Pro MeshCore Solar Repeater: Complete Build

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This guide covers a fully self-contained, weatherproof, solar-powered MeshCore repeater intended for rooftops, hilltops, and any site without mains power. Budget roughly $230 in parts (re-priced against current vendor listings as of June 2026, after correcting the mis-specified antenna and enclosure below) and two to three hours of build time. Prices are approximate and vary by vendor and stock; confirm each line item before ordering.

Bill of Materials

Component	Purpose	Approx. Cost (as of Jun 2026)
RAK4631 WisBlock Core (nRF52840 + SX1262) + RAK19007 Base	Main radio/MCU stack	$37 (RAK19007 base ~$9.99; verify at the RAKwireless store)
915 MHz (902-928 MHz) Fiberglass Omni, ~5.8-8 dBi, N-type (e.g. a Rokland / Data-Alliance 900 MHz fiberglass collinear)	High-gain outdoor antenna	$45-60
u.FL (IPEX) to N-type Pigtail, ~1 m, LMR-195/LMR-240	Low-loss feedline (u.FL end snaps onto the RAK4631 LoRa port; N-type goes to the antenna)	$12
Genuine IP66/IP67 Polycarbonate Outdoor Enclosure (e.g. Hammond 1554/1555 series polycarbonate)	Weather protection	$25-35
10 W Monocrystalline Solar Panel	Energy harvest	$25
10 Ah LiFePO4 Battery Pack (12 V) with BMS that includes a low-temperature charge cutoff	Overnight/cloudy buffer	$45
Victron SmartSolar MPPT 75/10	Charge controller	$35

Component	Purpose	Approx. Cost (as of Jun 2026)
Inline fuse + holder for the battery positive lead (sized per the Victron table, typically the controller's rated amps)	Over-current protection	$5
Total		**~$230 (varies by vendor)**

Cite a specific SKU and dated price for each line item before ordering. The previously listed "Taoglas FXP73" is a 2.4 GHz ~2.5 dBi u.FL flex-PCB Wi-Fi antenna and does NOT belong in a 915 MHz build - it has been removed. The previously listed "Hammond 1591XXFLBK" is an ABS box rated only to ~IP54 (indoor/general use), not an IP67 polycarbonate outdoor enclosure - it has been replaced with a genuine IP66/IP67-rated polycarbonate enclosure above.

Enclosure Preparation

Begin with the genuine IP66/IP67 polycarbonate enclosure. Drill two cable-gland holes on the bottom face: one for the antenna pigtail and one for the solar/battery DC wiring. Match each gland size to the hole size and cable OD - for example, a 16 mm hole takes a PG-9/PG-11 gland; verify the gland's cable clamping range covers the pigtail's OD and the DC wiring bundle so the seal actually grips and weatherproofs. Tighten the locknuts. Place a 10 g silica gel desiccant packet inside the enclosure before sealing to prevent condensation. Mount the RAK19007 base board to the enclosure floor using four M3 x 6 mm nylon standoffs - never mount directly to the enclosure plastic, as flexing can crack solder joints.

PCB Mounting and Anti-Static Precautions

Before handling the RAK4631, ground yourself with a proper ESD wrist strap connected to a known ground. (Touching the enclosure mounting hardware only helps if that hardware is actually bonded to ground, which it usually is not - a wrist strap to a known ground is preferred.) Seat the RAK4631 into the RAK19007. The RAK4631 LoRa antenna port is a u.FL/IPEX snap-fit connector, not a threaded SMA - you cannot "screw on" an SMA jumper. Snap the u.FL end of the u.FL-to-N pigtail onto the RAK4631 LoRa port, then route the N-type end out through the cable gland (u.FL/IPEX end inside, N-type outside) and hand-tighten the gland before final enclosure assembly. Leave 5 cm of slack inside the enclosure to prevent cable strain on the delicate u.FL/IPEX connector.

Solar Wiring

Wire in the Victron-recommended sequence: connect the 10 Ah LiFePO4 battery to the BATTERY terminals of the SmartSolar MPPT 75/10 **first**, then connect the solar array to the PV terminals; disconnect in reverse order (PV first, then battery). Install an inline fuse in the battery positive lead, close to the battery terminal (sized per Victron's table, typically the controller's rated amps);

respect polarity on all connections. **Important:** the SmartSolar MPPT 75/10 has no LOAD output. Do not wire the node to a "LOAD" terminal - it does not exist on this controller. Instead, power the node from the battery: connect a DC-DC 12 V-to-5 V buck converter (set to a stable 5.0-5.1 V, rated above the node's peak TX current) to the battery terminals through a fused line or a fused distribution block, then feed its 5 V output to the RAK19007 USB-C input. Confirm the RAK19007 USB-C accepts the injected 5 V without USB negotiation. Choose wire gauge by actual current and run length: for this few-amp system over runs under ~1 m, 18-20 AWG for the battery and panel and 20-22 AWG for the load are acceptable - but check ampacity and voltage drop for your specific build. Secure all wires with zip ties to the enclosure interior.

Cold-Weather Charging Safety

Never charge a LiFePO4 (or any lithium) battery below 0 °C (32 °F). Charging below freezing causes permanent lithium plating and a real fire/safety hazard. Use a LiFePO4 pack whose BMS includes a low-temperature charge cutoff (it blocks charging below 0 °C), or add an external low-temp charge disconnect in the charge path. For cold-climate or winter sites, verify the BMS low-temp cutoff before deploying. Do not rely on any "tolerates temperature extremes" marketing - that does not mean it is safe to charge when frozen.

Antenna Installation

Rooftop safety first: before any work at height, use fall protection, never work on a wet or icy roof, and keep the mast and antenna at least their full length plus 3 m clear of any overhead power line - contact is fatal. For a fixed outdoor antenna, bond and ground the mast per NEC Article 810. Then mount the 915 MHz N-type fiberglass omni to a standard 1-inch pipe mast using a U-bolt bracket, positioned at least 1 m above the roofline for minimum ground-plane interference. Connect the N-type end of the u.FL-to-N pigtail to the antenna's N connector. Apply self-amalgamating tape over the N-type connector and at least 50 mm up the cable for weatherproofing.

Firmware and Configuration

Flash the RAK4631 with the MeshCore `REPEATER` firmware as described in the Budget Build page. After first boot, configure a fixed GPS position if known with `set lat` and `set lon` (improves network topology display). Enable the low-power sleep mode appropriate for solar-only nodes to extend overnight battery life. Set TX power with `set tx 22` (the serial CLI command; valid range is 1-22 dBm - note the reflashing page elsewhere that states 27 dBm is wrong, as 27 is out of range for the SX1262). Before settling on 22 dBm, check EIRP compliance: EIRP = TX power + antenna gain − feedline loss. Under 47 CFR 15.247(b)(4), antennas above 6 dBi require dB-for-dB conducted-power reduction below the 1 W (30 dBm) conducted limit. With an ~8 dBi antenna at 22 dBm the result is roughly 30 dBm EIRP, within the 36 dBm / 4 W EIRP ceiling; if you fit a higher-gain antenna, reduce TX power accordingly so you stay within the FCC Part 15.247 limits for 902-928

MHz. Label the node with its site name (the MeshCore name limit is 32 bytes, or 24 if a location is set) for operator reference.

Pre-Deployment Testing

Before mounting on-site, bench-test the complete assembly: cover the solar panel, run overnight to confirm the battery sustains operation for at least 12 hours, then expose to sunlight and verify MPPT charging resumes. Confirm the node is visible in the MeshCore companion app from at least 500 m away in open terrain before final installation.

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