RAK4631 WisBlock Build Guide

Overview

The **RAK WisBlock** system is a modular hardware platform built around small snap-together modules. For LoRa mesh applications, the core build consists of:

- **RAK4631 Core Module** - Contains a Nordic Semiconductor **nRF52840** microcontroller and a **Semtech SX1262** LoRa radio on a compact daughter board.
- **RAK19007 Base Board** - The main carrier board with USB, battery connector, sensor slots, and IO headers. The RAK4631 plugs into the core slot.

Optional expansion modules (GPS, sensors, displays) plug into the modular slots on the base board without soldering.

Why Choose RAK WisBlock Over ESP32-Based Boards?

The nRF52840 microcontroller used in the RAK4631 has dramatically lower power consumption than the ESP32:

- **nRF52840 approximate average node current: 8 - 12 mA** - this is an approximate duty-cycled average, not a single datasheet figure. The RAK4631 datasheet lists discrete mode currents: BT Tx ~9 mA, BT Rx ~11.5 mA, LoRa Rx ~17 mA.
- **ESP32 approximate average node current: 40 - 80 mA** - also an approximate operating average; the Espressif datasheet rates active-mode current around 95-380 mA peak, with WiFi/BLE TX bursts at the high end.
- **nRF52840 sleep current: ~2-3 µA**

This difference makes the RAK4631 the preferred choice for:

- Solar-powered remote repeaters where power budget is tight

- Battery-only deployments requiring multi-week operation
- Installations where charging infrastructure is unavailable or unreliable

The trade-off is that RAK WisBlock is more expensive than Heltec or T-Beam, and the modular ecosystem can be initially confusing.

Bill of Materials

- **RAK19007** Base Board (or RAK5005-O for older builds)
- **RAK4631** Core Module (nRF52840 + SX1262)
- **RAK1910** GPS Module - optional, plugs into Slot A on the base board; uses a u-blox GPS module (check the current RAK1910 datasheet for the exact part).
- LiPo/Li-ion battery with a JST PHR-2 2.0 mm pitch connector (the connector used on the RAK19007 and RAK5005-O base boards).
- SMA antenna matched to your frequency band (868 or 915 MHz). Use the band legal for your region - in the US/Canada only 902-928 MHz (915 MHz) is permitted for unlicensed operation.
- Optional: RAKBox-B2 weatherproof enclosure, or any IP65+ electronics enclosure

Build Assembly

One of the significant advantages of WisBlock is that a basic build requires **no soldering**:

1. Align the **RAK4631 core module** with the core slot on the RAK19007 base board (the slot is keyed - it only fits one way).
2. Press down firmly until the module clicks into place. The board-to-board connectors are friction-fit.
3. If using the **RAK1910 GPS module**, slot it into Slot A (the larger expansion slot) on the base board in the same way.
4. Connect the antenna to the IPEX/u.FL RF connector on the RAK4631 (or to the SMA bulkhead if your base board/enclosure routes the u.FL out to one). For permanent outdoor installs, use a pigtail routed to an external SMA bulkhead connector. As good practice, connect the antenna **before** powering or transmitting.
5. Connect the LiPo/Li-ion battery to the battery connector on the RAK19007.

The board is now physically assembled and ready for firmware flashing.

Flashing Firmware

Meshtastic

The RAK4631 is supported by the Meshtastic web flasher:

1. Connect the RAK19007 base board via USB to a computer running Chrome or Edge.
2. Navigate to flasher.meshtastic.org.
3. Select **RAK WisBlock RAK4631** from the device list.
4. Click Flash and wait for completion.

MeshCore

MeshCore firmware for RAK4631 is available as a UF2 file for drag-and-drop flashing:

1. Download the latest RAK4631 firmware from the official MeshCore project releases (confirm you are on the official MeshCore repository before downloading - repo URLs change over time; cross-check against the MeshCore website / flasher at flasher.meshcore.io, as of 2026-06-08). Select the correct UF2 file for your role (Repeater, Client, etc.).
2. Double-press the reset button on the RAK4631 to enter bootloader mode. The board will appear as a USB mass storage device named **RAK4631** (or similar).
3. Drag and drop the UF2 file onto the mounted drive. The board will flash and reboot automatically.
4. Alternatively, flash using the Arduino IDE with the appropriate BSP (Board Support Package) for nRF52840.

Power & Battery Notes

- The RAK19007 and RAK5005-O base boards include an onboard charger that is **fixed for standard Li-ion/LiPo cells** (charge termination around 4.2 V, board max ~4.3 V).
- **WARNING - do not connect LiFePO4 (or any non-Li-ion chemistry) directly to the base board.** LiFePO4 charges to a lower voltage (~3.6 V/cell). The RAK base-board charger is set for Li-ion (4.2 V) and there is **no documented user-configurable LiFePO4 charge setting** (no solder jumper or register for this is published in the RAK datasheets). Connecting a LiFePO4 cell to the stock charger will **overcharge it**, which can cause the cell to vent or catch fire. If you want LiFePO4 for its temperature performance and cycle life, charge it with a dedicated external LiFePO4-rated charger (3.6 V/cell) - do not rely on the base-board charger. Use standard Li-ion/LiPo with the RAK19007/RAK5005-O.
- **Cold-charging caution:** never charge any lithium chemistry - including LiFePO4 - below 0 °C (32 °F). The low-temperature figures sometimes quoted for lithium cells are

discharge/storage limits, not charge limits. For outdoor installs, use a charger or charge controller with a low-temperature charge cutoff.
- The nRF52840 supports aggressive sleep modes. Ensure your firmware is configured to use deep sleep between transmit/receive windows for maximum battery life.

Enclosure Options

- **RAKBox-B2** - RAK's own weatherproof enclosure, designed to fit the WisBlock base boards with mounting points. Available with and without a solar panel lid option. Rated IP67.
- Any **IP65 or better** electronics enclosure that fits your base board dimensions. The RAK4631 core module is 20×30 mm and the RAK19007 base board is roughly 30×60mm (the core module adds some height), so a 100×68×40mm or larger box works comfortably.
- Cable management is simpler than ESP32 boards due to the lower current draw - thinner wiring and smaller connectors are sufficient.

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