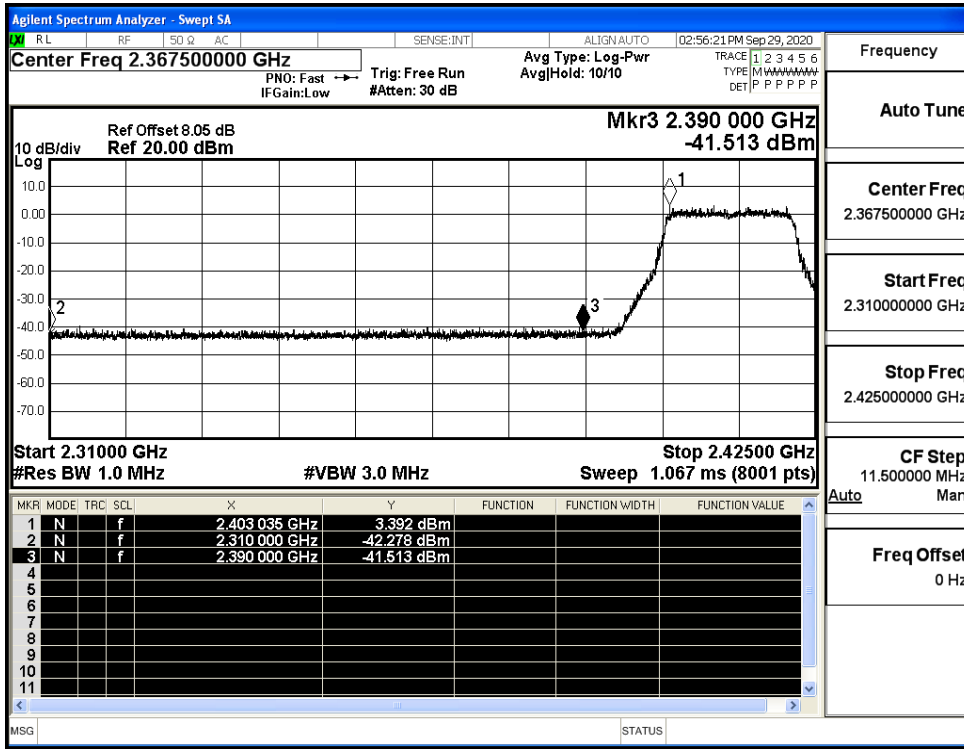
Restrict-band band-edge measurements_11G_2462_Ant1_PEAK



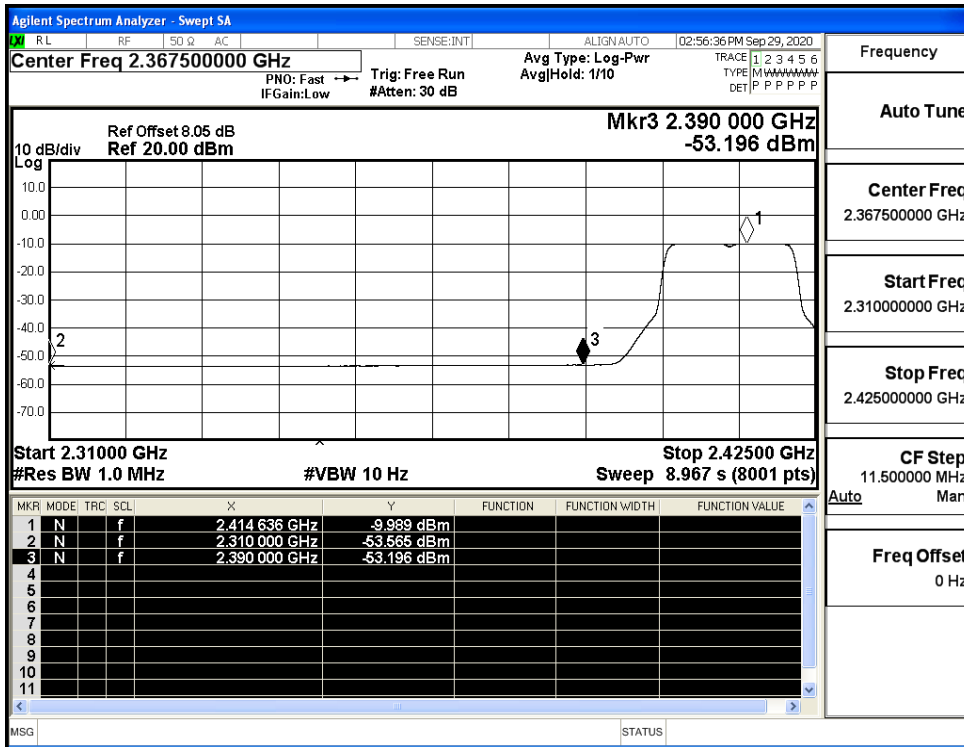
Restrict-band band-edge measurements_11G_2462_Ant1_AV



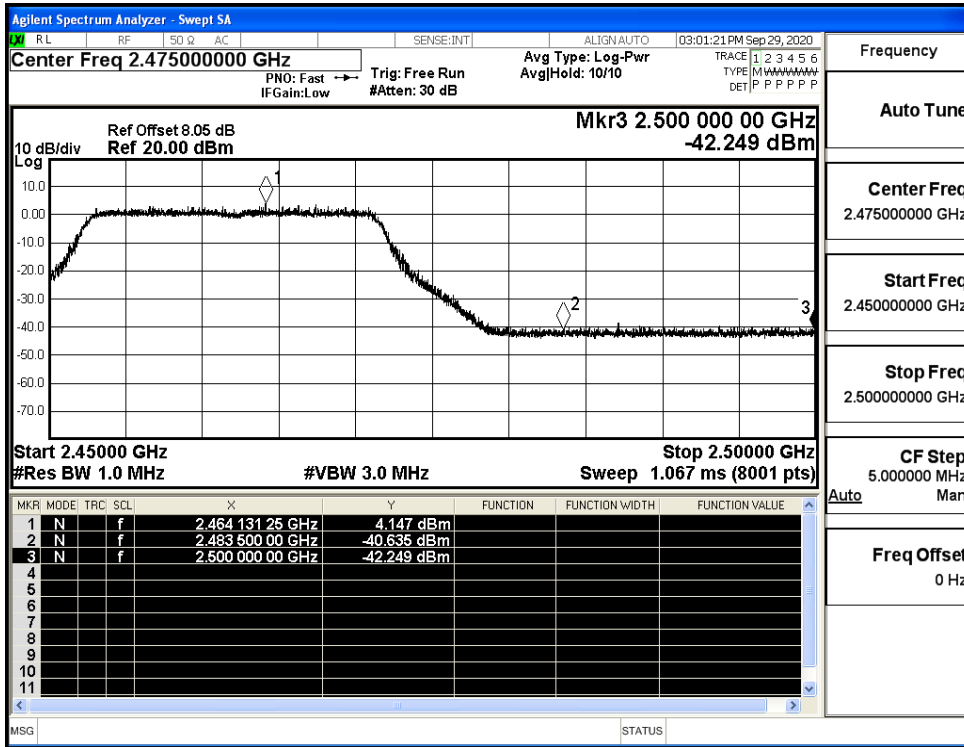
Restrict-band band-edge measurements_11N20SISO_2412_Ant1_PEAK



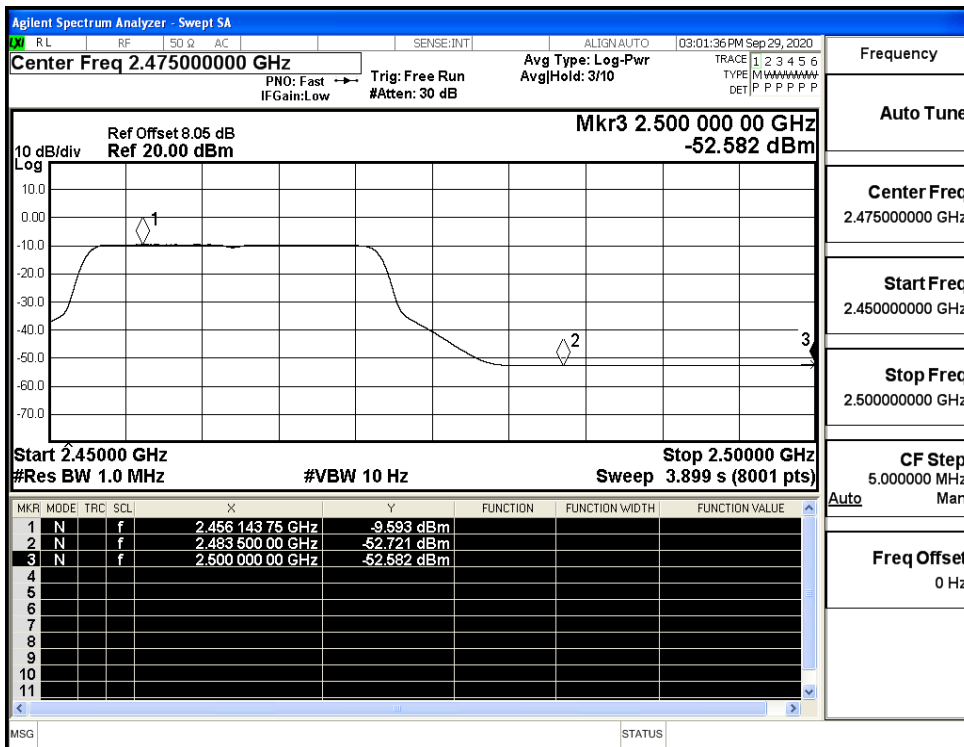
Restrict-band band-edge measurements_11N20SISO_2412_Ant1_AV



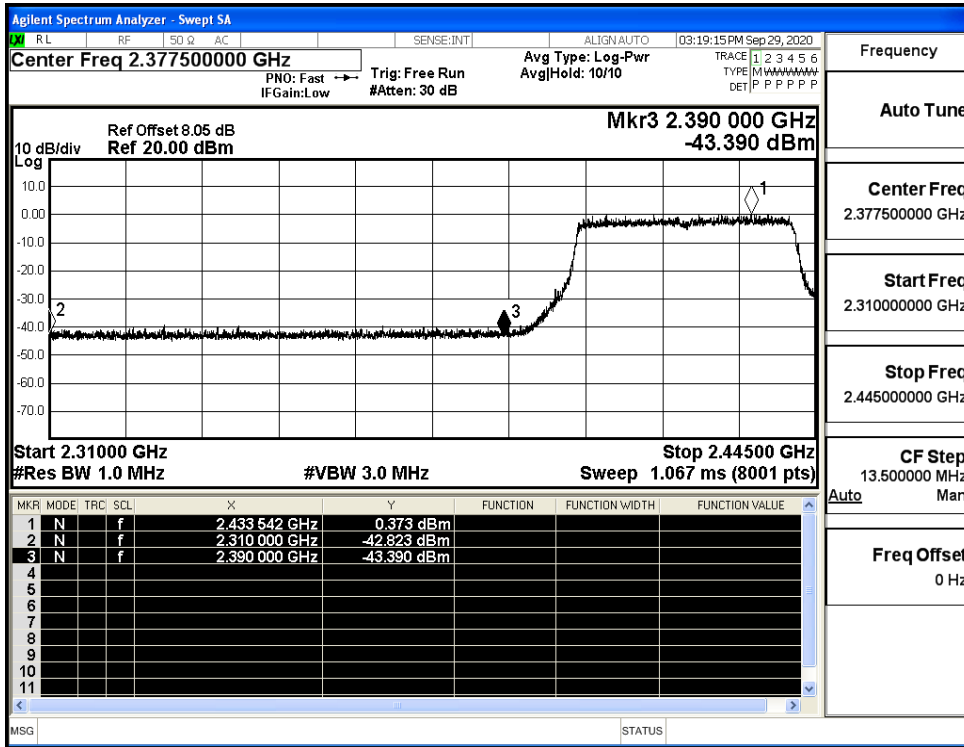
Restrict-band band-edge measurements_11N20SISO_2462_Ant1_PEAK



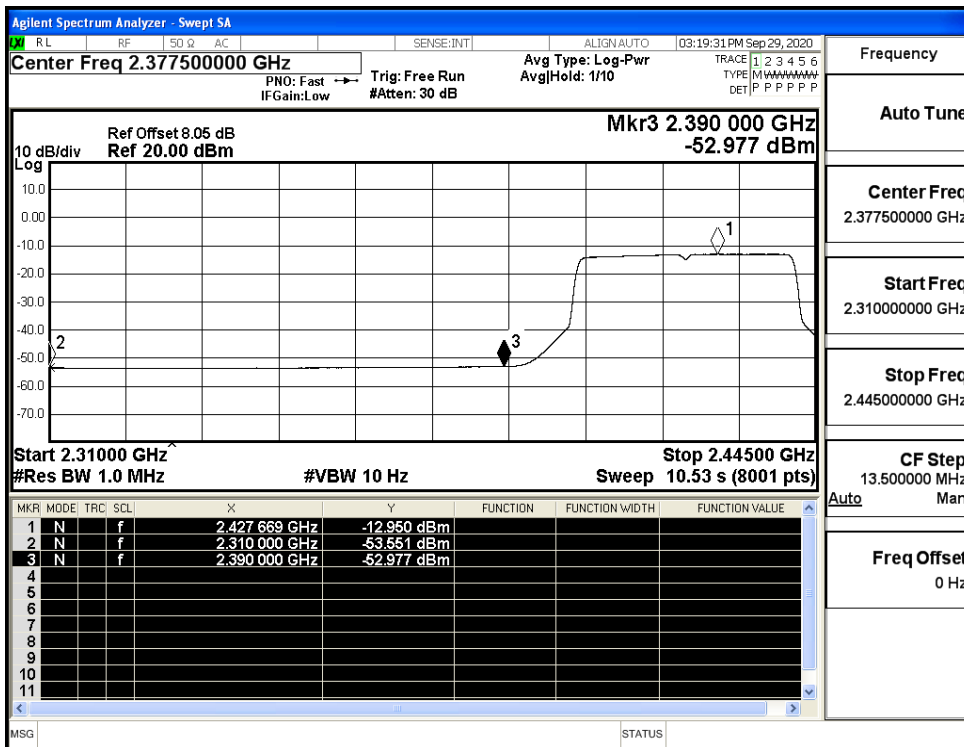
Restrict-band band-edge measurements_11N20SISO_2462_Ant1_AV



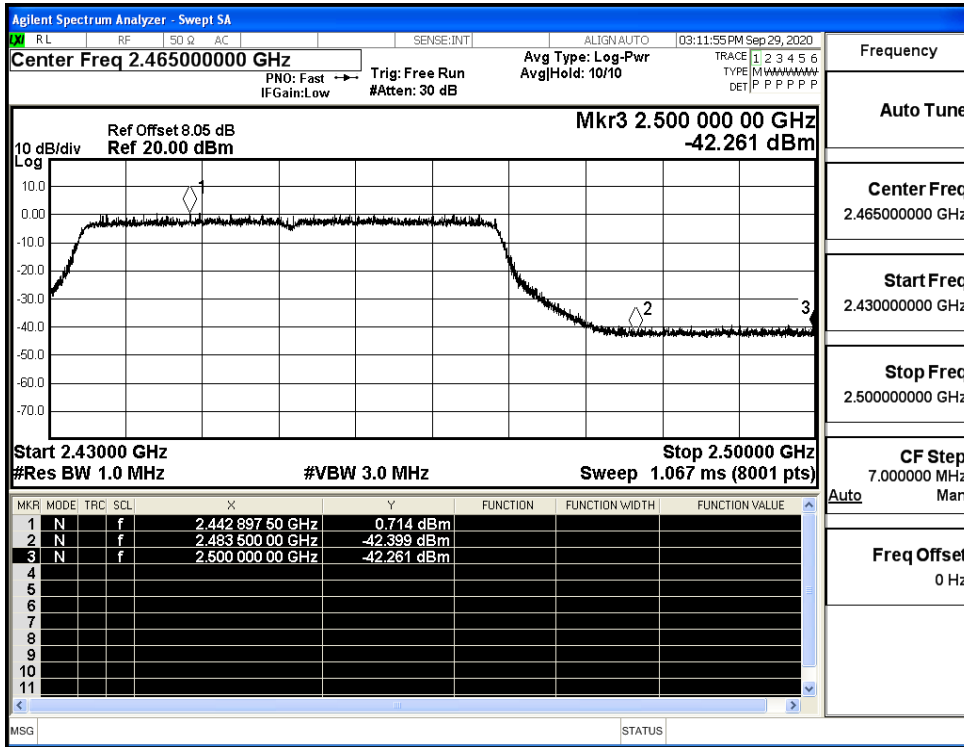
Restrict-band band-edge measurements_11N40SISO_2422_Ant1_PEAK



Restrict-band band-edge measurements_11N40SISO_2422_Ant1_AV



Restrict-band band-edge measurements_11N40SISO_2452_Ant1_PEAK



Restrict-band band-edge measurements_11N40SISO_2452_Ant1_AV

