Emerging & Specialty Hardware

- Heltec Mesh Node T096
- Ikoka Stick
- Harbor Breeze Solar Node (~$10 enclosure, ~$65 total build)
- Best Portable Nodes: Ranked

Heltec Mesh Node T096

Overview

The **Heltec Mesh Node T096** (Heltec's nRF52 part naming follows the HT-n5262 / HT-n5262M family) combines an nRF52840 MCU with an SX1262 radio and an *integrated power amplifier*. Heltec rates its maximum TX power at **28±1 dBm** via that PA — well above the SX1262's bare native +22 dBm — which it pairs with on-board GPS and an ultra-low sleep current, making it purpose-built for solar and remote deployments. *(TX-power figures for Heltec PA boards are contested across third-party sources; the 28±1 dBm here reflects Heltec's own current spec — verify against heltec.org before relying on it.)*

Specifications

Attribute	Value
Price	~$30 (Heltec lists ~$29.90-$33.90 depending on date/variant; as of 2026-06-08)
MCU	nRF52840
Radio	SX1262 + integrated power amplifier
TX Power	28±1 dBm (per Heltec, via integrated PA; verify against heltec.org)
GNSS	UC6580 - L1+L5, 6 constellations (GPS, GLONASS, BeiDou, Galileo, QZSS, NavIC)
Display	0.96″ color TFT (commonly 160×80 panels; confirm resolution against Heltec datasheet)
Sleep Current	12 µA
Bluetooth	BLE 5 + Bluetooth Mesh
Battery Connector	1.25 mm lithium
Solar Input	1.25 mm solar connector
MeshCore Support	Yes (compatible with Meshtastic and MeshCore per Heltec)

T096 vs. Heltec V4

Feature	T096	V4
TX Power	28±1 dBm (Heltec, via PA)	~22 dBm stock (contested; some sources cite up to ~27-28 dBm on PA variants — verify against heltec.org)
Price	~$30 (as of 2026-06-08)	~$17 - 20 (as of 2026-06-08)
GPS	Yes (UC6580, L1+L5)	No
Wi-Fi	No	Yes
Sleep Current	12 µA	Higher
Best Role	Solar / remote / field	Indoor / USB-powered nodes

RF output is **not** identical between the two: the T096 reaches 28±1 dBm via its integrated PA, whereas the Heltec V4's stock output is around 22 dBm (higher on some PA variants — the exact figure is contested, so verify against heltec.org). Beyond raw output, the T096's 12 µA sleep current and built-in GPS make it far more suitable for long-term solar-powered deployments, where the V4's Wi-Fi integration goes unused.

Target Use Cases

- Solar-powered relay nodes
- Remote repeaters (mountain tops, rural infrastructure)
- Portable field kits requiring GPS without an external module

Ikoka Stick

Overview

The **Ikoka Stick** is a community DIY design (by **ndoo**) for an ultra-compact stick-format LoRa node built on the **Seeed Studio XIAO nRF52840** paired with an **EBYTE E22-900M**-series LoRa module. It is a hobbyist build rather than a productized multi-MCU node. The compact stick form factor is suited to use as a pocket companion; higher-power builds (see below) require a larger enclosure and should not be confused with the pocketable stick.

Variants & Power Options

The base E22-900M module (SX1262) outputs up to **+22 dBm**. Higher-power "variants" are separate enclosure-based builds that use a higher-power EBYTE E22 module (e.g. E22-900M30S at 30 dBm) or add an external power-amplifier stage downstream of the module — these are not the compact pocket stick.

Variant	TX Power	Typical Use
Standard (compact stick)	22 dBm (~158 mW)	Personal carry / compact node
1 W (box build)	30 dBm	Infrastructure repeater

FCC caveat: The 1 W variant sits at the FCC Part 15.247 conducted limit of 30 dBm (1 W) and is only legal under Part 15 with an antenna of ≤6 dBi (higher-gain antennas require a dB-for-dB conducted-power reduction). A 2 W / 33 dBm build (using EBYTE's large E22-900M33S UART module) **exceeds the FCC Part 15 conducted limit and is not legal for unlicensed US use** — high-power tower use of such a variant generally requires an amateur Part 97 license (no encryption, station identification). Confirm conducted power plus antenna gain against 47 CFR 15.247 before deploying under Part 15. Note also that a 33 dBm module is a large, high-current part (drawing on the order of 1-2 A peak with significant heat dissipation needs) and cannot fit a pocketable stick form factor.

Key Specifications

- **MCU:** Seeed Studio XIAO nRF52840

- **Radio:** EBYTE E22-900M series (built on the SX1262, rated up to +22 dBm). The 1 W build uses a higher-power E22 module (e.g. E22-900M30S) or an external PA stage added after the base module.
- **Form factor:** Compact stick (the standard 22 dBm build). Higher-power builds require a larger enclosure and heatsinking and are not pocketable.

Community Deployments

The Ikoka Stick is the basis of CascadiaMesh's "*1 Watt Ikoka Box*" build - one of the most replicated community deployment designs, used for high-density urban and suburban coverage nodes. As an enclosure-based 1 W build, it is distinct from the pocketable standard stick.

RF Filtering

In electrically noisy environments (near industrial equipment, dense urban RF, tower-share sites), a LoRa cavity filter can suppress out-of-band interference and protect the receiver, improving effective range in difficult RF environments. The Baymesh (Nullrouten) cavity filter is one option; verify the exact SKU, center frequency (US-band LoRa filters are tuned near 906-915 MHz, not a single "910 MHz" point), and current price before purchasing.

Target Use Cases

- High-power infrastructure repeaters (enclosure-based 1 W box build, not the pocket stick)
- Tower mount and rooftop deployments
- Community mesh backbone nodes

Harbor Breeze Solar Node (~$10 enclosure, ~$65 total build)

Overview

The **Harbor Breeze Solar Node** converts a $10 - 15 Harbor Breeze 60-lumen solar LED floodlight (Lowe's item #SL1832) into a weatherproof, solar-powered mesh node. The floodlight already includes a small solar panel (rated ~0.6 W per the Lowe's listing; a rough estimate of ~90 mA at 5 V), an 18650 cell (the listing includes a 3.7 V ~1500 mAh 18650), a charge circuit, and a weatherproof enclosure - the hard parts are done for you. (Prices and specs as of 2026-06-08.)

Total cost including radio: approximately **$60 - 70** (as of 2026-06-08; the total tracks the volatile RAK4631 street price). Enclosure + solar hardware alone: $10 - 15.

Bill of Materials

All prices are commodity/street prices as of 2026-06-08 and will vary; recompute the total if the RAK4631 price changes.

Item	Cost
Harbor Breeze 60LM Solar LED Light (Lowe's #SL1832; includes a ~1500 mAh 18650)	$10 - 15
RAK4631 WisBlock Core (nRF52840 + SX1262)	$18 - 24 (street price, varies)
RAK19007 WisBlock Base Board (USB-C + JST) - $9.99 per store.rakwireless.com	$9.99
915 MHz LoRa Antenna 2 dBi SMA whip (typical commodity price)	$5 - 10
u.FL to SMA Bulkhead Pigtail (~10 cm; typical commodity price)	~$5

Item	Cost
18650 cell (optional - a ~1500 mAh cell is already included; only needed for a higher-capacity replacement or if depleted)	$5 - 10
Misc: heat-shrink, silicone sealant	~$5
Total (approx., as of 2026-06-08)	**~$60 - 70**

Assembly Overview

1. Remove the back cover of the floodlight housing.
2. Remove the LED assembly and cut existing wires near the board.
3. Drill a 1/4″ hole through the housing for the SMA bulkhead connector.
4. Install the RAK WisBlock base board and core module inside the housing.
5. Wire the battery: red = positive (+).
6. Wire the solar panel to the RAK19007 solar charge input header - **verify the exact header label and polarity against the RAK19007 datasheet before connecting**.
7. Weatherproof all cable entry points and the SMA hole with silicone sealant.
8. Reinstall the back cover.

Critical Warnings

- **Keep the solar input within the RAK19007's rated charge-input limit.** Confirm the exact maximum solar/charge input voltage against the current RAK19007 datasheet before connecting; as a conservative ceiling, do not feed more than ~6 V into the solar input. The Harbor Breeze panel is rated ~0.6 W trickle charge. Do not substitute a higher-voltage panel.
- Verify solar wire polarity *before* connecting to the charge-input header. Reverse polarity will damage the charge circuit.
- This panel provides trickle charge only - not suitable for high-duty-cycle backbone repeaters. Nodes that transmit frequently will discharge the battery faster than the panel can recharge it.

Best For

- Fence lines and yard boundary sensors
- Low-traffic area coverage (parking lots, fields, trails)
- Budget-conscious deployments where AC power is unavailable

Not recommended for high-traffic backbone repeaters or nodes that need continuous uptime.

Best Portable Nodes: Ranked

Overview

This ranked guide is based on community testing and field deployments. All devices listed support **Meshtastic** (with one caveat: the SenseCAP T1000-E uses an LR1110 radio, which per Meshtastic docs currently cannot receive packets from older SX127x nodes). MeshCore compatibility varies - notes are included where support differs by operating mode. Prices are volatile and shown as of 2026-06-08.

Rankings

#1 - LilyGo T-Echo ($65 - 75, as of 2026-06-08) - Best All-Around

- **Display:** 1.54″ e-ink (sunlight-readable, zero power when static)
- **GPS:** Yes (Quectel L76K)
- **Battery:** ~850 mAh internal LiPo (not user-swappable; requires disassembly) - roughly 5 - 7 day runtime depending on duty cycle
- **Antenna:** U.FL/IPEX connector (verify against LILYGO spec)
- **Size:** ~90×40×15 mm (approximate; LILYGO does not publish exact case dimensions)
- **Why #1:** The e-ink display is the standout feature for outdoor use - readable in direct sunlight with no backlight drain. Best balance of size, runtime, and usability.

#2 - SenseCAP T1000-E (~$40, as of 2026-06-08) - Best Budget Portable

- **Display:** None (phone-dependent)
- **GPS:** Yes
- **Radio:** LR1110 (note: currently cannot receive Meshtastic packets from older SX127x nodes, per Meshtastic docs)
- **Battery:** 700 mAh

- **Rating:** IP65 weatherproof
- **Size:** Credit card
- **Why #2:** The most pocketable GPS-equipped node available. IP65 rating handles rain and dust. No display means you need a phone, but at ~$40 it's the entry point for serious portable use.

#3 - RAK WisMesh Tag (~$50, as of 2026-06-08) - Best Wearable (editorial)

- **Display:** LED indicators only
- **GPS:** Yes (onboard AT6558R GNSS; triple-press to enable/disable on demand; all antennas built into housing)
- **Battery:** 1000 mAh
- **Rating:** IP66
- **Runtime:** 2 - 3 days
- **Why #3:** IP66 is the highest IP rating among the devices in this list (IP ratings extend to IP68/IP69 elsewhere). Badge/clip form factor designed for events and SAR operations. LED-only feedback keeps it simple and robust.

#4 - LilyGo T-Deck Plus ($85 - 100, as of 2026-06-08) - Best Standalone

- **Display:** 2.8″ color touchscreen (IPS)
- **Input:** Physical QWERTY keyboard + trackball
- **GPS:** Yes
- **Battery:** 2000 mAh
- **MeshCore:** Widely used as a standalone MeshCore companion device; confirm specific mode support against docs.meshcore.io
- **Why #4:** The only device here with a full keyboard for free-text composition standalone, so it's the most capable for extended messaging with no phone. (The T-Echo can also operate without a phone but only for limited interaction such as canned messages.) Best choice if you want a standalone communicator rather than a companion node.

#5 - LilyGo T-Beam Supreme ($55 - 70, as of 2026-06-08) - Most Versatile

- **Display:** 1.3″ OLED

- **Radio:** SX1262
- **GPS:** Yes (u-blox MAX-M10S high-sensitivity module)
- **Battery:** Replaceable 18650 (holder fits only unprotected flat-top cells)
- **MeshCore:** Plausible complete mode support; confirm against docs.meshcore.io
- **Why #5:** The only device here with a user-replaceable 18650 - carry spares to extend field time (subject to cell availability and recharging). Can also be configured as a portable repeater. High-sensitivity GPS performs better in urban canyons and dense canopy.

Quick Comparison

Device	Price	Battery	GPS	Display	IP Rating	Phone Needed?
T-Echo	$65 - 75	~850 mAh internal	Yes	E-ink	-	Optional
T1000-E	~$40	700 mAh	Yes	None	IP65	Yes
WisMesh Tag	~$50	1000 mAh	Yes	LED	IP66	Optional
T-Deck Plus	$85 - 100	2000 mAh	Yes	2.8″ touch	-	No
T-Beam Supreme	$55 - 70	18650 replaceable	Yes	1.3″ OLED	-	Optional

Prices above are volatile and shown as of 2026-06-08.

MeshCore Compatibility Note

All five devices support Meshtastic (with the T1000-E LR1110 RX caveat noted above). For MeshCore, the **T-Deck Plus** and **T-Beam Supreme** are widely used and likely offer broad operating mode support - confirm specific modes against the MeshCore supported-hardware docs (docs.meshcore.io). Other devices may have limited mode availability - check the MeshCore compatibility list before purchasing if MeshCore is your primary firmware.