

Appendix A: Test Results of Bluetooth Low Energy

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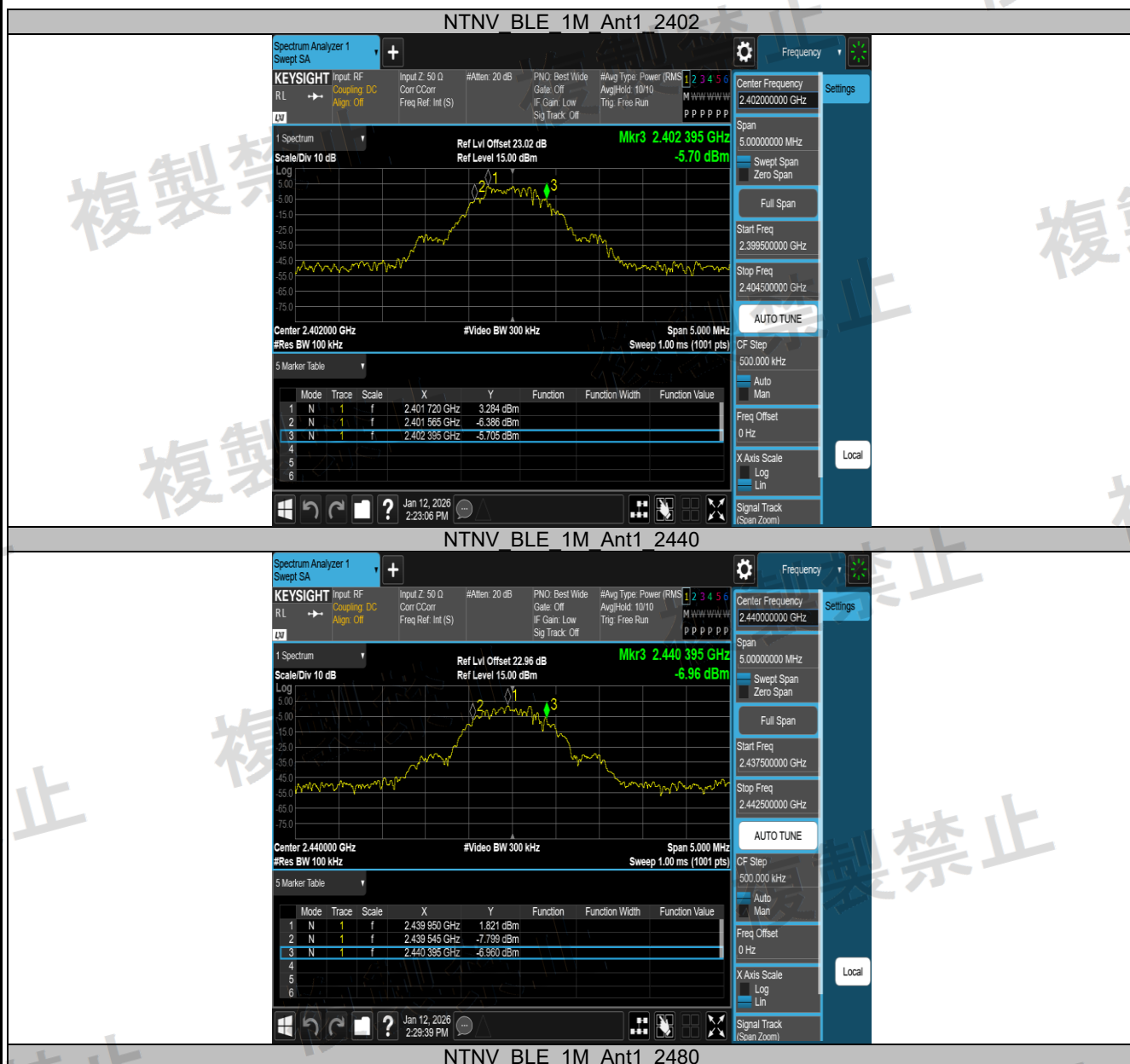
Appendix A.1: Test Results of Frequency Tolerance

Test Result

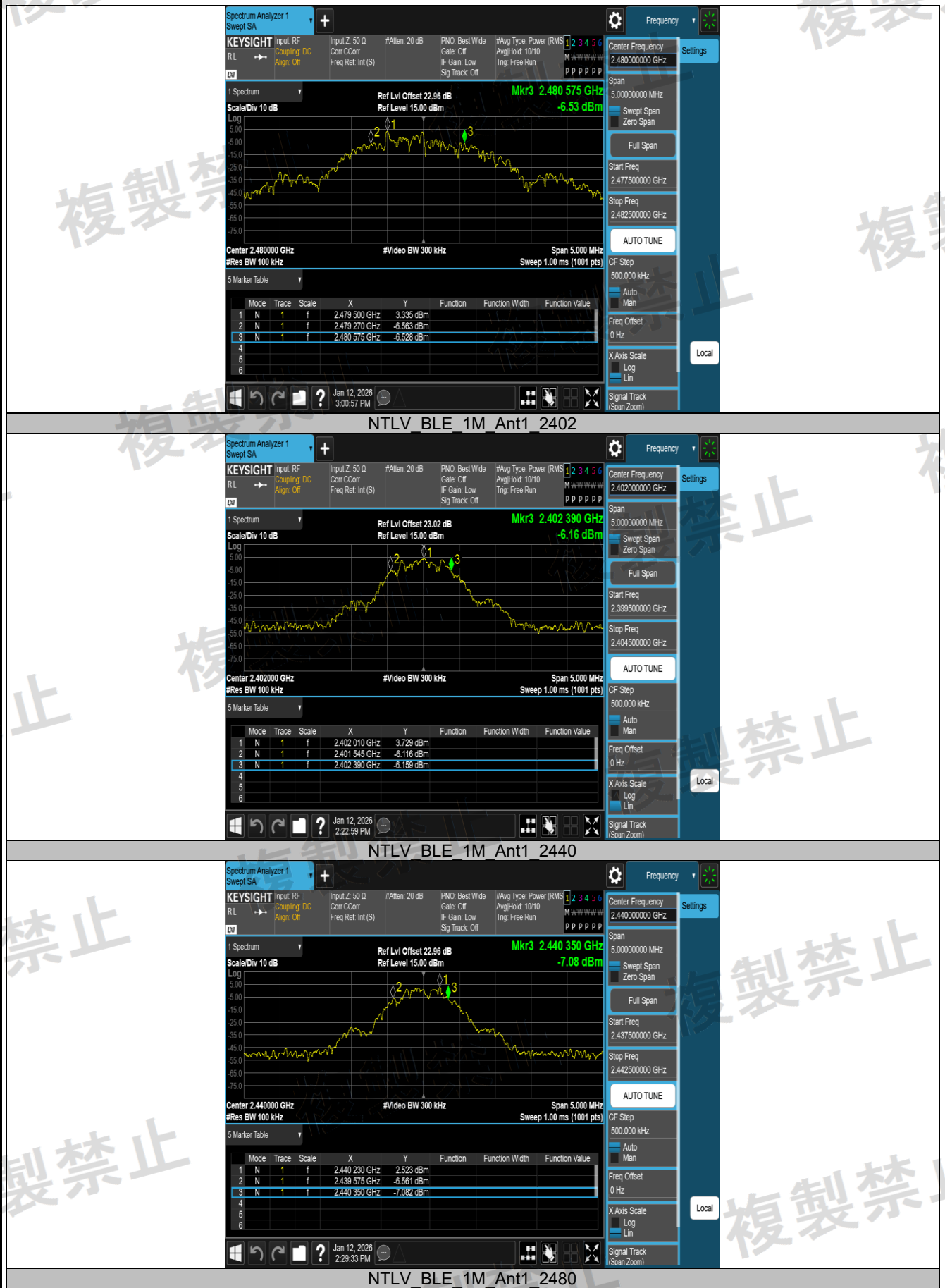
TestCondition	TestMode	Antenna	Freq(MHz)	Result[ppm]	Limit[ppm]	Verdict
NTNV	BLE_1M	Ant1	2402	-8.32640	±50	PASS
			2440	-12.29508	±50	PASS
			2480	-13.10484	±50	PASS
	BLE_2M	Ant1	2402	-27.06078	±50	PASS
			2440	-25.61475	±50	PASS
			2480	-31.25000	±50	PASS
NTLV	BLE_1M	Ant1	2402	-13.53039	±50	PASS
			2440	-15.36885	±50	PASS
			2480	-15.12097	±50	PASS
	BLE_2M	Ant1	2402	-28.10158	±50	PASS
			2440	21.51639	±50	PASS
			2480	-3.02419	±50	PASS
NTHV	BLE_1M	Ant1	2402	-17.69359	±50	PASS
			2440	1.02459	±50	PASS
			2480	-8.06452	±50	PASS
	BLE_2M	Ant1	2402	-16.65279	±50	PASS
			2440	-6.14754	±50	PASS
			2480	-28.22581	±50	PASS



Test Graphs















Appendix A.2: Test Results of Antenna Power

Test Result (EUT1#)

Antenna Power							
Test Condition	Test Mode	Antenna	Freq (MHz)	Result(dBm)	Result(mW)	Limit(mW)	Verdict
NTNV	BLE_1M	Ant1	2402	4.49	2.8119	≤10	PASS
			2440	4.16	2.6062	≤10	PASS
			2480	4.23	2.6485	≤10	PASS
	BLE_2M	Ant1	2402	4.46	2.7925	≤10	PASS
			2440	4.13	2.5882	≤10	PASS
			2480	4.21	2.6363	≤10	PASS
NTLV	BLE_1M	Ant1	2402	4.62	2.8973	≤10	PASS
			2440	4.16	2.6062	≤10	PASS
			2480	4.23	2.6485	≤10	PASS
	BLE_2M	Ant1	2402	4.47	2.7990	≤10	PASS
			2440	4.13	2.5882	≤10	PASS
			2480	4.22	2.6424	≤10	PASS
NTHV	BLE_1M	Ant1	2402	4.49	2.8119	≤10	PASS
			2440	4.16	2.6062	≤10	PASS
			2480	4.23	2.6485	≤10	PASS
	BLE_2M	Ant1	2402	4.46	2.7925	≤10	PASS
			2440	4.12	2.5823	≤10	PASS
			2480	4.20	2.6303	≤10	PASS

Tolerance								
Test Condition	Test Mode	Antenna	Freq(MHz)	Power (mW)	RatedPower (mW)	Result (%)	Limit (%)	Verdict
NTNV	BLE_1M	Ant1	2402	2.8119	10	-71.88	-80 to +20	PASS
			2440	2.6062	10	-73.94	-80 to +20	PASS
			2480	2.6485	10	-73.51	-80 to +20	PASS
	BLE_2M	Ant1	2402	2.7925	10	-72.07	-80 to +20	PASS
			2440	2.5882	10	-74.12	-80 to +20	PASS
			2480	2.6363	10	-73.64	-80 to +20	PASS
NTLV	BLE_1M	Ant1	2402	2.8973	10	-71.03	-80 to +20	PASS
			2440	2.6062	10	-73.94	-80 to +20	PASS
			2480	2.6485	10	-73.51	-80 to +20	PASS
	BLE_2M	Ant1	2402	2.7990	10	-72.01	-80 to +20	PASS
			2440	2.5882	10	-74.12	-80 to +20	PASS
			2480	2.6424	10	-73.58	-80 to +20	PASS
NTHV	BLE_1M	Ant1	2402	2.8119	10	-71.88	-80 to +20	PASS
			2440	2.6062	10	-73.94	-80 to +20	PASS
			2480	2.6485	10	-73.51	-80 to +20	PASS
	BLE_2M	Ant1	2402	2.7925	10	-72.07	-80 to +20	PASS
			2440	2.5823	10	-74.18	-80 to +20	PASS
			2480	2.6303	10	-73.70	-80 to +20	PASS



EIRP							
TestCondition	TestMode	Antenna	Freq(MHz)	Power (dBm)	EIRP(dBm)	Limit(dBm)	Verdict
NTNV	BLE_1M	Ant1	2402	4.49	3.29	≤12.14	PASS
			2440	4.16	2.96	≤12.14	PASS
			2480	4.23	3.03	≤12.14	PASS
	BLE_2M	Ant1	2402	4.46	3.26	≤12.14	PASS
			2440	4.13	2.93	≤12.14	PASS
			2480	4.21	3.01	≤12.14	PASS
NTLV	BLE_1M	Ant1	2402	4.62	3.42	≤12.14	PASS
			2440	4.16	2.96	≤12.14	PASS
			2480	4.23	3.03	≤12.14	PASS
	BLE_2M	Ant1	2402	4.47	3.27	≤12.14	PASS
			2440	4.13	2.93	≤12.14	PASS
			2480	4.22	3.02	≤12.14	PASS
NTHV	BLE_1M	Ant1	2402	4.49	3.29	≤12.14	PASS
			2440	4.16	2.96	≤12.14	PASS
			2480	4.23	3.03	≤12.14	PASS
	BLE_2M	Ant1	2402	4.46	3.26	≤12.14	PASS
			2440	4.12	2.92	≤12.14	PASS
			2480	4.20	3.00	≤12.14	PASS

Test Result (EUT2#)

Antenna Power							
TestCondition	TestMode	Antenna	Freq(MHz)	Result(dBm)	Result(mW)	Limit(mW)	Verdict
NTNV	BLE_1M	Ant1	2402	4.46	2.7925	≤10	PASS
			2440	4.13	2.5882	≤10	PASS
			2480	4.18	2.6182	≤10	PASS
	BLE_2M	Ant1	2402	4.44	2.7797	≤10	PASS
			2440	4.10	2.5704	≤10	PASS
			2480	4.19	2.6242	≤10	PASS
NTLV	BLE_1M	Ant1	2402	4.60	2.8840	≤10	PASS
			2440	4.11	2.5763	≤10	PASS
			2480	4.22	2.6424	≤10	PASS
	BLE_2M	Ant1	2402	4.45	2.7861	≤10	PASS
			2440	4.08	2.5586	≤10	PASS
			2480	4.18	2.6182	≤10	PASS
NTHV	BLE_1M	Ant1	2402	4.44	2.7797	≤10	PASS
			2440	4.11	2.5763	≤10	PASS
			2480	4.20	2.6303	≤10	PASS
	BLE_2M	Ant1	2402	4.44	2.7797	≤10	PASS
			2440	4.10	2.5704	≤10	PASS
			2480	4.16	2.6062	≤10	PASS

Tolerance								
Test Condition	Test Mode	Antenna	Freq(MHz)	Power (mW)	RatedPower (mW)	Result (%)	Limit (%)	Verdict
NTNV	BLE_1M	Ant1	2402	2.7925	10	-72.07	-80 to +20	PASS
			2440	2.5882	10	-74.12	-80 to +20	PASS
			2480	2.6182	10	-73.82	-80 to +20	PASS
	BLE_2M	Ant1	2402	2.7797	10	-72.20	-80 to +20	PASS
			2440	2.5704	10	-74.30	-80 to +20	PASS
			2480	2.6242	10	-73.76	-80 to +20	PASS
NTLV	BLE_1M	Ant1	2402	2.8840	10	-71.16	-80 to +20	PASS
			2440	2.5763	10	-74.24	-80 to +20	PASS
			2480	2.6424	10	-73.58	-80 to +20	PASS
	BLE_2M	Ant1	2402	2.7861	10	-72.14	-80 to +20	PASS
			2440	2.5586	10	-74.41	-80 to +20	PASS
			2480	2.6182	10	-73.82	-80 to +20	PASS
NTHV	BLE_1M	Ant1	2402	2.7797	10	-72.20	-80 to +20	PASS
			2440	2.5763	10	-74.24	-80 to +20	PASS
			2480	2.6303	10	-73.70	-80 to +20	PASS
	BLE_2M	Ant1	2402	2.7797	10	-72.20	-80 to +20	PASS
			2440	2.5704	10	-74.30	-80 to +20	PASS
			2480	2.6062	10	-73.94	-80 to +20	PASS



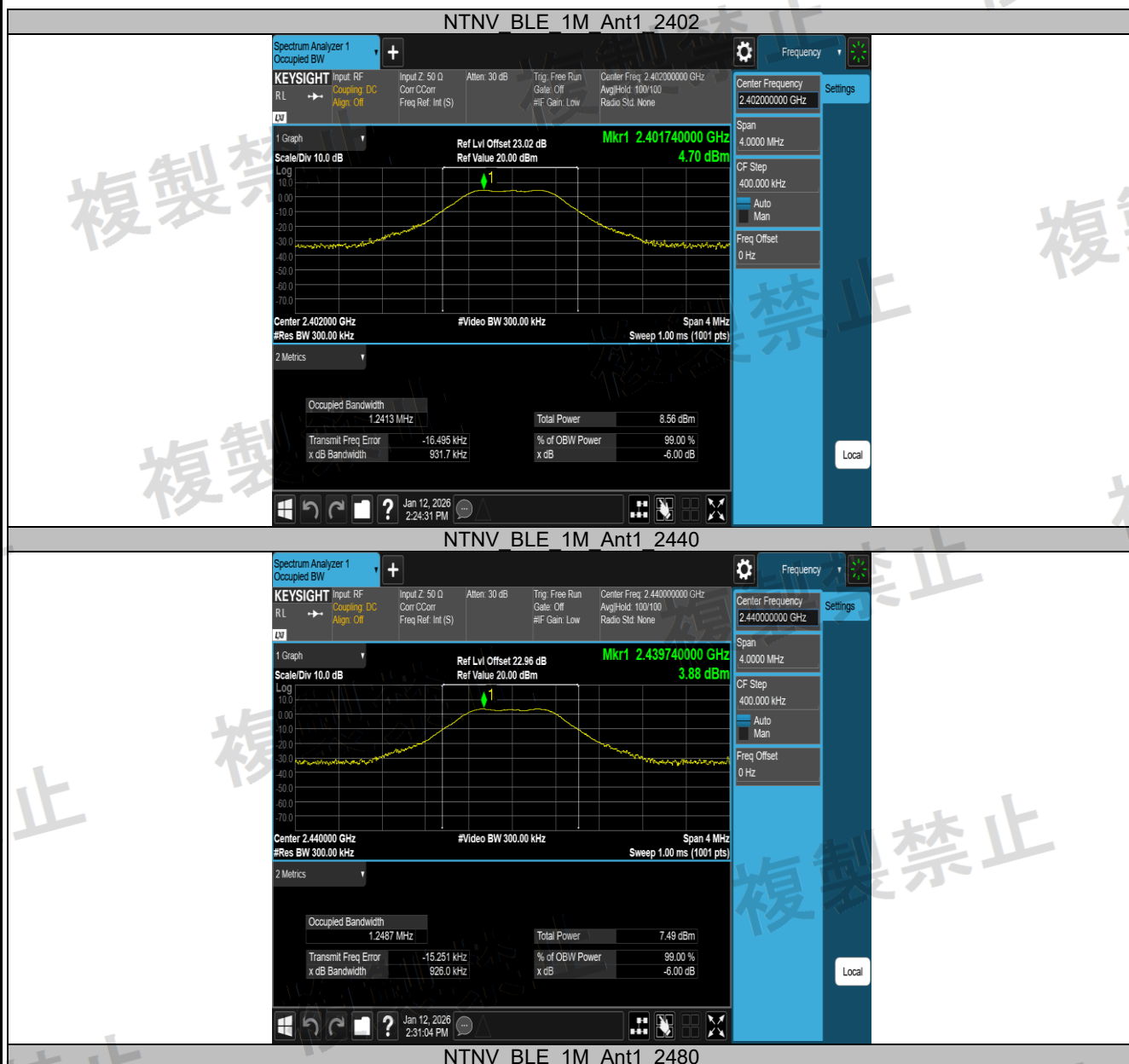
EIRP							
TestCondition	TestMode	Antenna	Freq(MHz)	Power (dBm)	EIRP(dBm)	Limit(dBm)	Verdict
NTNV	BLE_1M	Ant1	2402	4.46	3.26	≤12.14	PASS
			2440	4.13	2.93	≤12.14	PASS
			2480	4.18	2.98	≤12.14	PASS
	BLE_2M	Ant1	2402	4.44	3.24	≤12.14	PASS
			2440	4.10	2.90	≤12.14	PASS
			2480	4.19	2.99	≤12.14	PASS
NTLV	BLE_1M	Ant1	2402	4.60	3.40	≤12.14	PASS
			2440	4.11	2.91	≤12.14	PASS
			2480	4.22	3.02	≤12.14	PASS
	BLE_2M	Ant1	2402	4.45	3.25	≤12.14	PASS
			2440	4.08	2.88	≤12.14	PASS
			2480	4.18	2.98	≤12.14	PASS
NTHV	BLE_1M	Ant1	2402	4.44	3.24	≤12.14	PASS
			2440	4.11	2.91	≤12.14	PASS
			2480	4.20	3.00	≤12.14	PASS
	BLE_2M	Ant1	2402	4.44	3.24	≤12.14	PASS
			2440	4.10	2.90	≤12.14	PASS
			2480	4.16	2.96	≤12.14	PASS

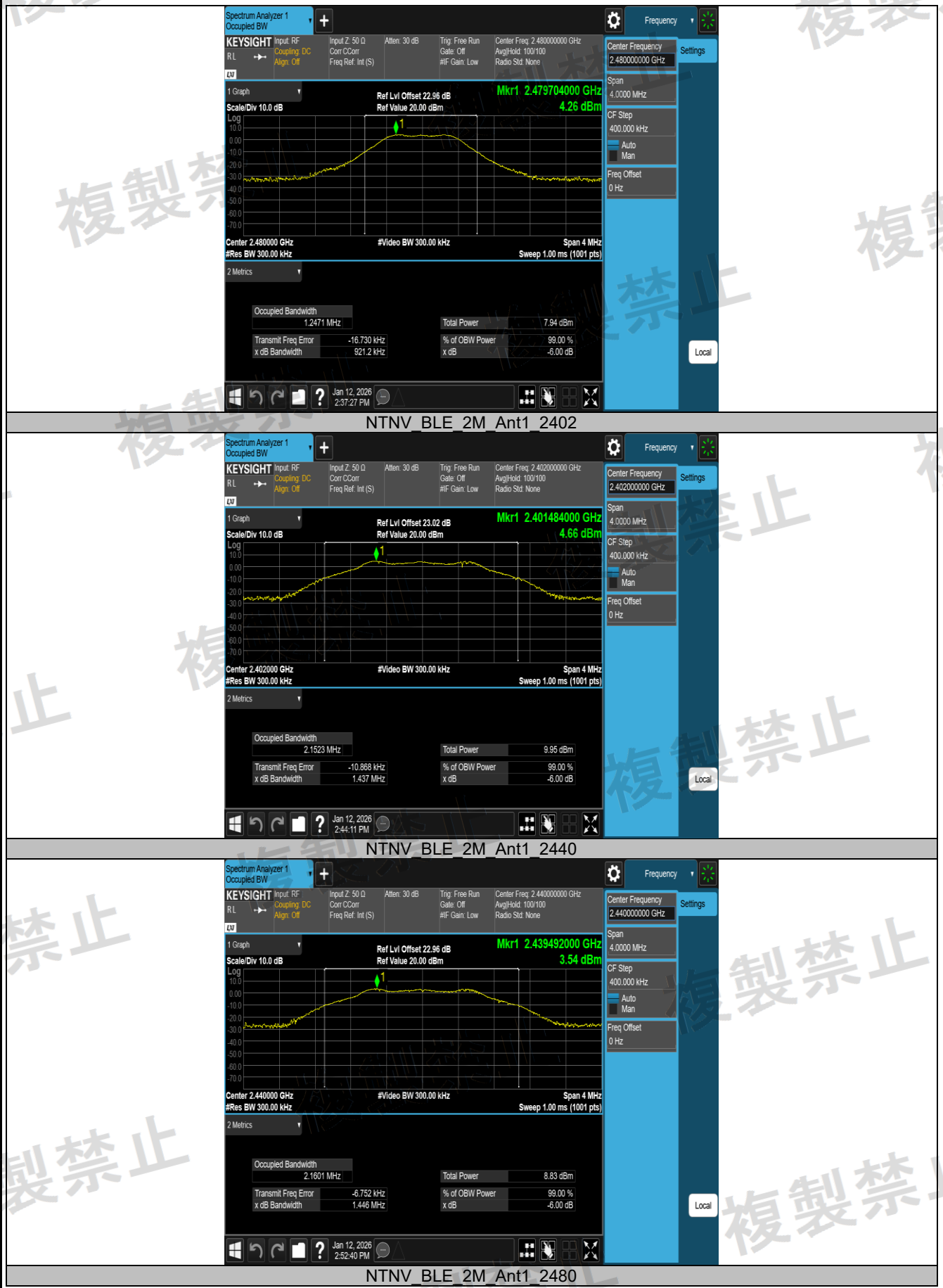
Appendix A.3: Test Results of Occupied Channel Bandwidth (99%)
Test Result

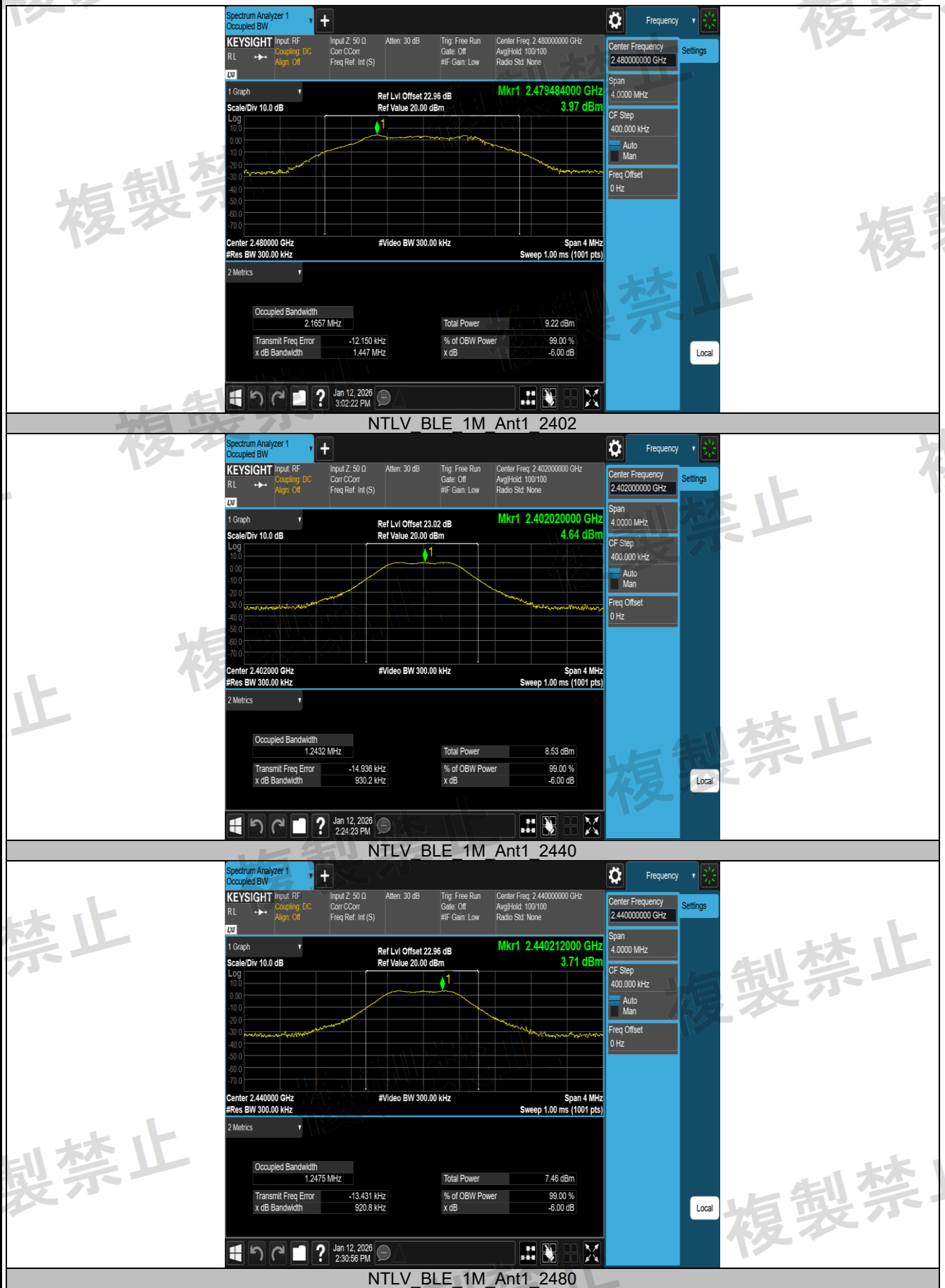
TestCondition	TestMode	Antenna	Freq(MHz)	Result [MHz]	Limit [MHz]	Verdict
NTNV	BLE_1M	Ant1	2402	1.241	≤26	PASS
			2440	1.249	≤26	PASS
			2480	1.247	≤26	PASS
	BLE_2M	Ant1	2402	2.152	≤26	PASS
			2440	2.160	≤26	PASS
			2480	2.166	≤26	PASS
NTLV	BLE_1M	Ant1	2402	1.243	≤26	PASS
			2440	1.248	≤26	PASS
			2480	1.248	≤26	PASS
	BLE_2M	Ant1	2402	2.152	≤26	PASS
			2440	2.169	≤26	PASS
			2480	2.167	≤26	PASS
NTHV	BLE_1M	Ant1	2402	1.242	≤26	PASS
			2440	1.247	≤26	PASS
			2480	1.249	≤26	PASS
	BLE_2M	Ant1	2402	2.156	≤26	PASS
			2440	2.158	≤26	PASS
			2480	2.171	≤26	PASS

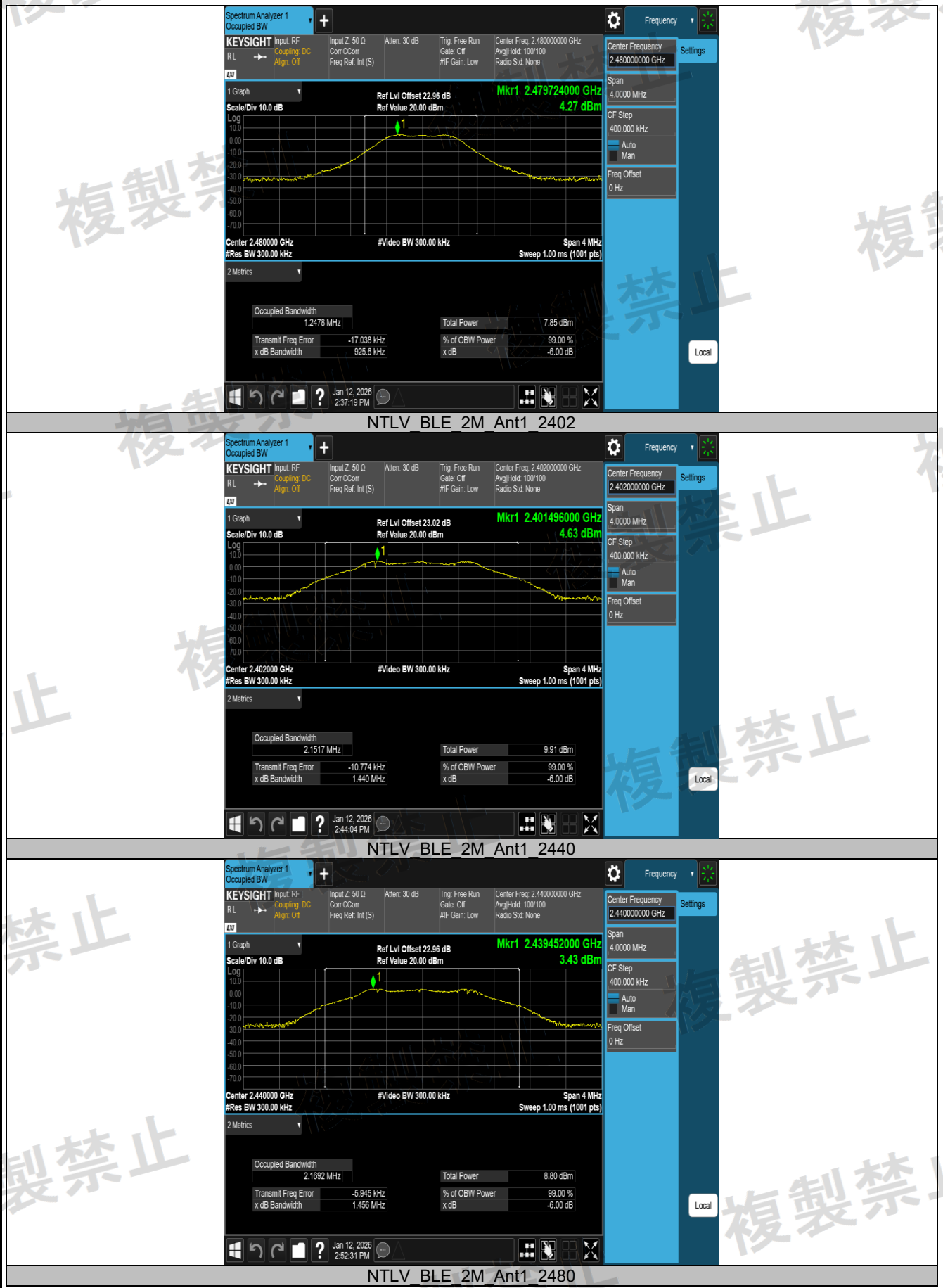


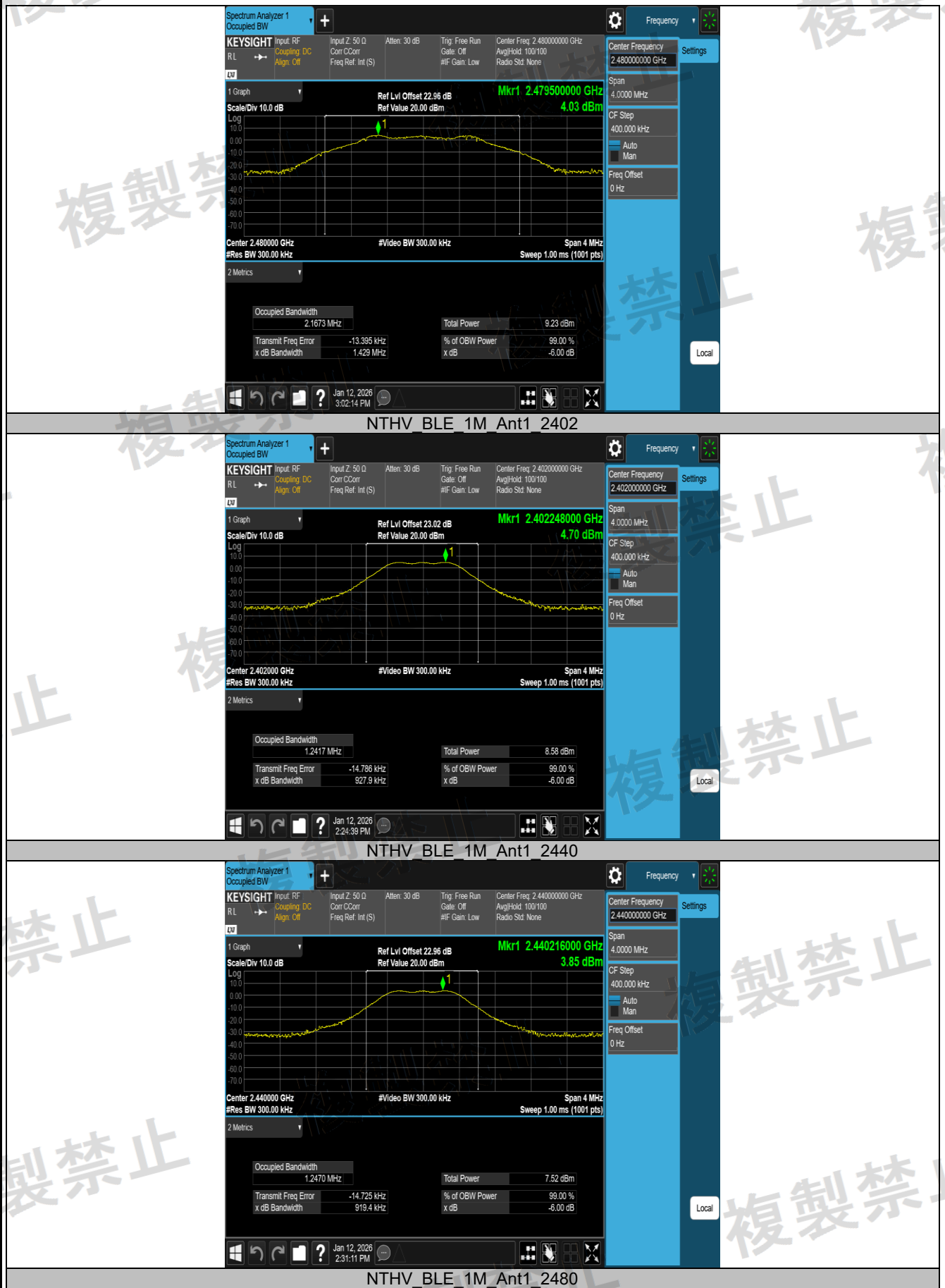
Test Graphs

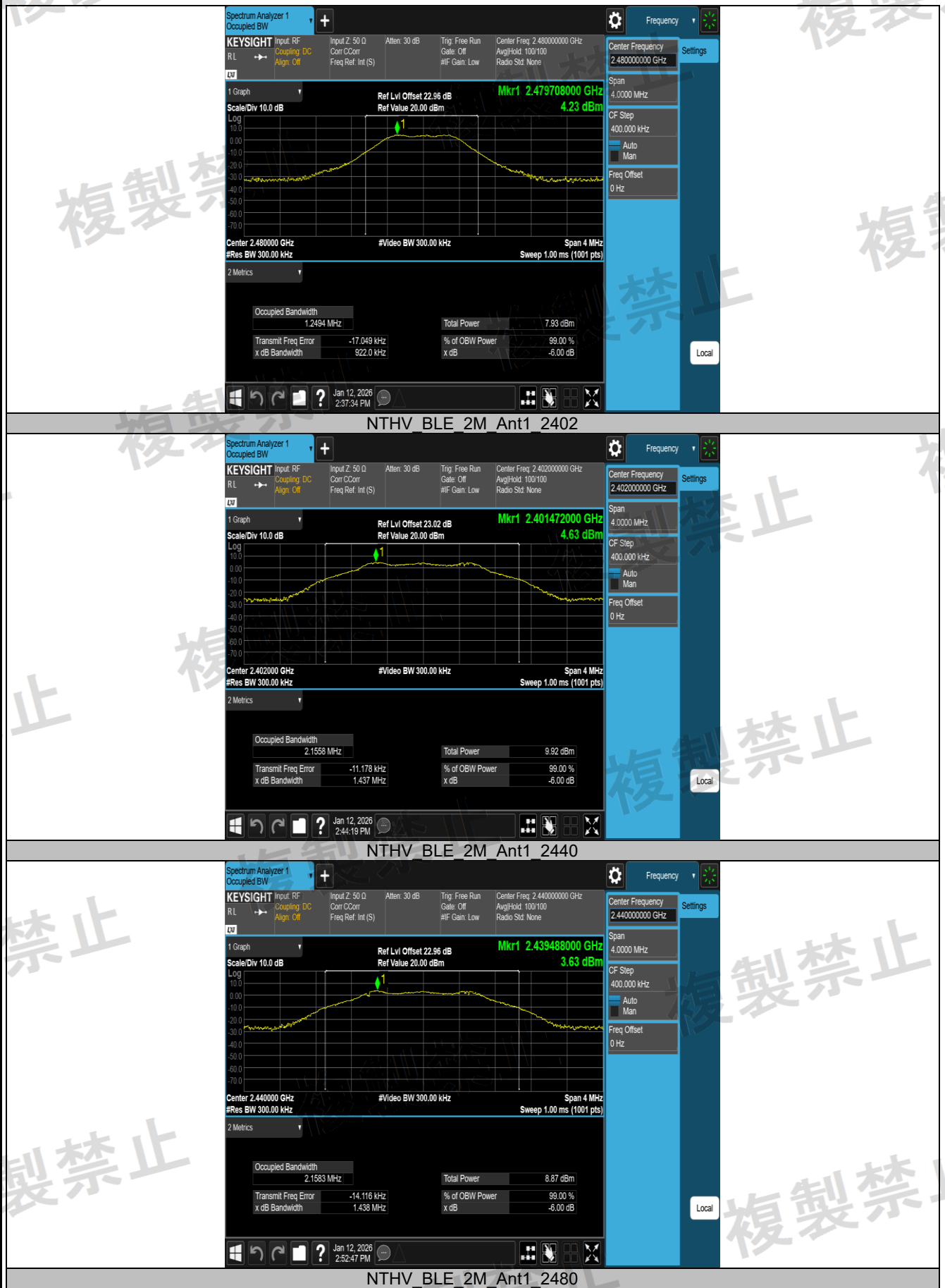


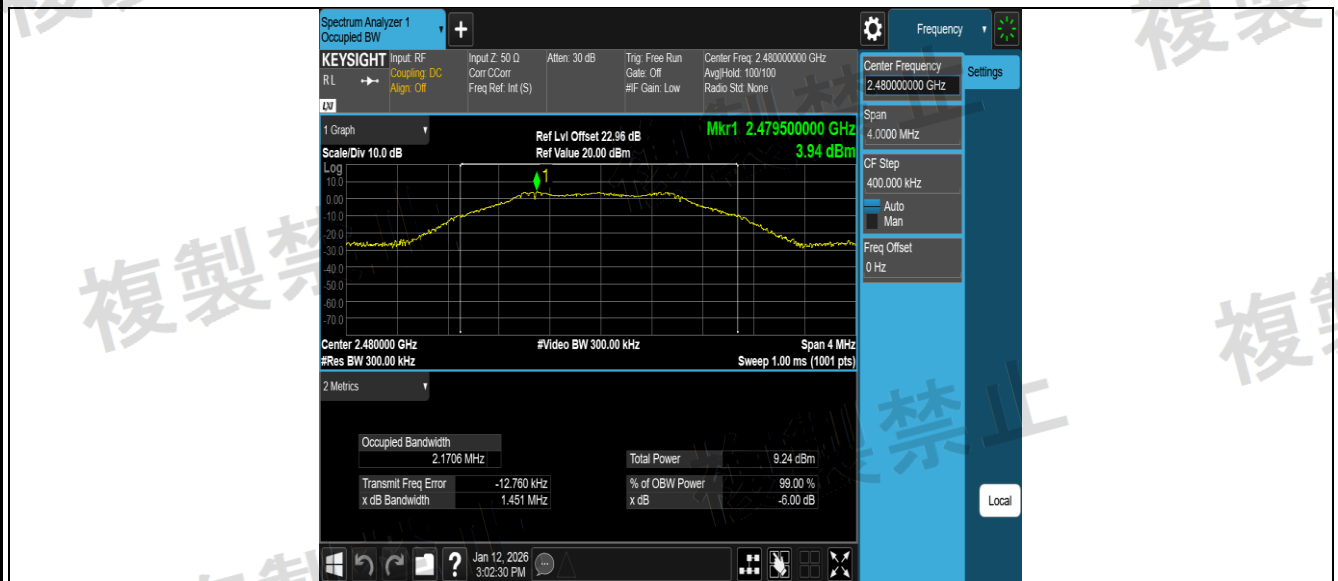














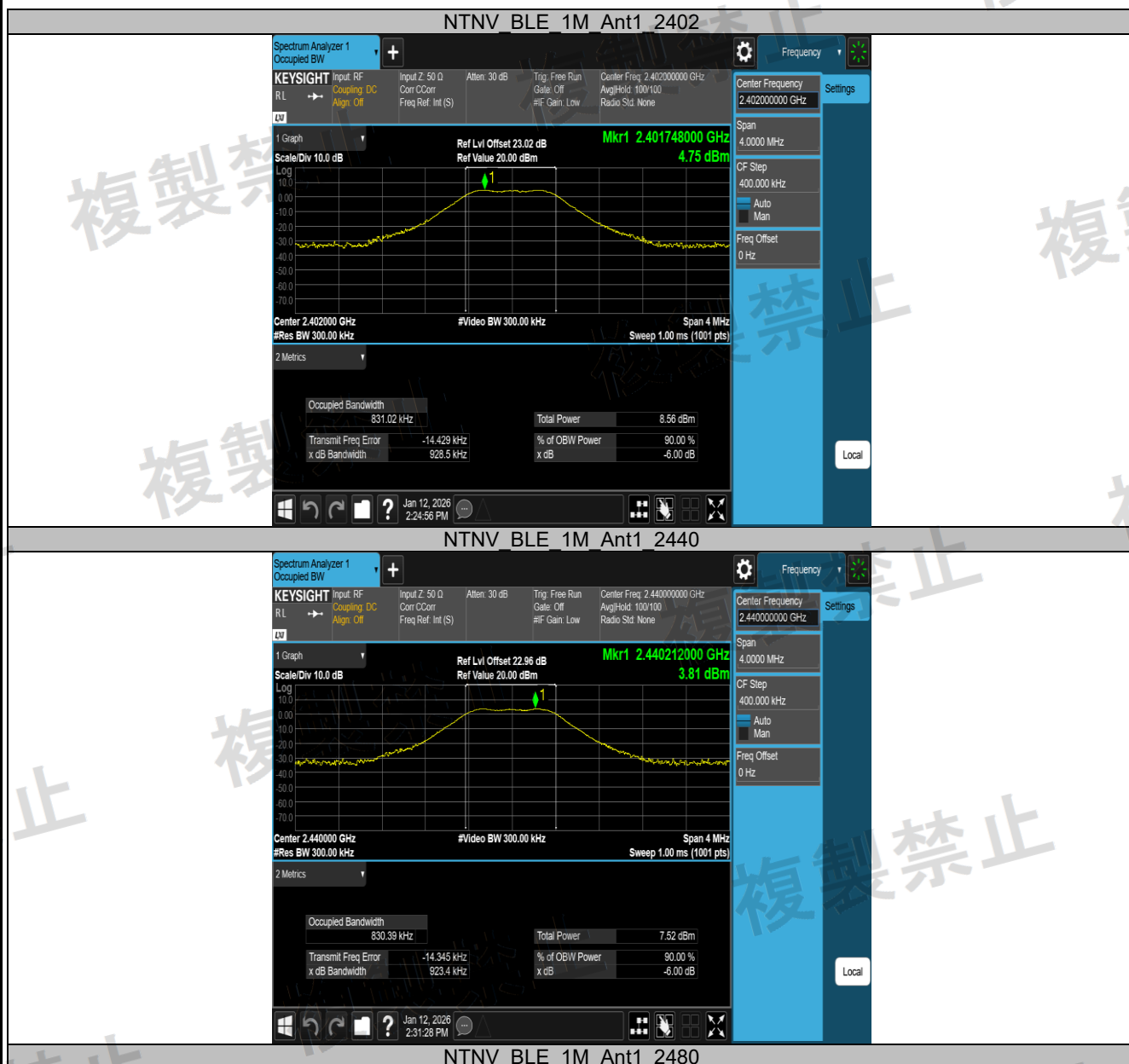
Appendix A.4: Test Results of Spread Bandwidth (90%)

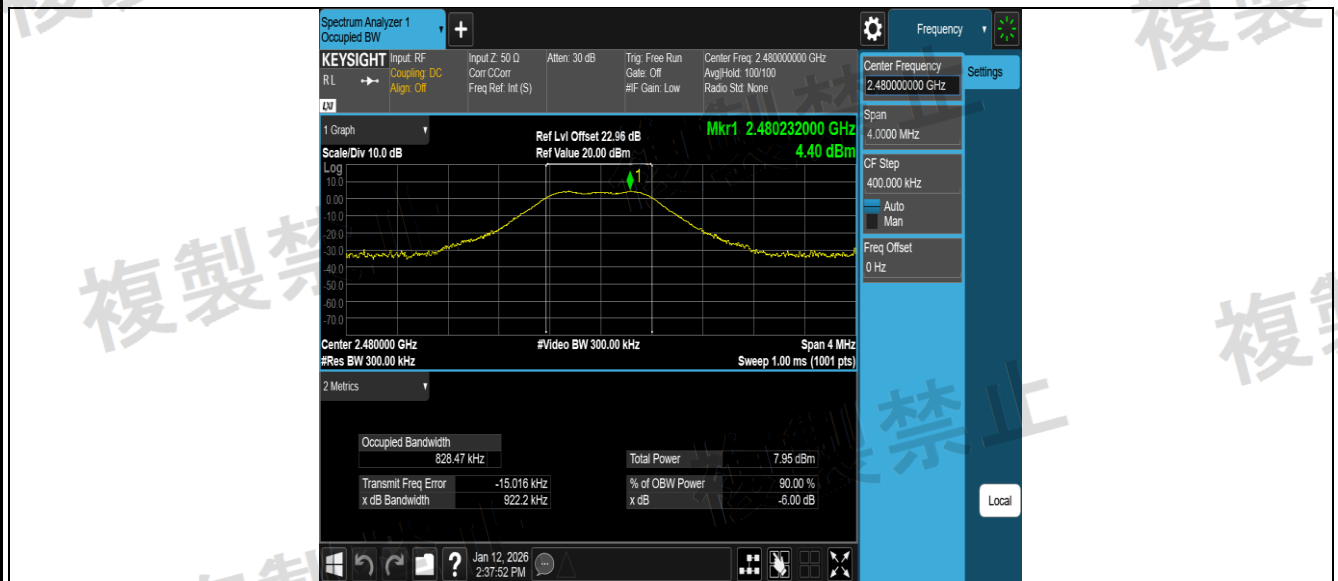
Test Result

TestCondition	TestMode	Antenna	Freq(MHz)	Result [MHz]	Limit [MHz]	Verdict
NTNV	BLE_1M	Ant1	2402	0.831	≥0.5	PASS
			2440	0.830	≥0.5	PASS
			2480	0.828	≥0.5	PASS
	BLE_2M	Ant1	2402	1.387	≥0.5	PASS
			2440	1.389	≥0.5	PASS
			2480	1.389	≥0.5	PASS
NTLV	BLE_1M	Ant1	2402	0.829	≥0.5	PASS
			2440	0.829	≥0.5	PASS
			2480	0.831	≥0.5	PASS
	BLE_2M	Ant1	2402	1.381	≥0.5	PASS
			2440	1.385	≥0.5	PASS
			2480	1.399	≥0.5	PASS
NTHV	BLE_1M	Ant1	2402	0.829	≥0.5	PASS
			2440	0.828	≥0.5	PASS
			2480	0.829	≥0.5	PASS
	BLE_2M	Ant1	2402	1.379	≥0.5	PASS
			2440	1.390	≥0.5	PASS
			2480	1.391	≥0.5	PASS

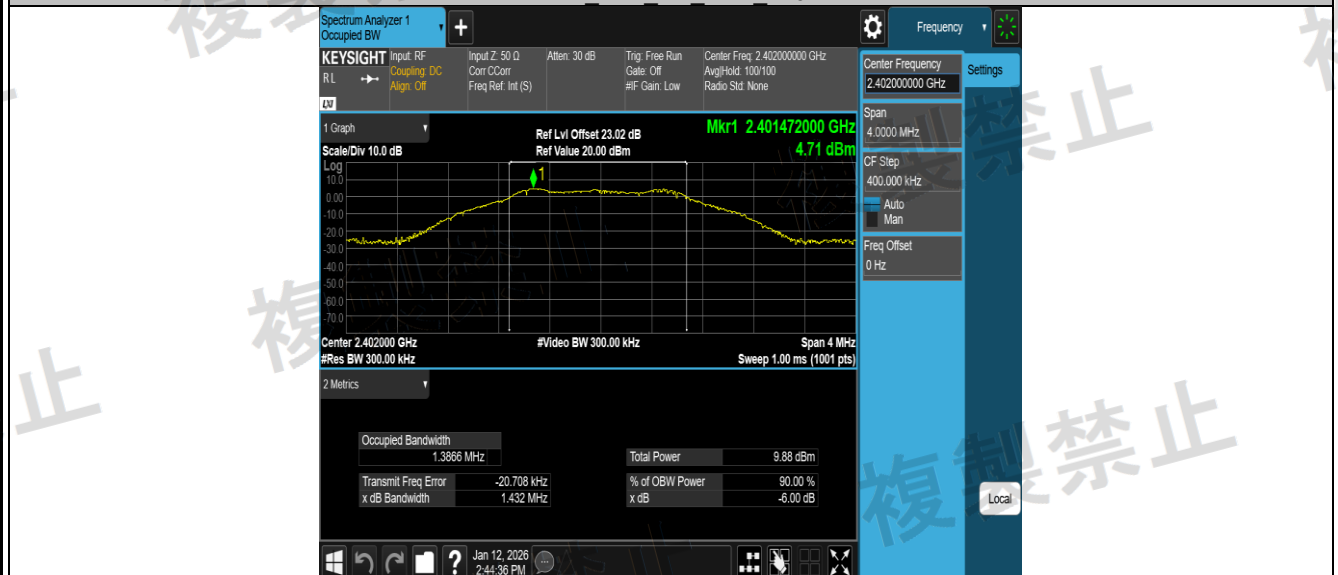


Test Graphs





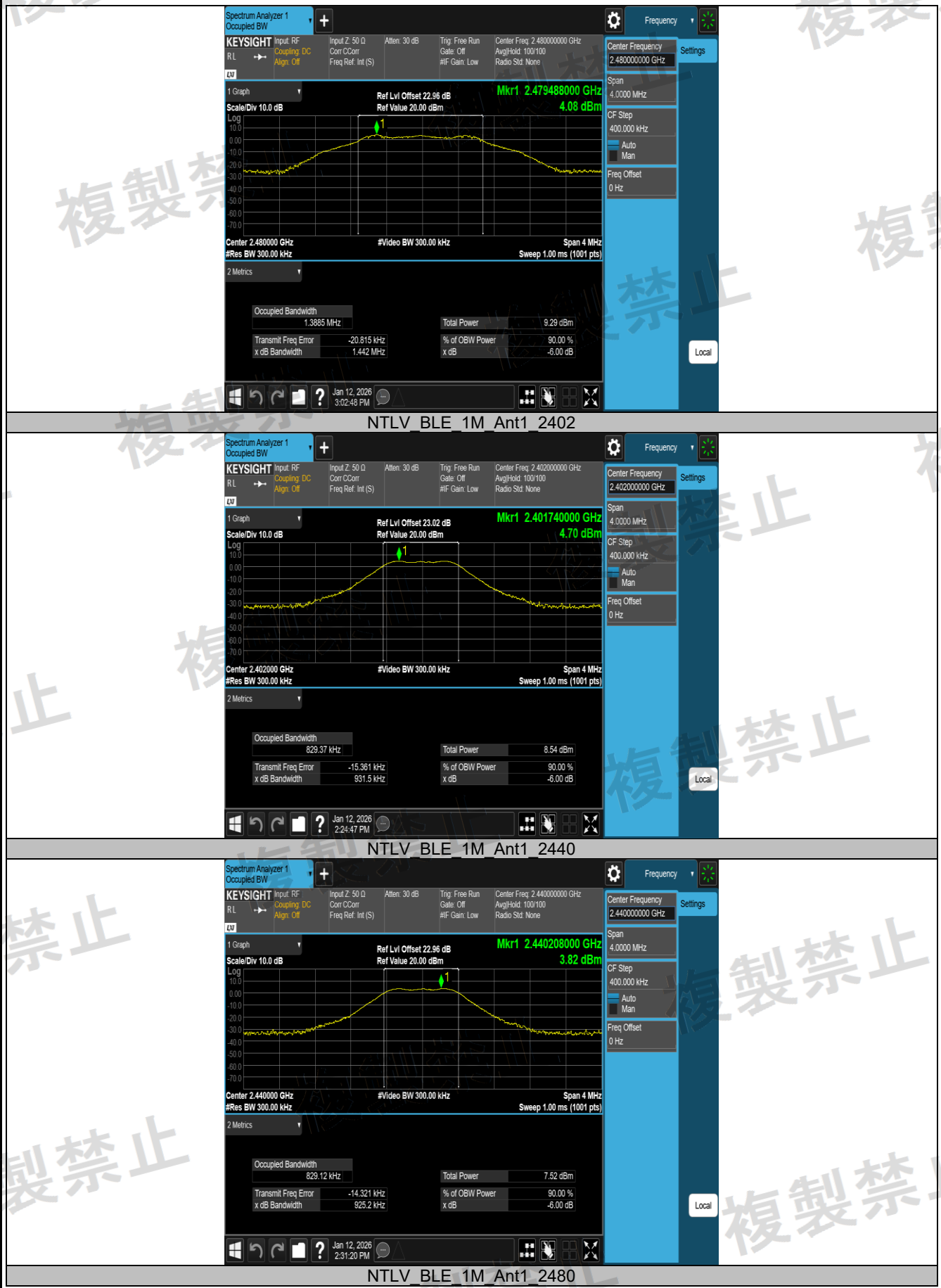
NTNV_BLE_2M_Ant1_2402

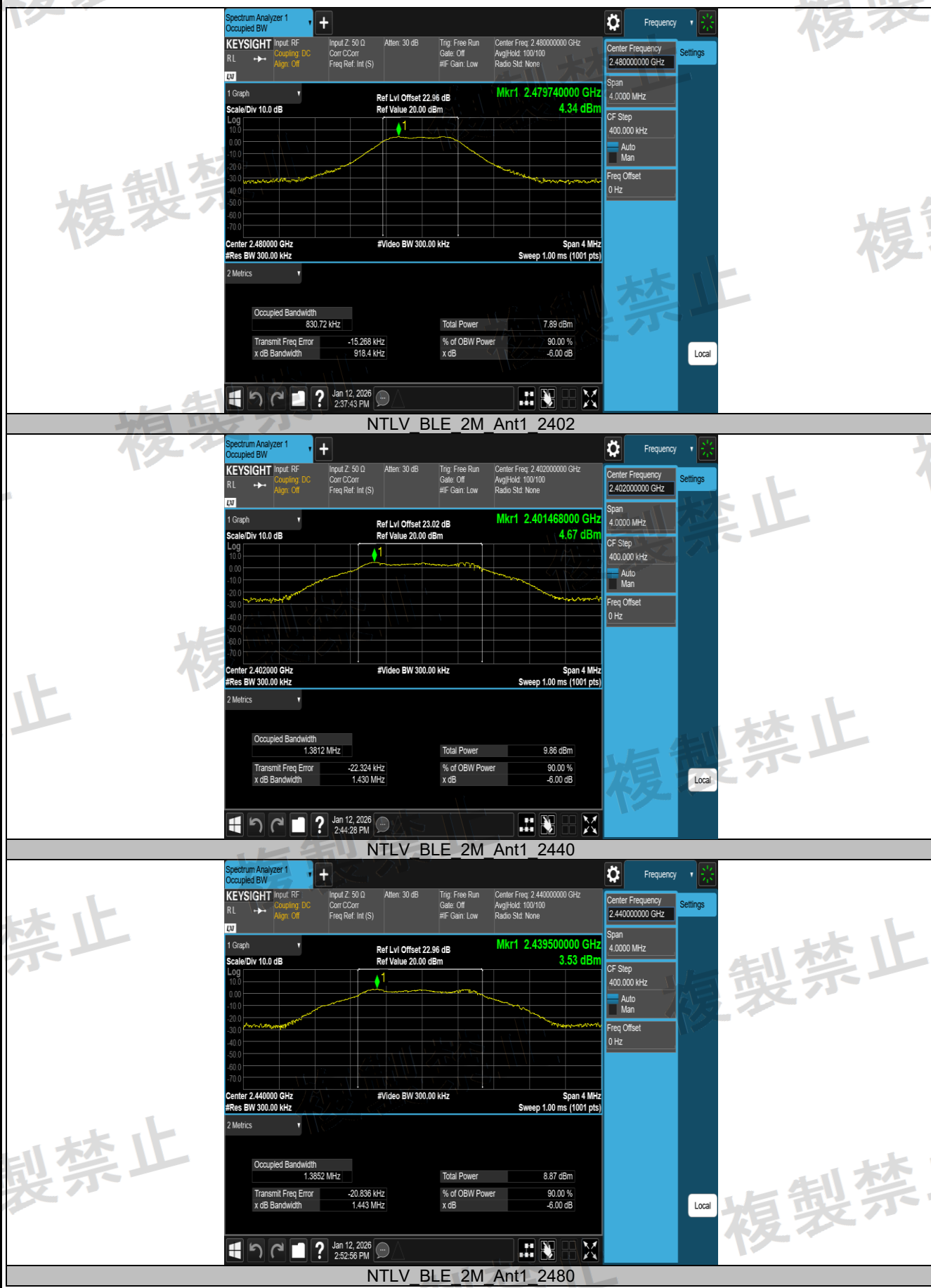


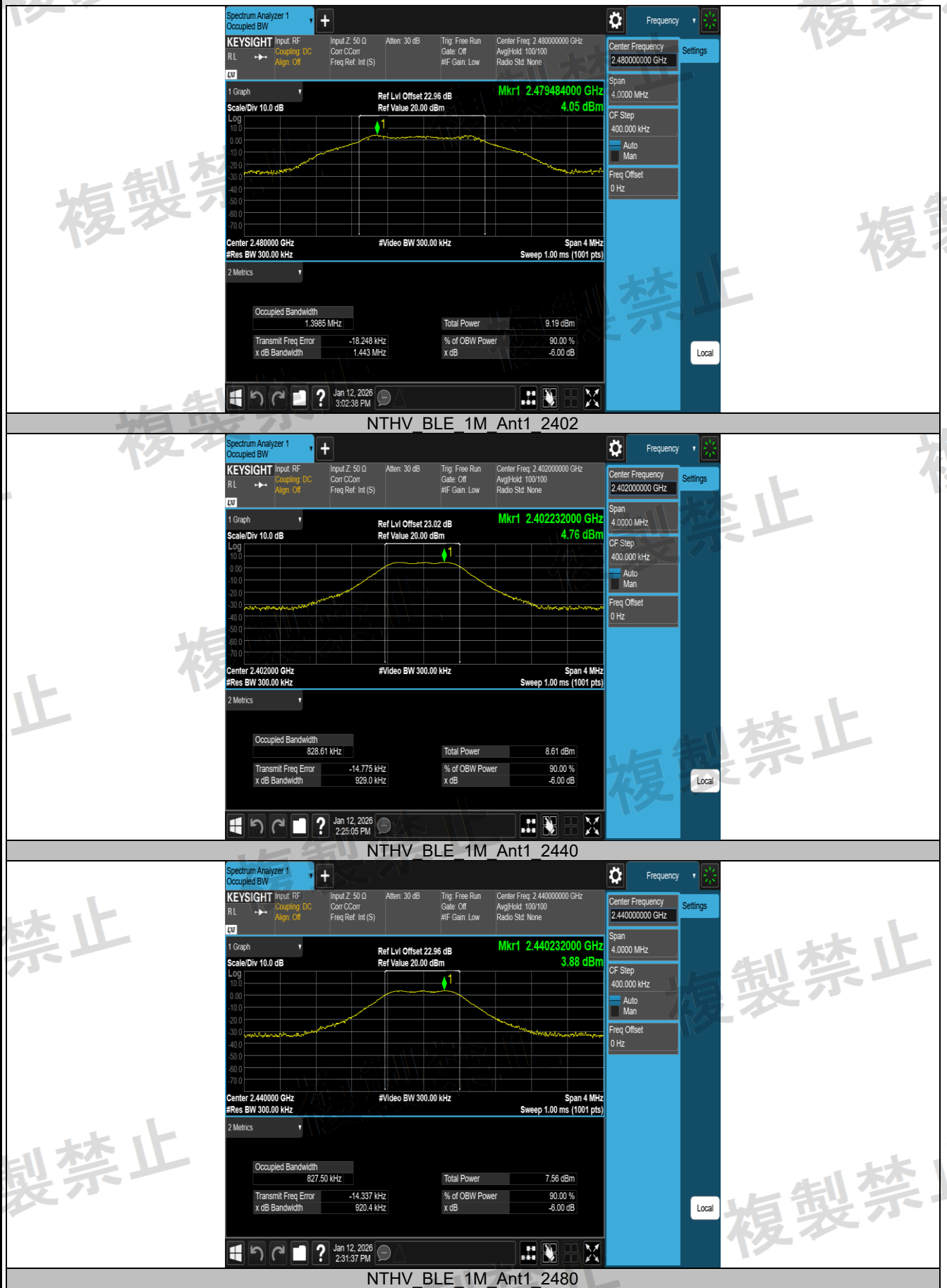
NTNV_BLE_2M_Ant1_2440

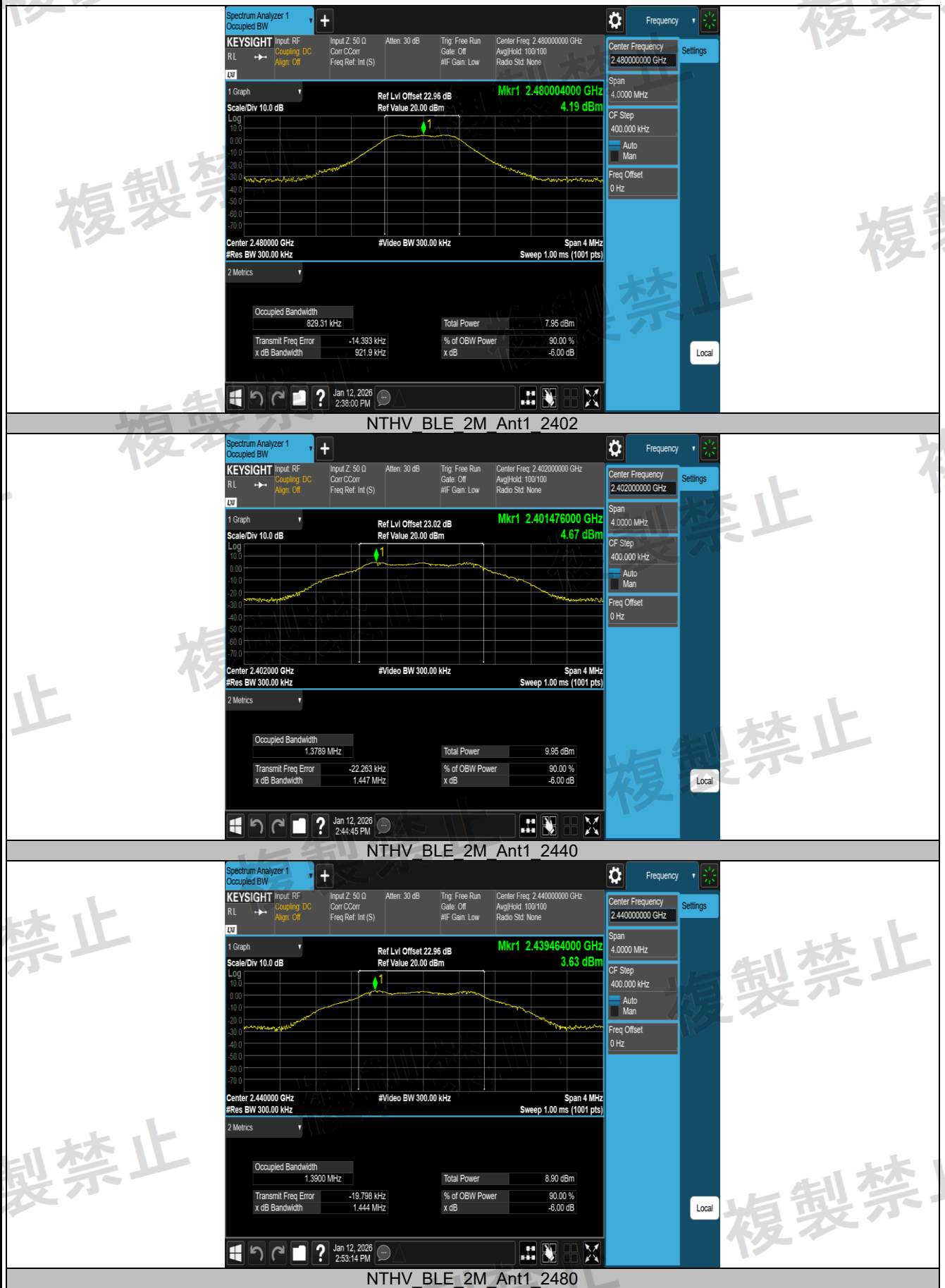


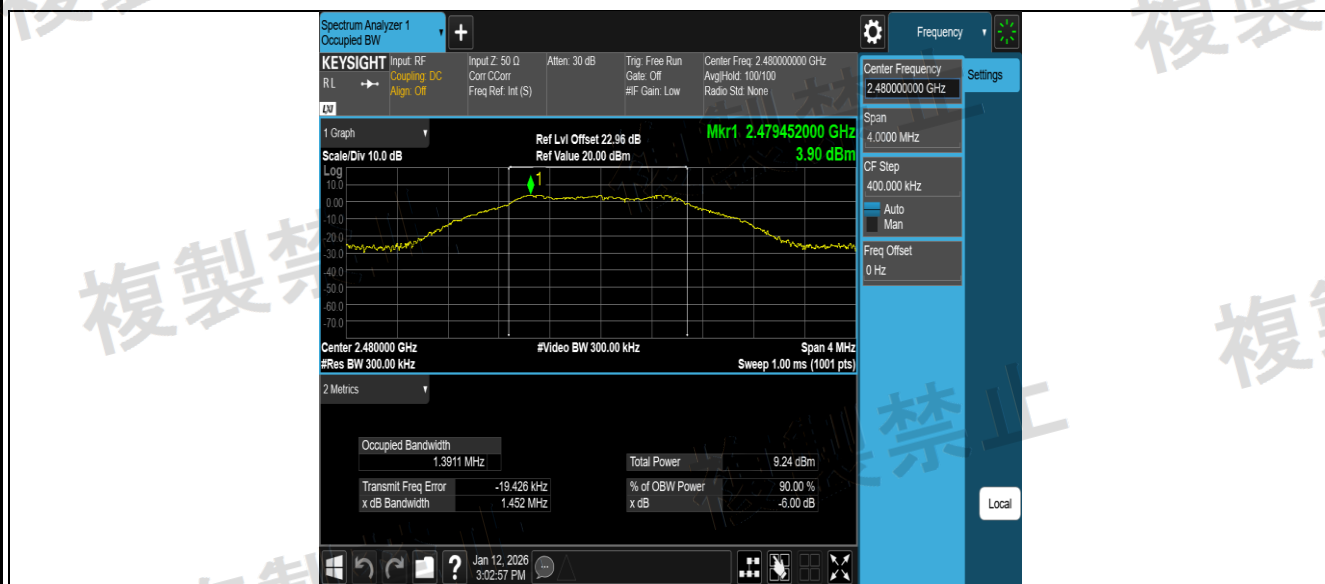
NTNV_BLE_2M_Ant1_2480











Appendix A.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	185.57	-42.97	≤-26	0.05047	≤2.5	PASS
				500~1000	511.25	-47.96	≤-26	0.01600	≤2.5	PASS
				1000~2387	2381.11	-43.96	≤-26	0.04018	≤2.5	PASS
				2387~2400	2399.99	-26.08	≤-16	2.46604	≤25	PASS
				2483.5~2496.5	2489.92	-39.26	≤-16	0.11858	≤25	PASS
				2496.5~13000	3805.24	-49.62	≤-26	0.01091	≤2.5	PASS
			2440	30~500	190.15	-43.11	≤-26	0.04887	≤2.5	PASS
				500~1000	507.00	-47.92	≤-26	0.01614	≤2.5	PASS
				1000~2387	2045.10	-48.29	≤-26	0.01483	≤2.5	PASS
				2387~2400	2397.87	-39.23	≤-16	0.11940	≤25	PASS
				2483.5~2496.5	2494.22	-38.71	≤-16	0.13459	≤25	PASS
				2496.5~13000	3793.68	-49.56	≤-26	0.01107	≤2.5	PASS
			2480	30~500	177.93	-43.27	≤-26	0.04710	≤2.5	PASS
				500~1000	530.75	-48.42	≤-26	0.01439	≤2.5	PASS
				1000~2387	2038.86	-48.94	≤-26	0.01276	≤2.5	PASS
				2387~2400	2397.67	-39.03	≤-16	0.12503	≤25	PASS
				2483.5~2496.5	2484.23	-35.23	≤-16	0.29992	≤25	PASS
				2496.5~13000	3505.89	-47.17	≤-26	0.01919	≤2.5	PASS
	BLE_2M	Ant1	2402	30~500	194.74	-43.34	≤-26	0.04634	≤2.5	PASS
				500~1000	546.50	-48.11	≤-26	0.01545	≤2.5	PASS
				1000~2387	2382.84	-44.21	≤-26	0.03793	≤2.5	PASS
				2387~2400	2400	-15.90	≤-16	25.70396	≤25	See table below
				2483.5~2496.5	2493.59	-38.93	≤-16	0.12794	≤25	PASS
				2496.5~13000	3812.06	-48.91	≤-26	0.01285	≤2.5	PASS
			2440	30~500	178.52	-42.64	≤-26	0.05445	≤2.5	PASS
				500~1000	511.63	-47.50	≤-26	0.01778	≤2.5	PASS
				1000~2387	1984.08	-47.92	≤-26	0.01614	≤2.5	PASS
				2387~2400	2399.08	-39.68	≤-16	0.10765	≤25	PASS
				2483.5~2496.5	2489.96	-38.85	≤-16	0.13032	≤25	PASS
				2496.5~13000	3786.33	-49.62	≤-26	0.01091	≤2.5	PASS
			2480	30~500	181.11	-43.07	≤-26	0.04932	≤2.5	PASS
				500~1000	522.75	-47.40	≤-26	0.01820	≤2.5	PASS
				1000~2387	1995.17	-48.57	≤-26	0.01390	≤2.5	PASS
				2387~2400	2396.41	-39.08	≤-16	0.12359	≤25	PASS
				2483.5~2496.5	2483.55	-34.85	≤-16	0.32734	≤25	PASS
				2496.5~13000	2520.13	-47.61	≤-26	0.01734	≤2.5	PASS
NTLV	BLE_1M	Ant1	2402	30~500	192.50	-43.05	≤-26	0.04955	≤2.5	PASS
				500~1000	512.13	-48.02	≤-26	0.01578	≤2.5	PASS
				1000~2387	2382.84	-43.81	≤-26	0.04159	≤2.5	PASS
				2387~2400	2400.00	-26.55	≤-16	2.21309	≤25	PASS
				2483.5~2496.5	2485.48	-39.02	≤-16	0.12531	≤25	PASS
				2496.5~13000	3223.87	-49.16	≤-26	0.01213	≤2.5	PASS
			2440	30~500	179.58	-42.53	≤-26	0.05585	≤2.5	PASS
				500~1000	526.75	-47.77	≤-26	0.01671	≤2.5	PASS
				1000~2387	2001.07	-48.26	≤-26	0.01493	≤2.5	PASS
				2387~2400	2387.05	-39.47	≤-16	0.11298	≤25	PASS
				2483.5~2496.5	2489.69	-39.18	≤-16	0.12078	≤25	PASS
				2496.5~13000	3789.48	-49.32	≤-26	0.01169	≤2.5	PASS
			2480	30~500	187.10	-42.85	≤-26	0.05188	≤2.5	PASS
				500~1000	513.00	-47.22	≤-26	0.01897	≤2.5	PASS
				1000~2387	1992.75	-48.76	≤-26	0.01330	≤2.5	PASS
				2387~2400	2389.01	-39.21	≤-16	0.11995	≤25	PASS
				2483.5~2496.5	2483.91	-35.28	≤-16	0.29648	≤25	PASS
				2496.5~13000	2499.13	-43.61	≤-26	0.04355	≤2.5	PASS
	BLE_2M	Ant1	2402	30~500	187.22	-42.87	≤-26	0.05164	≤2.5	PASS
				500~1000	538.38	-48.39	≤-26	0.01449	≤2.5	PASS
				1000~2387	2382.84	-43.95	≤-26	0.04027	≤2.5	PASS
				2387~2400	2400	-15.82	≤-16	26.18183	≤25	See table below
				2483.5~2496.5	2490.72	-39.37	≤-16	0.11561	≤25	PASS
				2496.5~13000	3764.80	-49.76	≤-26	0.01057	≤2.5	PASS
			2440	30~500	175.00	-42.69	≤-26	0.05383	≤2.5	PASS
				500~1000	580.75	-47.67	≤-26	0.01710	≤2.5	PASS

Appendix A

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Prüfbericht - Produkte
Test Report - Products

NTHV	BLE_1M	Ant1	2480	1000~2387	2176.52	-47.99	≤-26	0.01589	≤2.5	PASS
				2387~2400	2387.32	-39.37	≤-16	0.11561	≤25	PASS
				2483.5~2496.5	2491.22	-39.09	≤-16	0.12331	≤25	PASS
				2496.5~13000	3776.35	-48.86	≤-26	0.01300	≤2.5	PASS
				30~500	173.23	-43.07	≤-26	0.04932	≤2.5	PASS
			2402	500~1000	514.00	-47.85	≤-26	0.01641	≤2.5	PASS
				1000~2387	2056.20	-48.04	≤-26	0.01570	≤2.5	PASS
				2387~2400	2394.52	-39.14	≤-16	0.12190	≤25	PASS
				2483.5~2496.5	2485.16	-32.81	≤-16	0.52360	≤25	PASS
				2496.5~13000	3507.99	-43.10	≤-26	0.04898	≤2.5	PASS
	BLE_2M	Ant1	2402	30~500	178.64	-42.89	≤-26	0.05140	≤2.5	PASS
				500~1000	517.25	-48.20	≤-26	0.01514	≤2.5	PASS
				1000~2387	2383.53	-43.51	≤-26	0.04457	≤2.5	PASS
				2387~2400	2400.00	-25.52	≤-16	2.80543	≤25	PASS
				2483.5~2496.5	2486.15	-39.15	≤-16	0.12162	≤25	PASS
			2440	2496.5~13000	3773.73	-48.78	≤-26	0.01324	≤2.5	PASS
				30~500	196.62	-43.06	≤-26	0.04943	≤2.5	PASS
				500~1000	513.00	-47.39	≤-26	0.01824	≤2.5	PASS
				1000~2387	2032.62	-48.39	≤-26	0.01449	≤2.5	PASS
				2387~2400	2389.02	-38.58	≤-16	0.13868	≤25	PASS
			2480	2483.5~2496.5	2485.90	-39.13	≤-16	0.12218	≤25	PASS
				2496.5~13000	3595.17	-39.57	≤-26	0.11041	≤2.5	PASS
				30~500	203.20	-43.30	≤-26	0.04677	≤2.5	PASS
				500~1000	514.00	-48.15	≤-26	0.01531	≤2.5	PASS
				1000~2387	2057.59	-48.30	≤-26	0.01479	≤2.5	PASS
			2402	2387~2400	2389.03	-39.20	≤-16	0.12023	≤25	PASS
				2483.5~2496.5	2483.63	-35.61	≤-16	0.27479	≤25	PASS
				2496.5~13000	2501.23	-45.17	≤-26	0.03041	≤2.5	PASS
			2440	30~500	183.46	-42.68	≤-26	0.05395	≤2.5	PASS
				500~1000	552.38	-48.07	≤-26	0.01560	≤2.5	PASS
				1000~2387	2383.53	-46.52	≤-26	0.02228	≤2.5	PASS
				2387~2400	2400	-15.54	≤-16	27.92544	≤25	See table below
				2483.5~2496.5	2490.04	-39.47	≤-16	0.11298	≤25	PASS
			2480	2496.5~13000	3754.29	-49.61	≤-26	0.01094	≤2.5	PASS
				30~500	184.16	-43.12	≤-26	0.04875	≤2.5	PASS
				500~1000	508.50	-48.19	≤-26	0.01517	≤2.5	PASS
				1000~2387	2028.81	-48.51	≤-26	0.01409	≤2.5	PASS
				2387~2400	2395.99	-39.03	≤-16	0.12503	≤25	PASS
			2402	2483.5~2496.5	2486.67	-39.12	≤-16	0.12246	≤25	PASS
				2496.5~13000	3791.58	-48.50	≤-26	0.01413	≤2.5	PASS
				30~500	180.64	-42.69	≤-26	0.05383	≤2.5	PASS
				500~1000	551.38	-47.98	≤-26	0.01592	≤2.5	PASS
				1000~2387	1975.75	-48.86	≤-26	0.01300	≤2.5	PASS
			2480	2387~2400	2398.72	-39.65	≤-16	0.10839	≤25	PASS
				2483.5~2496.5	2485.62	-31.04	≤-16	0.78705	≤25	PASS
				2496.5~13000	2520.13	-46.79	≤-26	0.02094	≤2.5	PASS

Test Result_Step2

Test Condition	Test Mode	Antenna	Freq (MHz)	Freq. [MHz]	Result [dBm]	Limit [dBm]	Result [μW]	Limit [μW]	Verdict
NTNV	BLE_2M	Ant1	2402	2400.00	-24.44	≤-16	3.59749	≤25	PASS
NTHV	BLE_2M	Ant1	2402	2400.00	-24.27	≤-16	3.74111	≤25	PASS
NTHV	BLE_2M	Ant1	2402	2400.00	-24.46	≤-16	3.58096	≤25	PASS

Test Graphs

