
# Antenna Datasheet

**Product OC** (Antenna Only): YPCP003AA
**Product OC** (Antenna + EVB): YPCP003AAEVB
**Version:** 1.1
**Date:** 2023-04-10
**Status:** Released

**Product Name:** 4G SMD Antenna
**Key Features:**
Optimized for 4G/LTE/LTE-M/NB-IoT networks
High-efficiency, multiband SMD antenna
Low-profile antenna
Frequency band: 698–960 MHz, 1695–2200 MHz, 2300–2700 MHz
Peak efficiency: 79%
Dimensions: 28 × 8 × 3 mm
RoHS and REACH complaint

# Overview

This wideband LTE/cellular/CDMA SMT antenna is suitable for 4G/3G/2G applications. Operating at 698-960 MHz, 1695-2200 MHz and 2300-2700 MHz, it's a high-efficiency antenna which is mounted to the device host PCB using conventional PCB reflow process. Ideal for all 4G/LTE applications, it also supports worldwide Cat M and NB-IoT frequency bands. Supplied on tape and reel for high-volume applications, it is compatible with all Quectel's 4G/3G/2G including LPWA modules. We provide comprehensive antenna design support such as simulation, testing and manufacturing for custom antenna solutions to meet your specific application needs.

# Contents

# 1 Specification

**Test Condition: Assembled On EVB**

## 1.1. Electrical

| Electrical | |
|---|---|
| **Frequency Range** | 698–960 MHz, 1695–2200 MHz, 2300–2700 MHz |
| **Impedance** | 50 Ω |
| **Polarization** | Linear |
| **Radiation Pattern** | Omni-directional |

**Electrical - Detail**

| Band / SPEC | Band | B71 | B12 /B13 /B28 | B5 /B8 /B26 | B1 /B2 /B3 | B40 | WIFI 2G | B38 /B41 |
|---|---|---|---|---|---|---|---|---|
| | **Freq. (MHz)** | **600–700** | **700–810** | **820–960** | **1700–2170** | **2300–2400** | **2400–2500** | **2500–2690** |
| **Max VSWR** | **On 115 × 36 mm GND** | - | 7.8 | 2.6 | 3.8 | 2.2 | 2.1 | 2.4 |
| | **On 85 × 36 mm GND** | - | 9.9 | 4.3 | 4.6 | 2.8 | 2.1 | 2.2 |
| | **On 65 × 36 mm GND** | - | 10.8 | 5.5 | 3.6 | 2.8 | 2.3 | 2.4 |
| **Max Return Loss (dB)** | **On 115 × 36 mm GND** | - | -2.2 | -7.0 | -4.7 | -8.3 | -8.9 | -7.8 |
| | **On 85 × 36 mm GND** | - | -1.8 | -4.1 | -3.8 | -6.4 | -8.8 | -8.5 |
| | **On 65 × 36 mm GND** | - | -1.6 | -3.2 | -5.0 | -6.5 | -7.9 | -7.6 |
| **AVG Eff. (%)** | **On 115 × 36 mm GND** | - | 33.3 | 46.4 | 66.0 | 61.6 | 61.1 | 57.5 |
| | **On 85 × 36 mm GND** | - | 20.6 | 35.3 | 53.8 | 56.8 | 61.0 | 61.6 |
| | **On 65 × 36 mm GND** | - | 12.9 | 23.7 | 58.8 | 50.9 | 52.5 | 53.8 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **AVG Gain (dB)** | **On 115 × 36 mm GND** | - | -5.3 | -3.3 | -1.9 | -2.1 | -2.1 | -2.4 |
| | **On 85 × 36 mm GND** | - | -7.7 | -4.5 | -2.8 | -2.5 | -2.1 | -2.1 |
| | **On 65 × 36 mm GND** | - | -9.6 | -6.3 | -2.3 | -2.9 | -2.8 | -2.7 |
| **Max Peak Gain (dBi)** | **On 115 × 36 mm GND** | - | -0.4 | -0.1 | 3.3 | 3.2 | 2.9 | 2.9 |
| | **On 85 × 36 mm GND** | - | -2.0 | -1.2 | 3.3 | 1.9 | 1.9 | 1.8 |
| | **On 65 × 36 mm GND** | - | -3.7 | -3.4 | 2.7 | 2.0 | 2.0 | 1.6 |

| | | |
|---|---|---|
| **VSWR** | **On 115 × 36 mm GND** | ≤ 7.8 |
| | **On 85 × 36 mm GND** | ≤ 9.9 |
| | **On 65 × 36 mm GND** | ≤ 10.8 |
| **Return Loss** | **On 115 × 36 mm GND** | ≤ -2.2 dB |
| | **On 85 × 36 mm GND** | ≤ -1.8 dB |
| | **On 65 × 36 mm GND** | ≤ -1.6 dB |
| **Peak Gain** | **On 115 × 36 mm GND** | ≤ 3.3 dBi |
| | **On 85 × 36 mm GND** | ≤ 3.3 dBi |
| | **On 65 × 36 mm GND** | ≤ 2.7 dBi |

## 1.2. Supported Bands

| 5G NR / LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / GPRS / GSM / NB-IoT | | | | |
|---|---|---|---|---|
| **Band** | **Frequency (MHz)** | **Uplink (MHz)** | **Downlink (MHz)** | **Covered** |
| 1 | 2100 | 1920–1980 | 2110–2170 | √ |
| 2 | 1900 | 1850–1910 | 1930–1990 | √ |
| 3 | 1800 | 1710–1785 | 1805–1880 | √ |
| 4 | 1700 | 1710–1755 | 2110–2155 | √ |
| 5 | 850 | 824–849 | 869–894 | √ |
| 7 | 2600 | 2500–2570 | 2620–2690 | √ |
| 8 | 900 | 880–915 | 925–960 | √ |
| 9 | 1800 | 1749.9–1784.9 | 1844.9–1879.9 | √ |
| 11 | 1500 | 1427.9–1447.9 | 1475.9–1495.9 | - |
| 12 | 700 | 699–716 | 729–746 | √ |
| 13 | 700 | 777–787 | 746–756 | √ |
| 14 | 700 | 788–798 | 758–768 | √ |
| 17 | 700 | 704–716 | 734–746 | √ |
| 18 | 850 | 815–830 | 860–875 | √ |
| 19 | 850 | 830–845 | 875–890 | √ |
| 20 | 800 | 832–862 | 791–821 | √ |
| 21 | 1500 | 1447.9–1462.9 | 1495.9–1510.9 | - |
| 22 | 3500 | 3410–3490 | 3510–3590 | - |
| 23 | 2100 | 2000–2020 | 2180–2200 | √ |
| 24 | 1600 | 1626.5–1660.5 | 1525–1559 | - |
| 25 | 1900 | 1850–1915 | 1930–1995 | √ |
| 26 | 850 | 814–849 | 859–894 | √ |

| | | | | |
|---|---|---|---|---|
| 28 | 700 | 703–748 | 758–803 | √ |
| 31 | 450 | 452.5–457.5 | 462.5–467.5 | - |
| 34 | 2100 | 2010–2025 | | √ |
| 38 | 2600 | 2570–2620 | | √ |
| 39 | 1900 | 1880–1920 | | √ |
| 40 | 2300 | 2300–2400 | | √ |
| 41 | 2500 | 2496–2690 | | √ |
| 42 | 3500 | 3400–3600 | | - |
| 48 | 3500 | 3550–3700 | | - |
| 66 | 1700 | 1710–1780 | 2110–2200 | √ |
| 71 | 600 | 663–698 | 617–652 | - |
| 74 | 1500 | 1427–1470 | 1475–1518 | - |
| 77 | 3500 | 3300–4200 | | - |
| 78 | 3500 | 3300–3800 | | - |
| 79 | 4500 | 4400–5000 | | - |

**Note**:

- Covered √ means efficiency > 20%.
- Based on 115 × 36 mm GND.

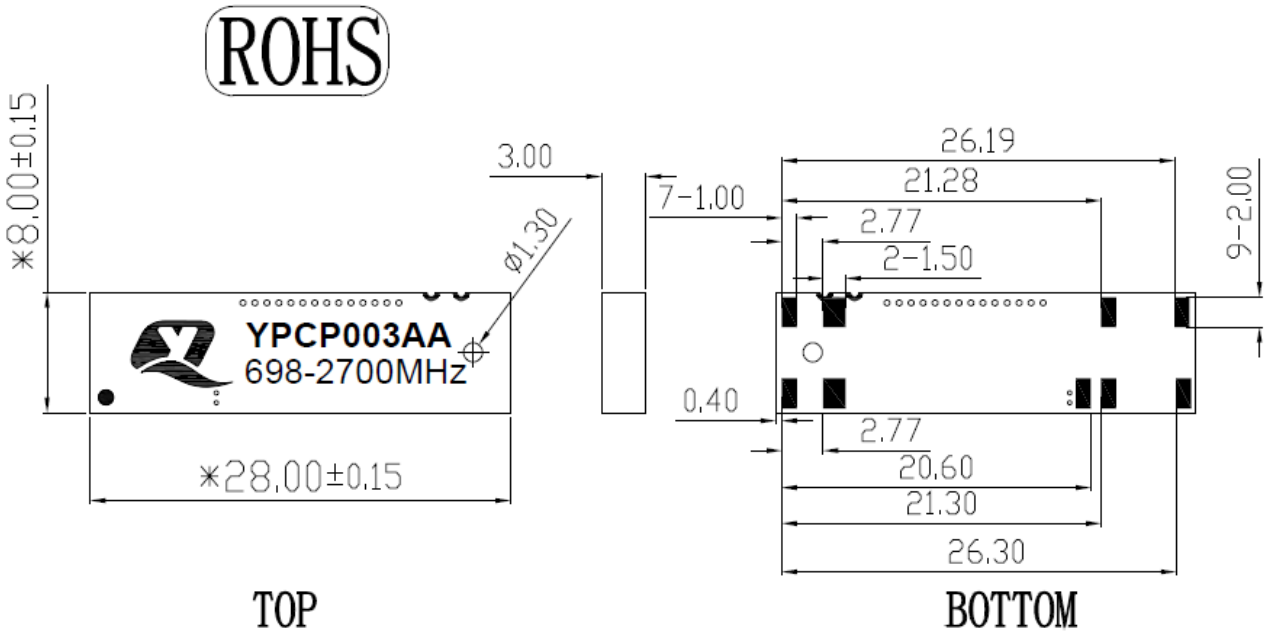
## 1.3. Mechanical, Environmental & Storage

| | |
|---|---|
| **Mechanical** | |
| **Antenna Size** | 28 × 8 × 3 mm |
| **Antenna Material & Color** | FR4 & Black |
| **Antenna Weight** | Typ. 1.5 g |
| **Mounting Type** | SMD |
| **Recommended EVB Size** | 130 × 36 mm |
| **Environmental** | |
| **Operation Temperature** | -40 °C to +85 °C |
| **RoHS & REACH Compliant** | Yes |

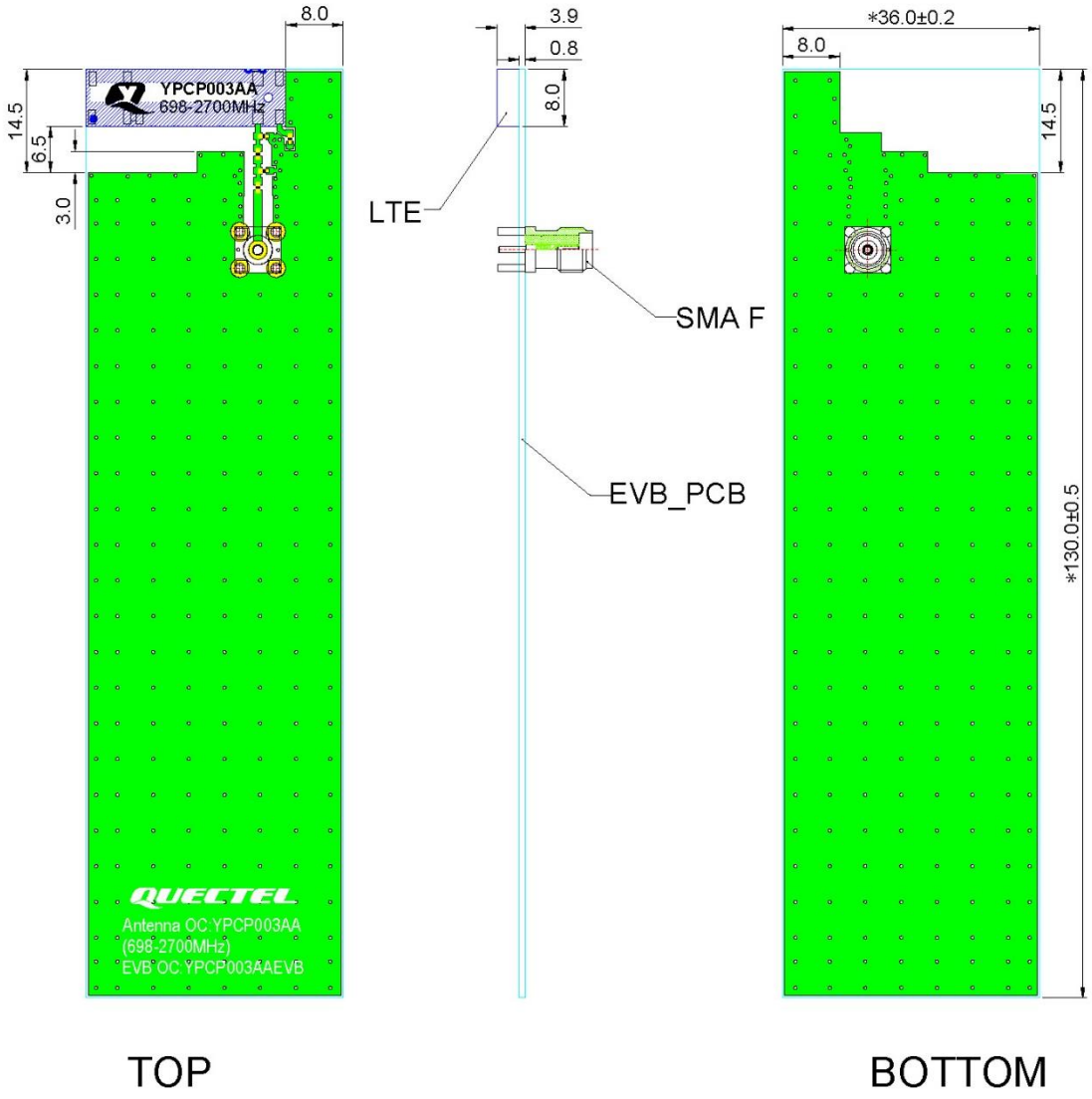
| | |
|---|---|
| **Storage** | |
| **Storage Temperature** | 18 °C to 27 °C |
| **Humidity** | 30–80 % RH |
| **Storage Place** | Away from corrosive gas and direct sunlight |
| **Packing** | Antennas should be stored in unopened sealed manufacturer's plastic packaging |

# 2 Drawing

## 2.1. Antenna



## 2.2. EVB

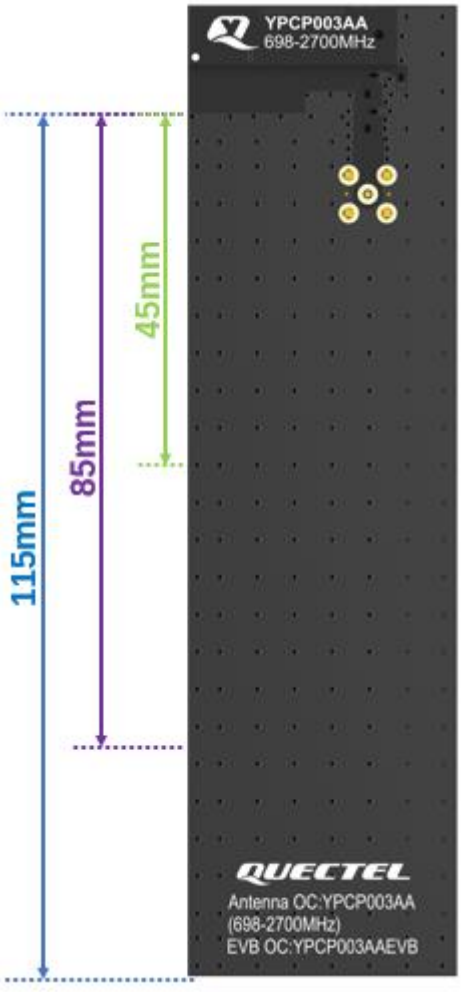



All dimensions are in mm

# 3 Detailed Performance

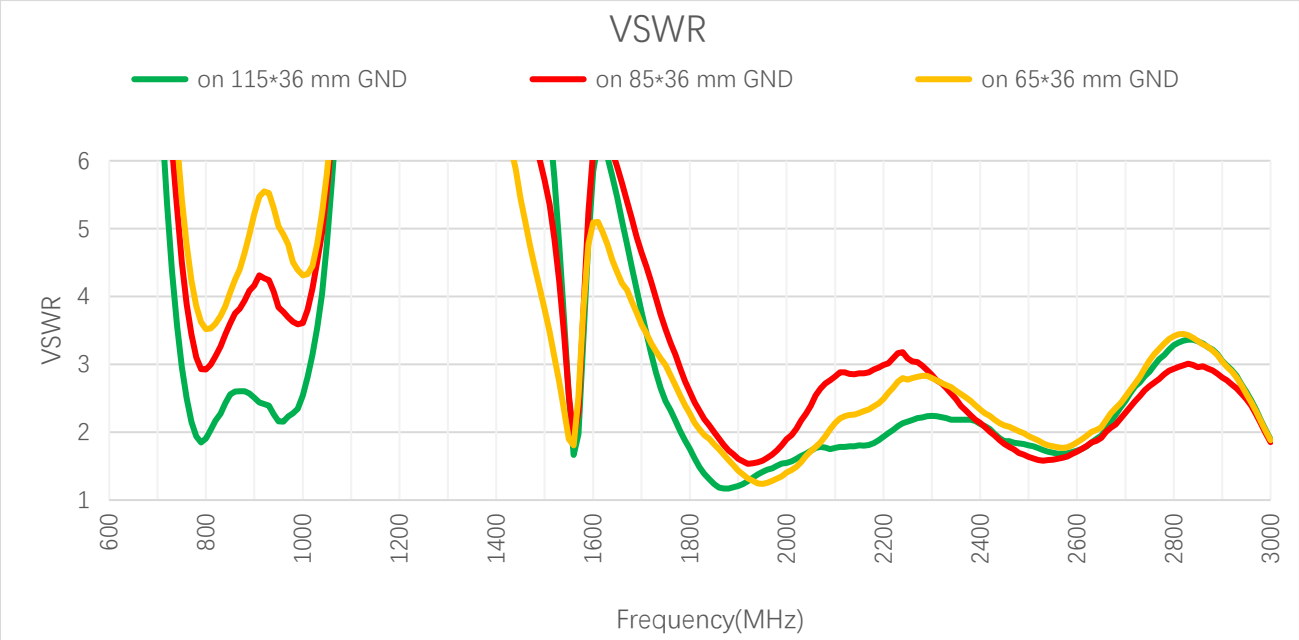
## 3.1. Overview

The performance of the low bands is highly dependent on the ground plane length. The host PCB ground needs to be as long as the device allows. Reducing the GND directly relates to the performance of the low bands. As shown below you can see the effect of the GND plane length vs the efficiency.



## 3.2. S-Parameter Test

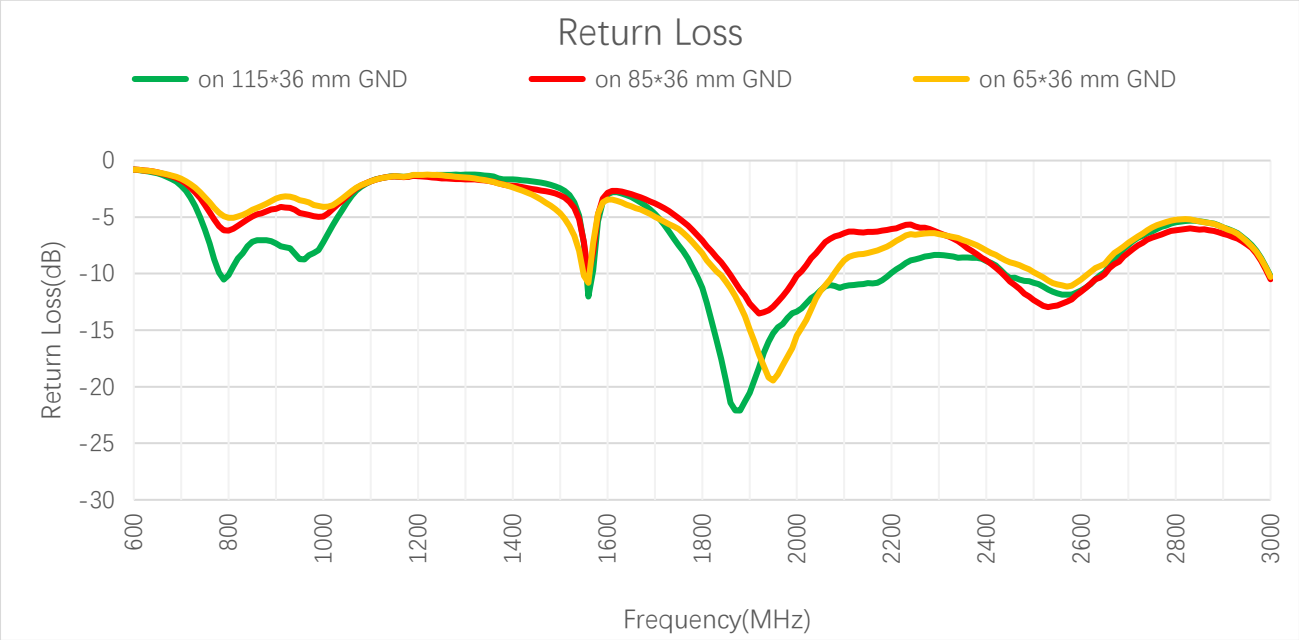
### 3.2.1. VSWR




**VSWR**

| Frequency (MHz) | 710 | 830 | 900 | 1740 | 1880 | 1950 | 2140 | 2350 | 2450 | 2600- |
|---|---|---|---|---|---|---|---|---|---|---|
| On 115 × 36 mm GND | 6.5 | 2.3 | 2.5 | 2.6 | 1.2 | 1.4 | 1.8 | 2.2 | 1.9 | 1.7 |
| On 85 × 36 mm GND | 8.6 | 3.3 | 4.2 | 3.7 | 1.7 | 1.6 | 2.9 | 2.5 | 1.8 | 1.7 |
| On 65 × 36 mm GND | 9.5 | 3.7 | 5.2 | 3.1 | 1.6 | 1.2 | 2.3 | 2.6 | 2.1 | 1.8 |

### 3.2.2. Return Loss

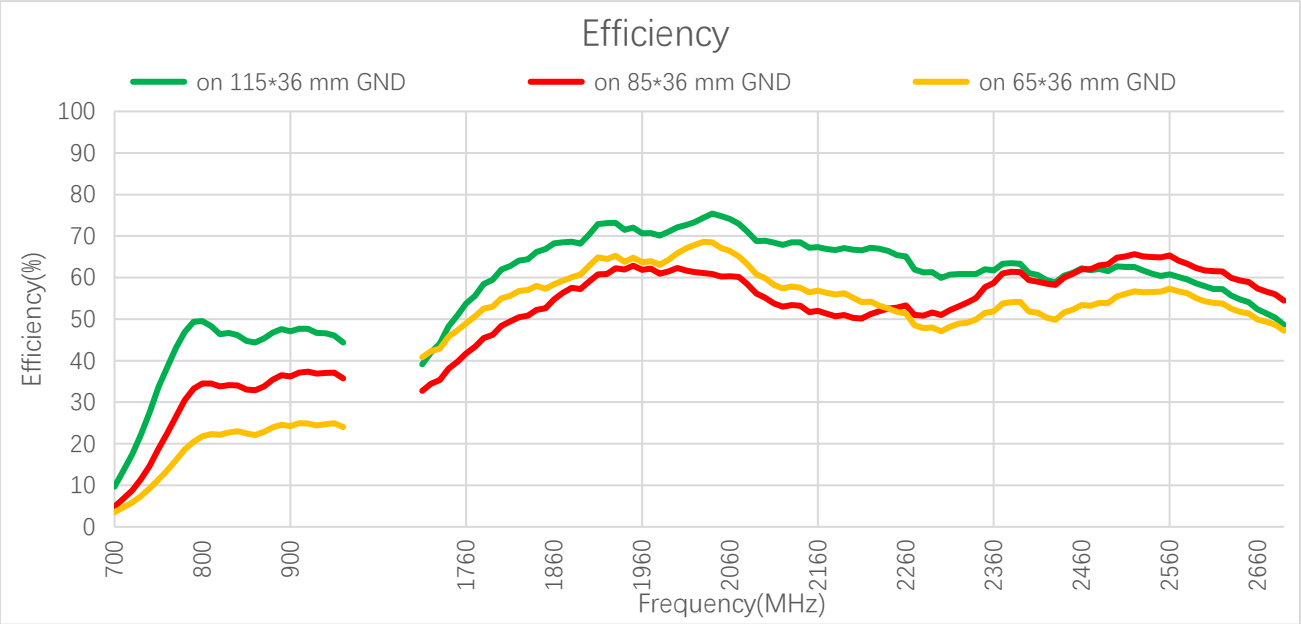



**Return Loss (dB)**

| Frequency (MHz) | 710 | 830 | 900 | 1740 | 1880 | 1950 | 2140 | 2350 | 2450 | 2600- |
|---|---|---|---|---|---|---|---|---|---|---|
| On 115 × 36 mm GND | -2.7 | -8.2 | -7.3 | -6.9 | -22.1 | -15.3 | -10.9 | -8.6 | -10.4 | -11.5 |
| On 85 × 36 mm GND | -2.0 | -5.5 | -4.3 | -4.8 | -11.4 | -12.9 | -6.4 | -7.4 | -10.7 | -11.6 |
| On 65 × 36 mm GND | -1.8 | -4.8 | -3.4 | -5.8 | -12.9 | -19.5 | -8.3 | -7.0 | -9.0 | -10.5 |

## 3.3. Radiation Performance Test

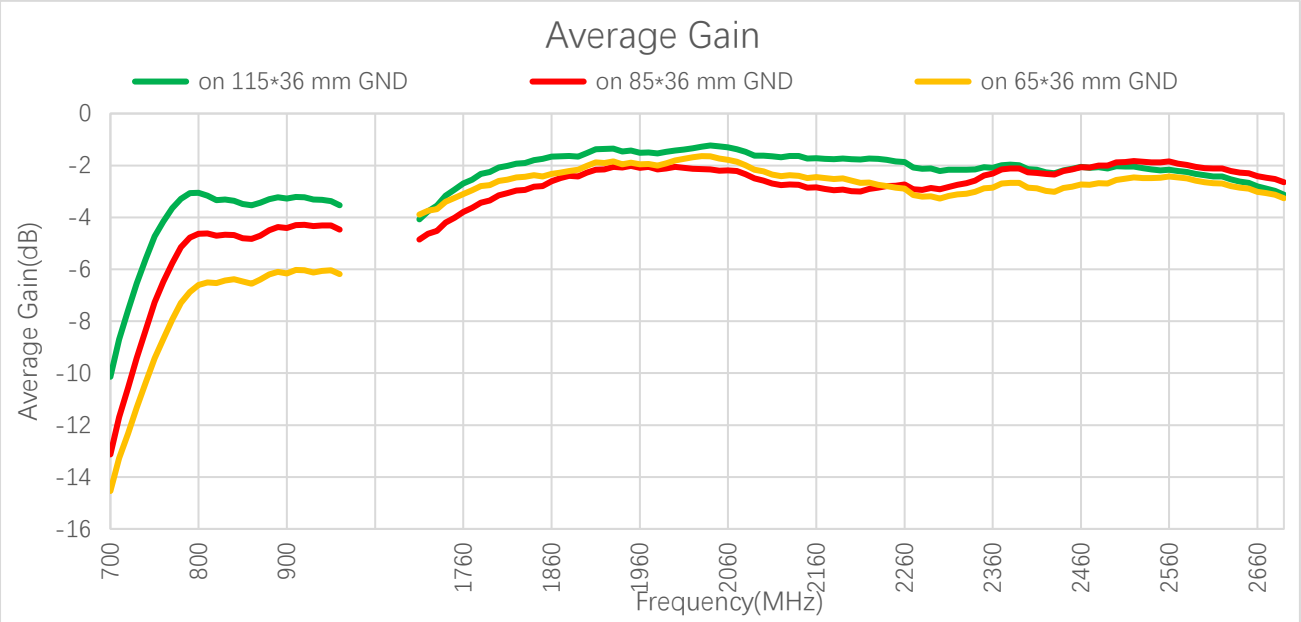
### 3.3.1. Efficiency




**Efficiency (%)**

| Frequency (MHz) | 710 | 830 | 900 | 1740 | 1880 | 1950 | 2140 | 2350 | 2450 | 2600- |
|---|---|---|---|---|---|---|---|---|---|---|
| On 115 × 36 mm GND | 13.5 | 46.7 | 47.1 | 48.2 | 68.7 | 72.0 | 68.5 | 62.0 | 61.2 | 57.9 |
| On 85 × 36 mm GND | 6.8 | 34.1 | 36.2 | 38.0 | 57.5 | 62.9 | 53.2 | 57.7 | 60.9 | 61.7 |
| On 65 × 36 mm GND | 4.7 | 22.8 | 24.2 | 45.8 | 60.1 | 64.8 | 57.5 | 51.6 | 52.3 | 54.3 |

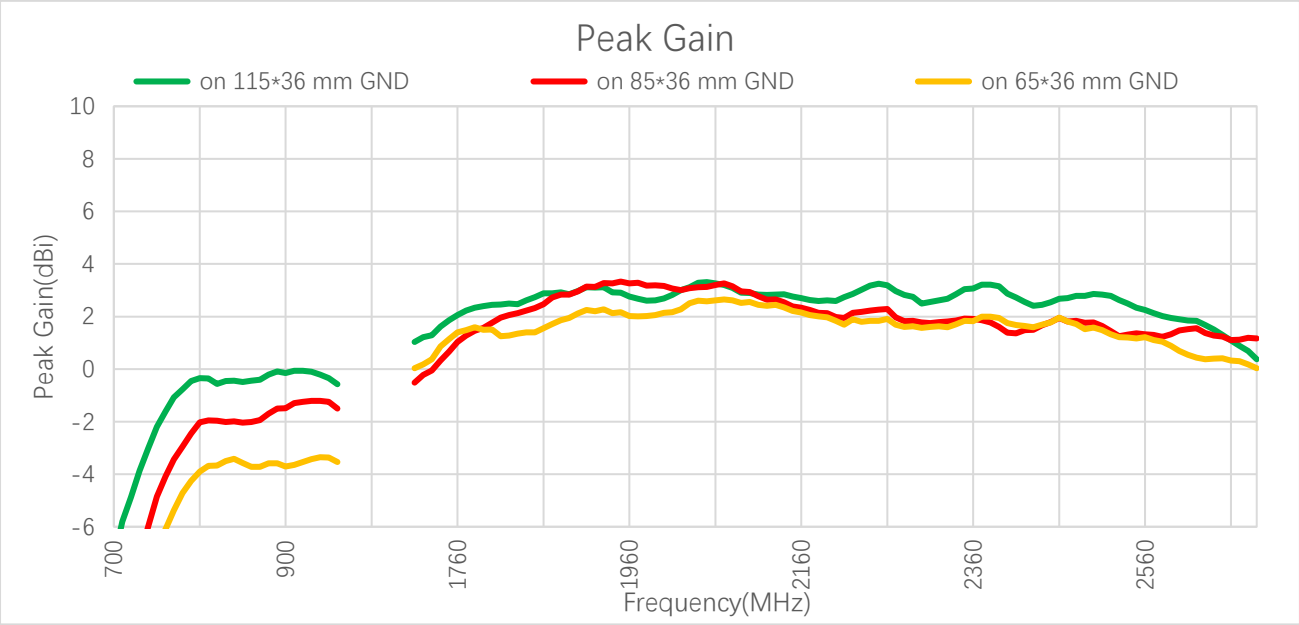
### 3.3.2. Average Gain




**Average Gain (dB)**

| Frequency (MHz) | 710 | 830 | 900 | 1740 | 1880 | 1950 | 2140 | 2350 | 2450 | 2600- |
|---|---|---|---|---|---|---|---|---|---|---|
| On 115 × 36 mm GND | -8.7 | -3.3 | -3.3 | -3.2 | -1.6 | -1.4 | -1.6 | -2.1 | -2.1 | -2.4 |
| On 85 × 36 mm GND | -11.7 | -4.7 | -4.4 | -4.2 | -2.4 | -2.0 | -2.7 | -2.4 | -2.2 | -2.1 |
| On 65 × 36 mm GND | -13.3 | -6.4 | -6.2 | -3.4 | -2.2 | -1.9 | -2.4 | -2.9 | -2.8 | -2.7 |

### 3.3.3. Peak Gain

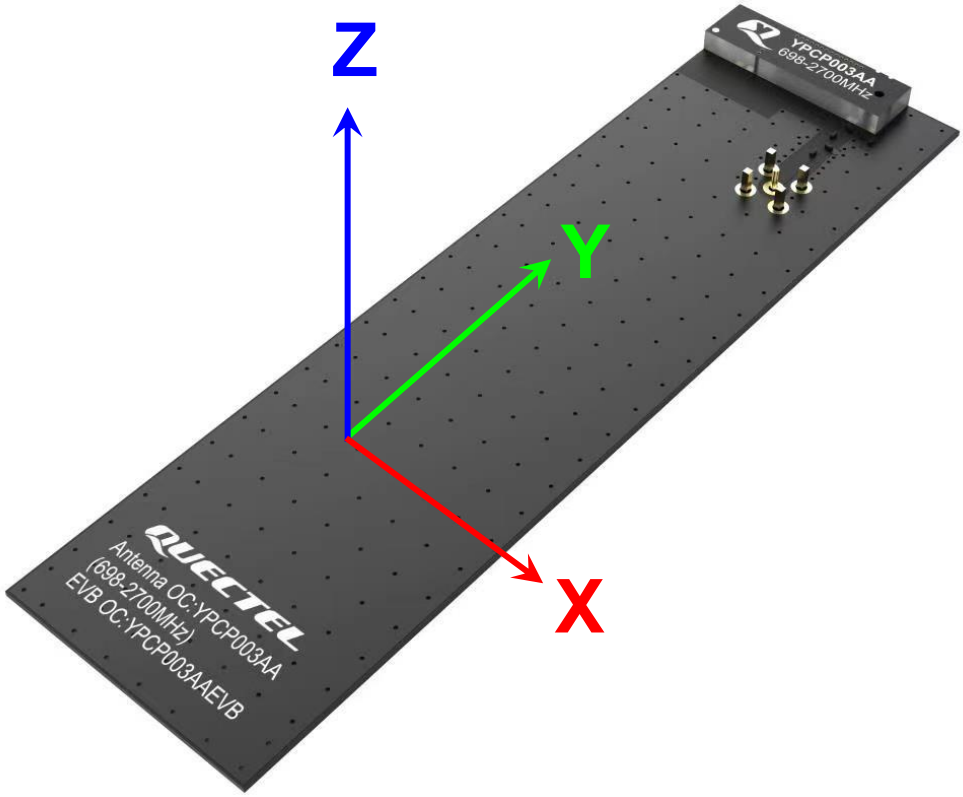



**Peak Gain (dBi)**

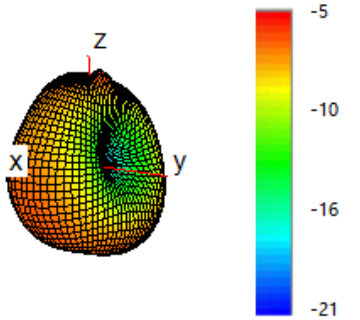
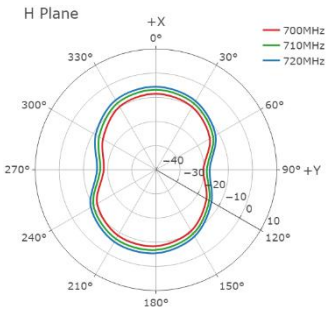
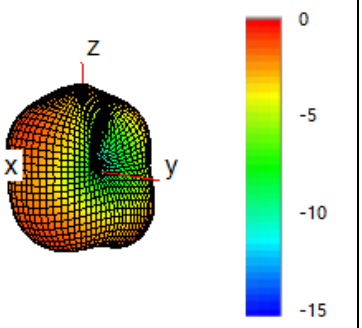
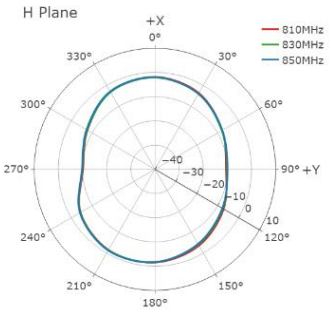
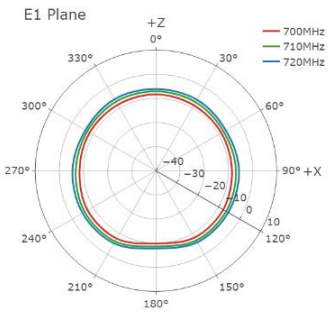
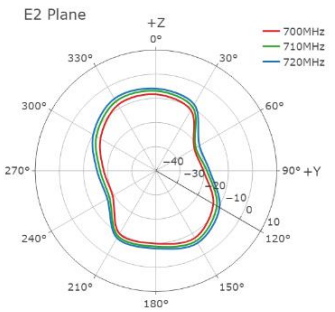
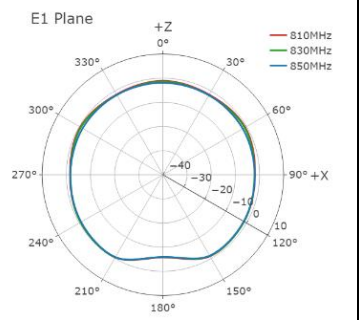
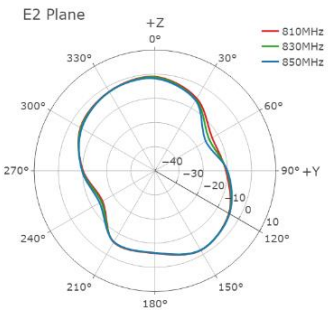
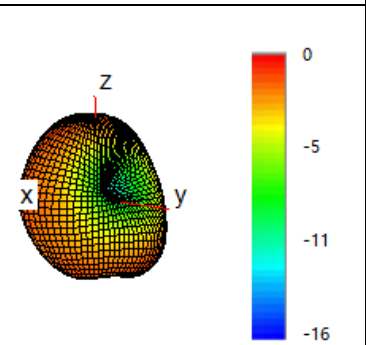
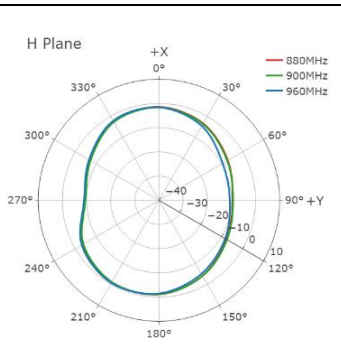
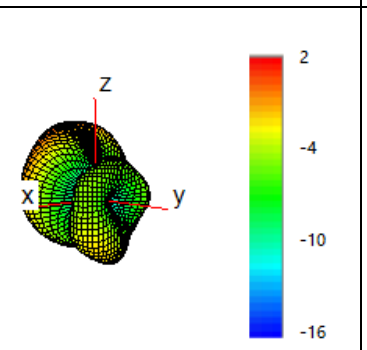
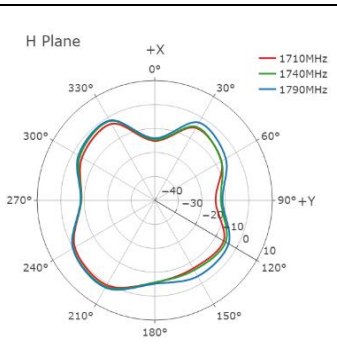
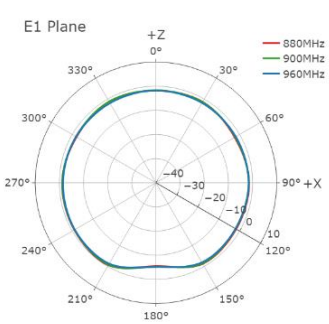
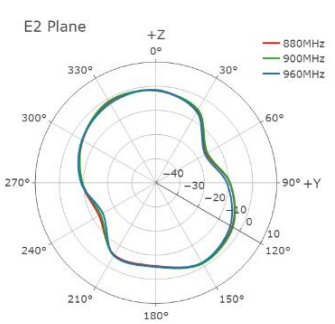
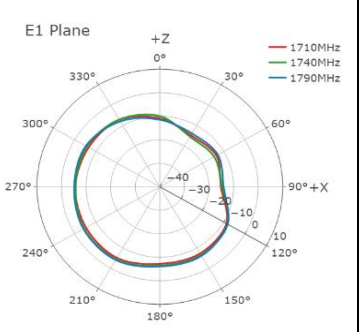
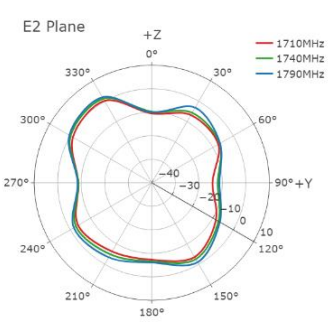
| Frequency (MHz) | 710 | 830 | 900 | 1740 | 1880 | 1950 | 2140 | 2350 | 2450 | 2600- |
|---|---|---|---|---|---|---|---|---|---|---|
| On 115 × 36 mm GND | -5.8 | -0.5 | -0.2 | 1.6 | 2.9 | 2.9 | 2.9 | 3.0 | 2.5 | 1.9 |
| On 85 × 36 mm GND | -9.2 | -2.0 | -1.5 | 0.3 | 2.8 | 3.3 | 2.5 | 1.9 | 1.8 | 1.5 |
| On 65 × 36 mm GND | -9.9 | -3.5 | -3.7 | 0.9 | 1.9 | 2.2 | 2.4 | 1.8 | 1.8 | 0.7 |

### 3.3.4. 3D & 2D Radiation Pattern

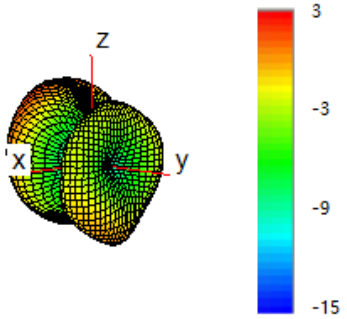
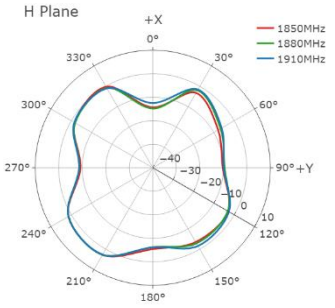
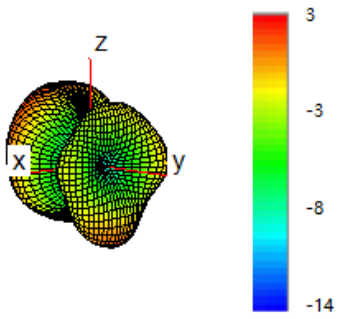
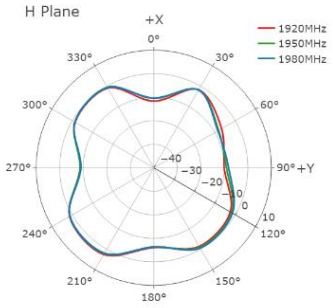
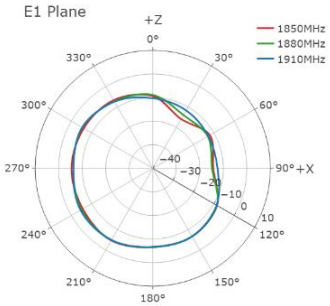
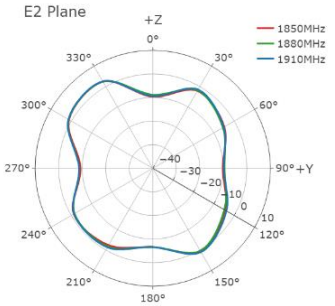
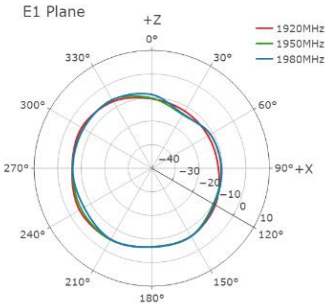
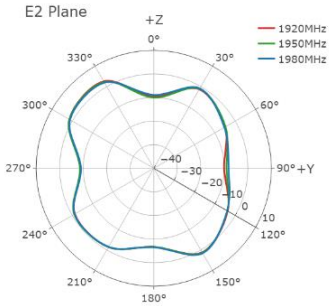
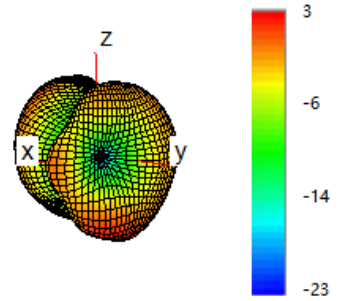
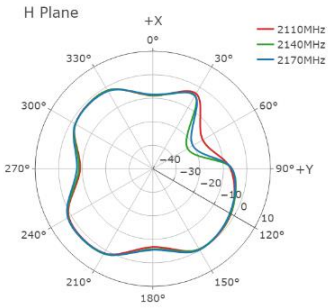
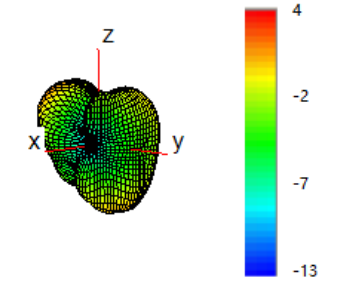
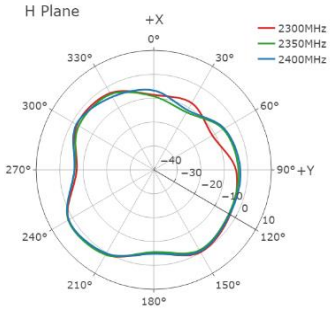
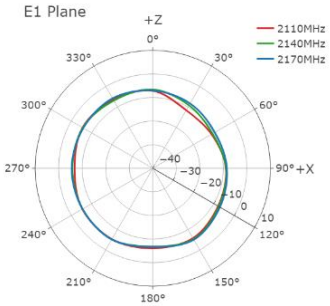
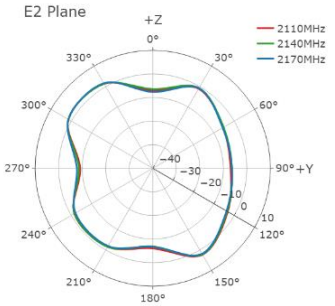
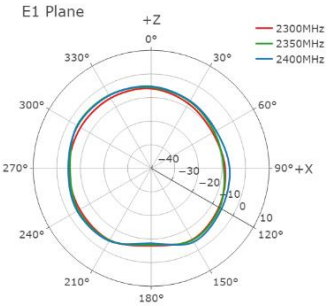
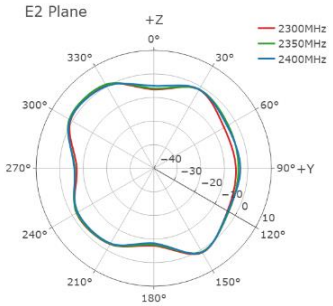
- Test Status: Assembled on 115 × 36 mm GND



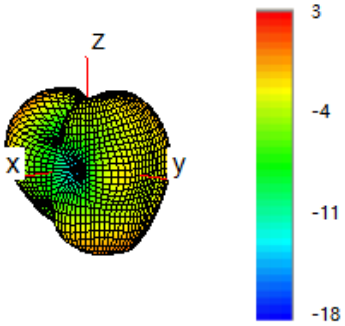
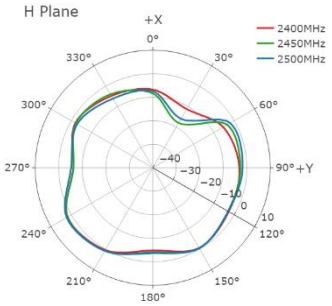
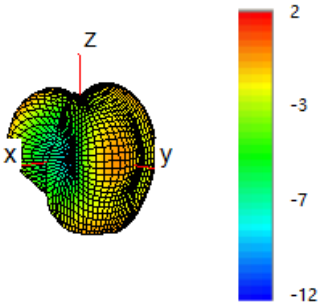
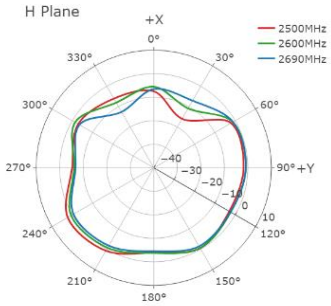
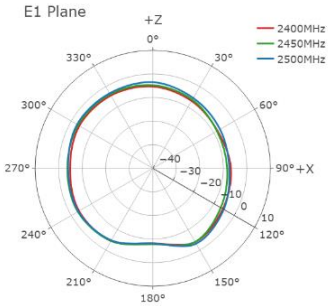
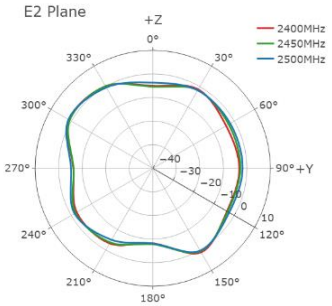
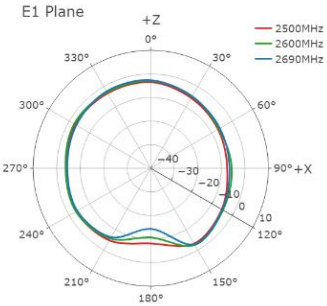
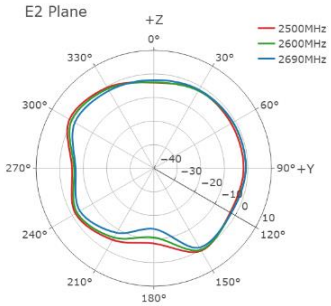
- 4G

| 710 MHz | | 830 MHz | |
|---|---|---|---|
|  |  |  |  |
|  |  |  |  |
| 900 MHz | | 1740 MHz | |
|  |  |  |  |
|  |  |  |  |

- 4G

| 1880 MHz | | 1950 MHz | |
|---|---|---|---|
|  |  |  |  |
|  |  |  |  |
| 2140 MHz | | 2350 MHz | |
|  |  |  |  |
|  |  |  |  |

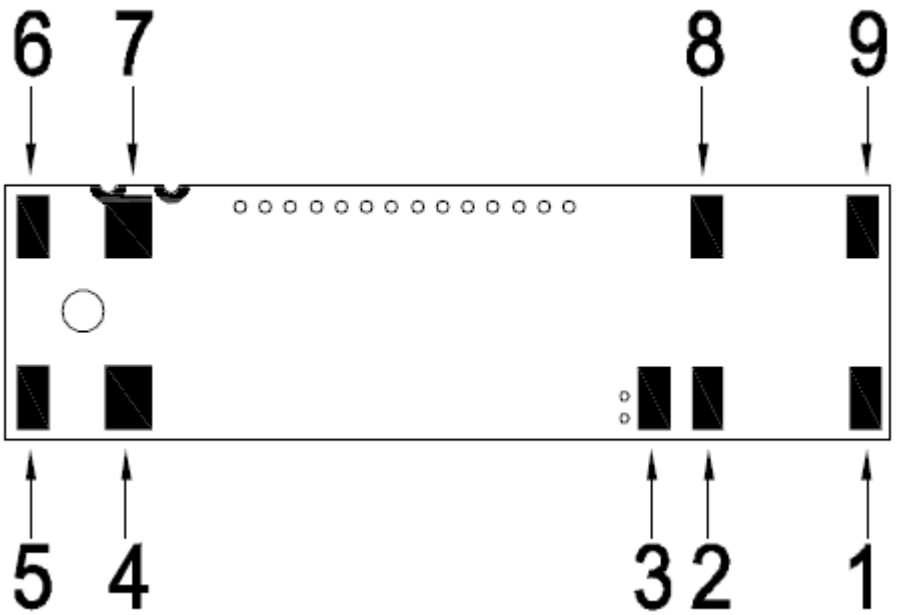
- 4G

| 2450 MHz | | 2600 MHz | |
|---|---|---|---|
|  |  |  |  |
|  |  |  |  |

# 4 Schematic Symbol and Pin Definition

- The pin assignment for the antenna is as follows.
- The antenna has 9 pins and only four work.
- All other pins are designed for mechanical strength.

| Pin #. | Description |
|---|---|
| 4 | FEED |
| 5 | Return / GND |
| 1, 6, 7, 8, 9 | Not Used (Mechanical Only) |
| 2, 3 | Antenna Tuning |



# 5 Transmission Line

The characteristic impedance of all transmission lines shall be designed as 50 Ω.

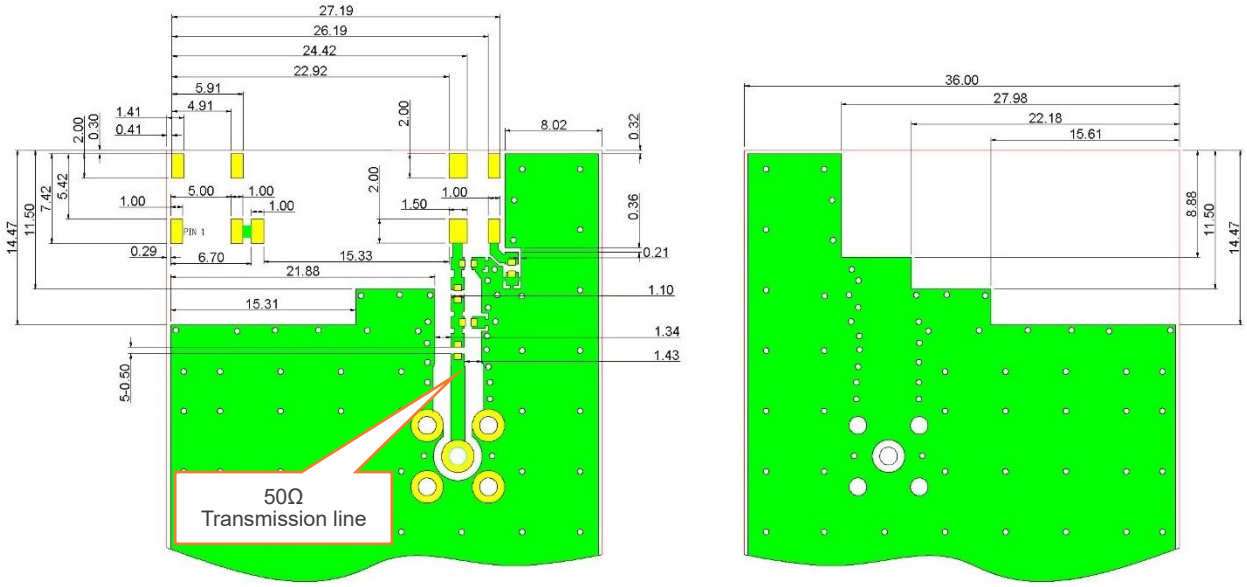
- The length of the transmission lines should be kept as short as possible.
- Any other part of the RF system, such as transceiver, power amplifiers, etc., shall also be designed with an impedance of 50 Ω.

- Once the material for the PCB has been chosen (PCB thickness and dielectric constant), a coplanar transmission line can easily be designed using any of the commercial software packages for transmission line design. For the chosen PCB thickness, copper thickness and substrate dielectric constant, the program will calculate the appropriate transmission line width and gaps on either side of the track so the characteristic impedance of the coplanar transmission is 50 Ω.

# 6 Recommended PCB Layout

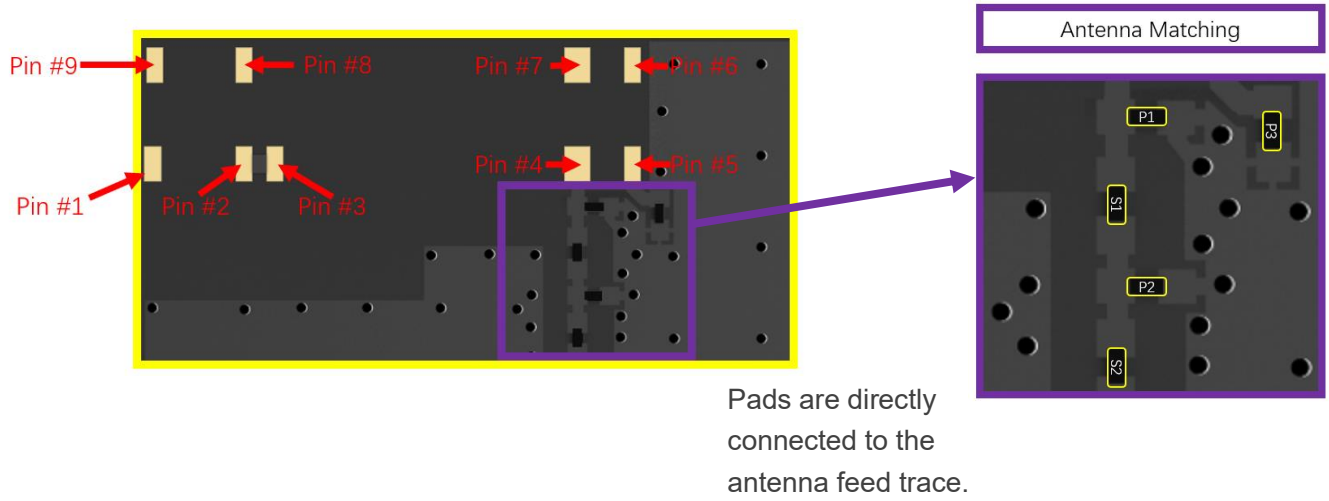
The host PCB must be designed using the PCB footprint shown with the correct clearances. An example of the PCB layout shows the antenna footprint. Please note this clearance area is critical to the performance of the antenna and must be applied through all layers of the PCB.

- Test EVB Size: 130 mm × 36 mm
- EVB Clearance Area: 14.5 mm × 28 mm



# 7 Matching Circuit

Demo Board Top View




Pads are directly connected to the antenna feed trace.

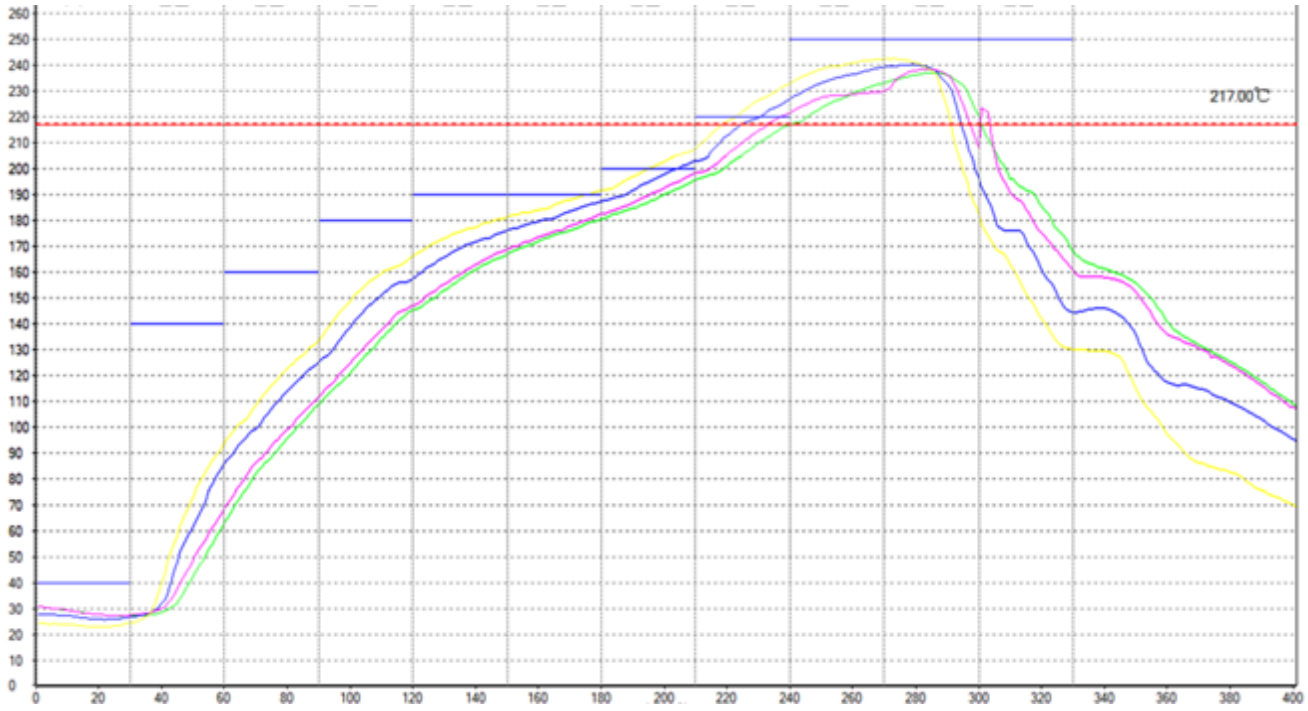
| | P1 | S1 | P2 | S2 | P3 |
|---|---|---|---|---|---|
| **Default Matching** | 27nH | 2.0pF | 27nH | 2.7nH | 6.2nH |
| **Tolerance** | ±5% | ±5% | ±5% | ±5% | ±5% |

| Pin #. | Description |
|---|---|
| 4 | FEED |
| 5 | Return / GND |
| 1, 6, 7, 8, 9 | Dummy Pad |
| 2, 3 | Antenna Tuning |

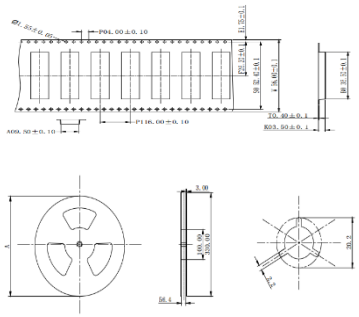
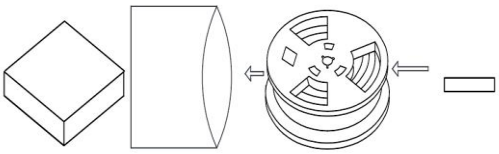
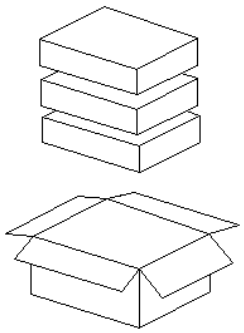
# 8 Soldering Temperature

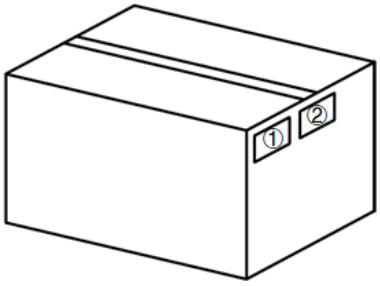
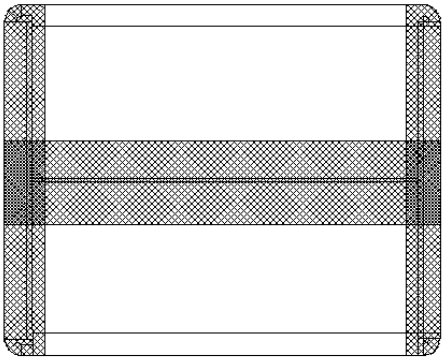
| Phase | Profile Features | PB-Free Assembly |
|---|---|---|
| RAMP-UP | Avg. Ramp-up Rate (Tsmax to Tp) | 4°C/second (Max.) |
| PREHEAT | Temperature Min (Tsmin)<br>Temperature Max (Tsmax) Time (tsmin to tsmax) | 150 °C<br>180 °C<br>120 seconds (Max.) |
| REFLOW | Temperature (TL) Total Time above TL (tl) | 217 °C<br>90 seconds (Max.) |
| PEAK | Temperature (Tp) | 230–250 °C |
| RAMP-DOWN | Rate | -4 °C/second (Max.) |

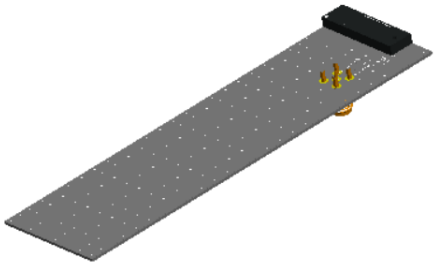
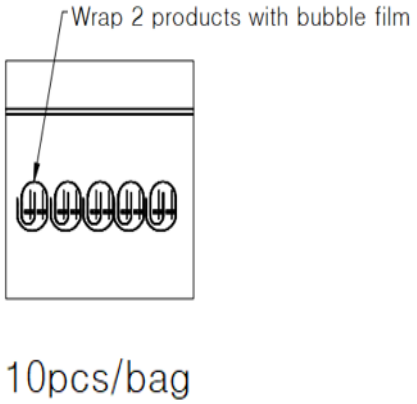
# 9 Reflow Profile

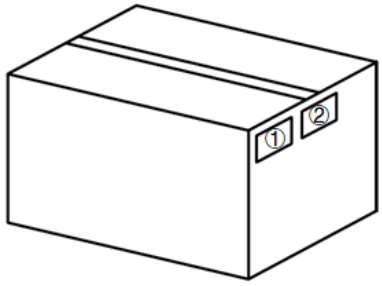
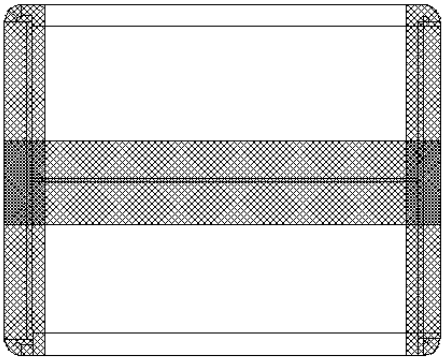


# 10 Packaging

| Step | Packaging Picture / 2D Picture | Description |
|---|---|---|
| 1 |  | Reel |
| 2 |  | 1100 Antenna Products / Reel<br>Reel tape is vacuumed into the inner box.<br><br>Inner Box Size:<br>L × W × H = 340 × 340 × 70 mm |
| 3 |  | 3 Inner Boxes / Carton Box<br>(3300 Antennas / Carton Box)<br><br>Carton Size:<br>L × W × H = 480 × 350 × 220 mm |

| | | |
|---|---|---|
| 4 |  | **Position for Attaching Labels**<br>① Carton Label<br>② Quality Label |
| 5 |  | **Sealing Cartons**<br>"工" type sealing cartons |

| Step | Packaging Picture / 2D Picture | Description |
|---|---|---|
| 1 |  | Product Drawing |
| 2 |  | Wrap every 2 products in a bubble film.<br>10 Antenna Products / PE Bag<br><br>PE Bag Size: L × W = 280 × 200 mm |

| | | |
|---|---|---|
| 3 |  | Place a clapboard at the bottom and top.<br>(20 PE Bags / Carton Box)<br>(200 Antennas / Carton Box)<br><br>Carton Size:<br>L × W × H = 340 × 245 × 270 mm |
| 4 |  | **Position for Attaching Labels**<br>① Carton Label<br>② Quality Label |
| 5 |  | **Sealing Cartons**<br>"工" type sealing cartons |

# Contact Us

**At Quectel, our aim is to provide timely and comprehensive services to our customers. If you require any assistance, please contact our headquarters:**

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# Revision History

| Version | Date | Author | Note |
|---|---|---|---|
| - | 2023-02-02 | Andy YAN/ Lance SUN/ David LIU/ Vinnie LIU | Creation of the document |
| 1.0 | 2023-02-02 | Andy YAN/ Lance SUN/ David LIU/ Vinnie LIU | First official release |
| 1.1 | 2023-04-10 | Andy YAN/ Lance SUN/ David LIU/ Vinnie LIU | Updated the figure style (Chapter 2). |

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