

1 概述/Overview

1.1 测试准备/ Test prepare

使用 SKB360 模块, 拿掉匹配电路并在天线馈点焊接信号线, 并就近接地。

Use SKB360 module and take away the matching circuit Then solder the RF cable at the antenna feed point and ground the cable as close to the feed as possible.



Figure 1: SKB360 Top View

1.2 测试目的/ Test goal

对 SKB360 的天线性能进行全面测试, 包括 天线效率, 增益, 方向图等 。

Test SKB360's PCB antenna with full test item, including antenna efficiency, gain and direction diagram.

样品编号 Sample No.	样品型号 Sample module	测试软件版本 Test software
1	SKB360	Dtm.hex
2	SKB360	Dtm.hex

2 测试项目 Test Item

测试项目 Test item	测试内容 Test content	备注 notice
天线效率 Antenna Efficiency	测试各个频点下的天线效率 To test antenna efficiency of different frequency	
天线增益 Antenna Gain	测试各个频点下的天线增益 To test antenna gain of different frequency	
方向图 Direction Diagram	测试各个频点下天线的立体方向图 To test the Antenna pattern of different frequency	

3 测试设备 Test Equipment

仪器设备名称 Equipment type	型号 Equipment model	上次校准日期 Last calibration date	校准到期日期 Calibration due date
网络分析仪 Network Analyzer	ZND7	2023.8.1	2024.9.1
网分探头 Network Analyzer detector	飞图 24 Feitu 24	2023.8.1	2024.9.1
OTA 测试系统 OTA test system		2023.8.1	2024.9.1

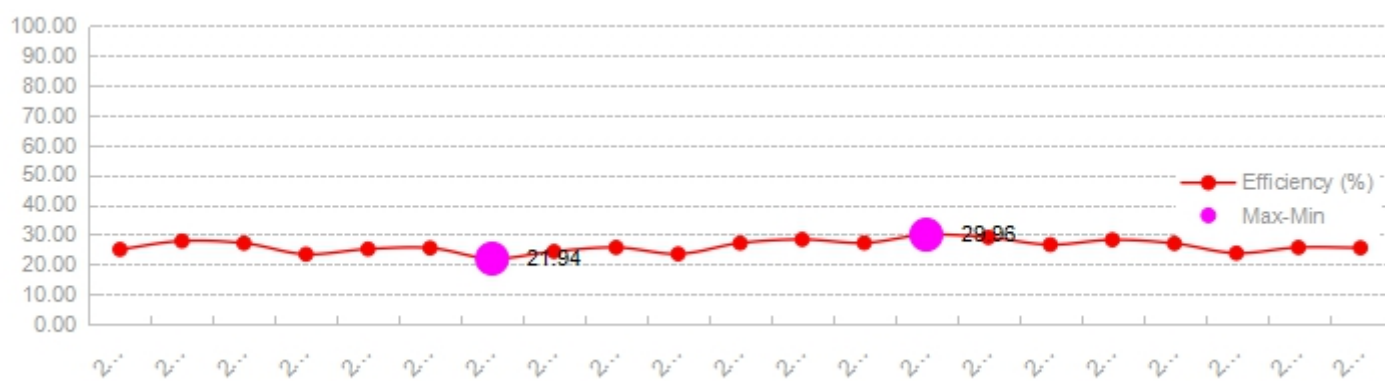
4 测试数据 Test data

4.1 天线效率 Antenna efficiency

在暗室中,使用 OTA 测试系统测试天线在各个频点的效率,测得结果如下 :

Use the OTA test system to test the antenna efficiency of different frequency. The result is as below:

Frequency (MHz)	2400.0	2405.0	2410.0	2415.0	2420.0	2425.0	2430.0
Efficiency (%)	25.02	27.84	27.11	23.42	25.16	25.50	21.94
Frequency (MHz)	2435.0	2440.0	2445.0	2450.0	2455.0	2460.0	2465.0
Efficiency (%)	24.33	25.69	23.52	27.16	28.37	27.22	29.96
Frequency (MHz)	2470.0	2475.0	2480.0	2485.0	2490.0	2495.0	2500.0
Efficiency (%)	29.05	26.64	28.24	27.03	23.77	25.68	25.57

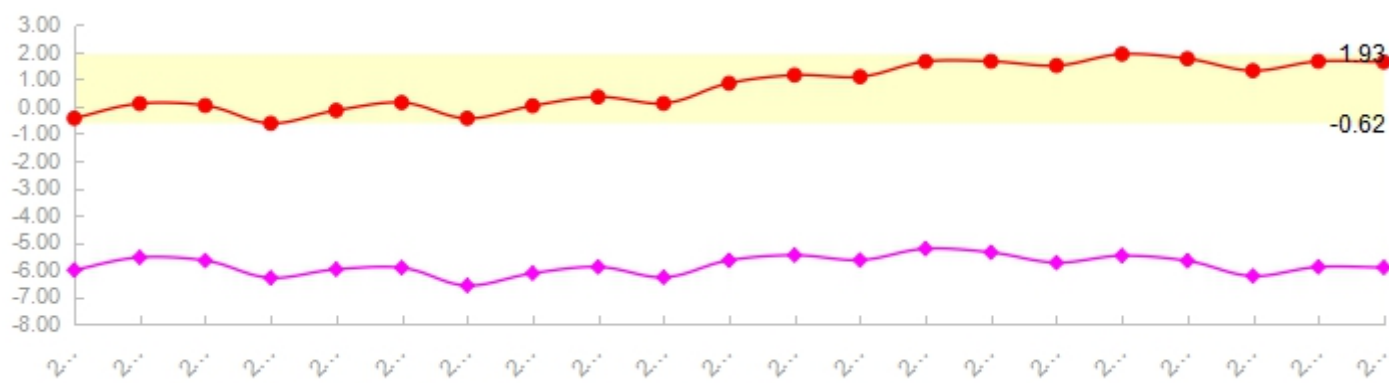


4.2 天线增益 Antenna Gain

在暗室中,使用 OTA 测试系统测试天线在各个频点的效率,测得结果如下。

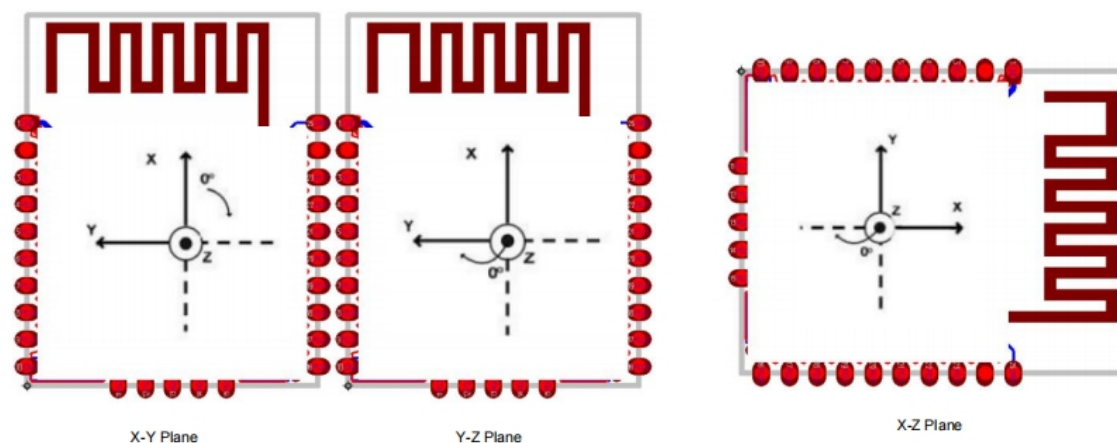
Use the OTA test system to test the antenna gain of different frequency. The result is as below:

Frequency (MHz)	2400.0	2405.0	2410.0	2415.0	2420.0	2425.0	2430.0
Gain (dBi)	-0.43	0.11	0.03	-0.62	-0.15	0.14	-0.44
Frequency (MHz)	2435.0	2440.0	2445.0	2450.0	2455.0	2460.0	2465.0
Gain (dBi)	0.02	0.35	0.11	0.85	1.15	1.09	1.65
Frequency (MHz)	2470.0	2475.0	2480.0	2485.0	2490.0	2495.0	2500.0
Gain (dBi)	1.66	1.50	1.93	1.76	1.32	1.66	1.64

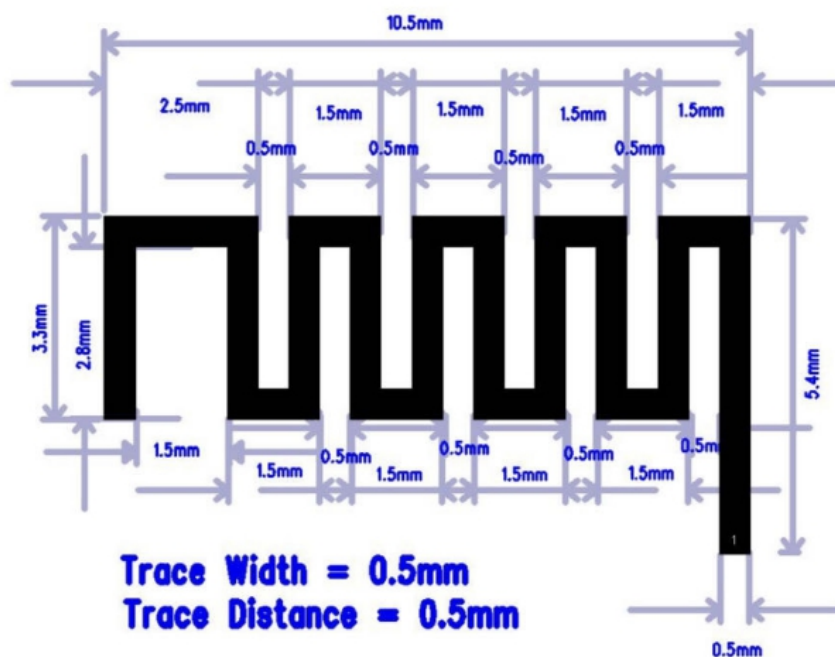


4.3 天线方向图 Antenna pattern

天线方向定义如下 The antenna direction is as follow figure:



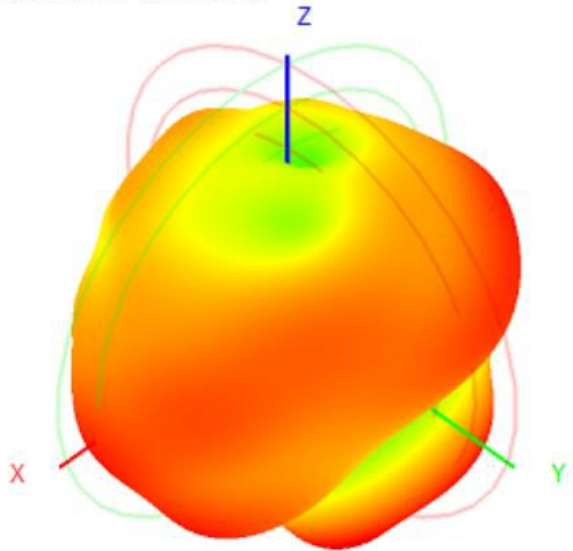
天线尺寸如下 The antenna size is as follow:



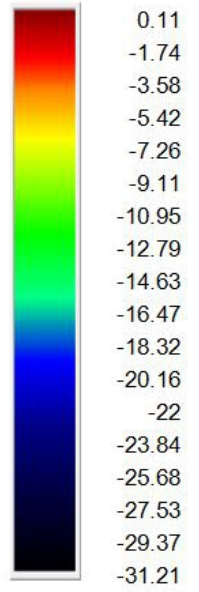
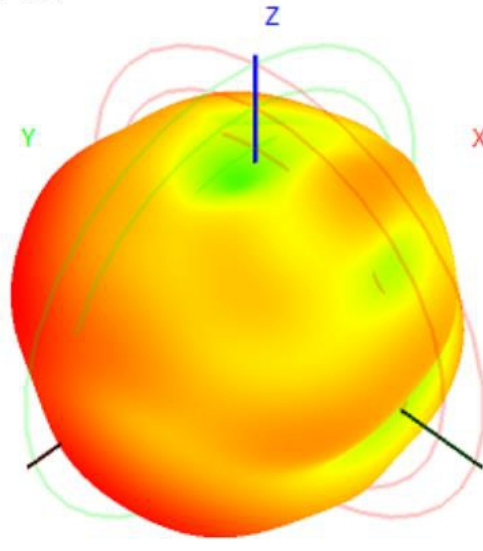
PCB 厚度 0.8mm±10%，板材 FR-4，介电常数=4.6，天线铜皮裸露，不盖绿油

立体方向图 3-D direction diagram@2405MHz:

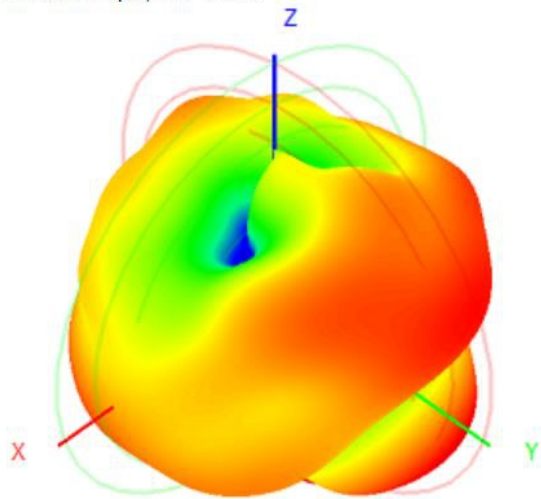
2405.0MHz H+V, Eff: 27.8%



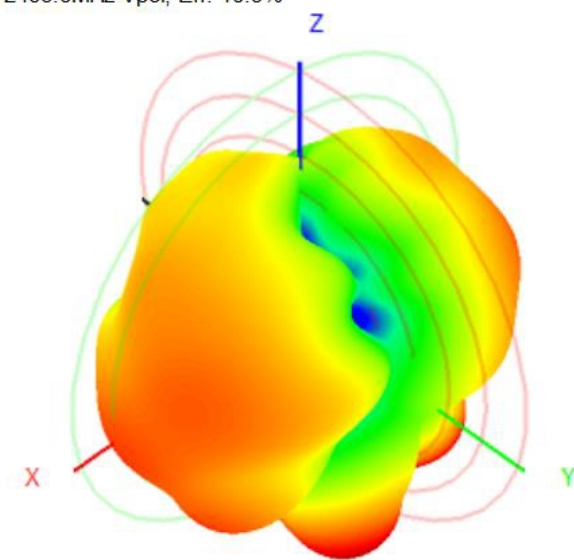
Back View



2405.0MHz Hpol, Eff: 16.9%

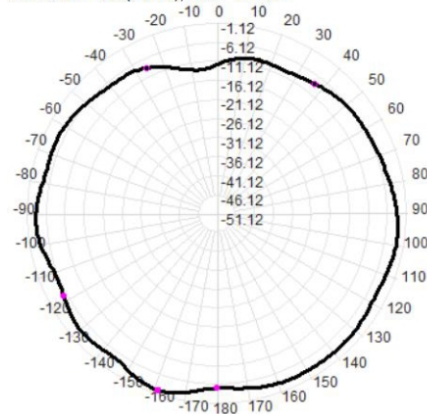


2405.0MHz Vpol, Eff: 10.9%

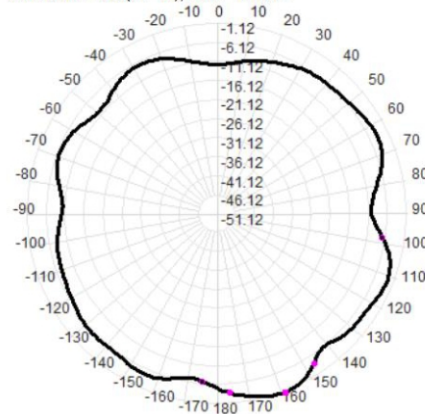


平面方向图 2-D direction diagram @2405MHz:

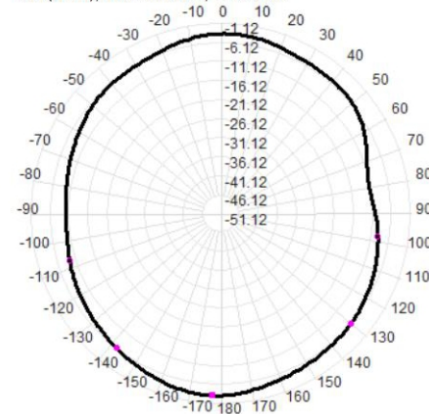
2405.0MHz Total(E1-XZ), Max= -2.44dBi



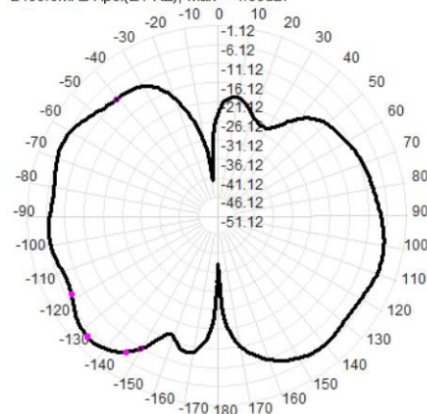
2405.0MHz Total(E2-YZ), Max= -1.12dBi



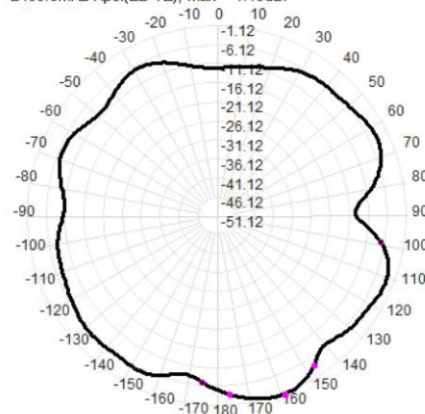
Total(H-XY), Max= -3.51dBi, CirD=8.03



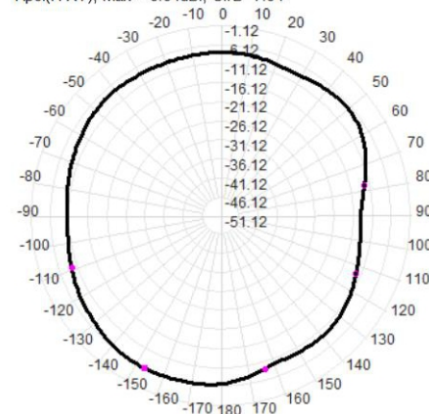
2405.0MHz Hpol(E1-XZ), Max= -4.65dBi



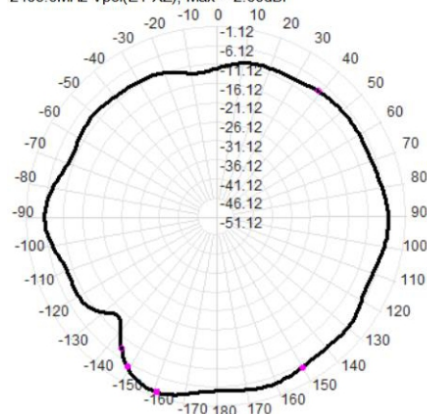
2405.0MHz Hpol(E2-YZ), Max= -1.19dBi



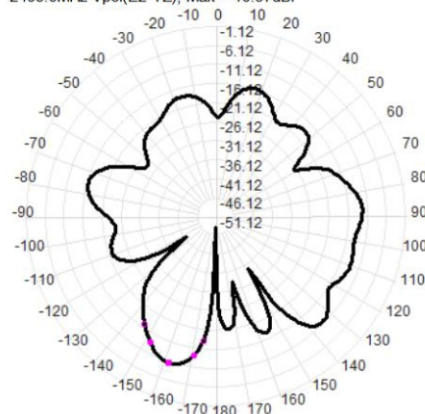
Hpol(H-XY), Max= -6.54dBi, CirD=7.94



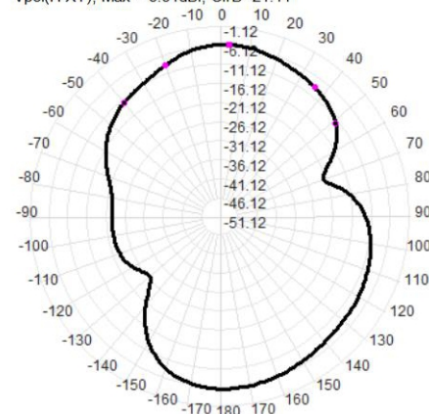
2405.0MHz Vpol(E1-XZ), Max= -2.60dBi



2405.0MHz Vpol(E2-YZ), Max= -10.97dBi

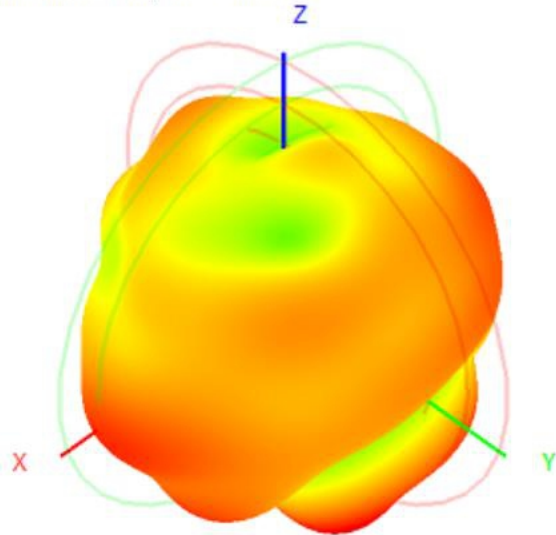


Vpol(H-XY), Max= -5.91dBi, CirD=21.11

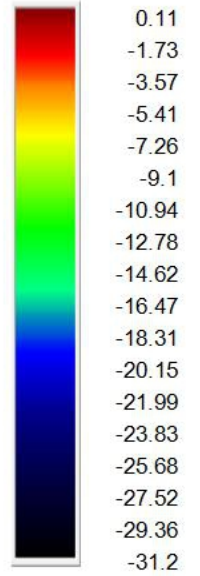
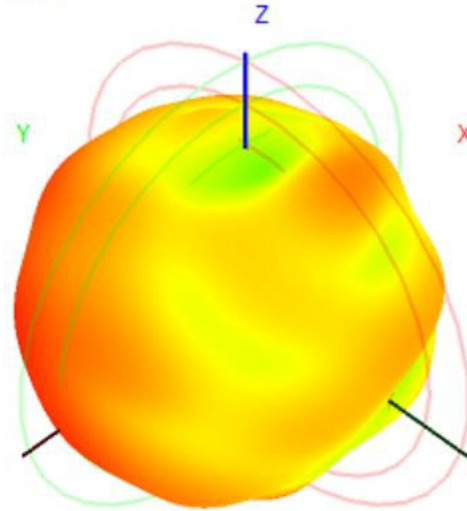


立体方向图 3-D direction diagram@2445MHz:

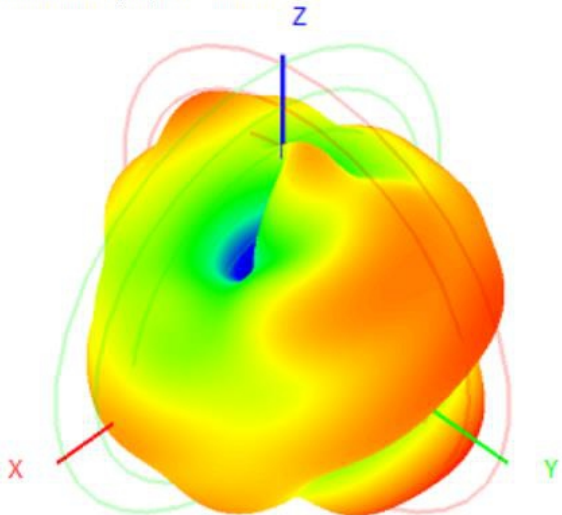
2445.0MHz H+V, Eff: 23.5%



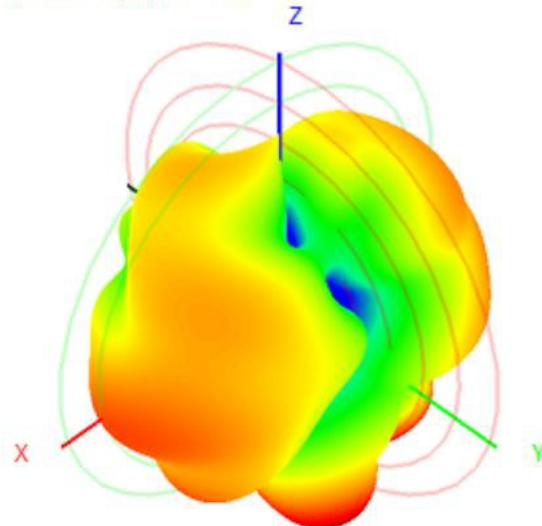
Back View



2445.0MHz Hpol, Eff: 14.4%

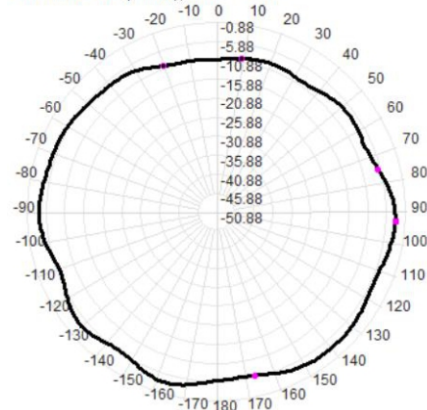


2445.0MHz Vpol, Eff: 9.1%

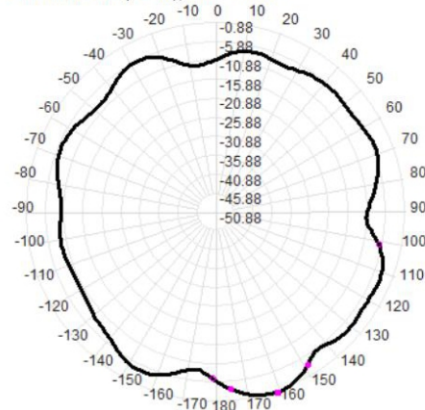


平面方向图 2-D direction diagram @2445MHz:

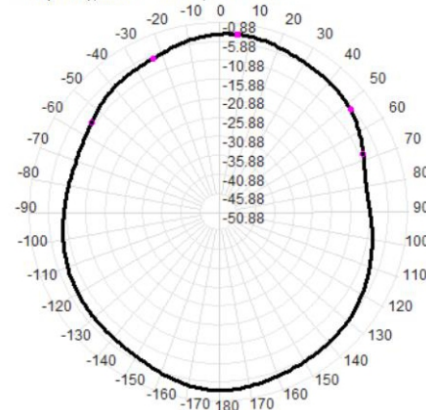
2445.0MHz Total(E1-XZ), Max= -3.89dBi



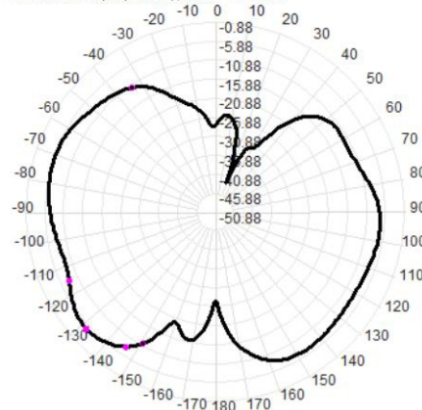
2445.0MHz Total(E2-YZ), Max= -0.88dBi



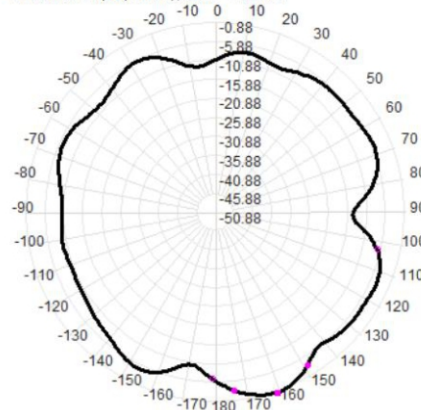
Total(H-XY), Max= -3.84dBi, CirD=7.72



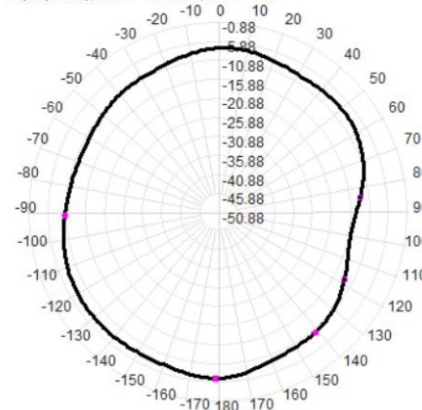
2445.0MHz Hpol(E1-XZ), Max= -5.23dBi



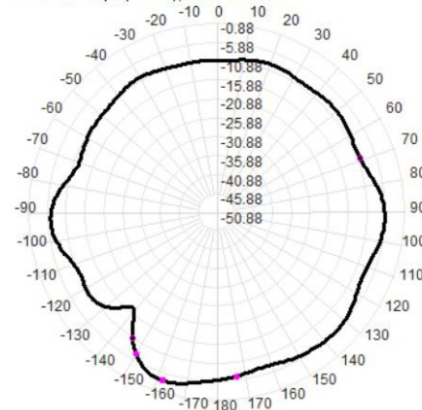
2445.0MHz Hpol(E2-YZ), Max= -0.90dBi



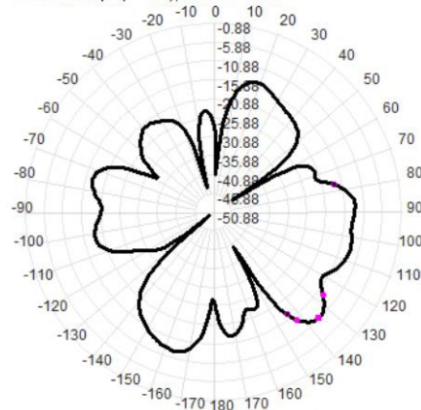
Hpol(H-XY), Max= -7.32dBi, CirD=8.32



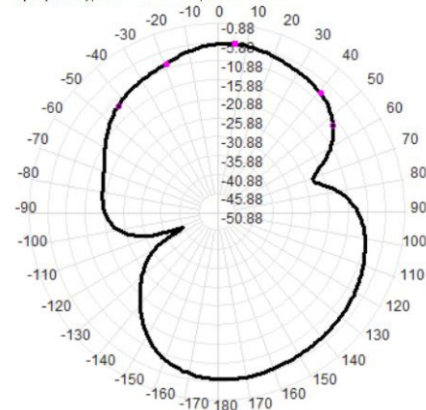
2445.0MHz Vpol(E1-XZ), Max= -4.32dBi



2445.0MHz Vpol(E2-YZ), Max= -11.56dBi

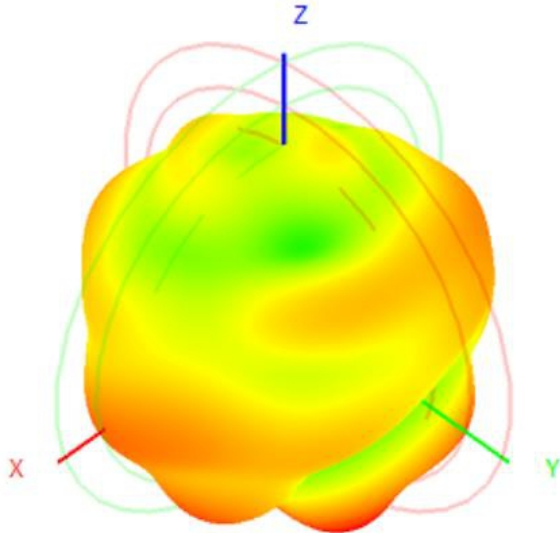


Vpol(H-XY), Max= -6.22dBi, CirD=34.90

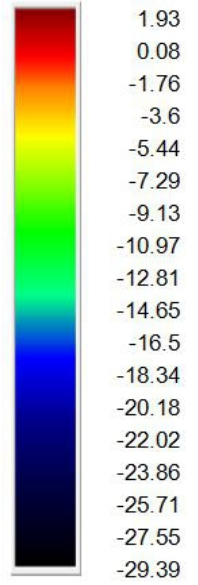
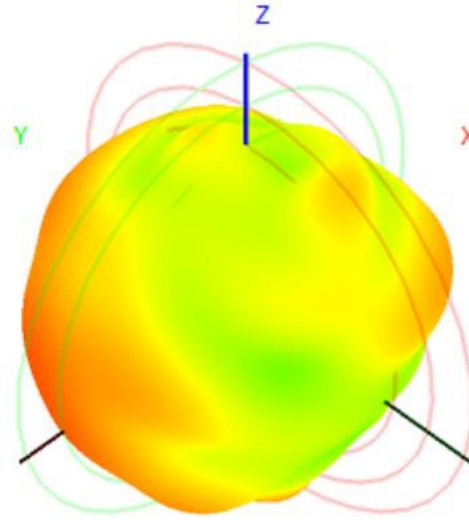


立体方向图 3-D direction diagram@2480MHz:

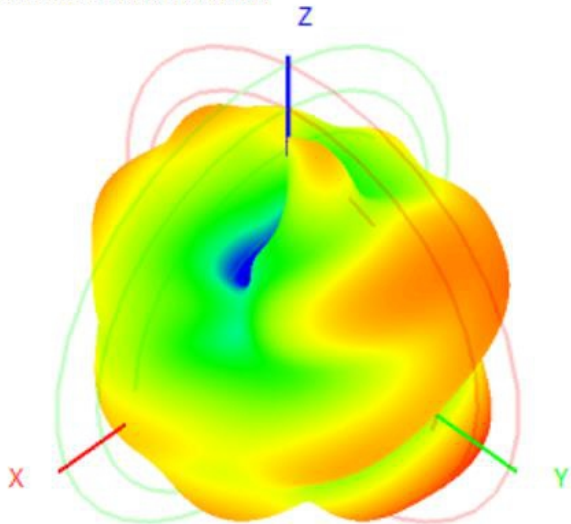
2480.0MHz H+V, Eff: 28.2%



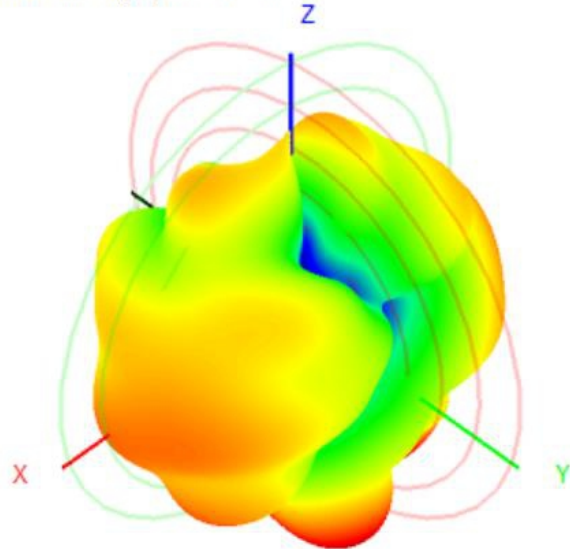
Back View



2480.0MHz Hpol, Eff: 16.8%

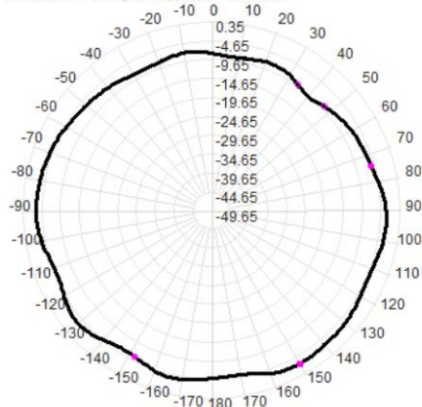


2480.0MHz Vpol, Eff: 11.5%

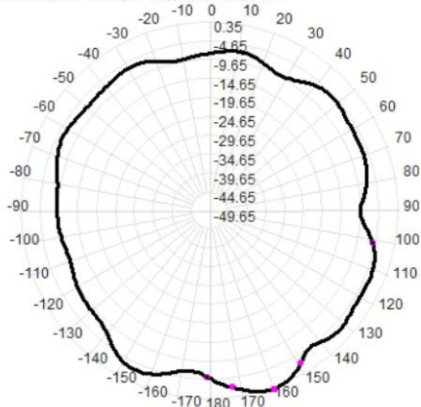


平面方向图 2-D direction diagram @2480MHz:

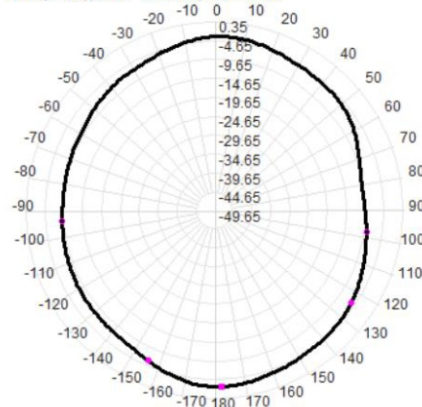
2480.0MHz Total(E1-XZ), Max= -3.02dBi



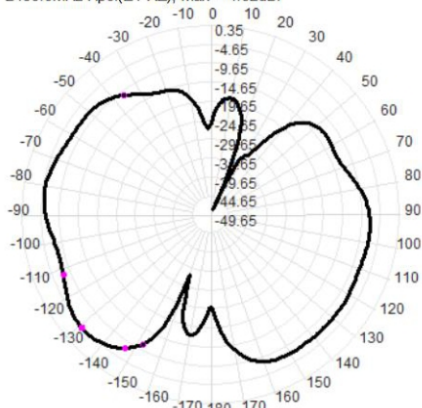
2480.0MHz Total(E2-YZ), Max= 0.35dBi



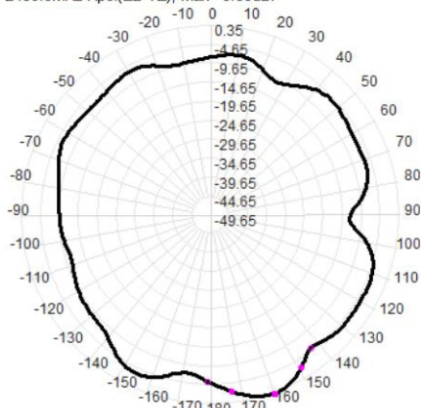
Total(H-XY), Max= -3.20dBi, CirD=7.10



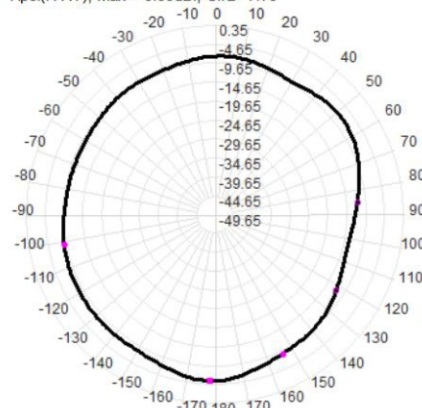
2480.0MHz Hpo(E1-XZ), Max= -4.52dBi



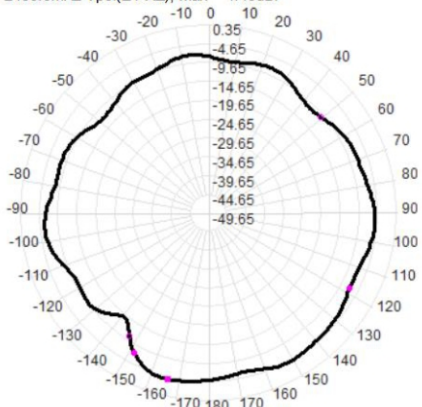
2480.0MHz Hpo(E2-YZ), Max= 0.30dBi



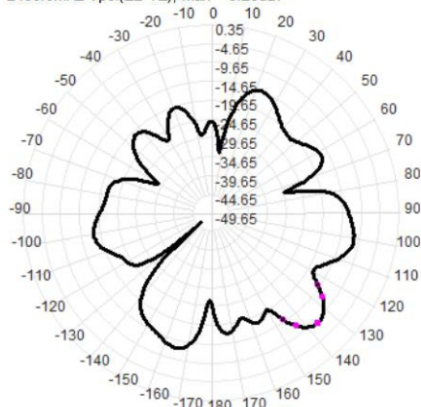
Hpo(H-XY), Max= -5.99dBi, CirD=7.79



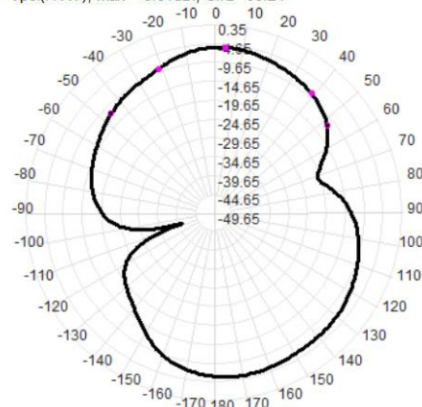
2480.0MHz Vpol(E1-XZ), Max= -4.40dBi



2480.0MHz Vpol(E2-YZ), Max= -9.23dBi



Vpol(H-XY), Max= -5.61dBi, CirD=35.24



5 总结 Conclusion

天线增益最大约 1.93dBi, 天线效率最高约29.96% , 方向图基本平稳, 符合板载天线设计要求。

The max gain is 1.93dBi, the max efficiency is 29.96%, the antenna pattern is basically stable. It meets PCB antenna design.

测试项	最大值	最小值
效率 (%)	29.96	21.94
增益 (dBi)	1.93	-0.62

6 联系方式 Contact Information

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