

Appendix A: Effective (Isotropic) Radiated Power

Test Result

Test Band: NB-IoT Band5												
Modulation	Subcarrier Spacing (KHz)	N _{tones}	Conducted Power (dBm)			Antenna gain		ERP(dBm)			Limit (dBm)	Verdict
			LCH	MCH	HCH	(dBd)	(dBi)	LCH	MCH	HCH		
BPSK	15	1sc	24.25	23.81	23.87	1.15	3.3	25.4	24.96	25.02	38.45	PASS
	3.75	1sc	23.81	23.43	23.17	1.15	3.3	24.96	24.58	24.32	38.45	PASS
QPSK	15	1sc	24.17	23.63	23.77	1.15	3.3	25.32	24.78	24.92	38.45	PASS
	15	Fullsc	22.05	21.61	21.71	1.15	3.3	23.2	22.76	22.86	38.45	PASS
	3.75	1sc	23.80	23.51	23.22	1.15	3.3	24.95	24.66	24.37	38.45	PASS

Note:

1) dBd = dBi - 2.15

2) EIRP = Conducted output power + Antenna gain (dBi)

3) ERP = Conducted output power + Antenna gain (dBd)

Appendix B: Peak-to-Average Ratio(CCDF)

Test Result

Band	Subcarrier Spacing (KHz)	Channel	Modulation	N _{tones}	Result(dB)	Limit(dB)	Verdict
Band5	3.75	824.2	QPSK	1sc	1.54	<=13	PASS
Band5	3.75	824.2	BPSK	1sc	1.81	<=13	PASS
Band5	3.75	836.5	QPSK	1sc	0.46	<=13	PASS
Band5	3.75	836.5	BPSK	1sc	0.70	<=13	PASS
Band5	3.75	848.8	QPSK	1sc	1.54	<=13	PASS
Band5	3.75	848.8	BPSK	1sc	1.55	<=13	PASS
Band5	15	824.2	QPSK	1sc	1.01	<=13	PASS
Band5	15	824.2	QPSK	Fullsc	5.98	<=13	PASS
Band5	15	824.2	BPSK	1sc	1.02	<=13	PASS
Band5	15	836.5	QPSK	1sc	0.54	<=13	PASS
Band5	15	836.5	QPSK	Fullsc	6.01	<=13	PASS
Band5	15	836.5	BPSK	1sc	0.51	<=13	PASS
Band5	15	848.8	QPSK	1sc	1.05	<=13	PASS
Band5	15	848.8	QPSK	Fullsc	6.00	<=13	PASS
Band5	15	848.8	BPSK	1sc	1.07	<=13	PASS

Test Graphs

3k75_PARP_CHL_824.2MHz_QPSK-1sc



3k75_PARP_CHL_824.2MHz_BPSK-1sc



Spectrum Analyzer 1
Power Stat CCDF

KEYSIGHT Input: RF Input Z: 50 Ω Atten: 30 dB Trig: RF Burst Center Freq: 836.411875 MHz
Coupling: DC Corr: CCorr #IF Gain: Low Counts: 10.0 M/10.0 Mpt
Align: Off Freq Ref: Int (S) Preamp: Off Radio Std: None

Center Frequency 836.411875 MHz
CF Step 5.000000 MHz
Auto Man
Freq Offset 0 Hz

1 Metrics
Average Power
22.28 dBm
79.33 % at 0 dB

10.0 % 0.36 dB
1.0 % 0.43 dB
0.1 % 0.46 dB
0.01 % 0.49 dB
0.001 % 0.50 dB
0.0001 % 0.52 dB

Peak 0.52 dB
22.80 dBm

2 Graph
Gaussian
0.0001 %
0.00 dB
Info BW 5.0000 MHz
20.00 dB

Local

Spectrum Analyzer 1
Power Stat CCDF

KEYSIGHT Input: RF
Coupling: DC
Align: Off

RL

Input Z: 50 Ω
Corr: CCorr
Freq Ref: Int (S)

Atten: 30 dB
Preamp: Off

Trig: RF Burst
#IF Gain: Low

Center Freq: 836.411875 MHz
Counts: 10.0 M/10.0 Mpt
Radio Std: None

Center Frequency
836.411875 MHz

CF Step
5.000000 MHz

CF Offset
0 Hz

Settings

1 Metrics

Average Power

21.97 dBm

89.89 % at 0 dB

10.0 % 0.53 dB

1.0 % 0.66 dB

0.1 % 0.70 dB

0.01 % 0.72 dB

0.001 % 0.73 dB

0.0001 % 0.75 dB

Peak

0.88 dB

22.85 dBm

2 Graph

Gaussian

0.0001 %

0.001 %

0.01 %

0.1 %

1 %

10 %

100 %

0.00 dB

20.00 dB

Info BW 5.0000 MHz

Local

3k75_PARP_CHH_848.8MHz_QPSK-1sc



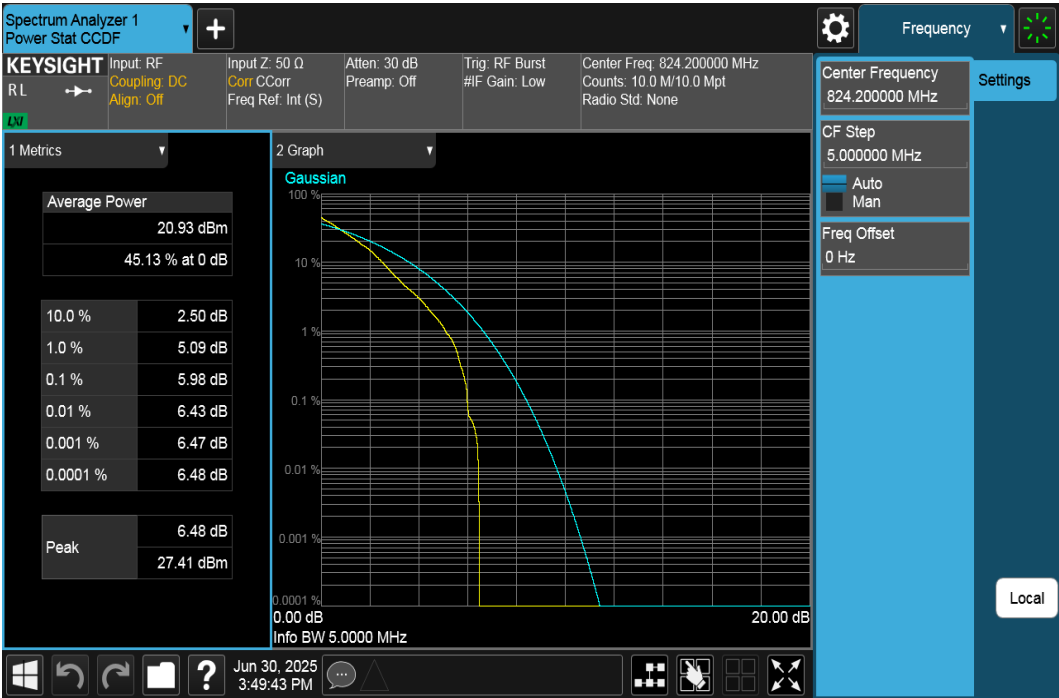
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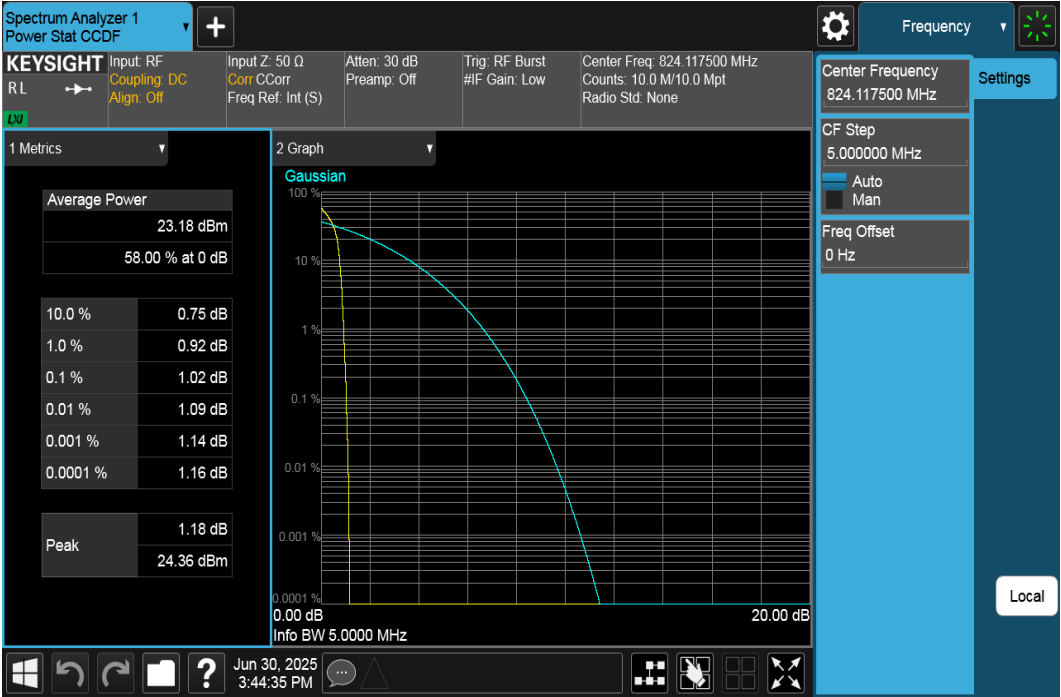
15k_PARP_CHL_824.2MHz_QPSK-1sc



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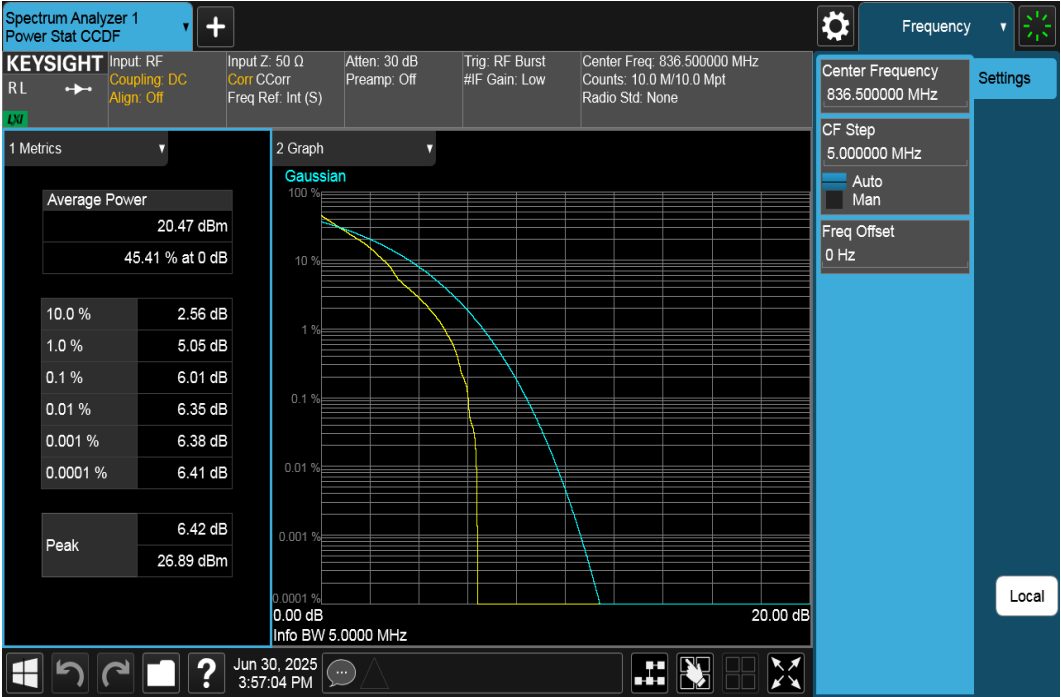
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15k_PARP_CHM_836.5MHz_QPSK-1sc



15k_PARP_CHM_836.5MHz_QPSK-Fullsc



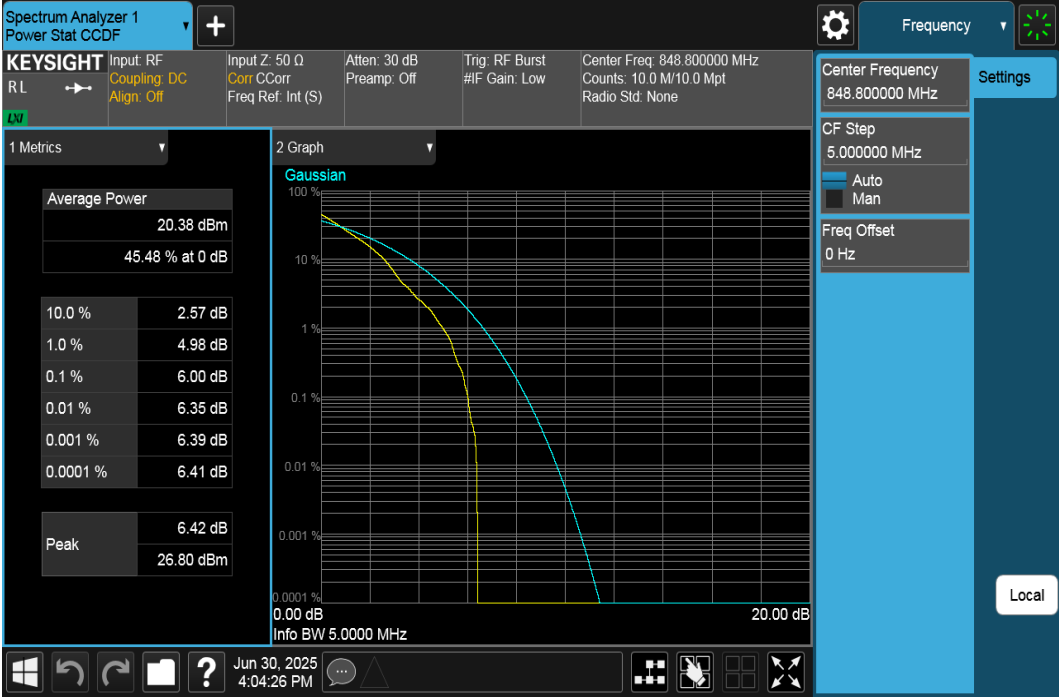
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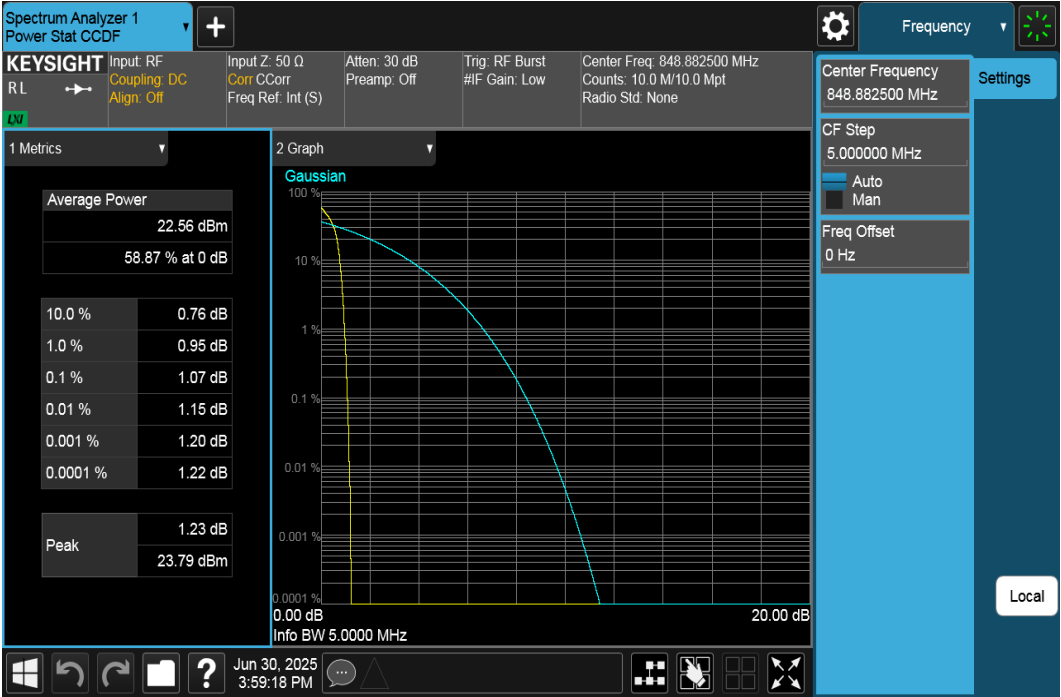
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15k_PARP_CHH_848.8MHz_QPSK-Fullsc



15k_PARP_CHH_848.8MHz_BPSK-1sc



Appendix C: 26dB Bandwidth and Occupied Bandwidth

Test Result

Band	Subcarrier Spacing (KHz)	Channel	Modulation	N _{tones}	Occupied Bandwidth (KHz)	26dB Bandwidth (KHz)	Verdict
Band5	3.75	824.2	QPSK	Fullsc	183.09	238.7	PASS
Band5	3.75	836.5	QPSK	Fullsc	183.66	252.3	PASS
Band5	3.75	848.8	QPSK	Fullsc	184.61	251.0	PASS

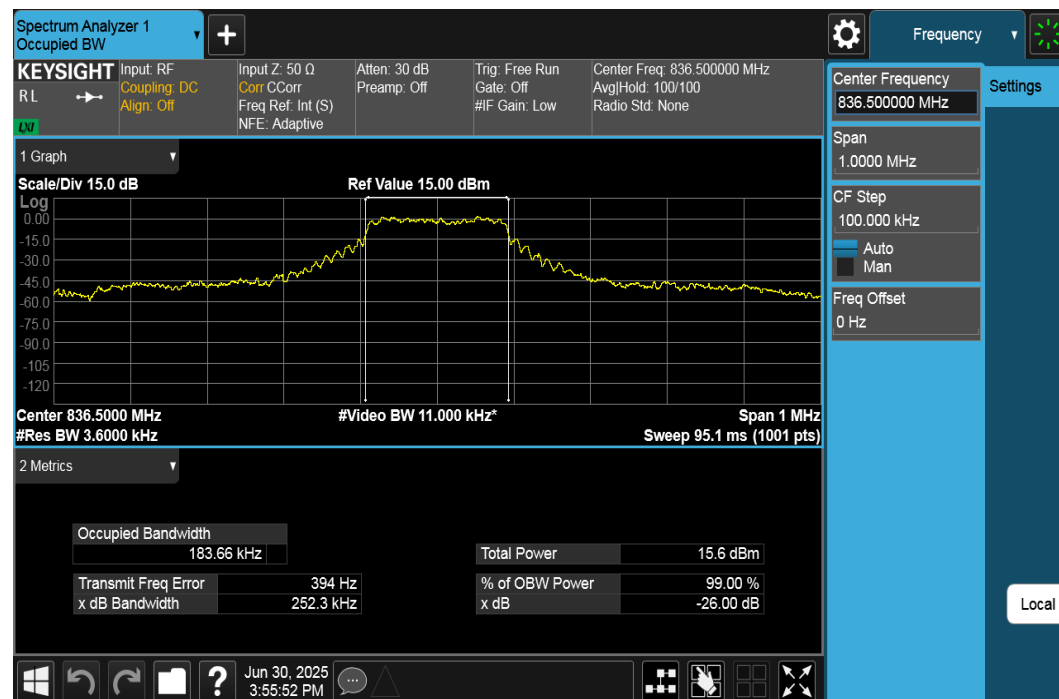
Note: only record the worse data.

Test Graphs

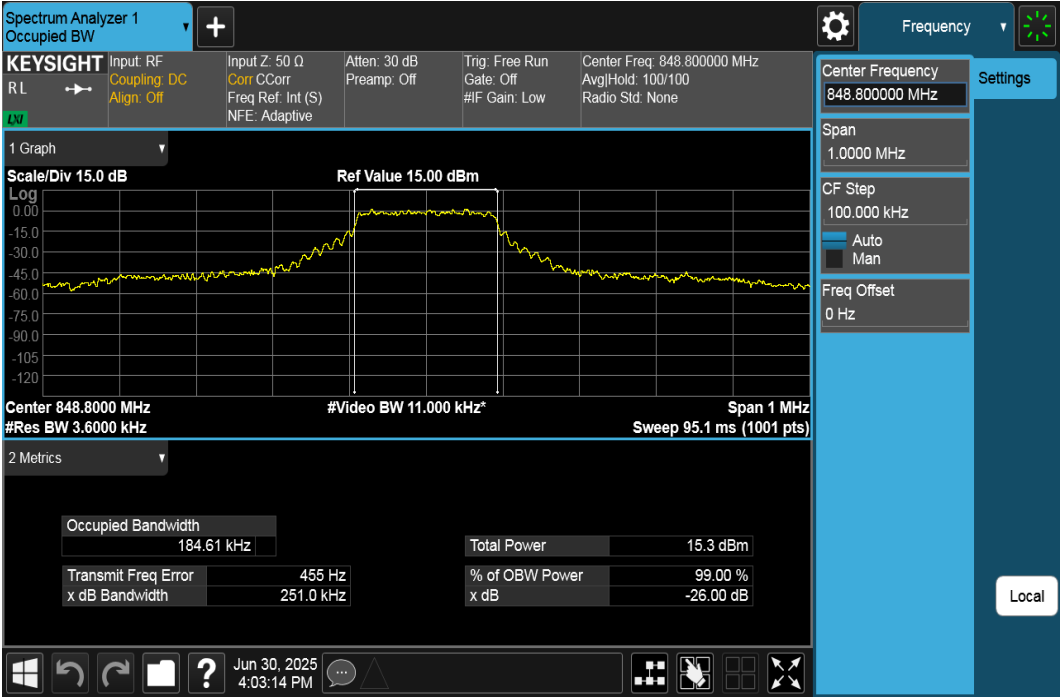
15k_OBW_CHL_824.2MHz_QPSK-Fullsc



15k_OBW_CHM_836.5MHz_QPSK-Fullsc



15k_OBW_CHH_848.8MHz_QPSK-Fullsc



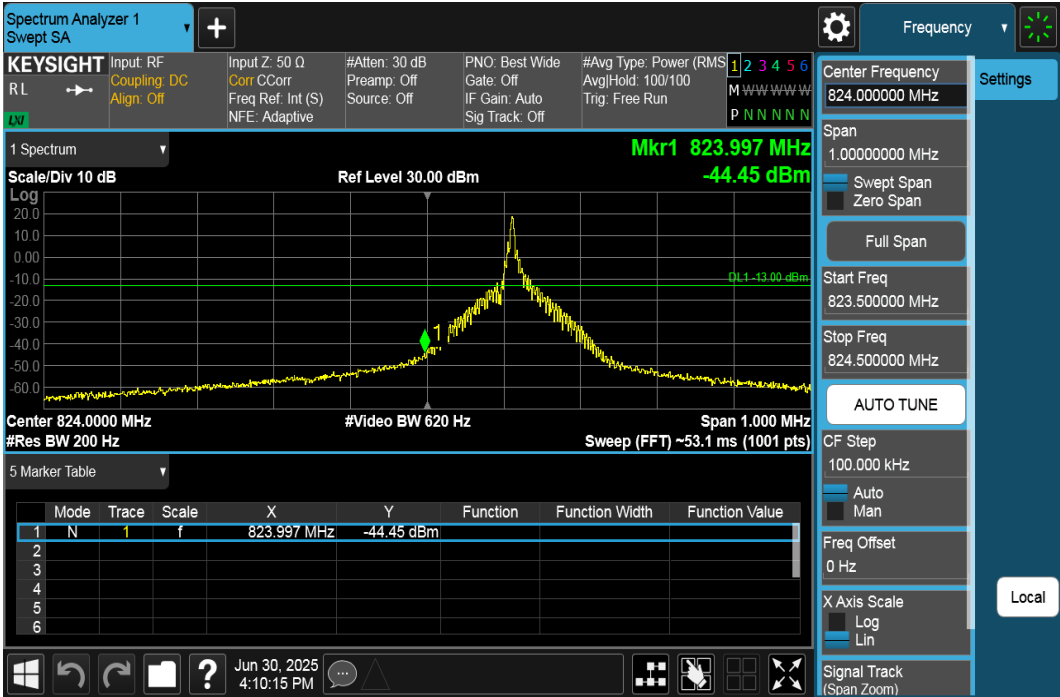
Appendix D: Band Edge

Test Result

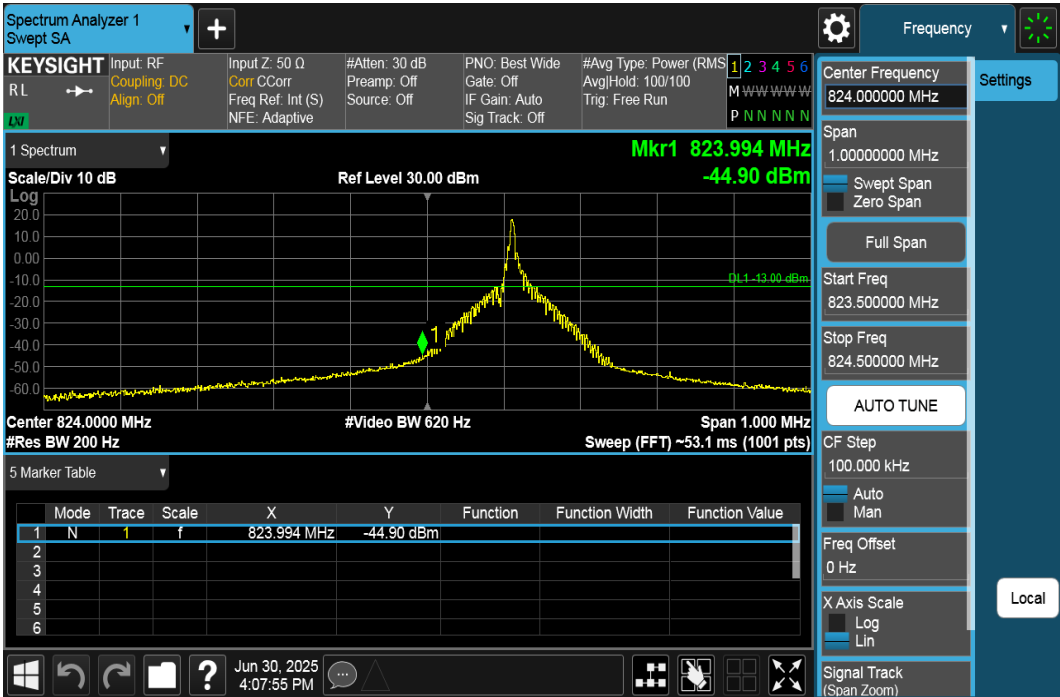
Band	Subcarrier Spacing (KHz)	Channel	Modulation	N _{tones}	Result(dBm)	Verdict
Band5	3.75	824.2	QPSK	1sc	-44.45	PASS
Band5	3.75	824.2	BPSK	1sc	-44.90	PASS
Band5	3.75	848.8	QPSK	1sc	-43.75	PASS
Band5	3.75	848.8	BPSK	1sc	-44.85	PASS
Band5	15	824.2	QPSK	1sc	-42.25	PASS
Band5	15	824.2	QPSK	Fullsc	-29.79	PASS
Band5	15	824.2	BPSK	1sc	-41.99	PASS
Band5	15	848.8	QPSK	1sc	-43.52	PASS
Band5	15	848.8	QPSK	Fullsc	-31.82	PASS
Band5	15	848.8	BPSK	1sc	-42.55	PASS

Test Graphs

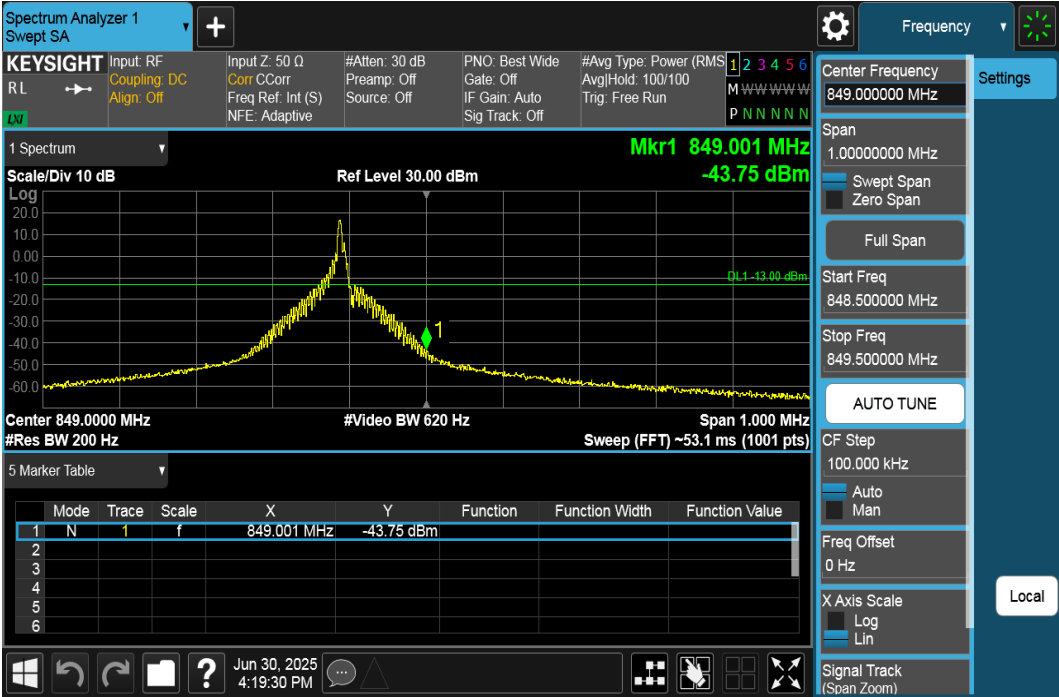
3k75_BE_CHL_824.2MHz_QPSK-1sc



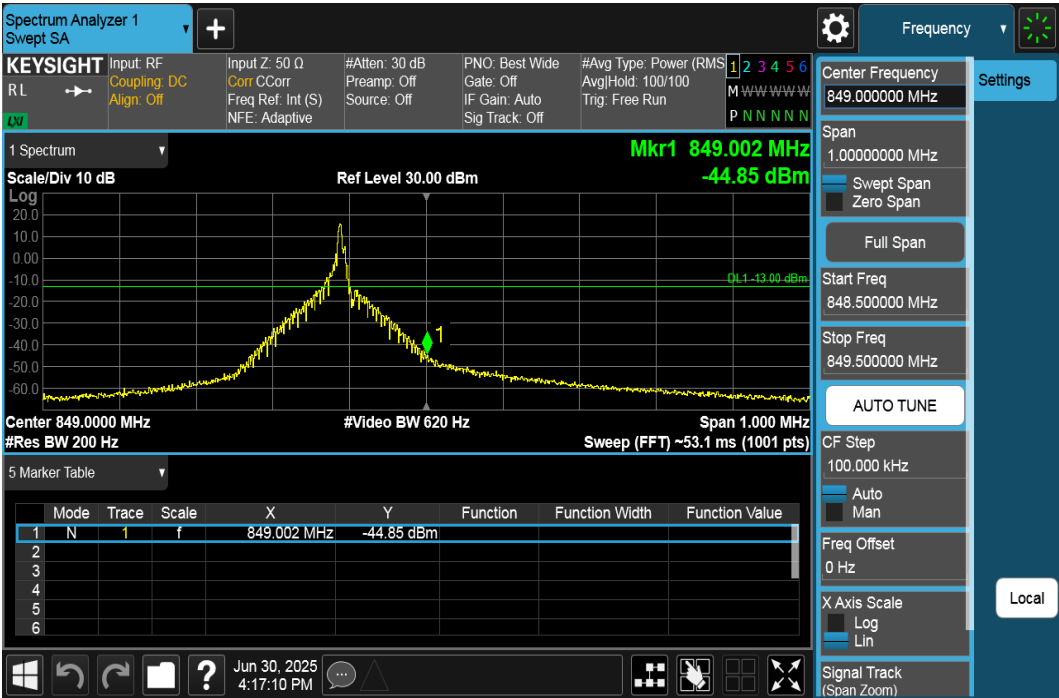
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3k75_BE_CHH_848.8MHz_QPSK-1sc



3k75_BE_CHH_848.8MHz_BPSK-1sc



15k_BE_CHL_824.2MHz_QPSK-1sc



15k_BE_CHL_824.2MHz_QPSK-Fullsc



15k_BE_CHL_824.2MHz_BPSK-1sc



15k_BE_CHH_848.8MHz_QPSK-1sc



15k_BE_CHH_848.8MHz_QPSK-Fullsc



15k_BE_CHH_848.8MHz_BPSK-1sc



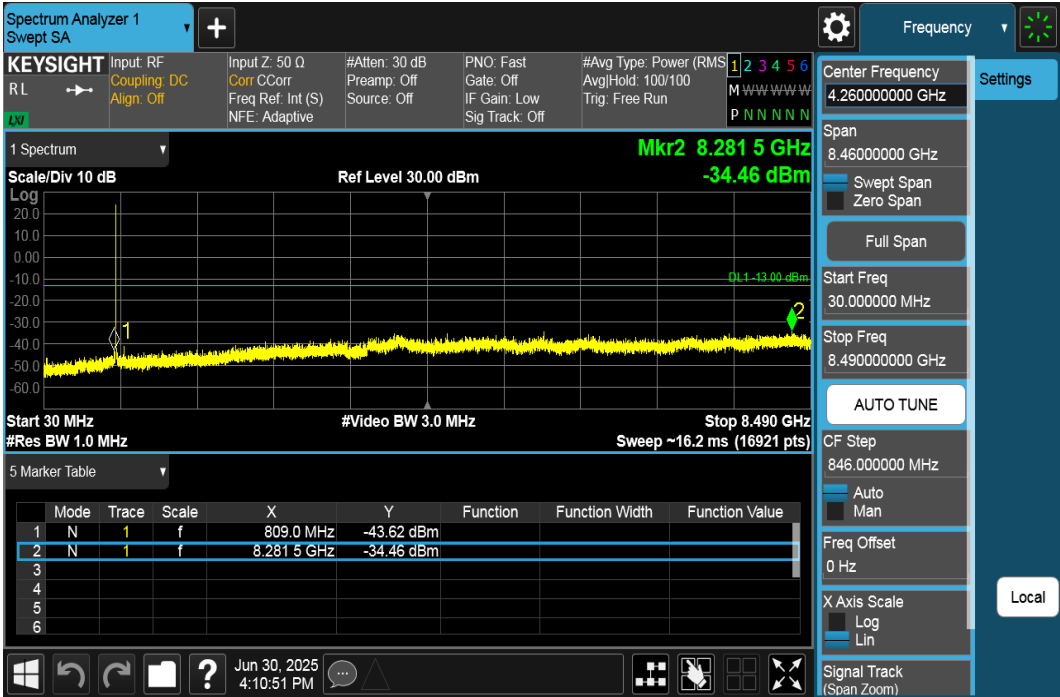
Appendix E: Conducted Spurious Emission

Test Result

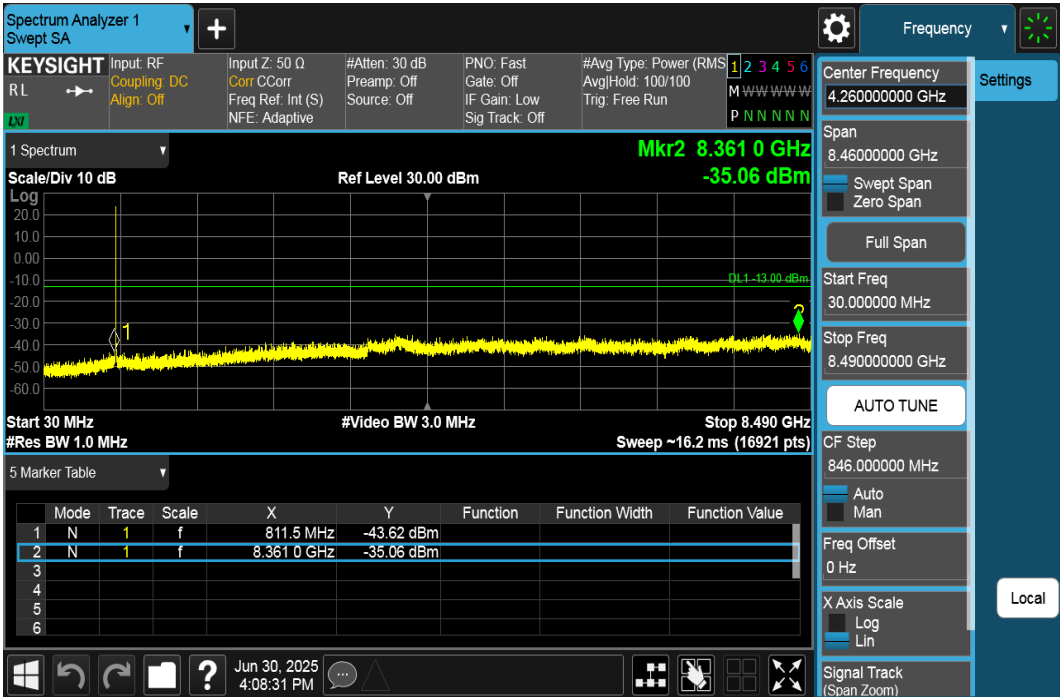
Band	Subcarrier Spacing (KHz)	Channel	Modulation	N _{tones}	Start Freq (MHz)	Stop Freq (MHz)	Result (dBm)	Verdict
Band5	3.75	824.2	QPSK	1sc	30	8490	-34.46	PASS
Band5	3.75	824.2	BPSK	1sc	30	8490	-35.06	PASS
Band5	3.75	836.5	QPSK	1sc	30	8490	-34.86	PASS
Band5	3.75	836.5	BPSK	1sc	30	8490	-34.70	PASS
Band5	3.75	848.8	QPSK	1sc	30	8490	-34.91	PASS
Band5	3.75	848.8	BPSK	1sc	30	8490	-34.78	PASS
Band5	15	824.2	QPSK	1sc	30	8490	-34.10	PASS
Band5	15	824.2	QPSK	Fullsc	30	8490	-34.10	PASS
Band5	15	824.2	BPSK	1sc	30	8490	-33.60	PASS
Band5	15	848.8	QPSK	1sc	30	8490	-35.20	PASS
Band5	15	848.8	QPSK	Fullsc	30	8490	-34.17	PASS
Band5	15	848.8	BPSK	1sc	30	8490	-34.94	PASS
Band5	15	848.8	QPSK	1sc	30	8490	-34.28	PASS
Band5	15	848.8	QPSK	Fullsc	30	8490	-34.86	PASS
Band5	15	848.8	BPSK	1sc	30	8490	-34.94	PASS

Test Graphs

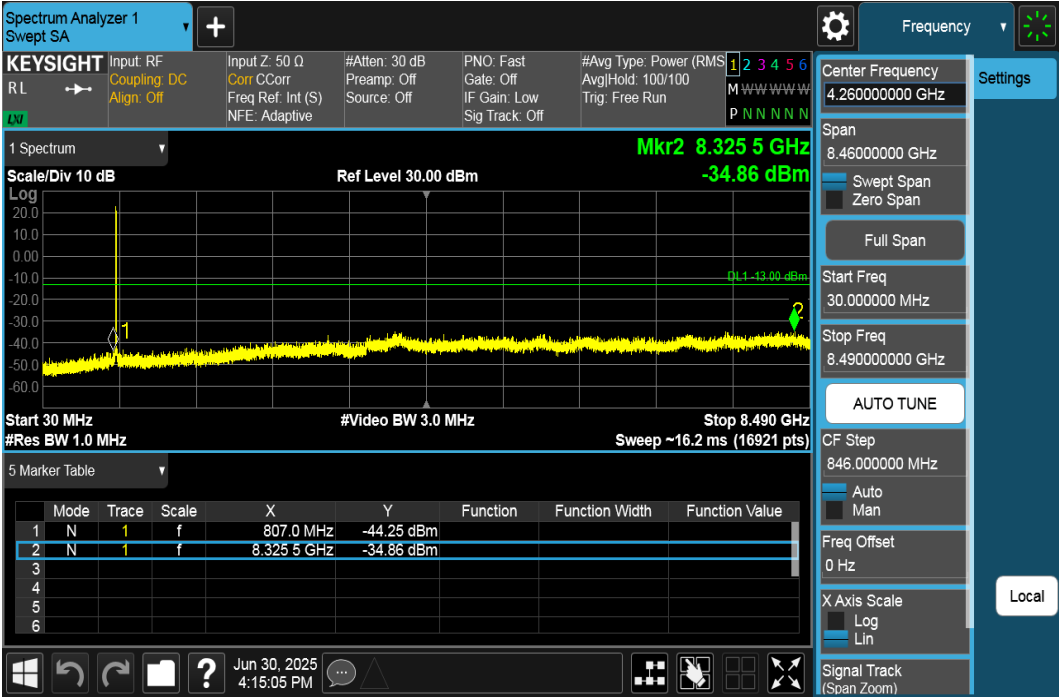
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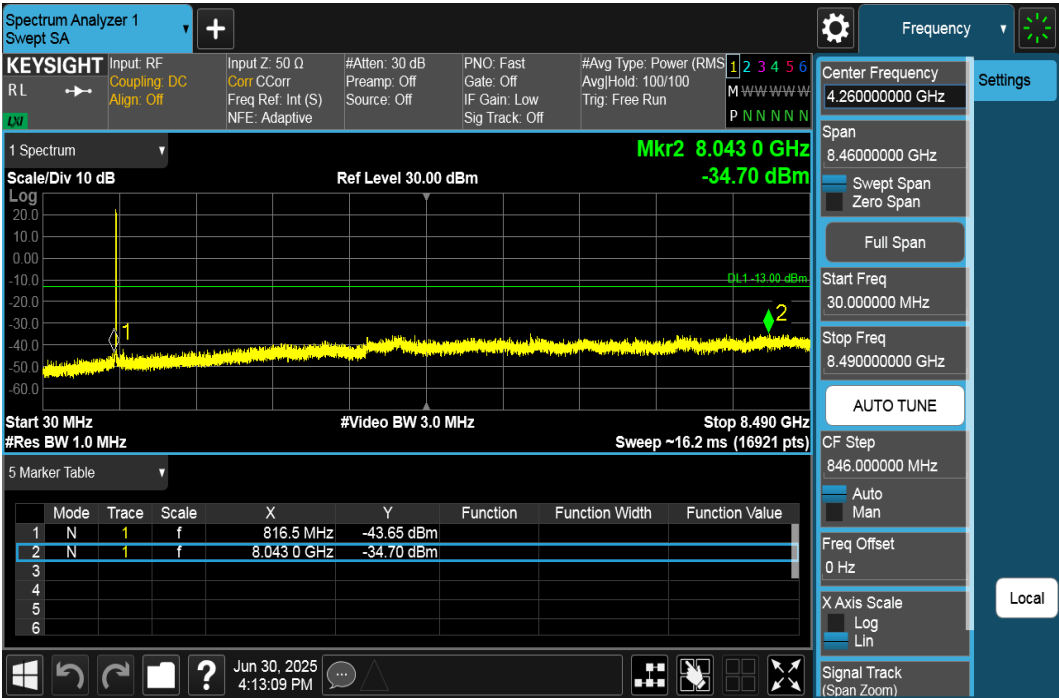
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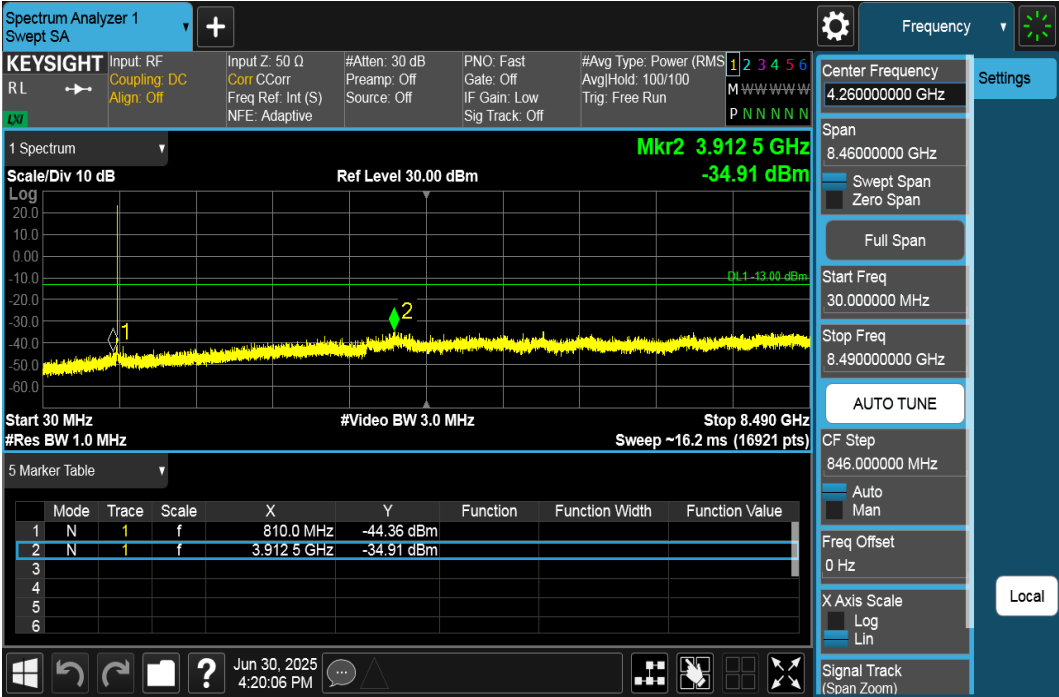
3k75_CSE1_CHM_836.5MHz_QPSK-1sc



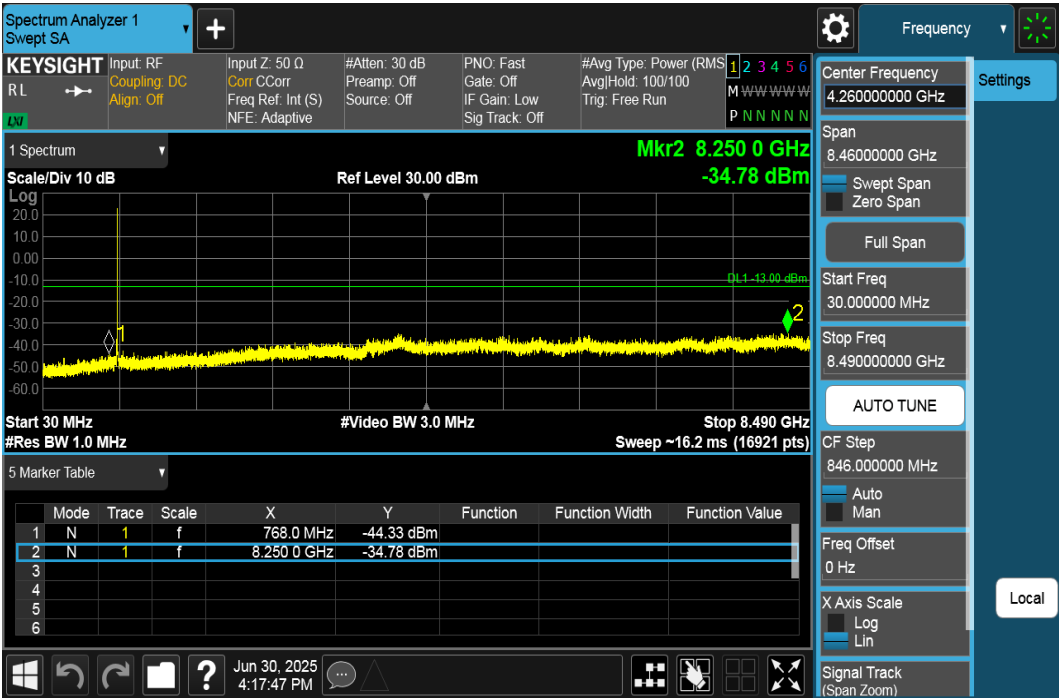
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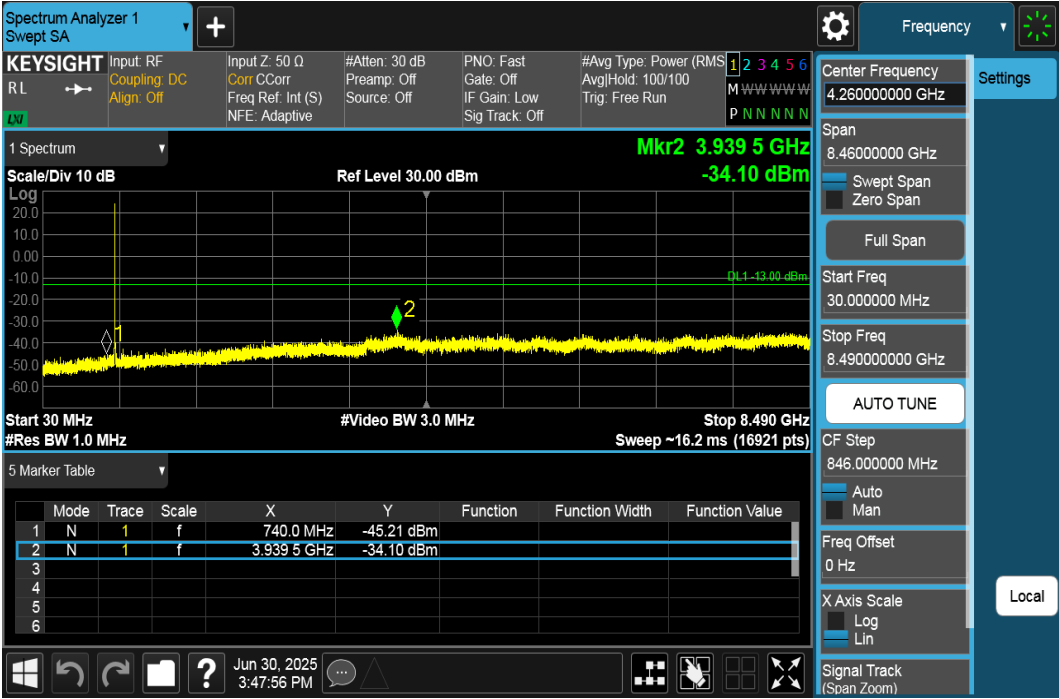
3k75_CSE1_CHH_848.8MHz_QPSK-1sc



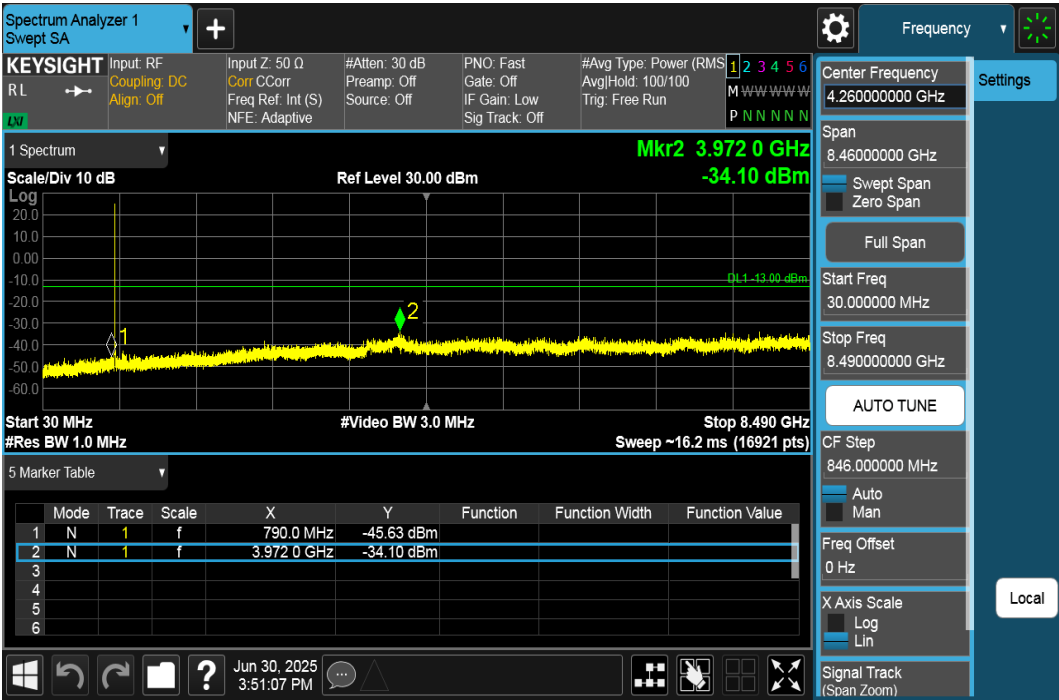
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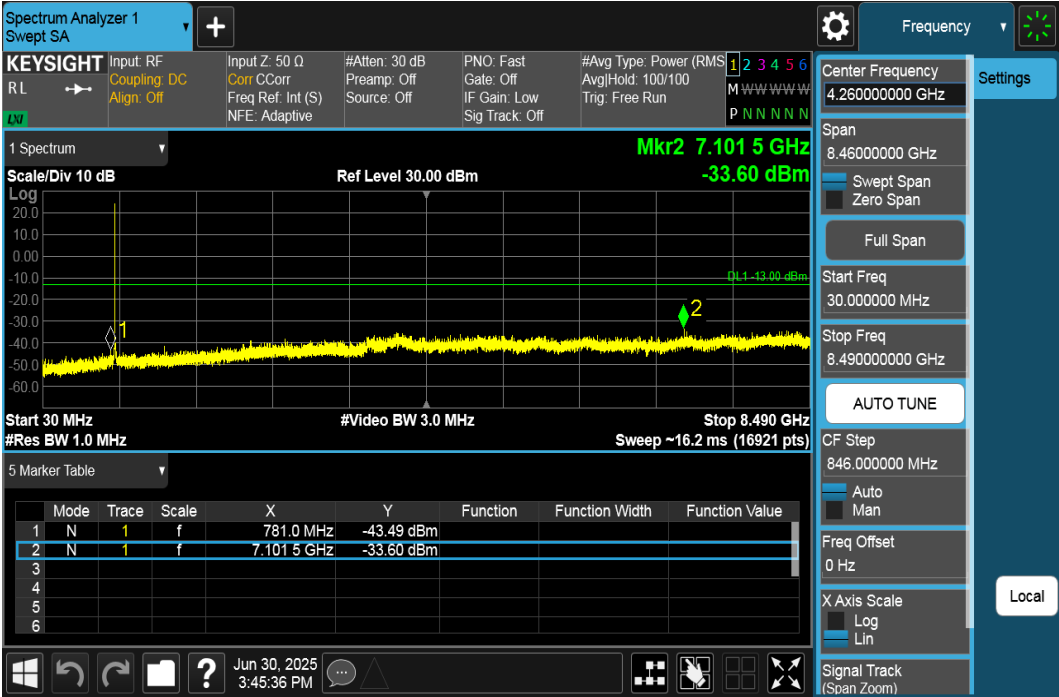
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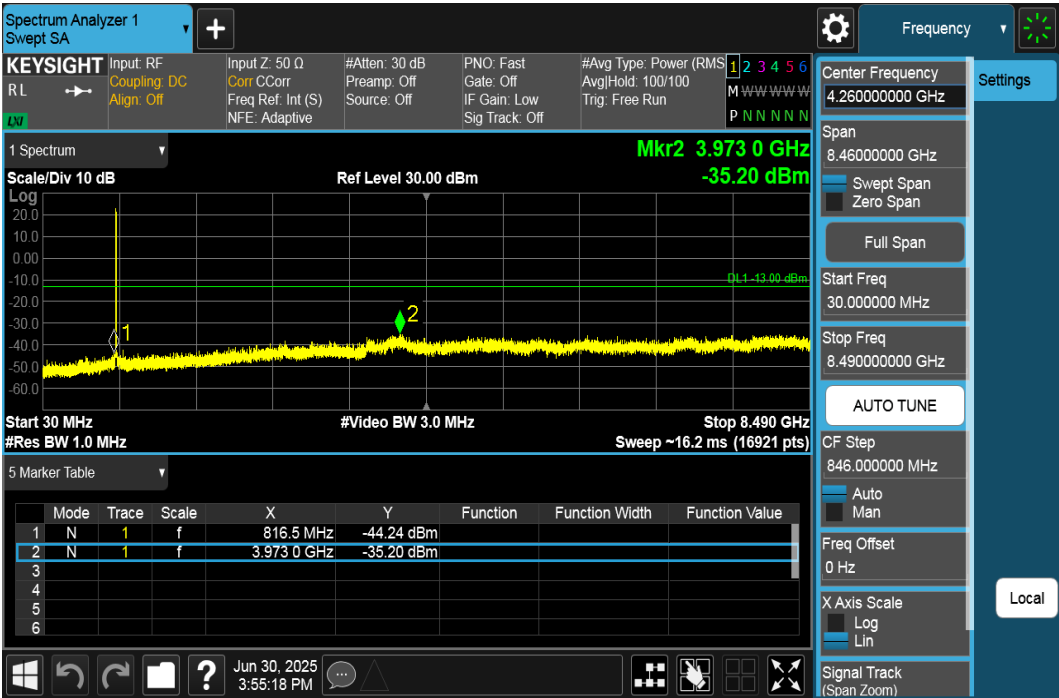
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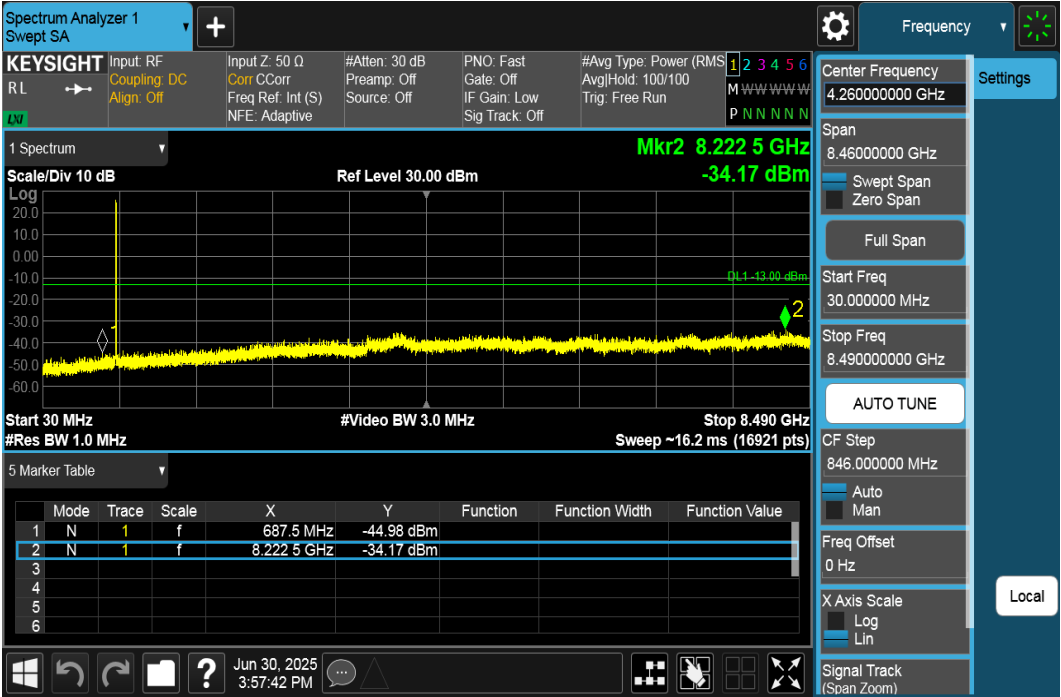
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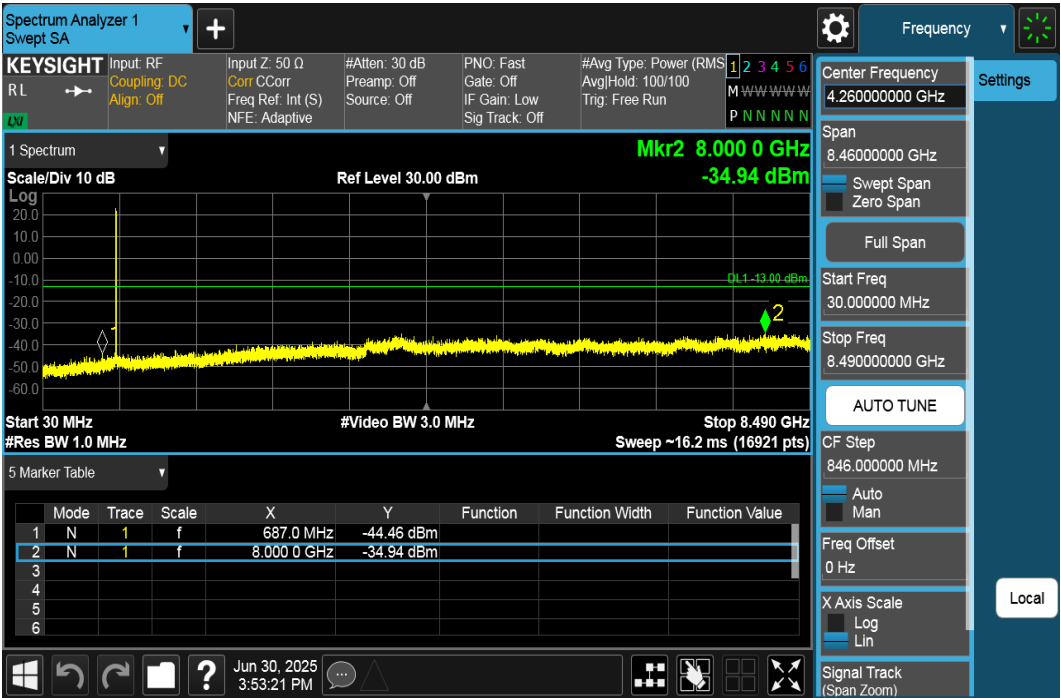
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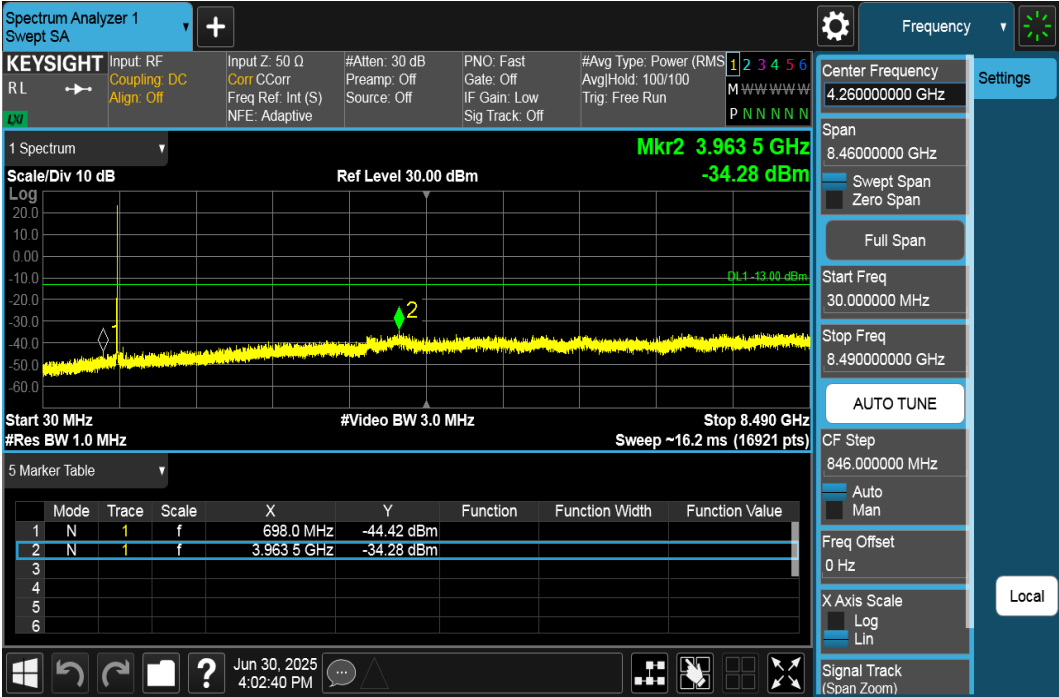
15k_CSE1_CHM_836.5MHz_QPSK-Fullsc



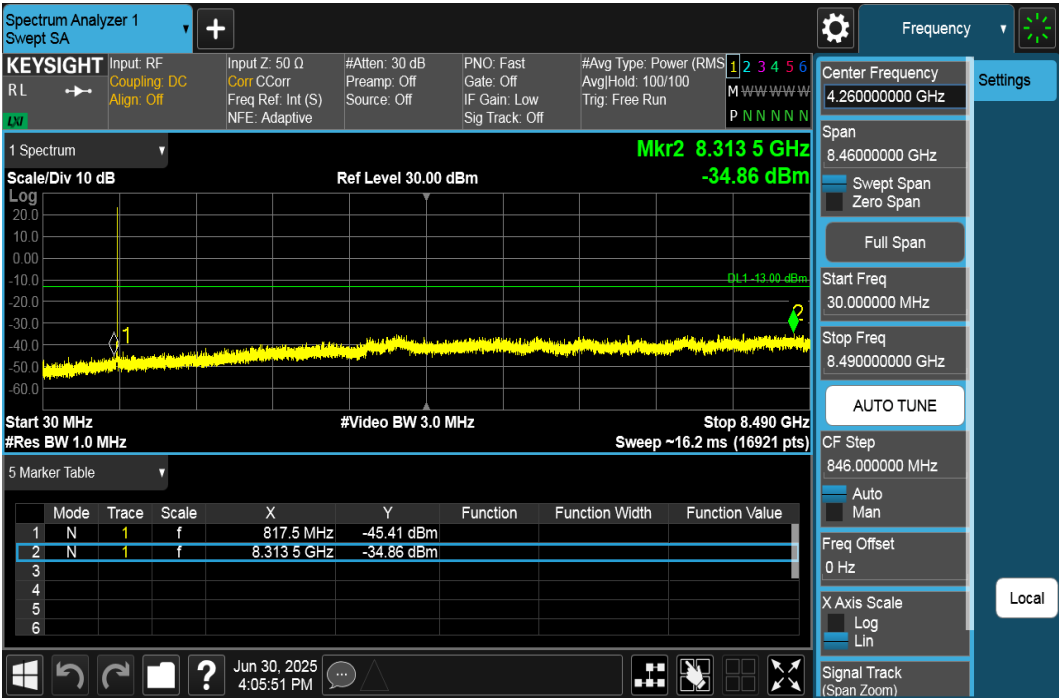
15k_CSE1_CHM_836.5MHz_BPSK-1sc



15k_CSE1_CHH_848.8MHz_QPSK-1sc



15k_CSE1_CHH_848.8MHz_QPSK-Fullsc



15k_CSE1_CHH_848.8MHz_BPSK-1sc



Appendix F: Frequency stability

Frequency Error VS. Voltage

Test Band	Test mode	Test Channel	Test Temp.	Test Volt.	Freq. Error [Hz]	Freq. vs. rated [ppm]	Verdict
NB-IoT Band 5	BPSK/ 15KHz	LCH	TN	VL	-0.03	-0.00004	PASS
				VN	0.26	0.00032	PASS
				VH	0.98	0.00119	PASS
		MCH	TN	VL	0.12	0.00014	PASS
				VN	0.93	0.00111	PASS
				VH	0.27	0.00032	PASS
		HCH	TN	VL	-0.12	-0.00014	PASS
				VN	-0.38	-0.00045	PASS
				VH	-0.02	-0.00002	PASS
	QPSK/ 15KHz	LCH	TN	VL	-0.15	-0.00018	PASS
				VN	0.39	0.00047	PASS
				VH	0.54	0.00066	PASS
		MCH	TN	VL	0.47	0.00056	PASS
				VN	-0.01	-0.00001	PASS
				VH	-0.55	-0.00066	PASS
		HCH	TN	VL	0.12	0.00014	PASS
				VN	0.25	0.00029	PASS
				VH	0.76	0.00090	PASS

Frequency Error VS. Temperature

Test Band	Test mode	Test Channel	Test Volt.	Test Temp.	Freq. Error [Hz]	Freq. vs. rated [ppm]	Verdict
NB-IoT Band 5	BPSK/ 15KHz	LCH	VN	-30	0.53	0.00064	PASS
				-20	0.25	0.00030	PASS
				-10	0.57	0.00069	PASS
				0	0.57	0.00069	PASS
				10	0.55	0.00067	PASS
				20	0.36	0.00044	PASS
				30	-0.22	-0.00027	PASS
				40	0.53	0.00064	PASS
				50	0.34	0.00041	PASS
		MCH	VN	-30	0.19	0.00023	PASS
				-20	0.22	0.00026	PASS
				-10	0.91	0.00109	PASS
				0	0.42	0.00050	PASS
				10	0.85	0.00102	PASS
				20	0.92	0.00110	PASS
				30	1.25	0.00149	PASS
				40	0.93	0.00111	PASS
				50	0.07	0.00008	PASS
		HCH	VN	-30	1.14	0.00134	PASS
				-20	0.54	0.00064	PASS
				-10	1.15	0.00135	PASS
				0	-0.15	-0.00018	PASS
				10	-0.27	-0.00032	PASS
				20	1.02	0.00120	PASS
				30	-0.31	-0.00037	PASS
				40	-0.09	-0.00011	PASS
				50	-0.69	-0.00081	PASS

Test Band	Test mode	Test Channel	Test Volt.	Test Temp.	Freq. Error [Hz]	Freq. vs. rated [ppm]	Verdict
NB-IoT Band 5	QPSK/ 15KHz	LCH	VN	-30	0.15	0.00018	PASS
				-20	0.16	0.00019	PASS
				-10	-1.74	-0.00211	PASS
				0	-1.58	-0.00192	PASS
				10	-0.25	-0.00030	PASS
				20	-0.44	-0.00053	PASS
				30	-0.52	-0.00063	PASS
				40	-0.65	-0.00079	PASS
				50	-0.35	-0.00042	PASS
		MCH	VN	-30	-0.06	-0.00007	PASS
				-20	-0.05	-0.00006	PASS
				-10	1.17	0.00140	PASS
				0	-0.11	-0.00013	PASS
				10	-1.37	-0.00164	PASS
				20	1.22	0.00146	PASS
				30	1.24	0.00148	PASS
				40	0.01	0.00001	PASS
				50	0.73	0.00087	PASS
		HCH	VN	-30	0.15	0.00018	PASS
				-20	0.42	0.00049	PASS
				-10	0.91	0.00107	PASS
				0	-0.22	-0.00026	PASS
				10	-0.07	-0.00008	PASS
				20	0.39	0.00046	PASS
				30	0.08	0.00009	PASS
				40	0.17	0.00020	PASS
				50	0.63	0.00074	PASS

- End of the Appendix -