



Appendix A

RF Test Data for 2.4G WIFI (Conducted Measurement)

Product Name: Cloud of Things ULE Gateway

Trade Mark: DeviceTone™

Test Model: COTGW-U2301

Environmental Conditions

Temperature:	21.2° C
Relative Humidity:	52.4%
ATM Pressure:	100.0 kPa
Test Engineer:	Wunder Wu
Supervised by:	Li Huan



Test Result

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant0	2412	10.120	2406.880	2417.000	0.5	PASS
		2437	8.680	2432.840	2441.520	0.5	PASS
		2462	10.040	2456.920	2466.960	0.5	PASS
11G	Ant0	2412	13.520	2405.920	2419.440	0.5	PASS
		2437	11.440	2431.800	2443.240	0.5	PASS
		2462	14.160	2455.360	2469.520	0.5	PASS
11N20SISO	Ant0	2412	12.240	2405.640	2417.880	0.5	PASS
		2437	13.640	2430.840	2444.480	0.5	PASS
		2462	14.160	2455.240	2469.400	0.5	PASS
11N40SISO	Ant0	2422	34.000	2405.520	2439.520	0.5	PASS
		2437	32.720	2420.520	2453.240	0.5	PASS
		2452	31.440	2438.080	2469.520	0.5	PASS

Agilent Spectrum Analyzer - Swept SA

Center Freq 2.412000000 GHz

Ref Offset 7.79 dB
Ref 30.00 dBm

ΔMkr3 10.12 MHz
-1.452 dB

10 dB/div
Log

Center 2.41200 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 40.00 MHz
Sweep 3.867 ms (1001 pts)

MARK	MODE	FREQ	SCAL	AM	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	2.40688 GHz					-3.341 dBm
2	N	2.41392 GHz					2.819 dBm
3	Δ1	10.12 MHz (Δ)					-1.452 dB

Frequency

Auto Tune

Center Freq
2.412000000 GHz

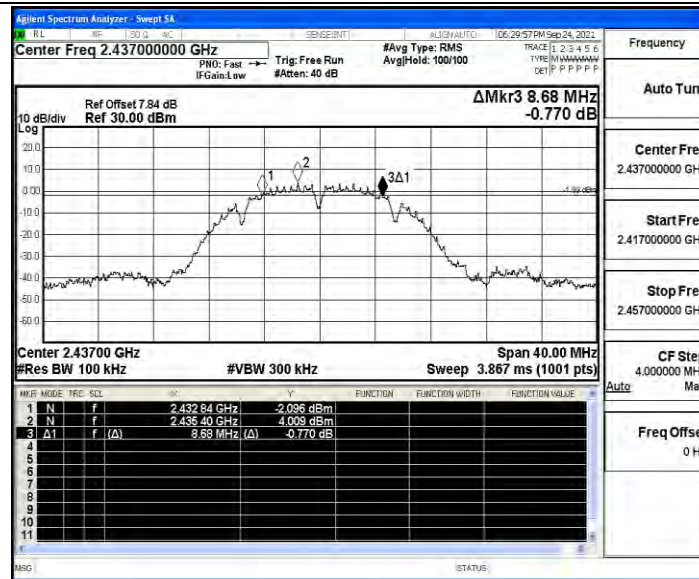
Start Freq
2.392000000 GHz

Stop Freq
2.432000000 GHz

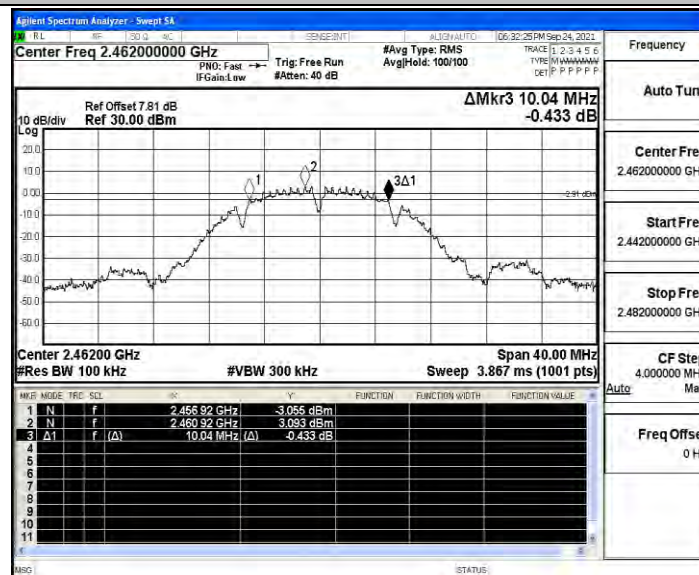
CF Step
4.000000 MHz
Auto Man

Freq Offset
0 Hz

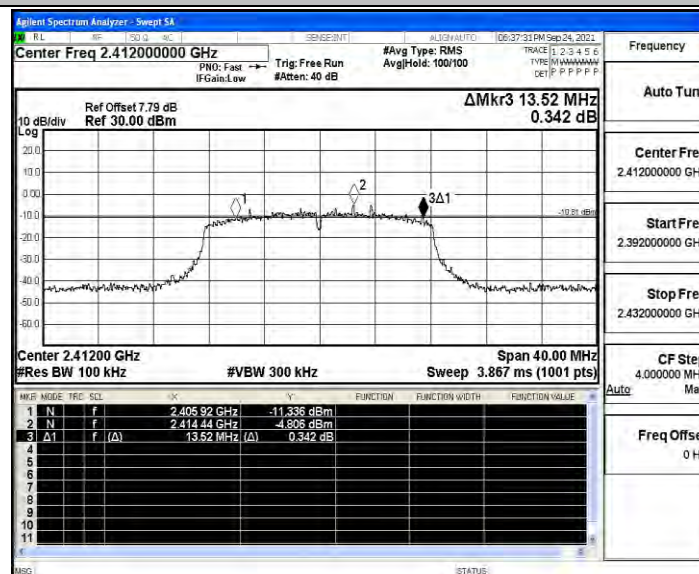
11B_Ant0_2412



11B_Ant0_2462



11G_Ant0_2412





Agilent Spectrum Analyzer - Sweep SA

Center Freq 2.43700000 GHz

Ref Offset 7.84 dB
Ref 30.00 dBm

Trig: Free Run
PNO: Fast
IF Gain: Low
#Att: 40 dB

#Avg Type: RMS
Avg Fold: 100/100

DATE/TIME: 06/41:59 PM Sep 24, 2021
TRACE 1: 2 3 4 5 6
TYPE: N/A
DEF: P P P P P

Frequency

Auto Tun

Center Freq
2.43700000 GHz

Start Freq
2.417000000 GHz

Stop Freq
2.457000000 GHz

CF Step
4.000000 MHz

Auto

Freq Offset
0 Hz

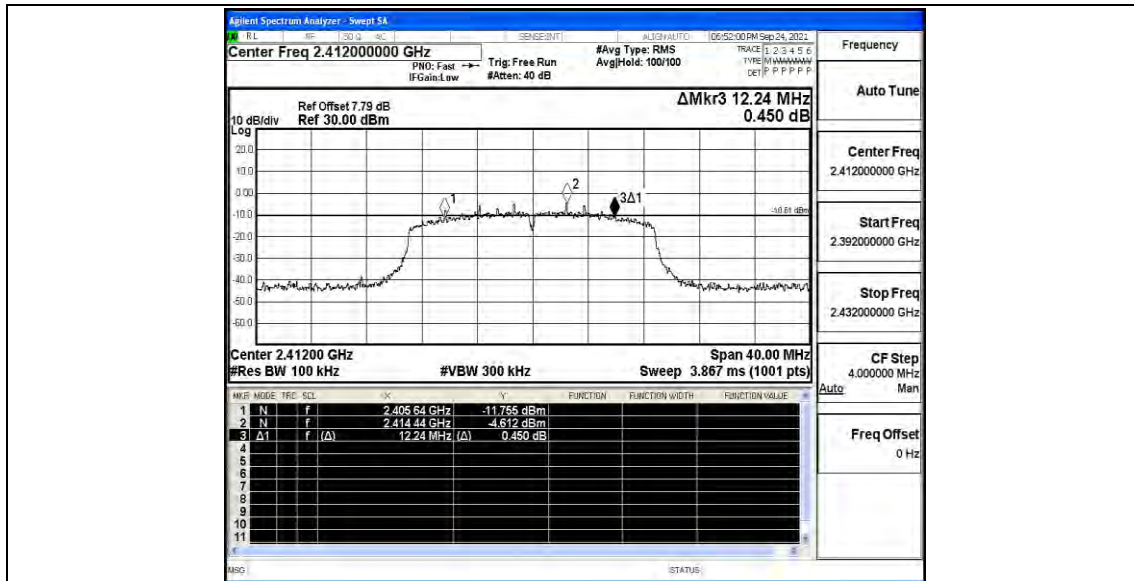
ΔMkr3 11.44 MHz
-1.356 dB

Center 2.43700 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 40.00 MHz
Sweep 3.867 ms (1001 pts)

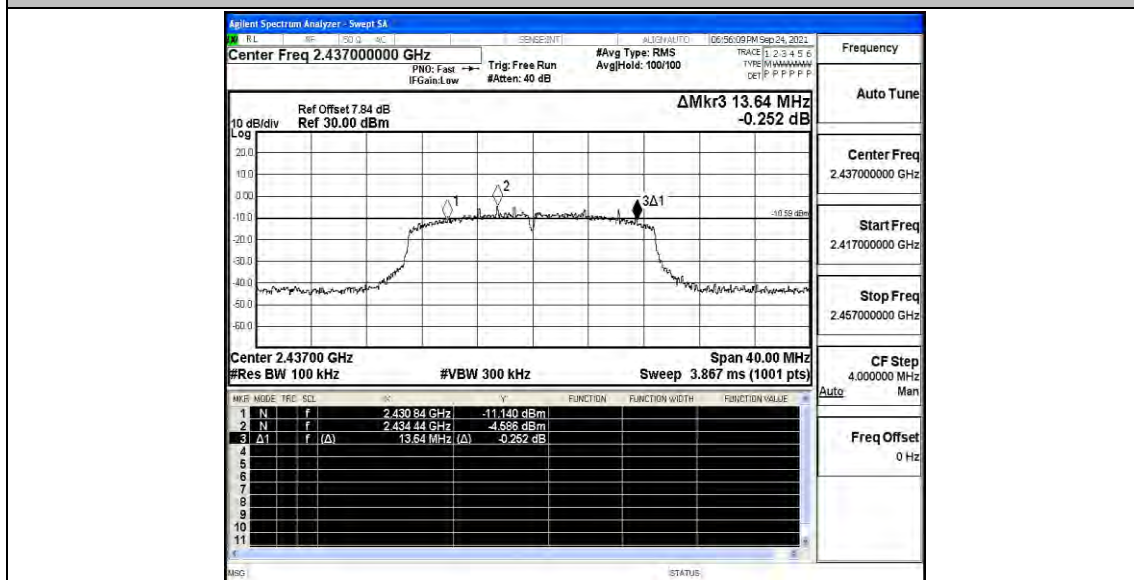
MNR	MEAS	TRIG	SCN	UNIT	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	F		2.431 80 GHz	-10.286 dBm		
2	N	F		2.438 20 GHz	-3.527 dBm		
3	Δ1	F	(Δ)	11.44 MHz (Δ)	-1.356 dB		
4							
5							
6							
7							
8							
9							
10							
11							

[illegible]

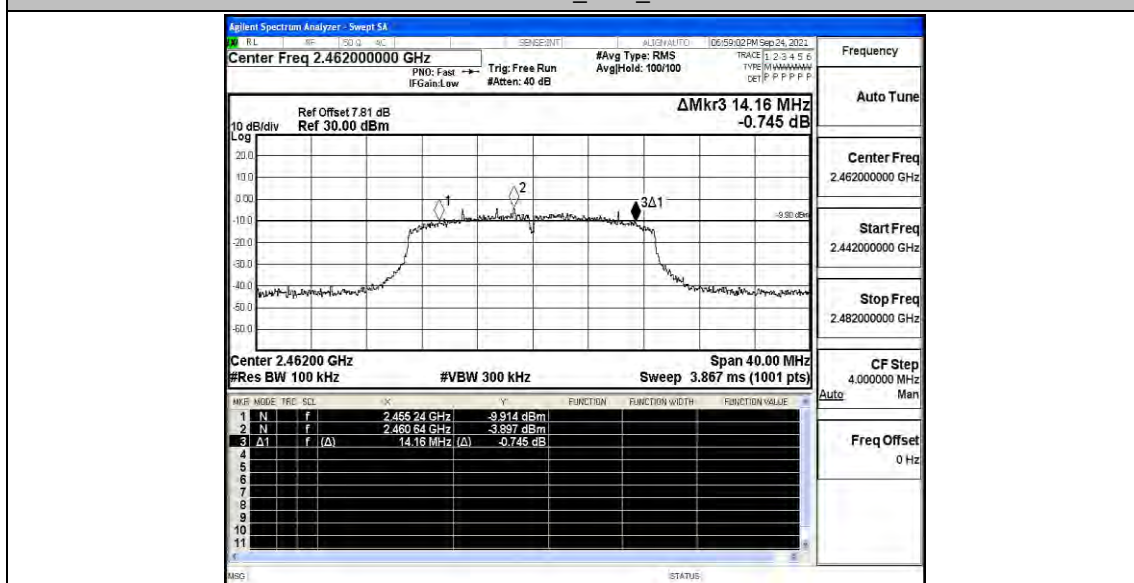
4



11N20SISO_Ant0_2437

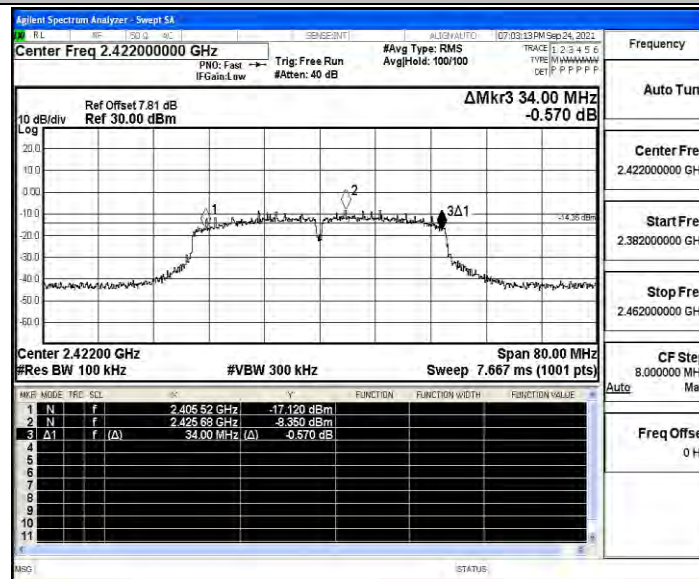


11N20SISO_Ant0_2462

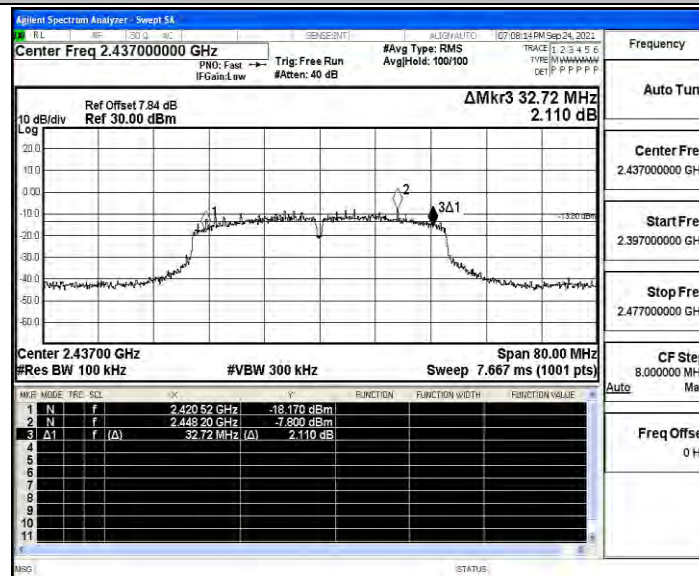




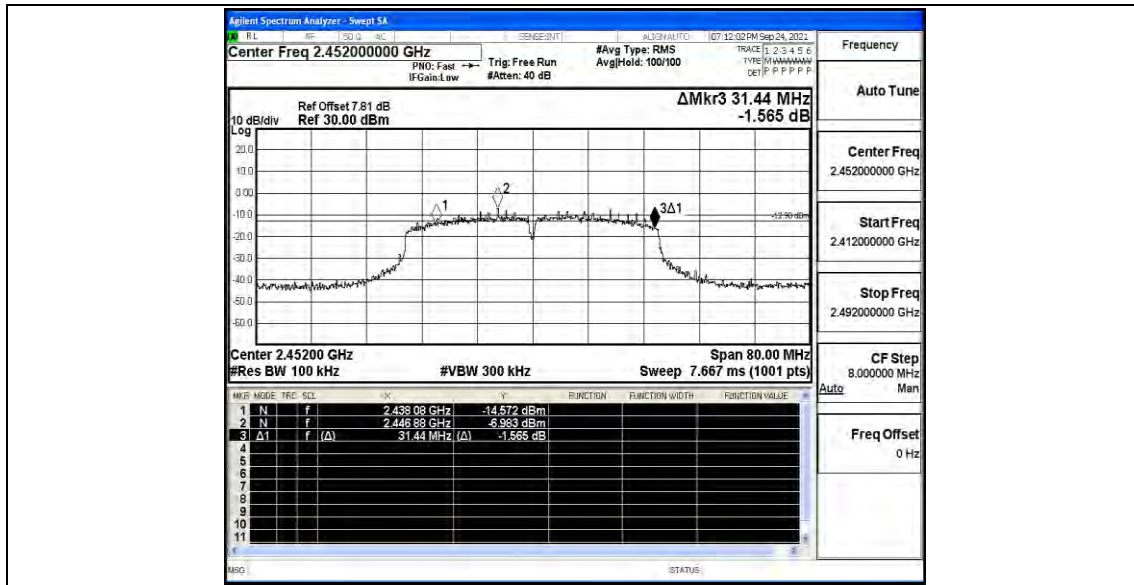
11N40SISO_Ant0_2422



11N40SISO_Ant0_2437



11N40SISO_Ant0_2452

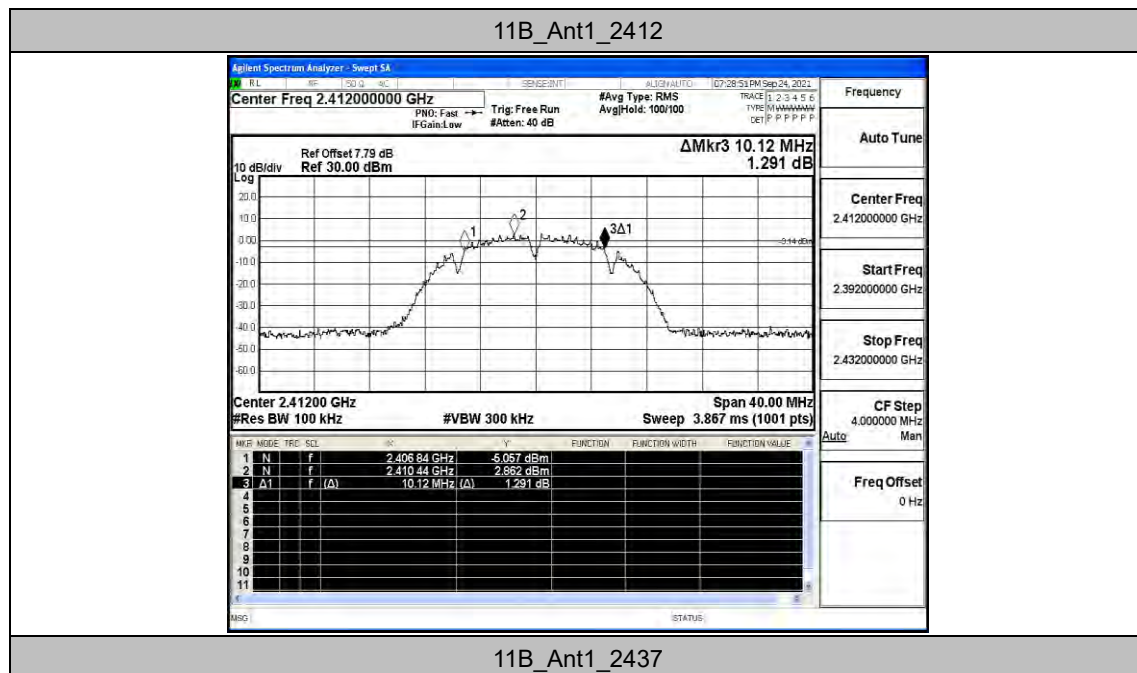


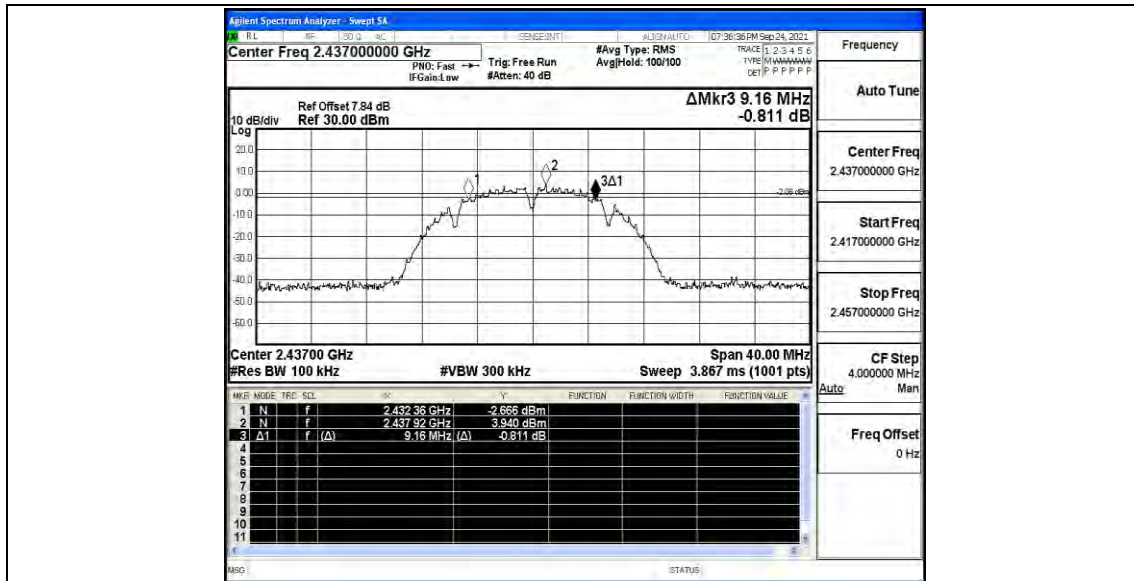


ANT1

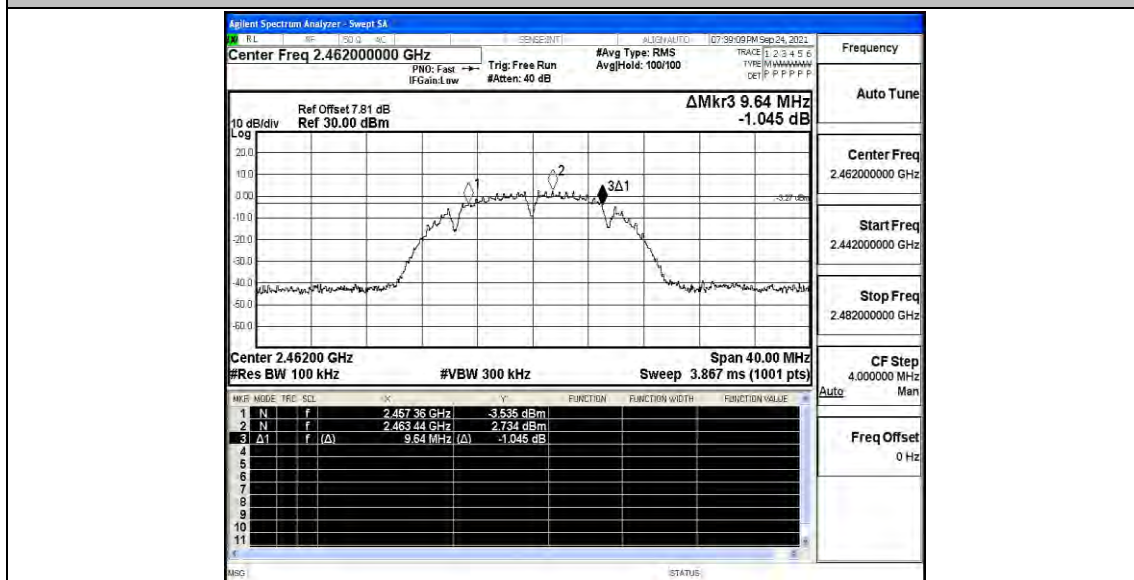
TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	10.120	2406.840	2416.960	0.5	PASS
		2437	9.160	2432.360	2441.520	0.5	PASS
		2462	9.640	2457.360	2467.000	0.5	PASS
11G	Ant1	2412	12.800	2405.680	2418.480	0.5	PASS
		2437	13.000	2431.480	2444.480	0.5	PASS
		2462	13.520	2455.600	2469.120	0.5	PASS
11N20SISO	Ant1	2412	12.720	2405.560	2418.280	0.5	PASS
		2437	13.920	2430.600	2444.520	0.5	PASS
		2462	12.680	2456.800	2469.480	0.5	PASS
11N40SISO	Ant1	2422	30.240	2406.800	2437.040	0.5	PASS
		2437	31.440	2420.600	2452.040	0.5	PASS
		2452	35.200	2434.320	2469.520	0.5	PASS

Test Graphs

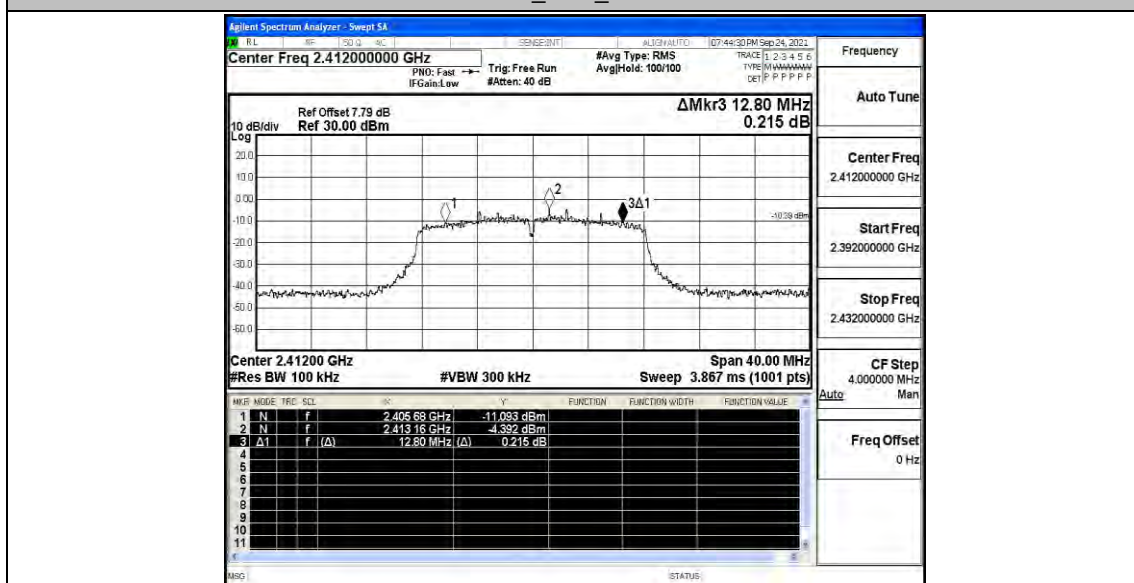




11B_Ant1_2462

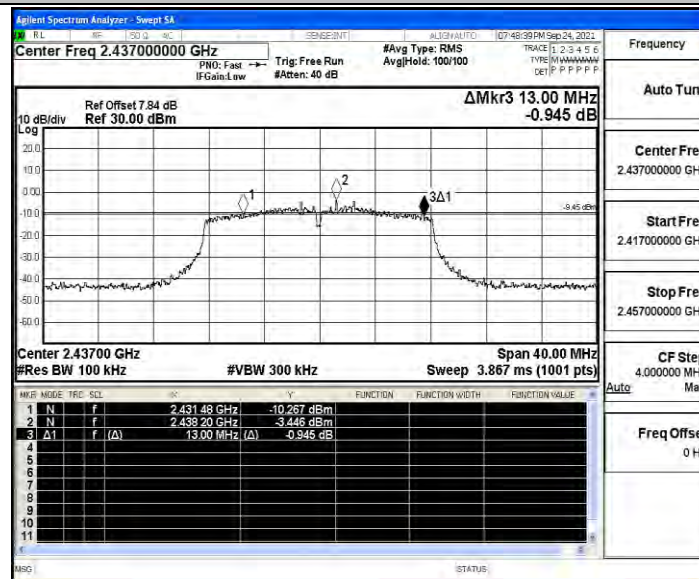


11G_Ant1_2412

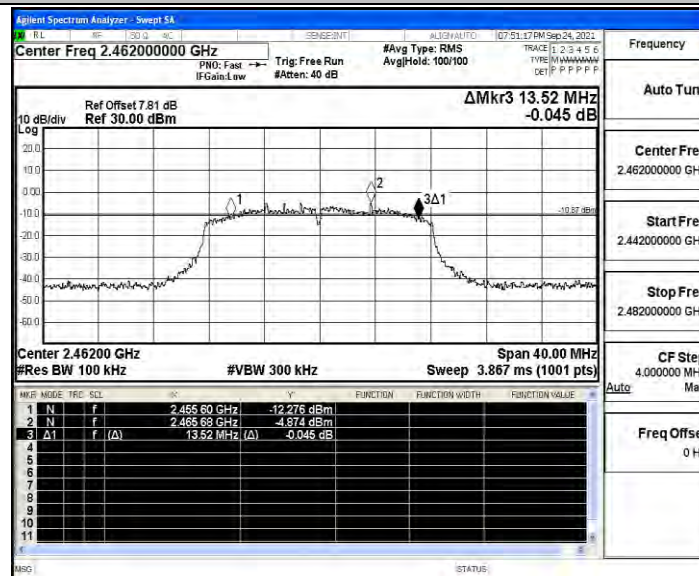




11G_Ant1_2437



11G_Ant1_2462

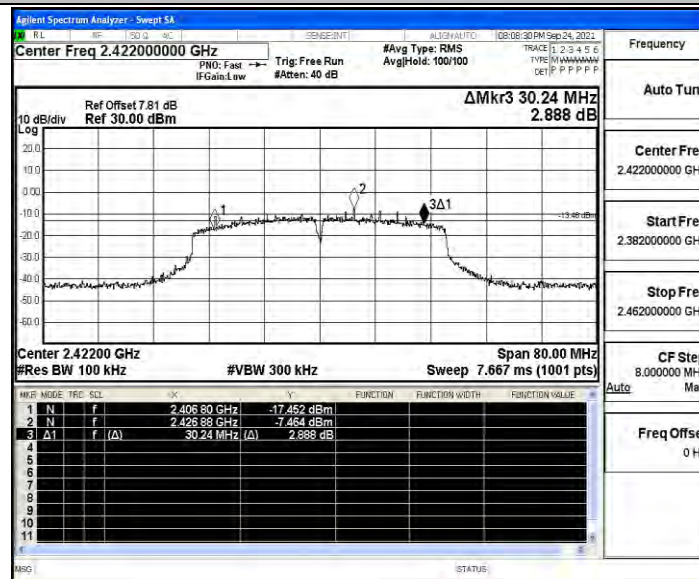


11N20SISO_Ant1_2412

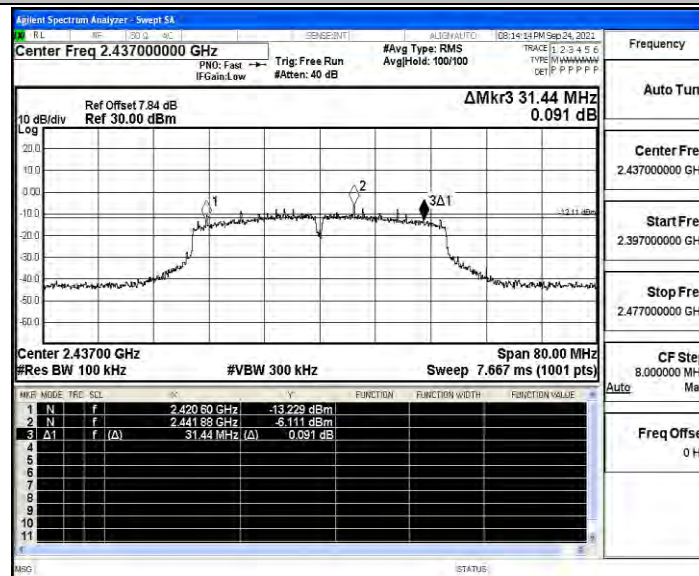




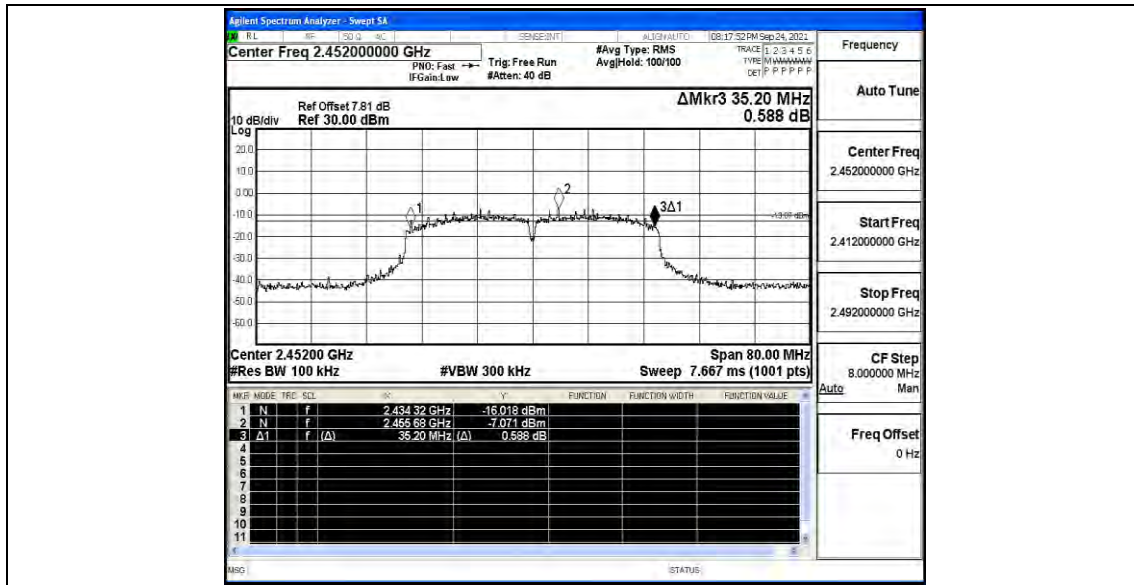
11N40SISO_Ant1_2422



11N40SISO_Ant1_2437



11N40SISO_Ant1_2452





A.2 Maximum Peak conducted output power

Test Result

Mode	Channel	Peak Power [dBm]			Limit [dBm]	Verdict
		Ant 0	Ant 1	Sum		
11B	LCH	15.87	15.69	/	30	PASS
	MCH	15.98	16.06	/	30	PASS
	HCH	15.60	15.14	/	30	PASS
11G	LCH	12.36	12.35	/	30	PASS
	MCH	13.22	13.30	/	30	PASS
	HCH	13.73	13.25	/	30	PASS
11N20	LCH	12.15	12.05	15.11	29.99	PASS
	MCH	12.97	12.68	15.84	29.99	PASS
	HCH	13.52	13.44	16.49	29.99	PASS
11N40	LCH	12.58	12.02	15.32	29.99	PASS
	MCH	12.79	13.28	16.05	29.99	PASS
	HCH	13.33	13.77	16.57	29.99	PASS



A.3 Maximum power spectral density

Test Result

Mode	Channel	PSD Level [dBm/3KHz]		Limit [dBm/3KHz]	Verdict
		Ant 0	Ant 1		
11B	LCH	-10.41	-10.45	8	PASS
	MCH	-9.97	-10.08	8	PASS
	HCH	-9.88	-10.84	8	PASS
11G	LCH	-18.34	-19.18	8	PASS
	MCH	-18.06	-18.06	8	PASS
	HCH	-17.2	-17.07	8	PASS
11N20	LCH	-20.11	-18.17	8	PASS
	MCH	-19.19	-19.63	8	PASS
	HCH	-18.03	-16.43	8	PASS
11N40	LCH	-21.41	-22.15	8	PASS
	MCH	-19.89	-19.95	8	PASS
	HCH	-21.8	-21.57	8	PASS

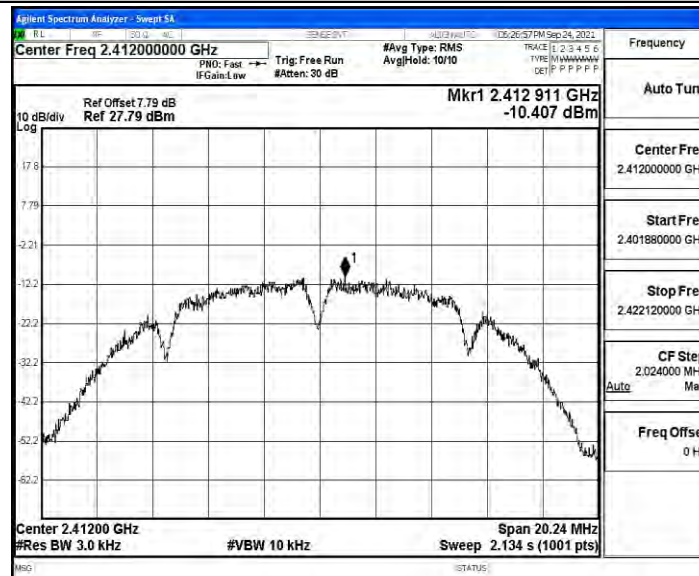
Mode	Channel	MIMO PSD [dBm/3KHz]			Limit [dBm/3KHz]	Verdict
		Ant 0	Ant 1	Sum		
11N20	LCH	-20.11	-18.17	-16.02	7.99	PASS
	MCH	-19.19	-19.63	-16.39	7.99	PASS
	HCH	-18.03	-16.43	-14.15	7.99	PASS
11N40	LCH	-21.41	-22.15	-18.75	7.99	PASS
	MCH	-19.89	-19.95	-16.91	7.99	PASS
	HCH	-21.8	-21.57	-18.67	7.99	PASS



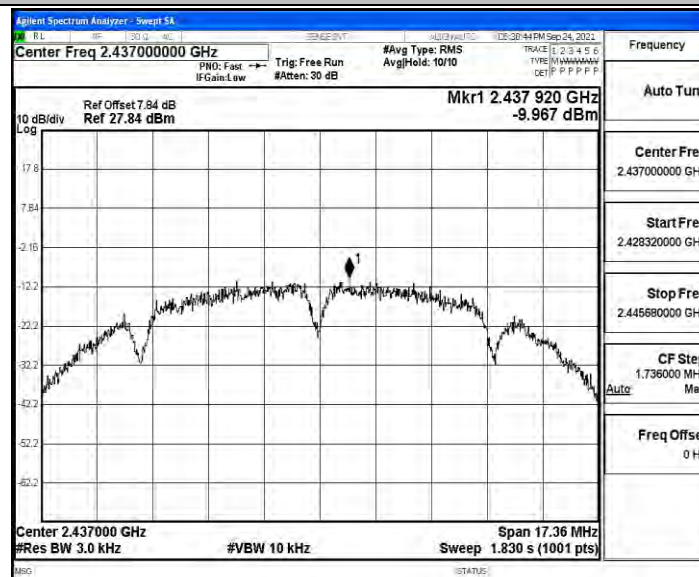
ANT0

Test Graphs

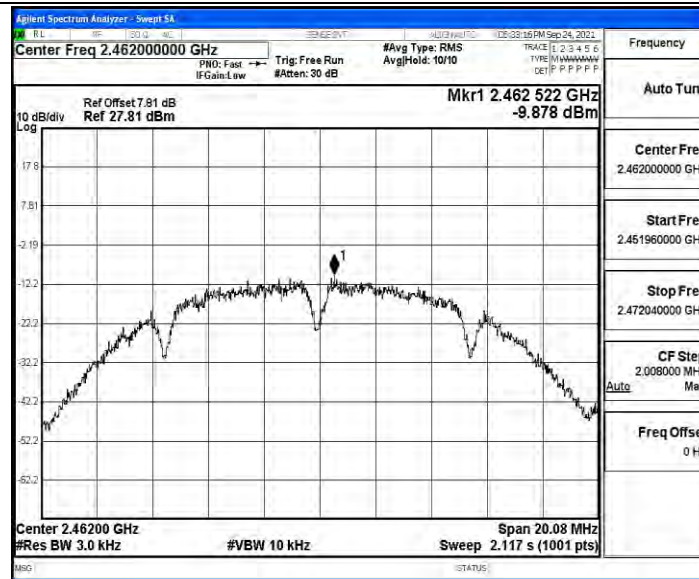
11B_Ant0_2412



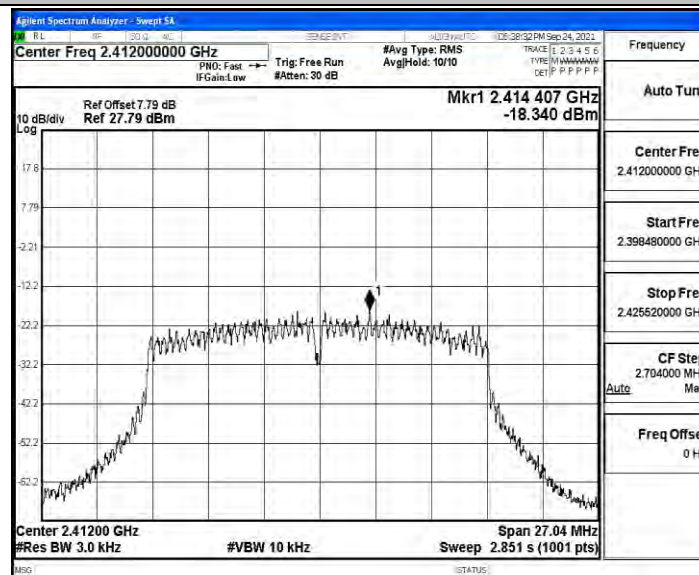
11B_Ant0_2437



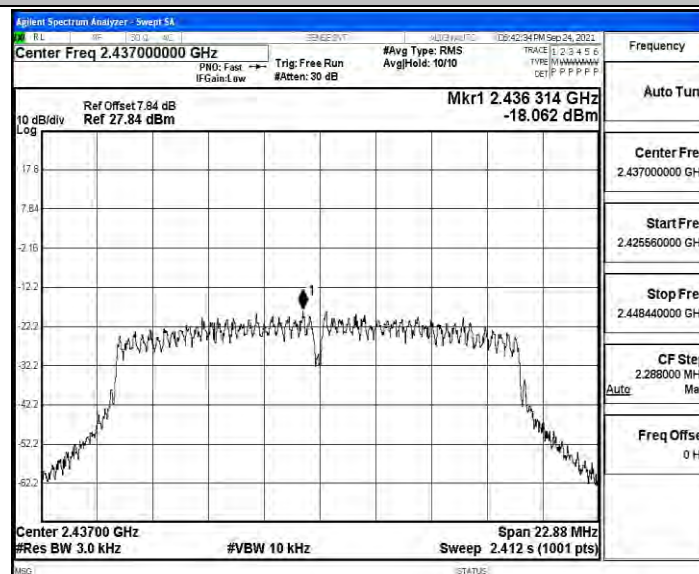
11B_Ant0_2462



11G_Ant0_2412

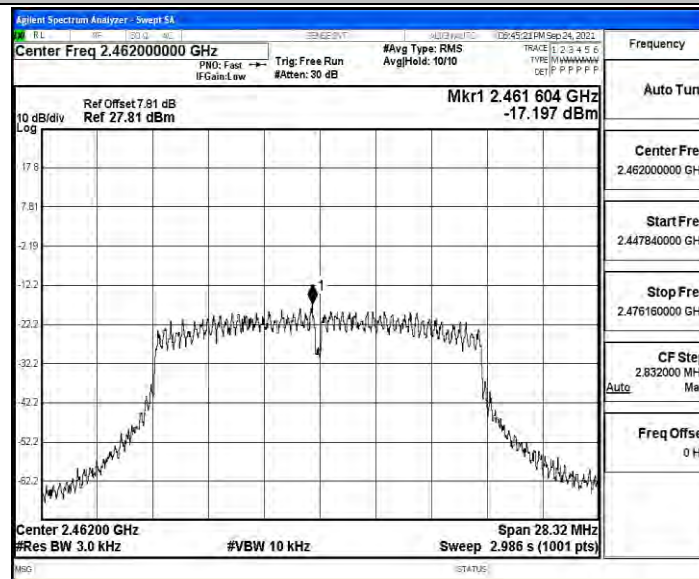


11G_Ant0_2437

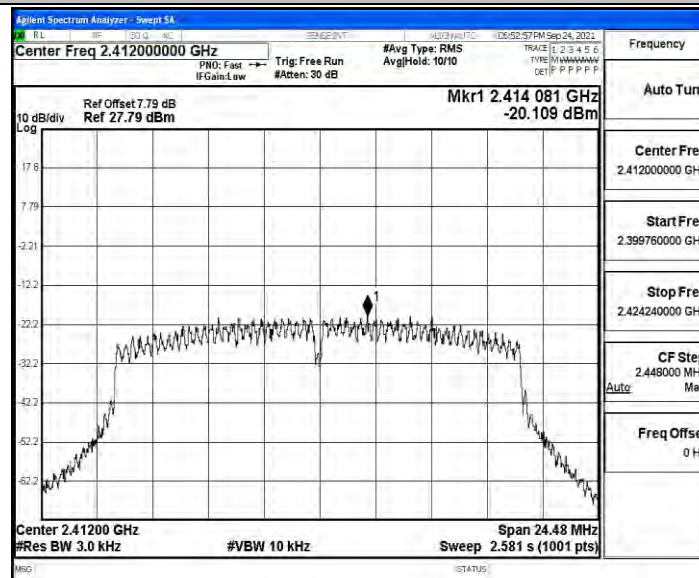




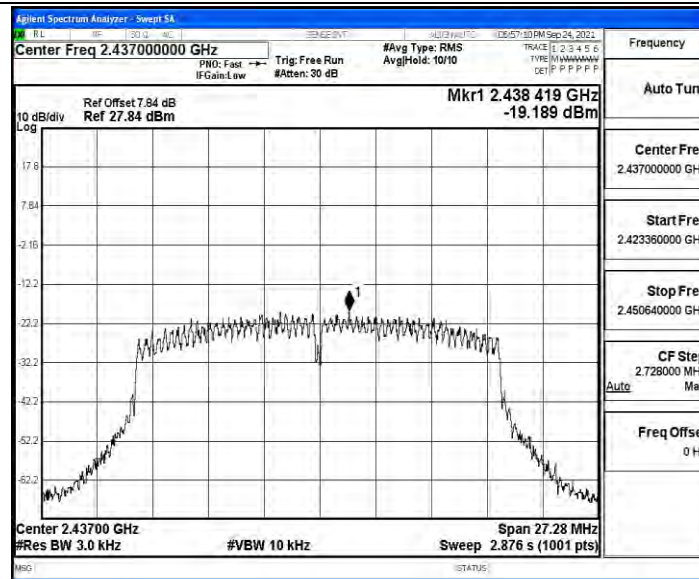
11G_Ant0_2462



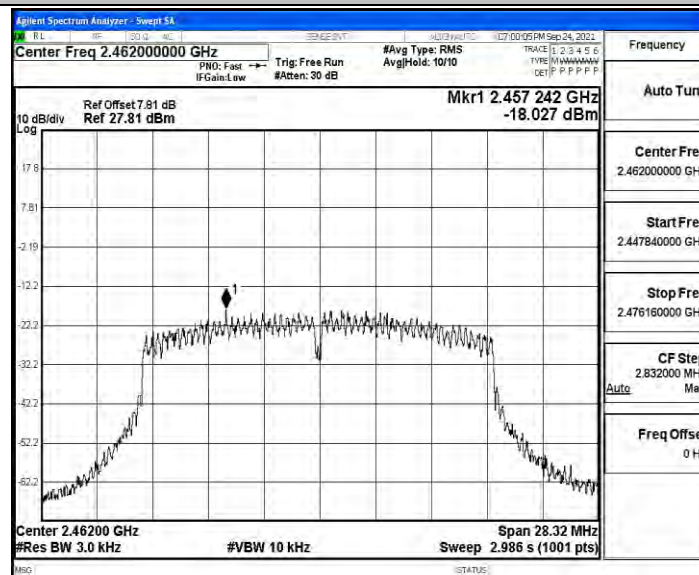
11N20SISO_Ant0_2412



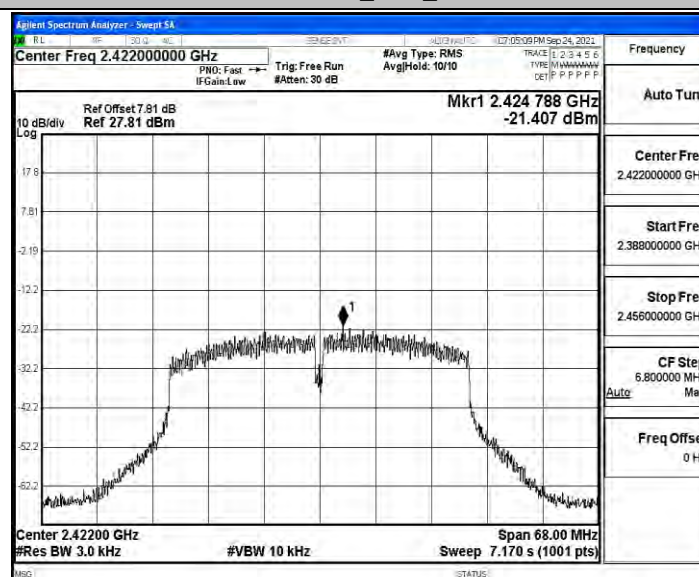
11N20SISO_Ant0_2437



11N20SISO_Ant0_2462

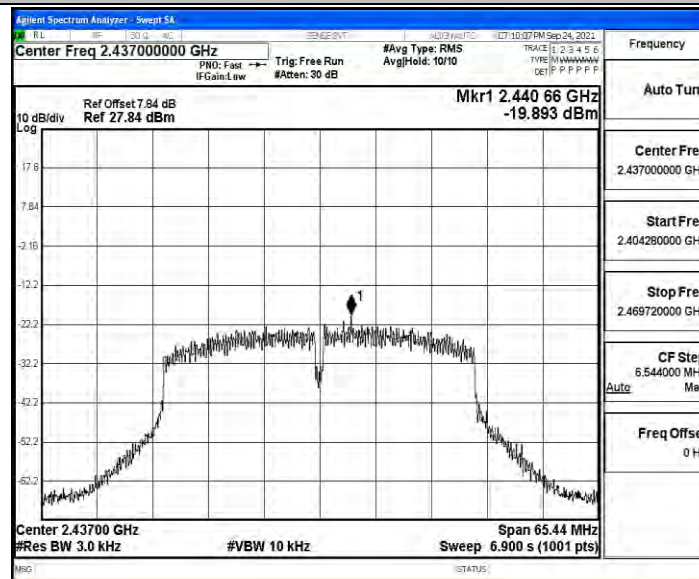


11N40SISO_Ant0_2422

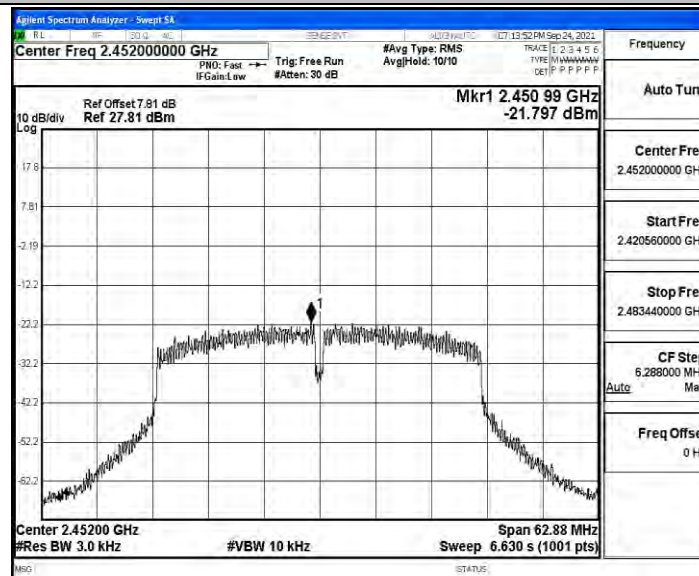




11N40SISO_Ant0_2437



11N40SISO_Ant0_2452

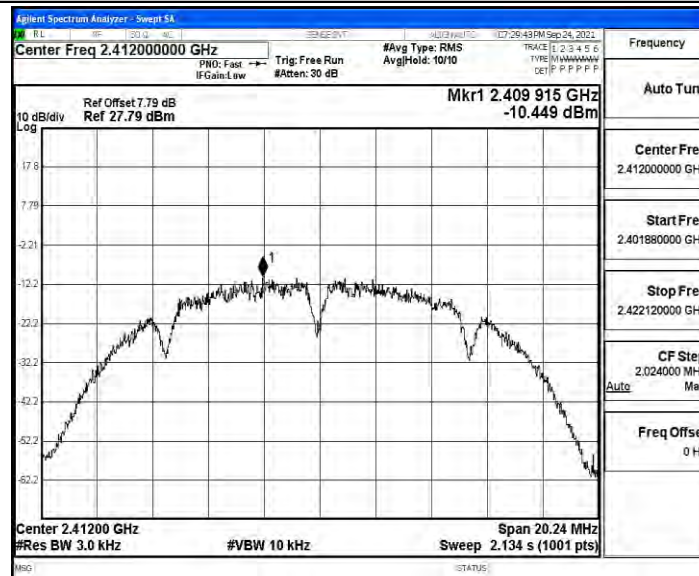




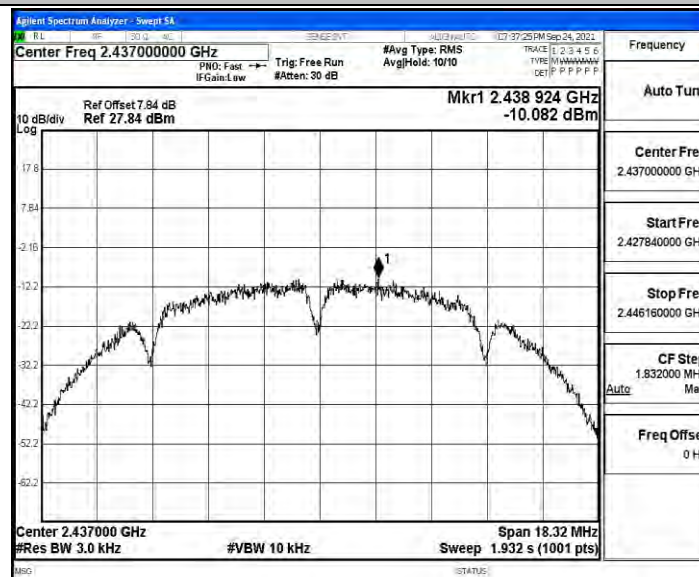
ANT1

Test Graphs

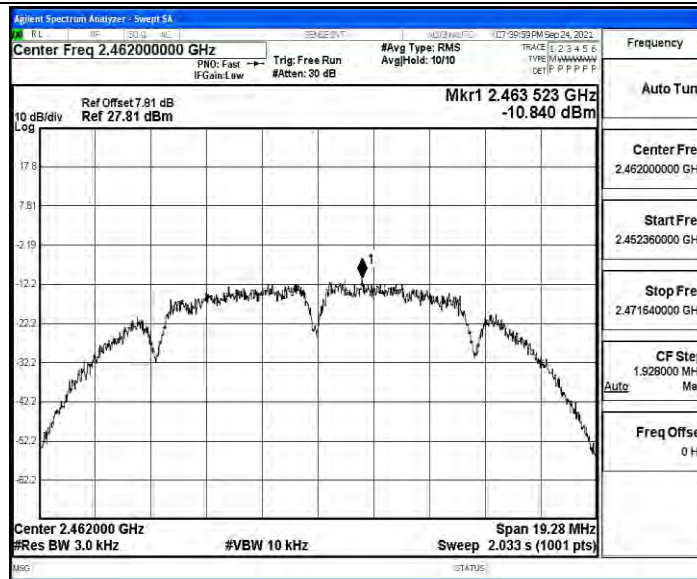
11B_Ant1_2412



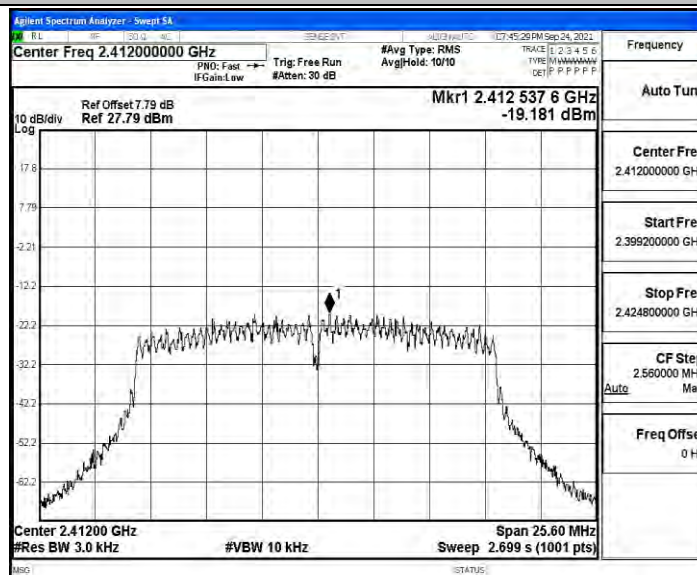
11B_Ant1_2437



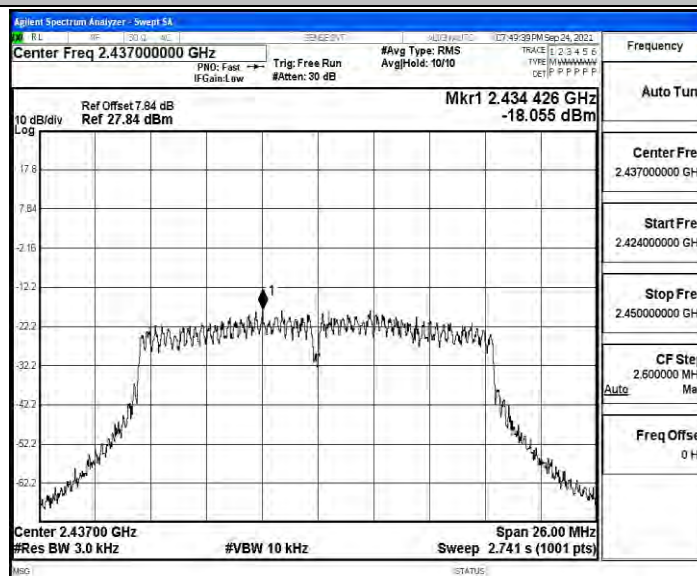
11B_Ant1_2462



11G_Ant1_2412

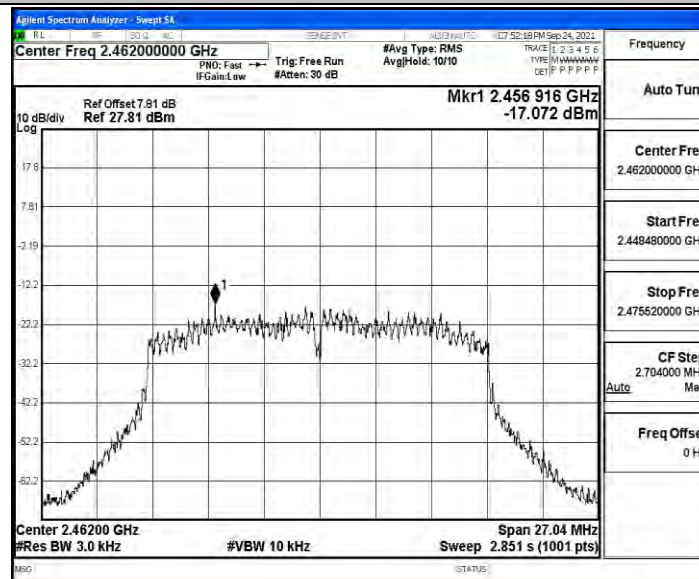


11G_Ant1_2437

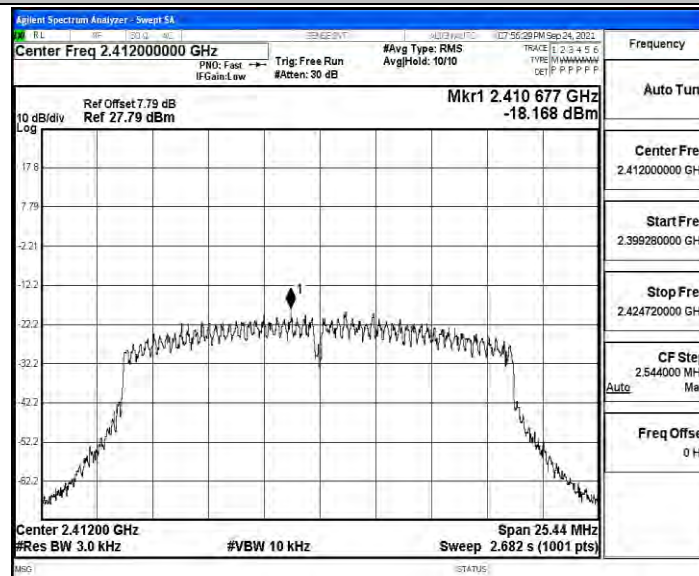




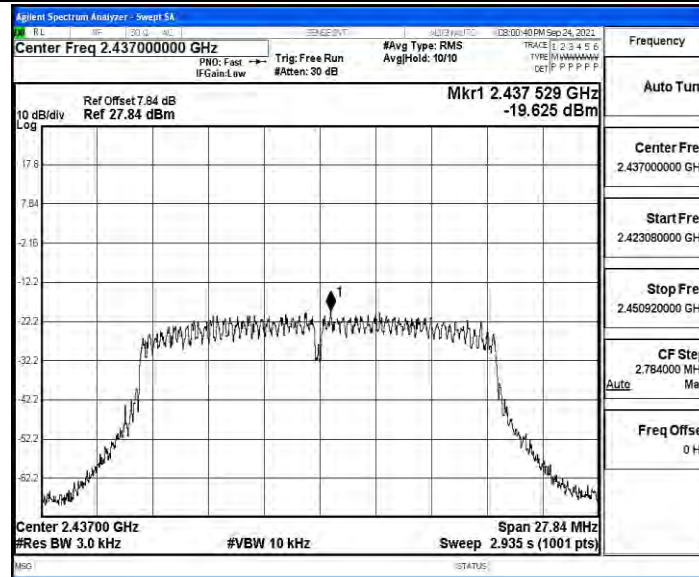
11G_Ant1_2462



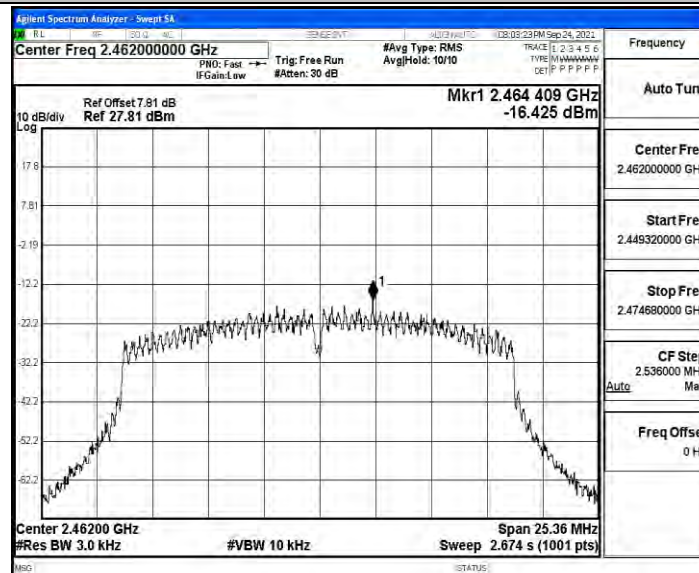
11N20SISO_Ant1_2412



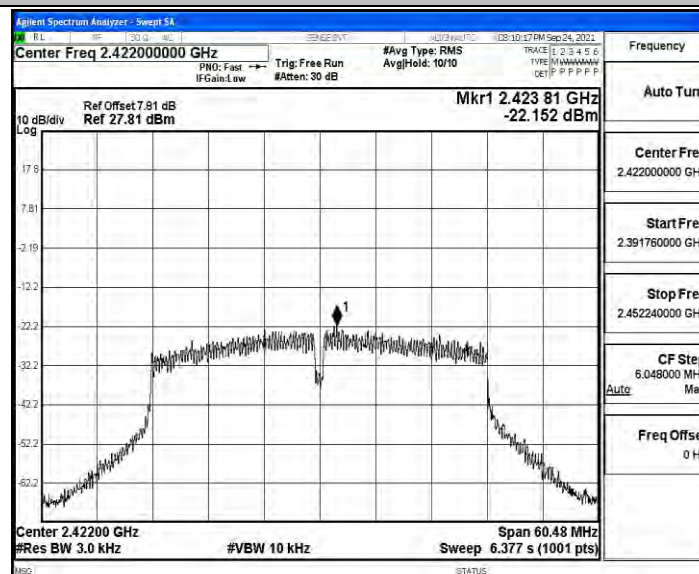
11N20SISO_Ant1_2437



11N20SISO_Ant1_2462

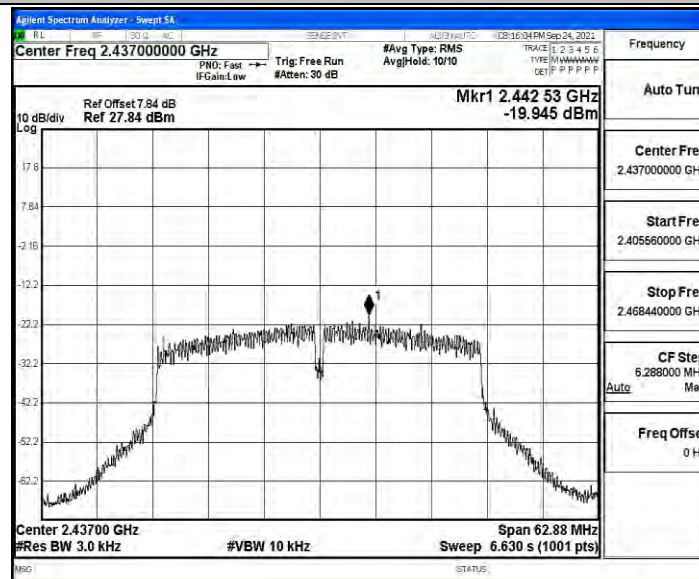


11N40SISO_Ant1_2422

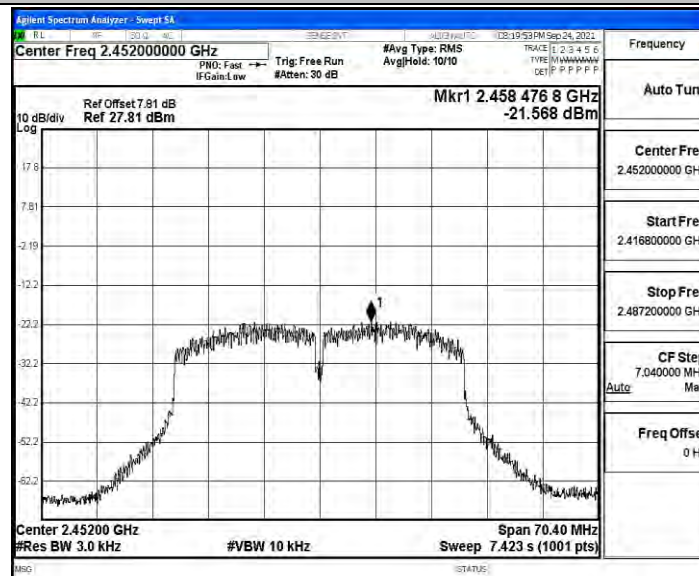




11N40SISO_Ant1_2437



11N40SISO_Ant1_2452





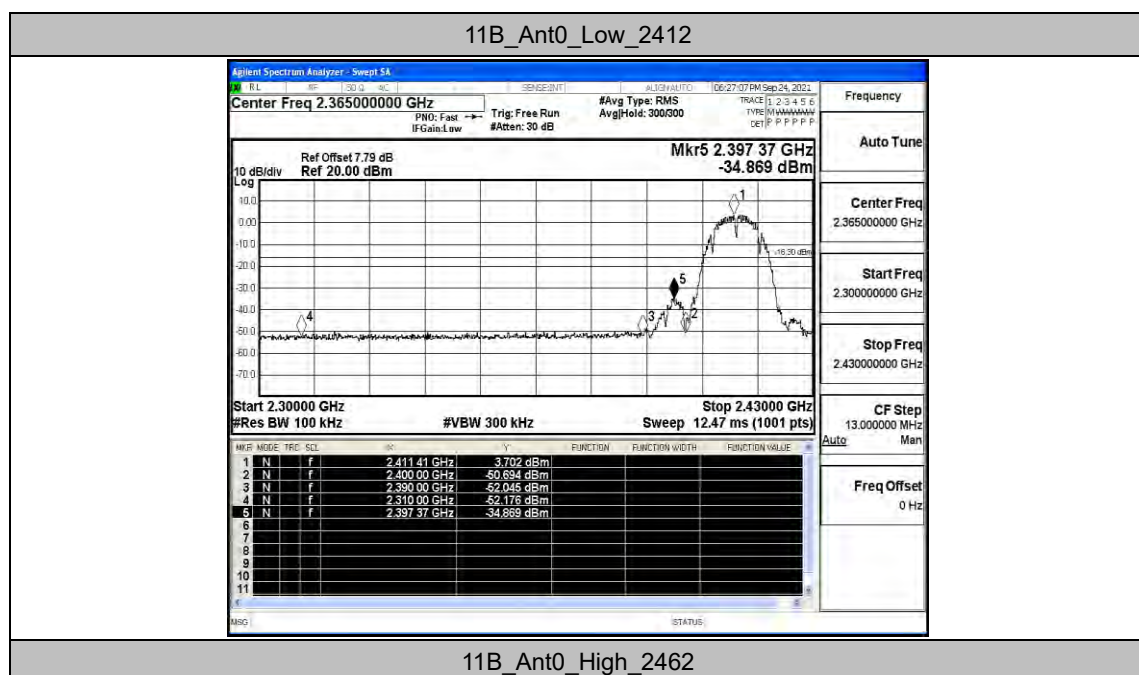
A.4 Band edge measurements

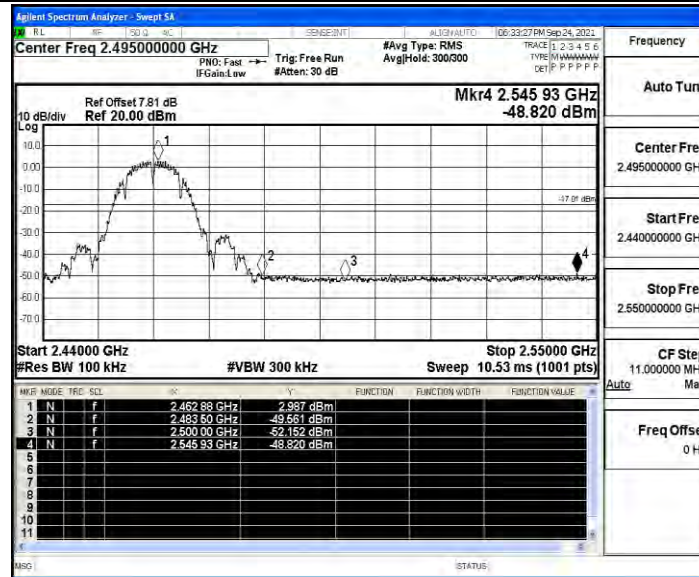
Test Result

ANT0

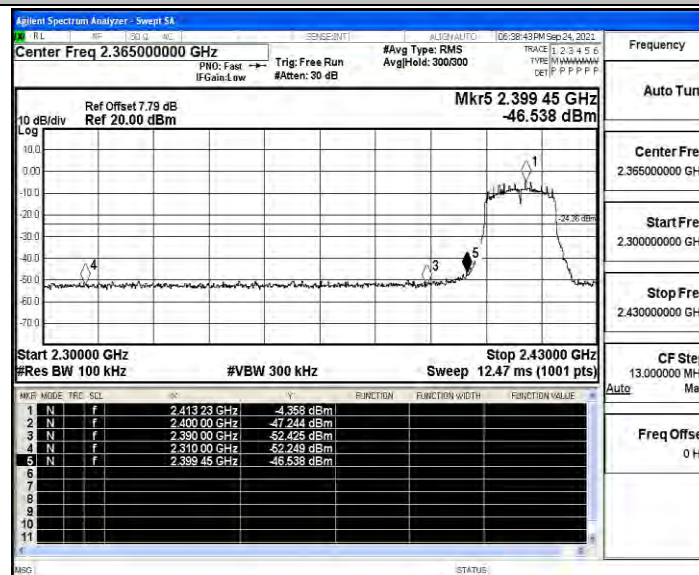
TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Ant0	Low	2412	3.70	-34.87	≤-16.3	PASS
		High	2462	2.99	-48.82	≤-17.01	PASS
11G	Ant0	Low	2412	-4.36	-46.54	≤-24.36	PASS
		High	2462	-3.07	-49.19	≤-23.07	PASS
11N20SISO	Ant0	Low	2412	-5.04	-46.3	≤-25.04	PASS
		High	2462	-3.07	-48.2	≤-23.07	PASS
11N40SISO	Ant0	Low	2422	-7.49	-39.05	≤-27.49	PASS
		High	2452	-6.85	-48.71	≤-26.85	PASS

Test Graphs

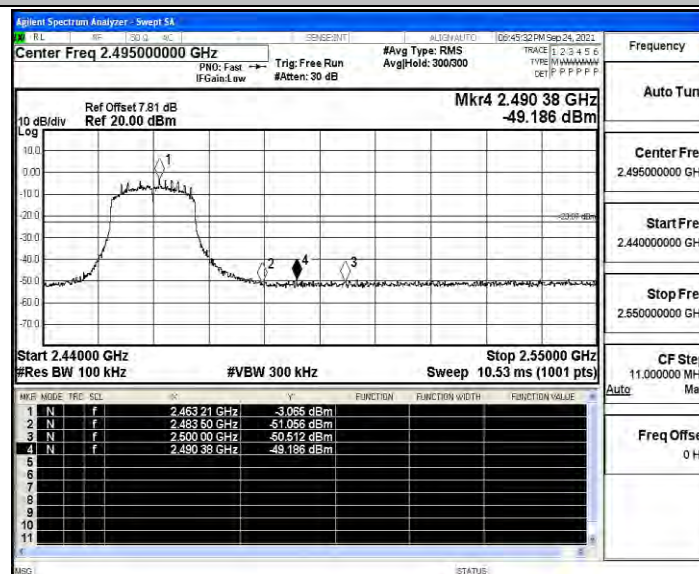




11G_Ant0_Low_2412

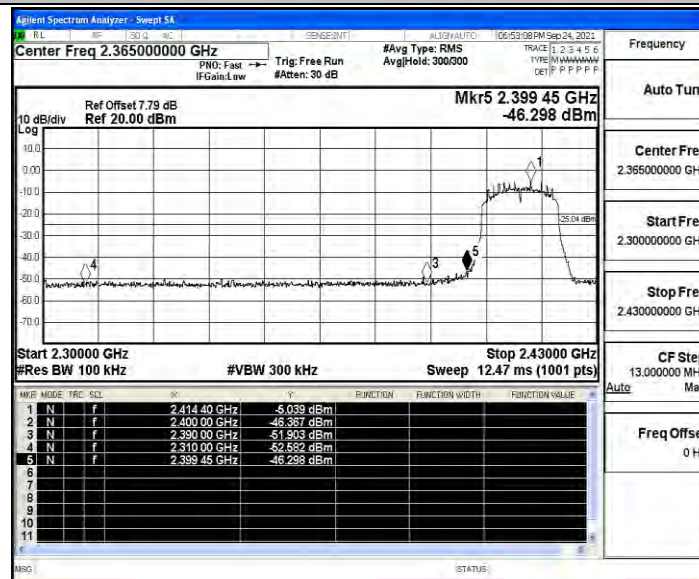


11G_Ant0_High_2462

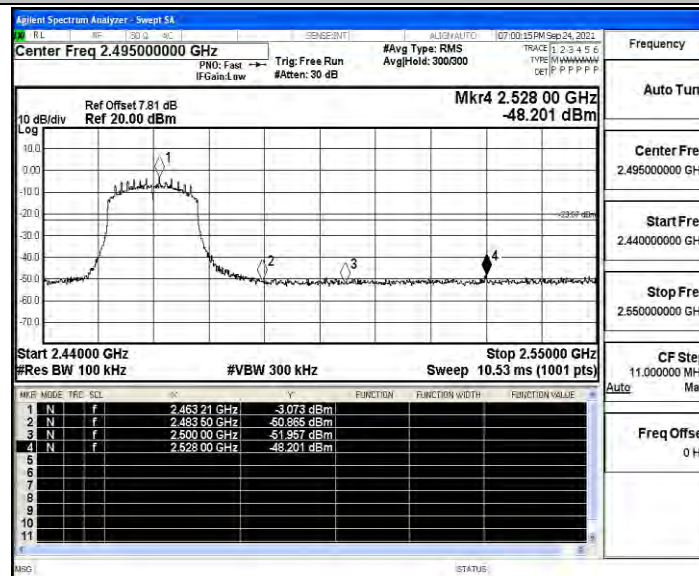




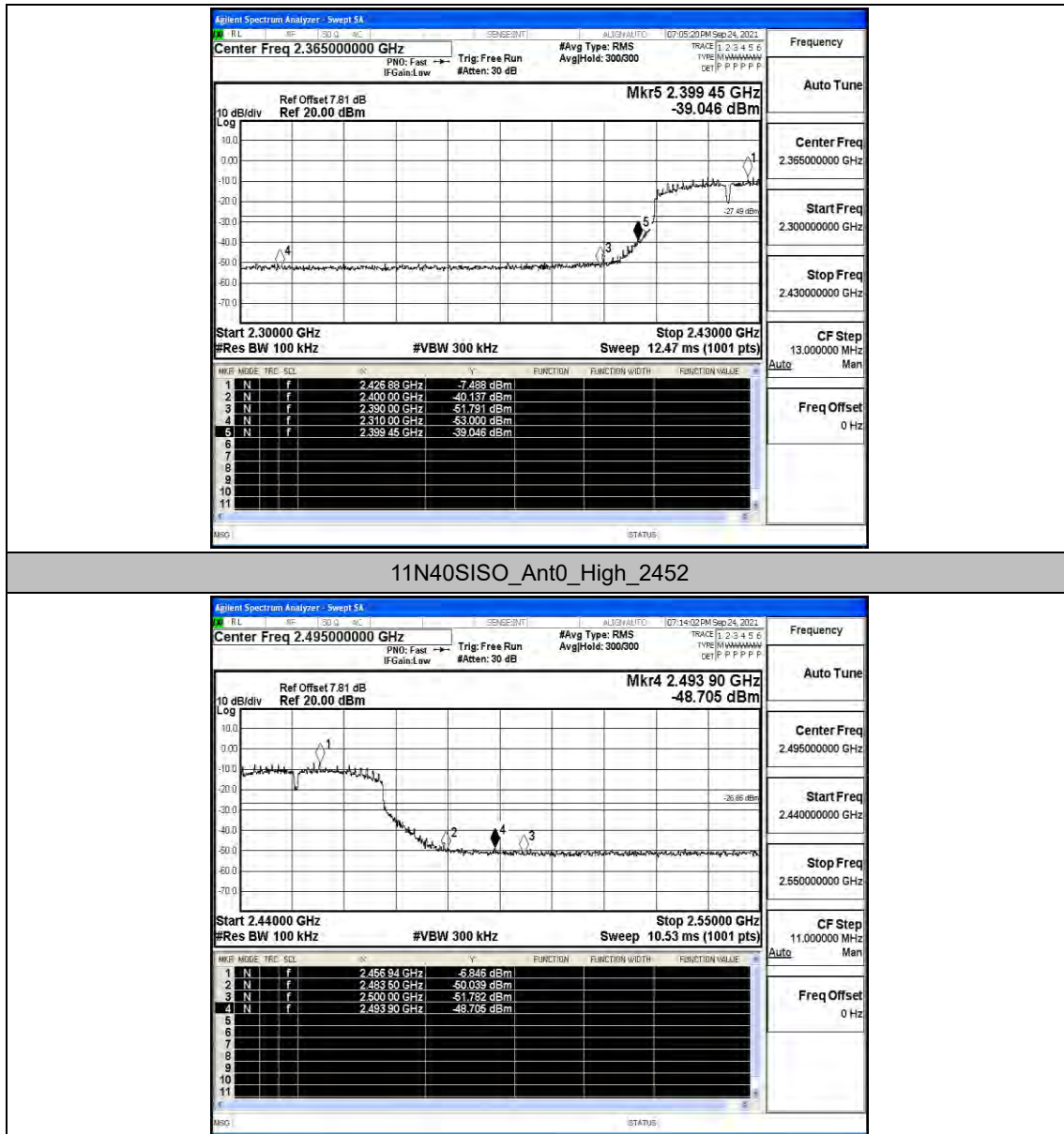
11N20SISO_Ant0_Low_2412



11N20SISO_Ant0_High_2462



11N40SISO_Ant0_Low_2422



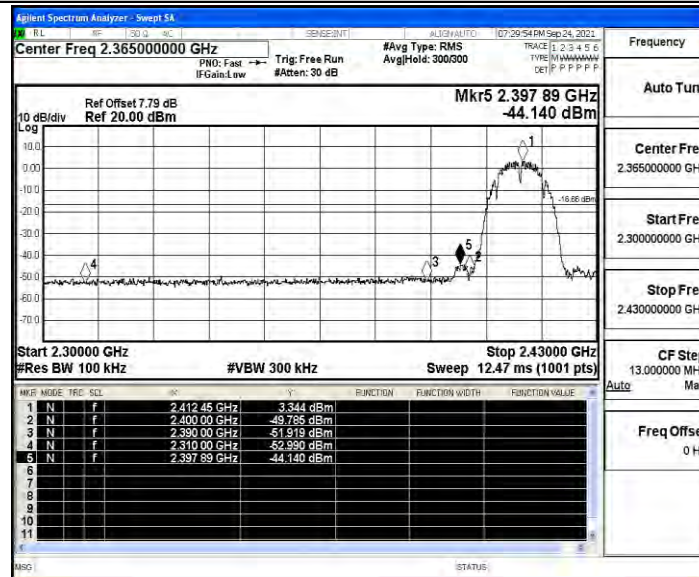
ANT1

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	Low	2412	3.34	-44.14	≤-16.66	PASS
		High	2462	2.98	-48.59	≤-17.03	PASS
11G	Ant1	Low	2412	-4.60	-48.95	≤-24.6	PASS
		High	2462	-3.74	-47.96	≤-23.74	PASS
11N20SISO	Ant1	Low	2412	-4.88	-48.6	≤-24.88	PASS
		High	2462	-3.68	-49.24	≤-23.68	PASS
11N40SISO	Ant1	Low	2422	-7.57	-39.33	≤-27.57	PASS
		High	2452	-6.50	-48.06	≤-26.5	PASS

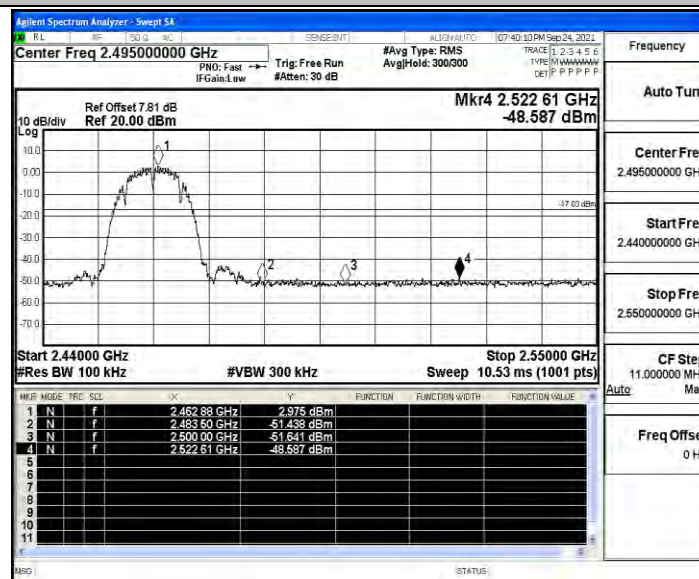


Test Graphs

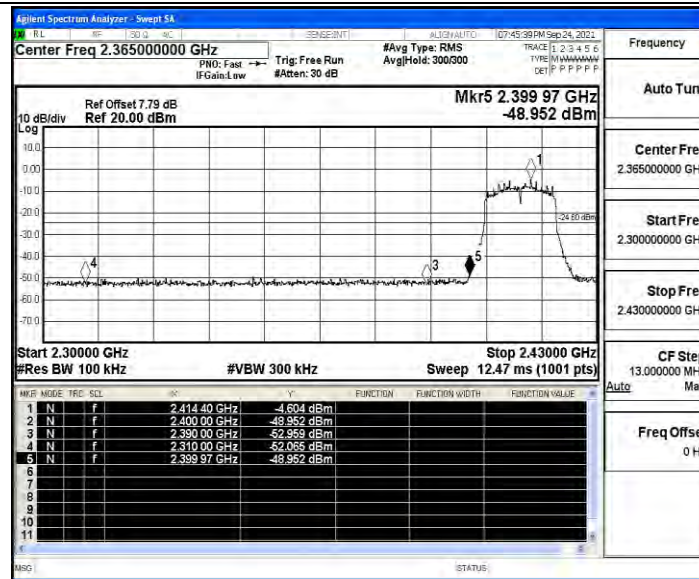
11B_Ant1_Low_2412



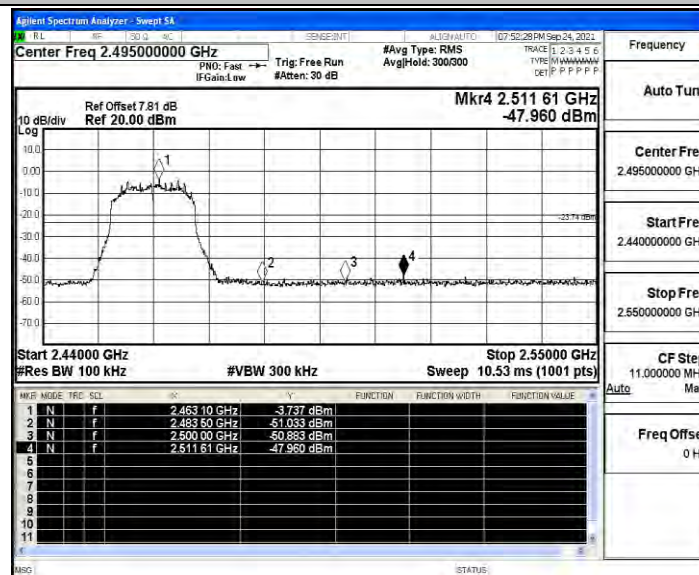
11B_Ant1_High_2462



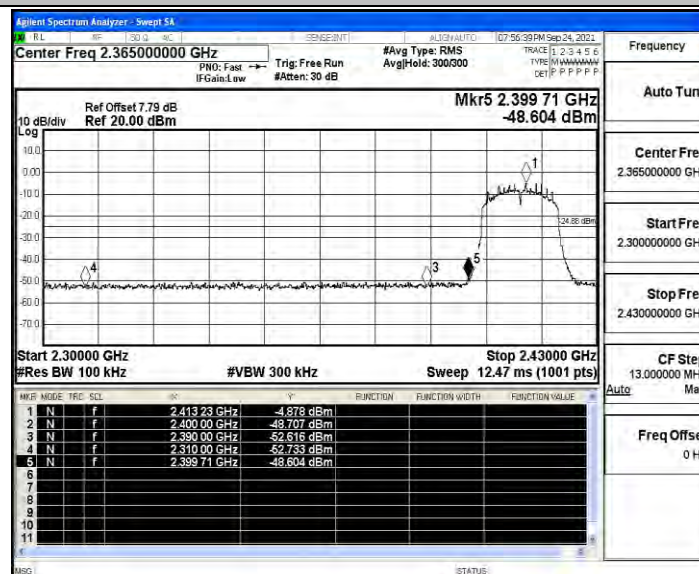
11G_Ant1_Low_2412



11G_Ant1_High_2462

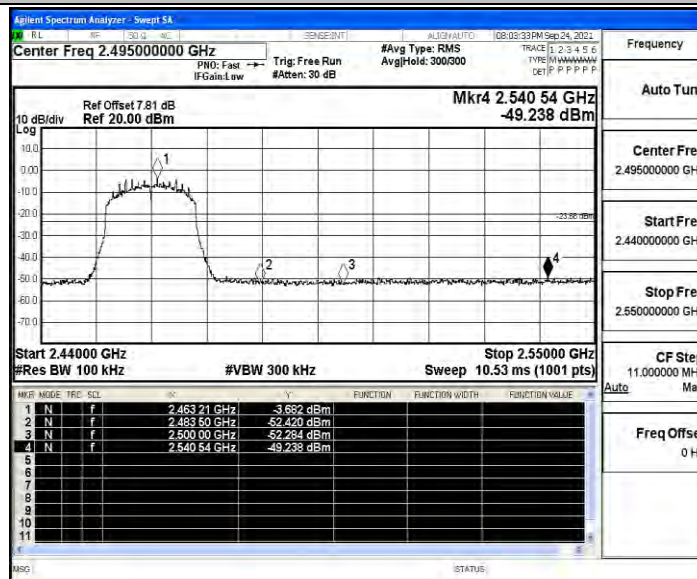


11N20SISO_Ant1_Low_2412

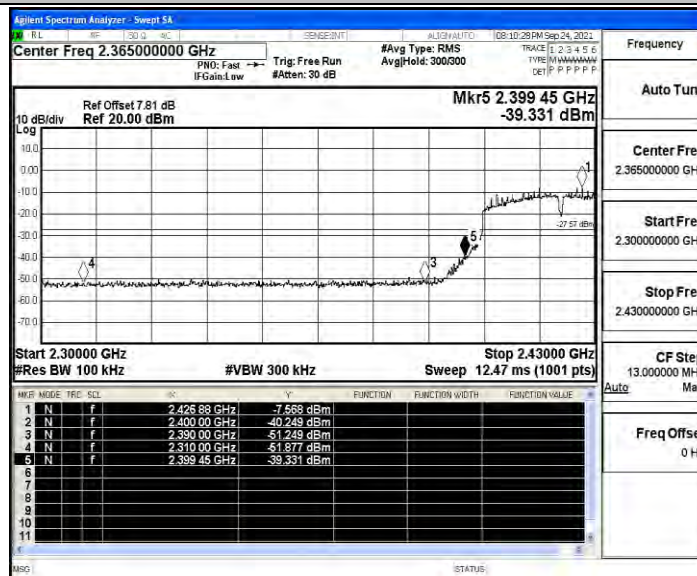




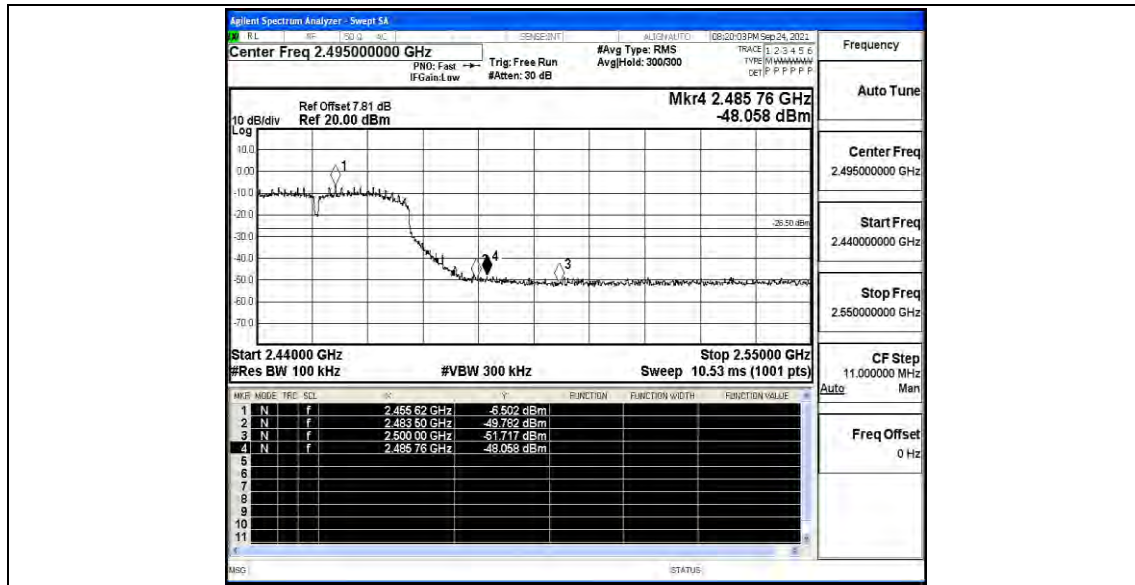
11N20SISO_Ant1_High_2462



11N40SISO_Ant1_Low_2422



11N40SISO_Ant1_High_2452





A.5 Conducted Spurious Emission

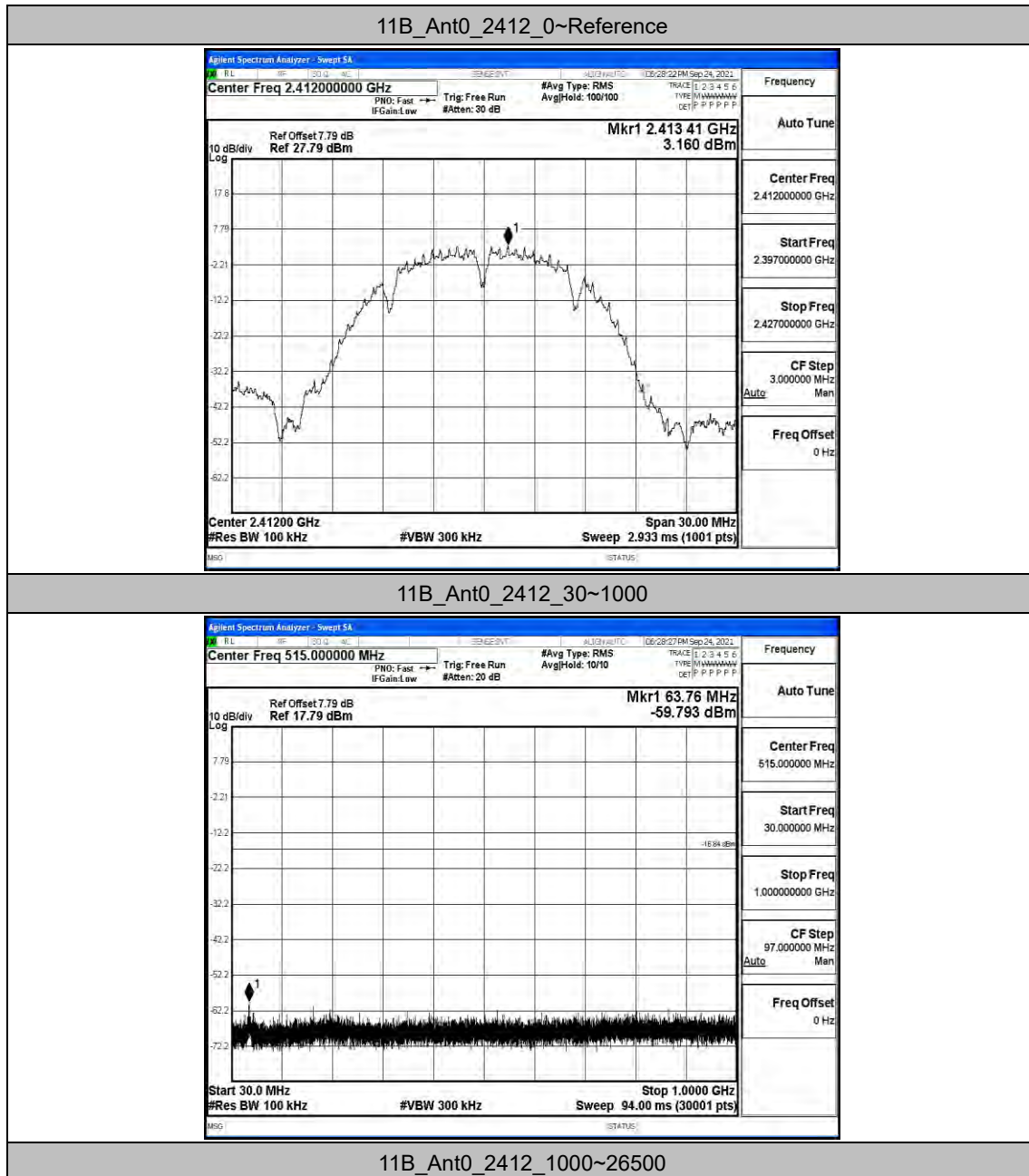
Test Result

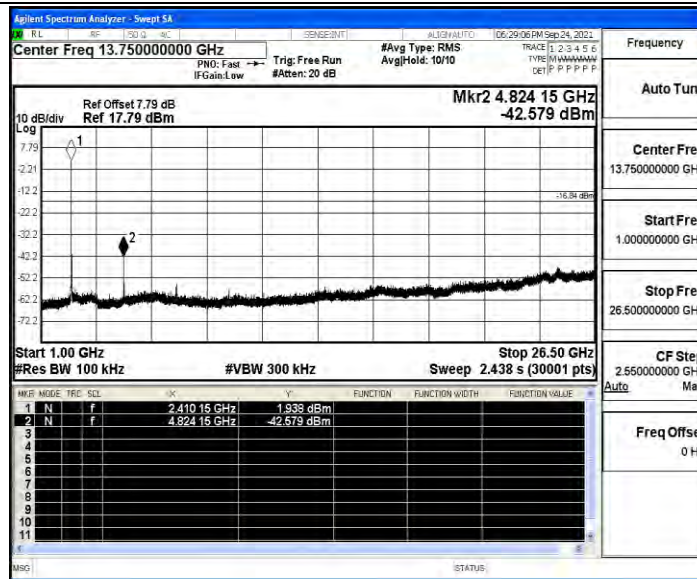
ANT0

TestMode	Antenna	Channel	FreqRange [Mhz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
11B	Ant0	2412	Reference	3.16	3.16	---	PASS
			30~1000	3.16	-59.79	≤-16.84	PASS
			1000~26500	3.16	-42.58	≤-16.84	PASS
		2437	Reference	3.15	3.15	---	PASS
			30~1000	3.15	-61.02	≤-16.85	PASS
			1000~26500	3.15	-42.01	≤-16.85	PASS
		2462	Reference	3.25	3.25	---	PASS
			30~1000	3.25	-61.54	≤-16.76	PASS
			1000~26500	3.25	-41.6	≤-16.76	PASS
11G	Ant0	2412	Reference	-7.54	-7.54	---	PASS
			30~1000	-7.54	-61.58	≤-27.54	PASS
			1000~26500	-7.54	-47.59	≤-27.54	PASS
		2437	Reference	-4.09	-4.09	---	PASS
			30~1000	-4.09	-61.19	≤-24.09	PASS
			1000~26500	-4.09	-47.24	≤-24.09	PASS
		2462	Reference	-3.81	-3.81	---	PASS
			30~1000	-3.81	-60.83	≤-23.81	PASS
			1000~26500	-3.81	-46.91	≤-23.81	PASS
11N20SISO	Ant0	2412	Reference	-5.04	-5.04	---	PASS
			30~1000	-5.04	-60.87	≤-25.04	PASS
			1000~26500	-5.04	-47.05	≤-25.04	PASS
		2437	Reference	-5.00	-5.00	---	PASS
			30~1000	-5.00	-61.44	≤-25	PASS
			1000~26500	-5.00	-46.36	≤-25	PASS
		2462	Reference	-3.96	-3.96	---	PASS
			30~1000	-3.96	-60.43	≤-23.96	PASS
			1000~26500	-3.96	-47.65	≤-23.96	PASS
11N40SISO	Ant0	2422	Reference	-7.89	-7.89	---	PASS
			30~1000	-7.89	-62.32	≤-27.89	PASS
			1000~26500	-7.89	-48.11	≤-27.89	PASS
		2437	Reference	-7.72	-7.72	---	PASS
			30~1000	-7.72	-61.33	≤-27.72	PASS
			1000~26500	-7.72	-47.55	≤-27.72	PASS
		2452	Reference	-7.19	-7.19	---	PASS
			30~1000	-7.19	-61.2	≤-27.19	PASS
			1000~26500	-7.19	-47.64	≤-27.19	PASS

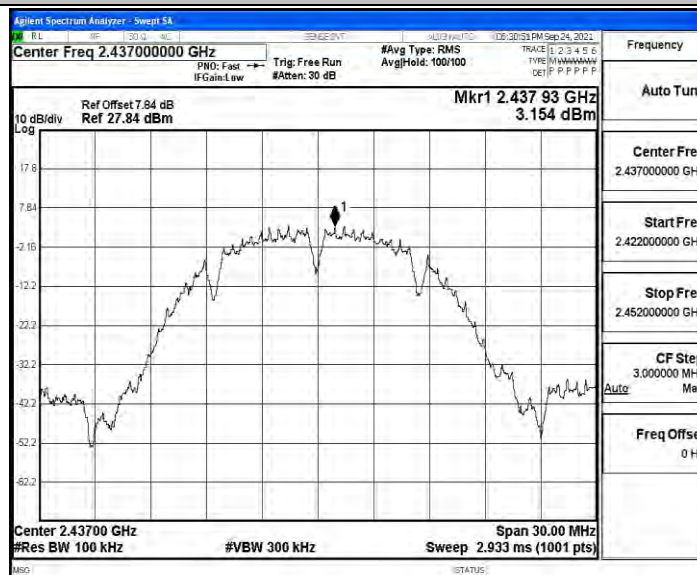


Test Graphs

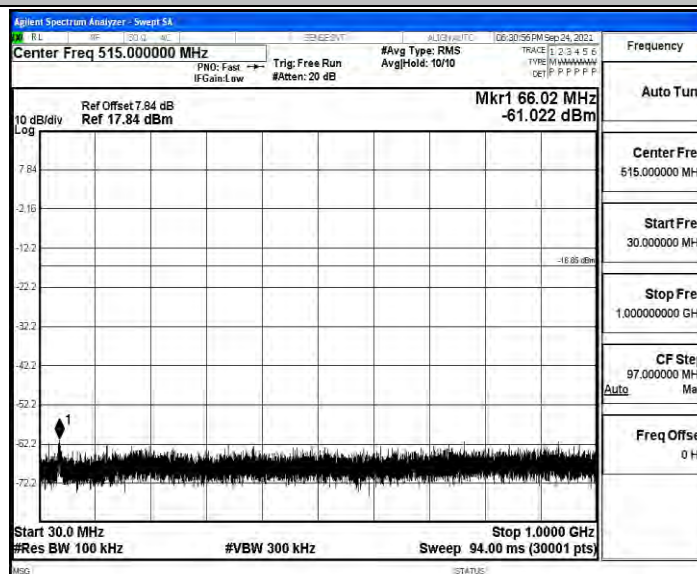




11B_Ant0_2437_0~Reference

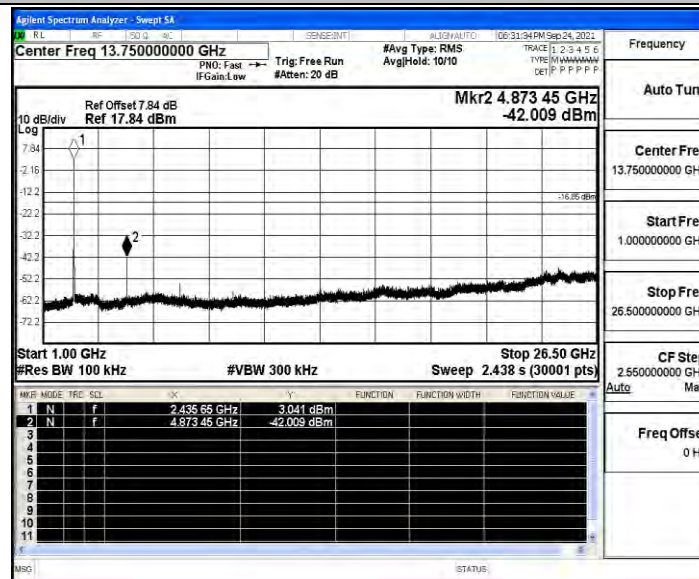


11B_Ant0_2437_30~1000

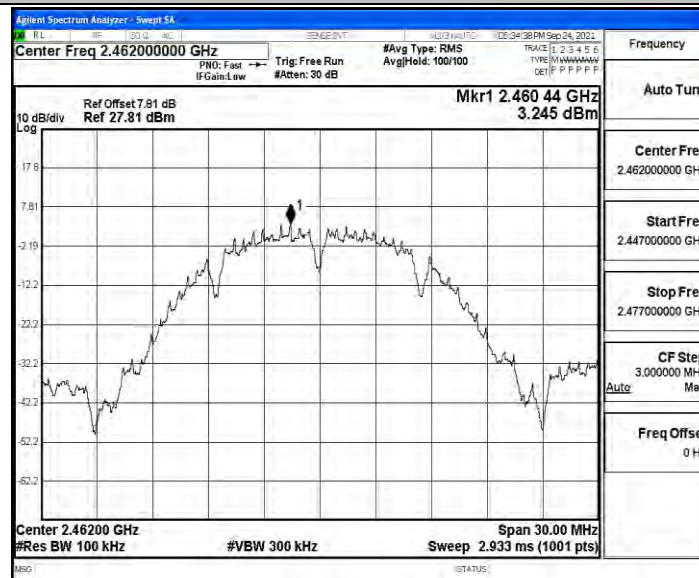




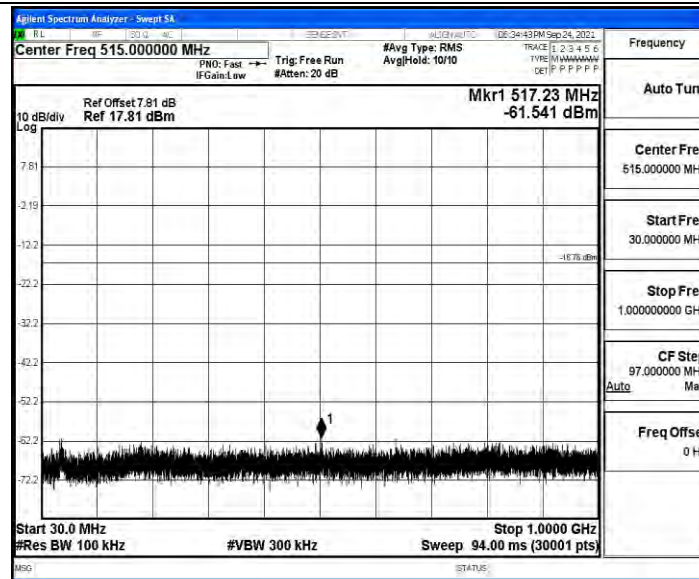
11B_Ant0_2437_1000~26500



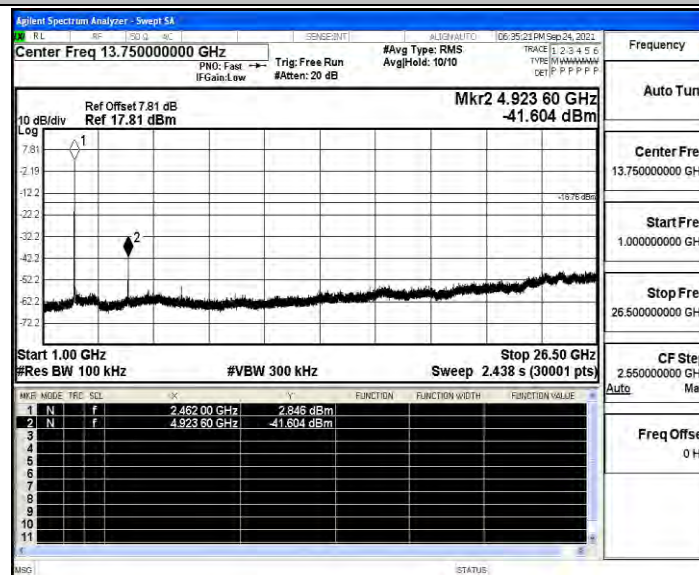
11B_Ant0_2462_0~Reference



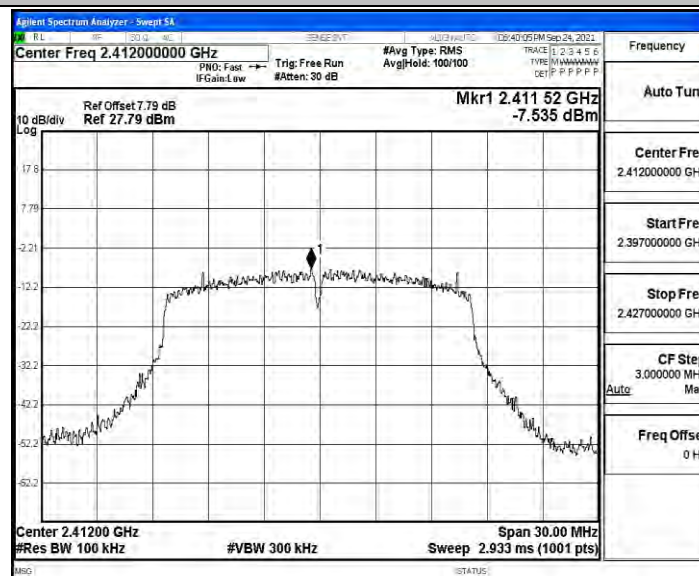
11B_Ant0_2462_30~1000



11B_Ant0_2462_1000~26500

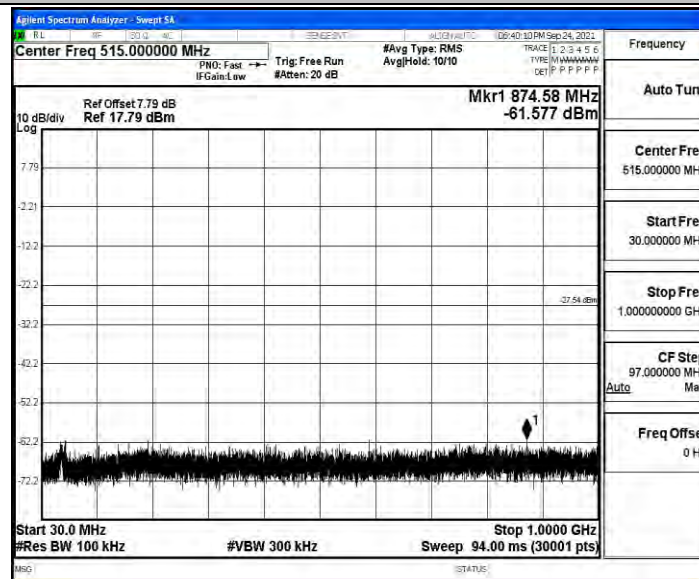


11G_Ant0_2412_0~Reference

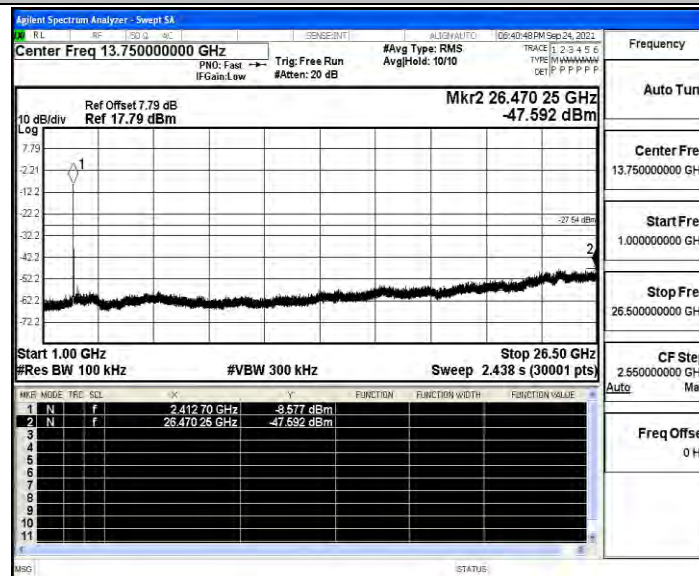




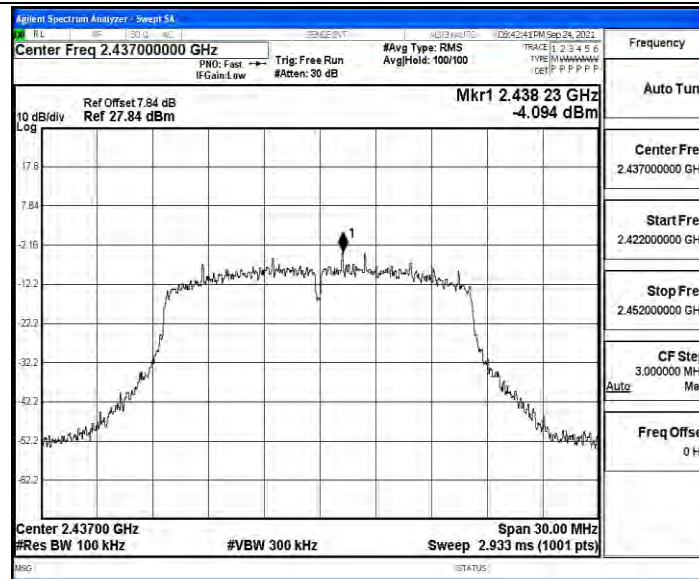
11G_Ant0_2412_30~1000



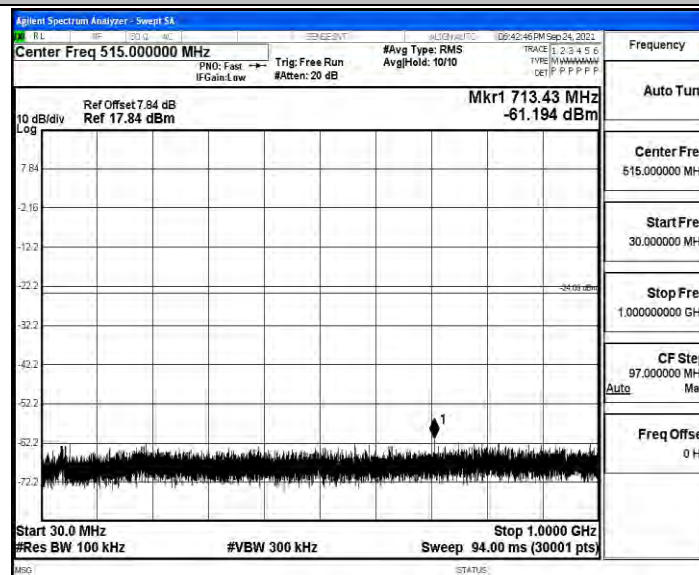
11G_Ant0_2412_1000~26500



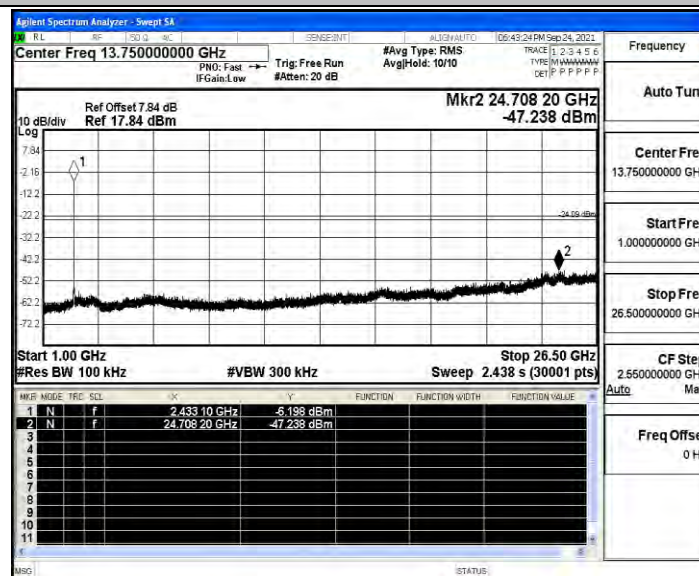
11G_Ant0_2437_0~Reference



11G_Ant0_2437_30~1000

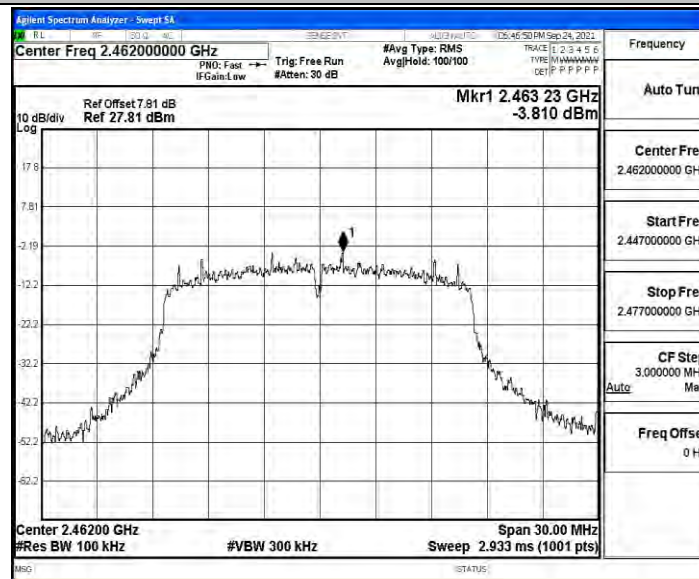


11G_Ant0_2437_1000~26500

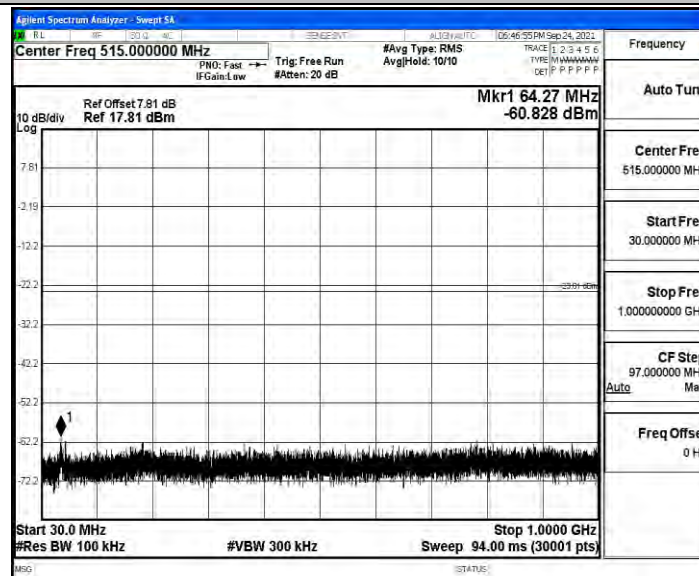




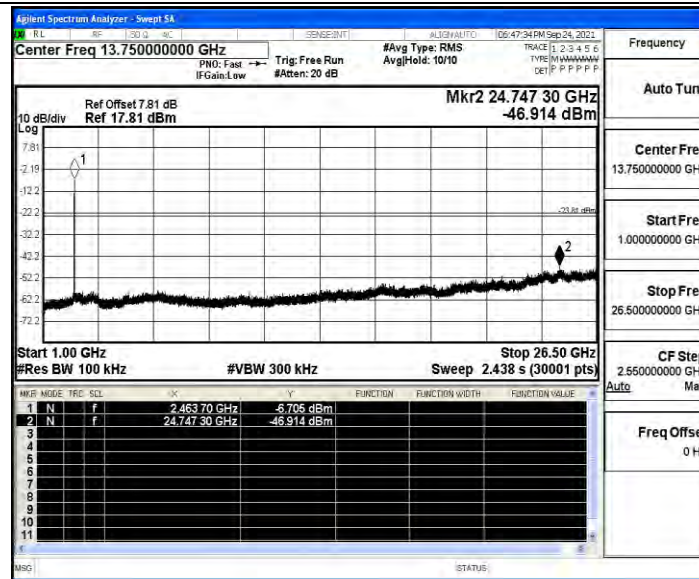
11G_Ant0_2462_0~Reference



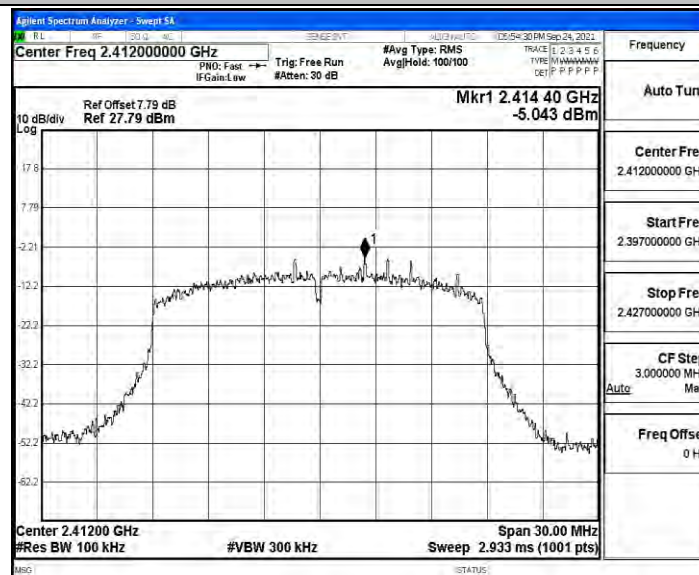
11G_Ant0_2462_30~1000



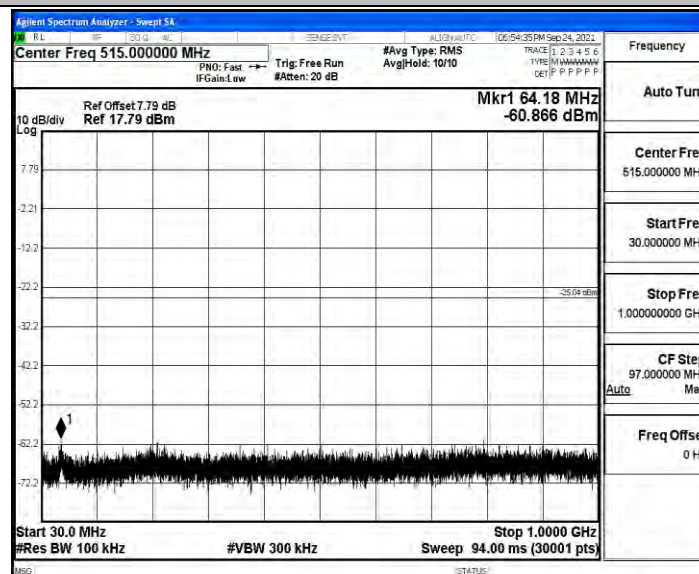
11G_Ant0_2462_1000~26500



11N20SISO_Ant0_2412_0~Reference

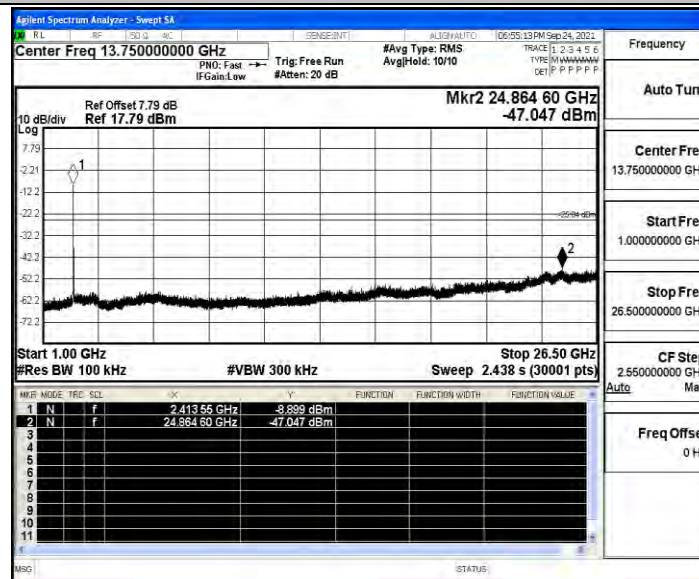


11N20SISO_Ant0_2412_30~1000

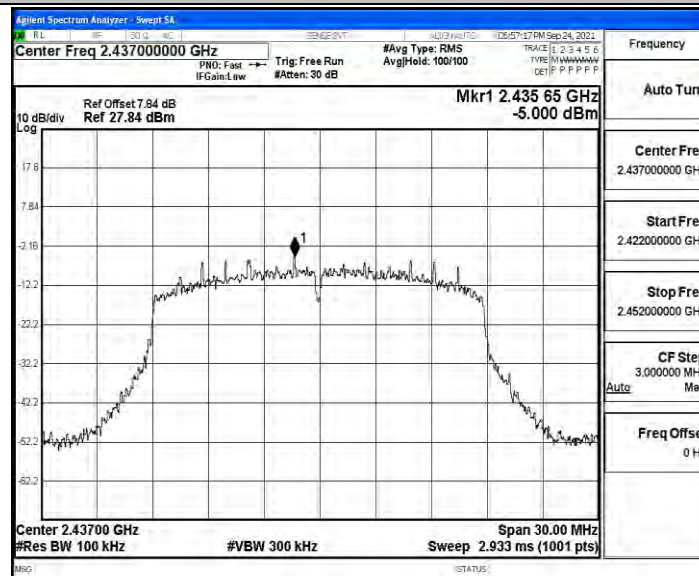




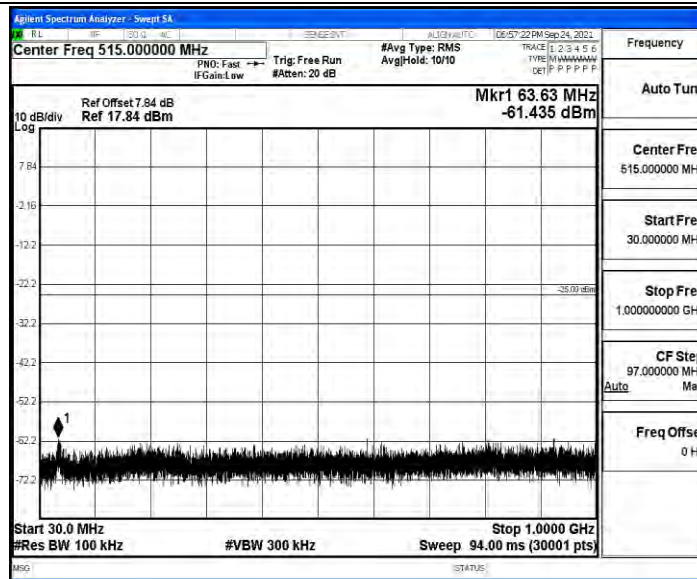
11N20SISO_Ant0_2412_1000~26500



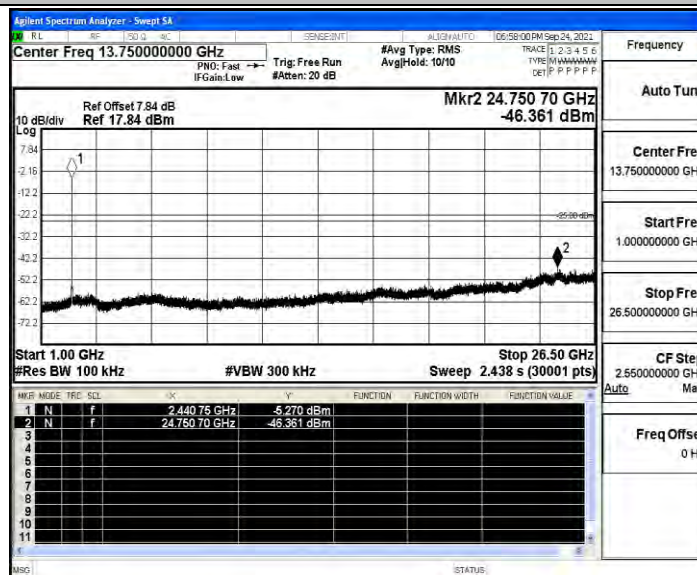
11N20SISO_Ant0_2437_0~Reference



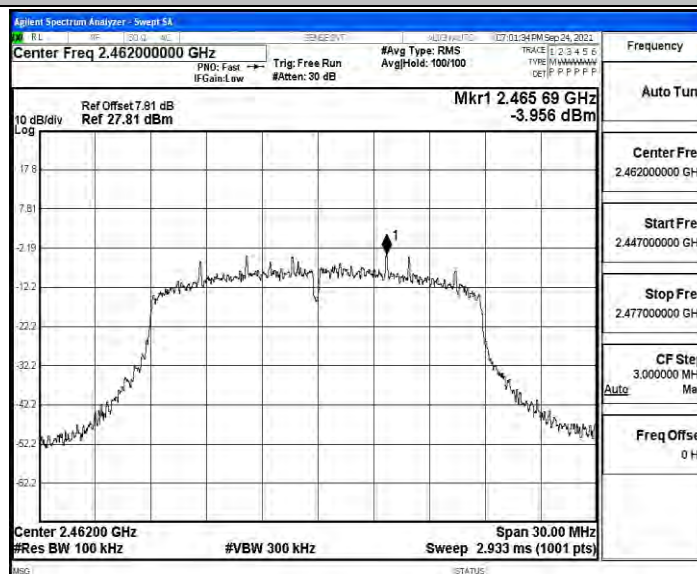
11N20SISO_Ant0_2437_30~1000



11N20SISO_Ant0_2437_1000~26500

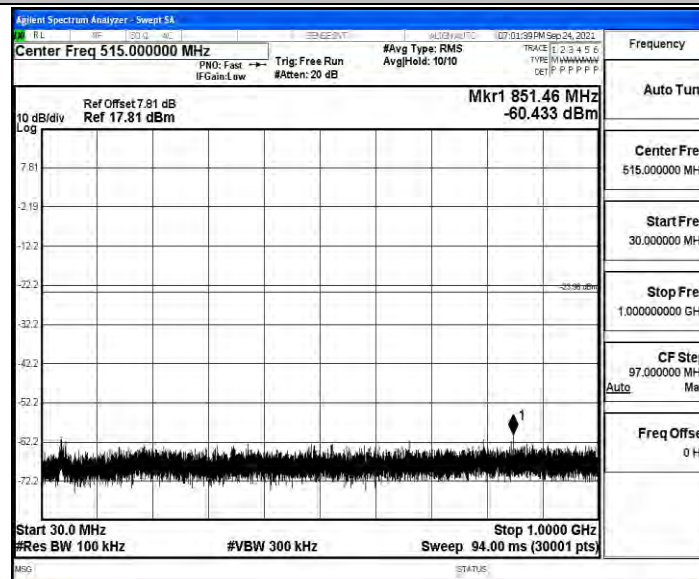


11N20SISO_Ant0_2462_0~Reference

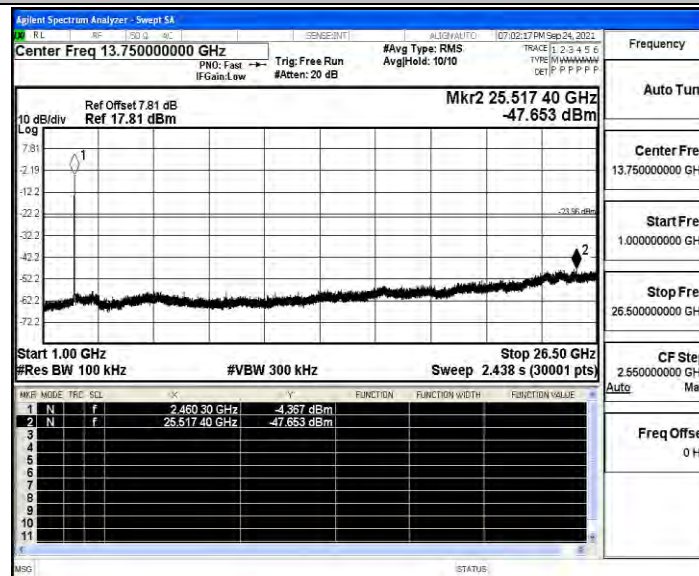




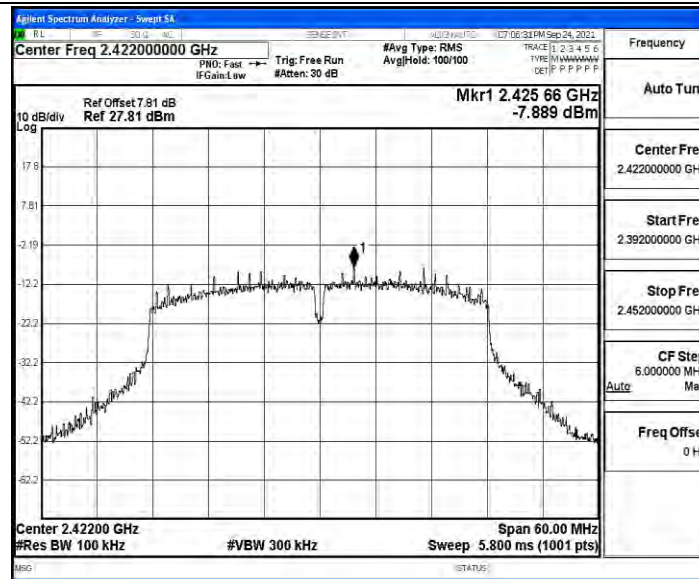
11N20SISO_Ant0_2462_30~1000



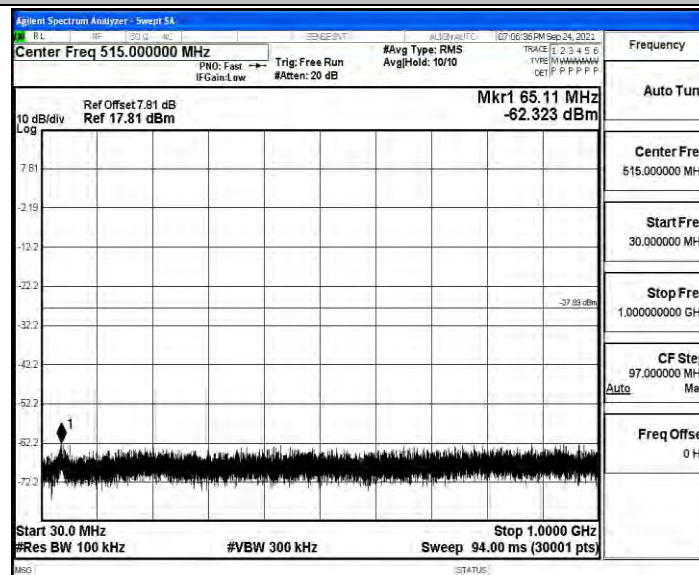
11N20SISO_Ant0_2462_1000~26500



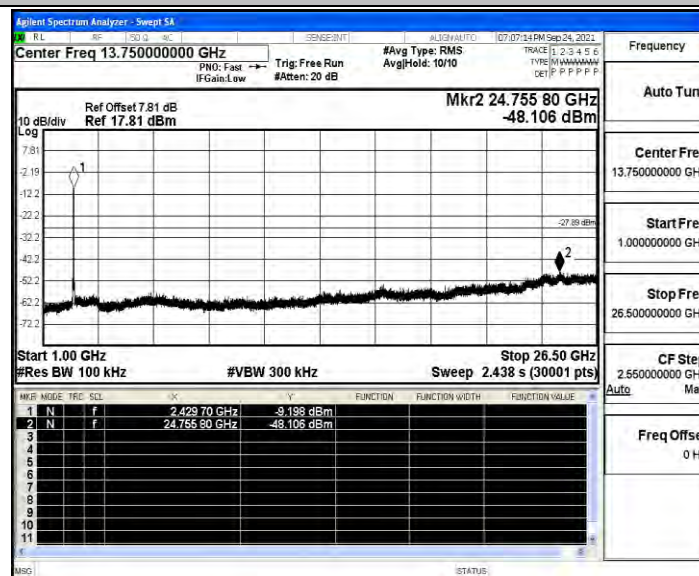
11N40SISO_Ant0_2422_0~Reference



11N40SISO_Ant0_2422_30~1000

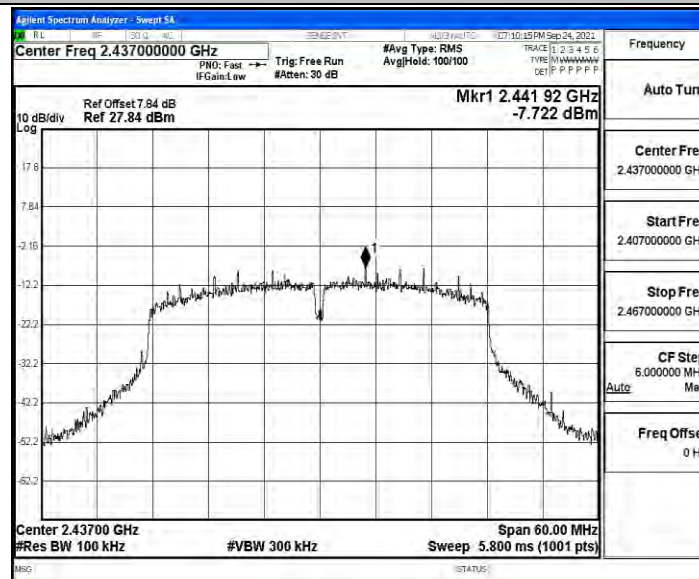


11N40SISO_Ant0_2422_1000~26500

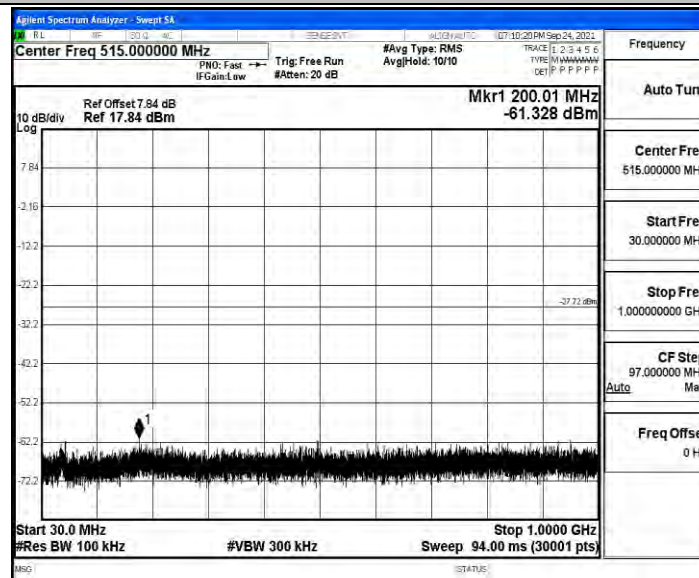




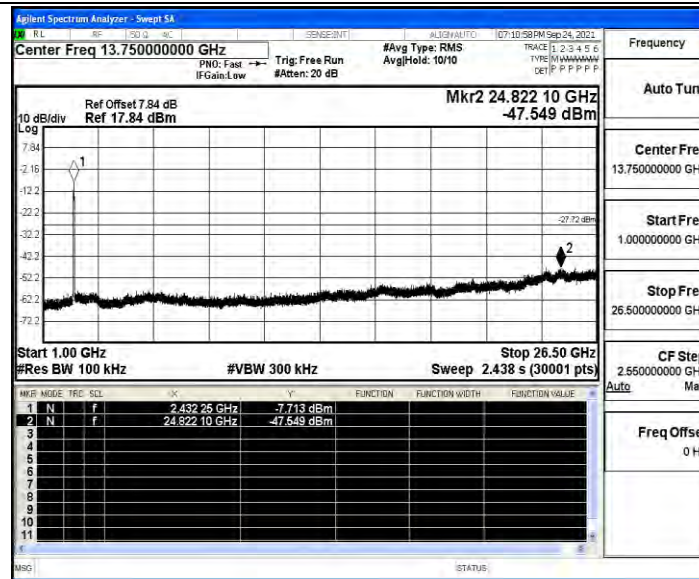
11N40SISO_Ant0_2437_0~Reference



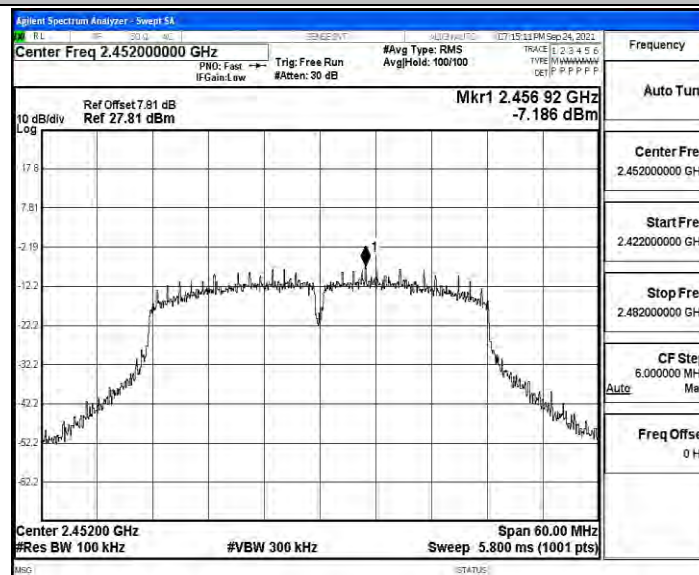
11N40SISO_Ant0_2437_30~1000



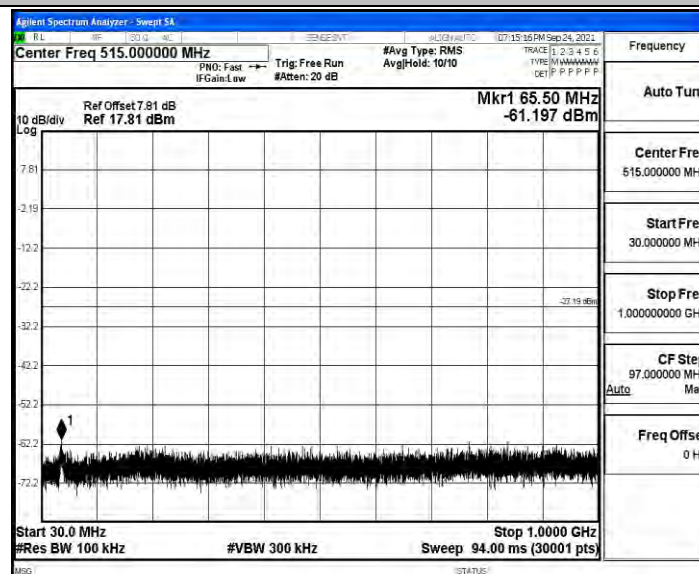
11N40SISO_Ant0_2437_1000~26500



11N40SISO_Ant0_2452_0~Reference

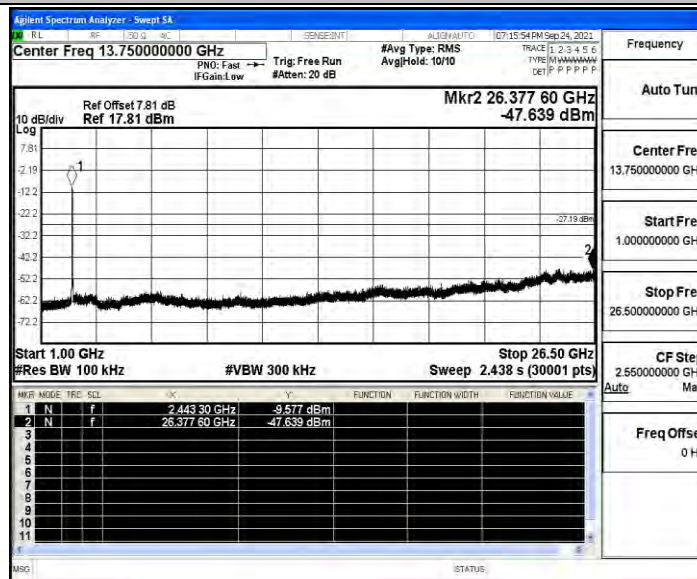


11N40SISO_Ant0_2452_30~1000





11N40SISO_Ant0_2452_1000~26500



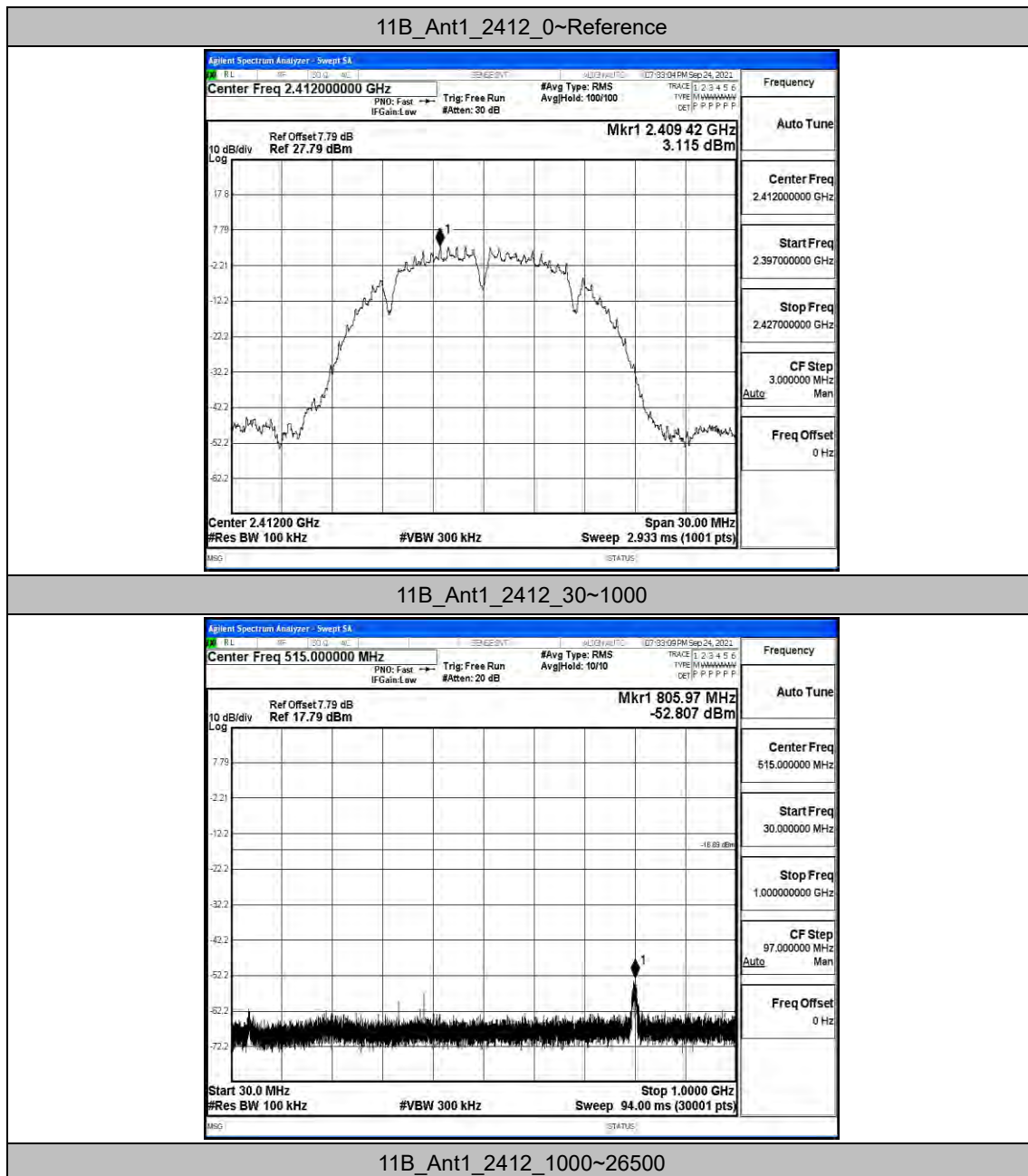


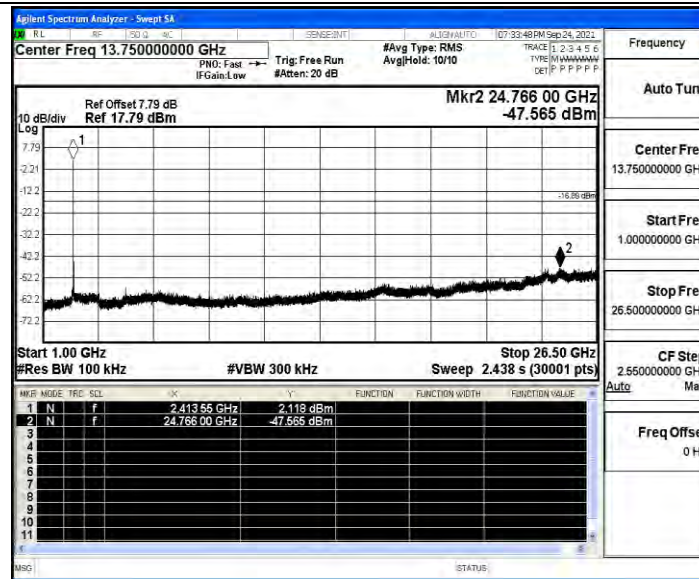
ANT1

TestMode	Antenna	Channel	FreqRange [Mhz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
11B	Ant1	2412	Reference	3.12	3.12	---	PASS
			30~1000	3.12	-52.81	≤-16.89	PASS
			1000~26500	3.12	-47.57	≤-16.89	PASS
		2437	Reference	3.39	3.39	---	PASS
			30~1000	3.39	-52.71	≤-16.61	PASS
			1000~26500	3.39	-47.67	≤-16.61	PASS
		2462	Reference	2.48	2.48	---	PASS
			30~1000	2.48	-55.24	≤-17.52	PASS
			1000~26500	2.48	-47.85	≤-17.52	PASS
11G	Ant1	2412	Reference	-5.14	-5.14	---	PASS
			30~1000	-5.14	-59.44	≤-25.14	PASS
			1000~26500	-5.14	-47.35	≤-25.14	PASS
		2437	Reference	-3.68	-3.68	---	PASS
			30~1000	-3.68	-49.76	≤-23.68	PASS
			1000~26500	-3.68	-47.02	≤-23.68	PASS
		2462	Reference	-6.16	-6.16	---	PASS
			30~1000	-6.16	-59.14	≤-26.16	PASS
			1000~26500	-6.16	-47.83	≤-26.16	PASS
11N20SISO	Ant1	2412	Reference	-4.95	-4.95	---	PASS
			30~1000	-4.95	-59.95	≤-24.95	PASS
			1000~26500	-4.95	-47.65	≤-24.95	PASS
		2437	Reference	-3.30	-3.30	---	PASS
			30~1000	-3.30	-48.36	≤-23.3	PASS
			1000~26500	-3.30	-47.94	≤-23.3	PASS
		2462	Reference	-3.26	-3.26	---	PASS
			30~1000	-3.26	-53.41	≤-23.26	PASS
			1000~26500	-3.26	-46.48	≤-23.26	PASS
11N40SISO	Ant1	2422	Reference	-7.19	-7.19	---	PASS
			30~1000	-7.19	-57.9	≤-27.19	PASS
			1000~26500	-7.19	-47.64	≤-27.19	PASS
		2437	Reference	-7.54	-7.54	---	PASS
			30~1000	-7.54	-52	≤-27.54	PASS
			1000~26500	-7.54	-47.48	≤-27.54	PASS
		2452	Reference	-7.32	-7.32	---	PASS
			30~1000	-7.32	-45.39	≤-27.32	PASS
			1000~26500	-7.32	-47.78	≤-27.32	PASS

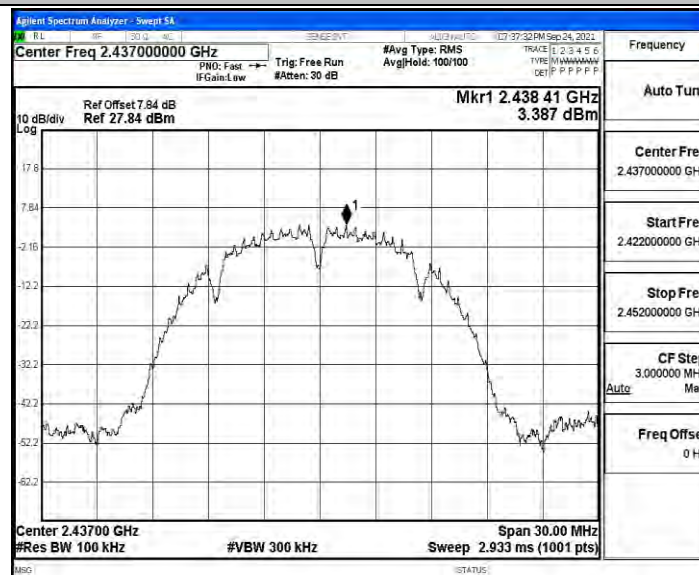


Test Graphs

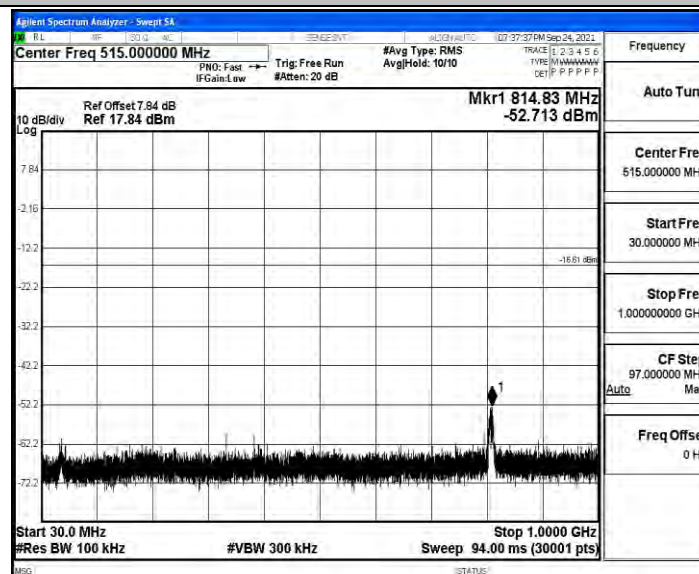




11B_Ant1_2437_0~Reference

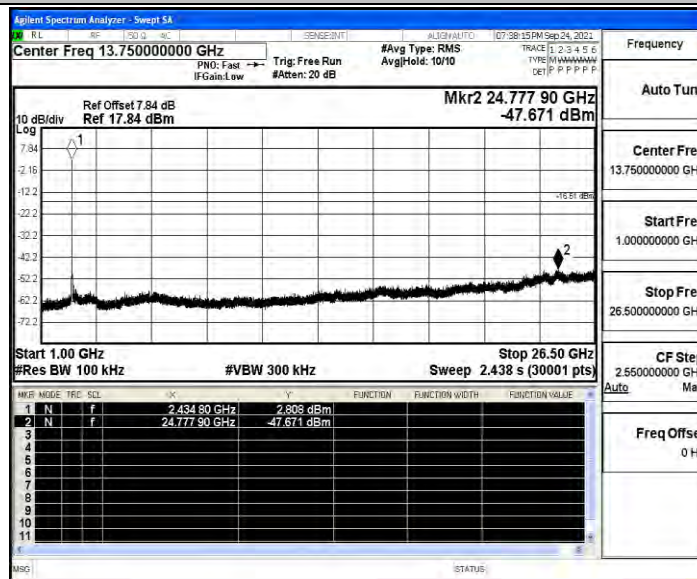


11B_Ant1_2437_30~1000

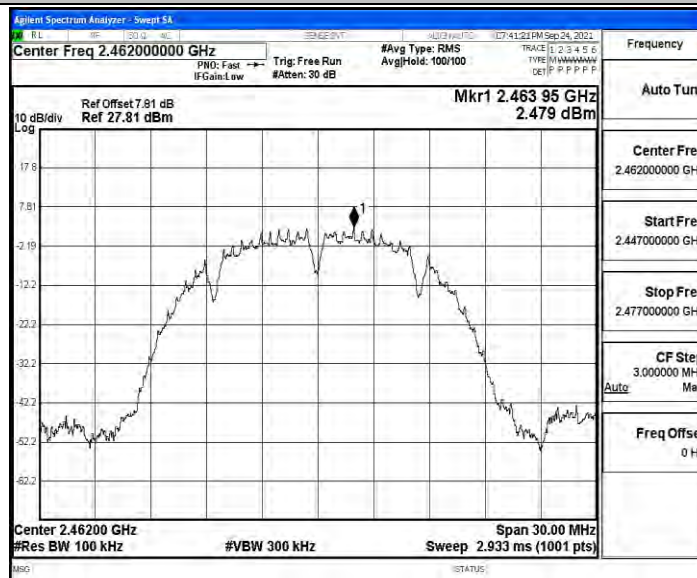




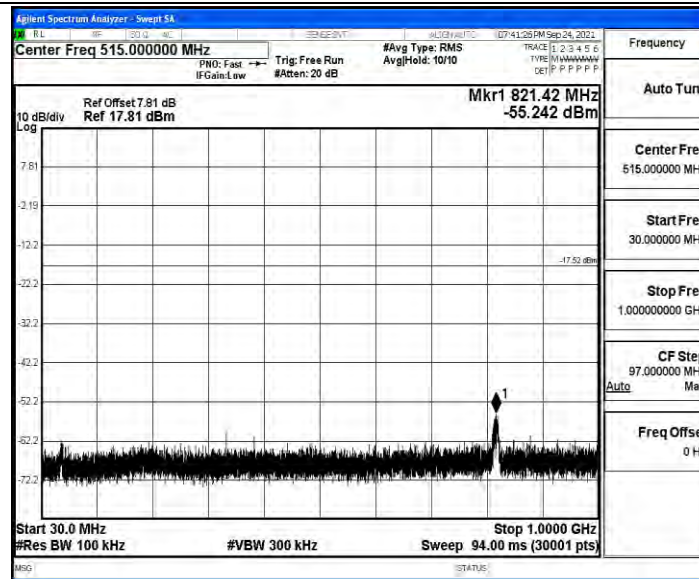
11B_Ant1_2437_1000~26500



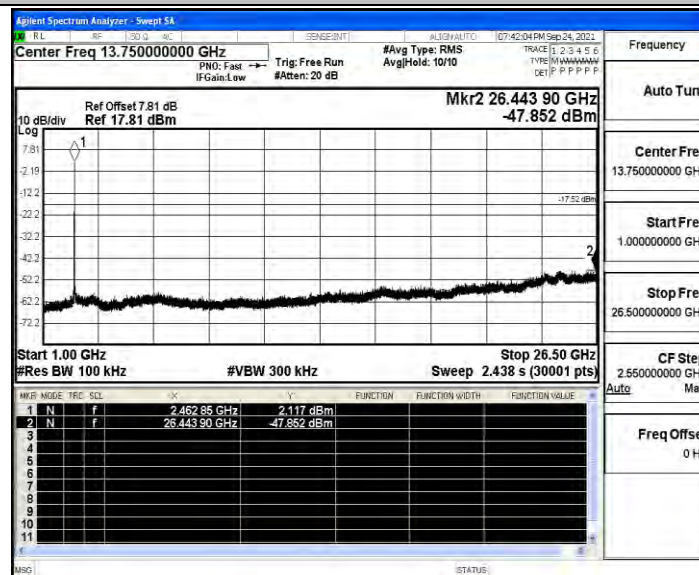
11B_Ant1_2462_0~Reference



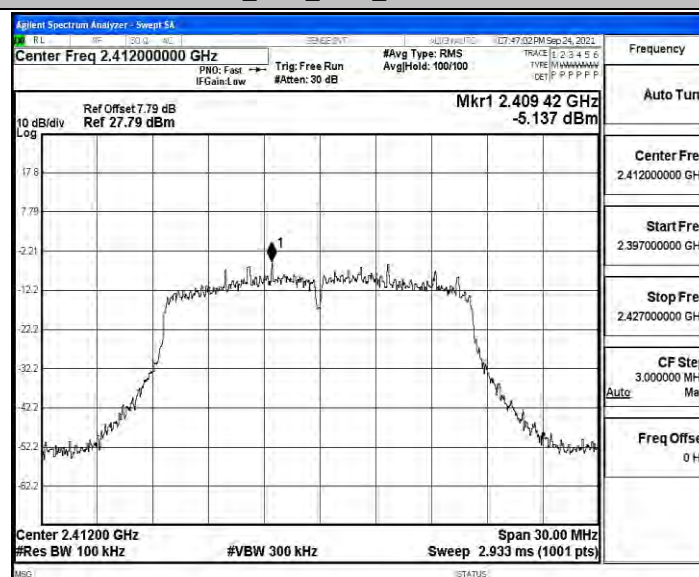
11B_Ant1_2462_30~1000



11B_Ant1_2462_1000~26500

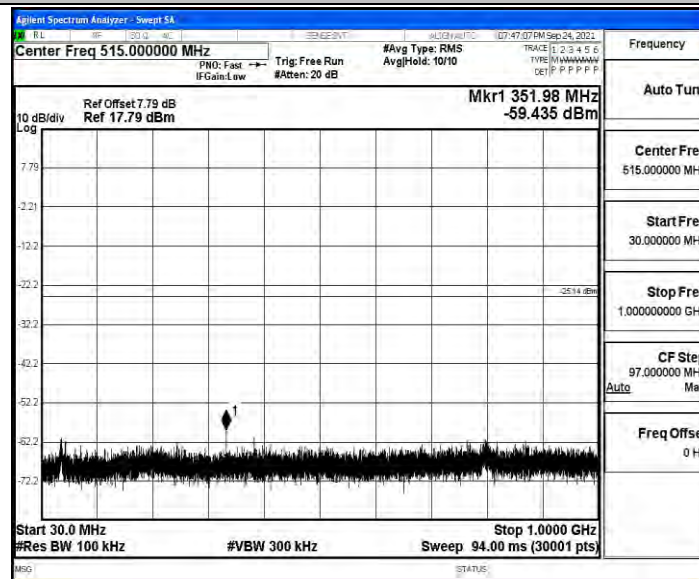


11G_Ant1_2412_0~Reference

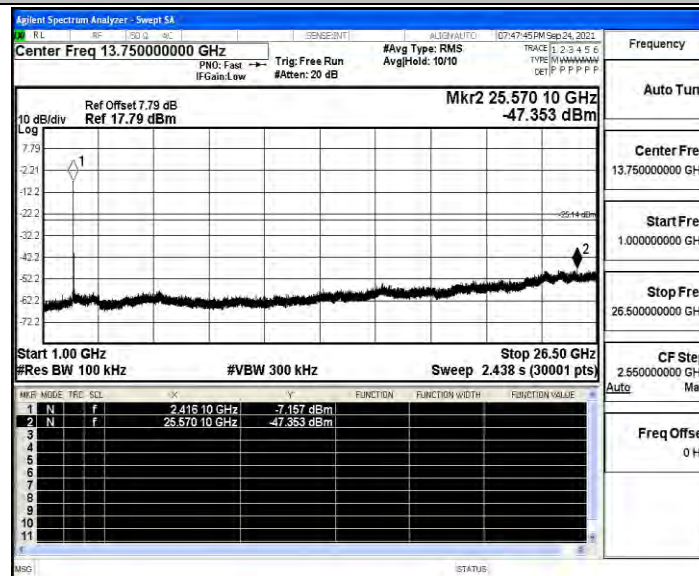




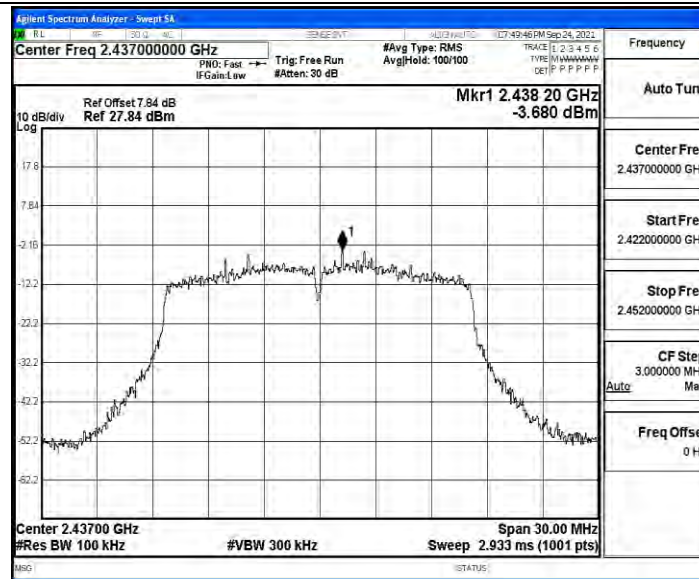
11G_Ant1_2412_30~1000



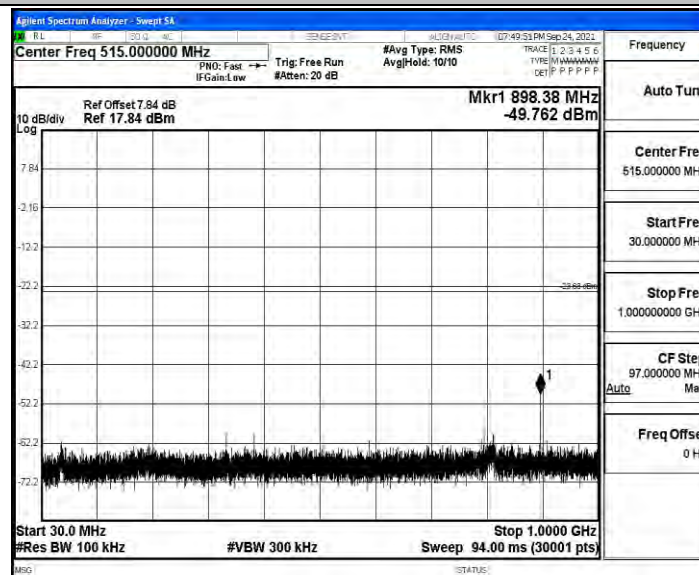
11G_Ant1_2412_1000~26500



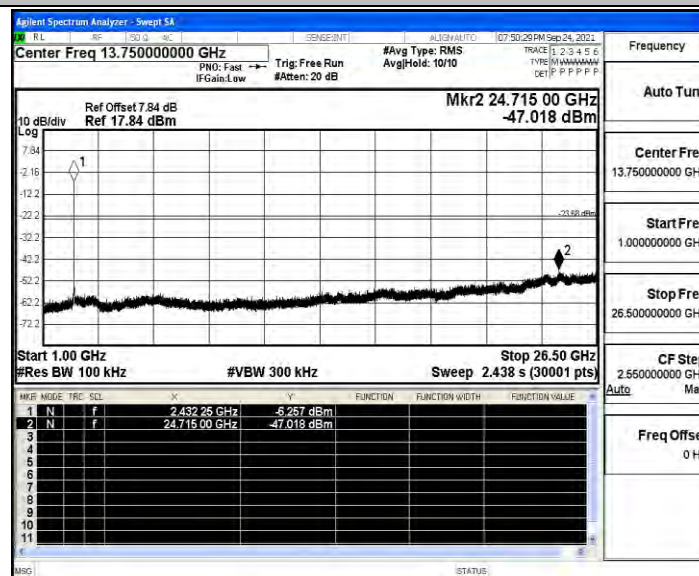
11G_Ant1_2437_0~Reference



11G_Ant1_2437_30~1000

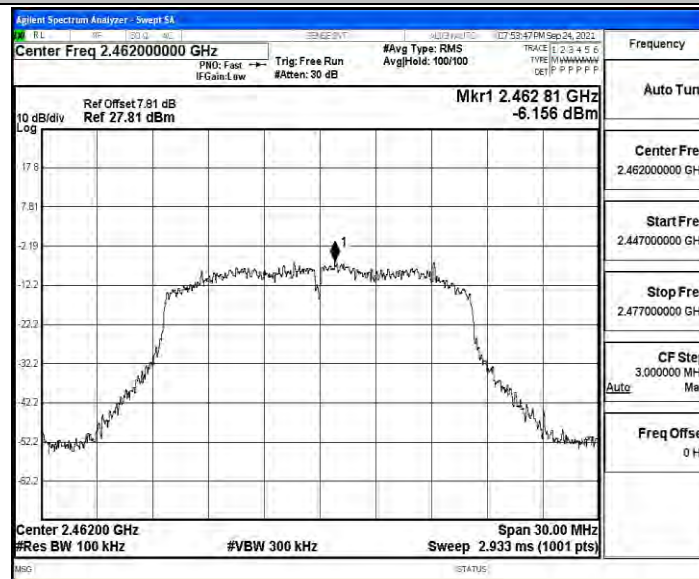


11G_Ant1_2437_1000~26500

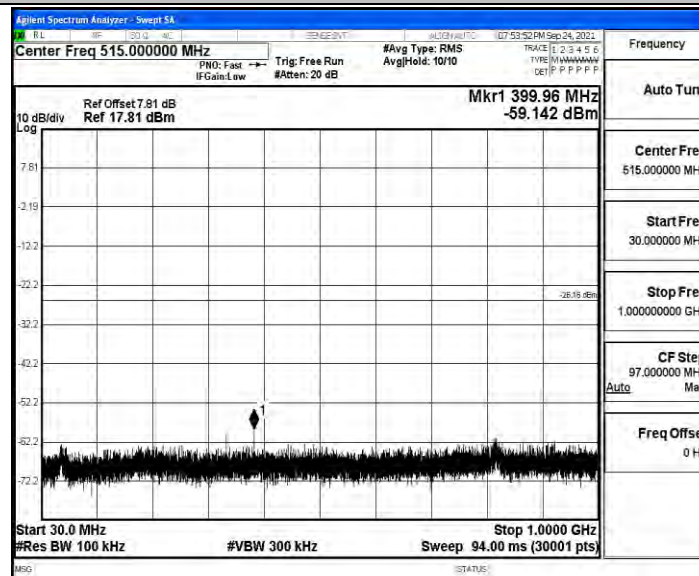




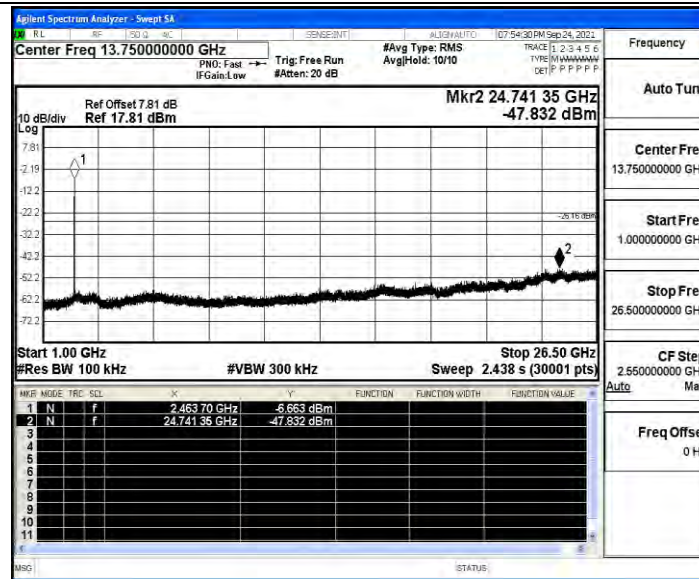
11G_Ant1_2462_0~Reference



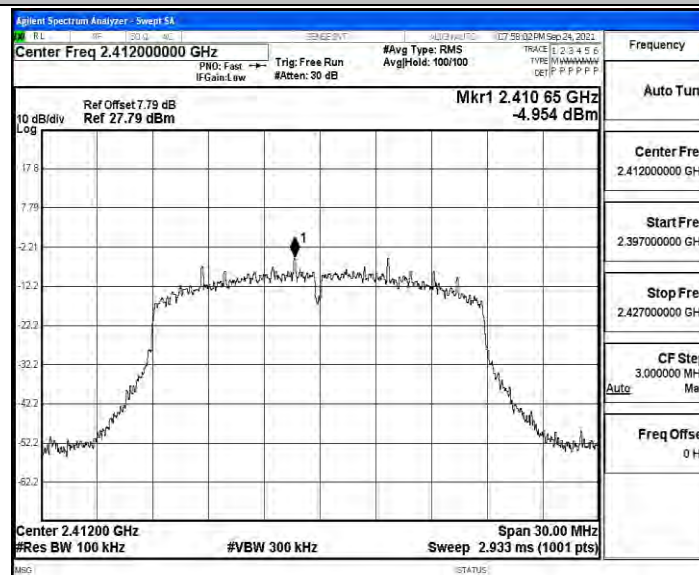
11G_Ant1_2462_30~1000



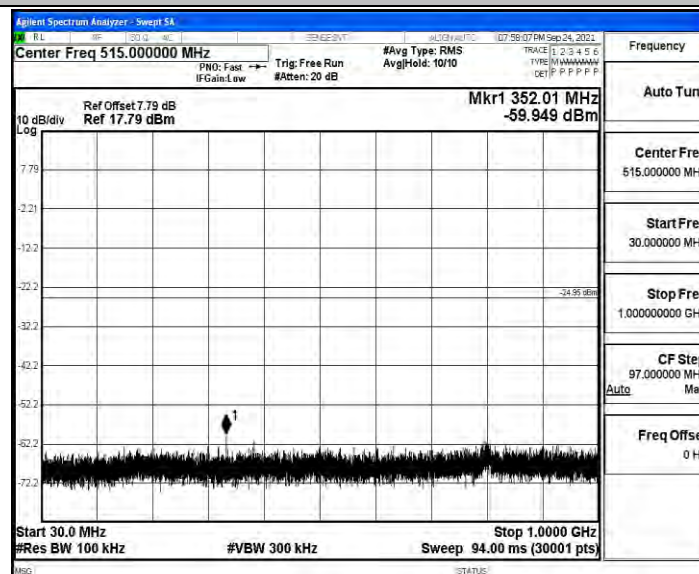
11G_Ant1_2462_1000~26500



11N20SISO_Ant1_2412_0~Reference

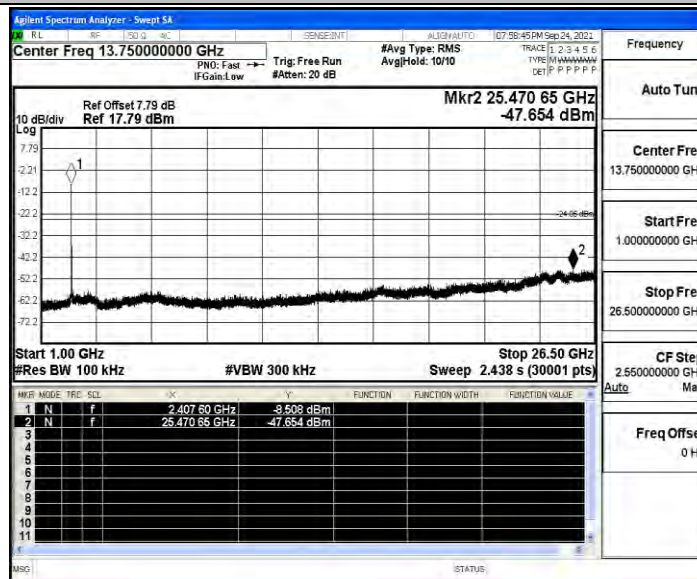


11N20SISO_Ant1_2412_30~1000

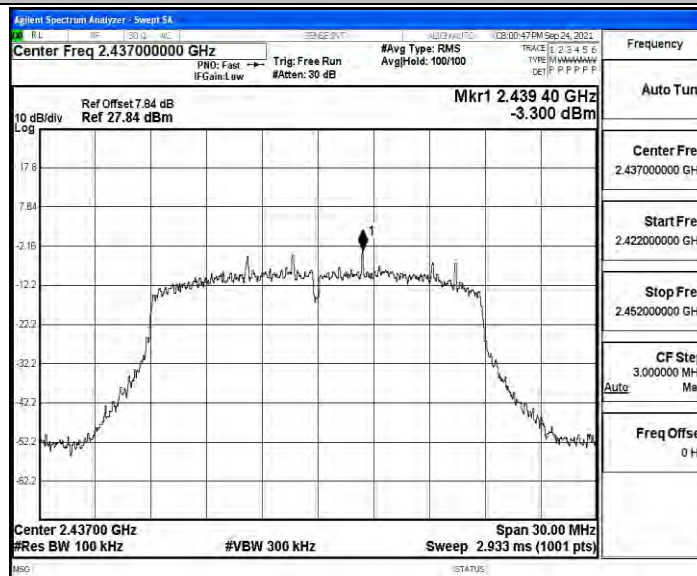




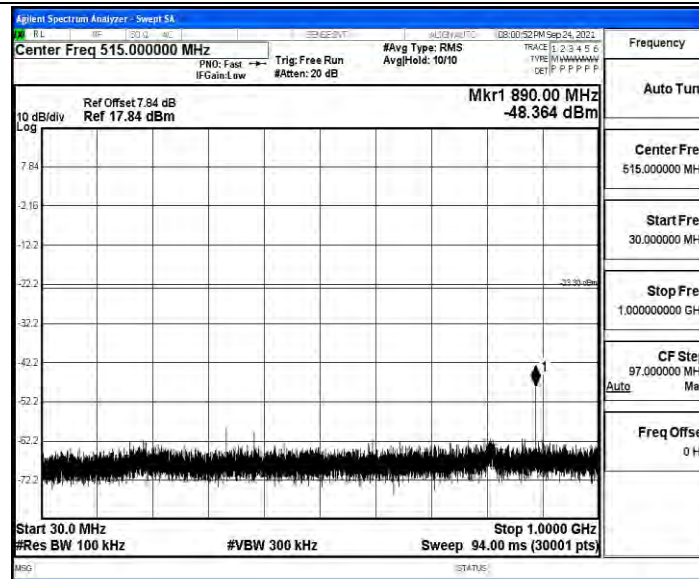
11N20SISO_Ant1_2412_1000~26500



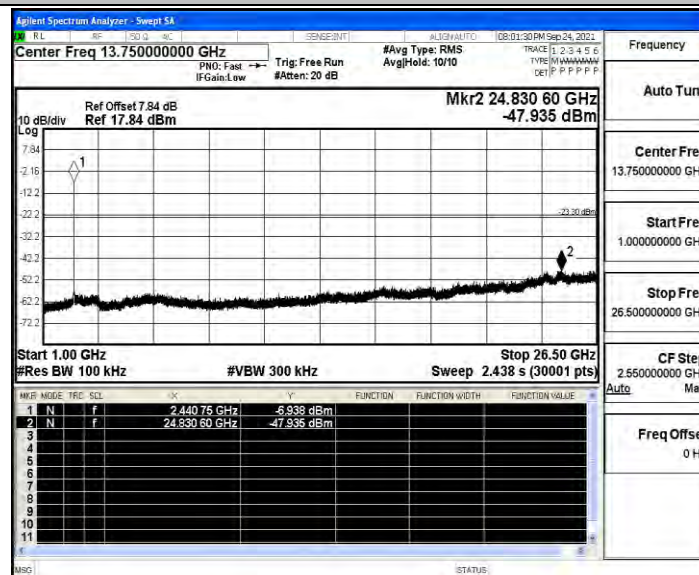
11N20SISO_Ant1_2437_0~Reference



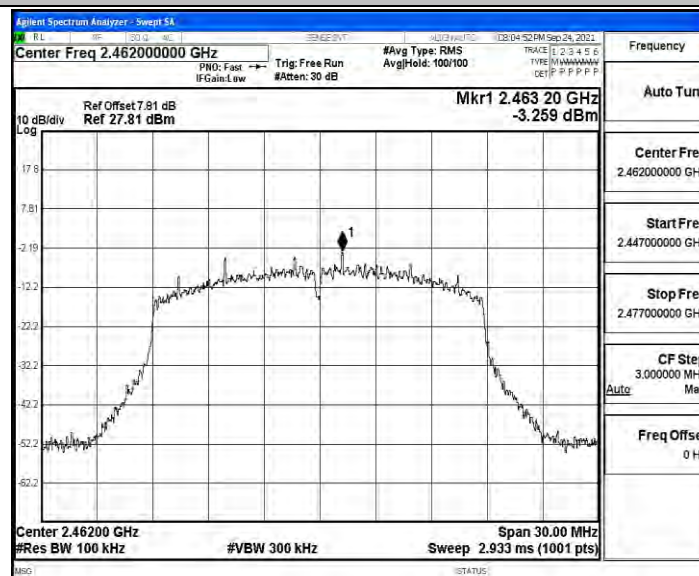
11N20SISO_Ant1_2437_30~1000



11N20SISO_Ant1_2437_1000~26500

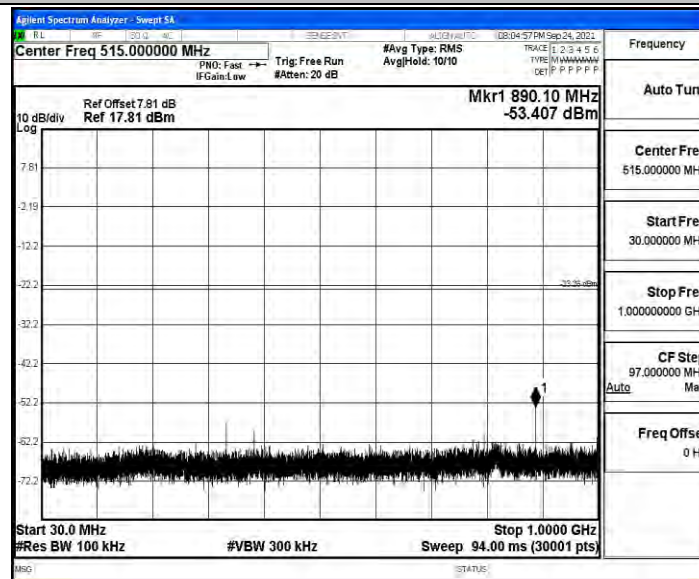


11N20SISO_Ant1_2462_0~Reference

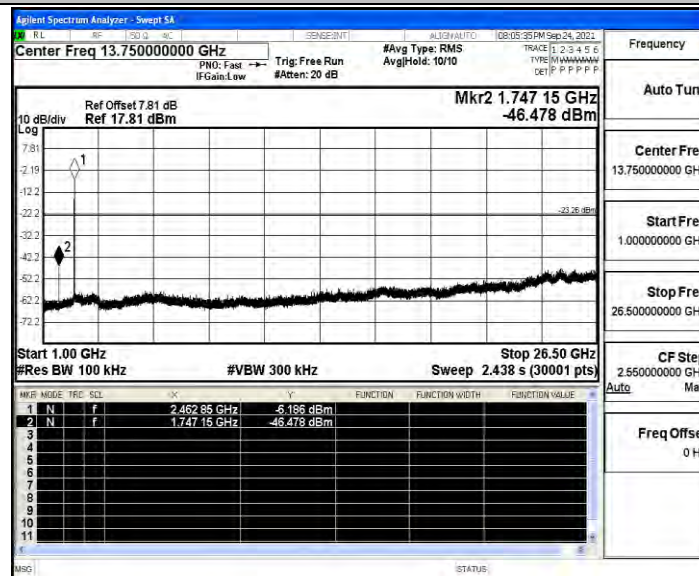




11N20SISO_Ant1_2462_30~1000



11N20SISO_Ant1_2462_1000~26500



11N40SISO_Ant1_2422_0~Reference