Appendix B

RF Test Data for Zigbee(Conducted Measurement)

Product Name: Axis Centrifugal Pump

Test Model: AX60

Environmental Conditions

Temperature:	23.8° C
Relative Humidity:	52.2%
ATM Pressure:	100.0 kPa
Test Engineer:	Nick Peng
Supervised by:	Ling Zhu

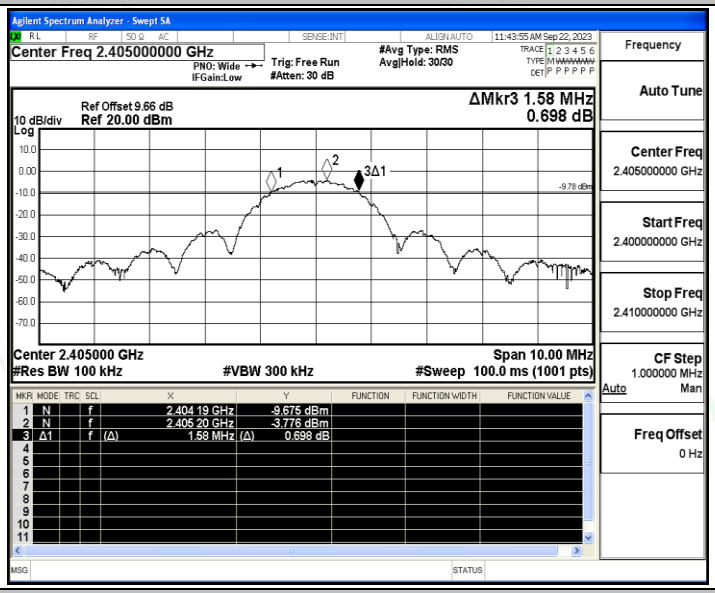
B.1 DTS Bandwidth

Test Result

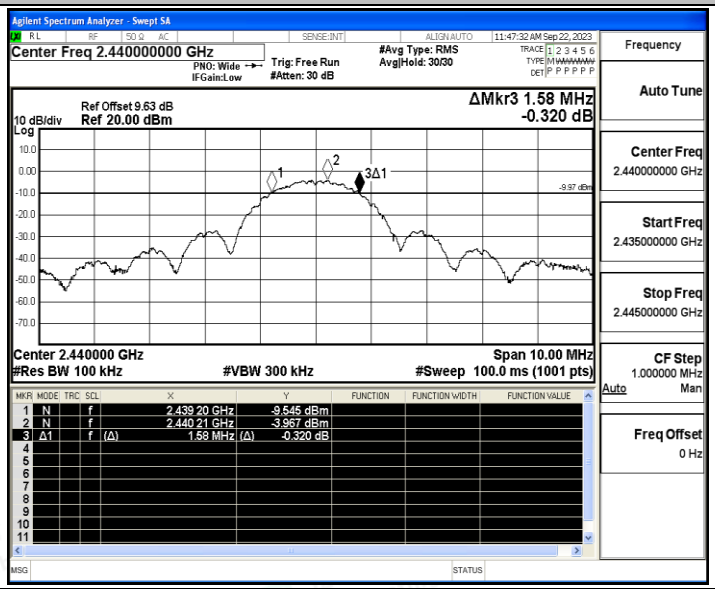
TestMode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
ZIGB	Ant	2405	1.580	2404.190	2405.770	0.5	PASS
		2440	1.580	2439.200	2440.780	0.5	PASS
		2480	1.590	2479.190	2480.780	0.5	PASS

Test Graphs

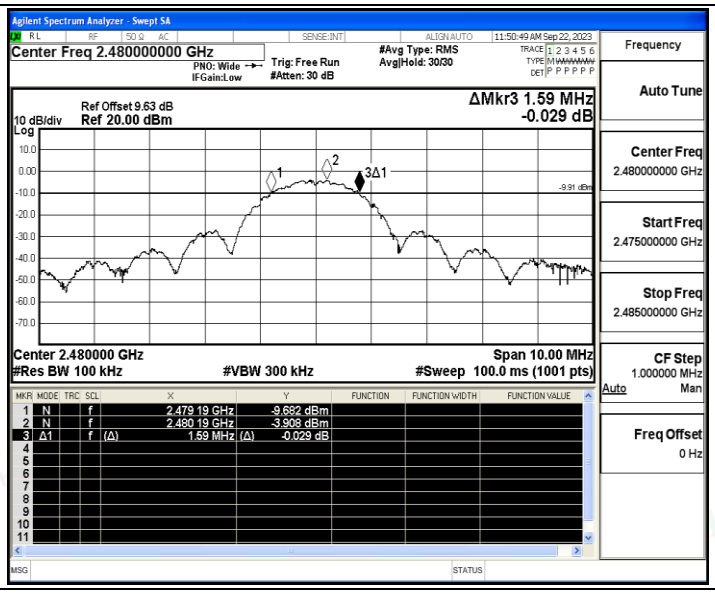
ZIGB_Ant_2405



ZIGB_Ant_2440



ZIGB_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: 30/30
11:50:49 AM Sep 22, 2023
Ref Offset 9.63 dB
10 dB/div Ref 20.00 dBm
Log
ΔMkr3 1.59 MHz
-0.029 dB
Center 2.480000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 10.00 MHz
#Sweep 100.0 ms (1001 pts)
1 N f 2.479 19 GHz -9.682 dBm
2 N f 2.480 19 GHz -3.908 dBm
3 Δ1 f (Δ) 1.59 MHz (Δ) -0.029 dB
Frequency
Auto Tune
Center Freq 2.480000000 GHz
Start Freq 2.475000000 GHz
Stop Freq 2.485000000 GHz
CF Step 1.000000 MHz
Auto Man
Freq Offset 0 Hz

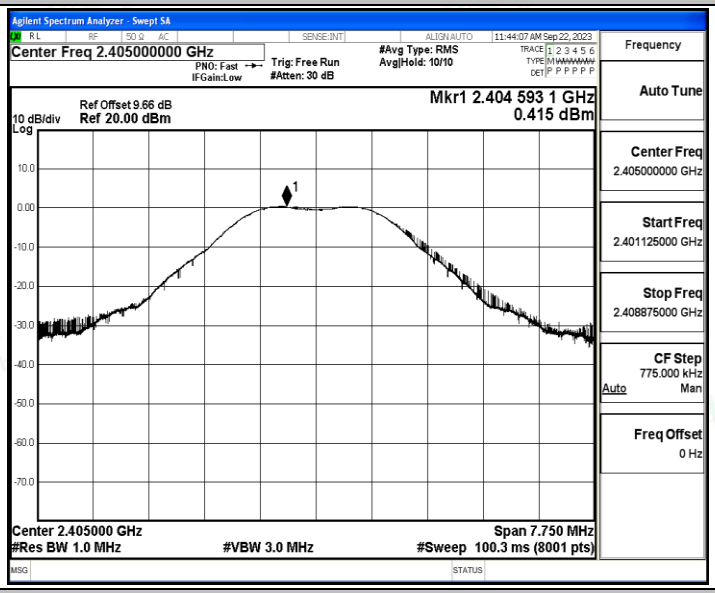
B.2 Maximum conducted output power

Test Result

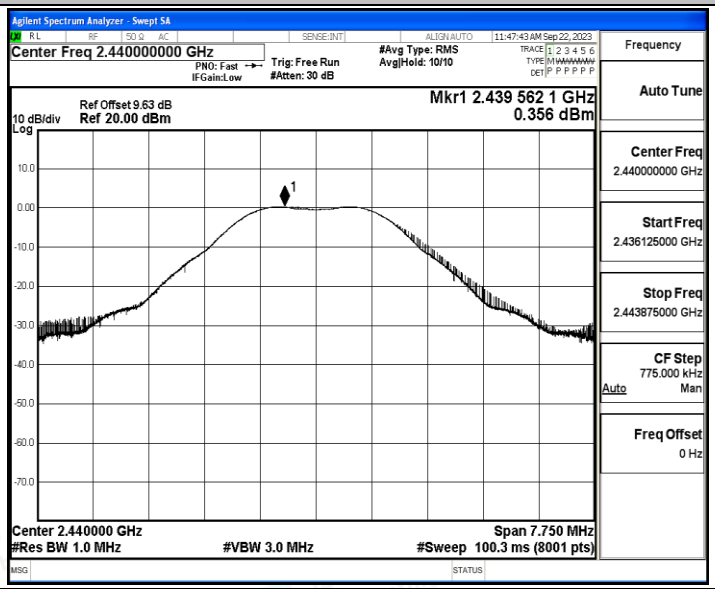
TestMode	Antenna	Frequency[MHz]	Result[dBm]	Limit[dBm]	Verdict
ZIGB	Ant	2405	0.42	≤30	PASS
		2440	0.36	≤30	PASS
		2480	0.29	≤30	PASS

Test Graphs

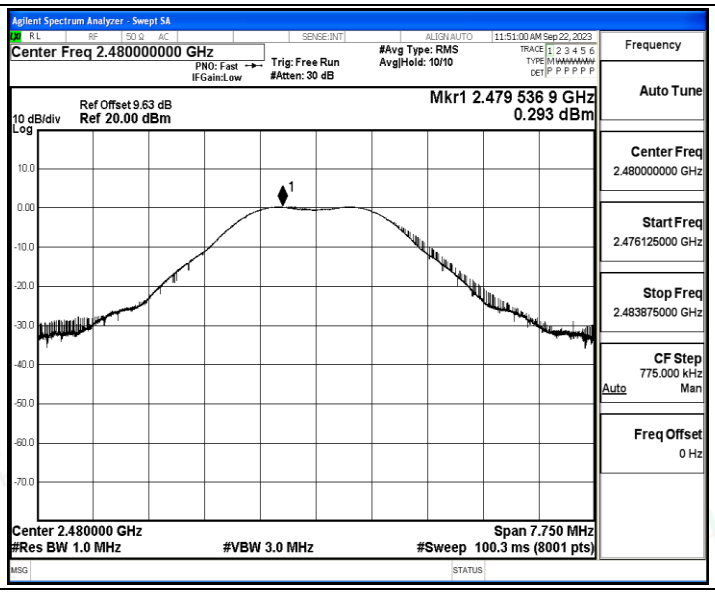
ZIGB_Ant_2405



ZIGB_Ant_2440



ZIGB_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: 10/10
11:51:00 AM Sep 22, 2023
Frequency
Auto Tune
Ref Offset 9.63 dB
10 dB/div Ref 20.00 dBm
Log
Mkr1 2.479 536 9 GHz
0.293 dBm
Center Freq
2.480000000 GHz
Start Freq
2.476125000 GHz
Stop Freq
2.483875000 GHz
CF Step
775.000 kHz
Auto Man
Freq Offset
0 Hz
Center 2.480000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Span 7.750 MHz
#Sweep 100.3 ms (8001 pts)

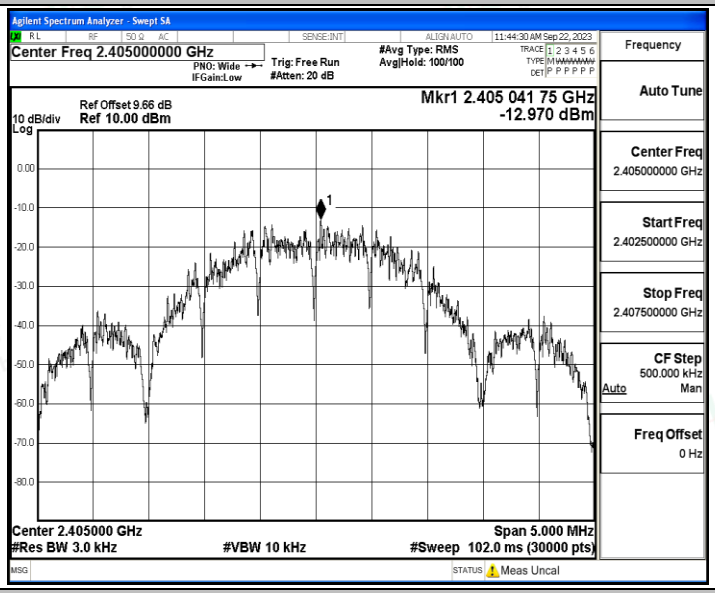
B.3 Maximum power spectral density

Test Result

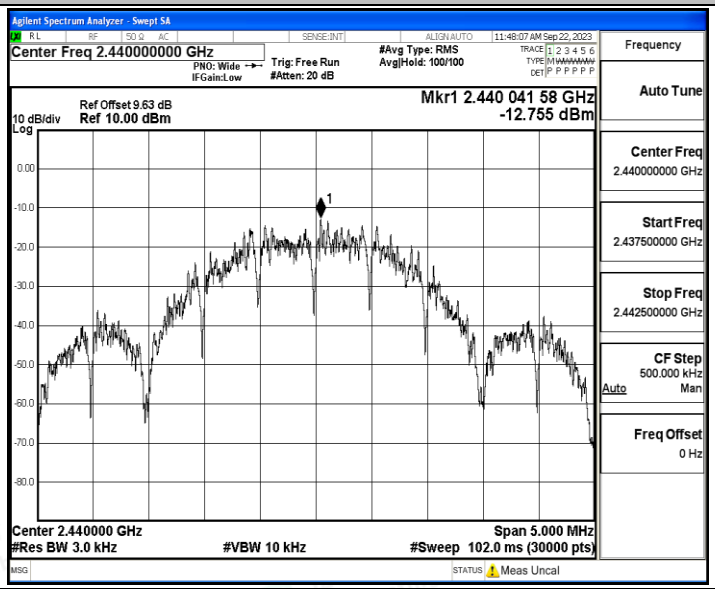
TestMode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
ZIGB	Ant	2405	-12.97	≤8.00	PASS
		2440	-12.76	≤8.00	PASS
		2480	-13.04	≤8.00	PASS

Test Graphs

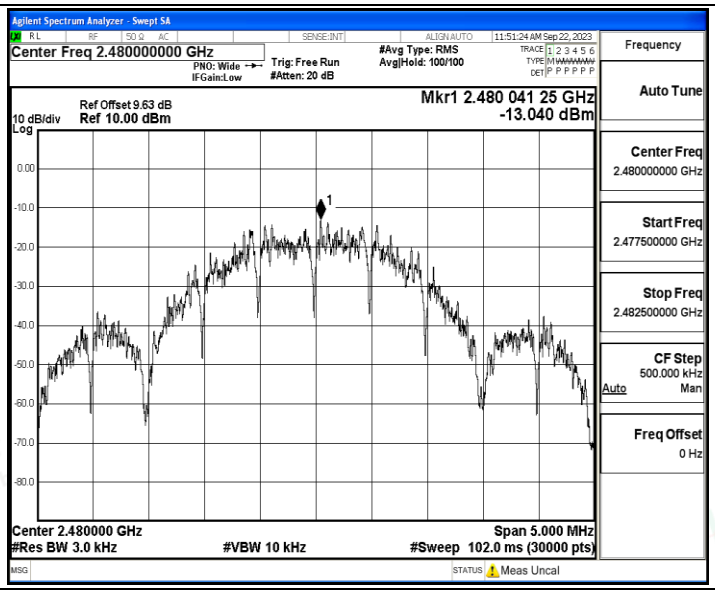
ZIGB_Ant_2405



ZIGB_Ant_2440



ZIGB_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: 100/100
11:51:24 AM Sep 22, 2023
Frequency
Auto Tune
Ref Offset 9.63 dB
10 dB/div Ref 10.00 dBm
Log
Mkr1 2.480 041 25 GHz
-13.040 dBm
Center Freq
2.480000000 GHz
Start Freq
2.477500000 GHz
Stop Freq
2.482500000 GHz
CF Step
500.000 kHz
Auto Man
Freq Offset
0 Hz
Center 2.480000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 5.000 MHz
#Sweep 102.0 ms (30000 pts)
Meas Uncal

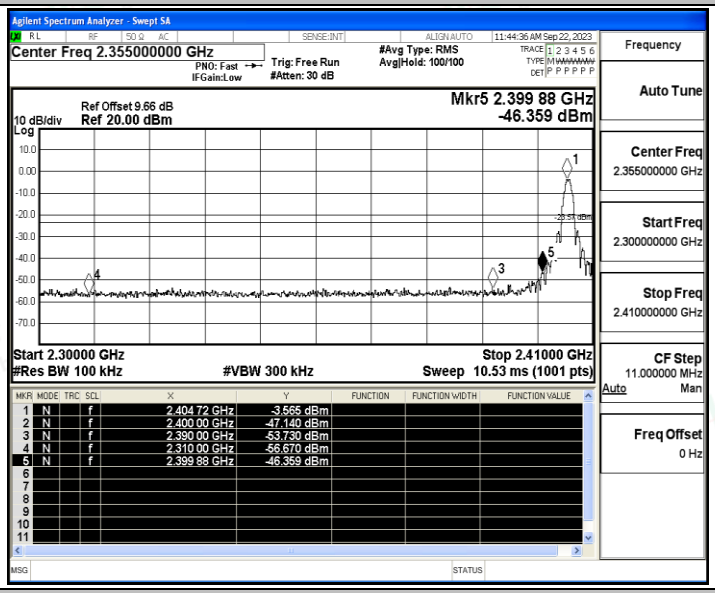
B.4 Band edge measurements

Test Result

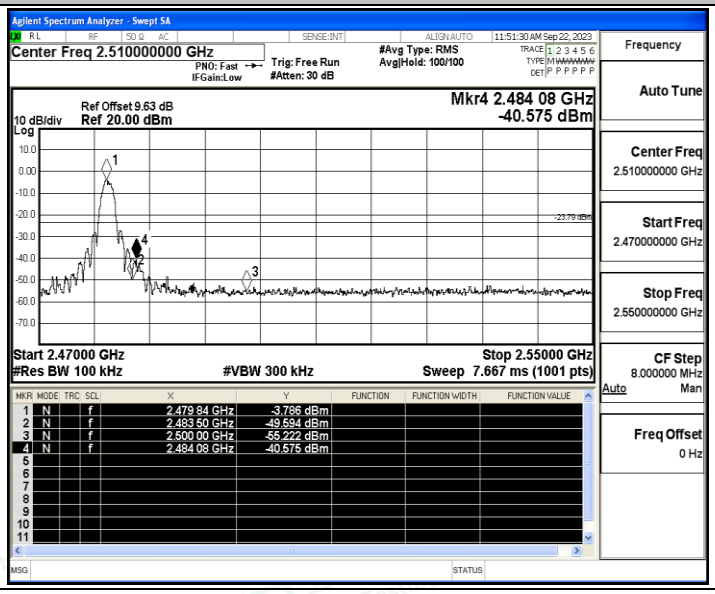
TestMode	Antenna	ChName	Frequency[MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
ZIGB	Ant	Low	2405	-3.57	-46.36	≤-23.57	PASS
		High	2480	-3.79	-40.58	≤-23.79	PASS

Test Graphs

ZIGB_Ant_Low_2405



ZIGB_Ant_High_2480



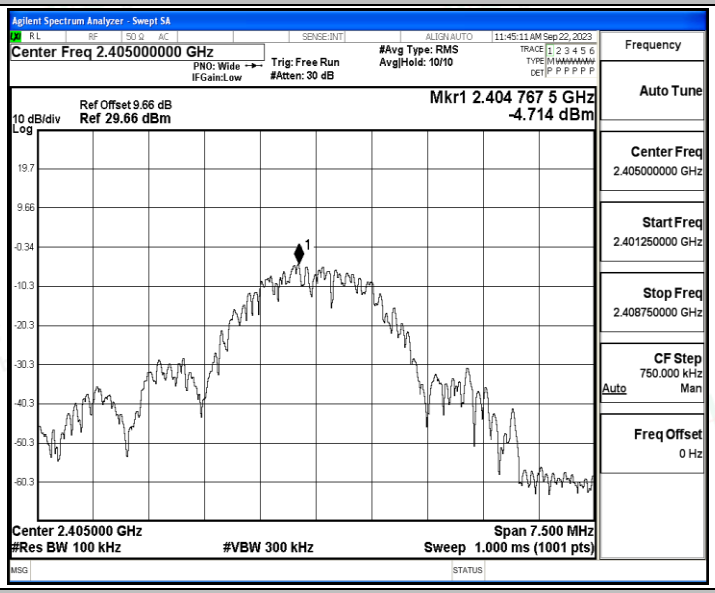
B.5 Conducted Spurious Emission

Test Result

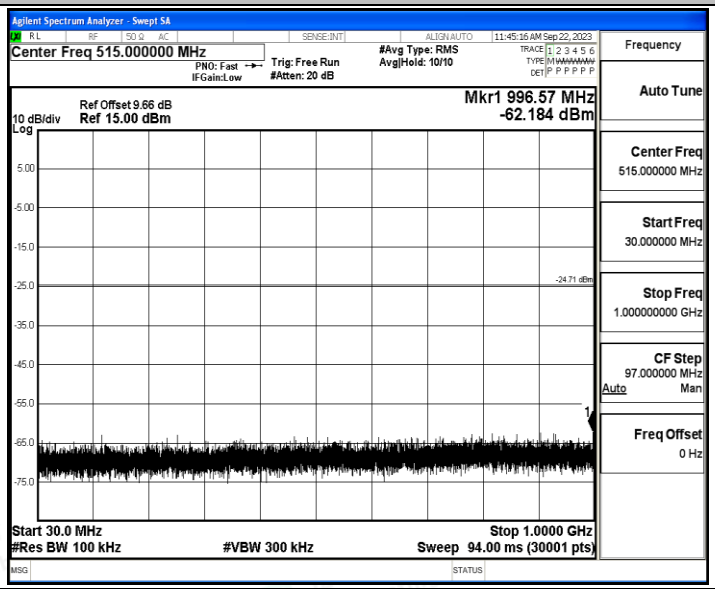
TestMode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
ZIGB	Ant	2405	Reference	-4.71	-4.71	---	PASS
			30~1000	-4.71	-62.18	≤-24.71	PASS
			1000~26500	-4.71	-41.51	≤-24.71	PASS
		2440	Reference	-5.24	-5.24	---	PASS
			30~1000	-5.24	-62.55	≤-25.24	PASS
			1000~26500	-5.24	-43.01	≤-25.24	PASS
		2480	Reference	-4.56	-4.56	---	PASS
			30~1000	-4.56	-62.5	≤-24.56	PASS
			1000~26500	-4.56	-45.7	≤-24.56	PASS

Test Graphs

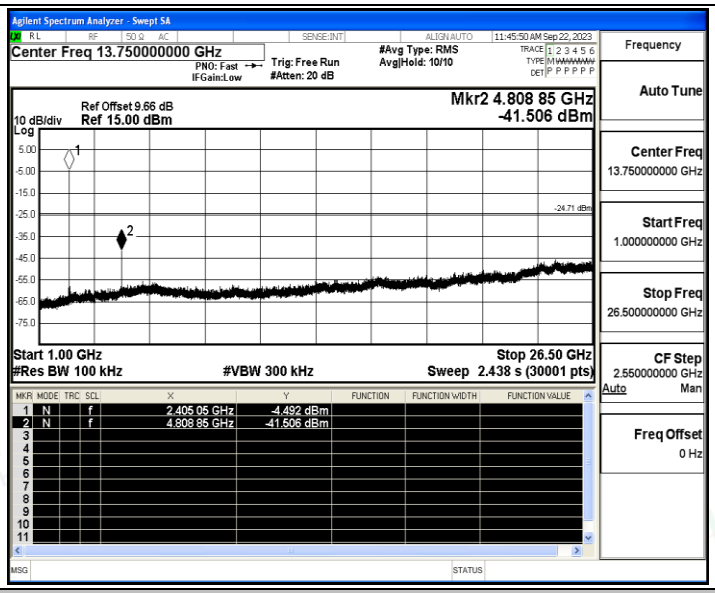
ZIGB_Ant_2405_0~Reference



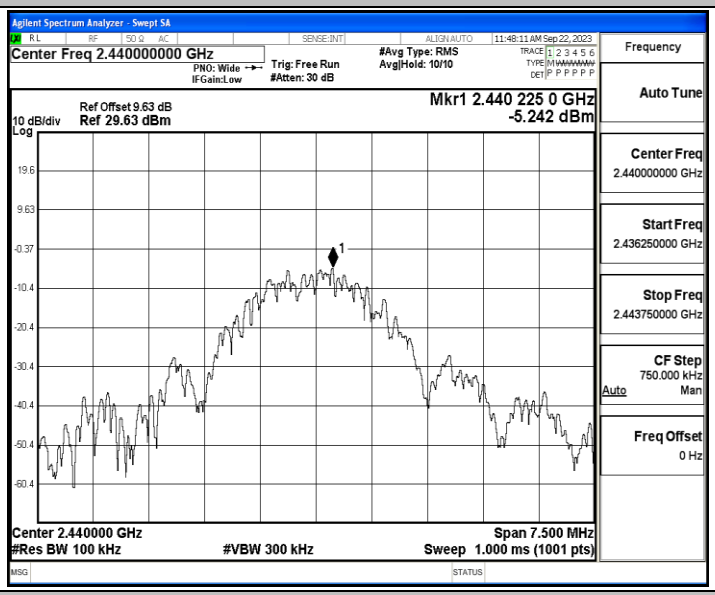
ZIGB_Ant_2405_30~1000



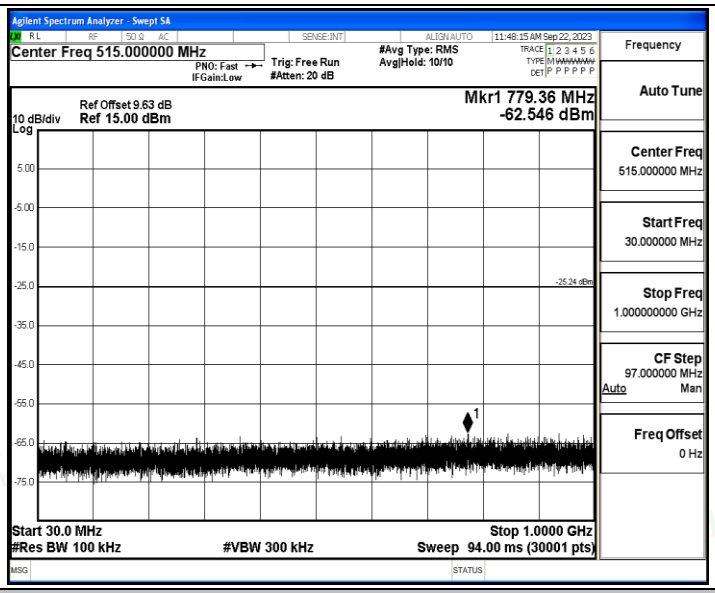
ZIGB_Ant_2405_1000~26500



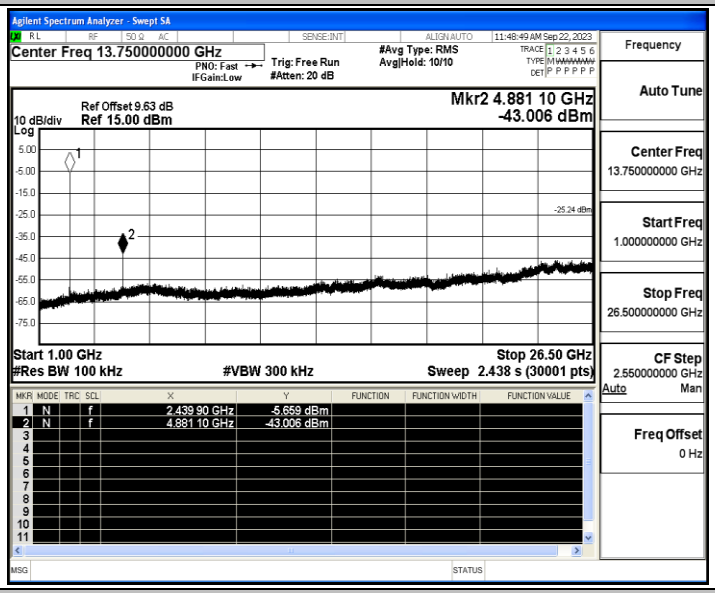
ZIGB_Ant_2440_0~Reference



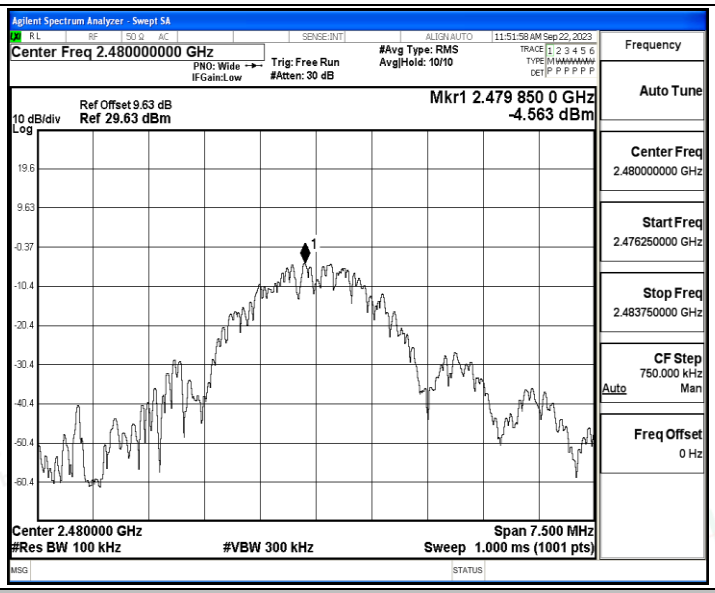
ZIGB_Ant_2440_30~1000



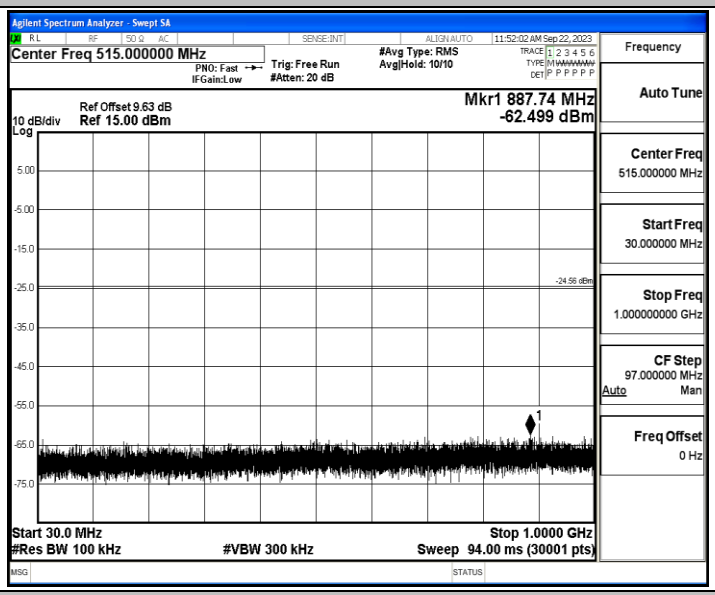
ZIGB_Ant_2440_1000~26500



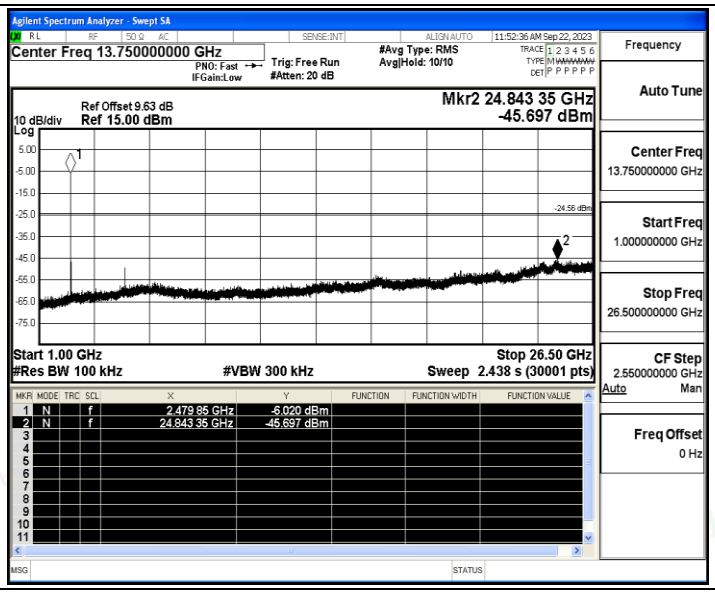
ZIGB_Ant_2480_0~Reference



ZIGB_Ant_2480_30~1000



ZIGB_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
11:52:36 AM Sep 22, 2023
Ref Offset 9.63 dB
10 dB/div Ref 15.00 dBm
Log
Mkr2 24.843 35 GHz
-45.697 dBm
-24.56 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 -6.020 dBm
2 N f 24.843 35 GHz -45.697 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

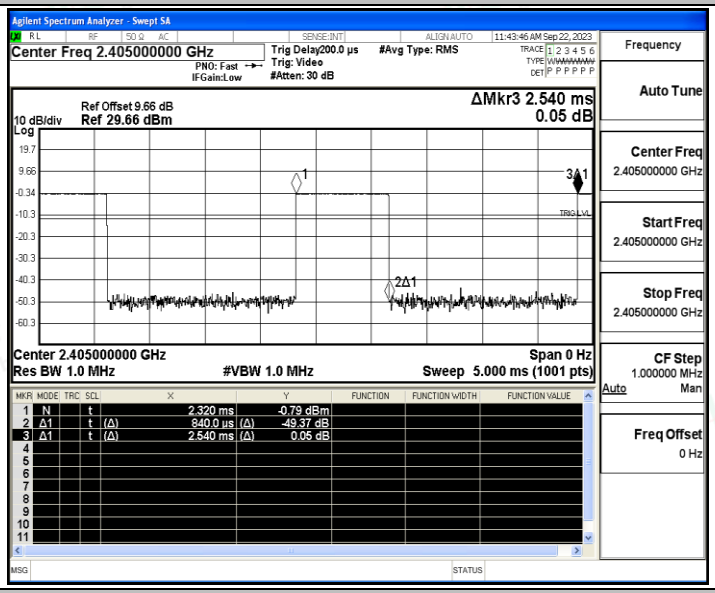
B.6 Duty Cycle

Test Result

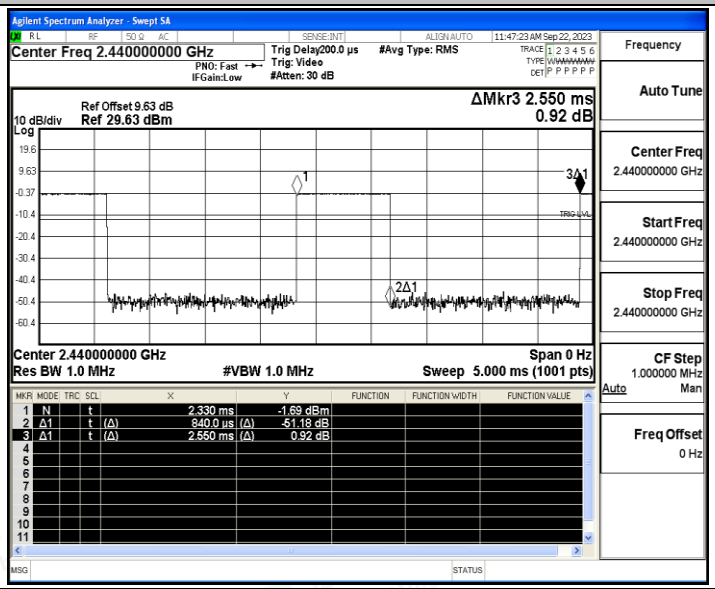
TestMode	Antenna	Frequency[MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	Limit	Verdict
ZIGB	Ant	2405	0.84	2.54	33.07	---	---
		2440	0.84	2.55	32.94	---	---
		2480	0.84	2.55	32.94	---	---

Test Graphs

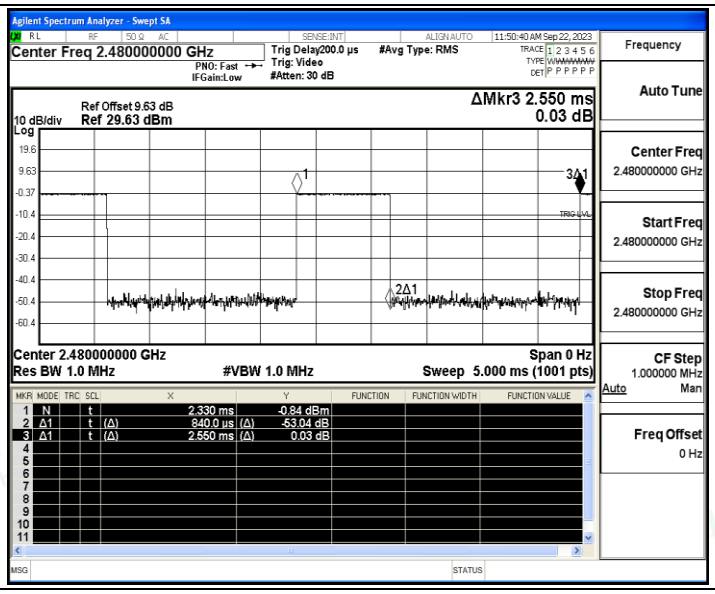
ZIGB_Ant_2405



ZIGB_Ant_2440



ZIGB_Ant_2480


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
Trig Delay200.0 µs
Trig: Video
#Atten: 30 dB
#Avg Type: RMS
11:50:40 AM Sep 22, 2023
Ref Offset 9.63 dB
10 dB/div Ref 29.63 dBm
ΔMkr3 2.550 ms
0.03 dB
Center 2.480000000 GHz
Span 0 Hz
Res BW 1.0 MHz
#VBW 1.0 MHz
Sweep 5.000 ms (1001 pts)
1 N t 2.330 ms -0.84 dBm
2 Δ1 t (Δ) 840.0 µs (Δ) -53.04 dB
3 Δ1 t (Δ) 2.550 ms (Δ) 0.03 dB
Frequency
Auto Tune
Center Freq 2.480000000 GHz
Start Freq 2.480000000 GHz
Stop Freq 2.480000000 GHz
CF Step 1.000000 MHz
Auto Man
Freq Offset 0 Hz

B.7 Emissions in Restricted Bands

Test Result

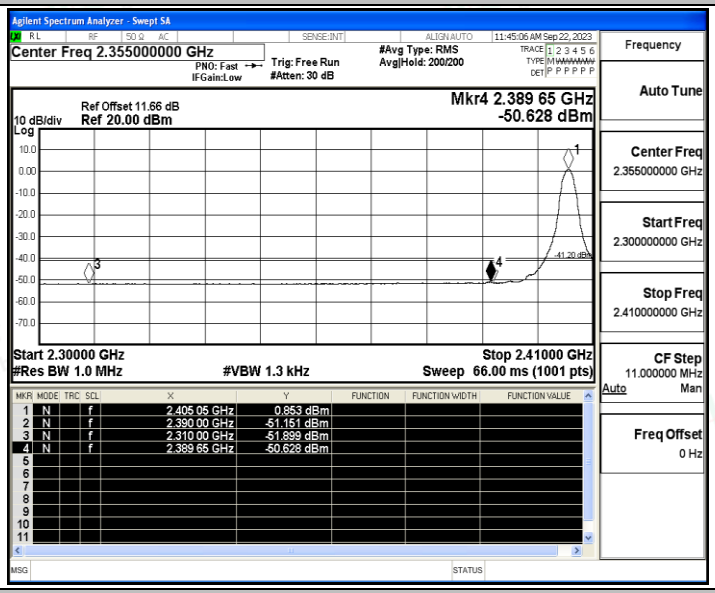
TestMode	Antenna	Frequency[MHz]	Detector	Freq. [MHz]	Result [dBm]	Limit [dBm]	Result [dBuV/m]	Limit [dBuV/m]	Verdict
ZIGB	Ant	2405	AV	2310.000	-51.9	≤-41.20	43.33	≤54	PASS
			AV	2389.650	-50.63	≤-41.20	44.60	≤54	PASS
			AV	2390.000	-51.15	≤-41.20	44.08	≤54	PASS
			Peak	2310.000	-44.13	≤-21.20	51.10	≤74	PASS
			Peak	2381.730	-40.56	≤-21.20	54.67	≤74	PASS
			Peak	2390.000	-43.88	≤-21.20	51.35	≤74	PASS
		2480	AV	2483.500	-43.07	≤-41.20	52.16	≤54	PASS
			AV	2483.520	-43.07	≤-41.20	52.16	≤54	PASS
			AV	2500.000	-51.02	≤-41.20	44.21	≤54	PASS
			Peak	2483.500	-38.22	≤-21.20	57.01	≤74	PASS
			Peak	2484.640	-37.03	≤-21.20	58.20	≤74	PASS
			Peak	2500.000	-44.25	≤-21.20	50.98	≤74	PASS

Note:

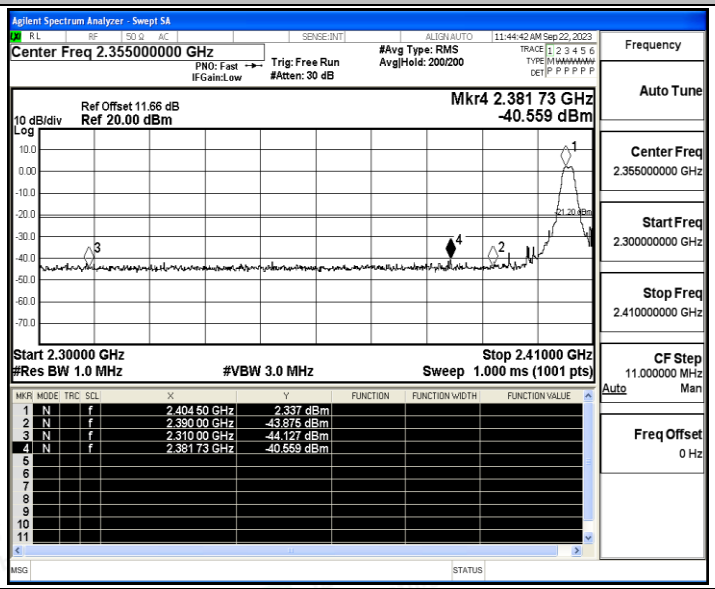
1. The Antenna Gain is compensated in the graph.
2. The limit in dBm for average detector is conversion from 54dBuV/m, according to 15.209(a). The limit in dBm for peak detector is 20dB above the limit of average detector in dBm.

Test Graphs

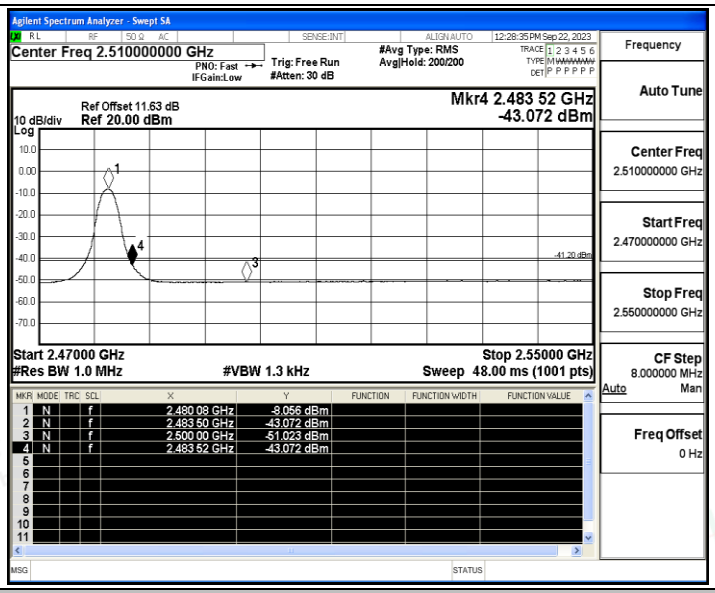
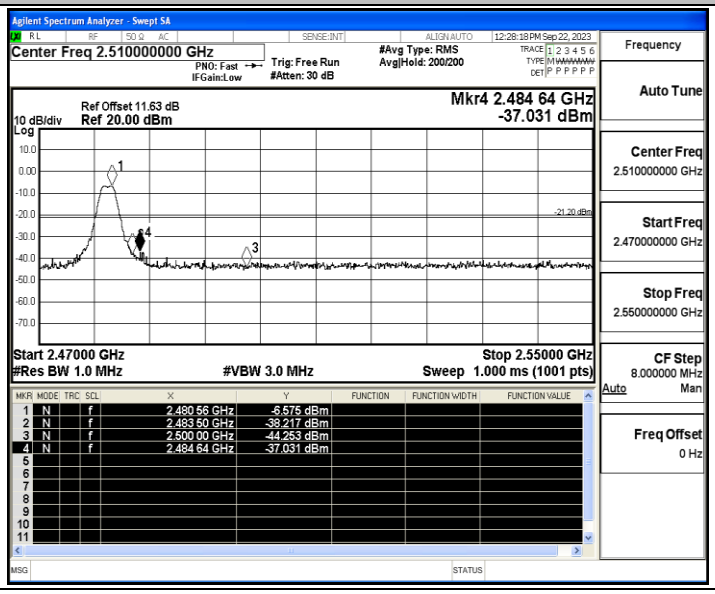
ZIGB_Ant_Low_2405_AV



ZIGB_Ant_Low_2405_Peak



ZIGB_Ant_High_2480_AV



ZIGB_Ant_High_2480_Peak