

1. Overview



The RAK2701C05D is a high-performance PCB chip antenna specifically engineered for LoRa wireless communication systems, optimized for the globally popular 868 MHz (EU band) and 915 MHz (NA band) frequency ranges. Constructed with high-quality FR4 PCB material, this antenna delivers exceptional signal reliability, compact form factor, and seamless compatibility with LoRa protocol requirements.

Designed for effortless integration into IoT devices, it meets the rigorous demands of low-power wide-area network (LPWAN) applications while ensuring simplified manufacturing processes and long-term operational stability. Its dedicated LoRa optimization, combined with PCB-based design, makes it a cost-effective and reliable solution for global IoT deployments.

2. Key Features

- Dedicated design optimized for LoRa 868 MHz & 915 MHz frequency bands
- High-performance FR4 PCB construction for balanced electrical properties and cost-effectiveness
- Compact Surface Mount Device (SMD) package enabling integration into space-constrained IoT products
- Omnidirectional radiation pattern for consistent signal coverage across

LPWAN deployments

- Linear polarization ensuring compatibility with standard LoRa transceivers
- RoHS/RoHS II compliant, adhering to global environmental standards
- Supports both hand soldering and automated reflow assembly processes
- Wide operating temperature range (-40 °C to +85 °C) for industrial and consumer IoT environments

3. Electrical Specifications

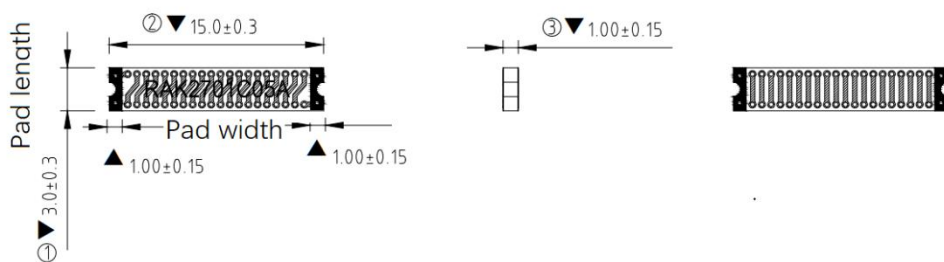
Parameter	Specification
Operating Frequency Range	868 MHz (±10 MHz) & 915 MHz (±10 MHz)
Center Frequencies	868 MHz & 915 MHz
Bandwidth	≥ 20 MHz per band
Average Efficiency	> 60% (868 MHz); > 60% (915 MHz)
Peak Gain	1 dBi (typical for both bands)
Return Loss	< -10.0 dB
VSWR (Voltage Standing Wave Ratio)	≤ 2.0:1
Characteristic Impedance	50 Ω (unbalanced)

Parameter	Specification
Polarization	Linear
Power Handling	3 W (Max.)
Feed Point Configuration	Single-ended feed
Radiation Pattern	Omnidirectional
Wavelength	1/4-wave

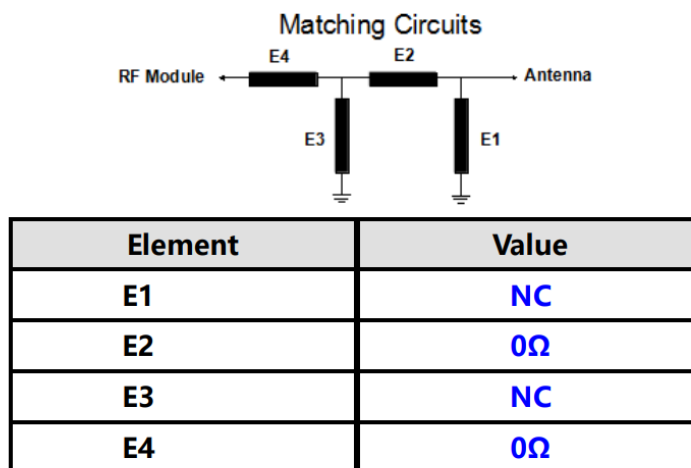
4. Mechanical Specifications

Parameter	Dimension (mm)	Tolerance
Length (L)	15.0	± 0.3
Width (W)	3.0	± 0.15
Height (H)	1.00	± 0.15
Pad Width	1.00	± 0.15
Pad Length	3.00	± 0.15
Weight (approx.)	0.03 g	-
Mounting Type	Surface Mount Technology (SMT)	-

Parameter	Dimension (mm)	Tolerance
Package Type	PCB chip antenna (SMD)	-
Substrate Material	FR4 (PCB)	-

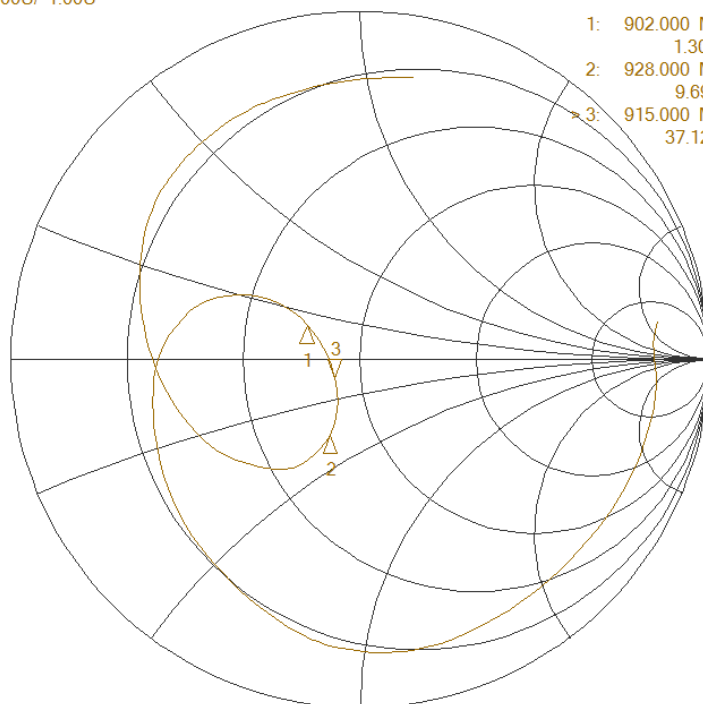


5 . Reserved matching circuit



The matching circuit shall be tuned in real time according to the shape and size of the PCB motherboard. The matching circuit varies with the different shapes and sizes of the PCB motherboard. As shown in the figure, the test data and matching circuit are based on a PCB motherboard with a length of 100 mm and a width of 50 mm.

Tr 1 S11 Smith 1.000U/ 1.00U

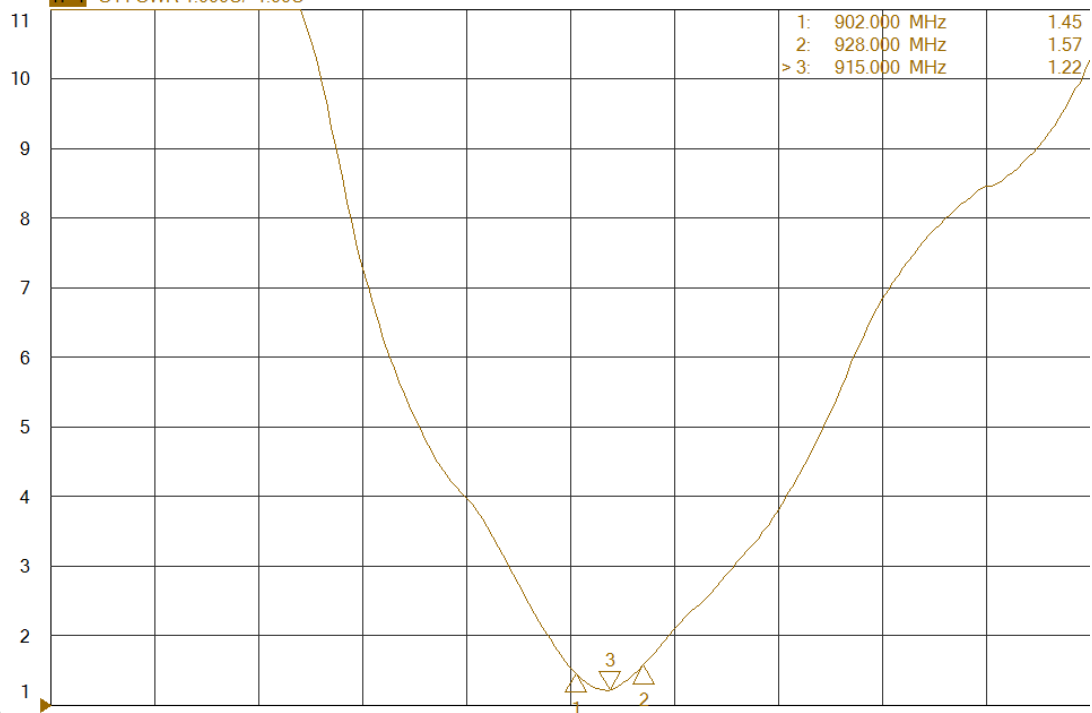


1:	902.000 MHz	36.28 Ω
	1.30 nH	7.39 Ω
2:	928.000 MHz	38.68 Ω
	9.69 pF	-17.71 Ω
> 3:	915.000 MHz	43.15 Ω
	37.12 pF	-4.69 Ω

>Ch1: Start 700.000 MHz —

Stop 1.10000 GHz

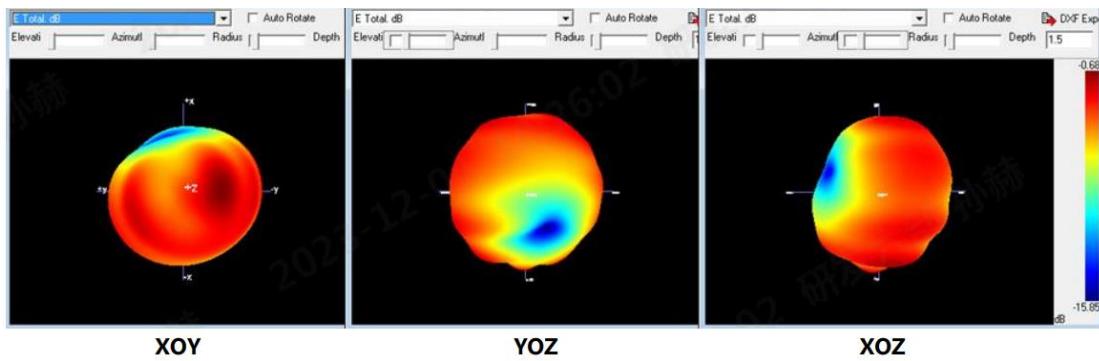
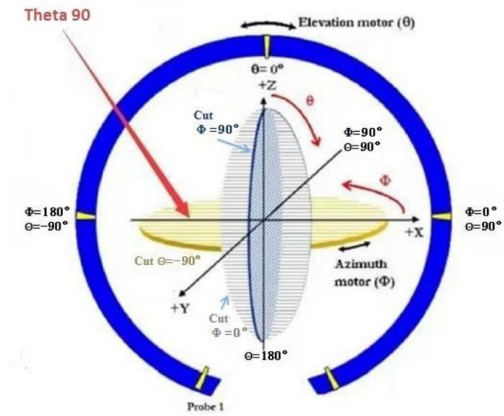
Tr 1 S11 SWR 1.000U/ 1.00U



1:	902.000 MHz	1.45
2:	928.000 MHz	1.57
> 3:	915.000 MHz	1.22

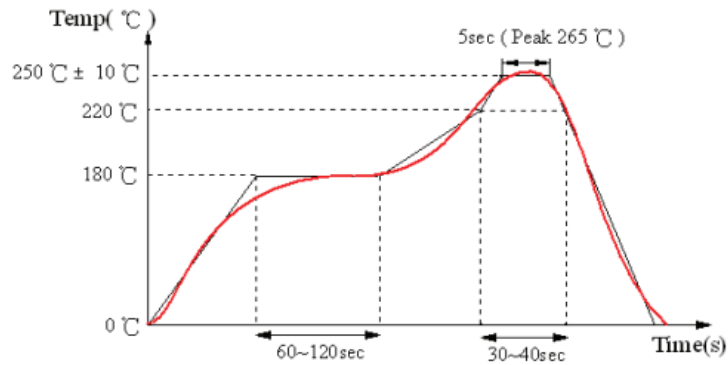
>Ch1: Start 700.000 MHz —

Stop 1.10000 GHz



6. Environmental Specifications

Parameter	Specification
Operating Temperature Range	-40 °C to +85 °C
Storage Temperature Range	-40 °C to +125 °C
Reflow Soldering Peak Temperature	265 °C



7. Antenna Footprint & PCB Layout Guidelines

7.1 Footprint Dimensions

Measure	Dimension (mm)	Tolerance
Pad Length	3.00	± 0.15
Pad Width	1.00	± 0.15
Clearance Area (Under Antenna)	No components, traces, or ground planes (Recommendation: 40 mm × 15 mm)	-

7.2 Layout Recommendations

1. Maintain a clear keep-out area directly beneath the antenna (no traces, vias, or components) to avoid signal interference and detuning.
2. The 50 Ω microstrip feed line from the LoRa transceiver to the antenna should be kept as short as practical (preferred length < 1/8 inch) to minimize signal loss.
3. For standard 1.57mm thick FR-4 PCB material, the microstrip trace width should be 2.87mm to ensure optimal impedance matching.
4. The ground plane counterpoise acts as an integral part of the antenna system; ensure it is properly sized to optimize resonance and stability across both 868 MHz and 915 MHz bands.

5. Avoid placing metal enclosures or conductive materials within 5 mm of the antenna to prevent performance degradation.
6. Vias (diameter 0.2 mm recommended) should be covered by solder mask and excluded from transmission line areas.
7. After layout completion, verify performance with a network analyzer to ensure $VSWR \leq 2.0:1$ across target bands.

8. Applications

Ideal for a wide range of LoRa-based IoT applications, including:

- Asset Tracking & Logistics (global deployments supporting 868/915 MHz bands)
- Smart Metering (water, gas, electricity)
- Industrial IoT Sensors (environmental monitoring, equipment status)
- Smart Home & Building Automation
- Wearable Devices (location trackers, health monitors)
- Agricultural Monitoring Systems
- M2M (Machine-to-Machine) Communication
- Low-Power Wide-Area Network (LPWAN) End Nodes
- Environmental Sensing (air quality, humidity, temperature)

9. Ordering Information

Part Number	Description	Packaging Options
RAK2701C05D	868 MHz & 915 MHz LoRa PCB Chip Antenna	4,000 pcs/reel; Bulk packaging available