## EBYTE EoRa-S3-900TB

# User Manual: EoRa-S3-900TB Test Board

ESP32-S3 SoC LoRa WiFi Bluetooth Test Board

## 1. Introduction

The EoRa-S3-900TB is a versatile development board designed by EBYTE, integrating the powerful ESP32-S3FH4R2 chip with a LoRa module. This board is engineered for a wide range of applications requiring Wi-Fi, Bluetooth LE, and LoRa wireless communication capabilities. It features a compact design with essential peripherals for rapid prototyping and testing.

The ESP32-S3 is a low-power MCU system-on-chip (SoC) that supports 2.4 GHz Wi-Fi and Bluetooth LE wireless communication. The chip integrates a high-performance 32-bit LX7 dual-core processor, an ultra-low-power co-processor, Wi-Fi baseband, Bluetooth baseband, RF module, and peripherals up to 240 MHz. The ESP32-S3FH4R2 package includes 384 KB of ROM, 512 KB of SRAM, 16 KB of RTC SRAM, 4 MB of FLASH, and 2 MB of PSRAM.

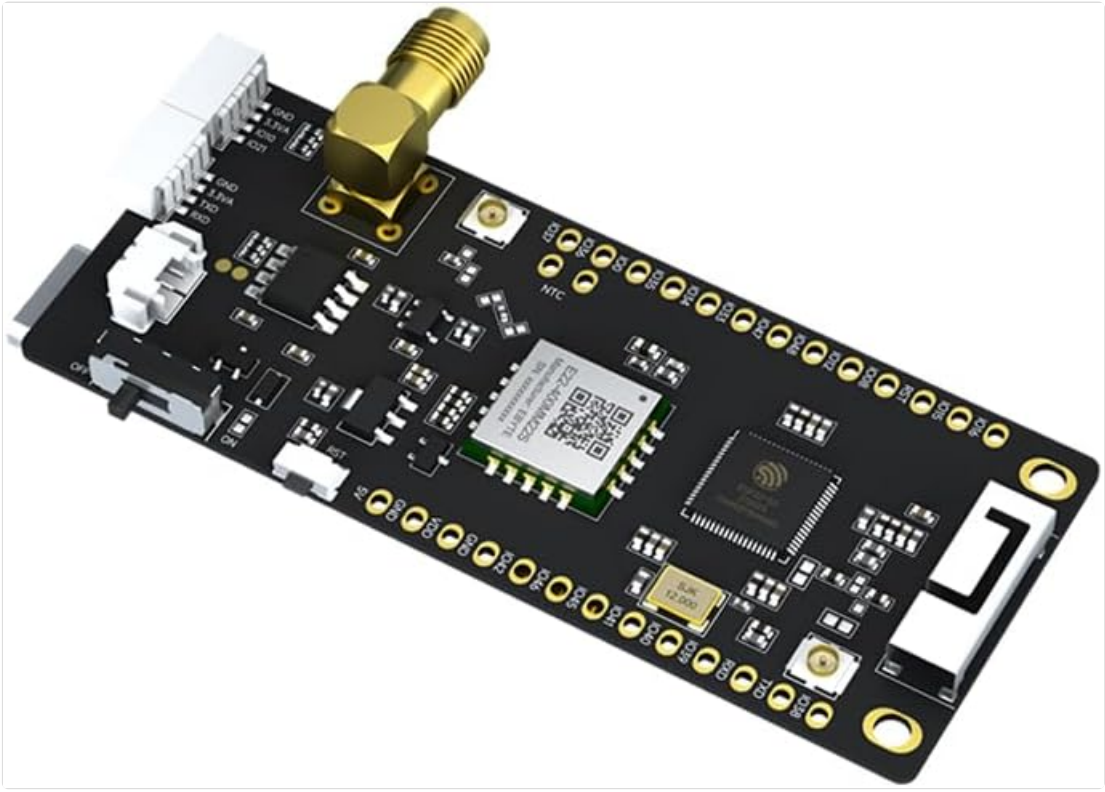


Image: Angled view of the EoRa-S3-900TB Test Board, showcasing its compact form factor and various components.

## 2. Key Features

- **Processor:** 32-bit LX7 dual-core processor, up to 240 MHz.
- **Memory:** Integrated 4 MB FLASH and 2 MB PSRAM.
- **Wireless Connectivity:** Supports 2.4 GHz Wi-Fi (IEEE 802.11b/g/n) and Bluetooth LE (Bluetooth 5, Bluetooth mesh).
- **LoRa Module:** E22-900MM22S with SX1262 chip, supporting 850 ~ 930 MHz operating frequency and +22 dBm max output power.
- **Display:** Integrated 0.96-inch OLED display.
- **Storage:** SD card slot for expanded storage.
- **Power Management:** Li-ion battery charging circuit with a rated charging current of 500mA.
- **Interface:** Type-C interface with USB 2.0 protocol for power and data.
- **Antenna:** Common antenna for Wi-Fi and Bluetooth.

## 3. Technical Specifications

| Specification | Value |
|---|---|
| Model Name | EoRa-S3-900TB |
| Brand | EBYTE |
| CPU Speed | 240 MHz |
| Memory Storage Capacity | 6 MB (4MB FLASH + 2MB PSRAM) |
| Connectivity Technology | Bluetooth, Wi-Fi |
| Wi-Fi Protocols | IEEE 802.11b/g/n (20 MHz and 40 MHz bandwidths) |
| Wi-Fi Data Rates | Up to 150 Mbps (1T1R mode) |
| Bluetooth LE Rates | 125 Kbps, 500 Kbps, 1 Mbps, 2 Mbps |
| LoRa Frequency | 850 ~ 930 MHz |
| LoRa Max Output Power | +22 dBm |
| OLED Display Size | 0.96 inches |
| Battery Charging Current | 500mA (rated) |
| Interface | Type-C (USB 2.0) |

## 4. Package Contents

The EoRa-S3-900TB package typically includes the following components:

- EoRa-S3-900TB Development Board (with integrated Type-C interface, E22-900MM22S LoRa module, 0.96-inch OLED display, SD card slot, Li-ion battery charging circuit, and power circuit)

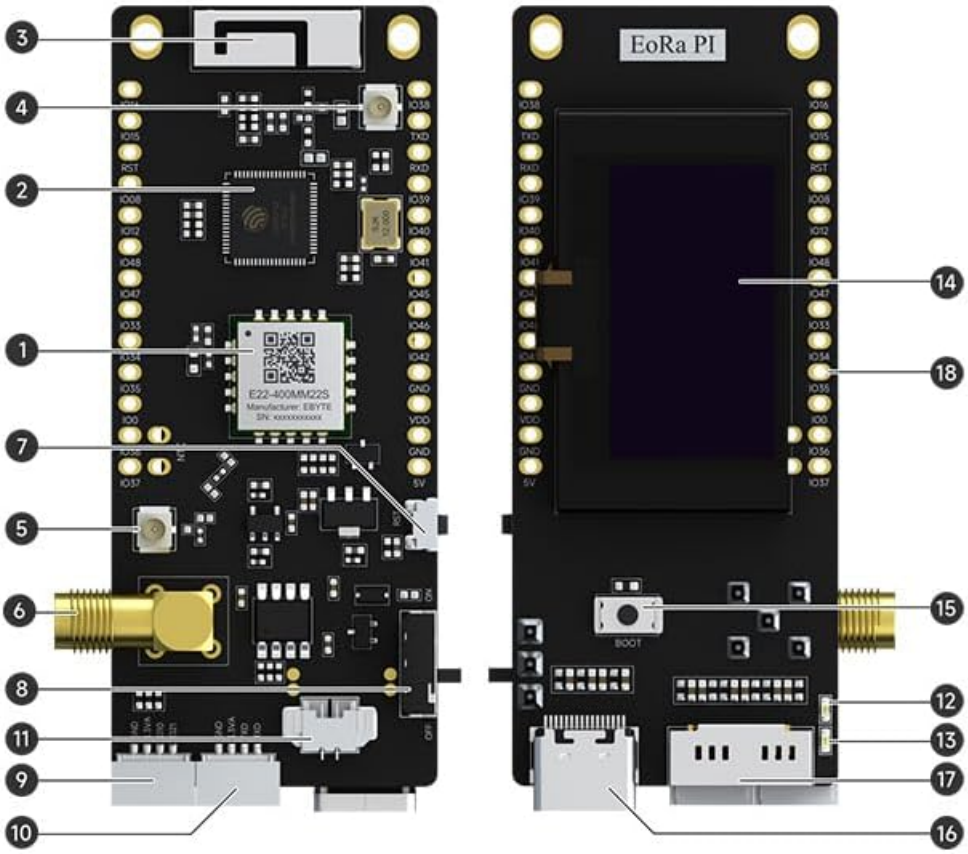

Image: The product packaging box, displaying manufacturer details and certifications.

## 5. Hardware Components and Pinout

The EoRa-S3-900TB board is designed with various accessible components and GPIO pins for development and testing. Below are diagrams illustrating the main components and the pin definitions.

Features

# Features




EoRa-S3-400TB and EoRa-S3-900TB features

| NO | Main hardware | Component Introduction |
|---|---|---|
| 1 | E22-400MM22S or E22-900MM22S | E22-400MM22S and E22-900MM22S are ultra-small size independently developed by Chengdu Ebyte Electronics Co., Ltd. based on the new generation of LoRa radio frequency chips SX1268 and SX1262 produced by American Semtech and are suitable for 433MHz, 470MHz868MHz and 915MHz patch-type LoRa wireless modules. |
| 2 | ESP32-S3 chip | ESP32-S3 is a low-power MCU system-on-chip (SoC) that supports 2.4GHz Wi-Fi and Bluetooth® LE wireless communications |
| 3 | 3D omnidirectional antenna (Wi-Fi antenna) | Maximum gain 4.9dBi, 2.4G Wi-Fi omnidirectional antenna |
| 4 | IPEX seat (Wi-Fi antenna) | IPEX first generation socket, 2.4G Wi-Fi antenna |
| 5 | IPEX seat (LoRa antenna) | IPEX first generation seat, LoRa antenna |
| 6 | SMA radio frequency interface (LoRa antenna) | Full length 14.5mm SMA head, LoRa antenna |
| 7 | Reset key | reset button |
| 8 | switch | For completely disconnecting battery power |
| 9 | GPIO external interface | GPIO from ESP32 |
| 10 | GPIO external interface | GPIO from ESP32 |
| 11 | External battery interface | SH 1.25mm, 2pin battery interface |
| 12 | Single color LED | Addressable RGB LED, driven by GPIO8 |
| 13 | Bicolor LED | Charging indicator light, red when charging, green when fully charged |
| 14 | OLED screen | 0.96-inch OLED screen |
| 15 | Boot key | Download button. Press and hold the Boot key and press the Reset key to enter the "firmware download" mode and download the firmware through the serial port. |
| 16 | USB download port | USB interface: can be used as the power supply for the development board or the communication interface between PC and ESP32-S3 chip |
| 17 | TF card slot | Short body TF card slot |

| | | |
|---|---|---|
| 18 | Pin | All available GPIO pins (except the SPI bus of the flash) have been led to the pin headers of the development board. Please see pin headers for more information |

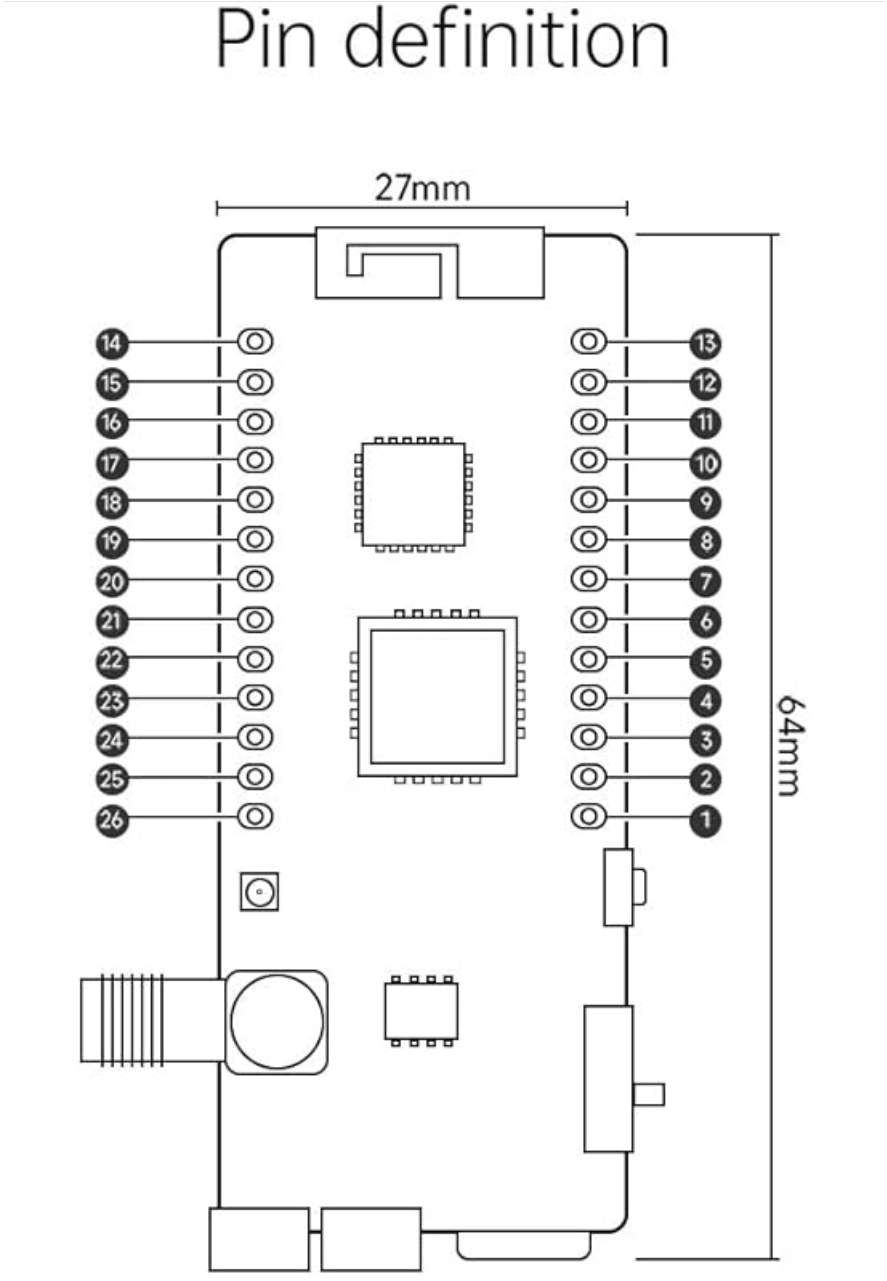
Image: Detailed diagram of the EoRa-S3-900TB board highlighting key components and their functions, including the LoRa module, ESP32-S3 chip, and various interfaces.

## 5.1. Component Introduction

| NO | Main Hardware | Component Introduction |
|---|---|---|
| 1 | E22-400MM22S or E22-900MM22S | Ultra-small size independently developed by Chengdu Ebyte Electronics Co., Ltd. Based on the new generation of LoRa RF chip SX1262. E22-400MM22S and E22-900MM22S are produced by American Semtech and are suitable for 433MHz, 470MHz, 868MHz and 915MHz patch-type LoRa wireless modules. |
| 2 | ESP32-S3 chip | ESP32-S3 is a low-power MCU system-on-chip (SoC) that supports 2.4GHz Wi-Fi and Bluetooth LE wireless communication. |
| 3 | 3D omnidirectional antenna (Wi-Fi antenna) | Maximum gain 4.9dBi, 2.4G Wi-Fi omnidirectional antenna |
| 4 | IPEX seat (Wi-Fi antenna) | IPEX first generation socket, 2.4G Wi-Fi antenna |
| 5 | IPEX seat (LoRa antenna) | IPEX first generation seat, LoRa antenna |
| 6 | SMA radio frequency interface (LoRa antenna) | Full length 14.5mm SMA head, LoRa antenna |
| 7 | Reset key | Reset button |
| 8 | switch | For completely disconnecting battery power |
| 9 | GPIO external interface | GPIO from ESP32 |
| 10 | GPIO external interface | UART serial port TXD |
| 11 | External battery interface | SH 1.25mm, 2pin battery interface |
| 12 | Single color LED | Addressable RGB LED, driven by GPIO8 |
| 13 | Bicolor LED | Charging indicator light, red when charging, green when fully charged |

| NO | Main Hardware | Component Introduction |
|---|---|---|
| 14 | OLED screen | 0.96-inch OLED screen |
| 15 | Boot key | Download button. Press and hold the Boot key and press the Reset key to enter the "firmware download" mode and download the firmware through the serial port. |
| 16 | USB download port | USB interface can be used as the power supply for the development board or the communication interface between PC and ESP32-S3 chip |
| 17 | TF card slot | Short body TF card slot |
| 18 | Pin | All available GPIO pins (except the SPI bus of the flash) have been led to the pin header of the development board. Please see pin headers for more information. |

## 5.2. Pin Definition




EoRa-S3-400TB and EoRa-S3-900TB pin definitions

| NO | Pin Name | Pin type | Pin Usage |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | VCC | power supply | Power pin, can be used as 5V power output after normal power supply |
| 2 | GND | power supply | Power GND |
| 3 | VDD | power supply | The power pin can be used as a 3.3V power output after normal power supply. At this time, it is forbidden to input another external power. |
| 4 | GND | power supply | Power GND |
| 5 | GPIO42 | input Output | — |
| 6 | GPIO46 | input Output | — |
| 7 | GPIO45 | input Output | — |
| 8 | GPIO41 | input Output | — |
| 9 | GPIO40 | input Output | — |
| 10 | GPIO39 | input Output | — |
| 11 | U0RXD | input | UART serial port RXD |
| 12 | U0TXD | Output | UART serial port TXD |
| 13 | GPIO38 | input Output | — |
| 14 | GPIO16 | input Output | — |
| 15 | GPIO15 | input Output | — |
| 16 | RST | input Output | Connect to ESP32-S3 reset pin |
| 17 | GPIO08 | input Output | Connect to the reset pin of the LoRa module |
| 18 | GPIO12 | input Output | — |
| 19 | GPIO48 | input Output | — |
| 20 | GPIO47 | input Output | — |
| 21 | GPIO33 | input Output | Connect to DIO1 of LoRa module |
| 22 | GPIO34 | input Output | BUSY connected to LoRa module |
| 23 | GPIO35 | input Output | — |
| 24 | GPIO0 | input Output | BOOT button connected to the base panel |
| 25 | GPIO36 | input Output | — |
| 26 | GPIO37 | input Output | LED connected to base plate |

Image: Diagram illustrating the pin layout and dimensions of the EoRa-S3-900TB board, crucial for connecting external components.

| NO | Pin Name | Pin Type | Pin Usage |
|---|---|---|---|
| 1 | VCC | Power Supply | Power pin, can be used as 5V power output after normal power supply |
| 2 | GND | Power Supply | Power GND |
| 3 | 3.3VA | Power Supply | The power pin can be used as a 3.3V power output after normal power supply. It is not allowed to connect to 3.3V or other external power. |
| 4 | GND | Power Supply | Power GND |
| 5 | GPIO42 | Input Output | - |
| 6 | GPIO46 | Input Output | - |
| 7 | GPIO41 | Input Output | - |
| 8 | GPIO40 | Input Output | - |

| NO | Pin Name | Pin Type | Pin Usage |
|---|---|---|---|
| 9 | GPIO39 | Input Output | - |
| 10 | U0RXD | Input | UART serial port RXD |
| 11 | U0TXD | Output | UART serial port TXD |
| 12 | GPIO38 | Input Output | - |
| 13 | GPIO16 | Input Output | - |
| 14 | GPIO15 | Input Output | - |
| 15 | RST | Input Output | Connect to ESP32-S3 reset pin |
| 16 | GPIO08 | Input Output | Connect to the reset pin of the LoRa module |
| 17 | GPIO12 | Input Output | - |
| 18 | GPIO48 | Input Output | - |
| 19 | GPIO47 | Input Output | - |
| 20 | GPIO35 | Input Output | Connect to DIO1 of LoRa module |
| 21 | GPIO34 | Input Output | BUSY connected to LoRa module |
| 22 | GPIO33 | Input Output | - |
| 23 | GPIO36 | Input Output | BOOT button connected to the base panel |
| 24 | GPIO37 | Input Output | LED connected to base plate |
| 25 | GPIO38 | Input Output | - |
| 26 | GPIO37 | Input Output | - |

## 6. Getting Started

### 6.1. Powering the Board

The EoRa-S3-900TB can be powered via its Type-C USB port. Connect the board to a computer or a 5V USB power adapter using a standard Type-C cable. The board also supports Li-ion battery power, with an integrated charging circuit. Ensure the battery is connected to the external battery interface (SH 1.25mm, 2pin) if using battery power.

### 6.2. Firmware Download

To upload new firmware or programs to the ESP32-S3 chip:

1. Connect the board to your computer via the Type-C USB download port.
2. Press and hold the **Boot key** (labeled 15 in the component introduction diagram).
3. While holding the Boot key, briefly press the **Reset key** (labeled 7).
4. Release the Boot key. The board should now be in firmware download mode, ready to receive firmware via the serial port.

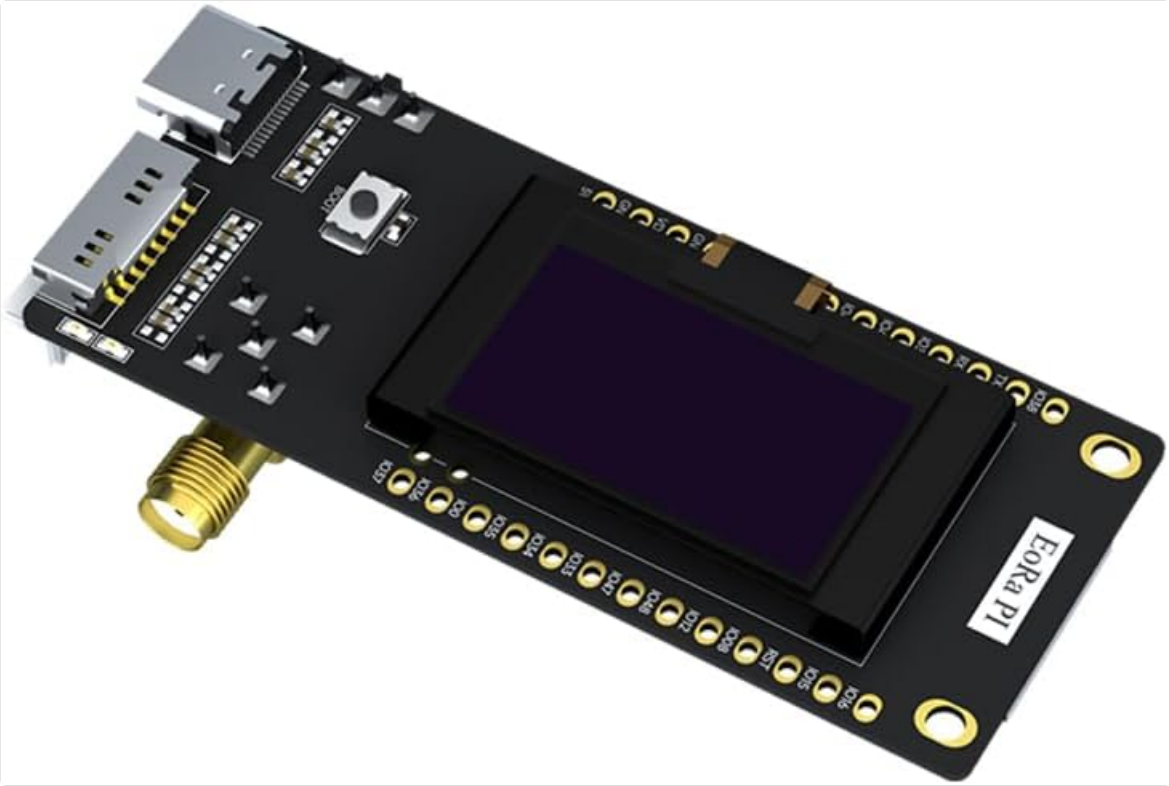



Image: The EoRa-S3-900TB board featuring its integrated 0.96-inch OLED display, which can be used for status indicators or data output.

## 7. Operating Modes

### 7.1. Wi-Fi Operating Modes

The ESP32-S3 supports various Wi-Fi operating modes:

- **Infrastructure BSS Station mode (STA mode):** The module acts as a client and connects to an existing Wi-Fi access point or router. In this mode, the module does not provide connections to other devices.
- **SoftAP mode (AP mode):** The module functions as a wireless access point, allowing other Wi-Fi devices to connect to it. It can establish TCP/IP-based server, client, and UDP connections, supporting up to 6 stations and up to 7 TCP Socket transmissions.
- **Station + SoftAP mode:** The module operates simultaneously as both a client (STA) and an access point (AP).

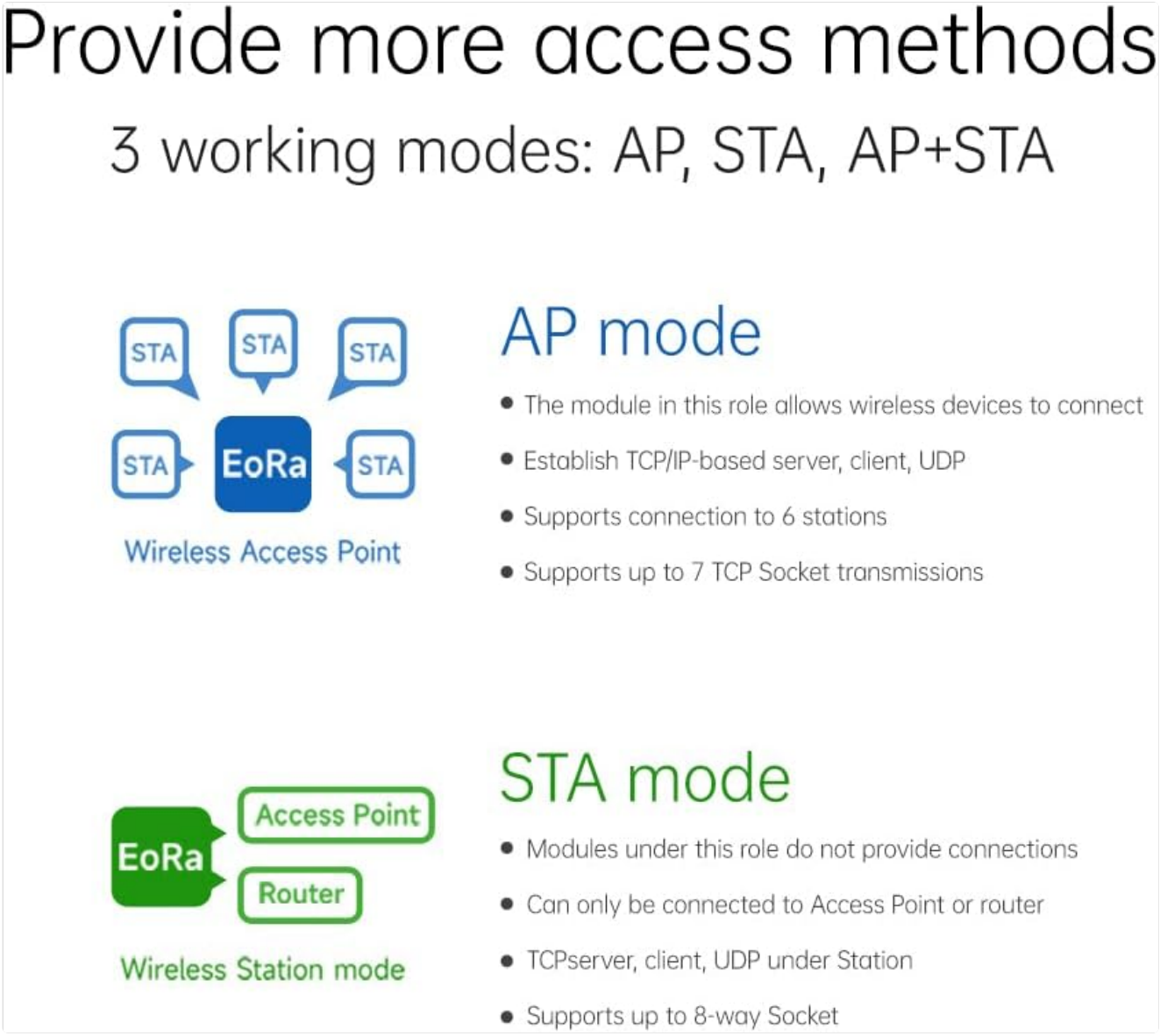



Image: Visual representation of the Wi-Fi operating modes (AP and STA) supported by the EoRa-S3-900TB board, illustrating how it can function as an access point or connect to an existing network.

### 7.2. Bluetooth LE Data Rates

The Bluetooth LE functionality supports multiple data rates, providing flexibility for various applications:

- 125 Kbps
- 500 Kbps
- 1 Mbps
- 2 Mbps


Image: Diagram illustrating the adjustable multi-level data rates for Bluetooth Low Energy (BLE) supported by the board, ranging from 125 Kbps to 2 Mbps.

## 8. Application Scenarios

The EoRa-S3-900TB board is suitable for a wide array of applications due to its versatile connectivity and processing capabilities:

- Smart home and industrial automation
- Healthcare devices
- Smart agriculture systems
- Service robotics
- General Purpose Low Power IoT Sensor Hubs
- General Purpose Low Power IoT Data Loggers
- Audio devices and camera video streaming
- USB devices and consumer electronics
- Speech recognition and image recognition systems
- Wi-Fi + Bluetooth network cards
- Touch and proximity sensing applications

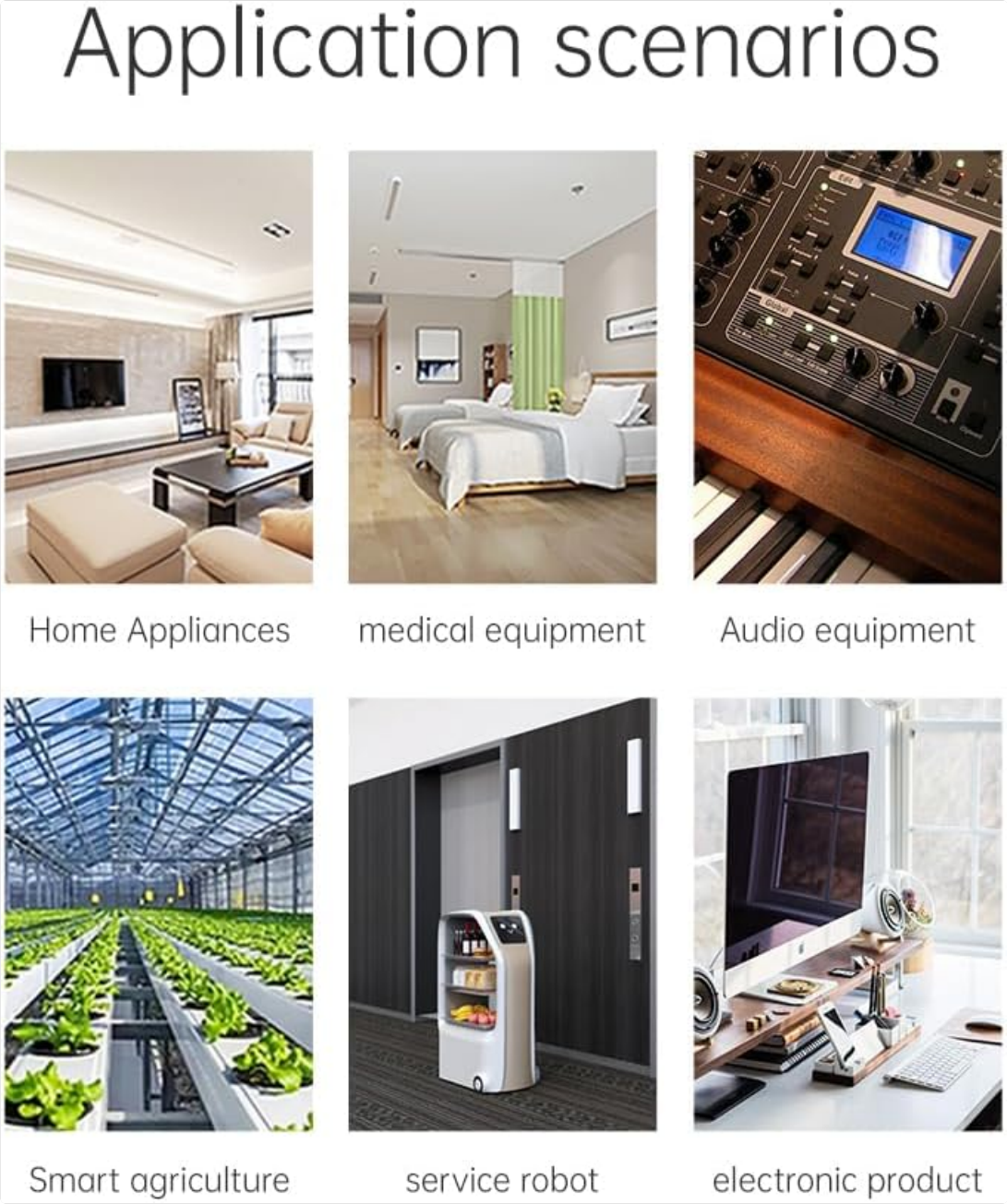



Image: Examples of diverse application scenarios for the EoRa-S3-900TB, including smart home, medical equipment, audio equipment, smart agriculture, service robots, and electronic products.

## 9. Troubleshooting

If you encounter issues with your EoRa-S3-900TB board, consider the following common troubleshooting steps:

- **No Power:** Ensure the Type-C cable is securely connected and the power source (USB port or adapter) is functional. If using a battery, check its charge level and connection.
- **Firmware Upload Failure:** Verify that the board is in download mode (Boot key pressed during reset). Check your serial port settings and driver installation on your computer.
- **Wi-Fi/Bluetooth Connectivity Issues:** Ensure antennas are properly connected. Check your code for correct Wi-Fi credentials or Bluetooth pairing procedures. Verify that the module is operating in the correct mode (AP, STA).
- **OLED Display Not Working:** Check connections to the OLED display. Ensure your code is correctly initializing and sending data to the display.
- **SD Card Not Detected:** Ensure the SD card is inserted correctly into the TF card slot. Check your code for proper SD card initialization and file system operations.

## 10. Maintenance

To ensure the longevity and optimal performance of your EoRa-S3-900TB board:

- **Keep Clean:** Regularly clean the board with a soft, dry brush or compressed air to remove dust and debris. Avoid using liquids or harsh chemicals.
- **Handle with Care:** Avoid dropping the board or subjecting it to physical shocks. Handle by the edges to prevent damage to components.
- **Proper Storage:** Store the board in a dry, cool environment, away from direct sunlight and extreme temperatures. Use anti-static bags if storing for extended periods.
- **Power Off When Not in Use:** Disconnect power when the board is not in use, especially if using battery power, to prevent unnecessary discharge.

## 11. Support and Warranty

For technical support, documentation, or further inquiries regarding the EoRa-S3-900TB test board, please contact the manufacturer:
**Manufacturer:** Chengdu Ebyte Electronic Technology Co., Ltd.
**Website:** http://www.cdebyte.com/
For EU customers, the authorized representative is:
**EU REP:** evalmaster Consulting GmbH
Bethaniestr. 30
60325 Frankfurt am Main
Germany
Please refer to the product packaging or purchase documentation for specific warranty terms and conditions.



### Related Documents - EoRa-S3-900TB

| | |
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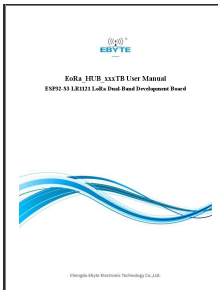
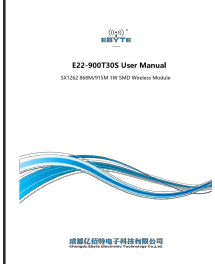
|  | Ebyte EoRa-HUB-xxxTB User Manual: ESP32-S3 LR1121 LoRa Dual-Band Development Board<br>Comprehensive user manual for the Ebyte EoRa-HUB-xxxTB development board, featuring ESP32-S3 and LR1121 LoRa dual-band technology. Covers features, specifications, hardware design, applications, and frequently asked questions. |
|  | E22-900T30S User Manual - EBYTE SX1262 Wireless Module<br>User manual for the EBYTE E22-900T30S wireless module, featuring SX1262 LoRa technology for 868M/915MHz bands. Covers specifications, features, applications, operation modes, hardware design, and troubleshooting. |

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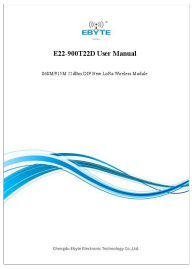
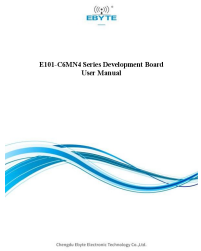
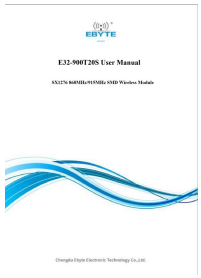
|  | ECM50-A<br>EBYTE ECM50-A ESP32-S3 Wi-Fi 4G LoRa |
|  | E22-900T22D LoRa Wireless Module User Manual<br>Comprehensive user manual for the EBYTE E22-900T22D LoRa wireless module, detailing specifications, features, applications, configuration, and hardware design for 868MHz/915MHz communication. |
|  | E101-C6MN4 Series Development Board User Manual - EBYTE<br>Comprehensive user manual for the E101-C6MN4 Series Development Board by EBYTE. This guide covers features, technical parameters, component descriptions, pin definitions, function introductions, and development notes for the ESP32-C6 based module. |
|  | E32-900T20S SMD Wireless Module User Manual<br>User manual for the EBYTE E32-900T20S, an 868MHz/915MHz SMD wireless module utilizing LoRa technology. Covers specifications, operation, commands, and hardware design. |