Appendix A

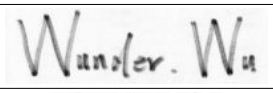
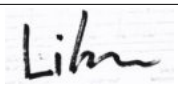
RF Test Data for BLE (Conducted Measurement)

Product Name: 77-S211 BLK

Test Model: 77-S211

HVIN: 77-S211

Environmental Conditions

Temperature:	23.5 ° C
Relative Humidity:	52.2%
ATM Pressure:	100.0 kPa
Test Engineer:	
Supervised by:	

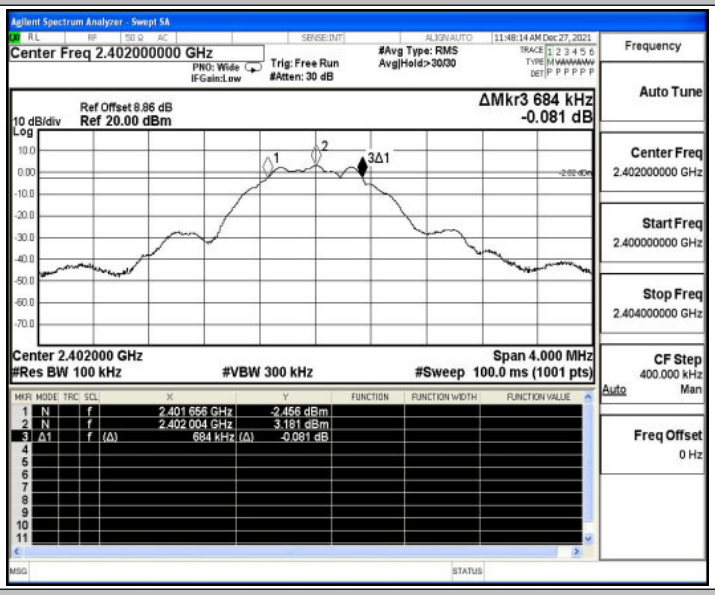
A.1 6dB Bandwidth

Test Result

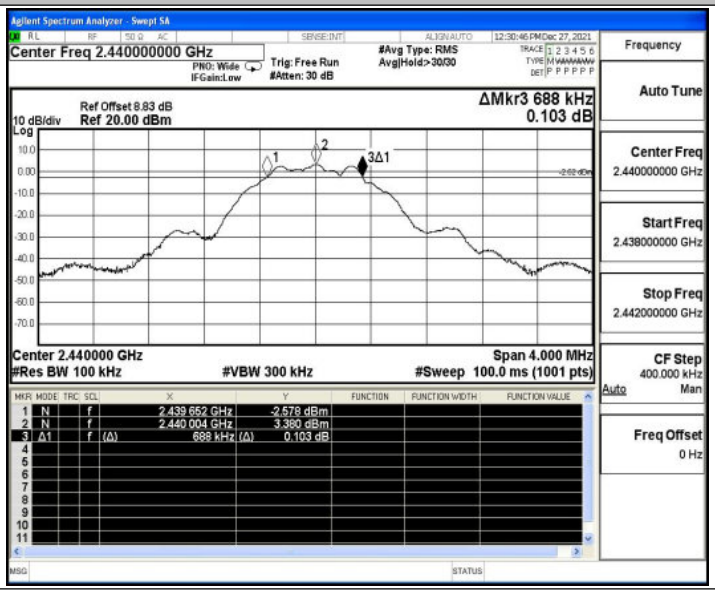
TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.684	2401.656	2402.340	0.5	PASS
		2440	0.688	2439.652	2440.340	0.5	PASS
		2480	0.688	2479.652	2480.340	0.5	PASS
BLE_2M	Ant1	2402	1.184	2401.384	2402.568	0.5	PASS
		2440	1.188	2439.380	2440.568	0.5	PASS
		2480	1.192	2479.380	2480.572	0.5	PASS

Test Graphs

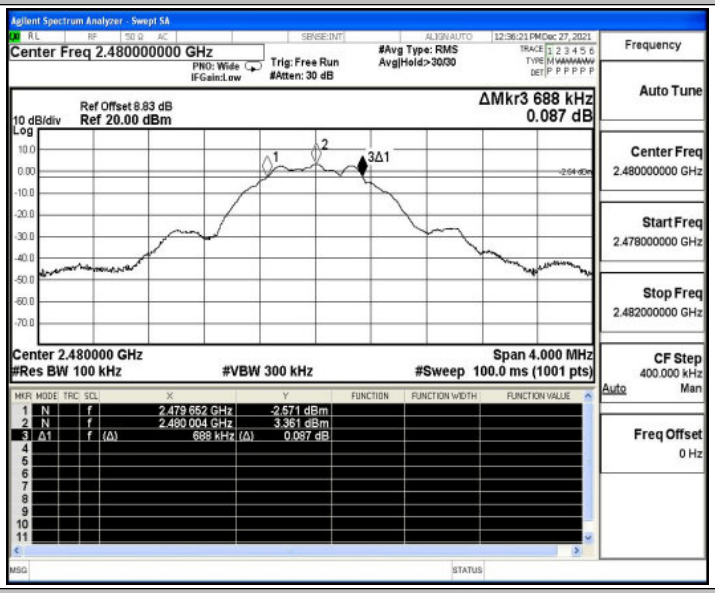
BLE_1M_Ant1_2402



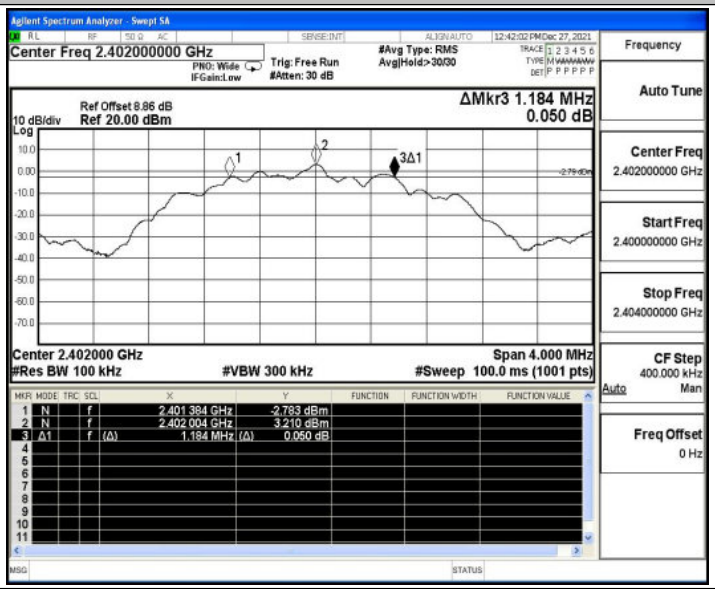
BLE_1M_Ant1_2440



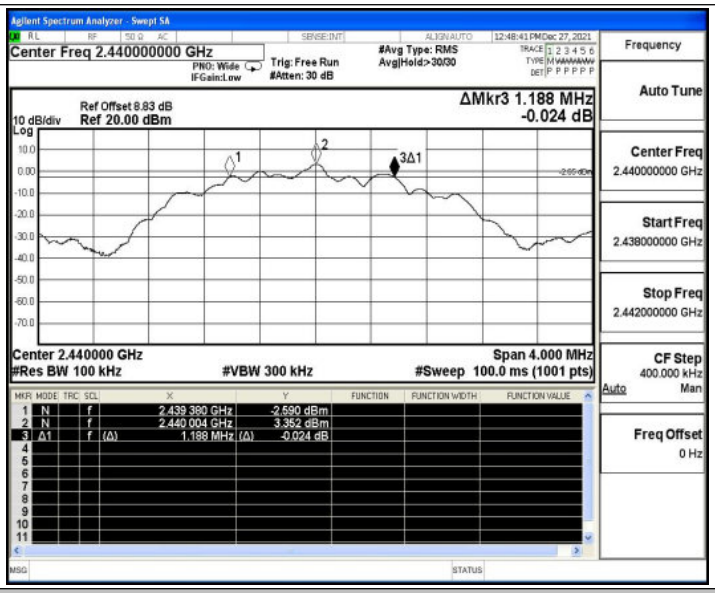
BLE_1M_Ant1_2480



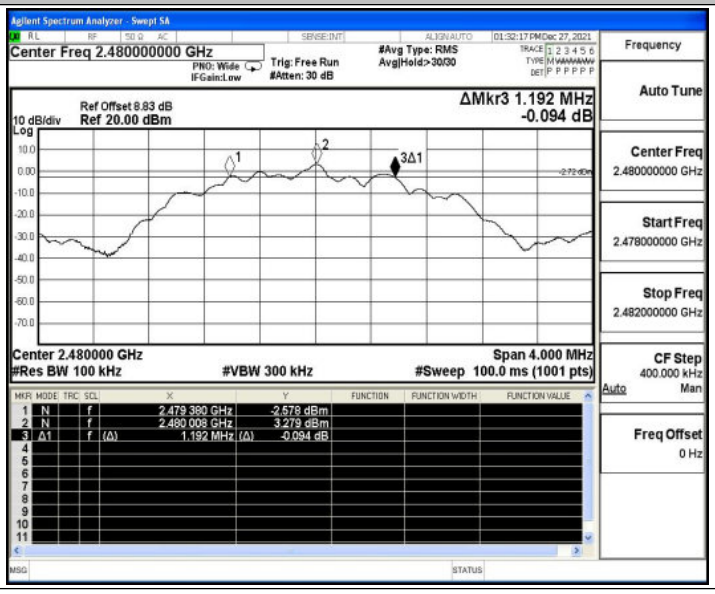
BLE_2M_Ant1_2402



BLE_2M_Ant1_2440



BLE_2M_Ant1_2480



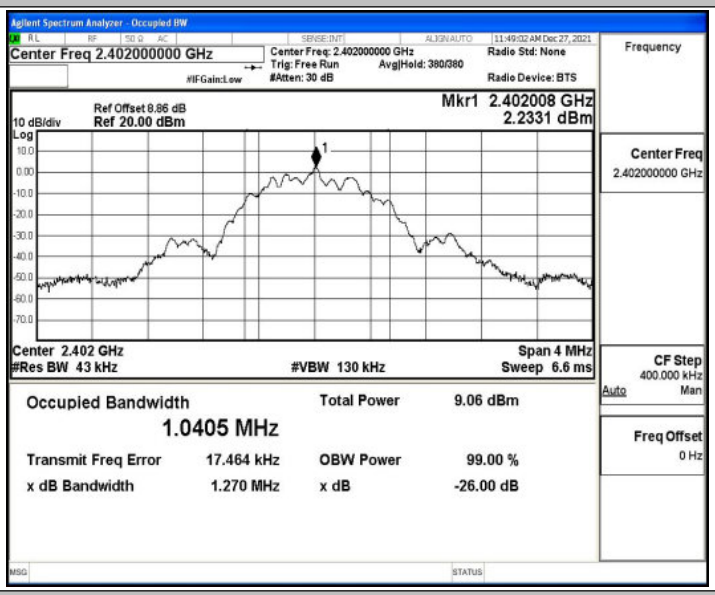
A.2 Occupied Channel Bandwidth

Test Result

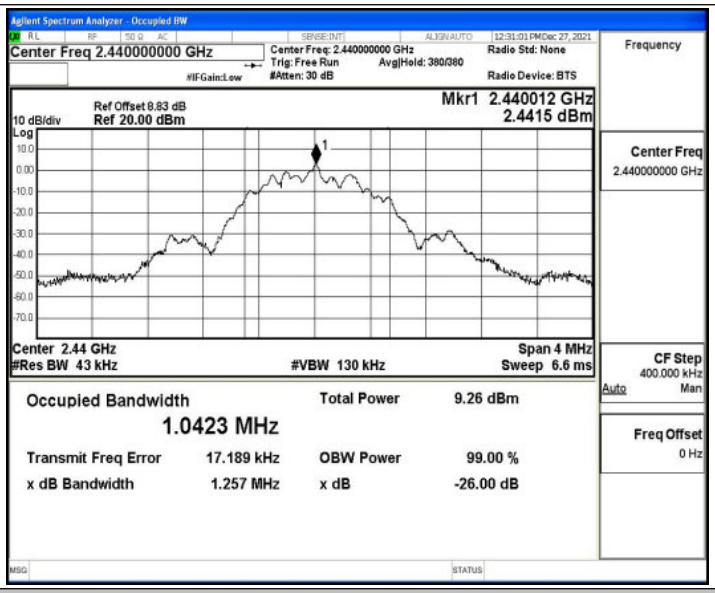
TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.0405	2401.497	2402.538	---	---
		2440	1.0423	2439.496	2440.538	---	---
		2480	1.0441	2479.494	2480.538	---	---
BLE_2M	Ant1	2402	2.0498	2400.999	2403.049	---	---
		2440	2.0487	2438.999	2441.047	---	---
		2480	2.0507	2478.998	2481.049	---	---

Test Graphs

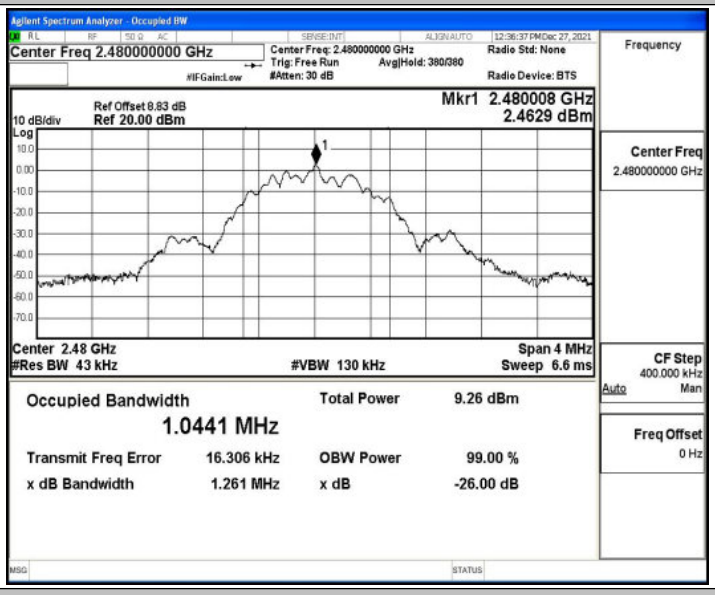
BLE_1M_Ant1_2402



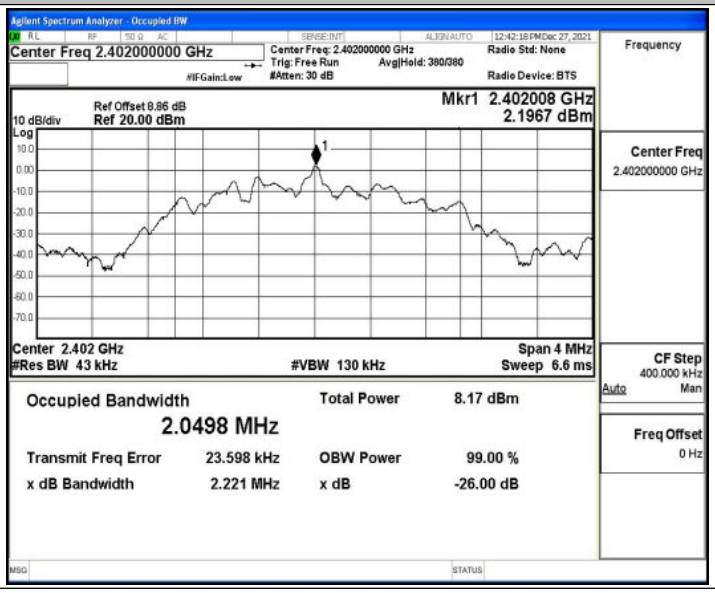
BLE_1M_Ant1_2440



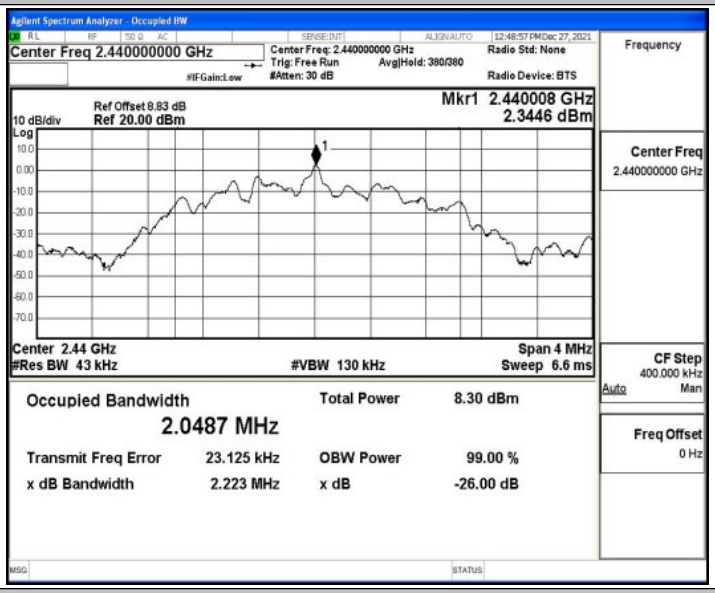
BLE_1M_Ant1_2480



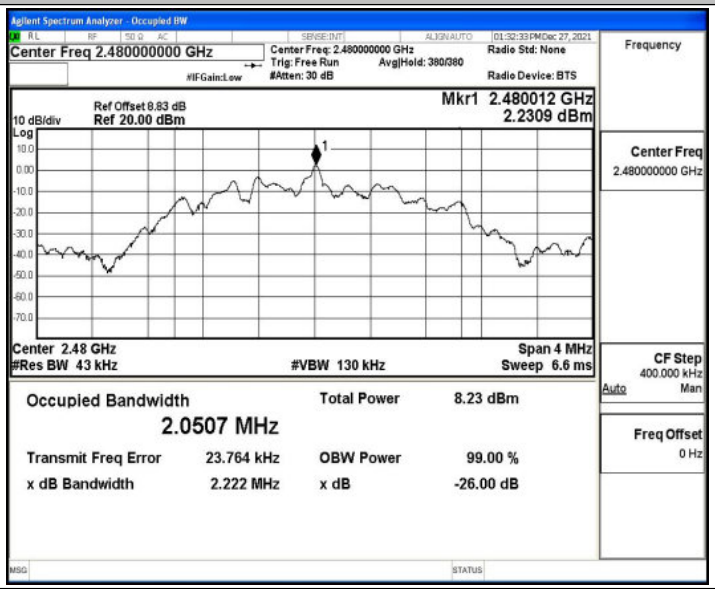
BLE_2M_Ant1_2402



BLE_2M_Ant1_2440



BLE_2M_Ant1_2480



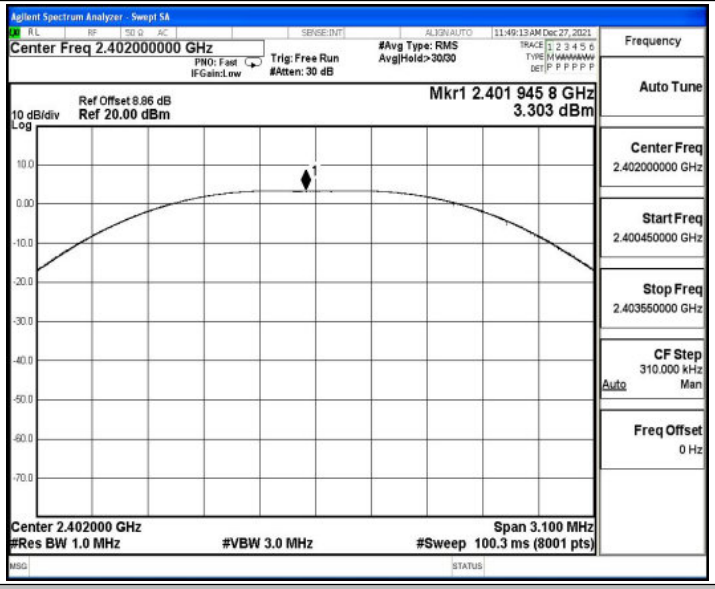
A.3 Maximum conducted output power

Test Result

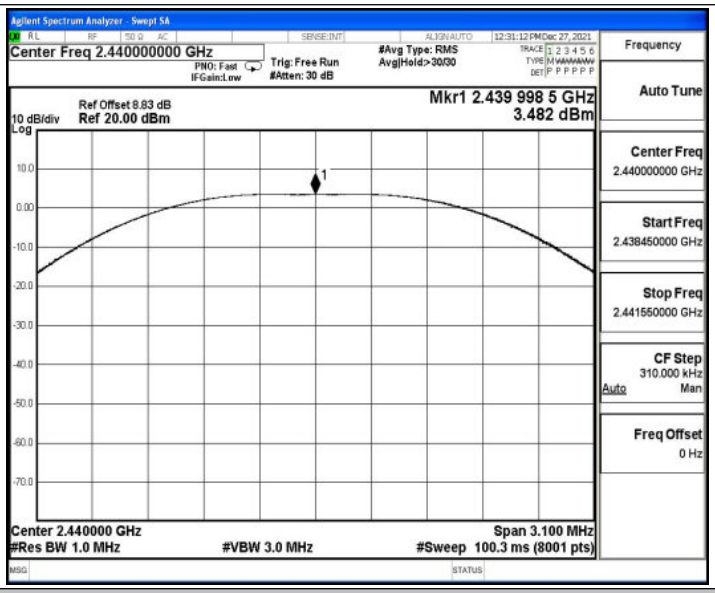
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	3.3	≤30	PASS
		2440	3.48	≤30	PASS
		2480	3.45	≤30	PASS
BLE_2M	Ant1	2402	3.38	≤30	PASS
		2440	3.49	≤30	PASS
		2480	3.42	≤30	PASS

Test Graphs

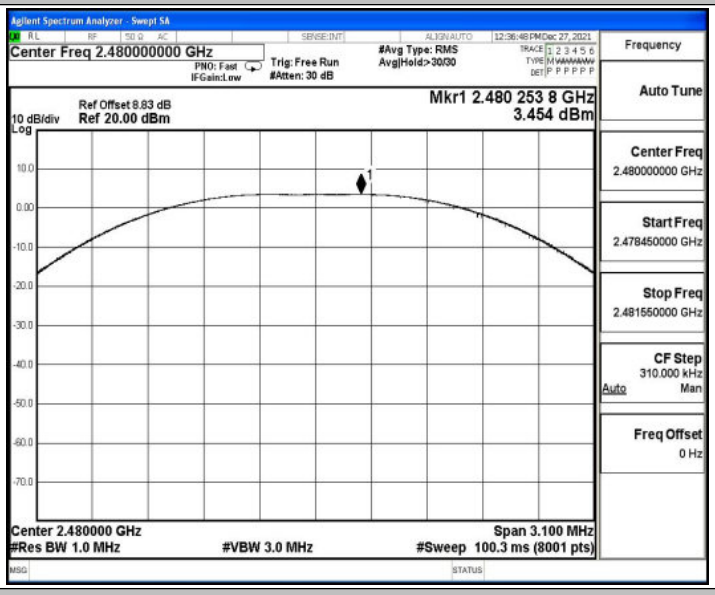
BLE_1M_Ant1_2402



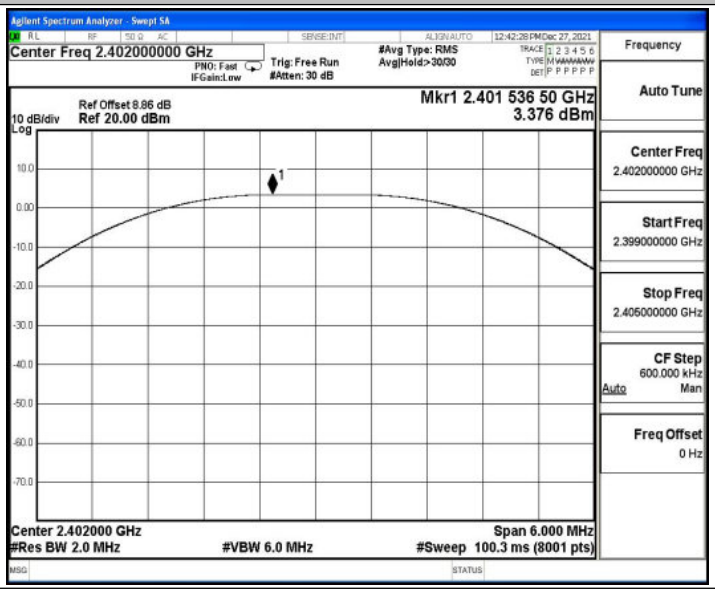
BLE_1M_Ant1_2440



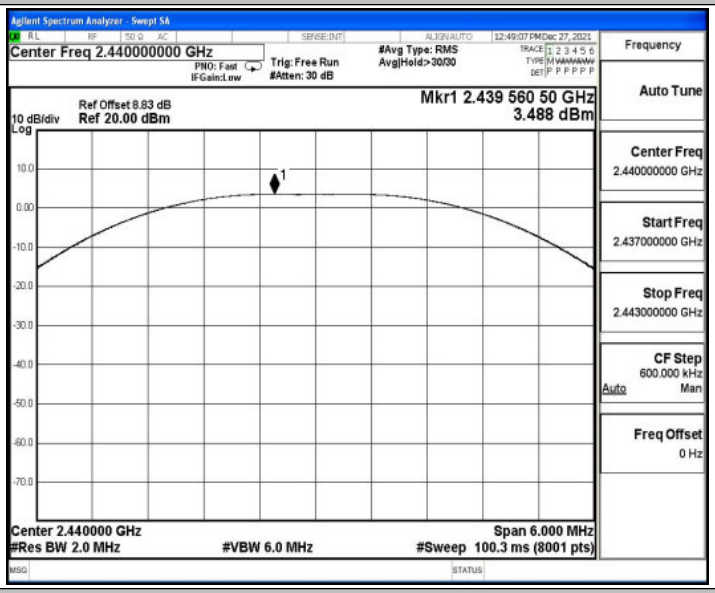
BLE_1M_Ant1_2480



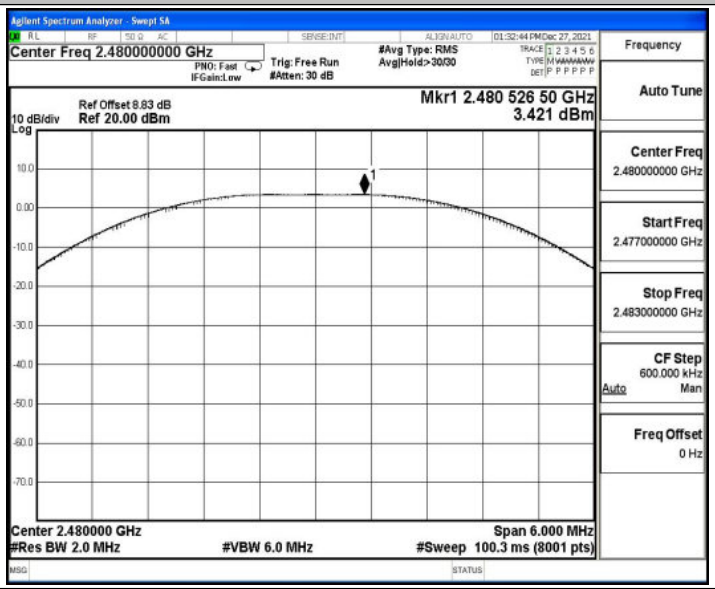
BLE_2M_Ant1_2402



BLE_2M_Ant1_2440



BLE_2M_Ant1_2480



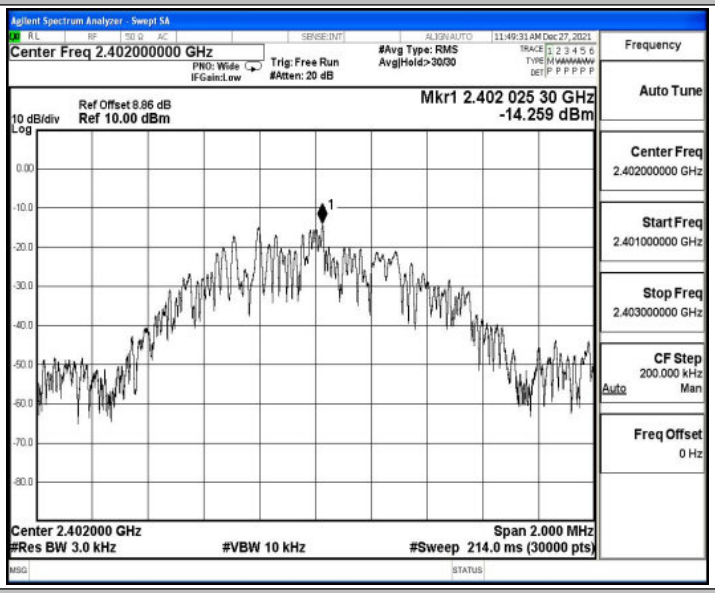
A.4 power spectral density

Test Result

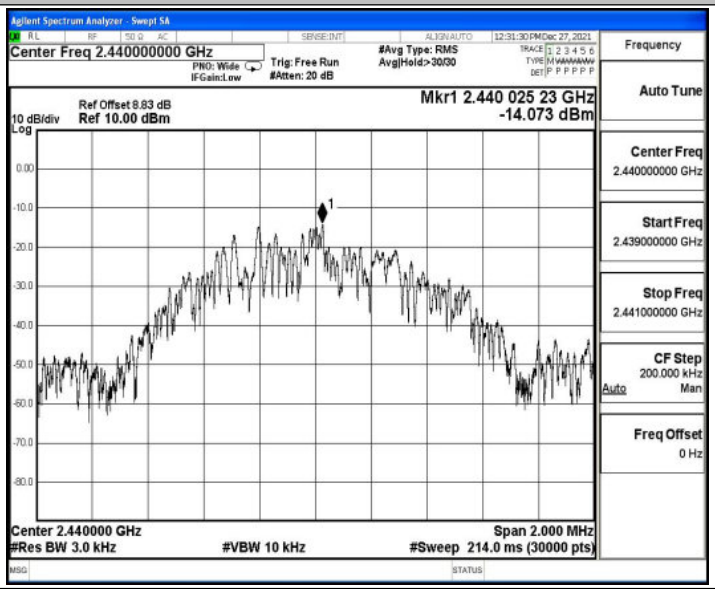
TestMode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-14.26	≤8.00	PASS
		2440	-14.07	≤8.00	PASS
		2480	-14.08	≤8.00	PASS
BLE_2M	Ant1	2402	-16.16	≤8.00	PASS
		2440	-15.96	≤8.00	PASS
		2480	-16.05	≤8.00	PASS

Test Graphs

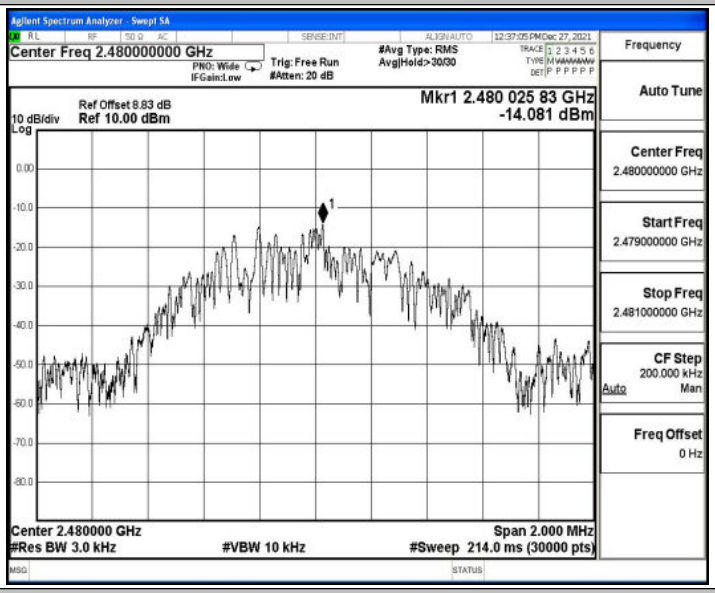
BLE_1M_Ant1_2402



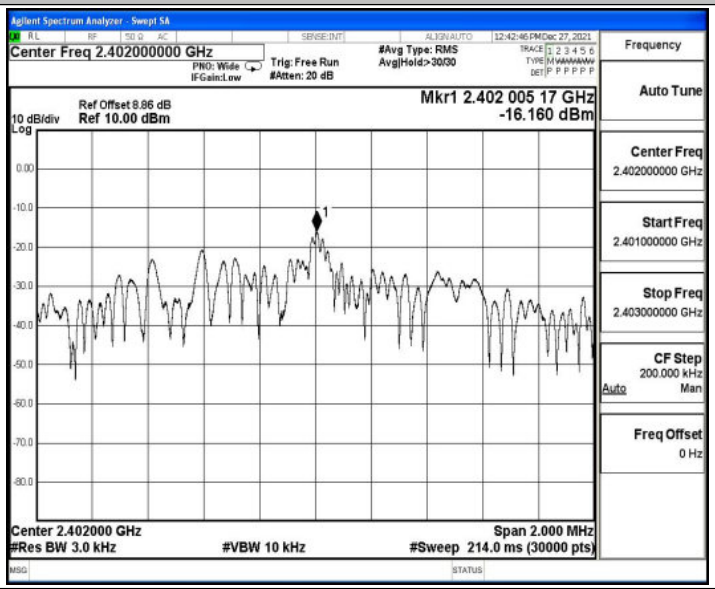
BLE_1M_Ant1_2440



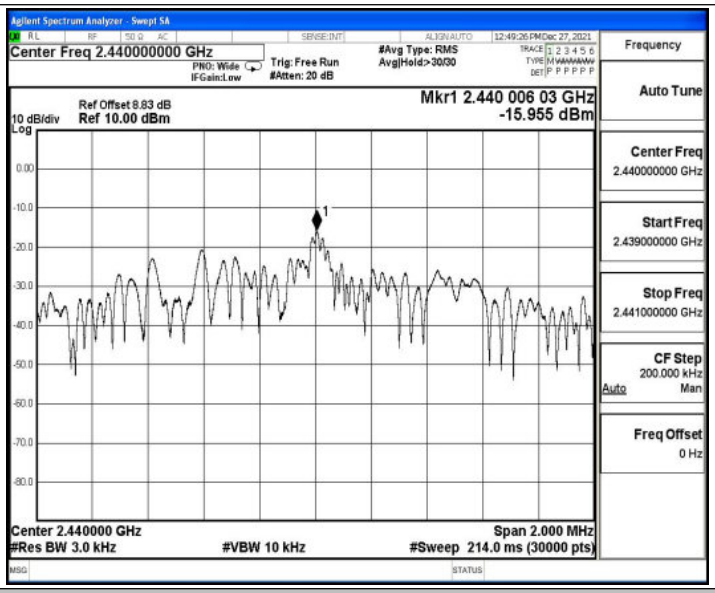
BLE_1M_Ant1_2480



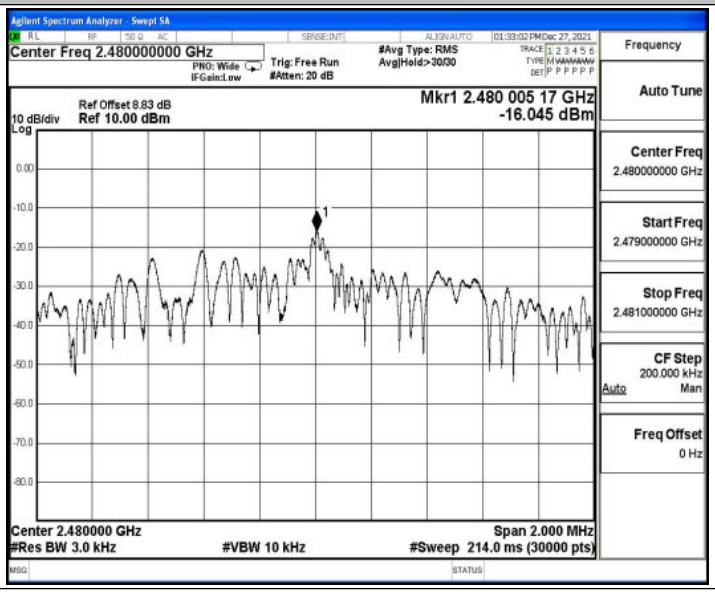
BLE_2M_Ant1_2402



BLE_2M_Ant1_2440



BLE_2M_Ant1_2480



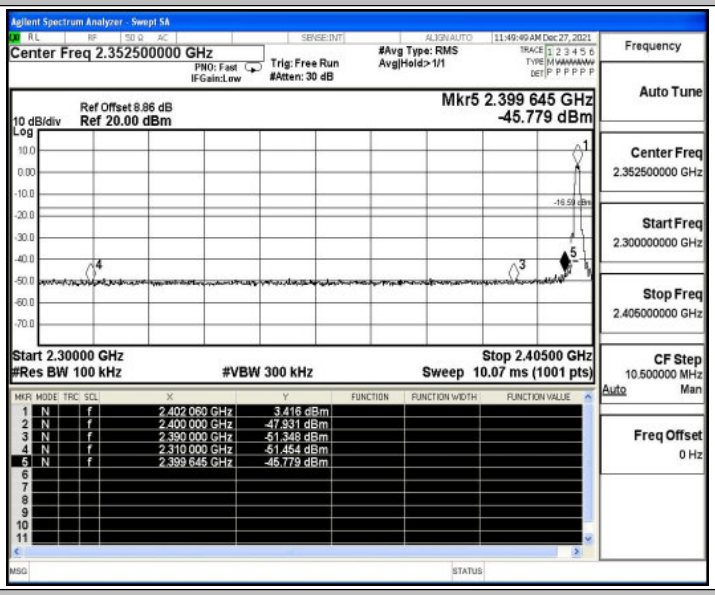
A.5 Band edge measurements

Test Result

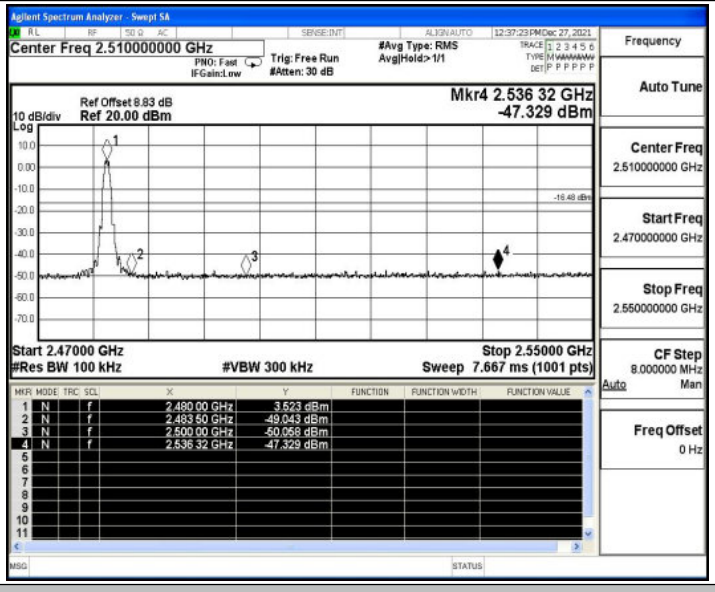
TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	Low	2402	3.41	-45.78	≤-16.59	PASS
		High	2480	3.52	-47.33	≤-16.48	PASS
BLE_2M	Ant1	Low	2402	3.43	-28.89	≤-16.57	PASS
		High	2480	3.50	-47.35	≤-16.5	PASS

Test Graphs

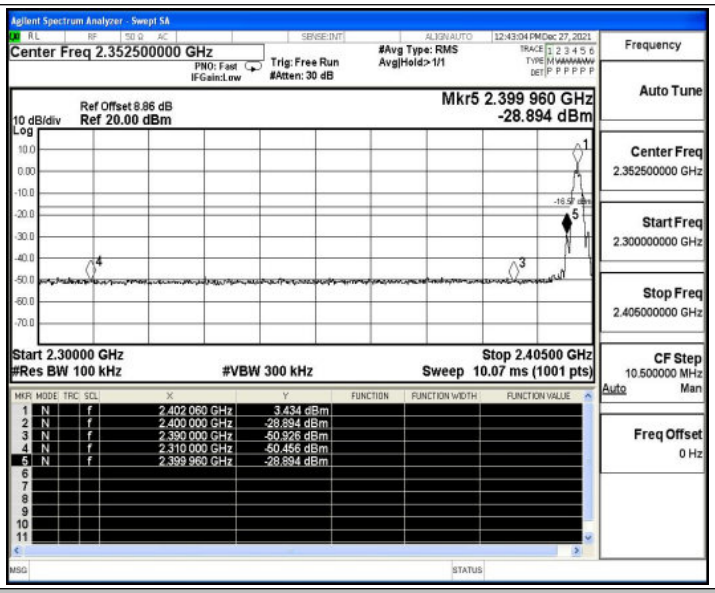
BLE_1M_Ant1_Low_2402



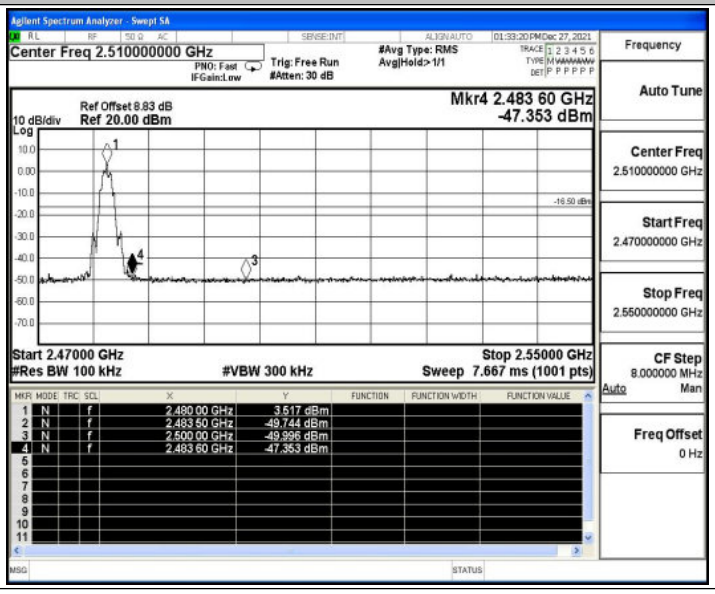
BLE_1M_Ant1_High_2480



BLE_2M_Ant1_Low_2402



BLE_2M_Ant1_High_2480



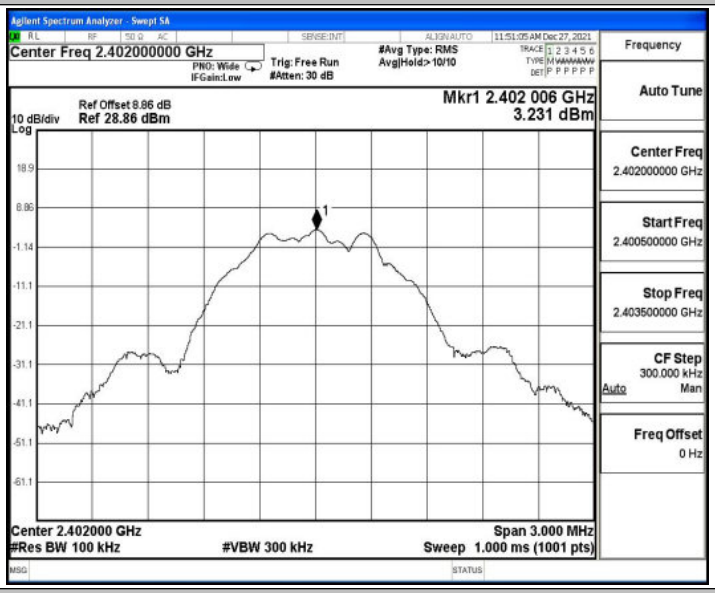
A.6 Conducted Spurious Emission

Test Result

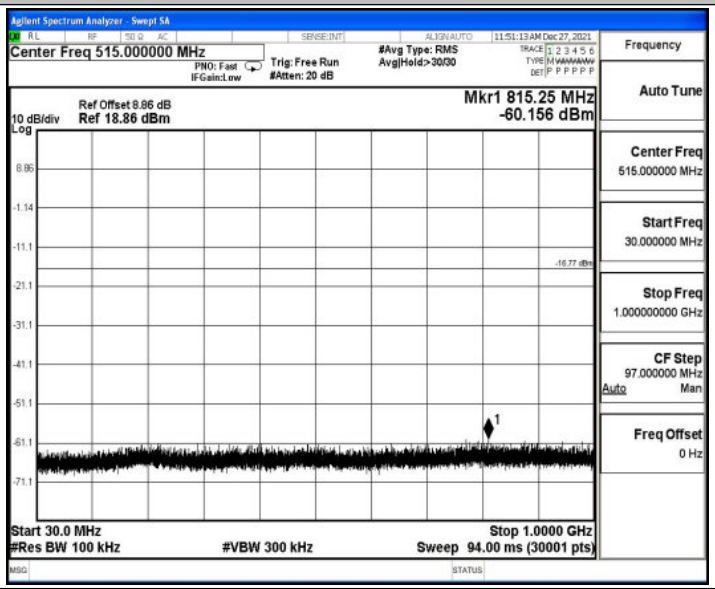
TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	Reference	3.23	3.23	---	PASS
			30~1000	3.23	-60.16	≤-16.77	PASS
			1000~26500	3.23	-36.63	≤-16.77	PASS
		2440	Reference	3.41	3.41	---	PASS
			30~1000	3.41	-60.29	≤-16.59	PASS
			1000~26500	3.41	-37.88	≤-16.59	PASS
		2480	Reference	3.39	3.39	---	PASS
			30~1000	3.39	-60.05	≤-16.61	PASS
			1000~26500	3.39	-38.57	≤-16.61	PASS
BLE_2M	Ant1	2402	Reference	3.25	3.25	---	PASS
			30~1000	3.25	-47.04	≤-16.75	PASS
			1000~26500	3.25	-38.12	≤-16.75	PASS
		2440	Reference	3.40	3.40	---	PASS
			30~1000	3.40	-42.26	≤-16.6	PASS
			1000~26500	3.40	-38.71	≤-16.6	PASS
		2480	Reference	3.33	3.33	---	PASS
			30~1000	3.33	-60.26	≤-16.67	PASS
			1000~26500	3.33	-40.09	≤-16.67	PASS

Test Graphs

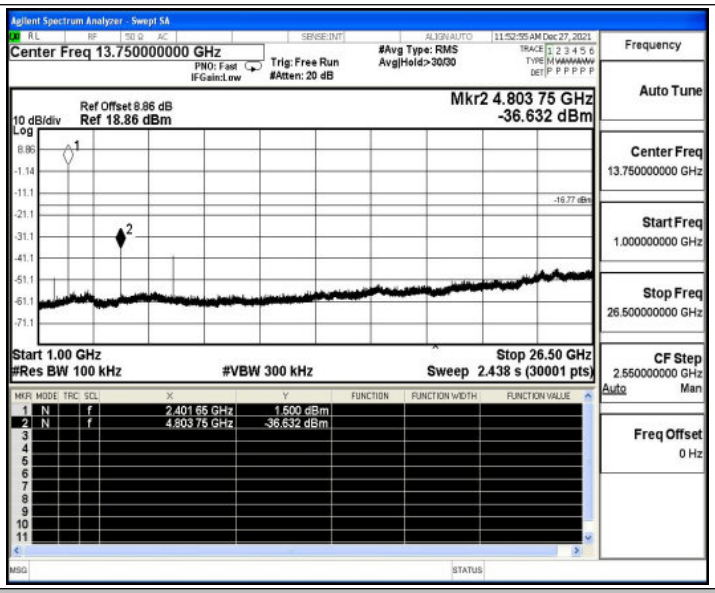
BLE_1M_Ant1_2402_0~Reference



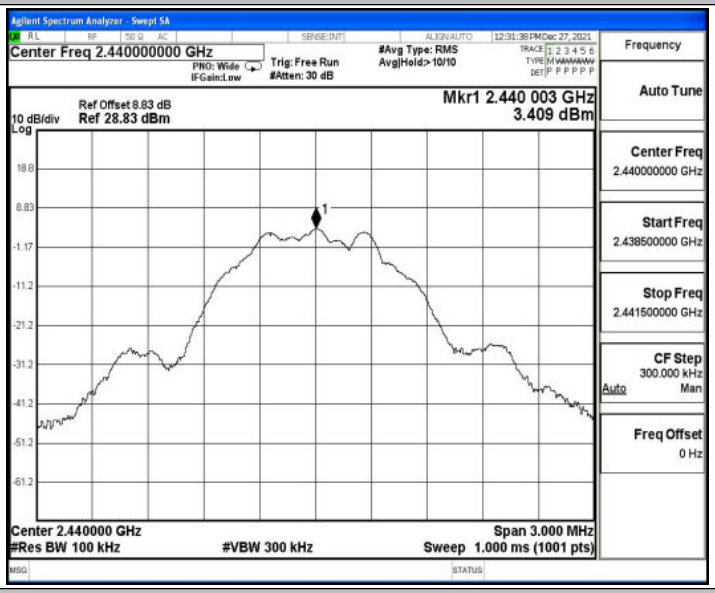
BLE_1M_Ant1_2402_30~1000



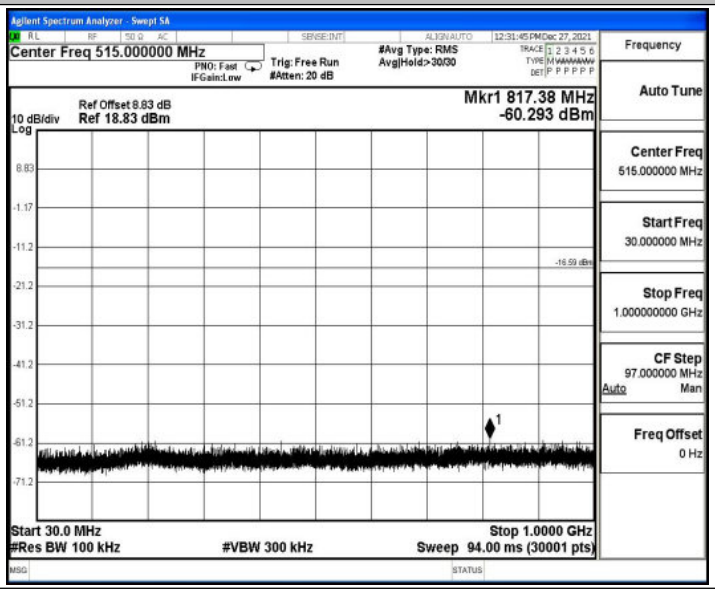
BLE_1M_Ant1_2402_1000~26500



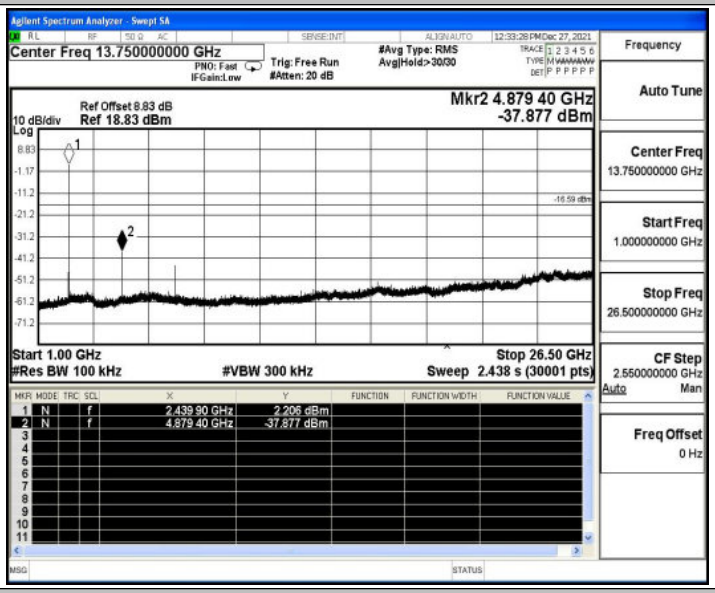
BLE_1M_Ant1_2440_0~Reference



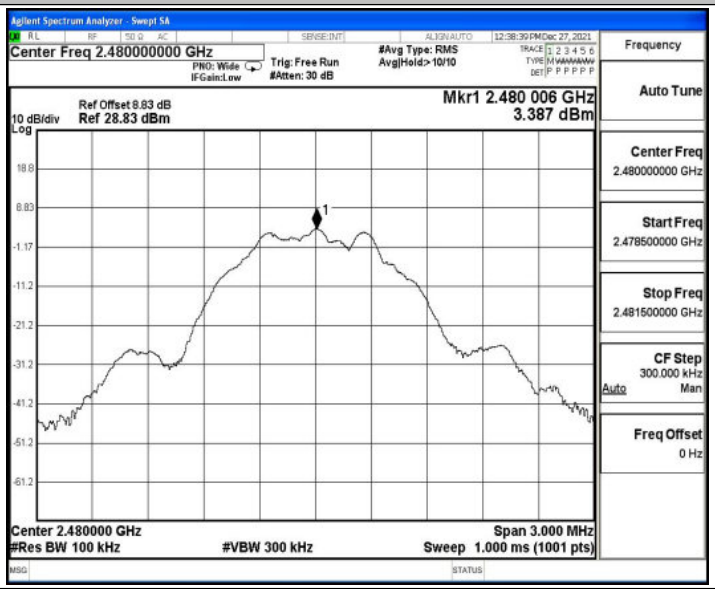
BLE_1M_Ant1_2440_30~1000



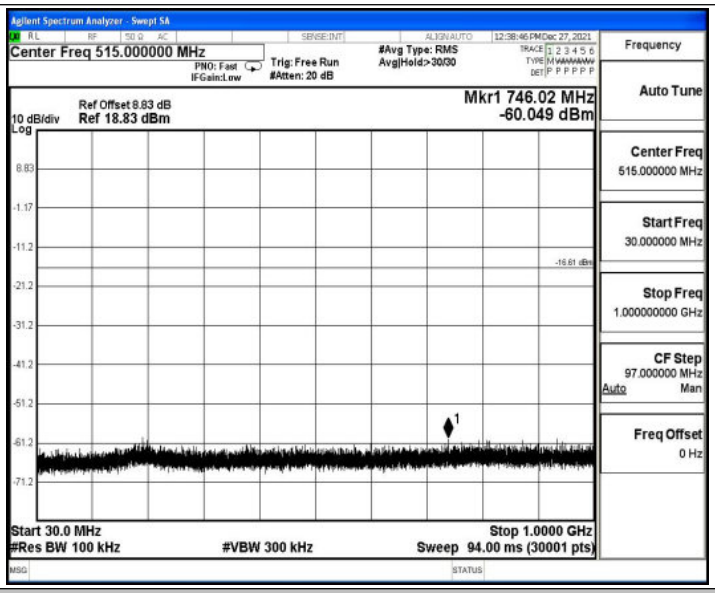
BLE_1M_Ant1_2440_1000~26500



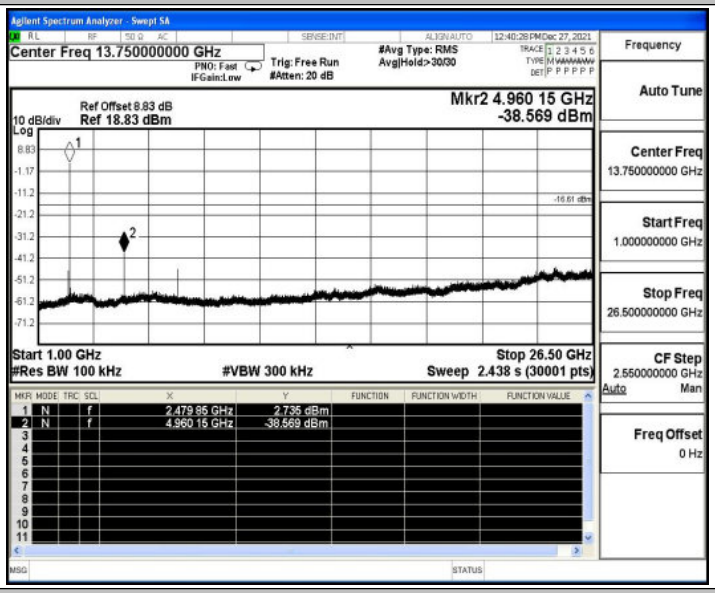
BLE_1M_Ant1_2480_0~Reference



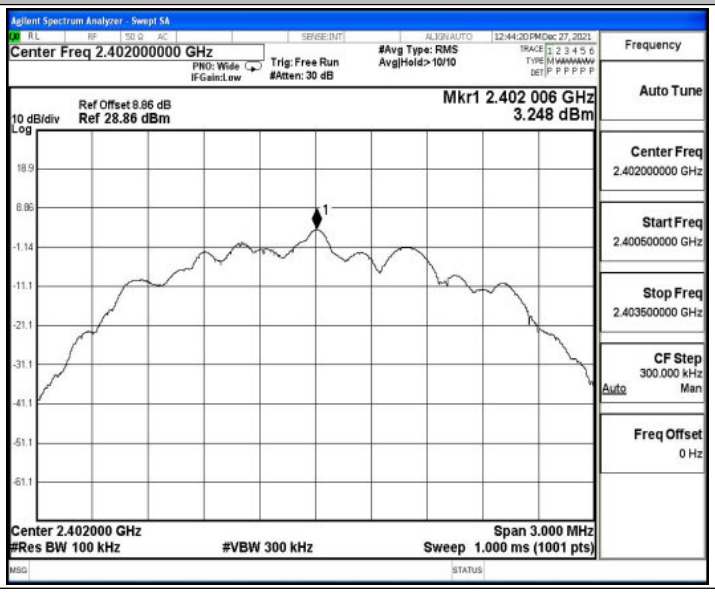
BLE_1M_Ant1_2480_30~1000



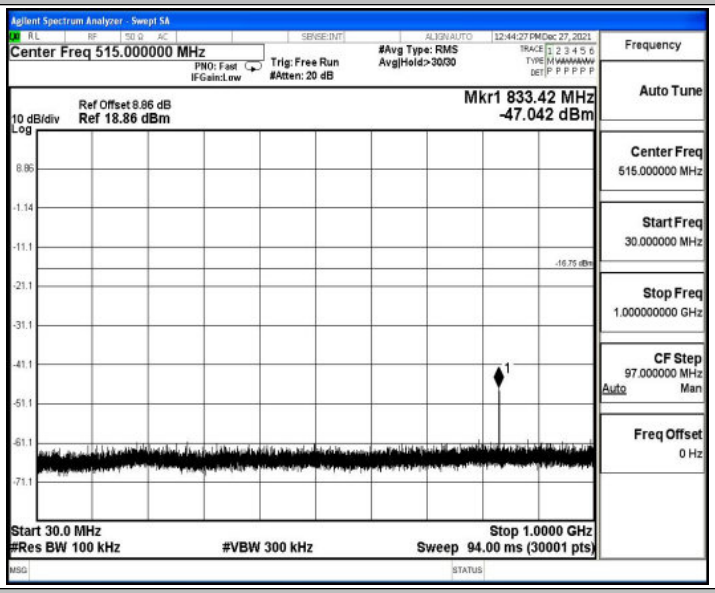
BLE_1M_Ant1_2480_1000~26500



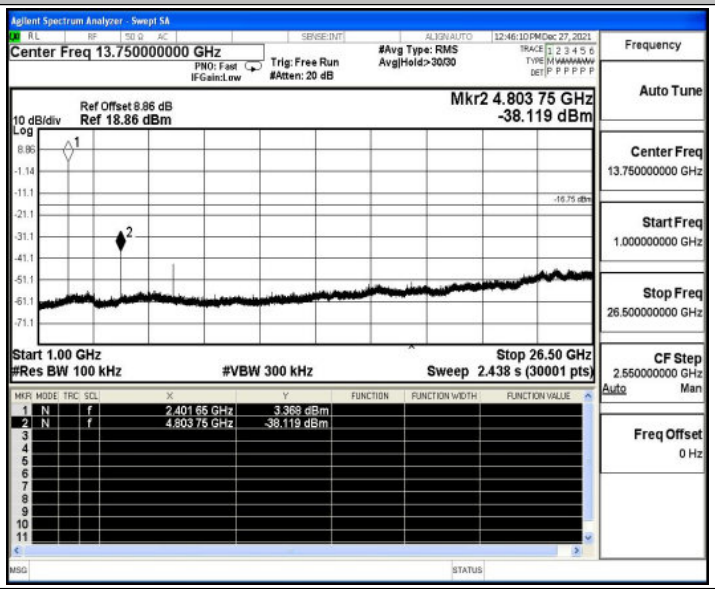
BLE_2M_Ant1_2402_0~Reference



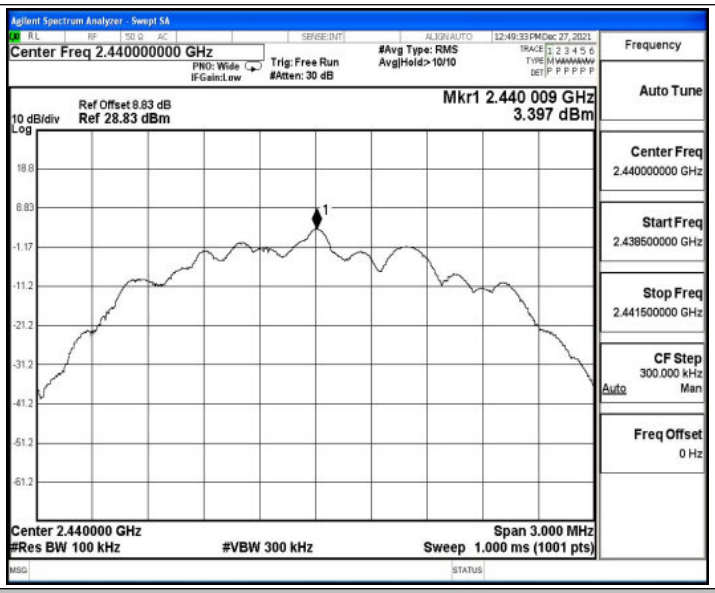
BLE_2M_Ant1_2402_30~1000



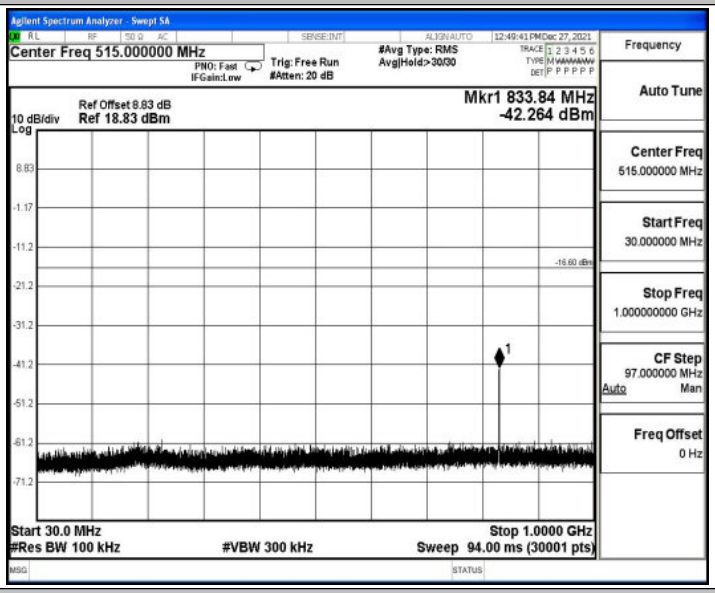
BLE_2M_Ant1_2402_1000~26500



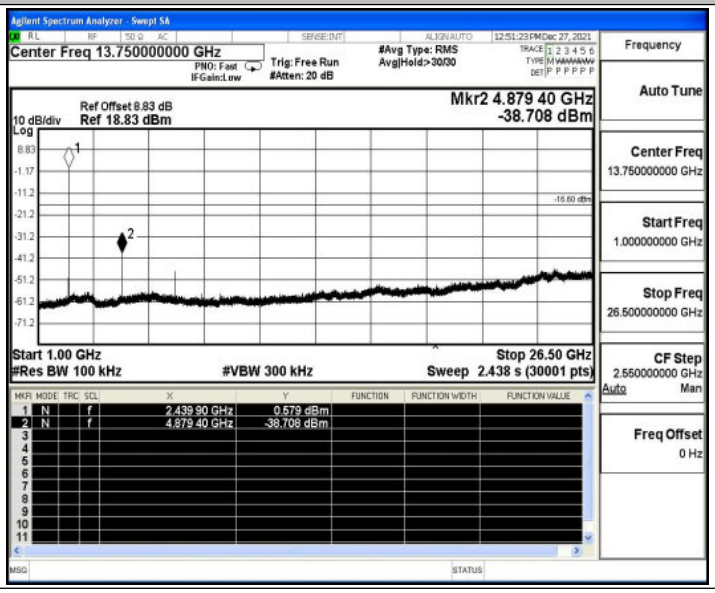
BLE_2M_Ant1_2440_0~Reference

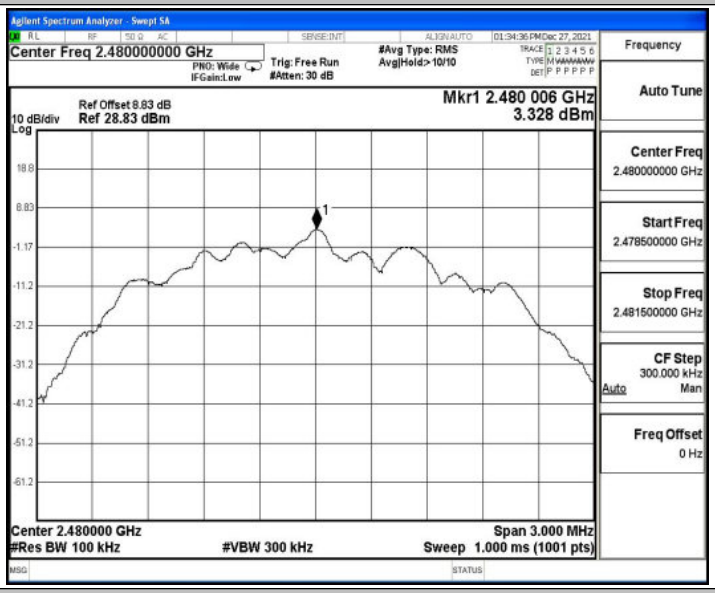
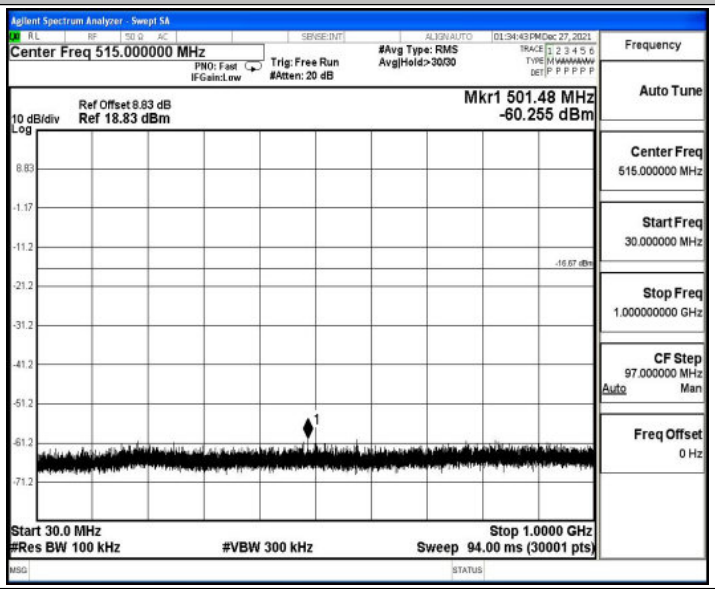


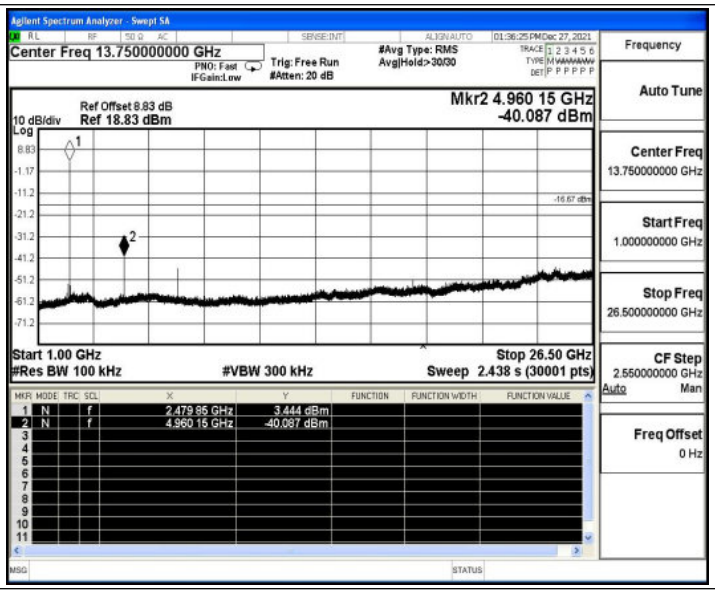
BLE_2M_Ant1_2440_30~1000



BLE_2M_Ant1_2440_1000~26500



BLE_2M_Ant1_2480_0~Reference

BLE_2M_Ant1_2480_30~1000

BLE_2M_Ant1_2480_1000~26500


Agilent Spectrum Analyzer - Swept SA
Center Freq 13.750000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold:>30/30
01:36:25 PM Dec 27, 2021
Frequency
Auto Tune
Mkr2 4.960 15 GHz
-40.087 dBm
Ref Offset 8.83 dB
10 dB/div
Ref 18.83 dBm
Log
8.83
-1.17
-11.2
-21.2
-31.2
-41.2
-51.2
-61.2
-71.2
-16.67 dBm
Center Freq
13.750000000 GHz
Start Freq
1.000000000 GHz
Stop Freq
26.500000000 GHz
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.438 s (30001 pts)
CF Step
2.550000000 GHz
Auto
Man
Freq Offset
0 Hz
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.479 85 GHz 3.444 dBm
2 N 1 f 4.960 15 GHz -40.087 dBm
MSG
STATUS

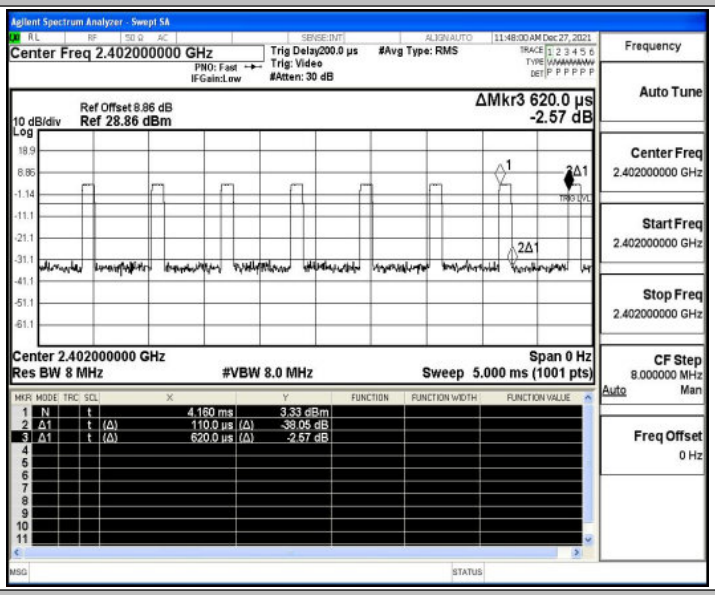
A.7 Duty Cycle

Test Result

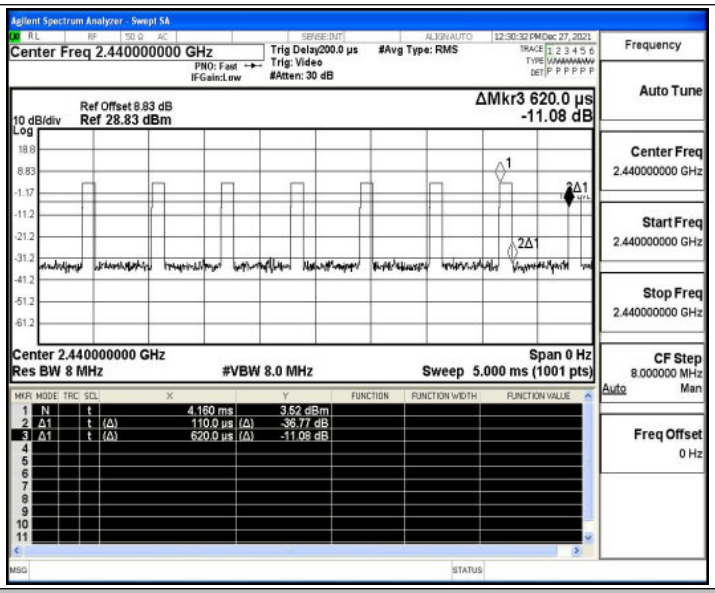
TestMode	Antenna	Channel	ON Time [ms]	Period [ms]	X	DC [%]	xFactor	1/T[KHz]
BLE_1M	Ant1	2402	0.11	0.62	0.1774	17.74	7.51	9.09
		2440	0.11	0.62	0.1774	17.74	7.51	9.09
		2480	0.11	0.62	0.1774	17.74	7.51	9.09
BLE_2M	Ant1	2402	0.06	0.62	0.0968	9.68	10.14	16.67
		2440	0.06	0.62	0.0968	9.68	10.14	16.67
		2480	0.07	0.62	0.1129	11.29	9.47	14.29

Test Graphs

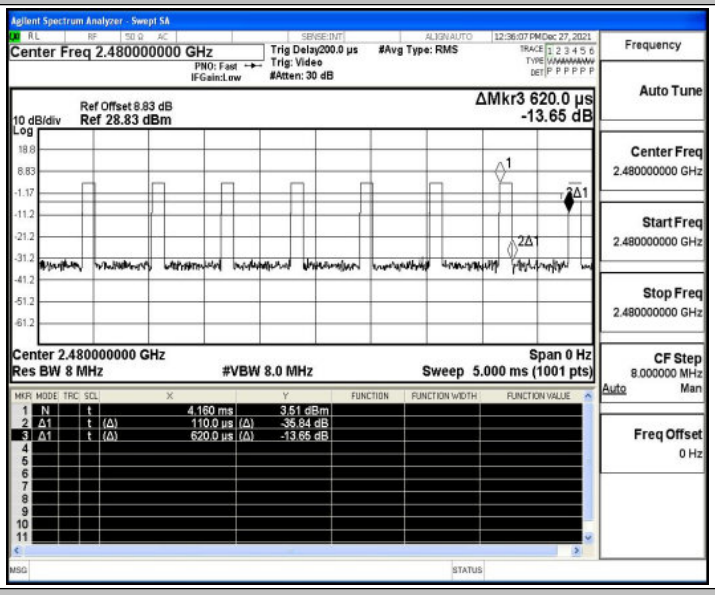
BLE_1M_Ant1_2402



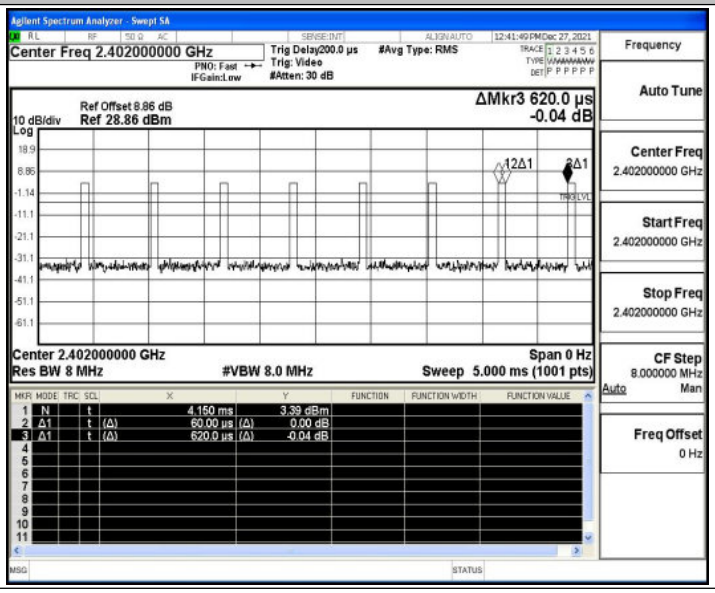
BLE_1M_Ant1_2440



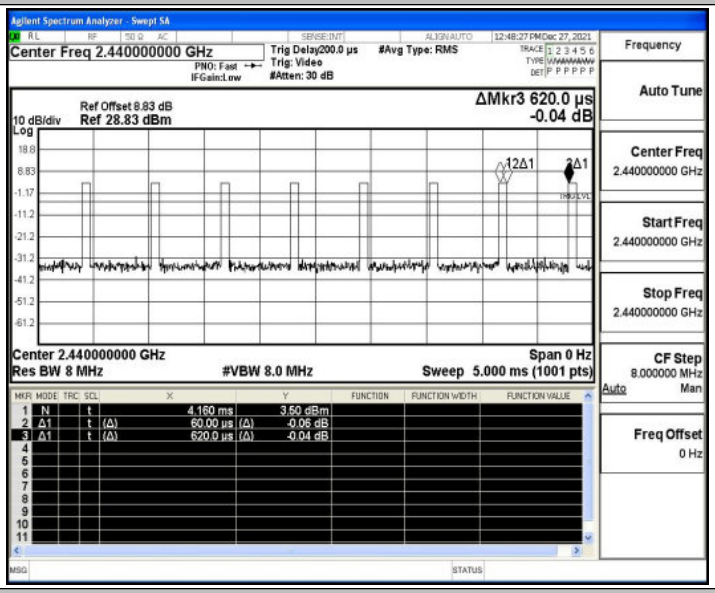
BLE_1M_Ant1_2480



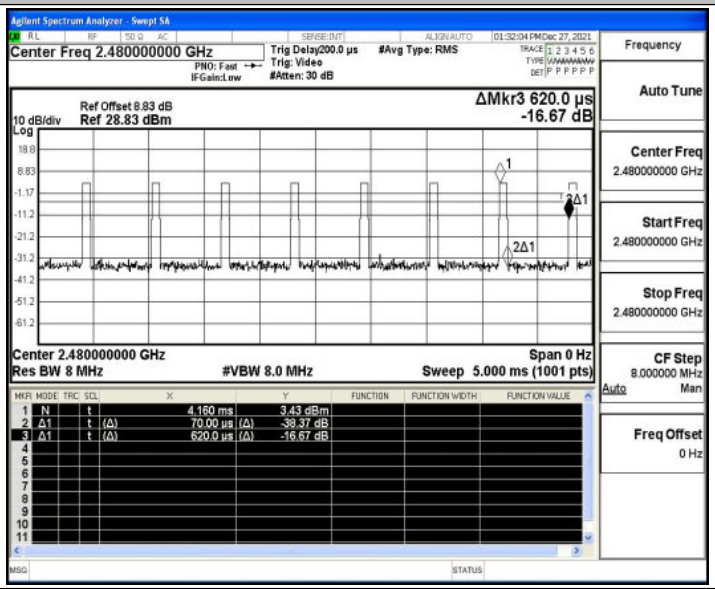
BLE_2M_Ant1_2402



BLE_2M_Ant1_2440



BLE_2M_Ant1_2480



A.8 Emissions in Restricted Bands

Test Result

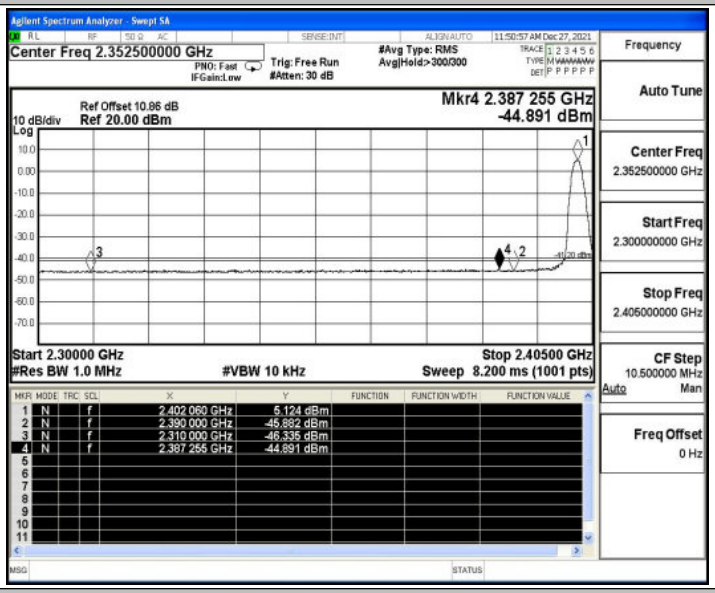
TestMode	Antenna	ChName	Channel	Detector	Freq. [MHz]	Result [dBm]	Limit [dBm]	Result [dBuV/m]	Limit [dBuV/m]	Verdict
BLE_1M	Ant1	Low	2402	AV	2310.000	-46.4	≤-41.20	48.80	≤54	PASS
				AV	2387.255	-44.89	≤-41.20	50.31	≤54	PASS
				AV	2390.000	-45.88	≤-41.20	49.32	≤54	PASS
				Peak	2310.000	-39.05	≤-21.20	56.15	≤74	PASS
				Peak	2381.900	-35.97	≤-21.20	59.23	≤74	PASS
				Peak	2390.000	-36.81	≤-21.20	58.39	≤74	PASS
		High	2480	AV	2483.500	-43.66	≤-41.20	51.54	≤54	PASS
				AV	2483.600	-43.49	≤-41.20	51.71	≤54	PASS
				AV	2500.000	-45.34	≤-41.20	49.86	≤54	PASS
				Peak	2483.500	-32.49	≤-21.20	62.71	≤74	PASS
				Peak	2483.680	-31.86	≤-21.20	63.34	≤74	PASS
				Peak	2500.000	-37.13	≤-21.20	58.07	≤74	PASS
BLE_2M	Ant1	Low	2402	AV	2310.000	-45.18	≤-41.20	50.02	≤54	PASS
				AV	2354.915	-44.32	≤-41.20	50.88	≤54	PASS
				AV	2390.000	-45.29	≤-41.20	49.91	≤54	PASS
				Peak	2310.000	-38.46	≤-21.20	56.74	≤74	PASS
				Peak	2378.960	-35.84	≤-21.20	59.36	≤74	PASS
				Peak	2390.000	-38	≤-21.20	57.20	≤74	PASS
		High	2480	AV	2483.500	-41.26	≤-41.20	53.94	≤54	PASS
				AV	2483.520	-41.25	≤-41.20	53.95	≤54	PASS
				AV	2500.000	-44.39	≤-41.20	50.81	≤54	PASS
				Peak	2483.500	-31.49	≤-21.20	63.71	≤74	PASS
				Peak	2483.520	-31.49	≤-21.20	63.71	≤74	PASS
				Peak	2500.000	-36.96	≤-21.20	58.24	≤74	PASS

Note：

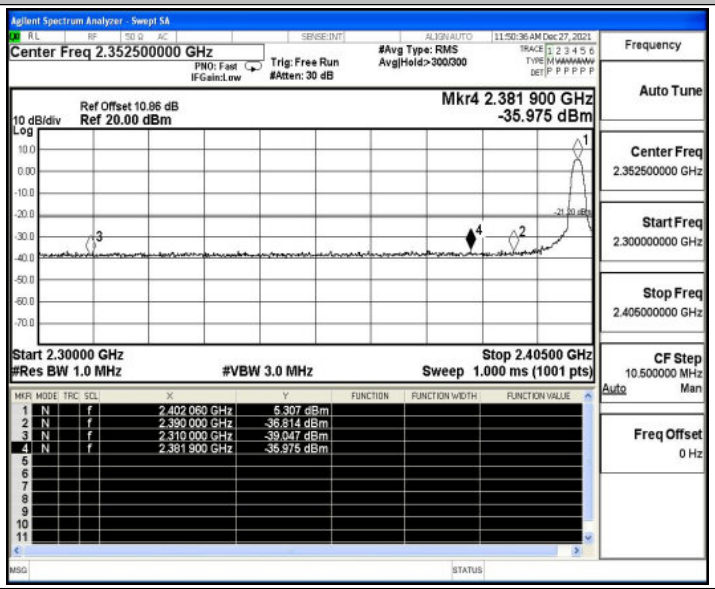
1. The Antenna Gain is compensated in the graph.
2. The limit in dBm for average detector is conversion from 54dBuV/m, according to 15.209(a). The limit in dBm for peak detector is 20dB above the limit of average detector in dBm.

Test Graphs

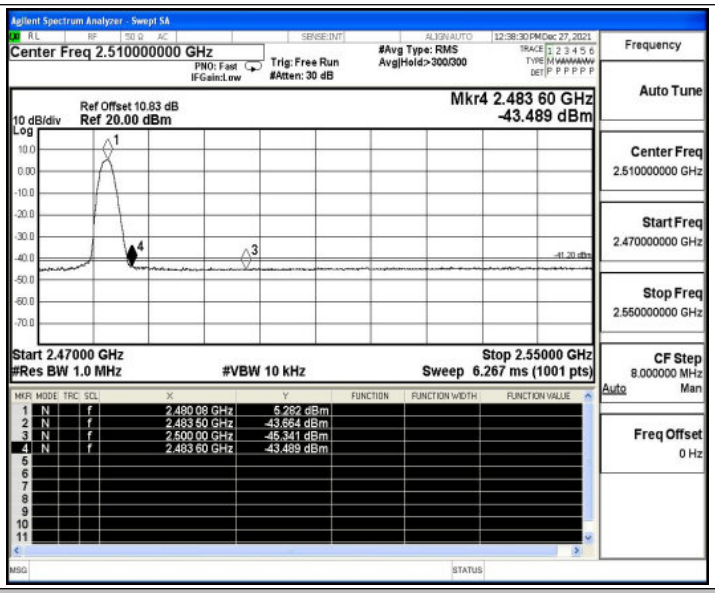
BLE_1M_Ant1_Low_2402_AV



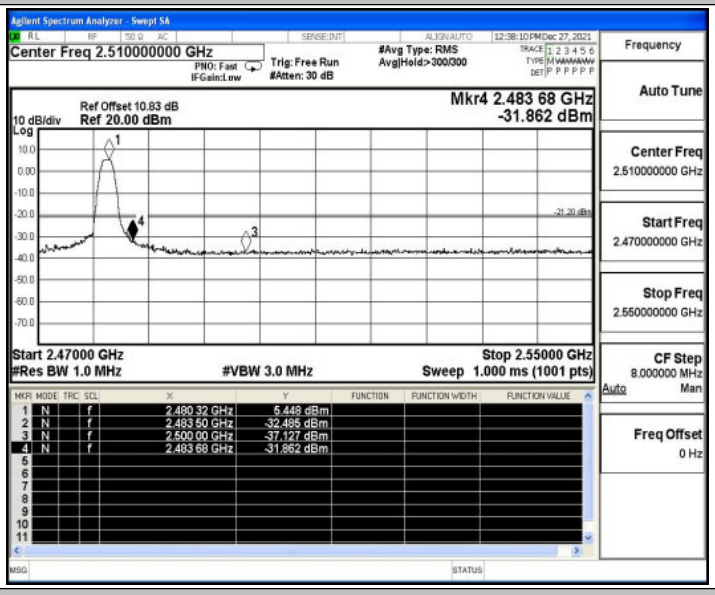
BLE_1M_Ant1_Low_2402_Peak



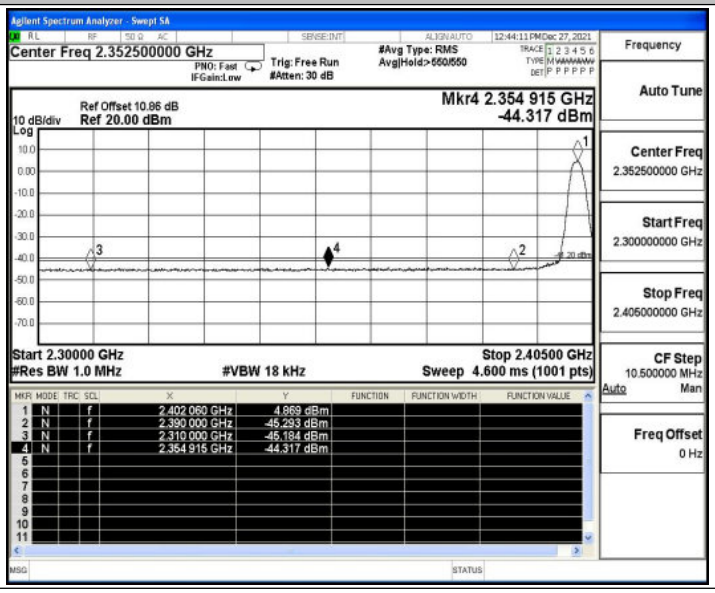
BLE_1M_Ant1_High_2480_AV



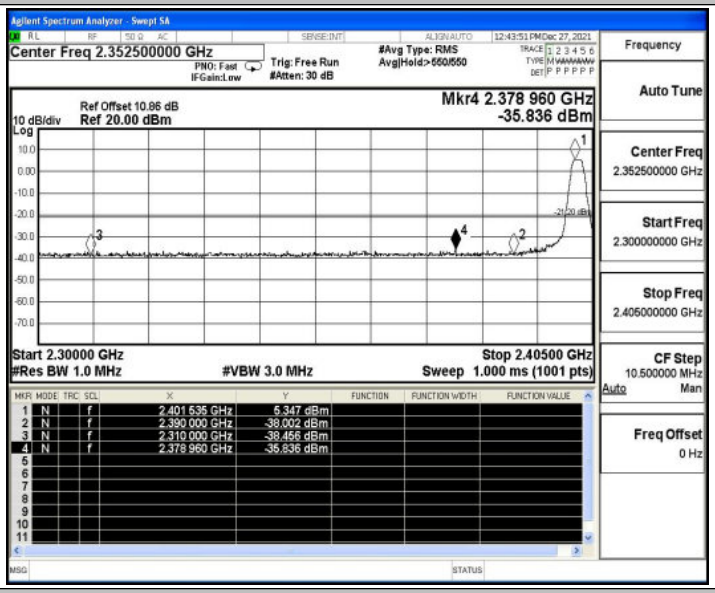
BLE_1M_Ant1_High_2480_Peak



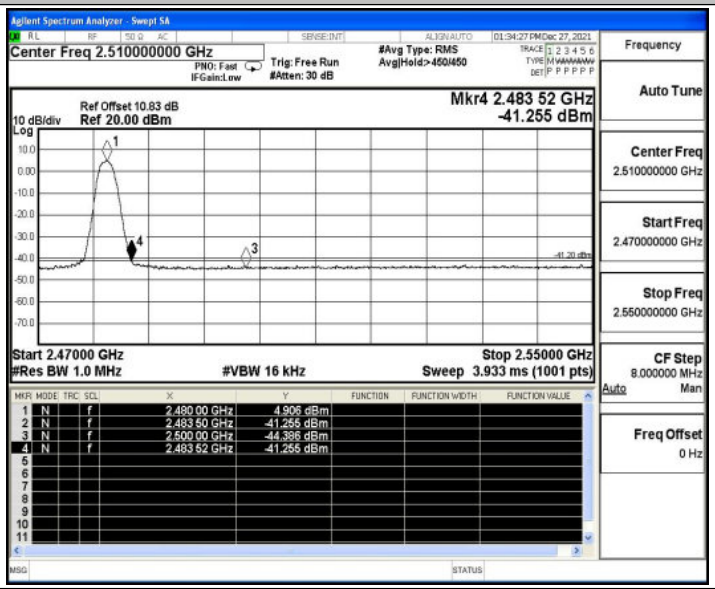
BLE_2M_Ant1_Low_2402_AV



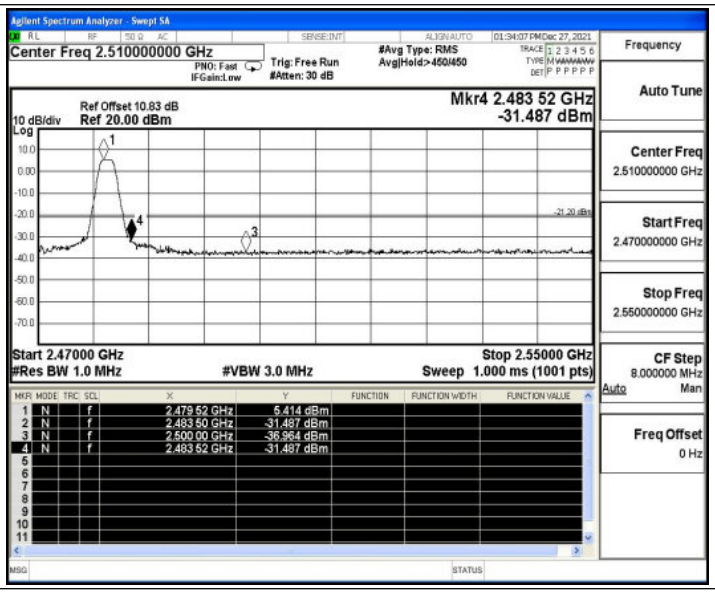
BLE_2M_Ant1_Low_2402_Peak



BLE_2M_Ant1_High_2480_AV



BLE_2M_Ant1_High_2480_Peak


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.510000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold:>450/450
01:34:07 PM Dec 27, 2021
Frequency
Auto Tune
Ref Offset 10.83 dB
10 dB/div
Ref 20.00 dBm
Mkr4 2.483 52 GHz
-31.487 dBm
-21.20 dBm
Center Freq
2.510000000 GHz
Start Freq
2.470000000 GHz
Stop Freq
2.550000000 GHz
Start 2.47000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 2.55000 GHz
Sweep 1.000 ms (1001 pts)
CF Step
8.000000 MHz
Auto
Man
Freq Offset
0 Hz
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.479 52 GHz 5.414 dBm
2 N 1 f 2.483 50 GHz -31.487 dBm
3 N 1 f 2.500 00 GHz -36.964 dBm
4 N 1 f 2.483 52 GHz -31.487 dBm
MSG
STATUS