



# SPECIFICATION

## SHEET FOR APPROVAL

|   |
|---|
| CUSTOMER: GSD   |
| model: WXP41-2  |
| PART NAME: WiFi Antenna   |
| Description: : WXP41-6.3-5.0/2.4G-5.8G<br>IPEX/63mm-50mm/600pcs//F01901000217 |
| NO.: G. P. 13. H019010217   |
| DATE:06/06/2023   |

| Han yang        |            |             |              |
|-----------------|------------|-------------|--------------|
| MANAGER CHECKED | ME CHECKED | RF CHECKED  | DATE         |
| Liu zhi gao     | Zhang shun | Lv jun peng | 2023 -06- 06 |

| CUSTOMER   |            |            |                 |
|------------|------------|------------|-----------------|
| QA CHECKED | ME CHECKED | RF CHECKED | MANAGER CHECKED |
|            |            |            |                 |

Manufacturer : SHENZHEN HANGYANG ANTENNA DESIGN CO., LTD.

Manufacturer address: 12A Floor, Bao Yunda Logistics Information Building, Qianjin Road, Bao 'an District, Shenzhen.

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## Revision record

| DATE       | Modify the content | version | Changed     |
|------------|--------------------|---------|-------------|
| 2023/06/06 | First production   | V01     | Liu zhi gao |
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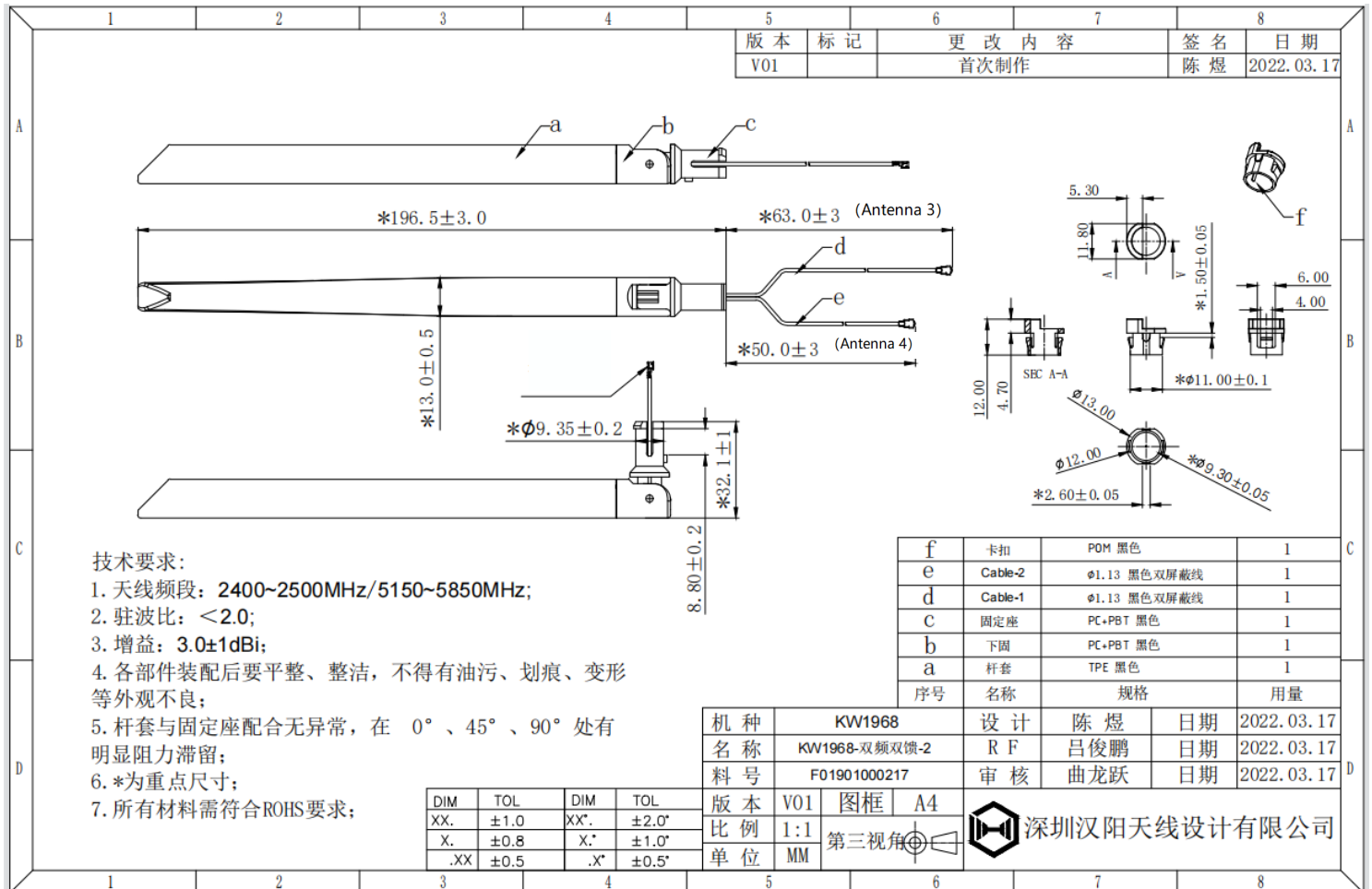


## Main technical parameters of products

| <b>Electrical index</b>         |                               |
|---------------------------------|-------------------------------|
| <b>Frequency Spectrum</b>       | 2400-2500MHz<br>5150-5850 MHz |
| <b>Characteristic Impedance</b> | 50Ω                           |
| <b>VSWR</b>                     | ≤ 2                           |
| <b>Peak Gain_dBi</b>            | 3dBi ± 1dBi                   |
| <b>Efficiency %</b>             | > 40%                         |
| <b>Polarization</b>             | Linear Polarization           |
| <b>Directivity</b>              | Omnidirectional               |
| <b>Operation/Storage Temp</b>   | -30 ~ 75°C                    |
| <b>Physical index</b>           |                               |
| <b>Antenna Material</b>         | FR4                           |
| <b>Cable</b>                    | 1.13 Black                    |
| <b>Antenna Casing</b>           | Black/ABS                     |
|                                 |                               |
|                                 |                               |



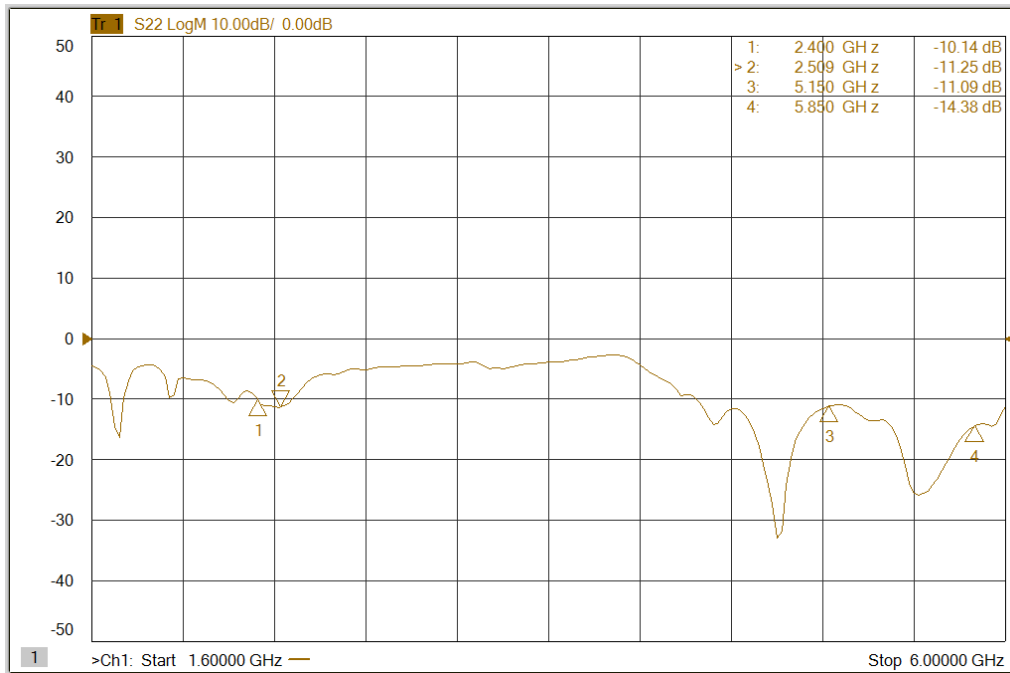
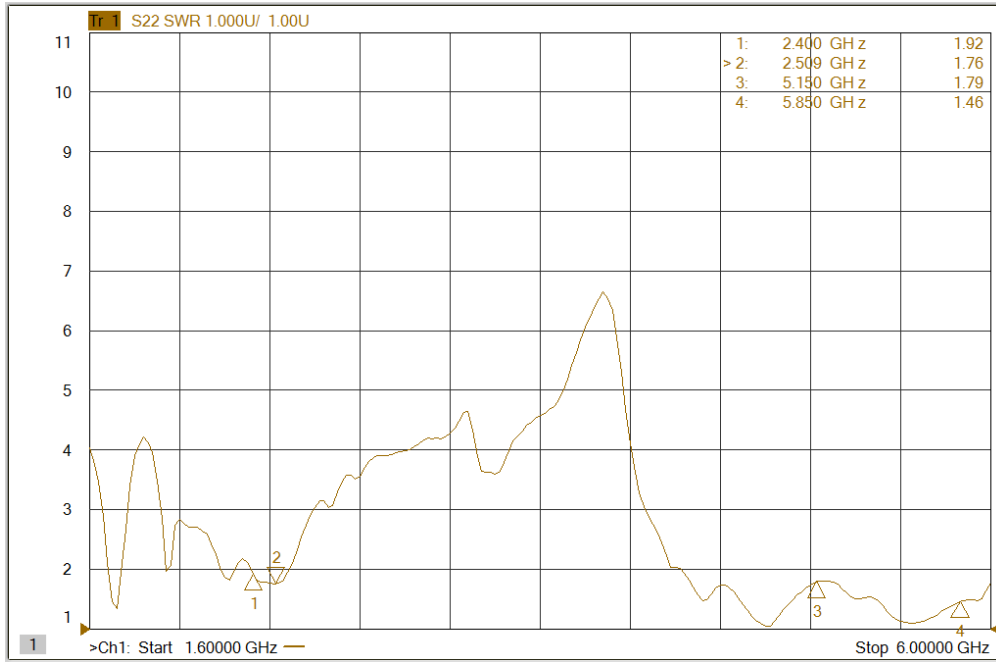
# 1. Mechanical Specification





## 2. L=63mm Down Antenna test data (Antenna 3)

### 2.1 VSWR / S-parameter



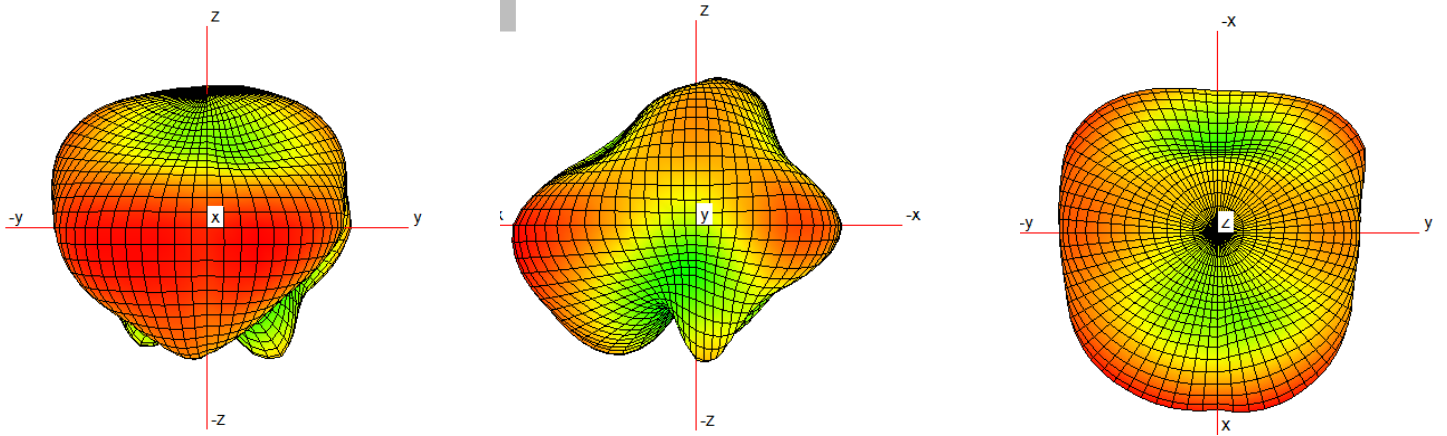


## 2.2 Efficiency & Gain

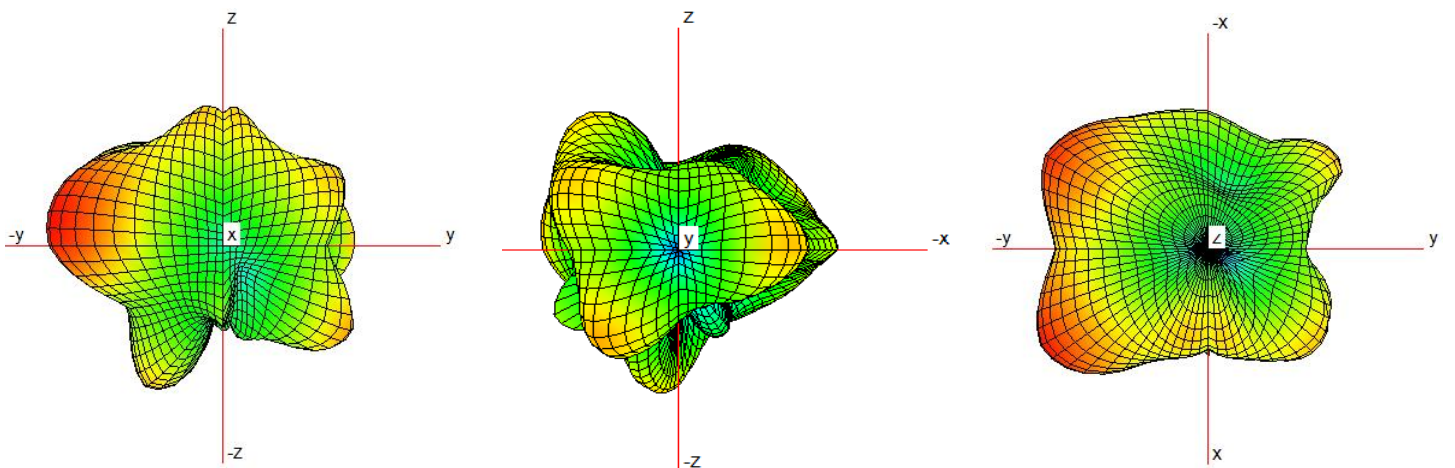
| Frequency    | 2400  | 2450  | 2500  | 5150  | 5550  | 5850  |
|--------------|-------|-------|-------|-------|-------|-------|
| Efficiency % | 45.46 | 42.26 | 43.65 | 52.83 | 60.48 | 52.10 |
| Gain dBi     | 0.69  | 0.54  | 0.49  | 1.68  | 2.50  | 2.74  |

## 2.3 3D Radiation Pattern

2450MHz



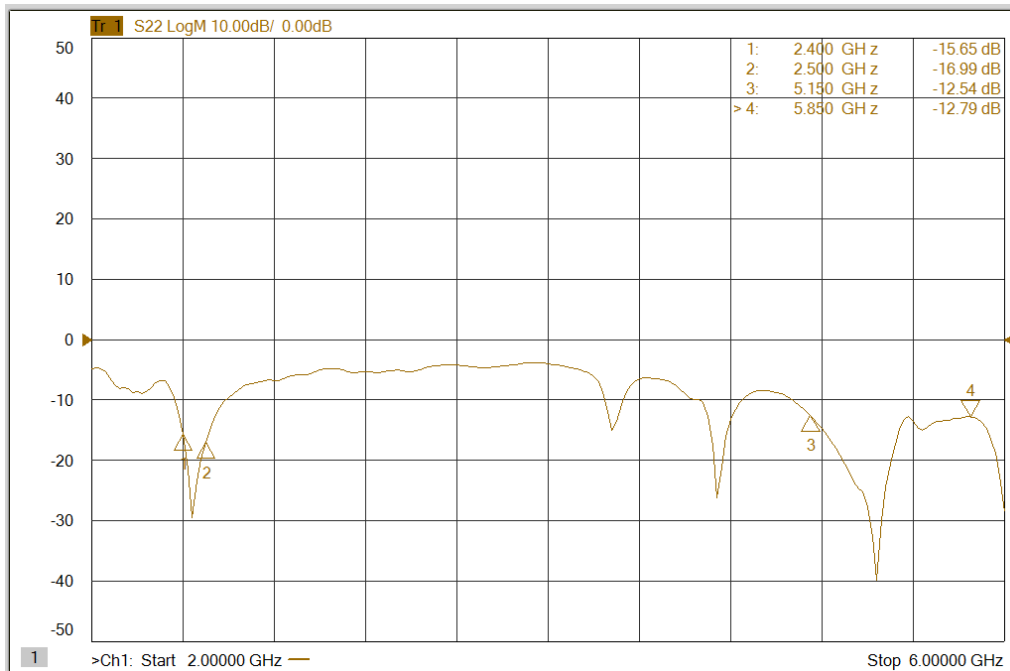
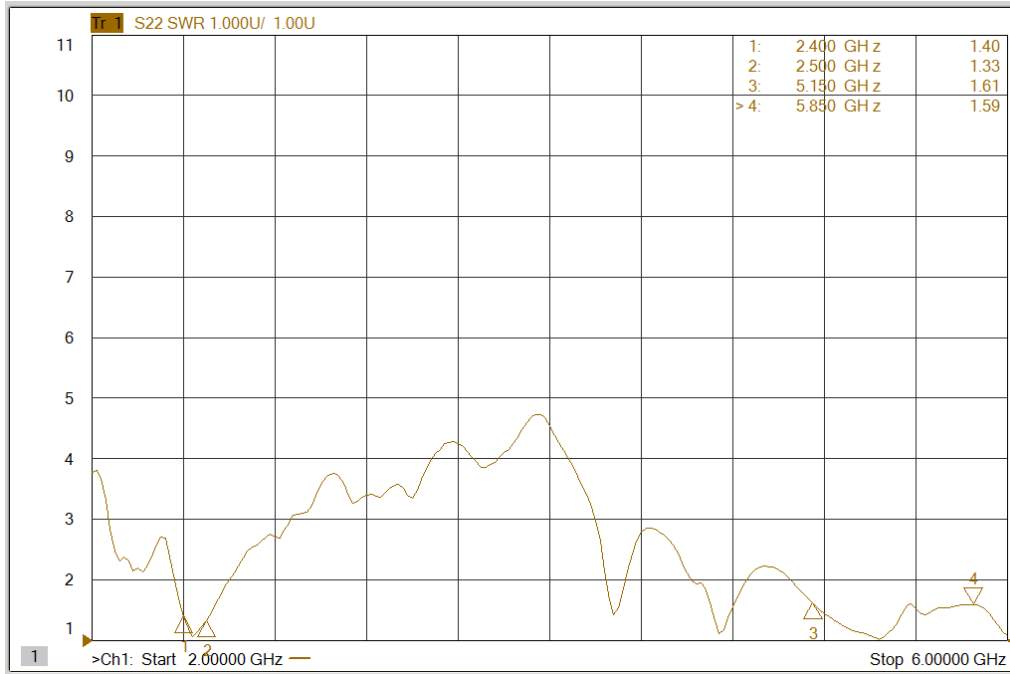
5550MHz





### 3. L=50mm Up Antenna test data (Antenna 4)

#### 3.1 VSWR / S-parameter





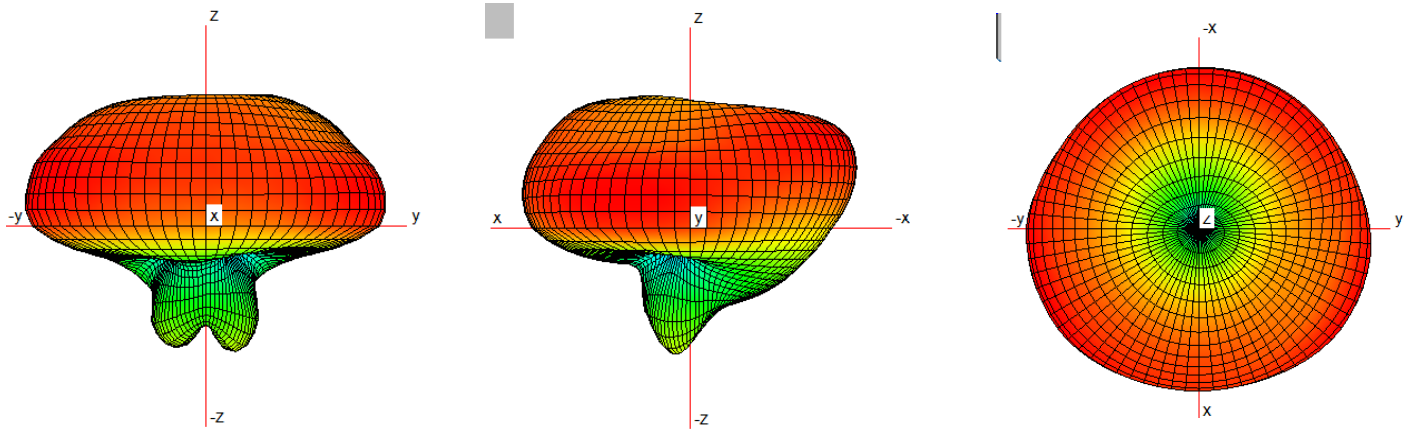


### 3.2 Efficiency & Gain

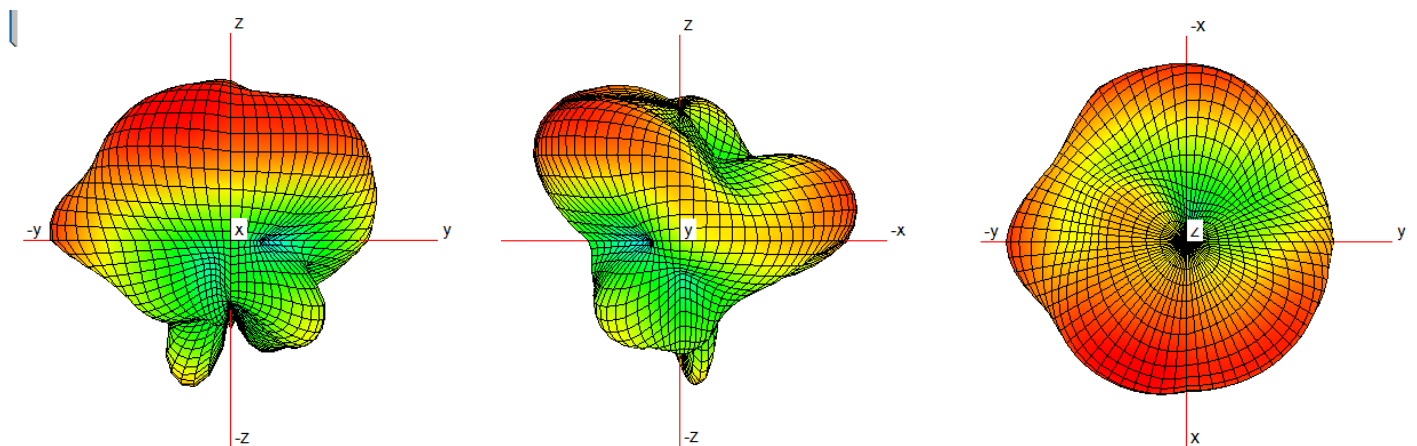
| Frequency    | 2400  | 2450  | 2500  | 5150  | 5550  | 5850  |
|--------------|-------|-------|-------|-------|-------|-------|
| Efficiency % | 59.27 | 57.73 | 54.41 | 49.43 | 44.88 | 46.25 |
| Gain dBi     | 1.89  | 1.02  | 0.87  | 0.96  | 2.05  | 1.81  |

### 3.3 3D Radiation Pattern

2450MHz

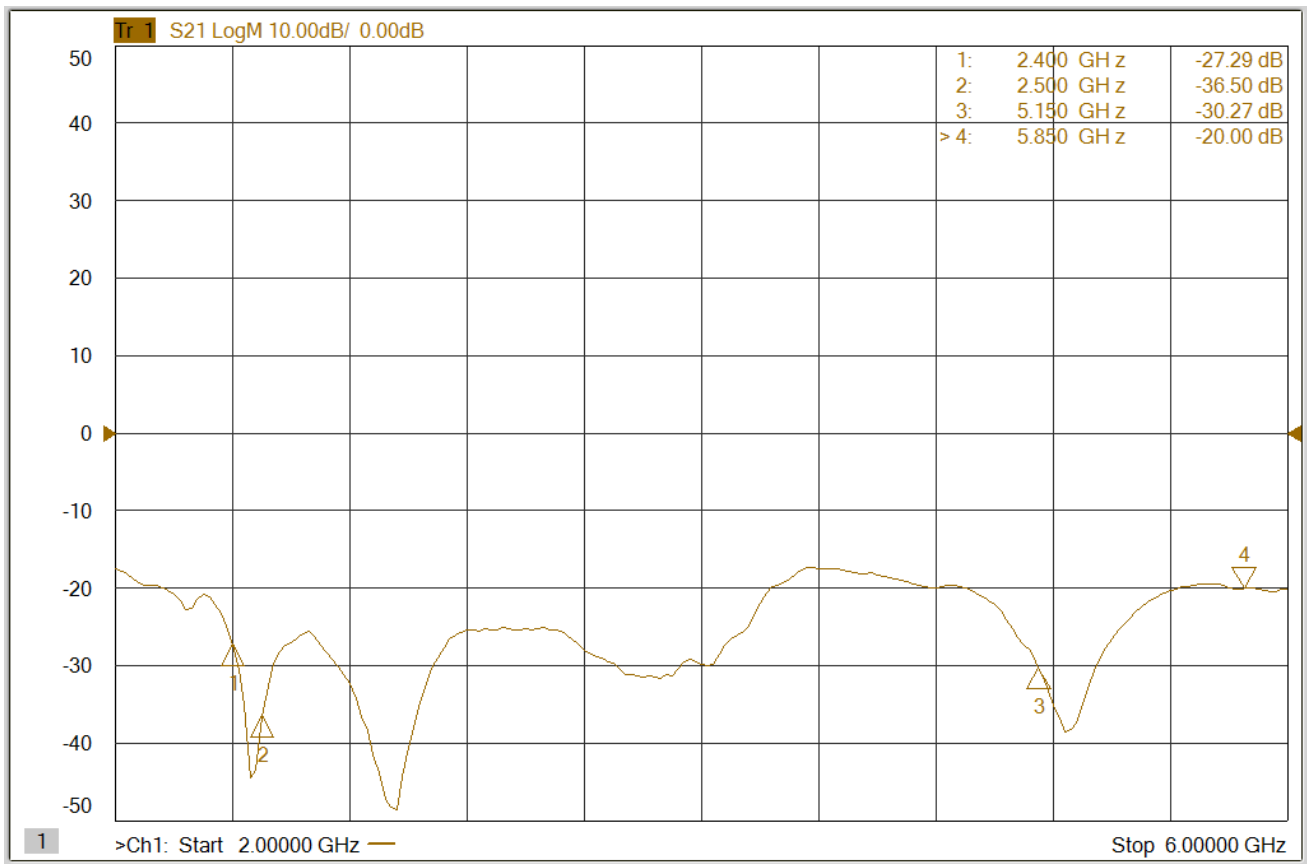


5550MHz





## 4. Isolation of upper and lower antennas





## 5. Reliability Testing:

|    | Test item                     | Specify  |
|----|-------------------------------|--|
| 1. | <b>Bending endurance test</b> | <p>Test purpose: to verify that the antenna elbow with bending function can meet the durability of long-term use;</p> <p>Preset conditions:</p> <ol style="list-style-type: none"><li>1) The electrical properties of the tested samples meet the requirements, and the appearance of the samples has no defects such as cracking and abrasion;</li><li>2) Minimum sample size: 3pcs. Test procedure:<ol style="list-style-type: none"><li>1) Check whether the mechanical and electrical functions of the antenna are normal before the test; Place the whole antenna horizontally and fix the antenna connector;</li><li>2) Manually or mechanically rotate the antenna base to the position of 90 degrees with the connector, and then rotate it to the original position, with one reciprocating count. The test frequency is 30-40 times per minute, with a total of 500 bends, with an interval of 5 minutes every 100 times</li><li>3) After the test, check the antenna appearance and mechanical performance criteria:<ol style="list-style-type: none"><li>1) There shall be no obvious physical damage to the antenna after the test, and it shall not slide when the antenna is folded at 30 degrees from the vertical.</li><li>2) The appearance of the sample has no defects such as cracking and abrasion;</li><li>3) There is no change in electrical performance before and after the test.</li></ol></li></ol></li></ol> |



|    |                                      |   |
|----|--------------------------------------|---|
| 2. | <b>Antenna lateral pressure test</b> | <p>Test purpose: to verify the lateral pressure resistance of the integrated external antenna of the product, and to test the strength of the antenna itself and the strength of the contact part between the product and the equipment, such as the strength of the shell and the strength of the anti-rotation limit rib.</p> <p>Preset conditions:</p> <ol style="list-style-type: none"><li>1) The electrical properties of the tested samples meet the requirements, and the appearance of the samples has no defects such as cracking and abrasion.</li><li>2) The antenna is installed on the product in a normal state, and the product is fixed.</li><li>3) Each test sample shall be at least 3pcs; ◦</li></ol> <p>Test steps:</p> <ol style="list-style-type: none"><li>1) Before testing, check the appearance and function of the sample to be tested;</li><li>2) Conduct the following two tests, using two sets of materials respectively:<br/>Test 1: Make the antenna open and straight, apply 20N force inward, outward, upward and downward at the position of 5mm at the antenna end, and keep it for 5S. Repeat this operation for 10 times in each direction.<br/>Test 2: Make the antenna in a 90-degree bending state, and when twisting the antenna until the rotation-stopping limit rib works, apply a force of 20N at the 5mm position at the antenna end, and keep it for 5S, and repeat this operation for 10 times. Complete the test of positive and negative limit positions.</li><li>3) In the above two groups of tests, if it is found that when the antenna is stressed, the antenna deformation angle is greater than 30 and the external force is still less than 20N, keep the deformation angle at 30, cancel the external force after 5 seconds, and repeat the above operations for 10 times; Complete 4 direction tests, totaling 40 times;</li><li>4) If there are multiple antennas on the same product, each antenna installation position on the product should be tested.</li></ol> <p>Criterion:</p> <ol style="list-style-type: none"><li>1. The mechanical and electrical functions of the antenna are normal after the test;</li><li>2. The antenna can be bent manually, the shell is not allowed to break, and the wire core is not allowed to break.</li><li>3. The limiting rib of the main equipment is cracked, and the buckle of the shell cannot be loosened or broken;</li><li>4. The electrical performance of the antenna has not changed before and after the test</li></ol> |
|----|--------------------------------------|---|



|    |   |   |
|----|---|---|
| 3. | <b>Antenna rotation durability test</b> | <p>Test purpose: to verify the durability requirements of the antenna with free rotation function between the antenna fixed head and the antenna body for long-term use;<br/>Preset conditions: the electrical properties of the test sample meet the requirements, and the appearance of the sample has no defects such as cracking and wear;</p> <p>test procedure:</p> <p>180 ° rotatable antenna:</p> <ol style="list-style-type: none"><li>1. Before testing, ensure that the mechanical and electrical functions of the antenna are normal, and there can be no physical damage;</li><li>2. Bend the antenna base into the direction perpendicular to the connector.</li><li>3. Install the antenna on the fixed platform of the corresponding model, and bend the antenna base to make it perpendicular to the connector.</li><li>4. Manually or mechanically rotate the antenna base to the horizontal position (90 degrees) to the left, then rotate it to the original position, then rotate the antenna base to the horizontal position (90 degrees) to the right, and then rotate it to the original position, and count the whole reciprocating once.</li><li>5. The test frequency is 30~40 times per minute, with a total rotation of 1000 times;</li><li>6. After the test, check the mechanical and electrical performance of the antenna.</li></ol> <p>360-degree rotatable antenna:</p> <ol style="list-style-type: none"><li>1. Before testing, ensure that the mechanical and electrical functions of the antenna are normal, and there can be no physical damage;</li><li>2. Bend the antenna base into the direction perpendicular to the connector.</li><li>2. Install the antenna on the fixed platform of the corresponding model, and bend the antenna base to make it perpendicular to the connector.</li><li>3. Manually or mechanically rotate 360 degrees to the left to return to the original position, then rotate the antenna base 360 to the right to return to the original position, and count the whole reciprocating twice.</li><li>4. The test frequency is 30~40 times per minute, with a total rotation of 1000 times;</li><li>5. After the test, check the mechanical and electrical performance of the antenna.</li></ol> <p>Criterion:</p> <ol style="list-style-type: none"><li>1. After the test, the antenna shall not be obviously physically damaged, and the antenna rotating head has the function of fixing the rotating position of the antenna after the test, and the limit structure of the main equipment is not damaged;</li><li>2. There is no change in electrical performance before and after the test.</li></ol> |
|----|---|---|




|    |  |   |
|----|--|---|
| 4. | <b>Free drop test of the whole machine</b> | <p>Verify whether the drop strength of desktop and handheld terminal meets the requirements during use/handling.</p> <p>Test procedure:</p> <p>Ensure that the mechanical and electrical functions of the sample are normal.</p> <p>Test conditions:</p> <ol style="list-style-type: none"><li>1) Ensure that the mechanical and electrical functions of the sample are normal.</li><li>2) The open state of the antenna, together with the falling height of the whole machine of 0.8m,6 faces, one cycle, recorded 6 times in total, marble platform,</li><li>3) During the test, it is required to check the appearance and function of each surface to be tested. When the next surface is tested, if the fault is caused, it can be recovered manually, and the test can be carried out after manual recovery.</li><li>4) After 1 cycle test is completed, check the mechanical function and electrical function of the sample.</li></ol> <p>Criterion:</p> <ol style="list-style-type: none"><li>1. The mechanical function and electrical function of the sample are normal.</li><li>2. Allow manual recoverable mechanical failure to occur.</li><li>3. Minor mechanical failures that do not affect the normal use and safety of users are allowed.。</li></ol> |
|----|--|---|



|    |                                    |   |
|----|------------------------------------|---|
| 5. | <b>Antenna tensile test</b>        | <p>Test purpose: to verify whether the strength of the antenna connection meets the requirements;</p> <p>Preset conditions: the electrical properties of the test sample meet the requirements, and the appearance of the sample has no defects such as cracking and wear; Test process:</p> <ol style="list-style-type: none"><li>1, the initial inspection before the test, to ensure that the prototype parts function normally before the test;</li><li>2. Fix the fixed head, and apply a pulling force of 5kgf to the rotating shaft of the antenna, and keep it for 2s when the force reaches 5kgf;</li><li>3. Repeat the operation step (2) for 20 times;</li><li>4. Fix the rotating shaft of the antenna, and apply a pulling force of 5kgf to the antenna end, and keep it for 2s when the force reaches 5kgf;</li><li>5. Repeat the operation step (4) for 20 times. Criterion:</li></ol> <ol style="list-style-type: none"><li>1. There shall be no obvious physical damage to the antenna after the test is completed.</li><li>2. There is no change in electrical performance before and after the test.</li></ol> |
| 6. | <b>Antenna installation force</b>  | <p>Test purpose: to verify whether the installation force of antenna in production and assembly meets the requirements of human comfort;</p> <p>Preset conditions: ONT and antenna must be brand-new samples and installed for the first time; The second installation will obviously reduce the installation force due to the wear of structural parts, which will lead to invalid test data;</p> <p>Test process:</p> <ol style="list-style-type: none"><li>1. Initial inspection before testing to ensure that the ONT shell and antenna are brand-new prototypes, and the antenna has not been installed;</li><li>2. Fix the ONT housing and press the antenna into the antenna mounting hole of the ONT housing; You can use a press to record the antenna installation force.</li><li>3. Number of prototypes: 13pcs</li></ol> <p>Checkpoints, requirements, indicators and expected results: 1. Antenna installation force is less than 30N;</p>   |
| 7. | <b>Antenna abnormal sound test</b> | <p>Test purpose: to verify that the antenna has no abnormal noise during shaking; Test criterion: manually shake the single antenna without abnormal noise;</p>   |



|    |                              |  |
|----|------------------------------|--|
| 8. | <b>Rotational force test</b> | <ol style="list-style-type: none"><li>1. Adjust the direction of the main equipment so that the antenna is placed horizontally, and the direction of the antenna rotation force is parallel to the horizontal desktop.(as shown in the figure below) to avoid the influence of antenna gravity on the measurement of rotating force<br/><br/>Schematic diagram of external antenna rotation force test</li><li>2. Push the antenna to rotate slowly and uniformly at the end of the antenna 5mm with a thrust meter, and keep the thrust direction perpendicular to the antenna during the rotation (the thrust arm is always equal to the distance from the point where the force acts to the rotating shaft). Take the maximum rotational damping force of the antenna in the process of forward and reverse full-angle rotation, measure it for 3 times, and the average value is f;</li><li>3. Measure each external antenna as described above.</li></ol> <p>The required indicators and expected results to be achieved by the checkpoint: 1. <math>0.6n \leq f \leq 2.6n</math>.</p> <ol style="list-style-type: none"><li>2. The lower limit of antenna rotation force shall meet the following requirements:<br/>A the antenna can overcome its own weight and remain in place at any position after the rotation durability test.<br/>B the antenna can overcome its own weight and remain in place at any position after high temperature storage test.</li><li>3. The difference of rotational force of the same type of external antenna on the same product is less than 30%, that is, (maximum rotational force <math>F_{max}</math>- minimum rotational force <math>F_{min}</math>)/ minimum rotational force <math>f_{min}</math> is less than 30%.</li></ol> <p>Test description:</p> <ol style="list-style-type: none"><li>1. The number of test samples is 3pcs. The number of test samples means that there are 2pcs antennas on the main equipment, so the total number of antennas tested is 6pcs.</li><li>2. This use case is suitable for investigating the matching performance between the external antenna device and the main equipment shell.</li></ol> |
|----|------------------------------|--|



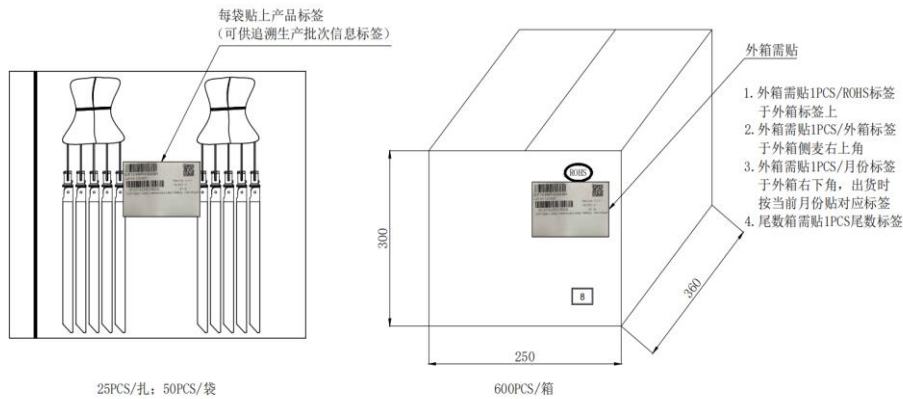


## 6. Environmental Protection

Meet the requirements of ROHS2.0 standard, meet the requirements of European RHOS\REACH, meet the requirements of China RHOS\REACH, and lead-free electroplating.。

## 7. Packing

|  |                    |   |                                   |
|--|--------------------|---|-----------------------------------|
|  | Incoming packaging | <ol style="list-style-type: none"> <li>1. The antenna monomer is packed in PE plastic bags, and then packed in the outer packing box;</li> <li>2. Stick the product label on the outer packing box;</li> <li>3. Traceable production batch information label</li> </ol> | See the figure below for details. |
|--|--------------------|---|-----------------------------------|



## Label picture format reference template





## 8. Environmental Requirement:

| environmental parameter          | Index  | 引用标准   |
|----------------------------------|--|--|
| Storage temperature range (°C)   | -60~+75  | Reference standard: IEC 60068-2-1/2/6/14/30/31/78 ETSI EN 300 019-2-1/2/3 GR-63-CORE |
| operating temperature range (°C) | -60~+75  |  |
| Storage humidity range           | 40°C, 95% humidity, 96 hours   |  |
| Operating humidity range         | 5%~95%   |  |
| <b>Alternating damp heat</b>     | <p>1) Check the test surface to keep it clean and dry, and at the same time, there are no bubbles and scratches on the product surface.</p> <p>2) put the sample into a constant temperature and humidity box, keep the temperature at +25°C, and raise the humidity to 95%RH within 1 hour.</p> <p>3) keep the humidity at 95% RH; Heating to+55 DEG C within 3 hours;</p> <p>4) Maintain +55°C and 95% RH for 9 hours.</p> <p>5) keep the humidity at 95% RH; Cooling to+25 DEG C within 3 hours;</p> <p>7) Repeat steps 2) to 5) for 5 times (6 cycles in total);</p> <p>8) Keep the temperature at +25°C and reduce the humidity to 50% within 1 hour;</p> <p>9) Maintain +25°C and 50% RH for 2 hours.</p> <p>Requirements, indicators and expected results to be achieved by the checkpoint:</p> |  |



|                          |  |  |
|--------------------------|--|--|
| <b>temperature cycle</b> | <p>1) Check the test surface to keep it clean and dry, and at the same time, there are no bubbles and scratches on the product surface.</p> <p>2) putting the product into a cold and hot shock test box, cooling to <math>-40^{\circ}\text{C}</math> at a rate of <math>1^{\circ}\text{C}/\text{min}</math>, and keeping it at <math>-40^{\circ}\text{C}</math> for 4 hours;</p> <p>3) Put the product into a cold and hot shock test box, raise the temperature to <math>+80^{\circ}\text{C}</math> at a rate of <math>1^{\circ}\text{C}/\text{min}</math>, and keep it at <math>+80^{\circ}\text{C}</math> for 4 hours. 4) Repeat the previous two steps for 8 times (9 cycles in total). And check the electrical performance of the equipment. 5) Raise the temperature to <math>+25^{\circ}\text{C}</math> at the rate of <math>1^{\circ}\text{C}/\text{min}</math> and keep it for 24 hours. 6) Test the adhesion of the test surface with "adhesive tape method".</p> <p>Requirements, indicators and expected results to be achieved by the checkpoint:</p> <ol style="list-style-type: none"><li>1. The antenna should not be discolored, cracked, degummed or warped.</li></ol> <p>Loss of function and so on.</p> <ol style="list-style-type: none"><li>2. The damping force of antenna and ONT has no obvious change, but the antenna and ONT have no obvious change.</li></ol> | Reference standard:<br><br>IEC 60068-2-1/2/6/14/30/31/78E<br>TSI EN 300 019-2-1/2/3 GR-63-CORE |
|--------------------------|--|--|

|                                 |   |  |
|---------------------------------|---|--|
| <b>High temperature storage</b> | <p>Heating to <math>70^{\circ}\text{C}</math> at the rate of <math>1^{\circ}\text{C}/\text{min}</math>, and keeping at <math>70^{\circ}\text{C}</math> for 24 hours; The temperature was reduced to <math>+25^{\circ}\text{C}</math> at the rate of <math>1^{\circ}\text{C}/\text{min}</math> and kept for 2 hours.</p> <p>Minimum sample size: 3pcs</p> <p>Requirements, indicators and expected results to be achieved by the checkpoint:</p> <ol style="list-style-type: none"><li>1. The antenna shall not be discolored, cracked, degummed, warped and deformed, or lose its function.</li><li>2. The damping force between the antenna and ONT has no obvious change, and the damping force matched with the product can keep the antenna at any angle.</li></ol> <p>Stability;</p> |  |
|---------------------------------|---|--|



|  |   |   |  |
|--|---|---|--|
| <b>Cryogenic storage</b>                     |   | <p>Cooling to -40°C at the rate of 1°C/min, and keeping at -40°C for 24 hours; Heating to 1°C/min. +25°C for 2 hours.</p> <p>Requirements, indicators and expected results to be achieved by the checkpoint:</p> <ol style="list-style-type: none"> <li>1. The antenna shall not be discolored, cracked, degummed, warped and deformed, or lose its function.</li> <li>2. The damping force between the antenna and ONT has no obvious change, and the damping force matched with the product can keep the antenna at any angle.</li> </ol> <p>Stability;</p> |  |
| <b>Constant salt spray</b>                   |   | <p>72 hours salt spray test, after the test, the product index at room temperature,<br/>All functions and mechanical properties are normal.</p>   |  |
| <b>Illumination</b>                          |   | /   |  |
| <b>Bare metal vibration</b>                  |   | <p>Requirements;</p> <ol style="list-style-type: none"> <li>1. Frequency: 10~30Hz, placing distance: 0.38mm,3 cycles, each cycle is 5 minutes;</li> <li>2. Frequency: 30~60Hz, placing distance: 0.38mm,3 cycles, each cycle is 5 minutes;</li> <li>3, according to the three axis direction repeat once;</li> </ol> <p>After the test, the product indexes, functions and mechanical properties are all normal.</p>  |  |
| <b>Belt packaging vibration</b>              |   | <p>No test is required, but it is required to go to GSD warehouse, and the antenna performance and appearance are ok.</p>   |  |
| <b>Static pressure with packaging</b>        |   |   |  |
| <b>Dumping with package</b>                  |   |   |  |
| <b>Impact with packaging</b>                 |   |   |  |
| <b>Free fall with packaging</b>              |   |   |  |
| <b>Environmental protection requirements</b> | Meet the requirements of RHOS\REACH in Europe | yes   |  |
|  | Meet the requirements of RHOS\REACH in China. | yes   |  |
|  | Lead-free requirements for electroplating     | yes   |  |