

Antenna Gain Specification

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Product Model: PCB Printed Antenna (Multilayer PCB Structure)

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1. Overview

This document specifies the structural dimensions, electrical performance, and environmental adaptability requirements for a multilayer PCB printed antenna. The antenna employs a hybrid planar inverted-F/monopole configuration with an integrated feed point and via-to-ground connection, and is intended for RF front ends in wireless communication terminal devices.

1.1 Key Features

- Integrated PCB structure eliminates separate antenna components and reduces assembly height
- Multilayer PCB design incorporating an antenna trace layer and Ground Layer 2
- Single feed point supporting single-port 50 Ω impedance matching
- Grounding-via design enhances structural stability and bandwidth

2. Structure and Dimensions

The antenna structure is shown in Figure 1; dimensional parameters are provided in Table 1.

2.1 Antenna Structure Diagram

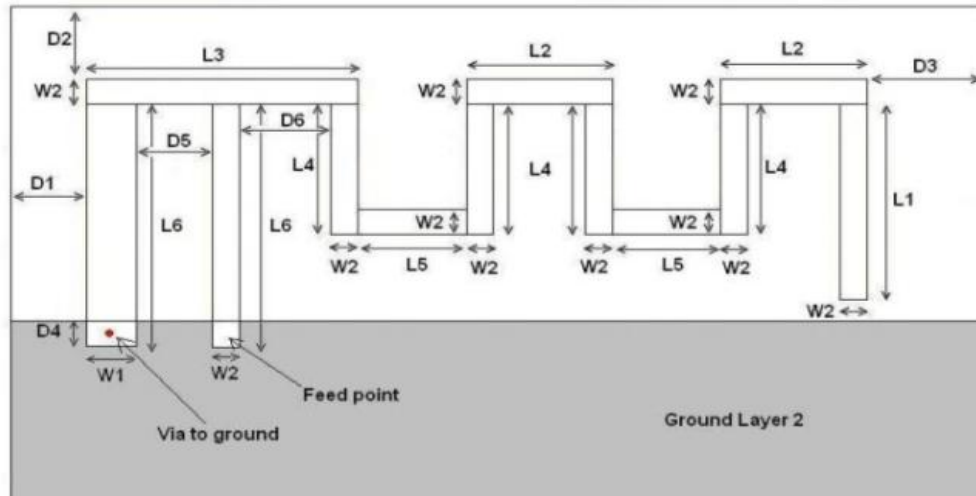


Figure 1. Antenna Structure Diagram

2.2 Antenna Dimensional Parameters

L1	3.94 mm
L2	2.70 mm
L3	5.00 mm
L4	2.64 mm
L5	2.00 mm
L6	4.90 mm
W1	0.90 mm
W2	0.50 mm
D1	0.50 mm
D2	0.30 mm
D3	0.30 mm
D4	0.50 mm
D5	1.40mm
D6	1.70 mm

Table 1: Antenna Dimensions

Figure 2. Antenna Dimensions

2.3 Antenna Radiation Characteristics

2.4 GHz PCB 天线辐射特性图

依据天线结构尺寸绘制 / Certification-style figure

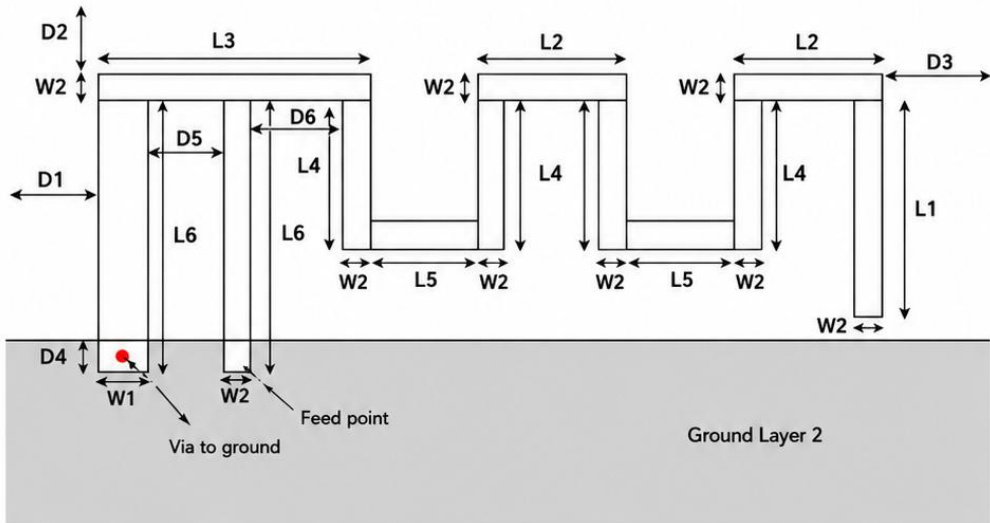
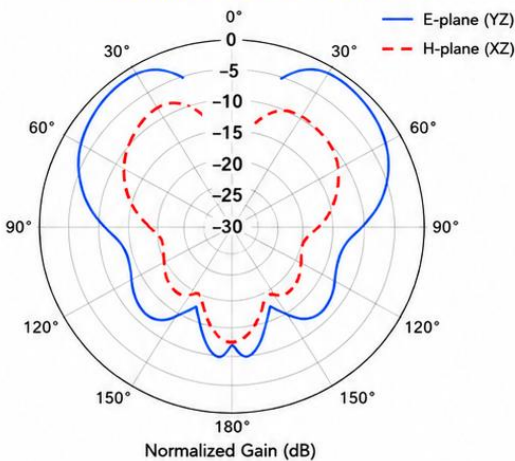


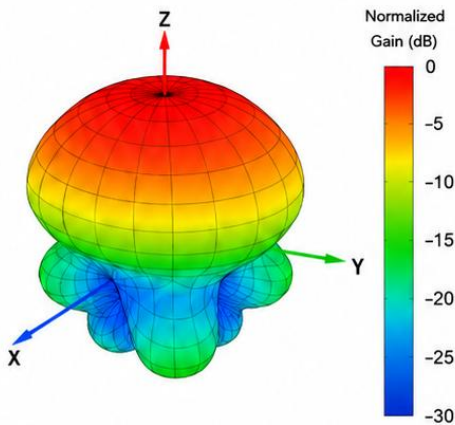
表 1 天线尺寸参数 / Table 1 Antenna Dimensions

L1	3.94 mm	D1	0.50 mm
L2	2.70 mm	D2	0.30 mm
L3	5.00 mm	D3	0.30 mm
L4	2.64 mm	D4	0.50 mm
L5	2.00 mm	D5	1.40 mm
L6	4.90 mm	D6	1.70 mm
W1	0.90 mm	—	—
W2	0.50 mm	—	—

二维方向图 / 2D Radiation Pattern



三维方向图 / 3D Radiation Pattern



说明：本图依据天线结构尺寸进行仿真风格绘制，用于认证资料排版展示。
频段：2.4 GHz；方向图为归一化结果。

3. Electrical Performance Specifications

The table below lists the key electrical performance characteristics of the antenna. All parameters shall be verified using a vector network analyzer and anechoic-chamber testing.

Parameter	Specification	Test Conditions
Impedance	50 Ω	Feed Port
Operating Frequency Band	2.400 - 2.4835 GHz/ 5.150-5.250 GHz	Based on the S11 curve
Peak Gain	2 dBi (typical) ≥ 1.0 dBi (well-optimized design)	Anechoic-chamber free-space test
Average Gain	-3 to -1 dBi (typical)	Anechoic-chamber omnidirectional average
Return Loss (S11)	≤ -10 dB	Within the operating frequency band
Polarization	Linear polarization	—
Radiation Efficiency	40% to 70% (typical)	Anechoic-chamber test
3D Radiation Pattern	Omnidirectional/dipole-like	Anechoic-chamber test

4. Mechanical and Environmental Specifications

Item	Specification	Test Method	Remarks
PCB Thickness	As specified by the mechanical design	Caliper/cross-section measurement	Recommended: 1.0 to 1.6 mm
Copper Thickness	≥ 35 μm	Copper thickness gauge	Outer-layer traces
Solder Mask Coverage	No coverage in the antenna area	Visual inspection	Prevents degradation of antenna performance
Operating Temperature	-20 $^{\circ}\text{C}$ ~ +70 $^{\circ}\text{C}$	Temperature chamber	Standard consumer-grade range
Storage Temperature	-40 $^{\circ}\text{C}$ ~ +85 $^{\circ}\text{C}$	Temperature chamber	—
Relative Humidity	$\leq 85\%$ RH	—	Non-condensing

5. Installation Instructions and Precautions

1. Do not place copper beneath the antenna area. Maintain the required keep-out zone and ensure that no interfering traces are routed above Ground Layer 2.
2. Reserve space for a π - or T-type matching network between the feed point and the RF front end to facilitate return-loss tuning.
3. The number and diameter of grounding vias shall meet RF return-current-path requirements; multiple grounding vias are recommended.
4. Antenna performance is strongly affected by the enclosure, metal components, battery, and human-body proximity. Final validation shall be conducted in the fully assembled product.
5. Before mass production, conduct first-article S11 and gain testing to confirm the effect of process variation on antenna performance.