2.4 GHz Bluetooth PCB antenna Specification

By KKM

1 KEYWORDS

- *HE02*
- *Name: 2.4 GHz Bluetooth PCB antenna*

2 INTRODUCTION

The PCB antenna used on the HE02 reference design is described in this application note.

This application note describes the antenna dimensions, the RF performance and considerations for complying with regulatory limits when using this design.

The antenna design requires no more than 15.2 x 5.7 mm of space and ensures a VSWR ratio of less than 2 across the 2.4 GHz ISM band when connected to a 50 ohm source.

Figure 1: HE02

Manufacturer: KKM Company Limited
Address: 3CDE, Building6, Baoneng Science& Technology Park, Qingxiang Rd, Longhua Street, Longhua District, Shenzhen City, Guangdong Province, China

3 Testing Conditions

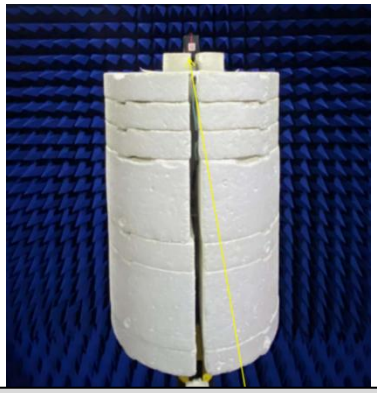


Figure 2:Testing environment

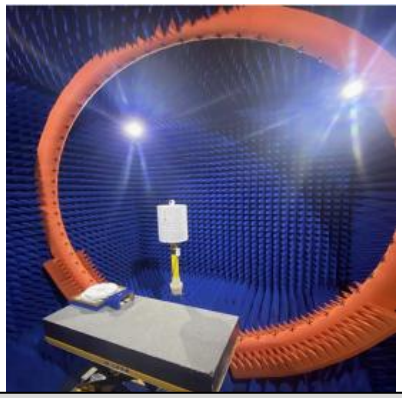


Figure 3:Testing 3D microwave darkroom(6m*6m*6m)

Product Testing Conditions

Parameters	Value
Working Temp	-30℃ ~ +60℃

3.1 Layout and Implementation

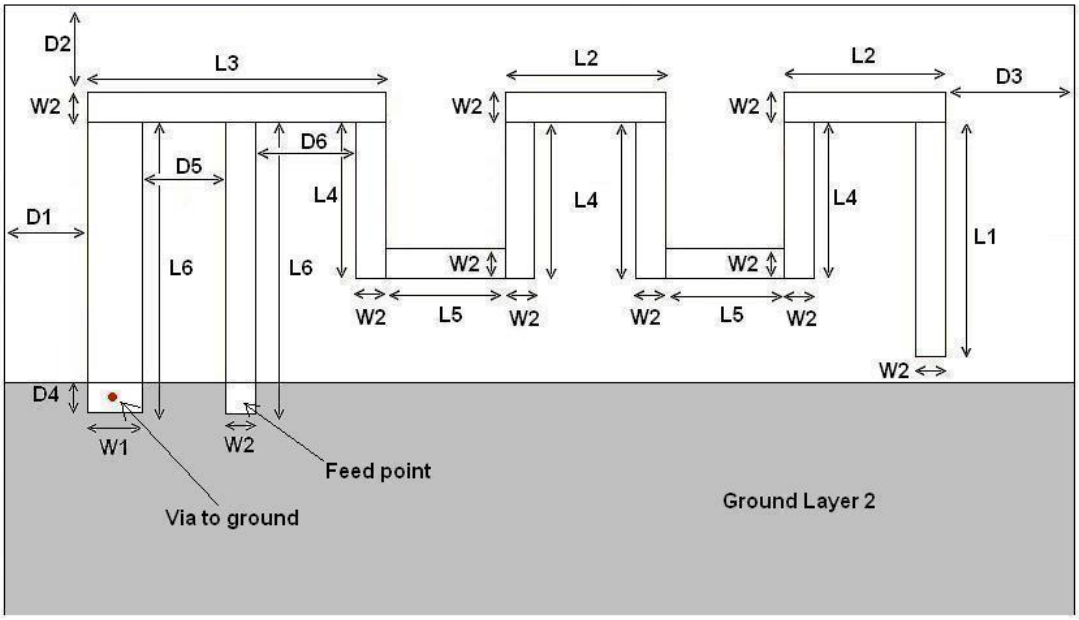
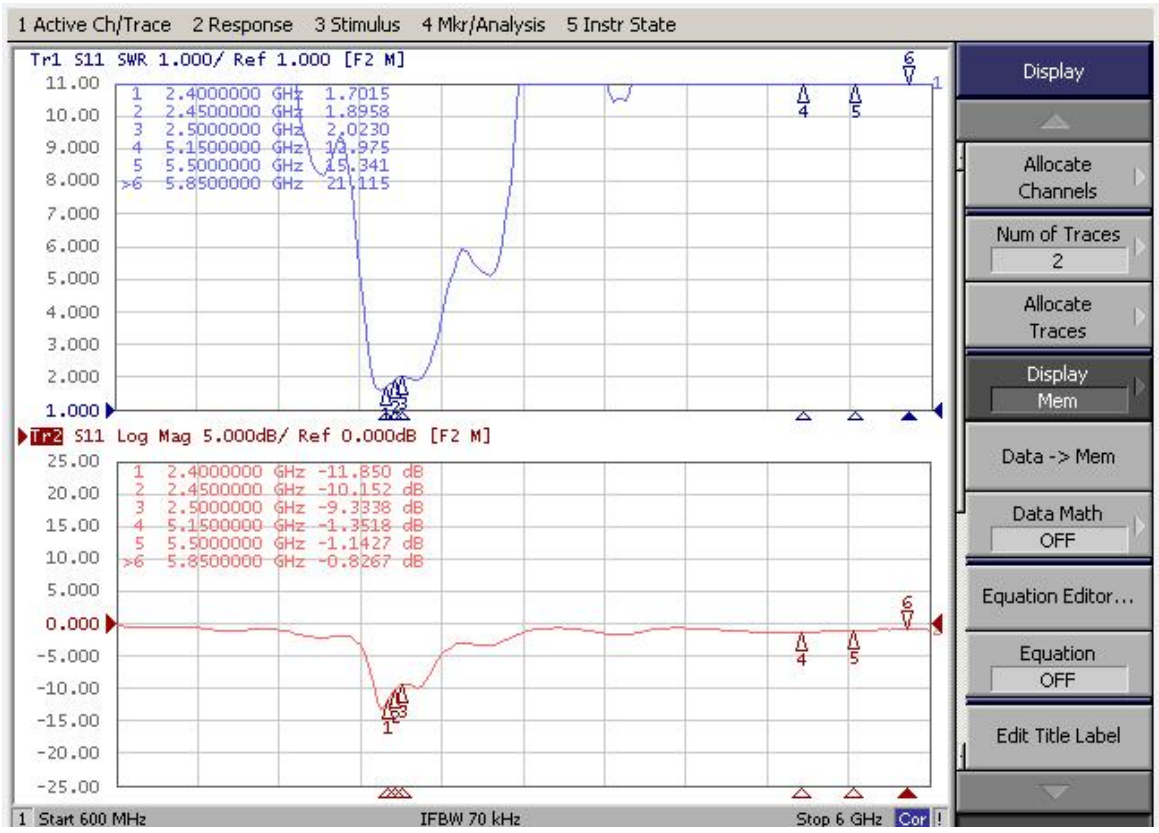


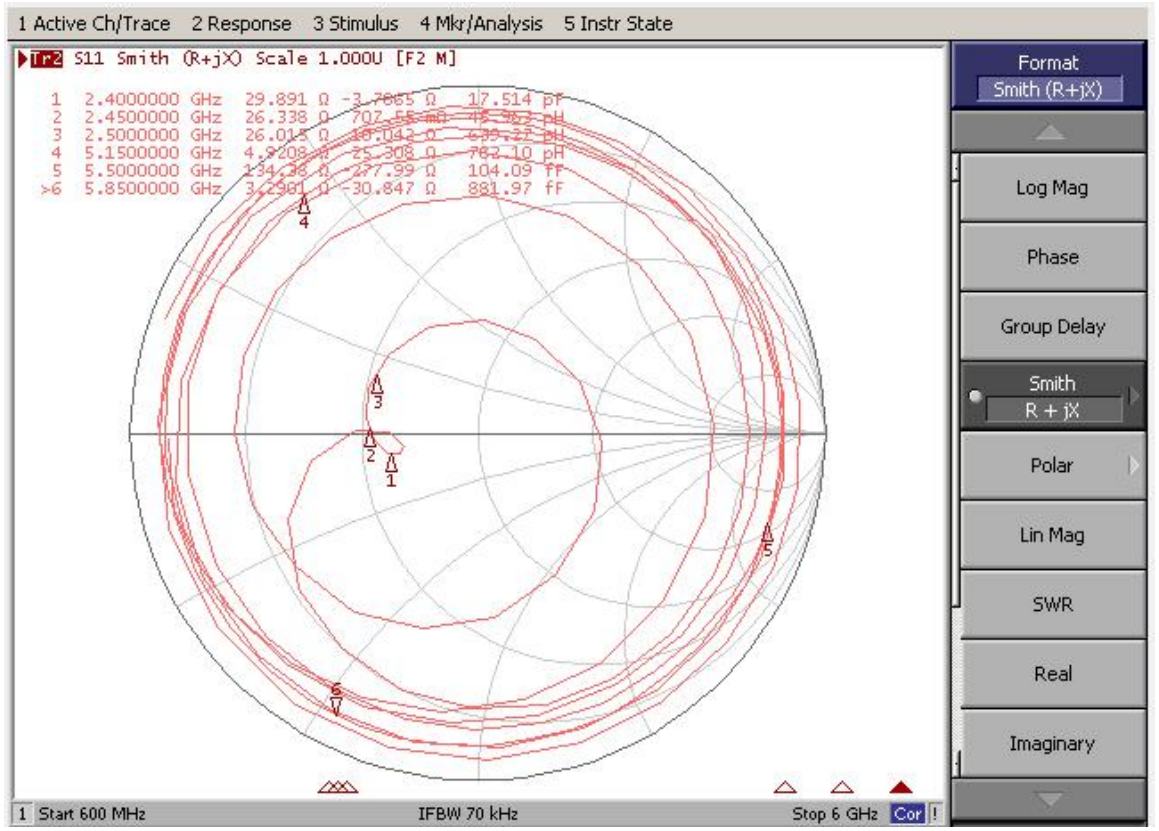
Figure 4: Antenna Dimensions

L1	3.94 mm
L2	2.70 mm
L3	5.00 mm
L4	2.64 mm
L5	2.00 mm
L6	4.90 mm
W1	0.90 mm
W2	0.50 mm
D1	0.50 mm
D2	0.30 mm
D3	0.30 mm
D4	0.50 mm
D5	1.40mm
D6	1.70 mm

Table 1: Antenna Dimensions

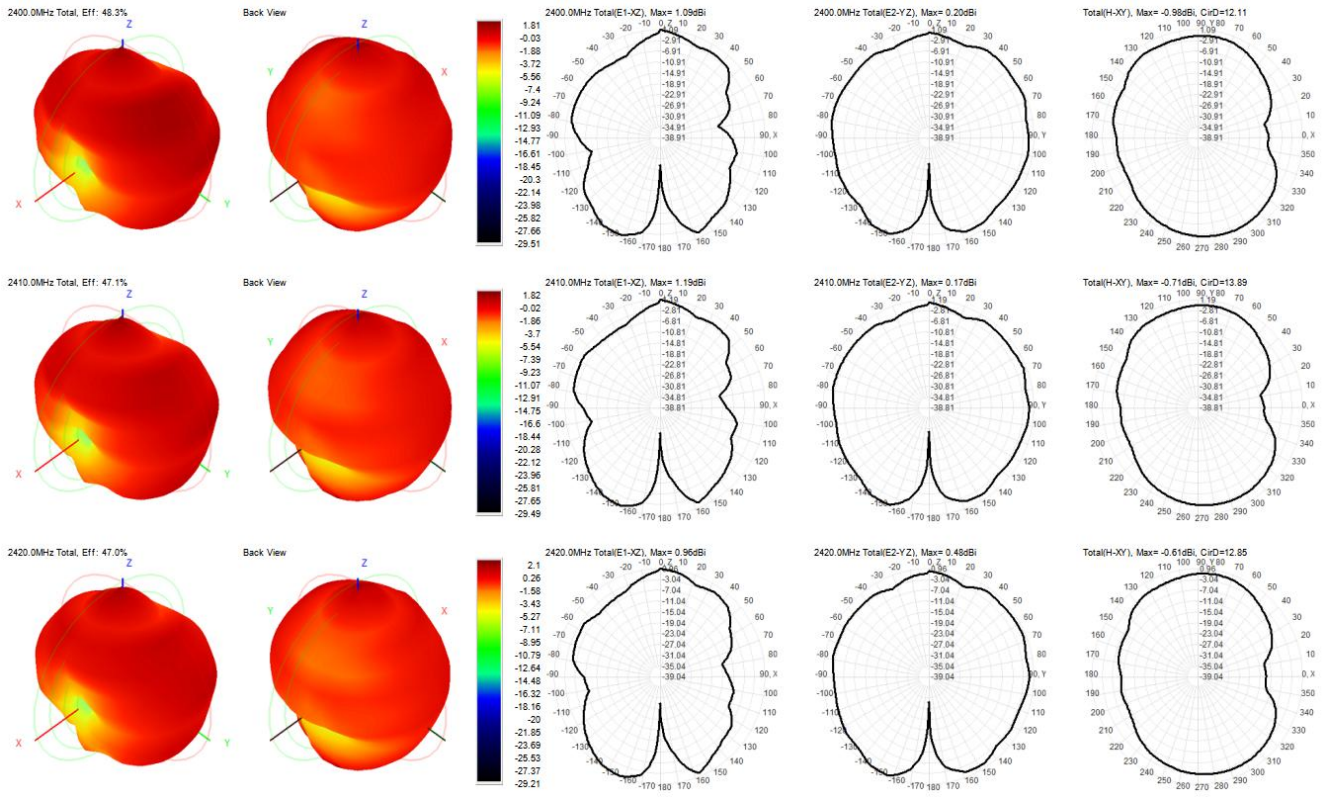
4 S Parameter_Return Loss&VSWR - Smith





5 Efficiency and Gain

Frequency ID	1	2	3	4	5	6	7	8	9	10	11
Frequency (MHz)	2400.0	2410.0	2420.0	2430.0	2440.0	2450.0	2460.0	2470.0	2480.0	2490.0	2500.0
Gain (dBi)	1.81	1.82	2.10	2.24	1.82	1.67	2.09	2.27	2.23	2.53	2.51
Efficiency (%)	48.27	47.10	46.98	47.49	46.99	46.48	45.89	46.60	46.91	46.51	46.35



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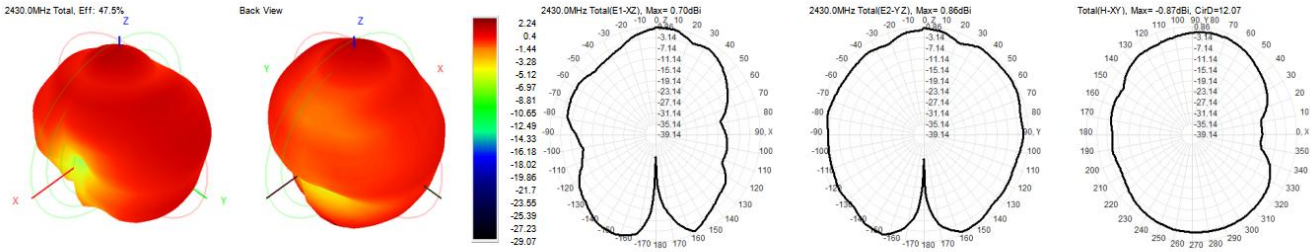
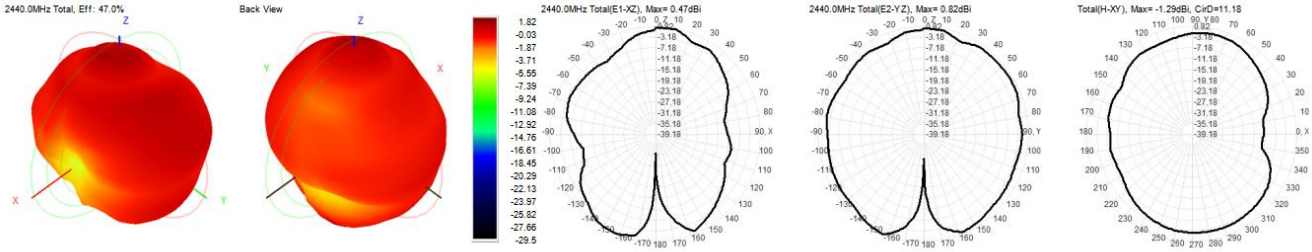
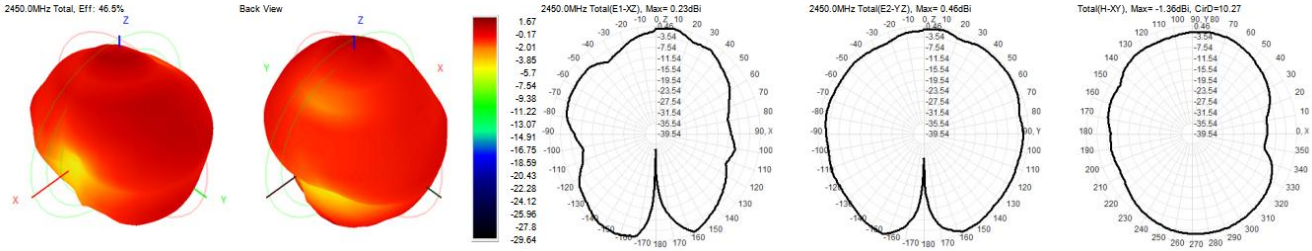
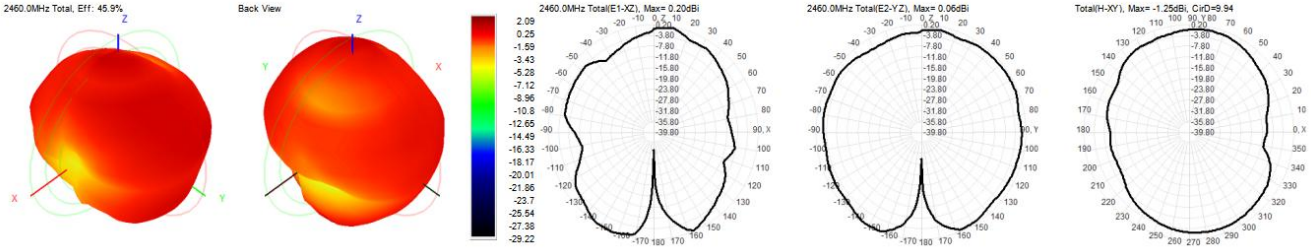
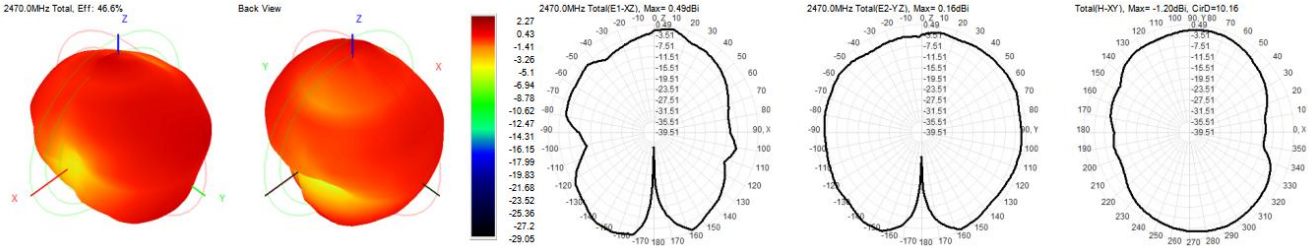
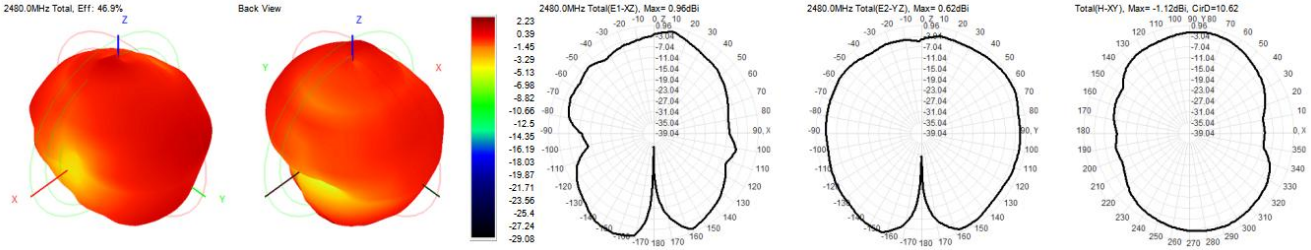

2430.0MHz Total, Eff: 47.5%
Back View
2430.0MHz Total(E1-XZ), Max= 0.70dBi
2430.0MHz Total(E2-YZ), Max= 0.86dBi
Total(H-XY), Max= -0.87dBi, CirD=12.07


2440.0MHz Total, Eff: 47.0%
Back View
2440.0MHz Total(E1-XZ), Max= 0.47dBi
2440.0MHz Total(E2-YZ), Max= 0.82dBi
Total(H-XY), Max= -1.29dBi, CirD=11.18


2450.0MHz Total, Eff: 46.5%
Back View
2450.0MHz Total(E1-XZ), Max= 0.23dBi
2450.0MHz Total(E2-YZ), Max= 0.46dBi
Total(H-XY), Max= -1.36dBi, CirD=10.27


2460.0MHz Total, Eff: 45.9%
Back View
2460.0MHz Total(E1-XZ), Max= 0.20dBi
2460.0MHz Total(E2-YZ), Max= 0.06dBi
Total(H-XY), Max= -1.25dBi, CirD=9.94


2470.0MHz Total, Eff: 46.6%
Back View
2470.0MHz Total(E1-XZ), Max= 0.49dBi
2470.0MHz Total(E2-YZ), Max= 0.16dBi
Total(H-XY), Max= -1.20dBi, CirD=10.16


2480.0MHz Total, Eff: 46.9%
Back View
2480.0MHz Total(E1-XZ), Max= 0.96dBi
2480.0MHz Total(E2-YZ), Max= 0.62dBi
Total(H-XY), Max= -1.12dBi, CirD=10.62

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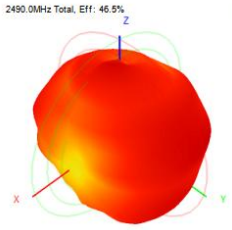
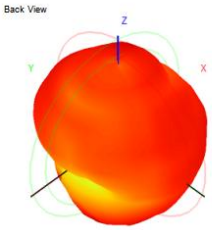
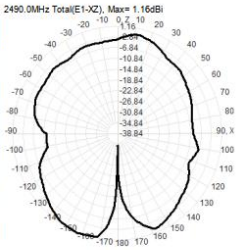
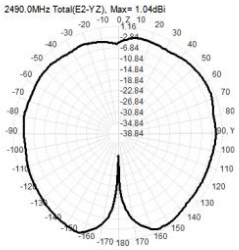
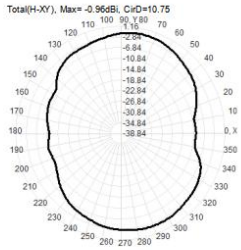

2490.0MHz Total, Eff: 46.5%
Z
X
Y

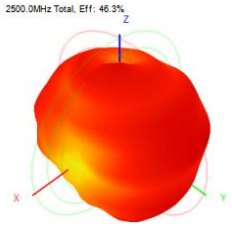

Back View
Z
Y
X

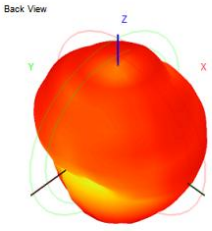

2.53
0.69
-1.15
-2.99
-4.84
-6.68
-8.52
-10.36
-12.2
-14.05
-15.89
-17.73
-19.57
-21.41
-23.26
-25.1
-26.94
-28.78


2490.0MHz Total(E1-XZ), Max= 1.16dBi

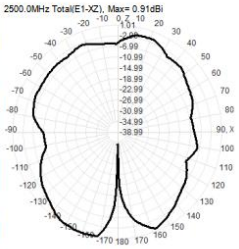

2490.0MHz Total(E2-YZ), Max= 1.04dBi

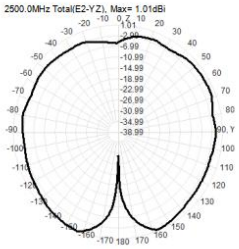

Total(H-XY), Max= -0.96dBi, CirD=10.75

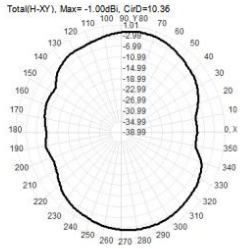

2500.0MHz Total, Eff: 46.3%
Z
X
Y

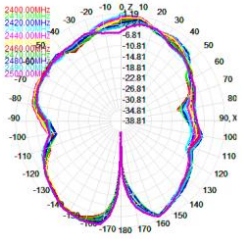

Back View
Z
Y
X

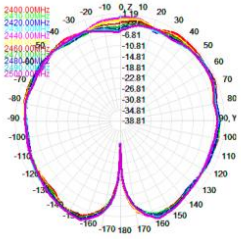

2.51
0.67
-1.17
-3.01
-4.86
-6.7
-8.54
-10.38
-12.22
-14.07
-15.91
-17.75
-19.59
-21.43
-23.28
-25.12
-26.96
-28.8

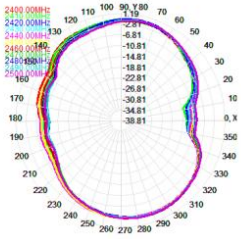

2500.0MHz Total(E1-XZ), Max= 0.91dBi


2500.0MHz Total(E2-YZ), Max= 1.01dBi


Total(H-XY), Max= -1.00dBi, CirD=10.36


2400.00MHz
2420.00MHz
2440.00MHz
2460.00MHz
2480.00MHz
2500.00MHz


2400.00MHz
2420.00MHz
2440.00MHz
2460.00MHz
2480.00MHz
2500.00MHz


2400.00MHz
2420.00MHz
2440.00MHz
2460.00MHz
2480.00MHz
2500.00MHz