Appendix A

RF Test Data for BLE (Conducted Measurement)

Product Name: Tire Tread Depth Examiner

Test Model: TTM113

Environmental Conditions

Temperature:	23.8° C
Relative Humidity:	52.1%
ATM Pressure:	100.0 kPa
Test Engineer:	Paddi Chen
Supervised by:	Nick Peng

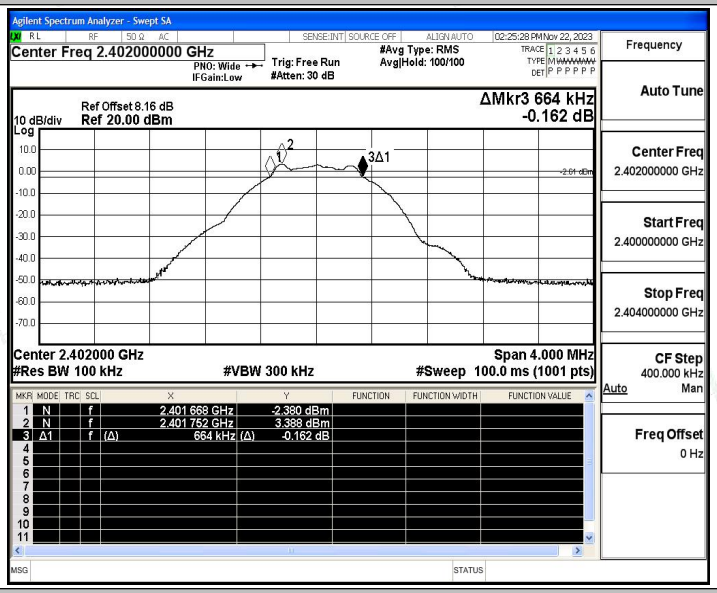
A.1 DTS Bandwidth

Test Result

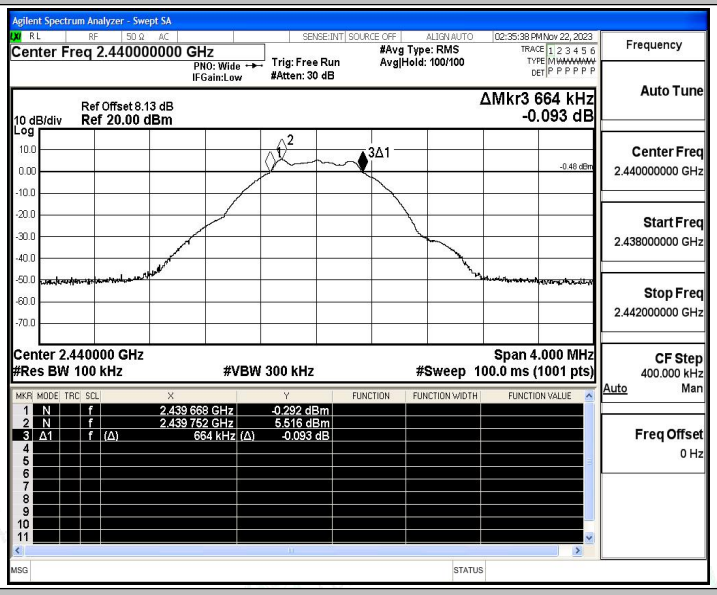
TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.664	2401.668	2402.332	0.5	PASS
		2440	0.664	2439.668	2440.332	0.5	PASS
		2480	0.664	2479.668	2480.332	0.5	PASS

Test Graphs

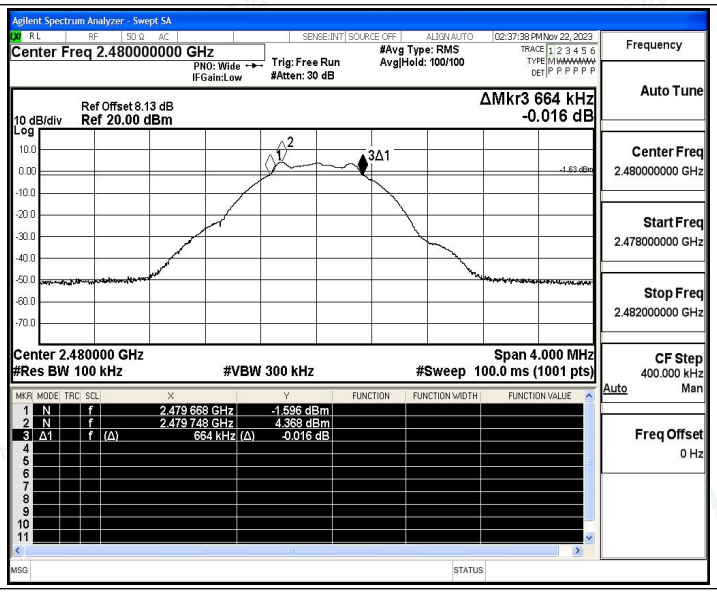
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_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
02:37:38 PM Nov 22, 2023
Ref Offset 8.13 dB
10 dB/div
Log
Ref 20.00 dBm
ΔMkr3 664 kHz
-0.016 dB
Center 2.480000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 4.000 MHz
#Sweep 100.0 ms (1001 pts)
1 N 1 f 2.479 668 GHz -1.596 dBm
2 N 1 f 2.479 748 GHz 4.368 dBm
3 Δ1 f (Δ) 664 kHz (Δ) -0.016 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

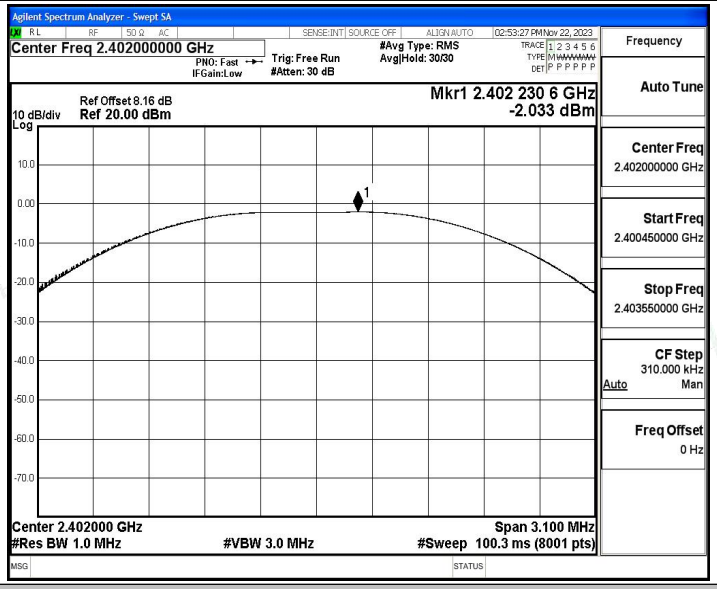
A.2 Maximum conducted output power

Test Result

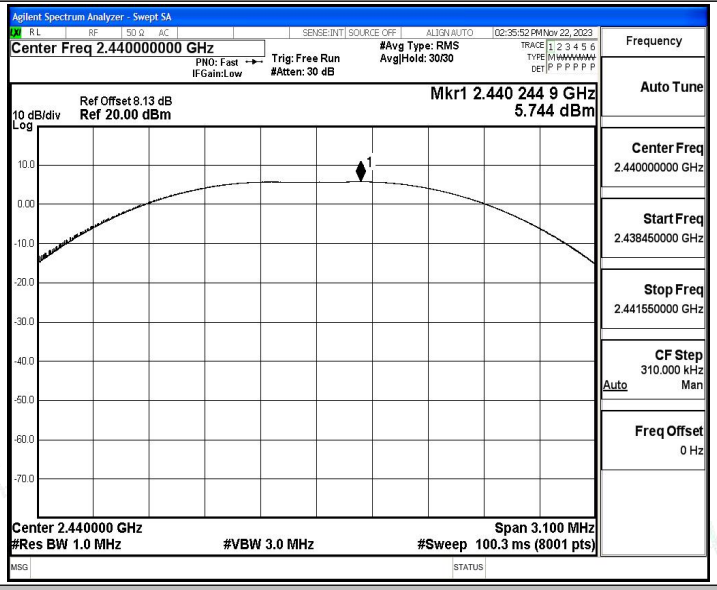
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	-2.03	≤30	PASS
		2440	5.74	≤30	PASS
		2480	-1.08	≤30	PASS

Test Graphs

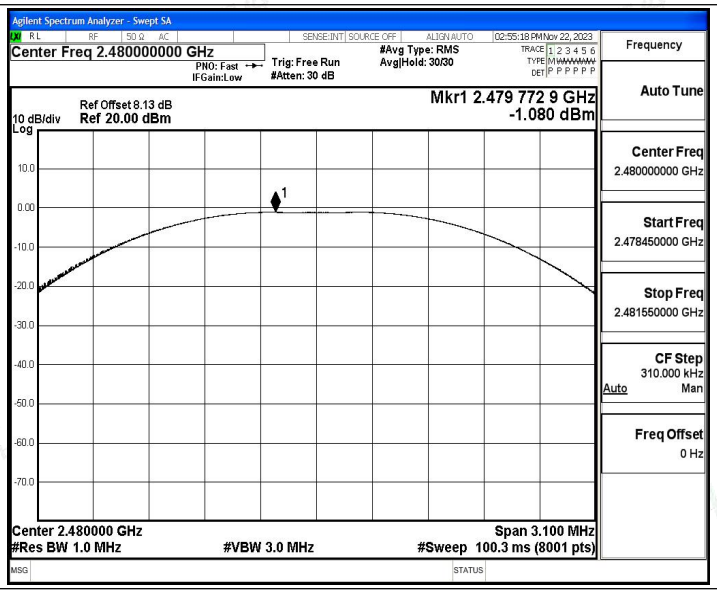
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_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
02:55:18 PM Nov 22, 2023
Ref Offset 8.13 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 2.479 772 9 GHz
-1.080 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

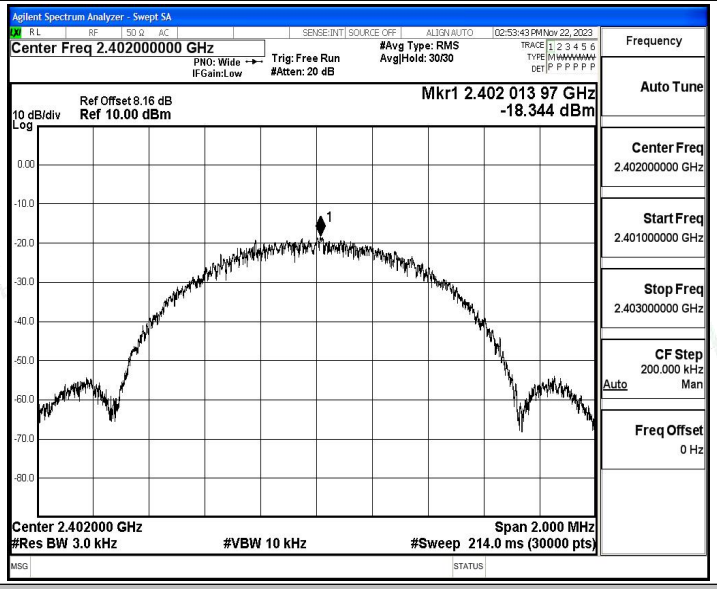
A.3 Maximum power spectral density

Test Result

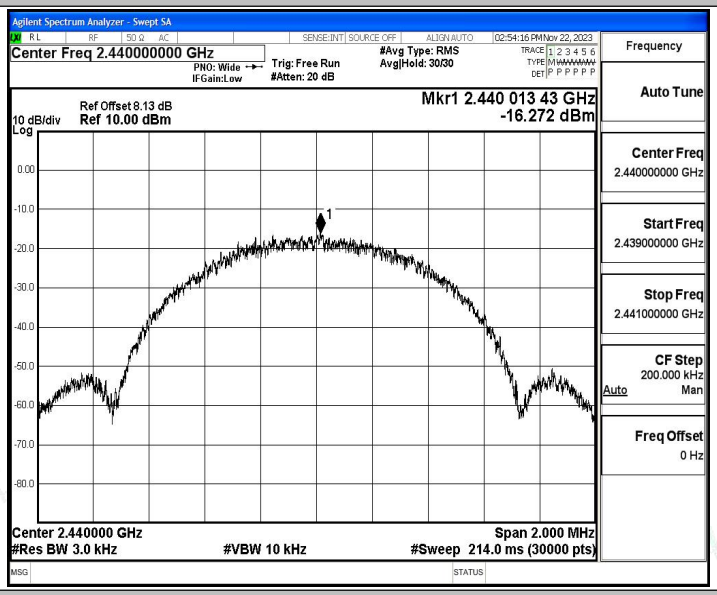
TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-18.34	≤8.00	PASS
		2440	-16.27	≤8.00	PASS
		2480	-17.36	≤8.00	PASS

Test Graphs

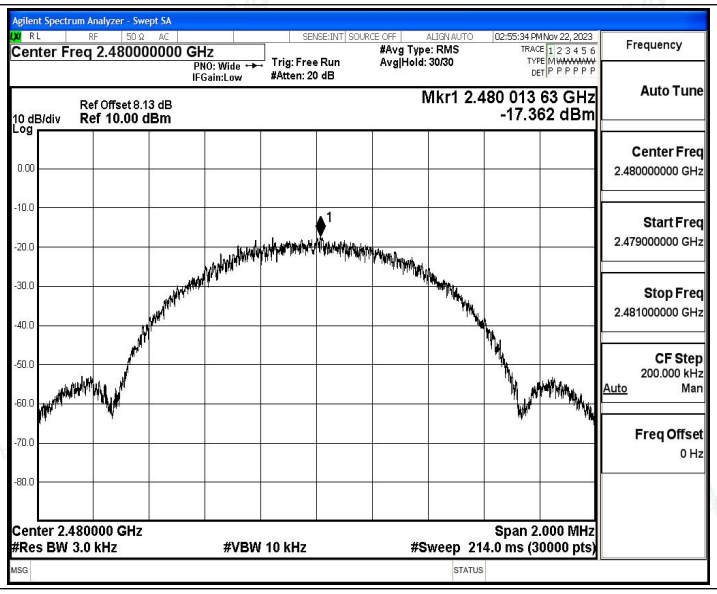
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_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
02:55:34 PM Nov 22, 2023
Frequency
Auto Tune
Ref Offset 8.13 dB
10 dB/div Ref 10.00 dBm
Log
Mkr1 2.480 013 63 GHz
-17.362 dBm
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
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
Center 2.480000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 2.000 MHz
#Sweep 214.0 ms (30000 pts)
MSG
STATUS

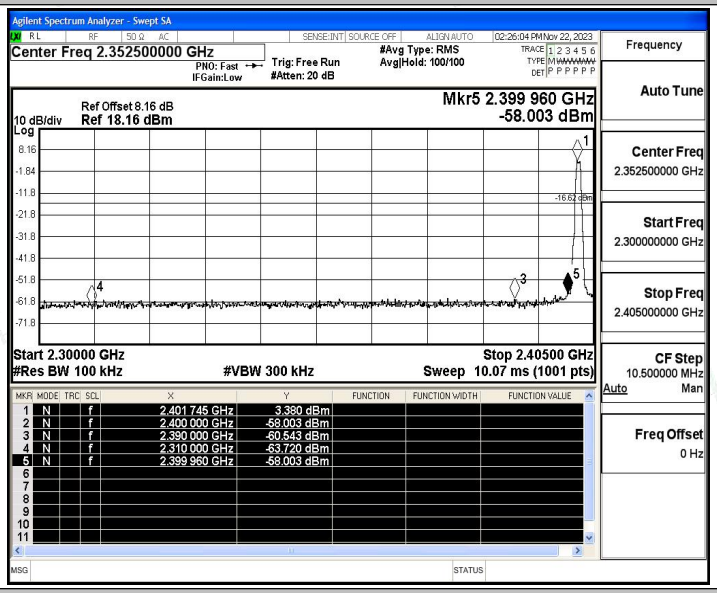
A.4 Band edge measurements

Test Result

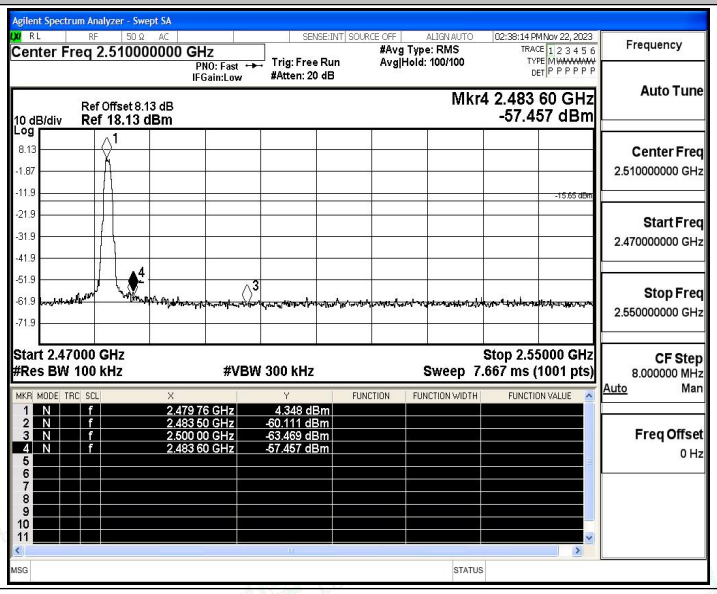
TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	Low	2402	3.38	-58	≤-16.62	PASS
		High	2480	4.35	-57.46	≤-15.65	PASS

Test Graphs

BLE_1M_Ant1_Low_2402



BLE_1M_Ant1_High_2480



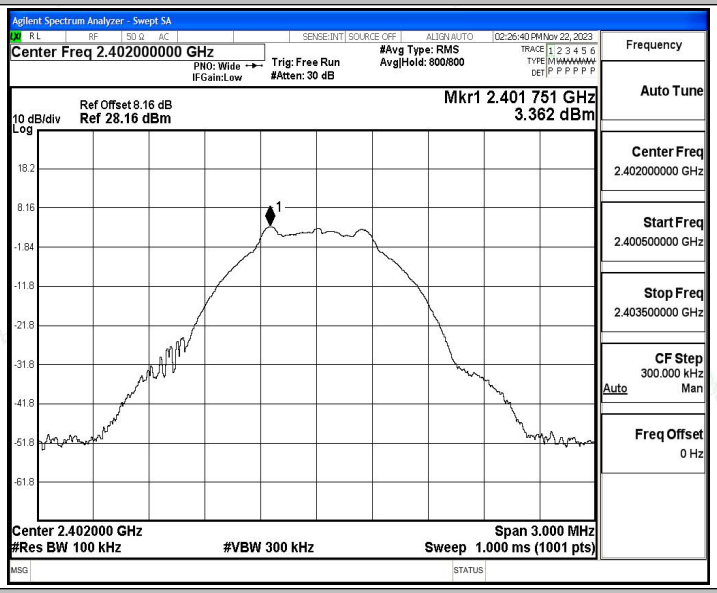
A.5 Conducted Spurious Emission

Test Result

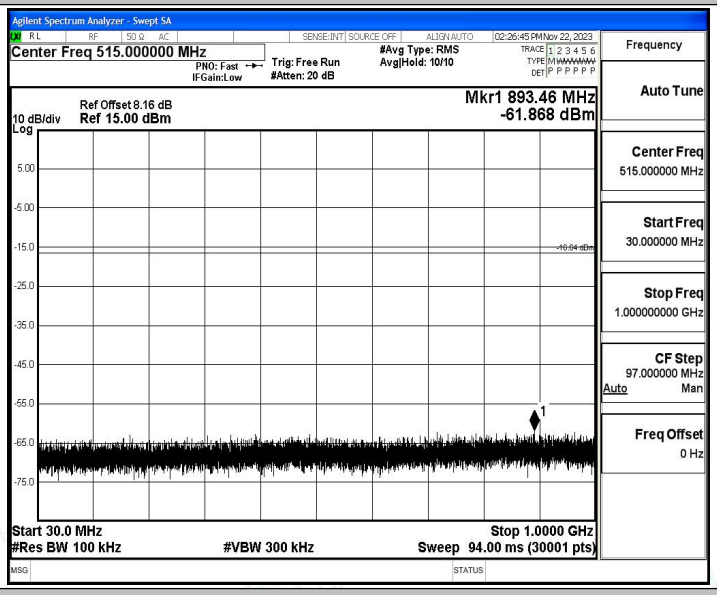
TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	Reference	3.36	3.36	---	PASS
			30~1000	3.36	-61.87	≤-16.64	PASS
			1000~26500	3.36	-48.85	≤-16.64	PASS
		2440	Reference	-0.14	-0.14	---	PASS
			30~1000	-0.14	-61.35	≤-20.14	PASS
			1000~26500	-0.14	-48.89	≤-20.14	PASS
		2480	Reference	4.27	4.27	---	PASS
			30~1000	4.27	-61.33	≤-15.73	PASS
			1000~26500	4.27	-48.24	≤-15.73	PASS

Test Graphs

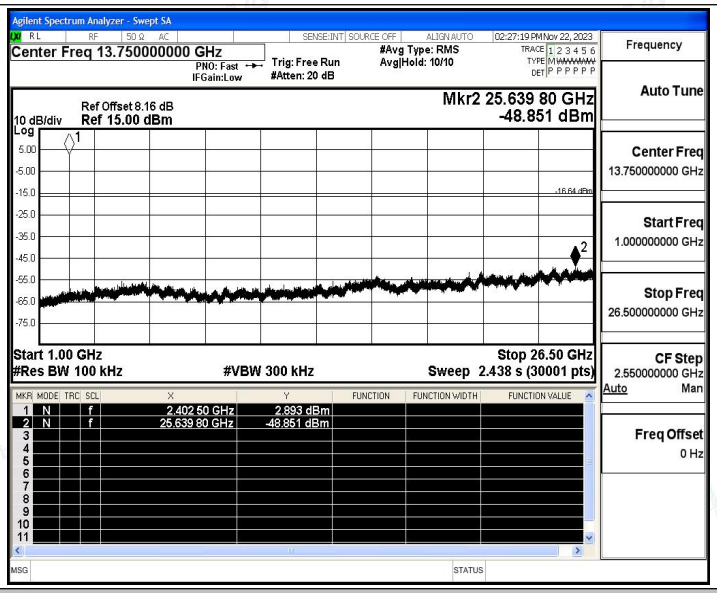
BLE_1M_Ant1_2402_0~Reference



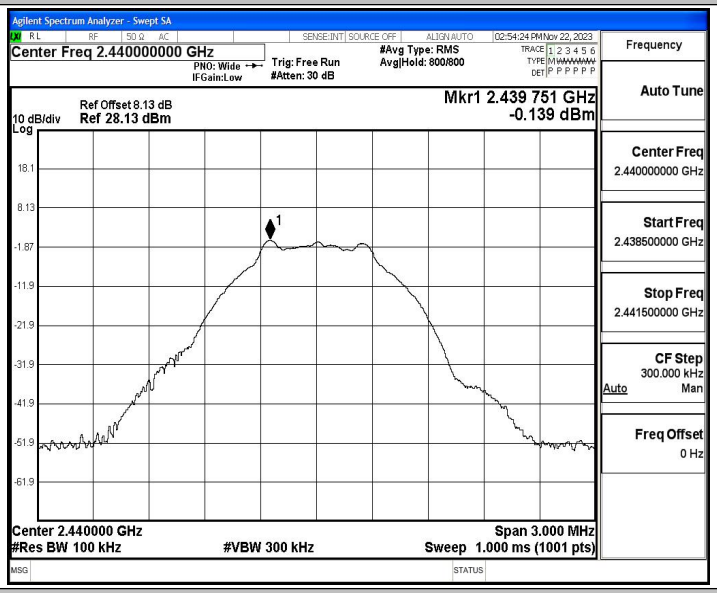
BLE_1M_Ant1_2402_30~1000



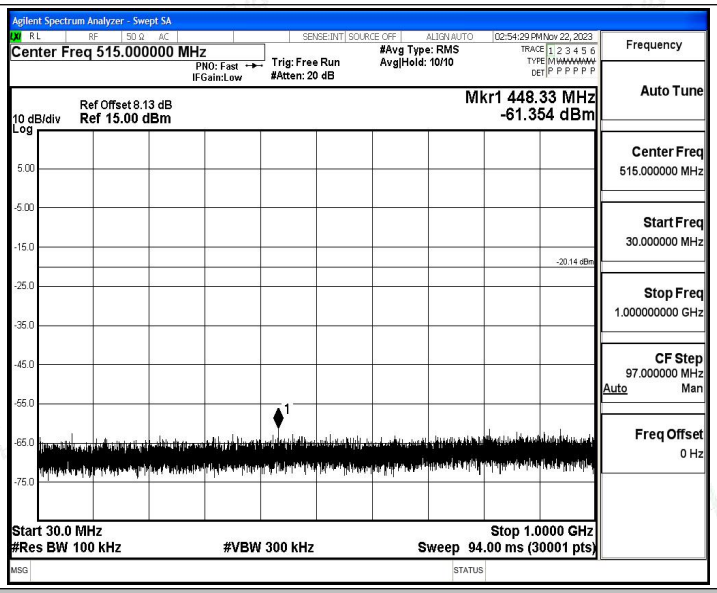
BLE_1M_Ant1_2402_1000~26500



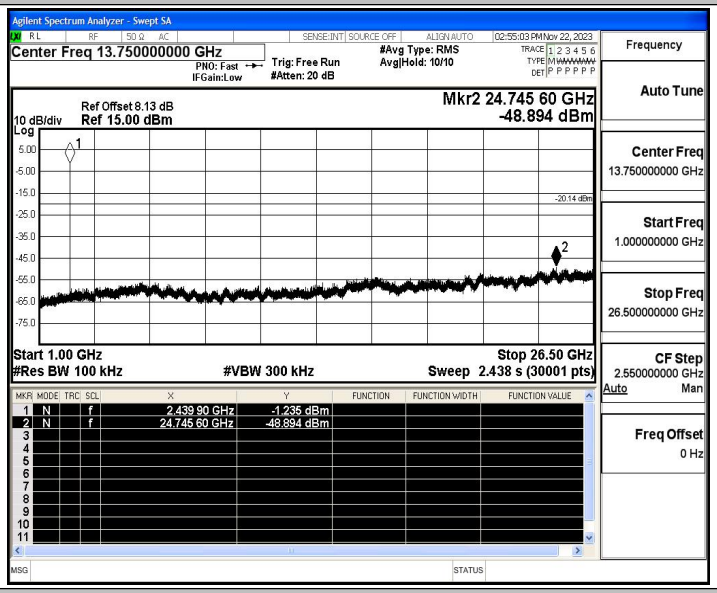
BLE_1M_Ant1_2440_0~Reference



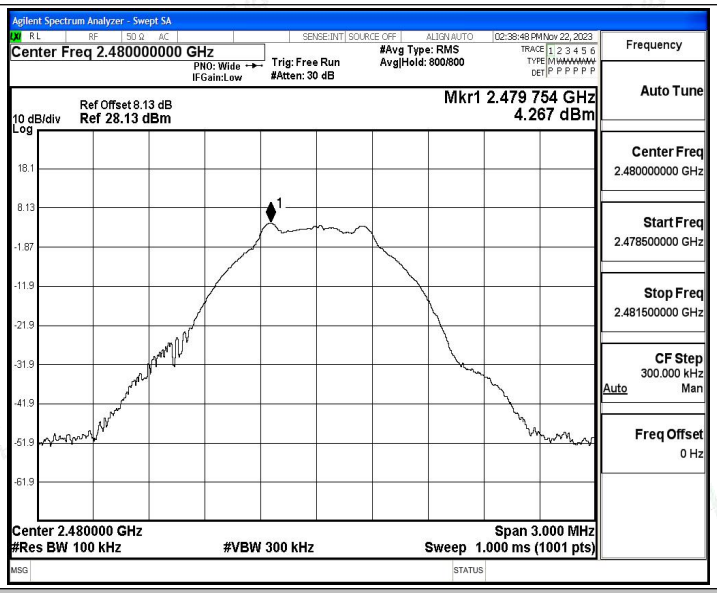
BLE_1M_Ant1_2440_30~1000



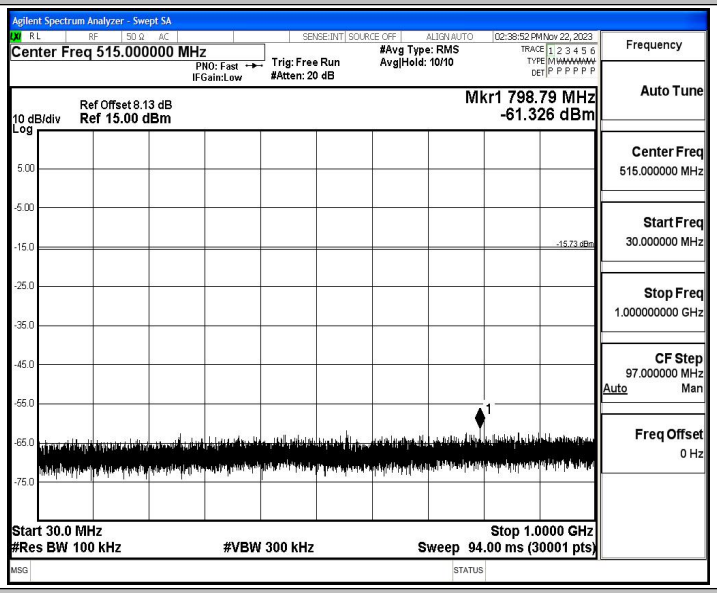
BLE_1M_Ant1_2440_1000~26500



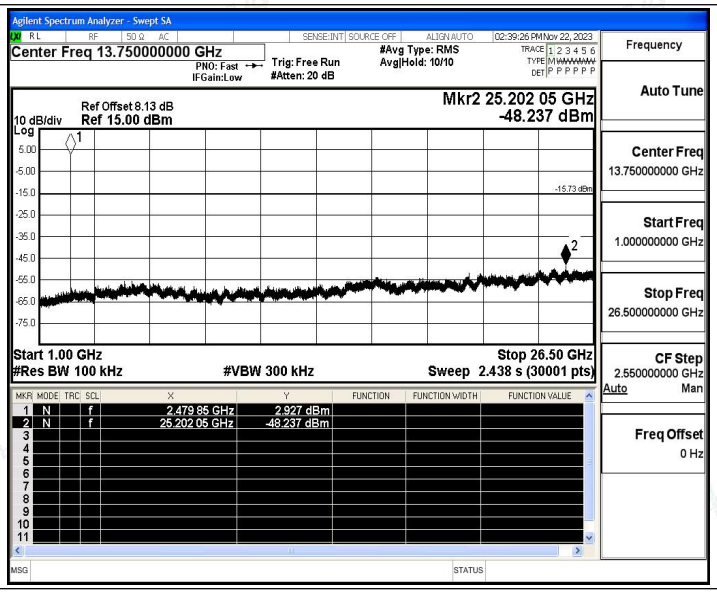
BLE_1M_Ant1_2480_0~Reference



BLE_1M_Ant1_2480_30~1000



BLE_1M_Ant1_2480_1000~26500


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
02:39:26 PM Nov 22, 2023
Ref Offset 8.13 dB
10 dB/div
Log
Ref 15.00 dBm
Mkr2 25.202 05 GHz
-48.237 dBm
-15.73 dBm
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.438 s (30001 pts)
1 N 1 f 2.479 85 GHz 2.927 dBm
2 N 1 f 25.202 05 GHz -48.237 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

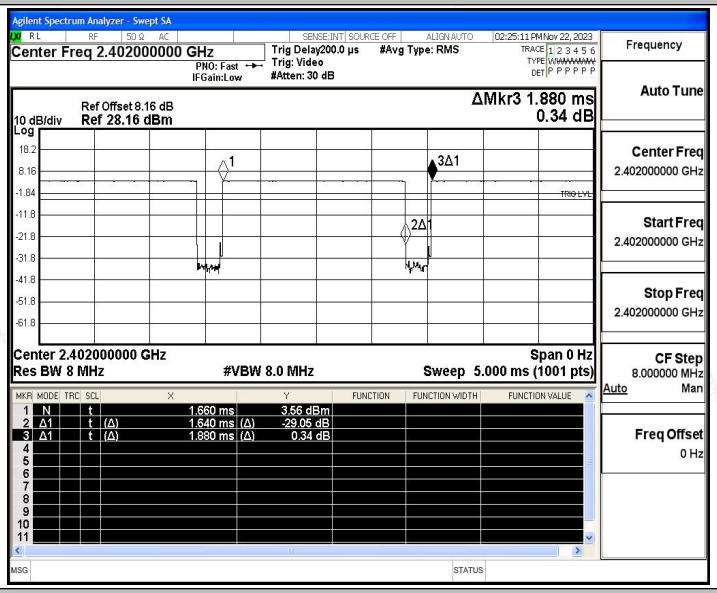
A.6 Duty Cycle

Test Result

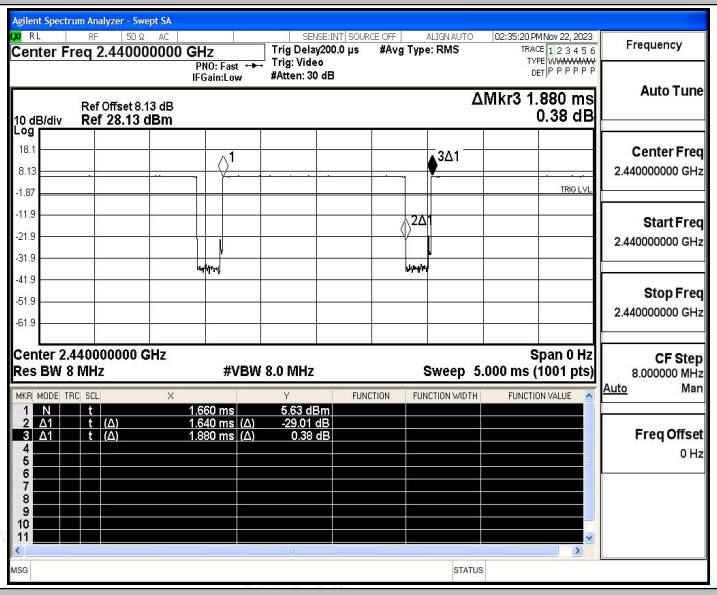
TestMode	Antenna	Channel	ON Time [ms]	Period [ms]	X	DC [%]	xFactor	1/T	Limit	Verdict
BLE_1M	Ant1	2402	1.64	1.88	0.8723	87.23	0.59	0.61	---	---
		2440	1.64	1.88	0.8723	87.23	0.59	0.61	---	---
		2480	1.64	1.88	0.8723	87.23	0.59	0.61	---	---

Test Graphs

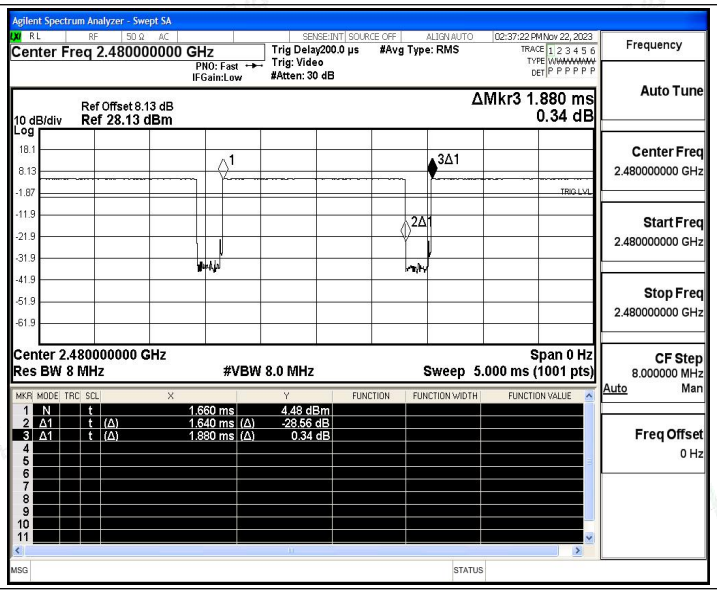
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_2480


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig Delay200.0 µs
Trig: Video
#Avg Type: RMS
#Atten: 30 dB
02:37:22 PM Nov 22, 2023
Ref Offset 8.13 dB
10 dB/div
Ref 28.13 dBm
ΔMkr3 1.880 ms
0.34 dB
Center 2.480000000 GHz
Res BW 8 MHz
#VBW 8.0 MHz
Span 0 Hz
Sweep 5.000 ms (1001 pts)
1 N 1 t 1.660 ms 4.48 dBm
2 Δ1 t (Δ) 1.640 ms (Δ) -28.56 dB
3 Δ1 t (Δ) 1.880 ms (Δ) 0.34 dB
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

A.7 Emissions in Restricted Bands

Test Result

Mode	Frequency (MHz)	Antenna	Spur Freq (MHz)	Power (dBm)	Gain (dBi)	E (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
BLE_1M	2402	Ant1	2310	-51.63	2	45.63	Peak	74	Pass
BLE_1M	2402	Ant1	2310	-57.67	2	39.59	Average	54	Pass
BLE_1M	2402	Ant1	2311.056	-47.1	2	50.16	Peak	74	Pass
BLE_1M	2402	Ant1	2386.416	-57.24	2	40.02	Average	54	Pass
BLE_1M	2402	Ant1	2390	-51.27	2	45.99	Peak	74	Pass
BLE_1M	2402	Ant1	2390	-57.4	2	39.86	Average	54	Pass
BLE_1M	2480	Ant1	2483.5	-48.75	2	48.51	Peak	74	Pass
BLE_1M	2480	Ant1	2483.5	-55.44	2	41.82	Average	54	Pass
BLE_1M	2480	Ant1	2487.16	-44.83	2	52.43	Peak	74	Pass
BLE_1M	2480	Ant1	2483.512	-55.44	2	41.82	Average	54	Pass
BLE_1M	2480	Ant1	2500	-51.01	2	46.25	Peak	74	Pass
BLE_1M	2480	Ant1	2500	-57.05	2	40.21	Average	54	Pass

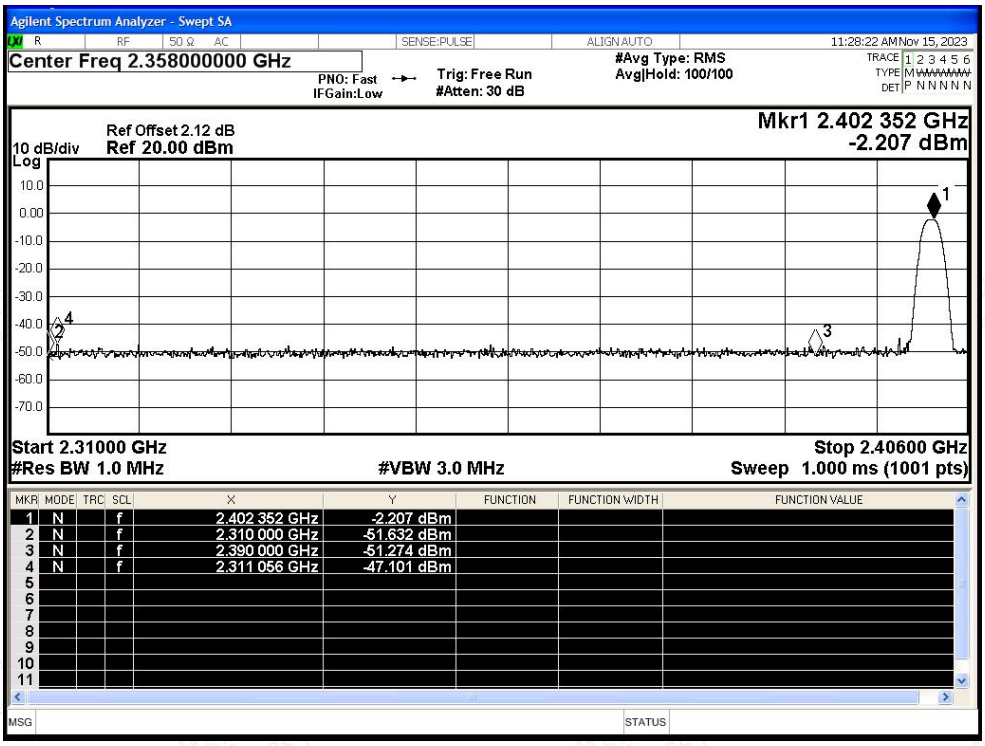
Note：

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.

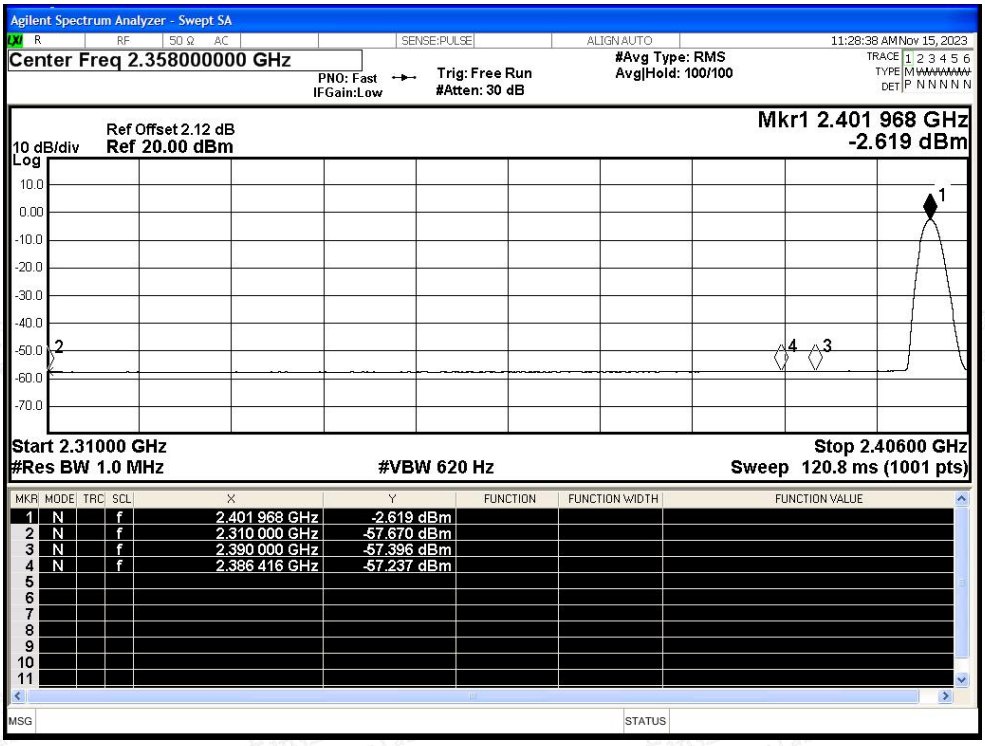
Test Graphs

Test Graphs

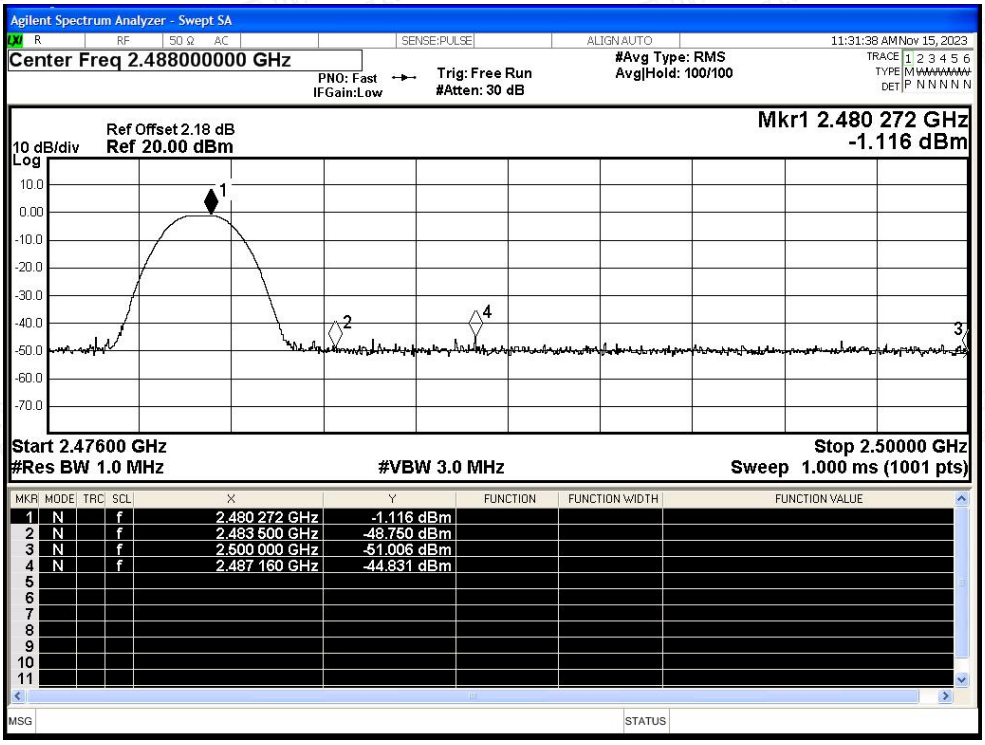
BLE_1M 2402MHz Ant1 Peak



BLE_1M 2402MHz Ant1 Average



BLE_1M 2480MHz Ant1 Peak



BLE_1M 2480MHz Ant1 Average