TACTICAL · OFF- GRID · MESHTASTIC

TAK HUB

LANCE

User Manual

LoRa ATAK Native Communication Extension

ATAK over Meshtastic & LoRa mesh networks

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TAKHUB GmbH · Germany

Contents

LANCE — **Lo**Ra **A**TAK **N**ative **C**ommunication **E**xtension — is an ATAK plugin that carries tactical data over a resilient off-grid LoRa mesh using Meshtastic radios. This is a hands-on operating manual: every function includes step-by-step **How to use** instructions so a new user can set up LANCE and confidently apply each feature in the field.

Part 5 · Settings & Radio

Part 6 · Limits & Best Practices

Part 7 · Troubleshooting

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PART 1

Getting Started

Install the plugin, connect a radio and get on the mesh — usually in under a minute, with no manual radio tuning.

Quick start — your first connection

1. Install **ATAK-CIV** on your Android device, then install the **LANCE** plugin, and open ATAK.
2. Power on your Meshtastic radio and pair it over **Bluetooth** (or plug it in over USB on Pro/Enterprise).
3. Wait for the link indicator to go from **yellow** to **green** — LANCE writes and verifies the radio configuration for you.
4. Make sure teammates run the **same region and operating mode**, then start sharing: drop a marker on the map and send it over the mesh.

1.1 Installation

LANCE is an ATAK plugin. Install **ATAK-CIV** on the device first, then install the LANCE plugin. **Free** is downloaded from Google Play; **Pro** is unlocked through a one-time in-app purchase on the same build; **Enterprise** is delivered through a separate organizational distribution and license flow.

Info

LANCE requires a compatible ATAK-CIV version and a Meshtastic-capable LoRa radio. Check the tested-hardware list before deploying.

1.2 First Launch

Open ATAK and tap the LANCE button in the toolbar. LANCE opens as a panel beside the map. Across the top are three tabs — Info, Events and User — plus a gear icon that opens LANCE Preferences. The link indicator shows whether a radio is connected and configured.

1.3 Connecting the Radio

LANCE connects to the radio directly — over **Bluetooth (BLE)** on every edition, or **USB serial** on Pro and Enterprise (hardware validation ongoing). Pair or plug in your Meshtastic device, then select it in LANCE. On connect, LANCE checks the radio against your selected operating mode and writes the effective channel template if needed — the link stays yellow (configuring) until the radio is verified, then turns green. You do not need the Meshtastic app for any of this. The connection, configuration and data exchange all run on our own proprietary codec — only the radio's stock firmware interfaces are used.

Important

Don't let a companion radio app hold the same radio while LANCE is operating. Keep radio ownership on the LANCE link. All radios on a mesh must share the same channel and region or they will not see each other.

How to connect a radio

1. On the radio: power it on and make sure no other app (e.g. the Meshtastic app) is connected to it.
2. In ATAK, open the LANCE panel and tap **Link** (or the connection indicator).
3. Choose **Bluetooth** and pick your radio from the scan list — or select **USB** if connected by cable (Pro/Enterprise).
4. Leave the radio untouched while the indicator is **yellow**; LANCE is writing and verifying the configuration. A brief red flash during the reboot is normal.
5. When the indicator turns **green**, you're on the mesh. If it stays yellow, see 7.2.

1.4 Connection Indicator

LANCE shows the radio link as a three-state indicator. It is readback-gated, so it never reports a link it hasn't actually verified:

State	Meaning
	No radio found. The phone can't see a radio over Bluetooth or USB — pair or plug one in, check it's powered, and make sure no other app is holding it.
	Configuring. LANCE is reading the radio's configuration, or writing your operating-mode template to it and verifying the result.
	Ready. The radio is connected and its configuration has been verified by readback against your operating mode — including the channel and PSK state.

The reboot is normal

When LANCE writes a new configuration, the radio reboots to apply it. The indicator briefly drops from yellow to red during that reboot, then returns to yellow while the new config is re-checked, and finally turns green once everything matches. A short red flash right after a settings change is expected behaviour, not a fault.

1.5 Recommended Hardware

The current tested LANCE baseline is a Meshtastic radio on the **RAK4631 / WisBlock** platform. Other Meshtastic-compatible radios may work, but should be treated as experimental until a successful LANCE field test — document the model, firmware and BLE behaviour first.

1.6 Permissions

Android requires Bluetooth and Location permissions for BLE scanning. Grant these on first launch; without them, LANCE cannot discover or connect to your radio.

PART 2

Architecture

How LANCE talks to the radio — a clean, proprietary stack on top of stock Meshtastic firmware.

2.1 A 100% Proprietary Codec

Everything about how LANCE talks to the radio is our own work. LANCE does **not** use open-source Meshtastic application code — not `mesh.proto`, and nothing taken from the Meshtastic companion app or the official Meshtastic ATAK plugin. We wrote our own codec, with our own protocols, and use only the documented interfaces of the stock Meshtastic firmware to exchange bytes with the radio.

That includes how LANCE connects over Bluetooth and USB, how it writes and verifies radio configuration, and how it frames and parses every payload. Each of these is an in-house implementation where we've made deliberate optimizations for the best possible field experience and the simplest onboarding.

2.2 The Lite Protocol Family

To carry ATAK data across a low-bandwidth LoRa mesh, we designed a dedicated, purpose-built standard for every ATAK function — and we call this set the **Lite family**. There's a protocol for each capability:

Protocol	Carries
PositionLite	Self position / PLI, as compact UPDATE and periodic FULL identity frames
MarkerLite	Markers and points, with acknowledgement-based delivery
ShapesLite	Circles, ellipses, rectangles and other shapes
RangeLite	Range & bearing lines
RouteLite	Routes and navigation lines
ChatLite	Text and CASEVAC, with modern short-string compression
AlarmLite	Emergency alerts (911, contact, geo-fence)

The Lite family is engineered for maximum information at minimum data. We use modern compression and strip out absolutely everything that isn't needed — only what's required to faithfully reconstruct a complete CoT message on the far side is ever transmitted. The guiding principle is simple: **every byte that doesn't have to be sent, isn't.** That's how a position update lands in roughly 8 bytes and most actions stay near 35 bytes on the air.

2.3 Stock Firmware, Proprietary Stack

To be unambiguous about where the line sits:

- **The radio firmware is stock Meshtastic.** You flash and run the standard, unmodified Meshtastic firmware on your device.
- **Everything above the firmware interface is LANCE.** The connection handling, configuration provisioning, the codec and the entire Lite protocol family are 100% proprietary, in-house development.
- **We use only public firmware interfaces.** LANCE communicates with the radio the way any client is intended to — through the firmware's documented BLE/serial interfaces — and nothing else.

> **In short**
> Stock firmware on the radio, a clean proprietary stack everywhere else. That separation is what makes LANCE both highly optimized and fully legal to sell.

2.4 How Received Objects Are Named

To keep transmissions tiny, LANCE never sends an object's name over the mesh — only a small type code and two identifiers. Each receiver builds a short, readable name on its own, so the same marker, shape or line shows the **same** name on every device without a single extra byte on the air.

A received name has two parts — a descriptive label and a five-character code — for example `HostileMine K7QM2`:

- **The label** is looked up on your own device from the object's type — a hostile mine becomes `HostileMine`; shapes become `Circle`, `Ellipse` or `Rectangle`.
- **The first 3 characters** identify the sender. They are a fixed fingerprint of that radio, so the same teammate always shows the same three characters — you quickly learn to recognise who an object came from.
- **The last 2 characters** identify the individual object. They are scrambled so they don't look like a running count, which keeps names distinct even when one sender shares many objects.

The five characters are a compact mix of digits and capital letters (not a plain number), so you'll also see names like `Rectangle 9F2QX`.

> **Why it's done this way**
> Because the name is computed rather than transmitted, it costs no airtime and is identical on every connected device. It is generated by the receiver, so it won't match a free-text name the sender may have typed on their own screen.

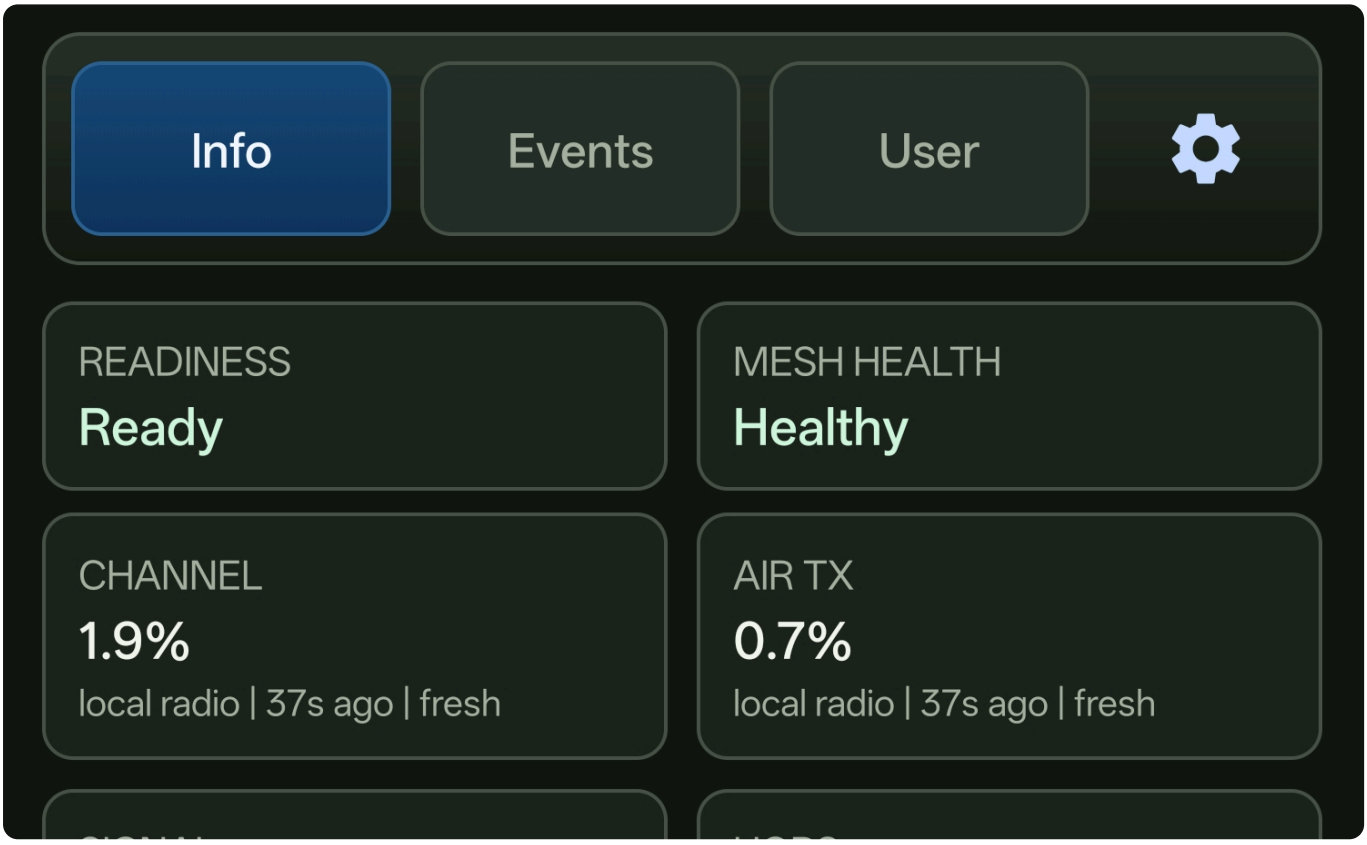
PART 3

The LANCE Menu

Everything you operate day to day lives in one plugin panel: Info, Events and User, plus the ATAK radial menu.

3.1 Opening the LANCE Menu

LANCE opens in ATAK as a panel beside the map. Open it from the ATAK toolbar (or the plugin/overflow menu) to reveal the LANCE panel. Across the top are three tabs — **Info**, **Events** and **User** — and a settings gear that opens `LANCE Preferences`. You can also reach the same preferences through ATAK `Settings → Tool Preferences → Specific Tool Preferences → LANCE Preferences`.



The LANCE panel beside the map, showing the Info, Events and User tabs and the settings gear.

3.2 Info Tab

The Info tab is your status-at-a-glance surface. It shows:

- **Local node identity** — the connected radio's node and your own call sign / identity as it goes out over the mesh.
- **Lite-family readiness** — whether Marker, Shape, Range and the other Lite functions are ready to send on the current link.

- **Live radio metrics** — current signal (RSSI), SNR, battery and hop information, plus the link state (configuring / yellow vs verified / green).

> **Read the link first**
> If the Info tab shows the link as configuring (yellow), give LANCE a moment to verify the radio before relying on sends — see 7.2 Link Stays Yellow.

3.3 Events Tab

The Events tab is the shared sync list for the **Lite protocol family**: every Lite-family object you create, receive, or delete shows up here as a card — markers, shapes, range & bearing lines, routes and more. (Position/PLI is automatic and does not appear here.) Every card carries:

- a family icon for its type — e.g. `Marker`, `Shape`, `R&B` (range & bearing) or `Route`;
- the object's display name, family and revision;
- an `ACK n` (acknowledgement) count on markers and range lines once confirming peers reply;
- a coloured status stripe, an action button, and a separate delete (trash) button.

The action button reflects exactly what the entry needs:

Button	Meaning
Send	A new or changed local object is waiting to sync to the mesh.
Sending	An update is in flight; a second send from the same card is blocked.
Sent	The current revision is synced, or a received remote object is being tracked.
Resend / Retry	The last send or delete failed (e.g. `no radio connected`, `timed out`) and can be tried again.
Deleting / Deleted	A delete is in flight, or the entry is a finished local delete / remote tombstone.

A **Send all** header appears whenever anything is pending and sends across all pending families at once (with a confirmation first). Finished **Deleted** and tombstone cards are hidden by default; the **Show deleted** toggle at the end of the list reveals up to the 300 most recent. A normal tap on an active card recentres the ATAK map on that object — the marker, the shape's centre, or the start of the range line. A **long-press** pins or unpins a card: a pinned card keeps its status colour but gets a thicker border and stays at the top, above a divider that separates pinned entries from the rest (see 3.5).

> **Status colours**
> Yellow stripe = pending / sending · green = sent or remote-tracked · red = delete pending · grey = deleted / tombstone. Pinned cards keep their status colour but get a thicker border, and a divider line separates pinned entries from the rest of the list.

3.4 User Tab

The User tab lists the mesh participants LANCE knows about — the contacts and nodes around you, drawn from received PLI and node info. Use it to see who is on the mesh, jump to someone on the map, and control how their traffic reaches you. Each user entry supports two actions — **pin** and **mute**:

- **Pin a user** — exactly the same idea as pinning a marker. Long-press the entry to keep that contact at the top of the list — its border thickens and it sits above a divider that separates pinned from unpinned entries. Handy for keeping key team members in view.
- **Mute a user** — silences that contact completely. While a user is muted, **every incoming object from them is discarded and never shown** — chat messages, markers, shapes, routes and any other events — until you unmute them.

How to mute and unmute a user

1. Open the **User** tab and find the contact you want to silence.
2. Tap **Mute** on their entry. LANCE asks you to **confirm** first — this deliberate extra step prevents muting someone by accident.
3. Confirm. From now on, anything that user sends over the mesh is dropped on arrival and won't appear on your map or in your lists.
4. To bring them back, tap **Unmute**. Unmuting takes effect **immediately, with no confirmation**, so you can lift the silence quickly when you need that contact again.

Local only

Muting and pinning are local UI states on your device. They are never sent over the mesh, and a muted user is not notified. Mute simply discards their traffic on your end while it is active.

3.5 Pinning & Focus

The Events and User lists share two interactions — **tap to focus** and **long-press to pin**:

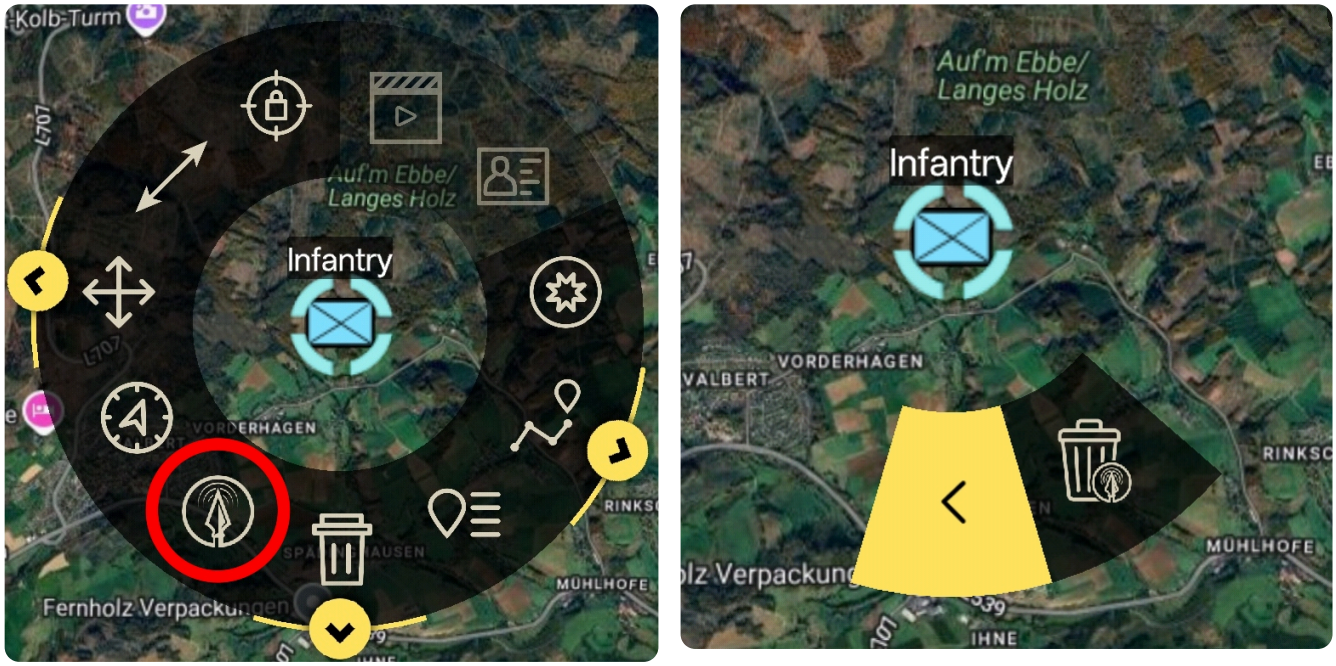
- **Tap to focus** — tap any active entry and the map recentres and zooms straight to that object: a contact's last known position in the User list, or a marker, shape or route in the Events list. It's the fastest way to locate a specific user or item on the map.
- **Long-press to pin** an active card to pin or unpin it. The pinned card gets a thicker border and moves to the top, above a divider that separates pinned entries from the rest.
- You can pin several entries — they stack in the order you pinned them (first pin highest).
- Unpinning returns the entry to its normal, stable position in the list.
- Delete and tombstone cards can't be pinned, and tapping them doesn't recentre the map.
- Pins are a UI convenience of the current panel only — they aren't saved to history or sent over the mesh, so they may not survive a plugin restart.

3.6 The ATAK Radial Menu

The **radial menu** is ATAK's circular action menu that appears when you tap (or long-press) a map object — markers, shapes and range lines fan out a ring of quick actions around the item. LANCE plugs into it so you can act on an object *directly on the map*, without first opening the LANCE Events tab:

- **Send over mesh** — push the selected object onto the LoRa mesh straight from its radial menu.
- **Delete over mesh** — remove it locally and, where supported, across the mesh, in one action. To reach it, press and hold the trash (delete) icon in the radial menu until the Delete over mesh action appears.

This keeps the common workflow — drop a marker, send it; remove a marker, delete it everywhere — at your fingertips on the map, while the Events tab remains the place to review status, retry failed sends, and manage history.



The ATAK radial menu: the LANCE “Send over mesh” action (left). Press and hold the trash icon to reveal “Delete over mesh” (right).

PART 4

Core Functions

The tactical data LANCE carries across the mesh — positions, markers, shapes, routes, chat, emergencies and node status.

4.1 Position Sharing (PLI)

Position location information (PLI) is automatic self-position sync. It sends on a configurable reporting interval as two frame types: a compact **UPDATE** (position only, ~8 bytes) most ticks, and an occasional **FULL** frame that re-establishes identity — call sign, team colour, role and battery. A short burst of FULL frames goes out after the radio links up and whenever your identity changes, then it settles into roughly one FULL for every nine UPDATEs. PLI is fire-and-forget (no acknowledgement), which keeps it light.

UPDATE FRAME	FULL FRAME
~8 bytes · position	**identity + battery**
CADENCE	DELIVERY
≈ 1 FULL : 9 UPDATEs	**Fire-and-forget**

How to use it

1. Set your **call sign and identity** in ATAK as usual — this rides the periodic FULL frame.
2. Once the link is **green**, position sharing is **automatic**; there is nothing to send by hand.
3. Adjust how often it transmits under **Preferences → Position Reporting Interval** (see 5.5).
4. Confirm teammates appear on your map and in the User tab as their PLI arrives.

How others know your position is current

You choose how often your position goes out in **Preferences → Position Reporting Interval**. That chosen interval is announced to everyone in each **FULL** identity frame, so each teammate knows when to expect your next position update. LANCE tracks that expected time for every user — if a PLI doesn't arrive when it should, that user's marker on the map turns **grey** after a short grace period to signal that the position is stale.

4.2 Marker Sharing

Markers are sent across the mesh and reconstructed as native ATAK objects on the receiver. Delivery is acknowledgement-based: a marker turns green only after a real remote ACK, not when transport merely progresses. You can send and delete markers straight from the ATAK radial menu, or manage them from the Events tab.

How to send & delete a marker

1. Place a marker in ATAK as you normally would (toolbar tool, or long-press the map and choose a type).
2. Tap the marker to open its **radial menu** and choose **Send over mesh** — or open the LANCE Events tab and tap **Send** on its card.
3. Watch the card: it turns **green** and shows `ACK n` once remote plugins confirm receipt.
4. If a send fails (e.g. `no radio`, `timed out`), tap **Resend / Retry**.
5. To remove it everywhere, **press and hold** the trash icon in the radial menu and choose **Delete over mesh** — or tap **Delete** on the Events card. Network-wide delete works on **every edition**, including Free.

4.3 Shapes

LANCE shares ATAK's drawing objects — **circles, ellipses/ovals, rectangles** and more — as lightweight mesh objects, with acknowledgement-based delivery. By release, LANCE supports **all shape types**; a shape that is too complex to fit a compact mesh payload is **simplified to fit** — exactly the way routes are — rather than dropped, so its overall form is preserved. Shapes carry the full 24-bit RGB colour, so the colour you draw is reconstructed faithfully on every connected client.

How to share a shape

1. Use ATAK's drawing tools to create a **circle, ellipse or rectangle**.
2. Set its colour in ATAK — the exact colour is preserved across the mesh.
3. Tap the shape to open its **radial menu** and choose **Send over mesh** (or use the Events tab).
4. Keep shapes simple — fewer vertices means less airtime and faster, more reliable delivery.

4.4 Range & Bearing Lines

A **Range & Bearing** line (R&B) communicates distance and direction between two points — useful for showing standoff, coverage, or a pointer to a feature. R&B lines are shared as lightweight mesh objects with acknowledgement-based delivery, and rebuild as native ATAK objects on every connected client with their colour preserved.

How to share a range & bearing line

1. Create a **Range & Bearing** line with ATAK's R&B tool — set the start point, then the endpoint.
2. Tap the line to open its **radial menu** and choose **Send over mesh** (or use the Events tab).
3. Confirm delivery on its Events card — it turns **green** and shows `ACK n` once peers confirm.

4.5 Routes

Routes and navigation lines are shared across the mesh and rebuilt as native ATAK routes on every connected client, with acknowledgement-based delivery and the route's full RGB colour preserved. A whole route is sent within a single normal mesh payload — which is exactly why a very large route may not arrive point-for-point identical. Here's what governs that:

- **Original detail:** a source route of up to **65,535** points can be processed.
- **On-the-wire cap:** the transmitted route holds up to **255** points (minimum 2).
- **Fit, don't truncate:** if a route is too detailed for the payload, LANCE simplifies it to fit rather than cutting it off — the start, end and overall shape are retained.
- **Bounded deviation:** when a route does need simplifying, LANCE keeps the simplified line within a small, automatically chosen distance of your original — it never just "rounds off" to kilometres. For everyday routes that distance is effectively negligible (well under a metre to a few metres), so they stay accurate. The much larger end of the range only ever comes into play for extreme, continent-scale routes with tens of thousands of points, where a little deviation is unavoidable to make them fit at all.
- **Efficient encoding:** points are stored as compact relative steps at about 1 m precision, so straightforward routes stay small without any simplification at all.

> **Why my route looks slightly different**
> If a long, highly detailed route arrives with gentle bends smoothed out, it was simplified to fit the mesh — always within the tolerance bound, so it never strays meaningfully from the line you drew. Keep routes shorter or with fewer points to preserve maximum fidelity.

How to share a route

1. Build a route in ATAK as usual — add your waypoints in order.
2. Set the route colour in ATAK; it is carried with the route.
3. Tap the route and choose **Send over mesh** (or send it from the Events tab).
4. For very long or dense routes, split them or reduce points to preserve maximum fidelity — minor smoothing within the tolerance bound is expected.

4.6 Chat

Chat sends compact text across the mesh from ATAK's normal chat tool — to all chat rooms, or as a direct 1:1 message to a live map contact. Messages are compressed to fit more text into a single LoRa packet, so you'll rarely hit the limit on normal tactical traffic, and are kept brief to protect channel airtime.

> **Pro only**
> Chat is available in LANCE Pro and Enterprise.

How to send a chat message

1. Open ATAK's normal **chat** tool.
2. Send to **All Chat Rooms** to reach the whole team, or pick a live map contact for a direct **1:1** message.
3. Keep it concise — each message is compressed and sent as a single LoRa packet; very long messages are trimmed (you're told when).

4.7 CASEVAC (9-line)

CASEVAC provides a structured **9-line casualty-evacuation** workflow. Instead of free text, you fill in the standard fields; LANCE sends them compactly over the mesh and rebuilds a proper ATAK medical event on the receiver — so the essential details stay consistent and readable under pressure.

Pro only
The CASEVAC workflow is available in LANCE Pro and Enterprise.

How to send a CASEVAC 9-line

1. Open the **CASEVAC / 9-line** workflow.
2. Fill in the structured fields — priority, patient counts, status and the supported 9-line entries.
3. Send; it rebuilds as a proper ATAK **medical event** on the receiver.

4.8 Emergency Alarms

LANCE listens to ATAK's stock **Alarm Tool** and sends the supported alerts over the mesh automatically — 911 Alert, Ring the Bell, Troops in Contact and Geo-fence Breached, plus the matching cancel. There is no separate LANCE alarm screen: trigger the emergency in ATAK's Alarm Tool and it rebuilds as a standard ATAK alert on remote clients. Cancels bypass rate-limiting so alert termination is delivered immediately.

How to raise & stand down an alarm

1. Trigger an emergency with ATAK's **Alarm Tool** — 911, Ring the Bell, Troops in Contact, or a geo-fence breach.
2. LANCE detects it and sends it over the mesh **automatically** — there is no separate LANCE control to find.
3. Confirm teammates see the standard ATAK alert appear on their map.
4. To stand down, **turn the emergency off** in ATAK; the cancel propagates immediately and clears the alert everywhere.

4.9 Node Status

The node view reports RSSI, SNR, battery and hop distance for connected radios, giving you an honest read on link quality before you depend on it.

How to read your link

1. Open the Info tab to see live **RSSI**, **SNR**, **battery** and **hop** figures.
2. Treat RSSI down toward **−112 dBm** as the usable floor, and watch for a positive **SNR**.
3. If the signal is marginal, reposition for line-of-sight, improve the antenna, or add a relay node between you and the team.

PART 5

Settings & Radio

Region, operating-mode presets, modem trade-offs, encryption and the per-edition controls — all written and verified for you.

5.1 Region & Frequency Bands

Region is the first radio setting, and it decides which legal sub-GHz frequency band the radio uses. It defaults to **EU** and is chosen independently of your operating mode — presets don't come in separate EU/US variants, they simply apply on top of the region you've picked.

Region	Band	Availability
EU868	868 MHz (Europe)	All editions · default
US915	915 MHz (US)	All editions
ANZ, Japan, Korea, Ukraine 868, India, Brazil, Taiwan, Thailand, Malaysia 919, Singapore 923, Philippines 915, Kazakhstan 863, Nepal 865	regional sub-GHz	common legal band per market
433 MHz, EU SRD variants, New Zealand 865	alternate / SRD	Pro
Every supported region	—	Enterprise

⚠ **Use your legal band**
Every radio on the mesh must run the same region. Non-standard or region-locked entries — such as 2.4 GHz LoRa, amateur 2 m bands, and the China and Russia regions — are intentionally not supported. Switching EU868 ↔ US915 reconfigures the radio and triggers a reboot/reconnect.

How to set your region

1. Open **LANCE Preferences** (the gear in the LANCE panel).
2. Open **Region** and choose the legal band for your country (default `EU868`).
3. Make sure **every radio** on the mesh uses the **same** region.
4. The link re-verifies after a change — wait for green before relying on it.

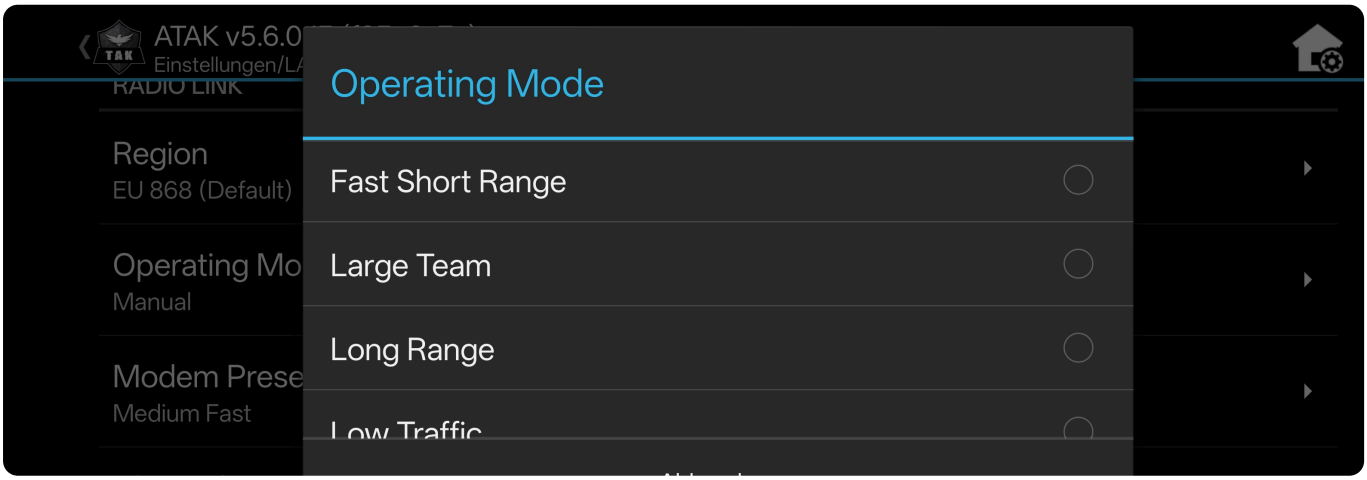
5.2 Operating Modes & Presets

The `Operating Mode` picker chooses a scenario-oriented preset that fills the detailed radio values for you — modem speed, channel, hop limit, position interval, ACK and rebroadcast — so you don't have to understand Meshtastic internals to be set up correctly. In a preset, those values are visible but locked; **Manual** mode unlocks them for expert control where your edition allows.

Free exposes the single `LANCE Free` preset. **Pro** adds the full preset set plus Manual mode. Each preset's effective values:

Preset	Modem	Hop	PLI	ACK	Rebroadcast	Tier
LANCE Free	Medium Fast	1	60 s	off	ALL	Free +
Pro	Long Fast	3	30 s	on	LOCAL_ONLY	Pro
Fast Short Range	Short Fast	2	10 s	on	LOCAL_ONLY	Pro
Large Team	Medium Fast	2	120 s	off	LOCAL_ONLY	Pro
Long Range	Long Slow	4	300 s	off	LOCAL_ONLY	Pro
Low Traffic	Long Fast	2	600 s	off	LOCAL_ONLY	Pro
Manual	All expert values editable and provisioned					Pro / Ent

`LANCE Free` keeps rebroadcast `ALL` in both Free and Pro so Pro users can stay compatible with the Free baseline. All other managed presets use `LOCAL_ONLY` to keep the focus on the local LANCE mesh and avoid relaying unrelated traffic. Changing a preset or a provisioning value drops the link out of green and re-verifies the radio before going green again.



The Operating Mode picker in LANCE Preferences.

How to choose an operating mode

1. Open **LANCE Preferences** → **Operating Mode**.
2. Pick the preset that matches your scenario (e.g. **Fast Short Range** for close, dense teams; **Long Range** for spread-out teams). On Pro, choose **Manual** for full control.
3. Wait for the link to re-verify and return to **green**.
4. Ensure the **whole team** runs the same preset / modem — mismatched modems can't hear each other.

5.3 Modem Presets Explained

A modem preset is the LoRa trade-off between **speed** and **range**. Faster presets move data quicker and use less airtime per message, but reach less far; slower presets travel further but cost more airtime and add latency. From fastest/shortest to slowest/longest:

Preset	Character	Good for
Short Fast	fast, short reach	dense teams at close range; lowest airtime
Short Slow	—	short range with a little more robustness
Medium Fast	balanced (Free default)	general use; good all-round baseline
Medium Slow	—	medium range, more robust
Long Fast	long reach, still brisk (Pro default)	the typical tactical sweet spot
Long Moderate / Long Slow	longer, slower	extended range, sparse teams
Very Long Slow	maximum reach	longest range; highest airtime, lowest throughput

Why no Short Turbo?
`SHORT_TURBO` is the fastest Meshtastic preset, but it uses a wider bandwidth that isn't legal in every region — so it isn't exposed in the LANCE preset list. Whatever preset you pick, every radio on the mesh must use the same one.

5.4 Channel & Encryption (PSK)

Mesh traffic is carried on a named radio channel, and encryption is set by that channel's pre-shared key (PSK). LANCE offers three PSK modes:

- **No encryption** — the channel runs with an empty key. This is the **Free** default (channel `LANCE-free`).
- **LANCE default key** — a managed key for the LANCE mesh.
- **Custom 256-bit key** — your own encryption profile.

Custom keys and the LANCE managed key are **Pro and Enterprise** capabilities; Free operates without encryption. A custom PSK is never shown in summaries, logs or field-log exports — diagnostics keep only a non-secret length and checksum, never the key itself. After any channel or key change, LANCE re-verifies the radio

(including the PSK state) before the link goes green, so a misconfigured key shows as *configuring* rather than silently failing.

> ☆ **Pro only**
> Encryption (a LANCE managed key or a custom 256-bit PSK) requires Pro or Enterprise. Free runs an open channel.

How to set encryption `Pro`

1. Open **LANCE Preferences** and find the channel / encryption setting.
2. Choose **No encryption**, the **LANCE default key**, or a **Custom 256-bit key**.
3. Share the chosen key with your team **out-of-band** (not over the open mesh) so everyone matches.
4. Wait for the link to re-verify to **green**; a mismatched key shows as *configuring* rather than silently failing.

> **Working with a custom key**
> For a **Custom 256-bit key** you can either paste in your own key, or have LANCE **generate** one for you. A generated key can then be **copied to the clipboard** or shown as a **QR code** so teammates can read it in. Automatically importing a custom key for a user is an **Enterprise** feature.

5.5 Position Reporting Interval

How often your own position (PLI) goes out is set by the `Position Reporting Interval`. You can choose from a set of cadences — `10 s, 30 s, 60 s, 120 s, 300 s, 600 s, 1200 s, 1800 s` — and each preset comes with a sensible default (LANCE Free uses 60 s, the Pro preset 30 s, Long Range 300 s, and so on).

LANCE sends a short burst of full identity frames when the radio first links up and whenever your identity changes, then settles into roughly one full frame for every nine compact updates. Shorter intervals give a fresher picture but cost more shared airtime as the team grows — see 6.1 LoRa Airtime & Duty Cycle for planning figures.

> **No reconnect needed**
> Position interval and Request ACK are runtime behaviour settings, not radio provisioning — changing them takes effect immediately without dropping the link or re-verifying the radio.

How to set the reporting interval

1. Open **LANCE Preferences** → **Position Reporting Interval**.
2. Pick a cadence — shorter (e.g. `30 s`) for a fresher picture, longer (e.g. `300 s`) for bigger teams or less airtime.
3. The change applies **immediately** — no reconnect. Check 6.1 to keep total channel load healthy.

5.6 Request ACK

`Request ACK` controls whether your transactional objects (markers, shapes, range lines) ask receivers for a confirmation. With ACK on, an object turns green only after a real remote plugin confirms it, and the Events card shows an `ACK n` count of unique confirming peers. With ACK off, sends are fire-and-forget.

Free sends with ACK **off** by default; the Pro preset turns it **on**. Position/PLI never uses ACK regardless of this setting — freshness comes from the next interval tick. See 6.4 ACK & Confirmed Delivery for how retries and airtime work.

5.7 Free vs Pro Settings

A quick reference for what's adjustable in each edition:

Setting	Free	Pro
Operating mode	LANCE Free only	All presets + Manual
Region	Common legal band	+ alternate & SRD bands
Modem preset	Preset-managed	Editable in Manual
Encryption (PSK)	None (open channel)	LANCE key or custom 256-bit
Hop limit	Preset-managed	Editable (1–7)
Position reporting interval	Adjustable	Adjustable
Request ACK	Off (managed)	On by default, editable
Relay / bridge to server	—	Optional light scope
Delete Lite History	—	Available
USB serial transport	—	Available

Enterprise
Enterprise adds centrally managed presets, curated device roles (including a hidden tactical role), signed configuration packages and policy-managed control on top of everything in Pro.

PART 6

Limits & Best Practices

LoRa is built for range, not throughput. Plan around airtime and the channel — these figures keep a mesh healthy.

6.1 LoRa Airtime & Duty Cycle

LoRa is built for range, not throughput. On the LongFast modem preset the nominal data rate is roughly 1 kbps, and EU868 allows about a 10% duty cycle per transmitting radio. Channel load is the aggregate airtime of every radio sharing the slot — so plan intervals and team size around the channel, not the byte count.

Planning figure	Approx. value	Notes
Airtime per acknowledged object	~1 s	Send + ACK on LongFast
PLI cadence cost (30 s)	~1.6% / device	Compact position update
~5 devices @ 30 s PLI	~8% aggregate	Before markers / shapes / chat
Usable RSSI floor	down to −112 dBm	Terrain dependent

⚠ **LoRa limitation**
Bursts dominate congestion. A large batch of object sends cannot fit cleanly into one minute on LongFast — rate limiting, batching and ACK policy matter more than shaving a byte.

6.2 Object & Payload Size

LANCE objects are deliberately compact — on the order of tens of bytes over the air. A position UPDATE is around 8 bytes of payload, a marker around 16, a shape 16–23, and a delete just 6; over the air, including LoRa overhead, most actions are roughly 35 bytes. Coordinates use a compact quantization with about 1.2 m precision in latitude (and finer toward the poles in longitude), so the picture stays accurate while the packets stay tiny. The limiting factor on LongFast is airtime, not payload size — concise, field-relevant data is always the right design.

6.3 Range & Hops

Line-of-sight range can reach kilometres; dense terrain reduces it sharply. Each relay is a hop — more hops extend reach but add latency and airtime. The Free preset uses a conservative hop limit; presets raise it where appropriate.

6.4 ACK & Confirmed Delivery

An **ACK** (acknowledgement) is a small reply a receiver sends back to confirm it actually got your object. LANCE uses ACKs to make delivery honest: a marker, shape or range line turns green only after a *real* remote ACK — not when the radio merely reports transport progress. The Events card then shows `ACK n`, counting unique confirming peers (a teammate three hops away still counts as one).

If no ACK arrives, LANCE retries the send **once after 30 seconds**, then stops — it won't keep hammering the channel. Receivers reply with a single ACK, lightly jittered to avoid everyone answering at the same instant. Because each acknowledged action costs both the send and the return ACK, confirmed delivery is reliable but not free in airtime — roughly a second per acknowledged object on LongFast. Position/PLI is deliberately fire-and-forget and never acknowledged, which keeps it cheap.

> **Tunable**
> Request ACK is off by default on Free and on by default with the Pro preset — see 5.6 Request ACK.

6.5 Battery Usage

Continuous radio activity draws power on both the phone and the radio. Longer reporting intervals and conservative hop limits extend field endurance.

PART 7

Troubleshooting

The four issues you're most likely to hit in the field, and how to clear them.

7.1 Device Not Found

Confirm Bluetooth and Location permissions are granted, the radio is powered and in range, and no companion app is holding it. Re-scan from the LANCE link panel and keep radio ownership on the direct BLE path.

7.2 Link Stays Yellow

Yellow means LANCE is still verifying or rewriting the radio to match the selected operating mode. Give it a moment after connect or a preset change; if it persists, the radio config (channel, region, PSK state) does not yet match the template. Confirm the radio isn't locked to an old channel name.

7.3 Nothing Received

Verify all radios share the same channel, region and PSK state. Mismatched settings silently prevent nodes from seeing each other.

7.4 Poor Signal

Check RSSI and SNR in the node view. Improve antenna placement, reduce obstructions, or add a relay node to bridge the gap.

APPENDIX A

Editions & Licensing

Free, Pro and Enterprise — what each unlocks and how it is distributed.

A Editions & Licensing

Edition	Price	For	Distribution
Free	€0 · permanent	Getting started, learning the mesh, simple off-grid ATAK workflows	Google Play
Pro	€14.99 · one-time	Power users, professionals and small-to-mid teams needing full control	Google Play (in-app unlock)
Enterprise	Per-device · on request	Organizations needing deployment, governance, security and fleet control	Separate organizational flow

Free is permanently usable — not a time-limited trial. It covers position sharing, basic marker send & receive, baseline shapes & range, and emergency alarms, on the single `LANCE Free` preset over an open channel.

Pro adds the full preset set and Manual mode, manual radio configuration, custom PSK / encryption, chat & CASEVAC workflows, network-wide marker delete, the optional light server relay, USB serial transport and Delete Lite History.

Enterprise adds mass & remote enrollment, fleet management & statistics, remote device & radio control (safety-gated), signed configuration packages, offline signed licensing, centrally managed presets, curated device roles, and policy-managed governance.

Privacy

LANCE is offline-first and on-device. Your positions, markers, messages and radio configuration are not transmitted to TAKHUB. Diagnostics never store secrets such as encryption keys.

APPENDIX B

Glossary

Key terms used throughout this manual.

B Glossary

Term	Meaning
ATAK / ATAK-CIV	Android Team Awareness Kit — the situational-awareness app LANCE plugs into.
Meshtastic	Open-source firmware and ecosystem for LoRa mesh radios. LANCE uses the stock firmware's documented interfaces.
LoRa	Long-range, low-bandwidth sub-GHz radio modulation. Great reach, very small payloads.
Mesh	A self-forming network where each radio can relay for others — no central server or tower.
CoT	Cursor-on-Target — ATAK's data format for positions, markers and events.
PLI	Position Location Information — a participant's self-position broadcast.
Lite family	LANCE's proprietary, compact protocols (PositionLite, MarkerLite, …) tuned for LoRa.
ACK	Acknowledgement — a small return packet confirming an object was received.
R&B	Range & Bearing line — distance/direction graphic shared across the mesh.
CASEVAC	Casualty Evacuation — a structured 9-line medical report.
PSK	Pre-Shared Key — the channel encryption key.
Hop	One relay step between radios. More hops extend range but add latency and airtime.
Duty cycle	The legal share of time a radio may transmit on a band (≈10% on EU868).
RSSI / SNR	Received Signal Strength / Signal-to-Noise Ratio — link-quality metrics.