

Repeaters vs Direct Mode: How to Extend Two-Way Radio Coverage on a Large Site

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On a small site, handheld radios talk straight to each other and everything works. As the site grows, with more floors, more steel, longer distances and more users, the radios start to lose each other. The usual fix is not more powerful handhelds. It is a repeater.

This guide explains how direct mode and repeaters differ, when each is the right choice, and what a repeater site needs in antennas and cable to perform properly.

The short answer. Use direct mode for a small site with short distances. Use a repeater when radios cannot reliably reach each other because of size, height or obstructions. A repeater works because it sits high on a good antenna and relays every call, so coverage no longer depends on one handheld reaching another.

How Direct Mode and a Repeater Work

In **direct mode** (also called simplex) radios talk to each other on a single frequency. The range is whatever a few watts from a handheld can achieve, and anything between two radios, such as a wall, a rack or a hill, weakens the signal.

A **repeater** is a fixed station with a high, well-placed antenna. It receives each transmission on one frequency and retransmits it on a second frequency at higher power. Every radio only has to reach the repeater, not each other, and the repeater relays the call to everyone.

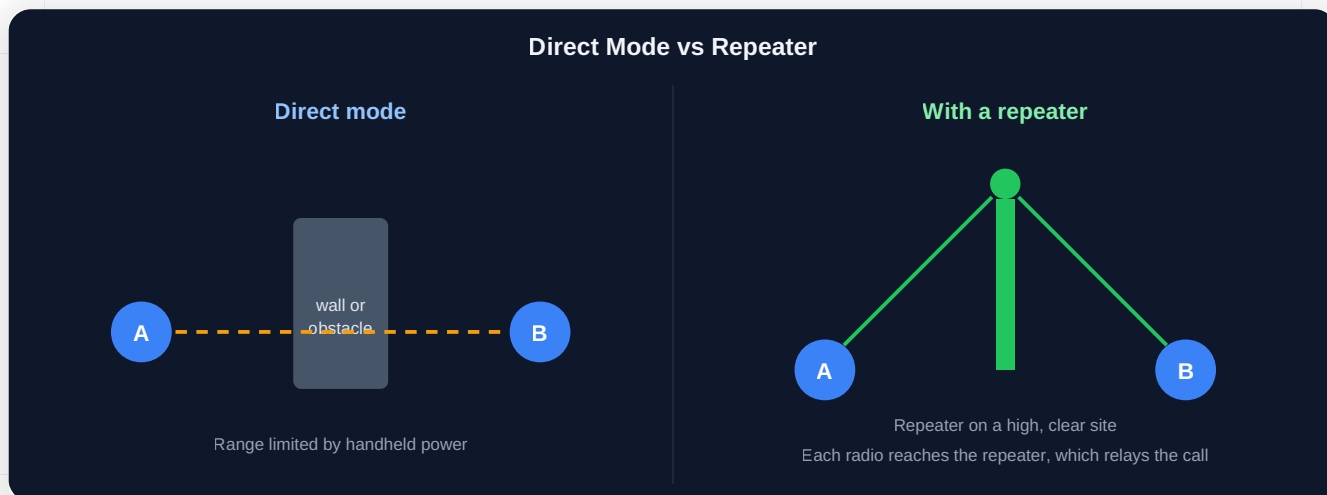


Figure 1 — In direct mode two radios must reach each other. With a repeater each radio only needs to reach the repeater.

Direct Mode vs Repeater at a Glance

Factor	Direct mode	Repeater
Coverage	Limited by handheld power and obstructions	Set by the repeater's height, power and antenna
Infrastructure	None	Repeater, duplexer, antenna, feedline, power supply
Cost	Lowest	Higher, plus installation
Frequencies	One	A pair (input and output)
Capacity	One conversation per channel	Two conversations per repeater on DMR digital, using timeslots
If it fails	Nothing to fail but the radios	Coverage drops until the repeater returns
Best for	Small sites and short distances	Large sites, tall buildings, multiple areas

When Direct Mode Is Enough

- A single building or compact site where radios are rarely far apart.
- Teams that work in the same area and need no coverage beyond it.
- Temporary events or short projects where installing infrastructure is not worth it.

When You Need a Repeater

- **Large sites** such as ports, plants, farms and construction projects where distances are long.
- **Tall or deep buildings** where handhelds on different floors or behind steel cannot reach each other. Very large buildings may need extra indoor antennas or a distributed antenna system as well.
- **Sites with obstructions** such as hills, containers or heavy structures that block direct paths.
- **Larger teams** where more users on one channel mean you want the extra capacity that two DMR timeslots give. See our [analog vs digital comparison](#).

Before you commit, test with the radios you plan to use. Coverage depends on the band as well, so read our guide to [VHF vs UHF](#) first.

What a Repeater Site Needs

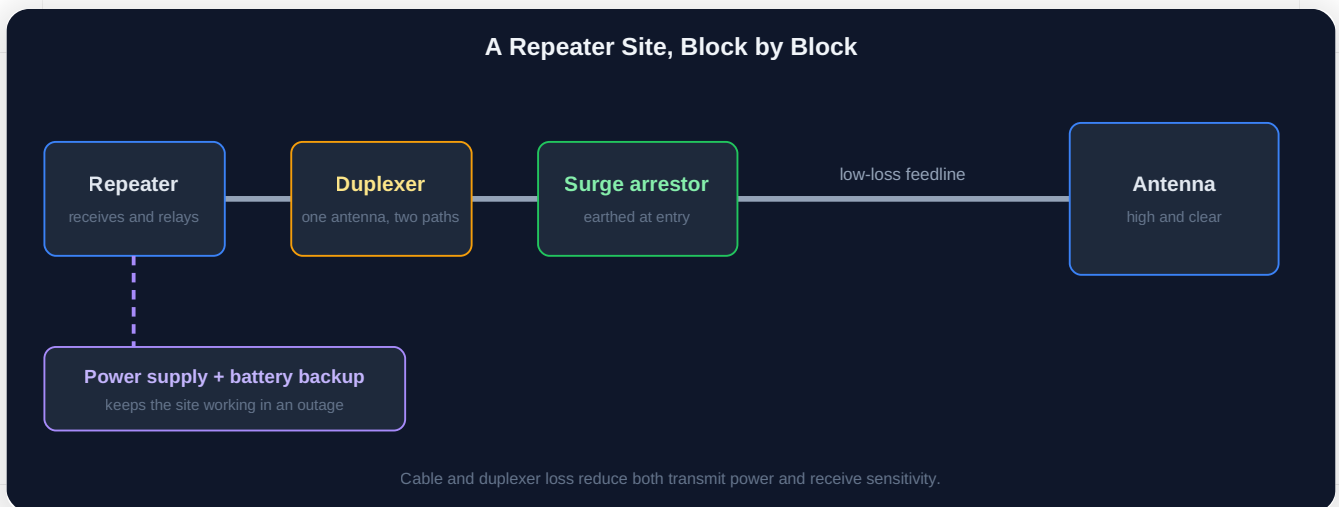


Figure 2 — The parts of a repeater site. Everything between the repeater and the antenna adds loss to both directions.

- **The repeater itself**, which should be rated for continuous duty, since it transmits for long periods.
- **A duplexer** (or separate antennas) so one antenna can transmit and receive at the same time. It adds a small loss that you must count with the cable loss.
- **The antenna**, mounted as high and clear as practical. Height is the biggest single factor in coverage.
- **Low-loss feedline**, kept as short as possible. See our guide to [coaxial cable for two-way radio base stations](#).
- **Grounding and surge protection**, installed as described in our [antenna installation and VSWR guide](#).
- **Power backup**, because a repeater that loses power takes the coverage with it.

Have a fallback. Many radios can switch to direct mode if the repeater is down. Set this up and tell users how to do it, so a failure reduces range instead of ending communication.

Every frequency a repeater uses must be licensed for your site, and a repeater needs a pair of them, so arrange this before you buy. Browse our [base station and repeater-capable radios](#) and our [LMR cable range](#).

Frequently Asked Questions

+ Do I need a repeater for a single building?

Often not, if the building is small. A multi-storey or steel-framed building can defeat handhelds in direct mode, in which case a repeater or extra indoor antennas help. Test with real radios before you decide.

+ Can one digital repeater carry two conversations?

Yes. A DMR repeater uses two timeslots on one frequency pair, so two independent conversations can happen at the same time. Each timeslot works like a separate channel.

+ What happens if the repeater fails?

Coverage drops until it is restored. Radios that support direct mode can keep talking at reduced range, which is why a backup plan and battery power for the site matter.

+ Does a repeater need special cable?

It needs low-loss cable like any base station, and the same rules apply: keep it short and choose the size for your band and run length. Because the repeater both transmits and receives through it, cable loss costs you in both directions.

Repeater-Ready Radios, Cable and Connectors

Bravosatcom supplies two-way radios from Motorola, ICOM and Kenwood, with the LMR cable and connectors to build a reliable radio site.

Base station radios → · LMR coaxial cable →