



Appendix A

RF Test Data for 2.4G BLE (Conducted Measurement)

Product Name: LED strip and driver

Test Model: MS-D2BRNPT4

Environmental Conditions

Temperature:	21.1 ° C
Relative Humidity:	52.2%
ATM Pressure:	100.0 kPa
Test Engineer:	Wunder Wu
Supervised by:	Huan Li



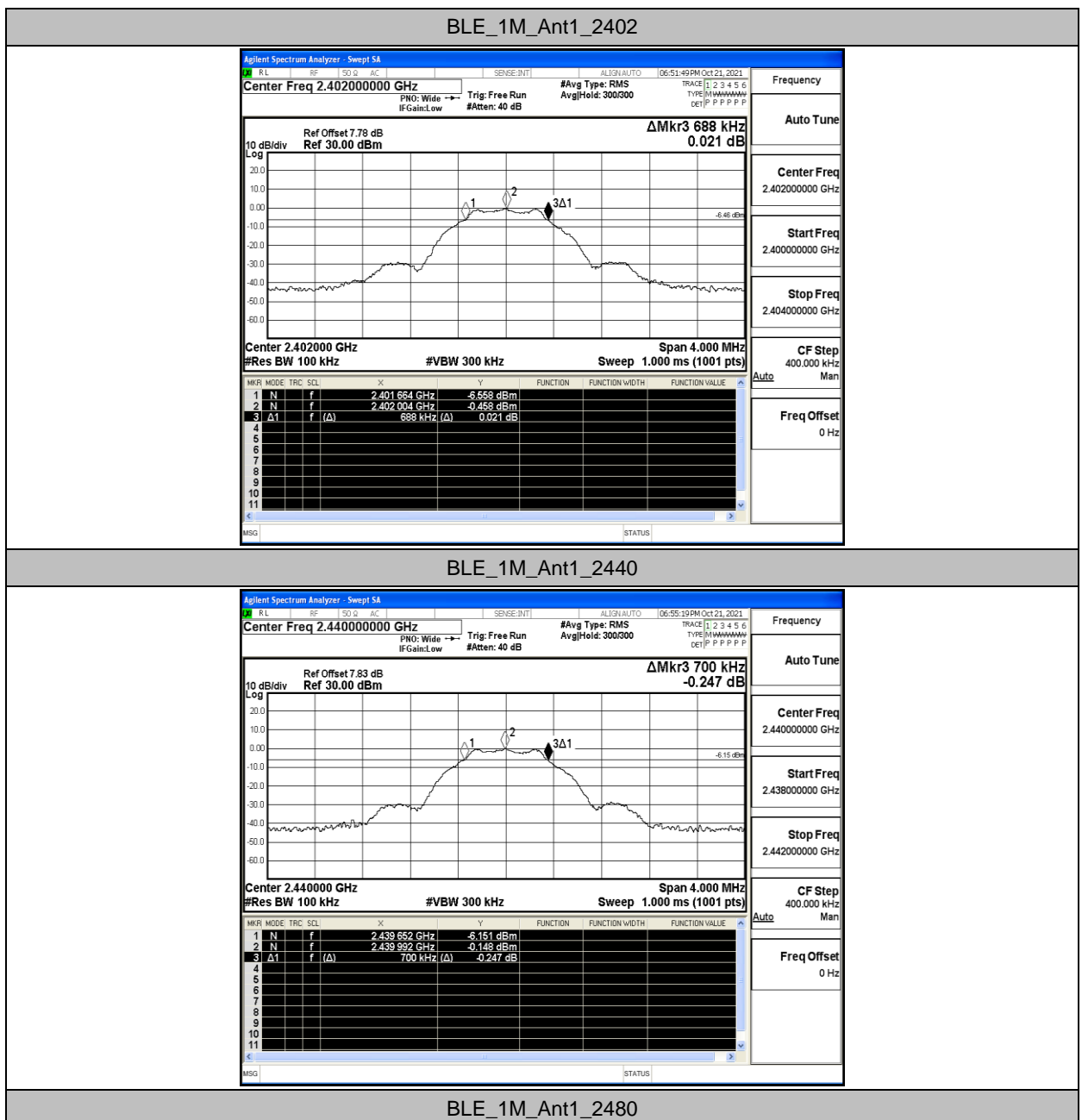
ANT1:

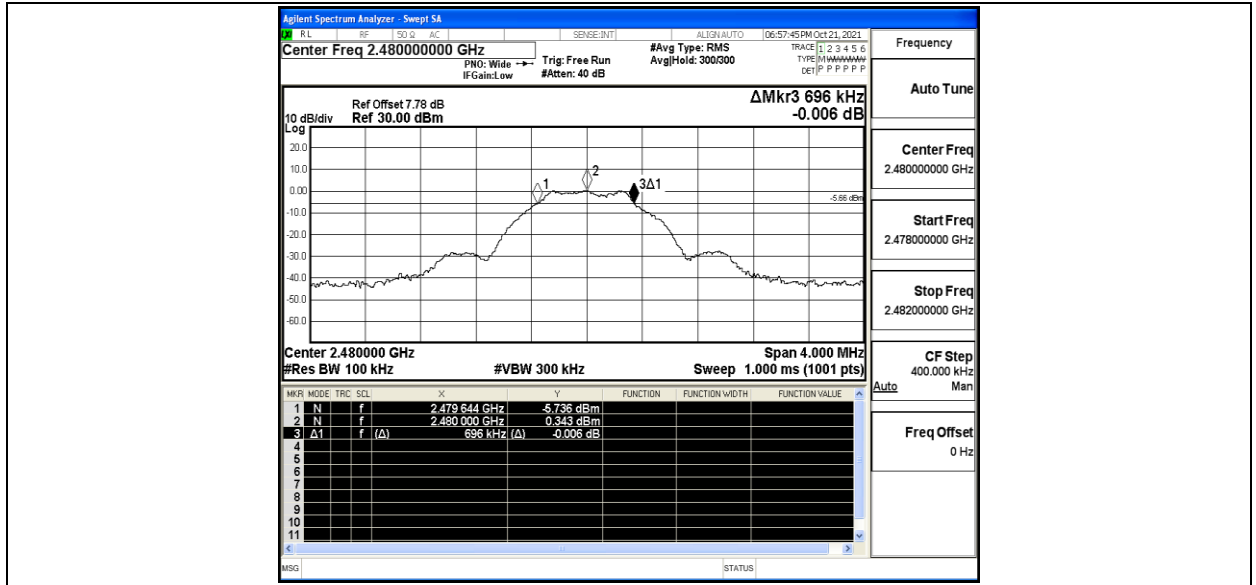
A.1 6dB Bandwidth

Test Result

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.688	2401.664	2402.352	≥0.5	PASS
		2440	0.700	2439.652	2440.352	≥0.5	PASS
		2480	0.696	2479.644	2480.340	≥0.5	PASS

Test Graphs





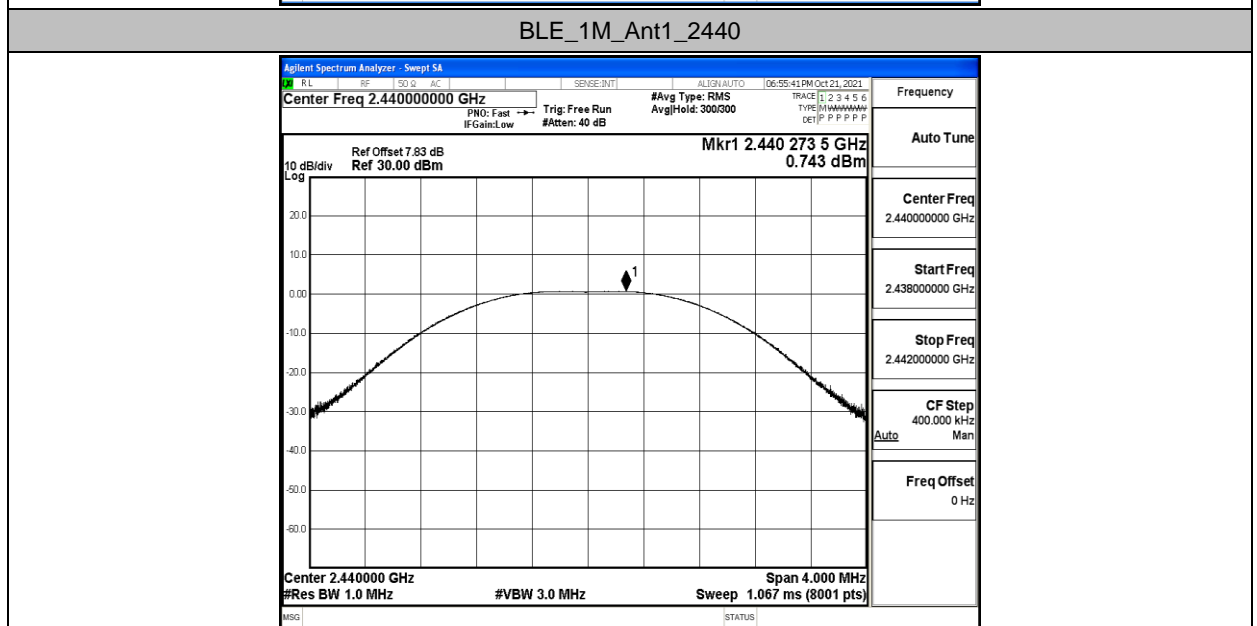
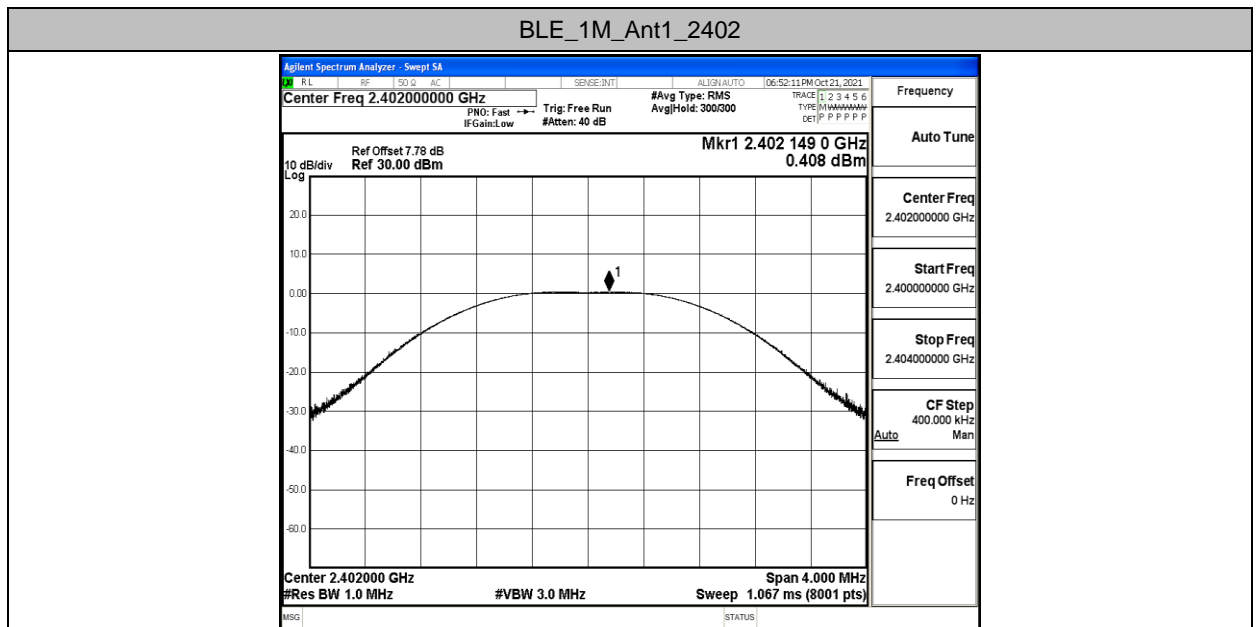


A.2 Maximum conducted output power

Test Result

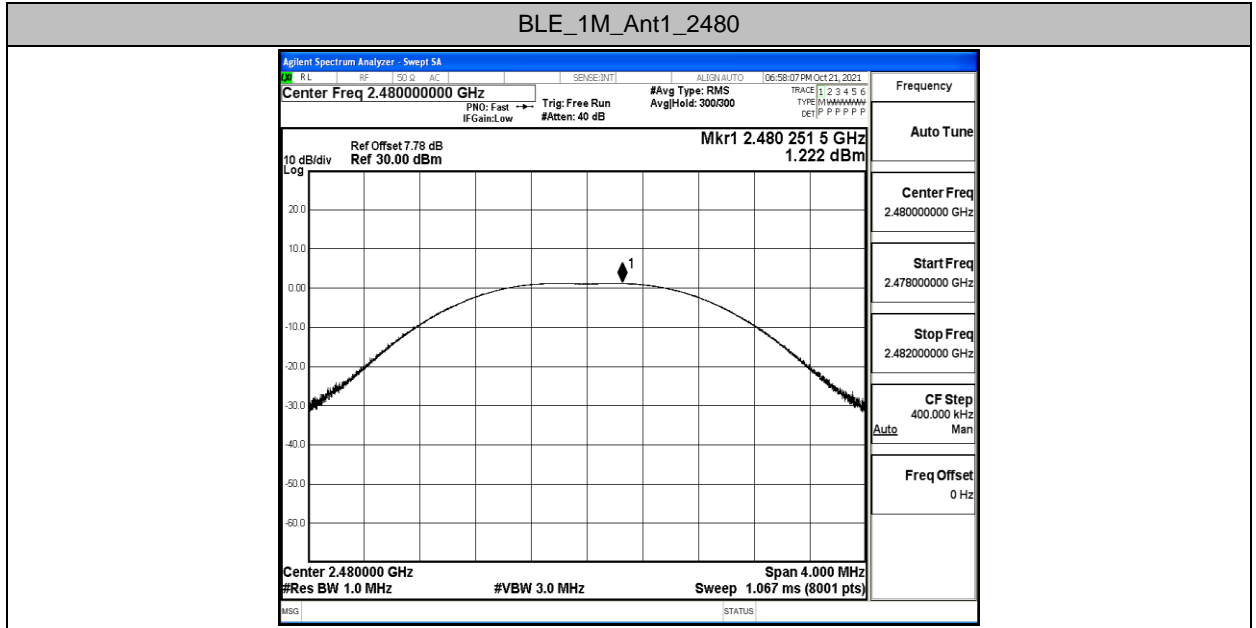
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	0.41	≤30	PASS
		2440	0.74	≤30	PASS
		2480	1.22	≤30	PASS

Test Graphs





BLE_1M_Ant1_2480



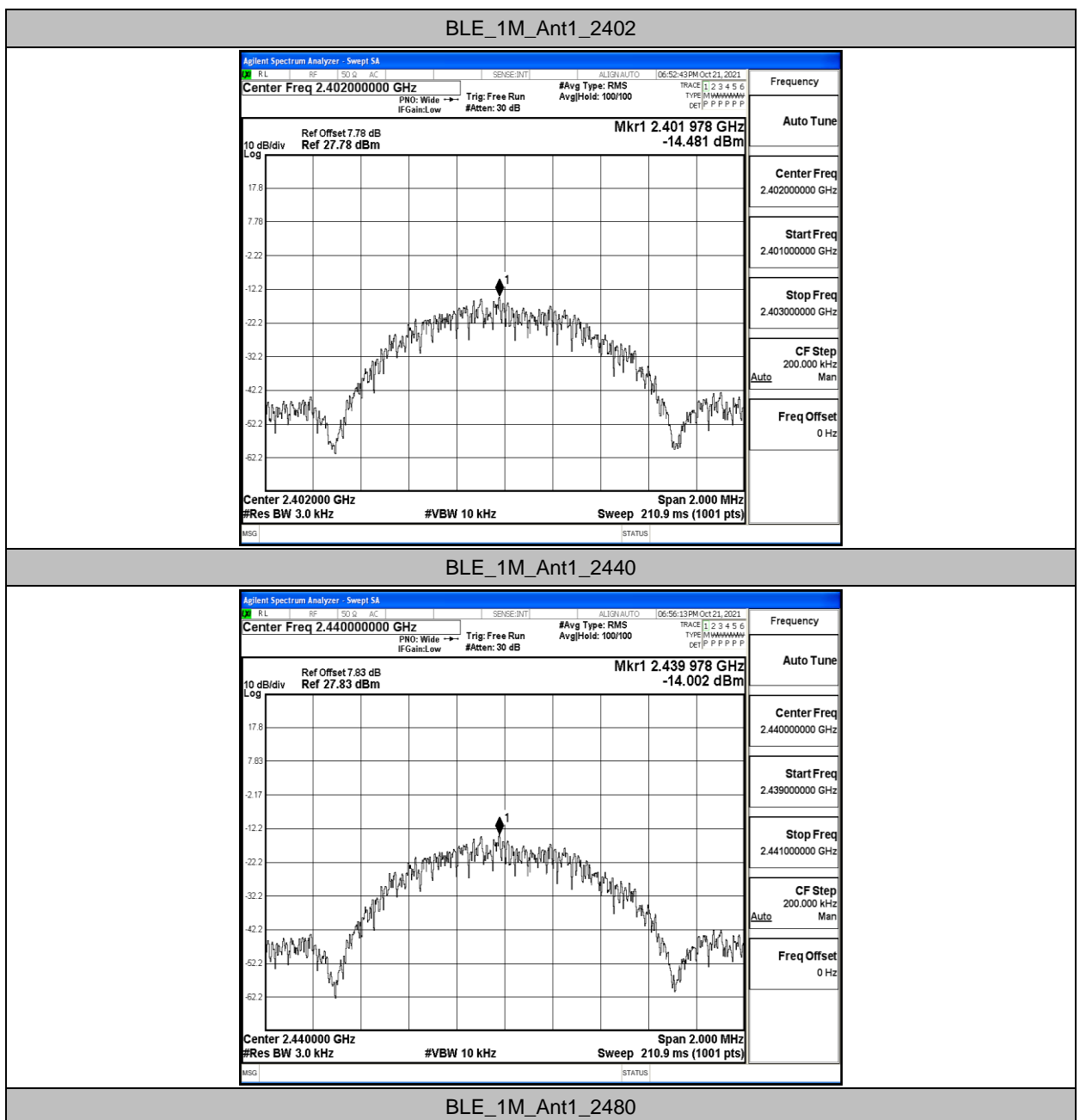


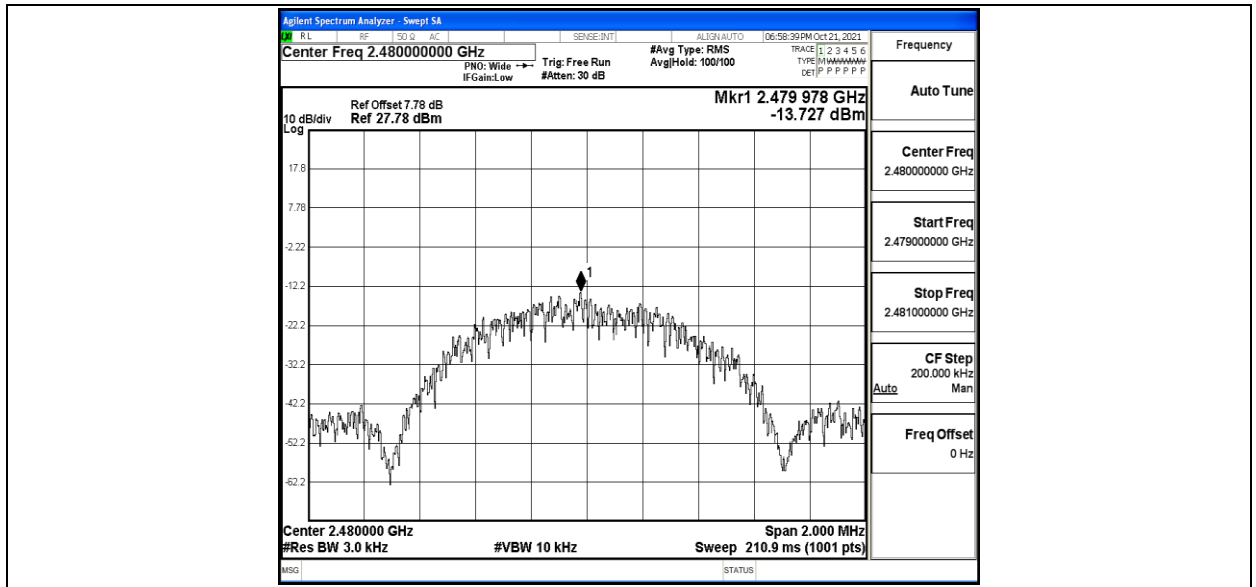
A.3 Maximum power spectral density

Test Result

TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-14.48	≤8	PASS
		2440	-14	≤8	PASS
		2480	-13.73	≤8	PASS

Test Graphs





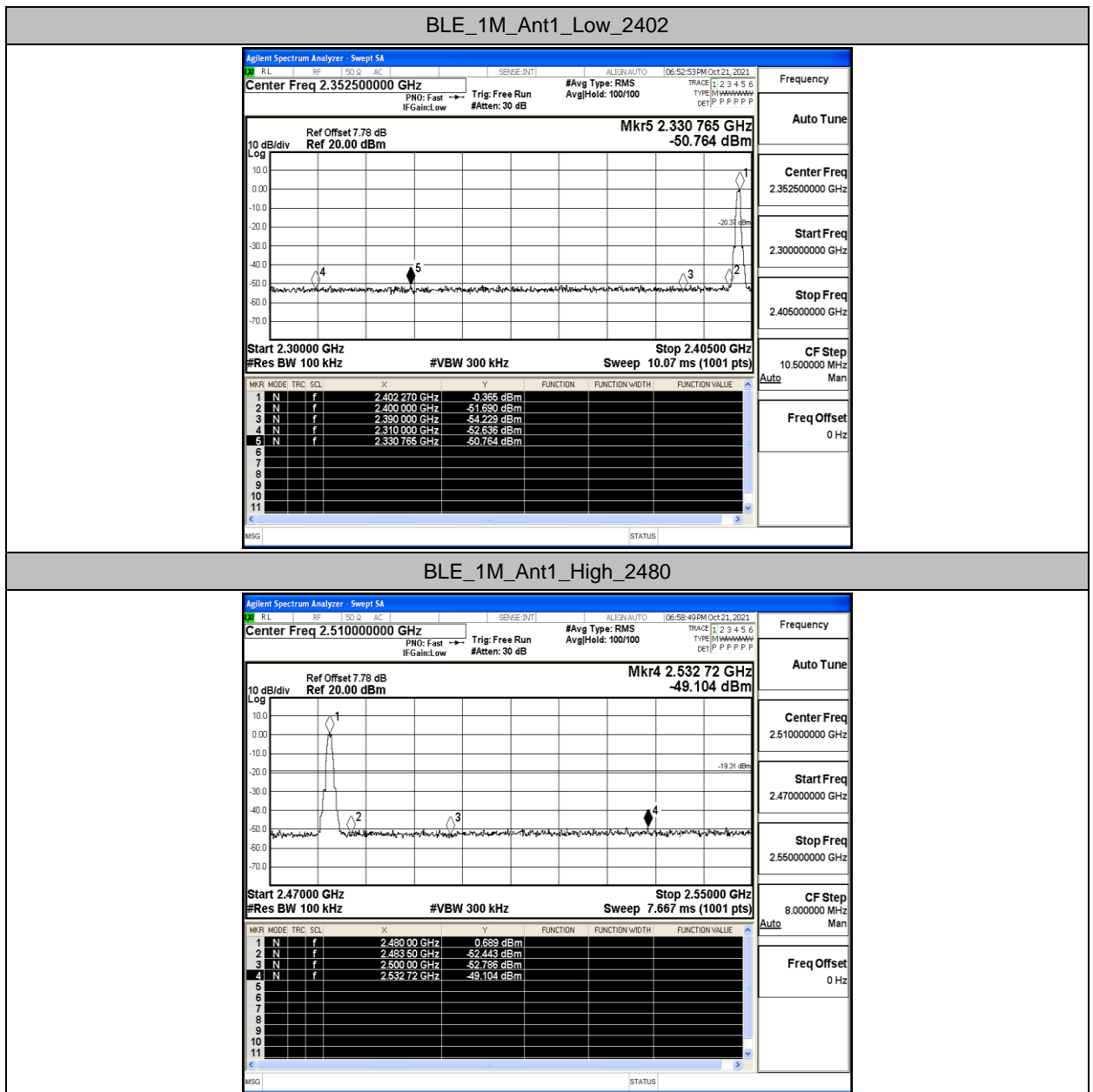


A.4 Band edge measurements

Test Result

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	Low	2402	-0.37	-50.76	≤-20.37	PASS
		High	2480	0.69	-49.1	≤-19.31	PASS

Test Graphs



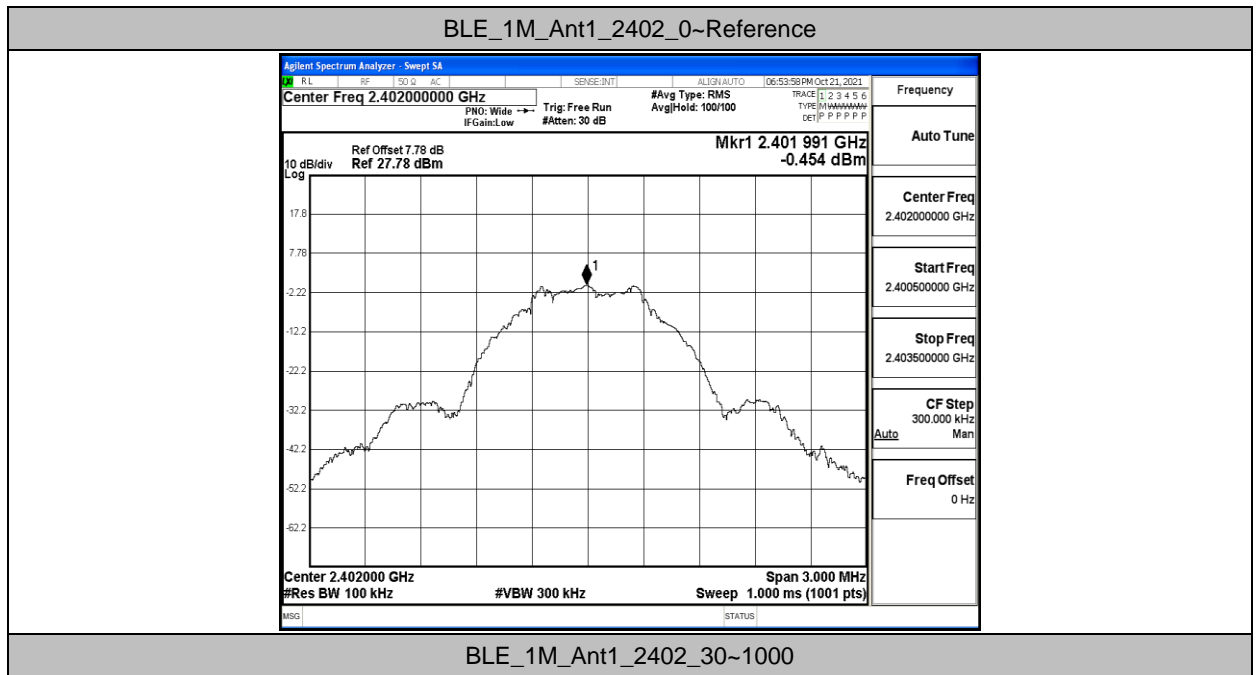


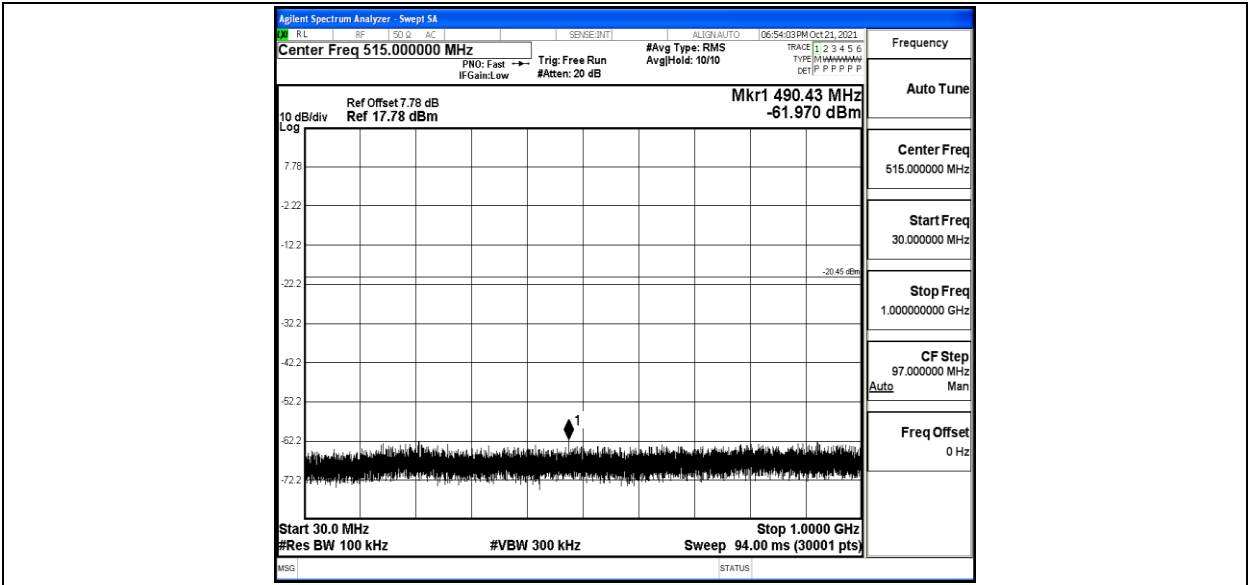
A.5 Conducted Spurious Emission

Test Result

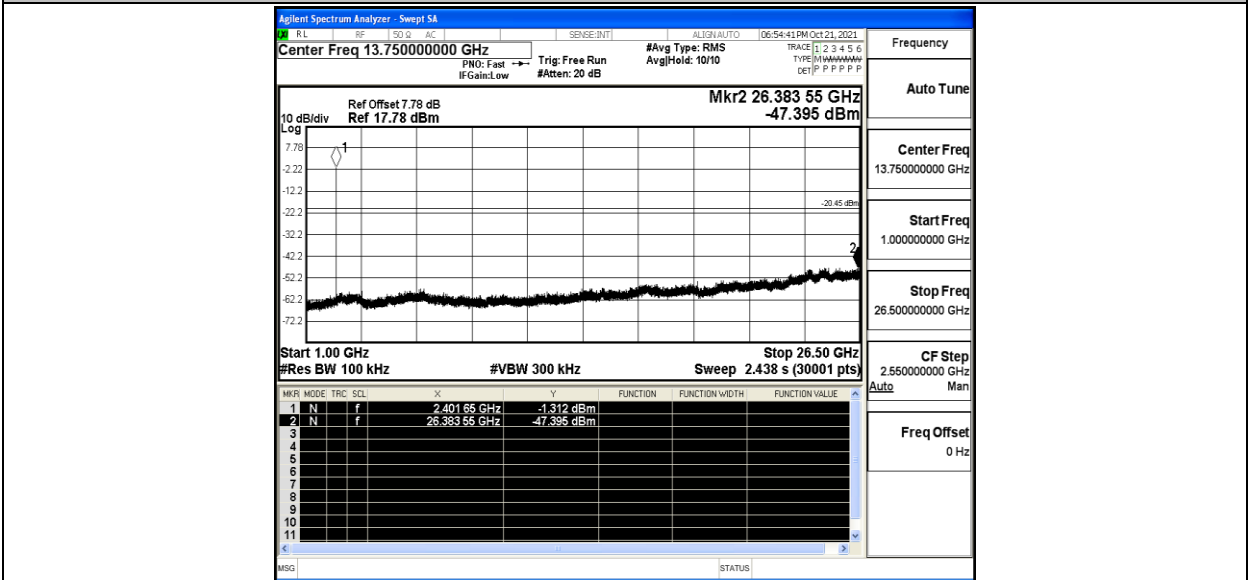
TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	Reference	-0.45	-0.45	---	PASS
			30~1000	-0.45	-61.97	≤-20.45	PASS
			1000~26500	-0.45	-47.4	≤-20.45	PASS
		2440	Reference	-0.06	-0.06	---	PASS
			30~1000	-0.06	-61.34	≤-20.06	PASS
			1000~26500	-0.06	-47.5	≤-20.06	PASS
		2480	Reference	0.37	0.37	---	PASS
			30~1000	0.37	-61.63	≤-19.63	PASS
			1000~26500	0.37	-47.5	≤-19.63	PASS

Test Graphs

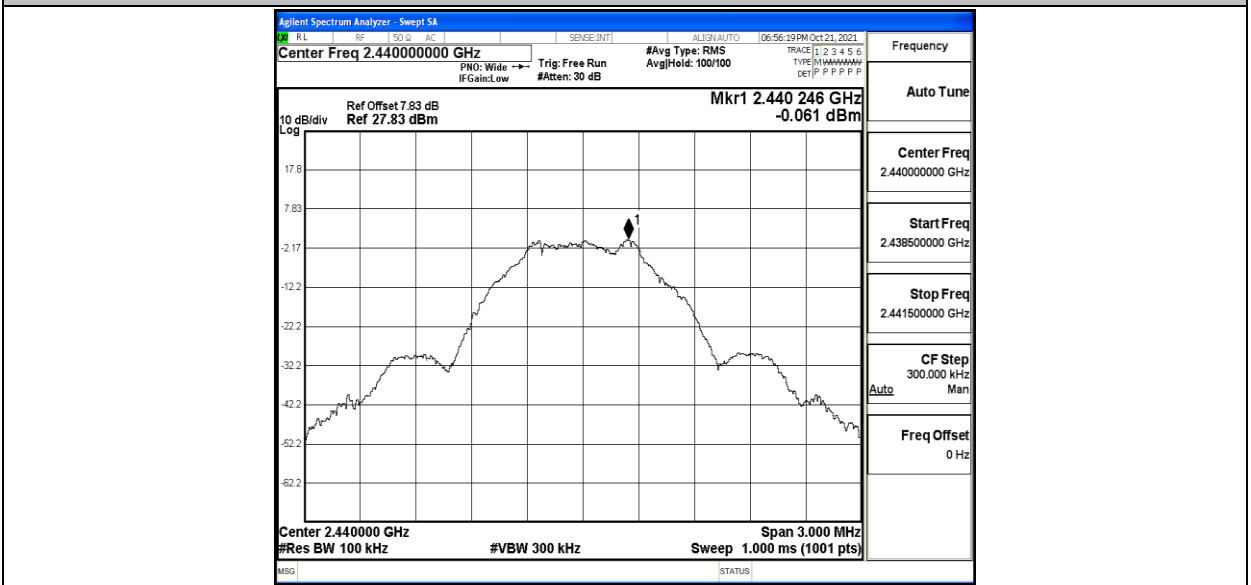




BLE_1M_Ant1_2402_1000~26500

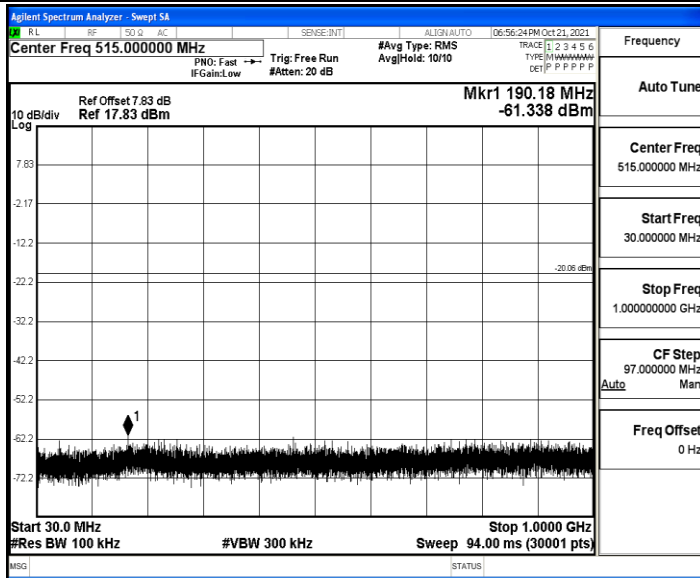


BLE_1M_Ant1_2440_0~Reference

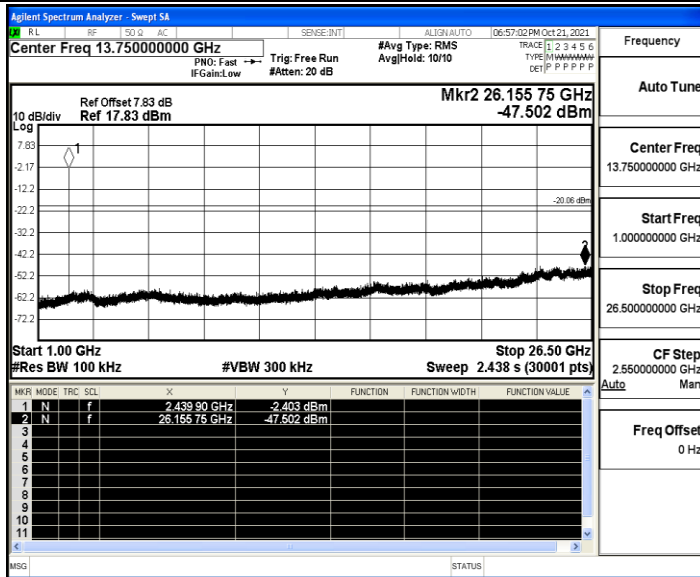




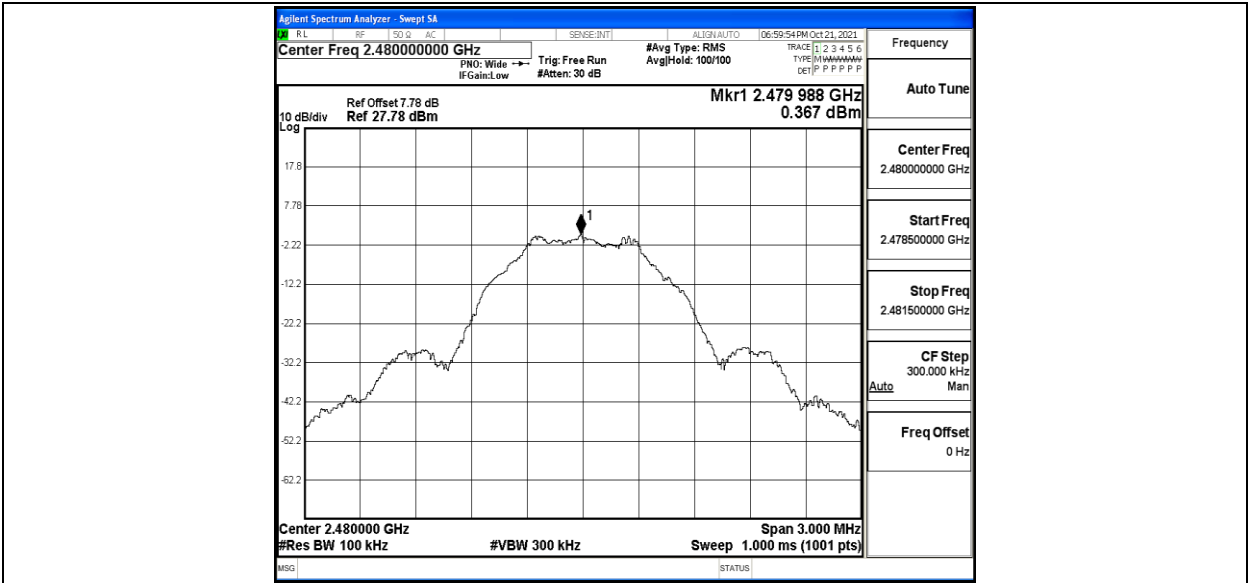
BLE_1M_Ant1_2440_30~1000



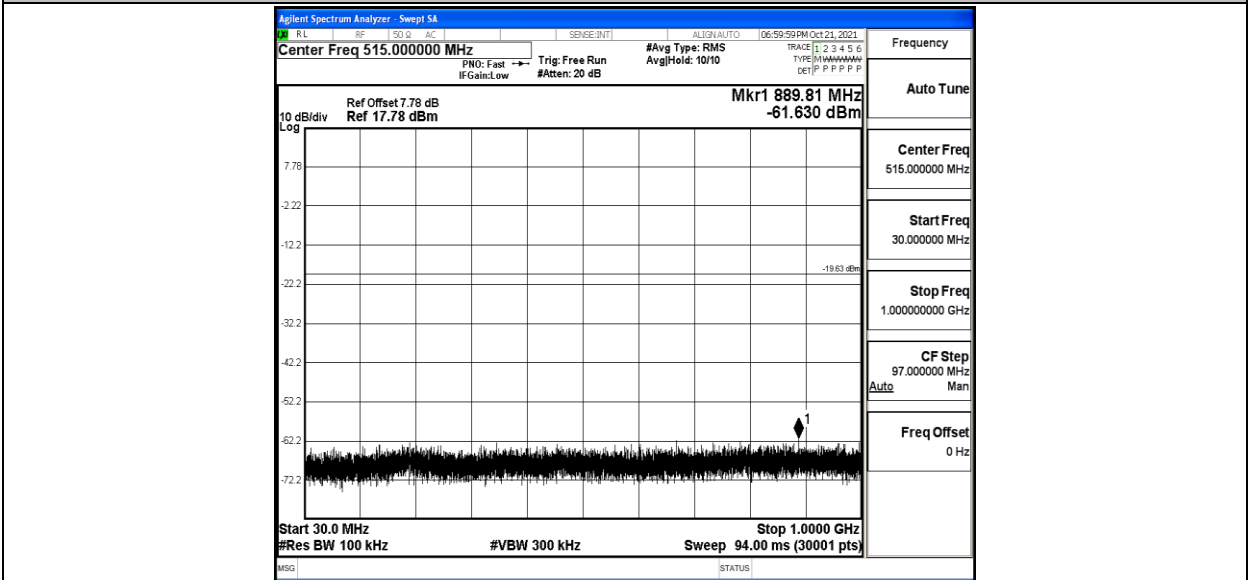
BLE_1M_Ant1_2440_1000~26500



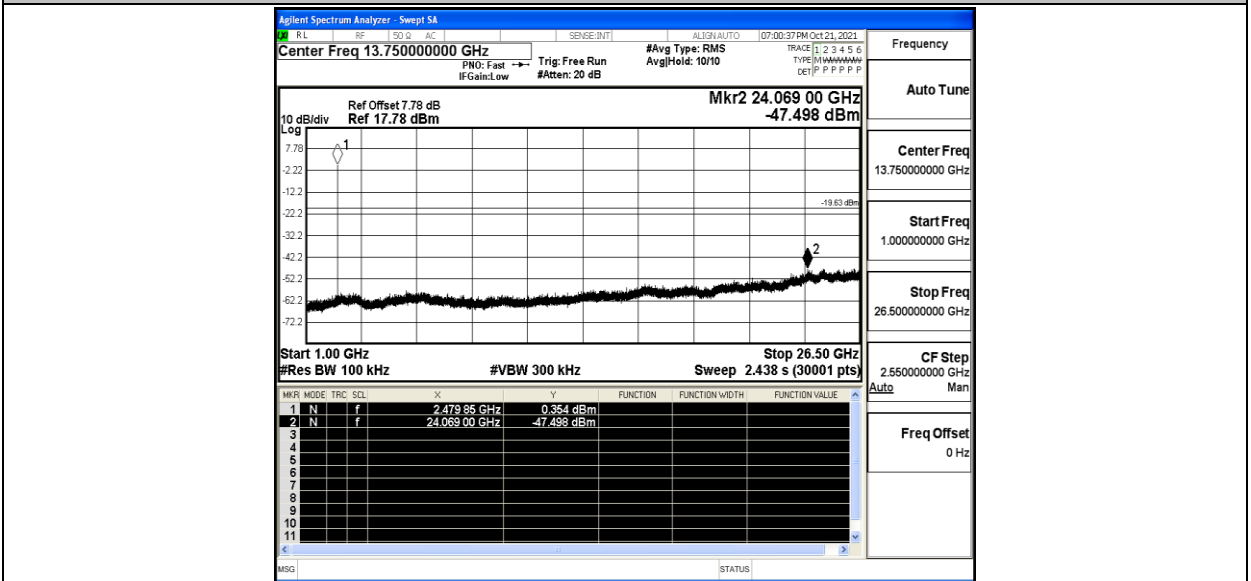
BLE_1M_Ant1_2480_0~Reference



BLE_1M_Ant1_2480_30~1000



BLE_1M_Ant1_2480_1000~26500



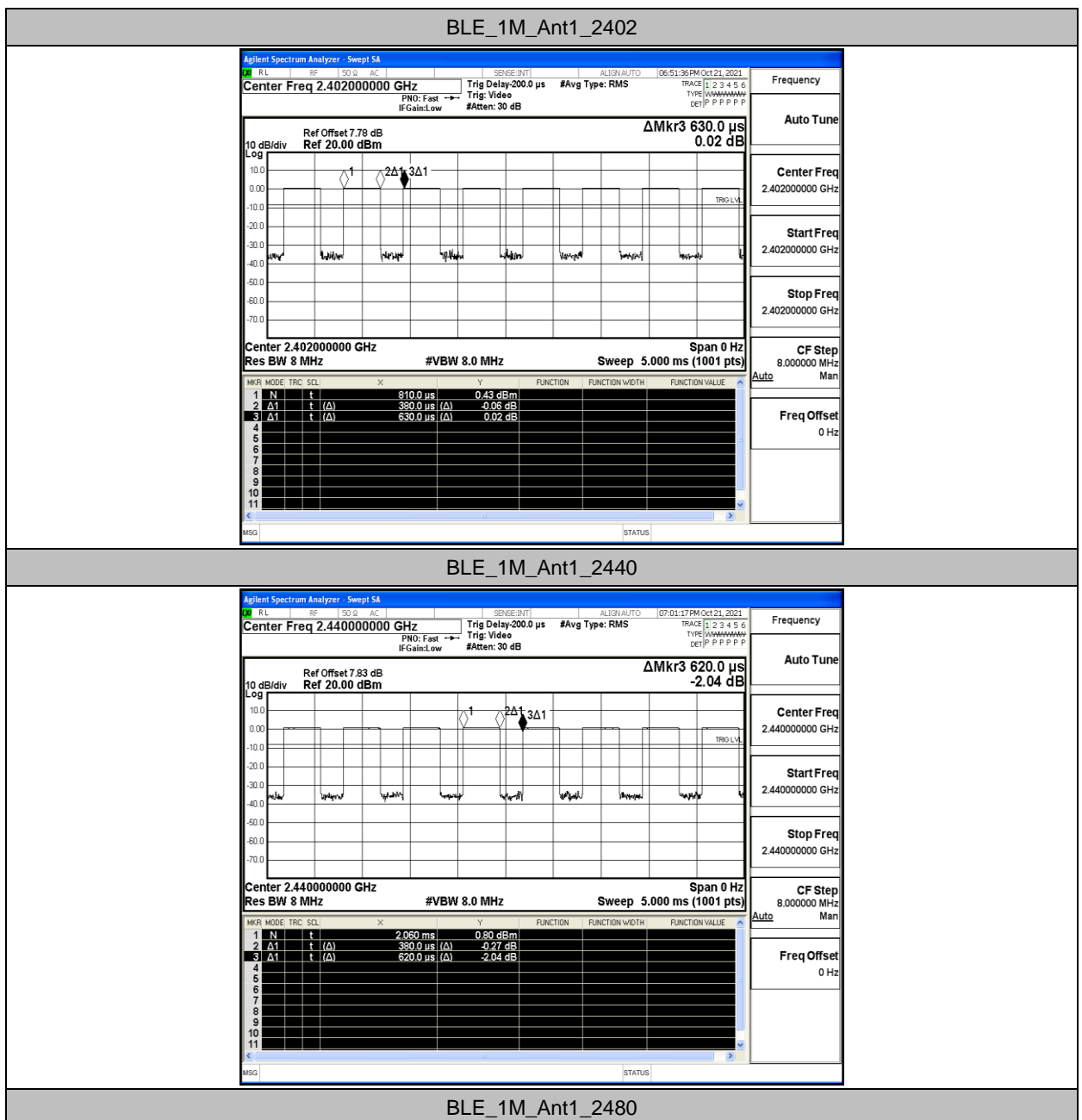


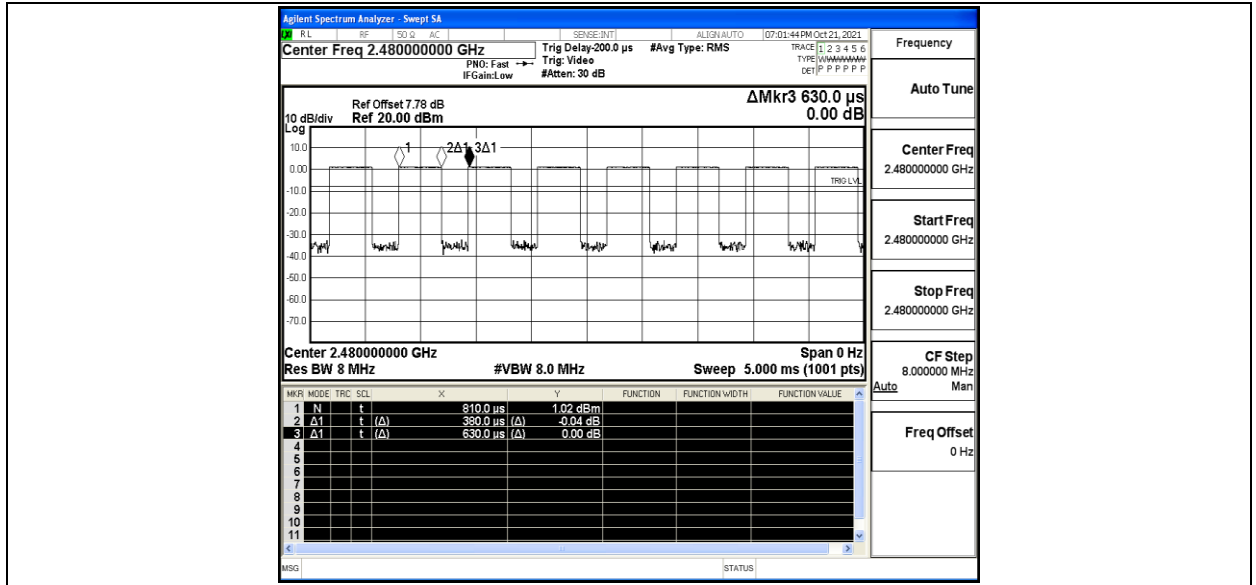
A.6 Duty Cycle

Test Result

TestMode	Antenna	Channel	ON Time [ms]	Period [ms]	X	DC [%]	xFactor	Limit	Verdict
BLE_1M	Ant1	2402	0.38	0.63	0.6032	60.32	2.20	---	PASS
		2440	0.38	0.62	0.6129	61.29	2.13	---	PASS
		2480	0.38	0.63	0.6032	60.32	2.20	---	PASS

Test Graphs







A.7 Emissions in Restricted Bands

Test Result

TestMode	Antenna	ChName	Channel	Detector	Freq. [MHz]	Result [dBm]	Limit [dBm]	Result [dBuV/m]	Limit [dBuV/m]	Verdict
BLE_1M	Ant1	Low	2402	AV	2310.000	-48.4	≤-41.20	46.80	≤54	PASS
				AV	2385.155	-47.57	≤-41.20	47.63	≤54	PASS
				AV	2390.000	-47.68	≤-41.20	47.52	≤54	PASS
				Peak	2310.000	-41.79	≤-21.20	53.41	≤74	PASS
				Peak	2377.490	-38.49	≤-21.20	56.71	≤74	PASS
				Peak	2390.000	-42.67	≤-21.20	52.53	≤74	PASS
		High	2480	AV	2483.500	-47.06	≤-41.20	48.14	≤54	PASS
				AV	2497.680	-46.77	≤-41.20	48.43	≤54	PASS
				AV	2500.000	-47.47	≤-41.20	47.73	≤54	PASS
				Peak	2483.500	-41.18	≤-21.20	54.02	≤74	PASS
				Peak	2495.200	-38.82	≤-21.20	56.38	≤74	PASS
				Peak	2500.000	-39.96	≤-21.20	55.24	≤74	PASS

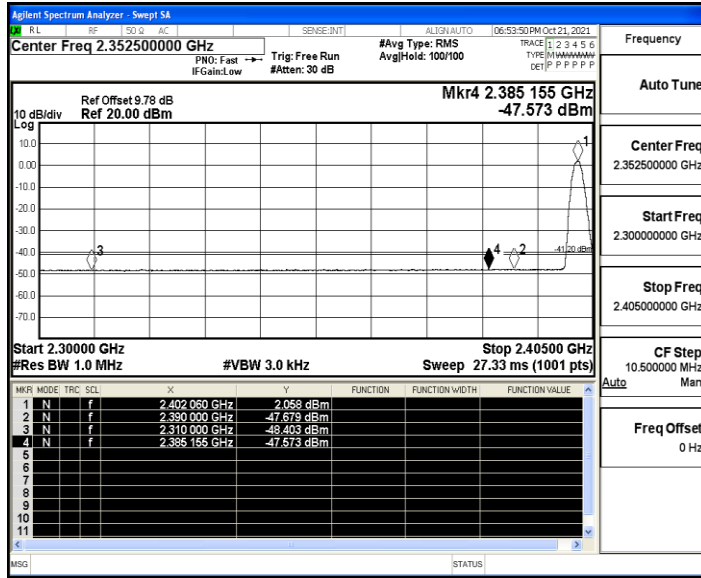
Note:

1. The Antenna Gain is compensated in the graph.
2. The limit in dBm for average detector is conversion from 54dBuV/m, according to 15.209(a). The limit in dBm for peak detector is 20dB above the limit of average detector in dBm.

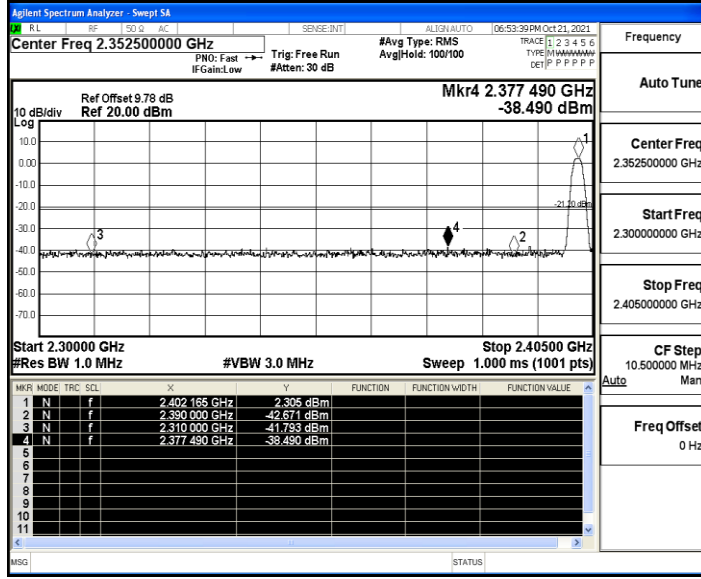


Test Graphs

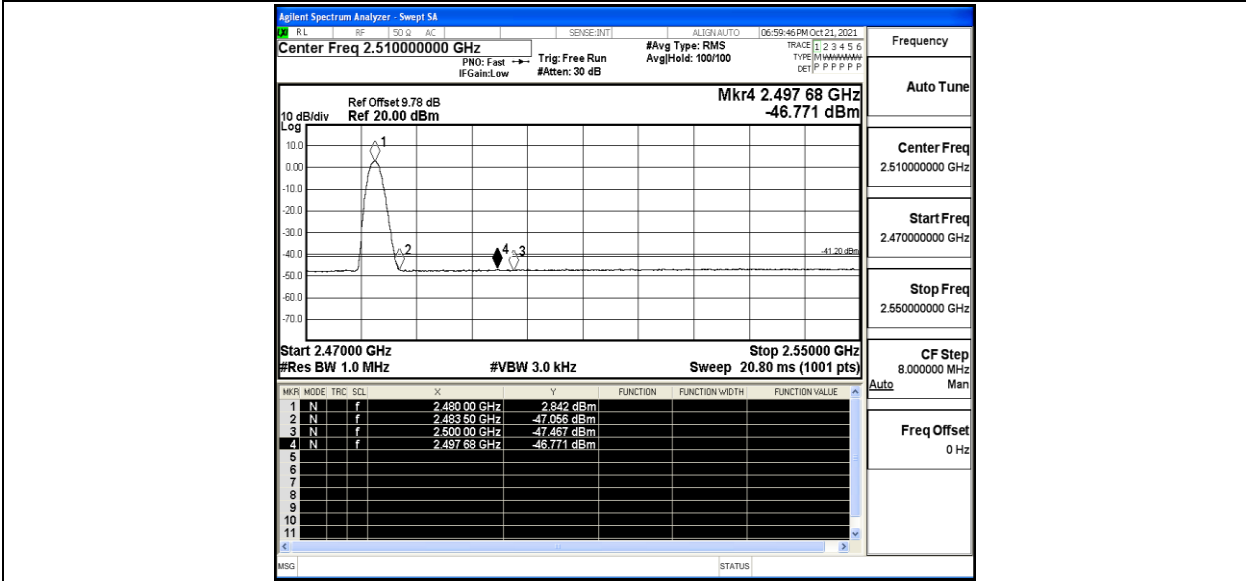
BLE_1M_Ant1_Low_2402_AV



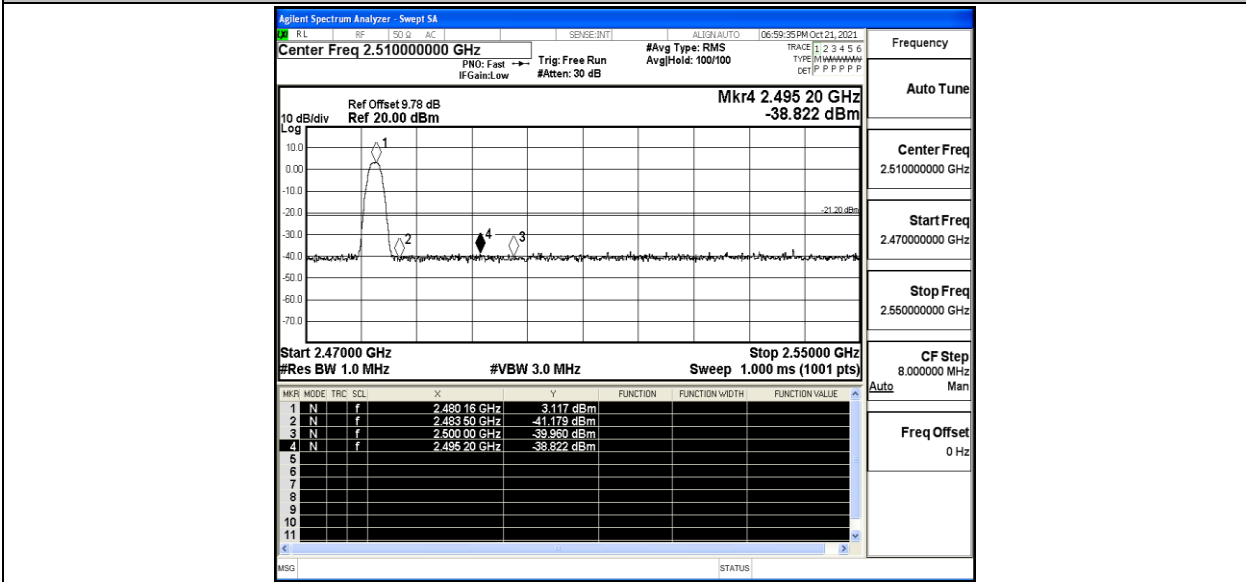
BLE_1M_Ant1_Low_2402_Peak



BLE_1M_Ant1_High_2480_AV



BLE_1M_Ant1_High_2480_Peak





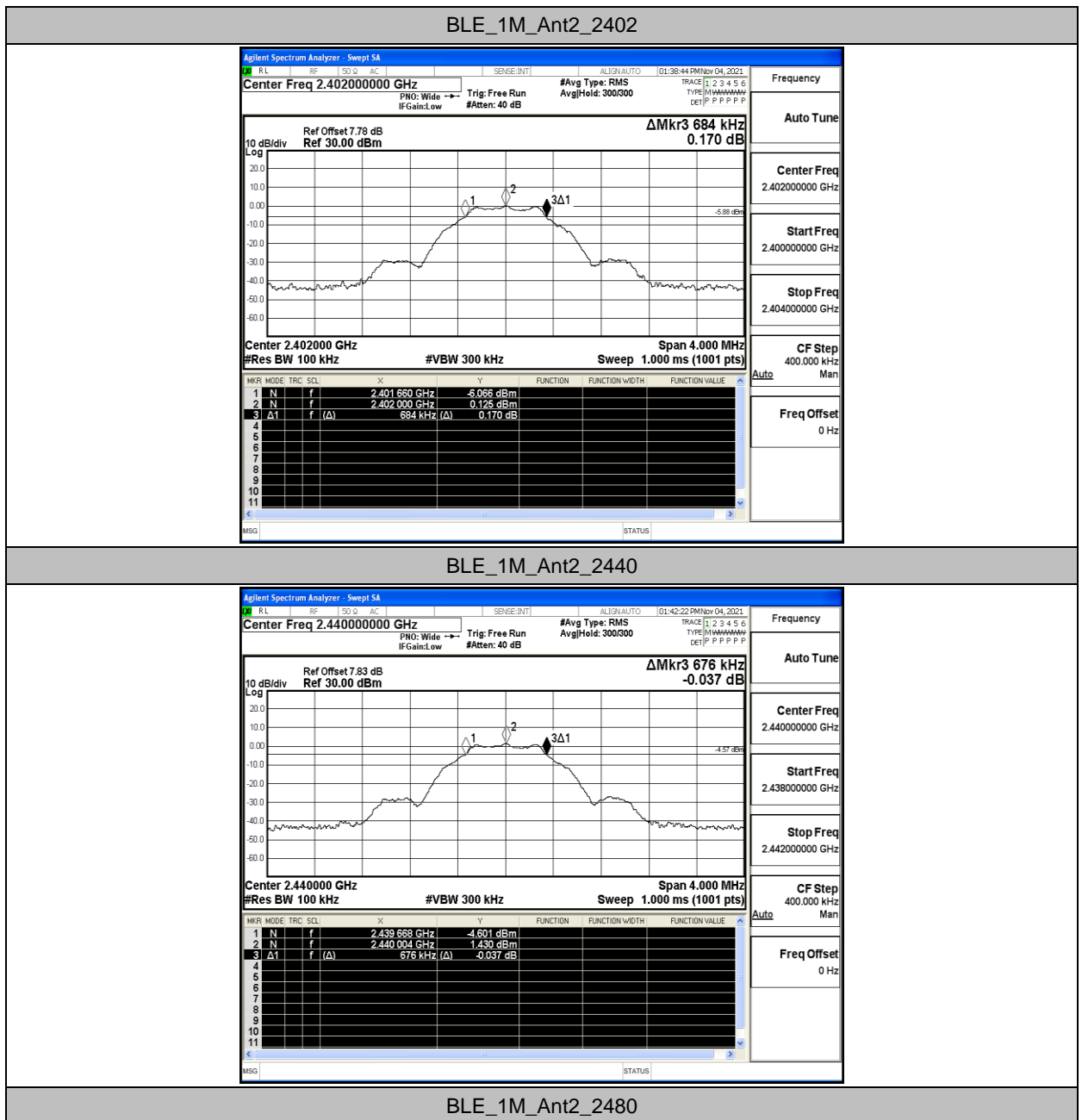
ANT2:

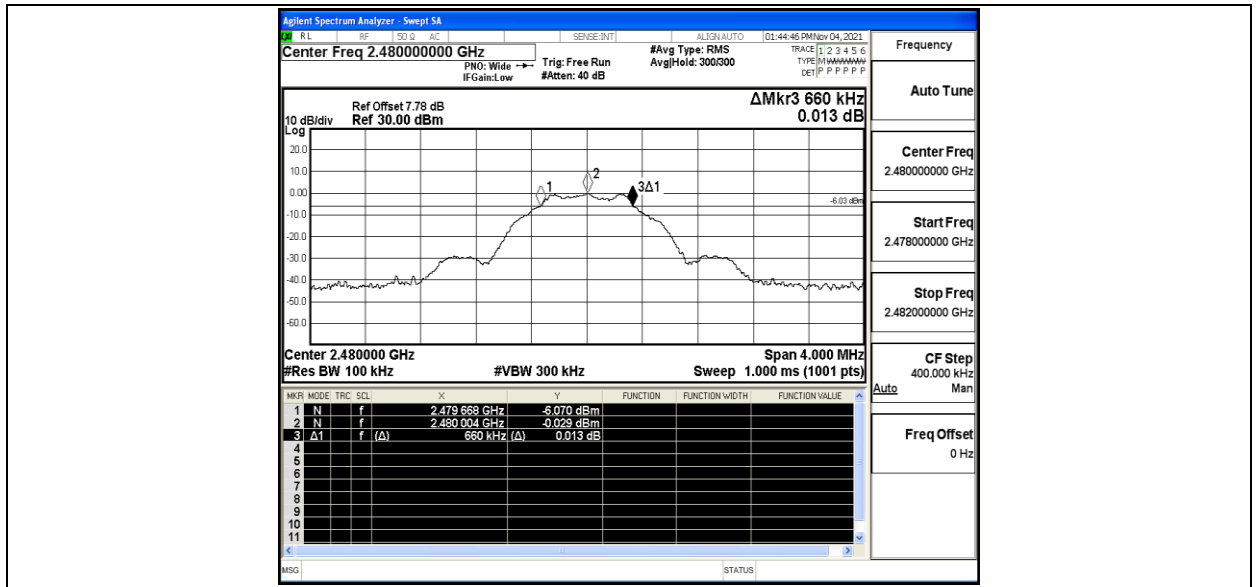
A.1 6dB Bandwidth

Test Result

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant2	2402	0.684	2401.660	2402.344	≥0.5	PASS
		2440	0.676	2439.668	2440.344	≥0.5	PASS
		2480	0.660	2479.668	2480.328	≥0.5	PASS

Test Graphs





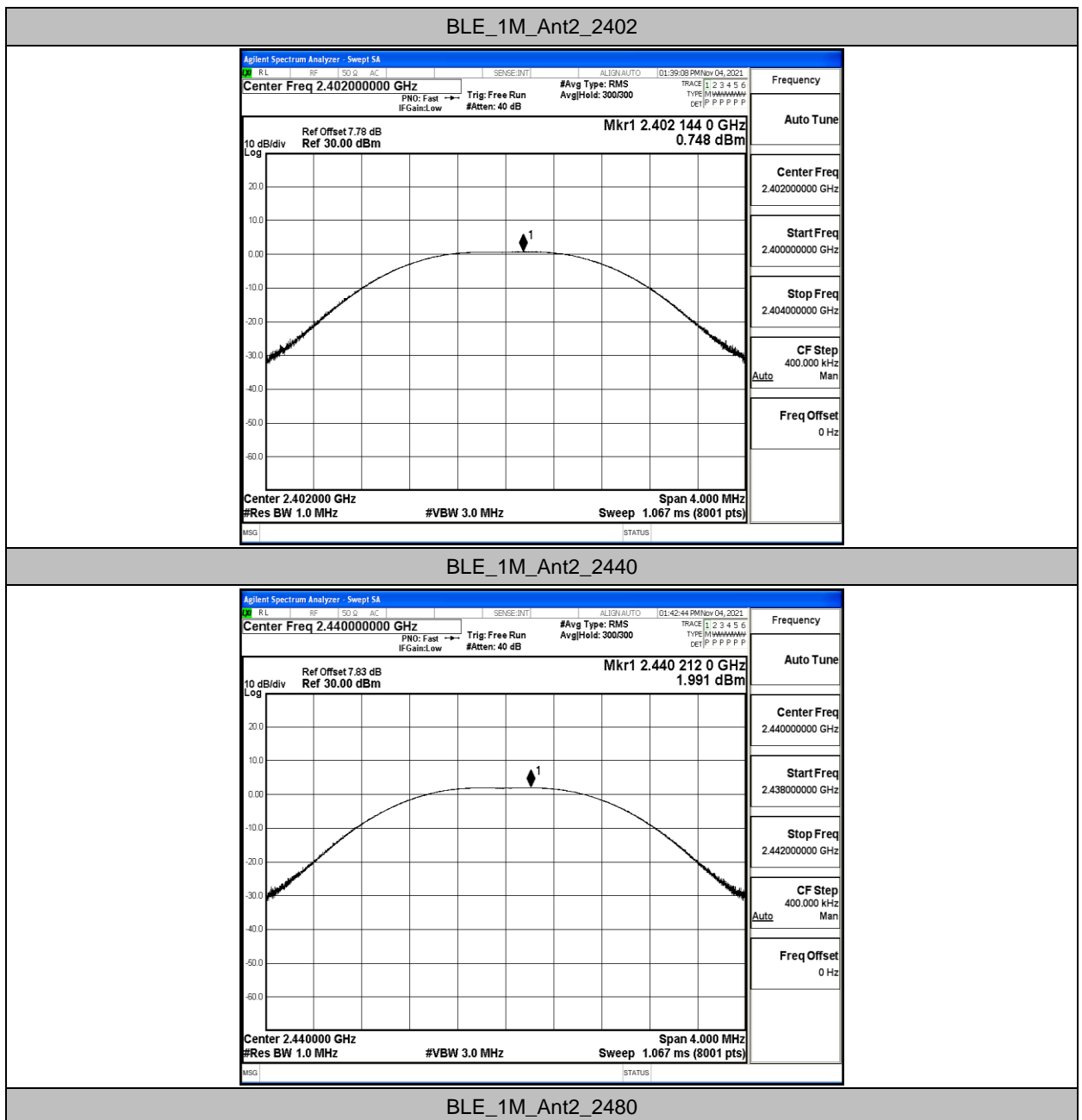


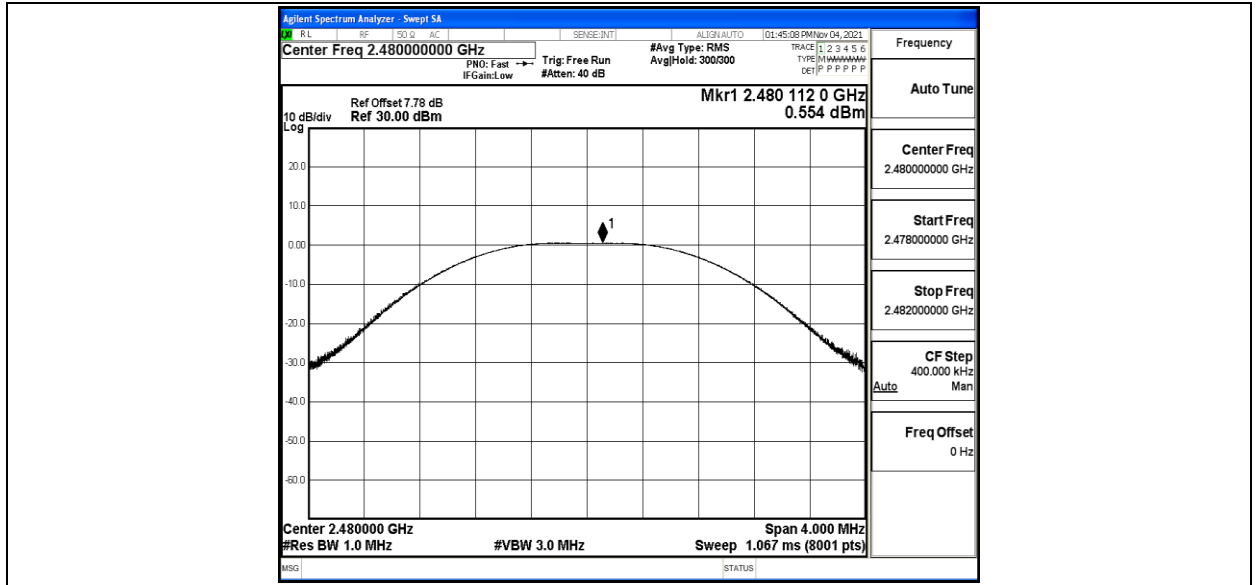
A.2 Maximum conducted output power

Test Result

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant2	2402	0.75	≤30	PASS
		2440	1.99	≤30	PASS
		2480	0.55	≤30	PASS

Test Graphs





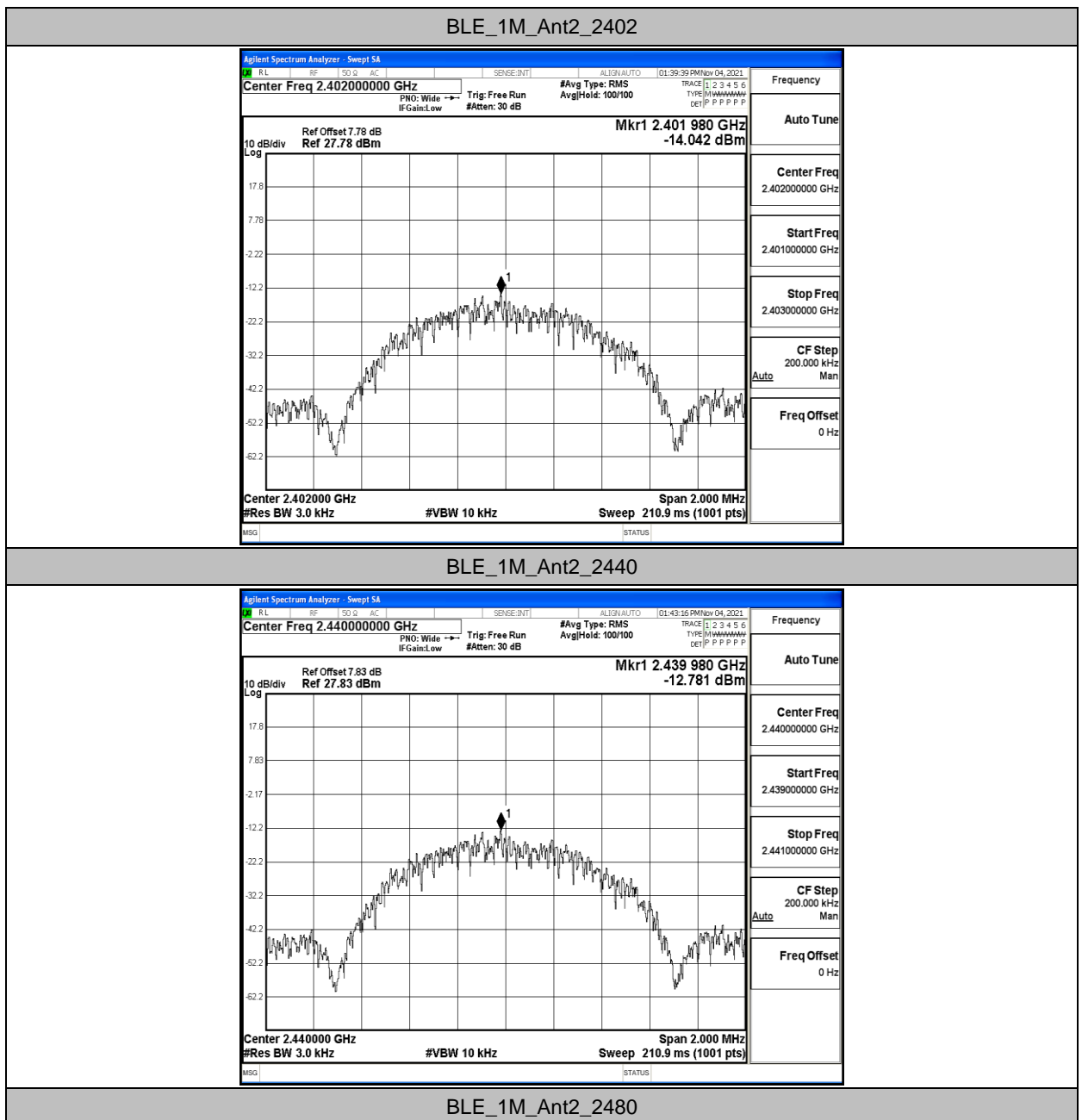


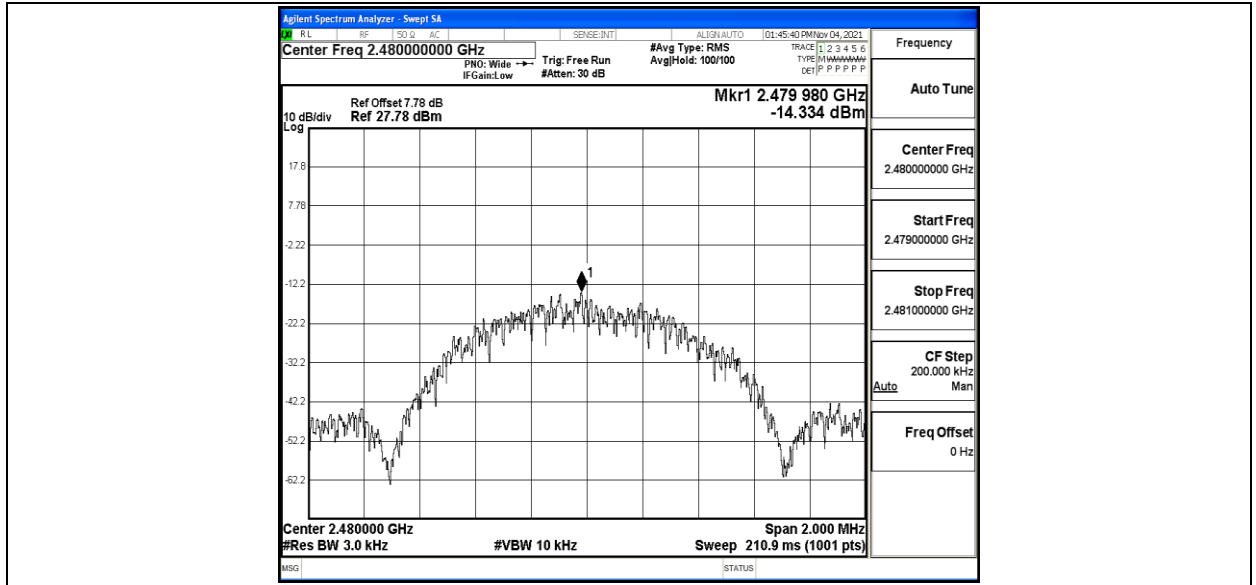
A.3 Maximum power spectral density

Test Result

TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant2	2402	-14.04	≤8	PASS
		2440	-12.78	≤8	PASS
		2480	-14.33	≤8	PASS

Test Graphs





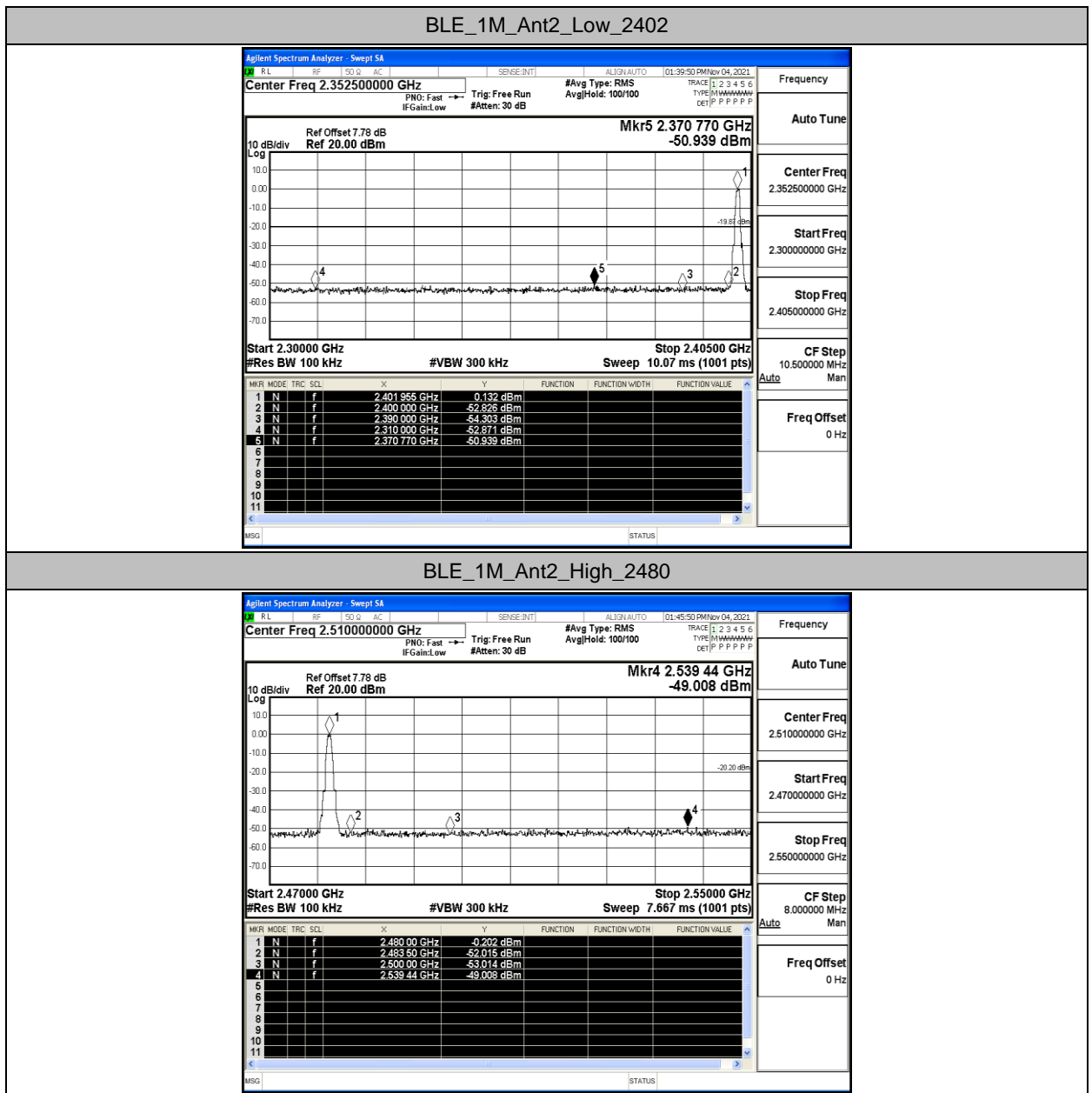


A.4 Band edge measurements

Test Result

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant2	Low	2402	0.13	-50.94	≤-19.87	PASS
		High	2480	-0.20	-49.01	≤-20.2	PASS

Test Graphs



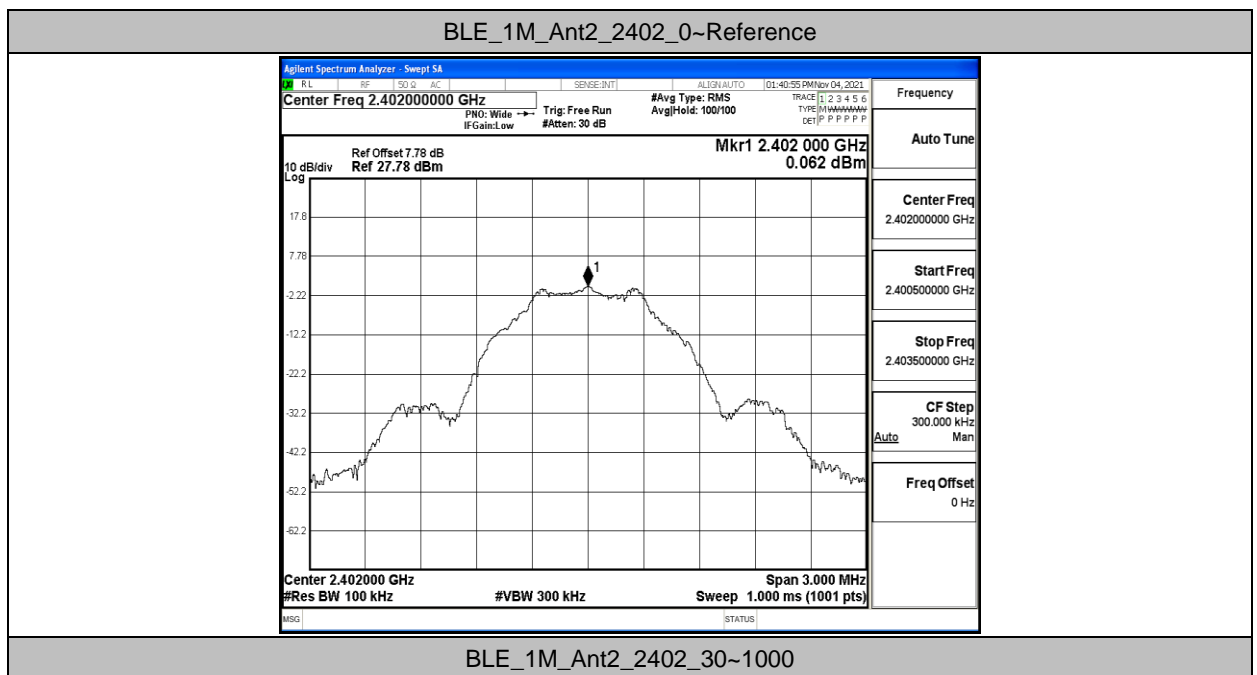


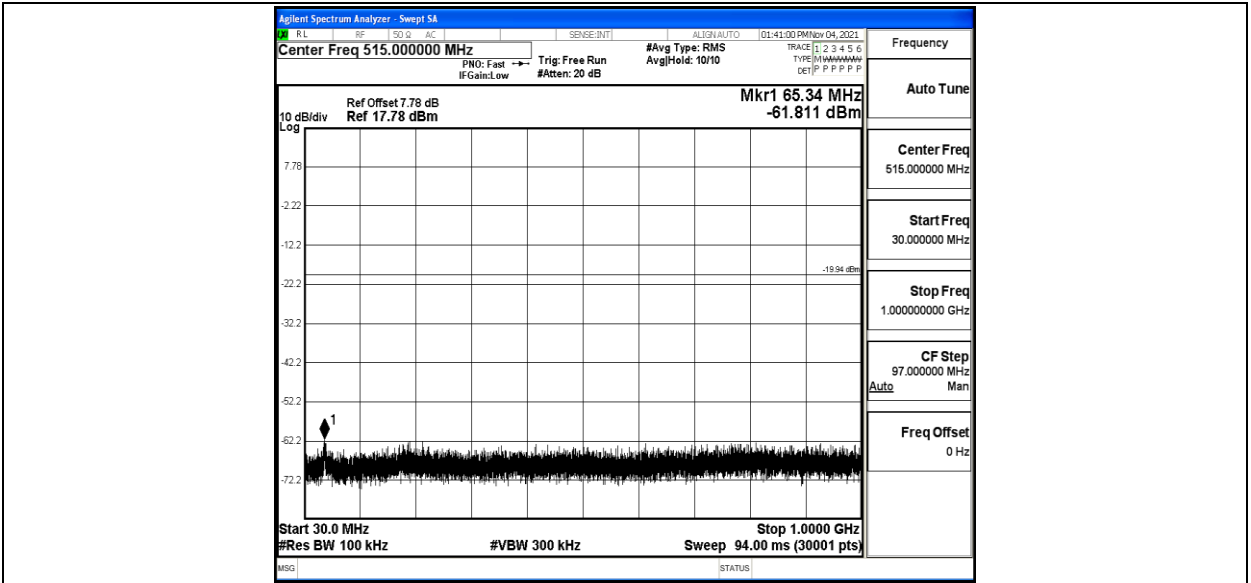
A.5 Conducted Spurious Emission

Test Result

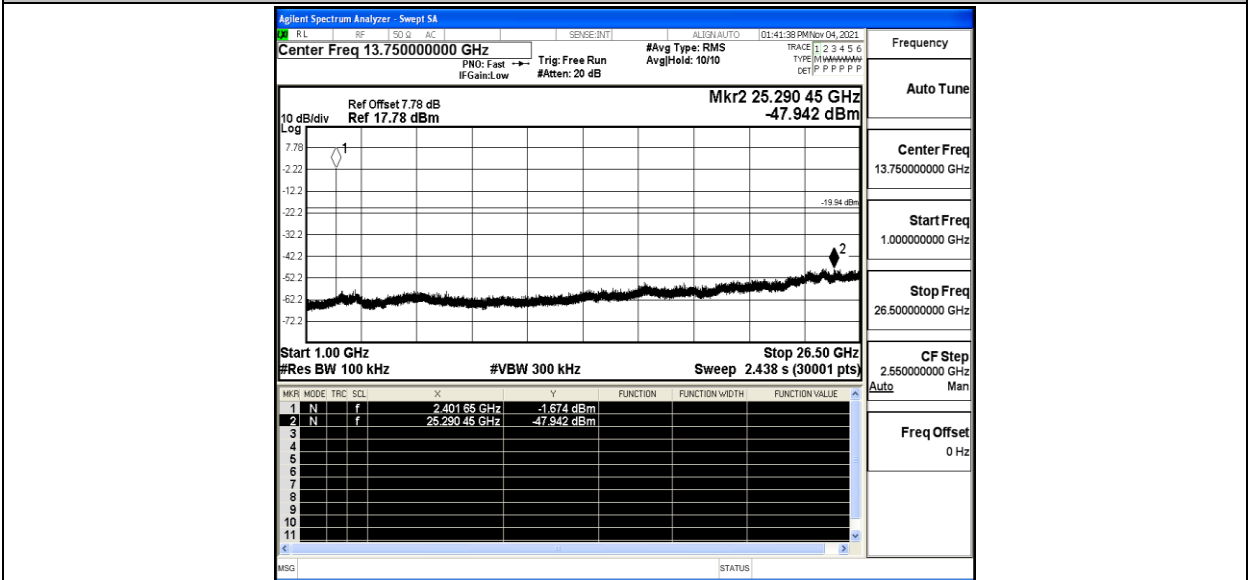
TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant2	2402	Reference	0.06	0.06	---	PASS
			30~1000	0.06	-61.81	≤-19.94	PASS
			1000~26500	0.06	-47.94	≤-19.94	PASS
		2440	Reference	1.38	1.38	---	PASS
			30~1000	1.38	-61.84	≤-18.62	PASS
			1000~26500	1.38	-47.99	≤-18.62	PASS
		2480	Reference	-0.75	-0.75	---	PASS
			30~1000	-0.75	-62.2	≤-20.75	PASS
			1000~26500	-0.75	-47.75	≤-20.75	PASS

Test Graphs

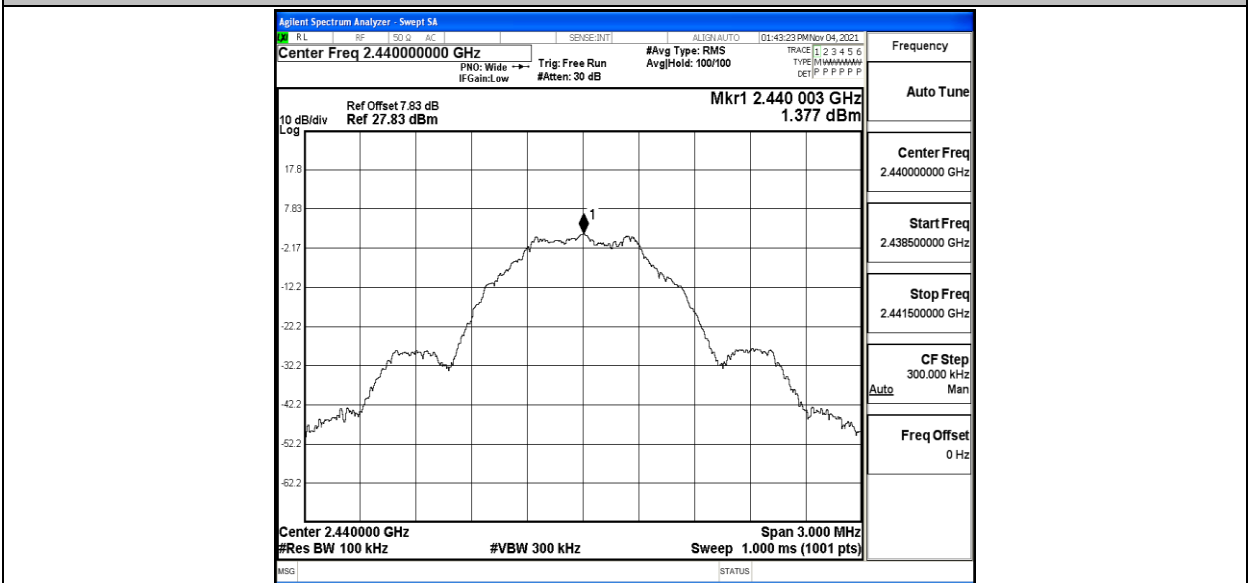




BLE_1M_Ant2_2402_1000~26500

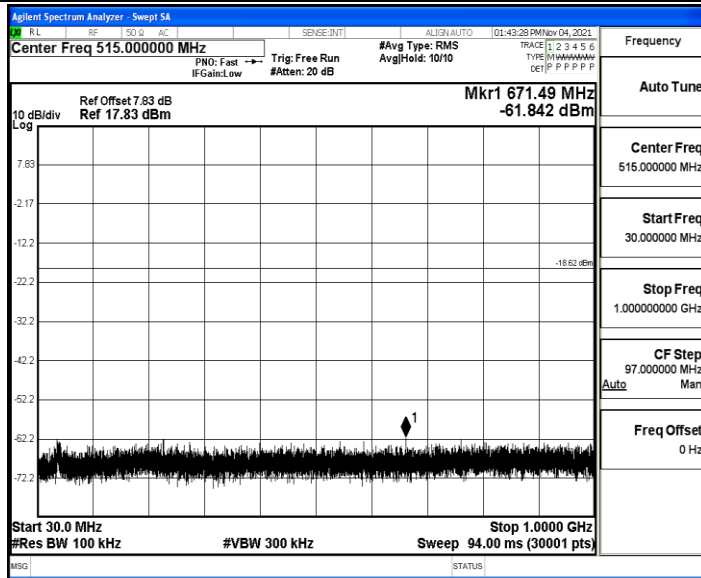


BLE_1M_Ant2_2440_0~Reference

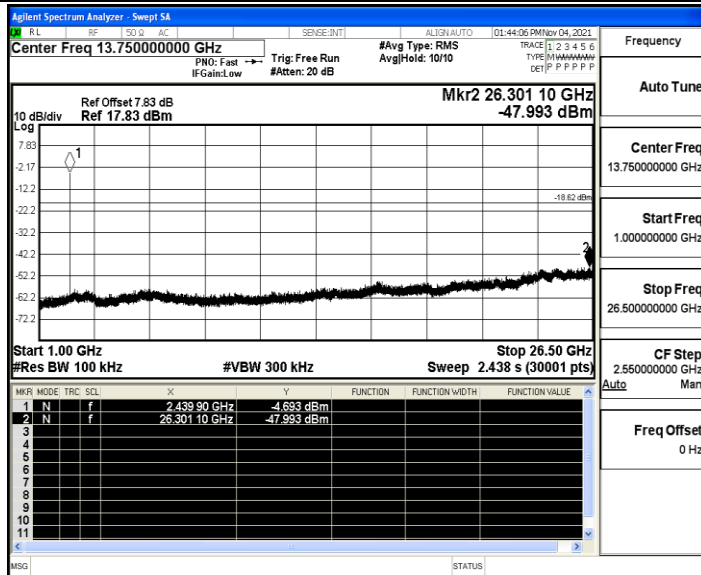




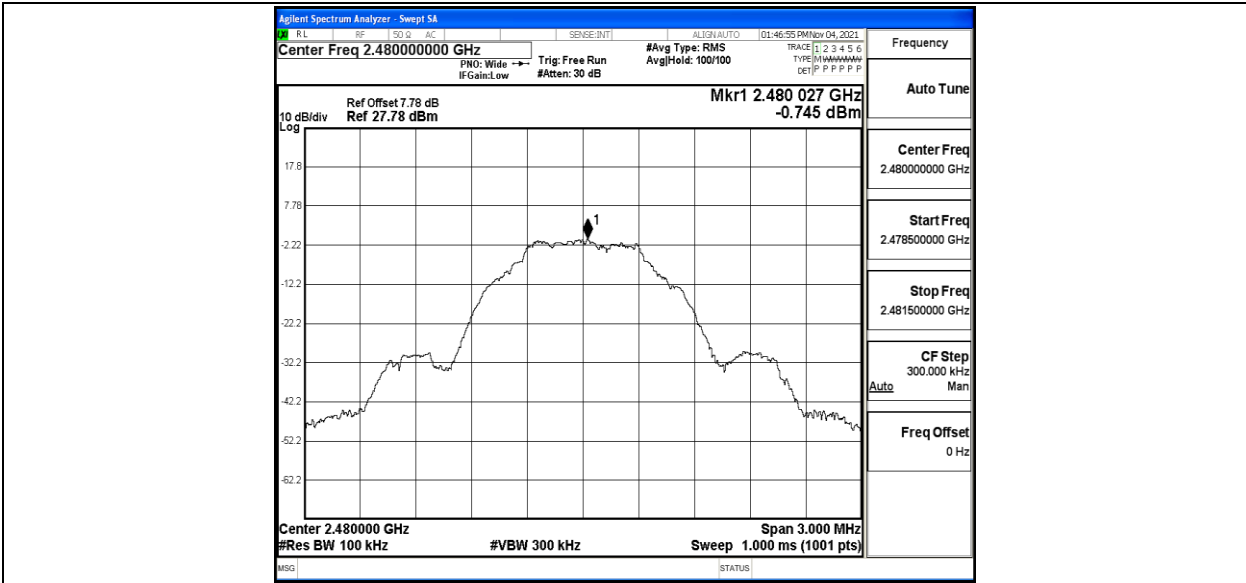
BLE_1M_Ant2_2440_30~1000



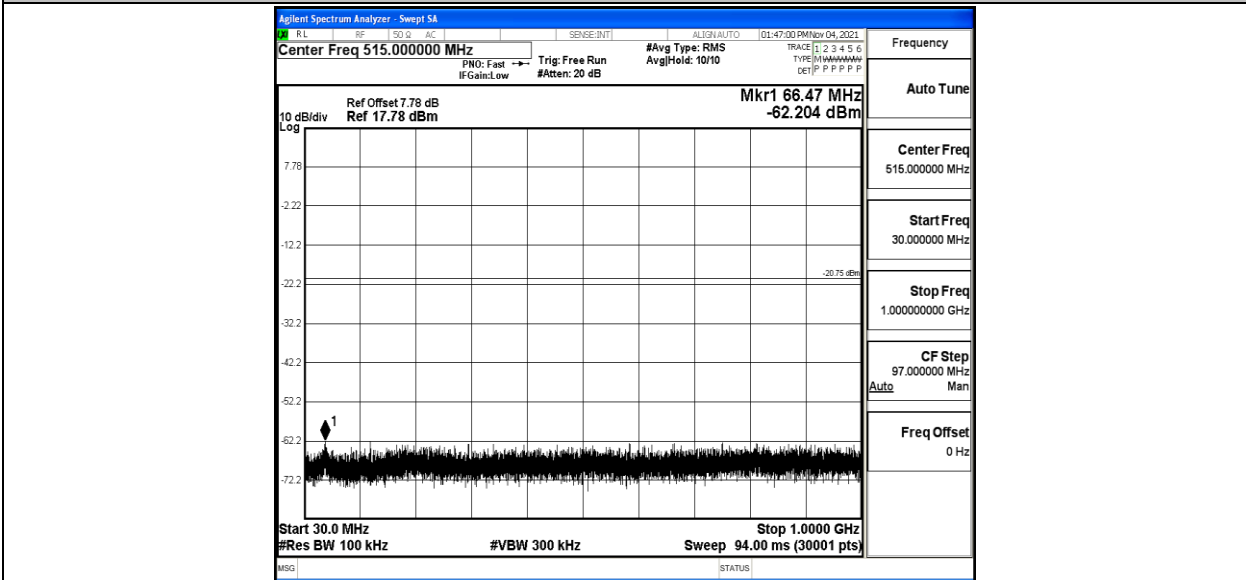
BLE_1M_Ant2_2440_1000~26500



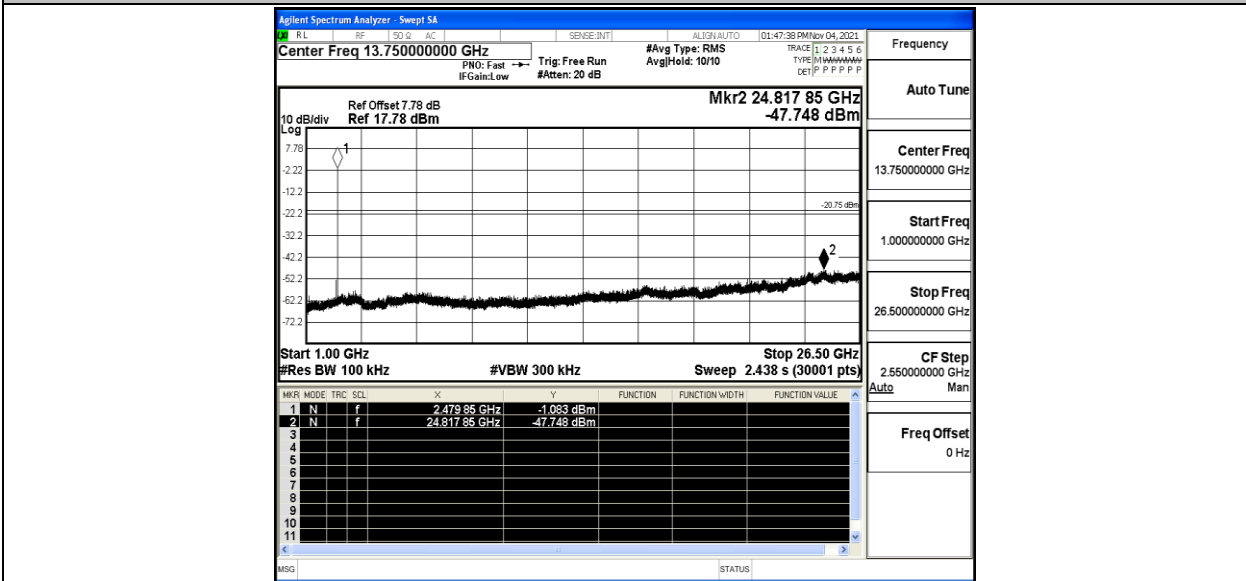
BLE_1M_Ant2_2480_0~Reference



BLE_1M_Ant2_2480_30~1000



BLE_1M_Ant2_2480_1000~26500



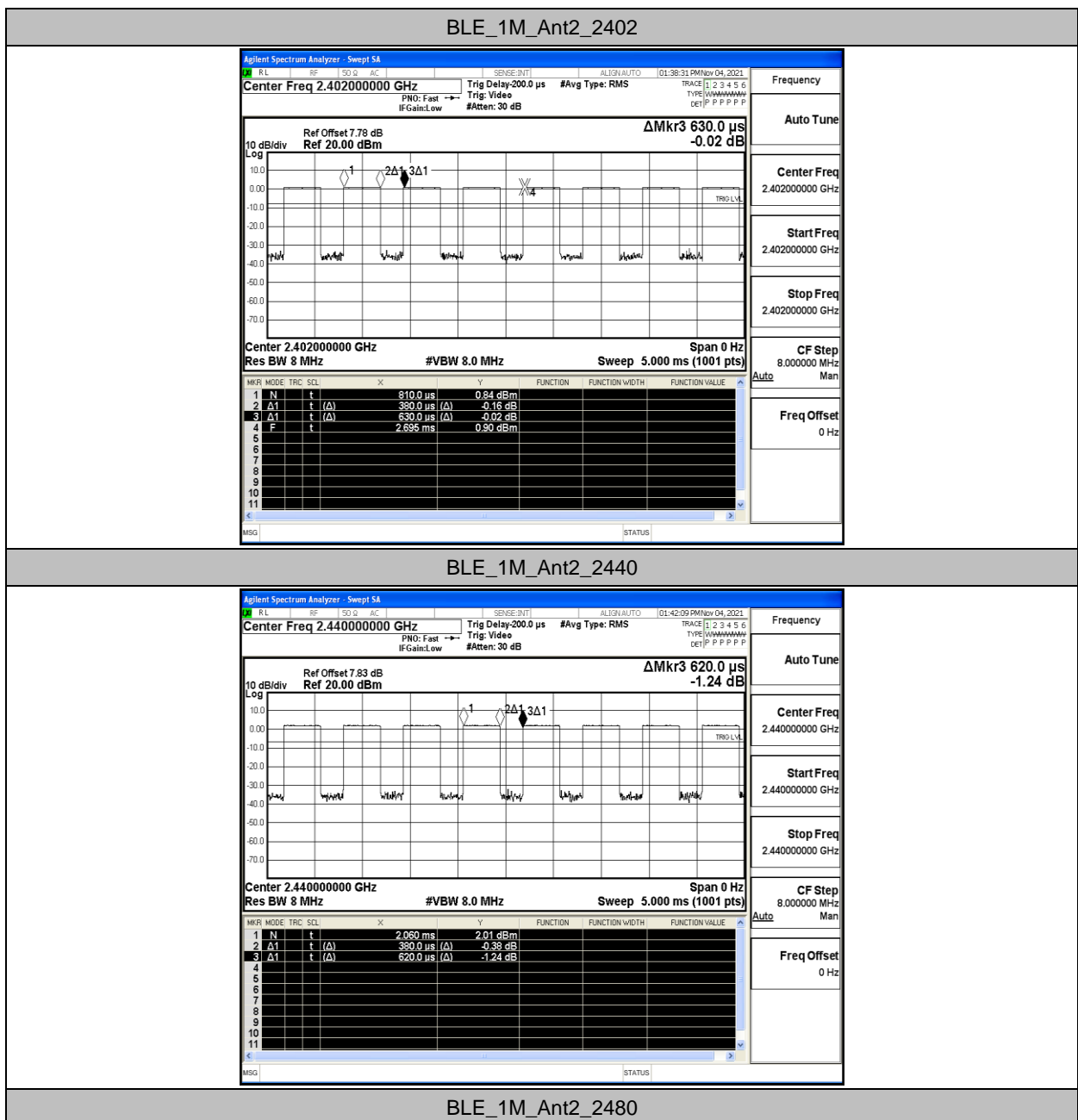


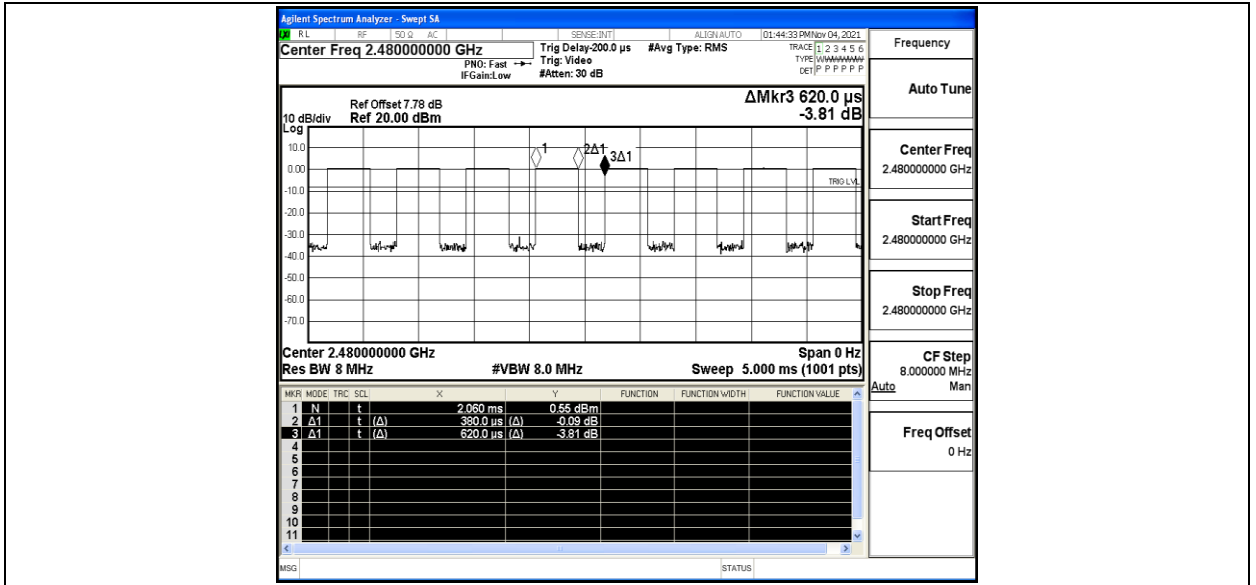
A.6 Duty Cycle

Test Result

TestMode	Antenna	Channel	ON Time [ms]	Period [ms]	X	DC [%]	xFactor	Limit	Verdict
BLE_1M	Ant2	2402	0.38	0.63	0.6032	60.32	2.20	---	PASS
		2440	0.38	0.62	0.6129	61.29	2.13	---	PASS
		2480	0.38	0.62	0.6129	61.29	2.13	---	PASS

Test Graphs







A.7 Emissions in Restricted Bands

Test Result

TestMode	Antenna	ChName	Channel	Detector	Freq. [MHz]	Result [dBm]	Limit [dBm]	Result [dBuV/m]	Limit [dBuV/m]	Verdict
BLE_1M	Ant2	Low	2402	AV	2310.000	-48.64	≤-41.20	46.56	≤54	PASS
				AV	2384.945	-47.91	≤-41.20	47.29	≤54	PASS
				AV	2390.000	-48.48	≤-41.20	46.72	≤54	PASS
				Peak	2310.000	-40.33	≤-21.20	54.87	≤74	PASS
				Peak	2312.390	-38.78	≤-21.20	56.42	≤74	PASS
				Peak	2390.000	-41.78	≤-21.20	53.42	≤74	PASS
		High	2480	AV	2483.500	-47.41	≤-41.20	47.79	≤54	PASS
				AV	2492.560	-47.23	≤-41.20	47.97	≤54	PASS
				AV	2500.000	-47.74	≤-41.20	47.46	≤54	PASS
				Peak	2483.500	-41.72	≤-21.20	53.48	≤74	PASS
				Peak	2486.080	-38.49	≤-21.20	56.71	≤74	PASS
				Peak	2500.000	-41.01	≤-21.20	54.19	≤74	PASS

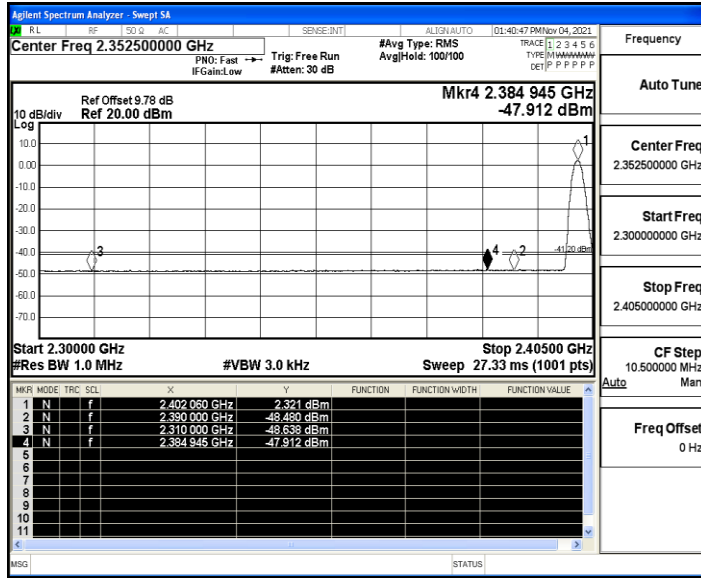
Note:

3. The Antenna Gain is compensated in the graph.
4. The limit in dBm for average detector is conversion from 54dBuV/m, according to 15.209(a). The limit in dBm for peak detector is 20dB above the limit of average detector in dBm.

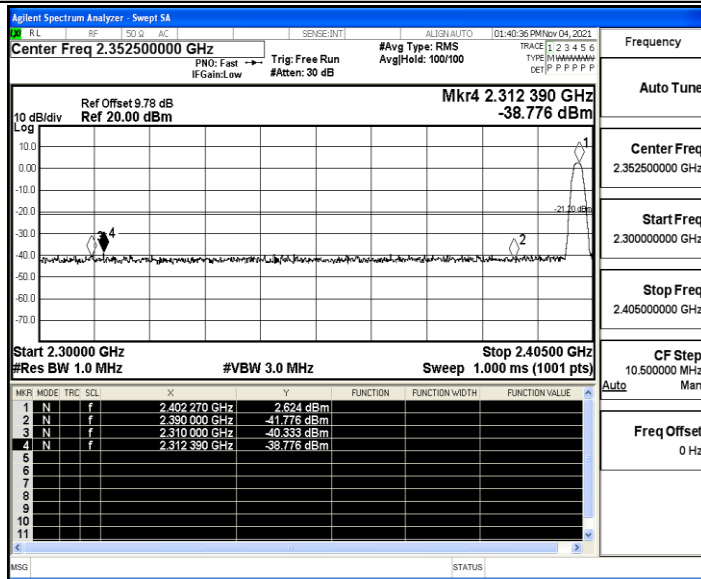


Test Graphs

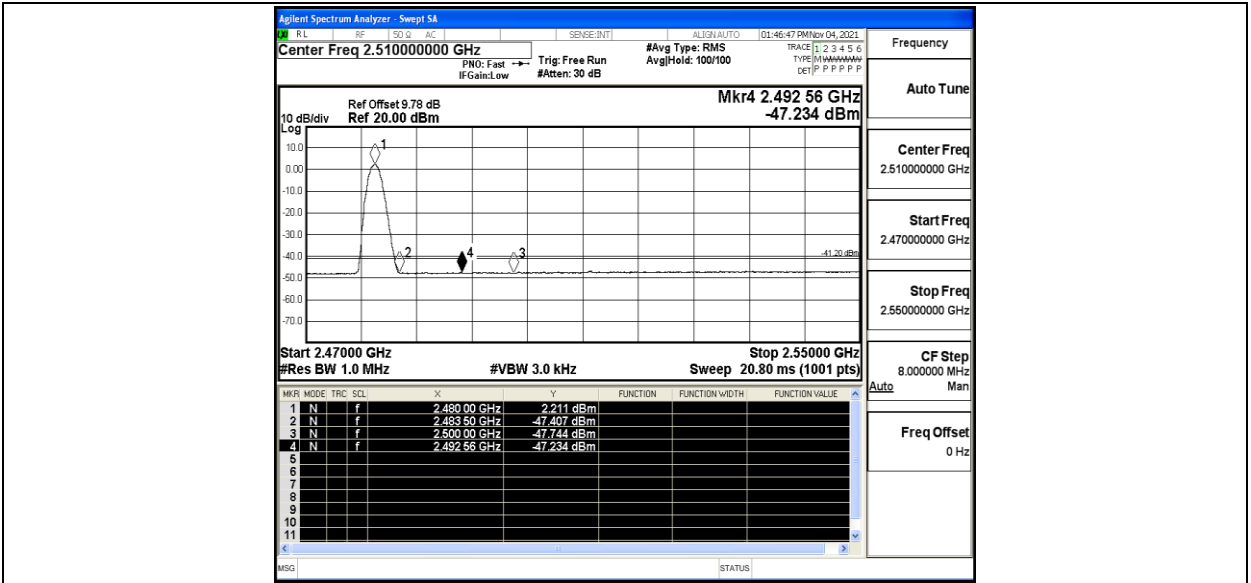
BLE_1M_Ant2_Low_2402_AV



BLE_1M_Ant2_Low_2402_Peak



BLE_1M_Ant2_High_2480_AV



BLE_1M_Ant2_High_2480_Peak

