LoRa Range: Realistic Expectations

Range is the most common question new users have, and the most complex to answer accurately. LoRa range depends on antenna height, terrain, preset configuration, and environmental conditions. Here's how to set realistic expectations for your deployment.

The Honest Range Summary

The figures below are community-reported estimates, not measured specifications. Real-world range varies widely with antenna height, terrain, preset, and line of sight, and the longer brackets assume clear line of sight between elevated antennas. Treat them as rough planning aids and confirm with an on-site range test.

Environment	Typical Range (stock antenna)	Typical Range (good external antenna)
Open flat terrain, low antennas	2-5 km	8-20 km
Suburban (houses, trees)	0.5-2 km	2-6 km
Dense urban (buildings)	200m - 1 km	1-3 km
One node elevated (hilltop/tower), line of sight	5-15 km	15-50 km
Both nodes elevated (mountain ridge), clear line of sight	20-80 km	50-200+ km

The largest factor in real-world range is antenna elevation. Raising an antenna from ground level to 30 feet (10m) often improves range dramatically - largely by clearing local rooftops, trees, and other clutter so more of the path has line of sight. Getting up to 100 feet (30m) can extend useful range much further still. The exact gain depends entirely on the surrounding terrain and the height of the far end, so treat any multiplier as a rough rule of thumb rather than a fixed figure. This is why community networks invest in hilltop and water tower installations.

Modem Preset vs. Range

Meshtastic's modem presets trade speed for range. Slower presets = longer range (throughput figures below are from the official Meshtastic radio-settings table):

Preset	Relative Range	Message Throughput	Best For
ShortTurbo	Shortest	~21 kbps	Dense urban, close range
ShortFast	Short	~10 kbps	Indoor/urban
MediumFast	Medium	~3.5 kbps	Suburban networks
LongFast	Long (default)	~1.1 kbps	Community networks (best balance)
LongModerate	Very long	~0.34 kbps	Rural sparse networks
LongSlow (deprecated)	Very long	~0.18 kbps	Deprecated - prefer Long Moderate for sparse rural meshes
VeryLongSlow (not recommended)	Maximum (in theory)	very low	The Meshtastic project recommends against this preset - it does not form meshes well and is unreliable; avoid it

Range Factors You Can Control

- **Antenna height:** The single biggest lever. Even a few extra meters of height can improve range substantially by clearing local obstructions; the exact improvement depends on the surrounding terrain.
- **Antenna quality:** A quality external fiberglass antenna can add several dB over the stock rubber-duck whip - often the single cheapest range upgrade. (Stock whips are typically ~0-2 dBi and consumer fiberglass antennas ~3-8 dBi; be skeptical of inflated gain claims from sellers. A decent external antenna ran about $30 as of 2026-06-07.)
- **Modem preset:** Switching from LongFast to a slower long-range preset can extend range at the cost of message throughput.
- **TX power:** In the US the legal limit is 1 W (30 dBm) conducted with up to 6 dBi antenna gain. Meshtastic already defaults to the maximum power your hardware and region allow (`tx_power 0` means "use default max"), so for range you should simply leave it at the default - the setting exists mainly to *reduce* power. Manually setting 30 usually does *not* extend range vs. the default, and most boards (e.g. SX1262-based) top out around +22 dBm regardless.

Range Factors You Can't Control

- **Terrain:** Hills, buildings, and forests attenuate signal significantly. Even a single building in the path can cut range drastically - sometimes by half or more, sometimes blocking the link entirely - depending on the construction and geometry.
- **Weather:** Rain has negligible direct effect at 915 MHz (well under 1 dB even in heavy rain - meaningful rain attenuation only begins above roughly 5-10 GHz). The real wet-weather losses come from wet foliage and water sitting on antennas and connectors, not the rain in the path itself.
- **Interference:** Other 900 MHz ISM devices sharing the band can raise the noise floor and reduce effective range.
- **Multipath fading:** In urban environments, reflections from buildings create constructive and destructive interference that causes range to vary significantly over short distances.

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