

Shenzhen Etheta Communication
Technology Co., Ltd.
(Shenzhen Etheta)

Customer: TCL Communication Ltd.

Project name: T513SP & T513V

Product name: T513SP & T513V - cellular & wifi
antenna

Date: 2025.02.08

1. Antenna specification and test location

Antenna 0/1/2/3/4/5/6/7

Material: FPC

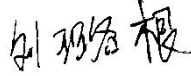
Manufacturer: Shenzhen Etheta

Manufacturer Address: Zone B, 3rd Floor, Building 1, Baisha Logistics Park, Xili Street, Nanshan District, Shenzhen.

Antenna gain and radiation pattern measured in SATIMO anechoic chamber.

Project date: 2024.11.15 - 2025.02.05

Test engineer: Lugen Liu



| Description | Manufacturer | Model | Cal Date |
|-------------------------|----------------------|--------|------------|
| Vector Network Analyzer | Agilent Technologies | E5071B | 2024.10.14 |
| Anechoic Chamber | SATIMO | SG16 | 2024.10.14 |

Test Equipment list

2. Test system introduction

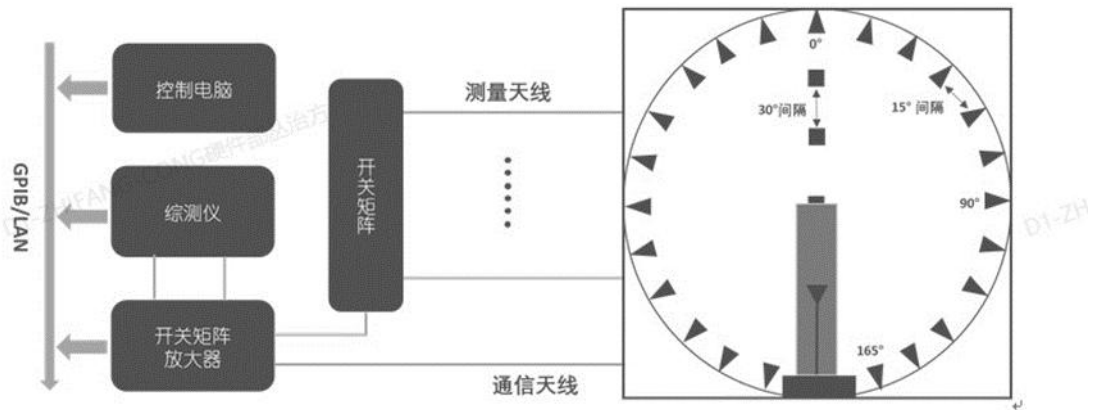
2.1 Anechoic chamber

Our company has a number of anechoic chamber for OTA test. It is ranging from 400 MHz to 8.5 GHz, which can provide passive test and active test, including OTA overall 2G, 3G, 4G, 5G FR test, WiFi multi-mode test, GPS active test, Bluetooth active test. The test system can provide antenna gain, efficiency, radiation pattern, upper and lower hemisphere efficiency values and mutual disturbance correlation coefficient analysis.



2.2 Test system Architecture

The figure above shows the connection and control process between the anechoic chamber of our company and the testing system and computer. The testing system has the characteristics of accurate, fast and simple testing. The operation interface is simple and humanized.



3. Test result

3.1 Antenna placement:

| Antenna | Type | Description |
|---------|------|---|
| 0 | FPC | LB TRX+MB MIMO PRX antenna |
| 1 | FPC | LB DRX+MB EN-DC TX+MB DRX antenna |
| 2 | FPC | MB TRX +UHB TRX antenna |
| 3 | FPC | UHB MIMO DRX antenna |
| 4 | FPC | HB TRX antenna |
| 5 | FPC | MB MIMO DRX +HB DRX +UHB MIMO PRX antenna |
| 6 | FPC | UHB MIMO DRX antenna |
| 7 | FPC | GPS+WIFI 2.4G/5G+ BT antenna |

3.2 Antenna Gain

Gain of Antenna 0

| Band | Gain average(dBi) | Gain Peak (dBi) |
|----------|-------------------|-----------------|
| GSM850 | -3.33 | -2.12 |
| GSM900 | -2.99 | -2.27 |
| WCDMA B5 | -3.33 | -2.12 |
| WCDMA B8 | -2.99 | -2.27 |
| LTE B5 | -3.33 | -2.12 |
| LTE B12 | -2.82 | -1.52 |
| LTE B13 | -2.83 | -1.32 |
| LTE B20 | -3.53 | -2.23 |
| LTE B28 | -2.91 | -1.73 |
| NR n5 | -3.33 | -2.12 |

Gain of Antenna 1

| Band | Gain average(dBi) | Gain Peak (dBi) |
|---------------|-------------------|-----------------|
| (ENDC)LTE B1 | -1.45 | -0.45 |
| (ENDC)LTE B2 | -1.52 | -0.63 |
| (ENDC)LTE B3 | -1.35 | -0.57 |
| (ENDC)LTE B66 | -1.85 | -0.47 |

Gain of Antenna 2

| Band | Gain average(dBi) | Gain Peak (dBi) |
|----------|-------------------|-----------------|
| GSM1800 | -1.30 | -0.41 |
| GSM1900 | -0.95 | -0.25 |
| WCDMA B1 | -0.85 | -0.27 |
| WCDMA B2 | -0.95 | -0.25 |
| LTE B1 | -0.85 | -0.27 |
| LTE B2 | -0.95 | -0.25 |
| LTE B3 | -1.30 | -0.41 |
| LTE B4 | -1.52 | -0.53 |
| LTE B48 | -3.96 | -2.92 |
| LTE B66 | -1.35 | -0.47 |
| NR n2 | -0.95 | -0.25 |
| NR n48 | -3.96 | -2.92 |
| NR n66 | -1.35 | -0.47 |
| NR n77 | -3.75 | -2.42 |
| NR n78 | -3.62 | -2.35 |

Gain of Antenna 4

| Band | Gain average(dBi) | Gain Peak (dBi) |
|--------|-------------------|-----------------|
| LTE B7 | -1.12 | -0.45 |

Gain of Antenna 7

| Band | Gain average(dBi) | Gain Peak (dBi) |
|---------------|-------------------|-----------------|
| GPS | -2.45 | -1.70 |
| Wi-Fi 2.4G/BT | -5.22 | -4.55 |
| Wi-Fi 5G | -5.52 | -4.98 |

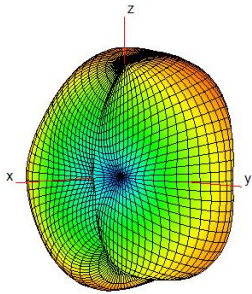
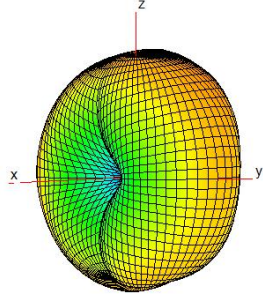
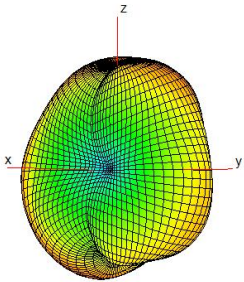
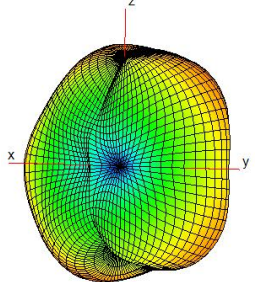
NFC antenna gain description:

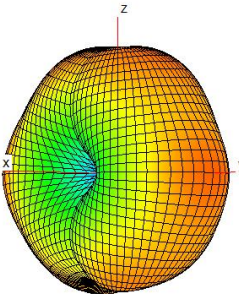
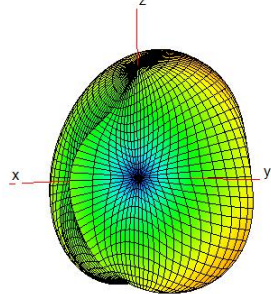
The device does not support the test of NFC gain. In addition, all measurements were performed radiated and

therefore additional antenna gain documentation is not required.

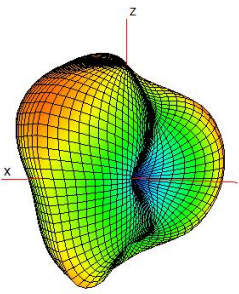
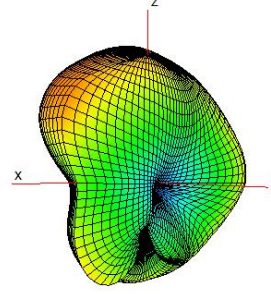
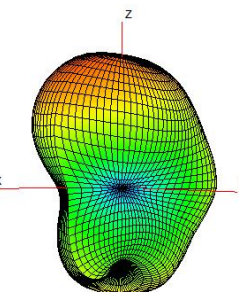
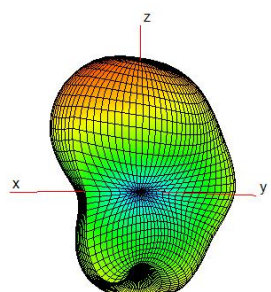
3.3 Radiation Pattern

Antenna 0

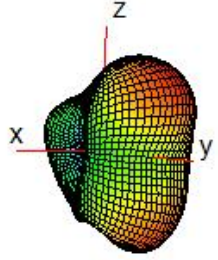
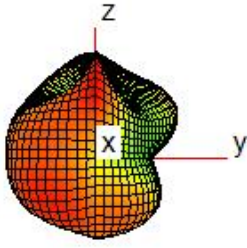
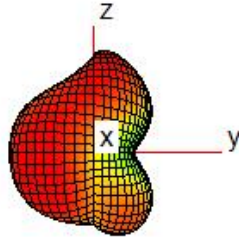
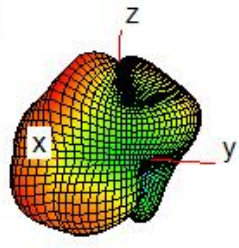
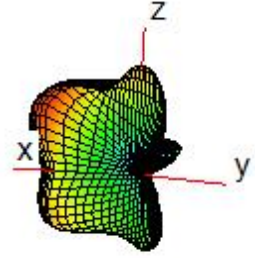
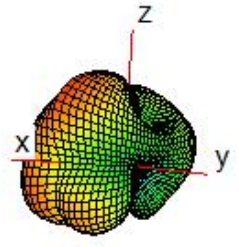
| (Frequency Band) | B5/n5 | B12 |
|----------------------|---|---|
| 3D Radiation Pattern |  |  |
| Efficiency[%] | 23 | 22 |
| Avg Gain [dBi] | -3.33 | -2.82 |
| Peak Gain [dBi] | -2.12 | -1.52 |
| (Frequency Band) | B13 | B20 |
| 3D Radiation Pattern |  |  |
| Efficiency[%] | 24 | 20 |
| Avg Gain [dBi] | -2.83 | -3.53 |
| Peak Gain [dBi] | -1.32 | -2.23 |
| (Frequency Band) | B28 | WCDMA B8 |

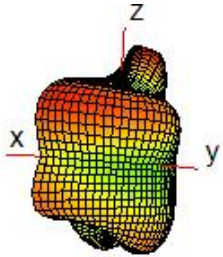
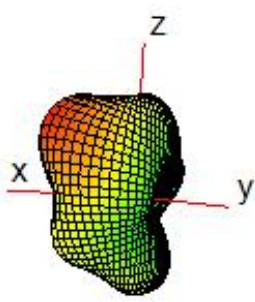
| | | |
|-------------------------|---|---|
| 3D Radiation Pattern |  |  |
| Efficiency[%] | 22 | 20 |
| Avg Gain [dBi] | -2.91 | -2.99 |
| Peak Gain [dBi] | -1.73 | -2.27 |

Antenna 1

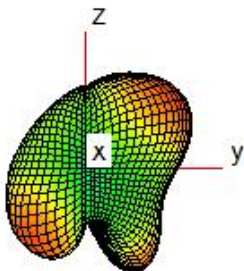
| (Frequency Band) | B1 | B2/n2 |
|-------------------------|---|---|
| 3D Radiation Pattern |  |  |
| Efficiency[%] | 42 | 45 |
| Avg Gain [dBi] | -1.45 | -1.52 |
| Peak Gain [dBi] | -0.45 | -0.63 |
| (Frequency Band) | B3 | B66/n66 |
| 3D Radiation Pattern |  |  |
| Efficiency[%] | 41 | 43 |
| Avg Gain [dBi] | -1.35 | -1.85 |
| Peak Gain [dBi] | -0.57 | -0.47 |

Antenna 2

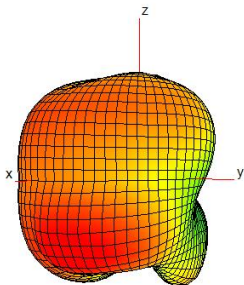
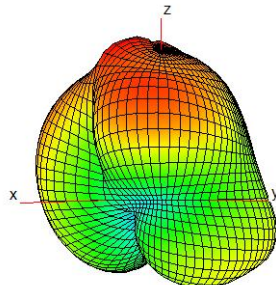
| | | |
|----------------------|---|---|
| (Frequency Band) | B1 | B2/n2 |
| 3D Radiation Pattern |  |  |
| Efficiency[%] | 47 | 45 |
| Avg Gain [dBi] | -0.85 | -0.95 |
| Peak Gain [dBi] | -0.27 | -0.25 |
| (Frequency Band) | B3 | B4 |
| 3D Radiation Pattern |  |  |
| Efficiency[%] | 36 | 36 |
| Avg Gain [dBi] | -1.30 | -1.52 |
| Peak Gain [dBi] | -0.41 | -0.53 |
| (Frequency Band) | B48/n48 | B66/n66 |
| 3D Radiation Pattern |  |  |
| Efficiency[%] | 21 | 36 |
| Avg Gain [dBi] | -3.96 | -1.35 |
| Peak Gain [dBi] | -2.92 | -0.47 |
| (Frequency Band) | n77 | n78 |

| | | |
|-------------------------|---|---|
| 3D Radiation Pattern |  |  |
| Efficiency[%] | 21.5 | 21 |
| Avg Gain [dBi] | -3.75 | -3.62 |
| Peak Gain [dBi] | -2.42 | -2.35 |

Antenna 4

| | |
|-------------------------|--|
| (Frequency Band) | B7 |
| 3D Radiation Pattern |  |
| Efficiency[%] | 30 |
| Avg Gain [dBi] | -1.12 |
| Peak Gain [dBi] | -0.45 |

Antenna 7

| | | |
|-------------------------|---|---|
| (Frequency Band) | WiFi 2.4G/BT | WiFi 5G |
| 3D Radiation Pattern |  |  |
| Efficiency[%] | 36 | 30 |
| Avg Gain [dBi] | -5.22 | -5.52 |

| | | |
|-----------------|-------|-------|
| Peak Gain [dBi] | -4.55 | -4.98 |
|-----------------|-------|-------|