



Appendix A

RF Test Data for BLE (Conducted Measurement)

Product Name: Bicycle Computer

Test Model: TR280

Environmental Conditions

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

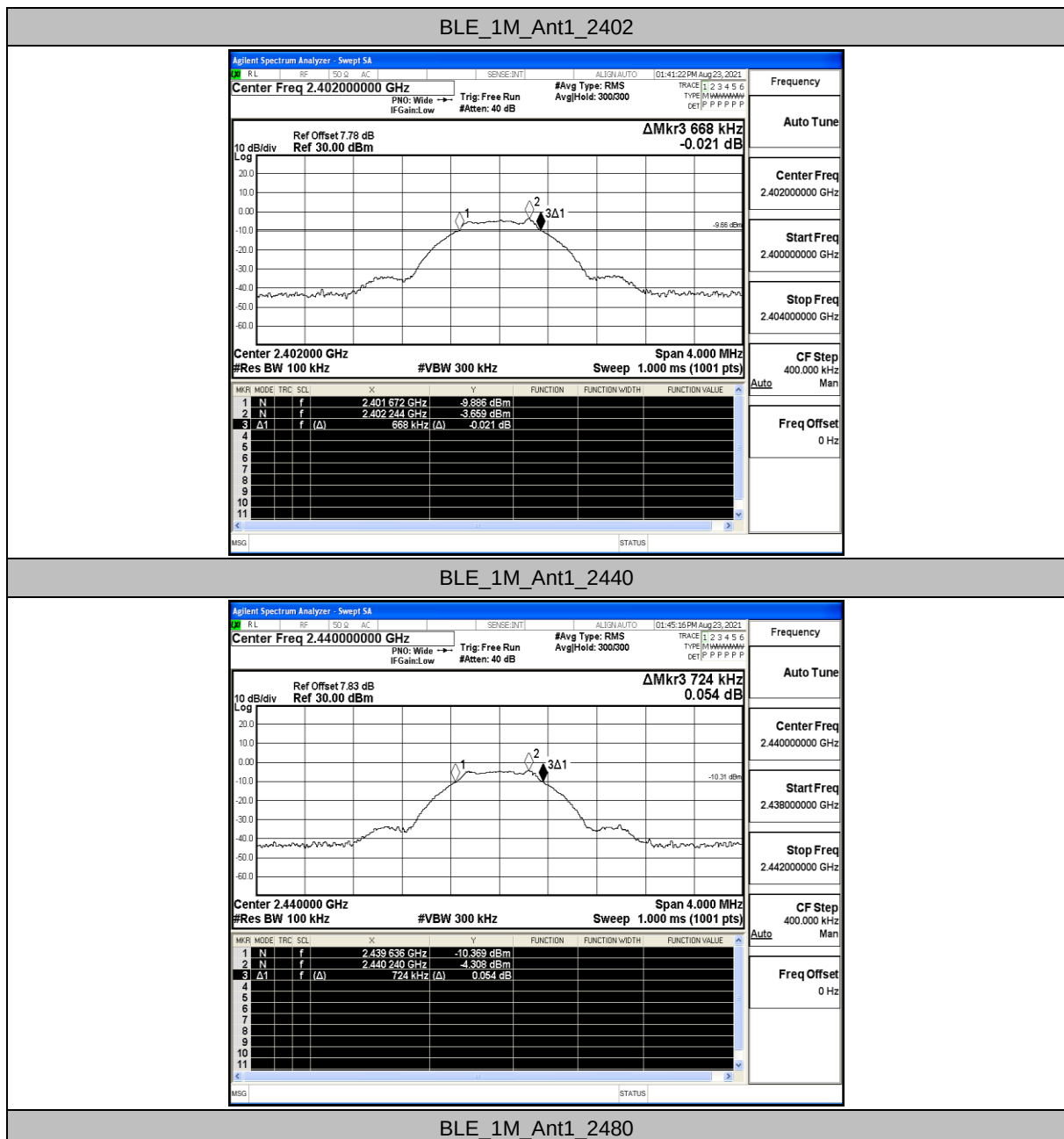


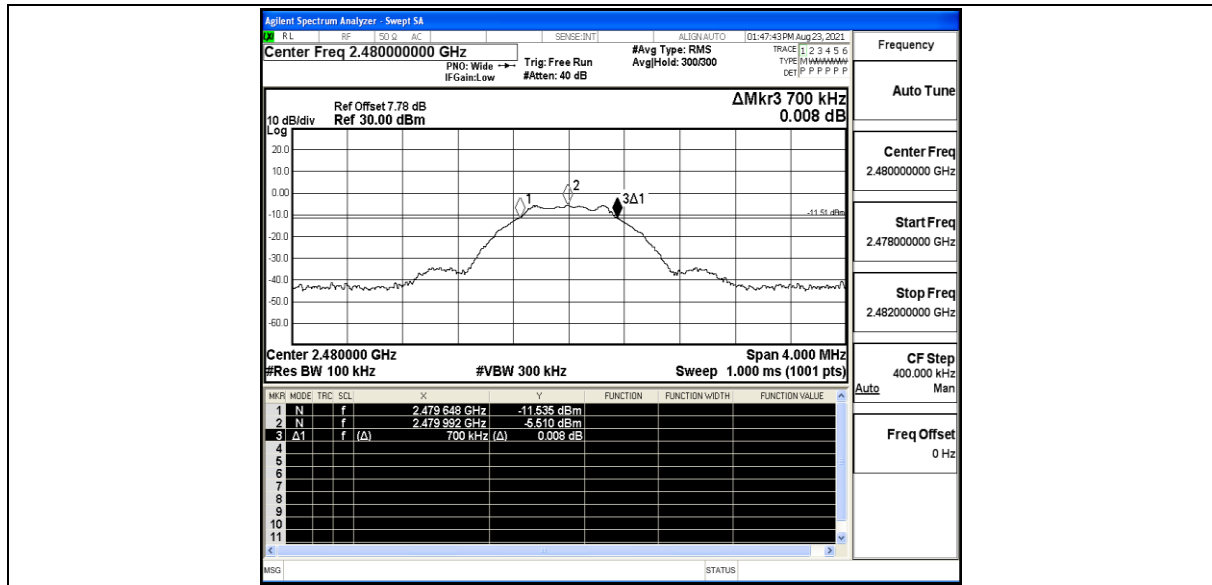
A.1 6dB Bandwidth

Test Result

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.668	2401.672	2402.340	≥0.5	PASS
		2440	0.724	2439.636	2440.360	≥0.5	PASS
		2480	0.700	2479.648	2480.348	≥0.5	PASS

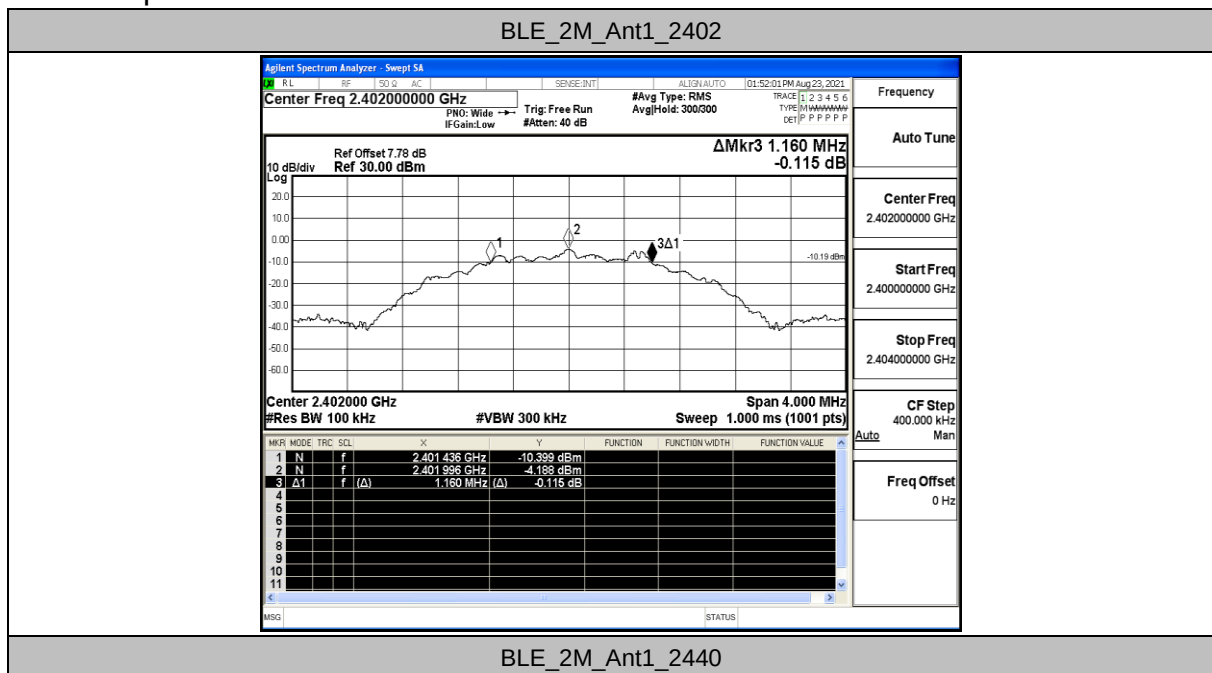
Test Graphs

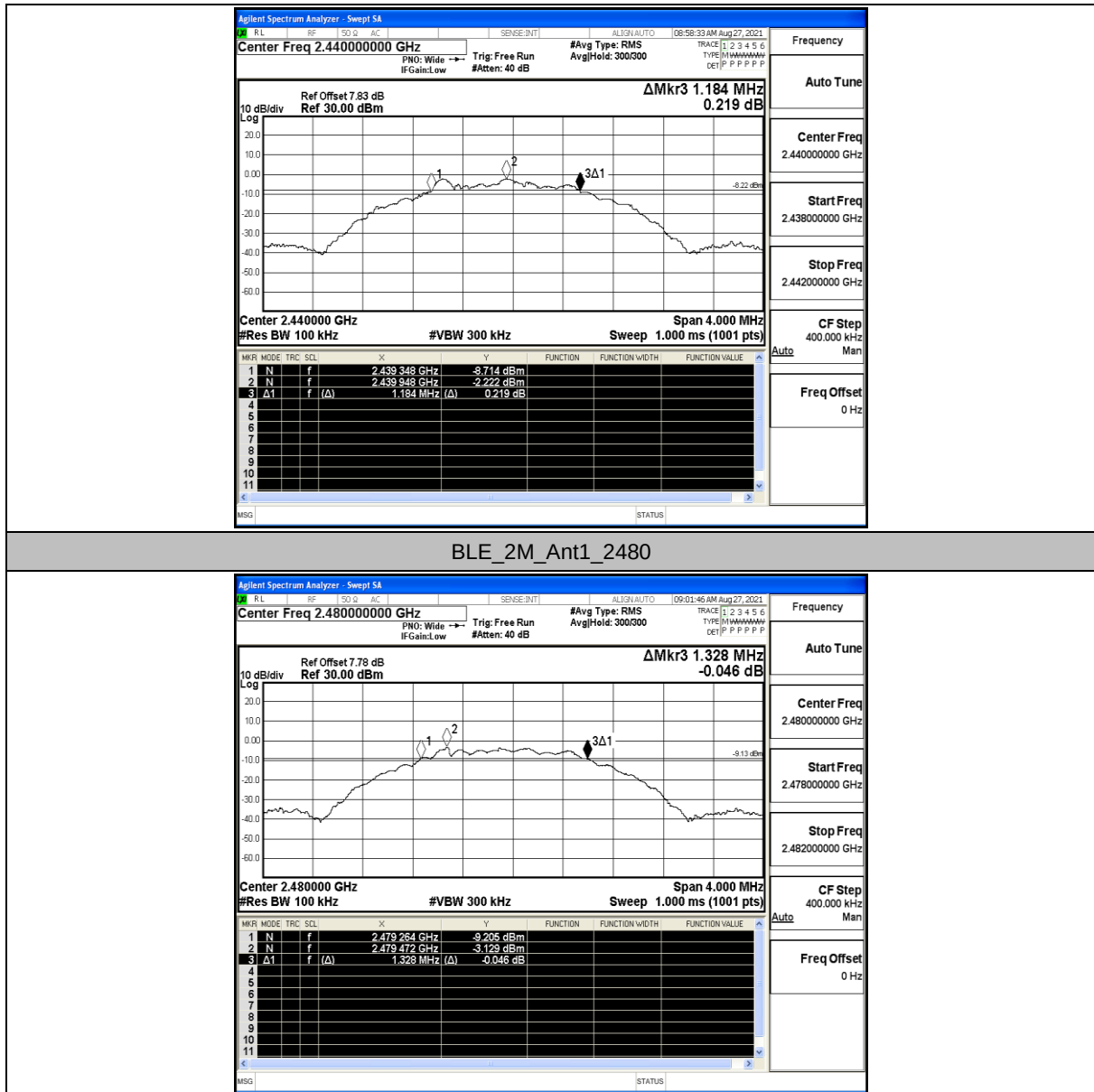




TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_2M	Ant1	2402	1.160	2401.436	2402.596	≥0.5	PASS
		2440	1.184	2439.348	2440.532	≥0.5	PASS
		2480	1.328	2479.264	2480.592	≥0.5	PASS

Test Graphs





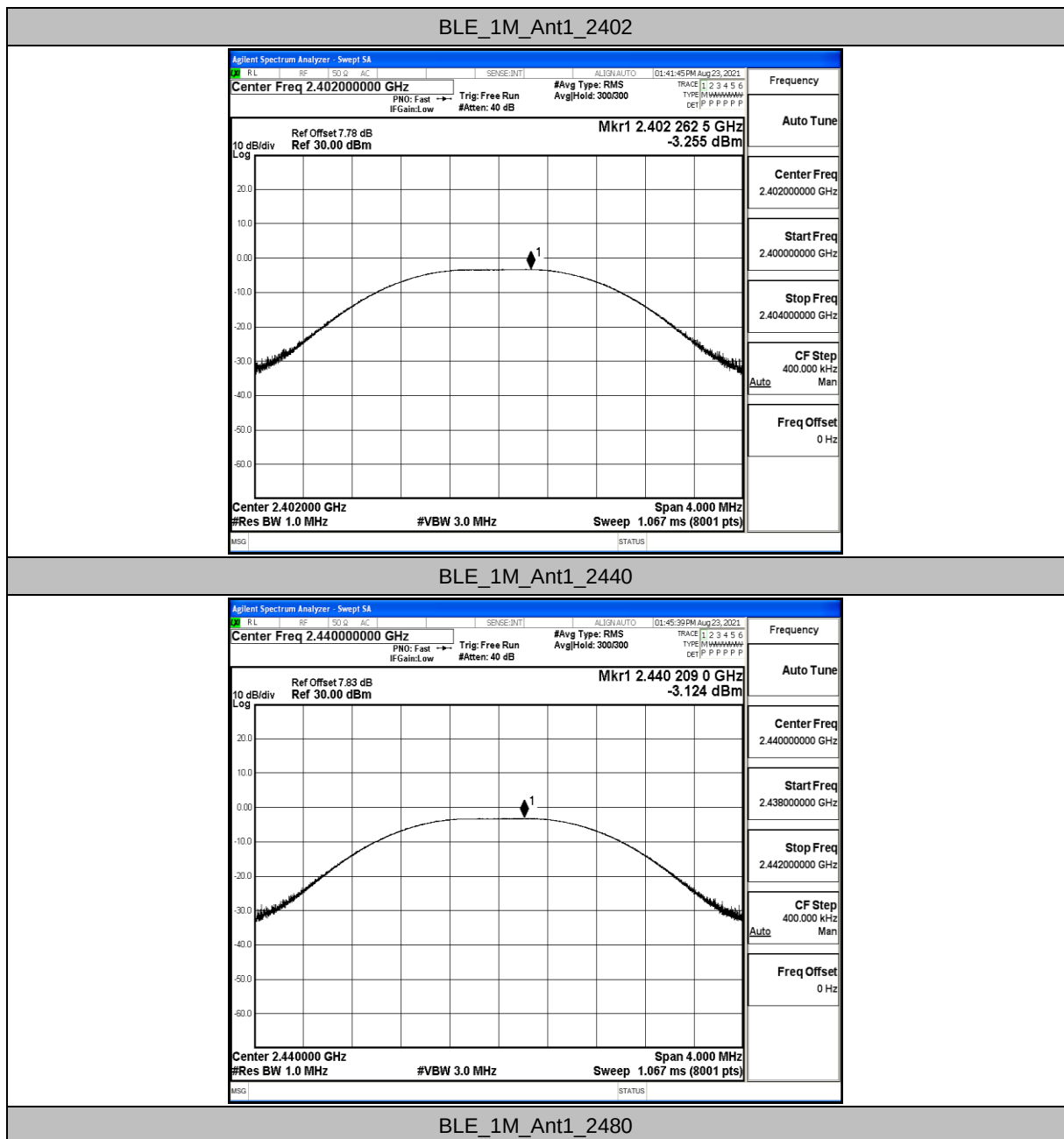


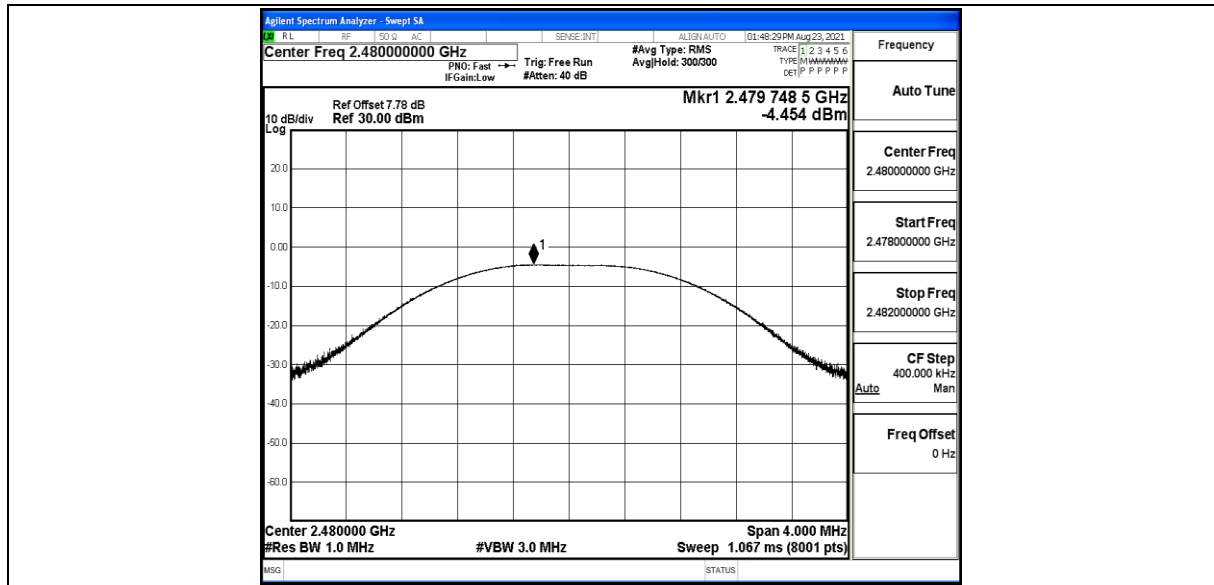
A.2 Maximum conducted output power

Test Result

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	-3.26	≤30	PASS
		2440	-3.12	≤30	PASS
		2480	-4.45	≤30	PASS

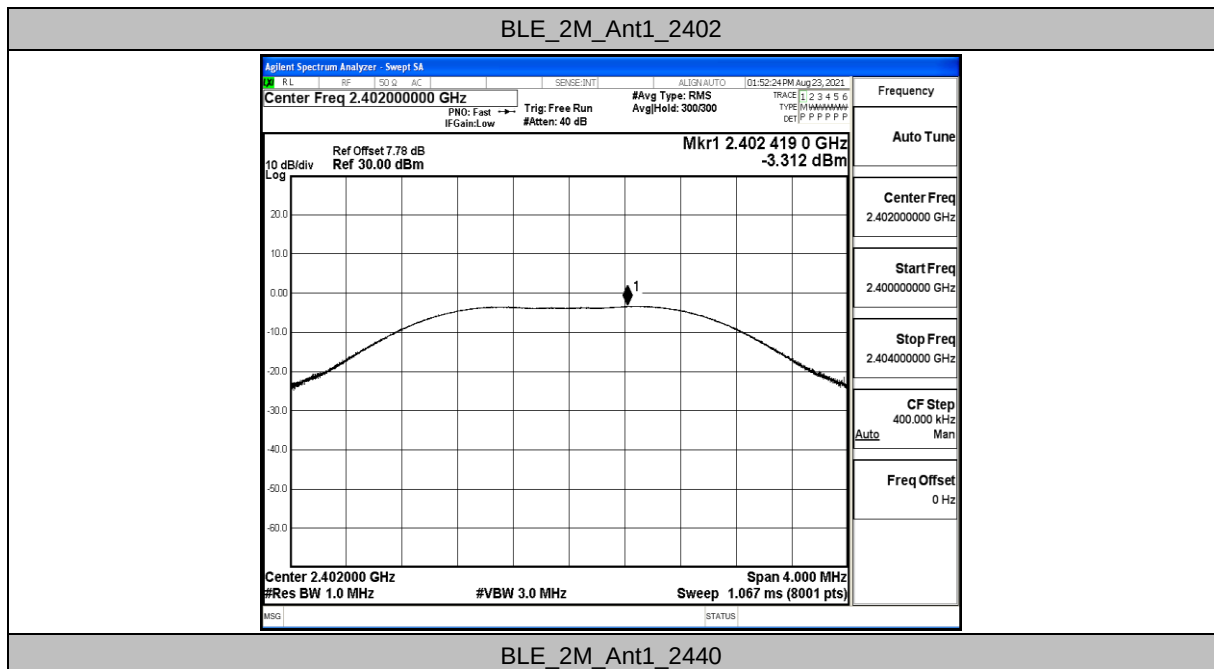
Test Graphs

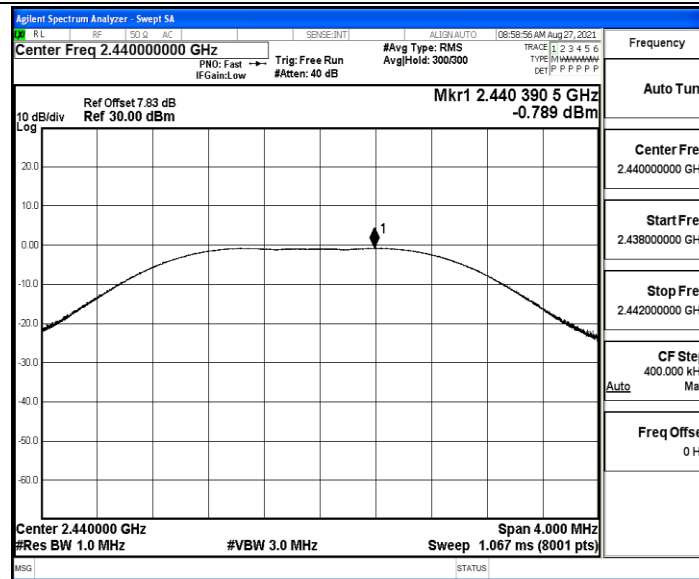




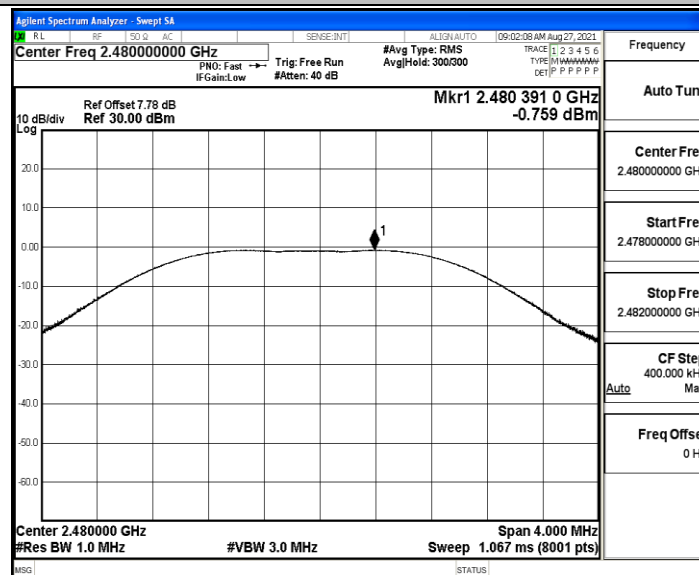
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_2M	Ant1	2402	-3.31	≤30	PASS
		2440	-0.79	≤30	PASS
		2480	-0.76	≤30	PASS

Test Graphs





BLE_2M_Ant1_2480



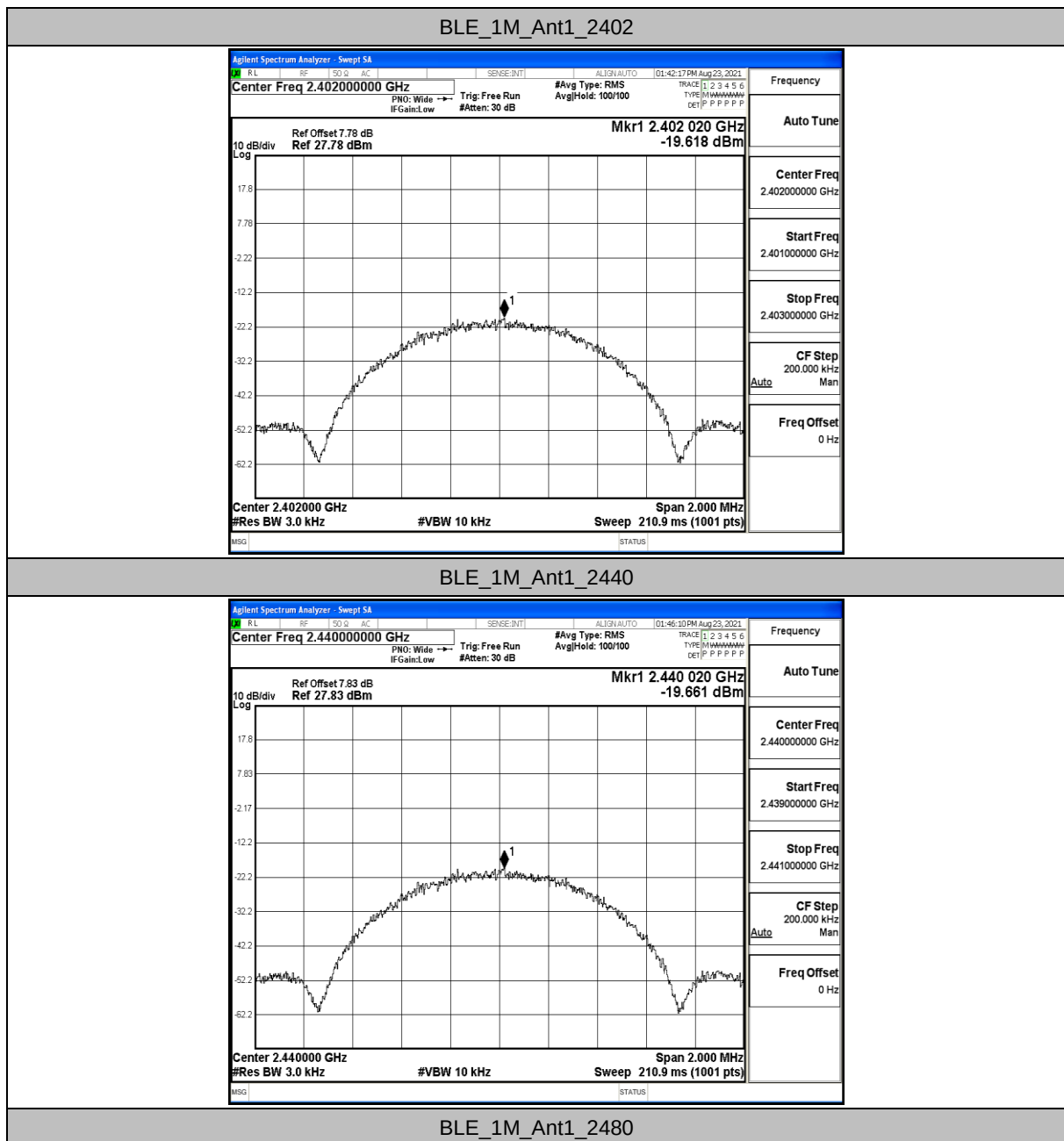


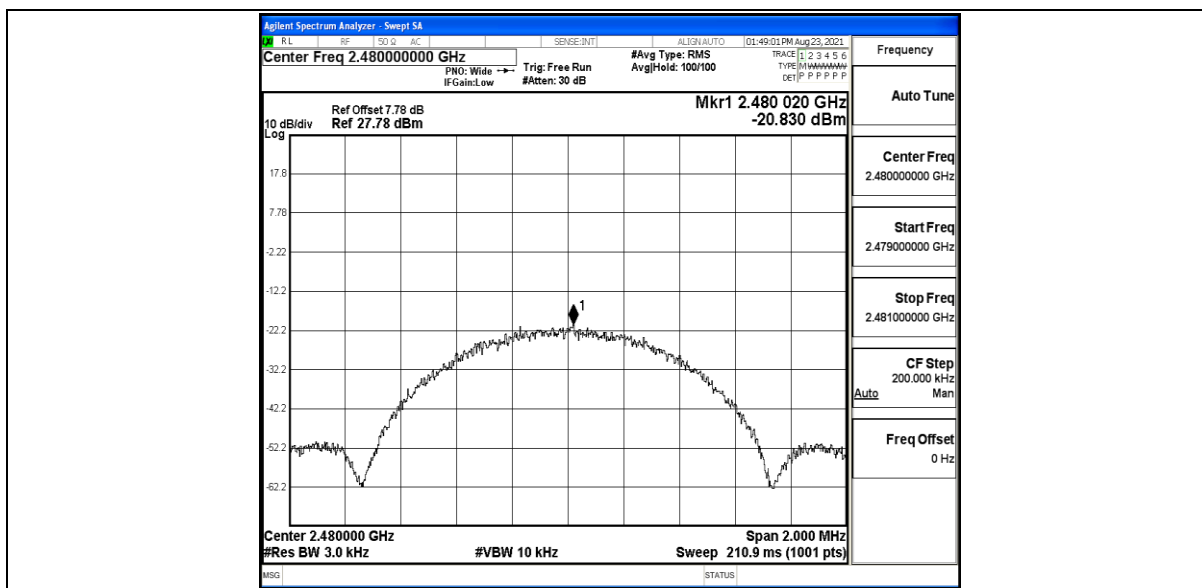
A.3 Maximum power spectral density

Test Result

TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-19.62	≤8	PASS
		2440	-19.66	≤8	PASS
		2480	-20.83	≤8	PASS

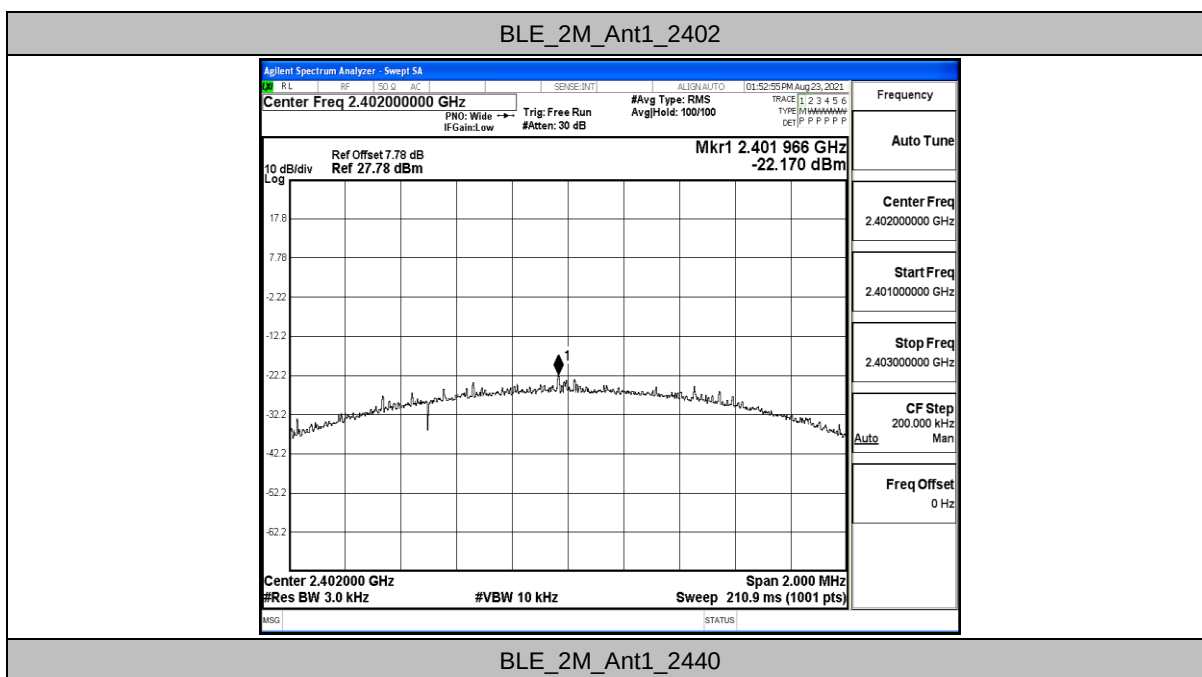
Test Graphs

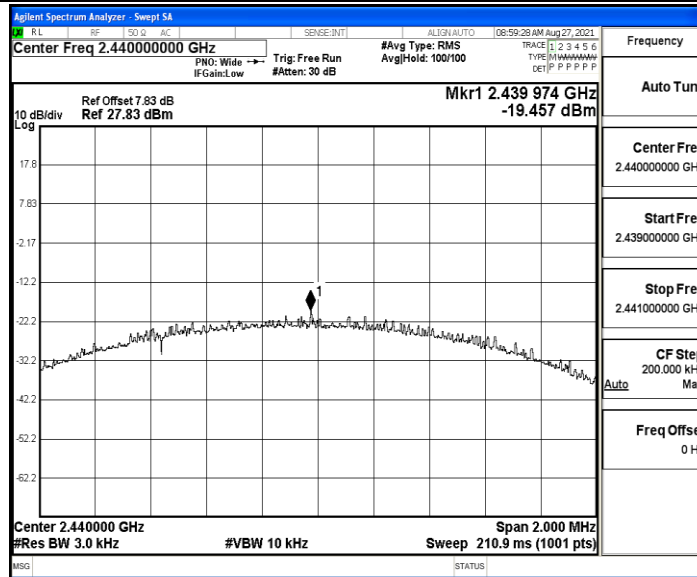




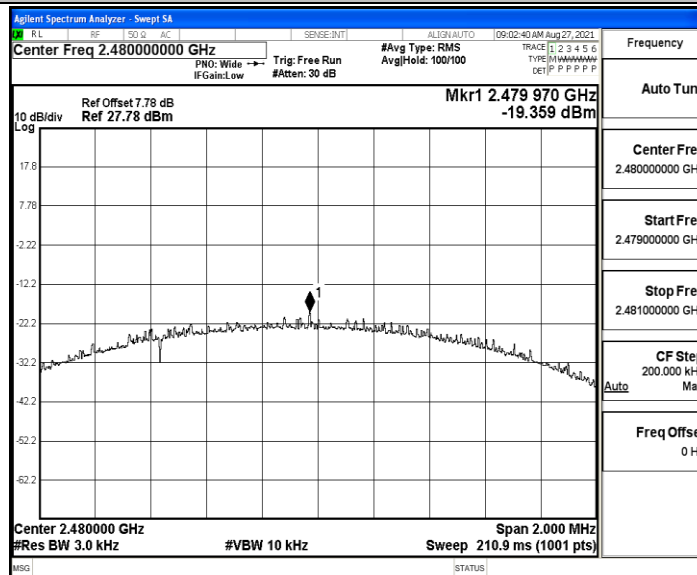
TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE_2M	Ant1	2402	-22.17	≤8	PASS
		2440	-19.46	≤8	PASS
		2480	-19.36	≤8	PASS

Test Graphs





BLE_2M_Ant1_2480



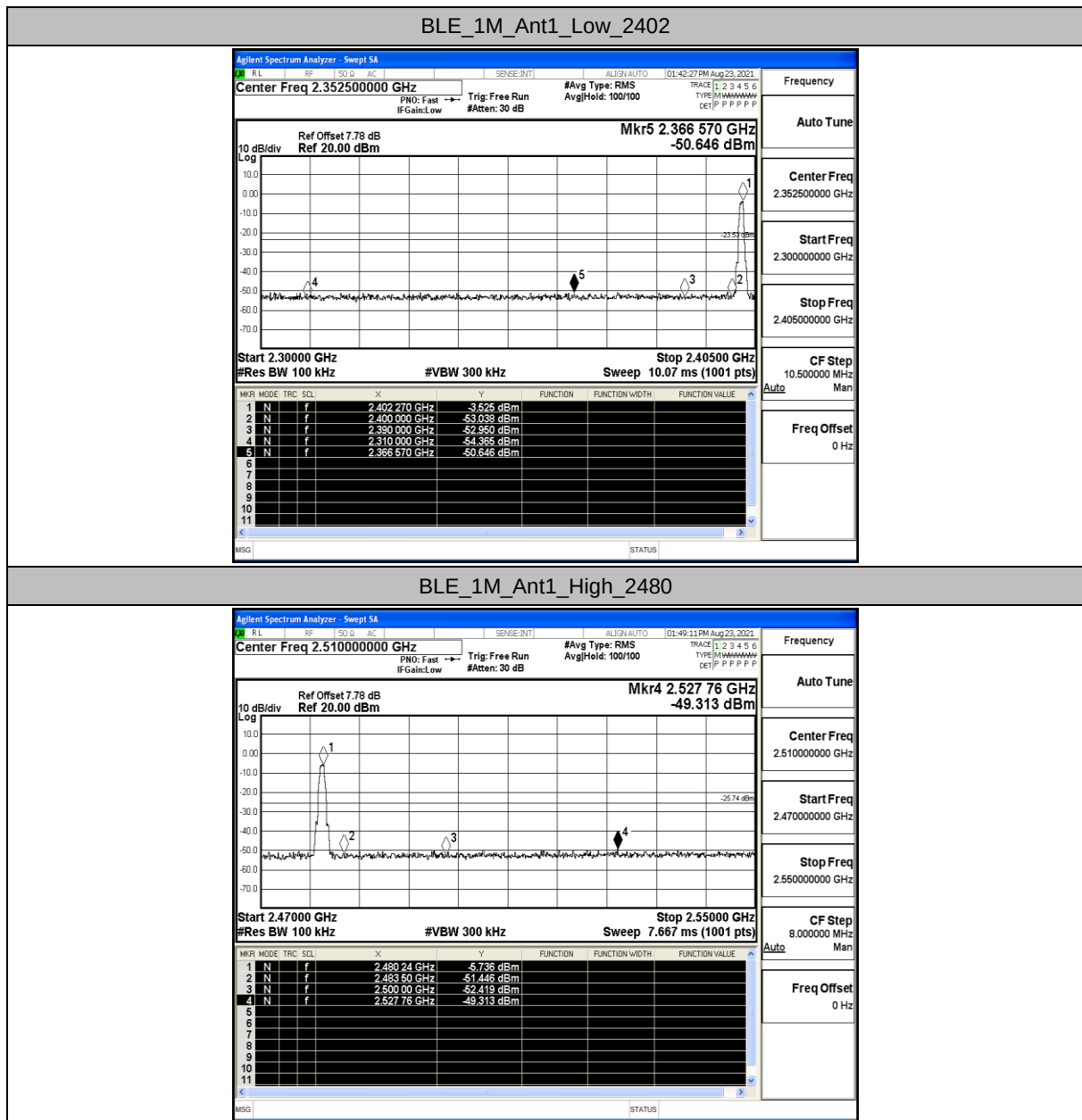


A.4 Band edge measurements

Test Result

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	Low	2402	-3.53	-50.65	≤-23.53	PASS
		High	2480	-5.74	-49.31	≤-25.74	PASS

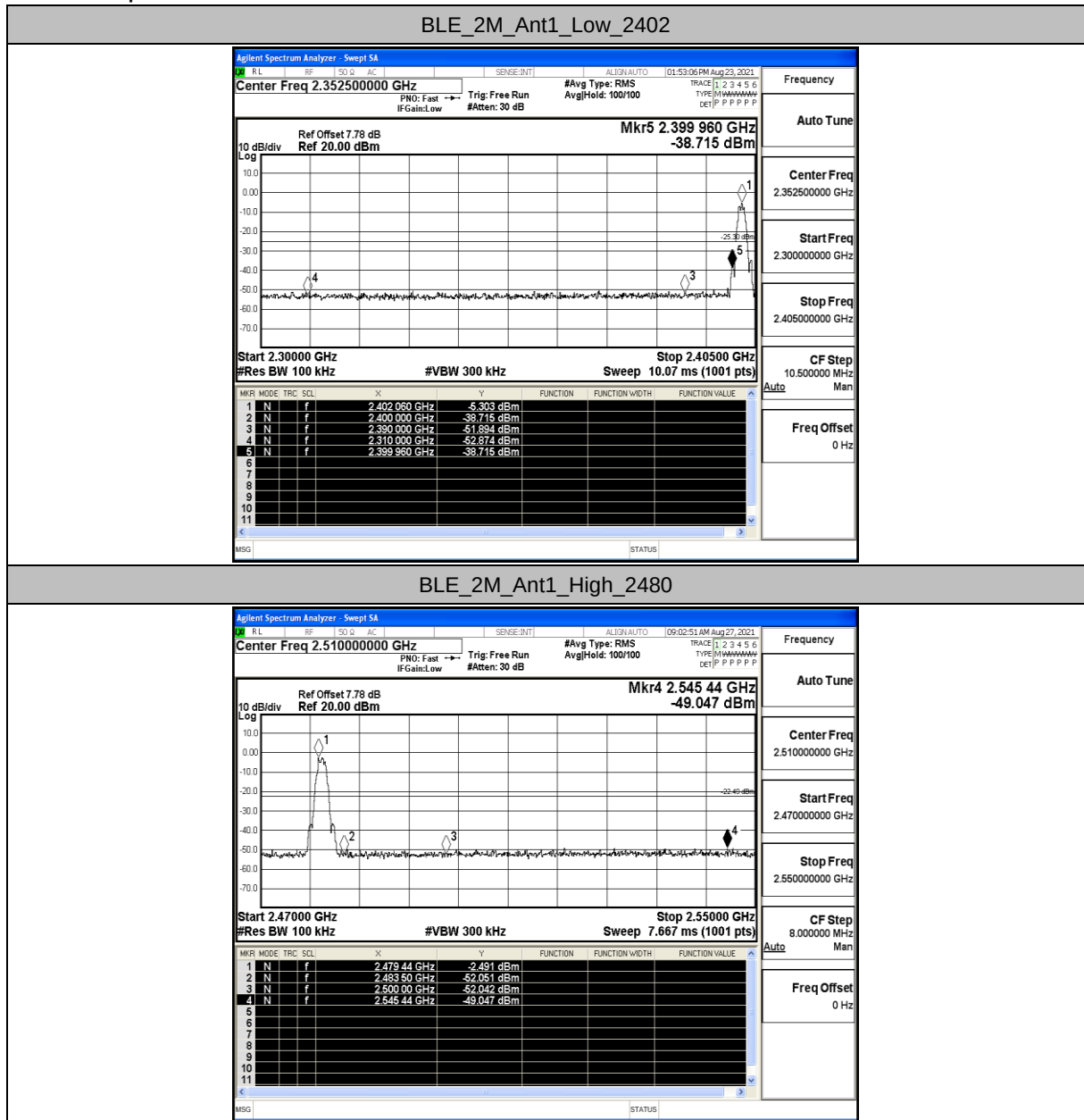
Test Graphs





TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_2M	Ant1	Low	2402	-5.30	-38.72	≤-25.3	PASS
		High	2480	-2.49	-49.05	≤-22.49	PASS

Test Graphs



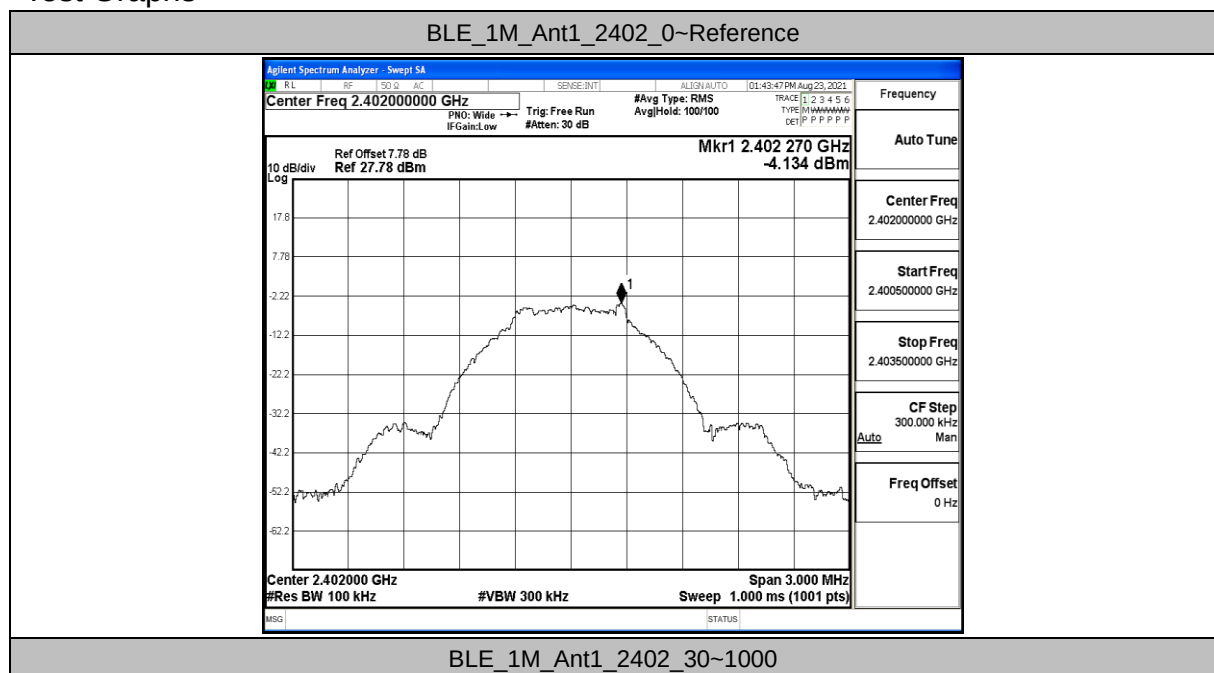


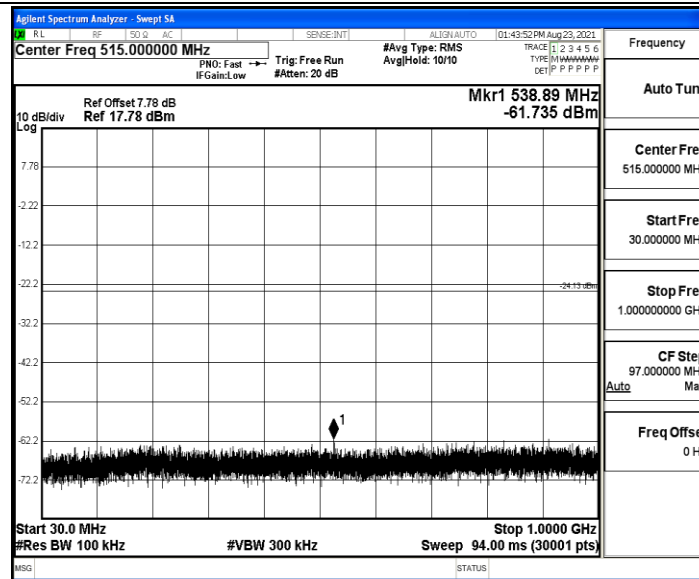
A.5 Conducted Spurious Emission

Test Result

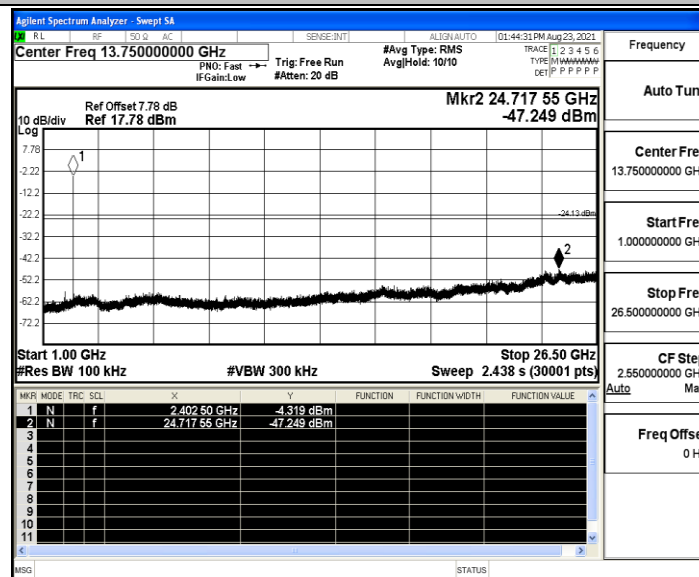
TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	Reference	-4.13	-4.13	---	PASS
			30~1000	-4.13	-61.74	≤-24.13	PASS
			1000~26500	-4.13	-47.25	≤-24.13	PASS
		2440	Reference	-3.91	-3.91	---	PASS
			30~1000	-3.91	-61.91	≤-23.91	PASS
			1000~26500	-3.91	-47.57	≤-23.91	PASS
		2480	Reference	-5.02	-5.02	---	PASS
			30~1000	-5.02	-61.96	≤-25.02	PASS
			1000~26500	-5.02	-46.97	≤-25.02	PASS

Test Graphs

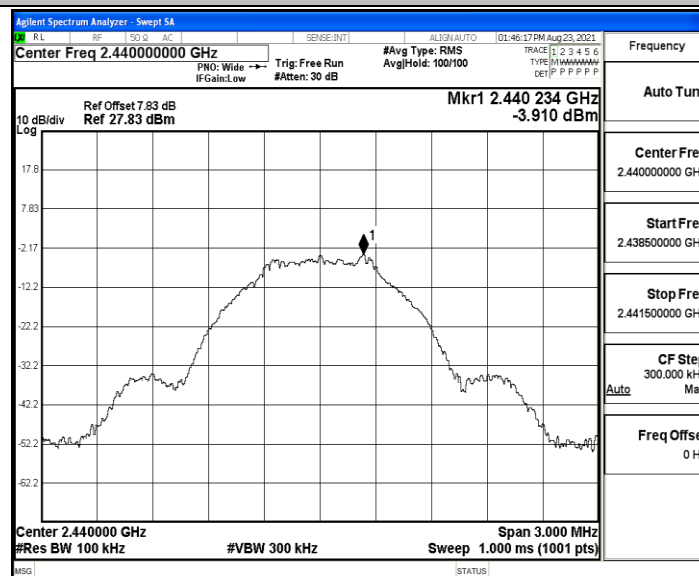




BLE_1M_Ant1_2402_1000~26500

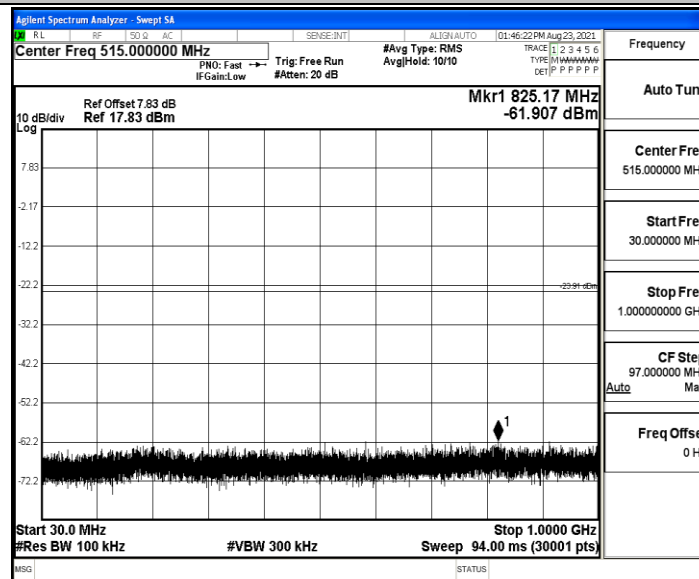


BLE_1M_Ant1_2440_0~Reference

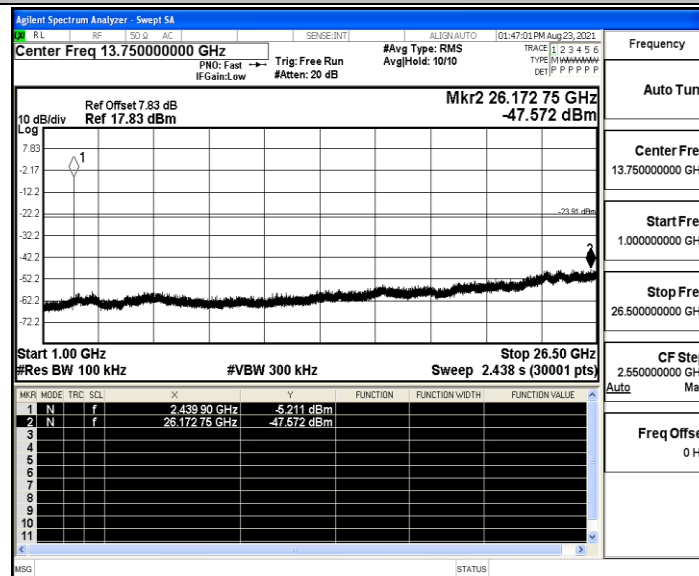




BLE_1M_Ant1_2440_30~1000



BLE_1M_Ant1_2440_1000~26500



BLE_1M_Ant1_2480_0~Reference

Agilent Spectrum Analyzer - Swept SA

RL RF SGP Q AC SENSE:INT1 ALIGN: AUTO 01:51:10PM Aug 23, 2021

Center Freq 13.75000000 GHz #Avg Type: RMS Avg/Hold: 10/10

PRN: Fast Trg: Free Run IF Gain: Low #Atten: 20 dB

Ref Offset: 7.78 dB Ref 17.78 dBm

Mkr2 24.686 95 GHz -46.974 dBm

10 dB/dBiv

Log

7.78

2.22

-12.2

-22.2

-32.2

-42.2

-52.2

-62.2

-72.2

Start 1.00 GHz Stop 26.50 GHz

Res BW 100 kHz #VBW 300 kHz Sweep 2.438 s (30001 pts)

MKR MODE TRG SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE

1	N	f	2.479 85 GHz	-5.464 dBm			
2	N	f	24.686 95 GHz	-46.974 dBm			
3							
4							
5							
6							
7							
8							
9							
10							
11							

Frequency

Auto Tuning

Center Freq 13.75000000 GHz

Start Freq 1.00000000 GHz

Stop Freq 26.50000000 GHz

CF Stop 2.550000000 GHz

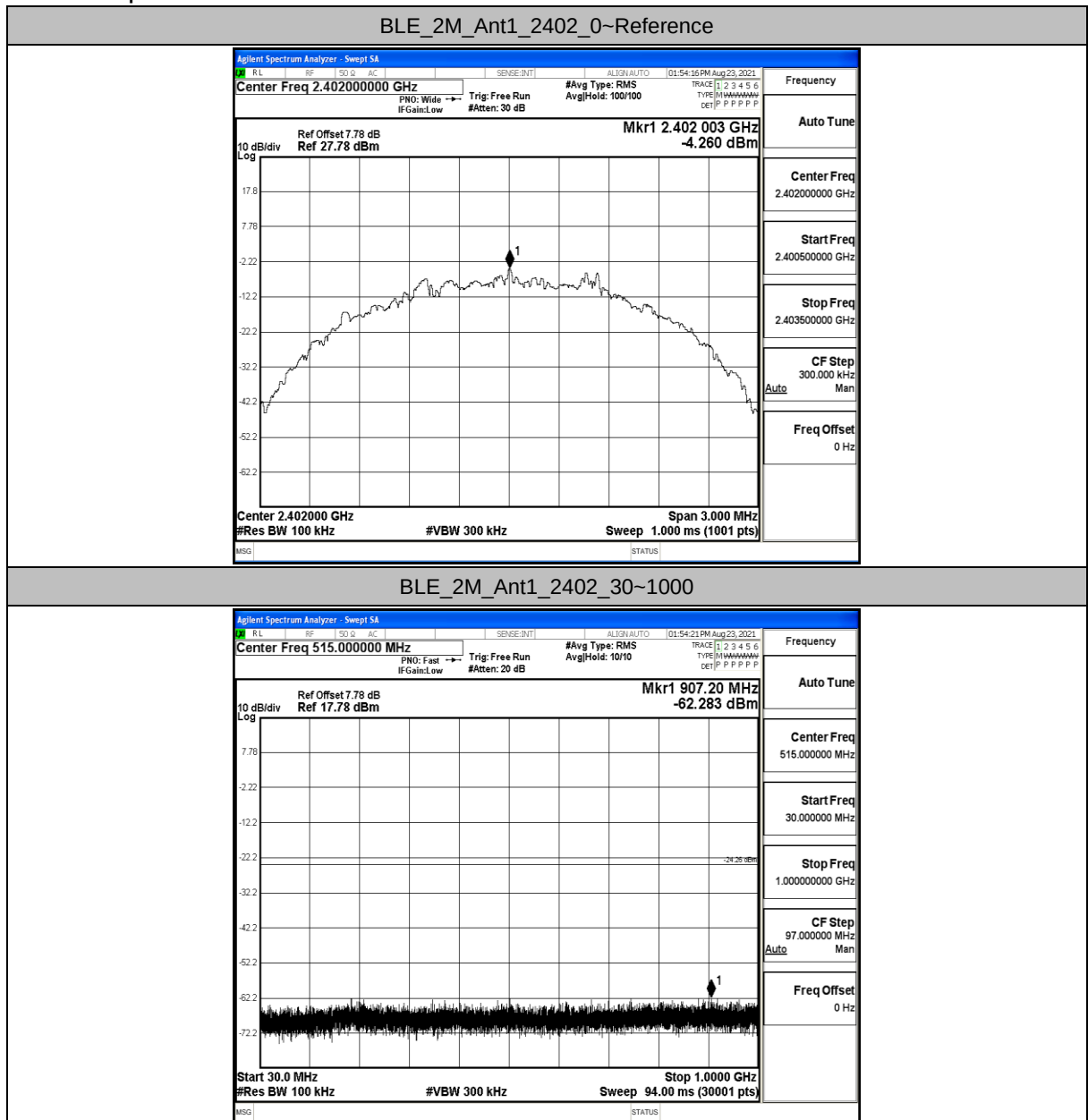
Auto

Frequency Offset 0 Hz



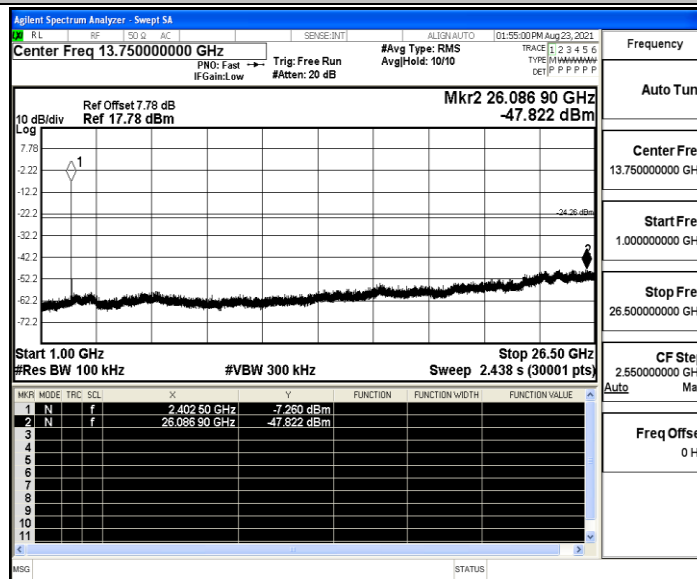
TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_2M	Ant1	2402	Reference	-4.26	-4.26	---	PASS
			30~1000	-4.26	-62.28	≤-24.26	PASS
			1000~26500	-4.26	-47.82	≤-24.26	PASS
		2440	Reference	-2.52	-2.52	---	PASS
			30~1000	-2.52	-62	≤-22.52	PASS
			1000~26500	-2.52	-47.54	≤-22.52	PASS
		2480	Reference	-2.34	-2.34	---	PASS
			30~1000	-2.34	-61.93	≤-22.34	PASS
			1000~26500	-2.34	-47.56	≤-22.34	PASS

Test Graphs

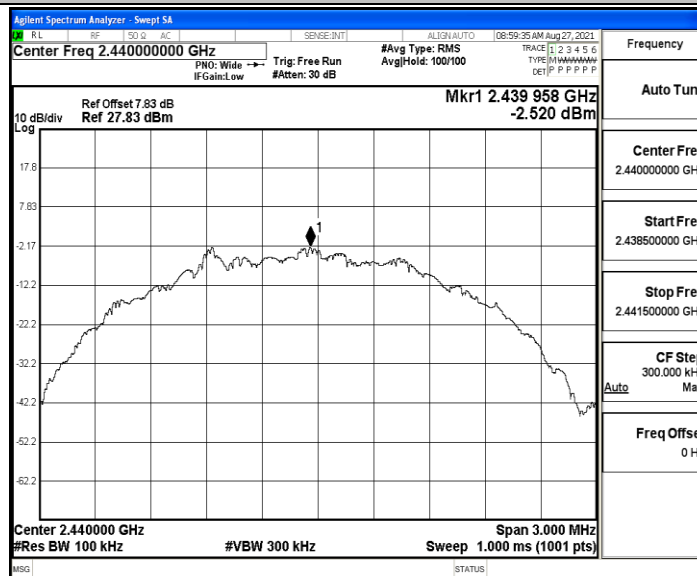




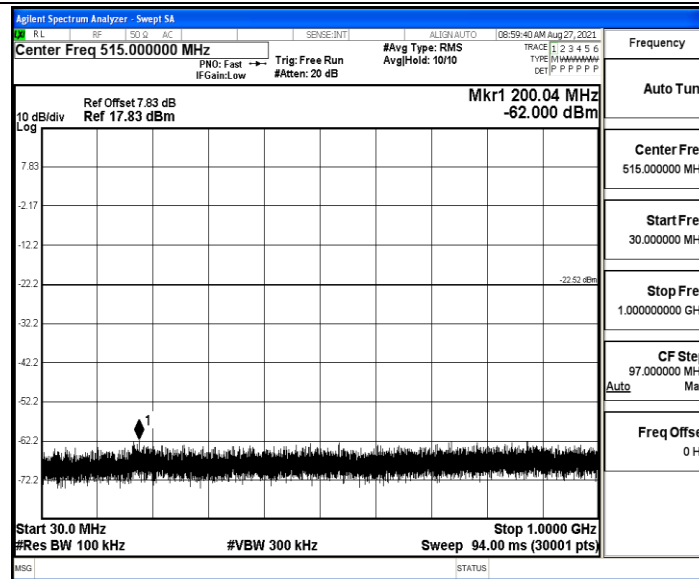
BLE_2M_Ant1_2402_1000~26500



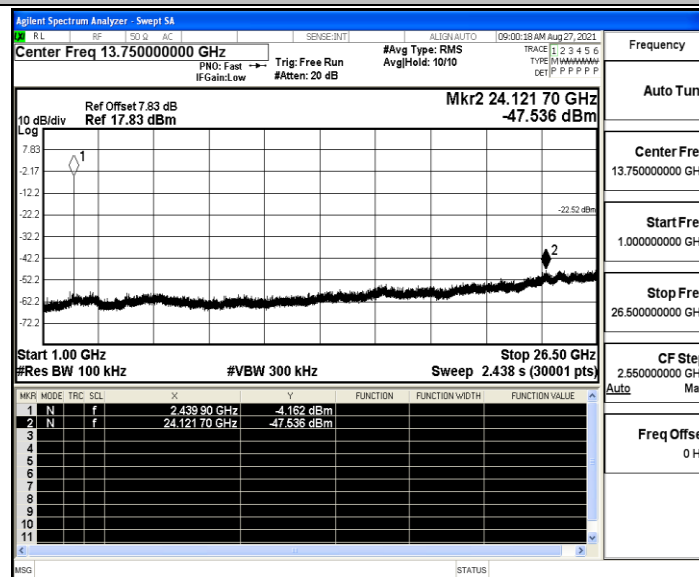
BLE_2M_Ant1_2440_0~Reference



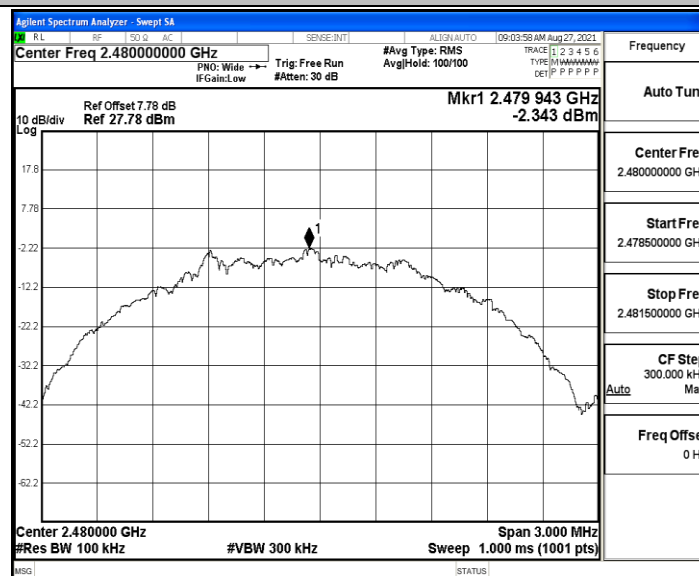
BLE_2M_Ant1_2440_30~1000



BLE_2M_Ant1_2440_1000~26500

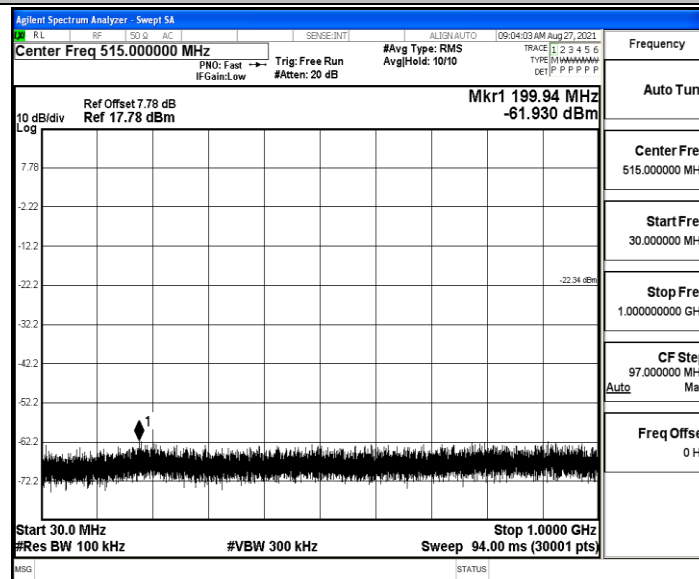


BLE_2M_Ant1_2480_0~Reference

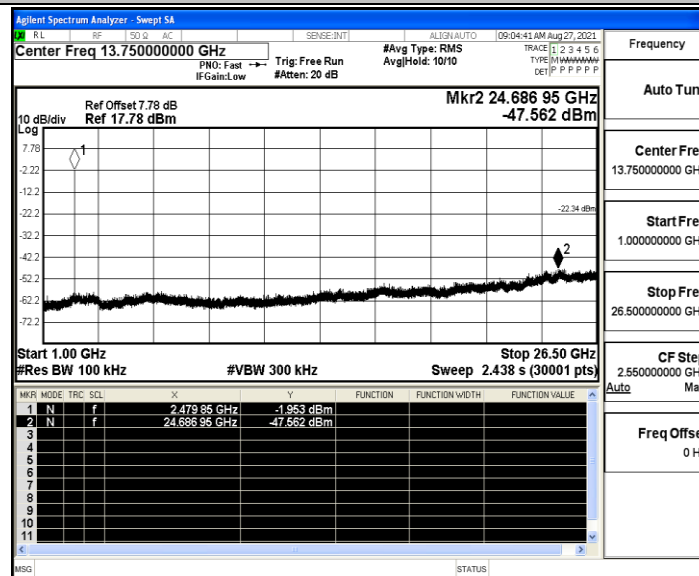


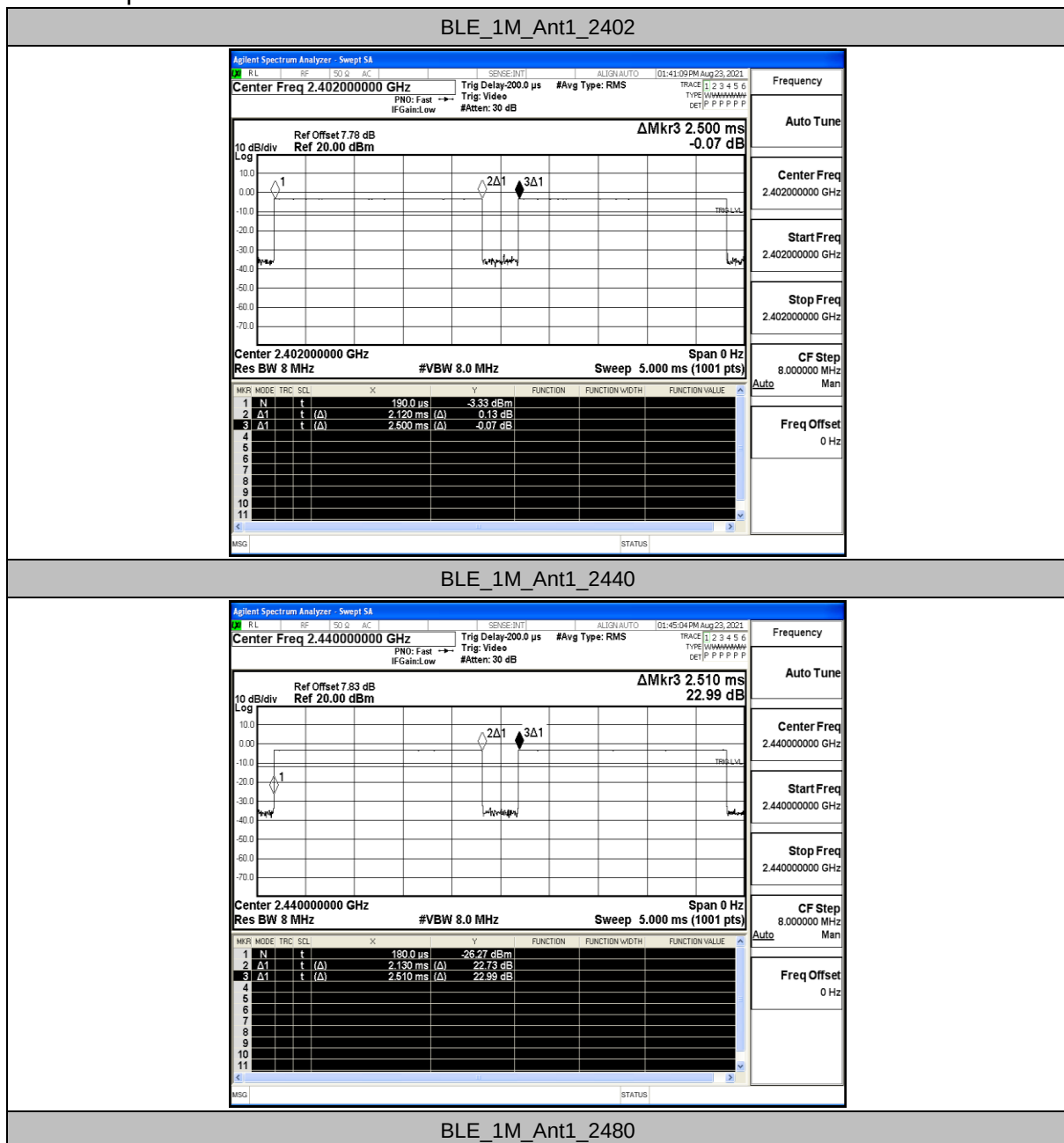


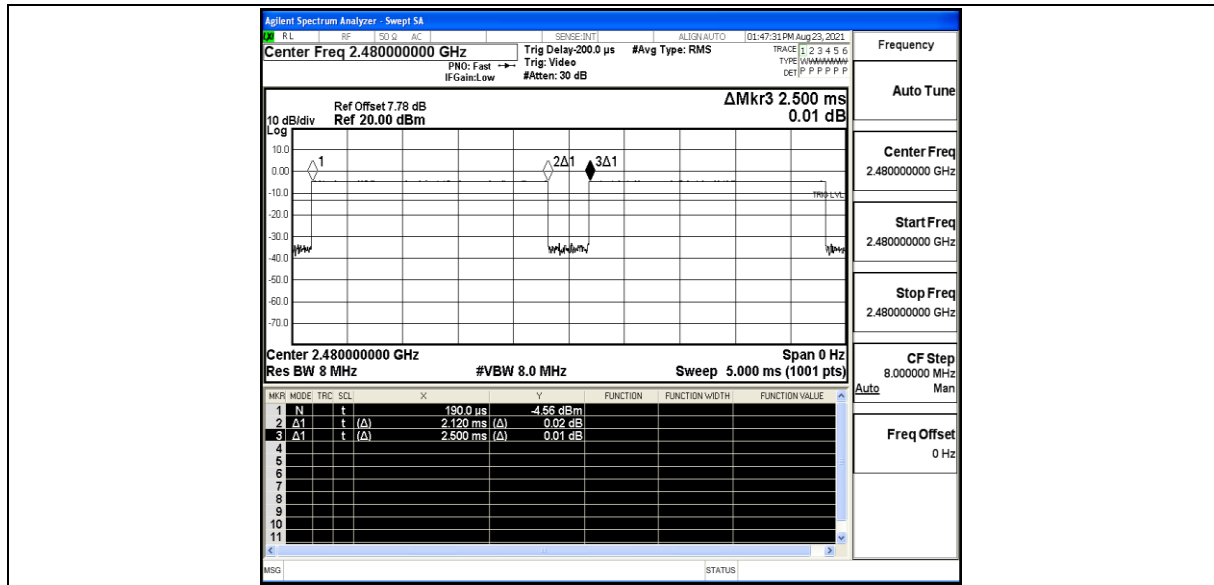
BLE_2M_Ant1_2480_30~1000



BLE_2M_Ant1_2480_1000~26500

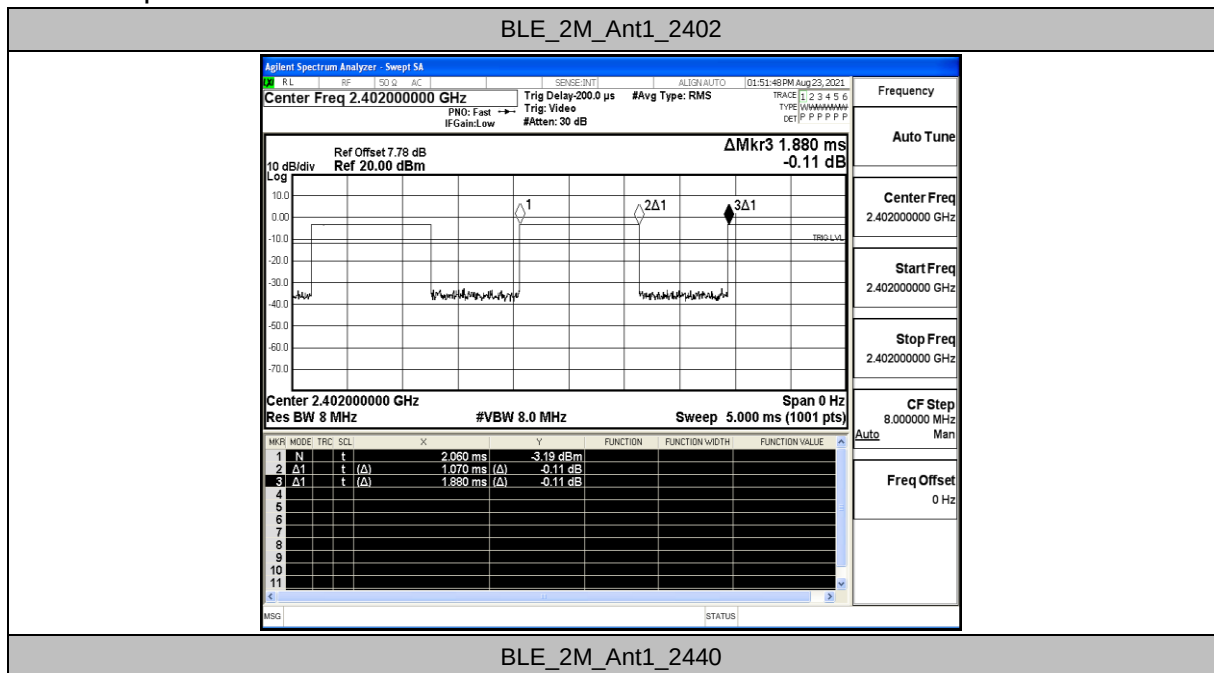


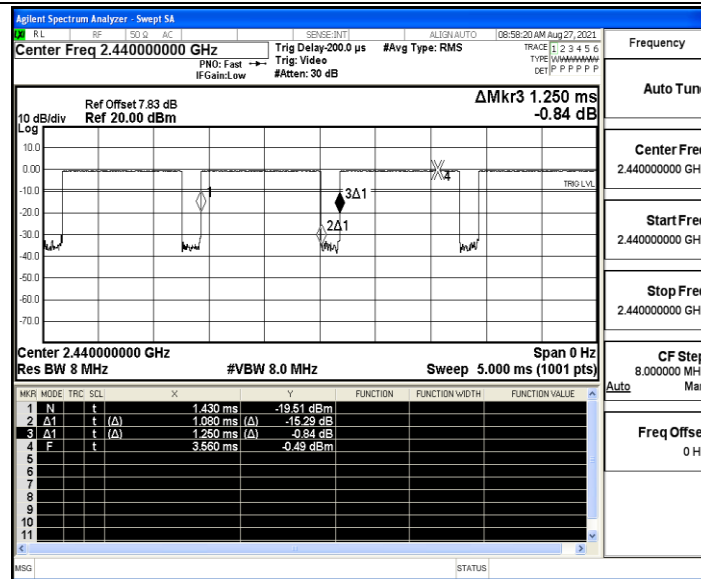




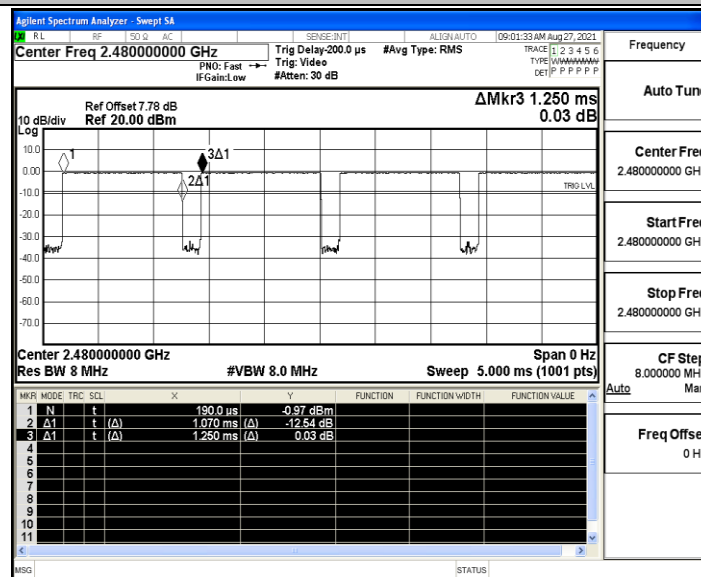
TestMode	Antenna	Channel	ON Time [ms]	Period [ms]	X	DC [%]	xFactor	Limit	Verdict
BLE_2M	Ant1	2402	1.07	1.88	0.5691	56.91	2.45	---	PASS
		2440	1.08	1.25	0.8640	86.40	0.63	---	PASS
		2480	1.07	1.25	0.8560	85.60	0.68	---	PASS

Test Graphs





BLE_2M_Ant1_2480





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	-48.95	≤-41.20	46.25	≤54	PASS
				AV	2379.485	-48.53	≤-41.20	46.67	≤54	PASS
				AV	2390.000	-48.69	≤-41.20	46.51	≤54	PASS
				Peak	2310.000	-41.63	≤-21.20	53.57	≤74	PASS
				Peak	2312.285	-39.32	≤-21.20	55.88	≤74	PASS
				Peak	2390.000	-41.11	≤-21.20	54.09	≤74	PASS
		High	2480	AV	2483.500	-48.12	≤-41.20	47.08	≤54	PASS
				AV	2498.160	-47.99	≤-41.20	47.21	≤54	PASS
				AV	2500.000	-48.07	≤-41.20	47.13	≤54	PASS
				Peak	2483.500	-38.95	≤-21.20	56.25	≤74	PASS
				Peak	2499.440	-38.55	≤-21.20	56.65	≤74	PASS
				Peak	2500.000	-40.97	≤-21.20	54.23	≤74	PASS

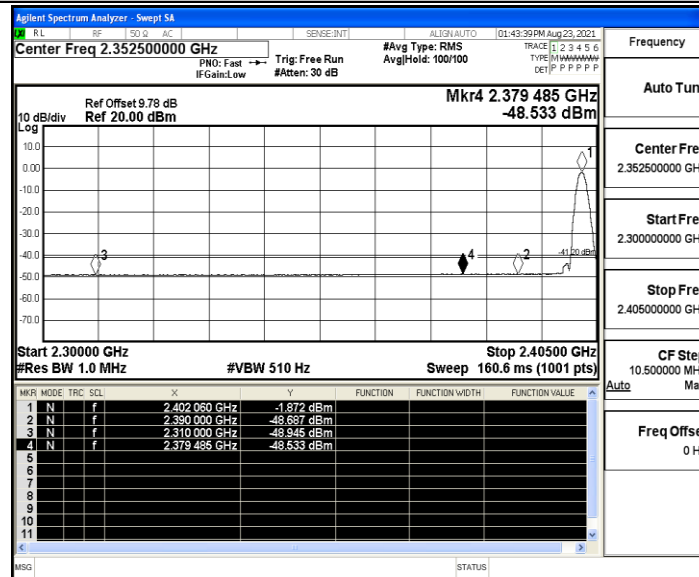
Note:

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.

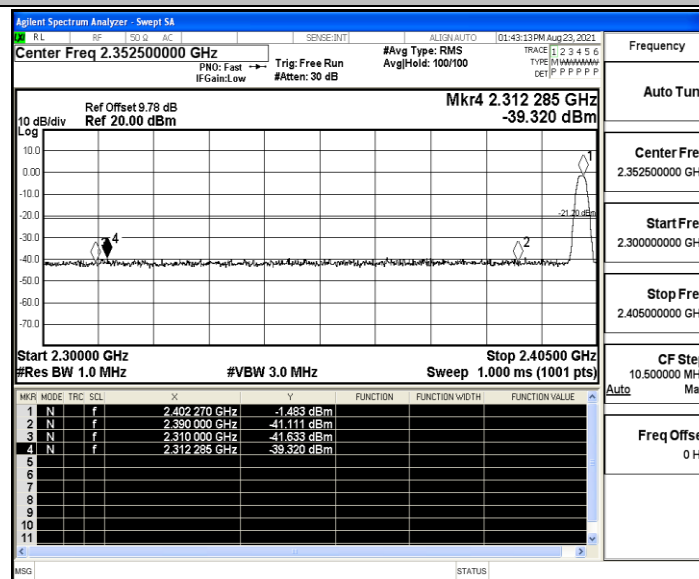


Test Graphs

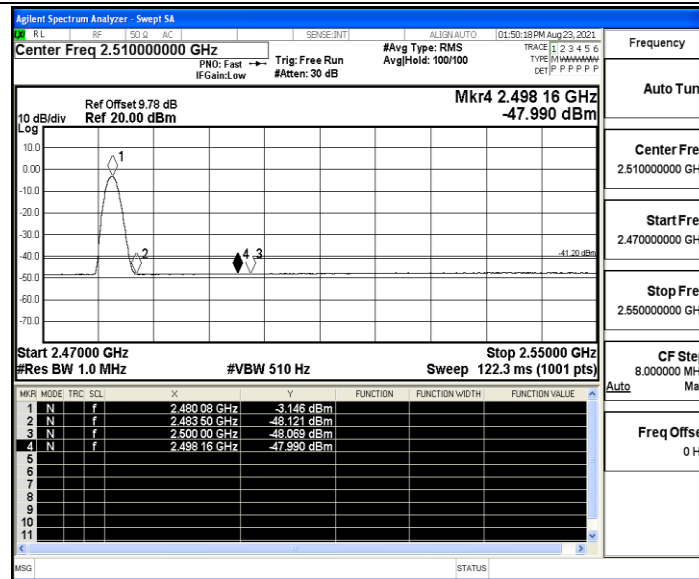
BLE_1M_Ant1_Low_2402_AV



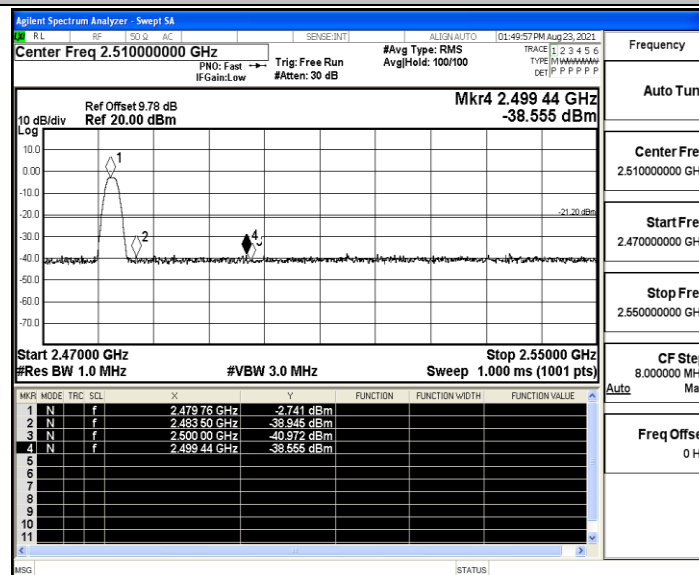
BLE_1M_Ant1_Low_2402_Peak



BLE_1M_Ant1_High_2480_AV



BLE_1M_Ant1_High_2480_Peak





TestMode	Antenna	ChName	Channel	Detector	Freq. [MHz]	Result [dBm]	Limit [dBm]	Result [dBuV/m]	Limit [dBuV/m]	Verdict
BLE_2M	Ant1	Low	2402	AV	2310.000	-48.86	≤-41.20	46.34	≤54	PASS
				AV	2383.370	-48.31	≤-41.20	46.89	≤54	PASS
				AV	2390.000	-48.55	≤-41.20	46.65	≤54	PASS
				Peak	2310.000	-41.76	≤-21.20	53.44	≤74	PASS
				Peak	2374.130	-38.59	≤-21.20	56.61	≤74	PASS
				Peak	2390.000	-40.83	≤-21.20	54.37	≤74	PASS
		High	2480	AV	2483.500	-46.86	≤-41.20	48.34	≤54	PASS
				AV	2496.640	-46.86	≤-41.20	48.34	≤54	PASS
				AV	2500.000	-47.73	≤-41.20	47.47	≤54	PASS
				Peak	2483.500	-41.46	≤-21.20	53.74	≤74	PASS
				Peak	2486.720	-37.51	≤-21.20	57.69	≤74	PASS
				Peak	2500.000	-40.79	≤-21.20	54.41	≤74	PASS

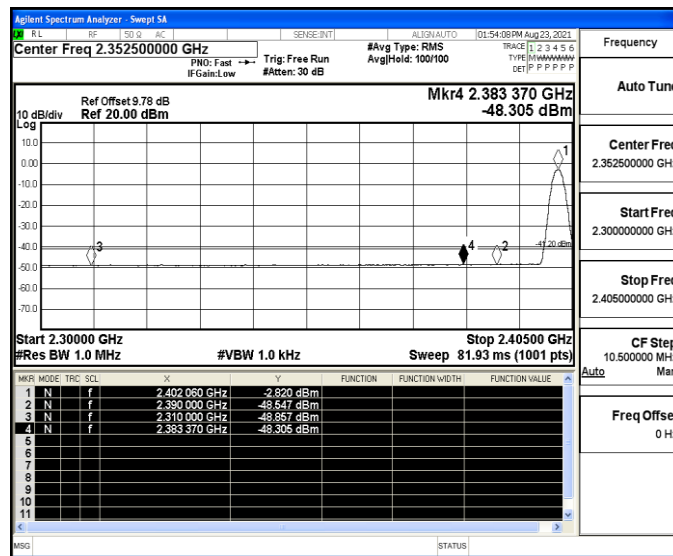
Note:

- The Antenna Gain is compensated in the graph.
- 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.

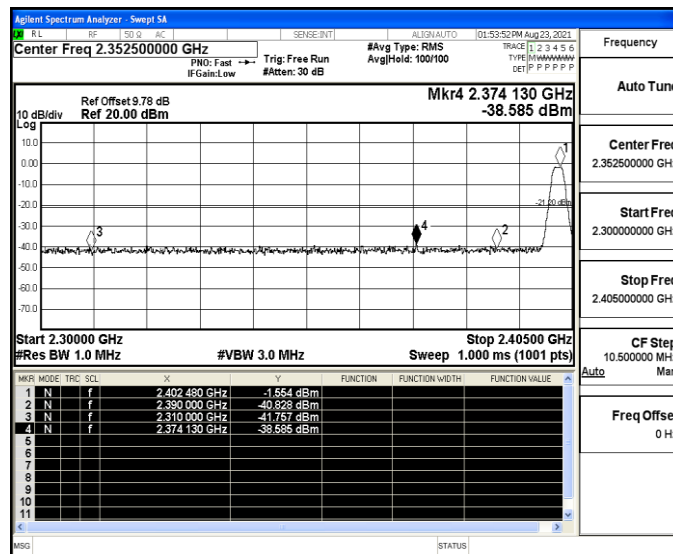


Test Graphs

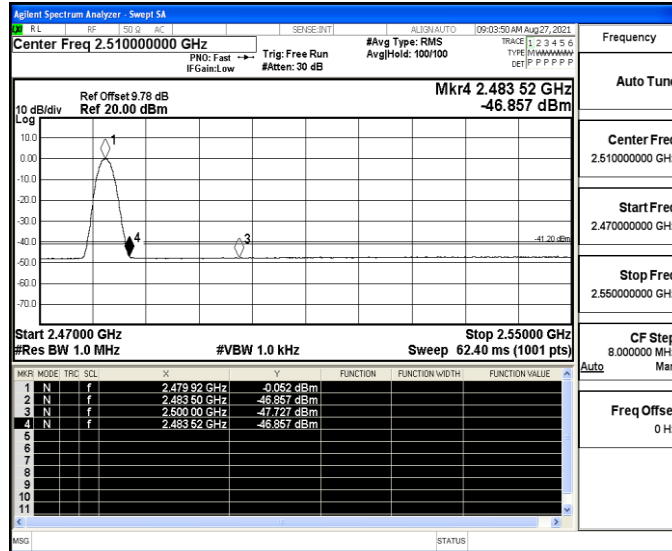
BLE_2M_Ant1_Low_2402_AV



BLE_2M_Ant1_Low_2402_Peak



BLE_2M_Ant1_High_2480_AV



BLE_2M_Ant1_High_2480_Peak

