What Is LoRa? (For Beginners)

LoRa stands for "Long Range." It is a radio modulation technique from Semtech that enables very long range wireless communication at very low power, at the cost of low data rates - the physical layer beneath Meshtastic and MeshCore.

How it works

LoRa uses **chirp spread spectrum** - the signal is spread across a wide frequency band using a continuously sweeping chirp tone. This spreading gives LoRa extraordinary resilience to noise. A receiver can decode a packet even when the signal is far below the background noise floor - a capability few low-cost radio systems offer. (Other spread-spectrum schemes, such as GPS, also operate below the noise floor.)

Key characteristics

- **Range:** 1 - 15 km typical; 30 - 50+ km achievable with elevated antennas
- **Data rate:** 0.2 - 22 kbps depending on preset - slower than a 1990s modem, but sufficient for text and GPS
- **Power:** Nodes run days to weeks on a small battery; active current is roughly 10 - 30 mA for nRF52-based boards and 40 - 100+ mA for ESP32-based boards. Days-to-weeks battery life applies mainly to nRF52-class hardware; size your battery for your specific board.
- **No subscription:** Operates in the unlicensed 902 - 928 MHz ISM band in North America. No SIM, no carrier fees.
- **License-free:** Standard operation under FCC Part 15.247 requires no amateur radio license

What LoRa is NOT

- **Not WiFi:** Far slower, far longer range. No web browsing or streaming.

- **Not cellular:** No towers, no coverage maps, no subscription. Works anywhere two nodes are within radio range of each other.
- **Not LoRaWAN:** LoRaWAN is a specific hub-and-spoke IoT architecture. Meshtastic and MeshCore are peer-to-peer mesh networks. Same radio hardware, completely different protocols. See the LoRa Mesh vs. LoRaWAN page for the full comparison.
- **Not Bluetooth or Zigbee:** Those are short-range (meters). LoRa is long-range (kilometers).

Why 915 MHz?

The 902 - 928 MHz ISM band is the North American LoRa mesh standard because it is unlicensed under FCC Part 15, has better building and vegetation penetration than 2.4 GHz, and yields practical antenna sizes (~8 cm quarter-wave).

The fundamental tradeoff

LoRa's extreme range comes at the cost of speed. A 50-byte text packet takes several hundred milliseconds to transmit. This is fine for messaging and GPS tracking - and impossible for voice, video, or large files. Design your use case around this constraint and LoRa delivers remarkable results.

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