Raccoon Tree Node Build (~$190)

The Raccoon Tree Node is a long-range forest repeater designed to be suspended from a tree branch using a throw line. In mature forest, hang heights of roughly 30-60 ft are typical, with up to ~100 ft an exceptional maximum that depends on tree height and throw skill. This build is presented as an example design attributed to the CascadiaMesh community; it prioritizes antenna elevation and link distance over minimal cost, making it ideal for rural coverage gaps and forested terrain.

Safety

- **Install entirely from the ground using a throw line - do NOT climb the tree.** Tree climbing to install or retrieve a node is fatal-fall work that requires an arborist's training and a proper rope/harness system. Working at height also triggers OSHA fall-protection requirements (4 ft general industry, 6 ft construction).
- When using a throw weight, keep bystanders clear of the launch and fall zone, wear eye protection, and **never throw near overhead power lines** - keep the line and weight well clear of the full fall radius of any line.
- Plan for retrieval and servicing before you deploy: a node 30-100 ft up is genuinely hard to recover. A line under tension and a falling node/throw-weight are real hazards.
- Use a UV-stable, low-stretch suspension line (UHMWPE/Dyneema or a UV-treated line) rated for the static load with a safety factor. Inspect and replace the suspension line periodically.

Parts List

Component	Approx. Cost	Source / Notes
Heltec V4.3.1 LoRa module	$26	Rokland (prices as of 2026-06-08; verify current listing). An optional RAK 1W booster (~$39 - $49) is available - see the FCC caution below before using it.

Component	Approx. Cost	Source / Notes
JMT 915 MHz bandpass filter	$14	Optional inline filter - cleans up out-of-band noise from the Heltec front end. Helpful in noisy/high-power outdoor use; not mandatory for every Heltec build (the beginner Heltec pages flash without one). Price/part as of 2026-06-08, unverified.
PeakMesh solar charging board	$13	Etsy (David's shop)
Aluminum waterproof enclosure 4.7×3.1×2.1"	$15	Amazon
Rokland 10 dBi Backcountry antenna, 45"	$50	Rokland. Note: 10 dBi exceeds 6 dBi, so conducted TX power must be reduced - see Antenna Elevation Strategy.
Zivif 6W 5V solar panels (qty 2)	$16 each / $32 total	-
Samsung 30Q 18650 3000 mAh cells (qty 3)	$4 each / $12 total	Wire as 3 in PARALLEL (~3.7V, ~9000 mAh, ~33 Wh) - see Power System for pack-safety notes.
Throw line (UV-stable UHMWPE/Dyneema), ~196 ft	-	For suspending node over a tree branch. You need roughly 2x the hang height plus working slack for throwing and tie-off, so ~196 ft supports a ~60-90 ft hang with margin. Do NOT use bare aramid (Kevlar) - it is UV-sensitive outdoors.
Total		**~$190** (as of 2026-06-08; line items are individually volatile and exclude pigtails/adapters and shipping)

Heltec RF Shielding & Filter

Some Heltec V4 boards have reported receive-sensitivity limitations from front-end self-interference (the V4 added an LNA and the antenna/filter network was revised between revisions). A definitive "produces RF noise / spurious emissions" claim is not confirmed by a primary manufacturer source, so treat the following as **recommended where you observe a problem**, not universally mandatory. Shielding is generally helpful; the inline bandpass filter is worth adding mainly in high-noise or high-power outdoor deployments:

1. **RF shielding:** Do **not** wrap the PCB in aluminum foil. An ungrounded foil wrap is not a Faraday shield - it can detune the antenna match and BLE antenna, short exposed pads, and couple noise back into the front end, and a foil-to-PCB short over a lithium cell is a fire hazard. If shielding is needed, use a proper grounded board-level shield can over the RF section.

2. **JMT 915 MHz bandpass filter (optional):** Install inline between the SMA port and antenna feedline. A 915 MHz BPF rejects out-of-band RX interference and attenuates TX harmonics, but it adds ~1-2 dB insertion loss (reducing both TX EIRP and RX sensitivity) and does **not** fix in-band FEM self-interference. Weigh the loss against the interference benefit for your site, and check the specific filter's datasheet (passband, insertion loss, rejection).

For very high-noise urban deployments, a higher-Q bandpass / coaxial-resonator filter (e.g., the ~$90 Baymesh 910 MHz part - confirm the actual filter topology and insertion loss on its datasheet) offers more rejection than the JMT ceramic filter, but at higher insertion loss. A bandpass filter does not fix in-band noise.

Antenna Elevation Strategy

The defining feature of this build is antenna elevation via tree suspension:

- Use a UV-stable, low-stretch line such as UHMWPE/Dyneema (not bare aramid/Kevlar, which is UV-sensitive and weakens in sunlight) to throw over a high branch.
- The 45" Rokland 10 dBi Backcountry antenna is weatherproof and designed for outdoor permanent installation. A high-gain, narrow-beam omni needs stable vertical mounting; in a swaying tree it can point energy above or below the horizon.
- Hang heights of ~30-60 ft are typical in mature forest; ~100 ft is an exceptional maximum, not routinely achievable. Higher elevation provides significant line-of-sight improvement over ground-level deployments, but plan for the overhead-load, line-failure, and retrieval hazards noted in Safety.
- The 10 dBi gain antenna combined with elevation can extend link distance in forested Pacific Northwest terrain, though dense vegetation absorbs 915 MHz energy and can offset some gain. **FCC Part 15 (47 CFR 15.247) note:** a 10 dBi antenna is 4 dB over the 6 dBi reference, so conducted TX power must be reduced by 4 dB (to ~26 dBm) to keep EIRP at or below the 36 dBm ceiling. Set the node's TX power accordingly - do not run full power into a 10 dBi antenna on unlicensed 915 MHz.
- **If you use the optional RAK 1W booster:** it raises conducted output to ~30 dBm. Combined with this build's 10 dBi antenna the EIRP exceeds the FCC Part 15 limit. With a 10 dBi antenna conducted power must be reduced to ~26 dBm. Do not use the 1W booster with a high-gain antenna on unlicensed 915 MHz.

Power System

- Two Zivif 6W 5V panels provide redundancy and increased harvest in partly-shaded forest environments.

- Three Samsung 30Q 18650 cells wired in **parallel** (~3.7V, ~9000 mAh, ~33 Wh) provide multi-day autonomy during cloudy periods common to the PNW. Actual runtime depends on the node's real average current. Use only matched cells of the same model and charge state, fuse the pack positive, and charge through a proper single-cell charger/BMS - do not put cells in series without a BMS.
- **Cold-charging warning:** standard 18650 Li-ion cells must NOT be charged below 0 °C (32 °F) - charging below freezing causes lithium plating and a risk of internal short and fire. Discharge works fine at low temperatures, but in freezing PNW winters use a charge controller/BMS with a low-temperature charge cutoff. If you substitute LiFePO4 cells for cold weather, you must also use a LiFePO4-appropriate charger (3.6 V/cell, not the 4.2 V Li-ion profile) with its own low-temp charge cutoff.
- PeakMesh charging board handles MPPT and battery management.

Firmware

Flash with MeshCore Repeater firmware via the MeshCore Web Flasher. Configure for CascadiaMesh settings (this US/Canada preset is a community/regional convention, not a universal standard):

- Frequency: 910.525 MHz / BW: 62.5 kHz / SF7 / CR 4/5
- Zero Hop Interval: 0 / Flood Advert Interval: 48 hours

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