

Appendix B: Test Results of Bluetooth LE

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Appendix B.1: Test Results of Frequency Tolerance

Test Result

Test Condition	Test Mode	Antenna	Freq(MHz)	Result[ppm]	Limit[ppm]	Verdict
NTNV	BLE_1M	Ant1	2402	-9.99167	±50	PASS
			2440	-5.53279	±50	PASS
			2480	-6.04839	±50	PASS
NTLV	BLE_1M	Ant1	2402	-6.86928	±50	PASS
			2440	-6.76230	±50	PASS
			2480	-9.07258	±50	PASS
NTHV	BLE_1M	Ant1	2402	-5.62032	±50	PASS
			2440	-9.83607	±50	PASS
			2480	-10.28226	±50	PASS

Test Graphs





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Appendix B.2: Test Results of Antenna Power

Test Result

Antenna Power									
Test Condition	TestMode	Antenna	Freq (MHz)	Result (dBm)	Result (mW)	90% BW (MHz)	Result (mW /MHz)	Limit (mW /MHz)	Verdict
NTNV	BLE_1M	Ant1	Hop	11.53	14.2233	72.068	0.1974	≤3	PASS
	AFH_BLE_1M	Ant1	Hop	11.78	15.0661	36.621	0.4114	≤3	PASS
NTLV	BLE_1M	Ant1	Hop	11.88	15.4170	72.068	0.2139	≤3	PASS
	AFH_BLE_1M	Ant1	Hop	11.88	15.4170	36.621	0.4210	≤3	PASS
NTHV	BLE_1M	Ant1	Hop	11.53	14.2233	72.068	0.1974	≤3	PASS
	AFH_BLE_1M	Ant1	Hop	11.89	15.4525	36.621	0.4220	≤3	PASS

Tolerance								
Test Condition	Test Mode	Antenna	Freq (MHz)	Power (mW /MHz)	RatedPower (mW /MHz)	Result (%)	Limit (%)	Verdict
NTNV	BLE_1M	Ant1	Hop	0.1974	0.8	-75.33	-80 to +20	PASS
	AFH_BLE_1M	Ant1	Hop	0.4114	1.5	-72.57	-80 to +20	PASS
NTLV	BLE_1M	Ant1	Hop	0.2139	0.8	-73.26	-80 to +20	PASS
	AFH_BLE_1M	Ant1	Hop	0.4210	1.5	-71.93	-80 to +20	PASS
NTHV	BLE_1M	Ant1	Hop	0.1974	0.8	-75.33	-80 to +20	PASS
	AFH_BLE_1M	Ant1	Hop	0.4220	1.5	-71.87	-80 to +20	PASS

EIRP							
Test Condition	TestMode	Antenna	Freq (MHz)	Power (dBm)	EIRP(dBm)	Limit(dBm)	Verdict
NTNV	BLE_1M	Ant1	Hop	-7.05	-6.45	≤6.91	PASS
	AFH_BLE_1M	Ant1	Hop	-3.86	-3.26	≤6.91	PASS
NTLV	BLE_1M	Ant1	Hop	-6.70	-6.10	≤6.91	PASS
	AFH_BLE_1M	Ant1	Hop	-3.76	-3.16	≤6.91	PASS
NTHV	BLE_1M	Ant1	Hop	-7.05	-6.45	≤6.91	PASS
	AFH_BLE_1M	Ant1	Hop	-3.75	-3.15	≤6.91	PASS

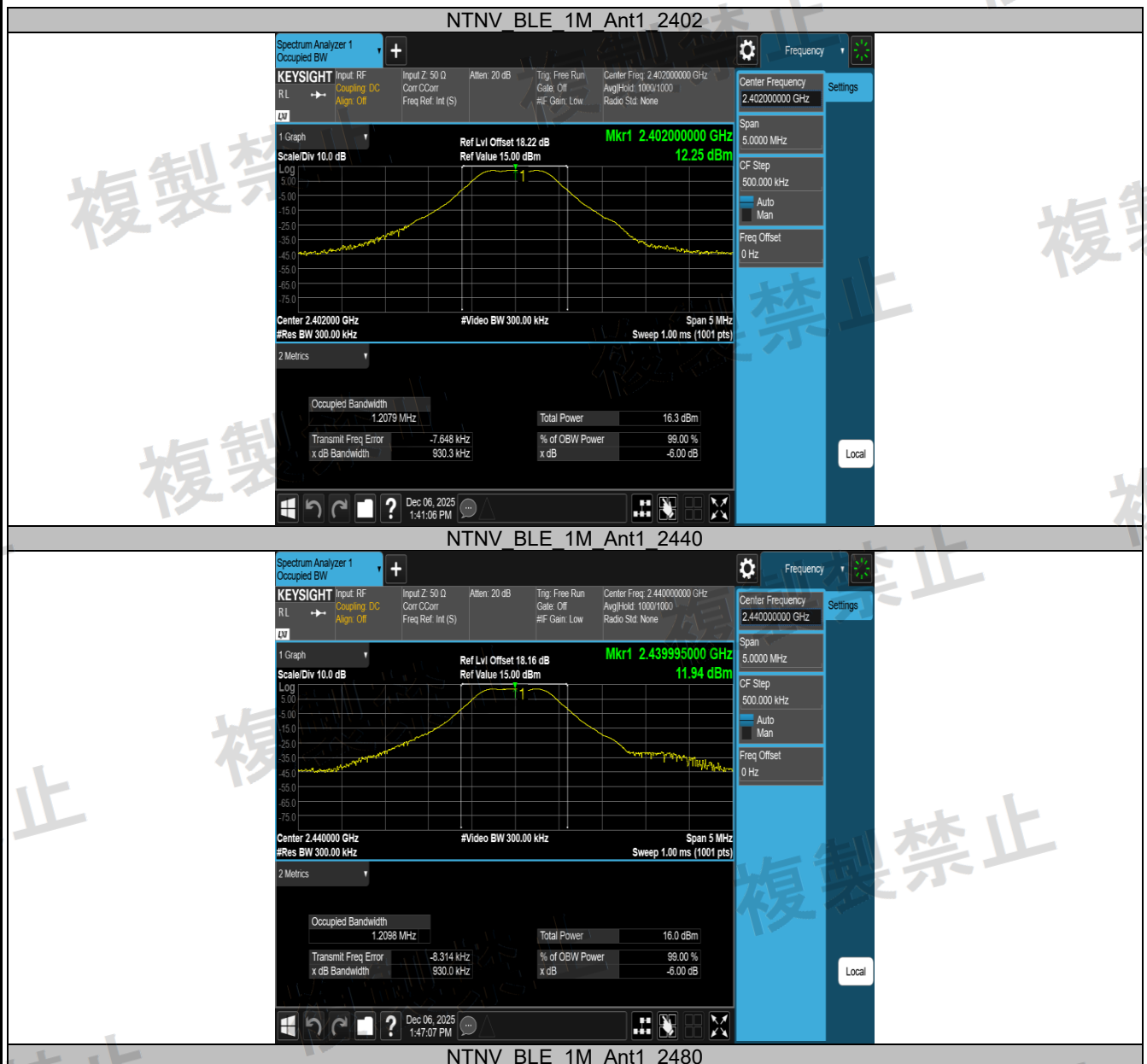
Appendix B.3: Test Results of Occupied Channel Bandwidth (99%)

Test Result

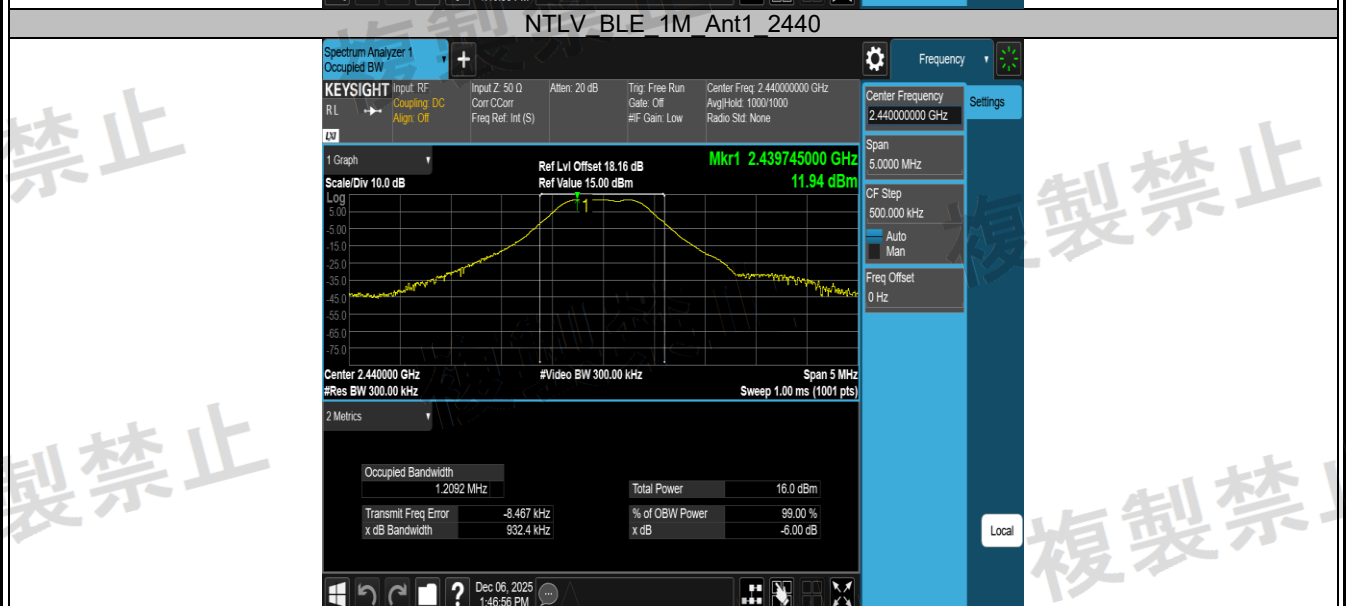
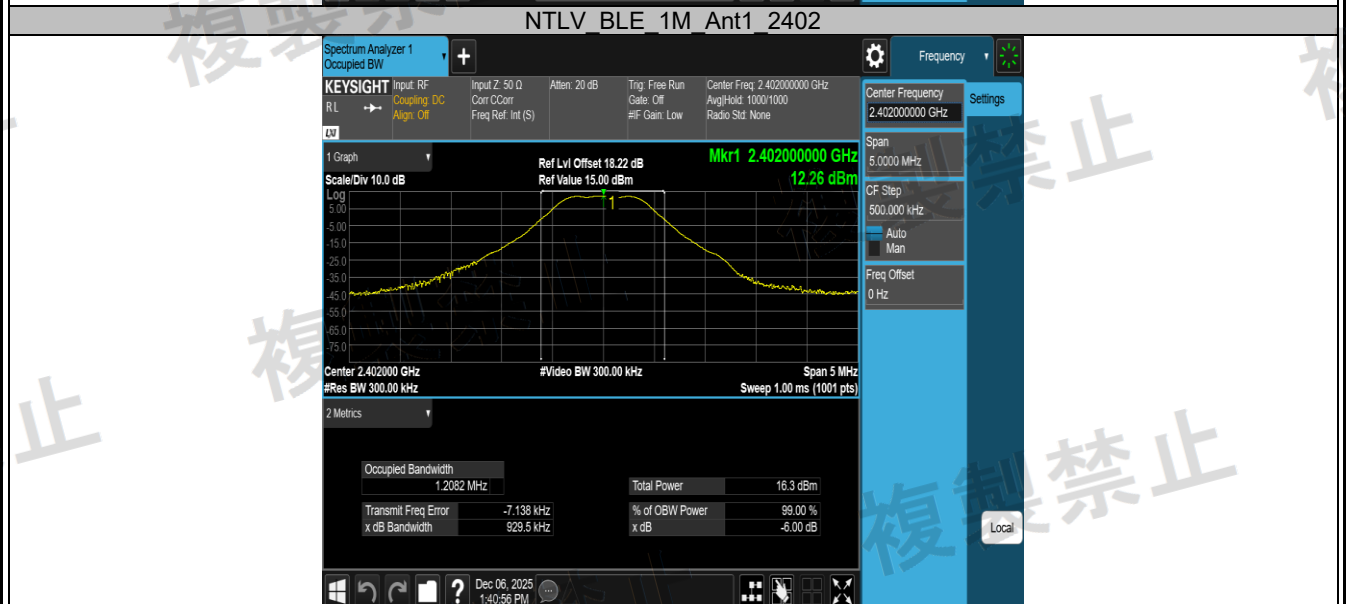
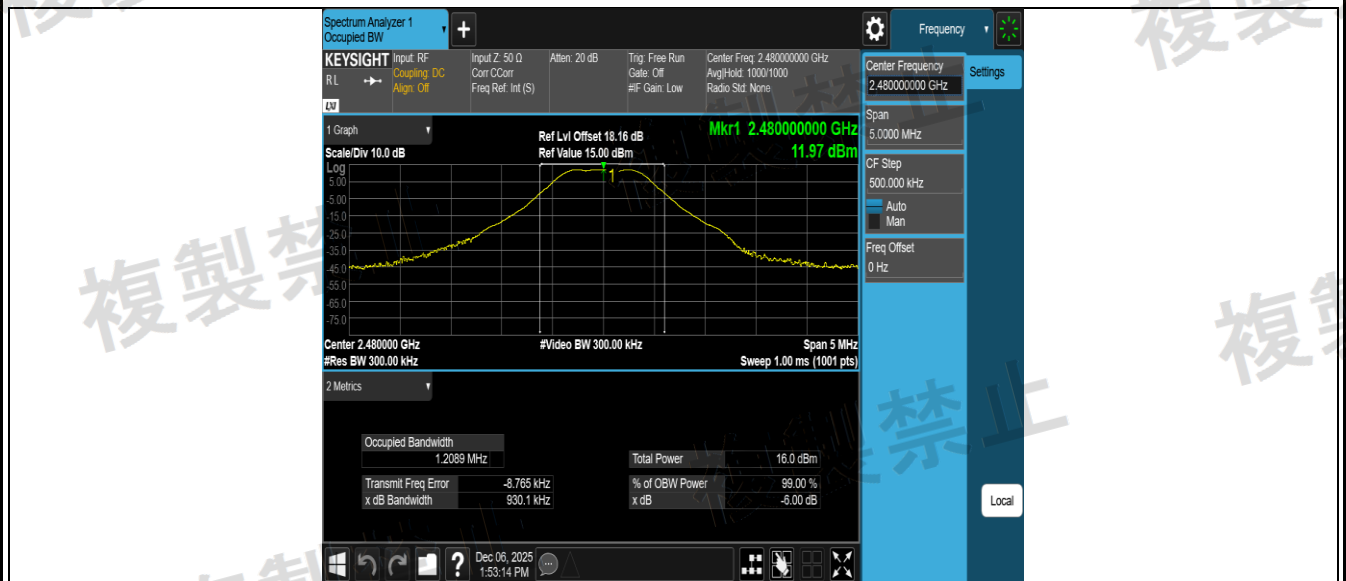
Test Condition	Test Mode	Antenna	Freq(MHz)	Result [MHz]	Limit [MHz]	Verdict
NTNV	BLE_1M	Ant1	2402	1.208	≤83.5	PASS
			2440	1.210	≤83.5	PASS
			2480	1.209	≤83.5	PASS
NTLV	BLE_1M	Ant1	2402	1.208	≤83.5	PASS
			2440	1.209	≤83.5	PASS
			2480	1.209	≤83.5	PASS
NTHV	BLE_1M	Ant1	2402	1.208	≤83.5	PASS
			2440	1.210	≤83.5	PASS
			2480	1.208	≤83.5	PASS

Test Condition	Test Mode	Antenna	Freq(MHz)	Result [MHz]	Limit [MHz]	Verdict
NTNV	BLE_1M	Ant1	Hop	78.480	≤83.5	PASS
	AFH BLE_1M	Ant1	Hop	38.735	≤83.5	PASS
NTLV	BLE_1M	Ant1	Hop	78.519	≤83.5	PASS
	AFH BLE_1M	Ant1	Hop	38.735	≤83.5	PASS
NTHV	BLE_1M	Ant1	Hop	78.445	≤83.5	PASS
	AFH BLE_1M	Ant1	Hop	38.736	≤83.5	PASS

Test Graphs



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NTLV_BLE_1M_Ant1_2402

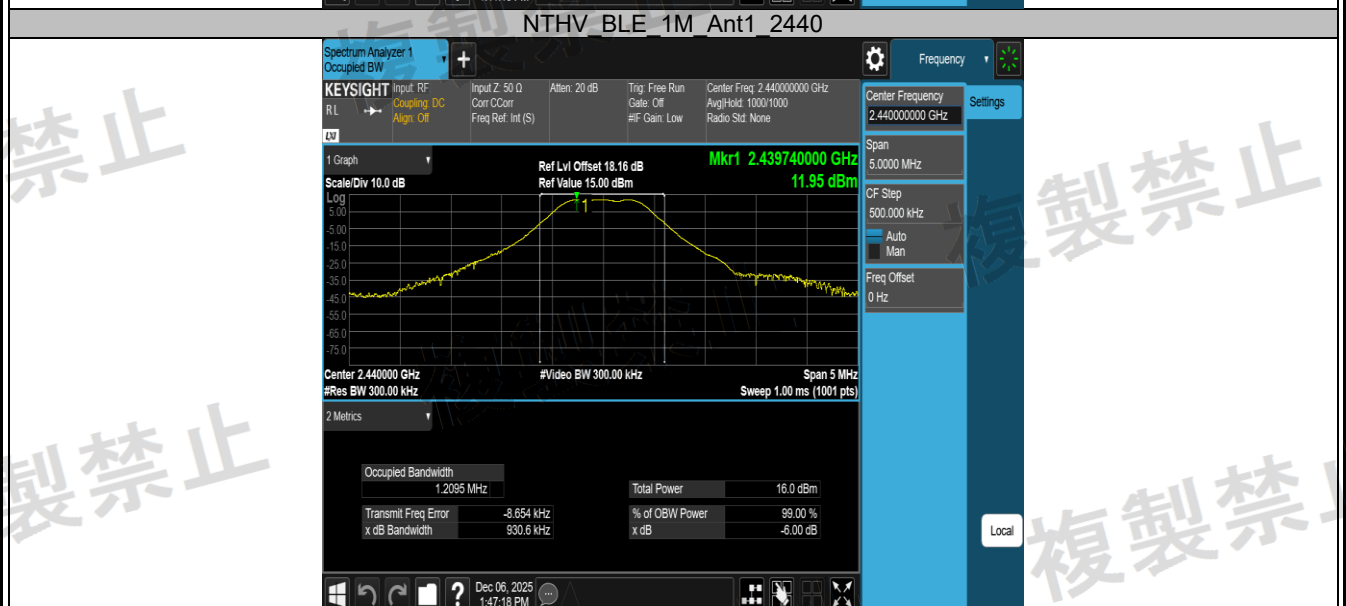
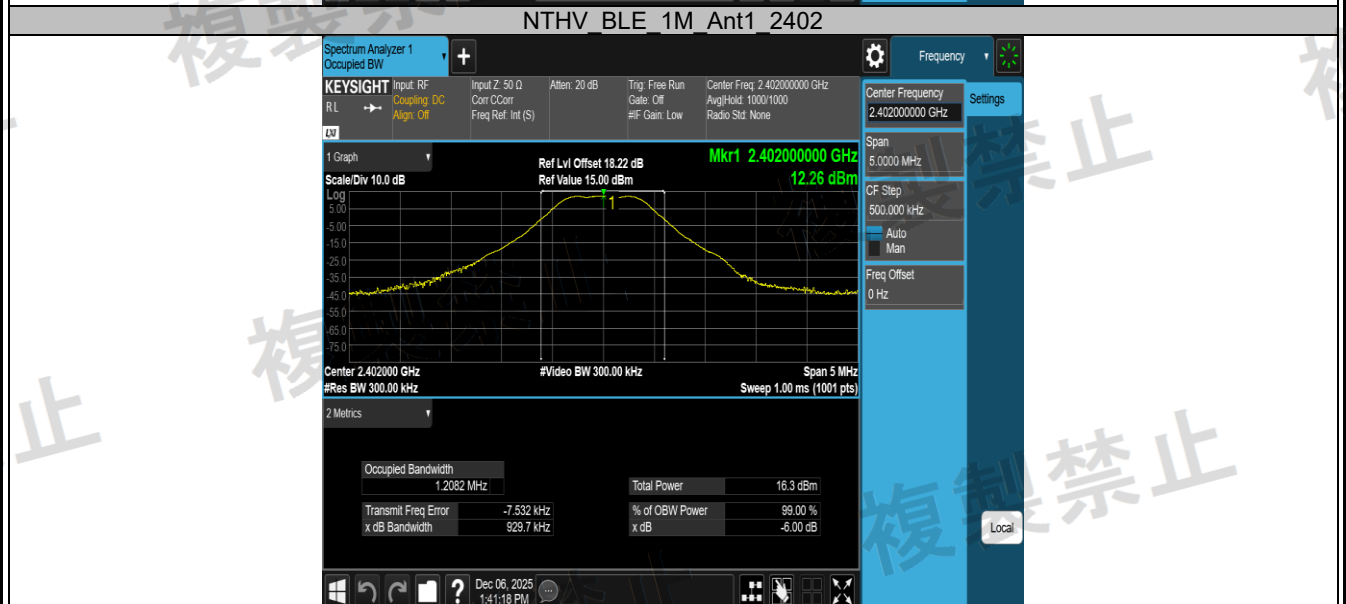
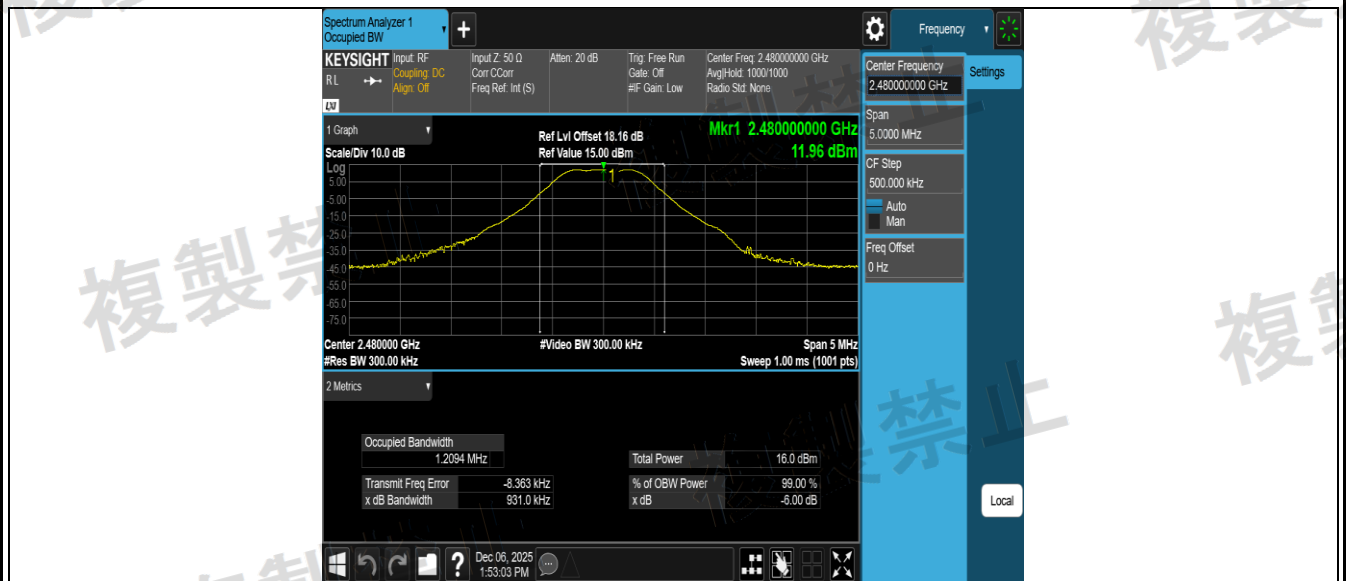
NTLV_BLE_1M_Ant1_2440

NTLV_BLE_1M_Ant1_2480

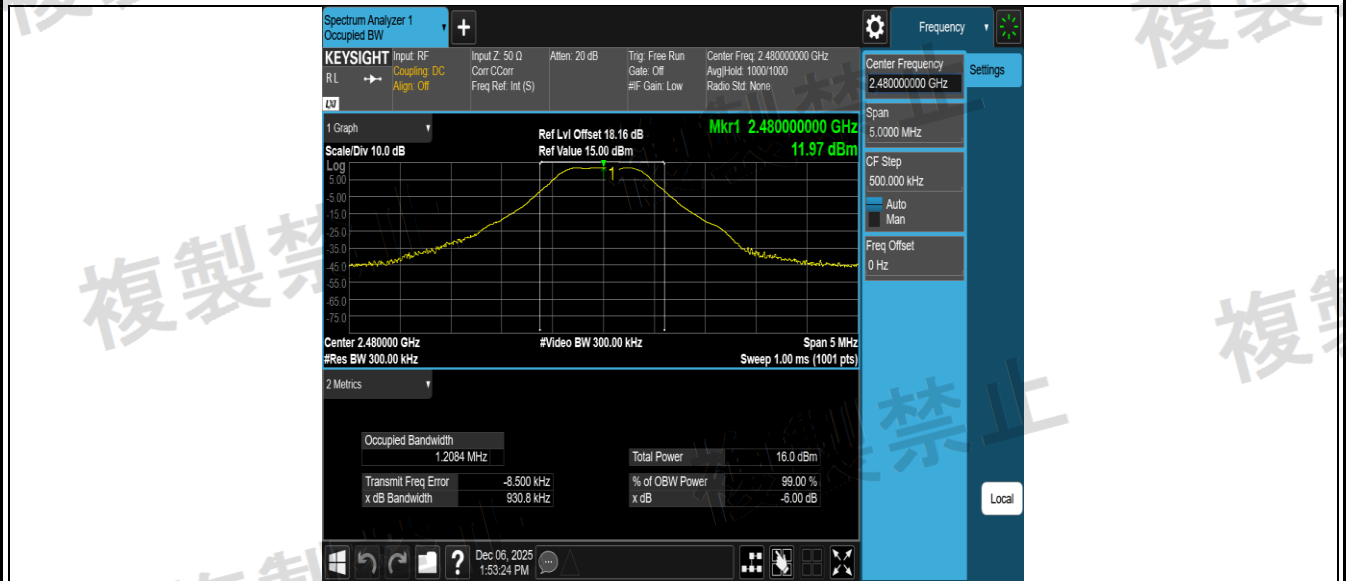
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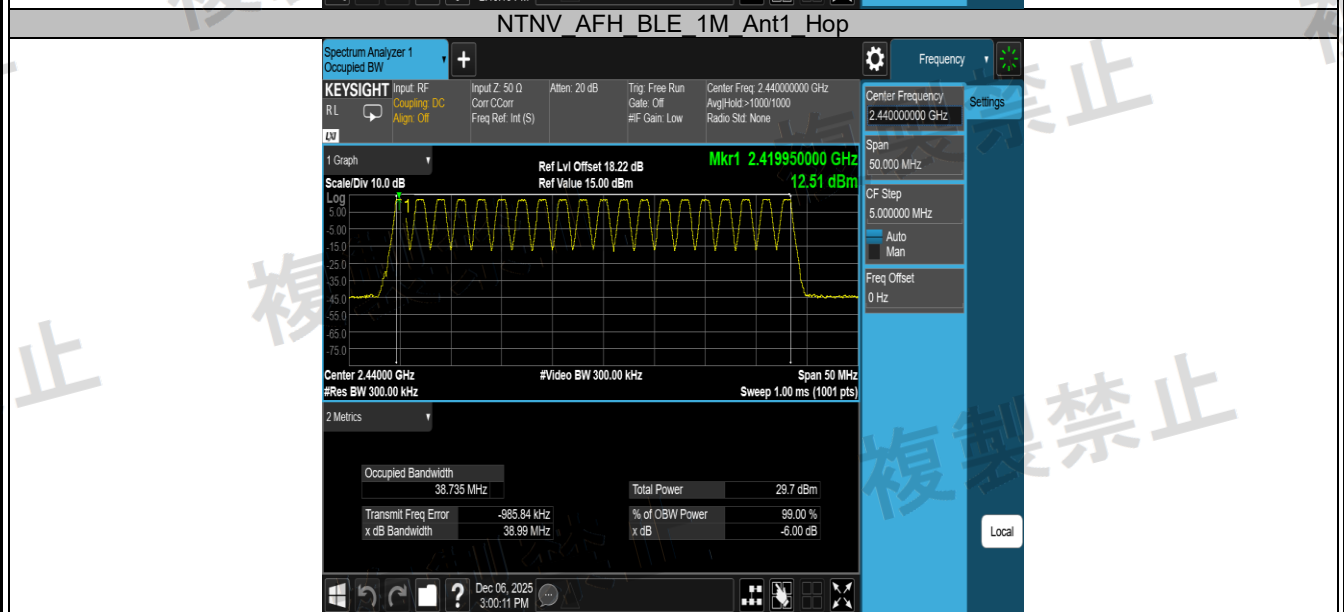
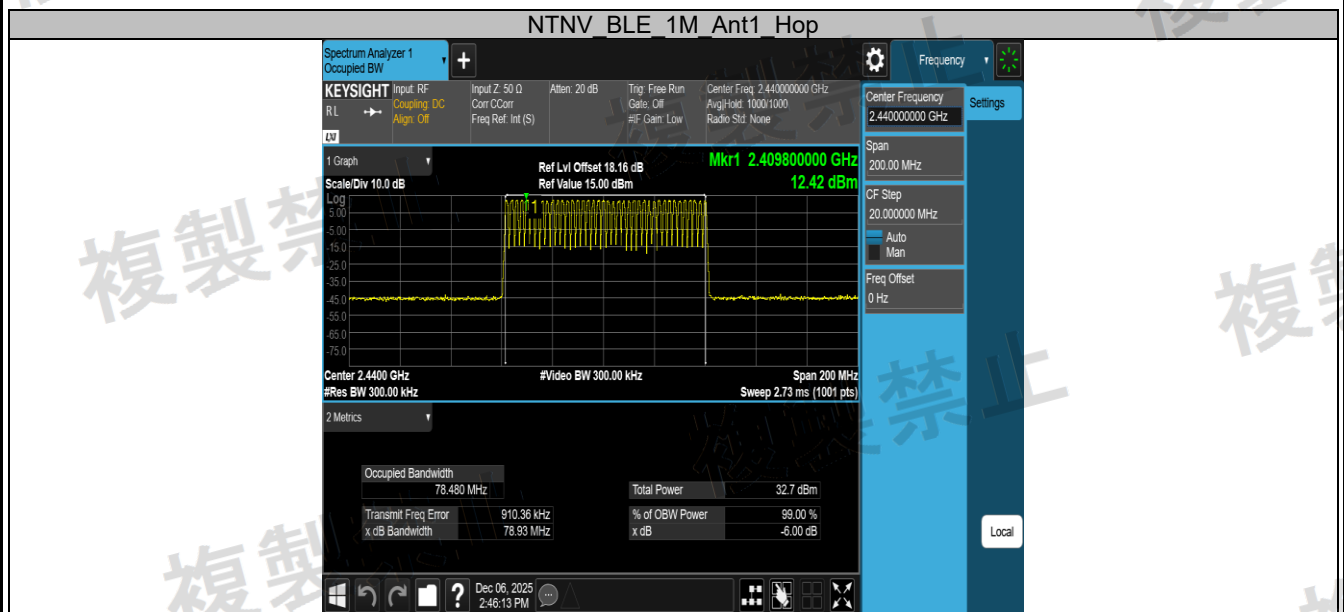
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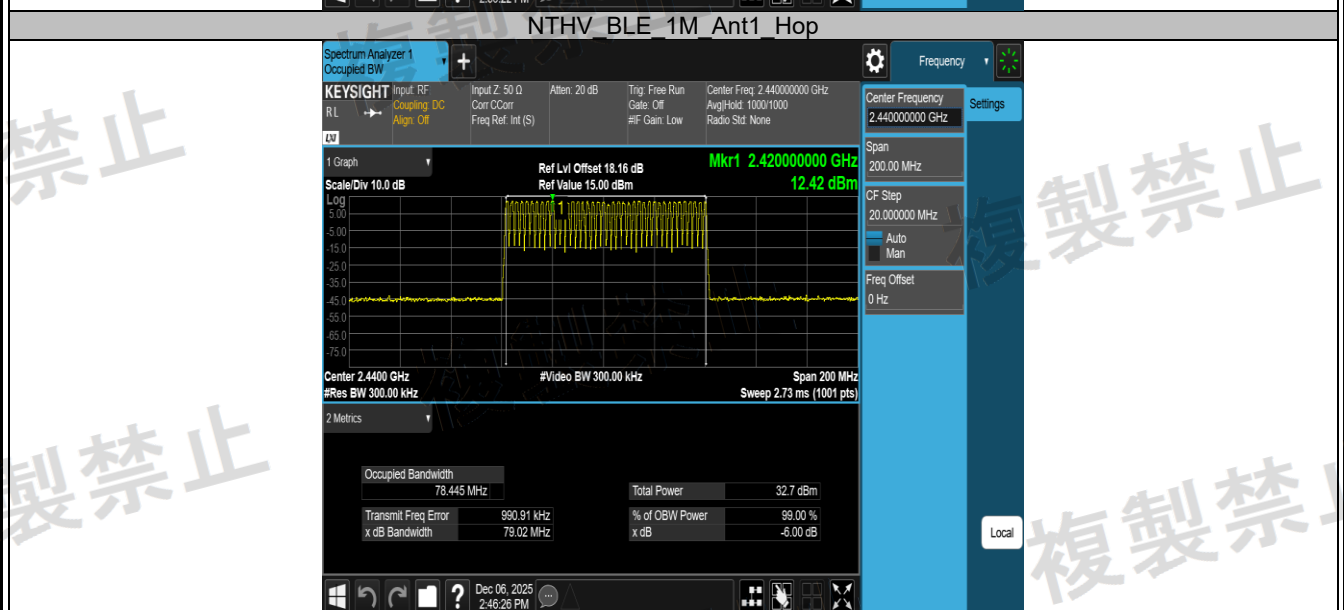
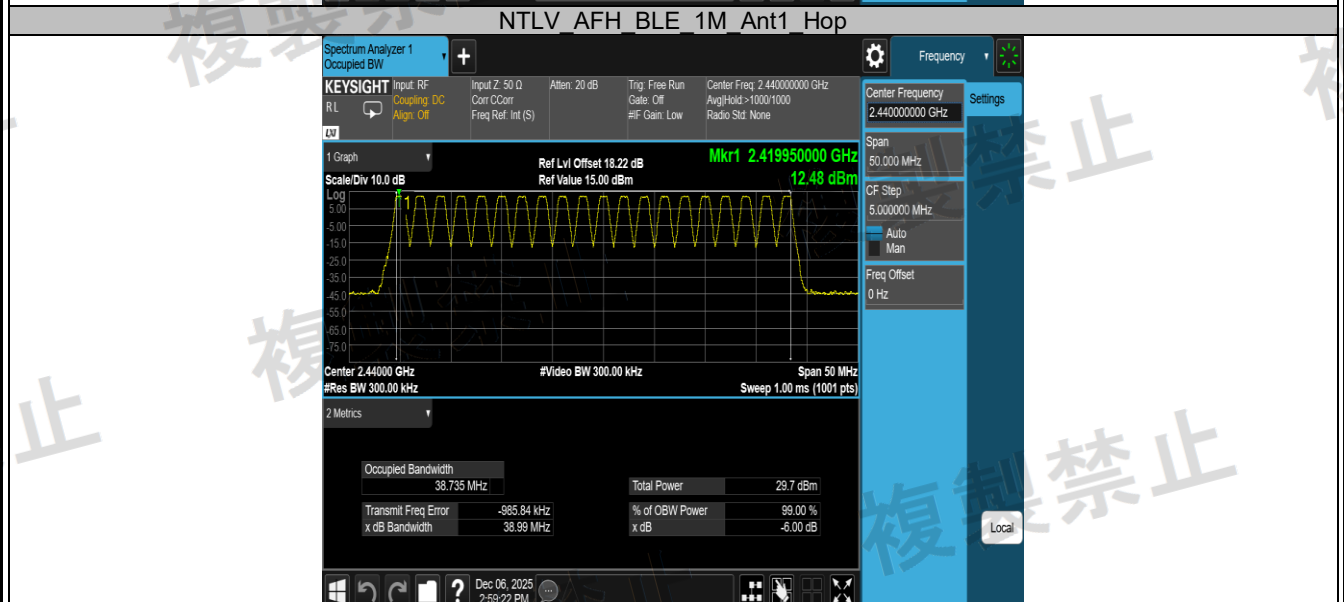
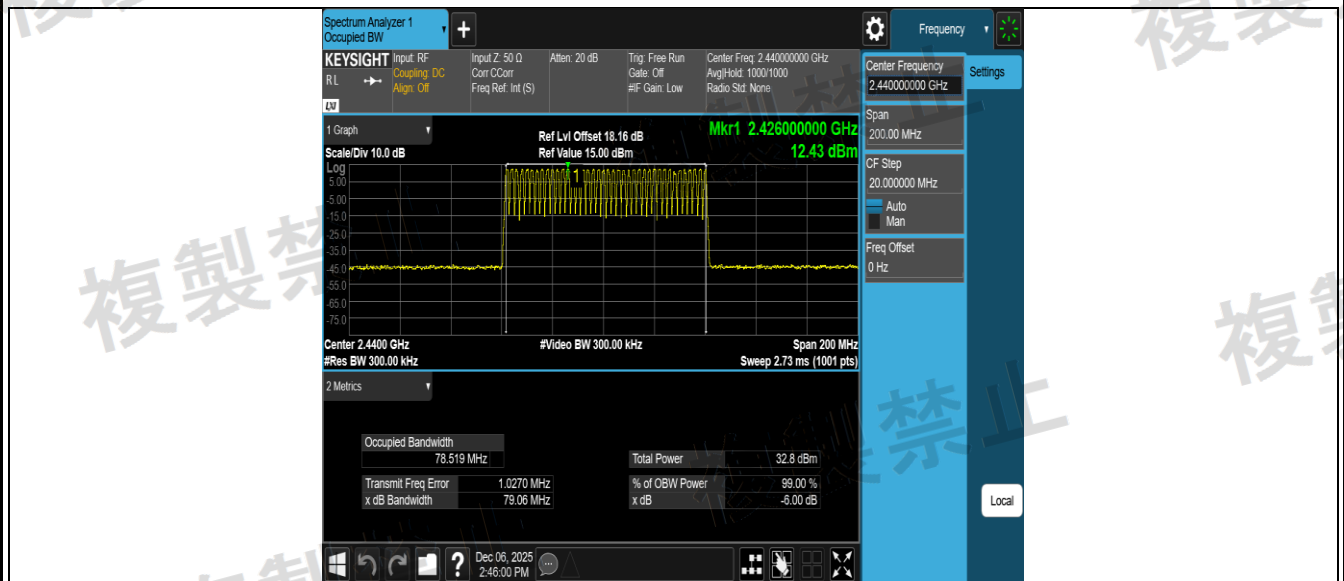
NTHV_BLE_1M_Ant1_2480

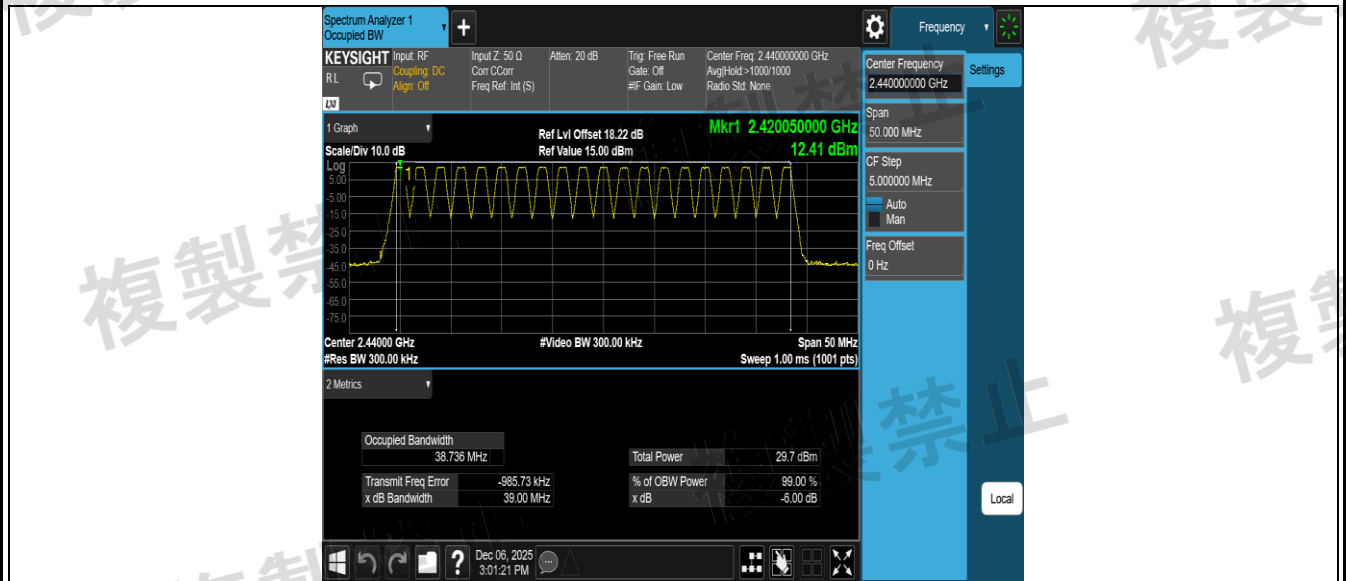




NTLV_BLE_1M_Ant1_Hop

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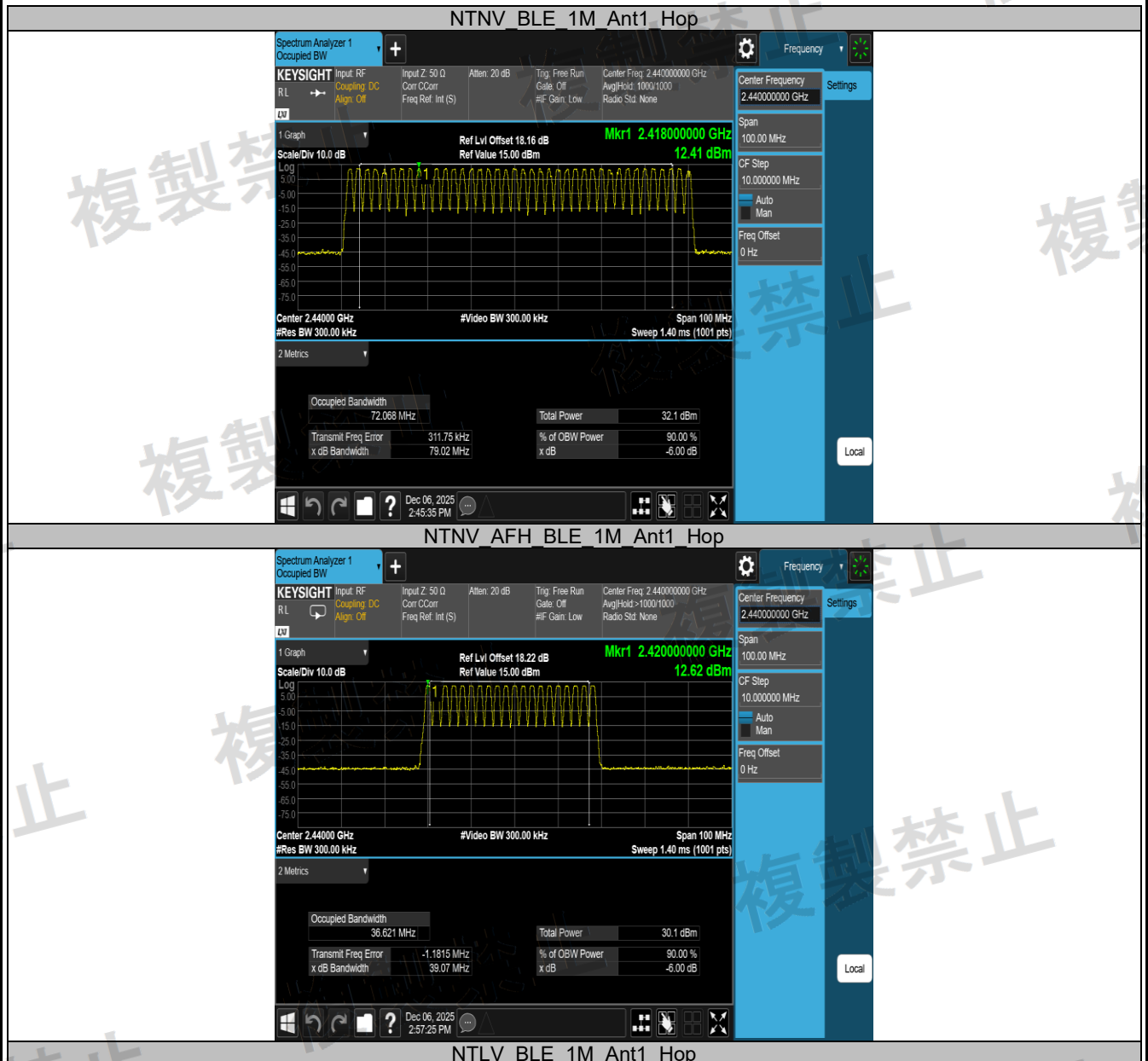


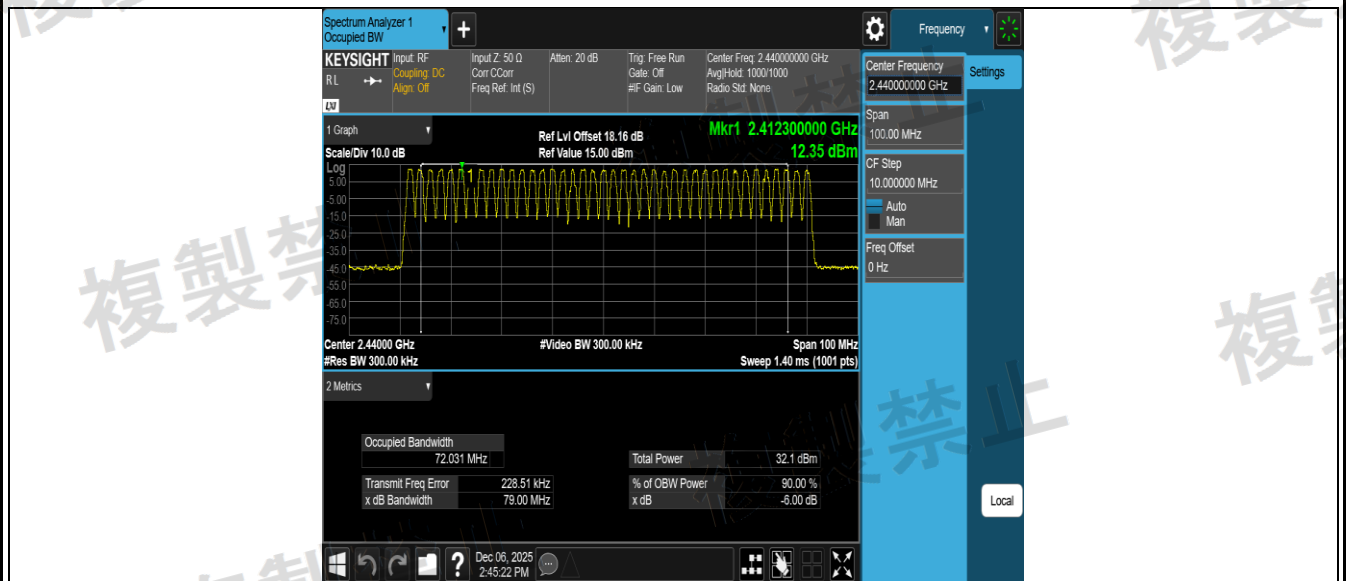
Appendix B.4: Test Results of Spread Bandwidth (90%)

Test Result

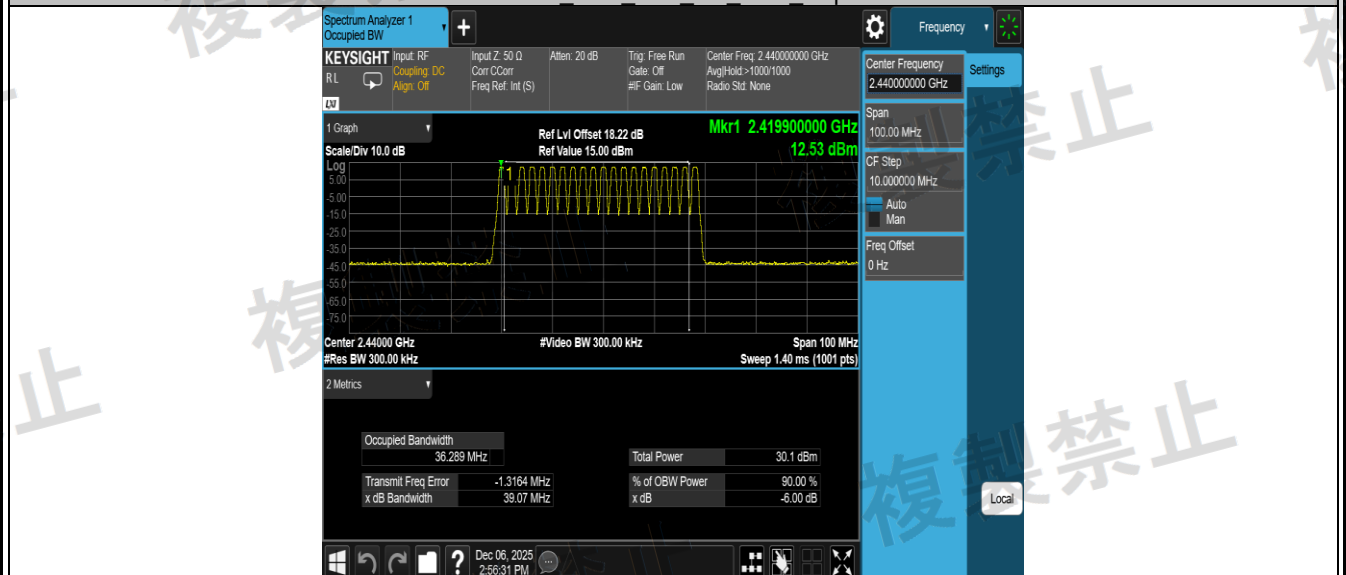
Test Condition	Test Mode	Antenna	Freq(MHz)	Result [MHz]	Limit [MHz]	SpreadFactor	Limit	Verdict
NTNV	BLE_1M	Ant1	Hop	72.068	≥0.5	72.068	>5	PASS
	AFH_BLE_1M	Ant1	Hop	36.621	≥0.5	36.621	>5	PASS
NTLV	BLE_1M	Ant1	Hop	72.031	≥0.5	72.031	>5	PASS
	AFH_BLE_1M	Ant1	Hop	36.289	≥0.5	36.289	>5	PASS
NTHV	BLE_1M	Ant1	Hop	71.879	≥0.5	71.879	>5	PASS
	AFH_BLE_1M	Ant1	Hop	36.872	≥0.5	36.872	>5	PASS

Test Graphs

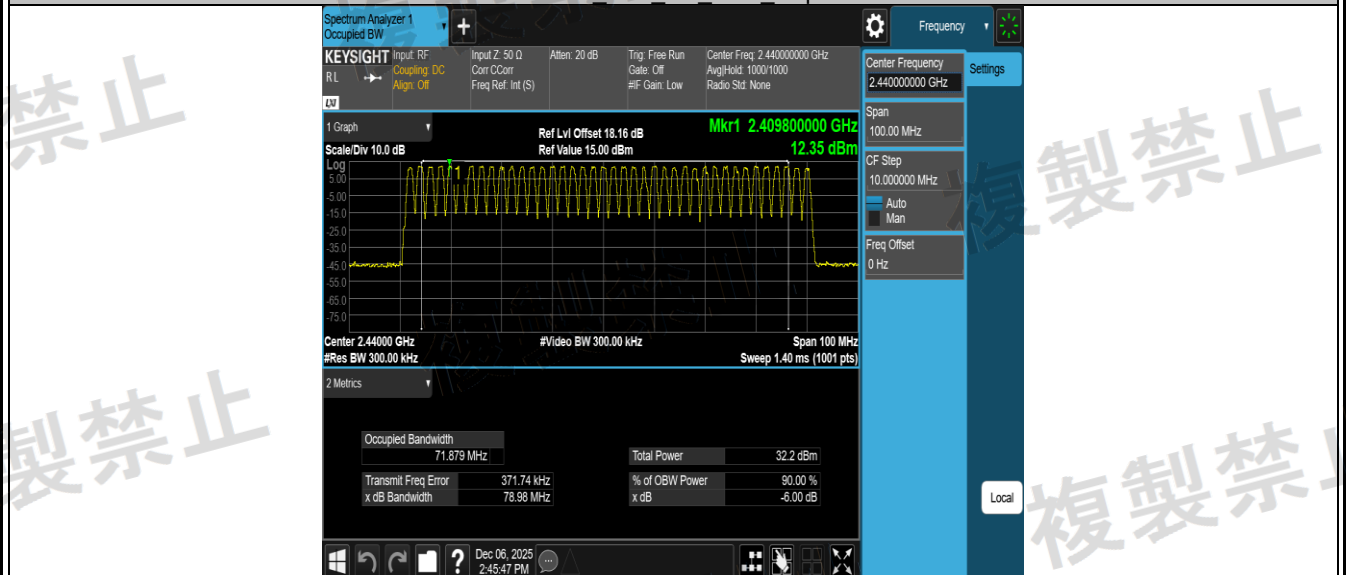




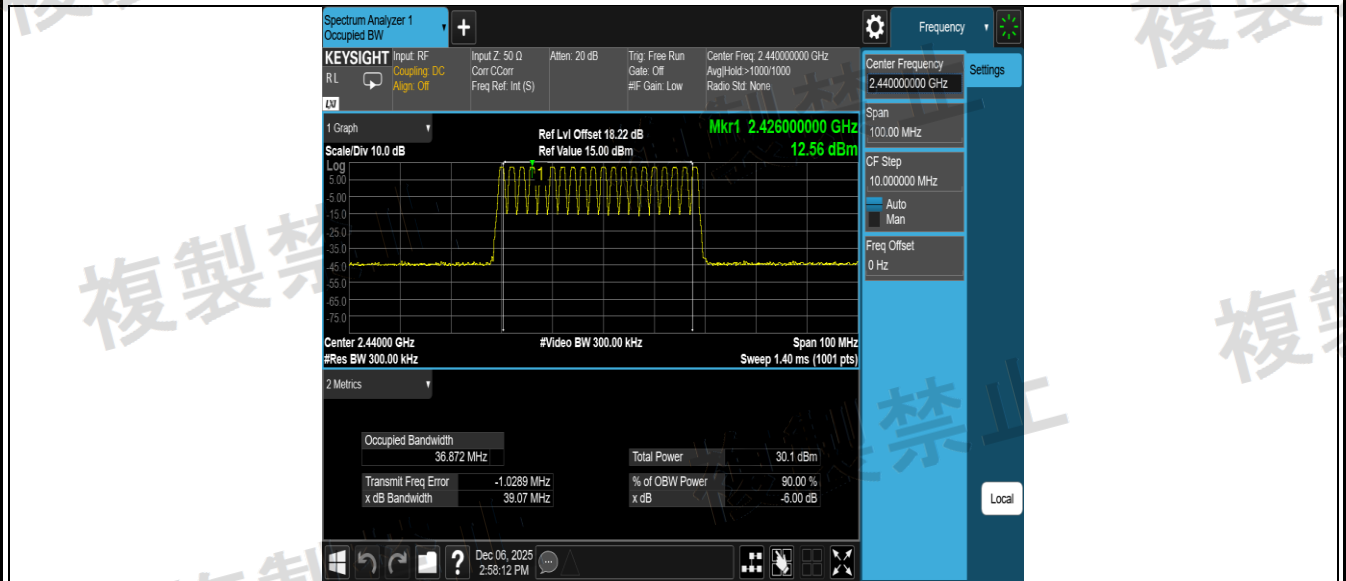
NTLV AFH BLE 1M Ant1 Hop



NTHV BLE 1M Ant1 Hop



NTHV AFH BLE 1M Ant1 Hop

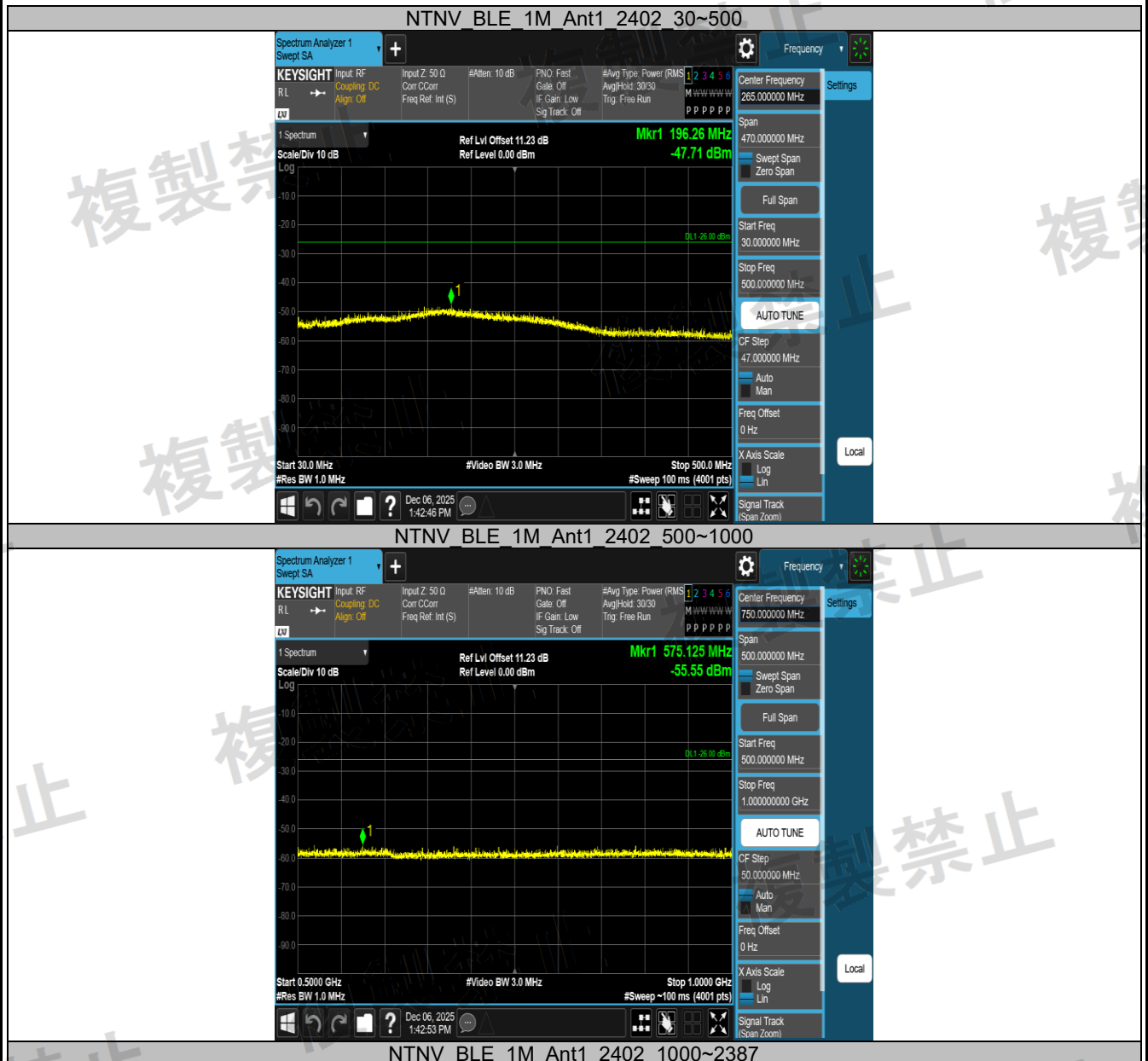


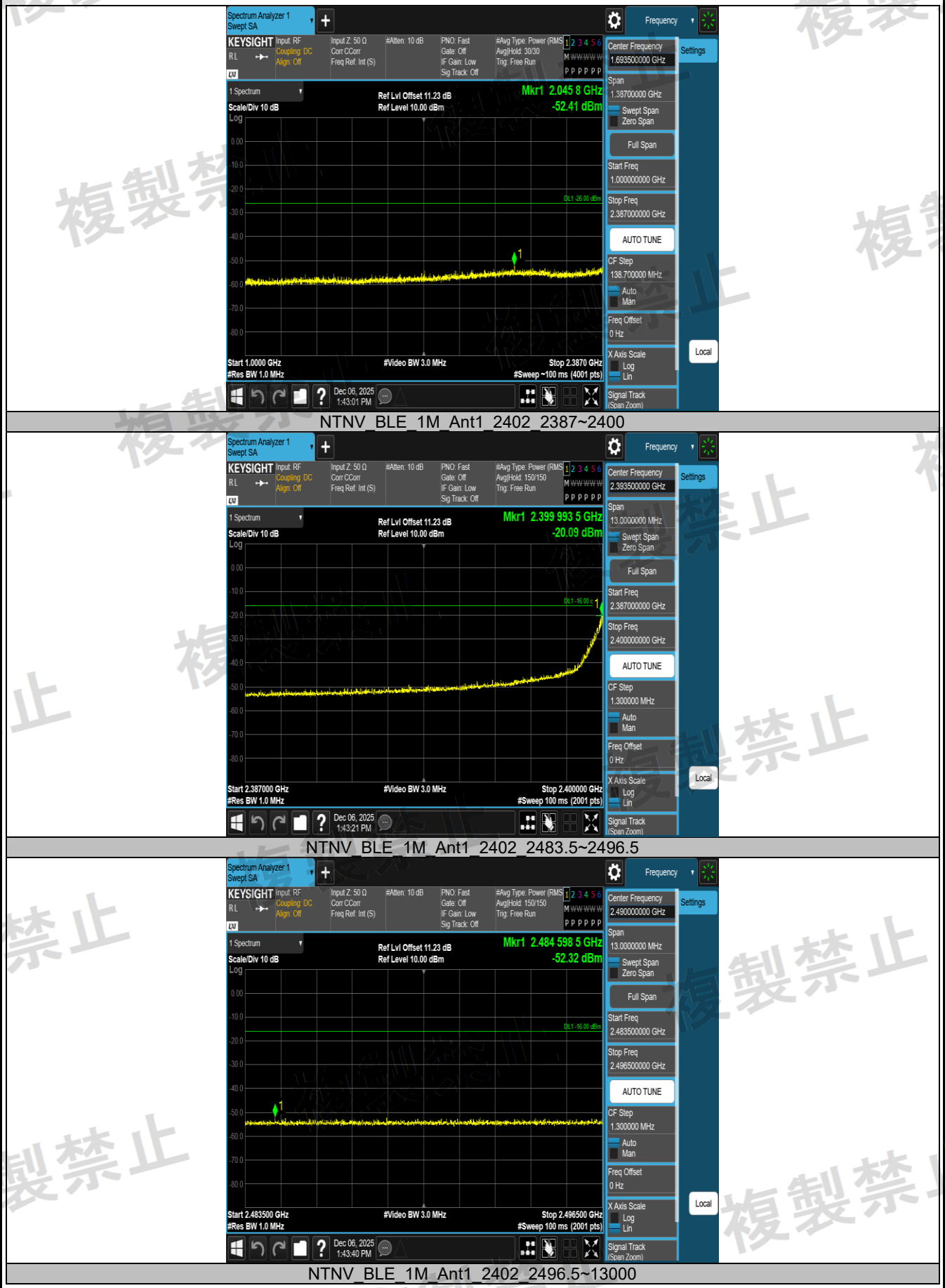
Appendix B.5: Test Results of Spurious Emissions for Transmitter

Test Result

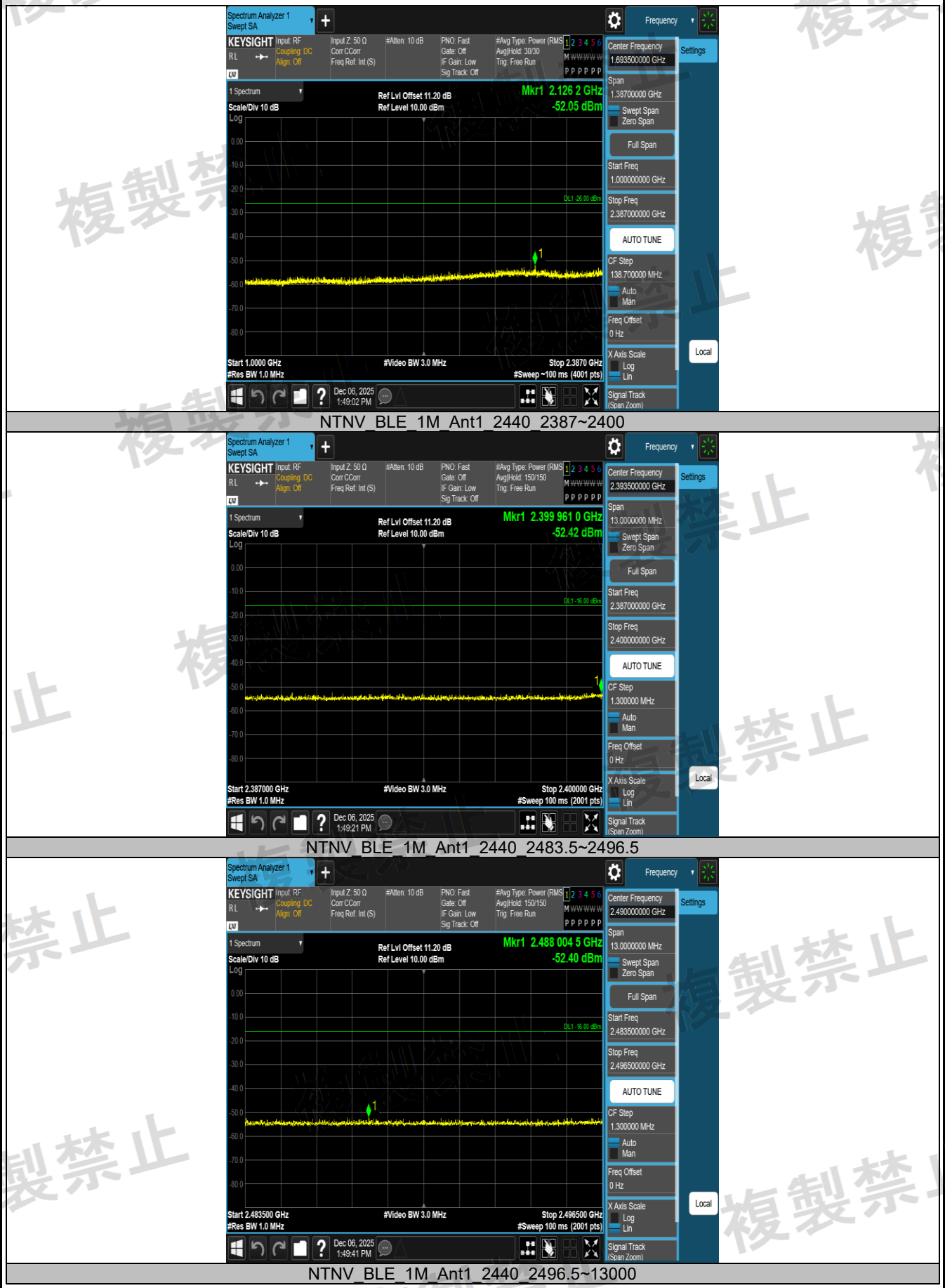
Test Condition	Test Mode	Antenna	Freq(MHz)	Freq.Range [MHz]	Freq. [MHz]	Result [dBm]	Limit [dBm]	Result [μW]	Limit [μW]	Verdict
NTNV	BLE_1M	Ant1	2402	30~500	196.26	-47.71	≤-26	0.01694	≤2.5	PASS
				500~1000	575.13	-55.55	≤-26	0.00279	≤2.5	PASS
				1000~2387	2045.80	-52.41	≤-26	0.00574	≤2.5	PASS
				2387~2400	2399.99	-20.09	≤-16	9.79490	≤25	PASS
				2483.5~2496.5	2484.60	-52.32	≤-16	0.00586	≤25	PASS
				2496.5~13000	4803.59	-44.64	≤-26	0.03436	≤2.5	PASS
			2440	30~500	200.38	-48.20	≤-26	0.01514	≤2.5	PASS
				500~1000	593.88	-55.39	≤-26	0.00289	≤2.5	PASS
				1000~2387	2126.24	-52.05	≤-26	0.00624	≤2.5	PASS
				2387~2400	2399.96	-52.42	≤-16	0.00573	≤25	PASS
				2483.5~2496.5	2488.00	-52.40	≤-16	0.00575	≤25	PASS
				2496.5~13000	4880.27	-44.48	≤-26	0.03565	≤2.5	PASS
			2480	30~500	188.98	-48.16	≤-26	0.01528	≤2.5	PASS
				500~1000	930.00	-55.37	≤-26	0.00290	≤2.5	PASS
				1000~2387	1965.01	-52.94	≤-26	0.00508	≤2.5	PASS
				2387~2400	2391.32	-52.63	≤-16	0.00546	≤25	PASS
				2483.5~2496.5	2483.90	-44.95	≤-16	0.03199	≤25	PASS
				2496.5~13000	4959.57	-44.78	≤-26	0.03327	≤2.5	PASS
NTLV	BLE_1M	Ant1	2402	30~500	180.40	-48.47	≤-26	0.01422	≤2.5	PASS
				500~1000	816.13	-55.70	≤-26	0.00269	≤2.5	PASS
				1000~2387	2342.27	-52.54	≤-26	0.00557	≤2.5	PASS
				2387~2400	2400.00	-20.07	≤-16	9.84011	≤25	PASS
				2483.5~2496.5	2484.90	-51.73	≤-16	0.00671	≤25	PASS
				2496.5~13000	4803.59	-44.97	≤-26	0.03184	≤2.5	PASS
			2440	30~500	187.45	-47.87	≤-26	0.01633	≤2.5	PASS
				500~1000	913.25	-55.92	≤-26	0.00256	≤2.5	PASS
				1000~2387	2036.78	-52.52	≤-26	0.00560	≤2.5	PASS
				2387~2400	2399.86	-51.37	≤-16	0.00729	≤25	PASS
				2483.5~2496.5	2492.05	-52.42	≤-16	0.00573	≤25	PASS
				2496.5~13000	4879.74	-44.76	≤-26	0.03342	≤2.5	PASS
			2480	30~500	175.58	-47.39	≤-26	0.01824	≤2.5	PASS
				500~1000	949.25	-55.68	≤-26	0.00270	≤2.5	PASS
				1000~2387	2051.35	-52.93	≤-26	0.00509	≤2.5	PASS
				2387~2400	2398.26	-52.73	≤-16	0.00533	≤25	PASS
				2483.5~2496.5	2483.76	-43.99	≤-16	0.03990	≤25	PASS
				2496.5~13000	4960.62	-44.72	≤-26	0.03373	≤2.5	PASS
NTHV	BLE_1M	Ant1	2402	30~500	184.04	-47.86	≤-26	0.01637	≤2.5	PASS
				500~1000	591.88	-55.71	≤-26	0.00269	≤2.5	PASS
				1000~2387	2387.00	-52.14	≤-26	0.00611	≤2.5	PASS
				2387~2400	2399.99	-19.84	≤-16	10.37528	≤25	PASS
				2483.5~2496.5	2492.93	-51.89	≤-16	0.00647	≤25	PASS
				2496.5~13000	4804.12	-44.54	≤-26	0.03516	≤2.5	PASS
			2440	30~500	191.68	-48.02	≤-26	0.01578	≤2.5	PASS
				500~1000	908.00	-55.96	≤-26	0.00254	≤2.5	PASS
				1000~2387	2007.66	-53.26	≤-26	0.00472	≤2.5	PASS
				2387~2400	2399.91	-52.41	≤-16	0.00574	≤25	PASS
				2483.5~2496.5	2484.48	-51.98	≤-16	0.00634	≤25	PASS
				2496.5~13000	4879.74	-44.28	≤-26	0.03733	≤2.5	PASS
			2480	30~500	172.76	-47.47	≤-26	0.01791	≤2.5	PASS
				500~1000	595.50	-56.02	≤-26	0.00250	≤2.5	PASS
				1000~2387	2030.89	-53.25	≤-26	0.00473	≤2.5	PASS
				2387~2400	2397.21	-52.99	≤-16	0.00502	≤25	PASS
				2483.5~2496.5	2483.59	-45.02	≤-16	0.03148	≤25	PASS
				2496.5~13000	4959.57	-44.89	≤-26	0.03243	≤2.5	PASS

Test Graphs

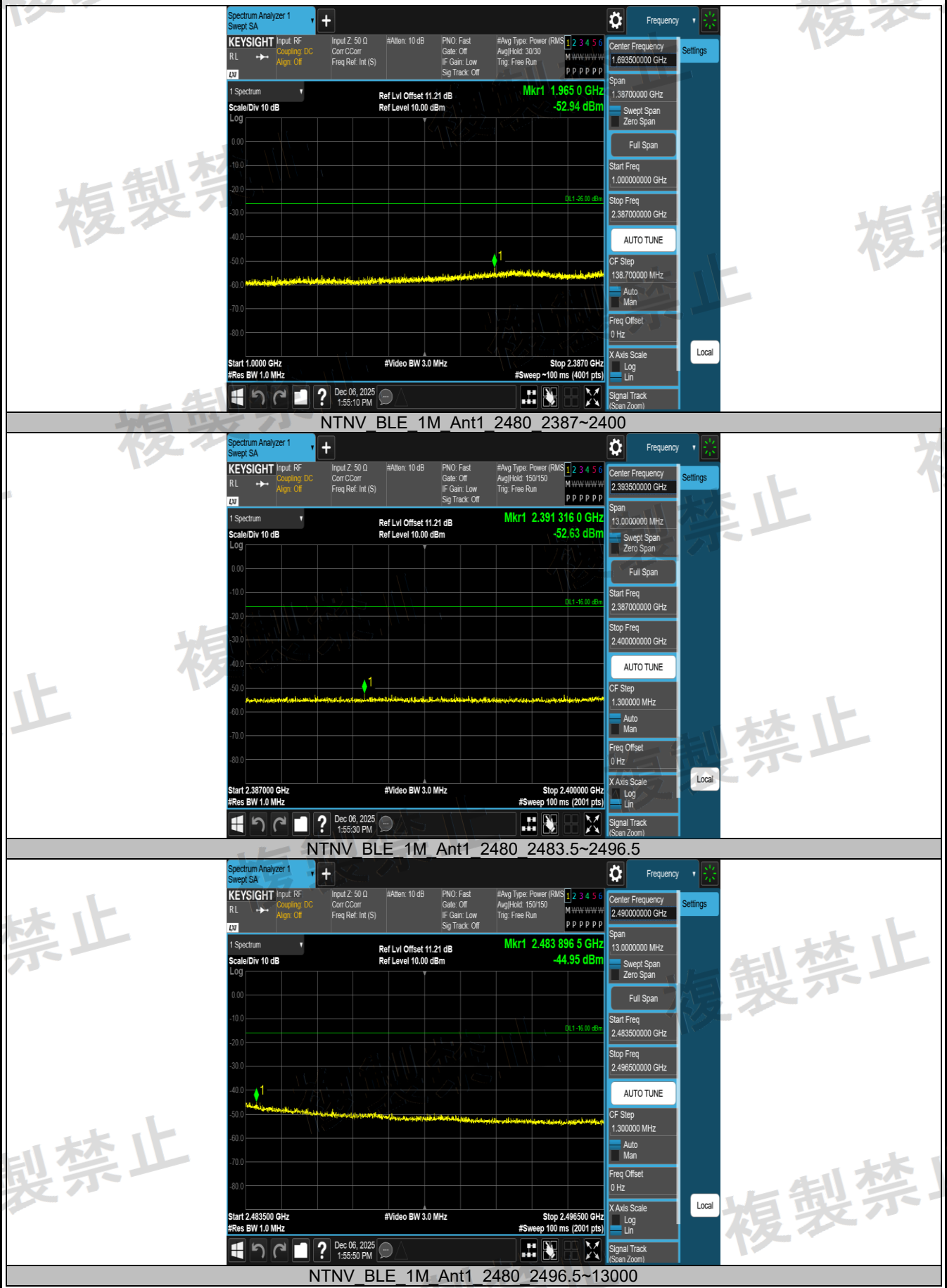




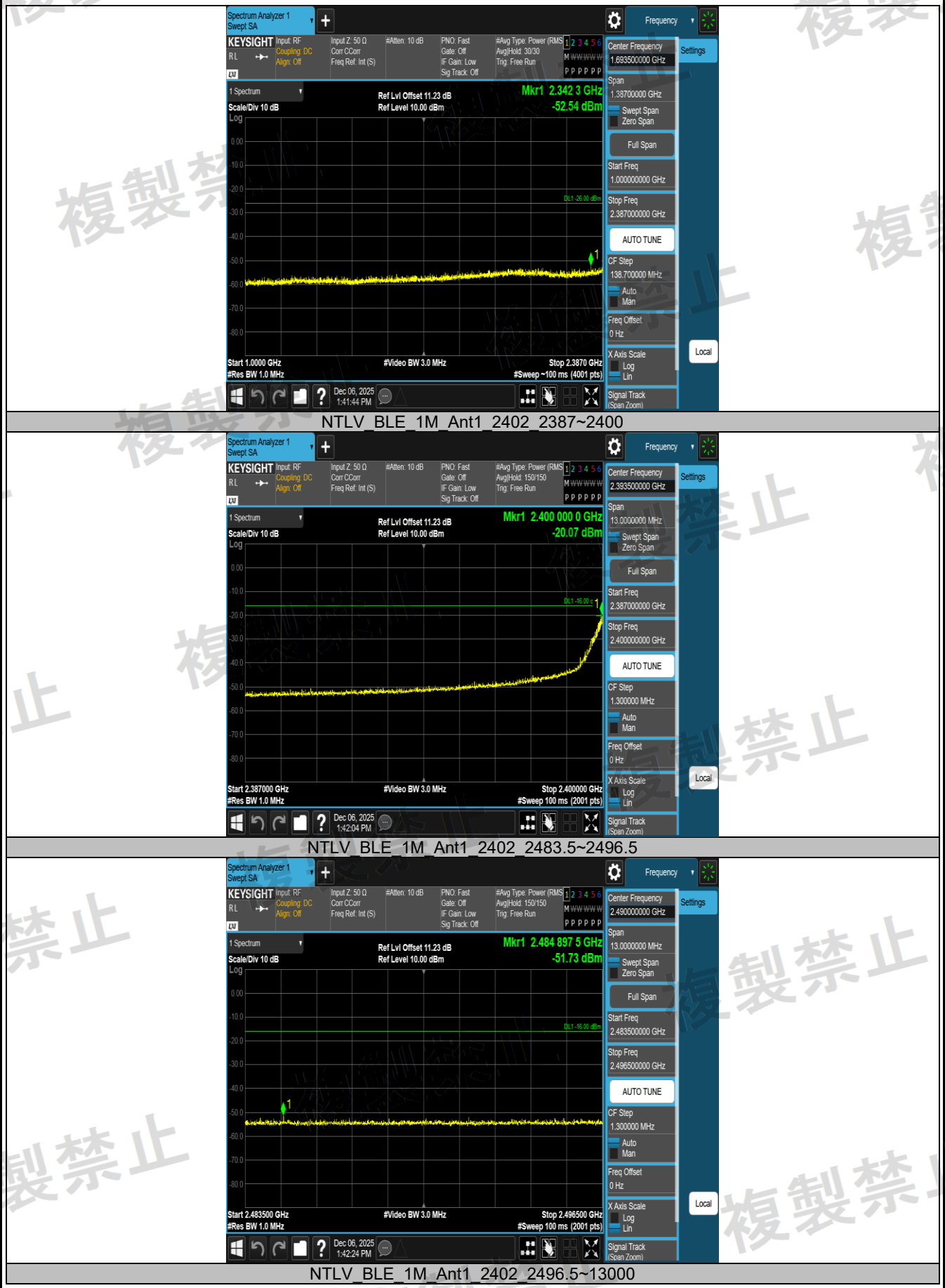








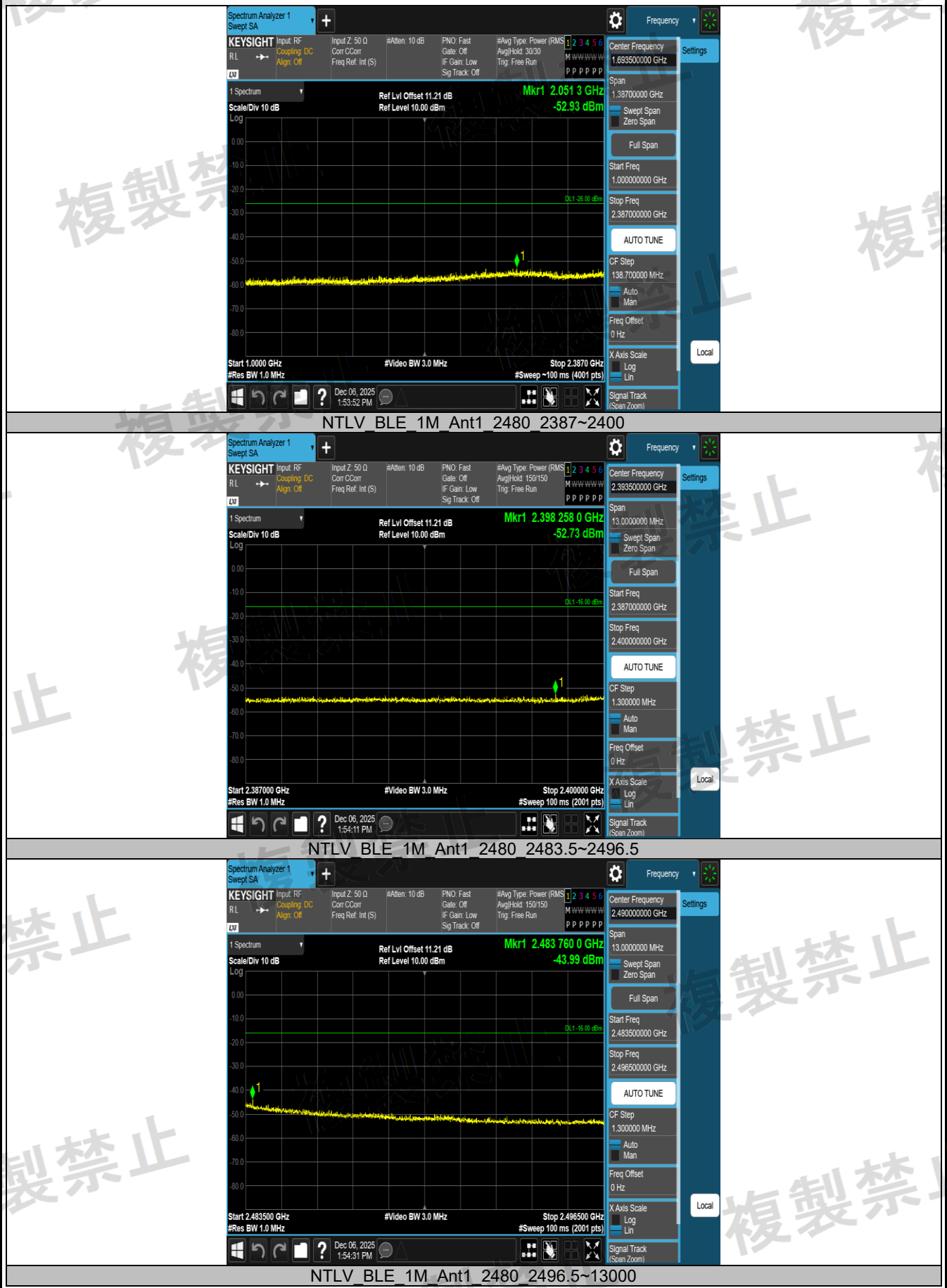




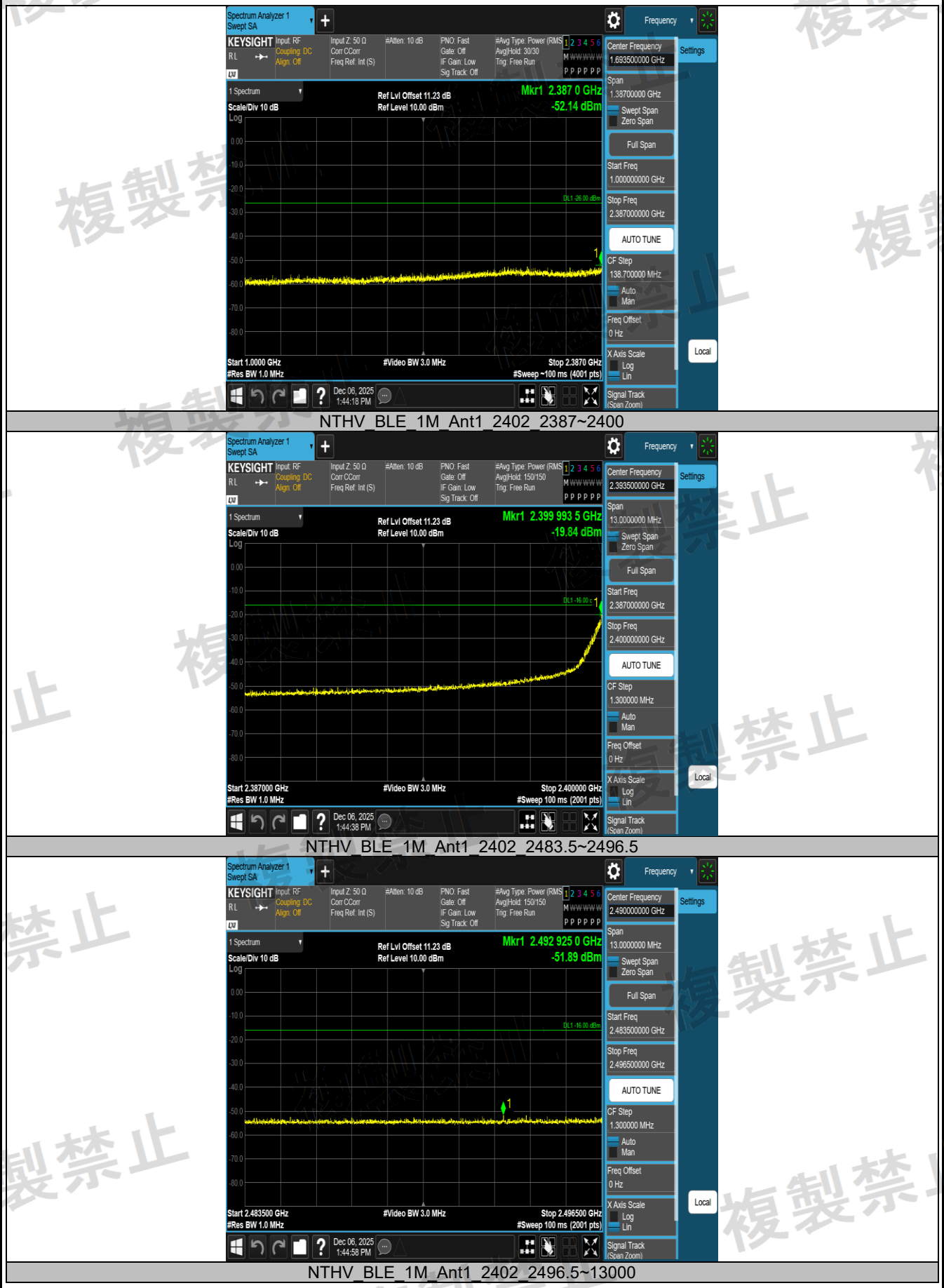








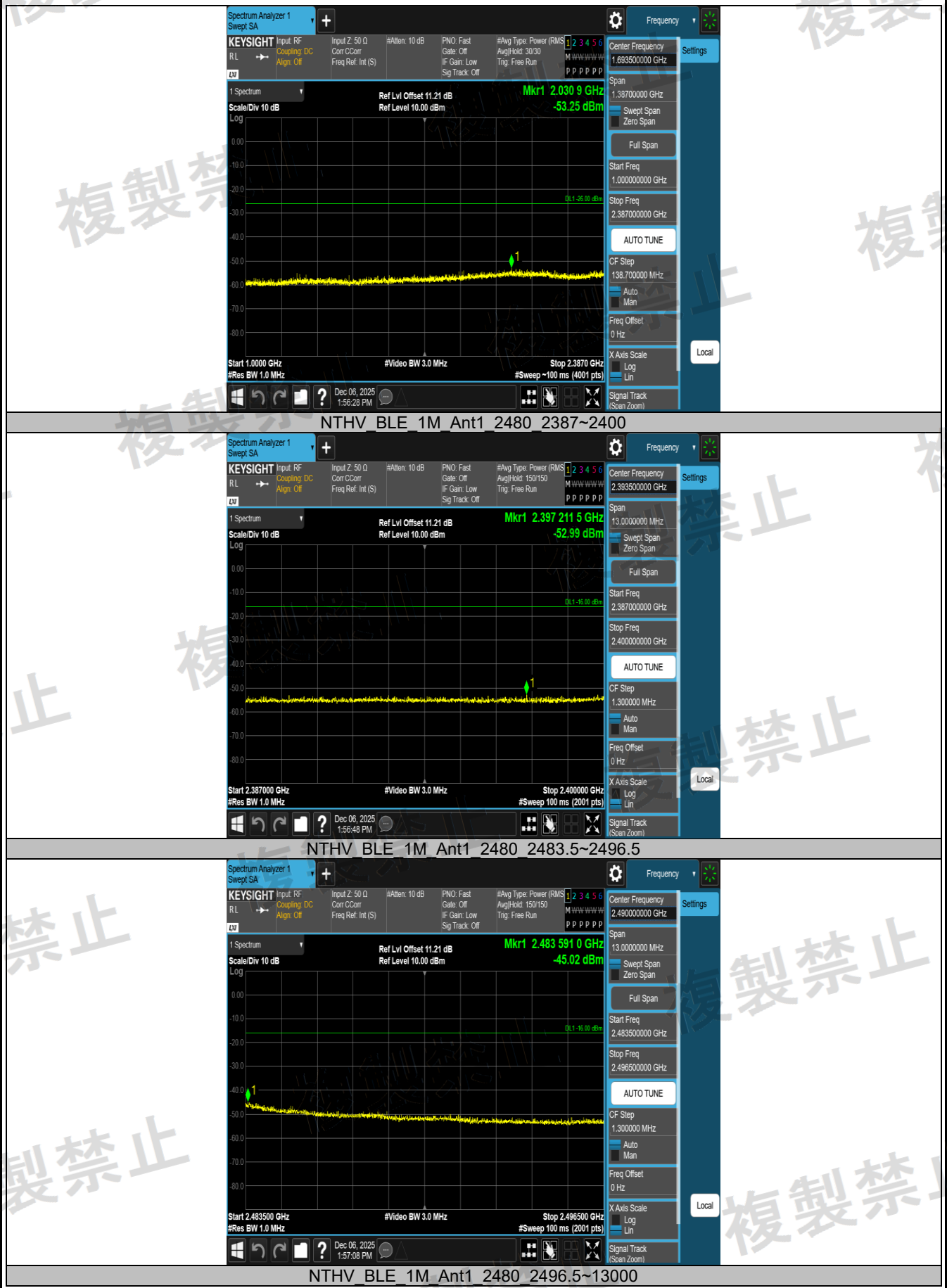


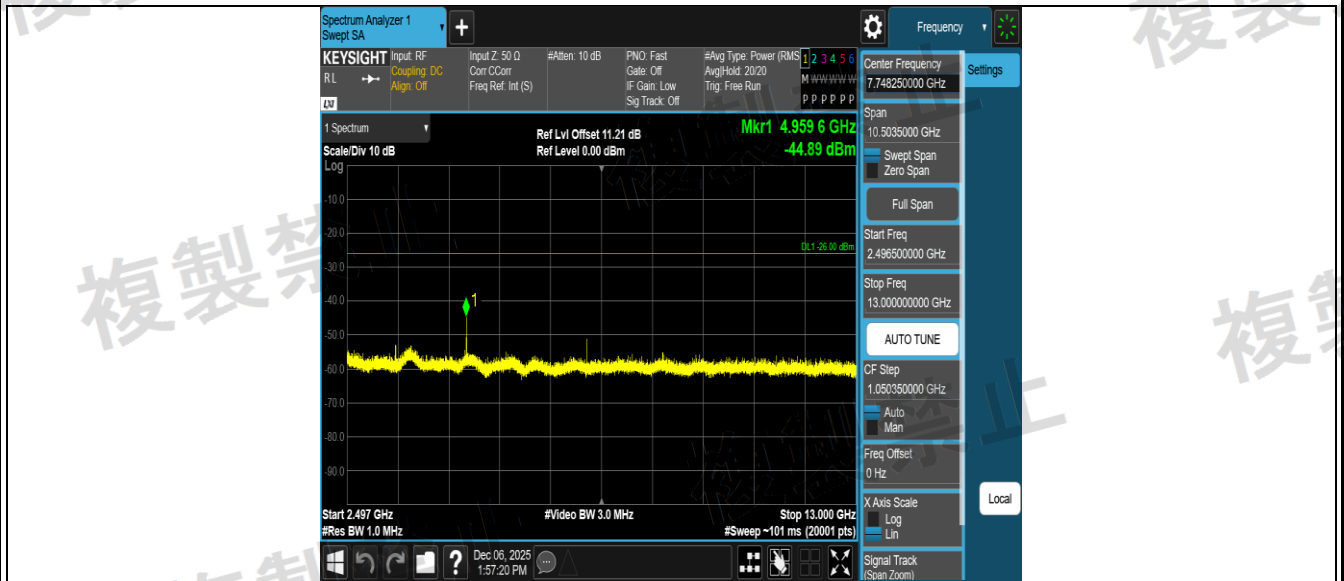










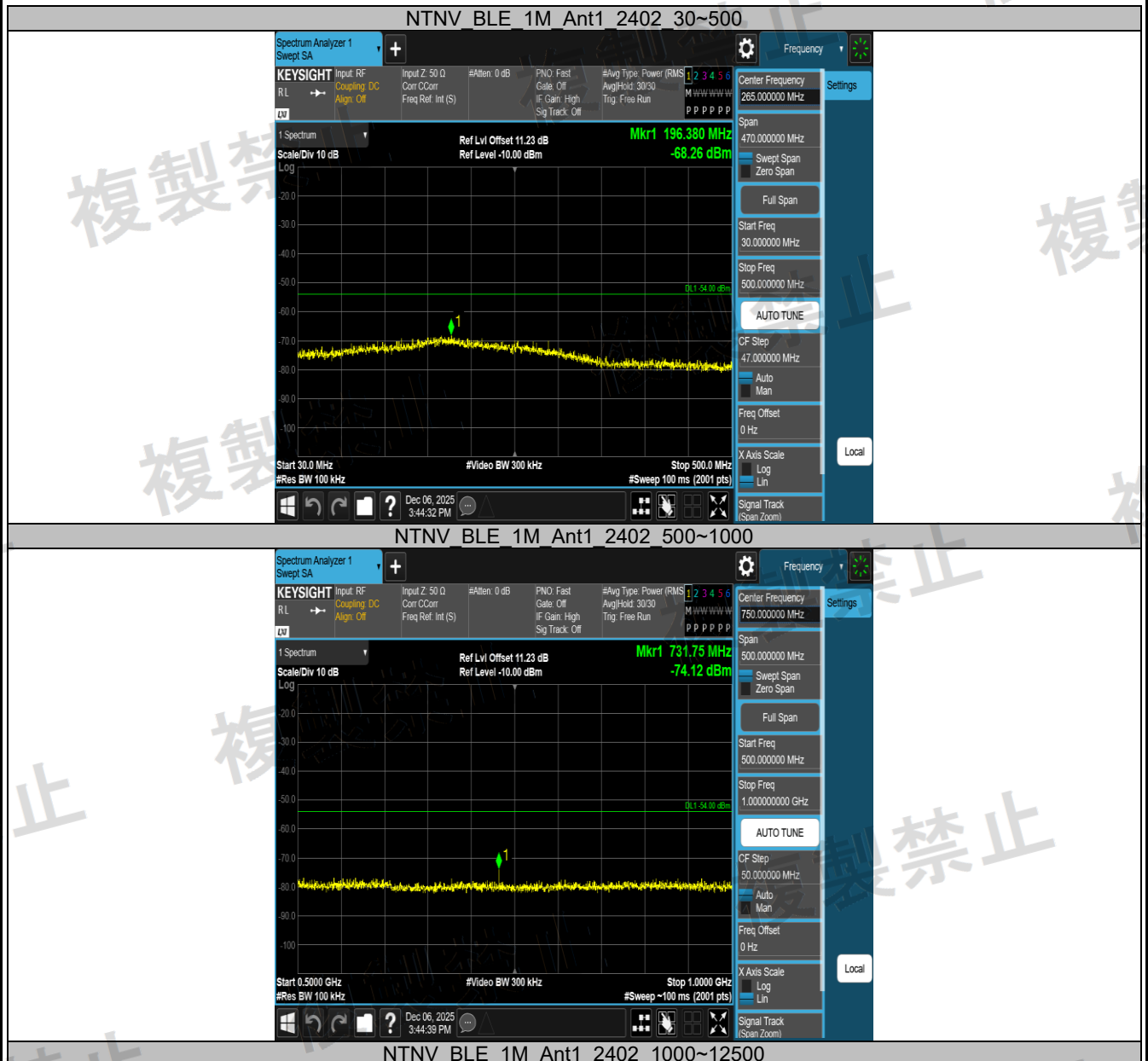


Appendix B.6: Test Results of Spurious Emissions for Receiver

Test Result

Test Condition	Test Mode	Antenna	Freq(MHz)	Freq.Range [MHz]	Freq. [MHz]	Result [dBm]	Limit [dBm]	Result [nW]	Limit [nW]	Verdict
NTNV	BLE_1M	Ant1	2402	30~500	196.38	-68.26	≤-54	0.14928	≤4	PASS
				500~1000	731.75	-74.12	≤-54	0.03873	≤4	PASS
				1000~12500	3826.13	-62.78	≤-47	0.52723	≤20	PASS
			2440	30~500	182.99	-67.84	≤-54	0.16444	≤4	PASS
				500~1000	731.75	-75.09	≤-54	0.03097	≤4	PASS
				1000~12500	3797.38	-61.57	≤-47	0.69663	≤20	PASS
			2480	30~500	197.56	-67.59	≤-54	0.17418	≤4	PASS
				500~1000	731.75	-74.73	≤-54	0.03365	≤4	PASS
				1000~12500	3789.33	-63.28	≤-47	0.46989	≤20	PASS
NTLV	BLE_1M	Ant1	2402	30~500	181.58	-68.26	≤-54	0.14928	≤4	PASS
				500~1000	731.75	-75.13	≤-54	0.03069	≤4	PASS
				1000~12500	3781.85	-62.92	≤-47	0.51050	≤20	PASS
			2440	30~500	181.58	-67.37	≤-54	0.18323	≤4	PASS
				500~1000	731.75	-75.13	≤-54	0.03069	≤4	PASS
				1000~12500	3776.68	-61.97	≤-47	0.63533	≤20	PASS
			2480	30~500	190.04	-67.87	≤-54	0.16331	≤4	PASS
				500~1000	731.75	-74.10	≤-54	0.03890	≤4	PASS
				1000~12500	3791.63	-61.55	≤-47	0.69984	≤20	PASS
NTHV	BLE_1M	Ant1	2402	30~500	182.75	-67.41	≤-54	0.18155	≤4	PASS
				500~1000	731.75	-74.43	≤-54	0.03606	≤4	PASS
				1000~12500	3841.08	-63.82	≤-47	0.41495	≤20	PASS
			2440	30~500	179.23	-68.03	≤-54	0.15740	≤4	PASS
				500~1000	731.75	-74.92	≤-54	0.03221	≤4	PASS
				1000~12500	3789.90	-63.50	≤-47	0.44668	≤20	PASS
			2480	30~500	162.07	-67.94	≤-54	0.16069	≤4	PASS
				500~1000	731.75	-75.56	≤-54	0.02780	≤4	PASS
				1000~12500	3813.48	-63.25	≤-47	0.47315	≤20	PASS

Test Graphs





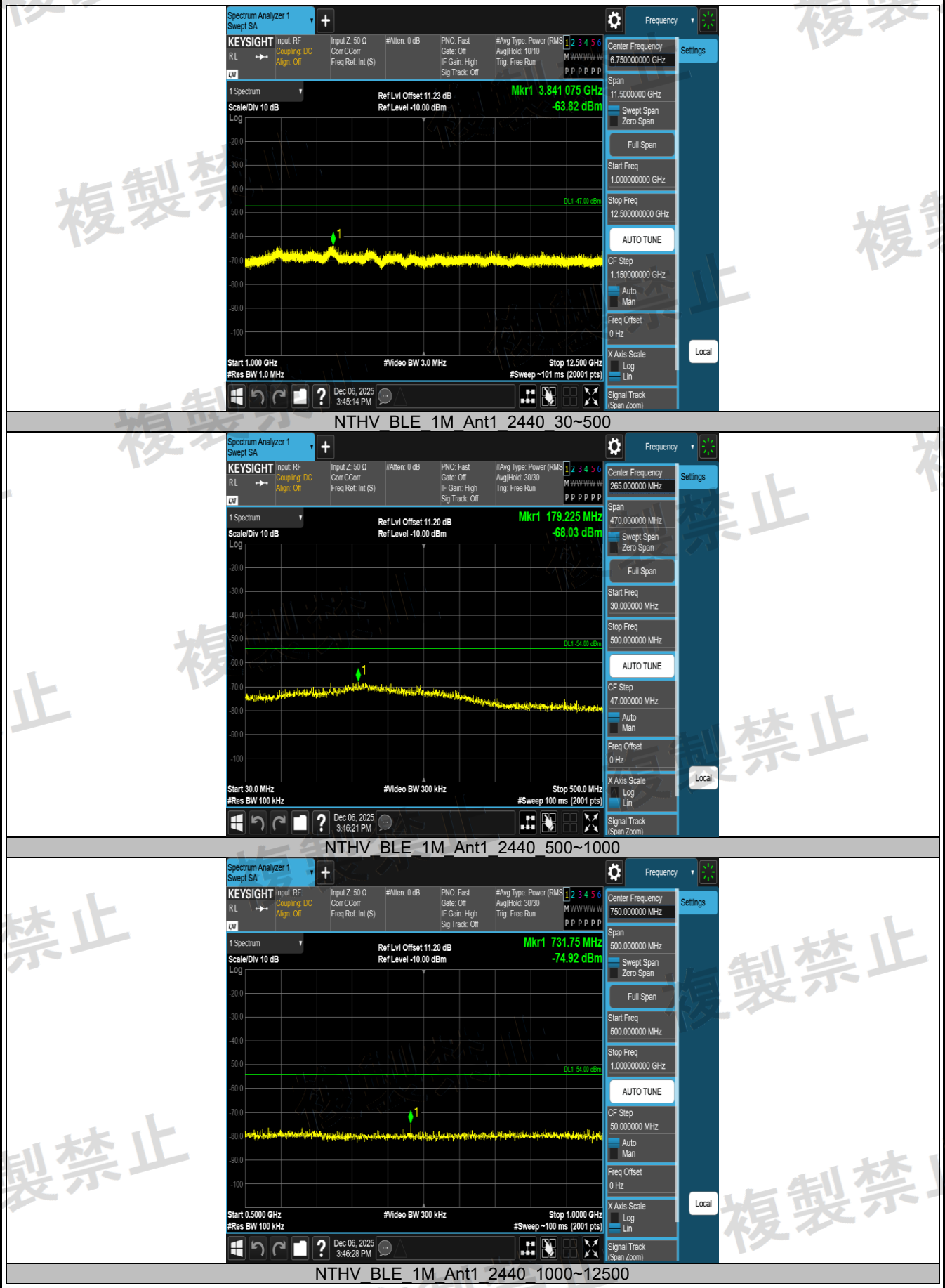




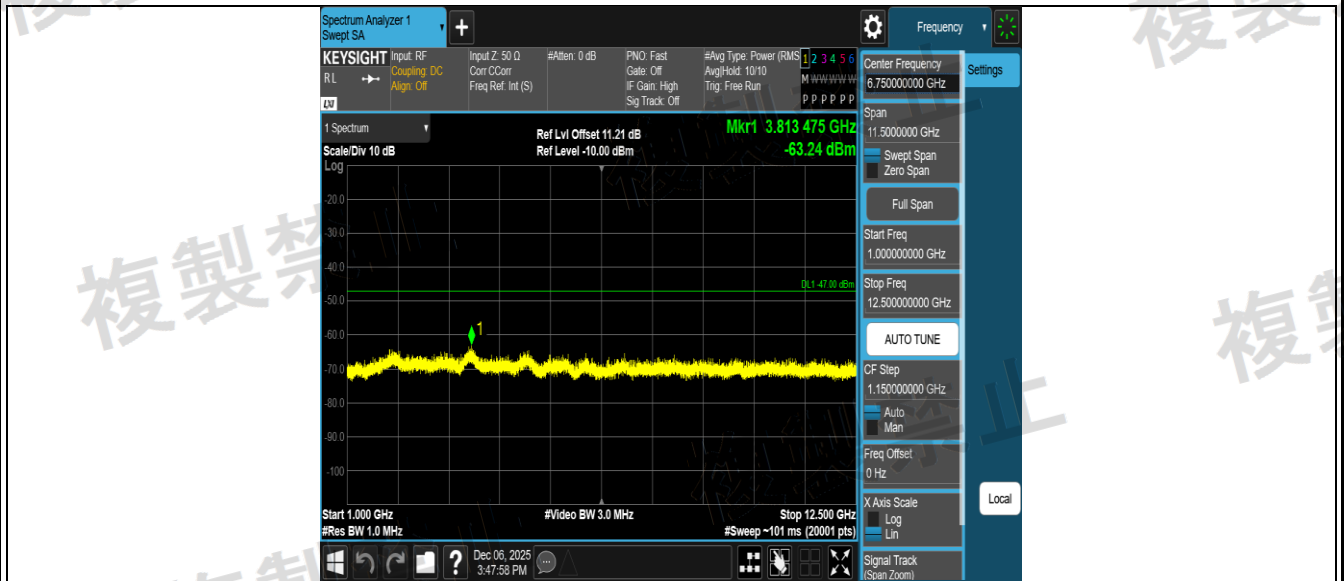












Appendix B.7: Test Results of Max. Burst Length / Dwell Time

Test Result

Test mode	Duty cycle	Spreading Bandwidth (MHz)	Channel numbers	Dwell Time (msec)	Limit (msec)	Verdict
BLE_1M	0.6032	72.068	40	0.43	0.4	PASS