

125 kHz LOOP COIL ANTENNA

SPECIFICATION

LF RFID Reader Antenna

Model: LAC4955-122K

Peak Gain: 0 dBi

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CONFIDENTIAL

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1. General Description

The LAC4955-122K is a 125 kHz loop coil antenna designed for Low Frequency (LF) RFID reader applications, including access control, animal identification, and proximity card systems. The antenna utilizes a multi-turn copper winding on a ferrite core to achieve efficient near-field magnetic coupling with transponder tags.

Key Features:

- Operating frequency: 125 kHz (LF RFID band)
- Peak gain: 0 dBi, omnidirectional H-plane pattern
- Typical read range: up to 10 cm (depending on tag type)
- High Q factor (~40) for efficient resonance
- Ferrite-loaded design for compact size
- Compatible with ISO 11784/11785, ISO 14223, EM4100, HID Prox

2. Electrical Specifications

2.1 General Parameters (T=25°C)

Parameter	Specification
Frequency Range	124 – 126 kHz (tuned to 125 kHz)
Center Frequency	125.0 kHz
Bandwidth (-3 dB)	≈ 3.1 kHz (Q ≈ 40)
Peak Gain	0 dBi (typical)
Average Gain	-2.0 dBi (typical)
Efficiency	≥ 40%
VSWR	≤ 2.0 (at resonance)
Return Loss	≤ -10 dB (at resonance)
Impedance	50 Ω (nominal, at resonance)
Inductance	680 μH ± 5%
DC Resistance	≤ 3.5 Ω
Quality Factor (Q)	35 – 45 (unloaded)
Polarization	Magnetic (H-field dominant)
H-Plane Beamwidth	360° (near omnidirectional)
E-Plane Beamwidth	~90° (typical)
Typical Read Range	Up to 10 cm (ISO 11784 tag)
Max Input Power	5 W (CW)

Parameter	Specification
Operating Temperature	-40°C to +85°C

2.2 Resonant Tuning Parameters

Parameter	Specification
Resonant Capacitor	2.35 nF (external, recommended)
Tuning Tolerance	± 0.5 kHz (adjustable via trimmer)
Parallel Resistor (damping)	5 – 10 kΩ (optional, for Q adjustment)

3. Mechanical Specifications

Parameter	Specification
Antenna Type	Ferrite-loaded multi-turn loop coil
Overall Dimensions	45 x 10 x 5 mm (L x W x H)
Coil Form	Rectangular ferrite rod core
Wire Gauge	0.12 mm (AWG 36) enameled copper
Number of Turns	~150 turns (typical)
Ferrite Material	Mn-Zn ferrite ($\mu_i \approx 2000$)
Termination	2-pin PCB through-hole (2.54 mm pitch)
Weight	~3.5 g
Encapsulation	Epoxy resin (optional)

4. Return Loss / VSWR

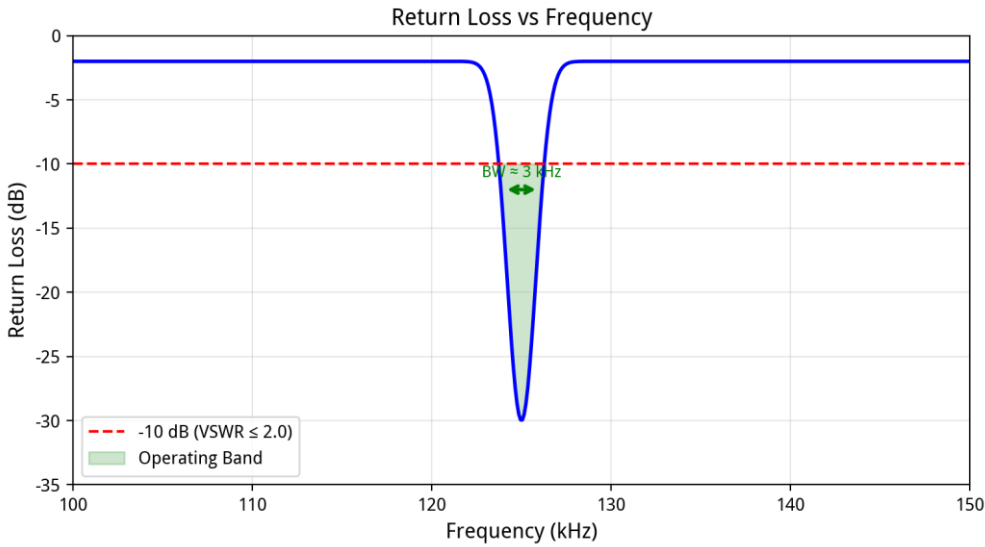


Figure 4: Return Loss vs Frequency

Parameter	Specification
Return Loss (at 125 kHz)	≤ -20 dB (typical, at resonance)
Bandwidth (S11 ≤ -10 dB)	≥ 3 kHz (123.5 – 126.5 kHz)
VSWR (at resonance)	≤ 1.5:1

5. Near-Field Characteristics

At 125 kHz ($\lambda \approx 2,400$ m), the antenna operates entirely in the near-field regime for any practical read distance. The magnetic field strength decays with the inverse cube of distance ($1/r^3$) in the reactive near field.

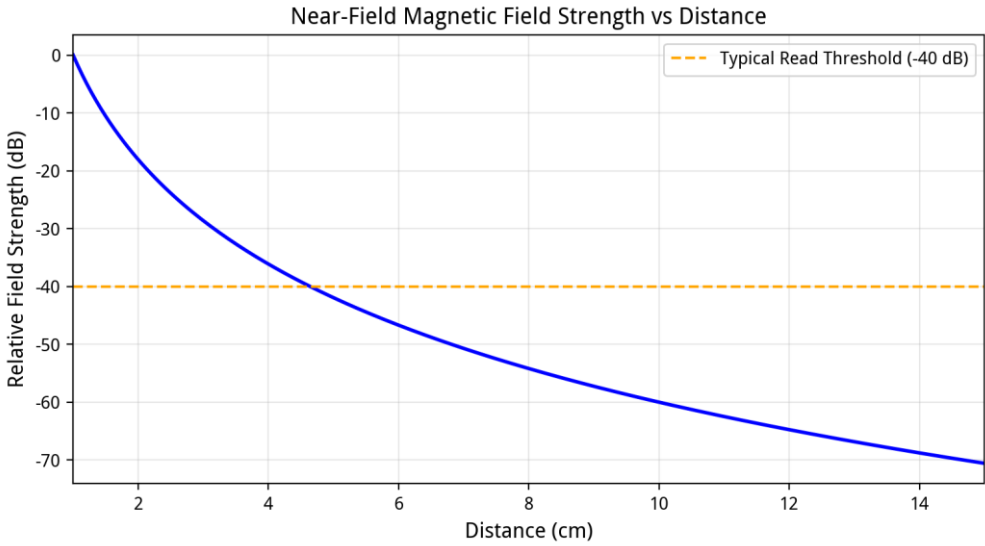


Figure 5: Relative Magnetic Field Strength vs Distance

Parameter	Specification
Field Decay	$1/r^3$ (reactive near-field)
Typical Read Range	0 – 10 cm (ISO 11784 tag)

Parameter	Specification
Max Read Range	Up to 15 cm (high-sensitivity tag)
Magnetic Field at 5 cm	1.5 A/m (typical, 1W input)

6. PCB Layout Guidelines

- Place the antenna away from metal surfaces (minimum 10 mm clearance) to avoid detuning
- Use short, direct traces from the reader IC to the antenna terminals
- Tuning capacitor should be placed as close to the antenna as possible
- Avoid routing high-speed digital traces near the antenna
- Ground plane beneath the antenna is acceptable but maintain clearance from the coil itself
- Use a trimmer capacitor (2–10 pF) in parallel for fine-tuning if needed
- For multiple antennas, maintain spacing > 2× the largest dimension to avoid mutual coupling

7. Environmental & Reliability

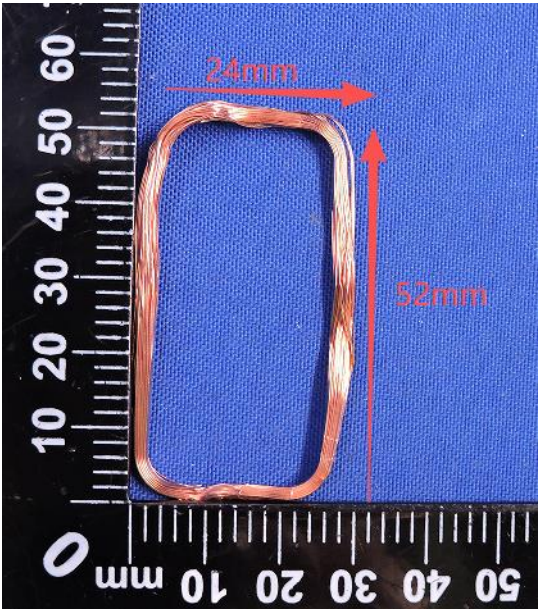
Test Item	Requirement
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +125°C
Humidity	5% – 95% RH (non-condensing)
Thermal Shock	-40°C / +85°C, 100 cycles, IEC 60068-2-14
Solder Heat Resistance	260°C × 10s, IEC 60068-2-20
Vibration	10–500 Hz, 0.75mm/0.5g, 2h/axis, IEC 60068-2-6
Drop Test	1.0 m free fall, 3 times, IEC 60068-2-31
Magnetic Immunity	No permanent shift after 10 A/m DC field exposure
RoHS Compliance	Compliant (lead-free)

8. Packaging Information

Parameter	Specification
Package Type	Tray (anti-static foam)
Quantity per Tray	50 pcs
Trays per Carton	20 trays (1,000 pcs total)
Carton Dimensions	400 x 300 x 200 mm
Gross Weight per Carton	~4.5 kg
Moisture Sensitivity Level	MSL 1 (unlimited floor life)

9. Applicable Standards

Standard	Description
ISO 11784/11785	RFID for animal identification
ISO 14223	Advanced transponders (LF RFID)
ISO/IEC 18000-2	LF RFID air interface (125–134 kHz)
EM4100 / EM4200	Common LF tag protocols
HID Prox	Proximity access control protocol
IEC 60068-2	Environmental testing



Dimensins Description	
L	52MM
W	24MM