

# Shanghai Sunnyway Communication Technology Limited Company

## Temporary antenna specification

|                                                                                                            |                           |                      |         |           |
|------------------------------------------------------------------------------------------------------------|---------------------------|----------------------|---------|-----------|
| Customer: XIANGCHENG                                                                                       |                           | The project: K0161   |         |           |
| Operating frequency band: WCDMA 1/2/4/5/8<br>LTE: B1/B2/B3/B4/B5/B7/B8/B20/B28/B38/B40/B41 WiFi b/g/n/a/ac |                           |                      |         |           |
|                                                                                                            |                           |                      |         |           |
| Shangyuan material specifications                                                                          |                           |                      |         |           |
| Specifications and models                                                                                  | Shangyuan material number | Customer part number |         |           |
|                                                                                                            |                           |                      |         |           |
|                                                                                                            |                           |                      |         |           |
|                                                                                                            |                           |                      |         |           |
| The record of project changes                                                                              |                           |                      |         |           |
| Date of preparation/change                                                                                 | Changes                   | Change of person     | version |           |
|                                                                                                            |                           |                      |         |           |
|                                                                                                            |                           |                      |         |           |
|                                                                                                            |                           |                      |         |           |
| Sunnyway counter-signature bar                                                                             |                           |                      |         |           |
| Research and development                                                                                   | ME:                       | Auditor:             | QE:     | Approver: |
|                                                                                                            | RF:                       | Auditor:             |         |           |
| Client Counter-signature bar                                                                               |                           |                      |         |           |
| EE                                                                                                         | PM                        | RF                   | QE      |           |
|                                                                                                            |                           |                      |         |           |

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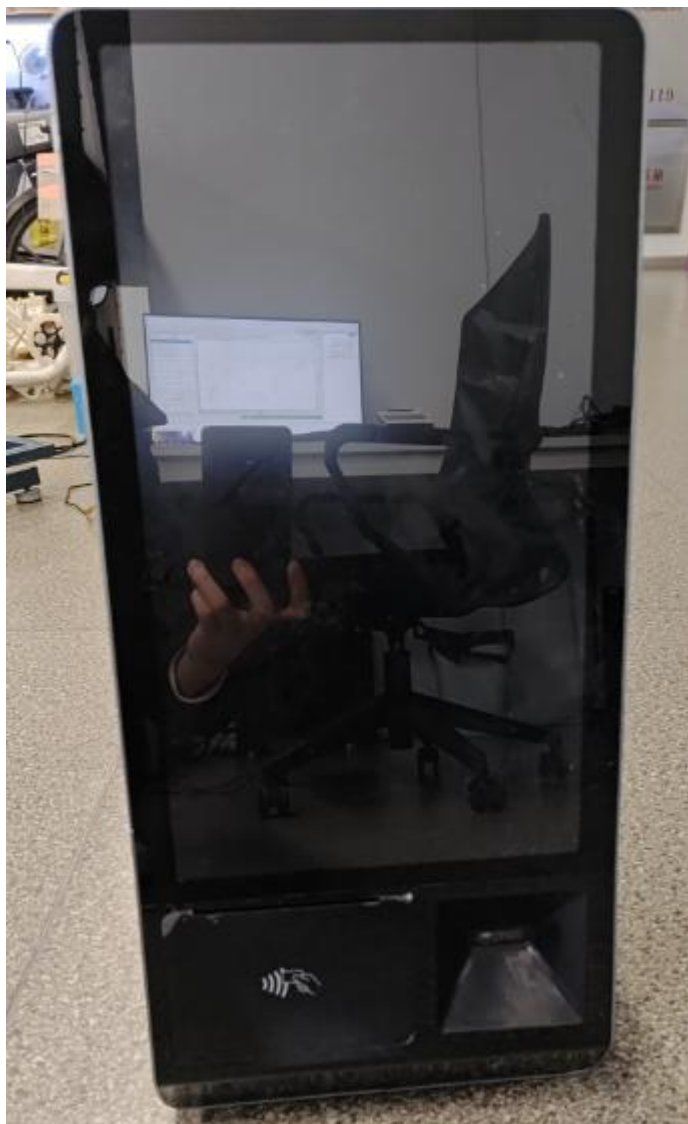
Shanghai R&D Center Address: 1st Floor, Building 4, No. 99, Lane 215, Gaoguang Road,  
Qingpu District, Shanghai

Shenzhen R & D Center Address: Shenzhen Guangming District South Taiyun Chuanggu Center 5  
Building 6 floor

Chongqing R&D Center Address: C08-1 Building-1, No. 19 Xiantao Data Valley East Road,  
Yubei District, Chongqing

## 1. Project information

### Machine information

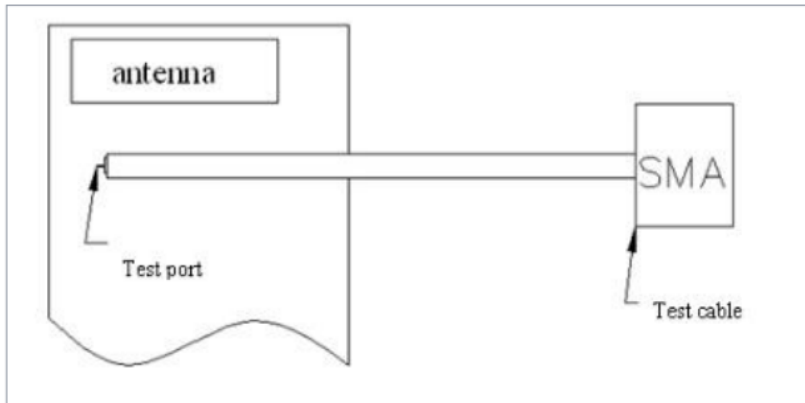


Note: The customer finally verified that the antenna performance prototype was retained in our company for at least one year, which is convenient for analysis and solution to abnormal situations in antenna mass production.

## 2. Test fixtures

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

How to make: The prototyping mechanism is made of a 50 ohm coaxial cable, one end is connected to the test point at the back of the matching circuit of the prototype motherboard (the front of the RF test hole), and the other end is connected to the SMA connector. The schematic diagram is as follows:



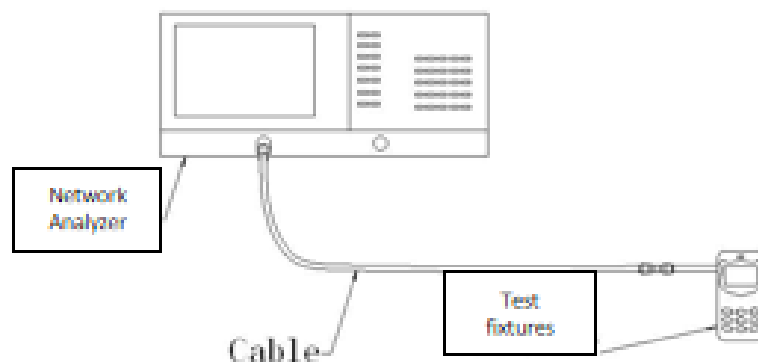
## 4. S11 test

### 5. 4. 1 S11 Test Method Description

6. Test Equipment: Network Analyzer (E5071C)

7. Test method: A 50 ohm CABLE cable is derived from the instrument test port, and the SMA connector of the prototype is connected after calibration using the calibrator to record the return loss and standing wave ratio corresponding to the relevant frequency point.

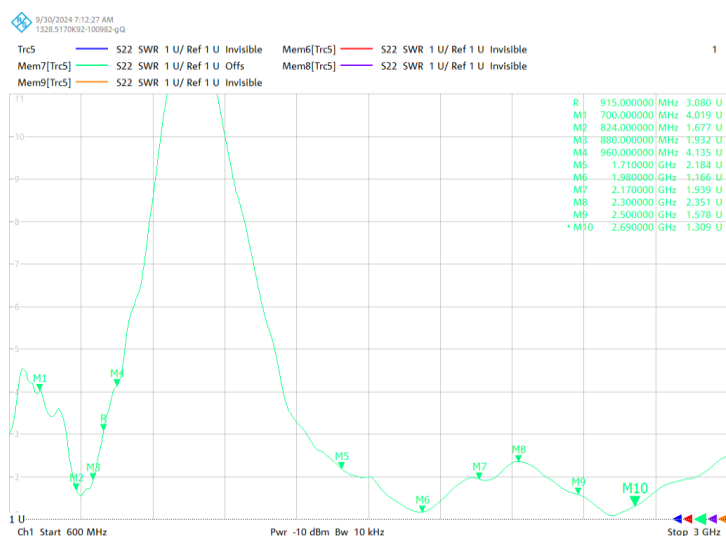
8. The test diagram is as follows:



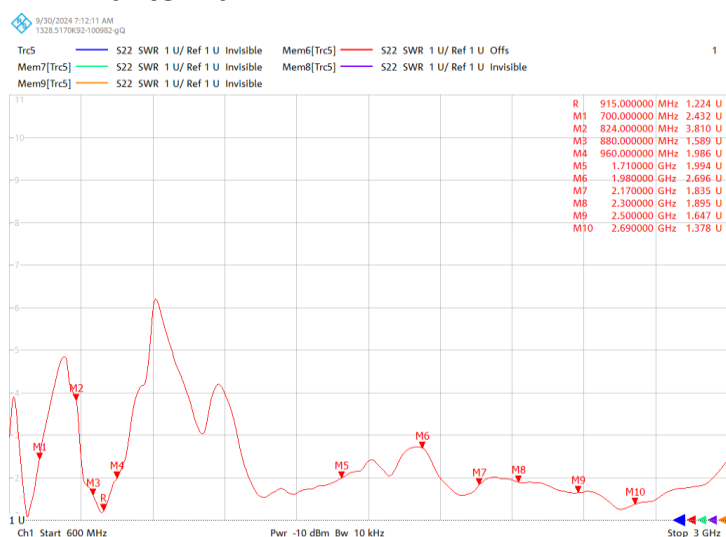
Test the schematic

## 4.2 S11 parameter

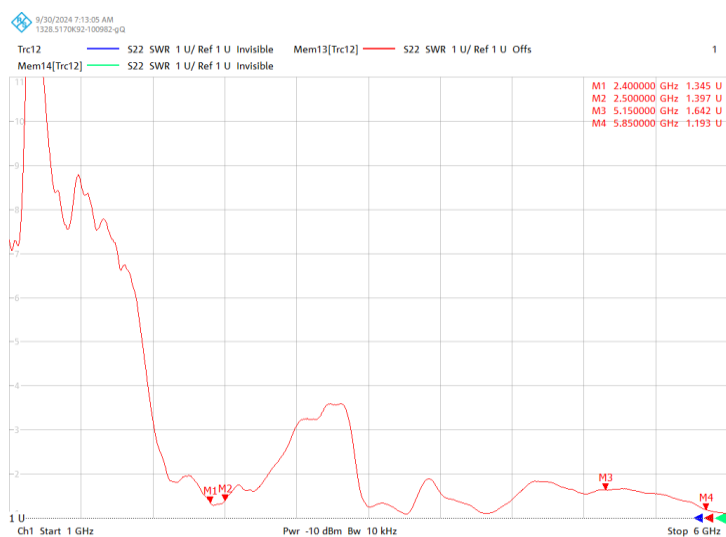
### Main antenna



### DIV antenna



### WiFi antenna



## 5 Darkroom test data

Test system: Shielded darkroom

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

Test equipment: When testing passive data, use the Network Analyzer Agilent E5062C When testing active data, the Comprehensive Tester Agilent 8960 /CMW500/E4438C is used

### MAIN antenna passive efficiency

| Fre/Mhz | Effi/dB | Effi/% | Gain/dBi | Fre/Mhz | Effi/dB | Effi/% | Gain/dBi | Fre/Mhz | Effi/dB | Effi/% | Gain/dBi |
|---------|---------|--------|----------|---------|---------|--------|----------|---------|---------|--------|----------|
| 700     | -7.32   | 18.55  | -1.45    | 1710    | -3.57   | 43.98  | 0.82     | 2300    | -3.46   | 45.08  | 2.17     |
| 710     | -7.13   | 19.37  | -0.71    | 1720    | -3.36   | 46.16  | 0.92     | 2310    | -3.36   | 46.13  | 1.77     |
| 720     | -6.86   | 20.63  | -1.08    | 1730    | -3.16   | 48.33  | 1.07     | 2320    | -3.24   | 47.42  | 2.33     |
| 730     | -6.6    | 21.87  | -1.08    | 1740    | -3.15   | 48.45  | 1.71     | 2330    | -3.19   | 47.97  | 2.08     |
| 740     | -6.52   | 22.29  | -0.84    | 1750    | -3.2    | 47.89  | 2.2      | 2340    | -3.16   | 48.3   | 2.67     |
| 750     | -6.68   | 21.49  | -0.13    | 1760    | -3.35   | 46.26  | 2.3      | 2350    | -3.28   | 46.98  | 2.09     |
| 760     | -6.85   | 20.67  | -0.54    | 1770    | -3.46   | 45.11  | 2.04     | 2360    | -3.32   | 46.55  | 2.15     |
| 770     | -6.25   | 23.71  | -0.39    | 1780    | -3.3    | 46.8   | 2.14     | 2370    | -3.37   | 46.02  | 2.12     |
| 780     | -5.73   | 26.74  | 0.4      | 1790    | -3.25   | 47.32  | 2.19     | 2380    | -3.2    | 47.86  | 2.7      |
| 790     | -5.42   | 28.73  | 0.59     | 1800    | -3.07   | 49.32  | 1.68     | 2390    | -3.33   | 46.45  | 1.85     |
| 800     | -4.82   | 32.98  | 0.51     | 1810    | -2.9    | 51.28  | 1.9      | 2400    | -3.2    | 47.86  | 2.51     |
| 810     | -4.41   | 36.24  | 0.76     | 1820    | -2.84   | 51.99  | 1.68     | 2410    | -3.21   | 47.75  | 2.51     |
| 820     | -4.23   | 37.78  | 1.04     | 1830    | -2.92   | 51.02  | 1.5      | 2420    | -3.21   | 47.75  | 2.15     |
| 830     | -4.09   | 38.99  | 0.93     | 1840    | -2.84   | 51.96  | 1.27     | 2430    | -3.22   | 47.64  | 2.78     |
| 840     | -3.78   | 41.88  | 1.08     | 1850    | -2.85   | 51.85  | 1.12     | 2440    | -3.09   | 49.09  | 2.13     |
| 850     | -3.62   | 43.45  | 1.35     | 1860    | -2.9    | 51.25  | 0.98     | 2450    | -2.95   | 50.69  | 1.98     |
| 860     | -3.7    | 42.66  | 1.31     | 1870    | -2.91   | 51.13  | 1.03     | 2460    | -2.88   | 51.52  | 2.23     |
| 870     | -3.94   | 40.36  | 0.82     | 1880    | -2.68   | 53.91  | 1.21     | 2470    | -2.88   | 51.52  | 2.71     |
| 880     | -4.19   | 38.11  | 0.89     | 1890    | -2.74   | 53.17  | 1.27     | 2480    | -2.86   | 51.75  | 2.12     |
| 890     | -4.42   | 36.14  | 1.13     | 1900    | -2.88   | 51.49  | 1.38     | 2490    | -2.93   | 50.93  | 2.51     |
| 900     | -4.75   | 33.49  | 1.07     | 1910    | -3.02   | 49.86  | 2.11     | 2500    | -2.97   | 50.46  | 2        |
| 910     | -5.21   | 30.15  | 0.77     | 1920    | -3.09   | 49.05  | 2.64     | 2510    | -3      | 50.11  | 2.1      |
| 920     | -5.45   | 28.51  | 0.21     | 1930    | -3.05   | 49.51  | 2.8      | 2520    | -2.88   | 51.52  | 1.74     |
| 930     | -6.09   | 24.6   | -0.25    | 1940    | -3.06   | 49.39  | 2.75     | 2530    | -2.97   | 50.43  | 1.93     |
| 940     | -6.5    | 22.39  | -0.35    | 1950    | -3.19   | 47.99  | 2.94     | 2540    | -2.96   | 50.55  | 2.06     |
| 950     | -7.06   | 19.68  | -0.52    | 1960    | -2.96   | 50.6   | 2.77     | 2550    | -2.78   | 52.68  | 1.99     |
| 960     | -7.24   | 18.88  | -0.87    | 1970    | -2.98   | 50.34  | 2.71     | 2560    | -2.75   | 53.05  | 2.42     |
|         |         |        |          | 1980    | -2.92   | 51.03  | 2.49     | 2570    | -2.76   | 52.93  | 2.42     |
|         |         |        |          | 1990    | -2.84   | 52.02  | 2.46     | 2580    | -2.83   | 52.08  | 2.46     |
|         |         |        |          | 2000    | -2.97   | 50.49  | 1.65     | 2590    | -2.83   | 52.08  | 2.34     |
|         |         |        |          | 2010    | -3.18   | 48.1   | 1.89     | 2600    | -2.78   | 52.68  | 1.95     |
|         |         |        |          | 2020    | -3.31   | 46.68  | 1.05     | 2610    | -2.66   | 54.16  | 2.15     |
|         |         |        |          | 2030    | -3.39   | 45.83  | 1.32     | 2620    | -2.53   | 55.81  | 2.72     |
|         |         |        |          | 2040    | -3.4    | 45.72  | 1.52     | 2630    | -2.46   | 56.71  | 2.18     |
|         |         |        |          | 2050    | -3.44   | 45.33  | 1.89     | 2640    | -2.51   | 56.06  | 2.15     |
|         |         |        |          | 2060    | -3.43   | 45.36  | 1.61     | 2650    | -2.67   | 54.04  | 2.24     |
|         |         |        |          | 2070    | -3.35   | 46.24  | 1.65     | 2660    | -2.85   | 51.85  | 0.81     |
|         |         |        |          | 2080    | -3.49   | 44.77  | 1.89     | 2670    | -3.23   | 47.5   | 1.62     |
|         |         |        |          | 2090    | -3.57   | 43.95  | 1.67     | 2680    | -2.77   | 52.8   | 0.86     |
|         |         |        |          | 2100    | -3.48   | 44.87  | 2.62     | 2690    | -2.91   | 51.13  | 0.51     |
|         |         |        |          | 2110    | -3.46   | 45.08  | 2.48     |         |         |        |          |
|         |         |        |          | 2120    | -3.48   | 44.87  | 2.52     |         |         |        |          |
|         |         |        |          | 2130    | -3.27   | 47.09  | 2.38     |         |         |        |          |
|         |         |        |          | 2140    | -3.24   | 47.42  | 2.52     |         |         |        |          |
|         |         |        |          | 2150    | -3.11   | 48.86  | 1.9      |         |         |        |          |
|         |         |        |          | 2160    | -2.96   | 50.58  | 2.79     |         |         |        |          |
|         |         |        |          | 2170    | -2.96   | 50.58  | 2.56     |         |         |        |          |

## DIV antenna passive efficiency

| Fre/Mhz | Effi/dB | Effi/% | Gain/dBi | Fre/Mhz | Effi/dB | Effi/% | Gain/dBi | Fre/Mhz | Effi/dB | Effi/% | Gain/dBi |
|---------|---------|--------|----------|---------|---------|--------|----------|---------|---------|--------|----------|
| 700     | -9.19   | 12.05  | -4.04    | 1710    | -3.94   | 40.38  | 1.57     | 2300    | -3.51   | 44.61  | 2.32     |
| 710     | -9.52   | 11.17  | -4.27    | 1720    | -3.78   | 41.9   | 1.59     | 2310    | -3.38   | 45.97  | 2.19     |
| 720     | -9.85   | 10.35  | -5.69    | 1730    | -3.71   | 42.59  | 1.41     | 2320    | -3.26   | 47.26  | 2.27     |
| 730     | -10.07  | 9.84   | -5.98    | 1740    | -3.84   | 41.33  | 1.35     | 2330    | -3.22   | 47.69  | 1.77     |
| 740     | -9.73   | 10.64  | -6.23    | 1750    | -4      | 39.83  | 1.36     | 2340    | -3.06   | 49.48  | 2.16     |
| 750     | -10.02  | 9.95   | -5.68    | 1760    | -4.23   | 37.78  | 1.28     | 2350    | -3.11   | 48.81  | 1.58     |
| 760     | -10.33  | 9.27   | -5.74    | 1770    | -4.47   | 35.75  | 1.97     | 2360    | -3.16   | 48.36  | 1.37     |
| 770     | -9.47   | 11.3   | -5.67    | 1780    | -4.46   | 35.83  | 1.79     | 2370    | -3.12   | 48.7   | 1.85     |
| 780     | -8.16   | 15.28  | -4.51    | 1790    | -4.11   | 38.84  | 1.8      | 2380    | -2.98   | 50.29  | 2.02     |
| 790     | -7.83   | 16.48  | -3.87    | 1800    | -3.72   | 42.49  | 1.55     | 2390    | -3.24   | 47.47  | 1.03     |
| 800     | -7.94   | 16.07  | -4.35    | 1810    | -3.4    | 45.74  | 2.03     | 2400    | -3.07   | 49.37  | 1.94     |
| 810     | -9.01   | 12.56  | -3.8     | 1820    | -3.33   | 46.48  | 1.93     | 2410    | -3.19   | 48.02  | 1.69     |
| 820     | -9.66   | 10.81  | -5.21    | 1830    | -3.24   | 47.45  | 1.77     | 2420    | -3.39   | 45.86  | 1.27     |
| 830     | -9.84   | 10.38  | -4.73    | 1840    | -3.28   | 47.02  | 1.47     | 2430    | -3.34   | 46.29  | 2.13     |
| 840     | -9.53   | 11.14  | -4.87    | 1850    | -3.58   | 43.88  | 1.02     | 2440    | -3.34   | 46.29  | 1.9      |
| 850     | -9.33   | 11.67  | -4.55    | 1860    | -4.05   | 39.38  | 1.21     | 2450    | -3.35   | 46.19  | 1.93     |
| 860     | -9.13   | 12.22  | -5.07    | 1870    | -4.56   | 35.01  | 1.78     | 2460    | -3.27   | 47.15  | 2.08     |
| 870     | -8.63   | 13.71  | -4.4     | 1880    | -4.66   | 34.22  | 2.05     | 2470    | -3.29   | 46.93  | 2.38     |
| 880     | -7.85   | 16.41  | -3.15    | 1890    | -4.8    | 33.13  | 2.07     | 2480    | -3.3    | 46.72  | 2.21     |
| 890     | -7.01   | 19.91  | -1.17    | 1900    | -4.89   | 32.45  | 1.99     | 2490    | -3.27   | 47.15  | 2.03     |
| 900     | -6.17   | 24.15  | 1.11     | 1910    | -4.97   | 31.86  | 2.42     | 2500    | -3.36   | 46.08  | 2.6      |
| 910     | -5.58   | 27.67  | 2.57     | 1920    | -4.94   | 32.09  | 1.83     | 2510    | -3.44   | 45.24  | 2.87     |
| 920     | -5.38   | 28.97  | 2.09     | 1930    | -4.73   | 33.67  | 1.95     | 2520    | -3.34   | 46.4   | 2.5      |
| 930     | -5.5    | 28.18  | 1.73     | 1940    | -4.52   | 35.33  | 2.13     | 2530    | -3.34   | 46.29  | 2.67     |
| 940     | -5.72   | 26.79  | 0.33     | 1950    | -4.02   | 39.65  | 2.46     | 2540    | -3.32   | 46.61  | 2.07     |
| 950     | -6.01   | 25.06  | -0.07    | 1960    | -3.69   | 42.78  | 2.33     | 2550    | -3.54   | 44.22  | 2.8      |
| 960     | -6.31   | 23.39  | -1.37    | 1970    | -3.81   | 41.54  | 2.44     | 2560    | -3.6    | 43.62  | 2.37     |
|         |         |        |          | 1980    | -3.6    | 43.6   | 2.45     | 2570    | -3.51   | 44.53  | 2.46     |
|         |         |        |          | 1990    | -3.63   | 43.3   | 2.83     | 2580    | -3.54   | 44.23  | 2.47     |
|         |         |        |          | 2000    | -3.63   | 43.4   | 2.87     | 2590    | -3.43   | 45.37  | 2.59     |
|         |         |        |          | 2010    | -3.8    | 41.73  | 1.04     | 2600    | -3.32   | 46.53  | 2.21     |
|         |         |        |          | 2020    | -3.84   | 41.35  | 1.16     | 2610    | -3.23   | 47.5   | 2.34     |
|         |         |        |          | 2030    | -3.92   | 40.6   | 1.68     | 2620    | -3.3    | 46.78  | 2.83     |
|         |         |        |          | 2040    | -3.91   | 40.69  | 1.45     | 2630    | -3.38   | 45.91  | 2.32     |
|         |         |        |          | 2050    | -4.05   | 39.4   | 2.16     | 2640    | -3.43   | 45.39  | 2.38     |
|         |         |        |          | 2060    | -4.15   | 38.5   | 2.51     | 2650    | -3.41   | 45.6   | 2.06     |
|         |         |        |          | 2070    | -4.18   | 38.15  | 2.2      | 2660    | -3.51   | 44.55  | 2.38     |
|         |         |        |          | 2080    | -4.14   | 38.59  | 2.1      | 2670    | -3.72   | 42.44  | 2.55     |
|         |         |        |          | 2090    | -4.06   | 39.22  | 1.95     | 2680    | -3.35   | 46.29  | 1.97     |
|         |         |        |          | 2100    | -3.87   | 41.07  | 2.64     | 2690    | -3.47   | 44.95  | 2.38     |
|         |         |        |          | 2110    | -3.78   | 41.93  | 1.88     |         |         |        |          |
|         |         |        |          | 2120    | -3.69   | 42.8   | 2.48     |         |         |        |          |
|         |         |        |          | 2130    | -3.47   | 45.03  | 2.03     |         |         |        |          |
|         |         |        |          | 2140    | -3.4    | 45.76  | 1.77     |         |         |        |          |
|         |         |        |          | 2150    | -3.42   | 45.55  | 1.32     |         |         |        |          |
|         |         |        |          | 2160    | -3.32   | 46.61  | 2.43     |         |         |        |          |
|         |         |        |          | 2170    | -3.32   | 46.61  | 2.13     |         |         |        |          |

## WiFi antenna passive efficiency

| Fre/Mhz | Effi/dB | Effi/% | Gain/dBi | Fre/Mhz | Effi/dB | Effi/% | Gain/dBi |
|---------|---------|--------|----------|---------|---------|--------|----------|
| 2400    | -3.07   | 49.29  | 2.11     | 5150    | -3.83   | 41.4   | 1.44     |
| 2410    | -3.1    | 48.96  | 1.81     | 5200    | -3.39   | 45.81  | 2.35     |
| 2420    | -3.11   | 48.85  | 2.27     | 5250    | -3.69   | 42.78  | 1.81     |
| 2430    | -3.19   | 47.96  | 2.27     | 5300    | -3.78   | 41.9   | 1.94     |
| 2440    | -3.23   | 47.52  | 1.52     | 5350    | -3.59   | 43.77  | 2.15     |
| 2450    | -3.24   | 47.4   | 1.87     | 5400    | -3.95   | 40.29  | 2.11     |
| 2460    | -3.4    | 45.69  | 1.53     | 5450    | -3.78   | 41.88  | 2.27     |
| 2470    | -3.3    | 46.76  | 2.23     | 5500    | -3.87   | 41.03  | 2.31     |
| 2480    | -3.18   | 48.06  | 2.25     | 5550    | -3.56   | 44.08  | 2.58     |
| 2490    | -3.16   | 48.28  | 2.37     | 5600    | -3.94   | 40.37  | 2.4      |
| 2500    | -3.12   | 48.73  | 2.11     | 5650    | -3.61   | 43.58  | 2.19     |
|         |         |        |          | 5700    | -3.64   | 43.27  | 2.36     |
|         |         |        |          | 5750    | -3.72   | 42.48  | 2.17     |
|         |         |        |          | 5800    | -3.77   | 41.99  | 2.2      |
|         |         |        |          | 5850    | -3.82   | 41.52  | 2.5      |

## 6. Mass production antenna indicators

When the antenna is mass-produced, the standing wave ratio is used as the mass production test standard. According to the differences in the project itself, the following criteria are given:

| frequency (MHz)     | Mass production standards                                              |
|---------------------|------------------------------------------------------------------------|
| 700-960;1710-2690   | VSWR (Mass production performance)<br><VSWR(Acknowledge performance)+1 |
| 2400-2500;5150-5850 | VSWR (Mass production performance)<br><VSWR(Acknowledge performance)+1 |