

# SUNNYWAY TECHNOLOGY(CHINA)

## ANTENNA SPEC

|                                                                                   |                 |                  |
|-----------------------------------------------------------------------------------|-----------------|------------------|
| Company name : Tianbo (Shenzhen) Co., Ltd                                         |                 | Entry name : T20 |
| Working band: GSM 850/E-GSM 900/DCS 1800/PCS 1900+WCDMA 1/8+LTE Band1/3/5/8/40/41 |                 |                  |
| Motherboard version :                                                             |                 |                  |
| Sunnyway Material specification                                                   |                 |                  |
| Specification type                                                                | Sunnyway number | Customer number  |
| MAIN Antenna                                                                      | SZ22060IB77     |                  |
|                                                                                   |                 |                  |

|                            |                |                |         |
|----------------------------|----------------|----------------|---------|
| Revision history           |                |                |         |
| Date of preparation/change | Change content | Altered person | Edition |
| 2023.06.08                 | New issue      | Chen min       | A       |
|                            |                |                |         |
|                            |                |                |         |

|                             |      |              |      |            |
|-----------------------------|------|--------------|------|------------|
| Sunnyway Countersign column |      |              |      |            |
| R&D                         | ME : | To examine : | QE : | Approval : |
|                             | RF : | To examine : |      |            |

|                               |                 |                     |                  |
|-------------------------------|-----------------|---------------------|------------------|
| Customer will sign the column |                 |                     |                  |
| Electronic Engineer           | Project manager | Structural Engineer | Quality Engineer |
|                               |                 |                     |                  |

## Directory

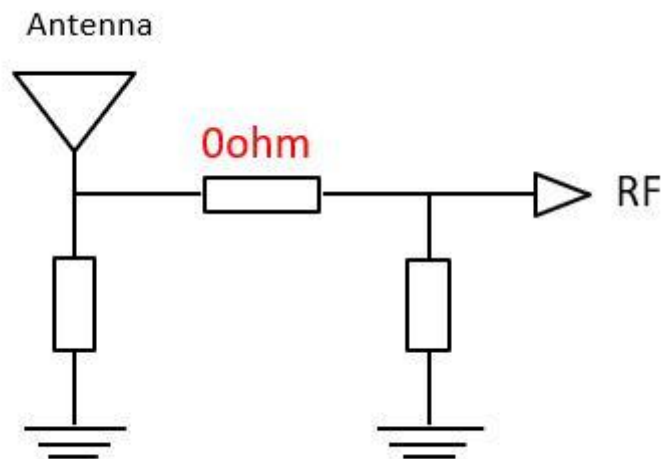
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## 1. Project information

### 1.1 Mockup picture



## 2. Matching circuit



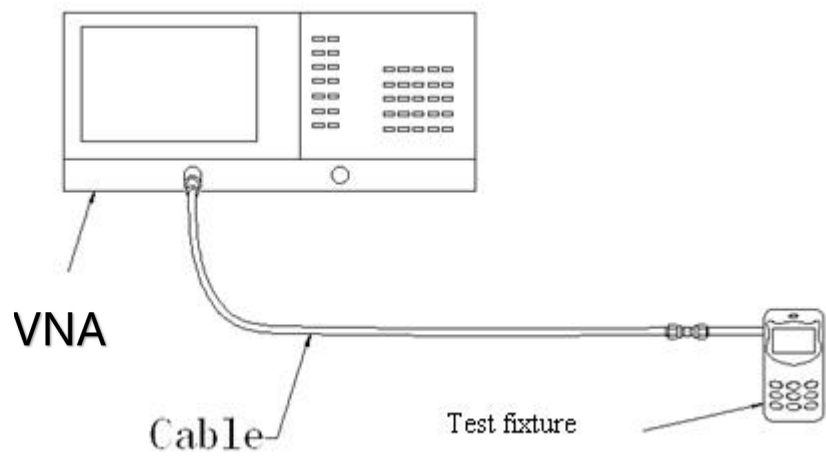
## 3. Antenna passive testing data

### 3.1 S11 Description of the test method

Test the equipment : Vector network analyzer (Agilent E5071C)

Test methodology : Use a 50 ohm CABLE cable to export from the instrument test port, use the calibration piece to calibrate and connect the SMA connector of the test fixture, and record the return loss and standing wave ratio corresponding to the relevant frequency point.

Below is a schematic picture of the test :

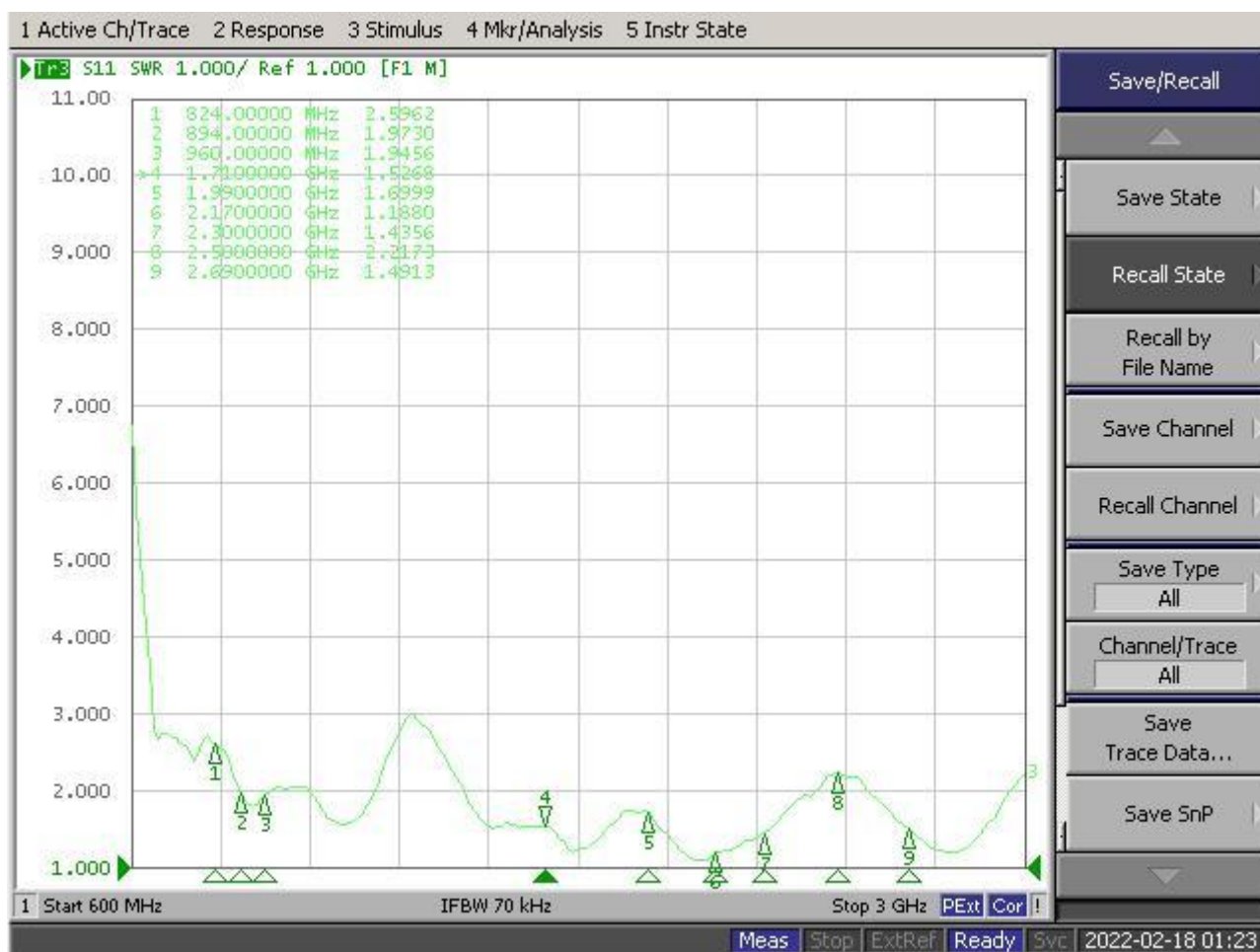


Test schematic diagram

3.2 S11 Test parameters

|           |     |     |     |      |      |      |      |
|-----------|-----|-----|-----|------|------|------|------|
| ( Freq. ) |     |     |     |      |      | 2300 | 2690 |
| MHz       | 824 | 894 | 960 | 1710 | 2170 |      |      |
| VSWR      | 2.5 | 1.9 | 1.9 | 1.5  | 1.1  | 1.4  | 1.4  |

驻波比 VSWR



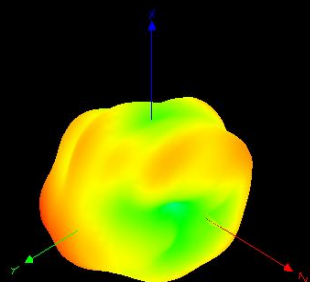
### 3.3.1 Antenna Efficiency

| Frequency/Mhz | MaxGain/dBi | Efficiency / % | Frequency/Mhz | MaxGain/dBi | Efficiency / % |
|---------------|-------------|----------------|---------------|-------------|----------------|
| 700           | -2.24       | 8.57           | 2070          | 4.42        | 52.48          |
| 710           | -2.27       | 9.23           | 2080          | 4.66        | 52.48          |
| 720           | -2.97       | 9.73           | 2090          | 4.7         | 52.36          |
| 730           | -4.06       | 10.05          | 2100          | 5.05        | 53.95          |
| 740           | -4.06       | 10.19          | 2110          | 4.94        | 53.21          |
| 750           | -3.46       | 10.96          | 2120          | 5.17        | 55.46          |
| 760           | -2.75       | 11.35          | 2130          | 5.06        | 55.21          |
| 770           | -2.54       | 10.86          | 2140          | 4.75        | 52             |
| 780           | -2.28       | 10.57          | 2150          | 4.63        | 53.09          |
| 790           | -1.95       | 10.33          | 2160          | 4.59        | 52.48          |
| 800           | -4.24       | 8.43           | 2170          | 4.58        | 52.24          |
| 810           | 0.8         | 7.6            | 2180          | 4.62        | 50.82          |
| 820           | 0.9         | 8.28           | 2190          | 4.64        | 49.43          |
| 830           | 0.9         | 9.04           | 2200          | 4.85        | 49.43          |
| 840           | -0.18       | 9.46           | 2210          | 4.96        | 48.75          |
| 850           | -0.01       | 10.45          | 2220          | 5           | 47.75          |

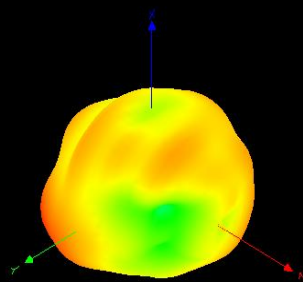
|      |       |       |      |      |       |
|------|-------|-------|------|------|-------|
| 860  | -4.71 | 11.51 | 2230 | 4.84 | 45.92 |
| 870  | -4.47 | 12.13 | 2240 | 4.75 | 46.03 |
| 880  | -4.67 | 11.91 | 2250 | 4.5  | 44.98 |
| 890  | -5.01 | 12.25 | 2260 | 4.18 | 43.75 |
| 900  | -4.95 | 12.79 | 2270 | 4.02 | 43.85 |
| 910  | -5.25 | 12.11 | 2280 | 4.03 | 43.85 |
| 920  | -5.86 | 11.38 | 2290 | 3.89 | 42.27 |
| 930  | -5.99 | 11.25 | 2300 | 3.86 | 42.07 |
| 940  | -5.5  | 11.4  | 2310 | 3.87 | 41.59 |
| 950  | -4.89 | 11.78 | 2320 | 3.71 | 41.4  |
| 960  | -4.44 | 12.13 | 2330 | 3.51 | 39.99 |
| 1700 | 2.26  | 40.27 | 2340 | 3.41 | 40.46 |
| 1710 | 2.2   | 41.59 | 2350 | 3.49 | 40.83 |
| 1720 | 1.51  | 42.17 | 2360 | 3.44 | 41.59 |
| 1730 | 1.22  | 42.46 | 2370 | 3.36 | 39.81 |
| 1740 | 1.03  | 42.07 | 2380 | 3.28 | 38.99 |
| 1750 | 0.78  | 41.4  | 2390 | 3.48 | 39.63 |
| 1760 | 1.03  | 41.78 | 2400 | 3.17 | 38.9  |
| 1770 | 1.2   | 41.4  | 2410 | 2.81 | 36.22 |
| 1780 | 1.22  | 40.83 | 2420 | 2.76 | 37.5  |
| 1790 | 1.16  | 40.27 | 2430 | 2.81 | 36.81 |
| 1800 | 0.81  | 39.72 | 2440 | 2.66 | 35.97 |
| 1810 | 0.79  | 38.9  | 2450 | 2.76 | 36.31 |
| 1820 | 1.54  | 39.17 | 2460 | 2.32 | 34.43 |
| 1830 | 2.01  | 38.37 | 2470 | 2.9  | 36.56 |
| 1840 | 2.33  | 38.37 | 2480 | 2.83 | 36.22 |
| 1850 | 2.3   | 37.67 | 2490 | 3.01 | 35.89 |
| 1860 | 2.29  | 36.64 | 2500 | 2.69 | 34.43 |
| 1870 | 2.2   | 35.08 | 2510 | 2.69 | 34.12 |
| 1880 | 2.2   | 35.81 | 2520 | 2.48 | 33.88 |
| 1890 | 2.06  | 36.39 | 2530 | 2.69 | 33.96 |
| 1900 | 2.03  | 37.07 | 2540 | 2.63 | 33.88 |
| 1910 | 1.92  | 38.64 | 2550 | 2.78 | 33.57 |
| 1920 | 1.51  | 38.11 | 2560 | 2.8  | 32.81 |
| 1930 | 1.33  | 38.64 | 2570 | 2.95 | 32.66 |
| 1940 | 1.41  | 40.18 | 2580 | 2.98 | 33.04 |
| 1950 | 1.58  | 41.5  | 2590 | 2.96 | 32.58 |
| 1960 | 1.8   | 41.4  | 2600 | 3.18 | 33.65 |
| 1970 | 2.26  | 43.95 | 2610 | 3.31 | 34.36 |
| 1980 | 2.31  | 44.46 | 2620 | 3.34 | 33.81 |
| 1990 | 2.4   | 44.06 | 2630 | 3.39 | 34.04 |
| 2000 | 2.69  | 44.77 | 2640 | 3.55 | 34.59 |
| 2010 | 2.86  | 45.39 | 2650 | 3.55 | 34.83 |
| 2020 | 3.11  | 45.39 | 2660 | 3.68 | 35.48 |

|      |      |       |      |      |       |
|------|------|-------|------|------|-------|
| 2030 | 3.42 | 47.1  | 2670 | 3.61 | 35.73 |
| 2040 | 3.94 | 49.77 | 2680 | 3.59 | 34.99 |
| 2050 | 4.17 | 50.93 | 2690 | 3.46 | 34.67 |
| 2060 | 4.28 | 51.17 | 2700 | 3.63 | 35.65 |

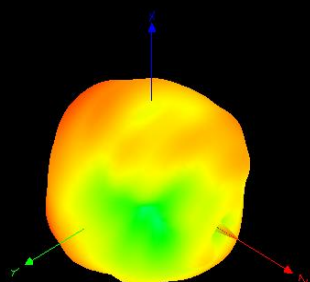
Freq:800MHz



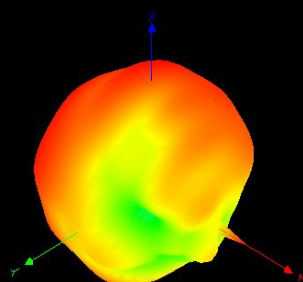
Freq:820MHz



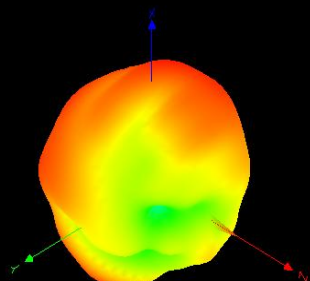
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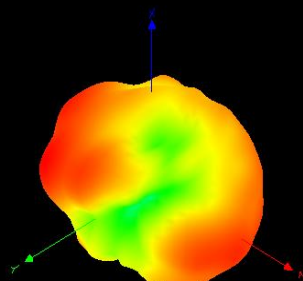
Freq:930MHz



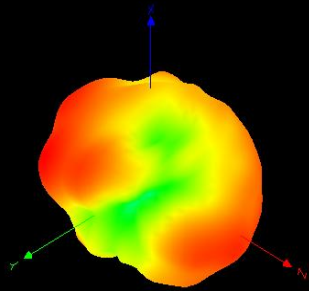
Freq:960MHz



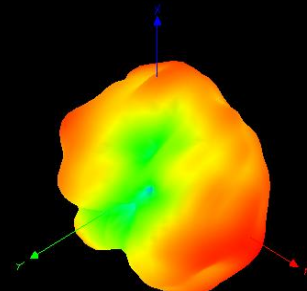
Freq:1710MHz



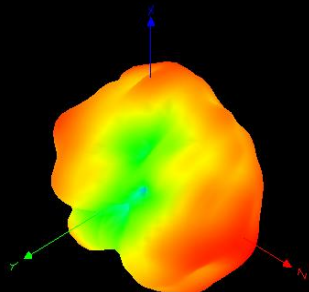
Freq:1710MHz



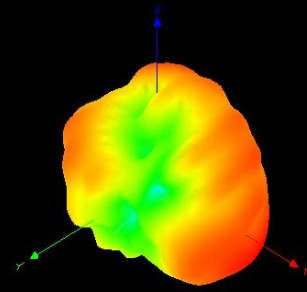
Freq:1800MHz



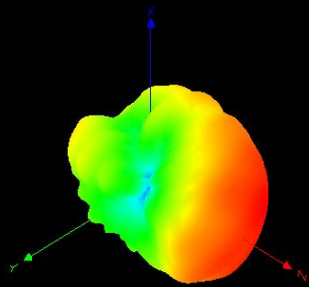
Freq:1800MHz



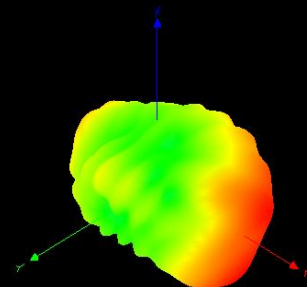
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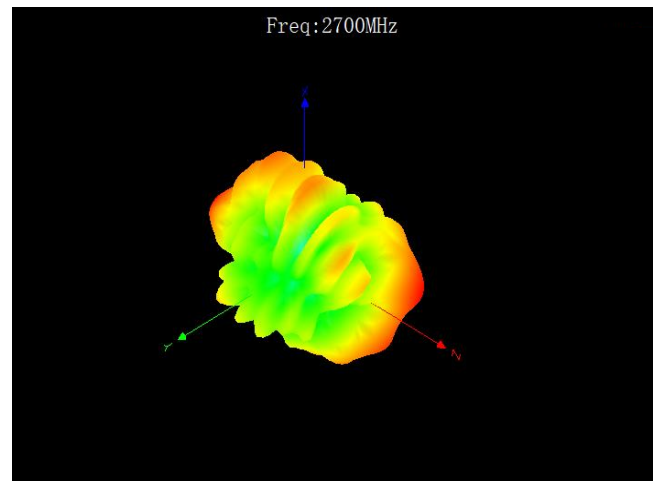
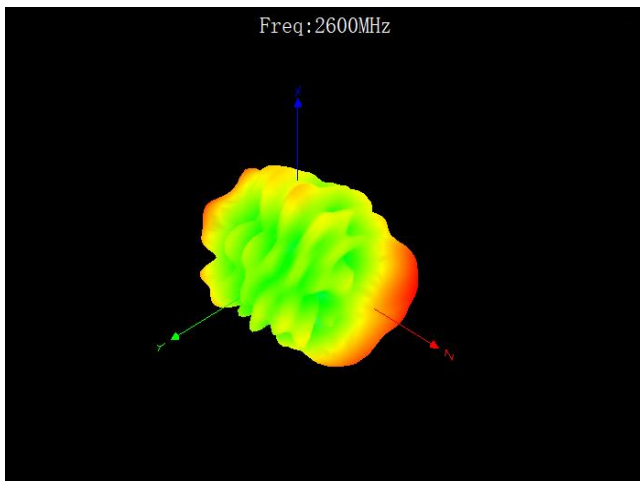
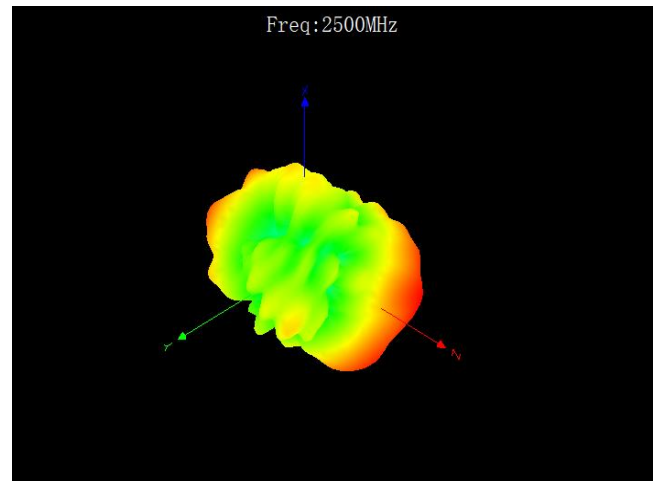
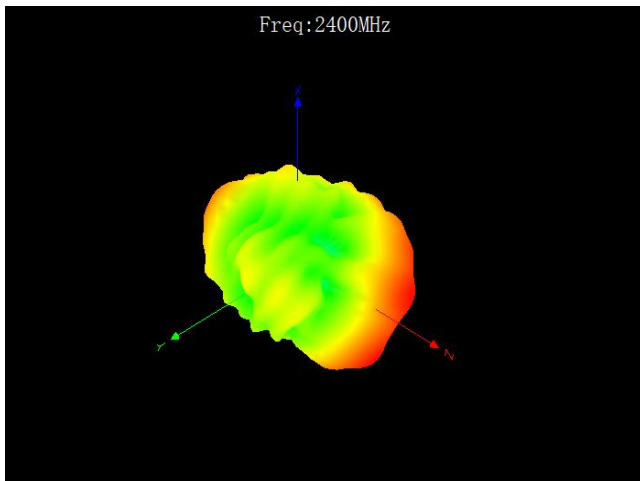


Freq:2150MHz



Freq:2300MHz





## *active testing data*

### *4.1 Test the environment*

Test the system : Multi-probe OTA measurement system ( XH-IoT )

Test the environment : Temperature  $22^{\circ}\text{C}\pm 3^{\circ}\text{C}$ , humidity  $50\%\pm 15\%$

Test the equipment : When testing passive data, use the network analyzer R&S ZND/ Agilent

E5071C

When testing active data, use the Agilent 8960/CMW500/SP9500E/SP8315

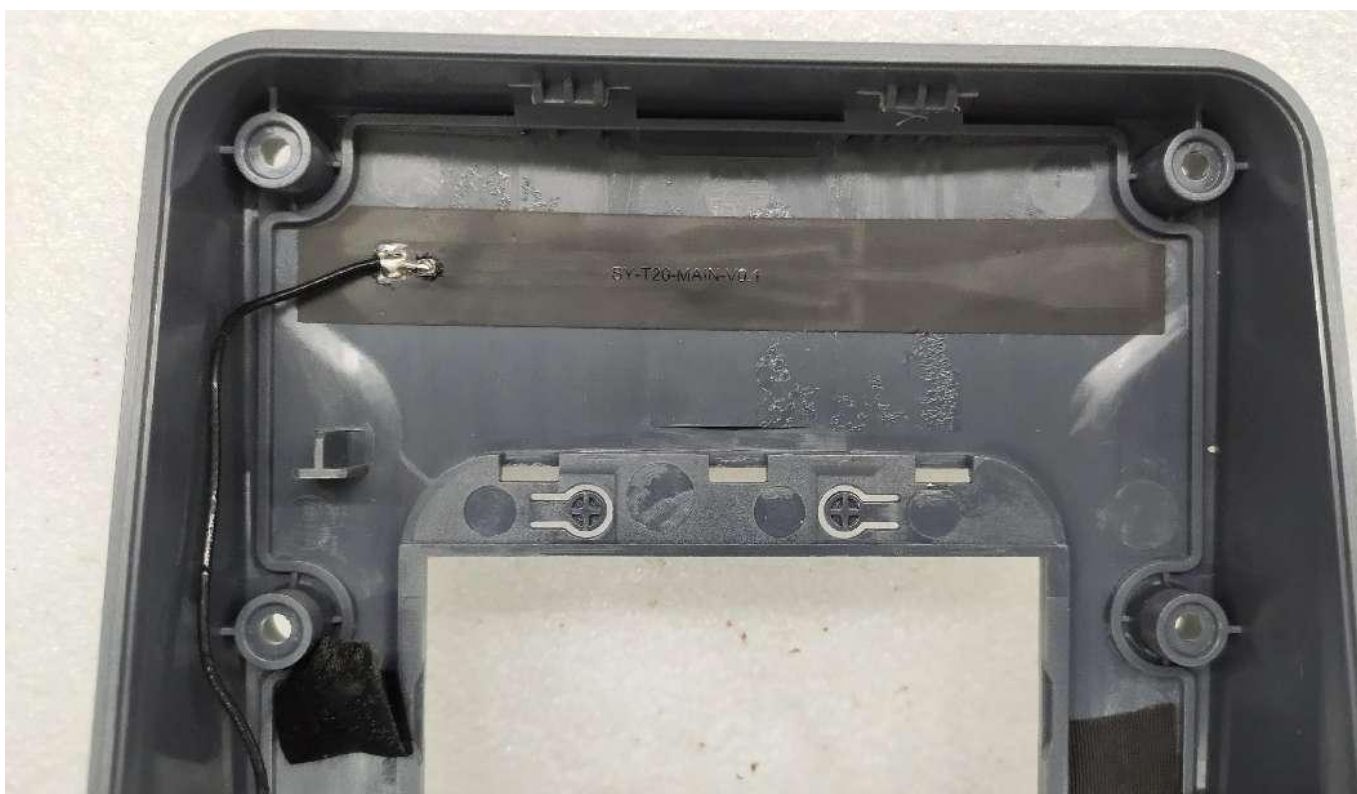


#### 4.2 OTA Active test data

| Measurement | Azimuths | Band          | Channel | Total  |
|-------------|----------|---------------|---------|--------|
| TRP         | Every30  | FDD_B1(10MHz) | 18050   | 17.88  |
| TRP         | Every30  | FDD_B1(10MHz) | 18300   | 18.37  |
| TRP         | Every30  | FDD_B1(10MHz) | 18550   | 21.6   |
| TIS(RSSI)   | Every30  | FDD_B1(10MHz) | 50      | -93.41 |
| TIS(RSSI)   | Every30  | FDD_B1(10MHz) | 300     | -91    |
| TIS(RSSI)   | Every30  | FDD_B1(10MHz) | 550     | -93.05 |
| TRP         | Every30  | FDD_B3(10MHz) | 19250   | 20.13  |
| TRP         | Every30  | FDD_B3(10MHz) | 19575   | 20.6   |
| TRP         | Every30  | FDD_B3(10MHz) | 19900   | 20.14  |
| TIS(RSSI)   | Every30  | FDD_B3(10MHz) | 1250    | -89.3  |
| TIS(RSSI)   | Every30  | FDD_B3(10MHz) | 1575    | -90.89 |
| TIS(RSSI)   | Every30  | FDD_B3(10MHz) | 1900    | -91.64 |
| TRP         | Every30  | FDD_B5(10MHz) | 20450   | 16.71  |
| TRP         | Every30  | FDD_B5(10MHz) | 20525   | 16.26  |
| TRP         | Every30  | FDD_B5(10MHz) | 20600   | 15.73  |
| TIS(RSSI)   | Every30  | FDD_B5(10MHz) | 2450    | -85.15 |
| TIS(RSSI)   | Every30  | FDD_B5(10MHz) | 2525    | -84.87 |
| TIS(RSSI)   | Every30  | FDD_B5(10MHz) | 2600    | -86.82 |
| TRP         | Every30  | FDD_B8(10MHz) | 21500   | 19.12  |
| TRP         | Every30  | FDD_B8(10MHz) | 21625   | 15.45  |
| TRP         | Every30  | FDD_B8(10MHz) | 21750   | 15.46  |
| TIS(RSSI)   | Every30  | FDD_B8(10MHz) | 3500    | -90.25 |
| TIS(RSSI)   | Every30  | FDD_B8(10MHz) | 3625    | -90.77 |

| Measurement | Azimuths | Band           | Channel | Total  |
|-------------|----------|----------------|---------|--------|
| TRP         | Every30  | TDD_B38(20MHz) | 37850   | 22.11  |
| TRP         | Every30  | TDD_B38(20MHz) | 38000   | 22.86  |
| TRP         | Every30  | TDD_B38(20MHz) | 38150   | 22.56  |
| TIS(RSSI)   | Every30  | TDD_B38(20MHz) | 37850   | -90.56 |
| TIS(RSSI)   | Every30  | TDD_B38(20MHz) | 38000   | -91.19 |
| TIS(RSSI)   | Every30  | TDD_B38(20MHz) | 38150   | -90.53 |
| TRP         | Every30  | TDD_B40(20MHz) | 38750   | 18.2   |
| TRP         | Every30  | TDD_B40(20MHz) | 39150   | 18.73  |
| TRP         | Every30  | TDD_B40(20MHz) | 39550   | 18.22  |
| TIS(RSSI)   | Every30  | TDD_B40(20MHz) | 38750   | -92.59 |
| TIS(RSSI)   | Every30  | TDD_B40(20MHz) | 39150   | -90.86 |
| TIS(RSSI)   | Every30  | TDD_B40(20MHz) | 39550   | -92.2  |
| TRP         | Every30  | TDD_B39(20MHz) | 38350   | 14.46  |
| TRP         | Every30  | TDD_B39(20MHz) | 38450   | 15.84  |
| TRP         | Every30  | TDD_B39(20MHz) | 38550   | 17.23  |
| TIS(RSSI)   | Every30  | TDD_B39(20MHz) | 38350   | -90.26 |
| TIS(RSSI)   | Every30  | TDD_B39(20MHz) | 38450   | -86.98 |
| TIS(RSSI)   | Every30  | TDD_B39(20MHz) | 38550   | -90.28 |
| TRP         | Every30  | TDD_B41(20MHz) | 40340   | 22.37  |
| TRP         | Every30  | TDD_B41(20MHz) | 40620   | 23.56  |
| TRP         | Every30  | TDD_B41(20MHz) | 41140   | 23.77  |
| TIS(RSSI)   | Every30  | TDD_B41(20MHz) | 40340   | -92.14 |
| TIS(RSSI)   | Every30  | TDD_B41(20MHz) | 40620   | -90.57 |

#### 4. Environmental treatment methods



#### 5. Standard for mass production antennas

When the antenna is mass-produced, the VSWR is used as the mass production test standard.

According to the differences in the project itself, the following criteria are given:

| Freq. (MHz) | Mass production standards                                                        |
|-------------|----------------------------------------------------------------------------------|
| 824-960     | $VSWR(\text{Production performance}) < VSWR(\text{Confirmed performance}) + 0.5$ |
| 1710-2690   | $VSWR(\text{Production performance}) < VSWR(\text{Confirmed performance}) + 0.5$ |

## 6. Engineering drawings

