



# 规格承认书

## Approval Sheet

客户名称 和裕智慧

(Customer Name)

产品名称 PCB-4G

(Specification)

客户料号

(Customer P/N)

产品料号

(O/I)

送样日期 2022-11-23

(Date)

|                       |        |         |  |
|-----------------------|--------|---------|--|
| Frequency band        | PCB-4G |         |  |
| Version               | A      |         |  |
| RF                    | 陈美队    | Confirm |  |
| Structural Engineer   | 杨学忠    |         |  |
| Customer confirmation |        |         |  |
| Date                  |        |         |  |

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5.1 Test Data

6. Structural drawings

## 1. Project image (for reference only)

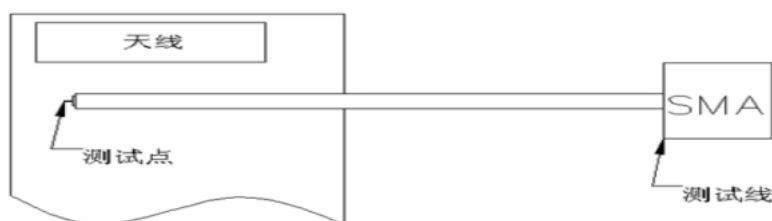


4G Antenna

## 2. Passive Test

Purpose: To test the passive parameters of the antenna as accurately as possible.

Method: This fixture uses a 50 ohm coaxial cable, with one end connected to the test point at the back end of the matching circuit (RF test hole front section) of the mobile phone motherboard, and the other end connected to the SMA connector. As shown in the following figure:



The following table presents the performance test indicators for PCB-4G antennas:

| 4G Antenna     |                  |            |                 |            |
|----------------|------------------|------------|-----------------|------------|
|                | Frequency (MHz)  | VSWR       | Frequency (MHz) | VSWR       |
| Frequency band | Transmitting end |            | Receiving end   |            |
| GSM850         | 824-849          | $\leq 4$   | 869-894         | $\leq 4$   |
| GSM900         | 880-915          | $\leq 4$   | 925-960         | $\leq 4$   |
| DCS1800        | 1710-1785        | $\leq 3.5$ | 1805-1880       | $\leq 3.5$ |
| PCS1900        | 1850-1910        | $\leq 3.5$ | 1930-1990       | $\leq 3.5$ |
| WCDMA-B1       | 1990-2025        | $\leq 3.5$ | 2035-2170       | $\leq 3.5$ |
| LTE-TDD-B38    | 2580-2610        | $\leq 3.5$ | 2580-2610       | $\leq 3.5$ |
| LTE-TDD-B39    | 1890-1910        | $\leq 3.5$ | 1890-1910       | $\leq 3.5$ |
| LTE-TDD-B40    | 2310-2390        | $\leq 3.5$ | 2310-2390       | $\leq 3.5$ |
| LTE-TDD-B41    | 2506-2593        | $\leq 3.5$ | 2506-2593       | $\leq 3.5$ |

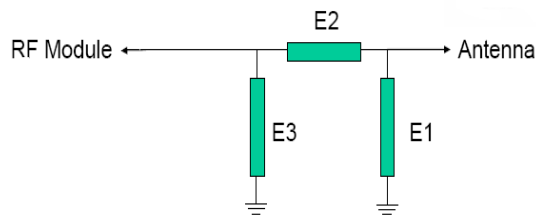
深圳市德仕勤科技有限公司

Dosking MicroElectronics Co.,Ltd

地址：深圳市南山区西丽大学城民企科技园 2 栋（港鸿基大厦）西座 403

TEL:0755-88602767 FAX:0755-82793883

### 3. Matching circuit



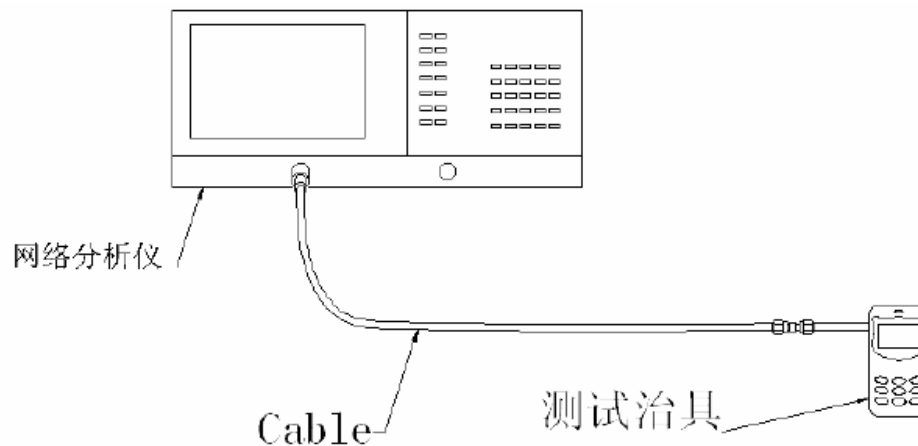
| Element | Matching Value |
|---------|----------------|
| E1      |                |
| E2      |                |
| E3      |                |

### 4. S11Test

#### 4.1 S11Test Method Description Specification Standards

VSWR The testing devices are sequentially connected as follows : E5071B Network analyzer → 50Ω Coaxial line → 120mm Copper tube → Test fixture.

Treatment of testing fixture: Use a hard cable to lead out the SMA-J connector from the 50 ohm test point of the antenna on the mobile phone PCB, connect it to a copper pipe with a choke ring, and then connect other devices in sequence.



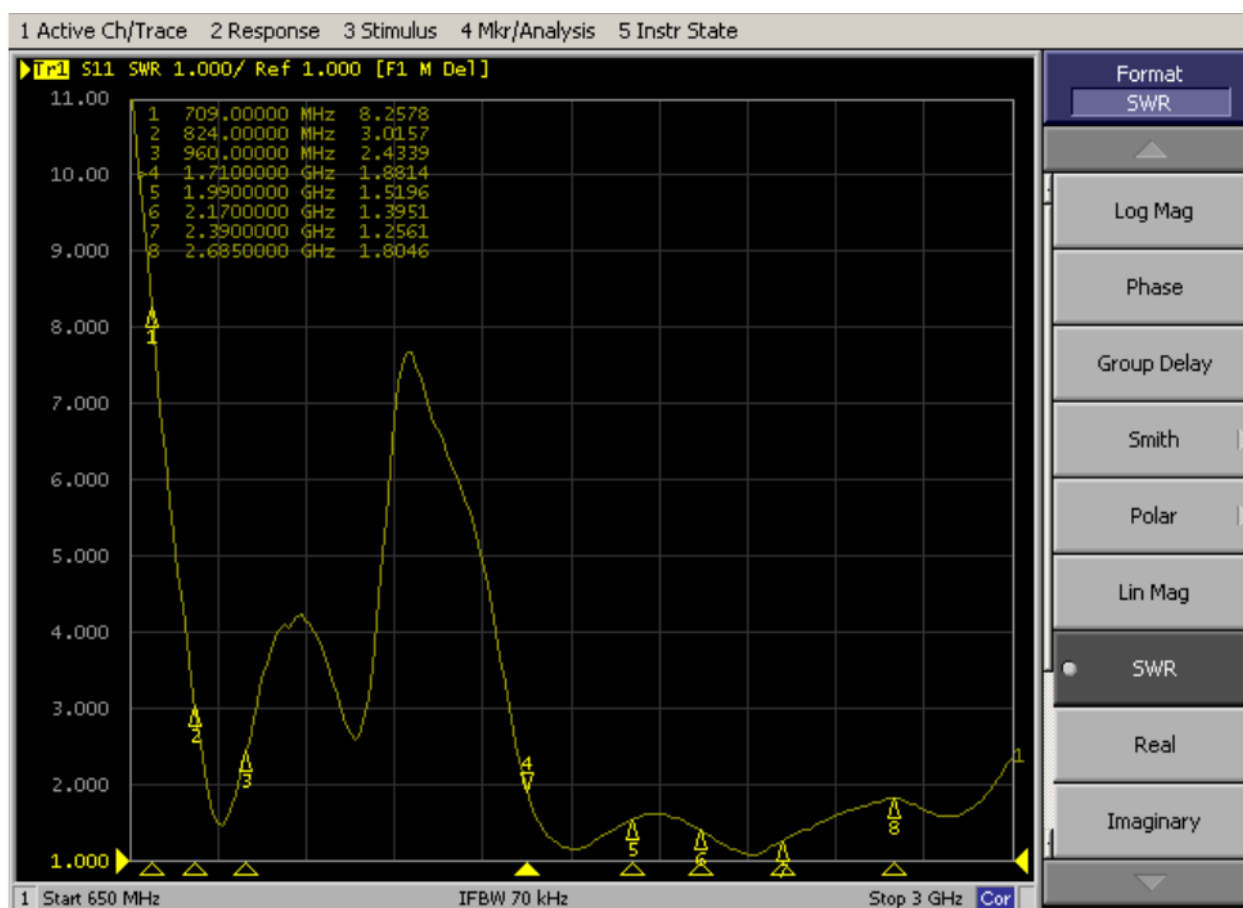
Test diagram

## 4.2 S11 parameters

The following table shows the standing wave ratio values at the edge frequency points of the operating frequency band of the PCB-4G antenna. The waveform diagrams related to Return Loss and VSWR obtained from the test are shown in the attachment.

|                | PCB-4G Antenna |     |      |      |      |
|----------------|----------------|-----|------|------|------|
| Frequency(MHz) | 824            | 960 | 1710 | 2170 | 2685 |
| Free space     | 3.0            | 2.4 | 1.88 | 1.39 | 1.8  |

## 4.3 S11 parameter image



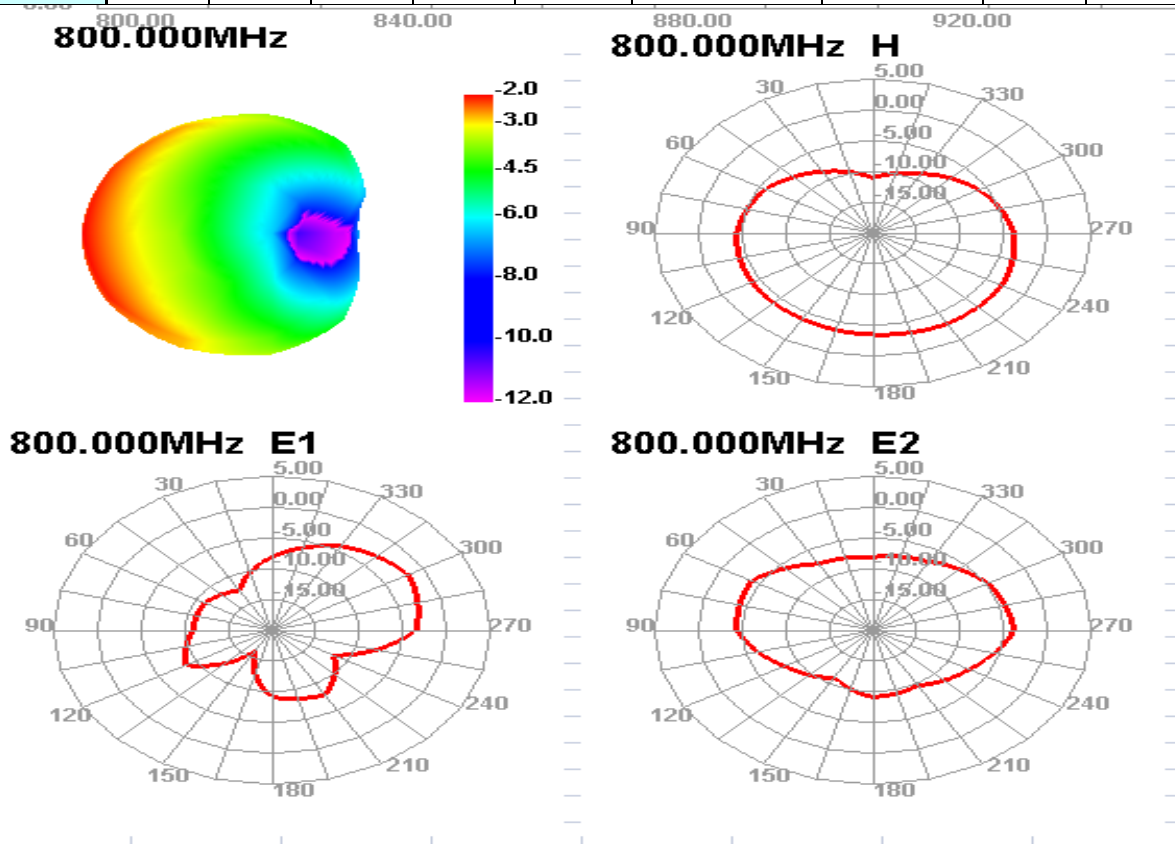
S11 SWR

## 5.Summary of Passive Electrical Performance

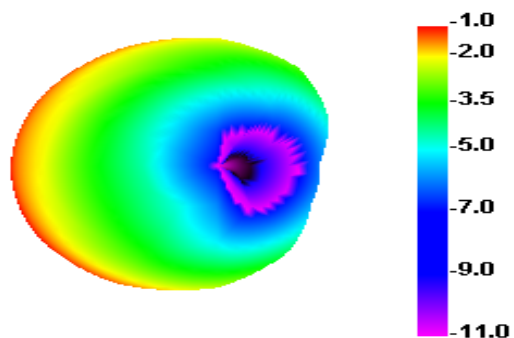
| Electrical Specifications                         |                              |
|---------------------------------------------------|------------------------------|
| 频率范围 Frequency range (MHz)                        | 4G full network connectivity |
| 极化方式 Polarization                                 | Vertical polarization        |
| 增益 Gain (dBi)                                     | 0.6/1.2/1.5dBi               |
| 输入阻抗 Input Impedance ( $\Omega$ )                 | 50 $\Omega$                  |
| 电压驻波比 VSWR (5800MHZ)                              | $\leq 4$                     |
| 最大功率 Maximum input power (W)                      | 2W                           |
| 机械参数 Mechanical Specifications                    |                              |
| 接头类型 Input connector type                         | IPX                          |
| 天线尺寸 Dimensions-mm (Height/Width/Depth)           | 13.5*95mm                    |
| 包装尺寸 Packing size (mm)                            | Customer specified           |
| 天线罩材料 Radome material                             | PCB                          |
| 天线罩颜色 Radome color                                | <b>Black</b>                 |
| 工作温度 Operating temperature ( $^{\circ}\text{C}$ ) | -30~60                       |
| 极限风速 Rated Wind Velocity (m/s)                    | 60                           |
|                                                   |                              |

## 5.1 Test Data

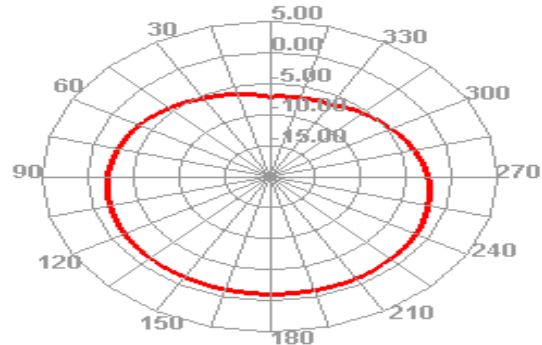
| Passive Test For 800-960 |          |           |            |          |          |                   |                 |           |           |
|--------------------------|----------|-----------|------------|----------|----------|-------------------|-----------------|-----------|-----------|
| Freq (MHz)               | Effi (%) | Effi (dB) | Gain (dBi) | Max (dB) | Min (dB) | Directivity (dBi) | Beamwidth (3dB) | AttH (dB) | AttV (dB) |
| 800                      | 23.45    | -6.3      | -1.96      | -1.96    | -16.13   | 6.3               | 60              | 39.15     | 38.4      |
| 810                      | 23.9     | -6.22     | -1.78      | -1.78    | -17.1    | 6.22              | 60              | 39.06     | 38.34     |
| 820                      | 23.89    | -6.22     | -1.94      | -1.94    | -16.68   | 6.22              | 60              | 38.77     | 38.08     |
| 830                      | 25.12    | -6        | -1.81      | -1.81    | -14.58   | 6                 | 30              | 38.93     | 38.3      |
| 840                      | 26.03    | -5.85     | -1.93      | -1.93    | -13.07   | 5.85              | 60              | 38.69     | 38.12     |
| 850                      | 28.84    | -5.4      | -1.75      | -1.75    | -12.16   | 5.4               | 30              | 38.54     | 38.03     |
| 860                      | 27.86    | -5.55     | -1.88      | -1.88    | -12.26   | 5.55              | 30              | 38.28     | 37.88     |
| 870                      | 29.42    | -5.31     | -1.52      | -1.52    | -12.73   | 5.31              | 30              | 38.16     | 37.92     |
| 880                      | 31       | -5.09     | -1.04      | -1.04    | -12.67   | 5.09              | 30              | 38.19     | 38.11     |
| 890                      | 34.93    | -4.57     | -0.54      | -0.54    | -12.08   | 4.57              | 30              | 38.12     | 38.2      |
| 900                      | 38.06    | -4.2      | -0.04      | -0.04    | -12.11   | 4.2               | 30              | 38.12     | 38.37     |
| 910                      | 38.73    | -4.12     | -0.11      | -0.11    | -12.44   | 4.12              | 30              | 38.25     | 38.64     |
| 920                      | 41.68    | -3.8      | 0.19       | 0.19     | -12.29   | 3.8               | 30              | 38.2      | 38.71     |
| 930                      | 40.54    | -3.92     | -0.06      | -0.06    | -12.12   | 3.92              | 30              | 38.26     | 38.85     |
| 940                      | 42.62    | -3.7      | 0.17       | 0.17     | -11.85   | 3.7               | 60              | 38.35     | 39.01     |
| 950                      | 42.96    | -3.67     | 0.18       | 0.18     | -11.84   | 3.67              | 60              | 38.22     | 38.93     |
| 960                      | 44.5     | -3.52     | 0.38       | 0.38     | -11.94   | 3.52              | 30              | 38.26     | 38.98     |



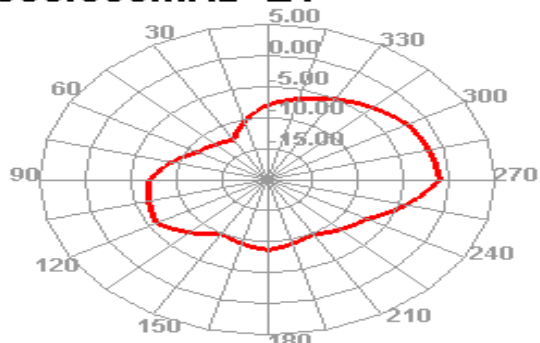
880.000MHz



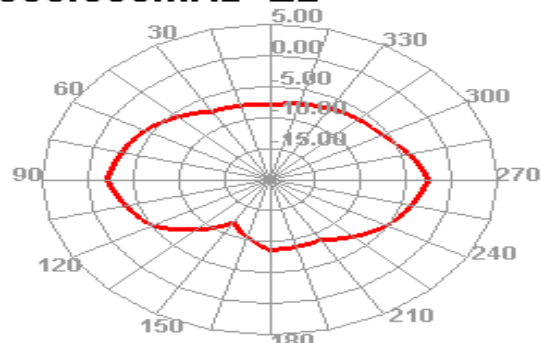
880.000MHz H



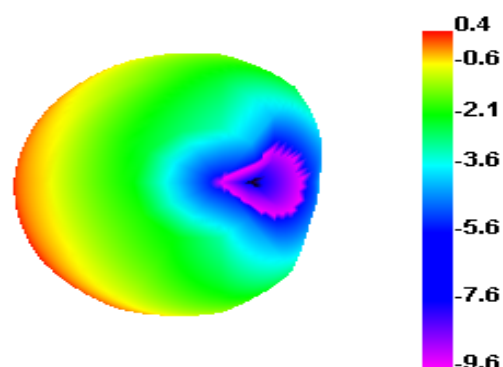
880.000MHz E1



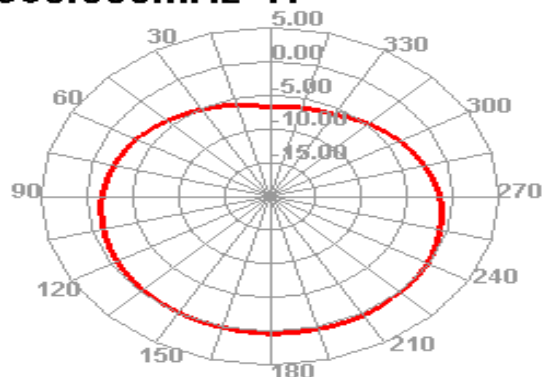
880.000MHz E2



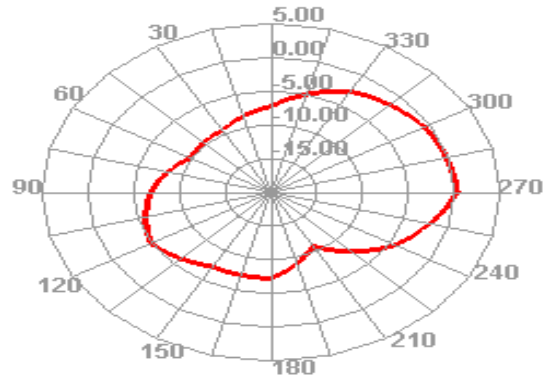
960.000MHz



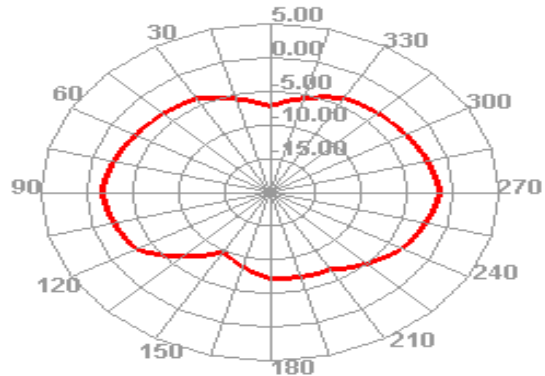
960.000MHz H



960.000MHz E1



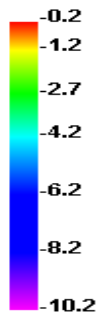
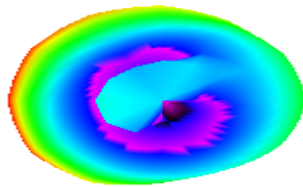
960.000MHz E2



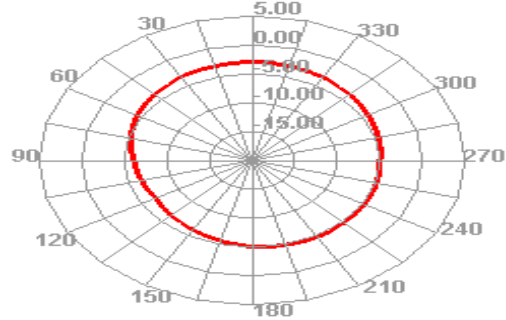
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| Passive Test For 1700-2700 |          |           |            |          |          |                   |                 |           |           |
|----------------------------|----------|-----------|------------|----------|----------|-------------------|-----------------|-----------|-----------|
| Freq (MHz)                 | Effi (%) | Effi (dB) | Gain (dBi) | Max (dB) | Min (dB) | Directivity (dBi) | Beamwidth (3dB) | AttH (dB) | AttV (dB) |
| 1710                       | 42.63    | -3.7      | 0.15       | 0.15     | -10.61   | 3.7               | 30              | 45.01     | 44.83     |
| 1750                       | 45.84    | -3.39     | 0.52       | 0.52     | -10.57   | 3.39              | 30              | 44.67     | 44.42     |
| 1800                       | 54.63    | -2.63     | 1.13       | 1.13     | -9.49    | 2.63              | 30              | 44.88     | 44.58     |
| 1850                       | 61.22    | -2.13     | 1.93       | 1.93     | -7.79    | 2.13              | 30              | 45.33     | 44.99     |
| 1900                       | 52.14    | -2.83     | 1.08       | 1.08     | -8.06    | 2.83              | 30              | 45.22     | 44.9      |
| 1950                       | 49.75    | -3.03     | 0.99       | 0.99     | -12.7    | 3.03              | 30              | 46.42     | 46.25     |
| 2000                       | 42.93    | -3.67     | 0.29       | 0.29     | -10.89   | 3.67              | 30              | 46.67     | 46.58     |
| 2050                       | 42.96    | -3.67     | 0.53       | 0.53     | -14.37   | 3.67              | 30              | 46.78     | 46.99     |
| 2100                       | 42.07    | -3.76     | 0.72       | 0.72     | -16.43   | 3.76              | 30              | 46.94     | 46.03     |
| 2150                       | 32.35    | -4.9      | -0.7       | -0.7     | -16.99   | 4.9               | 30              | 45.76     | 45.79     |
| 2200                       | 41.74    | -3.79     | 0.15       | 0.15     | -13.72   | 3.79              | 30              | 46.53     | 46.28     |
| 2250                       | 50.64    | -2.96     | 0.87       | 0.87     | -15.79   | 2.96              | 30              | 46.62     | 46.5      |
| 2300                       | 48.33    | -3.16     | 0.41       | 0.41     | -11.78   | 3.16              | 30              | 47.6      | 47.53     |
| 2350                       | 26.73    | -5.73     | -2.6       | -2.6     | -19.14   | 5.73              | 30              | 48.29     | 48.19     |
| 2400                       | 13.96    | -8.55     | -3.3       | -3.3     | -21.49   | 8.55              | 30              | 48.67     | 48.49     |
| 2450                       | 30.67    | -5.13     | 0.82       | 0.82     | -14.77   | 5.13              | 0               | 49.03     | 48.99     |
| 2500                       | 56.3     | -2.49     | 3.87       | 3.87     | -12.46   | 2.49              | 0               | 50.22     | 50.04     |
| 2550                       | 46.54    | -3.32     | 3.03       | 3.03     | -12.8    | 3.32              | 0               | 49.67     | 49.48     |
| 2600                       | 46.16    | -3.36     | 2.92       | 2.92     | -16.83   | 3.36              | 0               | 49.68     | 49.61     |
| 2650                       | 50.6     | -2.96     | 2.82       | 2.82     | -14.22   | 2.96              | 0               | 50.35     | 50.34     |
| 2700                       | 51.68    | -2.87     | 2.19       | 2.19     | -11.59   | 2.87              | 0               | 51.19     | 51.17     |

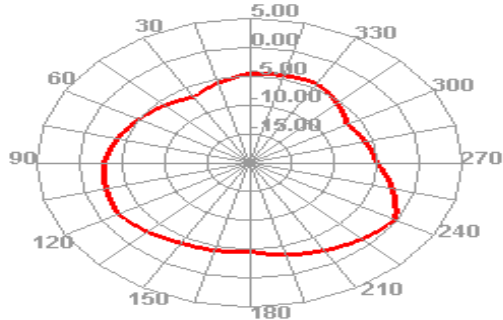
1700.000MHz



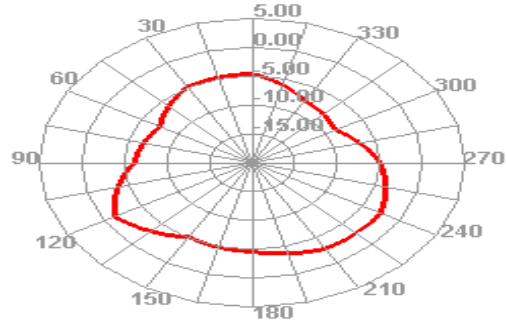
1700.000MHz H



1700.000MHz E1



1700.000MHz E2



1710.000MHz

1710.000MHz H

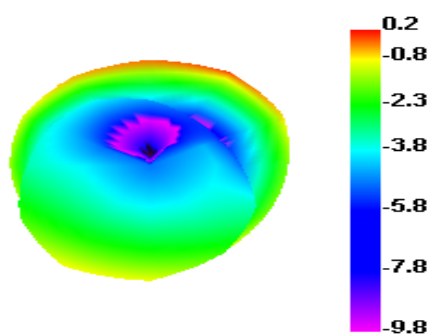
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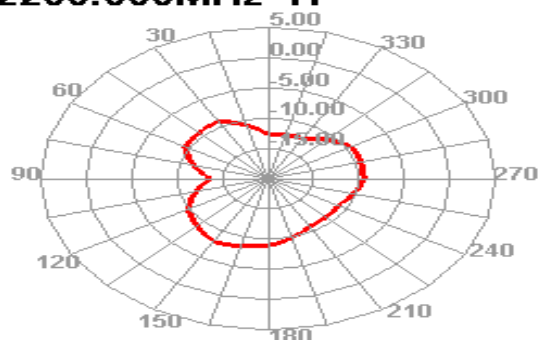
地址：深圳市南山区西丽大学城民企科技园 2 栋（港鸿基大厦）西座 403

TEL:0755-88602767 FAX:0755-82793883

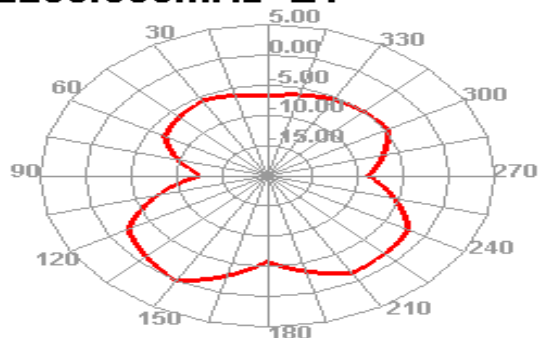
2200.000MHz



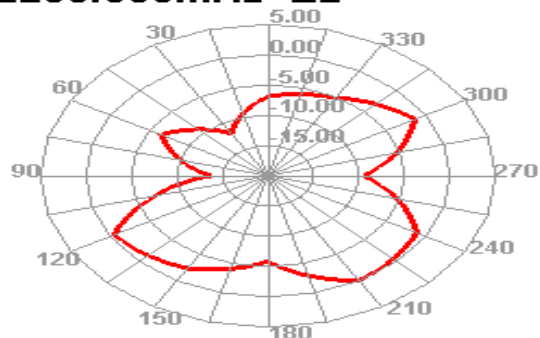
2200.000MHz H



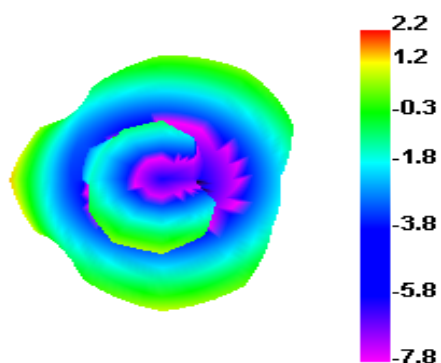
2200.000MHz E1



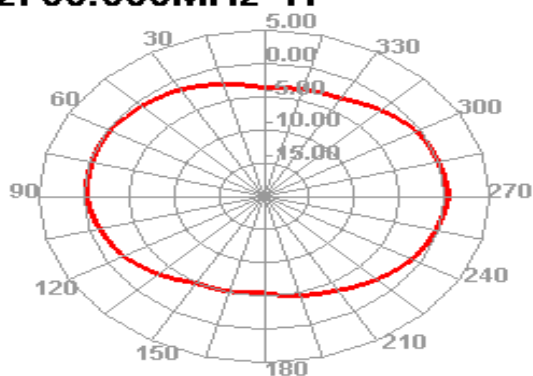
2200.000MHz E2



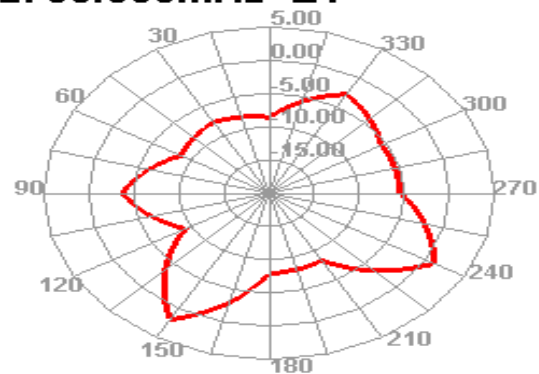
2700.000MHz



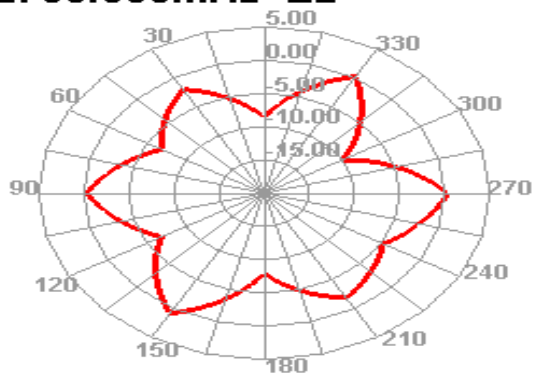
2700.000MHz H



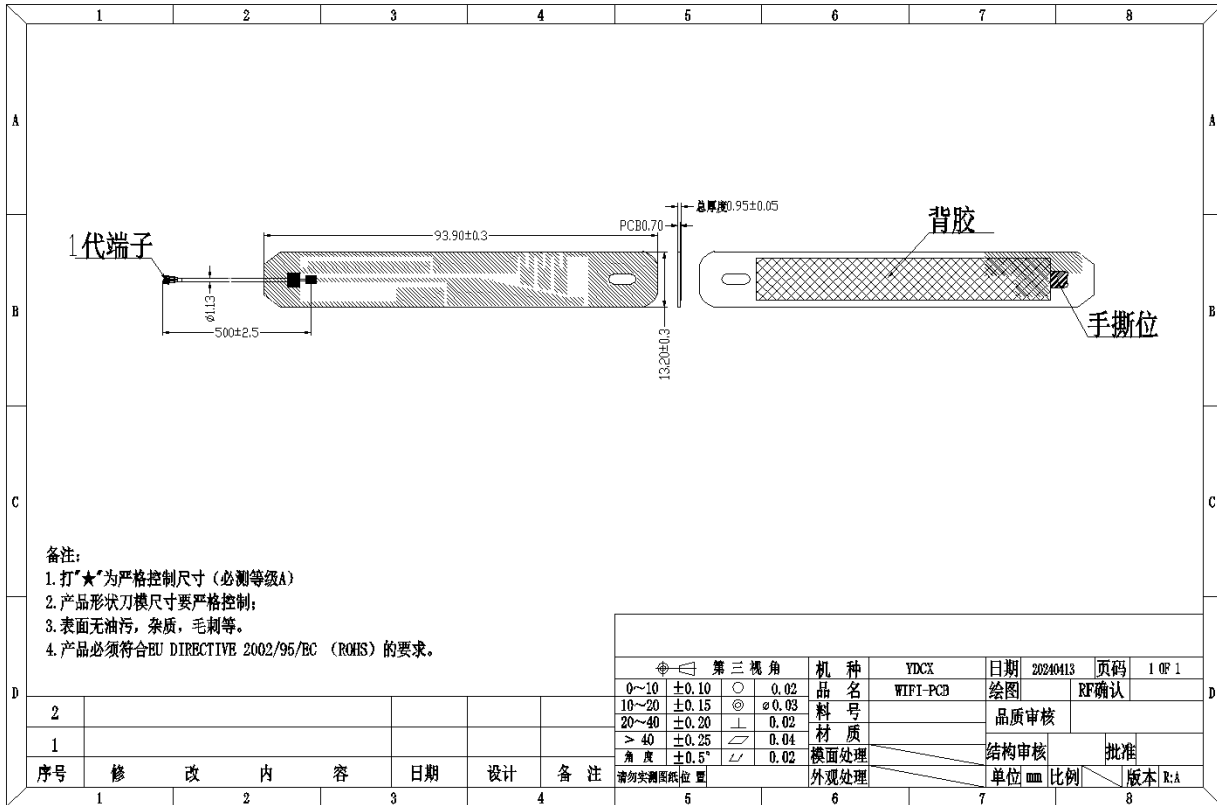
2700.000MHz E1



2700.000MHz E2



## 6.Structural drawings





# 规格承认书

## Approval Sheet

客户名称 和裕智慧

(Customer Name)

产品名称 PCB - WIFI

(Specification)

客户料号

(Customer P/N)

产品料号

(O/I)

送样日期 2022-11-23

(Date)

|                       |             |         |  |
|-----------------------|-------------|---------|--|
| Frequency band        | PCB – Wi Fi |         |  |
| Version               | A           |         |  |
| RF                    | 陈美队         | Confirm |  |
| Structural Engineer   | 杨学忠         |         |  |
| Customer confirmation |             |         |  |
| Date                  |             |         |  |

## 目 录

1. Project image

2. Test fixture

3. Matching circuit

4. S11Test electrical performance

4.1 S11Test Method Description Specification Standards

4.2 S11Parameter image

4.3 S11 parameter image

5. Summary of Passive Electrical Performance

5.1 Test Data

6. Structural drawings

## 1. Project image (for reference only)

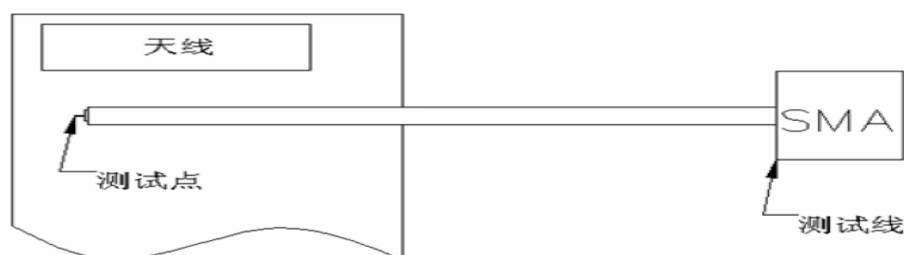


WiFi Antenna

## 2. Passive Test

Purpose: To test the passive parameters of the antenna as accurately as possible.

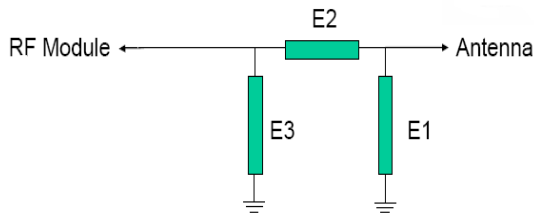
Method: This fixture uses a 50 ohm coaxial cable, with one end connected to the test point at the back end of the matching circuit (RF test hole front section) of the mobile phone motherboard, and the other end connected to the SMA connector. As shown in the following figure:



The following table presents the performance test indicators for PCB-WiFi antennas:

| WiFi Antenna   |                  |      |                 |      |
|----------------|------------------|------|-----------------|------|
|                | Frequency (MHz)  | VSWR | Frequency (MHz) | VSWR |
| Frequency band | Transmitting end |      | Receiving end   |      |
| WIFI           | 2400-2500        | ≤1.5 | 2400-2500       | ≤1.5 |

### 3. Matching circuit



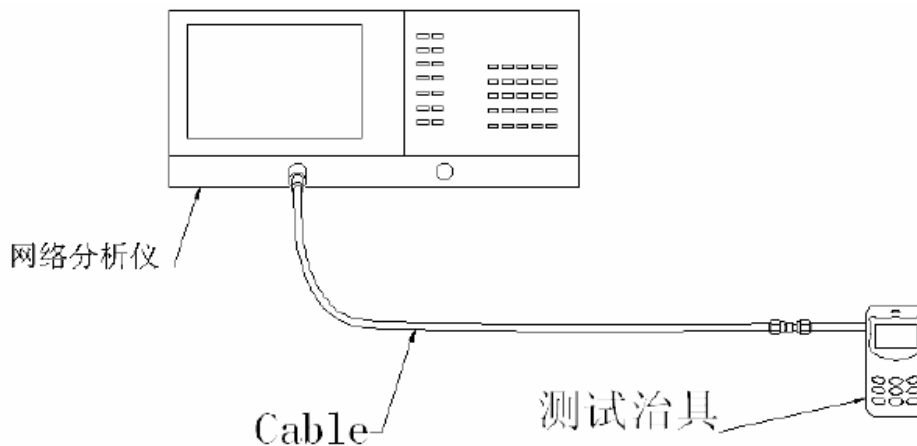
| Element | Matching Value |
|---------|----------------|
| E1      |                |
| E2      |                |
| E3      |                |

### 4. S11Test

#### 4.1 S11Test Method Description Specification Standards

VSWR The testing devices are sequentially connected as follows : E5071B Network analyzer → 50Ω Coaxial line → 120mm Copper tube → Test fixture.

Treatment of testing fixture: Use a hard cable to lead out the SMA-J connector from the 50 ohm test point of the antenna on the mobile phone PCB, connect it to a copper pipe with a choke ring, and then connect other devices in sequence.



Test diagram

#### 4.2 S11 parameters

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Dosking MicroElectronics Co.,Ltd

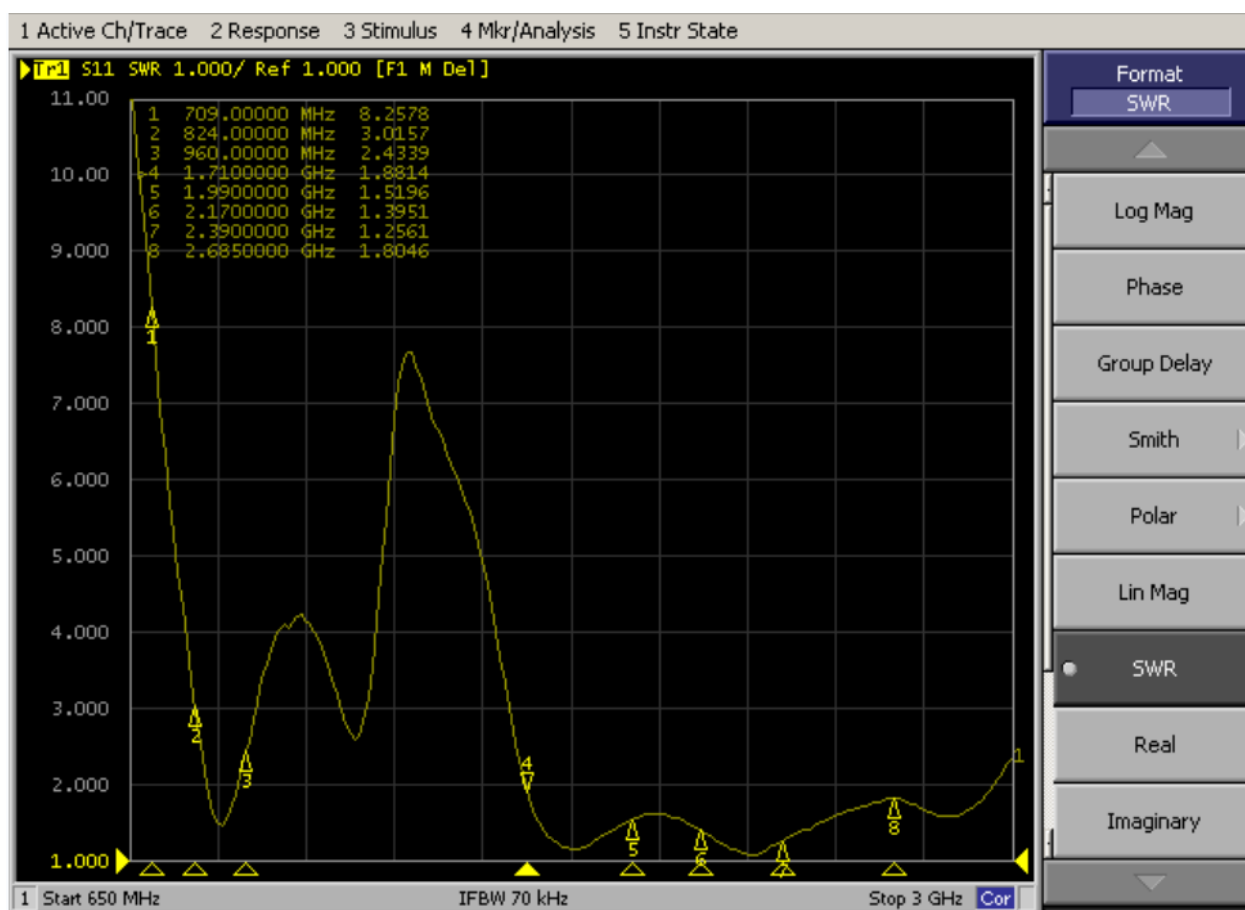
地址：深圳市南山区西丽大学城民企科技园 2 栋（港鸿基大厦）西座 403

TEL:0755-88602767 FAX:0755-82793883

The following table shows the standing wave ratio values at the edge frequency points of the operating frequency band of the PCB-WiFi antenna. The waveform diagrams related to Return Loss and VSWR obtained from the test are shown in the attachment.

|                |                           |
|----------------|---------------------------|
|                | <b>PCB - WIFI Antenna</b> |
| Frequency(MHz) | 2400-2500                 |
| Free space     | 1.2                       |

### 4.3 S11 S11 parameter image



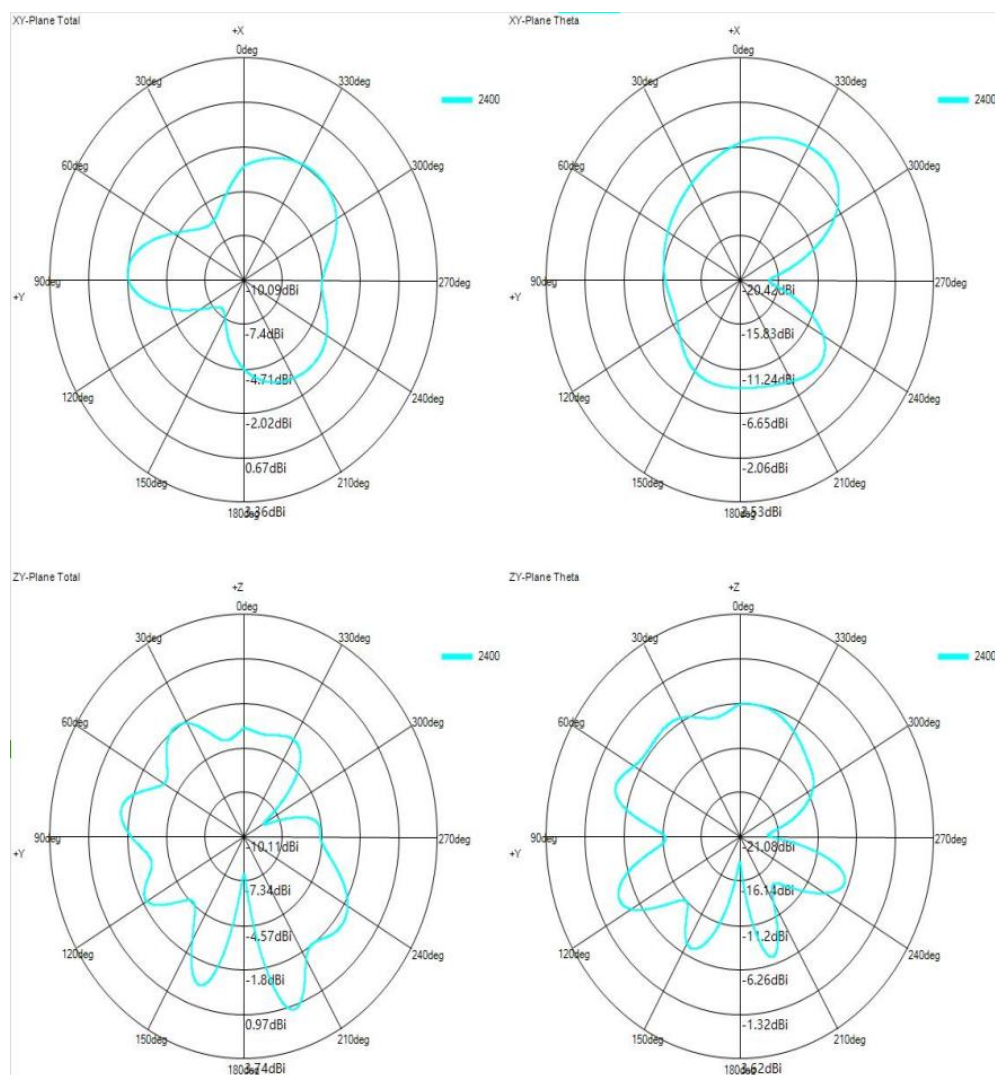
S11 SWR

## 5.Summary of Passive Electrical Performance

| Electrical Specifications                         |                       |
|---------------------------------------------------|-----------------------|
| 频率范围 Frequency range (MHz)                        | WiFi                  |
| 极化方式 Polarization                                 | Vertical polarization |
| 增益 Gain (dBi)                                     | 1.5dBi                |
| 输入阻抗 Input Impedance ( $\Omega$ )                 | 50 $\Omega$           |
| 电压驻波比 VSWR (5800MHZ)                              | $\leq 4$              |
| 最大功率 Maximum input power (W)                      | 2W                    |
| 机械参数 Mechanical Specifications                    |                       |
| 接头类型 Input connector type                         | IPX                   |
| 天线尺寸 Dimensions-mm (Height/Width/Depth)           | 13.5*95mm             |
| 包装尺寸 Packing size (mm)                            | Customer specified    |
| 天线罩材料 Radome material                             | PCB                   |
| 天线罩颜色 Radome color                                | <b>Black</b>          |
| 工作温度 Operating temperature ( $^{\circ}\text{C}$ ) | -30~60                |
| 极限风速 Rated Wind Velocity (m/s)                    | 60                    |
|                                                   |                       |

## 5.1 Test Data

| Passive Test For 2400-2500 |          |           |            |            |          |          |                  |                 |
|----------------------------|----------|-----------|------------|------------|----------|----------|------------------|-----------------|
| Freq (MHz)                 | Effi (%) | Effi (dB) | Gain (dBi) | Gain (dBd) | Max (dB) | Min (dB) | irectivity (dBi) | Beamwidth (3dB) |
| 2400                       | 54.86    | -2.61     | 2.95       | 0.8        | 2.95     | -13.43   | 2.61             | 30              |
| 2410                       | 51.1     | -2.92     | 2.68       | 0.53       | 2.68     | -13.88   | 2.92             | 30              |
| 2420                       | 54.43    | -2.64     | 2.89       | 0.74       | 2.89     | -13.14   | 2.64             | 30              |
| 2430                       | 57.18    | -2.43     | 3.03       | 0.88       | 3.03     | -13.35   | 2.43             | 30              |
| 2440                       | 56.71    | -2.46     | 2.86       | 0.71       | 2.86     | -13.64   | 2.46             | 30              |
| 2450                       | 51.37    | -2.89     | 2.51       | 0.36       | 2.51     | -14.57   | 2.89             | 30              |
| 2460                       | 55.8     | -2.53     | 2.85       | 0.7        | 2.85     | -15.46   | 2.53             | 30              |
| 2470                       | 52.62    | -2.79     | 2.66       | 0.51       | 2.66     | -16.82   | 2.79             | 30              |
| 2480                       | 54.43    | -2.64     | 2.72       | 0.57       | 2.72     | -17.26   | 2.64             | 30              |
| 2490                       | 59.74    | -2.24     | 3.09       | 0.94       | 3.09     | -16.15   | 2.24             | 30              |
| 2500                       | 57.85    | -2.38     | 2.8        | 0.65       | 2.8      | -15.22   | 2.38             | 0               |



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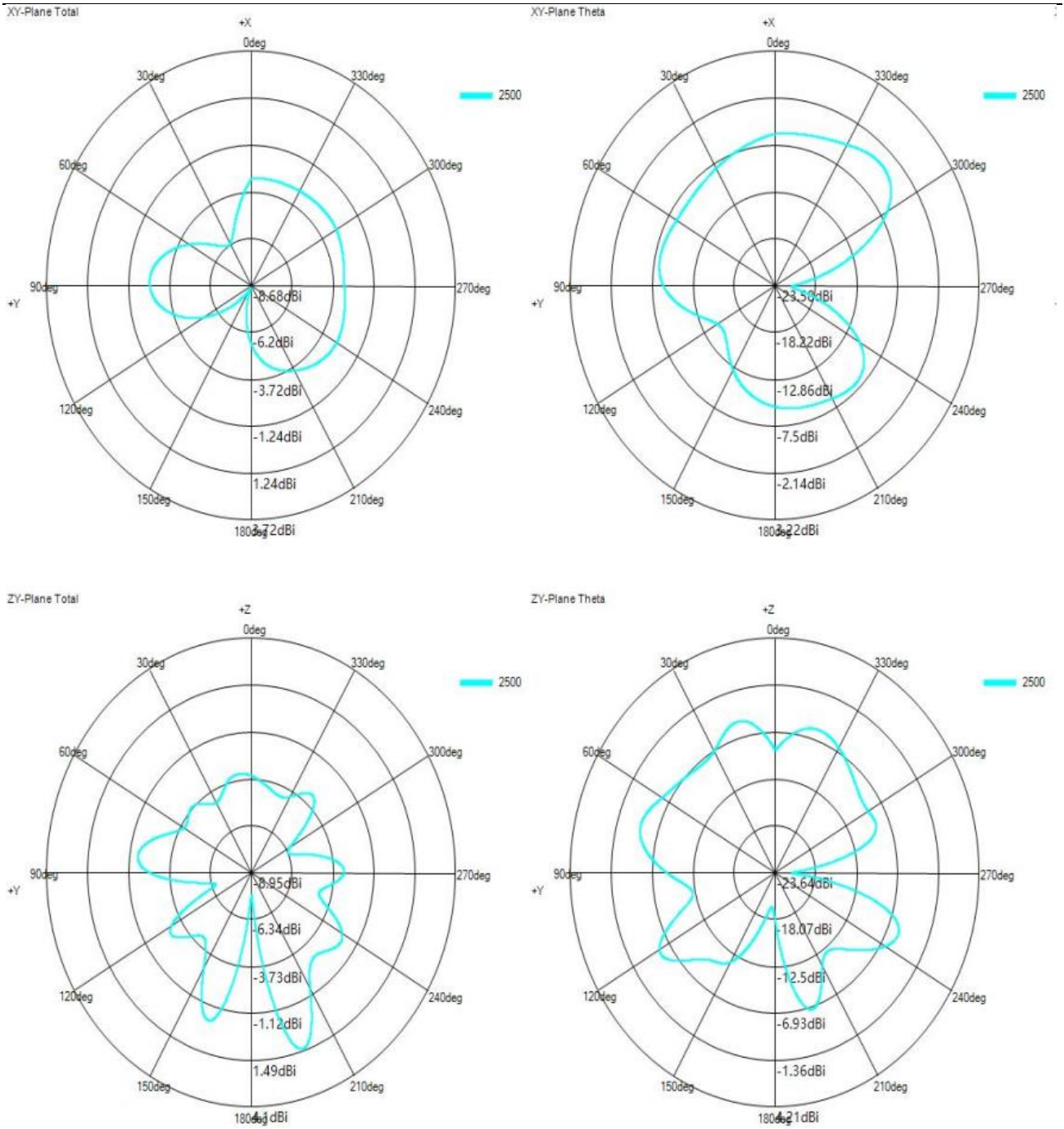
Dosking MicroElectronics Co.,Ltd

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## 6.Structural drawings

