Portable Go-Kit: Field-Deployable Mesh Node

A go-kit is a self-contained, rapidly deployable mesh node in a single weather-resistant case. It powers up in under 2 minutes. Runtime depends entirely on the battery, the node role, and display use: with the 12V 20Ah LiFePO4 pack specified below, a low-power RAK4631 will run for many days to weeks (see the corrected Power Budget); a small portable pack in client mode would give the shorter 12-48 hour figures sometimes quoted for compact kits.

Go-Kit Design Philosophy

The go-kit must satisfy three constraints:

1. **One-bag portability:** Everything fits in a carry-on-sized case. Target weight under 10 lbs including battery.
2. **Rapid deployment:** Someone with basic training should be able to set it up correctly in under 5 minutes.
3. **12+ hour autonomous operation:** Sufficient for most emergency activations without resupply.

Go-Kit Bill of Materials

Component	Choice	Notes
Case	Pelican 1510 or Nanuk 935	Carry-on size, weatherproof. The Nanuk 935 is the carry-on equivalent of the Pelican 1510; the smaller Nanuk 910 holds far less and is not interchangeable.
LoRa node	RAK4631 WisBlock	Lowest power; best for battery runtime
Battery	20Ah LiFePO4 12V (Dakota Lithium or Battle Born)	~256 Wh (12.8V nominal × 20Ah). Powers the node via the buck converter below - this pack runs a RAK4631 for weeks, not hours. Fuse and disconnect required (see safety note).

Component	Choice	Notes
Inline fuse + disconnect	Fuse holder sized to wiring + master switch	Fuse the battery positive lead at the battery terminal and add a master disconnect (see safety note below).
Charge controller	Victron MPPT 75/10	12/24V solar charge controller for the 12V LiFePO4 pack. Requires a solar panel with Vmp well above battery voltage (nominal 12V panel, Vmp ~18V).
12V→5V buck/USB regulator	12V to 5V USB buck converter	Required. The RAK4631 is a 3.3V nRF52 board powered via its USB/5V input - never feed 12V directly to the board. Wiring path: battery → fuse → MPPT → 12V bus → buck → 5V USB → RAK4631.
Solar panel	~25W foldable, nominal 12V (Vmp ~18V)	For extended deployments. Must have Vmp ~18V to work with the 75/10 on a 12V battery - a 5V USB-style panel will NOT work with this MPPT controller.
Antenna	915 MHz-tuned antenna (BNC base)	Use a proper 902-928 MHz antenna. A quarter-wave whip is only ~8 cm at 915 MHz; a generic 40 cm telescoping whip is non-resonant here (~1.2 wavelengths, high VSWR, poor performance). If you want collapsible, use one specifically tuned/loaded for the 902-928 MHz band.
Antenna cable	SMA to BNC, 3m	Allows antenna placement away from case
Display	OLED on RAK1921 module	Shows node status without phone

Battery safety: A 20Ah LiFePO4 cell can deliver hundreds of amps into a short - an unfused lead in a metal-tooled kit is an arc-flash and burn hazard. Fuse the battery positive at the terminal (sized to the wiring), include a master disconnect, and secure the battery so it cannot shift and short against tools or the case.

Power Budget

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RAK4631 system current depends heavily on role:
 - CLIENT / low-duty roles can average low single-digit to ~15 mA.
 - ROUTER / repeater role keeps the radio in continuous RX and disables sleep;
   community measurements report ~80-100 mA constant for a RAK19007 + RAK4631
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   in router mode. Measure your own setup before sizing.

Battery energy (use the pack's real voltage):
 - 12V LiFePO4 (12.8V nominal) x 20Ah = ~256 Wh
 - Capacity-based runtime (voltage-independent): 20,000 mAh / I_avg
     * at 15 mA (low-duty): ~1,333 h theoretical
     * at 100 mA (router): ~200 h theoretical
 - Derate ~2x for self-discharge, conversion losses, and TX:
   roughly 600+ h low-duty, ~100 h in router role.

For a 24-hour deployment:
 - Low-duty need: 24h * 15mA = 360 mAh
 - Router need:   24h * 100mA = 2,400 mAh
 - A 20Ah pack covers either easily; a 2Ah 18650 bank lasts ~5 days
   ONLY at ~15 mA - in router/repeater role (~100 mA) it lasts ~20 h.
   Measure your node's actual average current to size the pack.
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Deployment Checklist

- Place case on stable surface or tripod
- Extend or mount antenna (highest practical point - window, pole, rooftop)
- Connect antenna cable to node SMA connector
- Verify the battery positive lead is fused, then connect battery to charge controller; power the node through the 12V→5V buck regulator (never 12V direct to the board)
- Verify node powers on and OLED shows status
- Connect phone via Bluetooth and verify node joins network
- Send test message to confirm operation
- Note power level (if solar available, deploy panel south-facing)

Labeling and Documentation

Every component should be labeled inside the kit:

- Node ID and short name (on a label inside the lid)
- Channel key (in a sealed envelope or QR code sticker). Note: channel encryption is permitted for unlicensed Part 15 operation at stock RAK4631 power. It would be prohibited only if the kit were ever operated under an amateur (Part 97) license.
- Quick-start laminated card with 7 deployment steps
- Contact info for the kit owner
- Inventory list with last-check date

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