

Ground Planes for Monopole Antennas

A monopole antenna (vertical rod) radiates efficiently only when paired with a ground plane - a conducting surface that acts as the electrical other half of the antenna.

What counts as a ground plane

- **Vehicle roof:** Excellent. A metal roof is an ideal ground plane for NMO-mount antennas.
- **Metal enclosure:** A metal equipment housing near the feedpoint serves as a ground plane.
- **PCB ground plane:** The copper ground layers on a dev board act as a ground plane for the stock whip / helical ("rubber duck") antenna supplied with dev boards. Note that this is a *marginal* ground plane: the PCB is electrically small at 915 MHz, so performance from the stock antenna is often poor. Where range matters, mount the antenna on a proper ground plane or use a self-contained antenna rather than relying on the dev board.
- **Radials:** For antennas on non-conductive masts, attach 3-4 quarter-wave radials (8.2 cm at 915 MHz) at the base, angled 45 degrees downward.

Do commercial LoRa antennas need a ground plane?

Most commercial 915 MHz verticals designed for LoRa use a self-contained design - a balanced dipole structure, a collinear, or built-in radials - and so do not require an external ground plane. The caveat is common-mode current on the coax shield: even a "self-contained" antenna can effectively turn the feedline into part of the antenna unless it is decoupled (a choke or the antenna's own decoupling section). Check the manufacturer mounting instructions.

How to tell whether your antenna needs a ground plane: a bare whip with no visible radials and a single feed point is a monopole and needs a ground plane. An antenna labeled as a dipole, or one with a wider base section or its own radials, is self-contained. When you are unsure, check the product page, or measure SWR with and without a ground plane - a monopole that needs one will show a clear difference.

A poorly grounded monopole can have its radiation pattern tilted upward rather than horizontal, reducing effective range. This matters mainly for DIY wire antennas and bare whips, not for self-contained commercial products.

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