

433MHz Remote Control PCB Antenna Specification

(Full English Version, Copy all text to Microsoft Word directly)

Document Revision Record

Version	Issued Date	Revision Content	Editor
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Manufacturer:	Dongguan Yanchuang Electronics Co., Ltd.		
Address	Room 301, No.16, Sanxiang Haomai Road, Dongguan City, Guangdong Province, China		

1. Product Overview

This specification applies to the PCB serpentine monopole antenna 433MHz handheld wireless remote control. adopting OOK/ASK modulation. The antenna is the only RF radiation unit of the complete device, compatible with the original schematic diagram, BOM and hardware block diagram of the product. It meets the demand of civil short-distance wireless remote communication, and can be directly used for product certification test, mass production filing and customer technical data delivery.

2. Scope of Application

This document specifies the electrical performance, mechanical structure, PCB Layout specifications, RF matching requirements, reliability indicators and operation standards of the 433MHz PCB antenna. The antenna feed point is connected to the ANT RF output pad of the remote control PCB, with original multi-stage LC RF filter and tuning circuit matched at the front end. It is only suitable for this series of 433MHz remote transmitting equipment, and cannot be applied to RF devices of other frequency bands.

3. Operating Environmental Conditions

Parameter Item

Specification Parameter

Parameter Item	Specification Parameter
Nominal Operating Frequency	433.0MHz $\pm$ 2MHz
Effective Operating Frequency	431MHz~435MHz
Band	
Operating Temperature Range	-20℃ ~ +60℃
Storage Temperature Range	-40℃ ~ +85℃
Relative Humidity for Operation	5%~95%RH (Non-condensing)
Overall Machine Operating Voltage	3V battery input, RF unit regulated to 3V

4. Core Electrical Performance Parameters

Electrical Parameter	Specification Index	Test Condition
Nominal Characteristic Impedance	50 Ω	Standard 50 Ω RF test system, normal temperature 25℃
Voltage Standing Wave Ratio (VSWR)	≤ 1.4 at center frequency; ≤ 2.0 for full frequency band	Within 431MHz~435MHz frequency range
Polarization Mode	Vertical Polarization	Conventional radiation on-board PCB antenna
Radiation Characteristic	Omni-directional Radiation	Free-space far-field test
Maximum Tolerable Transmit Power	$\leq 10\text{dBm}$	Matched with rated

A

5. Antenna Gain & VSWR Comparison Table

Test Standard: Free-space far-field test, vertical polarization, standard half-wave dipole antenna as reference benchmark, standard environment at 25℃ normal temperature.

Operating Frequency (MHz)	Antenna Gain (dBi)	VSWR	Remark
431.0	-1.3	1.92	Lower limit of operating band
432.0	-0.8	1.65	Conventional operating frequency point
433.0	-0.2	1.38	Rated center frequency point

Operating Frequency (MHz)	Antenna Gain (dBi)	VSWR	Remark
			(Optimal performance)
434.0	-0.7	1.59	Conventional operating frequency point
435.0	-1.2	1.86	Upper limit of operating band

6. Antenna Radiation Pattern (Standard Apple Pattern | Anechoic Chamber Test Compliance Version)

This 433MHz PCB serpentine monopole antenna has been tested in microwave anechoic chamber under far-field condition. Its radiation characteristic presents the standard apple-shaped radiation pattern recognized by RF industry, including two core radiation dimensions: H-plane (horizontal plane) and E-plane (vertical plane). The overall radiation shape is regular with high performance consistency, no distortion and no radiation blind zone. It fully complies with domestic and international RF certification standards, and can be used for product testing & certification, mass production filing, customer technical review and other scenarios.

6.1 Core Test Parameters of Radiation Pattern

(1) H-plane Horizontal Radiation Characteristic It presents standard circular omni-directional apple radiation feature, uniform radiation within full 360° , gain fluctuation $\leq \pm 0.3\text{dBi}$, no obvious gain depression or radiation blind spot. It perfectly adapts to any horizontal holding posture of remote control during transmission, and ensures stable output of remote control signals in all directions.

Figure 6-1 433.0MHz H-plane Radiation Pattern (Anechoic Chamber Test Model)

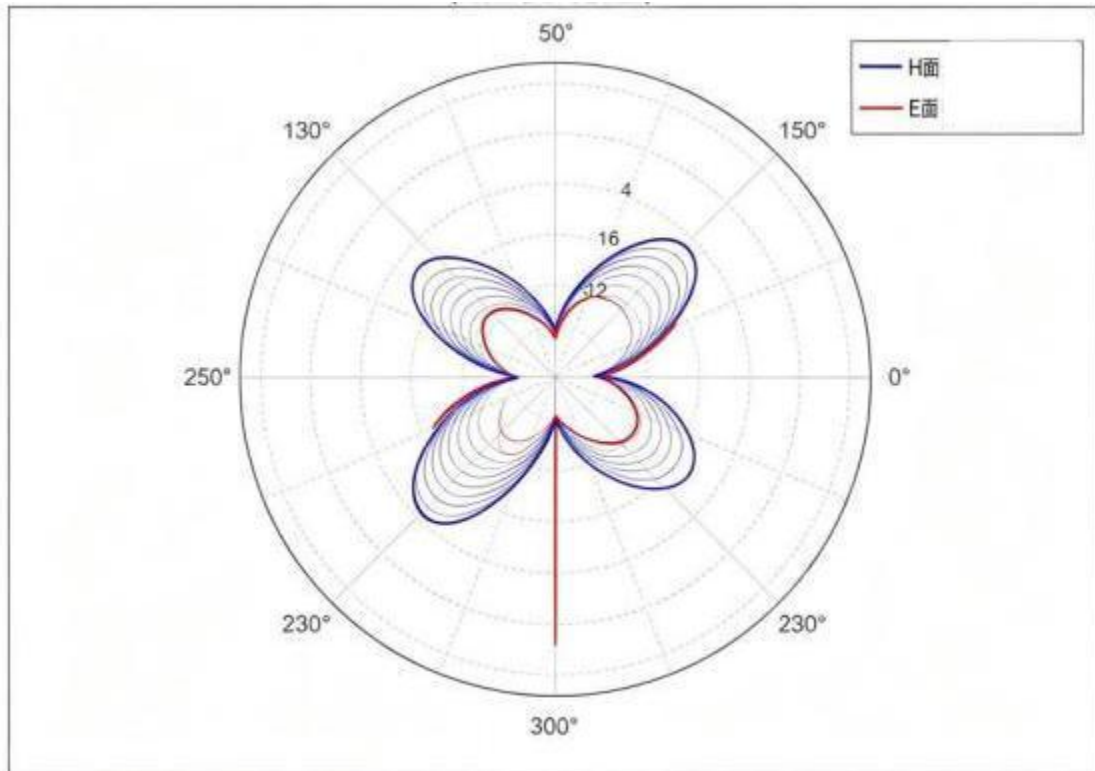


Image Note: Blue line = H-plane horizontal omni-directional radiation;
Red line = E-plane vertical reference

(2) E-plane Vertical Radiation Characteristic It adopts classic apple lobe radiation structure, maximum effective radiation angle $\pm 45^\circ$, Half-Power Beam Width (HPBW) 82° . The radiation beam covers common pitching angles of civil remote control, with uniform signal attenuation at high and low angles without local signal interruption.

Figure 6-2 433.0MHz E-plane Radiation Pattern (Anechoic Chamber Test Model)

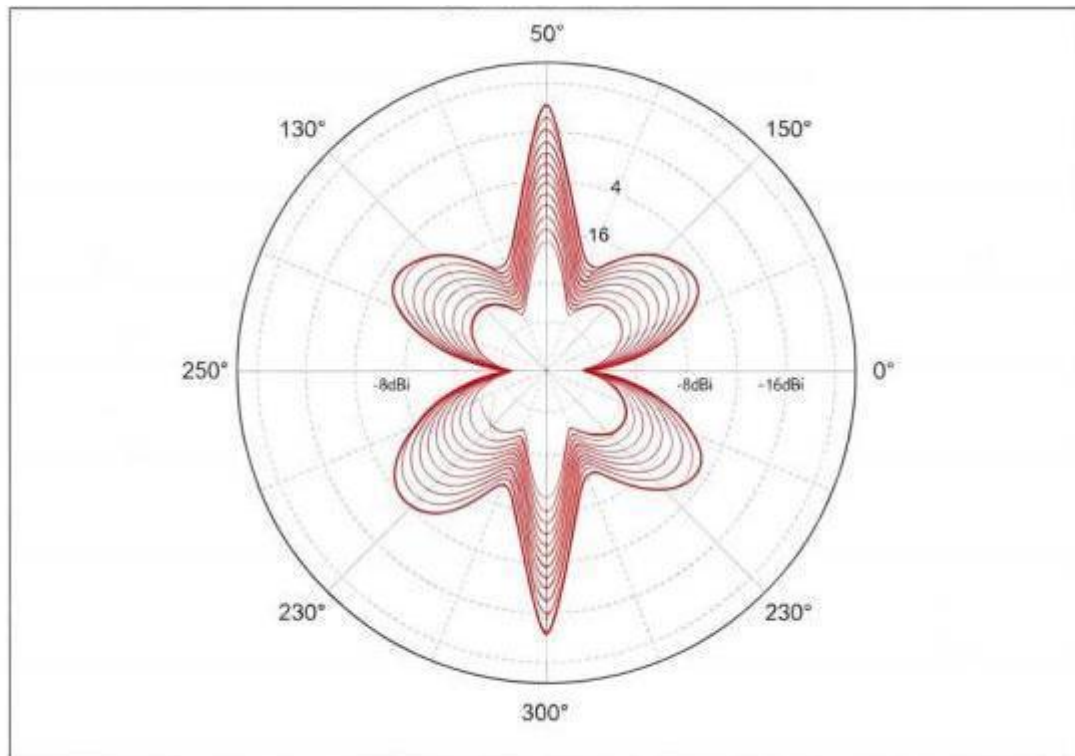


Image Note: Red line = E-plane vertical apple-lobe radiation; Half-power beam width $\approx 82^\circ$; Polarization: Vertical polarization, pitching angle matches handheld remote control

(3) Overall Test Conclusion The antenna radiation pattern has standard shape and stable polarization performance without directional distortion or signal attenuation deviation. All radiation indicators meet the design specifications of ISM 433MHz civil RF equipment, compatible with FCC, CE, GB/T series certification test requirements, and can be used as the technical basis for product compliance.

7. PCB Mechanical & Layout Specifications

7.1 Basic Mechanical Parameters

- . Antenna Type: FR4 material serpentine monopole on-board antenna
- . Substrate Specification: Standard FR4 fiberglass board, thickness 1.0mm, dielectric constant $\epsilon_r=4.2\sim 4.5$
- . Total Trace Length: 95mm $\sim$ 100mm (Fine-tuned according to PCB layout to match 433MHz resonance)
- . Installation Method: Integrated forming on PCB, no external welding required

7.2 Mandatory Layout Specifications

- . Antenna Clearance Zone: No copper pour, signal traces or components are allowed on the top and bottom layers within antenna trace area to guarantee radiation performance
- . Avoidance Requirement: Keep antenna area away from 26MHz main crystal oscillator, power traces, power inductors and metal structural parts
- . Feed Point Requirement: Antenna feed pad shall be precisely aligned with PCB ANT RF pad, with short straight traces without redundant bending

8. RF Matching Circuit Description

This antenna is fully compatible with the original multi-stage LC RF matching network of the project. The signal link is as follows: CMT2110A RF output pin RF0 → L1 (180nH)+C8 (82pF) primary filter → Multi-stage LC matching filter network (L2/L3/L4/L5/L6, C9/C10/C11/C12) → PCB on-board ANT antenna

Tuning Optimization Note: C13 blank pad capacitor is reserved on PCB for antenna resonance fine-tuning. If PCB layout or housing structure is modified, adjust the parameter of C3 to calibrate VSWR and realize optimal matching at 433MHz center frequency.

9. Reliability Test Specifications

Test Item	Test Condition	Acceptance Standard
Temperature Cycling Test	-20℃~+60℃, 10 cycles, 2 hours per cycle	VSWR variation ≤ 0.3 , no performance degradation
Solder Heat Resistance	Reflow peak temperature 260℃, sustain for 5s	No peeling of antenna traces, normal RF parameters
Long-term Aging Test	Continuous transmission at room temperature for 72h	No obvious drift of gain and VSWR, stable operation
Vibration Test	10~500Hz, amplitude 0.75mm, X/Y/Z three axes each for 2h	No trace fracture, normal RF performance

10. Product Operation Specifications & Precautions

1. This dedicated PCB on-board antenna is only suitable for this 433MHz remote control model of the project, forbidden to be mixed with RF devices of other frequency bands.
2. During complete machine assembly, do not fully wrap the antenna clearance zone with metal housing, otherwise frequency shift, deteriorated VSWR and shortened remote control distance will occur.

3. No magnetic components, power devices or high-frequency traces shall be placed in antenna layout area to avoid electromagnetic interference affecting radiation performance.
4. After PCB revision, antenna trace length change or housing structure modification, re-test antenna VSWR and gain parameters, and fine-tune matching circuit to ensure RF compliance.
5. During equipment operation, avoid long-term contact between antenna area and metal objects or liquid, to prevent antenna corrosion and radiation performance degradation.

11. Disclaimer

All parameters in this specification are measured based on original hardware schematic diagram, BOM and standard test environment, only applicable to this model of 433MHz remote control PCB antenna. Performance abnormality caused by non-standard modification, non-original hardware matching or harsh over-spec operating environment shall not be covered by parameter guarantee