

# Antenna Information

|                                  |                                                                                                                                                              |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Antenna picture                  | please refer to internal photo.                                                                                                                              |
| Antenna Type                     | Internal inverted F PCB antenna                                                                                                                              |
| Antenna Peak Gain                | ZigBee: 3.73 dBi; BLE: 3.24 dBi; Wi-Fi: 2.49 dBi                                                                                                             |
| Operating Band                   | 2400 MHz ~ 2483.5 MHz                                                                                                                                        |
| Test laboratory name and Address | IoT Antenna Test Laboratory, 3 / A, LEEDARSON LIGHTING CO., LTD.<br>Xingtai Industrial Park, Changtai Economic Development Zone, Zhangzhou,<br>363900, China |
| Antenna Manufacturer             | LEEDARSON LIGHTING CO., LTD.                                                                                                                                 |
| Model name                       | HCG-A41C-WZB-C621                                                                                                                                            |
| DUT photo                        | please refer to external photo.                                                                                                                              |
| Test System                      | SY-16 OTA System                                                                                                                                             |
| Test Engineer                    | Ou Min                                                                                                                                                       |
| Test Date                        | 2023-02-14                                                                                                                                                   |

## Test Standard

|                     |                      |                                            |                        |
|---------------------|----------------------|--------------------------------------------|------------------------|
| Antenna Performance | Radiation Efficiency | IEEE Standard Test Procedures for Antennas | ANSI/IEEE Std 149-2021 |
|---------------------|----------------------|--------------------------------------------|------------------------|

## Equipment List:

| Equipment        | Manufacturer | Model No. | Last Cal. | Due Date  |
|------------------|--------------|-----------|-----------|-----------|
| Network Analyzer | Agilent      | E5071C    | 2022.10.8 | 2023.10.7 |

## Test Software: EMQuest

## Test System

The SY-16 OTA system is an anechooic chamber, which can measures antenna passive data such as antenna efficiency, antenna gain, and 2D&3D pattern. The coordinates and topology are shown as follow:



Figure 1 SY-16 OTA system

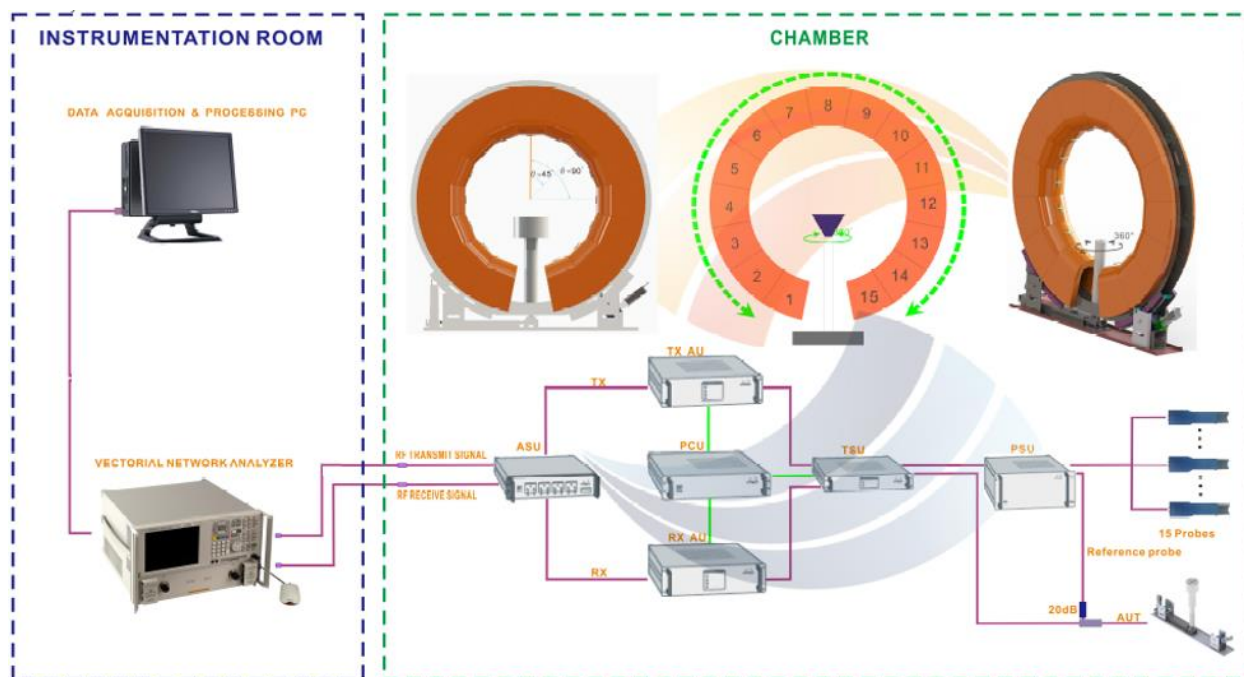


Figure 2 OTA measurement topology

## Test Result

### ZigBee Antenna

### Efficiency and Gain

Table 1 Antenna Efficiency and Gain

| Frequency (MHz) | Gain (dBi) | Efficiency (dB) | Efficiency (%) |
|-----------------|------------|-----------------|----------------|
| 2400            | 3.73       | -2.11           | 61.52          |
| 2410            | 3.6        | -2.36           | 58.08          |
| 2420            | 3.71       | -2.22           | 59.98          |
| 2430            | 3.44       | -2.3            | 58.88          |
| 2440            | 3.03       | -2.65           | 54.33          |
| 2450            | 2.96       | -2.89           | 51.40          |
| 2460            | 3.33       | -2.55           | 55.59          |
| 2470            | 3.28       | -2.55           | 55.59          |
| 2480            | 2.76       | -3.13           | 48.64          |
| 2490            | 2.83       | -3.16           | 48.31          |
| 2500            | 3.53       | -2.67           | 54.08          |

## Radiation Pattern

Table 3 3D radiation pattern

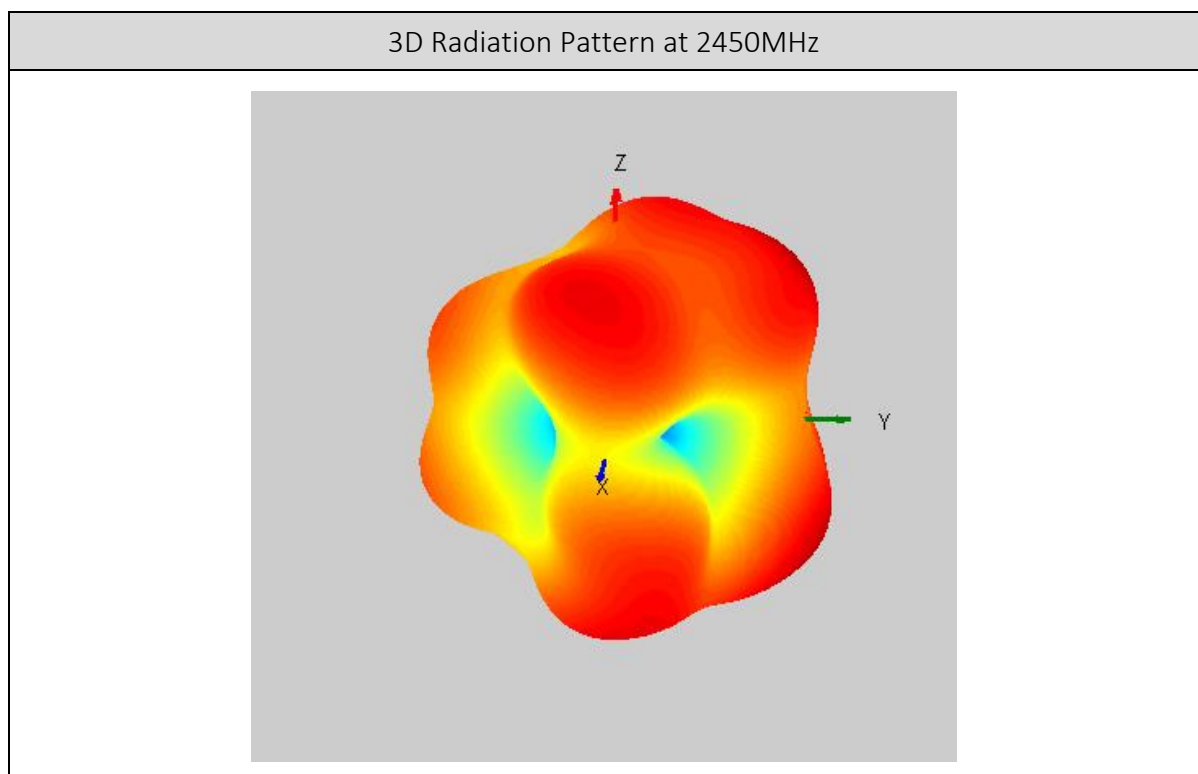


Table 4 Radiation pattern in XY Plane

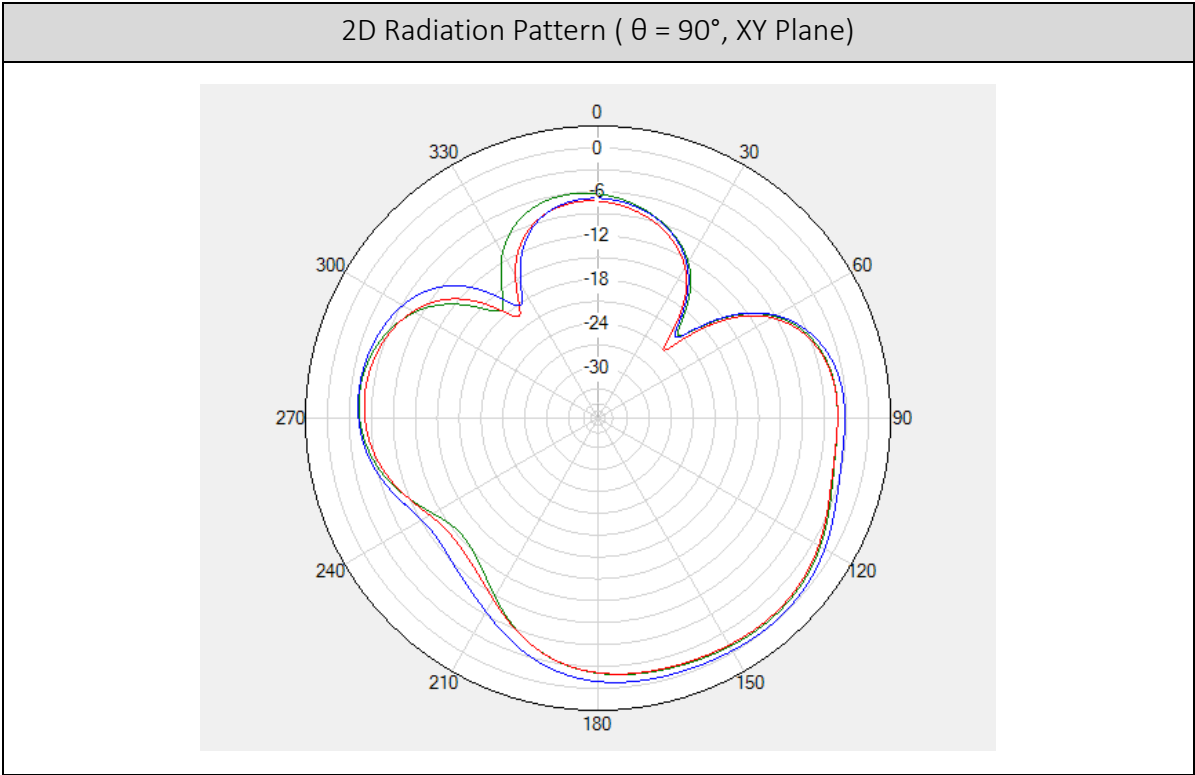


Table 5 Radiation pattern in XZ Plane

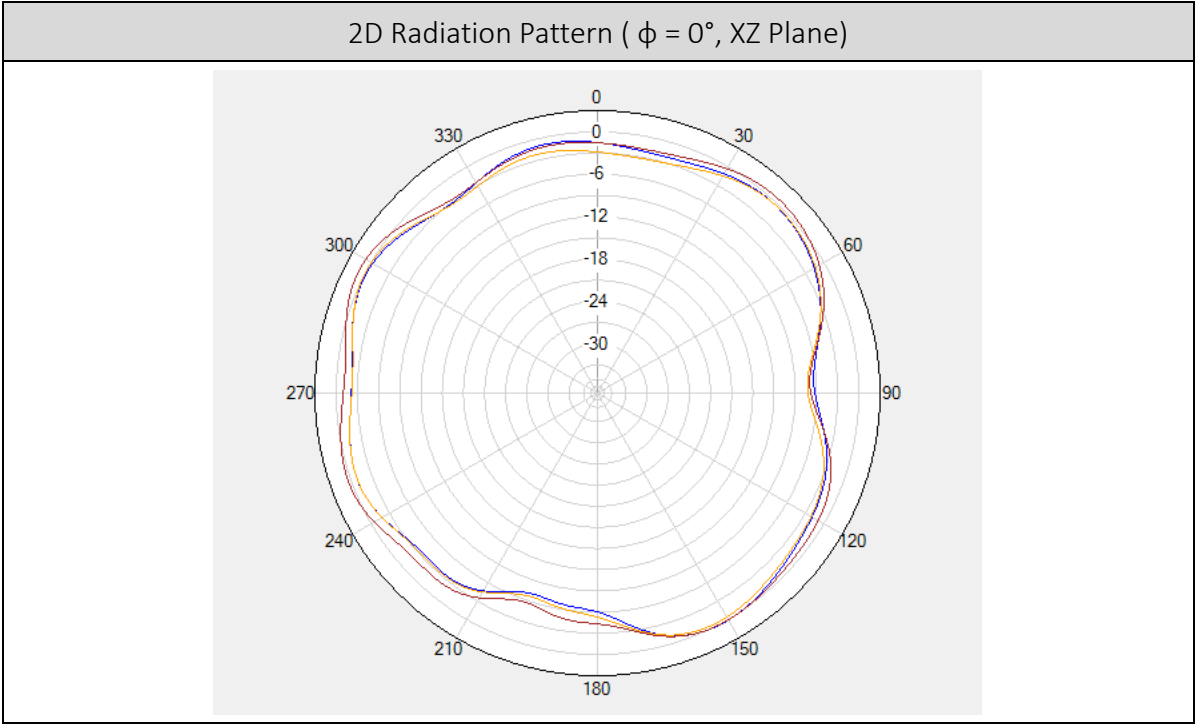
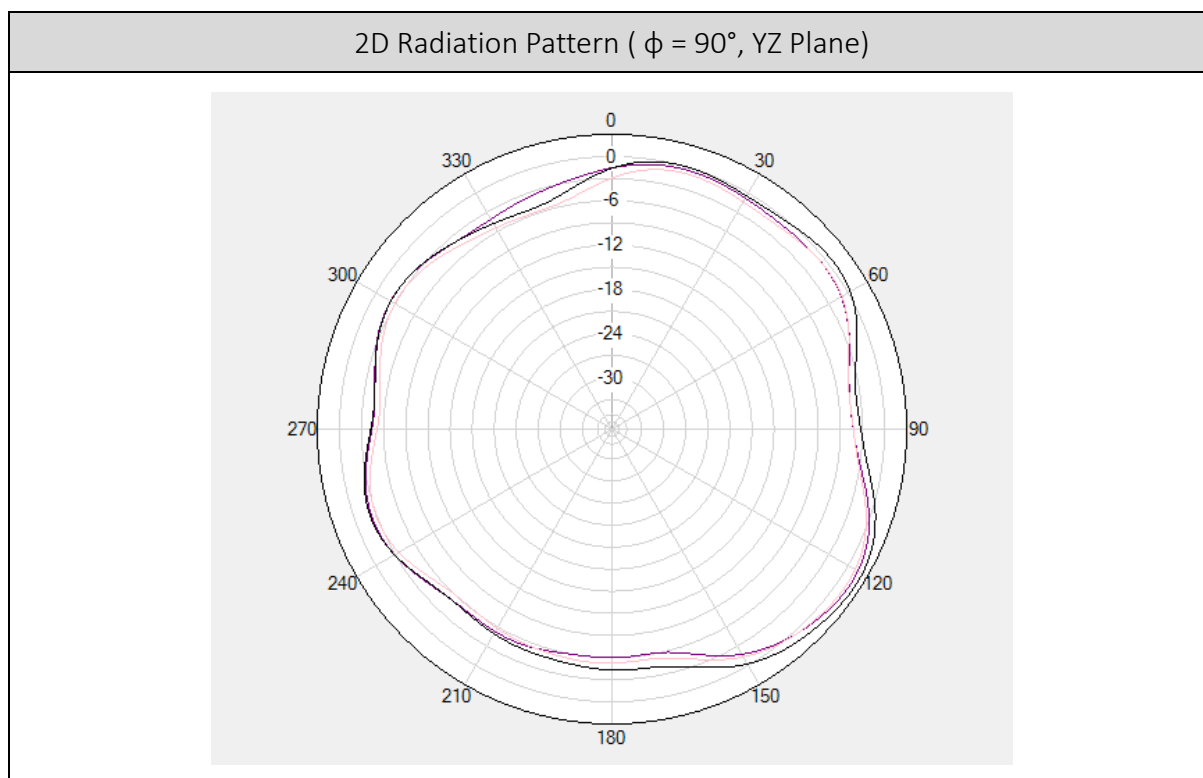


Table 6 Radiation pattern in YZ Plane



## BLE Antennna

## Efficiency and Gain

Table 7 Antenna Efficiency and Gain

| Frequency (MHz) | Gain (dBi) | Efficiency (dB) | Efficiency (%) |
|-----------------|------------|-----------------|----------------|
| 2400            | 3.24       | -1.85           | 65.31          |
| 2410            | 3.16       | -2.09           | 61.80          |
| 2420            | 3.16       | -2.08           | 61.94          |
| 2430            | 3.01       | -2.09           | 61.80          |
| 2440            | 2.85       | -2.24           | 59.70          |
| 2450            | 2.79       | -2.51           | 56.10          |
| 2460            | 3.04       | -2.32           | 58.61          |
| 2470            | 3.24       | -2.09           | 61.80          |
| 2480            | 3.06       | -2.33           | 58.48          |
| 2490            | 3.02       | -2.46           | 56.75          |
| 2500            | 3.66       | -2.03           | 62.66          |

## Radiation Pattern

Table 8 Product coordinates

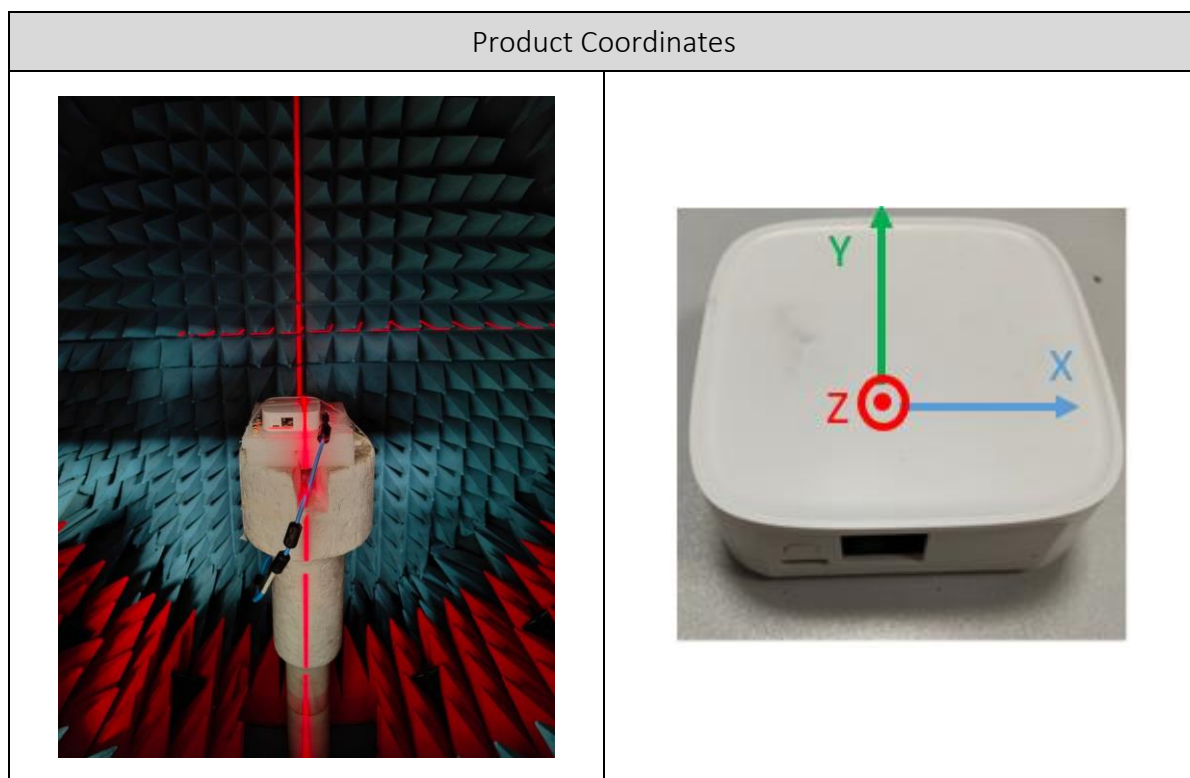


Table 9 3D radiation pattern

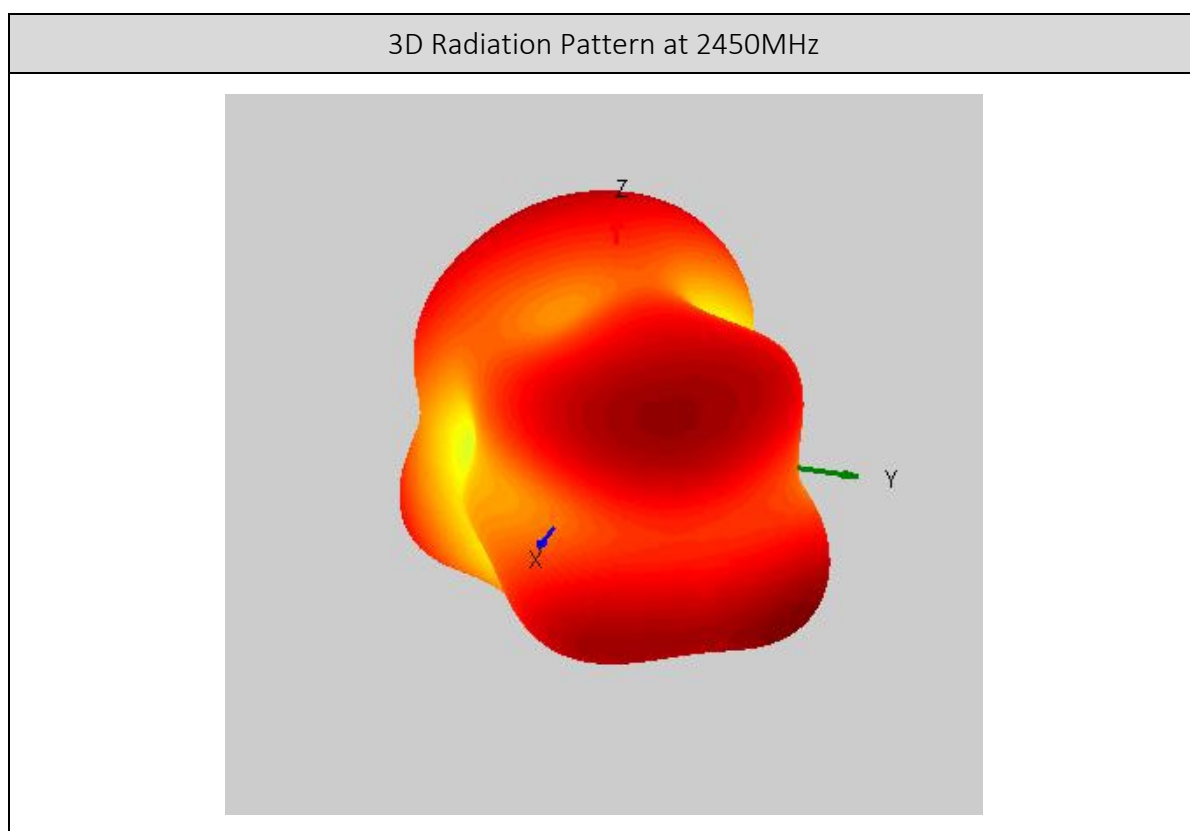


Table 10 Radiation pattern in XY Plane

2D Radiation Pattern (  $\theta = 90^\circ$ , XY Plane)

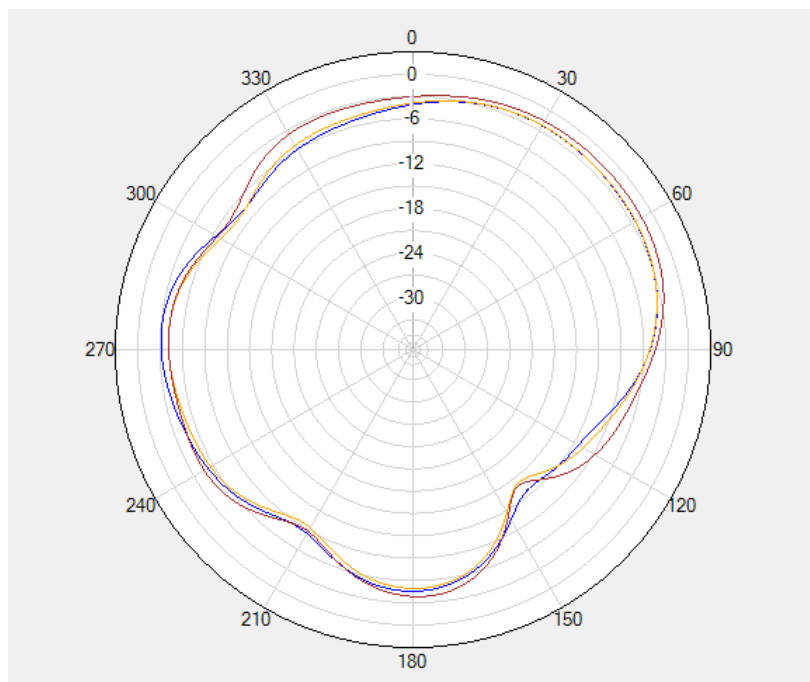


Table 11 Radiation pattern in XZ Plane

2D Radiation Pattern (  $\phi = 0^\circ$ , XZ Plane)

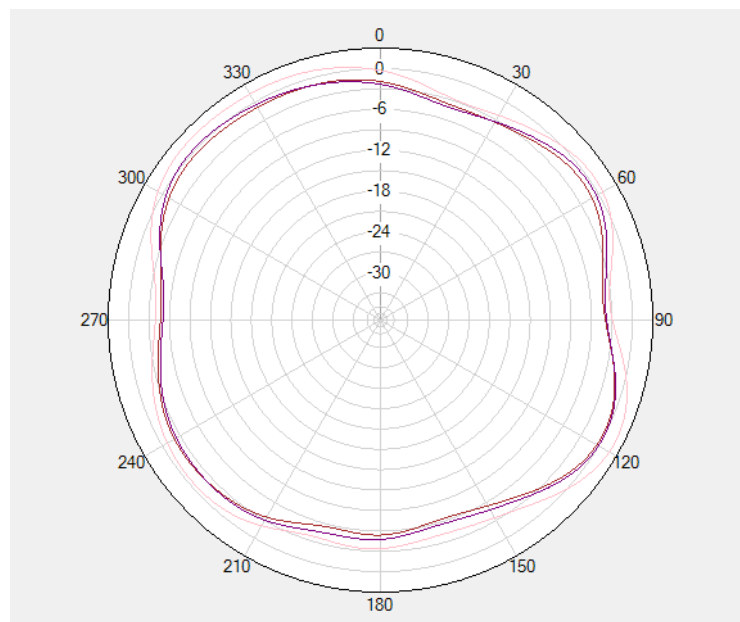
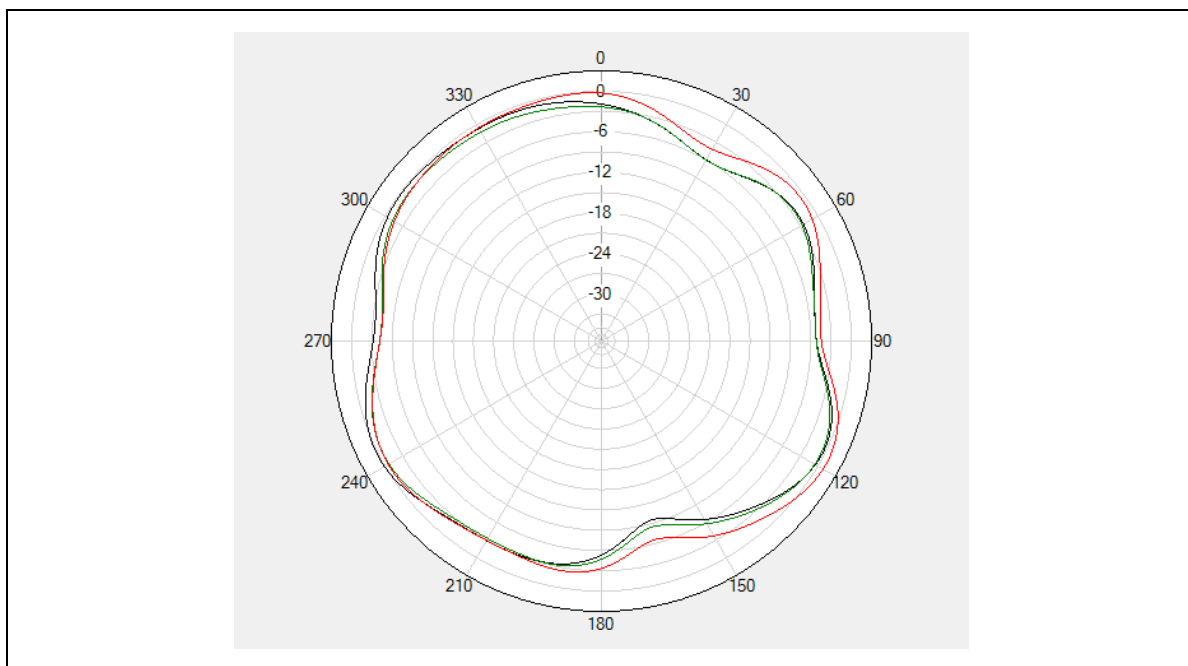


Table 12 Radiation pattern in YZ Plane

2D Radiation Pattern (  $\phi = 90^\circ$ , YZ Plane)





## Wi-Fi Antennna:

### Efficiency and Gain

Table 13 Antenna Efficiency and Gain

| Frequency (MHz) | Gain (dBi) | Efficiency (dB) | Efficiency (%) |
|-----------------|------------|-----------------|----------------|
| 2400            | 1.49       | -3.04           | 49.66          |
| 2410            | 1.52       | -3.03           | 49.77          |
| 2420            | 2.05       | -2.4            | 57.54          |
| 2430            | 1.68       | -2.51           | 56.10          |
| 2440            | 1.36       | -2.7            | 53.70          |
| 2450            | 1.97       | -2.2            | 60.26          |
| 2460            | 2.49       | -1.65           | 68.39          |
| 2470            | 2.12       | -1.93           | 64.12          |
| 2480            | 1.87       | -2.16           | 60.81          |
| 2490            | 2.2        | -1.84           | 65.46          |
| 2500            | 2.37       | -1.85           | 65.31          |

## Radiation Pattern

Table 14 Product coordinates

| Product Coordinates |
|---------------------|
|---------------------|

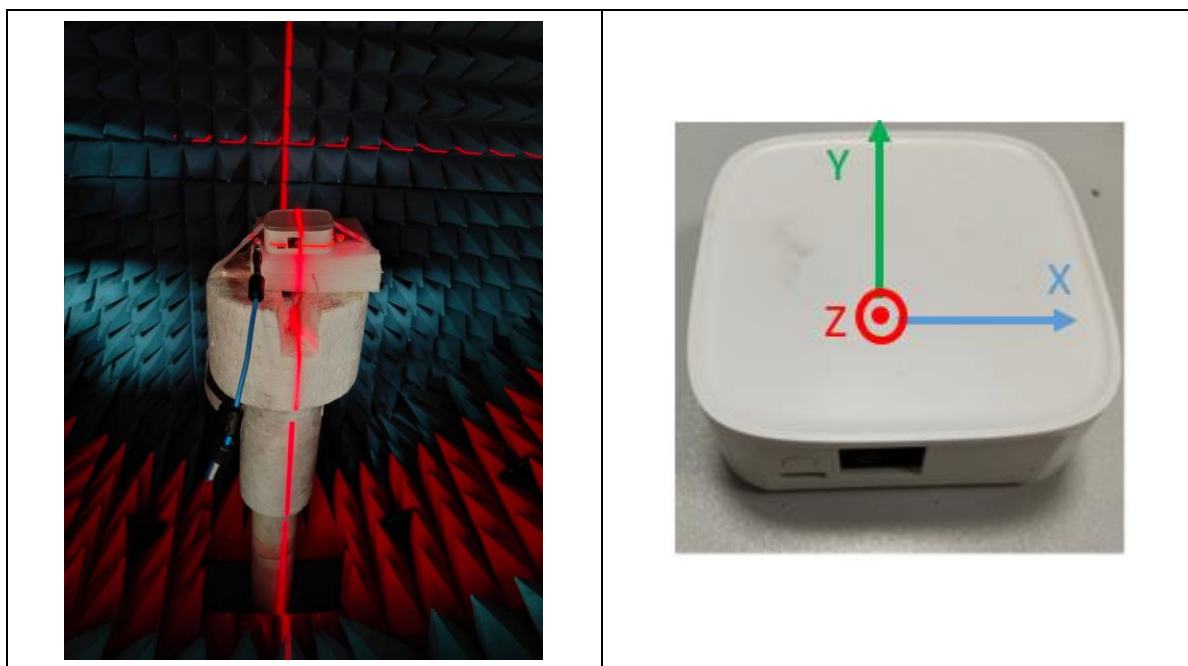


Table 15 3D radiation pattern

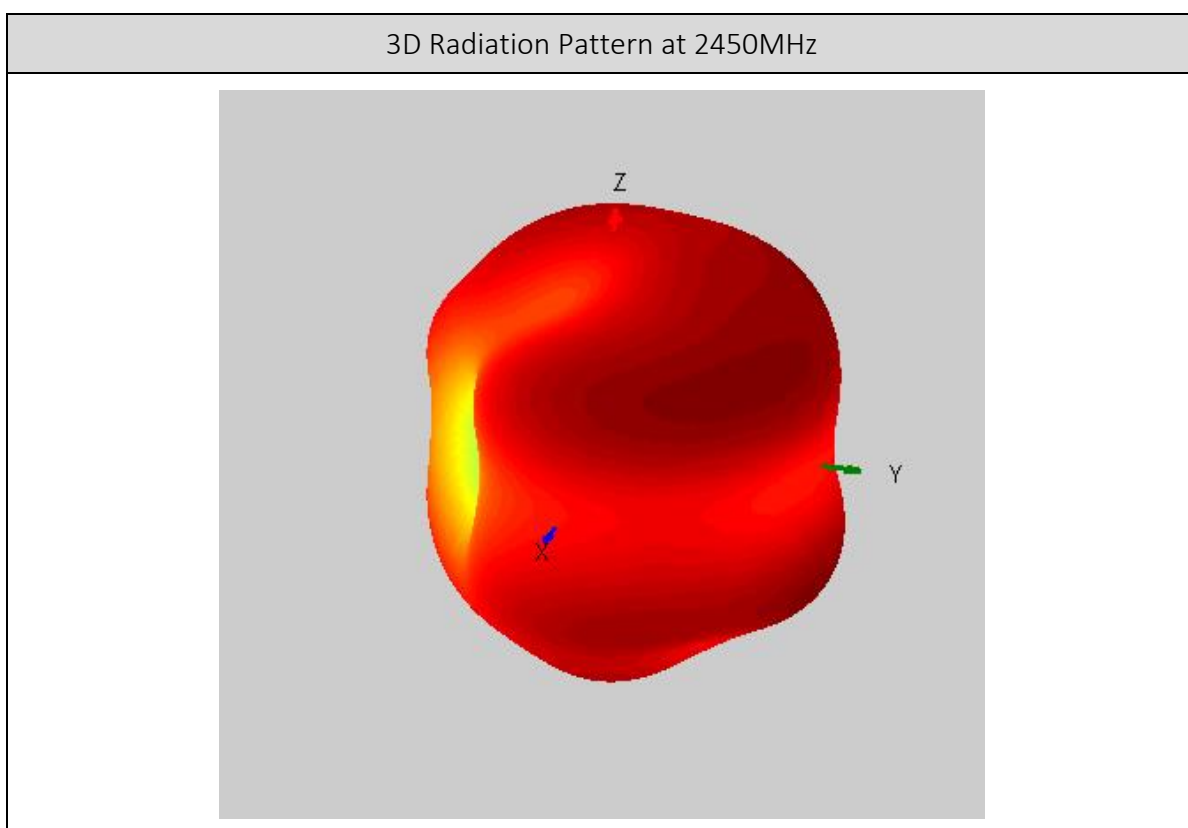
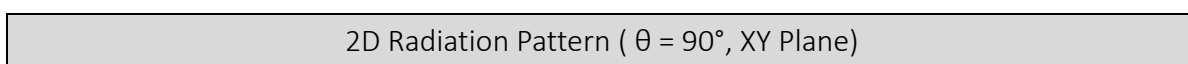


Table 16 Radiation pattern in XY Plane



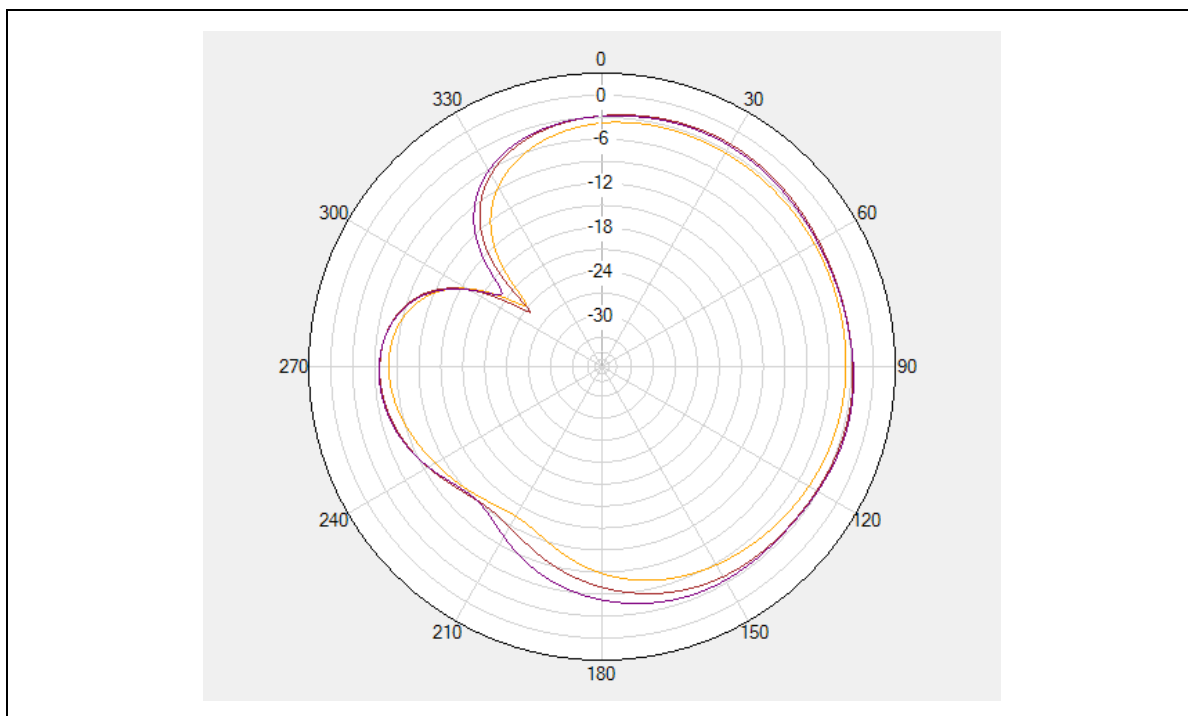


Table 17 Radiation pattern in XZ Plane

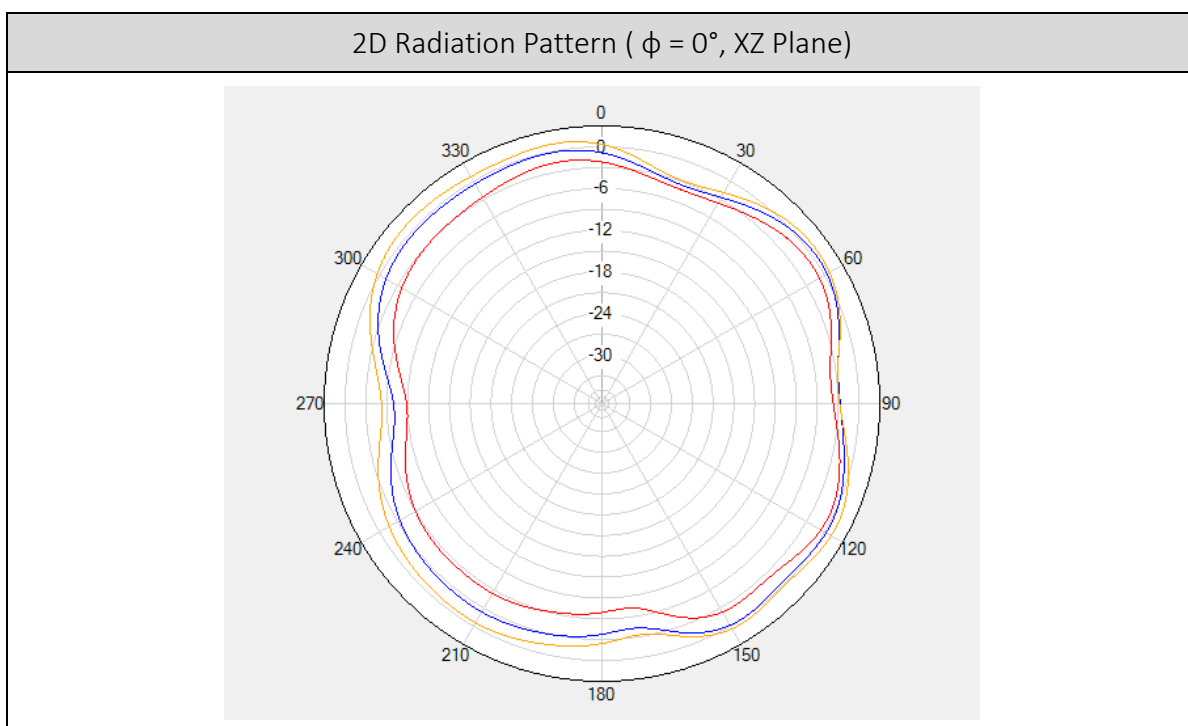


Table 18 Radiation pattern in YZ Plane

