

PCB Printed 125kHz Antenna Specification

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Product Name	PCB Printed 125kHz Antenna	Date	2025-05-25
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1. Overview

This specification defines the electrical, mechanical requirements for a PCB-printed 125kHz inductive antenna. The antenna is implemented as a rectangular spiral coil on a 6-layer FR-4 PCB, utilizing inner layer 1, 2, 3, 4 and bottom layer to achieve the required inductance for RFID low-frequency identification applications.

2. Antenna Structure & Dimensions

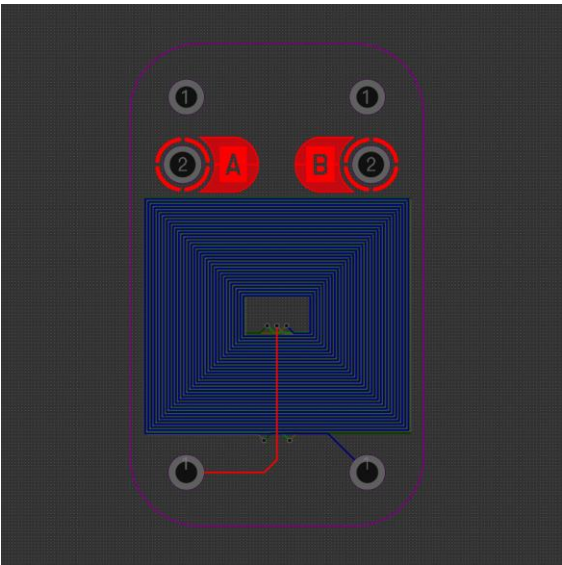


Figure 1. Antenna Design Drawing

2.1 Structural Parameters

Parameter	Value	Unit
Antenna Type	Rectangular Spiral	---
Overall Width	21.8	mm
Overall Height	19.38	mm
Trace Width	0.127	mm

Trace Spacing	0.127	mm
Feed Point	Bottom Center	---

2.2 PCB Stack-up Parameters

Parameter	Value	Unit
PCB Layers	6	---
Board Thickness	1.0	mm
Antenna Layers	Inner 1-4 + Bottom	---
Top Layer Usage	Unused (Reserved)	---
Copper Thickness (Outer)	1	oz
Copper Thickness (Inner)	0.5	oz

3. Electrical Performance

The following electrical characteristics are based on design calculation and measurement data. The inner layers 1-4 and bottom layer are connected in series to achieve the required inductance of 308 μH for 125kHz RFID applications.

Parameter	Typical	Tolerance	Conditions
Operating Frequency	125	± 2 kHz	Resonant
Inductance (L)	308	$\pm 5\%$	@ 125kHz
Quality Factor (Q)	≥ 20	---	With resonant cap
DC Resistance (DCR)	< 10	$< 15 \Omega$	@ 25°C
Resonant Capacitance	~ 330	---	Typical match to L

4. Material Specification

Item	Specification	Remark
Substrate Material	FR-4	Standard Tg 130-140°C
Dielectric Constant (ϵ_r)	4.3 -- 4.7	@ 1 MHz
Loss Tangent ($\tan \delta$)	≤ 0.025	@ 1 MHz
Copper Foil	Electro-deposited (ED)	---
Surface Finish	ENIG or HASL	For soldering pads
Solder Mask	Green (standard)	---

5. Connectors and Interface

The antenna PCB includes the following connection points:

Ref	Type	Function	Description
1	Mounting Pad	Mechanical	Mechanical mounting / Ground
2	Connection Pad	Antenna Terminal	A/B antenna connection points
A, B	Test Point	Test/Debug	Antenna performance test interface

6. Application Notes

Integration Recommendations:

1. A matching network is required between the antenna feed points and the RFID transceiver IC. The antenna is designed for 125kHz operation with 308 μ H inductance.

2. For resonance at 125kHz with $L = 308 \mu\text{H}$, the required resonant capacitance is approximately 330 pF. Account for PCB parasitic capacitance when selecting external matching capacitors.

3. Keep the antenna area free from large copper planes, metal shields, or ferrite plates on the opposite side to avoid Q-factor degradation and frequency shift.

4. If metal backing is unavoidable, place a ferrite sheet ($\mu' \geq 100$, thickness $\geq 0.3 \text{ mm}$) between the PCB and the metal surface.

5. The top layer is not used for antenna routing and can be used for other circuitry or left as a ground plane for shielding purposes.

7. Revision History

Version	Date	Description	Author
V1.0	2025-05-25	Initial release	小鱼造物 / Xiao Yu Creation

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