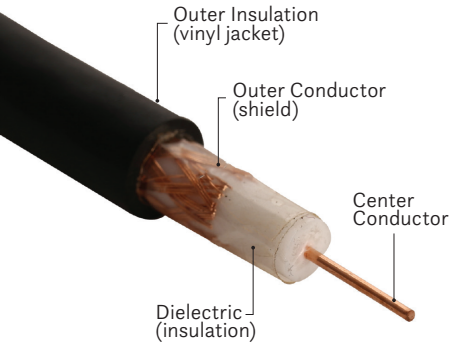
Times Microwave LMR 400 low-loss coaxial cable. The type shown here is rated for direct burial, which means it can withstand being buried in soil.

Shopping for Coaxial Cable

Feed lines, also called *transmission lines*, transport radio frequency (RF) energy from your transceiver to your antenna. Without a feed line, your signal is going nowhere. Here's a closer look at coax, the type of feed line you're most likely to encounter, with an eye toward how to determine what cable to buy for your station.



Coaxial cable is made of two conductors, one inside the other. In this example, the outer conductor (or *shield*) is made of braided copper wire. It completely surrounds the *center conductor*, which in this cable is made of stranded copper wire. The insulating *dielectric* in this example is made of white plastic. The exterior of coaxial cable is covered by a plastic *jacket*.

Coaxial cable is called that because it has two electrical conductors, one inside the other, within a circle. So, the circle has two axes — it is *co*-axial. In most cases the conductors are made of solid or stranded metal or wire.

The two conductors are separated by an insulator called a *dielectric*. The dielectric can be plastic or foam, or it may be nothing at all — just empty space filled with air.

Coax and Loss

Coaxial cable isn't perfect. Far from it, in fact. Unless your cable is immersed in super-cold liquid helium and acting as a superconductor (not a practical option for most installations), it's sure to lose some of the energy your radio pumps into it.

So, your task is to pick the cable that will keep your RF loss as low as possible. This is a technical and financial balancing act. You want to spend only as much as necessary to purchase a cable that will keep the losses at acceptable levels. Don't become obsessed with trimming loss at fractional levels. You won't notice the benefit.

Loss in coaxial cable depends on three factors:

- The length of the cable. Longer cables dissipate (lose) more energy.
- The frequency of the signal. The higher the frequency, the greater the loss.
- *Standing wave ratio* (*SWR*). The higher the SWR in the feed line, the greater the loss. (See page 17 of the January/February 2020 issue of *On the Air* for a definition of SWR.)

Feed line loss is measured in *decibels*. More decibels means more energy loss. Because of the way decibels work, loss escalates with astonishing speed. A loss of 3 dB in a feed line, for example, means that *half* of the energy created by your radio never makes it to the antenna. Jack that up to 6 dB, and only 25% of your power reaches the antenna.

This loss works in reverse as well. With cable that results in a 3 dB loss, half of the energy received by your antenna never reaches your radio. Fortunately, radios are exquisitely sensitive and can work just fine with a great deal of received-signal loss.

How much loss is acceptable? That's up to you! Let's say your transceiver generates 100 watts of power, your antenna is far away, and you can't afford the type of coaxial cable that would result in a loss of, say, 1 dB. However, you can afford a cable that results in a 3 dB loss. Yes, only 50 watts will get to your antenna, but you can still communicate with 50 watts. Your best option may be to purchase a less expensive cable, at least for the time being, and live with the fact that your radiated power will be substantially reduced.

Shopping for Coax

Before you begin shopping, you need to know two things:

- The distance between your radio and your antenna. In other words, the length of cable you'll need.
- The highest frequency on which you intend to operate.

Dealers usually advertise cable loss in "decibels per 100 feet" at a specific frequency. Let's say you're considering a cable with an advertised loss of 2 dB per 100 feet at 146 MHz. That's a decent cable for use on the 2-meter band. And remember that the loss decreases as the length decreases. If you only need 50 feet of this cable to reach your antenna, you've cut the effective loss in half, to only 1 dB.

A not-so-decent cable for 146 MHz would be one such as RG-58. One hundred feet of RG-58 would result in a staggering loss of 4.7 dB. With 100 watts at the input, only about 34 watts would reach your antenna!

But what if you only needed 25 feet of RG-58 to reach your antenna? Now the loss is just 1.1 dB, which is perfectly acceptable.

More Shopping Tips

- Unless you intend to attach the connectors yourself, try to find a dealer who will do it for you, or who sells cable lengths with connectors already attached. At frequencies below 148 MHz, PL-259 connectors work well. At higher frequencies, consider Type N connectors.
- If you plan to bury your coaxial cable in the ground, look for cable rated for *direct burial*.
- Cables with lower loss tend to be more rigid. For instance, a low-loss cable made by Times Microwave and known as LMR-600 is quite stiff; its popular cousin, LMR-400, is more flexible. The king of low-loss coaxial cable is *hard line*, a very rigid, expensive (100 feet can run hundreds of dollars) cable with a solid copper shield.

Loss Calculators Online
The easiest way to determine the amount of loss for a given cable type is to use one of the calculators available online, like kv5r.com/ham-radio/coax-loss-calculator. Just pick the cable type, enter the length, the highest operating frequency, and anticipated SWR (for shopping purposes, enter 1.5 or 1.5:1). The result will be the predicted loss in dB.