

2.4G PCB On-Board Antenna Specification Sheet

Company: Shenzhen Patch Technology Co., Ltd.

Address: Room 706, Building A, Fukang Science and Technology Park,
Longhua New District, Shenzhen City

1. Product Overview

This product is a compact PCB on-board antenna specifically designed for 2.4GHz ISM band (2.4GHz-2.5GHz) wireless communication systems. Adopting a microstrip line structure integrated on the PCB substrate, it features small size, low cost, easy installation and good consistency. It is suitable for various 2.4GHz band wireless communication devices such as Wi-Fi (802.11b/g/n), Bluetooth, ZigBee, and Wireless Sensor Networks (WSN).

2. Core Electrical Performance Parameters

Parameter Name	Specification Range	Test Conditions
Operating Frequency Range	2.4GHz ~ 2.5GHz	Center frequency 2.45GHz
Center Frequency	2.45GHz ± 10MHz	-
Voltage Standing Wave Ratio (VSWR)	≤ 2.0:1	Full operating frequency band
Peak Gain	0.881~2.499dBi	Center frequency, free space
Average Gain	≥-4 dBi	Center frequency, free space
Radiation Efficiency	≥ 75%	2.45GHz
Polarization	Linear Polarization	-

	(Vertical Polarization)	
Impedance	50Ω (Standard Characteristic Impedance)	Matching design target
Input Power	Maximum 2W (Peak)	Continuous operation not exceeding 1W
Radiation Pattern	Omnidirectional Radiation	Half-power beamwidth ≥ 120° in Horizontal Plane (H-plane), ≥ 80° in Vertical Plane (E-plane)
Phase Stability	≤ ±5°	Full operating frequency band

3. Mechanical Structure Parameters

3.1 Antenna Dimensions

- Antenna Body Dimensions (Length × Width × Thickness): 15.1mm × 4.8mm × 1.0mm (Standard version, customizable)
- Feed Point Position: 2mm from the antenna edge, fed by 50Ω microstrip line
- Grounding Requirement: A complete ground plane (reference ground) of ≥ 10mm×10mm shall be reserved under the antenna

3.2 PCB Substrate Parameters

- Substrate Material: FR-4 (Standard) / Rogers 4350 (High-performance version)
- Substrate Thickness: 1.6mm (Regular), supporting 0.8mm/2.0mm customization
- Dielectric Constant (ϵ_r): 4.4±0.2 (FR-4, 1GHz)
- Loss Tangent ($\tan\delta$): ≤0.02 (FR-4, 1GHz)
- Copper Foil Thickness: 1oz (35μm), supporting 2oz customization

4. Environmental Adaptability Parameters

Environmental Index	Specification Requirement	Test Standard

Operating Temperature Range	-40℃ ~ +85℃	IEC 60068-2-1/2
Storage Temperature Range	-55℃ ~ +125℃	IEC 60068-2-1/2
Relative Humidity	10% ~ 95% (No condensation)	IEC 60068-2-30
Vibration Test	10Hz ~ 2000Hz, acceleration 2g, 30 minutes per axis	IEC 60068-2-6
Shock Test	Peak acceleration 15g, pulse width 11ms	IEC 60068-2-27
Salt Spray Test	5% NaCl solution, continuous 48 hours	IEC 60068-2-11

5. Test Conditions Description

5.1 Electrical Performance Test Conditions

- Test Environment: Temperature 25℃±2℃, relative humidity 50%±5%, air pressure 86kPa~106kPa
- Test Equipment: Vector Network Analyzer (VNA, frequency range 1GHz~6GHz), Anechoic Chamber, Standard Gain Horn Antenna, Power Meter
- Test Methods:
 - VSWR/Impedance: Directly measure the reflection coefficient at the feed port through VNA to calculate VSWR
 - Gain/Efficiency: Comparative method in anechoic chamber, measured by comparing with standard gain antenna
 - Radiation Pattern: Rotate the antenna in anechoic chamber to measure the radiation field strength distribution at different angles

5.2 Mechanical and Environmental Test Conditions

- Dimensional Measurement: Digital caliper with accuracy 0.01mm, microscope
- Environmental Test: Walk-in High/Low Temperature Humidity Chamber, Vibration Table, Shock Table, Salt Spray Test Chamber

6. Installation Requirements

1. The antenna shall be horizontally installed at the edge or unobstructed area of the device PCB board. Avoid metal components (such as housing, battery, connector) being $\leq 5\text{mm}$ away from the antenna body to prevent affecting radiation performance;
2. The ground plane shall be reliably connected to the main ground of the device without breakpoints or hollowing out to ensure impedance matching and radiation efficiency;
3. The feed microstrip line shall avoid sharp bends and via holes to reduce signal loss;
4. Installation Torque (if fixing parts are involved): $\leq 0.5\text{N}\cdot\text{m}$ to avoid damaging the PCB substrate.

7. Application Scenarios

Suitable for smart home devices (such as smart speakers, sensors), wireless keyboards and mice, Bluetooth headsets, Wi-Fi routers (auxiliary antennas), industrial wireless controllers, Internet of Things (IoT) terminals and other 2.4GHz band wireless communication products.

8. Notes

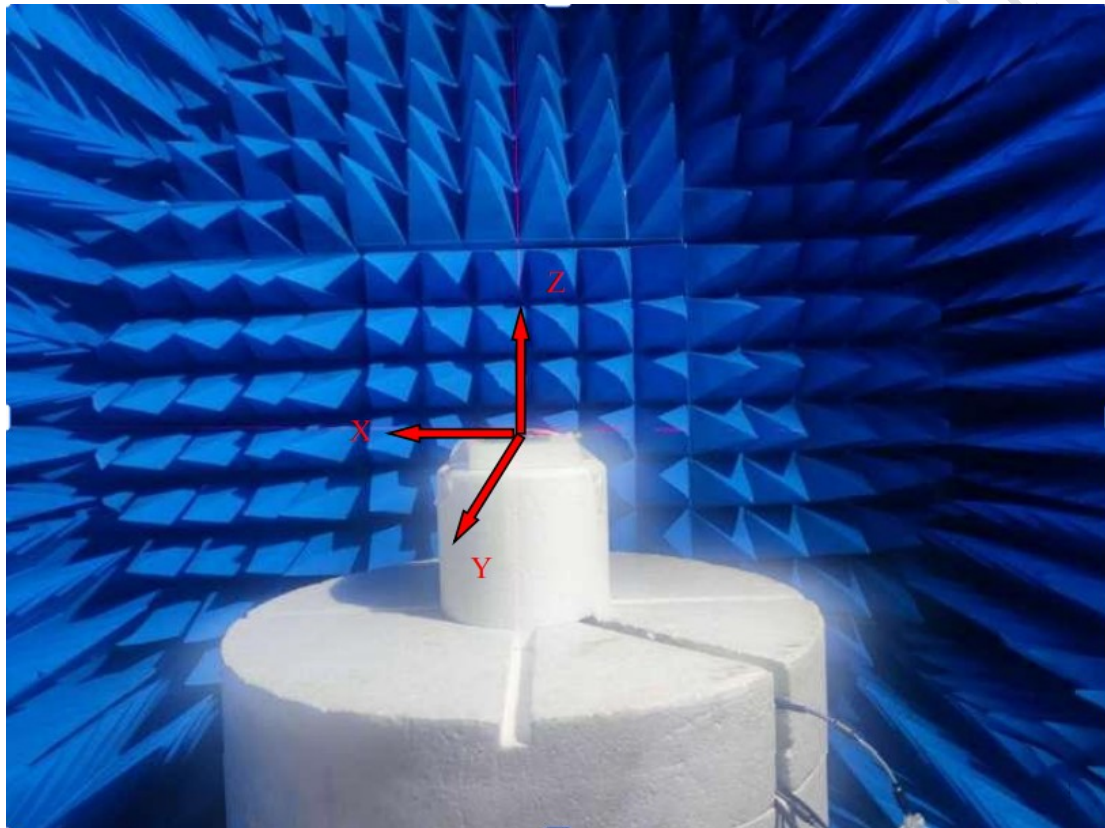
1. The parameters listed in this specification sheet are for standard products and can be customized according to customer requirements (such as size, gain, operating temperature);
2. In practical applications, the material of the device housing and internal layout will affect the antenna performance, so it is recommended to conduct complete machine matching tests;
3. During mass production, the consistency error of key parameters (such as VSWR, gain) shall be $\leq \pm 0.3\text{dBi}/\pm 0.2:1$.

9. Test Data

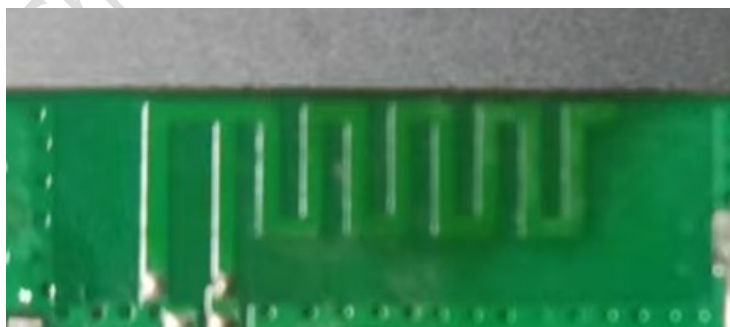
1. Test Data

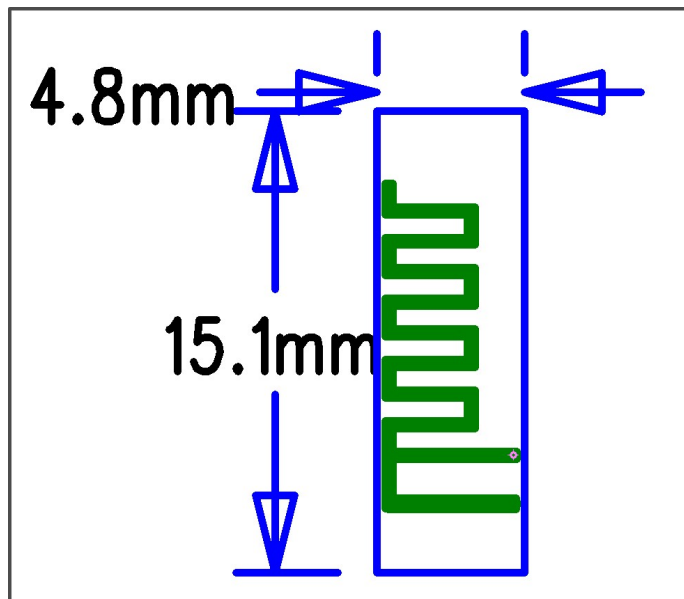
SPECIFICATIONS	
Frequency (MHz)	2400-2480
Peak Gain (dBi)	2.499
Average Gain (dBi)	> -4
VSWR	< 3.2
Impedance (Ω)	50 Ω
Antenna Type	Plannar Inverted F Antenna on board
Polarization	Linear

2.Test Environment



3.Antenna Size





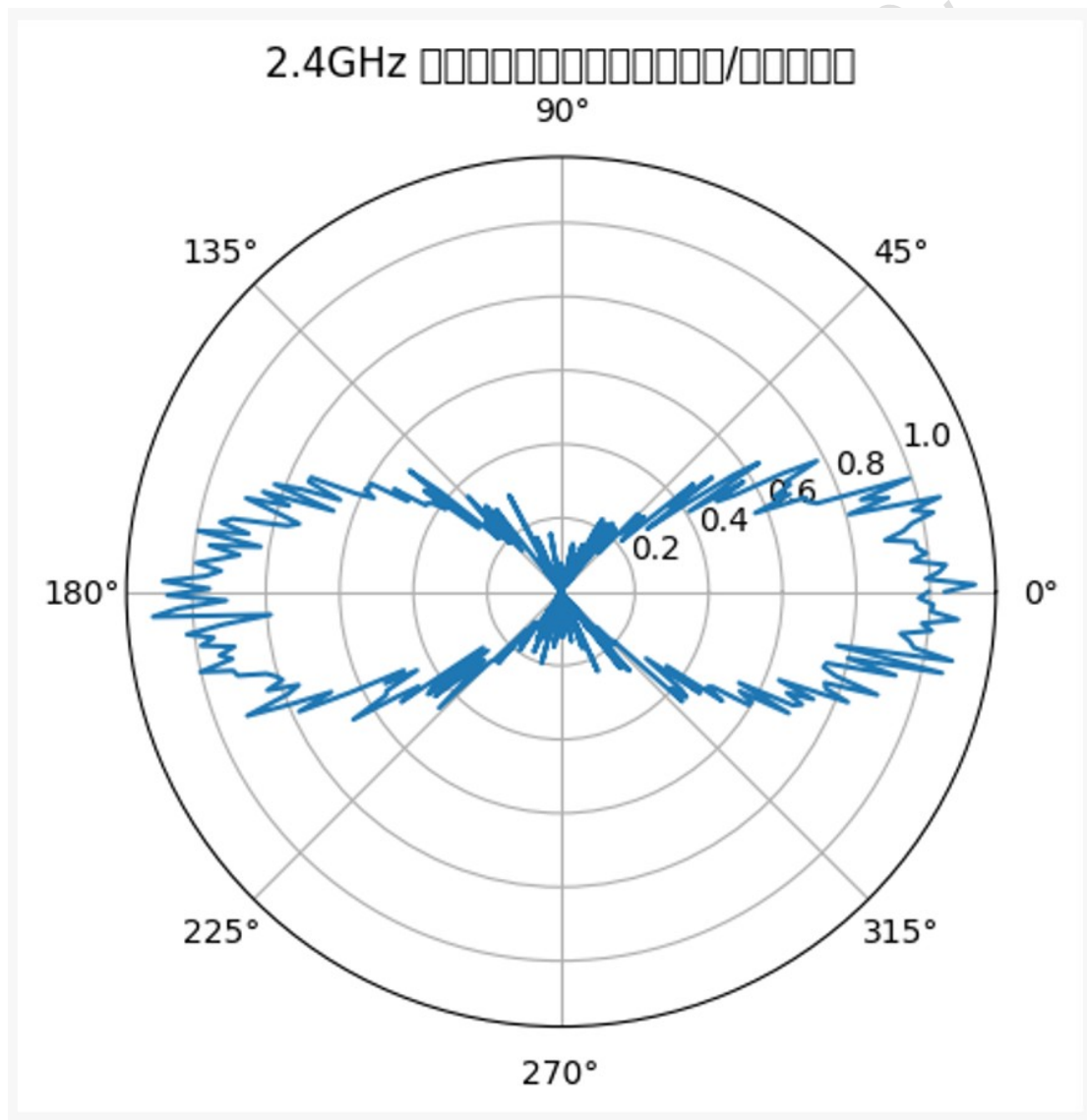
4. Antenna Passive S-parameters: Voltage Standing Wave Ratio (VSWR), Return Loss, and Smith Chart



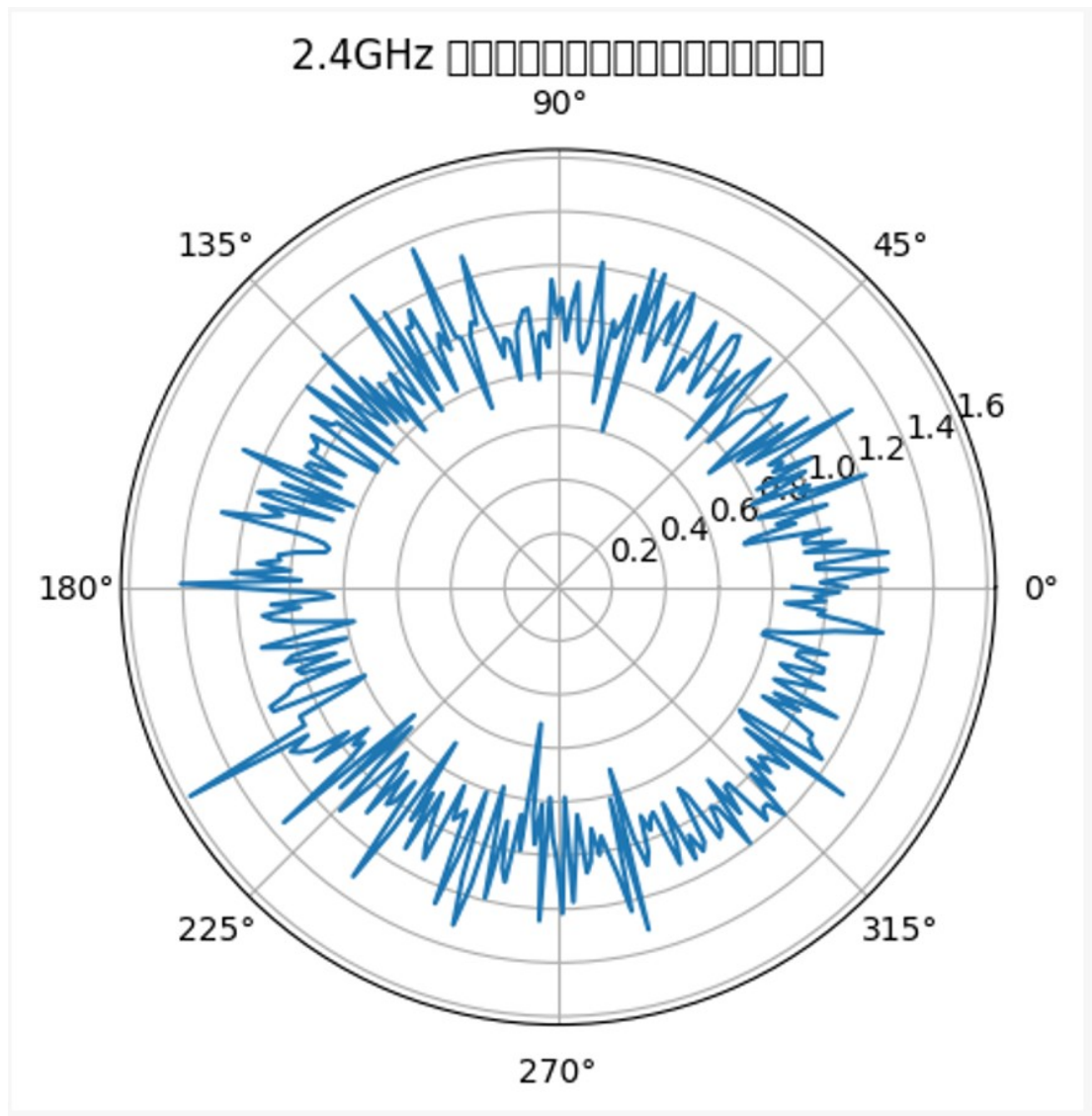
5. Antenna Efficiency and Gain

Frequency (MHz)	Gain (dBi)	Efficiency (%)	AverageGain (dBi)	Efficiency (dB)
2400	1.433	59.329%	-2.717	-2.267
2410	0.927	51.861%	-3.416	-2.852
2420	0.829	52.112%	-3.166	-2.831
2430	0.881	49.299%	-3.258	-3.072
2440	1.192	50.672%	-3.144	-2.952
2450	1.688	53.067%	-2.735	-2.752
2460	2.194	59.423%	-2.276	-2.260
2470	2.118	56.680%	-2.438	-2.466
2480	2.499	61.727%	-2.112	-2.095
Average	1.529	54.908%	-2.806	-2.616
Peak	2.499	61.727%	-2.112	-2.095

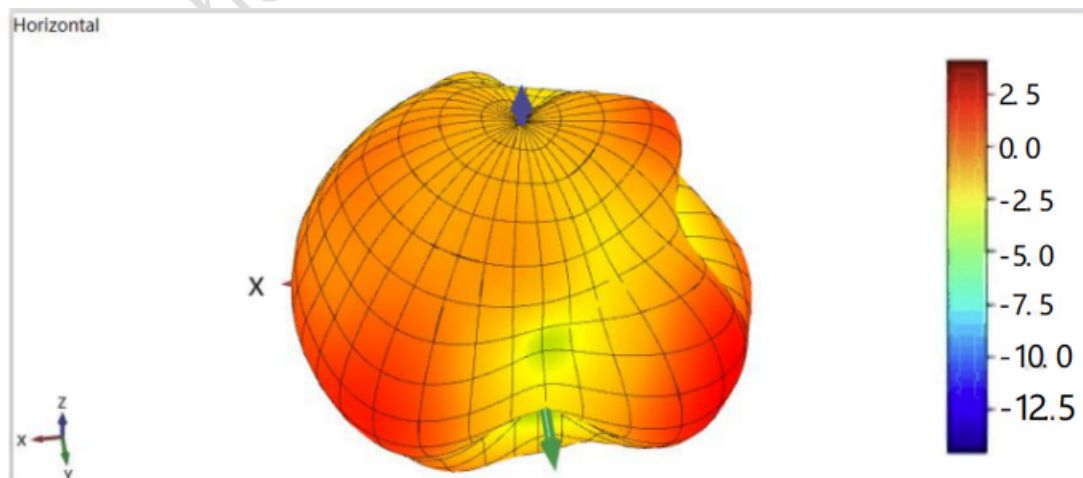
6.ANTENNA 2440MHZ 2D-THETA PATTERN



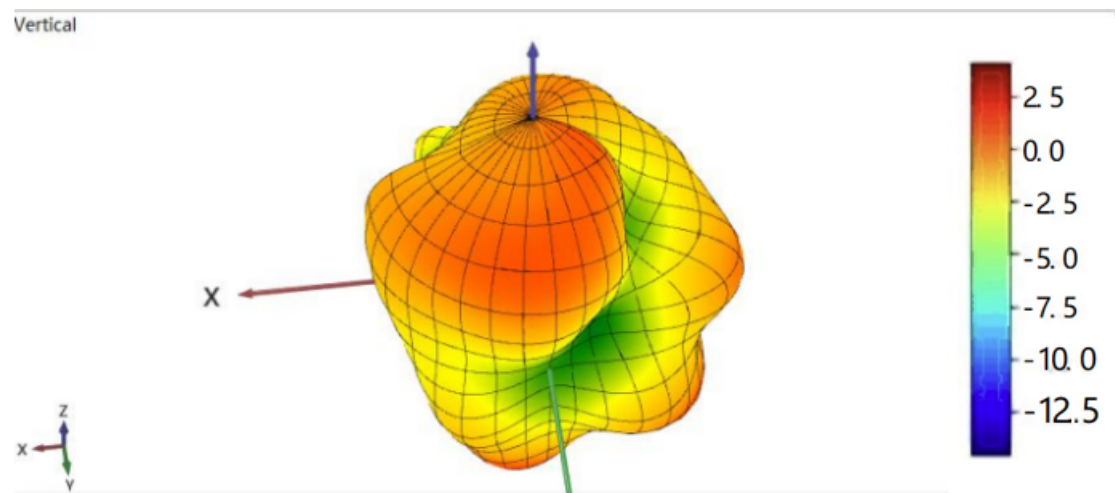
7.ANTENNA 2440MHZ 2D-PHI PATTERN



8. ANTENNA 2400MHZ 3D-HORIZONTAL PATTERN



9. ANTENNA 2440MHZ 3D-VERTICAL PATTERN



10. ANTENNA 2480MHZ 3D-TOTAL PATTERN

