

Two-Way Radio Antenna Installation: Connectors, Grounding and VSWR Checks

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A good radio and the right cable can still perform badly if the antenna is poorly installed. Most field faults in two-way radio systems, such as high VSWR, intermittent audio and range that gets worse after rain, trace back to a handful of installation details: the connector, how it was sealed, how the mast was grounded, and whether anyone measured VSWR before leaving site.

This guide walks through those details in the order you meet them on a real job. It assumes the feedline is already sized correctly; if not, start with our guide to [coaxial cable for two-way radio base stations](#).

Position the Antenna First

- **Mount it vertically.** Handheld and mobile radios use vertical polarisation, so a tilted or horizontal antenna loses signal.
- **Keep it high and clear.** Metal structures and other antennas close by distort the radiation pattern and can detune the antenna.
- **Match the antenna to the band.** A VHF antenna on a UHF system will not match, however well it is installed. Check the antenna's stated frequency range against your channels.

Choose the Right Connector

Connector	Typical use	Limits
N-type	Standard for UHF base stations and repeaters	Seals well when taped; needs the correct body for the cable

7/16 DIN	High-power repeater and shared tower sites	Larger and costlier; best weather sealing of the three
UHF (PL-259)	HF and VHF installations	Not constant-impedance, so avoid at UHF frequencies
BNC	Test leads and low-power jumpers	Not intended for permanent outdoor joints

Always buy the connector for the exact cable, since the body of an LMR-400 connector is not the same as an LMR-600 one. For the trade-offs between the two main outdoor options, see [7/16 DIN vs N-Type](#), and browse our [RF connector range](#).

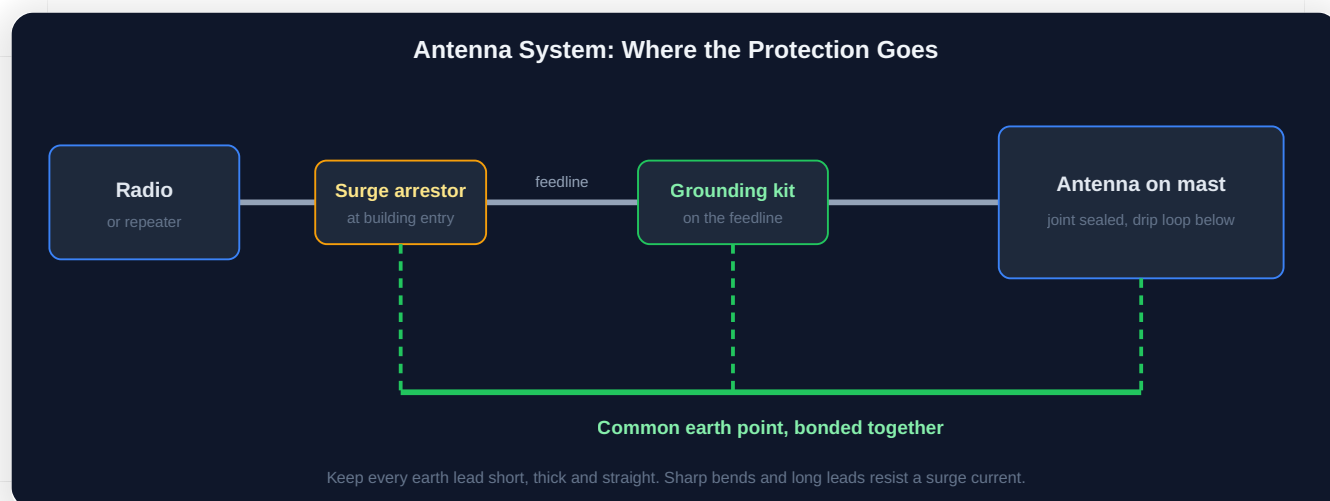


Figure 1 — Protection layout. Every protective device is bonded to the same earth point rather than to separate earths.

Weatherproof Every Outdoor Joint

Moisture in a connector or cable is the most common reason a system that tested well on day one degrades over the following months. Seal every outdoor joint the same way:

1. Clean and dry the connector, then tighten it firmly with the correct tool. Do not over-tighten.
2. Wrap self-amalgamating tape around the joint, stretching it and overlapping each turn by about half its width. Start below the joint and work up past it.
3. Cover it with UV-resistant vinyl tape for mechanical protection and sun resistance.
4. Form a drip loop in the cable below the joint, so water runs off the loop instead of down into the connector.

5. Support the cable with clips or ties about every metre on vertical runs, and do not exceed the bend radius at any corner. See [minimum bend radius](#).

Seal the outside of the joint, not the inside. Filling a connector with grease or sealant can disturb its impedance and trap moisture rather than keep it out.

Grounding and Lightning Protection

- **Bond the mast to the site earth** with a short, thick conductor. A long lead with sharp bends has high impedance to a fast surge, which is exactly when you need a low one.
- **Fit a coax grounding kit** where the feedline leaves the mast or tower and where it enters the building, bonded to the same earth.
- **Install a surge arrestor** at the building entry, earthed to the same point as the rest of the protection. See [RF surge protectors: what they do and how to specify them](#).
- **Use one common earth point.** Separate earths at different potentials can push surge current through the equipment.

A good arrestor adds only a fraction of a dB of loss, which is small compared with the damage a single surge can do to a radio or repeater.

Check VSWR Before You Leave Site

VSWR (voltage standing wave ratio) tells you how well the antenna system is matched to the radio. A perfect match is 1:1. Measure with an antenna analyser or an inline wattmeter at the operating frequency, and ideally sweep across the whole channel range. The table shows what the readings mean:

VSWR	Return loss	Power reflected	What it means
1.2:1	20.8 dB	0.8%	Excellent
1.5:1	14.0 dB	4%	Good; a commonly used acceptance target
2.0:1	9.5 dB	11%	Marginal; find the cause
3.0:1	6.0 dB	25%	Poor; fix before putting into service

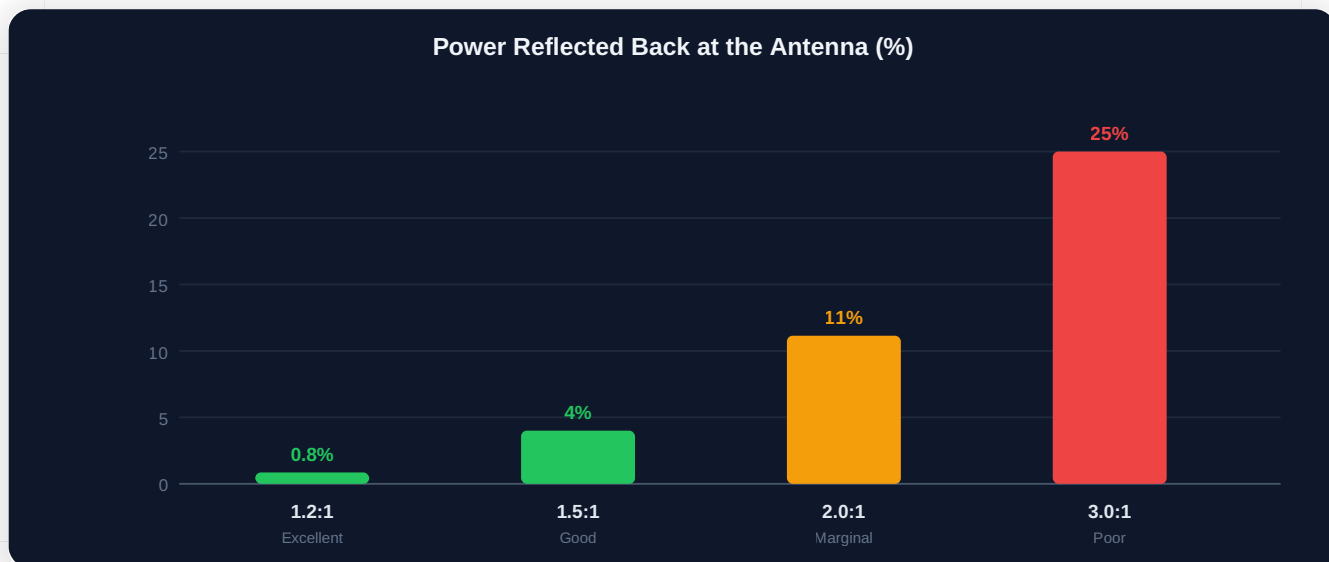


Figure 2 — Reflected power rises quickly once VSWR passes 2:1. At 3:1 a quarter of the power is sent back toward the radio.

High VSWR can look like a low-power fault. Many radios reduce their output automatically when VSWR is high to protect the amplifier, so an unexplained drop in power is a reason to check the antenna system first.

Reading the Symptoms

What you see	Likely cause
High VSWR across the whole band	Open or short, damaged connector, water in the cable, or a wrong or broken antenna
Lowest VSWR at the wrong frequency	Antenna built for a different band or not tuned to your channel
VSWR changes when the cable is moved, or in wind	Intermittent connector, or cable damaged by over-bending
Fine when dry, worse after rain	Water ingress at a connector or in the cable
VSWR looks excellent but range is poor	A lossy cable can hide a mismatch; check cable loss as well

Frequently Asked Questions

+ What VSWR is acceptable on a two-way radio antenna?

Under 1.5:1 is generally considered good and is a common acceptance target. Up to 2:1 may work, but about 11% of the power is being reflected, so find the cause. Above 2:1 the system should be fixed before it goes into service.

+ Should I measure VSWR at the radio or at the antenna?

Ideally both. Measuring at the antenna end of the feedline tells you about the antenna itself. Measuring at the radio end shows what the radio actually sees, but cable loss reduces the reflected signal on its way back, so a long or lossy cable can make a poor antenna look better than it is.

+ Do I need to ground an antenna on a rooftop?

Yes. Any exposed antenna and mast can pick up a lightning-induced surge. Bond the mast, grounding kits and surge arrestor to a common earth point, and follow local electrical requirements. For anything on a tower or a high-risk site, use a qualified installer.

+ Why not use a UHF connector for a UHF radio?

The name is misleading. The UHF (PL-259) connector dates from the early days of VHF and is not constant-impedance, so it matches poorly at UHF frequencies. Use N-type, or 7/16 DIN for high-power sites.

Connectors, Cable and Two-Way Radios

Bravosatcom supplies Times Microwave LMR cable, matching RF connectors and two-way radios from Motorola, ICOM and Kenwood for base station and repeater installations.

[Browse RF connectors →](#) · [Two-way radio base stations →](#)