

Yuande Electronics (Shenzhen) Co., Ltd

Sample Approval Sheet

Product Information:

Customer	Zhong Shan City Richsound Electronic Industrial Ltd
Material Description	Harwood WIFI-L Antenna
Customer's Part number	
Specifications	Harwood WIFI-L Antenna: FPC (L45.2*W12.2mm) +Black Coaxial Cable (ϕ 1.13*53mm) +Welding+UV adhesive
Supplier's Part number	136-HARWD-10A
Date	2022-03-11

Supplier:

Prepared By	Checked By	Approved By
Zhang Dengqiao	Chen Yanmin	Zhang Xiangting

Customer Approval:

Accepted By	Checked By	Approved By

Results:

- Full Approval
- Conditional Approval
- Unqualified
- Others:

This sample approval sheet is guaranteed to be true. If it is confirmed by your R&D department, please send it back to us as soon as possible. If there are other reasons, please inform us in writing.

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1、Specification

This report mainly provides the testing status of various electrical and structural performance parameters of Harwood Wifi-L Antenna.

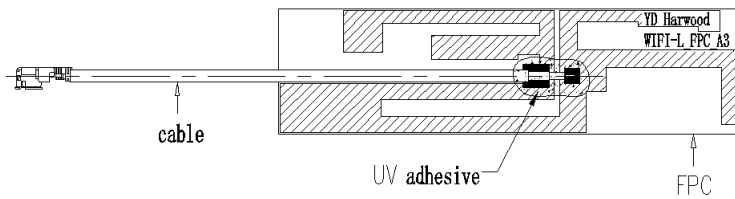


Figure 1 Antenna

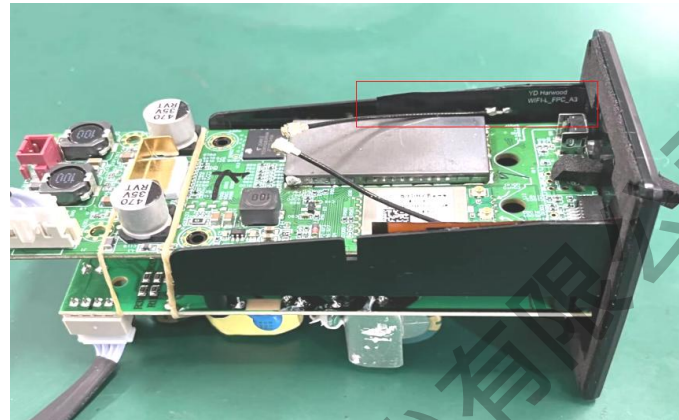


Figure 2 Antenna Placement

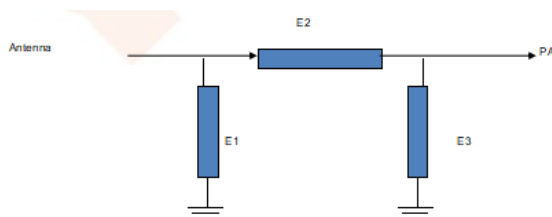
1.1 Electrical specification standard

1.1.1 Electrical Specifications

The antenna operates in the 2400-5850 MHz. The following table is the electrical performance index of the antenna designed by our company.

Antenna	Harwood WIFI-L Antenna
Frequency Range	2400-5850MHz
VSWR	<3
Efficiency	> 40%
Impedance	50 ohm
Polarization	Linear polarization

1.1.2 Antenna Matching Network



Element	Value
E1(0402)	N/A
E2(0402)	0R
E3(0402)	N/A

Schematic diagram of matching circuit modification

2、 Test

The antenna was debugged and tested with the prototype provided by the customer.

2.1 Test of passive S11

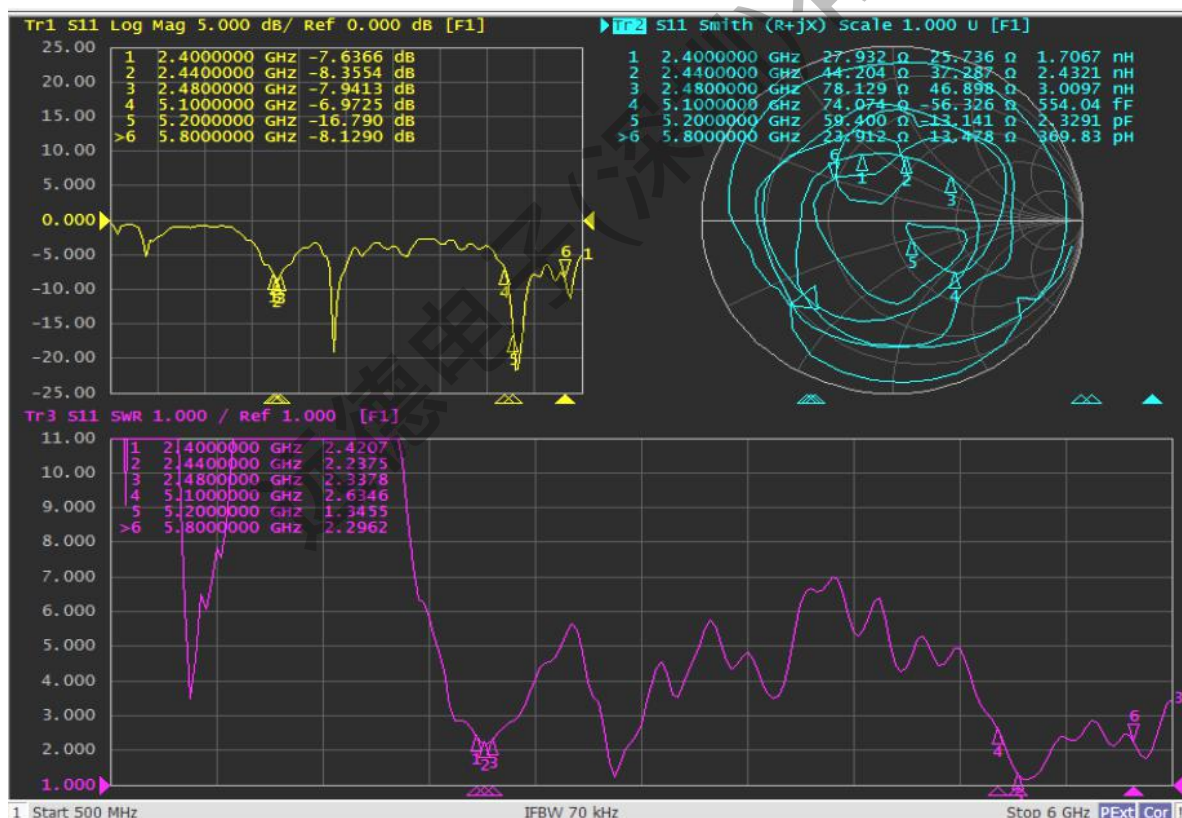
2.1.1 Test connection

The passive S11 test device is connected as follows: Network Analyzer → Test Line → Test Fixture.

2.1.2 Passive S11

The following table shows the standing wave ratio values of the edge frequency points of the antenna operating frequency band. The waveform of Return Loss and VSWR obtained by the test is shown as follows.

Harwood WIFI-L Antenna S11						
Frequency (MHz)	2400	2440	2480	5100	5200	5800
VSWR	2.42	2.23	2.33	2.63	1.34	2.29
Return Loss	-7.63	-8.35	-7.94	-6.97	-16.79	-8.12



2.2 Gain and efficiency test

2.2.1 Test Position

Yuande microwave anechoic chamber, the test frequency range is 400MHz-6GHz.

2.2.2 Test equipment

Network analyzer, standard horn antenna, multi-probe near field antenna test system, test computer, etc

2.2.3 Results Summary

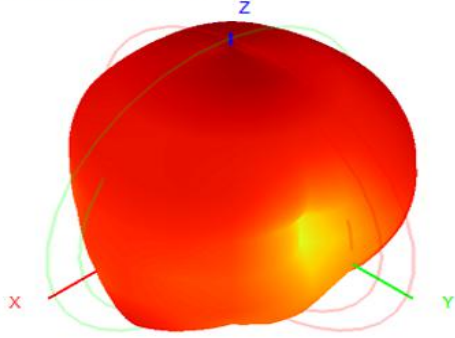
In the microwave anechoic chamber, the measured values related to efficiency and gain are shown in the table below.

Frequency(MHz)	Efficiency(%)	Efficiency(dB)	Gain(dBi)
2400	41.96%	-4.09	1.02
2410	42.58%	-3.71	1.40
2420	45.71%	-3.40	1.58
2430	49.73%	-3.03	1.80
2440	52.43%	-2.80	1.93
2450	53.55%	-2.55	2.16
2460	52.13%	-2.28	2.45
2470	51.03%	-2.14	2.69
2480	52.54%	-1.97	2.99

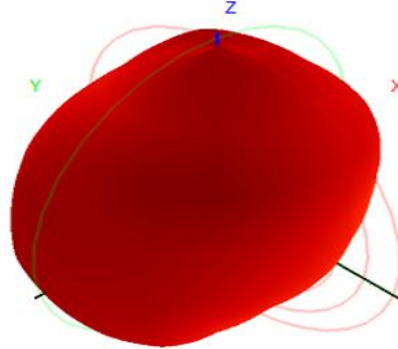
Frequency(MHz)	Efficiency(%)	Efficiency(dB)	Gain(dBi)
5150	56.75%	-2.09	2.56
5200	55.04%	-2.22	2.25
5250	57.82%	-2.02	2.35
5300	57.65%	-1.96	2.79
5350	58.31%	-1.92	2.44
5400	56.74%	-2.17	2.53
5450	57.12%	-2.43	2.10
5500	53.89%	-2.68	1.97
5550	49.22%	-3.08	1.87
5600	45.67%	-3.40	2.02
5650	46.40%	-3.33	2.13
5700	44.17%	-3.55	2.68
5750	44.20%	-3.55	2.47
5800	45.74%	-3.40	2.34
5850	46.26%	-3.35	2.08

2.2.4 Radiation Pattern Results

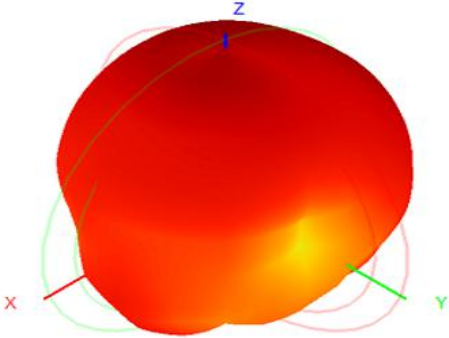
2400.0MHz H+V, Eff. 42.0%



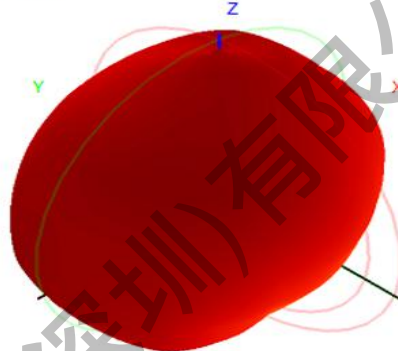
Back View



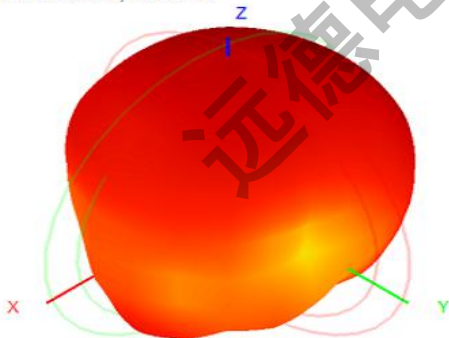
2440.0MHz H+V, Eff. 52.4%



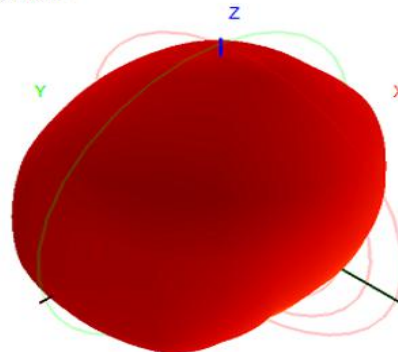
Back View



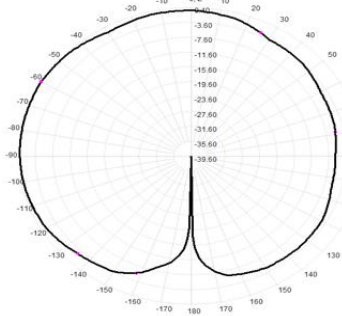
2480.0MHz H+V, Eff. 52.5%



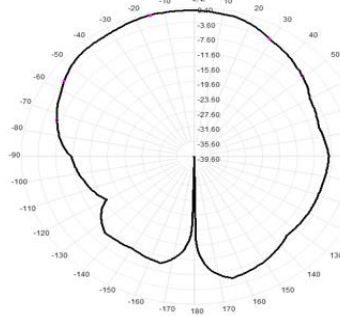
Back View



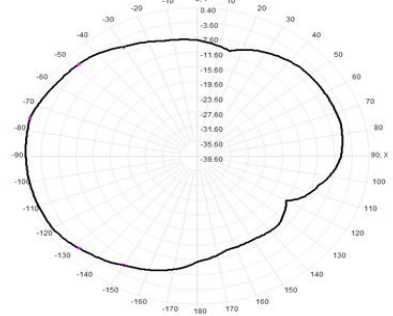
2400.0MHz Total(E1-XZ), Max= 0.40dBi



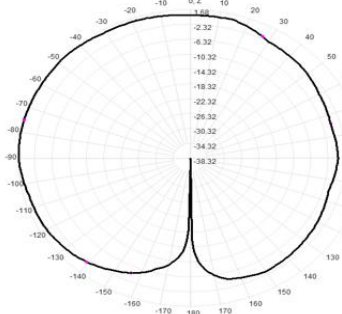
2400.0MHz Total(E2-YZ), Max= -0.33dBi



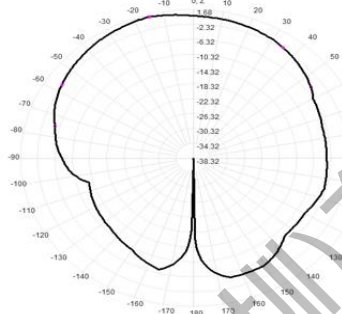
Total(H-XY), Max= 0.35dBi, CirD=16.12



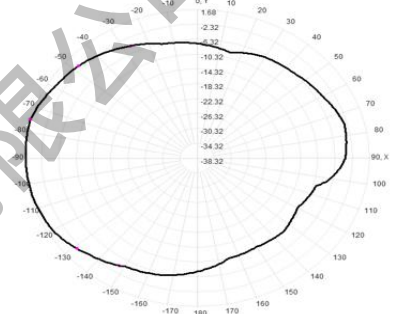
2440.0MHz Total(E1-XZ), Max= 1.49dBi



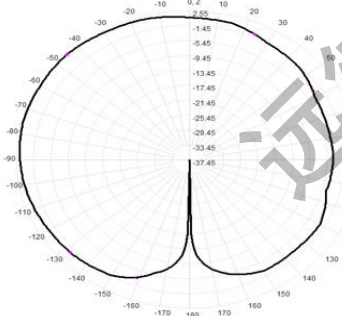
2440.0MHz Total(E2-YZ), Max= 1.03dBi



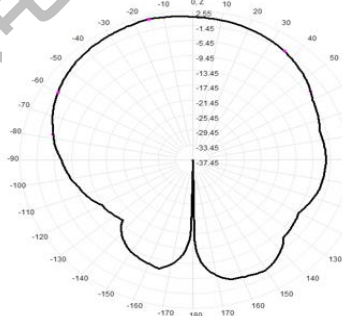
Total(H-XY), Max= 1.68dBi, CirD=13.31



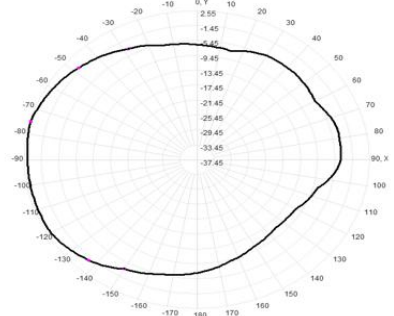
2480.0MHz Total(E1-XZ), Max= 2.55dBi



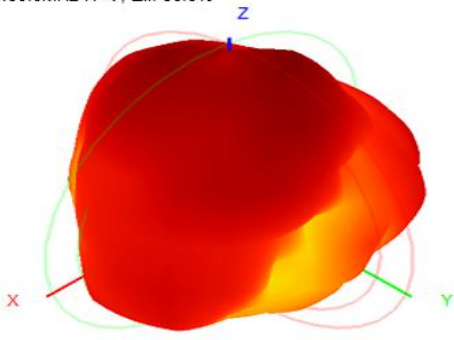
2480.0MHz Total(E2-YZ), Max= 1.60dBi



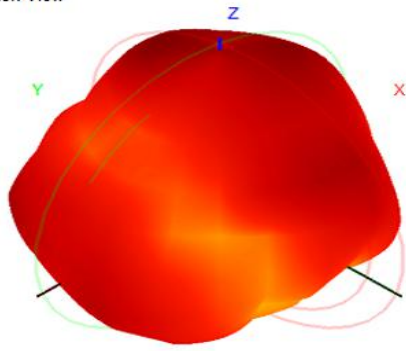
Total(H-XY), Max= 2.39dBi, CirD=14.08



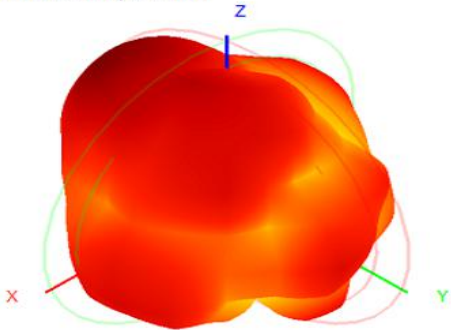
5150.0MHz H+V, Eff. 56.8%



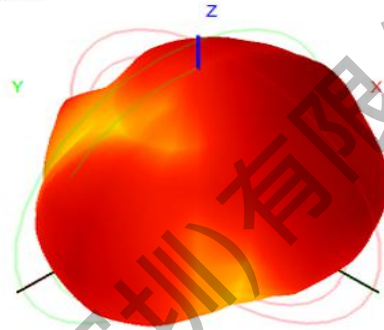
Back View



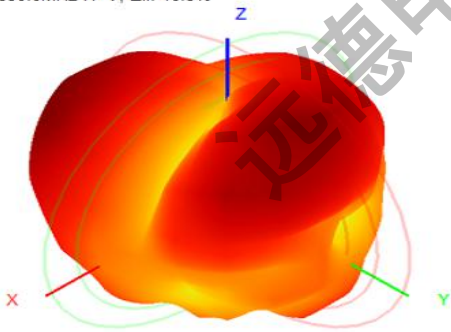
5450.0MHz H+V, Eff. 57.1%



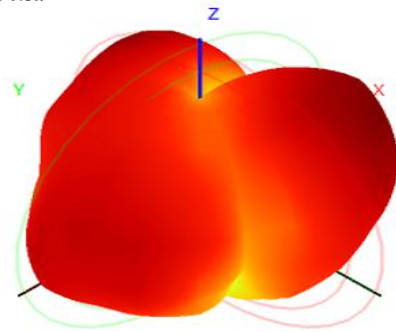
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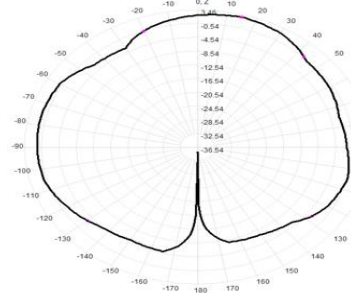
5850.0MHz H+V, Eff. 46.3%



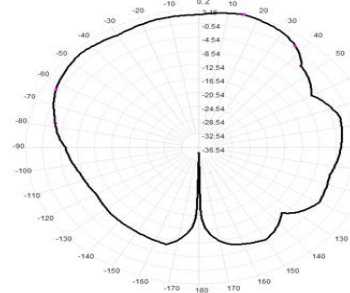
Back View



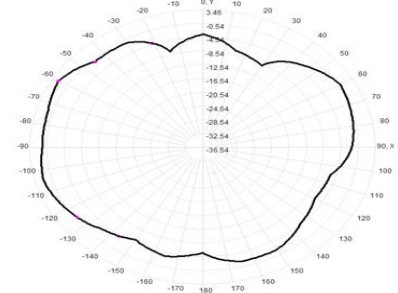
5150.0MHz Total(E1-XZ), Max= 2.67dBi



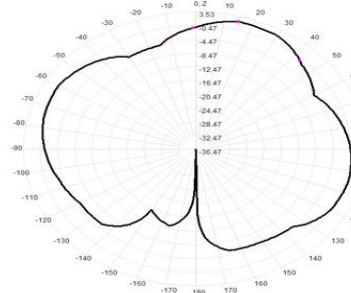
5150.0MHz Total(E2-YZ), Max= 3.46dBi



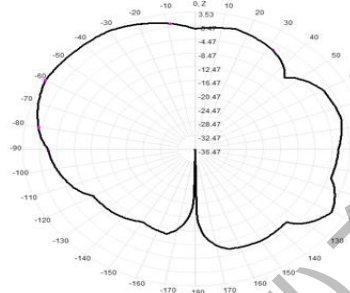
Total(H-XY), Max= 1.89dBi, CirD=11.03



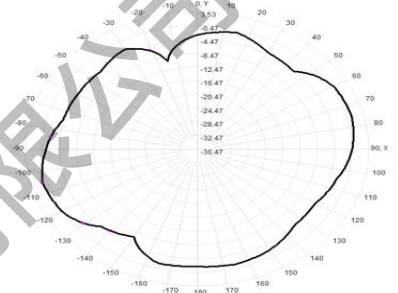
5450.0MHz Total(E1-XZ), Max= 1.96dBi



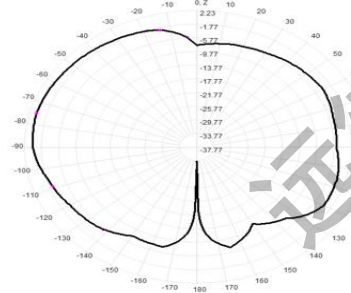
5450.0MHz Total(E2-YZ), Max= 3.53dBi



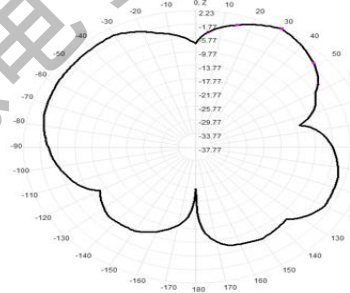
Total(H-XY), Max= 0.65dBi, CirD=10.60



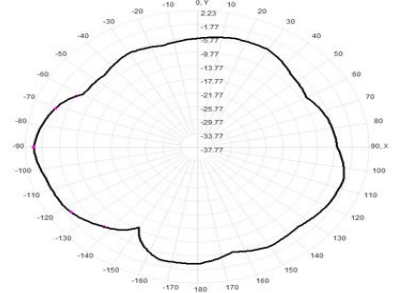
5850.0MHz Total(E1-XZ), Max= 0.64dBi



5850.0MHz Total(E2-YZ), Max= 2.23dBi



Total(H-XY), Max= 0.26dBi, CirD=10.96



迈德电子(深圳)有限公司

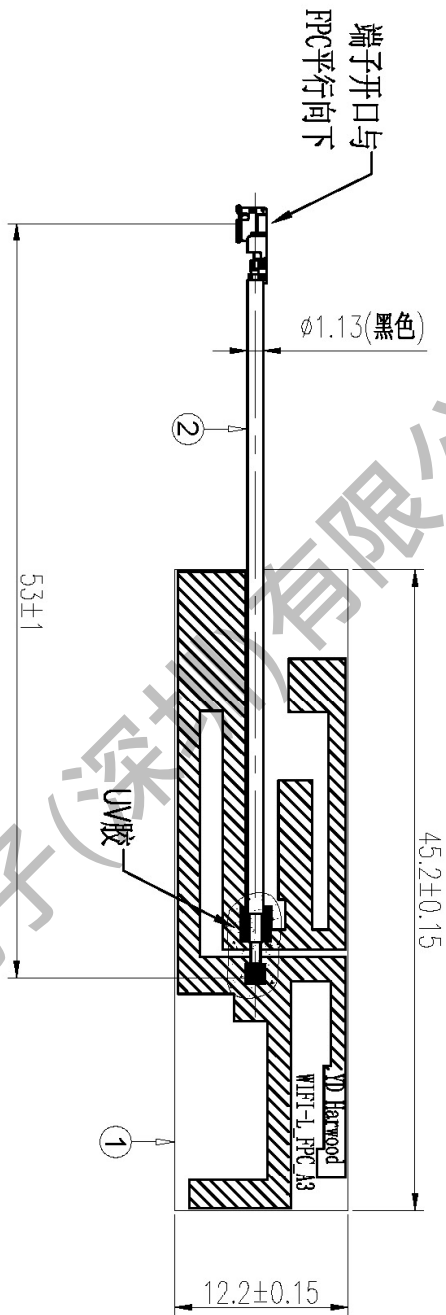
3、 Conclusion

This antenna is designed on the basis of the prototype provided by the customer. The above electrical performance parameters are tested under the environmental treatment conditions of the test prototype. The electrical parameters and structural performance have met the technical requirements. Please confirm!

4、 Part Drawing

远德电子(深圳)有限公司

Rev	Description	Date	Remark
A	New drawing		



- 技术要求:
1. 标“*”尺寸为重点管控尺寸;
 2. 未标注尺寸依照图纸;
 3. 无虚焊、假焊、连锡、短路、断路等焊接不良现象;
 4. 所有部件需符合RoHS要求。

No.		Part No.		Name		Specification		Amount		Remark	
1		164-0014B-008		43391 2.46 同轴线		Ø1.13mm/双绞线/黑色/-代端子		1			
2		100-HARWD-11A		Harwood WFI-L FPC		单面板PI电解铜, 黑色, 背胶3M9471		1			
1		1		2		3		4		5	

远德电子(深圳)有限公司 Yuan de Electronics (Shenzhen) Co. LTD			
Third Angle	Project	Harwood	Date
0~10 ±0.05	Part Name	WFI-L 米线	2022-03-04
10~18 ±0.10	Part No.	136-HARWD-10A	Designed by
18~30 ±0.12	Material	/	Checked by
30~40 ±0.15	Angle		RF
40~ ±0.20			MD
	Location		Approved by
			Unit
			mm
			Scale
			1:1
			Rev
			A2

Yuande Electronics (Shenzhen) Co., Ltd

Sample Approval Sheet

Product Information:

Customer	Zhong Shan City Richsound Electronic Industrial Ltd
Material Description	Harwood WIFI-R Antenna
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Specifications	Harwood WIFI-R Antenna: FPC (L45.2*W12.2mm) +White Coaxial Cable (ϕ 1.13*53mm) +Welding+UV adhesive
Supplier's Part number	136-HARWD-20A
Date	2022-03-11

Supplier:

Prepared By	Checked By	Approved By
Zhang Dengqiao	Chen Yanmin	Zhang Xiangting



Customer Approval:

Accepted By	Checked By	Approved By

Results:

- Full Approval
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1、 Specification

This report mainly provides the testing status of various electrical and structural performance parameters of Harwood Wifi-R Antenna.

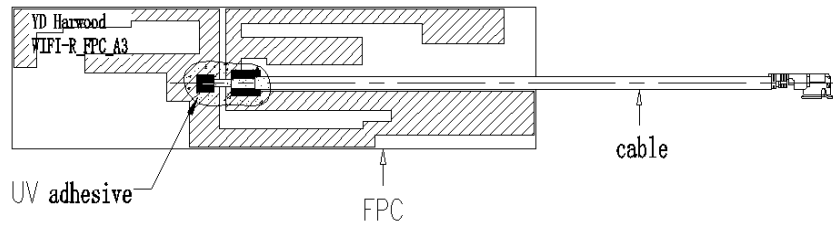


Figure 1 Antenna



Figure 2 Antenna Placement

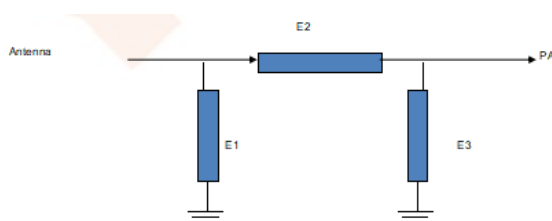
1.1 Electrical specification standard

1.1.1 Electrical Specifications

The antenna operates in the 2400-5850 MHz. The following table is the electrical performance index of the antenna designed by our company.

Antenna	Harwood WIFI-R Antenna
Frequency Range	2400-5850MHz
VSWR	<3
Efficiency	> 40%
Impedance	50 ohm
Polarization	Linear polarization

1.1.2 Antenna Matching Network



Element	Value
E1(0402)	N/A
E2(0402)	0R
E3(0402)	N/A

Schematic diagram of matching circuit modification

2、 Test

The antenna was debugged and tested with the prototype provided by the customer.

2.1 Test of passive S11

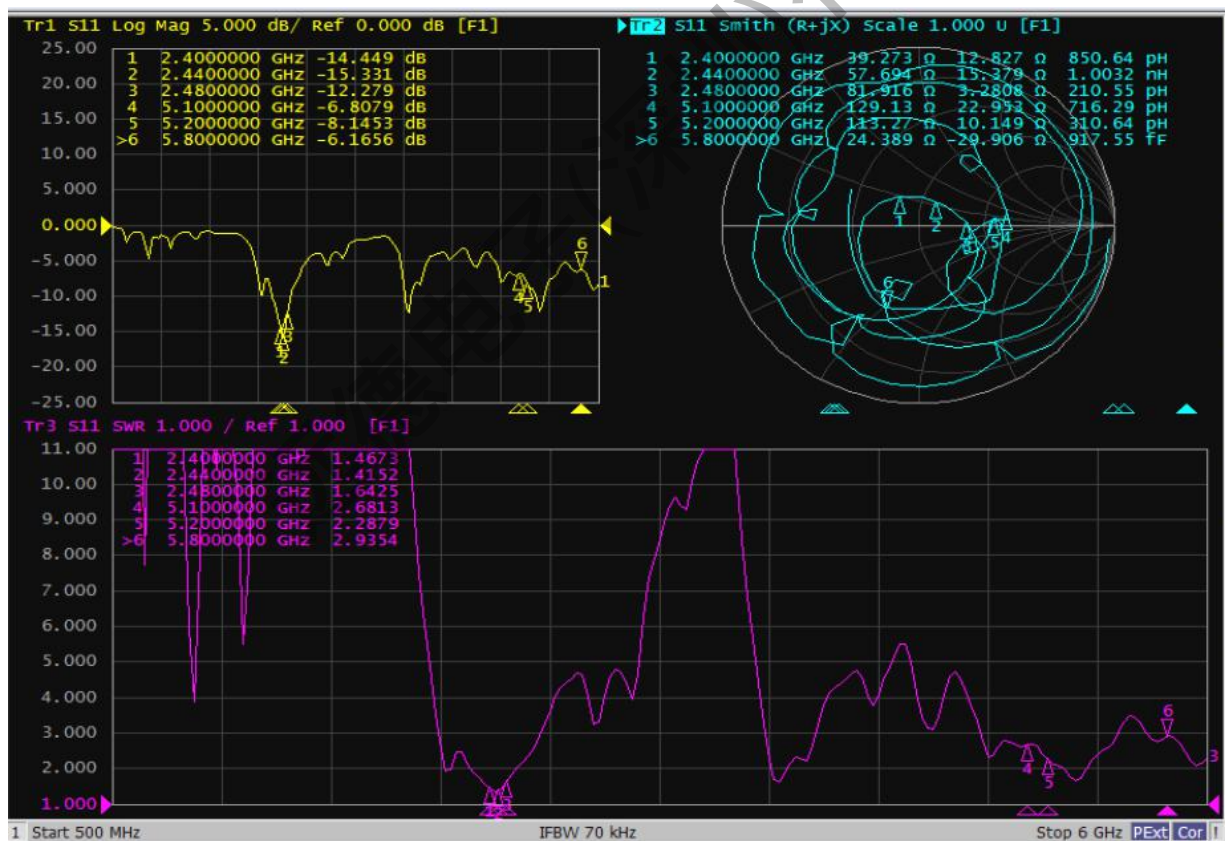
2.1.1 Test connection

The passive S11 test device is connected as follows: Network Analyzer → Test Line → Test Fixture.

2.1.2 Passive S11

The following table shows the standing wave ratio values of the edge frequency points of the antenna operating frequency band. The waveform of Return Loss and VSWR obtained by the test is shown as follows.

Harwood WIFI-R Antenna S11						
Frequency (MHz)	2400	2440	2480	5100	5200	5800
VSWR	1.46	1.41	1.64	2.68	2.28	2.93
Return Loss	-14.44	-15.33	-12.27	-6.80	-8.14	-6.16



2.2 Gain and efficiency test

2.2.1 Test Position

Yuande microwave anechoic chamber, the test frequency range is 400MHz-6GHz.

2.2.2 Test equipment

Network analyzer, standard horn antenna, multi-probe near field antenna test system, test computer, etc

2.2.3 Results Summary

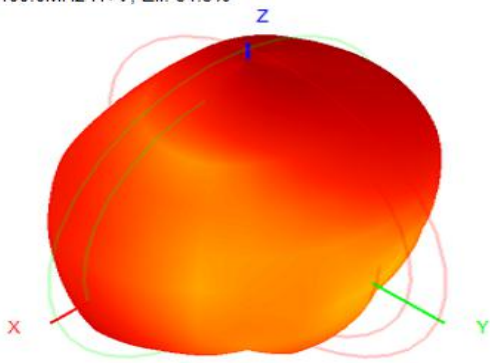
In the microwave anechoic chamber, the measured values related to efficiency and gain are shown in the table below.

Frequency(MHz)	Efficiency(%)	Efficiency(dB)	Gain(dBi)
2400	54.50%	-2.64	2.29
2410	55.08%	-2.36	2.59
2420	56.84%	-2.16	2.85
2430	54.15%	-1.93	2.13
2440	55.77%	-1.82	2.26
2450	57.76%	-1.69	2.38
2460	56.94%	-1.55	2.49
2470	56.25%	-1.53	2.58
2480	56.80%	-1.44	2.71

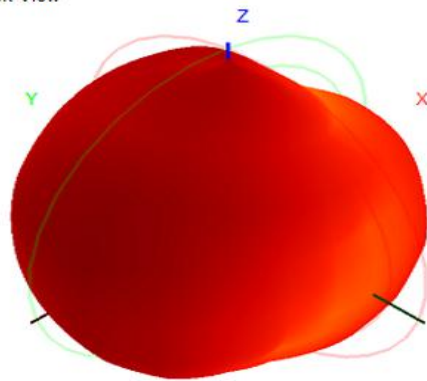
Frequency(MHz)	Efficiency(%)	Efficiency(dB)	Gain(dBi)
5150	56.43%	-2.48	2.42
5200	59.11%	-2.28	2.10
5250	53.54%	-1.97	2.20
5300	53.73%	-1.96	2.37
5350	52.88%	-2.02	2.56
5400	50.63%	-2.17	2.26
5450	49.93%	-2.22	2.64
5500	49.30%	-2.27	1.98
5550	47.46%	-2.41	2.20
5600	44.91%	-2.60	2.61
5650	45.47%	-2.56	2.19
5700	45.47%	-2.56	1.78
5750	45.39%	-2.57	1.91
5800	44.93%	-2.60	1.74
5850	46.91%	-2.45	1.90

2.2.4 Radiation Pattern Results

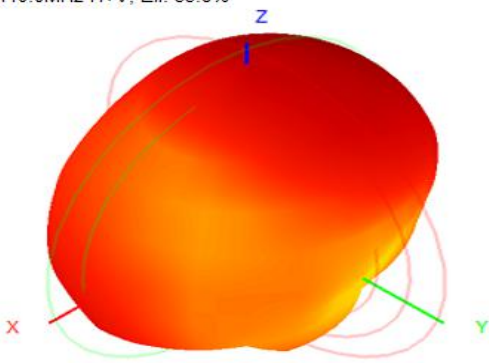
2400.0MHz H+V, Eff: 54.5%



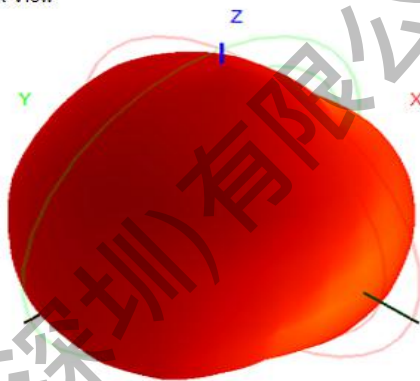
Back View



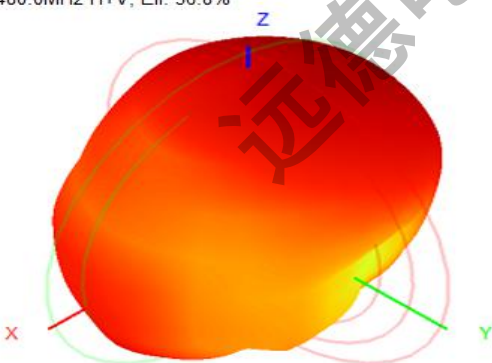
2440.0MHz H+V, Eff: 55.8%



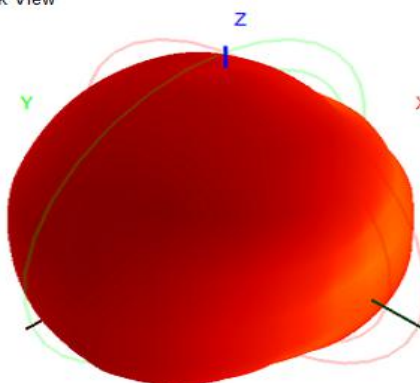
Back View



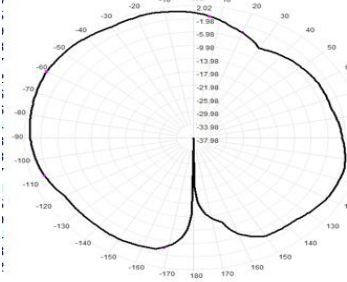
2480.0MHz H+V, Eff: 56.8%



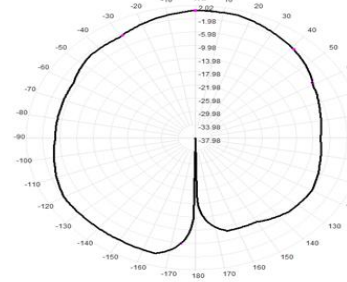
Back View



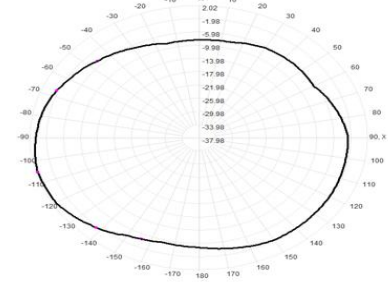
2400.0MHz Total(E1-XZ), Max= 2.02dBi



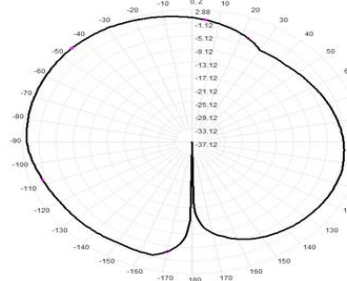
2400.0MHz Total(E2-YZ), Max= 0.50dBi



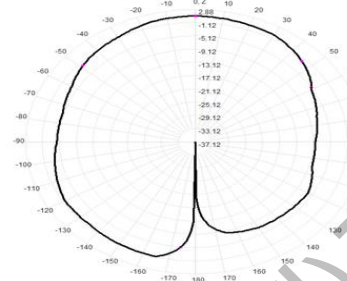
Total(H-XY), Max= 1.51dBi, CirD=10.01



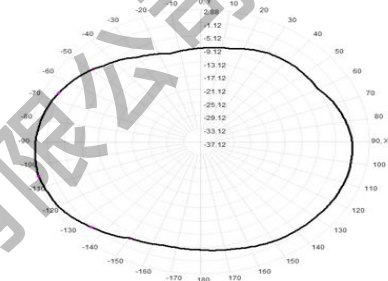
2440.0MHz Total(E1-XZ), Max= 2.88dBi



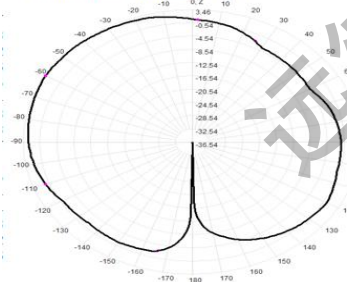
2440.0MHz Total(E2-YZ), Max= 0.88dBi



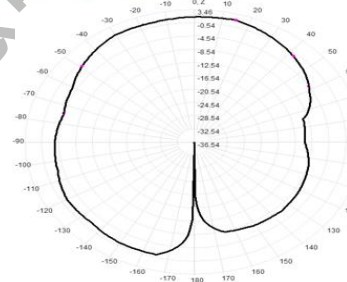
Total(H-XY), Max= 2.36dBi, CirD=11.95



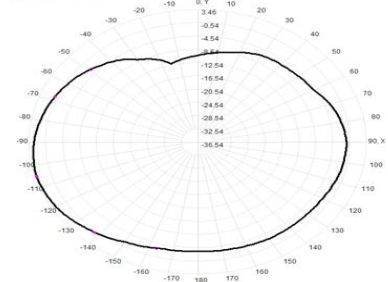
2480.0MHz Total(E1-XZ), Max= 3.46dBi



2480.0MHz Total(E2-YZ), Max= 1.52dBi

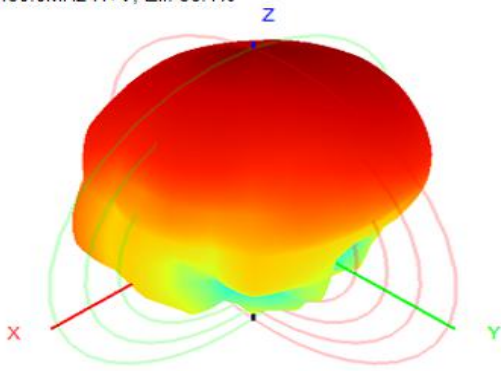


Total(H-XY), Max= 3.02dBi, CirD=15.08

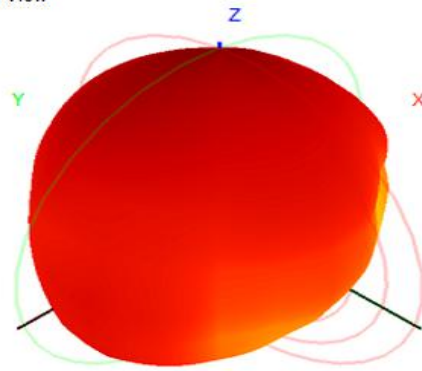


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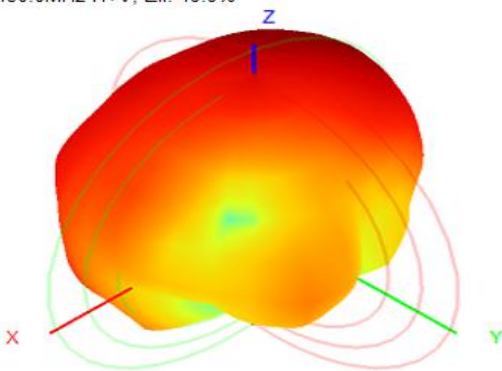
5150.0MHz H+V, Eff: 56.4%



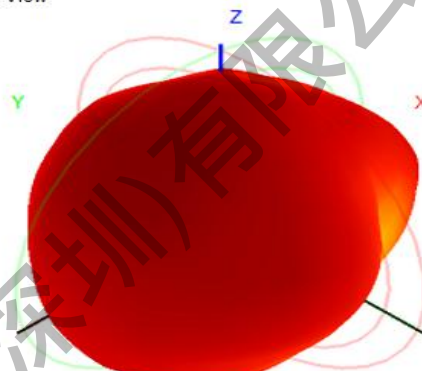
Back View



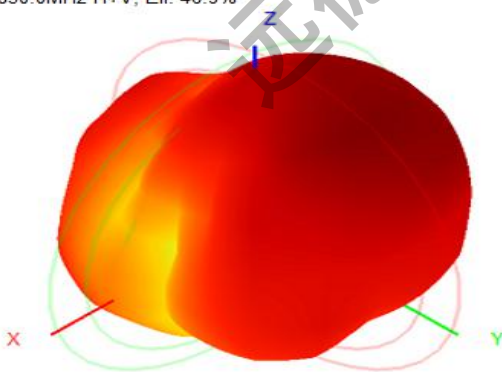
5450.0MHz H+V, Eff: 49.9%



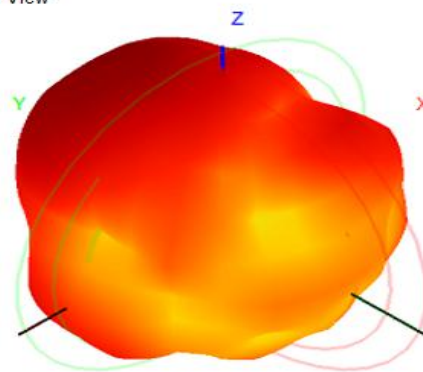
Back View



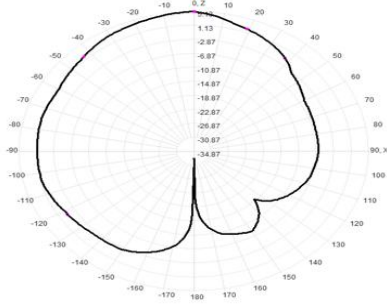
5850.0MHz H+V, Eff: 46.9%



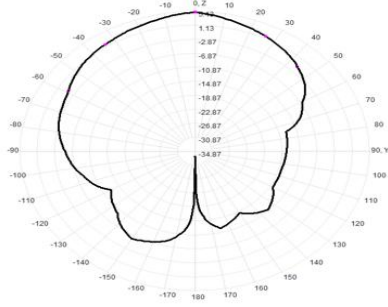
Back View



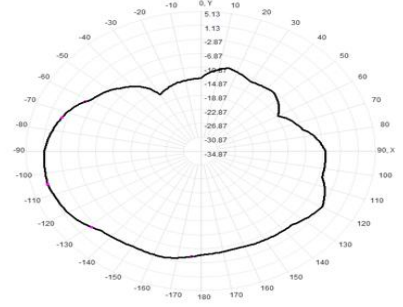
5150.0MHz Total(E1-XZ), Max= 5.13dBi



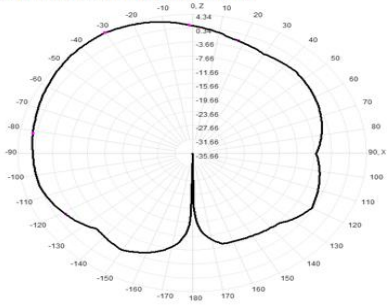
5150.0MHz Total(E2-YZ), Max= 4.88dBi



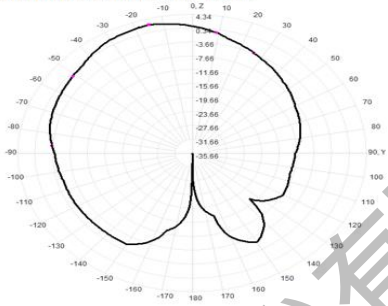
Total(H-XY), Max= 1.34dBi, CirD=17.51



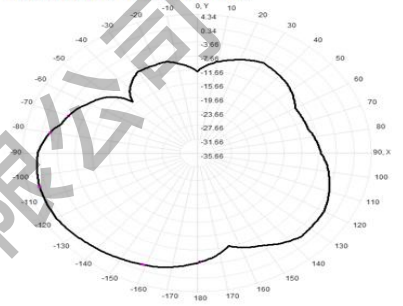
5450.0MHz Total(E1-XZ), Max= 4.34dBi



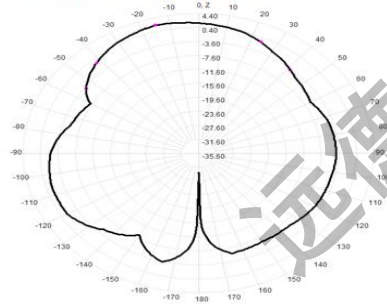
5450.0MHz Total(E2-YZ), Max= 2.58dBi



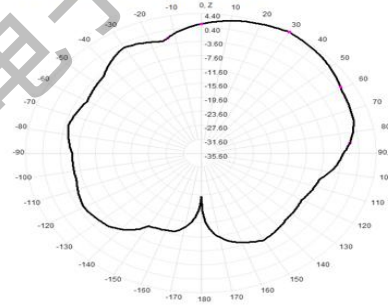
Total(H-XY), Max= 1.70dBi, CirD=16.39



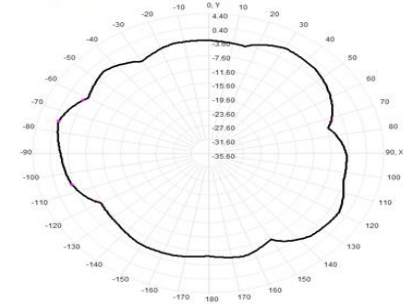
5850.0MHz Total(E1-XZ), Max= 2.29dBi



5850.0MHz Total(E2-YZ), Max= 4.40dBi



Total(H-XY), Max= -0.24dBi, CirD=7.25

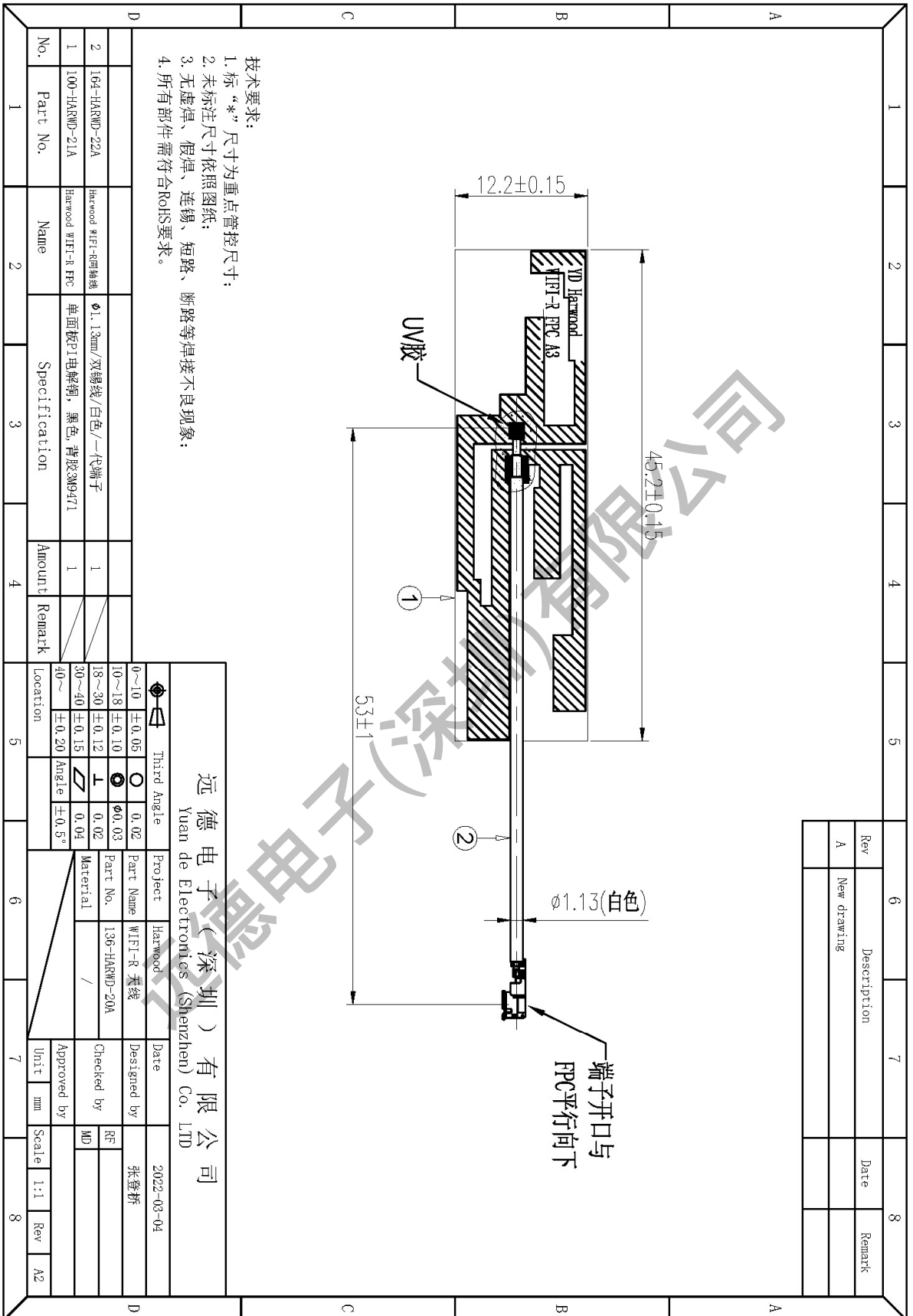


3、 Conclusion

This antenna is designed on the basis of the prototype provided by the customer. The above electrical performance parameters are tested under the environmental treatment conditions of the test prototype. The electrical parameters and structural performance have met the technical requirements. Please confirm!

4、 Part Drawing

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- 技术要求:
1. 标“*”尺寸为重点管控尺寸;
 2. 未标注尺寸依照图纸;
 3. 无虚焊、假焊、连锡、短路、断路等焊接不良现象;
 4. 所有部件需符合RoHS要求。

No.	Part No.	Name	Specification	Amount	Remark
1	100-HARWD-21A	Harwood WFI-R PPC	单面镀PI电解铜, 黑色, 背胶3M9471	1	
2	164-HARWD-22A	Harwood WFI-R同轴线	Ø1.13mm/双导线/白色/-一代端子	1	

<p style="text-align: center;">远德电子(深圳)有限公司 Yuan de Electronics (Shenzhen) Co. LTD</p>		<p style="text-align: center;">Project: Harwood Part Name: WFI-R 天线 Part No.: 136-HARWD-20A Material: /</p>		<p style="text-align: center;">Date: 2022-03-04 Designed by: 张彦桥 Checked by: RF Approved by: MD</p>	
<p>Third Angle</p> <p>0~10 ±0.05</p> <p>10~18 ±0.10</p> <p>18~30 ±0.12</p> <p>30~40 ±0.15</p> <p>40~ ±0.20</p>	<p>0.02</p> <p>0.03</p> <p>0.02</p> <p>0.04</p> <p>±0.5°</p>	<p>Project</p> <p>Part No.</p> <p>Material</p>	<p>Harwood</p> <p>WFI-R 天线</p> <p>136-HARWD-20A</p> <p>/</p>	<p>Date</p> <p>Designed by</p> <p>Checked by</p> <p>Approved by</p>	<p>2022-03-04</p> <p>张彦桥</p> <p>RF</p> <p>MD</p>
Location	Angle	Unit		mm	Scale
		mm		1:1	Rev A2

Rev	Description	Date	Remark
A	New drawing		