

## SPECIFICATION



深圳市大显科技有限公司

Shenzhen Daxian Technology Co., Ltd.

时空壶 A538(TMK009) 蓝牙天线

Timekettle A538(TMK009) BT Antenna

## 产 品 规 格 书

## Product Specification

|                                 |                    |                            |                    |
|---------------------------------|--------------------|----------------------------|--------------------|
| 客 户<br>connection               | 时空壶<br>Timekettle  | 频 段<br>frequency range     | 2400 ~ 2480MHz     |
| 项目名称<br>entry name              | A538(TMK009)       | 版 本<br>edition             | L4                 |
| 物料编号<br>Material No             | 1A-538XX-086       | 颜 色<br>Color               | 黑色<br>Balck        |
| 客户料号<br>Customer Item<br>Number |                    |                            |                    |
| R F 设计<br>R F Design            | 刘 啸<br>Xiao.Liu    | 结构设计<br>Structural Design  | 周锐斌<br>RuiBin.Zhou |
| 品质经理<br>Quality Manager         | 李高亮<br>GaoLiang.Li | 技术总监<br>Technical Director | 张 磊<br>Lei.Zhang   |
| 日 期<br>Date                     | 2026-07-24         |                            |                    |

客户确认:

Customer confirmation:

装配是否符合贵司要求: ☐OK ☐NGWhether the assembly meets your company's requirements: ☐OK ☐NG

深圳市大显科技有限公司

Shenzhen DaXian Technology Co., Ltd.

深圳市龙岗区布吉镇吉华路 513 号上水径村(国防培训基地  
对面) 达成工业园综合楼 7 楼

TEL:0755-28576002

FAX:0755-84276383

Buji Town, Longgang District, Shenzhen, China Jihua Road 513,  
Shangshuijing Village (opposite the national defense  
training base) Dacheng Industrial Park, Building 7.

TEL:0755-28576002

FAX:0755-84276383

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## 一 项目说明 Project Description

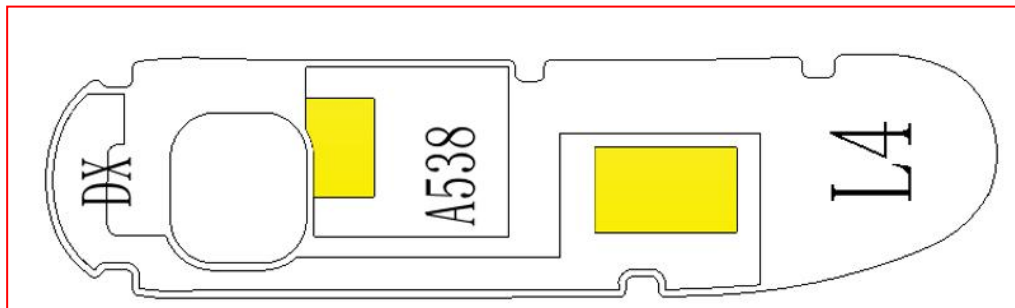
|                                    |                                                    |
|------------------------------------|----------------------------------------------------|
| 客户名:<br>Customer Name:             | 时空壶<br>Timekettle                                  |
| 整机类型:<br>Type of complete machine: | 蓝牙天线<br>Bluetooth antenna                          |
| 天线频段:<br>Antenna band:             | 2400 ~ 2480MHz                                     |
| 天线形式:<br>Antenna form:             | FPC 天线<br>FPC antenna                              |
| 硬件版本:<br>Hardware version:         | V01                                                |
| 天线制造商:<br>Antennamanufacturer:     | 深圳市大显科技有限公司<br>Shenzhen daxian technology co., ltd |

## 二 B T 天线 B T Antenna

### 1 规格 specifications

本报告主要提供 A538(TMK009) 项目天线的各项电气和结构性能参数的测试状况。

This report mainly provides the testing status of various electrical and structural performance parameters of the antenna for the TMK019 project.



天线外观图

antenna appearing diagram

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## 1.1 电气规格标准 Electrical specifications and standards

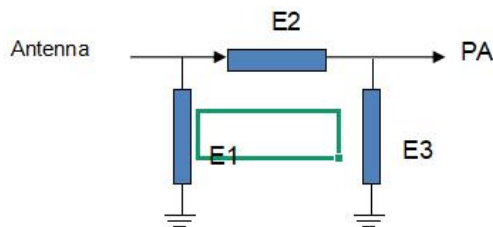
### 1.1.1 电性能指标 Electrical performance index

天线工作频段在 **2400~2480 MHz**。下表是大显设计和量产天线的电性能的指标。

The operating frequency band of the antenna is between 2400 and 2480 MHz. The following table shows the electrical performance indicators of large display design and mass production antennas.

| Frequency Range | Frequency (MHz) | VSWR     |
|-----------------|-----------------|----------|
| BT              | 2400 ~ 2480     | $\leq 2$ |

### 1.1.2 天线匹配图 Antenna Matching Diagram



| 左耳匹配<br>Left ear matching |    |
|---------------------------|----|
| matching                  |    |
| E1                        | NC |
| E2                        | 0欧 |
| E3                        | NC |



## 2 结构规格标准 Structural specifications and standards

### 1.2.1 天线组成 Antenna composition

天线主要是由 FPC 组成。

The antenna is mainly composed of FPC .

## 2、测试设备 The Equipment of Active Test

Satimo 3D Chamber  $4 \times 4 \times 4$  ( m )

CMW500 E5071C

Network analyzer-R&S ZVL

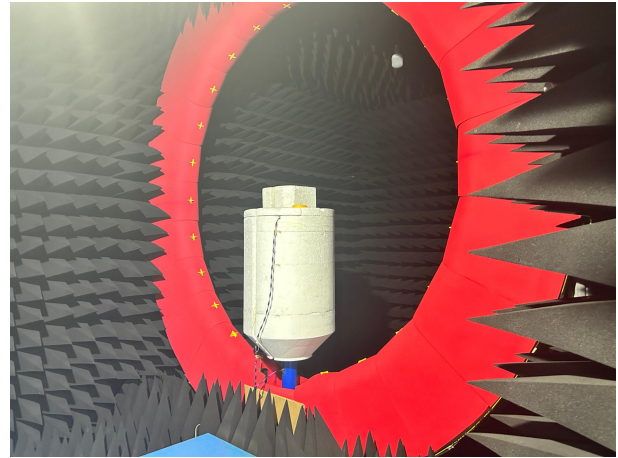
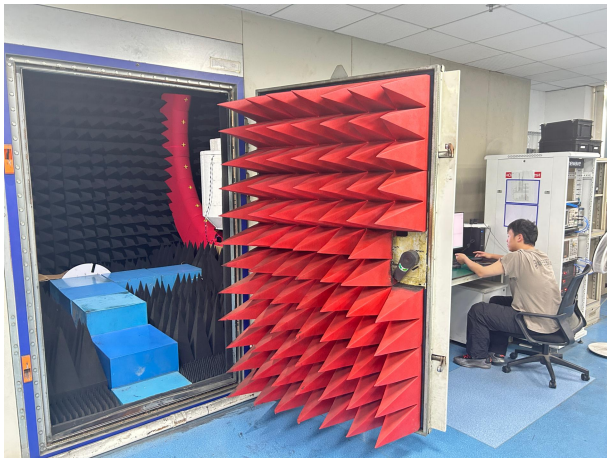


图 2

Figure 2

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### 3 测试 test

#### 3.1 驻波(VSWR)的测试 Test of standing wave (VSWR)

##### 3.1.1 测试连接: VSWR 测试装置依次的连接为: R&S ZVL 网络分析仪 → 测试线 → 测试治

Test connection: The VSWR test device is sequentially connected as follows: R&S ZVL network analyzer → test line → test fixture

##### 实测(附图)Actual measurement (attached drawing)

#### 3.2 增益及效率、功率 (TRP)、灵敏度 (TIS) 的测试

Gain and efficiency, power (TRP), sensitivity (TIS) testing

##### 3.2.1 测试的场地 Test site:

大显微波暗室。测试频率范围为 400MHz—6GHz, 静区范围为 50cm 圆周, 反射率小于 -50 dB。

Large display microwave anechoic chamber. The test frequency range is 400MHz - 6GHz, the static zone range is 50cm circumferential, and the reflectivity is less than -50dB.

##### 3.2.2 测试的仪表 Tested Instruments:

R&S ZVL 网络分析仪、CMW500 E5071C、标准喇叭天线、法国 SATIMO-SG24SYSTEM 系统、打印机等。

R&S ZVL network analyzer, Agilent 8960 E5515C, standard horn antenna, French SATIMO-SG24SYSTEM system, printer, etc.

##### 3.2.3 测试数据: 在微波暗室中, 测试的功率和灵敏度相关的数值如下表

Test data: In a microwave anechoic chamber, the values related to the power and sensitivity tested are shown in the table below

##### OTA 有源测试 OTA Active Test:

| 1#                 |      |        |  |                    |       |        |
|--------------------|------|--------|--|--------------------|-------|--------|
| 自由空间<br>Free Space | L边   |        |  | 头模<br>Head phantom | L边    |        |
|                    | TRP  | TIS    |  |                    | TRP   | TIS    |
|                    | 3.16 | -88.23 |  |                    | -1.67 | -82.88 |
|                    | 3.24 | -88.36 |  |                    | -1.42 | -83.25 |
|                    | 3.55 | -88.37 |  |                    | -1.56 | -83.35 |
| 2#                 |      |        |  |                    |       |        |
| 自由空间<br>Free Space | L边   |        |  | 头模<br>Head phantom | L边    |        |
|                    | TRP  | TIS    |  |                    | TRP   | TIS    |
|                    | 3.19 | -88.34 |  |                    | -1.71 | -83.02 |
|                    | 3.33 | -88.55 |  |                    | -1.45 | -83.27 |
|                    | 3.67 | -88.51 |  |                    | -1.51 | -83.33 |

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**无源效率&增益 Passive efficiency&gain:**

L 边——自由状态 L-edge-free space state

| Frequency (MHz) | Gain(dBi) | Efficiency(dB) | Efficiency (%) |
|-----------------|-----------|----------------|----------------|
| 2400            | -0.56     | -6.72          | 21.26          |
| 2410            | -0.53     | -6.49          | 22.42          |
| 2420            | -0.49     | -6.28          | 23.56          |
| 2430            | -0.46     | -6.26          | 23.64          |
| 2440            | 0.41      | -6.18          | 24.12          |
| 2450            | 0.37      | -6.11          | 24.49          |
| 2460            | -0.34     | -5.98          | 25.21          |
| 2470            | -0.32     | -5.91          | 25.65          |
| 2480            | -0.22     | -5.73          | 26.71          |

L 边——头模状态 L-edge-die state

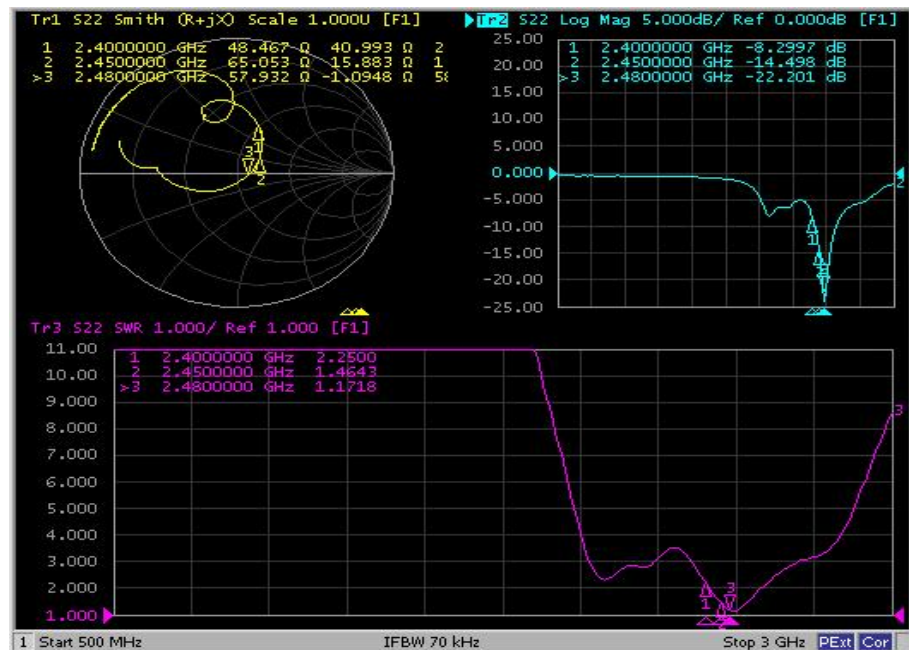
| Frequency (MHz) | Gain(dBi) | Efficiency(dB) | Efficiency (%) |
|-----------------|-----------|----------------|----------------|
| 2400            | -6.91     | -10.89         | 8.14           |
| 2410            | -7.01     | -10.85         | 8.23           |
| 2420            | -6.49     | -10.81         | 8.29           |
| 2430            | -6.43     | -10.76         | 8.39           |
| 2440            | -6.32     | -10.74         | 8.43           |
| 2450            | -6.53     | -10.77         | 8.37           |
| 2460            | -6.47     | -10.83         | 8.26           |
| 2470            | -7.04     | -10.87         | 8.18           |
| 2480            | -7.23     | -11.1          | 7.77           |

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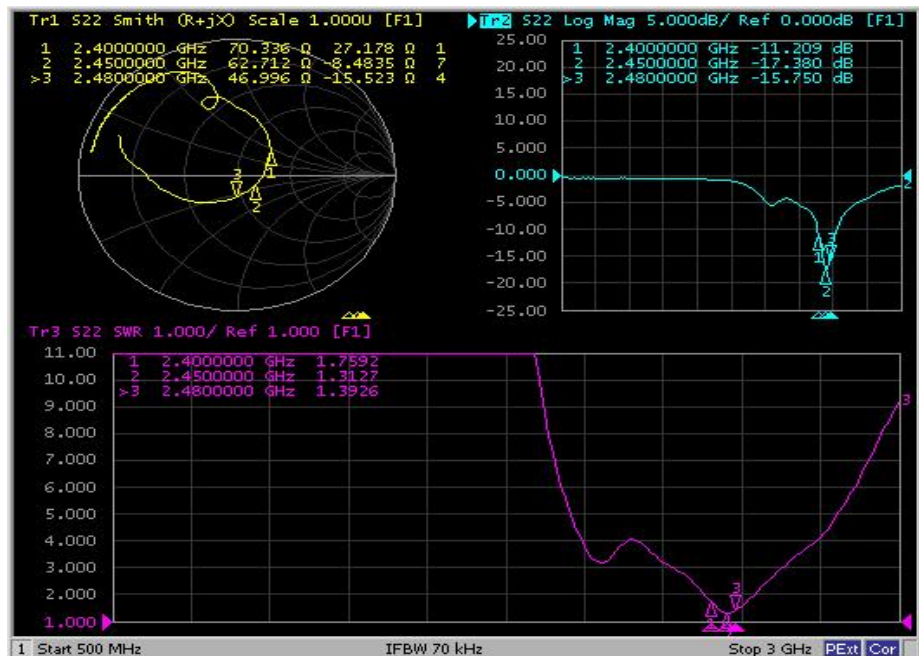
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#### 4、VSWR 参数图 VSWR parameter diagram

L 边——自由状态 L-edge-free space state



L 边——头模状态 L-edge-die state



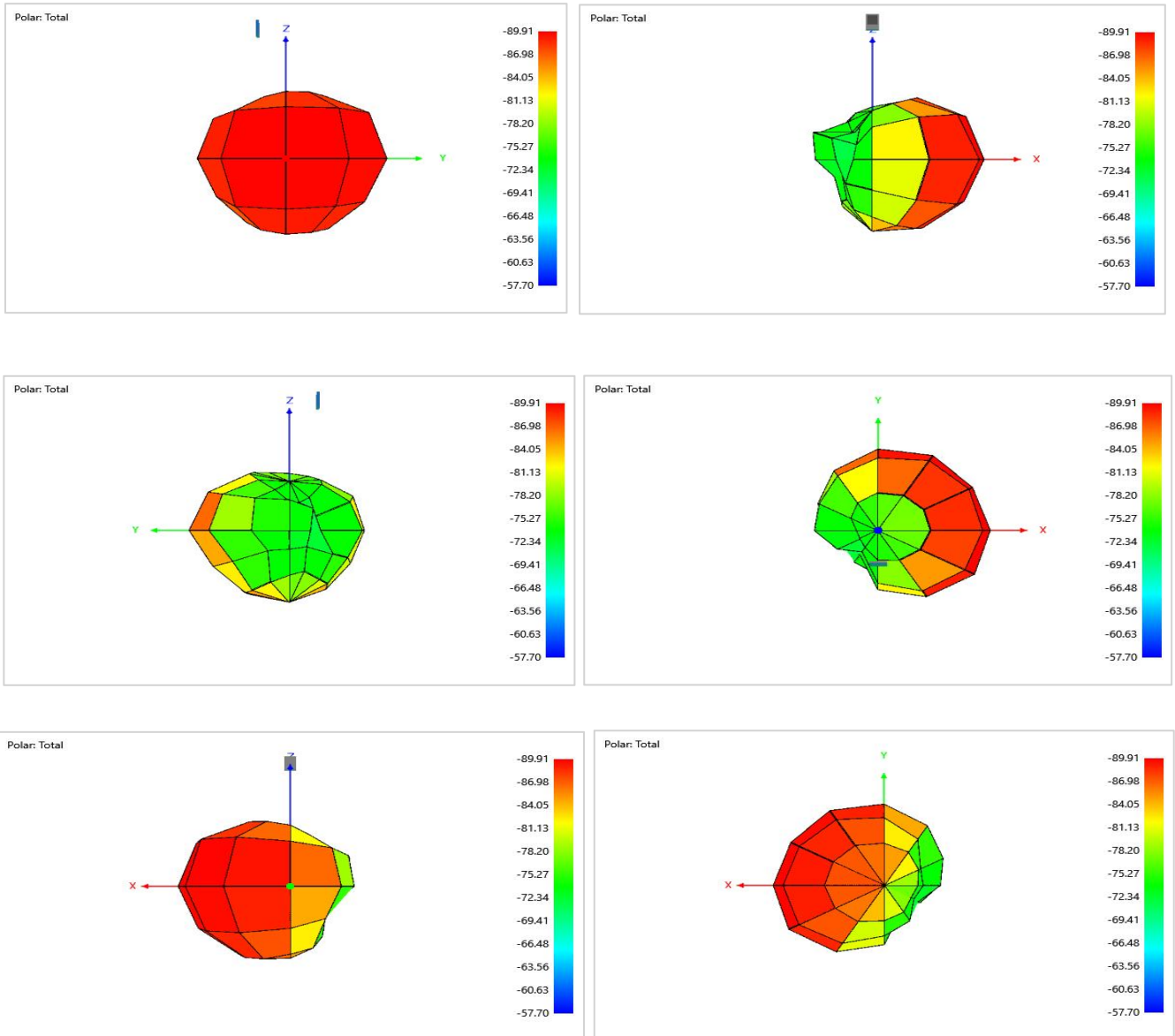
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## 5、有源场型图 Active field pattern diagram

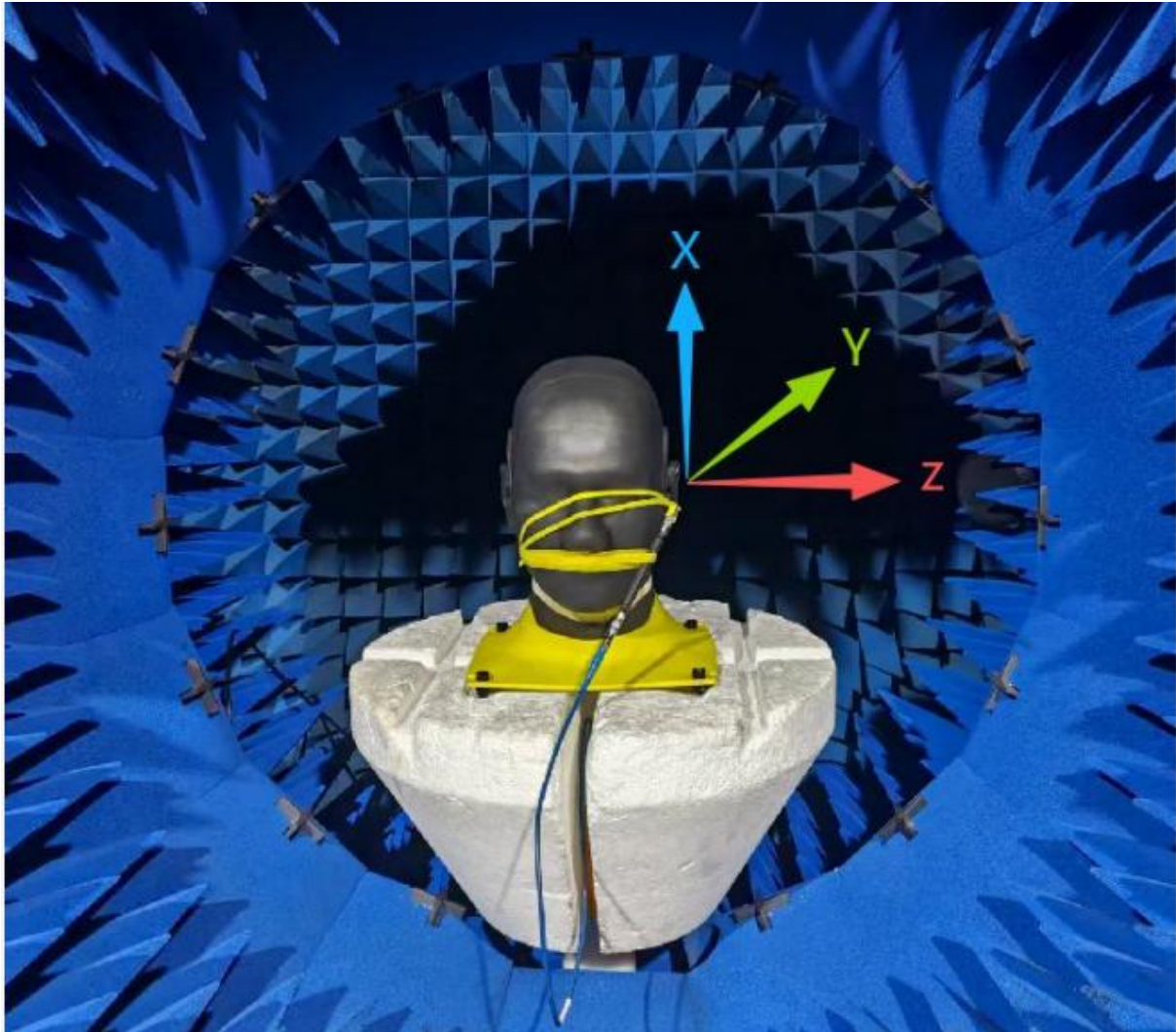
L 边--头模状态 R-edge-die state



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## 6、暗室坐标系 Darkroom coordinate system



## 7、结论 conclusion

此天线是在客户提供样机基础上设计，电参数和结构性能已达到技术要求，请确认！

This antenna is designed based on the prototype provided by the customer. The electrical parameters and structural performance have met the technical requirements, please confirm!

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