Board Selection by Use Case

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Use this guide to narrow down board options based on your deployment scenario. Every use case has a different set of priorities - power consumption, form factor, display needs, and software support all vary. Start with your primary use case and cross-reference the comparison table for spec details.

Personal Handheld / Hiking Node

Battery life and portability are the dominant concerns. You want GPS for position tracking and a display you can read outdoors.

- **Top pick: LilyGO T-Echo** - best battery life, ePaper screen doesn't drain battery, built-in GPS and nRF52840.
- **Budget pick: Heltec LoRa 32 V3** - cheap, OLED shows status, but its ESP32-S3 draws far more than an nRF52840. Real runtime depends entirely on the attached cell and OLED usage: with a small battery and the screen on, expect only a handful of hours (roughly 4-12 hours), stretching toward a day or two on a larger cell with the display dimmed.
- **Runner-up: RAK4631 WisBlock** - very low power, modular, but no screen.

Permanent Home Node (Window / Balcony)

Always-on, plugged in, no battery concern. Prioritize ease of setup and reliability over power efficiency.

- **Top pick: RAK4631** - plug into USB or small LiPo, stays on 24/7 on minimal power, no display needed.
- **Alternative: Heltec LoRa 32 V3** - fine on USB power since it's indoors and plugged in.
- **Not recommended: T-Beam** - bulkier, designed for mobile.

Solar-Powered Outdoor Repeater

Power budget is everything. The node must survive cloudy days on battery reserves. nRF52840 platforms are strongly preferred.

- **Top pick: Heltec T114 (MeshCore) or RAK4631 (Meshtastic)** - nRF52840 low power is essential. A small 5W panel can run these indefinitely.
- **Budget alternative: T-Beam with external LiFePO4 and proper charge controller** - works but needs a bigger panel due to ESP32 power draw.
- **High-power repeater: ZebraHat or Ikoka PA module** - for mountaintop/long-distance links, but requires larger solar/battery due to TX current draw. **Legal note:** 1 W (30 dBm) PA options sit at the FCC Part 15.247 conducted limit (and only with antennas ≤6 dBi; higher-gain antennas require a dB-for-dB conducted-power reduction). The Ikoka 2 W (33 dBm) variant *exceeds* the Part 15 conducted limit and is not legal for unlicensed US operation — it requires an amateur Part 97 license (no encryption, station identification). Confirm conducted power plus antenna gain against 47 CFR 15.247 before deploying.

Vehicle / Mobile

Reliable 12V power supply and physical durability matter more than ultra-low sleep current. Roof antenna mounting is a major range multiplier in this scenario.

- **Top pick: T-Beam v1.1 or Supreme** - tough, battery holder, can run from 12V car USB. The larger size is fine in a vehicle.
- **With external antenna:** use a T-Beam or Heltec with a magnetic-mount NMO antenna adapter. Roof antenna dramatically improves range over internal.

Fixed Infrastructure / Gateway with Internet

Internet backhaul lets your node bridge the mesh to MQTT or other services. The LoRa radio is a peripheral here; the compute platform matters more.

- **Top pick: Any board + Raspberry Pi** - use a cheap Heltec or T-Beam as the LoRa radio connected to a Pi Zero 2W running Meshtastic or MeshCore gateway software.
- **All-in-one option: T-Beam with WiFi enabled** - running Meshtastic's built-in MQTT client (no Pi needed for simple setups).

Developer / Experimenter

GPIO availability, modular expansion, and good toolchain documentation are the priorities. You're likely to change the hardware configuration frequently.

- **Top pick: RAK WisBlock** - modular system lets you add/remove GPS, sensors, displays. Clean Arduino/PlatformIO support. Good documentation.
- **Alternative: T-Beam Supreme** - ESP32-S3, more GPIO, good for prototyping.

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