

LoRa Devices and Mesh Networking

LoRa (Long Range) is a wireless radio modulation technique designed for low-power, long-distance communication. It is optimised for transmitting small amounts of data over several kilometres while using minimal energy, making it suitable for remote monitoring, sensor networks, and off-grid communications. LoRa defines only the physical radio layer, while LoRaWAN adds networking infrastructure and gateway management. However, many private and decentralised systems use LoRa independently of LoRaWAN.

In the United Kingdom, LoRa devices typically operate licence-exempt within the 868 MHz ISM (Industrial, Scientific and Medical) radio band, provided they comply with Ofcom regulations on transmission power, duty cycle limits, and interference management. Typical devices operate at up to 14 dBm (25 mW). Although encryption is not required by regulation, many systems use it to improve security and privacy.

Meshtastic is an open-source decentralised mesh communication platform that operates over LoRa radio hardware. It enables long-range text messaging and data exchange without relying on mobile networks or internet infrastructure. Meshtastic is commonly used for outdoor activities, emergency communication, and IoT applications where resilient off-grid networking is required.

MeshCore, developed by Liam Cottle, is another LoRa-based platform focused on encrypted text communication. It is intended for applications including disaster recovery, tactical communication, private security, and sensor networks. Both systems demonstrate how LoRa can support resilient communication in areas where traditional infrastructure is unavailable.

A wide variety of hardware devices can be used with LoRa mesh systems, with different trade-offs in power consumption, connectivity, and cost. Many devices can also support GPS or environmental sensors for location tracking and monitoring applications.

The **LilyGO T-Deck** is a portable handheld device with an integrated keyboard and display, making it suitable for standalone field communication. It also includes Wi-Fi, Bluetooth, USB-C charging, and expandable storage.

The **RAK4632** is designed for ultra-low-power operation and is well suited to solar-powered or long-life battery installations. It does not include Wi-Fi but supports Bluetooth Low Energy functionality through its nRF52840 microcontroller.

The **Heltec Wireless Stick V3** is one of the most widely used LoRa development boards due to its low cost and integrated Wi-Fi and Bluetooth connectivity. It is particularly useful for prototyping and applications requiring internet connectivity or web-based configuration, although its higher power consumption makes it less suitable for long-term battery-powered deployments.

The **Faketec** project provides a low-cost DIY alternative using freely available PCB designs and inexpensive fabrication services. In summary, LoRa mesh technologies provide flexible, energy-efficient, and resilient communication systems suitable for applications ranging from hobbyist projects to emergency communications and IoT infrastructure.