Appendix A

RF Test Data for BT LE (Conducted Measurement)

Product Name: Axis Centrifugal Pump

Test Model: AX60

Environmental Conditions

Temperature:	23.5℃
Relative Humidity:	52.2%
ATM Pressure:	100.0 kPa
Test Engineer:	Nick Peng
Supervised by:	Ling Zhu

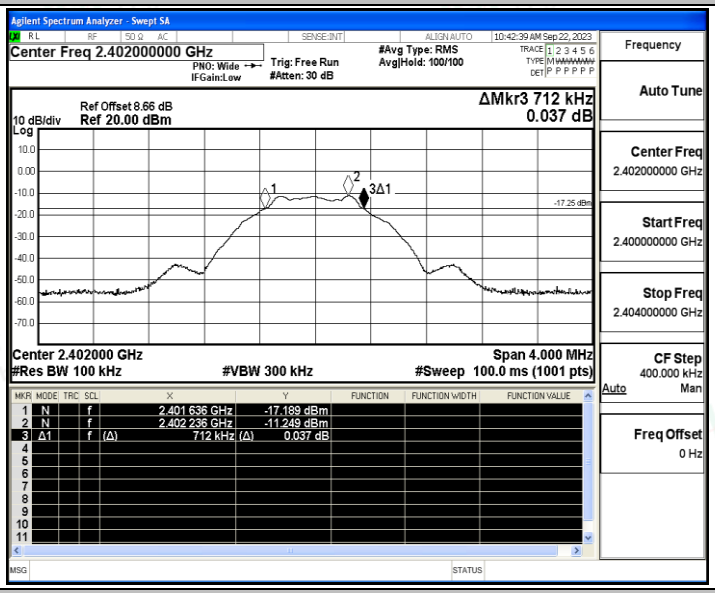
A.1 DTS Bandwidth

Test Result

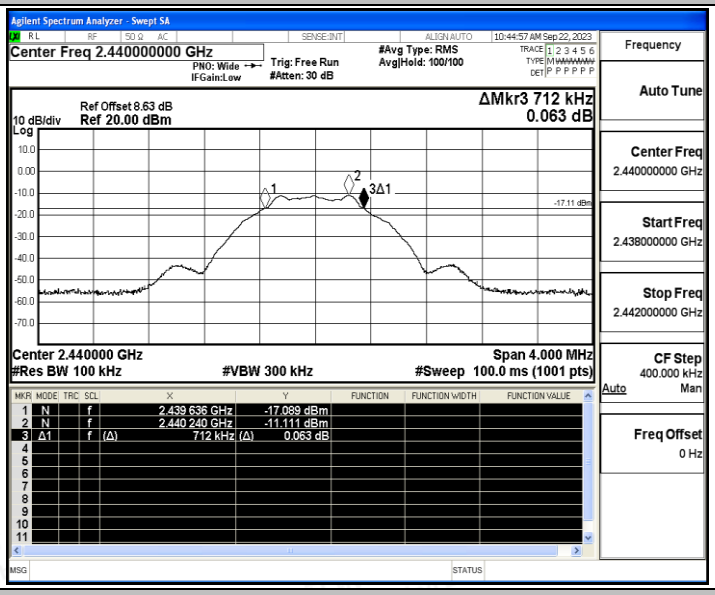
TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE	Ant	2402	0.712	2401.636	2402.348	0.5	PASS
		2440	0.712	2439.636	2440.348	0.5	PASS
		2480	0.716	2479.636	2480.352	0.5	PASS

Test Graphs

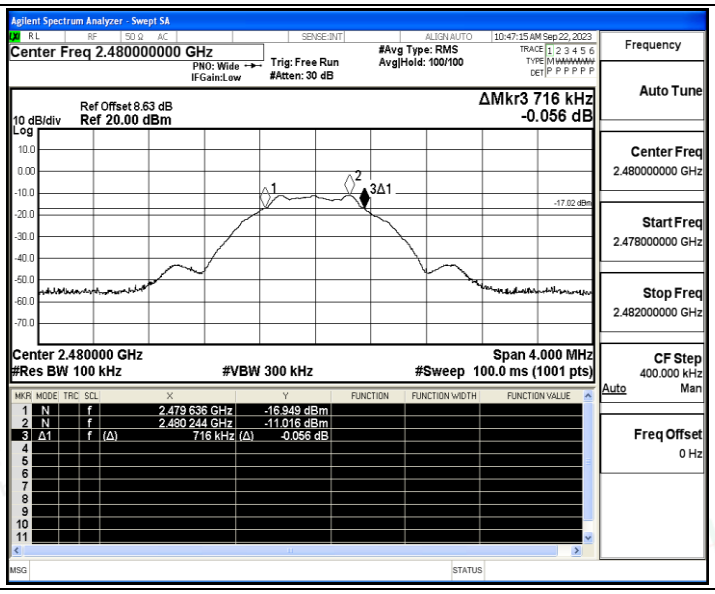
BLE_Ant_2402



BLE_Ant_2440



BLE_Ant_2480


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 100/100
10:47:15 AM Sep 22, 2023
Ref Offset 8.63 dB
10 dB/div Ref 20.00 dBm
ΔMkr3 716 kHz
-0.056 dB
Center 2.480000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 4.000 MHz
#Sweep 100.0 ms (1001 pts)
1 N f 2.479 636 GHz -16.949 dBm
2 N f 2.480 244 GHz -11.016 dBm
3 Δ1 f (Δ) 716 kHz (Δ) -0.056 dB
Frequency
Auto Tune
Center Freq 2.480000000 GHz
Start Freq 2.478000000 GHz
Stop Freq 2.482000000 GHz
CF Step 400.000 kHz Auto Man
Freq Offset 0 Hz

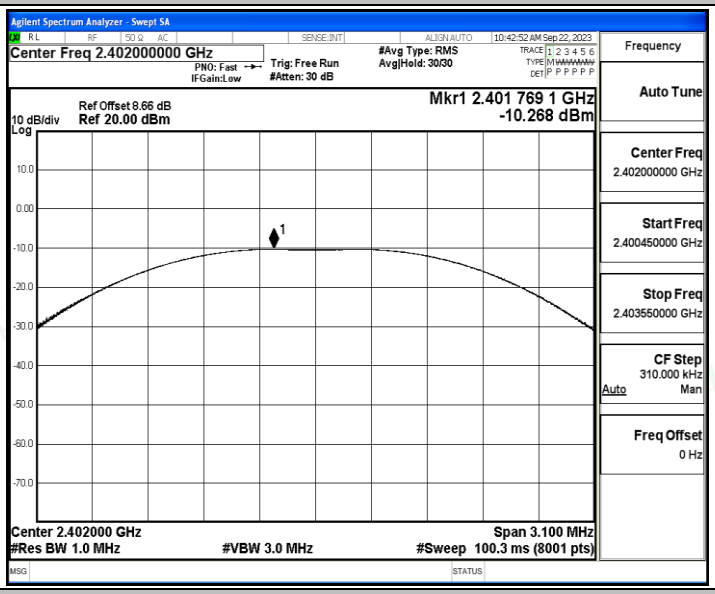
A.2 Maximum conducted output power

Test Result

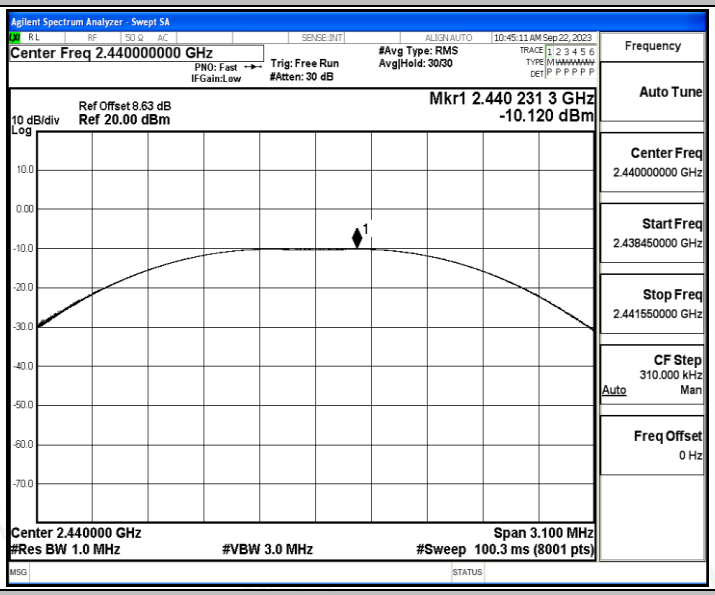
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE	Ant	2402	-10.27	≤30	PASS
		2440	-10.12	≤30	PASS
		2480	-10.01	≤30	PASS

Test Graphs

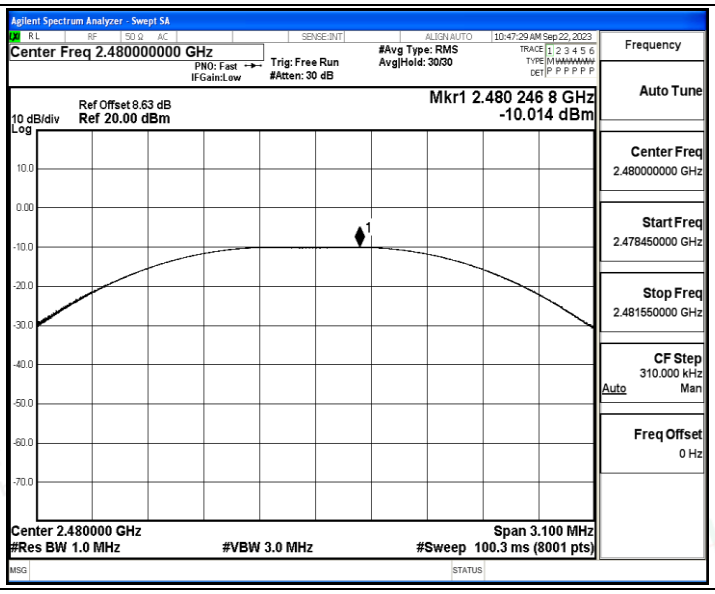
BLE_Ant_2402



BLE_Ant_2440



BLE_Ant_2480


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 30/30
10:47:29 AM Sep 22, 2023
Ref Offset 8.63 dB
10 dB/div Ref 20.00 dBm
Log
Mkr1 2.480 246 8 GHz
-10.014 dBm
Center 2.480000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Span 3.100 MHz
#Sweep 100.3 ms (8001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.478450000 GHz
Stop Freq
2.481550000 GHz
CF Step
310.000 kHz
Auto
Man
Freq Offset
0 Hz

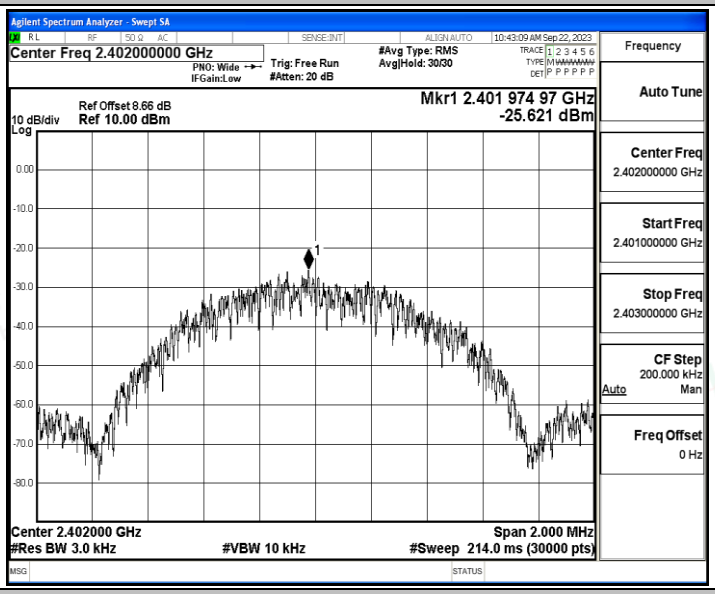
A.3 Maximum power spectral density

Test Result

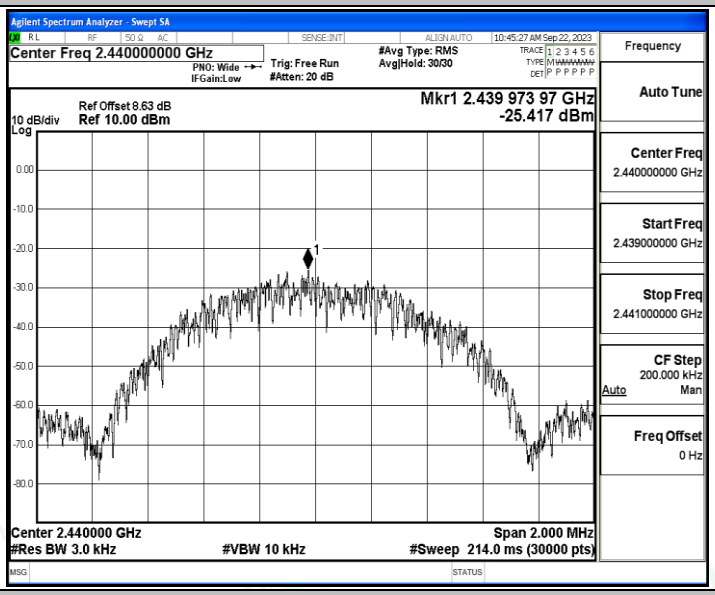
TestMode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE	Ant	2402	-25.62	≤8.00	PASS
		2440	-25.42	≤8.00	PASS
		2480	-25.41	≤8.00	PASS

Test Graphs

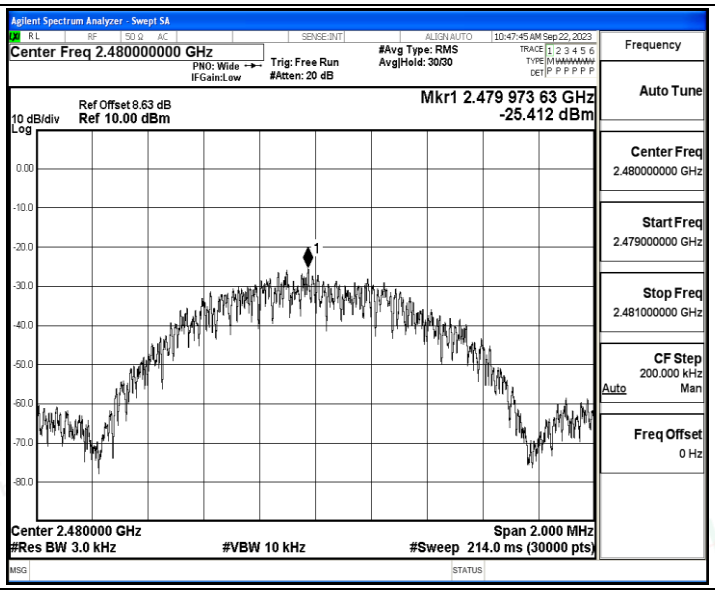
BLE_Ant_2402



BLE_Ant_2440



BLE_Ant_2480


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 30/30
10:47:45 AM Sep 22, 2023
Ref Offset 8.63 dB
10 dB/div Ref 10.00 dBm
Log
Mkr1 2.479 973 63 GHz
-25.412 dBm
Center 2.480000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 2.000 MHz
#Sweep 214.0 ms (30000 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.479000000 GHz
Stop Freq
2.481000000 GHz
CF Step
200.000 kHz
Auto Man
Freq Offset
0 Hz

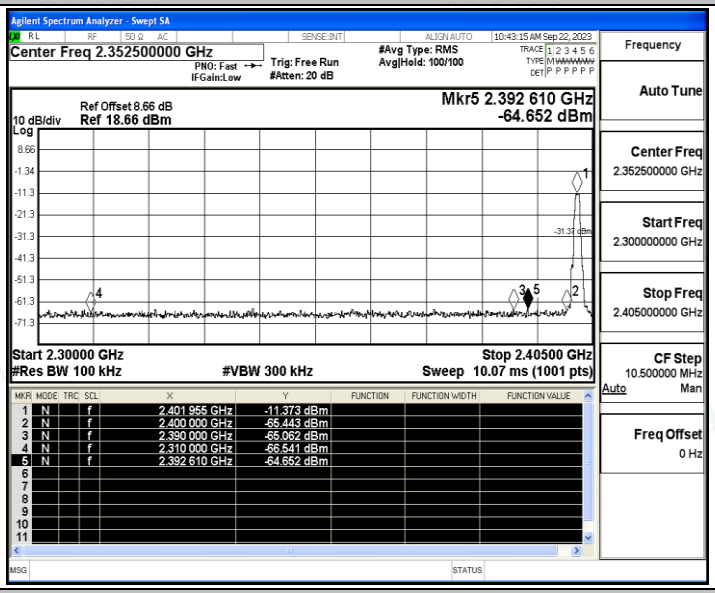
A.4 Band edge measurements

Test Result

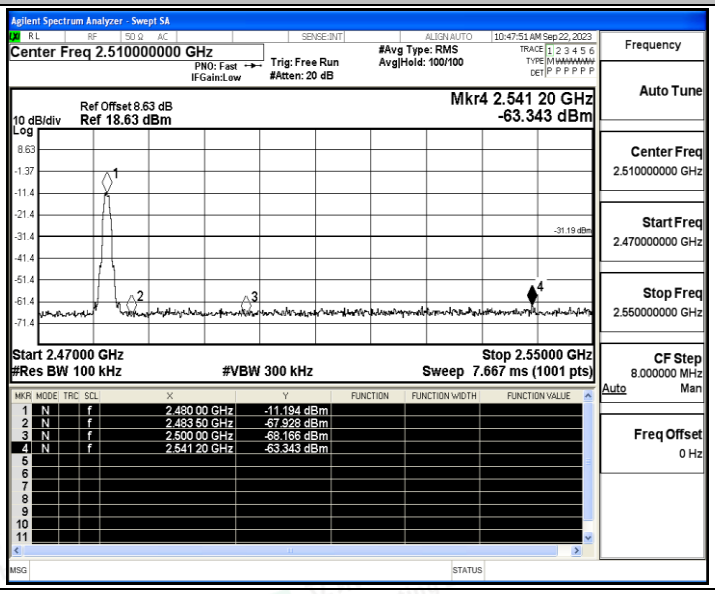
TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE	Ant	Low	2402	-11.37	-64.65	≤-31.37	PASS
		High	2480	-11.19	-63.34	≤-31.19	PASS

Test Graphs

BLE_Ant_Low_2402



BLE_Ant_High_2480



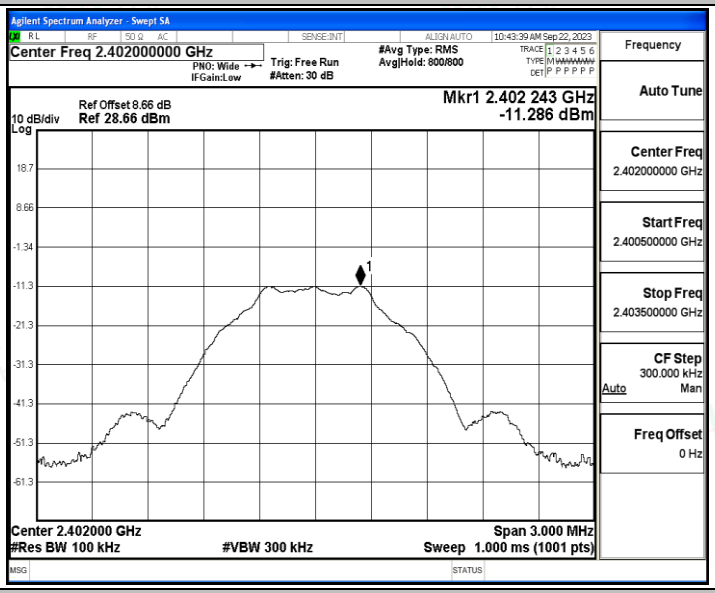
A.5 Conducted Spurious Emission

Test Result

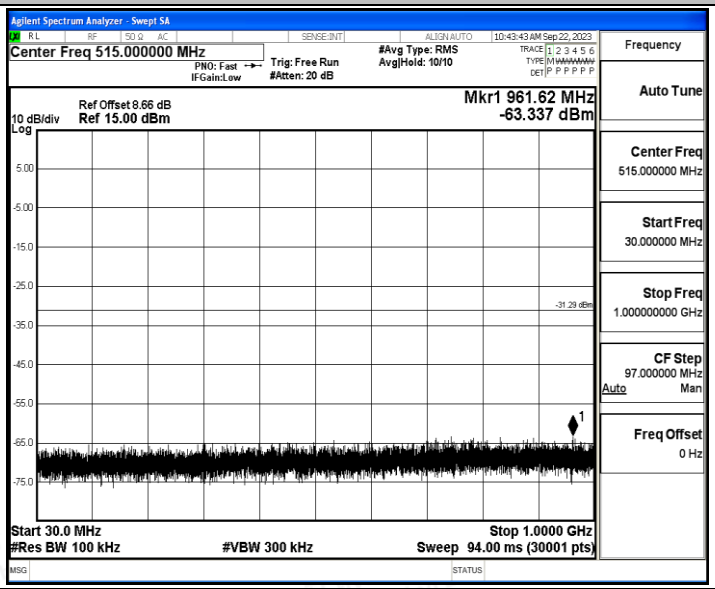
TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE	Ant	2402	Reference	-11.29	-11.29	---	PASS
			30~1000	-11.29	-63.34	≤-31.29	PASS
			1000~26500	-11.29	-46.14	≤-31.29	PASS
		2440	Reference	-11.12	-11.12	---	PASS
			30~1000	-11.12	-62.03	≤-31.12	PASS
			1000~26500	-11.12	-46.6	≤-31.12	PASS
		2480	Reference	-11.03	-11.03	---	PASS
			30~1000	-11.03	-63.07	≤-31.03	PASS
			1000~26500	-11.03	-46.82	≤-31.03	PASS

Test Graphs

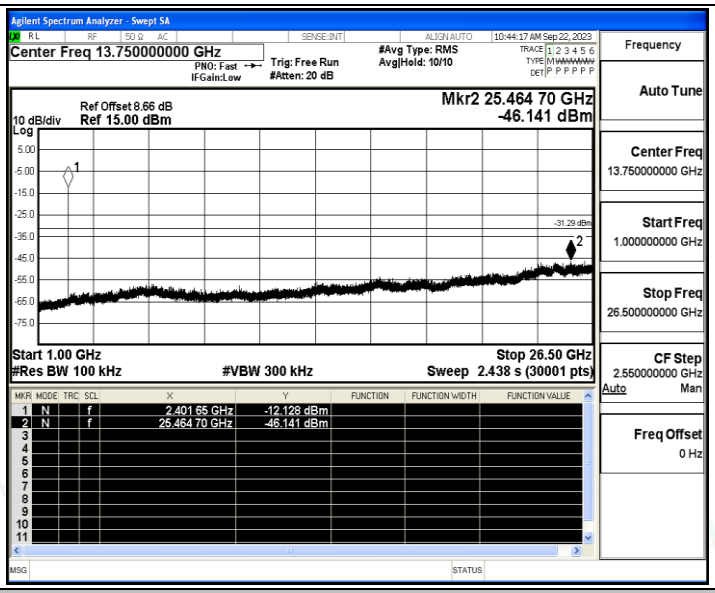
BLE_Ant_2402_0~Reference



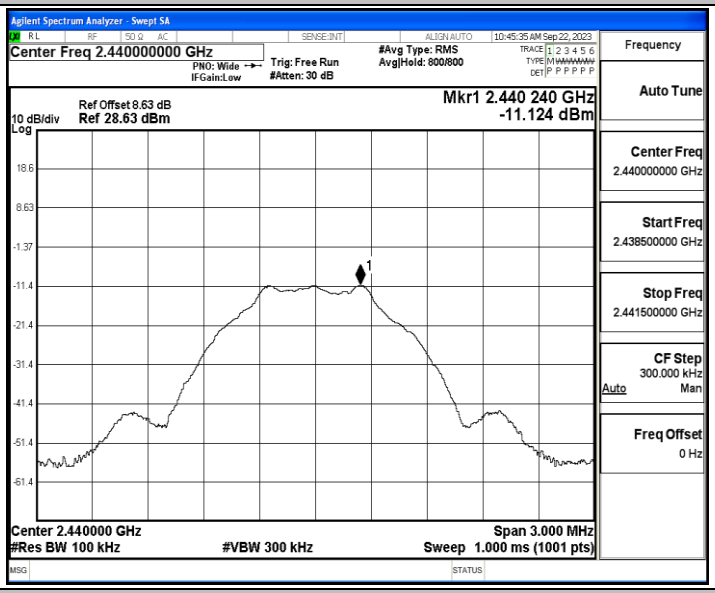
BLE_Ant_2402_30~1000



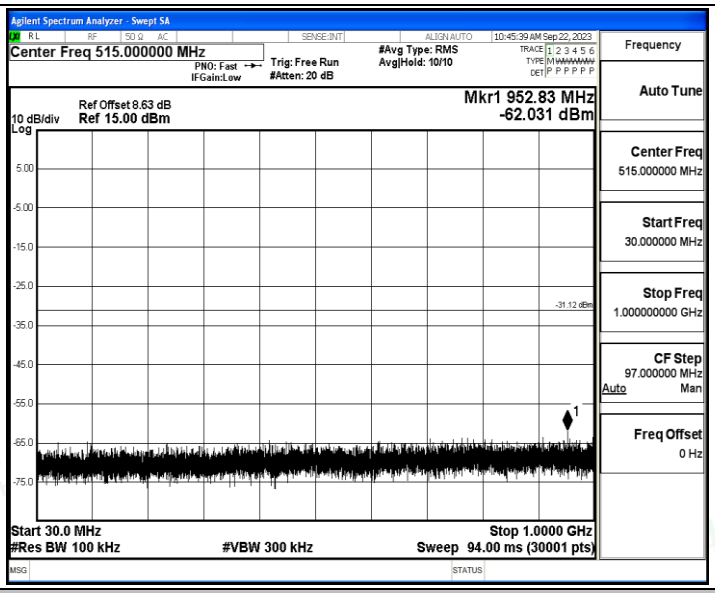
BLE_Ant_2402_1000~26500



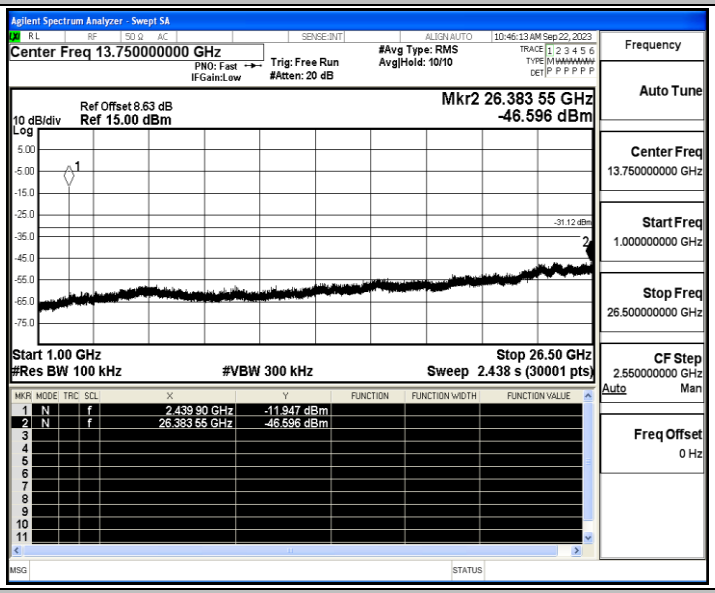
BLE_Ant_2440_0~Reference



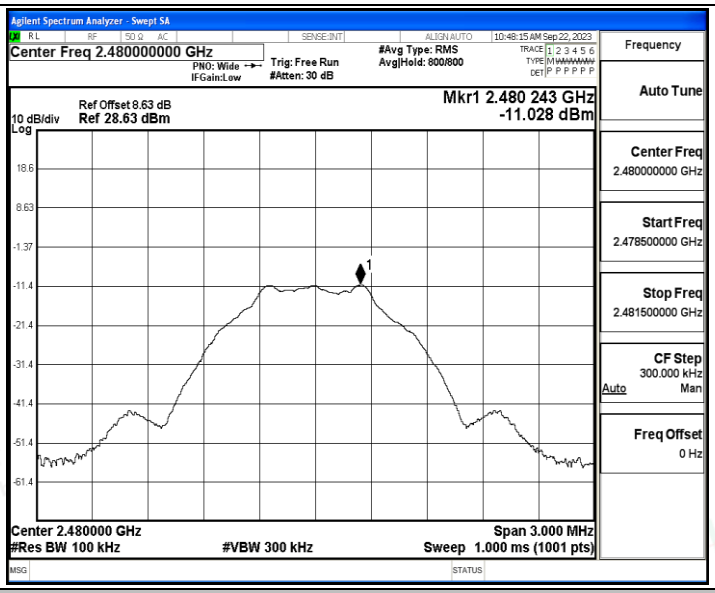
BLE_Ant_2440_30~1000



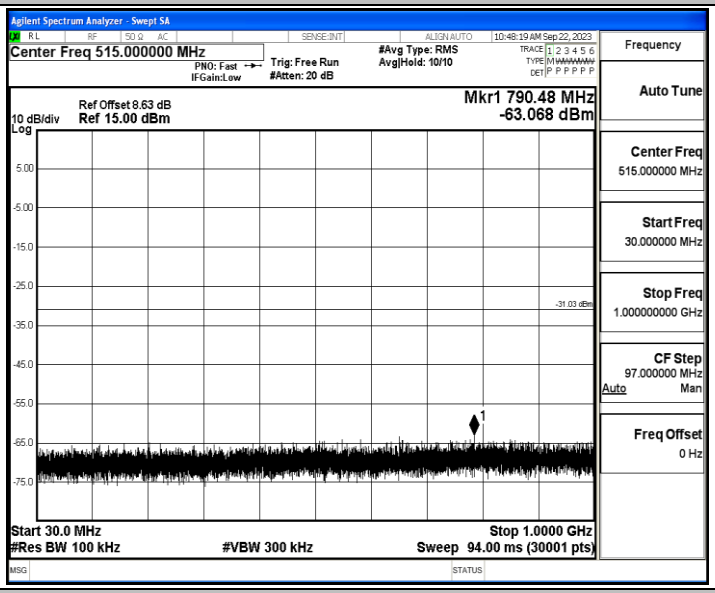
BLE_Ant_2440_1000~26500



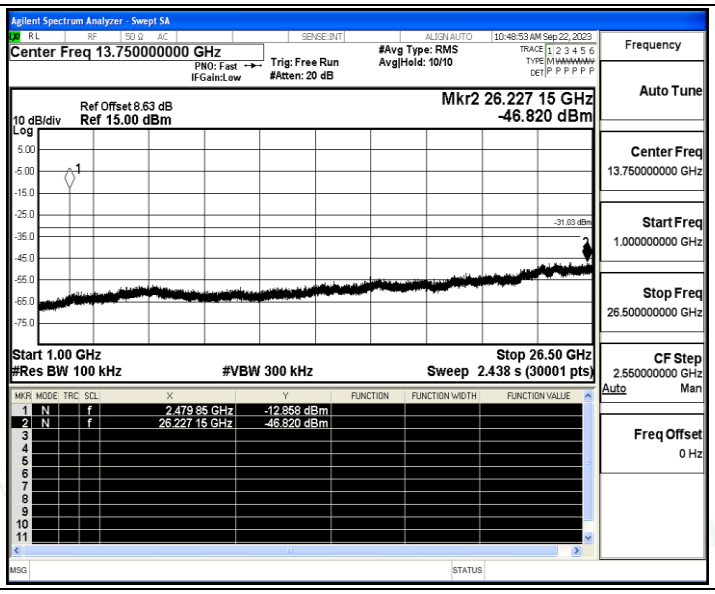
BLE_Ant_2480_0~Reference



BLE_Ant_2480_30~1000



BLE_Ant_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: 10/10
10:48:53 AM Sep 22, 2023
Ref Offset 8.63 dB
10 dB/div Ref 15.00 dBm
Log
Mkr2 26.227 15 GHz
-46.820 dBm
-31.03 dBm
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.438 s (30001 pts)
1 N f 2.479 85 GHz -12.858 dBm
2 N f 26.227 15 GHz -46.820 dBm
Frequency
Auto Tune
Center Freq
13.750000000 GHz
Start Freq
1.000000000 GHz
Stop Freq
26.500000000 GHz
CF Step
2.550000000 GHz
Auto Man
Freq Offset
0 Hz

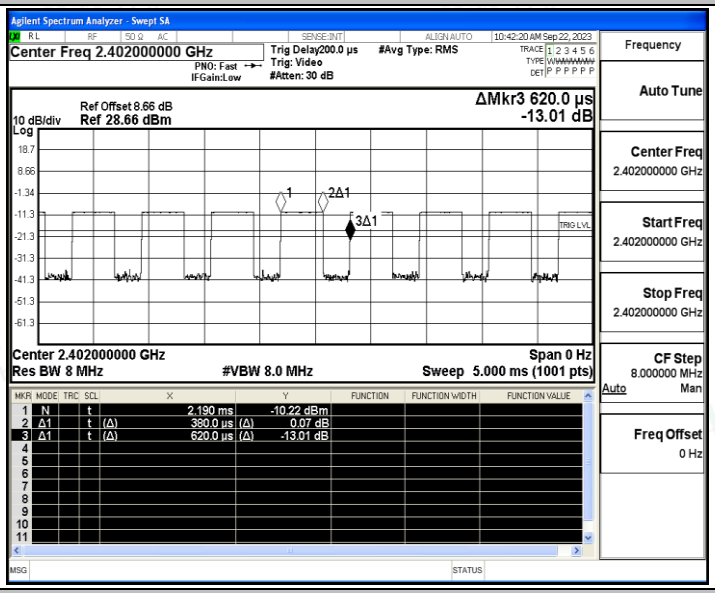
A.6 Duty Cycle

Test Result

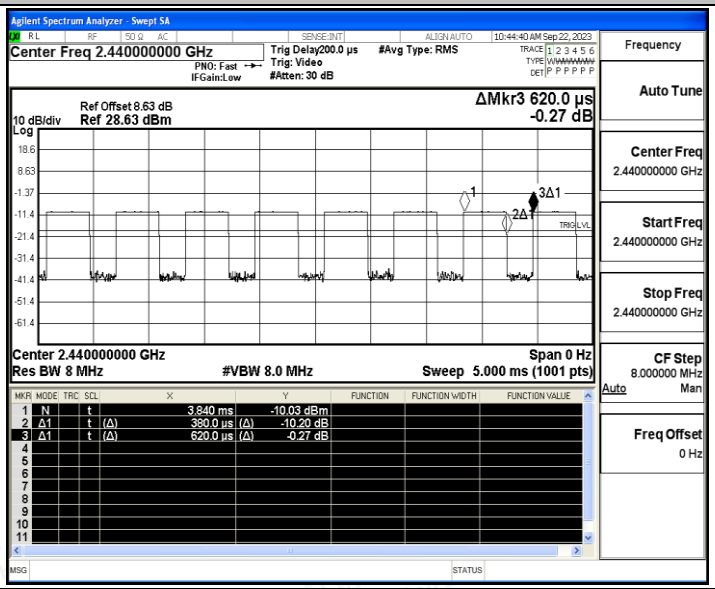
TestMode	Antenna	Channel	ON Time [ms]	Period [ms]	X	DC [%]	xFactor	1/T	Limit	Verdict
BLE	Ant	2402	0.38	0.62	0.6129	61.29	2.13	2.63	---	---
		2440	0.38	0.62	0.6129	61.29	2.13	2.63	---	---
		2480	0.39	0.63	0.6190	61.90	2.08	2.56	---	---

Test Graphs

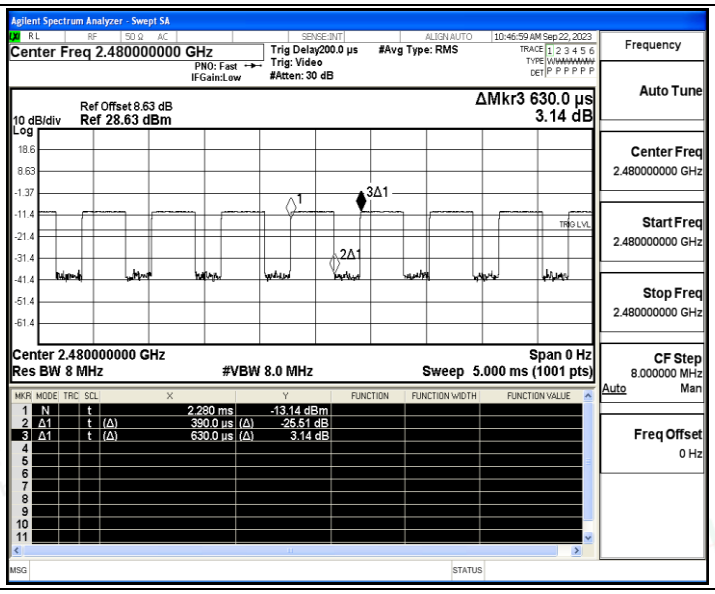
BLE_Ant_2402



BLE_Ant_2440



BLE_Ant_2480


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
Trig Delay200.0 µs
Trig: Video
#Atten: 30 dB
#Avg Type: RMS
10:46:59 AM Sep 22, 2023
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.480000000 GHz
Stop Freq
2.480000000 GHz
CF Step
8.000000 MHz
Auto Man
Freq Offset
0 Hz
Ref Offset 8.63 dB
10 dB/div Ref 28.63 dBm
ΔMkr3 630.0 µs
3.14 dB
Center 2.480000000 GHz
Res BW 8 MHz
#VBW 8.0 MHz
Span 0 Hz
Sweep 5.000 ms (1001 pts)
1 N t 2.280 ms -13.14 dBm
2 Δ1 t (Δ) 390.0 µs (Δ) -25.51 dB
3 Δ1 t (Δ) 630.0 µs (Δ) 3.14 dB

A.7 Emissions in Restricted Bands

Test Result

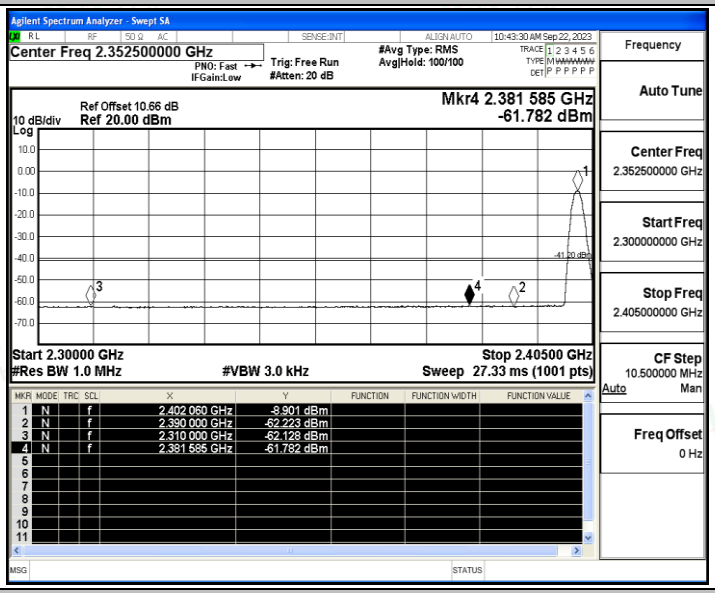
TestMode	Antenna	ChName	Channel	Detector	Freq. [MHz]	Result [dBm]	Limit [dBm]	Result [dBuV/m]	Limit [dBuV/m]	Verdict
BLE	Ant	Low	2402	AV	2310.000	-62.13	≤-41.20	33.07	≤54	PASS
				AV	2381.585	-61.78	≤-41.20	33.42	≤54	PASS
				AV	2390.000	-62.22	≤-41.20	32.98	≤54	PASS
				Peak	2310.000	-56.33	≤-21.20	38.87	≤74	PASS
				Peak	2379.275	-52.27	≤-21.20	42.93	≤74	PASS
				Peak	2390.000	-54.44	≤-21.20	40.76	≤74	PASS
		High	2480	AV	2483.500	-60.44	≤-41.20	34.76	≤54	PASS
				AV	2483.520	-60.44	≤-41.20	34.76	≤54	PASS
				AV	2500.000	-61.53	≤-41.20	33.67	≤54	PASS
				Peak	2483.500	-54.84	≤-21.20	40.36	≤74	PASS
				Peak	2491.760	-52.37	≤-21.20	42.83	≤74	PASS
				Peak	2500.000	-56.19	≤-21.20	39.01	≤74	PASS

Note：

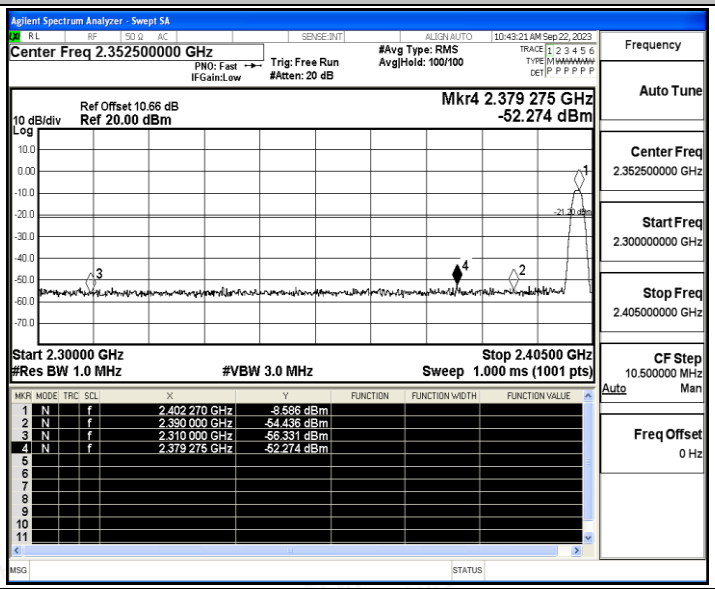
1. The Antenna Gain is compensated in the graph.
2. The limit in dBm for average detector is conversion from 54dBuV/m, according to 15.209(a). The limit in dBm for peak detector is 20dB above the limit of average detector in dBm.

Test Graphs

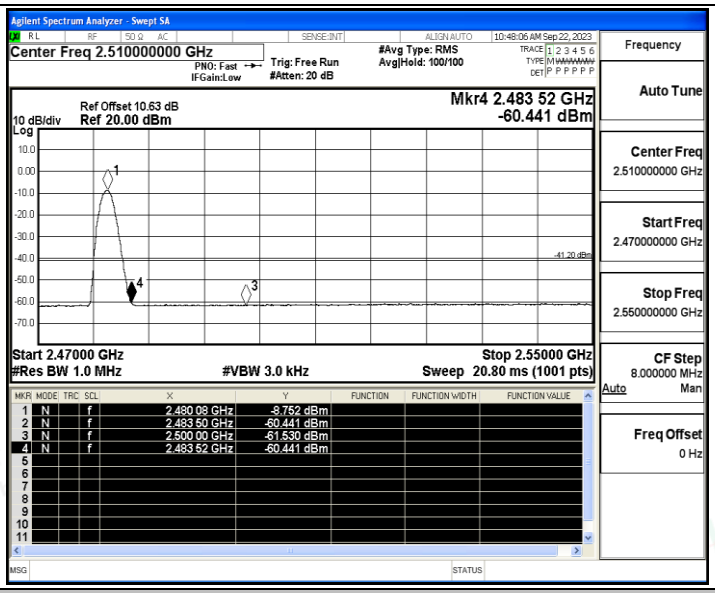
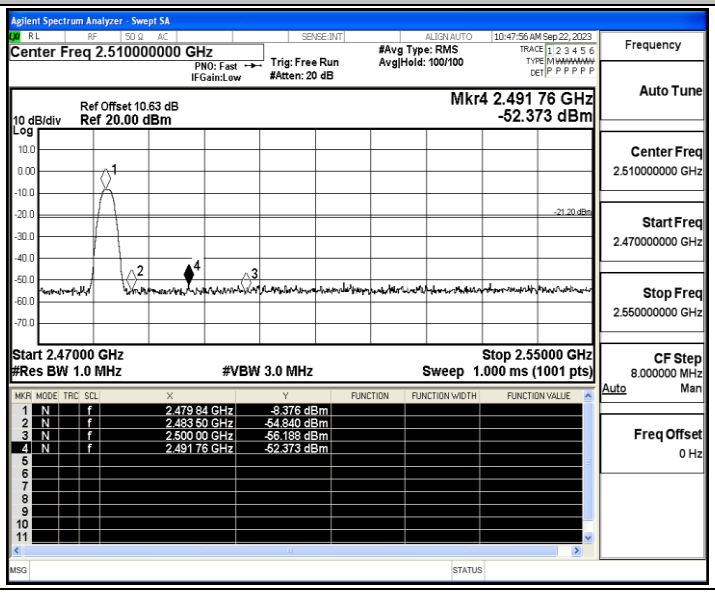
BLE_Ant_Low_2402_AV



BLE_Ant_Low_2402_Peak



BLE_Ant_High_2480_AV



BLE_Ant_High_2480_Peak